

Environmental Factors and the London Tideway Tunnel

Water Resources and Environmental Monitoring

ACNA5004

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1. Introduction

Where there are populations of people, there will also be sewage that requires safe disposal and treatment. Also known as urban waste water, sewage consists of waste water from toilets, sinks, baths and other household appliances, rainwater runoff from roads and rooftops, and waste water produced by industry (Department for Environment, Food and Rural Affairs, 2002). The way sewage has been managed in the United Kingdom has changed greatly over time, from very little active treatment to the modern system in place today. These changes largely started in London, which after the Industrial Revolution, and the increase in industry and population which occurred as a result, had increasing amounts of sewage requiring disposal. At the time, sewage was primarily released into the river Thames, which was causing damage to the river ecosystem, killing fish, and contaminating drinking water. Waterborne diseases such as cholera were widespread at this time (Johnstone and Horan, 1996; Science Museum, 2021).

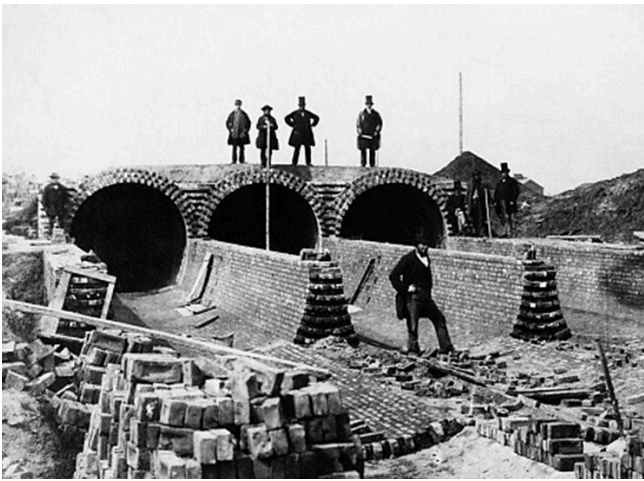


Figure 1: Construction of the sewage system (BBC Bitesize, 2024).

A particularly hot summer in 1958, combined with the amount of sewage in the Thames at the time, produced a stench so bad that it became known as the “Great Stink”, and the Houses of Parliament, located on the bank of the Thames, were forced to close. This led to the sewage problem being prioritised by the Westminster government, and Joseph Bazalgette, chief engineer of the Metropolitan Board of Works, was put in charge of developing a sewer system (see figure 1). This new system was designed to channel the waste out into the Thames estuary, to be transported away with the tide. Despite the pollution and disease issues it was intending to solve, the system of sewers and embankments was unpopular with some London residents at the time, as it cut off direct access to the river in some areas (Historic England, 2024).

