



The New Dutch Water Defense Line (Nieuwe Waterlinie): Preserving Historical Qualities in a Context of Very High Spatial Pressure

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The Dutch Water Defense Line (Hollandse Waterlinie) is a historic defense system in the Netherlands that integrates innovative flood defense mechanisms with the country's lowland topography across a 200 km span. Despite its effectiveness during periods of conflict, technological advancements rendered the defense system obsolete, letting it fall into a state of neglect. The Waterline laid dormant for a few decades until a revitalization effort began in 2001 – a multi-stakeholder endeavor encompassing heritage preservation, nature conservation and spatial development (UNESCO n.d.). In a densely inhabited area, multi-level collaborations were needed to identify new ways to connect water management and heritage preservation. Collaborative efforts among governmental bodies, local communities and private enterprise facilitated the repurposing of historical forts into venues for cultural activities, tourism, farming and hospitality. The successful revitalization of the Dutch Waterline serves as a compelling example of the value case methodology we promote in the course Water Systems Design: Learning from the Past for Resilient Water Futures. It is an example where heritage preservation is intricately linked with economic development, environmental sustainability and social well-being. As a model for eco- and hydro-systemic thinking, the Dutch Waterline offers valuable lessons for designing resilient water futures and nurturing sustainable landscapes.

Keywords: value case, ecosystemic thinking, multi-actor, heritage, stakeholders



< Fig. 1 View of the Waterline model at the Waterline Museum at Fort Vechten (Source: Lea Kayrouz, 2023).

Introduction: The Rise, Evolution and Legacy of the Dutch Waterline: Value Case in Becoming

The Dutch Water Defense Lines, or *Hollandse Waterlinie*, form a defensive system that stretches over 200 km, running partly alongside and partly straight through the core administrative and economic region of the Netherlands (fig. 1). Originally conceived in 1672, structurally improved beginning in 1815 and dismantled in 1963, the network of fortifications to shelter prominent cities against potential French army incursions gradually grew to become a sophisticated lowland defense system. The ingenuity of the Waterline lies in its innovative capability to flood the surrounding areas in case of ground invasion. Over the 150 years following its initial construction, the Waterline underwent significant improvements with military, strategic and architectural innovations, transforming from localized city-level fortifications into an extensive sub-national defense system (fig. 2).

The Waterline as a defense mechanism integrated the water management characteristics of the lowland topography with military defense principles, guaranteeing continued agricultural production. During the nineteenth century, a clever use of the geo-morphological wetland conditions enabled open field dairy farming. Water management devices such as locks, pumps, canals, dikes and inundation polders were collectively administered through the water management authorities (figs. 3–4). This defense feature of the Waterline made possible the neutrality of the Netherlands during World War I. However, technological advancements, especially the use of airplanes in warfare, made the defense system obsolete (Steenbergen et al. 2009).

Spanning 200 km of unoccupied blue-green infrastructure, the Waterline cuts through an area of high population density and of rapid transformation characterized by continued urban, agricultural and water management developments. The ingenuity of the redevelopment plans lies in the ability to combine different developments into a planning strategy able to integrate old forts that are now heritage structures with natural, recreational and economical values. In the professional education course *Water Systems Design: Learning from the Past for Resilient Water Futures*¹ we looked at the Dutch Waterline as a thoughtfully designed ecosystem, a relevant reference to incentivize learners to adopt eco- and hydro-systemic thinking. *Water Systems Design* conceptualizes the Dutch Waterline as a value case in the making, in which contested heritage structures – too expensive to be preserved – acquired new functions connected to the needs and potential of the surrounding territories, from water management to economic development.

