Mainstreaming approach: using urban dynamics for climate proofing

Pilot: Wielwijk Climate Proof

DRAFT - REPORT

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June 2012

MARE

The Interreg IVB North Sea Region Programme

Investing in the future by working together for a sustainable and competitive region

Content

Keywords

- Adaptation Opportunity
- Tipping Point
- Mainstreaming Moment
- Urban Renewal Cycle
- Sewerage
- Minor Water system
- Mayor Water system
- Open Water system
- Uncertainty
- Robustness
- Resilience

Chapter 1 Introduction

This is a document produced by the Dutch MARE LAA Dordrecht, its content describes the trajectory 'Water in the City'. Two years of working and learning within the pilot area 'Wielwijk Dordrecht' has resulted in a better understanding of the consequences of climate change and heavy rainfall in urban area's. The adaptation tipping point method is tested and developed as a work method for climate proofing existing urban areas. The current urban water management is mainly focused on the prevention of water nuisance caused by heavy rainfall. This new method is aligned with the dynamics of the city and the uncertainties in climate change. The mainstreaming approach integrates 'adaptation opportunities' in the urban system with 'tipping points' in the water system. The method consists of three main steps:

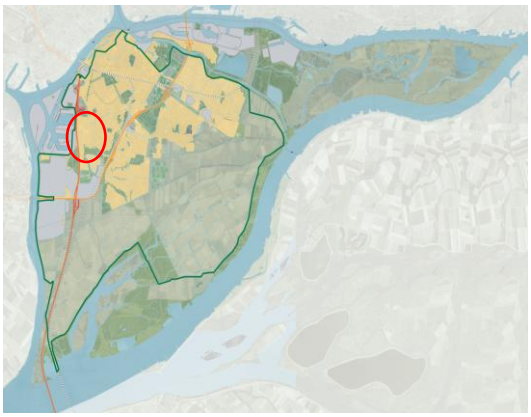
1. Analysis Adaptation opportunities
2. Analysis tipping points water system
3. Identify mainstreaming opportunities

The pilot 'Wielwijk Climate Proof' is used as a learning environment in which involved professionals learn to work with the combined approach of adaptation opportunities and tipping points: 'the mainstreaming approach'. This specific case is important for the development and improvement of this combined method and for practice-based lessons learned. It also helps to identify possible barriers for implementation in policy and to draw lessons for national policies. This method enables water managers when making a choice for measures to be taken for the water system and climate proofing it to combine this with other environmental measures in the same urban area. By doing so, the urban quality can be improved with smart combinations of measures while using budgets more efficiently. The economic crisis is an important driver for this process; adopting this new method can result into considerable cost reductions through smart urban planning and design.

1.1. Aims and objectives

1.2. Background

Wielwijk is a post-war neighbourhood, situated in the Western part of Dordrecht, in the polder 'Wieldrecht' (see figure 1.1). The district is largely established around the 1950's as an urban expansion to the South and is characterized by a strong urban design structure with one centre with all facilities and four densely populated neighbourhoods, separated by green areas. Four story flats/apartments and small houses are situated in an open allotment on green fields. Nowadays, the district is bordered by the highway A16 on the westside, the 'Laan der VN' in the North, the historic dyke 'the Zuidendijk' in the East and the 'Reeweg-Zuid' in the South.



Figuur 1.1 The location of Wielwijk in Dordrecht

1.3. The Mainstreaming Approach

Adaptation opportunities

It is most unlikely that decision makers in an urban environment adopt stand-alone measures for climate change, because of the large costs, inefficiency and because of political reasons. When climate adaptation measures are combined with other urban development's it is much more interesting. These are also called 'adaptation opportunities'. Specific adaptation opportunities like restructuring, large maintenance and other projects in the existing urban areas can be a driver for relatively cost-friendly climate adaptation. A method to identify this adaption opportunities in urban area's the urban dynamics is crucial for bringing climate adaptation in to practice. The MARE LAA Dordrecht used a method to 'identify urban renewal cycles' to identify adaptation opportunities. This method provides indications of the expected physical lifetime of all kind of structures in the urban environment.

