Leicester City Water Cycle Study Update

Final

January 2023

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Contract

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This report describes work commissioned by Leicester City Council, by an instruction dated 10 October 2022. The Client's representative for the contract was Paul O'Neill of Leicester City Council. Richard Pardoe of JBA Consulting carried out this work.

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Abbreviations

BATNEEC ..... Best Available Technology Not Entailing Excessive Cost

BRE..... Building Research Establishment

BREEAM ..... Building Research Establishment Environmental Assessment Methodology

BOD ..... Biological Oxygen Demand

CSO ..... Combined Sewer Overflow

DCG ..... Design and Construction Guidance

DWMP..... Drainage and Wastewater Management Plan

EA ..... Environment Agency

EU ..... European Union

FRA..... Flood Risk Assessment

LCC..... Leicester City Council

LLFA..... Lead Local Flood Authority

LPA ..... Local Planning Authority

NPPF..... National Planning Policy Framework

OEP..... Office for Environmental Protection

ONS ..... Office for National Statistics

RBMP..... River Basin Management Plan

REUL..... Retained European Union Law

SFRA..... Strategic Flood Risk Assessment

SOAF ..... Storm Overflow Assessment Framework

SSSI..... Site of Special Scientific Interest

STW ..... Severn Trent Water

SuDS..... Sustainable Drainage System

TAL..... Technically Achievable Limit

UKWIR ..... UK Water Industry Research Ltd

WCS..... Water Cycle Study

WFD ..... Water Framework Directive

WRMP..... Water Resource Management Plan

WRW..... Water Resources West

WRZ..... Water Resource Zones

WwTW..... Wastewater Treatment Works

Executive Summary

JBA Consulting were commissioned by Leicester City Council (LCC) to undertake an update to the Water Cycle Study (WCS) completed in 2020. This update should be read alongside the original study.

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

As the LCC Local Plan has developed the growth forecast has evolved from the forecast assessed in the original WCS. The number of dwellings overall has increased from approximately 22,000 to 23,000. The largest change is the inclusion of LCC's unmet need within the assessments which adds an additional 18,694 dwellings to the analysis in the original study. The growth forecast also includes 28ha of employment land.

Water resources

The recently published draft Water Resource Management Plan 2024 (dWRMP24) identifies an increased supply demand deficit for the Strategic Grid Water Resource Zone (WRZ) that serves Leicester City. It goes on to identify a number of actions to address this. This is now aligned with the Water Resources West Draft Regional Plan.

The growth forecast presented in this updated WCS is an increase on the forecast assessed in the original study. This is higher than the percentage growth accounted for in the dWRMP24 but not significantly so, and within the uncertainty planned for in the dWRMP.

It is for Local Authorities to establish a clear need to adopt the tighter water efficiency target through the building regulations. The evidence presented in the original study was updated and it is still recommended that the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010 is adopted for Leicester City.

In additional to this, it is recommended that a similar efficiency target be applied to non-household development with the Building Research Establishment Environmental Assessment Methodology (BREEAM) New Construction Standard used for this purpose.

Water supply

In the original study, Severn Trent Water responded to the request to assess the impacts of development on water supply infrastructure and confirmed that water supply is not expected to be a constraint to development.

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

The updated growth forecast does not contain any new sites and so the assessment performed by STW in the original study is retained and the original conclusions still apply.

Wastewater network

In the original study, STW provided an assessment of the wastewater sewer and surface water sewer capacity for development sites provided to them. This assessment identifies sites where there may be constraints in the sewer network that require some network reinforcement in order to accommodate growth.

Phasing of these sites needs to be carefully managed between Leicester City council and STW to ensure that infrastructure is in place prior to occupation.

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

Early engagement between developers, LCC and STW is recommended to allow time for any strategic infrastructure required to serve these developments to be planned.

Wastewater treatment

Growth that is forecast within the LCC Local Plan is likely to be served entirely by Wanlip WwTW to the north of Leicester. STW have highlighted the limited capacity at Wanlip in their draft Drainage and Wastewater Management Plan (dDWMP). In response to this several phases of investment are being planned by STW to ensure sufficient capacity is provided. STW have commented that they "would not anticipate any issues in providing capacity for the proposed growth for the Local Plan, subject to the completion of the currently proposed schemes for Wanlip WwTW in development".

There remains however very limited capacity at Wanlip in the short term, and discussions should take place between STW and LCC to explore any implications for phasing of development in the early stages of the plan until additional capacity is provided.

The storm tank overflow at Wanlip WwTW is operating above the threshold for an investigation under the Storm Overflow Assessment Framework. This is noted in the dDWMP and identified as a long-term priority. The Local Plan has a role to play in

ensuring development does not increase the frequency or duration of operation of this overflow by encouraging the use of SuDS to divert storm water away from the sewer network, reducing the volume that reaches the WwTW.

Water quality

The water quality modelling work undertaken in the original study was repeating using the updated growth forecast. The existing SIMCAT model from the original study was used, and flow at Wanlip and Whetstone WwTWs was updated using data provided by STW for the last three years (2019-2021).

Growth forecast in the LCC Local Plan is unlikely to cause a significant deterioration in water quality downstream of Wanlip WwTW (less than a 10% deterioration and no change in WFD class). It is also not predicted to prevent good ecological status being achieved in the future.

Environmental impact

Wanlip WwTW is a point source of pollution on the River Soar and has the potential to impact sites downstream with environmental designations. Water quality modelling using SIMCAT was used to predict the deterioration in water quality in watercourses adjacent to sites with environmental designations downstream. Deterioration was not found to be significant.

Development sites within Leicester City could also be sources of diffuse pollution from surface runoff. SuDS are required on all sites and their design must consider water quality as well as quantity. Runoff from these sites should be managed through implementation of a SuDS scheme with a focus on treating water quality of surface runoff from roads and development sites.

Opportunities exist for these SuDS schemes to offer multiple benefits of flood risk reduction, amenity value and biodiversity, as well as opportunities for groundwater recharge to provide a water resources benefit.

Leicester City Council, as LLFA, should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors.

1 Introduction

1.1 Terms of reference

JBA Consulting were commissioned by Leicester City Council to undertake an update to the Water Cycle Study (WCS) completed in 2020. This update should be read alongside the original study.

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

1.2 Structure of report

Since completion of the original study there have been a number of changes which need to be taken into account:

- Changes to policy, legislation, and guidance.
- New documentation is available:
  - Draft Water Resource Management Plan 2024 (WRMP24)
  - Draft Drainage and wastewater Management Plan (dDWMP)
- Storm overflow data is now publically available.
- Changes have been made to the Local Plan growth forecast as the Plan has been developed.

Where policy, legislation and guidance has changed this will be summarised in an updated policy section, which should be read alongside the original section.

The report is then divided into sections assessing the impact of growth on each topic in the water cycle study. Each section of the WCS has then been updated based on the new growth forecast and latest documentation and datasets.

1.3 The Water Cycle

Figure 1.1 below shows the main elements that compromise the Water Cycle and shows how the natural and artificial processes and systems interact to collect, store or transport water in the environment. The natural water cycle describes the continuous transfers of water around the planet, from atmosphere to surface and back via evaporation, transpiration and precipitation, and the various flows and storage processes that occur. The artificial water cycle looks at the availability of water resources for human consumption, its treatment and supply to homes and business, its use and consequently the generation of wastewater. It then looks at how wastewater is taken away, treated, and finally what happens when it is returned to the environment.

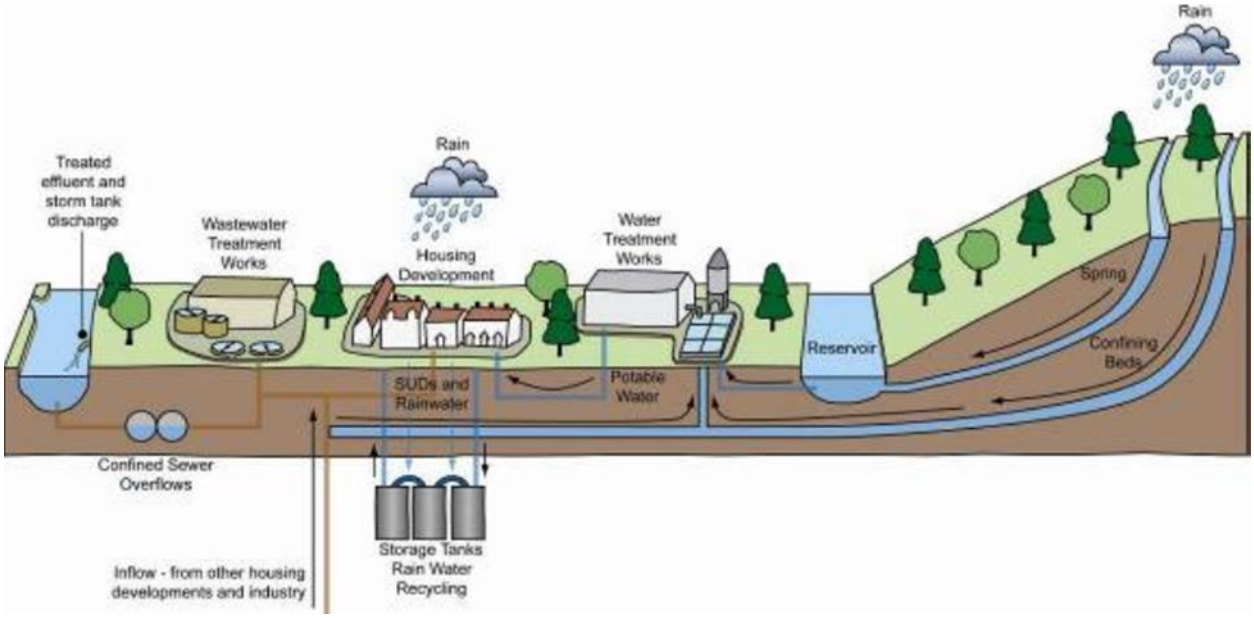

Figure 1.1 The Water cycle

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

1.4 Authorities responsible for water management

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

Table 1.1 Responsibilities of authorities within Leicester City

Authority Name	Key Responsibilities
Environment Agency	The EA are the environmental regulator in the UK with responsibilities for water quality, flood risk and administering licences for water abstraction. They are a statutory consultee for many development plan documents and for some planning applications. They advise on environmental and infrastructure capacity issues across the water cycle.

Authority Name	Key Responsibilities
Natural England	Natural England are the Government's advisors on the natural environment, which they have a responsibility to protect and enhance. In a WCS they may provide information on the conservation objectives, and guidance on, the protection of designated sites.
Severn Trent Water	STW as the water supplier for the City has a statutory duty under the Water Industry Act to maintain an efficient and economical system of water supply within its area and supply households with a reliable and sufficient supply of water. STW are also the sewerage undertaker for the City. Sewerage undertakers have a duty under the Water Industry Act to provide, improve and extend a system of public sewers (for both domestic and trade flows) so as to cleanse and maintain those sewers (and any lateral drain) to ensure that the area that they serve is effectually drained. There is also a duty to make provision for the emptying of those sewers, normally through sewage treatment works or where appropriate through discharges direct to watercourses.

2 Future growth in Leicester City

2.1 Updated growth forecast

As the Local Plan has developed, changes have been made to the growth forecast assessed in the original study. The number of dwellings overall has increased from approximately 22,000 to 23,000. The largest change is the inclusion of LCC's unmet need within the assessments which adds an additional 18,694 dwellings to the analysis in the original study.

