Herefordshire Council Water Cycle Study- Phase 1

Final

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This report describes work commissioned by Herefordshire Council, by an instruction dated: November 2022. The Client's representative for the contract was Stuart Powell of Herefordshire Council, changed to Victoria Eaton in June 2023. Jessica Creber, Alex Garratt, and Richard Pardoe of JBA Consulting carried out this work.

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Abbreviations

ALS	Abstraction Licence Strategy
AMP	Asset Management Plan
BOD	Biological Oxygen Demand
CAMS	Catchment Abstraction Management Strategy
CDC	Cotswold District Council
CFMP	Catchment Flood Management Plan
CIRIA	Company providing research and training in the construction industry
CSO	Combined Sewer Overflow
DCWW	Dŵr Cymru Welsh Water
DEFRA	Department of the Environment, Food and Rural Affairs (formerly MAFF)
EA	Environment Agency
EC	European Community
EN	English Nature
EPA	Environmental Protection Agency
GIS	Geographical Information System
GWMU	Groundwater Management Unit
HC	Herefordshire Council
HOF	Hands-off flow: river flow below which an abstractor may be required to stop or reduce abstraction.
ID	Identifier
JNCC	Joint Nature Conservation Committee
LPA	Local Planning Authority
MC	Management Catchment
NE	Natural England
NERC	Natural Environment Research Council
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
NRW	Natural Resources for Wales
PPG	Planning Policy Guidance
PR	Percentage Runoff
RAG	Red, Amber, Green
Ramsar	The intergovernmental Convention on Wetlands, signed in Ramsar, Iran, in 1971

RBMP	River Basin Management Plan
SAC	Special Area of Conservation, protected under the EU Habitats Directive
SEA	Strategic Environmental Assessment
SPA	Special Protection Area for birds, protected under the EU Habitats Directive
SSSI	Site of Special Scientific Interest
STW	Severn Trent Water
UKWIR	UK Water Industry Research Ltd
WFD	Water Framework Directive
WwTW	Wastewater Treatment Work

Executive Summary

JBA Consulting was commissioned by Herefordshire Council (HC) to undertake a Water Cycle Study (WCS) for their council area. The purpose of the WCS is to form part of a comprehensive and robust evidence base to inform the preparation of the new Local Plan, which will set out a vision and framework for development in the area up to 2041 and will be used to inform decisions on the location and timing of future development.

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.

This Stage 1 Scoping Study will assist HC 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, and the requirements of the environment. The Water Cycle Study has been carried out in co-operation with the water companies and the neighbouring Local Planning Authorities (LPAs).

Planned growth in and around Herefordshire is characterised in Section 2 of the report, before relevant environmental and water industry policy and legislation is presented in Section 3 to provide context for the following sections. The report is then divided into sections assessing the impact of growth on each topic in the water cycle. Finally, a summary is provided collating all of the recommendations from each section into one table.

The following key summaries were drawn:

Water resources and supply

Dwr Cymru Welsh Water (DCWW) commented that there are significant strategic water resource issues across Herefordshire and are in regular contact with the LPA about this. They have said they have resource to supply all the residential allocations and reasonable alternatives shown to them. However there is uncertainty surrounding the employment sites, as this category is not included in DCWW's resource planning. Further information about employment sites will be gathered at stage 2. This will ensure a more accurate demand forecast over time is represented in our growth scenario. There is uncertainty regarding supply capacity which should be explored further in the stage 2 study. This uncertainty is due to a number of treatment works which are currently under review by

DCWW. They have an agreement in place for Ross-on-Wye Water Resource Zone with LPAs for a set number of connections, due to the limited capacity to supply.

Wastewater network and treatment

DCWW indicated that all but four of the potential development sites require hydraulic modelling to assess the capacity of the sewer network which would serve these sites. Similarly, the five development sites within Severn Trent Water's (STW) area are all recommended to have hydraulic modelling carried out to assess capacity. Particularly, the sites classed as amber are of higher concern, as the networks downstream have historic sewer flooding issues.

Four of the network storm overflows in Herefordshire are above the threshold for investigation. Twelve of the remaining CSO's are classed as amber, being above the long term goal of 10 spills but below the threshold. Ongoing monitoring will help to assess which storm overflows will need to be considered for upgrades or permit changes.

STW suggest they could accommodate the residential allocations and reasonable alternatives in the area they serve without having to upgrade infrastructure. DCWW have indicated they could accommodate all the residential allocations/reasonable alternatives expected in the area they serve. However, they are unlikely to be able to accommodate the six employment sites proposed. The JBA headroom assessment indicates, the WwTWs of Bromyard, Leominster, Lower Cleeve (Ross-on-Wye) and Ledbury (allocation market towns) will exceed their permit limit sometime during the plan period with the growth forecast we have calculated. There are a number of CSO's which would serve allocation sites which already meet the trigger for investigation. It is important that additional growth in these catchments does not lead to an increase in the operation of storm overflows.

SUDS as an important measure to reduce runoff and ingress of storm water into sewer networks. As well as requiring appropriate SuDS on all developments, the Council should seek opportunities to reap multiple benefits from planned investment in nature-based solutions by DCWW and STW as part of their storm overflow plans.

There are 15 potential allocation sites located close to existing WwTWs which may be at risk of nuisance odour. At these sites, it is recommended that an odour assessment is carried out to investigate them further.

Water quality and environmental impact

Growth during the local plan period will increase the discharge of treated wastewater from WwTWs in Herefordshire. The specific issues around nutrient management in the Lugg, Wye and Clun catchments warrant a more detailed analysis of water quality than a typical WCS**.** During stage two detailed water quality modelling will be undertaken to examine the impact of local plan growth, climate change and change to diffuse (non-point source) sources of pollution across Herefordshire. This will inform change to water quality in general and in particular the protected sites which could be affected.

The potential impact of development on a number of protected sites such as SAC and SSSIs within, or downstream of the study area should be carefully considered in future plan making.

There are several Groundwater Source Protection Zones, in the study area. The impact of future development on the quality of groundwater sources should be explored during the stage two WCS. In addition, the Water Industry National Environment Programme (WINEP) data will be considered at stage 2. This will show the current actions to reduce abstraction and improve water quality, to reach the respective environmental destinations. It will be determined whether growth could likely put pressure on meeting the WFD goals of these waterbodies.

1 Introduction

1.1 Terms of Reference

JBA Consulting was commissioned by Herefordshire Council to undertake a Water Cycle Study (WCS) in two stages to inform the local plan. The purpose of the WCS is to form part of a comprehensive and robust evidence base for the Local Plan which will set out a vision and framework for development in the area up to 2041 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.

The brief identified the specific challenge of nutrient management in Herefordshire. The River Lugg Site of Special Scientific Interest (SSSI) is failing its phosphate target, meaning that is in unfavourable condition and failing its Conservation Targets as a part of the Wye Special Area of Conservation (SAC). The River Wye in Herefordshire is also assessed by Natural England (NE) as being at risk of failing its phosphate targets. Furthermore, the River Teme (SSSI) is failing to achieve favourable conservation status around water quality.

Following Natural England (NE) guidance, the Council had previously placed a moratorium on new development that could increase the phosphate load to the River Lugg, and is now granting permissions under a Nutrient Neutrality approach to reduce phosphate inputs. Consequently, the WCS should assess the water quality impacts of the proposed scale of development within the Lugg and wider Wye catchment, including identifying the levels of treatment that would be required to achieve nutrient neutral development.

1.2 Structure of report

The requirements and objectives of the WCS are set out in the section below. Planned growth in and around Herefordshire is characterised in Section 2 of the report, before relevant environmental and water industry policy and legislation is presented in Section 3 to provide context for the following assessment. The report is then divided into sections assessing the impact of growth on each topic in the water cycle study.

1.3 The Water Cycle

Planning Practice Guidance on Water Supply, Wastewater and Water Quality (Gov.UK a, 2019) 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 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 recommends a phased approach:

Stage 1: Scoping study, identifies if the water infrastructure capacity could constrain growth and if there are any gaps in the evidence you need to make this assessment. The scoping study will identify:

- The area and amount of proposed development;
- the existing evidence;
- main partners to work with; and
- evidence gaps and constraints on growth.

Stage 2: Detailed study, to provide the evidence to inform an integrated water management strategy. It will identify the water and flood management infrastructure that will mitigate the risks from too little or too much water. It will also identify what you need to do to protect and enhance the water environment.

As a WCS is not a mandatory document, Local Planning Authorities are advised to prioritise the stages of the WCS to integrate with their Local Plan programme. Figure 1-1 below shows the main elements that compromise the Water Cycle.

The natural water cycle describes the continuous transfers of water around the planet, from atmosphere to surface and back via evaporation, transpiration and precipitation, and the various flows and storage processes that occur. The artificial water cycle looks at the availability of water resources for human consumption, its treatment and supply to homes and business, its use and consequently the generation of wastewater. It then looks at how wastewater is taken away, treated, and finally what happens when it is returned to the environment.

Further information can be found here.

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.

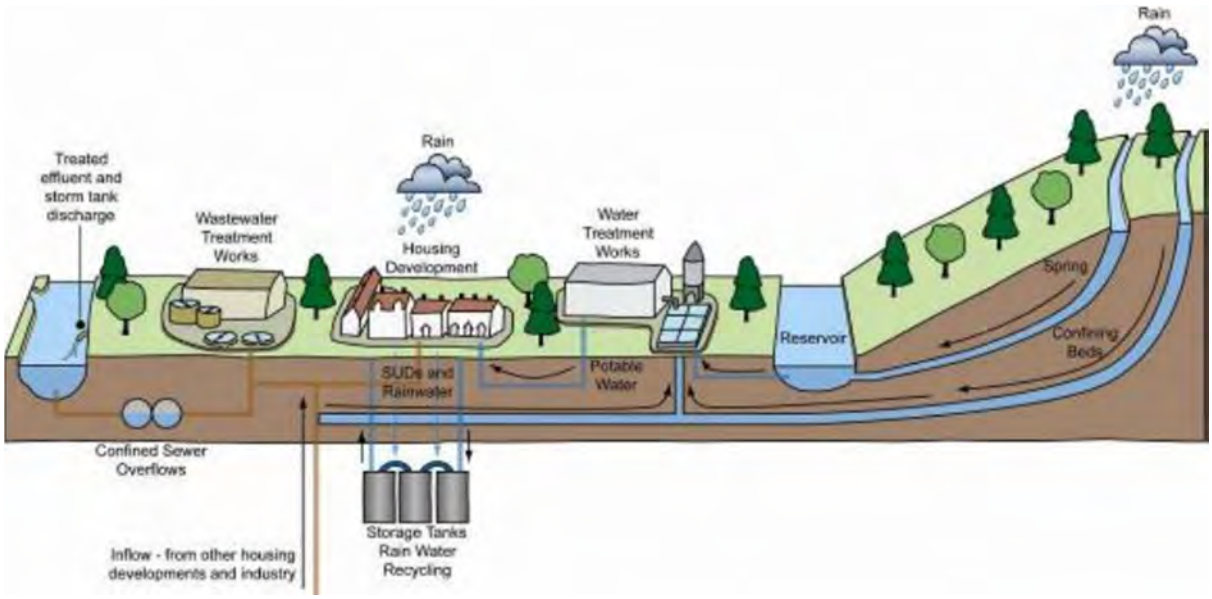


Figure 1-1 The Water Cycle. Source: Environment Agency – Water Cycle Study Guidance

1.4 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.

Objectives

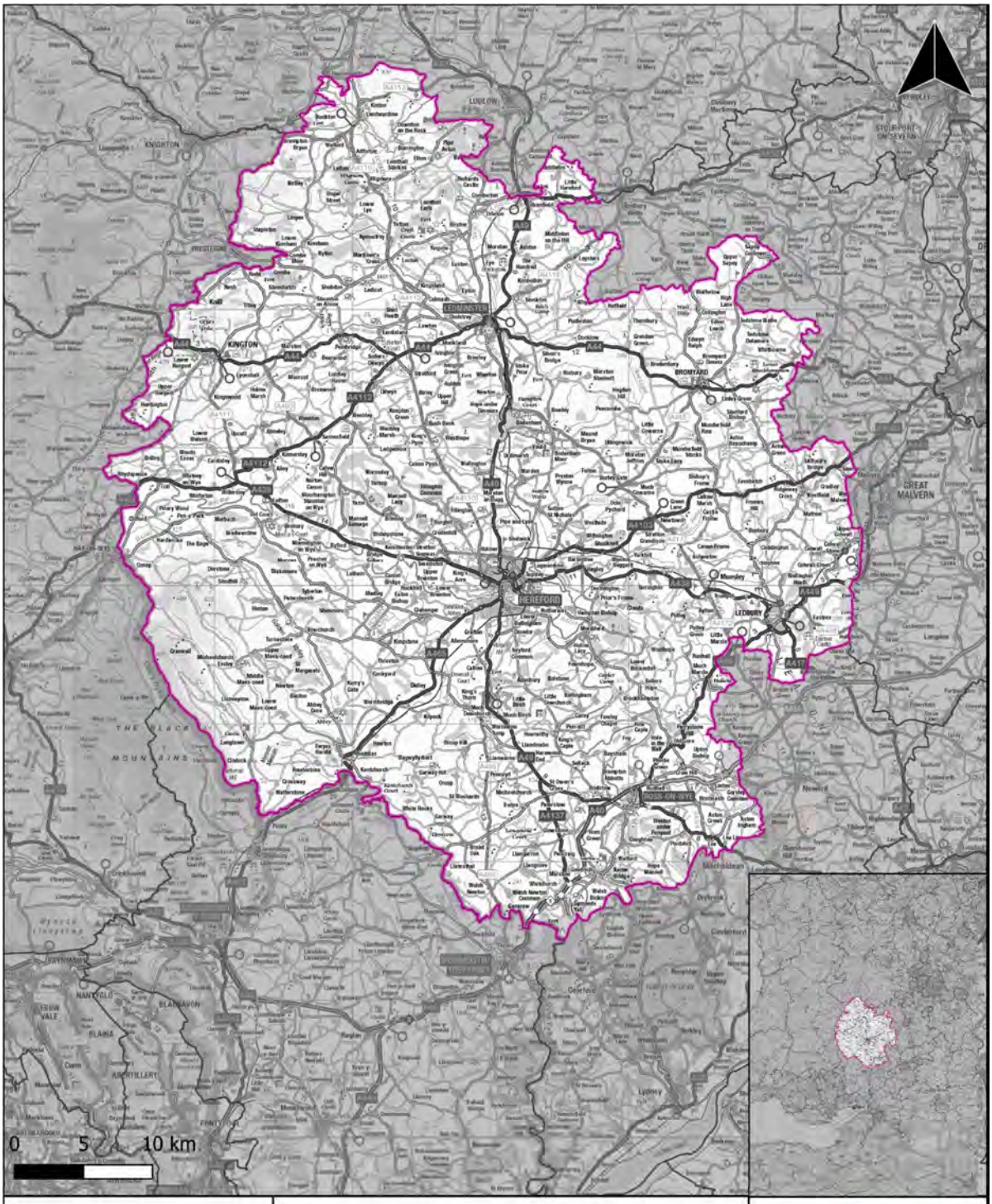
This Stage 1 scoping report is written to support the Herefordshire Local Plan Review. The overall objective of the WCS is to understand the environmental and physical constraints of development and identify opportunities for more sustainable planning and improvements that may be required to achieve the required level of development.

This WCS will consider the following issues:

- Water resources, demand, and supply.
- Wastewater infrastructure and treatment.
- Water quality and environmental impact.

1.5 Study area

The Local Planning Authority (LPA) area of Herefordshire Council is shown in Figure 1-2. The study area covers from just under Shelderton in the north to Welsh Newton Common in the south and stretches from Craswall in the west to West Malvern in the east.



Hereford study area	Figure name: Hereford Study Area
	Source: JSO-JBAU-XX-XX-EN-0001-S0.P01.01

Figure 1-2 Herefordshire study area

1.6 Authorities responsible for Water Resource and Wastewater Management in Herefordshire

Within Herefordshire there are several authorities and regulators responsible or involved in supplying, managing, and overseeing water supply, wastewater, and the environment. The table below explains the responsibilities of various bodies within the district.

Table 1-1 Responsibilities of authorities within Herefordshire

Authority Name	Key Responsibilities of Different Authorities
	The EA are the environmental regulator in England with responsibilities for water quality, flood risk and administering licences for water abstraction. They are a statutory consultee for many development plan documents and for some planning applications. They advise on environmental and infrastructure capacity issues across the water cycle.
Natural England	Natural England are the Government's advisors on the natural environment, which they have a responsibility to protect and enhance. In a WCS they may provide information on the conservation objectives, and guidance on, the protection of designated sites.
Severn Trent and Dŵr Cymru (Welsh Water)	Severn Trent and Dŵr Cymru (Welsh Water) are the water suppliers and sewerage undertakers within Herefordshire. They have a duty under the Water Industry Act to provide, improve and extend a system of public sewers (for both domestic and trade flows) so as to cleanse and maintain those sewers (and any lateral drain) to ensure that the area that they serve is effectually drained. There is also a duty to make provision for the emptying of those sewers, normally through sewage treatment works or where appropriate through discharges direct to watercourses.
New Appointment and Variations (NAV) suppliers	Limited companies providing water and/or wastewater services, primarily to new developments. The "wholesale supplier" remains the local supplier of water and/or wastewater services in that area. NAVs were introduced with the intention of providing competition in the monopolistic water market. Leep Networks and Independent Water Networks are two NAVs known to be operating within Herefordshire.
Retail suppliers to non-household customers	Businesses and other non-household customers are supplied via non-household water and wastewater service retailers. The "wholesale supplier" remains the local supplier of water and/or wastewater services in that area. Retail suppliers were introduced with the intention of providing competition in the monopolistic water market.

1.7 Record of Engagement

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. Further engagement will take place, if necessary, as the Local Plan progresses.

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

Inception meeting

Neighbouring authorities

Engaged Parties	Details
Powys Monmouthshire Forest of dean Malvern-Wychavon Shropshire	Request for water cycle studies conducted in their area, and allocation growth that would be served by a WwTW within or shared with Herefordshire Council.

Collaboration with Water Companies

Engaged Parties	Details
Severn Trent Water Dŵr Cymru (Welsh Water)	Wastewater treatment works flow data. Water company assessments of water and wastewater infrastructure and capacity constraints.

2 Future Growth in Herefordshire

2.1 Existing and emerging local plan

The Local Plan Core Strategy was adopted in 2015, which covers the period from 2011 to 2031. Relevant plans related to this adopted strategy were the Neighbourhood Development Plans, Sustainable Community Strategy and Economic Development Strategy.

In November 2020 the Cabinet Member for Infrastructure and Transport took the decision to update the adopted Core Strategy. This was in light of proposals set out in the government White Paper: Planning for the Future, updated housing figures and Herefordshire declaring a climate and ecological emergency. This Local Plan will cover the period from 2021-2041 and is being consulted on currently ahead of the Regulation 18 submission in June 2024.

The draft Local Plan includes:

- A vision for Herefordshire at 2041
- A set of objectives to deliver that vision
- A strategy which explains the approach to all development in the county
- Strategic policies that set out requirements for how development must be delivered across the whole county
- Place shaping policies which are specific to development for Hereford, for the market towns and in the rural areas.

Housing need

A key part of the strategy is to enable affordable housing to be developed across Herefordshire. The towns with the highest chance of delivering affordable housing are Hereford, Ross on Wye, Ledbury and Bromyard, with likely low numbers achievable in Kington and Leominster.

The calculated housing need during the plan period from 2021-2041, is 16,100 dwellings, with 805 delivered per year. Circa 6,500 dwellings have been built or granted planning permission since April 2021, which leaves 9,608 up to 2041, still to be delivered.

Alongside housing growth and small employment sites, 182 hectares of new strategic employment land will be identified within the plan period.

Policy CC1: A Carbon neutral Herefordshire - draft Local Plan

Development proposals will contribute to climate adaptation by: "Incorporating water efficiency, water recycling, and rainwater harvesting measures to mitigate the impact of drought and reduce resource and associated energy consumption. To minimise

adverse impacts on water quantity and quality, new residential developments must achieve water efficiency targets of: a minimum of 110 litres per person per day in areas outside the Rivers Wye and Clun Special Areas of Conservation (SACs) and 100 litres per person per day within these SACs. Non-residential development is expected to achieve a minimum of 3 credits under the measure “Wat01” of the BREEAM New Construction Standard."

Policy EE1: Protecting and enhancing the quality of the natural environment- draft Local Plan

The policy states the Local Plan will:

- *"protect and enhance key natural assets of agricultural soils, water, wetlands, woodlands, river meadows, or any scheme that could impact habitat diversity."*
- *"Improve water quality and restore and enhance riparian habitats."*
- *"Demonstrate that they will not result in an adverse impact on the integrity of any National Site Network Site (Special Area of Conservation, Special Protection Areas or Ramsar) through additional nutrient and pollution pathways."*

2.2 Supplementary planning documents and other strategies

Agricultural planning SPD

The SPD development is currently paused, due to prioritisation of the Local Plan Core Strategy. The purpose of this SPD is to outline the issues that could arise in relation to agricultural development and what assessments / supporting information may be required to support agricultural planning applications. It also aims to provide a methodology to determine phosphate loading of a proposed development to inform planning applications within the River Wye.

Alongside the agricultural planning SPD, HC are working on providing an updated tool to replace the Farmscoper decision support tool. This is used to assess diffuse agricultural pollutant loads to rivers and evaluate mitigation strategies, specifically for phosphorus.

The Cabinet Commission for Restoring the Wye is a consortium of Herefordshire, Powys, Monmouthshire and Forest of Dean councils. The aim of this is to develop proposals and solutions to restore the river Wye.

Environmental Building Standards SPD

Sets out the best practice recommendations to encourage the highest standards in building design and construction. Topics it covers are energy use, external environment, accessibility and construction.

Green and Blue Infrastructure (GBI) Strategy

The strategy was prepared for HC in 2023 as part of their Natural Environment Evidence to inform the Local Plan. Its aim is to guide and inform the investment and future delivery of GBI in the context of the county's growth agenda. It provides a holistic analysis and identification of Herefordshire's priority GBI zones.

2.3 Growth in Herefordshire

In order to assess the impact of new developments on water infrastructure and the environment, existing growth commitments and allocations from the adopted Local Plan (2011 to 2031) need to be understood alongside potential future allocations and reasonable alternatives. Reasonable alternatives are possible strategic sites which could be developed if the higher priority, current allocations are not found to be suitable. HC provided:

- Strategic sites (housing, employments and mixed)
- Reasonable alternatives
- Commitments
- Completions

Table 2-1 A summary of the growth in Herefordshire for the period (2021-2041)

Type of Growth	Number of Houses	Employment floorspace (m^2)
Allocations	7,002	1,050,122
Commitments	5,655	N/A
Completions	1,848	N/A
Reasonable Alternatives	12,445	299,064
Windfall	1,910	N/A
Neighbouring Authority/ allocations	498	12,0416

2.4 Development sites in Herefordshire

Potential allocations and reasonable alternatives within Herefordshire can be seen in Figure 2-1. From mapping provided by HC, 77 potential allocations and reasonable alternatives have been identified within Herefordshire.

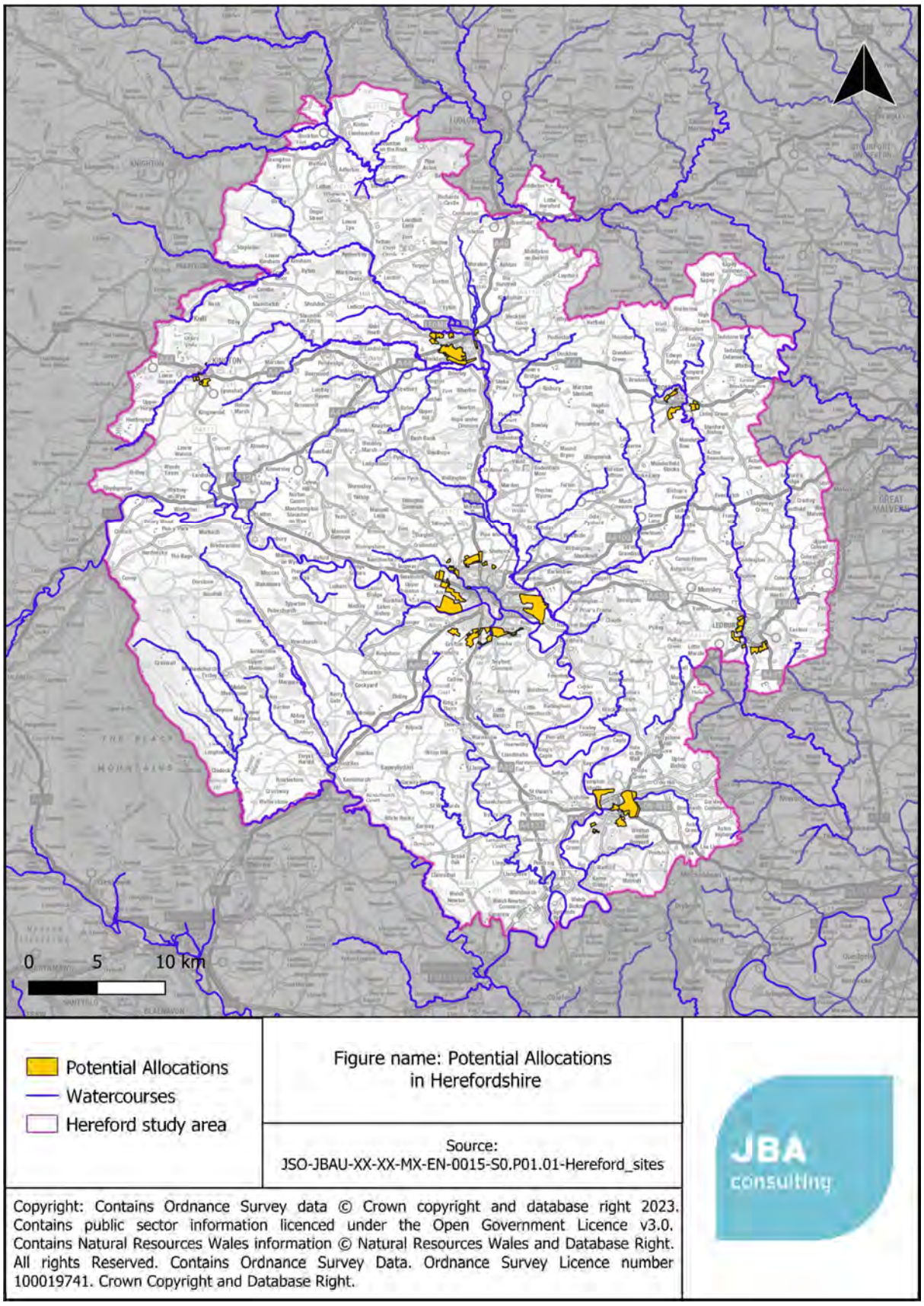


Figure 2-1 Potential allocations and reasonable alternatives within Herefordshire

2.5 Housing

2.5.1 HELAA

The Herefordshire Council Housing and Economic Land Availability Assessment (HELAA) is an important piece of evidence in preparing local plans and identifies possible sites for future housing and economic development. It also contains an assessment of development potential, suitability, likelihood, and timing of development. It does not determine whether a site should be allocated; this decision remains part of the local planning process. The HELAA is still being prepared by the Council, but initial considerations have helped to inform this study.

The first stage in the HELAA process is to identify sites for further assessment, and a "call for sites" has taken place. Further sites continue to be promoted, with this evidence based on a specific point in time. See Appendix A for the full list of sites.

2.5.2 Windfall

Windfall sites are sites that have not been specifically identified in the Local Plan. They normally comprise previously developed sites that have unexpectedly become available. Herefordshire have advised an annual estimate of 890 dwellings should be applied throughout the LP period.

2.6 Growth from outside Herefordshire

2.6.1 General approach

Where growth within a neighbouring Local Planning Authority (LPA) area may be served by infrastructure within or shared with Herefordshire, 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 Herefordshire.

Two neighbouring authorities have allocation sites that could possibly share wastewater infrastructure, Powys and Shropshire.

2.6.2 Powys

Powys Council has provided information on significant sites from the Adopted Local Plan (2011-2026). These sites would be served by Presteigne and Hay-on-Wye WwTW which are shared with the Herefordshire study area.

Table 2-2 Summary of growth in Powys served by infrastructure shared with Herefordshire.

WwTW	Proposed number of dwellings	Potential Employment Space (m^2)	Period
Presteigne	85	18,286	2022-2037
Hay-on-Wye	45	24,000	2022-2037

2.6.3 Shropshire

Shropshire has provided information on significant sites from the local plan allocation Reg 19 shapefiles provided by them. These sites would be served by Ludlow WwTW which is shared with the Herefordshire study area.

Table 2-3 Summary of growth in Shropshire served by infrastructure shared with Herefordshire.

WwTW	Proposed number of dwellings	Potential Employment Space (m^2)	Period
Ludlow	368	78,130	2016-2038

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 Planning Policy Framework

The National Planning Policy Framework (NPPF) was published on 27 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, July 2021, August 2022 and September 2023, but the changes were not significant from the July 2018 version for policy areas relevant to the WCS. More information can be found here.

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 153:
"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 174:
"…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".

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. DLUHC is in the process of updating the Planning Practice Guidance to consider the necessary 2018 and 2019 changes to the NPPF. Of the sections relevant to this study, only the Water Supply, Wastewater and Water Quality section has been updated in the guidance, this is summarised in section 3.3.

- Flood Risk and Coastal Change (UK Government, 2014)
- Water Supply, Wastewater and Water Quality (UK Government b, 2015)
- Housing - Optional Technical Standards (UK Government c, 2015)

3.3 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.

Infrastructure:

Plan Making:

- 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.

Planning applications:

Wastewater considerations include:

- First presumption is to provide a system for foul drainage discharging into a public sewer.
- Phasing of development and infrastructure, ensuring no occupation of properties until adequate infrastructure is in place.
- Circumstances where package sewage treatment plants or septic tanks are applicable.

Water Supply:

Planning applications:

- 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.
- This is recommended in all areas of water stress.

Water quality

Plan Making:

- 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.

Planning applications:

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; and
- directly or indirectly result in a deterioration in water quality or a breach of environmental legislation as a result of adequate infrastructure in place to accommodate additional development pressures.

Wastewater

Plan Making:

- The sufficiency and capacity of wastewater infrastructure.
- The circumstances where wastewater from new development would not be expected to drain to a public sewer.

Planning applications:

If there are concerns arising from a planning application about the capacity of wastewater infrastructure, applicants will be asked to provide evidence of initial liaison with Severn Trent Water (STW) or Dwr Cymru Welsh Water (DCWW) with reference to plans to accommodate additional wastewater flows or provide information about how the proposed development will be drained and wastewater dealt with.

Cross-boundary concerns

Plan Making:

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.

Planning applications:

No specific guidance (relevant to some developments).

SEA and Sustainability

Plan Making:

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.

Planning applications:

No specific guidance (should be considered in applications).

3.4 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 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 (EC Harris, 2014). The evidence for adopting the optional requirements is outlined in section 4.5.

3.4.1 Building Regulations

The Building Regulations (2010) Part G 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 (UK Government d, 2015).

3.4.2 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 (BRE, 2023), and commercial, leisure, educational facilities and mixed-use buildings by the Building Research Establishment Environmental Assessment Methodology (BREEAM) UK New Construction Standard (BRE b, 2018).

Using independent, licenced 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 Council has the opportunity to seek BREEAM or HQM status for all new, residential and non-residential buildings.

3.4.3 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 (Pickles, 2014) 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 (UK Government e, 2015). 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.

Herefordshire Council are the LLFA 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.

An updated version of the CIRIA SuDS Manual 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. The manual itself can be found here.

CIRIA also publish "Guidance on the Construction of SuDS" (C768) ,which contains detailed guidance on all aspects of SuDS construction, with specific information on each SuDS component available as a downloadable chapter. The downloadable chapter is available here.

As of April 2020, the new Design and Construction Guidance (DCG) 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. The guidance is available here.

3.5 Regional Policy

3.5.1 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.

3.5.2 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.

3.5.3 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:

- 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.

3.5.4 Regional water resource planning

Water resource planning is taking an increasingly regional focus, recognising the need for collaboration between water companies and sectors in order to address the challenges of climate change, increasing demand for water and protecting the water environment. Five regional groupings having been formed, including the Water Resources West (WRW) group which covers Herefordshire. An advisory group consisting of their regulators (Environment Agency and Ofwat) and Defra regularly attend meetings of WRW.

WRW are preparing a regional water resource plan for publication in Autumn 2023, which in turn will inform the next round of company WRMPs to be published in 2024. As part of this process, they have published an initial water resource position statement which sets out the water resources challenges and opportunities within the region.

3.6 Local Policy

3.6.1 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” (UK Government f, 2011).

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.

3.7 International Environmental Policy

3.7.1 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, within the context of sustainable development". A handbook on the wise use of wetlands is available from the Ramsar Convention Secretariat, which is available here.

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.

3.8 European Union Derived Environmental Policy

3.8.1 Urban Wastewater Treatment Regulations (UWWTR)

The Urban Wastewater Treatment Directive UWWTD 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 (European Commission, 2022). 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 was 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'.

3.8.2 Habitats Regulations

The EU Habitats Directive, transposed into law as The Conservation of Habitats and Species Regulations 2017, 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.

3.8.3 Bathing Water Regulations

The Bathing Water Directive was first published in 2006 and has been transposed into English and Welsh law through enactment of the Bathing Water Regulations 2013 (supersedes the Bathing Water Regulations 2008). The aims of the directive are the protection of public health whilst bathing, standardisation of publicly available water quality information and to improve management practices at bathing waters.

The UK has over 600 designated bathing waters defined as areas of inshore waters designated for public swimming, these areas are typically characterised by large numbers of swimmers and visitors per year. Under law the Environment Agency are required to monitor water quality at these sites regularly (usually weekly) throughout the Bathing Water Season. In England the Bathing Water Season is between 15th May and 30th September.

Water quality standards are based on the incidence of potentially harmful bacteria, E. coli and intestinal enterococci and are categorised as ‘excellent’, ‘good’, ‘sufficient’ or ‘poor’ on the basis of bacteria levels. Sites are rated annually and on a short-term

basis in response to any temporary pollution incidents. Blue flag designation is an international award given to beaches which meet stringent criteria on having excellent water quality and other facilities such as the provision of environmental information, lifeguards, toilets, and other facilities.

Achieving compliance with the Bathing Water Directive has driven some £2.5bn of investment by UK water companies since the early 1990s to reduce the impact of sewerage systems and treated wastewater discharges. Measures have included storage and surface water management to reduce storm overflow spills, moving or extending effluent outfalls and improving wastewater treatment, including ultra-violet (UV) treatment of final effluent.

By law under the Bathing Water Regulations 2013, the local council must display clear information at Bathing Waters about water quality and sources of pollution throughout the Bathing Season, as well as information on any temporary pollution incidents and how long these are expected to last. If Bathing Water is classed as poor the local council is required to put up an "advice against bathing" symbol, though this does not mean the site is closed to the public.

In contrast to some other European nations, the UK has not previously designated stretches of river as bathing waters, however the first freshwater river bathing water was designated on the River Wharf in North Yorkshire in 2021, and across England there are numerous campaigns by NGOs and members of the public to designate other stretches of river. It is anticipated that this could lead to a significant expansion of the number of inland bathing waters.

3.8.4 The Water Framework Regulations

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. Under the WFD the RBMPs, which were originally published in December 2009 were reviewed and updated in December 2015. 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 and when assessing the impact of additional demand on water supply when abstraction of groundwater is having an impact on river baseflow.

3.8.5 Protected Area Objectives

The water framework regulations 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.

Some areas may require special protection under more than one piece of EU-derived legislation 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;
- nutrient-sensitive areas, including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Waste Water Treatment Regulations; and
- 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 EU-derived set of regulations

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; and 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; and 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 Regulations 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.

3.8.6 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 sets out a series of position statements that detail how the Environment Agency delivers government policy on groundwater and protects the resources from contamination (Environment Agency, 2018). 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.

3.8.7 Derived European Legislation and Brexit

Much of the legislation behind the regulation of the water environment derives from the UK enactment of European Union (EU) directives. EU legislation which applied to the UK on 31 December 2020 became part of UK law when the UK left the EU.