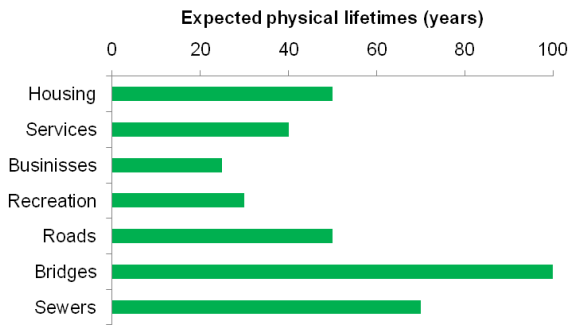


Figure 1.2 Expected physical lifetime of several urban object KNBL (Unesco IHE)

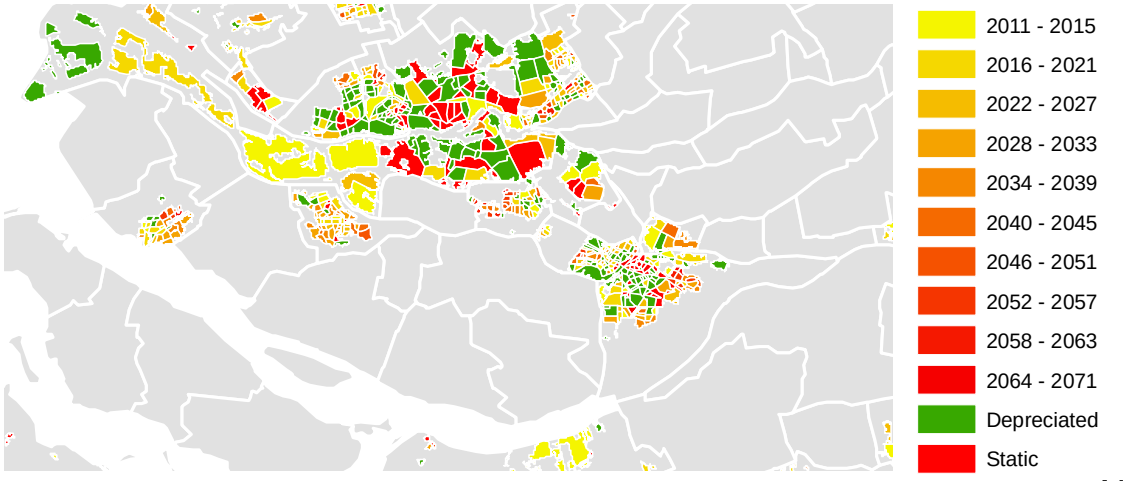


Figure 1.3 Natural adaptation opportunities in the region KNBL(UNESCO IHE)

Tipping points method

The tipping points method is an alternative method for assessment of the urban water system. It delivers a bandwidth between the earliest moment and the latest moment in time that (part of) the urban water system does not meet the norms (see table 1.1). This method provides much more information than the current (predictive) method, which only provides information about '*if* the system meets the norms' in a certain year in the future (2050). The tipping point method delivers this information too, but a great advantage it has compared to the current method is that the outcomes of the assessment of the water system can easily be adapted when new climate scenarios are available. Municipalities in the Netherlands have to deal with changing climate scenarios (KNMI cycle around 6 years). With the current 'predictive method' a new assessment based on the new climate scenarios is needed every 6 years and this is very time costly, expensive and inefficient. With some easy adjustments with the tipping points method, an assessment for a new scenario takes about 5 minutes (see figure 1.4).

Norm	Acceptabele standard	Source
Manhole flooding (lack of capacity minor drainage/sewerage)	2 years	Sewerage plan Municipality of Dordrecht
Prevention waternuisance with damage	50 years	RIONED Guideline, 2006
Prevention inundation from open water system	100 jaar	NWB, 2003
Prevention surface flooding by interaction mayor/minor system and open water system	2 jaar	Water Plan Dordrecht

