Wageningen Waterscape

Urban water system adaptation to climate change

Landscape Architecture thesis
Yi Zhou (860206987120)
Tutor: Dr.Dipl.Ing.MA(AA) S. Lenzholzer
Programme: MSc Landscape Architecture and Planning
Date: Jan. 2012

Yi Zhou

 This publication is written as a final master thesis report Landscape Architecture by order of the chairgroup of Landscape Architecture at Wageningen University.

uyi_z@hotmail.com

WAGENINGEN UNIVERSITY
WAGENINGEN UR

Wageningen Waterscape

Urban water system adaptation to climate change

Thesis Report
Master of Landscape Architecture

Dr.Dipl.Ing.MA(AA) S. Lenzholzer(Supervisor)

Prof.Dr.Ir. A van den Brink (Examiner)

Ir. R. de Waal (Examiner)

Jan. 2012

Preface

This thesis report is the result of one year (from March 2011 to January 2012) of research and design on 'Urban water system adaptation to climate change'. In the past year, I have researched the impact of climate change on the Dutch landscapes. Consequently I searched for possible adaptation measures, especially in the urban context. As a pilot project, I studied intensively on the city of Wageningen, its cityscape, its water system, its problems and its opportunities. For waterscape in Wageningen Municipality, I worked towards hydrological resilient, spatially qualitative, and climate adaptation measures. A landscape-based design approach to climate adaptation has resulted in a methodology which forms an interesting basis for climate adaptation in Wageningen Municipality.

I would like thank in particular my supervisor Sanda Lenzholzer from the Wageningen University. From the beginning until the end, she has invested time and energy in guiding the process of my master thesis. Her enthusiasm, criticism, and professional knowledge has inspired and motivated me a lot and proven to be fruitful and finally resulted in a scientific research and design exercise.

Furthermore, I would like to thank Klaas Metselaar from Soil physics, Eco-hydrology and Groundwater Management Group for his patient teaching on hydrology knowledges. I am especially grateful to Sybrand Tjiallingii from TU Delft for the long discussion at his home about the existing models and their applications. And I need to thank Richard van Vliet, Water Man from Wageningen Municipality, several meeting with him make me have a deep understanding of the current situation of the water system in Wageningen. Many crucial data which support my thesis are also provided by him. Besides that, I would like to thank Bert Holtslag from Center for Water and Climate, Wageningen University, Dimitri van Dam from Waterschap Vallei &Eem, Goosen Hasse from Altrra, Sake vander Schaaf & Piet warmerdam from Hydrology and Quantitative Water Management Group for their useful information.

Last but not least, I would like to thank my colleague students Jie Cong, Shuangyu Han, Hao liu, Hao Hu, friend Zilong Yin and my mom and dad for their positive support, interesting discussions, and critical listening.

Abstract

Not long ago, a torrential rain which had flooded Beijing just in hours attracted people's attention again on the urban water issues. The unprecedented flooding revealed the problem on drainage capability and flood resistance of urban water system. However, as more deeply considered, it does not only call for more water storage in the urban area but also shows the weakness of the modern consumption oriented urban water system and the lack of a panoramic view on the urban water system planning.

This thesis is a research on water system resilience to climate change in Wageningen municipality as an pilot project and a research on waterscape adaptation plan for 2050. Wageningen is situated in the middle of the Netherlands between the Utrecht ridge and the Veluwe. The major part of water system exists under ground in the east part as it has high permeable sandy soil. While in the west part, it has low permeable peat and clay, so there's lots of surface water. River Rhine passes Wageningen to the north with little connection to the city water system as the water quality is not good enough. The main problem on Wageningen water system lies in weak water circulation, flood, pollution and drought in summer. According to the climate change scenarios (KNMI,2006), the existing problems will increase to some extent. Less precipitation in summer will increase water shortage while large amount of precipitation will increase the load on water storage and capacity and drainage ability, and in the mean time, leading to more sewage overflows.

This master thesis proposes a combined water model including Tjallingii's circulation model and infiltration model to solve the existing water problems in Wageningen and to improve the resilience of the water system to the future climate change. Designs of water system are highly integrated with landscape quality and urban development requirements. This integration is expected to make the water system socially, environmentally and culturally sustainability and constitute the future waterscape and function as Ecodevice in the region. By applying the "combined model" on Wageningen, a circulation is build inside the water system in the municipality, more water is stored in catchments and cleaned by natural wetland purification. The waterscape will achieve 100% water self-sufficient, water balance, flooding resistance and purification till 2050.

Index

Chapter 4 Site introduction and landscape analysis

Chapter 5 The "wateropgave" (the water storage requirement)

Chapter 6 Concept

Chapter 7 Alternatives

Chapter 8 Detail design

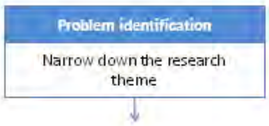
Chapter 9 Conclusion

Appendix

Chapter 1

Introduction

Index


Problem identification
Narrow down the research theme

1. 1 The conflict between urbanization and water management

Water is the earth's eye, looking into which the beholder measures the depth of his own nature.

Henry David Thoreau

1.1.1 Water efficiency

Water has played, plays and will play an important role in urban life.

Water is primary life-giving resource to the human beings. Its availability is an essential component in socioeconomic development. Actually, the whole life process requires the participation of water. Although 70% of the earth surface is covered by water, fresh water is still a scarce resource to human beings. According to Kirby (2000), the vast majority of world's water is too salty to use, that only 2.5% of the whole world's water is available for human consumption. Furthermore, 2/3 of the fresh water is locked in the icecaps and glaciers with only 0.08% of supply accessible.The Second United Nations World Water Development Report (UNESCO) has revealed that, if present level of consumption continue, two-thirds of the global population will live in areas of water stress by 2025.

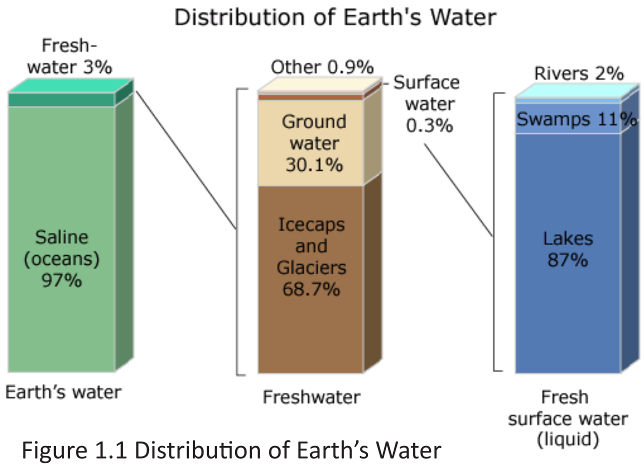


Figure 1.1 Distribution of Earth's Water
Source: US Geological Survey Earth's water distribution

Economic growth, environmental limits and increasing water demand

In fact, not only the water demand is increasing on a global scale, but also the quantity of available water is threatened. That originates from the human's great ambition of expanding in the past two hundred years which made the world changes dramatically with high industrialization and urbanization. The over development changes the patterns of water use, and leads to a higher share of total water use by industry. Cities are growing, and the weakness of the urban water system (such as pollution, high consumption, flood and low permeability) becomes even more obvious. Besides that, water supply and demand is very unbalanced due to the overpopulation: extensive industrialization results in high polluted water, high occupation of concrete constructions block the water from filtering into ground, separated water bodies slow the nature purifying process and even the UHI causes more water evaporation. All these factors make the urban system become vulnerable to hazards and hard to maintain the water system healthy. Therefore, the efficiency of water system can strongly affect urban life quality.

Growing need of water efficiency

According to Vickers (2001), water efficiency can be defined as:
1. The accomplishment of a function, task, process, or result with the minimal amount of water feasible;
2. An indicator of the relationship between the amount of water required for a particular purpose and the amount of water used or delivered.
Water efficiency focuses on reducing waste water rather than restricting use, according to Vickers, the purpose is to obtain the desired result or level of service with the least necessary water.

1.1.2 The omission of water in urban life

Water gradually disappear from the cityscape

Water is indispensable to human lives, however, it has been observed as a fading away feature in the urban cities. The water bodies, especially in big cities, gradually gave way to the urban expansion and industrial development. The water, has been "covered, polluted, over pumping, and gradually lost its existence in urban life and natural attraction" (Shannon 2010). Urbanization is inevitable, yet there is a strong desire to keep its landscape quality.

After De Meulder put forward clean urbanism that support "visual banishment of water", an engineering trick – out of sight and, consequently, out of mind. Sanitized, canalized, covered, cleaned, piped – hidden at 1997 (Shannon, 2008). Water loss its natural attraction. Water became absent from modern urbanism, especially in Unwin's observation, "water is reduced to a photograph of a ludicrous fountain". However, water has strong functions in the urban life like clean water source, the possibility of transport, water as a defense mechanism, a receptacle for storm water, etc. "This omission" (last more than 200 years) is quit strange that the water structure should be a keystone of the constructed urban area. (Shannon 2008)

However, in recent decades, this situation has been transformed – a cock tail of nostalgia and ecological concerns catapulted water back onto the scene of urbanism. The concreteness and tangibility of water, its natural form, dimension and character and deviation from the boring generic urban substance is what attracts the discipline. Recovering landscape architecture as the art of survival (Yu 2006), "all disciplines involved in the development of urban territories need solutions to shift their focus towards integrated, landscape-based solutions to the seemingly independent challenges of water and infrastructure provision, environmental and social improvement and creation of site-specific identities". Rather than trying to eliminate ecological processes and investing huge sums of money to replace them within controlled technical system, we need an "intellectual leap by comprehensively applying the understanding of ecological processes and natural system to human settlements and planning" (Mossop 2006)

The role of water in urban life

Then, what should be the proper role of water in urban life? How can water contribute to sustainable qualities of urban areas? According to Tjallingii(2008), "The motors of the urban economy, industry and commerce and increasingly also agriculture are highly dependant on transportation infrastructure", that water seems to be less important to urban life. As mentioned before, water has been hidden in urbanization process. It seems that people can live happily without the visual water bodies inside the city. However, apart from the economy aspect, "in the same way water networks or green-blue networks support the qualities of the quiet side: nature and biodiversity, sports and recreation" Tjallingii(2008). Obviously, the role of water can't be ignored as the quality of city life becomes a more demanded issue in recent years. The challenge to designers and planers is to integrate ecological aspects of water flows in plans for social and economic development of cities. Tjallingii has described the water role as "not something extra at the end of the planning process, but one of the backbones of urban development."

1. 2 Water cycle and urban water management effects

Hydrological cycle

The water we use in daily life comes mostly from the ground water and fresh water in lakes. In nature, water cycle is quite balanced, however the overuse of the fresh water resource by the human beings causes the water can not go back to the water cycle in time, thus, natural recharge cannot fulfil the water needs according to the exploding population. The natural process of purifying water also takes time. The current situation is that, if we only rely on the nature, fresh water will finish quite soon, therefore, measures need to be taken to protect and save the finite water resource.

Water is vital to existence on our planet. Fortunately, it is a renewable resource that moves in a cycle with neither beginning nor end. Water vapour (evaporated from oceans, lakes, forests, fields, animals, and plants) condenses and returns to Earth as precipitation, once again replenishing reservoirs, lakes, rivers, and other sources of water and providing the moisture required by plants and animals .

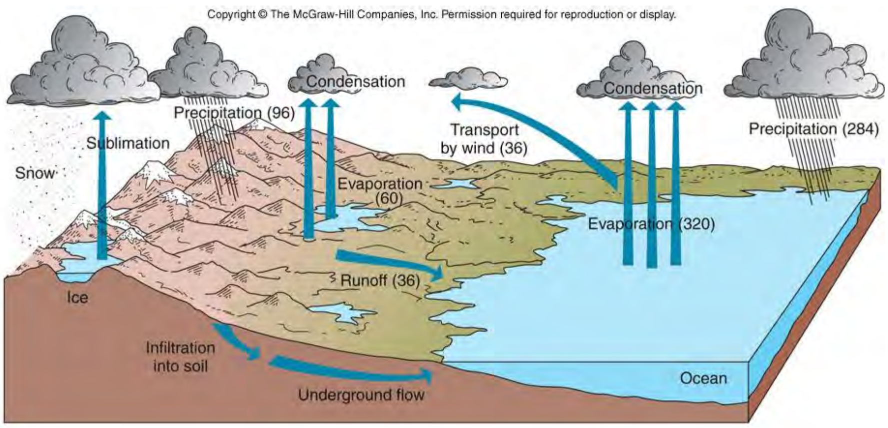


Figure 1.2 World's water cycle
Source: http://www.ocean.washington.edu/courses/envir202/Water_lecture_2.html

Figure 1.2 shows the water cycle in a natural process. It can be found that the runoff, infiltration and transport by wind process are hard to control while the percentage of the precipitation is quite huge in the whole water cycle which is comparably easier for people to collect and manage. However, this part of water has been ignored in the past. Rainwater just float into the drainage system, leaching into bare soil, and then back to the rivers. But nowadays, as the water shortage problem become more and more severe, people are staring to consider about collecting and making use of this special water coming from heaven.

Precipitation is water released from clouds in the form of rain, freezing rain, sleet, snow, or hail. It is the primary connection in the water cycle that delivers of atmospheric water to the Earth. Most precipitation falls as rain. Very characteristic is that the rain water is comparable clean and unevenly distributed between seasons. Other than just lead them into sewers, it has great opportunity to reuse them in the urban environment.

The ignored and wasted water usually happens in daily life use, irrigation, on the process of transportation and underutilized water (reusable water). Since we have so much rainfall, why not take advantages for solving the water shortage problem? Water resource is so limited that it's significant to save every drop of the water not only for the people of water-lack area but also for the future of ourselves.

Water management effects

Urban water management has largely changed natural water cycle. What always happens first is that urbanization brings water supply and disposal systems which are prerequisites for urban developments to natural hydrological cycle (Hough,1989).

Rodney (2006) concluded the following impacts which urbanization ¬¬has imposed on the natural water cycle:

1) It increases the importance of direct runoff relative to infiltration, and hence increases the risk of flood.

2) More water is abstracted for human use, as incomes increase and the population becomes more urban.

3) If abstraction exceeds aquifer recharge then the land may experience subsidence.

4) A variety of contaminants, both pathogenic and toxic, are introduced to the water.

5) These impacts combine to reduce the variety and abundance of aquatic fauna and flora.

Urban water management transform

There are ways to manage urban water. The built city looking for water and the climate change also ask for larger containers. The polar caps continue to melt, sea level will increase further and the soil subsidence remains, all these phenomenon call for urgent actions. It posts an increased political pressure on water issue with higher dikes, pumps stronger and bigger sewers, but clearly expensive. Nature is tamed by human force to some extent, but also quite costly. We are not sure if there is one day that human can not afford. The Deltaplan already show problems, higher river dikes actually leads to bigger problems downstream, stronger pumps cause the land drops. In the long run, taming the nature by human force is not the best choice since it goes against the natural process.

Over the past twenty years, thoughts about water reached a turning point from using human force to "tame" the nature to finding new strategies for integrated and sustainable water management. The ecological approach will not controlling or taming of nature in front but working with natural processes.

1.3 Climate change

While human activities have greatly shaped the appearance of the earth surface, the climate changes also have strong effects on all the livings on the earth.

1.3.1 Climate scenarios

The climate of the Netherlands will change a lot in the following 50 years. The KNMI's 06 scenario is based on the global temperature rise as well as changes in the air circulation pattern. According to it, several conclusions are drawn to characterize the future climate change.

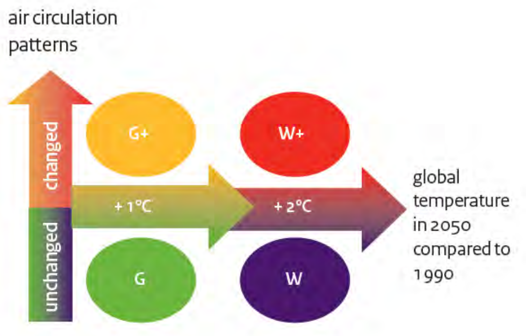


Figure 1.3 Climate scenarios
Source: KNMI

-Temperature will continue to rise. Mild winters and hot summers will become more common;

- On average, winters will become wetter and extreme precipitation amounts will increase;

- The intensity of extreme rain showers in summer will increase, however the number of rainy days in summer will decrease;

- The calculated change in wind is small compared to the natural fluctuations;

- The sea level will continue to rise.

1.3.2 Climate change impacts

Most important global climate models (GCMs) has calculated a global temperature rise combined with the greenhouse effect. The warming of the earth initiates the unexpected fast melting of sea ice at the North Pole, this can lead to changes in evaporation, sea level and precipitation. On the other hand, 'the warming is not equal on every location on earth. The Poles warm stronger than the tropics, and the continents generally warm stronger than the oceans. As a result, the atmospheric circulation patterns on earth could also change.'(Klein Tank and Lenderink, 2009)

The climate can be described in terms of the temperature at the earth's surface, the strength of the winds and ocean currents and the presence of clouds and precipitation, and has relationships with many aspects of the earth like sea level, snow cover and the biosphere. Climate can be described as weather averaged over a large geographical area and often over a long time-period, but information about events that deviate from the average ('extreme events') is also important. (EEA report,2009)

Impacts of climate change on global scale

The climate system evolves with time as a result of many factors as solar radiation activity, meteor crashes, volcanic eruptions etc. Firstly, the energy balance which means the amount of energy that the earth receives from the sun in the form of radiation. The absorbed solar radiation heats the earth and gases like water vapour, carbon dioxide(CO_2), methane(CH_4), nitrous oxide (N_2O) and others absorb this radiation partly which keep the heat in the system. These are called greenhouse gases which have increased significantly as an effect of human activities since 1850 and now far surpass pre-industrial values (Solomon et al., 2008). This increase in greenhouse gases during the industrial period has resulted in an increase in the average global temperature. Human activities make more greenhouse gases stored in the atmosphere that causes the greenhouse-effect.

More and earlier impacts of climate change have been observed in the world and understanding of these impacts has increased. Changes in biological and physical systems have also been observed in Europe, 89 % and 94 % of which, respectively, are consistent with those expected as a result of warming (IPCC, 2007b). The change in atmospheric composition and the resulting climate change have a cascade of impacts with many linkages as figure 1.4 shows.

Global climate change impacts

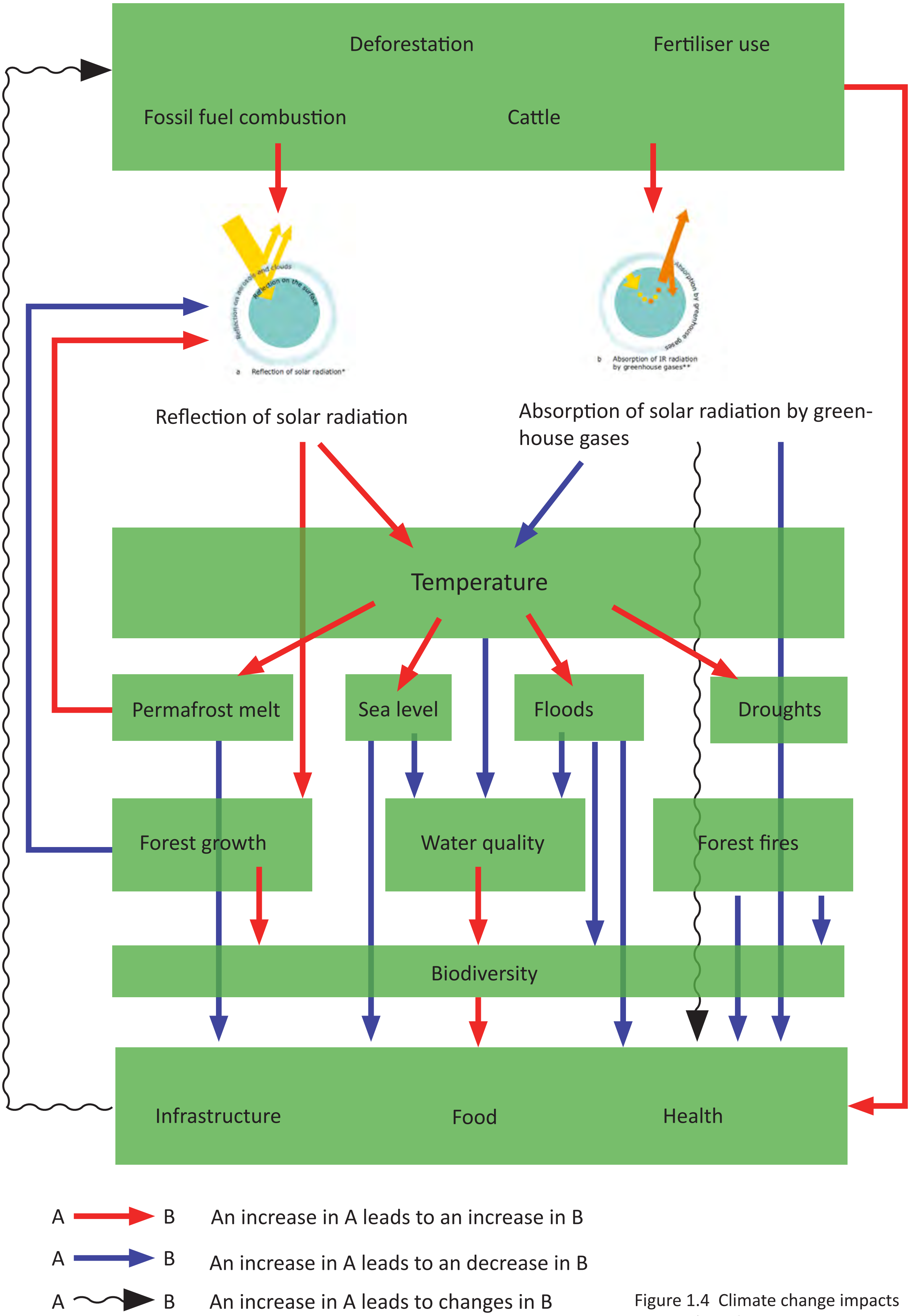


Figure 1.4 Climate change impacts
Source: based on EEA Report

Impacts of climate change on water system

For the water system, the dramatic change in precipitation will directly affect the local water system. "In all scenarios, the average precipitation amounts on extremely wet summer days increase due to the occurrence of heavier rain showers (largest increase in the W scenario). In winter the relative increase of the extreme 10-day precipitation amounts is approximately the same as the increase of the average precipitation amount, for all 4 scenarios."(KNMI'06 scenarios)

The sea level rise calls for extra measures in river deltas and low-lying areas, and increased extreme peak discharge in rivers can cause problems both upstream as well as downstream. Further¬more, extreme precipitation calls for better storage and discharge capacities on land, while extreme drought is related to the shortages of water. (Hajer and Loeber, 2007) In addition to that, large parts of the Netherlands are already subsiding due to peat oxidation and the settlement of clay, and this will become worse during extreme droughts, due to water shortages and high temperatures (high rate of peat oxidation).

Recent decades have seen notable changes in global and European climate. The changing climate bring new challenges and opportunities to Wageningen. Sea levels and temperatures are rising, precipitation is changing, and the intensity and frequency of weather extremes in many regions is increasing. All these change will have great effect on human life and the environment at a global scale, and subsequently largely change the local water system.

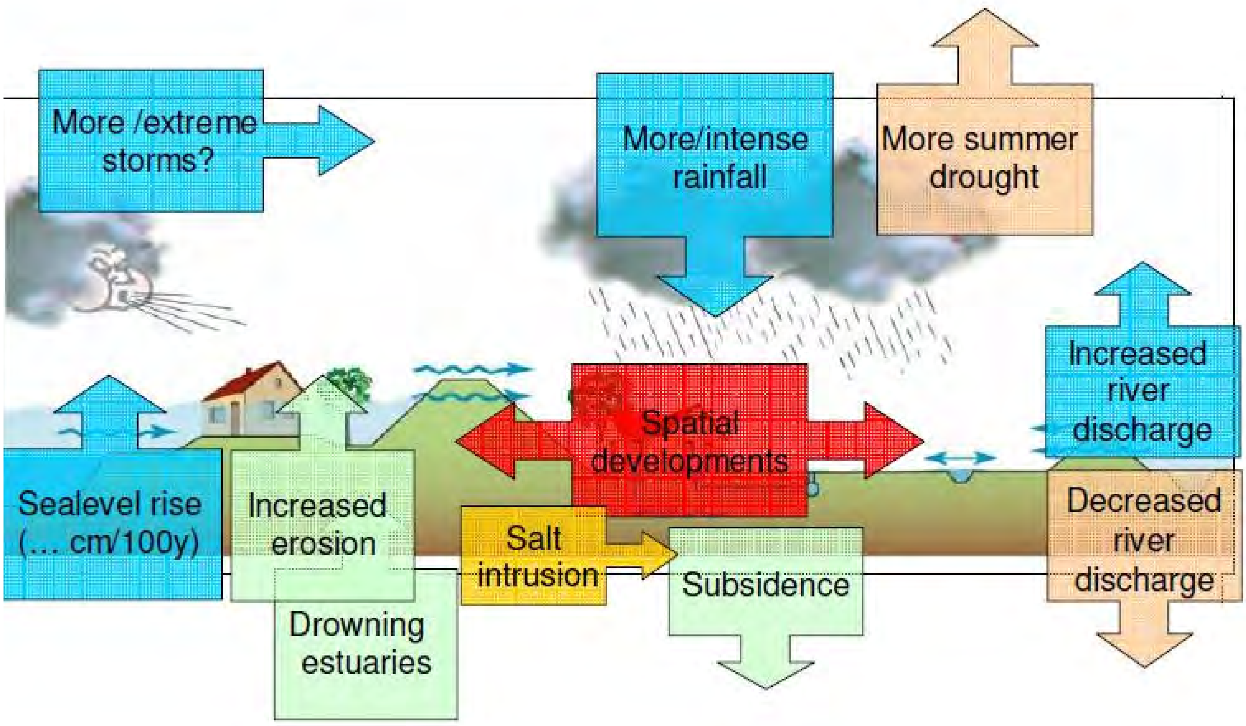


Figure 1.5 Climate change bring new challenges
Source: Wageningen Municipality Report

1.3 The Study area: Wageningen in the Gelderland Valley

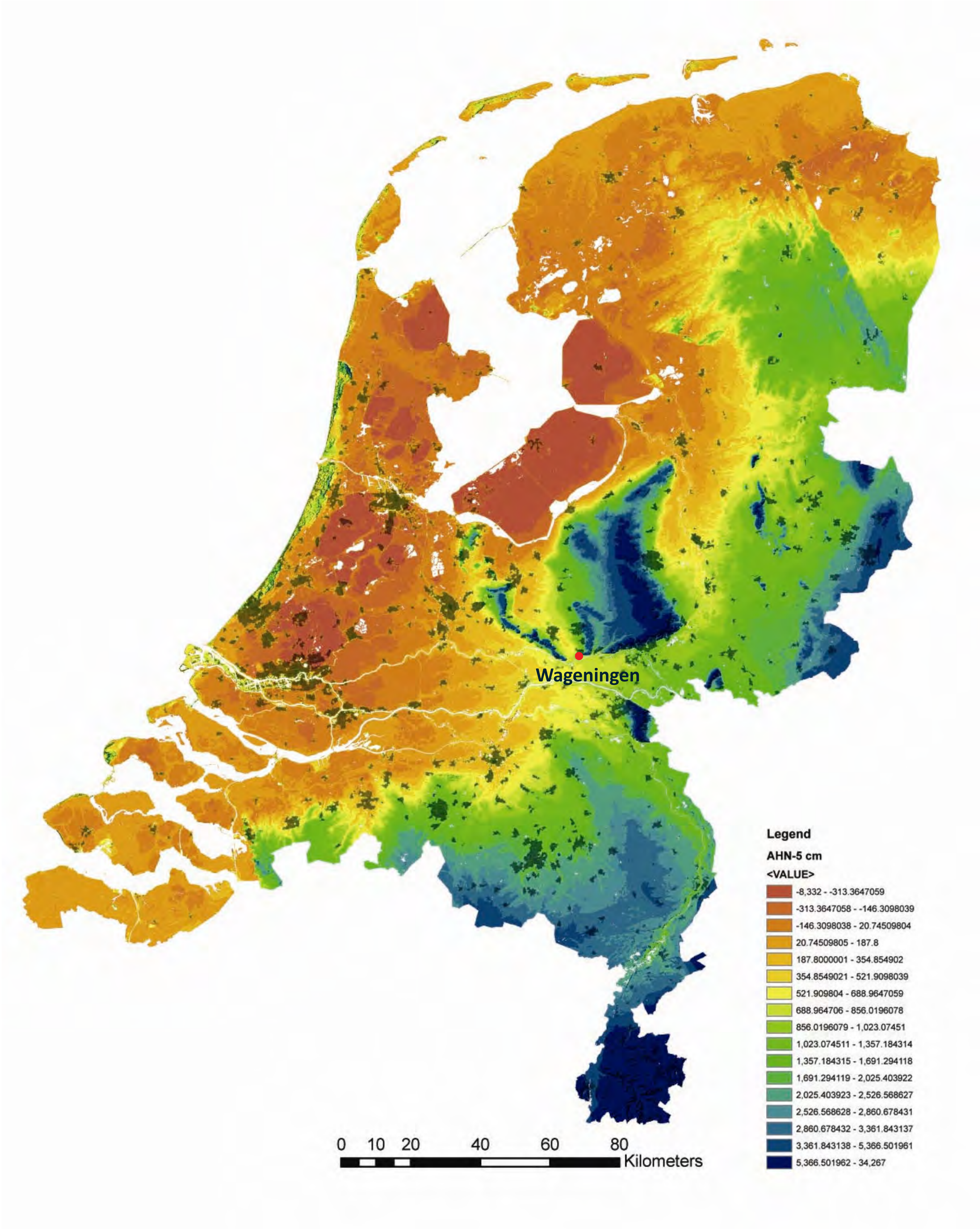


Fig1.6 Actual Height Map Netherlands (AHN)
Source: GIS Data

People in the Netherlands already notice the importance of the role of water in the urban life and the great effects of the climate change on landscape. This thesis will focus on the city of Wageningen in the Gelderland Valley.

The Gelderland Valley is situated at a remarkable transition zone between the Utrecht Ridge and the mountain Veluwe. This study is limited to the southern part where the pressure of urbanization is highest. Being protected by the mountains, this area offers excellent living conditions as an unique landscape comparing to rest parts of Netherlands.

The valley terrain makes the Gelderland valley a natural water reservoir. The Netherlands has abundant rainwater resource of 880mm/year with 500mm/year evaporation (Water in the Netherlands 2004-2005 and Riool in Cijfers 2005 – 2006). The heavy rain runs off to the bottom of the valley and causes flood there. However, with such abundant water resource, the city still suffers summer drought since there is no seasonal water storage now. Besides that, climate change effect is not included in the current water plan while it really changes the water balance a lot. More water retentions need to be identified to prepare for extreme rain storms inside the urban area and also helps to improve the landscape quality. In fact, there's a big chance to store and reuse the wasted water properly and transfer this invisible water resource into a beautiful waterscape in this area.

There are two different soil type inside Wageningen, the low permeable peat and clay in the northwest and high permeable sandy soil in the southeast. Water appearances are also different according to the soil type. In the sandy soil area, water infiltrate deeply into the ground. Therefore, there's seldom surface water there. While in the peat and clay region, water appears as surface water which forms a ditch network. Special strategy is required to deal with the different situation. It will be discussed in later chapters.

Chapter 2

Theory of water management solutions

Index


Problem identification
Narrow down the research theme
Hypothesis
Desired future

The design of the future waterscape in Wageningen is supported on several existing theories on urban water management. Firstly, the future water system should conform to the water policy of the Netherlands. Then, the “two lane strategy” guides the framework of the waterscape development while the “two guiding principles” provides inspiriting ideas on sustainable urban water management. Finally, the concrete water system model for Wageningen is guided by the “guiding models for urban water management”. All these applied theories will be explained separately in the flowing passages.

2.1 National water policy

-Retention
-Storing
-Removal

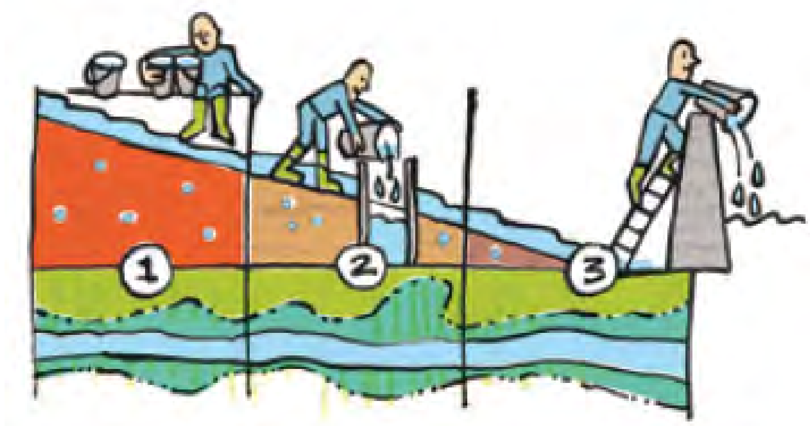


Fig 2.1 Water policy
Source: Wageningen Municipality

Climate change increases the threat of water. Furthermore, the values of protecting water have increased significantly in the last decades. The sustainable water safety policy of the Nederland focuses on ‘multi-layer safety’. It is a three-tier or ‘layer’ approach to water protection, the first layer of which is prevention (i.e. preventing flooding). This remains the cornerstone of water safety policy, even though it can never be ruled out completely. The second and third layers are therefore aimed at limiting the effects of flooding. The aim of the second layer is to create a sustainable spatial layout of the Netherlands and the third seeks to improve the organisational preparations for a potential flood (disaster mitigation).

The future water system should conform to the water policy of the Nederland.

This multi-layered approach to safety requires area-based public participation. Government is encouraging water managers associate with regional parties to establishing the role they are going to fulfill in disaster mitigation during an actual or impending flood. This thesis will work out a reasonable solution to the disaster mitigation plan by valuing different spaces inside the Wageningen region.

2.2 Two Lane Strategy

"Two Lane Strategy" guides the framework of the water-scape development

The role of the water system in urban development has given way to the urban expansion. However, in the recently years, water is proved to be a crucial criterion of sustainable development. The formation of guiding principle for city development touches the basic attitude of man towards nature. With the environmental issue become more and more important, the basic strategy of urban development is experiencing a transformation process from Economic Modernisation to Ecological Modernisation. This thesis takes the "Two Lane Strategy" from Tjallingii which puts the water system to an equal position to the urban infrastructure as the guide of developing framework of future Wageningen water system.

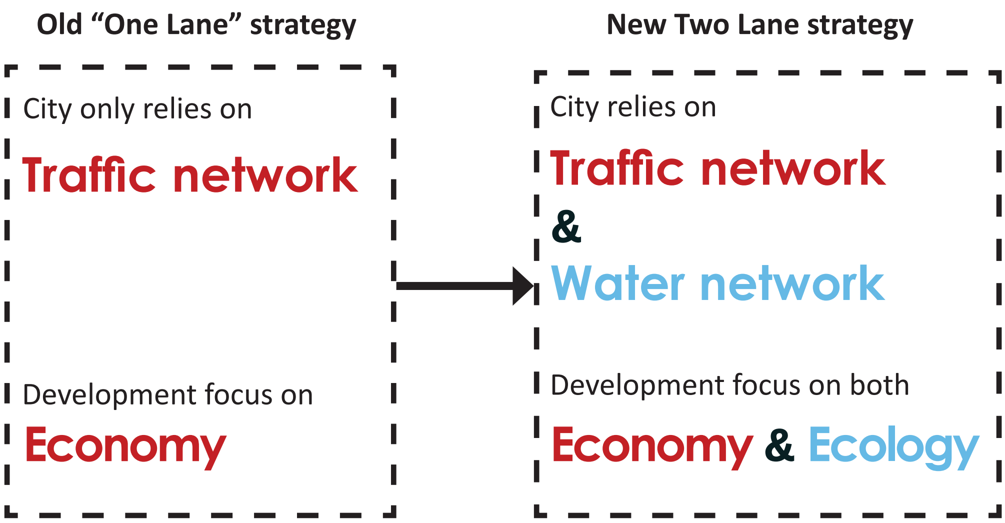


Fig 2.2 Urban developing strategy change
Source: made by author

"The Two Networks Strategy is a conceptual model that can guide planners and designers to create the spatial structure acting as a carrying condition for effective synergism between urban activities."(Tjallingii, 2006) This strategy takes the water and traffic networks as carriers of urban development. The traffic networks can be considered as the fast lane in the urban development which carries high dynamic economic activities, navigable rivers, high-speed traffic and rapid spatial change. On the other hand, the water network can be considered as the slow lane in the urban development which carries quiet recreation, wildlife, water retention, slow traffic and slow spatial change. Figure 2.3 shows how the water network and traffic network work together to support the urban social life. An urban space can be simply separated into four parts as the picture shows: nature+leisure, residential, industrial and agriculture space. Water network mainly exists on the nature + leisure part and then flow into the residential, industrial and agriculture part to receive and provide water. The traffic network mainly exists on residential and industry parts. And the connection with other parts relies on narrower secondary roads. The fast lane is highly related to the economical development and become a dominant framework in the urban area while the slow lane is usually be ignored or gave way to the high economy pressure. But nowadays, as eco-friendly thinking comes back to people's mind, planners and designers are now trying a more natural way to solve the problem that rapid urbanization causes. Currently, the Dutch water boards request that 10% of new developments should be available for surface water.

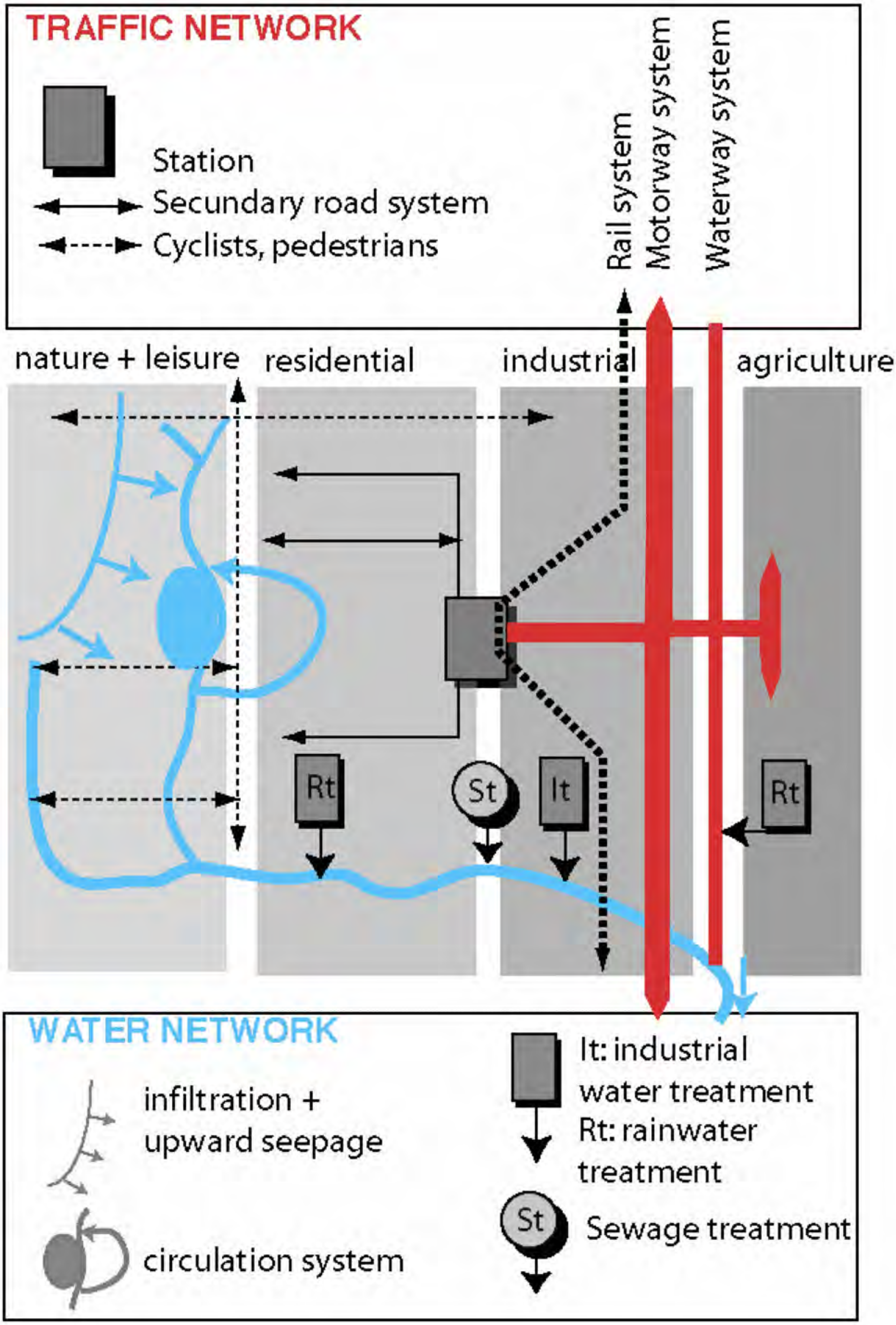


Fig 2.3 The Two Lane Strategy
Source: Tjallingii, 2006

2.3 Two guiding principles: Closing the cycle and cascading

"Two Guiding principles" provides inspiriting ideas on sustainable urban water management

With the "two lane strategy" giving a strategic guide on the structureal water system development, guiding principles are needed to direct the detail plan on urban water management. Ecologist Van Leeuwen (1981) has introduced the following model to analysis urban hydrological system. The model does not only consider the input and output but also cares about the system resistance and retention (on fig2.4 a) of the ecosystem. Since the design aims to create a sustainable and efficient water system, this model is suitable for the design site.

In graph a, the closed shape represents an urban water system. Two arrows shows the inflow and out flow. The concave and convex show water resistance and retention of the urban water system. Graph b lists some existing problems of urban water system: source problems, sink problems and internal problems. And in graph c, it gives out the strategy of "self reliant system" as the method to solve the existing problem. By taking the measures of less use of water, use rainwater, more storage, re-cycling of pollutants and pollution control, the water system will become more resilient. These five measures will also be the basic measures in this thesis design.

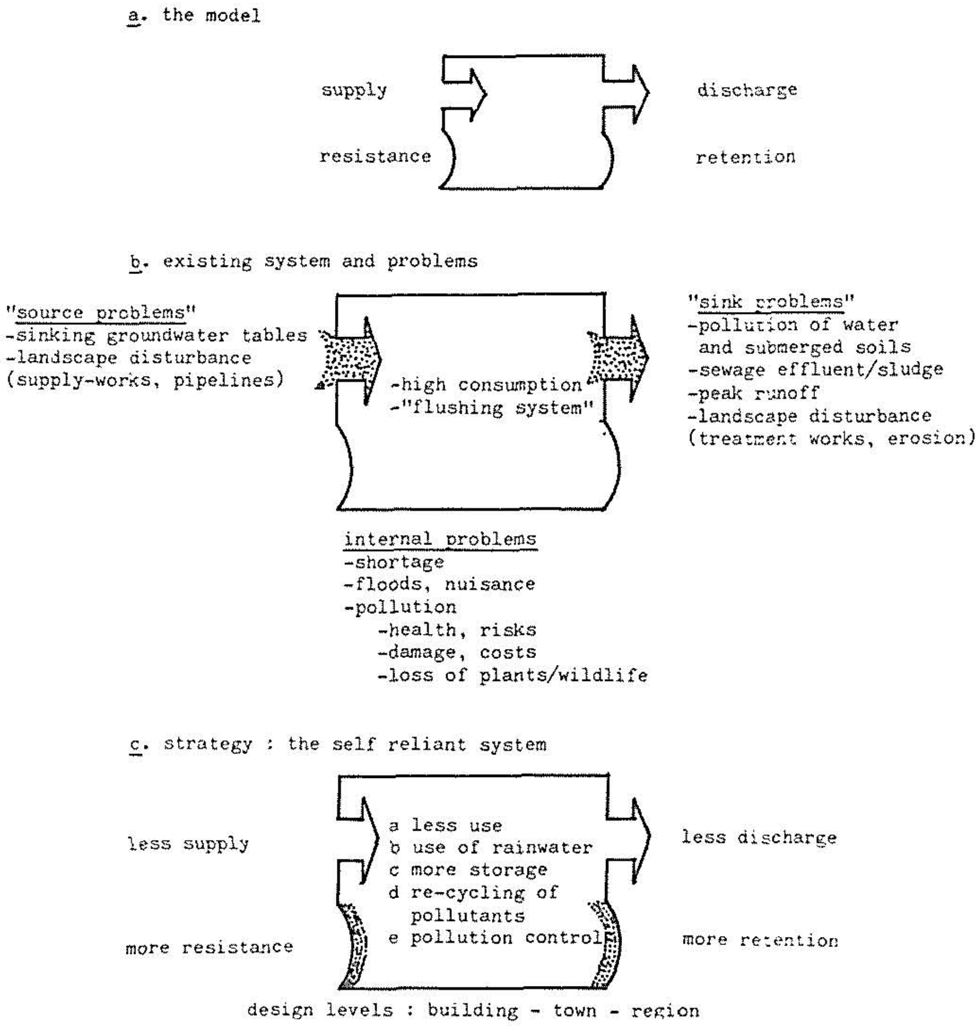
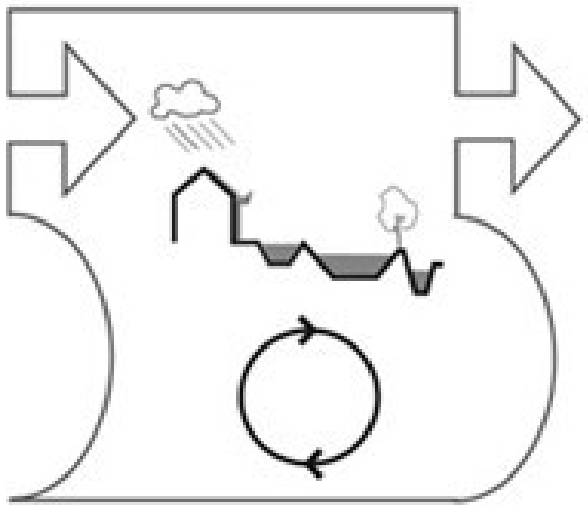


Fig 2.4 Water problems and their prevention, a general strategy for design
Source: Van Leeuwen 1981

The Wageningen water system situation is similar to this "existing system", it also has such problems like sinking ground water table, water pollution, water shortage, peak run off, sewage overflow, floods. This kind of water system can be characterised as a "flushing" system which highly depended on the adjacent systems according to the current policies of increasing supply and discharge in the Netherlands. Based on Leeuwen's model, Tjallingii proposed two guiding principles of "Cascading" and "Closing the cycle" to direct the sustainable management of urban water. Tjallingii call this scheme "ecodevice model". The life-support conditions are regulated by input and output flow control in this ecosystem. However, it can also regulate the essential flows by retention (represented by the convex side) or by resistance (shown by the concave side). The main idea of applying this model to Wageningen is that the city "can store a surplus of water for example, and use this storage to prevent shortage" (Tjallingii, 2008). Closing the cycle is a way of storing water and nutrients inside an ecosystem. The main idea of cascading is ''keeping water longer and clean".



Cascading and closing the circle

Fig 2.5 Two guiding principles: Cascading and Closing the circle
Source: Tjallingii 1998

2.4 Guiding models for urban water management

Concrete water system model for Wageningen is guided by the “guiding models for urban water management

Urban water system varies a lot mainly due to different soil type, topography, and so on. Therefore, different models are needed to suit different situations. Several different guiding models for urban water management has been put forward by Tjallingii (2007) to deal with different situations in different cities in Nederland. The guiding models are: deceleration model, circulation model, infiltration model, switching model.

Deceleration model

Circulation model

Switching model

Infiltration model

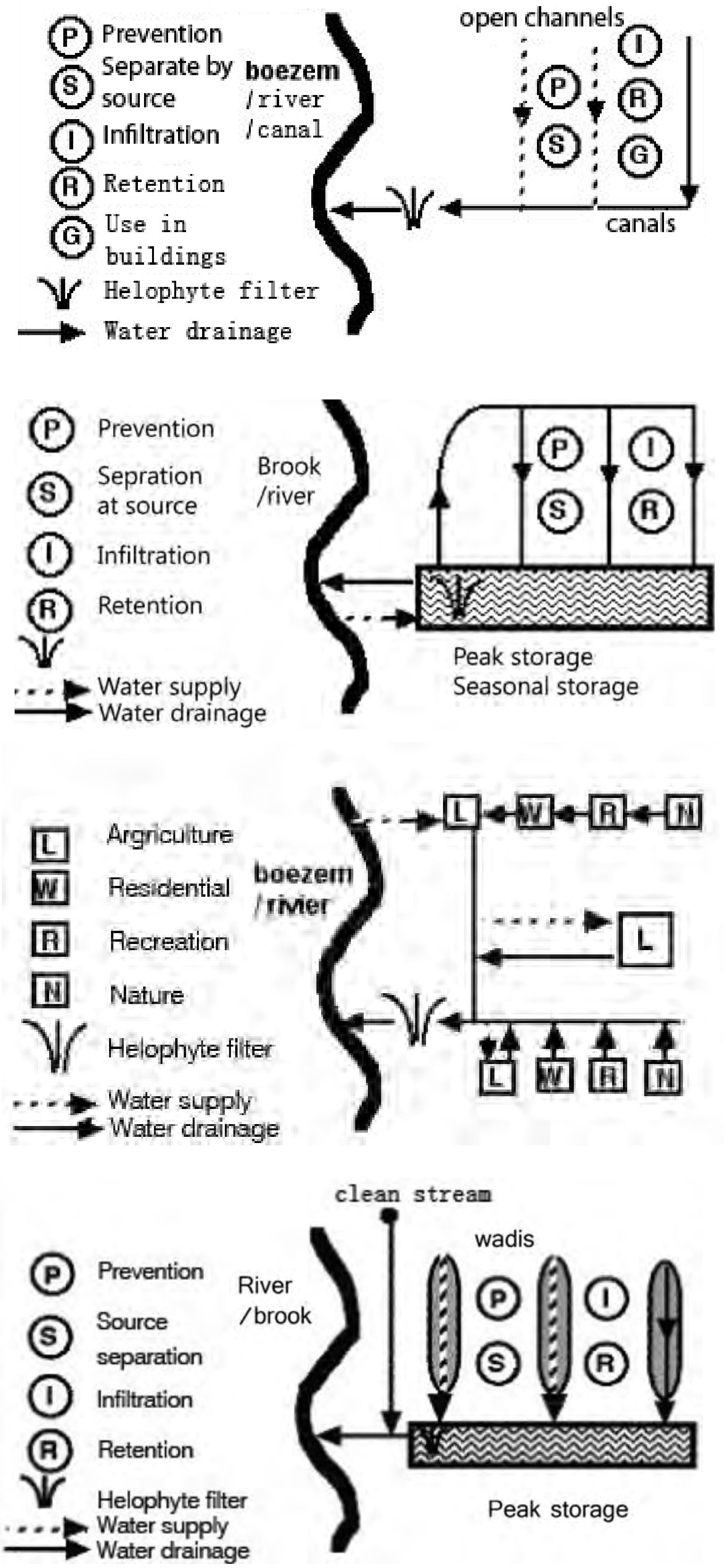


Fig 2.6 Guiding models for urban water management
Source: Tjallingii, 2007

2.4.1 Circulation model

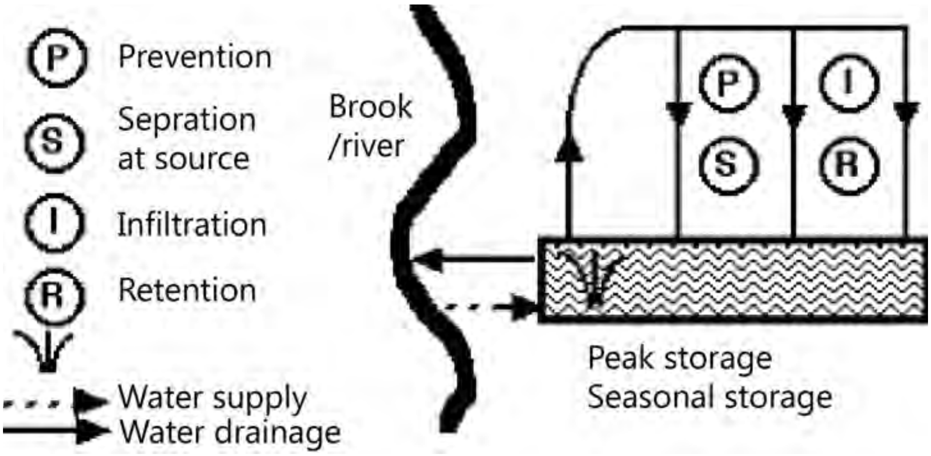


Fig 2.7 Circulation model
Source: Tjallingii, 2007

Circulation model suits the northwest part of Wageningen where the soil type is sandy soil

The circulation model is tailored to situations with limited infiltration and focuses on surface water retention. An own circulation of surface water system is introduced to the field. From the retention lake, water is pumped up and circulates through the canals of the built-up area back to the lake. The circulation pump is needed to keep water moving and supply water for dry period. Water quality is improved by keeping water moving to allo oxygen uptake and by the wetland. In the design of the system, water table fluctuations create sufficient retention capacity for the urban area to pass dry periods without an inlet of water from other areas. This prevents an input of polluting water. In existing urban districts with a combined sewer system the circulation model create conditions for disconnecting rainwater from the sewer system. Thus another source of surface water pollution can be removed. Retention lakes can be part of the city's park system or of recreation areas in the urban fringe and also create attractive views for new housing developments.

