West Oxfordshire District Council

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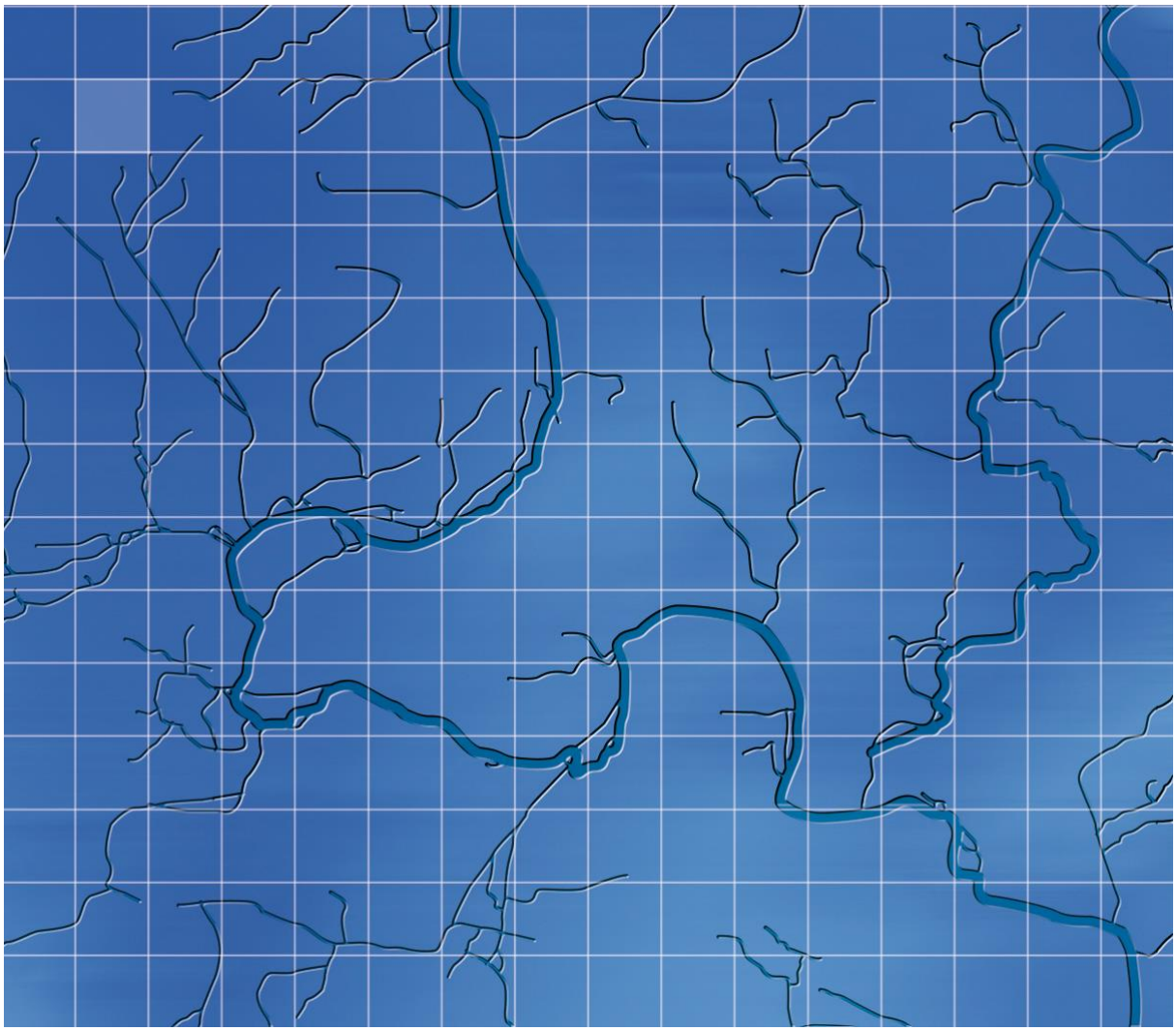
West Oxfordshire Water Cycle Study Scoping Report



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For and on behalf of Wallingford HydroSolutions Ltd.

The WHS Quality & Environmental Management system is certified as meeting the requirements of ISO 9001:2015 and ISO 14001:2015 providing environmental consultancy (including monitoring and surveying), the development of hydrological software and associated training.

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Glossary

Abstraction licence- Authorisation granted by the Environment Agency to allow the removal of water from a source.

Assessment Point (AP)- A significant point on a river, often where two major rivers join or at a gauging station.

Asset Management Period (AMP)- The AMP sets the framework for how water companies manage their assets, deliver services to customers, and invest in infrastructure over a five-year period. The AMP is regulated by Ofwat, the Water Services Regulation Authority in England and Wales. AMP 7 runs from 2020-2025, AMP8 will run from 2025-2030.

Combined Sewer Overflows (CSOs)- Many parts of England have a combined sewage system. with clean rainwater and wastewater conveyed in the same pipe. During heavy rainfall the capacity of these pipes can be exceeded, which means possible backing up of the system and inundation of STWs downstream. CSOs were developed as overflow valves to reduce the risk of sewage backing up during heavy rainfall. They are a necessary part of the sewer system but where they regularly spill it can indicate underlying issues with the sewer system's condition and capacity.

Compliance Assessment Report (CAR)- A written report compiled by Environment Agency officers when assessing compliance with an environmental permit. The CAR is used to record the findings of EA's site inspections, audits and monitoring activities. It also includes reviews of monitoring and other data/reports.

Deployable Output (DO)- The reliable output of an active source, or group of sources, or of a bulk supply of water, which is constrained by: environment; licence, if applicable; pumping plant and/or well/aquifer properties; raw water mains and/or aquifers; transfer and/or output main; treatment; water quality.

Discharge Permit- An environmental permit granted by the EA to discharge liquid effluent or waste water to a surface water or the groundwater body.

District Metering Area (DMA)- A DMA is a discrete area of the water distribution network that can be isolated by closing valves so that the quantities of water entering and leaving the area can be metered. The volume of water into and out of the DMA is measured by a district meter. The purpose of a DMA is to divide each WRZ into manageable sections to detect and determine the location of burst mains, calculate the level of leakage in each DMA and compare DMAs so that activities can be targeted to where they will have the greatest impact in reducing leakage.

Drainage and Wastewater Plan (DWMP)- Strategic plans where wastewater companies take a company-wide approach to managing their wastewater and drainage assets. DWMP look at current and future capacity, pressures, and risks to their networks such as climate change and population growth over a 25-year period.

Drought Permit- An authorisation granted by the Environment Agency under drought conditions, which allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis.

Dry Weather Flow (DWF)- Dry weather flow (DWF) is the wastewater flow in a sewer system during periods without rain. It mainly consists of domestic sewage, industrial wastewater, and other continuous flows from human activities, like washing and toilet use. Essentially, it represents the baseline flow in a sewer system when there is no stormwater or snowmelt contribution. The EA sets limits on the quality and quantity of treated effluent from STW so that STW do not cause an

unacceptable impact on the environment. The flow that may be discharged in dry weather is one of these limits.

Dry Year Annual Average (DYAA)- The annual average value of water demand, deployable output or some other quantity over the course of a dry year.

Dry Year Critical Period (DYCP)- The water demand, deployable output or some other quantity during the time in a dry year when demand is greatest, often termed the peak week. Also commonly known as the summer peak period.

Environmental Impact Assessment (EIA)- Environmental Impact Assessment (EIA) is a tool used to assess the significant effects of a project or development proposal on the environment.

Flood Zone 2- Areas situated in Flood Zone 2 have a medium probability of flooding and have an annual probability of river flooding between 1.0% and 0.1% and annual probability of sea flooding between 0.5% and 0.1%.

Flood Zone 3- Flood zone 3 is distinguished as land which has a 1% or greater annual probability of river flooding or a 0.5% or greater annual probability of sea flooding.

Flow to Full Treatment (FFT)- A measure of how much wastewater a treatment works must be able to treat before spilling. All STWs are built to be able to deal with a certain amount of wastewater, calculated depending on the area they serve, and many have a requirement in their environmental permit about the FFT level they must work to.

Good Ecological Potential (GES)- GES is the ecological quality that can be achieved in the affected water bodies without a significant adverse impact on the benefits provided by the uses or a significant adverse impact on the wider environment.

Groundwater Infiltration- Groundwater infiltration occurs when groundwater finds its way into the underground water and sewerage system. Small leaks, openings, defective joints and cracks are the main causes for infiltration.

Habitat Regulations Assessment (HRA)- A HRA is a process that determines whether or not development plans could negatively impact local plans on a recognised protected European site.

Hands off flow (HoF)- A condition attached to an abstraction license which states that if flow (in the river) falls below the level specified on the license, the abstractor will be required to reduce or stop the abstraction.

Headroom- The difference between the measured DWF and the consented DWF is termed headroom.

Household (HH) Consumption- Water consumed by household customers

Leakage- Water that leaks from our water mains and customer supplies pipes

Non-Household (NHH) Consumption- Water consumed by businesses

Natural Flood Risk Management (NFM)- NFM involves working with nature to reduce the risk of flooding for communities. It uses various techniques to restore or mimic the natural functions of rivers, floodplains and the wider catchment.

Olfactometry- Olfactometry is the process of measuring the concentration and intensity of odour. Olfactometry is often used for monitoring wastewater infrastructure, where controlling odorous emissions is important for environmental and health reasons.

Price Review (PR)- The price determination process undertaken by Ofwat every five years. Each water and sewerage undertaker submits a business plan covering the five-year period for which Ofwat will determine cost and revenue allowances.

Sewage Pumping Stations (SPS)- SPS typically move sewage from lower to higher elevations. The stations pump raw sewage and wastewater into pipes transporting the waste to a STW or other disposal site.

Sewage Treatment Works (STW)- Sewage treatment works are plants designed to treat and clean sewage and waste water before they are released into the environment. Treatment typically consists of three phases termed primary, secondary and tertiary water treatment.

Site of Specific Scientific Interest (SSSI)- A SSSI is a formal conservation designation. Usually, it describes an area that's of particular interest to science due to the rare species of fauna or flora it contains (Biological SSSI) - or important geological or physiological features that may lie in its boundaries (Geological SSSI).

Smarter Business Visit (SBV)- A location-based business programme that helps customers to fit water-saving devices, identify and potentially fix leaking toilets and fit free urinal controls if practical.

Source Protection Zones (SPZs)- SPZs are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.

Special Area of Conservation (SAC)- A site designated as being of special conservation value under the European Habitats Directive. It protects one or more special habitats and/or species – terrestrial or marine.

Storm Overflow Assessment Framework (SOAF)- The SOAF written by the EA sets out how sewer systems comply with current statutory requirements. The framework shows that any overflow reported to exceed the spill frequency thresholds set out in this document should be investigated.

Strategic Overview of Long-term Assets and Resources (SOLAR)- SOLAR is what Thames Water use to feed into their strategic upgrades plan, rather than waiting on approval of a site prior to undertaking modelling to understand what upgrades may be required.

Sustainable Drainage Systems (SuDS)- SuDS mimic nature and typically manage rainfall close to where it falls. SuDS can be designed to transport (convey) surface water, slow runoff down (attenuate) before it enters watercourses, they provide areas to store water in natural contours and can be used to allow water to soak (infiltrate) into the ground or evaporated from surface water and lost or transpired from vegetation (known as evapotranspiration).

Urban Creep- Urban creep is the increasing density of development, due to extension, paving over of gardens and other permeable areas, which increases the impermeability of developed areas and causes rates and volumes of runoff to rise.

Water Available for Use (WAFU)- The overall amount of water that is available to use. This takes account of the total deployable output minus water lost through planned and unplanned events, sustainability reductions, climate change, water transferred out of our supply area to other companies (exports) and water received from other companies (imports).

Water Framework Directive (WFD)- The Water Framework Directive (WFD) 2000/60/EC is an EU directive to establish a framework for the protection of all water bodies. The WFD set a programme

and timetable for Member States to set up River Basin Management Plans by 2009, which are then periodically updated every 5-years.

Water Resource Management Plan (WRMP)- WRMP sets out how water companies intend to achieve a secure supply of water for your customers and a protected and enhanced environment. Water companies in England or Wales, must prepare and maintain a water resources management plan (WRMP) every 5-years to align with the AMP.

Water Resource Zone (WRZ)- The largest possible zone in which all resources, including external transfers, can be shared and hence, the zone in which all customers will experience the same risk of supply failure from a resource shortfall.

Water Services Regulation Authority (Ofwat)- The Water Services Regulation Authority, or Ofwat, is the body responsible for economic regulation of the privatised water and sewerage industry in England.

Water Trading- An agreement with an existing licence holder to give part or all of their water abstraction right permanently or temporarily.

Windfall Development- Development not specifically allocated in a development plan but unexpectedly becomes available during the lifetime of a plan.

1 Introduction

1.1 Scope of Assessment

Wallingford HydroSolutions (WHS) has been commissioned by West Oxfordshire District Council to undertake a water cycle study scoping report. This will review the infrastructural capacity of water resource infrastructure, wastewater infrastructure and existing pressures on the water environment.

The study will inform the emerging Local Plan 2041[1] being developed by the council, which will allocate land for housing and employment development.

The study advises on the need for further work based on any infrastructural or environmental constraints and any evidence gaps identified.

Note, this is an interim scoping report submitted in advance of receiving all of the baseline data, including site allocations.

1.2 Water Cycle Study Scoping Report Objectives

Water cycle studies are voluntary studies that consider how strategic plans and development proposals will affect the water environment. The study's objectives include the following:

- Review the West Oxfordshire District Council extents and amount of proposed development.
- Communicate with key stakeholders including the district council, the Environment Agency (EA), Thames Water and neighbouring authorities.
- Identify existing evidence on water quality, water resources and flood risk.
- Identify environmental issues and constraints on development.
- Identify potential solutions.
- Inform wider policy planning requirements.
- Identify evidence gaps where further assessment may be required.

[1] West Oxfordshire District Council (2025) *Local Plan 2041 – preparation of a new plan*

2 Method Statement

The water cycle study has been completed using national EA guidance on water cycle studies[2]. It has also been guided by the specification provided by and further consultation with the council.

2.1 Initial Liaison and Data Collation

Development of the water cycle study scoping report has been underpinned by early stakeholder liaison and collaboration. The stakeholders identified to inform the study include the EA, Thames Water and neighbouring authorities. They have been engaged with in order to obtain the datasets required to progress the study and to gain a clear understanding of the water environment and water infrastructure for the district, in addition to the development pressures in neighbouring districts.

2.2 Data Sources

Following the initial liaison stage the following data sources were used to inform the water cycle study scoping report.

- Thames Water Revised Draft Water Management Plan 2024[3]- to determine future water demand and water resource options for the district and wider Thames Water supply area.
- Thames Water Drainage and Wastewater Management Plan (DWMP)[4]- to determine Thames Water's future goals with regard to drainage and wastewater infrastructure.
- Thames Water Oxfordshire, Swindon, Wiltshire, Gloucestershire and Warwickshire Catchment Strategic Plan[5]- to determine Thames Water's future plans with regard to drainage and wastewater infrastructure in the study area.
- EA Thames River Basin Management Plan[6]- to help understand current and existing pressures on the water environment and mitigation measures.
- EA Fluvial Flood Maps[7]– to quantify fluvial flood risk across the study area.
- EA Surface Water Flood Maps[8] – to quantify the pluvial flood risk across the study area.

2.3 Structure of Scoping Study

The first stage of the scoping study identifies the baseline conditions of the current water environment. Information has been gathered on precipitation, surface water, groundwater, water quality, land use and other relevant factors across the study area. The previous water cycle study for West Oxfordshire has also been reviewed.

After establishing the baseline conditions, the four elements listed overpage have been assessed, forming the basis of the scoping assessment.

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[2] Environment Agency (2021) *Guidance- Water Cycle Studies* https://www.gov.uk/guidance/water-cycle-studies
[3] Thames Water (2024) *Revised Draft Water Resources Management Plan 2024* dn9cxogfaqr3n.cloudfront.net/revised-draft/Technical+Report/rdWRMP24+-+Section+1+-+Introduction+and+Background.pdf
[4] Thames Water (2023) *Drainage and Wastewater Management Plan (DWMP)* https://www.thameswater.co.uk/about-us/regulation/drainage-and-wastewater-management/our-dwmp
[5] Thames Water (2023) *Oxfordshire, Swindon, Wiltshire, Gloucestershire and Warwickshire Catchment Strategic Plan* https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/oxfordshire-swindon-wiltshire-gloucestershire-warwickshire-catchment-strategic-plan.pdf
[6] EA (2022) Thames River basin district river basin management plan: updated 2022 https://www.gov.uk/guidance/thames-river-basin-district-river-basin-management-plan-updated-2022
[7] EA (2023) *Flood Map for Planning (Rivers and Sea) – Flood Zone 2* https://www.data.gov.uk/dataset/cf494c44-05cd-4060-a029-35937970c9c6/flood-map-for-planning-rivers-and-sea-flood-zone-2
[8] EA (2023) *Risk of surface water flooding* https://environment.data.gov.uk/DefraDataDownload/?Mode=rofsw

- Water resources and supply
- Wastewater infrastructure, water quality and environmental capacity
- Flood risk
- Other environmental issues

The scoping study has reviewed these four elements in the context of planned and proposed development across the district. The quantum of development expected across the plan period has been confirmed by the council. This totals 16,000 dwellings which is made up of site allocations from the emerging local plan and adopted 2031 local plan (11,700), existing planning permissions (2,330) and an allowance for windfall development (1,950). The four elements are also assessed in the context of climate change.

Further to this, opportunities to manage future development and protect and enhance the water environment have been identified, alongside any evidence gaps and constraints on development.

