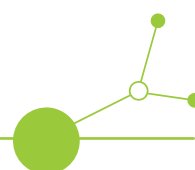


Urban Bathing Water Action Plan Osijek, Croatia



Final version





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1. Introduction

Urban bathing waters are increasingly recognised as important public health and recreational assets, particularly in cities where residents rely on local rivers and lakes as accessible blue spaces. At the same time, these environments are exposed to a combination of chemical, microbiological and environmental pressures that may affect the wellbeing of population that uses these blue spaces. Responding to these challenges requires coordinated approaches that integrate monitoring and local governance.

The Croatian Action Plan (AP) operationalises the Strategy developed under the UrbanBlueHealth. While the strategy defines shared goals for improving the safety, resilience and management of urban bathing waters across Central Europe, the purpose of this Action Plan is to translate those strategic objectives into concrete, implementable actions.

Urban bathing sites in Croatia, particularly those along the Drava coast, play an important role in public health and recreation. In the area along the Drava River, there has been a culture of enjoyment and use of river natural resources for generations, which includes swimming, recreation and enjoyment of nature in general. Coexistence with nature, which is woven into the lives of the local population, also contributes to the improvement of the physical and mental health of the population through increased physical activity and spending time in nature. Due to increasing temperature fluctuations and more frequent high temperatures during the summer, natural city beaches are increasingly attractive as a place to refresh and escape from the summer city heat. Maintaining natural bathing areas optimal for people to stay and bath also contributes to the preservation of the favourable state of freshwater ecosystems, which in themselves neutralize the negative effects of climate change in general.

Challenges identified in the Joint Transnational Strategy and the Transnational SWOT Analysis correspond directly to goals such as improving risk identification, expanding monitoring methodologies, preventing exposure through early warning systems, etc. Croatian partners contributed to these goals through targeted pilot activities. These activities included expanded chemical and microbiological monitoring, implementation of online measuring devices (multiparameter sondes and weather monitoring station) and testing the models of an early warning system.

This AP therefore serves as a practical roadmap for implementing strategic ambitions of UrbanBlueHealth in Croatia reflecting the conclusions of the Joint Transnational Strategy and the Transnational SWOT Analysis.





2. Local Context and Key Challenges

Osijek's Drava River bathing sites Copacabana, Pampas, and Željeznički most are official natural public beaches on the Drava River that attract significant number of bathers during bathing season in city of Osijek and the surrounding areas. In addition to these, there are many unregulated bathing sites where no official monitoring occurs. Key challenges include limited microbiological and chemical monitoring, short-term pollution following rainfall, and lack of clear protocols for beach closures. Climate change poses increasing risks, such as harmful algal blooms, runoff contamination, and pathogen proliferation, while public awareness of bathing risks remains limited.



3. Objectives of the Croatian Action Plan

- Improve monitoring scope and reliability through additional microbiological and chemical parameters for better understanding of health and environmental risks.
- Strengthen preparedness for short-term pollution events by testing models for early warning capacity, including data integration, exploratory and comparative modelling approaches, and definition of indicative risk thresholds, as a methodological foundation for future implementation when sufficient long-term datasets become available.
- Strengthen climate resilience of bathing sites through predictive tools and weather-related risk management.
- Enhance cooperation and communication among institutions, stakeholders, decision makers and the public.
- Support long-term sustainability through capacity building and gradual integration of risk-based management elements.



4. Action Areas and Measures

4.1. Improved Monitoring and Risk Identification

Activities:

- Based on the pre-pilot (2024) and pilot (2025) UrbanBlueHealth results Integrate *Salmonella*, somatic coliphages, and selected pharmaceuticals into monitoring of the bathing season 2026 in Osijek which will be provided by laboratories in Osijek and Zagreb (D3.1.1).
- Improved monitoring and risk identification at the Croatian pilot site will be further strengthened by incorporating AMR analysis methods developed and tested within the Hungarian pilot UrbanBlueHealth activities.
- Increase sampling frequency, especially after heavy rainfall during the bathing season 2026.
- Additional monthly sampling will be conducted from the end of the 2025 bathing season until the start of the 2026 season (period outside of bathing seasons) to capture seasonal variations in water quality, compare parameters values during and outside of bathing season and better understand year-round dynamics and risks.