2.2 Growth forecast overview

Table 2.1 contains a summary of the housing growth proposed in the LCC Local Plan. A more detailed description can be found within the draft Local Plan by clicking here.

Table 2.1 Housing provision from 2020-36

	Component	Dwellings
A.	Housing Need 2020-36 (Standard Method 2021)	39,424 (2,464 dwellings per annum)
B.	Completions 2020-21	1,050
C.	Completions 2021-22	842
D.	Total completions 2020-22 (B+C)	1,892
	Commitments	
E.	Commitments: detailed and outline permissions	9,410
F.	Saved previous Local Plan allocations	0
G.	Windfall allowance	2,354 (214 dwellings per annum for 11 years)
H.	Allocations identified in the draft plan	1,230
J.	Central Development Area capacity work	6,286
K.	Strategic sites	1,838
L.	Total anticipated supply within the city	21,118
M.	Overall supply (anticipated supply + completions) - D + L	21,118 + 1,892 = 23,010

	Component	Dwellings
N.	Local Plan Housing Target (2020-36) (Approximately 11% buffer)	20,730
O.	Unmet need	18,694

Source: City of Leicester Local Plan 2020-36 (Submission Regulation 19 Plan November 2022)

In addition to the housing growth, there is 28.35ha of employment land which is broadly in line with that factored into the original study.

2.3 Neighbouring authority growth

The original study contained growth from neighbouring authorities that would also be served by Wanlip WwTW. This is assumed to be unchanged from the original work and is separate to the unmet need stated in Table 2.1.

3 Policy and legislation

3.1 Introduction

The WCS completed in July 2020 contained a summary of the key policy and legislation relating to the water cycle. Since this date, some of this legislation has changed, and new documents and guidance has been published. Where this is the case, this WCS update presents the new documentation, superseding or adding to original summary.

3.2 Derived European legislation and Brexit

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

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

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

To read more about the Retained EU Law (Revocation and Reform) Bill go to the Government's website by clicking here.

3.3 Environment Act

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

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

- Effective collaboration between water companies through statutory water management plans.
- Minimise damage water abstraction may cause on environment.

- Modernise the process for modifying water and sewerage company licence conditions.

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

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

3.4 Water industry policy

3.4.1 Drainage and Wastewater Management Plans

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

The group recognised that great progress has been made by the water industry in its drainage and wastewater planning over the last few decades, but that, in the future, there needs to be greater transparency and consistency of long-term planning. The Drainage and Wastewater Management Plan (DWMP) framework (Water UK, 2018) sets out how the industry intends to approach these goals, with the objective of the water companies publishing plans by the end of 2022, in order to inform their business plans for the 2024 Price Review.

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

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

In the future, DWMPs will provide more transparent and consistent information on sewer flooding risks and the capacity of sewerage networks and treatment works, and this should be considered in SFRAs, Water Cycle Studies, as well as in site-specific FRAs and Drainage Strategies.

Severn Trent Water have published their draft DWMP which has been used to inform this WCS Update. Final publication is expected in March 2023.

The draft DWMP can be viewed on the STW website by clicking here.

3.4.2 Charges for new connections

STW offer an environmental discount scheme to encourage better water efficiency and aid the prevention of flooding. A discount of £280 on the clean water infrastructure charge is available if it can be demonstrated that a developer is building homes to 100 litres per person per day or less.

A further discount of £124 is available if there is no surface water connection made to a public sewer.

These discounts are available for 2022-23 up to the end of March 2023 when the scheme for 2023-24 will be published. Details of the STW discounts can be found on their website by clicking here.

3.4.3 Design and construction guidance

The water industry regulator OfWAT is required by the Water Industry Act 1991 to issue codes covering agreements between water and sewerage companies and developers, for the adoption of water (Water UK, 2020) and wastewater (Water UK, 2020b) infrastructure constructed by developers. These codes were fully revised in 2020 as the Design and Construction Guidance (DCG). This brought in particularly significant changes with respect to sewerage and the definition of adoptable assets. Prior to 2020, codes had been set out in Sewers for Adoption. This document, up to its final version 7, included a narrow definition of sewers to mean below-ground systems comprising of gravity sewers and manholes, pumping stations and rising mains. This essentially excluded the adoption of SuDS by water companies, except for below-ground storage comprising of oversized pipes or chambers.

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

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

The new Design and Construction Guidance (DCG) came into force in England.in April 2020. This contains details of the water sector's approach to the adoption of those SuDS which meet the legal definition of a sewer. The guidance replaces Sewers for Adoption 8. It differs from previous Sewers for Adoption guidance as compliance by water companies in England is now mandatory.

4 Water resources

4.1 Introduction

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

The conclusions from the original study are re-visited, taking into account the recently published Draft Water Resource Management Plan (dWRMP24), and the updated growth forecast outlined in Section 2.

4.2 Conclusions from original study

The original study drew the following conclusions:

- WRMP19 showed a supply demand deficit from 2021-22 for the Strategic Grid WRZ if no action were taken. A number of actions were defined to address this in the WRMP.
- Severn Trent Water commented that they have "no areas of concern regarding the sites proposed". While the Leicester Development area "does not pose a significant risk to the quantitative status of groundwater or surface waterbodies in the area", they recommended "that best practice is always used and that water efficiency measures are specified by the planning authority."
- Policies to reduce water demand from new developments, or to go further and achieve water neutrality in certain areas could be defined to reduce the potential environmental impact of additional water abstractions in Leicester City, help to achieve reductions in carbon emissions in Leicester and reduce energy and water bills for residents.
- A policy requiring new residential development to achieve the tighter water efficiency target of 110 l/p/d as described in Part G of Building Regulations is line with the strategic direction outlined in the National Water Resources Framework, and the recommendations of the River Basin Management Plan. Furthermore, it is viable, can be implemented at negligible cost and will reduce energy and water bills for residents.

4.3 Severn Trent Water's draft WRMP24

Each water company must publish a Water Resources Management Plan (WRMP), a 25-year strategy (updated every five years), which assesses future demand, water

availability, demand management measures and how the impact of climate change will be mitigated. Where necessary they also set out the requirements for developing additional water resources to meet growing demand and reductions in abstraction from other sources to meet their environmental responsibilities.

In the dWRMP24 the size of the supply demand deficit has increased to 244Ml/d by 2040-41 if no action were taken, considerably higher than expected in WRMP19.

It outlines four challenges that impact the supply and demand for water:

- Climate change
- Population
- Leakage
- Value for customers

The plan proposes a number of measures to deal with the forecast supply-demand deficit:

- Roll out universal metering (52Ml/d by 2035)
- Reduce leakage by 50% (135Ml/d by 2045)
- Deliver the Severn Trent Efficiency Plan (37Ml/d by 2050)

At the same time schemes will be delivered to boost the supply of water and ensure water supplies can cope with a 1 in 500-year drought and the impact of climate change.

The dWRMP24 can be found on the STW website by clicking here.

4.4 Draft Regional Plan for West of England

At the time of writing, Water Resources West, a collaboration of the water companies serving the west of England, including Leicester and the whole Severn Trent Water supply area, have issued a consultation version of their regional plan for 2025 to 2075 (WRW, 2022). From this water resources planning cycle, the role of this and other regional plans has been given much greater emphasis, given the need for a significant increase in water transfers and new strategic resources to address the challenges of climate change, a growing population, and the need to reverse over-abstraction which is harming water habitats. In the west of England, without intervention, this would amount 1,204Ml/d by 2050, as illustrated below.

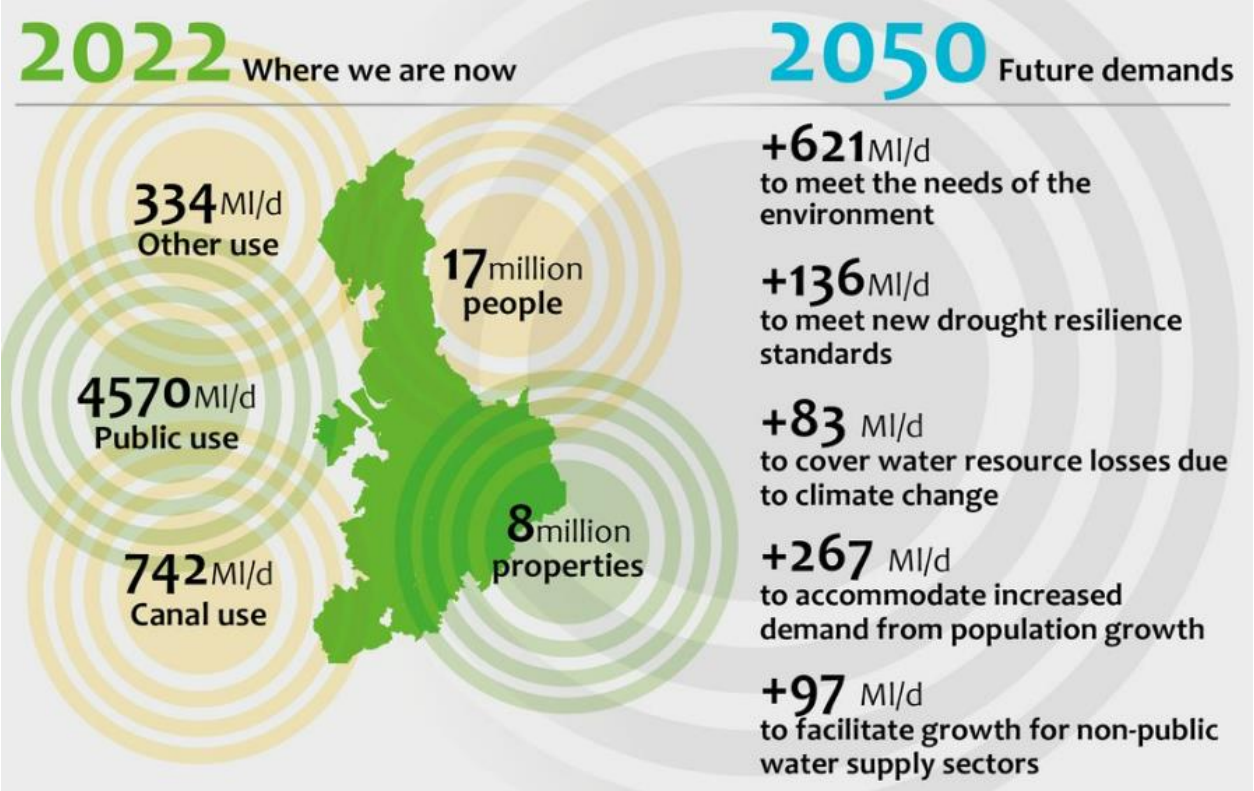

Figure 4.1 Summary of the water resources challenge in the west of England
(Source: Water Resources West 2022)

Around 590Ml/d can be met by implementing leakage and water efficiency policies, and measures already contained in drought plans can meet a further 390Ml/d. This leaves a deficit of 221Ml/d which will have to be mitigated by implementing new water resource supply options including transfers and new sustainable sources of water.

There are no specific schemes planned in Leicester, although the demand management measures will need to be applied everywhere. The plan makes minimal reference to new development and the role of the planning system in reducing water demand from new buildings.

The Water Resources West draft regional plan can be read on their website by clicking here.

