

SIR JOSEPH WILLIAM BAZALGETTE - THE INGENIOUS CIVIL ENGINEER WHO HAS CHANGED LONDON

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Abstract

The year 2024 marks the 205th anniversary of the birth of Sir Joseph William Bazalgette (1819-1891), the English civil engineer best known as the mastermind behind the sewerage system for Central London which he devised in the second half of the 19th century, in response to the Great Stink. In the summer of 1858, the hot weather increased the stench of the untreated human and industrial waste deposited on the banks of the Thames and into the river, resulting in about 12,000 fatalities due to contagious diseases. As Chief Engineer of the Metropolitan Board of Works, Bazalgette's solution was to build a sewer network that would collect the waste water and waste matter flowing freely on the London streets. Proposed in 1858, his project was completed in 1875. The complex infrastructure, consisting of 132 km (82 miles) of underground sewers, about 2,100 km (1,300 miles) of street sewers, and four pumping stations (Deptford, Crossness, Abbey Mills and Chelsea Embankment) has fundamentally reshaped the sewage system of the English capital and is still in use, making London the city it is today.

Key words: London, pumping station, sewage system, the Great Stink, the Thames.

INTRODUCTION

A period marked by contrasts and differences, the Victorian Age left an impressive heritage to Britain. Throughout almost 64 years of reign, Queen Victoria ruled a large empire that was to become the world's industrial power, and encouraged the development of knowledge under its most revolutionary forms, which ultimately led to a rapid change in the essence of the British society and an unprecedented evolution of science, technology and the arts. Creative imagination and masterly skills, doubled by innovative vision and high ideals, have generated various types of masterpieces that were then regarded as groundbreaking discoveries and even today are clearly acknowledged as not only factual and social achievements but also prominent cultural symbols of a nation at its very best moment in its history.

This paper is intended as a celebration of the life and work of one particular personality of the time: Sir Joseph William Bazalgette, the English civil engineer who is remembered as the creator of the first sewerage system for Central London in the mid-1800s. It is a descriptive-interpretive approach primarily

based on specialist literature and the engineer's own report, 'On the Metropolitan System of Drainage and the Interception of the Sewage from the River Thames', presented at the Institute of Civil Engineers on the 14th of March 1865 (Bazalgette, 1865). The analysis focuses primarily on the scientific aspects of the project, minutely advocated by facts and data, and also emphasizes the profoundly human nature of such an unprecedented enterprise. The boldness and complexity of the work stand as ultimate proof that civil engineering is a profession that successfully combines systematic knowledge based on evidence with creativity and resourcefulness for the sake of progress, of creating healthier and happier communities in safer and more secure environments.

THE SETTING

At the time of Queen Victoria's coronation on the 28th of June 1838, London was the capital of the British Empire and the largest city in the world, about to reach two million inhabitants consisting of locals as well as migrants from Ireland and continental Europe, Africa and

America, and colonists returning from North America and later Australia.

The emerging hub of the world was far from being ‘the flower of cities all’ (Dunbar, 2012). As personal stories were absorbed into the collective urban narrative, geographic and demographic expansion resulted in overcrowding and low living standards. Divided between the affluent West districts and the poverty-stricken East, the city was heavily dependent on coal heating to keep its buildings warm, manual pumps to provide clean water to its increasing population, a rainwater system to wash the dirt and filth off its streets, and human waste collectors (euphemistically called ‘night soil men’) to help maintain somewhat decent conditions in its domestic households. Nevertheless, what the individual dwelling place was striving to gain in comfort, the whole congregation was losing in safety: the air was unbreathable, the water was undrinkable.

The dark reality of Victorian London was exquisitely chronicled by Charles Dickens, the famous novelist who depicted the baffling incongruities between cynical prosperity on the one hand and despondent poverty on the other. The devout Londoner often placed his characters against the memorable landscape of a dynamic yet desolate urban agglomeration. In his first novel, *The Posthumous Papers of the Pickwick Club* (1836-1837), he refers to ‘the climate of London, which is extremely disagreeable’ (Dickens, 1992) and, six years later, he opens the first chapter of *Bleak House* (1852-1853) with an indelible image of the English capital:

“As much mud in the streets as if the waters had but newly retired from the face of the earth, and it would not be wonderful to meet a Megalosaurus, forty feet long or so, waddling like an elephantine lizard up Holborn Hill. Smoke lowering down from chimney-pots, making a soft black drizzle, with flakes of soot in it as big as full-grown snow-flakes - gone into mourning, one might imagine, for the death of the sun” (Dickens, 2003).

