

# AMP7 Environmental Investigations

## Warleigh Weir Investigation

Warleigh Weir is located around 8km upstream of Bath on the Bristol Avon. Originally built to provide water to a mill, it was raised in the early 1800s to supply water to the Kennet and Avon canal via Claverton pumping station. The weir is now a popular location for bathing and other in-river recreational activities and the people using this stretch of river have recently expressed concern about water quality.

The upstream river catchment is extensive (~1,452km<sup>2</sup>) and largely rural, but includes towns such as Bradford on Avon, Trowbridge, Frome, Melksham, Chippenham and Malmesbury and surrounding villages. Within this area Wessex Water operates 66 water recycling centres (WRC) and 222 storm overflows, but these are not the only influences on water quality in the catchment. Private sewage and trade discharges, septic tanks from properties not connected to mains sewerage and foul to surface water misconnections all influence water quality at Warleigh Weir, as does surface water running off land into the river with contaminants from livestock and wildlife.

The site is not officially designated as a Bathing Water and water quality has not been routinely monitored to assess compliance with Bathing Water standards (Box 1). Consequently, water quality at the weir and the factors that influence it are poorly understood.

### Box 1: Bathing Water Quality Standards

Bathing waters are classified as 'excellent', 'good', 'sufficient' and 'poor' quality based on the concentration of *E. coli* and intestinal enterococci present. Compliance is assessed retrospectively over a 20-week bathing season that runs from the 15 May to 30 September each year using 95<sup>th</sup> and 90<sup>th</sup> percentile values. This means that to achieve a particular classification, the concentration of *E. coli* and intestinal enterococci must be lower than specified thresholds 95% and 90% of the time over the bathing season.



In September 2020 intensive water quality monitoring took place, involving a partnership with The Rivers Trust with Bristol Avon Rivers Trust, Wessex Water, Sewage Free Swimmers and the Environment Agency, and a team of volunteers. While this 'snapshot' showed that water quality could be good or excellent at the time of that study, it also demonstrated the need to understand how water quality might vary seasonally and in response to weather conditions, the relative importance of the different influences and any steps that might be required to improve water quality.



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### The investigation

A more extensive investigation commenced in spring 2021 and will run to September 2023 with the following aims:

- Characterise water quality at Warleigh Weir under range of flow conditions;
- Identify main influences on water quality and a potential programme of measures for Wessex Water and others to address these;
- Trial innovative approaches to water quality monitoring; and
- Develop predictive alert systems, making information available to recreational users of Warleigh Weir.

Weekly samples were collected at Warleigh Weir and at 30 sites upstream in the 2021 bathing season. Outside of this time weekly sampling continued at the weir, with twice monthly sampling at the remaining sites. Continuous water quality monitoring equipment has also been installed at Warleigh Weir and two sites upstream (see Box 2).

### Box 2: Moving towards real-time water quality notifications

Currently the concentration of *E. coli* and intestinal enterococci cannot be continuously measured in the environment. This is a problem when trying to provide recreational water users with real-time water quality notifications.

Wessex Water are working with UnifAI, a company specialising in the use of artificial intelligence (AI) technology, to trial an approach that uses mathematical algorithms to develop relationships between readily measurable parameters and those used for bathing water compliance. In late 2021 continuous water quality monitoring sensors were installed at Warleigh Weir, Limpley Stoke and Monkton Combe to provide real-time measurements of temperature, pH, conductivity and dissolved oxygen. It is hoped that as more data is collected, the AI can be 'trained' to identify when water quality may be poor, so that this information can be passed to recreational users in real-time.

### Early findings and next steps

The monitoring in 2021 found much variation in water quality at Warleigh Weir during the bathing season; on 12 of the 20 sampling occasions water quality was better than the good or excellent concentration thresholds. However, if Warleigh Weir was a designated bathing water it would have been classed as poor because eight of the samples were less than the good threshold. Although water quality is sometimes poorer in wet weather, this is not always the



case and further analysis is required to understand the reasons for the patterns seen.

In the wider catchment all locations would have been classified as poor under the bathing water standards. A complex picture is emerging, with poorer water quality found both at locations downstream of our WRC discharges and at locations with no WRC upstream, such as upstream of the town of Frome, indicating that many factors influence poor water quality. Contrary to what might be expected, water quality on the lower River Frome and on the River Avon upstream of Warleigh Weir are generally better than elsewhere in the catchment. Poorer quality was found on tributaries including the Midford, Cam/Wellow and Semington Brooks.

We will continue monitoring in 2022, adding more sampling sites and new types of sensors to better understand the factors influencing water quality at Warleigh Weir. A trial of innovative environmental DNA techniques is planned to help understand the relative influence of human and animal contaminant sources. We also plan to trial an app with real-time water quality notifications which, if successful, will be made available to recreational users.



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