For Wageningen, this model fits western part which consists of low permeable peat and clay soil and has lots of surface water. But there's not much storage containers on the site. The purifying wetland is absent here too.

Infiltration model suits the southeast part of Wageningen where the soil type is peat and clay

2.4.2 Infiltration model

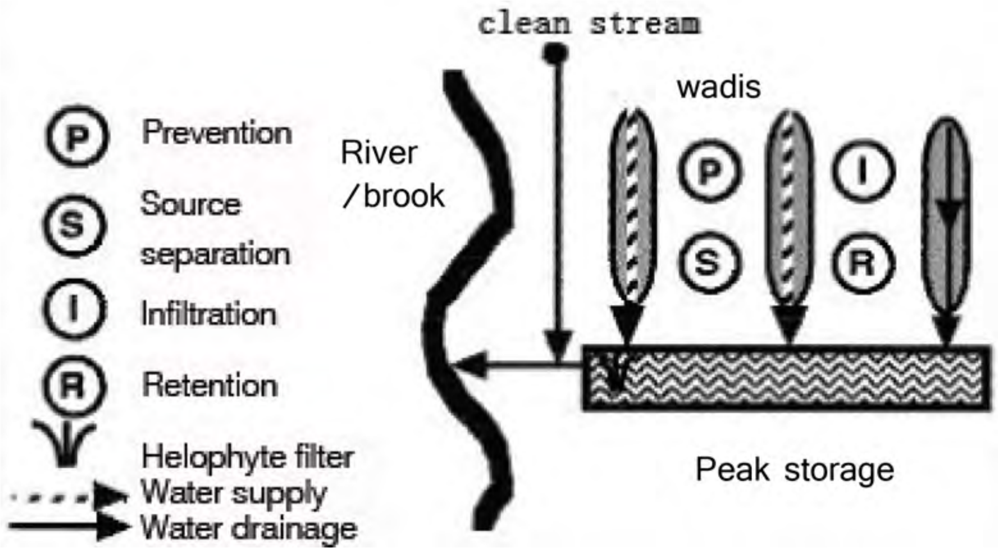


Fig 2.8 Infiltration model
Source: Tjallingii, 2007

The infiltration model is useful in situations of permeable soils. This model is usually applied in the sandy soils with low groundwater table to keep groundwater recharge. The increase in paved surface, drinking water and agricultural water levels caused a decrease of the groundwater levels. Infiltration ditches or swales can improve permeability. The rainwater infiltration ditches usually dry a few days after heavy rains. Therefore, it gives mosquitoes no chance to develop since the water is present only shortly. These wadis can be spatially integrated into green areas. The guide model also indicated a peak storage pond. The way to the river or stream passes through the runoff water from the district provides a constructed wetland for treatment. Networks of swales that only temporarily carry water can be designed as a green structure in districts.

This model is highly appropriate for the east part of Wageningen. The soil in the east part is high permeable sandy soil, and the hilly topography causes lot of run off. Currently there's no measurement has been take for the run off and some actions can be added to increasing the permeability.

2.5 Combined model in Wageningen

A combined model will be applied on Wageningen

The guiding models above show different water treatment strategies based on typical land types. In Wageningen, the situation is a kind of “mixed” of high sandy soil and lower peat and clay which needs applying more than one models to deal with it. The eastern part more suits the infiltration model and the western part suits the circulation model. Apart from the soil type, the low and flat topography in the western part also ask for a small modification of the circulation model.

The Wageningen model will be a combined model of circulation and infiltration model. A modified circulation model with wetland purification will be applied to the west part of Wageningen, while infiltration model will be applied to east part of Wageningen which infiltrates the water as much as possible and collects the runoff water at the hill foot. The two models are also connected and can supply each other with stored water. This thesis will make a further research through optional designs on the "combined model".

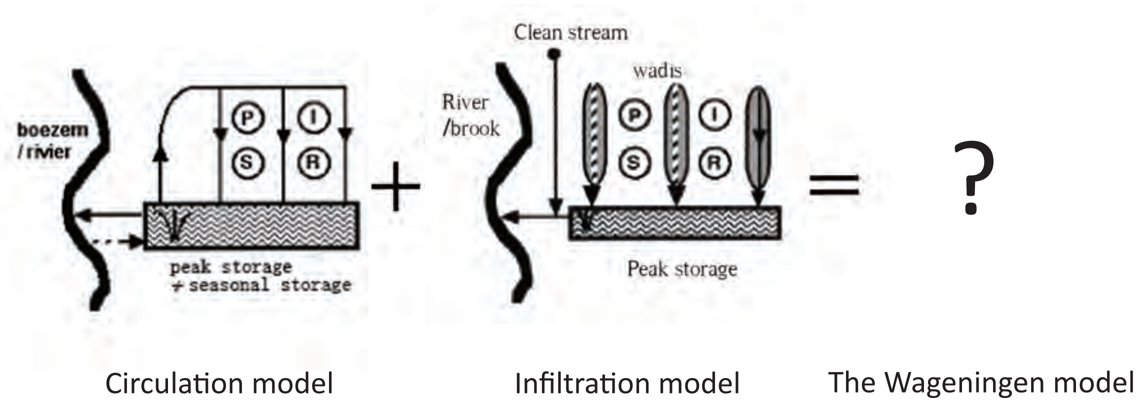
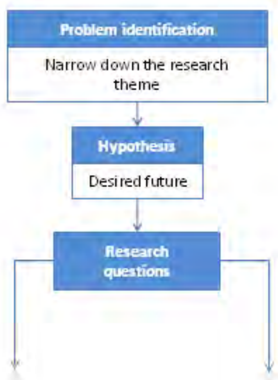


Figure 2.9   Combing two models in Wageningen
Source: made by author

Chapter 3

Problem definition and research structure

Index


Problem identification
Narrow down the research theme
Hypothesis
Desired future
Research questions

3.1 Problem definition

Wageningen is a former fortified Dutch city which locates in between the Gelderse Vallei and Mountain Veluwe. Large volumes of rainwater can be easily converged in this valley area. Eastern part of Wageningen is featured by high sandy soil which makes rainwater easily infiltrating into the ground. Consequently, this region has abundant groundwater storage. Ground water floats from high eastern part to the lower western part. In the western part, the soil is low permeable peat and clay and the ground water table here is close to the ground. Thus the land is quite wet and it sometimes causes flood on surface in rain storms. Current inventory leads to problems on water system:

Water challenges in Wageningen

1. The current water system in Wageningen can be described as a "flushing system". Inflow from upstream enter the system and directly flow out side. No water storage and circle made the system highly depended on adjacent water system: when it is dry, it needs more water inflow from upstream, and when extreme rainstorm happen, it adds heavy drainage load on downstream.

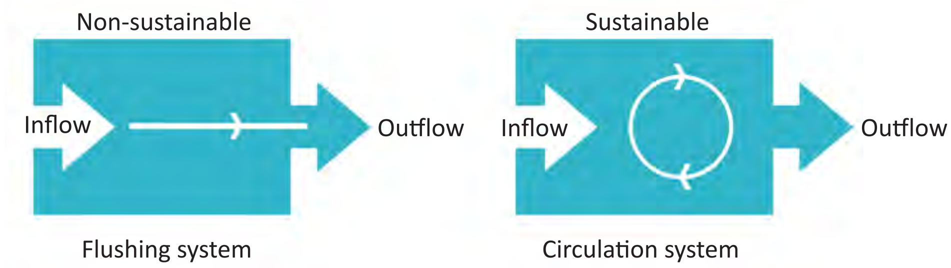


Fig 3.1 Flushing system vs. Circulation system
Source: made by author

2. Wageningen has abundant rain water resource, however, its distribution is not even throughout the year. Uneven rainwater distribution causes surface flood in rain time, and in the summer, there have been days that the ditches become dry.

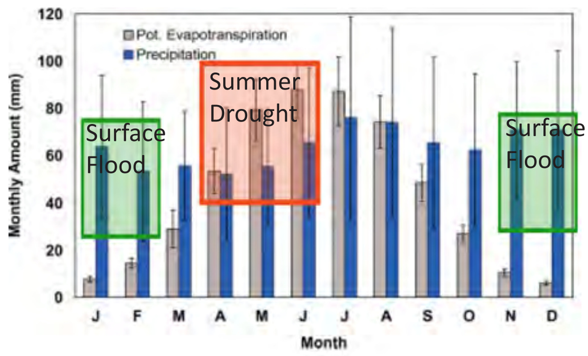


Fig 3.2 Uneven rain water distribution leads to summer drought and surface floods.
Source: Holtslag, 2009

3. Apart from that, the amount of water in this area is huge, but few of them can serve as urban amenities since they are all underground. The urban area of Wageningen city is quite dense with little recreation function water. This is partly caused by the city policy that the extension of the city can only happens when all the area is occupied by architectures. This is the reason why the city of Wageningen can not provide rich greenery experience, which stand for a high living quality.

Fig 3.3 Dense urban area and little green and water
Source: GIS data

4. Current water plan is not enough to deal with the water problem especially in a long period. In fact, there is already some water plans from the Municipality to deal with the water problems. However, these water plans only focus on the main water body in the city center, they try to find more inlet and reconnect the old moat. There's no plan considering the water problems in a much broader view which includes the seasonal storage and peat storage at present. That is why this thesis put the emphasis on a municipal scale and more concern about the future changes.

3.2 Goals and Aims

"Wageningen wil verantwoord met het water omgaan. Dat betekent ruimte bieden voor waterberging, en zorgen voor schoon en beleefbaar water in de stad." (Waterplan Wageningen, 2005 Nov.1)

Wageningen requires a water efficient and sustainable future. The municipality is searching for the alternative water resources and a flexible water system that can adapt to the future climate change. The existing water issues can be solved by the current water plan more or less. However, a water efficient system which can fit the changing climate in the future is missing. No city plan concerning the changing climate has been proposed for Wageningen. In this thesis, I want to do a research about future urban water system in the city of Wageningen. The main goal of this thesis is:

'Developing a strategy for the waterscape of Wageningen which can solve the existing problems, prepares for future climate change and improve the landscape quality.'

The research will focus on discovering different approaches on the issue of water saving and water capacity in urban areas that can contribute to a flexible waterscape in the city of Wageningen. The project aims at designing a sustainable and efficient

There are different ways to build a water-resilient and efficient system. In this thesis I will focus on how to use interrelationship between water and landscape as driving force for increasing water resilience. The sub goals are:
-Discover various solutions to reduce the wasted water in the urban area and find new water resource for urban life.
-Make the city more capable to the increasing future extremes by reorganizing the landscape and increase more natural area in the urban area.
-Use bio-technology to decrease the water pollution.

Concerning the character of Wageningen city and the relationship of water demand and supply in a larger area, this study will choose a suitable solution for Wageningen city to make a balanced water system in the context of a higher water quality.

3.3 Hypothesis

In the background of a worldwide changing climate and the problematic urban water system, I have noticed that the water smart technology has made its effort on solving the water issue with the changing ideas. Building efficient urban water system that fits the changing future requires new ways of saving, storing, reusing and purifying the limited water resource.

So the hypothesis is, **if a "combined model" (infiltration + circulation) is applied to water system in Wageningen Municipality, the local water system will be more resilient to the changing climate and the landscape quality will also be improved.**

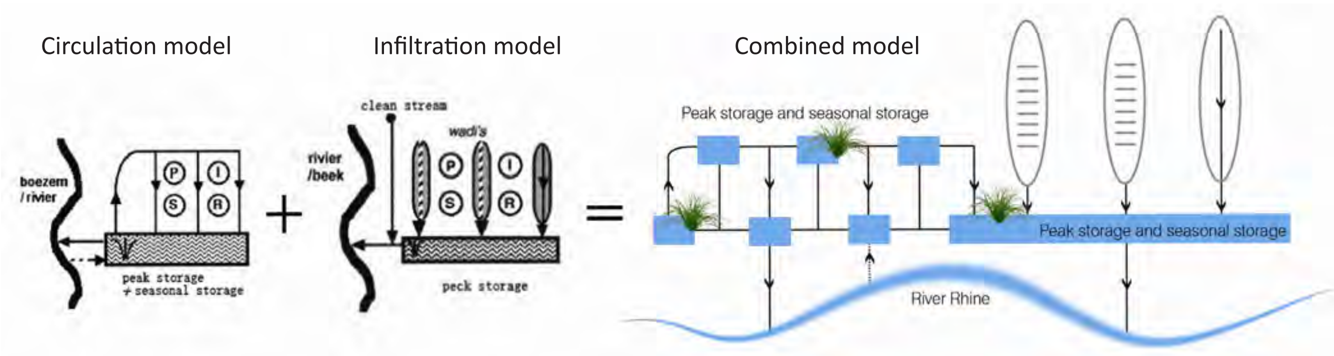


Fig 3.4 The Wageningen water system model
Source: made by author

3.4 Research question

This research is aiming at a flexible waterscape plan that can provide a water efficient and sustainable future, several questions in different realms need to be answered.

-How does the water system work in Wageningen?
-What are the existing water problem in Wageningen?
-What are the impacts of climate change on the waterscape of Wageningen?
-What is the proper water management method in different soil type area?And which suits Wageningen best?
-What are the possible solutions in order to prepare the city for the future climate change?

3.5 Research Methodology

This landscape design research methodology is based on "research by design". Generally speaking, research and design are two distinctive activities. However, Zeisel(2006) define the “research by design” as “an iterative process, in which, research draws on theory, training, accumulated knowledge, and experience to generate tentative ideas about how to solve problem, and design refines researches direction constantly.”

The framework in six levels proposed by Steinitz (2001) is imbedded into the design framework. All those steps have a certain contribution on the process. "Research by design" is not a liner process but a process which always goes and returns in a circle. Normally, after every step the researcher should look back at the research questions and hypothesis.

The research has 2 phases basically: creating “knowledge basis” and research by design.

Phase 1. Creating “knowledge basis” to guide design

Literature review and case studies play a significant role in searching for useful theoretical framework and design tools. Site analysis gives a general idea of identifying the thesis theme, and then a more focused view can be generate from it. The data collection contains: expert interviewing, literature review, precedent study and site analysis.

Two main issues exist in this research: efficient urban water system and using landscape design approaches to provide a urban landscape with high quality. These two issues are not separated entities but highly interrelated topics. Integrating mass information from different aspects needs the help of synthesising. Synthesis is a process of generating accurate figures and adapting suitable principles that can guide the design process. By synthesis of acquired information, the problem become clearer, and more opportunities and challenges can be found for the study area. In the first chapter, various aspects of urban water system have been described, and then two notable problems of water seasonal uneven distribution and lack of landscape quality as a result of hydrological, ecological and aesthetical problems are outlined.

Phase 2 Research by design

A concept of the master plan of Wageningen will be developed on the basis of the result of former phase. The design will be guided by a series of principles which extracted from the technical and theoretical research. The design has two levels, regional level and local level. The principles found and studied in the phase one (Two lane strategy, guiding models, closing the cycle and cascading) will be translated to a combined water system model based on the local inventory on the regional level. The model meets the water efficiency demand and help to improve the landscape quality. At the local scale, different water-driven landscape will be explored.

The whole process is ended up with reviewing original aims and evaluating design products and the adopted approaches. Feedbacks will be new input for adjusting previous steps in iterative process.

Research Framework

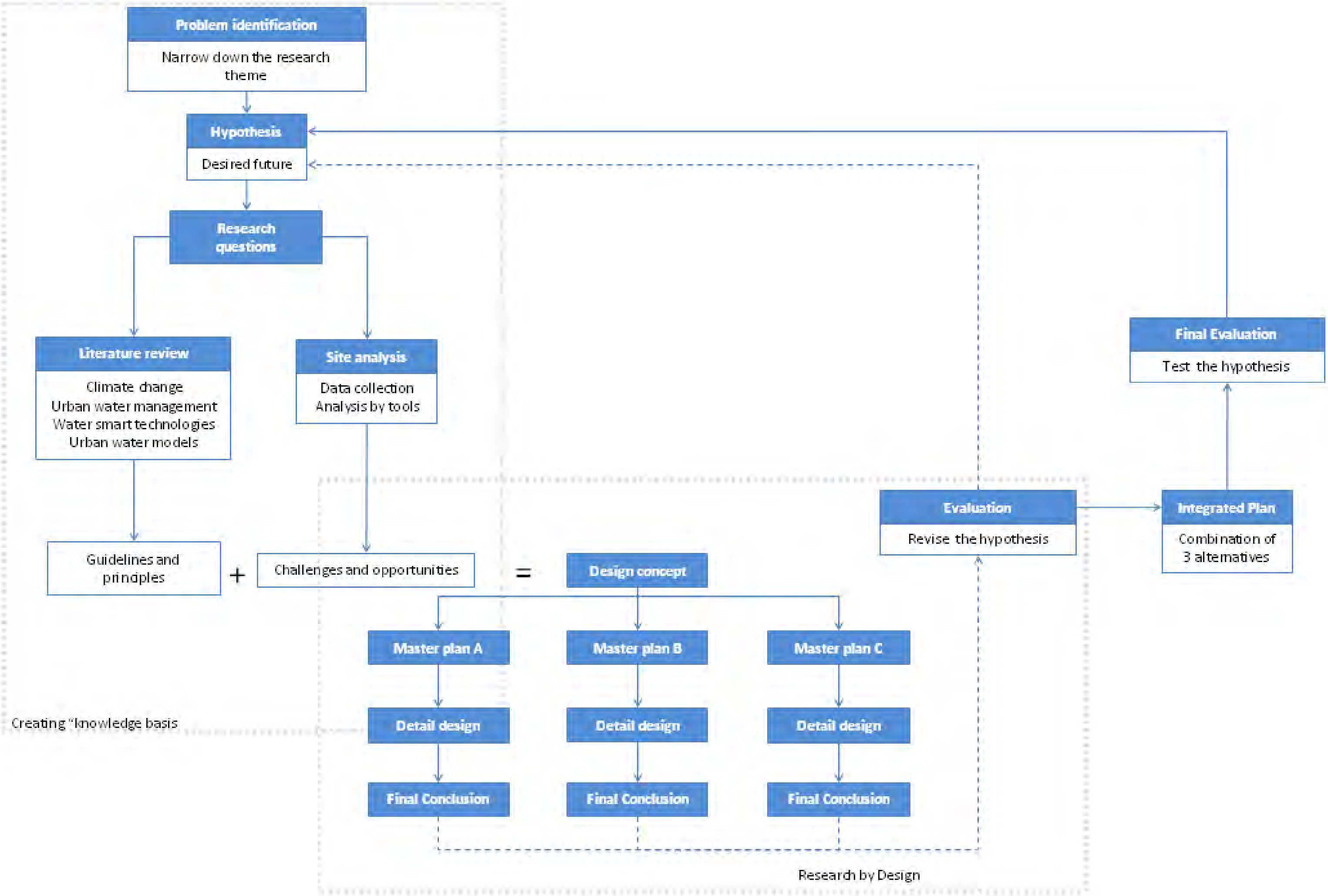
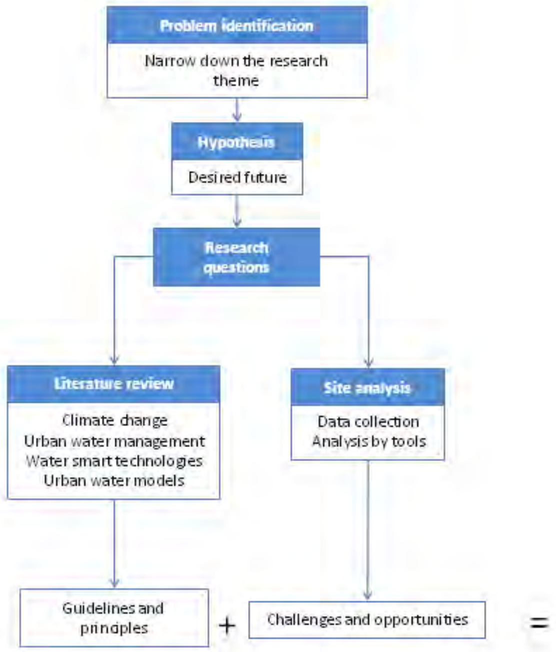


Fig 3.5 Research Framework
Source: Adapted from Steinitz 1990

Chapter 4

Site introduction and landscape analysis

Index

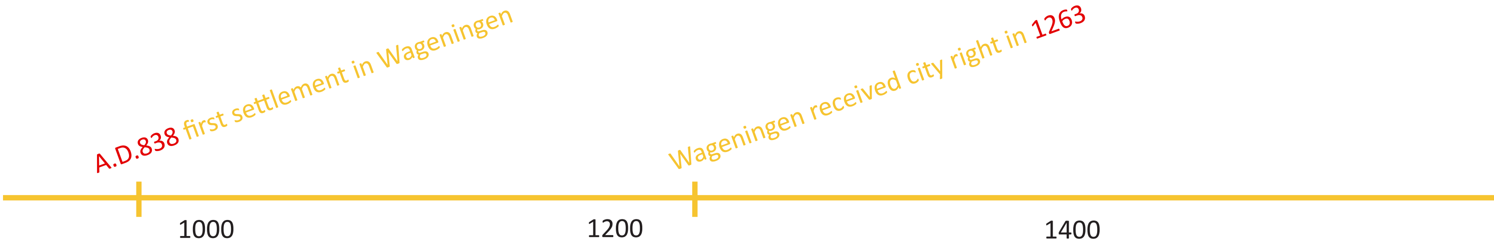


Problem identification
Narrow down the research theme
Hypothesis
Desired future
Research questions
Literature review
Climate change
Urban water management
Water smart technologies
Urban water models
Site analysis
Data collection
Analysis by tools
Guidelines and principles
+
Challenges and opportunities
=

4.1 Inventory

4.1.1 Human occupation and development in Wageningen

Wageningen has witnessed its dramatic change from a small village to a high-tech city since the first settlement in the 838 till now.



Earliest settlement: A.D. 838-1000

Archaeological discoveries show that already in prehistoric times, there was human activity on the territory of the municipality of Wageningen. However, no evidence shows that there is one or more permanent settlements until the early Middle Ages. The name of Wageningen was literally mentioned for its first time in 838. The neighborhoods were on the eastern border of the dry sandy soils and the lower bogs in the west. The development of the city has taken place much later. On the moraine, now called Wageningen Berg, stands a chapel around the year 1000. Later, in the peat bog, a city called Nijwageningen (New Wageningen) develops. During the early Middle Ages a small church was built on the hill at the east of the town. Lumbering have been found near the top of the hill.

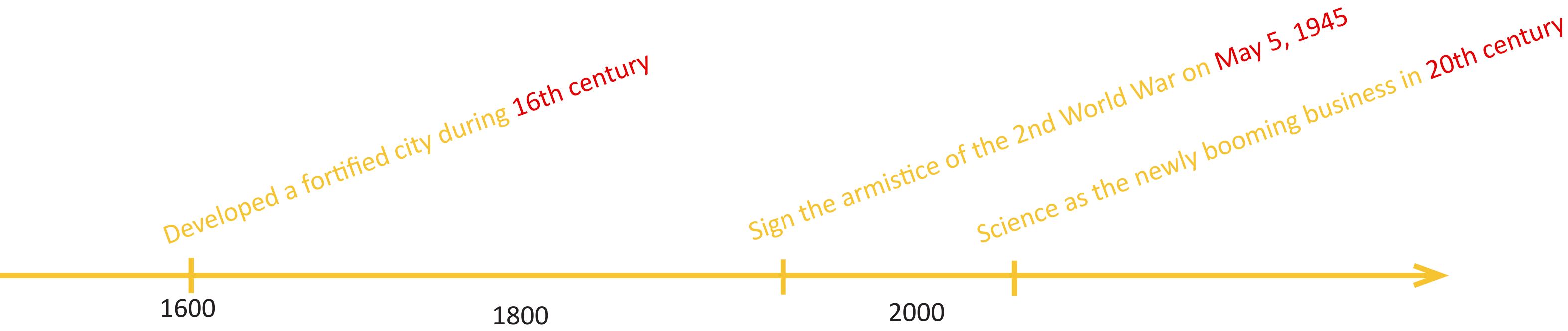
Figure4.1 Image Map of Wageningen around 1650
Source: Nic.van Geelkercken

Vestingstad (fortified city) 1200-1672

During the twelfth century, a small settlement has developed on the north bank of the Rhine since the departure of the Roman. After the construction of a dike to protect the city, the Gelderse Vallei (the current Hoogstraat) has been occupied. The oldest part of the present city was built to the south. The parts north of the Hoogstraat were built later.

The settlement of probably only a few dozen farms and houses received city rights in 1263 as the Wageningen city. The city was protected by a city wall and a ditch. In 1526 a castle was built. The castle was dismantled during the 18th century, but the foundations of three of the towers and part of the wall remain visible today.

In the Middle Ages, Wageningen controls the transport waterway on the river. Although Wageningen could become a thriving commercial city, that has never happened. In the first half of the sixteenth century, rises the castle of Wageningen in the south-east corner of the city and the fortifications of the city has been significantly strengthened and expanded. Wageningen existed as a border fortress and was quite important during the 80-year war as the guardian of the Veluwe. After the Peace of Westphalia signed in 1646, the fortifications remains good maintenance. In 1672, the city survived without a fight to the invading French troops. That is the end of Wageningen as a fortified city.



*Data collected on Wikipedia and Wageningen Municipality website

War and liberation: 1700-1945

The economy of Wageningen slowly grew in 17th century mainly depended on the agriculture. In the meanwhile, several industrials has developed: tobacco, cigar, brick and printing. Too much development hampered by war and competition from surrounding cities has limited the speed of the economic growth speed here.

The city centre has been destroyed during the Second World War. The reconstruction has been largely completed in 1941. On 5 May 1945, the German general Blaskowitz surrendered to the Canadian general Charles Foulkes, which officially ended the Second World War in the Netherlands. The Generals negotiated the terms of surrender in the Hotel de Wereld. Therefore, Wageningen is also world famous for its military history.

Figure 4.2 Liberation monument
Source: picture by Basvb

Recent development

With the completion of the tower of the Great Church on the market, the recovery of the great damage of Wageningen in the Second World Warwas almost complete. Meanwhile, after 1945 a rapid increase of population manifested, in particular the number of students at the Agricultural University. Science - the Agricultural and her 'supporters' of scientific institutions - becomes a booming business in Wageningen.

Though it might not be as stormy as hoped, Wageningen build so much houses after the war that the population become more than double to over 36,000 in between 1945 and the beginning of the twenty-first century. Meanwhile the traditional industries (cigars, brick and printers) disappeared. In recent years Wageningen are mainly engaged in the commercial and scientific services. WUR (Wageningen University and Research), the result of a merger between the Agricultural University (formerly Agricultural) and autonomous scientific institutions, remains a central role in the Wageningen economy, especially when it comes to attracting and retaining knowledge-intensive companies and dealing with food in the broadest sense of the word involved. This development owes its name Wageningen: City of Life Sciences.

Figure 4.3 Wageningen University of life sciences
Source: Wageningen University

4.1.2 Landscape change in wageningen

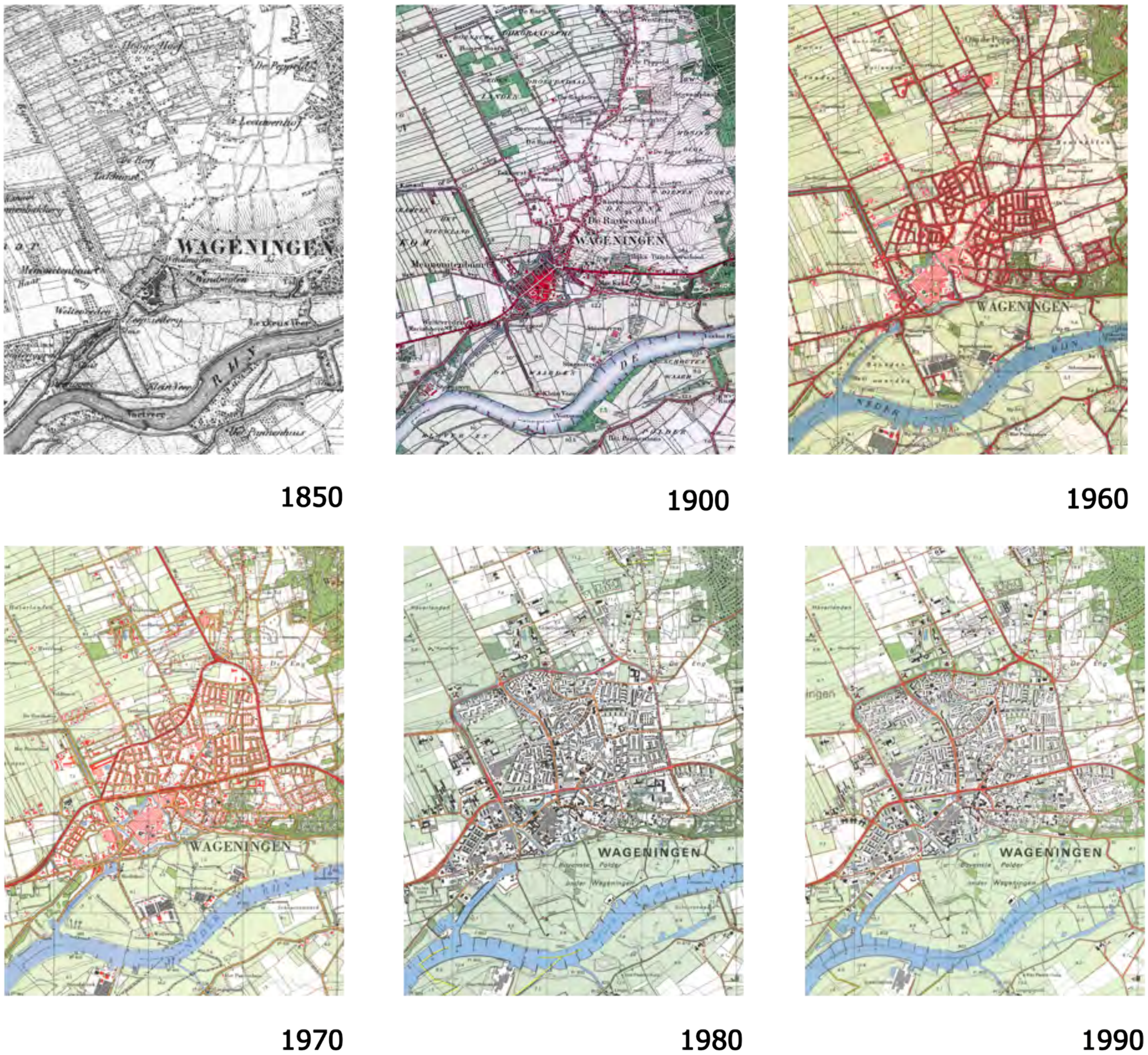


Figure 4.4 shows the landform change and city development from 1850 to 1996. In the 16th century, the city was shaped as a fortified city for the defense use which now becomes the main feature that stand for the local identity.

The major expansion took place after the Second World War, the figure above shows how the city expends step by step. Paved surfaces occupied green area, more roads came in. Until 1980, the city already expands almost today's size. Even up on the western hill, Wageningen-hoog, residential area can be found. The low permeable peat and clay soil limited the expansion on the west side of the old city centre.

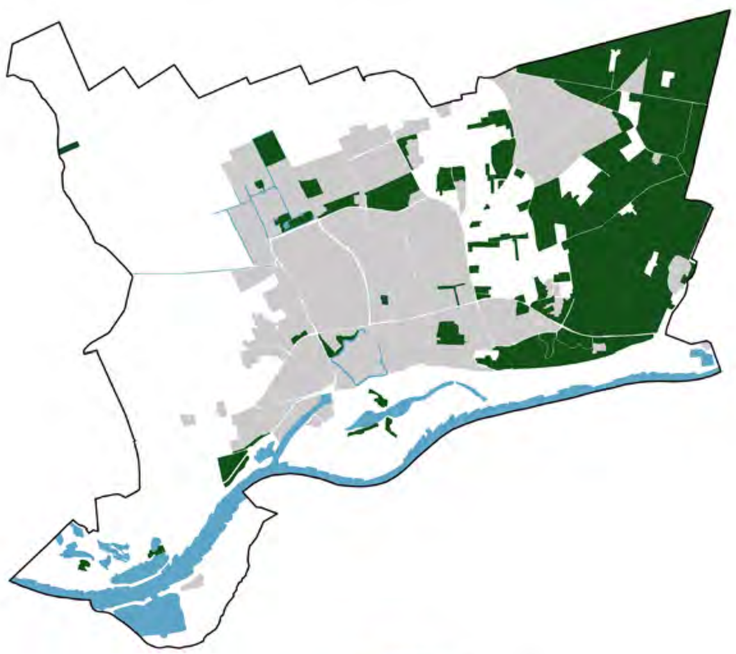
Figure 4.4 Wageningen historical maps
Source: GIS data

4.1.3 Wageningen landscape

The valley city of Wageningen

Wageningen is located at the border between the Utrecht ridge and the mountain Veluwe, in the province of Gelderland. The area is covered by Pleistocene sandy masses where water can easily infiltrate and clean rainwater can be stored and concentrated in the central area. It was largely moorland and for agricultural use around 1600. However, at 17th century, the artificial drainage made the water table reduced systematically. The current surface water system is carried by the Lower Rhine between Vallei and Eem. The water quality is influenced by agriculture. The extension of the living and work in the area will lead to an increased need for drinking and industrial water, capacity in the sewer and water treatment system.

Wageningen consists of high density urban area combined with an open natural country side. 37,579 population (figure 4.5) concentrated in less than 1/4 of the whole city area. While in the country side, houses can hardly be found. The earliest settlement in the Wageningen were located at the north of today's town centre. The total area of Wageningen is 32.35km^2. On the figure 4.6, urban area occupied 24% of the total area and half of land is agriculture field.



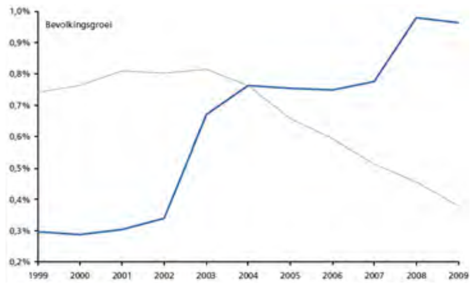


Figure 4.5 Development of population growth in Wageningen 1999-2009
10-year average population growth
The blue line is the score of Wageningen,
The gray line is the average of the benchmark cities.
Source: CBS

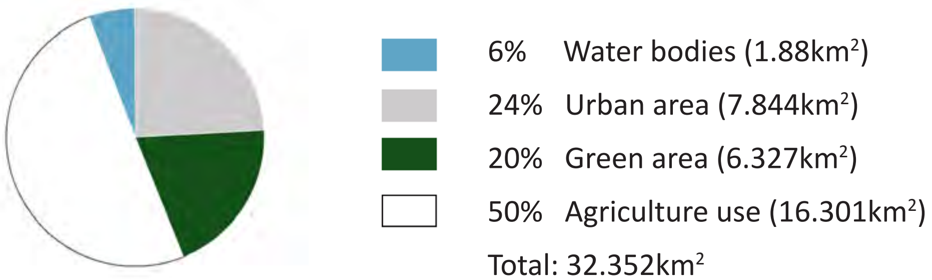


Figure 4.6 Land composition of Wageningen
Source: GIS data

The traffic here is quite convenient, three high ways (N225, N781, N782) pass through Wageningen, and from train station Ede-Wageningen there's a 15 minute bus connects the central bus station in the city centre. The old city centre (1) is surrounding by an artificial moat (2) which is left from fortified town period as its main water feature. A dike (3) was constructed to protect the city from the river Rhine. Natura 2000 appointed the flood plain (4) and the forest (5) as the protective area.

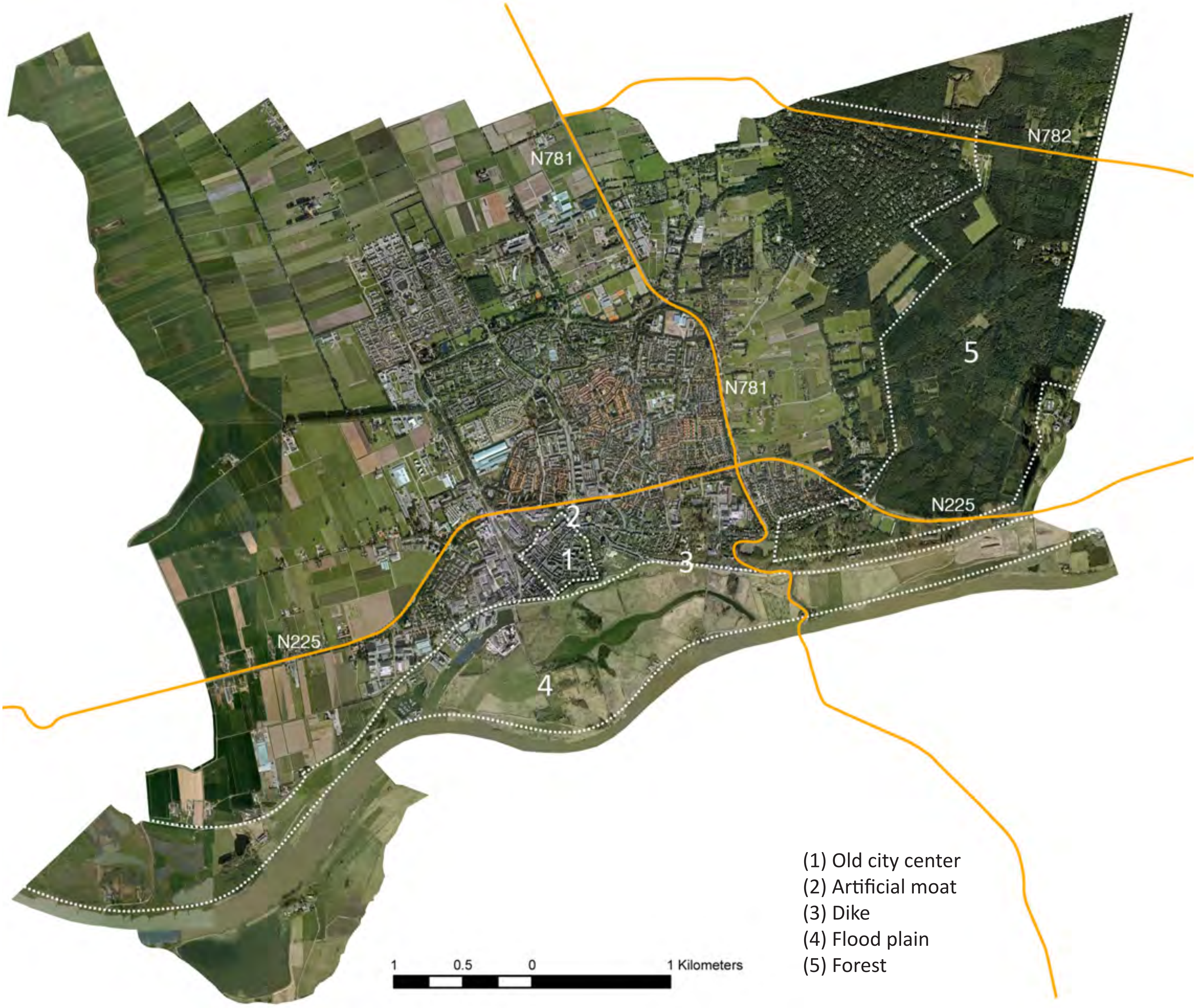


Figure 4.7 Wageningen Municipality
Source: Google map

Wageningen has various types of land uses which support every aspect in social life inside the region. The built up area is located at the center of the whole municipality region. To the east of the down town is huge forest on the mountain Veluwe. Farmland occupies the west part of Wageningen. And in the south, river Rihine passes through. There are also many scattered area like sports field, natural area, dumpland, park, garden inside the region.

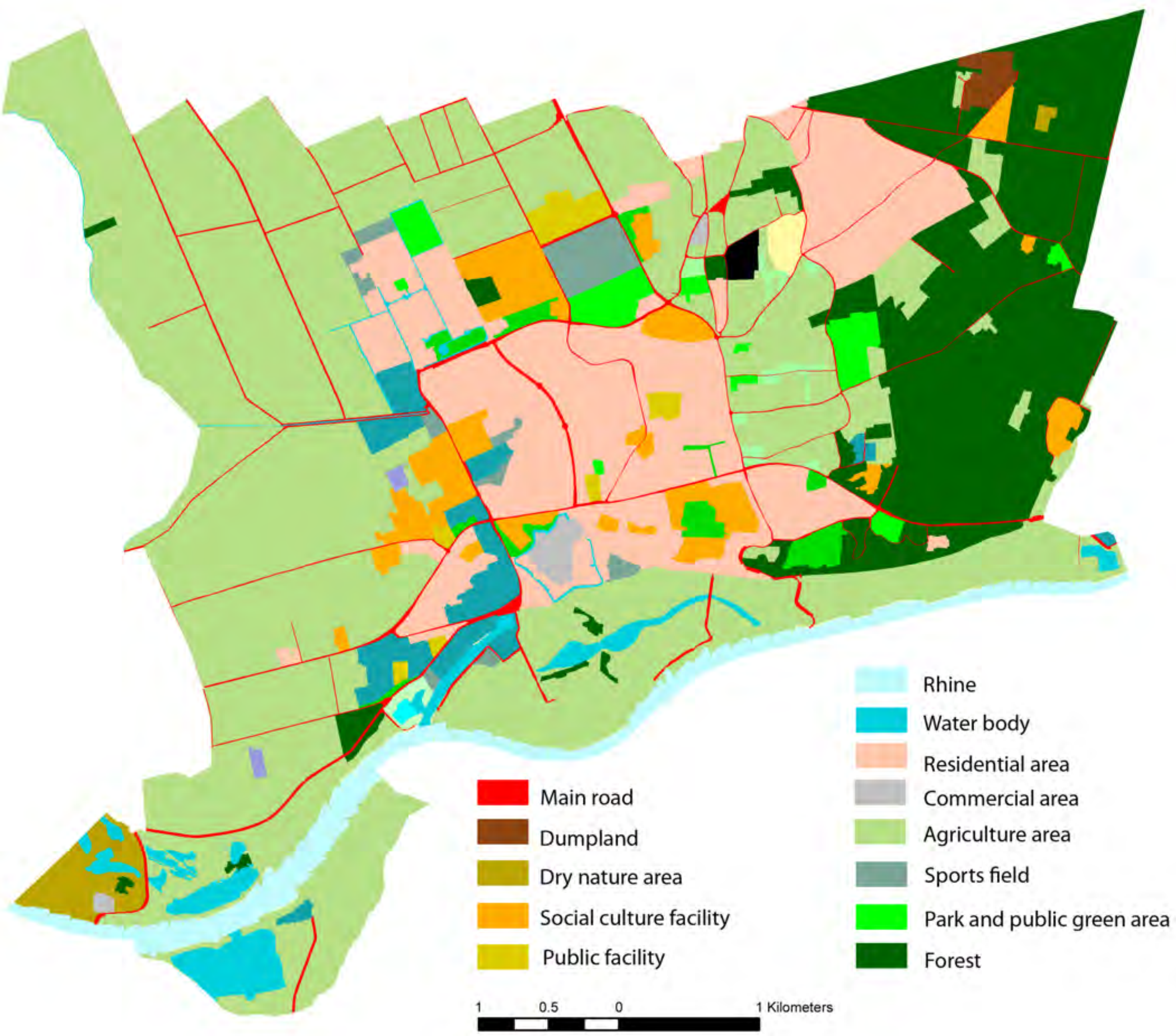


Figure 4.8 Landuse of Wageningen
Source: GIS data

4.1.4 Climate in Wageningen

The predominant wind direction in the Netherlands is south-west, which causes a moderate maritime climate, with cool summers and mild winters in Wageningen. The factor that affect the water system most is the precipitation and evapotranspiration. The Annual and seasonal characteristics of precipitation and evapotranspiration is analysed based on an 80-year data record (1928–2008) at Wageningen. The precipitation shows a mean annual rainfall of 765 ±130 mm with a relatively high inter annual variability [coefficient of variation (CV) = 17.0%]. Both the annual and seasonal rainfall trends show a small but statistically insignificant increase. Potential evapotranspiration was estimated by Makkink's formula, using observations of incoming solar radiation and air temperature as inputs. This provides a mean evapotranspiration of (525 ±50) mm a year with a relatively low inter annual variability (CV = 9.5%). The annual and seasonal trends appear to be statistically significant, except for the summer season. In addition, since 1992, actual evapotranspiration is measured by the eddy-covariance technique and these results were found to be highly correlated with the potential evapotranspiration (Eact ≈ 0.75Epot). (Holtslag,2009)

Based on Figure 4.9, the mean annual precipitation kept on increasing by about 6 mm per decade (0.8% per decade), that is 40.8mm in the past 80 years. The wettest year was 1966 with 1162 mm and the driest year was1977 with 450 mm.

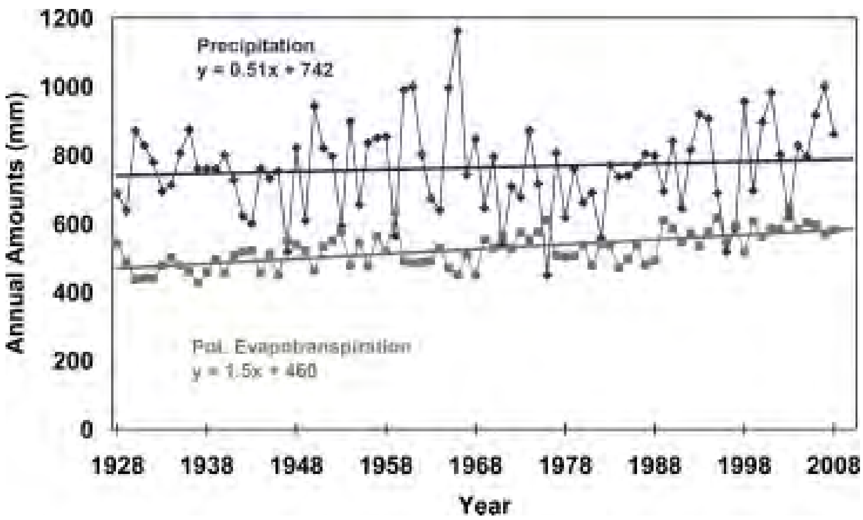


Fig 4.9 The courses of interannual precipitation and potential evapotranspiration, their trends and correlation coefficients during the observation period.
Source: Holtslag, 2009

4.2 Waterscape analysis in Wageningen

4.2.1 Regional water system

The water system of Wageningen belongs to Rhine water area (figure 4.10). It receives water from upstream of German cities. Unfortunately, in the old days those upstream cities didn't have water purifying systems, therefore the water quality was not high when it passed Wageningen. Now it becomes much better than 30 years ago, but it still can't match the water standard of good quality. So the Wageningen water bodies are not connect to the river.