The muddy streets and the smoke contribute to the general sense of discomfort and frustration generated by an oppressively grim environment, emphasised by the pervasive presence of fog, which adds an aura of mystery to easily recognisable geographic locations and,

at the same time, enhances mental anguish and emotional distress:

“Fog everywhere. Fog up the river, where it flows among green aits and meadows; fog down the river, where it rolls defiled among the tiers of shipping and the waterside pollutions of a great (and dirty) city. Fog on the Essex marshes, fog on the Kentish heights. Fog creeping into the cabooses of collier-brigs; fog lying out on the yards, and hovering on the rigging of great ships; fog drooping on the gunwales of barges and small boats. Fog in the eyes and throats of ancient Greenwich pensioners, wheezing by the firesides of their wards; fog in the stem and bowl of the afternoon pipe of the wrathful skipper, down in his close cabin; fog cruelly pinching the toes and fingers of his shivering little ‘prentice boy on deck” (Dickens, 2003).

Dense and dark, the description has repeatedly been anthologised not only for the literary value of the accumulation of tenebrous emotions forged by the dramatic exposition, but also for the oblique critique of the striking consequences of the fast industrial development on people and their surroundings. It is an inescapable trap that suffocates all living creatures and their ideals, since ‘the raw afternoon is rawest, and the dense fog is densest, and the muddy streets are muddiest.’ (Dickens, 2003).

The vicious circle metaphorically chronicled by the writer in many of his works was much harsher in reality, as the overcrowded and under-supplied boroughs were in imminent danger. The naturally occurring fog was becoming more dense due to the smoke, soot and ash resulting from coal burning in both homes and factories. The mud on the streets was thickened with dung from the hundreds of thousands of horses pulling the carriages and wagons on the streets. The human waste produced by 2.5 million Londoners was disposed of straight in the river, alongside animal carcasses and other rotting materials.

No wonder that more and more people were falling ill, with no hope of recovery. At first they blamed the odour emanating from decomposing organic matter but it soon became clear that it was the *Vibrio cholerae* that was proliferating in the city’s watercourse and passing into the pumps that supplied the

boroughs with water from the river. The bacteria caused three major cholera outbreaks: in 1831, when 6,536 people died; between 1848 and 1849, when 14,136 deaths were recorded; and between 1853 and 1854, when the disease claimed 10,738 lives. In 1854 the English physician John Snow identified the source of the epidemic as the public water pump located on Broad Street (today Broadwick Street) in Soho and persuaded the local council to disable it, subsequently noting the decline in the number of cases (Klein, 2015).

Nevertheless, as Londoners continued to pollute the river and its banks with their waste, the threat of hazards was critical. The year 1858 recorded a particularly hot summer, with temperatures of 35-36°C in the shade which caused a rapid decrease in the water level and a consequent increase in pollutant concentration. The unbearable smell rising from the river was to be remembered as 'The Great Stink', one of the major environmental crises in the history of the metropolis.

Dickens had given a worrying account of the life-threatening waterway passing through the heart of the city in *Little Dorrit* (1855-1857). In the third chapter of the novel, ironically titled 'Home', he contemplated the undergoing hardships of the Londoners forced to live in unhealthy conditions: "Miles of close wells and pits of houses, where the inhabitants gasped for air, stretched far away towards every point of the compass. Through the heart of the town a deadly sewer ebbed and flowed, in the place of a fine fresh river" (Dickens, 2004). The juxtaposition of the two images, the previously glamorous waters and the contemporary Styx slithering across the urban area, deepens the state of grimness. Even the rain adds to the decay and unpleasantness of the city: far from giving it new strength and energy, it "developed only foul stale smells, and was a sickly, lukewarm, dirt-stained, wretched addition to the gutters" (Dickens, 2004).