Responsibility: Croatian institute of Public Health (CIPH), Croatian Waters, Teaching Institute of Public Health for the Osijek-Baranja County

Timeframe: 2026

Resources: National funds + project-based financing

Indicative funding approx.: 700-1000 EUR

4.2. Testing Models for Early Warning System (EWS)

■ Activities:

- Integrate data from multiparameter sondes at Copacabana and Pampas bathing sites, the Copacabana weather station, hydrological measurements, and standard physicochemical and microbiological results from the prepilot (2024) and pilot (2025) UrbanBlueHealth activities into modelling tools to



explore and assess the feasibility of models for early warning approaches during the 2026 bathing season.

- Compile, review and harmonise available historical datasets, including pre-pilot (2024) and pilot (2025) monitoring data, to evaluate data completeness, consistency, and limitations relevant for the development and testing of predictive water quality models.
- Develop and test exploratory statistical and data-driven models to identify potential relationships between environmental conditions and short-term water quality variations.
- Define provisional risk thresholds for selected parameters to support internal risk assessment and future development of risk forecasting systems, acknowledging current data constraints.
- The exploratory activities of the testing models for Early Warning System will be extended to include data generated at the Polish pilot site, allowing cross-site testing and comparison within the UrbanBlueHealth project.

Responsibility: CIPH, Teaching Institute of Public Health for the Osijek-Baranja County, Croatian Waters

Timeframe: 2026

Resources: Project-based financing

Indicative funding approx.: 1000-1200 EUR

4.3. Climate Change Adaptation

Activities:

- Implement sampling after extreme rainfall or drought during bathing season 2026 in Osijek.
- Seasonal assessment of risks for algal blooms.
- Identify pollution hotspots during high and low water levels.
- Suggest long-term hydrotechnical improvements as needed.

Responsibility: Local authorities, Croatian Waters, State Hydrometeorological Service, Teaching Institute of Public Health for the Osijek-Baranja County



Timeframe: 2027

Resources: National funds

Indicative funding approx.: 700-1000 EUR

4.4. Public Awareness & Communication

Activities:

- One dissemination campaign will be organized to raise public awareness of safe bathing water practices and to present key project results to stakeholders, supporting discussion on the potential integration of new scientific findings into national bathing water legislation and management frameworks.
- Update the official project webpage maintained jointly by CIPH, Croatian Waters, the City of Osijek, public health authorities, and NGOs to ensure clear, timely communication of bathing water status, risks, and management actions.

Responsibility: City of Osijek, CIPH, Teaching Institute of Public Health for the Osijek-Baranja County, NGOs

Timeframe: 2026

Resources: project budget

Indicative funding approx.: 1000 EUR (2026)



4.5. Capacity Building

Activities:

- Croatian Bathing Water Group meeting in January 2026 to discuss implementation of action plan and propose solutions.
- One workshop for local government units and in Osijek-Baranja County in February 2026, with invited local government unit representatives from two neighbouring counties to raise awareness among stakeholders about the importance of water quality and its direct link to public health (D3.2.2).



- A training will be organized for operators and local authorities to mitigate health risks and raise awareness within the local community in May 2026. The aim will be to educate on the importance of monitoring and establishing official bathing sites to prepare them for bathing season (D3.2.1).
- City of Osijek will be signatory of the Declaration of Urban Blue Health Initiative (D3.3.2)
- Partners (CIPH, Teaching Institute) will contribute to set-up the transnational Bathing Water Platform (D3.3.1).