In order to gain a deeper understanding of these four elements, as part of liaison with stakeholders key documents have been identified to supplement this water cycle study. These include water company resource management plans, drainage and wastewater management plans, river basin management plans and abstraction licensing strategies.

2.4 Water Resources and Supply

Future water demand has been assessed against Thames Water's latest revised Water Resource Plan published in 2024. It sets out how it plans to provide a secure and sustainable supply of water for customers over the next 50 years (2025-2075), thereby incorporating the period being assessed in this study. West Oxfordshire District Council administrative boundary is located within the Swindon and Oxfordshire Water Resource Zone (SWOX WRZ). The plan also considers the whole Thames Water network, which is vital for putting development in the context of cumulative development across other functional catchment areas. Also considered are the impacts of climate change, the current and future supply and demand position, and potential resource options moving forward.

The study seeks to provide further comment on water efficiency including the tighter standards put forward in the government's Environmental Improvement Plan[9]. In this context, it outlines exemplar standards that developers could aim for and considers standards for non-residential development.

The EA's abstraction strategy applied to the district has been reviewed to assess current pressures and likely changes going forward.

Based on the findings of the above, the water cycle study scoping report advises on future demand and resource management in the study area. It also confirms if there are any evidence gaps that may warrant further assessment.

2.5 Wastewater Infrastructure, Water Quality and Environmental Capacity

The water cycle study scoping report reviews the infrastructural capacity of the wastewater system and environmental capacity of the receiving water environment. This assessment has been undertaken in the context of the level of development identified and climate change.

[9] HM Government (2023) *Environmental Improvement Plan 2023* https://assets.publishing.service.gov.uk/media/64a6d9c1c531eb000c64fffa/environmental-improvement-plan-2023.pdf

In terms of infrastructural capacity, relevant information from Thames Water has been obtained, including information on the major STWs and combined sewer overflows (CSOs).

To assess environmental capacity, the EA's catchment data explorer has been used to find the current trends in ecological and chemical status for a number of watercourses in the study area, with a particular focus on those containing STWs. The Thames River Basin Management Plan has been reviewed to identify the current measures in place to maintain water quality across the district.

Through a review of infrastructural and environmental capacity, any evidence gaps and constraints which may need further assessment have been identified.

2.6 Flood Risk

A high-level review of flood risk in West Oxfordshire has been carried out. The review of flood risk has focused on the potential impacts of future development.

An evaluation of the areas most sensitive to flood risk has been extrapolated to 2041 to consider the overall impact of the development proposed. This has used the EA national flood maps and DG5 records of sewer flooding. As well as accounting for the scale of development; climate change, local SuDS policy and urban creep have also been considered.

In addition to its impact on land use, the impact development may have on increasing discharges from STWs has been reviewed.

2.7 Other Environmental Constraints

This section principally covers protected sites and odour. There are a number of sites designated for their biodiversity importance within and surrounding West Oxfordshire. Wychwood national nature reserve is designated for its ancient semi-natural broadleaved woodland while Chimney Meadows National Nature Reserve is designated for its wildflower meadow and curlew breeding site. Other SSSI sites in the district include Blenheim Park, Bould Wood, Sarsgrove Wood, and Little Tew Meadows among others.

The location of STWs in relation to developments can contribute to odour risk. Odour risk within the district is reviewed, with steps to mitigating its risk discussed.

3 Baseline Assessment

The study area and main watercourses across it are shown in Figure 1. The study area comprises the administrative area of West Oxfordshire District Council.

The EA has classified the area served by Thames Water as being in "serious water stress"[10]. Serious water stress is defined in the Water Industry (Prescribed Conditions) Regulations 1999[11] as where *'the current household demand for water is a high proportion of the current effective rainfall which is available to meet that demand'.*

The River Thames is the main watercourse in the south of the district forming the entirety of the southern boundary and the southern half of the eastern boundary. Three other rivers flow southeastward through the district and join with the River Thames in the south. These are the River Windrush, River Evenlode, and River Glyme.

The West Oxfordshire district boundary is similar to the boundary of the Cotswolds WFD Management Catchment with the exception that Northleach, Stow-on-the-Wold and Moreton-in-Marsh are included within the management catchment but not the district boundary. In total, 14 are classed as *Poor*, and 16 are classed as *Moderate.* All catchments were measured to have a *Fail* chemical status in 2019. This shows the water environment to be vulnerable at present (more detail is provided in section 5.3.2).

According to the Met Office[12] average annual rainfall is approximately 682 mm (1991-2020). This is based on data from the Oxford weather station. Rainfall is delivered relatively uniformly across the year with moderate increases in the winter months.

In terms of groundwater, there is a wide range of geology. A large band of Oxford clay is present south of Carterton and Witney that runs across the entire width of the district. Mudstone is also present west of Charlbury and north of Burford. The rest of the district is underlain by a mixture of limestones and mudstones. The limestone formations in the centre and east of the district are designated as a highly productive aquifer west of Witney and a moderately productive aquifer east of Charlbury.

[10] Environment Agency (July 2021) Water Stressed Areas - Final Classification 2021. Version 1.0: www.gov.uk/government/publications/water-stressed-areas-2021-classification
[11] UK Statutory Instruments (1999) *The Water Industry (Prescribed Conditions) Regulations 1999* https://www.legislation.gov.uk/uksi/1999/3442/contents/made
[12] Met Office (2024) UK Climate Averages Oxford (Oxfordshire) https://www.metoffice.gov.uk/research/climate/maps-and-data/location-specific-long-term-averages/gcpn7mp10

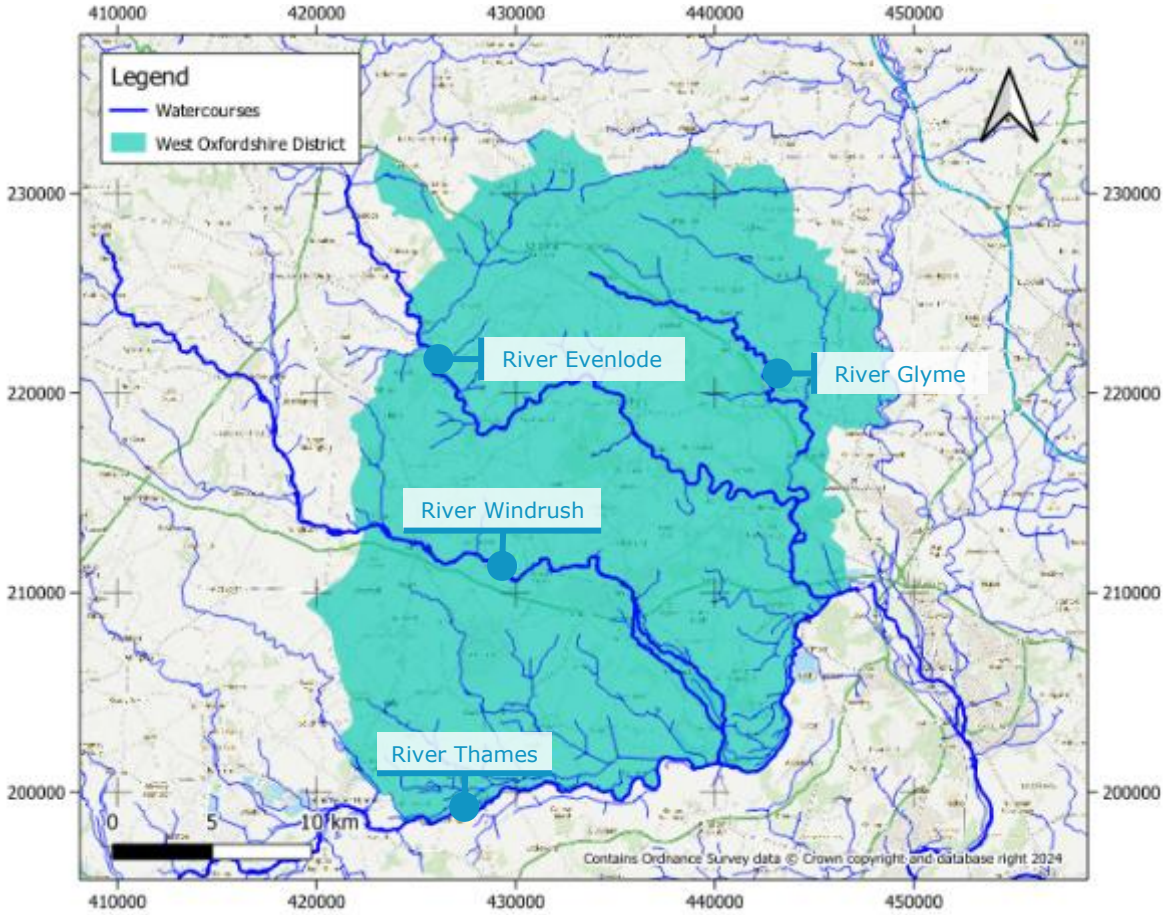

Figure 1- District Boundary and Watercourses

4 Water Resources and Supply

4.1 Introduction

This section first assesses the current water resources supplying the West Oxfordshire district area. Subsequently, the supply-demand position moving forward is reviewed against future development at the strategic level. The assessment investigates whether there will be enough water resources available to sustainably manage the projected development levels in the district area.

The existing abstraction license strategies across the district area are also reviewed. Recommendations are then made on future demand and resource management in the study area. Any requirements for further work are also provided.

4.2 Water Company Planning

Thames Water is responsible for water supply across West Oxfordshire. The water companies within England responsible for providing water supply and wastewater collection and treatment are funded in 5-year planning periods. The money they have available to spend is determined by the Water Services Regulation Authority (OFWAT) in consultation with government, the EA and consumer organisations amongst others. The consultation process is known as the Price Review (PR). The latest price review was in 2024 (PR24) and determined how much money water companies have available to spend between 2025 and 2030 termed Asset Management Plan 8 (AMP8). Once funding has been obtained for upgrading and/or building new infrastructure, there remain significant lead times for planning and construction before infrastructure can be considered functional. In this respect the water companies require detailed information on likely housing development well in advance. Table 1 outlines the lead time estimates provided by Thames Water.

Table 1- Thames Water estimate of infrastructure lead in times

Resource	Lead in time
Wastewater treatment upgrade	3-5 Years
Sewerage network upgrades	1-3 Years
Major resource development (new reservoir, new STW etc)	8-10 + Years

4.3 Water Resource Zone

The majority of West Oxfordshire falls within the SWOX WRZ, with the exception of a very small area in the north of the district that falls within the Strategic Grid (Severn Trent Water) WRZ. Figure 2 shows the SWOX WRZ relative to the West Oxfordshire district area.

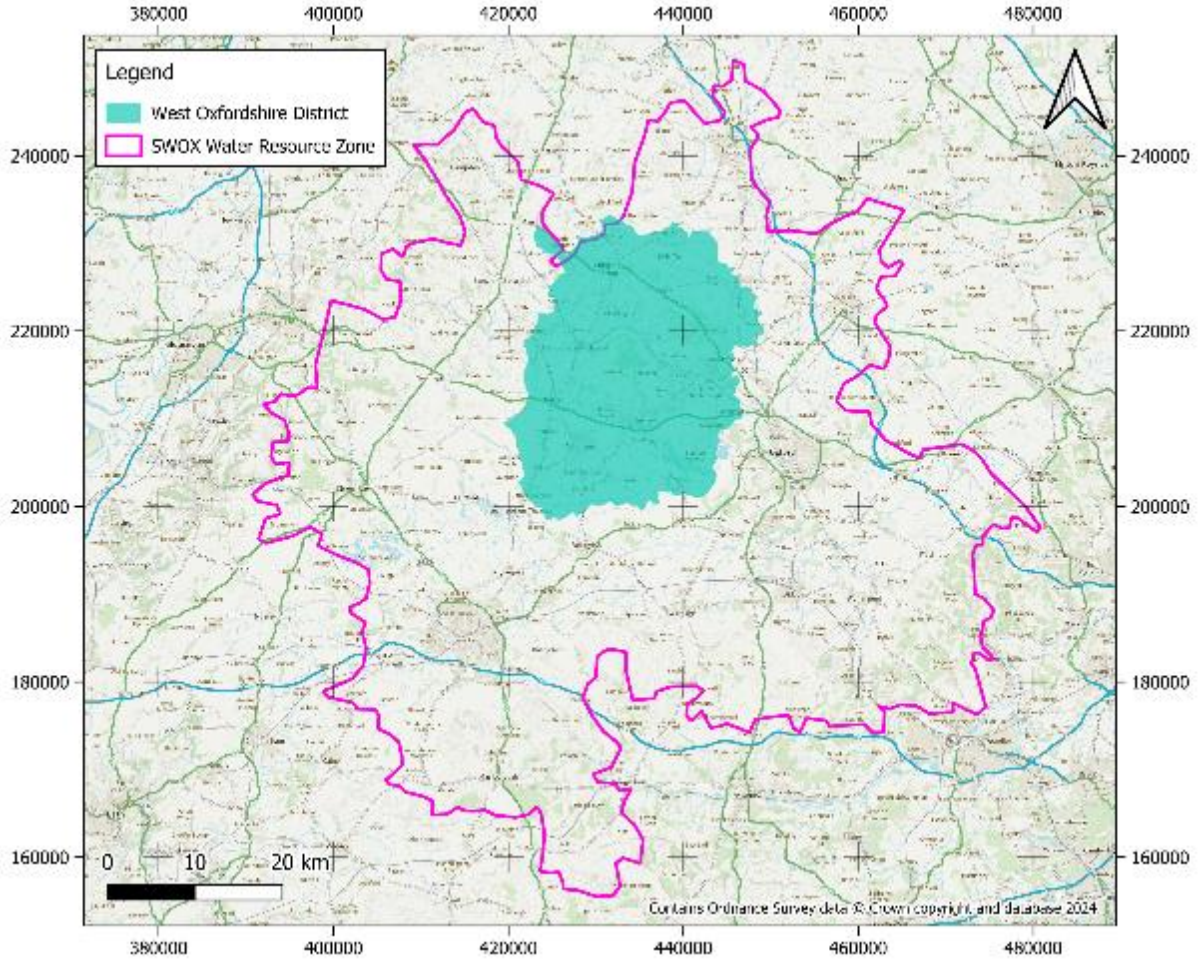

Figure 2- District Boundaries relative to Water Resource Zones

The SWOX WRZ is classified as a conjunctive use zone, in which approximately 60% of its supplies come from groundwater sources and 40% from surface water. The zone can be split into three 'sub-zones' which have major transfers between them, these are summarised as follows:

- North Oxfordshire (Oxford, Banbury, Witney, Farringdon): Surface water only via abstraction from the Thames into Farmoor Reservoir. It tends to produce more water than needed for local demand.
- Swindon & Cotswolds: Served by groundwater only mainly from Cotswolds Oolitic Limestone and Upper Kennet sources, it tends to produce less water than needed for local demand so relies on transfers from elsewhere, including from the Oxfordshire (Farmoor) Reservoir via the Blunsdon pipelines.
- South Oxfordshire (area stretching from Goring to Chinnor): Served by groundwater only from mainly chalk aquifer sources, it tends to produce more water than needed for local demand.

The major transfers within the WRZ are shown in Figure 3.

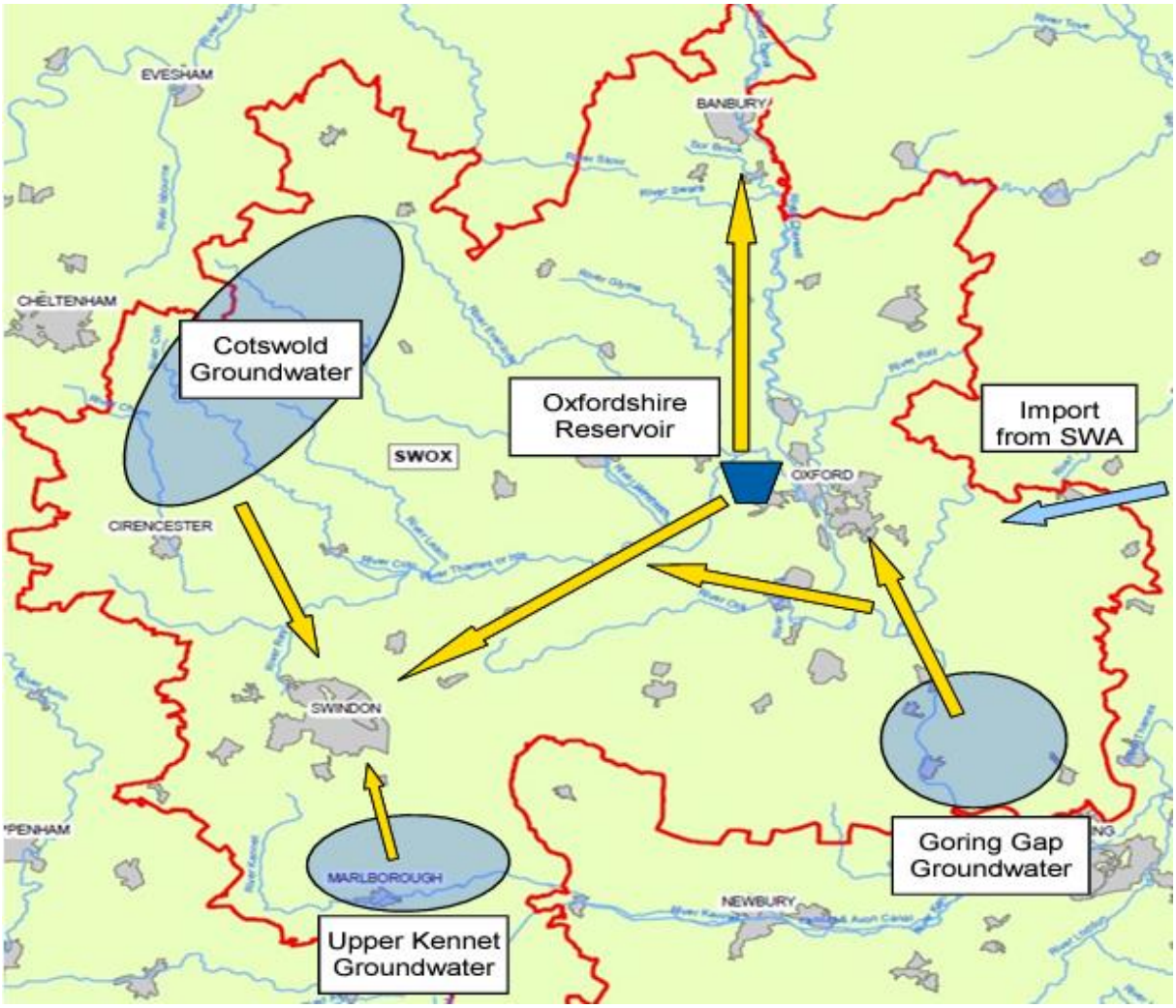

Figure 3- Principal Features of the SWOX WRZ (Source: Thames Water[13])

4.4 Population and Dwelling Forecast

Thames Water has assessed the impact of forecast population, household growth and non-household growth on water resources as part of its draft Water Resources Management Plan (WRMP) 2024. It sets out how they plan to provide a secure and sustainable supply of water for customers over the next 50 years (2025-2075). This scoping study has used the information from this latest WRMP to determine demand and delineate the potential impact of future development in the district.

