

Thurrock Water Cycle Study

Scoping Report

Thurrock Council

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Quality information

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Table of Contents

Abbreviations.....	1
1. Introduction.....	3
1.1 Water Cycle Study purpose	3
1.2 Study partners	4
1.3 Report Structure	4
2. Study drivers	5
2.1 Legislative and policy contact	5
3. Growth proposals and study area	8
3.1 Growth Proposal Summary	8
3.2 Initial Study Area	9
4. Hydrological baseline summary	10
4.1 Surface water	10
4.2 Groundwater	11
4.3 Flood risk.....	12
4.4 Water dependent habitats	13
5. Water Infrastructure Baseline Summary	14
5.1 Infrastructure provision.....	14
5.2 Water infrastructure planning	14
5.3 Water supply	15
5.4 Wastewater services	18
6. Capacity – constraints and opportunities	20
6.1 Wastewater treatment	20
6.2 Water Supply.....	23
6.3 Flood Risk	27
6.4 NbS opportunities.....	31
6.5 Evidence review summary	35
7. Growth area scoping summary	36
Appendix A Policy and Legislative Drivers Shaping the WCS.....	40
A.1 WFD Surface Water Body Status.....	40
A.2 Legislation	40
A.3 Strategies and Plans	41
A.4 Thurrock Council Core Strategy Full Policies	42
Appendix B NbS Opportunities.....	44
Appendix C Report Figures	46

Abbreviations

Acronym	Definition
ALS	Abstraction Licensing Strategies
AMP	Asset Management Plan
AW	Anglian Water
CAMS	Catchment Management Abstraction Strategy
CSTP	Core Strategy Thematic Policy
DEFRA	Department for Environment, Food & Rural Affairs
DWF	Dry Weather Flow
DWMP	Drainage and Wastewater Management Plan
EA	Environment Agency
EFI	Environmental Flow Indicator
EOETS	Ely Ouse to Essex Transfer Scheme
ESW	Essex and Suffolk Water
GOGS	Great Ouse Groundwater Scheme
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NbS	Nature Based Solutions
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
Ofwat	Office for Water Services
PCC	Per Capita Consumption
PPG	Planning Practice Guidance
RBMP	River Basin Management Plan
RNAG	Reasons for Not Achieving Good
RQP	River Quality Planning
SAGS	Stour Augmentation Groundwater Scheme
SFRA	Strategic Flood Risk Assessment
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
WCS	Water Cycle Study
WFD	Water Framework Directive
WRC	Water Recycling Centre
WRE	Water Resources East
WRMP	Water Resources Management Plan
WRZ	Water Resource Zone

Acronym	Definition
WSI	Water Services Infrastructure
WWNP	Working with Natural Processes

1. Introduction

1.1 Water Cycle Study purpose

A Water Cycle Study (WCS) has been produced for Thurrock Council as part of the evidence base to inform the spatial strategy of the Local Plan.

The objective of the WCS is to identify any constraints on planned housing and employment growth that may be imposed by the water cycle. The WCS then identifies how these can be resolved i.e. by ensuring that appropriate Water Services Infrastructure (WSI) can be provided to support the proposed development, including the planning policy required to deliver it. It should provide a strategic approach to the management and use of water which ensures that the sustainability of the water environment in the area is not compromised. A broad overview of the interaction between the water environment and WSI which the WCS is concerned with is provided within Figure 1-1¹.

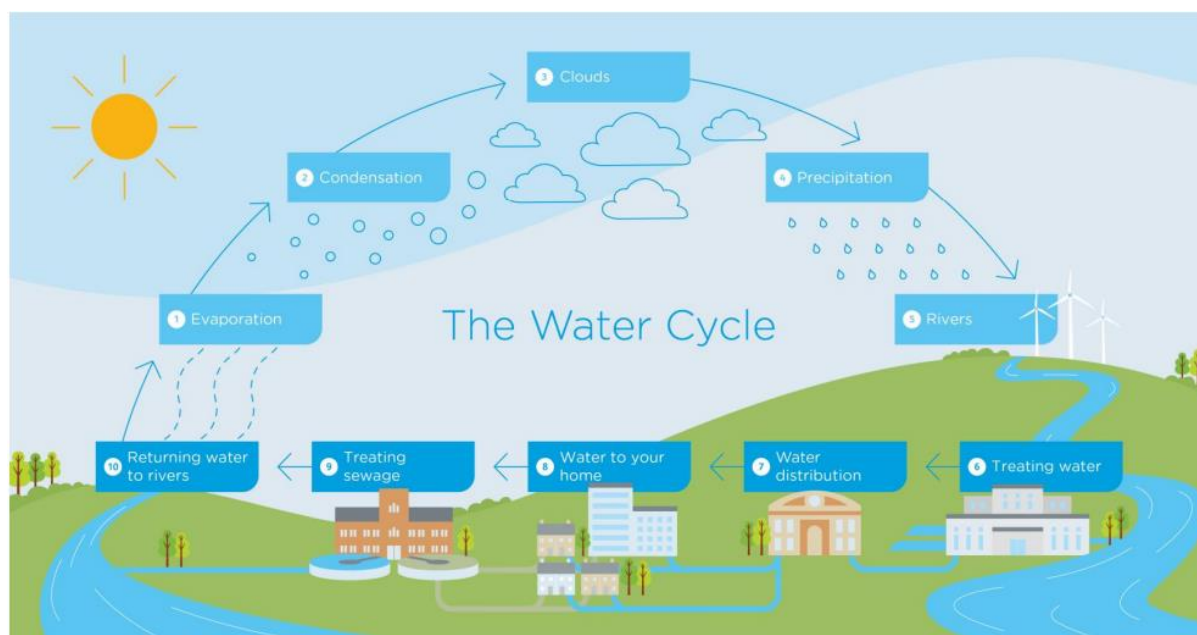


Figure 1-1 The water environment and water services infrastructure components

1.1.1 WCS Stages

There are two stages to preparing a WCS as described in the Environment Agency guidance² and listed below:

1. Scoping – this stage identifies if the water infrastructure capacity could constrain growth and if there are any gaps in the evidence to make this assessment,
2. Detailed – this stage provides the evidence to inform an integrated water management strategy. It will identify the water and flood management infrastructure that will mitigate the risks from too little or too much water and identify what is needed to protect and enhance the water environment.

This document presents the findings of the scoping stage. The aim of the Scoping WCS is to identify if existing water infrastructure capacity and environmental capacity could constrain growth across Thurrock and if there are any gaps in the evidence needed to make this assessment. In doing so, the Thurrock Scoping WCS considers three potential strategic growth strategies as part of the developing Local Plan and tests these at a high level against WSI and environmental water capacity.

¹ Source: <https://www.thameswater.co.uk/about-us/responsibility/education/the-water-cycle>

² Environment Agency (2021) Water cycle studies. Available at: <https://www.gov.uk/guidance/water-cycle-studies> (Accessed July 2023)

1.2 Study partners

The Scoping WCS has been carried out with the following contributors and partners:

- Thurrock Council as the Local Planning Authority and Lead Local Flood Authority (LLFA).
- Anglian Water (AW) as the wastewater provider to Thurrock.
- Essex and Suffolk Water (ESW) as the potable water supplier to Thurrock.

The Scoping WCS has also used relevant information from the following organisations:

- Environment Agency for information and guidance on flooding, water quality standards and water abstractions.
- South Essex Catchment Partnership.
- Water Resources East (WRE).
- British Geological Survey.

1.3 Report Structure

The Scoping WCS report is structured as follows:

- Section 2: **Study drivers** - includes the policy context.
- Section 3: **Growth proposals and study area** - defines the study area and the three strategic growth options assessed.
- Section 4: **Hydrological baseline summary** - provides information on the existing hydrological and hydrogeological context in Thurrock.
- Section 5: **Water infrastructure baseline summary** - provides information on the current WSI.
- Section 6: **Capacity - opportunities and constraints** - identifies the potential environmental and WSI capacity constraint issues and opportunities.
- Section 7: **Growth area scoping summary** - provides a summary of the Scoping WCS assessments and any recommendations for a Detailed WCS.

2. Study drivers

There are several legislative, regulatory and policy level drivers which shape the approach to the WCS. A full list of key legislative drivers shaping the Scoping WCS is detailed in Appendix A.

2.1 Legislative and policy contact

The National Planning Policy Framework (NPPF)³ states that the strategic policies in development plan documents should make sufficient provision for infrastructure for water supply, wastewater and flood risk and coastal change management. Planning Policy Guidance (PPG)⁴ states that a WCS can help plan for sustainable growth. WCSs prepared at an early stage of plan-making can provide the evidence base to ensure local development plans are sound. This is the key driver for completing a WCS as part of the Local Plan evidence base.

2.1.1 Legislation

The primary legislative drivers for this study are the Water Environment Water Framework Directive (WFD) Regulations 2017, the Conservation of Habitats and Species Regulations 2017 (as amended) and the Environment Act (2021). This is because these instruments set out how the water environment needs to be protected relative to planning for and delivering growth; these instruments are summarised below, alongside other relevant legislative instruments.

2.1.1.1 Water Framework Directive Regulations

The environmental objectives of the WFD Regulations, as published in the Environment Agency's River Basin Management Plans (RBMPs)⁵, which are relevant to this WCS are:

- To prevent deterioration of the status of surface waters and groundwater.
- To achieve objectives and standards for protective 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.

These environmental objectives are legally binding, and all public bodies should have regard to these objectives when making decisions (such as Local Plan development) that could affect the quality of the water environment. The Environment Agency publishes the WFD status and objectives of each surface water and groundwater body on the Catchment Data Explorer. Surface water bodies can be classed as high, good, moderate, poor or bad status and groundwater body status is classified on the basis of quantitative and chemical status and can be classified as good or poor.

The WFD Regulations are important to the WCS as provision of new WSI needs to ensure that the objectives of the Regulations are not compromised by ensuring that additional demand for water and discharge of additional wastewater does not adversely impact on the current and future status of waterbodies.

2.1.1.2 Conservation of Habitats and Species Regulations

The Conservation of Habitats and Species Regulations 2017 have designated some sites as areas that require protection to maintain or enhance the rare ecological species or habitats associated with them. Although the Regulations do not directly set overarching environmental standards related to water quality and quantity (flow or level), the Regulations can, by the requirement to ensure no detrimental impact on designated sites, require site specific water quality, water level and water flow targets to be set for specific locations. This may in turn require restrictions on discharges to (or abstractions from)

³ Department for Levelling Up, Housing and Communities (2023) National Planning Policy Framework. Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework-2> (Accessed March 2024)

⁴ Department for Levelling Up, Housing and Communities, Ministry of Housing, Communities and Local Government (2023) Planning Practice Guidance. Available at: <https://www.gov.uk/government/collections/planning-practice-guidance> (Accessed March 2024)

⁵ Thames River Basin District Management Plan (2022). Available at: <https://www.gov.uk/guidance/thames-river-basin-district-river-basin-management-plan-updated-2022> (Accessed July 2023)

water bodies which are hydrologically connected to water dependant habitats. These Regulations are important to the WCS as the provision of new WSI needs to ensure no detrimental impact on designated sites through discharge and abstraction impacts.

2.1.1.3 Environment Act 2021

The Environment Act 2021 provides a legal framework for environmental governance in the UK bringing in measures for improvement of the environment including for water. The Act is relevant to the WCS process as it:

- Places a duty on water companies to secure a reduction in adverse impacts of discharges from storm overflows on the environment.
- Makes drainage and sewerage planning a statutory duty through the requirement for water companies to produce Drainage and Wastewater Management Plans.
- Enables the revocation or variation of permanent abstraction licences where the change is necessary to protect the environment or where the licence is consistently underused.

2.1.1.4 Levelling Up and Regeneration Act 2023

The Levelling Up and Regeneration Act 2023 makes provision for the setting of levelling-up missions and reporting on progress in delivering them. The Levelling Up and Regeneration Act introduces a new duty on water companies in 'sensitive catchment areas' to upgrade their Wastewater Treatment Works. They will be required to achieve the highest technological levels for nutrient removal by 1 April 2030. Wherever possible, nature-based solutions should form part of the upgrades.

2.1.2 Local Policy

As described, the NPPF is a key national policy informing this WCS; however, the following local policy has also been considered. The Thurrock Council Core Strategy⁶ is the main local plan document and contains policies relevant to the WCS which are summarised here (the full policies are available in Appendix A).

CSTP25 – Addressing Climate Change

The council will require climate change adaptation measures to be considered in any development proposal through the application of green infrastructure techniques. Developers must consider the potential effects of climate change on water conservation, drainage and flood risk.

CSTP27 – Management and Reduction of Flood Risk

The council will ensure that flood risk management is implemented through effective land use planning and will work with the Environment Agency and other main stakeholders to ensure that fluvial and surface water flood risk is managed. The council will ensure that, where necessary, new development contains space for water and developers will be required to incorporate sustainable drainage systems and contribute towards flood risk management infrastructure where appropriate.

2.1.3 Other strategies and plans

Full details of other relevant regulatory strategies or plans which relate to the water environment or provision of WSI for development in Thurrock are provided in Appendix A. The key strategies or plans most relevant to the WCS include, but are not limited to:

- Integrated Plan for Delivering Clean and Plentiful Water (DEFRA, 2023).
- Environmental Improvement Plan 2023 (DEFRA, 2023).
- Drainage and Wastewater Management Plan (DWMP) (AW, 2023).

⁶ Thurrock Council (2015) Core Strategy and Policies for Management of Development (as amended). Available at: https://www.thurrock.gov.uk/sites/default/files/assets/documents/core_strategy_adopted_2011_amended_2015.pdf (Accessed August 2023)

- Draft Water Resources Management Plan (WRMP) (ESW, 2023).
- Draft Regional Water Resources Plan for Eastern England (WRE, 2022).
- Thurrock Borough Council Level 1 Strategic Flood Risk Assessment (SFRA) (AECOM, 2024).
- Thurrock Local Flood Risk Management Strategy (LFRMS) (Thurrock Council, 2015).
- Thurrock Green and Blue Infrastructure Strategy (Thurrock Council, 2023).
- Climate Change Strategy Update (Thurrock Council, 2023).
- Thurrock Climate Change Action Plan Update (Arup, 2021).
- South Essex Green and Blue Infrastructure Study (Association of South Essex Local Authorities, 2020).
- Thurrock Local Plan Design Strategy Supplementary Planning Document (Thurrock Council, 2016).

3. Growth proposals and study area

3.1 Growth Proposal Summary

Thurrock Council provided three potential growth options for the Borough to be considered in the Scoping WCS. Option 1 offers a 'low growth' strategy of 16,900 dwellings; Option 2 offers a 'medium growth' strategy with 23,180 dwellings while Option 3 offers a 'high growth' strategy with 33,480 dwellings. These growth strategies are split across 20 settlement areas (Table 3-1). Appendix C Figure 1 shows the approximate location of these settlement areas.

These three broad growth options have been initially tested at a high level as part of this WCS Scoping stage to inform the development plan and consultation process.

Table 3-1 Growth Options across Settlement Areas

Settlement	Option 1 – Low Growth	Option 2 – Medium Growth	Option 3 – High Growth
Aveley	800	950	950
Bulphan	10	10	10
Chadwell St Mary	1400	4200	4200
Corringham	750	3300	3300
East Tilbury	240	1240	1240
Fobbing	200	200	200
Grays	2650	2900	2900
Horndon on the Hill	50	60	60
Langdon Hills	180	180	180
North Stifford	0	0	0
Lower Langdon	0	0	4000
Orsett	100	120	120
Purfleet-on-Thames	2850	2850	2850
Southfields	0	0	1300
South Ockendon	4250	4750	4750
Stanford-le-Hope	1120	1370	1370
Tilbury	300	300	300
West Horndon	1500	0	5000
West Tilbury	0	0	0
West Thurrock	500	750	750
TOTAL	16,900	23,180	33,480

3.2 Initial Study Area

The scoping WCS area has initially been considered based on the administrative area of Thurrock and the three growth proposals within the council area as displayed in Appendix C Figure 1. The full study area is later defined in this WCS report after presentation of the baseline information in Section 7, where interactions with the water cycle outside of Thurrock's administrative area have the potential to influence the water environment and hence a wider area of assessment is required.

4. Hydrological baseline summary

This section defines the existing hydrological and hydrogeological context in Thurrock to understand the current condition and where there may be constraints or opportunities for future growth.

4.1 Surface water

4.1.1 Catchment context

Appendix C Figure 2 displays the surface water catchments covering Thurrock as defined for the WFD within the Thames RBMP.

With respect to the RBMP process, the majority of Thurrock is covered by the Essex South Management Catchment which has only one WFD Operational Catchment - the Mardyke. The Mardyke Operational Catchment is made up of three WFD surface water body catchments: Mardyke (West Tributary), Mardyke (East Tributary) and Mardyke. The Mardyke originates outside of Thurrock, draining catchment areas of both the London Borough of Havering and Brentwood to the north. The Mardyke (and several of its tributaries) are classified as a main river within the Thurrock administrative area. The north of the catchment is predominantly agricultural with clay soils giving a flashy flow regime with low baseline flows, while the south of the catchment is more urbanised with residential and industrial uses. The Mardyke discharges into the Thames at Purfleet via the Mardyke Sluice which prevents the Tidal Thames from flowing up the Mardyke.

The rest of the Essex South Management Catchment area within Thurrock which is not covered by the Mardyke catchment consists of smaller water bodies (see Appendix C Figure 2) which are not classified as separate WFD water body catchments in the RBMP; instead, these water bodies contribute to the Tidal Thames Operational Catchment (see below). Despite not having a separate WFD water body catchment definition, several of these watercourses are classified as main rivers including Stanford Brook as it flows through Stanford-le-hope, Fobbing Creek and Manorway Fleet. The majority of connecting tributaries to these watercourses are classified as ordinary watercourses, with several of them being tidally influenced.

The very west of Thurrock (including parts of South Ockenden and Aveley) is covered by the Roding, Beam and Ingrebourne Management Catchment which within Thurrock, is made up of the Roding, Beam and Ingrebourne Operational Catchment. The Roding, Beam and Ingrebourne Operational Catchment is made up of 13 surface water body catchments, with the Southall Sewer and Runningwater Brook WFD water body catchment covering this part of Thurrock. Parts of this watercourse are classified as main river within the boundary of Thurrock and form a key part of the Inner Thames Marshes Site of Special Scientific Interest (SSSI).

The Tidal Thames Operational Catchment is part of the Thames TraC Management Catchment and forms the southern border of Thurrock. It is made up of several transitional water body catchments including Thames Middle, Thames Lower and West Thurrock Lagoon which all relate to the study area.

4.1.2 Surface Water Body Condition

Defining the overall WFD 'status' of a surface water body is a complex assessment that combines standards for water quality, hydromorphology, and biology. Where a surface water body is classified under the WFD, the overall status of a water body is derived from the classification hierarchy made up of 'elements', and the type of water body will dictate what types of elements are assessed within it. Broadly, a WFD surface water body is given an ecological status and a chemical status, and these two aspects make up the overall WFD status of each surface waterbody.

Appendix C Figure 3 depicts the ecological status of the WFD surface water bodies in the study area. The West Thurrock Lagoon is a small artificial waterbody which has a 'Good' Ecological Status; this means the biological, hydromorphology and water quality elements making up Ecological Status are all classified as Good.

The remaining WFD water body catchments in the study area, including the Mardyke WFD waterbodies, the Thames Lower and Thames Middle water bodies, have a 'Moderate' Ecological Status. Appendix C

Figure 4 shows the Physico-Chemical status (which is a contributing element to Ecological Status) of these surface waterbodies as moderate and this demonstrates that physico-chemical quality is a key aspect for why Ecological Status is limited to moderate for the majority of WFD surface waterbodies in the study area.

