The Thames Tunnel experience: Collection system issues, options and solutions

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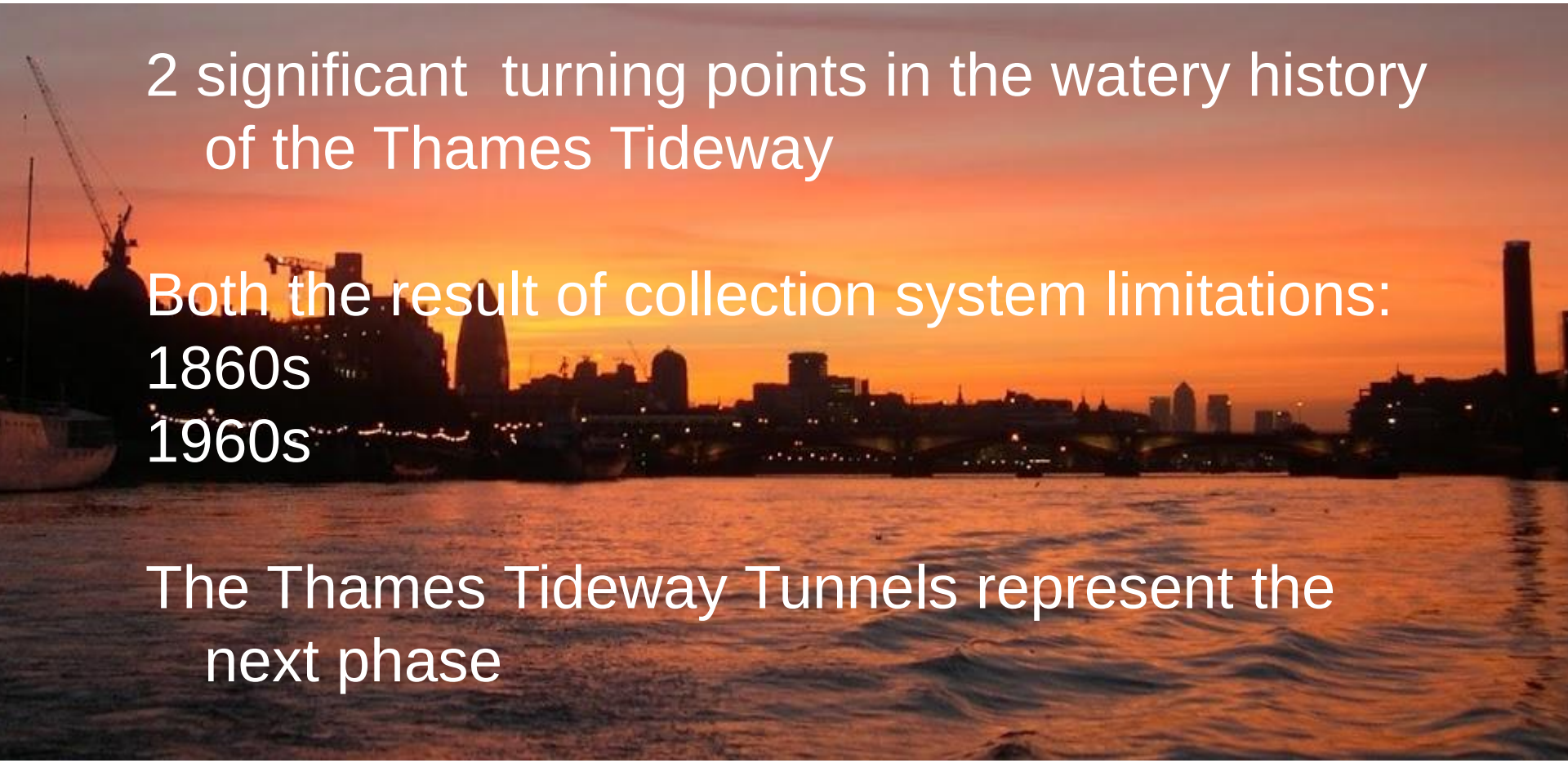

