Tides of change

Maritime heritage and climate-adaptive design in evolving landscapes

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Research Paper

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Annotation

Some images in this study have been edited with orange lines or markings to highlight important elements. Below the image, the relevant text is marked in **orange** to indicate what is being referenced. If an image has been modified, this is explicitly mentioned in the description.

Introduction & methodology

The Waterdriehoek under threat

The Dutch connection to water is deeply rooted in its history and cultural heritage, shaping its landscape and identity. This relationship is vividly reflected in the Waterdriehoek – a region where Dordrecht, the Biesbosch, and the windmills of Kinderdijk form a unique landscape. Linked by water and its history, this area is part of the heritage line Maritieme Industrie (figure 1), which extends to Hoek van Holland (Provincie Zuid-Holland, 2024). A heritage line is a geographic route connecting sites through a shared historical narrative, enhancing the visibility of the cultural landscape (Hein, 2020). This research focuses on the Waterdriehoek area only, following the rivers Beneden Merwede and the Noord.

As the starting point of the Dutch delta, the low-lying Waterdriehoek showcases centuries of Dutch water management expertise. Protective measures here date back centuries, alongside the many floods that shaped the region. However, water was seen not only as a threat but also as an opportunity, evident in shipyards (figure 2), dikes, windmills, pump stations, willow cultivation and fisheries (Rijksdienst voor het Cultureel Erfgoed, 2024). What was once pioneering infrastructure is now cultural heritage. An intangible aspect of this legacy is the tradition of innovative engineering and water management to address a constantly changing environment (Hein, 2020).

Despite its historical significance, the region faces threats from climate change. Over the past two centuries, industrialisation has disrupted this fragile delta, accelerating sea level rise and river peak discharges, putting the landscape under pressure (Gramsbergen, 2021). The rest of the Netherlands, with a quarter of its land below sea level, is similarly vulnerable to climate impacts and flooding (Daamen & Taylor, 2022). Public awareness of these risks remains limited, while urban delta areas like the Waterdriehoek face heightened consequences. Both protection and adaptation are crucial.

The success story of overcoming the water threats is now challenged by climate change. New strategies are needed to preserve both tangible and intangible heritage. Drawing lessons from this history – both successes and failures – can

figure 1: Heritage line Maritime Industry, with the highlighted Waterdriehoek area on the east (own picture, created on Mapcreator.io)

figure 2: Shipwarf The Merwede at the Rivierdijk, Boven-Hardinxveld (Regionaal Archief Dordrecht, 1965)

inform future water management and urban planning. Engineers and conservators propose integrating heritage into these strategies to create climate-resilient solution while safeguarding cultural legacies (Hein, 2020). The dynamic and adaptive character of the delta, combined with water-related heritage, can inspire innovative policies and designs. This approach continues a centuries-old tradition, not as a break from current practices but as a new phase (Hein, 2020).

This research paper examines the historical and landscape developments of the Waterdriehoek to identify steps for designing flood-resistant buildings in a maritime heritage context. Learning from the region's past in terms of landscape and architecture can provide a strong foundation for addressing future challenges.

't Zaagje

This paper supports a design task within the Waterdriehoek, located at the Watertoren site in Sliedrecht – an industrial floodplain along the Beneden Merwede. Know to locals as a historical floodplain called *'t Zaagje* (figure 3), the area holds a piece of Sliedrecht's heritage. Featuring only an abandoned shipyard and a derelict water tower, this site is slated for redevelopment (figure 4). A value assessment (Appendix A) has been conducted to establish the site's heritage context. The conclusion will summarise which aspects of the research are relevant for this site and which are not.

Research questions

Based on the introduction and problem statement, the following research question has been formulated:

How can insights from the historical landscape and architectural strategies in the Waterdriehoek inform the design of flood-resilient buildings in the maritime heritage context of this delta?

The main question is divided into several sub-questions, each addressing a specific aspect of the research:

1. *What key historical transformations in the Waterdriehoek's landscape were driven by climate and water management?*

2. *What lessons can be drawn from historical architectural adaptations in the Waterdriehoek to address water-related risks?*

3. *How can these historical measures be combined with contemporary approaches to design flood-resilient buildings in the Waterdriehoek?*

Each sub-question is explored in a dedicated chapter. The first two questions focus on historical developments in landscape and architecture, highlighting the formation of the maritime heritage context. The final question integrates these historical insights with current techniques and strategies, shifting the focus towards the future. The concluding chapter summarises the answers to these questions and briefly connects the findings to the design task.

Methodology

The research for the main question is primarily based on historical research, which is linked to current design strategies and theories. This has been examined using different methods.

The core of the study is literature research, which provides insights into historical developments in the Waterdriehoek, focusing on maritime architecture and its relationship with the water landscape. The history of maritime heritage in the Waterdriehoek can tell us more about architecture and its position in society.

In addition, the literature research also examines current measures and projects within the Waterdriehoek, as well as background information on general phenomena. The literature was mainly found in historical reports, studies, and (online) books, accessed through the online database Google Scholar and the TU Delft Library. This literature helps to understand the topic and forms the foundation of the research.

