London Tideway Improvements

creating a cleaner, healthier River Thames - an overview

In the 1850s, over 400,000 tonnes of sewage was flushed into the River Thames each day - around 150 million tonnes a year. The river was biologically 'dead' and the stench was overpowering. In the summer of 1858, Parliament had to be suspended because of the vile smell, which has been named the *'Great Stink',* and as a result, Parliament passed an enabling act to raise £3m to build a network of giant intercepting sewers, pumping stations and treatment works, to be designed by the engineer Sir Joseph Bazalgette. Whilst this network has been much improved and extended over the years, it still forms the backbone of London's sewerage system today.

The River Thames - Courtesy of Thames Water

Sewer overflows

By the time Bazalgette started his work, most of London's rivers and streams were carrying both sewage and rainwater. Separating the two was almost impossible, so he designed his new sewers to perform the dual function of dealing with 'foul' sewage and surface water run-off.

After heavy rainfall, the flows were greater than his sewers could take, so Bazalgette designed the system to overflow into the River Thames when necessary, and prevent sewage from backing up and flooding streets and buildings. His system brought big improvements to the residents of London, even though it overflowed from time to time.

When Bazalgette's network was built, the capital's population was around 2.5 million. He planned for population growth to around four million, not the eight million people Thames Water now serve. Additionally, he did not predict that climate change would bring less frequent but heavier rainfall, or that so many green spaces would be concreted over, preventing natural drainage.

Background study

Today, the system is struggling to cope with the demands of 21st century London, and discharges are now happening much more frequently - around once a week on average.

In 2000, the Thames Tideway Strategic Study was set up to consider the environmental impact of storm discharges to the tidal River Thames, and to propose potential solutions that would ensure compliance with the requirements of the EC Urban Wastewater Treatment Directive concerning the collection, treatment and discharge of urban wastewater.

Thames Water, the Environment Agency, the Greater London Authority, Defra and Ofwat (as an observer) all contributed to the study, which was independently chaired by engineering consultant Professor Chris Binnie. The study concluded that preventing discharges from combined sewer overflows alone would be not be enough to achieve new water quality standards. It was agreed that London's major sewage treatment works would also need to be expanded as they needed to treat considerably more wastewater.

Beckton STW - Courtesy of Thames Water

The CSO at Putney *Courtesy of Thames Water*

CSO discharge into the River Thames *Courtesy of Thames Water*

Two problems

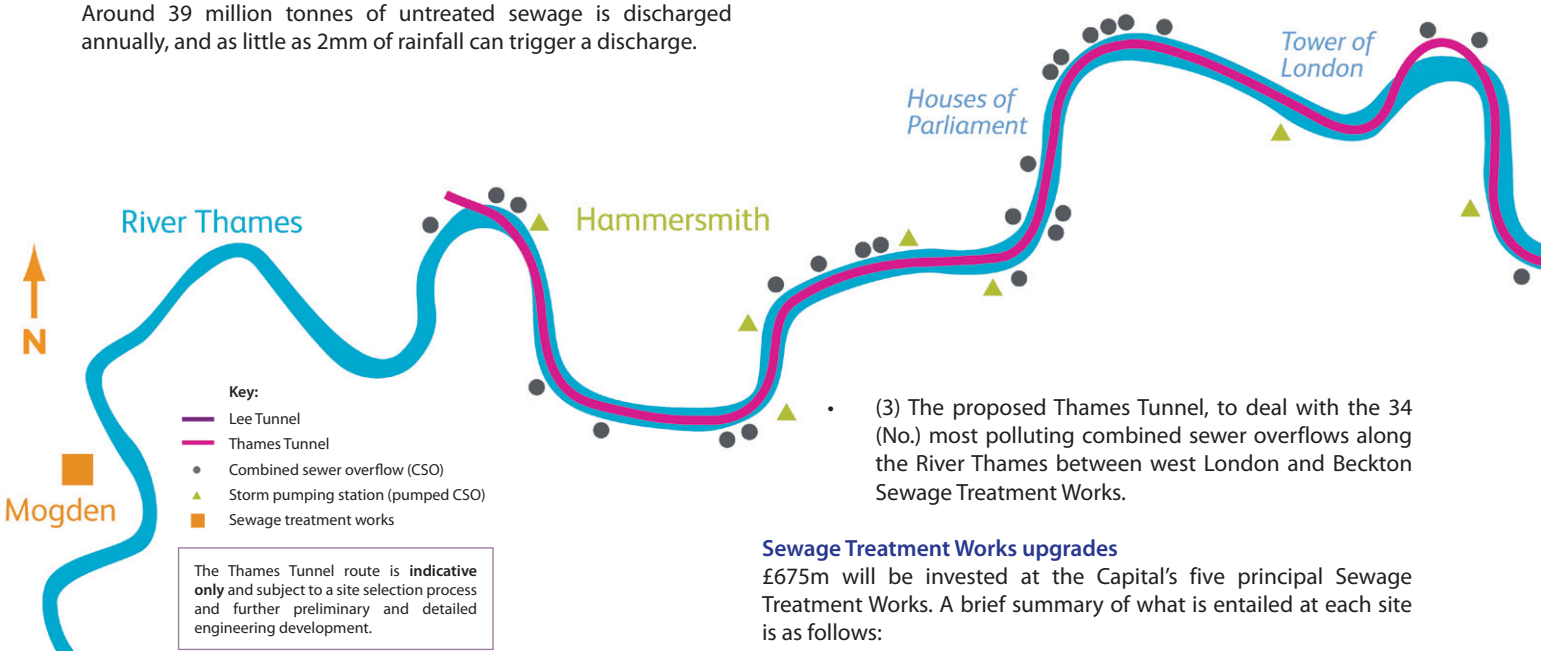
Overloaded sewage works: Although London's sewage works operate well under stable, dry weather conditions, in heavy rainfall they can become overloaded. Excess flows are diverted to storm tanks, for treatment when flows subside. But once the tanks are full, the only option is to discharge any additional excess flows to the river, to avoid sewage backing up onto the streets or even into people's homes.