In September 2022 the UK government introduced the Retained EU Law (Revocation and Reform) Bill. As currently drafted, this bill will result in all retained EU laws (REUL) being either repealed or assimilated into UK law by the end of 2023 and will repeal the principal of the supremacy of EU law. It will also give ministers powers to revoke, restate, replace or update REUL (UK Government g, 2022). A dashboard created to list REUL has identified 570 pieces of legislation which fall under the remit of Defra (UK Government h, 2021).

This bill has the potential to introduce very substantial change to the regulation of water and the environment from the start of 2024. If this does occur, it may be necessary to review parts of this Water Cycle Study.

3.9 UK Environmental Policy

3.9.1 Environment Act 2021

The Environment Act (UK Government i, 2021) came into UK law in November 2021 with the aim of protecting and enhancing the environment. The Act has objectives to improve air and water quality, biodiversity, waste reduction and resource efficiency. The implementation of the policies within the Environment Act has begun and legally binding environmental targets are being developed. This will be enforced by the newly created Office for Environmental Protection (OEP, more information available here.

The Environment Act (Part 5) contains policies concerning improvements to the water environment. These policies have the following aims:

- Effective collaboration between water companies through statutory water management plans.
- Minimise damage water abstraction may cause on environment.
- Modernise the process for modifying water and sewerage company licence conditions.

Further to this, there is specific legislation regarding storm overflows aiming to reduce the discharge of untreated sewage into waterways. This plan includes requirements for water companies to:

- report on the discharges from storm overflows;
- monitor the quality of water potentially affected by discharges;
- progressively reduce the harm caused by storm overflows; and
- report on elimination of discharges from storm overflows.

3.9.2 25-year Environment Plan

The Environmental Improvement Plan (EIP) is the first revision of the 25-year environment plan (25YEP) published in 2023. It contains ten goals which are shown in Figure 3-1. The full text of the EIP can be found here. Government must review and revise the plan, if needed, every five years to ensure continued progress against the ten 25YEP goals.

Of particular importance to a WCS is Goal 3 - Clean and plentiful water.

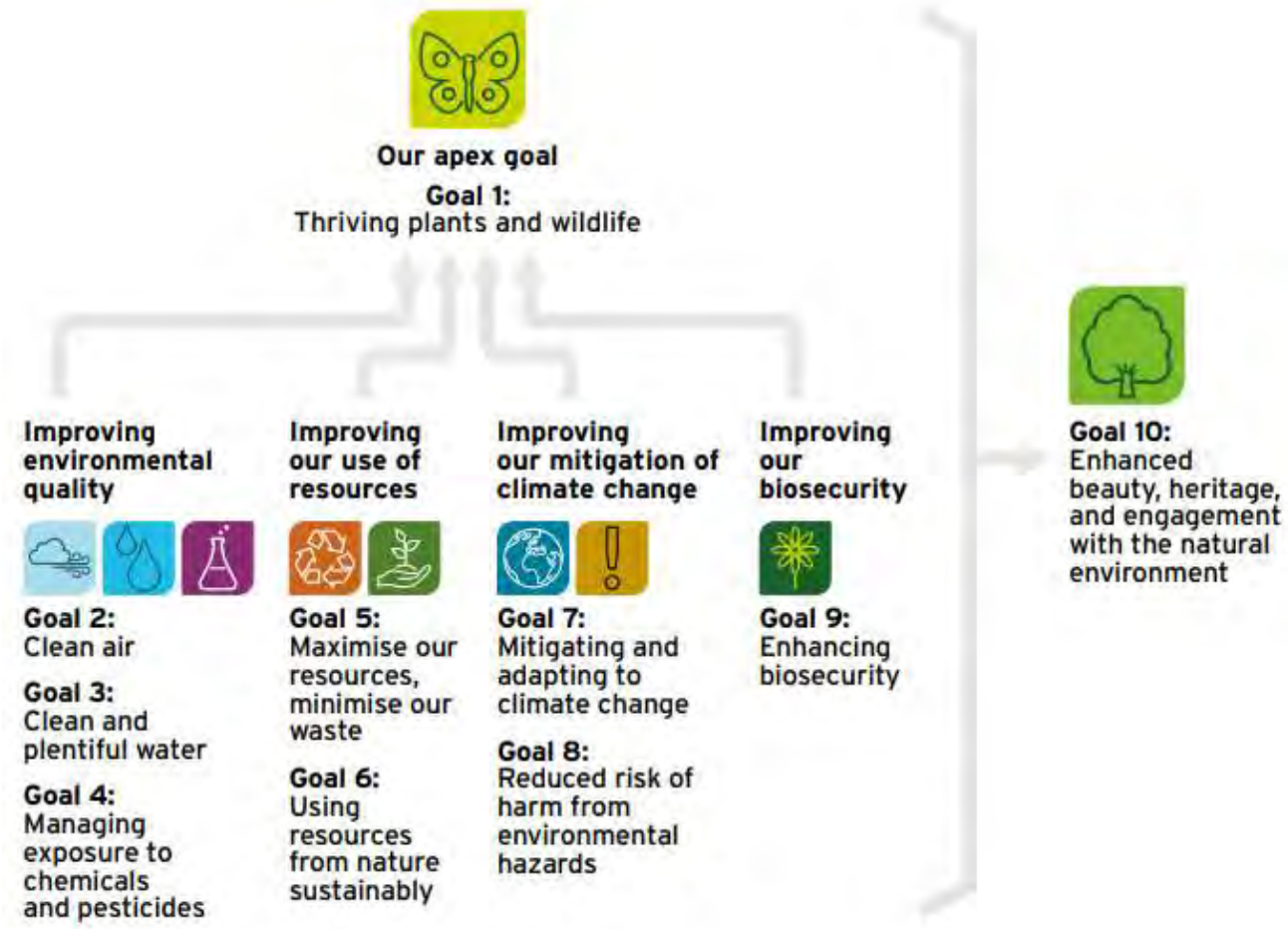


Figure 3-1 The 10 Environmental Improvement Plan goals

Under Goal 3 - Clean and plentiful water, there are eight sets of targets and commitments relating to different aspects of the water environment:

- Reduce nitrogen, phosphorus, and sediment pollution from agriculture into the water environment by at least 40% by 2038, compared to a 2018 baseline, with an interim target of 10% by 31 January 2028, and 15% in catchment containing protected sites in unfavourable condition due to nutrient pollution by 2028.
- Reduce phosphorus loadings from treated wastewater by 50% by 2028 and 80% by 2038 against a 2020 baseline.
- Halve the length of rivers polluted by harmful metals from abandoned mines by 2038, against a baseline of around 1,500km (approximately 930 miles.
- Reduce the use of public water supply in England per head of population by 20% from the 2019-20 baseline, 2038, with interim targets of 9% by 2027 and 14% by 2032, and to reduce leakage by 20% 2027 and 30% by 2032.
- Restore 75% of our water bodies to good ecological status.

- Require water companies to have eliminated all adverse ecological impact from sewage discharges at all sensitive sites by 2035, and at all overflows by 2050.
- Target a level of resilience to drought so that emergency measures are needed only once in 500-years.

To deliver these goals, the EIP outlines action across these areas:

- Improving wastewater infrastructure and water company environmental performance.
- Reducing pressures on the water environment from agriculture.
- Enabling the sustainable use of water for people, business, and the environment
- Tackling pressures from chemicals and pollutants.
- Restoring natural function and iconic water landscapes.
- Joined-up management of the water system.

Progress towards delivering the EIP will be monitored annually.

3.9.3 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.
- 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.

3.9.4 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." (UK Government j, 1981).

The Government's 25-year Environment Plan 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. The full 'A Green Future' report can be found here.

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).

3.9.5 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.

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." (UK Government k, 2006).

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."

3.10 Water Industry Policy

3.10.1 The Water Industry in England

Water and sewerage services in England and Wales are provided by eleven Water and Sewerage Companies (WaSCs) and six '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; and
- enabling developers to make connections to water and sewerage systems.

3.10.2 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;
- The Environment Agency - environmental regulation; and
- The 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 Business Plans, with a set of objectives, to ensure what are effectively supply monopolies, are operating efficiently. The industry is currently in Asset Management Plan 7 (AMP7) which runs from 2020 to 2025 and have submitted their draft Business Plans for 2025 to 2030 (AMP8).

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.

3.10.3 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 set out how the industry intends to approach these goals, with the objective of the water companies, at the time, having published their plans by the end of 2022, in order to inform their business plans for the 2024 Price Review. More information can be found here.

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 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.

DCWW released their draft DWMPs in 2022 and outlines plans and proposals they will undertake to 2050 including upgrades to treatment works, prevention of sewer

spills, and protection of properties at risk of flooding. The management plan can be found here.

STW released their final DWMP in 2023, outlining plans and proposals they will undertake to 2050. The management plan can be found here.

3.10.4 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.

3.10.5 Changes for New Connections

OfWAT, the water industry's economic regulator, published revised rules covering how water and wastewater companies may charge customers for new connections (OfWAT, 2020). These rules have applied to all companies in England since April 2018. STW and DCWW publish their charging arrangements annually (STW, 2023; DCWW, New water connections, 2023) . 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 paid 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.

3.10.6 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 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, except for 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

The aim of the water resources assessment is to ensure that sufficient water is available in the region to serve the proposed level of growth, and that it can be abstracted without a detrimental impact on the environment, both during the plan period and into the future. The report characterises the study area, identifying the key surface water and groundwater bodies, and local geology. It highlights the pressures on water resources in the region, identifies existing constraints on abstraction and provides evidence for adopting tighter water efficiency targets.

4.1.1 Surface Water

Tributaries of the River Lugg, Wye and Frome run throughout the Herefordshire study area. The River Wye runs into the study area from the west, flowing down to the south-east. The River Lugg flows south, south-east from the north-west of the study area, and the River Frome runs south-westerly into the study area. The River Clun and River Teme are to the north of the study area (see Figure 4-1 & Figure 4-2).

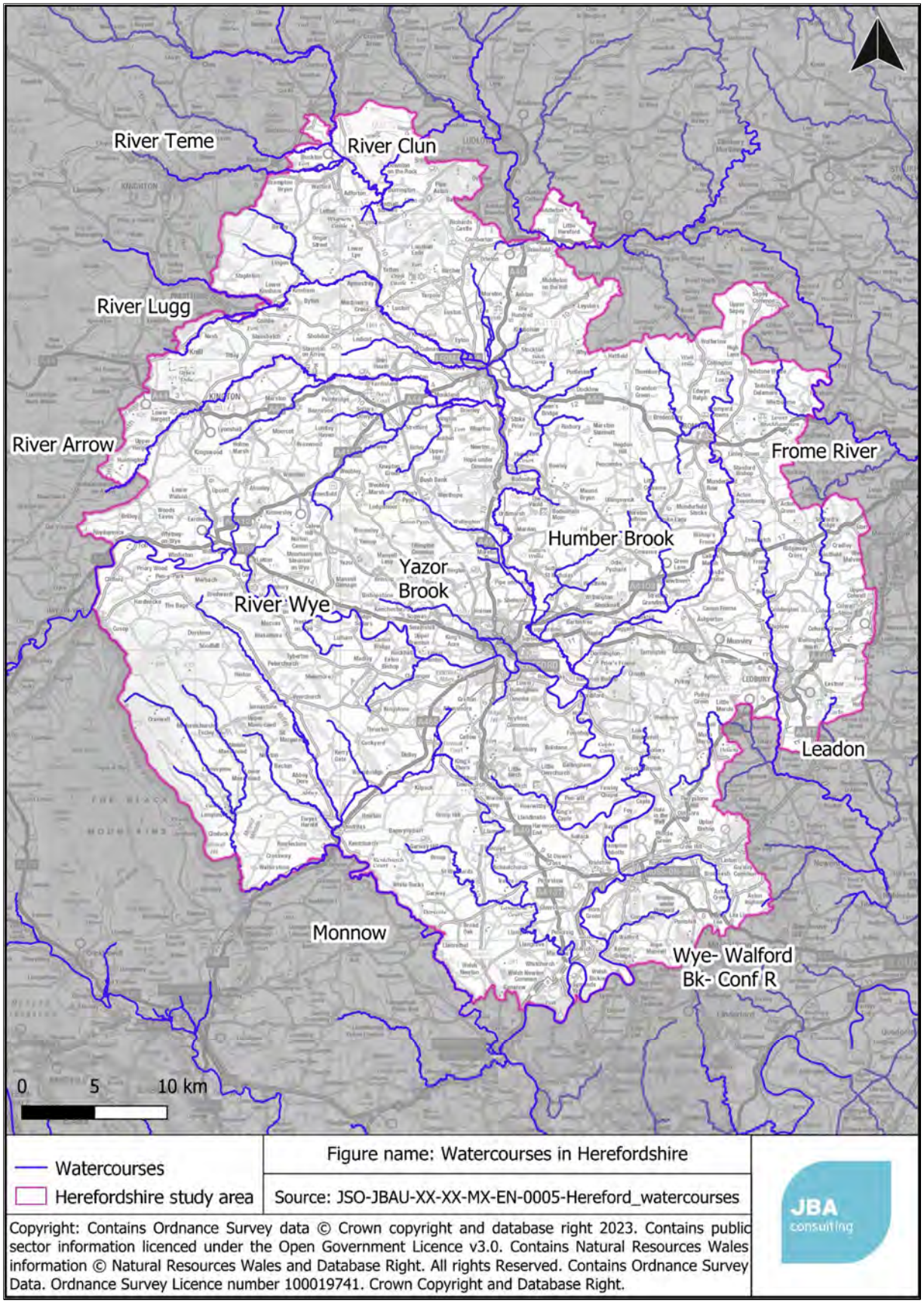

River Teme
River Clun
River Lugg
River Arrow
Frome River
Humber Brook
Yazor Brook
River Wye
Leadon
Monnow
Wye- Walford Bk- Conf R
0 5 10 km
Watercourses
Herefordshire study area
Figure name: Watercourses in Herefordshire
Source: JSO-JBAU-XX-XX-MX-EN-0005-Hereford_watercourses
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Figure 4-1 Watercourses in Herefordshire

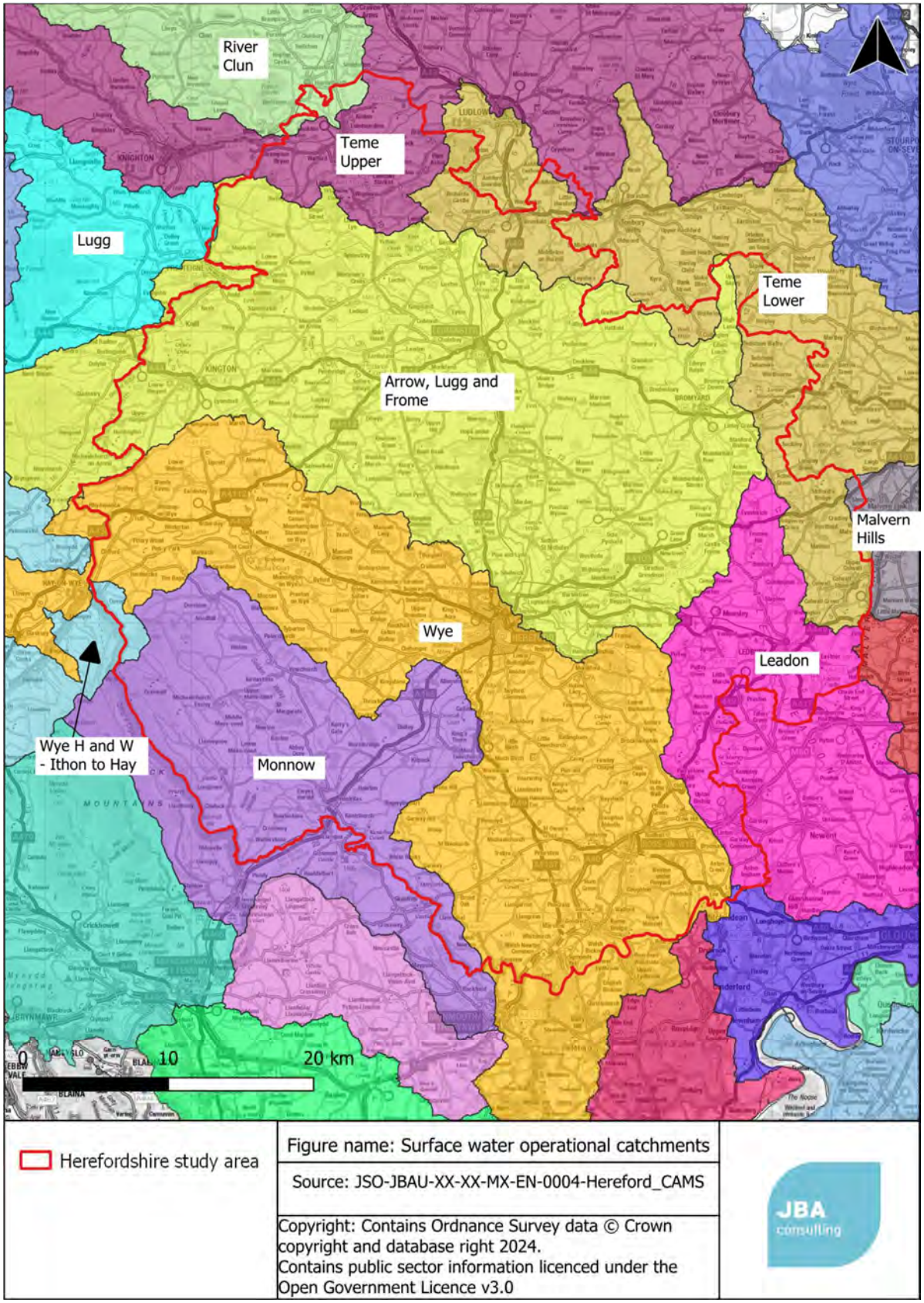

Figure 4-2 Surface water operational catchments within Herefordshire.

4.1.2 Geology

The geology of a catchment can be an important influencing factor in the way that water runs off the ground surface. This is primarily due to variation in the permeability of the surface material and bedrock stratigraphy. Figure 4-3 shows the bedrock geology of the Herefordshire study area which has two main bands: mudstone, siltstone, and sandstone and, sandstone and conglomerate, interbedded. There are pockets of limestone, mudstone, and calcareous mudstone to the north and east of the study area. Figure 4-4 shows superficial (at surface) geology, there is predominantly glacial sand and gravel, with alluvium beneath the major surface watercourses and some till.

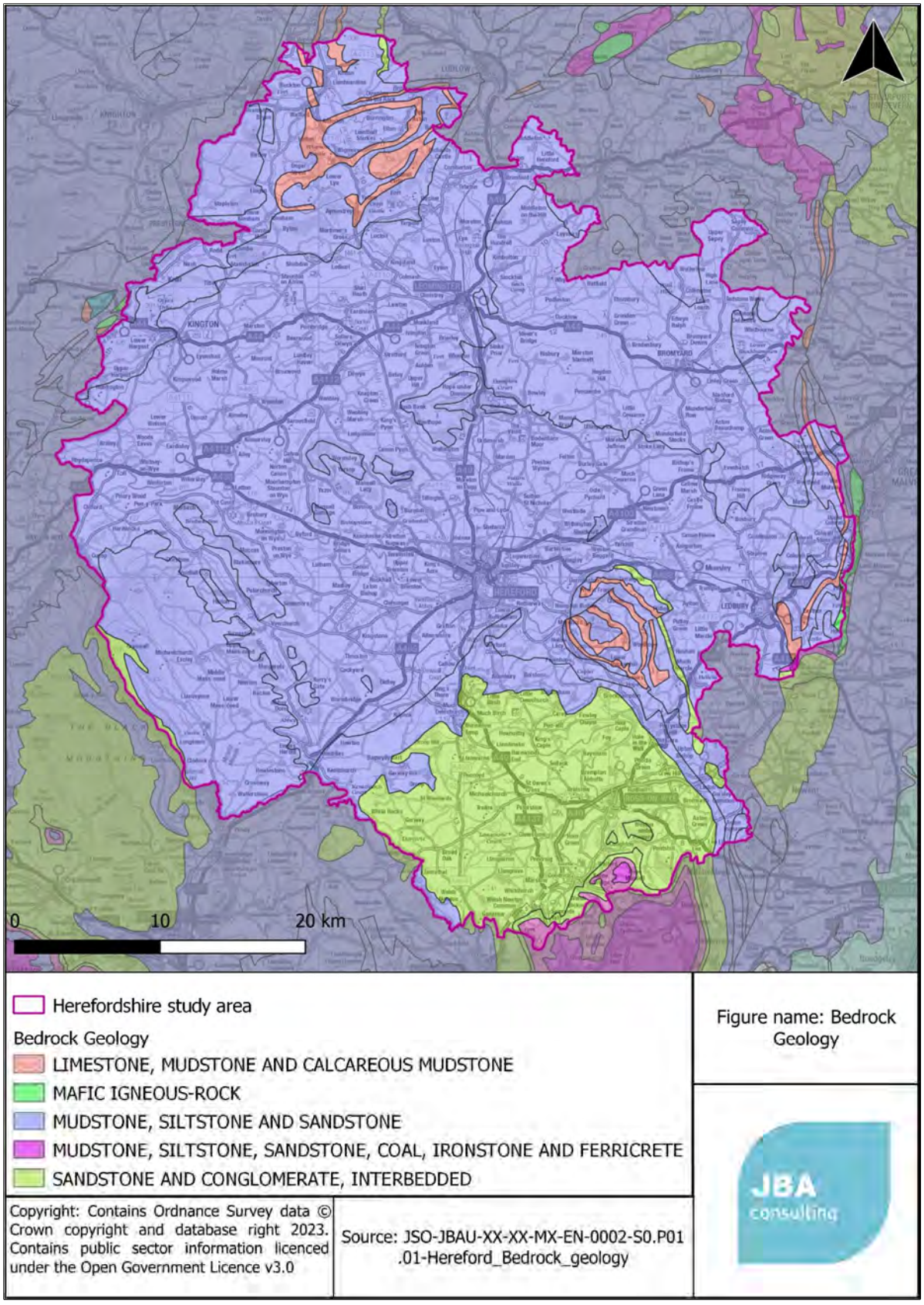

Figure 4-3 Bedrock geology of Herefordshire

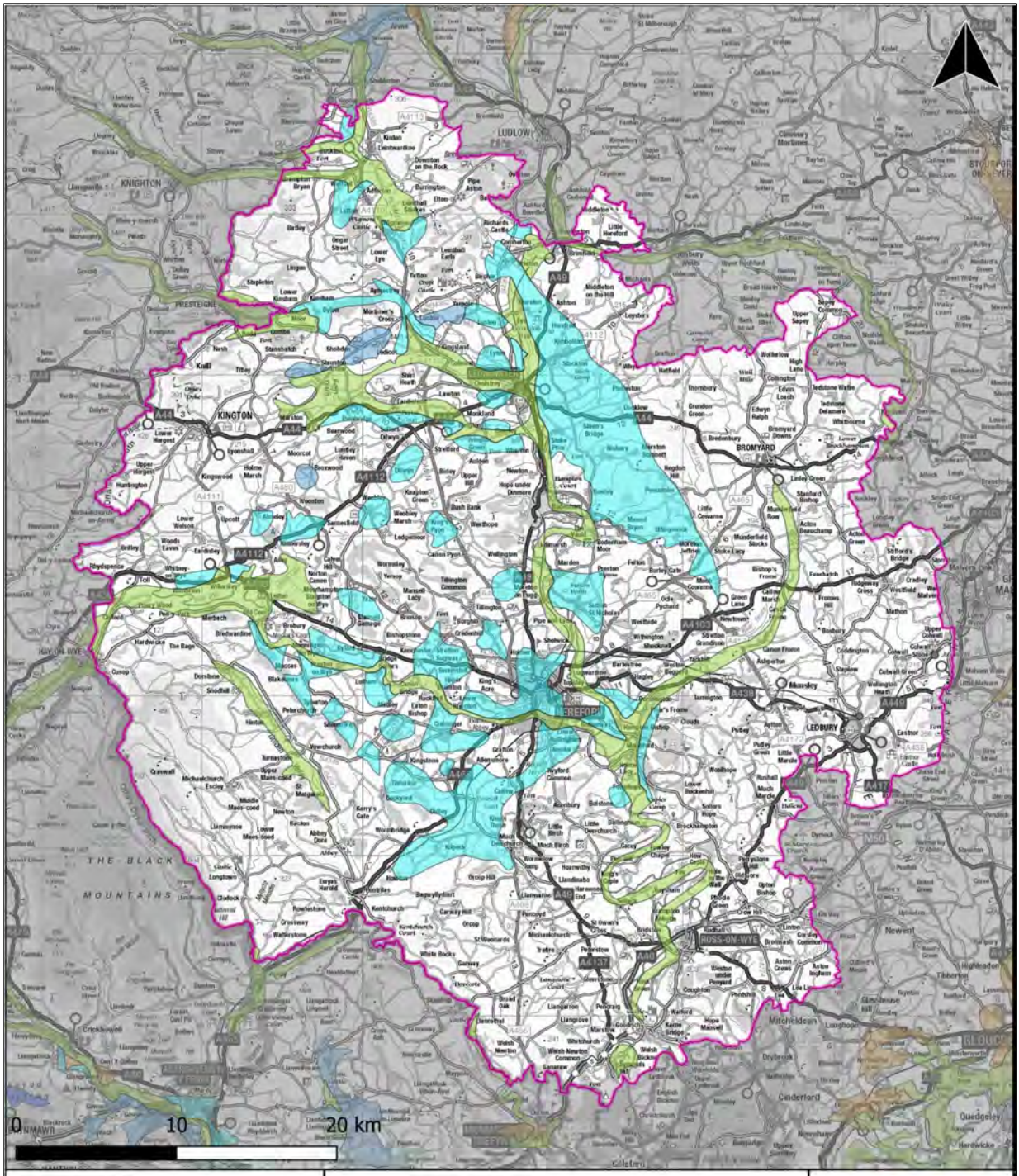

Figure 4-4 Superficial geology of Herefordshire

4.1.3 Availability of Water Resources

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 licences, 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 licence 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 (UK Government I, 2014). An abstraction licence is needed from Natural Resources Wales or the Environment agency if abstraction above 20m3/ day (4,400 gallons) a day from:

- rivers or streams
- reservoirs, lake or pond
- canal
- spring or
- an underground source

The licence is granted depending on the amount of water available.

The Herefordshire study is mainly in the Wye catchment with parts of the north in the Teme catchment and some of the east in the Severn Vale catchment, see Figure 4-5.

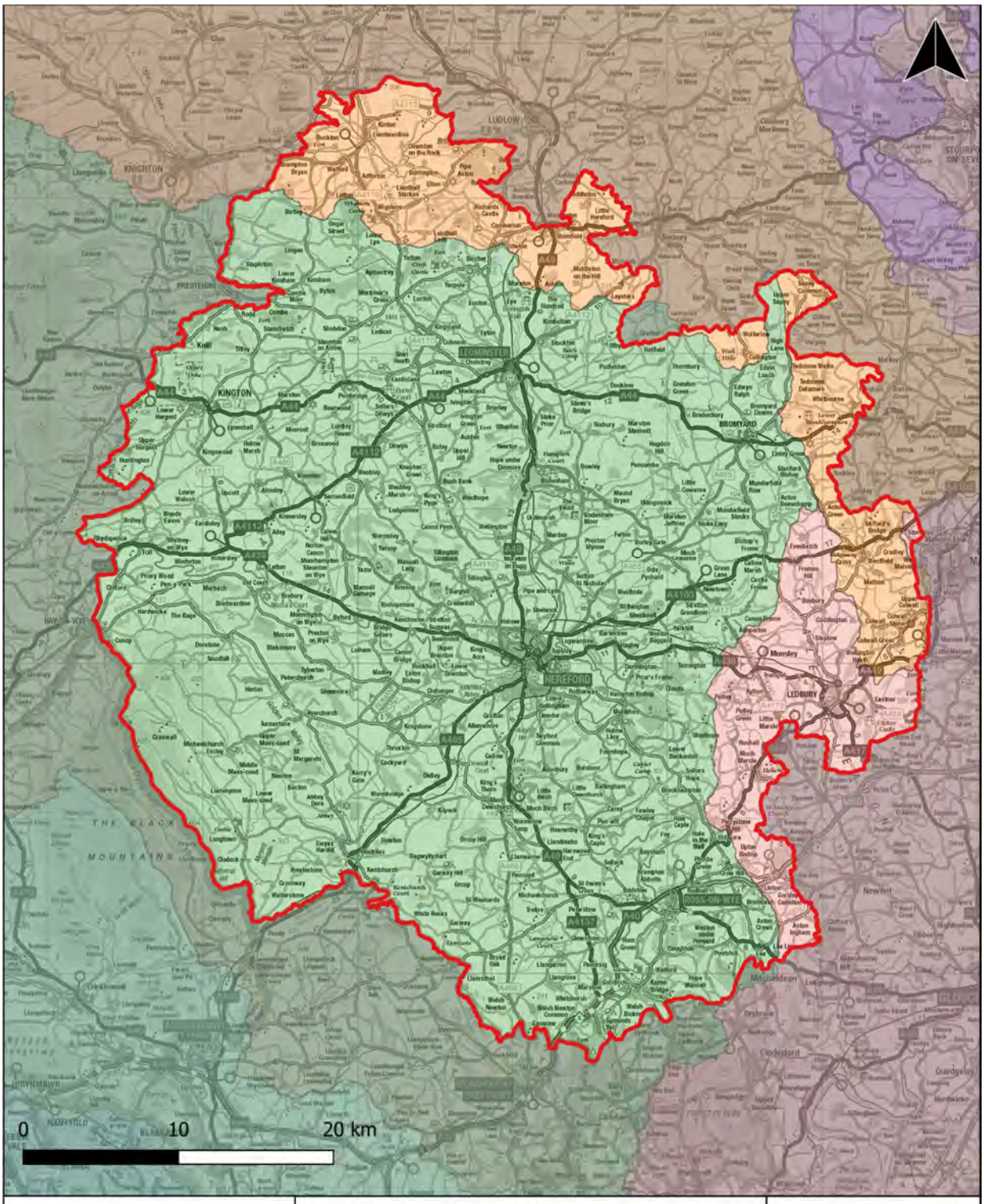
0
10
20 km
CAMS Boundaries
Severn Vale
Teme
Wye
Herefordshire study area
Figure name: CAMS Boundaries
Source: JSO-JBAU-XX-XX-MX-EN-0004-Hereford_CAMS
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Figure 4-5 CAMS boundaries

4.2 Resource Availability Assessment

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; and
- areas where abstraction may need to be reduced.

The availability of water for abstraction is determined by the relationship between the fully licenced (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 considered.

4.2.1 Wye Abstraction Licence Strategy (ALS)

The Wye catchment covers 4,171 km^2 covering areas in both England and Wales. Surface water is the main source of abstraction within the Wye catchment. Public water supply and agricultural business are the main pressures on water resources.

The River Wye catchment has several protected sites within Wales that may be impacted by water and wastewater services provided within Herefordshire. These include the Elenydd- Mallaen SPA, and 126 SSSIs, of which the Black Mountains, River Lugg and Stanners Rock SSSIs fall on the boundary of Herefordshire.

Within the catchment, there are 449 licence abstractions with 140 licences with HOF restrictions at 10 gauging stations. In drier years there is a likelihood that HOFs are used more to help preserve water resources. Resource availability is calculated at four different flows Q95 (lowest), Q70, Q50 and Q30 (highest) at points along the river called Assessment Points (APs).

At Q95 most catchment areas have water availability restricted for new abstractions. At Elan upstream (u/s) of Wye water is not available for new abstraction at all flow levels, mainly because the flow is dependent on reservoir release.

Resource reliability is a subject that is mentioned, with the ALS stating that abstraction will not be available for a large proportion of the year (from late spring to early autumn). This is because of low flow of the River Wye which triggers abstraction constraints.

APs are assessed on a case-by-case basis. When there are non-consumptive licences, where the abstracted water is returned close to the point of abstraction, there is no need to protect flows at a wider catchment level.

Within 2050 climate change projections low flows are predicted to be 65% lower but peak river flows to be higher than 40% (Environment Agency f, 2015).

4.2.2 Teme Abstraction Licence Strategy (ALS)

The Teme catchment covers an area of 1650 km^2 and includes tributaries of the Clun, Onny, Corve and the Rea. There are several SSSIs and SACs which may affect water availability. The main demand for water comes from public demand and

agriculture with little industrial use. The Teme catchment is relied upon for Hydroelectric Power Schemes and irrigation for agriculture.

23% of licences in Teme are time limited and have a common end date (CED). CEDs occur every 12 years, the next being in March 2025 (Environment Agency g, 2013). Across the Teme catchment, consumptive abstraction is available at least 70% of the time. Abstraction licences are still sometimes given in areas of low flow, and when the flow drops below a certain point a HOF constraint is put in place.

At Q30, Q50 and Q70 water is available for abstraction, but at Q95 there is limited water availability.

4.2.3 Severn Vale Abstraction Licence Strategy (ALS)

The Severn Vale catchment covers around 1,000 km^2, 94% of groundwater abstraction is from the Newent Permo-Triassic Sandstone is solely for public water supply, and the other 6% is from private or other abstractors. One of the Groundwater Management Units (GWMUs) is not available for abstraction, and the other three have restricted water availability.

Severn Vale will likely be impacted by climate change. In 2050 low flows are expected to be 65% lower but peak river flows are thought to be 30% higher.

The area of the Severn Vale catchment that covers the study area includes:

- AP3 at Glynch Brook at Bromsberrow gauging station
- AP 4 at Ell Brook
- AP 5 at River Leadon at Wedderburn Bridge gauging station
- AP6 at Red Brook

At Q30 and Q50 water is available for abstraction at AP4, AP5 and AP6. At Q70 and Q95 water is not available for abstraction or restricted at all APs in the study area. AP3 has no water available for abstraction at any flow scenario.

4.2.4 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 from achieving 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."

4.2.5 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 may 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 licenced for abstraction;
- whether there is more water available for abstraction in the area; and
- areas where abstraction may need to be reduced.

The availability of water for abstraction is determined by the relationship between the fully licenced (all abstraction licences being used to full capacity) and recent actual flows (amount of water abstracted in the last six 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, which mean abstractions must stop when the river flow or level falls below a particular value. This value is known as the HOF or HOL and ensures there is always a minimum flow in the river. Surface Water Flows can be assessed at Assessment Points (APs) which are significant points on the river, often where two main rivers join or at a gauging station.

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 considered.

Table 4-1 Implications for surface water availability

Water Resource Availability Colour	Implications for licensing
	There is more water than required to meet the needs of the environment. Licences can be considered depending on local/downstream impacts.
RED- 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.

Water resource availability is assessed under four different flow conditions:

- Q95 – very low flows which are exceeded 95% of the time.
- Q70 – low flows which are exceeded 70% of the time.
- Q50 – median flows which are exceeded 50% of the time.
- Q30 – high flows which are exceeded 30% of the time.

The resource availability for the Wye, Teme and Severn ALS is summarised below in Figure 4-6 Water resources available in Herefordshire.

In some catchments this assessment shows that there is limited or no water available for abstraction at Q70 but show that there is water available at Q95. This is likely to be because most abstraction licences are limited using a 'Hands off Flow' or 'Hands off Level', therefore within the catchment less water is being abstracted at very low flows and there is, consequently, water available.

This may not be the case across all catchments and, particularly in heavily modified catchments, there may be other artificial influences impacting on catchment flows. For example, if there are many discharges within the catchment or the flow is artificially augmented then this would artificially elevate flow particularly at lower flows. In some cases, the EA doesn't include this water in the amount available for licensing because it isn't guaranteed, but flow can potentially be more available.