Appendix C Figure 5 identifies reasons the WFD catchments have not achieved a status of 'Good'; these are termed Reasons for Not Achieving Good status (RNAG) under the WFD regulations. Mardyke (West Tributary) and Mardyke are impacted by physical modifications of the water bodies as well as from water industry sewage discharges. Mardyke (East Tributary) suffers from poor agricultural and rural land management as well as the physical modification of the water body. The Thames Middle and Thames Lower are impacted by the physical modifications of the water bodies. There are no confirmed reasons for Southall Sewer and Runningwater Brook not achieving a status of 'Good'.

4.2 Groundwater

4.2.1 Geology

Appendix C Figure 6 displays the bedrock and superficial geology underlying Thurrock. The bedrock beneath Thurrock comprises of the White Chalk Subgroup in the south-west of Thurrock. To the north of this there is a band of geology comprising the Thanet Sand Formation and the Lambeth Group. Beyond this, to the north of the A13, is the Thames Group and a small area of the Bracklesham Group and Barton Group. The bedrock across Thurrock varies in permeability, where generally the permeability decreases northwards; the Chalk bedrock in the south is permeable and the Thames Group in the north is largely impermeable.

The superficial geology consists of Alluvium in the south of Thurrock adjacent to the River Thames; Alluvium is also present within the floodplain of the River Mardyke in the northern part of Thurrock. Alluvium consists of clays, silts, sands and gravels of which the permeability can be highly variable depending on the exact composition of the material. In between the two areas of Alluvium, there is a band of undifferentiated River Terrace Deposits.

4.2.2 Hydrogeology context

The bedrock geology shown in Appendix C Figure 6 can also be used to spatially identify the associated aquifer designation as defined by the Environment Agency. The White Chalk Subgroup is classed as a Principal Aquifer. Principal Aquifers are defined as those which provide significant quantities of drinking water, and water for business needs. They may also support flow and water level in rivers, lakes and wetlands. The Thanet Sand Formation, Lambeth Group and the Bracklesham Group and Barton Group are all classed as 'Secondary A' Aquifers. Secondary A Aquifers are defined as those which comprise permeable layers that can support local water supplies and may form an important source of baseflow to rivers. The Thames Group is classed as Unproductive meaning it is largely unable to provide usable water supplies and is unlikely to have surface water and wetland ecosystems dependent on it.

Of these aquifers, WFD groundwater body classifications have been defined for some within in the RBMP as shown in Appendix C Figure 7. The South Essex Thurrock Chalk WFD groundwater body is located in the south-west of Thurrock. The South Essex Lower London Tertiaries WFD groundwater body is located immediately to the north of the South Essex Thurrock Chalk and in small areas dispersed across Thurrock.

Appendix C Figure 7 also displays the Source Protection Zones (SPZs) across Thurrock. SPZs are defined around large and public potable groundwater abstraction sites with the aim of reducing potentially polluting activities around these areas and to protect the quality of the groundwater for abstraction and potable use. SPZs are defined based on the time it takes for pollutants to reach an abstraction point from any point at the water table. It does not include the time taken for water to infiltrate from the surface down to the water table. The transmission time enables the Environment Agency to define three zones around a groundwater abstraction point.

- Zone 1 (Inner Protection Zone) – This is defined by a 50-day travel time for pollution from any point below the water table to reach the abstraction source.

- Zone 2 (Outer Protection Zone) – This is defined by a 400-day travel time from a point below the water table.
- Zone 3 (Total Catchment) – This is defined as the area around an abstraction source within which all groundwater can potentially feed into the abstraction source.

There are two SPZ1 and SPZ2 areas within Thurrock associated with two points of groundwater abstraction for public water supply and are surrounded by a larger SPZ3 area. The SPZ3 area covers a large proportion of Thurrock. SPZ1 and SPZ2 present limits on above ground activities/development.

4.2.3 Hydrogeological condition

Appendix C Figure 8 displays the WFD chemical and quantitative status of the two WFD groundwater bodies in Thurrock. The South Essex Lower London Tertiaries has 'Good' chemical and quantitative status. The South Essex Thurrock Chalk has 'Poor' chemical and quantitative status. Appendix C Figure 9 shows that there are no confirmed RNAG for the South Essex Thurrock Chalk. According to the Catchment Data Explorer, the Quantitative Water Balance is rated as 'Poor' leading to a 'Poor' quantitative status. The General Chemical Test is rated as 'Poor' leading to a 'Poor' chemical status.

4.3 Flood risk

Table 4-1 summarises flood risk across Thurrock using flood risk maps produced within the Level 1 Strategic Flood Risk Assessment (SFRA). Further detail on flood risk is set out within the Level 1 SFRA.

Table 4-1 Summary of Flood Sources and Risk

Flood Source	Description
Rivers and the Sea (Thurrock Council Level 1 SFRA Appendix A Figure 7)	Large parts of the borough are defined as Flood Zone 3 i.e. high probability of flooding ignoring the presence of defences from a combination of tidal flooding from the Thames and tidal tributaries as well as fluvial flooding from watercourses such as the Mardyke. The areas at greatest risk of tidal flooding in Thurrock (assuming no defences are present) include the London Gateway Port, Tilbury and Grays. The greatest overall flood risk from the Thames Estuary occurs when tidal surges coincide with particularly high tide levels and/or fluvial flooding the upper reaches of the catchment. Risk of flooding from the River Thames is considered residual in the event that the existing defences are breached or overtopped.
Surface Water (Thurrock Council Level 1 SFRA Appendix A Figure 8)	There are large flow paths of surface water flooding across the borough ranging from high to low probability.
Groundwater (Thurrock Council Level 1 SFRA Appendix A Figure 9)	The north of Thurrock predominantly has 'Potential for groundwater flooding to occur at surface' where chalk is confined. This generally reduces towards the south where areas have 'Potential for groundwater flooding of property situated below ground level' and 'Limited potential for groundwater flooding to occur'. Areas to the east of the borough are 'Not considered to be prone to groundwater flooding'.
Sewers (Thurrock Council Level 1 SFRA Appendix A Figure 6)	Areas to the south of Thurrock have significant numbers of internal flood incidents recorded. This reduces towards the north and east.
Reservoirs (Thurrock Council Level 1 SFRA Appendix A Figure 10)	Land above the docks in the south of Thurrock is at risk of flooding from reservoirs when river levels are normal, and also when there is also flooding from rivers. There is also a risk of flooding from reservoirs when river levels are normal in the north of the borough. This risk increases towards the south when there is also flooding from rivers.

4.4 Water dependent habitats

Thurrock contains several sites of ecological importance including Sites of Special Scientific Interest (SSSIs) and Special Protection Areas (SPAs). These sites have been reviewed to identify which have potential hydrological connectivity and therefore have a material dependency on water. Appendix C Figure 10 displays the water dependent habitats within Thurrock and the potential hydrological connectivity is identified in Table 4-2.

Table 4-2 Water Dependent Habitats in Thurrock

Site	Potential Hydrological Connectivity
Thames Estuary & Marshes SPA Mucking Flats & Marshes SSSI	River Thames, including watercourses directly connected to the Thames
Holehaven Creek SSSI	Holehaven Creek River Thames, including watercourses directly connected to the Thames
West Thurrock Lagoon & Marshes SSSI	River Thames, including watercourses directly connected to the Thames
Grays Thurrock Chalk Pit SSSI	White Chalk Subgroup – Principal Aquifer
Vange & Fobbing Marshes SSSI	Vange Creek Fobbing Creek Parting Gut
Inner Thames Marshes SSSI	Network of water drains River Thames, including watercourses directly connected to the Thames
Langdon Ridge SSSI	Network of unnamed ordinary watercourses
Purfleet Chalk Pits SSSI	White Chalk Subgroup – Principal Aquifer

5. Water Infrastructure Baseline Summary

5.1 Infrastructure provision

Two infrastructure providers operate within Thurrock:

- Anglian Water are responsible for providing sewerage and wastewater treatment to Thurrock.
- Essex and Suffolk Water are responsible for providing potable (clean) water to Thurrock.

5.2 Water infrastructure planning

It is important to consider the planning timelines for both the Local Plan and also for water and sewerage providers in terms of the funding mechanisms for new water supply and water treatment infrastructure. There are elements of water company planning that are pertinent to the WCS; specifically with regard to integration with spatial planning timelines for Local Planning Authorities (LPAs). Water companies have a statutory duty to supply water and wastewater services for residential development and therefore input to the planning process.

Financial and Asset Planning

Water company planning for asset management and funding is governed by the Asset Management Plan (AMP) process which runs in 5 year cycles. The Office for Water Services (Ofwat) is the economic regulator of the water and sewerage industry in England and Wales and regulates this overall process.

In order to undertake maintenance of its existing assets and to enable the building of new assets, water companies seek funding by charging customers according to the level of investment they need to make. The process of determining how much asset investment is required is undertaken in conjunction with key regulators and the outcome is a Business Plan which is produced by each water company setting out the required asset investment over the next 5 year period, the justification for it and the price increase required to fund it.

Overall, the determination of how much a water company can charge its customers is undertaken by Ofwat. Ofwat will consider the views of the water company, the other regulators (Environment Agency, and the Drinking Water Inspectorate) and consumer groups such as the Consumer Council for Water when determining the price limits, it will allow a water company to set in order to enable future asset investment. This process is known as the Price Review (PR) and is undertaken in 5 year cycles. When Ofwat determine a water company's business plan, the price limits are set for the following 5 years allowing the water company to raise funds required to undertake the necessary investment within the AMP round. The current AMP period is known as AMP7 which runs from 1st April 2020 to 31st March 2025. Water and Sewerage Companies are currently in the process of developing their business plans for PR24 that will influence their future investment in AMP8 (April 2025 to March 2030).

Water Resources

Water Resources East is an alliance of the four water companies that supply drinking water across East England, including ESW. WRE published a regional plan in December 2023 to ensure that there are resilient water resources available to meet the needs of the environment, growing population and regional economy through to 2050 and beyond, taking full account of climate change.

Water Resources Management Plan (WRMP)

Water companies undertake medium to long term planning of water resources to demonstrate that there is a long-term plan for delivering sustainable water supply within its operational area to meet existing and future demand. This is reported via a statutory WRMP produced every five years to coincide with each of the water companies' five-yearly asset management (or business) plans. ESW produced a Revised Draft WRMP in August 2023 following consultation.

Drainage and Wastewater Management Plan (DWMP)

Water companies undertake long-term planning of wastewater management to improve drainage and environmental water quality. This is reported via a DWMP which is a long-term plan spanning 25 years that sets out how water and wastewater companies intend to extend, improve, and maintain a robust and resilient drainage and wastewater system. The Environment Act 2021 has made the production of DWMPs statutory to assess current and future capacity, pressures, and risks to sewerage networks, and outline the investment needs to meet the challenges posed by population growth and climate change. AW published their DWMP in May 2023 which covers Thurrock.

5.3 Water supply

5.3.1 Local Surface Water Availability

The Environment Agency manages water resources at the local level using abstraction licensing strategies (ALS). Within the ALS, the Environment Agency's assessment of the availability of water resources is presented as a classification system. The classification gives a resource availability status which indicates the relative balance between the environmental requirements for water and how much is available to be licensed for abstraction. In doing so, it sets out whether water is available for further abstraction and areas where abstraction needs to be limited or reduced.

The categories of resource availability status are shown in Table 5-1. The classification is based on an assessment of a river system's ecological sensitivity to abstraction-related flow reduction. This classification is then used to assess the potential for additional water resource abstractions.

Table 5-1 Water Resource Availability Status Categories

Indicative Resource Availability Status	License Availability
Water Available for Licensing	There is more water than required to meet the need of the environment. New licenses can be considered depending on local and downstream impacts.
Restricted water available for licensing	Full Licensed flows fall below the Environmental Flow Indicators (EFIs). If all licensed water is abstracted there will not be enough water left for the needs of the environment. No new consumptive licenses would be granted. It may also be appropriate to investigate the possibilities for reducing fully licensed risks. Water may be available if you can 'buy' (known as licence trading) the entitlement to abstract water from an existing license holder.
No water available for licensing	Recent actual flows are below the EFI. This scenario highlights water bodies where flows are below the indicative flow requirement to help support Good Ecological Status. No further consumptive licences will be granted. Water may be available if you can 'buy' (known as license trading) the amount equivalent to recently abstracted from an existing licence holder.
Discharge Rich Waterbodies	These waterbodies have a modified flow that is influenced by reservoir compensation releases, or they have flows that are augmented. These are often known as 'regulated rivers' and may be managed through an operating agreement often held by a water company. The availability of water is dependent on these operating agreements. There may be water available for abstraction, the EA would need to be contacted to find out more.

The Environment Agency aims to protect the annual flow variability in rivers, from low to high flow conditions through the application of flow statistics derived from flow data collected at river gauging stations. Flow statistics are expressed as the percentage of time that flow is exceeded. Resource availability is calculated by the Environment Agency for four different flow scenarios:

- Q95 (lower flow);
- Q70;
- Q50; and,
- Q30 (higher flow)

Q95 is the flow exceeded for 95% of the time and is used as a low flow indicator. Q30 is the flow exceeded for 30% of the time and is a higher flow. Appendix C Figure 11 identifies the water availability for the four different flow scenarios within Thurrock and indicates that water is available for licensing across Thurrock during the Q30, Q50 and Q70 scenarios. During the Q95 lower flow scenario however, the majority of Thurrock has restricted water available for licensing.

5.3.2 Local Groundwater Availability

As identified in Appendix C Figure 12, the north of Thurrock is covered by confined chalk and therefore is assumed as having no water available for abstraction. This means that the groundwater unit balance shows more water has been abstracted based on recent amounts than the amount available and hence the EA will not grant further licenses.

The remaining area of Thurrock is assumed to have water available for abstraction as chalk in this area is unconfined. This means that the groundwater unit balance shows groundwater available for licensing. New licenses can be considered depending on impacts on other abstractors and on surface water.

5.3.2.1 Water stress classification

Although the ALS process identifies some potential for abstraction from local sources, the volumes available are likely to be small due to the water stress classification assigned to the study area. Along with the rest of the south east and east of England, the Environment Agency classified Thurrock to be within an area of serious water stress in 2021⁷. Water stress in this context applies to both the natural environment and to public water supplies, including how both are affected by climate change. A severe water stressed classification reflects that the household demand for water is a high proportion of effective rainfall that is available in the area to meet that demand.

The classification outcome shows where the Environment Agency believe there are (or are likely to be) environmental impacts caused by public water supplies and/or where the Environment Agency consider the need for major water resources developments; Thurrock is included in that classification.

5.3.3 Water company supply

ESW supply potable water to Thurrock which is managed by the WRMP process. Water companies undertake medium to long term planning of water resources in order to demonstrate that a long-term plan for delivering sustainable water supply within its operational area to meet existing and future demand. This is reported via statutory WRMPs produced every five years to coincide with each of the water companies' five-yearly asset management (or business) plans.

The ESW Revised Draft WRMP 2024⁸ was published in August 2023 and covers the period 2025 – 2050. This WRMP sets out that the average household per capita consumption (PCC) for ESW is 150 l/h/d (litres/head/day) in 2024/25⁸.

The plan identifies Thurrock to be within the Essex Water Resource Zone (WRZ). WRZs are areas defined by a water company where populations within the area are interconnected and hence can be

⁷ Environment Agency Water Stressed Areas <https://www.gov.uk/government/publications/water-stressed-areas-2021-classification> (Accessed July 2023)

⁸ Essex and Suffolk Water (2023) Draft Water Resources Management Plan 2024. Available at: <https://www.nwg.co.uk/responsibility/environment/wrmp/esw-draft-water-resources-management-plan-2024-consultation/>.

supplied by the same water resource options, thereby having the same overall surplus or deficit of available water supply.

The Essex WRZ is large and complex using local resources within the zone as well as import of treated and raw water into it (including for river augmentation), and significant movement of raw and treated water within the zone; this reflects the water stress classification of the area whereby meeting demand from local effective rainfall (and hence local raw sources alone) would be a challenge. As well as Thurrock, the zone includes all or most of the Essex local authorities of Basildon, Castle Point, Southend, Rochford, Brentwood, Chelmsford, and Maldon, as well as the London Boroughs of Barking & Dagenham and Havering.

Water resources used within the Essex WRZ include the rivers Chelmer, Blackwater, Stour and Roman River, which support pumped storage reservoirs at Hanningfield and Abberton, and treatment works near Langford, Langham, Hanningfield and Layer. A small proportion of water sourced within the Essex WRZ (approximately 2% of the total water supplied in the zone) is derived from groundwater via Chalk well and adit sources in the south and southwest of the zone. The remaining supply is transferred into the Essex WRZ from two sources, namely the Chigwell raw water bulk supply from Thames Water Utilities Lea Valley Reservoirs, and the Ely Ouse to Essex Transfer Scheme (EOETS) which is owned and operated by the Environment Agency. Additionally, the Environment Agency has groundwater river support schemes including the Stour Augmentation Groundwater Scheme (SAGS) and the Great Ouse Groundwater Scheme (GOGS) which have the potential to support river flows in the Essex WRZ.

The water supply network in the Essex WRZ is highly integrated with a large degree of flexibility for moving raw and potable water around the zone to where it is required. The preferred mode of operation during the summer is for Langham, Langford, Layer and Chigwell treatment works to provide a reasonably constant baseload, with output from Hanningfield treatment works varying to meet the remaining demand. The Langford recycling scheme intercepts effluent from Chelmsford Sewage Treatment Works and treats it to a very high standard so the water can be discharged into the River Chelmer. It is then available for re-abstraction via existing intakes supporting the Langford treatment works and storage into Hanningfield Reservoir.

In terms of the preferred sources supplying Thurrock, as displayed in Figure 5-1, water supply in the study area is primarily supplied by groundwater sources, however the area also has access to transfers from Thames Water and other connections to the wider sources supplying the Essex WRZ.



Figure 5-1 Essex WRZ Water Supply

ESW's assessment of available water for the Essex WRZ in their baseline identifies that the Zone would be in deficit for the whole planning horizon (2025 – 2050), up to a maximum of -42.08Ml/d in 2034/35 under average conditions if no new measures are put in place. The WRMP states that the reason for the deficit is largely due to climate change and a reduction in summer flows as well as the impacts of housing and population growth.

5.4 Wastewater services

Thurrock is served by two Water Recycling Centres (WRCs) which process, treat and return wastewater from housing and non-residential sources safely back to the water environment. The WRC coverage for Thurrock includes the Tilbury WRC which serves the majority of the urban areas of Thurrock and Upminster WRC which covers a very small area in the north-west of Thurrock; Upminster WRC's main catchment coverage is for populations within the London Borough of Havering and also Brentwood.

Areas of Thurrock are connected to the WRCs by a wastewater network which is mainly separated into foul and surface water sewer. There are few locations across Thurrock where a combined network is present (mostly in South Ockenden). The WRC catchments and network can be seen in Appendix C Figure 13. Appendix C Figure 13 also identifies where there are catchment overflows linked to the wastewater network with only one located in Corringham; however, there are storm tank discharges at both Tilbury (to the tidal River Thames) and Upminster (to the Mardyke).

5.4.1 Wastewater planning

AW manage wastewater assets within the Thurrock area. The AW DWMP⁹ identifies existing risks to the Tilbury and Upminster WRC catchments. The Tilbury WRC catchment has been assessed to have moderately significant issues with Dry Weather Flow (DWF) compliance, internal sewer flooding and storm overflows. It has been assessed to have very significant issues with pollution incidents and sewer collapses. The Upminster WRC catchment has been assessed to have very significant issues with pollution incidents and sewer collapses.