Overloaded sewers: Bazalgette's sewerage system was constructed with 57 combined sewer overflow points along the tidal River Thames. When the sewers fill to capacity after heavy rainfall, any excess sewage is discharged into the river via these overflows. Around 39 million tonnes of untreated sewage is discharged annually, and as little as 2mm of rainfall can trigger a discharge.

Three solutions

In line with the recommendations of the Thames Tideway Strategic Study, Thames Water are developing three separate schemes to address the problems with the overloaded sewerage network in the Capital:

- (1) A £675m investment to improve London's five principal Sewage Treatment Works at Mogden, Crossness, Beckton, Long Reach and Riverside.
- (2) The £635m Lee Tunnel, to deal with the largest combined sewer overflow point at Abbey Mills Pumping Station, which discharges into the River Lee.



- (3) The proposed Thames Tunnel, to deal with the 34 (No.) most polluting combined sewer overflows along the River Thames between west London and Beckton Sewage Treatment Works.

Sewage Treatment Works upgrades

£675m will be invested at the Capital's five principal Sewage Treatment Works. A brief summary of what is entailed at each site is as follows:

Mogden STW

Located in Isleworth, west London, Mogden STW currently serves 1.9 million people and covers an area of about 120 acres. A £140m upgrade is underway to extend the sewage treatment capacity by 50%, and allow for a 6% population increase until 2021.

This investment will significantly reduce the amount of storm sewage that overflows into the tidal stretches of the River Thames when the site becomes overloaded during heavy rainfall. The improvements will also help Thames Water to meet tighter quality standards for the effluent we discharge. As well as significantly reducing sewage discharges, these improvements will help reduce odour at the site, as the use of storm tanks will be reduced during heavy rain, and new and existing equipment will be covered over.

The project involves installing new equipment and upgrading the existing plant. To make space for this, we are reshaping the western embankment, which is within the existing site boundary. The landscape to the west of the site will be enhanced once complete, benefiting local wildlife.

Once complete in 2013, Mogden will generate up to 40% of its power requirements from renewable energy generated from *'poo power'* - where electricity will be generated by burning methane derived from sewage.

