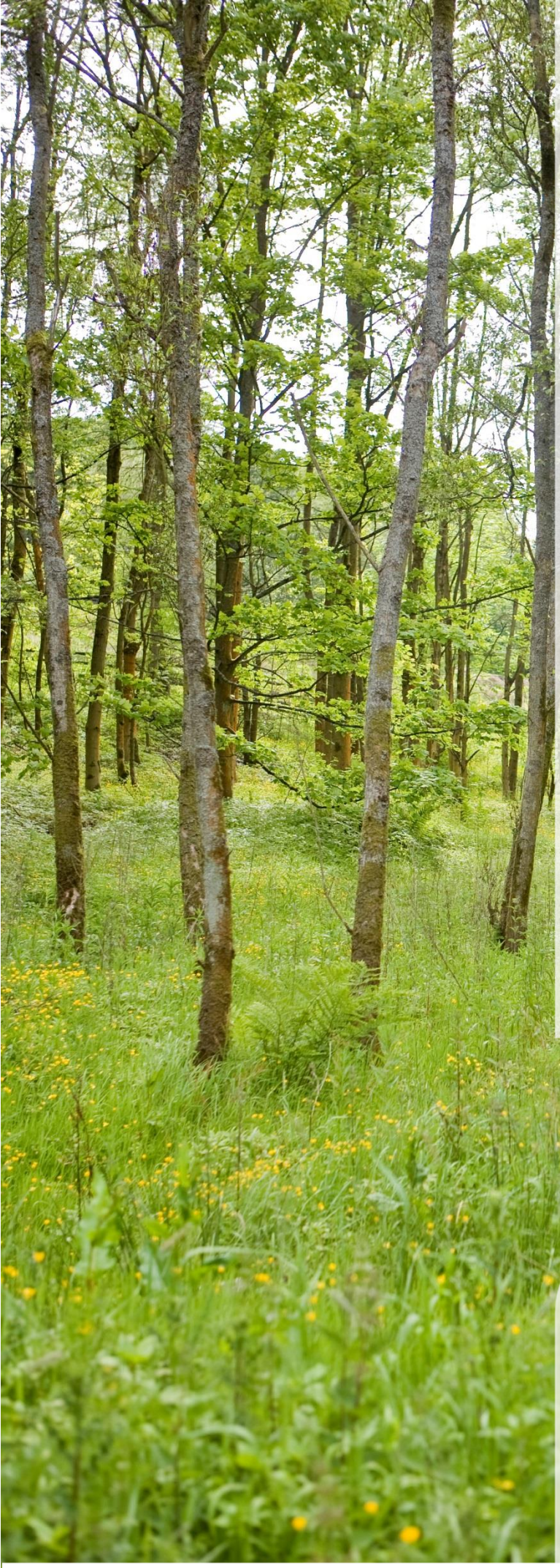

Wyre Forest District Council

Water Cycle Study

Final Report

May 2017

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Revision History

Revision Ref / Date Issued	Amendments	Issued to
Draft v1.0		Wyre Forest District Council, Environment Agency, Severn Trent Water
Draft v2.0	Amendments following comments from WFDC	Wyre Forest District Council, Environment Agency, Severn Trent Water
Final v1.0	Amendments following Comments from the Environment Agency	Wyre Forest District Council, Environment Agency, Severn Trent Water
Final v2.0	Amendments following Comments from WFDC	Wyre Forest District Council, Environment Agency, Severn Trent Water
Final v3.0	Amendments following comments from WFDC	Wyre Forest District Council, Environment Agency, Severn Trent Water

Contract

This report describes work commissioned by Wyre Forest District Council by an email dated 04/04/2016. Wyre Forest District Council's representative for the contract was Paul Bayliss. Holly Hart and Anna Beasley of JBA Consulting carried out this work.

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Purpose

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JBA Consulting has no liability regarding the use of this report except Wyre Forest District Council.

Acknowledgements

JBA Consulting would like to thank Wyre Forest District Council, the Environment Agency and Severn Trent Water Limited for assistance in preparing this report.

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Executive Summary

Introduction

In March 2010, Wyre Forest District Council (WFDC) produced a Water Cycle Strategy which assessed potential issues relating to water supply/resources, wastewater infrastructure, water quality and environmental issues. In April 2016, JBA Consulting was commissioned by the Wyre Forest District Council to produce an updated Water Cycle Study to support the development of the new local plan.

New homes require the provision of clean water, the 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. Climate change presents further challenges such as increased intensive rainfall and a higher frequency of drought events that can also be expected to put greater pressure on the existing infrastructure. Sustainable planning for water must take this into account for all development within the District. The water cycle can be seen in Figure 1-1 below, showing how natural and man-made processes and systems interact to collect, store or transport water through the environment.

Figure 1-1: The Water Cycle

*Source: Environment Agency – Water Cycle Study Guidance

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

This Water Cycle Study (WCS) has been carried out in co-operation with the Environment Agency (EA) and Severn Trent Water Limited (STWL). Overall, there are no major identified issues which indicate that the planned scale, location and timing of planned development within the District is unachievable from the perspective of supplying water and wastewater services and preventing deterioration of water quality in receiving waters. Significant sewerage constraints are identified at 5 sites; however, Severn Trent Water have not stated that these sites could not be serviced. Early developer engagement will, as in all major developments, be essential to ensure that sufficient time is available to construct capacity upgrades prior to connecting any new developments to the network.

This Water Cycle Study has also identified whether infrastructure upgrades are expected to be required to accommodate planned growth. Timely planning and provision of infrastructure upgrades will be undertaken through cooperation between the Wyre Forest District Council, Severn Trent Water, the Environmental Agency and specific developers.

Development Scenarios and Policy Issues

This Water Cycle Study encompasses an assessment of the impacts of the planned development within the Wyre Forest District. Wyre Forest District Council has identified 77 sites for proposed development in total. The District has identified two options for planned growth, Option A sites concentrate future growth in Kidderminster, whereas Option B sites would produce more dispersed growth across the District. The majority of the proposed sites are in both options, but there are additional residential and employment sites in each option individually. This Water Cycle Study is seen as key evidence for deciding on option and site allocations within the Wyre Forest District.

Legal agreements under the Town and Country Planning Act Section 106 agreement, and Community Infrastructure Levy agreements are not intended to be used to obtain funding for water or wastewater infrastructure. It is not therefore necessary for the Wyre Forest District Council to identify requirements for developers to contribute towards the cost of upgrades in its Local Plan.

The Water Industry Act sets out arrangements for connections to public sewers and water supply networks, developers should ensure that they engage at an early stage with Severn Trent Water Limited to ensure that site specific capacity checks have be undertaken and where necessary additional infrastructure constructed to accommodate the proposed development. Where permitted Severn Trent Water may seek developer contributions towards infrastructure upgrades. Upgrades to water resources/wastewater treatment works are funded through the company business plans.

Water Resources

All proposed development sites are located within the Environment Agency Catchment Management Abstraction Strategies (CAMS) of the Severn Corridor CAMS and the Worcester Middle Severn CAMS. Both CAMS have restricted water available for licensing so there is no overall preference between Options A and B in terms of available water resources.

All sites are located in Severn Trent Water Strategic Grid Water Resource Zone (WRZ) and would therefore be managed in the same way over the next 25 years. The Strategic Grid is likely to require significant investment in order to cope with rapid growth, reduce unsustainable abstractions and to manage the long term impacts of climate change. Despite this, Severn Trent Water commented that water capacity in the Wyre Forest District is not expected to be a constraint to growth for either option within the Wyre Forest District.

Water Supply Infrastructure

Severn Trent Water Limited (STWL) responded to the request for an assessment of water supply infrastructure within the Wyre Forest District. Severn Trent Water stated that the WRMP considers supply and demand issues for the next 25 years. As development within the Wyre Forest District occurs, it will be necessary to undertake detailed modelling of the water supply infrastructure to allow for appropriate infrastructure upgrades and local reinforcements. STWL does not expect water supply to be a constraint to development within the District.

Wastewater Collection and Treatment

Severn Trent Water completed a Sewerage System Capacity Assessment for all the development sites. Overall, 64% of the sites have capacity available to serve the proposed growth. 27% would require infrastructure and/or treatment updates and 6% would have major constraints to growth. 3% were not assessed as the sites are located outside the area currently served by the public sewerage system.

Of the 21 sites assessed as having an Amber RAG score (infrastructure and/or treatment upgrades required), 71% are in both Options A and B, 24% are in Option B only and 5% are Option A only. Of the 6 sites assessed as having a Red RAG score (major constraints to growth), 2 are in both Option A and B, 3 are in Option only and 1 is in Option B only.

It is clear that for the majority of the sites in Option A and B, there is capacity available. Both options have some sites that would require infrastructure and/treatment upgrades or the provision of new infrastructure to prevent wastewater collection and treatment from being a major constraint.

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

Severn Trent Water's preferred method of surface water disposal is using a sustainable drainage system (SuDS) discharging to ground or open watercourses, with connection to the sewerage system seen as the last option.

Wastewater Treatment Works Quality Consent Assessments

Severn Trent Water Limited provided an assessment of the available headroom and flow consents at each WwTW. The majority of sites are located within the Kidderminster WwTW catchment, apart from WA/UA/4 (Option A and B) which is within the catchment of Upper Arley WwTW. Kidderminster WwTW is likely to exceed capacity with the proposed levels of growth and would require upgrading. Upper Arley is also close to breaching its DWF permit, one additional development is unlikely to cause the breach but any future growth may mean upgrades are required. In summary, both Options A and B would have the same impact on WwTW flow and quality consents and both WwTWs with proposed growth would require investment and upgrades in the near future.

Wastewater Treatment Works Odour Assessment

An odour screening assessment was completed to identify sites that in close proximity to existing WwTWs where odour may be a cause of nuisance and complaints. Ten of the proposed development sites were assessed as being at risk from experiencing odour issues. Nine of these sites are in both Option A and Option B. Site FPH/1, only found in Option A, was also found to be less than 800m from a WwTW. There is therefore very little difference between Option A and B in terms of odour impact.

Water Quality Impacts Assessment

Water quality assessments were completed for the two WwTWs within the Wyre Forest District receiving growth in order to assess if the increased effluent discharges from WwTW as a result of the proposed levels of development could lead to an adverse impact on the quality of the receiving watercourse. The majority of Option A and B sites are served by Kidderminster WwTW; one site (in Option A and B) is served by Upper Arley WwTW.

The impacts of growth on Kidderminster WwTW was assessed based on Option A and Option B future growth separately to compare the impacts of each option. The results of the water quality assessment identified that there is little difference between the water quality impacts of Option A and B.

The key constraints to achieving Good Ecological Status at all two WwTWs are the limits of current technology rather than the impacts of the planned growth. Therefore, environmental capacity is not considered to be a constraint on growth.

Flood Risk

The WFDC Draft Strategic Flood Risk Assessment (SFRA) is the main source of information regarding the flood risk to the settlements and the proposed strategic site allocations. All 77 sites were assessed as part of the Level 1 Assessment.

Sites in both Options A and B have a mixed fluvial and pluvial flood risk. All sites only within Option A have a low flood risk (Green RAG score). Flood risk in Option B sites is also low, apart from site LI/5 that is identified as being at moderate surface water flood risk (Amber RAG score). Sites with more severe flood risk classifications are all located in both A and B so there is no preference between options in terms of flood risk.

An assessment was also carried out to determine whether increased discharges of treated effluent from each WwTW due to the increased development within the Wyre Forest District could lead to an increase in fluvial flood risk from the receiving watercourse. This assessment showed that the impact of increased effluent flows is not predicted to have a significant impact upon flood risk in any of the receiving watercourses in either option.

Environmental Constraints and Opportunities

GeoPDF maps have been created to allow for a range of notable environmental and fluvial designations and features to be displayed 'on' or 'off' with the aim of being able to quickly identify the presence of environmental features within or close to the proposed sites. The maps should be used in conjunction with Sustainability Appraisals (SA) and/or Strategic Environmental Assessments (SEAs) when these are available.

The environmental assessment provides an overview of the wider environment within the District and the potential risks and opportunities associated with the development of the proposed sites.

Climate Change

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

The capacity of the sewerage system and the water quality of receiving water bodies stand out as two elements of the assessment where the consequences of climate change are expected to be high but no account has been made of climate impacts in the assessment. This is a matter to be addressed at detailed assessment stage.

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Abbreviations

ALC ..... Agricultural Land Classification

ALS ..... Abstraction Licensing Strategy

AMP ..... Asset Management Plan

AONB ..... Area of Outstanding Natural Beauty

AP ..... Assessment Point

ASNW ..... Ancient Semi-Natural Woodland

BOD ..... Biochemical Oxygen Demand

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

CAMS ..... Catchment Abstraction Management Strategies

CAPEX ..... Capital Expenditure

CfSH ..... Code for Sustainable Homes

CSO ..... Combined Sewer Overflow

DWF ..... Dry Weather Flow

DWI ..... Drinking Water Inspectorate

DYAA ..... Dry Year Annual Average

EA ..... Environment Agency

EFI ..... Ecological Flow Indicator

EP ..... Environmental Permit

FWMA ..... Flood and Water Management Act

FZ ..... Flood Zone

GES ..... Good Ecological Status

GIS ..... Geographic Information Systems

HOF ..... Hands-Off Flow

IDB ..... Internal Drainage Board

IDP ..... Infrastructure Delivery Plan

JBA ..... Jeremy Benn Associates

LDE ..... Level Dependent Environments

LLFA ..... Lead Local Flood Authority

LPA ..... Local Planning Authority

l/p/d ..... Litres per person per day

Ml/d ..... Million litres per day

NH_4 ..... Ammonia

NNR ..... National Nature Reserve

NPPF ..... National Planning Policy Framework

OfWAT ..... Water Service Regulation Authority

OPEX ..... Operational Expenditure

OS ..... Ordnance Survey

P ..... Phosphorous

PE ..... Population Equivalent

p/h ..... Person per house
PPS ..... Planning Policy Statement
PR ..... Price Review
R/A/G ..... Red / Amber / Green assessment
RBD ..... River Basin District
RBMP ..... River Basin Management Plan
RMA ..... Rick Management Authority
RQP ..... River Quality Planning tool
RSS ..... Regional Spatial Strategy
RZ ..... Resource Zone
SA ..... Sustainability Appraisals
SAB ..... SuDS Approving Body
SAC ..... Special Area of Conservation
SDS ..... Strategic Direction Statements
SEA ..... Strategic Environmental Assessment
SEPA ..... Scottish Environmental Protection Agency
SFRA ..... Strategic Flood Risk Assessment
SHLAA ..... Strategic Housing Land Availability Assessment
SINC ..... Site of Importance for Nature Conservation
SNCI ..... Site of Nature Conservation Interest
SPA ..... Special Protection Area
SPZ ..... Source Protection Zone
SSSI ..... Site of Special Scientific Interest
SS ..... Suspended Solids
STWL ..... Severn Trent Water Limited
SU ..... Sewerage Undertaker
SuDS ..... Sustainable Drainage Systems
uFMfSW ..... Updated Flood Map for Surface Water
UWWTD ..... Urban Waste Water Treatment Directive
WaSC ..... Water and Sewerage Company
WCS ..... Water Cycle Study
WFD ..... Water Framework Directive
WFDC ..... Wyre Forest District Council
WRMP ..... Water Resource Management Plan
WRZ ..... Water Resource Zone
WQA ..... Water Quality Assessment
WSZ ..... Water Supply Zone
WTW ..... Water Treatment Works
WwTW ..... Wastewater Treatment Works

1 Introduction

1.1 Background

In March 2010, Wyre Forest District Council (WFDC) produced a Water Cycle Strategy which assessed potential issues relating to water supply, wastewater collection, and wastewater treatment works infrastructure. In April 2016, JBA Consulting was commissioned by Wyre Forest District Council to produce an updated Water Cycle Study.

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 within Districts may result in the capacity of existing available infrastructure being exceeded. This situation could potentially lead to service failures for water and wastewater customers, adverse impacts to the environment or high costs for the upgrade of water and wastewater assets being passes on to bill payers. Climate change presents future challenges such as increased intensive rainfall and a higher frequency of drought events that can be expected to put greater pressure on the existing infrastructure. Sustainable planning for water must take the impacts of climate change into account. The water cycle can be seen in Figure 1-1 below, and shows how the natural and man-made processes and systems interact to collect, store or transport water through the environment.

Figure 1-1: The Water Cycle

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

The Water Cycle Study (WCS) and associated Strategic Flood Risk Assessment (SFRA) will be utilised during the review of the new Wyre Forest Local Plan that is anticipated to be adopted in late 2017. This aims to provide a better understanding of the impact of the developments on the water supply and wastewater infrastructure and water quality. It is up to the developers within the Wyre Forest District to ensure that they provide up to date information within any planning applications and that they engage with water companies at an early stage to ensure that development is not delayed.

1.2 Objectives of the Water Cycle Study

The Wyre Forest District Council (WFDC) is in the process of identifying draft site allocations to meet their targets for housing and employment provision to 2031 in order to inform the production of an updated Local Plan. A Water Cycle Study (WCS) is required to assess the likely impacts of the potential growth upon water resources, wastewater services and the water environment in general.

The overall objective of this WCS is to understand the environmental and physical demands of the development and identify opportunities for more sustainable planning and improvements that may be required so that proposals do not exceed the water cycle capacity.

This is assessed by considering the following issues:

- Water Resources and Water Supply;
- Wastewater Collection and Treatment;
- Water Quality;
- The Environment;
- Flood Risk, and
- Climate Change.

This report focuses upon the proposed Option A and Option B site allocations provided by the Council. The report outlines the current status of the environment and infrastructure, identified the possible constraints to the development, the impacts and demands of the development, and gives recommendations as to any improvements or mitigation required including approximate costings.

1.3 Water Cycle Study Scope

The following topics and assessments have been covered as part of this Water Cycle Study:

Water Resources and Water Supply

- A review the Severn Trent Water Limited 2014 Water Resource Management Plan (WRMP) and its 2015 annual review,
- A review of the Catchment Abstraction Management Strategies (CAMS) affecting the Wyre Forest District.
- An assessment of water supply infrastructure by Severn Trent Water.

Wastewater Collection and Treatment

- An assessment of wastewater infrastructure and Wastewater Treatment Work capacity by Severn Trent Water.

Water Quality Assessment

- An assessment of the impacts of growth on the water quality in the receiving watercourses

Flood Risk Management

- An assessment of the fluvial and pluvial flood risk to the proposed sites
- An assessment of the impact of increased effluent discharge on flood risk

Environmental Constrains and Opportunities

- An assessment of environmental and fluvial designations in relation to the proposed development sites and the associated risks and opportunities

Climate Change

- A summary of the potential impacts of climate change on the assessments made in this water cycle study.

1.4 Structure of this report

Table 1-1: Report Structure and Topics

Chapter	Description
1. Introduction	This chapter provides the background, the objective and the scope of the project.
2. Key Developments	This chapter illustrates the scale and locations of the planned developments that were assessed in this study.
3. Legislation and Policy Framework	This chapter introduces the policy and legislative framework which drives the management of development and the water environment in England at local, national and European level.
4. Water Resources and Water Supply	This chapter looks at the availability of water resources to cover the future demand. It also covers the impact of the planned development on the existing capacity of the water supply infrastructure and highlights where upgrades or new infrastructure might be needed.
5. Wastewater Collection and Treatment	This chapter covers the impact of the planned development on the existing capacity of the sewerage system infrastructure and wastewater treatment works and highlights where upgrades or new infrastructure might be needed. It also looks at the potential impact of odour from the wastewater treatment works on new developments. Finally, it covers the water quality impact assessment of discharges from future wastewater treatment works into the receiving watercourses.
6. Water Quality Assessment	The chapter considers the impact of the increased discharge of effluent due to an increase in the population served by a WwTW may impact on the quality of the receiving water.
7. Flood Risk Management	This chapter considers the flood risk to the potential site allocations as well as the potential risk of increased flood flows in watercourses due to additional flows of sewage effluent.
8. Environmental Constraints and Opportunities	This chapter looks at the environmental risks and opportunities associated with the allocation sites.
9. Climate Change Impact Assessment	This chapter illustrates the qualitative assessment undertaken to assess the potential impacts of Climate Change on the assessments made in this water cycle study.
10. Summary and Recommendations	This chapter outlines whether the required upgrades and solutions for all the assessments covered by this study can be delivered where a Red status is scored. This chapter also summarises all the recommendations provided in each chapter.

1.5 Stakeholders and Consultation

It is important that a Water Cycle Study brings together all the partners and stakeholders knowledge, understanding and skills to help to understand the environmental and physical constraints to development. The following stakeholders were consulted during this WCS and have provided data for use within the study:

- Wyre Forest District Council (WFDC)
- Environment Agency (EA)
- Severn Trent Water Limited (STWL)

Future large-scale developments within and outside the Wyre Forest District can have the potential to affect water supply and demand, existing sewer networks and infrastructure. The following neighbouring authorities have been involved in the consultation process for this WCS:

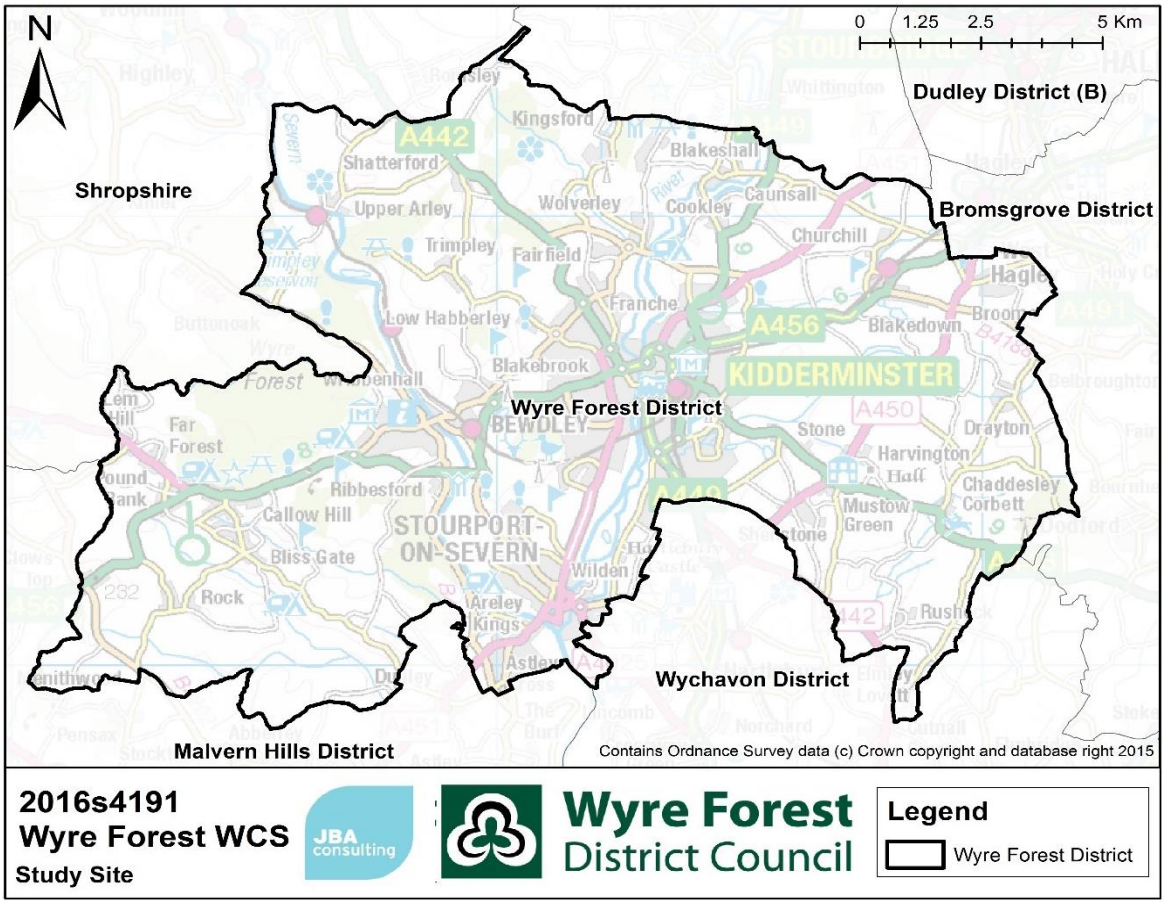
- Wychavon District
- Malvern Hills District
- South Staffordshire District
- Bromsgrove District
- Shropshire

1.6 Study Area

The Wyre Forest District is located in North Worcestershire and covers an area of around 195km^2 (Figure 1-2). The towns of Kidderminster, Bewdley and Stourport-On-Severn form a triangle of major population centres, these are surrounded by smaller settlements throughout the predominantly rural District. In 2012, the Office of National Statistics (ONS) estimated that the population of the Wyre Forest District was around 98,100.

The study area is mostly located within the Midlands Plateau Natural Area and is characterised by heathland, woodland and a variety of grasslands. Significant watercourses within the study area include the River Severn and the River Stour which both flow southwards through the District. Severn Trent Water Limited manages the water and wastewater services for the entire District.

Figure 1-2: Map of the Wyre Forest District



2 Key Developments

2.1 Introduction

The Wyre Forest District Council (WFDC) is currently in the process of undertaking a Local Plan Review. The new Local Plan will replace the current Adopted Core Strategy and is anticipated to be adopted in late 2017. In order to assist the WFDC in understanding the capacity for growth within the District, this WCS assesses 77 sites to understand the possible impacts on water resources, wastewater services and the water cycle as a whole.

2.2 Key Developments and Commitments

The Wyre Forest District Council has two Preferred Options for future development that will be included in Local Plan. Option A has future proposed development concentrated in Kidderminster and Option B has more dispersed development across the District. The Wyre Forest District Council has identified 77 proposed development sites for assessment, this includes residential and employment sites that are in either Option A, B, or both.

A summary of the sites is shown in Table 2-1, identifying the option allocation and proposed future use. Some of these sites will make up the WFDC housing allocations and this Water Cycle Study will form a key piece of evidence for the Wyre Forest District Local Plan.

To help identify if there are any constraints to growth within the Wyre Forest District, all 77 sites where the WFDC plan to focus growth will be assessed.

Table 2-1: Summary of Sites and Option Allocation

Option	Number of Sites
Option A and B Residential	47
Additional Option A Residential	4
Additional Option B Residential	9
Option A and B Employment	16
Additional Option A Employment	1
Total	**77**

Table 2-2 summarises the 47 proposed residential developments sites that feature in both Option A and Option B, Table 2-3 identifies 4 additional residential sites only in Option A and Table 2-4 details 9 residential sites only in Option B. The geographical locations of the residential sites across the Wyre Forest District are shown in Figure 2-1.

Table 2-2: Option A and B Residential Sites

Site Reference	Site Name	Housing Numbers	Area (Ha)
AKR/1	Bridge Street Basins	27	0.38
AKR/2	Cheapside	72	2.20
AKR/20	Carpets of Worth, Stourport on Severn	170	3.31
AKR/7	Swan Hotel and Working Men's Club	20	1.52
AS/1	Comberton Place	39	0.51
AS/5	Victoria Carpets Sports Ground, Spennells Valley Road, Kid	45	2.21
AS/6	Former Lea Street School Site	24	0.47
BHS/16	Park Lane Canalside	55	2.10
BHS/18	County Buildings and Blakebrook School Bewdley Road, Kid	50	1.38
BHS/2	Bromsgrove Street Area	75	3.59
BHS/26	Coopers Arms. Kidderminster	10	0.14
BR/BE/6	Land off Highclere	60	4.27
BR/RO/1	Clows Top	30	1.44
BR/RO/26	Land to rear of Walnut Cottage	5	0.30
BR/RO/4	Land adj Tolland bungalow, Far Forest	5	0.18
BR/RO/6	Land behind Orchard House, Far Forest	15	0.64

Site Reference	Site Name	Housing Numbers	Area (Ha)
BR/RO/7	New Road, Far Forest (South)	20	0.67
BW/1	Churchfields Business Park	230	7.09
BW/2	Limekiln Bridge	150	1.16
BW/3	Sladen School, Hurcott Road, Kidderminster	72	2.61
BW/4	Hurcott ADR	200	11.18
BW/6	Yew Tree Inn, Chester Road North, Kidderminster	10	0.30
FHN/9	78 Mill Street, Kidderminster	13	0.20
FPH/10	British Sugar Site Phase 2	70	1.59
FPH/17	Dowles Road Community Centre	11	0.24
FPH/18	Naylor's Field	35	1.65
FPH/6	Oasis Factory, Goldthorn Road, Kidderminster	91	1.78
LI/2	Wyre Forest Golf Club	80	4.21
LI/6/7/8	Land at Lickhill Road North (Bradley Paddocks and Field adj 17 Lickhill Road)	152	5.84
MI/1	County Buildings, Stourport	40	0.67
MI/28	35 Mitton Street, Stourport	15	0.22
MI/29	Chichester Caravans, Vale Road, Stourport on Severn	28	0.34
MI/3	Parsons Chain	114	6.03
MI/5	Baldwin Road	52	2.06
MI/6	Steatite Way, Stourport	106	3.10
OC/11	Stourminster School, Comberton Road, Kidderminster	56	2.15
OC/12	Comberton Lodge Nursery, Comberton Road, Kidderminster	10	0.84
OC/13	Land at Stone Hill (North)	0	57.31
OC/4	Land rear of Baldwin Road, Kidderminster	75	3.99
OC/5	Land adjacent to Hodge Hill Farm	40	2.11
WA/BE/1	Stourport Road (triangle), Bewdley	80	3.67
WA/BE/5	Land South of Habberley Road, Bewdley (The Gardens)	70	1.69
WA/UA/4	Allotments, Upper Arley	10	0.46
WFR/ST/1	Captains and The Lodge, Bromsgrove Road, Stone	135	4.59
WFR/ST/3	Land North of Stone Hill,	70	2.82
WFR/WC/15	Lea Castle Hospital	600	46.47
WFR/WC/18	Sion Hill School	46	2.10

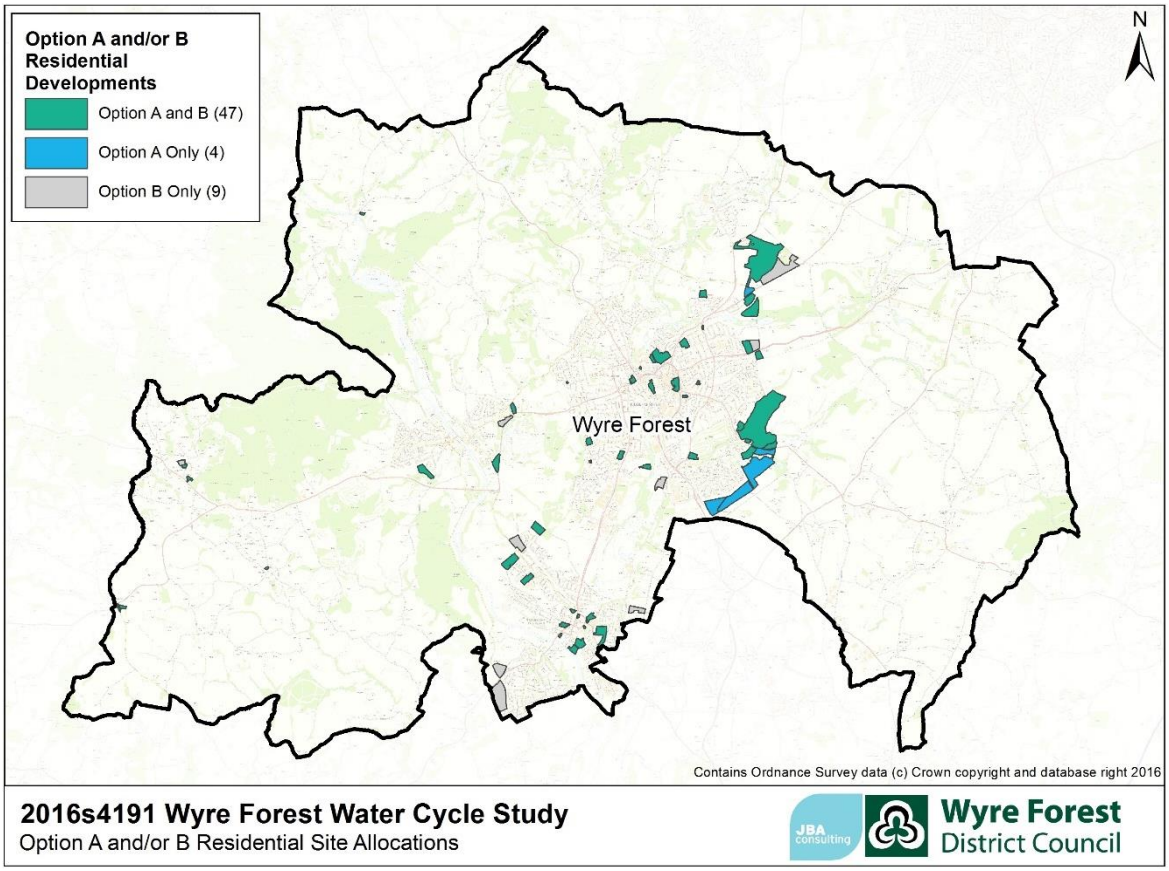
Table 2-3: Additional Option A Only Residential Sites

Site Reference	Site Name	Housing Numbers	Area (Ha)
AS/10	Land rear of Spennells / Easter Park	200	9.20
OC/13	Land at Stone Hill (South)	800	26.22
WFR/ST/2	Land Off Stanklyn Lane	330	14.42
WFR/WC/16	Land south of Wolverley Road and Park Gate Lane, Kidderminster	50	2.80

Table 2-4: Additional Option B Only Residential Sites

Site Reference	Site Name	Housing Numbers	Area (Ha)
AKR/15	Rectory Lane, Areley Kings	130	5.46
AKR14	Pearl Lane, Areley Kings	340	15.09
BR/RO/7	New Road, Far Forest (North)	20	1.54
FPH/1	Former British Sugar Settling Ponds, Wilden Lane, Kidderminster	100	4.06
LI/5	Land at Burlish Crossing	157	6.03
MI17	Land Rear of Stourport Manor	72	3.70
OC/4	Land rear of Baldwin Road (East part of site), Kidderminster	75	3.84
WA/BE/3	Catchems End, Bewdley	90	3.06
WFR/WC/32	East of Lea Castle	360	18.60

Figure 2-1: Residential Site Allocations in the Wyre Forest District

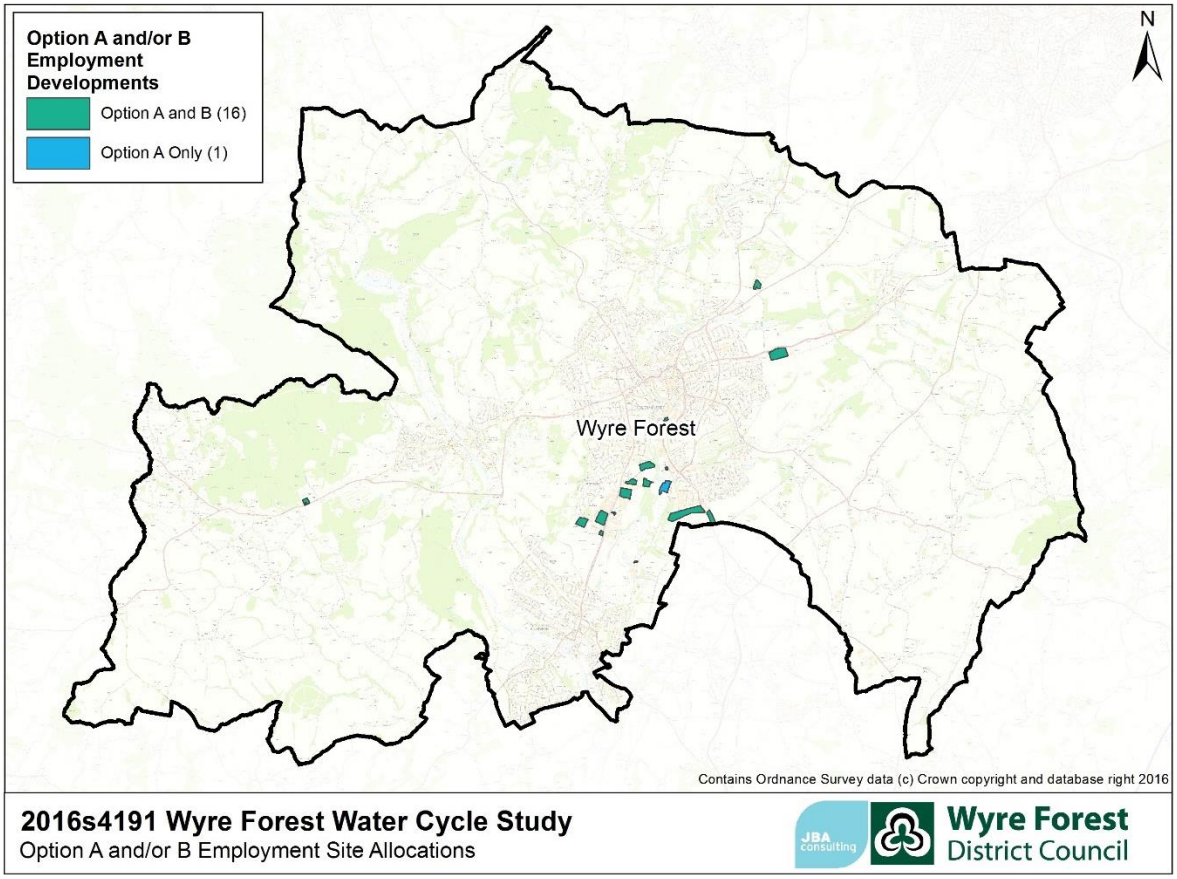


Wyre Forest District Council have also identified 16 employment site across the District. Option A also has one additional employment site, the Settling Ponds (FPH/1). All employment sites are summarised in Table 2-5. The geographical locations of the employment sites are shown in Figure 2-2.

Table 2-5: Options A and/or B Employment Sites

Site Reference	Site Name	Option	Area (Ha)
BHS/11	WFDC Depot, Green Street, Kidderminster	A and B	0.46
BR/RO/21	Alton Nurseries, Bewdley	A and B	1.32
FPH/10	British Sugar - Phase 2 (north)	A and B	3.72
FPH/23	British Sugar Phase 1 plot D	A and B	1.84
FPH/24	Romwire	A and B	4.99
FPH/25	Incinerator Site, Stourport Road, Kidderminster	A and B	2.17
FPH/26	Land adj Summerfield, Kidderminster	A and B	10.01
FPH/27	Land at Worcester Road, Kidderminster	A and B	2.53
FPH/28	Land at Hoo Brook	A and B	0.25
FPH/8	Land adj. SDF, Stourport Road, Kidderminster	A and B	4.28
FPH/9	Foley Drive	A and B	0.28
LI/1	Ceramaspeed	A and B	3.27
MI/18	North of Wilden Lane Industrial Estate	A and B	0.22
MI/26	Ratio Park, Finepoint	A and B	0.69
WFR/CB/7	Land Off Birmingham Road, Kidderminster (south)	A and B	7.13
WFR/WC/15	Part of Lea Castle, Kidderminster	A and B	1.96
FPH/1	Former British Sugar Settling Ponds, Wilden Lane, Kidderminster	A ONLY	4.06

Figure 2-2: Employment Site Allocations in the Wyre Forest District



3 Legislative and Policy Framework

The following sections introduce a number of national, regional and local policies that must be considered by the Local Planning Authorities (LPAs), Water Companies and developers during the planning stage. Key extracts from these policies relating to water consumption targets and mitigating the impacts on the water environment from the new development, are summarised below.

3.1 National policy

3.1.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)[1] was published on 27th March 2012, as part of reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. The NPPF provides guidance to planning authorities to take account of flood risk and water and wastewater infrastructure delivery in their Local Plans.

Paragraph 94:

> "Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change, taking full account of flood risk, coastal change and water supply and demand considerations"

Paragraph 99:

> "Local Plans should take account of climate change over the longer term, including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape. New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure."

Paragraph 100 states:

> "Local Plans should be supported by a strategic flood risk assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as Lead Local Flood Authorities and Internal Drainage Boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change".

Paragraph 156 states

> "Local planning authorities should set out the strategic priorities for the area in the Local Plan. This should include strategic policies to deliver...the provision of infrastructure for transport, telecommunications, waste management, water supply, wastewater, flood risk and coastal changes management, and the provision of minerals and energy".

In March 2014, the Planning Practice Guidance was issued by Department for Communities and Local Government (DCLG), with the intention of providing guidance on the application of the National Planning Policy Framework (NPPF) in England. Of relevance to this study;

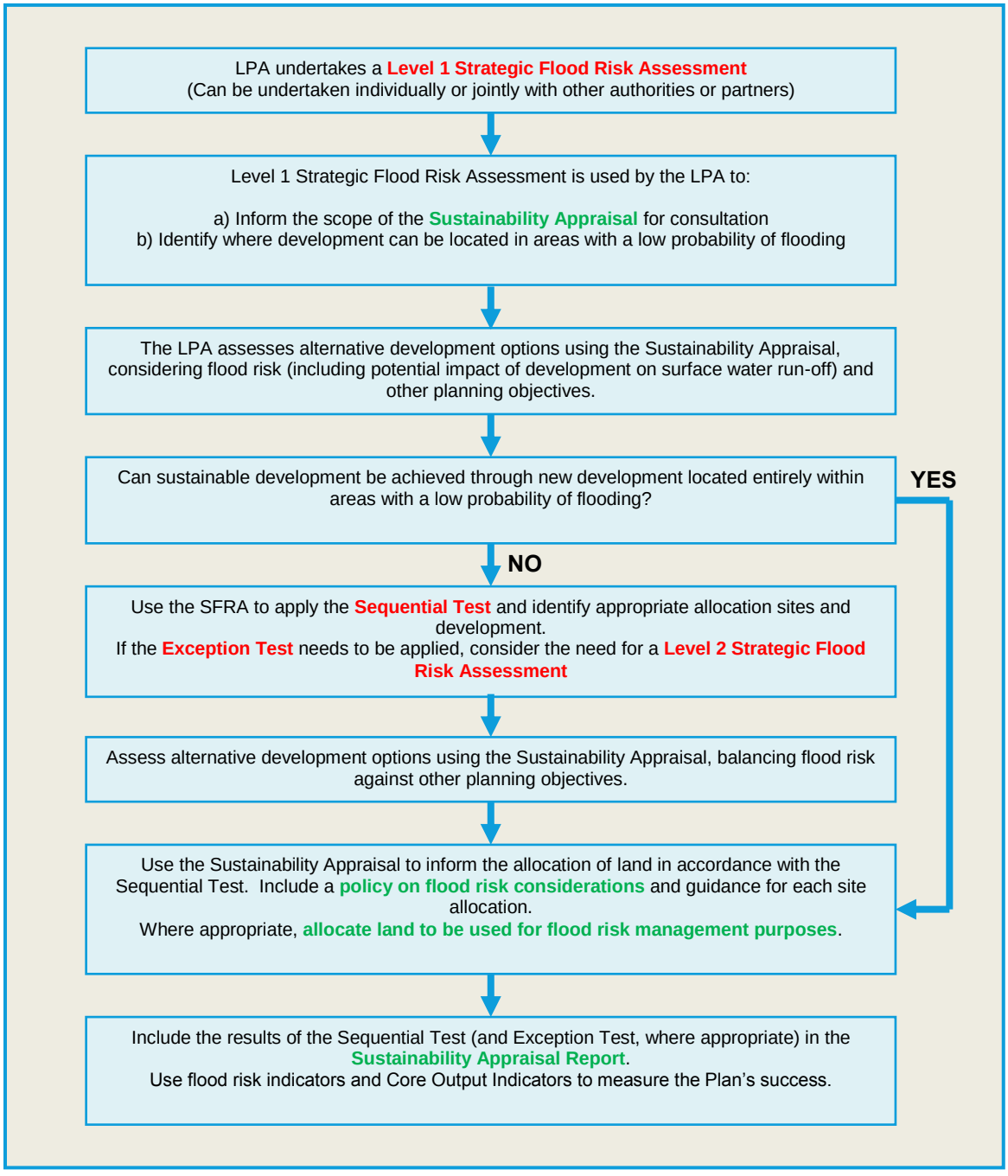
- Flood Risk and Coastal Change[2]
- Water Supply, Wastewater and Water Quality[3].
- Housing - Optional Technical Standards[4].

1 Department for Communities and Local Government (2012) National Planning Policy Framework
2 Department for Communities and Local Government (2014) Planning Practice Guidance: Flood Risk and Coastal Change (2014). Accessed online at http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/ on 05/05/2016.
3 Department for Communities and Local Government (2014) Planning Practice Guidance: Water supply, wastewater and water quality. Accessed online at http://planningguidance.planningportal.gov.uk/blog/guidance/ on 05/05/2016
4 Department for Communities and Local Government (2014) Planning Practice Guidance: Housing - Optional Technical Standards Accessed online at http://planningguidance.planningportal.gov.uk/blog/guidance/ on 05/05/2016

3.1.2 Planning Practice Guidance: Flood Risk and Coastal Change

Diagram 1 in the Planning Practice Guidance (PPG) sets out how flood risk should be taken into account in the preparation of Local Plans. These requirements are addressed principally in the Council's 2016 Draft Strategic Flood Risk Assessment (SFRA).

Figure 3-1: Flood Risk and the Preparation of Local Plans



Based on Diagram 1 of NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 004, Reference ID: 7-021-20140306) March 2014

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

A summary of the specific guidance on how infrastructure, water supply, wastewater and water quality considerations should be accounted for in both plan-making and planning applications is summarised below in Table 3-1.

Table 3-1: PPG: Water supply, wastewater and water quality considerations for plan making and planning applications

	Plan-making		Planning applications
Infrastructure	Identification of suitable sites for new or enhanced infrastructure. Consider whether new development is appropriate near to water and wastewater infrastructure. Phasing new development so that water and wastewater infrastructure will be in place when needed.		Wastewater considerations include: first presumption is to provide a system of foul drainage discharging into a public sewer. Phasing of development and infrastructure. Circumstances where package sewage treatment plants or septic tanks are applicable.
Water supply	Water efficiency guidance is set out in Planning Practice Guidance: Housing - Optional Technical Standards - see section 2		Planning for the necessary water supply would normally be addressed through the Local Plan ... exceptions might include: large developments not identified in Local Plans; where a Local Plan requires enhanced water efficiency in new developments.
Water quality	How to help protect and enhance local surface water and groundwater in ways that allow new development to proceed and avoids costly assessment at the planning application stage. The type or location of new development where an assessment of the potential impacts on water bodies may be required. Expectations relating to sustainable drainage systems.		Water quality is only likely to be a significant planning concern when a proposal would: involve physical modifications to a water body; or indirectly affect water bodies, for example as a result of the redevelopment of land that may be affected by contamination etc. or through a lack of adequate infrastructure to deal with wastewater.
Wastewater	The sufficiency and capacity of wastewater infrastructure. The circumstances where wastewater from new development would not be expected to drain to a public sewer.		If there are concerns arising from a planning application about the capacity of wastewater infrastructure, applicants will be asked to provide information about how the proposed development will be drained and wastewater dealt with.
Cross-boundary concerns	Water supply and water quality concerns often cross local authority boundaries and can be best considered on a catchment basis. Recommends liaison from the outset.		No specific guidance (relevant to some developments).
SEA and Sustainability Appraisal	Water supply and quality are considerations in Sustainability Appraisals and Strategic Environmental Assessment. Appraisal objectives could include preventing deterioration of water quality, taking climate change into account and seeking opportunities to improve water bodies.		No specific guidance (should be considered in applications).

3.1.4 Planning Practice Guidance: Housing - Optional Technical Standards

This guidance, advises planning authorities on how to gather evidence to set optional requirements, including for water efficiency. It states that "all new homes already have to meet the mandatory national standard set out in the Building Regulations (of 125 litres/person/day). Where there is a clear local need, local planning authorities can set out Local Plan policies requiring new dwellings to meet the tighter Building Regulations optional requirement of 110 litres/person/day." Planning authorities are advised to consult with the EA and water companies to determine where there is a clear local need, and also to consider the impact of setting this optional standard on housing viability. A 2014 study[5] into the cost of implementing sustainability measures in housing found that meeting a standard of 110 litres per person per day would cost only £9 for a four-bedroom house. It is the intention of the Wyre Forest District to meet the standard of 110 litres/ person/ day as stated in Draft Local Plan.

3.1.5 Building Regulations and Code for Sustainable Homes

The Building Regulations (2010) Part G[6] was amended in early 2015 to require that all new dwellings must ensure that the potential water consumption must not exceed 125l/person/day, or 110 l/person/day where required under planning conditions. The regulations include advice on how to calculate this.

The Code for Sustainable Homes (CfSH) was, from 2007 to March 2015, the Government's optional national standard for new housing. It became effective in England in April 2007 and a Code rating for new homes became mandatory in May 2008. The Code included six levels of water efficiency for new homes seeking to simplify the various building codes that house builders have to adhere to, the Government withdrew CfSH in March 2015, with the exception of legacy cases: *"where residential developments are legally contracted to apply a code policy (e.g. affordable housing funded through the national Affordable Housing Programme 2015 to 2018, or earlier programme), or where planning permission has been granted subject to a condition stipulating discharge of a code level, and developers are not appealing the condition or seeking to have it removed or varied".*

3.1.6 Sustainable Drainage Systems (SuDS)

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

The National Planning Policy Framework which requires that development in areas already at risk of flooding should give priority to sustainable drainage systems.

- The House of Commons written statement[7] setting out governments intentions that LPAs should "ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate" and "clear arrangements in place for ongoing maintenance over the lifetime of the development." In practice this has been implemented by making Lead Local Flood Authorities (LLFAs) statutory consultees on the drainage arrangements of major developments.
- The Defra Non-statutory technical standards for sustainable drainage systems[8]. These set out the government's high level requirements for managing peak flows and runoff volumes, flood risk from drainage systems and the structural integrity and construction of SuDS. This very short document is not a design manual and makes no reference to the other benefits of SuDS, for example water quality, habitat and amenity. Neither does it address adoption and maintenance.
- As the Lead Local Flood Authority (LLFA) Worcestershire County Council (WCC) are responsible for advising Local Planning Authorities, including Wyre Forest District Council and play a lead role in ensuring that the proposed drainage schemes for all new developments comply with technical standards and policies in relation to SuDS.

