

London's Super Sewer Construction.

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Introduction

Over the next ten years, London's ageing, broken, sewer system is going to be upgraded to a super sewer, stretching 25km under its chaotic city streets. The project is estimated to cost £5 billion, and is designed to alleviate the issues caused by the current system, which has been in use since 1866.

London's current system was designed and built by Sir Joseph Bazalgette. Born in Enfield when London is an unhealthy place to live.

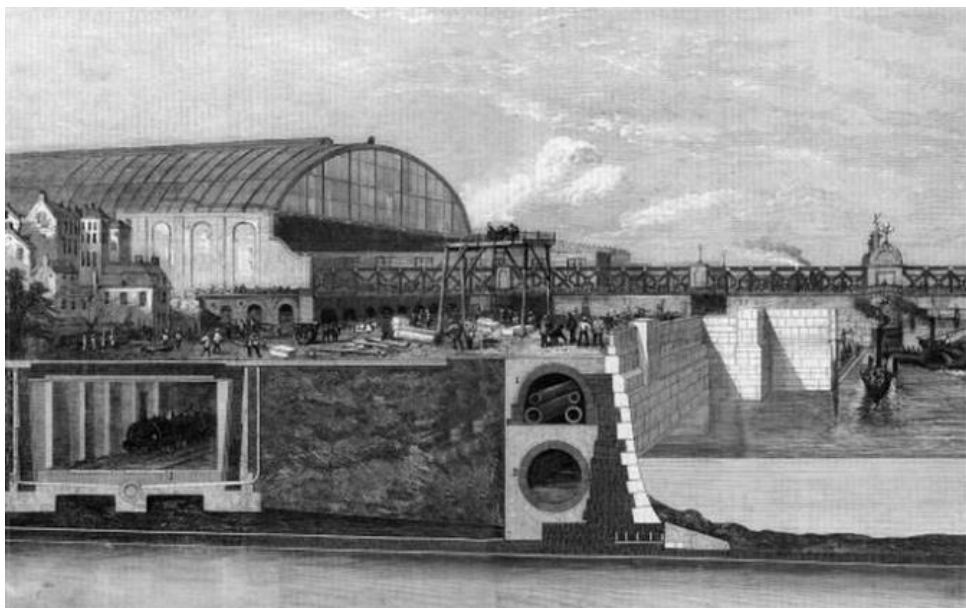
“When Joseph is 12, England has its first recorded case of cholera. It is a dangerous age. British people still need to take quinine to fight off the ever present threat of malaria. When Queen Victoria comes to the throne, only a half of London's infants live to their fifth birthday. Urban life expectancy is 35 when Joseph is born. It's down to 29 just a decade later.” (Source: HISTORY TV, 2019)

Bazalgette began his career in railway engineering, during which time he gained experience in drainage, and land reclamation. In 1843 he left public service and set up private practice in Westminster.

In 1856, he was named London Metropolitan Board of Works, Chief Engineer. This role involved supervising public works in the city, when in 1858, the stench from The Thames became so great it affected the politicians in parliament. Bazalgette submitted his plans to rid the city of foul water and ensure clean drinking water. His plans were approved, and so began the creation of London's current sewerage system.

By the time his plans began construction, over 30,000 Londoners were dead due to Cholera, caused by the waste entering the drinking water system