4.5 Comparison of Local Plan growth to the WRMP

The Office for National Statistics (ONS) household projections dataset reports a 9.3% increase in the number of households in Leicester City during the period 2020 to 2036. This is significantly lower than the level of growth proposed in the LCC Local Plan which, if delivered, would result in an increase of 16.6% over the Plan period. STW's WRMP contains a forecast for increase in the number of households within the Strategic Grid WRZ, STW's largest water resource zone serving some 2.4 million dwellings, including Leicester. In WRMP19 this was forecast to be 12.3%, and in the

dWRMP24 this has increased slightly to 13.1%. This percentage is less than is forecast by the LCC Local Plan, but not significantly so, and within the uncertainty built into the drop. The WRMPs do not include a breakdown of growth by local authority so it is not possible to identify the growth allowed for specifically in Leicester.

Table 4.1 Comparison of WRMP and Local Plan growth

Forecast	2020 (Dwellings)	2036 (Dwellings)	% Increase
2018 ONS Projections	124,953	136,608	9.3%
WRMP19 Forecast - Strategic Grid	2,406,140	2,703,240	12.3%
dWRMP24 Forecast - Strategic Grid	2,389,310	2,703,240	13.1%
Local Plan Housing Target (2020-36)	124,953	145,683 (+20,730) Does not include unmet need	16.6%

4.6 Summary of evidence for tighter efficiency standard

The original WCS presented the evidence required to justify the adoption of the tighter water efficiency target through the building regulations. This evidence was reviewed as part of the WCS Update and the following observations were made:

- Water stress: The EA have updated their assessment of water stress (Environment Agency, 2021) and the Severn Trent Water area (excluding the Chester zone) is now classified as being an area of serious water stress.
- River Basin Management Plans (RBMP): The Humber RBMP was updated in 2022 (Environment Agency, 2022). There is no significant change in the challenges identified from the 2015 version, with "changes to natural flow and levels of water" still noted as a significant challenge.
- National Water Resources Framework: The framework proposes that regional groups plan to help customers reduce their water use to around 110 l/p/d. This is unchanged and now supported by the regional plans.
- Impact on viability: the evidence presented in the original study that the 110 l/p/d target does not have an impact on viability is still valid.

A set out in the original study, it is therefore recommended that the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010 is adopted for Leicester City.

4.7 Water efficiency in employment sites

There is sufficient evidence to recommend the optional 110 litres per person per day design standard allowed under Building Regulations. This should be supported by an equivalent non-household water efficiency target. The BREEAM New Construction Standard (BRE, 2018) can be used for this, and it is recommended that non-household development achieves a minimum of 3 credits under the measure “Wat01” which provides a 40% improvement in water consumption compared to the baseline for that type of building.

4.8 High levels of water efficiency ambition

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

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

Until this changes, LPAs should encourage developers to go further than building regulations. This is supported by STW's Environmental Incentive scheme where a financial incentive is available for developers to design buildings to a standard of 100 l/p/d or less.

There is also an opportunity on larger residential developments and on commercial developments to incorporate rainwater harvesting and/or greywater recycling at the master planning stage in order to reduce water demand significantly below 110 l/p/d.

4.9 Conclusions

The recently published draft WRMP24 identifies an increased supply demand deficit for the Strategic Grid WRZ that serves Leicester City. It goes on to identify a number of actions to address this. This is now aligned with the Water Resources West Draft Regional Plan.

The growth forecast presented in this updated WCS is an increase on the forecast assessed in the original study. This is higher than the percentage growth accounted

for in the dWRMP24 but not significantly so, and within the uncertainty planned for in the WRMP.

It is for Local Authorities to establish a clear need to adopt the tighter water efficiency target through the building regulations. The evidence presented in the original study was updated and it is still recommended that the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010 is adopted for Leicester City.

In additional to this, it is recommended that a similar efficiency target be applied to non-household development with the BREEAM New Construction Standard used for this purpose.

4.10 Recommendations

Action	Responsibility	Timescale
Continue to regularly review forecast and actual household growth across the supply region through WRMP Annual Update reports, and where significant change is predicted, engage with Local Planning Authorities.	STW LCC	As part of the planning process
Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	LCC	Ongoing
Use planning policy to require the optional standard in Building Regulations of 110 l/p/d for new build housing.	LCC	In LCC Local Plan
Use planning policy to require new build non-residential development to achieve at least 3 credits in the Wat01 Measure for water in the BREEAM New Construction standard.	LCC	In LCC Local Plan
Larger residential developments and commercial developments should consider incorporating greywater recycling and/or rainwater harvesting into development at the master planning stage in order to reduce water demand.	LCC, STW	In LCC Local Plan
Water companies should advise LCC of any strategic water resource infrastructure developments within the study, where these may require safeguarding of land to prevent other type of development occurring.	STW, LCC	In LCC Local Plan

5 Water supply

5.1 Introduction

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

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

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

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

5.2 Conclusions from original study

Severn Trent Water responded to the request to assess the impacts of development on water supply infrastructure and confirmed that water supply is not expected to be a constraint to development. Early developer engagement is required to ensure that, as development occurs within the study area, any detailed modelling of water supply infrastructure that is required can be completed and any upgrades required can be completed without restricting the timing, location, or scale of the planned development.

5.3 Updated assessment

The updated growth forecast does not contain any new sites and so the assessment performed by STW in the original study is retained and the conclusions above still apply.

5.4 Recommendations

Table 5.1 Recommendations for water supply infrastructure

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

6 Wastewater network

6.1 Introduction

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

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

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

In combined sewerage systems, or foul systems with surface water misconnections, there is potential to create headroom in the system, thus enabling additional growth, by the removal of surface water connections. This can most readily be achieved during the redevelopment of brownfield sites which have combined sewerage systems, where there is potential to discharge surface waters via sustainable drainage systems (SuDS) to groundwater, watercourses, or surface water sewers.

STW are supportive of the use of SuDS and SuDS principles to manage surface water run-off. They recommend that the Drainage Hierarchy is used to direct surface water to natural outfall routes such as infiltration to ground or into watercourse, before utilising sewers, as supported by paragraph 56 of the NPPG. Surface water should also not be permitted to connect to a foul sewer.

6.2 Conclusions from original study

STW provided an assessment of the wastewater sewer and surface water sewer capacity for development sites provided to them as part of this study. This assessment

identifies sites where there may be constraints in the sewer network that require some network reinforcement in order to accommodate growth. Phasing of these sites needs to be carefully managed between Leicester City council and STW to ensure that infrastructure is in place prior to occupation.

6.3 Updated assessment

As for the water supply network assessment, the updated growth forecast does not contain any new sites and so the assessments made by STW in the original study are retained. Since the original study was published, new data is available on the performance of storm overflows which will be explored below.

6.4 Storm overflows

6.4.1 Background

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

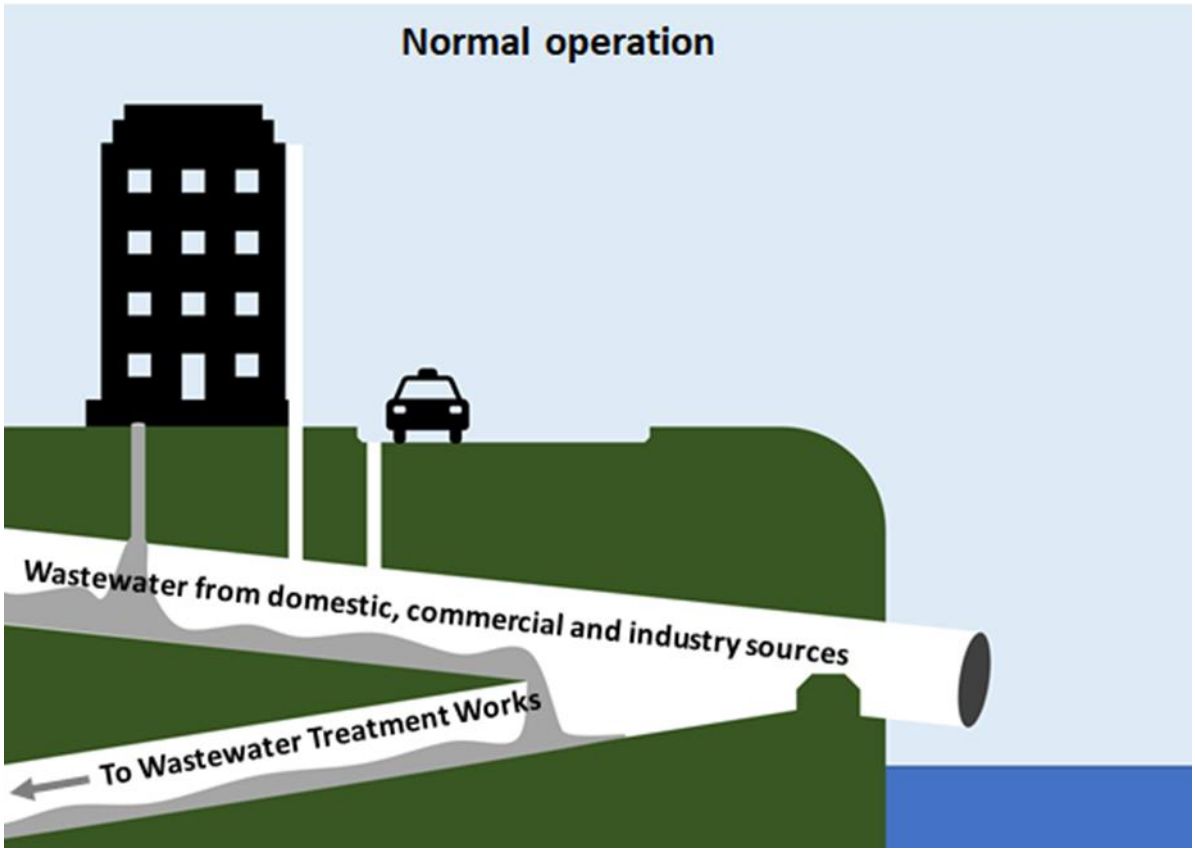

Figure 6.1 Storm overflow operation in normal conditions

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

Storm overflows become problematic when they operate frequently in moderate or light rainfall, or for long periods as a result of groundwater infiltration in the sewerage system – possibly in breach of their permit.