Population and dwelling forecasts are paramount in estimating future demand. Thames Water's population forecasts consider housing development, ageing population profiles and migration. The preferred population forecasts and dwelling figures are heavily based on local plans and also consider Office of National Statistics (ONS) trend-based projections. In addition to the central forecasts, Thames Water has also produced maximum and minimum scenarios in the production of demand

[13] Thames Water (2023) *Revised Draft WRMP24 – Technical Appendix A: WRZ Integrity* https://www.thameswater.co.uk/media-library/home/about-us/regulation/water-resources/wrmp24-draft/technical-appendices/water-resource-zone-integrity.pdf

forecasts for use in adaptive planning scenarios. Only the central forecasts (based on local plans) are considered for this study.

Thames Water, working with demographic analytics, calculated a range of population and dwelling growth forecasts across its supply area. Population and dwelling forecasts have been developed for each WRZ based on an aggregate of the findings for each local authority area. The values derived by Thames Water are used to inform future demand, which is subsequently used in determination of suitable resource options. The figures derived will be compared against the quantum development expected during the plan period to determine if the levels of growth are in excess of or below Thames Water's anticipated values.

According to the WRMP the base population (2021/22) in the SWOX area is 1,057,749. The West Oxfordshire area has an estimated population of 116,905 as of 2022. This is based on the office of national statistics (ONS) 2022 mid-year estimate[14]. As the area of West Oxfordshire located outside of the SWOX area is very small and entirely rural, its population is assumed to be negligible. Therefore approximately 11.1% of the total SWOX base population is located within West Oxfordshire (using 2022 estimates).

The central population forecasts for the SWOX area show an increase in population of 244,625 from the base year to 2041. In the absence of a breakdown for each local authority area, population growth is assumed to be uniform across the SWOX area. The population growth in West Oxfordshire is therefore expected to be 11.1% of 244,625 at 27,037.

Thames Water has also estimated dwelling numbers across the WRMP plan period (2025-2075). The base year shows 431,000 dwellings in the SWOX WRZ. The projected increase in dwelling numbers by 2041 is 116,533. Using the population proportion above (11.1%), this translates to 47,635 dwellings in the base year with an increase of 12,880 dwellings by 2041. This again assumes uniform growth across the WRZ and that occupancy rate remains relatively stationary with respect to population change. Table 2 summarises the values estimated in terms of population and dwelling growth.

Table 2-Base and Projected (2041) Population and Dwelling Estimates based on Thames Water's WRMP

	SWOX WRZ	West Oxfordshire
Base Population (2021/2022)	1,057,749	116,905
Projected Population (2041)	1,302,374	143,942
Base Dwelling (2021/2022)	431,000	47,635
Projected Dwellings (2041)	547,533	60,515

Comparing these figures with the development estimated by West Oxfordshire, shows the total number of dwellings forecast to come forward to be higher, with 16,000 dwellings compared to the 12,880 dwellings based on the scaled down Thames Water's figures.

It is important to note that a large number of dwellings within the local plan are required to fulfil the unmet needs of Oxford City. When Thames Water figures are scaled down to Oxford City (18,312 dwellings) and then compared to the quantum of development likely to come forward in the city

[14] ONS (2024) *Population estimates for England and Wales: mid-2022 https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/populationestimatesforenglandandwales/mid2022*

(9,851 dwellings based on their housing and economic land availability assessment, 2023), the trend is reversed with the Thames Water's scaled down figures significantly exceeding Oxford City Council's housing estimates. It should also be noted that assessing the district in isolation may not be reflective of future water availability, given that the availability of water in West Oxfordshire will also be shaped by pressures in the SWOX WRZ and wider Thames Water supply area as a whole.

In summary, assumptions have been made in terms of uniform population growth across both WRZ and occupancy rate which increase uncertainty in the scaled down figures for the district. The assessment also does not capture shortfalls in housing in other nearby authorities (i.e. Oxford City) which may play a role in explaining some of the disparity. However, the differences to the local plan are noteworthy with the Thames Water forecast close to 20% lower in terms of dwelling numbers. A further assessment is recommended investigating the plan data for West Oxfordshire used by Thames Water in the WRMP. This will confirm the true degree to which the expected quantum of development in the district is captured by the WRMP.

4.5 Demand

Demand includes household use, non-household use, operational use (water used maintaining the network), water taken unbilled and leakage. The main driver on demand is population, however several other factors also play a role, including the effects of climate change, improvements in efficiency, and changes in household/non-household consumption.

In terms of per capita demand this is expected to fall moving forward with changes in behaviour and increases in water efficiency. Climate change is expected to offset this slightly with increasing demand due to hot and dry weather, in which customers are likely to use more water for activities such as garden watering. On the other hand, climate change is likely to lead to milder winters, which will reduce leakages caused by contraction in cold weather.

It should be noted in the demand scenarios presented; new demand management activity ceases at the end of AMP7 (2025). The measures introduced under AMP7 include the installation of meters, leakage reductions and household use reductions (due to public awareness and water efficiency savings). The Ml/d savings earmarked for these measures introduced under AMP7 will still have a continued effect, however additional measures introduced as part of AMP8 and beyond are not accounted for. This means that the consumption estimates are considered to be conservative with further likely reductions in consumption that are not included in the forecast.

The WRMP has assessed demand using Dry Year Annual Average (DYAA) and Dry Year Critical Period (DYCP) forecasts. The DYAA is the annual average value of water demand over the course of a dry year. The DYCP forecast describes the average daily demand during the peak week for water demand, rather than an annual average across the year.

For the DYAA forecast, despite a per capita reduction in consumption (due to AMP7 measures), total demand in the SWOX region is expected to increase from 280.26 Ml/d in 2025/26 (the start of AMP8) to 301.08 Ml/d by 2041. The increases in demand are largely driven by population growth increasing household demand, non-household consumption is forecast to fall with a small decrease in leakage too.

Based on the DYCP forecast total demand in the SWOX region is expected to increase from 340.67 Ml/d in 2025/26 to 363.72 Ml/d by 2041. This is roughly comparable to the changes in the DYAA forecast in terms of percentage increases. Table 3 provides a summary of the changes to DYAA and DYCP values from the beginning of AMP8 (2025/26) across the plan period up to 2041. Values are provided for the SWOX WRZs with scaled down values also shown for the district based on the population proportion (11.1%).

Table 3-DYAA and DYCP Forecasts (2025-2041) based on Thames Water's WRMP

	SWOX WRZ	West Oxfordshire
DYAA (2025/2026)	280.26	31.11
Projected DYAA (2041)	301.08	33.42
DYCP (2025/2026)	340.67	37.81
Projected DYCP (2041)	363.72	40.37

4.6 Supply

As part of the WRMP, Thames Water has determined the amount of water that is available for water supply, termed the Deployable Output (DO). It has also estimated and forecast the Water Available for Use (WAFU). The WAFU is the amount of water that water companies expect to be able to supply under the demand conditions set out in the levels of service. The key components of WAFU are the DO and water from neighbouring water companies' resources zones. It also takes into account climate change, the water lost through process, planned and unplanned events (outages) sustainability reductions and water transfers to other companies. Note that in its WRMP, when estimating WAFU the DO values are estimated for a dry year pertaining to the 1 in 100-Year drought.

Looking to the future, water supplies are forecast to fall, the main cause being climate change. In the SWOX WRZ the water available for use (WAFU) in 2025/26 is 304.77 Ml/d and 330.02 Ml/d under DYAA and DYCP conditions respectively. Based on the demand figures estimated and shown above, this shows the WAFU to exceed demand under DYAA conditions, however during peak week (DYCP) conditions, there is a shortfall of 10.65 Ml/d.

Based on graphs provided in the WRMP[15], in 2041 the forecast WAFU is estimated to be 285 Ml/d and 310 Ml/d under DYAA and DYCP conditions respectively. Using the projected demand figures in Table 3 this points to a shortfall of 16.08 Ml/d under DYAA conditions and 53.72 Ml/d under DYCP conditions.

Figure 4 extracted from the WRMP shows the finding of Thames Water's climate change vulnerability assessment, which shows the SWOX area as being at medium vulnerability.

[15] Thames Water (2024) Figures 4-16 p58 rdWRMP24+-+Section+4+-+Current+and+Future+Water+Supply.pdf (dn9cxogfaqr3n.cloudfront.net)

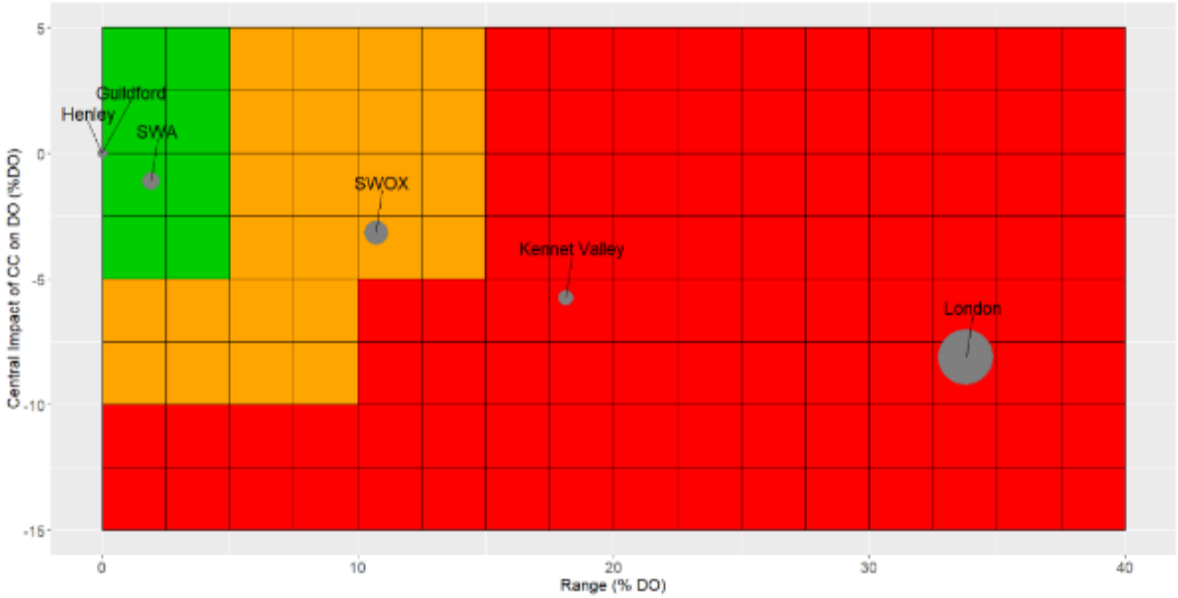

Figure 4- Thames Water Basic Vulnerability Assessment- Climate Change (Source: Thames Water[16])

Table 4 provides a summary of the changes to WAFU values from the beginning of AMP8 (2025/26) across the plan period up to 2041. Values are provided for the SWOX WRZs with scaled down values also shown for the district based on the population proportion (11.1%).

Table 4-WAFU DYAA and DYCP Forecasts (2025-2041) based on Thames Water's WRMP

	SWOX WRZ	West Oxfordshire
WAFU (Ml/d) DYAA (2025/2026)	304.77	33.83
Projected WAFU (Ml/d) DYAA (2041)	285.00	31.64
WAFU (Ml/d) DYCP (2025/2026)	330.02	36.63
Projected WAFU (Ml/d) DYCP (2041)	310.00	34.41

Table 5 provides a summary of the differences between WAFU and demand values from the beginning of AMP8 (2025/26) across the plan period up to 2041. It shows adequate supply for WAFU in 2025/2026 for all areas when considering DYAA conditions. Under DYCP conditions there is a small shortfall in the SWOX area. In the projected scenario for 2041, this shortfall is set to increase.

[16] Thames Water (2023) *Section 4 – Current and Future Water Supply p36* https://dn9cxogfaqr3n.cloudfront.net/revised-draft/Technical+Report/rdWRMP24+-+Section+4+-+Current+and+Future+Water+Supply.pdf

Table 5-Projected differences in WAFU and Demand (DYAA and DYCP) based on Thames Water's WRMP

	SWOX WRZ	West Oxfordshire	Percentage Shortfall
WAFU-Demand (Ml/d) DYAA (2025/2026)	24.51	2.72	+8.75%
Projected WAFU-Demand (Ml/d) DYAA (2041)	-16.08	-1.78	-5.34%
WAFU-Demand (Ml/d) DYCP (2025/2026)	-10.65	-1.18	-3.13%
Projected WAFU-Demand (Ml/d) DYCP (2041)	-53.72	-5.96	-14.77%

The current forecast indicates potential water shortages in the West Oxfordshire district under drought conditions. The growth in demand due to population growth and development outstrips any water demand management activity. Also, climate change affects the amount of water available to supply.

It should be noted that the values stated are based on several assumptions and are subject to uncertainty. Namely that the DYCP and DYAA figures can be scaled down based solely on population and that the trends in non-household demand and leakage for the WRZs will broadly match the trends in the district. Furthermore, for the demand scenarios presented, new demand management activity ceases at the end of AMP7 (2025) and the supply scenarios do not account for potential resource options, both of which are covered in section 4.7.

In any case the results do show that without corrective action, the supply for the district could be less secure for all the scenarios tested. This means that there could be a greater probability that demand restrictions will be required in dry years. If further assessment confirms that the WRMP does not account for the expected quantum of development these potential issues could be exacerbated.

4.7 Demand Management and Resource Options

When considering demand management options, Thames water has considered the three main components of water demand, which consist of:

- Household (HH) Consumption: water consumed by households
- Non-Household (NHH) Consumption: water consumed by businesses
- Leakage: water that leaks from water mains and customer supply pipes

Demand management is considered to be the best means to negate a water deficit in the short to medium term with resource options growing in importance in the longer term. Some of the primary measures include metering, household innovation, tariffs/incentives, government led demand reduction (e.g. water labelling and minimum standards) and media campaigns.

The WRMP has identified eight ambitions with respect to demand management:

- Reduce leakage by 50% (from 2017-18 levels) by 2050
- Maximise feasible Per Capita Consumption (PCC) reductions by 2050
- Smart meter all practicable connections by 2035

- Minimise un-meterable properties by 2040
- Wipe out most wastage by 2050
- Minimise impact on customer bills
- Minimise carbon cost
- Create a deliverable, resilient and ambitious programme

The WRMP has projected future changes to consumption and leakage based on four different demand management programmes (Low, Medium, High, High +). Table 6 shows the projected changes in household PCC and how these relate to the national government's PCC target of 110 l/head/day by 2050 which was set as part of the Environmental Improvement Plan 2023[17]. For context, in the demand scenarios presented in section 4.5, the measured PCC in 2041 is approximately 133.31 l/head/day which translates to a total household consumption of 176.36 Ml/d for the SWOX area. Based on the target values below, the PCC would be approximately 119 l/head/day, an 11% reduction which would result in a fall of 18.93 Ml/d for total household consumption. Comparing this to Table 5, this has the potential to completely offset the shortfall estimated under DYAA conditions of 10.65 Ml/d and significantly reduce the shortfall under DYCP conditions of 53.72 Ml/d.

Table 6- PCC (l/head/d) projections extracted from Thames Water WRMP

Demand Programme	2024/25	2037/38	2049/50
Low	142.9	128.9	113.9
Medium	142.9	126.0	108.4
High	142.9	126.0	108.4
High+	142.9	124.4	106.9
Target			110.0

Note for new build dwellings, a water efficiency calculation is a legal requirement set out in Part G of the Building Regulations. These calculations are required for all new build dwellings, as well as conversions. Part G requires that a dwelling must not use more than 125 l/head/day. However, the Planning Practice Guidance (PPG)[18] states that 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 l/head/day. The adopted 2031 local plan[19] for West Oxfordshire includes an expectation in Policy OS3 for new residential development to achieve the tighter standard of 110 l/head/day.