A few literary sources are especially important in this research and serve as the main sources of information. The book *Adaptive Strategies for Water Heritage: Past, Present, and Future* by Hein (2020) presents a multidisciplinary study connecting water and heritage, as well as the steps needed to preserve, transform, and reuse maritime heritage. The book also occasionally focuses on the Waterdriehoek. The article *Voor als de dijken doorgingen* by Toebast (2012) supports the historical research on measures taken in response to floods in the Waterdriehoek. More general sources are for example *Urbanized Deltas in Transition* from Meyer & Nijhuis (2012), where they provide general information on the transformation of urban deltas and possible future developments. The book *Adaptive Planning for Resilient Coastal Waterfronts* by Van Veelen (2016) examines current planning strategies for resilient urban waterfronts at both large and building scales. Additionally, the strategies outlined in *Meerlaagsveiligheid* by Pötz & STOWA (2014) are used. This book discusses different measures, such as multi-layer safety principles, and strategies at street and building levels.

In addition to the literature study, spatial analysis is used. This involves examining old maps and comparing them with current ones to track developments in both the landscape and urban planning within the Waterdriehoek. The website Topotijdreis provides most of these maps and is used for historical comparisons. However, this source only goes back to the 19th century, so other sources are needed for earlier periods.

Archival material plays a supporting role in this process. Old drawings, maps, and paintings help support the spatial analysis. While scale and orientation are not always precise, these materials still convey important underlying messages. Additionally, old photographs create a connection between the past and present. Archival materials are mainly obtained from municipal archives in the Waterdriehoek, such as the Historische Vereniging Sliedrecht and the Regionaal Archief Dordrecht. Other general archives, such as the Beeldbank Rijksdienst voor Cultureel Erfgoed and the Nederlands Nationaal Archief, are also used.

figure 3: The map of Sliedrecht with 't Zaagje (Topotijdreis, 1850)

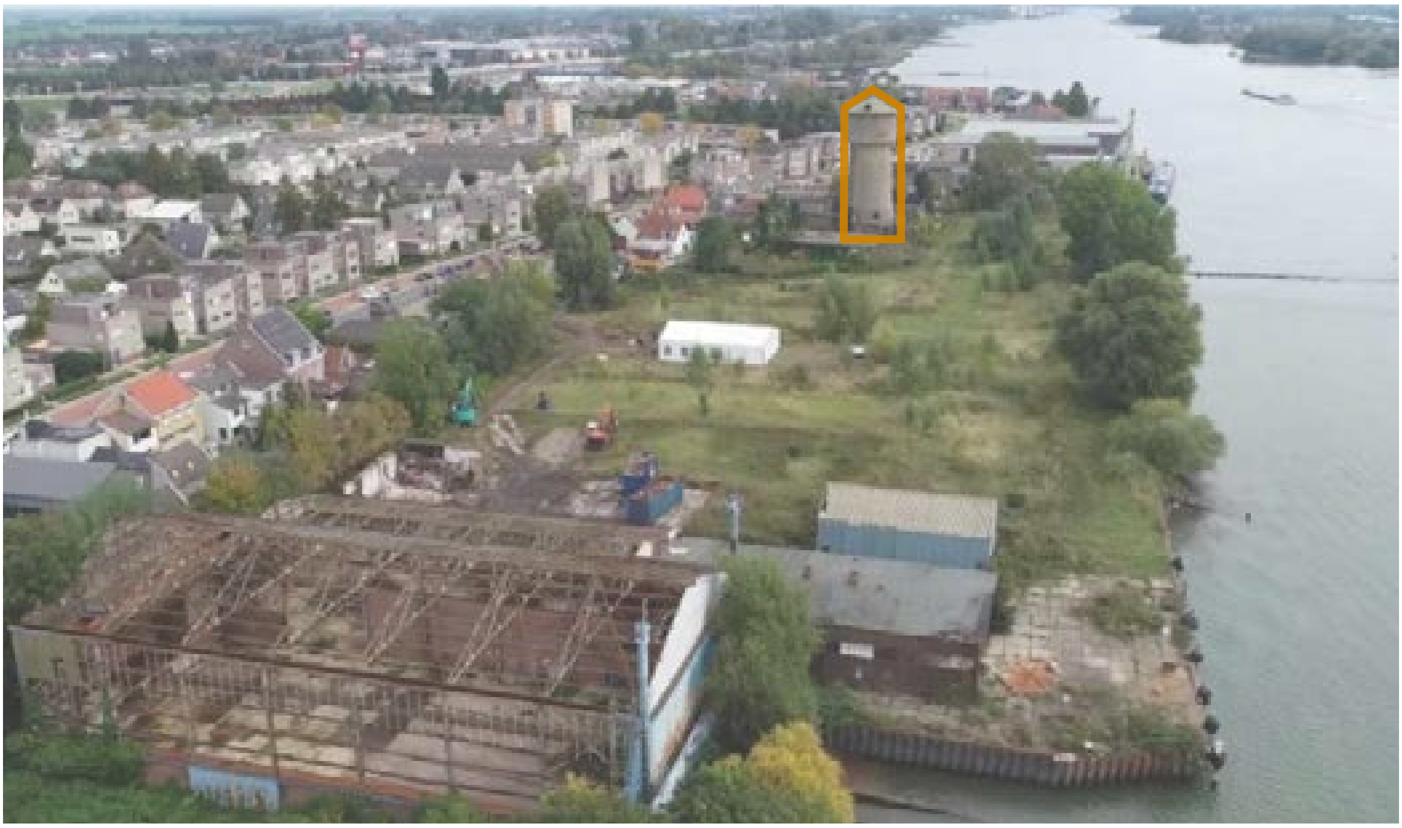

figure 4: The abandoned shipyard and Watertower in the background (by P. Donk, Sliedrecht24, 2021)

