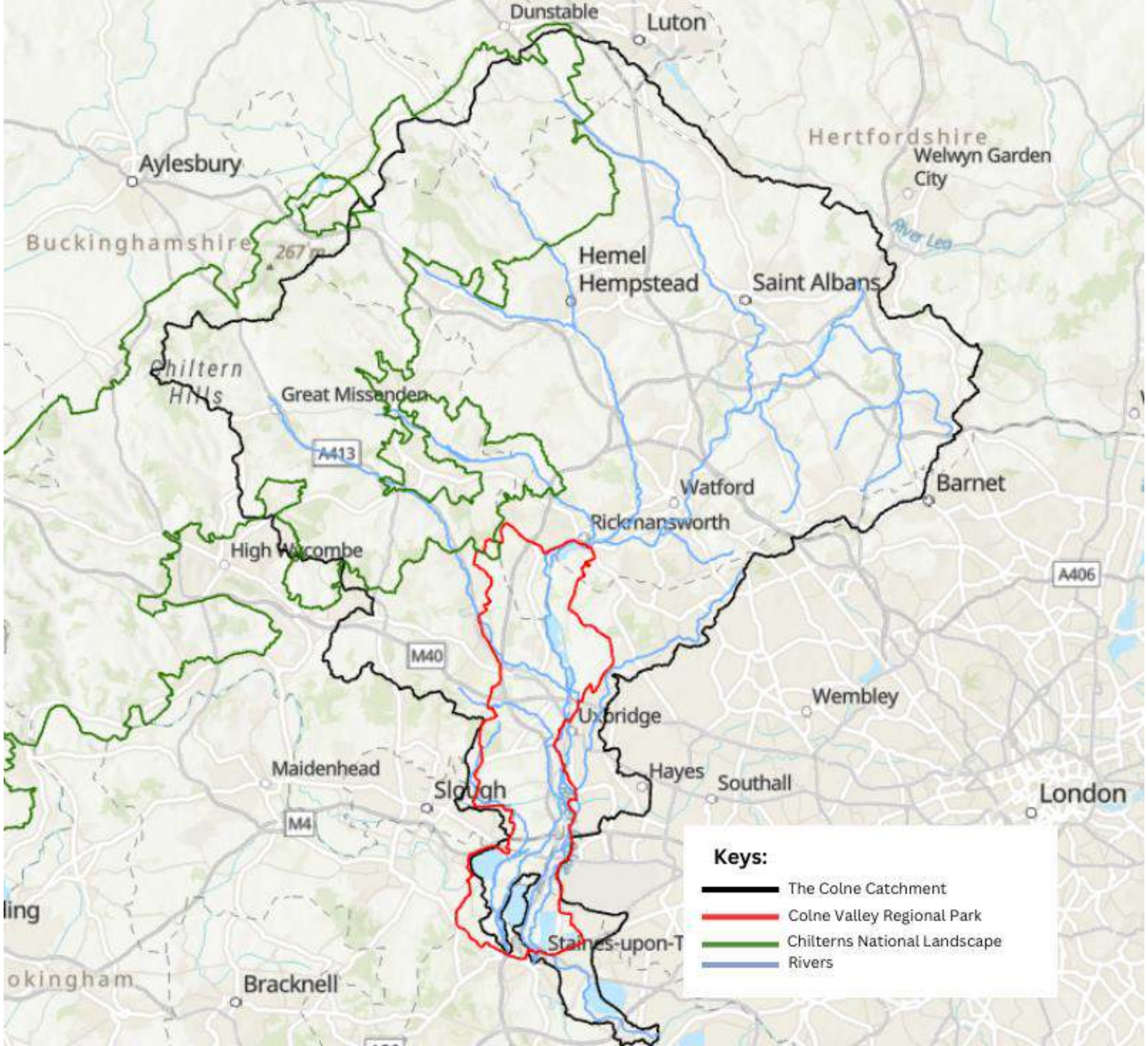
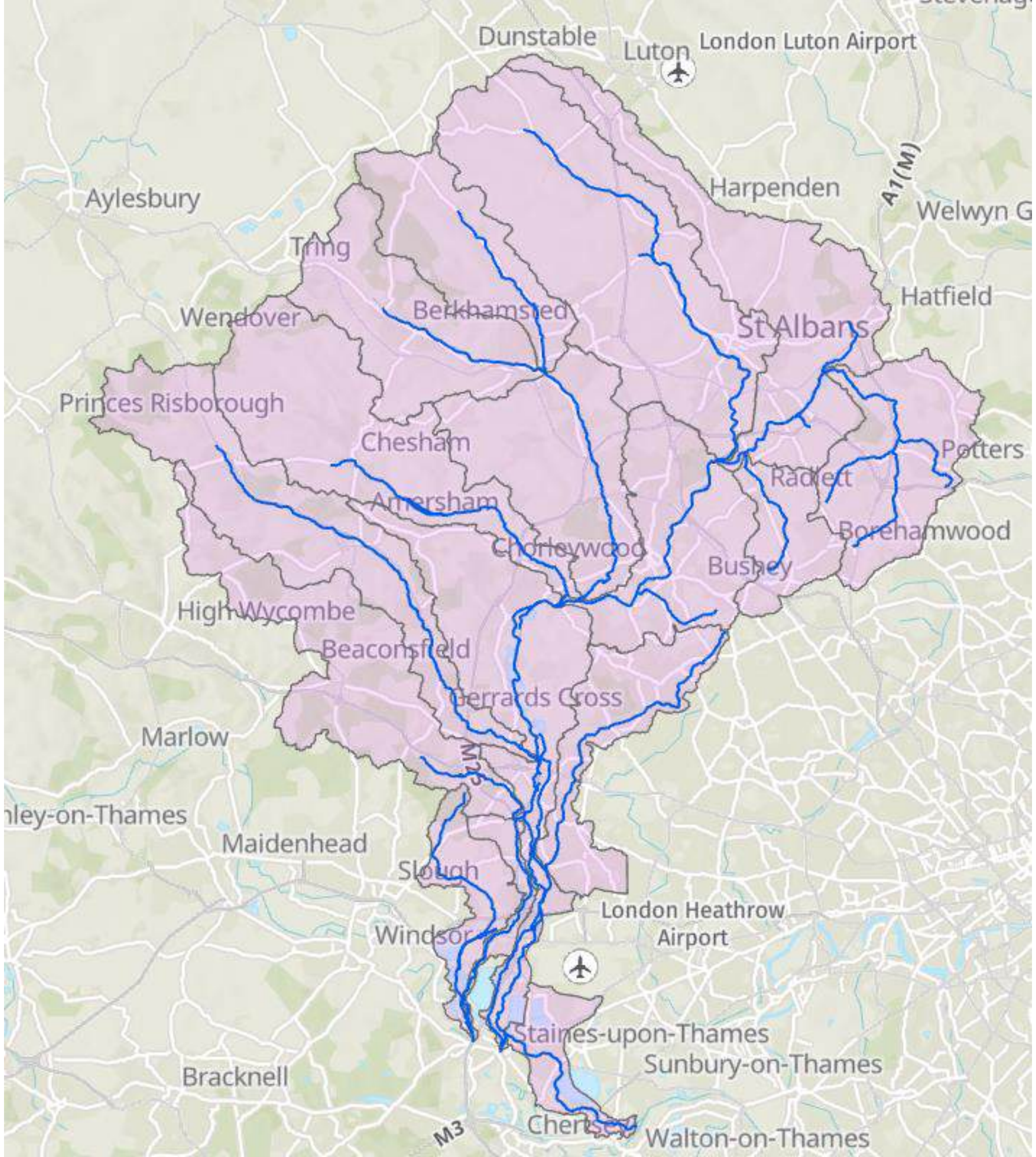
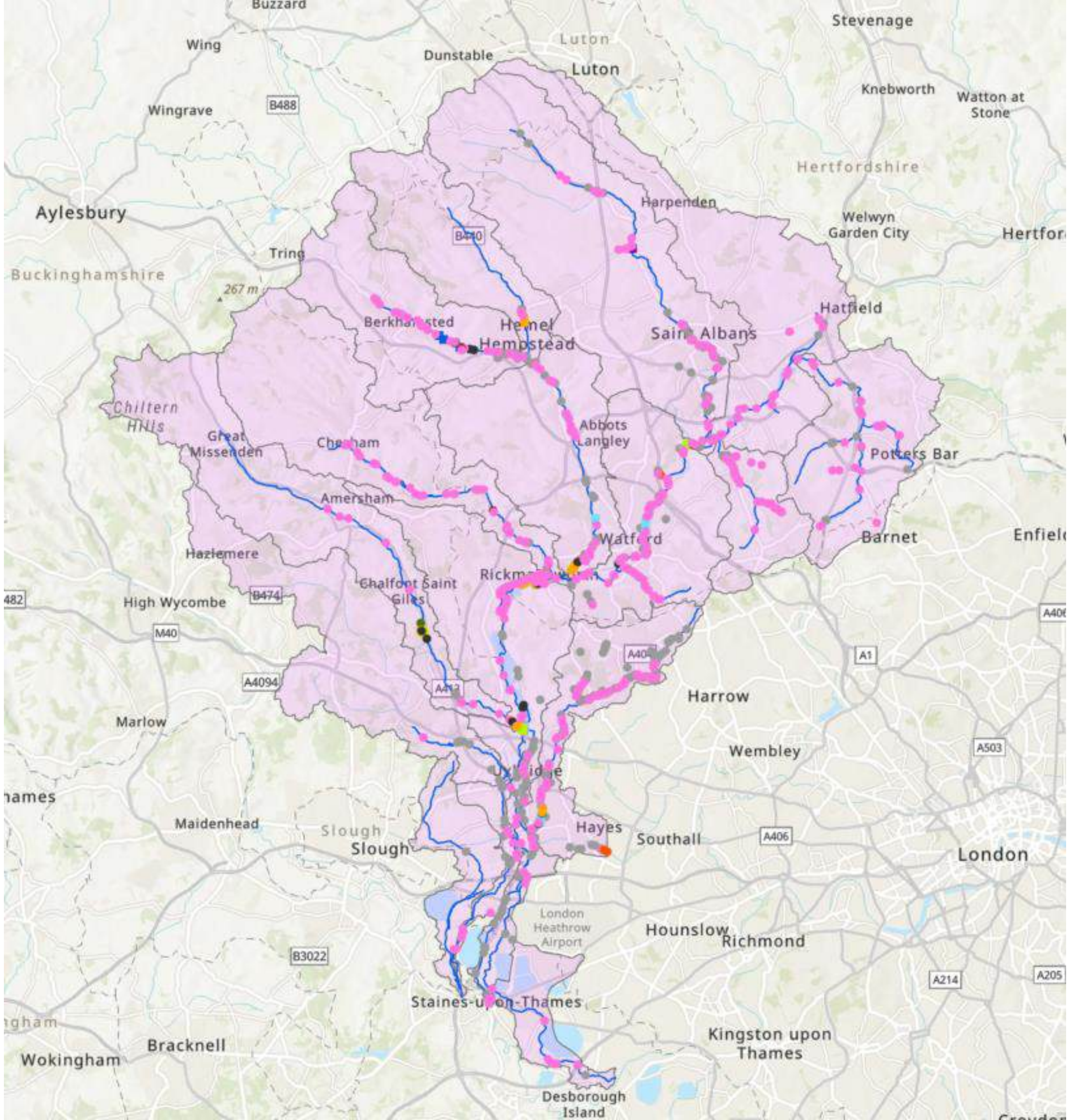


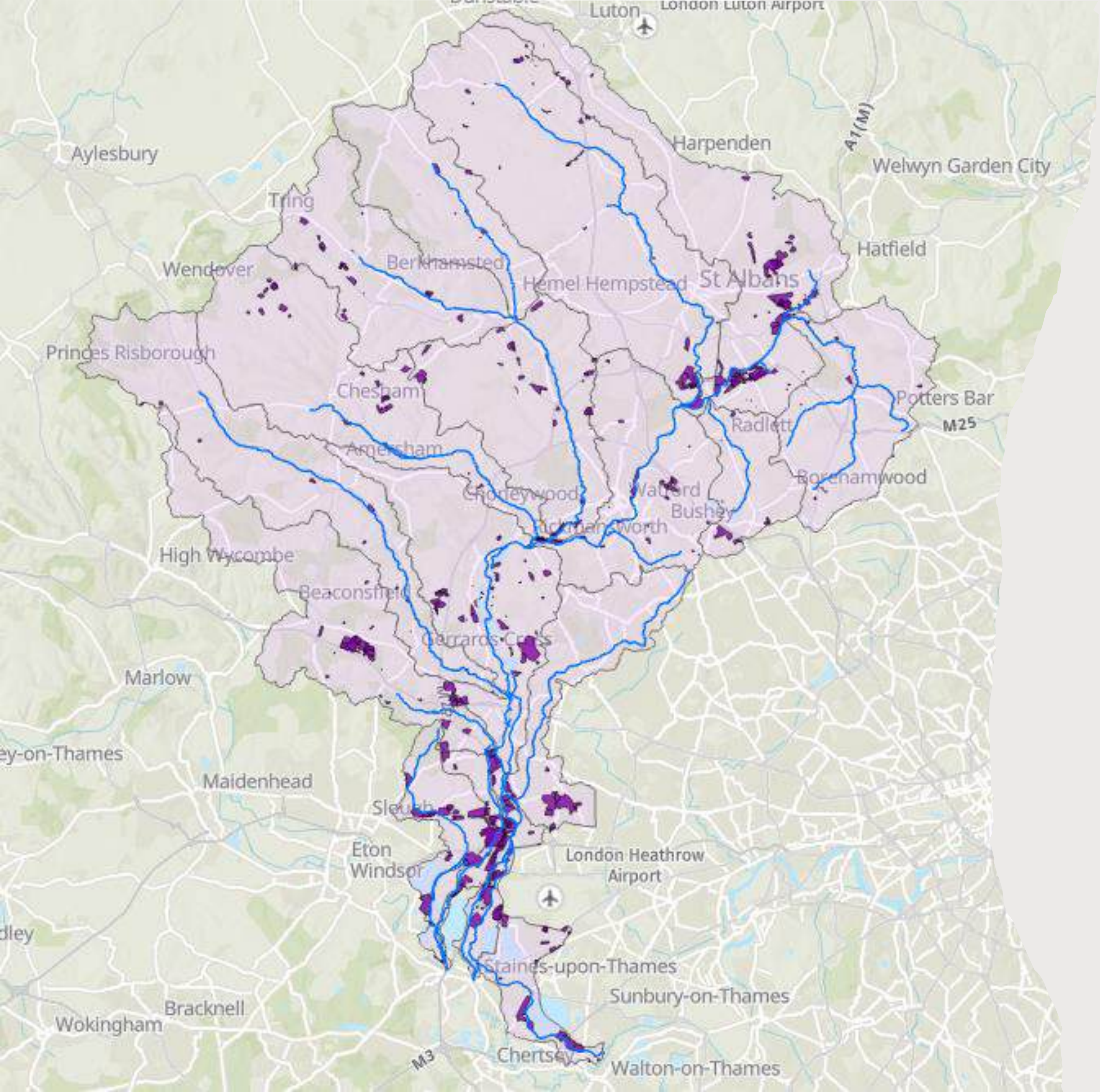
Dunstable
Luton
Hertfordshire
Welwyn Garden City
Aylesbury
River Lea
Buckinghamshire
267 m
Hemel Hempstead
Saint Albans
Chiltern Hills
Great Missenden
A413
Watford
Barnet
Rickmansworth
High Wycombe
A406
M40
Wembley
Uxbridge
Maidenhead
Hayes
Southall
Slough
London
M4
Staines-upon-T
Bracknell
okingham
Keys:
The Colne Catchment
Colne Valley Regional Park
Chilterns National Landscape
Rivers

Rivers in the Colne catchment

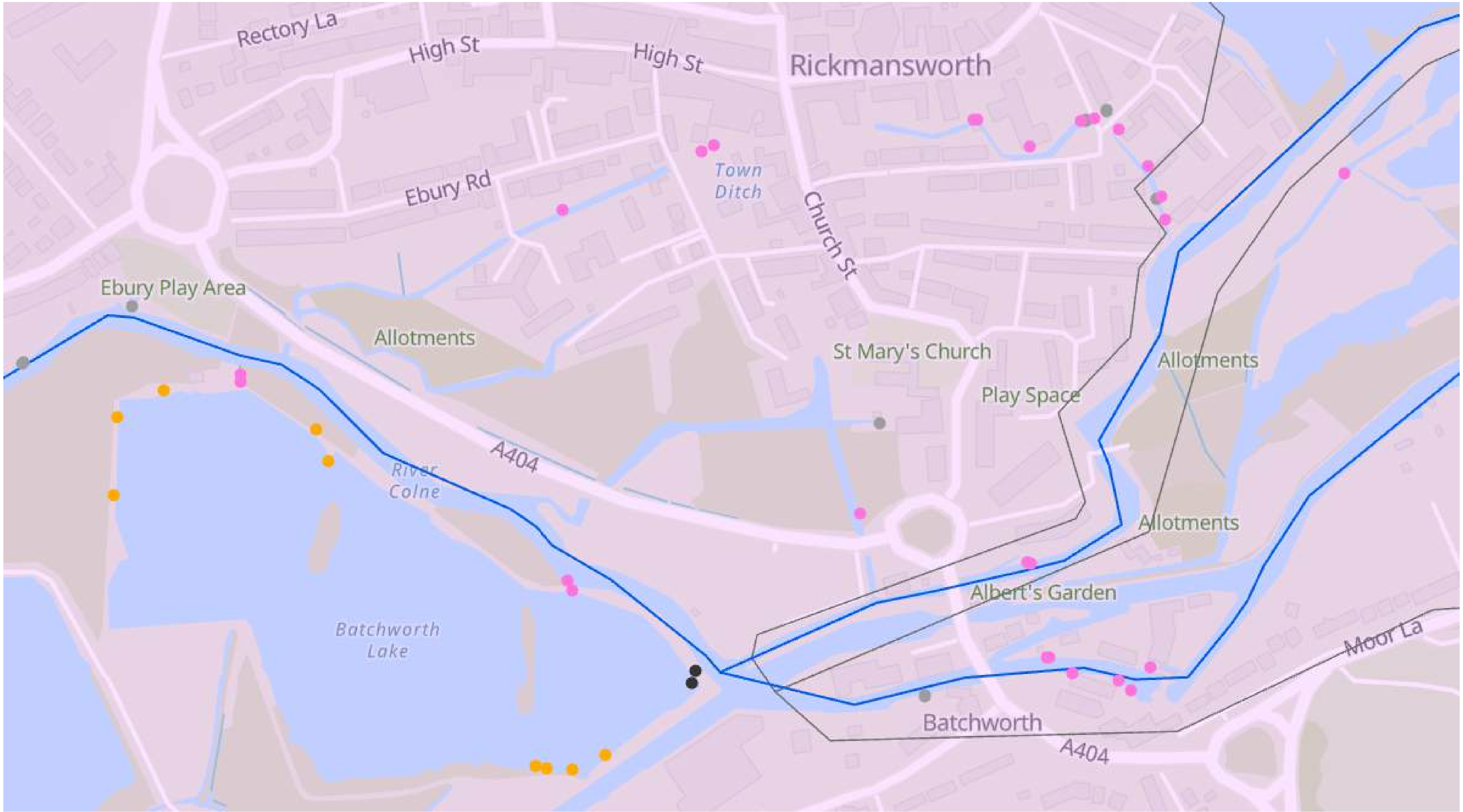


Potential pollution entry points identified from data and surveys



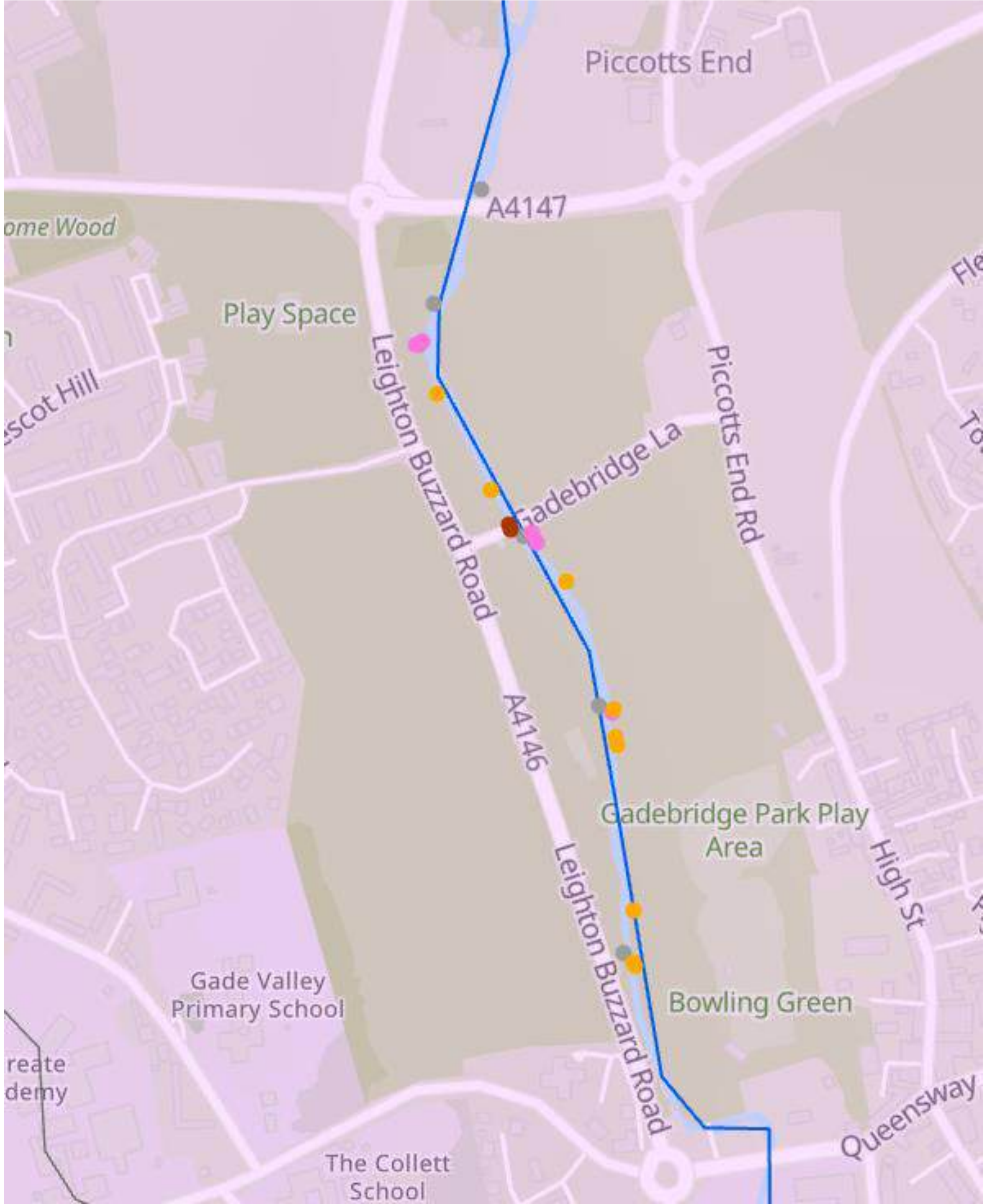


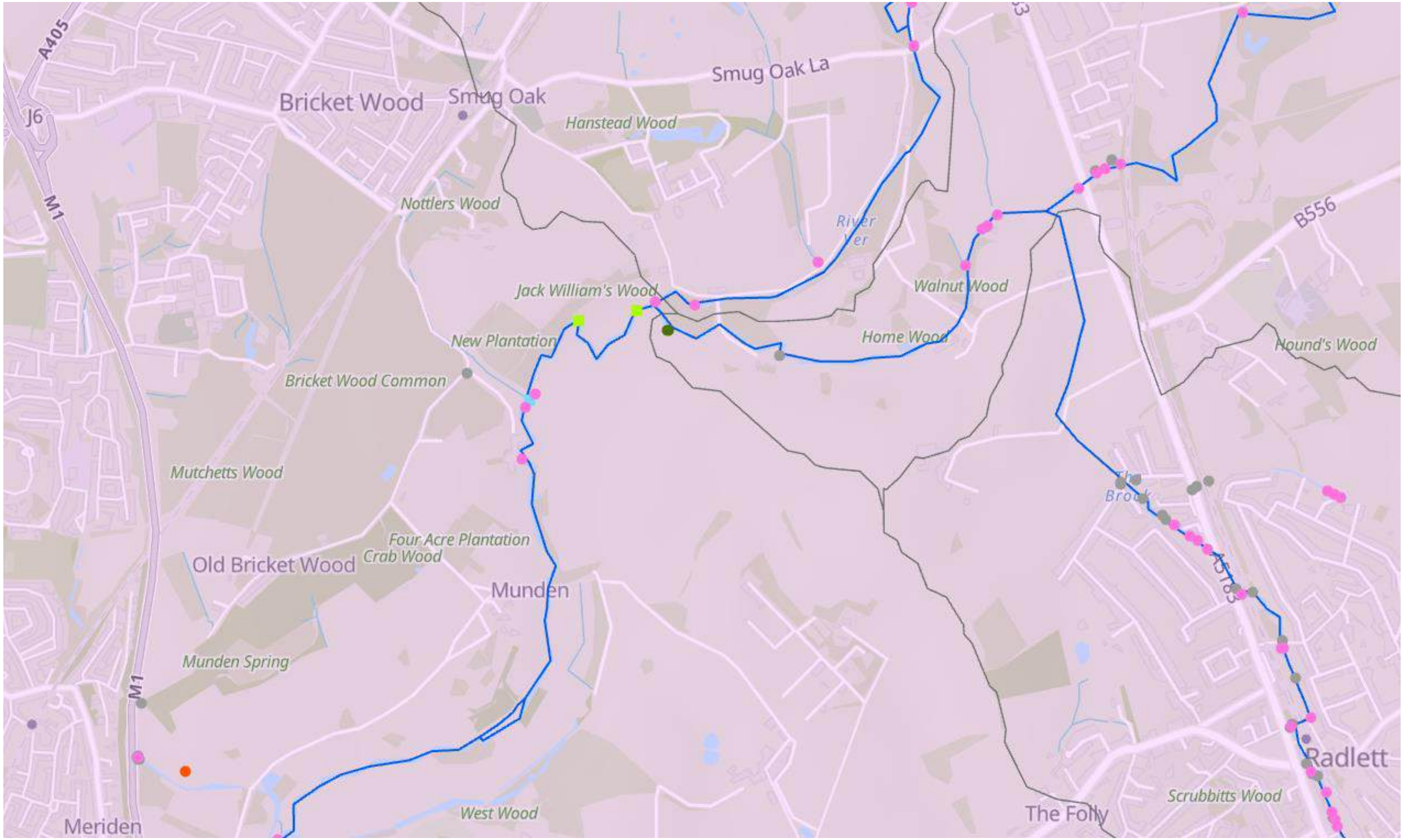
Colne catchment historic landfill



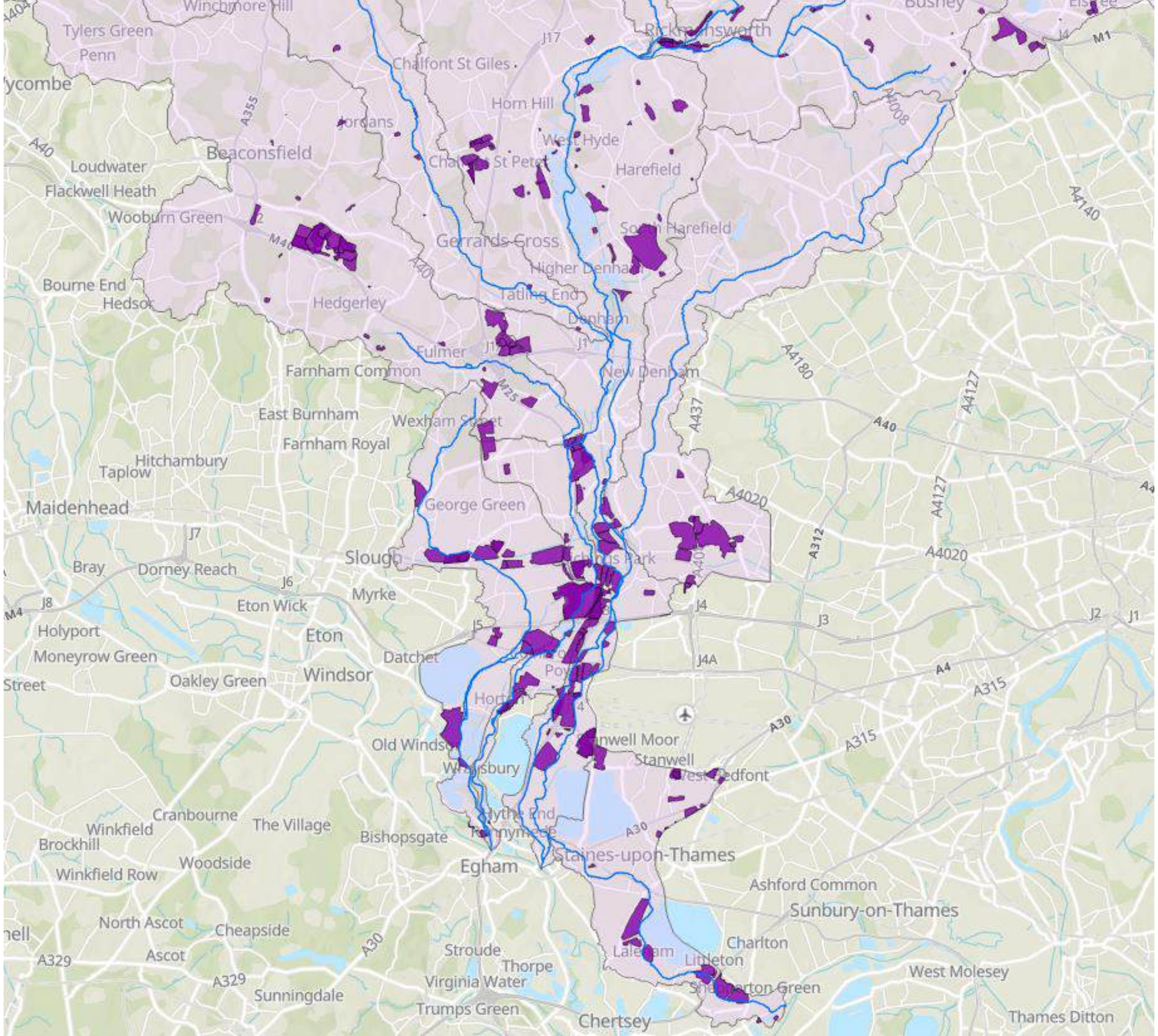
Potential pollution entry points – Rickmansworth

