



The Water Management System of Augsburg: UNESCO World Heritage Property, Global Practice Example and Role Model

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Abstract

The buildings and infrastructure of the UNESCO World Heritage property, the Water Management System of Augsburg, document the use of water resources over the course of 800 years. The system embodies sustainability and is recognised for its innovative solutions. The foundation for its management is the 2019 management plan, developed for the site's UNESCO nomination. Building upon this foundation, the City of Augsburg implemented its Klimawandelanpassungskonzept (Climate Adaptation Plan) in 2022. This subsequent program focuses on urban resilience and sustainable development, linking directly to the World Heritage property by identifying "water" as a key action field. Current responses to climate challenges, closely connected to the Augsburg World Heritage property, include three EU projects: Licca Liber, LIFE, and Contempo2, which aim to restore the Lech River and surrounding floodplain habitats.

Policy Recommendations

- Use Augsburg's proven 2019 management plan as a model for developing new transregional and international water strategies.
- Leverage historical water heritage sites to promote public awareness and foster the cross-border dialogue needed to address water challenges.
- Scale up innovative local solutions and pilot projects to create implementable measures for global water management.

KEYWORDS

UNESCO World Heritage
water management system
urban water landscape
water stewardship
sustainable hydropower

WATER ICONS



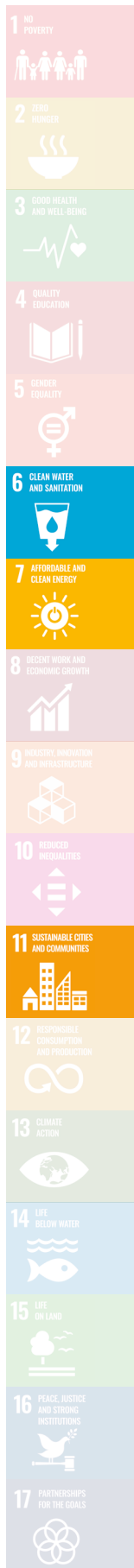
CLIMATE



Dfb: Humid continental climate



< Fig. 1 Around 1879, the Waterworks at Hochablass was put into operation, and the abundance of water was used to drive the state-of-the-art turbines of the time (Source: City of Augsburg/Martin Augsburgger).



Introduction

Representing a historical heritage, the UNESCO World Heritage property listed in 2019 as the Water Management System of Augsburg can be regarded as a best practice example with relevance to the future of sustainable urban water stewardship and climate-resilient city planning. The site represents a unique urban water landscape, consisting of 22 unique and interconnected elements that illustrate the local use of water resources over 800 years. These include a network of canals and watercourses, dating from the fifteenth to the twentieth century, that divide spring and river water, as well as monumental fountains, water towers with their associated infrastructure, and 10 power plants. Together, the elements serve as testaments to technological progress, the evolving aesthetics of water features in Augsburg, and the sustainable management of water resources.

The system is particularly remarkable for its continuous use, development and expansion over time. For many centuries, water has been a fundamental part of Augsburg's character, and throughout the city's over 2000-year-long history, the water management system has aligned with modern principles of sustainability and a focus on innovative solutions. This article presents the water-related and climate challenges and current projects addressed within the management of the Water Management System of Augsburg, as well as the use of water for power generation and human consumption.

Measures and Projects Connected to the World Heritage Management Plan

In developing the proposal for the site's inclusion on the World Heritage List in the 2010s, the City of Augsburg compiled an extensive nom-

ination dossier, which involved extensive research into its 22 individual elements. This dossier offers a thorough description of the site, justifies its Outstanding Universal Value (OUV), and includes a comprehensive global comparative analysis. A core component of this dossier, the management plan, serves as a key planning tool, outlining guidelines for the preservation and, an aspect that deserves special focus, the careful and sustainable development of the World Heritage property, all while maintaining high technological and design standards (Stadt Augsburg 2019, 33–35).

The management plan lists conservation measures, identifies potential conflicts and synergies, and establishes formal procedures for administration, monitoring, and stakeholder engagement. The plan operates within a legal framework defined by acts and ordinances concerning water pollution, nature conservation, heritage protection, and building. In the case of Augsburg's site, an important objective was to ensure that the protection of the World Heritage property was consistent with other goals integral to the City of Augsburg's concept of urban planning. This was a key consideration because the property's 22 individual elements are scattered throughout the city and linked by a watercourse system that covers the entire urban area. The water resources and the water management system are closely connected to the urban landscape and the city's livability. Consequently, the site's architectural and technological monuments are not lifeless relics of the past, but essential components of present-day life.