⁹ Anglian Water (2023) Drainage and Wastewater Management Plan. Available at: <https://www.anglianwater.co.uk/about-us/our-strategies-and-plans/drainage-wastewater-management-plan/> (Accessed July 2023)

6. Capacity – constraints and opportunities

This section looks at potential environmental and infrastructure capacity constraint issues, to identify any evidence gaps that need further assessment in detailed WCS. It also considers planned measures and the potential opportunities which could be explored.

6.1 Wastewater treatment

The Mardyke and Mardyke (West Tributary) WFD water bodies do not achieve a 'Good' Ecological Status due, in part, to water industry sewage discharges. This is a key aspect to consider when reviewing capacity at Upminster WRC.

The Thames Middle WFD waterbody does not currently have a RNAG Status attributed to discharges, however the volume and quality of discharge from Tilbury WRC still needs to be considered, particularly in relation to the connected water dependent habitats.

To support the scoping process, a high-level qualitative assessment of WRC capacity based on the three growth scenarios has been undertaken to determine whether there are likely key constraints which need further consideration in a detailed WCS. Appendix C Figure 1 and Table 3-1 displays how the proposed growth is split across the settlement areas within Thurrock. There is likely to be some flexibility in where water from this growth would drain once boundaries and site layouts are better known, however for the purposes of this Scoping WCS, it has been assumed that growth at West Horndon would drain to the Upminster WRC, and remaining growth in the other settlement areas would drain to the Tilbury WRC.

The headroom capacity at the Tilbury and Upminster WRCs has been assessed using current per capita consumption levels and using a measured discharge flow based on the average of the 2019, 2020 and 2021¹⁰ values provided by Anglian Water; this measured DWF was compared to the maximum DWF which each WRC is allowed to discharge under its current permit conditions to give a residual flow permit capacity.

As well as considering the three growth scenarios, the headroom capacity at the Tilbury and Upminster WRCs has also been estimated for three possible future PCC scenarios: one assuming all new houses continue to use the current PCC (150l/h/d); another assuming all new houses use the ESW target PCC for 2038 (122l/h/d) and a third assuming all new houses use the PCC 2050 target (110l/h/d) a detailed in the WRMP. The Occupancy Rate in Thurrock has been estimated using Census information and has been multiplied by each per PCC scenario to provide the dwelling demand for each scenario. The capacity for additional dwellings was then calculated based on the residual flow permit capacity and recorded in Table 6-1. An assumption for additional infiltration into the sewer system has also been allowed for by adding 10% to the calculation of DWF for each dwelling.

The results of the assessment show that there is capacity for the number of dwellings proposed in all Growth Options at Tilbury and Upminster WRCs with residual dwelling capacity for all Growth Options available once the proposed houses have been considered. The results also show the importance of achieving a low PCC for planned residential growth as it significantly increases the headroom capacity available at each WRC.

It should be noted that the combined growth outside of the Thurrock area has not been accounted for within these calculations, this is especially important for the Upminster WRC as the majority of the development served by this WRC is outside of Thurrock. Therefore, any Growth Option taken forward which includes houses within the Upminster WRC catchment will trigger the need for an expanded study area to consider growth from surrounding areas.

Further work may be required to confirm environmental capacity in receiving watercourses particularly for the Mardyke (West Tributary) given the current water quality pressures on the water body. An increase in DWF could result in the need to upgrade the treatment processes at the WRCs to ensure

¹⁰ Based on measured Q90 DWF

additional flow does not result in a deterioration of water quality or prevent the waterbodies from meeting their target status under the WFD regulations. Water quality assessments, including Load Standstill calculations and River Quality Planning (RQP) modelling, could be used as part of a Detailed WCS or further assessment could be undertaken by AW as part of updates to the DWMP.

Table 6-1 WRC DWF headroom assessment results

WRC & PCC Scenario			Current DWF Permit (m ³ /d)	Current Headroom Capacity		Approx. dwelling capacity up to 100% DWF permit (number of dwellings)	Residual capacity - Option 1 (number of dwellings)	Residual capacity - Option 2 (number of dwellings)	Residual capacity - Option 3 (number of dwellings)
				Current DWF Q90 (m ³ /d)	Calculated Headroom (m ³ /d)				
Tilbury – PCC 150l/h/d			40,000	28,004	11,996	28,965	12,065	5,785	485
Tilbury – PCC 122l/h/d			40,000	28,004	11,996	35,316	18,416	12,136	6,836
Tilbury – PCC 110l/h/d			40,000	28,004	11,996	39,196	22,269	15,989	10,689
Upminster 150l/h/d	–	PCC 6,300	6,300	4,019	2,281	5,508	4,008	5,508	508
Upminster 122l/h/d	–	PCC 6,300	6,300	4,019	2,281	6,715	5,215	6,715	1,715
Upminster 110l/h/d	–	PCC 6,300	6,300	4,019	2,281	7,448	5,948	7,448	2,448

6.1.1 Upminster WRC catchment

As seen in Table 6-1, the Upminster WRC has capacity for the number of dwellings in all the Growth Options and residual capacity for approximately 4,008, 5,215 and 5,948 dwellings for the 150l/h/d, 122l/h/d and 110l/h/d scenarios respectively for Growth Option 1. This would decrease to 508, 1,715 and 2,488 dwellings for the 150l/h/d, 122l/h/d and 110l/h/d scenarios respectively for Growth Option 3.

The DWMP states that the medium term strategy (2035) for Upminster WRC is to increase attenuation in the network and the long term strategy (2050) is to achieve 10% surface water removal.

6.1.2 Tilbury WRC catchment

As seen in Table 6-1, the Tilbury WRC has capacity for the number of dwellings in all the Growth Options and residual capacity for approximately 12,065, 18,416 and 22,269 dwellings for the 150l/h/d, 122l/h/d and 110l/h/d scenarios respectively for Growth Option 1. This would decrease to 485, 6,836 and 10,689 dwellings for the 150l/h/d, 122l/h/d and 110l/h/d scenarios respectively for Growth Option 3.

The DWMP states that the medium term strategy (2035) for Tilbury WRC is to increase attenuation in the network and the long term strategy (2050) is to implement process optimisation in the WRC and achieve 10% surface water removal.

6.1.3 Strategic growth location issues

Appendix C Figure 13 displays the sewer network across Thurrock. It can be seen that there potential for connection to the existing sewer network across the majority of the settlement areas where new housing is proposed. The existing sewer network may require upgrades to serve the proposed housing numbers. There is no existing sewer network in some locations to connect into including Fobbing, Langdon Hills, Lower Langdon and West Horndon, therefore new infrastructure would be required in these areas.

6.2 Water Supply

6.2.1 Future supply strategy

As set out in 5.3.3 of this report, ESW calculate a supply deficit in the Essex WRZ without measures to manage demand and provide additional water supply. DEFRA's Integrated Plan for Delivering Clean and Plentiful Water¹¹ and the Government's Environmental Improvement Plan¹² set pathways for reducing demand domestically to manage long term water supplies. These plans are key drivers in the development of measures to manage the forecast deficit and provide a focus for the following demand management measures set out within ESW's draft WRMP24:

- Reduce leakage by 40% by 2050.
- Reduce per capita consumption to 122 l/h/d by 2038 and 110 l/h/d by 2050.
- Reduce non-household demand by 9% by 2038.

In parallel, to increase water supplies in the Essex WRZ, the draft WRMP24 sets out a preferred plan which incorporates the following supply schemes to improve water treatment and lead to an increase in volume of potable water:

- Linford WTW.
- Abberton Raw Water Pumping Station and Langford Clarifiers.
- Langford Nitrate Reduction Scheme.
- Langham Ultraviolet Scheme.

¹¹ DEFRA (2023) Our integrated plan for delivering clean and plentiful water. Available at: [Our Integrated Plan for Delivering Clean and Plentiful Water \(publishing.service.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/118444/Our-integrated-plan-for-delivering-clean-and-plentiful-water.pdf) (Accessed December 2023)

¹² DEFRA (2023) Environmental Improvement Plan 2023. Available at: [Environmental Improvement Plan \(publishing.service.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/118444/Environmental-Improvement-Plan-2023.pdf) (Accessed December 2023)

- Langham Nitrate Reduction Scheme.

The reduction in demand and additional supplies ensures that the Essex WRZ remains in surplus over the planning horizon (2025 – 2050).

6.2.2 Supply planning review – residential demand

To validate whether the planned forecast supply demand balance within the WRMP24 preferred plan is appropriate for the level of growth to come forward in Thurrock, analysis has been completed of the number of houses allowed for from the Thurrock area in the ESW WRMP compared to the growth option scenarios considered within this scoping WCS.

This analysis has shown that between 2022-2050, ESW have allowed for 27,244 houses in Thurrock (973 houses per year) as part of the calculation of supply and demand balance within their preferred plan. Thurrock's Local Plan spans 20 years; the number of houses ESW have allowed for over the Local Plan period of 20 years is 19,460. This demonstrates that the number of dwellings which would come forward if Growth Option 1 (16,900) is selected is catered for; however, there is a shortfall of 3,720 dwellings in Option 2 and a shortfall of 14,020 dwellings in Option 3.

As part of a Detailed WCS, potential options should be investigated to identify if the shortfall in number of dwellings assessed in the WMRP24 can be met should those growth options come forward. This would include:

- consideration of the any surplus in the WRZ and whether it is adequate to allow for higher numbers of delivered houses by the end of the Plan period;
- whether feasible additional supplies could be brought forward in the Plan period, or;
- whether there is evidence and justification for implementing more stringent water demand/efficiency target within planning policies should Growth Options 2 or 3 come forward.

The review of implementation of more stringent planning policy targets could be undertaken in collaboration between ESW, Thurrock Council, the Environment Agency, Natural England and AW13 as part of a joint protocol, as is currently being developed by AW for their supply area.

A further consideration for a Detailed WCS is that Growth Option 3 provides an opportunity to implement best practice integrated water management solutions through the creation of new settlements or significant urban extensions. Such development allows water to be considered as part of master planning, and the WCS could develop guidance, via the creation of Supplementary Planning Documents (SPD) which requires integrated and efficient water and flood risk management for new dwellings in these locations.

6.2.3 Non-residential demand

Lambert Smith Hampton published an Employment Land Availability Assessment¹⁴ for Thurrock in February 2023. This study states that there is an average of 16.93ha per annum of employment land take-up. Employment land includes industrial, warehouse and compound use land. Over the 20 year plan period, this would total 338.60ha of employment land. Figure 6-1 shows the available employment land in Thurrock and Figure 6-2 shows the potential employment land in Thurrock, where potential is defined as land that is neither allocated for employment, nor within an established employment area but has been identified by the Council for assessment.

The majority of the available employment land is located in the south-east of Thurrock, including the London Gateway Park, Thames Enterprise Park and the oil refinery at Coryton. The remaining available employment land is located towards the southern boundary of Thurrock. The potential employment land includes areas in the south-east of Thurrock, in the Tilbury area, areas to the north of Purfleet, in South Ockenden and West Horndon.

¹³ Reduced consumption may also have benefits to reduced wastewater treatment volume.

¹⁴ Lambert Smith Hampton (2023) Employment Land Availability Assessment. Available at: <https://www.thurrock.gov.uk/sites/default/files/assets/documents/employmentlandavailability-202304-v02.pdf> (Accessed December 2023)

Thurrock Council have received a number of enquiries for potential hydrogen schemes which would use electrolysis; this includes the conversion of existing hydrogen production to electrolysis and potential new facilities. In part, this interest links to electricity grid connection enhancements in and around Tilbury. Hydrogen production through electrolysis has the potential for significant increases in demand for freshwater sources which would generate additional demand for water over and above that created by general increases in employment land.

DEFRA's Integrated Plan for Delivering Clean and Plentiful Water has set a legally binding target to reduce the overall amount of water supplied to non-households by 9% by 2038. Therefore, ESW may not be able to supply new businesses with treated water should they require significant non-domestic water supplies to operate. As set out in Figure 6-1 and Figure 6-2, and as outlined in relation to future potential for hydrogen production facilities via electrolysis, there is significant potential for non-residential growth in Thurrock through the Plan period and hence the potential to supply water for these developments is uncertain.

Non-domestic development will need to consider how it can source water supply complementary to what can be provided from public water supplies via ESW. Appendix C Figure 11 displays the CAMS surface water availability and shows that the available and potential employment land sites are in areas where there is water available for licensing during low, medium and high flows, and restricted water available for licensing during very low flows. Appendix C Figure 12 displays the CAMS groundwater availability and shows that the majority of the available employment land sites are to be in areas where there is water available for licensing from aquifers. Part of the south-east of Thurrock has confined chalk where it is assumed that water will not be available for abstraction. The potential employment sites located within the south of Thurrock (as well as the sites of interest for hydrogen facilities) are located within areas which have water available for licensing; however, as shown in Appendix C Figure 8, the WFD status of the South Essex Thurrock Chalk groundwater body is less than good in part due to the quantitative water balance test and hence licences for abstraction may be significantly limited in these locations. The potential employment sites in the northern part of Thurrock are in areas where there is confined chalk.

Although there is some potential for local new abstraction, there will be an increasing need for non-residential development to demonstrate that the demand for water has been minimised, through water efficiency and integrated water management practices, and moving towards a water neutral position may become a requirement. Hydrogen facilities requiring a reliable supply of freshwater will need to be able to demonstrate where this water could be sourced from. A Detailed WCS could investigate the feasibility of water neutrality (through measures such as water re-use) in non-domestic development to meet the requirements of the Local Plan and environmental considerations set out by Government.

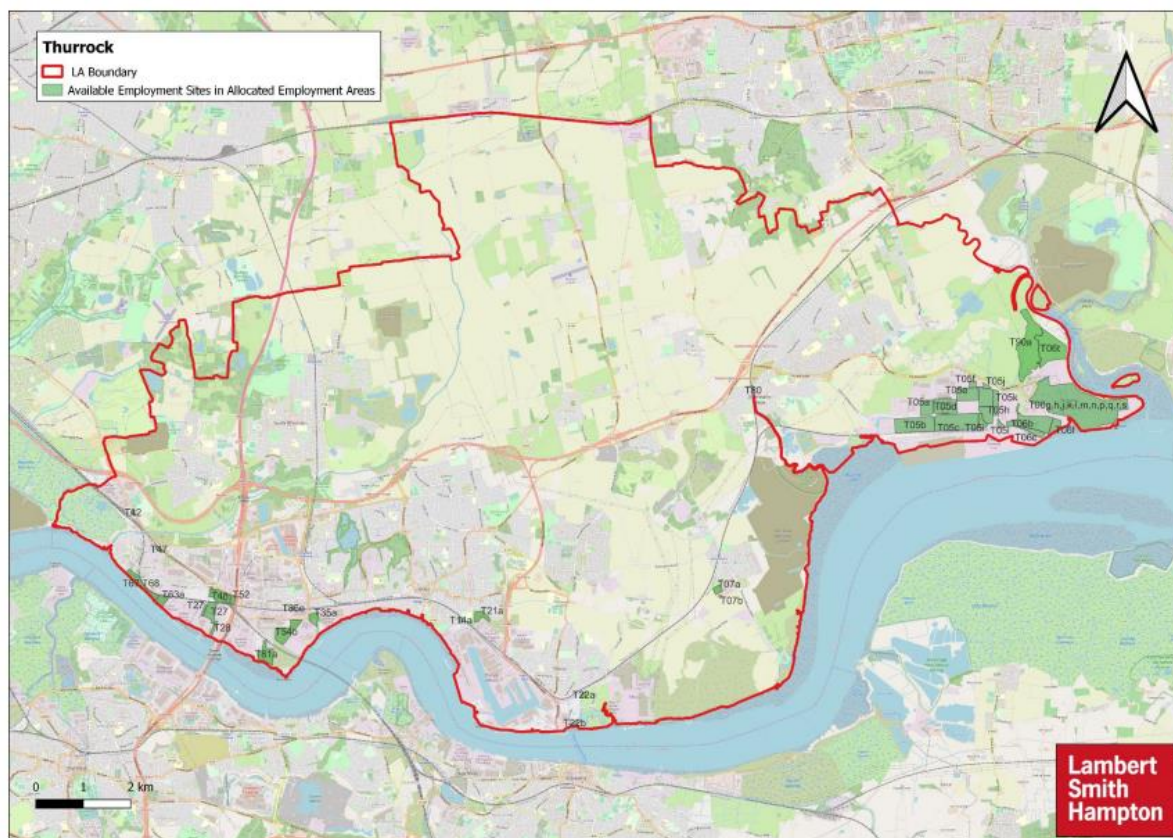


Figure 6-1 Available Employment Sites¹⁴

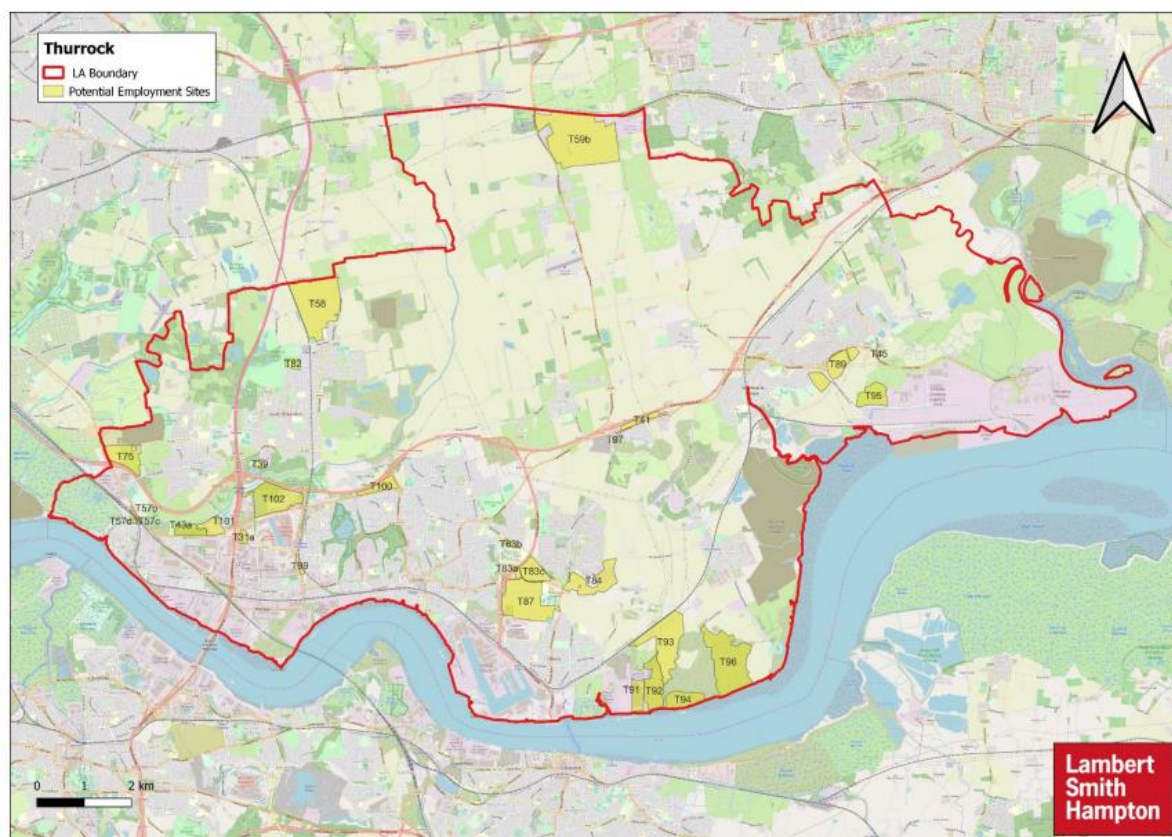


Figure 6-2 Potential Employment Sites¹⁴

6.3 Flood Risk

Table 6-2 summarises the flood risk to the settlement areas. The following figures from Appendix A of the Thurrock Council Level 1 SFRA have been used to assess the flood risk:

- Figure 7: Risk of Flooding from Rivers and Sea.
- Figure 8: Risk of Surface Water Flooding.
- Figure 9: Susceptibility to Groundwater Flooding.
- Figure 10: Risk of Flooding from Reservoirs.