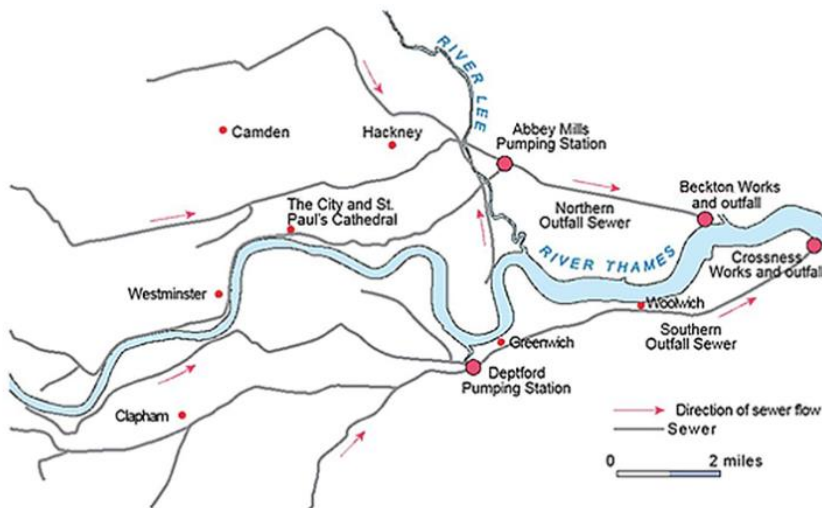
By 1866 most of London's sewers were connected by the system, which was built behind the Embankments, to avoid the time and financially consuming task of digging up London streets. The Embankments were so large, they would house the underground railways. Over 82 miles of sewers connected old pipes into the new system, 1100 miles of street sewers, fed into 4 pumping stations and sent to 2 treatment works further down The Thames.



Picture 1.1 Artists depiction of embankments and underground (Source: THECULTURETRIP.COM)

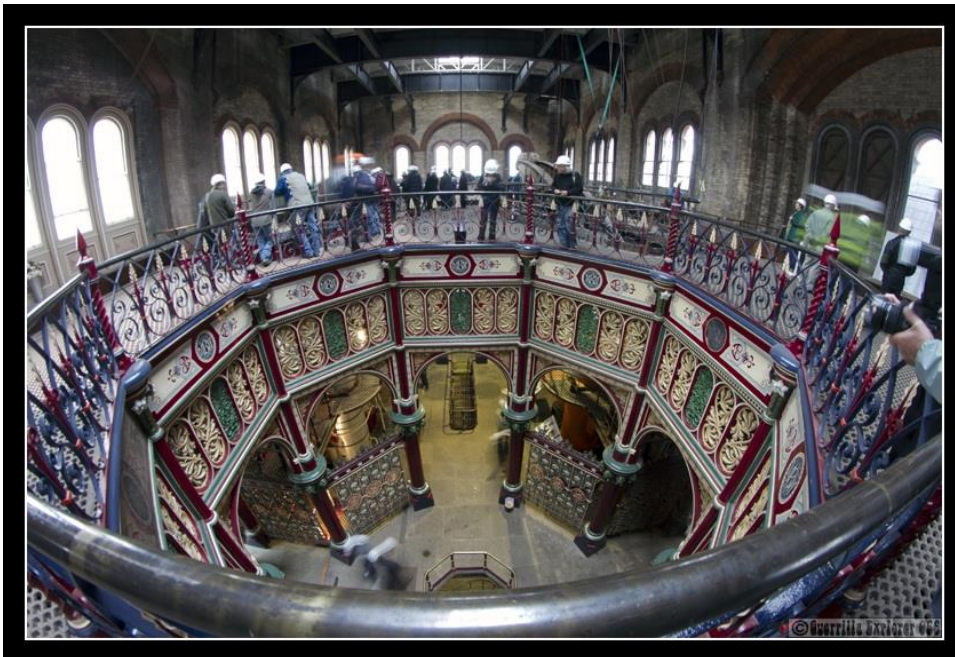
The Embankments project was finally finished in 1874, by 1875, Bazalgette spent £6.5 million building or renovating sewers in London. Each day it carried 1.8 billion litres of water and waste.

Bazalgette's great achievement has survived almost 200 years, through two World Wars, a monumental increase in inhabitants in London, and yet it still works well enough to be classed as an engineering feat.



A map of Bazalgette's 1858 scheme

PICTURE 1.2 Bazalgette Sewer System (Source: OPEN UNIVERSITY)



PICTURE 1.3 Pumping Station. (Source: GUERILLA EXPLORING)

Main Body

Problems with the system.

Limited capacity

Originally designed when London's population was a little over 3 million, this same system is still in use today with a population of almost 9 million people, plus millions of tourists each year.

Global Warming

Rising sea levels, and regular bad weather, now leave the sewer system struggling to deal with the pressure placed on it, and this results in overflow, causing sewer water to empty into The Thames.

Growth

The system has not been updated to consider the massive architectural expansion of London.