Chapter 1
The Waterdriehoek as a Delta

The river landscape of the Waterdriehoek is defined by three main rivers: the Beneden Merwede, the Noord and the Oude Maas, which transitions into the Dordsche Kil. In this area, these rivers branch into side streams, canals and distributaries, creating a deeply interconnected landscape. The strong relationship between the landscape and water has existed as long as this region has been described.

From a natural to managed Delta

As the mouth of major rivers, this landscape has undergone significant changes over centuries. The foundation of the Waterdriehoek dates back approximately 10.000 years. Around 5000 BCE, peat began forming, expanding significantly over time. However, in later centuries, the interconnected river system interrupted peat formation. Rising sea levels increasingly influenced the delta, with tides blocking river discharge and spreading sediment across the landscape (Safatij, 2006). This process marked the beginning of the current delta system in the Waterdriehoek, paving the way for human activity.

During the Middle Ages, human intervention intensified. Dykes were built to protect the land, significantly impacting nature, water management, buildings and industrialisation. An example is the Alblasserwaard dyke ring (figure 5), which included sluices. Fishing villages like Alblasserdam developed around these sluices, later growing through maritime industrialisation (Den Boer, 2019). Drainage systems were also established to facilitate agriculture. Over seven to eight centuries, some parts of the delta subsided by 6 to 8 meters due to drainage, resulting in land lying 5 to 6 meters below sea level (Meyer & Nijhuis, 2014).

Between the 12th and 15th centuries, erosion and floods drastically altered the landscape. One of the most significant floods was the St. Elisabeth's Flood of 1421, which transformed the former Grote Waard into a vast estuary. Around 30 villages were washed away, leaving Dordrecht as the sole surviving city, protected by its walls (figure 6). For nearly 150 years, the area remained

