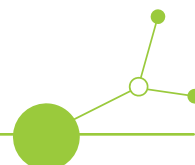


Solution on improving urban bathing sites - Łódź, Poland



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1. Introduction

According to the EU report on bathing water quality in European countries, Poland ranks second from last. Therefore, the implementation of solutions aimed at improving bathing water quality is of particular importance.

Urban bathing sites in Poland are established in ponds, rivers, reservoirs and lakes. Urban bathing waters are characterised by non-point sources of pollutions, including:

- runoff from surrounding urban areas (e.g. pavements, car parks, roads),
- runoff from agricultural and rural areas,
- discharges of reclaimed water from wastewater treatment plants (municipal and industrial),
- uncontrolled sewage discharges from domestic septic tanks/systems,
- water fowl faeces, which large scale is mainly caused by the widespread practice of feeding by local communities.

Furthermore, climate change contributes to rising water temperatures and lower volume of water in reservoir . More frequent episodes of heavy rainfall and prolonged drought may result in increased pollutant loads in bathing waters.

In Poland following the implementation of Pilot Action, a technical solutions involving the installation of water aeration device was deployed to improve water quality at an urban bathing site.

The solution has been chosen based on the preliminary assessment of technological solutions available on the market taking into account the characteristic of the selected water body. In solution selection process were engaged Łódź urban bathing sites operator (MOSIR) and the team of hydrobiologists from the University of Łódź to ensure the suitability of the selected technology for the hydrological and environmental conditions of the site.

The pond in Łódź where the Pilot Activity were implemented is fed by two rivers (Ner and Gadka), which carries a load of chemical and biological pollutants. Furthermore, the ponds are surrounded by deciduous vegetation, which constitutes a source of additional organic matter inputs, particularly during the leaf-fall period. At the Stefański Ponds, incidents involving fish mortality and dead wild birds were noted in previous years. During the mandatory bathing water monitoring carried out in 2023-2024, the bathing site was temporarily closed due to exceedances of the indicative bacterial parameters *E. coli* and intestinal enterococci.



Based on the technical analysis and expert consultations, a water aeration device was selected as the most appropriate solution. Following a market review, the ORKA MAX aeration system was chosen. The system is designed to increase dissolved oxygen concentrations and to induce water circulation, thereby supporting water quality conditions within the bathing area.

The global rise in temperatures has led citizens to seek respite in nature, preferably by water and surrounded by greenery. As there are only three natural urban bathing sites available in Łódź, the priority of the city authorities is providing citizens the clean and healthy recreational environment.

A measurable outcome of the Pilot Action implemented in Łódź was the opening of a bathing site for city residents throughout the entire bathing season. According to the data from the mandatory water quality monitoring, in the 2025 bathing season, for the first time, no exceedances of microbiological standards were recorded. The results of mandatory bathing water monitoring carried out in 2024-2025 are presented below (table 1-4).

The results of the Pilot Action were discussed during the UrbanBlueHealth project partners meeting held in Łódź in September 2025, as well as at the second meeting of the Polish Water Group. As no comments or objections were raised, the solution will be continued in accordance with the settings applied during the pilot action. A detailed description of the implemented solution is provided below in order to facilitate its replication and deployment at other bathing sites across the Central Europe region.

Table 1. Number of *E. coli* bacteria assessed according to PN-EN ISO 9308-3:2002, 2024-2025.

Month	Sampling date	Results [MPN/100 ml]	Sampling date	Results [MPN/100 ml]	Limit value
May	26.05.2024	45	28.05.2025	15	≤ 1000
June	12.06.2024	45	11.06.2025	30	
July	03.07.2024	127	09.07.2025	215	
	14.07.2024	1448			
	17.07.2024	61			
	24.07.2024	30			
August	07.08.2024	30	06.08.2025	46	
	21.08.2024	195			
September	11.09.2024	2418	10.09.2025	30	



Table 2 Number of intestinal enterococci assessed according to PN-EN ISO 7999-2:2004, 2024-2025

Month	Sampling date	Results [cfu/100 ml]	Sampling date	Results [cfu/100 ml]	Limit value
May	26.05.2024	24	28.05.2025	11	≤ 400
June	12.06.2024	24	11.06.2025	24	
July	03.07.2024	160	09.07.2025	57	
	14.07.2024	310			
	17.07.2024	16			
	24.07.2024	39			
August	07.08.2024	17	06.08.2025	33	
	21.08.2024	45			
September	11.09.2024	380	10.09.2025	100	

2. Solution implemented in Łódź

2.1. Characteristics of the Stefański Ponds

The Stefański Ponds in Łódź is a complex of two ponds fed by two inflowing rivers (Ner and Gadka). First reservoir is a small sedimentary pond on Ner inlet, second pond is the main reservoir with bathing area. Both Ner and Gadka carry a load of chemical and biological pollutants, but Gadka carries much more contamination than Ner. In Poland, uncontrolled discharges of municipal wastewater into ditches, streams, or rivers still occur, while agricultural runoff within catchment areas remains insufficiently regulated and monitored. Pollutants of chemical and biological origin are transported via surface runoff and river inflows. The climat-related factors, such as increasing water temperatures and reduced water availability during extended drought periods are also significant. The cumulative impact of these stressors has been reflected in ecological disturbances observed at the Stefański Ponds, including reported incidents of fish mortality, water blooms and the presence of dead wild birds. In addition, mandatory bathing water quality monitoring in previous years had identified exceedances of microbiological indicator values, resulting in periodic closures of the bathing site.