Poor Use and Hygiene Practices.

Massive amounts of sanitary products clog the system daily. Fats, oils, micro-plastics, food, refuse all clog the sewer.

Lack of Suitable Upgrades.

It is a 200-year-old system working at 3+ times its original capacity. Bazalgette never imagined his system would go this long without further intervention.

Pollution Killing Wildlife.

Toxic fumes found in water samples are killing Thames and surround area wildlife.

In 1858, London was home to two million people. Bazalgette had the foresight to build his sewer system for a population twice that size.

However today, the number of people living in the capital is approaching nine million.

So, while the sewers remain in excellent condition, they lack the capacity to meet the demands of modern-day London.

As a result, hundreds of thousands of tonnes of raw, untreated sewage overflow the system and spill into the Thames each year.

The effect on the river's fish, birds and aquatic mammals is profound.

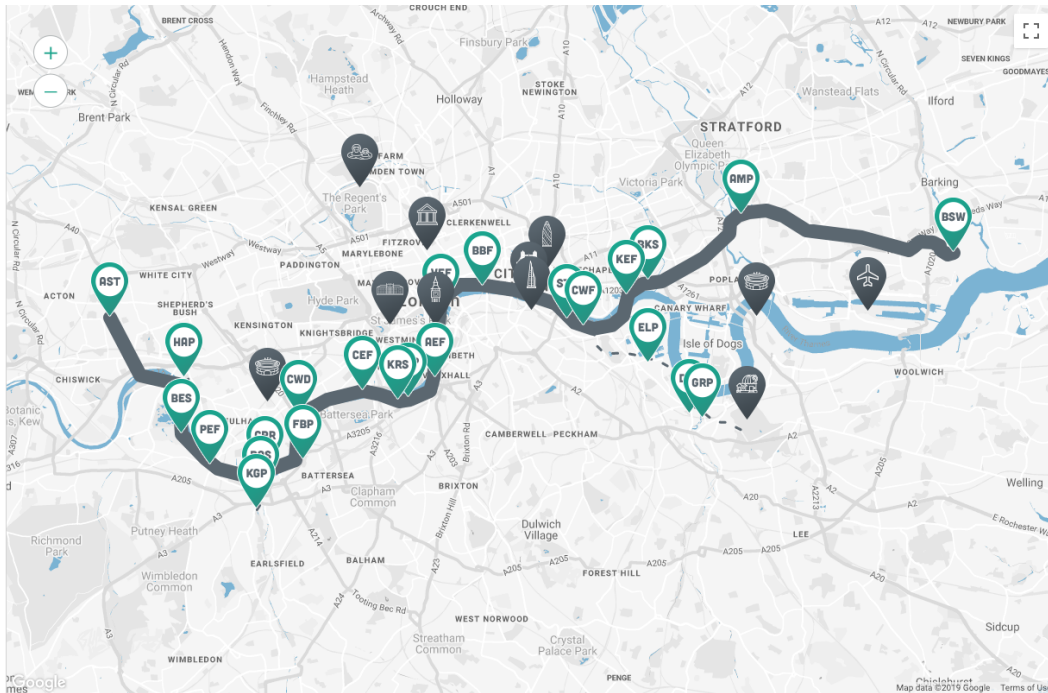
Ammonia found in sewage harms many of the Thames's inhabitants, while the bacteria that feed on the sewage deplete the river of oxygen, suffocating many of its fish.

This is shocking and unacceptable. (Source: TIDEWAY.LONDON)

Modern day London is as far removed from 1866 as could possibly be imagined, many thousands of clubs, bars, and restaurants, flush tonnes of food which then gets washed into the sewers. More foods than ever are clogging up the system, with several 'Fatbergs' having to be dissolved and removed in recent years.

What Can Be Done?

A new “Super Sewer” has been underway since 2016, this will involve creating a pipeline under The Thames. Due for completion in 2024 at a cost of near £5 billion it is a much-needed improvement to the current system.



PICTURE 1.4 Thames Tunnel Super Sewer. (Source: TIDEWAY LONDON)

At 25kms long, seven meters in diameter and depth of up to 65 metres below the river at some points, the tunnel will generally follow the route of the Thames, starting in Acton in the West and winding through to a treatment plant in Stratford in the East.