From Defense to Heritage: The Transformative Values of the Dutch Waterline

The first version of the Dutch Waterline was operationalized in 1672 as a response to the threat posed by the French army. It continued to be extended and renovated until it became a 200 km network of fortification. In 1815 King William I, leading the newly established Kingdom of the Netherlands, decided to extend, renovate and modernize the entire system. The outbreak of World War I in 1914 saw the Netherlands not participating, allegedly and in part, due to the perceived effectiveness of the Dutch Defense Line. However, during World War II in 1940, the De-

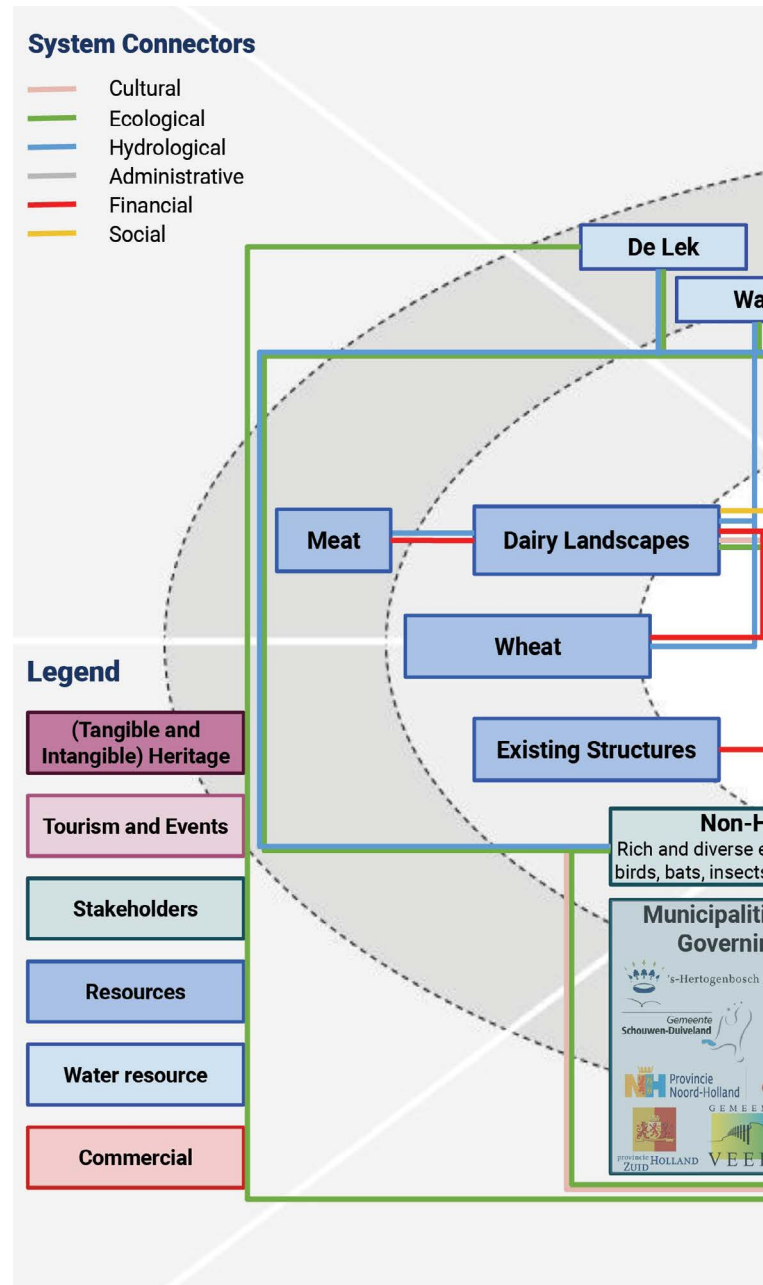
1. *Water Systems Design: Learning from the Past for Resilient Water Futures*, <https://online-learning.tudelft.nl/courses/water-systems-design-learning-from-the-past-for-resilient-water-futures/>.