2 significant turning points in the watery history of the Thames Tideway

Both the result of collection system limitations:
1860s
1960s

The Thames Tideway Tunnels represent the next phase

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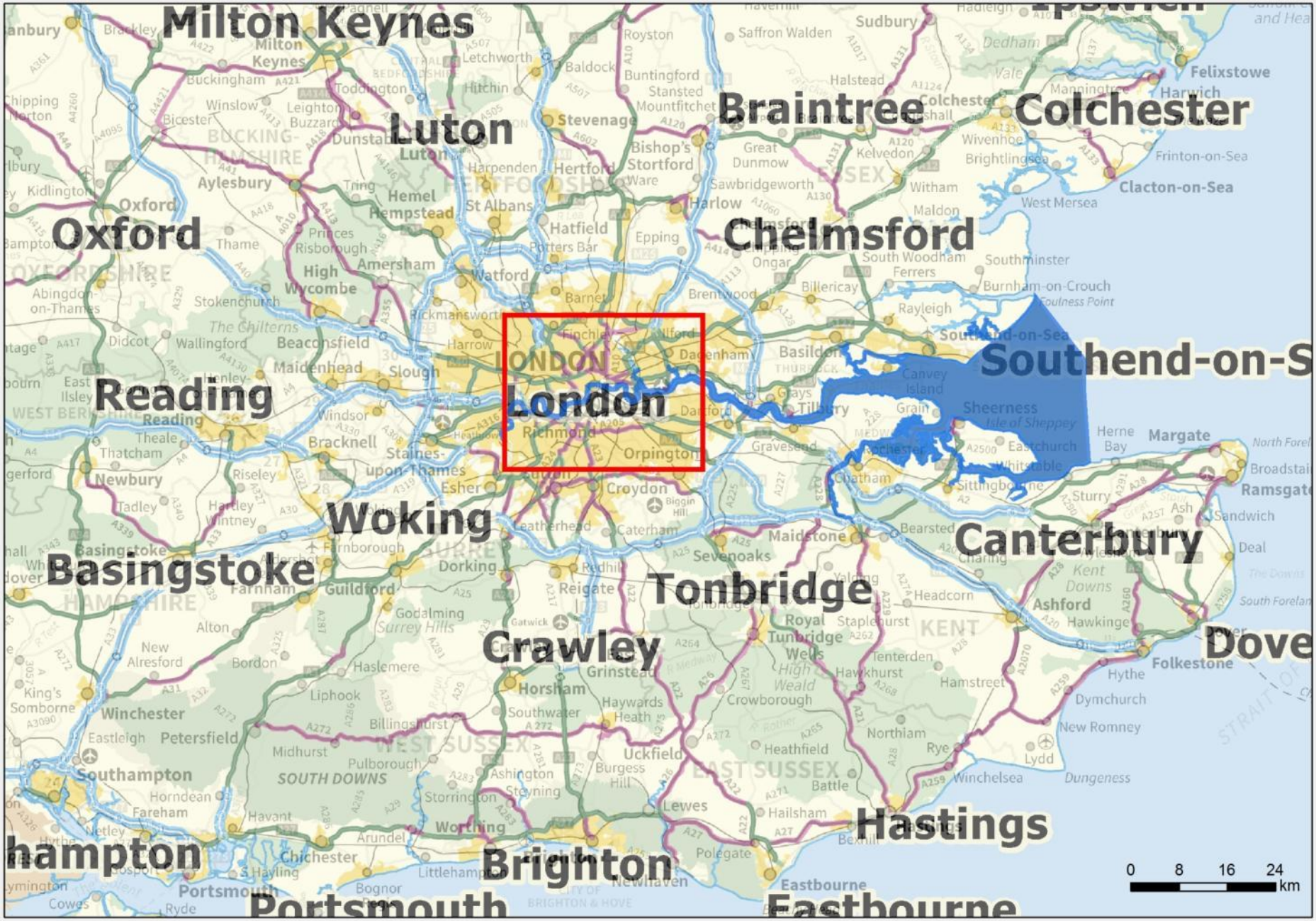
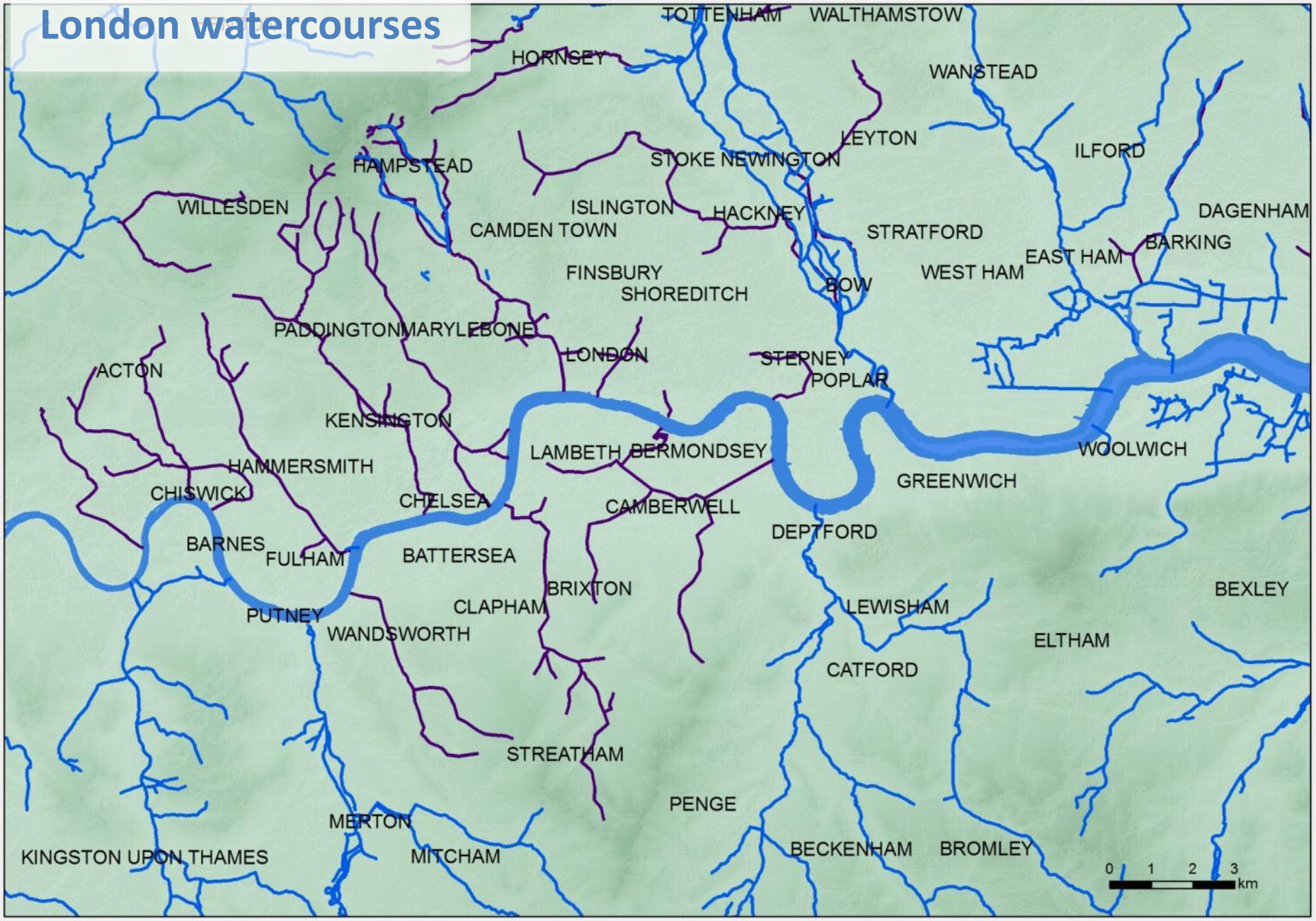
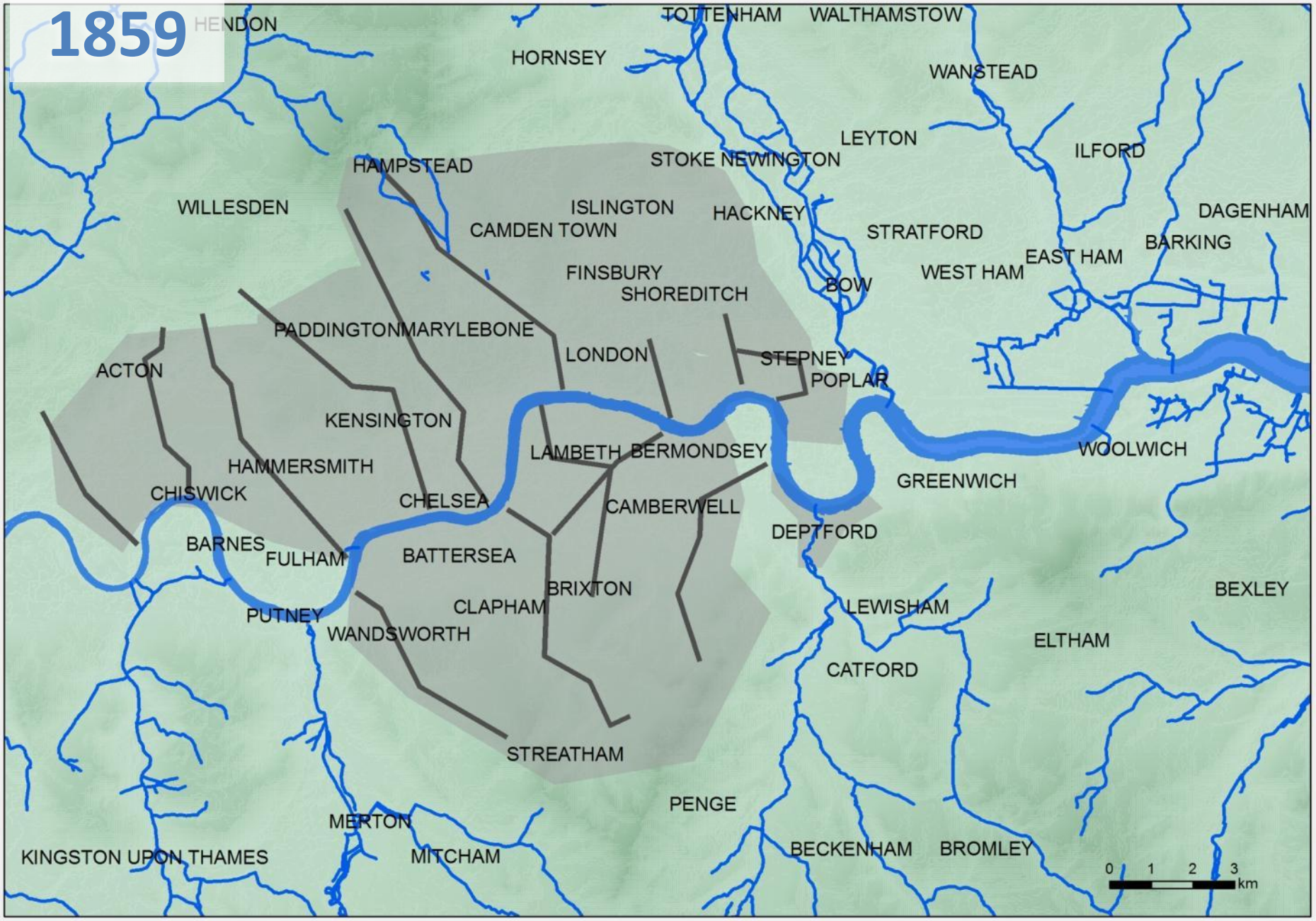