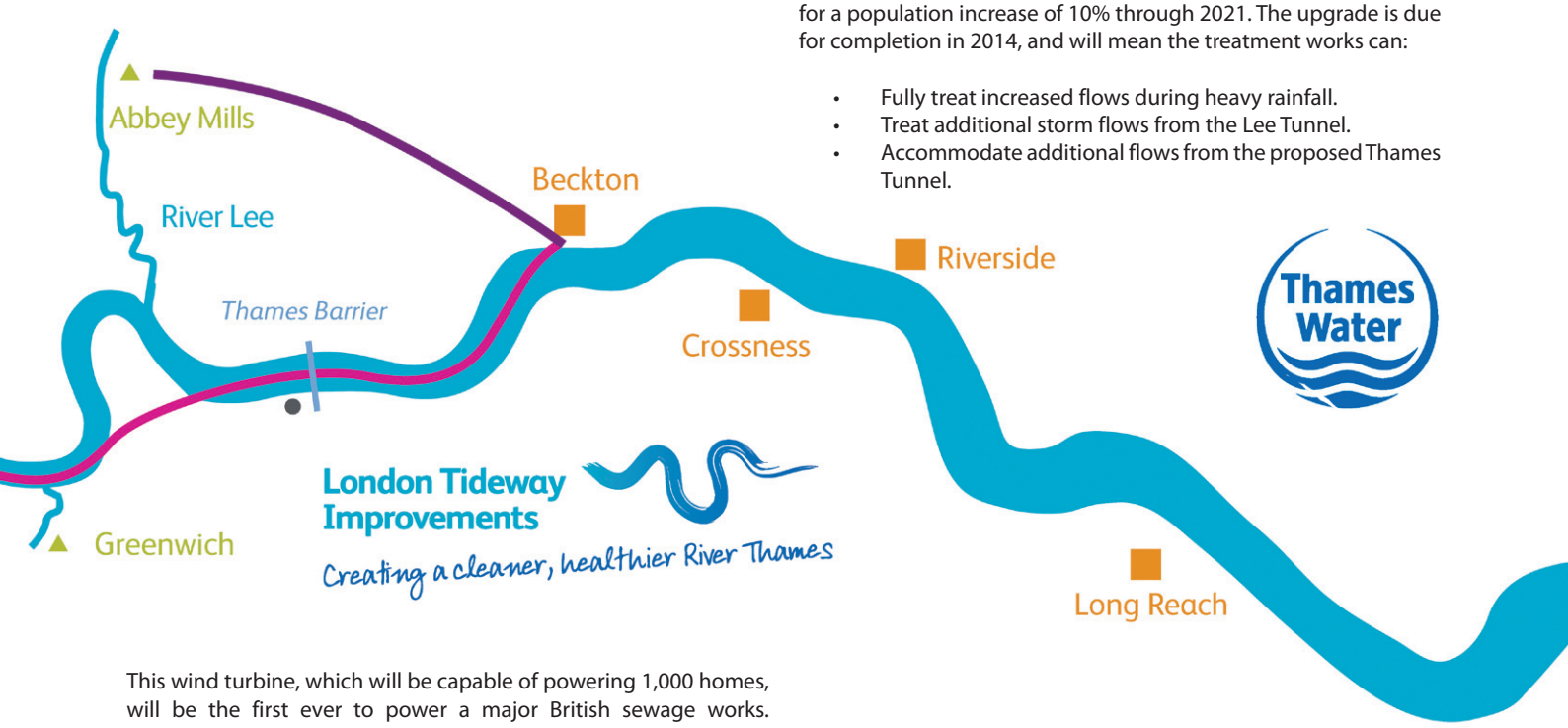

Mogden STW *Courtesy of Thames Water*


Crossness STW *Courtesy of Thames Water*

Crossness STW

Thames Water are carrying out a £220m upgrade at Crossness STW in east London, which serves two million Londoners. The improvements will enable the site to treat 44% more sewage than it does now, significantly reducing the amount of storm sewage during heavy rainfall, and allows for a 6% population increase until 2021.

The project also includes the installation of a wind turbine (planned to be installed in 2013) that will help generate up to half the energy needed to power the site when combined with the energy generated from processing sewage sludge.



This wind turbine, which will be capable of powering 1,000 homes, will be the first ever to power a major British sewage works.

The upgrade at Crossness will also see new odour-controlled treatment processes and environmental enhancements taking place at Crossness Nature Reserve and the Southern Marshes - including creating a suitable habitat for water voles and birds.

Beckton STW

Located in the London Borough of Newham, Beckton STW is one of Europe's largest sewage treatment works, and currently serves 3.5 million people. £190m is being invested at the works to upgrade the facility to handle 60% more sewage during storms, and allow for a population increase of 10% through 2021. The upgrade is due for completion in 2014, and will mean the treatment works can:

- Fully treat increased flows during heavy rainfall.
- Treat additional storm flows from the Lee Tunnel.
- Accommodate additional flows from the proposed Thames Tunnel.

As well as helping to protect the River Thames, other benefits resulting from this scheme include:

- The installation of a 1.5MW wind turbine that will help


Riverside STW Courtesy of Thames Water


Long Reach STW Courtesy of Thames Water

generate 8% of the energy needed to power the site.

- Enhancing the landscaping within the sewage works site, and improving the Barking Creekside habitat to encourage wildlife, including creating a new nature trail.
- Opening footpaths around the site and river and creating new paths along the northern edge of the site by the River Roding and River Thames.

In addition, Thames Water are investing a further £67m as part of a separate project to significantly reduce odour emissions by 50%. This will include covering all 16 (No.) of the primary settlement tanks – an area the size of ten football pitches.

Riverside STW

The £85m upgrade at Riverside STW, in Rainham, east London, is due for completion in 2012. This major scheme will not only improve water quality in the River Thames, it will also enable on site renewable energy production.