Table 1.1 Norms from policy and regulations for flooding in urban areas

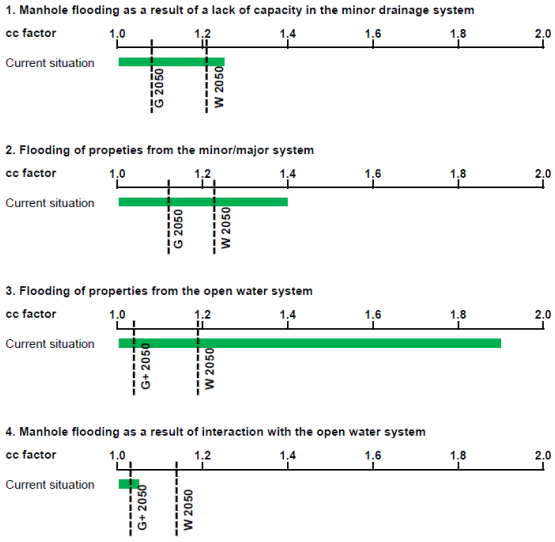


Figure 1.4 Tipping points in the current system with 2 climate scenario's G and W KNMI scenario's

Mainstreaming approach (tipping points and adaptation opportunities combined)

The mainstreaming approach integrates adaptation opportunities with tipping points in the water system. Moments of urban renewal are the drivers for climate adaptation and therefore gaining an understanding of urban renewal cycles is step 1 (see figure 1.5). Step 2 Indentifies the potential Adaptation Mainstreaming Moment (AMM's) in the urban area. Step 3 on the left side of the scheme compares AMM's with tipping point timings to test the effectiveness of adaptation mainstreaming. Step 4 on the left side is the last phase in which the renewal, or development in the urban area is modified in order to incorporate climate adaptation measures in the project.

Simultaneously steps 1 to 5 are assessed to identify the tipping points in the urban water system(s). The analyses are linked together several times. An important factor in this linkage is time. As mentioned earlier, the tipping point analysis results into a bandwidth, because of the uncertainty in climate change. It is important to identify this bandwidth as early as possible because it takes a lot of preparation time to incorporate climate adaptation measures in running projects. Besides that, stand-alone measures for climate adaptation without such a renewal moment are very expensive and would have fewer acceptances within society.

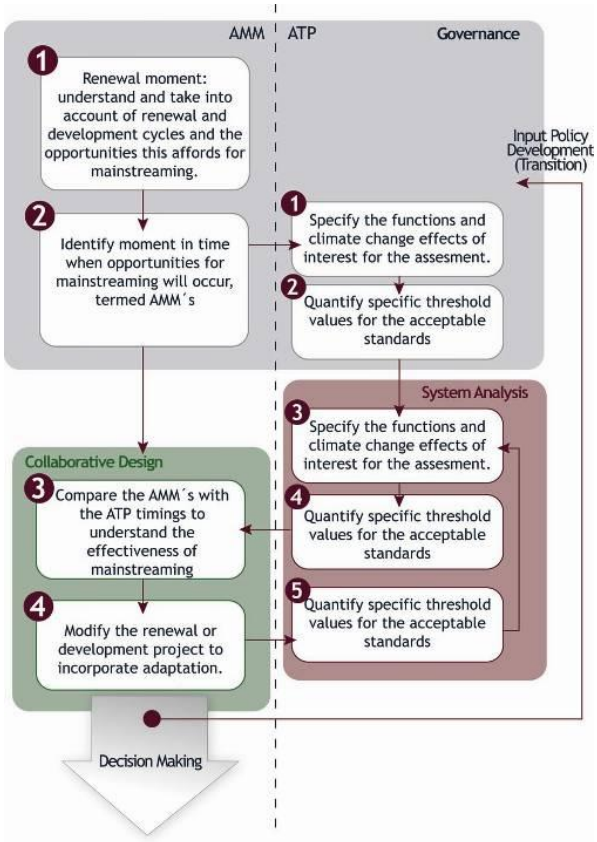


Figure 1.5 Combined approach adaptation opportunities and tipping points.

1.4. Timeline and flow diagram

Pilot Wielwijk Climate Proof

For the Dordrecht Learning and Action Alliance (LAA), 'Water in the City' is relatively new case study. Since 2009 the LAA members have been working on a method to deal with uncertainties in climate change in existing urban areas. Water in the City (MARE INTERREG) is a follow-up of the Urban Flood Management project that focused on flood risk management and urban development in unembanked areas. Since the end of 2008 the 'Living with Water' program has supported design sessions for the district Wielwijk. In October 2010 Wielwijk gained financial support from Deltaprogram 'Housing and Regeneration'. The full process is summarized in figure 1.6 and explained further below.