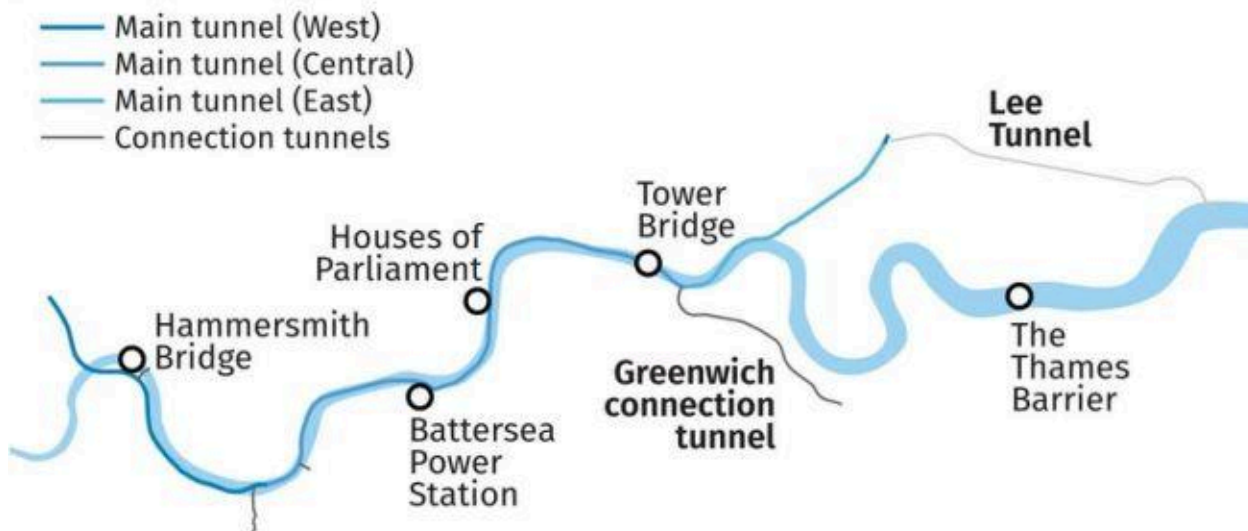
Today, issues caused by inadequate sewage systems are again presenting themselves, especially in densely populated London. As urban populations continue to grow, and more extreme weather events become more common due to the climate crisis, the current sewage infrastructure is increasingly unable to process the waste, and it is released by water companies into local water bodies (Woodward, 2023; The Rivers Trust, 2024). Sewage is well documented to be extremely damaging to aquatic ecosystems (Whelan *et al*, 2022; Albin *et al*, 2023), and it is also still harmful to humans, with people interacting with contaminated water bodies reporting illnesses ranging from stomach bugs to *E. coli* (Surfers Against Sewage, 2024).

2. Project Background

When the Metropolitan Board of Works built the sewer system in London in the late 19th century, the population of central London was estimated to be around three million. In 2024, the population of central London is over nine million, more than three times the amount that the sewer system was built to support (Hitchcock, 2023; World Population Review, 2024). Green spaces have also declined in London, with paving over front gardens becoming increasingly common in the last decade, increasing rainwater runoff entering the sewage system (Royal Horticultural Society, n.d). The increased pressures from population, lack of natural drainage, extreme weather events, as well as the change in materials entering the sewage system today compared to when it was originally constructed - such as oils and plastic wastes causing new issues such as 'fatbergs' - collectively created the need for an update to the sewer system in the London area (Collinson, 2019).

Thames Water is the water provider operating in both the London and Thames Valley area, and it has around sixteen million customers overall (Thames Water, 2024a). In 2000, they commissioned a report called the Thames Tideway Strategic Study, which assessed the damage being caused by sewage overflows at the time. This report recommended an additional major sewer that would run thirty five kilometres under the river Thames to catch the excess overflow material and transport it for treatment. The report was then reviewed in 2005, whereupon a twenty five kilometre tunnel was agreed upon instead, running to Abbey Mills Pumping Station (Honeyman, 2006) (see figure 2).

Tideway Tunnel route



PA graphic. Source: Tideway

Figure 2: The Tideway Tunnel route (ITVX, 2019).

The Tideway Tunnel, as it is known, began construction in 2016, being built by a company named Bazalgette Tunnel LTD, trading as Tideway. It was funded primarily by Thames Water, and will be operated by Thames Water when it is completed in 2025, aiming to reduce the sewage overflow release events by 95% (Thames Water, 2024b.)

While mounting pressures on the sewer system demonstrated the need for the increased capacity an additional sewer would provide, the release of sewage into water bodies was a primary concern. The reason that this occurs is because of the type of sewer system common in the UK. Known as the combined system (see figure 3), it involves all forms of sewage being transported together, from discharges from toilets which requires heavy treatment, to rainwater runoff from roads, which would require less heavy treatment if not mixed with foul water.