5 Department for Communities and Local Government (2014) Housing Standards Review: Cost Impacts. Accessed online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/353387/021c_Cost_Report_11th_Sept_2014_FINAL.pdf on 15/11/2016.

6 HM Government (2015) The Building Regulations (2010) Part G - Sanitation, hot water safety and water efficiency. 2015 edition. Accessed online at http://www.planningportal.gov.uk/uploads/br/BR_PDF_AD_G_2015.pdf on 10/05/2016.

7 Sustainable drainage systems: Written statement - HCWS161. Accessed online at http://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2014-12-18/HCWS161/ on 14/08/2015.

8 Defra (2015) Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems

- WCC does not currently have a published SuDS Design Guide however as statutory consultee to the planning application process they do recommend that a planning condition relating to SuDS management plan is attached to any grant of planning permission[9]. The statutory consultee role for major planning applications with drainage implications in the Wyre Forest has been delegated to North Worcestershire Water Management.
- An updated version of the CIRIA SuDS Manual[10] was published in 2015. The guidance covers the planning, design, construction and maintenance of SuDS for implementation within both new and existing developments. The guidance is relevant for a range of roles with the level of technical detail increasing throughout the manual. The guidance does not include detailed information on planning requirements, SuDS approval/adoption processes and standards, as these vary by region and should be checked.
- SuDS features not adopted by WCC or Severn Trent Water need to be maintained by householders (in the case of SuDS on private land) and by management companies for other SuDS on public open spaces and highways.

3.2 Local policy

3.2.1 Localism Act

The Localism Act outlined plans to shift and re-distribute the balance of decision making from central government back to councils, communities and individuals. The Localism Act was given Royal Assent on 15 November 2011. In relation to the planning of sustainable development, provision 110 of the Act places a duty to cooperate on Local Authorities. This duty requires Local Authorities to *"engage constructively, actively and on an ongoing basis in any process by means of which development plan documents are prepared so far as relating to a strategic matter"*[11].

The Localism Act also provides new rights to allow local communities to come together and shape new developments by preparing Neighbourhood Plans. This means that local people can decide not only where new homes and businesses should go and but also what they should look like. Local Planning Authorities will be required to provide technical advice and support.

3.2.2 Local Plan and Local Strategy

The Wyre Forest District is currently covered by the Adopted Core Strategy; this document sets out the amount of development to be delivered in the District until 2026 as well as the general locations for growth in terms of housing and other major development needs. The District Council has been undertaking a Local Plan Review since 2015. The new Local Plan will replace the Adopted Core Strategy; it is anticipated that it will be adopted in late 2017. The Water Cycle Study will inform the Review of the Districts Local Plan and will form an integral part of the Councils evidence base supporting the subsequent location specific development decisions.

3.2.3 Infrastructure Delivery Plan

The purpose of an Infrastructure Delivery Plan (IDP) is to evaluate various services to determine if there is sufficient infrastructure to support the future levels of housing and employment in the District. The IDP presents sources of funding to assist in the delivery of infrastructure to help upgrade facilities, promote economic growth to ultimately increase the quality of life. The plan aims to sustainably develop towns and districts whilst maintaining a high quality environment.

The WFDC Infrastructure Plan[12] is part of the evidence base that has informed the preparation of planning policy and site allocations within the District. The IDP examines the physical, social and green infrastructure provision that exists within the District and will seek to identify any gaps or capacity issues within this existing provision. The Wyre Forest Green Infrastructure Strategy[13] expands on research completed in the Green Infrastructure Study[14]. The strategy aims to develop green infrastructure further and sets out detailed guidance on incorporating green infrastructure into new developments within the District.

9 Worcester County Council - Flood Risk and Development. Accessed online at: http://www.worcestershire.gov.uk/info/20236/flood_risk_management/1045/flood_risk_and_development/4 on 28/9/2016
10 CIRIA (2015) The SuDS Manual (C753)
11 Localism Act 2011: Section 110. http://www.legislation.gov.uk/ukpga/2011/20/section/110
12 Wyre Forest District Council (Sept 2012) Infrastructure Plan. Accessed Online at: http://www.wyreforestdc.gov.uk/media/106013/EB062WFDC-IDP-September-2012.pdf on 28/09/2016
13 Wyre Forest District Council (Oct 2012) Green Infrastructure Strategy. Accessed online at: http://www.wyreforestdc.gov.uk/media/105947/EB047Final-GI-Strategy_opt.pdf on 05/10/2016
14 Wyre Forest District Council (Jan 2010) Green Infrastructure Study. Accessed online at: http://www.wyreforestdc.gov.uk/media/105935/Final-Green-Infrastruture-Study.pdf on 05/10/2016

3.3 Environmental Policy

3.3.1 Urban Wastewater Treatment Directive (UWWTD)

The UWWTD is an EU Directive that concerns the collection, treatment and discharge of urban wastewater and the treatment and discharge of waste water from certain industrial sectors. The objective of the Directive is to protect the environment from the adverse effects of the above mentioned wastewater discharges. More specifically Annex II A(a) sets out the requirements for discharges from urban wastewater treatment plants to sensitive areas which are subject to eutrophication. One or both parameters may be applied depending on the local situation. The values for concentration or for the percentage reduction shall apply. For specific information regarding concentration limits please refer to the UWWTD[15]. The Directive has been transposed into UK legislation through enactment of the Urban Waste Water Treatment (England and Wales) Regulations 1994 and 'The Urban Waste Water Treatment (England and Wales) (Amendments) Regulations 2003'. The River Stour is a designated sensitive eutrophic area under the UWWTD.

3.3.2 Habitats Directive

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

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

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

3.3.3 The Water Framework Directive

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

River Basin Management Plans (RBMP) are required under the WFD and are strategies. The Wyre Forest District falls within Severn River Basin District RBMP[16]. Under the WFD the RBMPs, which were originally published in December 2009 were reviewed and updated in December 2015.

A primary WFD objective is to ensure 'no deterioration' in environmental status, therefore all water bodies must meet the class limits for their status class as declared in the Final Severn River Basin Management Plans.

Another equally important objective requires all water bodies to achieve good ecological status. Future development needs to be planned carefully so that it helps towards achieving the WFD and does not result in further pressure on the water environment and compromise WFD objectives. The WFD objectives as outlined in the updated RBMPs are summarised below:

- "*To prevent deterioration of the status of surface waters and groundwater*
- *To achieve objectives and standards for protected areas*
- *To aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status*
- *To reverse any significant and sustained trends in pollutant concentrations in groundwater*
- *The cessation of discharges, emissions and loses of priority hazardous substances into surface waters*
- *Progressively reduce the pollution of groundwater and prevent/ limit the entry of pollutants.*"

Local Planning Authorities (LPAs) must have regard for Water Framework Directive as implemented in the Environment Agency’s River Basin Management Plans.

15 UWWTD. Accessed online at http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:31991L0271 on 14/08/2015.

16 Environment Agency (Dec 2015) Part 1: Severn River Basin District River Basin Management Plan. Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/501290/Severn_RBD_Part_1_river_basin_management_plan.pdf on 29/09/2016

3.3.4 Protected Area Objectives

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

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

The types of protected areas are:

- Areas designated for the abstraction of water for human consumption (Drinking Water Protected Areas);
- Areas designated for the protection of economically significant aquatic species (Freshwater Fish and Shellfish);
- Bodies of water designated as recreational waters, including areas designated as Bathing Waters;
- Nutrient-sensitive areas, including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Waste Water Treatment Directive (UWWTD); and
- Areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection including relevant Natura 2000 sites.

Many WFD protected areas coincide with water bodies; these areas will need to achieve the water body status objectives in addition to the protected area objectives. Where water body boundaries overlap with protected areas the most stringent objective applies; that is the requirements of one EC Directive should not undermine the requirements of another.

The objectives for Protected Areas relevant to this study are as follows:

Drinking Water Protected Areas

- Ensure that, under the water treatment regime applied, the drinking water produced meets the requirements of the Drinking Water Directive plus any UK requirements to make sure that drinking water is safe to drink; and
- Ensure the necessary protection to prevent deterioration in the water quality in the protected area in order to reduce the level of purification treatment required.
- A central band of the Wyre Forest District, to the west of Kidderminster, is located within a Drinking Water Safeguard Zone. The towns of Bewdley, Stourport-On-Severn and several smaller population centres fall within this protection zone.

Economically Significant Species (Freshwater Fish Waters)

- To protect or improve the quality of running or standing freshwater to enable them to support fish belonging to:
- Indigenous species offering a natural diversity; or
- Species the presence of which is judged desirable for water management purposes by the competent authorities of the Member States.

Nutrient Sensitive Areas (Nitrate Vulnerable Zones)

- Reduce water pollution caused or induced by nitrates from agricultural sources; and
- Prevent further such pollution.
- The majority of the Wyre Forest District is designated as a surface water and groundwater Nitrate Vulnerable Zone.

Nutrient Sensitive Areas (Urban Waste Water Treatment Directive)

- To protect the environment from the adverse effects of urban waste water discharges and waste water discharges from certain industrial sectors.

Natura 2000 Protected Areas (water dependent SACs and SPAs)

The objective for Natura 2000 Protected Areas identified in relation to relevant areas designated under the Habitats Directive or Birds Directive is to protect and, where necessary, improve the status of the water environment to the extent necessary to achieve the conservation objectives that have been established for the protection or improvement of the site's natural habitat types and species of Community importance in order to ensure the site contributes to the maintenance of, or restoration to, favourable conservation status.

Groundwater Source Protection Zones

The Environment Agency has a Groundwater Protection Policy to help prevent groundwater pollution. In conjunction with this the Environment Agency have defined groundwater Source Protection Zones (SPZs) to help identify high risk areas and implement pollution prevention measures. The SPZs show the risk of contamination from activities that may cause pollution in the area, the closer the activity, the greater the risk. There are three main zones (inner, outer and total catchment) and a fourth zone of special interest which is occasionally applied. Section 8 describes the Source Protection Zones within the district in more detail and discusses them in reaction to the sites of proposed development.

Zone 1 (Inner protection zone)

This zone is designed to protect against the transmission of toxic chemicals and water-borne disease. It indicates the area in which pollution can travel to the borehole within 50 days from any point within the zone and applies at and below the water table. There is also a minimum 50 metre protection radius around the borehole. There are eight inner protection zones within the Wyre Forest District, these are mostly located to the central and east of the district.

Zone 2 (Outer protection zone)

This zone indicates the area in which pollution takes up to 400 days to travel to the borehole, or 25% of the total catchment area, whichever area is the biggest. This is the minimum length of time the Environment Agency think pollutants need to become diluted or reduce in strength by the time they reach the borehole. There are eight outer protection zones around the identified inner protection zones identified.

Zone 3 (Total catchment)

This is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole. The majority of the central and east of the district is defined as a Zone 3 Source Protection Zone.

Zone of special interest

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

The Environment Agency's Groundwater protection: Principles and practice (GP3)[17] sets out a series of position statements that detail how the Environment Agency delivers government policy on groundwater and protects the resources from contamination. The position statement relevant to this study in terms of groundwater discharges include surface water drainage and the use of SuDS, discharges from contaminated surfaces (e.g. lorry parks) and discharges of treated sewage effluent.

Section 8, Environmental Constraints and Opportunities, identifies and discusses the environmental risks and opportunities associated with proposed development in the district in greater detail.

17 Environment Agency (2013) Groundwater protection: Principles and practice (GP3). Accessed online at https://www.gov.uk/government/publications/groundwater-protection-principles-and-practice-gp3 on 10/03/2016

3.4 Water Industry Policy

3.4.1 The Water Industry in England

Water and sewerage services in England and Wales are provided by 10 Water and Sewerage Companies (WaSCs) and 12 'water-only' companies. The central legislation relating to the industry is the Water Industry Act 1991[18]. The companies essentially operate as regulated monopolies within their supply regions, although very large water users and developments are able to obtain water and/or wastewater services from alternative suppliers - these are known as inset agreements.

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

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

3.4.2 Regulations of the Water Industry

The water industry is primarily regulated by three regulatory bodies;

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

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

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

3.4.3 Developer Contributions

Developments with planning permission have a right to connect to the public water and sewerage systems, although the Flood and Water Management Act removes the automatic right to connect surface water to sewerage systems.

Developers may either requisition a water supply connection or sewerage system, or self-build the assets and offer these for adoption by the water company or sewerage undertaker. Self-build and adoption are usually practiced for assets within the site boundary, whereas requisitions are normally used where an extension of upgrading the infrastructure requires construction on third party land.

The cost of requisitions is shared between the water company and developer as defined in the Water Industry Act 1991.

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

The Town and Country Planning Act Section 106 agreement and Community Infrastructure Levy agreements may not be used to obtain funding for water or wastewater infrastructure.

18 Water Industry Act 1991. Accessed online at http://www.legislation.gov.uk/ukpga/1991/56/contents

Case study: Nutrient off-setting in the River Mease, Leicestershire

Issues

An Environment Agency review of the River Mease Special Area of Conservation (SAC) identified a significant issue of poor water quality, due to high levels of phosphorous pollution. Phosphates were entering the river from sewage treatment works, roads and fields, causing the unsustainable growth of algae in the river and fish populations to decline. As a result, the River Mease failed to meet the requirements of the Habitats and Water Framework Directives.

The River Mease SAC Water Quality Management Plan

To reduce the levels of phosphorous within the River Mease SAC, meet the required environmental status of the SAC, and accommodate the planned levels of housing growth, a Water Quality (Phosphate) Management Plan (WQMP) was produced.

The interests and expertise of stakeholders across the catchment were taken into account, with the plan produced in partnership with the Environment Agency, Natural England, Severn Trent Water, North West Leicestershire District Council, South Derbyshire District Council and Lichfield District Council.

Way forward

The plan aims to limit levels of phosphorous in the River Mease to 0.06mg/l, and Local Planning Authorities are reluctant to accept any further increase in wastewater entering the public sewer system. To meet these targets, developers are now required to pay into the River Mease Developer Contribution Scheme for additional wastewater produced by any new development, which in turn funds phosphorous mitigation solutions.

The Environment Agency are enforcing stricter phosphorous limits on their discharge consents for water treatment works within the SAC, and are working with Severn Trent Limited to find alternative long-term solutions to managing wastewater in the catchment. These may involve higher standards of treatment or even transporting the wastewater to be treated outside the catchment. The River Mease SAC Water Quality Management Plan remains as a living document, and will be updated regularly by the key partners.

4 Water Resources and Water Supply

4.1 Introduction

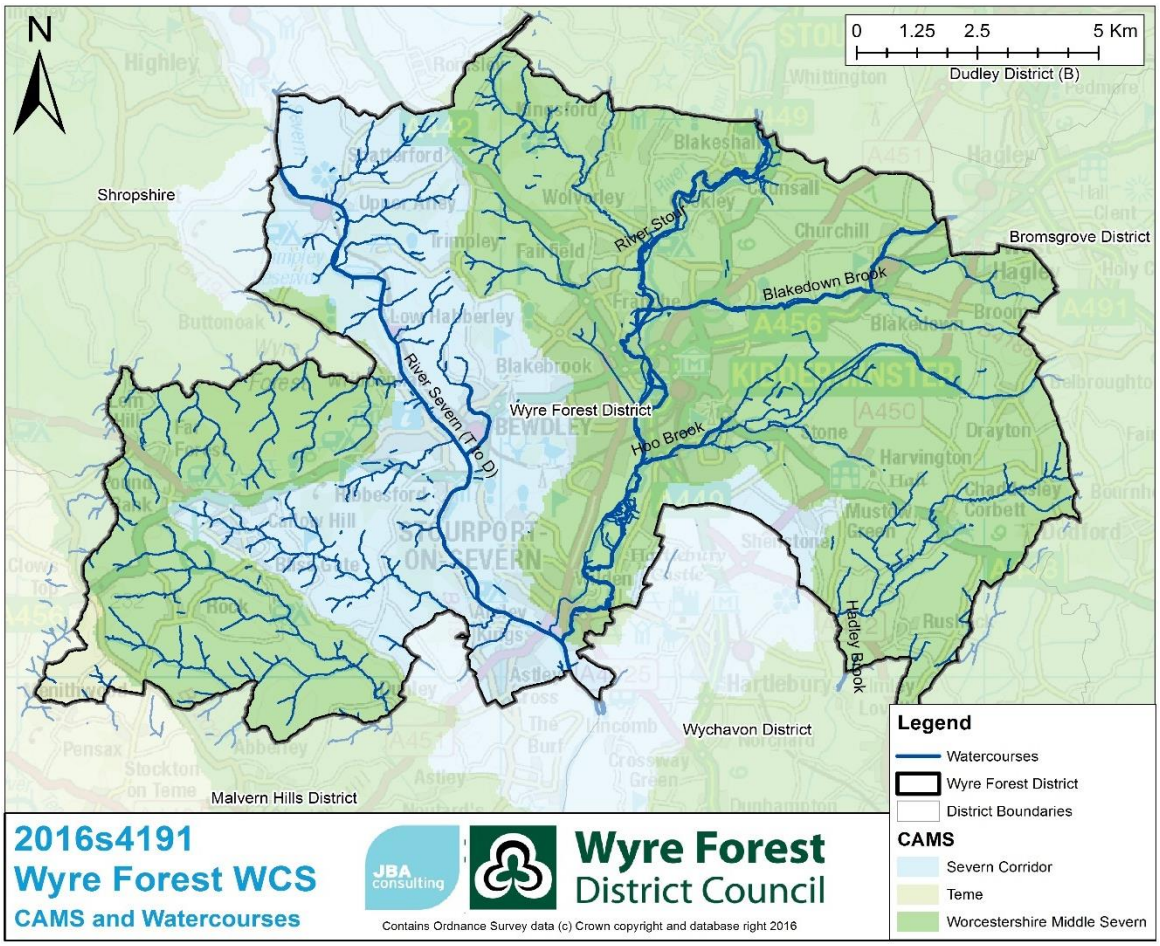
Catchment Abstraction Management Strategies (CAMS) are prepared by the Environment Agency. The Licensing Strategy sets out how water resources are managed within different areas of England and Wales and contributes to implementing the Water Framework Directive (WFD). CAMS provide information on the resources available and what conditions might apply to new licenses. The licences require abstractions to stop or reduce when a flow or water level falls below a specific point as a restriction to protect the environment and manage the balance between supply and demand for water users. CAMS are published in a series of documents known as Abstraction License Strategies (ALS's), but for clarity the term, CAMS will be used in this report.

Licences are often time limited, this allows for a periodic review of the specific area as specific circumstances may have changed since the licences were initially granted. These are generally given for a twelve-year duration, but shorter and longer duration licences can also be accepted. This is usually dependant on local factors such as the lifetime of the infrastructure, the availability of resources and future plans or changes in the area. The licences are then replaced or renewed near to the expiry date.

CAMS are important in terms of the Water Resource Management Plans (WRMP) as this helps to determine the current and future pressures on water resources and how the supply and demand will be managed by the relevant water companies[19]. The Wyre Valley District is almost entirely covered by two CAMS areas; the Severn Corridor and the Worcestershire Middle Severn, as shown in Figure 4-1. A tiny portion of the western District falls within the Teme CAMS but as there are no major settlements in this area and will not impact water resources significantly.

4.1.1 Surface Waters

Figure 4-1: Surface Waters and CAMS Boundaries Across the Wyre Forest District

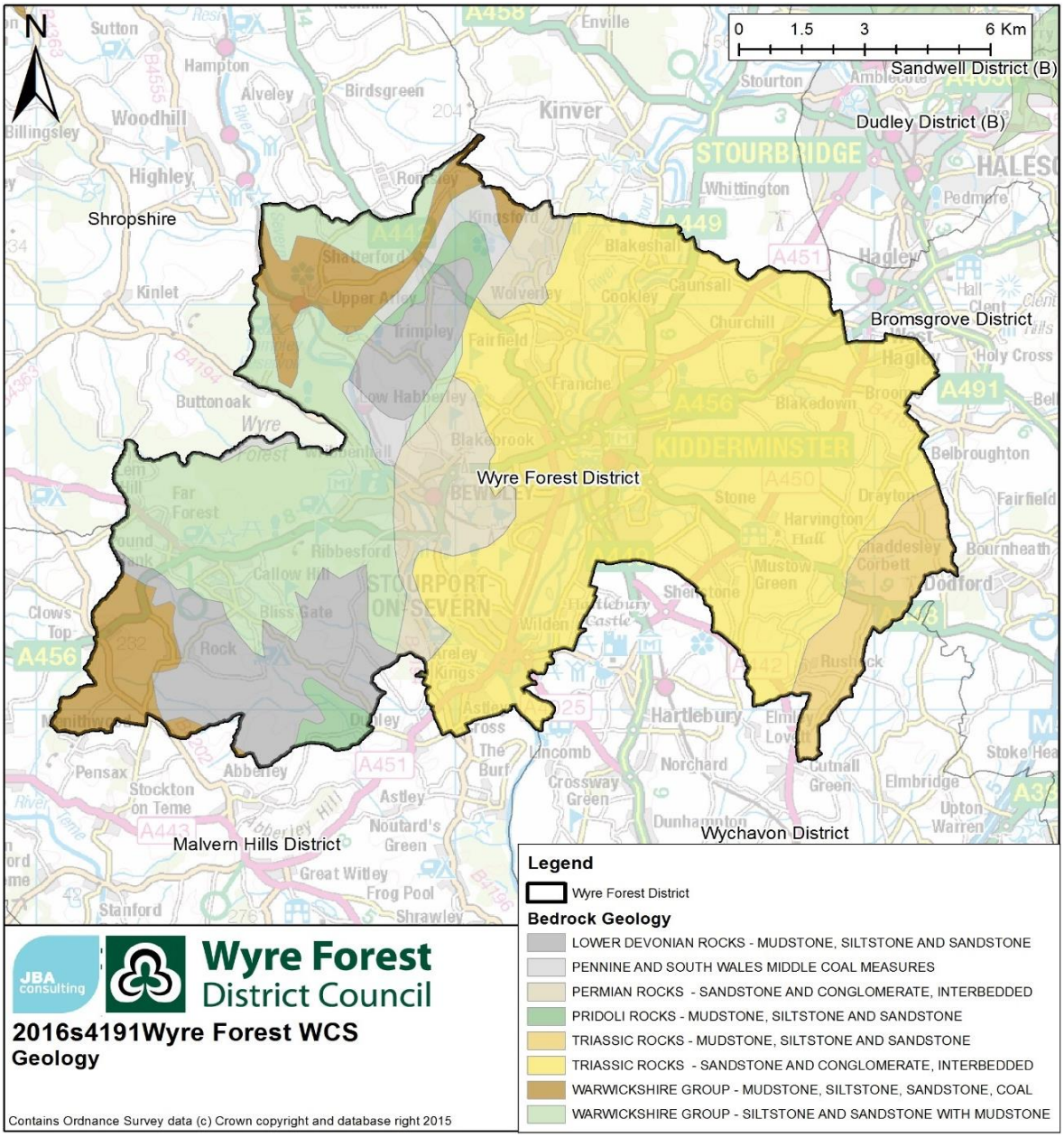


19 Environment Agency (2013) Managing Water Abstraction. Accessed Online at: https://www.gov.uk/government/collections/water-abstraction-licensing-strategies-cams-process (07/06/2016)

4.1.2 Geology

The geology varies greatly across the Wyre Forest District. A range of Triassic mudstone, siltstone and sandstone is found in the east of the catchment. The western portion of the catchment is much more varied, including a range of Permian rocks, Pridoli rocks, coal measures and Warwickshire group geologies. Figure 4-2 shows the geological variation across the Wyre Forest District.

Figure 4-2: Bedrock Geology of Wyre Forest



4.2 Availability of Water Resources

4.2.1 Resource Availability Assessment

In order to abstract surface water, it is important to understand what water resources are available within a catchment and where abstraction for consumptive purposes is allowed. The Environment Agency has developed a classification system which shows:

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

The availability of water for abstraction is determined by the relationship between the fully licensed (all abstraction licences being used to full capacity) and recent actual flows (amount of water abstracted in the last 6 years) in relation to the Environmental Flow Indicator (EFI). Results are displayed using different water resource availability colours, further explained in Table 4-1. In some cases, water may be scarce at low flows, but available for abstraction at higher flows. Licences can be granted that protect low flows, this usually takes the form of a "Hands off Flow" (HOF) condition on a licence.

Groundwater availability as a water resource is based on the corresponding surface water availability unless better information on principal aquifers is available or if there are specific local issues that need to be taken into account.

Table 4-1: Implications of Surface Water Resource Availability Colours.

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

4.2.1.1 Severn Corridor

The Severn Corridor CAMS[20] encompasses the upper reaches of the River Seven Catchment down the Severn Estuary. The main demand for water within this elongated catchment comes from the agricultural sector. The largest abstraction in terms of water quantity are for public water supply, the River Severn provides water to six million people. Water resources in this area of the Severn Corridor CAMS are reliable, as they are available at least 70% of the time. 12% of the existing licences in the Severn Corridor CAMS are time-limited. The next common end date is 31st March 2022 and the subsequent one is the 31st March 2034.

20 Severn Corridor Abstraction Licensing Strategy (2013) Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291406/LIT_7848_c0b50e.pdf (07/06/2016)

Surface water flows have been analysed at assessment points on the river (APs), the nearest to the Wyre Forest District is the River Severn at Bewdley (AP10). Currently there is restricted water available for licensing at AP10, water is available during periods of medium to high flows and are subject to HOF conditions when the River Severn falls below 1219 Ml/d.

Groundwater abstractions which directly affect surface water flows are assessed in the same way as surface water abstractions.

Table 4-2: Severn Corridor CAMS Resource Availability within the Wyre Forest District

AP	Name	CAMS	Local resource availability	HOF Q (1)	Days p.a. (2)	HOF (Ml/d) (3)	Gauging station at AP?
10	River Severn at Bewdley	Severn Corridor	Restricted water available for licensing	1219	328	55	Yes

4.2.1.2 Worcestershire Middle Severn

The Worcestershire Middle Severn CAMS area[21] encompasses just over 1000 km^2 of central England and covers the eastern and western areas of the Wyre Forest District study area. This CAMS areas is divided in two by the presence of the River Severn through the centre of the District. The River Severn water resources are separately assessed in the Severn Corridor CAMS.

Within this area, the main issue is the historic over-abstraction of groundwater for the public water supply and the environmental impact that accompanies this. There is also a high demand from agricultural within this rural CAMS for irrigation and this often coincides with periods of low flows within the CAMS. 25% of the licences in the Worcestershire Middle Severn CAMS are time-limited, the next common end date is the 31st March 2026.

Four Assessment Points (APs) are located within the Wyre Forest boundary. Currently abstraction is assessed as restricted and is only available during periods of high flows subject to HOF conditions. HOF conditions apply to AP2 when the Dowles Brook at Oak Cottage falls below 3 Ml/d and APs 5 to 7 when the River Stour flow falls below 260 Ml/d. A summary of resource availability within the Wyre Forest District is shown in Table 4-3.

All groundwater units within the Worcestershire Middle Severn areas are closed to further abstraction because the existing levels of licensed abstraction currently exceed the long term rate of aquifer recharge.

Table 4-3: Worcester Middle Severn CAMS Resource Availability within the Wyre Forest

AP	Name	CAMS	Local resource availability	HOF Q (1)	Days p.a. (2)	HOF (Ml/d) (3)	Gauging station at AP?
2	Dowles Brook at Oak Cottage	Worc Middle Severn	Restricted water available for licensing	3	328	0.4	Yes
5	River Stour at Caunsal	Worc Middle Severn	Restricted water available for licensing	260	73	26	No
6	River Stour at Callows Lane	Worc Middle Severn	Restricted water available for licensing	260	73	26	Yes
7	River Stour at Stourport-On-Severn	Worc Middle Severn	Restricted water available for licensing	260	73	26	No

(1) Hands off Flow restriction
(2) Number of days per annum abstraction may be available
(3) Approximate volume available at restriction (Ml/D)

21 Worcestershire Middle Severn Abstraction Licensing Strategy (2013) Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/305450/lit_5356_35376b.pdf (08/06/2016)

4.2.2 Recommendations for Better Management Practices

Due to abstraction, several water bodies in the District have fallen below the Ecological Flow Indicator (EFI) which may lead the EA to change or revoke some abstraction licenses. This underlines the need to reduce abstraction by using more efficient management practices. This would increase the sustainability of abstraction and reduce the impacts to the environment.

The main options for this identified in the CAMS are to adopt water efficiency and demand management techniques. Methods include:

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

This would ultimately cut the growth in abstraction and limit the impacts on flow and the ecology.

4.2.3 Water Stress

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

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

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

In the Environment Agency and Natural Resources Wales assessment[22] the Severn Trent supply region is classed as an area of "moderate" water stress.

4.2.4 River Basin Management Plans

The Wyre Forest District is included within the 2015 Severn River Basin District River Basin Management Plan (RBMP)[23]. This report highlights that several wetlands and surface water catchments within the Wyre Forest District are already being impacted by the over abstraction of groundwater. This includes areas such as the Hurcott and Podmore SSSI, Puxton and Stourvale SSSI, Hartlebury SSSI and the Blakedown Brook catchment. In the case of the Blakedown Brook, flows are below the Ecological Flow Standard required to achieve Good Ecological Status. Under the Water Framework Directive, these affected catchments must not deteriorate further.

Mitigation measures are already in place to alleviate the impact of abstraction in this catchment and further measures are planned in the AMP6 National Environment Programme for South Staffs Water and Severn Trent Water. Under the Restoring the Sustainable Abstraction Programme, the Environment Agency is working alongside water companies to overcome the impacts of unsuitable abstraction. It is recommended that in the Wyre Forest District, any additional abstraction should not be from the underlying groundwater aquifers in the areas. STWL should abstract from other areas within the Strategic Grid WRZ to meet the increased water demand.

The Environment Agency also encourage LPAs to adopt tighter (optional) water efficiency standards. Where there is a clear local and environmental need, local planning authorities can set out Local Plan policies requiring new dwellings to meet the tighter Building Regulations optional requirement of 110 litres/person/day.

22 Environment Agency and Natural Resources Wales (2013) Water Stressed Areas - Final Classification. Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244333/water-stressed-classification-2013.pdf on 18/07/2016

23 Environment Agency 2015. Severn River Basin District River Basin Management Plan. Accessed online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/501290/Severn_RBD_Part_1_river_basin_management_plan.pdf on 21/02/20176

Case study: Rainwater Harvesting in North West Cambridge

Issues

Rising rental prices and housing supply shortages are a longstanding issue within the city of Cambridge. As such, when looking for a space to provide affordable housing and research facilities for its growing numbers of staff and students, Cambridge University looked two miles outside the city centre.

However, concerns were raised over whether existing water scarcity and flood risk issues on the 150-hectare site could withstand the additional pressures of the new development.

The North West Cambridge Development

The North West Cambridge Development proposal put forward an innovative scheme to address both the water consumption and flood risk issues facing the site.

The finished site will contain the largest water recycling system in the country, which aims to reduce average water consumption to almost half of the UK average. This will be achieved through rainwater harvesting and water re-use. Rainwater from all building roofs will be collected, filtered and then stored in underground tanks onsite, for non-drinking uses, such as in toilets. The development aims to be drought resistant, through using native plant species, and watering open spaces using rainwater collected in water butts.

The issue of surface water flood risk was addressed through designing a suite of Sustainable Drainage Systems (SuDS). A system of swales, green corridors and a balancing pond will be installed to mimic the natural drainage of the area, by storing and slowly releasing water through the site, and to intercept pollutants from water running off the paved areas. This will minimise the risk of surface water flooding to the site itself and to downstream communities.

Results

The North West Cambridge Development proposal passed through the planning process with unanimous approval, and is on track for completion, with the first student accommodation due to open in Winter 2016/2017. Collaborative working was key to the success of the development at planning stages. Cambridge University remained in close consultation with the committee of local planning authorities and also with neighbouring communities, including the North West Community Forum. It is hoped that the North West Cambridge Development will inspire similarly innovative solutions for the management of water resources within future development across the UK.

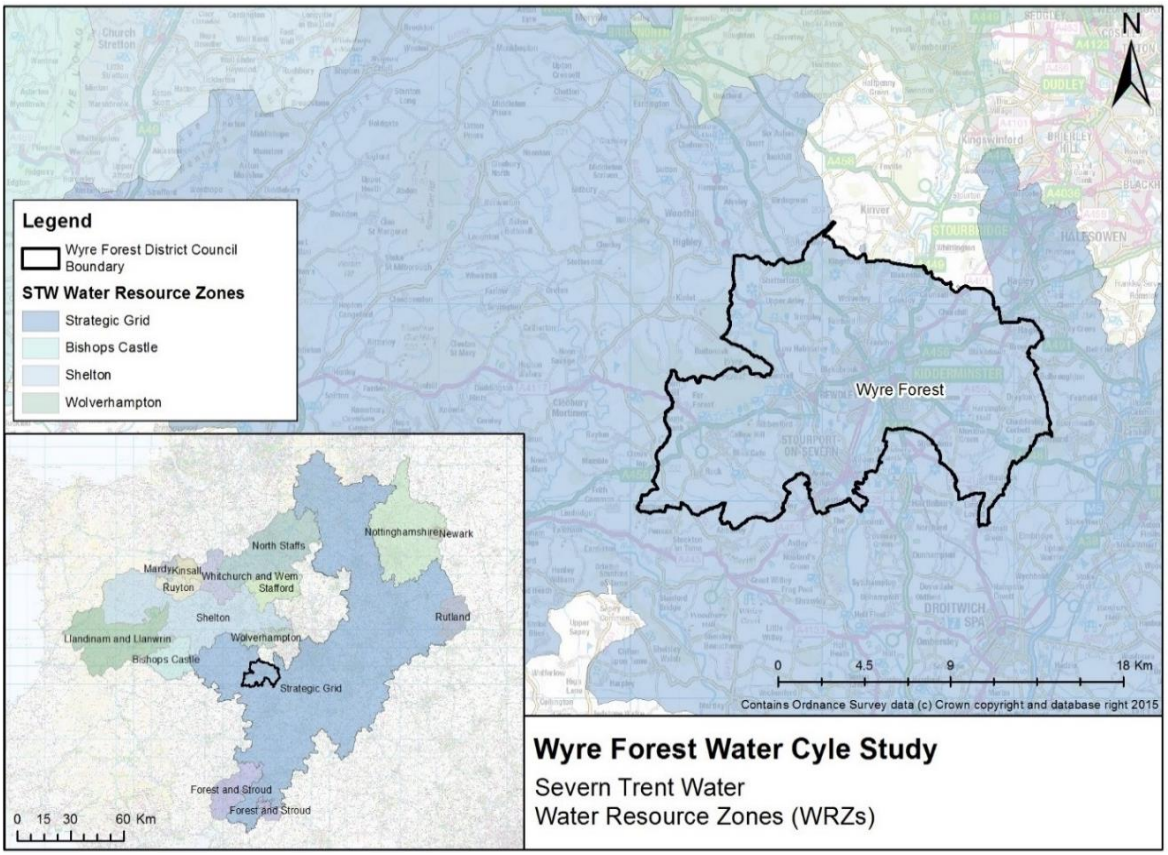
4.3 Water Resource Assessment: Water Resource Management Plans

When new development within a District is planned, it is important to ensure that there are adequate water resources in the area to cover the increase in demand without the risk of shortages in the future or during periods of high water demand.

The aim of this assessment is to determine whether the housing numbers proposed by the WFDC exceed the number that Severn Trent Water have considered whilst planning for the future water demand. It is important that this is assessed so that actions can be implemented and resources planned to overcome possible future water shortages.

This water resources assessment has been carried out using two approaches; initially by reviewing the Water Resource Management Plans (WRMPs) of Severn Trent Water, and secondly by providing the water company with growth scenarios for each settlement, allowing them to assess each settlement and the housing yields proposed.

Figure 4-3: Water Supply Company Boundaries Across the Wyre Forest District Area



4.3.1 Methodology

Severn Trent Water's Water Resource Management Plan (WRMP)[24] was reviewed and attention was mainly focussed upon:

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

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

Adopted WRMP has planned for the increase in demand.	Insufficient evidence in adopted WRMP to confirm that the planned increase in demand can be met.	Adopted WRMP does not take into consideration the planned increase in demand. Additional water resources may be required.

4.3.2 Data Collection

The datasets used to assess the water resource capacity were:

- Site locations in GIS format (provided by WFDC)
- Site details including location, proposed use and housing yields (provided by WFDC)
- Water company and water resource zone boundaries (provided by STWL)
- Water Resource Management Plan (provided by STWL)

4.3.3 Results

Severn Trent Water is responsible for supplying the Wyre Forest District with water. For the purposes of water resources planning, the supply area is divided into 15 Water Resource Zones (WRZ) which vary greatly in scale and have unique water resource concerns. The entire Wyre Forest District and all the proposed development sites are located within the Strategic Grid WRZ, the largest resource zone which supplies the majority of Severn Trent Waters customers.

Figure 4-3 shows the location and size of the Strategic Grid WRZ in relation to the other resource zones within the STWL area and the positioning of the Wyre Forest District within the strategic grid.

Severn Trent Water's Final Water Resources Management Plan 2014[25] was reviewed. The overview of the proposed strategy showed that STWL aims to reduce the overall demand for water across all 15 of its WRZs and make the best use of the existing water resources through a more flexible and sustainable supply system. To achieve that, the water company aims to:

- Reduce waste by reducing leakage by around 6% by 2020,
- Reduce the demand for water by working with customers to improve their water efficiency,
- Increase the efficiency, flexibility and resilience of water resources by utilising water trading,
- Expand existing water resources and develop new water resources when required,
- Utilise proactive catchment management measures to protect sustainable sources of drinking water supply from pollution risks.

Severn Trent Water's Key Points for the Strategic Grid WRZ

The Strategic Grid WRZ is likely to require significant investment in order to reduce environmentally unsustainable abstractions and to meet the longer term challenge of the impacts of climate change.

The largest challenge faced by the Strategic Grid is the impact of Natural Resources Wales' Review of Consents on the River Wye required by the Habitats Directive. This would result in a loss of deployable output of up to 75 Ml/d. Further abstraction licence reductions will lead to a further 5 Ml/d loss of deployable output. However, it is expected that this loss of deployable output can be accommodated before 2020. A summary of the Strategic Grid strategy can be seen in Table 4-4.

24 Severn Trent Water Limited (2014) Final Water Resources Management Plan 2014. Accessed online at https://www.severntrent.com/future/future-plans-and-strategy/water-resources-management-plan on 01/07/2016

25 Severn Trent Water (2014) Final Water Resources Management Plan 2014. Accessed online at: https://www.severntrent.com/future/plans-and-strategy/water-resources-management-plan on 06/07/2017

Table 4-4: Summary of Strategic Grid Water Management Strategy 2015 - 2040

Delivery Period	Scheme Description	Assumed Benefit
AMP6 2015-2020	Reduce leakage by 19Ml/d. Reduce demand by 5Ml/d through additional water efficiency activity Increase Uckington output in the Shelton zone to facilitate Upper Worfe flow augmentation which will be re-abstracted into the Strategic Grid zone from the River Severn.	19Ml/d 5Ml/d Maintain service levels
AMP7 2020-2025	Reduce leakage by 3Ml/d. Trimpley-Worcestershire groundwater conjunctive use. Whitacre aquifer storage and recovery, Phase 2. Draycote reservoir 6% expansion. Bromsgrove groundwater licence transfer. Upper and Lower Worfe flow augmentation	3Ml/d 15Ml/d 10Ml/d 7.5Ml/d 17Ml/d 30Ml/d
AMP8 2025-2030	Reduce leakage by 1.9Ml/d.	1.9Ml/d
AMP9 2030-2035	Reduce leakage by 3.7Ml/d.	3.7Ml/d
AMP10 2035-2040	Reduce leakage by 0.3Ml/d.	0.3Ml/d

Population and household growth:

For the base year 2012/13, the number of properties within the supply area were based on STWLs billing system TARGET. Property records were then linked to WRZs using their postcodes. These figures were used to forecast property numbers for each year to 2040. Forecasts for population growth and therefore housing yields are based on the 2011 population projections from the Office for National Statistics (ONS). The household growth estimates used in the 2014 WRMP26 for the strategic grid area shown in Table 4-5.

Table 4-5: STWL WRMP Household Growth Estimates for the Strategic Grid WRZ

Component	2015-2019	2020-2024	2025-2029	2030-2034	2035-2039	Total
Strategic Grid New Build Properties	67,850	63,380	74,370	76,250	77,600	**359,450**

The Strategic Grid WRZ is comprised of 26 full local authorities and 13 local authorities that are located on the periphery of the WRZ and are therefore partially covered. To provide a comparison using the latest household projections for each relevant local authority, the Department for Communities and Local Government's (DCLG's) February 2015 estimates for household growth were collated for the Strategic Grid supply area. For those districts partially covered, the percentage of the current population of each local authority within the WRZ was applied. Table 4-6 shows the 2015 DCLG housing projections for the local authorities within the Strategic Grid.

26 Severn Trent Water Limited (2013) Strategic Grid fWRMP Data Tables. Accessed via https://www.severntrent.com/content/ConMediaFile/1718 on 18/07/2016

Table 4-6: DCLG 2015 Household Projections in the STWL Strategic Grid WRZ

Local Planning Authority	Est. % pop. within WRZ		2015-2019	2020-2024	2025-2029	2030-2034	2035-2039	Total
Wyre Forest	**100%**		**1,070**	**1,399**	**1,315**	**1,178**	**815**	**5,777**
Erewash	100%		1,620	1,989	1,788	1,683	1,268	8,348
North East Derbyshire	100%		985	1,316	1,165	972	603	5,041
Amber Valley	100%		1,599	1,992	1,777	1,571	1,017	7,956
Derbyshire Dales	100%		922	1,192	1,143	984	627	4,868
Chesterfield	100%		842	1,164	978	898	595	4,477
Gloucester	100%		2,487	3,023	2,783	2,721	2,050	13,064
Cheltenham	100%		1888	2,428	2275	2296	1783	10,670
Hinckley and Bosworth	100%		1,465	1,857	1,762	1,597	1,024	7,705
Melton	100%		749	901	809	713	506	3,678
Harborough	100%		1,701	1,994	1,839	1,662	1,149	8,345
Blaby	100%		1,048	1,327	1,215	1,134	758	5,482
Charnwood	100%		3349	3770	3877	3780	2638	17,414
Oadby and Wigston	100%		36	227	442	466	338	1,509
Rugby	100%		1868	2425	2247	2189	1700	10,429
Warwick	100%		2186	3013	2946	2879	2123	13,147
Stratford-On-Avon	100%		1885	2463	2270	2060	1405	10,083
Nuneaton and Bedworth	100%		1805	2318	2136	2011	1538	9,808
Malvern Hills	100%		785	1073	1159	1097	727	4,841
Wychavon	100%		1164	1542	1525	1394	898	6,523
Worcester	100%		1470	1868	1616	1367	1002	7,323
Redditch	100%		868	1090	975	800	464	4,197
Coventry	100%		7722	9194	9210	9165	6988	42,279
Solihull	100%		2181	3060	3225	3193	2417	14,076
Derby	100%		3813	4814	4639	4656	3449	21,371
Leicester	100%		4693	5709	5879	6052	4411	26,744
High Peak	50%	Total	1,221	1,496	1,340	1,166	726	5,949
		WRZ	610	748	670	583	363	2,975
South Derbyshire	60%	Total	2,223	2,568	2,375	2,158	1,480	10,804
		WRZ	1,334	1,541	1,425	1,295	888	6,482
Bolsover	50%	Total	943	1,141	980	827	592	4,483
		WRZ	471	570	490	413	296	2,242
Forest of Dean	10%	Total	1,062	1,358	1,215	1,038	664	5,337
		WRZ	106	136	122	104	66	534
Stroud	60%	Total	1,814	2,333	2,237	2,044	1,422	9,850
		WRZ	1,088	1,400	1,342	1,226	853	5,910
Tewkesbury	95%	Total	1,666	2,006	1,882	1,733	1,233	8,520
		WRZ	1,583	1,906	1,788	1,646	1,171	8,094

Local Planning Authority	Est. % pop. within WRZ		2015-2019	2020-2024	2025-2029	2030-2034	2035-2039	Total
North West Leicestershire	90%	Total	1,057	1,353	1,309	1,193	824	5,736
		WRZ	951	1,218	1,178	1,074	742	5,162
Rushcliffe	10%	Total	1,836	2,209	2,181	2,001	1,393	9,620
		WRZ	184	221	218	200	139	962
North Warwickshire	85%	Total	600	865	851	744	503	3,563
		WRZ	510	735	723	632	428	3,029
Birmingham	80%	Total	16,449	21,680	22,536	21,801	16,884	99,350
		WRZ	13,159	17,344	18,029	17,441	13,507	79,480
Bromsgrove	85%	Total	1,130	1,405	1,500	1,416	957	6,408
		WRZ	960	1,194	1,275	1,204	813	5,447
Dudley	30.00%	Total	2,466	3,160	3,204	2,924	2,259	14,013
		WRZ	740	948	961	877	678	4,204
Shropshire	20%	Total	4,413	5,064	4,530	3,786	2,331	20,124
		WRZ	883	1,013	906	757	466	4,025
TOTAL			**72,781**	**92,122**	**90,122**	**85,971**	**62,704**	**403,700**

The comparison shows that Severn Trent Water forecast a housing yield of **359,450** between 2015 and 2039 in the Strategic Grid. The latest DCLG household growth estimates forecast a value of **403,700**. This is an 11% increase on the housing yield used in the 2014 WRMP and may require some further investigation.

4.3.4 Conclusions

All settlements and sites within the Wyre Forest District are supplied by Severn Trent Water and are located within the Strategic Grid WRZ. Severn Trent Waters WRMP demonstrates the pressures on water resources across the water company's supply area due to the impacts of population increases, resource uncertainty, climate change and the need to reduce abstractions to reduce the impacts on the natural environment.

There is an 11% disparity between the predicted housing growth allowed for in the Severn Trent Water WRMP and the latest DCLG household growth estimates. The difference between these figures will require some review as the STWL WRMP is planning for a growth rate below what is predicted by the DCLG.

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

4.3.5 Recommendations

Table 4-7: Water Resources Assessment Recommendations

Action	Responsibility	Timescale
Review population and housing growth forecasts within Severn Trent Water Strategic Grid WRZ	Severn Trent Water, WFDC	ASAP
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.	Severn Trent Water	Ongoing
Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	WFDC and other LPAs in STWL's Strategic Grid WRZ	Ongoing
Use planning policy to require the 110l/person/day water consumption target permitted by National Planning Policy Guidance in water-stressed areas.	WFDC	In draft Local Plan
Water companies should advise WFDC of any strategic water resource infrastructure developments within the District, where these may require safeguarding of land to prevent other type of development occurring. However, at present, no major potential schemes have been identified within the WFDC boundary.	STWL, WFDC	In draft Local Plan

4.4 Water Resource Assessment: Water Supply Infrastructure Assessment

Increases in water demand adds pressure to the existing water supply infrastructure. 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 infrastructure, smaller scale assets which convey water around settlements to customers. This assessment is focussed on the supply infrastructure. It is expected that developers should fund assessments and the modelling of the distribution systems to assess requirements for local capacity upgrades.

4.4.1 Methodology

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

4.4.2 Data collection

The datasets used to assess the water supply and distribution capacity are the following:

- Site locations in GIS format and housing numbers (provided by WFDC)
- Population equivalent using an occupancy rate of 2.35p/h (calculated by STWL)
- Water demand by multiplying the population equivalent by 136l/p/d (calculated by STWL)

4.4.3 Results

The following response was received Severn Trent Water was received in October 2016:

"Severn Trent Water's Water Resource Management Plan already considers the supply and demand issues for the next 25 years. However, the water supply network is a highly pressurized system and detailed modelling is required to determine whether additional demand will require capacity upgrades. As development occurs within the Wyre Forest District, Severn Trent Water modelling teams can then undertake detailed modelling but because infrastructural improvements and local reinforcements can usually be undertaken within 18 months to 2 years, water capacity is not expected to be a constraint to development."

4.4.4 Conclusions

Severn Trent Water responded to the request to assess the impacts of development on water supply infrastructure. STWL confirmed that water supply is not expected to be a constraint to development. Therefore, as development occurs within the District, detailed modelling of water supply infrastructure will allow any infrastructural upgrades to be completed without restricting the timing, location or scale of the planned development.

4.4.5 Recommendations

Table 4-8: Water Supply Infrastructure Assessment Recommendations

Action	Responsibility	Timescale
Where necessary, identify the scale of likely solutions to accommodate growth, and build the likely timescale for delivering the infrastructure into the overall delivery programme to identify key dates and potential programme constraints	STWL	Ongoing
Undertake technical studies to understand options to provide sufficient bulk and local transfer capacity and communicate results with WFDC.	STWL	Ongoing
Developers seek early consultation with Severn Trent Water in order to ensure adequate time is available to provide local distribution main upgrades to meet additional demand.	STWL	Ongoing

5 Wastewater Collection and Treatment

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

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

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

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

5.1 Sewerage System Capacity Assessment

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

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

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

5.1.1 Methodology

Severn Trent Water Limited were provided with the list of sites and the potential housing numbers. Using this information, STWL assessed each site using the range of datasets they hold.

STWL used the following red / amber / green traffic light definition to score each site:

Capacity available to serve the proposed growth	Infrastructure and/or treatment upgrades required to serve proposed growth or diversion of assets may be required	Major constraints to provision of infrastructure and/or treatment to serve proposed growth

5.1.2 Data Collection

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

- Site locations in GIS format (provided by WFDC)
- Potential housing numbers for each site (provided by WFDC)
- Populations equivalent using an occupancy rate of 2.3p/h (calculated by STWL)
- Water demand by multiplying the population equivalent by 136l/p/d (calculated by STWL)

5.1.3 Results

STWL provided a spreadsheet containing sewerage comments in terms of known network constraints, assumed connectivity and surface water disposal. STWL also provided an overall RAG score for the potential impact of the developments on sewerage infrastructure. The results of the sewerage system capacity assessment are presented in Table 5-1.

