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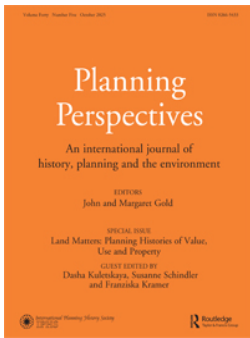
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# Planning the Arid Port City in Iran: Siraf's water heritage landscape as a Sassanid urban strategy

Marziyeh Tahmasbi <sup>a,b</sup>, Steffen Nijhuis <sup>b</sup> and Mehdi Haghighat Bin <sup>a</sup>

<sup>a</sup>Department of Architecture, Tarbiat Modares University, Tehran, Iran; <sup>b</sup>Department of Architecture and Built Environment, Delft University of Technology, Delft, The Netherlands

## ABSTRACT

This article examines the planning history of Siraf, an ancient port city on the Persian Gulf in Iran, through the lens of water heritage landscape. It argues that Siraf's water infrastructure was not a product of incremental, vernacular adaptation to aridity, but the result of deliberate urban planning rooted in Sassanid imperial policy, religious cosmology, and environmental knowledge. Drawing on archaeological evidence, historical texts, and spatial analysis, it explores how water collection, storage, and distribution systems were integrated into the urban fabric and aligned with settlement growth. The paper reframes five functionally zoned components of Siraf's water landscape as products of early planning rather than passive responses. It also engages with competing historical interpretations and recent reevaluations of this infrastructure as heritage. By foregrounding the role of planning in enabling urban life in a water-scarce environment, this study contributes to planning history discourse and offers insights for contemporary planners grappling with sustainability and heritage in dryland cities. Siraf's case exemplifies how ancient urban resilience emerged from engineering ingenuity and coordinated spatial and infrastructural foresight.

## KEYWORDS


Planning history; water heritage landscapes; siraf; urban resilience; water-sensitive planning; water infrastructure heritage

## Introduction: planning Siraf, water, trade, and urban form

In arid environments, water is not merely a resource but a determinant of urban possibility. Where and how cities emerged, grew, and survived often depended on the presence and planned management of water.<sup>1</sup> Yet, in planning history, water infrastructure has often been treated as a peripheral concern, rather than a central driver of urbanization.<sup>2</sup> This paper addresses that gap by focusing on Siraf, an ancient port city in Iran whose rise and resilience were closely tied to early and deliberate strategies of water-based planning.

This paper explores Siraf's urban water infrastructure not simply as a collection of technical features, but as a planned system integral to the city's formation and growth. It argues that the development of cisterns, wells, dams, and rainwater harvesting zones was not merely an adaptive response to climate, but a coordinated effort, likely initiated during the Sasanian era, to support a functioning port city in an environment with no natural freshwater sources.

By prioritizing the relationship between water systems and urban planning, this study repositions Siraf within the broader planning history in Iran and the Persian Gulf. It first traces how the spatial

**CONTACT** Marziyeh Tahmasbi  [M.Tahmasbi@tudelft.nl](mailto:M.Tahmasbi@tudelft.nl)

<sup>1</sup>Tvedt and Oestigaard, *Water and Urbanization*, Burmil et al., "Perceptions of Water in Arid Landscapes."

<sup>2</sup>Gandy, "The Fabric of Space."

organization of water infrastructure shaped urban development, drawing on archaeological, geographical, and historical evidence. Next, it explores the evolving interpretations of Siraf's water systems, including past misconceptions and emerging heritage perspectives. Finally, it considers how contemporary planning practice can benefit from historical insights, particularly in contexts of water scarcity.

Reframing Siraf as a historically planned city, not only as a cultural landscape, emphasizes the active role of early planning in producing sustainable, resilient, and functional urban forms. In doing so, the paper contributes to a deeper understanding of how pre-modern planning practices engaged with natural constraints, and how these practices continue to resonate in present-day heritage and sustainability debates.