Learning & Action Alliance

By definition the Learning & Action Alliance (LAA) is a group of individuals or organisations with a shared interest in learning and developing a certain innovation (van Herk et al., 2011), in this case the mainstreaming approach, the use of it (in Wielwijk, Dordrecht) and upscaling it. The pilot is a demand driven learning process on the basis of a concrete case to support decision making on regional development and related policy processes. The LAA is organised around the following activities (van Herk et al., 2011), that together constitute an interactive process where the first three activities are executed in parallel and feed eachother, through which shared knowledge is generated:

- System Analysis (SA): includes a.o. the analysis of the tipping points of the different subsystems of the urban water system in Wielwijk. By combining these with adaptation opportunities, optimal 'mainstreaming moments' can be found.
- Collaborative Design (CD) of strategies: a joint design task. Firstly adaptation opportunities are being identified (e.g. a design task for a certain part of a city). If it is a mainstreaming moment, potential adaptation measures are searched for that also add to other climate and environmental aspects, which together are combined into strategies.
- Governance (GOV): focused on i.e. involving stakeholders, discussing their ambitions, addressing institutional, administrative, policy and legal issues, etc.
- Project Management (MGT): design and management of processes and project overall.

Interactive process

After the design session 'Wielwijk 2009' an interactive process of strategy development, system analyses and governance started. The process of 'Wielwijk Climate Proof' was a separate process, along with the official regeneration project of Wielwijk. The innovation regarding climate adaptation took place in 'Wielwijk Climate Proof', eventhough the regeneration project was the incentive to have Wielwijk as pilot area for the adaptation mainstreaming approach. In 2010 and 2011 two design workshops and one international review session took place, in which the tipping point method was explained and improved. At this session site specific measures where devised, which not only brought about a solution for the increased rainfall but also solved other problems in Wielwijk like environmental, climate and social problems. By involving professionals that were also involved in the actual regeneration, site-specific adaptation opportunities were identified. Existing environmental and livability analysis were used by the MARE LAA. The design process was continuously feeded with information about the water system, sewer system and their sustainability (System analyses was supportive for design process). Financial, institutional and policy related issues were also discussed during the Wielwijk sessions. Most governance issues were

defined and these are crucial in the implementation phase of the ‘mainstreaming approach’. The activities were coordinated and supported by the MARE project group that discussed the results during project meetings.

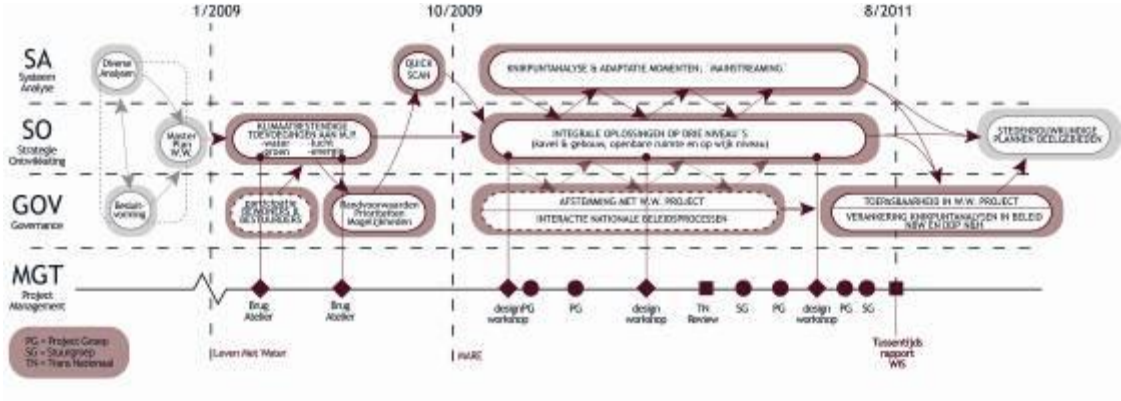


Figure 1.6 LAA actities over time

Chapter 2 Details – Case Wielwijk

This chapter contains a more detailed description of the case study 'Wielwijk' in Dordrecht. Some important background information about the water system, adaptation opportunities and the mainstreaming approach are explained here. The first paragraph describes the urban watersystem and sewer system. The second paragraph is about the problem definition and challenges faced. Paragraph 2.3 describes the options considered during the design process. Paragraph 2.4 explains more about the new 'Masterplan Wielwijk', which is positively influenced by the MARE LAA.