Potential pollution entry points – Gadebridge Park, Hemel Hempstead





Potential pollution entry points – Munden and Radlett


Winchmore Hill
Tylers Green
Penn
Rickmansworth
Bushey
Chalfont St Giles
Horn Hill
Jordans
Beaconsfield
West Hyde
Harefield
Loudwater
Flackwell Heath
Wooburn Green
Gerrards Cross
South Harefield
Higher Denham
Tatling End
Denham
Bourne End
Hedgerley
Fulmer
Farnham Common
New Denham
East Burnham
Farnham Royal
Hitchambury
Taplow
Maidenhead
George Green
Slough
Bray
Dorney Reach
Eton Wick
Myrke
Holyport
Moneyrow Green
Eton
Datchet
Windsor
Oakley Green
Old Windsor
Wraysbury
Stanwell
Cranbourne
The Village
Winkfield
Brockhill
Bishopsgate
Egham
Winkfield Row
Woodside
Staines-upon-Thames
Ashford Common
Sunbury-on-Thames
North Ascot
Cheapside
Charlton
Stroude
Thorpe
Littleton
West Molesey
Ascot
Virginia Water
Sunningdale
Trumps Green
Chertsey
Thames Ditton
A355
A40
M40
M25
A437
A4180
A4127
A4020
A312
A4140
A4008
M1
M4
A4
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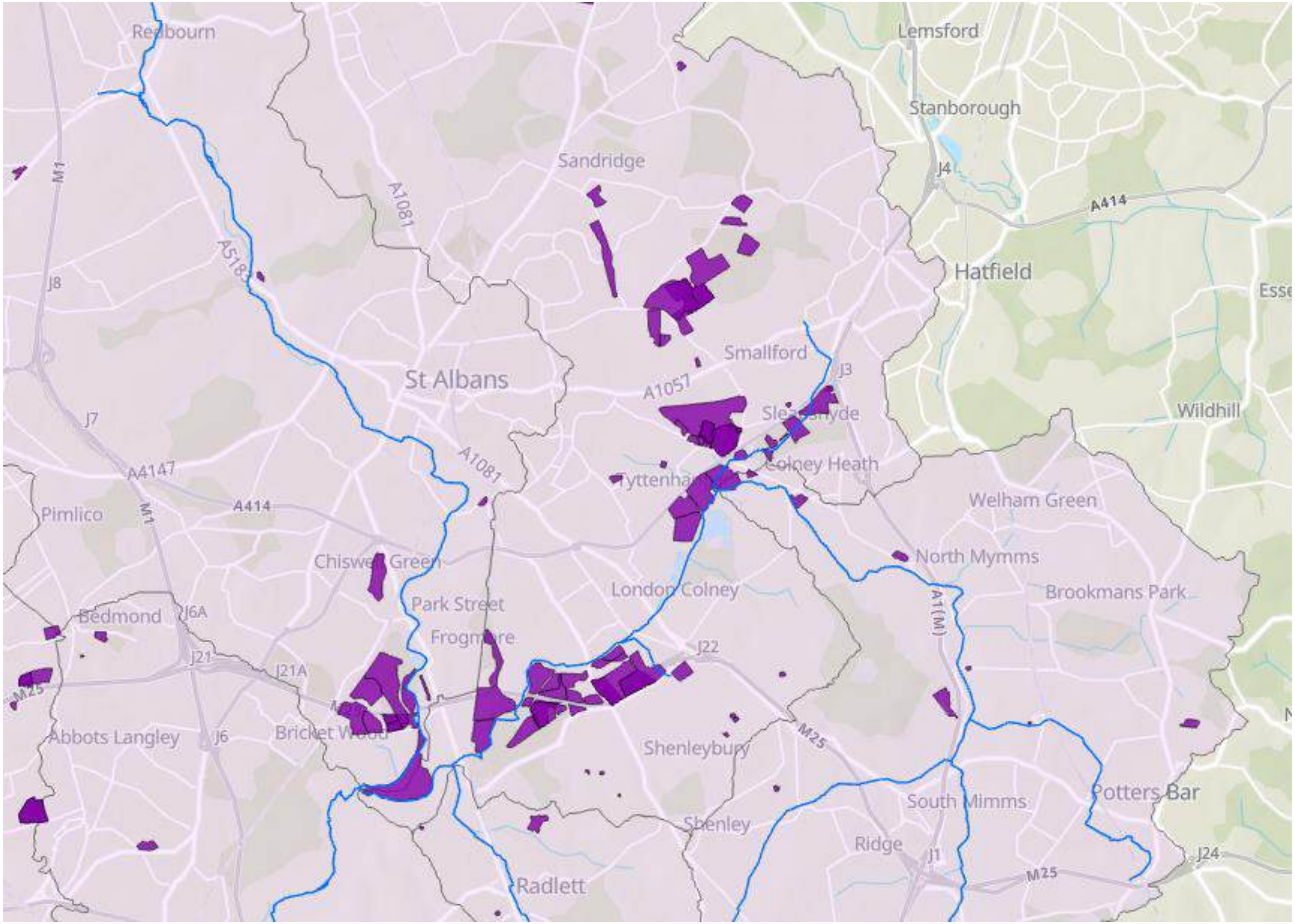
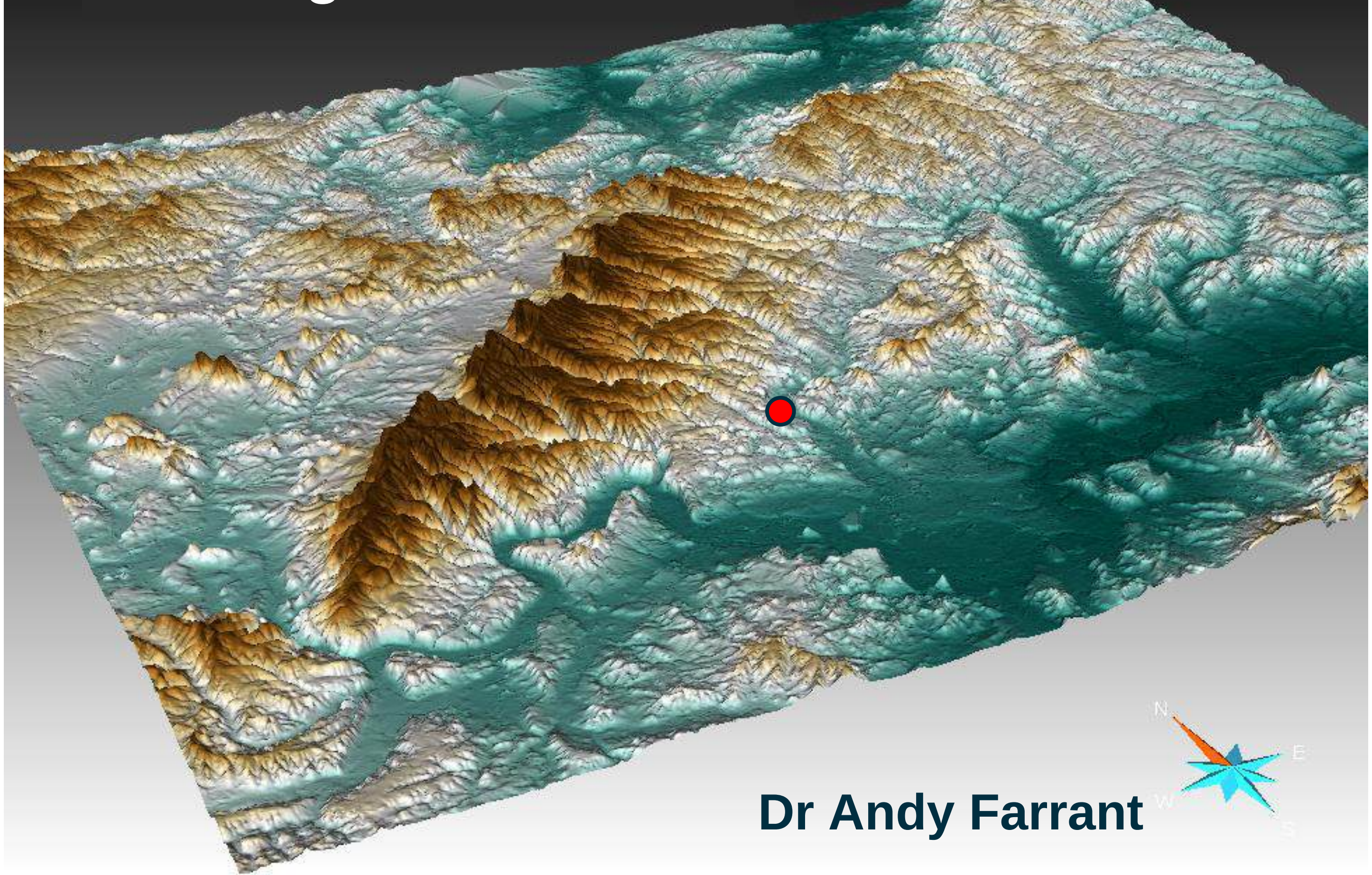
J8


Lemsford
Stanborough
Sandridge
J4
A414
A1081
Hatfield
A5183
J8
Smallford
St Albans
A1057
J3
J7
Colney Heath
A4147
A1081
Welham Green
Pimlico
M1
A414
North Mymms
Park Street
London Colney
Brookmans Park
Bedmond
J6A
J22
J21
J21A
M25
Abbots Langley
J6
Shenleybury
M25
South Mimms
Potters Bar
Shenley
Ridge
J1
J24
M25
Radlett
Wildhill
A1(M)
M1

ULTIMATE
BLACK
Mr Muscle
ZipWax
Patio Magic!
PATIOS • DRIVEWAYS • MASONRY
POWERFUL
OUST
DESCALER
ALL PURPOSE
Rustins
Quick Dry Matt Emulsion Paint
White
BS00E55
For indoor use
Dettol
750ml
NON-STOP FRESHNESS
Lenor
UNSTOPPABLES
Scent Booster
FRESH
FAIRY
MAX POWER
ORIGINAL
640ML
Liquid
Persil
bio
NIVEA SUN
protect & dry touch
SPF 50
MIST
200 ml
TOUGH ON GREASE
finish
44 QUANTUM
finish
SALT
WHITE MARKS FROM HARD WATER?
2Kg
ELVIVE
HYDRA
STAINS GONE AT 20°C
RESTORES WHITES
Vanish
Oxi Action
850g
ANTI GREYING
XL PACK
NON BIO CAPSULES
Persil
36
800ml
Flash
SPRAY WIPE + DONE
THICK BLEACH
CITRUS
KILLS 99.9%
VIAKAL
Nº1 LIMESCALE REMOVER
CONTRACEPTIVE PILLS
Taking Charge Of Your Fertility: The Definitive Guide To Natural Birth Control, Pregnancy Achievement, And Reproductive Health
Elizabeth K. Poole
Sainsbury's
Aspirin
300mg tablets
x16
STATIN
STATIN 40 mg
metaform
Amlodipine Tablets
5 mg
28 Tablets
alopurinol
300 mg
SANDOZ
Medicamento Genérico
Bob Martin
Clear
ONE DOSE TABLETS
3 in 1 WORMER TREATMENT
FOR SMALL DOGS & PUPPIES
UP TO 20kg
FRONTLINE
PLUS
KILLS FLEAS, TICKS & LICE
PREVENTS THE DEVELOPMENT OF FLEA EGGS
CATS AND FERRETS
puppy shampoo

Geological mapping and 3D modelling in the Chilterns

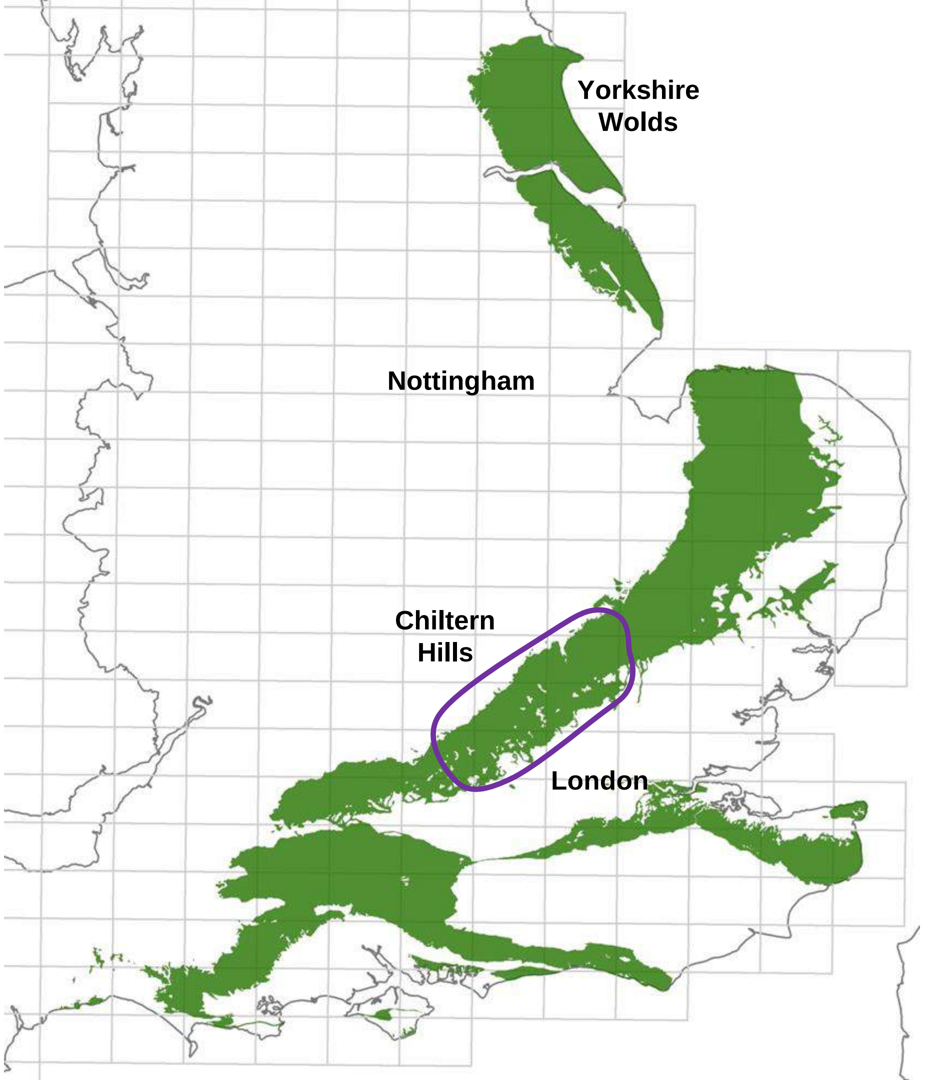
British Geological Survey



Dr Andy Farrant

Geological mapping & 3D modelling

- BGS is working with the Environment Agency and the water industry to produce a suite of new detailed geological maps and nine catchment-scale 3D models in the Chilterns, including the Colne and its tributaries
- The driver behind this work is the increasing pressure on the Chalk aquifer, both in terms of groundwater quality and availability.
- The EA and water companies require a better understanding of the Chalk aquifer, particularly its spatial and stratigraphical variability to manage the groundwater resource effectively.
- A detailed knowledge of the geology is key to better groundwater models and improved understanding of groundwater flow pathways to springs and rivers



3D models
Chess (Thames Water & EA)
Misbourne (EA)
Gade (EA)
Ver (EA)
Mimram (EA)
Beane (EA)
Upper Cam (Affinity)

Current projects
Rib-Ash-Stort (EA)
Henley area (EA)

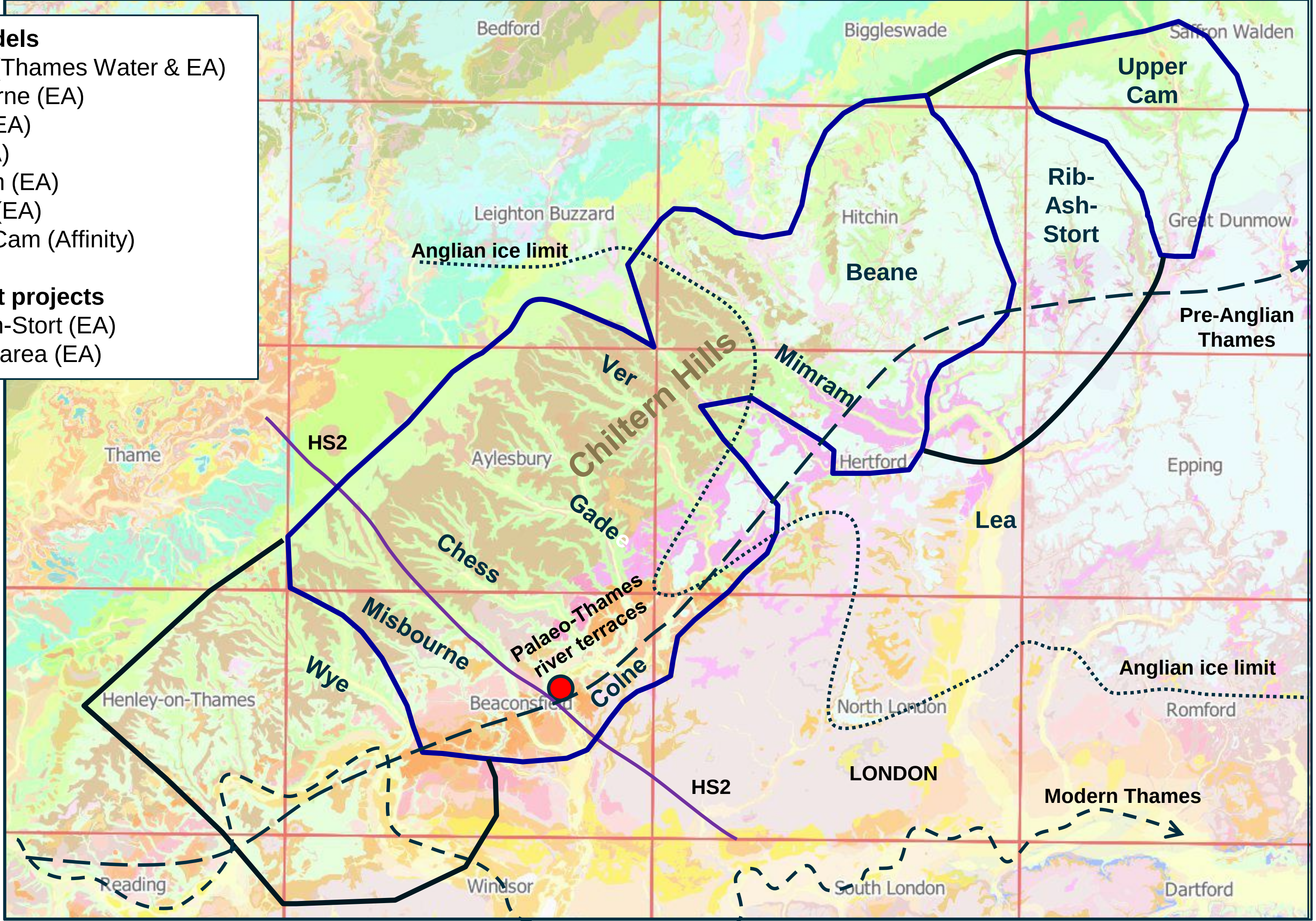


Photo and details courtesy of Rob Ward and Chris Train (Environment Agency)

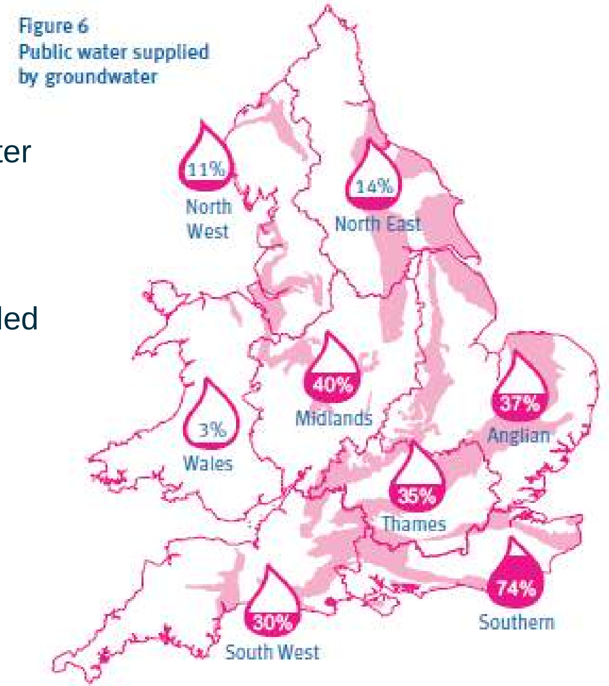
Why is geology important?

The chalk aquifer is an important groundwater resource

- Growing demand for water and increasing water stress - low flow streams, climate change and drought, groundwater flooding
- Issues with nitrate, agricultural pesticides and other contaminants. Better management needed
- Chalk springs support important habitats; England has 85 per cent of the world's chalk streams.

Major focus for civil engineering schemes with many major infrastructure projects.

- Significant geological heterogeneity, which influences fracture style and engineering/hydrogeological properties
- Flint density and style
- Karst, natural sinkholes and anthropogenic chalk mine collapse (deneholes)



http://www.groundwateruk.org/

Hasn't it been done already?

- **Improved geological understanding**

Increased stratigraphical resolution of key geological units (Chalk Group, Lambeth Group), better understanding of Quaternary deposits and palaeo-environments.

- **New datasets**

Aerial photographs, better base maps, Lidar data, geophysical data (seismic, geophysical logs), DTMs, new boreholes (HS2)

- **New methodologies**

3D modelling software, geophysical techniques (passive seismic), laser scanning, 3D visualisation, digital data collection.

- **Better products**

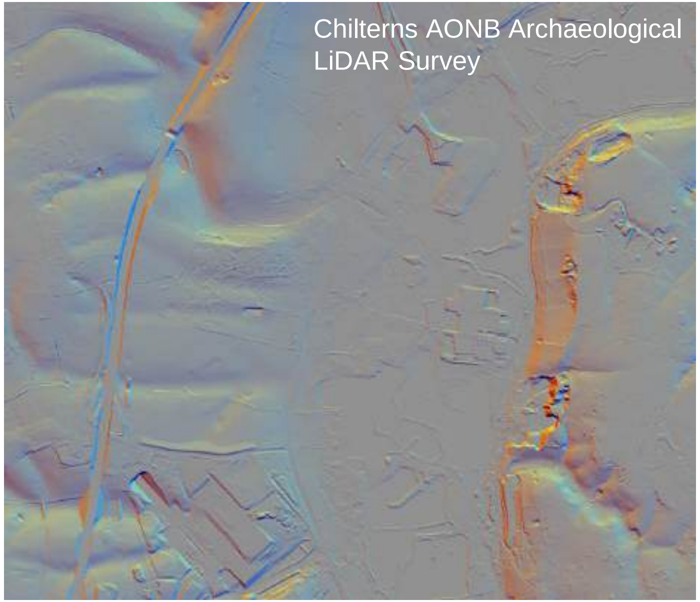
Products derived from geological maps are only as good as the baseline data. New ways of delivering data (3D models, gridded surfaces)

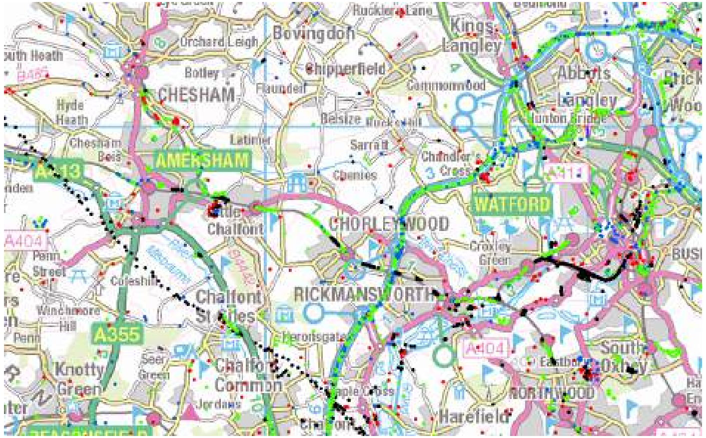
- **Shift in user requirements**

Major shift in user requirements: 2D to 3D

Increased computing power, more sophisticated software, big data, better visualisation & changing user needs

Geological data increasing becoming the limiting factor in computational models





Chalk Stratigraphy

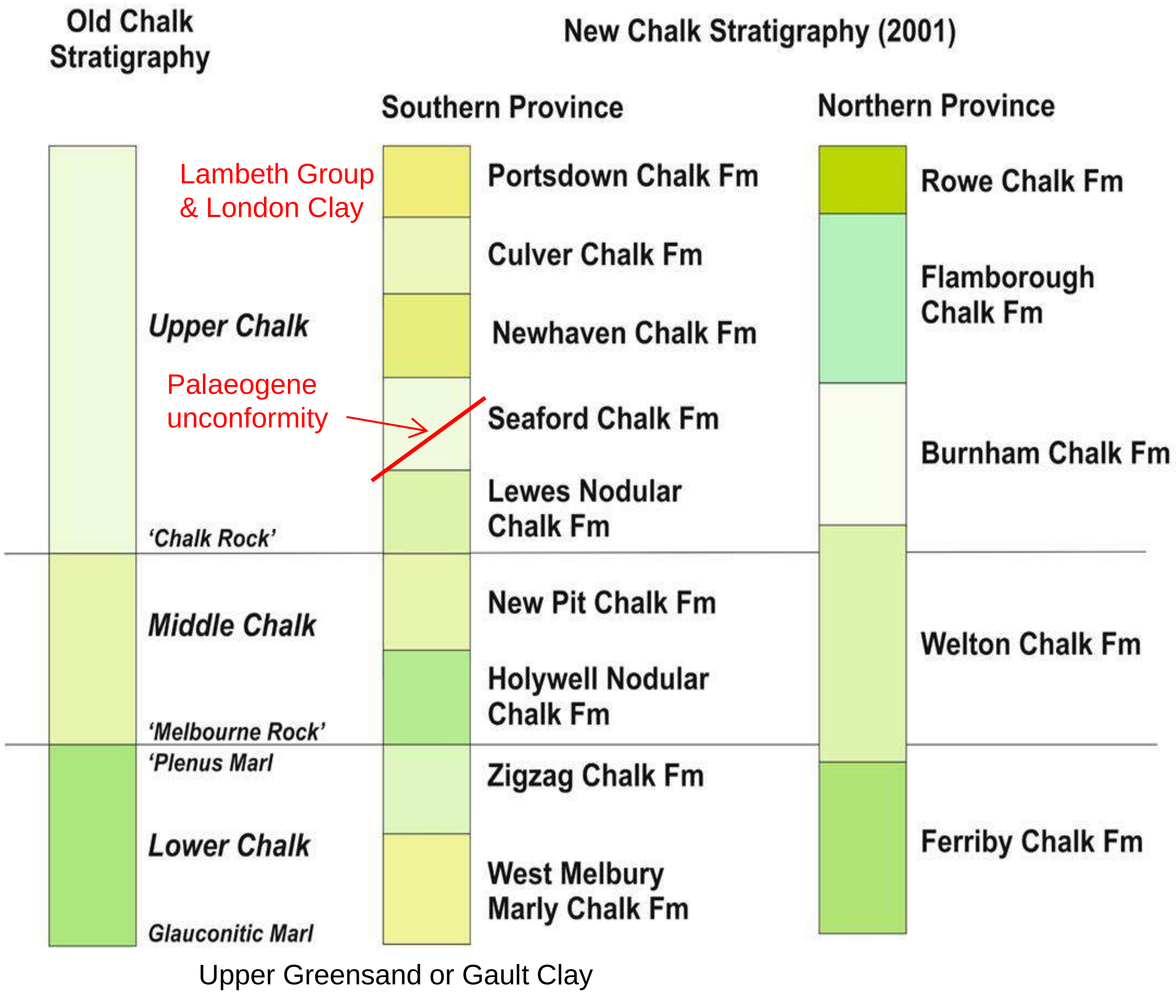
In the UK, the Chalk was traditionally divided into 3 units: Lower, Middle and Upper Chalk

We now divide the Chalk into nine lithologically-based mappable Formations, members and beds (6 are present in the Colne, the upper 3 are cut out by the Paleogene unconformity)

Each unit is lithologically different and can be equated with hydrogeological and engineering properties

Intra-formational marker beds or important hydrogeological horizons can be identified

Understanding Chalk heterogeneity is fundamental to producing better groundwater models



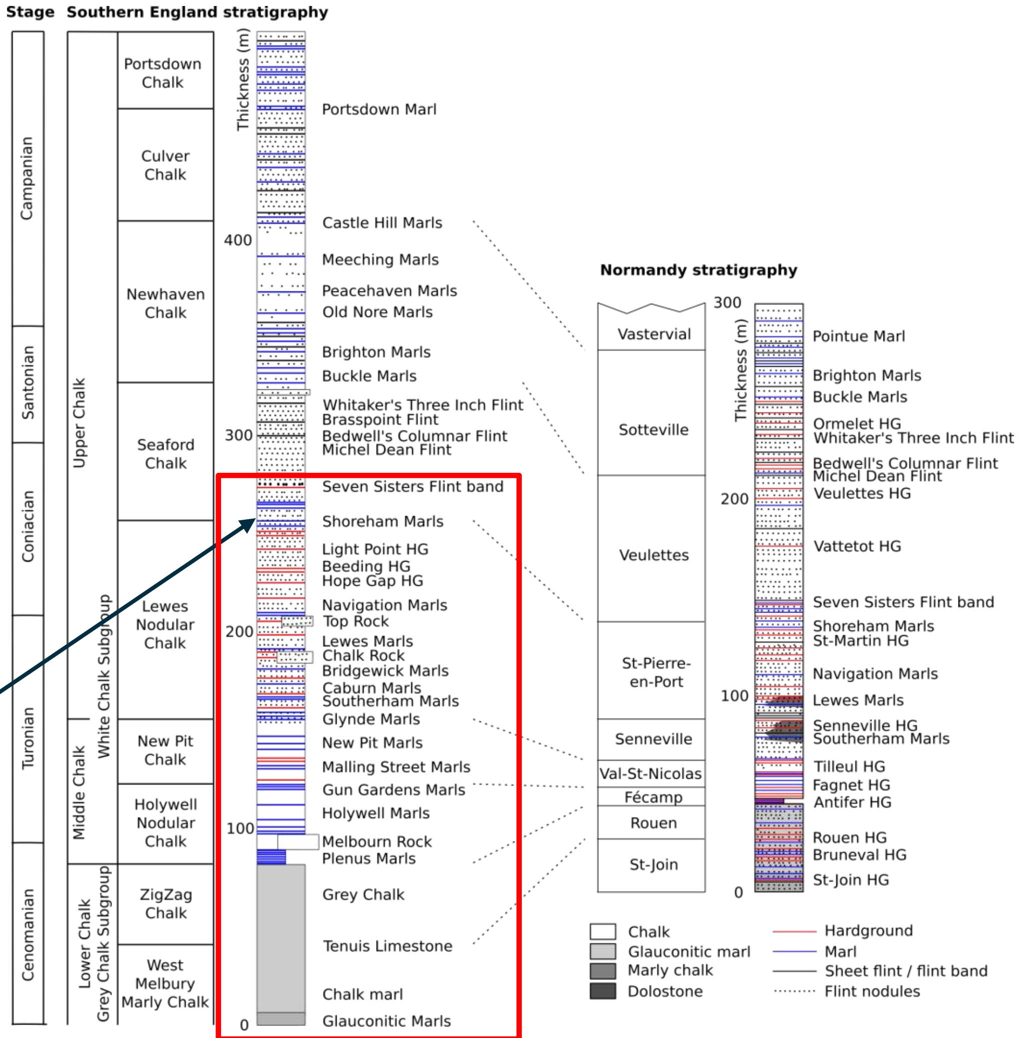
Chalk Stratigraphy

Key discontinuities:

- Hardgrounds – beds of more cemented chalk (‘chalk rock’) marking hiatuses in deposition
- Marl seams – thin cm thick clay beds, some of volcanic origin
- Sheet and semi-tabular flints – cm thick laterally continuous flints

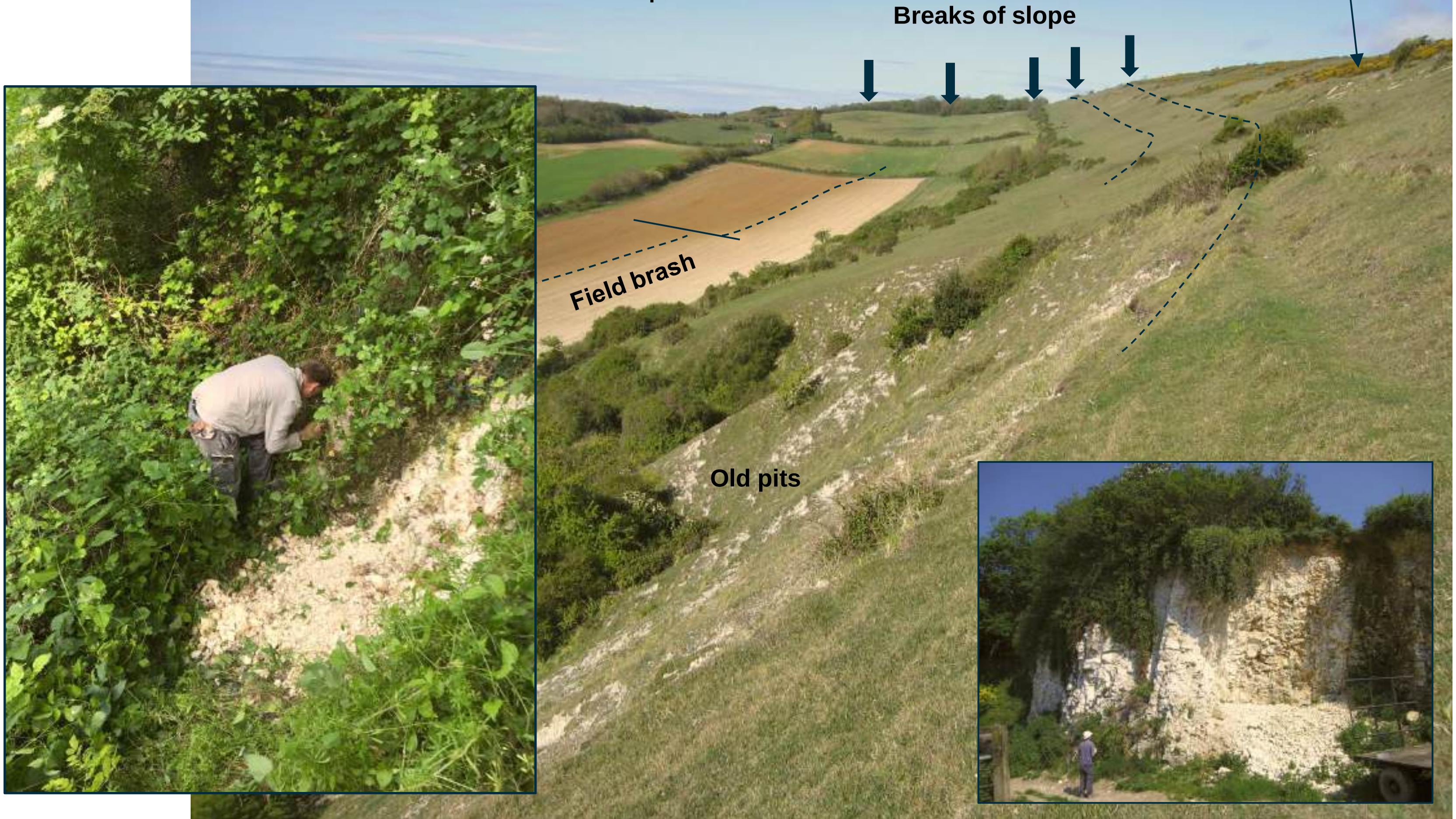
These are important for groundwater – forming preferential flow horizons with dissolutional conduits (caves) & rapid groundwater flow

Many of these marker beds can be traced across southern England, up to Yorkshire and into France.