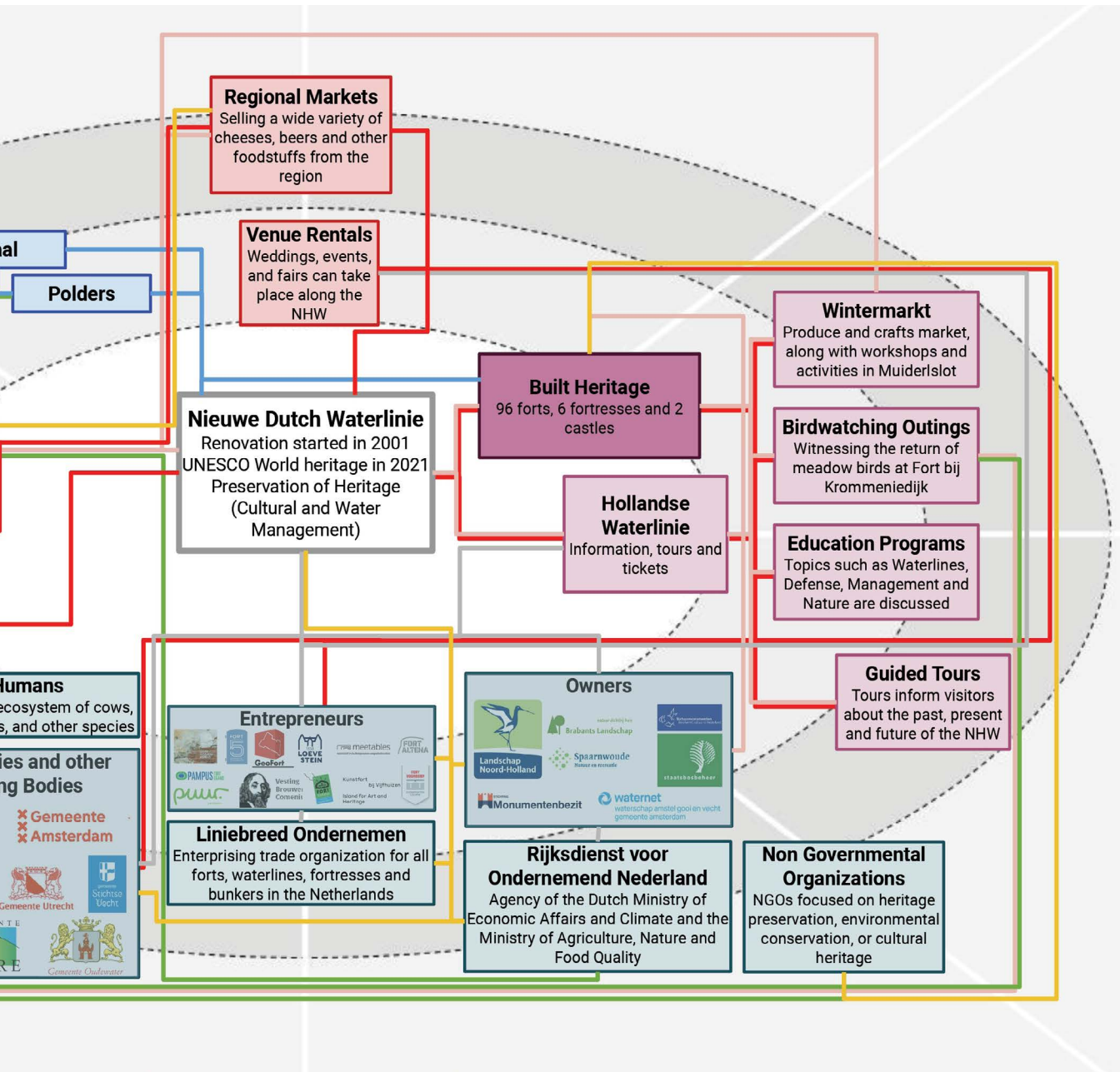
^ Fig. 2 View of the Waterline model overlooking Utrecht and the surrounding forts (including Fort Vossegat, Fort de Bilt and Fort de Lunetten). The model is featured in the Waterline Museum in Fort Vechten (Source: Lea Kayrouz, 2023).

fense Line proved inadequate against airstrikes launched by bomber planes, and some decades later, in 1963, legislative measures regarding fortifications and inundation were rescinded. A turning point for the Waterline came in 2001 when a substantial protection and revitalization initiative was launched by the national government as part of a public investment strategy. By 2009, the entire system and its components were officially designated as a National Monument, and in 2021 the Dutch Waterline extended the Defence Line of Amsterdam, which was already UNESCO World Heritage since 1996.