The newspapers of the time lamented over the infernal stench and the reprehensible condition of the river. On the 28th of June 1858, *The Standard* (today *The Evening Standard*) painted a grotesque picture of the Thames, ironically personified as a disgraced father figure: "Dirty Old Father Thames reached, on Wednesday last, a point of infamy which we firmly believe

was never before attained by any being, animate or inanimate, whose misdeeds fill up the chronicle of British wickedness. His noisome qualities have been execrated by the passengers of our bridges and the travellers in our penny steam boats; people have not only turned up, but stopped their noses, whenever they have approached his unsavoury banks; his foulness has supplied matter for many a smart leader in our journals whenever parliamentary debates have been uninteresting and foreign intelligence has been scant; "constant readers" have vied with each other in describing their particular sufferings under the influence of his abominable exhalations" (*The Standard*, 1858). The news of the severe situation generated by the dry weather was spreading outside the capital. *The Leeds Intelligencer and Yorkshire General Advertiser* reported the degradation of the river in its urban sector and its severe hazardous potential: "In London the concurrence of neap tides with the excessive heat has rendered the Thames an insupportable nuisance, and it seems probable that at last something or other will be done towards its purification, in spite of the Conservators of the Thames and the Board of Works. Indeed serious alarm is beginning to be felt lest some form of malignant fever should break out with all the violence of a pestilence" (*The Leeds Intelligencer and Yorkshire General Advertiser*, 1858).

Back in the city, *The Morning Chronicle* highlighted the ineffectiveness of the immediate bureaucratic measures in addressing the issue, focussing on the urgent need for effective procedures to control pollution: "The Board of Works - "Words" it has been irreverently termed - has exercised its function for nearly four years. Each year, as the summer heat has returned, the Thames has given off reeking filthy stenches, which have become on each occasion more and more intolerable, till at last we see a fleet of barges lying off the banks pitching lime into the river to prevent members of Parliament from being poisoned; and canvas, chemically steeped, stretched across all the windows, in order that the air for the assembled Commons may be purified to some extent of the deleterious matters with which it is loaded by the pestiferous exhalations from the Thames" (*The Morning Chronicle*, 1858).

On a lighter note, the inglorious event was conferred enduring fame in verse, as this ‘Poem about Father Thames’ personifies the river as a repulsive creature, raising concerns about the devastating impact of industrialisation upon the natural world:

“And from the cloud a perfume rose,
That might be smelt but never sung;
And every member to his nose,
The guardian bandana flung;
Slowly the cloud took form, and slow
The perfume to a centre grew,
And on the deck before them, lo!
A grisly form appear to view!
A trailing robe of sludge and slime,
Fell o’er his limbs of muddy green,
And now and then, a streak of lime
Showed where the Board of Works had been;
From out his mouth’s mephitic well,
Poured fetid stench and sulphurous flames,
And - was it sight, or was it smell? -
All there, somehow, knew Father Thames.”

(*The Morning Chronicle*, 1858).

However gloomy or light-hearted the approach was, the circumstances were extreme and action was mandatory. And, in times of crisis, a hero is needed.

THE MASTERMIND

Joseph William Bazalgette was born in a family of French descent. His grandfather, Jean-Louis Bazalgette, left France for the Americas and ended up a landowner in Jamaica. He arrived in England in 1775, and established himself as a merchant in London, building up a considerable fortune. He had three children from his first marriage, the first of which was Joseph William Bazalgette, the father of the future engineer. Born in 1783, he enrolled in the Royal Navy and was wounded in an engagement and retired in 1809. He married Teresa Philo Pilton with whom he had thirteen children, of which only four survived: three daughters (Theresa Philo, Louiza and Julia) and a boy, born on the 28th of March 1819 and named after his father: Joseph William (*Hourly History*, 2018).

The family lived in the residential area of Clay Hill in the north of Enfield Town until 1827, then moved to Hamilton Terrace in St John’s Wood, where eight-year old Joseph spent his

teenage and young adult years. He was privately educated and, at the age of 17, was already an apprentice of Sir John Benjamin Macneill, a distinguished Irish civil engineer. Between 1836 and 1838 he was involved in railway projects in Northern Ireland, and gained experience in land drainage and reclamation, partly in China and Ireland. In 1842 he moved to London, where he set up a private consultancy to provide expert advice on the expansion of the city’s railways. From his office in Westminster, he took part in various engineering projects, such as the Tame Valley Canal in Birmingham, Portsmouth Dockyard and railway surveys.