The following information was received alongside the assessment provided by STWL:

- The purpose of these desktop based assessments are to indicate where proposed development may have a detrimental impact on the performance of the existing public sewerage network taking into account the size of the development proposals.
- These are desktop assessments using readily available information and have not been subjected to detailed hydraulic modelling.
- For most new development the surface water should be managed sustainably through use of a SuDS the additional foul only flows will have a negligible impact on existing sewer performance but where there are pre-existing capacity constraints additional capacity improvements may be required.
- Where subsequent detailed modelling indicates capacity improvements are required such work will be phased to align with development occupancy with capacity improvement works funded by Severn Trent Water.
- "However, whilst Severn Trent have a duty to provide additional capacity to accommodate planned development, we also have a requirement to manage our assets efficiently to minimise our customers' bills. Consequently, to avoid potential inefficient investment we generally do not provided additional capacity until there is certainty that the development is due to commence. Where development proposals are likely to require additional capacity upgrades to accommodate new development flows it is highly recommended that potential developers contact Severn Trent as early as possible to confirm flow rates and intended connection points. This will ensure provision of additional capacity can be planned into our investment programme to ensure development is not delayed".

Case study: Catchment-scale discharge permits in the Bristol Avon

Issues

With a strong farming heritage in the upper catchment and a growing urban population in the lower catchment, the Bristol Avon receives high concentrations of phosphate pollution. The dominance of this nutrient has caused excessive growth of plants in the river, or 'eutrophication', which starves other aquatic organisms of oxygen.

Despite progress since 2000 in reducing levels of phosphorous in the River Avon, the catchment continues to fall short of the European Union Water Framework Directive water quality requirements.

One of the key sources of the pollutant is water leaving sewer treatment works, which has led to the requirement of higher phosphorous removal for all 24 Wessex Water sewage works within the Bristol Avon catchment.

Traditionally, each of the sewage works would require a separate discharge permit from the Environment Agency, as well as significant upfront capital investment. Delivering this scale of development and capital cost was unfeasible for Wessex Water, and would have resulted in a significant rise in customer bill prices, as well as a greater risk of the Bristol Avon catchment failing to meet its water quality targets.

Partnership initiative on a catchment scale

In order to find a more sustainable solution for the Bristol Avon, Wessex Water collaborated with the Environment Agency to develop a catchment-level discharge permit. The new permit provides the water company with a higher chance of meeting tight discharge standards, and ensuring that water quality targets in the catchment are met. It also requires less upfront investment, which maintains the affordability of customer bills.

This joined-up approach to achieving multiple benefits continues throughout the catchment, with the Bristol Avon Catchment Partnership working actively since 2012 to manage the river environment and water resources alongside stakeholder interests.

Next Steps

The catchment permit initiative is a first for the water industry. It will be trialled over a period of four years, starting in January 2017. Based on its success, similar schemes may be adopted elsewhere in the UK.

Table 5-1: Severn Trent Water Sewerage System Infrastructure Assessment

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
AKR/1	Bridge Street Basins	A and B	Kidderminster	There are no known network constraints downstream of these sites.	These sites drain by gravity to Moorhall lane pumping station and then to Worcester Road terminal pumping station.	Surface water could be managed using nearby watercourse or SUDS	Green
AKR/15	Rectory Lane, Areley Kings	B	Kidderminster	There are known hydraulic sewer flooding issues downstream of these developments. The receiving pumping station is also having storage issues. Given the size of these developments hydraulic modelling is required to determine any capacity improvements.	These sites will gravitate to Arley Kings pumping station and then to Worcester Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Amber
AKR/2	Cheapside	A and B	Kidderminster	There are no known network constraints downstream of these sites.	These sites will gravitate to Worcester Road terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
AKR/20	Carpets of Worth, Stourport on Severn	A and B	Kidderminster	There are no known network constraints downstream of these sites.	These sites will gravitate to Worcester Road terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
AKR/7	Swan Hotel and Working Men's Club	A and B	Kidderminster	There are no known network constraints downstream of these sites. However, modelling will be required to confirm the capacity of the CSO.	Sites located in the north east of Stourport and it is assumed they will flow via Vale road CSO and gravitate to the Worcester Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Green
AKR14	Pearl Lane, Areley Kings	B	Kidderminster	There are known hydraulic sewer flooding issues downstream of this developments. The receiving pumping station is also having storage issues. Given the size of this developments hydraulic modelling is required to determine any capacity improvements.	This site will gravitate to Astley Cross pumping station and then to Arley Kings and then to Worcester Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Red
AS/1	Comberton Place	A and B	Kidderminster	There are no known network constraints downstream of these sites	Drains through Comberton road CSO. Will Likely drain to Hoobrook terminal pumping station	Comberton place redevelopment will require existing surface water run-off to be managed sustainably. Efforts will be made to remove any surface water flows currently connected to the foul sewerage system. Surface water should be managed onsite by SUDs.	Green

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
AS/10	Land rear of Spennells / Easter Park	A	Kidderminster	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	These sites are to the east of the existing network. All green belt developments. Likely to drain by gravity to a small pumped catchment and then to Hoobrook terminal pumping station	Surface water should be managed onsite by implementing SUDs	Red
AS/5	Victoria Carpets Sports Ground, Spennells Valley Road, Kidderminster	A and B	Kidderminster	There are known hydraulic sewer flooding issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Will likely drain to Hoobrook terminal pumping station.	Surface water should be managed onsite by implementing SUDs	Green
AS/6	Former Lea Street School Site	A and B	Kidderminster	There are no known network constraints downstream of these sites	Drains through Comberton road CSO. Will Likely drain to Hoobrook terminal pumping station	Comberton place redevelopment will require existing surface water run-off to be managed sustainably. Efforts will be made to remove any surface water flows currently connected to the foul sewerage system. Surface water should be managed onsite by SUDs.	Green
BHS/11	WFDC Depot, Green Street, Kidd	A and B EMP	Kidderminster				Green
BHS/16	Park Lane Canalside	A and B	Kidderminster	There are no known network constraints downstream of these sites	Drains through to Stourport Rd CSO. Will likely drain to Hoobrook terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
BHS/18	County Buildings and Blakebrook School Bewdley Road, Kidderminster	A and B	Kidderminster	There are no known network constraints downstream of this site	Drains through Park Butts Ringway CSO. Will Likely drain to Hoobrook terminal pumping station	Suface water should be managed onsite by implementing SUDs	Green
BHS/2	Bromsgrove Street Area	A and B	Kidderminster	There are no known network constraints downstream of these sites	Drains through Oxford Street/Prospect Hill CSO. Will Likely drain to Hoobrook terminal pumping station	Any redevelopment of this site requires existing surface water run-off to be managed sustainably and every effort made to remove any surface water flows currently connected to the foul sewerage system. Surface water should be managed onsite by SUDs	Green

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
BHS/26	Coopers Arms. Kidderminster	A and B	Kidderminster	There are no known network constraints downstream of this site	Site is to the Western side of the sewerage system and is likely to drain by gravity to a pumped catchment.	Suface water should be managed onsite by implementing SUDs	Green
BR/BE/6	land off Highclere	A and B	Kidderminster	There are known hydraulic sewer flooding capacity issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Site is located to the south of the current sewerage system and drains by gravity to Stourport Road terminal pumping station.	Surface water could be managed using nearby watercourse or SUDS	Amber
BR/RO/1	Clows Top	A and B	N/A		This development sites is located in an area which is not currently served by the public sewerage system.		N/A
BR/RO/21	Alton Nurseries, Bewdley	A and B EMP	Kidderminster	There are known sewer flooding problems downstream of this small development location. Whilst the additional flows generated from 39 dwellings will have a negligible impact on sewer capacity further detailed hydraulic modelling will be required to confirm the extent of any capacity issues but any improvement work is not expected to be significant.	Site is located to the west of Kidderminster. Likely to drain to the existing gravity system	Suface water should be managed onsite by implementing SUDs	Green
BR/RO/26	Land to rear of Walnut Cottage	A and B	Kidderminster	There are no known network constraints downstream of this site	Located in the small Hamlett of Bliss Gate and will connect by gravity to a small pumped catchment	Suface water should be managed onsite by implementing SUDs	Green
BR/RO/4	Land adj Tolland bungalow, Far Forest	A and B	Kidderminster	There are known hydraulic sewer flooding and pumping station capacity issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Drains to Sugars Lane pumping station and then to Mopsons Cross pumping station and on to Stourport Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Amber
BR/RO/6	Land behind Orchard House, Far Forest	A and B	Kidderminster	There are known hydraulic sewer flooding and pumping station capacity issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Drains to Sugars Lane pumping station and then to Mopsons Cross pumping station and on to Stourport Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Amber

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
BR/RO/7	New Road, Far Forest (South)	A and B	Kidderminster	There are known hydraulic sewer flooding and pumping station capacity issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Drains to Sugars Lane pumping station and then to Mopsons Cross pumping station and on to Stourport Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Amber
BR/RO/7	New Road, Far Forest (North)	B	Kidderminster	There are known hydraulic sewer flooding and pumping station capacity issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Drains to Sugars Lane pumping station and then to Mopsons Cross pumping station and on to Stourport Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Amber
BW/1	Churchfields Business Park	A and B	Kidderminster	There are no known network constraints downstream of these sites	Passes through to Stourport Rd Syphon CSO (FLOC:16669). Will Likely drain to Hoobrook terminal pumping station	Surface water could be management using nearby watercourse.	Green
BW/2	Limekiln Bridge	A and B	Kidderminster	There are no known network constraints downstream of these sites	Passes through to Stourport Rd Syphon CSO (FLOC:16669). Will Likely drain to Hoobrook terminal pumping station	Surface water could be management using nearby watercourse.	Green
BW/3	Sladen School, Hurcott Road, Kidderminster	A and B	Kidderminster	There are no known network constraints downstream of this site	Located north east of Kidderminster city centre. Drains through Blackwell St island CSO. Will likely drain to Hoobrook terminal pumping station	Suface water should be managed onsite by implementing SUDs	Green
BW/4	Hurcott ADR	A and B	Kidderminster	There are known hydraulic sewer flooding issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Located in north eastern region of Kidderminster. Will likely drain to Hoobrook terminal pumping station. All or part of the sites may need pumping.	Suface water should be managed onsite by implementing SUDs for most of the sites. Hurcott ADR (South) has the potential to drain surface water to nearby water course	Amber

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
BW/6	Yew Tree Inn, Chester Road North, Kidderminster	A and B	Kidderminster	There are no known network constraints downstream of this site	Brownfield sewer located in the centre of Kidderminster. Connection to existing gravity system is assumed.	Any redevelopment of this site requires existing surface water run-off to be managed sustainably and every effort made to remove any surface water flows currently connected to the foul sewerage system. Surface water should be managed onsite by SUDs	Green
FHN/9	78 Mill Street, Kidderminster	A and B	Kidderminster	There are no known network constraints downstream of this site	Brownfield sewer located in the centre of Kidderminster. Connection to existing gravity system is assumed.	Any redevelopment of this site requires existing surface water run-off to be managed sustainably and every effort made to remove any surface water flows currently connected to the foul sewerage system. Surface water should be managed onsite by SUDs	Green
FPH/1	Former British Sugar Settling Ponds, Wilden Lane, Kidd	A EMP	Kidderminster	There are no known network constraints downstream of these sites	Will likely drain to Hoobrook terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
FPH/1	Former British Sugar Settling Ponds, Wilden Lane, Kidd	B	Kidderminster	There are no known network constraints downstream of these sites	Will likely drain to Hoobrook terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
FPH/10	British Sugar Site Phase 2	A and B	Kidderminster	There are no known network constraints downstream of these sites. Subject to detailed hydraulic modelling this development is not expected to have any capacity issues.	Will likely drain to Hoobrook terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
FPH/10	British Sugar - Phase 2 (north)	A and B EMP	Kidderminster	There are no known network constraints downstream of these sites. Subject to detailed hydraulic modelling this development is not expected to have any capacity issues.	Will likely drain to Hoobrook terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
FPH/17	Dowles Road Community Centre	A and B	Kidderminster	There are no known network constraints downstream of these sites	Will likely drain to Hoobrook terminal pumping station	Surface water should be managed onsite by implementing SUDs	Green

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
FPH/18	Naylor's Field	A and B	Kidderminster	There are known sewer flooding problems immediately downstream of this small development location and so subject to detailed hydraulic modelling this development is not expected to have any capacity issues.	Drains through Stourport road and Stourport road syphon CSO. Then will likely drain to Hoobrook pumping station	Surface water should be managed onsite by implementing SUDs	Green
FPH/23	British Sugar Phase 1 plot D	A and B EMP	Kidderminster	There are no known network constraints downstream of this site. Subject to detailed hydraulic modelling this development is not expected to have any capacity issues.	Site is located near the sewage treatment works and is likely to drain by gravity.	Suface water should be managed onsite by implementing SUDs	Green
FPH/24	ROMWIRE	A and B EMP	Kidderminster	This site is situated upstream of a small pumping station with known capacity issues. It is therefore envisaged that capacity improvements will be required to accommodate the additional flows generated from this development. Further modelling work will be required to determine the scope of any capacity improvements.	Site is located South of the sewerage system and is likely to drain by gravity to a small pumped catchment.	Suface water should be managed onsite by implementing SUDs	Amber
FPH/25	Incinerator Site, Stourport Road, Kidderminster	A and B EMP	Kidderminster	There are no known network constraints downstream of this site. Subject to detailed hydraulic modelling this development is not expected to have any capacity issues.	Will likely drain to Hoobrook terminal pumping station. However, the nearest gravity sewer is approximately 500m away and there may be a need to pump all or part of the site.	Surface water could be managed using nearby watercourse or SUDS	Green
FPH/26	Land adj Summerfield, Kidderminster	A and B EMP	Kidderminster	There are no known network constraints downstream of this site.	Greenfield site located to the south of Kidderminster. Likely to drain to the existing gravity system	Suface water should be managed onsite by implementing SUDs	Green
FPH/27	Land at Worcester Road, Kidderminster	A and B EMP	Kidderminster	There are no known network constraints downstream of this site. However, modelling will be required to confirm the capacity of the pumping station	Site is located South of the sewerage system and is likely to drain by gravity to a small pumped catchment.	Suface water should be managed onsite by implementing SUDs	Green
FPH/28	Land at Hoo Brook	A and B EMP	Kidderminster	There are no known network constraints downstream of this site	Site is in the South of the sewerage system and is likely to drain by gravity to a pumped catchment.	Suface water should be managed onsite by implementing SUDs	Green
FPH/6	Oasis Factory, Goldthorn Road, Kidderminster	A and B	Kidderminster	There are no known network constraints downstream of these sites	Drains through Stourport road and Stourport road syphon CSO. Then to Hoobrook pumping station	Surface water should be managed onsite by implementing SUDs	Green

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
FPH/8	Land adj. SDF, Stourport Road, Kidderminster	A and B EMP	Kidderminster	There are no known network constraints downstream of this site. Subject to detailed hydraulic modelling this development is not expected to have any capacity issues.	Site is located near the sewage treatment works and is likely to drain by gravity.	Suface water should be managed onsite by implementing SUDs	Green
FPH/9	Foley Drive	A and B EMP	Kidderminster	There are no known network constraints downstream of this site	Site is located near the sewage treatment works and is likely to drain by gravity.	Suface water should be managed onsite by implementing SUDs	Green
LI/1	Ceramaspeed	A and B EMP	Kidderminster	This site is situated upstream of a small pumping station with known capacity issues. It is therefore envisaged that capacity improvements will be required to accommodate the additional flows generated from this development. Further modelling work will be required to determine the scope of any capacity improvements.	Site is located South of the sewerage system and is likely to drain by gravity to a small pumped catchment.	Suface water should be managed onsite by implementing SUDs	Amber
LI/2	Wyre Forest Golf Club	A and B	Kidderminster	There are known sewer flooding problems immediately downstream of these developments locations and so subject to detailed hydraulic modelling these developments are not expected to have any capacity issues.	Sites located in the north of Stourport and it is assumed they will flow via gravity to the Worcester Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Green
LI/5	Land at Burlish Crossing	B	Kidderminster	There are known highway flooding downstream of these developments and a CSO. Given the size of these developments detailed hydraulic modelling is required to determine if any capacity improvements are required to the network and CSO.	Sites located in the north east of Stourport and it is assumed they will flow via Vale road CSO and gravitate to the Worcester Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Amber
LI/6/7/8	Land at Lickhill Road North (Bradley Paddocks and Field adj 17 Lickhill Road)	A and B	Kidderminster	There are no known network constraints downstream of these sites	These sites drain by gravity to Moorhall lane pumping station and then to Worcester Road terminal pumping station.	Surface water could be managed using nearby watercourse or SUDS	Green
MI/1	County Buildings, Stourport	A and B	Kidderminster	There are no known network constraints downstream of these sites. However, modelling will be required to confirm the capacity of the CSO.	Sites located in the north east of Stourport and it is assumed they will flow via Vale road CSO and gravitate to the Worcester Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Green

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
MI/18	North of Wilden Lane Industrial Estate	A and B EMP	Kidderminster	There are no known network constraints downstream of this site	Site is located South of the sewerage system and is likely to drain by gravity to a small pumped catchment.	Surface water could be managed using nearby watercourse or SUDS	Green
MI/26	Ratio Park, Finepoint	A and B EMP	Kidderminster	This site is situated upstream of a small pumping station with known capacity issues. Modelling work will be required to determine the scope of any capacity improvements.	Site is located South of the sewerage system and is likely to drain by gravity to a small pumped catchment.	Suface water should be managed onsite by implementing SUDs	Green
MI/28	35 Mitton Street, Stourport	A and B	Kidderminster	There are no known network constraints downstream of this site	Brownfield sewer located in the centre of Stourport-on-Severn. Connection to existing gravity system is assumed.	Any redevelopment of this site requires existing surface water run-off to be managed sustainably and every effort made to remove any surface water flows currently connected to the foul sewerage system. Surface water should be managed onsite by SUDs	Green
MI/29	Chichester Caravans, Vale Road, Stourport on Severn	A and B	Kidderminster	There are no known network constraints downstream of this site	Brownfield sewer located in the centre of Stourport-on-Severn. Connection to existing gravity system is assumed.	Any redevelopment of this site requires existing surface water run-off to be managed sustainably and every effort made to remove any surface water flows currently connected to the foul sewerage system. Surface water should be managed onsite by SUDs	Green
MI/3	Parsons Chain	A and B	Kidderminster	There are no known network constraints downstream of these sites.	These sites will gravitate to Worcester Road terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
MI/5	Baldwin Road	A and B	Kidderminster	There are no known network constraints downstream of these sites.	Sites located in the centre of Stourport and it is assumed they will flow via gravity to Worcester road terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
MI/6	Steatite Way, Stourport	A and B	Kidderminster	There are known highway flooding downstream of these developments and a CSO. Given the size of these developments detailed hydraulic modelling is required to determine if any capacity improvements are required to the network and CSO.	Sites located in the north east of Stourport and it is assumed they will flow via Vale road CSO and gravitate to the Worcester Road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Amber

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
MI17	Land Rear of Stourport Manor	B	Kidderminster	There are no known network constraints downstream of these sites.	These sites will gravitate to Worcester Road terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
OC/11	Stourminster School, Comberton Road, Kidderminster	A and B	Kidderminster	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	Could Drains to either Captain Spennels or Kittiwake Drive pumping station. All or part of the sites may need pumping. Will likely drain to Hoobrook terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
OC/12	Comberton Lodge Nursery, Comberton Road, Kidderminster	A and B	Kidderminster	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	Could Drains to either Captain Spennels or Kittiwake Drive pumping station. All or part of the sites may need pumping. Will likely drain to Hoobrook terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Green
OC/13	Land at Stone Hill (South)	A	Kidderminster	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	This site is at the head of the existing network. It is a greenfield development. All or part of the sites may need pumping. Will likely drain to Hoobrook terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Red
OC/13	Land at Stone Hill (North)	A and B	Kidderminster	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	This site is at the head of the existing network. It is a greenfield development. All or part of the sites may need pumping. Will likely drain to Hoobrook terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Red
OC/4	Land rear of Baldwin Road, Kidderminster	A and B	Kidderminster	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	These sites are to the east of the existing network. With the exception of Cavalier PH are all green belt developments. All or part of the sites may need pumping. Will Likely drain to Hoobrook terminal pumping station	Surface water should be managed onsite by implementing SUDs	Amber

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
OC/4	Land rear of Baldwin Road (East part of site), Kidderminster	B	Kidderminster	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	These sites are to the east of the existing network. With the exception of Cavalier PH are all green belt developments. All or part of the sites may need pumping. Will Likely drain to Hoobrook terminal pumping station	Surface water should be managed onsite by implementing SUDs	Amber
OC/5	Land Adjacent to Hodge Hill Farm	A and B	Kidderminster	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	These sites are to the east of the existing network. With the exception of Cavalier PH are all green belt developments. All or part of the sites may need pumping. Will Likely drain to Hoobrook terminal pumping station	Surface water should be managed onsite by implementing SUDs	Amber
WA/BE/1	Stourport Road (triangle), Bewdley	A and B	Kidderminster	There are no known network constraints downstream of this sites	Site is located to the south east of the sewerage network on Stourport road. There is a small pumping station adjacent to the site, but it appears that it may need to be pumped. The site will then gravitate to the Stourport road terminal pumping station	Surface water should be managed onsite by implementing SUDs	Green
WA/BE/3	Catchems End, Bewdley	B	Kidderminster	There are no known network constraints downstream of this sites	Site is located to the eastern extremities of Bewdley. It appears that all or part of the site will require pumping to the gravity sewer in Kidderminster road	Surface water could be managed using nearby watercourse or SUDS	Green

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
WA/BE/5	Land South of Habberley Road, Bewdley (The Gardens)	A and B	Kidderminster	There are no known network constraints downstream of this sites	Site is located to the eastern extremities of Bewdley. It appears that all or part of the site will require pumping to the gravity sewer in Kidderminster road	Surface water could be managed using nearby watercourse or SUDS	Green
WA/UA/4	Allotments, Upper Arley	A and B	Upper Arley	There are no known network constraints downstream of these sites. However due to the distance and size of the existing rural network, modelling will be required to confirm the capacity.	Sites will gravitate to the treatment works via the existing sewers	Surface water could be managed using nearby watercourse or SUDS	Green
WFR/CB/7	Land Off Birmingham Road, Kidderminster (south)	A and B EMP	Kidderminster	This site is situated upstream of a small pumping station with known capacity issues. It is therefore envisaged that capacity improvements will be required to accommodate the additional flows generated from this development. Further modelling work will be required to determine the scope of any capacity improvements.	Sites will gravitate to the treatment works via the existing sewers	Surface water should be managed onsite by implementing SUDs	Amber
WFR/ST/1	Captains and The Lodge, Bromsgrove Road, Stone	A and B	Kidderminster	This site is situated upstream of a small pumping station with known capacity issues. It is therefore envisaged that capacity improvements will be required to accommodate the additional flows generated from this development. Further modelling work will be required to determine the scope of any capacity improvements.	Site is located South East of the sewerage system and is likely to drain by gravity to a small pumped catchment.	Surface water could be managed using nearby watercourse or SUDS	Amber
WFR/ST/2	Land off Stanklyn Lane	A	Kidderminster	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	These sites are to the east of the existing network. All green belt developments. Likely to drain by gravity to a small pumped catchment and then to Hoobrook terminal pumping station	Surface water should be managed onsite by implementing SUDs	Red

Ref	Site Name	Option	WwTW	Known network constraints	Assumed connectivity	Surface water disposal	RAG
WFR/ST/3	Land North of Stone Hill,	A and B	Kidderminster	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	Likely to drain by gravity to a small pumped catchment. All or part of the sites may need pumping. Will then likely drain to Hoobrook terminal pumping station	Surface water could be managed using nearby watercourse or SUDS	Red-Amber
WFR/WC/15	Lea Castle Hospital	A and B	Kidderminster	Due to development size relative to the existing system capacity improvements are envisaged to ensure additional development flows do not increase sewer flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	Site is located South East of the sewerage system and is likely to drain by gravity to a small pumped catchment.	Surface water should be managed onsite by implementing SUDs	Amber
WFR/WC/15	Part of Lea Castle, Kidderminster	A and B EMP	Kidderminster	Due to development size relative to the existing system capacity improvements are envisaged to ensure additional development flows do not increase sewer flood risk or unsatisfactory PS or CSO performance. Modelling will be required	Site is located South East of the sewerage system and is likely to drain by gravity to a small pumped catchment.	Surface water should be managed onsite by implementing SUDs	Amber
WFR/WC/16	Land south of Wolverley Road and Park Gate Lane, Kidderminster	A	Kidderminster	There are known hydraulic sewer flooding issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Located in north eastern region of Kidderminster. Will likely drain to Hoobrook terminal pumping station. All or part of the sites may need pumping.	Suface water should be managed onsite by implementing SUDs for most of the sites. Hurcott ADR (South) has the potential to drain surface water to nearby water course	Amber
WFR/WC/18	Sion Hill School	A and B	Kidderminster	This site is situated upstream of a small pumping station with known capacity issues. It is therefore envisaged that capacity improvements will be required to accommodate the additional flows generated from this development. Further modelling work will be required to determine the scope.	Site is located North of the sewerage system. Flows from this site is assumed to flow via gravity to the existing system.	Suface water should be managed onsite by implementing SUDs	Amber
WFR/WC/32	East of Lea Castle	B	Kidderminster	Due to development size relative to the existing system capacity improvements are envisaged to ensure additional development flows do not increase sewer flood risk or unsatisfactory PS or CSO performance. Modelling will be required to assess the scope of any capacity improvements.	Site is located South East of the sewerage system and is likely to drain by gravity to a small pumped catchment.	Surface water should be managed onsite by implementing SUDs	Amber

5.1.4 Conclusions

The STWL assessment of sewerage system capacity in the Wyre Forest District has brought the following conclusions:

- 49 of the 77 sites within the Wyre Forest District are assessed as having sufficient capacity available to serve the proposed growth. Further modelling may be required in the future to ensure there is capacity on a site by site basis.
- 21 of the 77 sites would require infrastructure and/or treatment upgrades in order to serve the proposed growth, a diversion of assets may also be required to provide adequate sewerage capacity for the development of these sites.
- 5 of the 77 sites assessed would face major constraints to the provision of infrastructure and/treatment to serve the levels of growth proposed. 2 of proposed sites are not currently served by the public sewage system.
- Of the 21 sites assessed as having an Amber RAG score (infrastructure and/or treatment upgrades required), 15 are in both Options A and B, 5 are in Option B only and only 1 is in Option A only. Of the 6 sites assessed as having a Red RAG score (major constraints to growth), 2 are in both Option A and B, 3 are in Option A only and 1 is in Option B only. Of the sites 5 assessed as having a Red RAG score (major constraints to growth), 2 are in Option A and B, 3 are in Option A and only 1 is in Option B.
- Severn Trent Waters preferred method of surface water disposal is using a sustainable drainage system (SuDS) with connection to the sewer system seen as the last option.
- Sewerage Undertakers have a duty under Section 94 of the Water Industry Act 1991 to provide sewerage and treat wastewater arising from new domestic development. Except where strategic upgrades are required to serve very large or multiple developments, infrastructure upgrades are usually only implemented following an application for a connection, adoption or requisition from a developer. Early developer engagement with water companies is therefore essential to ensure that sewerage capacity can be provided without delaying development.
- Once a final development option for the Wyre Forest District has been chosen, the combined effect of the planned development should be given further consideration.

5.1.5 Recommendations

Table 5-2: Sewerage infrastructure assessment recommendations

Action	Responsibility	Timescale
Take into account sewerage infrastructure constraints in phasing development in partnership with Severn Trent Water.	WFDC	Ongoing
Severn Trent Water to continue to assess growth demands as part of their wastewater asset planning activities and feedback to WFDC where concerns arise.	STWL	Ongoing
Severn Trent Water and developers will be expected to work closely and early on in the planning promotion process to develop an outline Drainage Strategy for the site. The Outline Drainage strategy should set out sufficient detail to determine the likely timescales for the delivery of the infrastructure and the likely costs of the infrastructure. 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.	STWL and Developers	Ongoing
Developers will be expected to show that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to sewer seen as the last option.	Developers	Ongoing

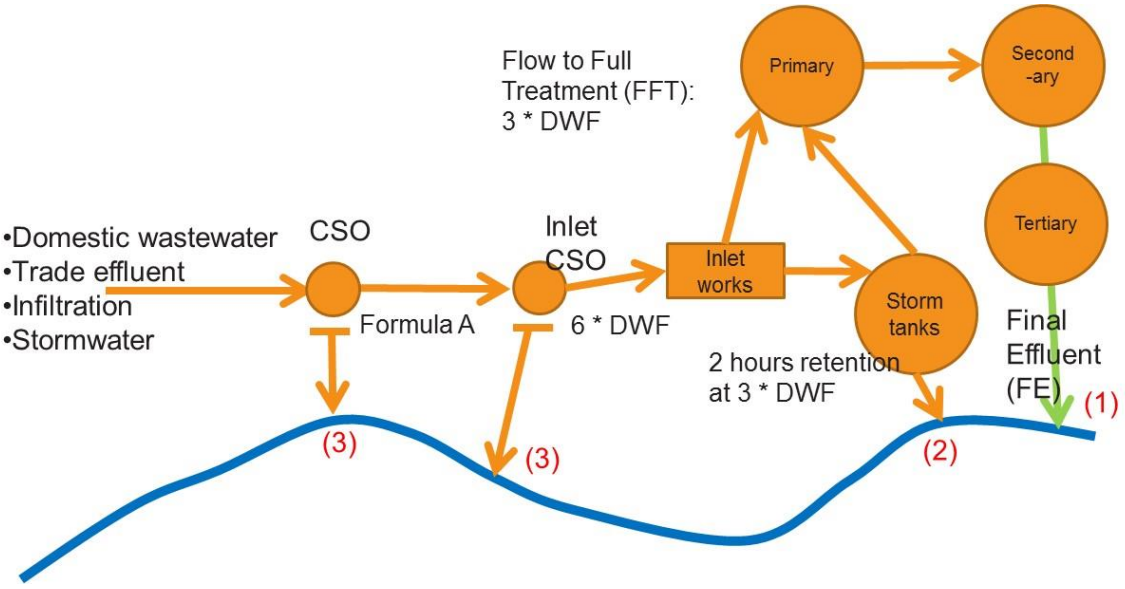
5.2 Wastewater Treatment Works Flow and Quality Consent Assessment

5.2.1 Introduction

The EA 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 5-1 summarises the different types of wastewater releases that might take place, although precise details vary from works to works depending on the design.

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

Figure 5-1: Overview of typical combined sewerage system and sewage treatment works discharges



Environmental permits are used alongside water quality limits as a means of controlling the pollutant load discharged from a sewage treatment work 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 sewage treatment work 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 (NH_4). These are determined by the Environment Agency with the objective of ensuring that the receiving watercourse is not prevented from meeting its environmental objectives, in particular that 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 of flow consents.

Case study: Severn Trent Environmental Protection Scheme And Metaldehyde Scheme

Introduction

As part of Severn Trent Waters £21 million plan for the period 2015 to 2020, the STW Catchment Team have launched two new farmer support schemes to aid farmers in reducing the impact of agricultural practises on the water environment, especially in terms of water quality.

Aims and Objectives

By working in partnership with farmers, Severn Trent Water aims to:

- Improve drinking water quality
- Reduce the need for additional water treatment
- Provide wider environmental benefits within its catchments, this includes benefits in terms of biodiversity and a reduction in flood risk

Severn Trent Environmental Protection Scheme

The Severn Trent Environmental Protection Scheme (STEPS) provides grants of up to £5000 to farmers for infrastructural improvements and changes to land management in Severn Trent Water target areas. The aim of STEPS is to protect and improve watercourses and the environment by supporting improvements which are above and beyond good agricultural practise. A key area that STEPS targets is the pollution of watercourses from diffuse pollution from agriculture, there is also scope for farmers to be funded for innovative methods where there is a clear water quality benefit.

Metaldehyde Schemes

The second scheme put in place by Severn Trent Water for 2015 to 2020 is the Metaldehyde Scheme, this scheme aims to support farmers in managing levels of metaldehyde in drinking water.

The common slug pesticide, metaldehyde, has historically entered Severn Trent Water's fresh water supply. Slugs can cause significant crop damage, and managing their populations through the use of metaldehyde allows farmers to produce consistent yields of wheat and oilseed rape. The pesticide causes no harm to humans, however as it cannot be removed during the conventional water treatment processes, it still enters rivers and reservoirs.

With the tight regulations of the EU Water Framework Directive requiring treated water to contain less than 0.1 micrograms per litre of any pesticide, the use of metaldehyde has prevented Severn Trent Water's supply region from meeting these standards. Defra are considering various approaches to deal with issues around metaldehyde, approaches include restricted usage and bans, unless levels can be appropriately managed.

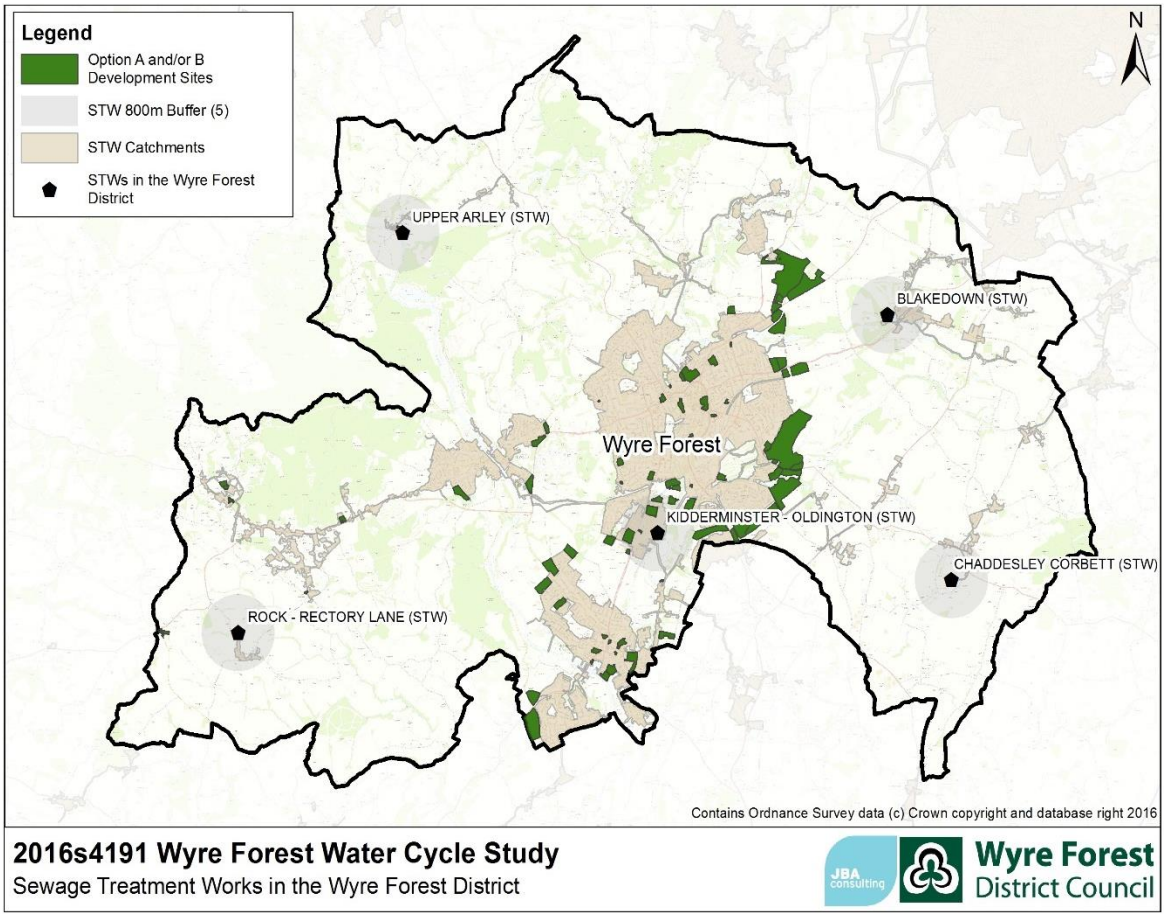
5.2.2 Methodology

Severn Trent Water were provided with the list of settlements and the potential/equivalent housing numbers for each site. They were invited to provide an assessment of the receiving WwTW and provide any additional comments.

An assessment of the WwTW capacity was carried out by calculating the extra flow reaching each WwTW. The extra flow was calculated by STWL by:

- Grouping the settlements that are served by the same WwTW using the sewerage drainage area boundaries shown in Figure 5-2;
- Multiplying the population equivalent using an occupancy rate of 2.35p/h (calculated by STWL);
- Multiplying the population equivalent for the water demand of 136 l/p/d (calculated by STWL)

Figure 5-2: Sewerage drainage boundaries and proposed sites within the Wyre Forest District



5.2.3 Data Collection

The datasets used to assess the WwTW capacity are the following:

- List of settlements (provided by WFDC)
- Planned housing numbers for each proposed site (provided by WFDC)
- WwTW locations and sewerage drainage area boundaries (used by STWL). Most growth would be seen in the Kidderminster WwTW catchment and some in the Upper Arley WwTW catchment
- Occupancy rate, water demand and the percentage of water that reach the WwTW (used by STWL)

5.2.4 Results

Severn Trent Water Limited has provided comments on each WwTW within the Wyre Forest District where there is proposed growth, these are shown in Table 5-3.

Table 5-3: Severn Trent Water comments on WwTWs within the Wyre Forest District

Wastewater Treatment Works	Severn Trent Water Comments
Kidderminster (26,874 PE)	Hydraulic capacity (headroom) is currently c.20,000 PE but this level of growth is likely to require treatment capacity upgrades. There is a potential scheme in AMP7 and AMP6 capital maintenance improvements have been deferred to AMP7, to be delivered between 2020 and 2025.
Upper Arley (61 PE)	Upper Arley is a small works where this amount of growth would likely create a requirement for additional investment due to DWF breach. No current plans for investment in AMP6 or AMP7.

5.2.5 Conclusions

Severn Trent Water provided an assessment of the available headroom in the flow consents at each WwTW within the Wyre Forest District to and their likely ability to accommodate additional wastewater flows from the proposed development sites.

Kidderminster and Upper Arley WwTWs are both assessed as requiring additional investment and treatment capacity upgrades.

5.2.6 Recommendations

Table 5-4: Wastewater treatment works capacity actions

Action	Responsibility	Timescale
Take into account the available WwTW capacity in phasing of development going to the same WwTW.	WFDC	Ongoing
Provide annual updates to STWL of projected housing growth.	WFDC	Annually
STWL to assess growth demands as part of their wastewater asset planning activities and feedback to WFDC where concerns arise.	STWL	Ongoing
STWL, WFDC and the EA will work closely to ensure the timely delivery of any necessary WwTW upgrades.	STWL, EA and WFDC	Ongoing
Where the water quality assessment indicates that permits may require a higher standard of treatment than currently achievable using Best Available Technologies, the EA should provide clear advice WFDC and STWL on: • the approach to permitting, • requirements for any additional studies (for example additional water quality sampling, modelling, macro-invertebrate surveys etc.), • advise where water quality constraints may limit the potential for growth.	EA	Ongoing

5.3 Wastewater Treatment Works Odour Assessment

5.3.1 Introduction

In locations where proposed new development encroaches upon an existing Wastewater Treatment Works (WwTW), odour from the WwTW may become a cause of nuisance and complaints for future residents. Managing odour at WwTWs can add considerate capital and operational costs, particularly when retro-fit to existing WwTWs.

National Planning Policy Guidance recommends that plan-makers considering whether new development is appropriate near to sites used (or proposed) for water and wastewater infrastructure, in particular due to the risk of odour impacting on residents and requiring additional investment to address.

5.3.2 Methodology

It is generally the case for water companies that a new development may need an odour assessment if the site is close to a WwTW and is encroaching closer to the WwTW than existing urbanised areas.

A GIS assessment was carried out by JBA Consulting to identify sites that are less than 800m from a WwTW and sites that are encroaching closer to the WwTW than the existing urbanised areas. If there are no existing houses it is more likely that an odour assessment is needed. Another important consideration is the location of the site in respect to the WwTW because the predominant winds blow from the south west.

A Red / Amber / Green assessment was applied:

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

5.3.3 Data Collection

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

- Sites location in GIS format (provided by the WFDC)
- WwTW locations (provided by STWL)
- OS Mapping

5.3.4 Results

The odour screening assessment identified 10 sites out of 77 that were located within an 800m radius of an existing WwTW. The sites of Allotments, Upper Areley (WA/UA/4), Former British Sugar Settling Ponds, Wilden Lane (FPH/1) and Land adj Summerfield, Kidderminster (FPH/26) also encroached on Upper Arley WwTW and Kidderminster WwTWs respectively. Encroachment is identified where sites are closer to the WwTW than the existing surrounding urbanised areas. Table 5-5 lists those sites where it is recommended that an odour assessment is undertaken.

Table 5-5: Sites where an odour assessment is recommended

Site Name	Site Ref	Option	WwTW	Distance from WwTW (m)	Encroachment?
Allotments, Upper Arley	WA/UA/4	A and B	Upper Arley	100	Yes
Ratio Park, Finepoint	MI/26	A and B EMP	Kidd	700	No
Romwire	FPH/24	A and B EMP	Kidd	500	No
Foley Drive	FPH/9	A and B EMP	Kidd	350	No
Land adj. SDF, Stourport Road, Kidderminster	FPH/8	A and B EMP	Kidd	350	No
British Sugar Phase 1 plot D	FPH/23	A and B EMP	Kidd	650	No
Incinerator Site, Stourport Road, Kidderminster	FPH/25	A and B EMP	Kidd	675	No
Former British Sugar Settling Ponds, Wilden Lane, Kidderminster	FPH/1	A EMP	Kidd	725	Yes
Land adj Summerfield, Kidderminster	FPH/26	A and B EMP	Kidd	775	Yes

5.3.5 Conclusions

The odour screening assessment concluded that 9 sites may be at risk of experiencing odour due to their proximity to the existing WwTWs (see Table 5-5). It is recommended that odour impact assessments are undertaken as part of the planning application process for the identified sites. All other proposed sites are unlikely to be affected by WwTW odours.

Table 5-6: Wastewater treatment odour summary

Site Name	Site Ref	Assessment
Allotments, Upper Arley	WA/UA/4	Site location is such that an odour impact assessment is recommended as part of the planning application process
Ratio Park, Finepoint	MI/26	
Romwire	FPH/24	
Foley Drive	FPH/9	
Land adj. SDF, Stourport Road, Kidderminster	FPH/8	
British Sugar Phase 1 plot D	FPH/23	
Incinerator Site, Stourport Road, Kidderminster	FPH/25	
Former British Sugar Settling Ponds, Wilden Lane, Kidderminster	FPH/1	
Land adj Summerfield, Kidderminster	FPH/26	
All Other Sites		Site is unlikely to be impacted by odour from WwTW

5.3.6 Recommendations

Table 5-7: Wastewater treatment odour actions

Action	Responsibility	Timescale
Consider odour risk in selection of site allocations.	WFDC	Ongoing
Carry out an odour assessment for 'amber' assessed sites.	Site promoters	Ongoing

6 Water Quality Assessment

6.1.1 Introduction

The increased discharge of effluent due to an increase in the population served by a WwTW may impact on the quality of the receiving water. The Water Framework Directive (WFD) does not allow a watercourse to deteriorate from its current class (either water body or element class).

It is Environment Agency (EA) policy to model the impact of increasing effluent volumes on the receiving watercourse. Where the scale of development is such that a deterioration is predicted, a new Environmental Permit (EP) may be required for the WwTW to improve the quality of the final effluent, so that the extra pollution load will not result in a deterioration in the water quality of the watercourse. This is known as a “no deterioration” or “load standstill".

EA guidance states that a 10% deterioration of the receiving watercourse can be allowed in some circumstances as long as this does not cause a class deterioration to occur. If a watercourse fails the 'good status' target, further investigations are needed in order to define the reasons for not achieving good status/potential (RNAG) and which actions could be implemented to reach such status. Where a watercourse is already classed as Poor, the worst classification, then no further deterioration is permitted.

For each future development site, the receiving WwTW was identified. This analysis identified 2 WwTWs with the Wyre Forest District to assess the risk of potential future capacity issues and impacts on the receiving watercourses as a result of growth. The following WwTWs have been assessed in terms of water quality:

- Kidderminster
- Upper Arley

The full water quality assessment in included in Appendix A. This section provides a summary of the methodology, key results, conclusions and recommendations.

6.1.2 Methodology

The contaminants assessed at each WwTW were Biochemical Oxygen Demand (BOD), Ammonia (NH_4) and Phosphorus (P).

The selected approach was to use the EA River Quality Planning (RQP) tool in conjunction with their recommended guidance documents: "Water Quality Planning: no deterioration and the Water Framework Directive" and "Horizontal guidance". This uses a steady state Monte Carlo Mass Balance approach where flows and water quality are sampled from modelled distributions based on data where available.

The data required to run the RQP software were:

Upstream river data:

- Mean flow
- 95% exceedance flow
- Mean for each contaminants
- Standard deviation for each contaminant

Discharge data:

- Mean flow
- Standard deviation for the flow
- Mean for each contaminants
- Standard deviation for each contaminant

River quality target data:

- No deterioration target
- 'Good status' target

The above data inputs should be based on observations where available. In the absence of observed data EA guidance requires that:

If the observed WwTW s discharge flow and quality data were not available, the following values were used:

- Flow mean: 1.25*DWF.
- Flow Standard Deviation: 1/3*mean.
- Quality data: permit values or assumed values.

If observed river flows were not available these were obtained from an existing model or a low-flows estimation software.

If observed water quality data were not available these were obtained from an existing model or a neighbouring catchment with similar characteristics, or the mid-point of the WFD class.

The observed data available for WwTWs discharges were analysed in the statistical tool, Aardvark and the values reported as "less than" (these are samples where was not possible to get an accurate value and a limit value was assigned) were multiplied for 0.5 as agreed with the EA.

6.1.3 Data Collection

The datasets required to assess the discharge permits were the following:

- River flow data (received from the EA)
- River quality data (received from the EA)
- Current WwTW permits (received from the EA)
- RQP tool (received from the EA)
- Existing water quality models: GIS SIMCAT model (received from the EA)
- Current river classifications (received from the EA)
- 2015 WFD river target for BOD, P and NH_4 (received from the EA)
- EA guidance documents (received from the EA)
- WwTW flow and quality data (received from the EA)
- WwTW discharge information (location, receiving watercourse, etc.) (received from the EA)

6.1.4 Results

Table 6-1 summarises the modelling results for each WwTW assessed for passing or failing the following targets:

- 'Good status'
- 'No 10% deterioration'
- 'No class deterioration'

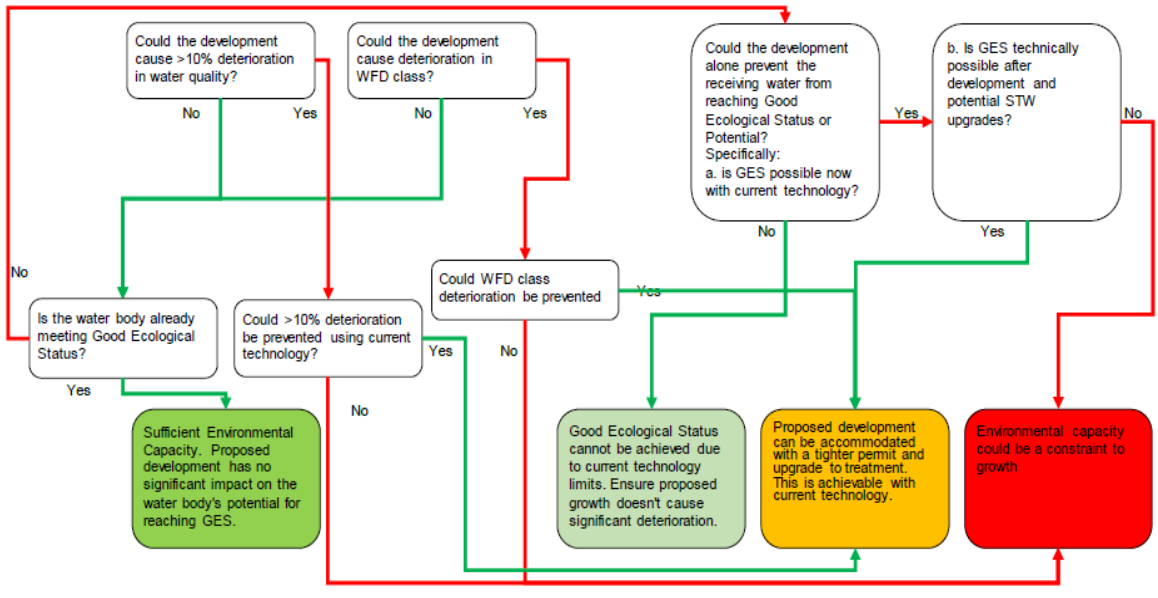
Table 6-1: RQP results summaries for passing or failing targets of: 'Good Status', 'No >10% Deterioration' and 'No Class Deterioration'.

Watercourse (WwTW discharging into it)	Scenario	Achieves 'Good status' target?			Achieves 'No > 10% deterioration' target?			Achieves No 'Class deterioration' target?		
		BOD	NH4	P	BOD	NH4	P	BOD	NH4	P
Key		Achieves good status			No deterioration			No class deterioration		
		NA			Up to 10% deterioration			NA		
		Fails good status			More than 10% deterioration			Class deterioration		
River Stour (Kidderminster) OPTION A	Present day	yes	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	Future growth	yes	yes	no	0.0%	5%	5%	yes	yes	yes
River Stour (Kidderminster) OPTION B	Present day	yes	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	Future growth	yes	yes	no	0.0%	5%	5%	yes	yes	yes
River Severn (Upper Arley)	Present day	yes	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	Future growth	yes	yes	no	0.0%	0%	0%	yes	yes	yes

6.1.5 Best Available Technology (BAT) Assessment

Where river targets failures were predicted, the models were rerun to test whether application of Best Available Technology (BAT) treatment processes could prevent deterioration and enable the receiving watercourse to meet the physio-chemical requirements to achieve Good Ecological Status or Potential. This assessment process has recently been set out in a guidance document by the Environment Agency's West Thames Area[27]. Whilst this document has no national status it provides a useful summary of how to interpret the results of the water quality assessment. This guidance is summarised in the flow chart below:

Figure 6-1: Water Quality Assessment Flow Chart



27 Environment Agency West Thames Area (2015) Water Cycle Study Guidance and Requirements - West Thames Area.

The EA advised that the following permit values are achievable using best available technology (BAT), and that these values should be used for modelling all WwTWs potential capacity irrespective of the existing treatment technology and size of the works:

- BOD (95%ile) = 5mg/l
- Ammonia (95%ile) = 1mg/l
- Phosphorus (mean) = 0.5mg/l

This assessment does not take in consideration if it is feasible to upgrade each existing WwTW to such technology due to constraints of cost, timing, space, carbon cost etc. Table 6-2 shows a summary of the conclusions using BAT.