Settlements at higher risk of flooding, particularly from rivers or the sea, may encounter constraints with planning due to guidance outlined in the National Planning Policy Framework³ and Planning Practice Guidance⁴.

The following measures have been set out in the Level 1 SFRA to manage and mitigate flood risk through spatial planning and development management:

- Development Layout and Sequential Approach.
- Finished Floor Levels.
- Safe Access/Egress.
- Safe Refuge.
- Surface Water Management.

Measures related to development layout and surface water management could consider opportunities at a catchment level through delivery of nature based solutions (see Section 6.4) as well as opportunities for integrated water management where development is likely to be delivered through new or expanded settlements.

These strategic growth locations present the opportunity to reduce flood risk both to strategic new development but also further downstream in the catchment. Targeted measures to reduce manage surface water strategically at large development locations would also contribute to the removal of surface water discharge to the sewer network, supporting measures to reduce storm discharges at Corringham CSO and the storm tanks at both WRCs, as well as supporting wider DWMP measures to increase treatment capacity at the WRC through surface water removal from the sewer system.

Table 6-2 Summary of Flood Risk to Settlement Areas**Key Risk**

	Low
	Medium
	High

Settlement	Fluvial/Tidal Flood Risk	Surface Water Flood Risk	Groundwater Flood Risk	Reservoir Flood Risk
Aveley	This area is not shown to be at risk of flooding from rivers or the sea.	This is within a critical drainage area and experiences flooding from surface water.	The majority of this area has limited potential for groundwater flooding to occur.	This area is not shown to be at risk of flooding from reservoirs.
Bulphan	This area is shown to be at risk of flooding from rivers or the sea.	This is within a critical drainage area and experiences flooding from surface water.	The majority of this area has the potential for groundwater flooding to occur at surface.	This area is not shown to be at risk of flooding from reservoirs.
Chadwell St Mary	The south of this area is shown to be at risk of flooding from rivers or the sea, but benefits from defences.	This is within a critical drainage area and experiences flooding from surface water.	This area has the potential for groundwater flooding of property situated below ground level.	This area is not shown to be at risk of flooding from reservoirs.
Corringham	This area is shown to be at risk of flooding from rivers or the sea, but benefits from defences.	This area is shown to be at risk of flooding from surface water.	This area has the potential for groundwater flooding to occur at surface.	This area is not shown to be at risk of flooding from reservoirs.
East Tilbury	This area is shown to be at risk of flooding from rivers or the sea, but benefits from defences.	This is within a critical drainage area and experiences flooding from surface water.	This area has limited potential for groundwater flooding to occur.	This area is not shown to be at risk of flooding from reservoirs.
Fobbing	This area is not shown to be at risk of flooding from rivers or the sea.	This is within a critical drainage area and experiences flooding from surface water.	This area is not considered to be prone to groundwater flooding.	This area is not shown to be at risk of flooding from reservoirs.
Grays	The majority of this area is shown to be at risk of flooding from rivers or the sea, but benefits from defences.	This area lies within a few critical drainage areas and experiences flooding from surface water.	This area has the potential for groundwater flooding of property situated below ground level.	This area is not shown to be at risk of flooding from reservoirs.

Settlement	Fluvial/Tidal Flood Risk	Surface Water Flood Risk	Groundwater Flood Risk	Reservoir Flood Risk
Horndon on the Hill	This area is not shown to be at risk of flooding from rivers or the sea.	This is within a critical drainage area and experiences flooding from surface water.	This area has the potential for groundwater flooding to occur at surface.	This area is not shown to be at risk of flooding from reservoirs.
Langdon Hills	This area is not shown to be at risk of flooding from rivers or the sea.	This area is shown to be at risk of flooding from surface water.	This area has the potential for groundwater flooding to occur at surface.	This area is not shown to be at risk of flooding from reservoirs.
North Stifford	This area is shown to be at risk of flooding from rivers or the sea to the north, but benefits from defences.	This area is shown to be at risk of flooding from surface water to the north.	This area has limited potential for groundwater flooding to occur.	The north of this area is shown to be at risk of flooding from reservoirs.
Lower Langdon	This area is not shown to be at risk of flooding from rivers or the sea.	This is within a critical drainage area and experiences flooding from surface water.	This area has the potential for groundwater flooding to occur at surface.	This area is not shown to be at risk of flooding from reservoirs.
Orsett	This area is not shown to be at risk of flooding from rivers or the sea.	This is within a critical drainage area and experiences flooding from surface water.	This area is not considered to be prone to groundwater flooding.	This area is not shown to be at risk of flooding from reservoirs.
Purfleet-on-Thames	This area is shown to be at risk of flooding from rivers or the sea, but benefits from defences.	This area is shown to be at risk of flooding from surface water.	This area has the potential for groundwater flooding of property situated below ground level.	This area is not shown to be at risk of flooding from reservoirs.
South Ockendon	This area is not shown to be at risk of flooding from rivers or the sea.	This is within a critical drainage area and experiences flooding from surface water.	This area has the potential for groundwater flooding to occur at surface.	This area is not shown to be at risk of flooding from reservoirs.
Southfields	This area is not shown to be at risk of flooding from rivers or the sea.	This area is shown to be at risk of flooding from surface water.	This area has the potential for groundwater flooding of property situated below ground level and the potential for groundwater flooding to occur at surface.	This area is not shown to be at risk of flooding from reservoirs.
Stanford-le-Hope	This area is shown to be at risk of flooding from rivers or the sea, but mostly benefits from defences in the south.	This area is shown to be at risk of flooding from surface water.	This area has the potential for groundwater flooding of property situated below ground level and the potential for groundwater flooding to occur at surface.	This area is not shown to be at risk of flooding from reservoirs.
Tilbury	This area is shown to be at risk of flooding from rivers or the sea, but benefits from defences.	This is within a critical drainage area and experiences flooding from surface water.	This area has the potential for groundwater flooding of property situated below ground level.	This area is shown to be at risk of flooding from reservoirs.

Settlement	Fluvial/Tidal Flood Risk	Surface Water Flood Risk	Groundwater Flood Risk	Reservoir Flood Risk
West Horndon	This area is at risk of flooding from rivers or the sea.	This area is shown to be at risk of flooding from surface water.	This area has the potential for groundwater flooding to occur at surface.	The east of this area is shown to be at risk of flooding from reservoirs.
West Tilbury	This area is not shown to be at risk of flooding from rivers or the sea.	This area is shown to be at risk of flooding from surface water.	This area has limited potential for groundwater flooding to occur.	This area is not shown to be at risk of flooding from reservoirs.
West Thurrock	This area is shown to be at risk of flooding from rivers or the sea, but benefits from defences.	This area is shown to be at risk of flooding from surface water.	This area has limited potential for groundwater flooding to occur.	This area is not shown to be at risk of flooding from reservoirs.

6.4 NbS opportunities

Nature based Solutions (NbS) are a multidisciplinary tool for sustainably utilising the landscape and its features to address socio-environmental challenges. Opportunities for NbS in Thurrock have been identified at a high level in this scoping study to explore existing and new nature based solutions to manage water resources and flood risk. NbS can be used as standalone adaptation measures, or they can be combined with traditional grey infrastructure solutions to provide water and flood risk benefit.

To identify the potential for water based NbS solutions which can provide water and flood risk management benefits in Thurrock, a review was undertaken of opportunities within the Thurrock Green and Blue Infrastructure Strategy¹⁵, the Working With Natural Processes (WWNP)¹⁶ dataset for natural Flood Management (NFM) opportunities, and also relevant catchment projects/opportunities in the South Essex Catchment Partnership¹⁷. Appendix C Figure 14 displays the opportunities for water based NbS identified.

The WWNP dataset shows that the southern area of Thurrock has fewer opportunities identified for NFM with large areas constrained for the planting of potential woodland, generally due to urbanisation. However, smaller scale opportunities are present in the southern area including small areas of floodplain reconnection potential and riparian woodland planting potential. The northern area of Thurrock shows greater potential for floodplain, riparian, and wider catchment woodland planting. There are also some areas where there is floodplain reconnection potential, for example along the River Mardyke and its tributaries. Runoff attenuation features are also possible in the northern area of Thurrock.

Appendix B provides more information on the water based projects/opportunities included within the Green and Blue Infrastructure Strategy and the South Essex Catchment Partnership website. Where these projects (and potential for NFM through the WWNP) could potentially be linked to contributions from strategic development as part of the proposed settlement or growth locations, this is set out in Table 6-3.

¹⁵ Thurrock Council (2023) Thurrock Green and Blue Infrastructure Study. Available at: <https://thurrockc.sharepoint.com/sites/ThurrockCouncilPublicDocuments/Website%20files/Forms/AllItems.aspx?id=%2Fsites%2FThurrockCouncilPublicDocuments%2FWebsite%20files%2FPlanning%20policy%2Fgreenblueinfrastructure%2D202302%2Dv01%2Epdf&parent=%2Fsites%2FThurrockCouncilPublicDocuments%2FWebsite%20files%2FPlanning%20policy&p=true&ga=1> (Accessed June 2023)

¹⁶ Working with Natural Processes (2018). Available at: https://assets.publishing.service.gov.uk/media/6036c5468fa8f5480a5386e9/Working_with_natural_processes_evidence_direct_ory.pdf (Accessed January 2024)

¹⁷ South Essex Catchment Partnership: <https://storymaps.arcgis.com/collections/a8d4bc8ee3da4d2f980553751680151c?item=5> (Accessed June 2023)

Table 6-3 Thurrock Areas of Growth and Opportunities for NbS and infiltration SuDS

Broad Area of Growth	Landscape Character Type	Infiltration SuDS Suitability¹⁸	Nearest Watercourse/WFD Catchment	Potential NbS
Aveley	River Gravels Terrace	Opportunities for bespoke SuDS /probably compatible for infiltration SuDS	Unnamed Watercourse to south-east and west (tributary of Tidal Thames)	Ordinary Opportunities for creation of woodland on outskirts and potential for runoff attenuation features including SuDS which could provide benefits as area is partially located within a Critical Drainage Area.
Bulphan	Fenland	Very significant constraints	Mardyke/Mardyke (East Tributary) waterbodies	WFD Opportunities to contribute to the Bulphan Flood Resilience project to improve flood risk posed by rivers and surface water in Bulphan. Opportunities for creation of woodland, runoff attenuation features and floodplain reconnection potential which could contribute to the NFM measures from 'catchment to coast' project to reduce downstream flood risk and contribute to improving Ecological Status of the Mardyke.
Chadwell St Mary	Farmland	Opportunities for bespoke SuDS /probably compatible for infiltration SuDS	Network of unnamed Ordinary Watercourses to south (tributaries of the Tidal Thames)	Potential for implementation of SuDS to improve surface water flood risk as area is partially located within a Critical Drainage Area.
Corringham	Farmland	Opportunities for bespoke SuDS /probably compatible for infiltration SuDS	Fobbing Creek	Opportunities for creation of woodland and SuDS. Potential to contribute to the Fobbing Marsh Restoration project which could result in secondary benefits such as reducing downstream flood risk and result in improvements in Ecological Status of the Thames Lower water body.
East Tilbury	Open Farmland Undulating	Opportunities for bespoke infiltration SuDS	Unnamed watercourse to east (part of Mucking Marshes)	Opportunities for riparian woodland and floodplain reconnection potential which could result in improving flood risk and contribute to improving the Ecological Status of the Middle Thames water body.
Fobbing	Open Farmland/Undeveloped Marsh	Probably compatible for infiltration SuDS	Fobbing Creek	Opportunities for creation of woodland and infiltration SuDS. Potential to contribute to the Fobbing Marsh Restoration project which could result in secondary benefits such as reducing downstream flood risk and result in improvements in Ecological Status of the Thames Lower water body.
Grays	Settled Chalk Ridge	Majority area has very significant constraints with parcels of highly compatible and probably compatible for infiltration SuDS	Unnamed watercourse to east	Opportunity to develop Little Thurrock community wetland creation project to reduce downstream flood risk. Potential for runoff attenuation features to improve surface water flood risk as areas are located within Critical Drainage Areas.

¹⁸ Identified using Figure 11 in Thurrock SFRA (available in Appendix B).

Broad Area of Growth	Landscape Character Type		Infiltration SuDS Suitability ¹⁸	Nearest Watercourse/WFD Catchment	Potential NbS
Horndon Hill	on the Open Farmland	Undulating	Probably compatible for infiltration SuDS	Stanford Brook/Mucking Creek	Potential for creation of woodland and runoff attenuation features which could contribute to the NFM measures from ‘catchment to coast’ project to reduce downstream flood risk.
Langdon Hills	Higher Hills		Mix of probably compatible/opportunities for bespoke infiltration SuDS and very significant constraints	Unnamed Ordinary Watercourse to south (Tributary of the Mardyke East WFD waterbody)	Potential for creation of woodland and runoff attenuation features which could improve downstream flood risk.
Lower Langdon	Lower Hill Slopes		Mix of probably compatible/opportunities for bespoke infiltration SuDS and very significant constraints	Upper tributaries of Mucking Creek	Potential for creation of woodland including riparian woodland. Opportunities for infiltration SuDS which could improve surface water flood risk as area is located within a Critical Drainage Area.
Orsett	Open Farmland	Undulating	Probably compatible for infiltration SuDS	Network of unnamed Ordinary Watercourses to north-west (tributaries to Mardyke WFD waterbody)	Potential for woodland creation on outskirts and runoff attenuation features and infiltration SuDS which could improve surface water flood risk as area is located within a Critical Drainage Area.
Purfleet-on-Thames	Settled Chalk Ridge		Very significant constraints with some areas which are highly/probably compatible	Mardyke WFD waterbody	Opportunities to contribute to the Mardyke Valley Plan project and the Mardyke Pennywort Removal project which could help reduce flood risk and contribute to improving Ecological Status of the Mardyke water body.
Southfields	Open Farmland	Undulating	Opportunities for bespoke/probably compatible for infiltration SuDS. Areas of very significant constraints.	Unnamed Ordinary Watercourse to south (drains to the Tidal Thames)	Opportunities for infiltration SuDS which could improve surface water flood risk.
South Ockendon	River Gravels	Terrace	Very significant constraints with some areas of opportunities for bespoke/highly/probably compatible	Mardyke WFD waterbody	Potential for the creation of woodland and implementation of runoff attenuation features which could improve surface water flood risk as area is located within a Critical Drainage Area. Opportunities to contribute to the Davy Down Floodplain Improvement project, Mardyke Valley Plan and the improving fish passage at Stifford Gauging Weir project which could contribute to improving the Ecological Status of the Mardyke.
Stanford-le-Hope	Farmland		Very significant constraints and probably compatible/opportunities for bespoke SuDS	Stanford Brook/Mucking Creek	Opportunities to contribute to the Balstonia Park project and implement this project in other locations to improve flood risk. Potential for the creation of woodland on outskirts which could improve flood risk downstream.

Broad Area of Growth	Landscape Character Type	Infiltration SuDS Suitability ¹⁸	Nearest Watercourse/WFD Catchment	Potential NbS
Tilbury	Developed Marsh	Very significant constraints and potential opportunities for bespoke SuDS	Unnamed watercourse to south and west (drains to the Tidal Thames)	Opportunity to develop Little Thurrock community wetland creation project to reduce flood risk. Area is located within a Critical Drainage Area, therefore potential opportunities for bespoke SuDS should be considered.
West Horndon	Fenland	Very significant constraints	Mardyke (East Tributary) WFD waterbody	Potential for creation of woodland and runoff attenuation features which could contribute to the NFM measures from 'catchment to coast' project to reduce downstream flood risk and contribute to improving the Ecological Status of the Mardyke (East Tributary) water body.
West Thurrock	Developed Marsh	Very constraints/probably for SuDS significant compatible	Mardyke WFD waterbody	Some opportunities for infiltration SuDS in some areas which could improve surface water flood risk as area is partially located within a Critical Drainage Area. Opportunities to contribute to the Mardyke Valley Plan project which could reduce flood risk and contribute to improving Ecological Status of the Mardyke water body.

6.5 Evidence review summary

The Scoping WCS has identified that there is likely to be sufficient treatment capacity at the Tilbury and Upminster WRCs to cater for the number of dwellings proposed in all Growth Scenarios subject to ensuring water demand is minimised in new housing, and there is no detriment to water quality in receiving water bodies. The study has also identified that the lower growth scenario has been catered for in ESW's WRMP24 and hence there are sufficient measures proposed to manage demand and increase supply to meet those future demands.

The following evidence gaps which warrant further consideration in a Detailed WCS are:

- Consideration of how the shortfall of houses accounted for in the ESW WRMP can be addressed if growth scenarios 2 or 3 are taken forward, for example by developing a pathway towards water neutrality to support implementation of policy to reduce PCC below 110 l/h/d or to consider the feasibility of the provision of additional water supplies. This could also include investigation of the feasibility of water re-use in non-domestic development to meet the requirements of the Local Plan and environmental considerations set out by Government.
- Consideration on the water quality impact on receiving water bodies from the additional proposed housing and resultant increase in treated wastewater discharges at Tilbury and Upminster WRC; this would include water quality assessment and modelling. Consider the impacts from additional wastewater and water demand on water dependent habitats specially linked to Tilbury discharges.
- With respect to Upminster WRC, once a growth scenario is confirmed and it is possible to determine more accurately how many houses might drain to the WRC, consideration of wider contributing growth in neighbouring boroughs will be required to ensure the WRC has capacity to cope with increased flows from Thurrock as well as these authorities. This would require the study area to be increased once a preferred growth scenario affecting the north of the Borough is confirmed and make allowance for cumulative growth within the Borough of Brentwood and the London Borough of Havering. The full study area therefore should not only include the administrative area of Thurrock, but also surrounding growth areas from the London Borough of Havering and Brentwood to ensure Upminster WRC has appropriate capacity.
- Further detail on NbS opportunities that should be considered for confirmed growth locations within a Detailed WCS, particularly where they reduce flood risk, are hydrologically linked to downstream water dependent habitats and offer opportunity for integrated water management.

7. Growth area scoping summary

Table 7-1 provides a summary of the opportunities and constraints for each settlement with proposed growth in Thurrock as identified in this Scoping WCS.