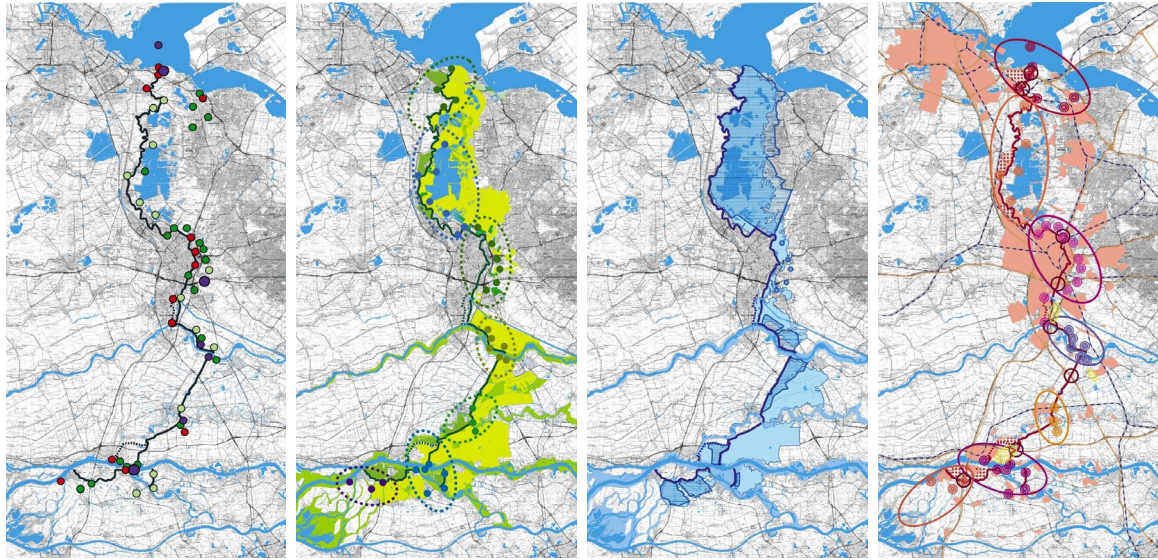
The transformative adaptation of the Waterline, after the loss of its defense function, underscores the evolutive nature of water values. A water-based defense system comprising ninety-six forts, along with the six fortresses and two castles and hundreds of bunkers, was turned into a water management project that allowed for heritage protection and served as a tourist attraction. This paradigm shift was initiated by a robust protection and revitalization program, supported by governmental stakeholders and based on collaboration with local entrepreneurs and institutions. Tangible and intangible water values of shelter and defense,² of agriculture and inundation,³ and laws and policies⁴ have been transformed into principles of preservation, adaptation, reuse and recreation. The comprehensive repositioning of the historical megastructure paved the way for an accessible heritage experience, which was facilitated by local NGOs and entrepreneurs, particularly those engaged in the hospitality business.



2. Demonstrated through the enhancement and expansion of defense systems, spanning from city to sub-national levels.
 3. Exemplified through intelligent utilization of geo-morphological wetland conditions, open-field dairy farming and collective water-management devices.
 4. Illustrated by the establishment of legal and financial frameworks for designing, constructing and operating military defense systems, along with funds to compensate farmers in the event of inundation.



^ Fig. 3 Network of flows and stakeholders surrounding the Nieuwe Dutch Waterlinie, developed by Lea Kayrouz based on literature on the Dutch Waterline and as a model for the course Water Systems Design (Source: Lea Kayrouz, 2023).



^ Fig. 4 A mapping of the components of the Waterline and the other spatial demands and opportunities in the area. From left to right: Map of the four different ownership and operational scenarios of fortifications of the Waterline; map of the continued agricultural and natural land use of green areas and fort clusters of the Waterline; map indicating the potential significance of inundation for future water retention; map of the clusters of fortifications providing multiple touristic arrangements along the Waterline (Source: Eric Luiten, 2023).