The tunnel for this will be created by a Tunnel Boring Machine (TBM) and will be the largest water construction project in the UK.

A TBM tunnels through the ground using its rotating cutterhead, while also creating the tunnel walls. Waste from the excavation is removed by conveyor, or pipe while concrete must be continuously delivered to front of the machine. The resulting pressure from the surrounding earth must be countered and the machine must be ventilated.

“The tunnel itself will work by intercepting sewage from 34 Combined Sewer Overflows (CSO) before it moves into the Thames. The CSO discharge points will be connected to the tunnel under the river and rather than flowing into the Thames, the dirty water will be stored in the sewer. It will then be pumped to the Beckton Sewerage Treatment Works and once treated, the clean water will be finally released into the river.” (Source: Ryan Tute 25 May 2018)

Still more needs to be done. Preventing water from reaching the sewers in the first instance would massively Richard Ashley writes:

“So what can architects do? You are in a pivotal position to ensure that services and infrastructure are considered holistically. This entails:

- *Seeing stormwater as an opportunity to enhance the public realm rather than as a threat;*
- *Using stormwater close to its source in buildings;*
- *Using green roofs for slowing down runoff and improving water quality;*
- *Ensuring that SUDS are the preferred option for draining new developments;*
- *Addressing drainage considerations at the outset of a project.”* (Source: Richard Ashley, October 2011)

All suggestions lead to prevention of surface water reaching the sewers in the first instance. Water-butts, more green areas, and planned irrigation would all be suitable options to reduce the amount of surface water that flows into the drains.

Public Attitudes to the Project.

A lot of public opinion lends to the idea of the project being too expensive. Despite the ecological benefits it would have to the animals that live in and around the Thames. (Source: PROF. CHRISTOPHER BINNIE 2014 THE GUARDIAN, SIR IAN BYATT 2015 FINANCIAL TIMES)

“The tunnel will do what it says it will do. But it is almost certainly a stupendous waste of money for very limited benefit,” “Since the tunnel was chosen, in the intervening 10 years, technology has moved on much and techniques such as sustainable drainage systems, real-time control of sewer flows, floating booms to retain floating litter, sewer separation and the like have been developed and are now widely used elsewhere.”(Source: Prof. Christopher Binnie THE GUARDIAN) putting a monetary value on the health and safety of the city’s inhabitants and the rivers wildlife. However, Professor Binnie was part of the committee that originally suggested the tunnel in the first place.

Whereas environmentalist opinion is very pro Thames Tunnel, in view of saving the wildlife and to create a cleaner, more useable river. London was built where it is because of the river, and the pollution in it prevents it from being used as much as it could.

"We welcome this announcement – the Thames Tideway Tunnel will make a key contribution to cleaning up one of our great rivers, bringing benefits to wildlife and people. But this should be seen as just one element of a strategy to reduce the vulnerability of London and the environment to sewer flooding during heavy rainfall. That’s why we are also calling on Thames Water and Local Authorities across London to make firm plans to invest in proven green infrastructure that can slow and store rainfall as it travels from roofs – to streets, to sewer and out to sea. Only then will London be ready to deal with the kind of chaos that climate change promises us." (Source: Rob Cunningham LONDON WILDLIFE TRUST)

Conclusion

The sewer project is a very divisive subject, with the project now well underway it is too late to pull out. Something must be done, and this is seemingly the most viable option. While this is a great start to decreasing the raw sewerage hitting the waterways, increasing public education on reducing water use and inappropriate use of sanitation and waste pipes, better ways to reduce the amount of water running into the system after severe rainfall should also be high on the list of priorities for the team developing this.

How long this system will last, with the population of London constantly increasing remains to be seen, and if it becomes a financial burden on Thames Water customers with its ever-growing costs it will be a disastrous result despite the benefits it will have for the residents and London's reputation in general.