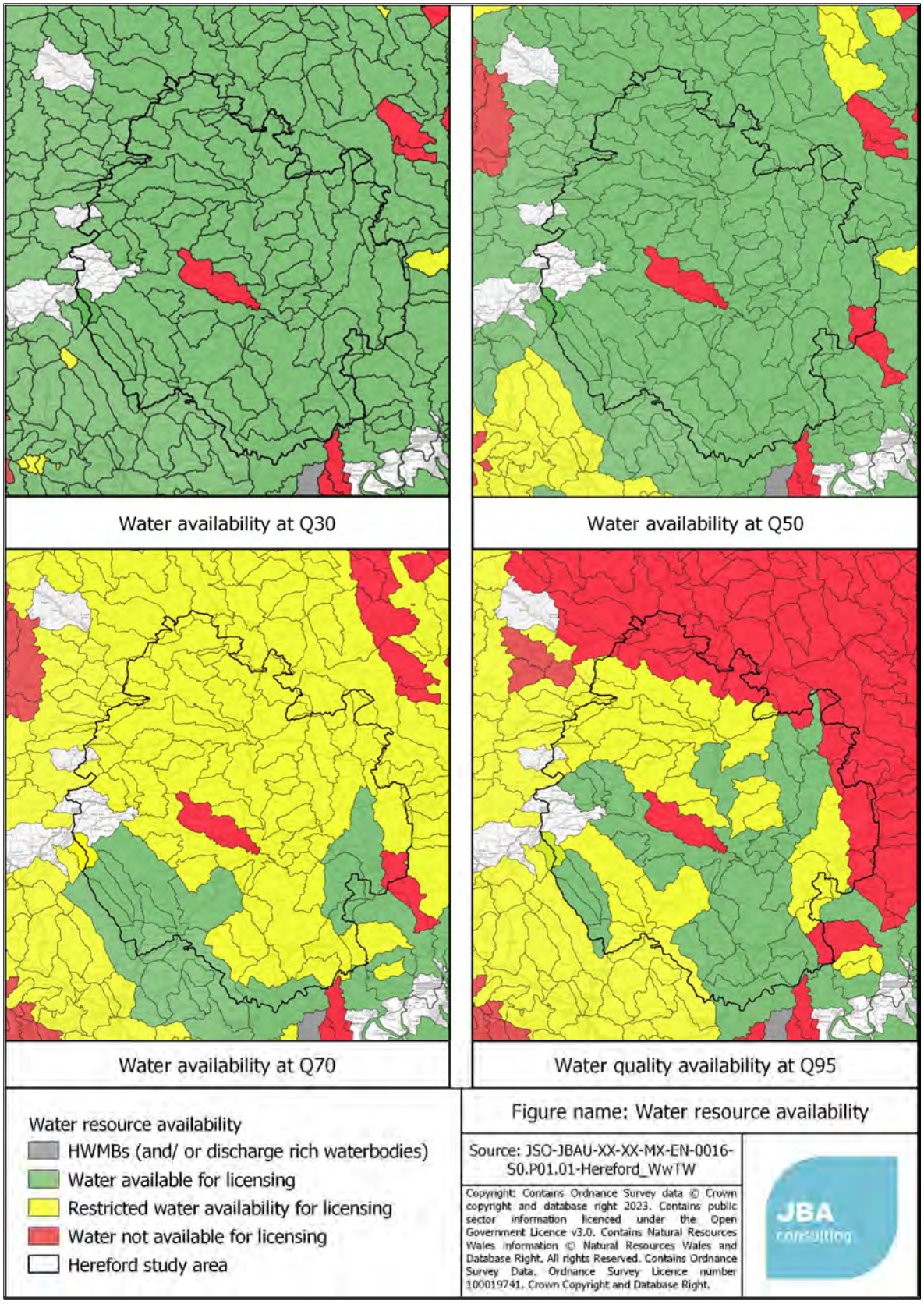


Figure 4-6 Water resources available in Herefordshire, sub-basins with no colouring did not have data available in the catchment abstraction management strategy

shapefile used

4.3 Water Resource Assessment: Water Resource Management Plans

4.3.1 Introduction

When new development within an LPA 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.

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 Dŵr Cymru (Welsh Water), and secondly by providing the water companies with growth scenarios for each settlement allowing them to assess each settlement and the housing yields proposed.

Herefordshire's Water Resource Zones (WRZs) are shown in Figure 4-7.

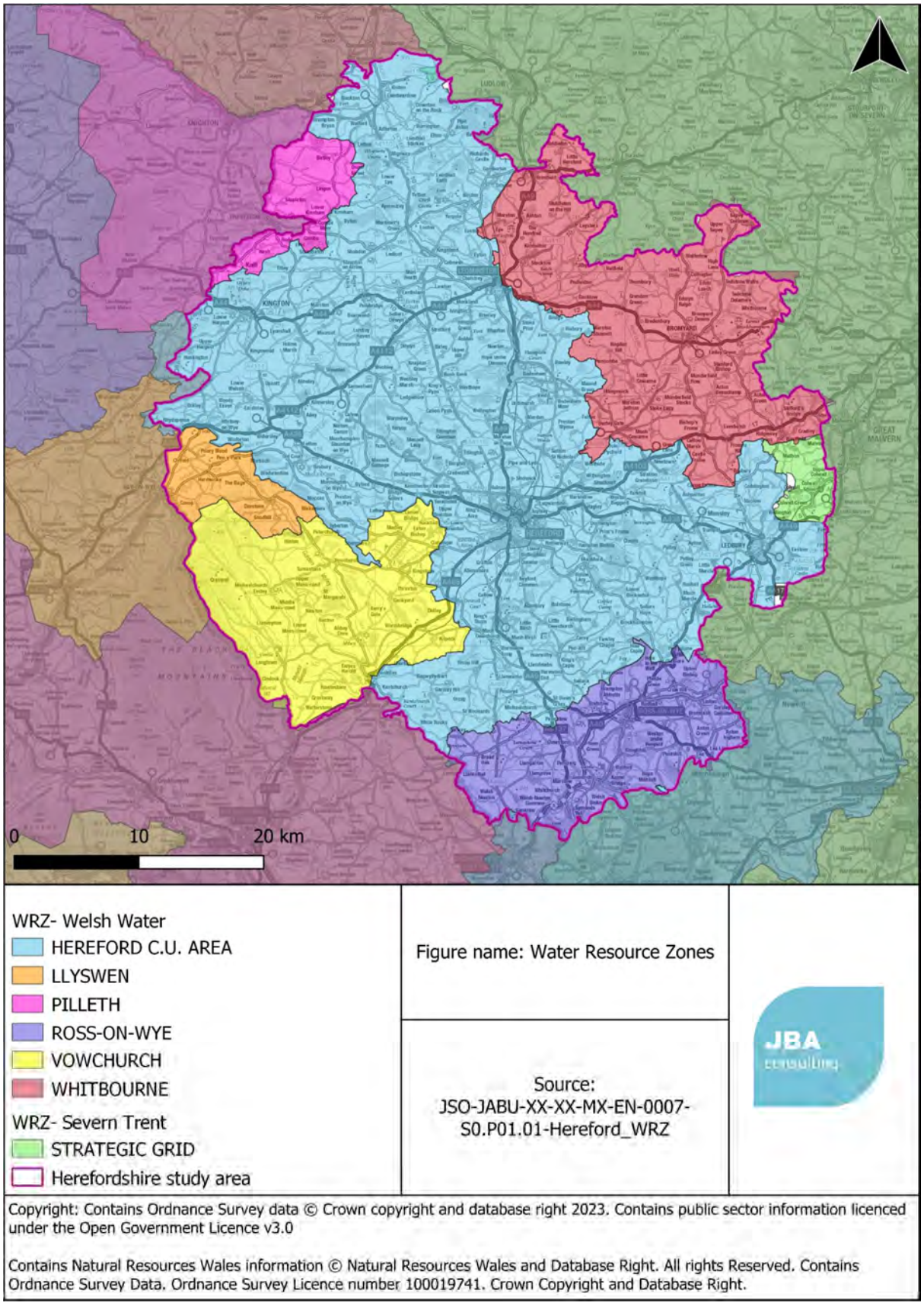


Figure 4-7 Herefordshire's WRZs

4.3.2 Methodology

The spatial boundaries for each water company's water resource zones were used to overlay the local authority boundaries. Severn Trent and Dŵr Cymru (Welsh Water) Water Resources Management Plans were reviewed. 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.

4.3.3 STW WRMP

Severn Trent's water comes from 40% reservoirs, 32% rivers and 28% groundwater. Challenges identified in the WRMP are:

- growing population
- leakages
- sustainable abstraction
- delivering the best value to customers

The draft for the Severn Trent 2024 WRMP was published in 2022 (Severn Trent, 2022).

In STW's 2024 draft, a focus on leak reduction, population, value for customers and climate change. This includes having home efficiency checks, school pop up sessions and a target of 110 l/p/d by 2050. Water transfers were also mentioned in the 2024 draft which was not mentioned in the 2019 WRMP. By transferring water between WRZs that need water it can help reduce pressure on reservoirs and abstraction sites.

The Strategic Grid Zone WRZ that covers part of the study area supplies most of Severn Trent's customers. Severn Trent's baseline supply and demand projections show Strategic Grid Zone WRZ is predicted to be in a deficit from 2029 to the end of the projections in 2085.

From AMP8 (2025-2030) expansion of multiple WTWs are planned, with an aim to save between 5- 15 million litres per day. An increase in outputs is also mentioned with an aim of saving 4-5 million litres per day. By working towards leakage reduction and water efficiency it is hoped that this will aid in reducing demand for future growth in STWs supply zone.

STW have presented several Strategic Resource Options (SROs) to increase water availability for abstraction. The SROs are presented in Table 4-2 Strategic Resource Options for STW

Table 4-2 Strategic Resource Options for STW

Strategic Resource Option (SRO)	Details
Severn to Thames Transfer	This proposes a water transfer between STW and Thames Water. It would also include United Utilities due to the need to move water from Wales, the North West, and other areas in the Midlands into the STW region.
Minworth	Minworth is a raw water source that will support either the Severn to Thames Transfer SRO or the Grand Union Canal SRO (Severn Trent Water b, 2023).
Upper Derwent Valley Reservoir Expansion	This reservoir expansion is working with Yorkshire Water to expand STWs current reservoir capacity (Severn Trent Water a, 2023).
The Grand Union Canal	STW are working with Affinity Water and the Canal and Rivers Trust to look at the possibilities of transferring water using the existing canal infrastructure to transport treated water from Minworth in the Midlands to Affinity Water in Hertfordshire and North West London (Severn Trent Water c, 2023).
Severn Trent Sources	This option aims to increase sources of raw water and will support the Severn to Thames Transfer SRO.

4.3.4 DCWW WRMP

In Dŵr Cymru's (Welsh Waters) 2019 WRMP Vowchurch, Whitbourne and Pilleth had no minimal surplus in AMP7 and similar figures up until 2050. In the 2024 draft WRMP, water transfers between these areas are discussed as well as between Hereford CUS WRZ and Llyswen which are also in the study area. External transfers are also discussed between Dŵr Cymru (Welsh Water) and Severn Trent Water.

Dŵr Cymru's (Welsh Water) largest bulk export as of the 2019 WRMP was to STW to supply Birmingham. In 2019 there was a focus on metering and leakage reduction, this is continued in the dWRMP24 report.

Within the dWRMP24, Vowchurch, Pilleth, Whitbourne and Hereford are said to have a surplus of water until 2050 although Vowchurch has been identified as a deficit zone. The main pressure to Vowchurch is that the aquifer that supports it is not resilient to extreme drought events. This is remedied by internal water transfers from

Hereford CUS WRZ. Diversifying water resources from transfers and focussing on leakage reduction and water efficiency, the increase in supply and demand can be managed for the increase in population.

4.3.5 DCWW Water Resource and Supply RAG assessment results

DCWW commented in summary and to provide context that: 'We have some significant strategic water supply issues in Herefordshire as a whole (we have previously liaised and communicated with the LPA and are in regular dialogue with them on the matter).'

DCWW have classified all additional employment water demand as amber for water resources, due to their WRMP taking into account only residential growth. Amber is defined as 'Insufficient evidence in adopted WRMP to confirm that the planned increase in demand can be met'. They have classed all residential allocation and alternatives as green, as there is sufficient capacity for these within the WRMP planning.

4.3.6 Water Resource West (WRW) emerging regional plan

Herefordshire is within the Water Resources West (WRW) regional water resources planning group. WRW have published their Emerging Regional Plan for the West of England which covers 2025-2085 (Water Resources West a, 2022). WRW relies on several major rivers such as the Severn, Dee, Trent, and Wye to supply 18 million people as well as agriculture and businesses. WRW aim for a 50% reduction of leakage by 2050 and deliver net environmental and biodiversity gain.

Figure 4-8 has been taken from the WRW website to illustrate the future demand for water within the area.

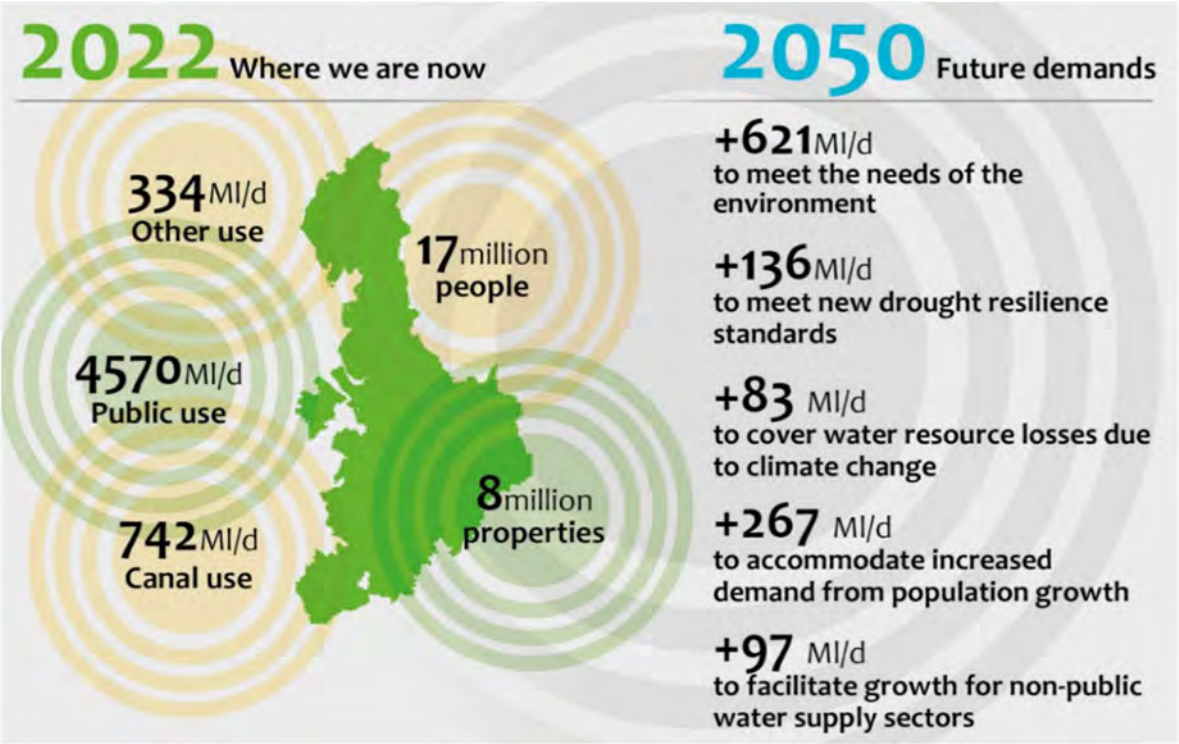


Figure 4-8 Future demands within the Water Resources West demand zone (Water Resource West b, 2022).

The report outlines their needs for the future, and a recent report published in April 2023 (Water Resources West c, 2023) further lay out their plans for managing drivers for change within the report. These drivers are:

- Growth and an increased need in services
- Climate change
- Environmental needs such as low flow and water quality (including drinking water quality).
- Flood (high flows)

Proposed actions are laid out within the report.

Within the emerging regional plan some of the biggest non-public uses in the area are chemicals, agriculture, and power. Issues such as over abstraction, pollution, and degradation of habitats make it difficult for some watercourses in the area to achieve 'good ecological status' under the WFD. WFD status is further spoken about in Section 10.4.1.

As it currently stands at the time of writing, the draft best value plan is:

- Reduce daily water demand, including the implementation of water labelling to help raise consumers awareness of how much water they are using. Water labelling is where a label is put on certain products such as washing machines and dishwashers saying how much water is used per use.

- Diversification water supply options to offset abstraction reduction.
- Developing new water resources to support water transfers.
- Upgrading networks in South-East Wales.
- Improving water quality and the natural environment.

Factors that will increase pressure on the water supply and demand to 2050 in the WRW region are:

- Climate change
- Drought resilience
- Environmental needs
- Demand growth

The area that WRW covers experiences extensive drought and severe drought. This creates more pressure on water resources. Baseline forecasts for the Strategic Grid WRZ show that in a 1 in 500-year drought scenario there will be a large deficit. All other WRZs under DCWW have a low risk of having a deficit in a 1 in a 500-year drought (Water Resources West d, 2021). WRW have a goal of 110 l/p/h/d by 2050 and a leakage reduction of 50% to try to manage the lack of water resources in the future. Drought measures, new supply and transfers between regions are also goals to help increase water resource availability in the future.

4.4 Summary

The study area has five major rivers:

- River Lugg
- River Wye
- River Frome
- River Clun
- River Teme

All three ALS areas have different levels of water abstraction restrictions at different flow rates. An overall theme is that in the future low flows could be detrimental to water supply for the growing population in each supply zone. Diversifying water resources and focussing on water efficiency is recommended for both water companies. The upgrading of WwTW and reducing leakage to withstand the growth in demand is also a positive way to increase water resources.

Within the WRMPs there are common themes of water efficiency in homes and water transfers to reduce pressure on the area's reservoirs.

The WRW draft regional plan mirrors points from the ALSs and the WRMPs. Leakage and water efficiency are common themes throughout all reports mentioned above. The WRW draft report mentions water reuse which neither of the WRMPs did. Water reuse could help the region manage the anticipated lack of water resources.

The WRW plan is currently in draft form, undergoing further work on defining the Environmental Destination (a long-term plan to address known and probable environmental issues related to abstraction), and further engagement with non-public water supply abstractors.

DCWW commented that there are significant strategic water resource issues across Herefordshire and are in regular contact with the LPA about this. They have said they could supply all the residential allocations and reasonable alternatives shown to them, however there is uncertainty surrounding the employment sites, as this category is not included in their resource planning.

Both DCWW and STW have set out adaptive pathways in their plans, enabling the plans to adapt to changes in external pressures (e.g. more severe impacts of climate change or higher population growth), or to failures to meet internal targets for example on household consumption and leakage. OfWAT and the Environment Agency are tasked with regulating the industry to meet the targets that they have committed to in the WRMPs and business plans.

4.5 Water efficiency and water reuse

4.5.1 Introduction

It is widely recognised that the climate is changing and in response, Herefordshire declared a climate and ecological emergency in March 2019, and reaffirmed in 2023. 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 several 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.

4.5.2 Water neutrality

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 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”.

(Environment Agency b, 2009).

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).

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 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 several ways to increase water efficiency, such as:

- 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.

Several of the options listed above are the responsibility of water companies and business and residential building owners. Suggestions for water-efficiency measures are listed below.

Measure	Examples
Education and promotional campaigns	Encourage community establishments (e.g., schools, hospitals) to carry out self-audits on their water use. Deliver water conservation message to schools and provide visual material for schools. Building awareness with homeowners/tenants
Water-efficient measures for toilets	Cistern displacement devices to reduce volume of water in cistern. Retro-fit or replacement dual flush devices

	Retro-fit interruptible flush devices Replacement low-flush toilets
Water-efficient measures for taps	Tap inserts, such as aerators. Low flow restrictors Push taps Infrared taps
Water-efficient measures for showers and baths	Low-flow shower heads Aerated shower heads Low-flow restrictors Shower timers Reduced volume baths (e.g., 60 litres) Bath measures
Rainwater harvesting and water reuse	Large-scale rainwater harvesting Small-scale rainwater harvesting for example with a water butt, or rainwater tank for toilet flushing. Grey water recycling
Water-efficient measures addressing outdoor use	Hosepipe flow restrictors Hosepipe siphons Hose guns (trigger hoses) Drip and condensation irrigation systems Mulches and composting
Commercial properties	Commercial water audits Rainwater recycling Grey water recycling Optimising processes Provide water efficiency information to all newly metered businesses
Metering	Promote water companies' free meter option. Compulsory metering (in water stressed areas) Smart metering (to engage customer with their consumption) Provide interactive websites that allow customers to estimate the savings associated with metering (environmental and financial). Innovative tariffs (seasonal, peak, rising block). Customer supply pipe leakage - supply pope repair and replacement
Other	Household water audits, including DIY or with help of plumber. Seek-and-fix internal leaks and/or dripping taps. Water efficient white goods included washing machines and dishwashers. Ask customers to spot and report leaks

Table 4-3 Consumer water-efficiency measures

Measure	Examples
Education and promotional campaigns	Encourage community establishments (e.g., schools, hospitals) to carry out self-audits on their water use. Deliver water conservation message to schools and provide visual material for schools. Building awareness with homeowners/tenants
Water-efficient measures for toilets	Cistern displacement devices to reduce volume of water in cistern. Retro-fit or replacement dual flush devices Retro-fit interruptible flush devices Replacement low-flush toilets
Water-efficient measures for taps	Tap inserts, such as aerators. Low flow restrictors Push taps Infrared taps
Water-efficient measures for showers and baths	Low-flow shower heads Aerated shower heads Low-flow restrictors Shower timers Reduced volume baths (e.g., 60 litres) Bath measures
Rainwater harvesting and water reuse	Large-scale rainwater harvesting Small-scale rainwater harvesting for example with a water butt, or rainwater tank for toilet flushing. Grey water recycling
Water-efficient measures addressing outdoor use	Hosepipe flow restrictors Hosepipe siphons Hose guns (trigger hoses) Drip and condensation irrigation systems Mulches and composting
Commercial properties	Commercial water audits Rainwater recycling Grey water recycling Optimising processes Provide water efficiency information to all newly metered businesses
Metering	Promote water companies' free meter option. Compulsory metering (in water stressed areas) Smart metering (to engage customer with their consumption) Provide interactive websites that allow customers to estimate the savings associated with metering (environmental and financial).

	Innovative tariffs (seasonal, peak, rising block). Customer supply pipe leakage - supply pope repair and replacement
Other	Household water audits, including DIY or with help of plumber. Seek-and-fix internal leaks and/or dripping taps. Water efficient white goods included washing machines and dishwashers. Ask customers to spot and report leaks

Adapted from: (Booth and Charlesworth, 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.

4.5.3 Rainwater Harvesting 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 Rainwater Harvesting

- 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 3/4 bed detached home).
- Payback periods are long as the cost of water is low so there is little incentive for homeowners to invest. Further information available here.

Greywater Recycling

Greywater refers to water that has been "used" in the home in appliances such as washing machines, showers, and hand basins. Greywater recycling (GwR) is the treatment and re-use of this water in other systems such as for toilet flushing. By their nature, GwR 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 GwR, 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 GwR 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.

4.5.4 River Basin Management Plans

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

- Government and agencies (Environment Agency) grant licences under the Water Resources Act 1991 to regulate how much water is taken from rivers, lakes estuaries and groundwater. The Environment Agency reviews the sustainability of time-limited abstraction licences as they expire, and the licence holders seek replacement licences.
- 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."

4.5.5 National Water Resources Framework

A new National Framework for Water Resources was published by the Government in March 2020. The framework can be found here. 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. However, to achieve an average of 110 l/p/d across the UK, including existing housing, a water efficiency target for new build housing of 110 l/p/d or higher would make this harder to achieve. New build housing should therefore be lower than 110 l/p/d.

4.5.6 Impact on viability

As outlined in section 3.10, 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 because of such water efficiency measures (Waterwise b, 2018). Water efficiency is therefore not only viable but of positive economic benefit to both private homeowners and tenants.

4.5.7 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 analysing the results of a 2019 consultation 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.

4.5.8 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.

4.6 Conclusions

The water providers for the study area are Severn Trent Water and Dŵr Cymru (Welsh Water). In both WRMPs there was a focus on water efficiency and demand management.

It is widely recognised that the climate is changing and in response Herefordshire Council declared a climate emergency in March 2019, reaffirmed in 2023. 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. Poor water quality can also impact the treatment and ability to use water for public supply and industry, as well as wildlife.

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, carbon emissions and chemical usage.

It is important that new development does not result in an unsustainable increase in water abstraction, for example it would be unacceptable to cause an increased deterioration risk in poor status groundwater bodies. This can be done in several 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.

There is sufficient evidence to recommend the optional 110 litres per person per day design standard allowed under Building Regulations. This should be supported by an equivalent non-household water efficiency target. The BREEAM New Construction Standard can be used for this, and it is recommended that non-household development achieves a minimum of 3 credits under the measure “Wat01” which provides a 40% improvement in water consumption compared to the baseline for that type of building.

Water resources are under significant pressure in the UK, and the direction of travel in water resources planning is to reduce per capita consumption in new build development below the optional building regulations standard of 110 l/p/d. Herefordshire Council require 110 l/p/d on all residential development. Currently this approach is not adequately supported in building regulations and the NPPF and policies requiring water efficiency standards less than 100l/p/d may only be supported at Local Plan inspection in exceptional circumstances, such as a direct link between water abstraction and damage to a Special Area of Conservation.

Until this changes, LPAs should encourage developers to go further than building regulations.

Overall, a lack of water resources is a continuing challenge within the study area. Actions such as water reuse, water efficiency measures and water metering can help lower water use and maximise the water resources available.

4.7 Recommendations

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 and WW	Ongoing
Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	HC	Ongoing
Use planning policy to require the optional standard in Building Regulations of 110 l/p/d for new build housing, and where possible achieve a greater target.	HC	In Herefordshire LP
Use planning policy to require new build non-residential development to achieve at least 3 credits in the Wat01 Measure for water in the BREEAM New Construction standard.	HC	In Herefordshire LP
The concept of water neutrality has the potential to provide a benefit in improving resilience to climate change and enabling all waterbodies to be brought up to "Good" status. Explore further with the water companies and the Environment Agency how the Council's planning and climate change policies can encourage this approach. This approach could have particular application in strategic sites and new settlements	HC, STW, DCWW and EA	In LP and Climate Change Action Plan
Larger residential developments (including new settlements), and commercial developments are required to consider incorporating greywater recycling and/or rainwater harvesting into development at the master planning stage in order to reduce water demand.	HC, STW and DCWW	In Herefordshire LP
Water companies should advise	HC, STW and	Part of

Herefordshire Council of any strategic water resource infrastructure developments within the study, where these may require safeguarding of land to prevent other type of development occurring. In addition, consideration of timescales for delivery and the provision of water should be accounted for.	DCWW	Herefordshire LP process
Water companies should use their AMP7/ 8 programme to support further refinement of underlying data sets that support WR policy and objectives in terms of Environmental Destination. This will influence resilience of supply and development of new options (including strategic resource options).	DCWW, STW	During AMP 7/8
Review this section of the WCS following publication of Severn Trent and Dŵr Cymru's (Welsh Waters) draft Water Resource Management Plan for 2024.	HC, STW and DCWW	Stage 2 WCS
Liaise with Water Resources West to explore the long term ability to supply the growth proposed, of DCWW and STW.	JBA	Stage 2 WCS
The Water Industry National Environment Programme (WINEP) data will be considered at stage 2. To assess whether growth could increase abstractions related to meeting environmental WFD goals for water quantity.	JBA	Stage 2 WCS

5 Water Supply Infrastructure

5.1 Introduction

An increase in water demand adds pressure to 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 scoping 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 “piggy back” on planned leakage or metering schemes, to survey and retrofit water efficient fittings into homes (Waterwise, 2009). This is particularly feasible within property owned or managed by the local authorities, such as social housing.

5.2 Methodology

The sites were provided to STW and DCWW who were asked to provide a site-by-site assessment of the impact of the preferred spatial growth option on the water supply network.
Within this section constraint that have been identified by water companies will be presented as well as any issues identified in the water companies DWMP.

5.2.1 Impact of preferred options

Regarding water supply DCWW commented that: 'Hereford, Ledbury and Leominster are fed from Broomy Hill WTW. A full review of the capability and capacity of this WTW is required – this is ongoing.' As such they were unable to classify the sites in

these towns with a RAG score at this time. All sites within Bromyard were scored as amber, they commented that hydraulic modelling would be required to assess whether capacity is sufficient to serve these sites. The one site in Kington was scored green for supply. The sites within Ross-on-Wye were not scored at this stage, however they commented that: 'We have an agreed position within the Ross on Wye WRZ where we can accept a set amount of new connections per annum. A review is ongoing regarding future resilience within the WRZ and may include the need to build in additional storage at Howle Hill Service Reservoir (SRV) within AMP8.' DCWW commented that because the location of the SRV would be outside the Ross-on-Wye settlement boundary, safeguarding the land would not be necessary.

5.3 Summary

There is uncertainty regarding supply capacity which should be explored further in the stage 2 study. This is because the WTW supplying Hereford, Ledbury and Leominster is currently under review by DCWW, and hydraulic modelling for supply to Bromyard has been recommended by them. DCWW have an agreement in place for Ross-on-Wye WRZ with the LPAs for a set number of connections, due to the limited capacity to supply. This WRZ is also being reviewed with the potential for additional storage within AMP8 at Howle Hill SRV.

5.4 Recommendations

Action	Responsibility	Timescale
DCWW and STW undertake network modelling to support the stage 2 WCS. If this is not possible, this should be done where appropriate as part of the planning application process to ensure adequate provision of water supply is feasible.	JBA STW DCWW	Ideally at stage 2, or as part of the planning process
Herefordshire Council and Developers should engage early with STW and DCWW to ensure infrastructure is in place prior to occupation.	HC STW DCWW	Ongoing

6 Wastewater Collection

6.1 Sewerage Undertaker for Herefordshire

Severn Trent and Dŵr Cymru (Welsh Water) are the Sewerage Undertaker (SU) for Herefordshire. The role of 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., 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 storm overflow (often referred to as Combined Sewer Overflows or 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. The WwTW catchments can be seen in Figure 6-1, with only larger ones labelled for visual clarity of the figure.

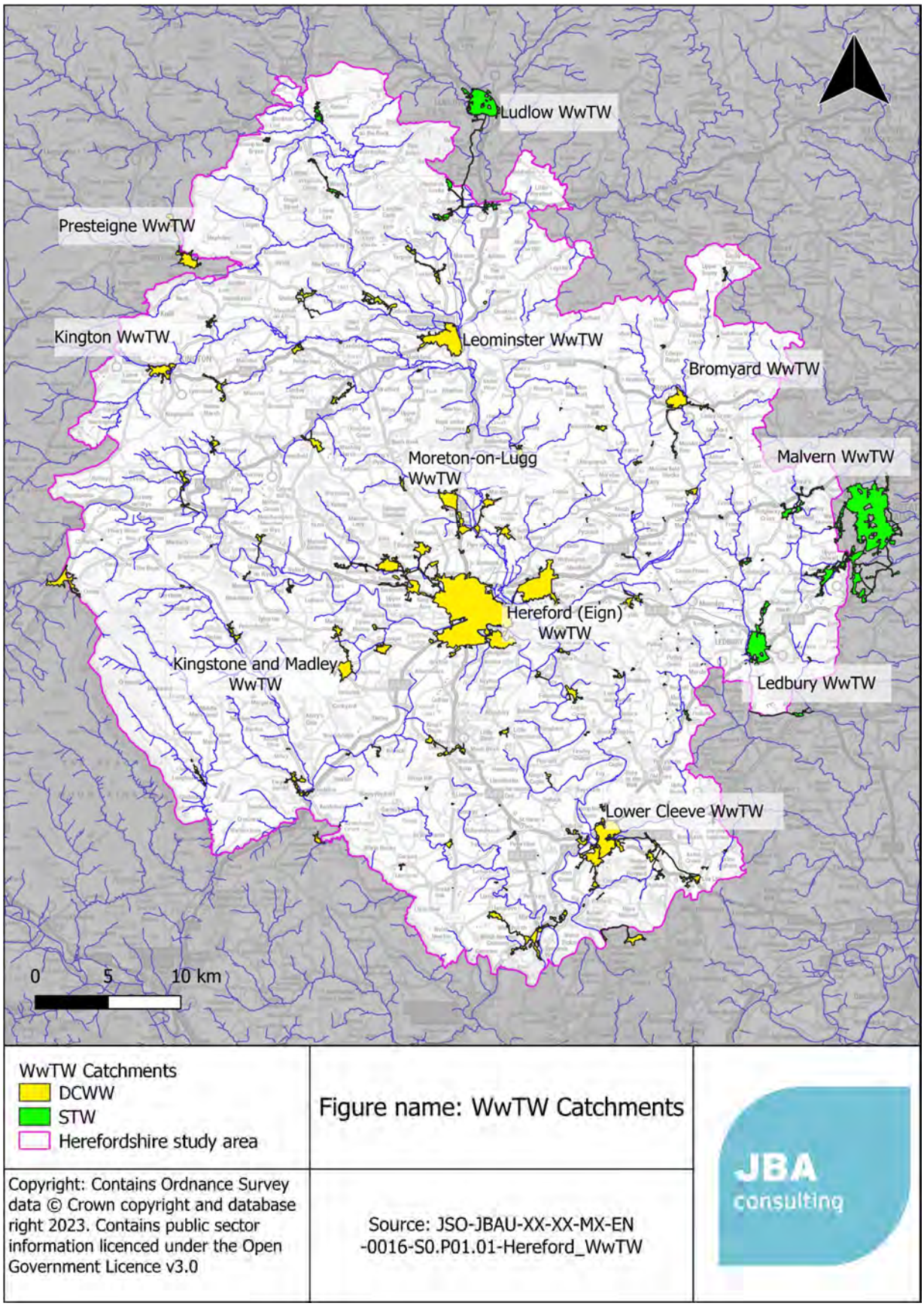

Ludlow WwTW
Presteigne WwTW
Kington WwTW
Leominster WwTW
Bromyard WwTW
Malvern WwTW
Moreton-on-Lugg WwTW
Hereford (Eign) WwTW
Kingstone and Madley WwTW
Ledbury WwTW
Lower Cleeve WwTW
0
5
10 km
WwTW Catchments
DCWW
STW
Herefordshire study area
Figure name: WwTW Catchments
Copyright: Contains Ordnance Survey data © Crown copyright and database right 2023. Contains public sector information licenced under the Open Government Licence v3.0
Source: JSO-JBAU-XX-XX-MX-EN-0016-S0.P01.01-Hereford_WwTW

Figure 6-1 WwTW catchments in Herefordshire

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.

6.2 Assessment of the Drainage and Wastewater Management Plans

6.2.1 DCWW DWMP

Dŵr Cymru's (Welsh Water) DWMP is still in its draft stage (dDWMP) this section will be discussing the draft dWRMP (DCWW, Drainage and Wastewater Management Plan 2024, 2022). This is the water companies first round of DWMPs. DCWWs stated long-term objectives are:

- Water quantity - reducing the risk of flooding to communities.
- Water quality - improving water quality for the environment.
- Resilience and maintenance - ensuring the ability to adapt to changes in the future.

Continued investment at present-day baseline levels will be insufficient to address existing flood risk, water quality and resilience issues, and these will be exacerbated in the future as a result of climate change, development and urban creep. Consequently an enhanced investment plan is required to address present-day and future challenges.

Storm overflows are one of DCWW's priorities for investment. DCWW's approach to storm overflows is that they can't single out storm overflows alone for improvement but need to look at the wider supply and demand infrastructure with a goal of zero spills by 2050.

DCWW have a goal to remove surface water from combined sewer network where possible, and to implement approaches that provide adaptation to the effects of climate change specifically where measures will reduce the frequency of sewer flooding and improve resilience of the service DCWW provide.

There is a focus on stakeholder engagement as well enabling collaboration to work towards common goals. Because of the DWMP still being in the draft stage at the time of writing, consultation is still open for the public to contribute to the final DWMP.

Key drivers discussed in the DCWWs draft DWMP (dDWMP) are listed as:

- Environmental challenges

- Behaviours and expectations
- Resilience

Environmental challenged incorporates tightening environmental standards including climate change, growing population, and increasing effective drainage and wastewater management.

Capacity is identified as a key factor that may be affected by future growth. Considerations for future capacity within the dDWMP are:

- Payment for ecosystem services
- Nutrient trading
- Amenity value
- Water quality forecasting

A Payment for Ecosystem Services approach is where a company or landowner is provided an incentive to manage their land to deliver an ecological service such as habitat creation, or natural flood management. The phosphate credits scheme set up to enable nutrient-neutral development in the River Lugg catchment is an example of this.. This incorporates phosphate credits from the Integrated Wetland project set up by Herefordshire Council (see section 9.7.1 for further details).

Amenity value is based on the wellbeing of those within areas served by DCWW. There is an emphasis on the well-being of individuals and making outside spaces available to people.