Table 7-1 Summary table of opportunities and constraints for growth in Thurrock

Settlements	WRC serving Settlement	WRC capacity			Local water abstraction potential (non-residential)	Sewer network connection	Surface or Groundwater Connectivity to water dependent habitats	Flood risk	Geology type and infiltration SuDS suitability	Nature-based solutions opportunities
Aveley	Tilbury	Growth capacity	Option 1:	Available	<u>Surface Water:</u> Water Available for Licensing for Q95, Q70, Q50 and Q30. <u>Groundwater:</u> Abstraction limited due to confined chalk.	Yes	No	-Critical Drainage Area -Surface water flood risk -Limited potential for groundwater flooding to occur -High number of sewer flood records	Bedrock: Thames Group Superficial: None Opportunities for bespoke/probably compatible for infiltration SuDS	Opportunities for creation of woodland on outskirts and potential for runoff attenuation features including SuDS.
Bulphan	Tilbury	Growth capacity	Option 1:	Available	<u>Surface Water:</u> Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. <u>Groundwater:</u> Abstraction limited due to confined chalk.	Yes	No	-At risk of flooding from the rivers or the sea -Critical Drainage Area -Surface water flood risk -Potential for groundwater flooding to occur at surface -Medium number of sewer flood records	Bedrock: Thames Group Superficial: None Very significant constraints	Opportunities to contribute to the Bulphan Flood Resilience project. Opportunities for creation of woodland, runoff attenuation features and floodplain reconnection potential which could contribute to the NFM measures from 'catchment to coast' project.
Chadwell St Mary	Tilbury	Growth capacity	Option 1:	Available	<u>Surface Water:</u> Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. <u>Groundwater:</u> Water Available for Licensing.	Yes	No	-South shown to be at risk of flooding from rivers or the sea, but benefits from defences -Critical Drainage Area -Surface water flood risk -Potential for groundwater flooding of property situated below ground level -Medium to high number of sewer flood records	Bedrock: Lambeth Group Superficial: River Terrace Deposits Opportunities for bespoke/probably compatible for infiltration SuDS	Potential for implementation of infiltration SuDS.
Corringham	Tilbury	Growth capacity	Option 1:	Available	<u>Surface Water:</u> Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. <u>Groundwater:</u> Abstraction limited due to confined chalk.	Yes – CSO present, therefore capacity would need to be considered.	Located upstream of Vange & Fobbing Marshes SSSI connected via the Fobbing Creek.	-At risk of flooding from rivers or the sea, but benefits from defences -Surface water flood risk -Potential for groundwater flooding to occur at surface -Medium number of sewer flood records	Bedrock: Thames Group Superficial: None Opportunities for bespoke/probably compatible for infiltration SuDS	Opportunities for creation of woodland and SuDS. Potential to contribute to the Fobbing Marsh Restoration project.
East Tilbury	Tilbury	Growth capacity	Option 1:	Available	<u>Surface Water:</u> Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Tidal water abstraction may be possible for some use needs. <u>Groundwater:</u> Water Available for Licensing.	Yes	Located upstream of the Thames Estuary & Marshes SPA and the Mucking Flats & Marshes SSSI connected via an unnamed watercourse.	- At risk of flooding from rivers or the sea, but benefits from defences -Critical Drainage Area -Surface water flood risk -Limited potential for groundwater flooding to occur -High number of sewer flood records	Bedrock: Thanet Sand Formation Superficial: Alluvium Opportunities for bespoke/probably compatible for infiltration SuDS Near to SPZ I and II	Opportunities for riparian woodland and floodplain reconnection potential.
Fobbing	Tilbury	Growth capacity	Option 1:	Available	<u>Surface Water:</u> Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. <u>Groundwater:</u> Abstraction limited due to confined chalk.	No	Located upstream of Vange & Fobbing Marshes SSSI connected via the Fobbing Creek.	-Critical Drainage Area -Surface water flood risk -Medium number of sewer flood records	Bedrock: Thames Group Superficial: None Probably compatible for infiltration SuDS	Opportunities for creation of woodland and infiltration SuDS. Potential to contribute to the Fobbing Marsh Restoration project.

Settlements	WRC serving Settlement	WRC capacity				Local water abstraction potential (non-residential)	Sewer network connection	Surface or Groundwater Connectivity to water dependent habitats	Flood risk	Geology type and infiltration SuDS suitability	Nature-based solutions opportunities
Grays	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Groundwater: Water Available for Licensing.	Yes	Near to Grays Thurrock Chalk Pit SSSI	-At risk of flooding from rivers or the sea, but benefits from defences -Critical Drainage Area -Surface water flood risk -Potential for groundwater flooding of property situated below ground level	Bedrock: White Chalk Subgroup Superficial: River Terrace Deposits Majority area has very significant constraints with parcels of highly compatible and probably compatible for infiltration SuDS	Opportunity to develop Little Thurrock community wetland creation project. Potential for runoff attenuation features.	
		Growth capacity	Option 2:	Available							
		Growth capacity	Option 3:	Available							
Horndon on the Hill	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Groundwater: Abstraction limited due to confined chalk.	Yes	Located upstream of the Thames Estuary & Marshes SPA and the Mucking Flats & Marshes SSSI connected via Mucking Creek.	-Critical Drainage Area -Surface water flood risk -Potential for groundwater flooding to occur at surface -Medium number of sewer flood records	Bedrock: Thames Group Superficial: None Probably compatible for infiltration SuDS	Potential for creation of woodland and runoff attenuation features which could contribute to the NFM measures from 'catchment to coast' project.	
		Growth capacity	Option 2:	Available							
		Growth capacity	Option 3:	Available							
Langdon Hills	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Groundwater: Abstraction limited due to confined chalk.	No	Upstream of Langdon Ridge SSSI connected via an unnamed watercourse.	-Surface water flood risk -Potential for groundwater flooding to occur at surface -High number of sewer flood records	Bedrock: Thames Group Superficial: None Mix of probably compatible/opportunities for bespoke infiltration SuDS and very significant constraints	Potential for creation of woodland and runoff attenuation features.	
		Growth capacity	Option 2:	Available							
		Growth capacity	Option 3:	Available							
Lower Langdon	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Groundwater: Abstraction limited due to confined chalk.	No	Located upstream of the Thames Estuary & Marshes SPA and the Mucking Flats & Marshes SSSI connected via Mucking Creek.	-Critical Drainage Area -Surface water flood risk -Potential for groundwater flooding to occur at surface -Medium to high number of sewer flood records	Bedrock: Thames Group Superficial: None Mix of probably compatible/opportunities for bespoke infiltration SuDS and very significant constraints	Potential for creation of woodland including riparian woodland. Opportunities for infiltration SuDS.	
		Growth capacity	Option 2:	Available							
		Growth capacity	Option 3:	Available							
Orsett	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Groundwater: Water Available for Licensing.	Yes	No	-Critical Drainage Area -Surface water flood risk -Potential for groundwater flooding of property situated below ground level -Medium number of sewer flood records	Bedrock: Lambeth Group Superficial: None Probably compatible for infiltration SuDS	Potential for woodland creation on outskirts and runoff attenuation features and infiltration SuDS.	
		Growth capacity	Option 2:	Available							
		Growth capacity	Option 3:	Available							
Purfleet-on-Thames	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Tidal water abstraction may be possible. Groundwater: Water Available for Licensing but may be limited by the WFD water balance status being less than good in the WFD Groundwater body.	Yes	Near to Purfleet Chalk Pits SSSI	-At risk of flooding from rivers or sea but benefits from defences -Critical Drainage Area -Surface water flood risk -Potential for groundwater flooding of property situated below ground level -High number of sewer flood records	Bedrock: White Chalk Subgroup Superficial: None Very significant constraints with some areas which are highly/probably compatible	Opportunities to contribute to the Mardyke Valley Plan project and the Mardyke Pennywort Removal project.	
		Growth capacity	Option 2:	Available							
		Growth capacity	Option 3:	Available							
Southfields	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Groundwater: Water Available for Licensing.	Yes	No	-Surface water flood risk -Potential for groundwater flooding at surface and of property situated below ground level -Medium number of sewer flood records	Bedrock: Lambeth Group Superficial: None Opportunities for bespoke/probably compatible for infiltration SuDS. Areas of very significant constraints.	Opportunities for infiltration SuDS.	
		Growth capacity	Option 2:	Available							
		Growth capacity	Option 3:	Available							

Settlements	WRC serving Settlement	WRC capacity				Local water abstraction potential (non-residential)	Sewer network connection	Surface or Groundwater Connectivity to water dependent habitats	Flood risk	Geology type and infiltration SuDS suitability	Nature-based solutions opportunities
South Ockendon	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Groundwater: Abstraction limited due to confined chalk.	Yes	No	-Critical Drainage Area -Surface water flood risk -Potential for groundwater flooding to occur at surface -Medium number of sewer flood records	Bedrock: Thames Group Superficial: River Terrace Deposits Very significant constraints with some areas of opportunities for bespoke/highly/probably compatible Near to SPZ I and II which may limit some land use types and infiltration options	Potential for the creation of woodland and implementation of runoff attenuation features. Opportunities to contribute to the Davy Down Floodplain Improvement project and the improving fish passage at Stifford Gauging Weir project.	
	Growth capacity	Option 2:	Available								
	Growth capacity	Option 3:	Available								
Stanford-le-Hope	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Groundwater: Water Available for Licensing.	Yes	Located upstream of the Thames Estuary & Marshes SPA and the Mucking Flats & Marshes SSSI connected via Mucking Creek.	- At risk of flooding from rivers or sea but benefits from defences -Surface water flood risk - Potential for groundwater flooding at surface and of property situated below ground level -High number of sewer flood records	Bedrock: Lambeth Group Superficial: None Very significant constraints and probably compatible/opportunities for bespoke SuDS	Opportunities to contribute to the Balstonia Park project and implement this project in other locations to improve flood risk. Potential for the creation of woodland on outskirts.	
	Growth capacity	Option 2:	Available								
	Growth capacity	Option 3:	Available								
Tilbury	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Tidal water abstraction may be possible. Groundwater: Water Available for Licensing but may be limited by the WFD water balance status being less than good in the WFD Groundwater body.	Yes	No	- At risk of flooding from rivers or sea but benefits from defences - Critical Drainage Area -Surface water flood risk - Potential for groundwater flooding of property situated below ground level -High number of sewer flood records -Reservoir flood risk	Bedrock: White Chalk Subgroup Superficial: Alluvium Very significant constraints and potential opportunities for bespoke SuDS	Opportunity to develop Little Thurrock community wetland creation project. Opportunities for bespoke infiltration SuDS.	
	Growth capacity	Option 2:	Available								
	Growth capacity	Option 3:	Available								
West Horndon	Upminster	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Groundwater: Abstraction limited due to confined chalk.	No	No	-At risk of flooding from rivers or the sea -Surface water flood risk -Potential for groundwater flooding to occur at surface -Low number of sewer flood records -Reservoir flood risk	Bedrock: Thames Group Superficial: None Very significant constraints	Potential for creation of woodland and runoff attenuation features which could contribute to the NFM measures from 'catchment to coast' project.	
	Growth proposed	Option 2:	No dwellings								
	Growth capacity	Option 3:	Available								
West Thurrock	Tilbury	Growth capacity	Option 1:	Available	Surface Water: Restricted Water Available for Licensing for Q95, Water Available for Licensing for Q70, Q50 and Q30. Tidal water abstraction may be possible. Groundwater: Water Available for Licensing but may be limited by the WFD water balance status being less than good in the WFD Groundwater body.	Yes	Located upstream of West Thurrock Lagoon & Marshes SSSI connected via Bill Meroy Creek/unnamed watercourses.	- At risk of flooding from rivers or sea but benefits from defences -Surface water flood risk -Limited potential for groundwater flooding to occur -Medium number of sewer flood records	Bedrock: White Chalk Subgroup Superficial: None Very significant constraints/probably compatible for SuDS Near to SPZ I and II which may limit some land use types and infiltration options.	Opportunities for infiltration SuDS in some areas. Opportunities to contribute to the Mardyke Valley Plan project.	
	Growth capacity	Option 2:	Available								
	Growth capacity	Option 3:	Available								

Appendix A Policy and Legislative Drivers Shaping the WCS

A.1 WFD Surface Water Body Status

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

A.2 Legislation

Directive/Legislation/Guidance	Description
The Conservation of Offshore Marine Habitats and Species Regulations 2017	Provides for the designation of Special Protection Areas.
Building Regulations Approved Document G – sanitation, hot water safety and water efficiency (March 2010)	The current edition covers the standards required for cold water supply, water efficiency, hot water supply and systems, sanitary conveniences and washing facilities, bathrooms and kitchens and food preparation areas.
Environment Act 1995	Sets out the role and responsibility of the Environment Agency.
Environment Act 2021	Provides a legal framework for environmental governance in the UK. Brings in measures for improvement of the environment in relation to waste, resource efficiency, air quality, water, nature and biodiversity, and conservation.
Environmental Protection Act 1990	Integrated Pollution Control (IPC) system for emissions to air, land and water.
Flood & Water Management Act 2010	The Flood and Water Management Act 2010 is the outcome of a thorough review of the responsibilities of regulators, local authorities, water companies and other stakeholders in the management of flood risk and the water industry in the UK. Its key features relevant to this WCS are: 1. To give the Environment Agency an overview of all flood and coastal erosion risk management and unitary and county councils the lead in managing the risk of all local floods. 2. To encourage the uptake of sustainable drainage systems by removing the automatic right to connect to sewers and providing for unitary and county councils to adopt SuDS for new developments and redevelopments. 3. To widen the list of uses of water that water companies can control during periods of water shortage and enable Government to add to and remove uses from the list. 4. To enable water and sewerage companies to operate concessionary schemes for community groups on surface water drainage charges. 5. To make it easier for water and sewerage companies to develop and implement social tariffs where companies consider there is a good cause to do so, and in light of guidance that will be issued by the Secretary of State following a full public consultation.
Future Water, February 2008	Sets the Government's vision for water in England to 2030. The strategy sets out an integrated approach to the sustainable management of all aspects of the water cycle, from rainfall and drainage, through to treatment and discharge, focusing on practical ways to achieve the vision to ensure sustainable use of water. The aim is to ensure sustainable delivery of water supplies and help improve the water environment for future generations.

Directive/Legislation/Guidance	Description
The Groundwater (Water Framework Directive) (England) Direction 2016	To protect groundwater against pollution by 'List 1 and 2' Dangerous Substances.
The Conservation of Habitats and Species Regulations 2017	To conserve the natural habitats and to conserve wild fauna and flora with the main aim to promote the maintenance of biodiversity taking account of social, economic, cultural and regional requirements. In relation to abstractions and discharges, can require changes to these through if they are impacting on designated European Sites. Also the legislation that provides for the designation of Special Areas of Conservation provides special protection to certain non-avian species and sets out the requirement for Appropriate Assessment of projects and plans likely to have a significant effect on an internationally designated wildlife site.
Land Drainage Act 1991	Sets out the statutory roles and responsibilities of key organisations such as Internal Drainage Boards, local authorities, the Environment Agency and Riparian owners with jurisdiction over watercourses and land drainage infrastructure.
National Planning Policy Framework	Planning policy in the UK is set by the National Planning Policy Framework (NPPF). NPPF advises local authorities and others on planning policy and operation of the planning system. A WCS helps to balance the requirements of various planning policy documents and ensure that land-use planning and water cycle infrastructure provision is sustainable.
Pollution Prevention and Control Act (PPCA) 1999	Implements the IPPC Directive. Replaces IPC with a Pollution Prevention and Control (PPC) system, which is similar but applies to a wider range of installations.
Ramsar Convention	Provides for the designation of wetlands of international importance
Urban Waste Water Treatment Directive (UWWTD)	This Directive concerns the collection, treatment and discharge of urban waste water and the treatment and discharge of waste water from certain industrial sectors. Its aim is to protect the environment from any adverse effects caused by the discharge of such waters.
Water Act 2003	Implements changes to the water abstraction management system and to regulatory arrangements to make water use more sustainable.
The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017	The WFD, combines water quantity and water quality issues together. An integrated approach to the management of all freshwater bodies, groundwaters, estuaries and coastal waters at the river basin level has been adopted. The overall requirement of the directive is that all river basins must achieve 'Good ecological status' by 2015 or by 2027 if there are no grounds for derogation. The Environment Agency is the body responsible for the implementation of the WFD in the UK. The Environment Agency have been supported by UKTAG ¹⁹ , an advisory body which has proposed water quality, ecology, water abstraction and river flow standards to be adopted in order to ensure that the water bodies in the UK (including groundwater) meet the required status ²⁰ . Standards and waterbody classifications are published via River Management Plans (RBMP) the latest of which were completed in 2015.
Natural Environment & Rural Communities Act 2006	Covering Duties of public bodies – recognises that biodiversity is core to sustainable communities and that Public bodies have a statutory duty that states that "every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.
Water Resources Act 1991	Protection of the quantity and quality of water resources and aquatic habitats. Parts have been amended by the Water Act 2003.
Wildlife & Countryside Act 1981 (as amended)	Legislation that provides for the protection and designation of SSSIs and specific protection for certain species of animal and plant among other provisions.

A.3 Strategies and Plans

Category	Author	Document Name	Publication Date
Water Resources	Anglian Water	Drainage and Wastewater Management Plan	2023
Water Resources	Essex and Suffolk Water	Revised Draft Water Resources Management Plan	2023

¹⁹ The UKTAG (UK Technical Advisory Group) is a working group of experts drawn from environment and conservation agencies. It was formed to provide technical advice to the UK's government administrations and its own member agencies. The UKTAG also includes representatives from the Republic of Ireland.

²⁰ UK Environmental Standards and Conditions (Phase I) Final Report, April 2008, UK Technical Advisory Group on the Water Framework Directive.

Category	Author	Document Name	Publication Date
Water Resources	Water Resources East	Draft Regional Water Resources Plan for Eastern England	2022
Flood Risk	AECOM	Thurrock Borough Council Level 1 Strategic Flood Risk Assessment	2018
Flood Risk	Thurrock Council	Thurrock Local Flood Risk Management Strategy	2015
Water Resources/Flood Risk	Thurrock Council	Green and Blue Infrastructure Study	2023
Water Resources/Flood Risk	Thurrock Council	Climate Change Strategy Update	2023
Water Resources/Flood Risk	Arup	Thurrock Climate Change Action Plan Update	2021
Water Resources/Flood Risk	Association of South Essex Local Authorities	South Essex Green and Blue Infrastructure Study	2020

A.4 Thurrock Council Core Strategy Full Policies

CSTP25 – Addressing Climate Change

“1. Adaptation

I. The Council will require climate change adaptation measures and technology to be considered from the outset in any development proposal including reduction of emissions, renewable and low carbon technologies, passive design, recycling and waste minimisation, and through the application of green infrastructure techniques.

II. The Council will work to ensure that vulnerability to climate change impacts is minimised in new development, and that such development does not increase vulnerability to climate change impacts.

III. The location and layout of new buildings should minimise vulnerability to climate change.

IV. Developers must consider the potential effects of climate change on their development, including:

- i. Water conservation and drainage*
- ii. Need for summer cooling*
- iii. Risk of subsidence*
- iv. Flood risk from tidal, fluvial and surface water*

2. Mitigation

I. The Council will require new and existing development and associated activities to adhere to local, regional and national targets for reducing carbon emissions.

II. The Council will seek the achievement and maintenance of the following minimum reductions in CO2 emissions compared to emissions in 2005:

Sector	By 2015	By 2020
Domestic: CO2 per household	4.0%	5.8%
Road Transport: CO2 per Annual Average Daily Traffic	6.0%	6.5%
Business: CO2 per job	9.0%	11.3%

III. The Council will employ innovative methods of reducing and mitigating emissions, including the introduction of a Carbon Offset Fund.”

CSTP27 – Management and Reduction of Flood Risk

I. The Council will ensure that flood risk management is implemented and supported through effective land use planning. The Sequential, and where necessary Exception Test, as set out in the NPPF and associated Planning Practice Guidance will be employed when allocating sites for development and an Emergency Plan for the Borough will be completed.

II. The Council will also continue to work collaboratively with the Environment Agency by supporting the area based policy approach adopted in the Thames Estuary 2100 Project. In particular the Council will seek to safeguard existing flood defences and new areas for flood defences, water storage and drainage areas, as well as seeking secondary defences for key assets.

III. The Council will support the work of the Environment Agency in the Environmental Enhancement Project for the Mucking Flats and Marshes to ensure the delivery of appropriate flood mitigation and environmental enhancement measures.