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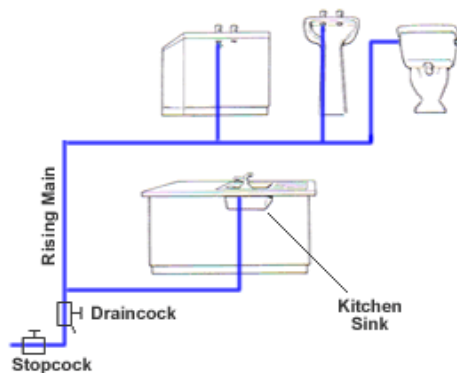
QUESTION 2.

Water Supply.

Water supply within a building can be either direct or indirect.

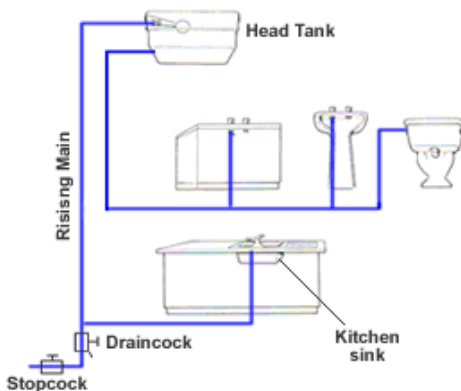
Cold Water Systems.

Direct cold water supply system: The mains water comes in via a rising main and directly feeds all the cold taps and a multi-point water heater - so all the taps and other water feeds are at mains water pressure. Sanitary feeds are fed by a mains supplied water cistern, which is also used to fill a hot water storage cylinder with a minimum capacity of 115 litres.



Picture 1.1 Direct Cold Water System (Source: Dolantehole)

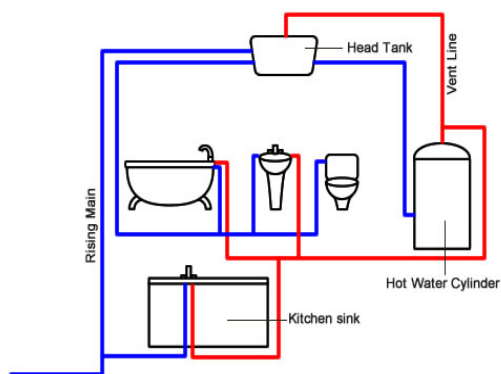
Indirect Cold water Supply is where all cold water draw offs apart from the kitchen sink are supplied via a cold water storage tank. Here water is drawn in from the rising man and split at a junction, directly to the kitchen sink and leading to a tank, usually situated in the loft. As the cistern in this system supplies sinks, baths, showers and the hot water tank it needs to be double the capacity of a cistern attached to a direct feed system. Minimum regulation standard cistern of 230 litres located in a loft space.



Picture 1.2 Indirect Cold Water System. (Source: Dolantehole)

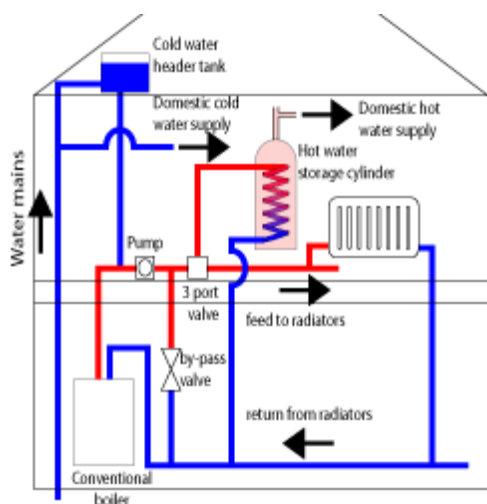
Hot Water Systems.

Direct hot water supply is used in homes that have no access to gas. Water is stored and heated in a cylinder, fed directly by the mains water tank, which is then drawn from when hot water is required and then refilled to be heated ready for use. On average a cylinder would need to have a capacity of 220 litres for a 3 bedroom property.