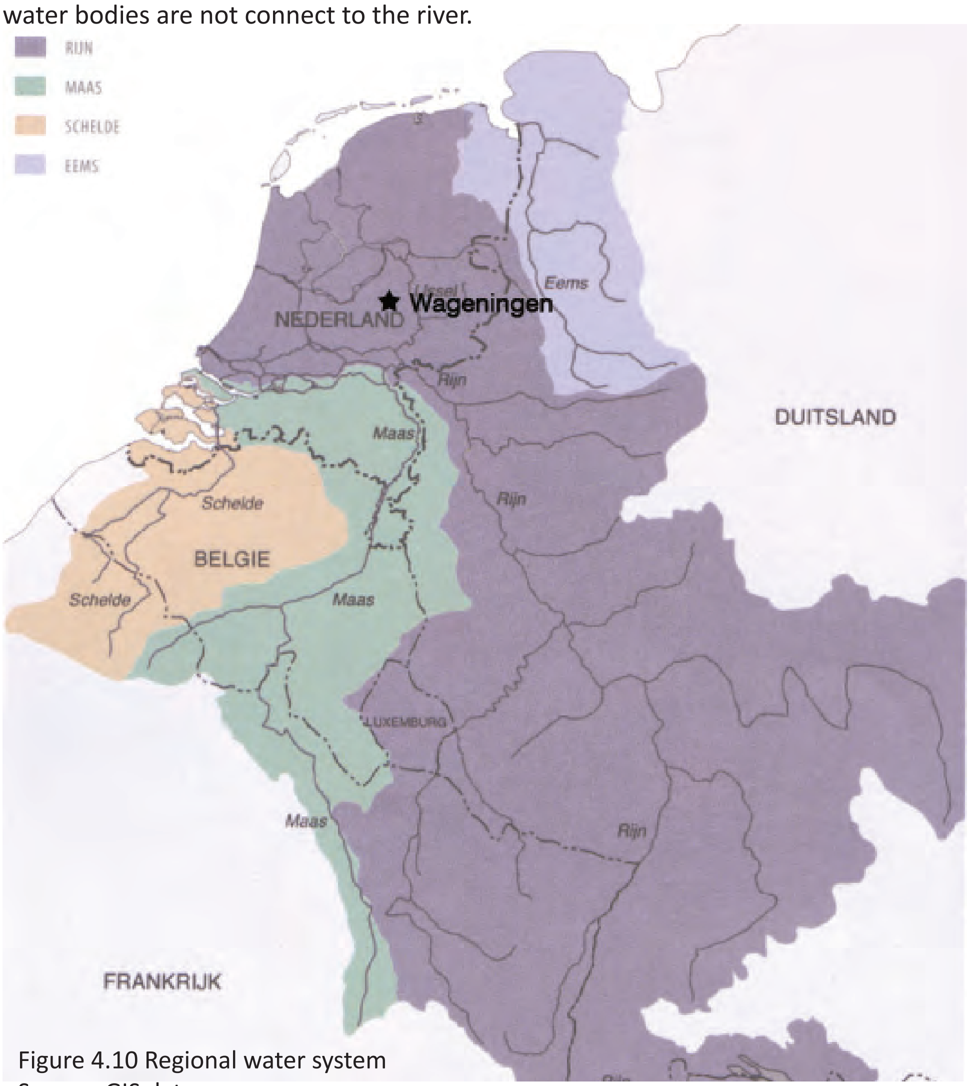


Figure 4.10 Regional water system
Source: GIS data

Combined water system

The hydrology in Wageningen is complex. The unique geographical location of the valley bottom helps Wageningen gather a large amount of water in this area. Generally, it can be considered as a combination of surface water system and ground water system. Wageningen water system can be roughly divided into two parts, northwest part and southeast part. It can be observed on figure 4.11, the northwest part has a complex and delicate ditch system while the southeast has little surface water bodies. The big difference is due to the different soil type of this two parts. In the southeast, most area is covered by sandy soil which result in easy rain water infiltration. Therefore, this part has a rich groundwater storage. On the other hand, the soil type gradually transformed into clay and peat type from southeast to northwest where the water can not easily infiltrate into ground. The difference in topography also affect the water flows. Run off water usually goes from the hilly south east to flat northwest.

4.2.2 Municipal water system

Water exists in different forms in Wageningen

Four different kinds of water can be found in Wageningen water system: river Rhine, urban water courses, ditch system in the farmland and ground water. These different water bodies altogether form the water system in Wageningen.

River Rhine passes by to the north of the city, but there's no clear connection between the inland water bodies with river Rhine. The surface water system highly depends on the pumping system. The old city centre is surrounded by an old moat from Middle Ages, and this moat becomes the main water feature that serves for people's recreation in Wageningen.

The moat is on average higher than the Rhine. According to Warmerdam (2000), due to the underground canal between the Rhine and the highly permeable soil, at that time, the moat is exist because this average water loss to the Rhine. Around 1963, the moat was maintained with pumped groundwater. But the present policy of Gelderland is aiming at reducing the ground water consume. Therefore, the groundwater pumping is stopped and the moat now gets water through a pump and pipelines with water from the Nieuw Kanaal.

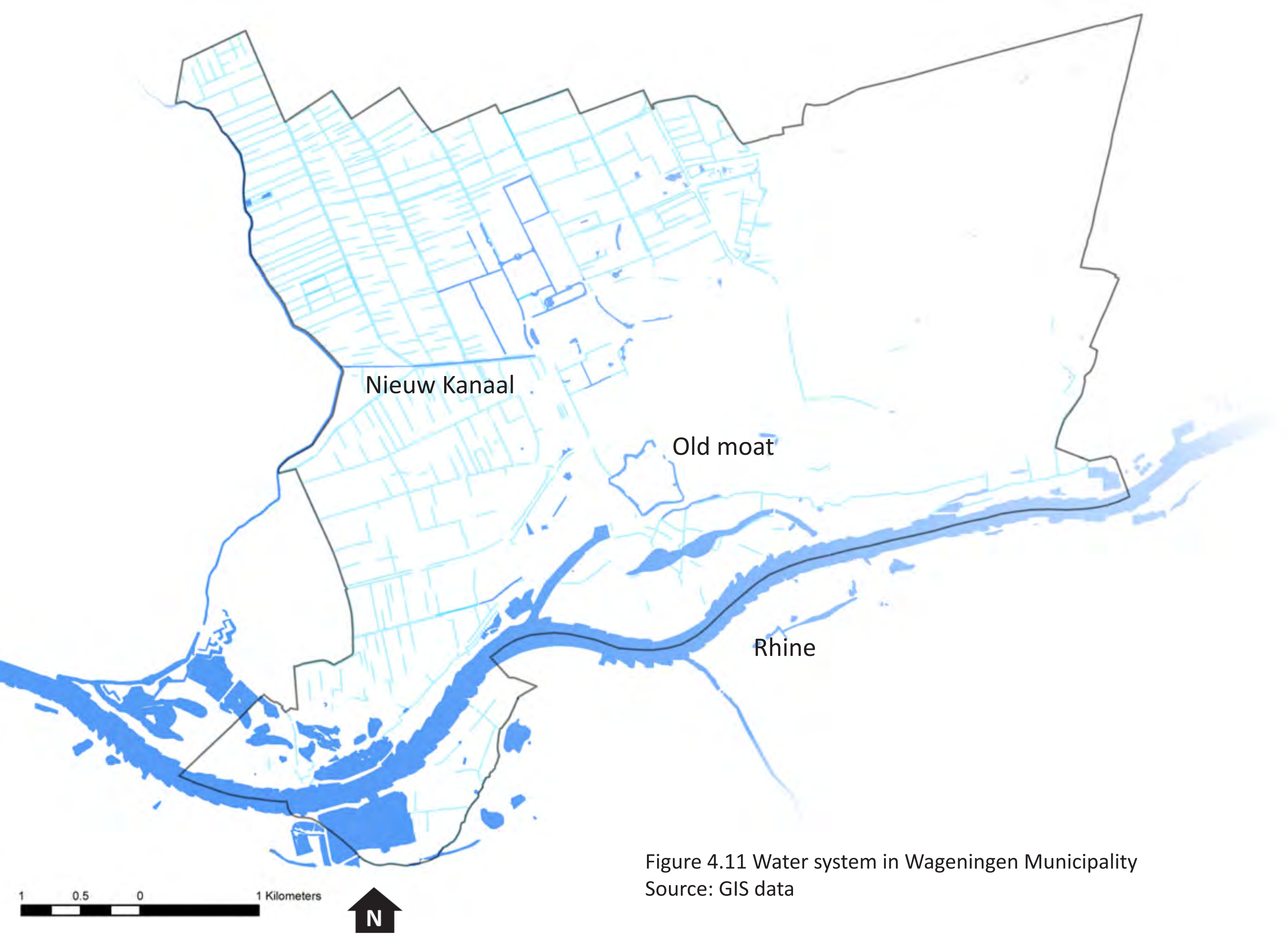


Figure 4.11 Water system in Wageningen Municipality
Source: GIS data

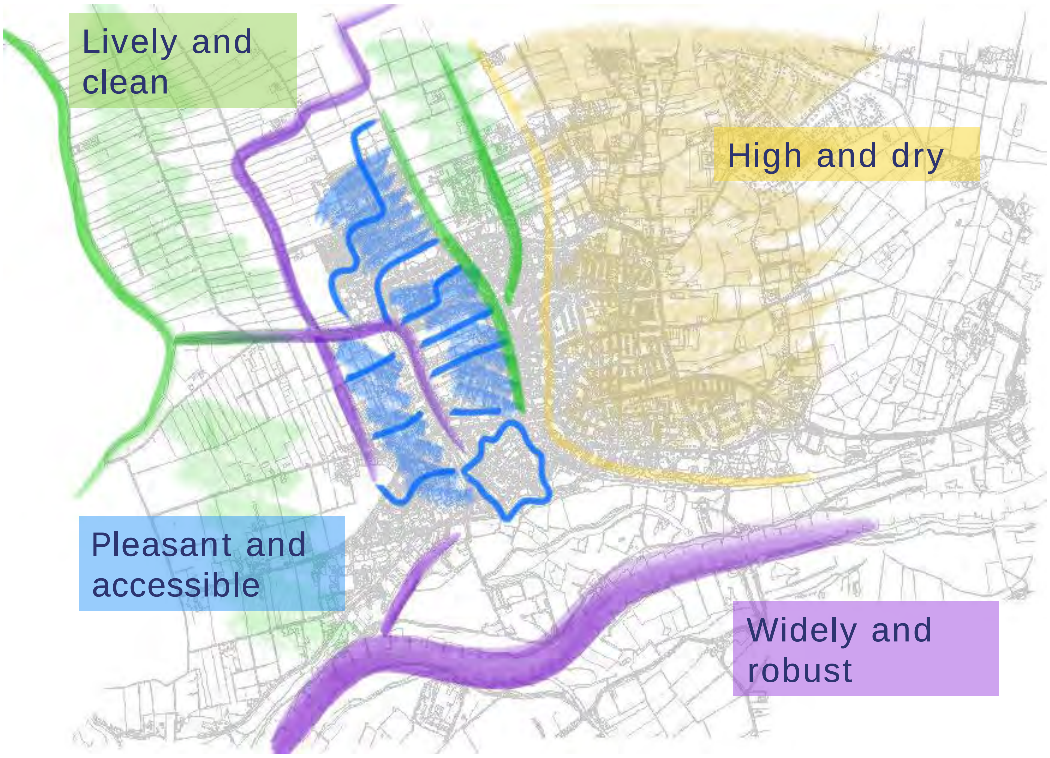


Figure 4.12 Four colour strategy
Source: Waterplan

According to the Wageningen water plan, there are four strategies for four different situations of the water in Wageningen as fig4.12 shows. Green marks the "lively and clean" area at northwest which cover the agriculture fields. Yellow area in the northeast stands for a "high and dry" area where most water is infiltrated and stored as groundwater. In the urban area, blue colour gives a "pleasant and accessible" definition to the function of the urban water. Purple of "widely and robust" reveals the characters of the river Rhine in the South. By respect to it, the proposed system in this thesis will also adapt to the four colour strategy.

In the water plan, a new water way will be reconstruct in the urban area which can connect and alive the former separated water bodies as fig 4.13 shows. This water flow will gradually accomplish in the near future. Basing on the water board Vallei and Eem's waterplan, the proposed water system is developed.

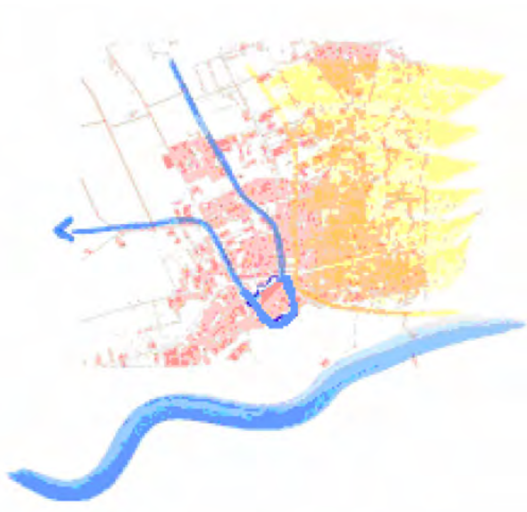


Figure 4.13 The water way inWageningen
Source: Waterplan

4.2.3 Urban water system

Wageningen urban area is situated at the transfer zone of the high sandy soil in the east and low permeable peat and clay in the west. Generally, the water usually first stored in the ground water at the eastern part and then flowing to the western part. The following figure 4.14 shows, in the urban area, the main surface water is distribute at the west part while in the east there are seldom surface water. Different existing forms of the water depend on different soil types. Therefore, varies strategies should be employed to deal with distinguishing situations in the urban area of Wageningen.


Dijkgraaf
Plassteeg
Bennekomsesteeg
Schuif normaal "open".
Schuif normaal "dicht".
Rijnsteeg
Wetering
Egelsteeg
Nieuwe steeg
Oordensloot
Voorbergsloot
De Geer
Slagsteeg
Hoge Steeg
Veensteeg
Nieuw Kanaal
Valleikanaal
Haarwal
Loost via stuw op Valleikanaal (bij Haarbrug)
BBB-Binnenhaven
RWA pompinst. (cap. 100m3/h)
te realiseren vijzelgemaal s.h. 6.70+ - 7.80+
te realiseren stuw s.h. 6.30+
Haarweg
Lawickse Allee
BBB-Troelstraweg
Wageningse Afweg
Zijdvang
WUR
(derden)
9623 (65)
9622
64
63
67
66
BBB 61
13048
13046
13047
13038
13035
13031
13029
13033
13030
13032

Figure 4.14 Urban water system in Wageningen
Source: Wageningen Municipality, translated by author

4.2.4 Groundwater analysis

Geological structure and Aquifer separating layers

The open water in Wageningen is located at the foot of the moraine which runs from Wageningen Berg till Lunteren,Warmerdam (2000). The Gelderse Valley is formed by the erosion of the melt ice-sheet about 150,000 years ago from the last ice age, the Saalien. An offshoot of the Scandinavian glaciers (which current in the Gelderland Valley) pushed the upper soil layers forward and sideways and left the pushing moraines. The highest point on the lateral moraine in Ede-Wageningen is NAP +50m above the sea level, the lowest point in the field within NAP+5m about sea level.

The Utrecht Ridge marks the west side of the basin while the Veluwe marks the east. Under the valley bottom remains about 80m of mainly coarse sand and permeable material (see fig4.15). The groundwater flow is influenced by the geological structure. Because of the transmissivity of the third aquifer is by far the highest, estimated to about 90% of high ground water runs through this rough layer, so only about 10% through the first and second aquifer flows into the Valley.

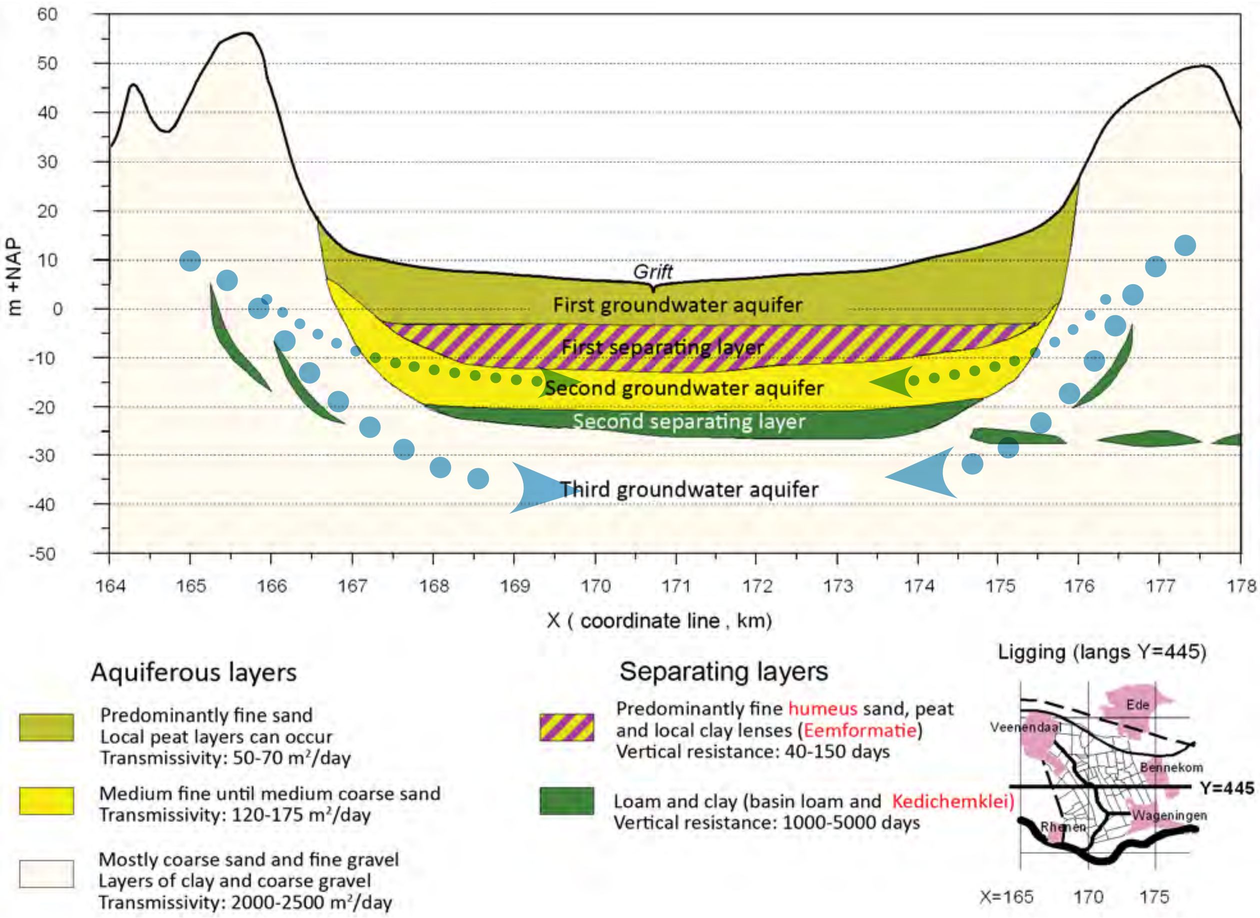


Figure 4.15 Cross-section through the lateral moraine Ede-Wageningen, within the field and the Utrecht Ridge along the line Y = 445 and separating layers of aquifers.
Source: Warmerdam 2000

At the Valley basin, low water table leads to an upward seepage from the third aquifer through the second to the first. The intensity of this movement is limited by two separated layers, especially the second. Where the layer is lacking, enhanced seepage occurs on. This seepage water was the main reason for the continuing flooding of the municipal hockey fields in the 70s.

Topography, soil type and ground water level

In the higher zone, rain water infiltrates in the ground almost entirely and stored as ground water while in the lower region rain water quickly runs off through an open ditch system to the down streams. Thus a high area with a low water table is constructed and groundwater flow oriented from the high area to the Valley bottom.

It’s not a coincidence that Wageningen city locates at the junction of a sandy area and the clay and peat area (see fig 4.20). Abundant ground water resource exists at this location, and in the meanwhile, the sandy soil won’t be too wet to live on. However, the recent city expansion enlarge the size of the city, the west part will encounter with the wet problem and the east part obviously has too little surface water. Different strategies which is based on different topography, soil type and ground water level will be introduced in the following chapters.

Topography

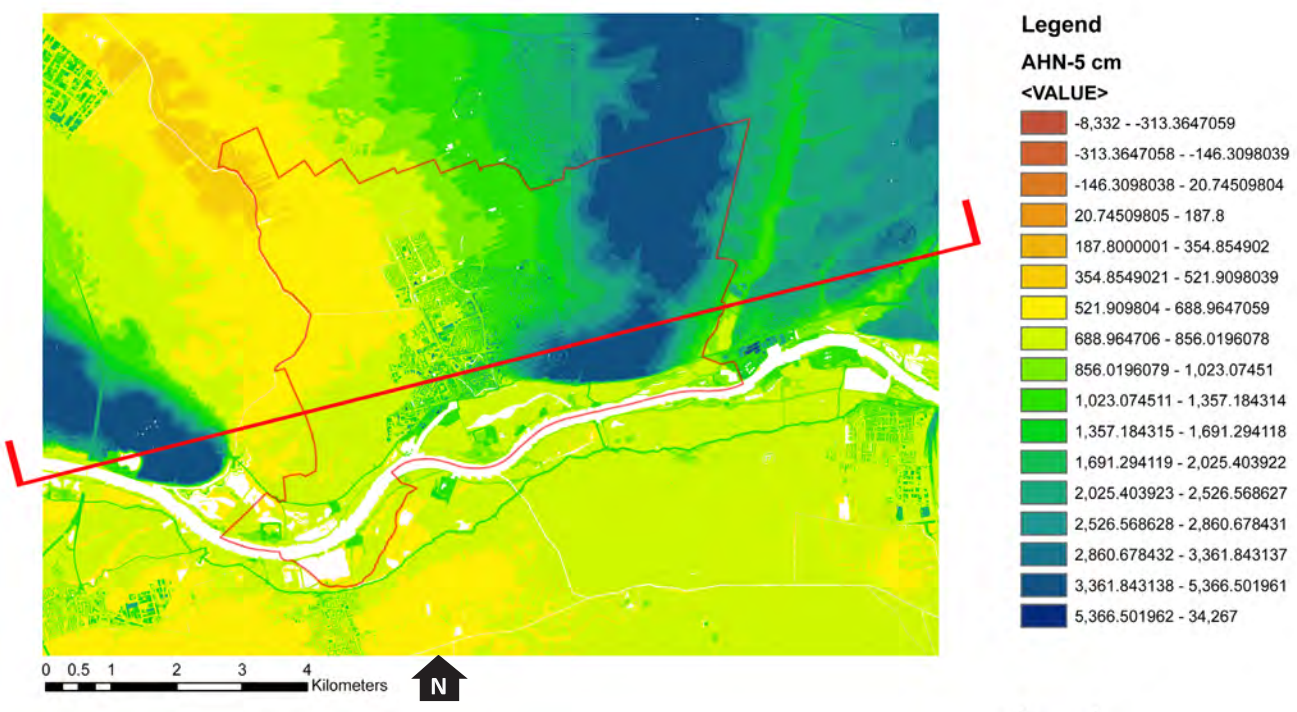


Figure 4.16 Topography of wageningen
Source: GIS data

Soil type

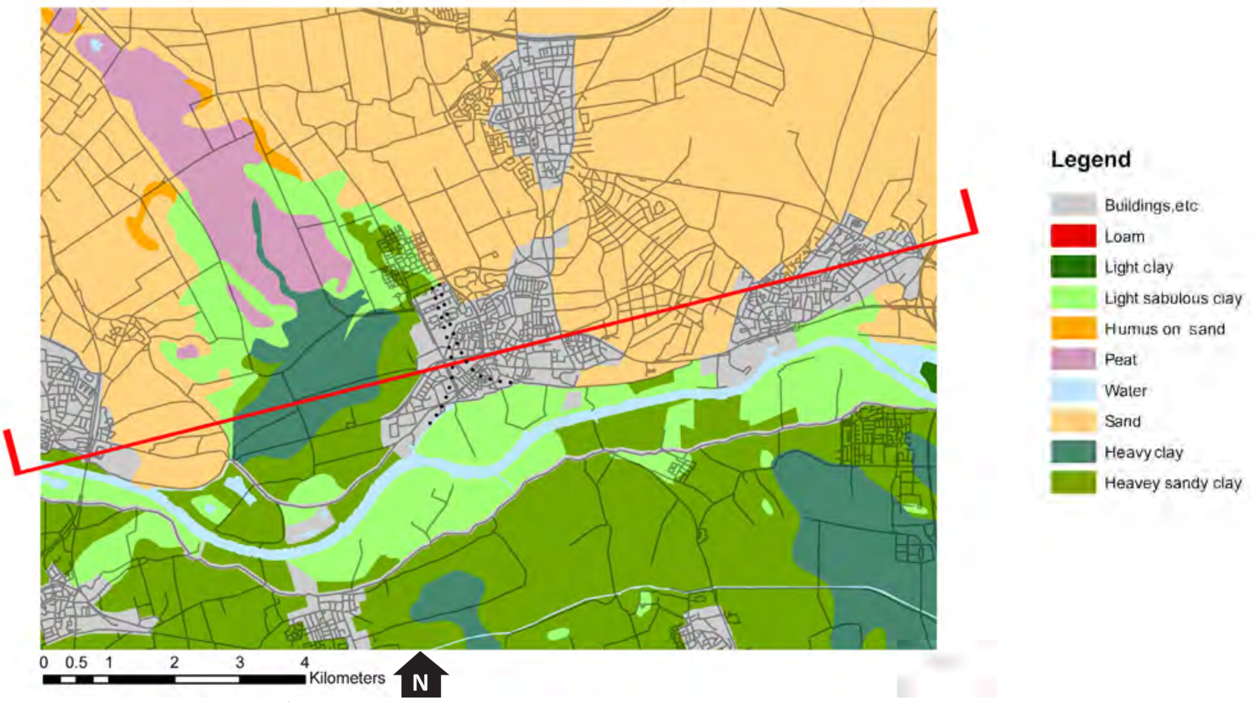


Figure 4.17 Soil type of wageningen
Source: GIS data

Groundwater level

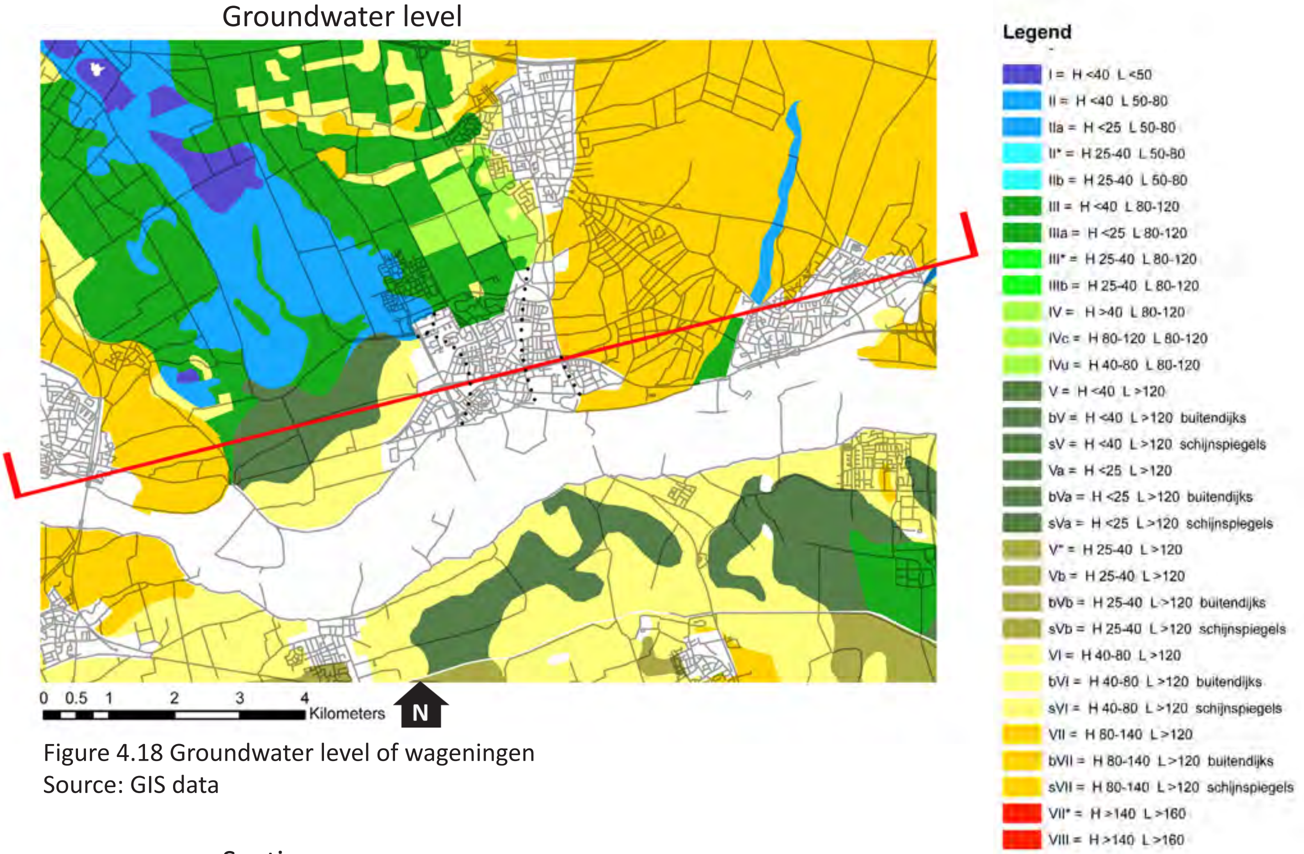


Figure 4.18 Groundwater level of wageningen
Source: GIS data

Section

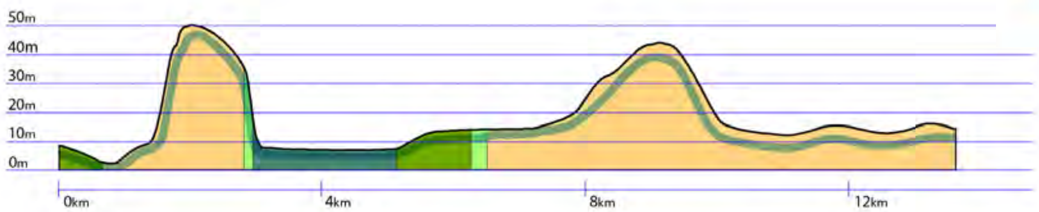


Figure 4.19 Section of wageningen
Source: made by author

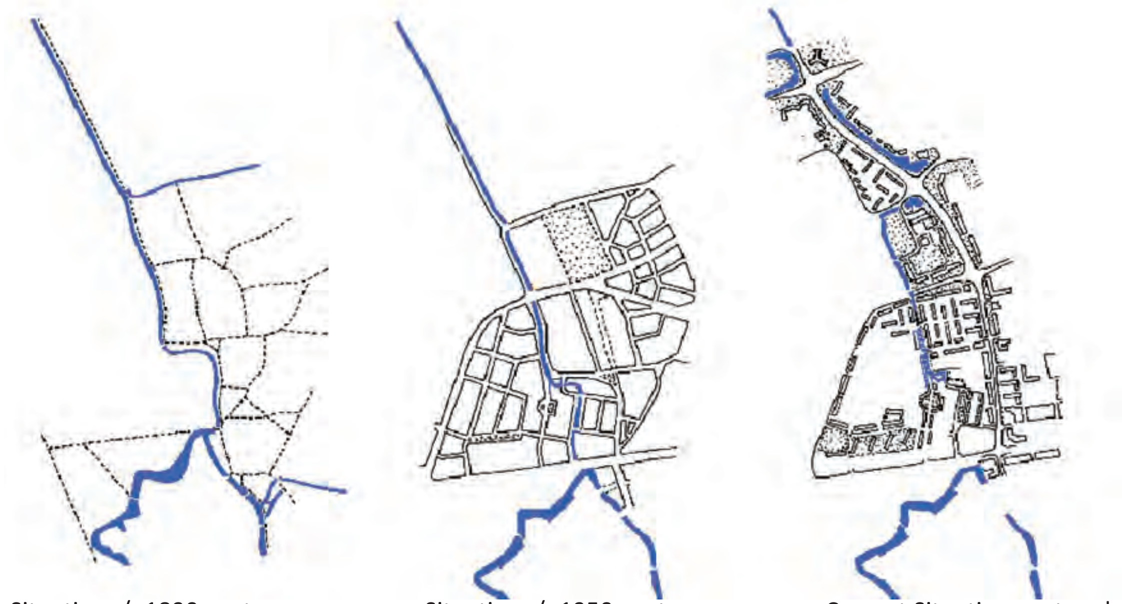
4.3. Problem analysis

4.3.1 Water problems in Wageningen

The current water situation in Wageningen is complex due to diverse soil types and terrain. Although Wageningen has abundant water resources, rapid urbanization and lacking of reasonable water system planning result in water's low-availability both in quantity and quality. By interviewing with Richard van Vliet, the Waterman in Wageningen Municipality, the water system exists problems of weak water circulation, flood problem, wet and drought problem, water pollution and water efficiency.

Weak water circulation

In the process of city expanding, water bodies gradually disappeared from the cityscape, the water circulation was cut off by construction of roads, houses and infrastructure. Consequently, the water quality decreased dramatically, and water courses lost the natural purification and transportation ability. The pictures show how the water bodies were gradually cut off and separated. There is already some plans to rebuild the natural circulation.



Situation+/- 1890: water traced from Oostersteeg, Dijkgraafseweg, Rooseveltweg

Situation+/- 1950: water traced from current Oostersteeg, Sumatrastraat, Lijnbaanstraat

Current Situation: water along north part of Rooseveltweg, old route Dijkgraaf remains, and then along Pomona, shows in dot line.

Figure 4.20 The disappearance of water from the cityscape
Source: Wageningen Water plan

Flood problem

There are many factors that cause the flood problem in Wageningen. Firstly, as Wageningen is a valley city, the run off water is easily gathered at the foot of the mountain when rain storms come (Topography). On the other hand, the part to the west of the city center is covered by peat and clay that the water can not infiltrate into the ground easily. As a consequence, the water is quite easily assembled on the streets when the rain is too heavy that excess the drainage capacity (soil type). Apart from that, when there is continuous rainfall, there will be an upward seepage from the ground water to the surface soil (soil moisture capacity). It will also cause the surface flood. And finally, the dike which protects the city from river Rhine have broke down several times that cause a river flood (river flood).

According to the flood pattern, the increases in water level when a storm comes varies between districts due to the location of the rainwater outlets, the area of surface water and the size of the culverts. The water storage basin will be guided by the flood pattern map in the following chapters.

Wet problem and drought problem

Wet problem: Wet soil will weaken the foundation of constructions, and the upward seepage even cause some floods on the surface. In the 70s, this seepage water was the main reason for the continuing flooding of the municipality in the hockey fields. Nowadays, at the foot of the veluwe, along the Mansholtlaan, this problem still exists. The soil contains too much moisture, thus the excess water is hard to drain away. Combined with the CSOs (combined sewer overflows), inhabitants suffered a lot from it.

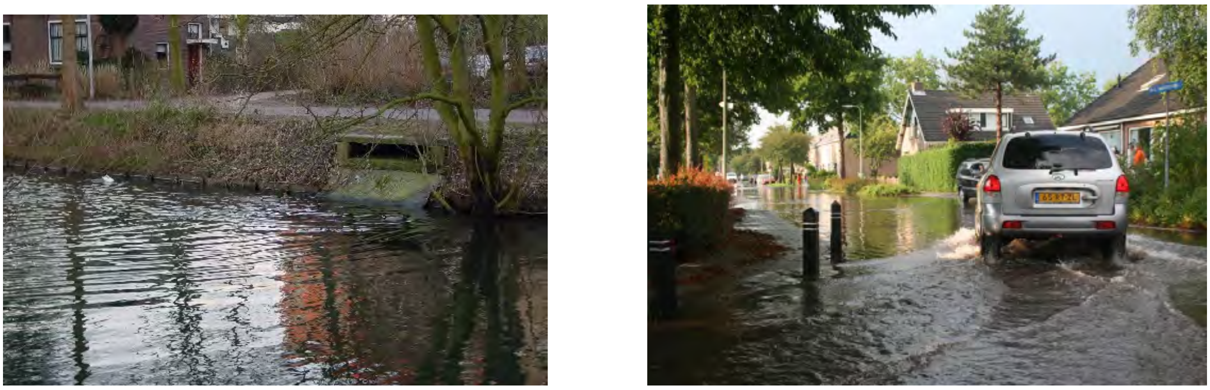


Figure 4.21 Flood in Wageningen
Source: Wageningen Municipality

Drought problem

The precipitation in Wageningen varies throughout the year. Usually the drought occurs from March to July and the rain peak happens in the winter. Figure 4.22 shows the uneven rainfall distribution causes extra water from September until next March and from May until August, the evapotranspiration amount excess the rainfall amount become the main reason of the drought. The situation is, there's not enough water recharge in the canals in summer while the storm comes in the winter, the city is under flooding risk. All these call for a seasonal storage inside Wageningen .Four water tanks have been built to adjust the uneven precipitation, but the capacity will not be enough according to the climate change.

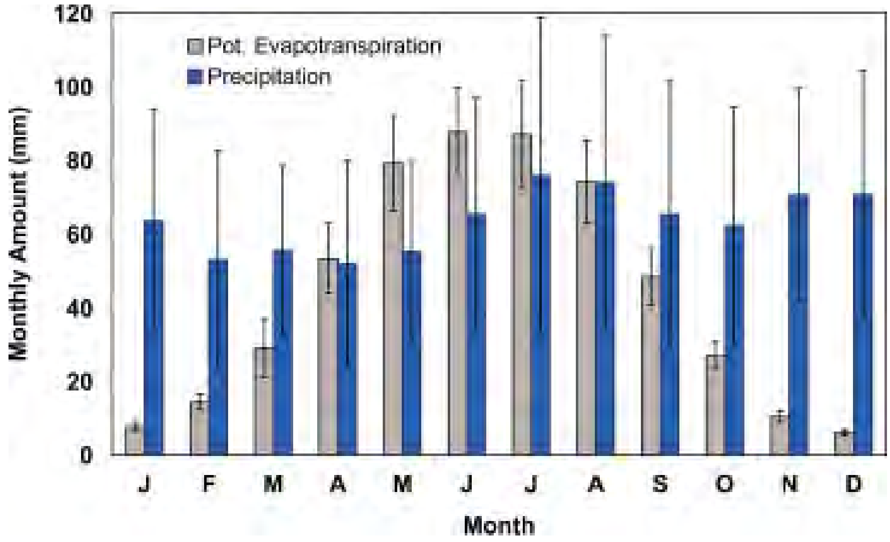


Figure 4.22 Monthly distributions of potential evapo-transpiration and precipitation (1928-2008)
Source: Wageningen University, Meteorology and Air Quality Group

Water pollution

The major pollution in Wageningen's water bodies comes from falling leaves (overflowbladval), precipitation (neerslag), bread (brood) ducks (eenden) and overflow (overstort). Figure 4.23 shows the overflow from the sewage system takes the biggest proportion. At the present time, in Wageningen most rainwater from roofs and pavements are discharged to the sewer. If rainwater directly flows into the open water instead of flowing into sewer, it will lead to less frequent overflows of the sewage and cleaner water in the city. Therefore, the Government started a project of uncoupling the roof rain water from the sewage system to reduce the pollution. The second chart shows the change of each pollution source after disconnect the rainwater from sewer. This measure will reduce 37% of the pollution in all, and the future pollution will mostly come from the animals living in the water.(Antici-pation by the Wageningen Municipality)

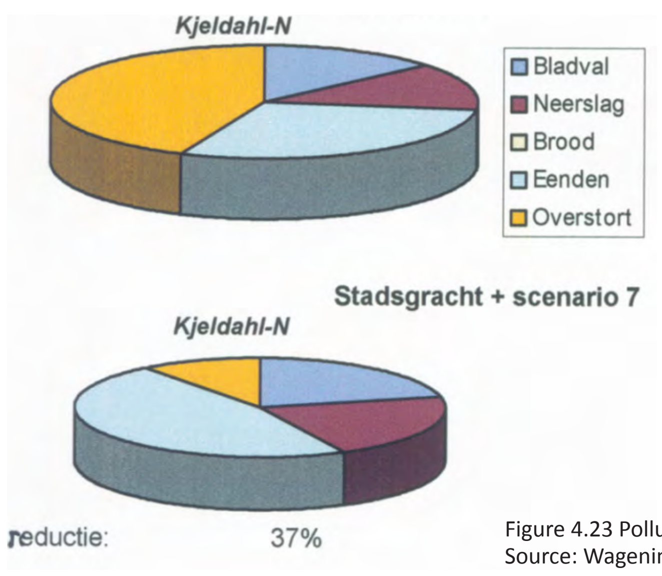


Figure 4.23 Pollution composition in Wageningen
Source: Wageningen Municipality

Combined Sewer Overflows :
The upper image in Figure 4.24 shows a combined sewer system that both sewage and storm water flow into one pipe. When it rains heavily, the sewer system can't handle the large volume of sewage and storm water. Instead of allowing water to back up into people's basements during a rainstorm, the combined sewer system allows the polluted water to be discharged directly into the River. This discharge into the river is known as a combined sewer overflow or CSO (CSO control program).

The sewer system of Wageningen consists of two types. One is a combined system, where household water and rainwater is transported in one pipe. All the water here is transported to the treatment plant. In case of extreme rain waterfall, when the capacity of the sewers is too little, dirt water streams through spill-overs into the surface water.

And the other one is a separated system. There are two different pipes for the household water. One is transporting dirty water to the plant, and another pipe for rainwater which is transported to surface water. The under picture shows separated system. For the country side (rural area), household water is transported with pressure pipes to the city and from there to the plant.

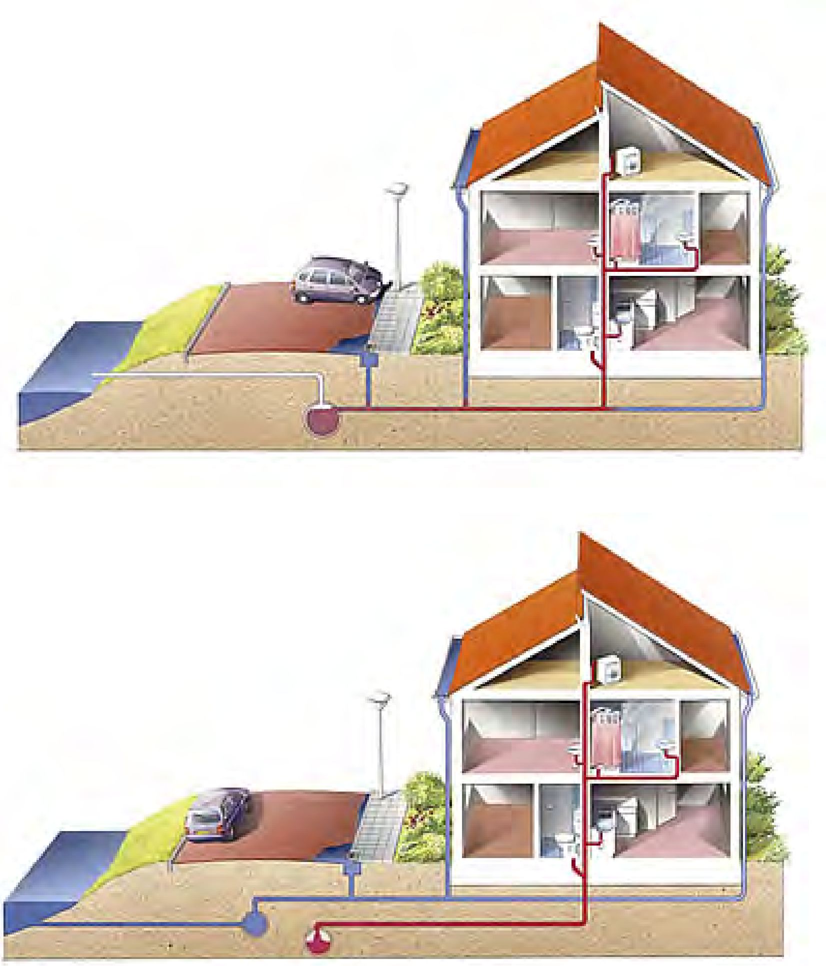


Figure 4.24 Combined sewer and separated sewer
Source: Wageningen Municipality

Water efficiency

Water can be used more efficiently in Wageningen. The government wants to make people be more aware of the importance of the water and build a water efficient city in Wageningen. More water sources can be added to future water supply as rainwater, storm water, grey water and reclaimed water other than the ground water and surface water. For example, the roof rainwater can be used on toilet flushing and garden watering. House owner will also be happy if it cuts the water fees.

Definition of water efficiency:
Generally, water efficiency is the long-term ethic of saving water resources through the employment of water-saving technologies and activities. Vickers (2001) has defined the “water efficiency” as: “the accomplishment of a function, task, process, or result with the minimal amount of water feasible” or “an indicator of the relationship between the amount of water required for a particular purpose and the amount of water used or delivered“. Using water efficiently will help ensure water supplies for future generations.

Conclusion on existing water problems and solutions

According to Mr. Vliet, the current water plan will be “OK” to deal with the current situation. The water problems are solved to some extent already, and there is no "best" way to deal with it, each method has its own benefit. But there’s much more need to be done for the future uncertainty . "The current water plan can deal with the current water situation more or less, but in the future, according to the climate change, the current system will not fit anymore."

The water problem has already existed and will become more serious in the future. This thesis is aiming at a long-term (for the next 50 years) water plan based on different climate scenarios that provided a flexible water system that can adapted to the climate changes.

4.3.2 Problematic sites

Several sites had been marked with water related problems during the interview with Wageningen Municipality officer.

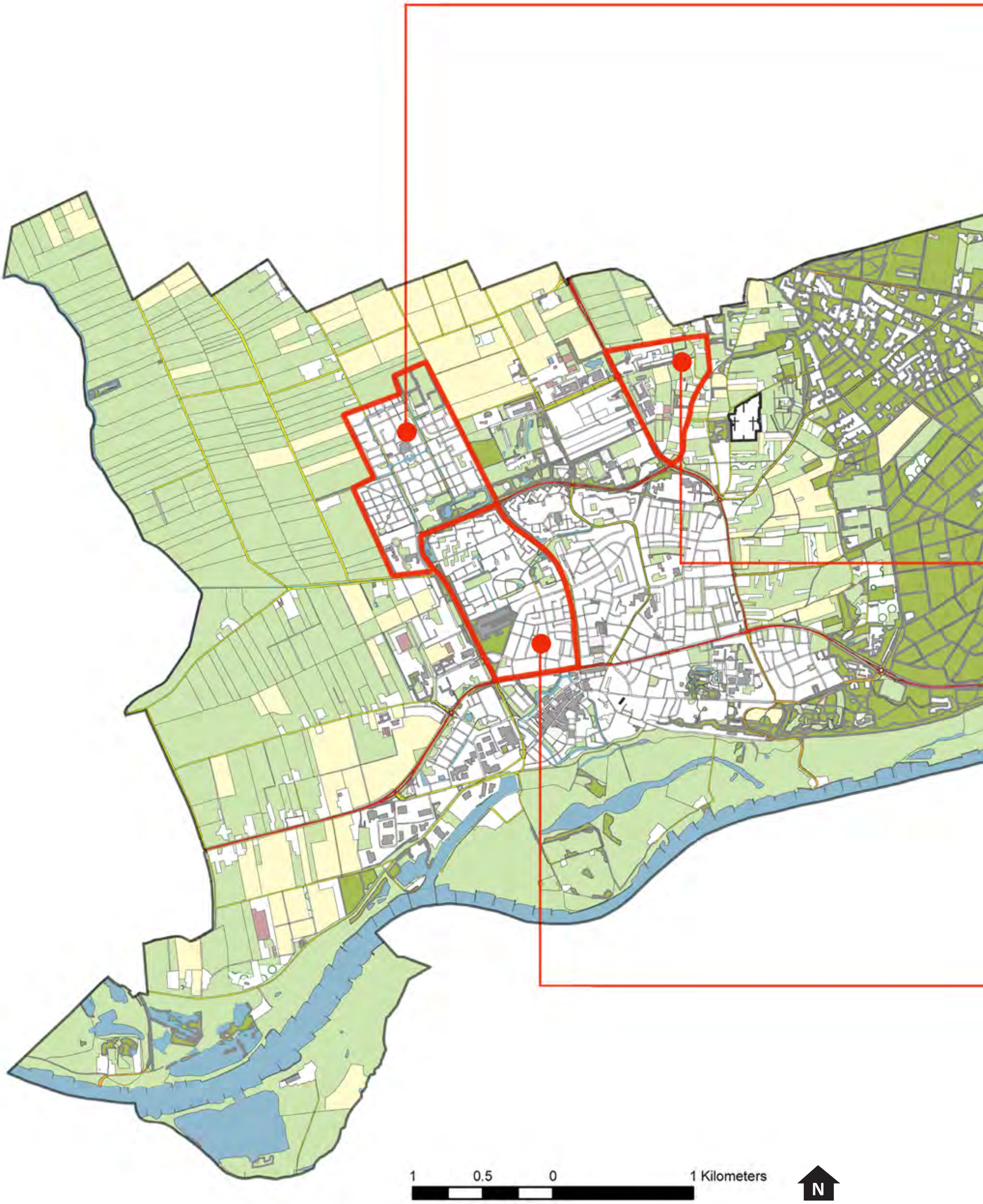


Figure 4.25 Problematic sites
Source: Wageningen Municipality

New residential area with open green area

The soil type of this area is peat and clay which make the water can not easily infiltrate into the ground. When a rain storm comes, the water is easily gathering on the streets. And since the ground water level is quite close to the surface at this place, the problem of upward seepage is quite obvious. Although there is a big water pond, the water storage need is still large.

Student house with some offices

It situated at the foot of mountain Veluwe. The run off water is quite easy to gathering here. Some students have report the overflows in this area.

Old residential area with some industry

The buildings are quite old with old sewer system that rainwater is not separated. Sewage water overflow is quite easy to happen here. The lack of open water makes the current situation even worse in this area.

Chapter 5

The "waterop-gave" (the water storage requirement)

Index

5.1 The possibility of Wageningen to be a self-sufficient system

Hydrology circulation in a water system

One of the main goals of this thesis is to make the Wageningen water system become 100% self-sufficient. Modeling the water system in Wageningen is a way to test the possibility. Figure 5.1 shows the components of hydrologic cycle in an open system. The water keeps moving inside a system through the form of precipitation, evaporation, groundwater inflow and outflow, groundwater exchange with surface water, surface water inflow and outflow.