Milton Keynes
Luton
Braintree
Colchester
Oxford
Chelmsford
Reading
London
Southend-on-S
Woking
Canterbury
Basingstoke
Tonbridge
Crawley
Dove
Hastings
Brighton
Portsmouth
Eastbourne
0 8 16 24
km


40cumecs

4cumecs

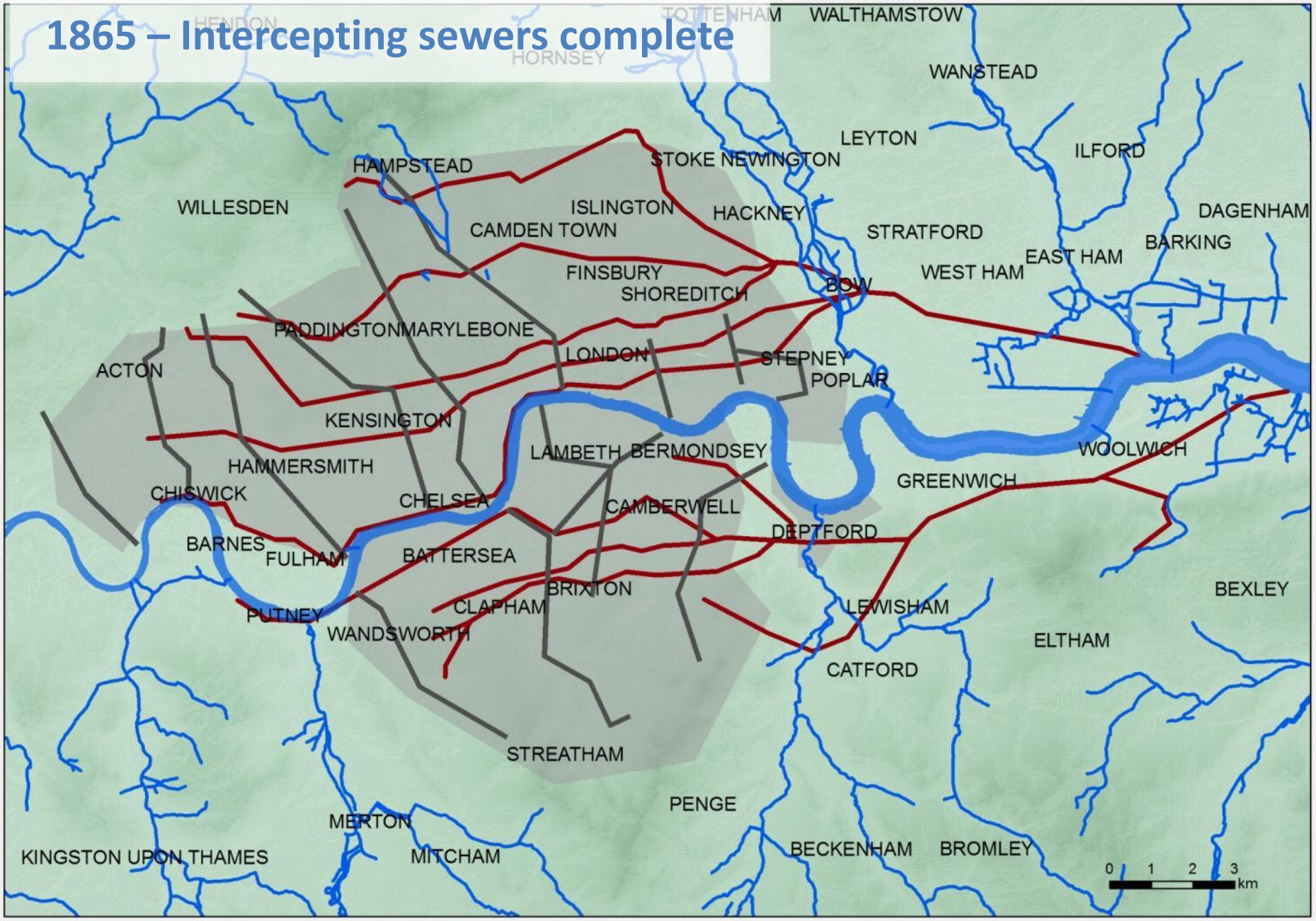
London watercourses



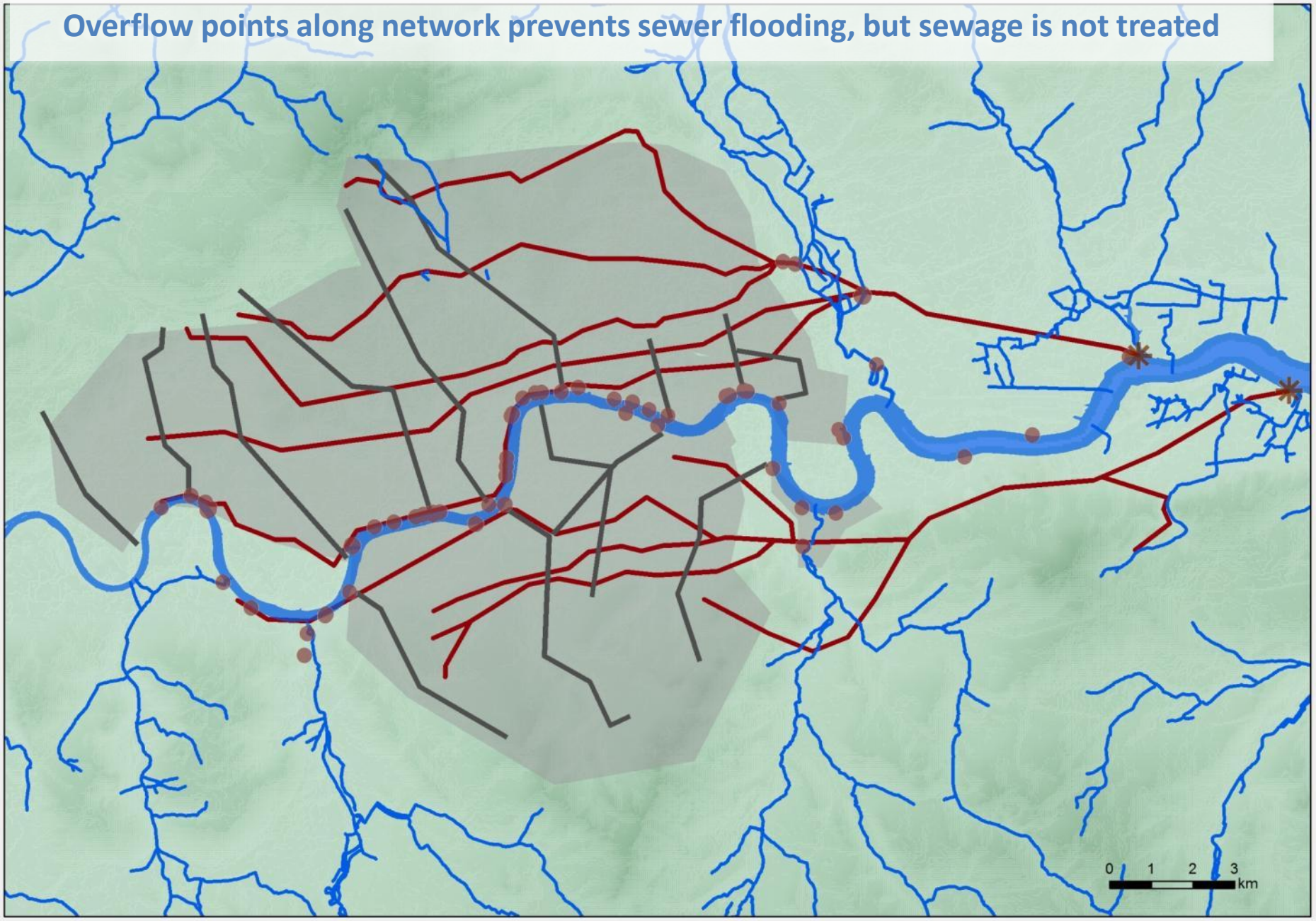

1859
HENDON
TOTTENHAM
WALTHAMSTOW
HORNSEY
WANSTEAD
LEYTON
ILFORD
HAMPSTEAD
STOKE NEWINGTON
WILLESDEN
ISLINGTON
HACKNEY
DAGENHAM
CAMDEN TOWN
STRATFORD
BARKING
EAST HAM
FINSBURY
WEST HAM
SHOREDITCH
BOW
