May 2020

Briefing Note

What is a Sewer Network?

On average, we each use between 79 and 307 litres of water every day, for drinking, cooking, washing, cleaning and hygiene[1]. And what comes into our homes and workplaces must leave it too, be treated to avoid the spread of disease, and then safely returned to the environment.

To achieve this, beneath our feet are networks of sewer pipes that bring waste water from us, to a waste water treatment plant. Across the EU, there are over 3,000,000 km of sewer networks, ranging from small pipes leaving our homes, to trunk sewers that can be several metres in diameter. All of these have to be continuously operated, maintained, and invested in, to keep those networks fit for current and future requirements.

As well as household waste water, excess rainfall is a problem for the built environment because it can cause flooding. To address this, many of our sewer networks carry sewage, rainwater and other runoff. These are referred to as combined sewer networks (see Figure 1).

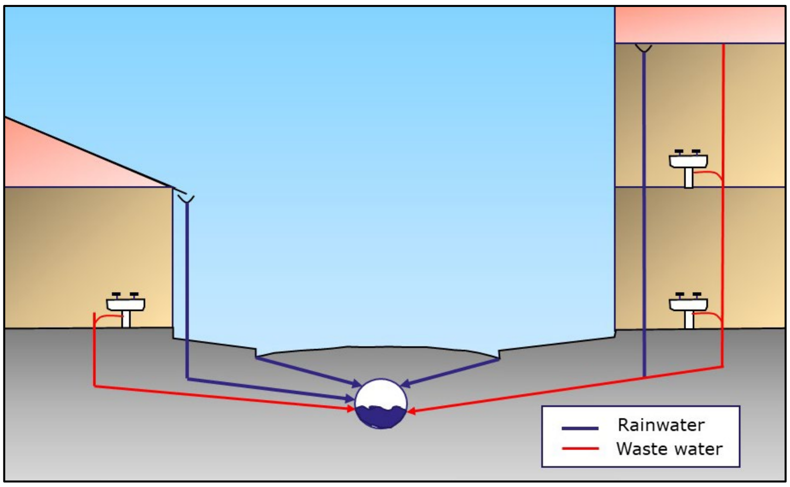

Figure 1: Combined sewer system; sewage (red) and rain water (blue) are collected in the same pipe

These networks have finite capacities that are exceeded at times of significant rainfall so they are equipped with relief points to prevent flooding. Those relief points discharge

[1] Forthcoming report on the *Governance of water services in Europe*, Edition 2020, EurEau.

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untreated but diluted waste water and are known as combined sewer overflows, or CSOs[2] (see Figure 2). These CSOs need to be properly designed, installed and maintained to avoid adverse impacts on the environment.

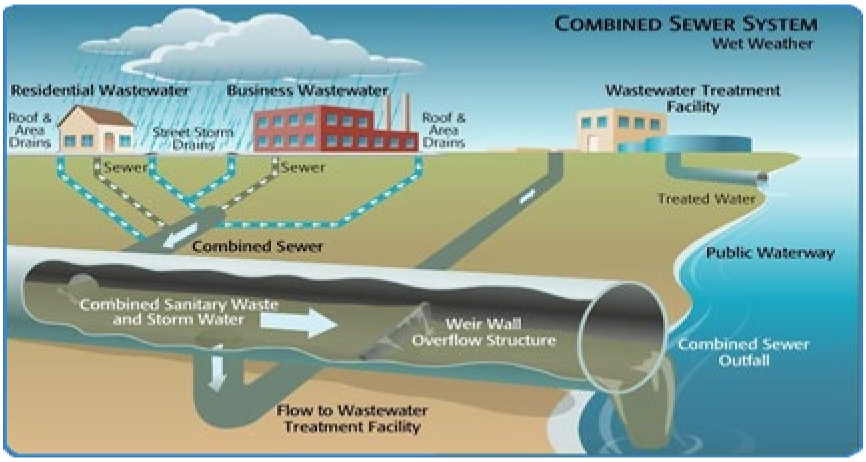

Figure 2: Combined Sewer Overflow (Source: Kentucky Water Utility, Henderson, USA)

As our environmental understanding has increased, so have our requirements for CSOs. These can include decreasing the amount of storm water that is allowed to flow in the sewer system, requirements to prevent solid debris escaping from overflows, and storage or other measures to reduce volumes discharged to watercourses.