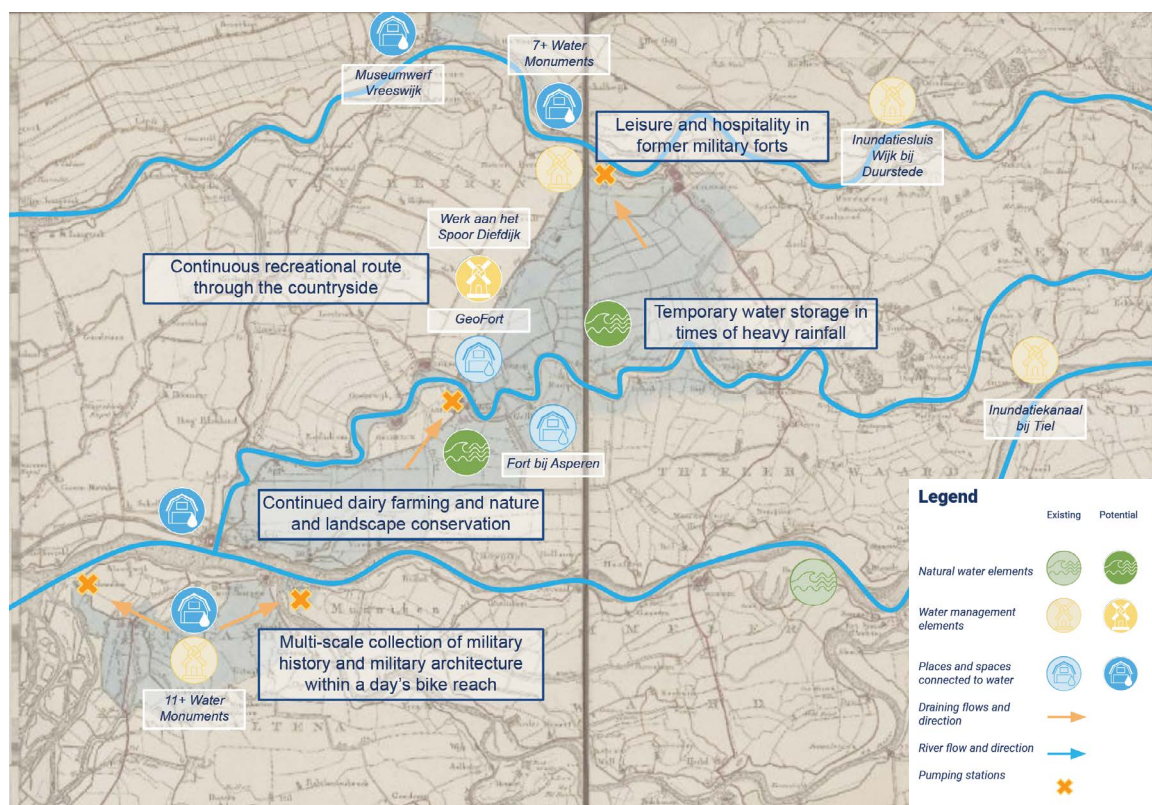
Situated Sustainability: Integrating Heritage, Nature and Spatial Development along the Dutch Waterline

The Dutch Waterline encompasses natural water bodies, water management structures and historical places with a continuous recreational route through the countryside. These elements have been reshaped into operative landscapes as the Waterline has undergone renovation, in a collective effort by a wide spectrum of stakeholders. This includes the Nieuwe Hollandse Waterlinie (NHW) planning office, operated by the Regional West branch of the Rural Area Service, which collaborates with four ministries, five provinces, various municipalities, water management boards and organizations and entrepreneurs specializing in cultural history, recreation and agriculture (fig. 3).

The national government launched the masterplan, which emphasized the importance of

guidelines for protection and an invitation to (re)development. The protective approach was based on the definition of the so-called primary defense line that runs through the heart of the Linie and the introduction of three comprehensive spatial regimes that needed elaboration and further definition under the responsibility of provincial and municipal authorities. It provided a foundation for heritage and landscape preservation that made it possible for the Waterline to become a national monument and UNESCO World Heritage Site.

The development standpoint (supported by fig. 4) anticipated the ongoing interest in transforming the area of the Waterline because of regional urban extension programs, agricultural development, tourism initiatives, infrastructural investments and quantitative water management and water retention challenges. The idea was to encourage institutional and private institutions to



^ Fig. 5 Mapping of the project envelope around Fort Vuren, Fort Vechten, Fort Nieuwe Steeg and Fort Honswijk (Source: Lea Kayrouz, 2023).

come and invest, but in such a way that the essential historical features of the Waterline would be enhanced. This redevelopment strategy made extensive use of multi-scalar collaboration. Once the masterplan was created, the regional and local governments took the responsibility of supervising the developments of the section of the Waterline under their jurisdiction – each one called a “project envelope.” This approach allowed the design of regulations and interventions more in tune with the different contexts and the requests of local actors. At the same time, a quality team responding to the national government monitored the work of each area therefore providing consistency among – and integration within – the different “project envelopes.”

