

Managing biofilms and disinfection residuals to protect drinking water safety

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1) Introduction

- The management of water quality throughout drinking water distribution systems (DWDS) is critical to the protection of drinking water quality.
- The use of **chloramines for secondary disinfection is growing**, particularly in systems struggling to maintain chlorine residuals or/and attain regulatory disinfection by-product concentrations. However, if not appropriately managed ammonia builds in chloraminated DWDS, promoting microbial growth.
- DWDS using chloramine often suffer adverse water quality impacts, including:

Nitrification

Discolouration

Microbial Failures

2) Aims & Objectives

Overarching Aim: To determine how chloramination can be better managed to reduce adverse water quality impacts in DWDS: Combining the interactions between chemical, physical and biological processes to understand the uncertain impacts of biofilms, such as growth rates and bulk water quality exchanges.

To achieve this aim, pipe loops will be installed at the network extremities of two Scottish Water DWDS. This will enable biofilms and water quality to be monitored under controlled conditions, representative of the DWDS.

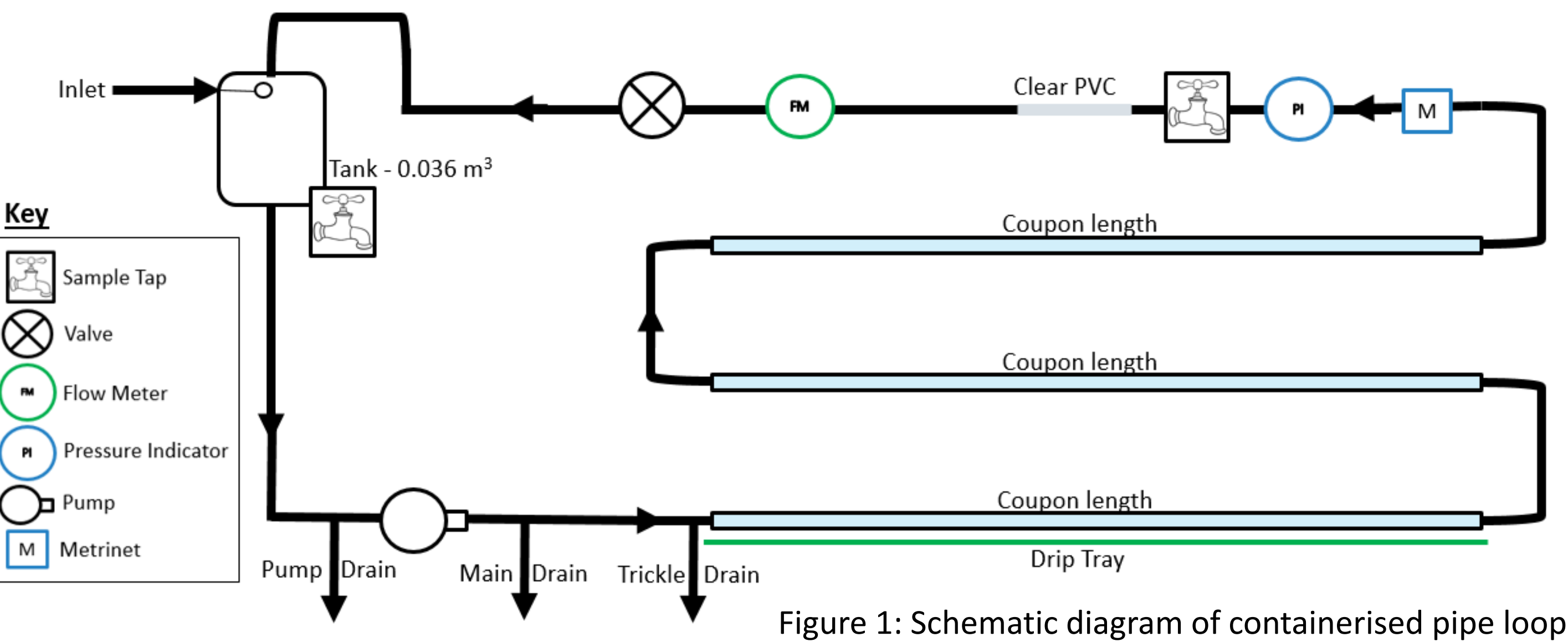
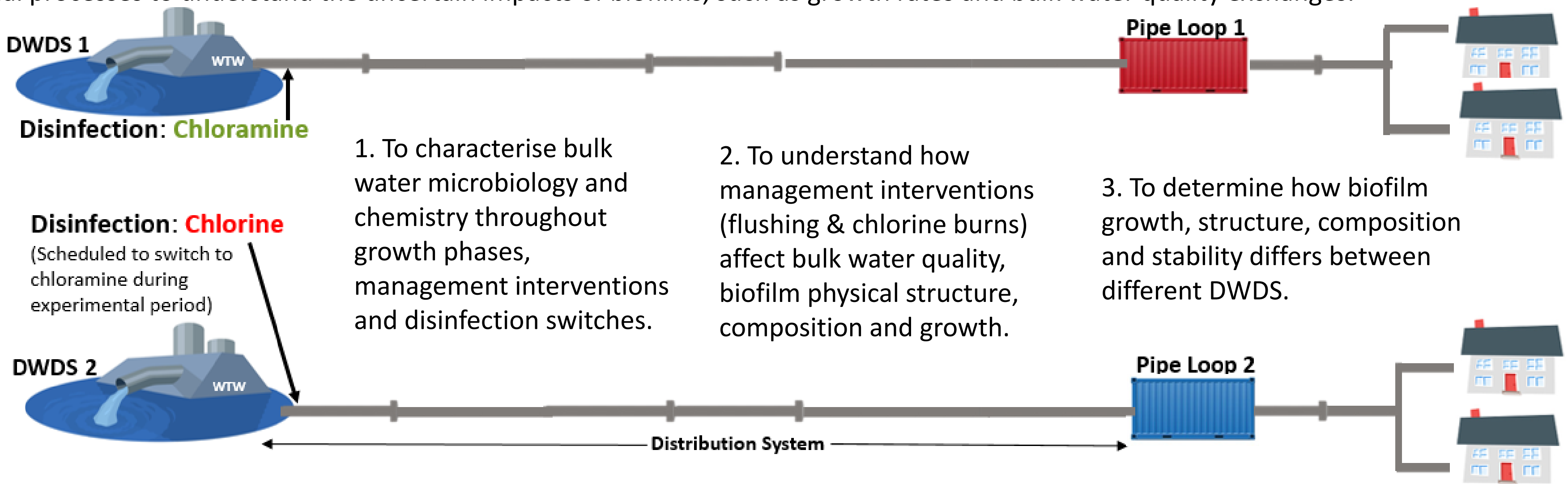