So – how do we improve the geological map?

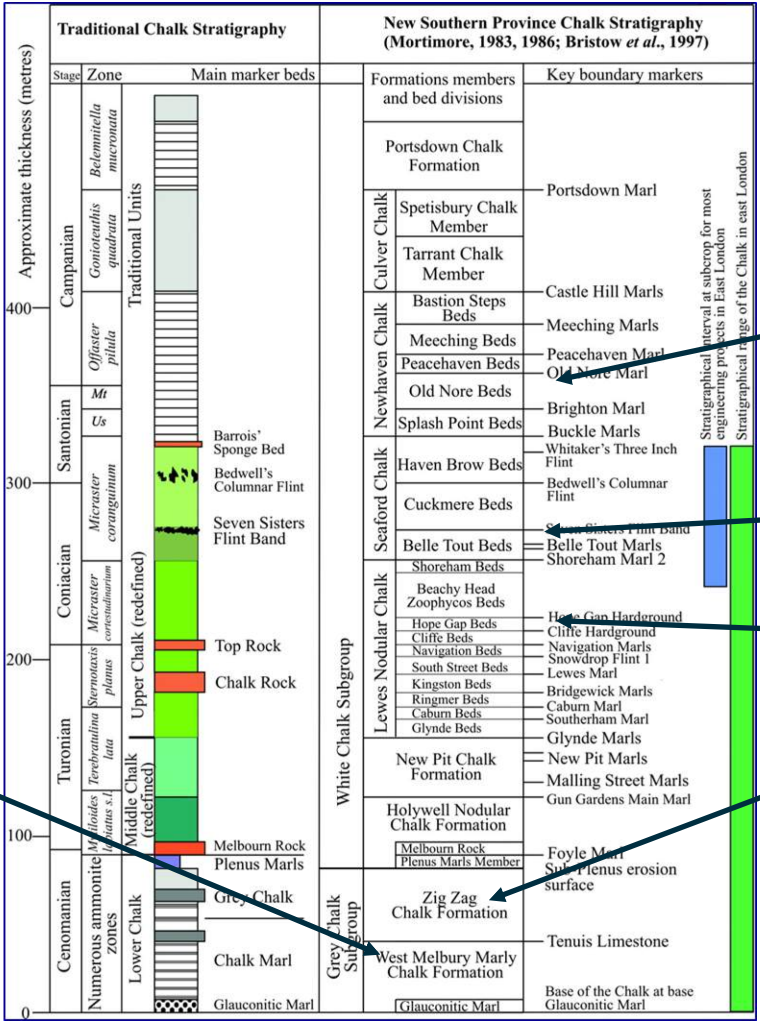
The clues are in the landscape



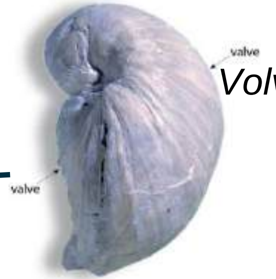
Geological Mapping

Biostratigraphy

Inoceramus crippsii



Marsupities testudinarius



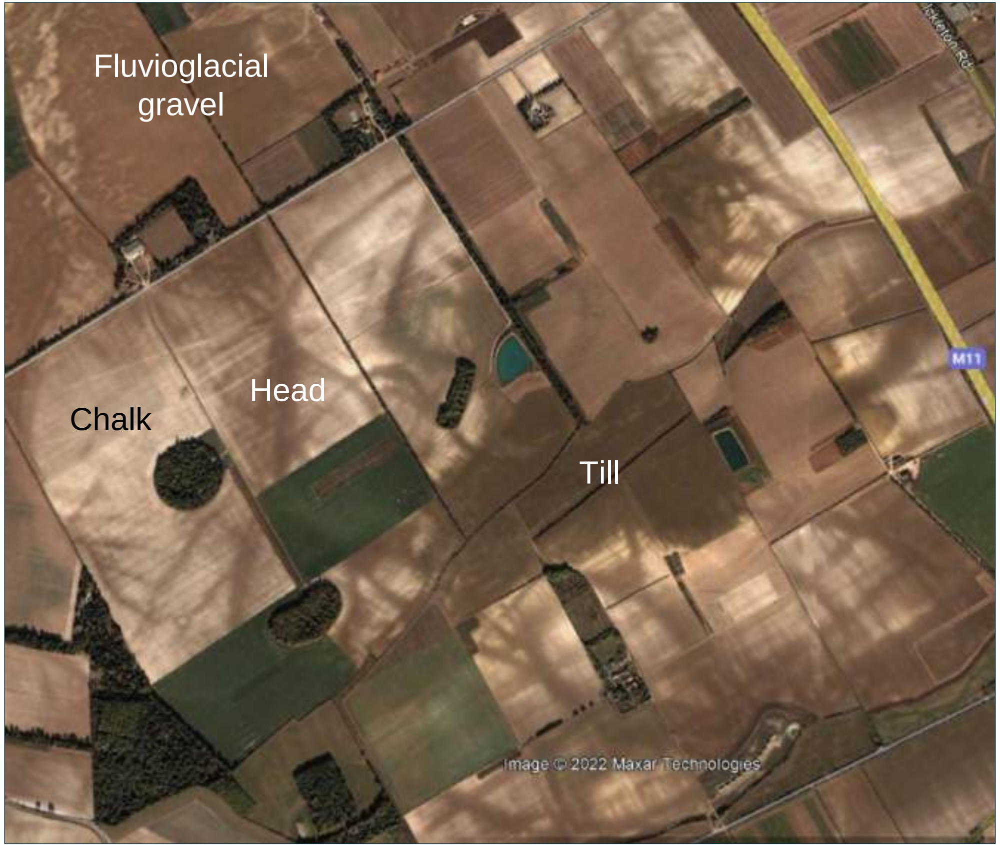
Volviceramus

M. cortestudinarium

Acanthoceras rhotomagense

Aerial photos

Images from google earth

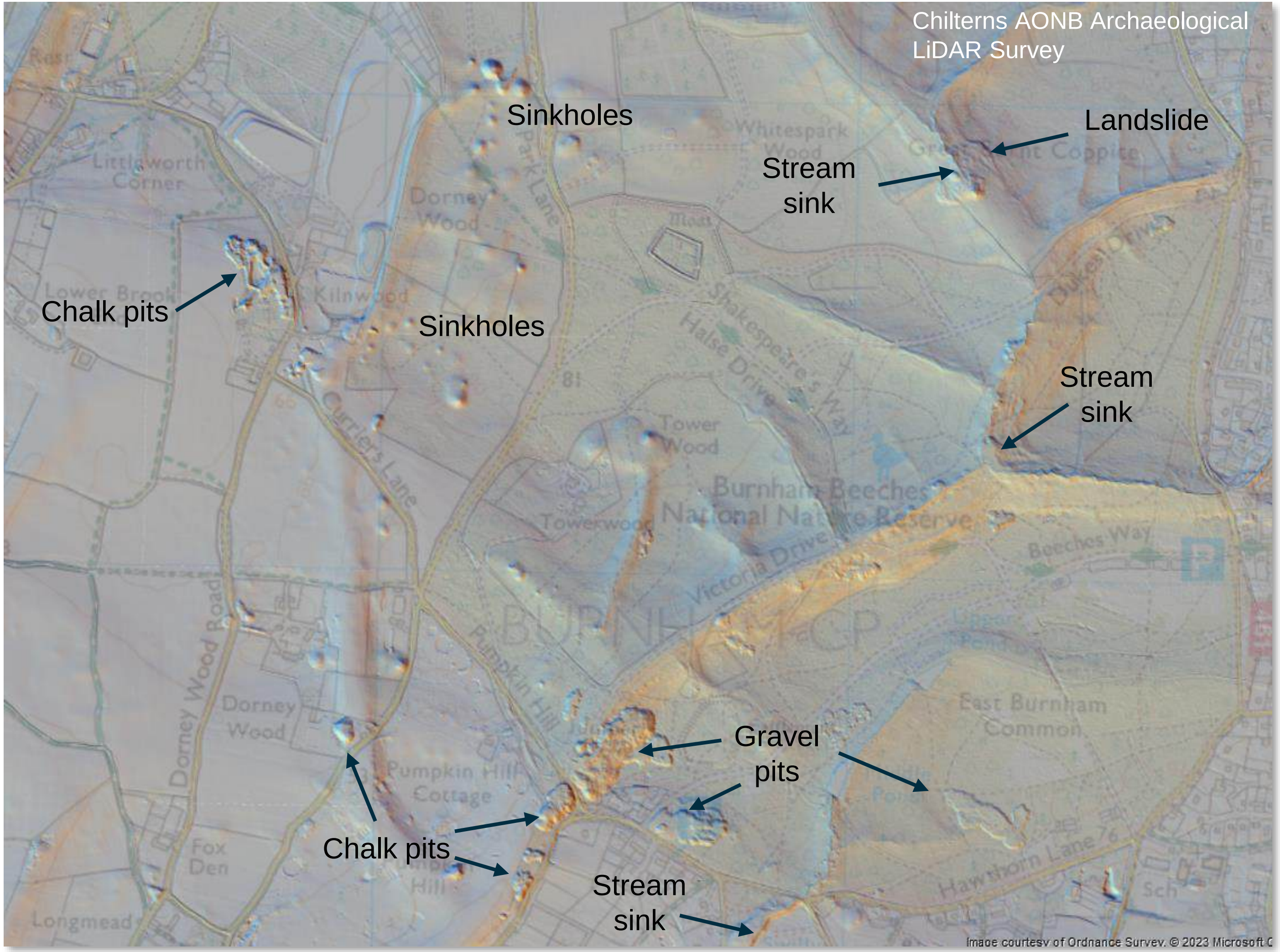


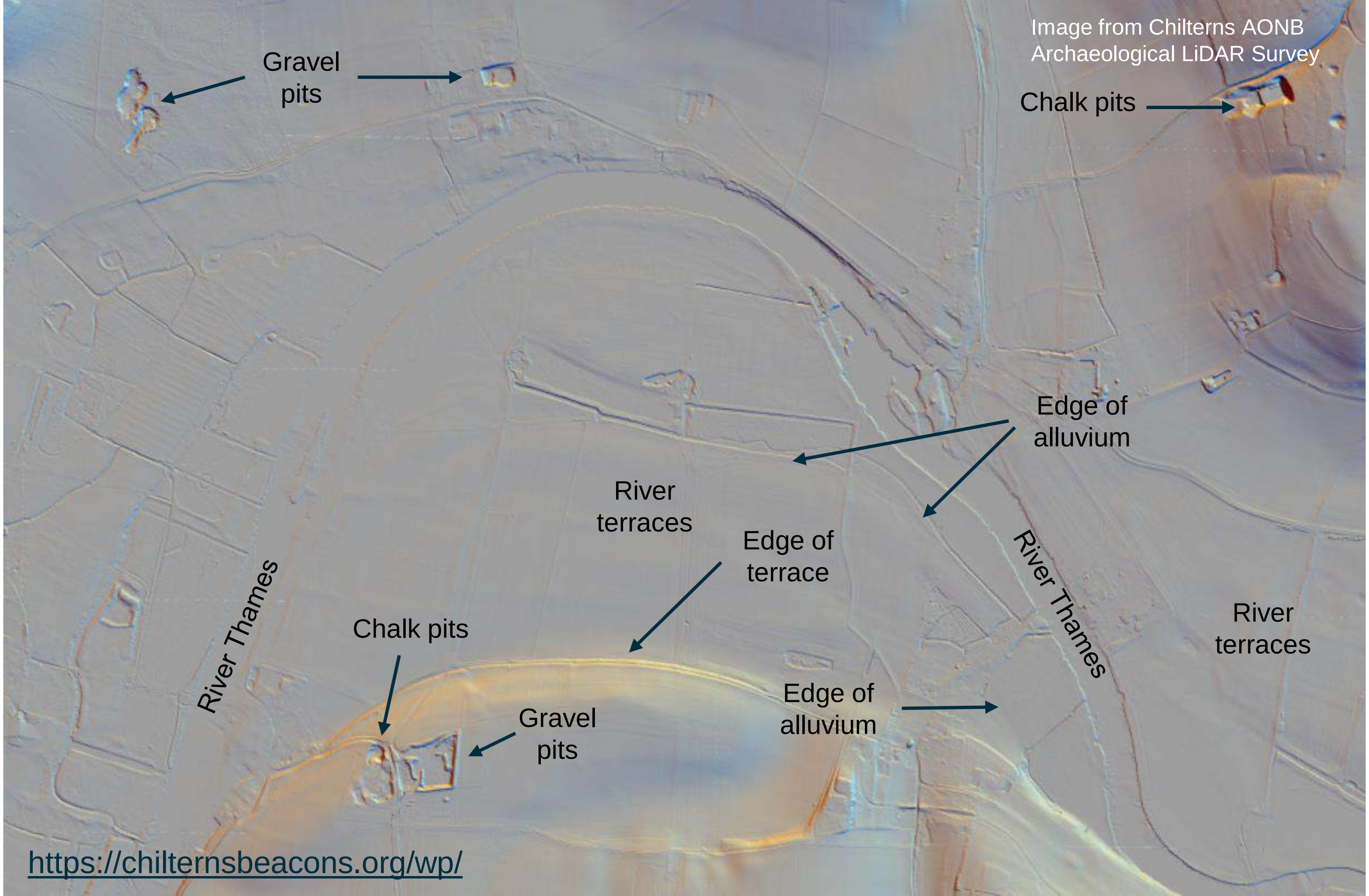
LiDAR

Data from EA or the Chilterns AONB Archaeological LiDAR Survey Portal

https://chilternsbeacons.org/wp/

Useful for identifying features of geological interest such as old pits, karst features and landslides.

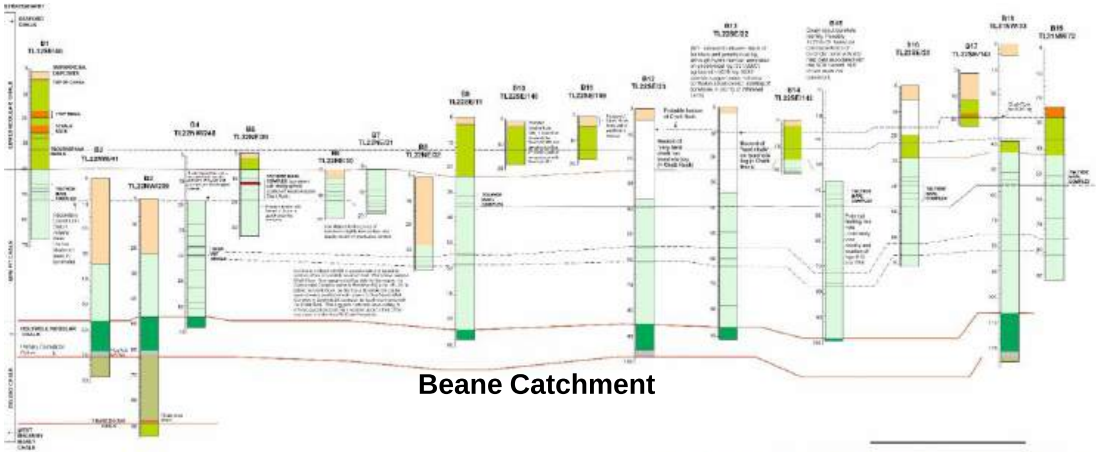




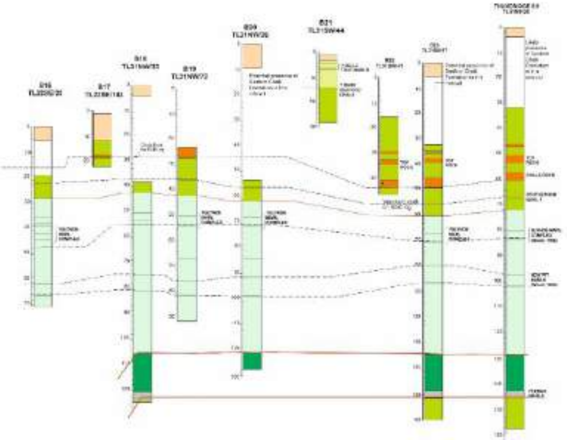
https://chilternsbeacons.org/wp/

Geophysical Logs

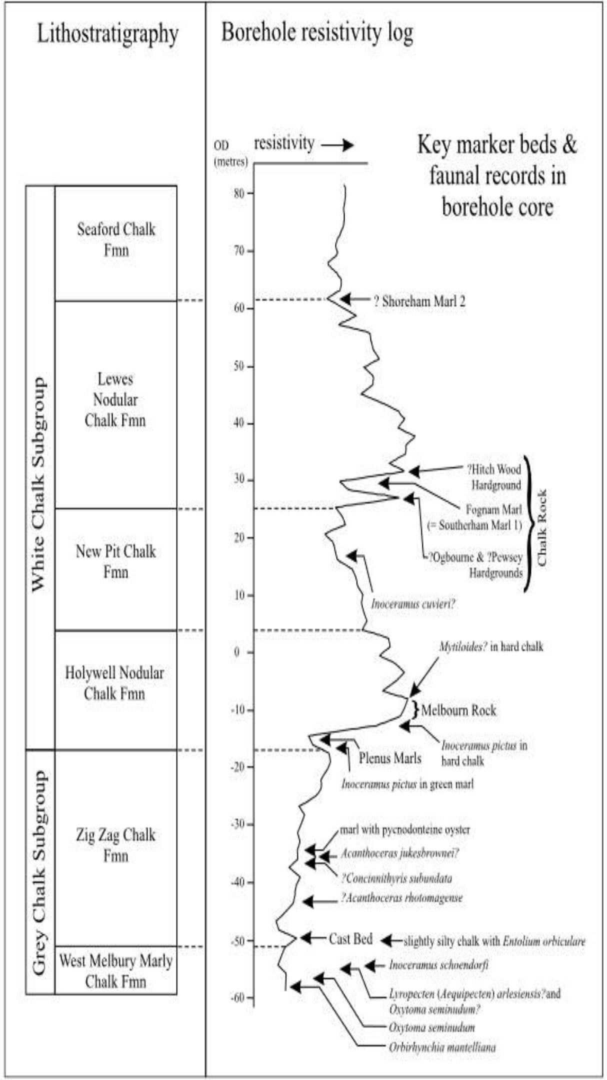
Geophysical log signatures from boreholes can be used to interpret the Chalk stratigraphy and produce correlations across the region



Beane Catchment



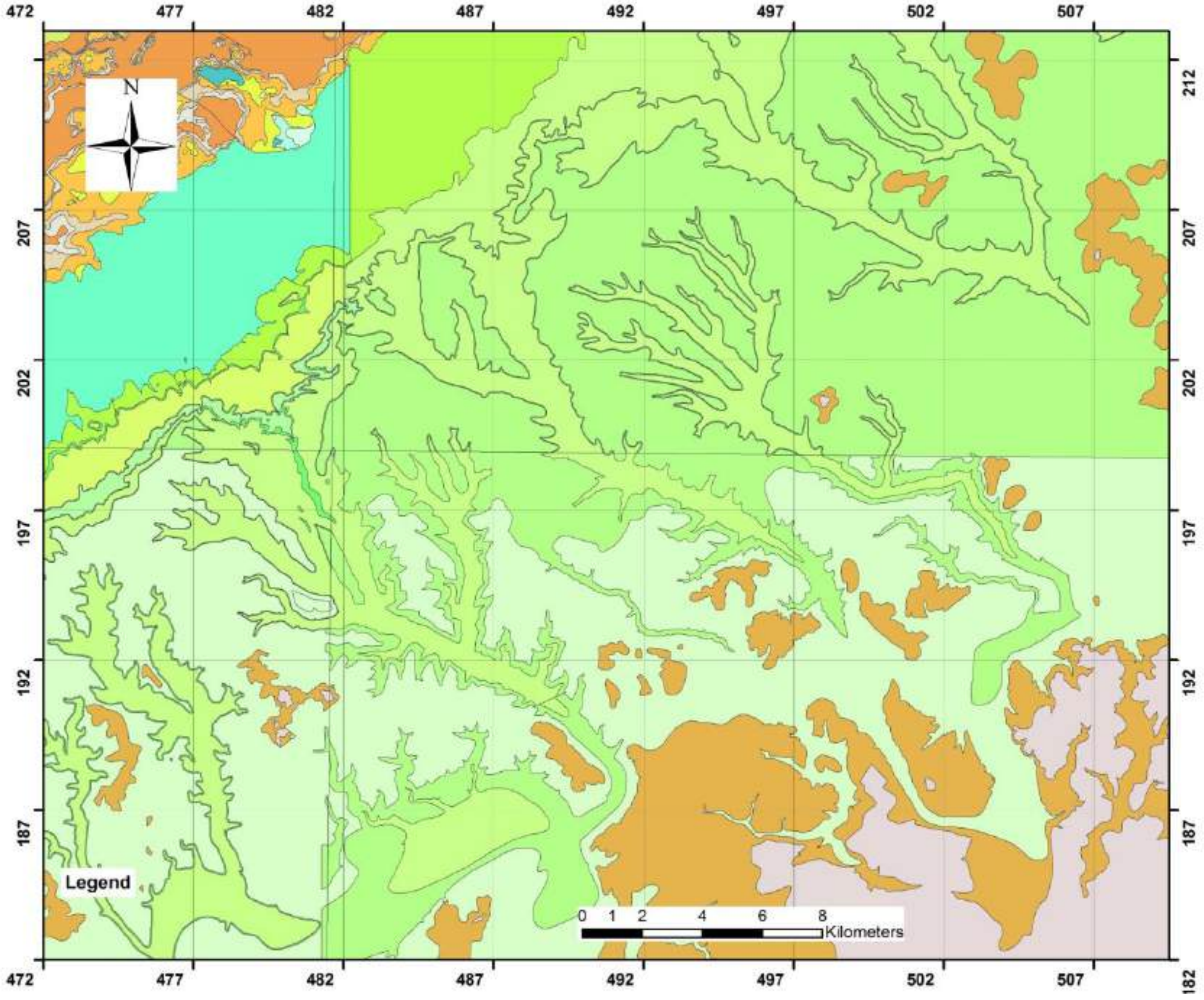
Map showing location of boreholes and line of correlation.



Bedrock mapping

River Chess and River Misbourne catchments

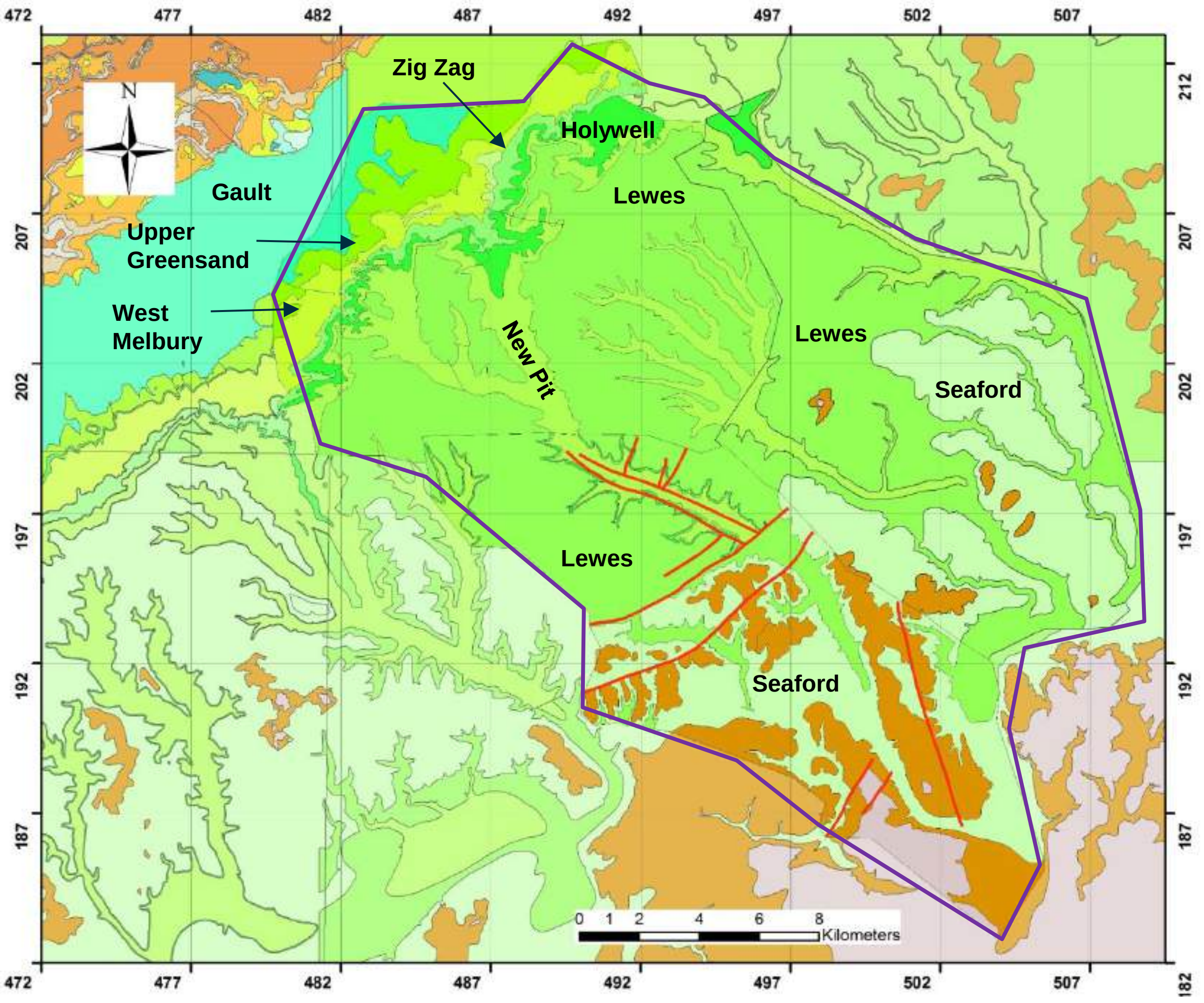
Old mapping



Bedrock mapping

River Chess and River Misbourne catchments

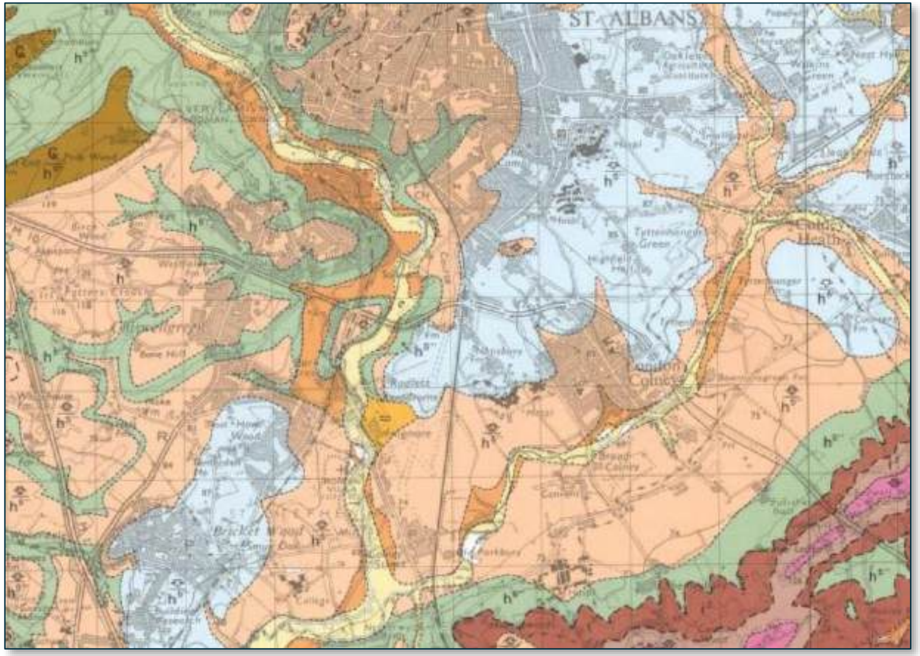
New mapping (more accurate, updated stratigraphy, additional faulting

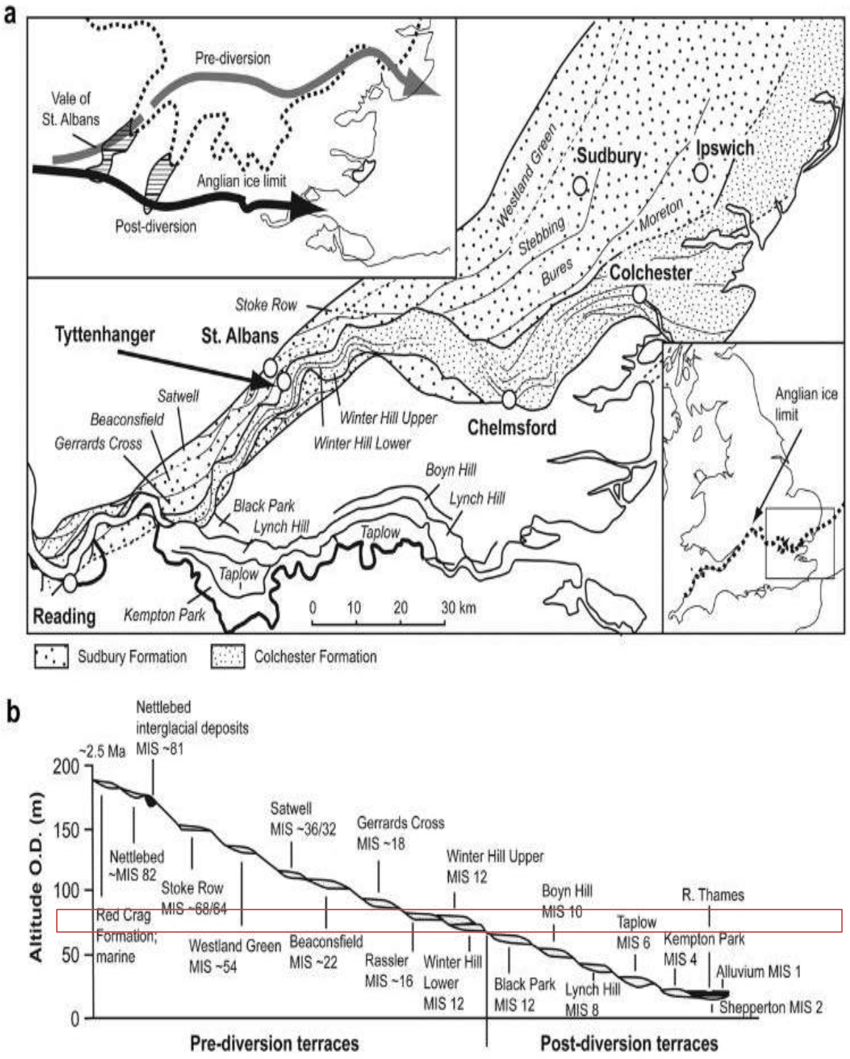


Palaeo-Thames terraces

The River Thames once flowed through the Vale of St Albans and across East Anglia, depositing a suite of river terraces. The river was diverted during the Anglian glaciation to its present course.