Table 6-2: Summary of results assuming best available technology is applied.

Watercourse (WwTW)	Greater than 10% deteriorations in water quality?	Deterioration in WFD class of any element	Could the development prevent the water body from reaching GES?
Key	See Figure 6-1		
River Stour (Kidderminster) Option A	Predicted deterioration is less than 10%. No WwTW upgrade is required	No class deterioration is predicted. No WwTW upgrade is required.	Good Ecological Status (GES) cannot be achieved due to technological limits. GES could only be achieved through addressing upstream sources of P. Therefore, growth alone would not prevent the watercourse from reaching GES.
River Stour (Kidderminster) Option B	Predicted deterioration is less than 10%. No WwTW upgrade is required	No class deterioration is predicted. No WwTW upgrade is required.	Good Ecological Status (GES) cannot be achieved due to technological limits. GES could only be achieved through addressing upstream sources of P. Therefore, growth alone would not prevent the watercourse from reaching GES.
River Severn (Upper Arley)	Predicted deterioration is less than 10%. No WwTW upgrade is required	No class deterioration is predicted. No WwTW upgrade is required.	Good Ecological Status (GES) could only be achieved by upstream water quality improvements alone. Improved P treatment is therefore not expected to be required.

6.1.6 Priority Substances and Other EU-Level Dangerous Substances

As well as the general chemical and physicochemical water quality elements (BOD, NH_4, P etc.) addressed above, a watercourse can fail to meet GES due to exceeding permissible concentrations of hazardous substances. Currently 33 substances are defined as hazardous or priority hazardous substances, with others under review. Such substances may pose risks both to humans (when contained in drinking water) and to aquatic life and animals feeding in aquatic life. These substances are managed by a range of different approaches, including EU and international bans on manufacturing and use, targeted bans, selection of safer alternatives and end-of-pipe treatment solutions. There is considerable concern within the UK water industry that regulation of these substances by setting permit values which require their removal at wastewater treatment works will place a huge cost burden upon the industry and its customers, and that this approach would be out of keeping with the "polluter pays principle".

Within this WCS we consider how the planning system might be used to manage priority substances:

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

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

6.1.7 Managing the Quality of Surface Water Runoff

The impact of diffuse pollution from urban surface water runoff is also considered a significant factor in compromising groundwater and receiving water body standards that are required by the EU Water Framework Directive. The Source > Pathway > Receptor model provides a useful way to assess the potential impacts of a development on the environment. The impact of housing and employment development on receiving watercourses is dependent on:

- The sources of pollutants deriving from different catchment surfaces (e.g. roads and roofs) and different land uses (housing, minor and major roads, commercial, industrial etc).
- The pathways by which polluted water may enter the environment, for example can surface water drain freely into an aquifer or is the site underlain by impermeable clay.
- The sensitivity of receptors, i.e. the receiving groundwater and receiving water. In particular are they designated, for example groundwater Source Protection Zones (SPZs) or Special Areas of Conservation (SACs).

It is therefore important to manage the quality of surface water runoff; this is best done on a site by site basis to ensure that discharges meet the water quality requirements of relevant legislation. The utilisation of the most appropriate sustainable drainage systems (SuDS) on sites will reduce the impact of surface water of water quality in the Wyre Forest District, the design of SuDS should be in accordance with appropriate guidance, including the Ciria SuDS Manual (C753)[28]. Previous national Pollution Prevention Guidance has now been withdrawn by the EA, but provides useful information where oil interceptors are required, and is still available online.[29]

No further analysis of the impact of surface water runoff on water quality will be undertaken as part of this study.

28 Ciria (2015) SuDS Manual (C753) Accessed online at: http://www.ciria.org/Memberships/The_SuDs_Manual_C753_Chapters.aspx

29 Environment Alliance (2006) Pollution prevention guidelines: Use and design of oil separators in surface water drainage systems: PPG 3. Withdrawn 14/12/2015. Accessed online at https://www.gov.uk/government/publications/choosing-and-using-oil-separators-ppg3-prevent-pollution on 23/02/2017.

6.1.8 Conclusions

The following conclusions are drawn from this water quality impact assessment:

- The proposed growth is not predicted to lead to any class deteriorations, or deteriorations of quality of greater than 10% for any determinand.
- For Phosphate all receiving watercourses at all WwTWs fail their WFD good target for the present-day situation:
    - At Kidderminster, even assuming that upstream water quality were to be improved to Good classification, it would not be possible to achieve Good due to the limitations of current P removal technology. Therefore the constraining factor is current technology, not the proposed growth.
    - National trials of new techniques to treat P are due to report in 2017, and it is anticipated that these may allow future treatment to an annual mean of 0.1mg/l. Water companies and the Environment Agency will be considering how, when and where such treatment technologies and permit conditions with be applied over the next AMP period of 2020 to 2025.
    - At Upper Arley, Good status for phosphorous could only be achieved by f addressing upstream sources of P. Upper Arley WwTW makes only a small contribution to the total P load in the River Severn, and therefore it is not anticipated that additional treatment would be required as a result of the proposed growth.
- For BOD all watercourses achieve their target.
- For NH_4 all watercourses achieve their target.
- There is no headroom in the current permit for Kidderminster WwTW, investment in this WwTW may be required to ensure that the no deterioration targets are met as the current limits are not set at BAT. This is not likely to be a barrier to growth, but future investment may be required. If growth processes (where there is insufficient WwTW headroom) prior to the installation of BAT limits (or before upstream sources of P) are addressed. The Environment Agency would apply a no deterioration approach.
- The key constraints to achieving Good Ecological Status downstream of Kidderminster and Upper Arley are the limits of current technology rather than the impacts of the planned growth. Therefore, environmental capacity is not considered to be a constraint upon growth.
- This Water Cycle Study focusses on the impacts of increased effluent discharge from Wastewater Treatment Works as a result of the proposed future growth. Other potential impacts of development on surface and groundwater should be considered at the site scale, and where necessary mitigation measures used to ensure that water bodies are protected.
- Alongside treated effluent discharges from Wastewater Treatment Works, diffuse urban pollution and runoff can also compromise water quality standards in receiving waterbodies, leading to the failure of EU Water Framework Directive Targets. It is widely considered that the increased use of Sustainable Drainage Systems (SuDS) should be applied to protect and improve water quality[30].
- Runoff discharged from any site should be of an acceptable water quality, this will protect the quality of the receiving surface waters and groundwaters. SuDS can be designed to treat and clean surface water runoff so that the receiving environment is protected, while at the same time providing conveyance, storage and infiltration services to reduce flood risk, morphological watercourse changes and water resources protection and delivering amenity and biodiversity benefits. Guidance on development and SuDS within the District is available from the Wyre Forest District Council[31].

30 Ciria (2015) The SuDS Manual (C753). Accessed online at http://www.ciria.org/Memberships/The_SuDs_Manual_C753_Chapters.aspx on 12/12/2016

31 Wyre Forest District Council, Planning, Health and Environment Division. A Planning Guide to Sustainable Drainage Systems. Accessed online at http://www.wyreforestdc.gov.uk/media/116986/AL18_Sustainable_Drainage.pdf on 12/12/2016

6.1.9 Recommendations

Table 6-3: Water quality assessment recommendations

Action	Responsibility	Timescale
Where possible, take into account the water quality constraints when allocating and phasing development sites.	WFDC	Ongoing
Where the water quality assessment indicates that permits may require a higher standard of treatment than currently achievable using Best Available Technologies, provide clear advice to sewerage undertakers and WFDC on: • the approach to permitting, • requirements for any additional studies (for example additional water quality sampling, modelling, macro-invertebrate surveys etc.), • advise WFDC where water quality constraints may limit the potential for growth	EA	Ongoing
Where necessary, identify the scale of likely solutions to accommodate growth, and build the likely timescale for delivering the infrastructure into the overall delivery programme to identify key dates and potential programme constraints.	STWL	Annually
Developers will be expected to show that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to sewer seen as the last option.	Developers	Ongoing

7 Flood Risk Management

7.1 Flood Risk Assessment

7.1.1 Introduction

This section considers the flood risk to each of the potential development sites within the Wyre Forest District. It also considers the potential risk of increased flood flows in watercourses due to additional sewage effluent flows.

7.1.2 Methodology

The WFDC Draft Strategic Flood Risk Assessment (SFRA) is the main source of information regarding the flood risk to the settlements and the proposed strategic site allocations. This document is comprehensive in covering the fluvial flood risk as well as flooding from other sources at a settlement level so there is no need to reproduce the contents within the WCS.

However, as flood risk is site specific and the flood maps produced by the Environment Agency are subject to periodic review, a simple Red / Amber / Green assessment has been prepared from the most up to date Flood Zone and updated Flood Map for Surface Water information.

A Red / Amber / Green assessment was applied as follows:

River or Sea Flood Risk	Pluvial Flood Risk
>95% of the site is within Flood Zone 1 (Low Risk). Very unlikely to be a constraint to development as long as access to the site can be maintained	<5% of site is within the updated Flood Map for Surface Water 1 in 1000-year outline (Low Risk). Potential surface water drainage constraints are extremely low.
90-95% of the site is within Flood Zone 1 (Low Risk). Unlikely to be a constraint to development as long as access to the site can be maintained	5-20% of site is within the updated Flood Map for Surface Water 1 in 1000-year outline (Low Risk). Potential surface water drainage constraints are very low to low.
<90% of the site is within Flood Zone 1 (Low Risk). Some constraint is likely for example housing numbers may be reduced	>20% of site is within the updated Flood Map for Surface Water 1 in 1000-year outline (Low Risk). Potential surface water drainage constraints are medium to very high

7.1.3 Data Collection

The datasets used to assess the risk of flooding have been provided by the EA through environment.data.gov.uk and are listed below:

- Flood Zone 2 and 3
- Updated Flood Map for Surface Water (uFMfSW)

7.1.4 Results

The percentage of each site within Flood Zone 1 and uFMfSW 1 in 1000-year outline is included within the final summary of results in Table 7-1. For fluvial and tidal flood risk the higher the percentage the lower the risk of flooding, whilst the opposite applies for pluvial flood risk. Table 7-1 below also shows the R/A/G score for fluvial flood risk and pluvial flood risk for a selection of the 77 proposed development sites within the District.

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Table 7-1: Flood risk assessment for the proposed development sites

Site Ref	Site Name	Option	Fluvial Flood Zones				Updated Flood Map for Surface Water			Historic Flood Map	Reservoir Inundation Mapping
			FZ3b	FZ3a	FZ2	FZ1	30yr	100yr	1,000yr		
AKR/1	Bridge Street Basins	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
AKR/14	Pearl Lane, Areley Kings	B	0%	0%	0%	100%	1%	1%	2%	0%	0%
AKR/15	Rectory Lane, Areley Kings	B	0%	0%	0%	100%	0%	0%	0%	0%	0%
AKR/2	Cheapside	A and B	22%	0%	28%	50%	0%	0%	0%	47%	34%
AKR/20	Carpets of Worth, Stourport on Severn	A and B	11%	0%	0%	89%	0%	1%	13%	1%	19%
AKR/7	Swan Hotel and Working Men's Club	A and B	0%	0%	0%	100%	0%	0%	4%	0%	0%
AS/1	Comberton Place	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
AS/10	Land rear of Spennells / Easter Park	A	0%	0%	0%	100%	0%	0%	0%	0%	0%
AS/5	Victoria Carpets Sports Ground, Spennells Valley Road, Kidderminster	A and B	0%	0%	98%	2%	17%	40%	87%	0%	75%
AS/6	Former Lea Street School Site	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
BHS/11	WFDC Depot, Green Street, Kidderminster	A and B EMP	0%	0%	98%	2%	12%	24%	46%	0%	100%
BHS/16	Park Lane Canalside	A and B	0%	2%	26%	72%	0%	2%	8%	0%	20%
BHS/18	County Buildings and Blakebrook School Bewdley Road, Kidderminster	A and B	0%	0%	0%	100%	0%	3%	18%	0%	0%
BHS/2	Bromsgrove Street Area	A and B	0%	0%	0%	100%	0%	1%	3%	0%	0%
BHS/26	Coopers Arms. Kidderminster	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
BR/BE/6	Land off Highclere	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
BR/RO/1	Clows Top	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
BR/RO/21	Alton Nurseries, Bewdley	A and B EMP	0%	0%	0%	100%	0%	0%	1%	0%	0%
BR/RO/26	Land to rear of Walnut Cottage	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
BR/RO/4	Land adj Tolland bungalow, Far Forest	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%

Site Ref	Site Name	Option	Fluvial Flood Zones				Updated Flood Map for Surface Water			Historic Flood Map	Reservoir Inundation Mapping
			FZ3b	FZ3a	FZ2	FZ1	30yr	100yr	1,000yr		
BR/RO/6	Land behind Orchard House, Far Forest	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
BR/RO/7a	New Road, Far Forest (South)	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
BR/RO/7b	New Road, Far Forest (North)	B	0%	0%	0%	100%	0%	0%	4%	0%	0%
BW/1	Churchfields Business Park	A and B	0%	0%	0%	100%	0%	0%	3%	0%	0%
BW/2	Limekiln Bridge	A and B	0%	0%	0%	100%	0%	0%	8%	0%	32%
BW/3	Sladen School, Hurcott Road, Kidderminster	A and B	0%	0%	0%	100%	0%	0%	1%	0%	0%
BW/4	Hurcott ADR	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
BW/6	Yew Tree Inn, Chester Road North, Kidderminster	A and B	0%	0%	0%	100%	0%	1%	6%	0%	0%
FHN/9	78 Mill Street, Kidderminster	A and B	0%	5%	95%	0%	0%	0%	2%	0%	76%
FPH/10a	British Sugar Site Phase 2	A and B	0%	0%	0%	100%	0%	0%	1%	0%	0%
FPH/10b	British Sugar - Phase 2 (north)	A and B EMP	0%	0%	0%	100%	0%	0%	2%	0%	0%
FPH/17	Dowles Road Community Centre	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
FPH/18	Naylor's Field	A and B	0%	0%	0%	100%	0%	0%	2%	0%	0%
FPH/1a	Former British Sugar Settling Ponds, Wilden Lane, Kidderminster	A EMP	0%	0%	4%	96%	0%	0%	1%	0%	17%
FPH/1b	Former British Sugar Settling Ponds, Wilden Lane, Kidderminster	B	0%	0%	4%	96%	0%	0%	1%	0%	17%
FPH/23	British Sugar Phase 1 plot D	A and B EMP	0%	0%	0%	100%	0%	0%	1%	0%	0%
FPH/24	Romwire	A and B EMP	0%	0%	0%	100%	0%	2%	25%	0%	0%
FPH/25	Incinerator Site, Stourport Road, Kidderminster	A and B EMP	0%	0%	0%	100%	0%	0%	0%	0%	2%
FPH/26	Land adj Summerfield, Kidderminster	A and B EMP	0%	0%	0%	100%	0%	1%	6%	0%	0%
FPH/27	Land at Worcester Road, Kidderminster	A and B EMP	0%	0%	0%	100%	0%	0%	2%	0%	0%

Site Ref	Site Name	Option	Fluvial Flood Zones				Updated Flood Map for Surface Water			Historic Flood Map	Reservoir Inundation Mapping
			FZ3b	FZ3a	FZ2	FZ1	30yr	100yr	1,000yr		
FPH/28	Land at Hoo Brook	A and B EMP	0%	0%	0%	100%	0%	0%	0%	0%	0%
FPH/6	Oasis Factory, Goldthorn Road, Kidderminster	A and B	0%	0%	0%	100%	1%	2%	7%	0%	0%
FPH/8	Land adj. SDF, Stourport Road, Kidderminster	A and B EMP	0%	0%	0%	100%	0%	0%	17%	0%	0%
FPH/9	Foley Drive	A and B EMP	0%	0%	0%	100%	0%	4%	16%	0%	0%
LI/1	Ceramaspeed	A and B EMP	0%	0%	0%	100%	1%	1%	5%	0%	0%
LI/2	Wyre Forest Golf Club	A and B	0%	0%	0%	100%	1%	2%	3%	0%	0%
LI/5	Land at Burlish Crossing	B	0%	0%	0%	100%	3%	5%	18%	0%	0%
LI/6/7/8	Land at Lickhill Road North (Bradley Paddocks and Field adj 17 Lickhill Road)	A and B	0%	0%	0%	100%	1%	2%	8%	0%	0%
MI/1	County Buildings, Stourport	A and B	0%	0%	0%	100%	0%	1%	6%	0%	0%
MI/17	Land Rear of Stourport Manor	B	0%	0%	0%	100%	0%	0%	0%	0%	0%
MI/18	North of Wilden Lane Industrial Estate	A and B EMP	5%	0%	0%	95%	0%	0%	0%	0%	10%
MI/26	Ratio Park, Finepoint	A and B EMP	0%	0%	0%	100%	0%	2%	28%	0%	0%
MI/28	35 Mitton Street, Stourport	A and B	23%	0%	0%	77%	1%	2%	6%	1%	44%
MI/29	Chichester Caravans, Vale Road, Stourport on Severn	A and B	0%	0%	0%	100%	5%	9%	23%	0%	0%
MI/3	Parsons Chain	A and B	0%	0%	0%	100%	0%	1%	4%	0%	0%
MI/5	Baldwin Road	A and B	13%	31%	1%	55%	1%	1%	11%	0%	41%
MI/6	Steatite Way, Stourport	A and B	0%	0%	0%	100%	0%	0%	6%	0%	0%
OC/11	Stourminster School, Comberton Road, Kidderminster	A and B	0%	0%	0%	100%	2%	13%	19%	0%	0%
OC/12	Comberton Lodge Nursery, Comberton Road, Kidderminster	A and B	19%	4%	11%	66%	1%	2%	5%	0%	54%
OC/13a	Land at Stone Hill (South)	A	0%	0%	0%	100%	0%	1%	1%	0%	0%
OC/13b	Land at Stone Hill (North)	A and B	4%	0%	2%	94%	1%	2%	6%	0%	7%

Site Ref	Site Name	Option	Fluvial Flood Zones				Updated Flood Map for Surface Water			Historic Flood Map	Reservoir Inundation Mapping
			FZ3b	FZ3a	FZ2	FZ1	30yr	100yr	1,000yr		
OC/4a	Land rear of Baldwin Road, Kidderminster	A and B	0%	0%	0%	100%	0%	0%	0%	0%	0%
OC/4b	Land rear of Baldwin Road (East part of site), Kidderminster	B	0%	0%	0%	100%	0%	0%	0%	0%	0%
OC/5	Land adjacent Hodge Hill Farm	A and B	0%	0%	0%	100%	0%	1%	5%	0%	0%
WA/BE/1	Stourport Road (triangle), Bewdley	A and B	0%	3%	2%	95%	0%	0%	1%	0%	0%
WA/BE/3	Catchems End, Bewdley	B	0%	0%	0%	100%	0%	1%	2%	0%	0%
WA/BE/5	Land South of Habberley Road, Bewdley (The Gardens)	A and B	0%	0%	0%	100%	0%	24%	70%	0%	0%
WA/UA/4	Allotments, Upper Arley	A and B	0%	0%	0%	100%	1%	1%	3%	0%	0%
WFR/CB/7	Land Off Birmingham Road, Kidderminster (south)	A and B EMP	0%	0%	0%	100%	0%	1%	4%	0%	0%
WFR/ST/1	Captains and The Lodge, Bromsgrove Road, Stone	A and B	0%	0%	0%	100%	1%	2%	5%	0%	0%
WFR/ST/2	Land off Stanklyn Lane	A	0%	0%	0%	100%	0%	0%	0%	0%	0%
WFR/ST/3	Land North of Stone Hill,	A and B	1%	0%	0%	99%	0%	0%	0%	0%	0%
WFR/WC/15a	Lea Castle Hospital	A and B	0%	0%	0%	100%	0%	0%	1%	0%	0%
WFR/WC/15b	Part of Lea Castle, Kidderminster	A and B EMP	0%	0%	0%	100%	0%	0%	0%	0%	0%
WFR/WC/16	Land south of Wolverley Road and Park Gate Lane, Kidderminster	A	0%	0%	0%	100%	0%	0%	0%	0%	0%
WFR/WC/18	Sion Hill School	A and B	0%	0%	0%	100%	0%	0%	9%	0%	0%
WFR/WC/32	East of Lea Castle	B	0%	0%	0%	100%	0%	0%	0%	0%	0%

7.1.5 Conclusions

The percentage of each proposed development site at risk from fluvial and surface water flooding was calculated. Flood risk within the Wyre Forest District is explored in greater detail within the WFDC Draft Strategic Flood Risk Assessment (SFRA), this document should be referred to for detailed flood risk assessments within the District.

7.2 Assessment of Additional Flood Risk from Increased WwTW Discharges

7.2.1 Introduction

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

7.2.2 Methodology

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

- Identify which WwTWs will be receiving additional flows;
- Calculate the increase in DWF as a result of planned growth;
- Identify the point of discharge of these WwTWs;
- At each outfall point, use the FEH CD-ROM v3.0 to extract the catchment descriptors;
- Use ReFH[32] method to calculate peak 1 in 30 (Q30) and 1 in 100 (Q100) year fluvial flows;
- Calculate the additional foul flow as a percentage of the Q30 and Q100 flow.

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

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

7.2.3 Data Collection

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

- Current and predicted future DWF for each WwTW
- Location of WwTW outfalls
- Catchment descriptors from FEH CD-ROM v3.0[33]

7.2.4 Results

Table 7-2 shows the results of the additional flood risk assessment for the WwTWs. This shows that in terms of additional flood risk at the WwTWs, the proposed development would have a negligible effect on the predicted peak flow events with return periods of 30 and 100 years. The WwTW with the highest flow increase is Kidderminster WwTW with a predicted 0.075% increased risk during the 30 year return period event.

32 Note: ReFH2 was released in February 2015. This implements improvements which are mainly relevant to permeable and urbanised catchments. As the study catchments are not permeable or highly urbanised, and that the ReFH method is not being used to generate hydrographs in this case, ReFH1 has been used.

33 FEH CD-ROM v3.0 © NERC (CEH). © Crown copyright. © AA. 2009. All rights reserved.

Table 7-2: Summary of the predicted DWF increases in the watercourse

WwTW	Water-course	ReFH Q30 (m^3/s)	ReFH Q100 (m^3/s)	Current DWF (m^3/d)	Flow Increase (m^3/s)	Flow Increase % Q5	Flow Increase % Q30	Flow Increase % Q100
Upper Arley	River Severn	523	842	1020	<0.001	<0.1%	<0.1%	<0.1%
Kidderminster Option A	River Stour	32	62	80	0.052	0.2%	0.1%	0.1%
Kidderminster Option B	River Stour	32	62	80	0.049	0.2%	0.1%	0.1%

7.2.5 Conclusions

The impact of increased effluent flows is unlikely to have a significant impact upon flood risk in the receiving watercourses.

7.2.6 Recommendations

No recommendations are required.

8 Environmental Constraints and Opportunities

8.1.1 Introduction and Methodology

A series of GeoPDF maps have been created for the Wyre Forest District to visually identify environmental risks and opportunities associated with proposed development in the District. The maps allow for a range of notable environmental designations and features to be displayed 'on' or 'off' with the aim of being able to quickly identify the presence of environmental features within or close to the sites of proposed development.

These maps have been used to identify key distances between proposed sites and key environmental features. The distance at which the feature becomes significant to the development of the site depends on the type, nature and potential sensitivity of different environmental designations and the features of the development sites themselves. Table 8-1 shows the environmental features assessed and Table 8-2 highlights the approximate distances at which a feature may become significant to a development site. The potential adverse impacts associated with the development of these sites were then considered in relation to these features and potential environmental opportunities.

This environmental assessment provides an overview of the wider environment within the WFDC area and the potential risks and opportunities associated with development.

8.1.2 Data Collection

Information was collected on a range of environmental features, detailed in Table 8-1. This information has been provided by the Environment Agency, Wyre Forest District Council or sourced from OS OpenData. Environmental features have been grouped into seven topic areas: Biodiversity, the Historic Environment, Landscape, Water, Geology and Soils, Air and Waste.

Table 8-1: Environmental Designations and Features

Environmental Feature	Description	Relevant to WFDC area
Agricultural Land Classification	Agricultural Land Classification (ALC) is a method for assessing the quality of farmland. The ALC system classifies land into five grades: Grade 1: Excellent Grade 2: Very Good Grade 3: 3a – Good / 3b – Moderate Grade 4: Poor Grade 5: Very Poor The highest quality and most versatile land is defined as Grades 1, 2 and 3a.	Yes
Ancient or Semi-Natural Woodland	Ancient woodland is land that has had a continuous woodland cover since at least 1600 AD, and may be ancient semi-natural woodland (ASNW), which retains a native tree and shrub cover that has not been planted.	Yes
Aquifer - Bedrock / Superficial Deposits	Aquifers are split into: Superficial (Drift) - permeable unconsolidated (loose) deposits. Bedrock - solid permeable formations e.g. sandstone, chalk and limestone. These classifications are further split into the following: Principle Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability. Secondary Aquifers include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage.	Yes
Groundwater Source Protection Zones	Source Protection Zones (SPZs) are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.	Yes

Environmental Feature	Description	Relevant to WFDC area
Landfill/Historic Landfill	Landfill sites and Historic landfill sites are places where records indicate waste materials have been buried. Some sites remain open to further waste deposits (landfill), whilst others are now closed or covered (historic landfill).	Yes
Listed Building	Listed buildings are buildings or structures of exceptional architectural or historic special interest. Listed building have three grades: Grade I buildings are of exceptional interest, sometimes considered to be internationally important; Grade II* buildings are particularly important buildings of more than special interest; and Grade II buildings are nationally important and of special interest.	Yes
Local Nature Reserve	Local Nature Reserve (LNR) is a statutory designation. To qualify for LNR status, a site must be of importance for wildlife, geology, education or public enjoyment. LNRs are of local, but not necessarily national, importance. LNRs are almost always owned by local authorities, and they often pass the management of the LNR onto County Wildlife trusts.	Yes
National Nature Reserve	A National Nature Reserve (NNR) is one of the finest sites in England for wildlife and/or geology. A NNR is given protection against damaging operations, and any such operations must be authorised by the designating body. It also has strong protection against development on and around it.	Yes
Registered/Historic Park and Garden	Registered parks and gardens are designated heritage assets and planning authorities must consider the impact of any proposed development on the landscapes' special character.	Yes
Scheduled Monument	Scheduled Monuments are historic sites of national importance and are protected under the Ancient Monuments and Archaeological Areas Act, as amended by the National Heritage Act 1983.	Yes
Site of Special Scientific Interest	Protected under a range of UK legislation, a Site of Special Scientific Interest (SSSI) is an area of land of special interest by reason of any of its flora, fauna, geological or physiographical features. An SSSI is given certain protection against damaging operations, and any such operations must be authorised by the designating body.	Yes
Watercourse	A river, stream or other riparian feature i.e., ditch, as shown on OS mapping.	Yes
Water Framework Directive (WFD) classification	The Water Framework Directive (WFD) requires that all 'water bodies' (rivers, lakes, estuaries, coastal waters and groundwater) achieve good ecological status/potential by 2015. Under the WFD, all waterbodies are classified by their current and future predicted water quality, and specifically their ecological and chemical status.	Yes

Table 8-2: Approximate distance at which an environmental feature becomes significant to the development of a proposed site

Topic	Environmental feature	Buffer (m)
Biodiversity	Site of Special Scientific Interest (SSSI)	1000m
	Special Area of Conservation (SAC)	2000m
	Special Protection Area (SPA)	2000m
	Ramsar site	2000m
	National Nature Reserve	1000m
	Local Nature Reserves	100m
	Ancient or Semi-Natural Woodland	100m
Historic environment	Scheduled Monument	500m
	Listed Building	100m
	Registered/Historic Park and Garden	500m
	World Heritage Site	500m
	Registered Battlefield	500m
Landscape	Area of Outstanding Natural Beauty (AONB)	1000m
	National Park	1000m
	National Trails	500m
	Green Belt	100m
Water	Watercourse	200m
	Water Framework Directive (WFD) classification	No Buffer applicable
	Groundwater source protection zones (SPZ)	Act as buffers around abstraction points
	Aquifer Maps - Superficial Deposits Designation	No Buffer applicable
	Aquifer Maps - Bedrock Designation	No Buffer applicable
Geology and soils	Agricultural Land Classification (ALC)	100m
Waste	Landfill	100m
	Historic Landfill	100m

8.1.3 Environmental Features of the Wyre Forest District

The Wyre Forest District is predominantly rural in character containing 3 main population centres, Kidderminster, Stourport -On-Severn and Bewdley surrounded by rural communities. Agriculture remains the dominant land use across the District. Wyre Forest contains a variety of environmental features and the landscape falls into three broad natural areas. The majority of the District falls within the Midlands Plateau, characterised by heathland, woodland and associated grassland. Small areas in the south of the District are characterised by the Severn and Avon Vales and the Malvern Hills and Teme Valley. Key environmental features of the District are listed below.

- There are 38 Sites of Special Scientific Interest (SSSI) Several of these sites are located within the vicinity of the proposed development sites and could therefore could potentially be affected by pollution or a reduction in water resources as a result of developments.
- There are 10 National Nature Reserves (NNRs) but these are located in the west of the District at a significant distance from the proposed development sites.
- There are 15 Local Nature Reserves (LNRs), some of which are located close to proposed sites.
- There is a significant amount of Ancient Woodland mostly found in the west of the District.
- Wyre Forest has 9 Scheduled Monuments; consent is required for any works affecting the monument from the Secretary of State.
- Wyre Forest has 692 Listed Buildings mostly within many of its small villages and towns.
- The District has 1 Registered Park/Garden that is included in the English Heritage National Register of Parks and Gardens of Special Historic Interest.

- Captain Spennels Agricultural land quality within the District varies but is generally of very good to good quality. There is a relatively large area of non-agricultural land to the west of the District.
- There are 34 historic landfill sites mainly located around the Districts main settlements. A few of the sites are located close to the known landfill sites. A risk assessment would be required to determine the potential for the development site to be contaminated or for the presence of pathways between the development site and landfill that could be created through its development. Contamination of groundwater and surface waters could occur if pathways from the landfill site are created.

8.1.4 Key Water Cycle Features of the Wyre Forest District

- River quality in the Wyre Forest District is generally classified as "Moderate" to "Poor" with the River Severn classified as "Poor" and the River Stour classified as "Moderate". Pressures on water quality in the District include phosphorus contamination through diffuse pollution from agricultural areas.
- The western area of the District is classified as Secondary A Aquifer. There is a central band of Principal Aquifer with a small section of Secondary B Aquifer along the eastern border of the District. Most of the proposed developments would overly the Principal Aquifer.
- There are several groundwater Source Protection Zones (SPZs) within the Principal Aquifer, these SPZs identify groundwater deposits that are sensitive to contamination, and within which pollution prevention measures may apply. Most of the sites are located within SPZ 3. Some sites are located within SPZs 1 and 2 where there may be a greater risk of major developments leading to groundwater pollution[34]. There may be restrictions on the use of SuDS in SPZs, although the risk of groundwater contamination from SuDS can be effectively managed. Where there are sites located in SPZs, guidance about development within SPZs should be taken into account during the allocation/planning stages.

8.1.5 Water Cycle Risks and Opportunities

A number of proposed development sites have a watercourse or drainage ditch running through them or along the proposed site boundary. Even proposed sites within close proximity to waterbodies, such as upstream or with the catchment area can create a risk. Potential adverse impacts on the water environment from the development of the draft allocation sites and associated water supply/sewerage infrastructure improvements include:

- Habitat loss and species disturbance in areas associated with developments;
- Increased surface runoff and sediment loading leading to increased turbidity in receiving watercourses;
- Pollutants in chemicals and sewage effluent affecting water quality in surface waters and groundwaters;
- Increased pressure on water resources within water resource zones due to over-abstraction for water supply;
- Increased flood risk at the sites of proposed development or increased flood flows in watercourses due to increased rates of surface water runoff and additional flows of sewage effluent;

River corridors form natural wildlife corridors and are an important feature of the landscape in the District, requiring adequate buffer zones free of development. An assessment should be made of the impact of site development on the WFD status of each waterbody that site water will drain into. The assessment should consider both water quality and quantity. Measures may need to be provided to avoid any impact on water quality or channel morphology in these waterbodies.

34 Environment Agency (2009) Groundwater Source Protection Zones - Review of Methods. Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/290724/scho0309bpsf-e-e.pdf on 04/10/2016

The Council should aim to set back development a minimum of 6m from watercourses (wider buffers of 7-8m are set by the EA regions for Main Rivers), providing buffer strip to 'make space for water' and allow additional capacity to accommodate climate change. Developments should look at opportunities for river restoration, de-culverting and river enhancement as part of the development. Such measures could provide an important contribution to the WFD objectives for the watercourse.

Most of the proposed development sites are located around Kidderminster are located on a Principle Aquifer, which is geology that exhibits high irregular and/or fracture permeability, usually providing a high level of water storage. Most sites at least fall within at least a Zone 3 Source Protection Zone (SPZ). Some sites are also on superficial deposits, mainly categorised as 'Secondary A', which are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases form an important source of base flow to rivers.

There may be restrictions on the use of SuDS in SPZs, although the risk of groundwater contamination from SuDS can be effectively managed. The use of SuDS also provides an opportunity to improve (or maintain) recharge of the aquifer. SuDS can have numerous benefits by creating wildlife habitats, recreation and amenity areas and improvements to the local landscape. The suitability of SuDS will need to be assessed on a site by site basis through a risk assessment which would require approval from the LLFA and EA.

8.1.6 Management Options and Policies

The following management options outline how the proposed site allocations can minimise their impact on the neighbouring watercourses by reducing both diffuse and point sources of pollution.

New developments are required to attenuate surface water runoff and SuDS are the recommended approach as stated in NPPF, paragraph 51[35] of the Planning Practice Guidance and Building Regulations H. The implementation of SuDS schemes can:

- Mitigate the impact on receiving waters by holding and treating urban surface water run-off at or near to the source;
- Slow down surface runoff during heavy rain, reducing flooding problems;
- Provide new still water (i.e., ponds and ditches) and wetland habitat to benefit biodiversity;
- Offer recreational and amenity opportunities to local residents; and
- Enhance the local landscape character.

HR Wallingford's study, '*Maximising the Ecological Benefits of Sustainable Drainage Schemes*' (2003)[36], advises that the maximum ecological benefits derived from SuDS may come from improvements to the still water aquatic environment and that the best that can often be achieved for the receiving waters is to prevent further deterioration. However, research indicates that whilst ponds and ditches may support quite rich wildlife communities, most SuDS schemes do not fulfil their ecological potential. This is due to inappropriate design features or a lack of maintenance of the structures leading to poor water quality and domination by common plant species. The design of a SuDS scheme would need to be specific to the development site and would need to meet the topographic and hydrological characteristics present there.

Impermeable surfaces in urban areas reduce rates of infiltration and therefore reduce rates of recharge to the underlying aquifers. Additional impermeable surfaces in areas with poor groundwater status will potentially reduce groundwater recharge further. The use of SuDS can help return water to groundwater by slowing down rainfall runoff in soakaways, permeable surfaces, ponds and wetlands. It is therefore recommended that SuDS are used wherever possible and particular in areas assessed as having poor groundwater status. SuDS can also provide ecological gain and in doing so have the potential to contribute towards the green infrastructure network in the District. The Wyre Forest has a comprehensive Green Infrastructure Study[37] and Strategy[38] to aid the Districts development of green infrastructure.

35 Planning Policy Guidance (revision date 23.03.2015). Accessed online at http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/reducing-the-causes-and-impacts-of-flooding/why-are-sustainable-drainage-systems-important/#paragraph_051 on 14/03/2016.

36 HR Wallingford Maximising the Ecological Benefits of Sustainable Drainage Schemes December 2003

37 Wyre Forest District Council (Jan 2010) Green Infrastructure Study. Accessed online at: http://www.wyreforestdc.gov.uk/media/105935/Final-Green-Infrastruture-Study.pdf on 04/10/2016

38 Wyre Forest District Council (Jan 2012) Green Infrastructure Strategy. Accessed online at: http://www.wyreforestdc.gov.uk/media/105947/EB047Final-GI-Strategy_opt.pdf on 04/10/2016

8.1.7 Opportunities

There are a number of environmental opportunities that could be considered for each of the proposed development sites. Implementation of these opportunities would have the potential to help mitigate the environmental impacts of development of each site and deliver environmental benefits, particularly in relation to biodiversity and water quality. The nature and scale of any environmental benefits achieved would depend upon the site characteristics and sensitivity of the surrounding environment. These environmental opportunities are summarised in Table 8-3.

Table 8-3: Environmental opportunities and benefits

Environmental opportunity	Potential environmental benefits
Allocation of green space for the provision of SuDS	• Potential to provide flood risk benefits through interception of surface runoff. • Reduced sediment loading in receiving watercourses and improved water quality. • Amenity value.
Retention and enhancement of existing water features on the site i.e., ponds, ditches and streams through creation of vegetated buffer strips.	• Increased biodiversity value, particularly for amphibians, invertebrates and small mammals. • Potential to provide flood risk benefits through interception of surface runoff. • Increased amenity value.
Creation of new water features on site i.e., ponds, ditches and streams.	• Increased biodiversity value, particularly for amphibians, invertebrates and small mammals. • Potential to provide flood risk benefits through interception of surface runoff. • Provision of amenity resource.
Terrestrial and marginal vegetation planting along river corridors to increase vegetation cover and improve water quality.	• Reduced river bank erosion. • Reduced water temperatures. • Increased biodiversity value, particularly for birds, invertebrates and fish. • Reduced sediment loading in receiving watercourses and improved water quality.
Planting of native broadleaved trees and retention of existing mature trees.	• Increased rainfall interception and reduced surface runoff. • Reduced sediment loading in receiving watercourses and improved water quality. • Increased local biodiversity, particularly in relation to birds, invertebrates and small mammals. • Increased shading and reduced heat-island effect. • Improved local air quality. • Increased amenity value.
Habitat creation and provision of amenity areas in location at risk of flooding.	• Maintain floodplain connectivity. • Increased biodiversity value of floodplain, particularly for birds, invertebrates and small mammals. • Reduced flood risk to people and properties. • Reduced sediment loading in receiving watercourses and improved water quality. • Increased amenity value.

8.1.8 Recommendations

This study has provided a high-level appraisal of the potential environmental risks and opportunities associated with each of the proposed development sites. More detailed assessment of the environmental issues associated with the development of each site should be undertaken prior to the approval for development to commence. Table 8-4 highlights the environmental constraints and opportunities recommendations

Table 8-4: Environmental Constraints and Opportunities Recommendations

Action	Responsibility	Timescale
Undertake consultation with WFDC ecologist and heritage officer in relation to the development of each site to further identify environmental risks and opportunities and to determine specific requirements for mitigation measures.	Developers and WFDC	Ongoing
Developers should seek to maximise the water quality and amenity/ecological benefits when installing SuDS for surface water flood management.	Developers and WFDC	Ongoing
Good design principles should be applied to all developments, particularly those located in sensitive or protected landscapes so as to minimise the impact on landscape character and visual amenity. Design advice provided by WFDC should be applied and consultation with the Council's landscape officer should be undertaken to inform the design of the development of a site.	Developers and WFDC	Ongoing

8.1.9 Conclusion

Development of the proposed development sites has the potential to cause a range of adverse impacts. Further environmental surveys and more detailed assessment are required for each of the sites to determine the acceptability of their development and to inform the requirement for mitigation measures. Sites shown on the GeoPDF maps in Appendix B to have few environmental features in close proximity should not necessarily be assumed suitable for development. Likewise, sites with a greater amount of environmental features in close proximity should not be assumed unsuitable for development, constraints could be appropriately addressed.

9 Climate Change Impact Assessment

9.1.1 Introduction and Methodology

A qualitative assessment has been undertaken to assess the potential impacts of climate change on the assessments made in this water cycle study. This has been done using a matrix which considers both the potential impact of climate change on the assessment in question, and also the degree to which climate change has been considered in the information used to make the assessments contained within the WCS (see Table 9-1).

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

Table 9-1: Climate Change Pressures Scoring Matrix

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

9.1.2 Results

Table 9-2: Scoring of Climate Change Consequences for the Water Cycle Study

Assessment	Impact of Pressure (source of information)	Have climate change pressures been considered in the assessment?	Climate Change Score
Water resources	High (1 and 2)	Yes - qualitative within WRMP and RMBP	
Water supply infrastructure	Medium - some increased demand in hot weather	Yes - qualitative consideration within WRMP	
Wastewater Collection	High - Intense summer rainfall and higher winter rainfall increases flood risk	No - not considered in STWL assessment	
Wastewater treatment	Medium - Increased winter flows and more extreme weather events could increase flood risk and increase sewer flooding and storm sewage flows	No - not considered in STWL assessment	
WwTW odour	Low	No - not considered	
Water quality	Nutrients: High (1) Sanitary determinands: Medium (1)	No - not considered	
Flood Risk	High - See SFRA for additional detail		
Flooding from increased WwTW discharge	Low	No - not considered	

Sources:
(1) River Basin Management Plan Severn River Basin District
(2) Severn Trent Water's Final Water Resource Management Plan 2014
(3) WFDC Draft Strategic Flood Risk Assessment

9.1.3 Recommendations

Table 9-3: Climate Change Actions

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

10 Summary and Recommendations

10.1 Water Cycle Study Summary

This Water Cycle Study has been carried out in cooperation with the Environment Agency and Severn Trent Water. Overall there are no major issues which indicate that the planned scale, location and timing of planned development within the Wyre Forest is unachievable from the perspective of supplying water and wastewater services and preventing the deterioration of water quality in the receiving watercourses.

The WCS has identified that infrastructure upgrades are expected to be required to accommodate the planned growth. Timely planning and provision of infrastructure upgrades will be undertaken through regular engagement between WFDC, STWL, the EA and developers. Table 10-1 provides a summary of the Red / Amber / Green analysis results for each site respectively.

Table 10-1: Summary of results for each site

Site Reference	Site Name	Option	Water Resources Assessment	Water Supply Infrastructure Assessment	WwTW Infrastructure Assessment	WwTW Odour Assessment	Fluvial Flood Risk	Pluvial Flood Risk	Additional Flood Risk
AKR/1	Bridge Street Basins	A and B	Green	Green	Green	Green	Green	Green	Green
AKR/15	Rectory Lane, Areley Kings	B	Green	Green	Amber	Green	Green	Green	Green
AKR/2	Cheapside	A and B	Green	Green	Green	Green	Green	Green	Green
AKR/20	Carpets of Worth, Stourport on Severn	A and B	Green	Green	Green	Green	Red	Green	Green
AKR/7	Swan Hotel and Working Men's Club	A and B	Green	Green	Green	Green	Red	Amber	Green
AKR14	Pearl Lane, Areley Kings	B	Green	Green	Red	Green	Green	Green	Green
AS/1	Comberton Place	A and B	Green	Green	Green	Green	Green	Green	Green
AS/10	Land rear of Spennells / Easter Park	A	Green	Green	Red	Green	Green	Green	Green
AS/5	Victoria Carpets Sports Ground, Spennells Valley Road, Kidderminster	A and B	Green	Green	Green	Green	Red	Red	Green
AS/6	Former Lea School Site	A and B	Green	Green	Green	Green	Green	Green	Green
BHS/11	WFDC Depot, Green Street, Kidderminster	A and B EMP	Green	Green	Green	Green	Red	Red	Green
BHS/16	Park Lane Canalside	A and B	Green	Green	Green	Green	Red	Amber	Green
BHS/18	County Buildings and Blakebrook School Bewdley Road, Kidderminster	A and B	Green	Green	Green	Green	Green	Amber	Green
BHS/2	Bromsgrove Street Area	A and B	Green	Green	Green	Green	Green	Green	Green
BHS/26	Coopers Arms. Kidderminster	A and B	Green	Green	Green	Green	Green	Green	Green
BR/BE/6	Land off Highclere	A and B	Green	Green	Amber	Green	Green	Green	Green
BR/RO/1	Clows Top	A and B	Green	Green	N/A	Green	Green	Green	Green
BR/RO/21	Alton Nurseries, Bewdley	A and B EMP	Green	Green	Green	Green	Green	Green	Green
BR/RO/26	Land to rear of Walnut Cottage	A and B	Green	Green	Green	Green	Green	Green	Green
BR/RO/4	Land adj Tolland bungalow, Far Forest	A and B	Green	Green	Amber	Green	Green	Green	Green
BR/RO/6	Land behind Orchard House, Far Forest	A and B	Green	Green	Amber	Green	Green	Green	Green
BR/RO/7	New Road, Far Forest (South)	A and B	Green	Green	Amber	Green	Green	Green	Green
BR/RO/7	New Road, Far Forest (North)	B	Green	Green	Amber	Green	Green	Green	Green

Site Reference	Site Name	Option	Water Resources Assessment	Water Supply Infrastructure Assessment	WwTW Infrastructure Assessment	WwTW Odour Assessment	Fluvial Flood Risk	Pluvial Flood Risk	Additional Flood Risk
BW/1	Churchfields Business Park	A and B	Green	Green	Green	Green	Green	Green	Green
BW/2	Limekiln Bridge	A and B	Green	Green	Green	Green	Green	Amber	Green
BW/3	Sladen School, Hurcott Road, Kidderminster	A and B	Green	Green	Green	Green	Green	Green	Green
BW/4	Hurcott ADR	A and B	Green	Green	Amber	Green	Green	Green	Green
BW/6	Yew Tree Inn, Chester Road North, Kidderminster	A and B	Green	Green	Green	Green	Green	Amber	Green
FHN/9	78 Mill Street, Kidderminster	A and B	Green	Green	Green	Green	Red	Green	Green
FPH/1	Former British Sugar Settling Ponds, Wilden Lane, Kidderminster	A EMP	Green	Green	Green	Green	Green	Green	Green
FPH/1	Former British Sugar Settling Ponds, Wilden Lane, Kidderminster	B	Green	Green	Green	Amber	Green	Green	Green
FPH/10	British Sugar Site Phase 2	A and B	Green	Green	Green	Green	Green	Green	Green
FPH/10	British Sugar - Phase 2 (north)	A and B EMP	Green	Green	Green	Green	Green	Green	Green
FPH/17	Dowles Road Community Centre	A and B	Green	Green	Green	Green	Green	Green	Green
FPH/18	Naylor's Field	A and B	Green	Green	Green	Green	Green	Green	Green
FPH/23	British Sugar Phase 1 plot D	A and B EMP	Green	Green	Green	Amber	Green	Green	Green
FPH/24	ROMWIRE	A and B EMP	Green	Green	Amber	Amber	Green	Red	Green
FPH/25	Incinerator Site, Stourport Road, Kidderminster	A and B EMP	Green	Green	Green	Green	Green	Green	Green
FPH/26	Land adj Summerfield, Kidderminster	A and B EMP	Green	Green	Green	Amber	Green	Amber	Green
FPH/27	Land at Worcester Road, Kidderminster	A and B EMP	Green	Green	Green	Green	Green	Green	Green
FPH/28	Land at Hoo Brook	A and B EMP	Green	Green	Green	Green	Green	Green	Green
FPH/6	Oasis Factory, Goldthorn Road, Kidderminster	A and B	Green	Green	Green	Green	Green	Amber	Green
FPH/8	Land adj. SDF, Stourport Road, Kidderminster	A and B EMP	Green	Green	Green	Amber	Green	Amber	Green
FPH/9	Foley Drive	A and B EMP	Green	Green	Green	Amber	Green	Amber	Green
LI/1	Ceramaspeed	A and B EMP	Green	Green	Amber	Green	Green	Amber	Green

Site Reference	Site Name	Option	Water Resources Assessment	Water Supply Infrastructure Assessment	WwTW Infrastructure Assessment	WwTW Odour Assessment	Fluvial Flood Risk	Pluvial Flood Risk	Additional Flood Risk
LI/2	Wyre Forest Golf Club	A and B	Green	Green	Green	Green	Green	Green	Green
LI/5	Land at Burlish Crossing	B	Green	Green	Amber	Green	Green	Amber	Green
LI/6/7/8	Land at Lickhill Road North (Bradley Paddocks and Field adj 17 Lickhill Road)	A and B	Green	Green	Green	Green	Green	Amber	Green
MI/1	County Buildings, Stourport	A and B	Green	Green	Green	Green	Green	Amber	Green
MI/18	North of Wilden Lane Industrial Estate	A and B EMP	Green	Green	Green	Green	Green	Green	Green
MI/26	Ratio Park, Finepoint	A and B EMP	Green	Green	Green	Amber	Amber	Green	Green
MI/28	35 Mitton Street, Stourport	A and B	Green	Green	Green	Green	Green	Red	Green
MI/29	Chichester Caravans, Vale Road, Stourport on Severn	A and B	Green	Green	Green	Green	Red	Amber	Green
MI/3	Parsons Chain	A and B	Green	Green	Green	Green	Green	Red	Green
MI/5	Baldwin Road	A and B	Green	Green	Green	Green	Red	Green	Green
MI/6	Steatite Way, Stourport	A and B	Green	Green	Amber	Green	Green	Amber	Green
MI17	Land Rear of Stourport Manor	B	Green	Green	Green	Green	Green	Amber	Green
OC/11	Stourminster School, Comberton Road, Kidderminster	A and B	Green	Green	Green	Green	Green	Amber	Green
OC/12	Comberton Lodge Nursery, Comberton Road, Kidderminster	A and B	Green	Green	Green	Green	Red	Amber	Green
OC/13	Land at Stone Hill (South)	A	Green	Green	Red	Green	Green	Green	Green
OC/13	Land at Stone Hill (North)	A and B	Green	Green	Red	Green	Amber	Amber	Green
OC/4	Land rear of Baldwin Road, Kidderminster	A and B	Green	Green	Amber	Green	Green	Green	Green
OC/4	Land rear of Baldwin Road (East part of site), Kidderminster	B	Green	Green	Amber	Green	Green	Green	Green
OC/5	Land adjacent to Hodge Hill Farm	A and B	Green	Green	Amber	Green	Green	Amber	Green
WA/BE/1	Stourport Road (triangle), Bewdley	A and B	Green	Green	Green	Green	Amber	Green	Green
WA/BE/3	Catchems End, Bewdley	B	Green	Green	Green	Green	Green	Green	Green

Site Reference	Site Name	Option	Water Resources Assessment	Water Supply Infrastructure Assessment	WwTW Infrastructure Assessment	WwTW Odour Assessment	Fluvial Flood Risk	Pluvial Flood Risk	Additional Flood Risk
WA/BE/5	Land South of Habberley Road, Bewdley (The Gardens)	A and B	Green	Green	Green	Green	Green	Red	Green
WA/UA/4	Allotments, Upper Arley	A and B	Green	Green	Green	Amber	Green	Green	Green
WFR/CB/7	Land Off Birmingham Road, Kidderminster (south)	A and B EMP	Green	Green	Amber	Green	Green	Green	Green
WFR/ST/1	Captains and The Lodge, Bromsgrove Road, Stone	A and B	Green	Green	Amber	Green	Green	Amber	Green
WFR/ST/2	LAND OFF STANKLYN LANE	A	Green	Green	Red	Green	Green	Green	Green
WFR/ST/3	Land North of Stone Hill,	A and B	Green	Green	Red	Green	Green	Green	Green
WFR/WC/15	Lea Castle Hospital	A and B	Green	Green	Amber	Green	Green	Green	Green
WFR/WC/15	Part of Lea Castle, Kidderminster	A and B EMP	Green	Green	Amber	Green	Green	Green	Green
WFR/WC/16	Land south of Wolverley Road and Park Gate Lane, Kidderminster	A	Green	Green	Amber	Green	Green	Green	Green
WFR/WC/18	Sion Hill School	A and B	Green	Green	Amber	Green	Green	Amber	Green
WFR/WC/32	East of Lea Castle	B	Green	Green	Amber	Green	Green	Green	Green

10.1.1 Development scenarios and policy issues

This Water Cycle Study is an assessment of the impacts of the planned development within the Wyre Forest District. Wyre Forest District Council identified 77 sites for proposed development in total. The District has two options for planned growth, Option A sites concentrate future growth in Kidderminster, whereas Option B sites would produce more dispersed growth across the District. Many of the sites are in both options but there are additional residential and employment sites in each individual option. This Water Cycle Study is important in the process of deciding on option and site allocations. Legal agreements under the Town and Country Planning Act Section 106 agreement, and Community Infrastructure Levy agreements are not intended to be used to obtain funding for water or wastewater infrastructure. It is not therefore necessary for Wyre Forest District Council to identify requirements for developers to contribute towards the cost of upgrades in its Local Plan.