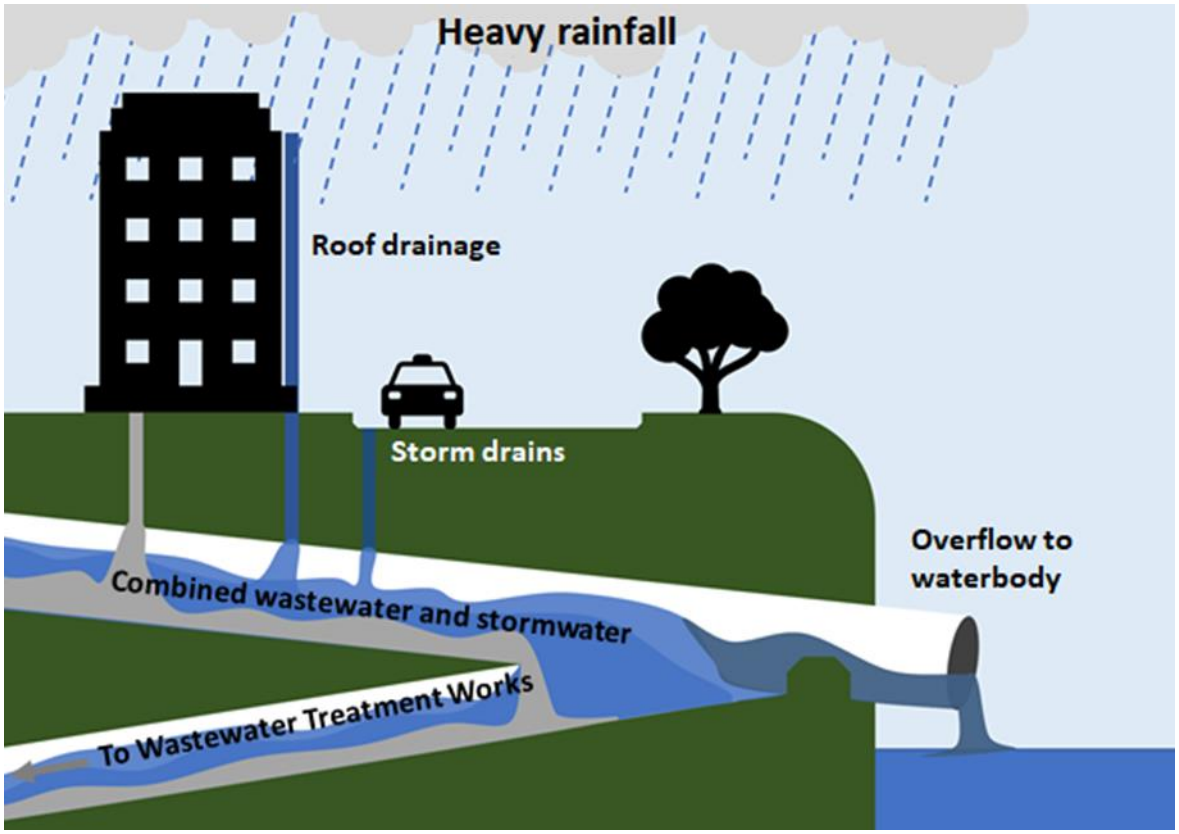

Figure 6.2 Storm overflow operation in exceptional rainfall

6.4.2 Storm overflow assessment

The Environment Act now requires water companies to report and monitor storm overflows as well as reduce the harm caused to the rivers they discharge to. Figure 6.3 below shows the location of storm overflows in the study area. Note that both storm overflows on the network, and storm tank overflows at WwTWs are shown. Overflows at WwTWs are discussed in Section 7.

The Storm Overflow Taskforce (made up of Defra, the EA, Ofwat, Consumer Council for Water, Blueprint for Water and Water UK) has agreed a long-term goal to end the damaging pollution caused by the operation of storm overflows. An important component of this is the monitoring of overflows, and a target has been set to monitor the frequency and duration of operation at all storm overflows by 2023. This is called Event Duration Monitoring (EDM). The EDM dataset (which contains performance

data on the 16,639 storm overflows monitored in 2021) has been used to provide information on storm overflows in Leicester City. The EA have set a threshold of 60 operations per year, above which a storm overflow should be investigated (if based on one year of data, the threshold is 50 for two years data and 40 for three years data).

The EA's description of the EDM dataset can be found by clicking here.

Table 6.1 summarises the performance of the storm overflows on the network in Leicester. None of the overflows are operating above the threshold to trigger an investigation.

Table 6.1 Network storm overflow frequency of operation and duration 2020/21

Overflow	Number of operations in 2020	Duration of operation in 2020 (hours)	Number of operations in 2021	Duration of operation in 2021 (hours)
AMY STREET PS /STORM SETT TANKS	-	-	10	74.83
BEATRICE ROAD / SYLVAN STREET CSO	12	1.15	5	1.08
BEATRICE ROAD/ RUBY STREET CSO	69	99.39	7	1.83
BEATRICE ROAD/HAWTHORNE STREET CSO	11	1.22	14	2.09
BELGRAVE - DYSART WAY (CSO)	18	7.66	21	14.17
CONDUIT STREET CSO	0	0.00	0	0.00
EASTERN MAIN RELIEF SEWER - STORM (EASTERN MAIN RELIEF SEWER SSO)	42	144.73	-	-
GWENDOLEN ROAD	0	0.00	1	0.47
HAMMERCLIFFE RD-ULVERSCROFT RD CSO	-	-	52	130.50
HAMMERCLIFFE ROAD STORM OVERFLOW	8	11.13	16	15.69
HOWARD ROAD CSO	-	-	32	577.46

Overflow	Number of operations in 2020	Duration of operation in 2020 (hours)	Number of operations in 2021	Duration of operation in 2021 (hours)
HUMBERSTONE DRIVE CSO	0	0.00	0	0.00
KNIGHTON FIELDS - WELFORD RD (CSO)	15	4.93	16	6.93
MARSDEN LANE CSO	3	24.89	7	46.78
MAYFIELD ROAD CSO	0	0.00	0	0.00
NARBOROUGH RD / WESTCOTE RD CSO	0	0.00	5	5.17
NEDHAM STREET CSO	2	0.14	7	1.58
NORTHGATE COMBINED SEWER OVERFLOW	-	-	To be installed Dec 2023	To be installed Dec 2023
RATBY LANE SEWAGE PUMPING STATION	-	-	To be installed Dec 2023	To be installed Dec 2023
RAW DYKES ROAD CSO	12	26.52	1	1.86
ST MARGARETS WAY CSO	0	0.00	0	0.00
STOUGHTON VILLAGE PS - SWS	-	-	0	0.00
THE NEWARKE CSO	4	0.86	2	0.96
TUDOR ROAD/PAGET ROAD CSO	10	7.89	28	26.05

Although the overflows are operating below the threshold, it is important to ensure that development does not increase the frequency or duration of operation. There are opportunities through the planning system to ease pressure on the wastewater network by separating foul and storm flow when redeveloping brownfield sites, and not allowing new surface water connections to combined sewerage systems. Surface water can also be better managed by retrofitting SuDS in existing residential areas, and in new development, ensuring SuDS are incorporated into designs at the master planning stage to maximise the potential benefits.

The Storm Overflow Reduction Plan which was published in August 2022 sets an objective that “storm overflows will not be permitted to discharge above an average of 10 rainfall events per year by 2050”. The Storm Overflow Reduction Plan can be found by clicking here.

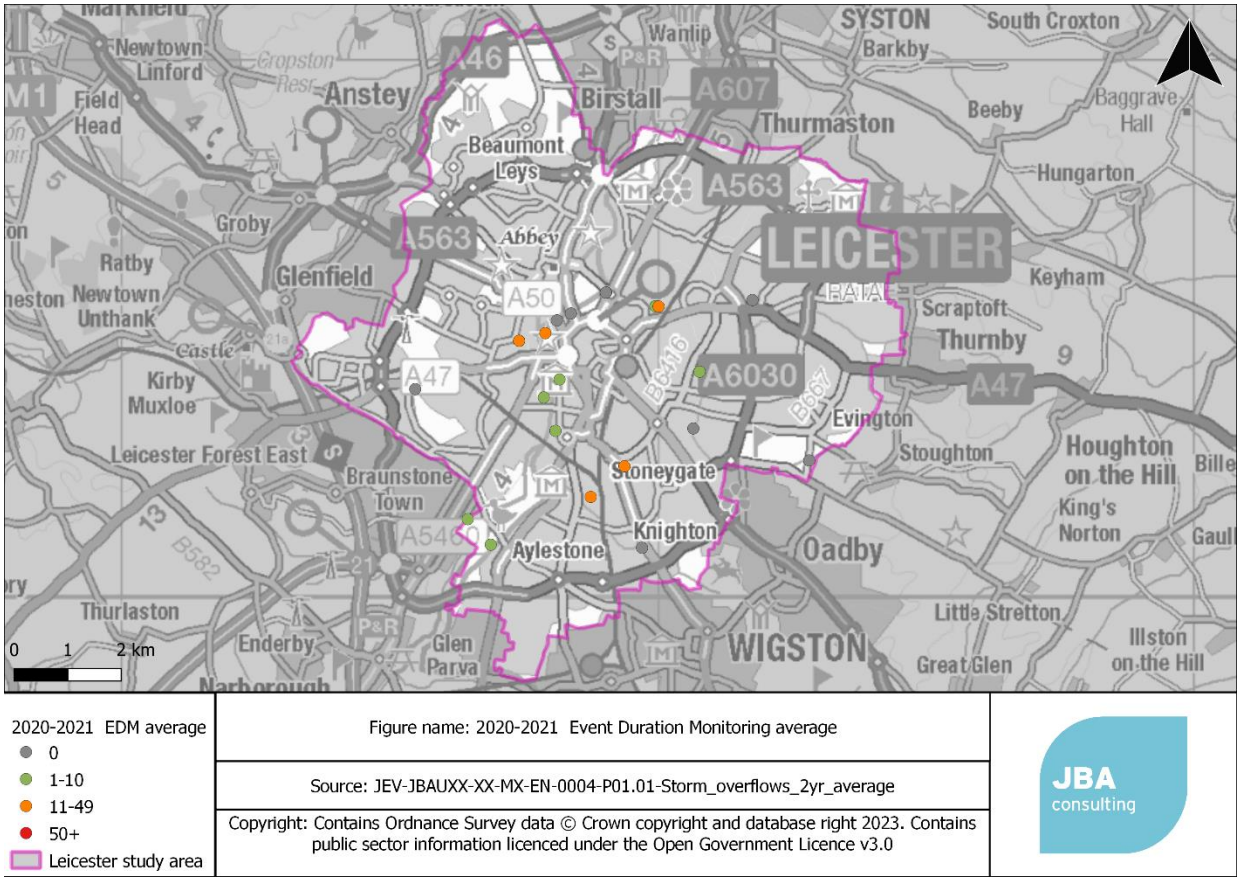

Figure 6.3 Location and performance of storm overflows in Leicester City

6.5 Conclusions

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

Early engagement between developers, LCC and STW is recommended to allow time for any strategic infrastructure required to serve these developments to be planned.