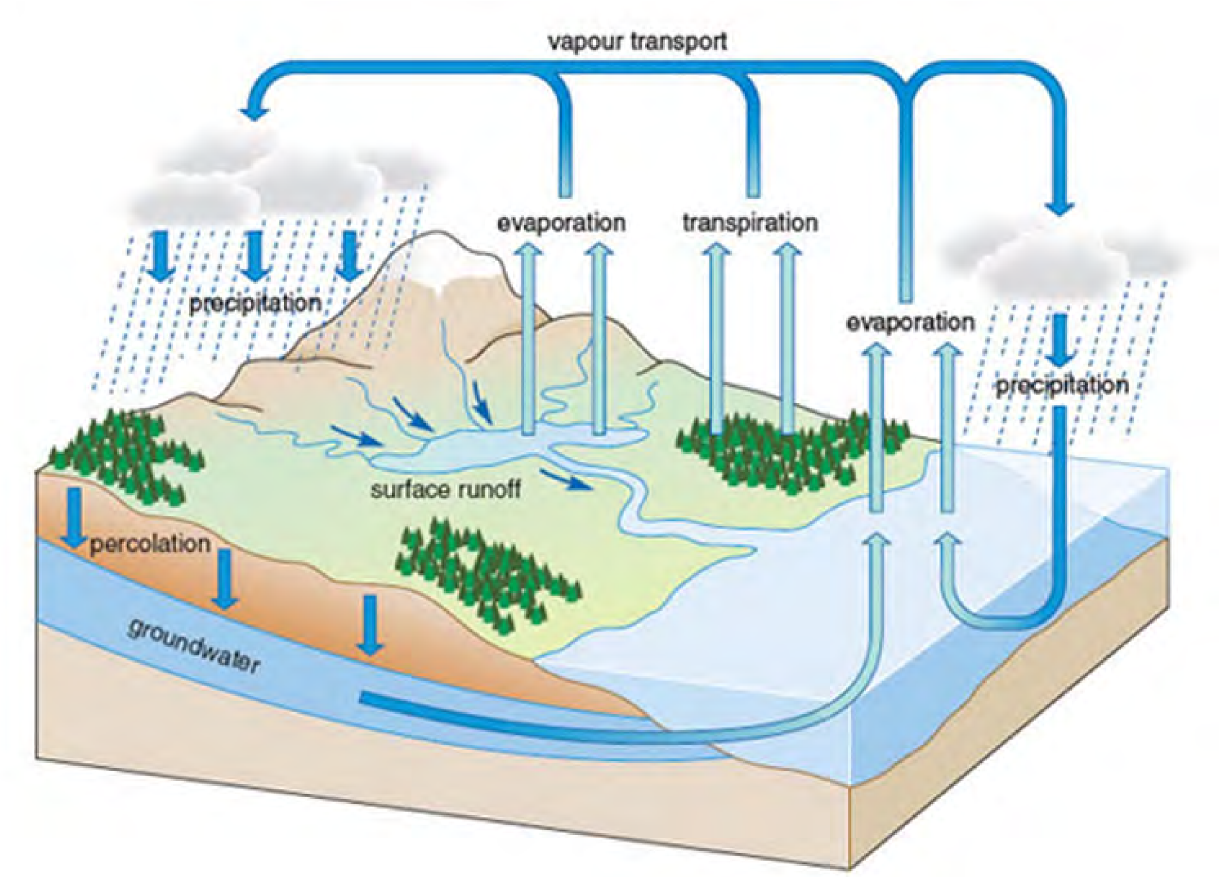


Figure 5.1 Components of hydrologic cycle in an open system: the major inflows and outflows of water from a parcel of land.
Source: Houghton, 2004

Although these water movements are always going on, there is a balance inside all these water movements. According to it, Wageningen water system can be modeled as follows:

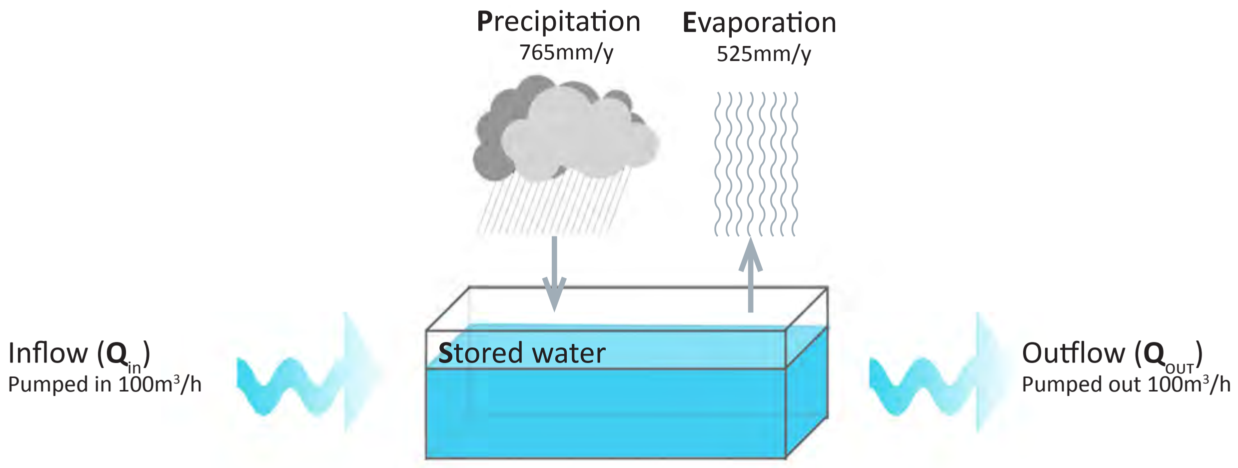


Figure 5.2 Wageningen water system model
Source: data from Wageningen Municipality

Modeling the Wageningen water system

Based on the System Hydrologic Budget (Todd & Mays 2005), for Wageningen, the ground water storage is stable throughout the year, so the formula is:

$$\mathbf{P-E+(Q_{in}-Q_{out})=S}$$

P=precipitation
Q_{out}=surface water flow out, Q_{in}=surface water flow in
E= evaporation
S=water storage

For a self sufficient water system, it doesn’t received from and send out any water, which means $Q_{out}-Q_{in}=0$. Therefore, the maximum storable water(S) inside Wageningen is:

S=P-E

=(Precipitation - Evaporation)* Area
=(765mm-525mm)*32.352km²
=7,764,480m³

In Wageningen, the annual water consumption currently stands at 2,050,904m³. And it keeps a growth trend at a rate of 42m³/year (140liter*300person) by population expansion. The yearly water consumption in Wageningen is 2,050,940m³ and the water loss in dry summer is 2,315,750m³.

It's possible to build a self-sufficient water system in Wageningen

Obviously, Wageningen can supply more than enough water for itself: 7,764,480m³ **(storable water)**>2,050,940m³ (**water consumption)** + 2,315,750m³ (**water loss in summer)**.

At present, there’s no seasonal water storage in Wageningen, the excess water just goes out the system as outflow. Meanwhile the city is consuming huge amount of clean tap water and suffering from summer drought. According to Tjallingii(2008)’s theory, the best way to make the water system more efficient is “closing the circle” and “cascading”, which means “store a surplus of water and use it to prevent shortage” and “keeping water long and keeping it clean”. If the storable water is enough for people’s water consume and can compensate the water loss in summer, the Wageningen system can be self-sufficient theoretically.

So, how much water does Wageningen need to store?

5.2 Calculated figures from the water board about peak discharge

The national discharge standard used by the water board is 1.4 l/s/ha after a storm with a return period of once every 10 years (T = 10). That means in urban areas, 10% of the gross surface must be reserved for urban water storage. Obviously, Wageningen does not meet these requirements. The govement already considers about 8 ha extra required retention in the urban area(Oliemans,2005). An additional difficulty is to realizing the retention within the urban environment. Here are some major possible retention sites:

8 ha extra water retention needed for rain storm in urban area according to Wageningen Municipality

-The Born of the University campus.
There is a plan includes several large buildings in the Born (94 ha). Besides that, extra water can be realized for increased water drainage after rain storms in this site. If possible, the stored water will be used as input for the Wageningen waterbodies. In addition, a number of additional storage ponds on the Born are built to store and purify seepage water from the area between the Mansholtlaan and Dijkgraaf.

-Between Kortenoord and Science Park
The municipality and Wageningen UR jointly faced with the task to further develop Wageningen as the City of Life Sciences. For this purpose, new and existing locations are set up to refurbished. Kortenoord is a redevelopment area. Municipality and the Wageningen UR have agreed on the re-developments in the Kortenoord, the Water storage has a significant place in the development plan. The area offers good opportunities for water retention since Kortenoord located at the end of the urban drainage system. There will be 14.5% of the development area of about 60 ha are used for water storage (8.7ha).

8.7ha

-Expansion of industrial park Nude
The expansion of the industrial park Nude (18 ha) also provides a good opportunity to realize additional retention. Also in this area, 14.5% of the development area will be used for water storage. (2.61ha)

2.61ha

Figure 5.3 Possible water retention site in Wageningen
Data Source: Wageningen Water plan

4-6 ha extra water retention in Binnenveld

In 1998 the water board ‘Vallei and Eem’ has done several (model) calculations and concluded that the water system of Wageningen needs lots of extra water retention. The water from the urban area of Wageningen flows very fast in to the rural area (Binnenveld), causing problems there. They calculated an area of between 4 and 6 ha with 11 series of rainfall situations with a probability of occurrence once in ten years. The series consists of long and short rainfall situations. The water storage amount was calculated based on the model output and "the water that flows normally from a non-urban area" (based on the ground water table, like Wageningen was not build).

10% plus according to the climate change

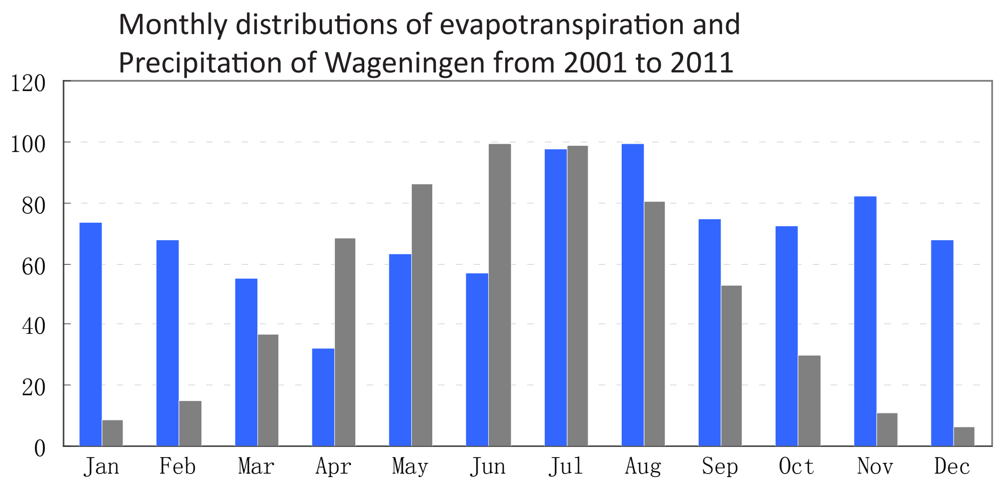
This calculation didn’t conclude the climate change in those days ('98-99) since there were no figures about climate change, and then they adjusted it as 10% plus to the formal calculation according to the climate change.

After the Wageningen Municipality separated the rain water from the sewer system and infiltrated into the ground in the east part of Wageningen. More rainwater can be stored. 8.8ha water storage is needed in the future according to Wageningen Municipality. However, for the urban area, there is little space for developing surface water. Therefore, techniques are needed in the water system developement plans that makes the urban area also benefit from the stored water.

The 8.8 ha water retention needs is only for the urban area without any seasonal sotrage consideration. In the following chapter, the water will be stored as much as possible for a resilient water system.

5.3 Seasonal storage

The precipitation and evaporation varies a lot between seasons. By analyzing 10 years’ (from 2001 July to 2011 July) precipitation and evapotranspiration data of Wageningen (source: KNMI, Appendix 5.1), I found that from April to



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation	73.37	67.92	55.23	32.01	63.15	57.09	97.69	99.48	74.46	72.61	82.22	67.98
Evapotranspiration	8.7	14.81	36.97	68.29	85.87	99.13	98.99	80.18	52.88	29.66	11.14	6.38

Figure 5.4 Monthly distributions of evapotranspiration and precipitation of Wageningen from July 2010 to July 2011
Data Source: KNMI, Calculation by author

July, the evapotranspiration excess the precipitation. It means the rainwater can not compensate the amount of water evaporate into the air. Thus, the drought probably appears and causes more water consumption. In the dry summer, the soil loses much moisture to the air, thus extra watering is required mainly by plant growth. However, the seasonal storage is usually being ignored by people. In fact, the water requirement during the dry period is compensate by more tap water consumption. Take the water consume statistic of 2009 and 2010 for example, in 2009, the Wageningen consumes 1,902,096m^3 of water for the whole year, while in the 2010, which is a dry year, it consumes 2,050,904m^3. That is 14,880m^3 increase in the water consumption. In the former chapter I discussed the advantages of seasonal storage to a certain area under the instruction of the ‘Two guiding principles’ (Tjallingii, 2006). In this case, the following passages will make an in-depth discovery of the amount of seasonal storage water of the Wageningen to avoid the drought.

Monthly uneven precipitation and dry summer ask for the seasonal storage

The following calculation uses the climate data from the nearest station De Bilt (KNMI) as the Wageningen climate data. The calculation method is based on Hamers'(2009) calculation for seasonal storage.

Figure 5.5 KNMI station: De Bilt
Source: www.knmi.nl

The precipitation and evaporation data of the past 10 years (2001-2011) are used to study the need seasonal water storage.

Precipitation data from 2001 to 2011:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	86.1	63.2	23.7	7.8	30.2	114.2						
2010	40.4	76.6	54.1	30.4	65.6	17.9	76.7	155.1	89.8	87.7	82.6	42.6
2009	53.1	54.7	47.8	19.6	64.7	53.2	106.5	46.5	32.7	89.3	119.8	83.7
2008	96.2	39	91.4	33.3	32.6	39.5	126.8	113.3	99.7	90.9	90	23.6
2007	103.6	67.4	84.2	0.2	137.8	90	159.8	41.8	96.2	31.7	58.2	75.9
2006	14.6	58.3	104.2	39.2	90.2	17.5	14.6	180	7.7	108.9	92.3	74.5
2005	53	72.9	49.3	62.8	54	51.2	158.4	95.5	63.2	55.6	97.1	55.8
2004	122.8	78.8	41.3	32.4	30.6	68.9	121.9	126.8	62	47.4	75.3	45.9
2003	76	29	23.4	45.5	91.7	34.1	29.2	8.4	51.3	84	39.2	95.5
2002	77.9	139.3	32.9	48.9	34.1	84.4	96.5	111.7	31.6	90.3	82.7	88.8
2001							86.5	115.7	210.4	40.3	85	93.5
Average	72.37	67.92	55.23	32.01	63.15	57.09	97.69	99.48	74.46	72.61	82.22	67.98

Figure 5.6 Monthly Precipitation of Wageningen from July 2001 to 2011
Data Source: KNMI, Calculation by author

Evaporation data from 2001 to 2011:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	8.8	12.7	41	78.6	93.7	92.2						
2010	8.6	11.2	36.3	72.4	75.3	112	113.5	69.8	47.1	29.2	9.5	5
2009	9.7	11.2	35.1	71.9	91.4	100	100.8	93.2	53.8	27.8	10.1	6.5
2008	8	19.4	30	60.7	99.3	100.8	90.5	71.5	48.5	28.8	10.5	7.7
2007	8.3	13.4	39	87.2	84.4	87.4	86.1	82.8	45	29.1	10.9	7.8
2006	8.9	11	34.2	58.2	83.4	103.8	127.8	65.3	60.8	28.9	12.3	5.9
2005	10.7	15.1	32.3	62	85.9	106.5	84.7	79.8	58.6	35.9	12.2	7.5
2004	7	15.1	33.7	62.4	86.7	86.6	91.2	83.5	58.1	29.3	9.8	5.4
2003	7.9	20.8	46	69.4	79.3	109.4	102.9	93.8	57.4	29.1	12.3	6.6
2002	9.1	18.2	42.1	60.1	79.3	92.6	91.8	77.8	56.3	27.8	12.7	5.1
2001							100.6	84.3	43.2	30.7	11.1	6.3
Average	8.7	14.81	36.97	68.29	85.87	99.13	98.99	80.18	52.88	29.66	11.14	6.38

Figure 5.7 Monthly Evaporation of Wageningen from July 2001 to 2011
Data Source: KNMI, Calculation by author

Average moisture lost in 2001 to 2011:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pre	73.37	67.92	55.23	32.01	63.15	57.09	97.69	99.48	74.46	72.61	82.22	67.98
Eva	8.7	14.81	36.97	68.29	85.87	99.13	98.99	80.18	52.88	29.66	11.14	6.38
Eva-Pre	-64.67	-53.11	-18.26	36.28	22.72	42.04	1.3	-19.3	-21.58	-42.95	-71.08	-61.6

Figure 5.8 Monthly Evaporation and precipitation difference analysis of Wageningen from July 2001 to 2011
Data Source: KNMI, Calculation by author

The total amount of excess evaporation is 36.28+22.72+42.04+1.3=102.34mm as the red figure shows in Figure 5.4. That means in the dry season, the total moisture loss is 102.34mm. In Wageningen, 6% of the gross surface is water bodies, 24% is urban area and 70% is green area. This amount of water loss ideally will cause 0.1m decrease of the water body in three months and 102.34mm*22.628km2= 2,315,749.52m3 water loss in the green area. But it won’t affect too much in the urban area. It’s a really huge and non-ignorable amount of water loss for balancing the water budget.

275ha seasonal storage required in dry summer for the past ten years

For the past 10 years, the average required seasonal water storage in dry summer: 2,315,749.52m^3
When set the average height of the catchment as 0.5m, the surface for water retention is 463 ha. Minus the existing water surface of 188 ha, the needed extra water storage is 275 ha.

2003 and 2006 are very dry years, using the data of these two years to see the water needs in extreme dry years.

Year2003 :

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pre	76	29	23.4	45.5	91.7	34.1	29.2	8.4	51.3	84	39.2	95.5
Eva	7.9	20.8	46	69.4	79.3	109.4	102.9	93.8	57.4	29.1	12.3	6.6
Eva-Pre	-68.1	-8.2	22.6	23.9	-12.4	75.3	73.7	85.4	6.1	-54.9	-26.9	-88.9

Figure 5.9 Monthly precipitation and evaporation of Wageningen in 2003
Data Source: KNMI, Calculation by author

The total amount of excess evaporation is 22.6+23.9+75.3+73.7+85.4+6.1=287mm in 2003.

Year 2006:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pre	14.6	58.3	104.2	39.2	90.2	17.5	14.6	180	7.7	108.9	92.3	74.5
Eva	8.9	11	34.2	58.2	83.4	103.8	127.8	65.3	60.8	28.9	12.3	5.9
Eva-Pre	-5.7	-47.3	-70	19	-6.8	86.3	113.2	-114.7	53.1	-80	-80	-68.6

Figure 5.10 Monthly precipitation and evaporation of Wageningen in 2006
Data Source: KNMI, Calculation by author

The total amount of excess evaporation is 19+86.3+113.2+53.1=271.4mm in 2006.

In the extreme dry year like 2003, The total amount of excesses evaporation is 287mm as the red figure shows in Figure 5.9. This figure is even much bigger than the past 10 years average. That show even greater water storage is need to avoid drought in the summer. That means, 287mm*22.628km^2=6,494,236m^3 water loss. When set the average height of the catchment as 0.5m, the surface for water retention is 1298 ha. Minus the existing water surface of 188 ha, the needed extra water storage is 1110 ha.

1110ha seasonal storage required in extreme dry years of 2003

5.4 Peak storage

CSOs and surface flood occur during extreme rain storms

Wageningen have abundant rainwater resource. It can be utilized as a future water resource which brings much benifit to the local residents. However, there will be an surplus of the water. Especially at extreme showers or long period rain, when the precipitation amount excess the drainage capacity, the annoying things will happen: When the drainage system is overwhelmed by stormwater, waste water may appear on surface, producing detrimental environmental impacts. Then the surface flood appears when the water level raises to the road level. Stormwater runoff can carry pollutants, overwhelm urban infrastructure, erode stream channels, and degrade aquatic habitats. Therefore, the continously pumping or extra catchment are needed.

Overflow sewage will occur when: Precipitation> Drainage capacity + Pumping capacity (*This draft calculation formula come from the discussion with Municipality officer Richard van Vliet). The sewage capacity in Wageningen is : 16,400m^3 (10 mm over 164 hectare paved surface, source form Water board Vallei and Eem). The pumping capacity is 2.4 m^3/h. That means if the precipitation excess 121mm per day, the sewer will full. The bad smell of the sewer overflow is really annoying and the death of fish and water plants is even worse. Therefore, the government is trying to separate the rainwater from the sewer. This action will decrease the CSOs occurrence but also add a big loan on the surface water storage during extreme rainstorms.

That means more surface floods will happen in the future since it receives more rain water. It won't make too much trouble in the agriculture area and natural area like forest and river front, therefore, surface flood prevention is focused on the build up area.

In this thesis, the flood pattern is used to calculate the needed water storage during extreme rainstorms.

According to the water board’s research, there are several areas in Wageningen with higher risk of flooding during extreme rainstorms. The 13 red areas in figure 5.11 show the areas where the water level will rise above the controlling height respectively. The water level increase is different due to the location of the rainwater outlets, the area of surface water and the size of the culverts. Therefore, water storage requirements are different in those areas.

13 risky area of surface flood in the urban area

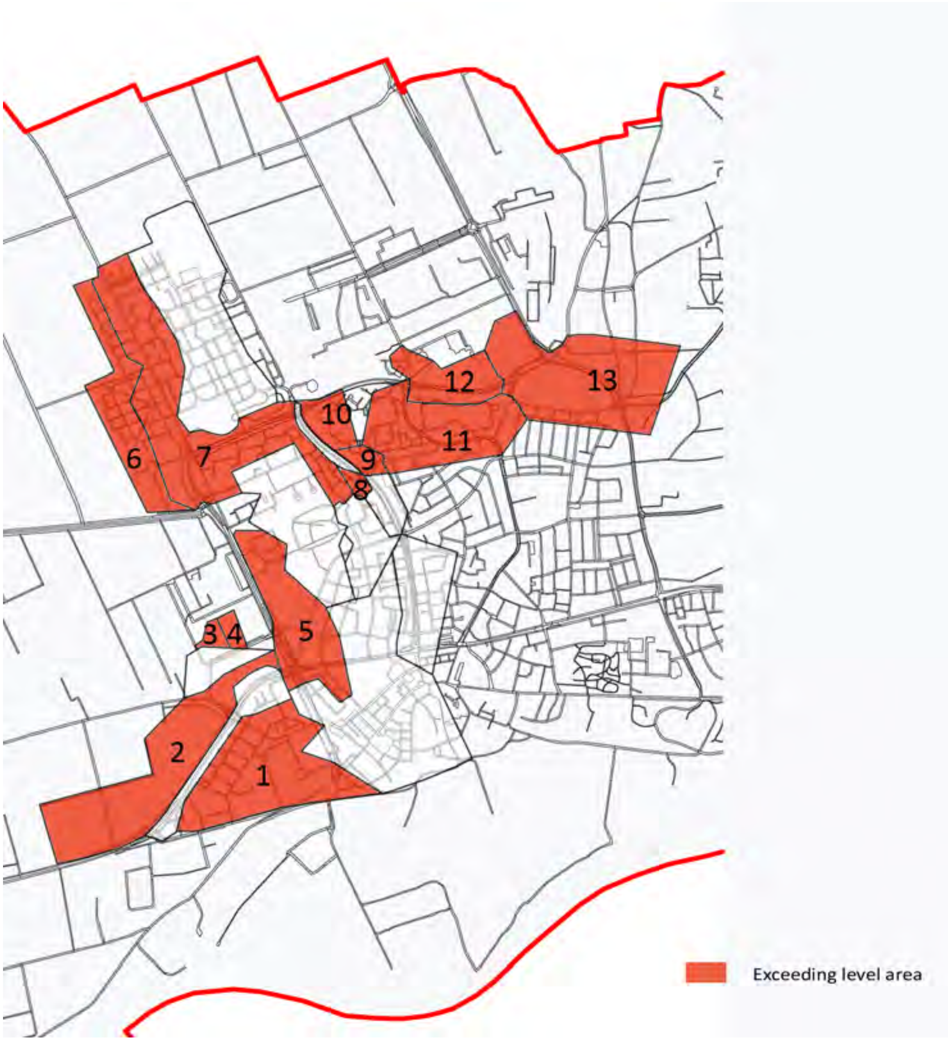


Figure 5.11 Exceeding area of Wageningen in floods
Source: Water board Vallei and Eem

Those red areas are most dangerous areas when a rainstorm comes. In the following pages, the exceeding rainwater will be calculated according to 1/10 years flood pattern and 1/100 years flood pattern. Thus, we can see where and how much water storage is needed to avoiding the floods.

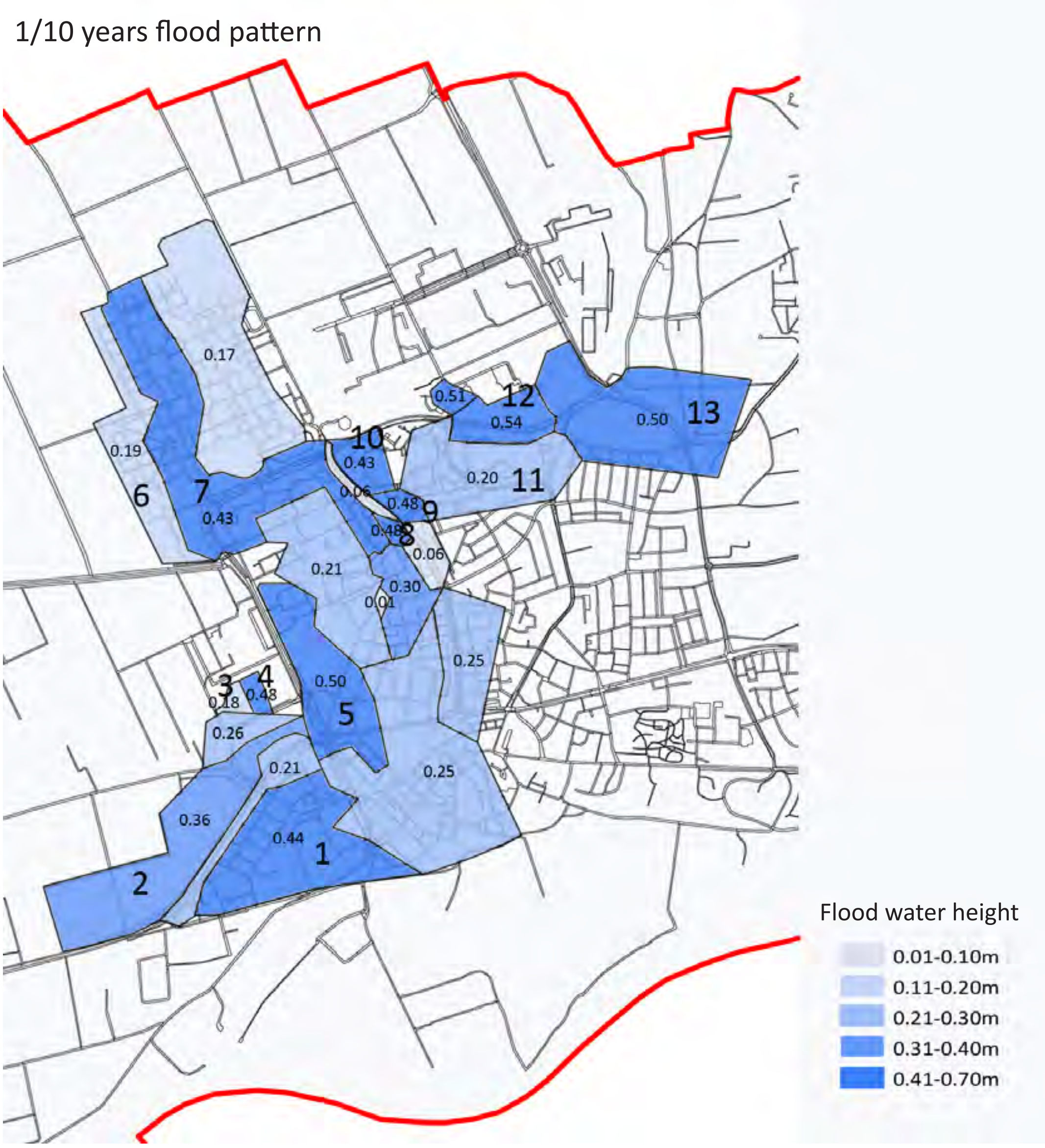


Figure 5.12 1/10 years rainstorm flood pattern of Wageningen
Source: Water board Vallei and Eem

Required water storage in 1/10 years extreme precipitation
Required water storage= flood water height * area

	Area (m2)	Flood water height(m)	Required water storage(m3)
Area1	309501	0.45	139275.45
Area2	321843	0.53	170576.79
Area3	13242	0.44	5826.48
Area4	15181	0.77	11689.37
Area5	206668	0.5	103334
Area6	165475	0.58	95975.5
Area7	434909	0.42	182661.78
Area8	11324	0.58	6567.92
Area9	22603	0.58	13109.74
Area10	51982	0.42	21832.44
Area11	233672	0.41	95805.52
Area12	101533	0.54	54827.82
Area13	357015	0.53	189217.95
Total			1090700.76

Figure 5.13 Required water storage according to 1/10 years flood pattern
Source: calculated by author

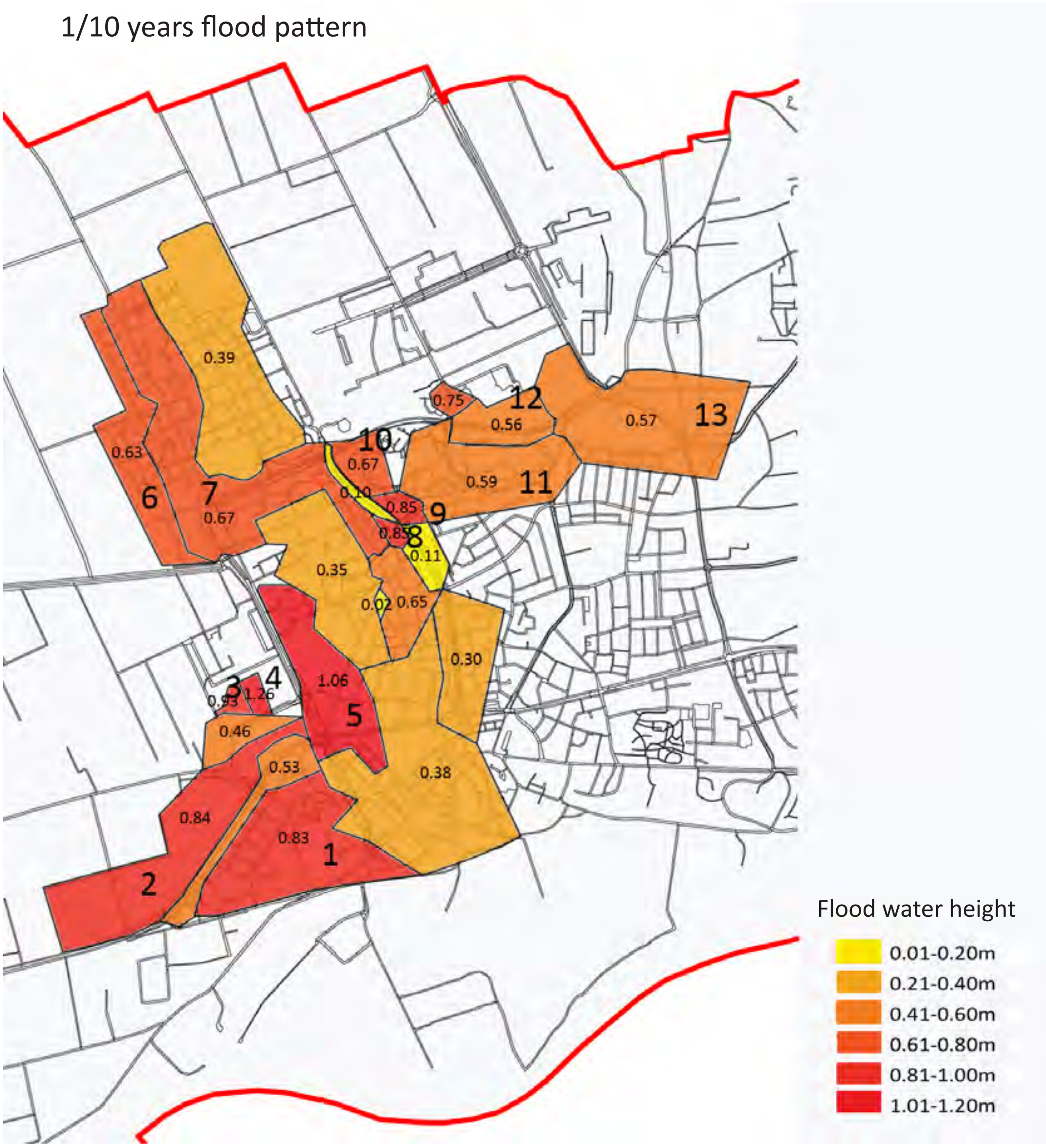


Figure 5.14 1/100 years flood pattern of Wageningen
Source: Water board Vallei and Eem

Required water storage in 1/100 years extreme precipitation
Required water storage= flood water height * area

	Area (m2)	Flood water height(m)	Required water storage(m3)
Area1	309501	0.83	256885.83
Area2	321843	0.84	270348.12
Area3	13242	0.93	12315.06
Area4	15181	1.26	19128.06
Area5	206668	1.06	219068.08
Area6	165475	0.63	104249.25
Area7	434909	0.67	291389.03
Area8	11324	0.85	9625.4
Area9	22603	0.85	19212.55
Area10	51982	0.67	34827.94
Area11	233672	0.59	137866.48
Area12	101533	0.56	56858.48
Area13	357015	0.57	203498.55
Total			1635272.83

Figure 5.15 Required water storage according to 1/100 years flood pattern
Source: calculated by author

Through the statistic calculation, we can find that:

30ha peak storage requirement during 1/10years floods and 139ha peak storage requirement during 1/100years floods

For an 1/10 years flood, the required water storage in the urban area is 1,090,700.76m^3. When setting the average height of the catchment as 0.5m, the surface for water retention is 218 ha. Minus the existing water surface of 188 ha, the needed extra water storage is 30 ha.

And for an 1/100 years flood, the required water storage in the urban area is 1635272.83m^3. When setting the average height of the catchment as 0.5m, the surface for water retention is 327 ha. Minus the existing water surface of 188 ha, the needed extra water storage is 139 ha.

5.5 “Wateropgave” according to Climate scenarios

Impacts of climate change on water system

The climate of the Netherlands will change a lot in the following 50 years. KNMI made a scenario for the changing climate till 2050 based on two basic changes: change in air circulation and temperature increase. Changes in the precipitation patterns have a major influence on the stream systems in the Netherlands. This is due to the fact that in the coming decades the water system in the Netherlands will faced a higher discharge of water during the winter, drought situations during the summer and more frequent occurrences of extreme peak discharges throughout the year. In addition, the water temperature is also gradually rising as a result of climate change.

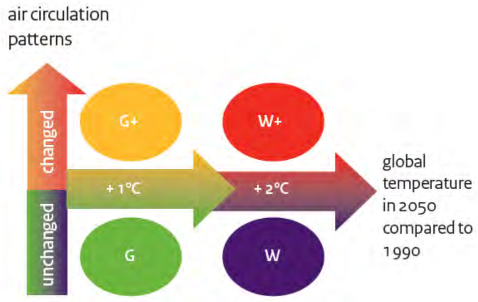


Figure 5.16 The KNMI’s 06 scenarios
Source: KNMI

G	Moderate*	1°C temperature rise on earth in 2050 compared to 1990 no change in air circulation patterns in Western Europe
G+	Moderate +	1°C temperature rise on earth in 2050 compared to 1990 + milder and wetter winters due to more westerly winds + warmer and drier summers due to more easterly winds
W	Warm	2°C temperature rise on earth in 2050 compared to 1990 no change in air circulation patterns in Western Europe
W+	Warm +	2°C temperature rise on earth in 2050 compared to 1990 + milder and wetter winters due to more westerly winds + warmer and drier summers due to more easterly winds

*Legend for the KNMI’06 climate scenarios. * ‘G’ is derived from ‘Gematigd’ = Dutch for ‘Moderate’*

		G	G+	W	W+
	Global temperature rise	+1°C	+1°C	+2°C	+2°C
	Change in air circulation patterns	no	yes	no	yes
Winter [3]	average temperature	+0.9°C	+1.1°C	+1.8°C	+2.3°C
	coldest winter day per year	+1.0°C	+1.5°C	+2.1°C	+2.9°C
	average precipitation amount	+4%	+7%	+7%	+14%
	number of wet days (≥ 0.1 mm)	0%	+1%	0%	+2%
	10-day precipitation sum exceeded once in 10 years	+4%	+6%	+8%	+12%
	maximum average daily wind speed per year	0%	+2%	-1%	+4%
Summer [3]	average temperature	+0.9°C	+1.4°C	+1.7°C	+2.8°C
	warmest summer day per year	+1.0°C	+1.9°C	+2.1°C	+3.8°C
	average precipitation amount	+3%	-10%	+6%	-19%
	number of wet days (≥ 0.1 mm)	-2%	-10%	-3%	-19%
	daily precipitation sum exceeded once in 10 years	+13%	+5%	+27%	+10%
	potential evaporation	+3%	+8%	+7%	+15%
Sea level	absolute increase	15-25 cm	15-25 cm	20-35 cm	20-35 cm

[1] data on changes in 2100 can be found at www.knmi.nl/climatescenarios
[2] the climate in the baseline year 1990 is described with data from the period 1976 to 2005
[3] ‘winter’ stands for December, January and February, and ‘summer’ stands for June, July and August

Figure 5.17 Schematic overview of the four KNMI’06 climate scenarios
Source: KNMI

According to the KNMI's 06 scenarios, the former calculated water storage requirement for Wageningen will changes as follows:

	G	G+	W	W+
Average Precipitation in summer	+3%	-10%	+6%	-19%
Potential evaporation in summer	+3%	+8%	+7%	+15%
Moisture loss in dry summer (mm)	105.41	155.51	113.07	214.8
Seasonal storage (m^3)	2,385,217.48	3,518,880.28	2,558,547.96	4,860,494.4
When setting the average height of the catchment as 0.5m, the surface for water retention is	447 ha	703 ha	512 ha	972 ha
1/10 years extreme precipitation	+13%	+5%	+27%	+10%
Peak discharge (m^3)	1,232,491.86	1,145,235.8	1,385,189.97	1,199,770.84
When setting the average height of the catchment as 0.5m, the surface for water retention is	246 ha	229 ha	277 ha	240 ha

Figure 5.18 Water requirements according to climate change, calculation on appendix 5.2
Source: made by author

Currently, the Wageningen doesn't has any seasonal storage plan besides the 8ha extra water storage in the urban area. However, through the analysis and calculation, the actual water storage requirement is much bigger than that in the future. Due to the limited spaces, future water management has to deal with priorities.

259 to 784 ha water storage requirement for dry summer according to differnt climate secnarios

There is 188 ha existing open water. Therefore, when set the height of the catchement as 0.5m, for dry summer, the needed extra water storage is 275 ha. According to the KNMI 06’s climate scenario, in the G scenario, 259 ha extra water storage is needed. In the G+ scenario, 515 ha extra water storage is needed. In the W scenario, 324 ha extra water storage is needed. In the W+ scenario, 784 ha extra water storage is needed. To summarise, the needed water storage for dry summer is around 259 to784 ha according to the climate scenarios. This figure is an ideal situation that all the needed water can be charge inside the water cycle of Wageningen water system and the water loss in summer can be fully covered. In fact, this part of needed water now is compensating by the inflow water and tapped water. Thus, it can be put as the second priority. It can be gradually fulfilled In the future that aims at realizing 100% water self-sufficient till 2050.

For extreme rain storms, the needed extra water storage is 30 ha. According to the KNMI 06’s climate scenario, in the G scenario, 58 ha extra water storage is needed. In the G+ scenario, 41 ha extra water storage is needed. In the W scenario, 89 ha extra water storage is needed. In the W+ scenario, 52 ha extra water storage is needed. To summarise, the needed water storage for peak discharge is around 41 to 89 ha according to the climate scenarios. This requirement should be put as the first priority that aims at realizing 100% flooding resistance and water purification till 2050.

41 to 89 ha water storage requirement for peak discharge according to differnt climate secnarios

5.6 Conclusion of water needs

Conclusion of water storage needs in Wageningen

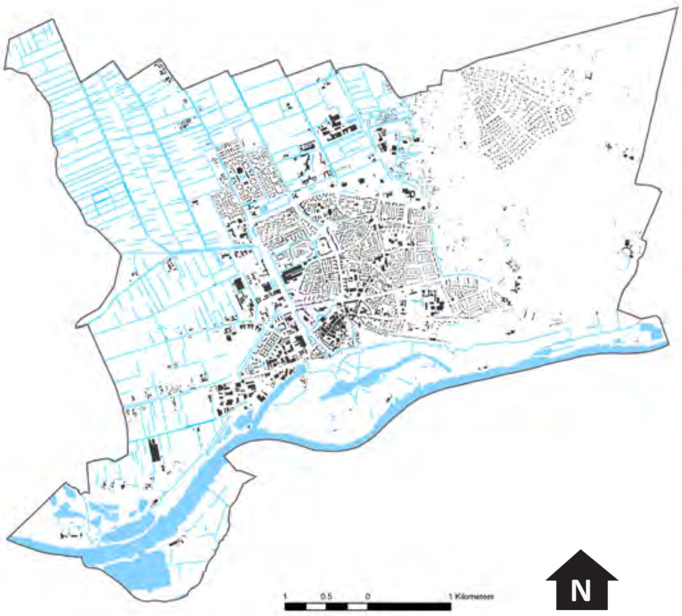
There are different water needs figures in the former pages. First, there is the water needs from Municipality which is based on the current situation. And then, there is calculated seasonal storage and peak storage. Finally, these figure changes according to the climate scenarios.

Figure 5.19 shows the result of the needed storage respectively in seasonal storage and peck storage under different situations. To build a self-sufficient future, according to former calculations, the needed extra water storage is (based on 0.5m storage pound):

		Current	G	G+	W	W+	2003
Seasonal storage (ha)		275	259	515	342	784	1110
Peak storage (ha)	1/10 years	30	58	41	89	52	No data
	1/100 years	139	No data	No data	No data	No data	No data

Figure 5.19 Extra water storage needs
Source: calculated by author

The water demand varies quite a lot under 4 scenarios in the future. This thesis will work on methods which deals with different situation.



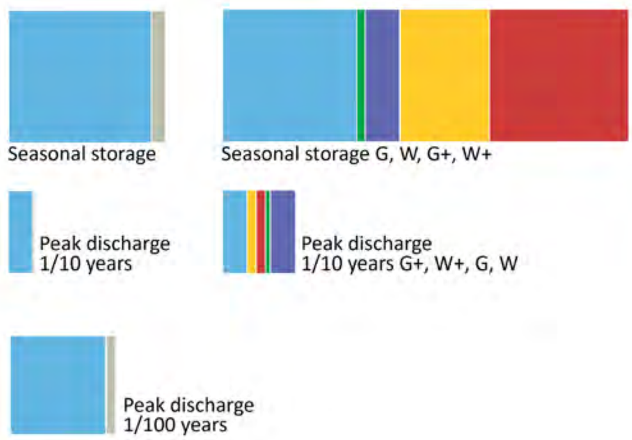


Figure 5.20 Extra water storage needs in Wageningen
Source: picture by author

Figure 6.2 shows when set the retention height at 0.5meter, the required water storage area for seasonal storage and peak discharge. Comparing to the gloss surface of Wageningen municipality, for the seasonal storage, the water retention requirement is really huge under the scenario G+, W+ and extreme year of 2003. It is not reasonable to build such big water retention inside Wageningen. The proper way to deal with this condition is to receive and expel water from external system. This thesis will build water storage that can satisfy the current, G and W condition which are275ha, 259 ha, and 342 ha.

G, W scenario water storage requirement will be fulfilled in this design

However, the 275ha, 259ha and 342ha is still a big figure for Wageningen. To minimize the occupation of existing lands, the height of the catchment can be raised according to different geography structure. In the lower northwest, the max height can be 0.8m, while in the southeast, the max height can be 1.2m. Even deeper catchment is also possible according to special technique like build impermeable layers.

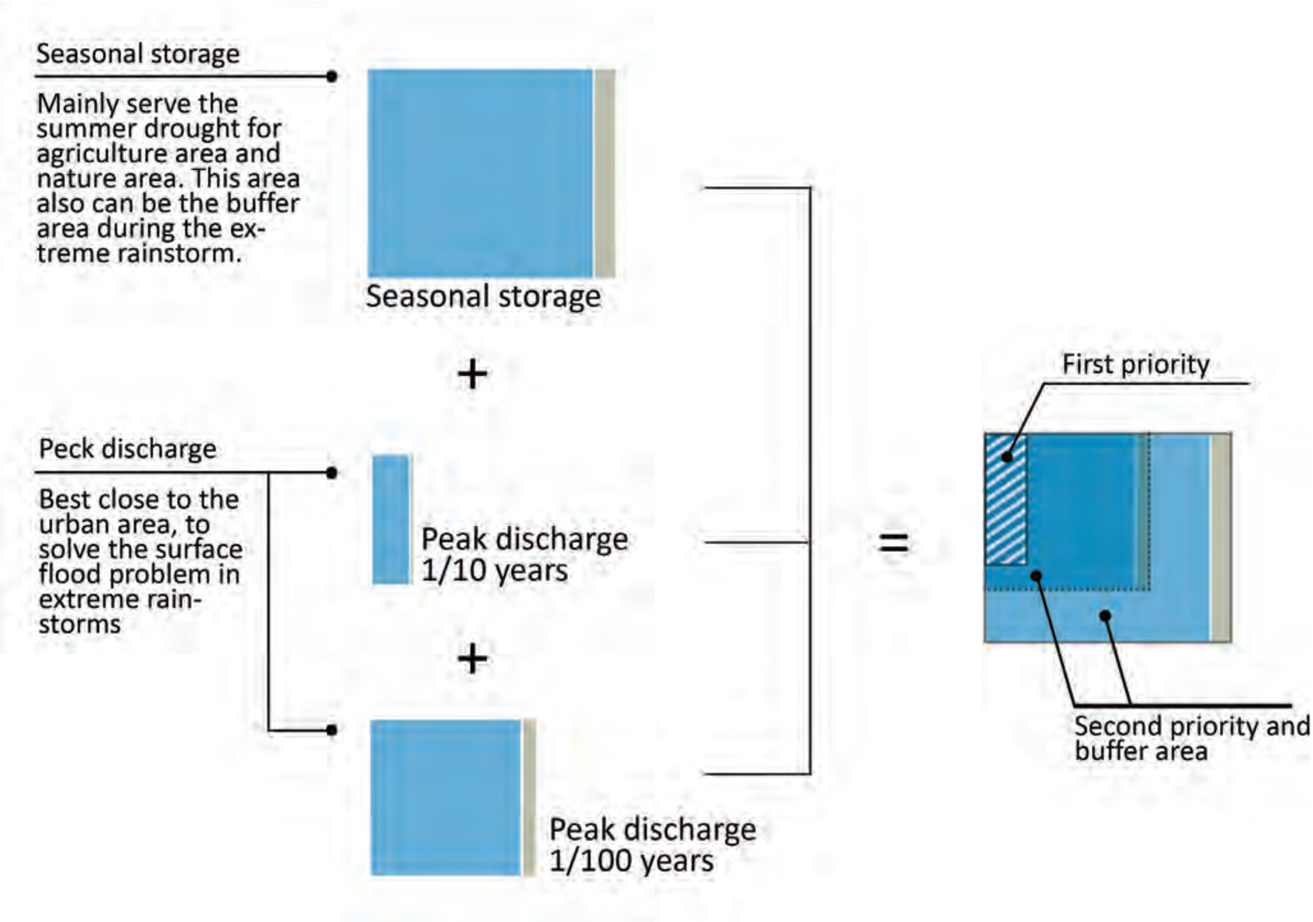


Figure 5.21 Relationship of different water storage needs and priorities.
Source: picture by author

There are two kinds of water storage needs including in this calculation, one kind is for the dry summer water loss caused by the high evaporation under high temperature, and the other one is for the surface flood water storage during extreme rainstorm. Integrating all these factors, the 1/10 years flood should be put at the fist priority considering the limited urban space while the 1/100 years flood and the seasonal storage should be put at the second place. For the seasonal storage, concrete storage basins are needed while for the peak discharge the storage can be temporary basins or buffer area.

One water catchment can be multifunctional to cover both requirement of seasonal storage and peak discharge

These storage needs can be mixed, so that one basin can be multifunctional for satisfying both needs. The catchment gradually collects the rainwater until the tank is full. When the summer drought occurs (from April till June), the stored water will be pumped out to farmlands. At the end of June, the water in the catchment will be almost fully pumped out. That leaves spaces for peak discharge for June, July and August which is when the extreme rainstorm happens in Wageningen. From figure 5.22, seasonal storage is much bigger than the peak storage needs. That is to say, if the Wageningen water storage can meet seasonal storage requirement, no extra space for peak discharge retention is need. The designed catchment can be used in turns. Figure 6.4 shows how the water retention works during one year’s time.