This was known prior to the 1920’s. However, some published BGS 1:50K map sheets (Hertford, Aylesbury) do not identify these river terraces, which are lumped together as ‘glacial gravels’

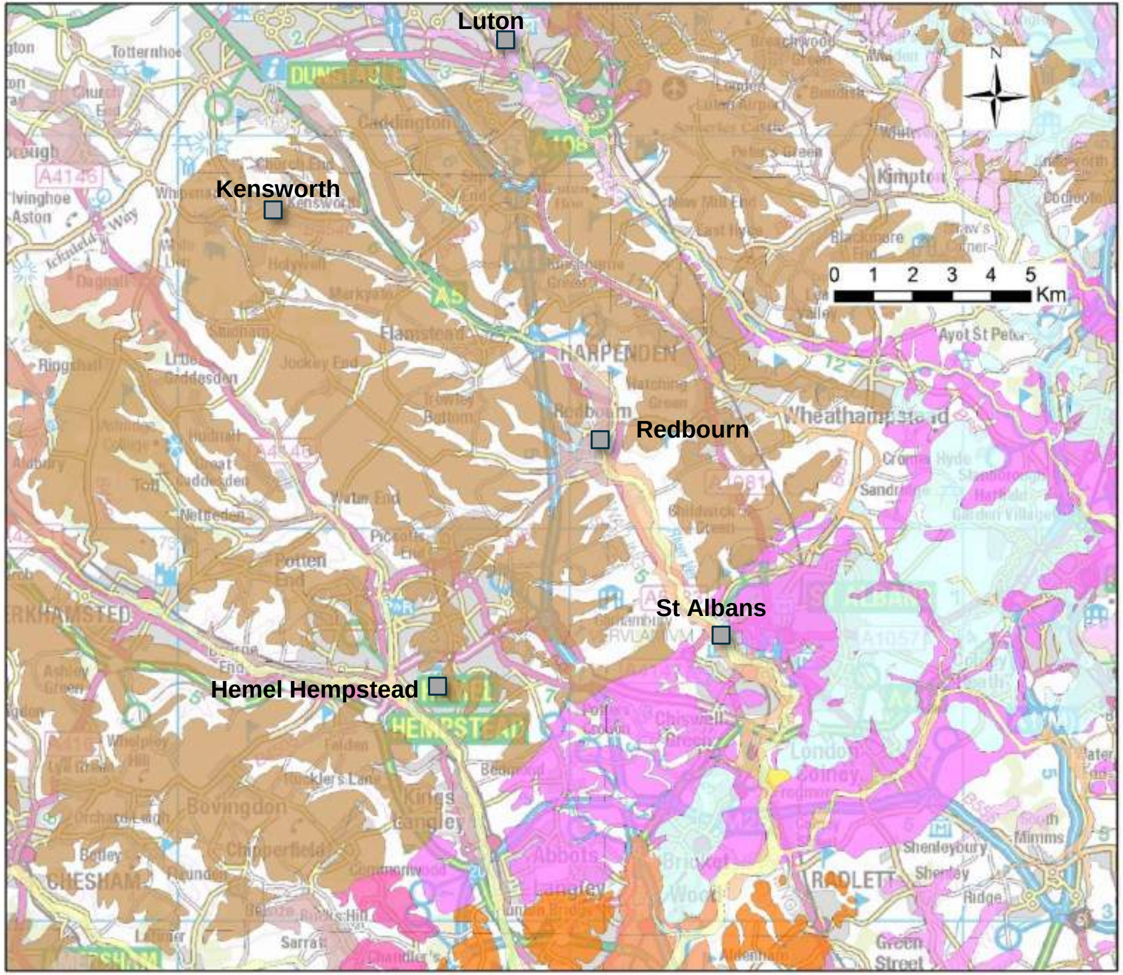




Superficial mapping

Ver Catchment

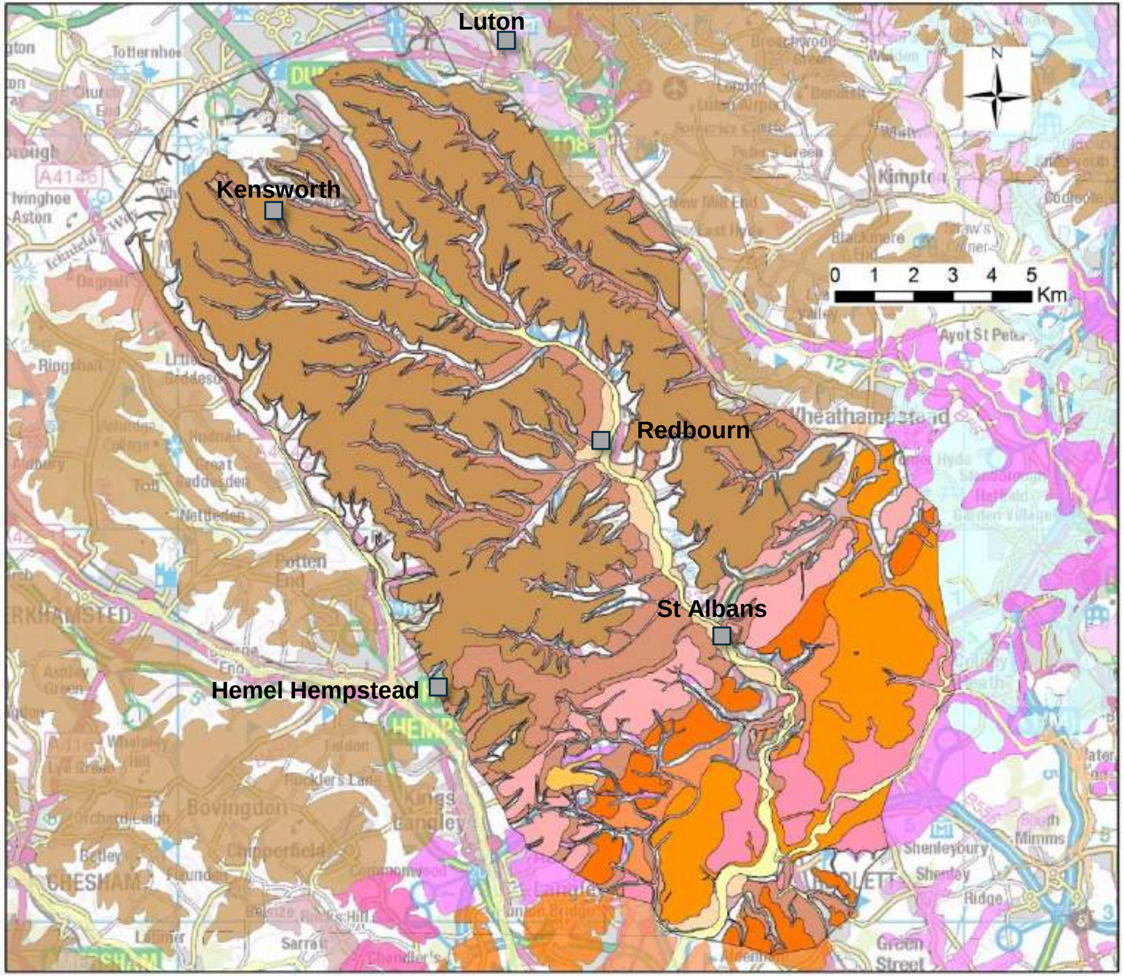
Old mapping



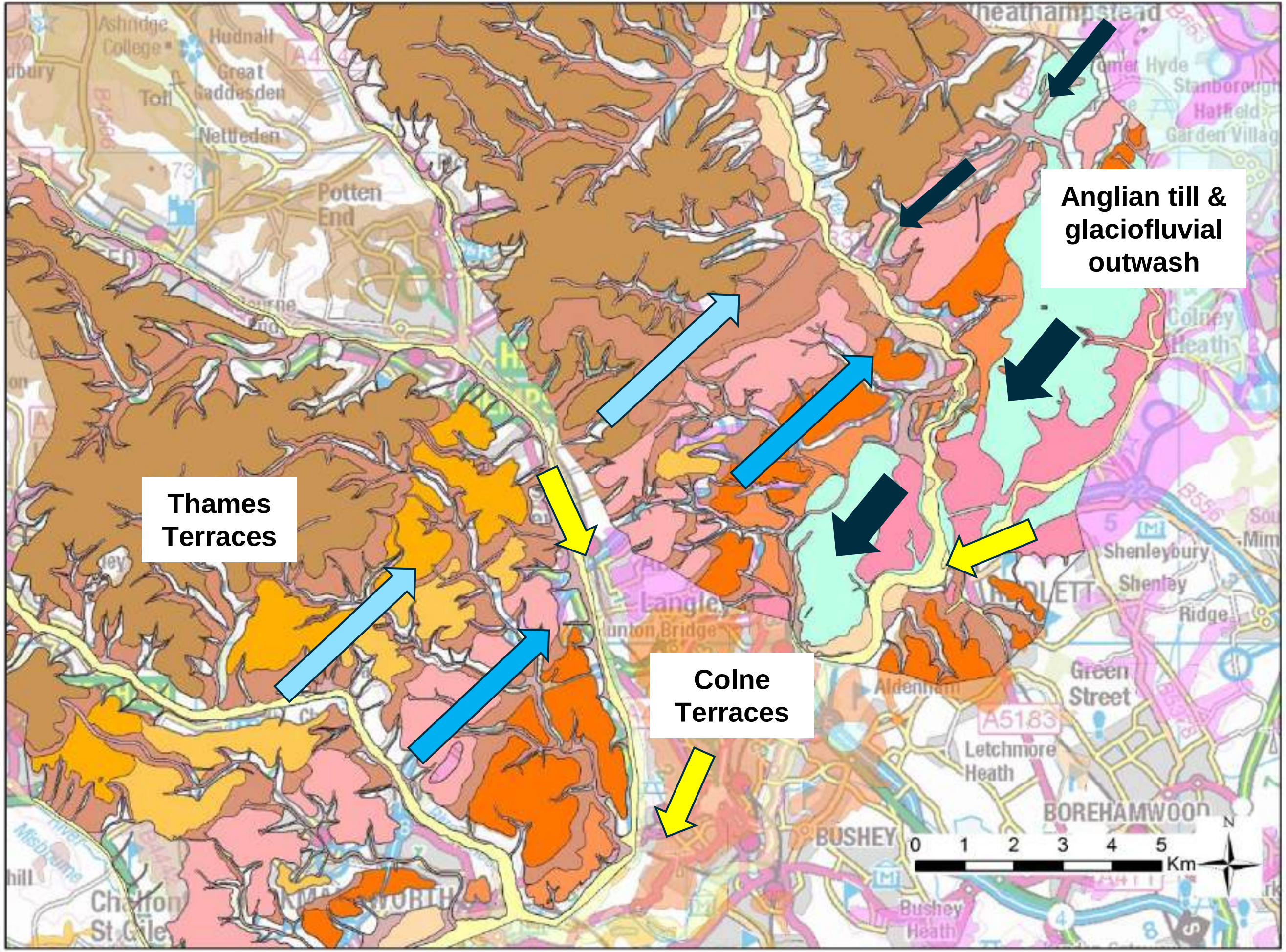
Superficial mapping

Ver Catchment

New mapping



Ver & Chess catchments



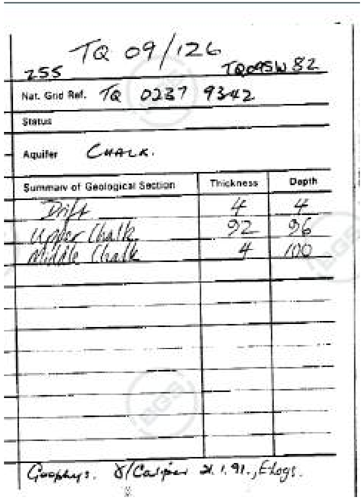
3D Modelling

Used borehole data, new map linework, seismic data and cross sections to generate model

Borehole data is generally pretty poor except in urban areas. No deep seismic

Deep chalk boreholes often just state ‘Chalk’, other boreholes typically very shallow and along roads.

At this scale, modelling relies heavily on new geological map data, rather than boreholes, esp. for Quaternary



255 TQ 09/126 TQ09SW82

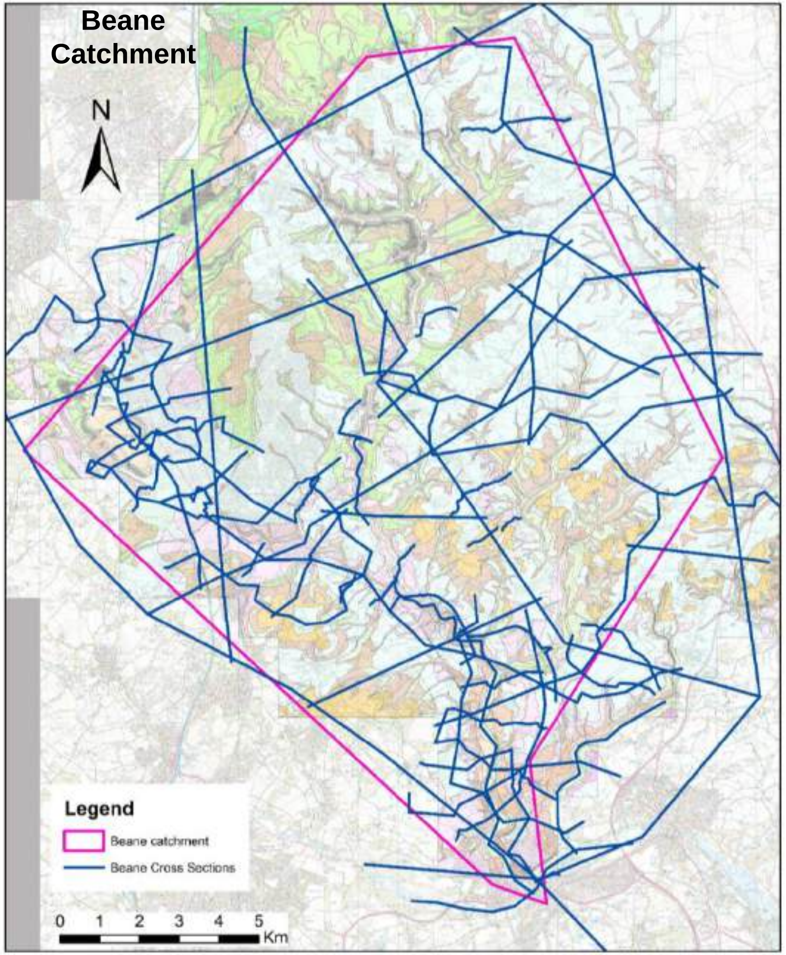
Nat. Grid Ref. TQ 0237 9342

Status

Aquifer CHALK.

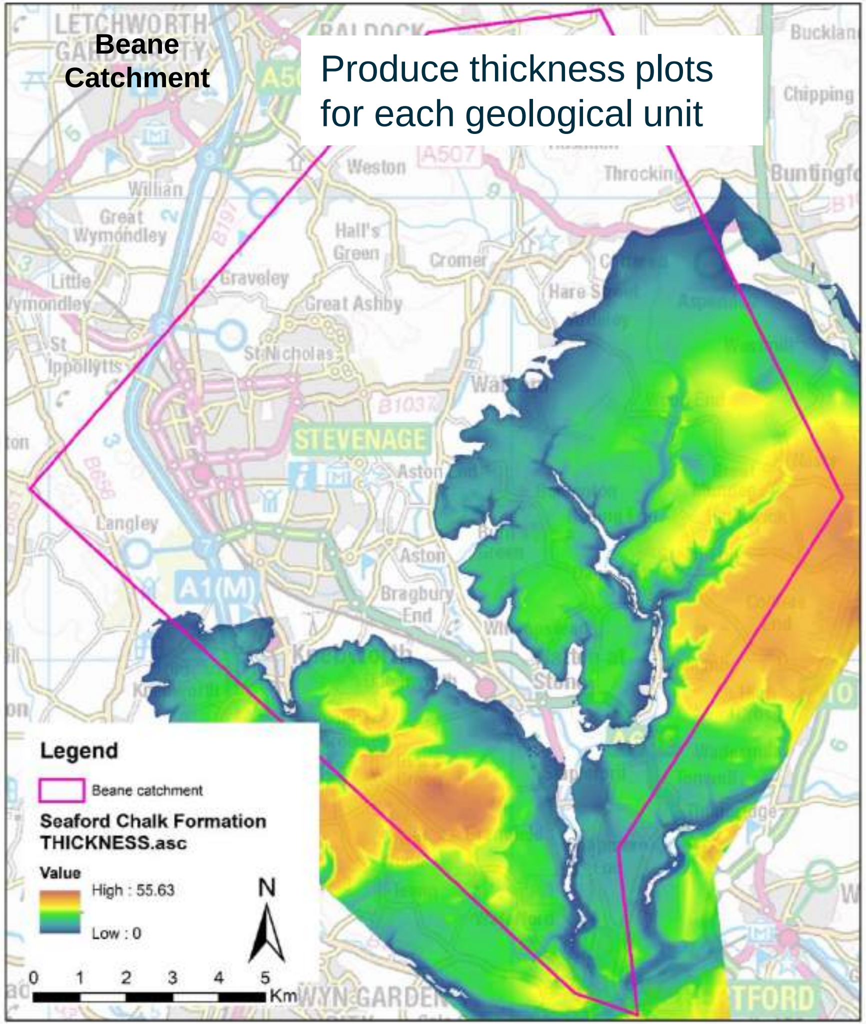
Summary of Geological Section	Thickness	Depth
Drift	4	4
Upper Chalk	92	96
Middle Chalk	4	100

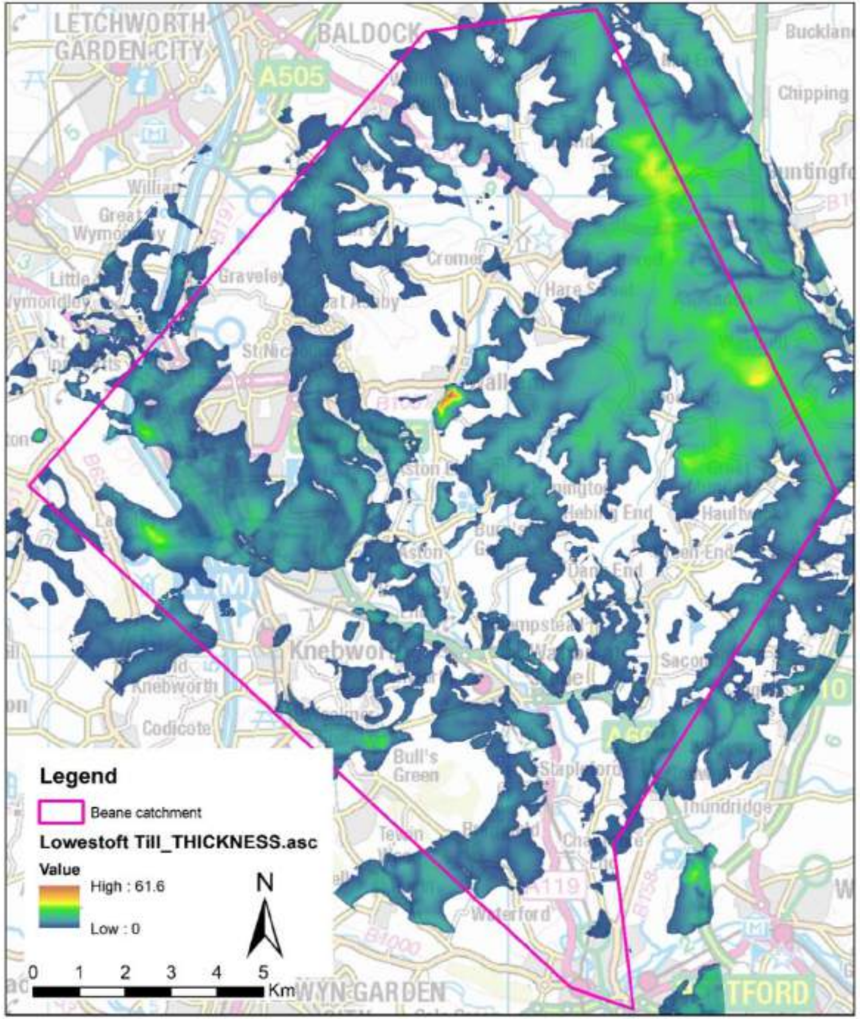
Geophys. γ/Caliper 21.1.91, E logs.



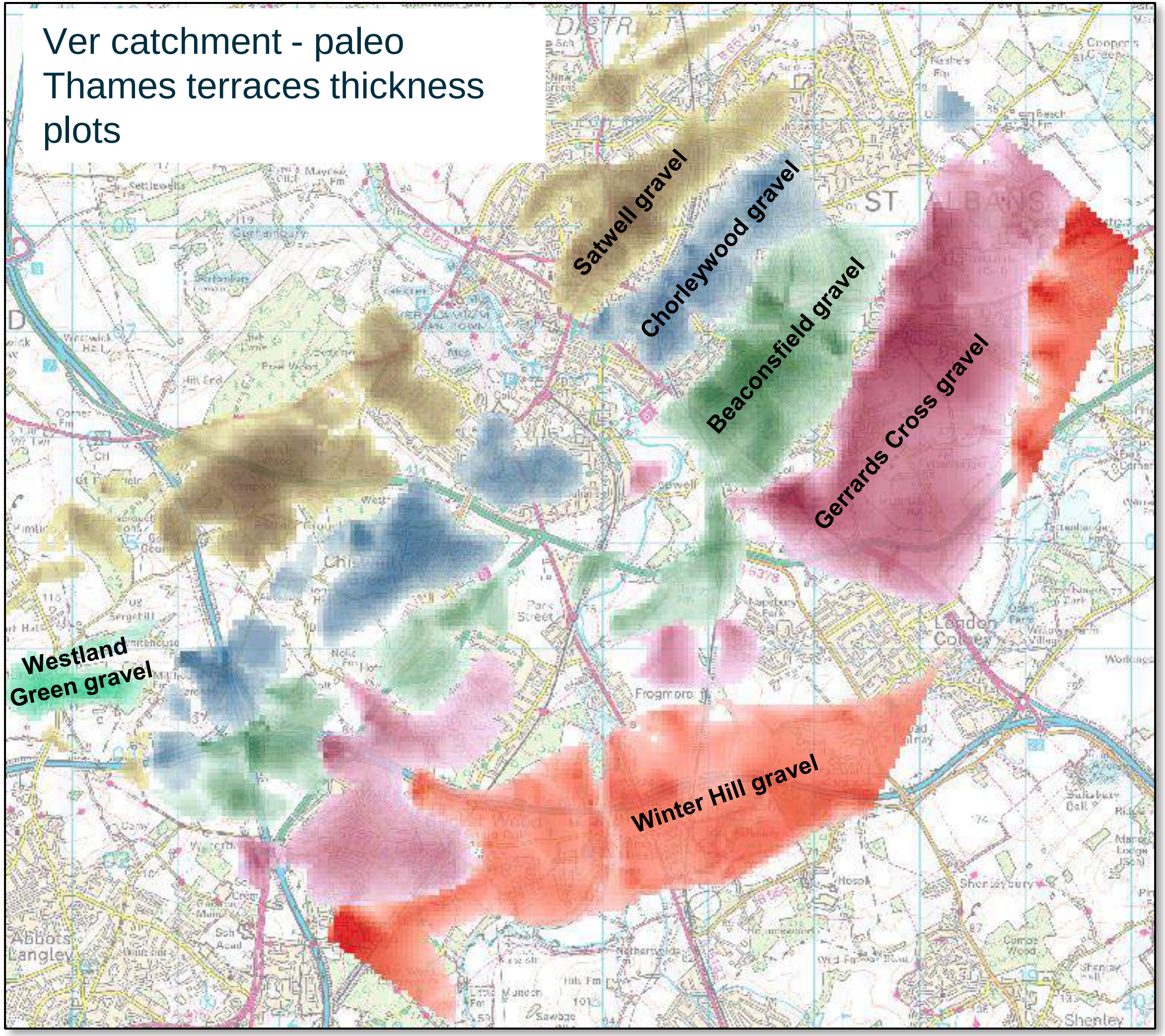
Beane Catchment

Produce thickness plots for each geological unit





Ver catchment - paleo Thames terraces thickness plots



Chalk Karst

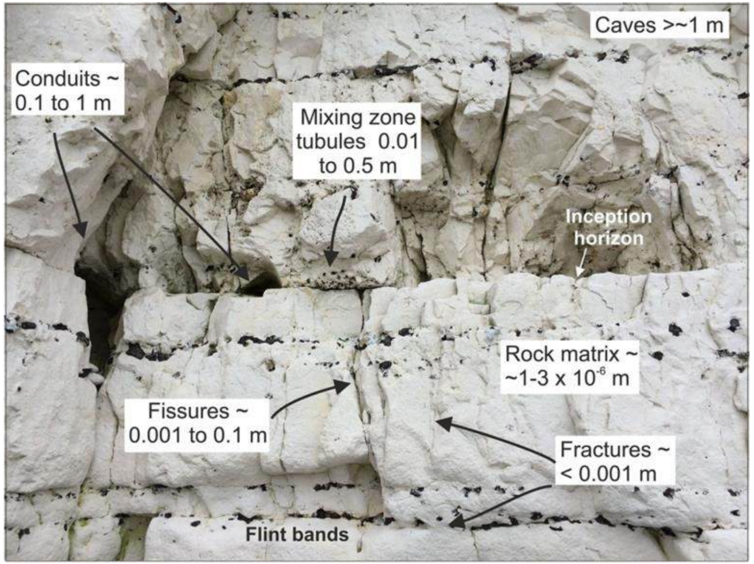
Chalk is soluble so prone to dissolution and the formation of conduits, caves and sinkholes (karst)

Has a big influence on groundwater flow and is also important for foundation design and designing cuttings and tunnels.

Features include stream sinks, large springs and sinkholes.

Dissolutional conduits and caves can promote rapid groundwater flow over long distances, often on stratigraphical discontinuities (hardgrounds, marl seams, flints)

Areas of very irregular rockhead, especially beneath River Terrace gravels and Clay-with-Flints



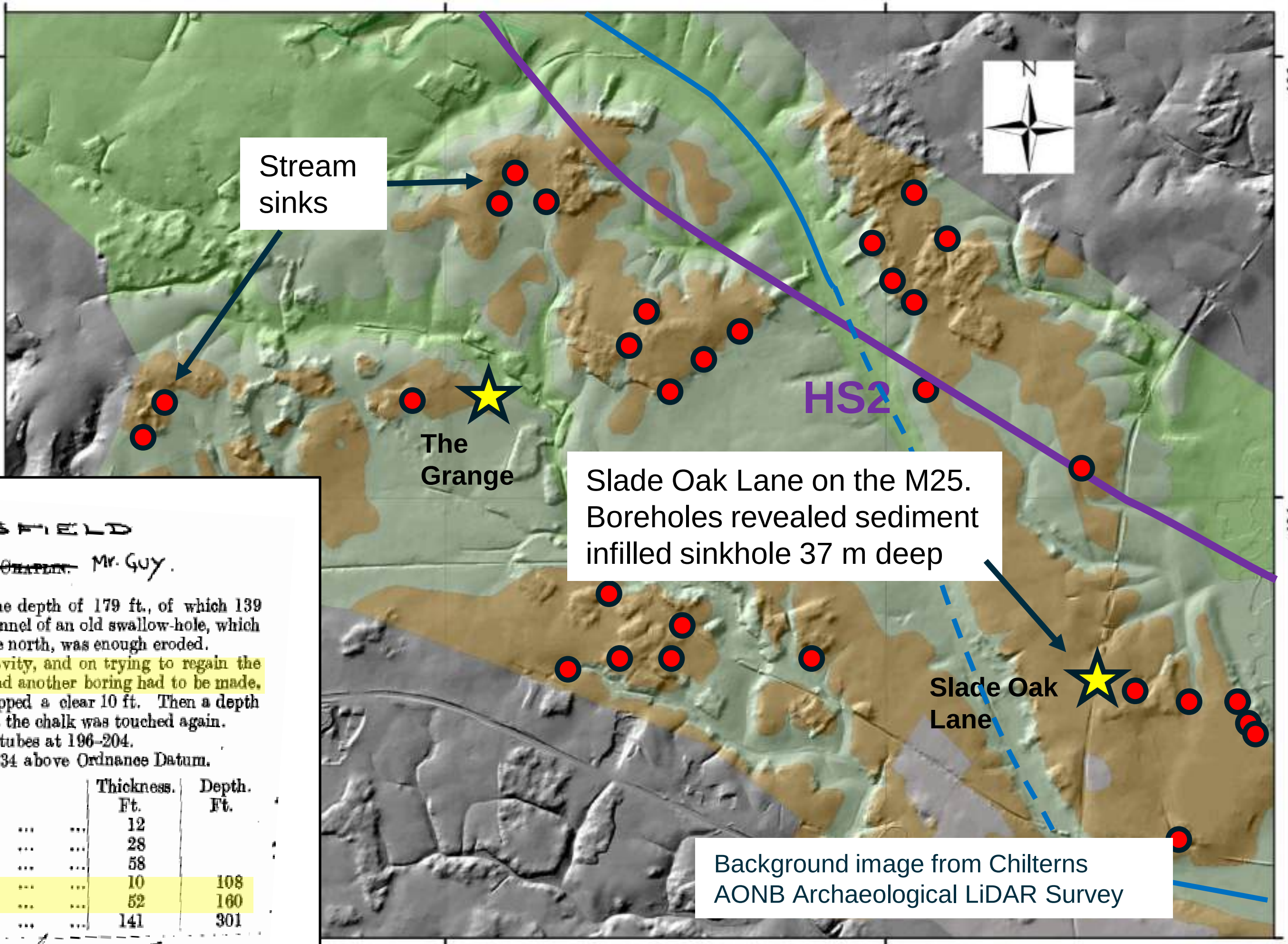
Louise Maurice et al. Geological Society, London, Special Publications 2021;517:SP517-2020-267

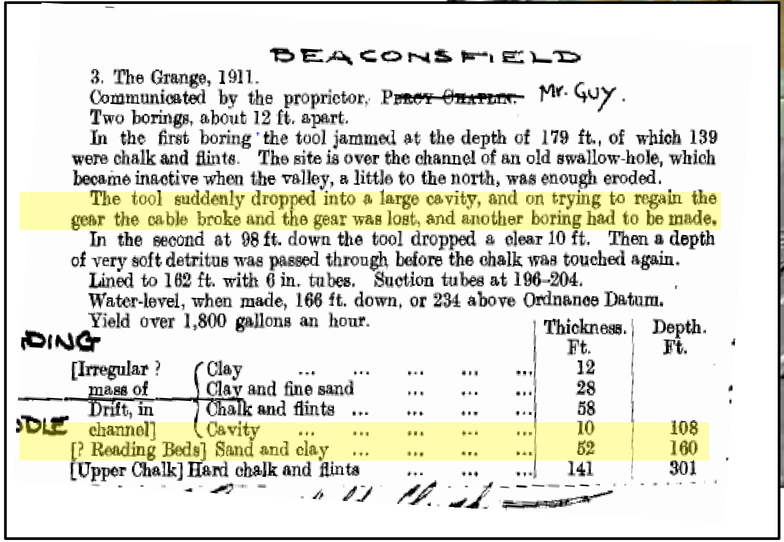
Stream sink, Mimrams copse (Pang)

Dissolution pipes M25, HS2 excavations

A borehole north of Beaconsfield intersected a cavity within the Chalk. An initial borehole had to be abandoned when the drill bit dropped into a large cavity at 54 m depth.

A second borehole a few metres away hit a 3 m high cavity at 29.8 m depth with another 16 m of sand and clay infill below before hitting Chalk at 48.8 m depth.





BEACONSFIELD

3. The Grange, 1911.
Communicated by the proprietor, ~~Percy Chaplin.~~ Mr. Guy.
Two borings, about 12 ft. apart.
In the first boring the tool jammed at the depth of 179 ft., of which 139 were chalk and flints. The site is over the channel of an old swallow-hole, which became inactive when the valley, a little to the north, was enough eroded.
The tool suddenly dropped into a large cavity, and on trying to regain the gear the cable broke and the gear was lost, and another boring had to be made.
In the second at 98 ft. down the tool dropped a clear 10 ft. Then a depth of very soft detritus was passed through before the chalk was touched again.
Lined to 162 ft. with 6 in. tubes. Suction tubes at 196–204.
Water-level, when made, 166 ft. down, or 234 above Ordnance Datum.
Yield over 1,800 gallons an hour.

DING

		Thickness. Ft.	Depth. Ft.
[Irregular ? mass of Drift, in channel]	Clay	12	
	Clay and fine sand	28	
	Chalk and flints	58	
	Cavity	10	108
[? Reading Beds]	Sand and clay	52	160
[Upper Chalk]	Hard chalk and flints	141	301

DLE

https://chilternsbeacons.org/wp/

Conclusions

The application of a detailed stratigraphy has revolutionized our understanding of the Chalk, and its engineering and hydrogeological properties

Also better understanding of the Palaeogene (Lambeth Group and London Clay)

The benefits of the new stratigraphy have been facilitated by detailed geological mapping of the Chalk and Paleogene strata across the Chilterns.