6.6 Recommendations

Table 6.2 Recommendations for wastewater network assessment

Action	Responsibility	Timescale
Early engagement between Developers, LCC and STW is required to ensure that where upgrades to infrastructure is required, it can be planned in by STW.	Developers LCC STW	As part of the planning process
Take into account wastewater infrastructure constraints in phasing development in partnership with the sewerage undertaker	LCC STW	Ongoing
Developers will be expected to work with the sewerage undertaker closely and early in the planning promotion process to develop an outline foul Drainage Strategy for sites to the satisfaction of the LPA that the development will not increase sewer flooding or the frequency or duration of storm overflow operation. The Outline Foul Drainage strategy should set out the following: What – What is required to serve the site Where – Where are the assets / upgrades to be located When – When are the assets to be delivered (phasing) Which – Which delivery route is the developer going to use s104 s98 s106 etc. The Outline Drainage Strategy should be submitted as part of the planning application submission, and where required, used as a basis for a drainage planning condition to be set.	Developers STW	Ongoing
Developers will be expected to demonstrate to the Lead Local Flood Authority (LLFA) that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to foul sewers seen as the last option. New connections for surface water to foul sewers will be resisted by the LLFA. Where a surface water connection is proposed to the public sewerage network, it should be demonstrated to Severn Trent Water that there is no other technically feasible option by selecting options as high as possible within the surface water hierarchy.	Developers LLFA STW	Ongoing

7 Wastewater treatment

7.1 Introduction

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

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

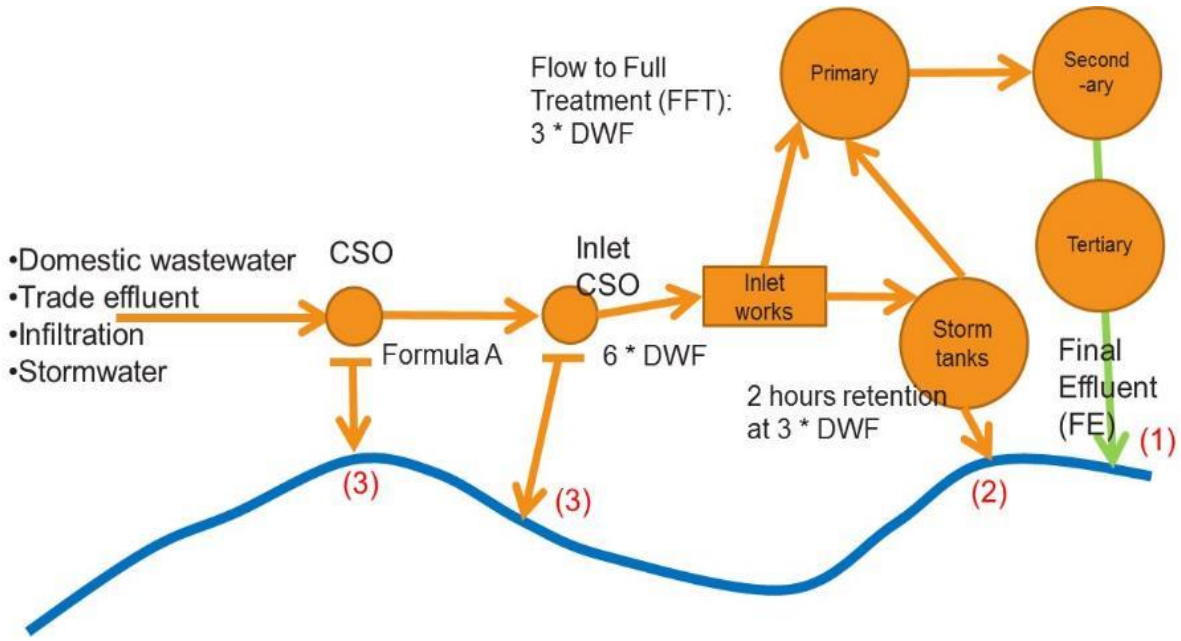

Figure 7.1 Overview of typical combined sewerage system and WwTW discharges

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

Permitted discharges are based on a statistic known as the Dry Weather Flow (DWF). As well as being used in the setting and enforcement of effluent discharge permits, the

DWF is used for WwTW design, as a means of estimating the ‘base flow’ in sewerage modelling and for determining the flow at which discharges to storm tanks will be permitted by the permit (Flow to Full Treatment, FFT).

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

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

7.2 Overview

Wastewater services in Leicester City are provided by Severn Trent Water and the whole of Leicester City is served by Wanlip WwTW to the north of Leicester. In the original study it was noted that Wanlip WwTW was operating close to its flow permit, and STW advised that a short-term solution of transferring some flow from Wanlip to Whetstone WwTW to the south of Leicester was being considered. During the course of the WCS Update, STW have advised that this transfer is no longer under consideration.

Whilst the original study considered growth served by Wanlip WwTW from neighbouring authority areas, the unmet need from LCC Local Plan was not considered. An update to the WwTW capacity assessment is therefore required.

7.3 WwTW Capacity Assessment

Leicester's unmet need (18,694 dwellings) is subject to a Statement of Common Ground between Leicester City and neighbouring authorities, and it is not yet known where this portion of growth will be situated. For this study, it is assumed that it will all be on the periphery of Leicester City and served by Wanlip WwTW.

STW were asked for an assessment of capacity at Wanlip WwTW and responded with a summary of information taken from their recently published draft Drainage and Wastewater Management Plan (DWMP).

The first assessments were of flow and load and STW commented that: "As part of our DWMP process we have readily available assessments of our WwTW capacity, based on the current permits and the last 5 years of flow data. Based on this information we have been able to determine the amount of spare capacity in m^3/d and convert this to a Population equivalent. This has been compared with the proposed Populations from the Office of National Statistics resulting in the following

assessment. The Treatment assets and process have been assessed to understand the spare treatment capacity within the WwTW and compare this with the % increase in population." This is presented in Table 7.1.

Wanlip WwTW has been rated a "very high risk" for flow and load status, indicating the WwTW may be at or close to its capacity. STW also comment that several phases of investment are planned over the next five to ten years to provide adequate treatment capacity. It should be noted that the level of growth that would result from delivering the LCC Local Plan is higher than the ONS population forecasts.

Table 7.1 RAG status for flow and load and Wanlip

Assessment Type	Assessment	Comments
Flow Status	Very High Risk	We are planning several phases of investment over the next 5-10 years to ensure the provision of adequate treatment capacity
Load Status	Very High Risk	We are planning several phases of investment over the next 5-10 years to ensure the provision of adequate treatment capacity

STW also provided an assessment of environmental constraints (Table 7.2) with the following description:

"We have also reviewed existing and future permit limits for key parameters such as ammonia, phosphate and BOD against the current BATNEEC (Best Available Technology Not Entailing Excessive Costs) levels for removal/reduction of these parameters within flows we return to the environment. Where the current permit limits are at or close to the BATNEEC levels, then there is risk that standard upsizing of the WwTW will not be possible without causing environmental damage. As Severn Trent is subject to Section 94 of the Water industries Act, we have a requirement to find or create a solution for the provision of additional capacity. Such solutions are likely to be more complicated, may take longer and be more expensive than where such technological constraints are not in existence. The Spatial Constraint is an assessment of the current extent of site land use, adjacent land use and proximity to SSSIs and Flood Zones to determine if there are any risk that could prevent development from expanding or increase the cost of WwTW expansion."

Table 7.2 Status for environmental and spatial constraints

Assessment Type	Assessment	Comments	Resulting Risk
Environmental Constraint	Very High Constraint	There is limited environmental capacity within the watercourse for additional	Medium Risk

Assessment Type	Assessment	Comments	Resulting Risk
		nutrient load, however it is anticipated that through management of all our WwTW on the river reach a solution will be viable, subject to the relevant discussions with the Environment Agency	
Spatial Constraint	High Constraint	The spatial constraint is related to proximity to Flood Zone 3; however, this could be resolved through Flood Compensation works or development within the existing operational area.	Medium Risk

STW provided the overall comment that "Based on this assessment we would not anticipate any issues in providing capacity for the proposed growth for the Local Plan, subject to the completion of the currently proposed schemes for Wanlip WwTW in development."

JBA carried out an independent headroom assessment using the data provided by STW during the original study and the WCS update. The Wanlip WwTW flow data was provided by STW. Figure 7.2 shows the 80th percentile exceedance flow (the metric used by the Environment Agency for setting flow permit levels). The data indicates that there is no available headroom at Wanlip. STW's comments indicate that they do not anticipate any issues providing capacity at Wanlip, however the data suggests that there is a risk of the WwTW capacity being exceeded without careful consideration of the trajectory of development in Leicester by both the Council and STW.

Permit compliance is assessed by the Environment Agency using the 90th percentile statistic (not shown in the graph) which in general results in a lower value than the 80th percentile. Compliance of Wanlip WwTW is not within the scope of the WCS and the assessment below should not be used to infer non-compliance.

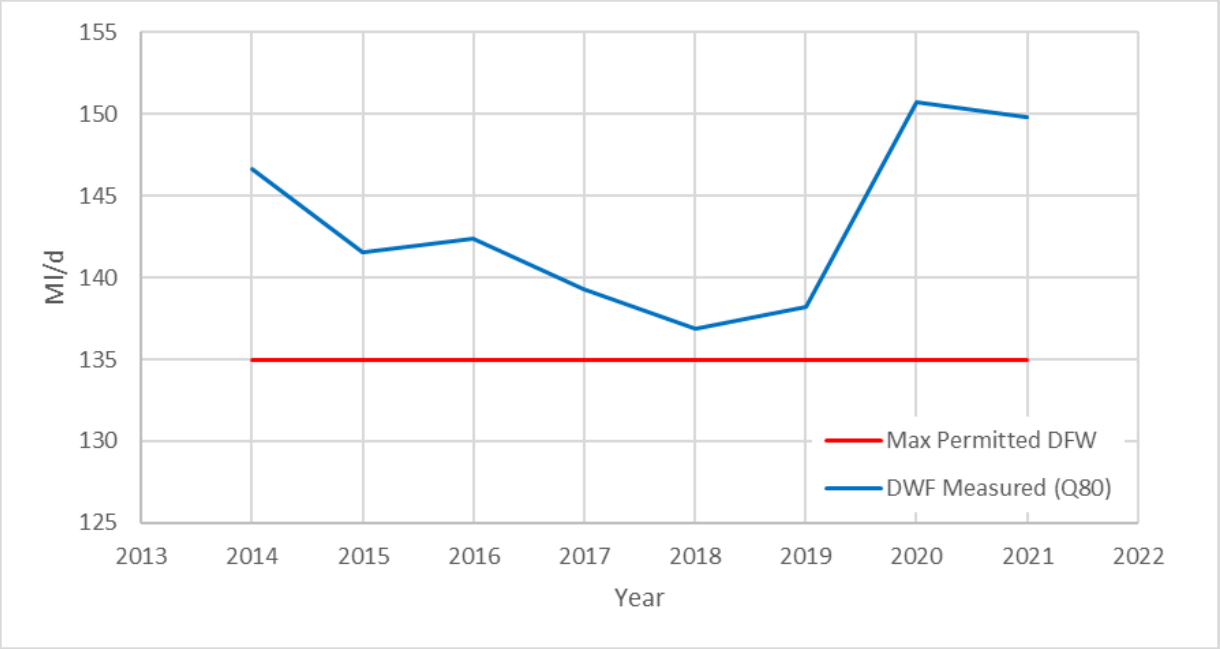

Figure 7.2 Headroom assessment for Wanlip WwTW (80th%ile flow)

7.4 Storm overflow assessment

Table 7.3 presents the performance of storm overflows at Wanlip WwTW. Three overflows are present, one of which is operating above the threshold for an investigation based on monitoring in 2020/21.

Where a storm tank overflow is operating in periods of moderate or light rainfall, or even in dry conditions it indicates either an infiltration problem within the network, or that the WwTW or its storm tanks are undersized for the population served. Further development within a catchment that has a poorly performing storm tank overflow is likely to exacerbate the issue. It is important that development does not increase this frequency. The local plan can contribute to this by encouraging the use of SuDS to divert storm water away from the sewer network, reducing the volume that reaches the WwTW.

The Risk Based Catchment Screening (RBCS) in the draft DWMP notes that the Wanlip catchment has a "trigger" for an investigation under the Storm Overflow Assessment Framework (SOAF) and defines this as a long-term priority.