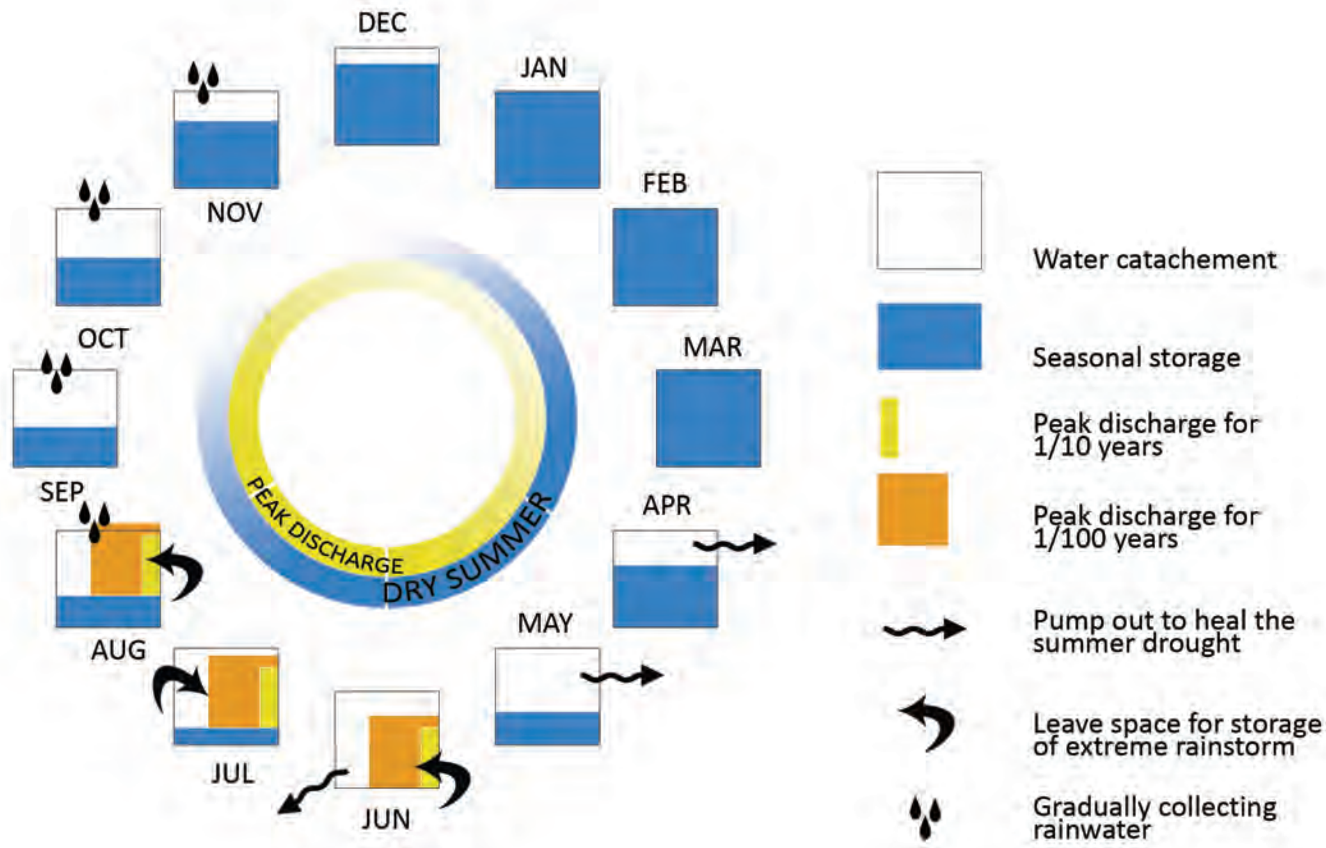


Figure 5.22 Monthly water distribution in main water retention
Source: picture by author

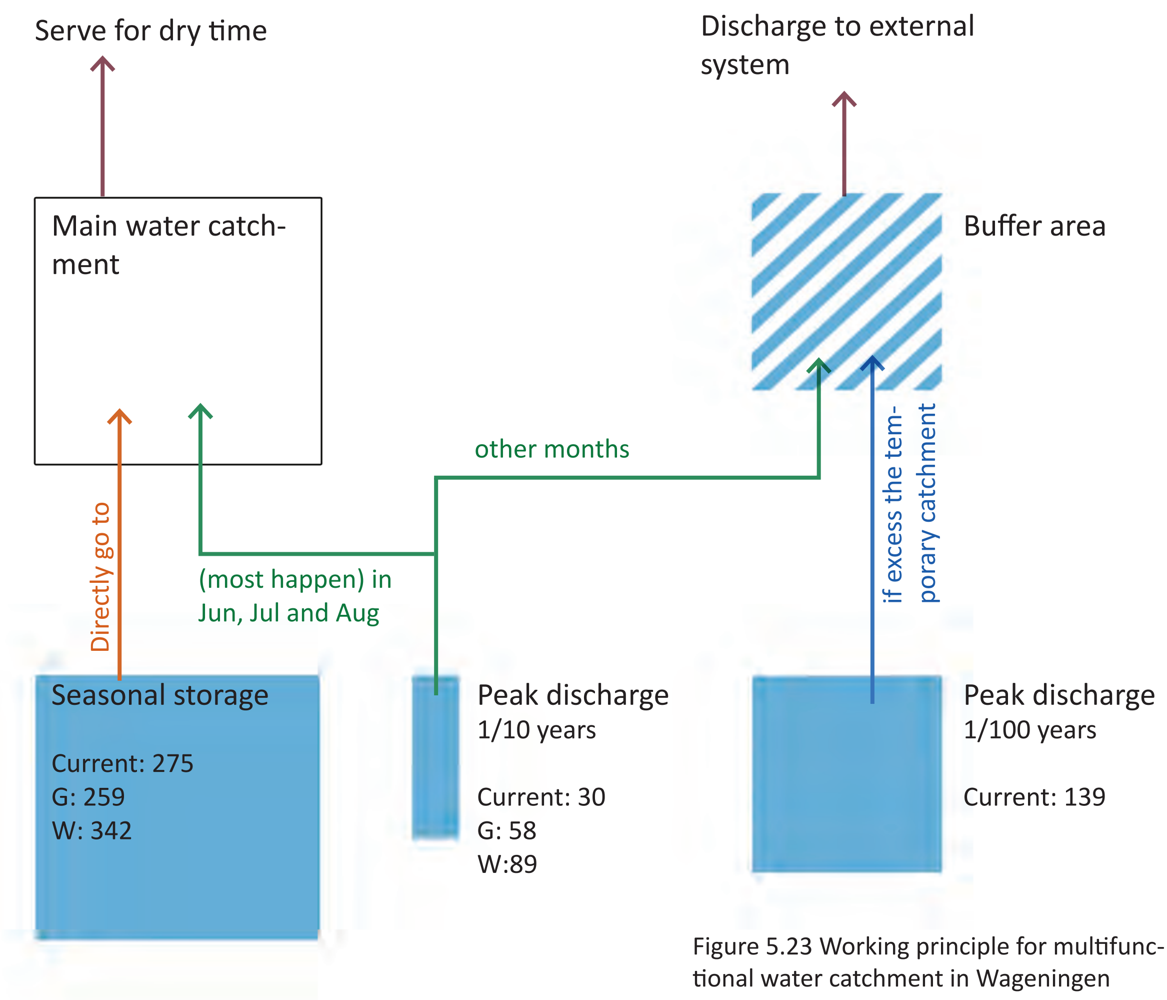


Figure 5.23 Working principle for multifunc-tional water catchment in Wageningen
Source: made by author

Working principle of the main water retention

Three types of water storages are included in Wageningen water system to im-prove the sustainablity and resilience. Main water catchments are huge open water storage tanks that hold water inside the local system. They collect excess rain water and serve it to the city in dry time. Temporary water catchment is sunken spaces in the urban area that can temporary hold the water in extreme rain storms. Buffer area is huge space in the agriculture area to receive pumped water form the city when the rain water excess the temporary storage capac-ity, and it will be discharge to the external system later. Figure 5.23 shows how these water storage works together.

6

Chapter 6

Concept and Design

Index

6.1 Zoom in the waterscape in Wageningen

Wageningen is located at the intersection of a number of typical landscapes: the moraine which runs from the Wageningen Berg to Lunteren, the Gelderland Valley, which spread till the Eemmeer and the river landscape of the (Lower) Rhine.

Within the municipal territory, the waterscape can be divided as the following districts: the Eng and Wageningen Berg (1), the Gelderland Valley and the Binnenveld (2) and the floodplains and river banks (3).

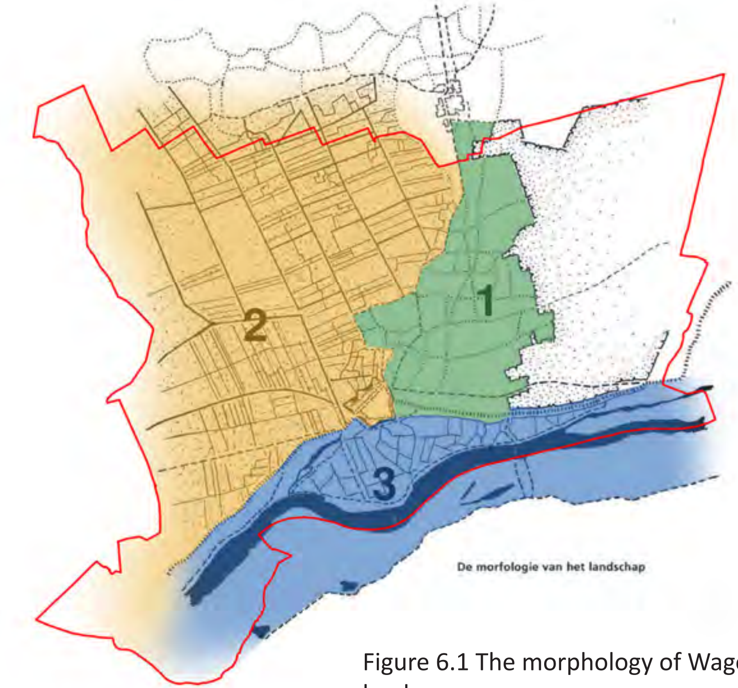


Figure 6.1 The morphology of Wageningen landscape
Source: Waterplan Wageningen

(1) The Eng and the Wageningen mountain

The Eng is an open, high and dry area locates on the lateral moraine till the forest of the Veluwe. Wageningen-Hoog forms a buffer between the city and the nature reserve on Veluwe. The soil is permeable coarse sand and the area has a deep water table (GT VII). The Eng is a rainwater infiltration area. The Eng runs through the neighborhoods like the Benedenbuurt and Hamelakkers. These districts are therefore suitable for the infiltration of rainwater into the ground.

Figure 6.2 The landscape of Eng and Wageningen mountain
Source: taken by Oranje Nassau Oord Bos

(2) Gelderland Valley and the Binnenveld

The field lies in the lowland area between Wageningen, Ede, Veenendaal and Rhenen. It is a wet area with a lot of visible water and high water tables (GT I, II and III6). The soil are peat and clay soils in the west and sandy soils in the west. Within the field, the peat has been extracted in the peat mining period. Now the area is part of the Ecological network and is designed as a quiet and natural area. The area is especially important for various types of grassland birds, small mammals and closed and riparian vegetation. In the foothills of the field, neighborhoods such as Noord-West, Ooststeeg and Tarthorst can be found. The high water table combined with the presence of impermeable clay soil makes water infiltration in these areas impossible. Storage of rainwater can be done only in watercourses.

Figure 6.3 The landscape of Binnenveld
Source: picture taken by Wrtb8mm

(3) Riverbanks and flood plains

Riverbanks and river landscape exist in the south Wageningen. The Wageningen floodplain contains a rich topography and relatively high altitude landscape. The floodplains are part of the Ecological Network in the Netherlands. Before and after flood periods, water presents in ponds which is created by clay mining for brick manufacturing. The floodplains are planed as natural wet park and provide a robust corridor between the Veluwe massief, the Binnenveld and Utrecht Ridge.

Figure 6.4 The landscape of riverbanks and flood plains in Wageningen
Source: taken by the author

6.2 Concept "Combined model"

The concept of the design on Wageningen waterscape is called "combined model" in this thesis. Sustainability is the main goal of this Wageningen waterscape design concept. For water issue, "sustainability implies that the supply of 'natural capital' is maintained. The use of renewable sources—such as water—should not exceed the rate of renewal, the use of nonrenewable resource—like fossil fuel—should be such that they will not be exhausted before alternative sources are available, and fundamental ecological processes and structures should be maintained" ("Water 21" project). In Wageningen Water system, sustainability means a water system can "keep the balance of the water system" and "clean it by nature process". According to different situation inside Wageningen (soil type, topography, land use, etc.), more than one water management models are applied to Wageningen water system. Generally, the infiltration model is applied to the high sandy soil northeast and the circulation model is applied to the lower peat and clay southwest. Figure 6.5 shows how the two different model combined together to serve the Wageningen water system.

Combined model for Wageningen water management: "keeping the balance of the water system"and "cleaning it by nature process"

Water system has been viewed as a second developing infrastructure in addition to the traditional traffic network according to Tjallingii's "two lane strategy". In this concept design, the function of the water system as developing infrastructure will be paid special attention to in building the future sustainability. The main goal of this thesis is to create a waterscape of 100% water self-sufficient, water balance, flooding resistance and purification till 2050. The designed system consists of several connected water basins which can hold more water inside the system and form a water cycle. Rainwater from the urban districts is separated form the sewer, collected by gutters and ditches and led to the new water storage basins. In the future water system, the water is kept clean by natural purification wetlands which offer good quality water in the dry summer period.

The storage of excess rainwater during extreme rainstorms can be treated differently since the construction density is quite high in the urban area. Temporary water storage places can be set to hold the excess water and it also can be pumped to the catchments during June to September. For other months, if the rainstorm came, the agriculture area can be the buffer area to temporally store this water.

In the urban area, the water system can be upgraded by reconnecting water bodies and ditches which form a water circulation. The water circulation connects all the water storage basins that enhance the water resilience and also receive clean water form the purifying wetland.

The location and the form of the combined model are based on the open space, topography, existing pumping station, flood pattern, etc. Different ways of implementing the needed water storage have been taken into consideration. Figure 6.6 shows the combined model for Wageningen on plan and section.

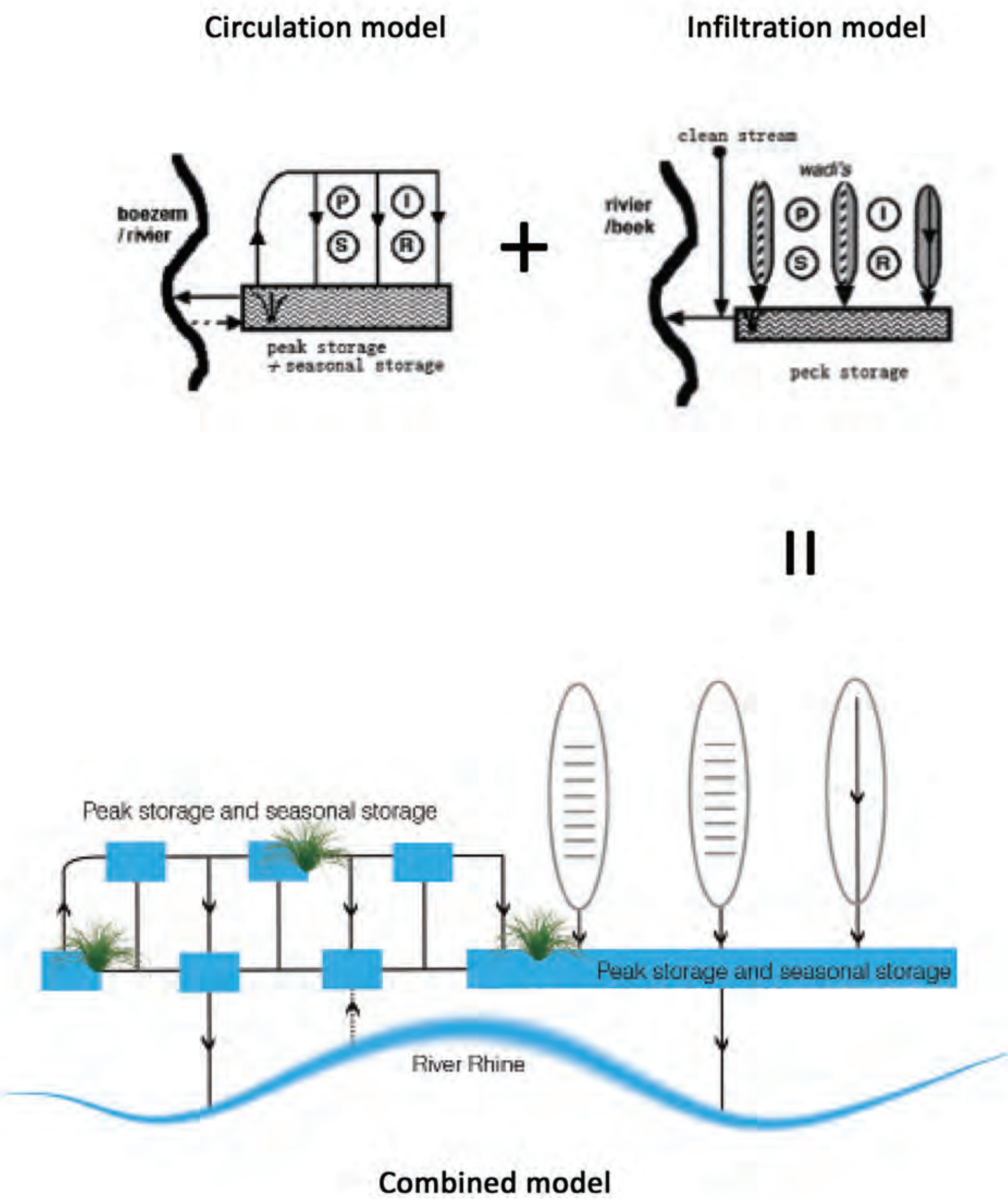
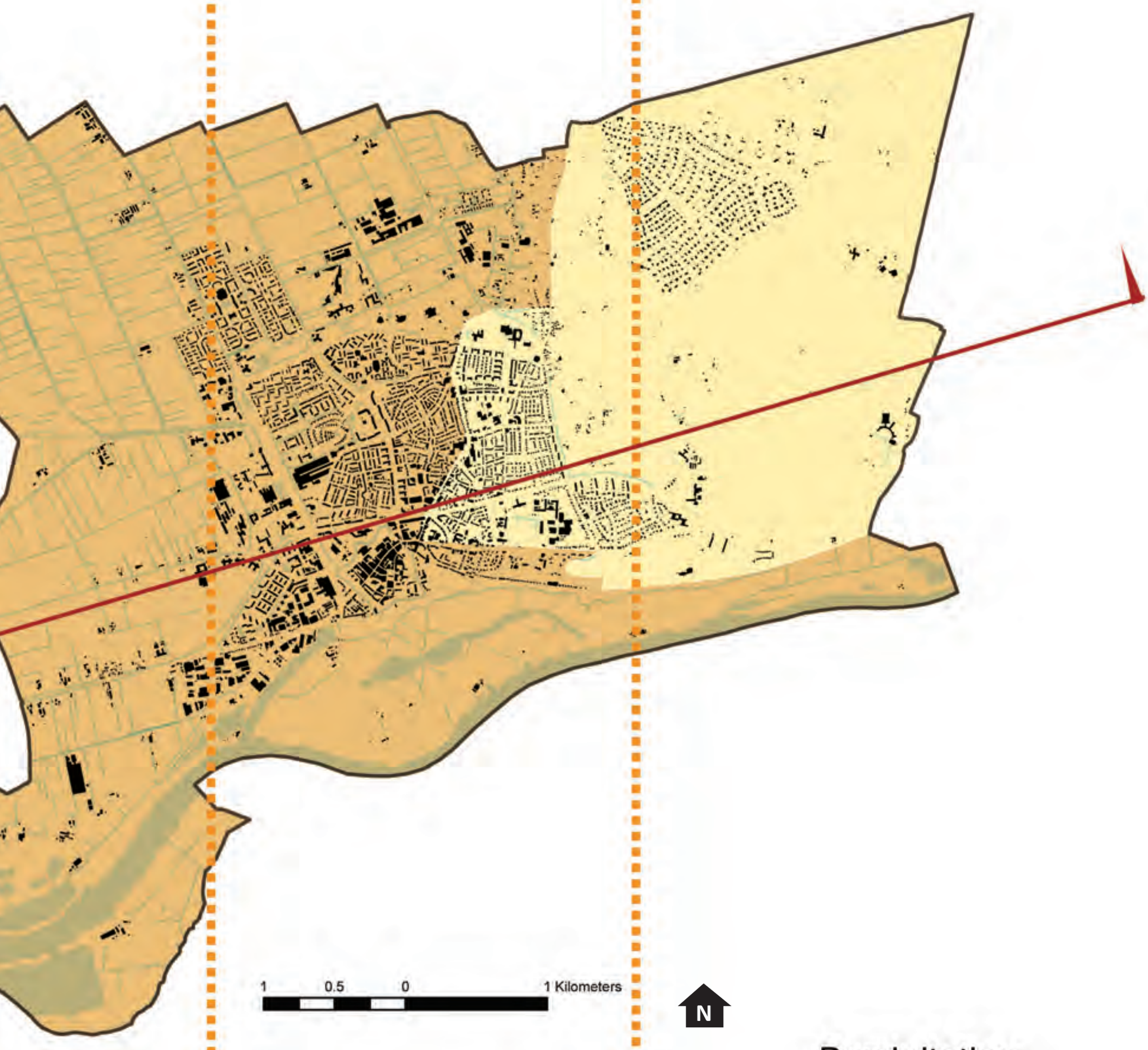
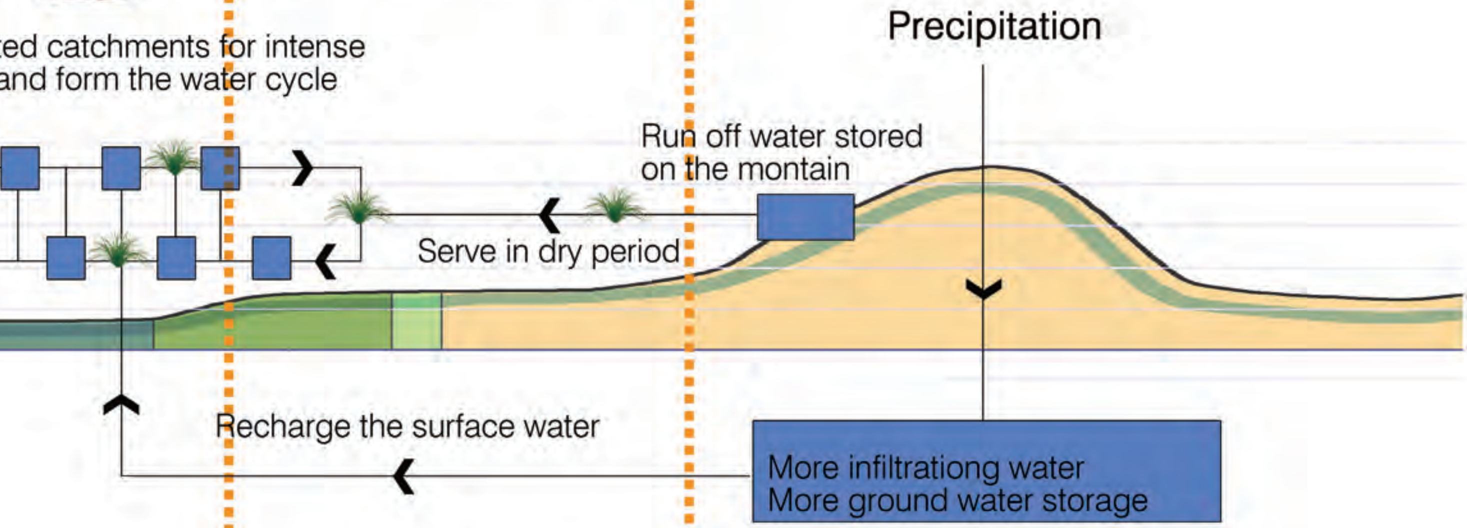


Figure 6.5 Concept plan
Source: made by author



ed catchments for intense
and form the water cycle



and

rage pond for
r use.

Urban area

Connected catchments with purifying wet land

High rural area

Infiltrating the water as much as possible to increase the ground water storage

Store the water on high mountain that serve for dry season with out pumping

6.3 Proposed water system

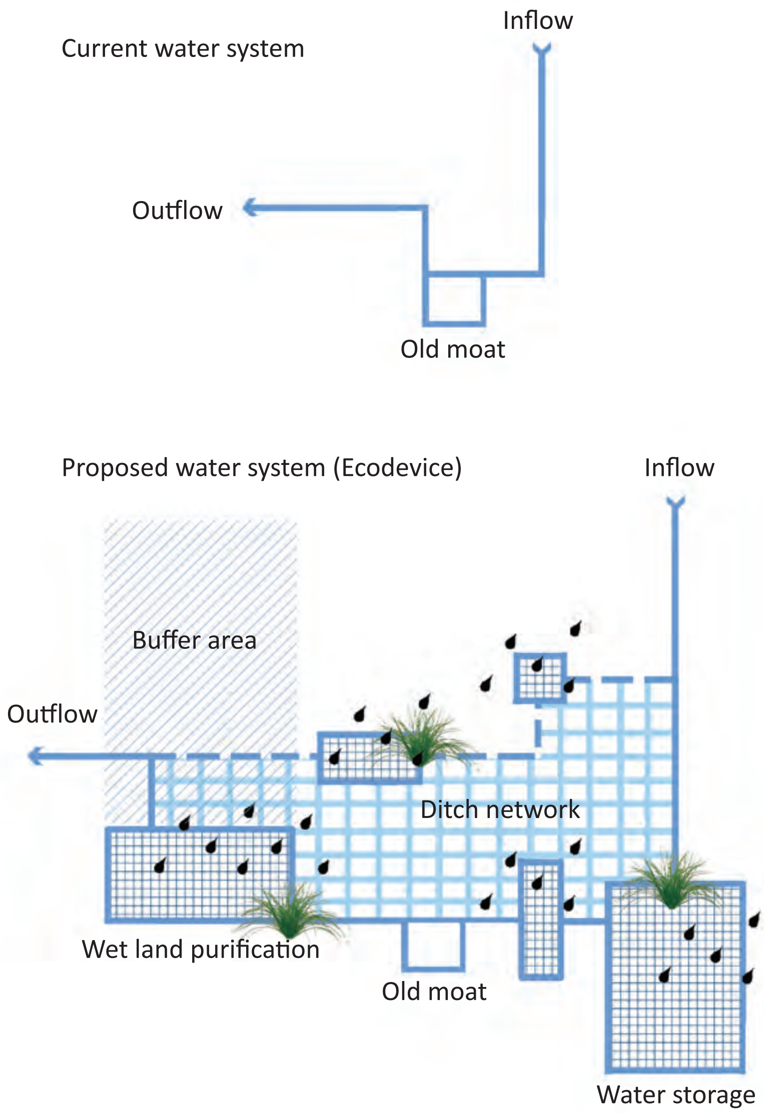


Figure 6.6 Current water system and proposed water
Source: made by author

The current water system can be generalized as an flushing system (figure 6.6 upper image). It receives inflow from external system and directly flow out with any delay. The surplus water is expelled from the system immediately.

By making connection with the inflow and outflow, the water circulation forms in Wageningen water system. This is already a great promotion of the water system. However, this simple system still can not fulfill the sustainable and resilient needs. By applying the Tjallingii's two guiding principles of "closing the cycle and cascading" and integrated urban water management guiding models, the proposed water system has been developed as figure 6.6 shows.

- By adding more water storage and buffer area, water resilience to events such as extreme rainfall will be increased.

- By creating nature wetland, the water quality will be improved.

- A connection will be developed to make a cycle inside Wageningen to keep the water stay longer inside the system for reuse and self-purification.

6.4 The working principle of the future water system

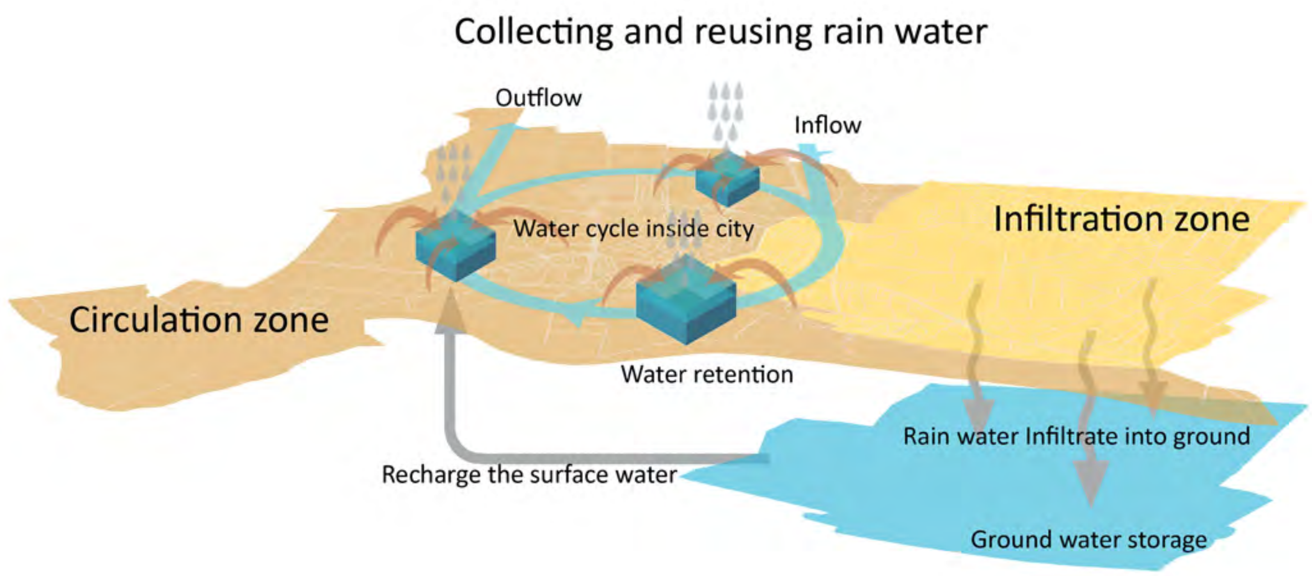


Figure 6.7 The working principle of future water system
Source: made by author

Figure 6.7 shows how the future water system works on Wageningen. Wageningen can be divided into two zones (infiltration zone and circulation zone) based on different soil types. The infiltration zone is located in the northeast with high permeable sandy soil. In this zone, special strategy (introduced in Chapter7) will be used to infiltrate more rain water into ground water. For circulation zone, the surface is composed of low permeable peat and clay, so the water will be easily stored on the surface. Therefore, several water catchments according to the calculated water storage need will be set on the surface of Wageningen. Thus, the surplus rainwater will be hold in the catchments and purified by helophyte filters. Besides that, the water in the catchments is not still. A circulation is established in between the water catchments, so the water can be kept running in the system. The ground water can also discharge the surface water at west since the ground water level is close to the surface. The water retention is also possible to build in infiltration zone with some low permeable soil layers to block the fast leakage.

6.5 Design Strategy

To create a more sustainable environment, a large diversity of aspects should be involved in the design process apart form the water issues. However, nowadays, some aspects may have been ignored by contemporary landscape designers. Meyer (2008) recognises aesthetics as an important, but often neglected aspect in sustainable landscape design. The modernistic designer is concerned with 'the artifact, the product, the form and space rather than the process, people and place and their context' (Koh, 2004). Modern designs became indifferent to 'the perception of users', 'socially irrelevant, unresponsive to ecosystems, and alienating users groups' (Koh, 1982).According to Saito, the writer of " Everyday Aesthetics", Western aesthetic theories of the past few centuries has neglected everyday aesthetics because of their almost exclusive emphasis on art.

Several pioneers of sustainable landscape design tried to define the related aspects:
'The very act of designing-and-building' of landscapes 'cannot be appropriately explained, designed, and evaluated without reference to physical, biological, cultural, and psychological environments' (Koh, 1982).
To design natural and cultural sustainable cities designers need to incorporate 'function, form, feeling, meaning, human and ecological functions' (Spirn, 1988).

In this thesis, in order to create a landscape design with high quality, the design will involves aspects of function, aesthetics and Ecology.

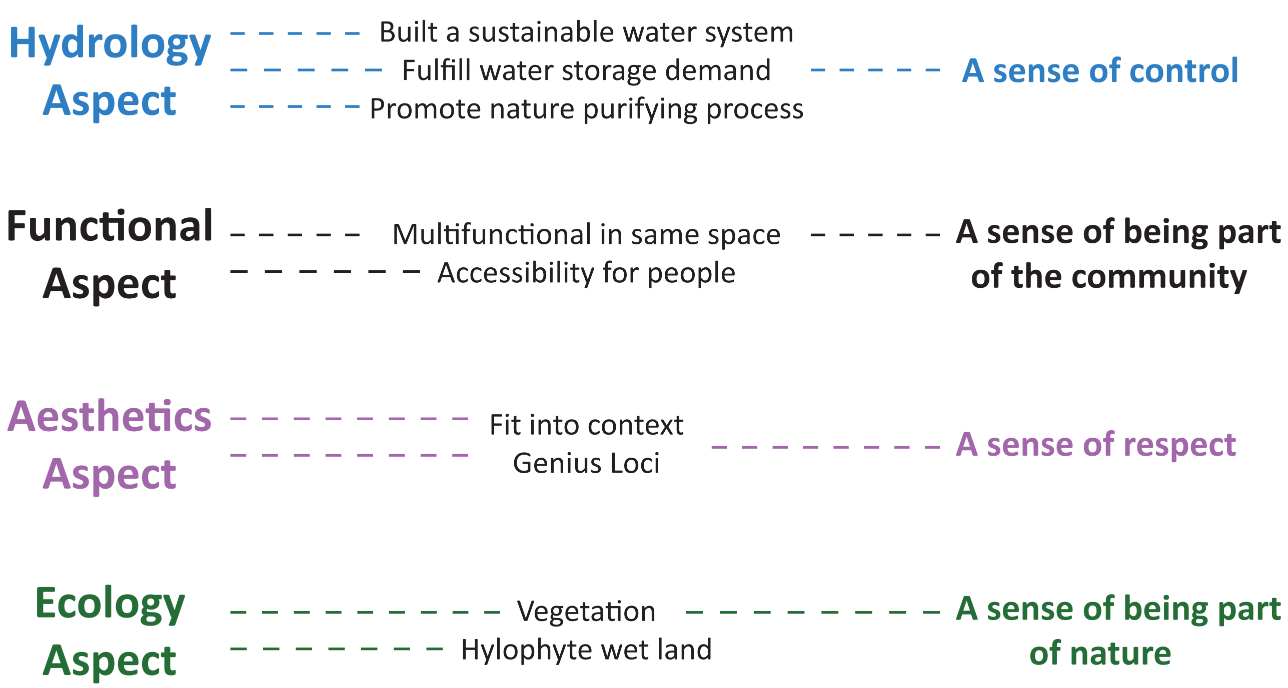
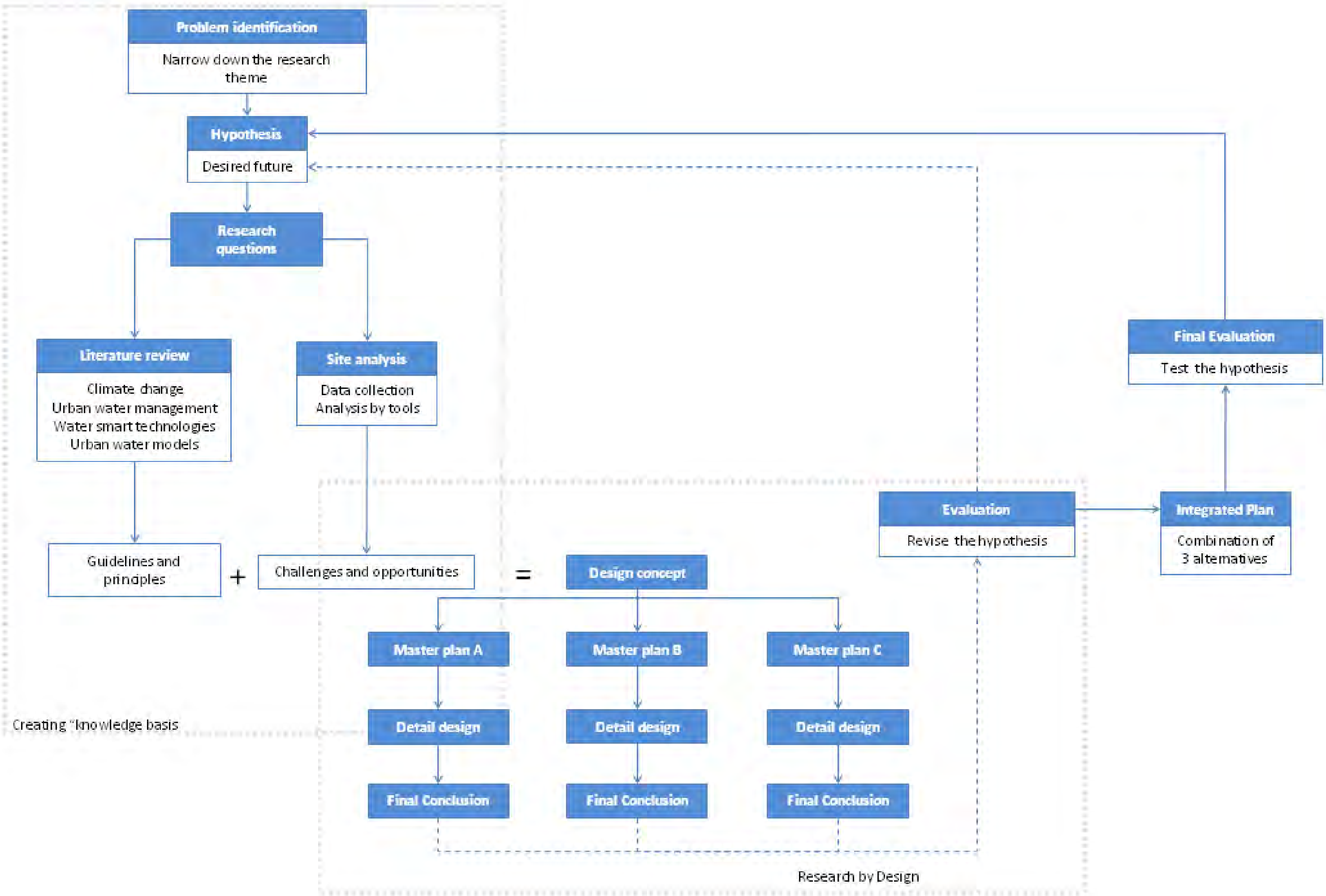


Figure 6.8 Design strategy
Source: made by author

Chapter 7

Design alternatives and Master plan

Index



Problem identification
Narrow down the research theme
Hypothesis
Desired future
Research questions
Literature review
Climate change
Urban water management
Water smart technologies
Urban water models
Site analysis
Data collection
Analysis by tools
Guidelines and principles
+
Challenges and opportunities
=
Design concept
Master plan A
Master plan B
Master plan C
Detail design
Detail design
Detail design
Final Conclusion
Final Conclusion
Final Conclusion
Evaluation
Revise the hypothesis
Integrated Plan
Combination of 3 alternatives
Final Evaluation
Test the hypothesis
Creating "knowledge basis
Research by Design

As the water demand of seasonal storage and peck storage has been calculated and the city also asks for stronger identity, these required criteria will be tested in the following optional plans based on different landscape zone.

7.1 Diverse landscapes in Wageningen

Wageningen can be roughly divided into five zones as figure 7.1 shows: River front area, Wageningen Low area, Urban area, Hillfoot in-between area and Wageningen High area. The features of each place are listed on the following table.

Possibility of the calculated water storage will be tested in different landscape zones

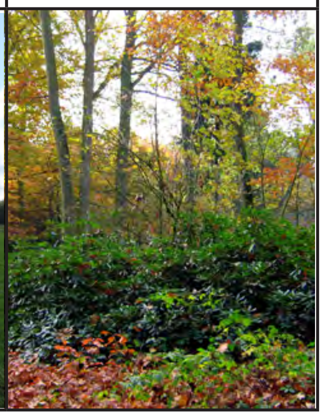
Each zone has its special environment with both advantages and disadvantages in building a sustainable waterscape. The possibility will be tested in the following pages within each landscape zone. However, urban area is almost fully developed with buildings and paved surfaces. So there's no place for huge water retention. And the Water front area is a protective area. Therefore, the implement of water retention will be tested on the other three areas.

	River Front
Landscape	Nature wetland landscape Protective area
Waterscape	River Rhine pass by the place
Soil type	Clay
Special feature	Wetland protective area
Function	Conservation area with some entertainment
Altitude	Low
Image	

Figure 7.1 Landscape zones in Wageningen
Source: made by author

Wageningen Low	Urban area	Hill foot in-between area	Wageningen High
Broad pasture and farmland plots The whole area is quite flat, no ob-stacle made a broad view	Urban landscape with dense buildings, small gardens and busy trans-portation	Small plots of pasture and farmland with some hedges	Nature forest on the mountain
Dense ditch system for irrigation and drainage, small water ponds for excess water storage and upward seepage	Artificial water course for bring in water and city drainage	A few ditches	Non-water feature landscape
Low permeable peat and clay	Construction	High permeable sandy soil	High permeable sandy soil
Poplar tree line along main streets	Old fortified city	Fertile earth with agriculture gardens	High forest mountain
Agriculture area with several indus-try, social facilities and dwellings.	Center of commercial dis-trict and municipality Main residential area Social facilities	Mainly agri-culture, some social facilities and dwellings	Nature conservation forest
Low area in Wageningen	In between the lower pol-der area and the mountain	At the hill foot	High on the mountain



7.2 Research by design: alternatives

"What is the best way to apply the 'combined model' on Wageningen's inventory" will be tested on design alternatives

Water problems in Wageningen and their causes have been researched in the former chapters. However, the problem of "how to apply the 'combined model' on Wageningen's inventory" still remains. The research will be carried out by design. First, three optional plan are developed based on different landscapes. To fulfill the water retention need, a huge amount of water surface is needed. In the five kinds of landscape zones, the Urban area and is too dense to located such amount of water, while the Water front area is an conservation site. Therefore, possibility will be tested in the other three landscape zones of Wageningen Low area, In-between area and Wageningen High area. In this chapter, the best way to applying the "combined model" will be revealed after testing and evaluating different design alternatives.

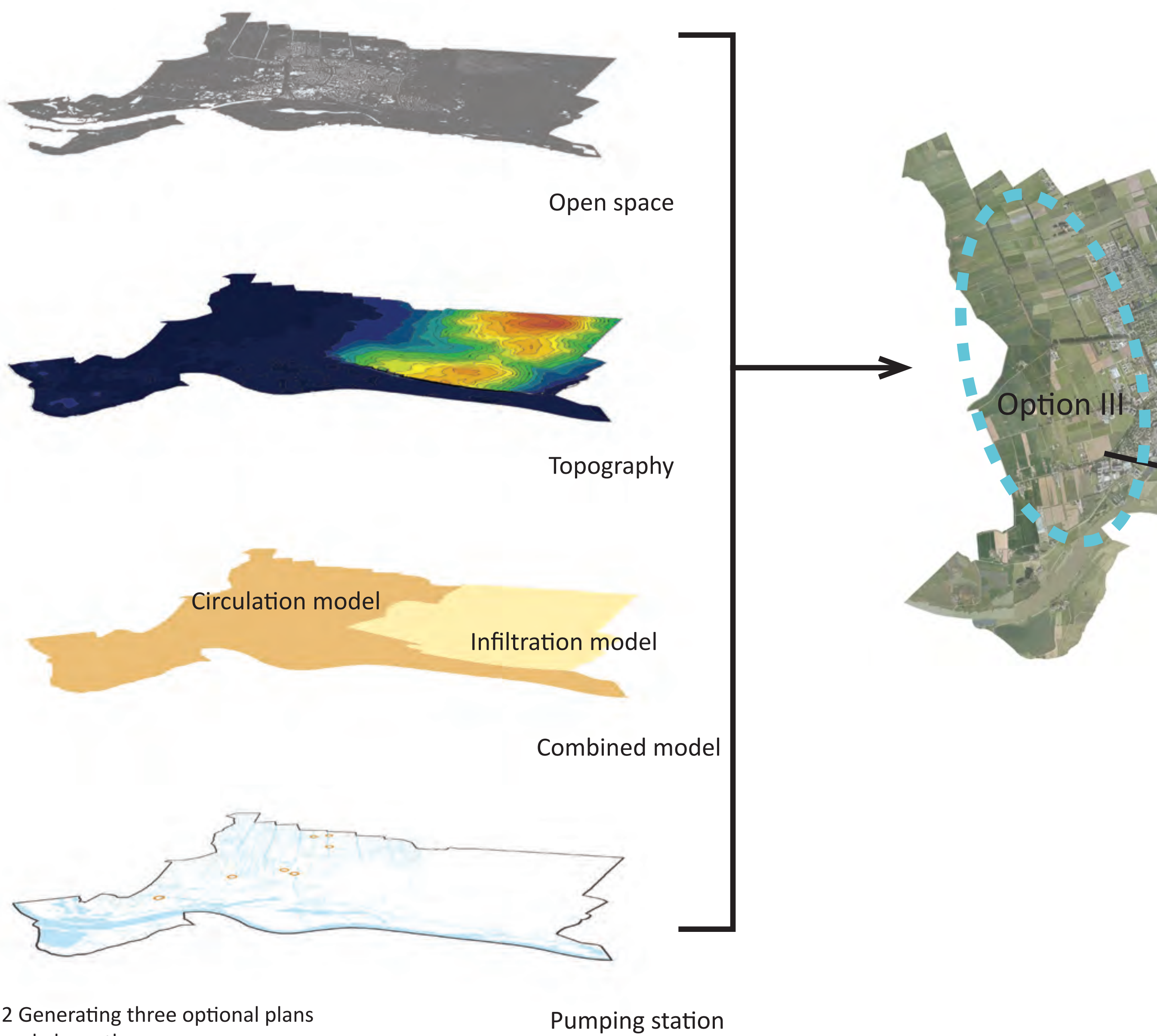
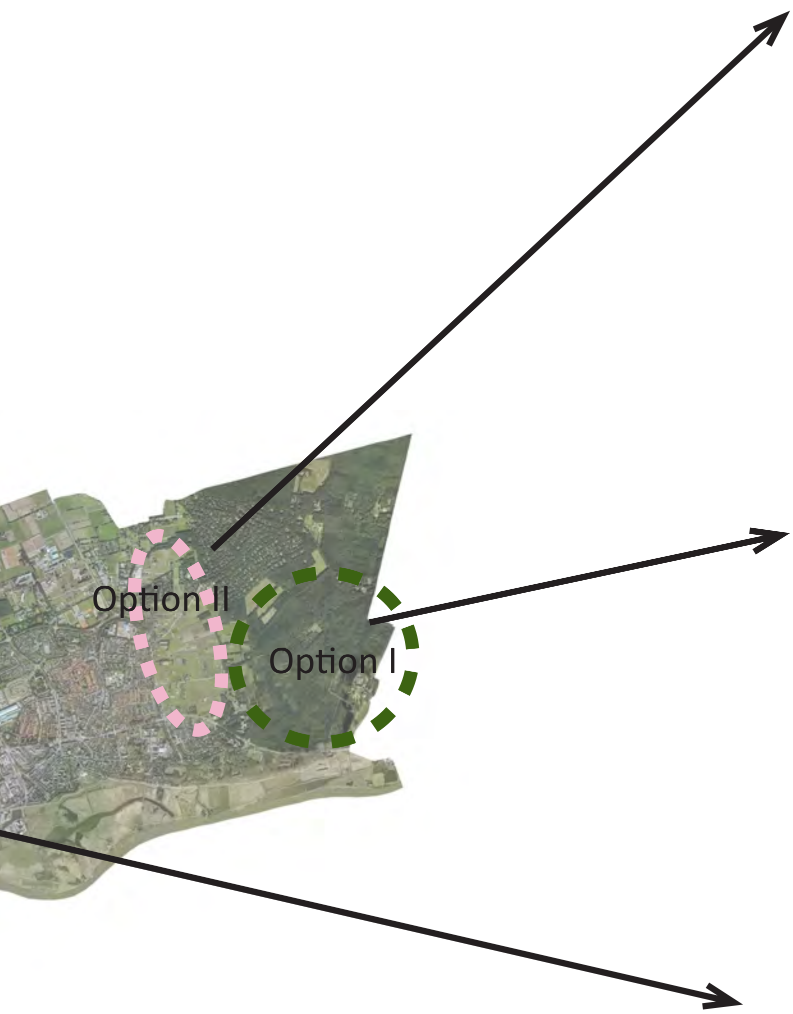


Figure 7.2 Generating three optional plans
Source: made by author



Option I: Up Hill

The main water retention will locate on the mountain Veluwe. Taking the advantage of the high position, water can flow to the city in dry period without pumping. And the ground water level is relatively low which makes deeper catchment possible. There's a difference of 1.2m between the surface and the ground water. The catchments are planned along the contour lines at different levels, thus the water can hold on the mountain. However, the implementation of water retention need to sacrifice some of the trees on the hill and actions need to be take to block the high permeable soil at the bottom of the catchments. And the excess water in the lower part needs to transport here by pumps.

Option II: Hill Foot

Option II employs the open farmland between the urban area and mountain Veluwe in the east of Wageningen. These agriculture fields can be transferred to aquaculture lands which offer great opportunity for seasonal storage, purifying wetland and at the same time keep the agriculture function. It is located at the foot of the hill, run off water will rapidly collected here. The stored water can be pumped out for agriculture use in the dry period. There's a difference of 0.8m between the surface and the ground water.

Option III: On Polder

Option III sets the water retentions mainly on the northwest farmlands with low permeable soil which is suitable for collecting water. But the water table is quite near the surface so that the retentions cannot be deeper than 0.5m. The occupied farmland also can turn to aquaculture or wetland parks. The possible space is considerable wider than the east part, thus more water can be stored here. However, it needs pumping the water back to the city since it is the lowest place in Wageningen.

7.3 Alternative I: Water ways on “Wageningen High”

7.3.1 Site inventory

Mainly forest
Few scatter houses
Some pasture in the NW
Total area accounts for 345.8 ha

Currently this area is mainly forest. There are very few houses exist in the forest. Besides that, some pasture plots are situated in the west. The total area accounts for 345.8 ha. The big ambition is to transform this area into a large water retention and a water recreation place for the locals. The added water bodies can not only balance the local water system but also add to the city identity of sustainability.

Very characteristic of this areas is the woodsy mountain and varies topography. Taking advantages of the high position, the future water ponds can supply water to the lower urban area and farmlands naturally. Besides that, the combination of forests and water ponds also created a beautiful scenery in the real nature.

Figure 7.3 Location of alternative I
Source: Google map

7.3.2 Landscape experience

Highway crossing the forest

Quiet rest in the nature

Figure 7.4 Landscape experience of alternative I
Source: made by author

Walking path in the forest

Old trees

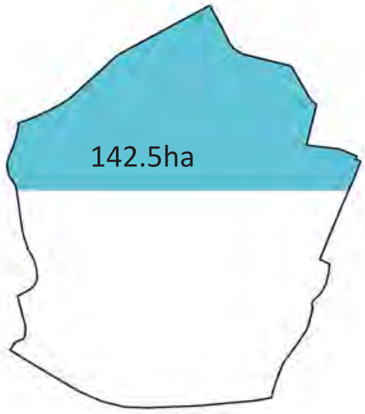
House and animals

7.3.3 Landscape analysis

Spacial analysis

Figure 7.5 Land use of alternative I
Source: GIS data

Figure 7.6 Vegetation of alternative I
Source: GIS data



Needed water storage

Needed water storage ($10000m^2$)		Height of the retention (m)	Offer water storage area (ha)
Current	137.5	1.2	114.6
G	129.5		107.9
W	171		142.5

Figure 7.7 Needed water storage of alternative I under different KNMI's climate scenarios
Source: data form KNMI, calculated by author

It is possible to fulfil all the water needs in "Wageningen High", however, it will sacrifice too much trees

According to different climate scenarios, the needed water storage accounts to 142.5ha at maximum. It's about 1/3 of the total area of this landscape zone. It is possible to put the main water retention at this site, however, a lot of precious tree will be sacrificed. This is obviously what most people don't want to see. The design should also consider the local identity. The proper way to store water and take advantage of the high position of the mountain is to identify some spare spaces inside and around the forest.

Fit into the context

Figure 7.8 Current situation in mountain Veluwe
Source: Google map

Figure 7.9 Reference picture: Pond mountain in Arnhem
Source: Photo by author

The nature environment and full of trees can represent the spirit of this area. They are loved by the local peoples, therefore, it is not wise to fulfill the water storage needs in this option. However, to increase the infiltration and take advantage of the high position, scatter spaces should be utilized. Actually, there are broad space on the walking path under trees. Connected ditches can be dug out as the reference picture shows. Apart from that, some spaces which has little vegetation in bad conditions can be transferred into separated ponds inside the forest. And at the hill foot, there are some locations with demolished house which are perfect for storing water.