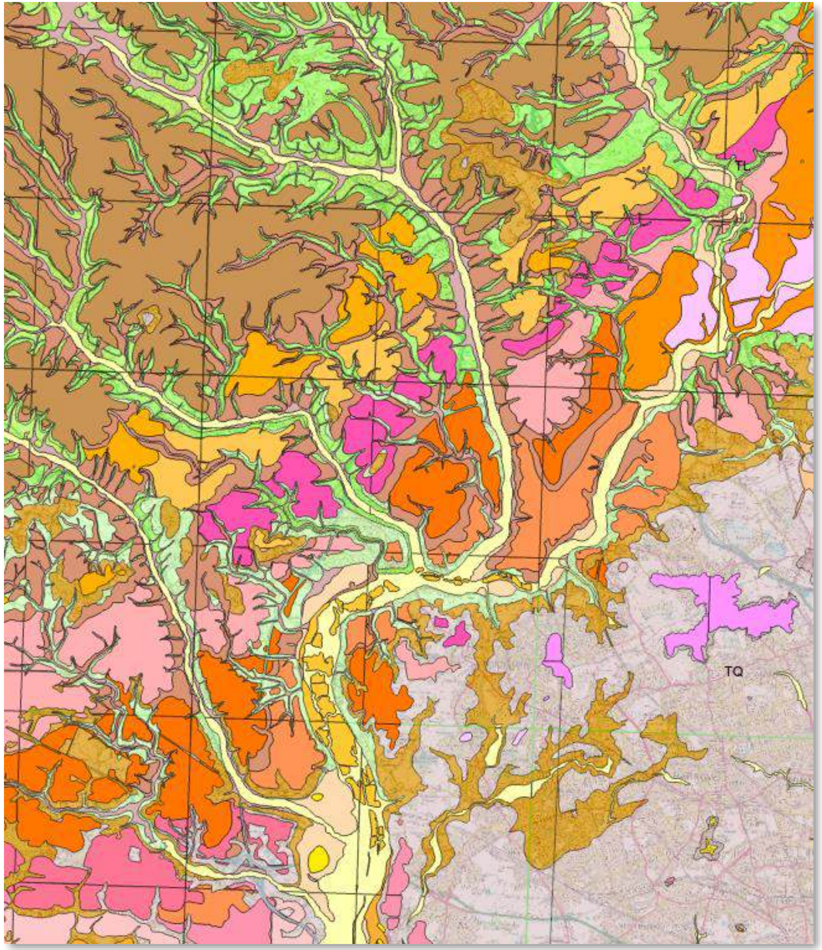
Not just mapping, but increasingly through the production of detailed 3D geological models

Geological mapping and modelling have helped unravel the complex Quaternary deposits in the Vale of St Albans, deposited at the margin of the Anglian ice sheet

The mapping has also identified many karst features and helped us understand better groundwater flow within individual catchments

Data being used by the EA, water companies, consultants and engineering industry.

Geology matters!!



Thanks to:

The Environment Agency
Affinity Water
Thames Water

Michael Kehinde
Michael Jones
Vicky Fry
Anibal Vivanco
Haydon Bailey
Melinda Lewis
Peter Hopson
Cath Cripps
Nigel Hoad
Gareth Jenkins
Illias Karaponis
Simon Starling

Rory Mortimore
Jo Thompson
Keith Westhead
Lou Maurice
Ian Wilkinson
Mark Felgett
Rhian Kendall
Romaine Graham
Andy Newell
Alessando Marseli
Helen Burke
Jon Ford

Don Aldiss
Helen Smith
John Bloomfield
Steve Thorpe
Rowan Vernon
Rolf Farrell
Dave Morgan
Mark Woods

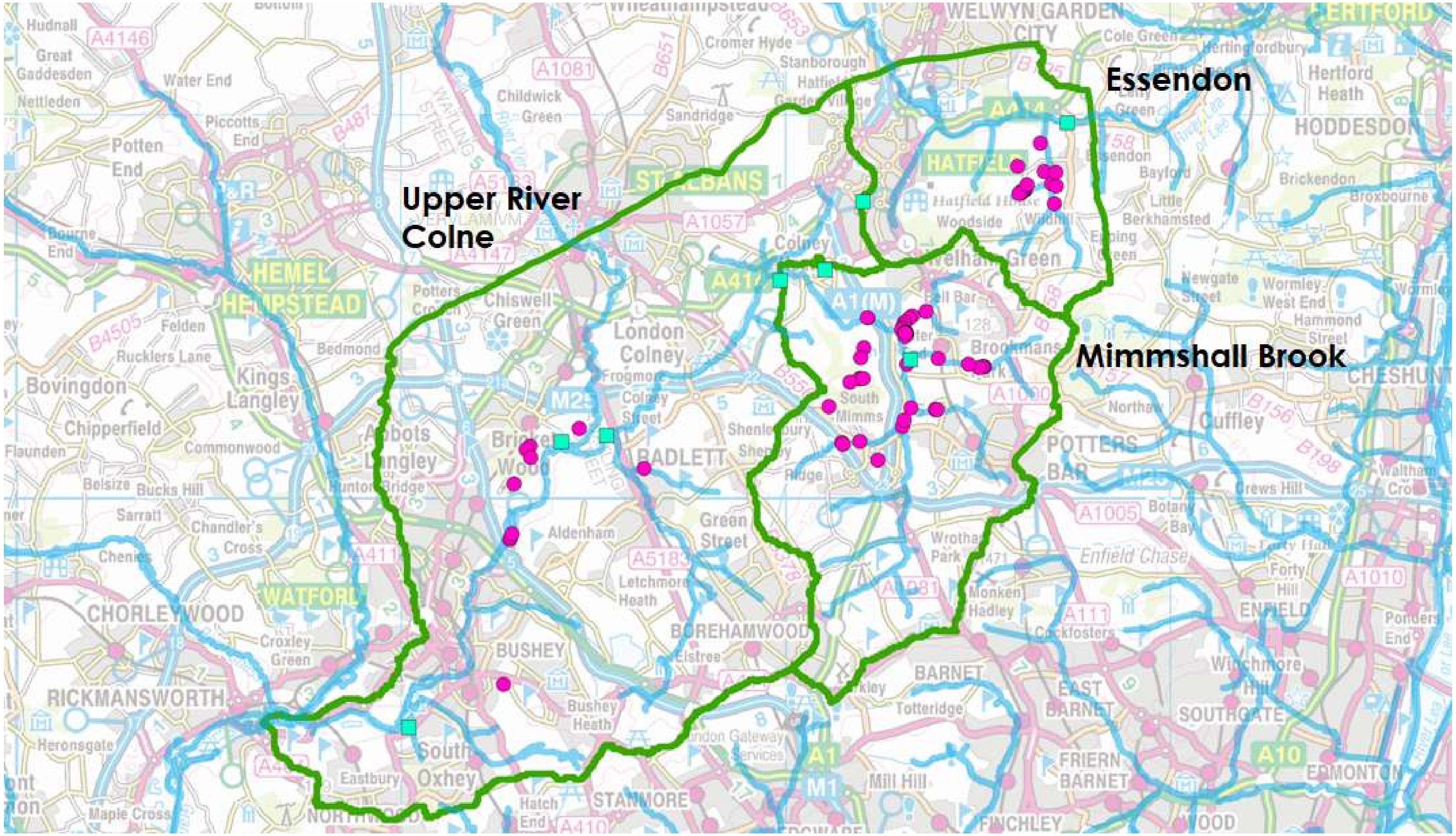
Thank you for your attention

Affinity Water

Improving understanding of karst geology to protect drinking water through catchment management: Case study from the Upper Colne

Alister Leggatt
Integrated Catchment Manager

Farming 4 Clean Water Scheme area (2017 to present)



- Covers wider area (250km2) due to connectivity, land use and **unique geology**
- Key issues in the Upper Colne are nitrates, pesticides and sediment (turbidity)
- Worked with BGS to map karst features in the catchment
- Working with farmers since 2011 with schemes to reduce pollution

Understanding these swallow holes

Tracer testing (2020 to present)

- PhD study – University of Leeds
- Investigate the largest swallow holes
- Use of bacteriophage and dye tracers
- Constant monitoring at our sources

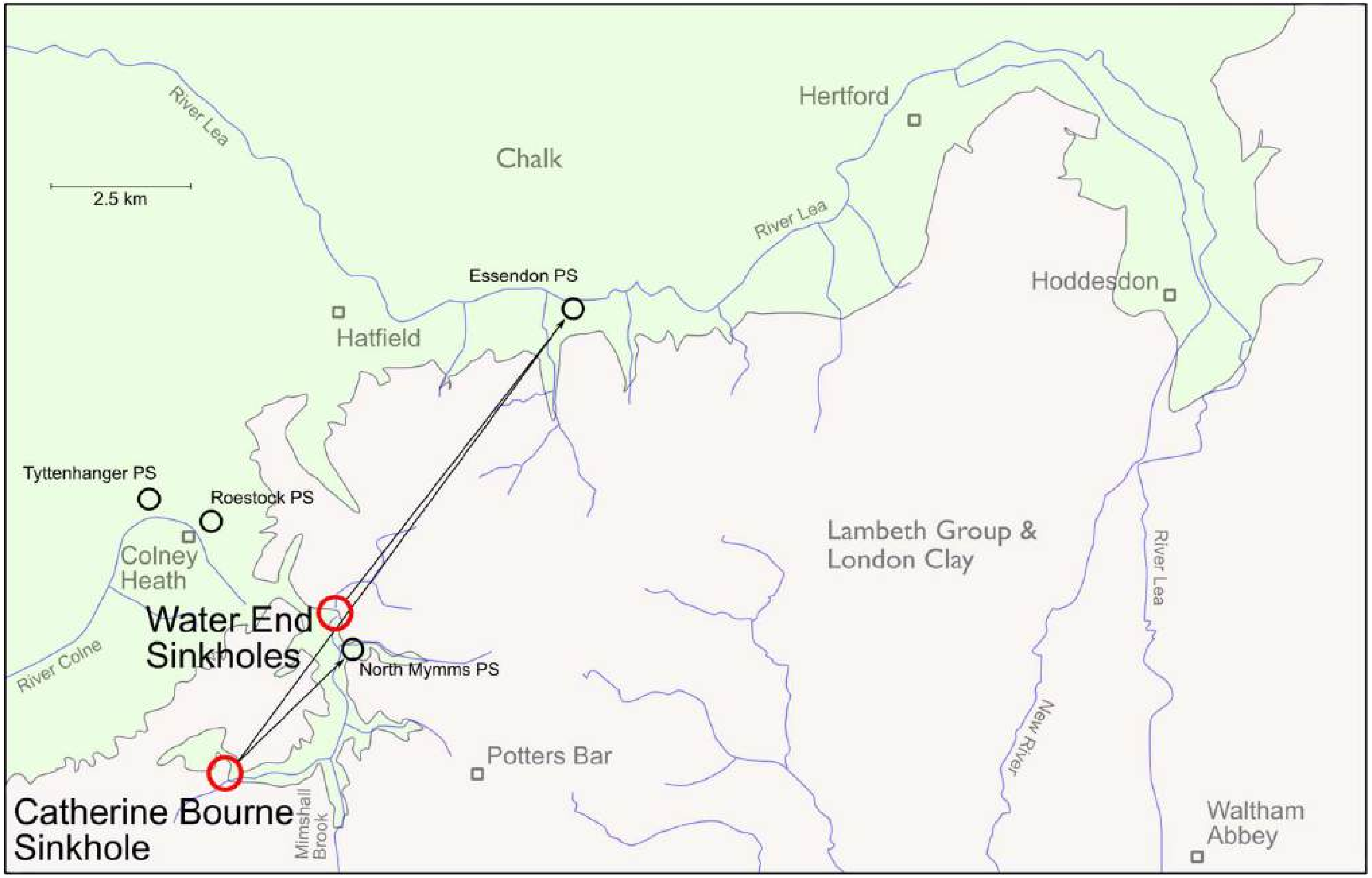
AffinityWater

Tracer Test – Water End swallow holes

- Largest complex
- 600m north of North Mymms WTW
- Deterioration of quality in Mimmshall Brook = rapid response in GW
- Past tracer testing

Tracer Test – Catharine Bourne swallow holes

Tracer Test results (November 2021 and April 2022)

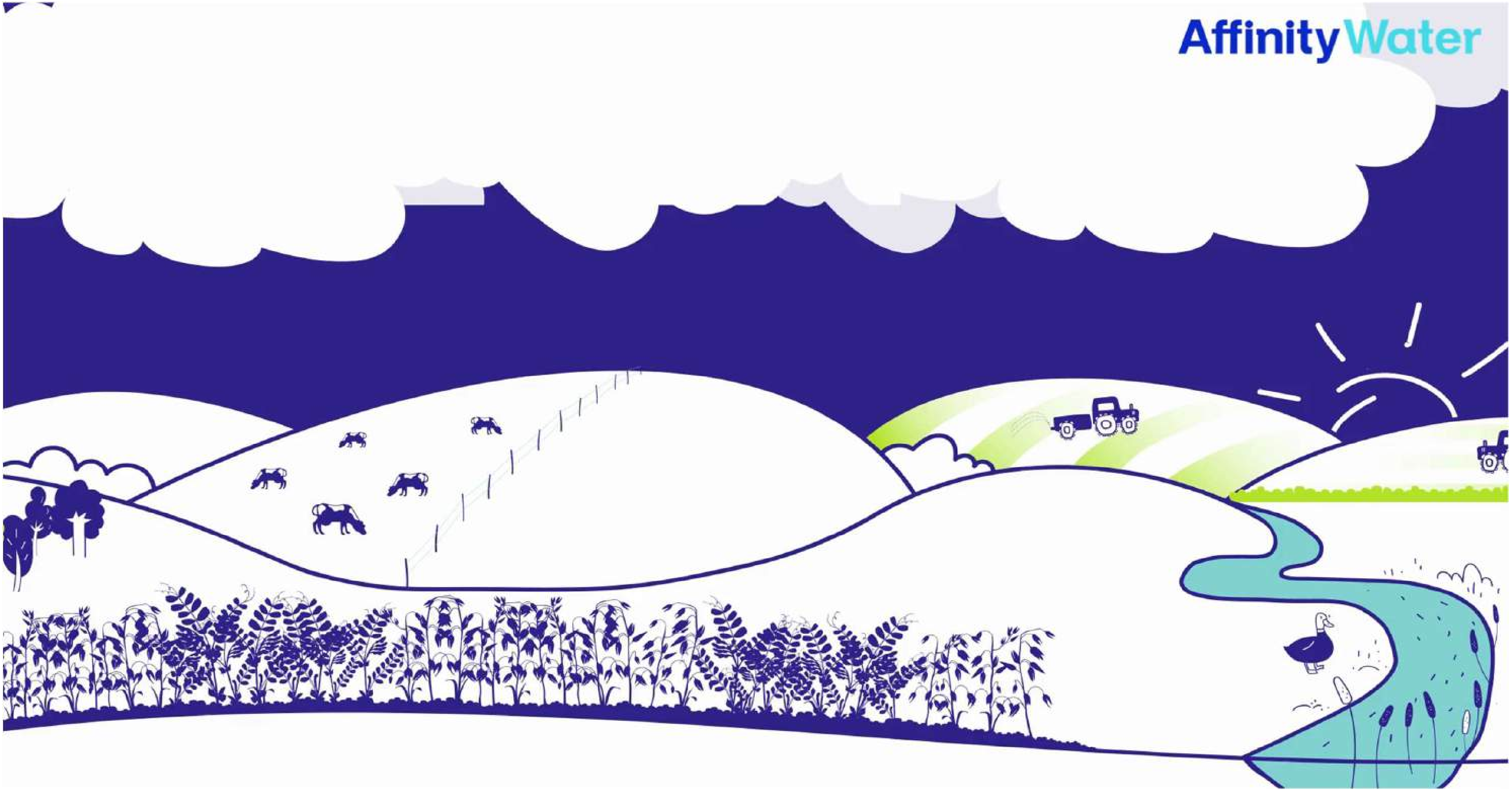


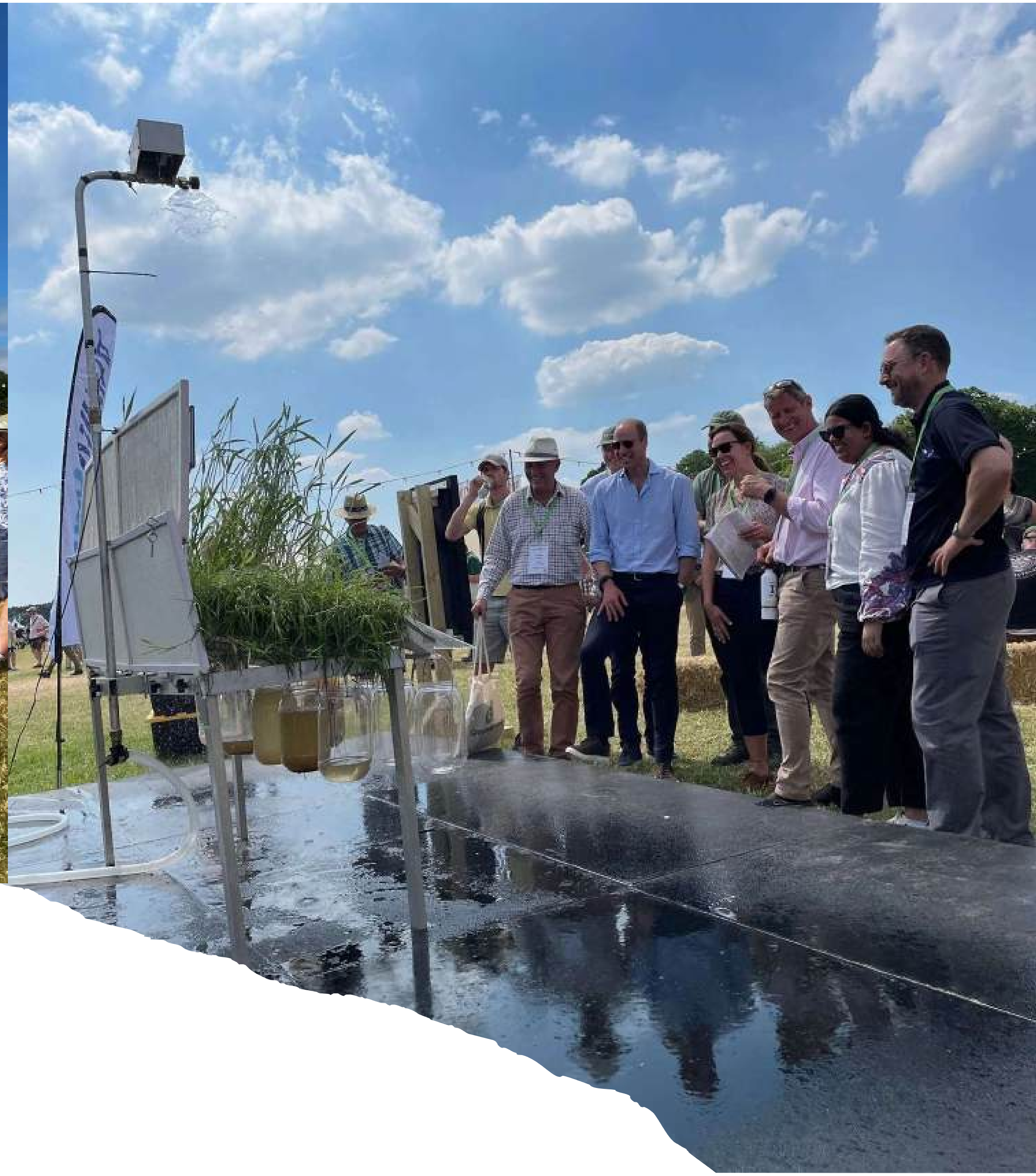
- Two tests have been carried out
- Catherine Bourne connection to North Mymms source which is 2.8km away. Tracer arrived in 20.75 hours and had a velocity of **136m per hour**
- CB also connected to Essendon 10km away and this was even quicker at **153m per hour** velocity
- **Water End was not connected to North Mymms** and karst GW does not appear to travel in SE direction
- Water End swallow holes are connected to our Essendon source 7km away with a velocity of **232m per hour**

Vital Data for shaping a catchment funding scheme

AffinityWater

Why focus on soil health?





Rainfall simulator and

soil health demonstrations

Funding Options available to farmers since 2021
Upper River Colne, Mimmshall Brook and Essendon

Overwinter cover crops

Alternative Break Crops to OSR and Beans

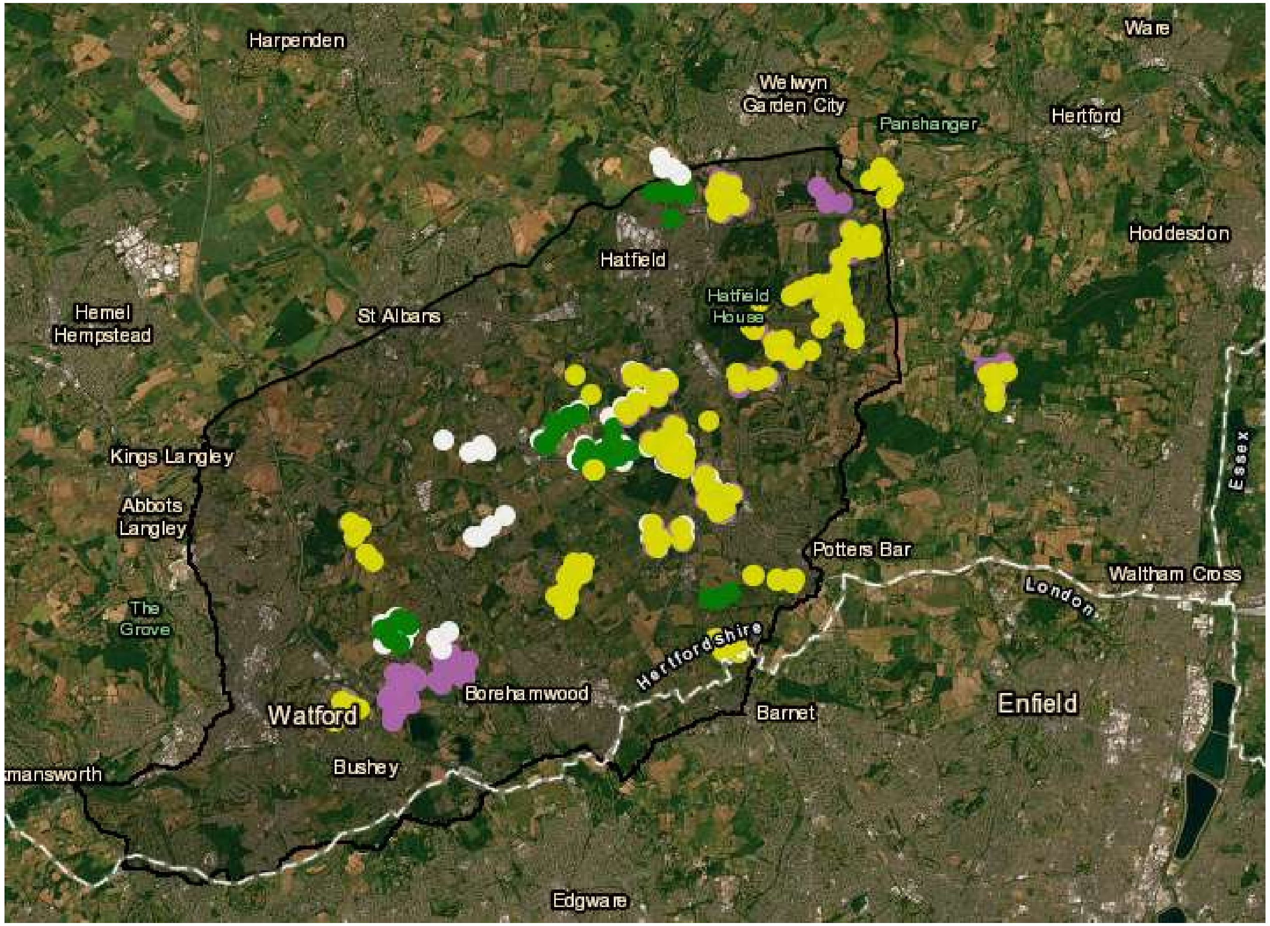
Companion cropping OSR

Full Year Cover crops

Scheme options all either eliminate propyzamide use or are backed up by trials showing a reduced risk

Soil & Water Innovation Fund (up to £15K grant)

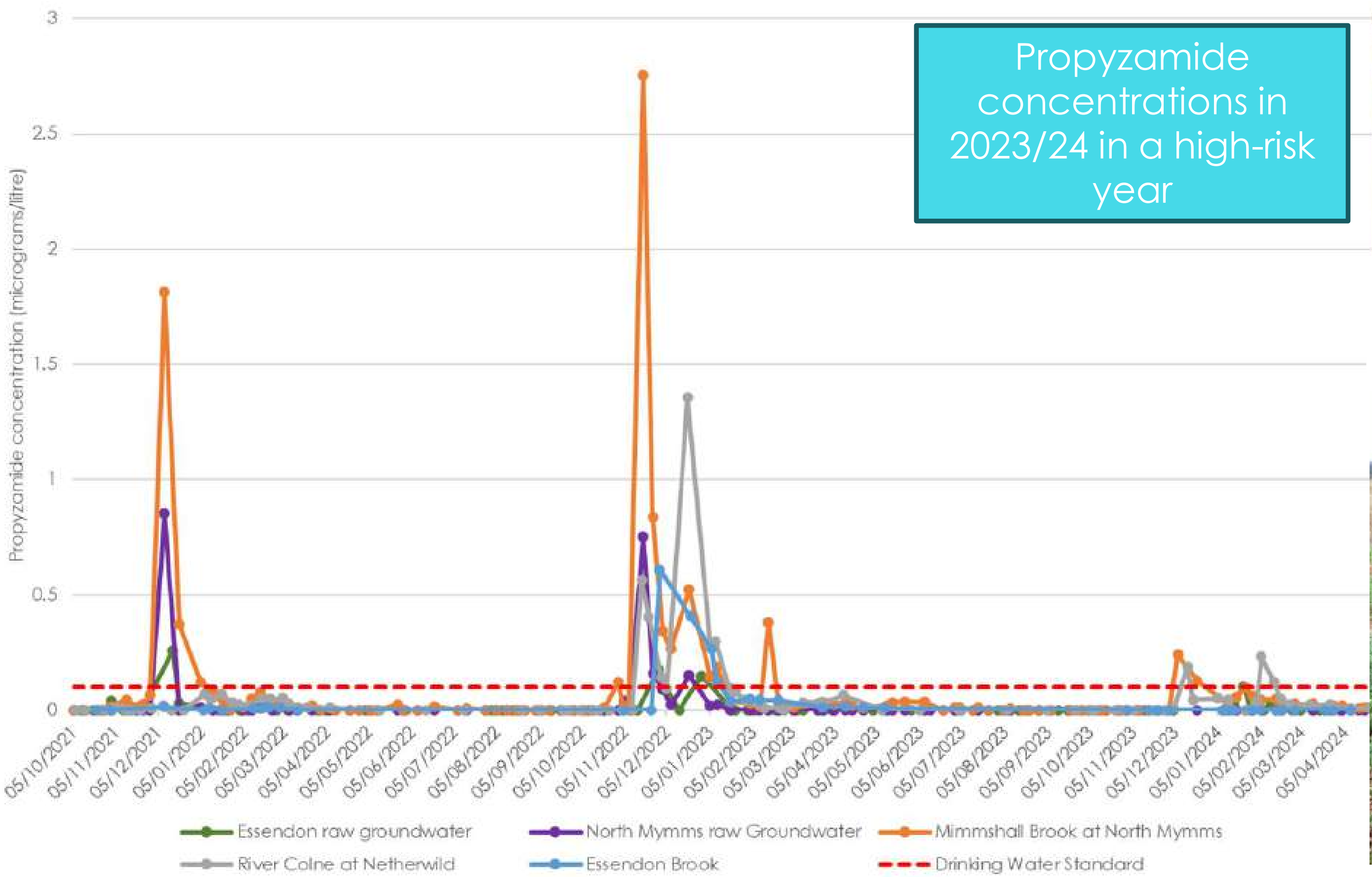
Upper Colne, Mimmshall Brook and Essendon scheme



2023/24 season

- Over 380ha overwinter cover crops & farmers switched to spring crops across Mimmshall Brook, Essendon and Upper Colne
- 228ha oilseed rape companion cropped
- Including 170ha of companion crops in Radlett and Upper Colne did not have propyzamide applied due to low blackgrass pressure
- 26ha year long cover crops and 1 year grass ley in Mimmshall Brook
- Over 600ha land influenced by scheme in 2023/24
- Scheme is run through an online application form (in-house) in 2024/25

Propyzamide concentration in raw surface water and groundwater



Propyzamide concentrations in 2023/24 in a high-risk year

AffinityWater


Thank you, any questions?

Colne Valley Sewerage History and Overview

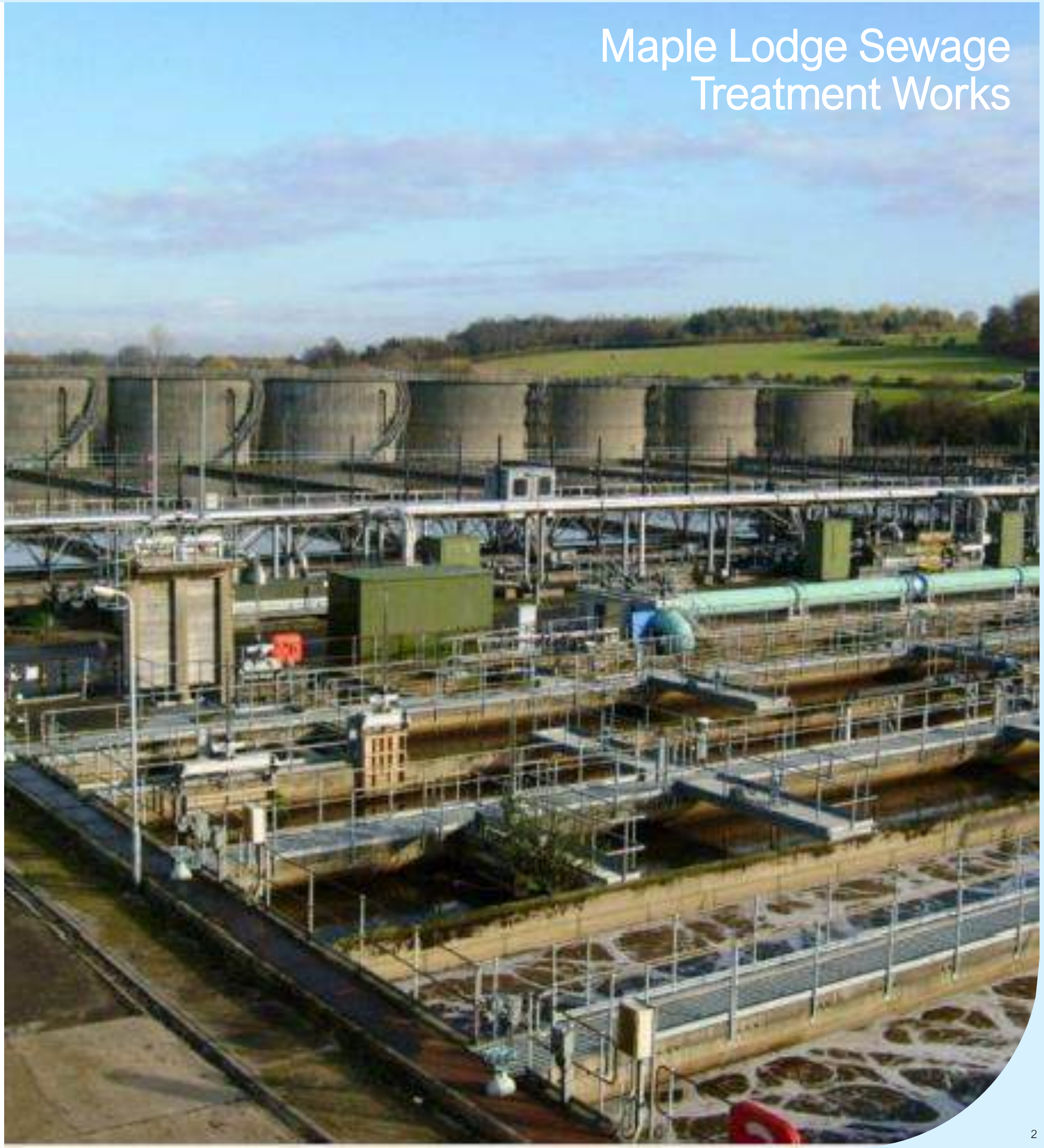
David Harding

October 2024

Colne Valley Sewerage

Contents

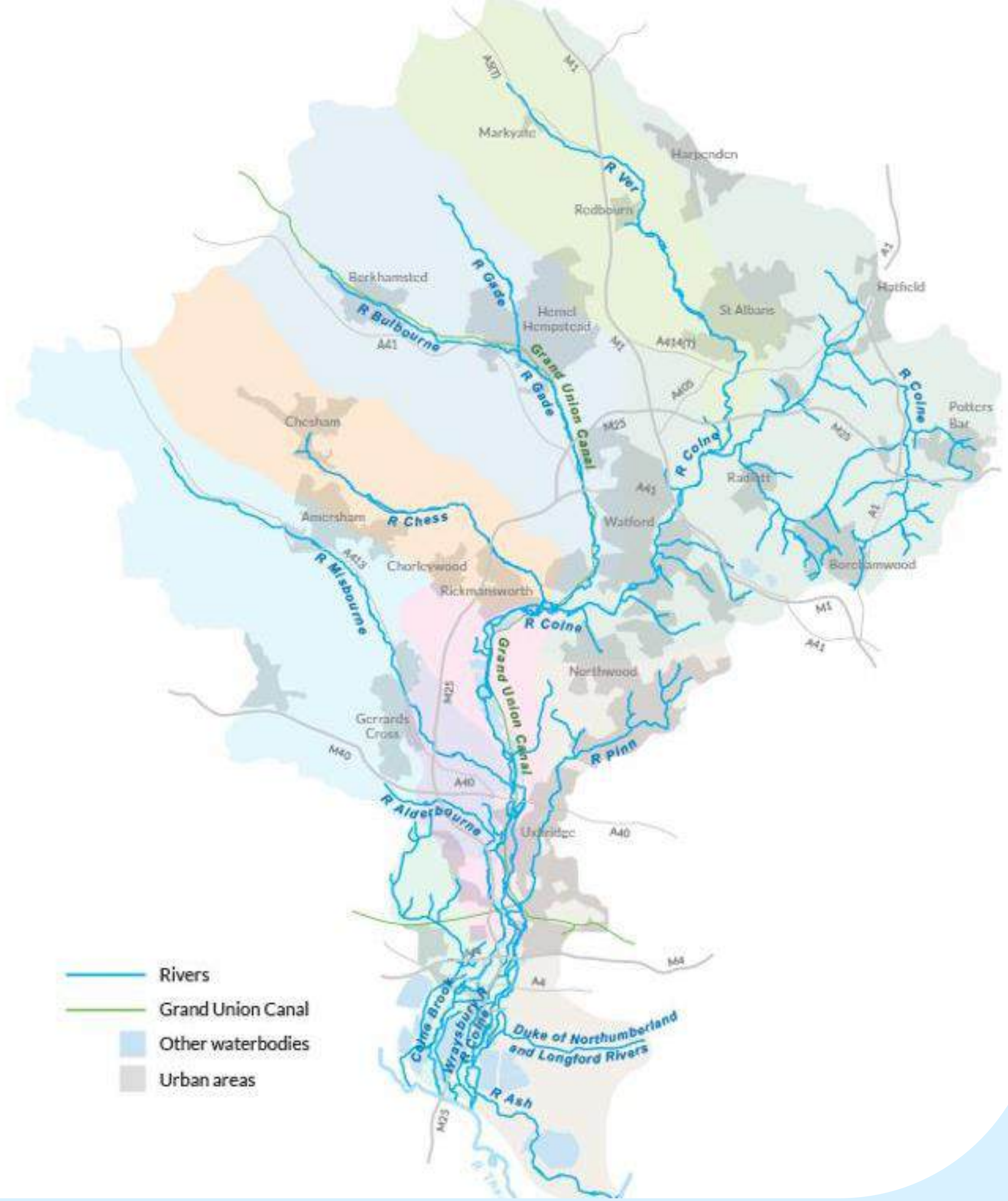
1. Background
2. Timeline of Colne Valley Sewerage Scheme
3. Overview of the scheme
4. The system today
5. Groundwater and sewers
6. Infiltration management