Water quality within the dDWMP focusses on four determinands, ammonia, nitrate, biological dissolved oxygen, and phosphate. The BRAVA modelling carried out by DCWW shows that 35-60% of their WwTWs are likely to fail the Ecological Quality Status (EQS) compared to the current baseline.

An assessment has been carried out using a Baseline Risk and Vulnerability Assessment (BRAVA). Planning objectives that have been identified are:

- Internal sewer flooding risk
- Pollution risk
- Sewer Collapse risk
- Risk of sewer flooding in a 1 in 50-year storm
- Storm overflow performance
- Risk of WwTW compliance failure

Focussing on the Wye River Basin Catchment (RBC) Summary, the catchment has been deemed vulnerable by a Risk Based Catchment Screening.

Risks that the Wye RBC is most vulnerable to are:

- Sewer flooding due to extreme wet weather events

- Treatment work Dry Weather Flow compliance. Dry Weather Flow is the flow into a wastewater treatment during dry weather, and is a key metric used to design and regulate treatment works.
- Planned residential development.

The BRAVA assessment for the Wye RBC looking at risk up until 2025 shows flooding in extreme storms has a 'very significant risk', treatment works - storm tank overflow compliance also has a 'very significant risk'. The assessment for 2050 reflects the 2025 risks, but with the addition of external flooding - due to blockage having a more prominent 'very significant risk' rating. Internal flooding due to storms is not scored at all for risk in either 2025 and 2050.

6.2.2 STW DWMP

Severn Trent Water's DWMP (Severn Trent c, 2023) lays out eight key ambitions:

- Guarantee future water supply.
- Ensure water is used wisely.
- Deliver a high quality, affordable service.
- Lower the risk of flooding and pollution.
- Protect and enhance our environment.
- Support a more circular economy.
- Make a positive social difference.
- Maintain a safe, inclusive, and fair workplace.

There are 2,647 storm overflows in the Severn Trent Water region, and by 2050, 1,097 of them are predicted to be classed as high priority activating higher than 10 times per year, which is above the national annual allowance. By 2030 STW aim to align to the Storm Overflow Discharge Reduction Plan by addressing 39% of high priority storm overflows causing harm and 26% of all overflows activating more than 10 times a year. Reducing storm overflow operation can be achieved by upgrading WwTWs or the sewer network ensuring that storm overflows only operate in unusually heavy rainfall.

An assessment has been carried out using a Baseline Risk and Vulnerability Assessment (BRAVA) for a 1 in 50-year storm with various climate change scenarios taken into consideration (no temperature change, 2°C increase and 4°C increase). The scenarios looked at how many properties would be at risk of internal sewer flooding. Currently there are 112,000 properties at risk of internal flooding which amounts to 2.58% of connected properties in the Severn Trent region. If no upgrades of WwTW occur, by 2050 this percentage is expected to rise to 39% (155,998 properties), assuming a 2°C increase in temperature.

As part of STWs option development and appraisal section, an option presented included maximising investment opportunities. Investment opportunities encompass

internal sewer flooding in a storm and storm overflows. The investment would incorporate alleviating flood risk by undertaking surface water separation scenarios taking surface water out of combined sewers. As for storm overflow investment, money towards improving site screening for pollutants and addressing high priority storm overflows are mentioned.

Maximising blue-green nature-based solutions was focussed on to work towards a more sustainable approach to reducing the inflow of surface water in the sewer network. The main solution for this was using SuDs.

Overall, there is a focus on reduction of storm overflow operations, upgrading WwTW and creating more sustainable water management options, such as SuDS.

6.3 Storm Overflows

Storm overflows are an essential component in the sewer network – however when they operate frequently, they can cause environmental damage. They occur on combined sewer systems where the sewer takes both foul flow (sewage from homes and offices) and rainwater runoff. In normal conditions all of this flow passed through the sewer network and is treated at a wastewater treatment works.

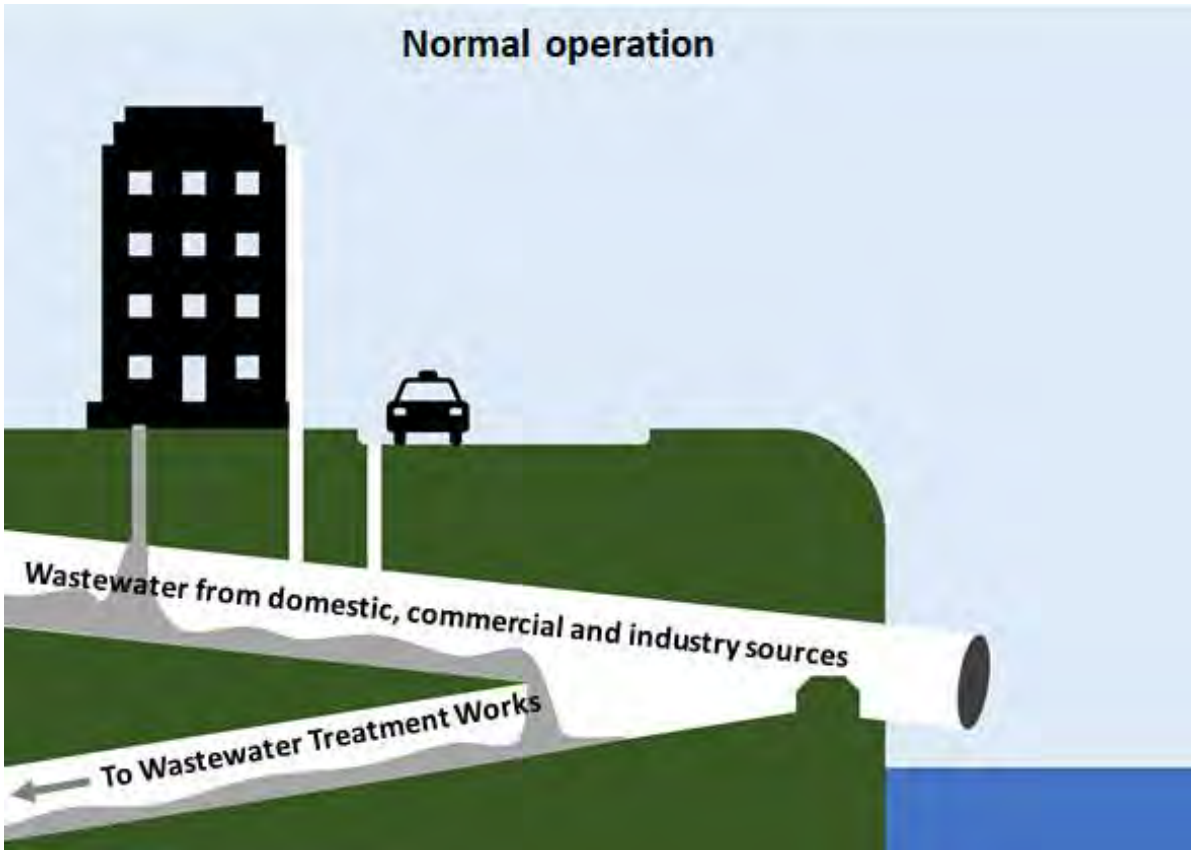


Figure 6-2 Storm overflow operation in normal conditions

In periods of exceptional rainfall, the capacity in a combined sewer may be used up by the additional flow from rooftops and storm drains. Once the capacity is exceeded, wastewater would back up into homes, businesses and on to roads. A storm overflow acts as a relief valve, preventing this from happening.

Storm overflows become problematic when they operate frequently in moderate or light rainfall, or for long periods as a result of groundwater infiltration in the sewerage system – possibly in breach of their permit. Their impacts can include aesthetic pollution, acute or chronic impacts on water quality and river ecology, and impacts on humans where surface waters are used for swimming and water recreation.

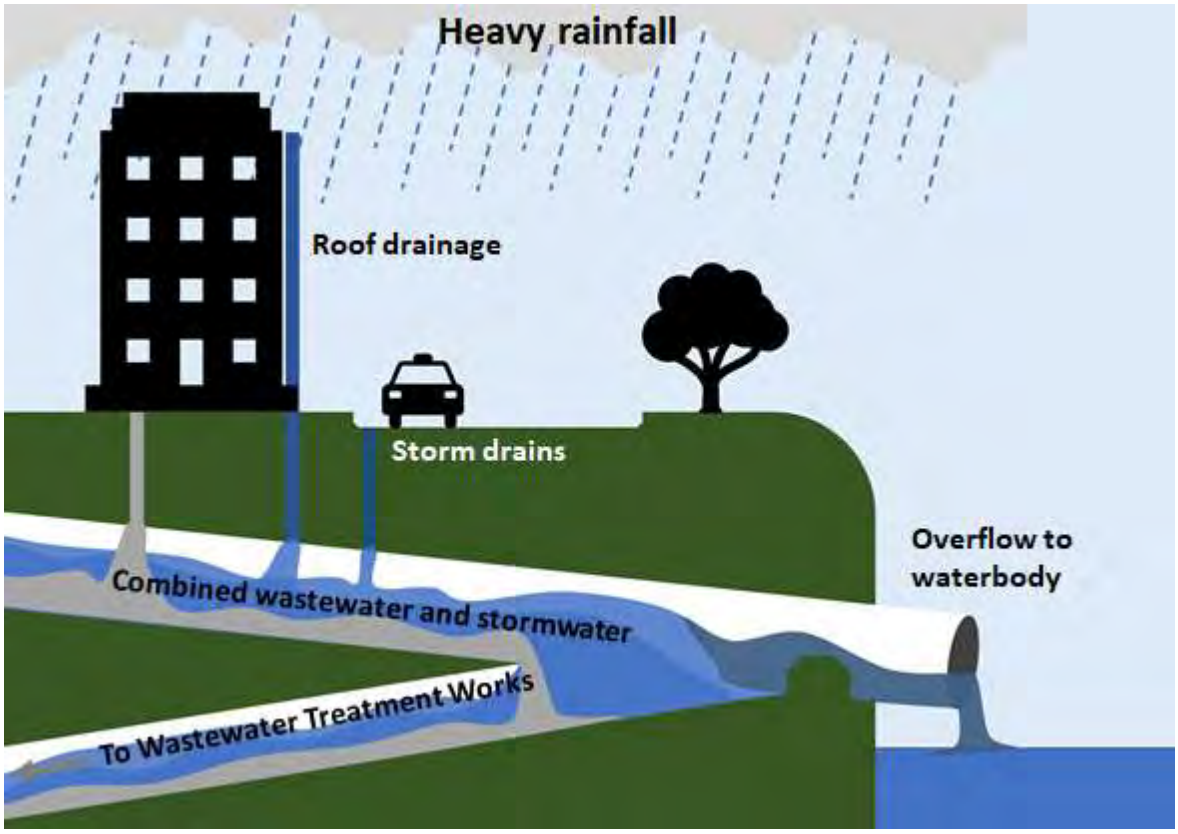


Figure 6-3 Storm overflow operation in exceptional rainfall

6.4 Methodology

6.4.1 Sewerage System Capacity Assessment

New residential developments 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.

6.4.2 Storm overflow assessment

The Environment Act now requires water companies to report and monitor storm overflows as well as reduce the harm caused to the rivers they discharge to.

The Storm Overflow Taskforce has agreed a long-term goal to end the damaging pollution caused by the operation of storm overflows. An important component of this is the monitoring of overflows, and a target has been set to monitor the frequency and duration of operation at all storm overflows by 2023. This is called Event Duration Monitoring (EDM). The EDM dataset (which contains performance data on the 16,639 storm overflows monitored in 2021) has been used to provide information on storm overflows in Herefordshire. The EA have set thresholds above which a storm overflow should be investigated. Where there is one year of EDM data this should be if there are over 60 operations per year, over 50 operations for two years of data and 40 operations for three years of data. We have included a maximum of 3 years of data in our assessment, where less years were available we have applied the above corresponding threshold.

Table 6-1 Definition of RAG scoring applied

Sewer Overflows RAG Score	Number of operations per year (average of available data)	Commentary
Green	0-10	Overflow is currently operating within the long-term (2050) target. Need to ensure that this is maintained in the long-term considering upstream development, climate change and urban creep.
Amber	11 - threshold for individual CSO	An investigation is not required at present, but improvements will need to be made in the network and/or catchment to meet the long-term target.
Red	Above threshold	The overflow may already be operating beyond the threshold which would trigger an investigation. Upstream development could further increase the discharge frequency, so mitigation should be required prior to significant development.

An overview of the EDM network storm overflow data from 2020-2022 can be found in Table 6-2 and Figure 6-4.

There are a number of CSO's which are over the threshold for investigation, these are; Colwall, Congretional Chapel - Sherford and Hay-on-Wye. A red rating means that an investigation should be carried out an submitted to the Environment Agency. A further 12 of the 19 CSO's are classed as amber, as they are not meeting the long term goal. HCC have commented that New Court SPS (AN0362401) is directly impacting the River Lugg which is a SSSI and requires Nutrient Neutrality.

There are opportunities through the planning system to ease pressure on the wastewater network by separating foul and storm flow in existing combined systems, and not allowing new surface water connections. Surface water can also be better managed by retrofitting SuDS in existing residential areas, and in new development, ensuring SuDS are incorporated into designs at the master planning stage to maximise the potential benefits.

Table 6-2 Network storm overflow frequency of operation from 2020-2022, including average operation and RAG assessment

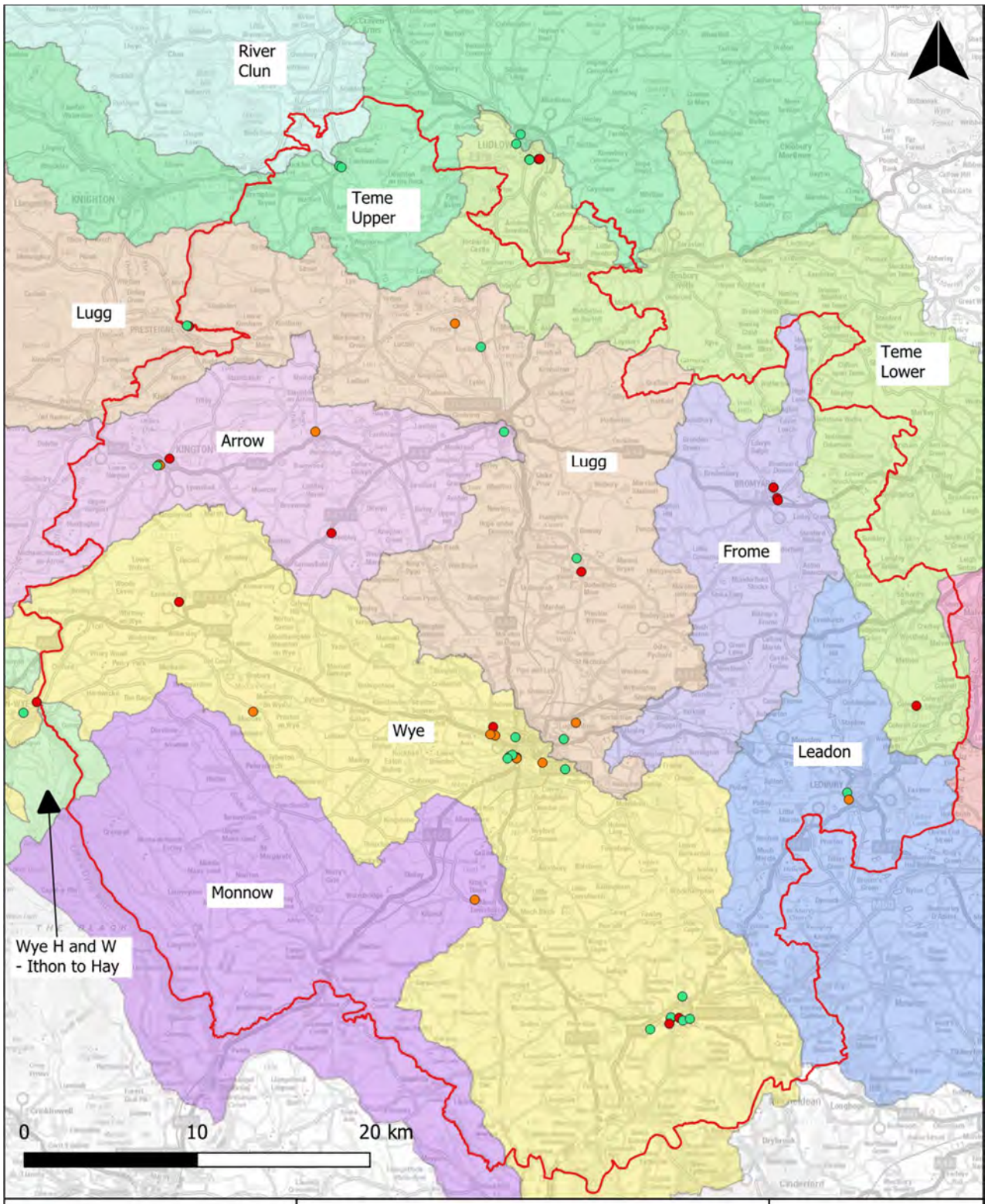
Storm overflow name	Permit number	Number of operations in 2020	Number of operations in 2021	Number of operations in 2022	Averages of either 2 or 3 years, where available	RAG rating
SPS AT EARDISLEY STW	AL1001102	71	47	47	55	Red
HOMS ROAD PUMPING STATION CSO	AN0014401	88	33	28	49.7	Red
CAWDOR ARCH COMBINED SEWER OVERFLOW	AN0014501	1	0	0	0.3	Green
BRAMPTON STREET CSO	AN0014601	79	31	41	50.3	Red
STATION ST COMBINED SEWER OVERFLOW	AN0014701	2	0	0	0.7	Green
CONGREGATIONAL CHAPEL CSO	AN0069801	81	67	53	67	Red
PORTHOUSE FARM INDUSTRIAL SITE PS	AN0069901	16	13	16	15	amber
GREYFRIARS BRIDGE CSO	AN0077101	72	51	122	81.7	Red
GRANDSTAND ROAD CSO	AN0077701	55	48	28	43.7	Red
WHITECROSS ROAD CSO HEREFORD	AN0078001	4	6	4	4.7	Green
SEATON AVENUE CSO	AN0078101	1	2	0	1	Green

Storm overflow name	Permit number	Number of operations in 2020	Number of operations in 2021	Number of operations in 2022	Averages of either 2 or 3 years, where available	RAG rating
ST MARTINS ALLOTMENTS CSO HEREFORD	AN0078501	41	33	29	34.3	amber
BELMONT ROUNDABOUT CSO	AN0078601	12	35	7	18	amber
3 ELMS ROAD COMBINED SEWER OVERFLOW	AN0078801	14	8	14	12	amber
THREE ELMS ROAD CSO	AN0078901	3	13	19	11.7	amber
HOPE AND ANCHOR CSO	AN0084201	97	71	42	70	Red
JUNCTION OF CRUXWELL ST & ROWBERRY	AN0122001	112	100	0	70.7	Red
MANHOLE 27 COMBINED SEWER OVERFLOW	AN0125601	28	24	20	24	amber
KINGTON - MANHOLE 29	AN0125701	55	32	21	36	amber
MANHOLE 50 COMBINED SEWER OVERFLOW	AN0125801	5	5	6	5.3	Green
MANHOLE 9 CSO	AN0125901	64	63	48	58.3	Red
MUCH DEWCHURCH NEW STW OS PARCEL 24	AN0231302	19	18	22	19.7	amber
MISS CHAVES COMBINED SEWER OVERFLOW	AN0266301	18	1	2	7	Green

Storm overflow name	Permit number	Number of operations in 2020	Number of operations in 2021	Number of operations in 2022	Averages of either 2 or 3 years, where available	RAG rating
BARTON ROAD COMBINED SEWER OVERFLOW	AN0266401	5	14	9	9.3	Green
PETTY BRIDGE SPS	AN0270001	75	54	53	60.7	Red
LEYMANS FIELD PS BRAEMAR GARDEN	AN0270801	12	8	0	6.7	Green
NEW COURT SEWAGE PUMPING STATION	AN0362401	50	28	21	33	amber
WILTON SEWAGE PUMPING STATION	AN0372801	9	0	4	4.3	Green
Hay-on-Wye (Main) SPS	AN0379801	156	183	168	169	Red
PUMPING STATION AT MOCCAS STW	AN0379901	18	41	30	29.7	amber
CSO at Presteigne - O/S SPS Tanyard	BB3694FC	60	33	31	41.3	Red
Hay-on-Wye (Warren Close) SPS	BB3694ZK	No data	0	1	0.5	Green
PEMBRIDGE CSO	JP3525XF	11	45	37	31	amber
OLD STREET CSO	S/09/05082/O	No data	23	19	21	amber
LUDFORD SPS - EMERG O/F & STORM O/F	S/09/12194/O	5	6	0	3.7	Green

Storm overflow name	Permit number	Number of operations in 2020	Number of operations in 2021	Number of operations in 2022	Averages of either 2 or 3 years, where available	RAG rating
COLWALL CSO	S/09/20392/O	39	84	79	67.3	Red
HIGH STREET CSO	S/09/21067/O	5	0	0	1.7	Green
WATLING STREET CSO	S/09/21088/O	6	10	9	8.3	Green
TEMESIDE PUMPING STATION	S/09/21650/O	65	48	37	50	Red
LOWER ROAD TRADING ESTATE CSO	S/21/23083/O	6	6	2	4.7	Green
SSO AT LITTLE MARCLE ROAD P/STATION	S/21/26218/O	18	0	16	11.3	amber
LUDLOW - ROCK LANE (CSO)	TBC	No data	69	No data	69	Red
TBC	TBC	No data	0	8	4	Green
LUDLOW - THE LINNEY CSO	TSC1173	No data	4	3	3.5	Green
ROSS-ON-WYE ASHBURTON TRADING ESTATE	Unpermitted -31139	No data	1	1	1	Green
Eign Road CSO, Hereford	Unpermitted -31896	No data	33	38	35.5	amber
Belvedere Lane CSO,	Unpermitted	No data	6	2	4	Green

Storm overflow name	Permit number	Number of operations in 2020	Number of operations in 2021	Number of operations in 2022	Averages of either 2 or 3 years, where available	RAG rating
Hereford	-31903					
Netherton SPS, Ross	Unpermitted -31925	No data	0	No data	0	Green
LUSTON VILLAGE	Unpermitted -33630	13	1	1	5	Green
Kington CSO - Access Road to STW	Unpermitted -72664	71	65	55	63.7	Red
Yarpole SPS	Unpermitted -73026	No data	26	12	19	amber
BODENHAM MOOR	Unpermitted -73340	100	84	13	65.7	Red
BODENHAM MILLCROFT	Unpermitted -73341	5	0	0	1.7	Green
1 Caradoc Drive CSO, Leominster	Unpermitted -75049	No data	1	7	4	Green
Tanyard Pumping Station CSO/EO	WQD00044 1	2	4	0	2	Green



Herefordshire study area

Figure name: RAG assessment for CSOs on the sewer network

Source: JSO-JBAU-XX-XX-MX-EN-0004-Hereford_CAMS

Figure 6-4 The RAG assessment of CSO storm overflows overlayed on the receiving river catchment

6.5 Water company Red, Amber, Green (RAG) assessment of allocation and reasonable alternative sites

6.5.1 Introduction

The two water companies providing sewerage to Herefordshire have provided a RAG classification for both foul sewerage and surface water collection. This assessment indicates the likely impact of developing a site on the respective systems. Their definitions of RAG, which vary by company and system, are included in the relevant sections below for reference.

6.5.2 STW Foul Sewerage Network capacity

Amber - Medium impact - Historic flood incidents and recent connections.

Green - low impact - if surface water is managed sustainably.

Red - high impact - there are no sites categorised as red by STW.

STW classified sites LEDB3 - Land south of Little Marcle Road and LEDB4 and Lawnside and Market Street Regeneration Area as green for foul sewerage network capacity. These sites would drain to Little Marcle Rd Ledbury pumping station. It is recommended that surface water separation betterment opportunities are investigated for LEDB4, and surface water managed sustainably on site for both sites.

The remaining sites would drain to Full Pitcher pumping station, these have been classed as amber. STW provided the following comment:

"The site will connect into the network connecting to Ledbury - Full Pitcher sewage pumping station. There are historic flooding incidents in downstream network and additional developments have recently connected into this location. It is important that surface water is managed sustainably, otherwise the risk will be higher."

For all of the sites STW recommend hydraulic modelling to understand the potential impact more fully. This would typically take place once there is greater certainty on the certainty and timing of development sites.

6.5.3 STW Surface Water capacity

Red - High impact - no existing surface water sewers

Amber - Medium impact - possible upgrades required

Green - Low impact - site can discharge to watercourse

STW have classified HLAA/755/001 - Land to the South West of Ledbury and LEDB2 - Land to the South East of Ledbury, South of Leadon Way as amber. They comment:

"Surface water may require connection into the surface water sewers in the adjacent development site, there is a risk that this will require upsizing to accommodate additional flow. It is recommended that the site is surveyed to understand if there are available water courses or ditches that surface water could discharge into instead of the surface water sewer."

Site LEDB4 - Lawnside and Market Street Regeneration Area has been classed as red, as there are no existing surface water sewers in the area. If there is no nearby watercourse to discharge into then additional infrastructure may be required, following the drainage hierarchy, with connection to a foul sewer the last resort. In either case, SuDS should be used on site to provide betterment, and developers may need to engage with STW to demonstrate how the site can be delivered without increasing the likelihood of storm overflow operation.

6.5.4 DCWW Foul Sewerage Network capacity

Amber - Hydraulic modelling assessment required.

Green - Connection point available.

DCWW have classified all the sites as amber in their assessment, apart from four, which are green and state the name of the connection point to the foul sewer. For the remaining amber sites, they comment that hydraulic modelling to further understand sewer capacity is required.

6.5.5 DCWW Surface Water capacity

At this stage DCWW have not classified sites with a surface water RAG score, they comment that the applicant for the site will determine the drainage method at the time of application. They state no surface water shall be permitted to discharge into the public sewerage network.

6.5.6 Conclusions

Four of the network storm overflows in Herefordshire are above the threshold for investigation; Hay-on-Wye, Colwall, Congregational Chapel - Sherford and Kingsland. Twelve of the remaining CSO's are classed as amber, being above the long term goal of 10 spills but below the threshold. Ongoing monitoring will help to assess which storm overflows will need to be considered for upgrades or permit changes.

DCWW indicated that all but four of the potential development sites require hydraulic modelling to assess the capacity of the sewer network which would serve these

sites. Similarly, the five development sites within STW's area are all recommended to have hydraulic modelling carried out to assess capacity. Particularly, the sites classed as amber are of higher concern, as the network downstream has historic sewer flooding issues. STW's surface water assessment gave a red rating to site LEDB4 as there are no existing surface water sewers adjacent to this site. Efforts should be made to identify a point of connected to a watercourse in order to prevent using the public foul sewer. SuDS should be used to ease the pressure on the foul network.

6.6 Recommendations

Action	Responsibility	Timescale
Consider the available WwTW capacity when phasing development going to the same WwTW.	Herefordshire Council DCWW STW	Ongoing
Provide Annual Monitoring Reports to DCWW and STW detailing projected housing growth.	HC	Ongoing
DCWW and STW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	DCWW STW	Ongoing
In the stage 2 WCS, work with water companies to determine whether allocation sites could increase the frequency of storm overflow operation.	DCWW, STW	Stage 2 WCS

7 Wastewater Treatment

7.1 Wastewater Treatment Works in Herefordshire

7.1.1 Introduction

Severn Trent Water and Dŵr Cymru (Welsh Water) provide wastewater services for development in Herefordshire. STW and DCWW refer to their wastewater processing plants as Wastewater Treatment Works (WwTW), for consistency this is how they shall be referred to in this report. They may also be referred to as Sewerage Treatment Works in some documents and data sources.

There are 44 WwTWs in Herefordshire, with seven wastewater treatment works expected to serve new growth, with proposed development within their sewerage catchments. The cross over of sewerage catchments into neighbouring authorities has been accounted for by including proposed neighbouring development in the site tracker assessment. The location of the WwTWs serving Herefordshire are listed in Appendix D.

Allocation & reasonable alternative sites, commitments, and an allowance for windfall, were assigned to a WwTW using the sewerage drainage area boundaries provided by STW and DCWW to assess headroom at each WwTW through the future AMP periods. Actual connection of a development site to a particular WwTW may be different and will depend on the capacity of the receiving works, and the local sewer network. 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 7-1 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.

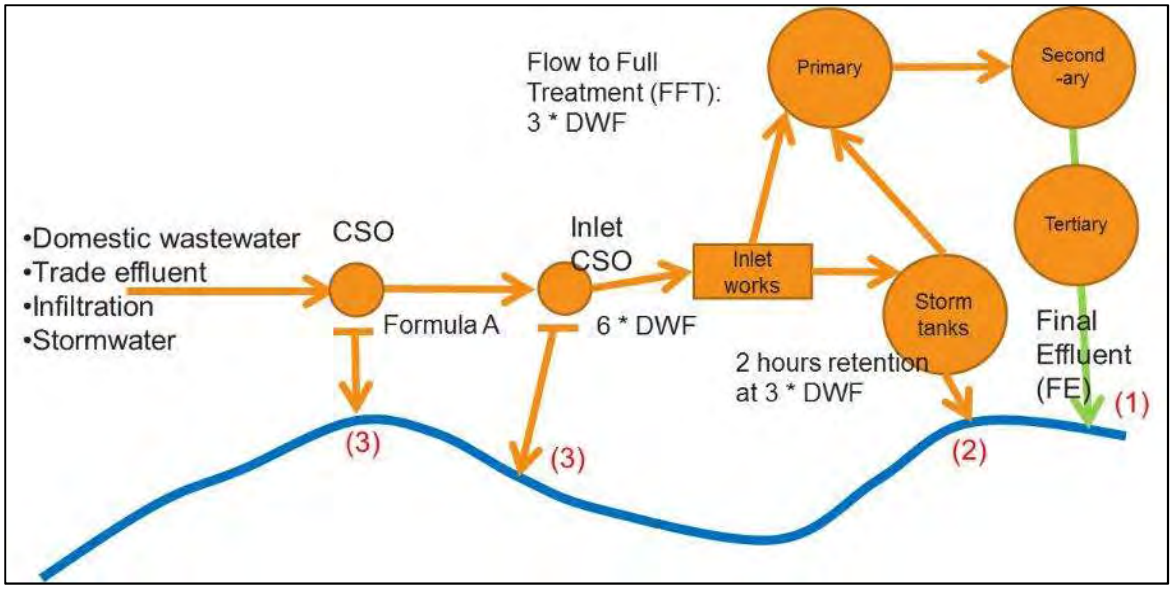


Figure 7-1 Overview of typical combined sewerage system and WwTW discharges

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.

SuDS are an important measure to reduce runoff and ingress of storm water in the sewer network. For further details see Section 11.5.8.

7.2 STW WwTW Level 1 Assessment

As part of the data request STW supplied a hydraulic headroom assessment, including a RAG classification for estimated spare capacity and watercourse constraints for each of their 8 WwTWs within Herefordshire. In (Table 7-1) below, the headroom as population equivalent is outlined, beside the estimated population growth for each WwTWs.

Bosbury RBC works has a present day spare capacity of 18 m^3/day, which aligns with JBA's assessment for this works of + 15% at 2042. This result comes from using the most recent flow data for this works, the RAG classification in Table 7-3 is based on the preceding 3 year average flow rate (2019/21), which shows a more severe outlook as there was a very high flow year which skewed the average significantly. It is not possible to calculate the future predicted capacity in population equivalent for this works.

STW's assessment of Colwall works shows some spare capacity at 2028, which is broadly similar to JBA's, however at 2048, STW project a more severe deficit, with roughly - 5% capacity remaining, whereas JBA project - 1% at 2042.

Cradley works shows a negative capacity at 2025 (-5%, JBA), and at 2028 (STW), going against what STW have commented in Table 7-3 for this works, JBA's assessment indicates investment will be needed in AMP8. There is potential for provision of additional capacity in future, however this could be limited.

STW forecast that the population served by Ledbury WwTWs will decrease by roughly 2,000 people by 2028, and then rise by 800 by 2048, which results in a net decrease in population, and potentially still leaves 2220 population equivalent capacity. However, our assessment shows the capacity decreasing at each AMP period in the plan period, becoming negative by 2035, capacity is shown as -21% by 2042.

Leintwardine works shows low-capacity constraints in both JBA and STW assessments. Ludlow WwTWs is currently at zero spare capacity, in both STW and JBA assessments, and this decreases over the plan period down to -20% at 2042, a scheme has been promoted to increase capacity here.

JBA's assessment of Whitbourne and Wigmore works shows substantial spare capacity up to 2042. At 2048 STW's assessment gives a population equivalent of 3 for Whitbourne and -11 for Wigmore. As such, both a currently compliant but they will continue to monitor these works.

Table 7-1 STW Level 1 WwTWs hydraulic headroom assessment

Wastewater Treatment Works Name	Current Population Equivalent	3 year Average (Q80) (m3/d) (2019 2021)	Current DWF consent (m3/d)	Estimated spare hydraulic capacity in Population Equivalent based on a 5 year average	Estimated Population by 2028 based on ONS	Spare capacity in population equivalent at 2028**	Estimated Population by 2048 based on extrapolated ONS	Spare capacity in population equivalent at 2048***
BOSBURY RBC	275	91*	82	-8	279	-	297	-
COLWALL	2,057	748	760	65	2,090	32	2,226	-104
CRADLEY	1,159	208	213	14	1,177	-4	1,254	-81
LEDBURY	11,773	2,390	3,068	723	9,646	2850	10,276	2220
LEINTWARDINE	753	92	215	127	724	156	772	108
LUDLOW	12,375	3,514	3,500	0	12,584	-209	13,358	-983
WHITBOURNE	357	47	76	32	363	26	386	3
WIGMORE	764	112	158	52	776	40	827	-11

* This figure is based on 2019-2021 data, the latest data puts this 3-year average at 64, giving a present day positive headroom of 18 m^3/d population equivalent.

/* This has been calculated by JBA to allow an approximate comparison of spare capacity to our assessment.

Table 7-2 provides a definition of the RAG assessment categories found in Table 7-3, the spare capacity and watercourse constraints.

Table 7-2 Key for the STW RAG assessments

Key	Estimated Spare Capacity (RAG)	Watercourse constraints
Not measured	No flow monitoring - scale of WwTW is below that requiring flow monitoring	Non-Numeric - Permit does not require measurement of specific contaminant levels
Low	Not expected to be an issue	No land or other constraints preventing expansion
Medium	Marginal concern subject to size of development	Some constraints that could limit provision of additional capacity
High	Probable issue	Limited scope to provide additional capacity
Very High	Issue currently being investigated	No scope to provide additional capacity

STW expect spare capacity at Cradley WwTW and Ludlow WwTW to be a 'probable issue' in the future. Comments from STW on Cradley STW note that analysis indicated there was no need for investment in AMP8, but monitoring will continue. As for Ludlow WwTW a scheme has been promoted to ensure DWF compliance.

Colwall WwTW and Wigmore WwTWs spare capacity are rated at 'marginal concern' subject to the size of future developments. STW commented that for Ludlow WwTW timelines for LPA plans would be required to confirm need for investment. As for Wigmore WwTW, STW note that it is currently compliant with DWF so there is no need for investment in AMP8, but monitoring will continue. Bosbury RBC WwTWs spare capacity is rated 'very high' here, STW state that it is being investigated, the latest flow data shows .

Colwall WwTW, Ledbury WwTW and West Malvern WwTWs watercourse constraints are ranked at 'very high' with no scope to provide additional capacity. As for Wigmore WwTW there is limited scope to provide additional capacity.

Table 7-3 STW spare capacity and watercourse constraints RAG

Wastewater Treatment Works name	Estimated Spare Capacity (RAG)	Watercourse Constraints	Any other comments
BOSBURY RBC (STW)	Very High	Medium	Minimal growth expected, current headroom issues to be investigated
COLWALL (STW)	Medium	Very High	Timelines for LPA plans would be required to confirm need for investment
CRADLEY (STW)	High	Medium	Analysis indicated there is no need for investment in AMP8 but we will keep monitoring
LEDBURY (STW)	Low	Very High	N/a
LEINTWARDINE (STW)	Low	Low	N/a
LUDLOW (STW)	High	Medium	Scheme promoted to ensure DWF compliance
WHITBOURNE WORKS (STW)	Low	Low	N/a
WIGMORE (STW)	Medium	High	Currently compliant with DWF so no need for investment in AMP8 but we will keep monitoring

7.3 STW Wastewater RAG Assessment of allocation and reasonable alternatives

The allocations and reasonable alternatives fall within Ledbury WwTWs catchment for the STW area. They classed all sites as green, and commented that:

'From a high level assessment of the capacity of the works it looks like the flow from the proposed dwellings would likely be accommodated without a works expansion but we would have to closely monitor the performance of the works and the quality of our discharge to the watercourse. A timeline for delivery would be appreciated to allow us to plan ahead as required.'