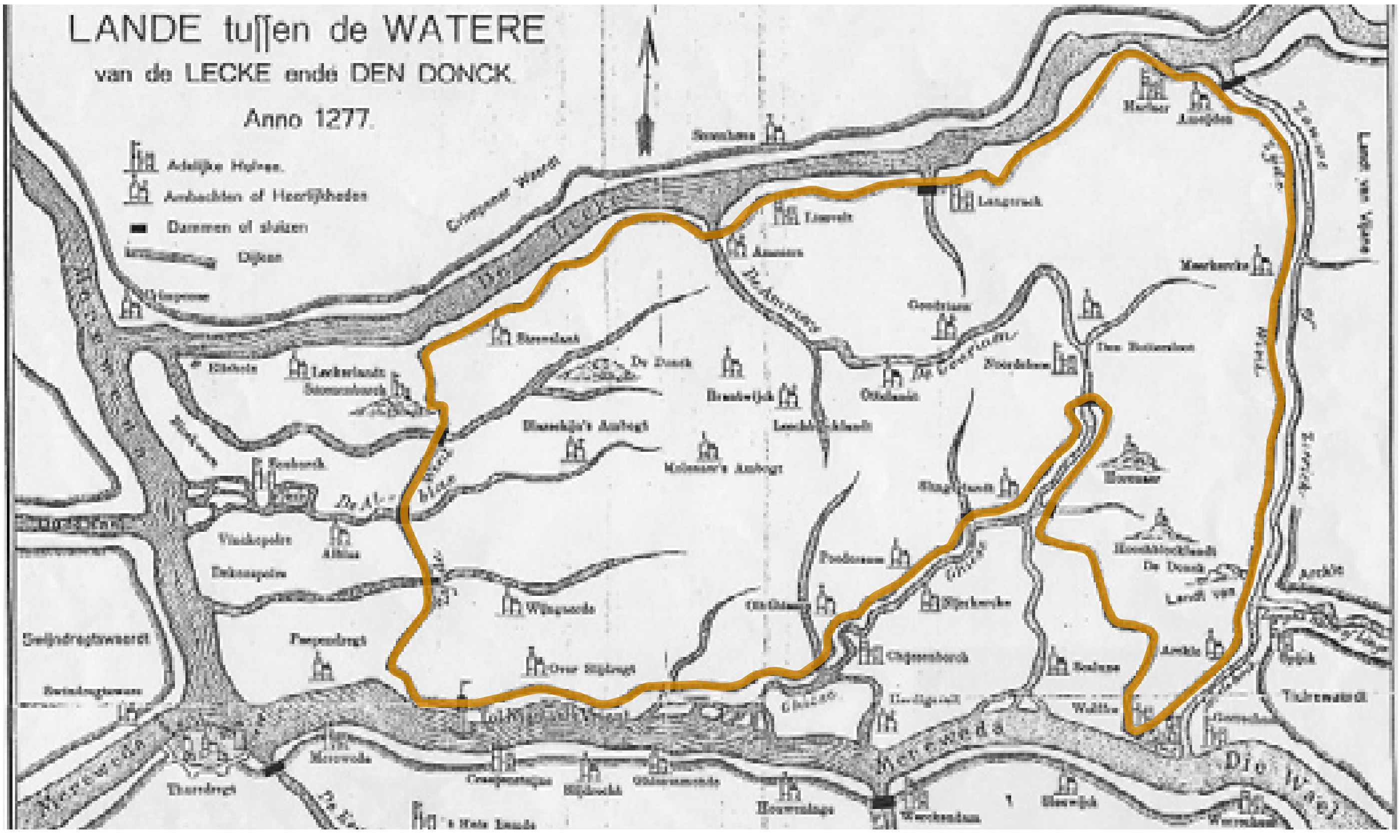

figure 5: Dyke ring of Alblasserwaard anno 1277 (Sliedrecht24, 2024. Edited by my own)

figure 6: Dordrecht surrounded by water after the St. Elisabethsflood (P. Sluyter, 1560. Edited by my own)

flooded, allowing the river free rein (Maas, 2000), marking the creation of the Biesbosch.

Residents attempted to reclaim lost land using silt traps, dams and poldering. However, human impact remained limited until the 18th century, when interventions increased. The most significant change was the construction of the Nieuwe Merwede in 1885 (figure 7), altering the flow of the Rhine and Maas (Safatij, 2006). This led to increased summer riverbeds and the formation of sandbanks on the northern side of the Merwede (Maas, 2000).

Growth of the modern landscape

In the 19th and 20th centuries, the Waterdriehoek evolved into a human-controlled delta. The natural dynamics of the delta landscape served as the foundation for networks of dykes and drainage canals (Meyer & Nijhuis, 2014). The canalisation of the Merwede and the Noord required new urban layouts. Cities incorporated harbours, sluices and canals into their built environments (figure 8) (Den Boer, 2019).

Industrialisation accelerated sea-level rise and peak discharges, disrupting the balance of water inflow and outflow (Gramsbergen, 2021). Urban delta areas like the Waterdriehoek face a combination of tidal, coastal and fluvial flooding, compounded by local wind and wave effects (Van Veelen, 2016).

The constant threat of water drove the development of maritime industries. The construction of the Nieuwe Waterweg transformed the region into an industrial hub for shipbuilding, dredging and metal industries (Arcadis, 2024). The banks of the Noord and Merwede became attractive for industrial development (figure 9) due to economic and logistical advantages, such as river access, low land costs and cold water availability (Den Boer, 2019). These areas were artificially elevated to 3.2 and 4 meters above NAP (Meyer & Nijhuis, 2014), providing a relatively high floodplain suitable for harbour facilities and maritime industries, contrasting sharply with the lower-lying urban and agricultural areas protected by the dykes.

Conclusion

The historical landscapes and maritime architecture of the Waterdriehoek have evolved together, shaped by the region's ongoing struggle with and reliance on water. From medieval dyke systems and windmills to moder industrial complexes, each era demonstrates adaptive strategies to address environmental challenges while driving economic and cultural growth. Moving forward, integrating this heritage into sustainable development will be key to preserving the region's legacy for future generations.

figure 7: The map of the Waterdriehoek with the Nieuwe Merwede (Topotijdreis, 1885. Edited by my own)

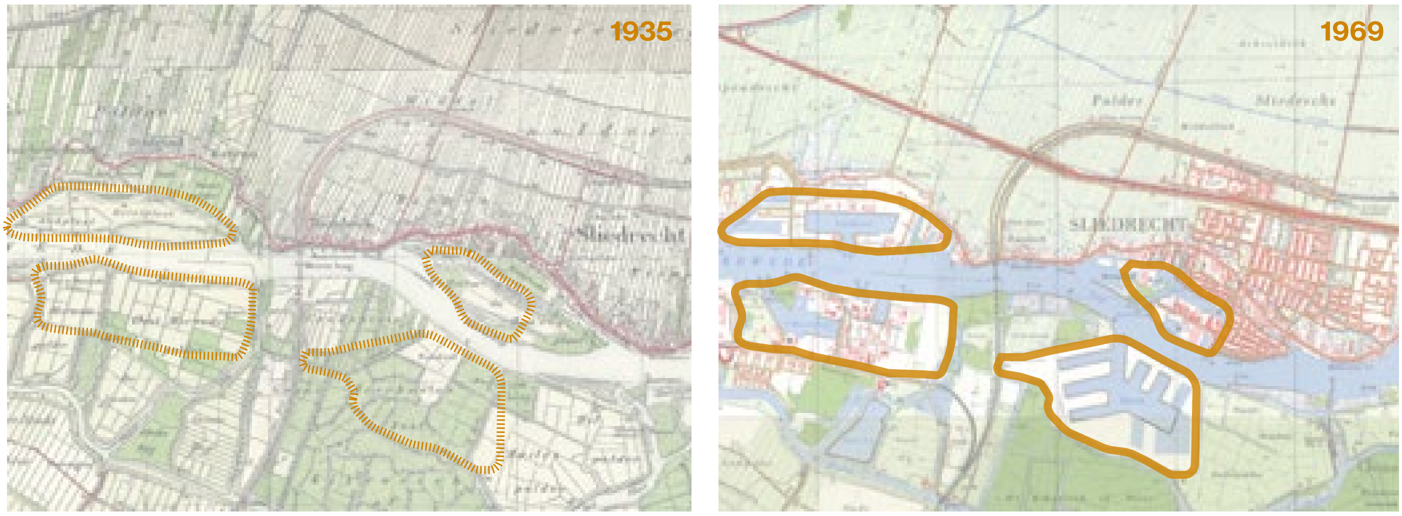

figure 8: Integration of harbours into the urban fabric of Sliedrecht in 1935 and 1969 (Left: Topotijdreis, 1935. Right: Topotijdreis, 1969. Edited by my own).