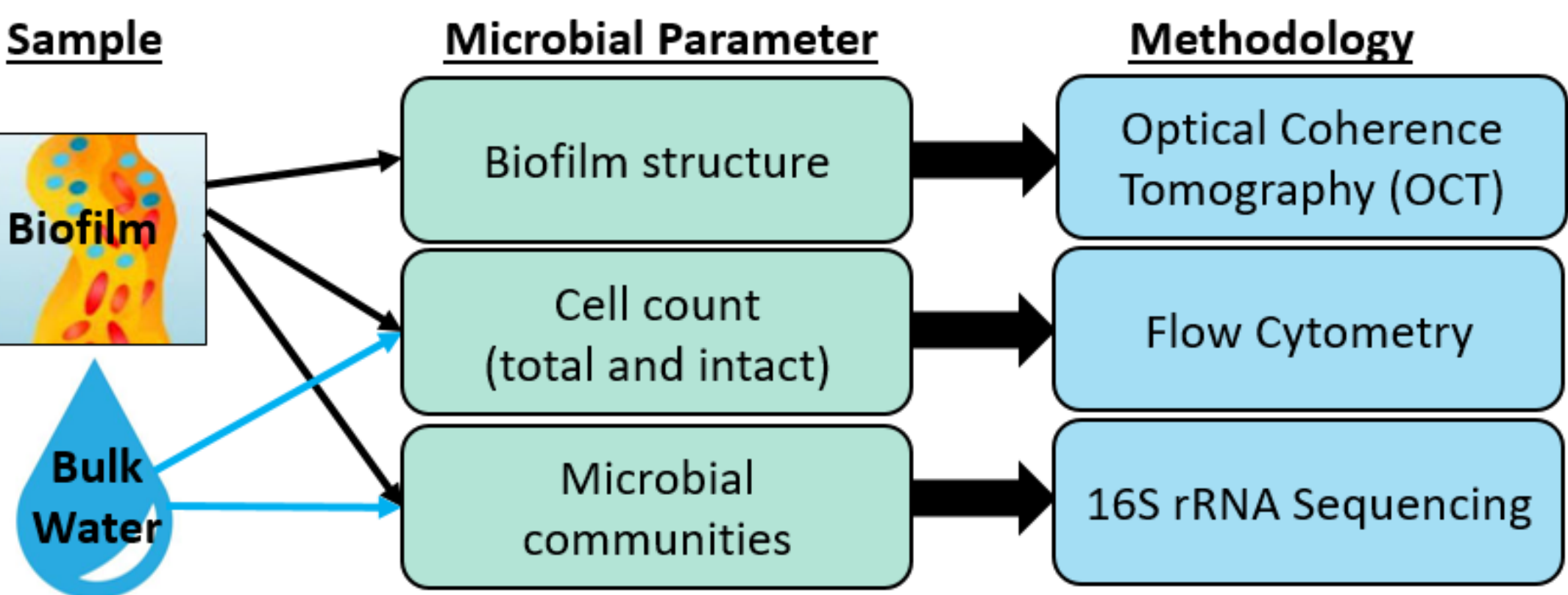
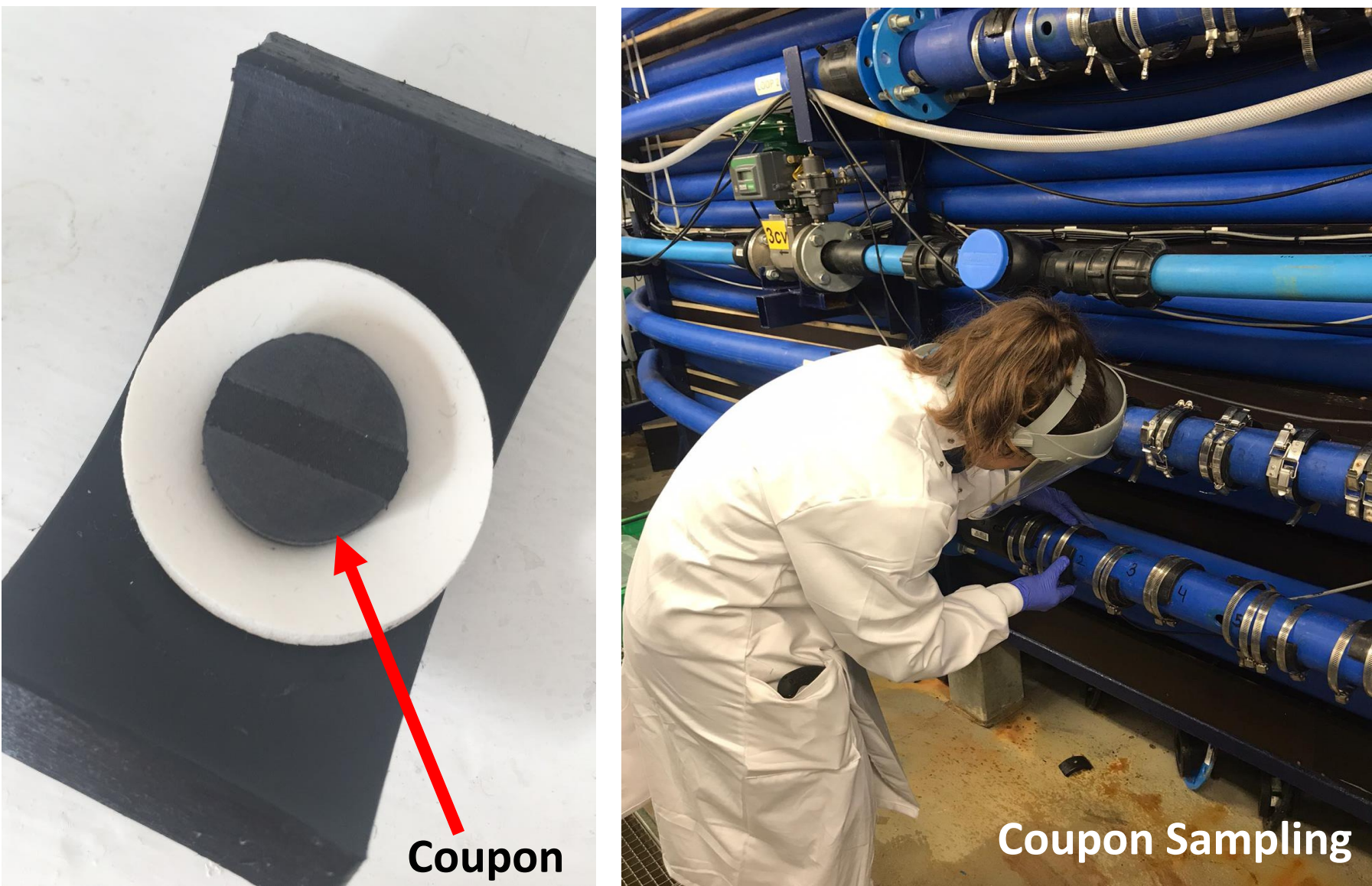
Figure 1: Schematic diagram of containerised pipe loop

3) Pipe Loop Design

- The pipe loop design (Figure 1) has been specially developed to achieve the research objectives.
- Pipe loops are housed within shipping containers, allowing for installation and monitoring out in the DWDS.
- Each container will contain two mirrored pipe loops, fed by the same inlet water. This will allow different interventions to be compared.
- Biofilms will grow naturally on coupon surfaces, enabling direct sampling from internal pipe surface.
- Pumps & valves will maintain 0.4 l/s during growth phases.

4) Pipe Loop Experimental Methods

- Biofilm growth phases will be the same length across all pipe loops
- Coupons and water quality samples will be taken at the beginning, middle and end of growth phases as well as post intervention (chlorine burn and flushing).



5) Project Importance

Despite the increasing use of chloramines, research into its management in full scale DWDS is limited.

This project will be the first to monitor how disinfection regimes and management interventions impact biofilms and water quality at the network extremities of a live DWDS