2.1. Analysis and assessment

Wielwijk has for the largest part been constructed in the years 1955-1956. Change of usage, physical deterioration and a lack of image have made investments in the district necessary. The area of Wielwijk has a combined watersystem, which is a combination of the sewerage system (minor system), the public space (mayor system) and the open water system. These systems have their own dynamics, but are also connected.

Sewerage: current state
The current sewerage system of Wielwijk is mixed (see figure 2.1). The tipping point analyses shows that the current system has quite some overcapacity, which makes its capacity very robust. Information about the capacity of the sewerage can be very important for choices on investments in sewerage and public space. The current robustness of the sewerage could be a reason for the municipality for postponing sewerage replacements and could also have substantial influence on design choices for public spaces.

Video inspection
Video inspection, on the other hand, shows that the technical state of the sewerage is very poor (see figure 2.2) and that the system needs to be replaced on the short term. The municipality of Dordrecht uses these video inspections for their maintenance programs, in which maintenance is planned a few years ahead. The tipping point analysis does not assess the current physical state of the system as it uses a sewerage model.

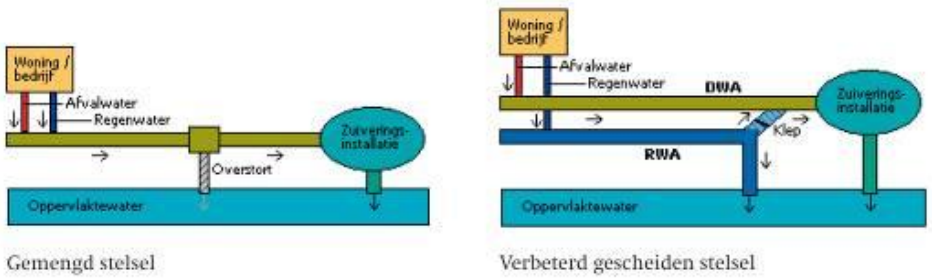


Figure 2.1 Principles of a mixed and seperated sewer system (Source: STOWA)

Figure 2.2 Picture of sewerage Wielwijk from a recent video inspection

(Source: Municipality of Dordrecht)

Open water system

The open water system is visualized in figure 2.3. The water flows form the North of the area to the South. Most of the water is situated at the ends of the area, the Wielwijkpark (South) and near the Zuidendijk (East). The waterways are very fragmented and for this reason that many culverts are placed. Affectively, the water quality becomes very poor. In the preferred situation (when the new Masterplan is adopted) the culverts should be replaced by an open waterway.

Figure 2.3 The water structure in Wielwijk; light blue is the current situation, dark blue will be further constructed in the Urban planning vision (2006)

Green structure

The 'Wielwijk Park' on the South of the area is the most important green zone of Wielwijk. Unfortunately, the accessibility of this park is not optimal and the park is not really integrated in the rest of the area. The larger green zones are situated on the ends of the urban area. The apartments and flats are also surrounded by smaller green zones.

Figure 2.4 The green zone structure in Wielwijk, darkgreen is the current situation, light green is will be further constructed in the Urban planning vision (2006)

2.2. Problem definition

This research by the MARE LAA Dordrecht has as a starting point not to wait with taking adaptation measures until it becomes necessary because of climate change, but to consider this when change of the respective system is possible, as during times of restructuring.

The restruction of Wielwijk is an opportunity to integrate resilience to climate change in the urban area. As mentioned, 'stand alone' measures for climate adaptation are too expensive and they are politically not well accepted. For Wielwijk mainly social, but also environmental problems have been the reasons for renewal. The research results from MAREs' 'Mainstreaming Approach' are intended as to enrich the current urban plans for Wielwijk. The current masterplan for Wielwijk should tackle multiple problems like, poor quality of the air (because of the nearby freeway), an isolated and poorly used park, the amount of traffic, unilateral building stock and a poorly functioning water system.