Background

Sewerage in the Colne Valley

- Historically, development has always been intertwined with the Colne and its tributaries
- During the interwar period there was intensive development in the Colne valley
- This led to the overloading of local sewage treatment works and the proliferation of septic tanks and cesspools
- In 1938, Colne Valley Sewerage Board began constructing the Colne Valley Sewerage Scheme, to collect the sewage from much of the area, and treat it at a single location



Colne Valley Sewerage

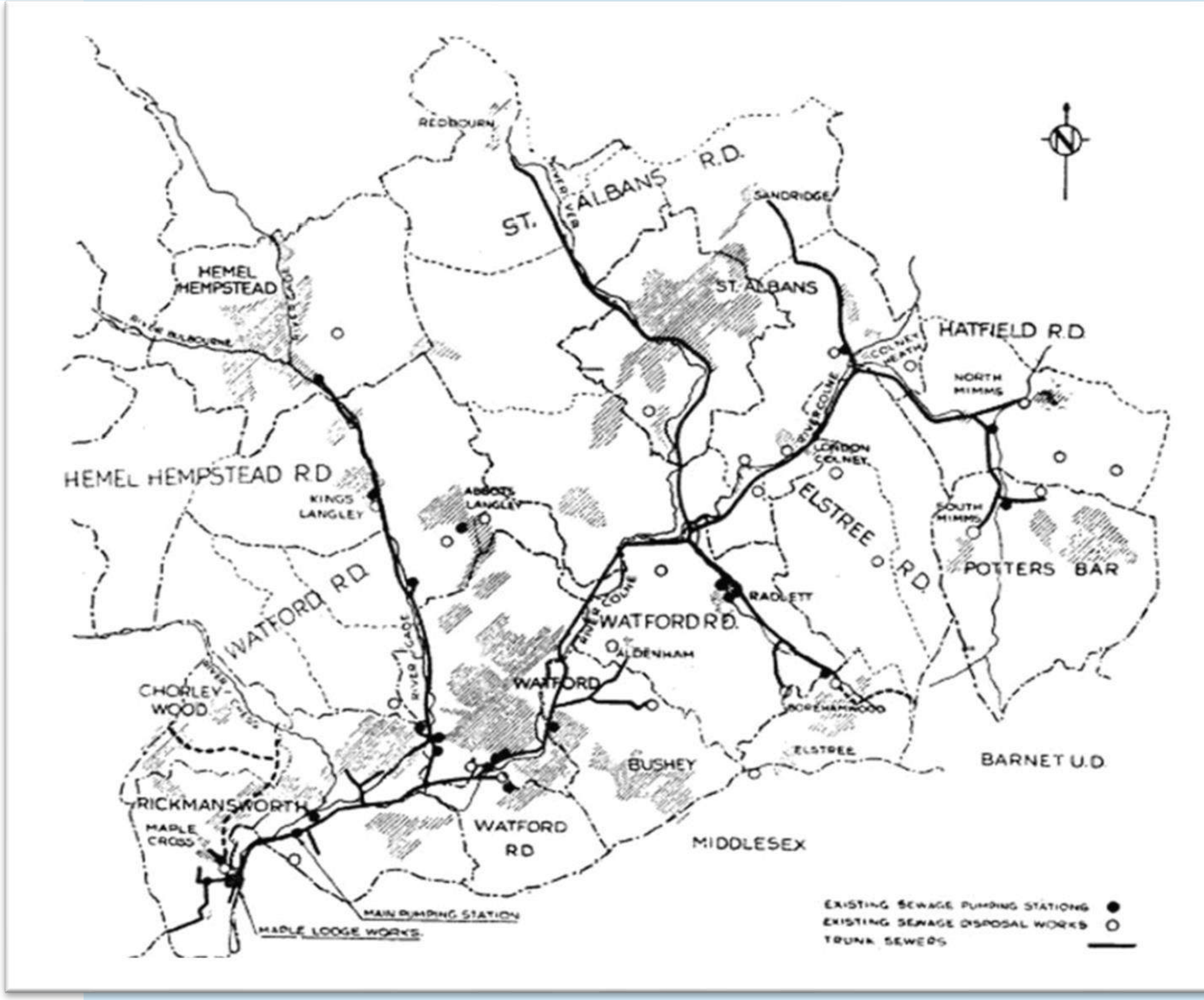
Timeline

- 1934 Greater London Drainage Report proposes a regional scheme
- 1935 Hertfordshire County Council starts to promote the scheme
- 1937 Colne Valley Sewerage Act gains Royal assent
- 1938 construction starts
- 1946 construction resumes
- 1951 Maple Lodge Sewage Treatment Works goes online

Colne Valley Sewerage Act

Areas fully or partially served

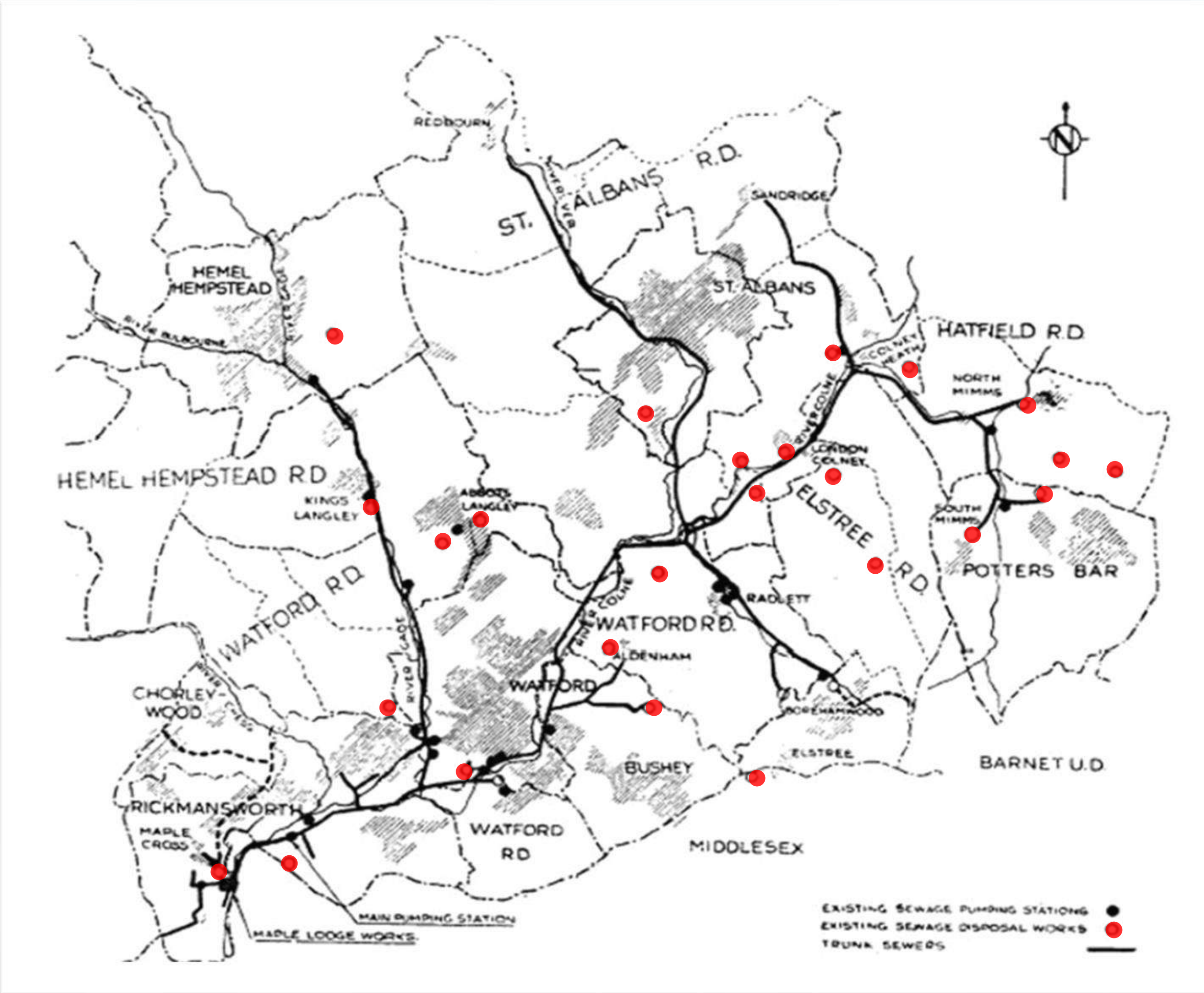
- St Albans
- Hatfield
- Potters Bar
- Barnet
- Watford
- Bushey
- Hemel Hempstead
- Chorleywood
- Berkhampstead
- Tring
- Rickmansworth
- Chesham
- Amersham



Colne Valley Sewerage Act

Initial scheme 1937

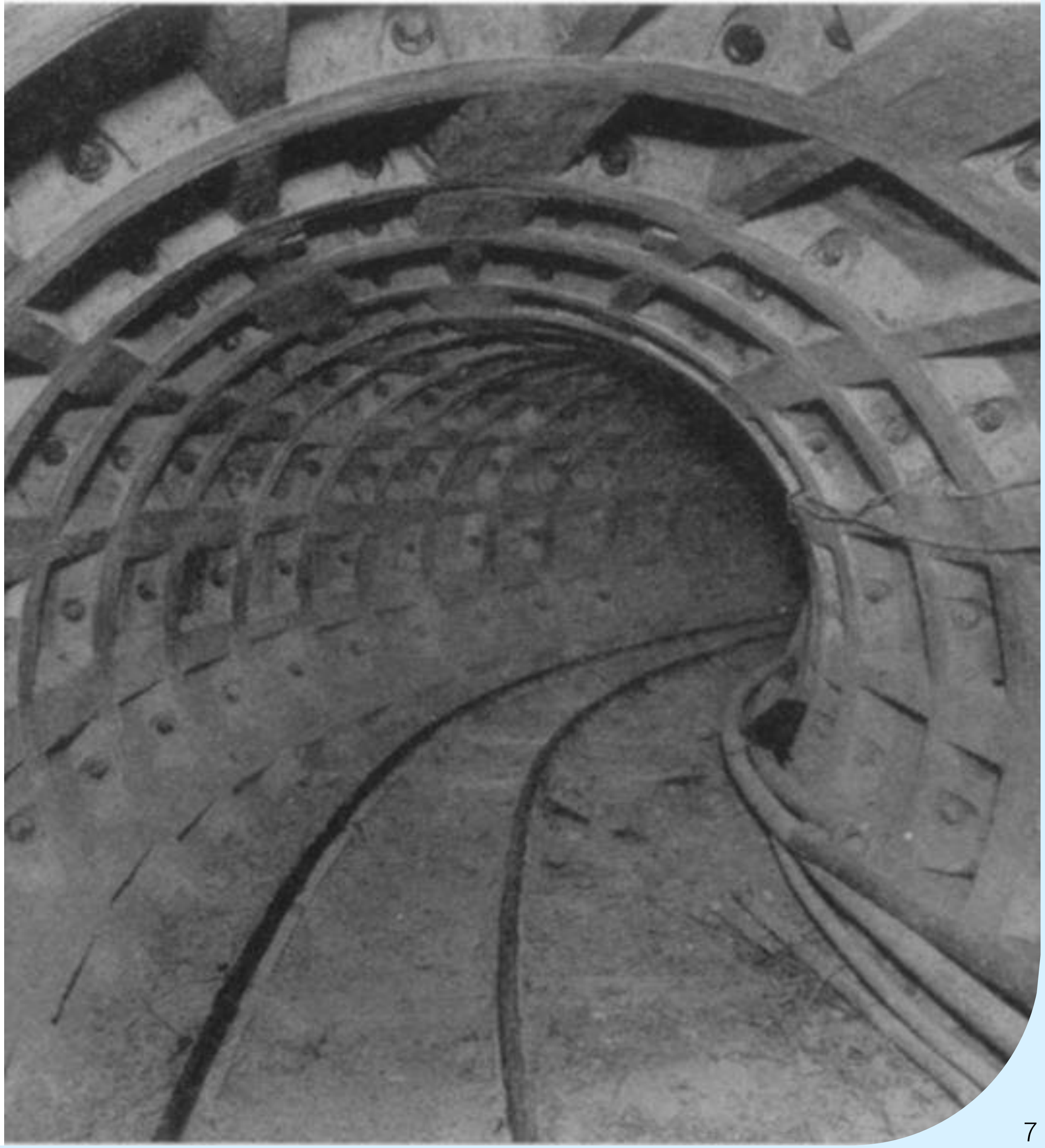
- Population in 1936 **220,000**
- Trunk sewers were designed for a 1965 population of **500,000**
- There were around 30 sewage treatment works in the scheme area (red dots mark the main ones)
- Some were located in the river valleys and sewage gravitated to them
- Others were located on higher ground and received pumped flows
- Some local works were retained
- The scheme was designed so that all flows to be intercepted, could drain to the trunk sewers via gravity



Colne Valley Sewerage Act

Trunk Sewers

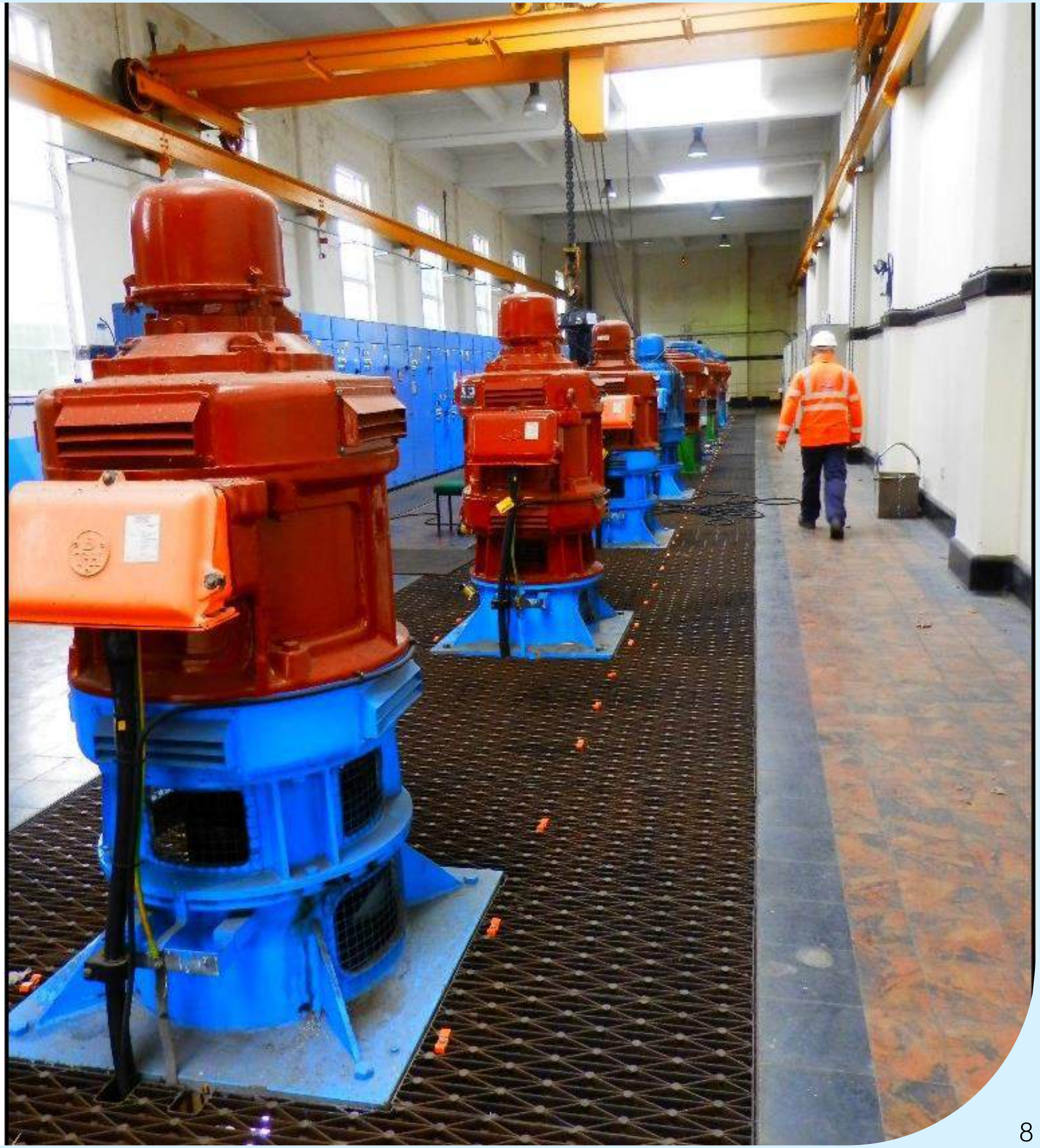
- 55 miles (90 Km) of trunk sewers
- Diameters from 15” to 75” (380mm to 1.9m)
- Trunk sewers largely follow the course of rivers and the natural gradient of the valleys
- The ground was saturated gravels or chalk
- Smaller sewers were spun concrete or iron
- Larger sections were tunnelled, initially using segmented cast iron blocks, lined with reinforced concrete
- Postwar tunnels employed precast concrete segments, a technique first used to build air raid shelters during the war



Colne Valley Sewerage Act

Pumping Stations

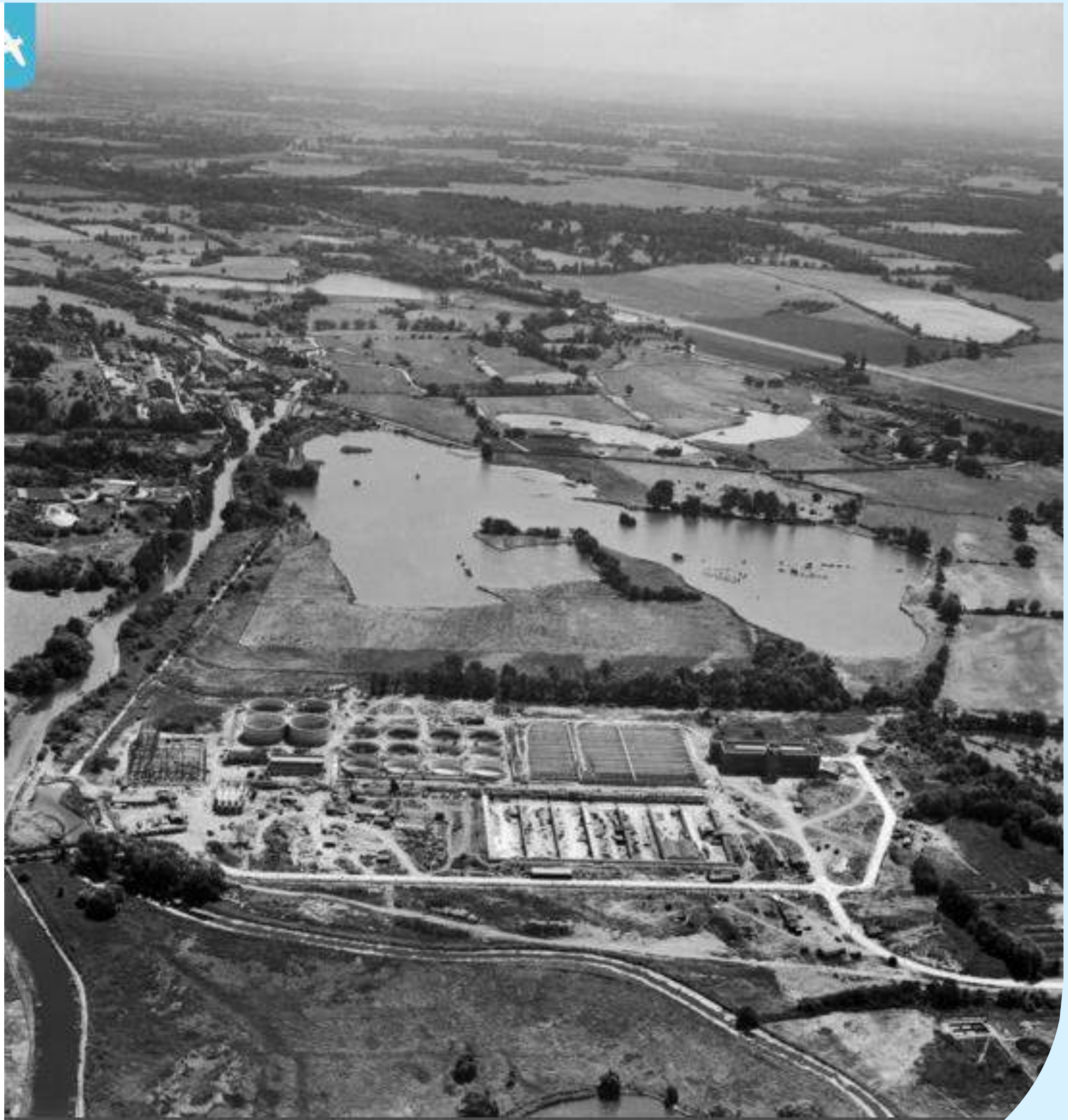
- The trunk sewers deliver flows by gravity, to the vicinity of Maple Lodge treatment works
- However, the works is surrounded by lakes, a river and a canal
- Continuing the trunk sewers to the works would have involved multiple river crossings and high groundwater
- To avoid laying gravity sewers in these conditions, it was decided to pump flows the final distance
- There are three “terminal” pumping stations:
  - ➢ Juniper Hill, which serves the Eastern area
  - ➢ West Hyde, which serves the Western area
  - ➢ Maple Cross, which serves Chorleywood and Maple Cross village



Colne Valley Sewerage Act

Maple Lodge Sewage Treatment Works

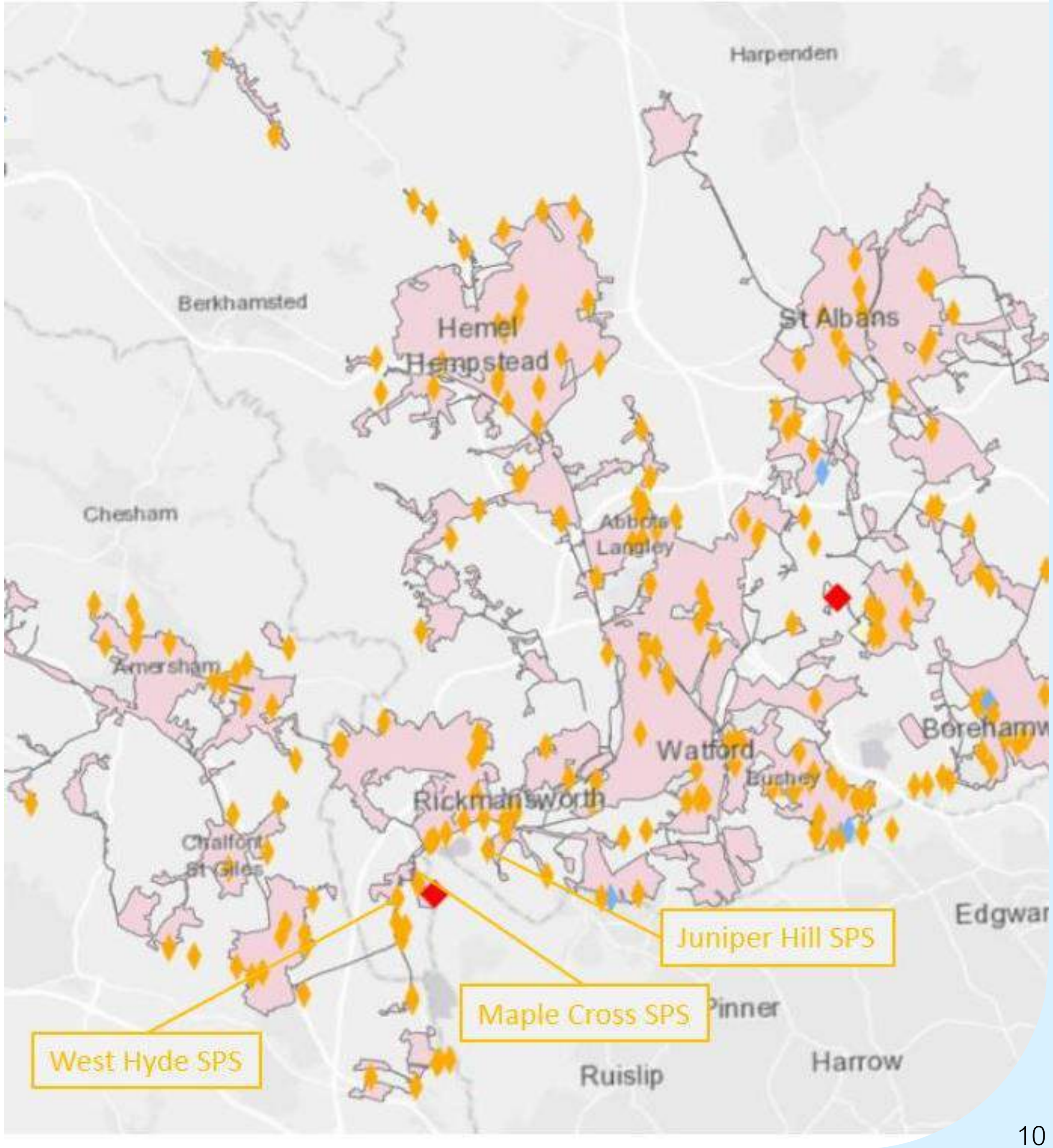
- Work started in 1938 and paused in 1940
- Resumed 1946, employing 500 German prisoners of war
- Completed 1951
- All tanks above ground, due to groundwater
- First use of dual-fuel engines to generate electricity from biogas



www.britainfromabove.org.uk/image/EAW024490

The System Today

- Current population equivalent Maple Lodge: 559,430
- Several trunk sewers have been duplicated
- Blackbirds STW built in 1974, to return flows to the Upper Colne
- Flow is pumped from the “C-Line” trunk sewer, at Drop Lane pumping station
- It is treated and discharged to the Colne
- Current population equivalent Blackbirds: 81,043



Groundwater and Sewers

Groundwater Infiltration

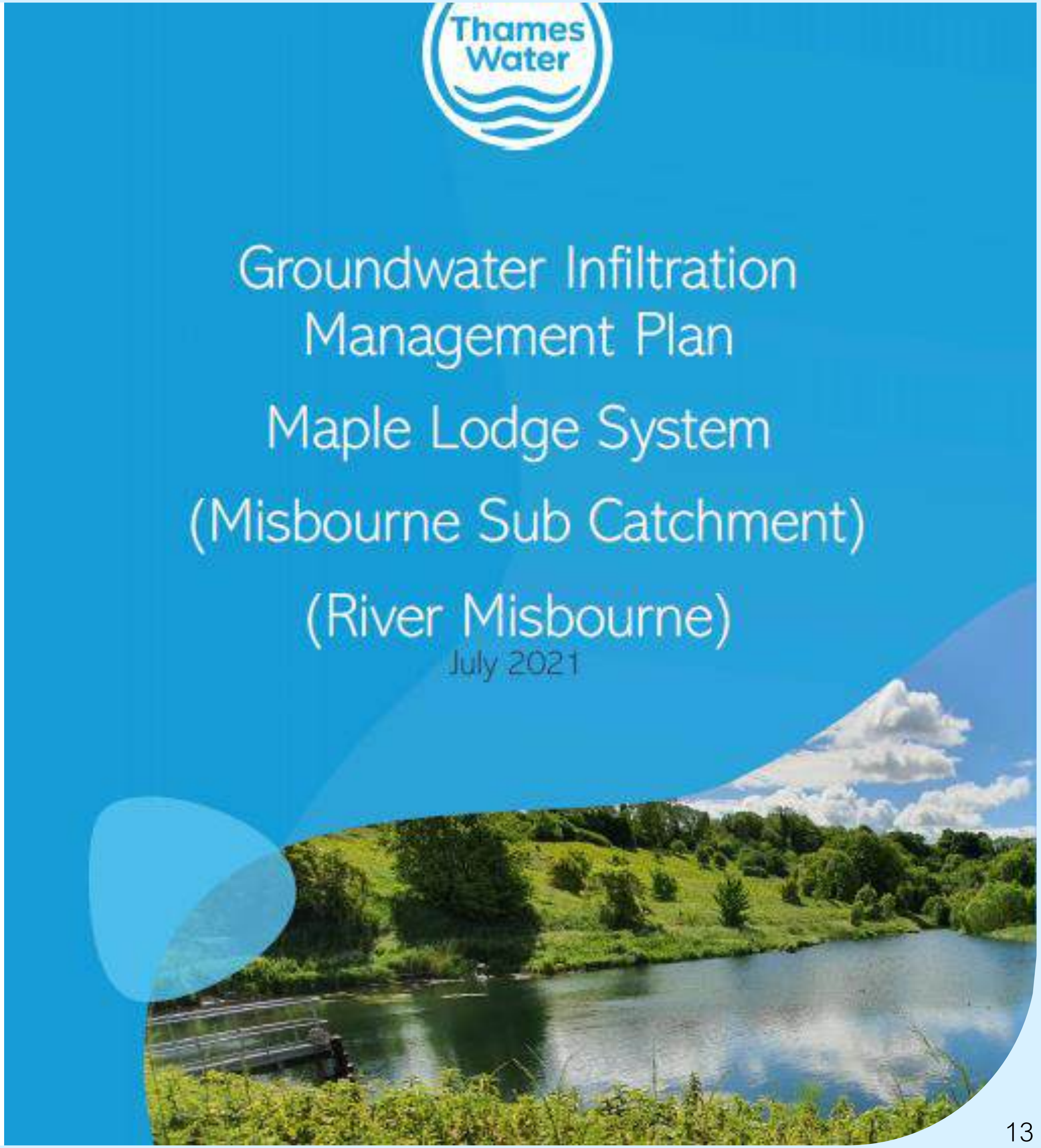
- Groundwater exerts significant hydraulic pressure on underground structures and will infiltrate through joints and even minor defects
- Gravity sewers and chambers are vulnerable to infiltration, even when new
- In high groundwater, sewers and treatment works can become overloaded, leading to flooding and prolonged storm discharges
- Last Winter, Maple Lodge received 1 billion litres of additional flow per week
- Increasing system capacity only admits more groundwater
- The only solution is to manage infiltration
- This is very costly and disruptive, so must be carefully targeted