When a site had an employment use they also commented:

'We would like to understand more about the employment nature of the industry and potential trade effluent traders which could impact the ability to meet specific permits.'

7.4 DCWW Wastewater RAG Assessment of allocation and reasonable alternatives

DCWW classified all of the residential allocation growth as green, which indicates that it wouldn't lead to capacity issues at the works. They commented that for all of the employment sites a trade effluent consent may be required depending on the end use. There are 6 sites which they classified as amber with the reason that there was unlikely to be capacity to accommodate the number of employees. DCWW explained that this was due to the particularly high indicative numbers of employees, combined with unknown employment uses for those sites. These 6 are within the catchments of Bromyard, Leominster and Lower Cleeve WwTWs.

7.5 JBA headroom assessment methodology

An assessment of WwTW capacity was carried out by JBA using measured flow data supplied by STW & DCWW. The process was as follows:

- STW provided their calculated 80th percentile exceedance flow statistic for each WwTW.
- Sites already in the planning system, windfall and neighbouring authority growth was 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 7-4), 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.
- For employment sites, wastewater demand was estimated based on the predicted number of new employees. Floor space, employment use types, and employment densities were used to estimate the number of employees.

Table 7-4 Per capita consumption values used in water demand calculations

Water Company	Water Resource Zone	Occupancy rate (persons per dwelling)	Per capita residential consumption (m3/person/day)	Per capita employment consumption (m3/person/day)
Dŵr Cymru (Welsh Water)	Hereford CU Area	2	0.116	0.1
Dŵr Cymru (Welsh Water)	Ross-on-Wye	2	0.120	0.1
Dŵr Cymru (Welsh Water)	Whitbourne	2	0.126	0.1
Dŵr Cymru (Welsh Water)	Vowchurch	2	0.232	0.1
Dŵr Cymru (Welsh Water)	Pilleth	1.8	0.115	0.1
Dŵr Cymru (Welsh Water)	Llyswen	1.9	0.114	0.1
Severn Trent	Strategic Grid	2.2	0.120	0.1

7.6 JBA headroom results

A map showing estimated capacity at each WwTW is shown in Figure 7-2 below.

The following definition was used by JBA to score each WwTW:

Capacity for growth during local plan period	Limited capacity during local plan period	Issues identified – WwTW capacity could be a constraint to growth

In general, in the case that a WwTW is likely to exceed its permit, the permit would be reviewed by the EA and if a higher flow consent was agreed, a tighter permit limit for substance concentrations is very likely to be required. In some cases, this may not be possible if that means concentrations tighter than the Technically Accepted Limit (TAL) which is 0.25 mg/l for P for example.

Canon Pyon, Dilwyn and Much Dewchurch WwTWs are currently exceeding their DWF permit. None of Herefordshire's allocations or reasonable alternatives are planned within the catchments of these works, however all three are forecast to have increased DWF from the baseline at the end of AMP8 (2030), resulting from committed growth.

Growth within the catchments of Bromyard, Leominster, Lower Cleeve (Ross-on-Wye) and Ledbury, is forecast to exceed the DWF permit limit over the plan period, see Figure 7-2. These are market towns with allocation sites planned by HC. Based on our current growth scenario, the earliest of these four exceeding the limit is at the end of AMP9 (2035) for Leominster and Lower Cleeve. Bromyard is expected to exceed at the end of AMP10 (2040). We have spread the allocation growth evenly over the last 15 years of the plan period (2028-42), as there was no trajectory available from HC at this time. The majority of the proportion of wastewater demand for these works results from proposed allocations or alternatives, rather than commitments etc. This means there is potential for HC to select sites in other market towns to reduce the demand placed on these works. Ludlow WwTW is currently not compliant with its permitted DWF, this negative capacity becomes increasingly negative throughout the plan period. Other WwTWs that are not expected to serve allocations that could exceed their permit limit are Cradley, at AMP7 (2025) and Colwall, at AMP8 (2030). Hay-on-Wye, Kingstone and Madley, and Morton on Lugg works are classed as being near to the permit limit by the end of the plan period, they have between 1-10% headroom remaining.

Regarding wastewater treatment specifically, where possible if allocation growth can be focused more in Hereford/Kington, this may relieve pressure on the market towns with negative headroom at the end of the plan period. The River Lugg (a tributary of the upper Wye) is a nutrient neutral catchment with 37 WwTWs discharging to it, including Leominster and Moreton-on-Lugg. This presents a constraint on development in the catchment.

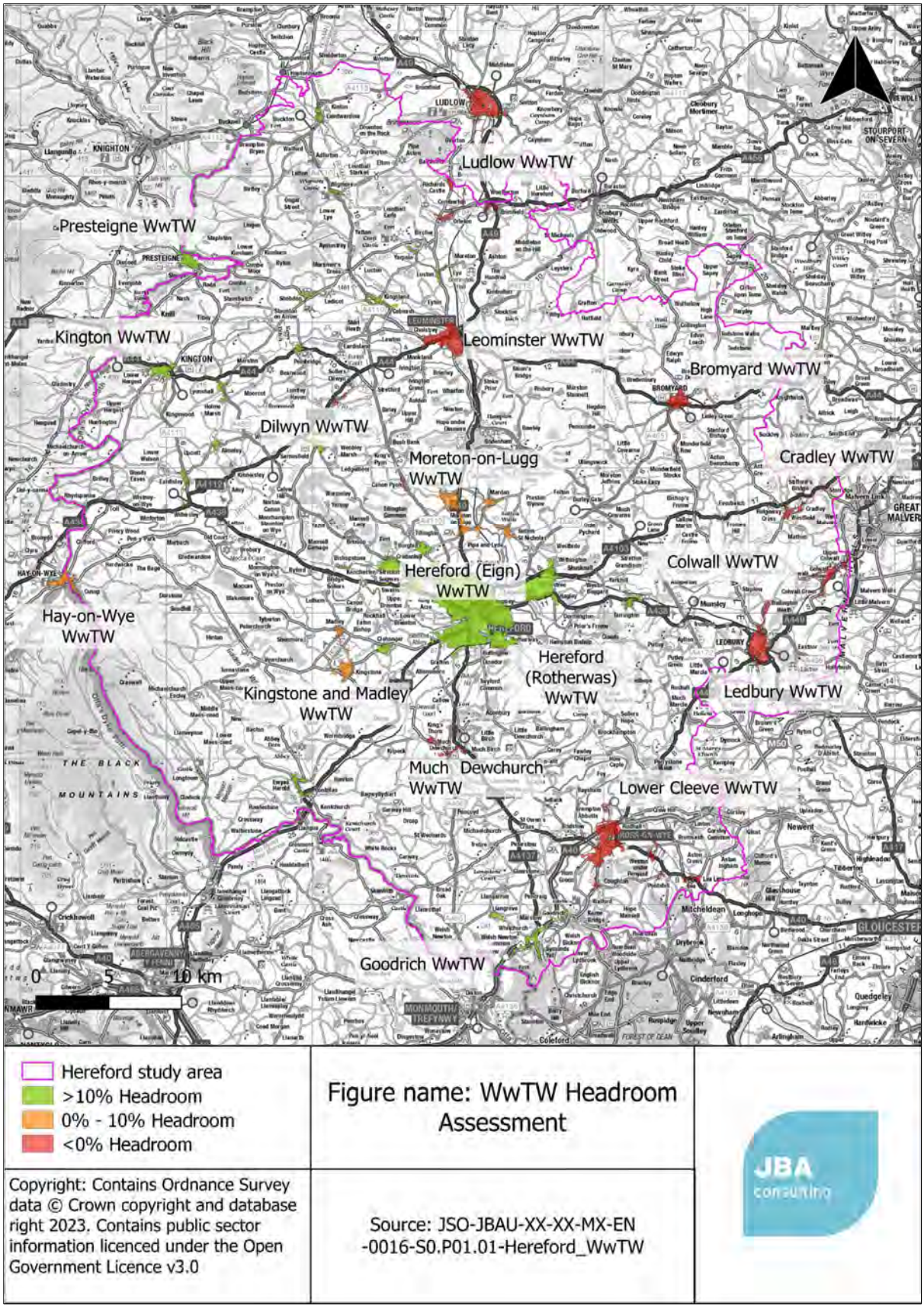


Figure 7-2 WwTW Headroom assessment - RAG scoring is forecast headroom at 2042 - larger works are labelled and all that are either classified as red or orange.

Our development forecast predicts almost 14 Ml/d of additional demand by the end of the plan period, this can be found in Table 7-5. 60% is entering the river Wye, with the next largest being the River Lugg.

Table 7-5 The sum of the additional wastewater demand for the plan period split by receiving river catchment.

River catchment	Wastewater Demand (Ml/d)	Percentage
Arrow	0.047	0.3%
Frome	0.945	6.8%
Leadon	1.468	10.5%
Lower Teme	0.727	5.2%
Lugg	1.942	13.9%
Monnow	0.056	0.4%
Teme Upper	0.018	0.1%
Wye NE SAC	8.335	59.9%
No WwTW assigned	0.381	2.7%
Total	13.923	100%

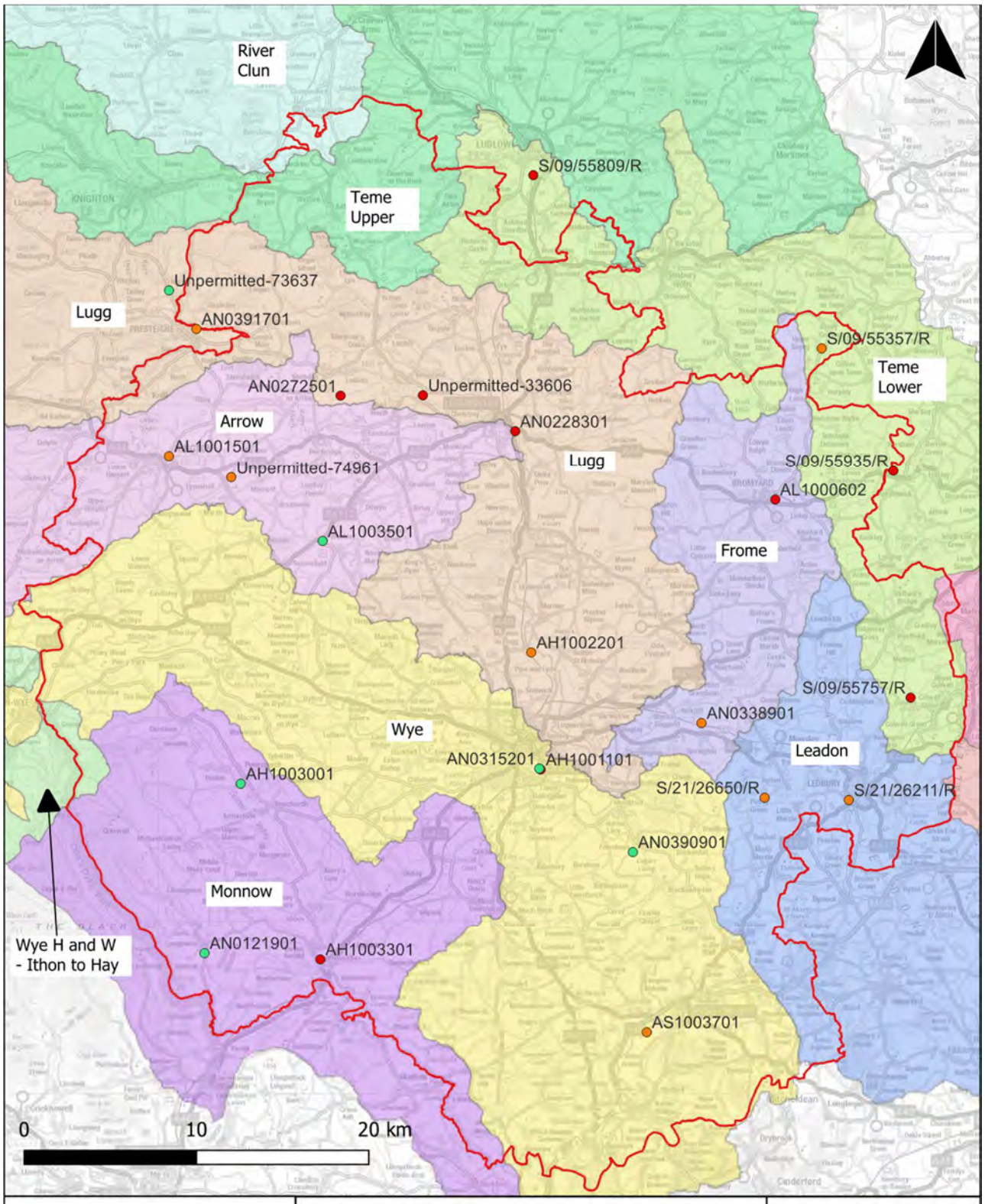
7.7 Storm Tank Overflows

The EDM data for the WwTW storm overflows, Table 7-6, was available for 1, 2 and 3 years depending on the overflow. An average was calculated where 2 or 3 years were available. Eleven of the overflows meet the EA threshold for investigation. There are planned allocation sites within Leominster, Lower Cleeve, Bromyard and Eign WwTWs sewer catchments, which already meet the trigger for investigation. It is important that growth in these catchments does not lead to an increased storm overflow operation. The information from Table 7-6 is summarised in Figure 7-3.

Table 7-6 WwTW storm tank overflow frequency of operation from 2020-2022, including average and RAG rating

Wastewater treatment works storm tank overflow	Permit number	Number of operations in 2020	Number of operations in 2021	Number of operations in 2022	Averages of either 2 or 3 years where available	RAG rating
EIGN WASTEWATER TREATMENT WORKS	AH1001101	82	50	36	56	Red
MORETON ON LUGG WWTW	AH1002201	64	33	6	34	amber
PETERCHURCH WASTEWATER TREATMENT WK	AH1003001	no data	7	12	10	Green
PONTRILAS WASTEWATER TREATMENT WRKS	AH1003301	no data	66	65	66	Red
CSO AT BROMYARD WWTW	AL1000602	141	13	7	54	Red
KINGTON WASTEWATER TREATMENT WORKS	AL1001501	31	27	25	28	amber
WEOBLEY WWTW	AL1003501	no data	0	12	6	Green
Longtown STW PS	AN0121901	no data	8	10	9	Green
LEOMINSTER WASTEWATER TREATMENT WKS	AN0228301	66	44	43	51	Red
SHOBDON STW	AN0272501	114	126	103	114	Red
EIGN 1B COMBINED SEWER OVERFLOW	AN0315201	12	0	10	7	Green
CSO AT TARRINGTON STW	AN0338901	31	49	40	40	amber
FOWNHOPE SEWAGE TREATMENT WORKS	AN0390901	0	1	0	0	Green

Wastewater treatment works storm tank overflow	Permit number	Number of operations in 2020	Number of operations in 2021	Number of operations in 2022	Averages of either 2 or 3 years where available	RAG rating
Settled Storm Sewage from Presteigne WwTW	AN0391701	23	19	11	18	amber
ROSS LOWER CLEEVE WWTW	AS1003701	69	0	7	25	amber
UPPER SAPEY SEWAGE TREATMENT WORKS	S/09/55357/R	27	15	60	34	amber
COLWALL SEWAGE TREATMENT WORKS	S/09/55757/R	104	141	103	116	Red
LUDLOW SEWAGE TREATMENT WORKS	S/09/55809/R	98	122	28	83	Red
WHITBOURNE SEWAGE TREATMENT WORKS	S/09/55935/R	58	157	66	94	Red
LEDBURY SEWAGE TREATMENT WORKS	S/21/26211/R	48	30	8	29	amber
PUTLEY GREEN STW	S/21/26650/R	no data	no data	44	44	amber
Kingsland WwTW CSO	Unpermitted-33606	no data	109	31	70	Red
Norton WwTW Storm Overflow	Unpermitted-73637	no data	2	no data	2	Green
Lyonshall WwTW Storm	Unpermitted-74961	no data	18	8	13	amber



Herefordshire study area

Figure name: RAG assessment for storm tank overflows at WwTW

Source: JSO-JBAU-XX-XX-MX-EN-0004-Hereford_CAMS

Figure 7-3 RAG assessment results of WwTW storm tanks with permit number and receiving river catchment

7.8 Conclusions

STW suggest they could accommodate the residential allocations and reasonable alternatives in the area they serve without having to upgrade infrastructure. They would welcome information on the employment nature of the industry and potential trade effluent traders which could impact the ability to meet specific permits. DCWW have indicated they could accommodate all the residential allocations/reasonable alternatives expected in the area they serve. However, they are unlikely to be able to accommodate the six employment sites proposed.

The JBA headroom assessment indicates, the WwTWs of Bromyard, Leominster, Lower Cleeve (Ross-on-Wye) and Ledbury (allocation market towns) will exceed their permit limit sometime during the plan period with the growth forecast we have calculated. In particular, our assessment of Ledbury WwTWs differs significantly to STW, theirs results in a net decrease in population at 2048, which potentially still leaves 2220 population equivalent capacity, whereas our assessment shows the capacity decreasing during each AMP cycle in the plan period, becoming negative at 2035, capacity is shown as -21% at 2042. Leominster, Lower Cleeve and Bromyard WwTWs storm overflows already meet the trigger for investigation. It is important that additional growth in these catchments does not lead to an increase in the operation of storm overflows.

7.9 Recommendations

Action	Responsibility	Timescale
Early engagement with STW and DCWW is required to ensure that provision of WwTW capacity is aligned with delivery of development.	HC	Ongoing
Provide Annual Monitoring Reports to DCWW and STW detailing projected housing growth.	HC	Ongoing
DCWW and STW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	DCWW and STW	Ongoing
Direct allocation growth towards Hereford/Kington	HC	Local plan development

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. Following advice from sewerage undertakers in previous studies, a distance of 800m from the WwTW has been used for screening purposes. Another important aspect is the location of the site in respect to the WwTW.

A red / amber / green assessment was applied:

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

8.2.1 Data Collection

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

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

8.3 Results

There are 15 of the allocations and reasonable alternatives within 800m of WwTW's which are RAG rated in Table 8-1. These are sites that have fallen within or touching the 800m buffer from a WwTW. The sites shown as 'amber' have been included within Table 8-1, these can be viewed spatially in Appendix G.

Table 8-1 Allocations which are within 800m of a WwTW in the study area

Allocations*	RAG rating	Allocation or reasonable alternative
HLAA/017/001 at Kington	Amber	Reasonable alternative
HLAA/121/a at Ledbury	Amber	Reasonable alternative
HLAA/263/001b at Kington	Amber	Reasonable alternative
NPD/Broc/008 at Bromyard	Amber	Reasonable alternative
HLAA/154/001/002 at Bromyard	Amber	Reasonable alternative
HLAA/451/003 at Hereford	Amber	Reasonable alternative
NDP/Broc/005 at Bromyard	Amber	Reasonable alternative
Land west of Linton Trading Estate	Amber	Allocation
Land south of Little Marcle Road	Amber	Allocation
HLAA/177/001 at Ross on Wye	Amber	Reasonable alternative
HLAA/755/0 at Ledbury	Amber	Reasonable alternative
HLAA/267/0 at Ledbury	Amber	Reasonable alternative
HLAA/771/001 at Ross on Wye	Amber	Reasonable alternative
HLAA/758/001 at Leominster	Amber	Reasonable alternative
HLAA/263/001a at Kington	Amber	Reasonable alternative

*Labelled maps of Amber and Red ranked sites can be found in Appendix G.

8.4 Conclusion

There are 15 of the potential allocation & reasonable alternative sites which may be at risk of nuisance odour, these sites area Local Plan allocation sites. At these sites, it is recommended that an odour assessment is carried out to investigate them further. This should be undertaken as part of the planning process, paid for by developers. These sites have been given an amber assessment. The remaining sites have been given a rating of green.

8.5 Recommendations

Action	Responsibility	Timescale
Consider odour risk in the sites identified to be potentially at risk from nuisance odour	HC	Ongoing
Carry out an odour assessment for sites identified as being at risk of nuisance odour	Developers	Ongoing

9 Nutrient Management

9.1 Introduction

The River Wye is a designated Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI). The River Wye has these designations because of it having an array of wildlife such as Atlantic salmon (*Salmo salar*), European otters *(Lutra lutra*) and White-clawed crayfish (*Austropotamobius pallipes*). It is also known for having and supporting habitats such as broad-leaved deciduous woodland and bogs and marshes (Natural Resources Wales, 2008; JNCC, 2023).

The River Lugg, a major tributary of the Wye and a SSSI, also runs through the study area. The River Lugg has over 121 plant species in it which provide homes for birds, invertebrates, and fish, including European otters, Atlantic salmon, and Trout (*Salmo trutta*). The River Clun also runs through Herefordshire down from Shropshire and is one of three rivers in England that is designated a SAC for Freshwater pearl mussel (*Margaritifera margaritifera*) (Shropshire Council, 2021).

The River Lugg has been identified by NE having declined in salmon, water quality and White clawed crayfish. And the Wye has had a decrease in Macrophytes, Salmon and White clawed crayfish (Johnson, 2023). As for the Clun it is exceeding targets for both phosphate and nitrates (Herefordshire County Council h, 2023). Therefore, nutrient neutrality is required in the Clun and Lugg catchment to enable developments to be built.

Within this section of the report evidence has been collated to give a representation of Hertfordshire's rivers and their health. Because of the declining health of Herefordshire's rivers, and the excess nutrients that is prevalent within them, NE have published advice to developers and LPAs (Natural England a, 2022; Natural England d, 2022). Subsequently, all developments in the Lugg and Clun catchments need to demonstrate nutrient neutrality according to Natural England (NE) (Eustice, 2022).

In recognition of the above issues, NE sent a letter to Herefordshire Council in 2022, as well as other LPAs, advising them under the Habitats Regulations, to carefully consider the nutrient impact of any new plans and projects (including new development proposals) on habitats sites (Natural England c, 2022). LPAs have also been advised to consider whether those impacts may have an adverse effect on the integrity of a habitats site that requires mitigation, including through nutrient neutrality.

NE state in their Nutrient Neutrality Generic Methodology that '*At the screening stage, plans and projects should only be granted consent where it is possible to exclude, on the basis of objective information, that the plan or project will have significant effects on the sites concerned. Where it is not possible to rule out likely significant effects, plans and projects should be subject to an appropriate assessment'* (Natural England d, 2022).

Overall, it can't be ruled out with certainty that excess nutrients are not having an adverse impact on the integrity of protected sites, such as the River Wye and River Lugg, when completing development projects or plans. Nutrient neutrality is a legal requirement in the

Lugg and Clun catchments, the draft local plan will be requiring at least nutrient neutrality for all development proposals in the catchments of special areas of conservation, such as the Wye. The River Wye has recently been downgraded to unfavourable, with an indication that it is declining and that it is moving towards failure. The HCC Local Plan, through strategic policies, will be requiring at least nutrient neutrality for all development proposals in SAC Catchments.

9.2 Nutrient neutrality

Nutrient neutrality is a means of ensuring that a plan or project does not add to existing nutrient burdens so there is no overall increase in nutrients because of the plan or project (Natural England b, 2022). Where nutrient neutrality is required to prevent increased nutrient loading of a designated waterbody, Local Plans and developers need to prove the project or new plans will be nutrient neutral before they are implemented. This comes in the form of nutrient offsetting and the use of phosphate credits, SuDS, or onsite land use change. If onsite mitigation is not possible for developments, off site mitigation can occur by constructed wetlands or other land use changes (Herefordshire County Council c, 2022).

Natural England have developed nutrient budget calculators for the Lugg and Clun catchments to calculate the increase in nutrients from development and the contribution from mitigation measures. The calculators come in the form of Excel spreadsheets and can be accessed online here.

9.3 The current condition of Herefordshire's rivers

Phosphate

Common Standard Monitoring Guidance (CSMG) is guidance developed to provide an agreed approach to the assessment of conditions on statutory designated sites in the UK.

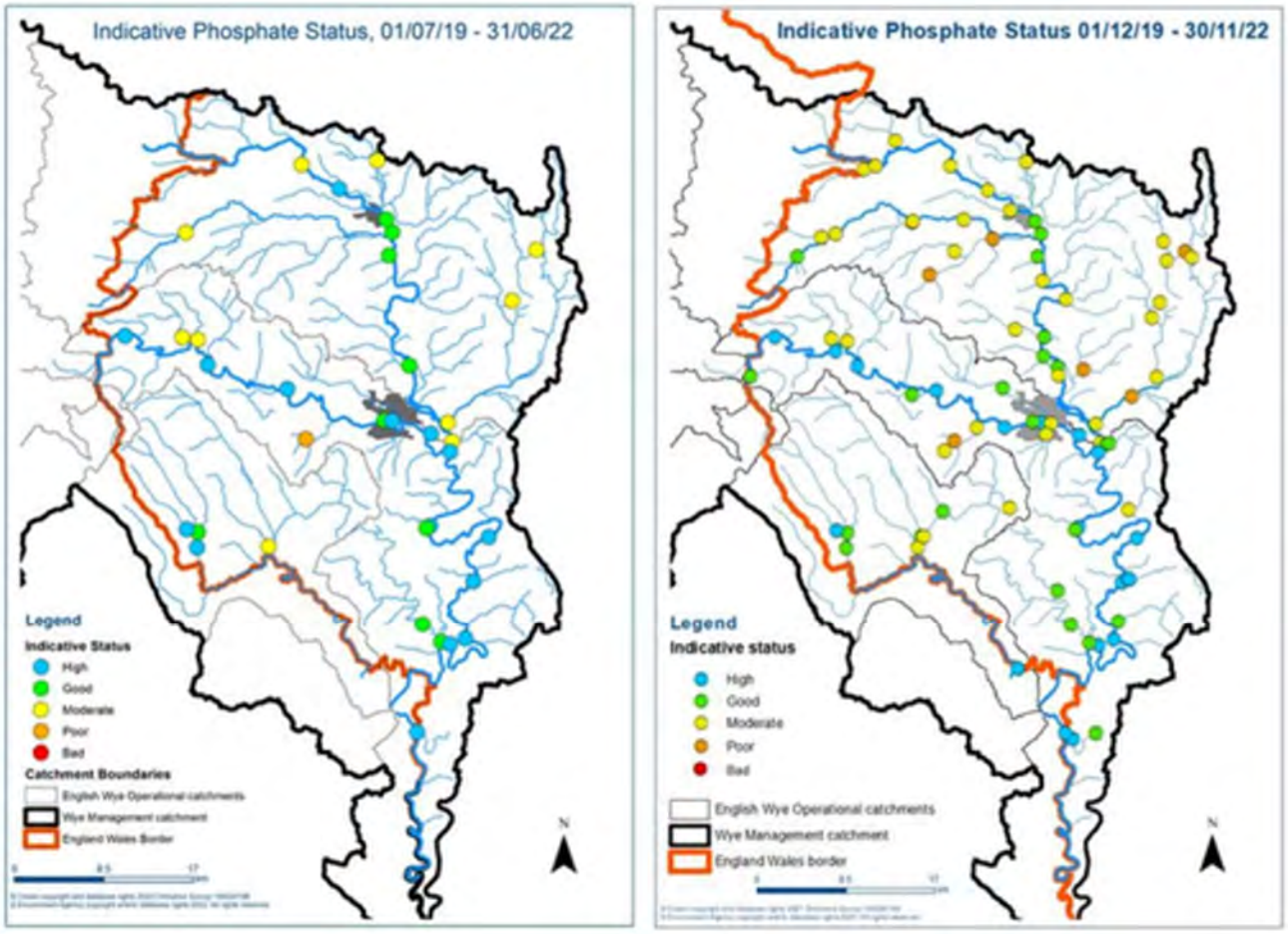


Figure 9-1 Change in indicative status for phosphate calculated for sites within the Wye Management Catchment (between the previous indicative classification from 01/07/2019-30/06/2022 and the most recent indicative classifications from 01/12/2019- 30/11/2022) (Environment Agency I, 2023).

As seen in Figure 9-1, several assessment points within the Wye catchment have a moderate or poor indicative status. When assessing the 3-year rolling average from the CSMG from 2019-2022, three sites across the River Wye SAC had "improved" status and eight sites had "deteriorated" status. These sites are as below:

Improved:

- 50135, Pentaloe Brk D/S Stw(At Rd.Bg) from Moderate to Good 30
- 50192, Moreton Brook At Lugg Conf from Poor to Moderate
- 50195, Bodenham Brook At Conf With Lugg from Poor to Moderate

Deteriorated:

- H0000004, River Monnow At Clodock Mill from High to Good.

- H0000078, R Lugg @ Gilberts Farm and RSN1975, Lugg Ds Hindwell Brook from High to Moderate.
- 50044, R.Lugg @ Hampton Crt.Bdg.Upper, 50119, Coldstone Brk U/S King & Mad STW, 50281, R.Arrow At Pembridge Bridge and RSN0774, Arrow Ds Arrow Green from Good to Moderate.
- 50066, R Frome At Instone Bridge from Moderate to Poor.

The main source of excess nutrients in the River Lugg and River Wye catchments comes in the form of phosphate.

In 2014, the River Wye SAC Nutrient Management Plan stated that within the River Wye WwTWs resulted in >60% of phosphate in the river and that livestock attributed to >20%. (Environment Agency and Natural England, 2014).

In 2020 sources of phosphate within the River Lugg attributed to:

- Agriculture 66%
- WwTWs 25%
- Other 9%

Within the Herefordshire Nutrient Management Board meeting minutes, it was stated that within AMP7 there was an expectation for these percentages to decrease slightly with WwTW upgrades (Herefordshire County Council g, 2020).

In 2023, the EA has apportioned the sources of phosphate within the Wye and Lugg catchments as:

- Agriculture - 72-74%
- Discharge from WwTWs- 21-23%
- Storm overflows- 1-2%
- Other sources such as septic tanks or urban runoff - 3-5%
- Legacy phosphate

(Environment Agency k, 2023)

The 2014, 2020 and 2023 data are not directly comparable, since they use different categories of phosphorus sources, and do not cover consistent geographic areas. Neither do these data sources include information on total loads from the different sectors. However, the data broadly suggests that the relative contribution from wastewater systems has reduced whilst the relative contribution from agriculture has increased and is now the primary source.

RePhoKus is an organisation focussed on redistributing phosphate in the agricultural food production system. They have a focus on understanding the importation and exportation of phosphate in and out of the Wye catchment. There is ~6500 t P/ yr^{-1} imported as animal feed (78%), fertiliser (18%) and detergents (5%). Exports of P total ~3100 t P yr^{-1}. As presented by these numbers, there is more phosphate coming into the catchment than going out of it. It is acknowledged that some of this is consumed by livestock. Further

calculations within the RePhoKus report show that agricultural losses to water amount to ~3000- t P/ yr^{-1} or 17 kg/ $ha^{-1/}$ yr^{-1}. This shows there is an excess of nutrients coming into the catchment, which need to be redistributed or managed better so they do not impact watercourses.

Legacy phosphate is also an issue in Herefordshire. This is where excess phosphate is stored in the soil and sediment of the catchment which can then be released over time causing continuous nutrient loading. For more information about Herefordshire's legacy phosphate click here.

Ammonium

Ammonium is another form of nutrients in Herefordshire, although it is not harmful to aquatic life. It is often associated with poultry farming, which occurs in the River Wye and Lugg catchments. Within a report published by the EA, spikes in Ammonium have been found to correlate with rainfall (Environment Agency I, 2023) see Figure 9-2

and Figure 9-3. The spikes identified in the data have been linked to peaks in ammonium after rainfall events by the EA. This has also been mirrored in the Lugg and Arrow catchments (Environment Agency I, 2023).

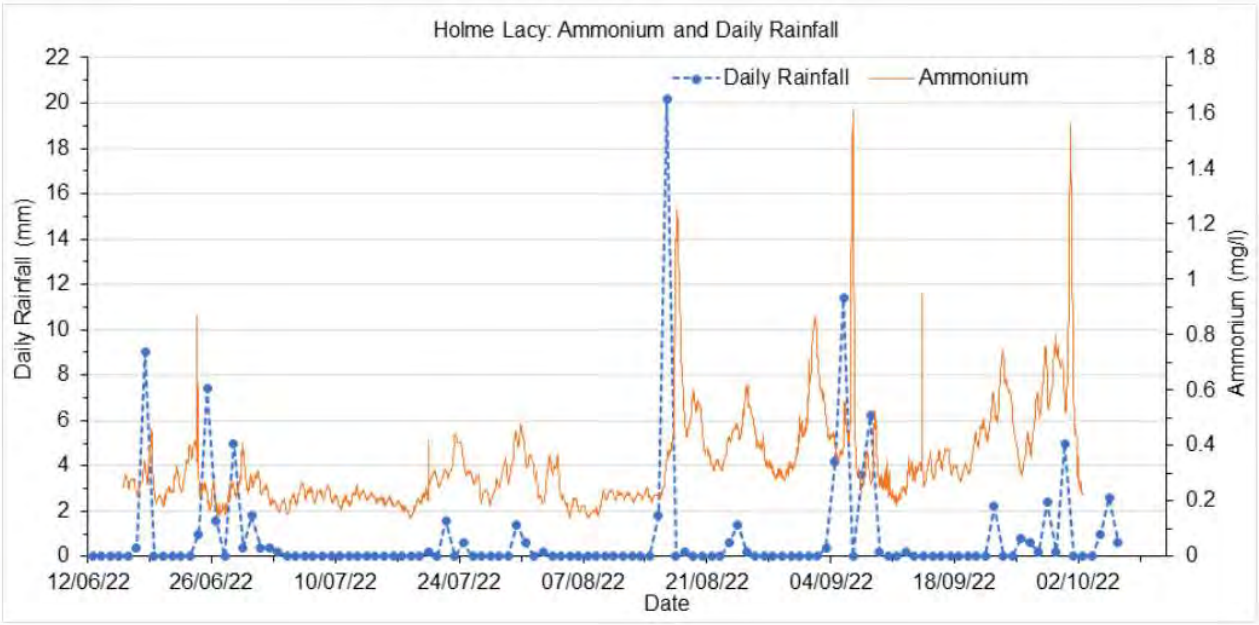


Figure 9-2 Time series of daily rainfall and ammonium recorded from Holme Lacy (Environment Agency I, 2023).

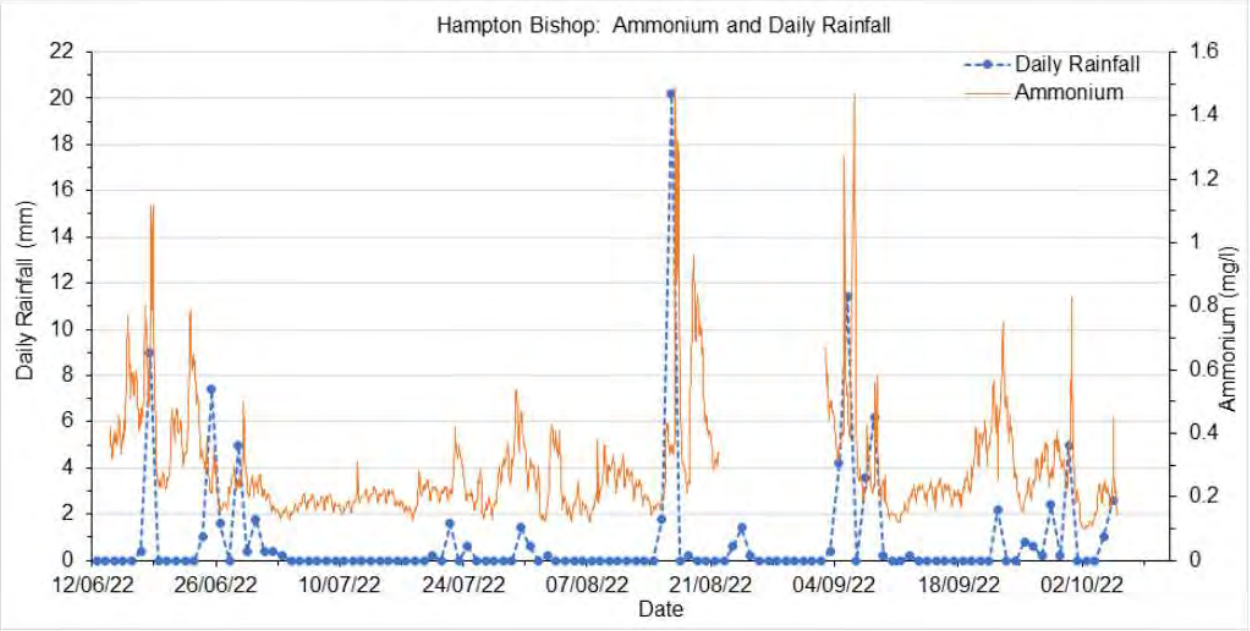


Figure 9-3 Time series of daily rainfall and ammonium recorded from Hampton Bishop (Environment Agency I, 2023).