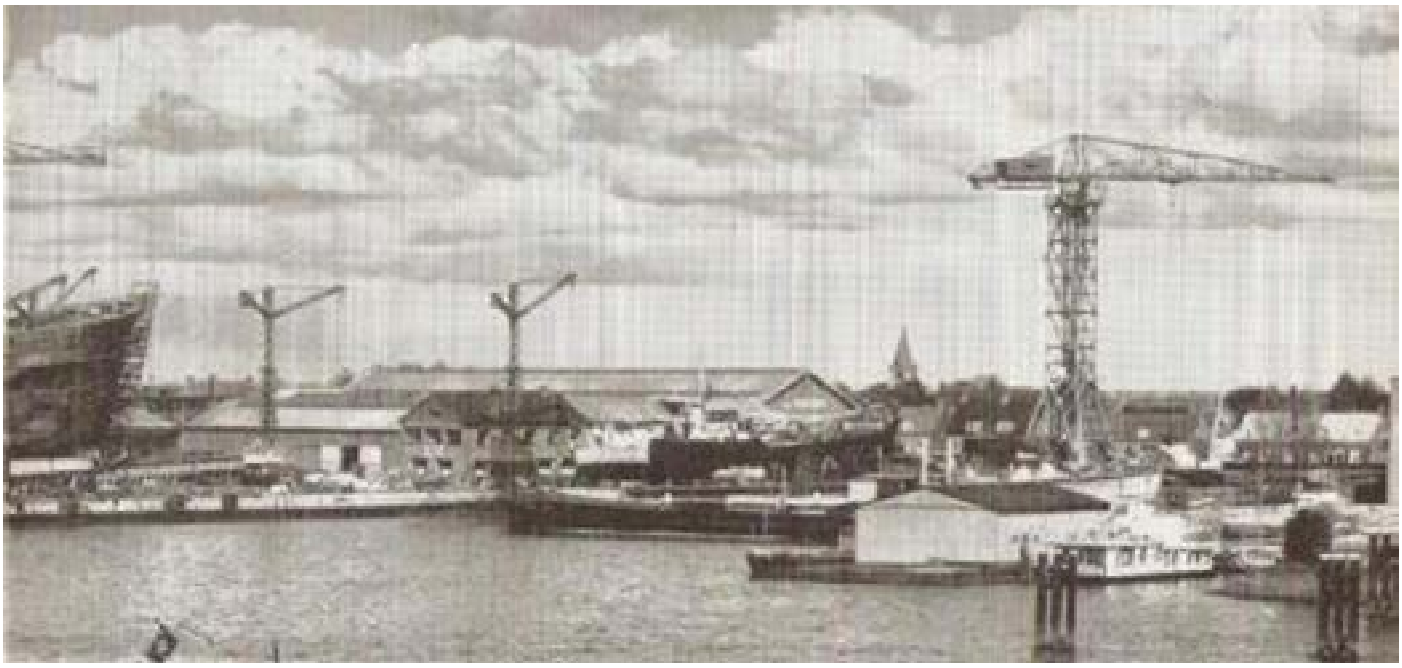

figure 9: The skyline of Alblasserdam halfway the 20th century (J. Kramer, n.d.)

Chapter 2
Historical strategies

The Waterdriehoek has a rich history of coping with the constant threat of flooding. Communities in the region developed innovative architectural and landscape strategies that not only protected them from high water but also shaped the cultural heritage of the area. These measures – ranging from dike construction to adaptive building designs – demonstrate deep knowledge of living with the threat of water.

Early measures

Since the earliest settlements in prehistoric times, the inhabitants of the Waterdriehoek focused on higher parts of the landscape, such as river dunes and levees. This was due to the rivers regularly overflowing their banks. The lower-lying basin grounds were used as meadows. As mentioned in the previous chapter, dikes continued to evolve during the 12th century, providing better protection to the hinterland. However, this necessitated the regular raising and strengthening of the dikes, which, in turn, led to more severe consequences when a dike breach occurred (Toebast, 2012).

In addition to large-scale interventions, smaller-scale measures were also taken. Living on 'terpen', artificial mounds, was another strategy. In use since the 5th century BCE, these provided elevated locations for homes, farms and churches (figure 10). This allowed space for water to spread without causing too much damage.