## Siraf in urban planning history

The establishment and growth of Siraf were not incidental but part of a broader Sassanian strategy for spatial and infrastructural planning.<sup>3</sup> Located along the Persian Gulf in present-day Bushehr Province, Siraf held a crucial position within the Sasanian network of coastal ports and inland cities. Archaeological and textual evidence suggest that the port may have been founded or significantly developed during the reign of Ardashir I (224–241 CE).<sup>4</sup> Malekandathil (2002) noted that Ardashir I actively established or redeveloped several ports in the Persian Gulf, including Siraf, as part of a maritime policy aimed at securing trade with India. This period of administrative consolidation was characterized by a deliberate approach to urban and infrastructural development. Siraf thus provides a valuable case for examining how imperial planning ideologies, shaped by governance, religious frameworks, and economic imperatives, influenced both urban form and water management strategies.

The Sasanian state was actively engaged in city-building to organize space, project authority, and sustain economic functions. As a satellite port for Gur, Siraf likely served both military and commercial purposes within a planned territorial hierarchy. Whitehouse notes that Siraf functioned as the maritime outlet for Gur, one of the principal Sasanian cities in the Fars region, founded by Ardashir I<sup>5</sup> (Figure 1). This connection places Siraf within a deliberate spatial logic of inland-capital-coastal-port relationships that required infrastructure to facilitate communication, trade, and settlement continuity across arid landscapes.

A critical component of this planning strategy was water infrastructure. The Sasanian state developed sophisticated hydraulic systems across its territory, including qanats, dams, canals, and reservoirs.<sup>6</sup> These systems were not merely technical responses to environmental constraints; they reflected a centralized ideology of governance in which water management was an expression of both political power and religious obligation. Zoroastrianism, the dominant religion of the period, held water as sacred, reinforcing the imperative to safeguard and organize its use.<sup>7</sup> This convergence of political, spiritual, and practical interests likely influenced the planning of Siraf, where ensuring water access was a precondition for urban viability.

Despite the scarcity of written records specifically naming the planners or engineers of Siraf's infrastructure, the spatial coherence and scale of its water system imply a coordinated vision. The alignment of wells, cisterns, and collection pools with the city's topography and settlement patterns (Figure 2) supports the argument that Siraf was not only shaped by its environment, but by

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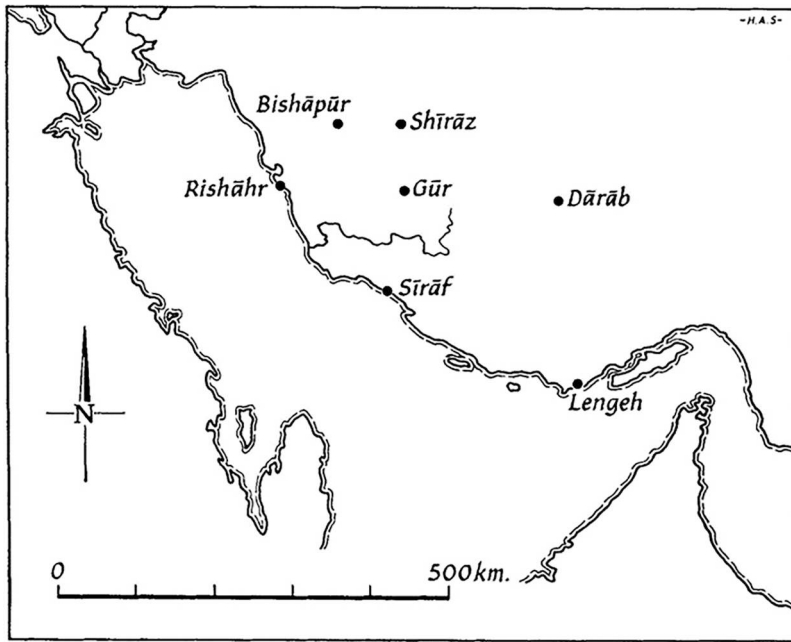
<sup>3</sup>Noruzzadeh Chegini et al., "From the Palace to the City."