Nowadays, new or extended sewerage systems are increasingly separated so as to address some of the shortfalls of combined systems. This means that there is one pipe for foul sewage and another for storm runoff (see Figure 3).

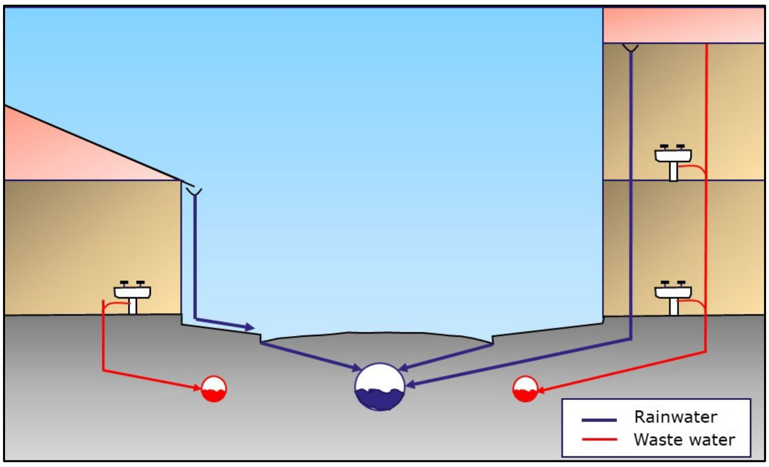

Figure 3: Separate Sewer System; sewage (red) and rain water (blue) are collected in different pipes.

[2] For more details see our position paper on overflows from collecting systems.

Whilst separate systems avoid CSO impacts, they bring their own challenge of keeping the two systems separate, whether this is at the individual household level, or a complete neighbourhood. All the same, we have to bear in mind that in general, due to pollution from pavements, streets and many other sources entering the gutters, discharges from the storm separate sewers should not be considered as clean water.

Taking the idea of separating systems a stage further, more recent thought has turned to how to reduce or slow down storm water runoff before it enters the combined or storm sewer. To meet this challenge, the concept and implementation of Sustainable Urban Drainage Systems (SUDS) has increased markedly over the last decade (see Figure 4).