IV. The Council will work with the Environment Agency and other main stakeholders to ensure that fluvial and surface water flood risk is managed within Thurrock. This will include supporting the policies identified in the South Essex Catchment Flood Management Plan, such as identifying and safeguarding areas of land for existing and future areas of water storage in Policy Units 9, 10, 11 & 12 and in formulating System Asset Management Plans (SAMP) and the Integrated Urban Drainage Plans for Stanford-le-Hope, Tilbury and Purfleet. A Surface Water Management Plan will also be carried out to assist in the identification and mapping of areas susceptible to surface water flooding as recommended by Defra and the Pitt Review. Development proposals that will affect these locations will be expected to contribute towards infrastructure improvements, including where appropriate green infrastructure, in these locations to enable the development to proceed.

V. The Council will ensure that, where necessary, new development throughout the Borough contains space for water including naturalisation and environmental enhancement.

VI. Developers will be required to incorporate sustainable drainage systems as a priority and to contribute towards flood risk management infrastructure where appropriate.

VII. Planning applications received for sites within Flood Zone 3 will be treated in accordance with the NPPF, this policy and Policy PMD15."

Appendix B NbS Opportunities

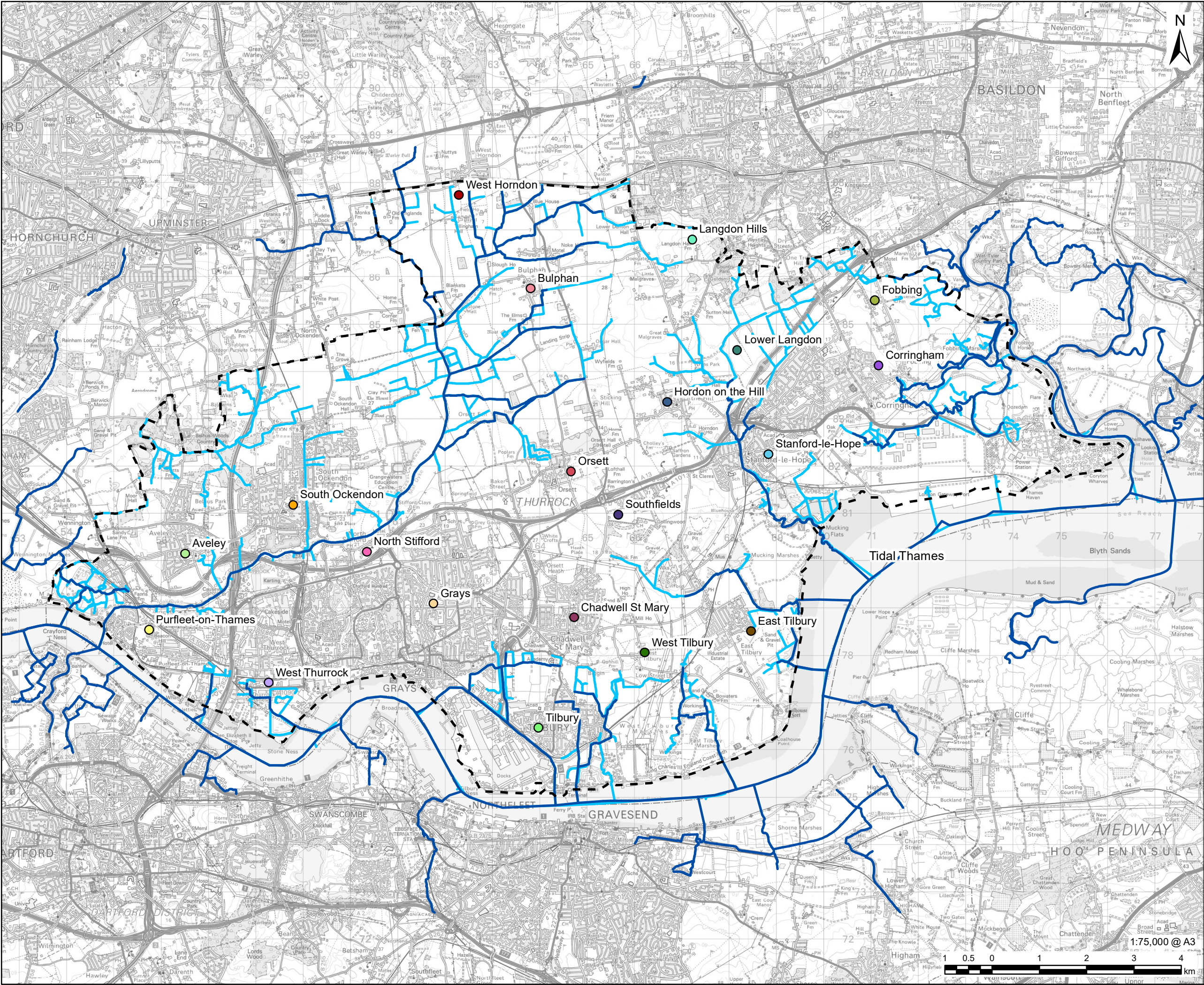
**Project/Opportunity
Number on Appendix
C Figure 14**

Project/Opportunity Number on Appendix C Figure 14	Project Name	Study	Lead Organisation	Status	Description of Project
1	Davy Down Floodplain Improvement	South Essex Catchment Partnership	Thames21	Completed	The project aims to improve the Mardyke floodplain at Davy Down riverside park through the creation of pond and scrape habitats. This will create important features of wetland habitat whilst also increasing the floodplain's ability to store flood water.
2	NFM measures from 'catchment to coast'	South Essex Catchment Partnership	Thurrock Council	Planned	Thurrock Council LLFA are leading a joint bid with Southend Council LLFA to the Defra Innovative Resilience Fund to introduce an innovative approach to flood management that spans the upper catchment to the coast in the Stanford-le-Hope area. This will include NbS and community engagement.
3	Fobbing Marsh Restoration	South Essex Catchment Partnership	Essex Trust	Wildlife Planned	Restoration of Fobbing Marsh will connect 6 miles of marshland across South Essex. The marshes are part of an SSSI. The unimproved coastal grassland and associated dykes and creeks support a diversity of maritime grasses and herbs. Many of these plants are nationally uncommon or rare, and together form an outstanding assemblage of plants. The combination of grazing land, watercourses and fringing saltmarsh also provides an ideal habitat for numerous invertebrates and birds.
4	Mardyke Pennywort Removal	South Essex Catchment Partnership	Thames21	Ongoing	The project aims to carry out annual management of the Invasive Non-Native Species (INNS) Floating Pennywort on the Mardyke River.
5	Little Thurrock community wetland creation and flood mitigation	South Essex Catchment Partnership	Thames21	Idea	An opportunity exists to turn a disused area of Thurrock Council land situated off Rockery Lane in Little Thurrock into a community wetland space. Water could be diverted into this space from an adjacent surface water drain, reducing downstream flood risk.
6	Improving fish passage at Stifford Gauging Weir	South Essex Catchment Partnership	Environment Agency	Idea	Potential project to either remove Stifford Gauging Weir or retrofit it with eel tiles and a fish pass.

Project/Opportunity Number on Appendix C Figure 14	Project Name	Study	Lead Organisation	Status	Description of Project
7	Lower Thames Crossing Biodiversity Net Gain Opportunities	South Essex Catchment Partnership	All South Essex Catchment Partners	Potential	The arrival of the Lower Thames Crossing will likely bring opportunities for projects involving biodiversity net gain.
8	Mink Monitoring and Control	South Essex Catchment Partnership	Essex Trust	Wildlife Planned	A project planned to monitor and control mink in the Mardyke catchment.
9	Bulphan Flood Resilience	Thurrock Blue and Green Infrastructure Study	Thurrock Council	Ongoing	Thurrock Council aims to create interventions within the upper catchment which intend to help Bulphan in terms of flows and to build a large pond and wetland system as it is the lowest part of the catchment which then flows into the Mardyke River. The overall aim is to build flood resilience in Bulphan and to create a hydro citizenship to uptake these sorts of projects and maintain them down the line.
10	Balstonia Park	Thurrock Blue and Green Infrastructure Study	Thurrock Council	Ongoing	The project is aiming to utilise flood and rainwater as pipe connection water within Balstonia Park. If it is successful, then the overall aim is to roll out this intervention across Thurrock.
11	Mardyke Valley Plan	Thurrock Blue and Green Infrastructure Study	Thurrock Council	Ongoing	The project aims to create a continuous parkland from Purfleet to Grangewaters that acts as a corridor for active travel, natural flood management and biodiversity, and provide opportunities for landscape restoration.

Appendix C Report Figures

- Figure 1 Study Area and Growth
- Figure 2 WFD Catchments and Waterbodies
- Figure 3 WFD Surface Waterbodies – Ecological Status
- Figure 4 WFD Surface Waterbodies – Physico-Chemical Status
- Figure 5 WFD Surface and Transitional Waterbodies RNAG
- Figure 6 Geology and Aquifer Designation
- Figure 7 WFD Groundwater Bodies and Source Protection Zones
- Figure 8 WFD Groundwater Body Chemical and Quantitative Status
- Figure 9 WFD Groundwater Bodies RNAG
- Figure 10 Water Dependent Habitats
- Figure 11 CAMS Surface Water Availability
- Figure 12 CAMS Groundwater Availability
- Figure 13 Wastewater Assets
- Figure 14 Nature Based Solutions Opportunities



AECOM

PROJECT

Thurrock Council Scoping
Water Cycle Study (WCS)

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THURROCK COUNCIL

CONSULTANT

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LEGEND

Thurrock Borough Boundary
 Main River
 Ordinary Watercourse

Settlement

Aveley
 Bulphan
 Chadwell St Mary
 Corringham
 East Tilbury
 Fobbing
 Grays
 Hordon on the Hill
 Langdon Hills
 Lower Langdon
 North Stifford
 Orsett
 Purfleet-on-Thames
 South Ockendon
 Southfields
 Stanford-le-Hope
 Tilbury
 West Horndon
 West Thurrock
 West Tilbury

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Proposed housing growth numbers available in Section 3 of WCS report.

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WCS REPORT

PROJECT NUMBER

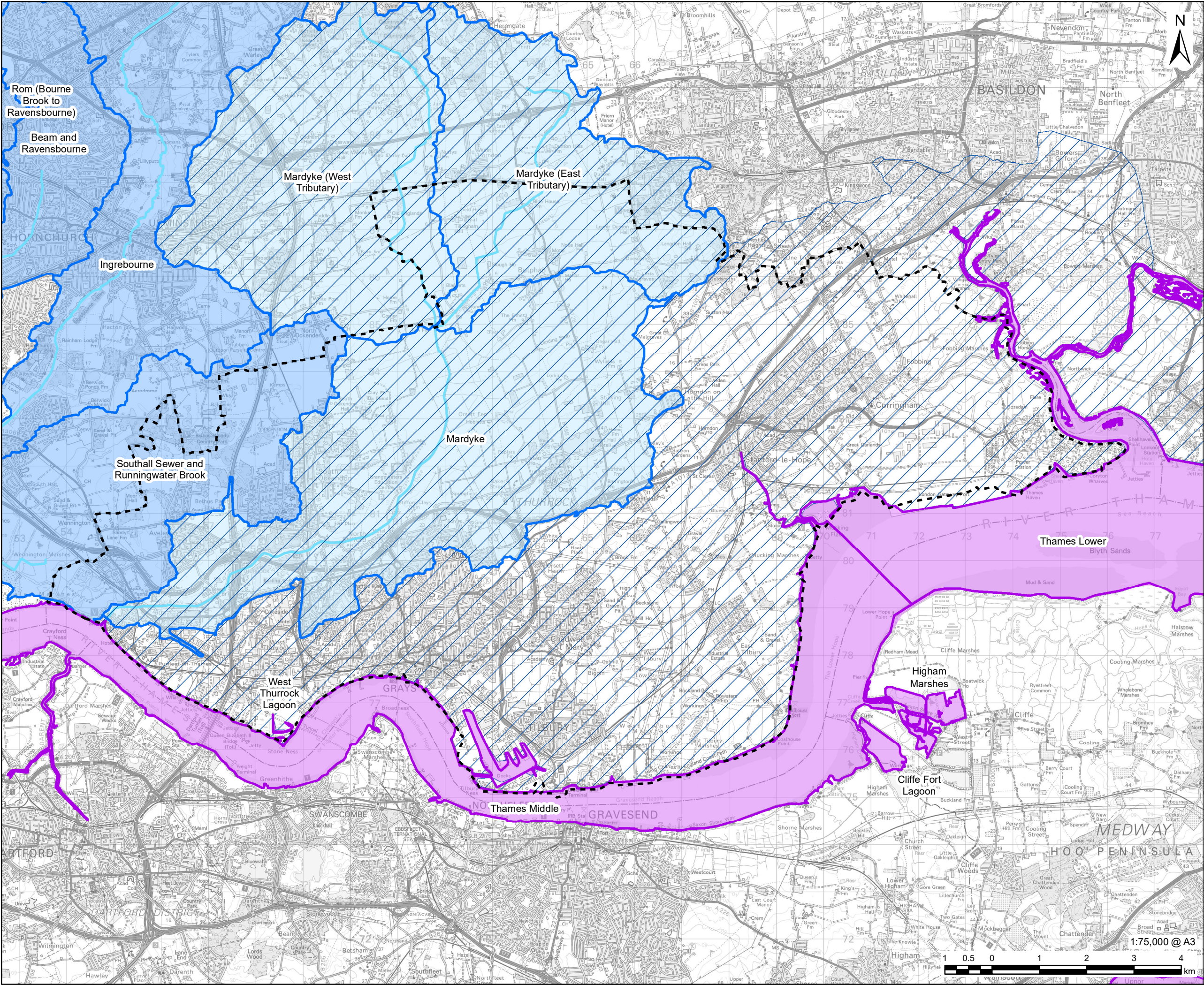
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FIGURE TITLE

STUDY AREA AND GROWTH

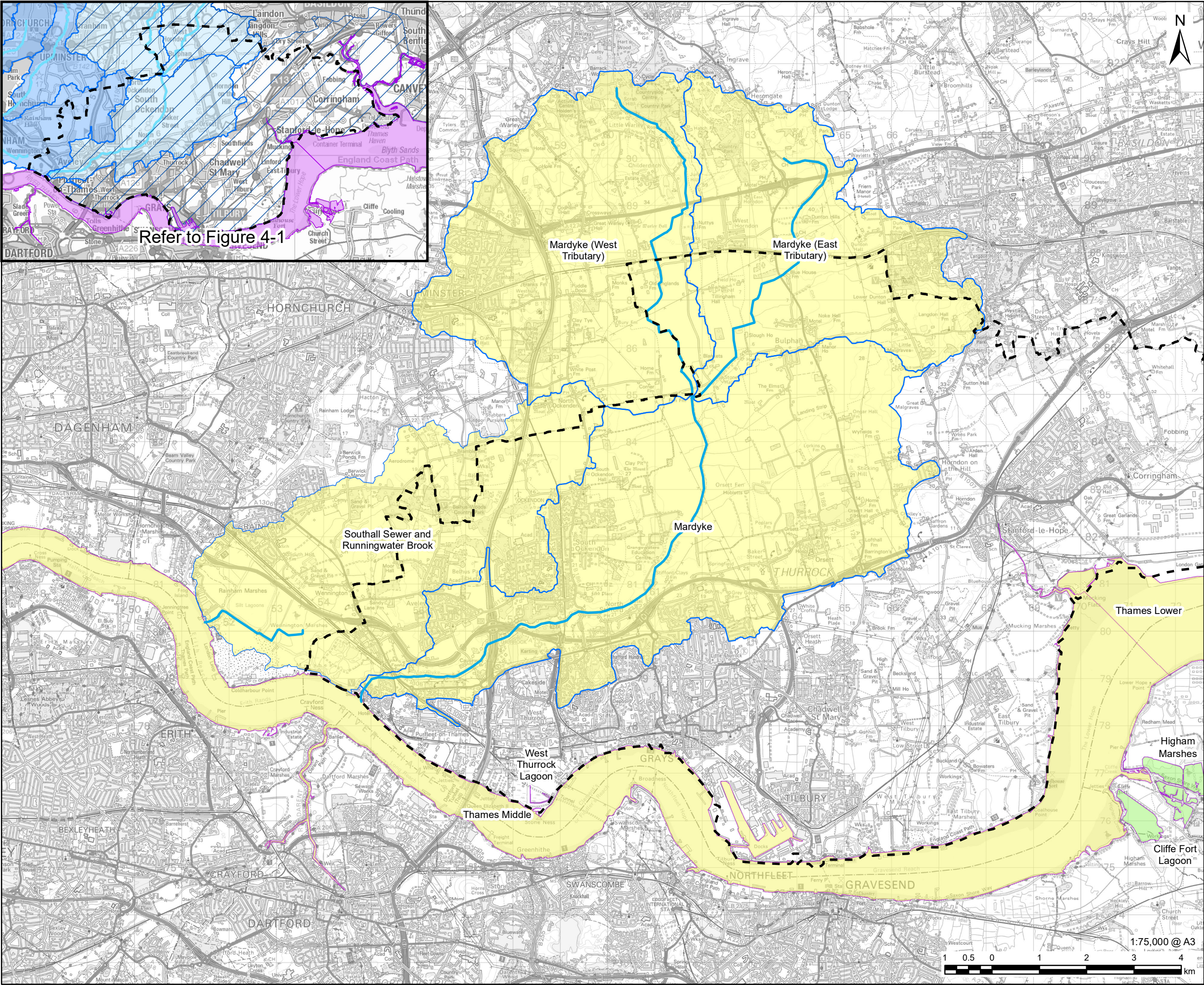
FIGURE NUMBER

Figure 1



- Thurrock Borough Boundary
- Essex South Management Catchment
- Mardyke Operational Catchment
- Roding, Beam and Ingrebourne Management and Operational Catchment
- Thames TraC Management Catchment and Tidal Thames Operational Catchment
- Surface Water Body Catchment
- Transitional Water Body Catchment
- Surface Water Body

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LEGEND

- Thurrock Borough Boundary
- Surface Water Body Catchment
- Transitional Water Body Catchment
- Surface Water Body