Table 7.3 Storm overflow performance at Wanlip WwTW

Overflow	Number of operations in 2020	Duration of operation in 2020 (hours)	Number of operations in 2021	Duration of operation in 2021 (hours)
Storm Tank - A3	129	968.0	56	559.7
Storm Tank - A4	22	172.9	43	374.5
SO Inlet	-	-	28	75.7

7.5 Conclusions

Growth forecast within the LCC Local Plan is likely to be served entirely by Wanlip WwTW to the north of Leicester. STW have highlighted the limited capacity at Wanlip in their draft Drainage and Wastewater Management Plan. In response to this several phases of investment are being planned by STW to ensure sufficient capacity is provided. STW have commented that they "would not anticipate any issues in providing capacity for the proposed growth for the Local Plan, subject to the completion of the currently proposed schemes for Wanlip WwTW in development".

There remains however very limited capacity at Wanlip in the short term, and discussions should take place between STW and LCC to explore any implications for phasing of development in the early stages of the plan until additional capacity is provided.

The storm tank overflow at Wanlip WwTW is operating above the threshold for an investigation under the Storm Overflow Assessment Framework. This is noted in the dDWMP and identified as a long-term priority. The Local Plan has a role to play in ensuring development does not increase the frequency or duration of operation of this overflow by encouraging the use of SuDS to divert storm water away from the sewer network, reducing the volume that reaches the WwTW.

7.6 Recommendations

Table 7.4 Recommendations for wastewater treatment

Action	Responsibility	Timescale
Consider the available WwTW capacity at Wanlip when phasing development in the early stages of the Local Plan.	LCC STW	Ongoing
Provide Annual Monitoring Reports to TW detailing projected housing growth.	LCC	Ongoing
STW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	STW	Ongoing

8 Water quality

8.1 Introduction

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

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

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

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

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

A more detailed description of the methodology can be found in the original WCS report.

8.2 Methodology

8.2.1 Overview

SIMCAT is used by the Environment Agency to model potential deterioration of waterbodies and to support decision making to guide development to locations where environmental deterioration will be reduced.

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

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

- Ammonia (95%-ile): 1mg/l
- BOD (95%-ile): 5mg/l
- Phosphorus (mean): 0.25mg/l

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

8.2.2 Modelling approach

In the original study, existing SIMCAT models developed by the Environment Agency were supplied for the River Trent catchment which includes the River Soar; one modelling Ammonia and BOD, the other modelling Phosphorous. The models were understood to have been largely based on observed flow and quality data for the period 2010 to 2012. A widespread update of the model, and the resultant recalibration was not within scope of either the original study or the update. It was therefore decided to update just the effluent flow and quality statistics at Wanlip and Whetstone WwTWs in the existing models used in the original study. In addition to this, Severn Trent Water provided details of upgrades to phosphate treatment processes at a number of WwTWs that would have an impact on overall water quality in the catchment. These were incorporated into the baseline model.

Additional effluent flow from growth during the local plan period was added to current flow at Wanlip treatment works and the model re-run as a future scenario.

Figure 8.1 shows the River Soar as it passes through Leicester with the relative position of Wanlip and Whetstone WwTWs.

It should be noted that where this modelling work predicts a theoretical risk of deterioration in water quality downstream of a WwTW, the EA would not allow a deterioration under the Water Framework Directive, and in reality STW will work with the EA to ensure this does not occur.

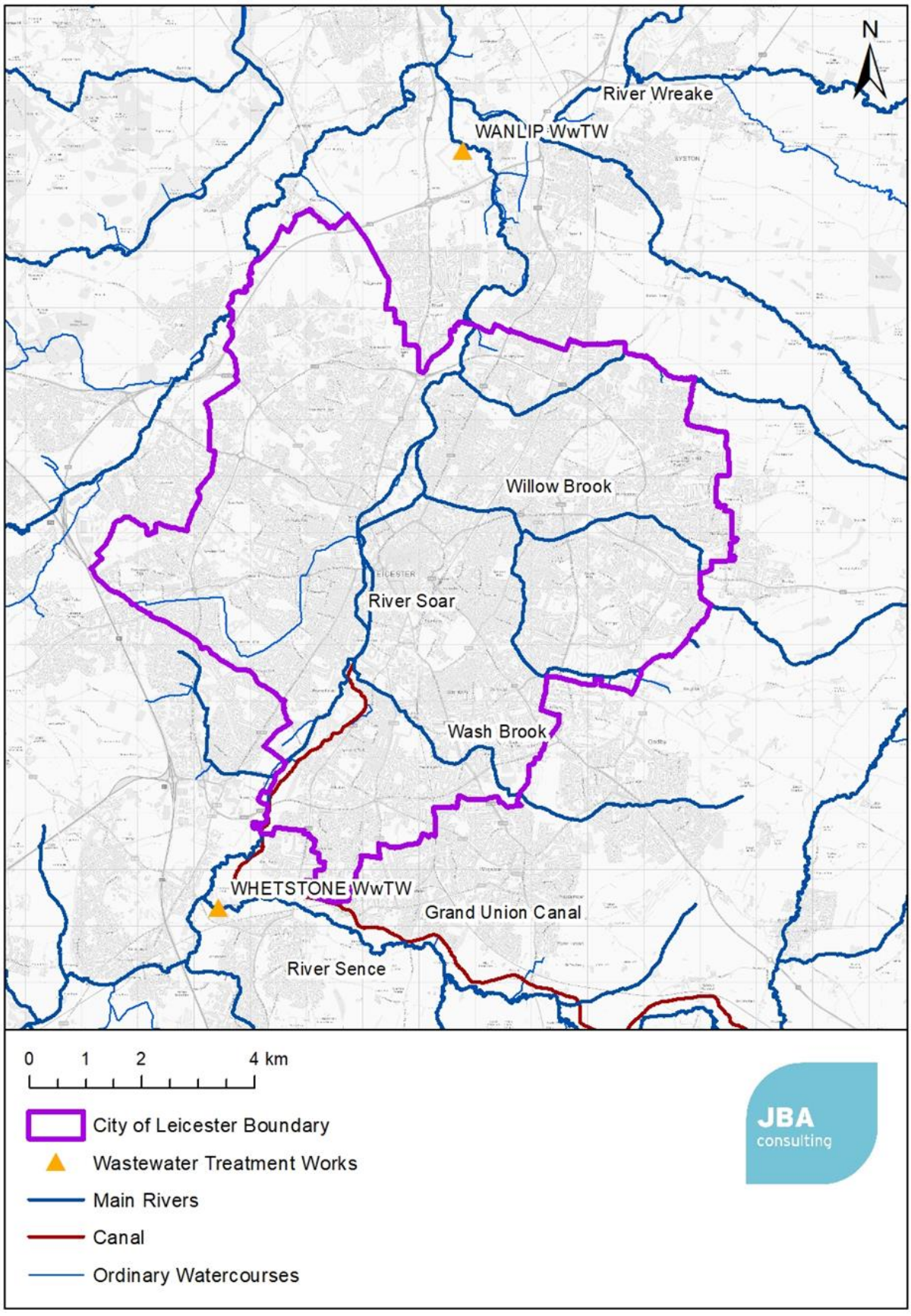

Figure 8.1 Location of WwTWs serving growth in Leicester City

8.3 Results

8.3.1 Water Framework Directive Status

Figure 8.2 shows the Water Framework Directive overall waterbody classifications for the watercourses within the study area and Figure 8.3 shows the ecological status. Since the original study the 2019 dataset is available and shows the River Soar deteriorating from moderate to poor ecological status. The tributaries to the soar remain at moderate status, and the small part of the Leicester Line of the Grand Union Canal to the south of the city remains at good ecological status. The majority of waterbodies in Leicester have a moderate ecological status, with a small part of the Leicester Line of the Grand Union Canal in the south of the City having a good ecological status.