COMBINED SYSTEM

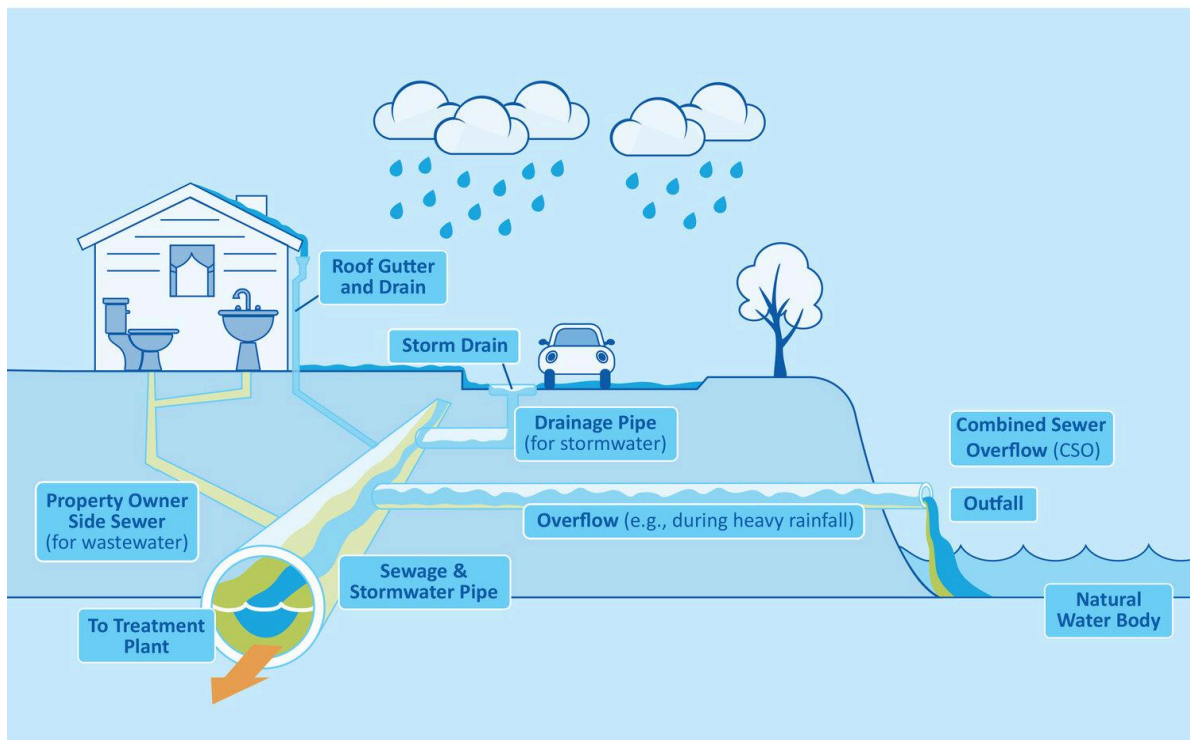


Figure 3: Combined sewage system (Shape Our Water, n.d).

Part of this combined sewer system is the concept of “combined sewage overflows”. This is a mechanism by which when the system is inundated, diluted sewage is released into water bodies to prevent it flooding houses or streets. This is described as a necessary part of the system for it to function correctly (Hawkes, 2023). Combined sewage overflows are only supposed to release highly diluted sewage, due to being intended as an overflow in flooding conditions, where there would be large amounts of rainwater entering the system anyway (Dŵr Cymru Welsh Water, n.d). However, in 2019, the sewer system in the London area was

estimated to always be at 80% capacity, even in normal weather conditions. This means that releases would take place even when heavy rain events were not occurring (Munro *et al*, 2019).

There are fifty seven combined sewage overflows that either discharge directly into the Thames river, or into tributaries. Of these fifty seven, thirty six showed evidence of causing environmental damage in 2012, including introduction of pathogens, causing aesthetic damage and lowering levels of dissolved oxygen (Lloyd, 2012). As the organic matter in sewage breaks down, it uses up large amounts of the dissolved oxygen content in water. As many organisms living in the water require this to breathe, lack of dissolved oxygen can increase susceptibility to disease, limit growth and development, and cause species death (Mahaffey *et al*, 2020; Bhat and Qayoom, 2021; Ali *et al*, 2022).

In addition, there are also legislative controls for water quality management that Thames Water needed to comply with. The Urban Waste Water Directive outlines the need for adequate systems to be in place to prevent damage to the environment from waste water, as has been described as happening in the above paragraph in the London and Thames Valley area. The Water Framework Directive also requires protection and enhancement of water bodies, and specifically states that while sewer overflows are permitted in exceptional circumstances, it is only to occur in those exceptional circumstances, not routinely (Department for Environment, Food and Rural Affairs, 2015).