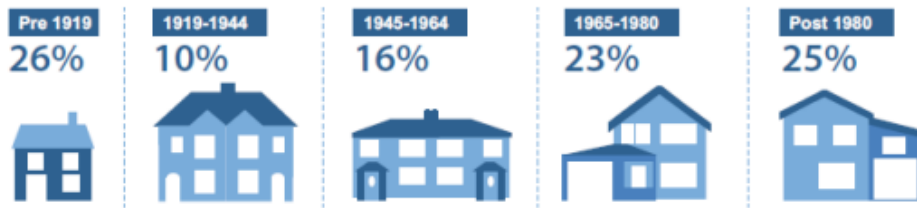
Picture 1.3 Direct Hot Water System (Source: HEATINGPLUMBERS.CO.UK)

Indirect hot water supply has nothing inside to heat the water. Therefore, it relies on an external source of heat, such as a boiler or fire. The boiler feeds the hot water into the cylinder. The indirect cylinder has an internal coil in the hot water cylinder to heat the water as it passes through when drawn on by taps or central heating.



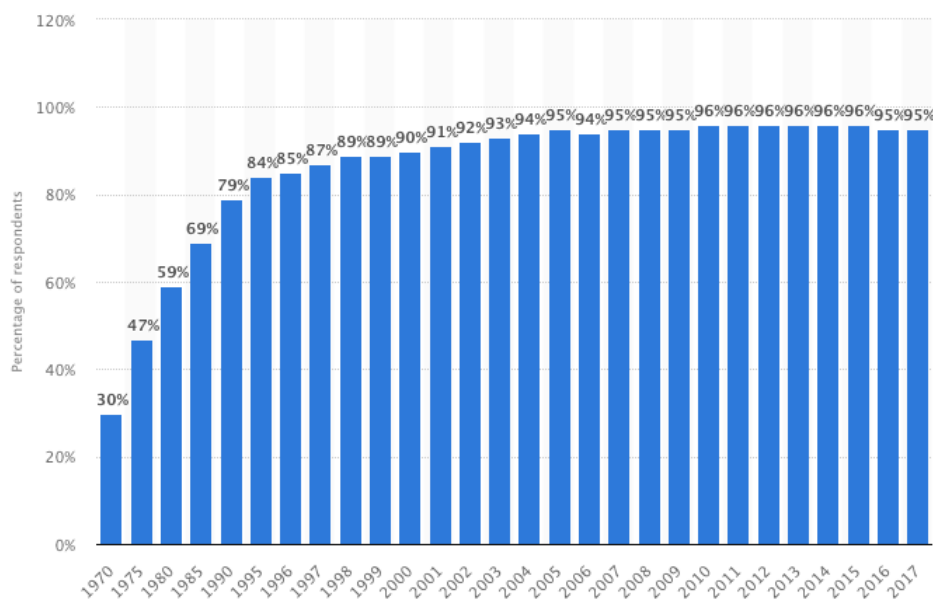
Picture 1.4 Indirect Hot Water System (Source: MAURICIOLEMUS.COM)

There are currently 1.35 million homes in Wales. Research Data Wales suggests that 7.9% of those are likely to be using direct hot water provision, due to the age of the housing stock, condition of the dwelling, proximity to gas main pipeline, use of other fossil fuel powered boilers. (Source: WELSH HOUSING CONDITIONS SURVEY 2017-2018)



Picture 1.5 Housing stock data (Source: WELSH HOUSING CONDITIONS SURVEY 2017-2018)

52% of the housing stock is pre 1970, as gas central heating did not become widely available until the late 1960's, many of these run on oil or electric heating systems, making up for a large portion of the percentage currently running on direct hot water systems, as retrofit to gas is costly and in houses with solid walls can be unsightly. Wales also has many flats and apartments, in which it would be difficult to produce enough water pressure to run gas boilers, so these properties have direct water supply and usually electric heating source.



Picture 1.6 Percentage of households with central heating systems in the United Kingdom (UK) from 1970 to 2017 (Source: STATISTA.COM)

“21 million homes in Britain are heated by mains gas (83 per cent of all homes): 84 per cent in England, 76 per cent in Scotland and 79 per cent in Wales.” (Source: OFF-GAS CONSUMERS)

Most recent new build properties have solar panels, these can also be used as a hot water back up source to reduce energy bills with an environmental drive to push away from fossil fuel usage, predictions are that less new builds will be equipped with boilers, instead returning to electric powered hot water and heating systems.

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