Ecological Status

- High
- Good
- Moderate
- Poor
- Bad

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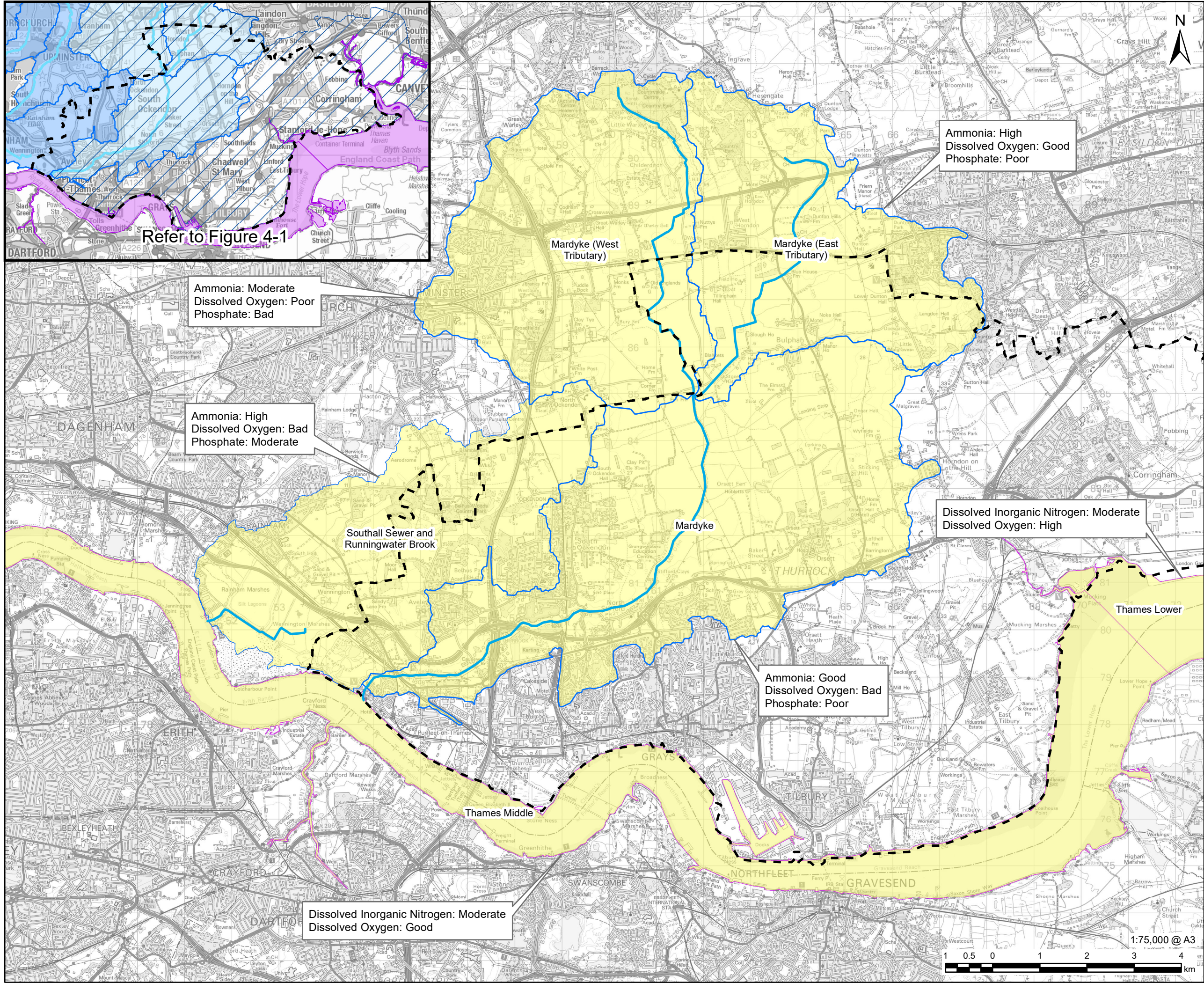
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FIGURE TITLE

WFD SURFACE WATERBODIES -
ECOLOGICAL STATUS

FIGURE NUMBER

Figure 3



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LEGEND

- Thurrock Borough Boundary
- Surface Water Body Catchment
- Transitional Water Body Catchment
- Surface Water Body

Physico-Chemical Status

- High
- Good
- Moderate
- Poor
- Bad

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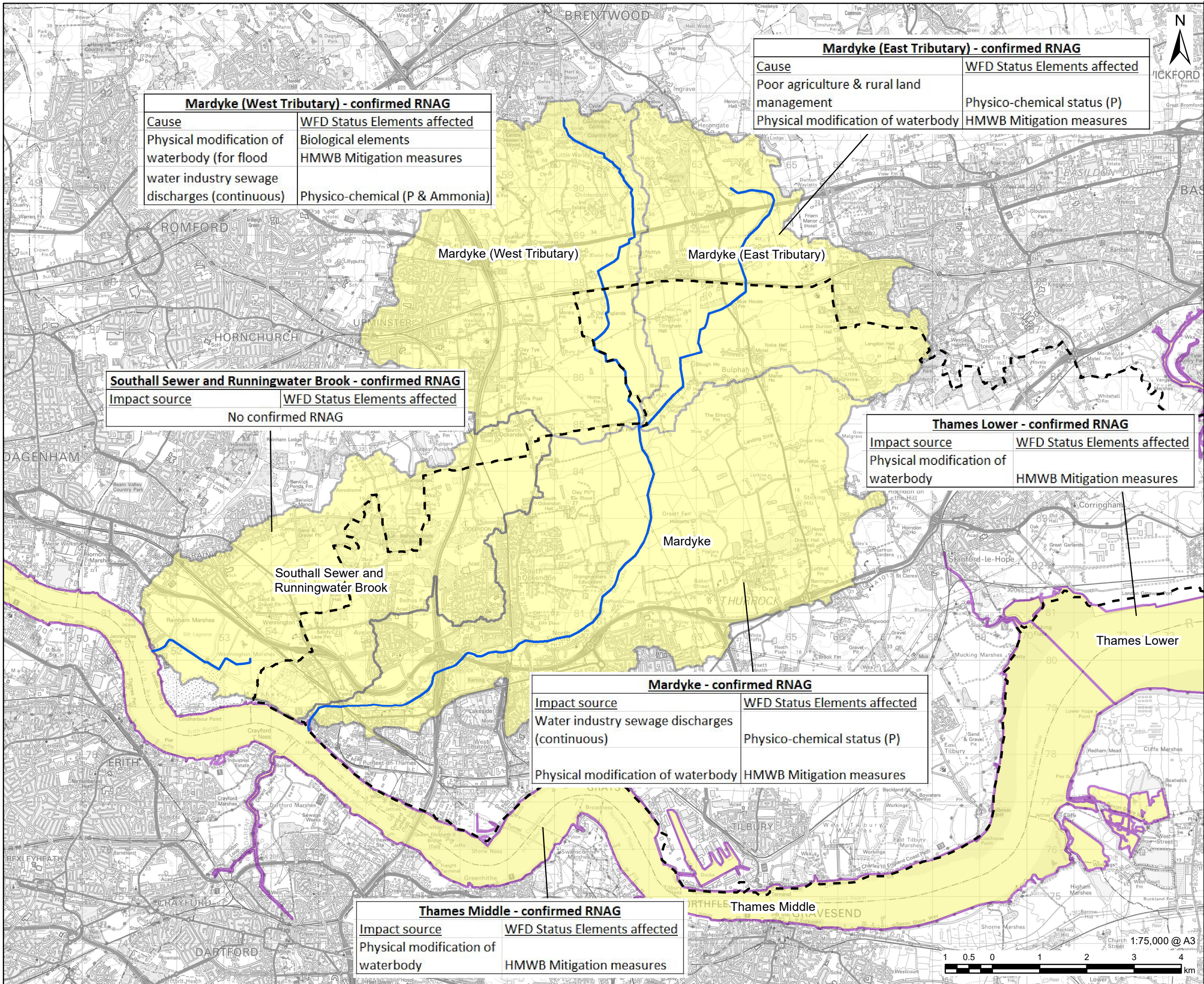
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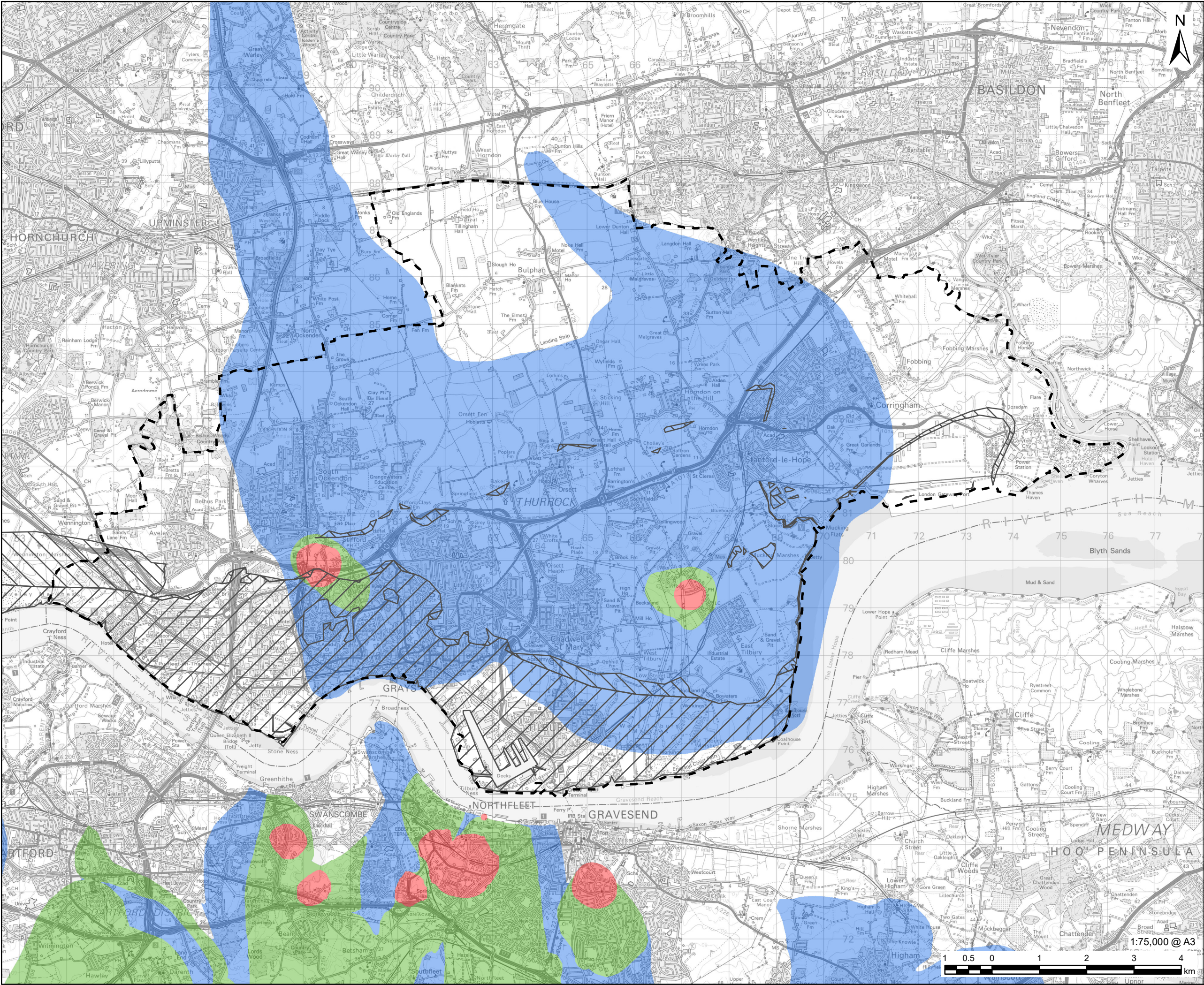
FIGURE TITLE

WFD SURFACE WATERBODIES - PHYSICO-CHEMICAL STATUS

FIGURE NUMBER

Figure 4





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LEGEND

- Thurrock Borough Boundary
- South Essex Lower London Tertiaries WFD Groundwater Body
- South Essex Thurrock Chalk WFD Groundwater Body
- Source Protection Zone**
 - Zone I - Inner Protection Zone
 - Zone II - Outer Protection Zone
 - Zone III - Total Catchment
 - Zone of Special Interest

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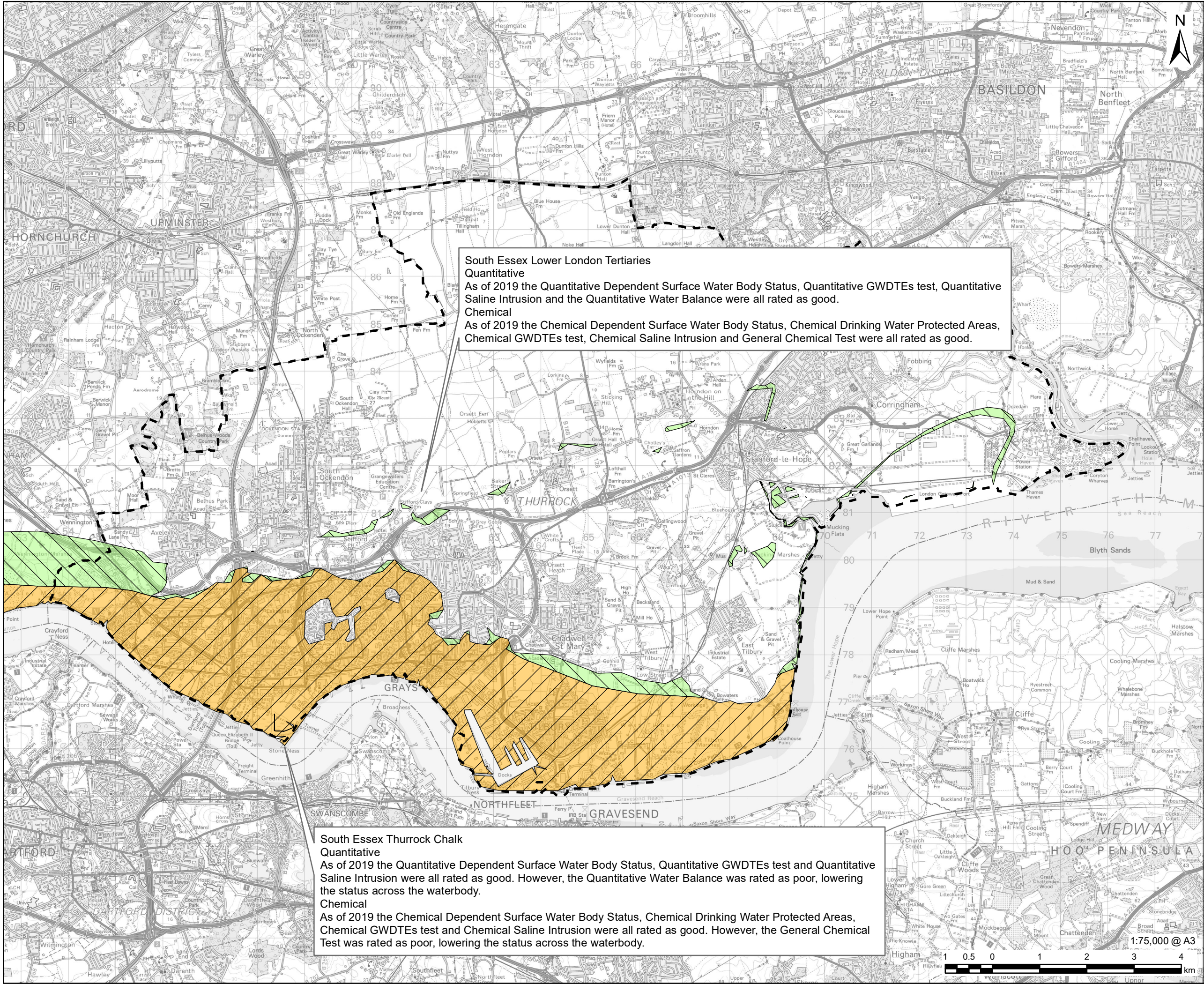
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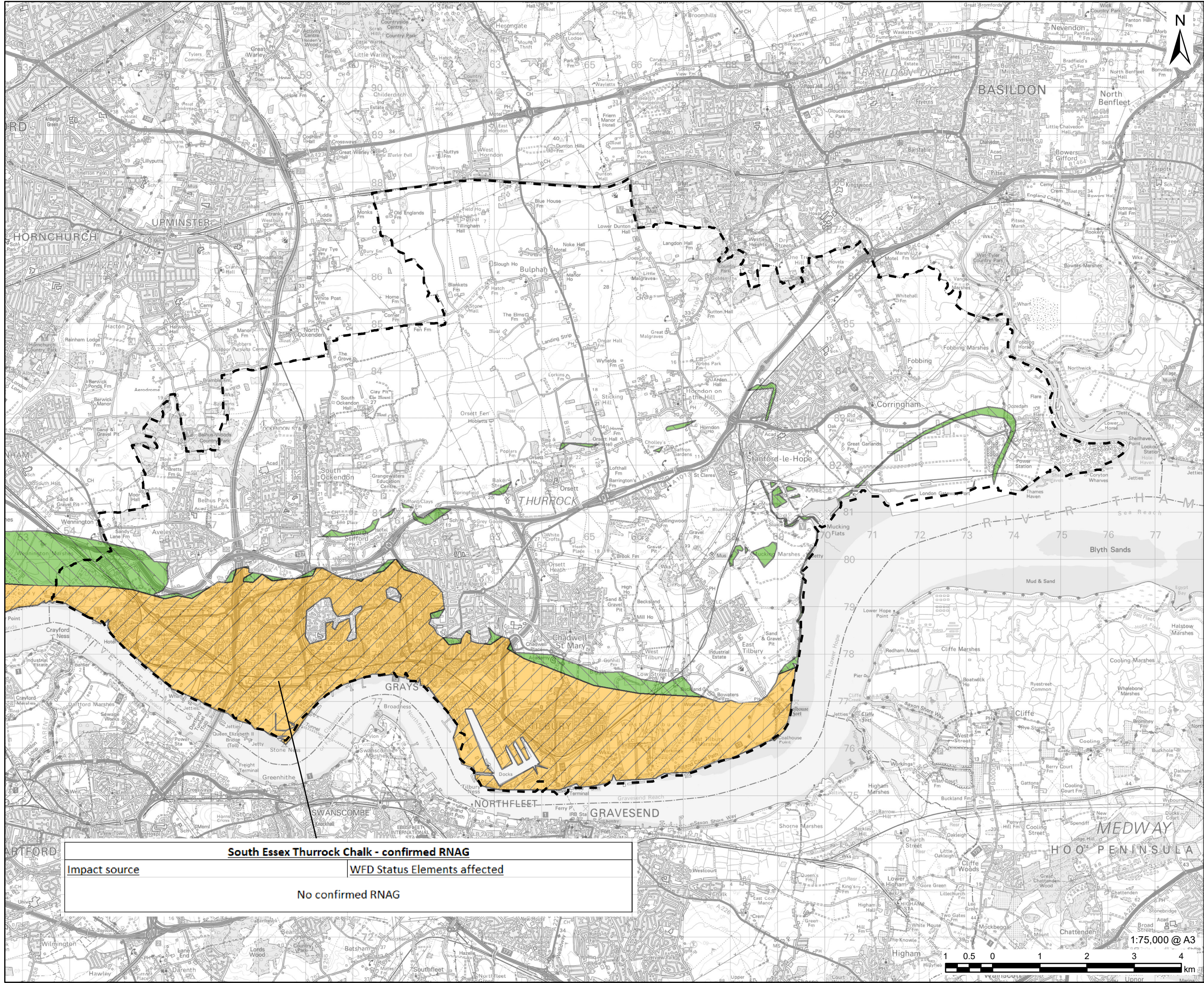
FIGURE TITLE

WFD GROUNDWATER BODIES AND
SOURCE PROTECTION ZONES

FIGURE NUMBER

Figure 7





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LEGEND

- Thurrock Borough Boundary
- WFD South Essex London Lower Tertiaries
Good Overall Status
- WFD South Essex Thurrock Chalk
Poor Overall Status