In 1845 he married Maria Kaugh and over the next 16 years they had 11 children, six sons and four daughters, born between 1846 and 1861. The following year he became a full member of the Institute of Civil Engineers, the independent professional association for civil engineers in the United Kingdom. At 28, he was the head of a team of engineers who carried out a wide variety of transport-related works across the country, from ship canals and railways, water supply and sewage treatment processes to land reclamation from the sea to the construction of a tunnel between Dover and Calais.

Despite his personal and professional success, the young engineer collapsed under the pressure of increasingly demanding responsibilities (*Hourly History*, 2018). In 1847, he left London for the countryside to recover and returned two years later, when the second cholera epidemic was devastating the capital. He was appointed assistant surveyor to the Metropolitan Commission of Sewers, a public institution established with the declared purpose to unify, adapt and develop the existing structures into a coherent sewer and drainage infrastructure. The debates and dissensions divided and eventually dissolved the group, leading to the formation of three subsequent advisory bodies. The fifth Commission, to which Bazalgette was chief engineer, was set up in 1852 but the lack of funding forced its members to resign in 1854. The crisis was solved the following year, when the Metropolis Management Act provided for the foundation of the Metropolitan Board of Work, the first central government for the City of London that was granted power to carry out

construction projects including roads, bridges, parks, and sewers. On the 1st of January 1856, Joseph Bazalgette was formally asked to become chief engineer to the new board, a position that was to become crucial for the future of the city. Zealous and meticulous, he dedicated himself to the work that would bring him immortality.

THE MASTER PLAN

In only 59 years, London's population had doubled, reaching about 2-2.5 million people, which resulted in a massive rise in human waste that its outdated drainage systems could not support. Although the fish and fauna in the Thames were killed by the sewage dumped into it, the majority of Londoners were still using water from the river for domestic consumption, which posed a major health to the population.

Fully aware of the precarious situation, in 1856 Bazalgette submitted a plan including the construction of sewers that would prevent waste matter from flowing into the Thames in or near the metropolis. According to his scheme, the area north of the river would be drained by three low-level intercepting sewers collecting the wastes at Beckton, while the area south of the river would be served by two high-level intercepting sewers emptying into the river at Crossness during high tide. The five sewers would be fully encased in brick subterranean tunnels stretching along 82 miles to which 1,300 miles of sewers would be added above the ground to transfer rainwater and wastewater from dwellings and street level.

The plan raised various concerns, such as the distance from the Palace of Westminster to keep the effluvia far from the Members of Parliament, and the total funds necessary for the construction and maintenance of such a system.

And then came the Great Stink of 1858, with the record-breaking summer temperatures decomposing the waste in the river and releasing the legendary unbearable malodour plaguing the city. The acute environmental and public health crisis prompted the adoption of the Metropolis Local Management Amendment Act that stipulated the urgent provision of funding for sewage disposal as far away from the city as practically possible, so work on the

new sewage system began in 1859. What became known as the most expensive work of modern times, at a cost of £4.1 million (roughly between £160 million and £1.7 billion today), was going to last for about 16 years, until 1875. Bazalgette's genius consisted not only in his overview but especially in his perspective regarding the viability of his project beyond his times. He calculated the number of people living in each area of London and the approximate amount of waste matter they could produce, and doubled the figure. He also analysed the existing water supply and estimated it for the increasing population, together with the amount of rainfall predicted for the next decades. Then he used the huge figures anticipating the considerable expansion of the metropolis to provide the foundations of the mega project that was designed to last for at least one century ahead.

The three main intercepting lines of sewers were constructed on each side of the Thames, and were named considering the terrain elevation to be crossed: the High Level, the Middle Level, and the Low Level. The first two sewers were planned to discharge by gravitation, whereas the third only by the aid of pumping. North of the river the sewers converged at Abbey Mills, where the contents would be carried on a concrete embankment across the marshes to Barking Creek, and discharged into the river by gravitation. According to Bazalgette, Abbey Mills Pumping Station was planned to be "the largest establishment of the kind on the Main Drainage Works, providing, as it does, engine power to the extent of 1,140 H.P., for the purpose of lifting a maximum quantity of sewage and rainfall of 15,000 cubic feet/minute a height of 36 feet" (Bazalgette, 1865). South of the river, the three intercepting lines united at Deptford Creek, where Deptford Pumping Station was planned to lift the sewage from the Low-Level Sewer into the Outfall Sewer at a height of 18 feet. Subsequently, the contents would flow in one channel through Woolwich to Crossness Reservoir and Pumping Station, where four engines would lift the sewage from the deep sewers into a reservoir with a capacity of 25 million gallons and covering an area of over six acres, then discharge it in Erith Marshes at high tide. According to Bazalgette, "The maximum

quantity of sewage to be lifted by these engines will ordinarily be about 10,000 cubic feet/minute” (Bazalgette, 1865).