Responsibility: City of Osijek, CIPH, Teaching Institute of Public Health for the Osijek-Baranja County

Timeframe: 2026

Resources: Project-based financing

Indicative funding approx.: 700-1000 EUR



5. Implementation Timeline

■ 2025

- Expanded monitoring (*Salmonella*, somatic coliphages, pharmaceuticals)
- Increase in sampling frequency (incl. post-rainfall)
- Strengthen laboratory capacities and risk identification
- Test and evaluate potential predictive models for early warning using integrated historical, pre-pilot, and pilot datasets obtained through UrbanBlueHealth pilot activities

■ 2026

- Continue enhanced monitoring
- Incorporate AMR analysis methods developed in the Hungarian pilot to further strengthen monitoring and risk identification at the Croatian pilot site
- Assess model reliability, data gaps, and limitations for operational use
- Extend exploratory Early Warning System model testing to include datasets from the Polish pilot site
- Launch public awareness activities + update official project webpage
- Conduct capacity-building trainings and joint workshops (D3.2.2) and joint training curriculum (D3.2.1)
- Osijek will sign the Declaration of Urban Health Initiative (D3.3.2)
- Participation in setting-up the transnational Bathing Water Platform (D3.3.1)

■ 2027

- Formulate evidence-based recommendations on the conditions required for future implementation of models for forecasting and Early Warning System (e.g. data density, monitoring duration, governance arrangements)
- Discuss with stakeholders implementation of climate-related monitoring (extreme weather sampling, algal bloom assessment)



- New Project proposals related to the development of fully operable Early Warning System
- Plan long-term hydrotechnical improvements if necessary



6. Governance and Stakeholder Roles

- City of Osijek
 - Leads local implementation of the Action Plan
 - Coordinates communication between institutions and with the public
 - Oversees installation and maintenance of on-site communication tools (information boards, signage)
- Croatian Institute of Public Health (CIPH)
 - Provides methodological guidance and risk-based management expertise
 - Supports advanced monitoring design and interpretation of results
 - Leads capacity-building activities and training sessions
- Teaching Institute of Public Health for the Osijek-Baranja County
 - Conducts routine microbiological and chemical monitoring
 - Validates monitoring data used for testing exploratory modelling of an Early Warning System
 - Supports operational responses to pollution events
- Hrvatske vode (Croatian Waters)
 - Supplies hydrological data and identifies pollution sources
 - Supports integration of UrbanBlueHealth project results into risk assessment
 - Collaborates on long-term climate adaptation and hydrotechnical planning
- Bathing Site Operators (Copacabana, Pampas, Željeznički Most)
 - Implement daily site management and hygiene measures
 - Support data collection and site-specific observations relevant to model testing
 - Inform the public about temporary restrictions or safety notices
- NGOs and Citizen Groups
 - Support public awareness campaigns and community engagement
 - Assist in disseminating risk communication materials



- Encourage responsible behaviour among bathers and visitors



7. Expected Results

Implementation of the Action Plan is expected to significantly improve the safety and management of Osijek's urban bathing sites. Expanded monitoring and improved risk identification will enable earlier detection of microbiological and chemical hazards, reducing public exposure to contaminated water.

The exploratory development and testing of models of Early Warning System will improve understanding of short-term pollution dynamics, particularly following rainfall and hydrological changes. While a fully operational early warning system cannot yet be established due to limited data, the activities will support timelier, data-informed decision-making and lay the groundwork for future predictive tools. Climate-adapted monitoring and model testing will strengthen local capacity, improve preparedness for extreme events, and contribute to greater resilience of bathing water management under increasing climate variability.

Improved communication tools and public awareness campaigns will enhance transparency, promote safer behaviour among bathers, and increase overall trust in bathing water quality. Capacity-building activities will ensure that local authorities, operators, and health institutions have the skills needed to apply WHO-aligned risk-based management. Overall, the Action Plan will lead to more coordinated governance, better protection of public health, and long-term sustainability of Osijek's urban bathing environment.



8. Abbreviation and acronyms

AMR.....	antimicrobial resistance
AP.....	action plan
CIPH	Croatian Institute of Public Health
NGO	non governmental organisation