Pressure Grouting of Manhole Shafts – before and after

Long Term Plans

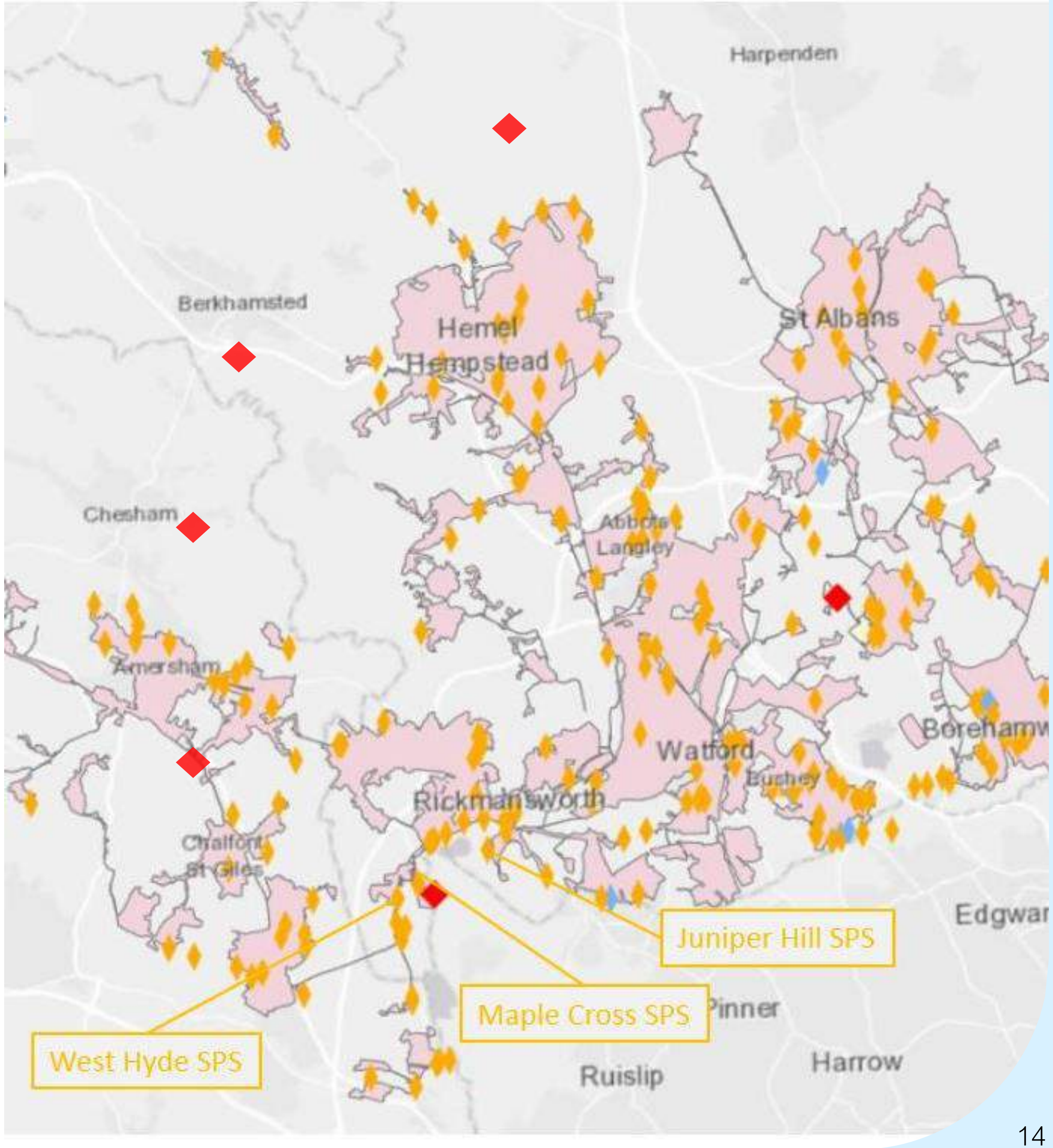
GISMP

1. Ongoing programme of monitoring and targeted interventions
2. Identifying and prioritising areas of significant ingress
3. Targeted sealing of system against groundwater ingress and river inundation
4. Updated annually
5. Data collection starts in each May
6. There are 54 GISMPs across the Thames region (out of 353 sewage catchments)



GISMPs in Colne Catchment

- Chesham
- Misbourne Valley
- Berkhamstead
- Markyate



Thank you

Integrating citizen science in catchment management: the River Chess

Hannah Parry-Wilson
Citizen Science Co-Ordinator
Chilterns Chalk Streams Project

River Chess Smarter Water Catchment

Chilterns National Landscape

Chess Smarter Water Catchment

River Chess Smarter Water Catchment

Chilterns National Landscape

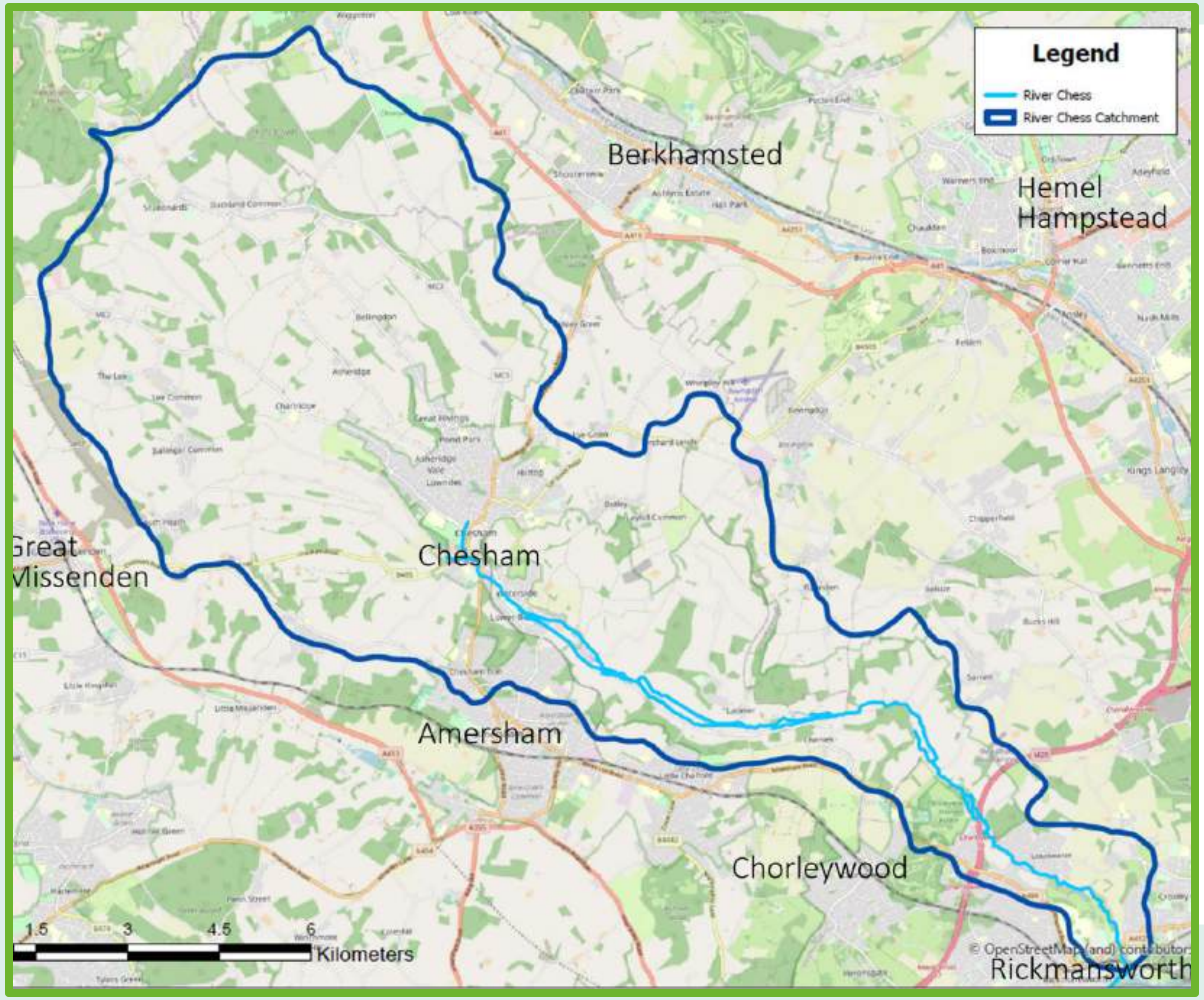
Each catchment has developed a 10-year plan to use a ‘catchment-based approach’ with aims to use an evidence-based, partnership-led methodology to:

- Protect and enhance the environment
- Prioritise partnership objectives
- Embed our approach into water industry planning

Working in partnership

Thames Water · The River Chess Association · Chilterns Chalk Streams Project · Chilterns Conservation Board · Chiltern Society · Buckinghamshire Council · Environment Agency · Affinity Water · Herts & Middlesex Wildlife Trust · Queen Mary University of London

Chess Smarter Water Catchment



Only ~**320** chalk streams in the world; over **200** of these are in England.

Chalk streams have **endemic** invertebrate species found nowhere else.

Little Chess / main River Chess channel **split** after Chesham and **confluence** between Sarratt watercress beds.

Why do citizen science and what are our key aims?

Smarter Water Catchment citizen science provides evidence to support:

- Improvements to water quality
- Improvements to physical habitats
- Increasing biodiversity

River Chess Smarter Water Catchment

Chilterns National Landscape

The story so far…

60 registered Chess citizen scientists:

- Around 41 routinely surveying
- Up to 8 survey types per person

1. Improving water quality
    - Water quality sensors and dashboard
    - Flow monitoring
    - MudSpotter
    - Emerging contaminants
    - NOSES

4. Improving wildlife corridors
    - Modular River Survey (MoRPH)
    - Riverfly (as part of Chilterns Chalk Streams Project)
    - SmartRivers
    - Water vole monitoring
    - Tracking the Impact (birds, butterflies, plants)
    - Ponds in the Chess Catchment

5. Involving people
    - Social events
    - Monthly e-newsletter
    - Citizen Science Portal

River Chess Smarter Water Catchment

Chilterns National Landscape

Water quality sondes

River Chess: six sondes

xylem

PROTEUS

eureka

Measuring:

- Temperature
- pH
- Dissolved Oxygen
- Conductivity
- Turbidity
- Ammonium
- Ammonia
- Nitrate
- Tryptophan
- COD
- BOD

Calibrations conducted:

Every month:

- Eureka sondes x2
- Ammonium sensors for Xylem & Proteus sondes

Every quarter:

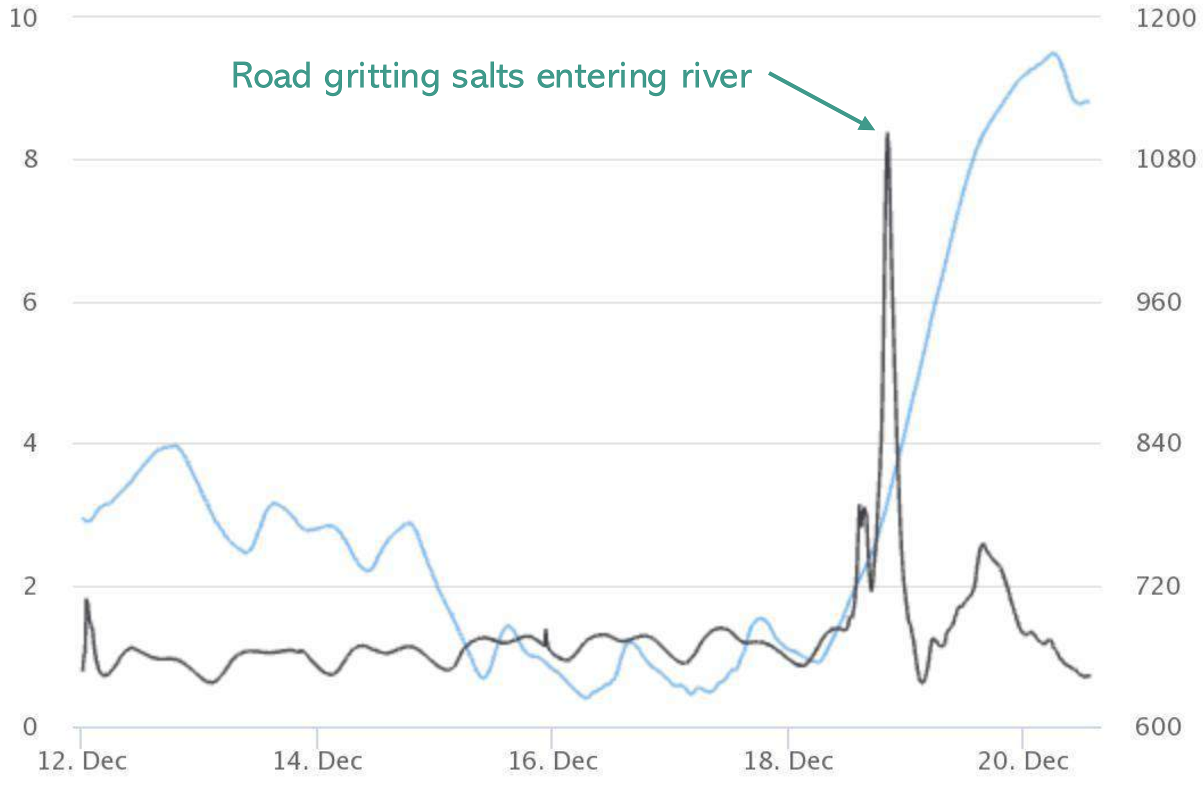
- Xylem sondes x2
- Proteus sondes x2

River Chess Smarter Water Catchment

Chilterns National Landscape

What have we used the sensors for?

Monitoring weather-related events



River Chess Smarter Water Catchment

Chilterns National Landscape

What have we used the sensors for?

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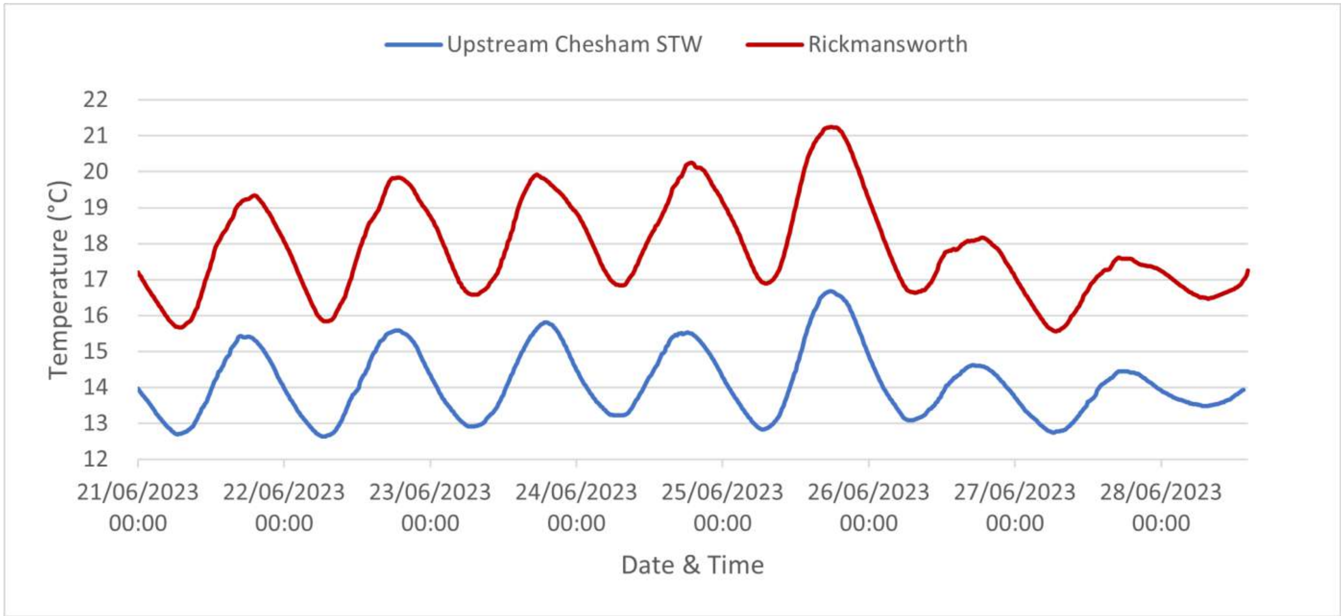
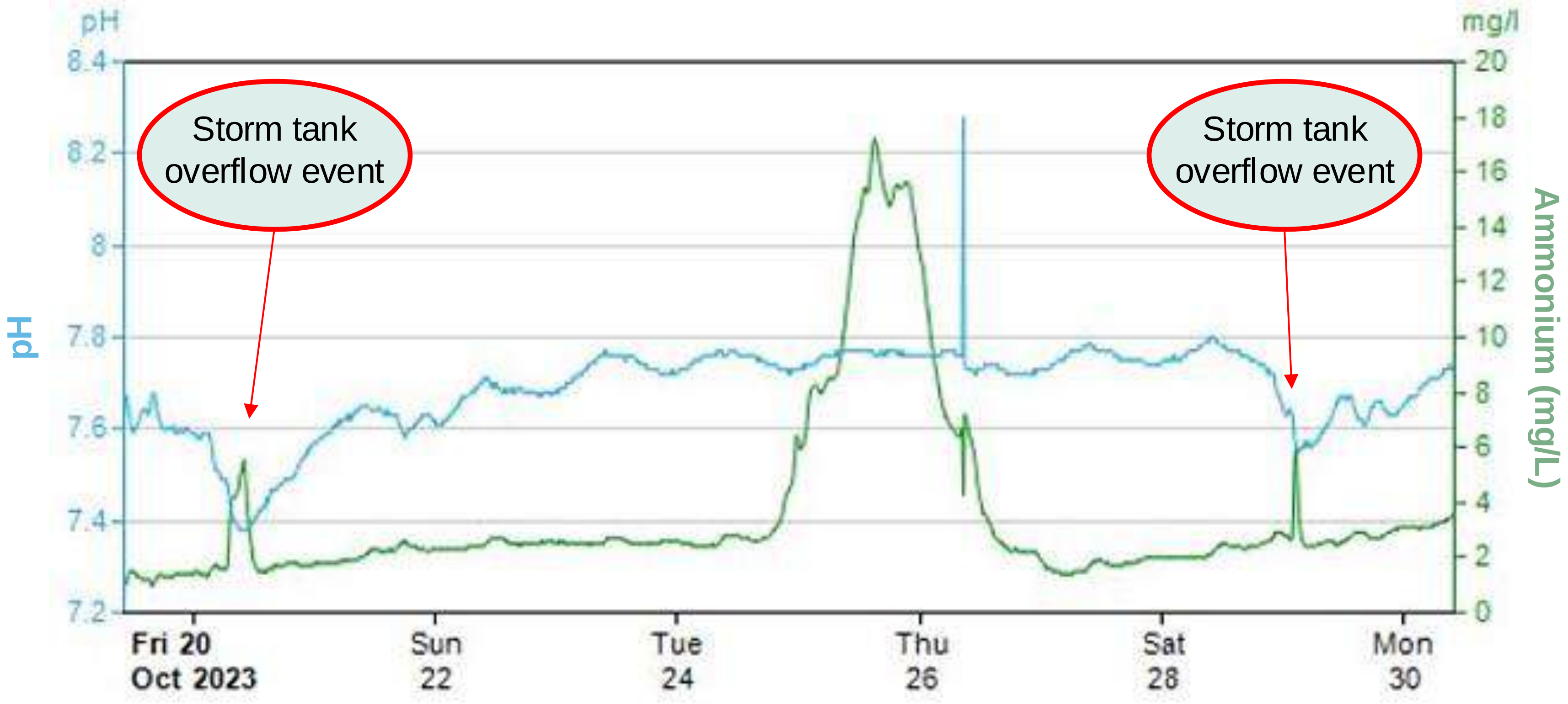


Chalk stream water temperatures should emerge from the underlying aquifer at 10°C

What have we used the sensors for?

Ammonia treatment issue at sewage treatment works

Sonde at Restore Hope Latimer, downstream of the sewage treatment works outfall.



Thames Water quick to respond to our queries.

One of the sewage treatment works dissolved oxygen probes had malfunctioned and created a false reading for the system.

System believed there was enough dissolved oxygen and did not call for additional blowers to run, resulting in elevated ammonia.

Issue rectified on the 25th October.

River Chess Smarter Water Catchment

Chilterns National Landscape

How are citizen scientists involved?

Water Quality Data Dashboard – open access data

Data dashboard continues to be managed by citizen scientist Hefin Rhys, with additional functionality added recently.

River Chess Smarter Water Catchment

Chilterns National Landscape

Sediment studies

Why is fine sediment a problem?

- Fine sediment **infills gravels** and prevents exchange of ground and surface water
- A coating of fine sediment **smothers the riverbed**, preventing fish from finding suitable areas to lay eggs, and aquatic plants from taking root
- Fine sediment **carries pollutants** such as metals and hydrocarbons from urban runoff
- Fine sediment **lowers oxygen levels** in the spaces between gravels preventing fish eggs from developing

Sediment studies

ROTHAMSTED RESEARCH

Question: Where is the sediment coming from in the catchment?
Method: Sediment source apportionment

Question: At which locations is the sediment entering the river?
Method: Citizen science, MudSpotter

Queen Mary University of London

Question: What impact is the sediment having on ecology?
Method: Desktop & field analysis cf. ecological data

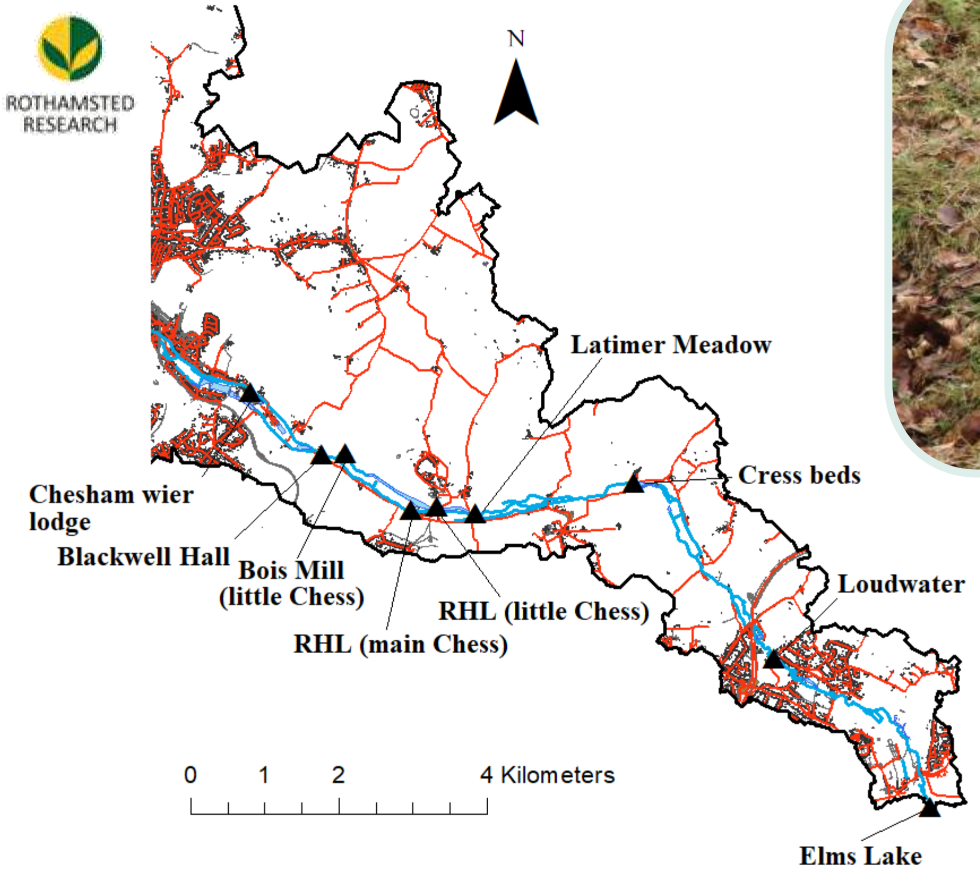
APEM/

River Chess Smarter Water Catchment

Chilterns National Landscape

Suspended sediment traps

12-month research study looking at sediment mass



Suspended and channel bed sediment sampling locations.

River Chess Smarter Water Catchment

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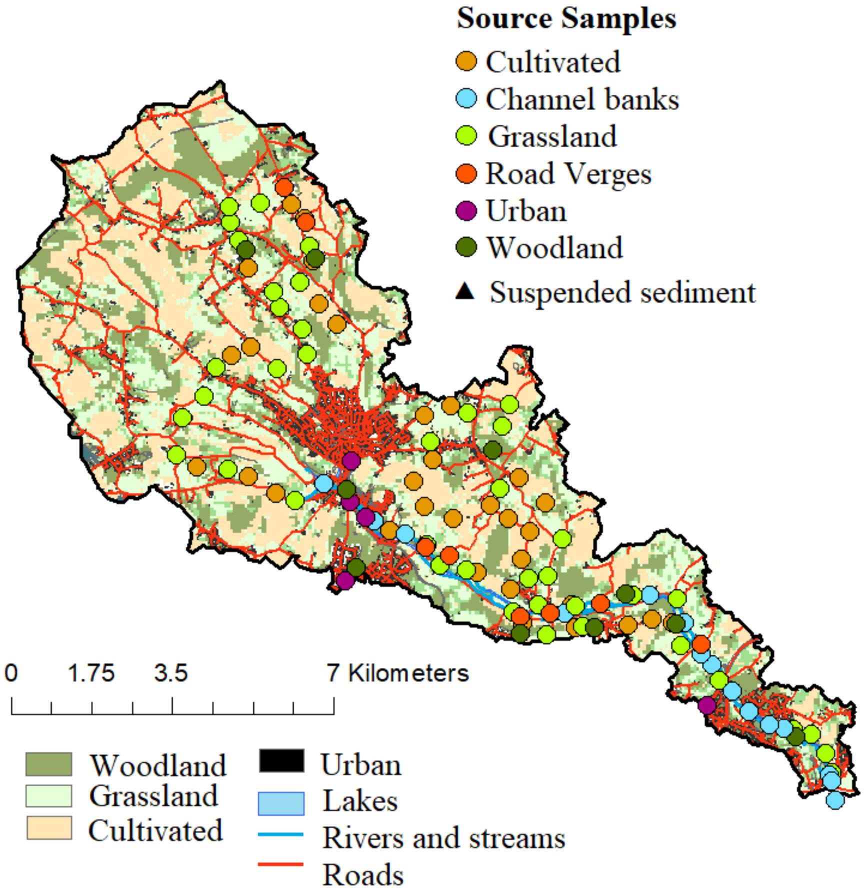
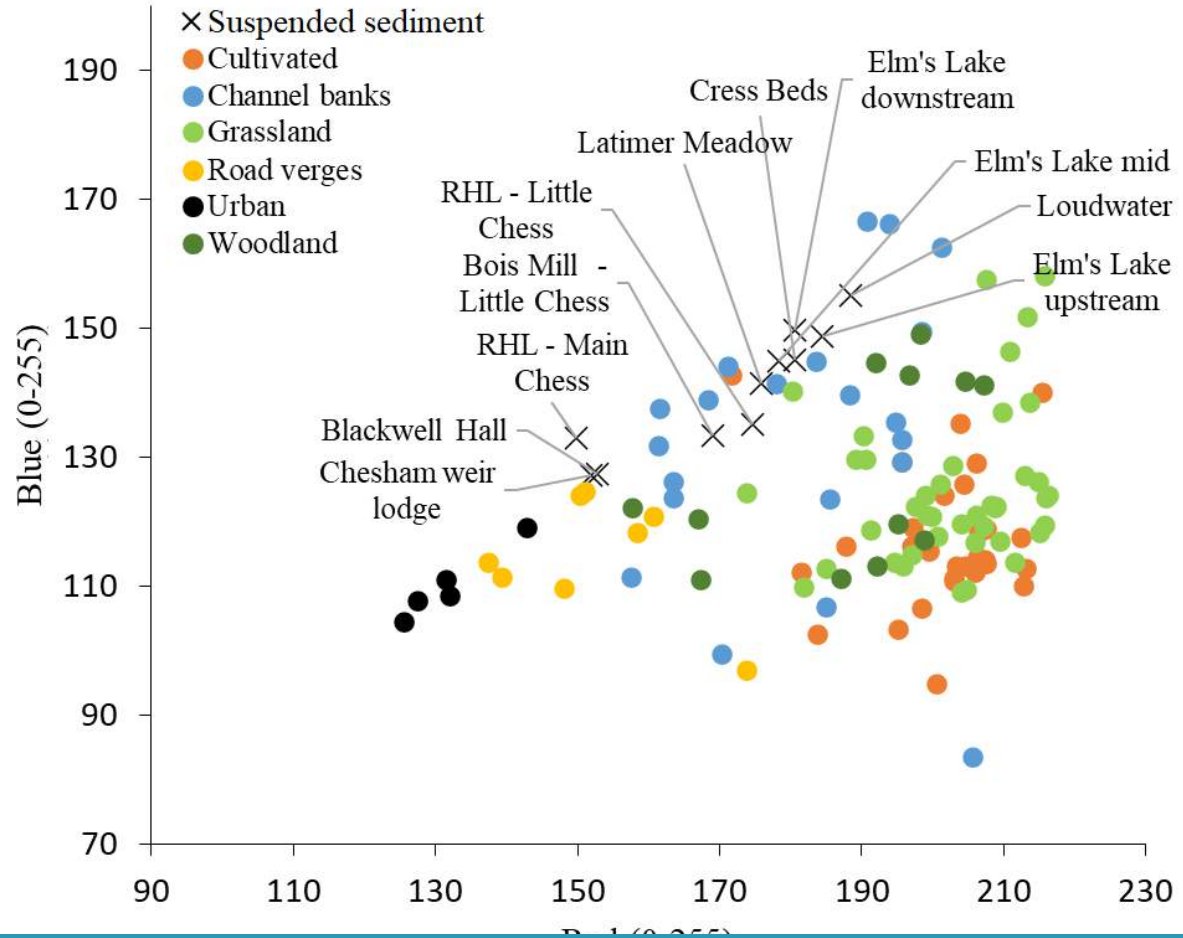
Suspended studies

Rothemstead Research Group

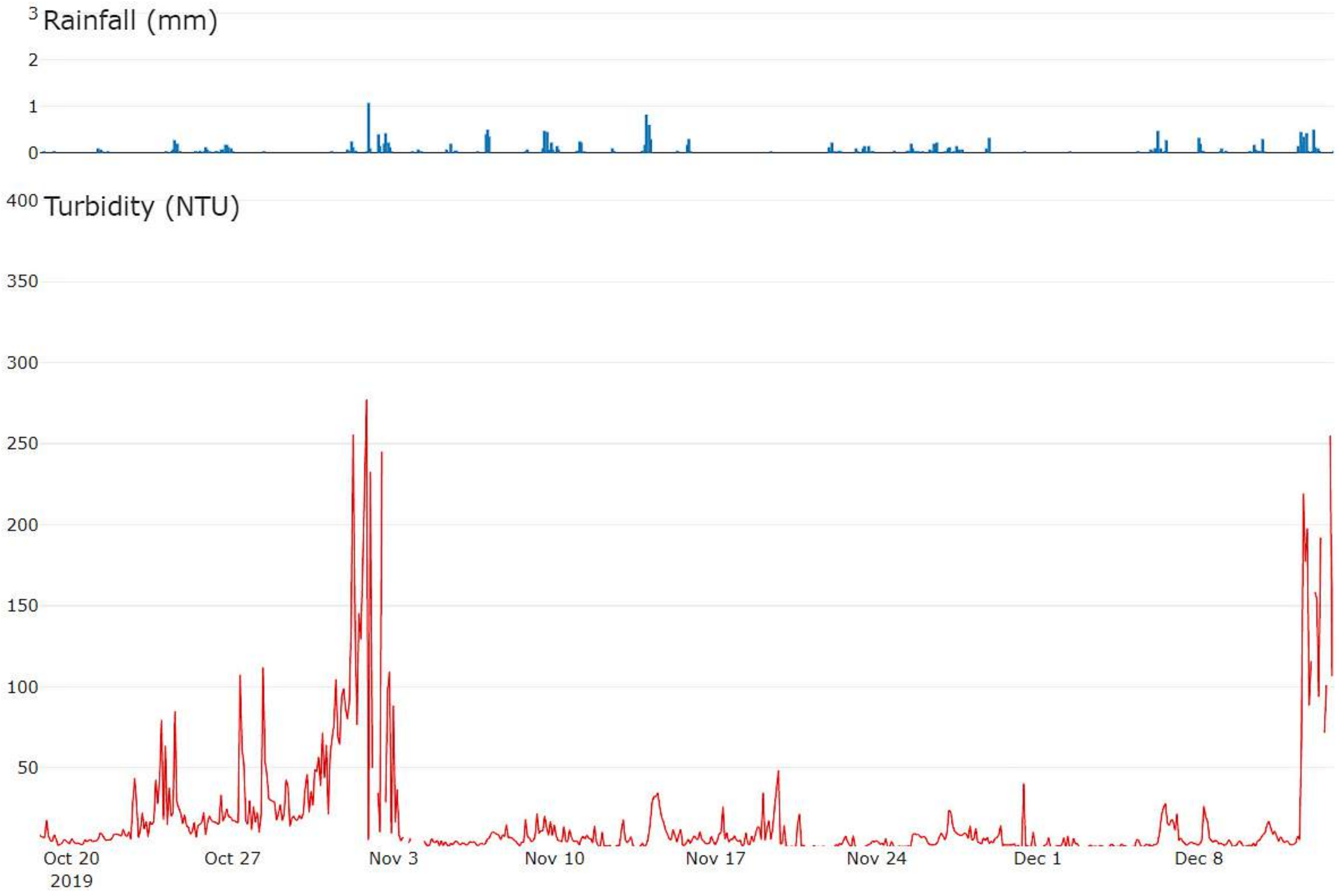




Moderate (<50%) contributions of sediment from urban road dusts in the most upstream reaches, with channel banks the dominant source of sediment throughout the rest of the River Chess. Improving flow may mitigate siltation issues.