The southern system was the first stage of the project and was completed in 1865, when it was inaugurated by Edward, Prince of Wales. The northern system would be completed in 1868, ten years after the first works began, and the whole project would come to an end in 1875 (Figure 1).



Figure 1. Crossness Pumping Station
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As works on the southern system were nearing completion, Bazalgette prepared a report that highlighted the importance of developing a modern system for the well-being of both the city and its citizens, based on the history of London’s drainage system since medieval times. On the 14th of March 1865, he defended his views expressed in the document, titled ‘On the Metropolitan System of Drainage, and the Interception of the Sewage from the River Thames’, before his fellow members of the Institute of Civil Engineers. In a formal and cautiously measured tone, he warned of the consequences of neglecting proper waste management and emphasised the urgent necessity of sewage systems and proper sanitation in urban areas:

“The majority of the inhabitants and towns are frequently unconscious of the magnitude, intricacy, and extent of the underground works, which have been designed and constructed at great cost, and are necessary for the maintenance of their health and comfort. It is, however, impossible for large numbers of the human species to congregate and live upon a

limited space, without provision being made for the rapid removal of the refuse thereby produced. This necessity is perhaps most forcibly illustrated, by the fearful destruction of life from malaria produced amongst troops suddenly encamped upon ground not previously so prepared for human habitation” (Bazalgette, 1865).

In his address, the engineer pointed out the negative impact of population growth and urban development on the environment, specifically on the use of cesspools and the pollution of the sewers due to human activities. He commented on the excessive changes made to the natural landscape and the environmental degradation caused by human intervention in the natural environment, stressing the importance of sustainable practices and responsible urban planning in managing the increasing population density: “As the population of London increased, its subsoil became thickly studded with cesspools, improved household appliances were introduced, and overflow drains from the cesspools to the sewers were constructed; thus the sewers became polluted, and covered brick channels were unnecessarily substituted for existing open streams” (Bazalgette, 1865).

Naturally, his exposition included the recent cholera outbreaks and their catastrophic consequences - “The metropolis had suffered severely in the cholera visitation of 1831-2, again in 1848-8, and lastly in 1853-4. In 1849 the deaths were 18,036, and in 1854 nearly 20,000...” (Bazalgette, 1865), which prompted the consideration of developing an updated disposal network for the metropolitan area. The engineer advocated for goals and benefits of implementing a new drainage system to rectify the deficiencies of the existing infrastructure and to achieve specific objectives related to sewage management and pollution prevention, concluding that “It is easier and more economical to originate a new and complete system of drainage having these objects in view, than to adapt existing and defective sewers to a uniform and more perfect system” (Bazalgette, 1865).

The introduction was followed by a minutely detailed description of the main sewers, including technical specifications and locations, accompanied by numerous appendices, and was illustrated by a map of London, together with

models and enlarged diagrams of some of the principal works, as well as a complete set of specifications and contract drawings, in tune with the engineer's meticulous nature. The precise details and accurate explanations render the reasoning behind the construction process very clearly and easily to understand even by non-specialists. The descriptive-argumentative account, although abundant in technical terms, is highly visual, developing each phase shot by shot, as in a motion picture, highlighting the exquisite professionalism of the 19th century specialist.

Concluding his elaborated communication with a systematic summary of the logistics and resources required for such an extensive engineering endeavour, he called attention to the massive scale of the project, highlighting the cost and amounts of the materials and resources involved in the construction project: "Three hundred and eighteen millions of bricks, and 880,000 cubic yards of concrete have been consumed, and 3½ million cubic yards of earth have been excavated in the execution of Main Drainage Works. The total pumping power employed is 2,380 nominal H.P.; and if at full work night and day, 44,000 tons of coals per annum would be consumed, but the average consumption if estimated at 20,000 tons" (Bazalgette, 1865).