<sup>4</sup>Semsar, *Siraf's Historical Geography*, Malekandathil, "Sasanians and Indian Maritime Trade."

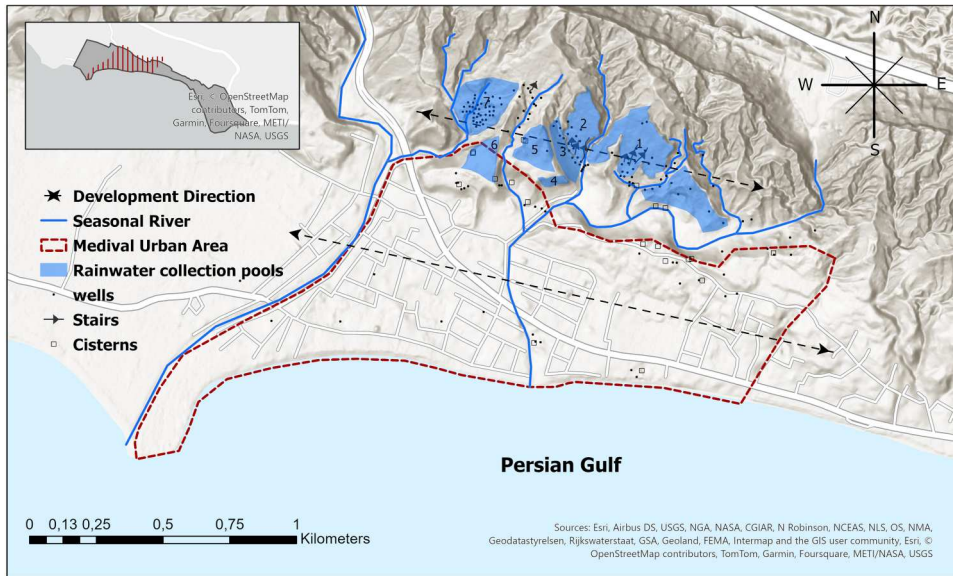
<sup>5</sup>Whitehouse, "Siraf: A Sasanian Port."

<sup>6</sup>Montakab, "Irrigation Management in Ancient Iran."

<sup>7</sup>Hartnell, "Sustaining Abundance."



**Figure 1.** Sassanian ports in the Persian Gulf. Sassanian had three important cities, Bishapur, Firuzabad (Gur), and Darab, with three port related. Rishahr Port served Bishapour, Siraf was a port for Gur city and Lenge Port served Darab city (Adopted from Whitehouse, ‘Siraf: A Sasanian Port.’).



**Figure 2.** Map showing the alignment of the water heritage landscape with the expansion of the ancient city of Siraf, overlaid on the current city layout (Created by Author using ArcGIS).

proactive planning decisions. Rather than infrastructure reacting to urban growth, Siraf's urban layout was structured around water access, a hallmark of forward-looking urban design. This section lays the groundwork for understanding how these infrastructural choices shaped the city's spatial structure and long-term sustainability.

### Designing for water in an arid coastal landscape

Siraf's urban survival in an arid coastal environment depended on its capacity to collect and manage rainwater through a strategically organized infrastructure. This system was not a collection of ad hoc responses but a spatially coordinated outcome of environmental assessment and urban planning. The elements of this water landscape, distributed across the city's topography, demonstrate a coherent vision for sustainable water provision and risk management. Building on interdisciplinary spatial analysis and fieldwork<sup>8</sup>, Siraf's water system can be understood through five functional zones (Figure 3), each integral to the planned urban metabolism:

- (1) Nourishment Zone (mountain recharge): Located north of the settlement, this zone consists of thousands of carved pools, recharge wells, and staircases that directed rainfall into porous geological layers, replenishing the aquifer below.
- (2) Storage Zone (foothill margins): Cisterns were constructed at the city's upper edges to store water during dry periods. Their locations and materials reflect a conscious effort to reduce evaporation and optimize distribution.
- (3) Harvesting Zone (urban core): A network of pumping wells within residential areas accessed groundwater for daily use. Their proximity to dense settlement areas indicates deliberate urban service planning.
- (4) Farming Zone (peri-urban terraces): Located on the hillside and foothills, this area hosted agricultural wells and brick structures likely designed to support grapevine cultivation.
- (5) Crisis Protection Zone (city perimeter): Barrier dams and percolation structures were built to control floods from mountain runoff and to buffer the coastline against storm surges.