It is not wise to fulfil all the water needs in the mountain area since the precious forests should be protected

Soil type and ground water level

Figure 7.10 Soil type of alternative I
Source: GIS data

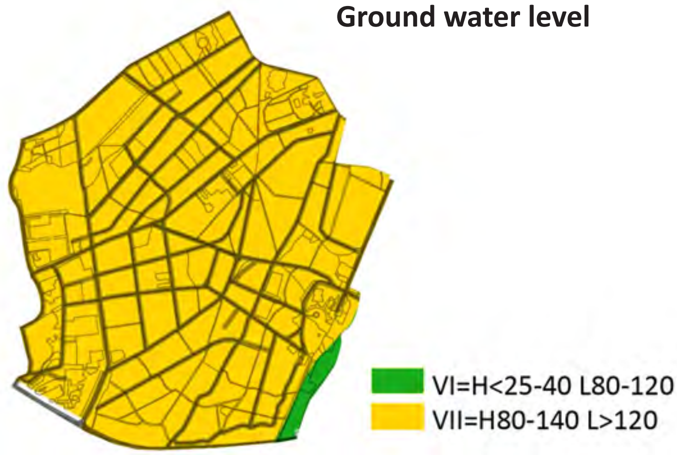


Figure 7.11 Ground water level of alternative I
Source: GIS data

The soil type on the mountain Veluwe is high permeable sandy soil, and the ground water level is about 80-140cm beneath the surface at the highest point and more than 120cm at the lowest point. As we all know, the sandy soil is a high permeable soil. But how fast it can infiltrate the water? And are there some methods to increase the permeability on this site? Is it possible to store water on this permeable soil?

Figure 7.12 shows how fast can water infiltrate into the soil. For sandy loam, which close to the sandy soil on Veluwe, the water travels about 2.5cm/hour. While in the clay, water can only travel 0.05cm/hour.

Average permeability for different soil textures in cm/hour

Sand	5.0
Sandy loam	2.5
Loam	1.3
Clay loam	0.8
Silty clay	0.25
Clay	0.05

Figure 7.12 Average permeability for different soil textures in cm/hour
Source: Food and Agriculture Organization of United Nations

Making it more clear, figure 7.13 shows the needed time of water travelling 1 meter in different soils. It is 2 minutes in gravel and 200 year in clay.

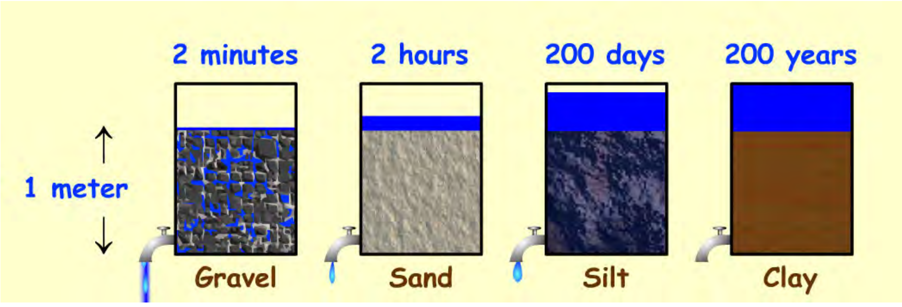
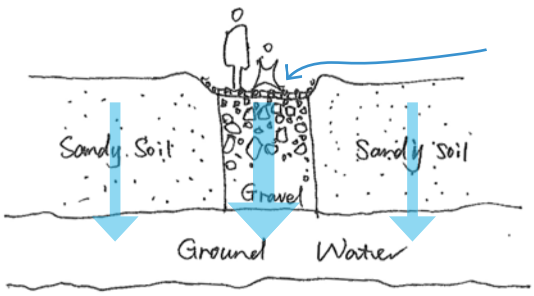


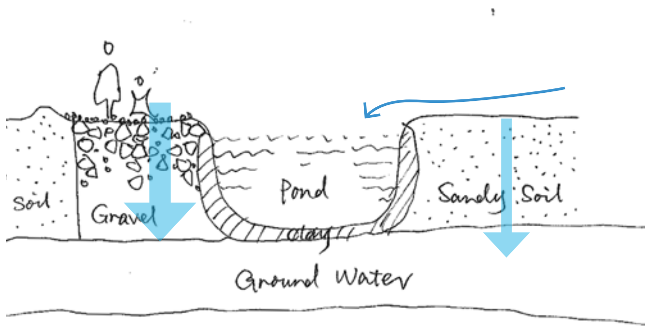
Figure 7.13 The time of water travelling 1 meter in different soil types
Source: Michigan Environmental Education Curriculum

Thus, different strategy can be found to change the permeability on Veluwe. To increase the infiltration, gravel can be paved under paths. To hold water on the mountain, a layer of clay can be added at the bottom of the dug ponds. Coincidently, the needed clay can be dug out from the lower polder in Wageningen. Figure 7.14 shows different combinations of changing the permeability of the soil for different aims.

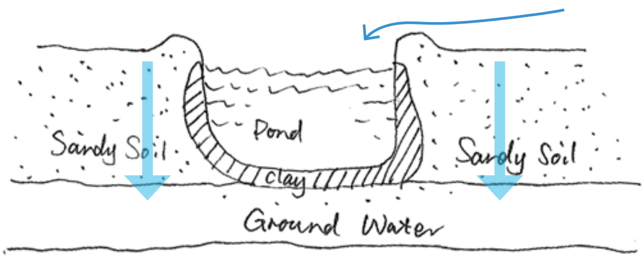
Changing the permeability on mountain Veluwe by paving gravel to increase infiltration and clay to hold water



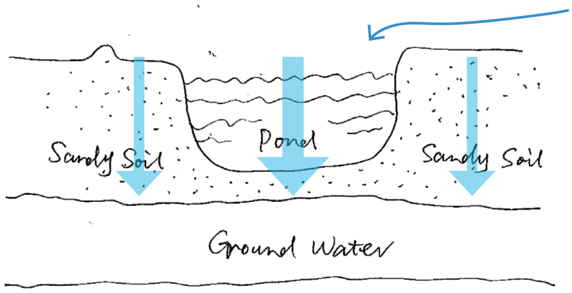
Infiltration path with gravel layer underneath to increase infiltration



Storage pond combine with infiltration path



Storage pond with clay layer to hold and store runoff water



Infiltration Pond without clay layer to hold runoff water and infiltrate more into ground water

Figure 7.14 Different combinations of change the permeability on Veluwe
Source: made by author

Topography, water flow and traffic

Topography and water flow

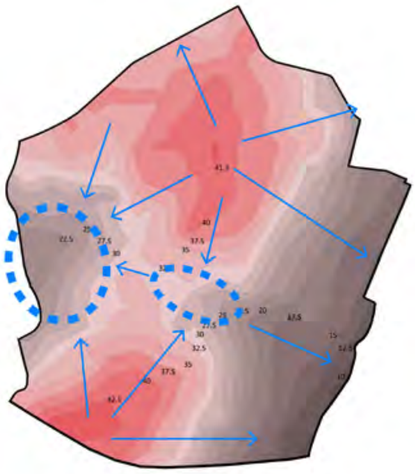


Figure 7.15 Topography and water flow of alternative I
Source: GIS data

Traffic

Figure 7.16 Traffic of alternative I
Source: GIS data

By analysing the topography map on Wageningen high area, the location where can easily store water is fond (shown in dash line in figure 7.15). These locations can be utilized as the future water retentions. The water will always flow to the low place make it a problem to hold water on the mountain. Therefore, the ditches and ponds should on the same contour line. Figure 7.17 shows the potential water ponds and ditches on mountain Veluwe. The water courses are designed also based on the existing roads. Figure 7.18 shows there are two different types of the ponds and ditches. The blue ones show the ponds for storing water which are mainly located in the “easy collecting water” zone. And the yellow ones show the ponds for increasing infiltration.

Figure 7.17 Potential water ponds on Veluwe
Source: made by author

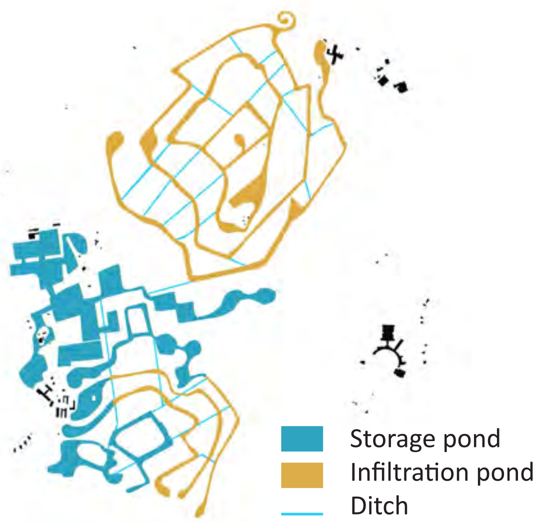


Figure 7.18 Storage ponds and infiltration ponds on Veluwe
Source: made by author

Figure 7.19 Plan of alternative I
Source: made by author

7.3.4 Conclusion

This site does not fit for huge amount of water retention since the nature forest needs to protect. However, scatter spaces under trees can be utilized into water landscape. By creating ditches inside the mountain, runoff water can be stored and hold. Walking paths also can be more permeable via using high permeable gravel texture under them. The possible water retention it can offer is 510,000m^3 (42.5ha). The left water needs can be fulfilled in other locations.

Not affecting the precious forest too much, this site can offer 510,000m^3 water retentions at maximum for storage and more infiltration.

7.4 Alternative II: Water ponds on arable land of Eng

7.4.1 Site inventory

Alternative II set the main water retention at the transform area between the mountain Veluwe and the urban area of Wageningen. Currently this area is mainly covered by grassland and farmland. Residential area exists between Bennekomsweg and Oude Diedenweg, bedsides that, several farm houses scattered in this area. A graveyard seats next to the residential area. The total area accounts for 182 ha.

Mainly pasture and farmland
Arable land and beautiful gardens
Some accommodation
Total area accounts for 182ha

Four kind of land types features this area: beautiful gardens around houses, open grass land with sheep and horses on it, farmland of cornfield and crop field and mysterious woods connected to the forest. The future water retention, running through all these different features, brings waterscape into this non-water landscape.

The big ambition is to transform this area into large water retention and a water recreation place for the locals.

Figure 7.20 Location of alternative II
Source: Google map

7.4.2 Landscape experience

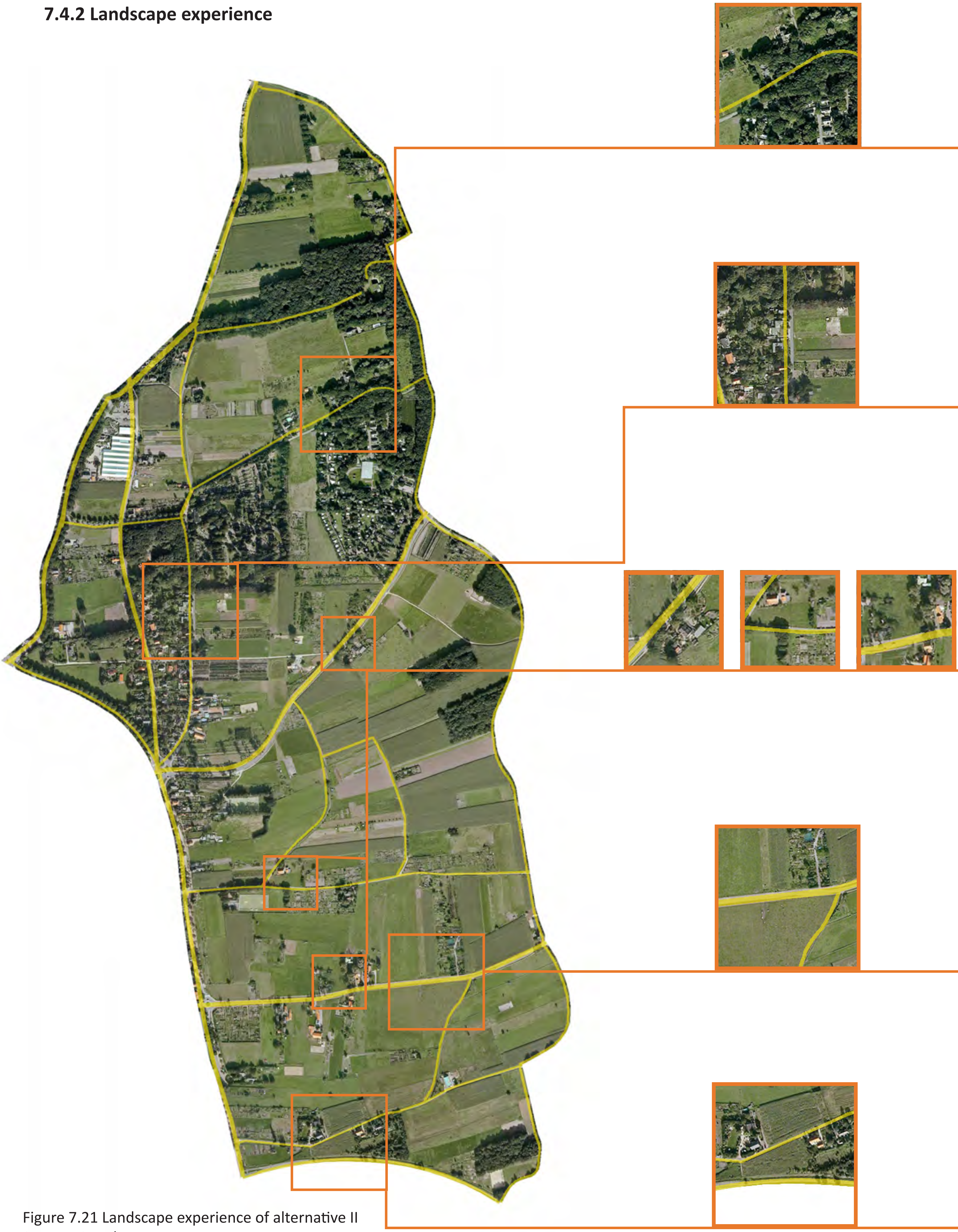


Figure 7.21 Landscape experience of alternative II
Source: Google map

Forest

Garden along highway

Houses

Beautiful gardens

Farmland and pasture

Pasture along highway

7.4.3 Landscape analysis

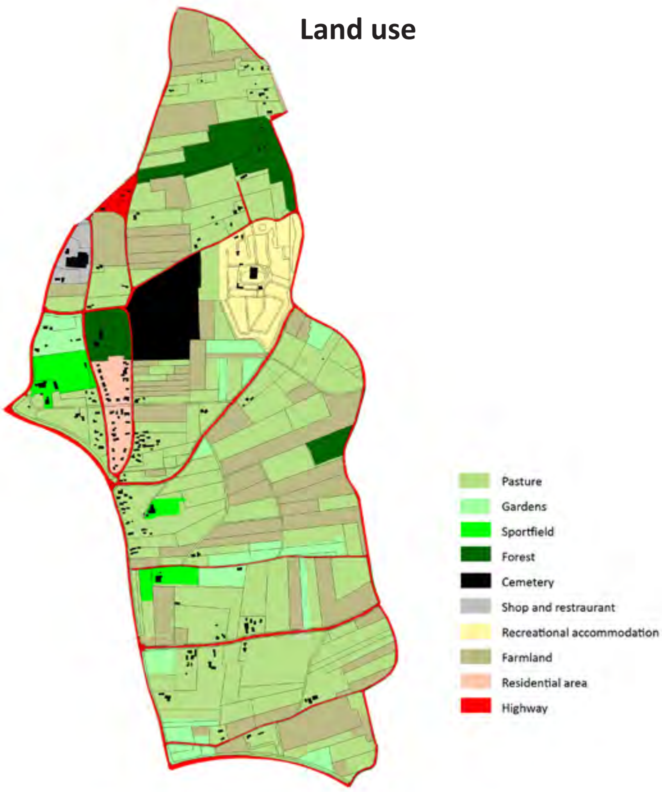


Figure 7.22 Land use of alternative II
Source: GIS data

Figure 7.23 Traffic of alternative II
Source: GIS data

Lots of unbuild space
busy traffic junction
Gardens and arable land are loved by locals

There lots of un-build spaces in the site as the land use map show. Theoretically, it is suitable for water storage. However, I would like to say “no” to huge retention on this site after I visited there. There are lots of beautiful gardens and the soil is quite arable for growing crops which can stand for the local identity there. And it is a busy traffic junction as well (figure 7.23). The place welcomes visitors from all directions and is loved by the locals. Therefore, I would like to protect this area rather than change it. But some small water features are still welcomed by the locals to vivid the scenery.

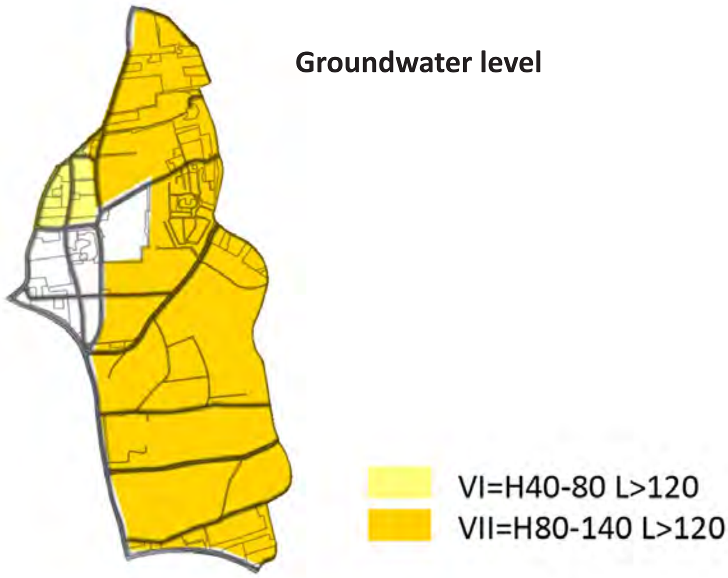


Figure 7.24 Groundwater level of alternative II
Source: GIS data

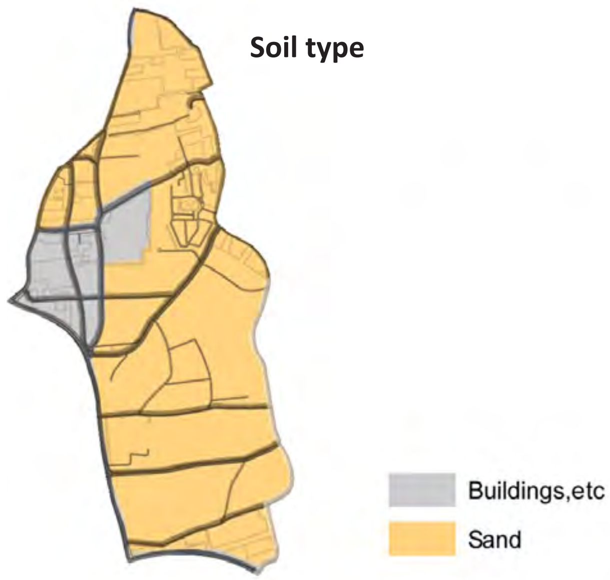


Figure 7.25 Soil type of alternative II
Source: GIS data

The ground water level in the “in between” area is not as close to the surface as the west part. The highest point of the ground water is between 80cm and 140cm, and the lowest point is more than 120cm (shows in figure 7.24). Therefore, the possible water retention height is about 0.8m in this site.

The area is covered by high permeable sandy soil, that means, if we want to build water catchments, low permeable layers are needed at the bottom to block the infiltration.

Needed water storage

According to different climate scenarios, the needed water storage accounts to 213.75ha at maximum. It is even more than the total area of this landscape zone. Therefore it is not possible to put the main water retention at this site. However, sites with great opportunity to storing water remain to be discovered.

Needed water storage ($10000m^2$)		Height of the retention (m)	Offer water storage area (ha)
Current	137.5	0.8	171.8
G	129.5		161.8
W	171		213.75

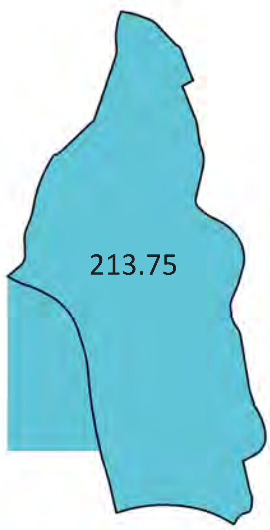
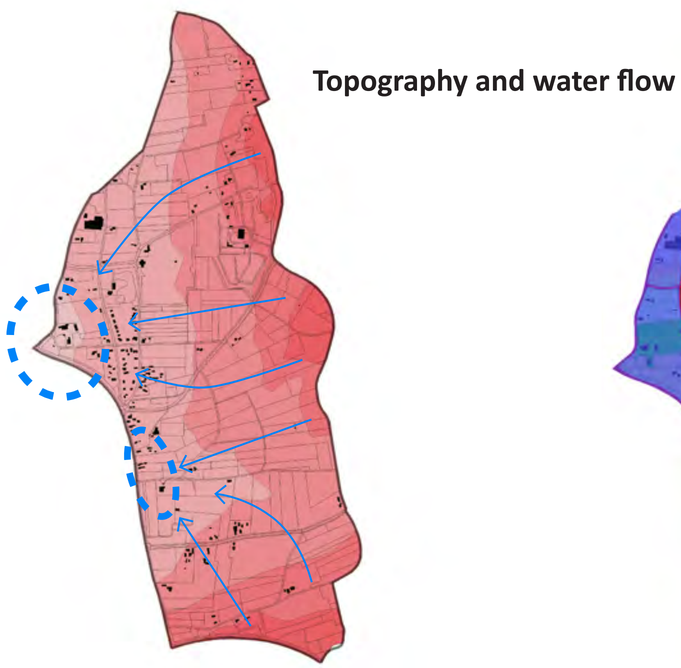


Figure 7.26 Needed water storage area in alternative II
Source: made by author



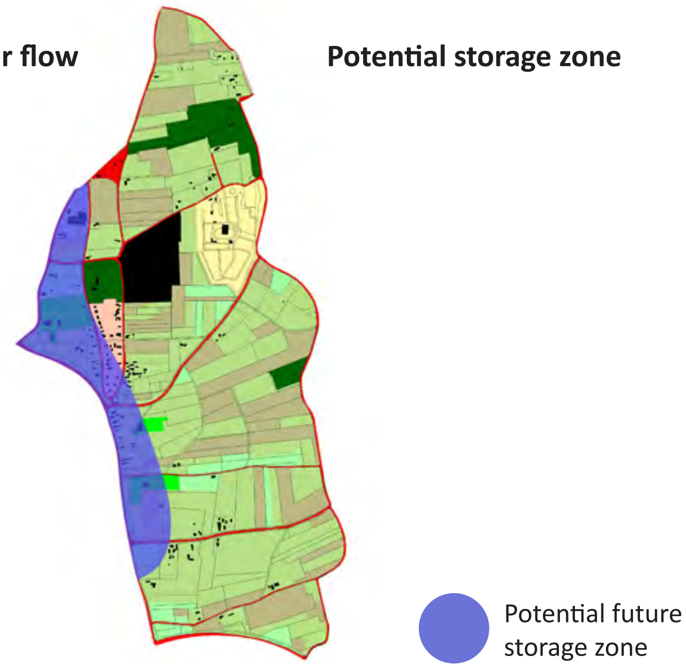


Figure 7.27 Topography and water flow of alternative II
Source: GIS data

Figure 7.28 Potential storage zone in alternative II
Source: made by author

A potential storage zone is discovered and other places will remain the same

It is a little bit higher in the east and gradually lower down to the west. The topography map shows zones with height difference of 5 meters. Since the site is not flat, the water will flow from high to low by the force of gravity. According to the topography, the water will easily gather in the northwest part as figure 7.27 shows (in dash line). As the suitability of implementing huge water retention has been discussed, in this site, a potential storage zone is appointed in figure 7.28. The other places will be kept as it is.

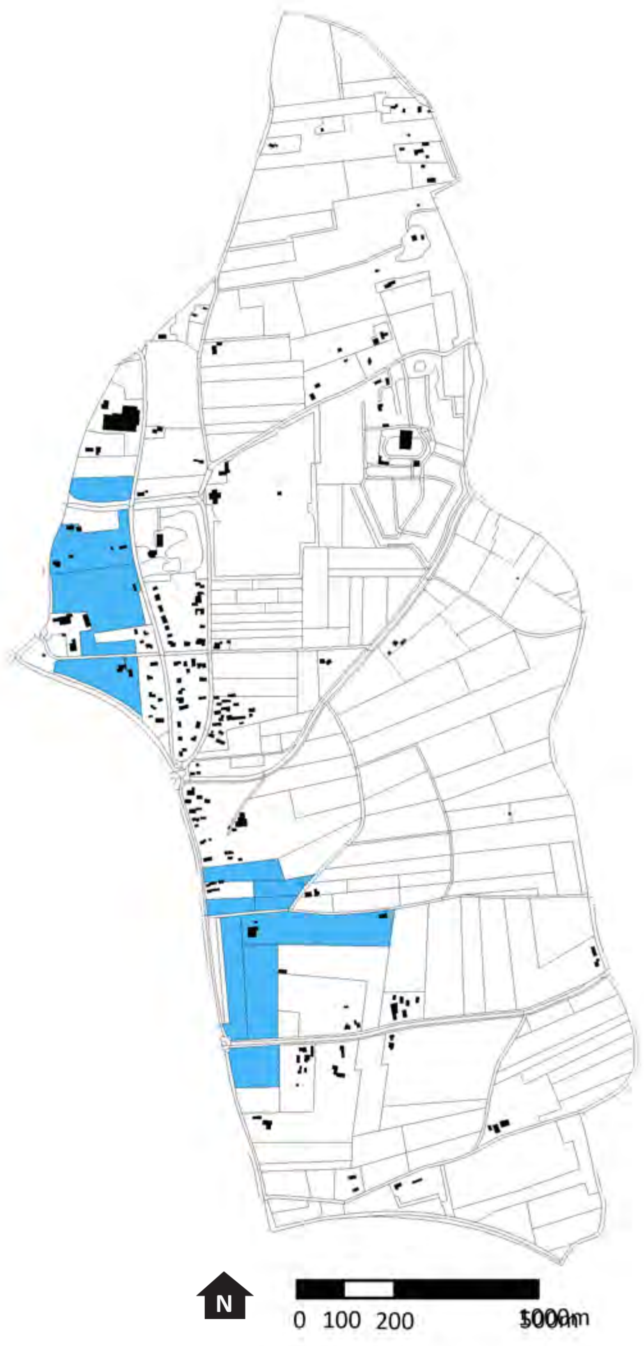


Figure 7.29 Potential water plots of Alternative II
Source: made by author

7.4.4 Conclusion

This site has great potential of collecting rainwater as it located at the hill foot of mountain Veluwe. However, the beautiful garden landscape and fertilized earth is also deserve to be protected and the sandy soil is not suitable for water retention. Therefore, only a narrow stripe zone which located at the lowest area is selected to offering some future water storage.

To keep the current fabric and local identity, this site can offer about 10 ha water retention,and 1-2 ha purifying wetland.

7.5 Alternative III: Water plots on “Wageningen Low”

7.5.1 Inventory

Alternative III set the main water retention at lowest part of Wageningen on the northwest. Currently this area consists of plots of pastures and farmlands. Residential area exists along in the east, besides that, several farm houses scattered all over the area. The total area accounts for 1060 ha.

Three kinds of land types feature this area: beautiful open grass land with sheep and horses on it, farmland of cornfield and crop field and some woods. This broad and flat area with few constructions has great potential of storing water.

The big ambition is to transform this area into a large water retention and a water recreation place for the locals.

Mainly plots of pasture and farmland
Residential area in the east
Some scatter houses
Total area accounts for 1060ha

Figure 7.30 Location of alternative III
Source: Google map

7.5.2 Landscape Experience

Figure 7.31 Landscape experience of alternative III
Source: made by author

Typical poplar tree line crossing farmlands

Residential area in low land

Industrial area and business park

Scatter farm house on pasture

Farm houses and farmlands along the high way



Pasture

Farmland

Forest


Typical poplar tree line along main roads




Ditch net work

Wetlandscape in residential area

River Grift




Beautiful farm houses




Conservation area

Redshank

Limosa

Stork

Figure 7.32 Remarkable Landscape in alternative III
Source: made by author

7.5.3 Landscape Analysis

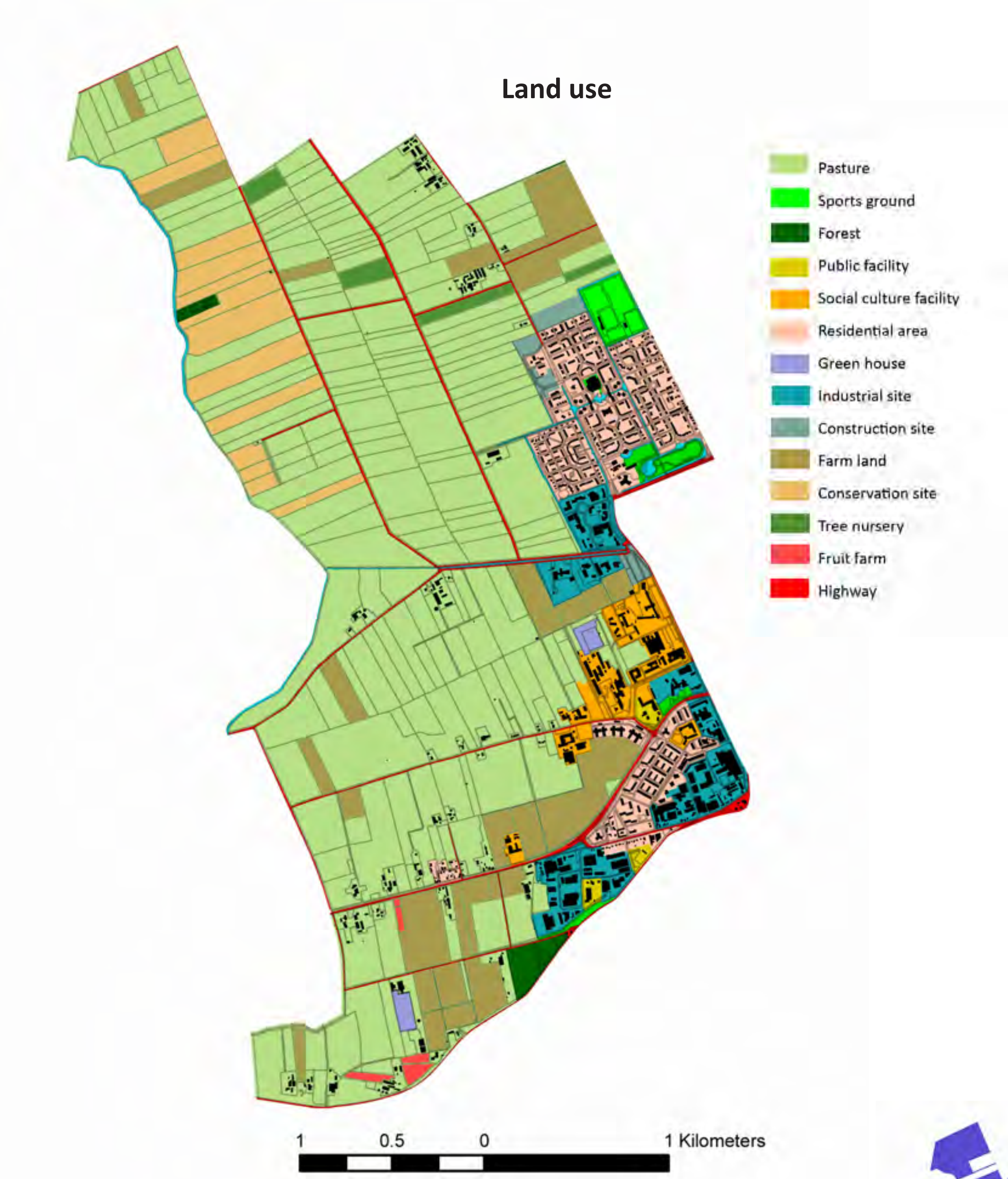


Figure 7.33 Land use of alternative III
Source: made by author

According to the land use map, there are lots of pasture and farmland plots which have great opportunity for future water retention. Figure 7.31 shows the suitable water retention area according to the land use map.

Figure 7.34 Suitable water retention area according to land use of alternative III
Source: made by author

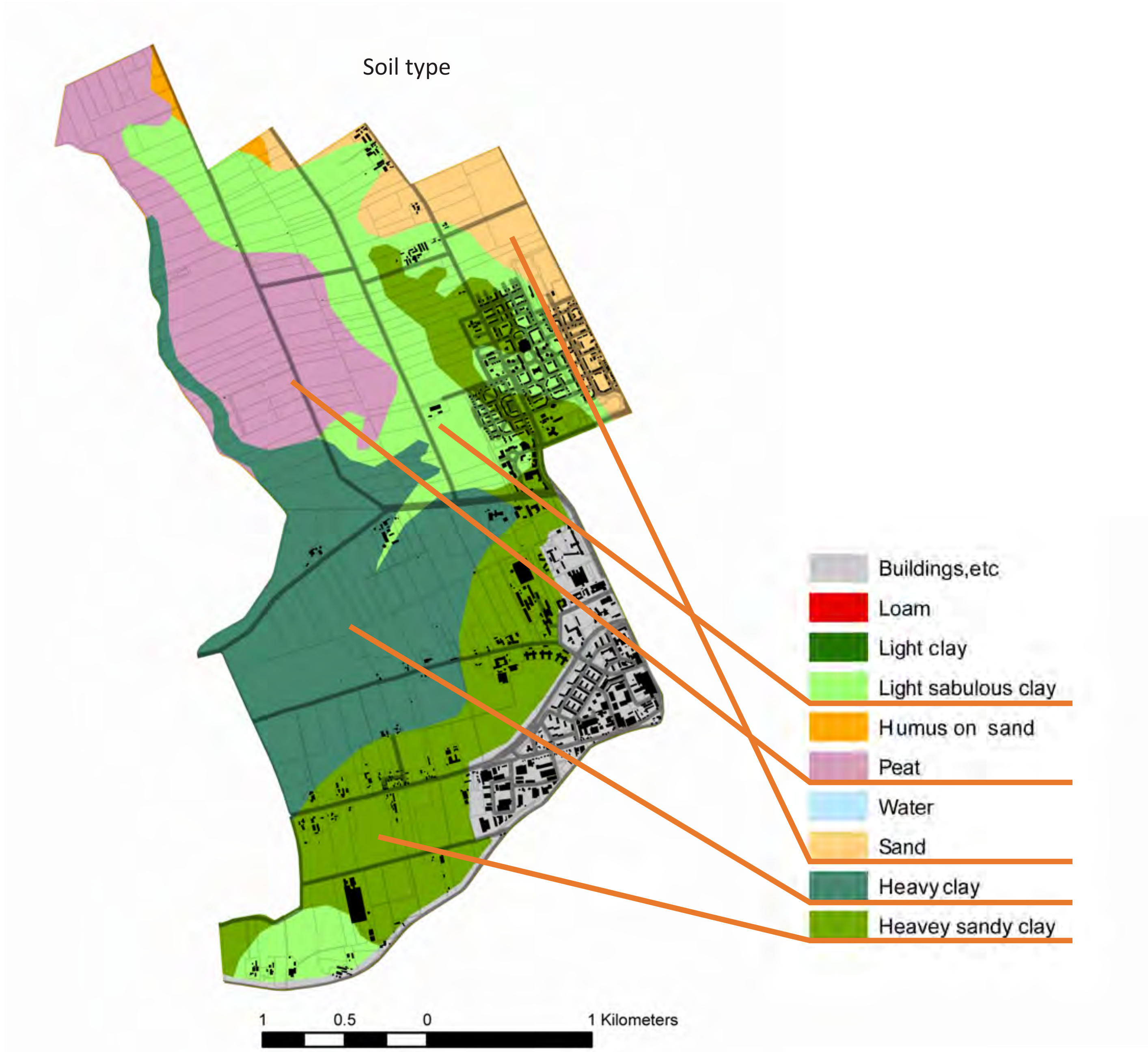


Figure 7.35 Soil type of alternative III
Source: GIS data

There are 5 different kinds of soils on the choosing site. From the permeability aspect, Heavy Sandy Clay and Heavy Clay are suitable soils for retaining water while the Heavy Sandy Clay is arable soil for agriculture. The suitable water retention should locate on the Heavy clay zone. Figure 7.36 shows the suitable water retention area according to the soil type.

Figure 7.36 Suitable water retention area according to soil type of alternative III
Source: made by author

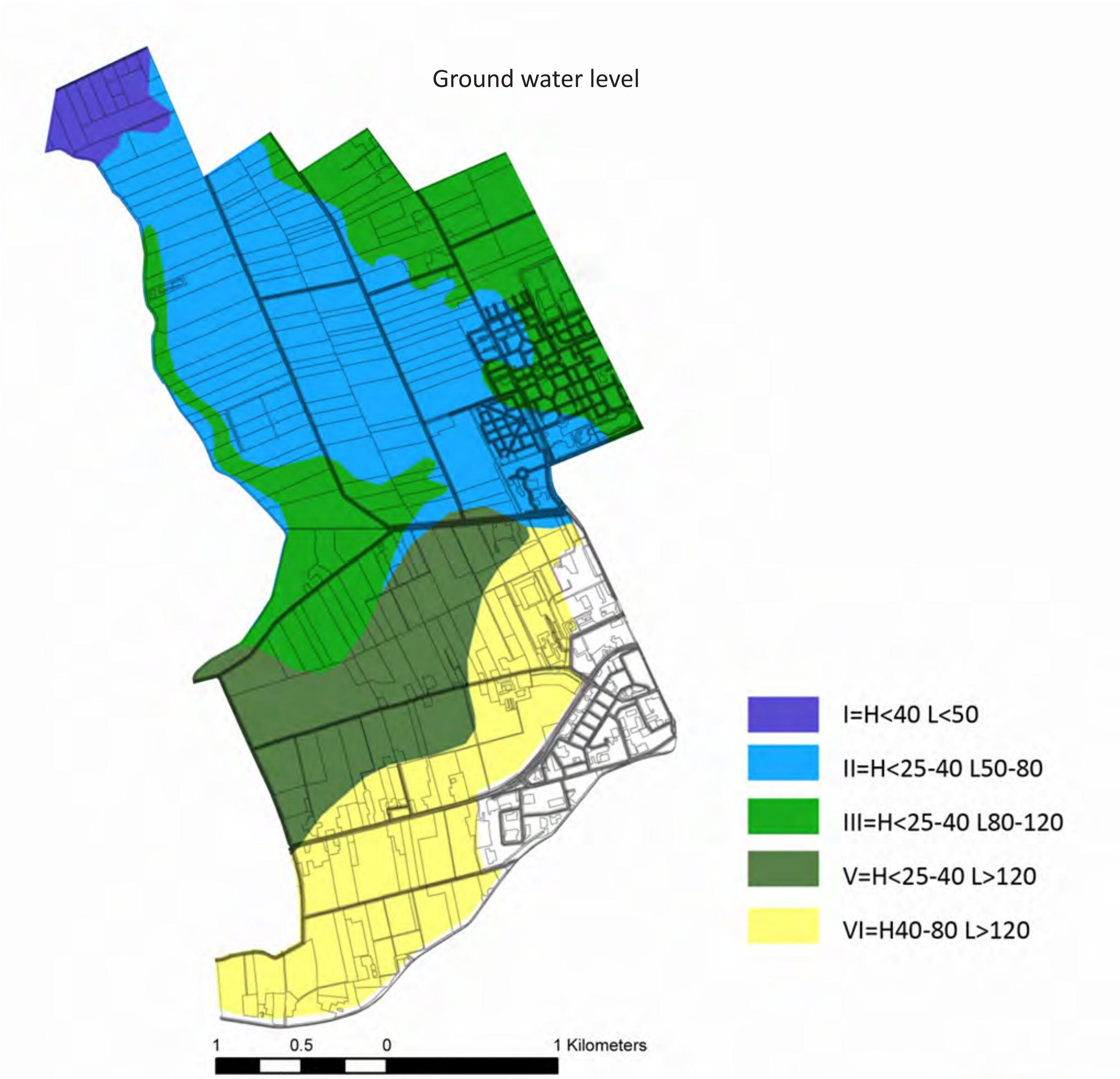


Figure 7.37 Groundwater level of alternative III
Source: GIS data

There are 5 different groundwater zones on the choosing site. So the height of the water catchments will be also different. As the ground water level map shows, for example, in the yellow area, the water catchment can be about 0.7m while in the blue area the height can be about 0.4m. Therefore, the ability of storing water in different zones can be rank as: yellow area > dark green area > green area > blue area > purple area. Therefore, the water retention should be set in the yellow, dark green and green area at the first priority. Figure 7.38 shows the suitable water retention area according to the ground water level.

Figure 7.38 Suitable water retention area according to groundwater level of alternative III
Source: made by author

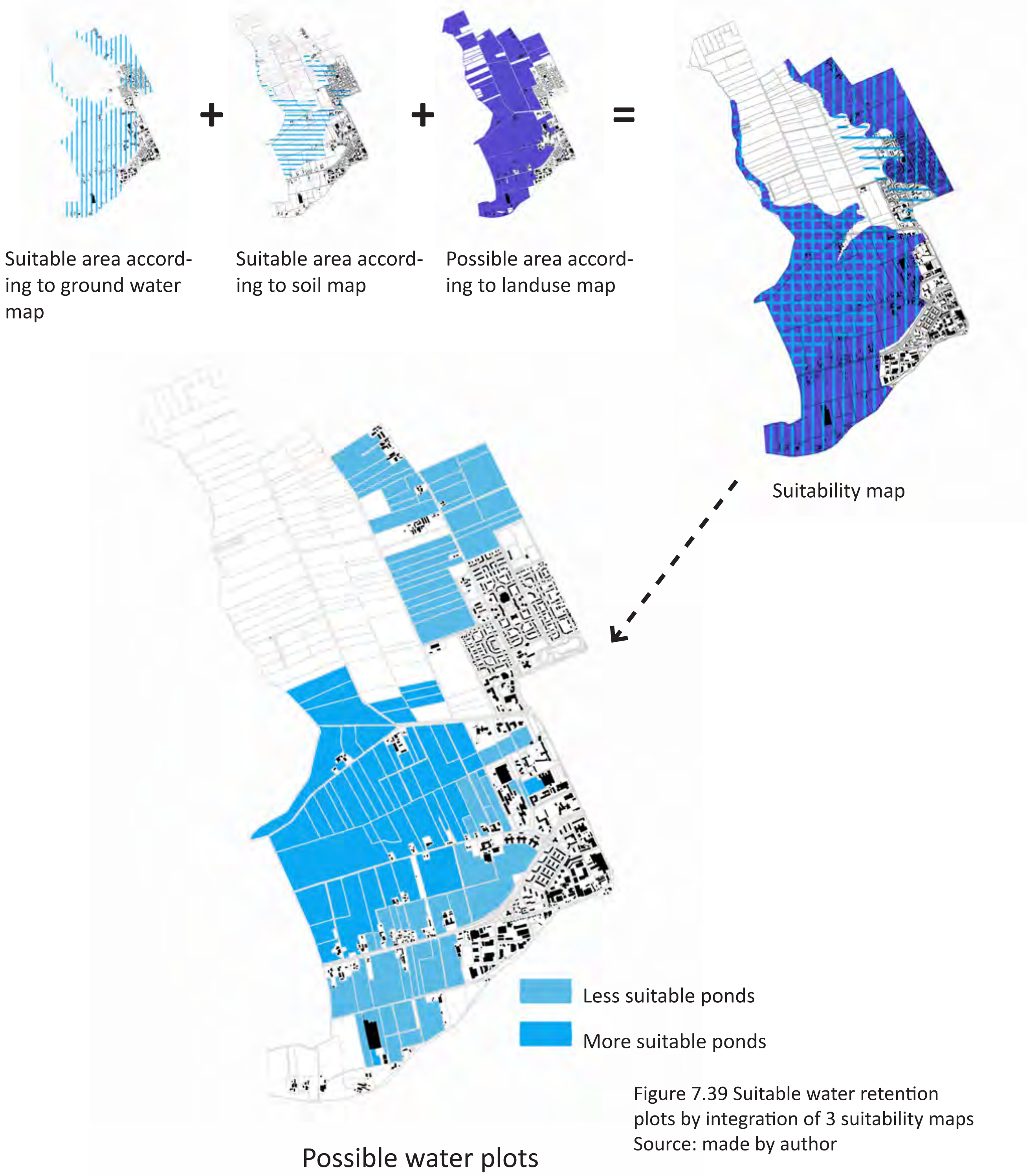


Figure 7.39 Suitable water retention plots by integration of 3 suitability maps
Source: made by author

The possible water plots map is made by integrating 3 suitability maps. The blue ones shows the suitable plots for future water retention. The darker ones are more suitable than the lighter ones. Therefore the plots in the darker blue zone will be the first choice.

Fit into context

Existing fabric

Locating the water in the fabric

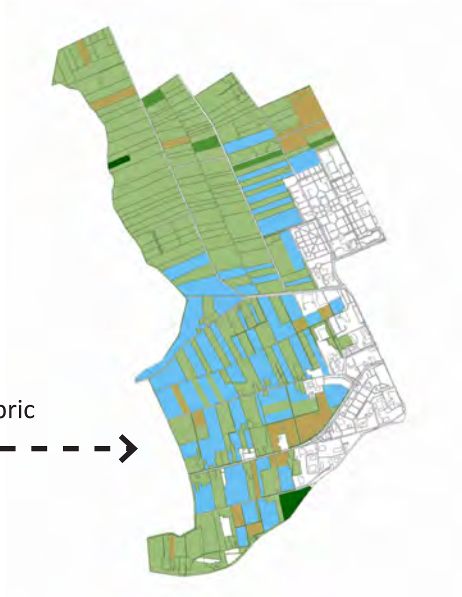


Figure 7.40 Possible water plots according to existing plots
Source: made by author

The local identity of this place is the pasture and farmland plots. Large water retention will change the landscape scale. Therefore, the future water will be fit into the existing plots. Some plots will be transferred into future water tank according to water needs. Therefore, after implementing water retention in the site, there will be 3 kinds of plots: pasture plot, farmland plot and water plot. Figure 7.40 shows the possible water plots on the site.

Needed water storage

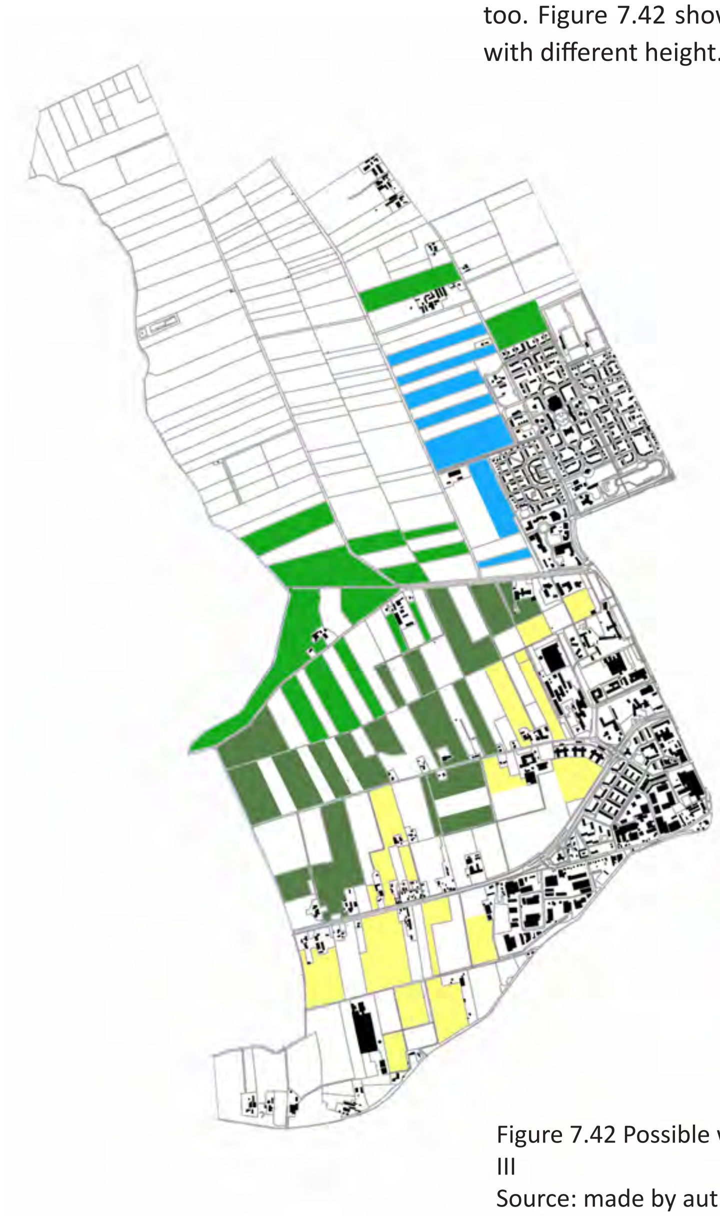
Needed water storage ($10000m^2$)		Height of the retention (m)	Offer water storage area (ha)
Current	137.5	0.6	229
G	129.5		215.8
W	171		285

Figure 7.41 Needed water storage area in alternative III
Source: made by author

According to different climate scenarios, the needed water storage accounts to 285ha. It is less than 1/3 of the total area of this landscape zone. Therefore it is not only possible but also suitable to put the main water retention at this site.

Water retention with different height

According to water storage needs and the existing plots, some plots are selected to be the future water retention. Those ponds located on different groundwater level zones, therefore, their storage capacity can be various too. Figure 7.42 shows water ponds located at different groundwater level with different height.



Offer water storage:

	Area (Ha)	Height (m)	Stored water ($10000m^2$)
II	37.675	0.4	15.07
III	73.18	0.5	36.59
V	86.21	0.6	51.73
VI	96.54	0.7	67.58
Total			170.97

II= 0.4m water pond zone
III=0.5m water pond zone
V=0.6m water pond zone
VI=0.7m water pond zone

Figure 7.42 Possible water plots on different groundwater level in Alternative III
Source: made by author

The figure shows this selected plots all together can offer 170,970,000m3 water retention which can fulfill all the water needs of Wageningen. This design is a restructuring design on the existing city fabric which is a very typical mosaic fabric. Some plots are chosen and transformed into water retention. They are not separated entities but connected by ditches along the roads system. The design introduced a significant amount of water throughout the site with helophyte filters which can purify the water. And there are some small wetland parks with small platforms near the residential area which offering water related entertainment for locals.

The working principle of the plots as water retention

The water plots group, connecting by narrow water ways, collects rainwater on the site and also receives excess water during heavy rains in the urban area. Since it locates at the lowest part of Wageningen, all the excess water will concentrated into these ponds finally. The water will be purified by the helophyte filters after a long journey through all the plots. When the dry period comes, the water can be pumped back to urban area for replenishment of the moisture loss.