Ammonia

Ammonia has one less hydrogen atom than ammonium making it more harmful to aquatic wildlife and habitats. The EA have produced a graph showing the long term annual average Ammonia concentration, see Figure 9-4. From 1993 Ammonia stayed below 0.1 mg/l apart from a spike to 0.12 mg/l in 2015.

Ammonia is ranked "High" in the latest WFD cycle assessment. High levels of Ammonia can lead to overgrowth of algae called eutrophication and subsequent degradation of wildlife health.

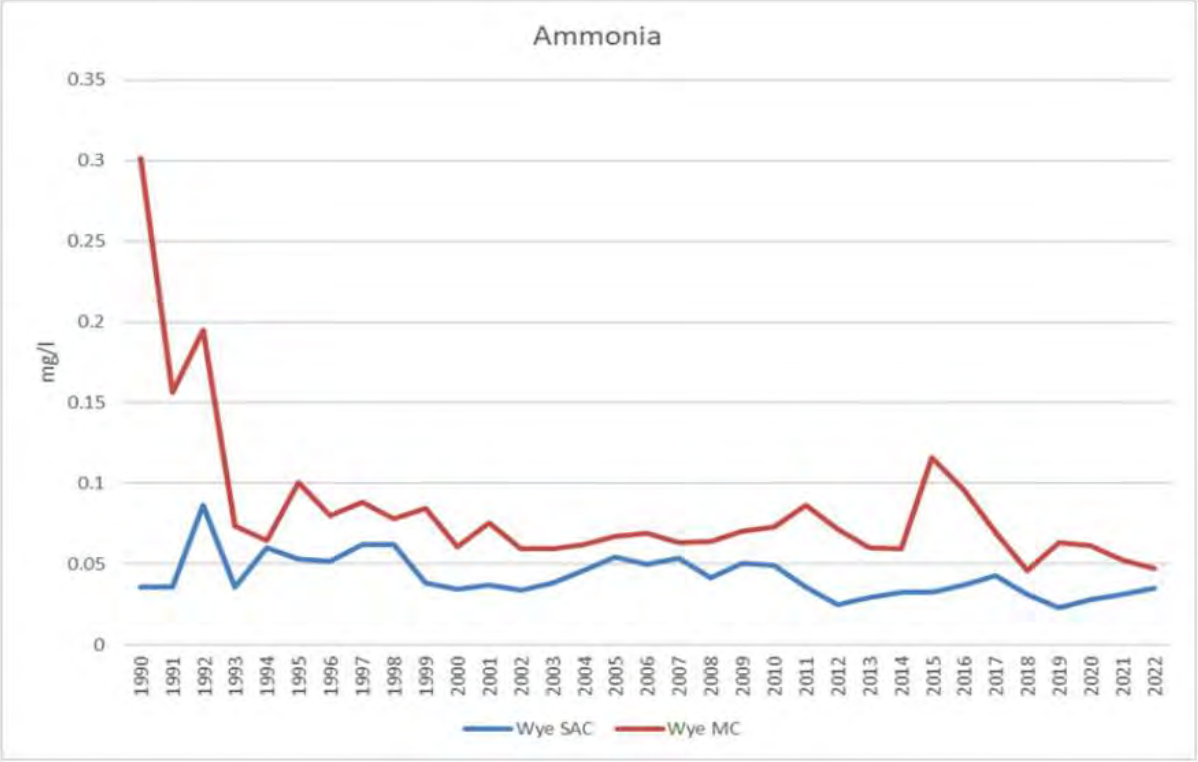


Figure 9-4 Long term annual average ammonia data (mg/l) for English section of the Wye SAC and the English Wye Management Catchment (Wye MC) (Environment Agency I, 2023).

Nitrate

In the EAs 2022 River Wye Management Catchment report, the number of chicken sheds per hectare was compared to the mean oxidised nitrogen, also known as nitrate, found in operational catchments from 2018-2021.

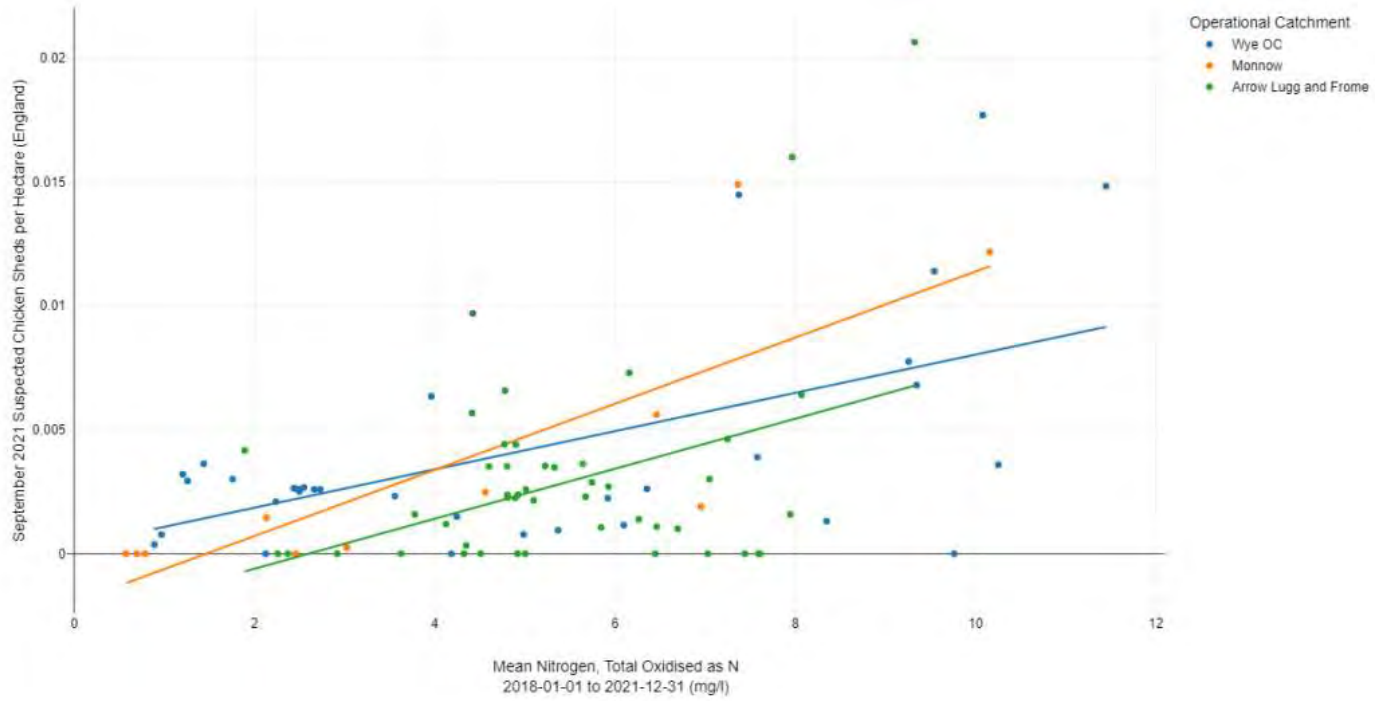


Figure 9-5 Correlation between number of chicken sheds in a catchment and total oxidised nitrogen, estimated using analysis of satellite imagery (Environment Agency, 2022)

As seen in Figure 9-5, the higher the number of chicken sheds, the more nitrate found.

9.4 Farm nutrient management

Agriculture is a large contributor to excess nutrients within the River Wye. The Wye and Usk Foundation (WUF) work with farmers, advising them on how to improve nutrient management, including advice here.

A key issue highlighted by the WUF is that the time when fertiliser and manure is spread needs to be carefully considered. Weather and soil conditions are important when aiming to decrease run off and thus excess nutrients within the watercourses. In times of higher rainfall, runoff of excess nutrients is more likely. The WUF suggest spreading fertiliser at least 10m away from watercourses and at a rate that suits the crop requirement to decrease leaching or runoff (WUF, 2022).

Another focus is on farmyard infrastructure, and the importance of storing fertiliser, manure and silage correctly so excess nutrients is not spread by rainwater. This entails having watertight areas / covering silage correctly as well as having guttering connected to a clean water drainage system.

If the effluent produced during the fermentation of silage gets into a watercourse it can strip out the oxygen, causing aquatic life to suffocate (WUF b, 2023). Excess nutrients from fertiliser and manure can also have adverse effects such as eutrophication causing algal blooms.

Further information on agricultural management can be found in Section 11.5.1.

9.5 Other nutrient inputs and guidance

9.5.1 Package Treatment Plants (PTP)

Herefordshire Council have Interim Guidelines towards Package Treatment Plants (PTP) within the Lugg catchment (Herefordshire County Council e, 2023). PTPs are small treatment facilities used for developments which are located too far from a public sewerage system to make connection viable. The Environment Agency would usually object to any plans to install a PTP where the distance from the development site boundary to a public sewer is less than 30m multiplied by the number of dwellings.

Discharges from septic tanks directly into surface waters are no longer legal so must now either be upgraded to a PTP or be fitted with a drainage field. Discharges to ground may use septic tanks or PTPs, but in either case the discharge should be via a drainage field (an array of perforated pipes set in a permeable bedding material). The guidelines provided by Herefordshire Council provide an argument for PTPs being used to work towards nutrient neutrality or decreasing nutrient outputs.

Old model PTPs have a mean effluent concentration of approximately 9.7 mg/l (May and Woods 2016) and septic tanks have a mean concentration of 11.6 mg/l (O'Keeffe et al, 2015). Emerging PTP technology may have the potential to have an output of less than 1 mg/l (WTE Ltd., 2023). These figures are used in Natural England's budget calculator and support the idea of replacing septic tanks or old PTPs with new more efficient PTPs. However, specific consideration of each project is required to determine whether these kinds of measures can contribute to achieving nutrient neutrality.

9.5.2 Wastewater Treatment Works

WwTW permits are typically set at 5mg/l where no tertiary phosphorus removal processes are installed. Where phosphate removal processes are in place, permits typically range between 2.0mg/l and 0.25mg/l. In 2018 the Technically Achievable Limit for phosphate was reduced from 0.50 mg/l to 0.25 mg/l, following trials of new treatment techniques under the Chemicals Investigation Programme (CIP) (UKWIR, 2018).

Tertiary phosphate removal normally consists of chemical and biological phosphorus removal processes resulting in a reduction of total phosphorus to 0.5 mg/l - 1 mg/l (Neethling et al., 2007). The above figures in this section and Section 9.5.1 highlight why connection to the public sewer is preferable.

9.5.3 Drainage Fields

Drainage fields are areas where PTPs, septic tanks or smaller WwTWs discharge to groundwater. There are a number of conditions that have been produced by Herefordshire Council along with Natural England to assess whether each drainage field is to be 'screened out' of the Habitats Regulation Assessment process. The conditions put forward in the criteria document are:

- "The drainage field is more than 50m from the designated site boundary (or sensitive interest feature.
- The drainage field is more than 40m from any surface water feature e.g., ditch, drain, watercourse.
- The drainage field is in an area with a slope no greater than 15%.
- The drainage field is in an area where the high-water table groundwater depth is always at least 2m below the surface.
- The drainage field will not be subject to significant flooding, e.g., it is not in flood zone 2 or 3.
- There are no other known factors which would expedite the transport of phosphorus for example fissured geology, insufficient soil below the drainage pipes, known sewer flooding, conditions in the soil/geology that would cause remobilisation phosphorus, presence of mineshafts, etc.,
- To ensure that there is no significant in combination effect, the discharge to ground should be at least 200m from any other discharge to ground."

(Herefordshire County Council a, 2022).It is possible to have a drainage field which does not conform to the above conditions, so long as it meets general binding rules, but it will require an Appropriate Assessment if it falls in a nutrient neutral catchment.

9.6 Citizen science

Citizen science has been used by the WUF to measure water quality changes within Herefordshire. The WUFs citizen science groups monitoring areas cover 339 sites within the Wye catchment.

As seen in Figure 9-6, in 2017 the annual average reactive phosphate measures just above 0.05 mg/l, and after a slight increase in 2018, the reading in 2022 decreased to 0.28 mg/l.

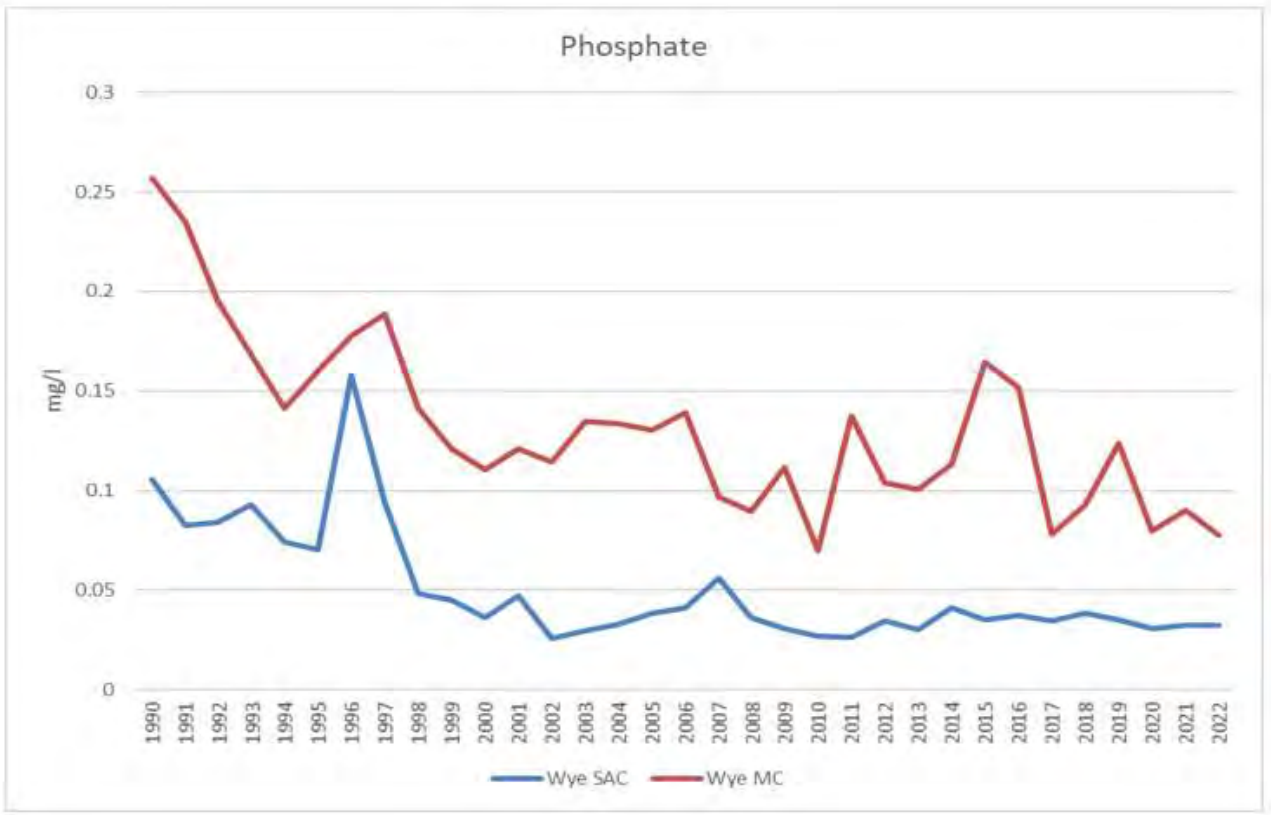


Figure 9-6 Long term annual average phosphate concentration (mg/l) for English section of Wye SAC and the English Wye Management Catchment (Wye MC) *.

Graph source: (Environment Agency I, 2023)

*Maps of the Wye SAC and Wye MC areas are included in Appendix E.

The WUFs citizen science group also created a water quality monitoring report from March 2021- February 2022. The report presents findings from monitoring points along the river Wye. When measuring phosphorus, multiple testing methods were used (EA labs, Hanna checker, NRW lab and test strips) and averages from each season were calculated. The tests found that over all season's phosphate was higher in the English section of the Wye. In Wales, most of the mean phosphate readings measured less than 0.05ppm PO4-P across all seasons. Hotspots in the Welsh section of the Wye according to the report were:

- Afon Llynfi
- Afon Iethon
- Afon Irfon

In the English section of the Wye there is higher variability in results than in the Welsh section. All results can be seen in the monitoring report mentioned above.

9.6.1 Citizen science data validation and inclusion in modelling during stage 2

It may be possible to validate the Phosphorus readings taken by the WUF using the data within the regulatory SIMCAT models at the same location. If the readings were found to be valid when compared, the models could be refined to include the WUF data, where there

isn't currently measured data (e.g., small tributaries of the Wye), which could produce more representative results in these tributaries. The extent of regulatory water quality monitoring can be a limiting factor in modelling, there is potential including this data would enhance the process, which could be targeted towards water bodies receiving effluent from WwTWs with significant volumes of planned development.

9.7 Nutrient Trading

Nutrient trading is a process of offsetting additional nutrient load from new developments by reducing existing nutrient emissions, either on or off-site of the new development, thereby creating nutrient credits. In cases where offsite mitigation is needed, land use change, such as creating integrated wetlands or removing land from agricultural production, can offset anticipated nutrients from new developments. The credits created from the offsetting of the anticipated increase of nutrients are then traded between the mitigation owner, commonly the LPA or private landowners, and developers.

Although this is an option for developers to build within the constraints of nutrient neutrality, limiting the amount of nutrients at the source should be prioritised. For example, updating septic tanks to PTPs, upgrading WwTWs or including SuDS within developments (see Section 11.5.6).

9.7.1 Herefordshire Councils Integrated Wetland Project

An integrated constructed wetland (ICW) is an artificial wetland created for the purpose of treating effluent, usually following primary or secondary treatment, including 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. In the case of Herefordshire these consist of natural reedbeds that are designed to absorb phosphate before discharging to the River Lugg or other tributaries. In 2021 HC produced a Nutrient Certainty Update for Developers (Herefordshire County Council b, 2021) and purchased two sites to generate nutrient credits from for their Integrated Wetland Project.

In May 2022 a framework was agreed for the introduction of phosphate credits. The up-front funding for the Integrated Wetland Project came from the Council's New Homes Bonus and will be supplemented by Marches Local Enterprise Partnership through the Getting Building Funds (Herefordshire County Council c, 2022). One of the sites is close to a DCWW plant near Luston, the location of the second site is unknown at the time of writing. It is unknown if any further wetlands will treat effluent from other WWTWs.

10 Water Quality

10.1 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.

10.2 Herefordshire in the wider catchment

This section provides an understanding of how Herefordshire fits into the wider catchment. By knowing Herefordshire's position in the catchment, it can help in understanding where changes need to be made.

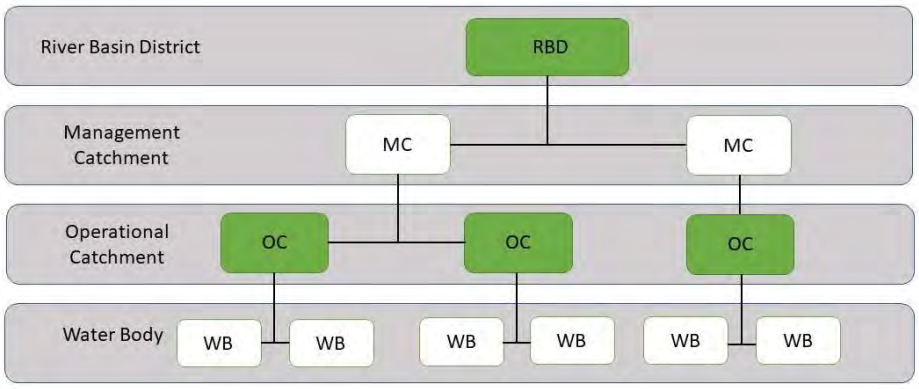


Figure 9.1 Catchment hierarchy (adapted from an Environment Agency diagram)

The Severn River Basin District (RBD) covers the study area and is an amalgamation of 11 Management Catchments (MCs). The Wye MC, Severn Vale and Teme MCs cover the study area. Within the Wye MC there are 3 operational catchments (OCs) that the study area falls into, these are the:

- Monnow
- Arrow Lugg and Frome
- Wye OC

The Teme MC has three OCs with the Teme Lower OC covering the north part of the study area. The Severn Vale has eight OCs which includes the Leadon OC that covers the area to the east of the study area. The waterbodies are shown in Figure 10-1.

10.3 Methodology

A qualitative assessment was conducted using available data on WFD Cycle 3 status for the receiving watercourse, forecast growth for each WwTW and existing water quality assessments conducted on each WwTW where available.

10.4 Results

10.4.1 Water Framework Directive Overview

The Water Framework Directive (WFD) aims to ensure "no deterioration" in the environmental status of rivers and sets objectives to improve rivers to meet "good" status. LPAs must have regard to the WFD and associated statutory objectives as implemented in the EA's River Basin Management Plans (RBMPs).

Figure 10-1 Overall WFD status of watercourses in and around Herefordshire and Table 10-1 WFD overall status of watercourses in the study area show the overall WFD classification (2022) for waterbodies in Herefordshire (a full list of watercourses can be found in Appendix C). This is usually assessed in WCSs for each of the waterbodies that are predicted to receive additional effluent from growth during the plan period. Several of the WwTWs discharge to small watercourses which do not have a WFD classifications.

The overall WFD status is made of Ecological and Chemical status, which are further broken down into sub-elements, the measurement of which is prioritised for each waterbody based on its characteristics and risk, hence not all elements are reported for every waterbody.

Table 10-1 WFD overall status of watercourses in the study area

Status	Bad	Poor	Moderate	Good	High
Overall Status	2	10	31	24	0

Within the Severn catchment there are several significant water management issues identified using the EA's "reasons for not achieving good" database. These issues are:

- Agriculture and rural land management
- Water industry
- Local and central government
- Urban and transport

The above issues can lead to pollution from rural areas, changes to the natural flow and level of water and physical modifications of watercourses (Environment Agency i, 2022).

All waterbodies in the Wye MC are natural rivers, canals, and surface water transfers (Environment Agency h, 2022). All 51 waterbodies fail the chemical status for surface water

under the WFD classification. An overview of the catchments ecological status is summarised in Table 10-2.

Table 10-2 Ecological status for surface water in the Wye Management catchment

Ecological status or potential	Bad	Poor	Moderate	Good	High	Total
Number of waterbodies	3	11	33	4	0	51

When considering chemical status in Cycle 3 from the EAs assessment of English waterbodies, all waterbodies have the status of 'does not require assessment', see Appendix C. This is because reflecting on the Cycle 3, 2019 data collected for chemical status all waterbodies in England failed because of a high level of four groups of global pollutants, also known as ubiquitous, persistent, bio-accumulative, and toxic substances (uPBTs). The four groups are:

- Polybrominated diphenyl ethers (PBDEs- a group of brominated flame retardants)
- Mercury
- Certain Polycyclic aromatic hydrocarbons (PAHs)
- Per- and polyfluoroalkyl substances (PFAs) - which includes PFOS

Other ubiquitous chemicals in the environment include pharmaceuticals and hormones.

Within the EAs Catchment Data Explorer, there is a map available showing the chemical status of waterbodies without the uPBTs being assessed. Within the Herefordshire study area, all waterbodies pass chemical status with the omission of the uPBTs, apart from Yazor Brook which also fails on Nickel (Environment Agency m, 2022).

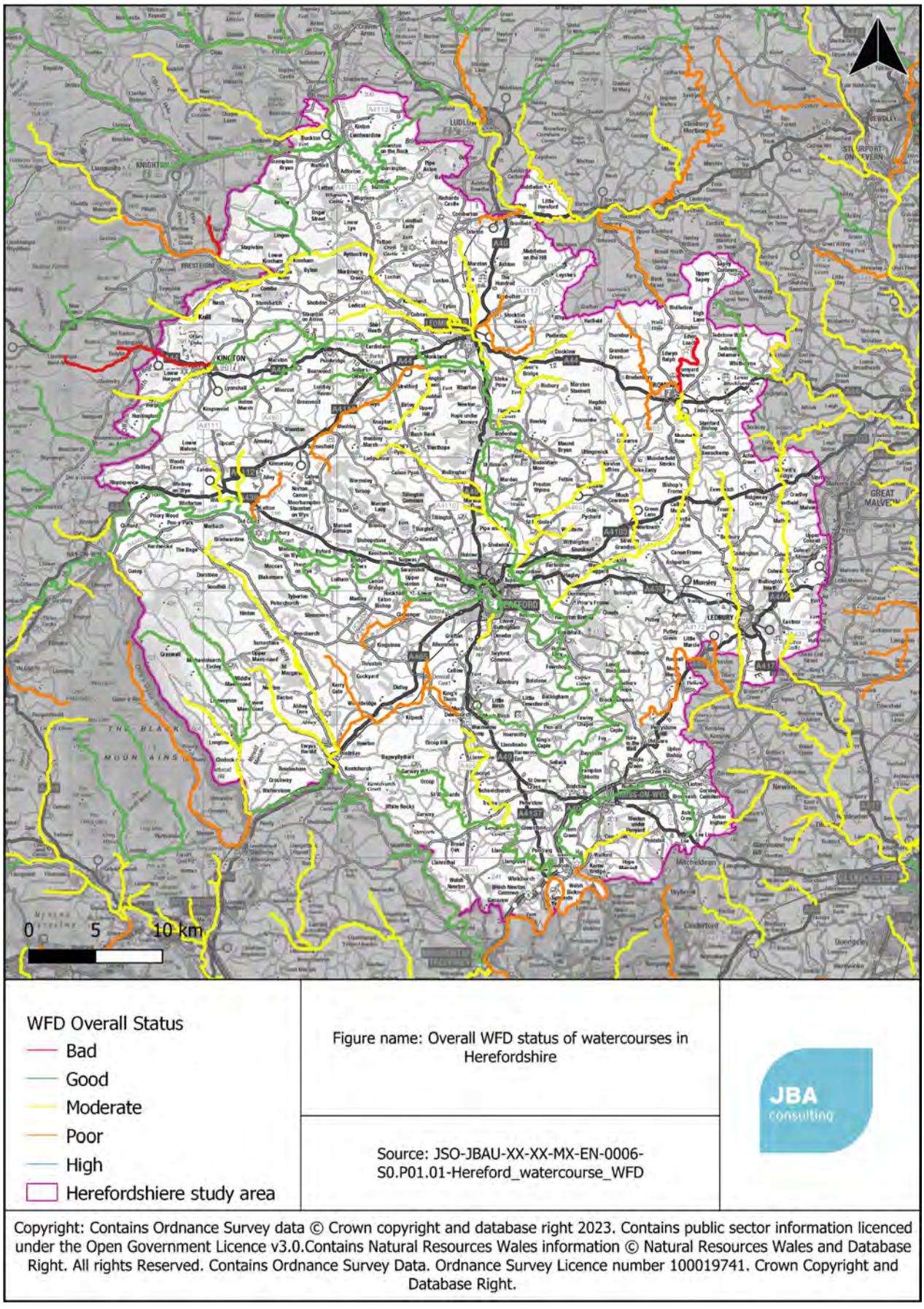


Figure 10-1 Overall WFD status of watercourses in and around Herefordshire

10.5 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 on 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.

Consideration should be given to 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 11.5.
- 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.

10.6 Conclusions

Growth during the local plan period will increase the discharge of treated wastewater from WwTWs in Herefordshire. There is a potential for this to cause a deterioration in water quality in the receiving watercourses and this must be carefully considered. Water quality modelling to test potential impacts is recommended in a Stage 2 WCS.

10.7 Recommendations

Action	Responsibility	Timescale
Provide annual monitoring reports to STW and DCWW detailing projected housing growth in the Local Authority	Herefordshire	Ongoing
Take into account the full volume of growth (from Herefordshire and neighbouring authorities) within the catchment when considering WINEP schemes or upgrades at WwTW	STW and DCWW	Ongoing

10.8 Proposed modelling methodology for stage 2

10.8.1 Overview

The specific issues around nutrient management in the Lugg, Wye and Clun catchments warrant a more detailed analysis of water quality than a typical WCS. This proposed scope was developed following discussion with the Council. We recommend that it be reviewed by the EA and NE prior to implementation.

Herefordshire is covered by two of the EA's regional SIMCAT water quality models, the majority in the Wye model and a small area in the Severn model. There are proposed allocation sites within both catchments, therefore both models will need to be used for this study.

We propose to examine the impact of planned growth, potential change in diffuse pollution and future climate change on the quality of rivers in Herefordshire. The effluent standards needed to achieve 'good' status in rivers, now and in future will be determined. An assessment will take place to see whether the planned growth could, in future, prevent rivers reaching 'good' ecological status, in the case they were classed 'good' upstream of the WwTWs.

The modelling will include an assessment of how, or whether, nutrient neutrality can be achieved. This will consider WwTW upgrades using industry best practice for phosphate removal (known as the Technically Achievable limit of 0.25mg/l), and theoretical reductions in diffuse agricultural sources of phosphate.

10.8.2 Modelling approach

In total there will be 40 model simulations, 20 for both Wye and Severn models. The variables that will be changed across the simulations will be:

- The impact of employment and housing growth on wastewater effluent flow between baseline and future.
- The diffuse pollution values will be adjusted by 10% +/- from the baseline.
- Climate change will be accounted for by adjusting the river flow for medium and high climate change scenarios, and increasing water temperature by 1.5ºC (or catchment-specific values if an ongoing EA science project on future water temperatures is available in time).

For further detailed information of the individual model runs planned, see Appendix F.

10.8.3 Reporting

Tables showing comparisons between selected runs for the WwTWs modelled will be presented, results shown graphically as maps of the rivers within the model regions will also be included. From the results, WwTWs that could lead to a deterioration in WFD class status, and under what conditions will be identified, for Phosphate, Ammonia and Biochemical oxygen demand. The effluent quality requirements needed, up to the technically achievable limit, to prevent a deterioration in class will be reported. The allocation and reasonable alternative sites can then be selected to ensure river water quality deterioration doesn't occur and that meeting 'good' status is not prevented in future by the planned growth.

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. In the context of a Water Cycle Study, the impact of development on the aquatic environment is under assessment.

A source-pathway-receptor approach can be taken to investigate the risk and identify where further assessment or action is required.

11.2 Sources of pollution

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 unlicenced 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

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. 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. After or during heavy rainfall, the first flush of water carrying accumulated dust and dirt is often highly polluting.

Whilst the threat posed by an individual site may be low, a number of sites together may pose a cumulative impact within the catchment.

Runoff from development sites should be managed by a suitably designed SuDS scheme. 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.

11.3 Pathways

Pollutants can take a number of different pathways from their source to a “receptor” – a habitat or species that can be impacted. This could be overland via surface water flow paths, via the river system, or via groundwater or a combination of all three.

11.4 Receptors

A receptor in this case is a habitat or species that is adversely impacted by a pollutant. Both the rivers and groundwater as well as being pathways, can also be considered to be receptors.

Within the study area and downstream are many sites with environmental designations such as:

- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)
- Sites of Special Scientific Interest (SSSI)
- Ramsar sites (Wetlands of International Importance)
- Priority Habitats and Priority Headwaters

A description of these, and the relevant legislation that defines and protects them, can be found in Section 3.7. Sites such as functional linkage habitats such as those that support migratory species (these habitats are not always designated) should also be considered as receptors.

In order to identify protected sites that may be at risk, Flood Zone 2 from the Risk of Flooding from Rivers and the Sea mapping was used to define an area that was either adjacent to a river or could be reasonably expected to receive surface water from a river. Where a WwTW was present in the catchment upstream of the protected site, it was considered that there was a risk of deterioration in water quality due to growth during the local plan period, all upstream WwTWs must also be considered in future analysis. Where there were no WwTWs serving growth upstream, risk of deterioration is considered to be low, and would not be shown by water quality modelling. However, in these cases the overall catchment water quality should be considered where for example they are designated for migratory fish species that may spend part of their lifecycle elsewhere in the catchment.

Priority Habitats are available to view on the DEFRA Magic Map website, which can be accessed here.

There are 146 SSSIs considered in the screening, including sites outside of Herefordshire that are downstream of treatment works, and as such, could be impacted, these are shown in Figure 11-1. These sites are listed in Appendix B, with the above criteria applied. There are 20 sites which meet both criteria.

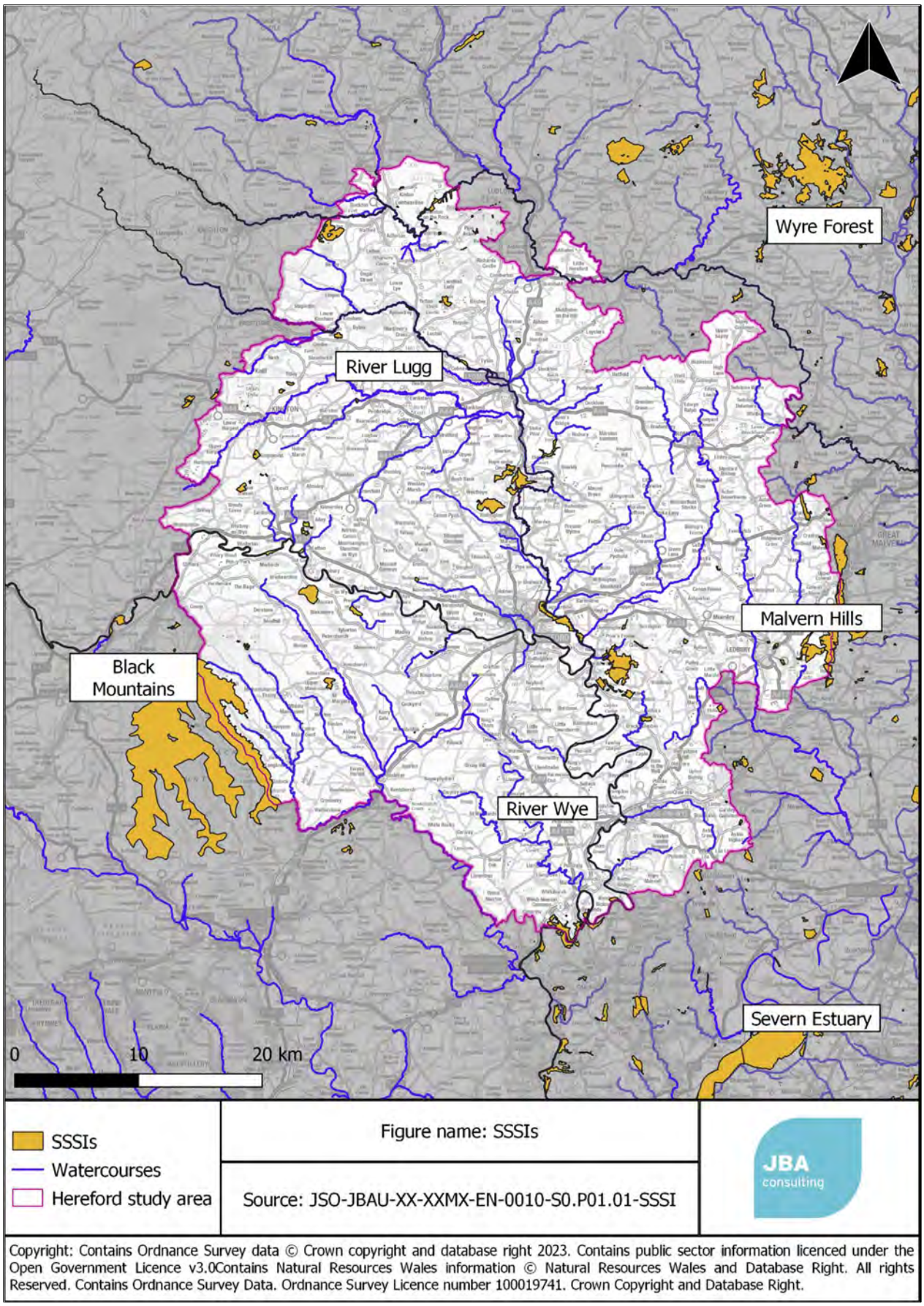


Figure 11-1 SSSIs in Herefordshire

The River Lugg and the River Wye run throughout the study area and are SSSIs. The Severn Estuary is to the south of the study area, this site is a SSSI, Ramsar, SAC and SPA. There are no other Ramsar of SPA sites within or around the study area but there are connections to the Severn Estuary SAC and species assemblage which may be affected by negative impacts to receptors such as decrease in water quality.