This system, previously interpreted primarily through heritage and landscape lenses by Tahmasbi et al. (2024), can also be understood as a manifestation of pre-modern planning intelligence. It demonstrates how Siraf's spatial design aligned technical, topographical, and social considerations to create a resilient urban form. This approach parallels the hydraulic intentionality seen in Sasanian royal architecture, where water basins and springs were embedded in the site planning of key complexes such as Ardeshir's palace.<sup>9</sup> Similar integrative strategies are visible in Sasanian settlements on the Deh Luran Plain, where water and agricultural planning were foundational to settlement viability.<sup>10</sup> to create a resilient urban form.

### Competing interpretations and adaptive systems

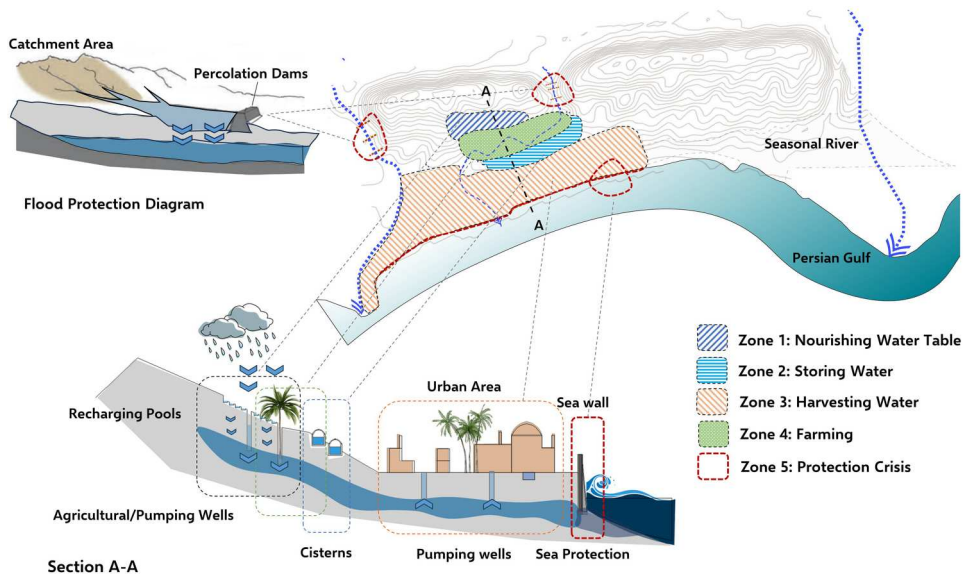
While the physical remnants of Siraf's water infrastructure suggest deliberate spatial and engineering planning, historical accounts offer multiple, and sometimes conflicting, interpretations of how the city sustained its water supply. These competing narratives highlight the challenges of

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<sup>8</sup>Tahmasbi et al., "Unveiling Water Legacy of Siraf."

<sup>9</sup>Valaei, "Sasanian Architectural Works and Urban Planning."

<sup>10</sup>Neely, "Parthian and Sasanian Settlement Patterns."



**Figure 3.** Different zones of the water heritage landscape based on functions (Adopted from Tahmasbi, Haghighat Bin, and Nijhuis 2024).

reconstructing pre-modern planning processes and underscore the adaptability of infrastructure over time.