Currently, as mentioned the national government's PCC target is 110 l/head/day, however tighter standards may be sought going forward. Previous governments have consulted on introducing more ambitious requirements through the Building Regulations including Defra's 2021 Consultation on measures to reduce personal water use[20]. This discussed the potential to change the baseline standard of 125 l/head/day to 110 l/head/day, it also discussed a staged introduction of tighter standards down to 50 l/head/day. Furthermore, the Environmental Improvement Plan 2023

[17] DEFRA (2023) Environmental Improvement Plan 2023 https://www.gov.uk/government/publications/environmental-improvement-plan
[18] Department for Levelling Up, Housing and Communities (2015) *Housing: optional technical standards* https://www.gov.uk/guidance/housing-optional-technical-standards
[19] West Oxfordshire District Council (2018) *West Oxfordshire Local Plan 2031* https://www.westoxon.gov.uk/media/feyjmpen/local-plan.pdf
[20] DEFRA (2021) *Consultation on measures to reduce personal water use* https://assets.publishing.service.gov.uk/media/60dee0bdd3bf7f7c2b7f30b7/Summary_of_responses_for_the_consultation_on_measures_to_reduce_personal_water_use_.pdf

discusses how the building regulations should be periodically reviewed with a view to setting more ambitious statutory requirements in the future.

Given the issues of water stress in the district, adoption of tighter standards (when enforceable) may be sought by the council during the plan period. A number of public and private bodies have investigated the potential for tighter standards. In response to the EA's publication, *Meeting our Future Water Needs: a National Framework for Water Resources*[21] a road map is being developed by national government towards greater water efficiency in new developments and retrofits. The Future Homes Hub are providing input to the Roadmap by bringing together industry stakeholders. It has published a report[22] which highlights the need for changes in future PCC standards, fittings, labelling, water reuse and water positivity to enable sustainable growth. In terms of PCC specifically, it has reviewed foreseeable changes in fittings and technology to set out a roadmap for future standards between 2025-2035. These are shown in Table 7, with different standards set depending on levels of water stress.

Table 7- Future Homes Hub Litres per person per day framework

Demand Programme	2025	2030	2035
Achieved through fittings approach	105 l/head/day	100 l/head/day	90 l/head/day
In water stressed areas	100 l/head/day	90 l/head/day	80 l/head/day
In seriously water stressed areas	90 l/head/day	To be determined	To be determined

RIBA has also developed in consultation with other professional UK construction bodies voluntary performance targets for water use[23] with regard to construction. The performance targets align with the future legislative horizon and set out challenging but achievable targets in order to have a realistic prospect of achieving net zero carbon for the whole UK building stock by 2050. In terms of water use it sets a standard of 95 l/head/day by 2025 and 75 l/head/day by 2030. BREEAM[24] does not set specific standards for PCC, however, does set graded standards for individual water fittings which developers can use to reduce water consumption. The Future Homes Hub, RIBA and BREEAM standards are all voluntary standards at this stage that developers could choose to align with.

It should be noted that reducing PCC to tighter standards across the district will likely require demand reduction actions from Thames Water in combination with government led policy changes.

Table 8 shows the projected changes for non-household consumption as percentage reductions. Note currently Thames Water has no variable options for non-household use reduction. For non-household use, the differences between the Low/Medium and High/High+ programmes result from the differing levels of the Smarter Business Visit (SBV) option and innovation in general. Note, a SBV includes a free visit by qualified plumbers to install water saving devices and fix leaking utilities in non-households. This is seen as one of the most effective demand reduction programmes in non-

[21] EA (2020) *Meeting our future water needs: a national framework for water resources* https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources

[22] Future Homes Hub (2024) *Water Ready- A report to inform HM Government's roadmap for water efficient new homes* https://irp.cdnwebsite.com/bdbb2d99/files/uploaded/Water%20Ready_A%20report%20to%20inform%20HM%20Government-s%20roadmap%20for%20water%20efficient%20new%20homes.pdf

[23] RIBA (2021) *RIBA 2030 Climate Challenge* https://www.architecture.com/-/media/files/Climate-action/RIBA-2030-Climate-Challenge.pdf?srsltid=AfmBOopW1CKKCWUCJ76wMu2194M2EVKmfsT9sCZT-NoSvN8rClGvzGv1

[24] BREEAM (2024) *BREEAM Standards* https://breeam.com/standards

households. For context SWOX had a non-household consumption of 54.1 Ml/d in 2021/22, assuming a linear fall from 2017/18 to 2049/50 target levels, this would result in an estimated non-household consumption of 49.1 Ml/d in 2041.

Table 8- Demand programme business use reductions from 2019/20 levels

Demand Programme	2024/25	2037/38	2049/50
Low/Medium	12.7%	7.9%	5.3%
High/High +	12.7%	16.0%	20.7%
Target		9%	15%

The PCC targets set for residential dwellings do not apply for non-household development. However, non-household development should be encouraged to demonstrate the installation of water efficient products where possible. SBVs and water efficiency labelling can help in this regard, however government actions to set exemplar standards for non-households will likely be required to regulate non-household developments more closely.

Table 9 shows the projected changes for leakage as percentage reductions. Note there is no variation around Low, Medium, and High programmes for leakage. This results from the expectation that Thames Water hits its leakage target for 2049/50, resulting in the value constraining each programme. High+ presents an accelerated leakage profile, with a target of near 50% reduction by 2037/38. This programme heavily relies on expensive leakage innovation and mains rehabilitation policies. For context SWOX had a reported leakage of 68.5 Ml/d in 2021/22, assuming a linear fall from 2017/18 to 2049/50 for the target levels, this would result in an estimated leakage of 48.5 Ml/d in 2041.

Table 9- Demand programme leakage reductions from 2017/18 levels

Demand Programme	2024/25	2026/27	2031/32	2037/38	2049/2050
Low/Medium/High	25.2%	32.8%	40.3%	45.0%	52.5%
High+	25.2%	33.2%	42.1%	49.6%	57.8%
Target		20%	30%	37%	50%

In terms of resource options, the latest WRMP has identified a number of potential resource options following a screening process which was primarily based on stakeholder engagement and scenario testing. The main options proposed include a new reservoir near Abingdon-on-Thames in the Vale of White Horse. The reservoir would be filled from the River Thames in the winter. When river levels fall or demand increases, water would be released from the reservoir back into the river for re-abstraction downstream.

Thames Water intend to submit a development consent order (DCO) in 2026, seeking permission to construct and maintain the new reservoir. If granted, construction is forecast to begin in 2029 with the reservoir planned to begin operating in 2040. Supply to the Thames Water supply area could be increased by up to 271 Ml/d, some of the supply would also be provided to other water companies. In terms of the SWOX WRZ specifically, it is expected that supplies could be bolstered by up to 48 Ml/d after 2050 for the more extreme future scenarios[25]. This is close to the end of the local plan period; however, it could offer some additional security to the district.

[25] Thames Water (20) South East Strategic Reservoir Option (SESRO) Technical Supporting Document B7 https://www.thameswater.co.uk/media-library/home/about-us/regulation/regional-water-resources/south-east-strategic-reservoir/gate-2-reports/B-7---SESRO-SEA.pdf

Other reservoir options in Chinnor, South Oxfordshire and Marsh Gibbon, Buckinghamshire are also being explored by Thames Water. These reservoirs would also serve a number of WRZs across the Thames Water supply area. Estimates suggest that Chinnor could provide an additional 66 Ml/d to the overall supply area, with Marsh Gibbon up to 149 Ml/d.

Raw water transfers could also supply a significant amount of additional yield. A raw water transfer from the River Severn in Deerhurst, Gloucestershire to Culham, South Oxfordshire could potentially supply 107 Ml/d of additional yield to the Thames Water supply area. A transfer from the Oxford Canal could also provide up to 15Ml/d to the SWOX WRZ specifically.

A further yield of 11.1 Ml/d could be found from groundwater abstractions, internal inter-zonal transfers, and the removal of pumping constraints.

Whilst these supply options offer large increases in yield, they are subject to significant lead times, with the majority forming part of Thames Water's long-term plan (2045-2099). Table 10 summarises the feasible list of resource options for the SWOX WRZ. Note, given the surplus of water within the Henley WRZ further resource options have not been explored.

Table 10-Feasible Resource Options for SWOX WRZ

Option Type	Name	Output (Ml/d)	Commentary
Raw Water Transfer (conveyance)	Severn Thames Transfer	107	107 Ml/d is the mid range option. A lower range and upper range option of 80 Ml/d and 134 Ml/d are also being explored. The transfer would serve the entire Thames Water supply area.
	Oxford Canal Transfer	15	
New Reservoir	Abingdon-on-Thames Reservoir	185	The output value stated is for a 100Mm^3 reservoir. Sizes from 75-150 Mm^3 are being considered providing between 149-271 Ml/d in terms of output. The reservoir would serve the SWOX, London and SWA WRZs. It would also help provide supply to other water companies.
	Chinnor Reservoir	66	The reservoir would serve the SWOX, London and SWA WRZs.
	Marsh Gibbon Reservoir	103	The output value stated is for a 50 Mm^3 reservoir. Sizes from 30-75 Mm^3 are being considered providing between 66-149 Ml/d in terms of output. The reservoir would serve the SWOX, London and SWA WRZs.
Groundwater	Moulsford	2	
	Woods Farm	2.4	
Removal of Constraints to Deployable Outputs	Ashton Keynes borehole pumps	2	
Internal Inter-Zonal Transfer	Henley to SWOX	2.4	Option to transfer 5 Ml/d also considered feasible.
	Kennet Valley to SWOX	2.3	Option to transfer 4.5 Ml/d also considered feasible.

In addition to the supply options outlined above, the WRMP has also identified a number of drought permit options. Drought permits are options that enable water companies to abstract more water than permitted by their abstraction licenses. These options are only available in drought situations and require the water company to demonstrate that there has been an exceptional shortage of rainfall. For the SWOX WRZ, the drought permit for Gatehampton has the potential to offer an additional yield of 3.5 Ml/d. For the Henley WRZ, the drought permit for Sheeplands/Harpsden has the potential to offer an additional yield of 5.6 Ml/d.

Unlike the supply options, the demand options are able to deliver from the first year of implementation due to shorter lead times. Whilst the yield from such measures are typically less than those found for the supply options, they still offer significant savings. Based on a review of the figures estimated in the WRMP, reductions in consumption and leakage could yield approximately 43.9 Ml/d in the SWOX area by 2041 based on the target estimates. This should be sufficient to significantly offset some of the deficits measured in the development scenarios tested by Thames Water. However, it should be noted that there remains an element of risk around the expectation on the public and on the government to assist in the demand reductions set.

4.8 Abstraction Licenses

A data request was sent to the EA to establish the existing water abstraction licenses currently in use in the West Oxfordshire District. Currently there are a total of 114 abstraction licenses in place, all of which are understood to be point abstractions. In total 55 of the abstractions come from agriculture, 29 are for private water supplies, 24 are for industrial uses, 4 are for environmental improvements and 2 are for amenity. The 114 licenses are distributed across 48 license holders, with many license holders having multiple point abstractions at a given site. Figure 6 maps the location of the abstractions. Appendix 1 provides the full abstraction records provided by the EA.

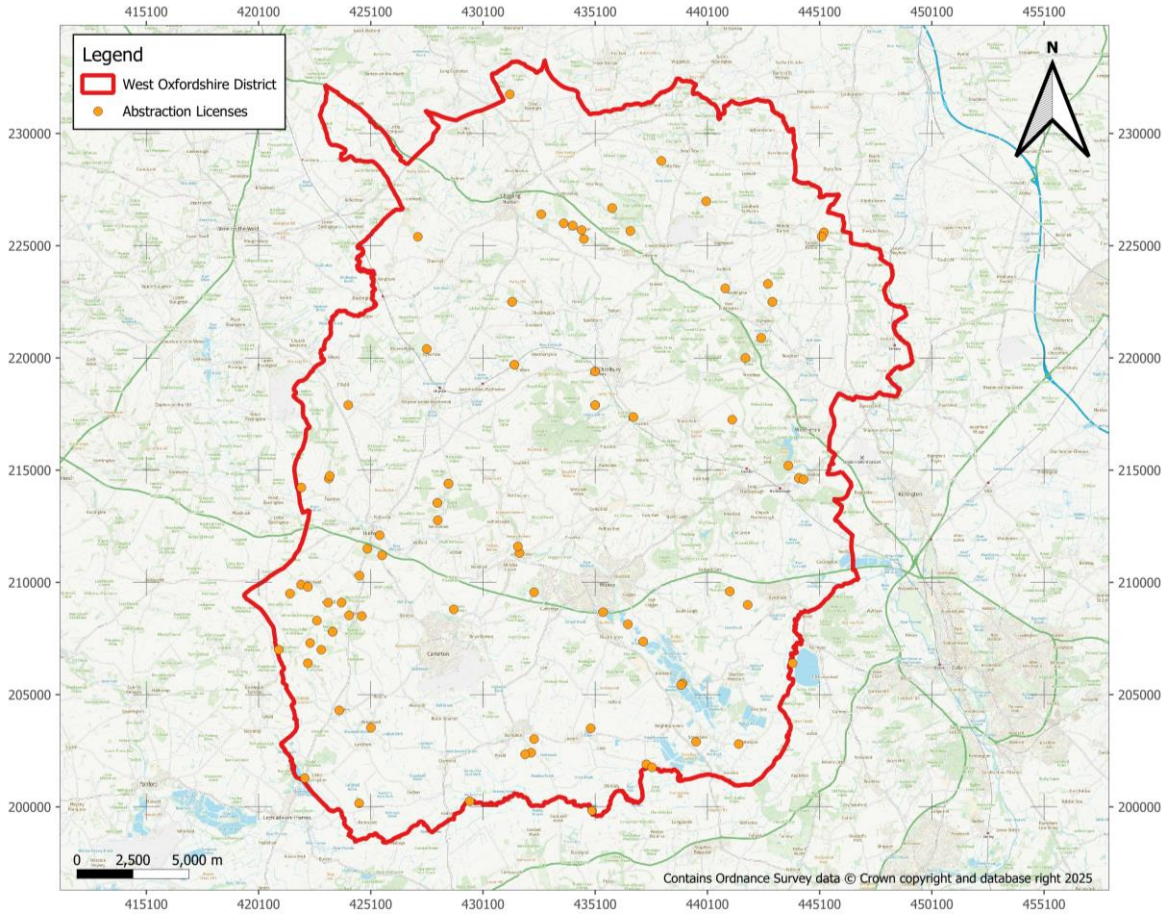

Figure 5- Location of abstraction licenses in West Oxfordshire

Based on the Thames Abstraction License Strategy[26] the Cotswolds catchment which encompasses the majority of the district is classed as 'restricted water available' at the Q30 flow. The Q30 is the flow that will be equalled or exceeded for at least 30% of the time it is typically equivalent to the mean flow. At the Q50 flow and below the district is classed as 'water not available' for use.

However, the strategy states that there is no evidence to show that managing the Cotswold and wider Thames catchment to the highly restrictive Q30 hands off flow (HoF) identified in the resource assessment will benefit the river and its ecology. Evidence shows that the current management of abstraction in the Lower Thames is not preventing it from reaching 'Good Ecological Potential (GEP)' and the EA recognise that it has a duty to ensure abstraction meets the needs of people, businesses and the environment.

The bespoke strategy devised allows abstractions of less than 2 Ml/d to take place when flows recorded on the River Thames at Kingston are above Q50 (based on daily mean flows over the preceding 5 days). For all abstractions above 2 Ml/d, a hands-off flow (HoF) of between the Q50 and Q30 is applied based on the perceived level of risk in the area. The abstraction strategy also highlights that more stringent requirements may also be required in protected areas for example Special Areas of Conservation (SAC) and Special Protection Area (SPA).

Groundwater licences that do not have a direct impact upon river flow and will not contribute to the deterioration of groundwater quantitative status may be permitted without the same restrictions. In these cases, restrictions will be determined on a case-by-case basis and applications will be subject to the normal licence determination process.

Note, the Thames Abstraction License Strategy[27] covers the southern part of the district. It is also based on flows recorded at the River Thames at Kingston and has the same restrictions in place.

Further abstraction for water supply may be required going forward. This will depend on development and climate pressures not only in the district but across the wider Thames Water supply area. It will also be influenced by the implementation of Thames Water's WRMP. In this regard, existing abstractions may need to be reduced through better management practices. DEFRA's water abstraction plan[28] lists the following measures to reduce abstraction:

- Introducing controls on more licences to better protect the environment, particularly at low flows.
- Capping licences to prevent increased abstraction damaging the environment.
- Fine tuning the use of surface water and groundwater sources to make the best use of water when it is available while protecting the environment.
- Supporting rapid water trading where it is needed most to allow abstractors to share access to water quickly.
- Allowing some winter abstractors to take water at the highest flows in the summer to boost the use of stored water.

[26] EA (2019) *Thames Abstraction License Strategy* https://assets.publishing.service.gov.uk/media/5de4ebc940f0b650c268495f/Thames-Abstraction-Licensing-Strategy.pdf
[27] EA (2019) *Kennet and Vale of White Horse License Strategy* https://assets.publishing.service.gov.uk/media/5cb70475e5274a4f43fa5077/Kennet-and-Vale-of-White-Horse-Abstraction-Licensing-Strategy.pdf
[28] DEFRA (2021) *Water abstraction plan* https://www.gov.uk/government/publications/water-abstraction-plan-2017/

- Sharing real-time information on river flows and forecast changes to help abstractors plan their water use.
- Managing water discharges to benefit abstractors downstream who depend on them.

4.9 Summary

Based on the DYAA and DYCP forecasts in Thames Water's latest WRMP there could be shortfalls in water up to 2041 and beyond.