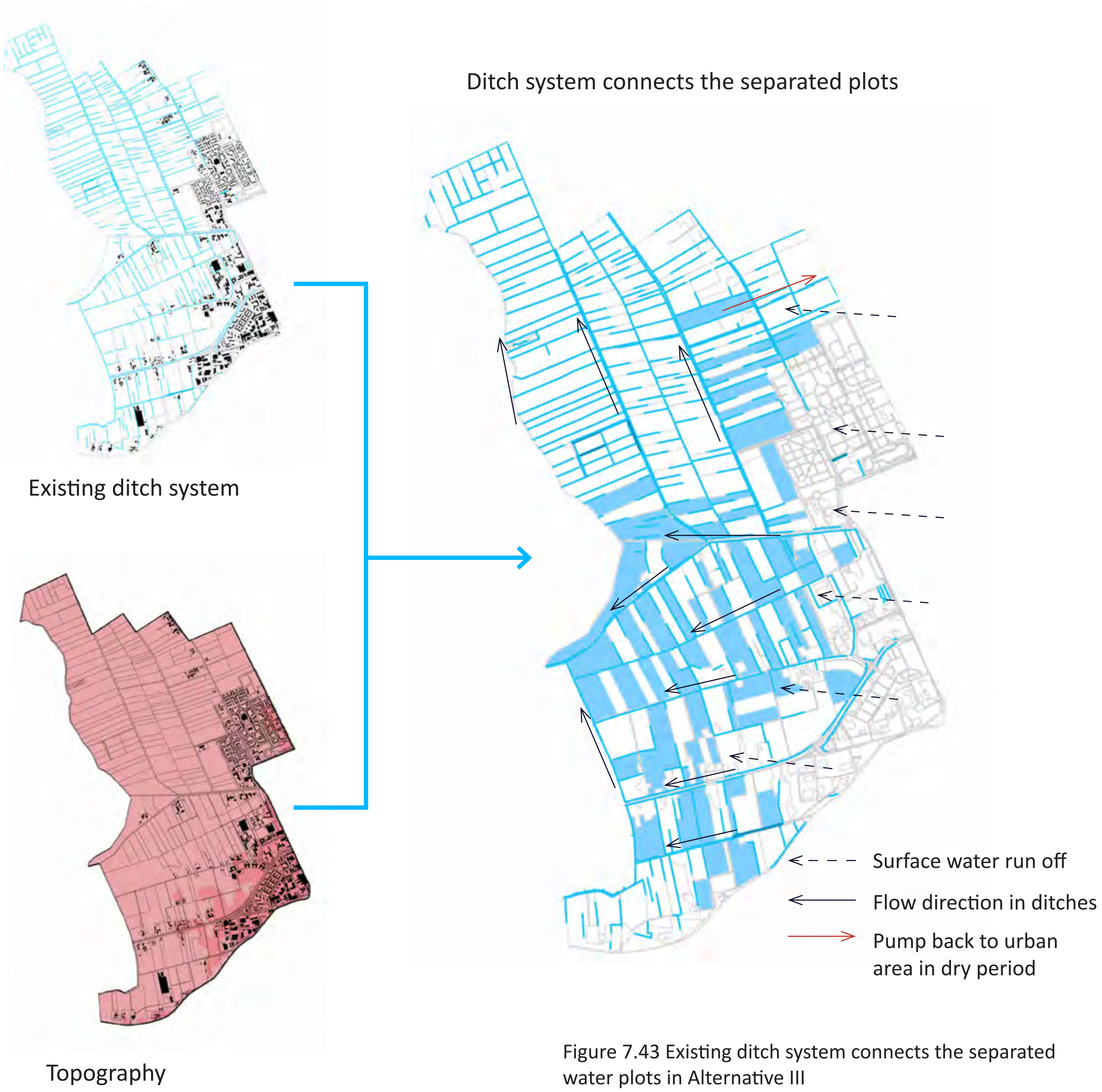


Figure 7.43 Existing ditch system connects the separated water plots in Alternative III
Source: made by author

Function and landscape structure

Apart from the water issues, this option also takes an important role in landscape structure in Wageningen. A liner wetland park zone will be built along the residential area and industry area as the dark green zone shows in figure 7.44. In this park zone, wooden platforms will be set on the water plots which can offer a walking route for people. And along the cycling route, there will be parks with some rest places.

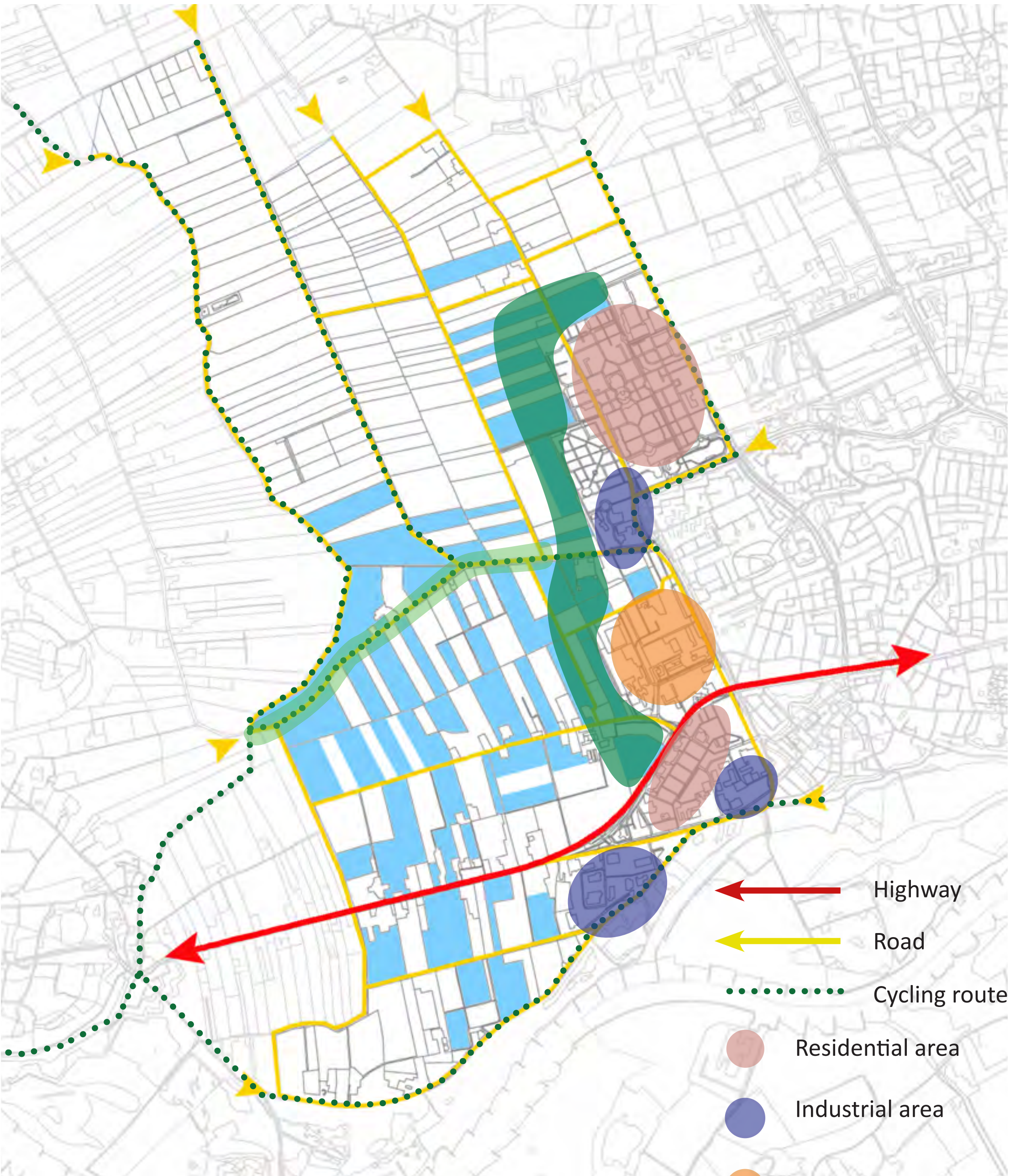


Figure 7.44 Landscape structure of Alternative III
Source: made by author

Vegetation and purifying wetland

Very characteristic of this place is the typical tree lines. There are poplar tree line and oak tree line standing on the broad and flat field. Besides the typical tree lines, there are also some single willows. Few trees in the wide area make a vacant feeling and are not suitable for wild animals hiding. In the future, various trees like birch, beech, elm, cherry, and hazelnut can be introduce to the site to improve the bio-diversity. At the southeast, there are some tree nursery and fruit farming which require windshield. As a result, in the future, more trees will be plant in the site as figure 7.45 shows.

Poplar

Oak

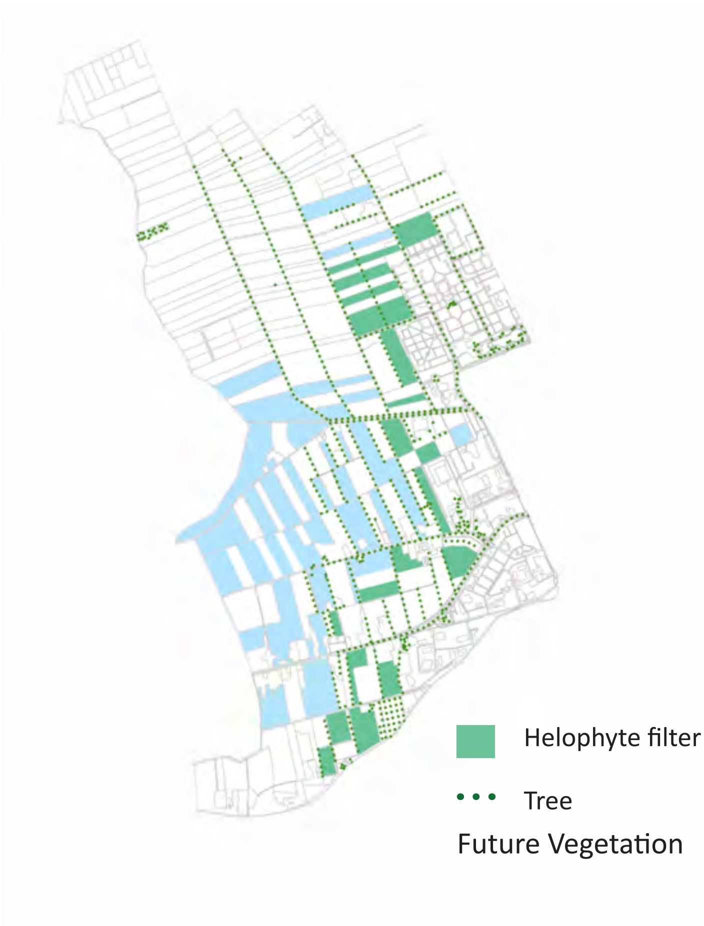


Figure 7.45 Vegetation of alternative III
Source: made by author

Figure 7.46 Plan of alternative III
Source: made by author

7.5.4 Conclusion

It is possible to fulfil all the water needs of 1,710,000m^3 at this location and it can also offer 66.7ha purifying wetland

This site can offer main water storage spaces with flat and broad pasture and farmland plots. In order to keep the existing fabric and fit the design into the context, some separated plots are selected to be the future water retention. They are connected by existing dense ditch system. Apart from that, those selected ponds are located on different soils and ground water level, so their storage ability are also different. Ponds with larger storage ability are chosen as much as possible. It can offer 1,710,000m^3 water retention which fulfills the water needs. And it can offer 66.7ha purifying wetland.

7.6 Evaluation of the three alternatives

		Alternative I High on the mountain	Alternative II Hill foot	Alternative III Lower polder
Hydrology Aspect	Place Area	354.8 ha	182 ha	1060 ha
	Groundwater Level	1.2m	0.8m	0.5m
	Needed water storage area	142.5ha	213ha	342ha
	Possible water retention	42.5ha (only can fulfill a small portion of the total water needs)	Less than 10 ha (main water retention should place on other place)	342 ha (can fulfill the water needs)
	Soil type	Sandy soil	Sandy soil	Peat & Clay
	Permeability	High	High	Low (suitable for water retention)
Function Aspect	Offering services	Small water ponds in the mountain for water storage and people entertainment	Some wetland park for purification and people entertainment	Water ponds for retention Wetland parks for purification and people entertainment
	Pump station	Far away	Far away	Close
	Altitude	High (can be used to hold some runoff water)	Middle (quickly gathering runoff water from the mountain)	Low (gradually gathering the water from higher area)
	Accessibility	Little bit far away from the urban area	High accessibility (Close to urban area and residential area)	High accessibility (close to residential area and some social facilities)
Aesthetic Aspect	Landscape change	Non-waterscape forest to waterscape Some pasture, farmland and forest change into water ponds	Non-waterscape farmland to waterscape Some pasture and farmland change into water ponds	Non-waterscape pasture to waterscape Lots of pasture and farmland change into water ponds
	Landscape Quality	Waterscape for entertainment appears	Waterscape for entertainment appears	Less agriculture pollution and more nature purification Waterscape for entertainment appears
	Fit into context	Small water ponds and narrow water ways are built which doesn't change the landscape much.	A few of plots change into water retention and wetland purification that which doesn't change the whole picture much.	Scatter plots are selected to keep the original landscape scale. However, if implement all water needs here, the total image will be change
Ecology Aspect	Vegetation	Less trees and pastures	Less pastures	More tree lines as wind shield
	Wetland	4-8 ha	1-2 ha	66.7 ha

Positive change (orange)

Negative change (green)

Figure 7.47 Evaluation of three alternatives
Source: made by author

Drawbacks can be found in each alternative, so it's better to make an integrated plan to avoid negative change and maximum positive change

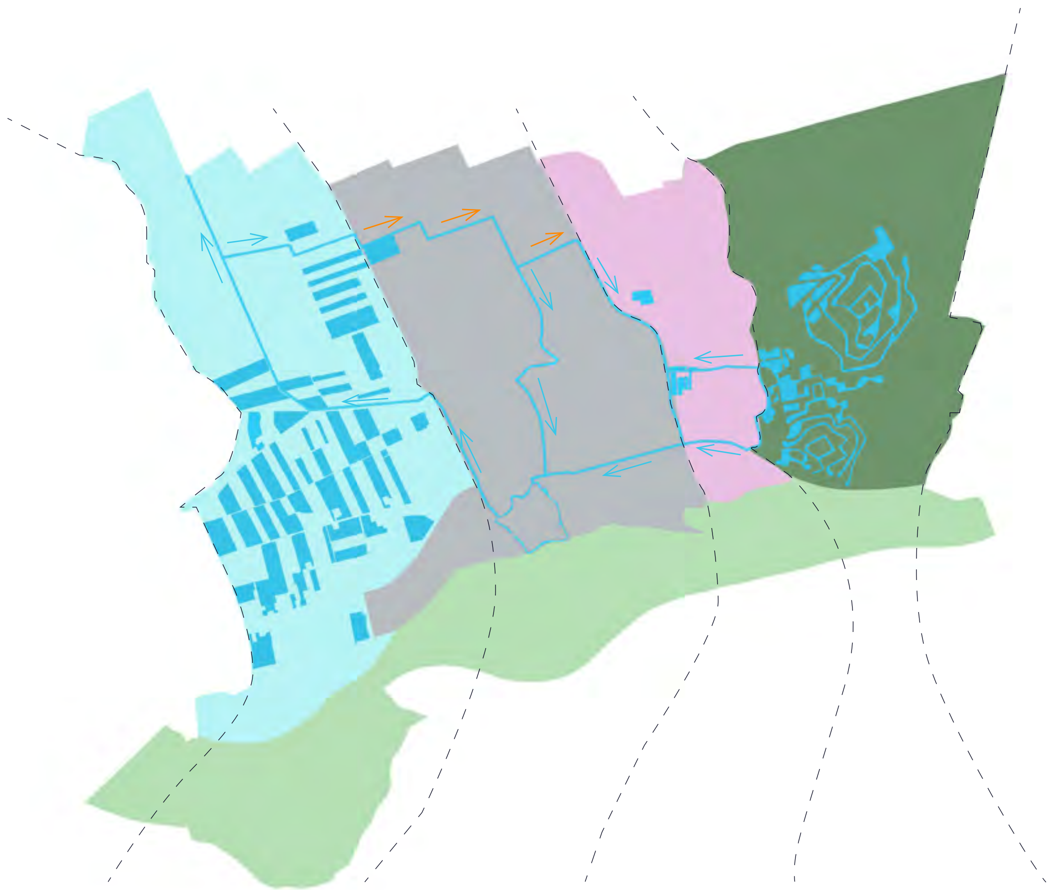
Conclusion of three alternatives

By assessing the three alternatives, both positive change and negative changes can be found. For Alternative I, if implement the whole water needs in this site, the forest will be destroyed. For Alternative II, the site is not enough for the whole water retention. And for Alternative III, although the area is enough, the water retention is still huge to this site. The landscape will be totally changed. Therefore, an integrated plan will be developed to maximum the positive changes and avoid the negative changes.

7.7 Integrated Master Plan

By choosing the most suitable water retention sites in three alternatives, to fulfill the storage need, an integrated water plan is developed. As figure 7.48 show, there are some separated ponds and ditches on the mountain Veluwe, some water plots in the hill foot area and the main water retention is set on the Wageningen Low area. Not much water retention is selected in the urban area since it is really dense. However, several ditches (shows in orange arrows) are built in the urban area which has an important role in connecting the water bodies of Wageningen low and high. By adding this water way, a circulation is also established in the Wageningen water system.

Suitable sites in three alternatives are selected to be future retention and a circulation of water is built on Wageningen surface



	Wageningen low	Urban area	Hill foot in-between area	Wageningen high	Water front
Possible water storage (10000m^3)	171	0	10	51	0
Actually water storage in the integrated plan (10000m^3)	129	0	8	34	0
Offering wetland purification (ha)	66.7	0	8	10	0
Offering communication park (ha)	62	0	6.7	16	0

Figure 7.48 Integrated plan
Source: made by author


1
0.5
0

Figure 7.49 Master plan
Source: made by author

Chapter 8

Detail design

Index

Figure 8.1 Detain design map
Source: made by author

Four detail designs are selected based on different landscape zones.
Detail 1 is located on "Wageningen High" area, detail 2 is located in "In-between" area, detail 3 in located in "Wageningen Low" area and detail 4 is located in "Urban" area.

8.1 Detail 1: Water courses on “Wageningen High”

8.1.1 Site plan

The “Wageningen High” is composed of high permeable sandy soil and lies on the mountain Veluwe. The high permeable soil and relatively low ground water level is suitable for storing groundwater while the high position makes the rainwater quickly run off to the foothill. Thus, to storing water in this area, the first task is to cut down run off water. There are two ways to reduce runoff water: increase the permeability of the paved surfaces and hold water on the mountain. Besides that, the changing landform makes it not easy to hold the water. Therefore the contour line becomes an important reference in designing the water courses.

Figure 8.2 Location of detail 1
Source: picture by author

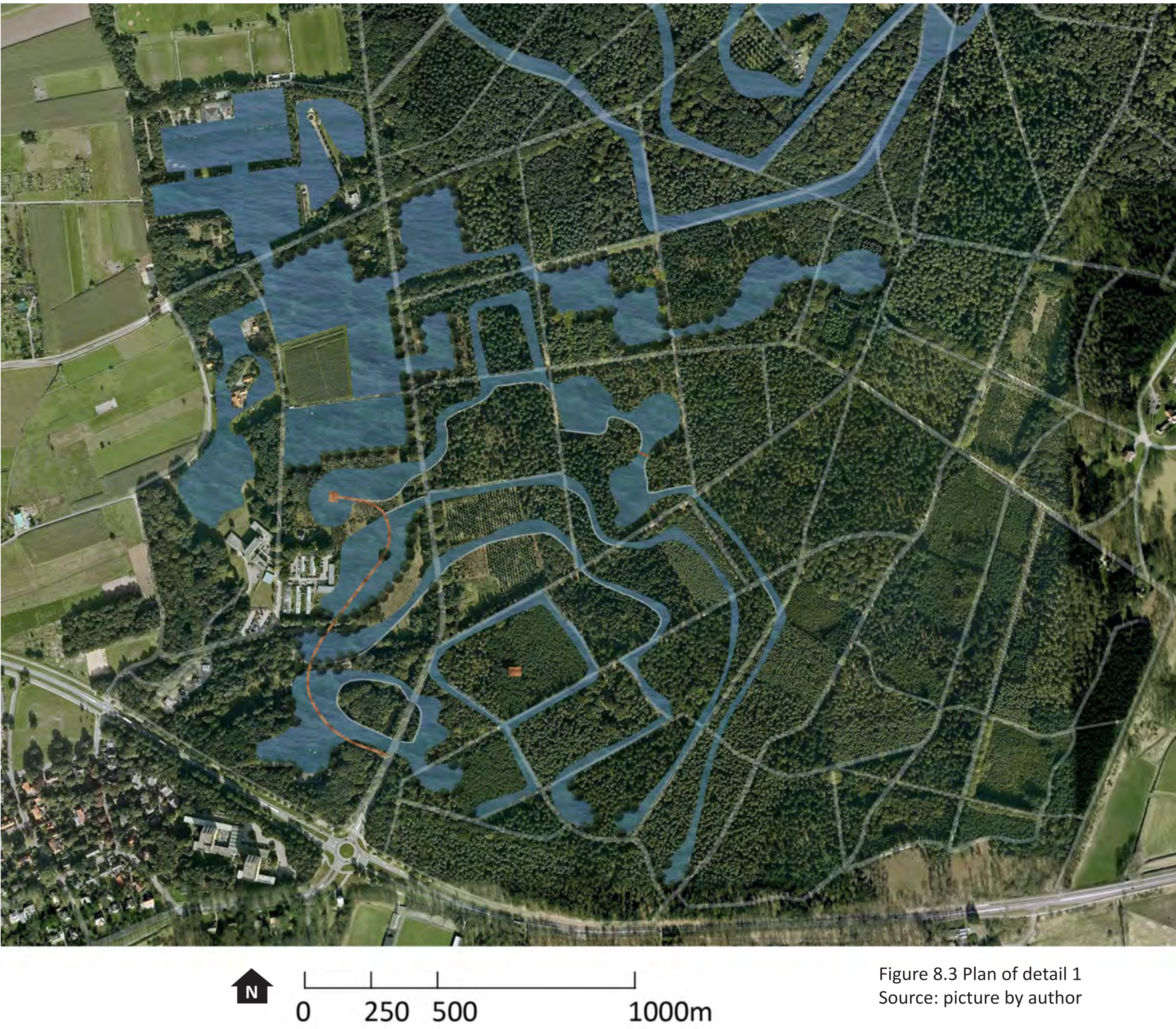


Figure 8.3 Plan of detail 1
Source: picture by author

8.1.2 Travelling routes and cross-section

New travelling route and a new landmark

Besides the current travelling route the new design offers a new route (shows in figure 8.4) which people will have a feeling of "travelling with water." The existing route (figure 8.4) is shaped in grids without any designed "route", that means people can choose the route whatever they want. However, it doesn't mean a freedom for the travelers; the dense and high bush blocks the view. Actually, people, especially for first visitors, will have no idea where they are and where they could go. Therefore, a new route with a leading function is quite crucial to the site. The new route (figure 8.5) follows the built ditches which are designed according to the contour line and the existing roads. Following the water course, the new route will lead people to the top of the mountain. And at the top of the mountain, there is a new landmark: an out look for people to climbing up and have a overview of the Wageningen (figure 8.6)!

Current travelling route

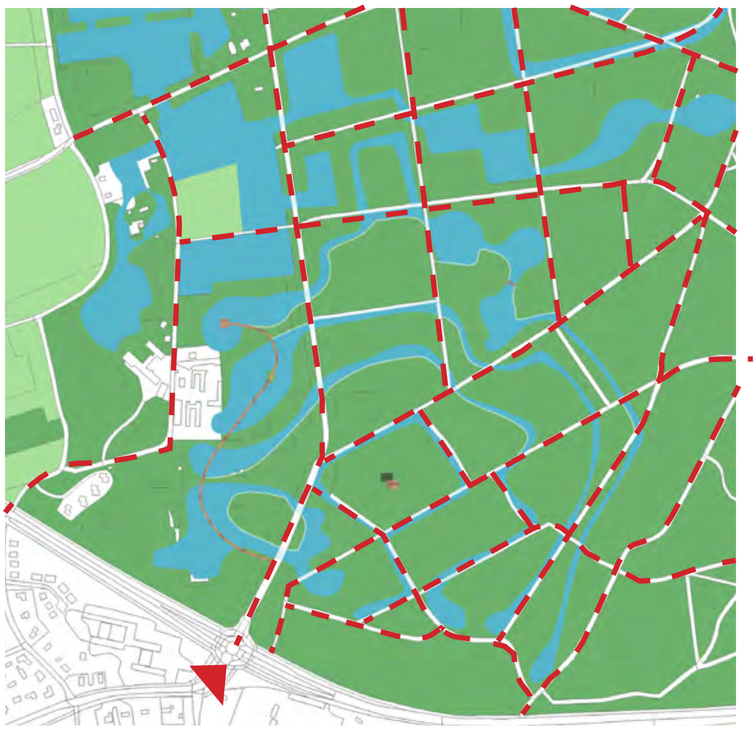
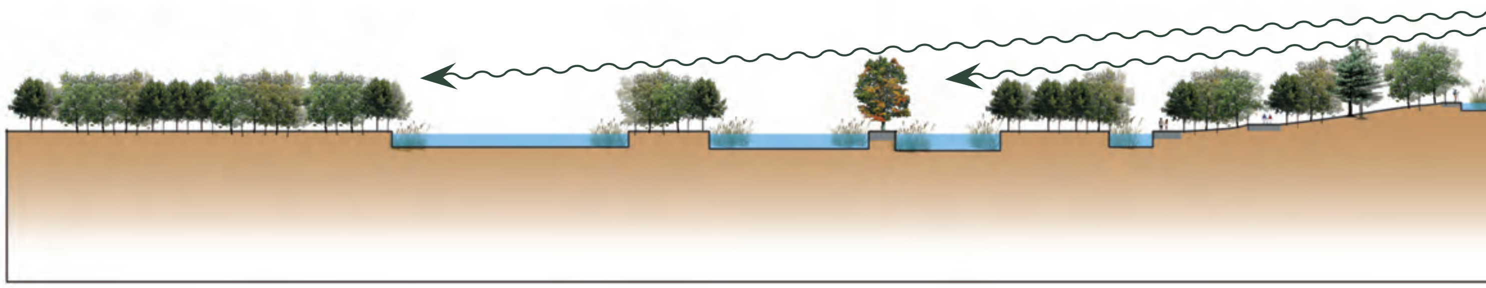


Figure 8.4 Current traveling route of detail 1
Source: picture by author

Offering new travel experience route: "travel with water"

Figure 8.5 New traveling route of detail 1
Source: picture by author


a



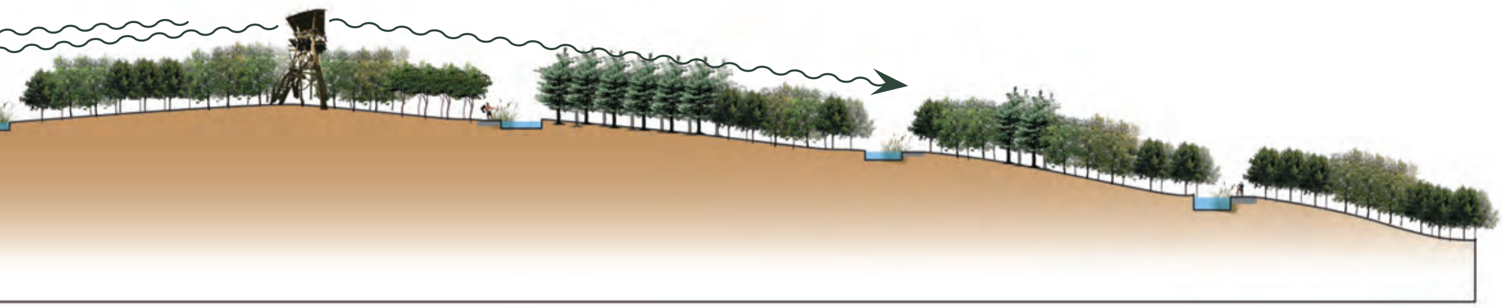


Figure 8.6 Cross section a-a’
Source: picture by author

8.1.3 Water way along the paths

Ditches can be set along the existing path since they are quite broad

Although there are quite a lot trees in the forest, there are broad spaces along the existing path. It can be transferred into future water ways for holding and storing water. And the path can be paved by high permeable materials (like gravel) for more infiltration. Figure 8.10 shows the future image of the ditch alongside the existing walking path.

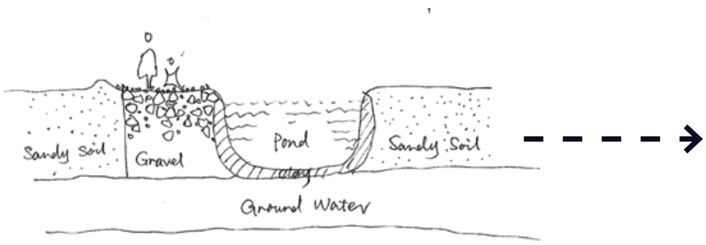


Figure 8.7 Design model for waterway along the existing paths
Source: picture by author

Figure 8.8 Current situation of the existing paths
Source: picture by author

Figure 8.9 Cross-section b-b’
Source: picture by author

Figure 8.10 Future image for water way along the existing paths
Source: picture by author

8.1.4 Ponds in the forest

Locations with poor plant condition can be transferred into future ponds

There are some places in the forest that the condition of the plants is not very good as figure 8.9 shows. The future water ponds will be located at the place like that. After implement of the water ponds, the traveler will found a beautiful water feature surrounded by trees which is really a surprise to them (figure 8.13).

Figure 8.11 Location of the ponds in the forest
Source: picture by author

Figure 8.12 Current situation of selected ponds location
Source: picture by author

Figure 8.13 Future image of the ponds in the forest
Source: picture by author

8.1.5 Water retention at the hill foot

At the hill foot, there are some pasture plots and demolished houses, which are suitable for future water retention. And they are also on the “easy collecting” zone (analysed in Chapter 7). Apart from the storing function, the water retention can also combine some recreation function. Some wandering wooden paths are built on the water, so that people can travel into the wetland. And the big old tree in good condition will be well maintained in the design as figure 8.15 shows.

Figure 8.14 Future image of the ponds in the forest
Source: picture by author

Figure 8.15 Future image of the ponds in the forest
Source: picture by author

8.2 Detail 2: Wetland park in the Eng

8.2.1 Site plan

The choosing water plots in this "In-between" area are located on the "easy collecting" zone (analysed in Chapter7). There is a sport field in the center of the site and the residential area sites to the west. After implementing the wetland park in this site, it will become an integrated communicating center for the nearby neighborhoods. The function of the park concludes: water retention for seasonal storage, a neighborhood park, a sports field and a helophyte filter.

Figure 8.16 Location of detail 2
Source: picture by author

Figure 8.17 Plan of detail 2
Source: picture by author

8.2.2 Travelling routes

The site consists of private pasture plots currently, so that there're not many connections to the surroundings. After the design, the place will be transformed into a wetland park which is open to the public. Therefore, more connection roads are needed for convenience of the visitors. Some wooden platforms are built on the water, so that the travelers have a chance of walking into the water and play with it.

By adding more connections, the site is open to the public.

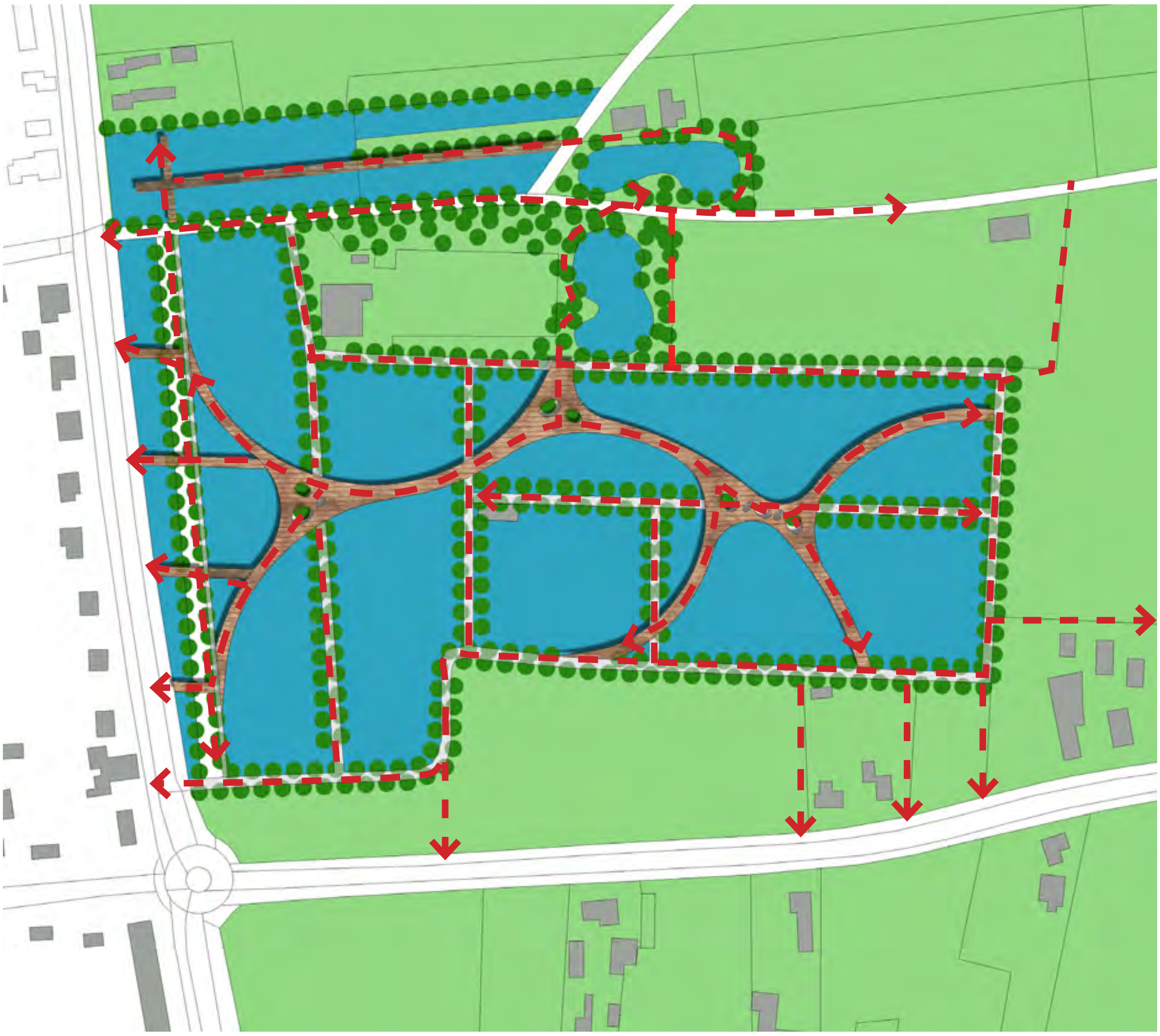


Figure 8.18 New route of detail 2
Source: picture by author

8.2.3 Plaza on the Wetland

The wooden paths offer a travelling route on the water. And there’re several landscape knots set at the junctions for people gathering, resting, chatting or even holding parties. The park offers the visitors a feeling as they are on an island surrounded by water. Figure 8.19 shows the section of the plaza while figure 8.20 shows the future image of the plaza on water. Beautiful flowers are also introduced in the plaza to make it more attractive.

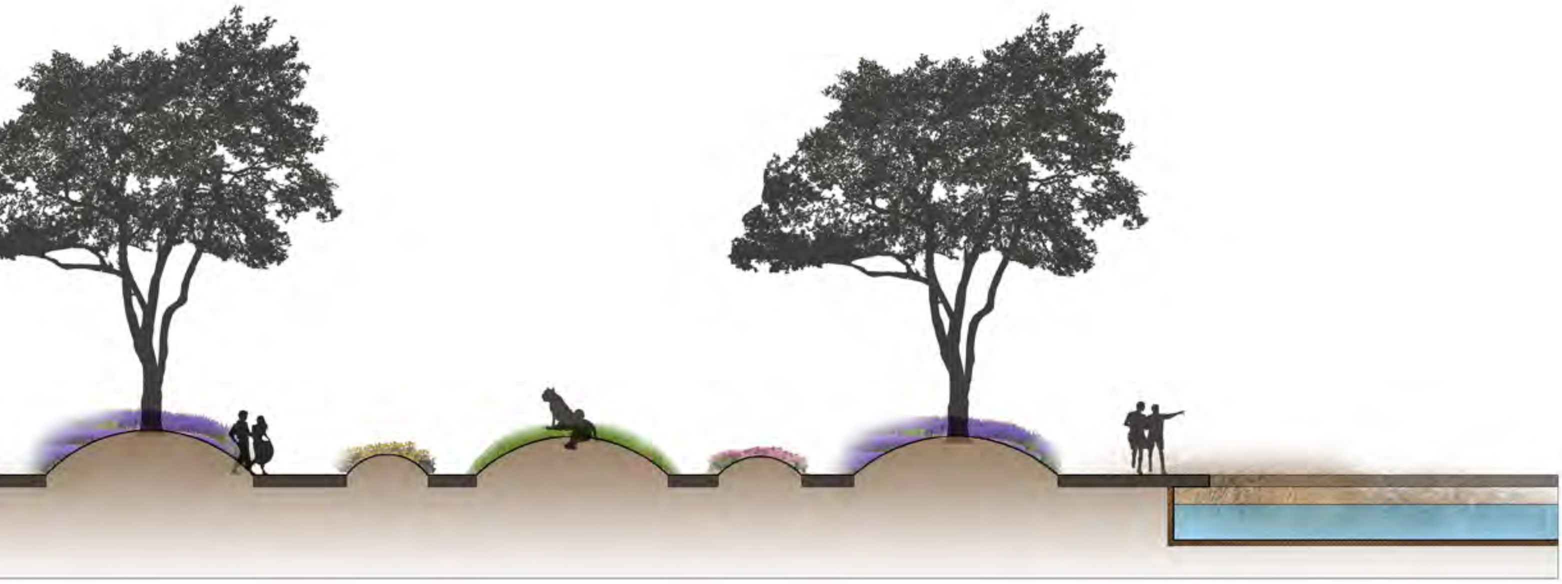


Figure 8.19 Cross-section c-c’
Source: picture by author

Figure 8.20 Future image of plaza on the wetland
Source: picture by author

8.2.4 Entrance alongside Diedenweg

There will be many entrances of the wetland park along the Diedenweg in the future since it is opposite to the residential area. The new entrances offer shortcuts for the residents there. Figure 8.21 shows the current situation on Diedenweg, while figure 8.22 shows the future image: several wooden bridges connect the wetland park and the walking path on Diedenweg.

Figure 8.21 Current situation along Diedenweg
Source: Google map

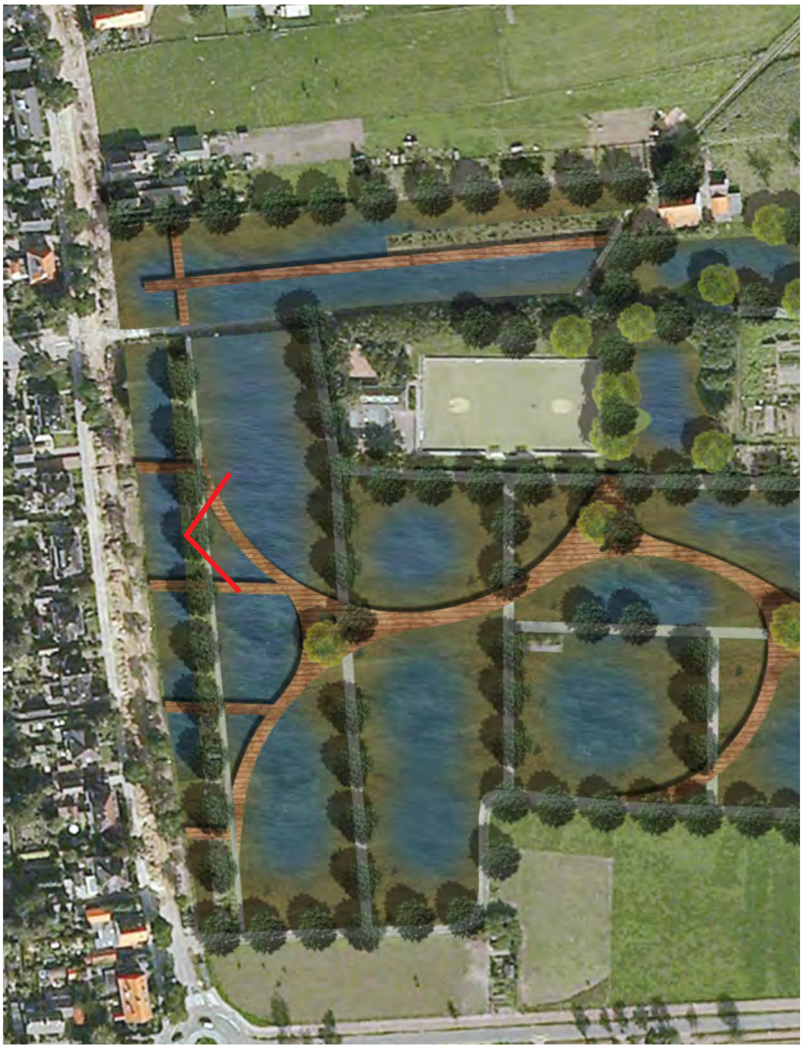


Figure 8.22 Cross-section of " Patch-corridor-matrix"
Source: picture by author

8.3 Detail 3: Wetland park for residents in Binnenveld

8.3.1 Site plan

The main water retention is set at the lowest part of Wageningen in the northwest. Currently, this area consists of pasture and farmland plots. The new wetland park is built next to the residential area of Binnenveld. By adding some water plots into the landscape, the experience becomes more interesting than before. Several landscape knots, consist of platforms or plazas, offering entertainment and rest place for visitors.

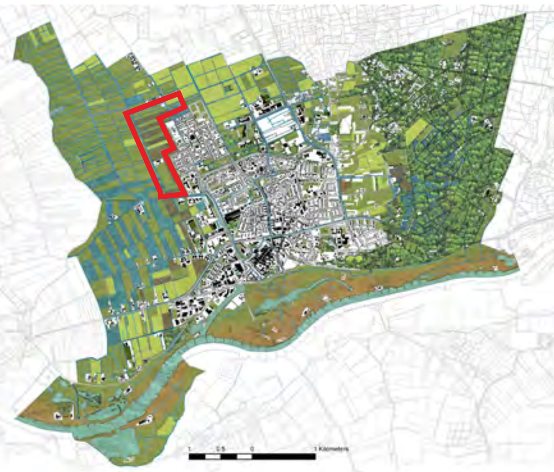


Figure 8.23 Location of detail 3
Source: made by author

Figure 8.24 Plan of detail 3
Source: made by author

8.3.2 Travelling route

There are many connections in the new travelling route which connect the existing roads and the newly build wooden paths on water as figure 8.25 shows. Besides that, there are four landscape knots (shown in dash circle) in which people can gathering and have fun. It not only offers a good place to go for the residents and also visitors from long distance, but also takes a strong role in storing and purifying the water.

Figure 8.25 Travelling route of detail 3
Source: made by author

8.3.3 Plaza on the wetland park

Figure 8.27 shows one of the landscape knots in Wetland Park. It is an island shaped plaza, half of it is suspending on water and the rest is landing on the pasture. The landscape quality will be high according to the rich plants resource and helophyte filter. Apart from that, there is a protective wetland nearby. After implementing the wetland park, the place will also welcomes some wild animals from the conservation area.

Figure 8.26 Current situatio
Source: Google map

n of the plaza on wetland park

Figure 8.27 Future image of plaza on the wetland
Source: picture by author

8.3.4 Landscape experience changes on the cycling road

Monotonic landscape become changeable by adding some water plots

By implementing some water plots into the site, the monotonic landscape changes into a changeable landscape. So the travelling experience will be not so boring as before. For the vegetation, there is already some tree line along the road with some broken parts. It will be replanted on both sides of the road. Figure 8.29 shows the future image on the cycling route: some plots turn into water plots, tree line is completed, and some wooden paths are set for getting closer to the water. Figure 8.30 to figure 8.32 shows diverse landscape experience along the national cycling route.

Figure 8.28 Current situation on the cycling route
Source: Google map

Figure 8.29 Future image on the cycling route
Source: made by author


d
d'
e
e'
f
f'
0
100
200
500m

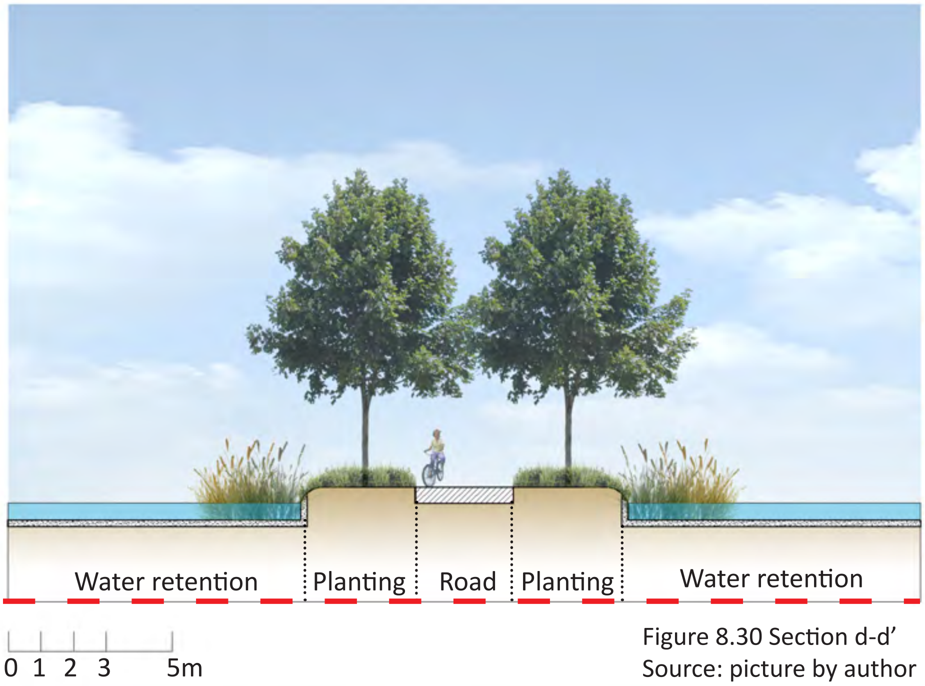


Figure 8.30 Section d-d'
Source: picture by author

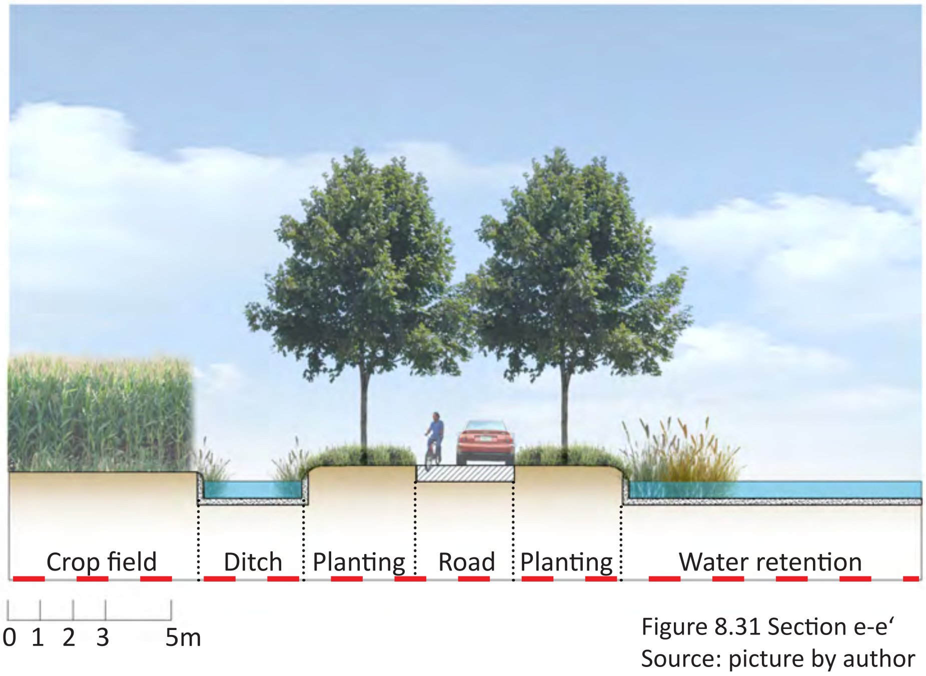


Figure 8.31 Section e-e'
Source: picture by author

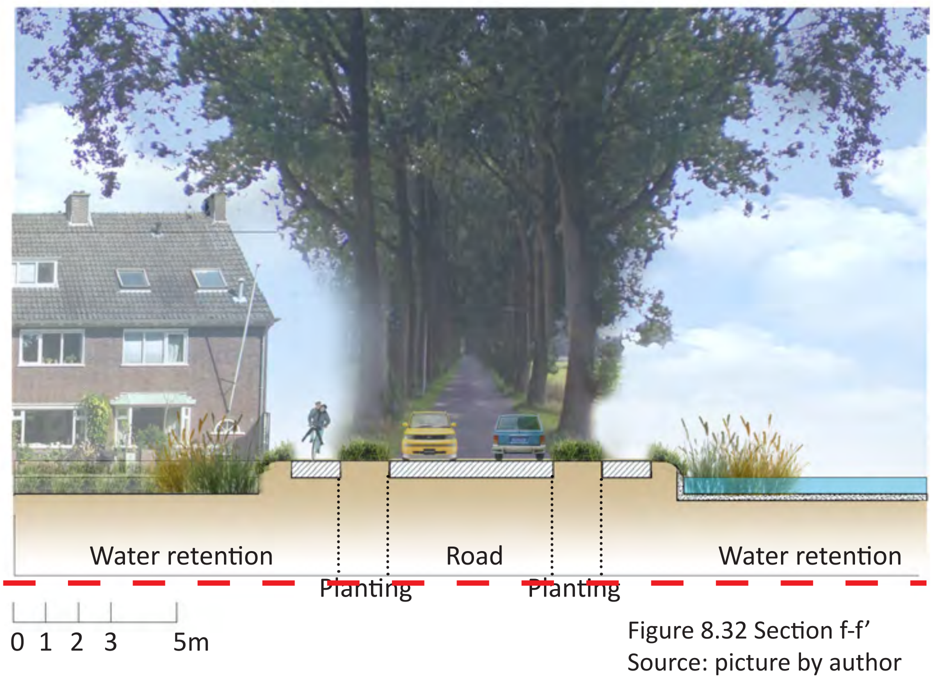


Figure 8.32 Section f-f'
Source: picture by author

8.3.5 Small wooden paths upon water

Some small wetland parks with wooden platforms are designed near the residential area. The water catchments do not only leave space for excess water but also offer an opportunity for people to relax from work and enjoy the nature. It brings more fun to urban life and breaks the monotonic landscape of enclosed farmlands and pastures. The parks add residents participatory to the landscape.