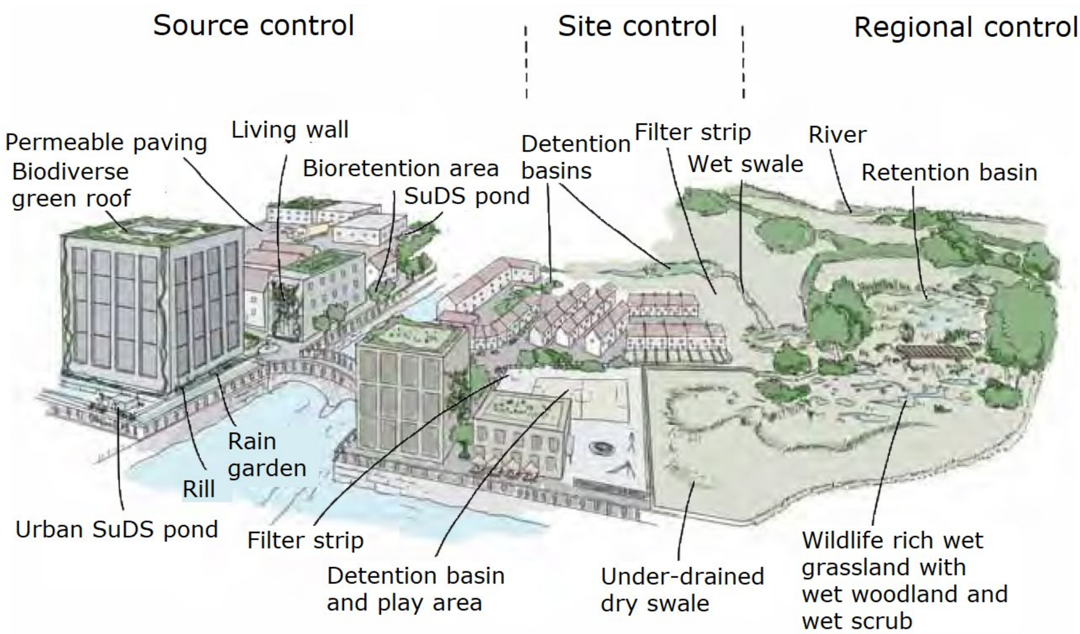

Figure 4: SUDS examples[3]

SUDS involves using a variety of surface features, such as wetlands and open channels that allow for optimised infiltration and retention on the surface to limit the flow of water entering the sewer. The objective of such local-specific solutions is to limit the level of water in streets or watercourses and avoid flooding. Many cities are improving collaboration between city planners and waste water operators around the installation of Blue-Green Infrastructure (BGI) which incorporates SUDS. BGI can provide multiple benefits besides reducing flows entering the sewer networks, including increased biodiversity, well-being for people, improved air quality and reduced heat island effect. BGI is seen as an important tool for cities' climate change adaptation plans.

To ensure that our sewer networks function properly, we need to keep educating people on their proper use, that is to say domestic sewers are only for pee, poo and toilet

[3] Modified from https://www.rspb.org.uk/globalassets/downloads/documents/positions/planning/sustainable-drainage-systems.pdf.

paper. Misuse of the sewer network can cause blockages, whether it is in disposing of wet wipes, other so-called 'flushables', or fats, oils and greases[4], or even detritus and solid waste entering through the gutters in the streets. Those blockages prevent the networks operating as intended, lead to environmental and societal impacts, and are costly in both money and resources to address. Similarly, people must not use toilets to dispose of unused pharmaceuticals, or other household products, as these can cause pollution of the water environment or harm wildlife.

In addition to domestic waste water, industrial effluents are also often discharged into the public sewerage network. These can vary in nature, from the benign to effluents that require pre-treatment before they can be safely accepted, and volumes that can overload sewer capacity. Without proper control at source, the fabric of the sewer, the people who work on them, the downstream waste water treatment plants, and ultimately the receiving environment, are all at risk[5].

There is one final component that our sewer networks contain. Water coming out of the ground - referred to as infiltration - can enter pipes where there are joints or cracks. The amount of infiltration entering into any one sewer network will depend on a number of factors including the geology the pipes pass through, the time of year, the ground water level, the connection of building drains and the condition of the pipes. Under some combinations, infiltration can significantly reduce the available capacity in parts of the network. And in some areas, the converse can apply; exfiltration can leave the sewer network into the surrounding ground, which brings its own issues, including the potential contamination of groundwater.

Wherever appropriate, sewage drains by gravity to the waste water treatment plants. In some circumstances however, sewage may need to be pumped uphill so that it can reach the rest of the network and treatment plants. In those circumstances, sewage pumping stations are constructed, along with a rising main (reinforced connecting pipe), to lift the sewage between two levels. Pumping stations and associated rising mains bring their own performance risks, and it is key to ensure that such sites can continue to function as required, even during times of mechanical and/or electrical failure. Moreover, energy efficiency is also a key issue in the management of the sewer network, especially in these pumping stations.

The sheer scale and diversity of our sewer networks (see Figure 5) means that we need an array of experienced people to plan, implement, operate and maintain them, all working to common goals. Alongside people, technology is commonly used, including in keeping basic records, monitoring and modelling the current and future performance of networks, identifying problems in real-time, or in scheduling and implementing maintenance regimes (see Figure 6). All this information allows us to verify and improve the knowledge about existing assets, including the extent and status and existing performance of those networks.

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[4] For more details look at our position paper Toilets are not a bin!.
[5] For more information on pollution in waste water, see our paper on addressing micropollutants: a holistic approach.