Three principal theories have emerged regarding Siraf's water sources:

- Water transfer from Jam to Siraf
- Direct utilization of rainwater
- Utilization of sinks, springs, and wells within the port

Some accounts suggested that Siraf's water requirements were met by Jam.<sup>11</sup> However, confusion arises due to the existence of a city<sup>12</sup> named Jam, leading some to mistakenly believe that the author referred to that location. While no evidence supports the notion of water transfer from the city of Jam to Siraf, alternative sources indicate that the mountain overseeing Siraf, known as Jam, was the intended water source.<sup>13</sup> This clarification dispels misconceptions and aligns with the geographical realities of the region.

Alternative historical sources suggested that rainwater was crucial in meeting Siraf's water needs.<sup>14</sup> This method involved direct utilization of rainwater, which was collected in small pools and due to the high permeability of rocks allowed it to infiltrate to the ground and prevent evaporation during hot seasons. The ancient inhabitants of Siraf devised a system to collect rainwater on Mount Jam, storing it in underground aquifers and retrieving it from wells as needed. While all three may have played a role, archaeological evidence and topographic analysis support the second view as the primary system.

<sup>11</sup>Istakhri, *Al-Masalik wa-Al-Mamalik*.

<sup>12</sup>Approximately 40 km.

<sup>13</sup>Hawqal, *Ibn Hawqal's Travelogue*.

<sup>14</sup>Mustawfi Qazvini, *Nuzhat al-qulub*, 234.



**Figure 4.** The Mountain overlooking Siraf which was known as Jam, featured numerous rock-cut hollow rectangles, and wells, created a unique landscape (Photo: Author).

A key example of shifting interpretation concerns the rectangular rock-cut hollows scattered across the mountain slopes overlooking the city (Figure 4). Once misidentified as a cemetery<sup>15</sup>, due to the discovery of bones and human remains in a small number of the hollows, more detailed analysis has shown that these structures were originally designed to collect rainwater and recharge underground aquifers.<sup>16</sup> Many contain waterproofing layers, and their standardized dimensions and layout diverge from known burial practices of the period. While some may have been repurposed for burials following events such as the Great Siraf earthquake, this secondary use does not negate their original function. Further supporting this reinterpretation is strong presence of water management system elements in the landscape, including recharging pools, wells, cisterns, dams, aqueducts, indicating a coordinated urban-scale water strategy. Excavations near the Great Mosque<sup>17</sup> have also revealed gravestones (Figure 5), confirming the presence of a designated cemetery elsewhere.

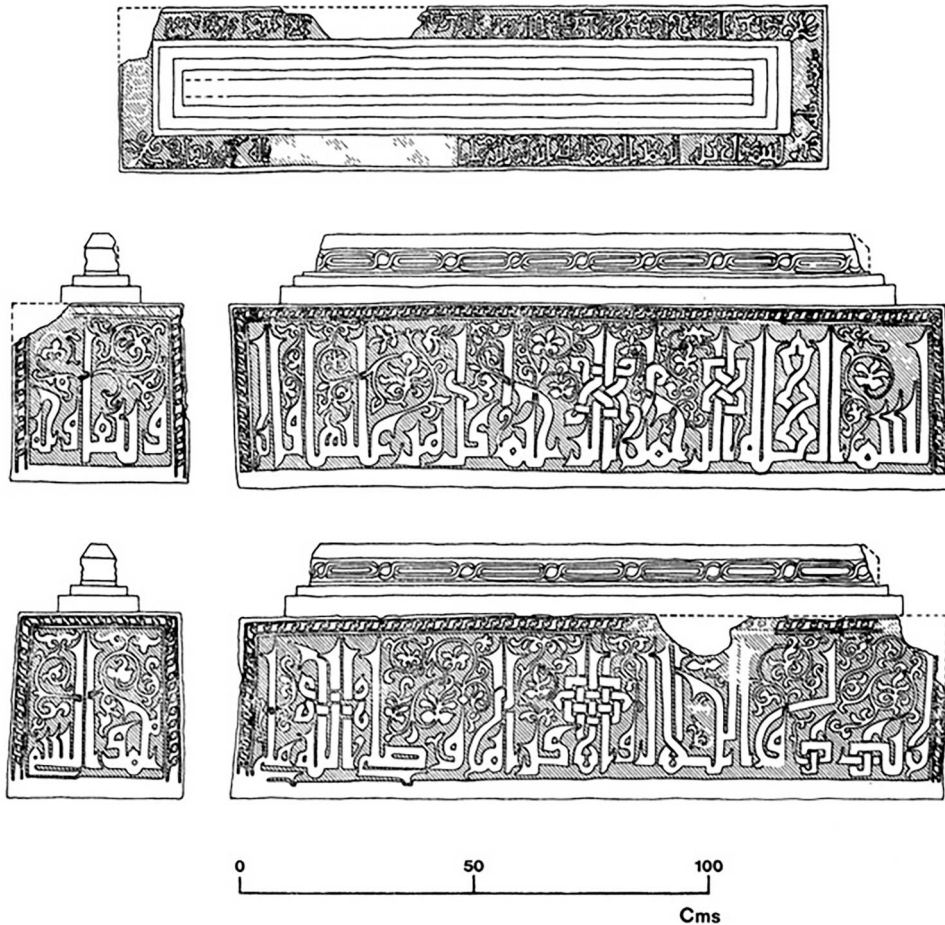
Rather than a static system, Siraf's infrastructure reveals a dynamic interplay between planned design and historical adaptation. Pools may have shifted from infiltration basins to burial sites; this responsiveness to environmental, demographic, and cultural change underscores a flexible planning logic capable of long-term adjustment. Even amid interpretive uncertainty, the integrated placement of water structures with dwellings, pathways, and agricultural areas reflects a coherent vision that balances functionality with resilience.