Water-Related Challenges

The management of The Water Management System of Augsburg involves addressing com-

plex water-related challenges within the heart of a modern Bavarian city of over 300,000 inhabitants. The World Heritage Office's ongoing tasks, therefore, include monitoring quality assurance of water resources and monument conservation, ensuring compliance with local, state, and federal heritage and environmental law, and balancing the interests of various urban stakeholders, including municipal utilities (*Stadtwerke*), private mill owners, environmental groups, and residents. Consequently, new measures and projects are subject to negotiation, and their feasibility must be aligned with the needs of the contemporary urban environment.

The management plan addresses these specific urban challenges in depth. This includes guiding the further development of technical components, such as hydropower plants, which must comply with evolving safety, environmental, and energy efficiency standards, while also accommodating inevitable infrastructure additions, such as new roads or streetcar lines.

In response to these challenges, it outlines guidelines that align with numerous United Nations and UNESCO charters and documents. Most importantly, this includes compliance with the *Zukunftsleitlinien für Augsburg* (Future guidelines for Augsburg), adopted by the Augsburg City Council in 2016, in accordance with the 2030 Agenda for Sustainable Development. In the context of Augsburg's World Heritage property, SDG 6 ("Ensure availability and sustainable management of water and sanitation for all"), SDG 7 ("Ensure access to affordable, reliable, sustainable and modern energy for all") and SDG 11 ("Make cities and human settlements inclusive, safe, resilient, and sustainable") play a central role (Stadt Augsburg 2019, 68–70).

Additionally, the *Erklärung zur Erhaltung historischer Stadtlandschaften* (Recommendation on the Historic Urban Landscape), adopted by the UNESCO General Conference in 2011, is of particular importance. The recommendation emphasizes that the maintenance of historic heritage within conurbations can only be ensured if the heritage is viewed not in isolation but rather within the existing urban context. The City of Augsburg accordingly defines its World Heritage property as an integral and central component of urban development and the urban social fabric (Stadt Augsburg 2019, 130). Thus, the definition of the World Heritage Status of the Water Management System of Augsburg is closely aligned with international framework documents.

In the 2019 management plan for The Water Management System of Augsburg, the outlined challenges and guidelines for addressing them result in specific projects. These include measures to make Augsburg's watercourses and canals more attractive to residents and visitors, to maintain and restore individual elements and to implement protective measures and educational frameworks. The plan also initiates projects that go beyond the preservation, presentation and further development of the site. In addition to the establishment of the World Heritage Info Center in the town hall square, the construction and inauguration of the Umweltbildungszentrum (environmental education center) is noteworthy. Located on the grounds of the Augsburg Botanical Garden, it was completed in 2023 and provides the Umweltstation Augsburg, an officially recognized institution for environmental education, which opened in 2007, with offices and adequate facilities for workshops, seminars and exhibitions. The center is located between the Western Forests Nature Park and the inner-city area. Its tasks include providing education concerning the connection

between the brooks in the city forest and the history of Augsburg's drinking water supply system (Stadt Augsburg 2019, 110).

“The Water Management System of Augsburg” Management Plan and Climate Change Challenges

The 2019 management plan for the property proactively considers the potential effects of environmental changes, including water shortages, flooding, and utilization pressure from tourism (Stadt Augsburg 2019, 54–111).

In 2022, three years after the site was inscribed on the World Heritage List, these efforts to address new challenges culminated with the adoption of the City of Augsburg's climate adaptation plan (*Klimawandelanpassungskonzept der Stadt Augsburg*). This strategic plan focuses on promoting urban resilience and sustainable development, and it is closely linked to the World Heritage property through its identification of “water” as a key area for action. In the Augsburg area, numerous systems – both natural and man-made – depend on water. The plan identifies particular areas of concern: groundwater and drinking water, high and low water levels in surface water, and urban area drainage, especially where heavy precipitation events lead to flooding. These concerns, common to many other cities and regions worldwide, pose even greater challenges for Augsburg, with its abundance of water. On the other hand, educational programs and public presentation of the World Heritage property can increase public awareness, encourage international networking, and stimulate scientific and political discussion (Herrmann 2024, 116–20).

Current responses to climate challenges that directly support the goals of the Augsburg