PADDINGTONMARYLEBONE
LONDON
STEPNEY
ACTON
POPLAR
KENSINGTON
LAMBETH
BERMONDSEY
WOOLWICH
HAMMERSMITH
GREENWICH
CHISWICK
CHELSEA
CAMBERWELL
DEPTFORD
BARNES
FULHAM
BATTERSEA
BRIXTON
BEXLEY
CLAPHAM
PUTNEY
LEWISHAM
WANDSWORTH
ELTHAM
CATFORD
STREATHAM
PENGE
MERTON
KINGSTON UPON THAMES
MITCHAM
BECKENHAM
BROMLEY
0 1 2 3
km

“The Great Stink” threatens to close parliament

1865 – Intercepting sewers complete



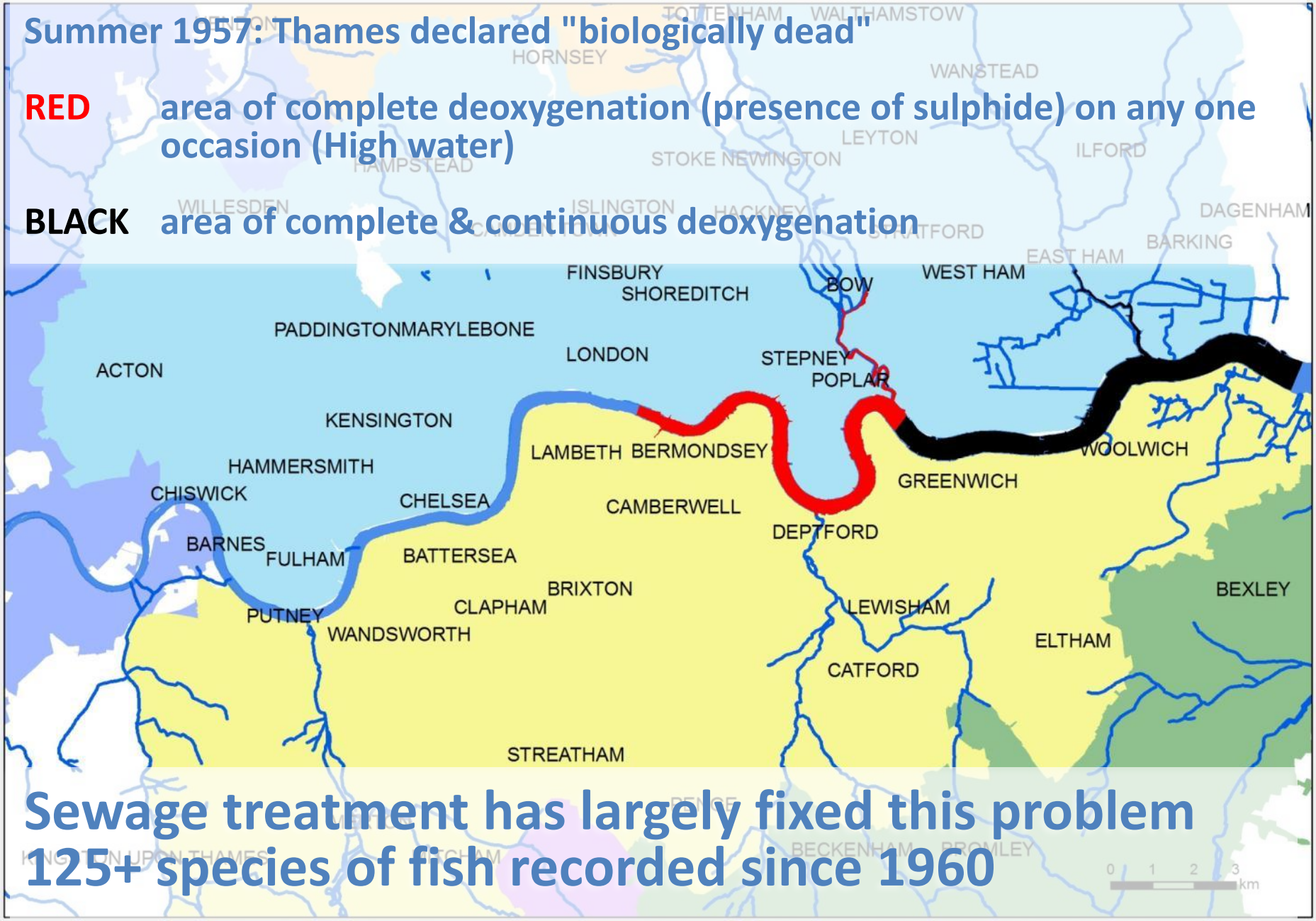
Overflow points along network prevents sewer flooding, but sewage is not treated