Already since the year 2000 has the municipality of Dordrecht worked on the renewel process of Wielwijk. In 2006 a future vision was defined, which is the fundament for the spatial and social-economic renewal of the district. This vision did not explicitly incorporate resilience to climate change and this has been identified as an opportunity by the MARE LAA to feed this process. Now, large investments in public space are planned like the replacement of the sewer system, the new public space and the real estate of the housing corporations. These investments can create an urban area that is ready for the future, and with the proper climate adaptation measures is also ready for climate change. The MARE LAA has a pro-active attitude towards these 'climate adaptation measures' by providing support for the design process and assessing the effects of measures on the water system. The design options are explained in the following paragraph.

2.3. Options considered

Retaining and storing water on the surface level

Many opportunities appeared in the renewal process of Wielwijk for storing and retaining surface level water. The design of buildings and streets has a potential role in storing water and which could alleviate the watersystem of Wielwijk at the time of heavy rainfall. This has provided some interesting street and building details. The following is a selection of promosing measures that have been created in the design sessions.

Rainwater is stored underground through permeable pavements in parking lots. This gives room as well to include more green space in the design because of the large number of parking facilities that need to be realised.

Source: ´Hosper Landschapsarchitectuur en Stedenbouw´

Filtration of the disconnected rainwater that falls on a new road is linked to the construction of nature-friendly banks.

Source: Rijnbout Architectuur, Stedenbouw en Landschap

A 'waterporch' that function as a big rain barrel and which can be used as a special residential in an urban area.

Source: Faro Architecten

A 'green gutter' with differences in elevation which enables temporarily storage of water. This measure can be integrated in the construction of new park zones in the centre of the district.

Source: Hosper Landschaps-architectuur en Stedenbouw

2.4. Selected options

New sewerage system
As mentioned in paragraph 2.1, the current state of the sewerage is very poor and replacement on the short term is necessary. With this replacement, the municipality of Dordrecht has the ambition to transform the sewerage into a new improved separated system. Polluted water can then be transported to the freshwater treatment plant, while clean water is transported to the open water system. Above ground measures are complementary to this system and will make it more robust. Finally, the system becomes more 'climate proof', because less rainwater is transported to the open water system.

Open water near the freeway
A new waterway will be placed right next to the Freeway (A16), which replaces the current culvert. It also improves the quality of the living for future citizens in that area, since the open water combined with trees and a sound barrier will reduce the traffic noise from the freeway.

Park in the centre of the area
The centre of Wielwijk is enriched with a stretched park through the hart of the area. This park can also be combined with water storage and retainment and is much better accessible than the current park.

Vision + climate adaptation measures = Vision 2.0
The results from the design meeting are translated into a vision for climate adaptation 'vision 2.0'. The climate adaptation measures are incorporated in the existing restructuring plans. With these new measures the tipping points for the water system are delayed until appr. 2080. The proposed measures stimulate the ecology in Wielwijk and hereby a new dimension to the urban planning is introduced. The ambition to improve Wielwijk as a green urban area is supported by these new measures. The climate adaptation measures will be included as much as possible during the further implementation and execution of the restructuring process.