The WRMP has identified demand management through a combination of leakage reduction, smart metering and the promotion of water efficiency as the best means to negate a water deficit in the short to medium term. This should be sufficient to offset some of the deficits estimated, however supply options are likely to be necessary, especially in the longer term. In this regard, Thames Water is exploring a number of options for its supply area including a new reservoir near Abingdon-on-Thames, raw water transfers and groundwater abstractions. These have the potential to offset the deficits estimated, however will require significant lead in times and are proposed to serve the Thames Water supply area rather than the district in isolation.

In terms of infrastructural capacity, upgrades may be required across the district to ensure that water supply infrastructure is in place to accommodate the development being brought forward as part of the local plan. Typically, these upgrades would have a lead time of 1-3 years. In this regard, the developer is encouraged to work with Thames Water early on in the planning process to understand what infrastructure is required, in addition to where, when and how it will be delivered.

The assessment for the district provides an understanding of water resource pressures in the context of future development and climate change. However, it is important to note that the findings are caveated on the basis of several assumptions. The main evidence gaps are identified as:

- Whether the demand and supply changes forecasted for the SWOX WRZ based on population and dwellings fully translate to the West Oxfordshire district.
- The full scope of water network upgrades remain unclear until development allocations come forward and more detailed modelling is carried out by Thames Water.

To address the first evidence gap, further technical work would be required in order to refine population estimates and derive specific deficits for the district considering the quantum of development proposed in the local plan. However, this should be captured in future updates to Thames Water's WRMP which will make use of more recent local plan data including the local plan 2041. Furthermore, assessing West Oxfordshire in isolation may not be reflective of future water availability, given that the availability of water in West Oxfordshire will also be shaped by pressures in the SWOX WRZ and wider Thames Water supply area as a whole. At this stage it is recommended that Thames Water is contacted to check the dwelling numbers used for West Oxfordshire in their WRMP. This will confirm whether the full quantum of development being brought forward in the district has been captured.

In terms of the second evidence gap, once the location and size of site allocations are known it is recommended that these are provided to Thames Water. This will allow it to generate RAG reports detailing where water supply upgrades will likely be required to manage future development. The deliverability of upgrades to the water network would also require further technical input from Thames Water as sites are brought forward through the planning process.

5 Wastewater Infrastructure, Water Quality and Environmental Capacity

5.1 Introduction

This section assesses the infrastructural capacity of the wastewater system and environmental capacity of the receiving water environment. The infrastructural capacity is defined as the ability of the wastewater system to collect, transfer and treat wastewater from homes and businesses. The environmental capacity is defined as the water quality needed to protect aquatic wildlife and the environment. The latter is associated with the water quality targets required to protect waterbodies and the associated STW and storm discharge environmental permits in place to achieve this. Both are assessed in the context of future development.

5.2 Infrastructural Capacity

5.2.1 Drainage and Wastewater Management Plan & Catchment Strategic Plan

Water and sewerage companies must produce Drainage and Wastewater Management Plans (DWMPs) covering a minimum of 25 years looking at current and future capacity, pressures, and risks to their networks such as climate change and population growth. DWMPs must detail how companies will manage these pressures and risks through their business plans and how they will work with other risk management authorities and/or drainage asset owners.

Thames Water published its DWMP in 2023[29], and as part of this produced a long-term Strategic Plan for Oxfordshire, Swindon, Wiltshire, Gloucestershire and Warwickshire[30]. The DWMP process is iterative and will be repeated every 5 years, with the next version due in 2028. The current DWMP has three main goals:

- Stop internal and external property sewer flooding- up to a 1 in 50-year storm event.
- Eliminate harm from storm overflows - no more than an average of 10 discharges per annum by 2045 at overflow locations and no adverse ecological impact.
- Enhancing resilience at sewage treatment works - to ensure 100% permit compliance and protect river water quality.

Linked to the goal on storm overflows above, is the government's requirement that by 2035 water and sewerage companies in England must improve all storm overflows discharging into or near designated bathing waters and 75% of those near high-priority ecological sites. By 2050, all remaining storm overflows will be addressed. These targets are part of the Storm Overflows Discharge Reduction Plan[31], which aims to improve water quality and protect public health.

The area covered by Thames Water's DWMP includes West Oxfordshire and encompasses the upper reaches of the River Thames and its tributaries. The region mostly has separate sewer systems that convey wastewater and surface water from homes and businesses. However, combined sewers still make up a significant proportion of the sewer network and many of the separate systems ultimately drain into combined sewers. Rainfall runoff from roofs is often collected by soakaways. Surface water

[29] Thames Water (2023) *Drainage and Wastewater Management Plan (DWMP)* https://www.thameswater.co.uk/about-us/regulation/drainage-and-wastewater-management/our-dwmp
[30] Thames Water (2023) *Oxfordshire, Swindon, Wiltshire, Gloucestershire and Warwickshire Catchment Strategic Plan* https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/oxfordshire-swindon-wiltshire-gloucestershire-warwickshire-catchment-strategic-plan.pdf
[31] DEFRA (2023) *Storm overflows discharge reduction plan* https://www.gov.uk/government/publications/storm-overflows-discharge-reduction-plan

sewers and highway drainage discharge directly into nearby watercourses. The river water quality status in this region and within the district specifically is generally moderate to poor (see section 5.3.2 for more detail on watercourse classifications).

The DWMP's initial risk-based screening found that 77% of catchments were vulnerable to the risks associated with development and climate change and warranted long-term planning. The analysis has also identified significant risks of pollution and sewer collapses in the area. If no actions are taken over the next 25 years, properties at risk of flooding internally (up to a 1 in 50-year storm) are forecast to increase from 5% in 2020 to 7% in 2050. In terms of storm overflows, there would be a 36% increase in the number of overflows per annum from 2020-2050 and for STWs, the number of water quality compliance failures would increase from 24% in 2020 up to 37% in 2050.

To prevent these outcomes, Thames Water have identified the following options:

- Sewer lining and manhole sealing - Undertaking a programme of sewer lining and manhole sealing to reduce areas of high infiltration risk that lead to unwanted flows in sewerage systems.
- Network improvements - Managing the impact of surface water on the sewerage system, through the identification of network improvements to address deficiencies in the sewerage network capacity.
- Individual property level protection - Providing vulnerable homes with active and passive sewer flood protection measures.
- Existing inter-catchment transfers - Optimise existing connections between catchments and STWs, to transfer flows in stressed areas to catchments with available capacity.
- Surface water management - Surface water separation and the installation of features to collect, store and/or infiltrate surface water from buildings and impermeable areas.
- Treatment process technologies **-** Implementation of a range of different technologies identified to enhance the performance of the STWs. This will include the use of more intensive wastewater treatment processes which have the capacity to meet future demands.

The widespread implementation of these measures could be vital in ensuring sufficient infrastructural and environmental capacity going forward. The strategic plan produced as part of the DWMP has specifically identified the Witney STW catchments which serves part of the district for future improvement due to issues with capacity, overflows and sewer flooding. In these catchments the measures outlined above will be prioritised.

5.2.2 Sewage Treatment Works

Discharges from STWs are controlled by discharge consents set by the EA, which detail the flow rate and effluent quality that the STW must meet to achieve water quality targets. The Dry Weather Flow (DWF) is a key parameter in this regard, it is the flow that may be discharged in dry weather (i.e. flow which occurs in the absence of any runoff from rainfall, snow melt or other sources). The DWF permit specifies the allowable discharge flow rate and required effluent quality of the flow.

Flow to Full Treatment (FFT) is a measure of how much wastewater a treatment works must be able to treat before spilling can occur. All wastewater treatment works are built to be able to deal with a certain amount of wastewater, calculated depending on the area they serve and many have a requirement in their environmental permit about the FFT level they must work to. Where the FFT level is exceeded, water may need to be diverted to storm tanks (if available). Water will typically be held in these tanks until the storm passes. The contents of these storm tanks can then be returned to be treated by the works. Where a storm is prolonged or sustained, then often the environmental permit will allow the water company to release the extra incoming rainwater and diluted wastewater

into the environment, normally after partial treatment. If a water company is diverting this rain and wastewater to storm tanks or the environment before reaching the works' FFT level, they would be breaking the conditions of their environmental permit.

Population growth could increase the amount of treated sewage being discharged to the receiving water environment. If population increase causes effluent flows to increase above the consented flow, then there will be a risk of failing to meet water quality objectives. To mitigate against this, the treatment capacity at STWs may need to be increased to yield a higher FFT. Current DWF permits may also need to be renegotiated.

In terms of the STWs serving the area (see Figure 6), a number have been operating outside of their permits in recent years. Thames Water has acknowledged that Bampton, Carterton, Woodstock, Chipping Norton and Witney along with Church Hanborough STWs all fall into this category. A number of schemes are underway or planned to address these issues. This includes compliance schemes where Thames Water is not confident that the site can achieve robust compliance with all aspects of its permit, under all conditions, and need to invest in improvements. Compliance schemes have been undertaken or are ongoing at Carterton, Cassington, Charlbury, Chipping Norton, Church Hanborough and Middle Barton STWs.

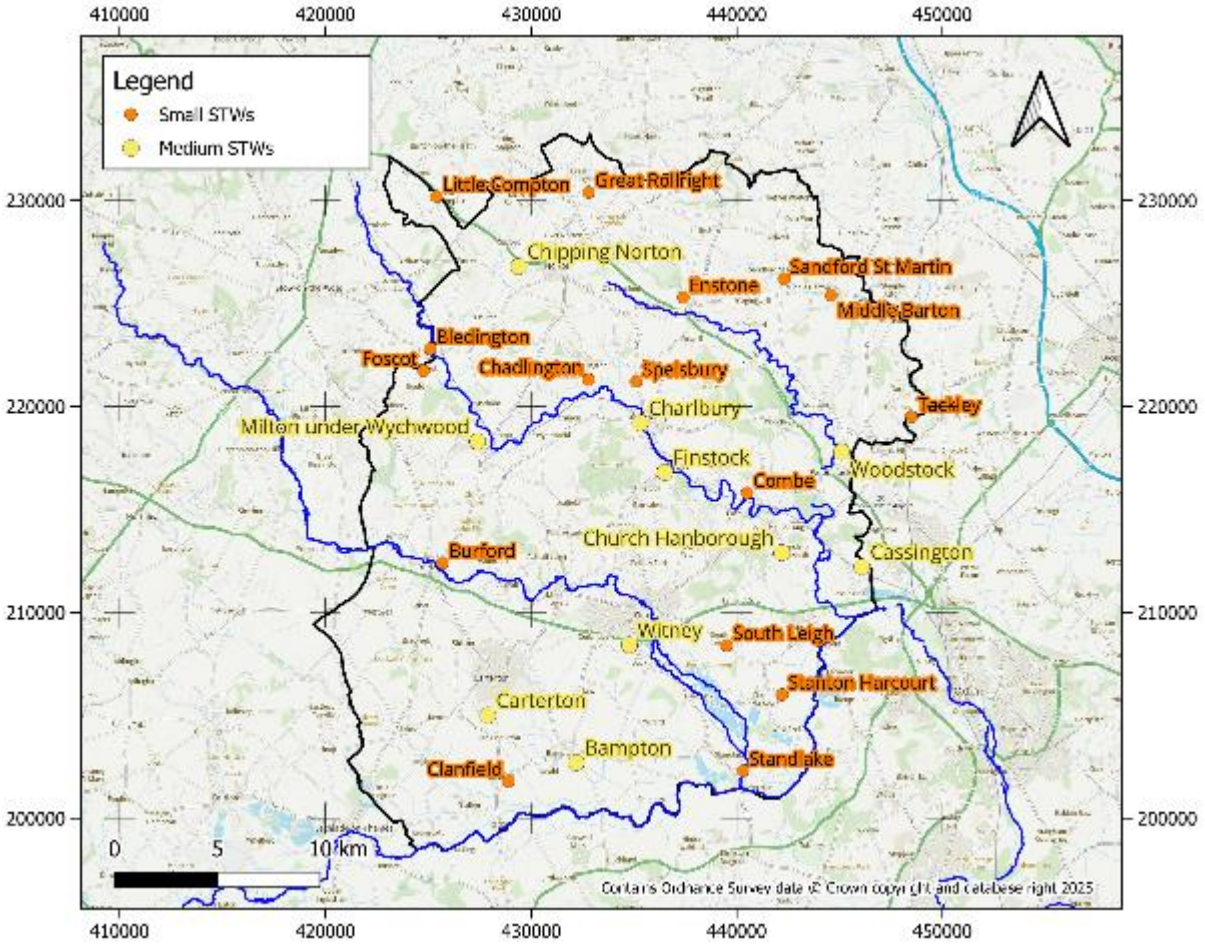

Figure 6- STWs in West Oxfordshire District

A number of Asset Management Period 7 (AMP7) schemes are also completed, ongoing or delayed. These schemes look to achieve specific goals set out in the Water Industry National Environment Programme (WINEP). They cover the period 2020-2025 and includes South Leigh, Finstock and Milton-under Wychwood. It also includes a major scheme at Witney STW to increase its FFT from 240 l/s to 399 l/s.

As part of AMP8, further schemes are earmarked for a number of sites with a large focus in West Oxfordshire at high spilling sites. A lack of capacity at STWs has been one of the contributing factors to combined sewer overflows (CSOs) operating more than expected which has in turn led to significant pollution in local rivers, affecting wildlife and water quality.

Infiltration of groundwater could also be significant in some STW catchments potentially compounding some of the issues outlined above if sewer networks are not properly maintained and upgraded as required. It can result in large volumes of groundwater infiltrating into the sewerage network and increasing water volumes reaching STWs. This extra volume causes a STW to have to process higher volumes of effluent during periods of high groundwater levels. In Oxfordshire specifically, in response to stage 1 of Oxfordshire Infrastructure Strategy (OxIS)[32] the EA has recommended that a study is conducted to identify the networks affected by groundwater infiltration and that this infrastructure is considered for upgrades as a priority. Thames Water is best placed to take a lead on this work and have undertaken a number of groundwater impacted system management plans (GISMPs) across Oxfordshire specifically, including a plan in Witney[33] completed in October 2024.

5.2.3 Combined Sewer Overflows (CSOs)

Many parts of England have a combined sewerage system which transports both clean rainwater and wastewater. During heavy rainfall the capacity of these pipes can be exceeded, which means possible inundation of STWs and backing up of network infrastructure. Combined sewer overflows (CSOs) were developed as overflow valves to reduce the risk of sewage backing up during heavy rainfall. These overflows discharge diluted untreated sewage during heavy rainfall. CSOs discharge to watercourses in the district.

The EA works closely with water companies to ensure CSOs are closely monitored to identify where the system is not operating as it should. The Environment Act 2021[34] introduced new requirements, stipulating that storm overflow discharges in England must be reported, including their location and the duration of any spill.

The national government's Storm Overflows Discharge Reduction Plan[35] sets targets for regulators and water companies to prioritise improving the water environment. This ties into some of the aims set out in Thames Water's DWMP (see section 5.2.1). The reduction plan states that by 2035 water and sewerage companies in England must improve all storm overflows discharging into or near designated bathing waters and 75% of those near high-priority ecological sites. Further to this it

[32] City Science (2021) *Oxfordshire Infrastructure Strategy (OxIS)* https://mycouncil.oxfordshire.gov.uk/documents/s59528/OxIS%20Stage%201%20Chapter%201.pdf
[33] Thames Water (2024) *Witney groundwater impacted system management plan* https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-reports/groundwater-infiltration-management-plans/witney-groundwater-infiltration-management-plan.pdf
[34] Parliament of the United Kingdom (2021) *The Environment Act 2021* https://www.legislation.gov.uk/ukpga/2021/30/contents
[35] UK Government (2023) *Storm overflows discharge reduction plan* https://www.gov.uk/government/publications/storm-overflows-discharge-reduction-plan

states that by 2040, water companies should have improved 87% of overflows discharging into high-priority sites and 60% of all overflows. By 2050 all overflows should be improved. Note, for a CSO (including both CSOs at STWs and network CSOs) to be considered as improved, it must meet the following criteria:

- It must be demonstrated that discharges from the CSOs have no local adverse ecological impact.
- The CSO will not be permitted to discharge above an average of 10 rainfall events per year.
- The CSO has screening controls that avoid pollution by limiting discharge of persistent inorganic material. Disinfection may be required in some cases to reduce harmful pathogens.
- The CSO spills no more than 2 times per season when upstream of a designated bathing water.

Thames Water was contacted to obtain data on CSO monitoring within the West Oxfordshire district. The CSOs monitored in the last five years (2018-2024) across the district are summarised in Table 11. Appendix 2 provides the full dataset which includes further information on spills outside of the study area, spill durations and figures for previous years dating back to 2018. The data shows CSO spills to be most prevalent in the Standlake STW catchment.

Table 11- CSOs monitored in study area

Name	Eastings	Northings	WFD Waterbody	Years of Record	Average spills per year
Burford STW	425650	212270	Windrush and tributaries (Little Rissington to Thames)	4 (since 2019)	0.0
Cassington STW	446600	210100	Thames (Evenlode to Thame)	5 (since 2018)	14.2
Compton STW	452600	179000	Pang	5 (since 2018)	20.7
Standlake STW	440400	202301	Windrush and tributaries (Little Rissington to Thames)	5 (since 2018)	33.2
Tackley STW	448180	220440	Cherwell (Nell Bridge to Bletchingdon)	5 (since 2018)	1.8

Note, the data provided by Thames Water to date on CSOs is considered incomplete as it is known that more CSOs are monitored in the district. As part of future work, the EA's event duration monitoring data will be used to better determine the status of CSOs in the district.