The Water Industry Act sets out arrangements for connections to public sewers and water supply networks, and developers should ensure that they engage at an early stage with Severn Trent Water to ensure that site specific capacity checks can be undertaken and where necessary additional infrastructure constructed to accommodate the development. Where permitted Severn Trent Water may seek developer contributions towards infrastructure upgrades. Upgrades to water resources and wastewater treatment works are funded through the company business plans.

10.1.2 Water resources

All proposed development sites are located within the Environment Agency Catchment Management Abstraction Strategies (CAMS) of the Severn Corridor and the Worcester Middle Severn CAMS. Both CAMS have restricted water available for licensing so there is no preference between Options A and B. All sites are also in an area considered to be under moderate water stress by the EA.

All sites are located in Severn Trent Water Strategic Grid Water Resource Zone (WRZ) and would therefore be managed in the same way over the next 25 years. The Strategic Grid is likely to require significant investment in order to cope with rapid growth, reduce unsustainable abstractions and to manage the long term impacts of climate change. Severn Trent commented that water capacity in the Wyre Forest District is not expected to be a constraint to growth for either option within the Wyre Forest District.

10.1.3 Water Supply infrastructure

Severn Trent Water responded to the request for an assessment of water supply infrastructure within the Wyre Forest District. STWL stated that the WRMP consider supply and demand issues for the next 25 years. As development within the Wyre Forest District occurs, it will be necessary to undertake detailed modelling of the water supply infrastructure to allow for appropriate infrastructure upgrades and local reinforcements. STWL does not expect water supply to be a constraint to development within the District.

10.1.4 Wastewater Collection and Treatment

Severn Trent Water completed a Sewerage System Capacity Assessment for all the development sites. Overall, 64% of the sites have capacity available to serve the proposed growth. 27% would require infrastructure and/or treatment updates and 6% have major constraints to growth. 3% were not assessed as the sites are located outside the area managed by the public sewerage system.

Of the 21 sites assessed as having an Amber RAG score (infrastructure and/or treatment upgrades required), 71% are in both Options A and B, 24% are in Option B only and 5% are Option A only. Of the sites 5 assessed as Red (major constraints to growth), 2 are in Option A and B, 3 are in Option A and only 1 is in Option B.

It is clear that both Options A and B, the majority of sites have capacity available. However, both have some sites that would require infrastructure and/treatment upgrades or the provision of new infrastructure to prevent wastewater collection and treatment from being a major constraint to growth in either Options.

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

Severn Trent Water's preferred method of surface water disposal is using a sustainable drainage system (SuDS) discharging to ground or open watercourses, with connection to the sewerage system seen as the last option.

10.1.5 Wastewater Treatment Works Flow and Quality Consents Assessment

Severn Trent Water Limited provided an assessment of the available headroom and flow consents at each WwTW. All sites are located within the Kidderminster WwTW catchment, apart from WA/UA/4 (Option A and B) which of managed by Upper Arley WwTW. Kidderminster is likely to exceed capacity with the proposed levels of growth and would require upgrading. Upper Arley is close to breaching its DWF permit, one site is unlikely to cause the breach but future growth may mean upgrades are required. In summary, both WwTWs with proposed growth would require investment and upgrades in the near future and both Options A and B would have the same impact on WwTW flow and quality consents.

10.1.6 Wastewater Treatment Works odour assessment

An odour screening assessment was completed to identify sites that in close proximity to existing WwTWs where odour may be a cause of nuisance and complaints. Nine proposed development sites were assessed as being at risk from experiencing odour due to their proximity to existing WwTWs. 9 of these sites are in both Option A and Option B. Site FPH/1, an employment site only in Option A, was also found to be less than 800m from a WwTW. There is therefore very little difference between Option A and B in terms of Odour impact.

10.1.7 Water Quality Impacts Assessment

Water quality assessments were completed for the WwTWs within the Wyre Forest District in order to assess if the increased effluent discharges from WwTWs as a result of the proposed levels of development could lead to an adverse impact on the quality of the receiving watercourse. The majority of Option A and B sites are served by Kidderminster WwTW; one site (in Option A and B) is served by Upper Arley WwTW.

The impacts of growth on Kidderminster WwTW was assessed based on Option A and Option B future development separately to compare the impacts of each option. The results of the water quality assessment identified that there is little difference between the water quality impacts of Option A and B.

It was found that:

- The proposed growth is not predicted to lead to any class deteriorations, or deteriorations of quality of greater than 10% for any determinand.
- For Phosphorus, all receiving watercourses for the WwTWs fail their WFD targets for the present-day situation:
- At Kidderminster and Upper Arley, phosphorous good status could only be achieved by a combination of addressing upstream sources and treatment to a standard above what is achievable with current technology, even for present-day flows.
- For BOD all watercourses achieve their target.
- For Ammonia all watercourses achieve their target.

The key constraints to achieving Good Ecological Status at all two WwTWs are the limits of current technology rather than the impacts of the planned growth. Therefore, environmental capacity is not considered to be a constraint upon growth.

10.1.8 Flood Risk

The WFDC Draft Strategic Flood Risk Assessment (SFRA) is the main source of information regarding the flood risk to the settlements and the proposed strategic site allocations where all 77 sites were assessed as part of the Level 1 Assessment.

Sites in both Options A and B have a mixed fluvial and pluvial flood risk. All sites only within Option A have a low flood risk (Green RAG score). Flood risk in Option B is also low, apart from site LI/5 that was a moderate surface water flood risk (Amber RAG score). Sites with more severe flood risk classifications are all located in both A and B so there is no preference between options in terms of flood risk.

An assessment was also carried out to determine whether increased discharges of treated effluent from each WwTW due to the increased development within the Wyre Forest District could lead to an increase in fluvial flood risk from the receiving watercourse. This assessment showed that the impact of increased effluent flows is not predicted to have a significant impact upon flood risk in any of the receiving watercourses in either option.

10.1.9 Environmental constraints and opportunities

GeoPDF maps have been created to allow for a range of notable environmental designations and features to be displayed 'on' or 'off' with the aim of being able to quickly identify the presence of environmental features within or close to the proposed sites. The maps should be used in conjunction with Sustainability Appraisals (SA) and/or Strategic Environmental Assessments (SEAs) when these are available. The environmental assessment provides an overview of the wider environment within the District and the potential risks and opportunities associated with the development of the proposed sites.

10.1.10 Climate change

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

The capacity of the sewerage system and the water quality of receiving water bodies stand out as two elements of the assessment where the consequences of climate change are expected to be high but no account has been made of climate impacts in the assessment. This is a matter to be addressed at detailed assessment stage.

10.2 Developer engagement

The value of early developer engagement with water and sewerage companies is emphasised throughout this report. This is particularly true where a new settlement or major urban extension is being promoted. Here, the water companies would recommend that a mini Integrated Water Management Strategy (IWMS) to be produced to support the promotion of the development. The scope of the mini IWMS could include:

- assessment of the existing water supply infrastructure in the local area;
- assessment of the existing water supply infrastructure in the local area;
- assessment of the existing sewerage and drainage infrastructure in the local area;
- consideration of the likely range of demands for water supply, sewerage and drainage through the development phases;
- proposals for a range of options to minimise drinking water demand, maximise grey/rainwater re-use, maximise the use of sustainable drainage systems;
- assess the spatial implications of any required infrastructure; and
- assess the outline costs and programming of any required infrastructure.

For all other major developments, it is still important that the developer's produce a detailed water and drainage strategy early on in the development planning process to identify any on and or off site drainage infrastructure impacts, how these will be resolved, at what phases of the development they will be constructed, by what means and establishing the delivery route for that infrastructure. The water companies recommend that this is produced well before the planning application is submitted.

10.3 Timescales for implementing infrastructure upgrades

This WCS has identified where additional water and wastewater infrastructure may be required to enable planned growth, but the details of designing asset upgrades will be the responsibility of Severn Trent Water Limited. The timescale required to implement any specific infrastructure upgrade will depend on many site-specific factors, including but not limited to the scale of works, engineering complexity, planning and environmental constraints, negotiation of land purchase, access and wayleave, ground conditions and traffic conditions.

It is beyond the scope of this water cycle study to assess the timescales required to make individual infrastructure upgrades, however, Table 10-2, developed with advice from several water companies, provides indicative timescales for different types and sizes of upgrade:

Table 10-2: Indicative timescales for implementing water infrastructure upgrades

Infrastructure type	Trigger for water company to assess requirements and develop plans	Indicative project timescales for infrastructure upgrades or other interventions		
		Minor	Major	Strategic
Water resources	Publication of Local Plans and associated updates		Demand management measures, minor new resource e.g. borehole: 3-5 years	New reservoir: 10 to 20 years.
Water supply	Pre-development enquiries Planning applications	Localised supply pipe upgrades: 18 month to 3 years	New supply mains, boosters, service reservoirs: 3-5 years	Implementation of new technologies or a new treatment works: 5 to 10 years
Wastewater treatment	Pre-development enquiries Planning applications	Minor upgrade of existing treatment works: 2-4 years	Treatment works upgrade 18 months to 3 years	Implementation of new technologies or a new treatment works: 5 to 10 years.
Sewerage	Pre-development enquiries Planning applications	Localised sewerage upgrades: 18 month to 3 years	New collector sewers or other strategic assets: 3-5 years	Strategic tunnel: 10 to 20 years.

As is emphasised throughout this study, early developer engagement with water companies is essential to ensure that water and wastewater providers have adequate time to provide infrastructure upgrades required to accommodate growth.

10.4 Recommendations

Aspect	Action	Responsibility	Timescale
Water Resources: Water Resource Management Plans	Review population and housing growth forecasts within Severn Trent Water Strategic Grid WRZ	STWL, WFDC	ASAP
	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.	STWL	Ongoing
	Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	WFDC and other LPAs in STWL's Strategic Grid	Ongoing
	Use planning policy to require the 110l/person/day water consumption target permitted by National Planning Policy Guidance in water-stressed areas.	WFDC	In draft Local Plan
	Water companies should advise WFDC of any strategic water resource infrastructure developments within the District, where these may require safeguarding of land to prevent other type of development occurring. However, at present, no major potential schemes have been identified within the WFDC boundary.	STWL, WFDC	In draft Local Plan
Water Resources: Water Supply Infrastructure Assessment	Where necessary, identify the scale of likely solutions to accommodate growth, and build the likely timescale for delivering the infrastructure into the overall delivery programme to identify key dates and potential programme constraints	STWL	Ongoing
	Undertake technical studies to understand options to provide sufficient bulk and local transfer capacity and communicate results with WFDC.	STWL	Ongoing
	Developers seek early consultation with Severn Trent Water in order to ensure adequate time is available to provide local distribution main upgrades to meet additional demand.	STWL	Ongoing

Aspect	Action	Responsibility	Timescale
Wastewater Collection and Treatment: Sewerage System Capacity Assessment	Take into account sewerage infrastructure constraints in phasing development in partnership with Severn Trent Water.	WFDC	Ongoing
	Severn Trent Water to continue to assess growth demands as part of their wastewater asset planning activities and feedback to WFDC where concerns arise.	STWL	Ongoing
	Severn Trent Water and developers will be expected to work closely and early on in the planning promotion process to develop an outline Drainage Strategy for the site. The Outline Drainage strategy should set out sufficient detail to determine the likely timescales for the delivery of the infrastructure and the likely costs of the infrastructure. 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.	STWL and Developers	Ongoing
	Developers will be expected to show that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to sewer seen as the last option.	Developers	Ongoing
Wastewater Treatment Works Flow and Quality Consent Assessment	Take into account the available WwTW capacity in phasing of development going to the same WwTW.	WFDC	Ongoing
	Provide annual updates to STWL of projected housing growth.	WFDC	Annually
	STWL to assess growth demands as part of their wastewater asset planning activities and feedback to WFDC where concerns arise.	STWL	Ongoing
	STWL, WFDC and the EA will work closely to ensure the timely delivery of any necessary WwTW upgrades.	STWL, EA and WFDC	Ongoing
	Where the water quality assessment indicates that permits may require a higher standard of treatment than currently achievable using Best Available Technologies, the EA should provide clear advice to WFDC and STWL on: the approach to permitting, requirements for any additional studies (for example additional water quality sampling, modelling, macro-invertebrate surveys etc.), advise where water quality constraints may limit the potential for growth.	EA	Ongoing
Wastewater Treatment Works	Consider odour risk in selection of site allocations.	WFDC	Ongoing

Aspect	Action	Responsibility	Timescale
Odour Assessment	Carry out an odour assessment for 'amber' assessed sites.	Site promoters	Ongoing
Water Quality Assessment	Where possible, take into account the water quality constraints when allocating and phasing development sites.	WFDC	Ongoing
	Where the water quality assessment indicates that permits may require a higher standard of treatment than currently achievable using Best Available Technologies, provide clear advice to sewerage undertakers and WFDC on: the approach to permitting, requirements for any additional studies (for example additional water quality sampling, modelling, macro-invertebrate surveys etc.), advise WFDC where water quality constraints may limit the potential for growth	EA	Ongoing
	Where necessary, identify the scale of likely solutions to accommodate growth, and build the likely timescale for delivering the infrastructure into the overall delivery programme to identify key dates and potential programme constraints.	STWL	Annually
Environmental Constraints and Opportunities	Undertake consultation with WFDC ecologist and heritage officer in relation to the development of each site to further identify environmental risks and opportunities and to determine specific requirements for mitigation measures.	Developers and WFDC	Ongoing
	Developers should seek to maximise the water quality and amenity/ecological benefits when installing SuDS for surface water flood management.	Developers and WFDC	Ongoing
	Good design principles should be applied to all developments, particularly those located in sensitive or protected landscapes so as to minimise the impact on landscape character and visual amenity. Design advice provided by WFDC should be applied and consultation with the Council's landscape officer should be undertaken to inform the design of the development of a site.	Developers and WFDC	Ongoing
Climate Change Recommendations	When undertaking detailed assessments of environmental or asset capacity, consider how the latest climate change guidance can be included.	EA, STWL, WFDC	As required
	Take "no regrets" decisions in the design of developments which will contribute to mitigation and adaptation to climate change impacts.	WFDC, Developers	As required

Appendices

A Water Quality Assessment

Appendices

A Water Quality Assessment

A.1 Introduction

The increased discharge of effluent due to a growth in the population served by a Wastewater Treatment Works (WwTW) may impact on the quality of the receiving water. The Water Framework Directive (WFD) does not allow a watercourse to deteriorate from its current class (either water body or element class).

It is Environment Agency (EA) policy to model the impact of increasing effluent volumes on the receiving watercourse. Where the scale of development is such that a deterioration is predicted, a new Environmental Permit (EP) may be required for the WwTW to improve the quality of the final effluent, so that the extra pollution load will not result in a deterioration in the water quality of the watercourse. This is known as a “no deterioration” or “load standstill".

It is the objective of the Water Framework Directive (WFD) that all water bodies should meet Good Ecological Status (GES), or where they have been highly modified meet Good Ecological Potential (GEP). It is therefore also necessary to assess whether the proposed increase in effluent could prevent a watercourse from meeting GES or GEP. If a watercourse fails the GES target, further investigations are needed in order to define the 'reasons for fail' and which actions could be implemented to reach such status.

For each future development site, the receiving WwTW was identified. This has allowed the calculation of the total future DWF for each WwTW. This analysis identified two Wastewater Treatment Works to assess potential future capacity issues and impacts on the receiving watercourse due to growth:

- Kidderminster
- Upper Arley

This report assesses the potential water quality impacts due to growth in WwTW effluent flows and loads at these WwTWs discharge points.

A.2 Standards

The WFD targets for Good Ecological Status (GES) for Biological Oxygen Demand (BOD), Ammonia (NH_4) and Phosphorus (P) set by the EA for lowland and high alkalinity water bodies are shown in Table 1 below:

Table 1: WFD targets for "good" status lowland and high alkalinity water bodies

Determinand	Statistic	Target
BOD	90 percentile	5gm/l
NH_4	90 percentile	0.6mg/l
P	Mean	site specific

The EA has provided WFD 2015 set catchment/reach-specific targets for phosphorus. On this basis the following targets (see Table 2) have been used at the WwTW discharge points assessed:

Table 2: Phosphorus targets for "good" status by WwTW

WwTW	P mean mg/l	Waterbody/ WQ point
Kidderminster	0.083	GB109054044710
Upper Arley	0.068	GB109054049145

A.3 Methodology

The contaminants assessed were Biochemical Oxygen Demand (BOD), Ammonia (NH_4) and Phosphorus (P).

The selected approach was to use the EA River Quality Planning (RQP) tool in conjunction with their recommended guidance documents: "Water Quality Planning: no deterioration and the Water Framework Directive" and "Horizontal guidance". This uses a steady state Monte Carlo Mass Balance approach where flows and water quality are sampled from modelled distributions based on data where available.

The data required to run the RQP software were:

Upstream river data:

- Mean flow
- 95% exceedance flow
- Mean for each contaminants
- Standard deviation for each contaminant

Discharge data:

- Mean flow
- Standard deviation for the flow
- Mean for each contaminants
- Standard deviation for each contaminant

River quality target data:

- No deterioration target
- 'Good status' target

The above data inputs should be based on observations where available. In the absence of observed data EA guidance require that the following values are used:

    - Flow mean: 1.25*DWF.
    - Flow SD: 1/3*mean.
    - Quality data: permit values or assumed values.
- If observed river flows were not available these were obtained from an existing model or a low-flows estimation software.
- If observed water quality data were not available these were obtained from an existing model or a neighbouring catchment with similar characteristics, or the mid-point of the WFD class.

The observed data available for WwTWs discharges were analysed in Aardvark and the values reported as "less than" (these are samples where the sample testing did not attain an accurate value and a limit value was assigned) were multiplied by 0.5 as agreed with the EA.

A.4 Study Objectives

RQP models were required to be set up and run using the present-day and a single future scenario representing development of all draft site allocations by 2031 (housing and employment) which would drain to each WwTW as reported in Table 3 below.

The Wyre Forest District Council has two options for future growth. Option A focusses growth in Kidderminster whereas Option B has more dispersed proposed growth. Future growth will affect two WwTWs in the Wyre Forest District, Kidderminster and Upper Arley. In Options A and B growth in the Upper Arley WwTW catchment is the same so has been assessed once. Growth in the Kidderminster WwTW catchment varies between Options A and B so has been assessed separately with slightly greater levels of growth seen in Option A. Separate assessments have been completed to compare the impacts of growth in each option.

Table 3: Present-day and Future DWF

WwTW	Mean DWF (Ml/d)			
	Present Day Flow (measured mean flow at the STWs)	Additional Flow	Future Flows	Percentage Change
Upper Arley Option A and B	0.1	0.0032	0.1032	3%
Kidderminster Option A	26.77	4.45	31.2	17%
Kidderminster Option B	26.77	4.23	31.0	16%

The study was required to calculate changes to effluent flows as a result of future development and to assess the impact of the increased contaminant loads on the receiving watercourses. These results were required to assess the potential impact on the watercourse which could cause the failure of one of the targets: Good ecological status (GES), no more than 10% deterioration and no class deterioration.

Where a WwTW is predicted to lead to a WFD class deterioration, or a deterioration of greater than 10% or a Good status failure it is necessary to determine a possible future permit value which would prevent a class deterioration or a >10% deterioration or the Good status targets failure. The value is determined using the RQP tool function that calculates the required discharge quality according to the specified river target.

Where failure was predicted for any of the future scenarios, and the upstream river quality did not achieve 'good status', the model was re-run assuming that the river had 'good status', in order to assess the impact of the effluent if upstream point and/or diffuse sources of pollutants were to be resolved.

When a new consent value was calculated, due to a target failure, this was compared against the effluent quality that can be achieved using Best Available Technology (BAT). The EA advised that the following permit values are achievable using best available technology, and that these values should be used for modelling all WwTW potential capacity irrespective of the existing treatment technology and size of the works:

- BOD (95%ile) = 5mg/l
- Ammonia (95%ile) = 1mg/l
- Phosphorus (mean) = 0.5mg/l.

Note that phosphorus removal is the subject of ongoing national trials investigating novel techniques and optimisation of existing methods. This major study, which involves all UK water companies, is not due to report until 2017, therefore this assessment is based on the current assumption of BAT for phosphorus.

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

The increase of DWF for each WwTW was calculated by using an occupancy rate of 2.35 persons per dwelling and a consumption of 136 l/p/d as confirmed by Severn Trent Water by email with 110% of flow reaching the WwTW (it is assumed that this is intended to represent an allowance for base infiltration in the sewer flows).

A.5 Data Collection

The datasets required to assess the discharge permits were the following:

- River flow data (received from the EA)
- River quality data (received from the EA)
- Current WwTW permits (received from the EA)
- RQP tool (received from the EA)
- Existing water quality models: GIS SIMCAT model (received from the EA)
- Current river classifications (received from the EA)
- 2015 WFD river target for BOD, P and NH4 (received from the EA, see section A.2)
- EA guidance documents (received from the EA)
- WwTW flow and quality data (received from the EA)
- WwTW discharge information e.g. location, receiving watercourse, etc. (received from the EA)

A.6 WFD Compliance

Compliance against WFD targets for the scenarios modelled was calculated using the Present Day situation as the baseline. Compliance / or non-compliance is indicated on the results tables as follows:

Modelled water quality is within the WFD target for the determinand in question	Modelled water quality does not meet the WFD target for the determinand in question

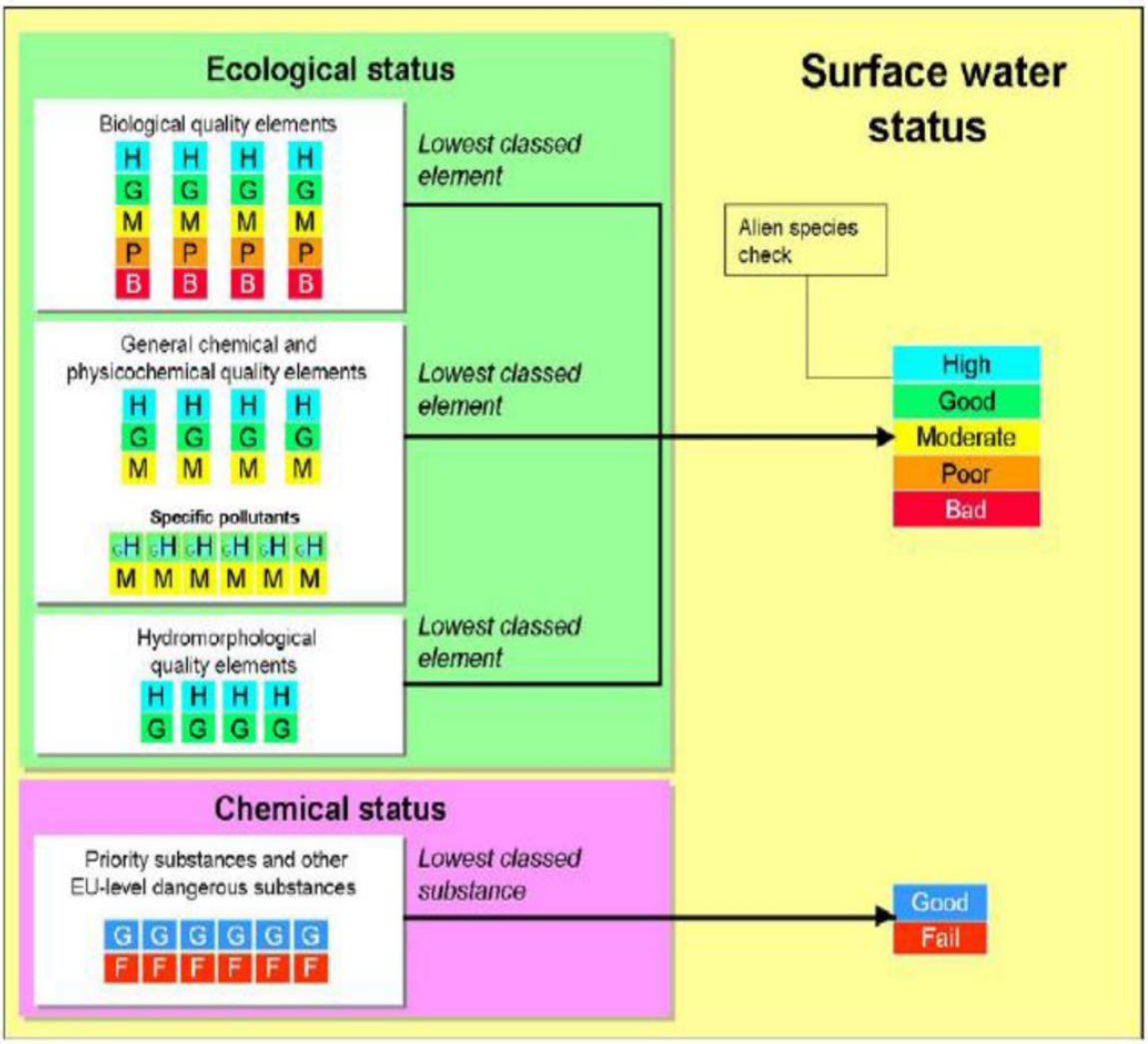
The status of the receiving watercourse is reported using the same RAG colour scheme used by the EA "Method statement for the classification of surface water bodies v3" as shown in Figure 1. The 'Ecological status' is defined as the lowest class element between the 'Biological quality elements', the 'General chemical and physicochemical quality elements' and the 'Hydromorphological quality elements'. Each element is classified as bad, poor, moderate, good or high. The 'Chemical status' is defined as the lowest classed substance defined in the 'Priority substances and other EU-level dangerous substances'. Each substance is classified as fail or good.

For each WwTW a summary table (based on Table 4) for the receiving watercourse reports the single status for BOD, 'NH4' and 'P', the 'Ecological' status and the 'Overall' status and their objectives.

Table 4: Summary table representing 2015 watercourse status and its objectives.

	Overall	BOD	Ammonia	Phosphorus
2015 status	Overall watercourse's status	Watercourse's status for BOD	Watercourse's status for NH4	Watercourse's status for P
Objective	Overall watercourse's objective	Watercourse's objective for BOD	Watercourse's objective for NH4	Watercourse's objective for P

Figure 1: Classification of Surface Water Status from "Method statement for the classification of surface water bodies v3".



A.7 Input Data

The input data and RQP result table used to summarise the modelling exercise contain also the data source. The list below explains the meaning of the source used:

- Low Flow software: values calculated using the Low Flow software.
- Mid class "class": midpoint of the permissible pollutant concentrations for the watercourse's current classification. This was used when non observed data were available.
- Assumed mid class "class": the mid class of the pollutant class is assumed. This was used when no observed and classification data were available.
- Observed data: obtained from statistical analysis of observed data.
- EA suggested value: valued used by the EA when no observed or consent data are available.
- Calculated using WwTW parameters: an occupancy rate of 2.35 p/h, a water consumption of 136 l/p/d and a 110% of flow reaching the work were used to calculate the future DWF (based on advice from Severn Trent Water).

The DWF permit assessment was carried out by comparing the works dry weather flow permit value against the 80-percentile flow (Q80) in accordance with the EA's approach to calculating DWF for planning purposes[1]. The former was provided by the EA whilst the latter was calculated by JBA using the observed data provided and they are shown on Table 5 below (see relevant paragraphs for the data analysis details):

Table 5: DWF permit and Q90

WwTW	Observed Mean WwTW Flow (m3/d)	DWF permit condition (m3/d)	Observed Q80 (m3/d)	Data period
Upper Arley	102	65	61	2013-15
Kidderminster	26,774	26,504	22,870	2013-15

It should be noted that 2014 and 2015 were years of exceptionally high rainfall. The 2013-15 data period was used for Kidderminster because of the increase in flow compared to the average values for the 2005-15 data period. Across the Severn-Trent region, CEH estimate that the annual rainfall had a 1 in 10-15 year return period in 2014[2], and 1 in 2-5 in 2015[3]. Consequently, river levels in the Severn were 119% of the long-term average for 2014 and 2015. In these conditions, many wastewater collection systems would be expected to exhibit higher than average infiltration flows. The EA has commissioned research (currently unpublished) into identifying periods of "unusual" rainfall which should be excluded from the calculation of actual DWF. This method has not been applied to the calculation of actual DWF in Table 5. It is therefore possible that the Q90 flows were atypical during 2014, and if so this would lead to an under-estimation of headroom at these WwTWs.

1 An Improved Definition of Sewage Treatment Works Dry Weather Flow: http://pioneer.tynemarch.co.uk/tynemarch/publications/msciwemymp.pdf

2 Centre for Ecology and Hydrology Hydrological Summary for December 2014. Accessed online at http://nora.nerc.ac.uk/509404/1/HS_201412.pdf on 09/08/2016

3 Centre for Ecology and Hydrology Hydrological Summary for December 2015. Accessed online at http://nora.nerc.ac.uk/512654/1/HS_201512%20v2.pdf on 09/08/2016.

A.8 Kidderminster WwTW

Kidderminster WwTW discharges into the River Stour (GB109054044710) as shown in Figure 2. The Water Framework Directive water body classification for the River Stour is summarised in Table 6. Overall, the watercourse has a Moderate classification, BOD and Ammonia are high but Phosphate has a poor classification.

Figure 2: Kidderminster WwTW discharge location.

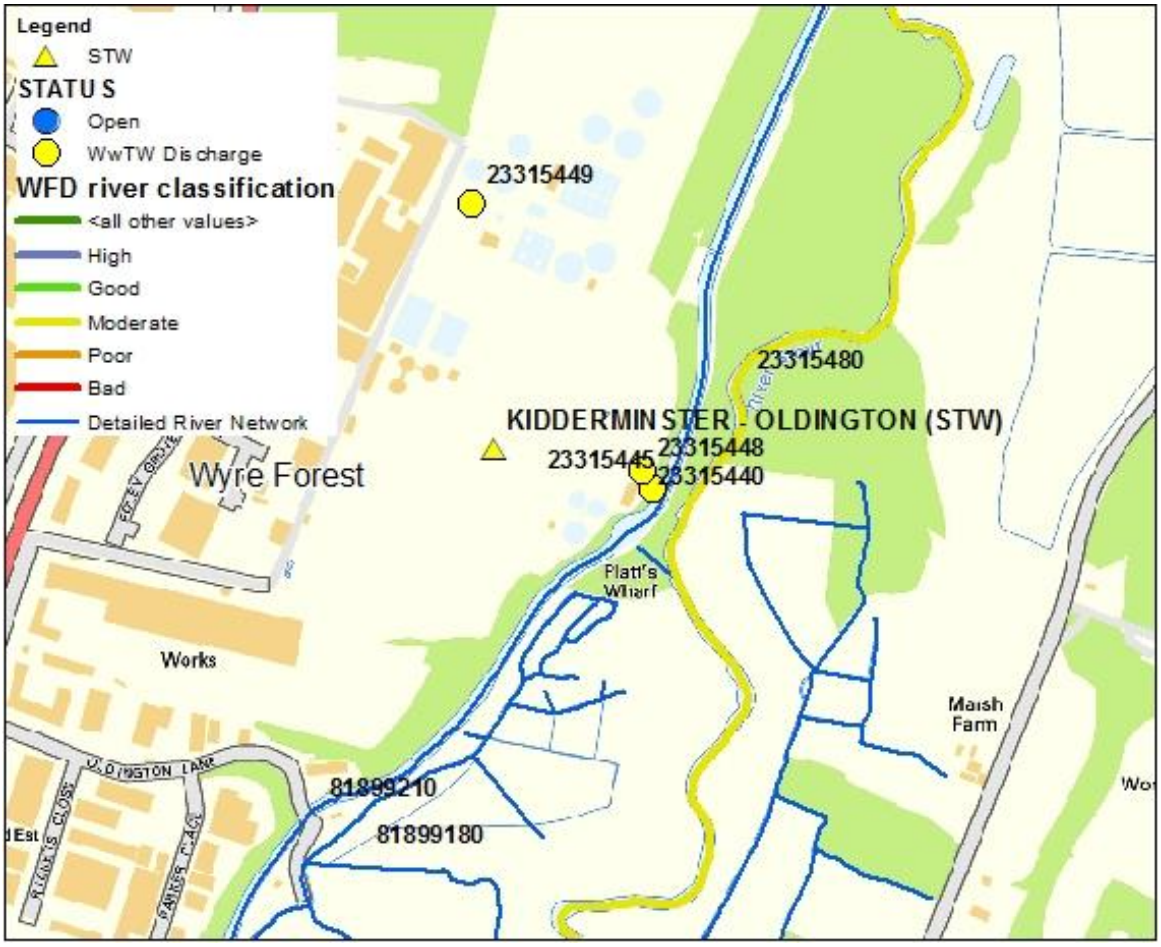


Table 6: River Stour status and objectives.

	Overall	Ecological	BOD	Ammonia	Phosphate
2015 Status	Moderate	Moderate	High	High	Poor
Objective	Good by 2027	Good by 2027	Not Available	Not Available	Good by 2027

Table 8 shows the input data and RQP results for Kidderminster WwTW for Options A and B. The works has permitted values for DWF, BOD and NH_4 and it is currently operating within the limits for all of them. Future scenarios predict that work will be still operating within its permit.

Table 7: Input data and RQP results for Kidderminster WwTW Option A

Para-meter	Stat	River	Source	Present Day			Future Growth		
				WwTW	Source	RQP Result	WwTW	Source	RQP Result
Flow (Ml/d)	Mean	256.43	Low Flows	26.77	Observed data		31.22	Calculated using Severn Trent Water parameters	
	SD			6.13			10.40		
	5%ile	90.11							
BOD (mg/l)	Mean	1.15	Mid class high	1.47	Observed data	1.97	1.47	Observed data	1.97
	SD	0.69		1.45			1.45		
	Target 90%ile	4.00	2015 WFD						
NH4 (mg/l)	Mean	0.090	Mid class high	0.29	Observed data	0.19	0.29	Observed data	0.20
	SD	0.050		0.57			0.57		
	Target 90%ile	0.30	2015 WFD						
P (mg/l)	Mean	0.634	Mid class poor	0.63	Observed data	0.64	4.94	Observed data	0.64
	SD	0.211		0.26			1.08		
	Target Mean	0.083	2015 WFD						
P (mg/l)	Mean	0.064	Mid class good	0.63	Observed data	0.13			
	SD	0.021		0.26					
	Target Mean	0.083	2015 WFD						

Table 8: Input data and RQP results for Kidderminster WwTW Option B

Para-meter	Stat	River	Source	Present Day			Future Growth		
				WwTW	Source	RQP Result	WwTW	Source	RQP Result
Flow (Ml/d)	Mean	256.43	Low Flow Software	26.77	Observed data		31.00	Calculated using Severn Trent Water parameters	
	SD			6.13			10.30		
	5%ile	90.11							
BOD (mg/l)	Mean	1.15	Mid class high	1.47	Observed data	1.97	1.47	Observed data	1.97
	SD	0.69		1.45			1.45		
	Target 90%ile	4.00	2015 WFD						
NH4 (mg/l)	Mean	0.090	Mid class high	0.29	Observed data	0.19	0.29	Observed data	0.20
	SD	0.050		0.57			0.57		
	Target 90%ile	0.30	2015 WFD						
P (mg/l)	Mean	0.634	Mid class poor	0.63	Observed data	0.64	0.63	Observed data	0.64
	SD	0.211		0.26			0.26		
	Target Mean	0.083	2015 WFD						
P (mg/l)	Mean	0.064	Mid class good	0.63	Observed data	0.13			
	SD	0.021		0.26					
	Target Mean	0.083	2015 WFD						

The RQP result is the calculated concentration in the receiving watercourse.

For both Options A and B, the model results indicate that for BOD and Ammonia, there are no class or deterioration target failures. For Phosphate, in both the present day and future scenario, the model indicates a failure of the Good Ecological Status (GES) target with a bad classification. It also fails to reach GES when assuming good status upstream of the WwTWs.

The RQP function was used to calculate the required discharge quality for P to meet the river targets also assuming good status upstream. The model results in Table 9 and Table 10 indicate that the targets cannot be achieved in either present day or future growth scenarios using BAT. With the current poor status upstream, the RQP tool cannot calculate any concentration able to meet the good target. Assuming good status upstream, the RQP tool gives a target concentration that is not achievable with BAT. Although the target status is not achievable with BAT, it may be achievable under some circumstances. In addition, the results of ongoing phosphate treatment trials may result in a reduced BAT limit, so this may become achievable in the future.

Table 9: Discharge quality required to meet good targets at Kidderminster WwTW for Option A

Pollutant	Target	Upstream river quality	Scenario	Mean	SD	95%ile
P	0.083 - good	Poor	Future Growth	River quality target only achievable with improvements to the water quality of the river upstream of the WwTW discharge		
P	0.083 - good	Poor	Present day	River quality target only achievable with improvements to the water quality of the river upstream of the WwTW discharge		
P	0.083 - good	Assumed mid class good	Present day	0.23	0.09	0.40

Table 10: Discharge quality required to meet good targets at Kidderminster WwTW for Option B

Pollutant	Target	Upstream river quality	Scenario	Mean	SD	95%ile
P	0.083 - good	Poor	Future Growth	River quality target not achievable without improving the water quality of the river upstream of the WwTW discharge		
P	0.083 - good	Poor	Present day	River quality target not achievable without improving the water quality of the river upstream of the WwTW discharge		
P	0.083 - good	Assumed mid class good	Present day	0.23	0.09	0.40

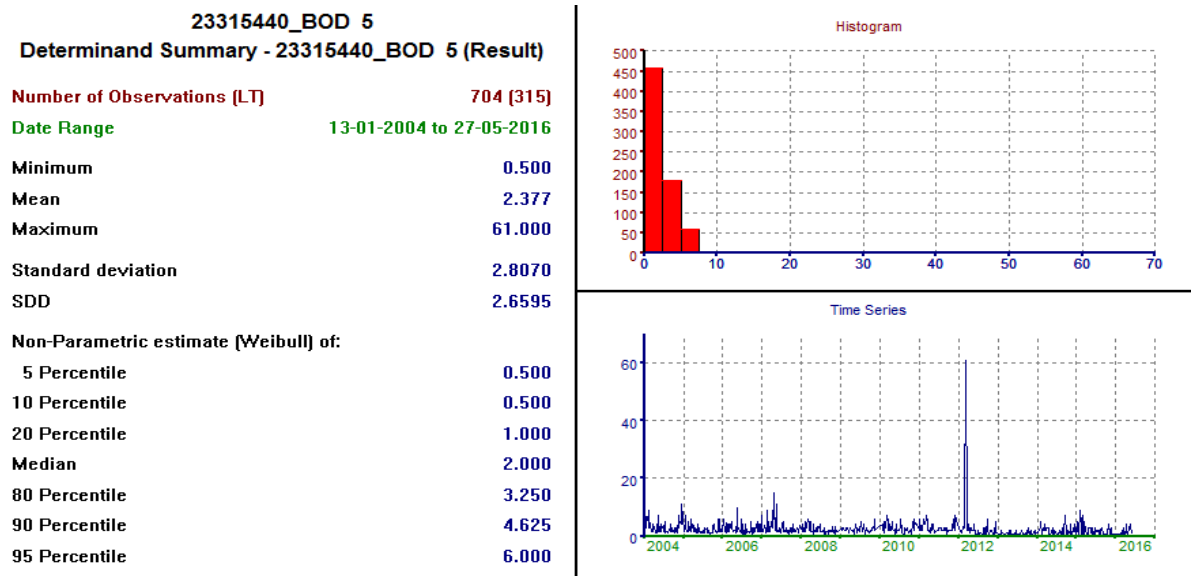
A.8.1 Aardvark analysis for Kidderminster WwTW (sampling ref: 23315440) discharge data

Observed data is available for BOD, Ammonia and Phosphate for the Kidderminster WwTW.

BOD

There are 704 samples for BOD from 2004 to 2016, of which 315 are "less than". Figure 3 shows the summary statistics for BOD. Aardvark detected a significant step change, shown in Figure 4 and Figure 5. One value was considered an outlier, it was removed and the data was reanalysed. Figure 6 shows the summary statistics for BOD without outliers. Aardvark detected an additional significant step change, this is shown in Figure 7 and Figure 8. Data without outliers from 30/05/12 was used for the final analysis. Final summary statistics are shown in Figure 9.

Figure 3: Aardvark summary for BOD for Kidderminster WwTW



23315440_BOD 5
Determinand Summary - 23315440_BOD 5 (Result)

Number of Observations (LT)	704 (315)
Date Range	13-01-2004 to 27-05-2016
Minimum	0.500
Mean	2.377
Maximum	61.000
Standard deviation	2.8070
SDD	2.6595
Non-Parametric estimate (Weibull) of:	
5 Percentile	0.500
10 Percentile	0.500
20 Percentile	1.000
Median	2.000
80 Percentile	3.250
90 Percentile	4.625
95 Percentile	6.000

Figure 4: Aardvark graph cumulative analysis for BOD for Kidderminster WwTW

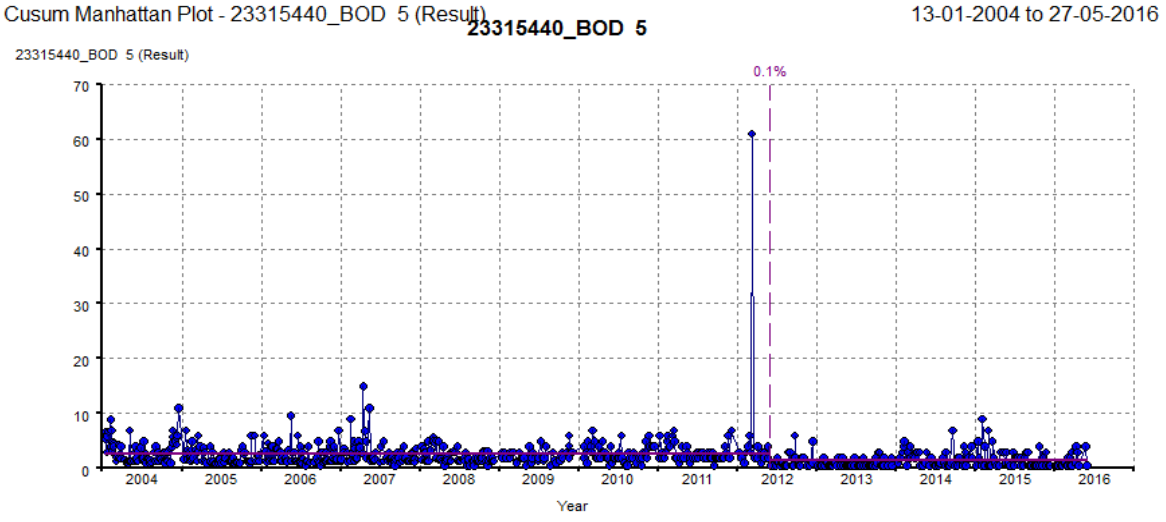


Figure 5: Aardvark summary cumulative analysis for BOD for Kidderminster WwTW

Cusum Stats - 23315440_BOD 5 (Result)

23315440_BOD 5

13-01-2004 to 27-05-2016

	Start Date	End Date	N	Mean	Std Dev	SDD	Significance
1	13-01-2004	19-05-2012	513	2.72	3.101	2.993	
							0.1%
2	30-05-2012	27-05-2016	191	1.47	1.447	1.401	

Figure 6: Aardvark summary for BOD for Kidderminster WwTW without outlier.

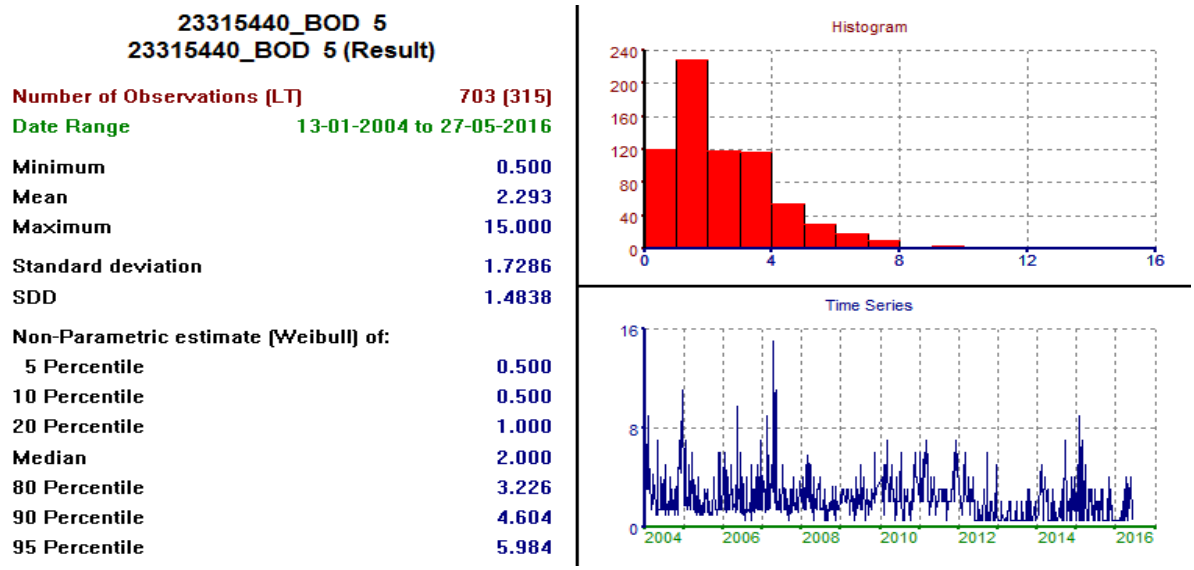


Figure 7: Aardvark graph cumulative analysis for BOD for Kidderminster WwTW without outlier.