3. Project Impacts

Any large infrastructure project is going to have impacts, both positive and negative, on the local ecology and community. The Thames river has been highly modified by human activity throughout history, and it already has the species array of a depleted riverine ecosystem, including the presence of many non-native invasive species (Ollard and Aldridge, 2022). Many construction projects have been carried out along its banks, like much of the Tideway Tunnel project, and these have contributed to damage and pollution over the years. A common

mitigation method for construction projects is financial contribution towards some form of restoration, but this does not negate the damage caused, or lessen more subtle influences of construction. An example of this is the disturbance of settled sediment that is artificially rich in nutrients such as phosphorus, and construction activities lead to the phosphorus becoming remobilised in the water column, causing harmful algae growth and increased eutrophication (Richardson and Soloviev, 2021).

The Tideway Tunnel is a large project (see figure 4), and was expected to have a number of negative environmental impacts during the construction phase. The environmental impact assessment highlights air and noise pollution in construction site areas due to increased vehicle traffic and equipment use, and

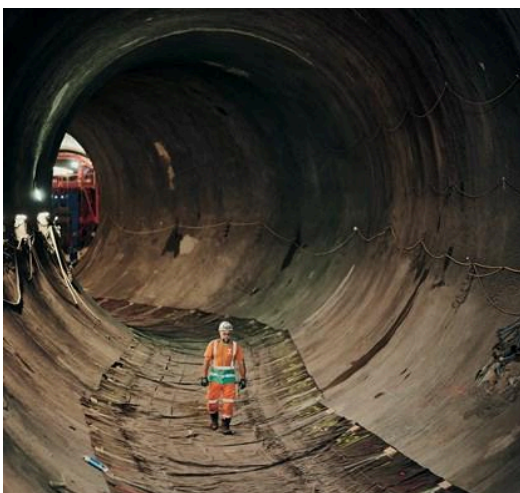


Figure 4: Inside the tunnel (Tideway, 2021).

the construction of new operational buildings on the river's edge removing foreshore habitat. It is also noted that care must be taken to not affect the freshwater aquifer under London (Thames Water, 2014a).

Despite outlining the damage to foreshore habitat due to construction of new buildings, it is unclear what mitigation is being undertaken in response to this. While the environmental impact assessment cited in the previous paragraph describes “fendering” being put into place on the outside of foreshore structures, suggesting that this will help the restoration of river ecology, how it will do so is not elaborated upon further in that document. The design principles guidance document also mentions timber fendering used to allow boats to moor alongside the structure at the Putney Embankment Foreshore (see figure 5), but there is no further mention of restoration of lost foreshore habitat (Thames Water, 2014b).



Figure 5: Putney Embankment Foreshore (Fereday Pollard, 2024).

While negative environmental impacts occur during construction, the Tideway Tunnel is predicted by Thames Water to have an extremely positive effect on water quality in the river Thames when it is operational and preventing sewage overflows, as discussed in section 2. Efforts were also made during construction to find the concrete mix with the smallest CO₂ impact which was then used to construct the tunnel (Denis *et al*, 2023).

It has also been argued that despite the predicted positive effects for water quality when the sewer is operational, a project of this size did not need to be undertaken at all to achieve the same results. It is criticised as an infrastructure heavy, overly Victorian style answer to the complex problem presented by river management and water quality preservation in heavily urbanised areas (Loftus and March, 2017). Increasing treatment capacity at the sewage works, so overflows aren't required, is argued to be a less disruptive solution, and some scholars push back against the financial focus of the water sector (Grafe, 2020). The many financial stakeholders in the Tideway Tunnel and their conflicting interests make it harder for planning and operational guidelines to sufficiently protect public interest, they suggest (Tomaney, 2018). The project is partially being funded directly by Thames Water, and partially by increases to customer water bills going forward. However, in 2022, the chief executive was criticised for accepting bonuses that took his annual salary to almost one million pounds, even as the project was being delayed and overall cost estimates increasing (Lawson, 2017).