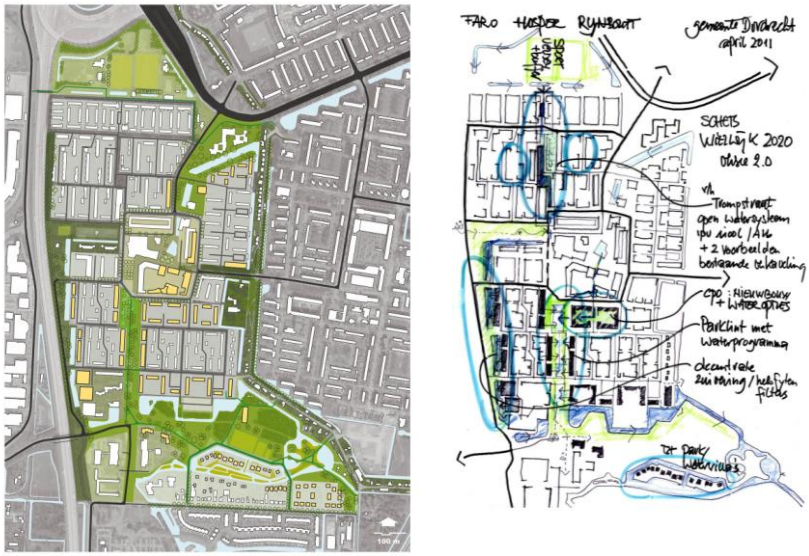


Figure 2.5: Regeneration Wielwijk 2006 (left) Vision 2.0 with potential climate adaptation measures(Right)

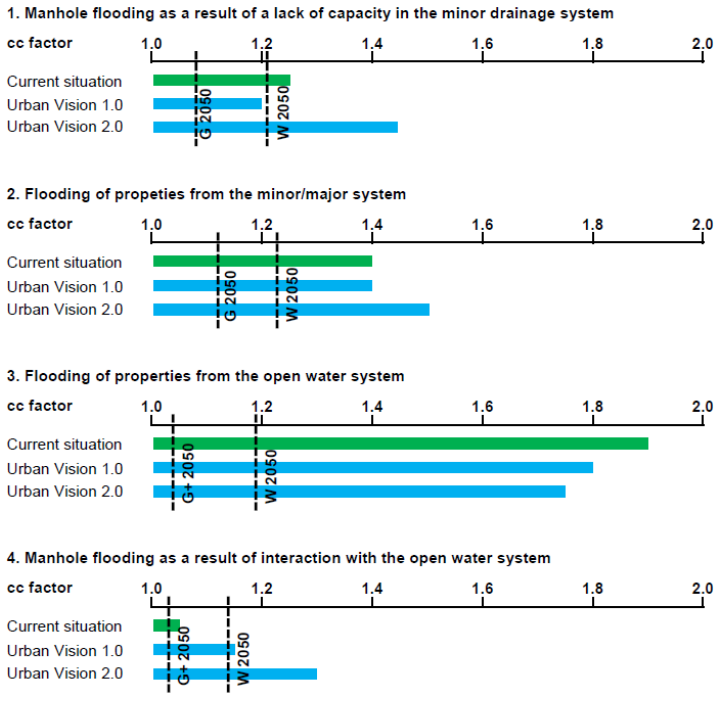
Implementation

The implementation of the final measures from vision 2.0 will be integrated in the executive phase of the project. The urban planners from Dordrecht will integrate the measures from the MARE design sessions in the eventual urban planning. This phase has not started yet and therefore it is important that the MARE LAA will continue to monitor and feed the regeneration process of Wielwijk.

2.5. Performance of selected options

The performance described in this paragraph is the performance in terms of 'deferring the tipping points in the water system'. Figure 2.6 in this paragraph shows a comparison of Vision 2.0 (climate adaptation measures included) with the current situation and Urban vision 1.0. It is clear that the urban vision 2.0 has a very positive influence on the different water systems.

1. In Vision 2.0 the norms for flooding of the minor drainage system (once every 2 years norm sewerage), will be exceeded with a climate change factor of 1.4. Both in the G (slow climate change) and the W (fast climate change) scenario the system meets the norms until far over the year 2050.
2. Flooding of the minor/mayor system means flooding of sewerage together with the storage capacity in the public space. Through Urban vision 2.0 the tipping point for this norm is also deferred, by adding storage capacity in the public space.
3. Flooding of properties from the open water system is already very robust in Wielwijk but the tipping point is brought forward a little bit with the urban vision 2.0. The norm for this event is once in 100 years.
4. The tipping point for manhole flooding as result of interaction with the open water system is deferred substantially. Compared to the current situation the system is able to meet the norms until far after the year 2050 even in the W scenario. The norm for this event is once in 2 years.



Chapter 3 Learning Points

3.1. Learning points for Wielwijk Case

Urban dynamics as driver for integrating climate adaptations measures

Within the current economic and political climate it is unlikely for cities to implement 'stand alone' measures for climate adaptation. Therefore, the integration of adaptation measures should always be part of 'mainstreaming' with other projects. At this moment regeneration and large maintenance projects do not always take climate uncertainties into account. The mainstreaming approach works with adaptation opportunities by using urban dynamics, and delivers the input for a climate proof city without dependency on changing scenario's.