Despite the definitive facts and figures, the over-scrupulous genius concluded his presentation with a focus on the remaining work to be done on the Low Level Sewer north of the river, detailing the timeline for its completion in relation to yet another project, the walkway along the Thames:

"The whole of the Main Drainage scheme is now completed, with the exception of the Low Level Sewer on the North side of the Thames, which is being formed in conjunction with the Thames Embankment and the new street to the Mansion house, and will therefore probably not come into operation for a couple of years. The proportion of the area drained by that Sewer is one seventh of the whole" (Bazalgette, 1865).

The construction of the 82 miles of main sewer running parallel to the Thames to the outflows at Barking and Crossness and the additional 1,300 miles of subsidiary tunnels was carefully supervised by the perfectionist engineer. Bazalgette personally chose a particular type of brick for the sewer tunnel, as he considered that

the high crushing strength and low water absorption of Staffordshire blue brick were able to resist the scouring effect of water falling through the system from high to low level. He also insisted on the use of the relatively recently invented Portland cement, that had been patented in 1825, owing to its water resistance and unique capacity to strengthen when constantly exposed to water. He substantiated his choice on carefully detailed tests, and it was for the first time that this material was used in any large-scale public project.

However, Bazalgette's capabilities went beyond inflexible engineering tasks. Together with architect Charles Henry Driver, he turned the two main pumping stations, Abbey Mills and Crossness, into genuine artworks. The 'cathedrals of sewage', as they are sometimes labelled, are conspicuous through their stunning Victorian industrial architecture combining Italian Venetian, French Gothic, Flemish, Byzantine/Moorish, Russian Orthodox and Celtic styles (Abbey Mills), and ancient Roman and Byzantine styles (Crossness) (Figure 2).



Figure 2. The Octagon, Crossness Pumping Station
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The interiors featuring intricately wrought iron patterns and cast iron columns, and the colorful paintings of naturalistic motifs alluding to sacred and symbolic spaces reveal the engineer's artistic side, stressing both the

practical effectiveness and the aesthetically pleasing design of the two buildings.

Bazalgette and Driver continued their collaboration after the completion of the massive engineering project that changed the history of London and the Thames, as they united their creative efforts in shaping The Embankment. To avoid digging off central London in order to incorporate the huge pipes of the main sewers, they proposed raised structures along the Thames, which also helped protect the low-lying districts from flooding, and eventually created an important green space in one of the busiest part of the English capital. Over one mile long, the wide promenade was lined with trees and decorated with bronze mooring rings cast in the shape of lion heads; originally lit with dolphin-shaped, cast iron lamps, it became the first London street to be electrified in December 1878.

LEGACY

Joseph Bazalgette remained chief engineer with the Metropolitan Board of Works until the institution was replaced by the London County Council in 1889. His outstanding skills as a surveyor, planner, and engineer received national acknowledgment, and he was made a Commander of the Bath in 1871 and knighted by Queen Victoria at Windsor in 1874. Towards the end of this life, he was appointed the 24th President of the Institution of Civil Engineers, a position that he held for only two year, between 1882 and 1884. He retired in 1889, after a long and illustrious career.

He died at his home near Wimbledon on the 15th of March 1891, less than two weeks before his 72nd birth anniversary. His death was marked by a lengthy obituary in the Proceedings of the Institution of Civil Engineers, the organisation of which he had been a member for more than 40 years and to which he had served as president for two years. Many national newspapers paid their respects to the genius who had undertaken engineering work on an unprecedented scale. On the 17th of March 1891, *The Leeds Mercury* wrote:

“The death of Sir Joseph Bazalgette removes from this generation one who must ever be memorable on its annals. What Baron Haussmann was to Paris Sir Joseph Bazalgette

was to London. He drained and purified London, and he did much to beautify it by giving the Thames a swifter course, by building embankments planted in boulevard fashion with trees, and by constructing bridges. [...] There is one monument of his skill as an engineer that will endure as long as any monument in Venice. That is the Embankment between Blackfriars Bridge and Westminster. The health of London was advanced immensely by this great work and its consequent enterprises” (*The Leeds Mercury*, 1891).