Several local authorities of areas which the Tunnel passes through initially opposed construction, citing concerns about community impact, and suggested that a mix of smaller scale solutions may be more appropriate (Morse, 2017). In Lewisham, part of the Tunnel was constructed directly alongside a primary school, and Lewisham local authority opposed until mitigation methods such as the restoration of green spaces after construction was completed

were agreed upon (Lewisham Council, 2020). People affected by construction were also able to apply for financial compensation from Thames Water (2017). The Tideway project itself has a “legacy” programme focused specifically on long term project impacts, including the social impact. They provided apprenticeship opportunities, and worked with charities that encourage young people in science, technology, engineering and maths fields, and employed people with previous convictions on their legal records who were otherwise struggling to find employment (Tideway, 2023).

4. Project Reception

Responses to environmental projects are often complex. Individuals, environmental groups, and news and media may have differing viewpoints and priorities, as well as levels of knowledge about environmental and technical aspects of undertakings. In the 1970s, the term “Not In My Back Yard”, or NIMBY, was created to describe people who oppose developments taking place in their local area, but have no objections when it isn’t their community being directly affected. Renewable energy projects in particular have been connected with NIMBYism (Cui *et al*, 2023). However, it is often acknowledged that objections may be more than simply a NIMBY attitude, with concerns about community, control and justice being recognised as valid questions (O’Neil, 2020).

Attitudes towards Thames Water in general are often negative. Increasingly they are criticised by the media for failing to address sewage being released into water bodies, primarily from a human health perspective, and being opaque about profits made by external investors (Lawrence, 2023; Jordan and King, 2024). While the Tideway Tunnel is intended to fix the sewage pollution issue, the project was controversial when first announced. Media at the time primarily appears to have focused on the issues caused by the age of the sewage system, including demonstrating fatbergs, and calling for drastic and immediate infrastructure change (BBC, 2013; BBC, 2014).

Many environmental groups, including those specifically local to London, agreed with the need for the tunnel, describing their other restoration efforts as less effective when the river is still being inundated with sewage. Interestingly however, many of the statements upon confirmation of the tunnel construction specifically state that the tunnel must be just one part of green infrastructure application if London is to become climate resilient (Thames21, 2014). Ecology being conserved throughout construction, and use of other forms of sustainable urban drainage alongside the tunnel are identified as priorities.

The Tideway Tunnel is supposed to be fully operational in 2025. The chief executive now describes the project as a way to “buy time” for London to adapt a better system to deal with rainwater, a perspective not voiced by the Tideway company when construction was initially being announced (Fisher, 2024). The London branch of the environmental organisation Waterkeeper Alliance suggests that nature based solutions such as increasing green spaces to

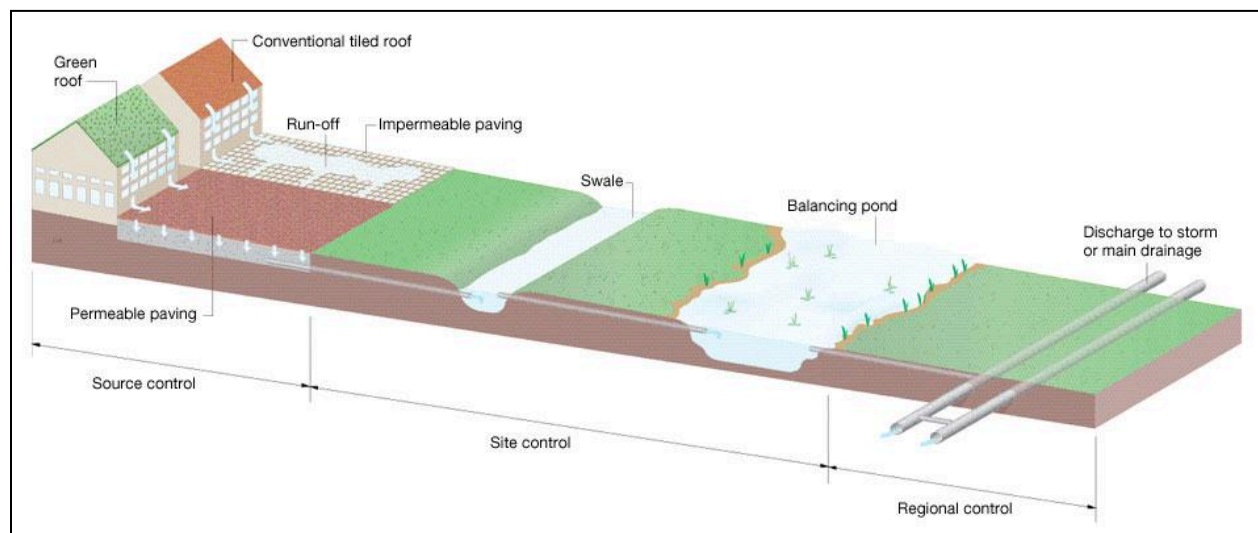
allow more natural drainage may have been deemed too complicated to implement, as opposed to a single, large project (London Waterkeeper, 2023).