As outlined in section 5.2.2, recent sewage discharges from Thames Water's storm overflows have contributed to significant pollution in local rivers, affecting wildlife and water quality. Further development has the potential to increase risks unless infrastructural capacity is in place.

5.3 Environmental Capacity

5.3.1 Thames River Basin Management Plan

The Thames River Basin Management Plan (RBMP) was initially published by DEFRA and the EA in 2015 and updated in 2022. The purpose of the RBMP is to provide a framework for protecting and enhancing the water environment. To achieve this, and because water and land resources are closely linked, it also informs decisions on land use planning.

The RBMP covers the following areas which relate to management of land and water:

- Baseline classification of water bodies
- Statutory objectives for protected areas
- Statutory objectives for water bodies
- Challenges for the water environment
- Summary programme of measures to achieve statutory objectives

The Water Framework Directive (WFD)[36] transposed into law by the Water Environment Regulations 2017 in England and Wales[37] provides most of the legislative basis for the RBMP. Water bodies are assessed based on the WFD indicator, which measures the health of the water environment and assigns them a status. The assessment is based on a range of quality elements relating to the biology and chemical quality of surface waters. Table 12 gives a description of each of the status classes.

Table 12- Definition of ecological status in Water Framework Directive

Status	Definition
High	Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife, or fisheries.
Good	Slight change from natural conditions because of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife
Moderate	Moderate change from natural conditions because of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.
Poor	Major change from natural conditions because of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.
Bad	Severe change from natural conditions because of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

These status classes feed into the overall environmental objectives of the WFD and the associated RBMP. The environmental objectives are

- To prevent deterioration of the status of surface waters and groundwater
- To achieve objectives and standards for protected areas
- To aim to achieve good status for all water bodies
- To reverse any significant and sustained upward trends in pollutant concentrations in groundwater
- The cessation of discharges, emissions and priority hazardous substances into surface waters
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants

The RBMP outlines the measures potentially needed to achieve these statutory objectives and the regulators/operators responsible. These measures are/will be essential in maintaining environmental capacity in response to increased housing and population growth. Table 13 summarises some of the key measures relevant to the study area. A full list of the measures for the Thames river basin is provided in Appendix 3.

[36] European Commission, *Water Framework Directive (2000)*, http://ec.europa.eu/environment/water/water-framework/index_en.html
[37] Parliament of the United Kingdom (2017) *The Water Environment (Water Framework Directive) (England & Wales) Regulations (2017)* https://www.legislation.gov.uk/uksi/2017/407/contents

Table 13- Key measures summarised from Thames RBMP

Category	Description	Key Stakeholders
Advice Schemes	Advice to farmers on environmental improvements and nutrient management	NFU
Education, targeted information	Aquatic Biosecurity Campaigns- Slowing spread of invasive species via public awareness	GB Non Native Species Secretariat
	Behaviour campaigns on water use	EA and TW
Financial incentives	Environment Management capital programme including diffuse pollution control initiatives	EA
	EA Flood and Coastal Risk Management capital programme- includes river restoration	EA
	England Woodland Creation Offer- Tree planting to improve water quality	Forestry Commission
	Green recovery challenge fund- various environmental improvement projects	Defra
	Environment Land Management Schemes- Various environmental improvements by land managers	Defra
	Water Environment Improvement Fund- Local habitat improvement schemes and pollution control initiatives	EA
Guidance/Process	Water Leaders Group to act as advocates for restoration of natural processes within freshwater catchments	EA
	Water Environment Transformation (WET) Programme - to support wider implementation of nature-based solutions through PR24 process and the agriculture sector	EA
	Drainage Wastewater Management Plans to inform measures identified by Water Industry in Price Review24	EA and TW
Non-regulatory	Nature Recovery Network- Various actions to protect, improve, expand, and connect habitats including water and water-dependent environments	Natural England
Partnerships	Catchment partnership led projects and measures related to multiple funding streams and outcomes for water quality, quantity, habitat and flood risk reduction	EA and TW
Regulatory	Water Industry National Environment Programme schemes - Habitat improvements and farm nutrient management plans	EA and TW
	Sustainable abstraction improvements through changes to abstraction licences, licence conditions and non-licence changes at specific sites	EA and TW
	Sewage treatment improvements by changes to licence conditions at specific sites	EA and TW
Research	Water Leaders Group developing shared guidance and case studies for integrating investment in and across catchments	EA

5.3.2 Surface Water

The EA's catchment data explorer was used to extract information about the water environment for several catchments in the West Oxfordshire area. The dataset provides information on the ecological and chemical status of catchments throughout the UK.

Aforementioned, the ecological status of catchments can be classified as *Bad, Poor, Moderate, Good* and *High*. For the chemical status, catchments are classed as either as a *Fail* or *Good*. For this study the classifications are used to assess the existing pressures on specific catchments in the study area and as a measure of their environmental capacity. Figure 7 shows the WFD management catchments which intersect the district.

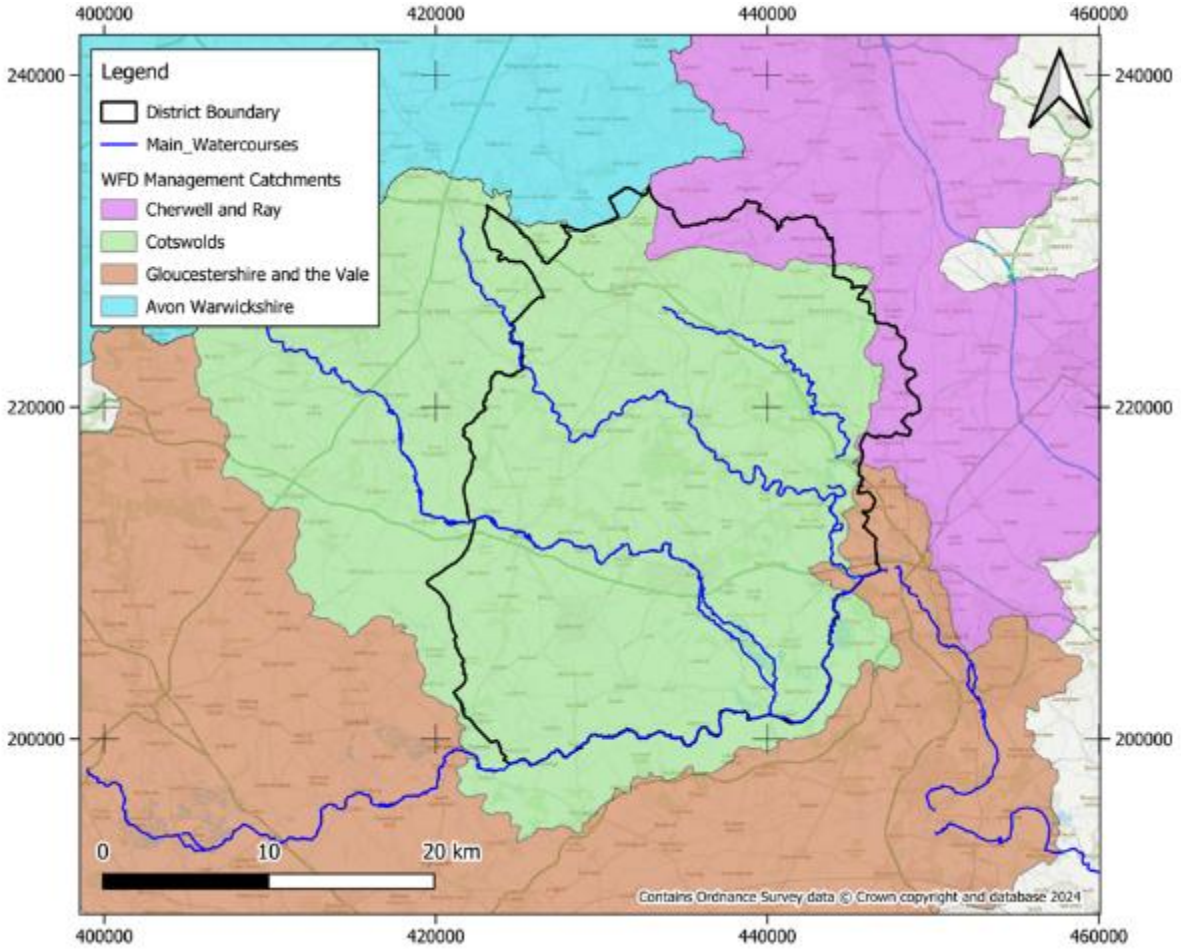

Figure 7- Surface Water WFD Management Catchments intersecting district

Table 14 shows the ecological and chemical status of the 30 WFD waterbodies which fall within the district. In total, 14 are classed as *Poor*, and 16 are classed as *Moderate.* All catchments were measured to have a *Fail* chemical status in 2019. For the 2019 assessment of chemical status, the EA changed some methods and increased their evidence base. Due to these changes, all water bodies now fail chemical status. This is largely due to the introduction of thresholds for newly introduced substances. The assessment is not comparable to previous year's assessments. The table also lists where the water industry has been identified as a reason for the watercourse not achieving good status, based on its effect on a specific metric used to determine ecological and chemical classifications. In many of these cases the water industry is not the only reason listed with agriculture, transport and waste management often also being cited as reasons for not achieving good status. Where the water industry is not identified as a reason, the waterbody failures lie outside of the scope of this study. Those being impacted by the water industry could be more sensitive to future development given its potential impact on increasing pollutant loads.

Table 14- Ecological and Chemical Status of Surface Waterbodies in the study area

Waterbody Name	Ecological	Chemical	Reasons for not achieving good status (water industry)
Broadwell Brook	Moderate*	Fail	
Cherwell (Bletchingdon to Ray)	Moderate	Fail	
Cherwell (Nell Bridge to Bletchingdon)	Moderate	Fail	Water industry listed as reason for deterioration in macrophytes and phosphate
Chil and Limb Brooks (source to B4044)	Poor	Fail	Water industry listed as reason for deterioration in macrophytes, phosphate, dissolved oxygen, ammonia, and invertebrates
Coldron and Taston Brooks	Moderate	Fail	
Cornwell Brook and tributaries (Source to Evenlode)	Moderate	Fail	Water industry listed as reason for deterioration in macrophytes and phosphate
Deddington Brook (Source to Cherwell)	Moderate	Fail	
Dorn (Source to Glyme)	Poor	Fail	Water industry listed as reason for deterioration in macrophytes and phosphate
Evenlode (Bledington to Glyme confluence)	Moderate	Fail	Water industry listed as reason for deterioration in macrophytes and phosphate
Evenlode (Compton Bk to Bledington Bk) & 4 Shires	Poor	Fail	Water industry listed as reason for deterioration in macrophytes, phosphate, and dissolved oxygen
Evenlode (Glyme to Thames)	Poor	Fail	Water industry listed as reason for deterioration in phosphate and dissolved oxygen
Glyme (Dorn confluence to Evenlode)	Poor	Fail	Water industry listed as reason for deterioration in macrophytes, phosphate, and dissolved oxygen
Glyme (Enstone to Dorn)	Moderate*	Fail	
Glyme (Source to Enstone)	Moderate*	Fail	
Hazelford and Coombe Brook	Poor	Fail	Water industry listed as reason for deterioration in macrophytes and phosphate
Heythorpe Stream and tributaries	Poor	Fail	
Highmoor Brook at Brize Norton	Moderate	Fail	Water industry listed as reason for deterioration in fish
Hook Norton Brook (Source to Swere)	Poor	Fail	Water industry listed as reason for deterioration in macrophytes, phosphate, and dissolved oxygen
Leach (Source to Thames)	Poor	Fail	Water industry listed as reason for deterioration in macrophytes and phosphate
Little Compton Brook and tributaries (Source to Evenlode)	Moderate	Fail	Water industry listed as reason for deterioration in macrophytes and phosphate
Littlestock Stream to tributary of Evenlode at Shipton	Poor	Fail	Water industry listed as reason for deterioration in macrophytes and phosphate
Radcot Cut	Moderate	Fail	Water industry listed as reason for deterioration in phosphate
Sars Brook (source to Evenlode downstream Bledington)	Moderate*	Fail	
Shill Brook and Tributaries	Poor	Fail	Water industry listed as reason for deterioration in macrophytes
Thames (Evenlode to Thame)	Poor	Fail	Water industry listed as reason for deterioration in phosphate and tributyltin compounds
Thames (Leach to Evenlode)	Poor	Fail	Water industry listed as reason for deterioration in phosphate, fish, and hydrological regime
Upper Swere (Source to Wigginton)	Moderate*	Fail	
Westcote Brook (source to Evenlode at Bledington)	Moderate	Fail	Water industry listed as reason for deterioration in phosphate
Windrush and tributaries (Little Rissington to Thames)	Moderate	Fail	Water industry listed as reason for deterioration in macrophytes and phosphate
Nethercote Bk - source to conf R Stour	Poor	Fail	Water industry listed as reason for deterioration in macrophytes and phosphate

*Classification from 2019, no classification available for 2022

The current status of watercourses within the district shows them to be vulnerable, with limited environmental capacity especially likely in catchments with failures in nutrient status (e.g. Phosphate, Biochemical Oxygen Demand etc). It should be noted that not all the failures or deterioration necessarily impose a limit to growth. In some cases, they may be due to physical modifications, barriers to fish and hydrological regime amongst other factors. However, for the majority of watercourses in West Oxfordshire sewerage discharge is a significant reason for watercourses not achieving good status.

The findings further highlight the importance of STW upgrades in line with development. When implemented, these should improve the headroom available to allow some development to take place without compromising water quality. However, further detailed work and liaison with Thames Water will be required to confirm the infrastructural capacity needed to accommodate future development and the timescales required to reach this capacity.

As well as the additional wastewater draining to STWs, development can also affect surface water flow routes and water quality through direct runoff to waterbodies. This has the potential to impact upon the ecology of the watercourses running through district. In this regard, the use of SuDS and associated flow control should be encouraged to ensure development does not affect or has minimal impact on water quality or flow regimes (more detail on SuDS is provided in section 6.4).

5.3.3 Groundwater

The EA catchment data explorer was also used to assess the status of groundwater bodies. As shown in Figure 8 a total of 9 groundwater bodies intersect the district. Groundwater bodies are measured against a quantitative status and a chemical status. Good quantitative status can be achieved by ensuring that the available groundwater resource is not reduced by the long-term annual average rate of abstraction. In addition, impacts on surface water linked with groundwater or groundwater-dependent terrestrial ecosystems should be avoided, as should saline intrusions.

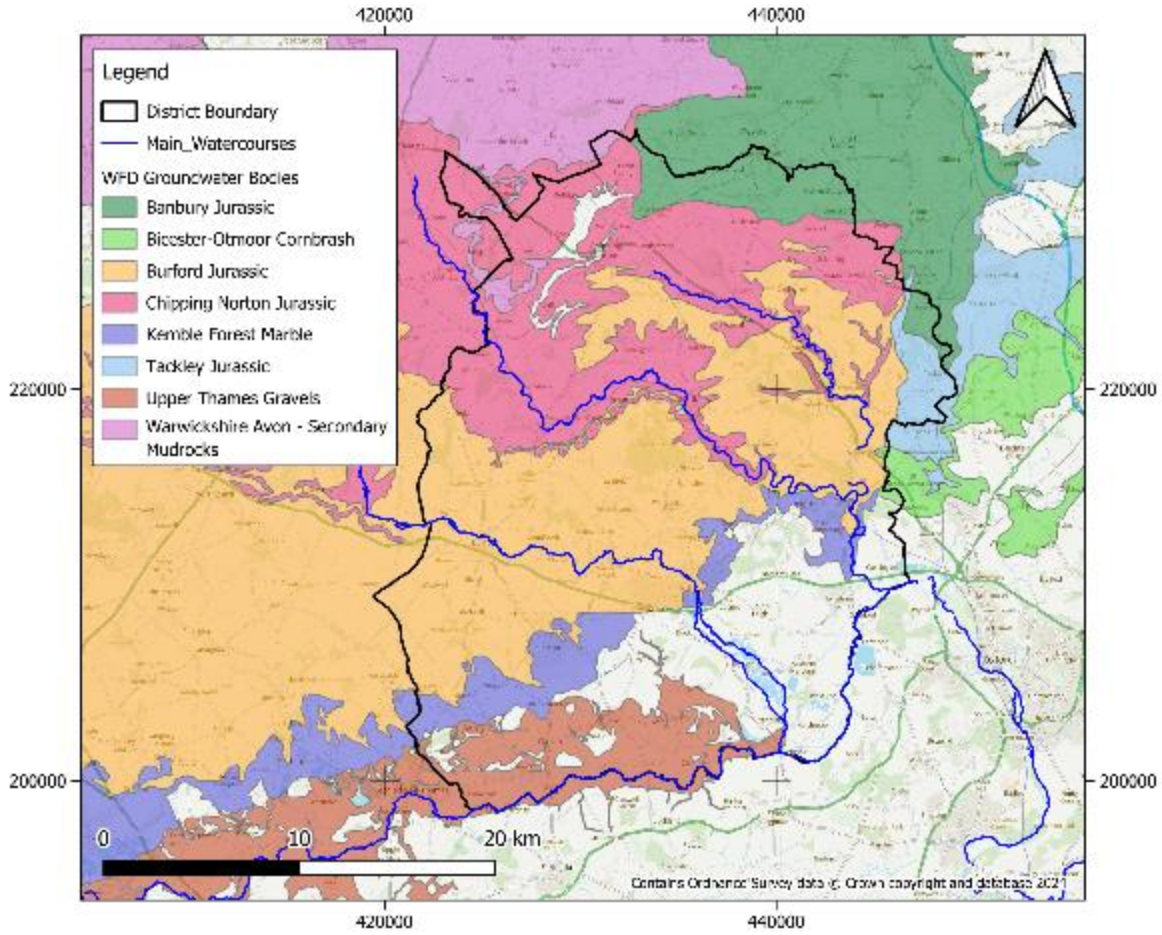

Figure 8- WFD Groundwater Catchments intersecting district

Table 15 shows the WFD groundwater classifications for the 8 WFD groundwater catchments identified. In total, 6 have a *Poor* overall status and 2 have *Good* status. This is mostly caused by a *Poor* chemical status with Quantitative status generally *Good* across the catchments.