Examples for interventions in “project envelopes” include the surrounding area of Fort Vuren, Fort Vechten, Fort Nieuwe Steeg, Fort Honswijk and dedicated efforts focused on nature and landscape conservation. By leasing inundation areas to farmers, financial benefits accrue to the Waterline, fostering economic viability. Furthermore, the advocacy by nature organizations for biodiversity preservation, coupled with the careful integration of old flooding structures with water reservoirs, addresses contemporary challenges like water scarcity, floods and the salinization of agricultural waste (fig. 5).

Other transformative initiatives include collaborative endeavors with several water manage-

ment authorities for water storage and treatment, reducing costs and increasing profits; another example is engaging students in the maintenance and restoration of forts (Durville and Boérée 2012) which lowers the costs of preservation for the Nieuwe Hollandse Waterline, while creating an educational experience. The adaptive reuse of former military forts exemplifies another synergy created during the revitalization project, wherein these historical sites are repurposed as wedding and conference venues, museums, offices or accommodations for overnight stays and leisure and cultural activities are sustained and sustain a growing hospitality sector. The Liniebreed Ondernemen Foundation (LOF) provides entrepreneurs with the support and advice necessary to catalyze sustainable futures for the forts and their surroundings (LOF 2023). The LOF has contributed to numerous projects, including but not limited to the publication of route guides, the development of campaigns and festivals, and the setting up of exhibitions pertaining to water heritage. These initiatives were facilitated by governmental stakeholders that provided strategic direction, shaping policies that are attuned to the different regions and their respective needs. In an approach described as “planning by invitation,” governments broadly outline areas where spatial changes are desirable, considering long-term forecasts and the preservation of values. However, these outlines are not imposed on the area, as doing so would position the government as an unwelcome guest. Instead, the approach revolves around discerning what the area itself appears to be requesting based on existing values and user inputs; the government can only suggest what is desirable since it is unable to fund said desires. Users, residents and dwellers are responsible for funding the renovation and its economic viability, inviting them to step into the role of policymakers.

These diverse strategies showcase the comprehensive and forward-thinking approach employed in the renovation of the Dutch Waterline to integrate historical, natural and economic elements into a sustainable framework, fostering water resilience and adaptability for the future (Bakker et al. 2022; Luiten 2011).

Conclusion: Ecosystemic Revitalization of Heritage and the Value Case Methodology

The renovation of the Dutch Waterline managed to address the interests of heritage management and water security while adding value for the territory. The plan serves as an exemplary instance of a value case, integrating climate-resilient infrastructure, robust partnerships, economic development and innovative water management while preserving historical elements. The renovation initiative aligns with various Sustainable Development Goals (SDGs) generating beneficial effects across the sectors of agriculture and farming, culture and heritage, water management, nature and landscape conservation.

This case not only offers an effective strategy for actively preserving heritage but also demonstrates that the economic viability of preserving the Waterline is contingent upon a comprehensive program involving numerous stakeholders. The New Dutch Waterline was chosen as an example for the Water Systems Design course because it epitomizes a cohesive and collaborative approach that safeguards historical attributes and revitalizes heritage structures into dynamic and adaptable spaces that resonate with contemporary needs and values.

Policy Recommendations

- Heritage preservation in areas that are under high spatial pressure is best organized as a twofold initiative: to be straightforward about what should be protected and to be precise under which conditions spatial transformation and modification are invited and appreciated. A policy framework that stands on these two legs will serve as a strong basis for combined preservation and revitalization.
- Make a clear distinction between the different levels of responsibility to achieve a sustainable future for historical material. The experience of the Dutch Waterline program revealed that a jointly edited master plan initiated by the public sector proved to be a binding factor in the distribution of spatial initiative, in the qualitative evaluation of singular projects and in the elaboration of planning guidelines on a local level.
- A variety of instruments can be implemented in a heritage context: ownership and operation, financial or material incentives, legal rules and regulations and supportive communication. Take them all into account when exploring the potential of a larger heritage structure or system.

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