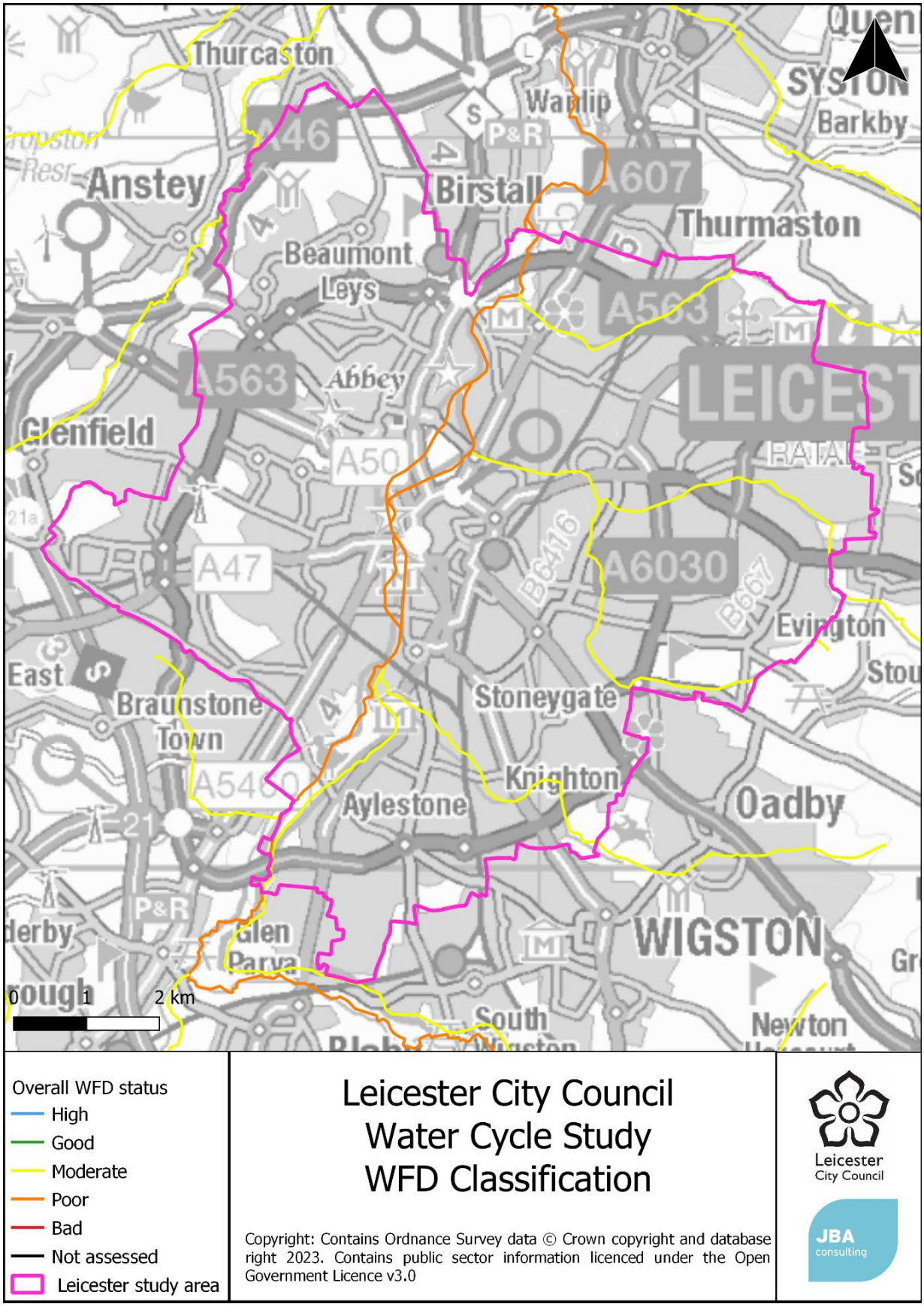

Figure 8.2 WFD classification of waterbodies in Leicester

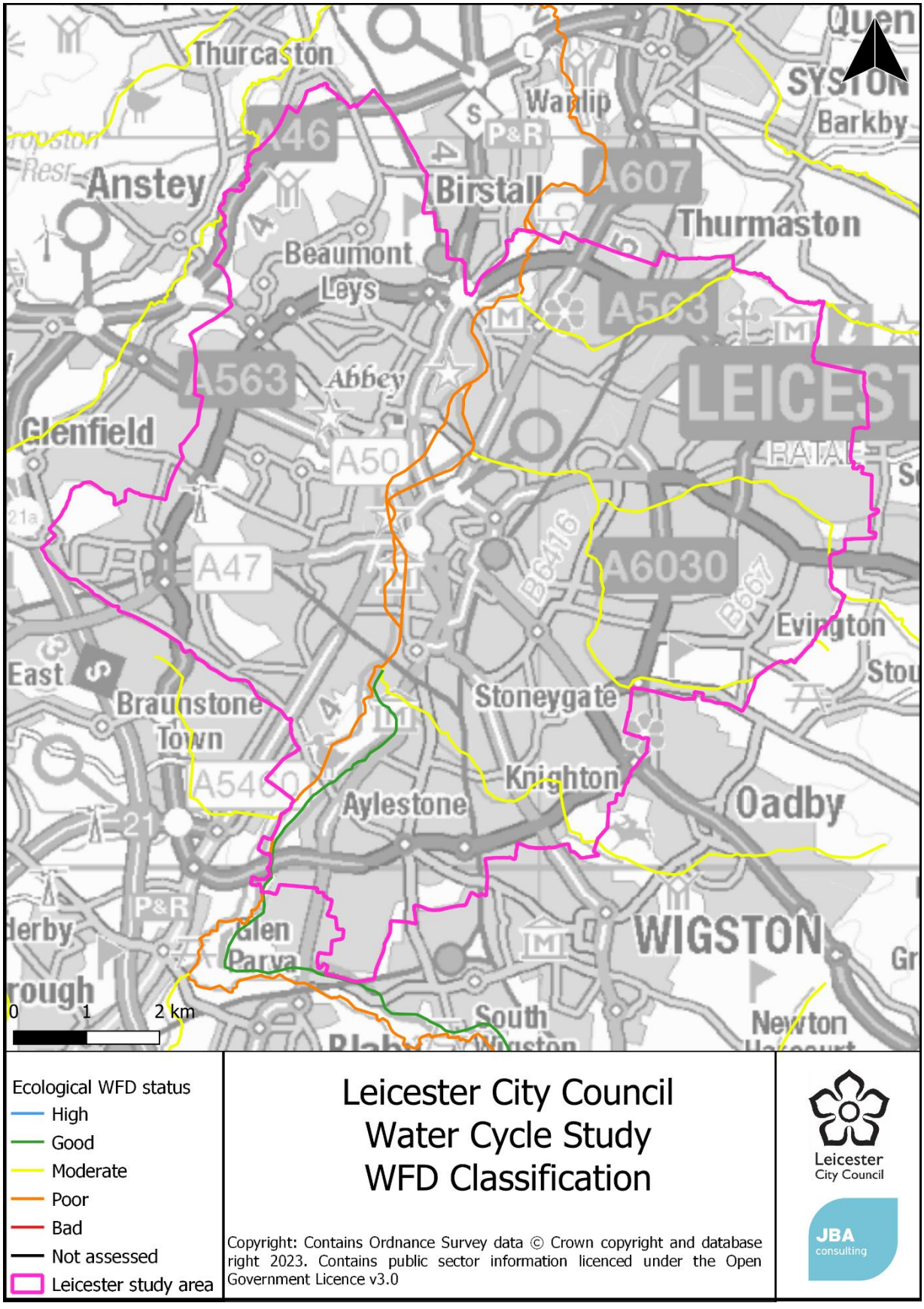

Figure 8.3 WFD Ecological status for waterbodies in Leicester

Table 8.1 and Table 8.2 show the WFD targets for BOD, ammonia, and phosphate for the study area. Phosphate has targets which vary by river reach, and so the locations relevant to this study are presented.

Table 8.1 WFD targets for Ammonia and BOD

Determinand	High (ug/L)	Good (ug/L)	Moderate (ug/L)	Poor (ug/L)
Ammonia	0.3	0.6	1.1	2.5
Biochemical Oxygen Demand (BOD)	4	5	6.5	9

Table 8.2 WFD targets for Phosphate for selected watercourses in the study area

WQ Sampling Point	Site Name	High (ug/L)	Good (ug/L)	Moderate (ug/L)	Poor (ug/L)
WQ 46261980	RIVER SOAR AT EVANS WEIR	42	77	189	1041
WQ 46259100	RIVER SOAR AT WANLIP	43	79	193	1050
WQ 46257100	RIVER SOAR AT SILEBY MILL	43	80	194	1052

Table 8.3 shows the current WFD classification and WFD status predicted by the baseline SIMCAT model, which is a match for Ammonia and Phosphate. BOD is no longer included in the WFD classification.

Table 8.3 WFD Summary for River Soar from Sence to Rothley Brook

	WFD Ecological Status	BOD	Ammonia	Phosphate
2019 WFD Cycle 2 Classification	Poor	N/A	High	Poor
SIMCAT 2022 Baseline	N/A	High	High	Poor

(Note: Ecological status depends on a number of determinands in addition to the three assessed in this study so SIMCAT cannot be used to infer an ecological status).

Table 8.4 presents the reasons for not achieving good status for the river reach which Wanlip WwTW discharges to. Sewage discharge - both continuous (from the WwTW) and intermittent (from storm overflows) is cites as a reason for not achieving good status for Macrophytes and Phytobenthos (aquatic plants) and sewage discharge (continuous) is also cited a reason for not achieving good status for Phosphate.

Table 8.4 Reasons for not achieving good status (River Sence from Countesthorpe Brook to Soar)

Type	Activity	Category	Classification Element
Diffuse source	Transport Drainage	Urban and transport	Phosphate
Point source	Sewage discharge (intermittent)	Water industry	Macrophytes and Phytobenthos Combined
Point source	Sewage discharge (continuous)	Water industry	Macrophytes and Phytobenthos Combined
Point source	Sewage discharge (continuous)	Water industry	Phosphate
Unknown (pending investigation)	Unknown (pending investigation)	Sector under investigation	Dissolved oxygen
Unknown (pending investigation)	Unknown (pending investigation)	Sector under investigation	Perfluorooctane sulphonate (PFOS)
Measures delivered to address reason, awaiting recovery	Not applicable	No sector responsible	Mercury and its Compounds
Measures delivered to address reason, awaiting recovery	Not applicable	No sector responsible	Polybrominated diphenyl ethers (PBDE)

8.3.2 Modelling results

Could the development cause a greater than 10% deterioration in water quality?

The baseline model was re-run after the additional effluent flow from development was added to Wanlip WwTW. The effect on water quality is shown in Table 8.5. A deterioration in BOD and ammonia of 2.4% and 1.9% respectively is predicted downstream of Wanlip WwTW. Deterioration in Phosphate was predicted to be 3%.

It can therefore be said that growth is not predicted to cause a 10% or greater deterioration in quality.

It should be noted that improvements in phosphate treatment at Whetstone WwTW and Wigston WwTW (upstream of Whetstone on the River Sence) are planned in AMP7 and have already been incorporated into the baseline model.

Could the development cause a deterioration in WFD class of any element assessed?

The results in Table 8.5, when compared to the WFD targets in Table 8.1 and Table 8.2 show that no change in WFD class is predicted for any of the three modelled determinands downstream of Wanlip WwTW.

Development is not predicted to cause a deterioration in WFD class.

Table 8.5 Predicted deterioration in water quality

Location	WQ Sampling Point	Baseline NH4	Baseline BOD	Baseline P	Future NH4	Future BOD	Future P	% Det. NH4	% Det. BOD	% Det. P
Upstream off WwTW	WQ 46259100	0.17	2.47	0.26	0.17	2.47	0.26	0.0%	0.0%	0.0%
At point of discharge	WANLIP WwTW	0.43	3.87	0.33	0.43	3.94	0.34	0.0%	1.8%	3.0%
Downstream of WwTW	End of Reach	0.41	3.76	0.33	0.42	3.83	0.33	2.4%	1.9%	0.0%
River Soar	WQ 46257100	0.27	2.78	0.31	0.28	2.82	0.31	3.7%	1.4%	0.0%

Could the development alone prevent the receiving watercourse from reaching Good Ecological Status (GES) or Potential?

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

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

a) Is GES possible now with current technology?

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

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

The modelling predicts that ammonia and BOD both achieve GES, both before and after growth, however phosphate remains Poor in both scenarios.

RQP was used to carry out a single site assessment at Wanlip WwTW. In this assessment it is assumed that improvements in the catchment have improved the upstream river water quality to the mid-point of good class for each determinand. The targets for use in this assessment are shown in Table 9.9 and Table 9.10 below.

Table 8.6 WFD Targets

Determinand	Statistic	High	Good	Mid-point of Good
BOD	90 %ile	4.0	5.0	4.5
Ammonia	90 %ile	0.3	0.6	0.45
Phosphorous	Annual mean	0.043	0.079	0.061

Table 8.7 WFD Mid-point of "Good"

Determinand	90%ile (mg/l)	Coefficient of variation (mg/l)	Mean (mg/l)	Standard Deviation (mg/l)
BOD	4.5	0.6	2.58	1.55
Ammonia	0.45	1	0.22	0.22
Phosphorous	N/A	0.8	0.061	0.049

The assessment predicted that in order to achieve GES, a discharge water quality of 0.1 mg/l would be required at Wanlip WwTW. The same level is required (within the precision of RQP) to achieve GES once growth has been factored in. This exceeds the technically achievable limit for phosphate treatment so it can be said that GES cannot be achieved due to current technology limits and would not be prevented due to growth.

A further assessment was undertaken with the river quality target set to moderate status. This predicts that should upstream water quality be improved, a discharge water quality permit limit of 0.41 would allow moderate ecological status to be attained, and this is not affected by the addition of growth.

It should be noted that this modelling work uses a SIMCAT model that has subsequently been updated by the EA and should not be used to infer future permit limits at Wanlip WwTW. This work should be undertaken by the EA in collaboration with STW.

Table 8.8 Permit levels required to meet WFD targets for Phosphate at Wanlip WwTW

Target	WQ required at current flow (mg/l)	WQ required to accommodate future flows (mg/l)
Good ecological status	0.10	0.10
Moderate ecological status	0.41	0.40

8.4 Conclusions

The water quality modelling work undertaken in the original study was repeating using the updated growth forecast. The existing SIMCAT model from the original study was used, and flow at Wanlip and Whetstone WwTWs was updated using data provided by STW for the last three years (2019-2021).

Growth forecast in the LCC Local Plan is unlikely to cause a significant deterioration in water quality downstream of Wanlip WwTW (less than a 10% deterioration and no change in WFD class). It is also not predicted to prevent good ecological status being achieved in the future.

8.5 Recommendations

Table 8.9 Recommendations for water quality

Action	Responsibility	Timescale
Provide annual monitoring reports to STW detailing projected housing growth in the Local Authority.	LCC	Ongoing
Take into account the full volume of growth (from LCC and neighbouring authorities) within the catchment when planning future upgrades to Wanlip WwTW.	STW	Ongoing

9 Environmental impact

9.1 Introduction

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

The original study also recommended the use of SuDS to manage diffuse pollution from surface water runoff. Information on the benefits of SuDS can be found in the original report.