SAC designated sites in the study area are shown in Figure 11-2.

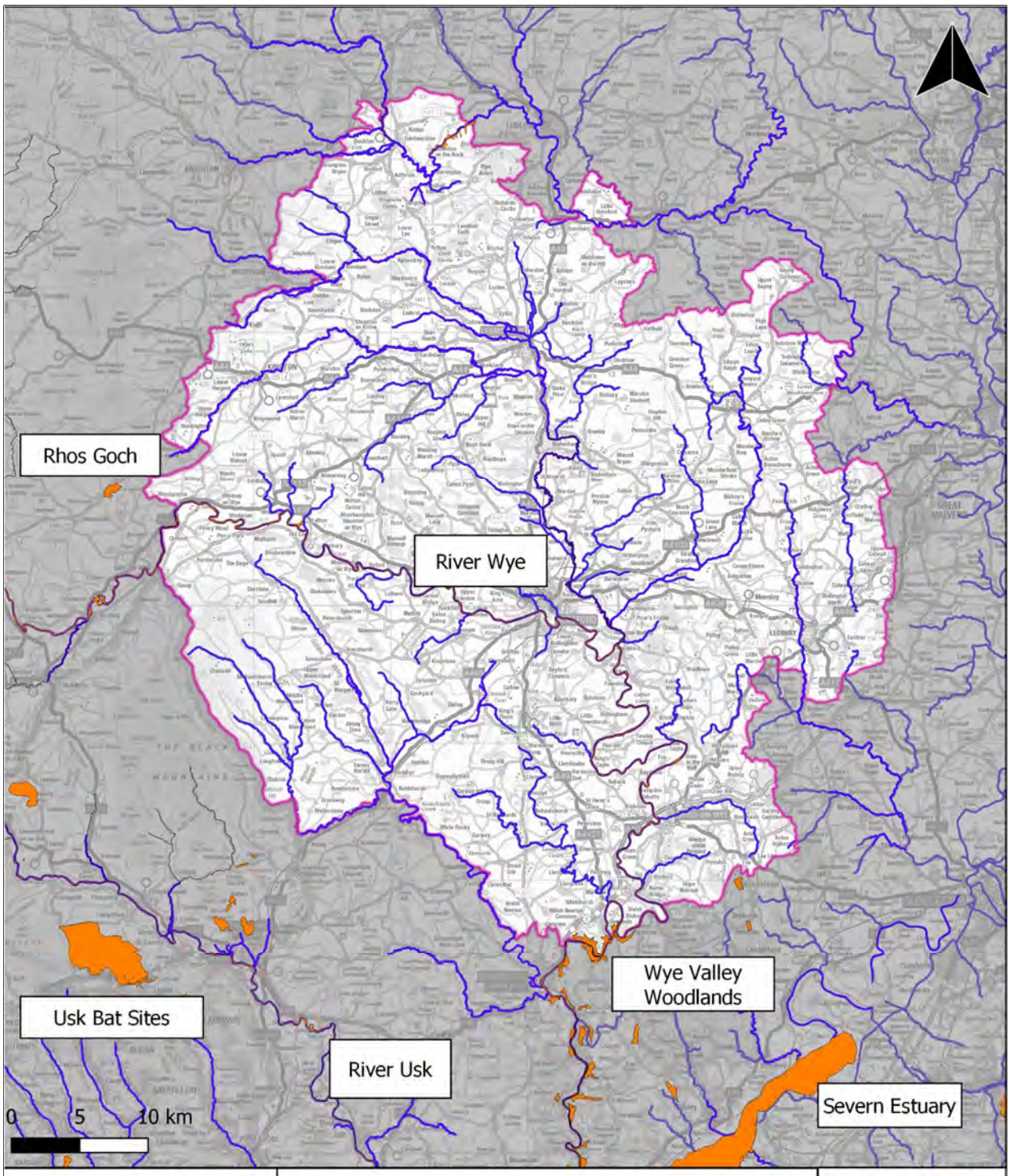


Figure 11-2 SAC sites in and around Herefordshire

11.5 Protection and mitigation

11.5.1 Agricultural Management

The Environment Agency's 'Reason for Not Achieving Good' database indicates that one of the reasons for some of the watercourses in the district are not meeting 'Good' WFD standards can be related to agriculture and rural land use. The cause of this includes pollution from fertilisers, manures, pesticides, and soils washing into streams when it rains or percolating into the groundwater. Other pressures from agriculture include deepening, widening or re-routing of streams for land drainage, gravel removal and bankside erosion.

There is a big potential to improve water quality by interventions aimed at agricultural sources, especially considering the measures already taken by the water companies to reduce their contribution to phosphate load.

Potential schemes could include:

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

There is considerable overlap with Natural Flood Management (NFM) measures, and the challenges are also very similar. Exact impacts are difficult to measure, although modelling tools such as Farmscoper exist to help with this (ADAS, 2023). 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.

The Farming Rules for Water is a resource to help those in agricultural industries to reduce and prevent diffuse water pollution. This includes planning the application of organic manures and inorganic fertilisers and the assessment of crops and soil when planning. Further information can be found here.

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

11.5.2 Barriers

Whilst there are many benefits to implementing NFM and constructed wetlands, or modifying agricultural practises, the impact of these techniques is hard to quantify, and relies on ongoing maintenance to maintain that benefit. Where a potential scheme is not on a development site it will also require permission and support of the landowner. It may not be possible to influence this through planning policy.

11.5.3 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. Sites within Herefordshire that could be considered as sources of additional runoff, and receptors in the form of sites with environmental designations are summarised in Appendix B. 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 site 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.

11.5.4 Groundwater Protection

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 it 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 outlining its approach to groundwater protection which includes direct discharges to groundwater, discharges of effluents to ground and surface water runoff (Environment Agency e, 2018). This is of relevance to this water cycle study where a development may manage surface water through SuDS.

Groundwater is an important source of water in England and Wales, and half of Herefordshire water supply is derived from groundwater sources.

Sewage and trade effluent

Discharge of treated sewage of 2m^3 per day or less to ground are called small sewage discharges (SSDs). Most SSDs do not require an environmental permit if they comply with certain qualifying conditions. A permit is required for all SSDs discharging into a 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 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 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 for sustainable drainage systems (UK Government n, 2015) – these should be used in conjunction with the NPPF and PPG; and
- use a SuDS management treatment train (see section 11.5.5)

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 Herefordshire

Source protection zones (SPZs) form a key part of the Environment Agency's approach to controlling the risk to groundwater supplies from potentially polluting activities and accidental releases of pollutants. The Environment Agency's approach to groundwater protection, (Environment Agency, 2018), is a position statement which sets out a tiered, risk-based approach to protecting groundwater.

Proposed development locations within or close to Source Protection Zones, should be assessed in relation to the Environment Agency guidance, which identifies some forms of development that they will object to within specific SPZs. For residential development, this specifically relates to:

- Sewage effluent discharges inside SPZ1
- Infiltration SuDS in SPZ1 (except where these serve only roof water)

For employment sites the specific guidance related to proposed uses should be followed. SPZs that are present in the study area are shown in Figure 11-3.

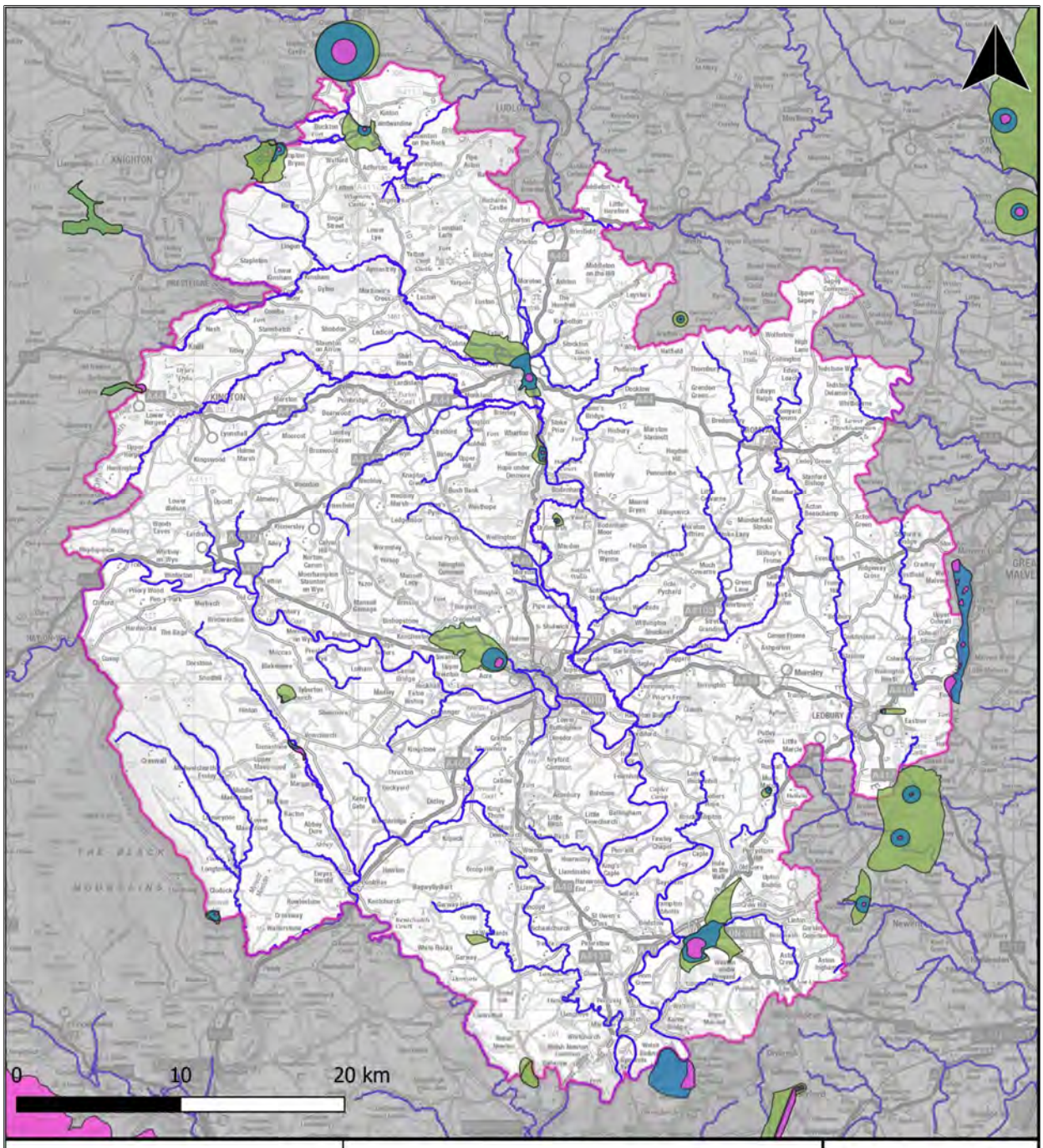


Figure 11-3 Source Protection Zones

11.5.5 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 several 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 Table 11-1.

Table 11-1

Table 11-1 Considerations for SuDS design for water quality

Consideration	Details
	Where practicable, treatment systems should be designed 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 delt 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	SuDS design should consider the likely presence and significance of any contaminate that may pose a risk to the

Consideration	Details
	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 ensure 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 ladings 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.

11.5.6 Use of SuDS in Nutrient Neutrality

The report 'Using SuDS to reduce phosphorus in surface water runoff', agreed with Natural England, (CIRIA, 2022). Sets out the necessary SuDS deployed as 'treatment trains' to achieve phosphorus removal from residential surface water runoff. This focuses on SuDS as a mitigation for sensitive receiving waters and conservation sites. It has examples of good practice which can be used by developers when designing residential developments.

Multiple types of SuDS can be used for phosphorus removal, at varying efficiencies, including:

Swales, Detention basins, Retention basins, Wetlands, Ponds, Rain garden, Tree pits, Floating wetlands, Filter strips, Filter drains, Permeable paving.

Swales are a type of SuDS used to manage surface water consisting of a linear depression, usually in grass, which routes surface water to a storage or discharge system. The grass

acts as a filter and slows down surface water movement allowing oily residues and sources of pollution to be broken down in the top layer of soil and vegetation. Aside from water being conveyed to storage of discharge points (SuDS Wales, 2023).

Within the Environmental Protection Agencies (EPA) Stormwater Management Model Reference Manual (EPA, 2016) it was found that swales have a TP removal rate/ concentration treatment of 29-45%. Another source found that the removal rate/ concentration treatment was 58-78% (Pratt, 2004).

The first step of the treatment train should be to infiltrate as much runoff as possible and then capture sediment, which can remove considerable proportions of phosphorus and protect further treatment methods from becoming clogged. A treatment train which includes vegetated features can remove part of the dissolved phosphorus. Each site is unique and understanding the characteristics of soil type, infiltration potential and seasonal groundwater level etc. should be established before designing begins (CIRIA, 2022).

11.5.7 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. 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 scarce 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.

11.5.8 Suitable SuDS Techniques

The hydraulic and geological characteristics of each property development site across Herefordshire should be assessed to identify the most appropriate forms of surface water management and any constraining factors to the utilisation of SuDS. These assessments are designed to inform the early-stage site planning process and should be followed up the site-specific detailed drainage assessments.

Appropriate SuDS techniques have been categorised into five main groups, as shown in

Table 11-2. 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 11-2 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

11.5.9 Integrated constructed wetland management

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 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, except for nitrite 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 (DEFRA, 2015).

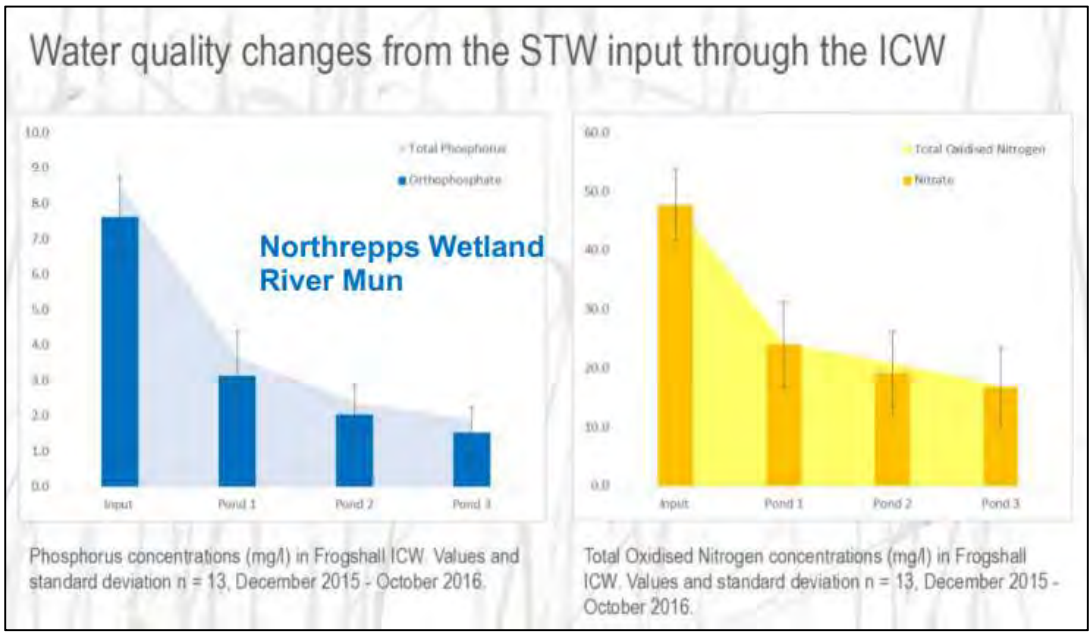
The mean reduction in Total Phosphorus across the evidence base was 78%.

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) (Norfolk Rivers Trust, 2018).

11.5.10 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 Herefordshire 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 retention 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 (Gov.UK, 2021) to support the implementation of NFM and with JBA produced maps showing locations with the potential for NFM measures (Environment Agency j, 2020). 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.

11.5.11 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 water quality.

Many NFM measures can 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.)

11.5.12 Nature Based Solutions (NBS)

Nature Based Solutions (NBS) is an umbrella term for are actions that enhance nature in a way that solves environmental challenges. NFM and SuDS are two types of NBS, but there are many others. For example, building a wetland which can help improve water quality and increase biodiversity for wildlife.

NBSs can also be used as additional treatment of wastewater by creating Integrated Constructed Wetlands (ICW). This in turn can also help increase habitats for wildlife, as well as natural flood management.

Water companies are known to work with the Wildlife Trust to deliver catchment projects, when presenting this topic, the EA state that 'we would encourage optioneering to promote integrated solutions'.

11.6 Conclusion

The potential impact of development on a number of protected sites such as SAC and SSSIs within, or downstream of the study area should be carefully considered in future plan making.

There are several Groundwater Source Protection Zones, in the study area. The impact of future development on groundwater should be investigated fully.

Development sites within the study area could be sources of diffuse pollution from surface runoff.

SuDS are required on all development sites. Their design should consider both water quantity and water quality and site level investigations should be undertaken to define the most appropriate SuDS types for each specific development.

Opportunities exist for these SuDS schemes to offer multiple benefits of flood risk reduction, amenity value and biodiversity.

Herefordshire Council should be consulted at an early stage of development to ensure that 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.

11.7 Recommendations

Table 11-3 Recommendations for managing environmental opportunities and constraints

Action	Responsibility	Timescale
Consider the environmental impact of development on protected sites downstream of receiving wastewater treatment works in the Habitats Regulations Assessment	HC	Local Plan Development
The Local Plan should include policies that require all development proposals with the potential to impact on areas with environmental designations to be considered in line with the relevant legislation and where stated, in consultation with Natural England and Natural Resources Wales (for national and international designations and priority habitats).	HC	Ongoing
The Local Plan should include policies that require development sites to adopt SuDS to manage water quality of surface runoff.	HC	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.	HC, EA STW DCWW	Ongoing
Developers should include the design of SuDS at an early stage to maximise the benefits of the scheme.	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 Herefordshire.	HC, EA, NEW, NRW	Ongoing

12 Summary

12.1 Recommendations

Section	Action	Responsibility	Timescale
Water Resources and Water Supply	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.	ST and WW	Ongoing
	Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	HC	Ongoing
	Use planning policy to require the optional standard in Building Regulations of 110 l/p/d for new build housing. It is also encouraged that developments try and go further with greater targets where possible.	HC	In Herefordshire LP
	Use planning policy to require new build non-residential development to achieve at least 3 credits in the Wat01 Measure for water in the BREEAM New Construction standard.	HC	In Herefordshire LP
	The concept of water neutrality has the potential to provide a benefit in improving resilience to climate change and enabling all waterbodies to be brought up to "Good"	HC, STW, DCWW and EA	In LP and Climate Change Action Plan

	status. Explore further with the water companies and the Environment Agency how the Council's planning and climate change policies can encourage this approach. This approach could have particular application in strategic sites and new settlements		
	Larger residential developments (including new settlements), and commercial developments are required to consider incorporating greywater recycling and/or rainwater harvesting into development at the master planning stage in order to reduce water demand.	HC, ST and DCWW	In Herefordshire LP
	Liaise with Water Resources West to explore the long term ability to supply the growth proposed, of DCWW and STW.	JBA	Stage 2 WCS
	The Water Industry National Environment Programme (WINEP) data will be considered at stage 2. To assess whether growth could increase abstractions related to meeting environmental WFD goals for water quantity.	JBA	Stage 2 WCS
	Water companies should advise Herefordshire Council of any strategic water resource infrastructure developments within the	HC, ST and DCWW	Part of Herefordshire LP process

	study, where these may require safeguarding of land to prevent other type of development occurring.		
	Review this section of the WCS following publication of Severn Trent and Dŵr Cymru's (Welsh Waters) draft Water Resource Management Plan for 2024.	HC, ST and DCWW	Stage 2 WCS
Water Supply and Infrastructure	Undertake network modelling where appropriate as part of the planning application process to ensure adequate provision of water supply is feasible	HC STW DCWW	As part of the planning process
	Herefordshire Council and Developers should engage early with STW and DCWW to ensure infrastructure is in place prior to occupation.	HC STW DCWW	Ongoing
Wastewater Collection	Consider the available WwTW capacity when phasing development going to the same WwTW.	Herefordshire Council DCWW STW	Ongoing
	Provide Annual Monitoring Reports to DCWW and STW detailing projected housing growth.	HC	Ongoing
	DCWW and STW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	DCWW STW	Ongoing
Wastewater Treatment	Early engagement with STW and DCWW is required to ensure that provision of WwTW	HC	Ongoing

	capacity is aligned with delivery of development.		
	Provide Annual Monitoring Reports to DCWW and STW detailing projected housing growth.	HC	Ongoing
	DCWW and STW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	DCWW and STW	Ongoing
Odour	Consider odour risk in the sites identified to be potentially at risk from nuisance odour.	HC	Ongoing
	Carry out an odour assessment for sites identified as being at risk of nuisance odour.	Developers	Ongoing
Water Quality	Provide annual monitoring reports to STW and DCWW detailing projected housing growth in the Local Authority	Herefordshire	Ongoing
	Take into account the full volume of growth (from Herefordshire and neighbouring authorities) within the catchment when considering WINEP schemes or upgrades at WwTW	STW and DCWW	Ongoing
Environmental opportunities and constraints	Consider the full volume of growth (from Herefordshire and neighbouring authorities) within the catchment when considering WINEP schemes or upgrades at WwTW.	STW and DCWW	Ongoing
	Consider the environmental impact of development on	HC	Local Plan Development

	protected sites downstream of receiving wastewater treatment works in the Habitats Regulations Assessment		
	The Local Plan should include policies that require all development proposals with the potential to impact on areas with environmental designations to be considered in line with the relevant legislation and where stated, in consultation with Natural England and Natural Resources Wales (for national and international designations and priority habitats).	HC	Ongoing
	The Local Plan should include policies that require development sites to adopt SuDS to manage water quality of surface runoff.	HC	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.	HC, EA STW DCWW	Ongoing
	Developers should include the design of SuDS at an early stage to maximise the benefits of the scheme.	Developers	Ongoing
	Opportunities for Natural Flood Management that include schemes aimed at reducing / managing runoff should be considered to reduce nutrient and sediment	HC, EA, NEW, NRW	Ongoing

	pollution within Herefordshire.		

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14 Appendix

A Appendix A: Site tracker

B Appendix B: Study area SSSIs

Table 14-1 SSSI screening using downstream of WwTW and within Flood Zone 2 as criteria

SSSI NAME	REFERENCE	Downstream of WwTW	In Flood zone 2
Aileshurst Coppice	SO773502	No	Yes
Aston Ingham Meadows	SO688240	No	Yes
Bank and Cother Wood	SO755467	No	No
Berrington Pool, Herefordshire	SO509630	No	No
Birch Wood	SO612323	No	No
Birchend	SO669445	No	No
Birches	SO297537	No	No
Bishon Meadow	SO427436	No	Yes
Black Mountains	SO264345	No	No
Blaentrothy Meadows (Caeau Blaentroddi)	N/a	No	No
Blaisdon Hall	SO698169	No	No
Boxbush Meadows	N/a	No	No
Bradnor Hill Quarry	SO290577	No	No
Brampton Bryan Park	SO357717	No	No
Broad Green	SO770560	No	No
Brooks Head Grove	SO586144	No	Yes
Burfa Boglands		No	No
Burrington Farm Stream Section	SO438727	No	Yes
Burrington Meadow	SO445716	No	Yes

SSSI NAME	REFERENCE	Downstream of WwTW	In Flood zone 2
Burrington Sections	SO442725	No	Yes
Bushy Hazels & Cwmma Moors	SO286510	No	No
Byton & Combe Moors	SO363633	Yes	Yes
Caeau Cwmcoynant (Caeau Cwncaenant)		No	No
Caeiron Meadow	SO283386	No	No
Cage Brook Valley	SO450386	Yes	Yes
Capler Wood	SO588325	Yes	Yes
Castlemorton Common	SO783392	No	No
Chanstone Wood	SO356353	No	No
Cherry Hill Wood	SO576352	No	No
Church Hill Quarry	SO411737	No	No
Collinpark Wood	SO750278	No	No
Common Hill	SO585348	Yes	No
Coughton Wood and Marsh	SO590210	No	No
Crews Hill Wood	SO733529	No	No
Crumpton Hill Wood	SO760488	No	No
Dinmore Hill Woods	SO509515	Yes	No
Dolyhir Meadows	N/A	No	No
Dolyhir Quarry	N/A	No	No
Downton Gorge	SO445742	Yes	Yes
Dymock Woods	SO690287	No	No

SSSI NAME	REFERENCE	Downstream of WwTW	In Flood zone 2
Eastnor Park	SO745378	No	Yes
Edgehills Quarry	SO660167	No	No
Elton Lane Cutting	SO465703	No	No
Fiddlers Elbow		Yes	No
Fishpool Valley	SO450661	No	No
Flintsham & Titley Pools	SO325595	No	No
Frog End Meadow	SO649634	No	No
Gaer House Woods	N/A	No	No
Great Doward	SO547164	No	No
Halesend Wood	SO740493	Yes	No
Hall Wood	SO672332	No	No
Hanley Dingle	SO686665	No	No
Haugh Wood	SO590366	Yes	No
Hay Wood and Tinkers' Coppice	SO737573	No	No
Hen-allt Common	N/A	No	No
Hill Hole Dingle	SO534536	Yes	Yes
Hillend Meadow & Orchard	SO749610	No	No
Hobb's Quarry, Longhope	SO694193	No	No
Kempley Daffodil Meadow	SO676301	No	No
Land Grove Quarry, Mitcheldean	SO672185	No	No
Lea & Pagets Woods	SO598343	No	No
Ledbury Cutting	SO711385	No	No
Leigh Brook	SO745516	No	Yes

SSSI NAME	REFERENCE	Downstream of WwTW	In Flood zone 2
Valley			
Linton Quarry	SO677257	No	No
Little Byefields Meadow	SO745490	No	No
Little Hill	SO610381	No	No
Littlemarsh Common	SO438377	No	No
Longhope Hill	SO693185	No	No
Lord's Wood Meadows	SO732552	No	Yes
Lugg And Hampton Meadows	SO542403	Yes	Yes
Mains Wood	SO644386	No	No
May Hill	SO694213	No	No
Mayhill Wood	SO722369	No	No
Moccas Park	SO341425	No	No
Mocktree Quarries	SO415753	No	No
Monnington Scar	SO353444	Yes	Yes
Mortimer Forest	SO474717	No	No
Moseley Common, Pembridge	SO378581	Yes	No
New Inn Meadow	SO758493	No	No
Newton Court Stable Block	N/A	No	No
Nine Holes Meadows	SO610670	No	No
Olchon Farm Meadows	SO302309	No	Yes
Orchid Bank, Winslow Mill	SO624362	No	No
Osebury Rock	SO737555	Yes	No
Park Wood	SO586177	Yes	Yes
Penny Hill Bank	SO753615	No	No
Pen-yr-hen-Allt	N/A	No	No

SSSI NAME	REFERENCE	Downstream of WwTW	In Flood zone 2
Perton Roadside Section and Quarry	SO594398	No	No
Pikes Farm Meadows	SO289380	No	Yes
Puddlebrook Quarry	SO646183	No	No
Quarry Farm Meadow	SO750612	No	No
Quebb Meadow	SO301520	No	No
Queestmoor Meadow	SO305520	No	No
Ridgeway Wood	SO742389	No	No
River Lugg	SO440625	Yes	No
River Lugg Meanders	SO465612	Yes	Yes
River Teme	SO507745	Yes	Yes
River Wye	SO519384	Yes	Yes
River Wye (Lower Wye) / Afon Gwy (Gwy Isaf)	N/A	Yes	Yes
River Wye (Upper Wye) / Afon Gwy (Gwy Uchaf)	N/A	Yes	Yes
Rockhall Quarry	SO422654	Yes	Yes
Scully Grove Quarry	SO657185	No	No
Severn Estuary	ST529870	Yes	Yes
Scutterdine Quarry	SO577368	No	No
Sharpnage Wood	SO602368	No	No
Stanner Rocks		No	No
Starling Bank	SO777379	No	No
Stenders Quarry	SO659182	No	No

SSSI NAME	REFERENCE	Downstream of WwTW	In Flood zone 2
Teme Bank	SO507742	Yes	Yes
Temeside	SO518742	Yes	Yes
The Bury Farm	SO499522	Yes	Yes
The Flits	SO377410	No	Yes
The Malvern Hills	SO761386	Yes	Yes
The Sturts	SO336474	No	Yes
Upper Hall Farm Quarry and Grassland	SO718383	No	No
Upper Welson Marsh	SO292515	No	No
Upper Wye Gorge	SO546154	Yes	Yes
Wayne Herbert Quarry	SO335320	No	No
Wellington Wood	SO486496	No	No
Westbury Brook Ironstone Mine	SO661166	No	No
Wigpool Ironstone Mine	SO654197	No	No
Wilton Bluff, Ross-on-Wye	SO596240	Yes	Yes
Wood Green Quarry & Railway Cutting	SO694166	No	No
Woodbury Quarry	SO743636	No	No
Woodshuts Wood	SO579375	No	No
Wormbridge Common	SO425313	No	No

C Appendix C: WFD overall status of watercourses in the study area

Table 14-2 WFD status of waterbodies in the study area (WFD England)

ID	Name	Overall Status	Chemical Status	Ecological Status
GB109054044410	Kyre Bk - source to conf R Teme	Poor	Does not require assessment *	Moderate
GB109054044420	Brimfield Bk - source to conf R Teme	Poor	Does not require assessment	Moderate
GB109054044430	Wigmore Drain - source to conf R Teme	Good	Does not require assessment	Moderate
GB109054044440	Tributary - source to conf Wigmore Drain	Good	Does not require assessment	Poor
GB109055042000	Ridgemoor Bk - source to conf R Lugg	Moderate	Does not require assessment	Moderate
GB109055042030	Lugg - conf Norton Bk to conf R Arrow	Moderate	Does not require assessment	Moderate
GB109055042060	Lime Bk - source to conf R Lugg	Good	Does not require assessment	Poor
GB109054044390	Sapey Bk - source to conf R Teme	Good	Does not require assessment	Poor
GB109055036620	Arrow - conf Gladestry Bk to conf Gilwern Bk	Moderate	Does not require assessment	Moderate

ID	Name	Overall Status	Chemical Status	Ecological Status
GB109054032520	Ell Bk - source to conf R Leadon	Moderate	Does not require assessment	Moderate
GB109055036630	Tippets Bk - source to conf Stretford Bk	Good	Does not require assessment	Moderate
GB109055036650	Tarrington Bk - source to conf R Frome	Good	Does not require assessment	Poor
GB109055036660	Lodon - source to conf R Frome	Moderate	Does not require assessment	Poor
GB109054043950	Redlake - source to conf R Clun	Moderate	Does not require assessment	Moderate
GB109055036670	Pentaloe Bk - source to conf R Wye	Good	Does not require assessment	Poor
GB109055036710	Withington Marsh Bk - source to conf R Little Lugg	Moderate	Does not require assessment	Poor
GB109055036720	Little Lugg - source to conf R Lugg	Moderate	Does not require assessment	Moderate
GB109055036740	Bodenham Bk - source to conf R Lugg	Moderate	Does not require assessment	Bad
GB109055029620	Monnow - conf Escley Bk to conf Afon Honddu	Moderate	Does not require assessment	Good
GB109055029690	Garren Bk - conf Gamber Bk to conf R Wye	Good	Does not require assessment	Poor

ID	Name	Overall Status	Chemical Status	Ecological Status
GB109055029700	Walford Bk - source to conf R Wye	Moderate	Does not require assessment	Moderate
GB109055029710	Garren Bk - source to conf Gamber Bk	Good	Does not require assessment	Moderate
GB109055029730	Rudhall Bk - source to conf R Wye	Good	Does not require assessment	Good
GB109055036860	Escley Bk - source to conf R Monnow	Good	Does not require assessment	Poor
GB109055036580	Stretford Bk - source to conf R Arrow	Poor	Does not require assessment	Poor
GB109055036870	Dore - source to conf R Monmow	Moderate	Does not require assessment	Moderate
GB109055036610	Honeylake Bk - source to conf Little Arrow	Moderate	Does not require assessment	Moderate
GB109055036880	Gamber Bk - source to conf Garren Bk	Moderate	Does not require assessment	Moderate
GB109055036890	Wriggle Bk - source to conf R Wye	Good	Does not require assessment	Moderate
GB109054039620	Glynch Bk - source to conf R Leadon	Moderate	Does not require assessment	Moderate
GB109055036930	Norton Bk - source to conf R Wye	Moderate	Does not require assessment	Moderate
GB109055036940	How Caple Bk - source to conf R Wye	Good	Does not require assessment	Poor

ID	Name	Overall Status	Chemical Status	Ecological Status
GB109054039640	Leadon - source to conf Preston Bk	Moderate	Does not require assessment	Moderate
GB109055036960	Cage Bk - source to conf R Wye	Poor	Does not require assessment	Moderate
GB109055037000	Preston Bk - source to conf R Wye	Good	Does not require assessment	Moderate
GB109055036750	Wellington Bk - source to conf R Lugg	Moderate	Does not require assessment	Poor
GB109055036771	Humber Bk - source to conf R Lugg	Moderate	Does not require assessment	Moderate
GB109055036780	Frome - conf Tedstone Bk to conf R Lugg	Moderate	Does not require assessment	Poor
GB109055036790	Lugg - conf R Arrow to conf R Wye	Good	Does not require assessment	Moderate
GB109054043990	Clun - conf R Unk to conf R Teme	Good	Does not require assessment	Moderate
GB109055036810	Dulas Bk - source to conf R Dore	Moderate	Does not require assessment	Moderate
GB109055036820	Olchon Bk - source to conf R Monnow	Moderate	Does not require assessment	Poor
GB109055036840	Worm Bk - source to confl R Dore	Poor	Does not require assessment	Moderate
GB109055036850	Monnow - source to conf Escley Bk	Good	N/a	N/a

ID	Name	Overall Status	Chemical Status	Ecological Status
GB109055037180	Moreton Bk - source to conf R Lugg	Moderate	Does not require assessment	Bad
GB109055041820	Curl Bk - source to conf R Arrow	Good	Does not require assessment	Moderate
GB109054044490	Ledwyche Bk - conf Dogditch Bk to conf R Teme	Moderate	Does not require assessment	Moderate
GB109055041840	Arrow - conf Gilwern Bk to conf R Lugg	Good	Does not require assessment	Moderate
GB109054039590	Preston Bk - source to conf R Leadon	Poor	Does not require assessment	Poor
GB109054044500	Teme - conf R Clun to conf R Onny	Good	Does not require assessment	Poor
GB109055041850	Frome - source to conf Tedstone Bk	Poor	Does not require assessment	Poor
GB109054044510	Teme - conf R Onny to conf R Severn	Moderate	Does not require assessment	Good
GB109055041860	Tedstone Bk - source to conf R Frome	Bad	Does not require assessment	Poor
GB109055041930	Hindwell Bk - conf Knobley Bk to conf R Lugg	Moderate	Does not require assessment	Moderate
GB109055041940	Pinsley Bk - source to conf R Lugg	Moderate	Does not require assessment	Poor