World Heritage management and adaptation plans include three EU-funded projects: Licca Liber, LIFE, and Contempo2, which aim to restabilize the Lech River and surrounding floodplain habitats. An important project that extends beyond the city limits is Licca Liber, which aims to return large stretches of the Lech to their natural state and to stabilize the river, which has been canalized over the past 200 years, with its depth regulated by numerous barrages. The project “LIFE. Stadt-Wald-Bäche” (hereafter LIFE) is intended to last from 2019 to 2027 and is funded by the City of Augsburg and the Bavarian State Ministry of the Environment and Consumer Protection. It focuses on the Lechauen, the floodplain habitats in the city forest extending along the banks of the Lech River, which are an important part of the wildlife corridor of Lechtal (Lech Valley). With a budget of over EUR 6,640,000, the project covers an area of more than 2,250 hectares. The entire city forest is part of the buffer zone of the World Heritage property. The goals of LIFE are to restore uninterrupted ecological continuity within the city forest area, reconnect the brooks in the city forest to the Lech, restore the alluvial forest habitats, and provide environmental education and public relations support to raise awareness of the network of protected areas called “Natura 2000,” which includes the project area. Another EU-funded project, Contempo2, spans from 2022 to 2028 and is coordinated by LEW Wasserkraft GmbH, a subsidiary of the power supply company Lechwerke AG. Contempo2 analyzes the effects of climate change on the Lech, and the Lechkanal (Lech Canal) north of Augsburg is one of its focal points. The canal, an artificial diversion of the Lech, as well as the three hydropower plants located on the canal, are included in the World Heritage property. The project aims to investigate how the ecosystem of the Lech can be strengthened despite the utilization of waterpower (Settele 2024, 121–34).



^ Fig. 2 The Hochablass waterworks, a 19th-century element of Augsburg's World Heritage system, supplied drinking water using sustainable hydropower (Source: City of Augsburg/ Martin Augsburgberger).

Water for Power and Consumption

In addition to the projects mentioned above, both drinking water production in the city forest and the generation of electricity in hydropower plants are closely connected to the World Heritage property, due to their use of water as well as their location. The City of Augsburg has been pursuing a sustainable water policy for centuries. Its efforts allow high quality drinking water to continue to be supplied from resources in the city forest. The vast expanse of woodland belongs to the City of Augsburg, which means Augsburg is among the cities with the largest publicly owned forests in Germany. In Augsburg, the development of a supply network and the quality assurance of the drinking water – initially supplied by canals constructed to carry

spring water, and since the nineteenth century by pumps and pipelines – were matters of key importance. The pioneering role in water management Augsburg assumed in the Middle Ages runs like a golden thread through the city's history and still holds true today. In strict accordance with the highest quality standards, the Stadtwerke Augsburg, a subsidiary company of the City of Augsburg, supplies the conurbation with drinking water sourced from the protected area, which is, for the most part, located in the city forest. The untreated drinking water is directly obtained from groundwater. It is a pure natural product characterized by a very low level of nitrate and a desirable mineral content, and is therefore suitable for use in baby food. The quality of Augsburg's drinking water is rated among the best in Europe. The drinking

water supply relies on the use of sustainable energy sourced from waterpower – generated by the Stadtwerke Augsburg, for instance, at the Waterworks at Hochablass, an element of Augsburg's World Heritage property. Drinking water is available free of charge at numerous fountains scattered throughout the city. As far as the supply to households is concerned, apart from a base rate, the Stadtwerke offers citizens of Augsburg the so-called Regenio-Tarif, which includes a customized drinking water analysis and co-funds conservation projects in the region. Introduced in 2009, the Regenio-Tarif combines health protection and quality assurance, water and nature protection, and the use of renewable energy in a way that is almost unique (Ottilinger 2017, 228–33).

With numerous plants on the city's watercourses, Augsburg has always been renowned for its intensive use of hydropower. In the nineteenth century, premodern waterwheels and pumping stations were gradually replaced by turbines and modern power plants, which still count among the primary features of the cityscape. In Augsburg, hydropower supplies a significant amount of electricity. Renewable energy is produced in the 10 plants (such as Hochablass waterworks, see fig. 2) located in and around the city that are elements of the World Heritage property and a dozen others, which are mainly under private ownership, but feed surplus electricity into the public power grid (Häußler 2015, 11–84).

Conclusion

In the 2010s, in addition to the nomination dossier, an extensive management plan was completed as part of the proposal for the Water Management System of Augsburg to be considered for inclusion in UNESCO's World

Heritage List. The tasks outlined in the plan aim to preserve the World Heritage Property and its inherent value, to support appropriate presentation and education efforts and enable sensitive and sustainable further development while maintaining high technological and design standards. Another important objective is to promote the sustainable use of water resources on the local, national and international levels, positioning the Water Management System of Augsburg as a role model. Thanks to the intensive work and research carried out when preparing the nomination file and, even more importantly, in the years since the site's inscription, the management plan has proven to be a vital reference and guiding tool. It supports not only the site's day-to-day management, but also its long-term protection, development and transmission to future generations.

Consequently, the proven success of the 2019 management plan offers key lessons for broader water strategies. It demonstrates that historical water heritage sites can be powerful catalysts for public awareness and the cross-border dialogue needed to address water and climate challenges. Furthermore, Augsburg's experience shows that local, context-specific solutions and pilot projects can provide innovative and implementable measures for sustainable water management on a global scale.

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