Attention for a climate proof city

The degree of climate proofness is made explicit by the mainstreaming approach. The design session showed that climate related ambtions can be combined with other ambtions in the city. Waternuisance is a problem and the design session showed that a smart solution for this problem can also solve problems with airquality, heat stress, drought, energy supply and even social problems. In all cases the local possibilities are crucial for the selected options (measures) in that area. The mainstreaming approach is a supportive tool for this process.

Communication, decision making and better corporation

The mainstreaming approach is a dialogue supporting tool. It supports corporation on local level, by which local interests and knowledge feeds the process. By definition urban renewal supports various social, economical and fysical purposes that should be valued by different actors. The mainstreaming approach supports the communication about climate adaptation between decision makers. A discussion about the degree of 'climate resilience' is supported by this approach. Finally, this new approach is important in the transition from sector based- to integral water management in urban areas.

3.2. Difficulties encountered/expected

Scale level city compared to single urban area

The mainstreaming approach is now assessed on one mainstreaming moment 'the restructuring of Wielwijk'. The full potential of the approach is not clear yet. The approach should be assessed on city level with both an assessment of the water systems combined with the adaptation opportunities like urban development, control and maintenance planning.

Quantify financial potention of the mainstreaming approach

The decision-making regarding urban development and climate change is complex, especially the planning, effects of measures and the allocation of costs between actors. In concepts mainstreaming seems very cost effective. However there is uncertainty about the costs and benefits of climate adaptation measures, including the 'no regret' measures. City wide implementation of this method should be combined with a financial analysis to get a better understanding about the cost-benefit aspect. This would support decision making and increase the support for the method.
A discussion about what we are willing to pay for 'climate adaptation measures' should be held. Despite 'no regret measures' there are risks for measures that cost money. For example, over dimensioning of the system to increase the resilience or robustness, can lead to unnecessary investments. Furthermore, costs are not equally divided between actors when there is an exchange of budgets between open water, sewerage and public space. Municipality, Waterboard and development agencies have to negotiate about the process. These organisations all work with different planning horizons which makes it even more complex. Policy, guidelines or best practices of a 'process approach' are most wanted.

Finding the opportunities

Wielwijk has limited problems with the water system and large adaptation opportunities, because of the size of the investments. Other parts of the city have to deal with limited renewal planning and less budget. Lots of renewal planning is postponed at the moment and housing corporation are focused more on renovation and maintenance then replacement of the existing real estate. In some areas the private ownership is much larger, which makes it more difficult to have large regenerations. Identification of the proper tippling points and adaptation opportunities with underlying budgets is therefore very important.

3.3. Learning points work packages MARE

WP 1:The mainstreaming approach is an innovative example of a translation from an academic model (tipping points) to the daily urban dynamics of the city (practitioners). A Learning and Action Alliance is crucial to implement this method in the city. As described in the previous paragraph the actors at stake will be confronted with the exchange of measures between sewerage, open water and public space. The interaction in that process should be supported by a network, focused on practice based innovation.

WP 2: The pilot 'Water in the City' is all about meeting the norms. The mainstreaming approach enables practitioners to understand the performance of the current system and the performance of the system with climate change included. The practitioners from Dordrecht learned how 'meeting the norm' can be combined with lots of other urban problems. The measures for climate adaptation also add up to all kinds of other objectives in the city and these improve the daily urban quality of the city.

WP 3: The demonstration project 'Wielwijk' has led to potential climate adaptation measures for Wielwijk. The potential for climate adaptation within the regeneration program Wielwijk is improved by the MARE LAA.

WP 4: The mainstreaming approach helps cities to deal with the uncertainties of climate change. The current policy does not stimulate 'dealing with uncertainties' and the potential for this new method is discovered at the level of Wielwijk. The full potential of the approach will be clear by using the approach on city level. The representative organisations for seweragre (Rioned) and for Waterboards (STOWA) are already involved in the process to identify potential for policy changes.

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