ID	Name	Overall Status	Chemical Status	Ecological Status
GB109055041950	Cheaton Bk - source to conf R Lugg	Poor	Does not require assessment	Poor
GB109055037010	Hay Dulas Bk - source to conf R Wye	Moderate	Does not require assessment	Good
GB109055037040	Yazor Bk - source to conf R Wye	Good	Does not require assessment	Moderate
GB109055037070	Willersley Bk - source to conf R Wye	Moderate	Does not require assessment	Moderate
GB109055037100	Kinnersley Bk - source to conf R Wye	Moderate	Does not require assessment	Moderate
GB109054044960	Teme - source to conf Ffwdwen Bk to conf R Clun	Good	Does not require assessment	Moderate
GB109055037111	Wye - conf Walford Bk to Bigsweir Br	Poor	Does not require assessment	Moderate
GB109054039910	Cradley Bk - source to conf Suckley Bk	Moderate	Does not require assessment	Moderate
GB109055037112	Wye - Hampton Bishop to conf Kerne Br	Good	Does not require assessment	Good
GB109055037113	Wye - Bredwardine Br to Hampton Bishop	Good	Does not require assessment	Moderate

ID	Name	Overall Status	Chemical Status	Ecological Status
GB109055037120	Letton Lake Bk - source to conf R Wye	Poor	Does not require assessment	Moderate

* From Environment Agency Catchment Data Explorer

Table 14-3 WFD status of waterbodies in the study area (Natural Resources Wales)

Name	Waterbody ID	Overall Status	Chemical Status	Ecological Status
Ell Bk - source to conf R Leadon	GB109054032520	Moderate	Good	Moderate
Preston Bk - source to conf R Leadon	GB109054039590	Poor	Good	Poor
Glynch Bk - source to conf R Leadon	GB109054039620	Moderate	Good	Moderate
Leadon - source to conf Preston Bk	GB109054039640	Moderate	Good	Moderate
Cradley Bk - source to conf Suckley Bk	GB109054039910	Moderate	Good	Moderate
Redlake - source to conf R Clun	GB109054043950	Moderate	Good	Moderate
Clun - conf R Unk to conf R Teme	GB109054043990	Moderate	Good	Moderate
Sapey Bk - source to conf R Teme	GB109054044390	Poor	Good	Poor
Kyre Bk - source to conf R Teme	GB109054044410	Moderate	Good	Moderate
Brimfield Bk - source to conf R Teme	GB109054044420	Moderate	Good	Moderate
Wigmore Drain - source to conf R Teme	GB109054044430	Moderate	Good	Moderate
Tributary - source to conf Wigmore Drain	GB109054044440	Moderate	Good	Moderate
Ledwyche Bk - conf Dogditch Bk to conf R Teme	GB109054044490	Good	Good	Good
Teme - conf R Clun to conf R Onny	GB109054044500	Good	Good	Good
Teme - conf R Onny to conf R Severn	GB109054044510	Good	Good	Good
Cage Bk - source to conf R Wye	GB109055036960	Moderate	Good	Moderate
Kinnersley Bk - source to conf R Wye	GB109055037100	Moderate	Good	Moderate

Name	Waterbody ID	Overall Status	Chemical Status	Ecological Status
Wye - conf Walford Bk to Bigsweir Br	GB109055037111	Moderate	Good	Moderate
Wye - Hampton Bishop to conf Kerne Br	GB109055037112	Poor	Good	Poor
Wye - Bredwardine Br to Hampton Bishop	GB109055037113	Moderate	Good	Moderate
Teme - source to conf Ffwdwen Bk to conf R Clun	GB109054044960	Moderate	Good	Moderate
Bodenham Bk - source to conf R Lugg	GB109055036740	Poor	Good	Poor
Wellington Bk - source to conf R Lugg	GB109055036750	Poor	Good	Poor
Humber Bk - source to conf R Lugg	GB109055036771	Good	Good	Good
Frome - conf Tedstone Bk to conf R Lugg	GB109055036780	Moderate	Good	Moderate
Lugg - conf R Arrow to conf R Wye	GB109055036790	Moderate	Good	Moderate
Dulas Bk - source to conf R Dore	GB109055036810	Moderate	Good	Moderate
Olchon Bk - source to conf R Monnow	GB109055036820	Moderate	Good	Moderate
Afon Honddu - source to conf R Monnow	GB109055036830	Poor	Good	Poor
Worm Bk - source to confl R Dore	GB109055036840	Moderate	Good	Moderate
Monnow - source to conf Escley Bk	GB109055036850	Moderate	Good	Moderate
Escley Bk - source to conf R Monnow	GB109055036860	Moderate	Good	Moderate
Dore - source to conf R Monmow	GB109055036870	Moderate	Good	Moderate
Gamber Bk - source to conf Garren Bk	GB109055036880	Good	Good	Good
Monnow - conf	GB109055029620	Good	Good	Good

Name	Waterbody ID	Overall Status	Chemical Status	Ecological Status
Escley Bk to conf Afon Honddu				
Garren Bk - conf Gamber Bk to conf R Wye	GB109055029690	Poor	Good	Poor
Walford Bk - source to conf R Wye	GB109055029700	Poor	Good	Poor
Garren Bk - source to conf Gamber Bk	GB109055029710	Moderate	Good	Moderate
Monnow - conf Afon Honddu to conf R Wye	GB109055029720	Good	Good	Good
Rudhall Bk - source to conf R Wye	GB109055029730	Good	Good	Good
Stretford Bk - source to conf R Arrow	GB109055036580	Moderate	Good	Moderate
Arrow - source to conf Gladestry Bk	GB109055036590	Good	Good	Good
Gladestry Bk - source to conf R Arrow	GB109055036600	Moderate	Good	Moderate
Honeylake Bk - source to conf Little Arrow	GB109055036610	Moderate	Good	Moderate
Arrow - conf Gladestry Bk to conf Gilwern Bk	GB109055036620	Moderate	Good	Moderate
Tippets Bk - source to conf Stretford Bk	GB109055036630	Moderate	Good	Moderate
Tarrington Bk - source to conf R Frome	GB109055036650	Poor	Good	Poor
Lodon - source to conf R Frome	GB109055036660	Poor	Good	Poor
Withington Marsh Bk - source to conf R Little Lugg	GB109055036710	Moderate	Good	Moderate
Little Lugg - source to conf R Lugg	GB109055036720	Moderate	Good	Moderate
Wriggle Bk - source to conf R Wye	GB109055036890	Poor	Good	Poor

Name	Waterbody ID	Overall Status	Chemical Status	Ecological Status
Pentaloe Bk - source to conf R Wye	GB109055036670	Poor	Good	Poor
Norton Bk - source to conf R Wye	GB109055036930	Moderate	Good	Moderate
How Caple Bk - source to conf R Wye	GB109055036940	Moderate	Good	Moderate
Moreton Bk - source to conf R Lugg	GB109055037180	Moderate	Good	Moderate
Curl Bk - source to conf R Arrow	GB109055041820	Moderate	Good	Moderate
Gilwern Bk - source to conf R Arrow	GB109055041830	Bad	Good	Bad
Arrow - conf Gilwern Bk to conf R Lugg	GB109055041840	Moderate	Good	Moderate
Preston Bk - source to conf R Wye	GB109055037000	Moderate	Good	Moderate
Frome - source to conf Tedstone Bk	GB109055041850	Poor	Good	Poor
Tedstone Bk - source to conf R Frome	GB109055041860	Bad	Good	Bad
Hay Dulas Bk - source to conf R Wye	GB109055037010	Moderate	Good	Moderate
Yazor Bk - source to conf R Wye	GB109055037040	Moderate	Good	Moderate
Willersley Bk - source to conf R Wye	GB109055037070	Moderate	Good	Moderate
Wye - Scithwen Bk to Brewardine Br	GB109055037116	Good	Good	Good
Letton Lake Bk - source to conf R Wye	GB109055037120	Poor	Good	Poor
Hindwell Bk - conf Knobley Bk to conf R Lugg	GB109055041930	Moderate	Good	Moderate

Name	Waterbody ID	Overall Status	Chemical Status	Ecological Status
Pinsley Bk - source to conf R Lugg	GB109055041940	Poor	Good	Poor
Cheaton Bk - source to conf R Lugg	GB109055041950	Moderate	Good	Moderate
Ridgemoor Bk - source to conf R Lugg	GB109055042000	Moderate	Good	Moderate
Lugg - conf Norton Bk to conf R Arrow	GB109055042030	Good	Good	Good
Norton Bk - source to conf R Lugg	GB109055042040	Bad	Good	Bad
Lime Bk - source to conf R Lugg	GB109055042060	Good	Good	Good

D Appendix D: List of WwTW

Table 14-4 WwTW serving Herefordshire

WwTW	Water Company	Permit Reference
BOSBURY RBC (STW)	STW	S/21/25795/R
COLWALL (STW)	STW	S/09/55757/R
CRADLEY (STW)	STW	S/09/55946/R
LEDBURY (STW)	STW	S/21/26211/R
LEINTWARDINE (STW)	STW	S/09/55912/R
LUDLOW (STW)	STW	S/09/55809/R
WEST MALVERN (STW)	STW	S/09/55762/R
WHITBOURNE WORKS (STW)	STW	S/09/55935/R
PRESTEIGNE	STW	S/09/55933/R
HAY-ON-WYE	DCWW	AW1005101
GROSMONT	DCWW	AW1002301
BODENHAM	DCWW	AH1001001
BROMYARD	DCWW	AL1000401
CANON PYON	DCWW	AL1000602
CLEHONGER	DCWW	AL1000901
DILWYN	DCWW	AL1001001
EARDISLEY	DCWW	AN0218201
FOWNHOPE	DCWW	AH1000901
GOODRICH	DCWW	AS1001101
HEREFORD (EIGN)	DCWW	AH1001101
HEREFORD (ROTHERWAS)	DCWW	AH1001201
KINGSLAND	DCWW	AL1001401
KINGSTONE & MADLEY	DCWW	AH1001901
KINGTON	DCWW	AL1001501
LEOMINSTER (WORCESTER RD)	DCWW	AN0228301
LONGTOWN	DCWW	AH1002101
LOWER CLEEVE (NEW)	DCWW	AS1003701
LUSTON & YARPOLE	DCWW	AL1001701
LYONSHALL	DCWW	AL1001801
MORETON-ON-LUGG	DCWW	AH1002201
MUCH DEWCHURCH	DCWW	AN0231301
PEMBRIDGE	DCWW	AL1002401
PETERCHURCH	DCWW	AH1003001
PONTRILAS	DCWW	AH1003301

WwTW	Water Company	Permit Reference
SHOBDON	DCWW	AN0272501 or AL1002701
TARRINGTON	DCWW	AH1003701
WEOBLEY	DCWW	AL1003501
WOOLHOPE (VILLAGE)	DCWW	AH1003901

E Appendix E: Wye SAC and Wye MC areas

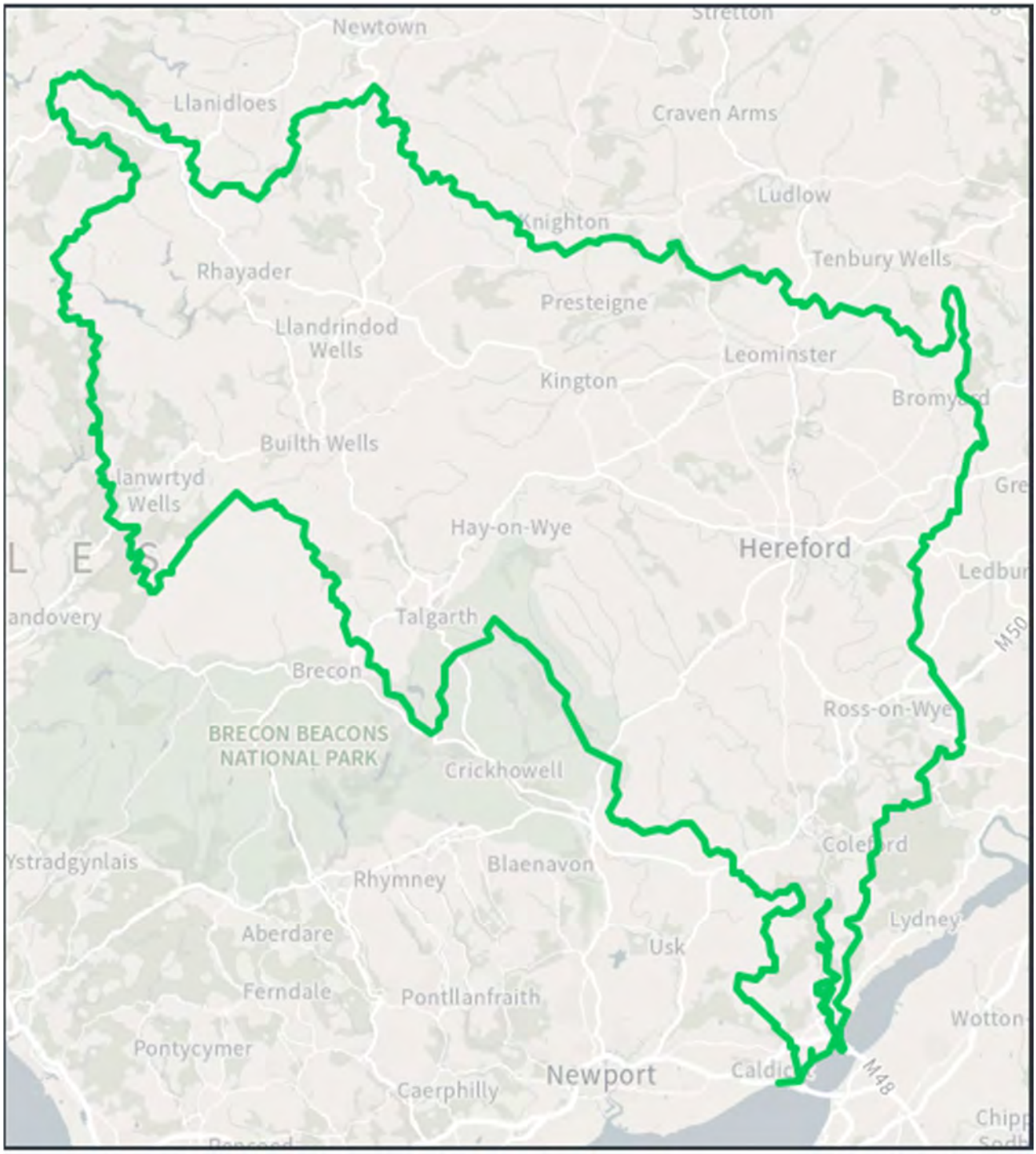


Figure 14-1 The Wye MC area taken from the Environment Agencies Catchment Data Explorer page.

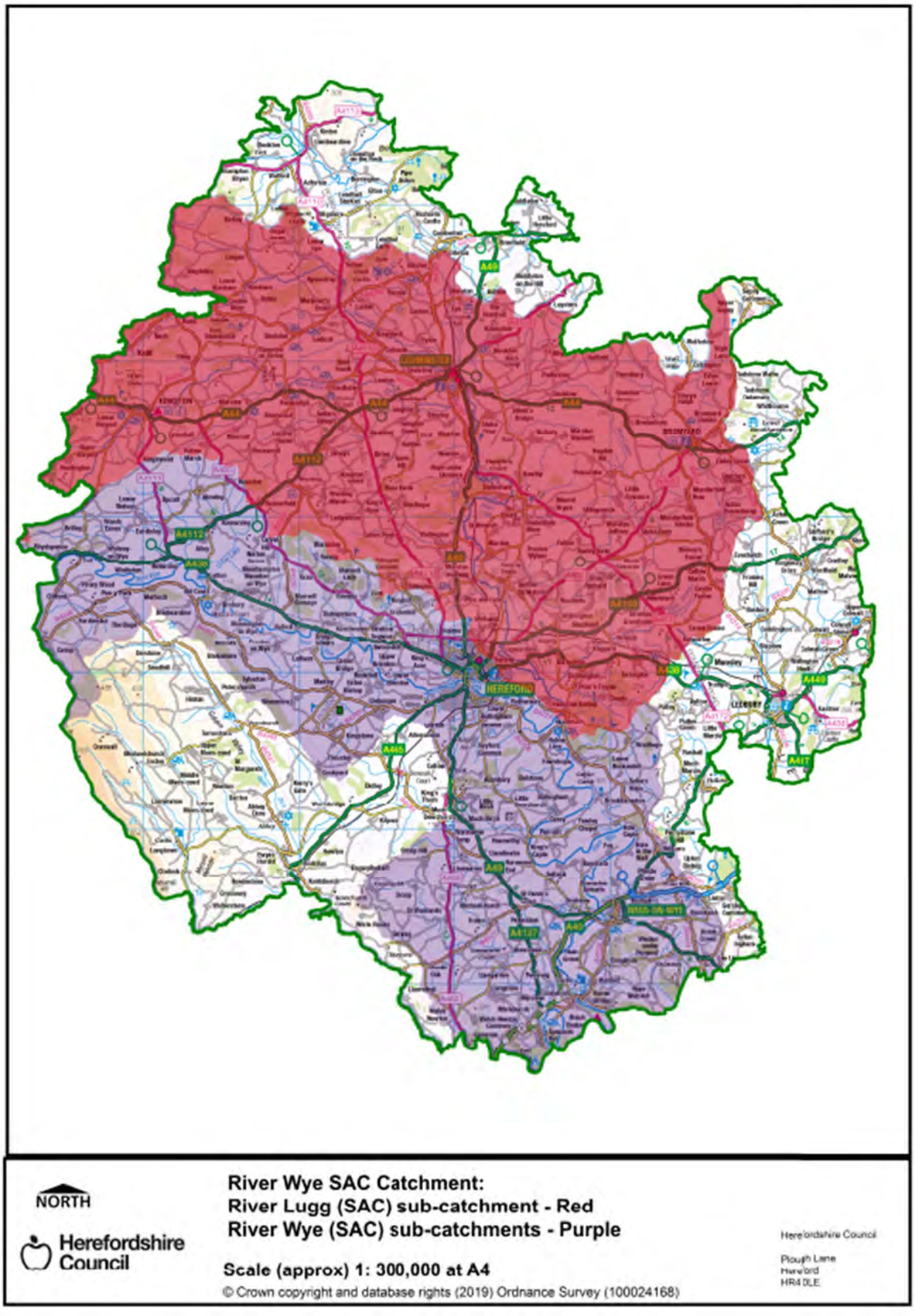


Figure 14-2 Wye and Lugg SAC areas from the Herefordshire Council Website

F Appendix F: Planned water Quality modelling

Table 14-5 SIMCAT model runs and parameters proposed to assess impact of growth

Basin	Unique run no.	Growth	Diffuse flow	Climate Change (flow.)	Climate Change (temp.)	Treatment standard
Wye	1	Baseline	Baseline	Baseline	Baseline	Baseline
Wye	2	Baseline	10%	Baseline	Baseline	Baseline
Wye	3	Baseline	-10%	Baseline	Baseline	Baseline
Wye	4	Baseline	Baseline	High	1.5oC	Baseline
Wye	5	Baseline	Baseline	Medium	1.5oC	Baseline
Wye	6	Baseline	10%	High	1.5oC	Baseline
Wye	7	Future	Baseline	Baseline	Baseline	Baseline
Wye	8	Future	10%	Baseline	Baseline	Baseline
Wye	9	Future	-10%	Baseline	Baseline	Baseline
Wye	10	Future	Baseline	High	1.5oC	Baseline
Wye	11	Future	Baseline	Medium	1.5oC	Baseline
Wye	12	Future	10%	High	1.5oC	Baseline
Wye	13	Baseline	Baseline	Baseline	Baseline	Run type 8 with TAL
Wye	14	Future	Baseline	Baseline	Baseline	Run type 8 with TAL
Wye	15	Future	10%	Baseline	Baseline	Run type 8 with TAL
Wye	16	Future	-10%	Baseline	Baseline	Run type 8 with TAL
Wye	17	Future	10%	High	1.5oC	Run type 8 with TAL
Wye	18	Baseline	Set to target by SIMCAT	Baseline	Baseline	Run type 9
Wye	19	Future	Set to target by SIMCAT	Baseline	Baseline	Run type 9
Wye	20	Future	Set to target by SIMCAT	High	1.5oC	Run type 9
Severn	21	Baseline	Baseline	Baseline	Baseline	Baseline
Severn	22	Baseline	10%	Baseline	Baseline	Baseline
Severn	23	Baseline	-10%	Baseline	Baseline	Baseline
Severn	24	Baseline	Baseline	High	1.5oC	Baseline
Severn	25	Baseline	Baseline	Medium	1.5oC	Baseline
Severn	26	Baseline	10%	High	1.5oC	Baseline
Severn	27	Future	Baseline	Baseline	Baseline	Baseline
Severn	28	Future	10%	Baseline	Baseline	Baseline
Severn	29	Future	-10%	Baseline	Baseline	Baseline
Severn	30	Future	Baseline	High	1.5oC	Baseline
Severn	31	Future	Baseline	Medium	1.5oC	Baseline
Severn	32	Future	10%	High	1.5oC	Baseline
Severn	33	Baseline	Baseline	Baseline	Baseline	Run type 8 with TAL
Severn	34	Future	Baseline	Baseline	Baseline	Run type 8 with TAL
Severn	35	Future	10%	Baseline	Baseline	Run type 8 with TAL
Severn	36	Future	-10%	Baseline	Baseline	Run type 8 with TAL
Severn	37	Future	10%	High	1.5oC	Run type 8 with TAL
Severn	38	Baseline	Set to target by SIMCAT	Baseline	Baseline	Run type 9
Severn	39	Future	Set to target by SIMCAT	Baseline	Baseline	Run type 9
Severn	40	Future	Set to target by SIMCAT	High	1.5oC	Run type 9

G Appendix G: Odour Assessment

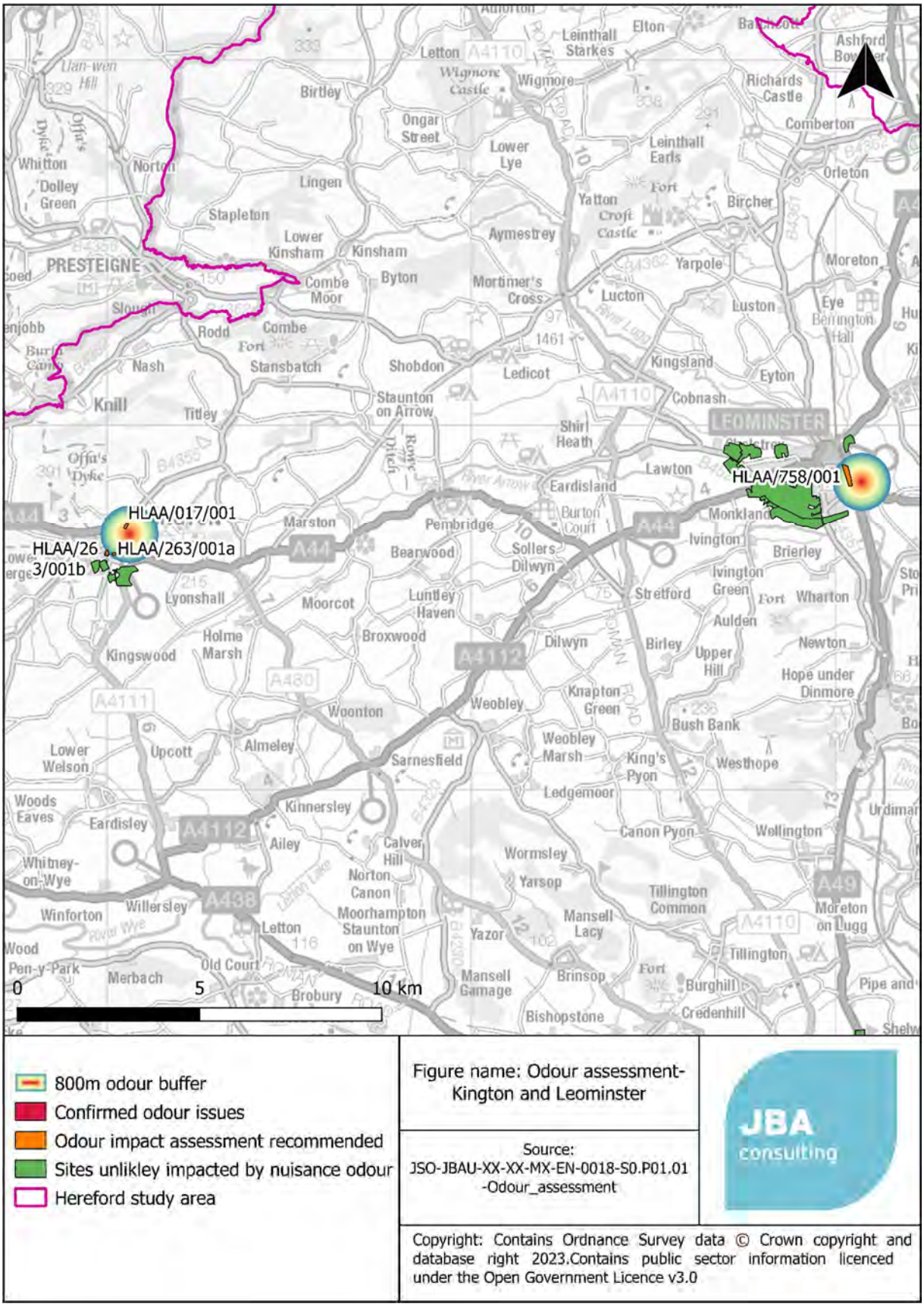


Figure 14-3 Kington and Leominster odour assessment site map

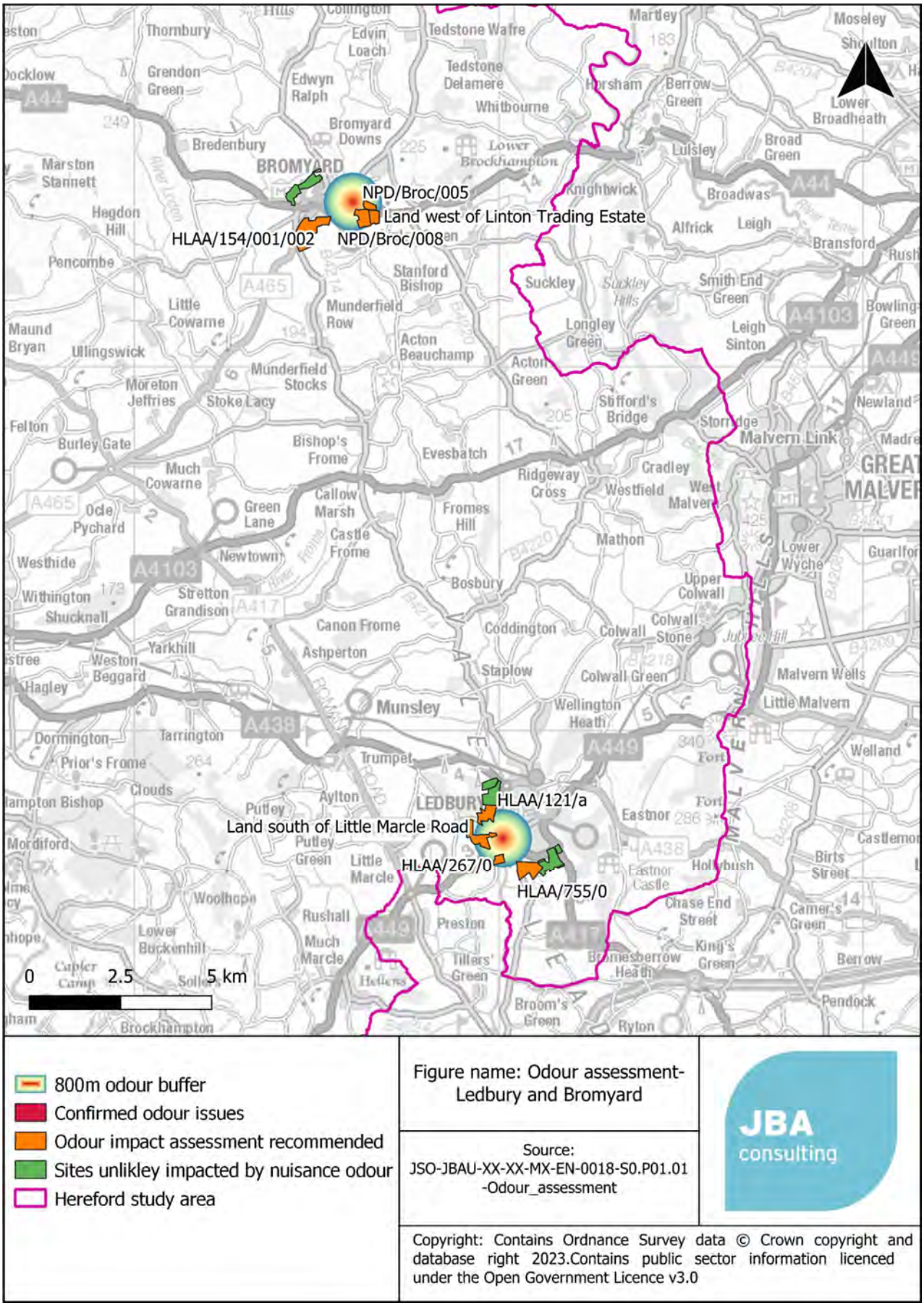


Figure 14-4 Ledbury and Bromwell odour assessment site map

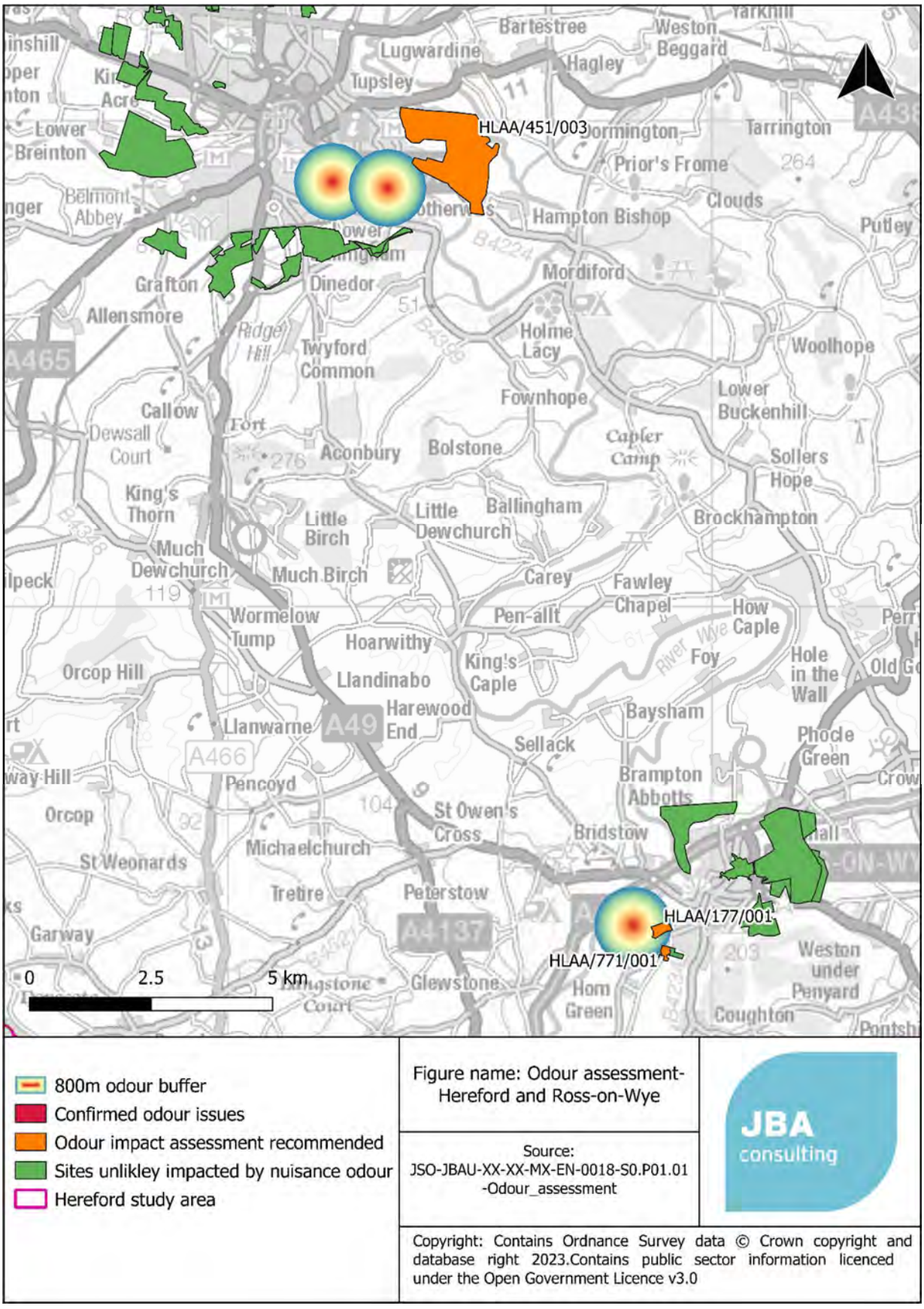
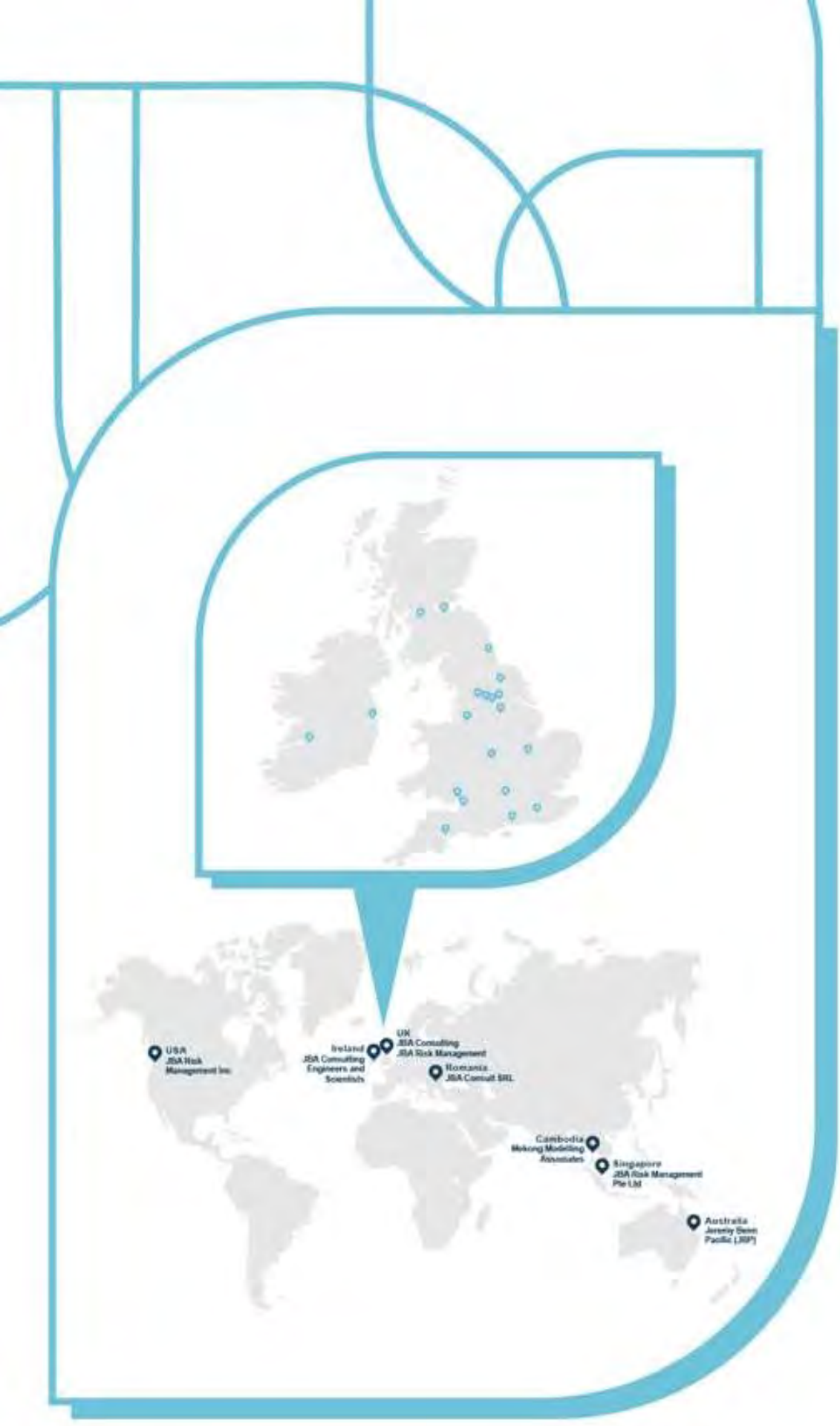


Figure 14-5 Ross-on-Wye and Hereford odour assessment site map



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