This layered understanding of Siraf's infrastructure sets the stage for further historical interpretation. Below is a timeline highlighting significant events in Siraf's history, including changes in its rainwater management landscape (figure 6).

<sup>15</sup>Whitehouse, "Excavations at Sirāf; First Interim Report."

<sup>16</sup>Pourhasan Darabi and Alamolhodaei, *A New Attitude towards Ancient Finds of Siraf*; Tahmasebi, "Indigenous Knowledge for Water Management in Siraf."

<sup>17</sup>Whitehouse, "Excavations at Sirāf: Fourth Interim Report."



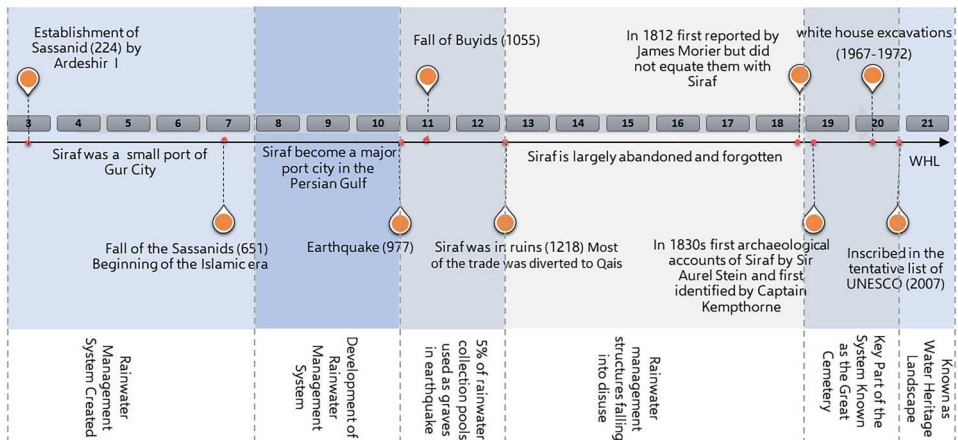
**Figure 5.** A stone grave covered with an elaborate plaited Kufic inscription which includes the date Jumada II 383/993. It is one of the earliest epitaphs discovered at Siraf (the earliest being the British Museum's example of 991). The cover is one of two epitaphs preserved in situ in a small cemetery some 750 m – northeast of the Great Mosque. The cover was carved from a single sandstone block and measures 1.51 \*0.34\*0.50 m. Along the top runs a crest, 0.15 m. high. (Adopted from Whitehouse, 'Excavations at Siraf: Fourth Interim Report.')