9.2 Updated assessment

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

In the original study, a screening exercise was conducted to identify sites downstream of Wanlip WwTW that had to potential to be affected by a deterioration in water quality. These are shown in Table 9.1.

Table 9.1 Wanlip WwTW relative to environmental designations

Source	Pathway	Receptor	Distance downstream (km)
Wanlip WwTW	River Soar	Barrow Gravel Pits SSSI (SK568166)	8.5km
Wanlip WwTW	River Soar	Cotes Grassland SSSI (SK553208)	15km
Wanlip WwTW	River Soar	Loughborough Meadows SSSI (SK538216)	17km

The water quality modelling results were then used to predict the deterioration in water quality in the watercourse adjacent to the protected site. The updated results were used to update this assessment and are shown in Table 9.2 below. Deterioration has increased slightly from the original study but is not predicted to be significant.

Table 9.2 Predicted deterioration in watercourse adjacent to SSSIs

Assessment Point	Name	Ammonia % Deterioration	BOD % Deterioration	Phosphate % Deterioration
MD-46257100	River Soar at Sileby Mill	3.7%	1.4%	0.0%

9.3 Conclusions

Wanlip WwTW is a point source of pollution on the River Soar and has the potential to impact sites downstream with environmental designations. Water quality modelling using SIMCAT was used to predict the deterioration in water quality in watercourses adjacent to sites with environmental designations downstream. Deterioration was not found to be significant.

Development sites within Leicester City could also be sources of diffuse pollution from surface runoff. SuDS are required on all sites and their design must consider water quality as well as quantity. Runoff from these sites should be managed through implementation of a SuDS scheme with a focus on treating water quality of surface runoff from roads and development sites.

Opportunities exist for these SuDS schemes to offer multiple benefits of flood risk reduction, amenity value and biodiversity, as well as opportunities for groundwater recharge to provide a water resources benefit.

Leicester City Council, as LLFA, should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors.

9.4 Recommendations

Table 9.3 Recommendations for environmental section

Action	Responsibility	Timescale
The Local Plan should include policies that require development sites to adopt SuDS to manage water quality of surface runoff.	LCC	In Local Plan
The local plan should include policies that require all development proposals with the potential to impact on areas with environmental designations to be considered in consultation with Natural England (for national designations).	LCC	In Local Plan
In partnership, identify opportunities for incorporating SuDS into open spaces and green infrastructure, to deliver strategic flood risk management and meet WFD water quality targets.	LCC, STW, and EA	Ongoing

Action	Responsibility	Timescale
Developers should include the design of SuDS at an early stage to maximise the benefits of the scheme.	Developers	Ongoing
Work with developers to discourage connection of new developments into existing surface water and combined sewer networks. Prevent connections into the foul network, as this is a significant cause of sewer flooding.	LCC, STW	Ongoing

10 Conclusions

Table 10.1 Table of conclusions

Topic	Conclusion
Water resources	The recently published draft WRMP24 identifies an increased supply demand deficit for the Strategic Grid WRZ that serves Leicester City. It goes on to identify a number of actions to address this. This is now aligned with the Water Resources West Draft Regional Plan. The growth forecast presented in this updated WCS is an increase on the forecast assessed in the original study. This is higher than the percentage growth accounted for in the dWRMP24 but not significantly so, and within the uncertainty planned for in the WRMP. It is for Local Authorities to establish a clear need to adopt the tighter water efficiency target through the building regulations. The evidence presented in the original study was updated and it is still recommended that the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010 is adopted for Leicester City. In additional to this, it is recommended that a similar efficiency target be applied to non-household development with the BREEAM New Construction Standard used for this purpose.
Water supply	In the original study, Severn Trent Water responded to the request to assess the impacts of development on water supply infrastructure and confirmed that water supply is not expected to be a constraint to development. Early developer engagement is required to ensure that, as development occurs within the study area, any detailed modelling of water supply infrastructure that is required can be completed and any upgrades required can be completed without restricting the timing, location, or scale of the planned development. The updated growth forecast does not contain any new sites and so the assessment performed by STW in the original study is retained and the conclusions above still apply.
Wastewater network	In the original study, STW provided an assessment of the wastewater sewer and surface water sewer capacity for development sites provided to them. This assessment identifies sites where there may be constraints in the sewer network that require some network reinforcement in order to accommodate growth.

Topic	Conclusion
	Phasing of these sites needs to be carefully managed between Leicester City council and STW to ensure that infrastructure is in place prior to occupation. Development in areas where there is limited wastewater network capacity will increase pressure on the network, increasing the risk of a detrimental impact on customers, and increasing the likelihood of storm overflow operation. Early engagement with developers and STW is required, and further modelling of the network may be required at the planning application stage. Furthermore, in areas where the current network is a combined sewer system, separation of foul and surface water may be required, as well as suitably designed SuDS. Early engagement between developers, LCC and STW is recommended to allow time for any strategic infrastructure required to serve these developments to be planned.
Wastewater treatment	Growth forecast within the LCC Local Plan is likely to be served entirely by Wanlip WwTW to the north of Leicester. STW have highlighted the limited capacity at Wanlip in their draft Drainage and Wastewater Management Plan. In response to this several phases of investment are being planned by STW to ensure sufficient capacity is provided. STW have commented that they "would not anticipate any issues in providing capacity for the proposed growth for the Local Plan, subject to the completion of the currently proposed schemes for Wanlip WwTW in development". There remains however very limited capacity at Wanlip in the short term, and discussions should take place between STW and LCC to explore any implications for phasing of development in the early stages of the plan until additional capacity is provided. The storm tank overflow at Wanlip WwTW is operating above the threshold for an investigation under the Storm Overflow Assessment Framework. This is noted in the dDWMP and identified as a long-term priority. The Local Plan has a role to play in ensuring development does not increase the frequency or duration of operation of this overflow by encouraging the use of SuDS to divert storm water away from the sewer network, reducing the volume that reaches the WwTW.
Water quality	The water quality modelling work undertaken in the original study was repeating using the updated growth forecast. The existing SIMCAT model from the original study was used, and flow at Wanlip and Whetstone WwTWs was updated using data provided by STW for the last three

Topic	Conclusion
	years (2019-2021). Growth forecast in the LCC Local Plan is unlikely to cause a significant deterioration in water quality downstream of Wanlip WwTW (less than a 10% deterioration and no change in WFD class). It is also not predicted to prevent good ecological status being achieved in the future.
Environmental impact	Wanlip WwTW is a point source of pollution on the River Soar and has the potential to impact sites downstream with environmental designations. Water quality modelling using SIMCAT was used to predict the deterioration in water quality in watercourses adjacent to sites with environmental designations downstream. Deterioration was not found to be significant. Development sites within Leicester City could also be sources of diffuse pollution from surface runoff. SuDS are required on all sites and their design must consider water quality as well as quantity. Runoff from these sites should be managed through implementation of a SuDS scheme with a focus on treating water quality of surface runoff from roads and development sites. Opportunities exist for these SuDS schemes to offer multiple benefits of flood risk reduction, amenity value and biodiversity, as well as opportunities for groundwater recharge to provide a water resources benefit. Leicester City Council, as LLFA, should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors.

11 Recommendations

Table 11.1 Table of recommendations

Topic	Recommendation	Responsibility	Timescale
Water resources	Continue to regularly review forecast and actual household growth across the supply region through WRMP Annual Update reports, and where significant change is predicted, engage with Local Planning Authorities.	STW LCC	As part of the planning process
Water resources	Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	LCC	Ongoing
Water resources	Use planning policy to require the optional standard in Building Regulations of 110 l/p/d for new build housing.	LCC	In LCC Local Plan
Water resources	Use planning policy to require new build non-residential development to achieve at least 3 credits in the Wat01 Measure for water in the BREEAM New Construction standard.	LCC	In LCC Local Plan
Water resources	Larger residential developments and commercial developments should consider incorporating greywater recycling and/or rainwater harvesting into development at the master planning stage in order to reduce water demand.	LCC, STW	In LCC Local Plan
Water resources	Water companies should advise LCC of any strategic water resource infrastructure developments within the study, where these may require safeguarding of land to prevent other type of development occurring.	STW, LCC	In LCC Local Plan
Water supply	As appropriate as part of the planning process, undertake	STW LCC	As part of the planning

Topic	Recommendation	Responsibility	Timescale
	network modelling to ensure adequate provision of water supply is feasible		process
Water supply	LCC and Developers should engage early with STW to ensure infrastructure is in place prior to occupation.	LCC STW Developers	Ongoing
Wastewater network	Early engagement between Developers, LCC and STW is required to ensure that where upgrades to infrastructure is required, it can be planned in by STW.	Developers LCC STW	As part of the planning process
Wastewater network	Take into account wastewater infrastructure constraints in phasing development in partnership with the sewerage undertaker	LCC STW	Ongoing
Wastewater network	Developers will be expected to work with the sewerage undertaker closely and early in the planning promotion process to develop an outline foul Drainage Strategy for sites to the satisfaction of the LPA that the development will not increase sewer flooding or the frequency or duration of storm overflow operation. The Outline Foul Drainage strategy should set out the following: What – What is required to serve the site Where – Where are the assets / upgrades to be located When – When are the assets to be delivered (phasing) Which – Which delivery route is the developer going to use s104 s98 s106 etc. The Outline Drainage Strategy should be submitted as part of the planning application submission, and where required, used as a basis for a drainage planning condition to be set.	Developers STW	Ongoing

Topic	Recommendation	Responsibility	Timescale
Wastewater network	Developers will be expected to demonstrate to the Lead Local Flood Authority (LLFA) that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to foul sewers seen as the last option. New connections for surface water to foul sewers will be resisted by the LLFA. Where a surface water connection is proposed to the public sewerage network, it should be demonstrated to Severn Trent Water that there is no other technically feasible option by selecting options as high as possible within the surface water hierarchy.	Developers LLFA STW	Ongoing
Wastewater treatment	Consider the available WwTW capacity at Wanlip when phasing development in the early stages of the Local Plan.	LCC STW	Ongoing
Wastewater treatment	Provide Annual Monitoring Reports to TW detailing projected housing growth.	LCC	Ongoing
Wastewater treatment	STW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	STW	Ongoing
Water quality	Provide annual monitoring reports to STW detailing projected housing growth in the Local Authority.	LCC	Ongoing
Water quality	Take into account the full volume of growth (from LCC and neighbouring authorities) within the catchment when planning future upgrades to Wanlip WwTW.	STW	Ongoing
Environmental impact	The Local Plan should include policies that require development sites to adopt SuDS to manage water quality of surface runoff.	LCC	In Local Plan
Environmental impact	The local plan should include policies that require all	LCC	In Local Plan

Topic	Recommendation	Responsibility	Timescale
	development proposals with the potential to impact on areas with environmental designations to be considered in consultation with Natural England (for national designations).		
Environmental impact	In partnership, identify opportunities for incorporating SuDS into open spaces and green infrastructure, to deliver strategic flood risk management and meet WFD water quality targets.	LCC, STW, and EA	Ongoing
Environmental impact	Developers should include the design of SuDS at an early stage to maximise the benefits of the scheme.	Developers	Ongoing
Environmental impact	Work with developers to discourage connection of new developments into existing surface water and combined sewer networks. Prevent connections into the foul network, as this is a significant cause of sewer flooding.	LCC, STW	Ongoing

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