Bazalgette was interred alongside his wife Maria and five of their children in the family mausoleum in the grounds of St Mary's Church, Wimbledon, in the London Borough of Merton. The simplicity of the Grade II listed structure made of Portland stone is given by the rusticated base and the obelisk atop, stating the names of the family members laid to rest inside. At present the deteriorating mausoleum is at risk of internal collapse due to water ingress but the church is taking steps for restoration work in partnership with a south-west London based charity.



Figure 3. Sir Joseph Bazalgette bust, Victoria Embankment
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In 1899, sculptor George Blackall Simonds created a memorial to the Victorian engineer. The bronze bust set in a decorative stone wall can be found on the Victoria Embankment, a few steps away from Hungerford and Golden Jubilee Bridges (Figure 3). The inscription above the bust reads “Flumini vincula posuit” (“He put the river in chains”).

In 1974, Greater London Council erected a blue plaque at 17 Hamilton Terrace, St John's

Wood, the North-West London home of Bazalgette between 1827 and 1845, to remember the notable resident of the brick double house.

In 2006, a BBC survey nominated Bazalgette's sewers as one of the nation's favourite wonders ever created by humans in the UK. The "triumph of Victorian engineering", as it is often called, was included in the ten episodes' TV series named *Seven Man-Made Wonders of London* that ran throughout the summer of that year.

Ten years later, on the occasion of the 200-year anniversary of the Institute of Civil Engineers, the exhibition "Invisible Superheroes" paid tribute to some of the past and present champions of civil engineering whose innovative work changed lives and shaped the world. Among others, it honoured the engineer nicknamed "Drainy Jo" in his lifetime as Captain Sanitation, for his groundbreaking project and its environmental effects.

On the 1st of November 2023, to mark National Engineering Day, Transport for London joined the Royal Academy of Engineering to draw up an Engineering Icons Tube Map of London as a means to "inspire people of all backgrounds to study science, technology, engineering (in particular) and mathematical subjects, and then pursue them professionally", as stated on the TfL blog. The map showcased 274 engineers across 11 themes such as Life and Health, Environment, Infrastructure, Energy and Power, Materials and Manufacturing, and others. Sir Joseph Bazalgette was featured at Blackfriars Underground Station on the Circle and District Lines, in celebration of the public space next to Blackfriars Bridge that had been named after the 'King of Sewers' three years earlier.

His memory still lives on through his descendants, great-great-grandsons Peter and Edward. Peter Lytton Bazalgette, a television executive and producer better known for bringing the American TV show *Big Brother* to the UK, was invited to present a documentary about the Great Stink for Channel Five in 2002 and set up Crossness Engines Trust in 1985, raising £4.5 million to restore the pumping station built by his ancestor. In 2015, as Chair of Arts Council England, he was also invited by King's College London to discuss his great-

great-grandfather's accomplishments in a public meeting with the academic community. His third cousin, Edward Bazalgette, a television director and former musician, directed and produced the drama-documentary 'The Sewer King' broadcast by BBC Two in March 2003, as part of the series called *The Seven Wonders of the Industrial World*.

CONCLUSIONS

Sir Joseph Bazalgette will be forever remembered as the Victorian engineer, city planner, bridge builder and landscape architect who shaped London into the city of today. Many of his master creations are confined to the depths of the metropolis, winding under its streets and parks. And yet, what can be seen still amazes with the fineness of the engineering, architectural and artistic details: Abbey Mills and Crossness Pumping Stations have been included on the Grade I list of sites, owing to their exceptional national importance and those who have the opportunity to visit their exhibition centres can only bow to the English engineer's extraordinary ability to think ahead and turn his vision into a reality that transcends centuries. He anticipated population growth and planned the sewage system to serve twice as many inhabitants as was necessary in his times.

For about 150 years, Bazalgette's network has been functional for millions of Londoners. Today, with the city approaching 10 million inhabitants, it has reached its full capacity, so a consortium of investors proposed a new super-sewage to meet the present and future demands of the ever-expanding conurbation. The construction of Thames Tideway Tunnel, a 16 miles' long combined tunnel extending from Acton, Ealing, to Beckton Sewage Treatment Works in Newham, started in 2016 and ended in March 2024, and is currently followed by a testing and handover phase expected to conclude in 2025.

Building on Bazalgette's achievements, the new project preserves his legacy in the 21st century, addressing some of the environmental challenges posed by the new Millennium and maintaining the Thames one of the cleanest metropolitan rivers in the world.