The project will involve providing additional treatment processes to improve the quality of treated effluent returned to the River Thames and to meet new Environment Agency standards. This will help boost oxygen levels in the tidal stretches of the river, improving water quality and habitats for fish.

On top of this, the plant will be equipped to turn solid waste, left behind after treatment, into enough renewable energy to power the entire site. This will be done through anaerobic digestion, where solid waste is broken down in enclosed tanks in the absence of oxygen. The process generates biogas, which will be used to generate the renewable energy to power the site. To ensure no additional odour on site, tried and tested technology will be installed, as well as covering up key parts of the plant.

A new wetland area will be developed to attract water voles and birds, as well as building bat boxes and planting trees and shrubs. Enhancements will also be made to the existing lagoon.


Beckton STW Courtesy of Thames Water

Long Reach STW *(featured in detail elsewhere in this publication)*
£40m is being invested to upgrade the Long Reach STW in Dartford, Kent, and is due for completion in 2012. The improvements will enable the site to deal with increased sewage resulting from population growth until 2021 and help improve water quality in the River Thames and meet new Environment Agency standards.

On top of this, the plant will generate more renewable energy from the sewage treatment process - providing enough energy to power over half the site. Odour will be reduced at Long Reach by installing new technology and tank covers.

Extensive landscaping and tree planting in recycled excavated soil will help screen the site.

Borehole drilling outside Parliament *Courtesy of Thames Water*

Lee Tunnel *(featured in detail elsewhere in this publication)*
The Lee Tunnel is the first of two tunnels, which will collectively capture an average of 39 million tonnes of sewage a year from the 35 (No.) most polluting Combined Sewer Overflows (CSOs). The £635m tunnel will tackle discharges from London's largest CSO at Abbey Mills Pumping Station in Stratford, which accounts for almost 40% of the total discharge into the River Thames.

The four-mile tunnel will run beneath the London Borough of Newham from Abbey Mills to Beckton and will help prevent more than 16 million tonnes of sewage, mixed with rainwater, overflowing into the River Lee (and subsequently the Thames) each year, by capturing it and transferring it to Beckton STW, which is being expanded to enable it to deal with the increased volumes.

Constructing the Lee Tunnel
The challenge of boring London's deepest-ever tunnel will involve tunnelling through high groundwater pressures and passing through four miles of the most abrasive ground, without any other shafts along the way. Construction work started in September 2010 to build the 80m deep shaft at Beckton STW, from where tunnelling work will start.

A 120-metre-long tunnel boring machine, named *"Busy Lizzie"* by a local primary school for good luck, will be used to construct the 7m diameter tunnel - equivalent to the width of three London buses. The machine has been custom-built to suit the ground conditions, which are predominantly chalk with highly abrasive flint. *"Busy Lizzie"* is a 'slurry closed faced' tunnel boring machine, which will blend over 100 tonnes of excavated chalk with water for every one metre of tunnel advance, forming a white slurry – a similar consistency to single cream, before transporting it through a pipe the length of the tunnel, so it can be processed above ground.

Tunnelling work is due to begin in January 2012 and is likely to progress at a rate of 17m a day. Tunnelling is expected to finish in late 2013.

The Thames Water project team - Mark Sneesby, Nick Fawcett & Roger Mitchell next to "Busy Lizzie", The Lee Tunnel TBM *Courtesy of Thames Water*

Sir Joseph Bazalgette *Courtesy of Thames Water*

Thames Tunnel

The proposed Thames Tunnel is the final and most challenging piece of the overall plan to tackle sewage discharges into the River Thames in London. After as little as 2mm of rainfall, London's Victorian sewers, which capture both sewage and rainfall can fill up. As there is nowhere else for the excess flows to go, it spills into the river via 57 combined sewer overflows. Without tackling the problem now, in ten years time the 39 million tonnes of sewage, which is currently discharged into the river in a typical year, is forecast to rise to an unthinkable 70 million tonnes.

Proposal: The Thames Tunnel sewer will run approximately 20 miles from west to east London, up to 75 metres below ground, broadly following the route of the River Thames. It will connect up to the 34 (No.) most polluting sewer overflows, as identified by the Environment Agency, to capture sewage which would otherwise spill into the Thames, before transferring it to Beckton STW for treatment.

***Consultation*:** From September 2010 to January 2011 Thames Water carried out phase one consultation on the proposed sites needed to construct and operate the Thames Tunnel, and the potential routes across London that the tunnel could take. The feedback from this phase of consultation is currently being analysed and a further phase of public consultation is planned for Autumn 2011.

Conclusion

The London Tideway Improvements is a massive undertaking. Once complete it will ensure that London has a wastewater collection and treatment system worthy of a 21st century capital city and significantly improve water quality in the River Thames.

The Editor and Publishers thank Thames Water for providing the information for the above article.