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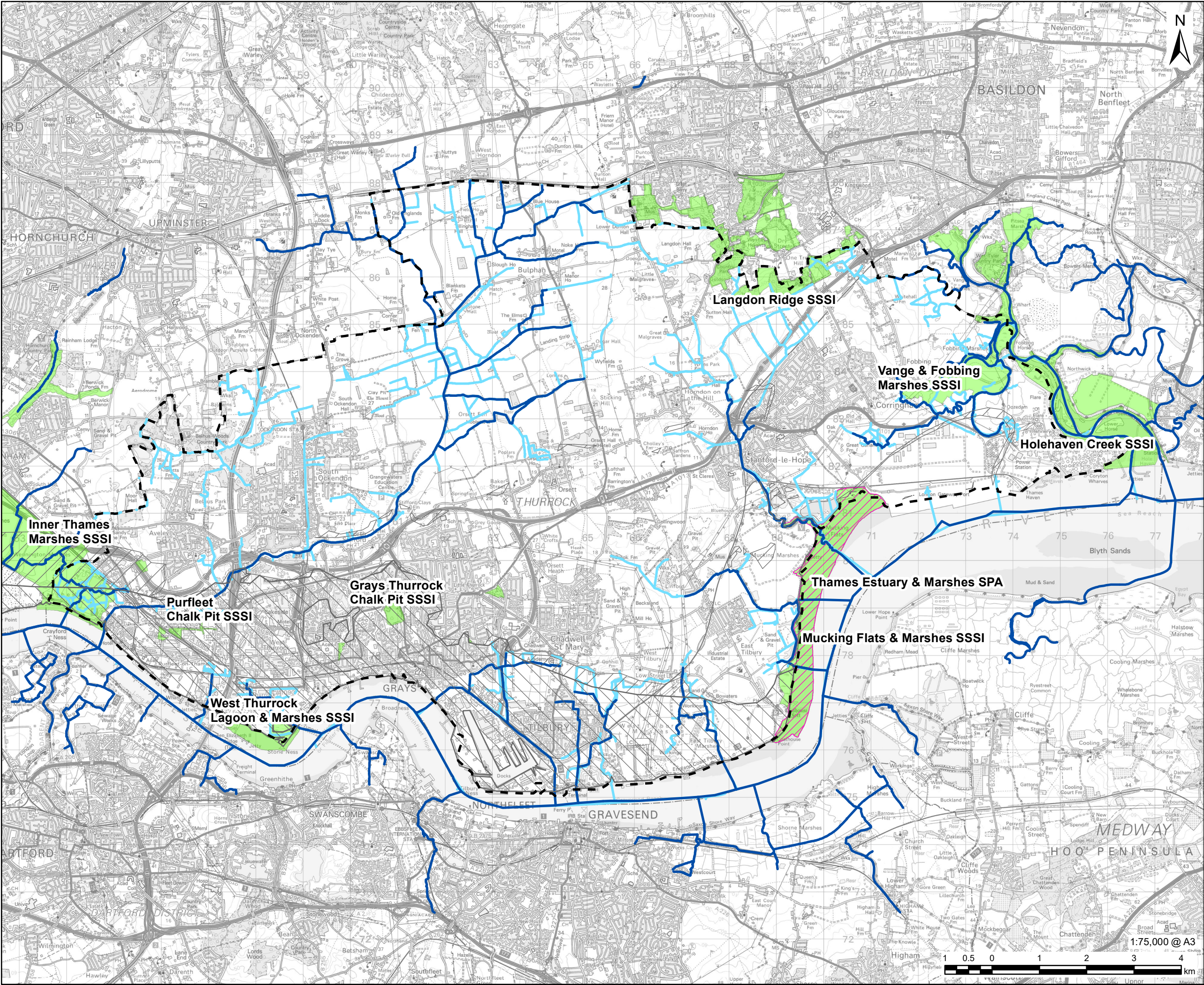
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FIGURE TITLE

WFD GROUNDWATER BODIES
RNAG

FIGURE NUMBER

Figure 9



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LEGEND
Thurrock Borough Boundary
South Essex Lower London Tertiaries
WFD Groundwater Body
South Essex Thurrock Chalk WFD
Groundwater Body
Main River
Ordinary Watercourse
Special Protection Area
Site of Special Scientific Interest

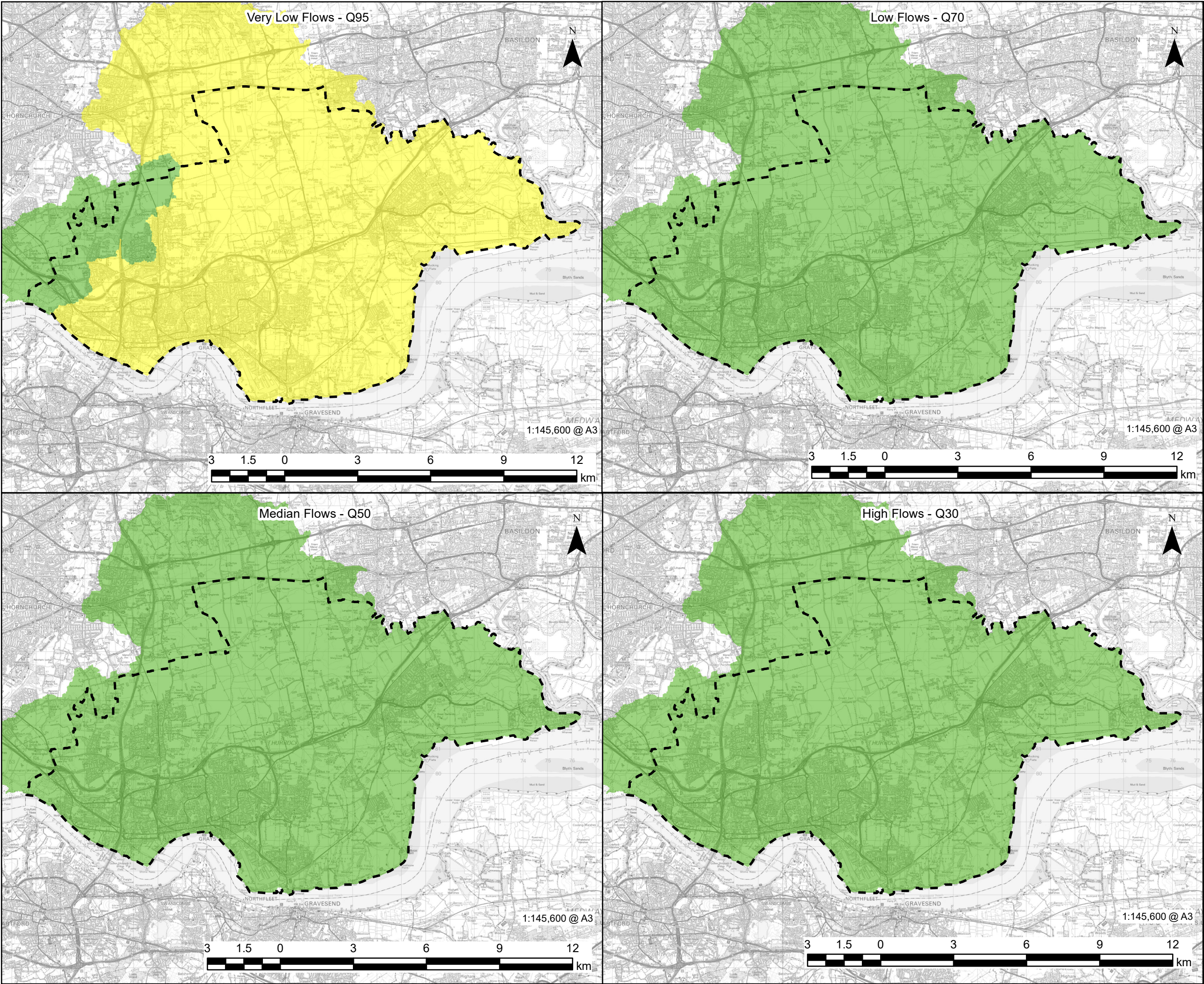
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FIGURE TITLE
WATER DEPENDENT HABITATS

FIGURE NUMBER
Figure 10



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LEGEND

- Thurrock Borough Boundary
- Water Available for Licensing
- Restricted Water Available for Licensing
- Water Not Available for Licensing

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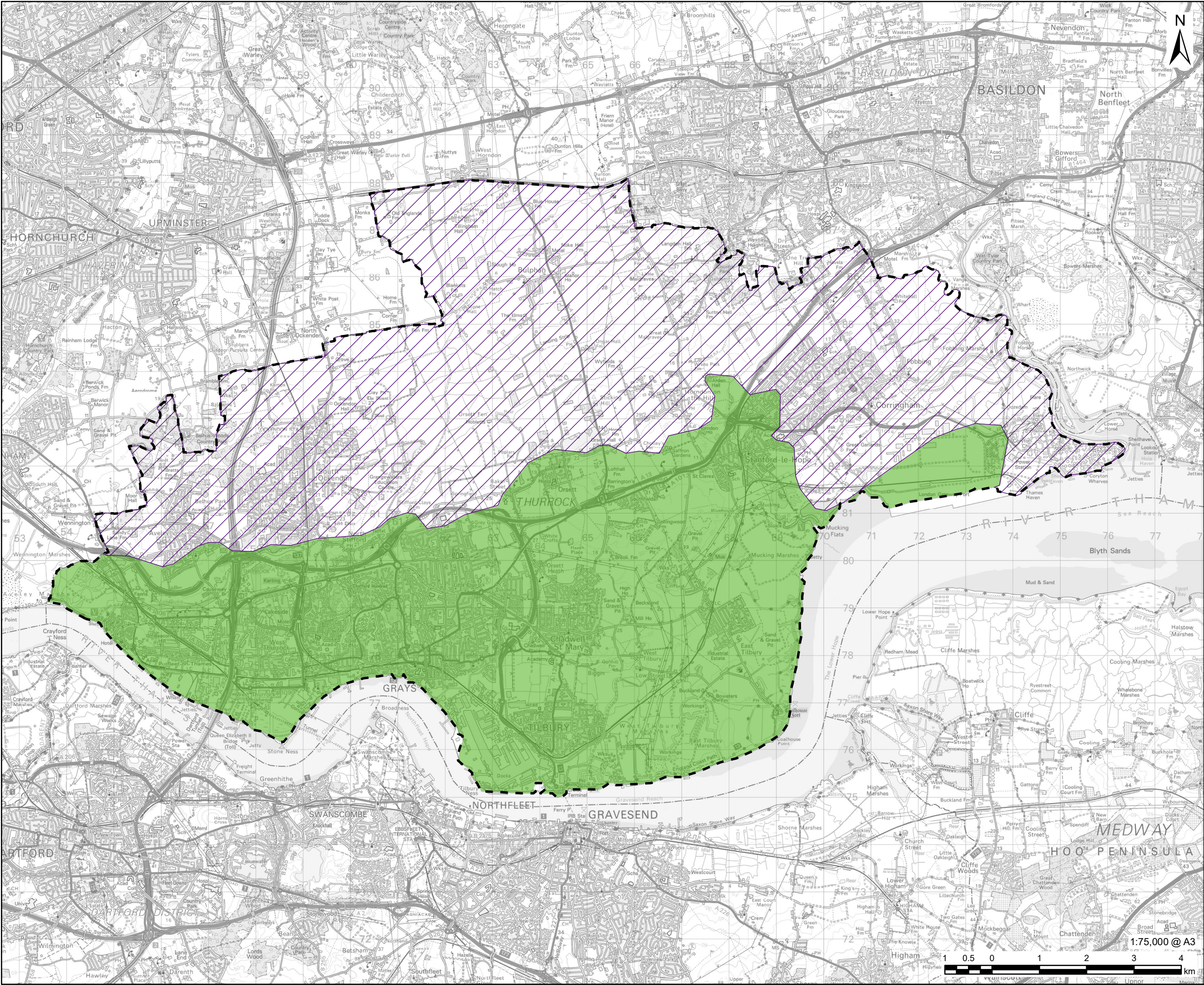
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FIGURE TITLE

CAMS SURFACE WATER AVAILABILITY

FIGURE NUMBER

Figure 11



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LEGEND

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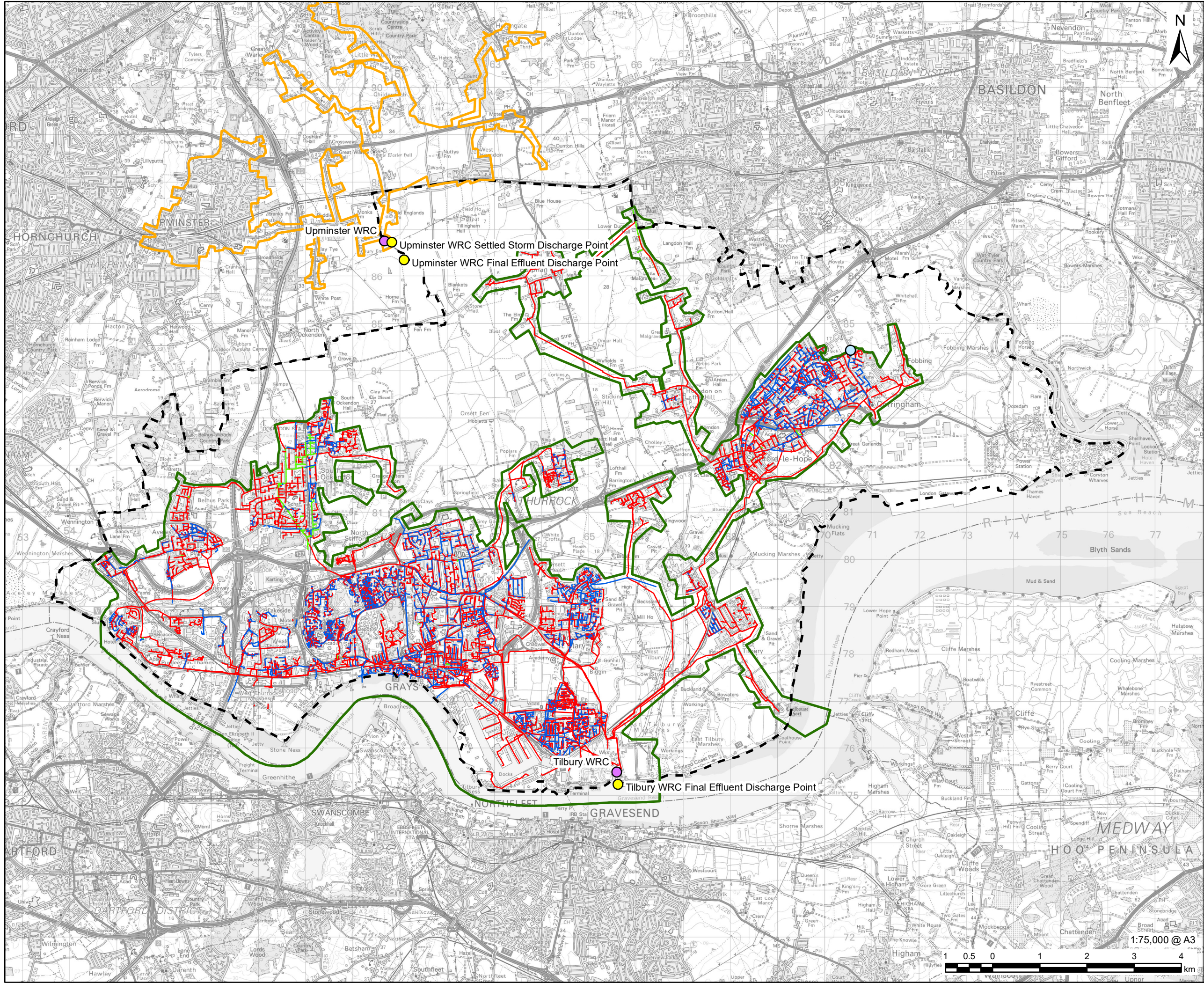
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FIGURE TITLE

CAMS GROUNDWATER
AVAILABILITY

FIGURE NUMBER

Figure 12



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LEGEND
Thurrock Borough Boundary
Tilbury WRC Catchment
Upminster WRC Catchment
WRC
WRC Discharge Point
Catchment Overflow
Sewer by Purpose
Combined
Foul
Surface Water

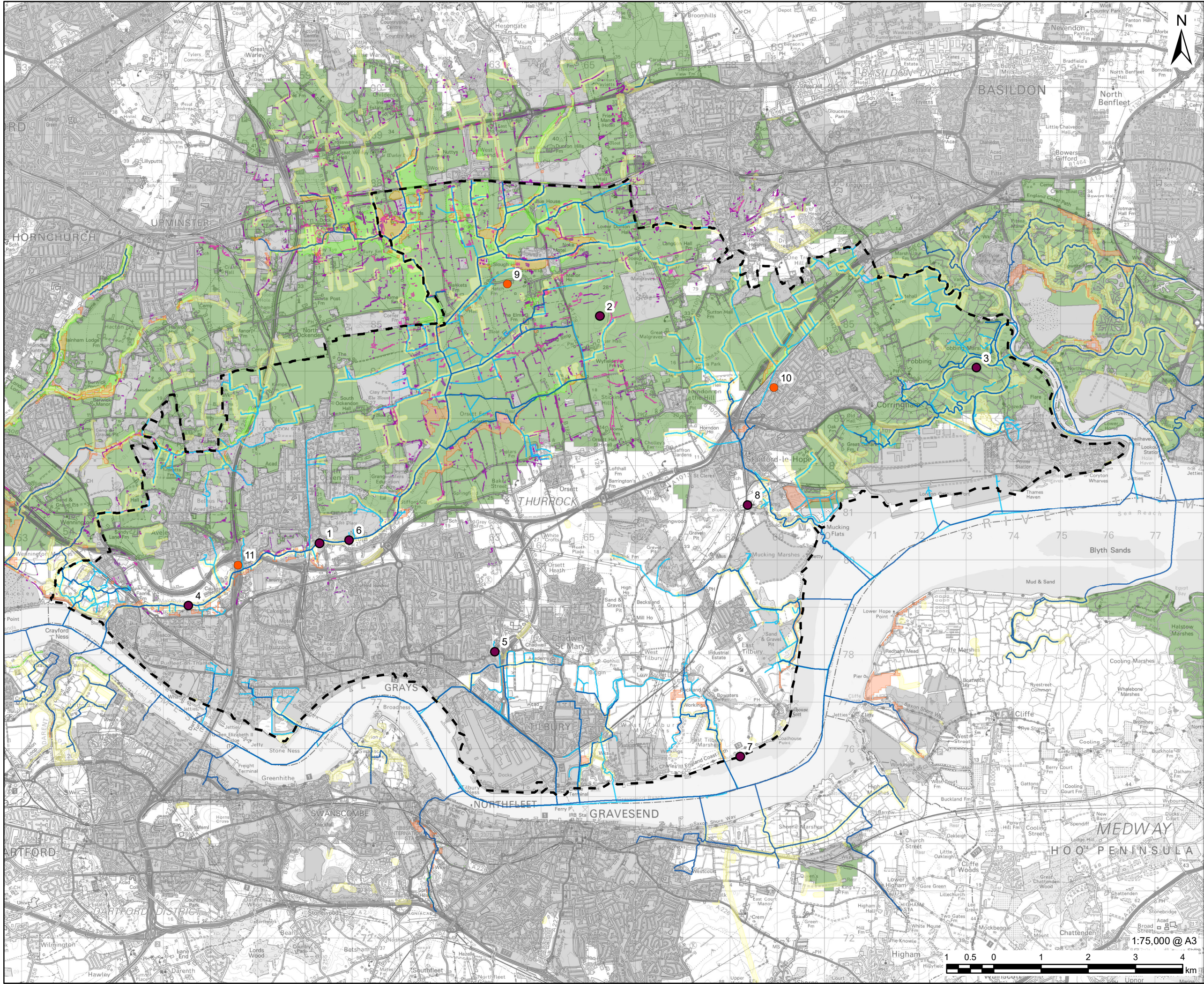
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PROJECT NUMBER
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FIGURE TITLE
WASTEWATER ASSETS

FIGURE NUMBER
Figure 13



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LEGEND

Thurrock Borough Boundary

South Essex Catchment
Partnership Opportunities

Thurrock Blue Green
Infrastructure Opportunities

Ordinary Watercourse

Main River

Working With Natural Processes

Runoff Attenuation Features - 1% AEP

Runoff Attenuation Features - 33% AEP

Floodplain Reconnection Potential

Riparian Woodland Potential

Floodplain Woodland Potential

Wider Catchment Woodland Potential

Woodland Constraints

NOTES

1. See Scoping WCS report for details on the
Catchment Group Opportunities labelled on
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FIGURE TITLE

NATURE BASED SOLUTIONS
OPPORTUNITIES

FIGURE NUMBER

Figure 14

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