Table 15- Overall, Quantitative and Chemical Status of Groundwater Waterbodies in the study area

Waterbody Name	Overall	Quantitative	Chemical
Upper Thames Gravels	Poor	Good	Poor
Burford Jurassic	Poor	Good	Poor
Tackley Jurassic	Good	Good	Good
Banbury Jurassic	Poor	Good	Poor
Chipping Norton Jurassic	Poor	Good	Poor
Kemble Forest Marble	Poor	Good	Poor
Bicester-Otmoor Cornbrash	Poor	Good	Poor
Warwickshire Avon - Secondary Mudrocks	Good	Good	Good

5.4 Summary

The sewer network in the district currently manages the demand of over 116,000 people. This is set to increase significantly as a result of population growth, and it is essential that there is sufficient infrastructural and environmental capacity to safeguard against issues such as ecological damage and sewer flooding.

The STWs serving the district are the most important infrastructural asset with respect to future development. As highlighted in section 5.2.2, there are challenges at some of the STWs and uncertainty regarding the headroom available. Once the location and size of site allocations are

known it is recommended that these are provided to Thames Water. This will allow them to generate RAG reports detailing where STW and wastewater network upgrades will likely be required to manage future development. Further detailed work and liaison with Thames Water will also likely be required to confirm the infrastructural capacity needed to accommodate future development and the timescales required to reach this capacity.

In terms of environmental capacity, the EA's catchment data explorer suggests that most of the watercourses in the study area have *Poor* ecological status and *Fail* with regard to chemical status. This suggests that overall, they are vulnerable at present. Once the location and size of site allocations are known it should be possible to identify watercourses potentially vulnerable to future growth.

Future upgrades to the sewer network alongside measures identified in the Thames River Basin Management Plan and Thames Water's DWMP could help in reducing impacts but will take time to take effect. It is vital that the correct measures are followed by several stakeholders, including developers, the EA, local authorities and Thames Water, to ensure that the current statuses of the watercourses improve.

6 Flood Risk

6.1 Introduction

This section includes a high-level review of the flood risk relevant to this study across the district and its relationship with the development proposed. How flood risk might be managed moving forward is also addressed.

The level 1 SFRA[38] supporting the local plan includes a more detailed assessment of the flood risk constraints across the district.

6.2 Overview of Flood Risk relevant to WCS

The River Thames is the main watercourse in the south of the district forming the entirety of the southern boundary and the southern half of the eastern boundary. Three other rivers flow southeastward through the district and join with the River Thames in the south. These are the River Windrush, River Evenlode, and River Glyme. Fluvial flood risk is present along these main rivers (which are the responsibility of the EA) and ordinary watercourses (which are the responsibility of the Oxfordshire County Council acting as the Lead Local Flood Authority (LLFA) and riparian owners).

Surface water flood risk also effects many locations across the district, including the settlements of Witney, Chipping Norton, Kingham, Milton-under-Wychwood, Shipton-under-Wychwood, Eynsham, Middle Barton, Carterton, and Tackley, amongst others. Flooding of land from surface water runoff is caused by intense rainfall and usually occurs in lower lying areas often where the drainage system is unable to cope with the volume of water. Surface water flooding problems are inextricably linked to issues of poor drainage and sewer flooding.

Sewer flooding often occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and/or when sewers cannot discharge properly to watercourses due to high water levels. Groundwater flooding, which is likely to be more common across the centre and east of the district due to the limestone bedrock, can also contribute to sewer flooding through groundwater infiltration, where groundwater finds its way into the sewer system. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system.

The Thames Water DG5 sewer flooding register is available at the 5-digit postcode level and has been obtained to further assess the spatial distribution of sewer flooding. In total there have been 184 incidents in the district since records began in 1989 with privatisation of the water industry. The total number of recorded incidents has been aggregated for each of the postcode areas intersecting the district. These are shown in Figure 9. Generally, these show that most incidents occur in the south of the district, particularly in the urban areas of Burford and Carterton.

[38] WHS (2025) *West Oxfordshire Level 1 Strategic Flood Risk Assessment* West Oxfordshire District Council Level 1 SFRA_v1.0.pdf

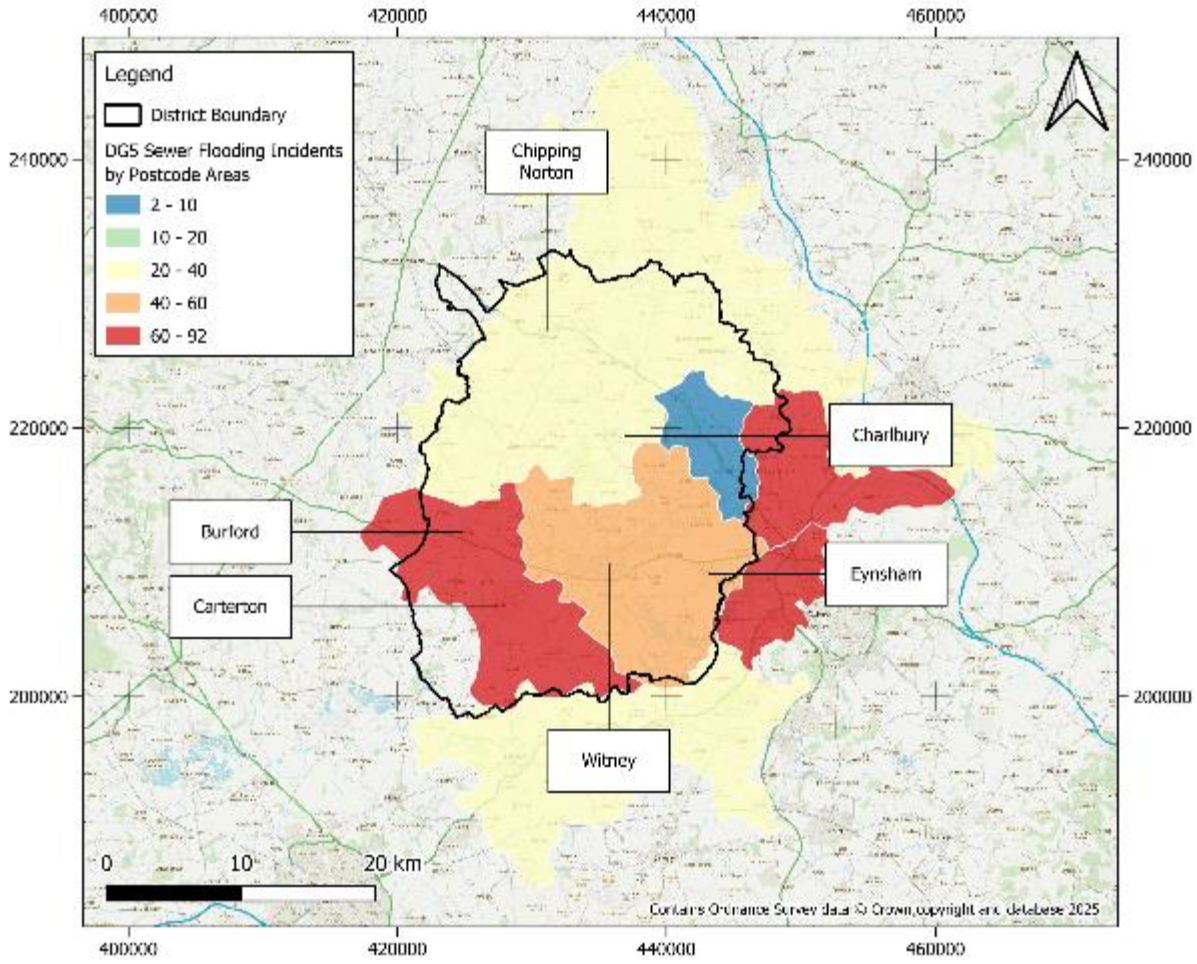

Figure 9- DG5 Sewer Flooding Records for Postcode Areas intersecting the district

6.3 Impacts of Development on Flood Risk

Development if not properly managed has the potential to impact a wide range of flood mechanisms, including those identified in section 6.2. Land use change influences the characteristics of how rainwater runs off land into local water networks such as drains, streams and rivers. Localised changes in land use can alter the pre-existing baseline behaviour of an individual area, and when this occurs collectively over multiple areas within a catchment it can cause a change in flooding characteristics for the area. As such, this may incur detrimental impacts downstream on a catchment-wide scale. Instances in which this can occur can be seen in the development of previously rural land, which increases the amount of impermeable surfaces.

It is expected that given the rural setting of the district many sites will be developed upon greenfield land. If insufficient measures are taken, the replacement of rural land use with impermeable surfaces will increase the volume and rates of surface water runoff following rainfall. When instances of this happen repeatedly across a catchment, this can result in a catchment experiencing shorter amounts of time between rainfall events and peak flood levels, resulting in greater magnitude floods and making effective flood response more difficult. This can impact both fluvial flood risk and surface water flood risk. Windfall sites and urban creep could also contribute to these forms of flood risk by the same mechanism.

In addition, the development of greenfield land may result in the loss of floodplain area causing reduced floodplain storage capacity which could have a detrimental impact on fluvial flood risk on immediately neighbouring land, as well as downstream. Instances of practices that may cause this, include changes in a buildings footprint which could reduce flood storage area, whilst the raising of land levels above the existing floodplain may interfere with storage and floodwater conveyance. The impacts of this are often managed through the provision of compensatory storage.

An indirect impact of development on fluvial flood risk which is relevant to this study, is increasing discharges from STWs as a result of changes to current discharge permits. Generally, this is not considered to be a significant contributor to flood risk given that the flows discharged from STWs tend to be many orders of magnitude smaller than the flood flows in the watercourses they discharge to. However, caution may be required when setting the maximum flow volume in the future especially with regards to local flood risk where STWs discharge to smaller watercourses.

Development across the district could also contribute to sewer flooding. As more land drains to the sewer network, its capacity will need to increase to ensure that it is not overloaded and surcharges. Windfall sites and urban creep present a further risk, especially if their impact is not captured in the planning process for future sewer upgrades.

6.4 Mitigation Options

Flood risk is a key factor in spatial planning. Government policy seeks to ensure that all developments are safe with respect to flooding, and that floodplains are used for their natural purposes. As mentioned, development on a floodplain is both at risk from flooding and also has the potential to reduce the ability of the river corridor to convey and store flood waters without suitable mitigation measures. This means that if development is not adequately controlled, there will be a detrimental effect on third party flood risk, with the floodplain's capacity reduced and water displaced elsewhere.

Through application of the National Planning Policy Framework (NPPF)[39] a Sequential Test will be taken in the local plan to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites in areas with a lower probability of flooding. If following this exercise, sites still need to be allocated in at risk areas, an Exception Test is typically required, which will ensure the development is safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

In terms of the local plan, whilst development wherever possible will largely be sited outside of floodplain areas, it still has the potential to exacerbate flood risk due to increased runoff from hard impermeable surfaces. There will be a change in land use in some areas as a result of the local plan. To accommodate such a change, it is likely that mitigation options will need to be implemented at a number of sites in order to facilitate development, ensuring development is both safe and does not increase third party flood risk elsewhere. Options to be considered include:

- Increase floodplain storage/provide compensatory storage should the development require any ground raising above measured/modelled flood levels.
- Sustainable Drainage System (SuDS) guidelines to achieve no net increase in runoff as a result of the development proposals (obligatory for most development sites).
- Possibility of developer contributions to fund local improvement schemes elsewhere.

[39] Ministry of Housing, Communities and Local Government (2023) *National Planning Policy Framework* https://www.gov.uk/government/publications/national-planning-policy-framework--2

- Flood resilient and resistant building design.
- Flood incident management (flood warning) and emergency planning.
- Opportunities for integrated urban drainage schemes at locations where there is mutual benefit in relation to reducing overall flood risk to new and existing developments.

SuDS in particular are seen as key in ensuring development does not lead to increased runoff rates and volumes. SuDS are designed to manage stormwater locally (as close to its source as possible), to mimic natural drainage and encourage its infiltration, attenuation and passive treatment. The non-statutory guidance[40] for SuDS published by DEFRA (2015), sets out the technical Standards for SuDS systems in England. Oxfordshire County Council acting as the LLFA also sets out local standards and guidance[41] on SuDS and drainage requirements within the county. Major developments (more than 10 dwellings) within Oxfordshire should meet these standards. Note, the local standards stipulate a 10% allowance for urban creep in new development sites to safeguard against drainage schemes becoming non-compliant.

In managing stormwater locally through infiltration and attenuation, SuDS also has the potential to reduce the amount of surface water runoff entering sewer systems and thereby sewer flood risk overall. SuDS also has the potential to treat and enhance water quality. Both of these facets will be key in managing the infrastructural and environmental capacity available across the district, in addition to limiting significant increases in discharges from STWs. In terms of the latter, upgrades to STWs including the provision of new storm tanks could allow for more water to be stored at STW for subsequent treatment and discharge when water levels downstream are within normal range.

As part of its DWMP, Thames Water is taking a 'SuDS-first' approach when prioritising options to manage flood risk. Stating further, that they will work in collaboration with partners to increase the amount of SuDS delivered across the Thames Valley. When considering sites in the Local Plan and windfall sites, any developer is encouraged to work with Thames Water early in the planning process to understand what infrastructure is required, in addition to where, when and how it will be delivered. Urban creep and climate change will also need to be considered in any liaison to ensure the infrastructure upgrades implemented are resilient going forward. During the plan period, mitigation may also be implemented at the catchment wide scale, encompassing natural flood risk management (NFM), river engineering, wide scale sewer network upgrades, rural land management, urban design and defence infrastructure. These measures have the potential to reduce flood risk for new and existing development.

6.5 Summary

Both the impact of development on flood risk, and the impact of flood risk on development can be reduced by following the Sequential and Exception tests outlined in the NPPF and ensuring that development in the study area follows SuDS guidelines.

At the site-specific level, SuDS should be implemented at all of the sites. Ground raising and compensatory storage may also be required where sites are at flood risk. Furthermore, ensuring local sewer upgrades are in place prior to development will safeguard against pronounced surface water

[40] Department for Environmental, Food and Rural Affairs (2015) *Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

[41] Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire, OCC. 2021. Available from: https://www.oxfordshirefloodtoolkit.com/wp-content/uploads/2022/01/LOCAL-STANDARDS-AND-GUIDANCE-FOR-SURFACE-WATER-DRAINAGE-ON-MAJOR-DEVELOPMENT-IN-OXFORDSHIRE-Jan-22-2.pdf

and sewer flood risk. In line with NPPF, it is also recommended that where possible development should seek to reduce flood risk overall. Methods to reduce flood risk at sites and downstream may include creating flood storage areas, establishing wetland features, promoting vegetation growth and the use of NFM practices. Alongside these site scale measures; catchment scale measures may help reduce flood risk in a number of areas throughout the district. A reduction in flood risk could also be supported by a direct financial contribution from developers to wider flood risk management infrastructure through section 106 agreements or a community infrastructure levy.

The assessment of flood risk undertaken to date is high level. The specific upgrades required to the sewer network in response to development are likely to require further technical work by Thames Water in collaboration with developers. The level 1 SFRA supporting the local plan includes a more detailed assessment of the flood risk constraints across the district. In terms of the risk posed by increases in discharge volumes from STWs, once the specific locations of site allocations are known it will give a clearer idea on the potential changes for DWF permits required at key STW sites. The findings of which should give a clearer idea on likely changes to the volumes draining from STWs to accommodate future development.

7 Other Environmental Constraints

7.1 Protected Sites

Further environmental constraints arise mainly from the protected status of numerous sites across the district.

Firstly, there is one Special Area of Conservation (SAC) within the district. SACs are strictly protected sites designated under the European Union's Habitats Directive. Any developments that are close to or within the boundary of a SAC, may require a Habitat Regulations Assessment (HRA) if they could have an adverse effect on the site. An initial screening stage would be required, followed by an appropriate assessment if needed. The HRA process is focused on protecting the qualifying features of designated sites.

Where it is considered that an adverse effect on the integrity of the SAC is likely, and no alternatives are available, the project can only go ahead if there are imperative reasons of over-riding public interest and if the appropriate compensatory measures can be secured. Planning authorities can also insist that developments carried out without necessary planning permission are removed. Figure 10 shows the location of SACs across the district and in the surrounding area.