A similar approach was taken in the city of Dordrecht. Historical structures such as the Grote Kerk were strategically built on elevated and reinforced foundations to withstand the wet and unstable soil of the area (Hoogwater en Wateroverlast, n.d.). As early as the 12th century, people lived in this area around a smaller church. Another measure implemented after the St. Elisabeth's Flood was transforming the Voorstraat into a water-retaining dyke (figure 11). This dyke served a dual purpose as both a flood barrier and a central urban axis. Door thresholds, ground floors, and entrances were built higher than street level, which became a hallmark of Dordrecht's adaptive architecture. An example of this can be seen at the Korte Engelenburgkade, located close to the Oude Maas (figure 12). Lower-lying

figure 10: Churches on mounds in the Waterdriehoek, detail of the right outer panel of the Elisabeth Alterpiece with the flooding of the Grote Waard (Master of the Holy Elisabethspanels, ca. 1490)

houses used sandbags and barriers for protection. Additionally, features such as floodboards and water-resistant barriers were integrated into house facades (Hoogwater en Wateroverlast, n.d.). Several times a year, the water would rise into the quays, and the area outside the dikes would be flooded even more frequently. Dordrecht's residents learned to live with the threat of water.

Despite centuries of provisions against high water, very few architectural measures from before the 17th century remain due to the less durable building materials used at the time. Most surviving flood-related applications in the Waterdriehoek date from the 18th and 19th centuries (Toebast, 2012).

Rural innovations

In the Alblasserwaard polder of the Waterdriehoek, agricultural communities began developing methods in the early 18th century to protect themselves, their livestock and their crops from flooding. Flood barns safeguarded livestock and hay by being built on mounds, having elevated stables or combining both. These barns were permanently elevated above water levels and featured high-positioned manure hatches and stable and stable windows (Toebast, 2012).

Unlike in central parts of the Netherlands, in the Waterdriehoek only the foundations were made of stone, while the walls were constructed from wood due to the weak peat soil (figure 13). This weak soil also complicated the expansion of mounds, especially as livestock numbers grew. A new solution was developed: livestock and hay were placed in the attic of the farmhouse itself. During floods, people and animals moved to these 'water attics'. In residential houses, water attics or water rooms were also common. Often, there was a high external door allowing access to a boat during high water (figure 14) (Toebast, 2012). By the late 19th century, attic spaces in houses and farms were improved with cupboards, beds and stoves, enabling prolonged stays.

In addition to safeguarding people and livestock, buildings themselves were protected as much as possible. One method was wrapping buildings in reeds or planks or placing barriers between trees. The standard use of wood, due to the peat soil, had another advantage: some planks could be removed to allow water to flow inside, reducing pressure on the façade (Toebast, 2012). Eventually, brick facades replaced wooden ones due to their durability and better resistance to water.

Landscape adaptation

In the 16th century, engineer Andries Vierlingh published a philosophy on land reclamation and dike construction. Vierlingh emphasised that giving rivers space was more important than fighting water – what he referred to as working 'not with brute force but with a gentle hand' (Meyer & Nijhuis, 2014). He warned against reckless land reclamation and overconfidence in controlling nature. This philosophy inspired the modern 'Room for the River' program and illustrates how historical practices can inform contemporary water management.

An example of flood management inspired by the past is the case of the Noordwaard polder in the Biesbosch. Due to land reinforcements in the 20th century, many historical elements had disappeared. The new design (figure 15) restored old waterways to their original locations, reviving patterns. The reintroduction of the ancient ditch system not only reduced flood risk but also enhanced the ecological and cultural qualities of the landscape. Additionally, the centuries-old terp dwelling strategy was reintroduced. The design also incorporated innovative dykes, such as wave-resistant structures and planted weeping willow forests to break waves (Hein, 2020). This holistic approach balances safety, nature conservation and cultural heritage while reviving historical water management techniques.

Conclusion

The water management heritage of the Waterdriehoek offers valuable lessons for today's challenges posed by climate change and rising water levels. By acknowledging flood risks, we create opportunities to consider ways to reduce the potential consequences of flooding. Floods themselves also leave a cultural legacy in the form of landscape and architectural adaptations. Traditional practices such as terp dwellings, building protection, dyke raising and creating space for water highlight the importance of historical knowledge. The long history and innovative character of water management in the Waterdriehoek can inspire adaptive designs for the future that are both resilient and culturally valuable.

figure 11: The Voorstraat protecting the hinterland of Dordrecht (J. van Deventer, 1550. Edited by my own)

figure 12: Houses at the Korte Engelenburgkade are built to flood only at the basements (Reizen langs rivieren, n.d.)

figure 13: Example of a barn with a stone foundation and wooden walls (Rijksdienst voor het Cultureel Erfgoed, 1976. Edited by my own)

figure 14: Barn in Alblasserdam with a highered flooddoor (VVV Alblasserwaard, n.d. Edited by my own)

figure 15: 'Ontpoldering' of the Noordwaard project (West8, 2015)

Chapter 3
Learning from the past

As concluded in the previous chapter, much can be learned from historical measures against the threat of flooding. Adapting maritime heritage to flooding challenges, as well as addressing the newly built environment, requires strategies that combine these historical lessons with modern protective measures. This approach can yield strategies that promise flood resilience while safeguarding the historical and ecological value of the Waterdriehoek landscape.

Flood-resilient strategies and measures

Flood-resilient architecture in maritime heritage areas must strike a balance between structural integrity, cultural value and environmental sustainability. In terms of flood safety, integrating multi-layer safety principles (*meerlaagsveiligheid*) is crucial (Pötz & STOWA, 2014):

- **Prevention**: Strengthening primary defences, such as dykes, to mitigate the most probable threats.