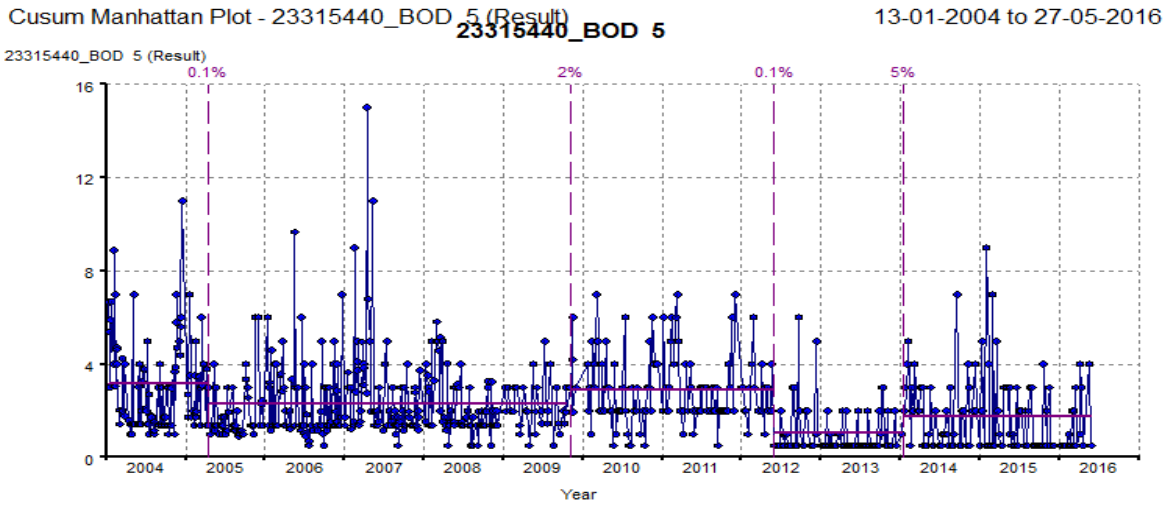


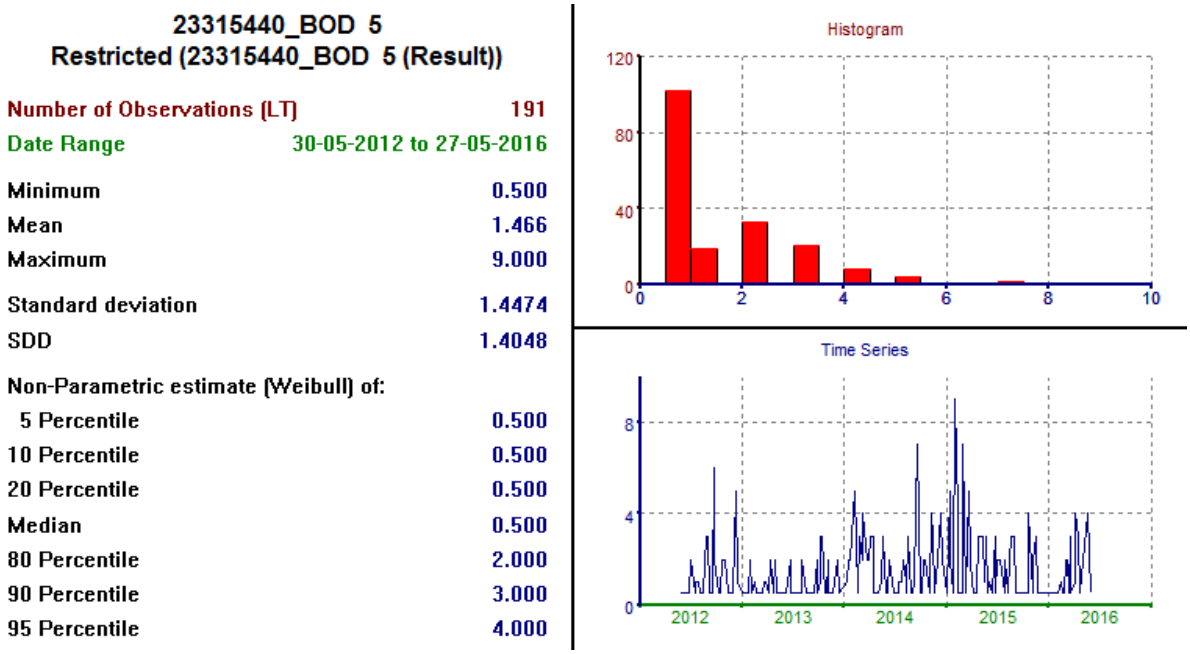
Figure 8: Aardvark summary cumulative analysis for BOD for Kidderminster WwTW without outlier

Cusum Stats - 23315440_BOD 5 (Result) 13-01-2004 to 27-05-2016

23315440_BOD 5

	Start Date	End Date	N	Mean	Std Dev	SDD	Significance
1	13-01-2004	13-04-2005	95	3.14	1.986	1.639	
							0.1%
2	13-04-2005	15-10-2009	297	2.31	1.662	1.539	
							2%
3	04-11-2009	19-05-2012	120	2.90	1.502	1.326	
							0.1%
4	30-05-2012	09-01-2014	77	1.05	1.034	1.006	
							5%
5	17-01-2014	27-05-2016	114	1.75	1.615	1.617	

Figure 9: Aardvark summary for BOD for Kidderminster WwTW without outlier with data from 30/05/12.



23315440_BOD 5
Restricted (23315440_BOD 5 (Result))

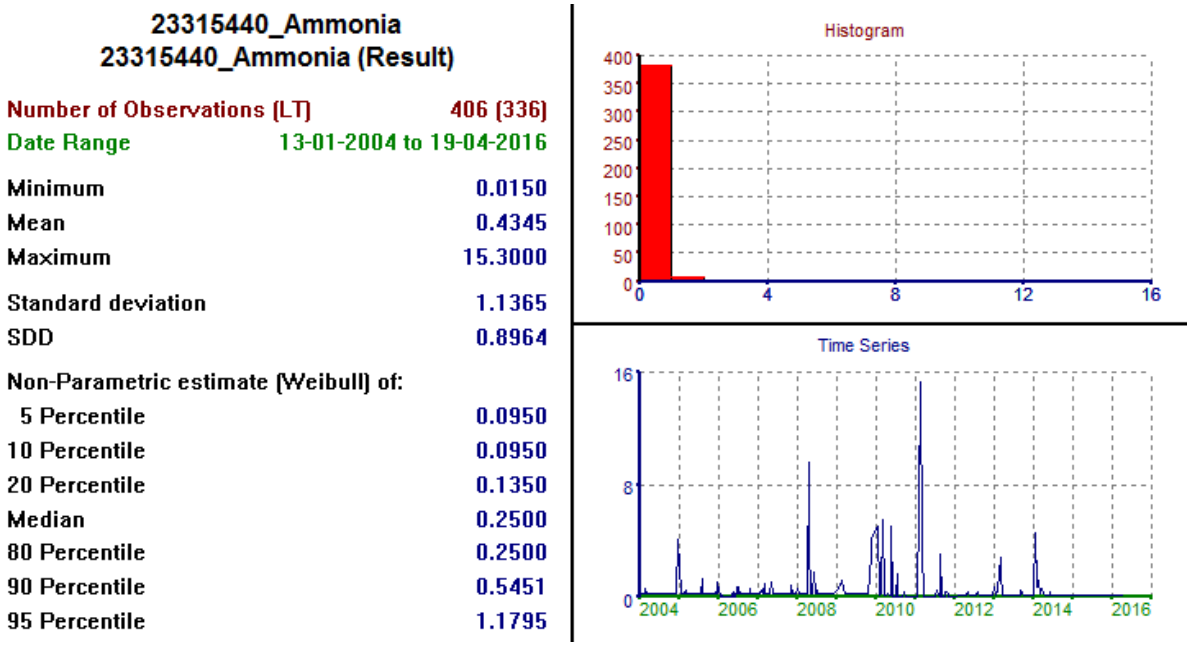
Number of Observations (LT)	191
Date Range	30-05-2012 to 27-05-2016
Minimum	0.500
Mean	1.466
Maximum	9.000
Standard deviation	1.4474
SDD	1.4048
Non-Parametric estimate (Weibull) of:	
5 Percentile	0.500
10 Percentile	0.500
20 Percentile	0.500
Median	0.500
80 Percentile	2.000
90 Percentile	3.000
95 Percentile	4.000

NH4

There are 406 samples for NH_4 from 2004 to 2016 of which 336 are "less than".

Figure 10 shows the summary statistics for NH_4. Aardvark detected some significant step changes as shown in Figure 11 and Figure 12. Data from 16/03/11 was used for the final analysis, Figure 13 shows the summary statistics.

Figure 10: Aardvark summary for NH_4 for Kidderminster WwTW



23315440_Ammonia
23315440_Ammonia (Result)

Number of Observations (LT)	406 (336)
Date Range	13-01-2004 to 19-04-2016
Minimum	0.0150
Mean	0.4345
Maximum	15.3000
Standard deviation	1.1365
SDD	0.8964
Non-Parametric estimate (Weibull) of:	
5 Percentile	0.0950
10 Percentile	0.0950
20 Percentile	0.1350
Median	0.2500
80 Percentile	0.2500
90 Percentile	0.5451
95 Percentile	1.1795

Figure 11: Aardvark graph cumulative analysis for NH_4 for Kidderminster WwTW

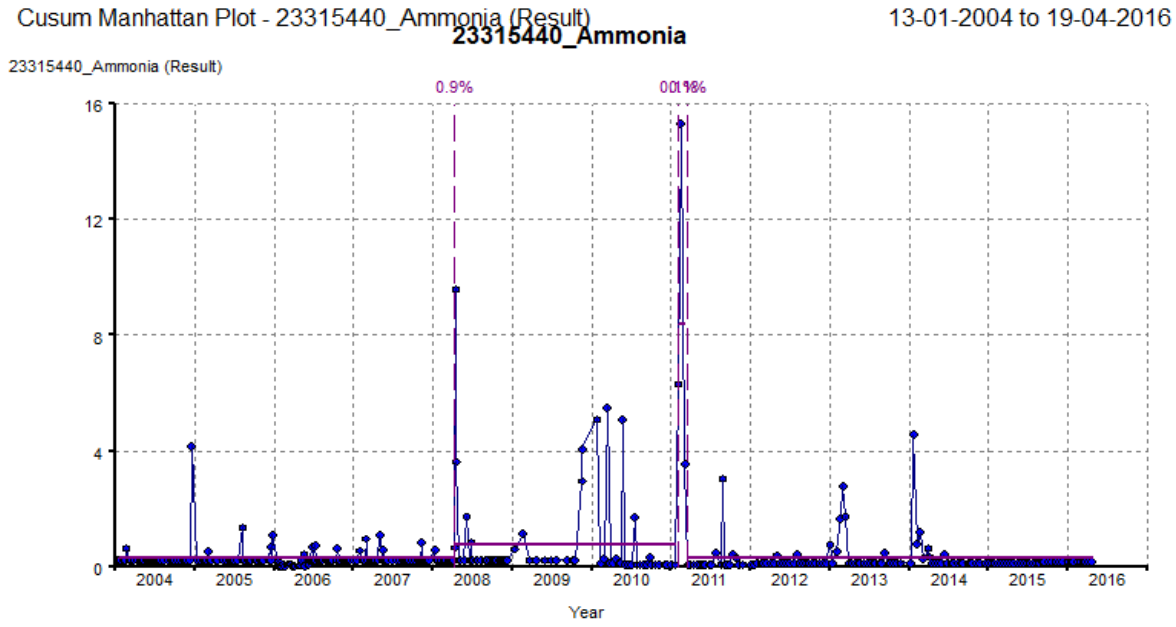


Figure 12: Aardvark summary for NH_4 for Kidderminster WwTW without outlier.

Cusum Stats - 23315440_Ammonia (Result) 13-01-2004 to 19-04-2016

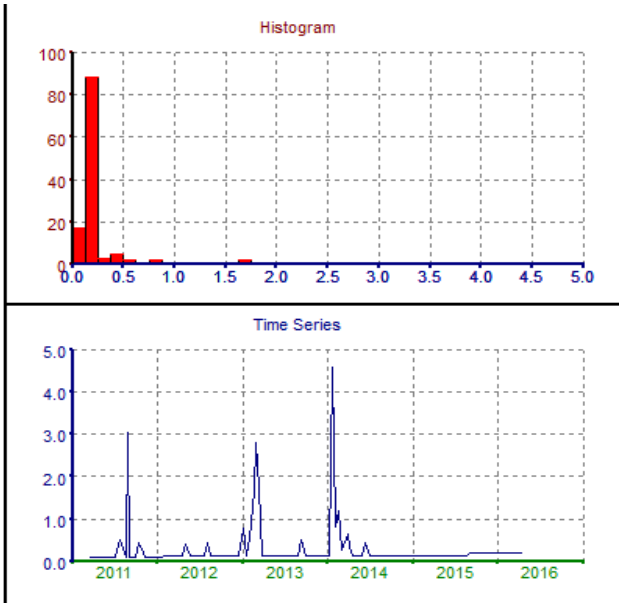
23315440_Ammonia

	Start Date	End Date	N	Mean	Std Dev	SDD	Significance
1	13-01-2004	04-04-2008	207	0.29	0.316	0.315	
							0.9%
2	09-04-2008	19-01-2011	72	0.76	1.603	1.399	
							0.1%
3	03-02-2011	04-03-2011	3	8.38	6.146	7.400	
							0.1%
4	16-03-2011	19-04-2016	124	0.29	0.572	0.497	

Figure 13: Aardvark summary for NH_4 for Kidderminster WwTW with data from 16/03/11.

23315440_Ammonia
Restricted (23315440_Ammonia (Result))

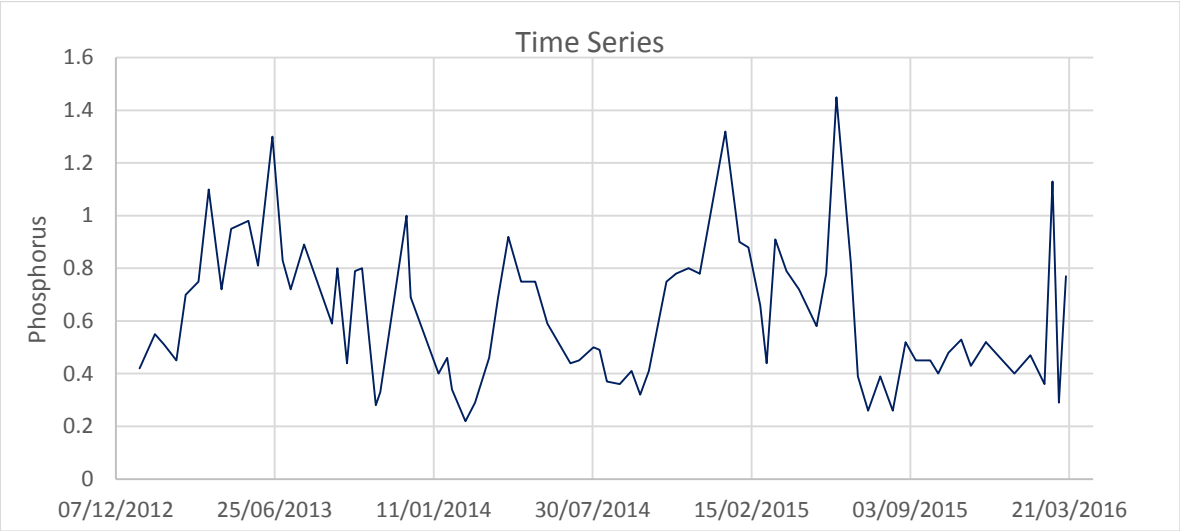
Number of Observations (LT)	124
Date Range	16-03-2011 to 19-04-2016
Minimum	0.0950
Mean	0.2902
Maximum	4.5700
Standard deviation	0.5719
SDD	0.4992
Non-Parametric estimate (Weibull) of:	
5 Percentile	0.0950
10 Percentile	0.0950
20 Percentile	0.1350
Median	0.1350
80 Percentile	0.2050
90 Percentile	0.4700
95 Percentile	1.0925



Phosphate

There are 78 samples for P from 2013 to 2016. There are no outliers for P and the relevant time series is shown in Figure 14. Data from 06/01/2013 to17/03/2016 was used.

Figure 14: Aardvark summary for P for Kidderminster WwTW



A.8.2 Effluent flow data analysis for Kidderminster WwTW

Figure 15 shows the observed flow at Kidderminster WwTW and the summary statistics can be found in Table 11. It was decided to use data from 2013 to 2015 for effluent flow.

Figure 15: Kidderminster WwTW discharge flow.

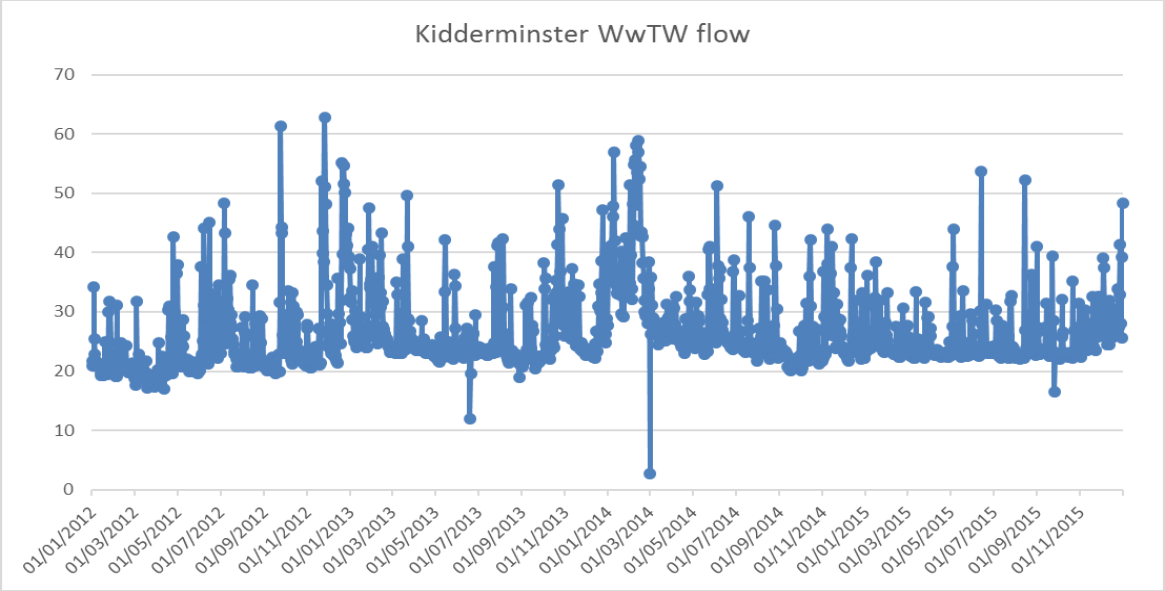


Table 11: for Kidderminster WwTW discharge flow summary statistics.

Data period	Mean	SD	80%ile (Q80)
all data	23.933	5.855	20.060
2012-15	26.306	6.524	22.320
2013-15	26.774	6.132	22.870
2014-15	27.005	6.413	22.944

A.9 Upper Arley WwTW

Upper Arley WwTW discharges into an unnamed small watercourse that itself discharges approximately 100m downstream into the River Severn as shown in Figure 16. Given this close proximity to the Severn, it was considered that the assessment should consider the impact of Upper Arley WwTW on the Severn. The status of the receiving watercourse is summarised in Table 12.

Figure 16: Upper Arley WwTW discharge location.

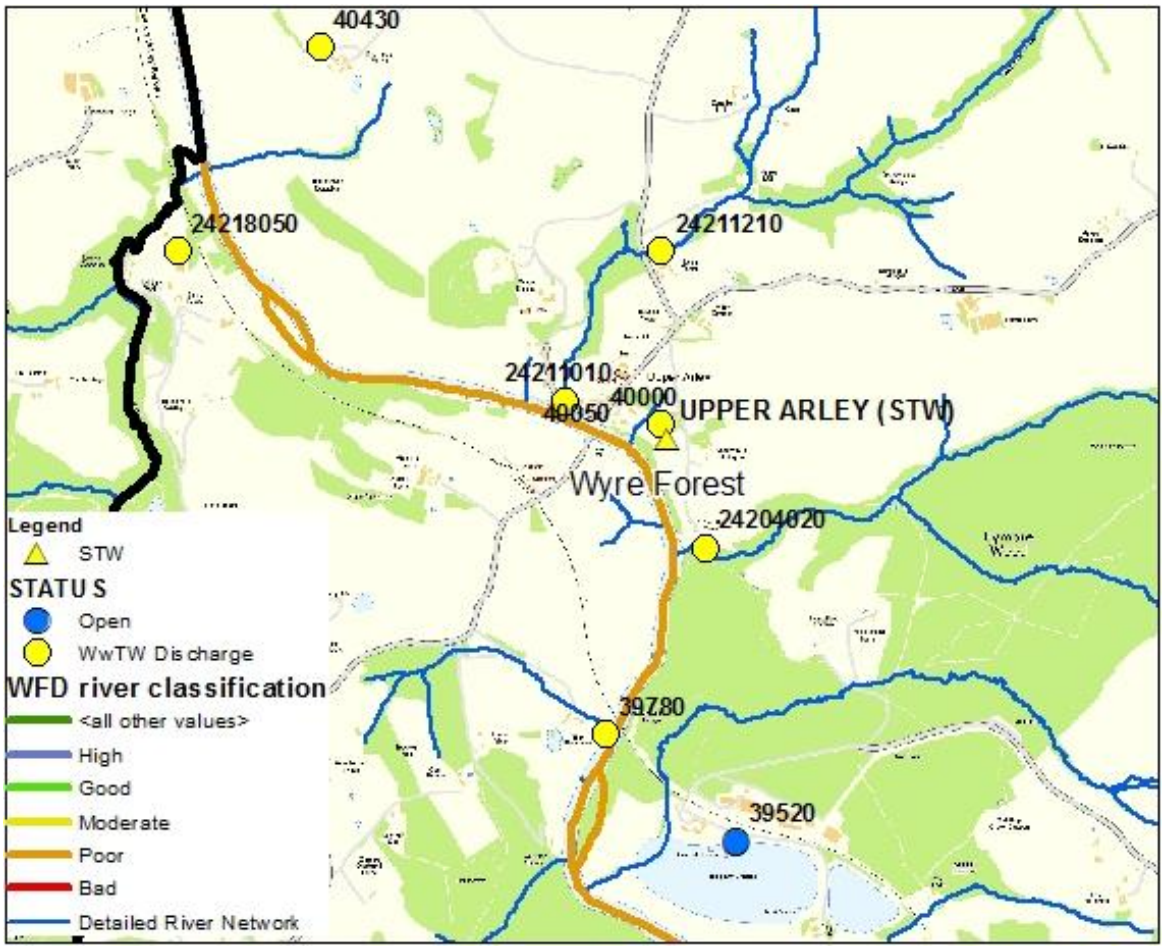


Table 12: River Severn WFD Classifications

	Overall	Ecological	BOD	Ammonia	Phosphate
2015 Status	Poor	Poor	High	High	Moderate
Objective	Good by 2027	Good by 2027	Not Available	Not Available	Good by 2027

Table 14 shows the input data and RQP results for Upper Arley. The works has permitted values for DWF and BOD and it is currently operating within the limits for all of them. Future scenarios predict that the work will be still operating within its permits. There are no upstream water quality sampling points.

Table 13: Input data and RQP results for Upper Arley WwTW

Para-meter	Statistic	River	Source	Present day			Future growth		
				WwTW	Source	RQP Result	WwTW	Source	RQP Result
Flow (Ml/d)	Mean	5655.7	Low Flow software	0.10	Observed data		0.13	Calculated using STW parameter	
	SD			0.07			0.01		
	5%ile	681							
BOD (mg/l)	Mean	2.29	Mid class good	7.04	Observed data	3.98	7.04	Observed data	3.98
	SD	1.38		7.51			7.51		
	Target 90%ile	4.00	WFD "Good Status" Target						
NH4 (mg/l)	Mean	0.09	Mid class high	3.73	Observed data	0.18	3.73	Observed data	0.18
	SD	0.05		3.73			3.73		
	Target 90%ile	0.30	WFD "High Status" Target						
P (mg/l)	Mean	0.120	Mid class moderate	6.73	Observed data	0.12	6.73	Observed data	0.12
	SD	0.040		3.05			3.05		
	Target Mean	0.068	WFD "Good Status" Target						
P (mg/l)	Mean	0.052	Assumed mid class good	6.73	Observed data	0.05	6.73	Observed data	0.05
	SD	0.017		3.05			3.05		
	Target Mean	0.068	WFD "Good Status" Target						

The RQP result is the calculated concentration in the receiving watercourse.

The model results indicate that for BOD and NH4 there is no class or deterioration target failure. For P, both present day and future scenario, the model indicates a failure of the good target with a poor status even assuming good class upstream of the works. There is no failure of the good target if the good quality is assumed upstream.

The RQP function was used to calculate the required discharge quality for P to meet the river targets considering the actual moderate upstream quality. The model results in Table 15 indicate that the targets cannot be achieved. With the current moderate status upstream, the RQP tool cannot calculate any concentration able to meet the good target. This is not surprising given that Upper Arley WwTW contributes such a tiny percentage of the flow of the River Severn. In terms of phosphorous, it currently contributes an additional 0.1% to the mean phosphorous load in the River Severn. Therefore, non-compliance of the River Severn for P would need to be addressed by reducing major upstream diffuse and point sources.

Table 14: discharge quality required to meet good WFD targets for P at Upper Arley WwTW.

Pollutant	Target	Upstream river quality	Scenario	Mean	SD	95%ile
P	0.068 - good	Mid class moderate	Future Growth	River quality target only achievable with improvements the water quality of the river upstream of the WwTW discharge		
P	0.068 - good	Mid class moderate	Present day	River quality target only achievable with improvements the water quality of the river upstream of the WwTW discharge		
P	0.068 - good	Assumed mid class good	Future Growth	River quality target only achievable with improvements the water quality of the river upstream of the WwTW discharge		

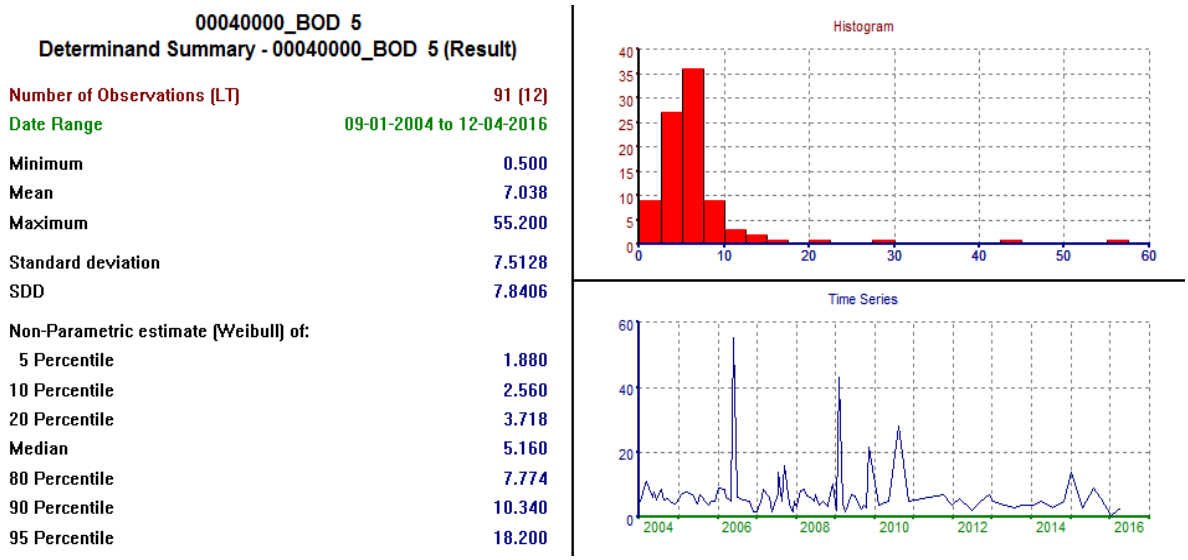
A.9.3 Aardvark analysis for Upper Arley WwTW (sampling ref: 00040000) discharge data.

Observed data are available for BOD, Ammonia and Phosphate for Upper Arley WwTW.

BOD

There are 91 samples for BOD from 2004 to 2016 of which 12 are "less than". Figure 17 shows the summary statistics for BOD where no outliers were found. Aardvark did not detect any step changes as shown in Figure 21.

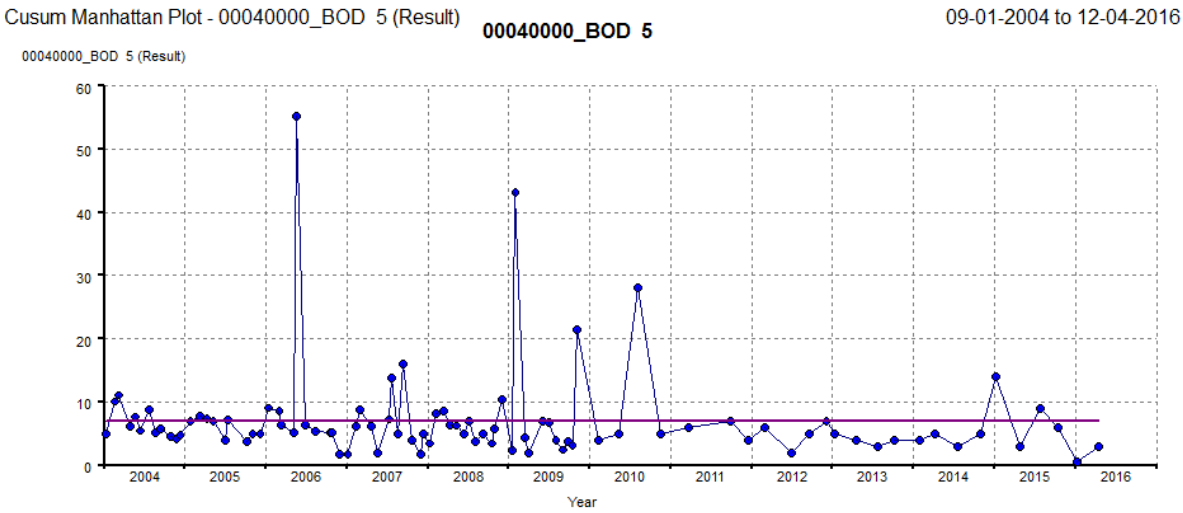
Figure 17: Aardvark summary for BOD for Upper Arley WwTW



00040000_BOD 5
Determinand Summary - 00040000_BOD 5 (Result)

Number of Observations (LT)	91 (12)
Date Range	09-01-2004 to 12-04-2016
Minimum	0.500
Mean	7.038
Maximum	55.200
Standard deviation	7.5128
SDD	7.8406
Non-Parametric estimate (Weibull) of:	
5 Percentile	1.880
10 Percentile	2.560
20 Percentile	3.718
Median	5.160
80 Percentile	7.774
90 Percentile	10.340
95 Percentile	18.200

Figure 18: Aardvark graph cumulative analysis for BOD for Upper Arley WwTW

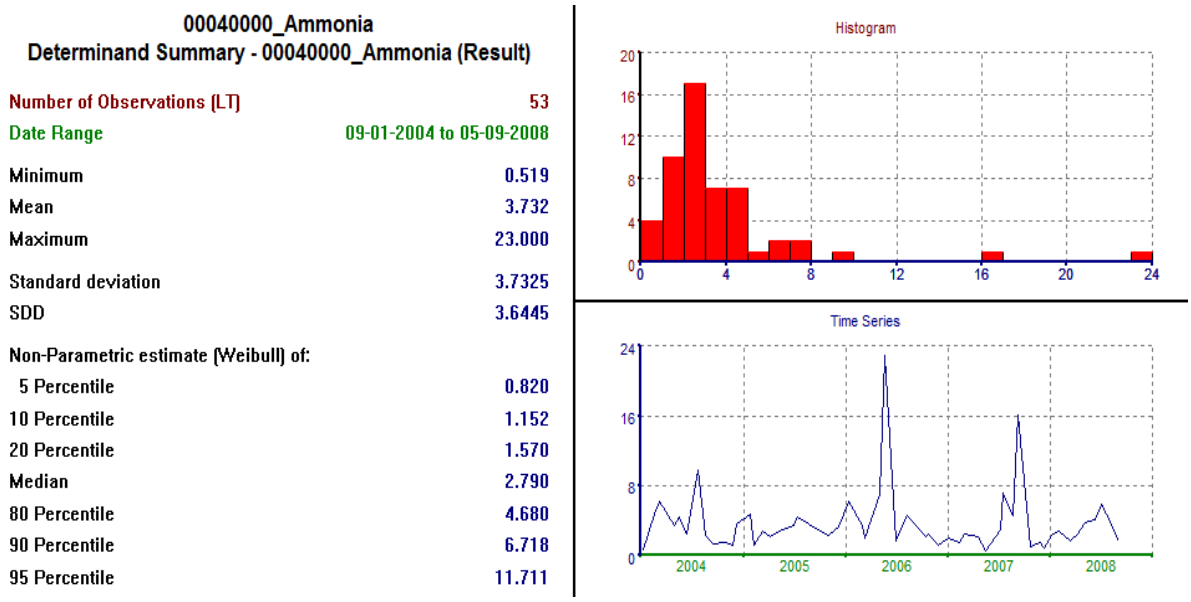


NH4

There are 53 samples for NH_4 from 2004 to 2008.

Figure 19 shows the summary statistics for NH_4 where no outliers were found. Aardvark did not detect any step changes (see Figure 23) and all data within the dataset was used.

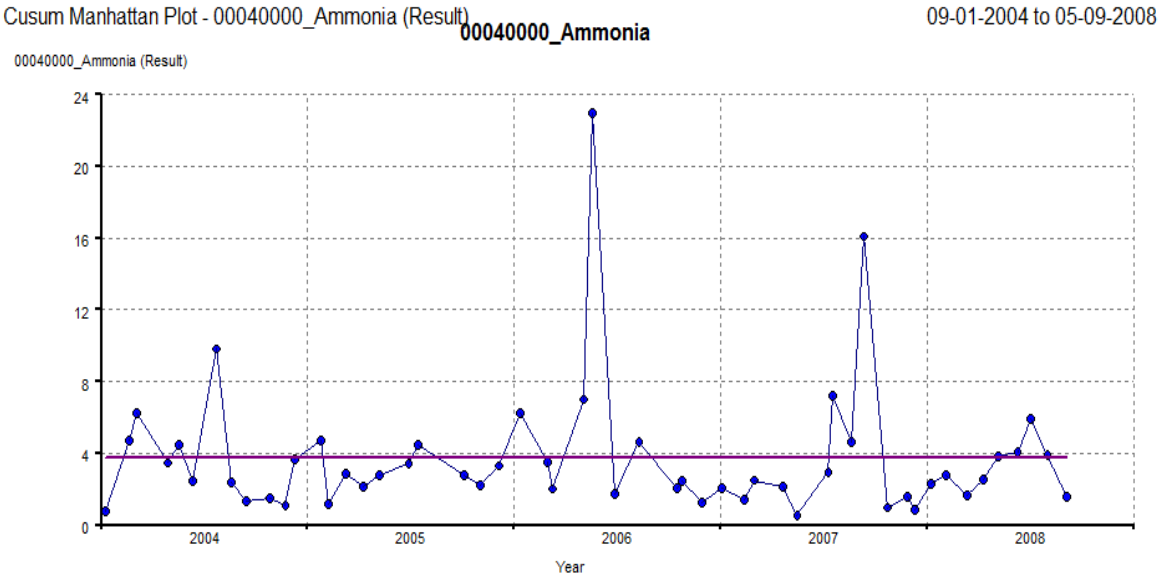
Figure 19: Aardvark summary for NH_4 for Upper Arley WwTW



00040000_Ammonia
Determinand Summary - 00040000_Ammonia (Result)

Number of Observations (LT)	53
Date Range	09-01-2004 to 05-09-2008
Minimum	0.519
Mean	3.732
Maximum	23.000
Standard deviation	3.7325
SDD	3.6445
Non-Parametric estimate (Weibull) of:	
5 Percentile	0.820
10 Percentile	1.152
20 Percentile	1.570
Median	2.790
80 Percentile	4.680
90 Percentile	6.718
95 Percentile	11.711

Figure 20: Aardvark graph cumulative analysis for NH_4 for Upper Arley WwTW



P

There were 53 samples for P from 2004 to 2008. Figure 21 shows the summary statistic for P where no outliers were found. Aardvark also did not detect any significant step changes as shown in Figure 23. All data within the dataset was used.

Figure 21: Aardvark summary for P for Upper Arley WwTW

00040000_Orthoph
Determinand Summary - 00040000_Orthoph (Result)

Number of Observations (LT)	53
Date Range	09-01-2004 to 05-09-2008
Minimum	1.31
Mean	6.73
Maximum	12.50
Standard deviation	3.045
SDD	2.452
Non-Parametric estimate (Weibull) of:	
5 Percentile	1.59
10 Percentile	2.54
20 Percentile	3.87
Median	7.47
80 Percentile	9.61
90 Percentile	10.58
95 Percentile	11.53

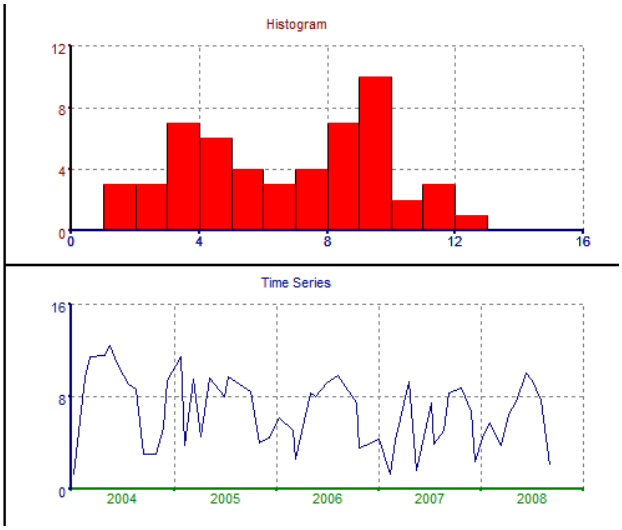


Figure 22: Aardvark graph cumulative analysis for P for Upper Arley WwTW

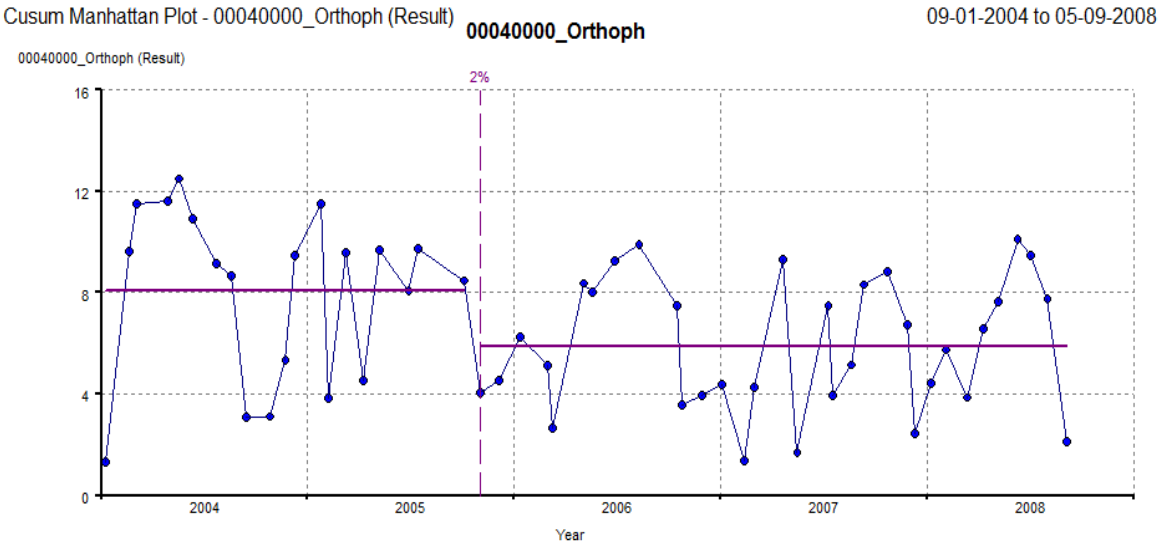


Figure 23: Aardvark summary cumulative analysis for P for Upper Arley WwTW

Cusum Stats - 00040000_Orthoph (Result) — **00040000_Orthoph** — 09-01-2004 to 05-09-2008

	Start Date	End Date	N	Mean	Std Dev	SDD	Significance
1	09-01-2004	03-10-2005	20	8.09	3.322	2.744	
							2%
2	01-11-2005	05-09-2008	33	5.91	2.580	2.191	

A.9.4 Effluent flow data analysis for Upper Arley WwTW

Figure 24 and Figure 25 show the available flow data for Upper Arley WwTW, summary statistics are also shown in Table 15 for this data period.

Figure 24: Upper Arley WwTW discharge flow.

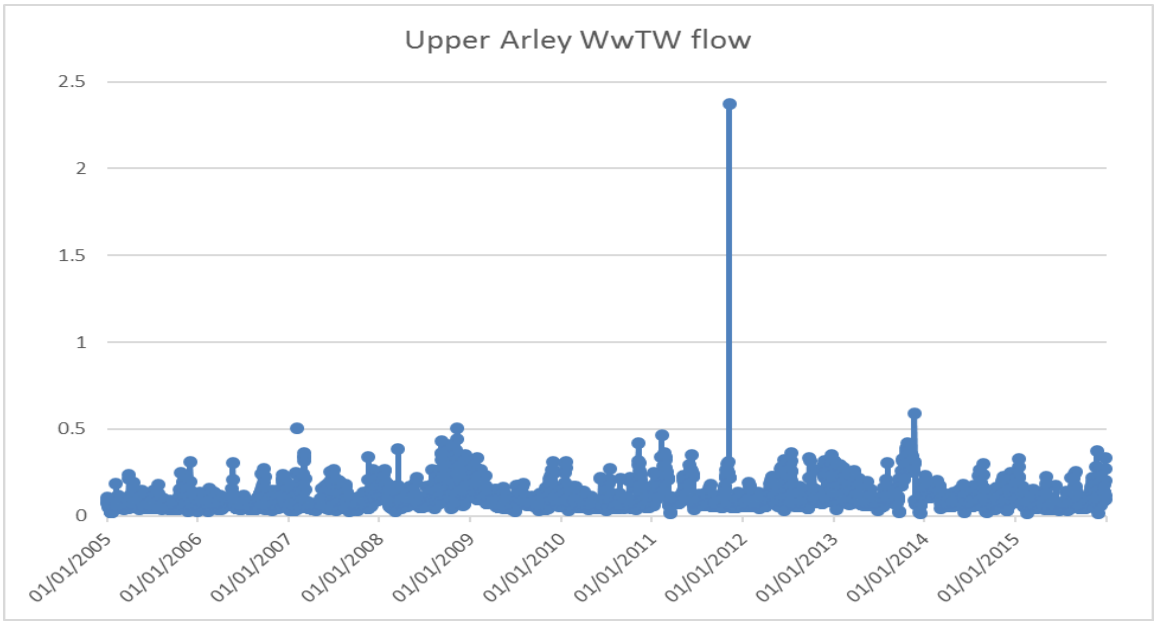


Figure 25: Upper Arley WwTW discharge flow without outlier.

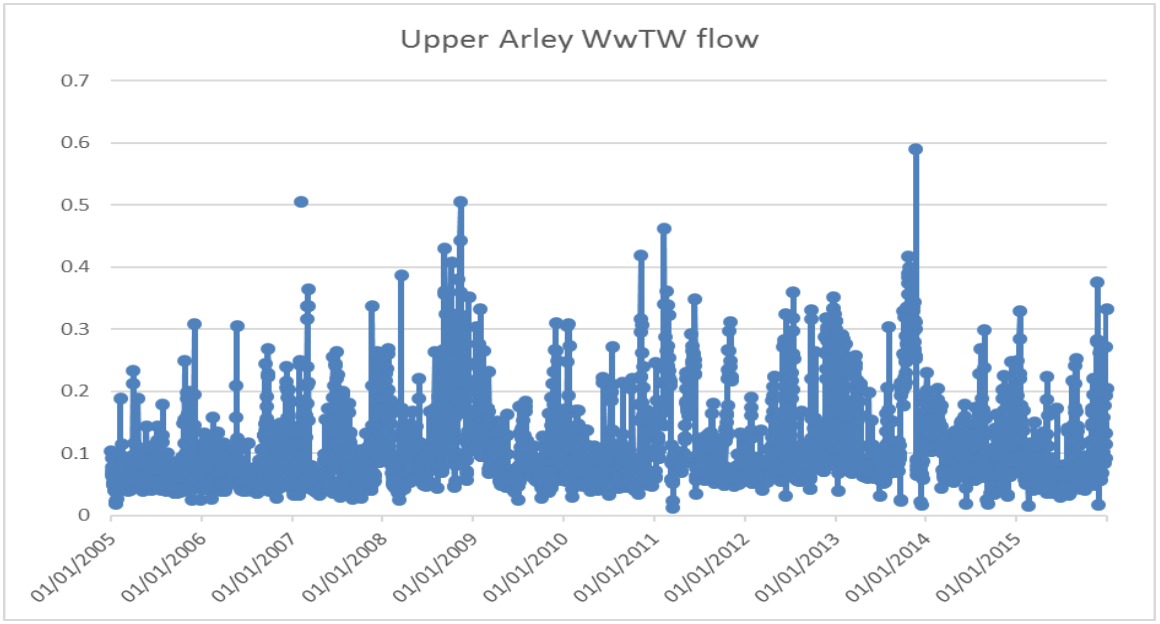


Table 15: Upper Arley WwTW discharge flow summary statistics.

Data period	Mean	SD	90%ile (Q90)
all data	0.102	0.076	0.046
all data no outlier	0.102	0.066	0.046
2013-15	0.110	0.070	0.052
2014-15	0.096	0.052	0.047

A.10 Summary and conclusion

A.10.5 Method

The increased discharge of effluent due to an increase in the population served by a Wastewater Treatment Works (WwTW) may impact on the quality of the receiving water. The Water Framework Directive (WFD) does not allow a watercourse to deteriorate from its current class (either water body or element class).

It is Environment Agency policy to model the impact of increasing effluent volumes on the receiving watercourse. Where the scale of development is such that a deterioration is predicted, a new permit may be required for the WwTW to improve the quality of the final effluent, so that the extra pollution load will not result in a deterioration in the water quality of the watercourse. This is known as a “no deterioration” or “load standstill".

During the preparation of this Water Cycle Study (WCS) two WwTWs were identified which were anticipated to receive significant future increases in wastewater flows as a result of development in their catchments as a result of the Wyre Forest Options A and B Preferred Options.

The assessment was undertaken using the EA's River Quality Planning (RQP) tool which enables a Monte-Carlo analysis to be undertaken at a single point of discharge to a watercourse. RQP models were set up and run, for each WwTW, for the present-day situation and the future scenarios.

Where failure was predicted for any of the scenarios, and the upstream river quality did not achieve ‘good status’, the model was run by assuming that the river had ‘good status’. The reason for this approach is to assess the actual impact of the effluent if upstream point and/or diffuse sources were to be resolved.

A.10.6 Results

Table 16 summarises the modelling results for passing or failing of the following targets:

- 'Good status';
- 'No 10% deterioration';
- 'No class deterioration'.

Table 16: RQP results summaries for passing or failing targets of: 'Good Status', 'No >10% Deterioration' and 'No Class Deterioration'.

Watercourse (WwTW discharging into it)	Scenario	Achieves 'Good status' target?			Achieves 'No > 10% deterioration' target?			Achieves No 'Class deterioration' target?		
		BOD	NH4	P	BOD	NH4	P	BOD	NH4	P
Key		Achieves good status			No deterioration			No class deterioration		
		NA			Up to 10% deterioration			NA		
		Fails good status			More than 10% deterioration			Class deterioration		
River Stour (Kidderminster) OPTION A	Present day	yes	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	Future growth	yes	yes	no	0.0%	5.0%	5.0%	yes	yes	yes
River Stour (Kidderminster) OPTION B	Present day	yes	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	Future growth	yes	yes	no	0.0%	5.0%	5.0%	yes	yes	yes
River Severn (Upper Arley)	Present day	yes	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	Future growth	yes	yes	no	0.0%	0.0%	0.0%	yes	yes	yes

A.10.7 Best Available Technology (BAT) Assessment

Where river target failures occurred, the modelling results were compared against BAT to assess if improving the works to such level of performance could prevent the failure to occur. This assessment process has recently been set out in a guidance document by the Environment Agency's West Thames Area[4]. Whilst this document has no national status, it provides a useful summary of how to interpret the results of the water quality assessment. This guidance is summarised in the flow chart below:

Figure 26: Water quality assessment flow chart

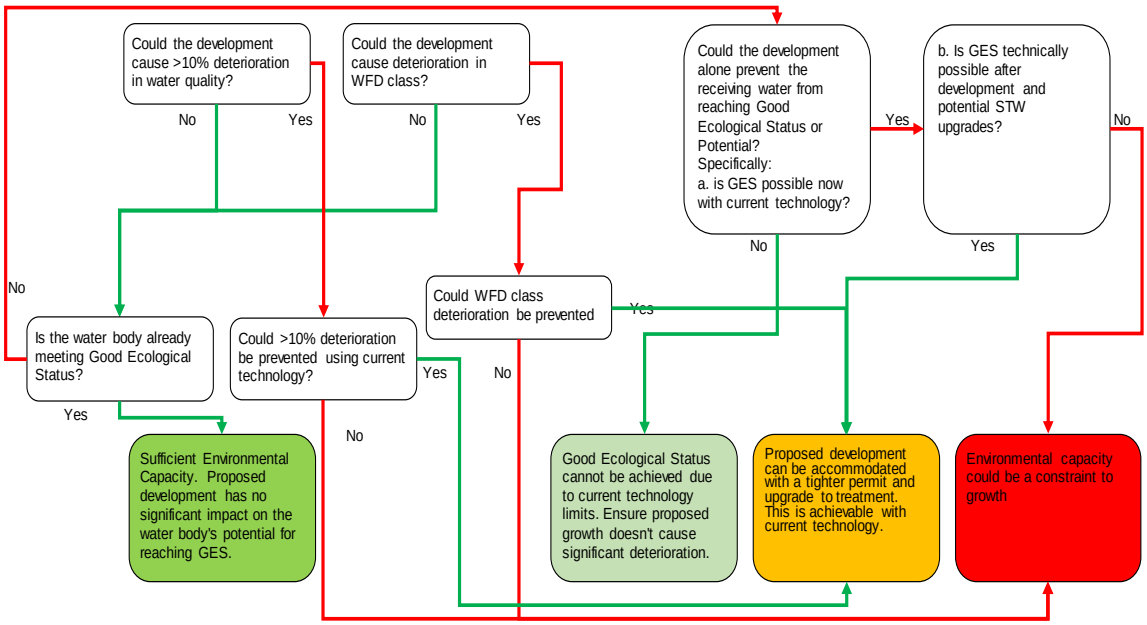


Table 17 summarises for each WwTW the following questions:

- Will the WwTW remain within its existing permit?
- Do any of the determinands experience a 10% deterioration and if so can this be prevented by application of BAT?
- Do any of the determinands experience a class deterioration and if so can this be prevented by application of BAT?
- Do any of the determinands experience a failure in reaching good status and if so can this be prevented by application of BAT?
- Do any of the determinands experience a failure in reaching the actual WFD status and if so can this be prevented by application of BAT?

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

- BOD (95%ile) = 5mg/l
- Ammonia (95%ile) = 1mg/l
- Phosphorus (mean) = 0.5mg/l

This does not take in consideration if it is feasible to upgrade each existing WwTW to such technology due to constraints of cost, timing, space, carbon cost etc.

4 Environment Agency West Thames Area (2015) Water Cycle Study Guidance and Requirements - West Thames Area.

Table 17: Summary of results assuming BAT is applied

Watercourse (WwTW)	Greater than 10% deteriorations in water quality?	Deterioration in WFD class of any element	Could the development prevent the water body from reaching GES?
Key	See Figure 29		
River Stour (Kidderminster) Option A	Predicted deterioration is less than 10%. No WwTW upgrade is required	No class deterioration is predicted. No WwTW upgrade is required.	Good Ecological Status (GES) cannot be achieved due to technological limits. GES could only be achieved through addressing upstream sources of P. Therefore, growth alone would not prevent the watercourse from reaching GES.
River Stour (Kidderminster) Option B	Predicted deterioration is less than 10%. No WwTW upgrade is required	No class deterioration is predicted. No WwTW upgrade is required.	Good Ecological Status (GES) cannot be achieved due to technological limits. GES could only be achieved through addressing upstream sources of P. Therefore, growth alone would not prevent the watercourse from reaching GES.
River Severn (Upper Arley)	Predicted deterioration is less than 10%. No WwTW upgrade is required	No class deterioration is predicted. No WwTW upgrade is required.	Good Ecological Status (GES) could only be achieved by upstream water quality improvements alone. Improved P treatment is therefore not expected to be required.