### From utility to heritage: revaluing water infrastructure

What began as a utilitarian response to environmental constraints has become a symbol of resilience, ingenuity, and identity. As Siraf's water infrastructure transitioned from active use to archaeological remains, its meaning expanded. Once overlooked or misunderstood, these systems are now increasingly recognized as heritage assets. As Carola Hein (2023) notes, the relation between water and heritage may be less obvious when water systems are embedded in ordinary practices such as drinking, irrigation, or architectural adaptation to rainfall.<sup>18</sup> Recent studies, including value-based heritage frameworks<sup>19</sup>, help clarify why such infrastructure deserves protection. The multifaceted

<sup>18</sup>Hein, "Toward a Research and Action Agenda."

<sup>19</sup>Pereira Roders, *RE-ARCHITECTURE*, Capelo et al., "Why are Cultural Landscapes of Various Values?"



**Figure 6.** Siraf as an ongoing history (Adopted and modified from Tahmasbi, Haghghat Bin, and Nijhuis 2024).

values attached to Siraf's water heritage landscape, combining both tangible and intangible aspects, highlight the city's ability to adapt and thrive in its harsh environment.

This transition, from functional infrastructure to a valued heritage landscape, aligns with the broader discussions on water and heritage that emphasize the need to recognize water systems not only as technical artifacts but as carriers of cultural memory, spatial identity, and adaptive knowledge embedded in everyday life.<sup>20</sup>

For planning historians and contemporary urbanists, these heritage values are not just symbolic. They reveal historical practices of adaptive infrastructure, collective investment, and environmental intelligence. They also suggest that heritage conservation should encompass functional infrastructure, not only monuments.

### Conclusion: A planned landscape for water and trade

Siraf's historical water infrastructure reveals the active role of planning in shaping cities under environmental constraints. Rather than an incidental adaptation, it reflects deliberate decisions rooted in state governance, religious ethics, and urban design. The city's spatial coherence and functional sustainability were underpinned by a layered system that integrated water management into urban form.

Reframing Siraf's infrastructure as planned, not improvised, contributes to the planning history of ancient cities and informs contemporary heritage and sustainability debates. It reminds us that urban resilience depends not only on technology but on foresight, coordination, and landscape-based knowledge. As planners today confront new water crises, learning from Siraf may provide a model for building resilient futures from historical insights.

### Notes on contributors

*Marziyeh Tahmasbi* is a PhD student at the Department of Architecture at Tarbiat Modares University in Iran, and a visiting researcher at the Department of Architecture and Built Environment, at Delft University

<sup>20</sup>Hein et al., "Introduction: Connecting Water and Heritage for the Future."

of Technology in the Netherlands. Her research focuses on water heritage landscapes and developing landscape-based solutions for these areas. Tahmasbi's work contributes to understanding how historical and cultural contexts can influence modern environmental and urban planning strategies.

*Steffen Nijhuis* is a full professor of landscape-based urbanism at Delft University of Technology. He leads the Landscape Architecture section. His research and teaching focus on integrating landscape-based approaches into urban design to promote sustainable urbanization, climate adaptation, and biodiversity. He also actively collaborates with governments, NGOs, and businesses to bridge the gap between academia and practical applications in urban planning and landscape architecture.

*Mehdi Haghighatbin* is an associate professor at the Department of Architecture at Tarbiat Modares University in Iran. His research primarily focuses on historical and contemporary urban design and landscape architecture, with a particular emphasis on Persian gardens and urban regeneration.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## ORCID

Marziyeh Tahmasbi  <http://orcid.org/0009-0007-0854-2241>

Steffen Nijhuis  <http://orcid.org/0000-0001-6066-822X>

Mehdi Haghighat Bin  <http://orcid.org/0000-0001-8910-2967>

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