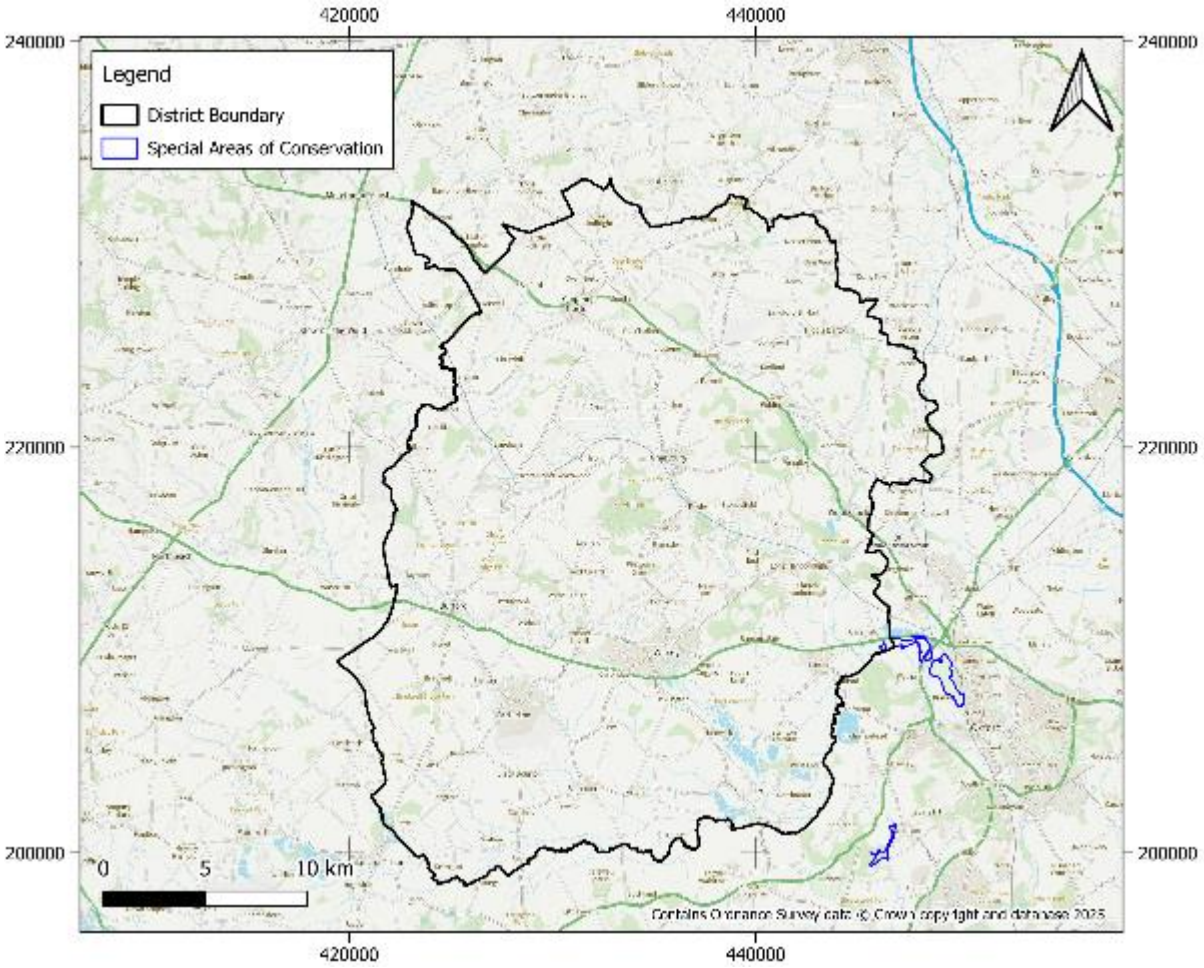

Figure 10- SACs across the district and in the surrounding area

There are 37 Sites of Special Scientific Interest (SSSI) within the district with many SSSIs also located in the surrounding area. A SSSI is a formal conservation designation. Usually, it describes an area that is of particular interest to science due to the rare species of fauna or flora it contains (Biological SSSI) or important geological or physiological features that may lie in its boundaries (Geological SSSI).

Local planning authorities are required to have policies in their development plans which protect SSSIs. They are also required to consult the appropriate conservation body over planning applications which might affect the special interest of a SSSI. The landowners of SSSIs are also required to obtain consent from the relevant nature conservation body if they want to permit potentially damaging activities. Figure 11 shows the location of SSSIs across the district and surrounding area.

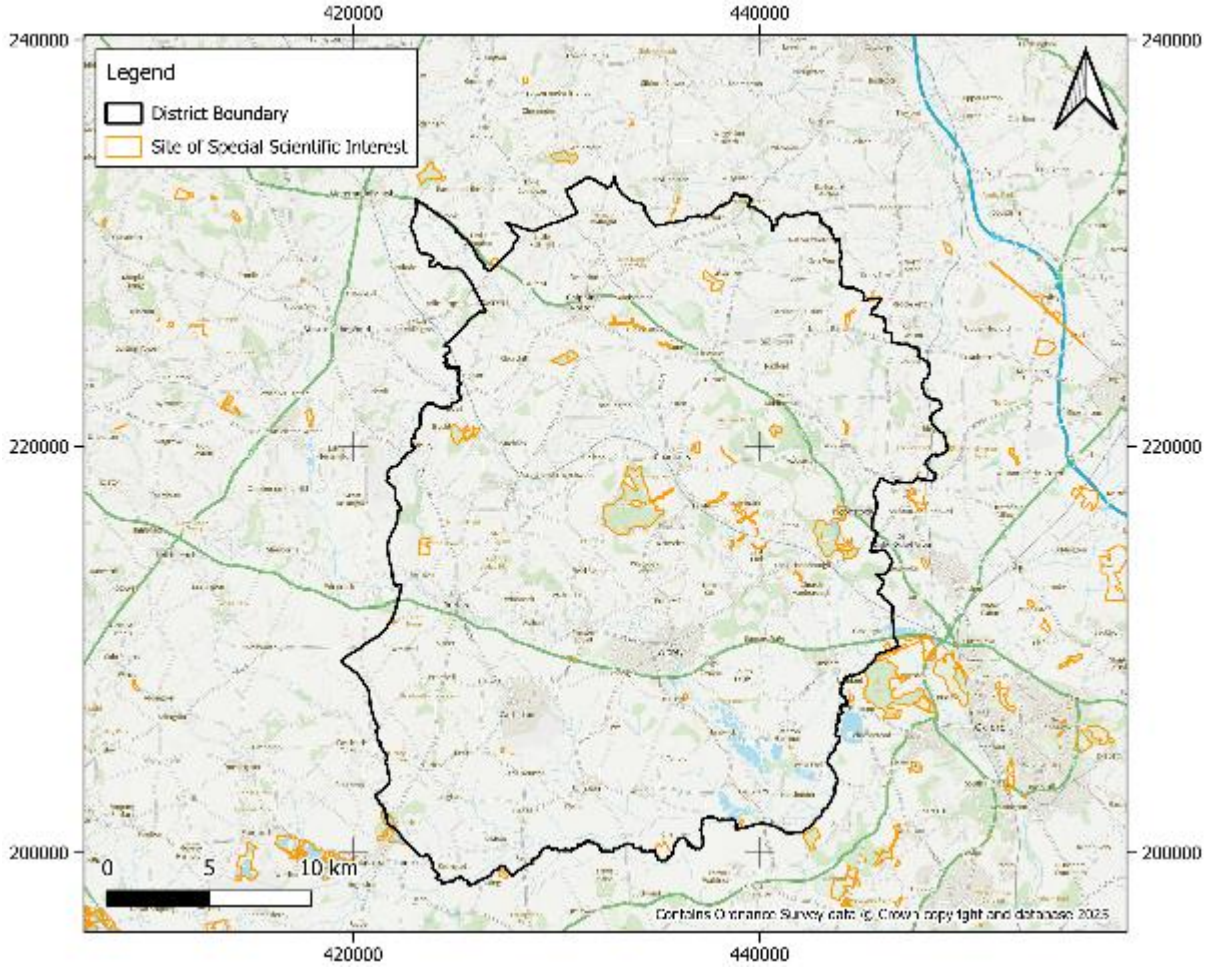

Figure 11- SSSIs across the district and surrounding area

Often protected sites play a key function in terms of water quality which is vital for maintaining the environmental capacity across the district. If development is not properly managed, it could lead to a deterioration in water quality or changes in the flow regime at protected sites. Care needs to be taken both during and after construction to ensure that runoff from development sites is adequately treated before entering the local drainage network. This will in turn safeguard environmental capacity and allow for further development to be delivered sustainably.

7.2 Odour Risk

STWs and other wastewater sites, like pumping stations and storm tanks, can sometimes be odour sources. They were originally built a significant distance away from urbanised areas; however, population growth means these once remote sites are now potential locations for development. Thames Water has published guidance[42] for new and 'change of use' developments proposed near STWs and large pumping stations.

Thames Water aims to ensure all proposed developments near their wastewater sites are risk assessed and, where necessary, that developers fund any mitigation needed to enable them to build there. Developers should contact Thames Water to discuss any encroachment close to STWs prior to submitting a planning application. In general, Thames Water will look closely at any proposals within either 800 metres of a STWs or 15 metres of a large sewage pumping station. The degree of odour complaint levels at the wastewater site will also be considered. This initial screening will then recommend whether further modelling work is needed. Figure 12 shows the location of each STWs in the district with an 800m buffer added. The area within these buffers could be at risk of odour.

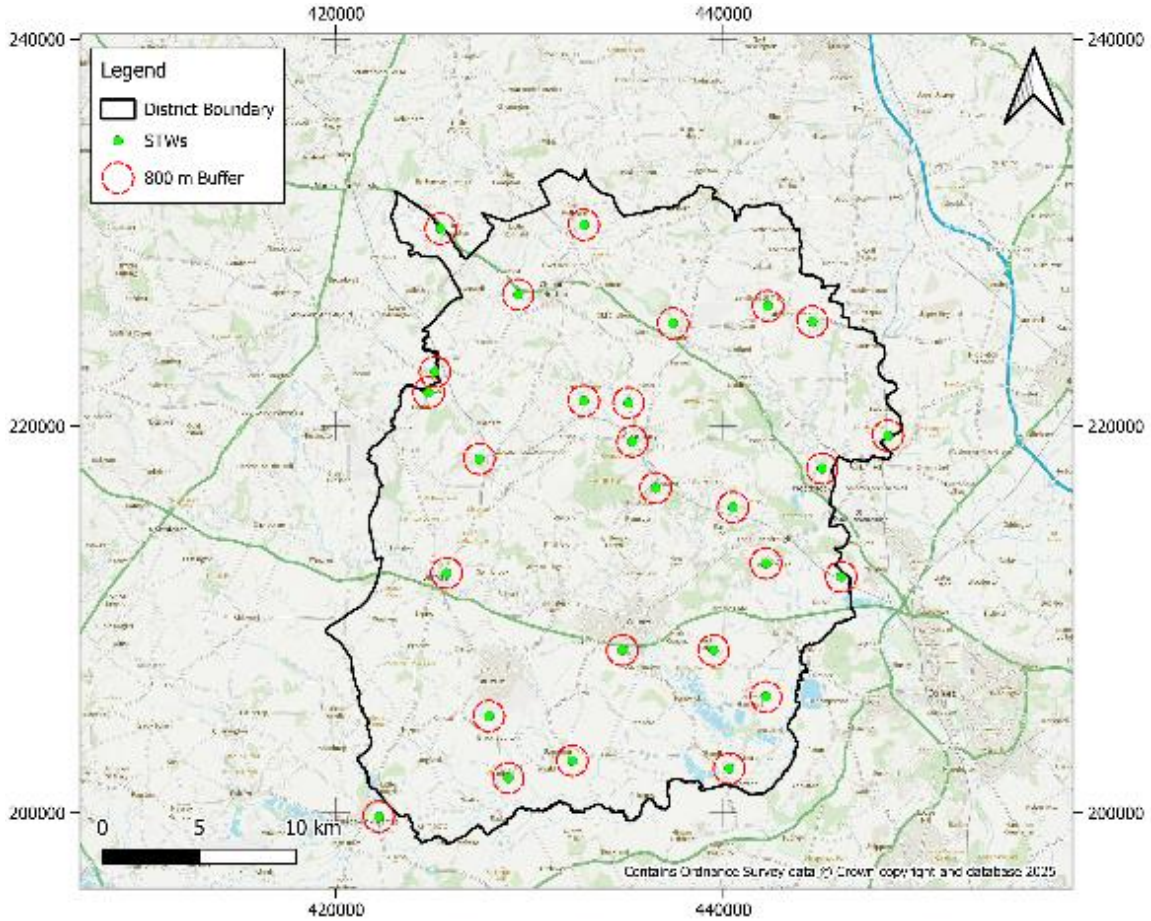

Figure 12- STWs with 800m buffer

[42] Thames Water (2020) *Risk of Odour Encroachment* https://www.thameswater.co.uk/media-library/home/developers/larger-scale-developments/planning/water-and-wastewater-capacity/odour-encroachment-guidance.pdf

Odour risk should be assessed before the planning application stage. This will enable issues to be identified and resolved where possible, meaning fewer delays at the planning and construction stages. Typically, Thames Water undertakes risk assessments in phases – by desktop and then sample surveys. If this shows the development is at odour risk based on its assessment criteria, it will object to the development. The developer must then submit an odour modelling assessment, in consultation with Thames Water. This assessment should typically consist of a full sample survey including source measurements at all relevant sources by olfactometry, followed by dispersion modelling. The odour assessment should be submitted to the local planning authority in support of the developer's planning application.

Where mitigation is required, the developer must fund this. It can be costly to reduce and treat odour. Measures include increased maintenance of plant and equipment, covers for tanks, the use of enclosure and venting and end of pipe treatments (i.e. dilute, disperse or abatement).

7.3 Summary

The district includes a number of protected sites and designated habitats which present constraints to development in certain areas. Conversely, ensuring these areas continue to serve their function will help maintain environmental capacity which is vital for allowing development to continue sustainably into the future.

At this stage, this scoping study has identified the main environmental constraints with respect to protected sites. Further work at the planning application stage including Environmental Impact Assessments (EIAs) and HRAs may be required to determine impacts on specific SACs and SSSIs and any required mitigation.

For the sites identified where odour risk could be a concern, developers should contact Thames Water prior to submitting a planning application. This will enable issues to be identified and resolved at an early stage where possible, meaning fewer delays at the planning and construction stages.

The assessments outlined above should be sufficient to address the evidence gaps identified in this scoping study without the need for further assessment as part of a water cycle study detailed report.

8 Conclusions & Recommendations

The conclusions and recommendations from this study are as follows:

Water Resources and Supply

- Based on the forecasts in Thames Water's latest WRMP there could be shortfalls in water supply up to 2041 and beyond. Without corrective action, the supply to the district could be less secure which will mean a greater probability that demand restrictions will be required in dry years.
- The total number of dwellings forecast to come forward in West Oxfordshire could also be higher than those used in Thames Water's WRMP which could exacerbate shortfalls. However this is subject to uncertainty at this stage.
- The WRMP has identified and forecasted the effects of several design management options on household consumption, non-household consumption and leakage. The options should be sufficient to offset some of the deficits in the development scenarios tested by Thames Water.
- Thames Water has also identified several resource options including new reservoirs, raw water transfers and groundwater abstractions. These supply options offer large increases in yield, however, are subject to significant lead times.
- The demand options are able to deliver from the first year of implementation due to shorter lead times and will be important early in the plan period. However, the need for supply options could increase as more development comes forward.
- New interventions from the district council such as stricter water use standards may also be required during the plan period.
- At this stage it is recommended that Thames Water is contacted to check the dwelling numbers used for West Oxfordshire in their WRMP. This will confirm whether the full quantum of development being brought forward in the district has been captured.
- Once the location and size of site allocations are known it is recommended that these are provided to Thames Water. This will allow it to generate RAG reports detailing where water supply upgrades will likely be required to manage future development.

Wastewater Infrastructure, Water Quality and Environmental Capacity

- The STWs serving the district are the most important infrastructural asset with respect to future development in the district. There are challenges at some of the STWs and uncertainty regarding the headroom available.
- In terms of environmental capacity, the EA's catchment data explorer suggests that most of the watercourses in the study area have *Poor* ecological status and *Fail* with regard to chemical status. This suggests that overall, they are potentially vulnerable to future growth.
- Future upgrades to the sewer network alongside measures identified in the Thames River Basin Management Plan and Thames Water's DWMP could help in this regard but will take time.
- Once the location and size of site allocations are known it is recommended that these are provided to Thames Water. This will allow it to generate RAG reports detailing where STW and wastewater network upgrades will likely be required to manage future development.

Flood Risk

- Development has the potential to impact on a wide range of flood mechanisms including fluvial, surface water and sewer flooding.
- Both the impact of development on flood risk and the impact of flood risk on development can be reduced by following the Sequential and Exception Tests outlined in the NPPF and ensuring that development in the study area follows SuDS guidelines.
- At the site-specific level, SuDS should be implemented at all of the sites. Ground raising and compensatory storage may also be required where sites are at flood risk.
- Ensuring local sewer upgrades are in place prior to the occupation of development will safeguard against surface water and sewer flood risk impacts.
- The assessment of flood risk undertaken to date is high level. Once the specific locations of site allocations are known it will give a clearer idea on the potential changes for DWF permits required at key STW sites. The findings of which should give a clearer idea on likely changes to the volumes draining from STWs to accommodate future development.
- The specific upgrades required to the sewer network in response to development are likely to require further technical work by Thames Water in collaboration with developers during the planning stage.
- The level 1 SFRA supporting the local plan includes a more detailed assessment flood risk constraints across the district.

Other Environmental Constraints

- The district includes a number of protected sites and designated habitats which present constraints to development in certain areas.
- Further work at the planning application stage including Environmental Impact Assessments (EIAs) and HRAs may be required to determine impacts on specific SACs and SSSIs and any required mitigation.
- In terms of odour risk, a number of sites proposed in the local plan could encroach on land close to STWs. This will become clearer once the specific location of site allocation is known.
- For the sites identified where odour risk could be a concern, developers should contact Thames Water prior to submitting a planning application.

Appendix 1 - List of Abstraction Licenses

Appendix 2 - Thames Water Combined Sewer Overflows Data

Appendix 3 – Thames River Basin Management Plans Measures