Summer 1957: Thames declared "biologically dead"

RED area of complete deoxygenation (presence of sulphide) on any one occasion (High water)

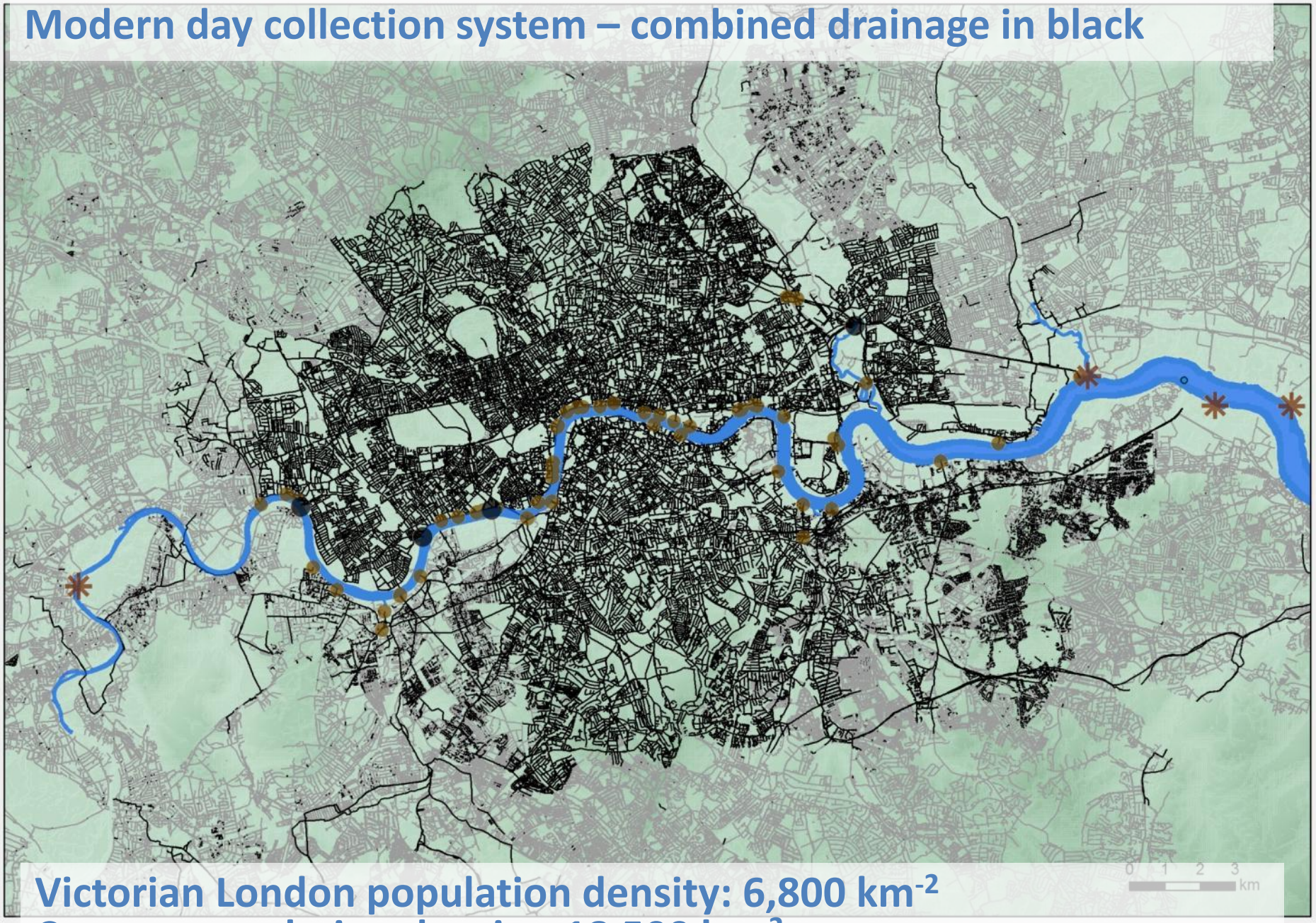
BLACK area of complete & continuous deoxygenation