As with the impacts of this project, the reception of the Tideway Tunnel has not been simple. There are many stakeholders, and many conflicting desires.

5. Discussion and Analysis

Making large urban areas safe for residents, environmentally friendly, and climate resilient is an ongoing challenge globally. High resource use, high waste output, large and diverse populations, and historical infrastructure are just some of the issues London faces in attempting to futureproof its systems, as described in the previous sections of this report. A solution to the sewage release problem in London was undoubtedly needed, and the Tideway Tunnel has potential to be very successful. However, longevity has to be considered for successful urban water management. A project of this scale is expensive, disruptive and time consuming, and when there is evidence that enlarging sewer pipes alone will not be enough to achieve urban flood resilience, the long term worth of such projects is brought into question (Kapetas and Fenner, 2020).

Combinations of traditional, channelised drainage, and nature based solutions such as sustainable urban drainage systems have been demonstrated to be most effective over time (Miguez *et al*, 2014) (see figure 6). In highly populated urban areas, lack of space can prevent natural urban drainage systems being utilised, and they may not be able to deal with the amount of water present. Public acceptance for less traditional and understood techniques may also pose issues, as described at the beginning of section 4 (Shkaruba *et al*, 2021).



Nature based solutions slowing water flow to avoid inundating sewer system (PermCalc, n.d).

Sustainable urban drainage systems, in mimicking the hydrology of an area with use of green space such as water gardens and swales, also provide ecosystem services such as prevention of the urban heat island effect that are not achieved by a project such as the Tideway Tunnel (Ossa-Moreno *et al*, 2019). Sustainable urban drainage systems have not had regular use in England, compared to use in Scotland and Wales (Melville-Shreeve *et al*, 2019), and as highlighted by many environmental groups, these techniques are not being utilised alongside the Tideway Tunnel by Thames Water.

This report demonstrates the need identified by many scholars for flexible, multi-aspect approaches to urban water management. The Tideway Tunnel must be only one part of ongoing integrated and proactive management strategies in the London area for the city to become truly climate resilient well into the future.

6. Conclusion

Sewage management in London has a long history, with many negative environmental and human health impacts having occurred. The Tideway Tunnel project, a twenty five kilometre sewer running under the river Thames, aims to solve the issue of sewage pollution in the river by transporting overflows from the overburdened system away to be treated, increasing capacity in the ever growing city. However, there are many environmental and socio-cultural impacts to a project of that size in such a densely populated area, both detrimental and beneficial. Construction will disturb riverside habitats, while the project operation is intended to greatly improve river quality. Local communities including schools and domestic buildings will be affected by noise and air pollution, but have opportunities for financial compensation. Both environmental groups and scholars have highlighted the need to move away from treating single, large infrastructure projects as the only change required to become climate adaptable, and instead foreground mixed approaches, utilising and restoring natural hydrological systems alongside more traditional sewage tunnel systems. The long term effect of the Tideway Tunnel's operation is yet to be observed, and further research is recommended in this area moving forward.

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