- **Spatial adaptation**: Designing buildings and landscapes to reduce vulnerability, such as elevated structures or neighbourhoods with storage capabilities.

- **Disaster management**: Establishing clear evacuation routes and resilient infrastructure to provide escape options during floods.

Two main strategies emphasise this balance and multi-layered approach: robust planning under uncertainty on a larger scale and adaptive measures at building and neighbourhood levels (van Veelen, 2016).

Robust planning under uncertainty

Due to the uncertainties of climate change and water dynamics, robust planning is essential for developing long-term flood protection. This involves keeping options open and avoiding irreversible decisions. Conditional planning strategies, implemented step-by-step, are highly effective for adapting to changing flood risks (Van Veelen, 2016). At smaller scales, the most effective approach

figure 16: This building resists the highwater in Dordrecht (R. Boon, 2012)

shifts from rigid, norm-based policies to performance-oriented strategies that respond to local needs and vulnerabilities. This requires customised solutions based on thorough risk assessments and community-focused approaches, differing by area. Such approaches not only strengthen flood resilience but also create opportunities for added value and better integration into urban environments (Van Veelen, 2016). This is particularly important in areas like the Waterdriehoek, where the threat of water is significant, but the historical and ecological values are perhaps even greater.

Flood resilient measures: streetscape level

1. **Flood-resilient building techniques:** Buildings in the Waterdriehoek require adaptations that protect against water while preserving historical integrity. Measures include:

- **Elevated construction**: Raising buildings on mounds, platforms, or stilts, as historically seen in this delta region. Ground floors can also be designed for storage or parking.

- **Raised floor levels or thresholds:** Reintroducing elevated thresholds offers protection against moderate water levels up to several centimeters.

- **Water-resistant materials (dry-proofing):** Using durable materials such as concrete, brick, steel, glass, and water-resistant insulation to limit structural damage and accelerate recovery (figure 16). Structural elements must withstand water pressure (Pötz & STOWA, 2014).

- **Sealable openings**: Incorporating floodboards, barriers, and closable shafts. This is particularly applicable in areas prone to moderate flooding (0.1–1 meter of water) with a relatively high probability (up to 1/50–1/100 annually) (Van Veelen, 2016). However, fully sealing buildings is rarely cost-effective and often unsuitable in urban heritage locations (Pötz & STOWA, 2014).

2. **Neighbourhood-level resilience :** At the community scale, measures include both small- and large-scale interventions:

- **Integrated water storage**: Parks, sports fields, and other open spaces can serve as flood retention basins, as demonstrated in the "Room for the River" program (Meyer & Nijhuis, 2014).

- **Street-level measures**: Elevated sidewalks can prevent water intrusion into homes during limited flooding. Hollow streets can increase water retention and drainage capacity, directing water elsewhere (Pötz & STOWA, 2014). This strategy has already been implemented in th Waterdriehoek in the past (figure 17).

3. **Floating buildings:** For areas with frequent flooding, floating buildings are an option. These structures are anchored but can rise and fall with the water level, requiring attention to stability and flexible utility connections. An example is the floating homes in Maasbommel (figure 18). However, high costs due to specialised infrastructure make this solution less practical (Pötz & STOWA, 2014).

4. **Dynamic and temporary water barriers:** Temporary defences, such as panels and inflatable tubes, can protect entire neighbourhoods while preserving the urban structure, a long-established method. (figure 19). However, they are costly and add no aesthetic value to the city. These solutions offer robust short-term protection (Pötz & STOWA, 2014).

Learning from the past

An example of combining historical and modern strategies is the initiative "The River as a Tidal Park" in the Rotterdam port area. Chapter 2 already highlighted the importance of working with, rather than against, water. This principle is applied today in the "Room for the River" program. This project in Rotterdam demonstrates how dynamic landscapes can be reintroduced to provide ecological benefits, flood mitigation, and recreational opportunities (Hein, 2020). Transforming steep, hard embankments into green wetlands not only strengthens water defences but also restores historical character. Reintroducing dynamic delta elements, such as wetlands and floodplains, should be an essential part of cultural and historical policy, even in urban areas.

Conclusion

Applying these strategies to maritime heritage requires careful consideration of both physical and cultural constraints. While measures like raised platforms and flood barriers offer technical solutions, they must be designed to harmonise with the historical character of the environment. Similarly, restoring natural elements, such as wetlands and tidal zones, enhances resilience while reinforcing the ecological and cultural identity of maritime landscapes. Designing flood-resilient architecture and landscapes in maritime heritage contexts requires a nuanced approach that blends historical preservation with modern resilience strategies. By leveraging adaptive measures, learning from historical practices, and employing robust planning frameworks, it is possible to safeguard these valuable areas against the increasing threats of climate change. Ultimately, successful implementation depends on interdisciplinary collaboration and a commitment to preserving both the cultural and ecological integrity of maritime heritage sites .

figure 17: Water drainage on the streetsurface, already implemented in the so called 'stoepen' in Sliedrecht (left).
(Left: Historische Vereniging Sliedrecht, 1962. Edited by my own. Right: Pötz & STOWA, 2014)

figure 18: Floating houses in Maasbommel (Climatescan, n.d.)