Impacts of rainfall

Water quality sondes and Chenies rainfall data



Sonde downstream of Chesham at Blackwell Hall is showing patterns of high sediment density after rainfall events.

Confirming lots of sediment coming into river in Chesham during wet weather spells.

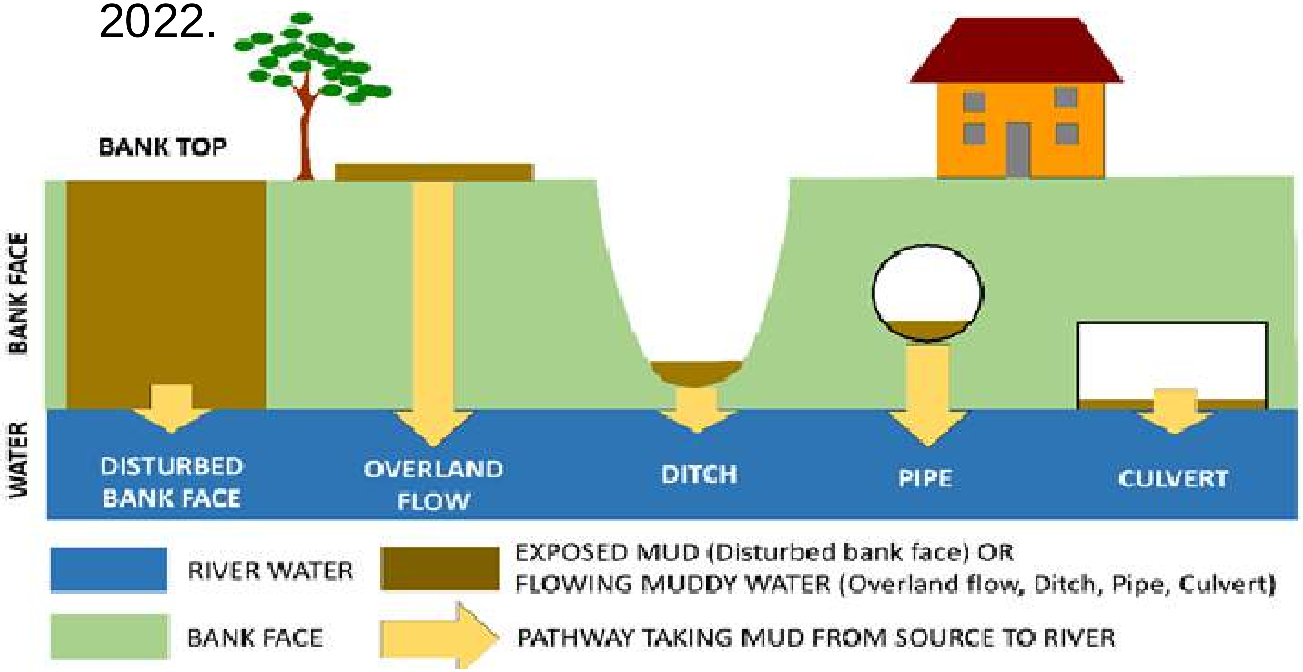
River Chess Smarter Water Catchment

Chilterns National Landscape

What is MudSpotter?

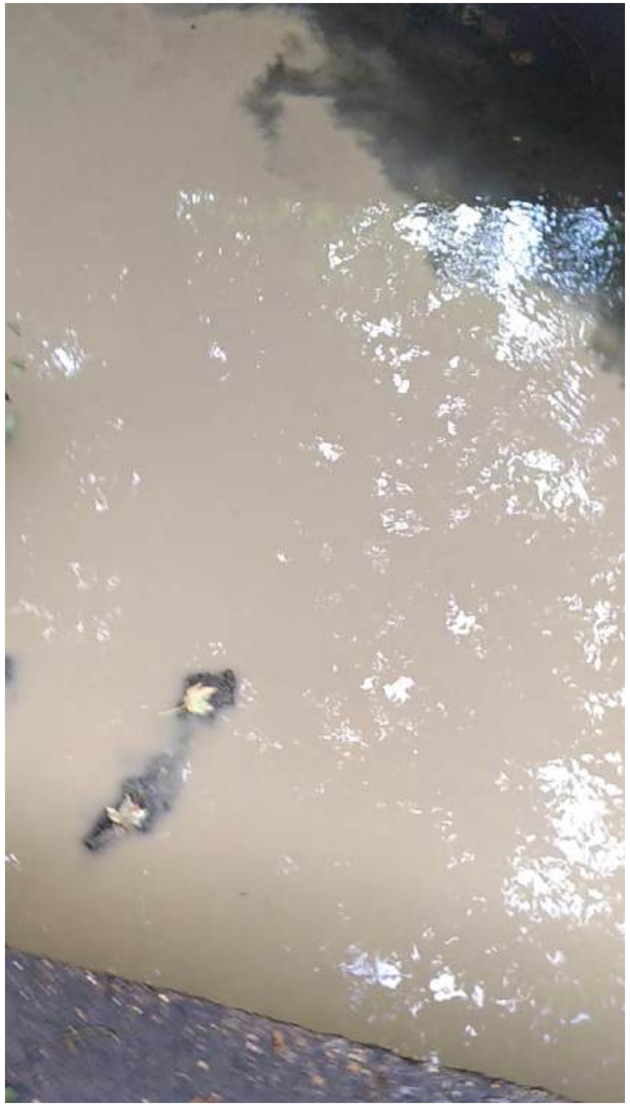
Citizen science surveys

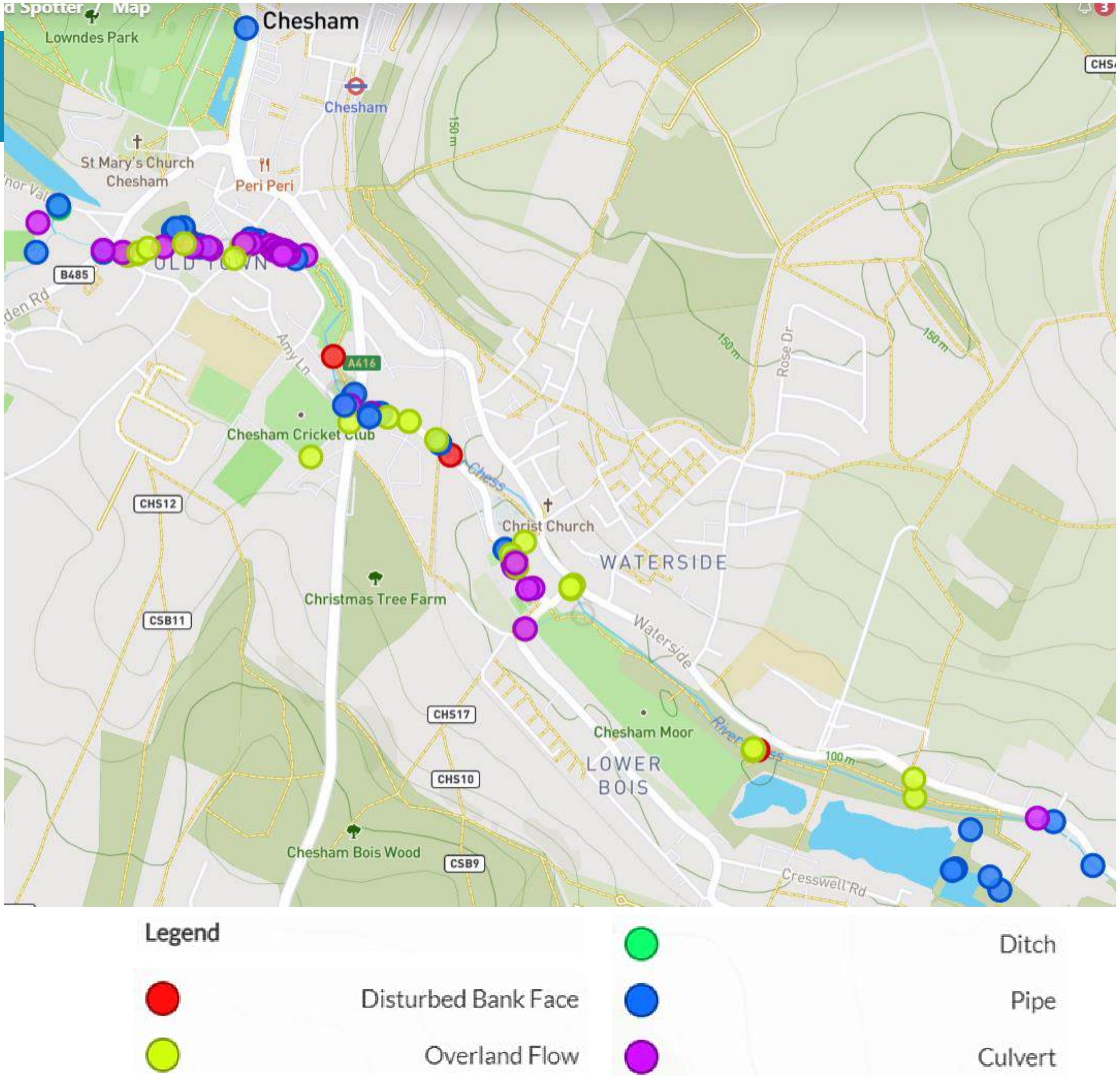
- An investigative survey, monitoring riverbanks for possible sources of sediment input.
- Conducted within 24 hours of rainfall event (ideally during).
- Has been piloted in Chesham since 2022.



MudSpotter pilot

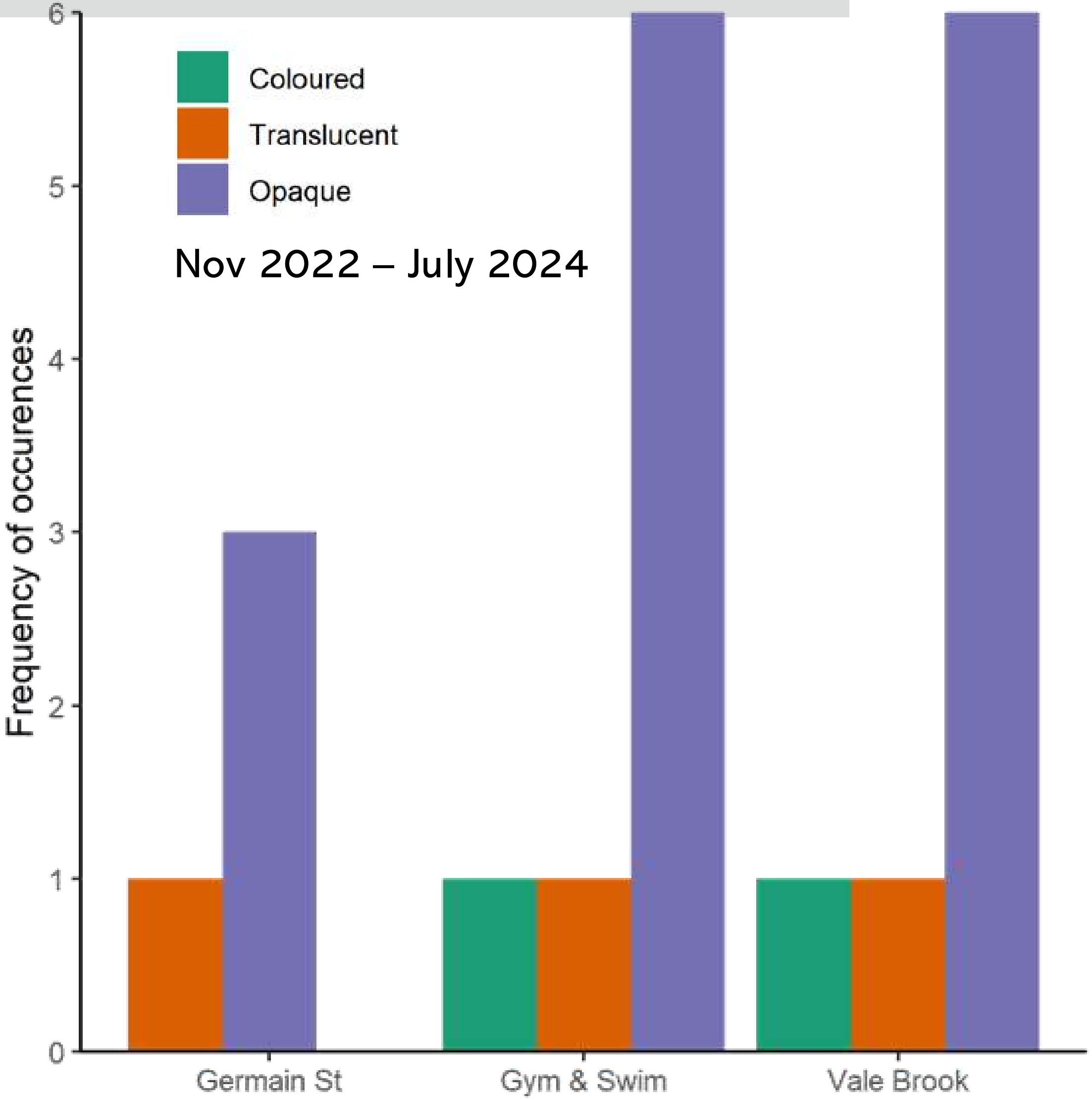
Chesham: types of sediment entry points

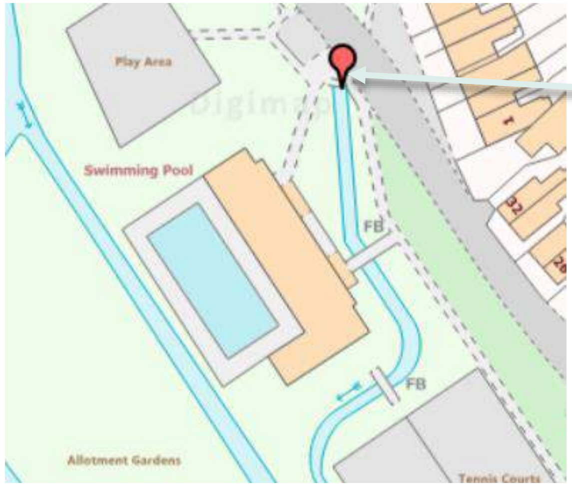


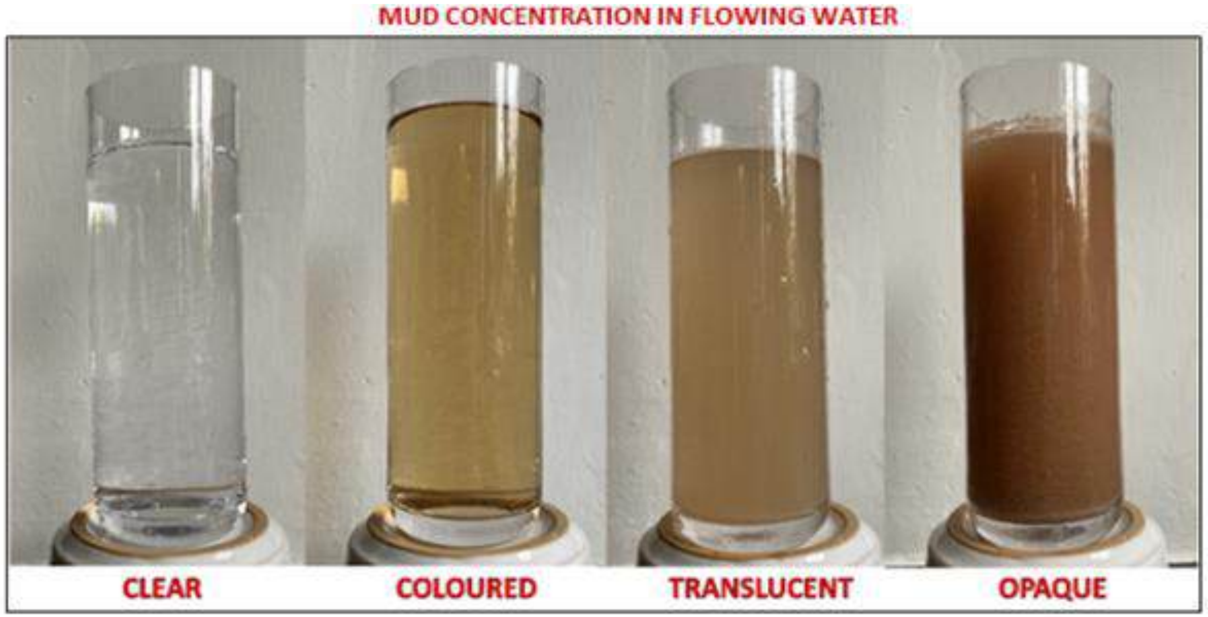


Chesham repeat offenders

Mud concentration in flowing water







Chesham repeat offenders

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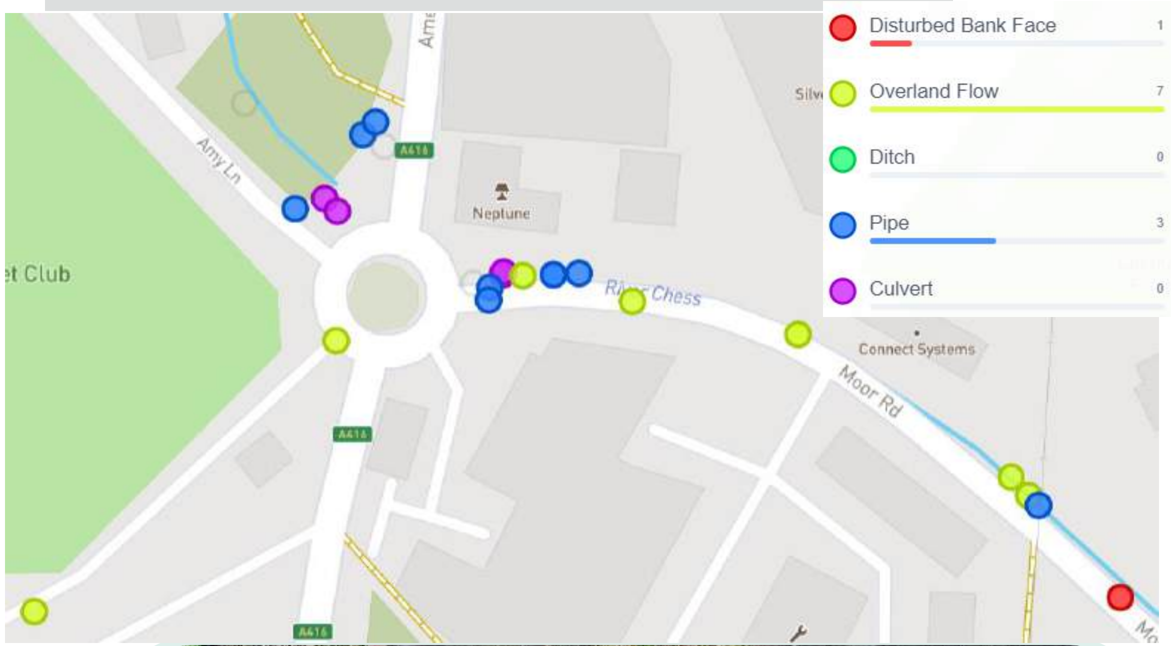
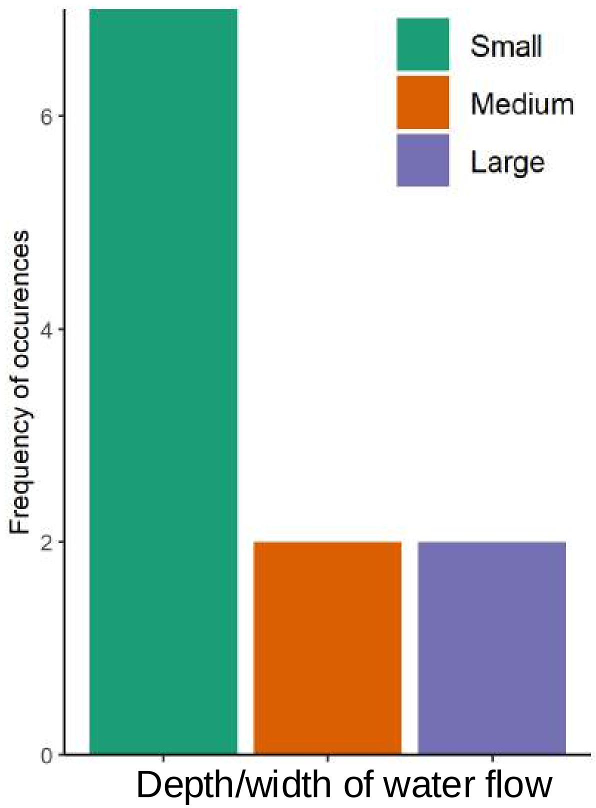
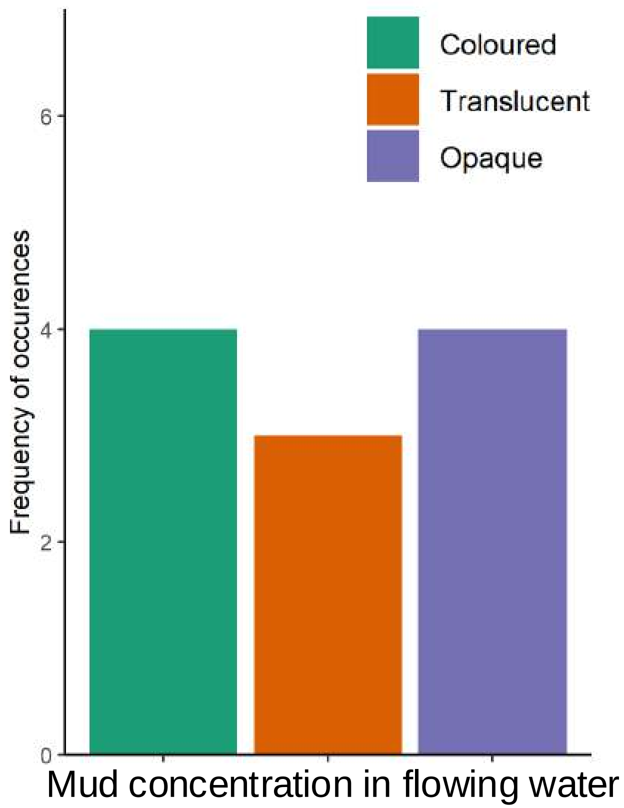


Nov 2022 – July 2024





SmartRivers bed sediment pressure index

Ecological impacts of fine sediment in the riverbed

Chilterns AONB: River Chess

Spring Survey 2024

Ordnance Survey data © Crown copyright and database right 2023

Sites

1: Broadwater Bridge
2: Main River (Marshfield)
3: Little Chess
4: Loudwater Estate
5: Scotsbridge Mill
6: Caravan Lane

Overall is a slightly better picture in relation to ecological pressure from sedimentation

Emerging contaminants of concern

Emerging contaminants of concern

Imperial College London

River Chess Smarter Water Catchment

Chilterns National Landscape

Collection of river water samples, sent away to Imperial College London to determine concentrations of up to 200 chemical compounds, some of which are on the **EU Water Framework Directive Watchlist**.

26.7.2022 | EN | Official Journal of the European Union | L 197/117

COMMISSION IMPLEMENTING DECISION (EU) 2022/1307

of 22 July 2022

establishing a watch list of substances for Union-wide monitoring in the field of water policy pursuant to Directive 2008/105/EC of the European Parliament and of the Council

(notified under document C(2022) 5098)

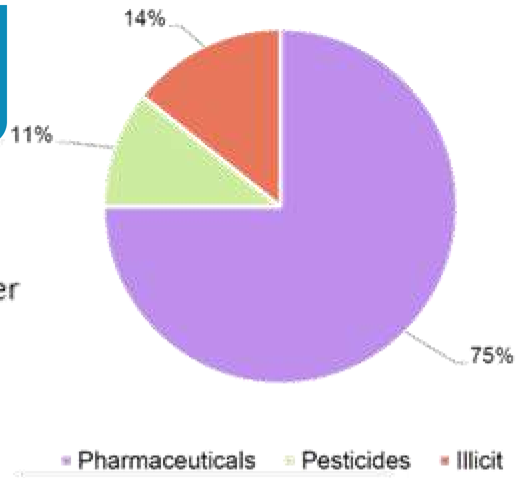
(Text with EEA relevance)

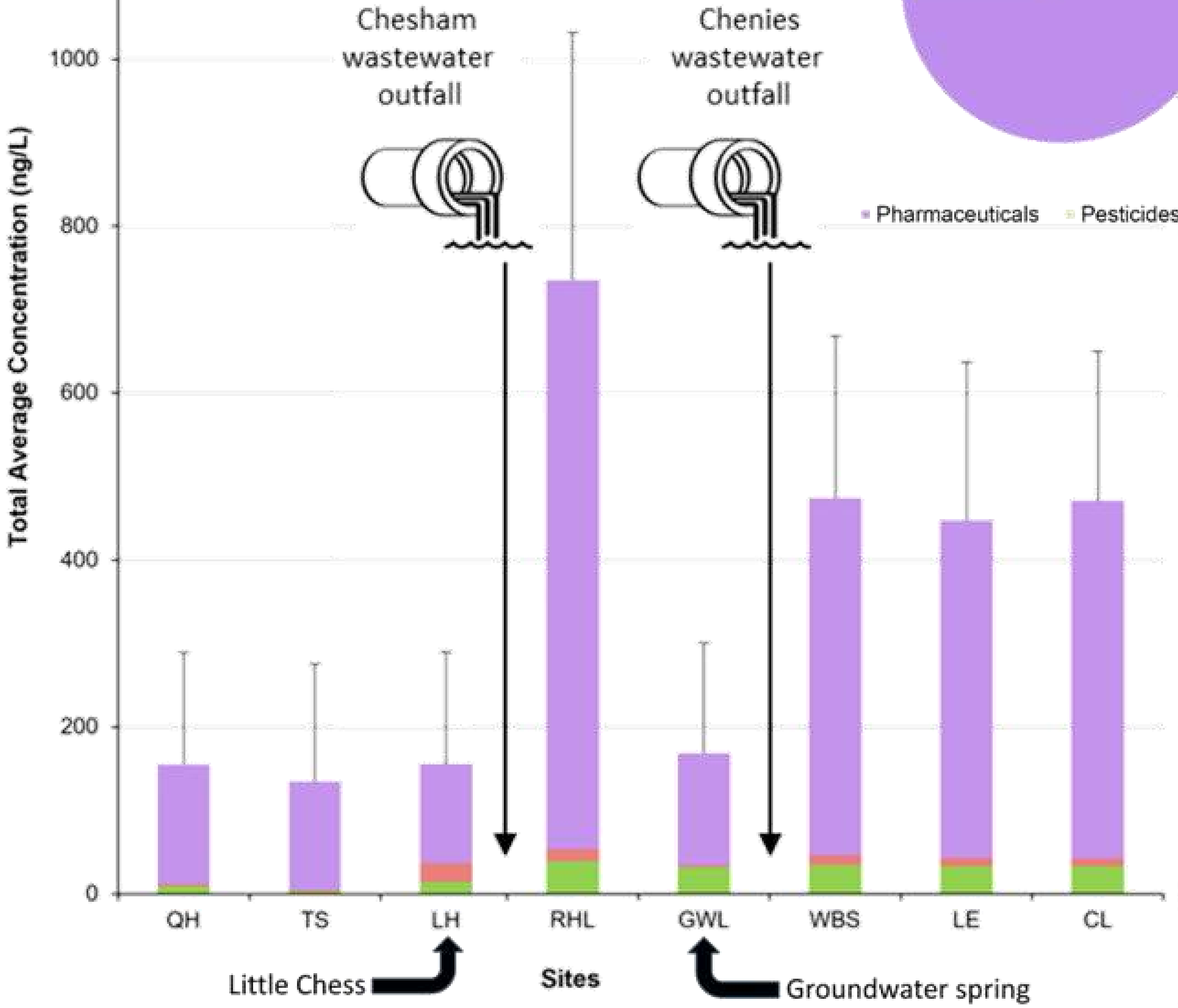
THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council ([1]), and in particular Article 8b(5), first subparagraph, thereof,

What did we find?





Key findings:

1. Highest average concentrations on main channel below sewage treatment works.
2. Pesticides, illicit drugs and pharmaceuticals found in the River Chess.
3. Majority of chemicals found are pharmaceuticals.
4. Some pharmaceuticals found upstream of sewage treatment works outfall and in groundwater.

What did we find?

Importance of time of year.

River Chess Smarter Water Catchment

Chilterns National Landscape

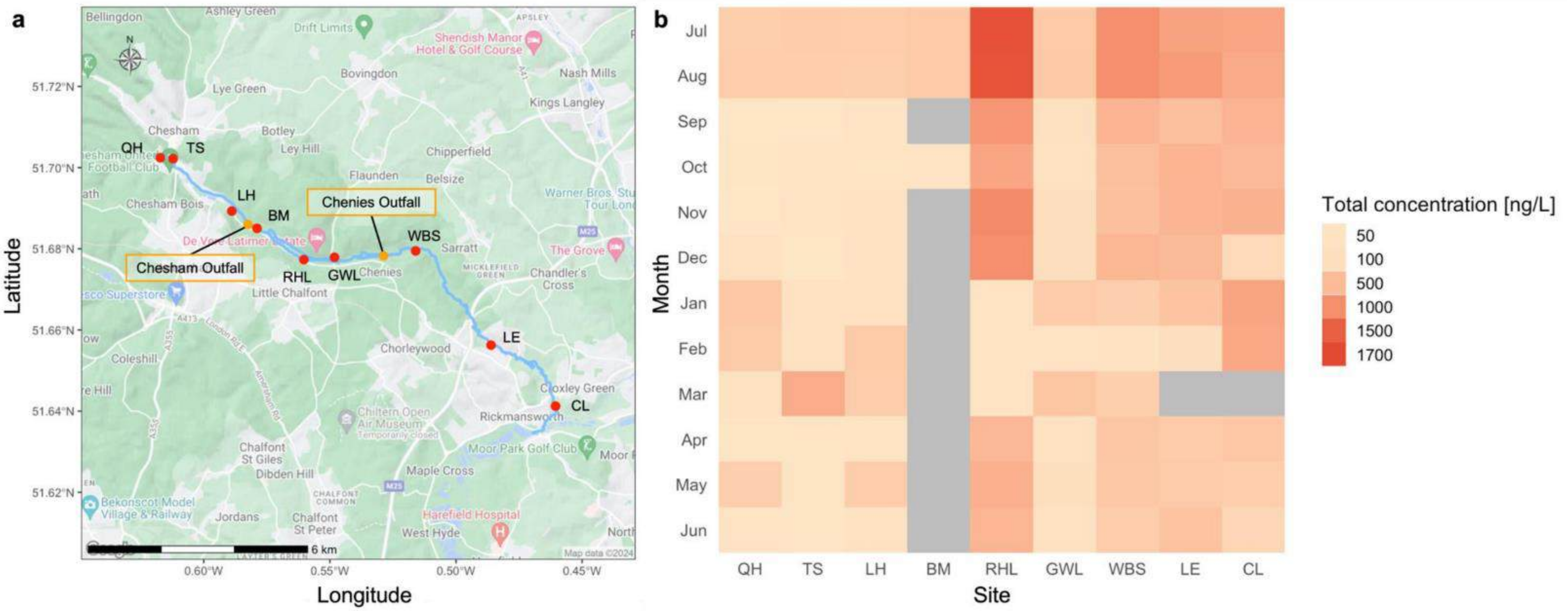


Figure 7: (a) *Sampling locations and (b) heatmap of the respective total concentration of contaminants (ng/L) per month at each site across the sampling campaign from July 2022 to June 2023. Sites for which there is no data are indicated in grey.*

Insecticides: legacy chemicals and current use

Acetaprimid

Atrazine (Banned in 2004)

The Water Framework Directive (EU) sets environmental standards for pesticides in surface water. It has set a precautionary standard of 100 nanograms/litre for pesticides, reflecting the need to keep pesticide concentrations in groundwater at low levels. The highest value of **Acetamiprid** observed was 62.7 ng/l at Restore Hope Latimer in Sept 2022.

The UK Environment Agency sets standards for herbicides in surface water. It has set a standard that individual herbicides should not exceed 100 nanograms/litre and a combined limit for all herbicides present of 500 nanograms/litre . The highest value observed of **Atrazine** was 43.2 ng/l at the groundwater spring on Latimer Meadow.

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Thank you
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Please see posters for additional information on our other Chess citizen science activities

RANDOM NUMBERS

1,613,300

&

2,463,750,000

WHAT DO THEY DENOTE?