2.2. Technical description

The aeration device has been selected to ensure its efficiency meets the specific needs of the bathing site at Stefański Ponds with taking into account cost effectiveness. In selection of the



aeration device were included the following parameters: the depth of the reservoir, the characteristics of the pond bed (degree of silt accumulation), the location of river inlets in relation to the bathing area, and the overall size of the bathing site. The water aeration system implemented at the Stefański Ponds represents a Nature-Based Solutions (NBS) aimed at enhancing the natural self purification capacity of the pond ecosystem. By introducing oxygen into the deeper water layers the system enhance the natural self-purification processes within the ecosystem of the Stefański Ponds.

At the Stefański Ponds the „ORKA MAX bathing water aeration set” was installed. The ORKA MAX set was procured directly from its manufacturer, the Polish company AKWATECH SYSTEMY Sp. z o.o. (www.akwatech.pl).

The device was purchased with an extended manufacturer’s warranty valid for five years from the date of purchase, along with a blower cover and additional filter cartridges. The aeration system was installed by the staff of MOSiR in Łódź, the bathing site operator.

The set consist of:

- a blower/pump,
- diffuser grid segments,
- a reinforced hose,
- buoys,
- instruction.

Main technical parameters of the blower:

- model of side channel blower: SCL K04MS MOR,
- motor power and type: 1.5 kW, 3-phase,
- manufacturer: FPZ, Italy.

Additional requirements include:

- ensuring access to an electricity supply,
- a hardened and stable surface for blower installation,
- regular replacement of air filters in the pump in order to ensure proper operation of the pump and to maintain warranty conditions.

The blower installation should be carried out by a person with appropriate electrical qualifications or the system should be ordered together with an installation service.



Regular maintenance, including the replacement of air filters and inspection of the pump and diffuser grid segments, is essential to ensure proper system operation and to maintain warranty conditions.

Electrical protection includes a motor circuit breaker with an adjustable setting fixed at 3.5A, and a control circuit protection fuse rated at B 6A.

Pressure gauge readings corresponding to the water depth were as follows: 0.2 bar/120 cm depth. According to the manufacturer's information, the volume of air introduced into the water by the ORKA MAX set is approximately 55 m³/h.

2.3. Safety for people

The system has to be installed to ensure the safety of personnel and people using bathing site, including electrical protections, stable installation and clear marking of components located in the water.

2.3.1 Safety of the staff

All operations related to the maintenance and servicing of the water aeration system must be performed by personnel with the appropriate qualifications, including electrical certifications required for working with pumps and electrical installations.

The blower has to be installed on a hardened and stable surface, outside of the water, which significantly reduces the risk of contact the device with water and enhances operator safety. Additionally, the blower has to be physically protected with fencing or a safety barrier to prevent unauthorised access.

2.3.2 Safety of the reservoir users

The reservoir is used not only by swimmers, but also by fishers, kayakers, pedal boarders, children learning to sail, and other people recreating in the vicinity of the reservoir. Therefore, the aeration system must be installed to minimize risk for people using the reservoirs.

Diffuser grids should be installed close to the bathing area, but always outside the swimming zone, preventing accidental contact or entry onto the equipment. All in-water components are clearly marked with buoys or other visual indicators.

The blower has to be physically protected with fencing or a safety cover to prevent unauthorized access. Also, electrical cables must be installed in a way that ensures safety, e.g. buried underground, to prevent accidental contact.



3. Transferability

The water aeration system meets a key project criterion concerning the potential for replication of the tested solution in other regions and countries of Central Europe. The system can be applied in reservoirs of varying depth and surface area and does not require expensive or extensive infrastructure. System scalability can be achieved by adjusting the number of diffusive segments or by multiplying the number of sets, depending on the size of the reservoir.

The system design allows for easy installation and dismantlement without integration into the reservoir bottom, thereby eliminating the need for heavy specialized equipment. The materials used to build set are resistant to corrosion and long-term exposure to the aquatic environment, which contributes to extending the service life of the installation and reducing maintenance costs.

The autotimer enables automation of the system operation and ensures its operational flexibility. As a result, the system can be activated automatically at predefined times or operating cycles, without the need for additional staff involvement, e.g. it can also operate when personnel are not present.

Furthermore, the system does not introduce chemical substances and it is not permanently installed in the reservoir, it can be relocated which under Polish laws conditions does not require obtaining additional permits from Polish Waters, as the owner of the surface waters, where the bathing site is located.

Moreover, the system operation can be adjusted to the needs resulting from the current conditions at the bathing site by shortening or extending the device operating time.

The automation and operational flexibility of ORKA MAX reduce the intervention costs and limit the risk of temporary closure of the bathing site. In the long term, this contributes to stabilizing reservoir maintenance costs and improving the quality of recreational services.

The applied solution is cost-effective and characterized by low electricity demand.

4. Summary

The implemented solution involves the installation of a water aeration system that improves water quality by inducing water circulation and movement, thereby supporting natural self-purification processes within the reservoir. This solution follows the NBS approach, aiming to enhance environmental conditions while minimizing technical intervention.

Proper installation and safeguarding of the system ensure the safety of bathing site users during full operation of the device.



The implemented aeration system constitutes an effective, scalable and replicable tool for improving the quality of surface waters in bathing sites and recreational reservoirs. The system is characterized by high operational flexibility, low operating cost and the absence of chemical substances and permanent interference with the aquatic environment.

Automation of the device's operation allows its performance to be adopted to current conditions, reducing intervention costs and limiting the risk of temporary closure of the bathing site. Thanks to its simple installation and low infrastructure requirements, the solution meets key criteria of durability, economic efficiency and deployment potential in other regions of Central Europe.