Sewage treatment has largely fixed this problem

125+ species of fish recorded since 1960

Modern day collection system – combined drainage in black



Victorian London population density: 6,800 km^{-2}
Current population density: 18,500 km^{-2}

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Aesthetic impact

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Elevated health risk

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Ecological damage

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Driver:

Urban Waste Water Treatment Directive

Aim: "protect the environment from the adverse effects of urban waste water"

Overflows *(intermittents) should only discharge following unusually heavy rainfall. Measures should be taken to* **limit pollution**

Sewage works - *must treat sufficiently under normal local climatic conditions*

Sewerage system and pollution measures should be **cost effective**

Also Water Framework Directive measure

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Thames Tideway Strategic Study (2000-2005)

TTSS Objective:

Reduce the impact of intermittent sewage discharges and further improve water quality in the Thames Tideway, to benefit the ecosystem, and facilitate use and enjoyment of the river.

Members:

Thames Water, Environment Agency, Defra, Ofwat, with independent chair.

- Define Objectives
- Investigate Solutions
- Make recommendations

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Dissolved Oxygen Design Objectives

Dissolved Oxygen (mg/l)	Return Period (years)	Duration (tides)	Basis
4	1	29	Protection against chronic effects (behavioural and physiological)
3	3	3	Managing scale and frequency of mortalities
2	5	1	
1.5	**10**	**1**	Protection against Mass mortalities **Return period better defined**
Apply to any continuous length of river ≥ 3 km. Duration means that the DO must not fall below the limit for more than the stated number of tides. A tide is a single ebb or flood.			

Solution Strategies considered:

Before rainwater enters the system

Within the sewerage system

At the interface between the sewers and the river

In the river itself

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Strategy 1: **Prevent rainwater entering the collection system**

Retro-fitting of SuDS is disruptive and costly at best – technically infeasible at worst

No clear delivery mechanism

Even extremely optimistic scenarios fail to meet design objectives

No alternative means of disposal – watercourse or soakaway

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Strategy 2: **Make space within the sewerage system**

Problems in the London context:

In sewer detention increases flood risk

Additional on-line storage generally not possible

Off-line storage expensive and disruptive

Separation expensive and disruptive

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Strategy 3: **At the interface between the sewers and the river**

Several different ways to deal with intercepting the polluting flow at (or near) the CSOs evaluated

Only feasible concept was interception to a storage tunnel
- this was recommended

Consistent with the approach taken to address historic urban catchment issues worldwide

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Strategy 4: **In-river treatment**

Does not meet requirement to “collect and treat”