figure 19: Flood-resilient panels being tested in Dordrecht in 1955 and 2021. (Left: Regionaal Archief Dordrecht, 1955. Right: D. Koorevaar, 2021)

Conclusion

Final findings

This paper sought to answer the main question —*How can insights from the historical landscape and architectural strategies in the Waterdriehoek inform the design of flood-resilient buildings in the maritime heritage context of this delta?*— through three sub-questions. In addressing these questions, it became evident that designing flood-resilient buildings in the Waterdriehoek, within the context of maritime heritage, requires an integrated approach that acknowledges both historical and contemporary challenges. The delta's transformations and adaptive strategies developed over time provide valuable knowledge, inspiring designs that are both resilient and respectful of cultural and ecological integrity.

The Waterdriehoek's evolving landscape reflects continuous human-water interaction. Communities have historically adapted to water threats, turning challenges into opportunities. Large-scale floods emphasised proactive water management, leading to landscape changes like the formation of the Biesbosch, and innovations such as land reclamation and water-retaining urban structures like Dordrecht's Voorstraat. These adaptations highlight architecture and infrastructure's crucial role in risk reduction.

From elevated structures to adaptive urban architecture, historical solutions offer valuable lessons for modern design. Combining past strategies, such as making space for rivers and restoring wetlands, with innovations like floating structures and temporary water barriers, helps balance safety, sustainability, and heritage conservation. The principle of multi-layer safety provides a structured approach to enhancing resilience at different levels.

Robust planning under uncertainty is also essential. Keeping options open and avoiding rigid decisions allows communities to adapt flexibly. Local solutions tailored to the specific areas enhance resilience while contributing to the spatial and cultural value of the region.

In summary, by integrating historical knowledge with contemporary design principles, the Waterdriehoek can serve as an example of flood-resilient design within the context of maritime heritage and historical settings. Succes depends on interdisciplinary collaboration and a shared commitment to preserving its cultural and ecological integrity. Only through this integrated vision, the Waterdriehoek can continue its legacy as a source of inspiration for sustainable development.

Design specific conclusion

Not all regions within the Waterdriehoek can adopt the same strategy, nor can the Watertorenterrein in Sliedrecht. Due to its small scale and isolated position, the focus here should primarily be on small-scale landscape interventions and architectural adjustments. One advantage of the site is its minimal existing development, allowing for landscape-oriented measures. Fully elevating the floodplain is not an option due to the existing structures and the character of the floodplain, which must be preserved as much as possible. Its original function can be partially restored by allowing space for the river during high water. This can be achieved by reintroducing the Gantel, an old waterway around the floodplain, simultaneously bringing a piece of history back.

The site could also incorporate green strips with water retention features and as many soft, green embankments as possible. For residential construction, it is important to consider how these homes can be made water resilient. Allowing space for the river—in the past frequently used—could provide a solution. By avoiding essential functions on the ground floor, water can flow through the space if necessary. Thresholds or water-resistant doors can prevent flooding during minor water level rises. Historical techniques, such as a stone base for the house with a lightweight structure on top, could be reintroduced. Slightly elevating main roads ensures that evacuation routes remain available when needed. Roads can also include small interventions, such as channels to divert water to green strips with retention features.

By limiting hard surfaces in the floodplain, the site can reclaim some of its original function. New technologies, such as floating homes, could also be partially applied, provided they do not obstruct the flow of the Merwede. The key for this area, as with others, lies in coordinated interventions across the site. Flexibility for future measures must also be prioritised. Only through close collaboration and a shared vision can the Watertorenterrein be adapted while respecting its historical and ecological context.

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Appendix A

High value Regular value Low value

	age value	historical value	art value	commemorative value	use value	newness value	rarity value	nostalgic value
surrounding				Watertower is an industrial landmark for Sliedrecht	Location close to Sliedrecht city centre and unique location next to the river		Big empty outer-dike area	Locals see watertower from distance which remembers them of the past
story		Watertower and shipyard marks innovation in water related management		Watertower terrain tells the story of the maritime background of Sliedrecht	Showing the typical history of Sliedrecht			Shipyard remembers locals of flourishing times of Sliedrecht
site	Gantel water on the site Trees	Strong historical relation with the river that slowly disappears		Terrain is an iconic place for Sliedrecht	A lot of green and close access to the water		Lot of open space	Gantel was used as a recreative and functional water for the inhabitants
structure	The structure of Delta is rusted and damaged in some areas				Structure of watertower tells about the former use of the tower			
space plan					Large open space plan in Delta Shipyard available for re-use			
skin	The facades and roofs of both of the buildings are in big decay or demolished. Lot of rust and vegetation		Characteristic blue color on facades and iconic doors Characteristic brick pattern in Watertower facades	Decayed walls reminds of the shift in maritime industry and water management	Big doors are iconic and can be re-used		Very old watertower that is still standing	
service	Old crane rails are still there, rusted and overgrown with vegetation				Slope with rails tells about the maritime use of the Delta building			
stuff								
social				Working atmosphere on Delta Shipyard wharf and close relation with water				

Heritage Value Matrix of the Watertower terrain. Own image, 2024