Note that phosphorus removal is the subject of ongoing national trials investigating novel techniques and optimisation of existing methods. This major study, which involves all UK water companies, is not due to report until 2017, therefore this assessment is based on the current assumption of BAT for phosphorus.

Table 18 reports information on the model results used to compare against Best Available Technology (BAT). Further explanation of column headers are shown below:

- Scenario: specifies the discharge flow and quality scenario data used as input in the RQP run;
- Target: specifies the target to achieve;
- Upstream river quality: specifies if the upstream river condition used for the run is the actual situation or if GES was assumed;
- Mean, SD and 95%ile: these are the RQP tool output representing the discharge value required to meet the specific target. For BOD and NH_4
- The value to compare with BAT is the 95%ile whilst for P is the mean.

Table 18: Runs and the model results used to compare against BAT.

WwTW	Pollutant	Target	Upstream river quality	Scenario	Mean	SD	95%ile
Kidderminster Option B	P	0.083 - good	Poor	Future Growth	River quality target only achievable with improvements the water quality of the river upstream of the WwTW discharge		
Kidderminster Option B	P	0.083 - good	Poor	Present day	River quality target only achievable with improvements the water quality of the river upstream of the WwTW discharge		
Kidderminster Option B	P	0.083 - good	Assumed mid class good	Present day	0.23	0.09	0.40
Kidderminster Option B	P	0.083 - good	Poor	Future Growth	River quality target only achievable with improvements the water quality of the river upstream of the WwTW discharge		
Kidderminster Option B	P	0.083 - good	Poor	Present day	River quality target only achievable with improvements the water quality of the river upstream of the WwTW discharge		
Kidderminster Option B	P	0.083 - good	Assumed mid class good	Present day	0.23	0.09	0.40
Upper Arley Option A and B	P	0.068 - good	Mid class moderate	Future Growth	River quality target only achievable with improvements the water quality of the river upstream of the WwTW discharge		
Upper Arley Option A and B	P	0.068 - good	Mid class moderate	Present day	River quality target only achievable with improvements the water quality of the river upstream of the WwTW discharge		
Upper Arley Option A and B	P	0.068 - good	Assumed mid class good	Future Growth	River quality target only achievable with improvements the water quality of the river upstream of the WwTW discharge		

A.10.8 Conclusions

The following conclusions are drawn from this water quality impact assessment:

- The proposed growth is not predicted to lead to any class deteriorations, or deteriorations of quality of greater than 10% for any determinand.
- For Phosphate all receiving watercourses at all WwTWs fail their WFD good target for the present-day situation:
    - At Kidderminster, even assuming that upstream water quality were to be improved to Good classification, it would not be possible to achieve Good due to the limitations of current P removal technology. Therefore, the constraining factor is current technology, not the proposed growth.
    - National trials of new techniques to treat P are due to report in 2017, and it is anticipated that these may allow future treatment to an annual mean of 0.1mg/l. Water companies and the Environment Agency will be considering how, when and where such treatment technologies and permit conditions with be applied over the next AMP period of 2020 to 2025.
    - At Upper Arley, Good status for phosphorous could only be achieved by f addressing upstream sources of P. Upper Arley WwTW makes only a small contribution to the total P load in the River Severn, and therefore it is not anticipated that additional treatment would be required as a result of the proposed growth.
- For BOD all watercourses achieve their target.
- For NH_4 all watercourses achieve their target.

The key constraints to achieving Gold Ecological Status (GES) at the two WwTWs assessed are the limits of current technology and not the impacts of planned growth. Therefore, environmental capacity is not considered to be a constraint upon growth.

Offices at
Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
South Barn
Broughton Hall
SKIPTON
North Yorkshire
BD23 3AE
United Kingdom

t:+44(0)1756 799919
e:info@jbaconsulting.com

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Registered in England
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B Environmental Constraints and Opportunities GeoPDFs

2016s4191 Wyre Forest District Council Water Cycle Study

Overview Map

Legend

Wye Forest District Boundary

Detailed Maps

Residential Sites

Option A and B

Option A Only

Option B Only

Employment Sites

Option A and

Option A Only

Click on the individual detailed map extents to view details of the sites in each area

JBA consulting

Wyre Forest District Council

Water Constraints and Opportunities

N

Upper Arley

Broadwaters

Habberley

Offmore Farm

Kidderminster

Bewdley

Hoobrook

Spennels

Foley Park

Callow Hill

Far Forest

Hales Park

Burlish Park

Wilden

Bliss Gate

Clows Top

Stourport-on-Severn

Arley Kings

0 1.25 2.5 5 Kilometers

Legend

Water Constraints and Opportunities

Wilden

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications

- High
- Good
- Moderate
- Poor
- Bad

Groundwater

Source Protection Zones

- Zone I - Inner Protection Zone
- Zone II - Outer Protection Zone
- Zone III - Total Catchment
- Zone of Special Interest

Aquifer Designation Map (Bedrock)

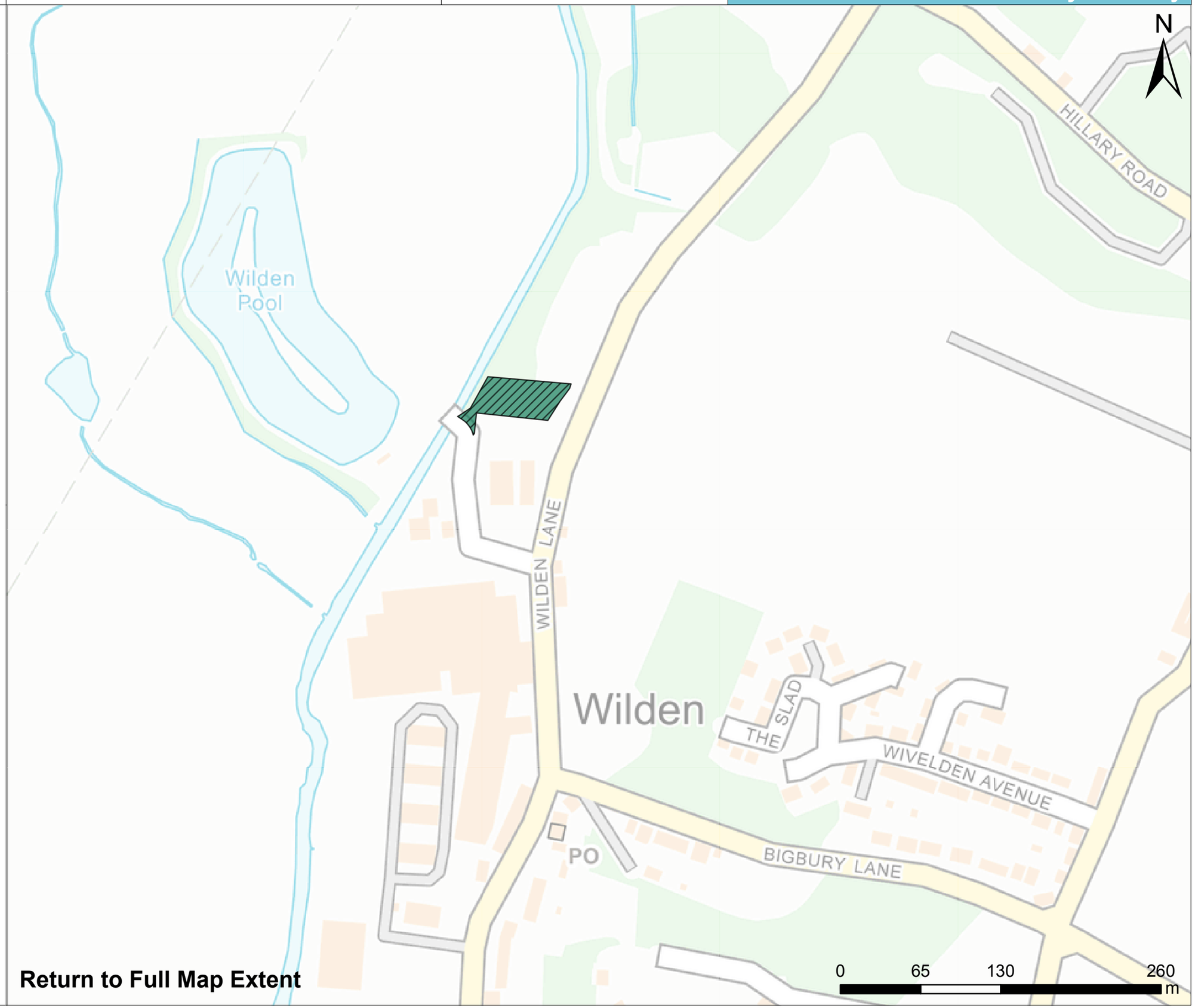
- Principal
- Secondary A
- Secondary B
- Secondary (undiff)
- Unproductive

Aquifer Designation Map (Superficial)

- Principal
- Secondary A
- Secondary B
- Secondary (undiff)
- Unproductive

Wyre Forest District Council

JBA consulting



Return to Full Map Extent

Legend

Water Constraints and Opportunities

Upper Arley

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites
- Option A and B
- Option A Only
- Option B Only

Employment Sites
- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications
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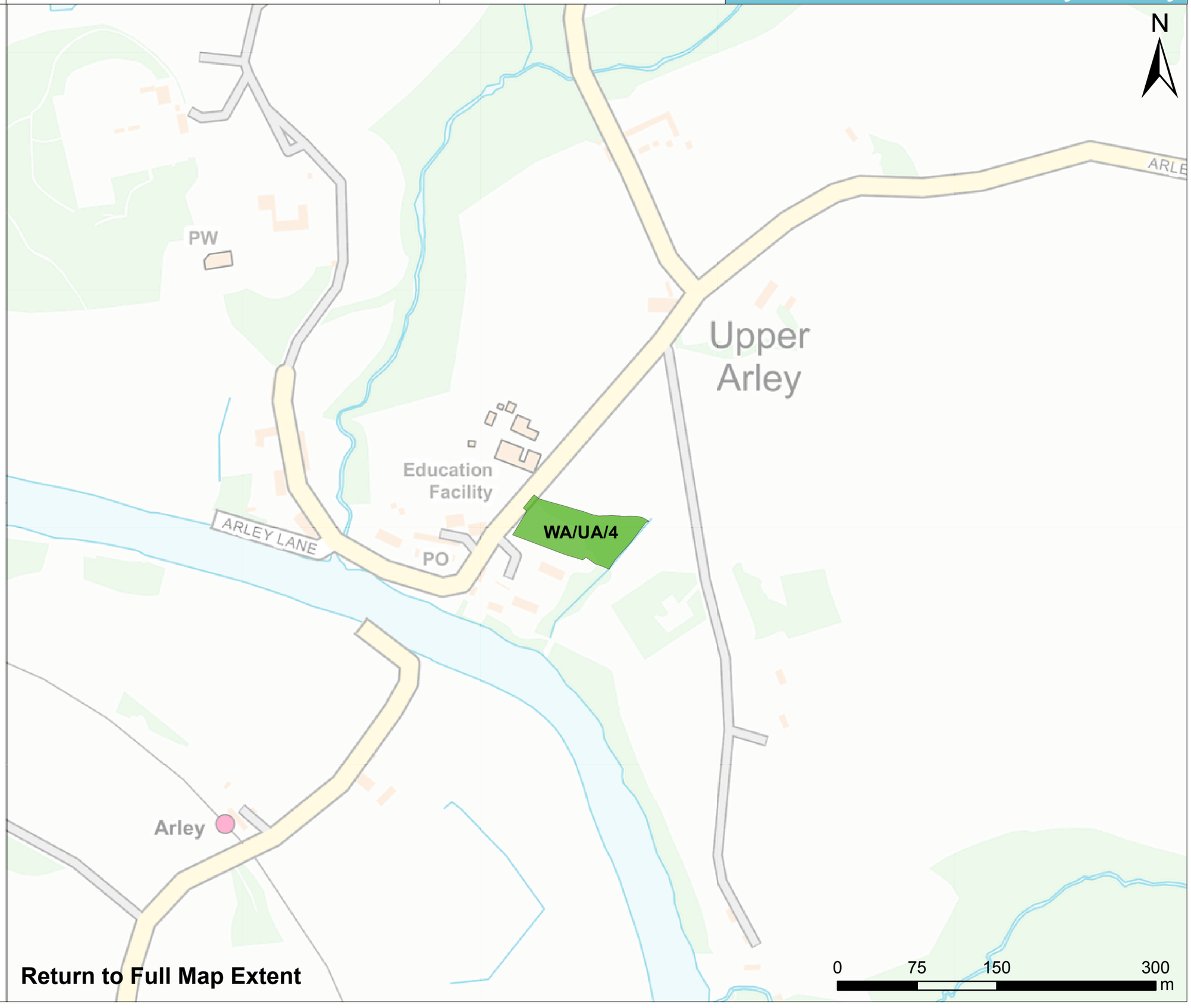
Wyre Forest District Council

JBA consulting



Legend

Water Constraints and Opportunities

Stourport-on-Severn

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites
- Option A and B
- Option A Only
- Option B Only

Employment Sites
- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications
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- Good
- Moderate
- Poor
- Bad

Groundwater

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- Unproductive

Aquifer Designation Map (Superficial)
- Principal
- Secondary A
- Secondary B
- Secondary (undiff)
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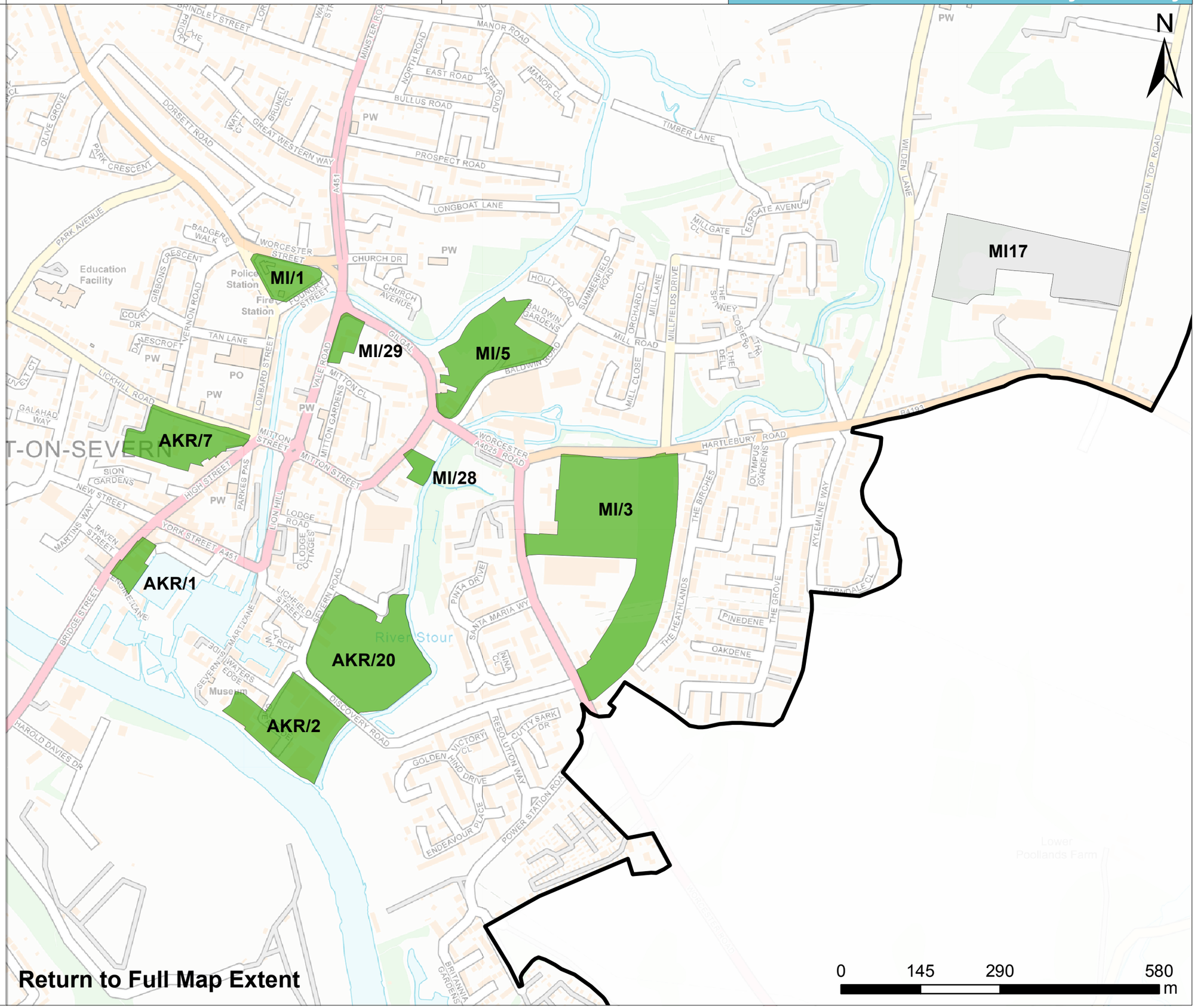
Wyre Forest District Council

JBA consulting



Return to Full Map Extent

Legend

Water Constraints and Opportunities

Spennels

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites
- Option A and B
- Option A Only
- Option B Only

Employment Sites
- Option A and B
- Option A Only

Surface Water
- Detailed River Network

WFD Cycle 2 Classifications
- High
- Good
- Moderate
- Poor
- Bad

Groundwater

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Aquifer Designation Map (Bedrock)
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- Unproductive

Aquifer Designation Map (Superficial)
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Wyre Forest District Council

JBA consulting

BHS/2
AS/6
AS/1
AS/5
AS/10
FPH/26
FPH/27
OC/13
OC/11
OC/12
WFR/ST/3
WFR/ST/1
OC/13
WFR/ST/2

Comberton
Kidderminster
Kidderminster Town
Spennells
Hoobrook
Stone
Stanklyn
Stanklyn Wood
Mustow Green
Silver Birches
Bissell Estate
Ferny Rough
Stenson

N

Return to Full Map Extent

0 250 500 1,000 m

Legend

Water Constraints and Opportunities

Offmore Farm

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications

- High
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Groundwater

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- Unproductive

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OC/4

OC/4

OC/5

WFR/CB/7

Offmore Farm

Education Facility

Hodge Hill Farmhouse and B

Railw Cotta

HURCOTT LANE

BIRMINGHAM ROAD

A456

A456

BIRMINGHAM ROAD

ROSEMARY ROAD

HUSUM WAY

BARRIE AVENUE

SHAKESPEARE DRIVE

SHAKESPEARE DR

CARLYLE AVENUE

SHAW AVENUE

OSBORNE CL

BRONTE DR

BRONTE DR

WORDSWORTH CRESCENT

DUNBAR

BRUCE ROAD

BALDWIN ROAD

COATES ROAD

ROAD

N

0 87.5 175 350 m

Return to Full Map Extent

Legend

Water Constraints and Opportunities

Kidderminster

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications

- High
- Good
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Groundwater

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Wyre Forest District Council

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BW/1
BW/2
BW/3
FHN/9
BHS/18
BHS/16
BHS/2
BHS/11
AS/1
AS/6

KIDDERMINSTER
Blakebrook
River Stour

Return to Full Map Extent

N

0 162.5 325 650 m

Legend

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

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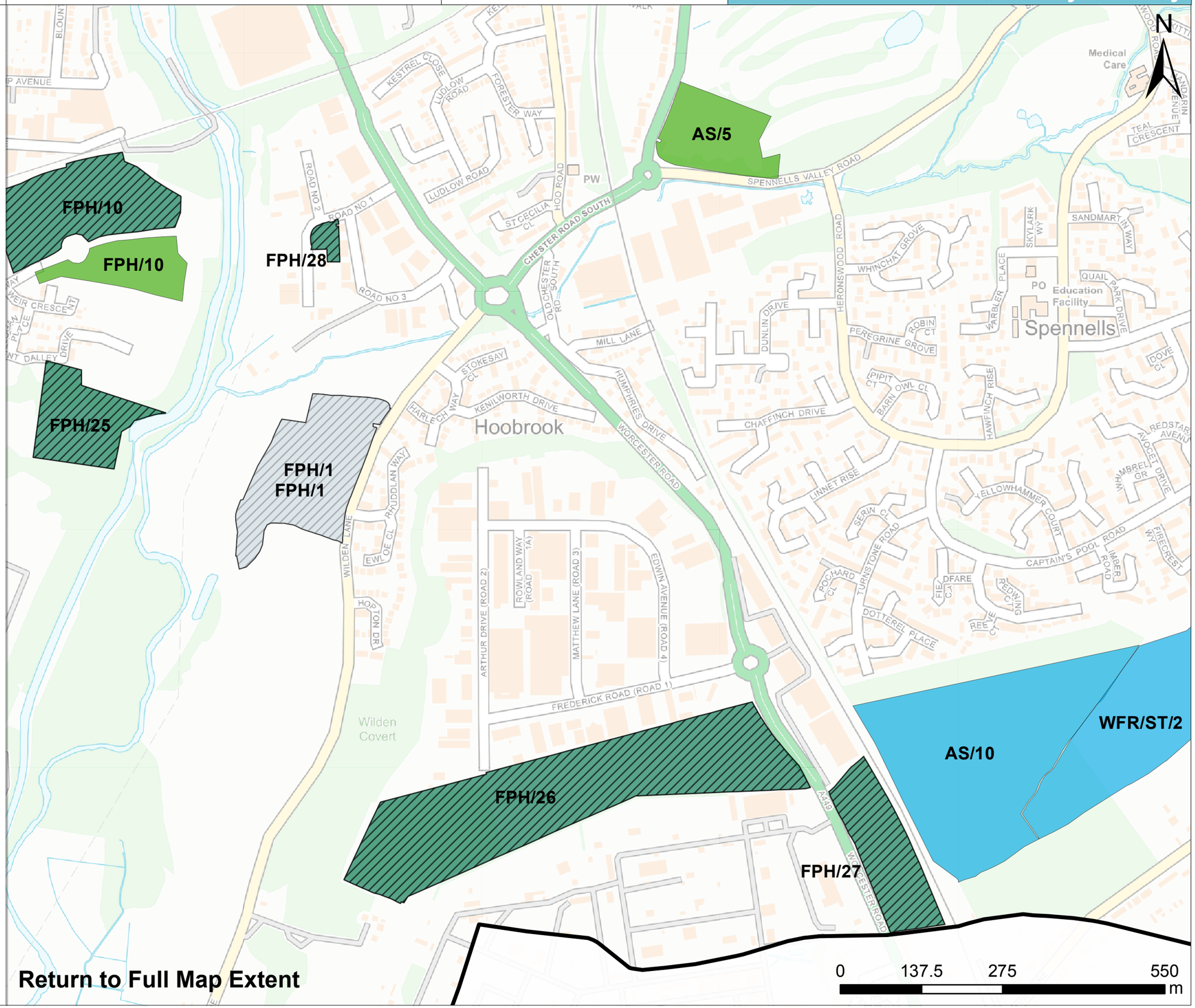
Wyre Forest District Council

JBA consulting

Water Constraints and Opportunities

Hoobrook

2016s4191 Wyre Forest District Council Water Cycle Study



Return to Full Map Extent

Legend

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

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- Secondary (undiff)
- Unproductive

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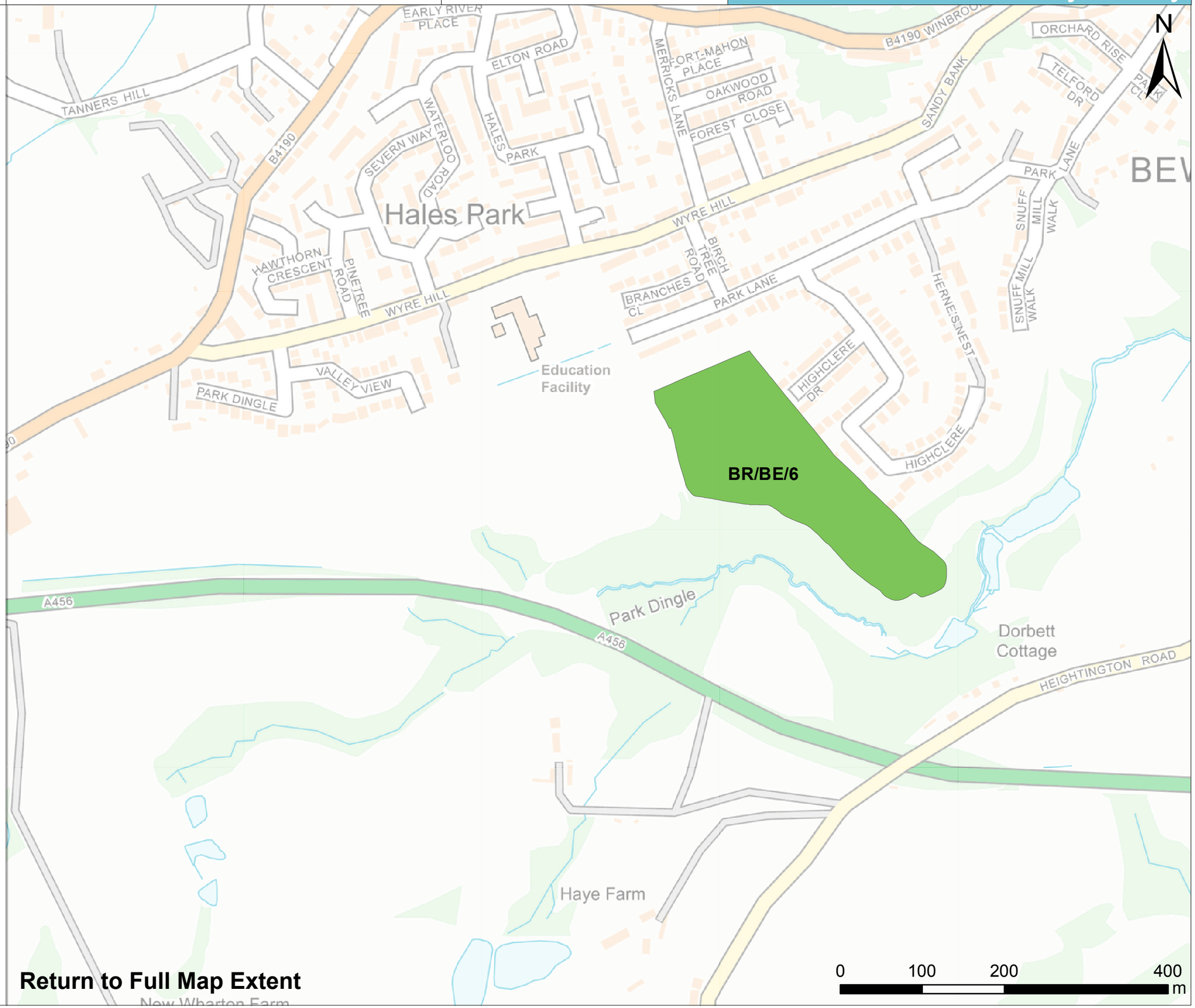
Water Constraints and Opportunities

Hales Park

2016s4191 Wyre Forest District Council Water Cycle Study



Return to Full Map Extent

Legend

Water Constraints and Opportunities

Habberley

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites
- Option A and B
- Option A Only
- Option B Only

Employment Sites
- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications
- High
- Good
- Moderate
- Poor
- Bad

Groundwater

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- Secondary B
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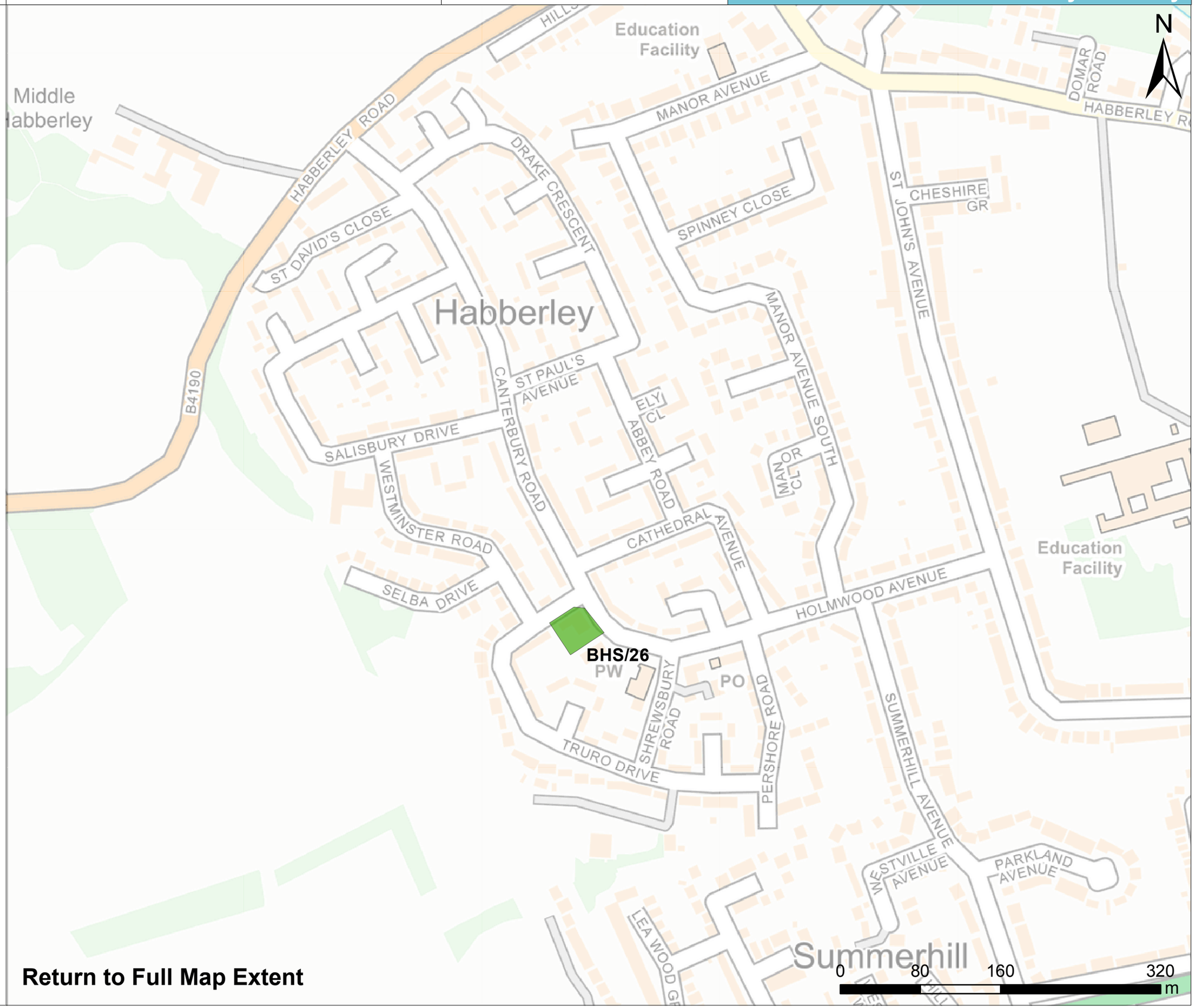
Wyre Forest District Council

JBA consulting



Return to Full Map Extent

Legend

Water Constraints and Opportunities

Foley Park

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites
- Option A and B
- Option A Only
- Option B Only

Employment Sites
- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications
- High
- Good
- Moderate
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Groundwater

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- Unproductive

Aquifer Designation Map (Superficial)
- Principal
- Secondary A
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- Secondary (undiff)
- Unproductive

Wyre Forest District Council

JBA consulting

FPH/18
FPH/6
FPH/17
FPH/10
FPH/10
FPH/28
FPH/23
FPH/25
FPH/1
FPH/1
FPH/8
FPH/9
FPH/24
FPH/26
LI/1
MI/26

Foley Park
Whitehill Wood
Gorse Covert
Birchen Coppice
Wilden Covert
River Stour
Education Facility
PO
PW

Return to Full Map Extent

N

0 175 350 700 m

Legend

Water Constraints and Opportunities

Far Forest

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications

- High
- Good
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Groundwater

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- Unproductive

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- Principal
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- Unproductive

Wyre Forest District Council

JBA consulting

Return to Full Map Extent

Legend

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications

- High
- Good
- Moderate
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- Bad

Groundwater

Source Protection Zones

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Aquifer Designation Map (Bedrock)

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- Secondary A
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- Unproductive

Aquifer Designation Map (Superficial)

- Principal
- Secondary A
- Secondary B
- Secondary (undiff)
- Unproductive

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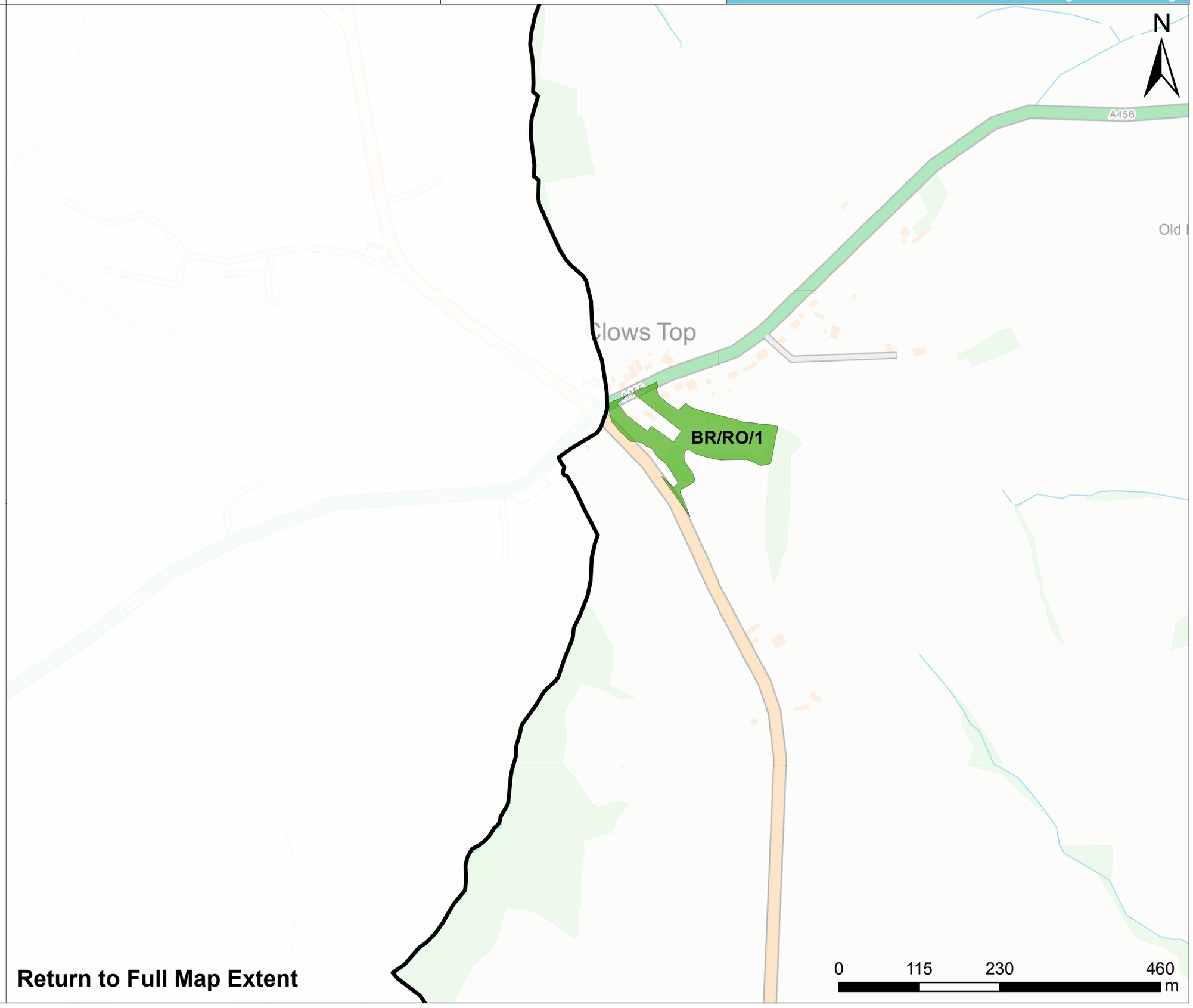
Water Constraints and Opportunities

Clows Top

2016s4191 Wyre Forest District Council Water Cycle Study



Return to Full Map Extent

Legend

Water Constraints and Opportunities

Callow Hill

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications

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Groundwater

Source Protection Zones

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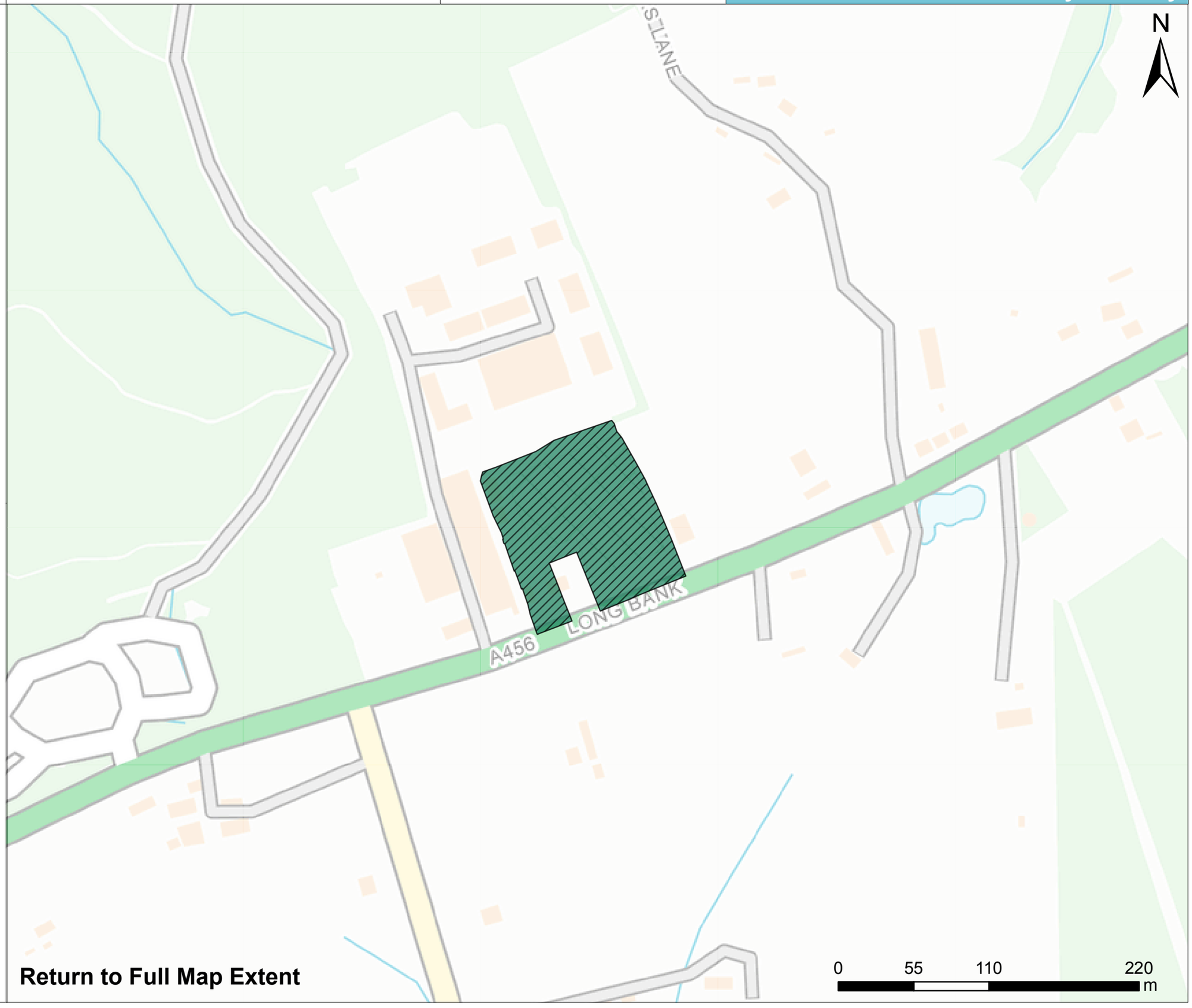
Wyre Forest District Council

JBA consulting



Return to Full Map Extent

Legend

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications

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- Secondary (undiff)
- Unproductive

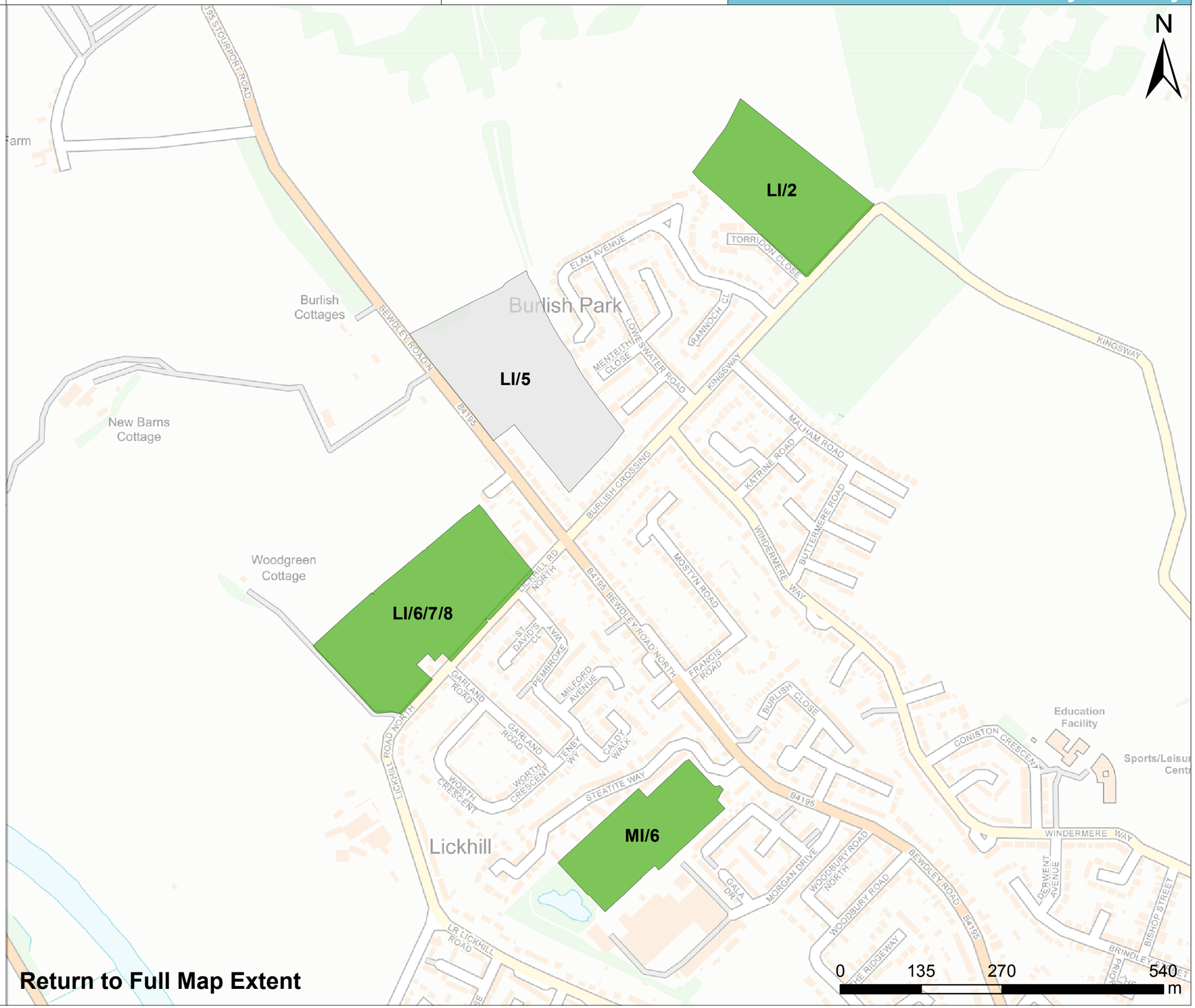
Wyre Forest District Council

JBA consulting

Water Constraints and Opportunities

Burlish Park

2016s4191 Wyre Forest District Council Water Cycle Study



Return to Full Map Extent

Legend

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

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Aquifer Designation Map (Superficial)

- Principal
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- Secondary (undiff)
- Unproductive

Wyre Forest District Council

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Water Constraints and Opportunities

Broadwaters

2016s4191 Wyre Forest District Council Water Cycle Study

WFR/WC/15

WFR/WC/32

WFR/WC/15

WFR/WC/16

WFR/WC/18

BW/4

BW/4

BW/6

Broadwaters

Return to Full Map Extent

0 180 360 720 m

Legend

Water Constraints and Opportunities

Bliss Gate

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites
- Option A and B
- Option A Only
- Option B Only

Employment Sites
- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications
- High
- Good
- Moderate
- Poor
- Bad

Groundwater

Source Protection Zones
- Zone I - Inner Protection Zone
- Zone II - Outer Protection Zone
- Zone III - Total Catchment
- Zone of Special Interest

Aquifer Designation Map (Bedrock)
- Principal
- Secondary A
- Secondary B
- Secondary (undiff)
- Unproductive

Aquifer Designation Map (Superficial)
- Principal
- Secondary A
- Secondary B
- Secondary (undiff)
- Unproductive

Wyre Forest District Council

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Return to Full Map Extent

Legend

Water Constraints and Opportunities

Bewdley

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

Residential Sites
- Option A and B
- Option A Only
- Option B Only

Employment Sites
- Option A and B
- Option A Only

Surface Water
- Detailed River Network

WFD Cycle 2 Classifications
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Groundwater

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WA/BE/5

WA/BE/3

WA/BE/1

Wribbenhall

Bewdley

Catchems End

Ling Farm

Heath Farm

Sports/Leisure Centre

Spring Grove Lodge

Spring Grove House

Spring Grove Farm

Lower Lantarn Cottage

Education Facility

Education Facility

Sports/Leisure Centre

Goosefoot Cottage

Museum

KIDDERMINSTER ROAD

B4190

B4195

A456

A458

Return to Full Map Extent

N

0 140 280 560 m

Legend

Development Sites

Residential Sites

- Option A and B
- Option A Only
- Option B Only

Employment Sites

- Option A and B
- Option A Only

Surface Water

- Detailed River Network

WFD Cycle 2 Classifications

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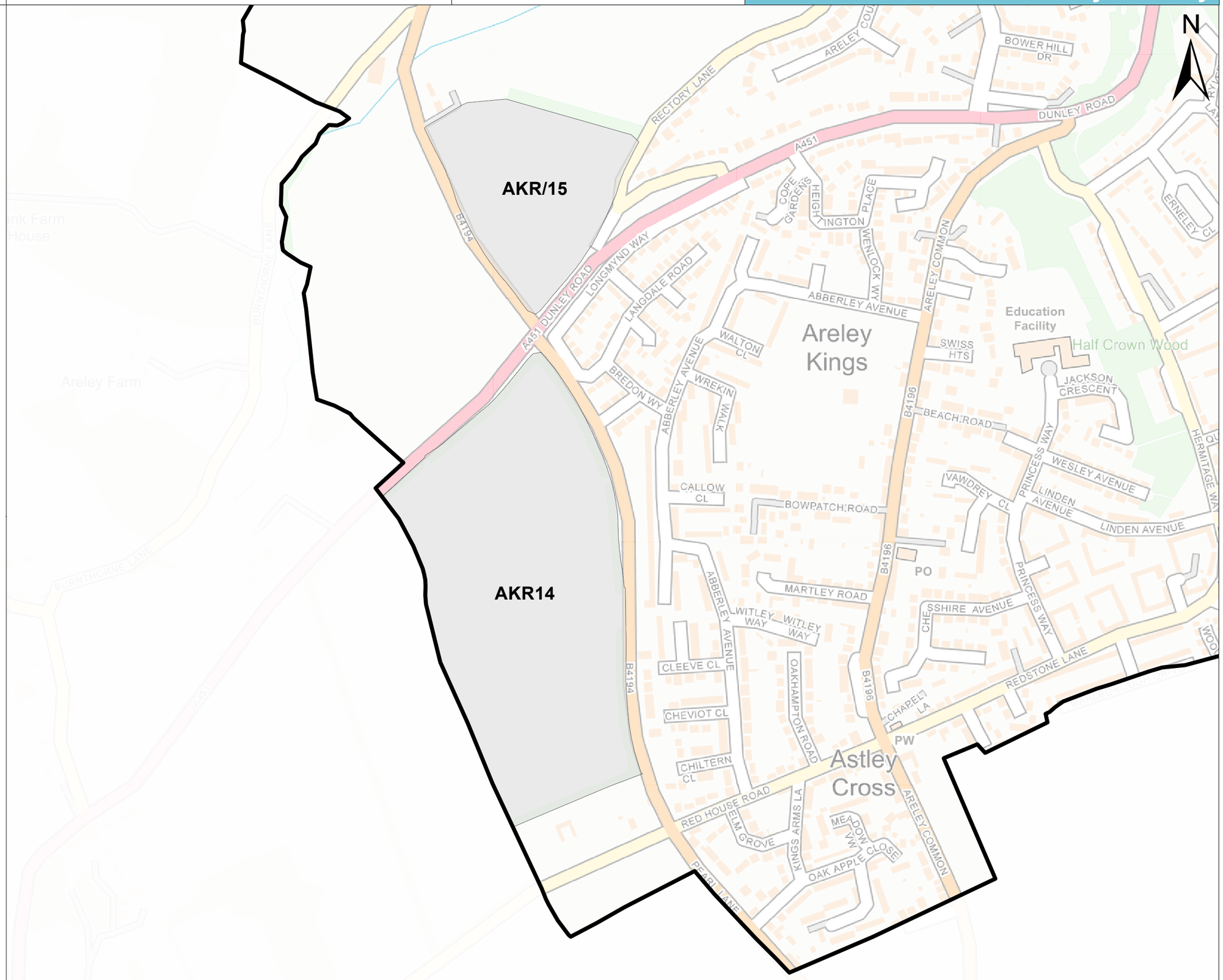
Water Constraints and Opportunities