Oxygenation options only partially addresses dissolved oxygen issues

No existing technology remedies sewage litter or public health risk

Navigation – impact on access and disruption to traffic unacceptable

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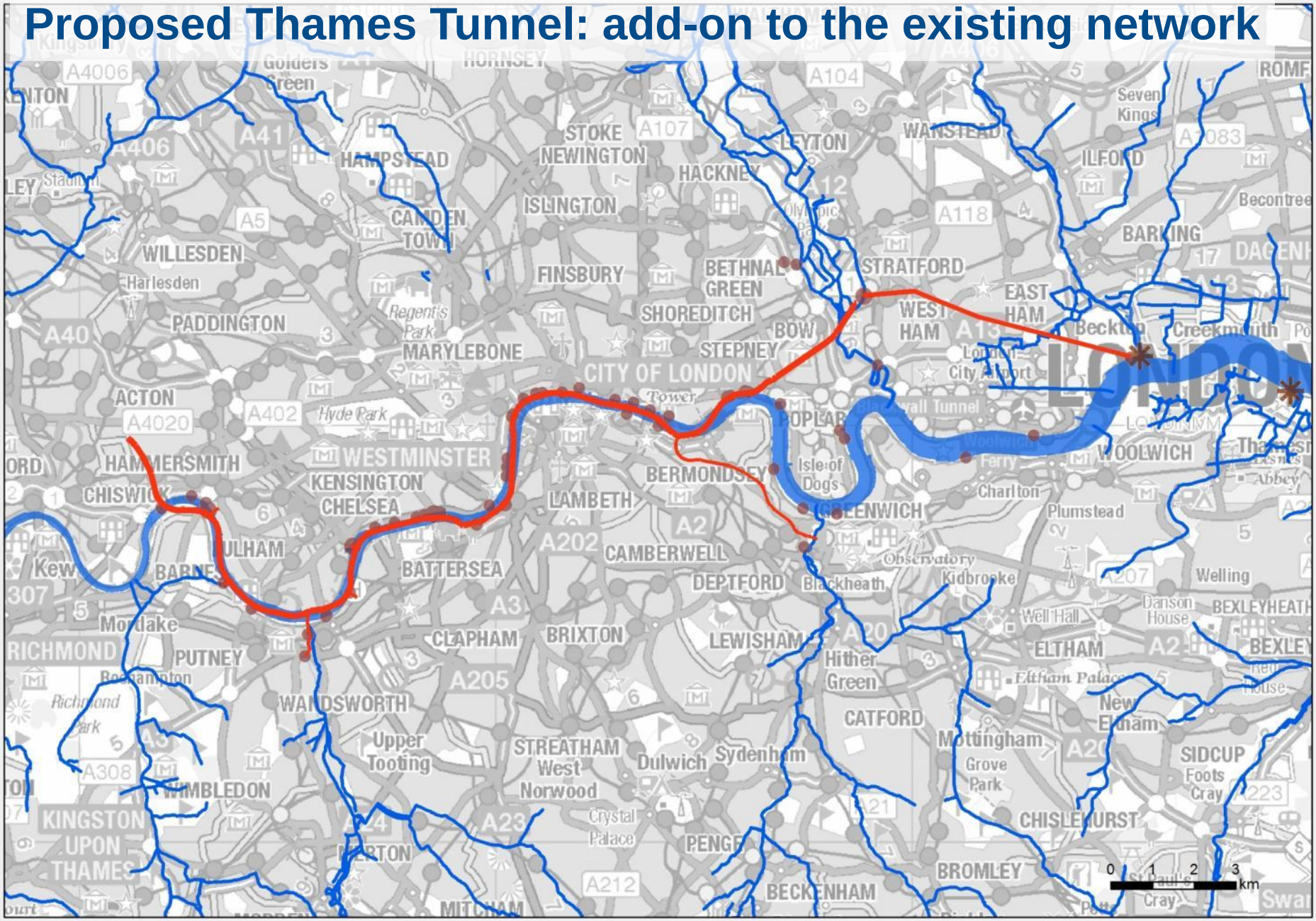
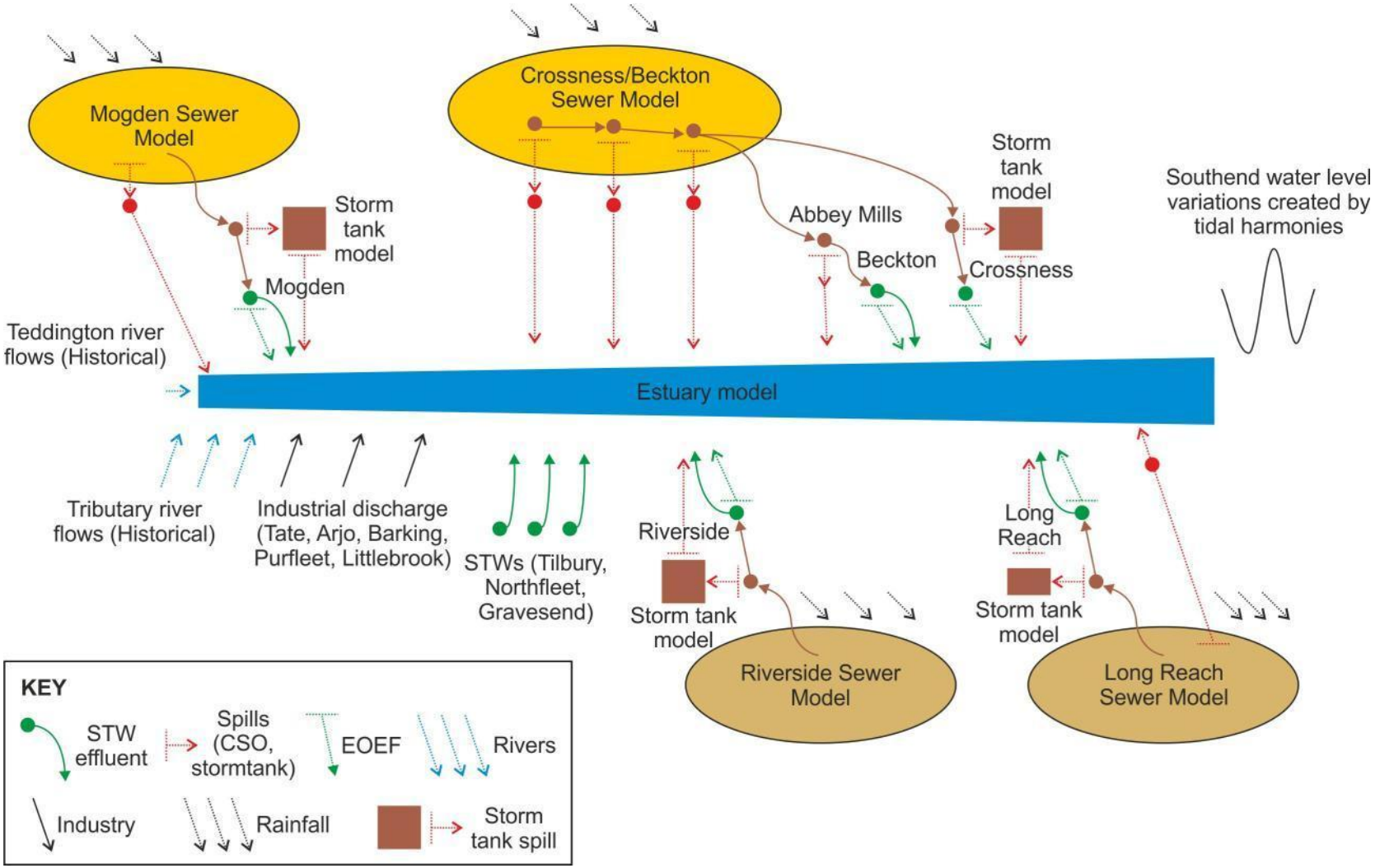
Proposed Thames Tunnel: add-on to the existing network



How do we know the Thames Tideway Tunnels will work?



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Thames Tideway Tunnel
Construction: 2016-2023
Length: 25 kilometres
Diameter: 7.2 metres
Capacity: 1.6 million m^3
Estimated cost: £4.2Bn (2011 prices)

Thank you!

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