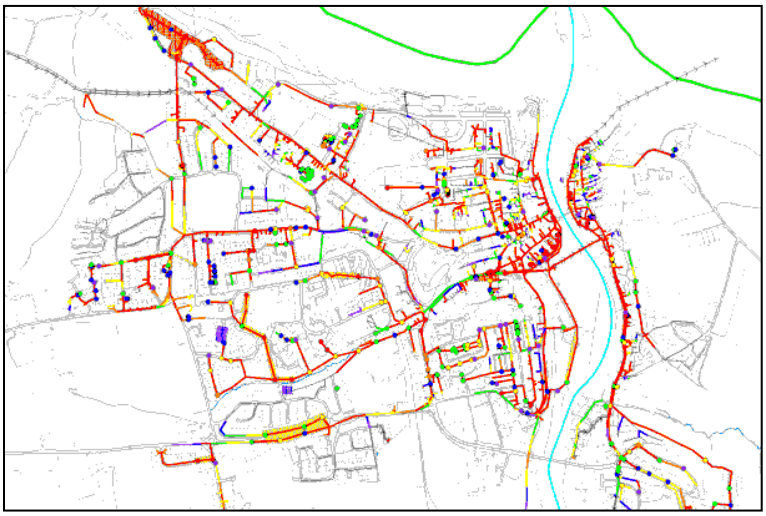

Figure 5: Sewer network plan (Yorkshire Water, UK)

Additionally it must be remarked that many sewers in old European cities are more than a century old. This fact, coupled with other congested underground utility infrastructure and overground transport, often in a constricted environment, means that it can be a significant challenge to refit or rebuild those assets in such locations.

Figure 6: Example of part of a sewer network

It is easy to take our sewer networks for granted. They are out of sight, and their performance is only usually seen when they are not functioning as we want. Yet the investment decisions we make in relation to them spans decades, and even longer. Climate, changing populations and the requirements we place on our urban environment are all changing. Our challenge is to understand how these sewer networks (see Figure 7), will give us systems that continue to be resilient, fit for purpose and affordable[6]. And to do this in ways that gives our customers and communities confidence that this is happening efficiently and effectively, both now, and into the foreseeable future.

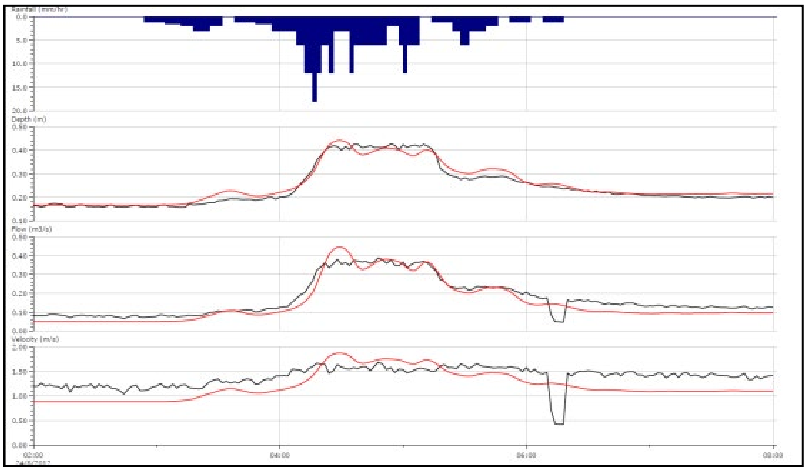

Figure 7: Understanding network performance. This bar chart represents precipitation, black solid lines are the measured flowrate in different location of the sewer and red solid lines represent the modelled flow rates once the model is calibrated to represent the dynamic of the flow in the sewer under dry and wet weather.

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Our members are 34 national associations of water services. At EurEau, we bring national water professionals together to agree European water sector positions regarding the management of water quality, resource efficiency and access to water for Europe's citizens and businesses. The EurEau secretariat is based in Brussels.

With a direct employment of around 476,000 people, the European water sector makes a significant contribution to the European economy.

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[6] For more information, look at our Briefing note on waste water and storm water networks.