Arley Kings

2016s4191 Wyre Forest District Council Water Cycle Study



Return to Full Map Extent

2016s4191 Wyre Forest District Council Water Cycle Study

Overview Map

Legend

Wye Forest District Boundary

Detailed Maps

Residential Sites

Option A and B

Option A Only

Option B Only

Employment Sites

Option A and

Option A Only

Click on the individual detailed map extents to view details of the sites in each area

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Wyre Forest District Council

Environmental Constraints and Opportunities

N

Upper Arley

Broadwaters

Habberley

Offmore Farm

Kidderminster

Bewdley

Hoobrook

Spennels

Foley Park

Callow Hill

Far Forest

Hales Park

Burlish Park

Wilden

Bliss Gate

Clows Top

Stourport-on-Severn

Arley Kings

0 1.25 2.5 5 Kilometers

Legend

Development Sites

- [x] **Residential Sites**
  - Option A and B
  - Option A Only
  - Option B Only
- [x] **Employment Sites**
  - Option A and B
  - Option A Only

Environmental Assessment

- [ ] Ancient & Semi Natural Woodland
- [ ] Ancient Replanted Woodland
- [ ] NNR
- [ ] SSSI
- [ ] Local Nature Reserve

Historic Environment

- [ ] ▲ Listed Buildings
- [ ] Scheduled Ancient Monuments
- [ ] Registered Parks and Gardens

Geology and Soils

- [ ] **Agricultural Land Class**
  - Grade 1
  - Grade 2
  - Grade 3
  - Grade 4
  - Non Agricultural
  - Urban

Waste

- [ ] Historic Landfill Sites

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Environmental Constraints and Opportunities

Arley Kings

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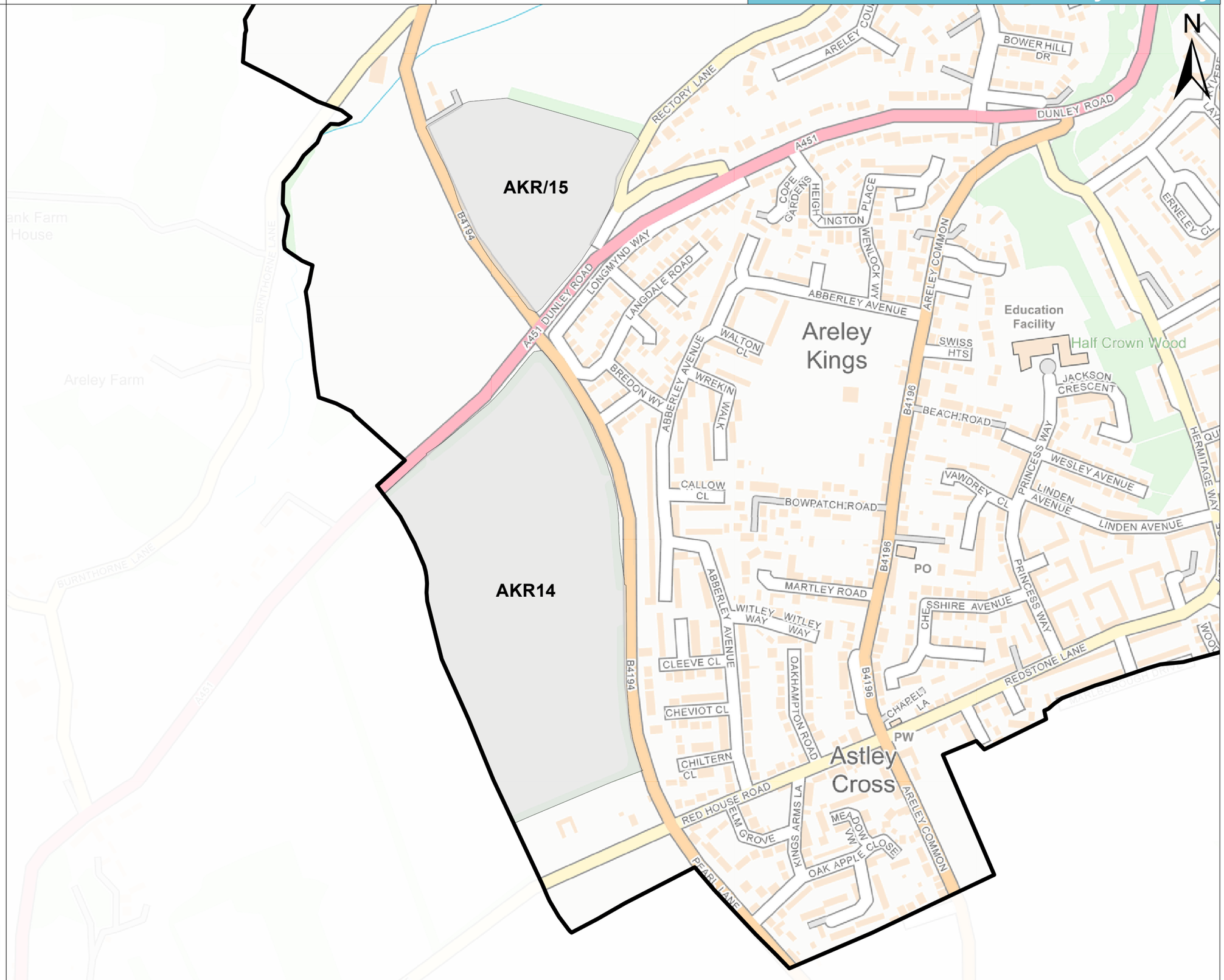

Return to Full Map Extent

Legend

Development Sites

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  - Option B Only
- [x] **Employment Sites**
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Waste

- [ ] Historic Landfill Sites

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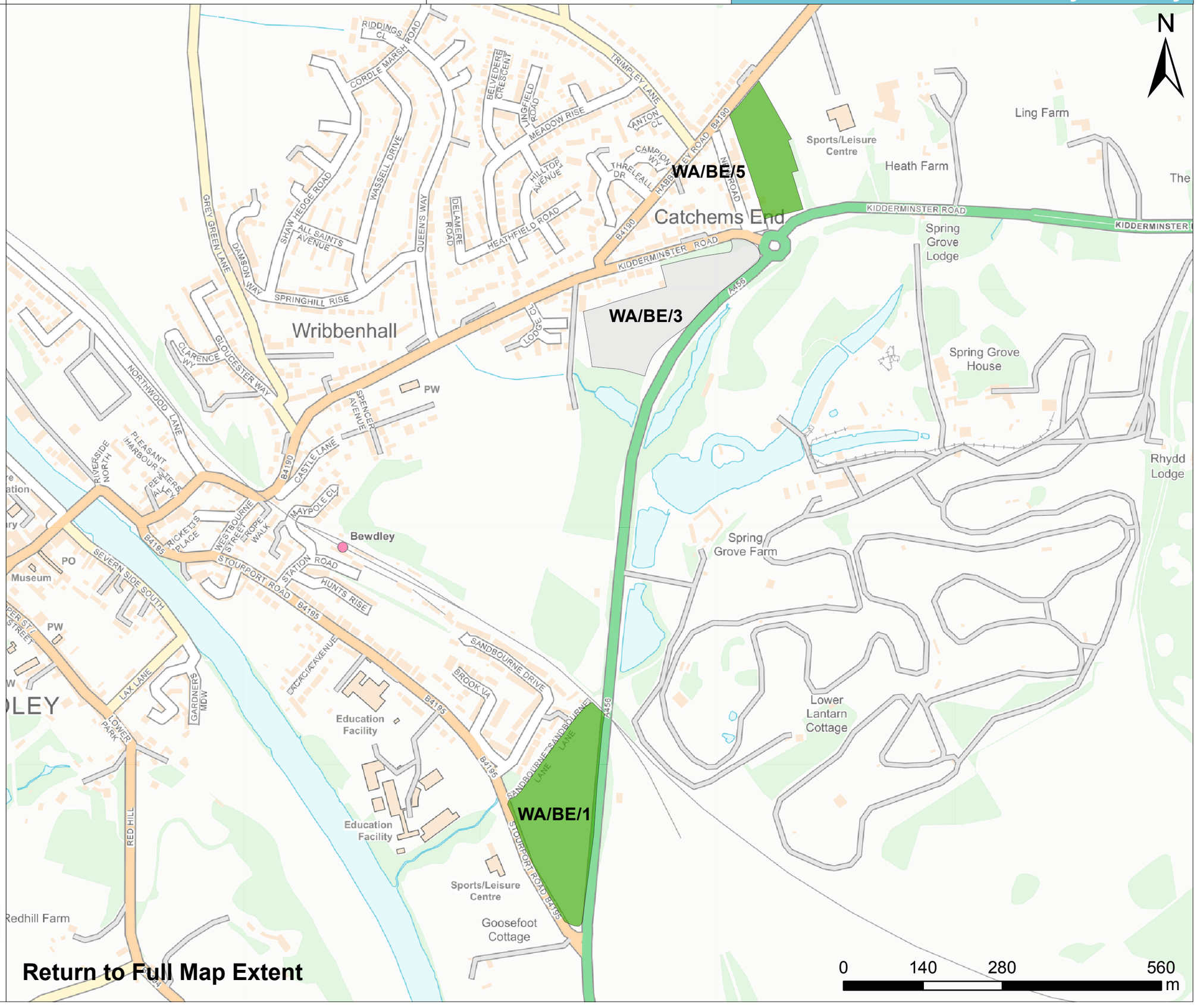
Environmental Constraints and Opportunities

Bewdley

2016s4191 Wyre Forest District Council Water Cycle Study



Return to Full Map Extent

Legend

Development Sites

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  - Option B Only
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Waste

- ☐ Historic Landfill Sites

Wyre Forest District Council

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Environmental Constraints and Opportunities

Bliss Gate

2016s4191 Wyre Forest District Council Water Cycle Study

Return to Full Map Extent

Legend

Development Sites

- [x] **Residential Sites**
  - Option A and B
  - Option A Only
  - Option B Only
- [x] **Employment Sites**
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Waste

- [ ] Historic Landfill Sites

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Environmental Constraints and Opportunities

Broadwaters

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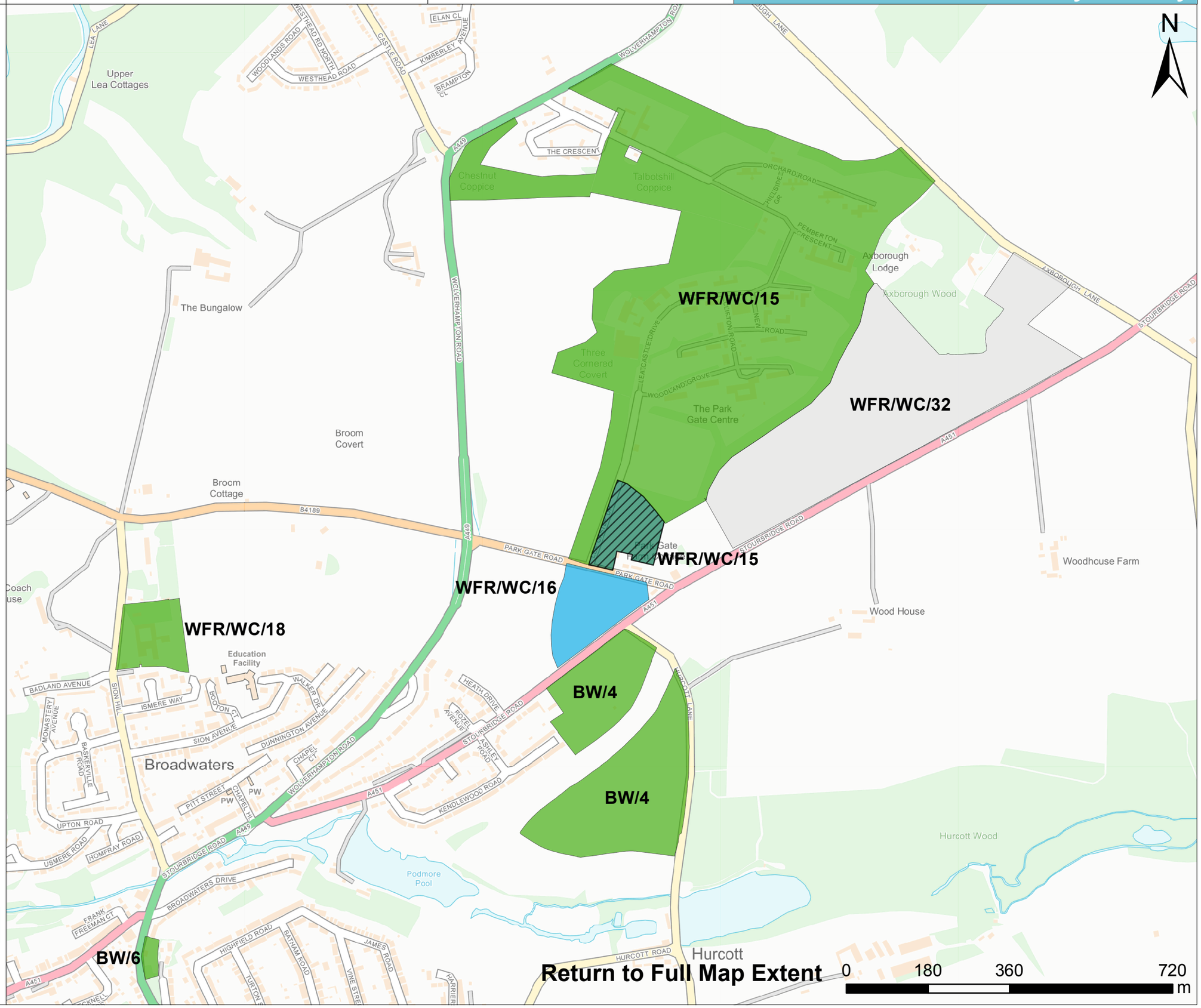

Legend

Development Sites

- [x] **Residential Sites**
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Waste

- [ ] Historic Landfill Sites

Wyre Forest District Council

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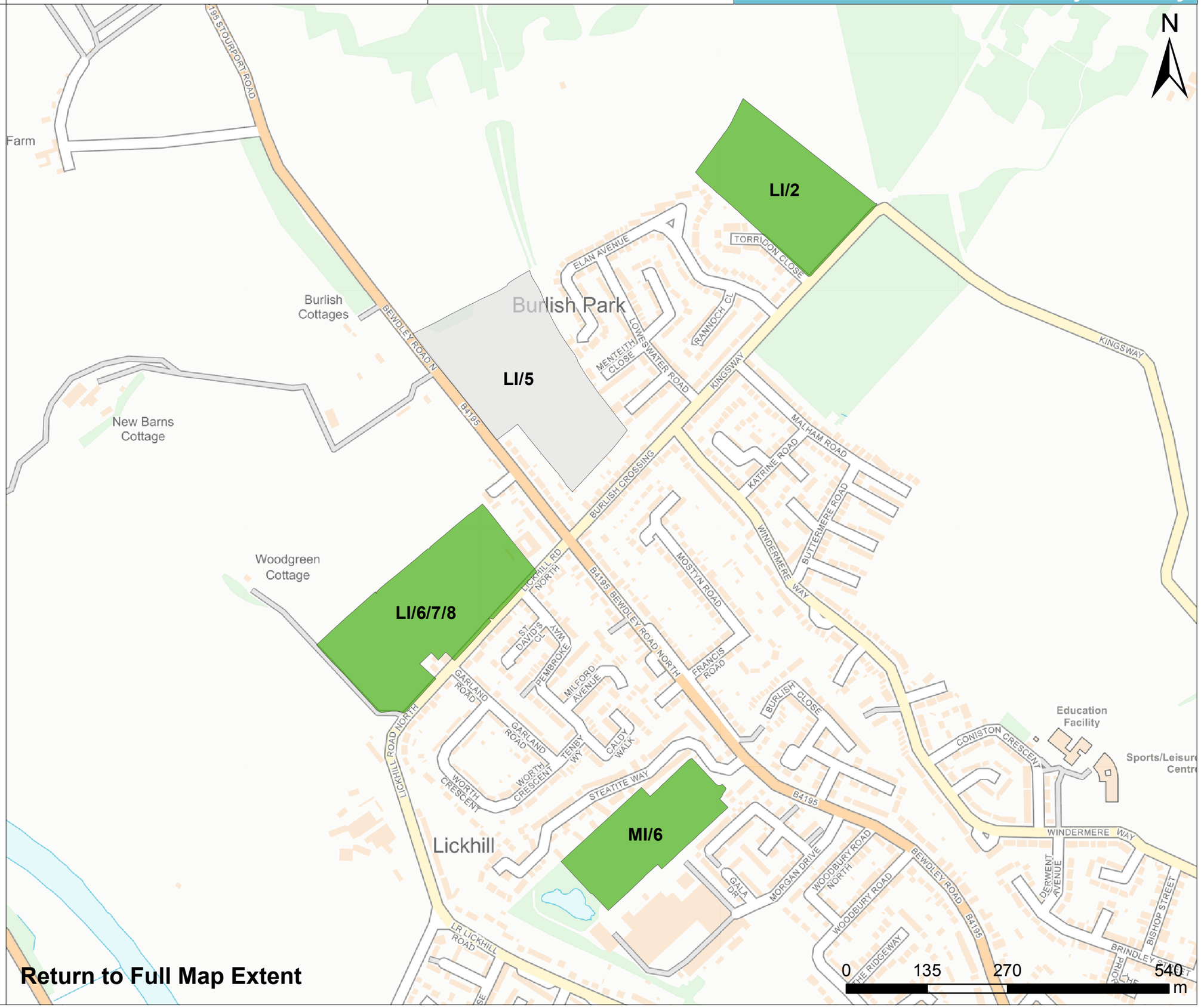
Environmental Constraints and Opportunities

Burlish Park

2016s4191 Wyre Forest District Council Water Cycle Study



Return to Full Map Extent

Legend

Development Sites

Residential Sites

- Option A and B
- Option A Only
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- Urban

Waste

- Historic Landfill Sites

Wyre Forest District Council

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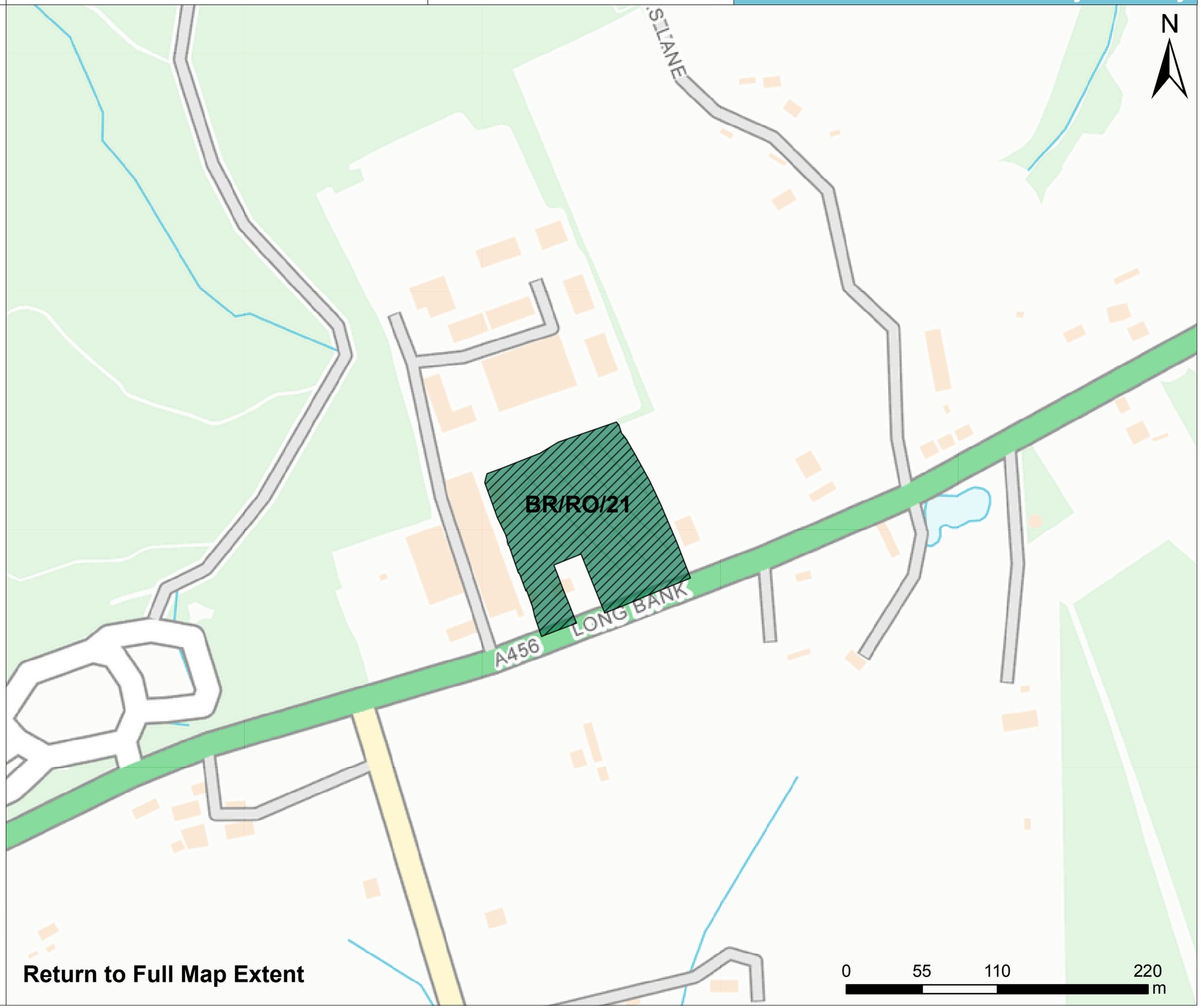
Environmental Constraints and Opportunities

Callow Hill

2016s4191 Wyre Forest District Council Water Cycle Study



Legend

Development Sites

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Waste

- [ ] Historic Landfill Sites

Wyre Forest District Council

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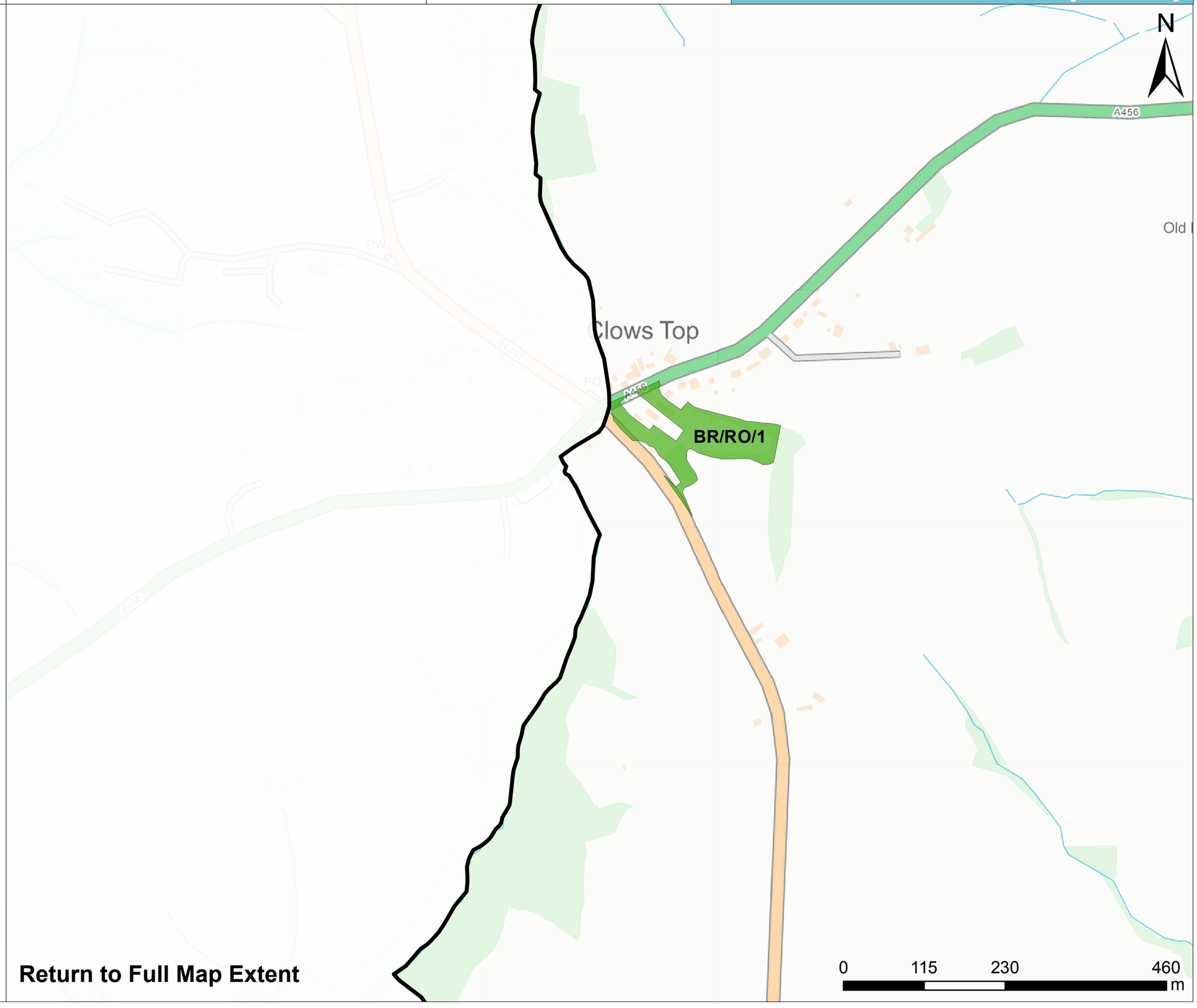
Environmental Constraints and Opportunities

Clows Top

2016s4191 Wyre Forest District Council Water Cycle Study



Return to Full Map Extent

Legend

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Waste

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Environmental Constraints and Opportunities

Far Forest

2016s4191 Wyre Forest District Council Water Cycle Study

Return to Full Map Extent

Legend

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Waste

- [ ] Historic Landfill Sites

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Environmental Constraints and Opportunities

Foley Park

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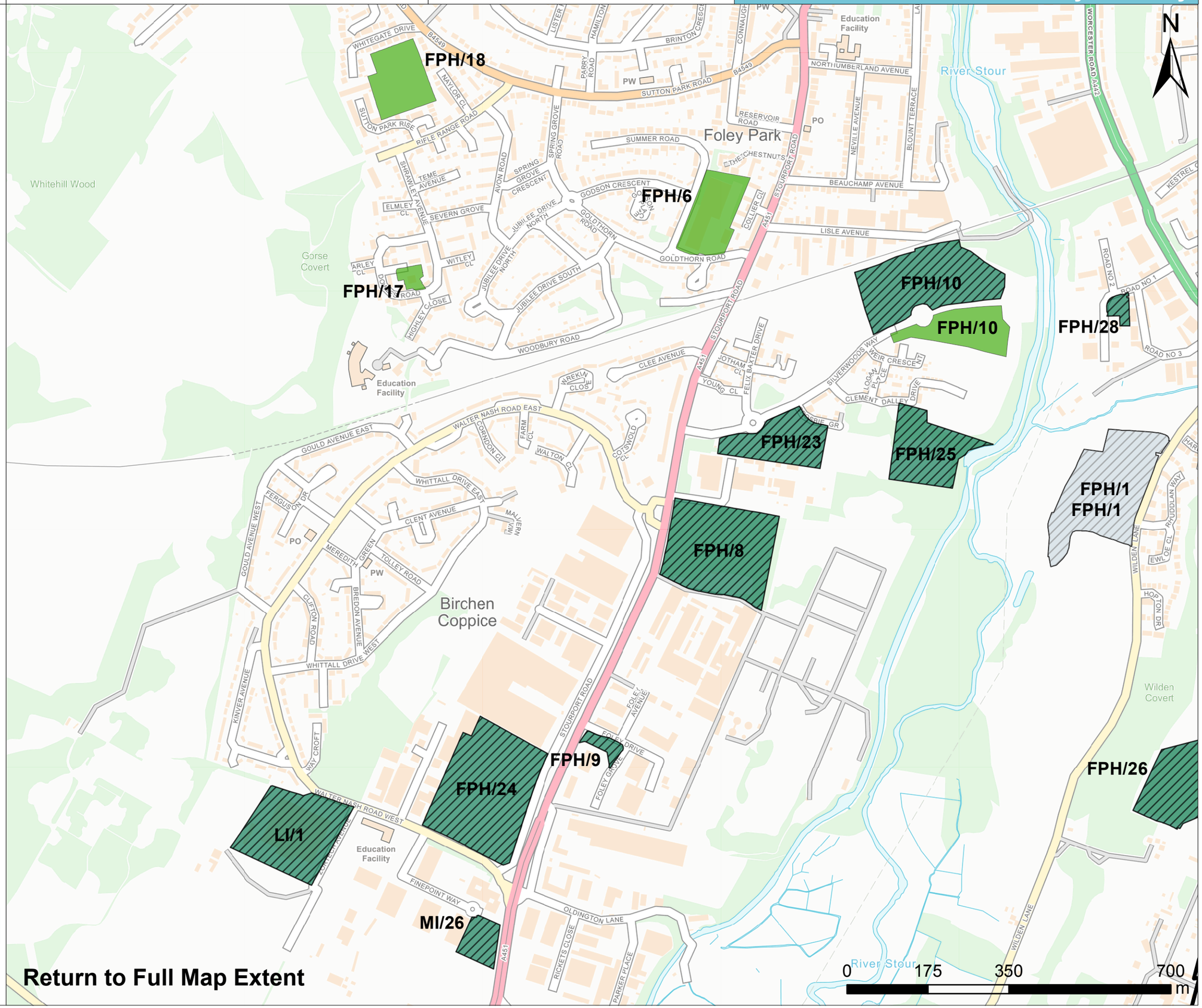

Return to Full Map Extent

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Wyre Forest District Council

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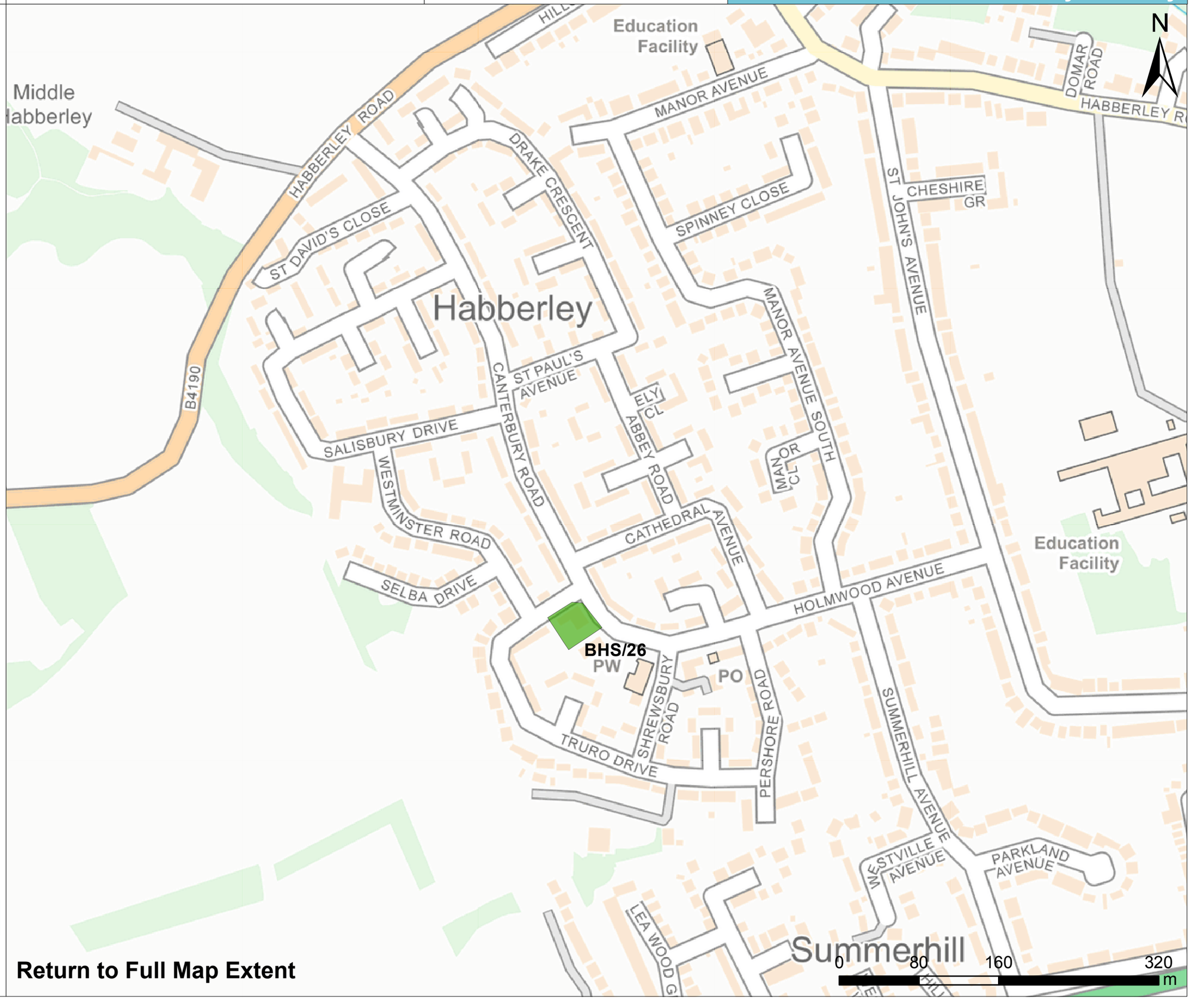
Environmental Constraints and Opportunities

Habberley

2016s4191 Wyre Forest District Council Water Cycle Study



Return to Full Map Extent

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Waste

- [ ] Historic Landfill Sites

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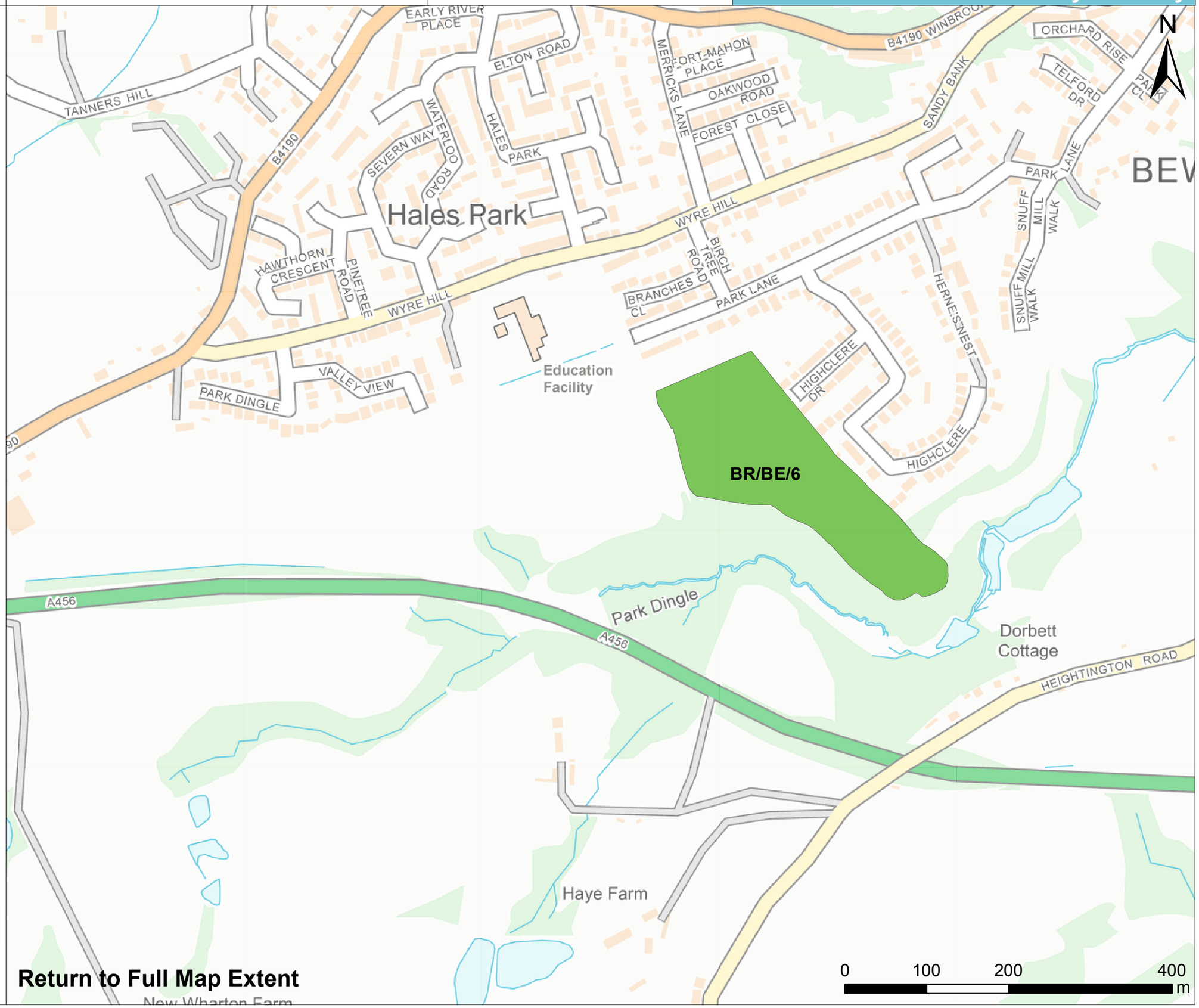
Environmental Constraints and Opportunities

Hales Park

2016s4191 Wyre Forest District Council Water Cycle Study



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Wyre Forest District Council

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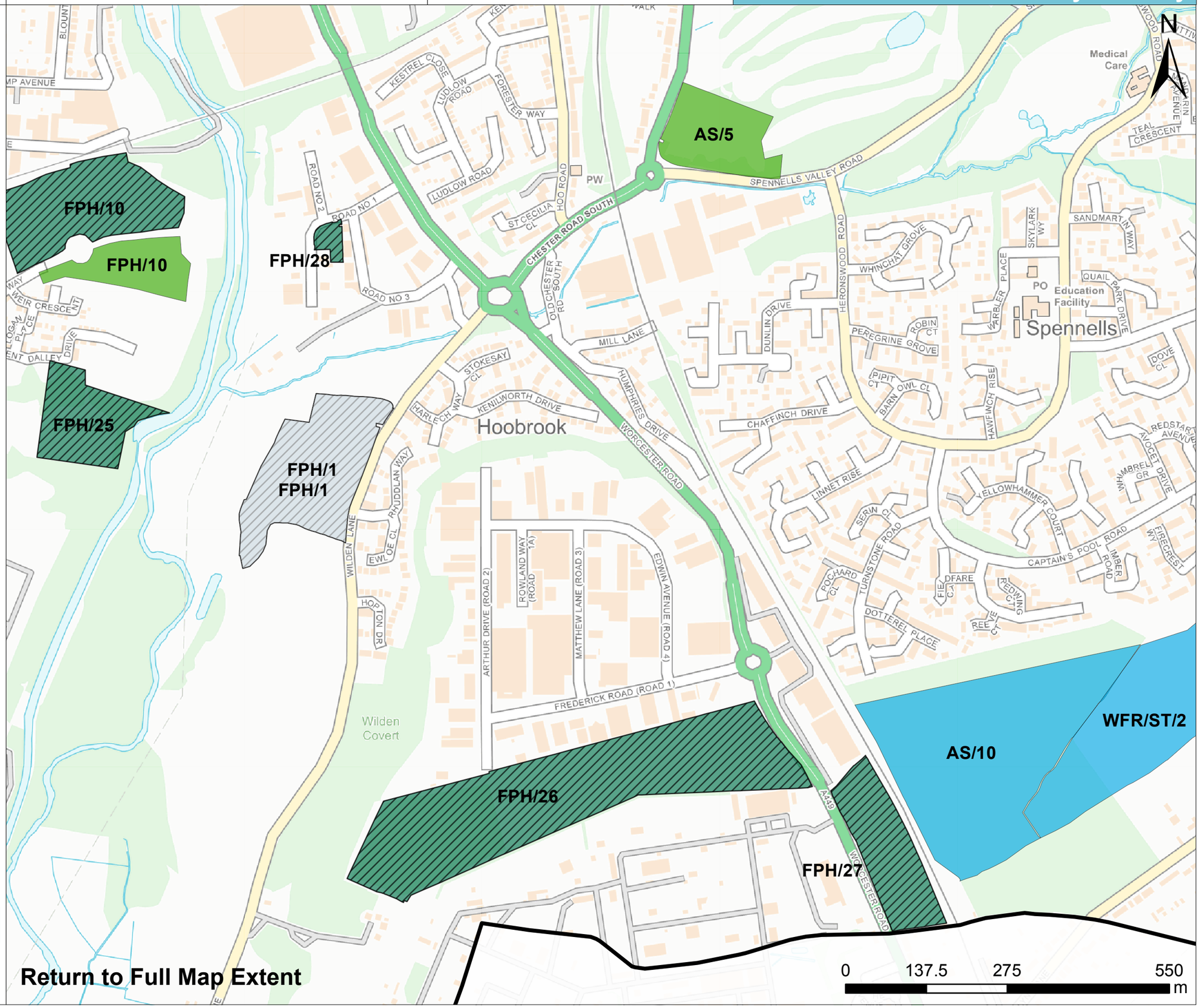
Environmental Constraints and Opportunities

Hoobrook

2016s4191 Wyre Forest District Council Water Cycle Study



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Waste

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Environmental Constraints and Opportunities

Kidderminster

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BW/1
BW/2
BW/3
FHN/9
BHS/18
BHS/16
BHS/2
BHS/11
AS/1
AS/6

KIDDERMINSTER
Blakebrook
River Stour

Return to Full Map Extent

0 162.5 325 650 m

Legend

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- [ ] Historic Landfill Sites

Wyre Forest District Council

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Environmental Constraints and Opportunities

Offmore Farm

2016s4191 Wyre Forest District Council Water Cycle Study

Return to Full Map Extent

Legend

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Waste

- [ ] Historic Landfill Sites

Wyre Forest District Council

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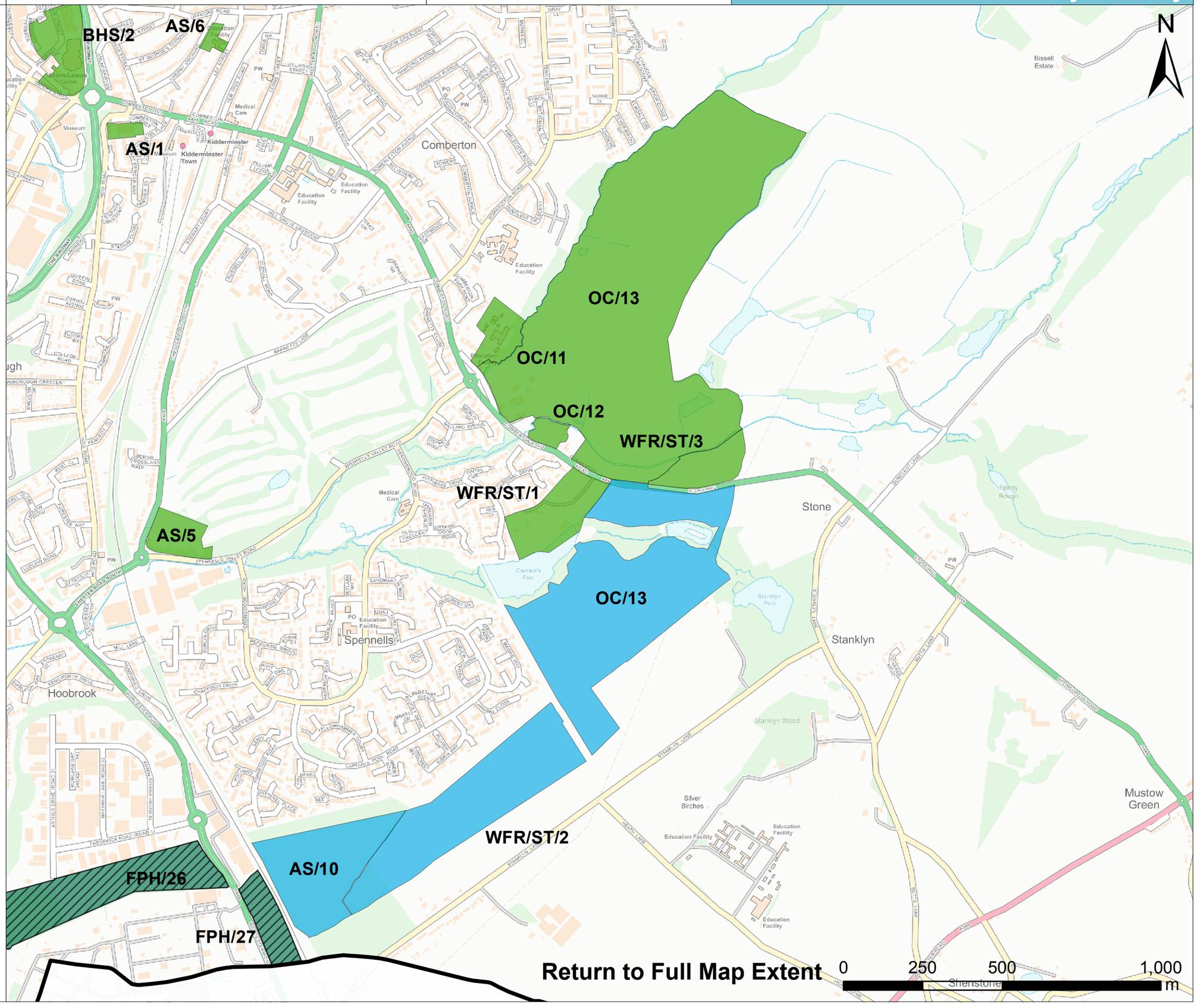
Environmental Constraints and Opportunities

Spennels

2016s4191 Wyre Forest District Council Water Cycle Study



Legend

Environmental Constraints and Opportunities

Stourport-on-Severn

2016s4191 Wyre Forest District Council Water Cycle Study

Development Sites

- ☑ **Residential Sites**
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Waste

- ☐ Historic Landfill Sites

Wyre Forest District Council

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MI/1
MI/29
MI/5
MI/28
MI/3
MI17
AKR/7
AKR/1
AKR/20
AKR/2

Return to Full Map Extent

N

0 145 290 580 m

Legend

Development Sites

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Waste

- [ ] Historic Landfill Sites

Wyre Forest District Council

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Environmental Constraints and Opportunities

Upper Arley

2016s4191 Wyre Forest District Council Water Cycle Study

Return to Full Map Extent

Legend

Development Sites

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- Option A and B
- Option A Only
- Option B Only

☑ **Employment Sites**

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Waste

- ☐ Historic Landfill Sites

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Environmental Constraints and Opportunities

Wilden

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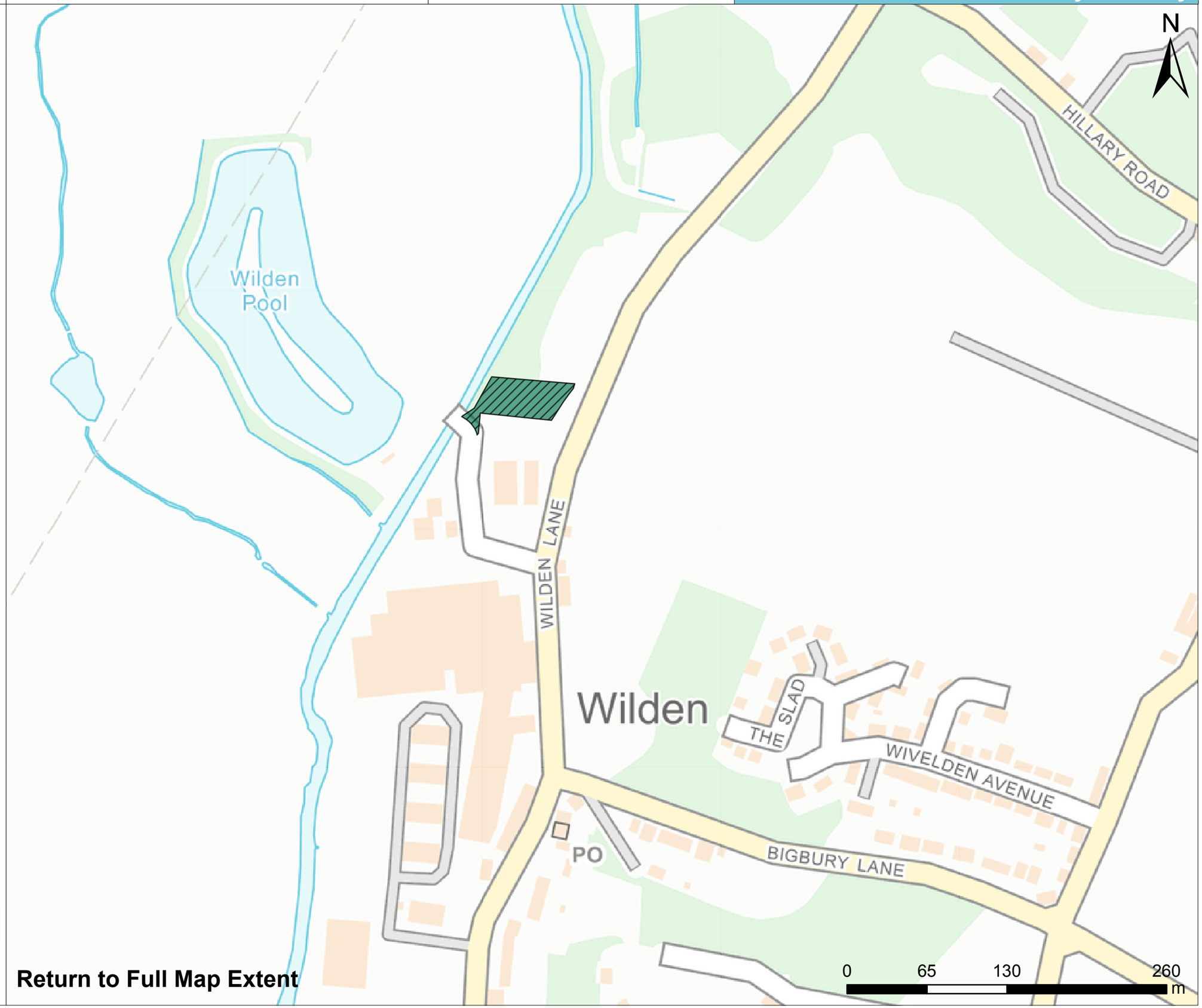

Return to Full Map Extent

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

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