Figure 8.33 Future image of the small wooden paths
Source: picture by author

8.4 Detail 4: Entrance park in the city center

8.4.1 The “missing link” in the city center

Current problem:
Missing link in the moat and park ring
No clear entrance to the main street

The city center of Wageningen can be dated from 16th century. It is a typical fortified city with protective moat, city wall and fortifications. Only the city moat remains till today for people to trace back the history. Therefore, it strongly stands for the place identity.

However, there is a missing link in both the city moat and garden ring at the northeast corner as figure 8.34 shows. For the purpose of reviving the city center and consolidation the place identity, the municipality is considering re-connecting the moat. For this thesis, this moat is also a very important water body in the water system.

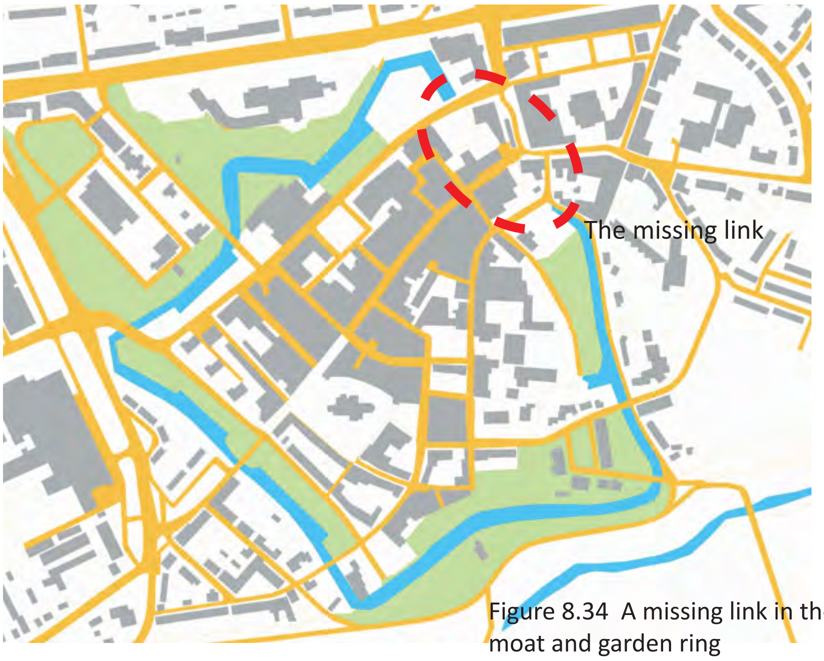


Figure 8.34 A missing link in the city moat and garden ring
Source: GIS data

Inventory

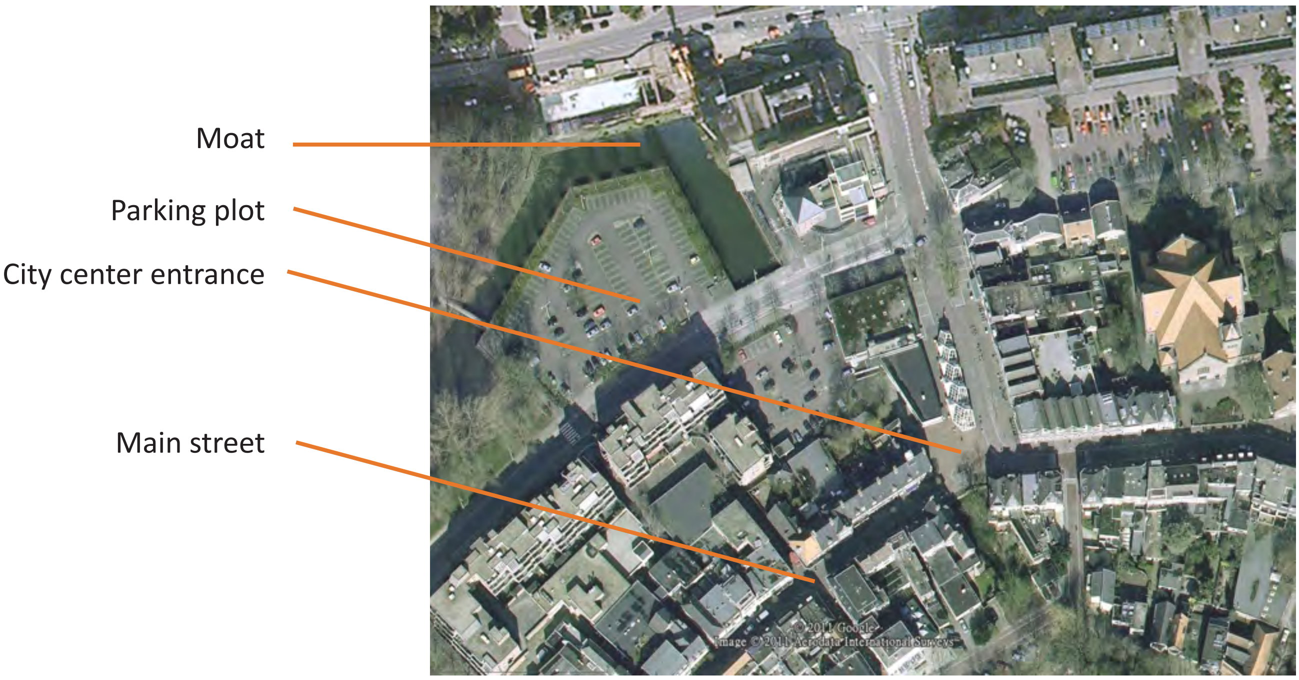


Figure 8.35 Inventory of city center
Source: made by author

8.4.2 Plan of city center

The moat around current city center is a main water feature in the urban area in which people can participate a lot. And its historical value can not be ignored. By re-connecting the moat and adding helophyte filter, the water quality of the moat can be largely improved. The proposed wetland park also fills the missing link in the garden ring along the moat. The meandering wooden paths in the wetland offer opportunity of getting closer to the water, in the meanwhile, the purifying helophyte can guarantee the human safety. Shops can also be embedded in side the landscape.

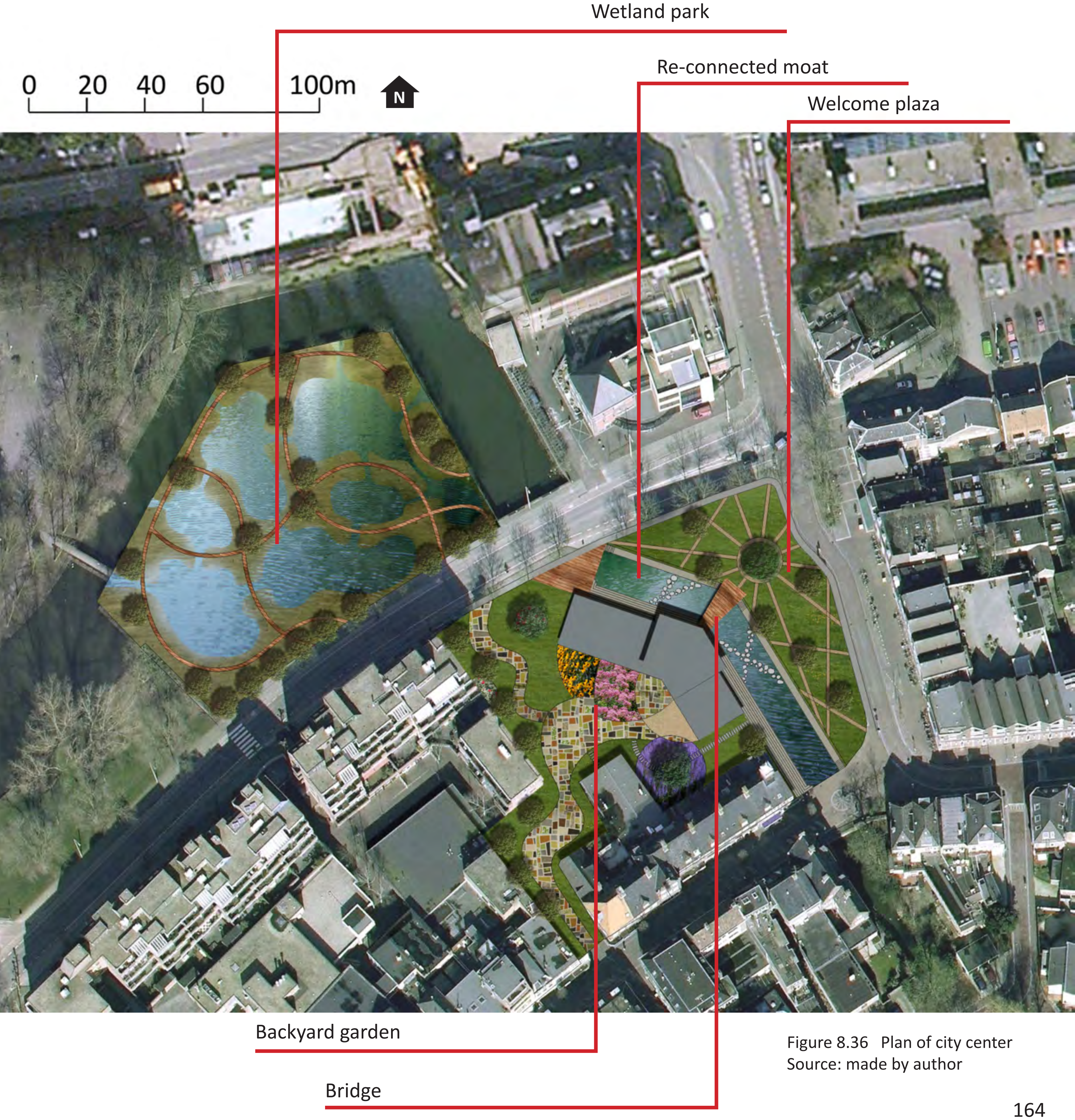
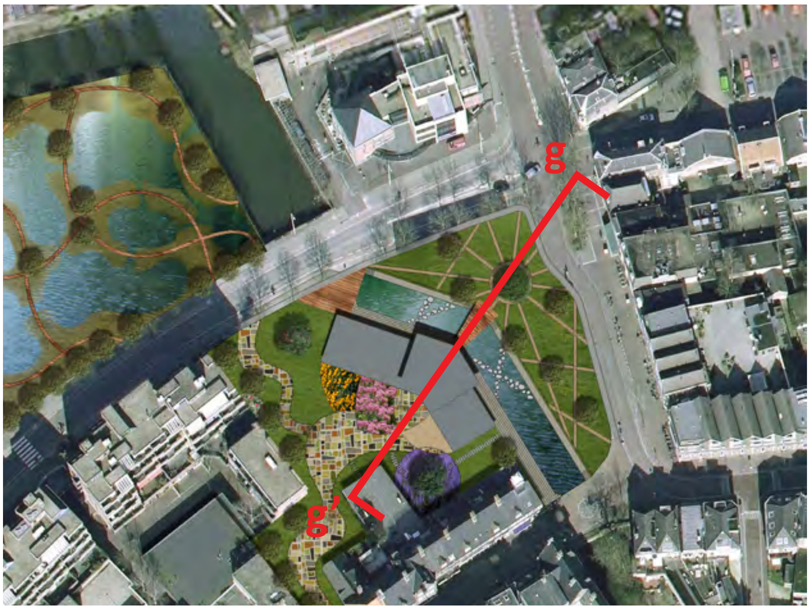


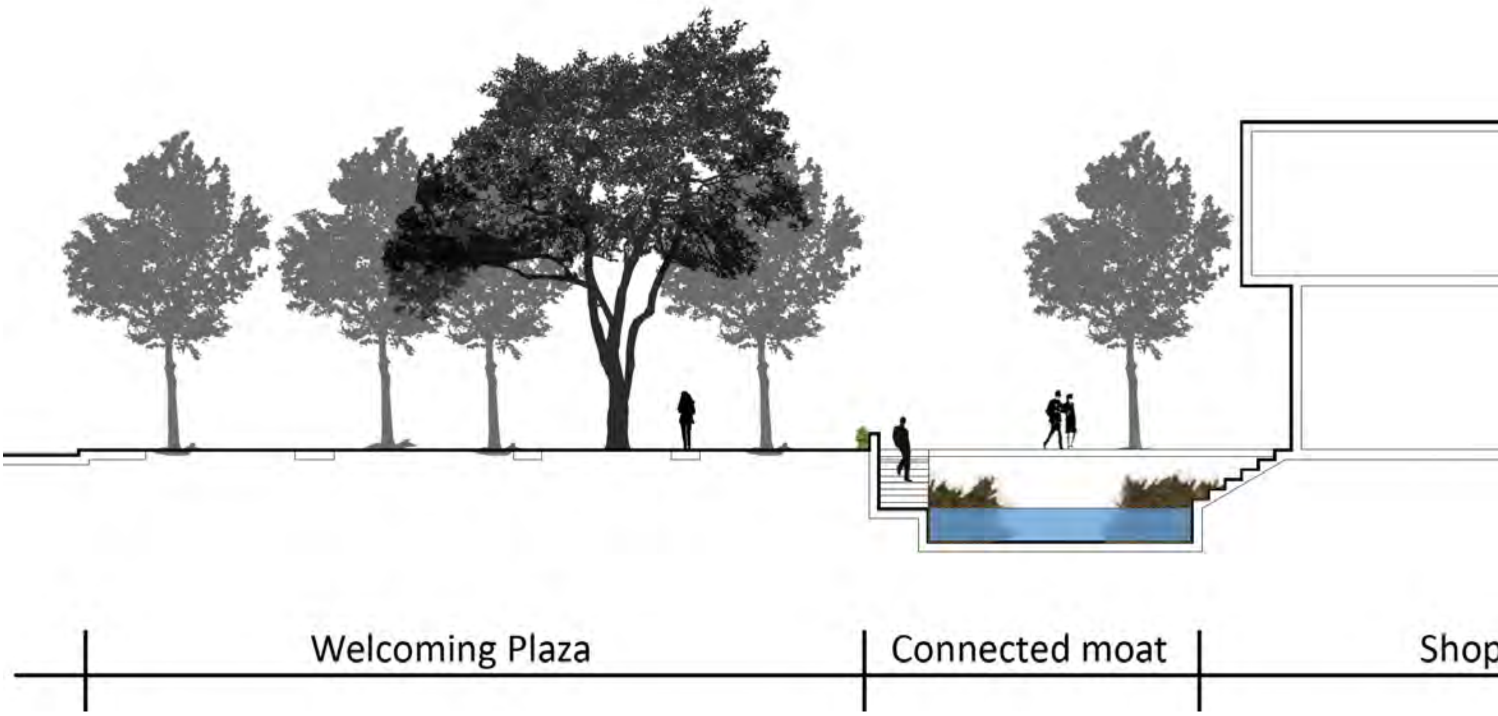
Figure 8.36 Plan of city center
Source: made by author

8.4.3 Travelling route and cross-section

A new travelling route is designed for Wageningen center.

After design, a welcome plaza is built in the front. People can travel across the welcome plaza first. And then, after passing the wooden bridge on the reconnected moat, visitors will enter the main building of Wageningen center. After it, there is a backyard garden which is full of beautiful flowers leading to the main street (figure 8.37) .





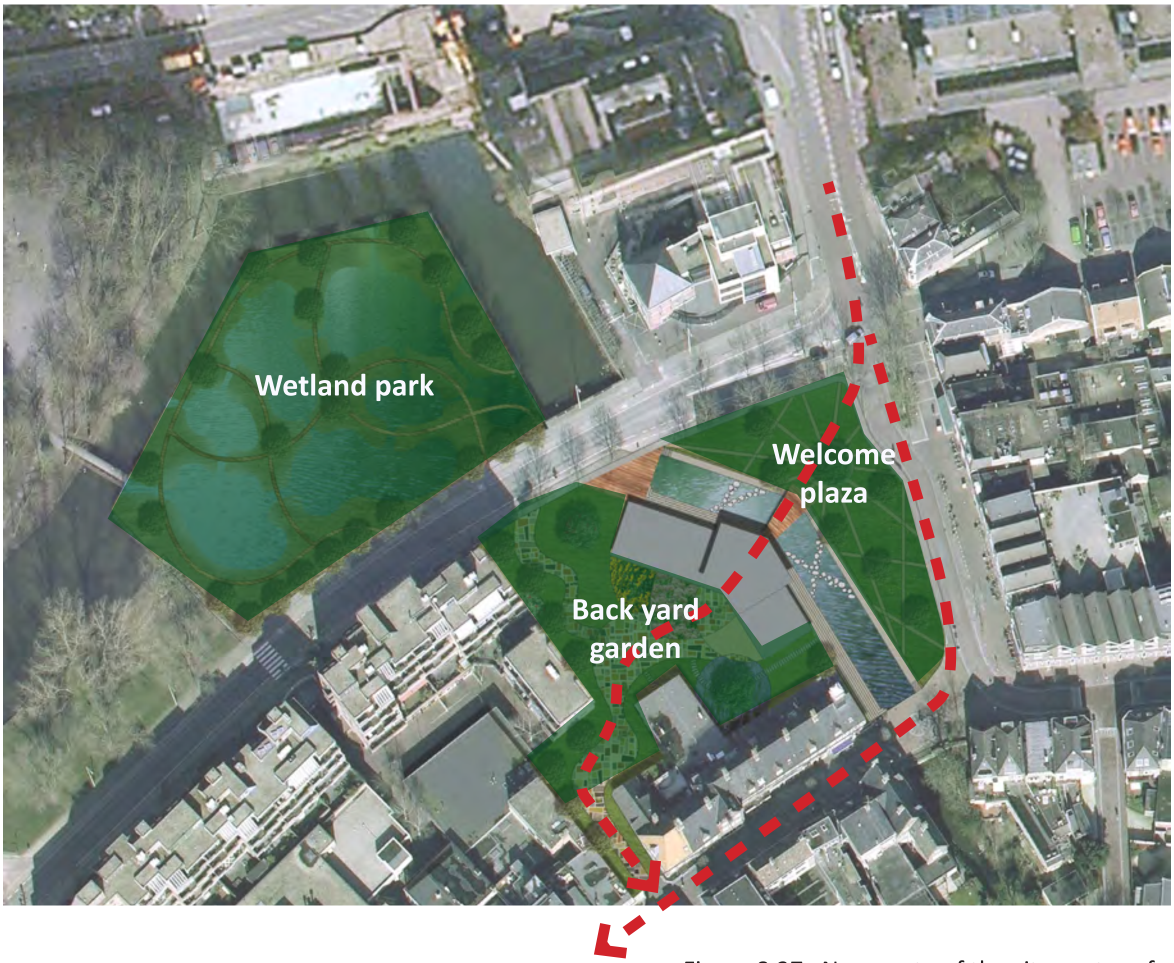


Figure 8.37 New route of the city center of Wageningen
Source: made by author

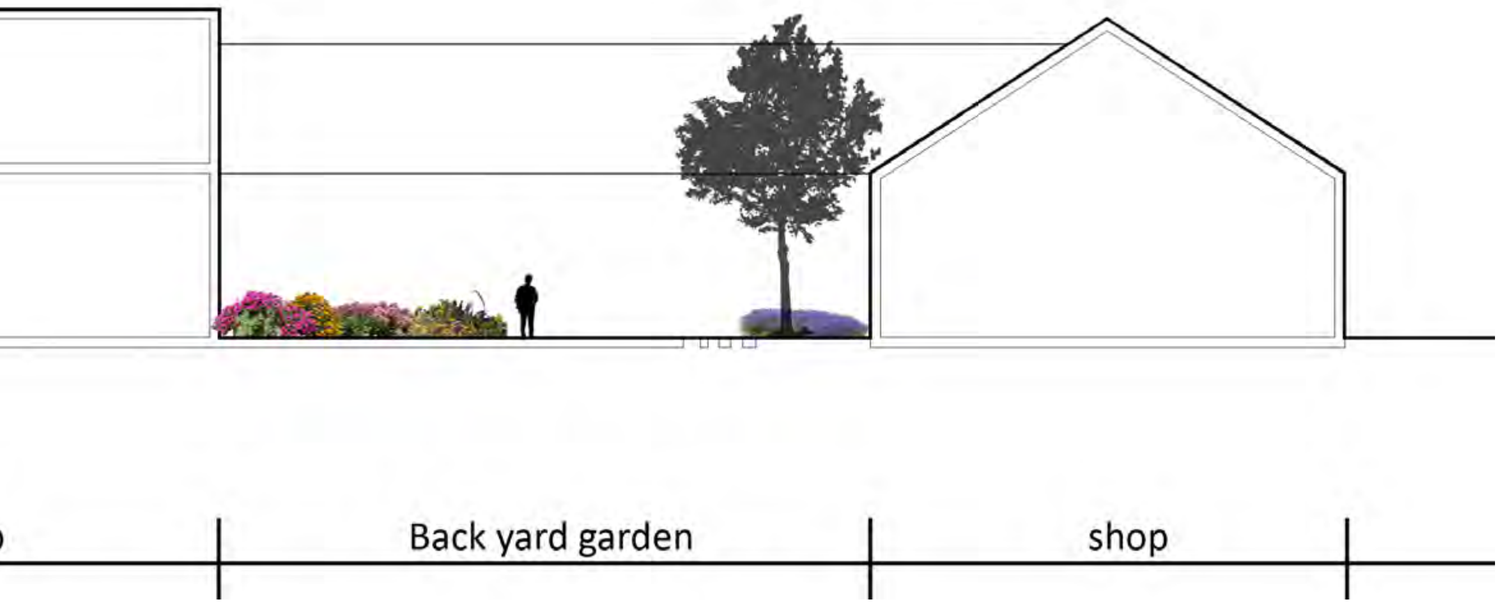


Figure 8.38 Cross-section g-g' of city center 1:200
Source: made by author

8.4.4 Images of the new entrance of city center

Figure 8.39 shows the image of the welcome plaza. An old tree is planted in the center and the pavement shapes in a pattern of the sign of Wageningen Municipality. It offers a comfortable grass land for people resting and gathering here.

Figure 8.40 shows the image of the reconnected moat. In the design, it does not only connect the broken moat, but also offering the citizen a chance to get close to the water and play with it.

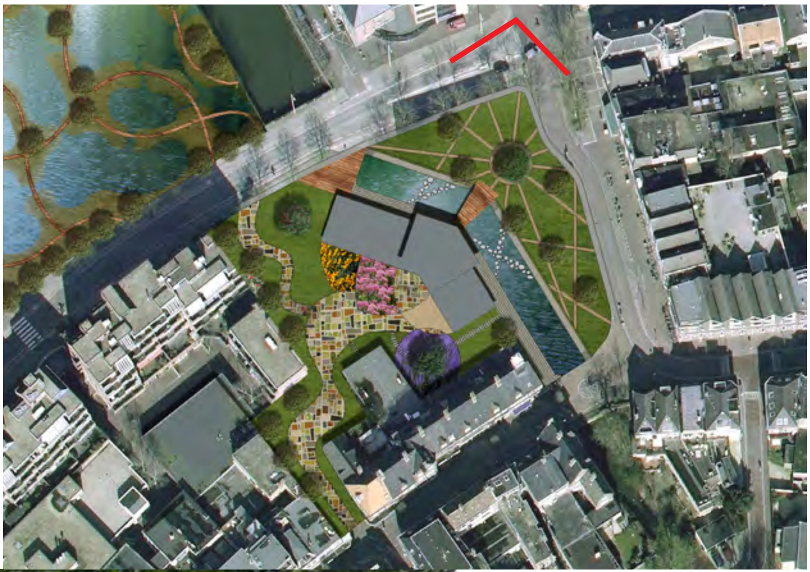


Figure 8.39 Future image of the new entrance
Source: made by author

Figure 8.40 Future image of the re-connected moat
Source: made by author

Chapter 9

Final evaluation and Conclusion

Index

9.1 Final evaluation

After the design, a sustainable system based on water network is established in addition to the existing infrastructure of Wageningen. The assessment of the design uses the criteria of the design strategy. For hydrology aspect, the design fulfills calculated water needs under current, scenario W and G and improves the nature purifying process by adding helophyte filters in water retention. For function aspect, in the design, the wetland park is multifunctional for a place for entertainment, a water tank for storage and a purification filter of the water. The parks usually are located next to residential area that people can get there easily. For the aesthetic aspect, the design tries to protect the local identity like the forest and the arable land in the Eng which are loved by the locals. And in the places where the changes take place, the design tries to fit the catchments into the context by analysis the existing morphology, pattern and landuse. For the ecology aspect, the design tries to protect the existing vegetation and introduce more species to increase the biodiversity. However, the space and environment for various species vegetation is limited.

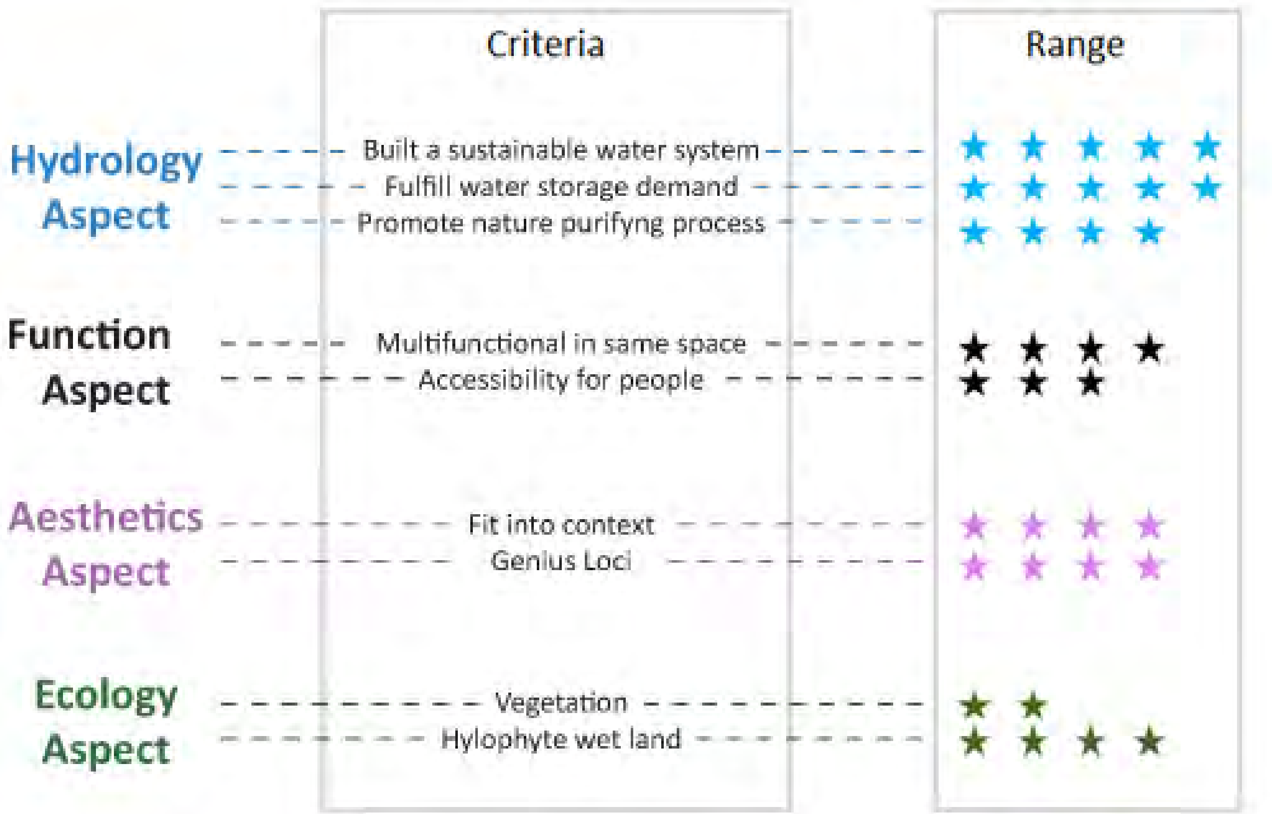


Fig 9.1 Final evaluation on the design
Source: made by author

9.2 Conclusion

Main goal

The main aim of this master thesis is to developing a strategy for the waterscape of Wageningen which can solve the existing problems, prepare for future climate change and improve the landscape quality.

Global water issues

The thesis starts with global water issues of “the omission of water in the urban life”, increasing water demands and threatened water quality. However, the abundant water resource that most Netherlands cities have has a great opportunity to solve the water problems and change the cities into a properly functioning ecosystem and an attractive landscape. Therefore, the city of Wageningen is chosen to be the research objective as a pilot project of urban water system management.

Analysis on problems

Research question 1 “How does the water system work in Wageningen?” and 2 “What are the existing water problem in Wageningen?” have been answered in chapter 4. Wageningen water system can be generalized as a flushing system which is non-sustainable and highly depending on the adjacent systems. Human’s interference of regulating waterways, eliminating water elements and replacing them with underground sewerage system causes the water feature gradually disappear during the expansion. Uneven rainwater distribution leads to surface flood in rain storms and drought in summer, and the climate change will make the situation even more dramatic. The dense urban area with little green and water aggravate the degradation of the landscape quality. Falling leaves, precipitation, bread, ducks, and overflows consist the major pollutions in urban area while the pollutions in rural area mainly come from farming.

Research question 3 “What are the impacts of climate change on the waterscape of Wageningen?” has been answered in Chapter 1 and 5. Climate change has great influence on all the aspect of the earth. Especially on the water system, the climate change will lead to temperature rise, sea level rise, mild winters and hot summers, more wetter winters, more extreme precipitation, increase of the intensity of extreme rain showers and decrease of the number of rainy days in summer. All these changes greatly affect the balance of the water system. For Wageningen, the precipitation has an increase trend, there will be more intensive rain fall and summer drought will become more serious.

Analysis on solutions

Research question 4 “What is the proper water management method in different soil type area? And which suits Wageningen best?” has been answered in chapter 2 and 6. This thesis makes reference to the Tjallingii’s guiding models for urban water management. Each model correspondence to different water system based on different soil types. For Wageningen, the situation is quite distinct from SW to NE. In the southwest, the soil is mainly peat and clay which is low permeable soil that a lot surface water appears. While in the northeast, its altitude is higher, and the place is covered by low permeable sandy soil, therefore, there is seldom surface water. Therefore, in order to manage the Wageningen water system as a whole, integrated strategy which suits both situations and well-connected is needed. The “combined model” is developed based on the “circulation model” and “infiltration model” to maximum the efficiency and sustainability of the water system.

Research question 5 "What is the possible solution in order to prepare for the future climate change?" has been answered in Chapter 5. The observed statistic change according to the effect of the climate change on water system is the fluctuation on the amount of precipitation and evaporation. By calculation the past 10 years' data, we can find that the precipitation has an increasing trend. By adaptation the KNMI's scenarios, the amount of the increased water can be roughly calculated which becomes the base of the following design.

Hypothesis

The hypothesis is "If a "combined model" (infiltration + circulation) is applied to water system in Wageningen Municipality, the local water system will be more resilient to the changing climate and the landscape quality will also be improved" has been testified by the design.

Research by design: testing alternatives

Possibility of implementation of the required criteria has been tested on different design alternatives on different landscape zones. By comparing all the pros and cons, integrated plan have been drawn to maximum the advantages and avoid the disadvantages. There are always contradictories between the affect factors like availability of the space, protecting place identity and the occupation of water retention, ecology, sustainability and economy development. There is not a single method that can satisfy all the aspects. That requires designers to balance all these factors, apply multi-function on one site and offer diverse spectrum of activities and spatial experience.

Conclusion

After the design, Wageningen can offer 1,710,000m3 water retention, which can cover the water need under the situation of scenario W and G, 84.7 ha wetland and communication park for purifying the water and people's entertainment. As a result, the designed area become more resilient to the climate change under scenario W and G and the landscape quality is also improved by wetland purification and more nature rest places.

Reference

Books and Journals:

Bremer, J (Eds.). 2006. *Climate in the 21st century 'four scenarios for the Nederlands'.* KNMI. De Bilt. The Nederlands.

EEA Report. 2008. *Impacts of Europe's changing climate - 2008 indicator-based assessment.* Website: http://www.eea.europa.eu/publications/eea_report_2008_4/

Forman, R.T.T. 1981. *Interaction among landscape elements: a core of landscape ecology.* Proc. Int. Congr. Neth. Soc. Landscape Ecol., Veldhoven. Pudoc, Wageningen, The Netherlands

Hamers, J. 2009. Thesis report: *Wetlandscape:Adaption to climate change on the island of Ijsselmonde. P138-141*

Hajer, M. & Loeber, A. 2007. *De hype voorbij, klimaatverandering als structureel ruimtelijk vraagstuk.*

Hermens, P., Salm, J.N. & Zwet, C. 2010. *A working landscape for New Orleans.* Wageningen University. Wageningen

Holtslag, A. A. M., Heusinkveld, B. G and Jacobs, A. F. G. 2009. *Eighty years of meteorological observations at Wageningen, the Netherlands: precipitation and evapotranspiration.* International Journal of climatology

Houghton, J. 2004. *Global Warming* (3rd edition). Cambridge University Press

Meyer, E.K., 2008. *Sustaining beauty. The performance of appearance. A manifesto in three parts.* Journal of Landscape Archtitecture, spring 2008

Marsh, W.M. & Dozier, J. 1986. *Landscape: An Intoduction to Physical Geography.* John Wiley & Sons, Inc.

Mossop, E. 2006. *Landscape of Infrastructure. In The landscape Urbanism Reader.* New York: Princeton Architectural Press.

Mostert, E. 1998. *Beyond sustainability indicators. Paper for NWO international conference.* "Beyond sustainability," November 1998, Amsterdam. The Hague, the Netherlands:

Jacobs, A.F.G, Heusinkveld, B. G. a & Holtslag, A. A. M. 2009. Wageningen University, Meteorology and Air Quality Group. *Eighty years of meteorological observations at Wageningen, the Netherlands: precipitation and evapotranspiration.* International Journal of Climatology. Published online in Wiley InterScience

Kirby, A. 2000. http://www.oppapers.com/essays/The-Most-Severe-Threat-We-Face/582800?topic accessed on 2011-4-25

Klein Tank, A.M.G. and Lenderink, G (Eds.). 2009. *Climate change in the Netherlands; Supplements to the KNMI'06 scenarios.* KNMI. De Bilt. The Netherlands.

Koh, J., 1982. *Ecological design: a post-modern design paradigm of holistic philosophy and evolutionary ethic.* Landscape Journal, Vol. 1, no 2, 1982.

Koh, J., 2004. *Ecological reasoning and architectural imagination*. Wageningen: Blauwdruk in assoc. with Wageningen University and stichting Lijn in landschap.

Oliemans, W.J. & Zigterman, H. 2005. Waterpan Wageningen

UNSECO. 2006. *Water, a shared responsibility: The United Nations World Water Development Report 2.* Berghahn Books. Paris. http://www.unesco.org/water/wwap/wwdr/wwdr2/table_contents.shtml

Vickers, A. 2001. *Handbook of Water Use and Conservation: Homes, Landscapes, Businesses, Industries, Farms*. Water Plow Press

Shannon, K. 2008. *Water urbanisms*. Sun. Amsterdam

Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K., Tignor, M. & Miller, H. 2008. *Climate change 2007: the physical science basis.* Cambridge University Press Cambridge, New York, Mel¬bourne, Madrid, Cape Town, Singapore, São Paulo, Delhi.

Schaaf, S. & Warmerdam, P.M.M. 2000. *Herstel van het watersysteem in het bebouwde gebied van Wageningen.*

Spirn, A.W., 1988. *The poetics of city and nature: towards a new aesthetic for urban design.* Landscape Journal, Volume 7

Steinitz, C. 1990. *A framework for theory applicable to the education of landscape architects (and other design professionals).* Landscape Journal 9:136-143

Todd, D.K. & Mays, L.W. 2005. *Groundwater Hydrology.* WILEY. USA.

Tjallingii, S, Bron, E.R & Berendsen, R. 2007. *Ontwerpen met Water: droombeelden, doembeelden denkbeelden.* UItg. Techne Press, Amsterdam

Tjallingii, S. 2008. *The water issues in the existing city. More Urban Water: Design and Management of Dutch Water Cities.* Taylor & Francis. Netherlands.

Vickers, A. 2001. *Handbook of Water Use and Conservation: Homes, Landscapes, Businesses, Industries, Farms*. Water Plow Press

Waterschap Vallei & Eem, Waterplan Wageningen, 2005 Nov.1

World Commission on Environment and Development. Our Common Future. Oxford, UK: Oxford University Press, 1987.

Yu, K., and Padua, M. 2006. The Art of Survival. Recovering Landscape Architecture, Victoria: Images Publishing Group Ltd.

Zeeuw, J.W. de, 1954. *Hydrologische problemen in een hellend gebied en een 14e eeuwse oplossing.* Referaat van de voordracht voor het Agrohydrologisch Colloquium van de Commissie Onderzoek Landbouwwaterhuishouding Nederland te Utrecht op 15 maart 1954.

Zeisel, John. 2006. *Inquiry by design.* W. W. Norton.

Interview:

Richard van Vliet, Wageningen Municipality officer, interviewed on 2011-5-4

Websites:

Food and Agriculture Organization of United Nations
ftp://ftp.fao.org/fi/CDrom/FAO_Training/FAO_Training/General/x6706e/x6706e09.htm accessed on 2011-12-5

Houtan Park: http://www.turenscape.com/English/news/view.php?id=259

Michigan Environmental Education Curriculum
http://techalive.mtu.edu/meec/module06/Permeability.htm accessed on 2011-12-5

Natura 2000: http://natura2000.eea.europa.eu/ accessed on 2011-6-15

Transformative Water: Pitkin County, Colorado, U.S.A: http://www.asla.org/sustainable-landscapes/transwater.html

Wageningen Municipality: http://www.wageningen.nl/ accessed on 2011-4-30

Wiki Pedia: http://nl.wikipedia.org accessed on 2011-5-2

CSO control program: http://www.rougeriver.com/cso/what.html accessed on 2011-4-30

http://www.waterland.net/index.cfm/site/Water%20in%20the%20Netherlands/pageid/82F77A67-F8E6-0465-01179B9CD26816FF/index.cfm accessed on 2011-4-28

http://www.portlandonline.com/bes/index.cfm?c=44407 accessed on 2011-5-2

http://www.epa.gov/owow/NPS/lid/ accessed on 2011-5-2

List of figures

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Figure 5.6 Monthly Precipitation of Wageningen from July 2001 to 2011
Data Source: KNMI, Calculation by author

Figure 5.7 Monthly Evaporation of Wageningen from July 2001 to 2011
Data Source: KNMI, Calculation by author

Figure 5.8 Monthly Evaporation and precipitation difference analysis of Wageningen from July 2001 to 2011
Data Source: KNMI, Calculation by author

Figure 5.10 Monthly precipitation and evaporation of Wageningen in 2006
Data Source: KNMI, Calculation by author

Figure 5.10 Monthly precipitation and evaporation of Wageningen in 2006
Data Source: KNMI, Calculation by author

Figure 5.11 Exceeding area of Wageningen in floods
Source: Water board Vallei and Eem

Figure 5.12 1/10 years rainstorm flood pattern of Wageningen
Source: Water board Vallei and Eem

Figure 5.13 Required water storage according to 1/10 years flood pattern
Source: calculated by author

Figure 5.14 1/100 years flood pattern of Wageningen
Source: Water board Vallei and Eem

Figure 5.15 Required water storage according to 1/100 years flood pattern
Source: calculated by author

Figure 5.16 The KNMI's 06 scenarios
Source: KNMI

Figure 5.17 Schematic overview of the four KNMI'06 climate scenarios
Source: KNMI

Figure 5.18 Water requirements according to climate change, calculation on appendix 5.2
Source: made by author

Figure 5.19 Extra water storage needs
Source: calculated by author

Figure 5.20 Extra water storage needs in Wageningen
Source: picture by author

Figure 5.21 Relationship of different water storage needs and priorities.
Source: picture by author

Figure 5.22 Monthly water distribution in main water retention
Source: picture by author

Figure 5.23 Working principle for multifunctional water catchment in Wageningen
Source: made by author

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Appendix

Climatology data from KNMI (July 2001- July 2011)

```
# THESE DATA CAN BE USED FREELY PROVIDED THAT THE FOLLOWING SOURCE IS ACKNOWLEDGED:
# ROYAL NETHERLANDS METEOROLOGICAL INSTITUTE
#
#
# STN        LON        LAT      ALT  NAME
# 260:     5.177       52.101    2.00  DE BILT
#
# YYYYMMDD = Date (YYYY=year MM=month DD=day);
# RH     = Daily precipitation amount (in 0.1 mm) (-1 for <0.05 mm);
# RHX    = Maximum hourly precipitation amount (in 0.1 mm) (-1 for <0.05 mm);
# EV24   =  Potential evapotranspiration (Makkink) (in 0.1 mm);
#
# STN,YYYYMMDD,   RH,  RHX, EV24

260,20010701,    0,    0,   47
260,20010702,    0,    0,   24
260,20010703,    0,    0,   53
260,20010704,    0,    0,   58
260,20010705,    0,    0,   57
260,20010706,   -1,   -1,   39
260,20010707,   82,   72,   22
260,20010708,   98,   23,    4
260,20010709,    2,    1,   25
260,20010710,   35,   25,   24
260,20010711,   73,   39,   30
260,20010712,   76,   29,   25
260,20010713,  104,   44,   24
260,20010714,   57,   18,   12
260,20010715,   18,   18,   23
260,20010716,    0,    0,   33
260,20010717,    8,    7,   35
260,20010718,  127,   23,   21
260,20010719,  102,   65,   22
260,20010720,    4,    4,   20
260,20010721,   40,   24,   12
260,20010722,    2,    2,   40
260,20010723,   36,   17,   32
260,20010724,    0,    0,   41
260,20010725,    0,    0,   43
260,20010726,    0,    0,   46
260,20010727,    2,    2,   29
260,20010728,    0,    0,   43
260,20010729,    0,    0,   43
260,20010730,    0,    0,   44
260,20010731,    0,    0,   35
260,20010801,   -1,   -1,   35
260,20010802,   15,   13,   33
260,20010803,    5,    4,   23
260,20010804,   13,    7,   29
260,20010805,  124,   49,   28
260,20010806,  149,  106,   21
260,20010807,  205,   92,   19
260,20010808,  134,   62,   18
260,20010809,   90,   27,   19
260,20010810,   88,   35,   22
260,20010811,   -1,   -1,   32
260,20010812,   61,   22,    9
260,20010813,    2,    1,    7
260,20010814,    0,    0,   43
260,20010815,    0,    0,   41
260,20010816,   14,   11,   26
260,20010817,    0,    0,   36
260,20010818,   -1,   -1,   30
260,20010819,    1,    1,   27
260,20010820,   -1,   -1,   25
260,20010821,    0,    0,   32
260,20010822,    0,    0,   33
260,20010823,    0,    0,   29
260,20010824,    0,    0,   36
260,20010825,    0,    0,   38
260,20010826,  162,  106,   25
260,20010827,   15,    9,   35
260,20010828,    0,    0,   29
260,20010829,    0,    0,   31
260,20010830,   -1,   -1,   17
260,20010831,   84,   51,   15
260,20010901,    3,    3,   22
260,20010902,   11,    6,    6
260,20010903,  208,   95,    8
260,20010904,  167,   26,   16
260,20010905,    9,    3,   23
260,20010906,    4,    4,   17
260,20010907,   16,    4,   12
260,20010908,   79,   20,   22
260,20010909,  129,   27,   12
260,20010910,   32,    8,   17
260,20010911,   57,   32,   17
260,20010912,   78,   35,   10
260,20010913,  102,   47,   15
260,20010914,   -1,   -1,   16
260,20010915,  134,   57,   15
260,20010916,  112,   33,   16
260,20010917,  235,   77,   12
260,20010918,   -1,   -1,   11
260,20010919,  296,   50,    2
260,20010920,   -1,   -1,    8
260,20010921,   37,   23,   18
260,20010922,   35,   20,   20
260,20010923,    1,    1,   15
260,20010924,  233,   93,    9
260,20010925,    1,    1,   14
260,20010926,   28,   14,   15
260,20010927,   48,   20,   12
260,20010928,    0,    0,   22
260,20010929,   43,   23,   14
260,20010930,    9,    5,   16
260,20011001,   12,    9,    6
260,20011002,   95,   31,    3
260,20011003,    2,    2,   16
260,20011004,   -1,   -1,   13
260,20011005,    0,    0,   17
260,20011006,   66,   44,   12
260,20011007,    6,    5,   13
260,20011008,    1,    1,   12
260,20011009,    2,    2,    9
260,20011010,    0,    0,   15
260,20011011,   -1,   -1,    4
260,20011012,    0,    0,   16
260,20011013,    0,    0,   15
260,20011014,    1,    1,   10
260,20011015,    4,    4,   13
260,20011016,    0,    0,   15
260,20011017,    0,    0,   13
260,20011018,   13,    5,   11
260,20011019,    0,    0,    7
260,20011020,   -1,   -1,   11
260,20011021,    1,    1,    6
260,20011022,   -1,   -1,    4
260,20011023,  136,   44,    2
260,20011024,    7,    7,    6
260,20011025,   -1,   -1,   10
260,20011026,    3,    3,   10
260,20011027,   12,   11,    8
260,20011028,   -1,   -1,    8
260,20011029,    0,    0,    5
260,20011030,    0,    0,   11
260,20011031,   48,   21,    6
260,20011101,    4,    4,    8
260,20011102,    0,    0,    9
260,20011103,    0,    0,    4
260,20011104,   -1,   -1,    2
260,20011105,   -1,   -1,    6
260,20011106,   27,   11,    3
260,20011107,   88,   64,    3
260,20011108,  112,   18,    3
260,20011109,   30,   13,    6
260,20011110,    0,    0,    5
260,20011111,    1,    1,    2
260,20011112,   35,   11,    2
260,20011113,    3,    3,    4
260,20011114,    4,    4,    7
260,20011115,    0,    0,    7
260,20011116,    1,    1,    3
260,20011117,    2,    2,    3
260,20011118,   -1,   -1,    3
260,20011119,    1,    1,    2
260,20011120,   -1,   -1,    1
260,20011121,   26,    8,    3
260,20011122,   73,   28,    2
260,20011123,   19,    9,    5
260,20011124,   35,    6,    1
260,20011125,   67,   20,    2
260,20011126,    8,    3,    3
260,20011127,   44,   17,    5
260,20011128,    3,    2,    6
260,20011129,  167,   30,    0
260,20011130,  104,   17,    1
260,20011201,   41,    8,    1
260,20011202,   38,   30,    2
260,20011203,   17,    5,    2
260,20011204,   47,   25,    1
260,20011205,   33,   17,    2
260,20011206,    2,    1,    5
260,20011207,    0,    0,    4
260,20011208,    0,    0,    4
260,20011209,    0,    0,    3
260,20011210,    0,    0,    4
260,20011211,   -1,   -1,    1
260,20011212,   -1,   -1,    1
260,20011213,   -1,   -1,    2
260,20011214,    0,    0,    3
260,20011215,    1,    1,    1
260,20011216,    0,    0,    4
260,20011217,    6,    4,    3
260,20011218,    1,    1,    1
260,20011219,   51,   25,    1
260,20011220,   11,    7,    3
260,20011221,  187,   25,    0
260,20011222,   34,    6,    2
260,20011223,   -1,   -1,    5
260,20011224,   65,   14,    0
260,20011225,   71,   17,    3
260,20011226,   57,   10,    1
260,20011227,  108,   19,    0
260,20011228,   72,   24,    2
```

260,20011229, 55, 17, 1
260,20011230, 33, 15, 1
260,20011231, 9, 7, 4
260,20020101, 0, 0, 3
260,20020102, -1, -1, 1
260,20020103, 0, 0, 5
260,20020104, 0, 0, 4
260,20020105, 0, 0, 3
260,20020106, 1, 1, 1
260,20020107, 0, 0, 2
260,20020108, -1, -1, 1
260,20020109, 0, 0, 5
260,20020110, 0, 0, 3
260,20020111, 15, 8, 1
260,20020112, 16, 5, 0
260,20020113, 0, 0, 5
260,20020114, 2, 2, 1
260,20020115, 65, 18, 0
260,20020116, -1, -1, 6
260,20020117, 27, 13, 2
260,20020118, 16, 10, 5
260,20020119, 25, 10, 4
260,20020120, 107, 37, 1
260,20020121, 12, 5, 1
260,20020122, 11, 5, 2
260,20020123, 32, 18, 1
260,20020124, 54, 11, 1
260,20020125, 28, 10, 4
260,20020126, 229, 66, 2
260,20020127, 72, 22, 4
260,20020128, 27, 18, 6
260,20020129, 1, 1, 5
260,20020130, 1, 1, 4
260,20020131, 41, 15, 8
260,20020201, 2, 1, 3
260,20020202, 0, 0, 11
260,20020203, 1, 1, 6
260,20020204, 101, 21, 3
260,20020205, 74, 20, 2
260,20020206, 48, 30, 3
260,20020207, 39, 16, 4
260,20020208, 20, 5, 5
260,20020209, 33, 17, 3
260,20020210, 34, 8, 5
260,20020211, 233, 42, 1
260,20020212, 2, 1, 8
260,20020213, -1, -1, 7
260,20020214, 0, 0, 11
260,20020215, 0, 0, 11
260,20020216, 0, 0, 11
260,20020217, 0, 0, 10
260,20020218, 8, 6, 8
260,20020219, 118, 31, 8
260,20020220, 152, 32, 9
260,20020221, 19, 10, 11
260,20020222, 142, 37, 4
260,20020223, 32, 19, 6
260,20020224, 33, 8, 9
260,20020225, 116, 19, 2
260,20020226, 130, 22, 9
260,20020227, 4, 3, 12
260,20020228, 53, 41, 7
260,20020301, 27, 13, 11
260,20020302, 1, 1, 13
260,20020303, -1, -1, 11
260,20020304, 0, 0, 5
260,20020305, 0, 0, 9
260,20020306, 11, 6, 3
260,20020307, 8, 8, 17
260,20020308, 0, 0, 16
260,20020309, 11, 3, 17
260,20020310, 0, 0, 18
260,20020311, 0, 0, 18
260,20020312, 9, 4, 10
260,20020313, 28, 5, 2
260,20020314, 12, 8, 13
260,20020315, -1, -1, 8
260,20020316, -1, -1, 20
260,20020317, 42, 16, 8
260,20020318, 91, 25, 6
260,20020319, 10, 3, 13
260,20020320, 68, 16, 12
260,20020321, 13, 8, 13
260,20020322, 2, 2, 10
260,20020323, -1, -1, 18
260,20020324, 0, 0, 14
260,20020325, 0, 0, 18
260,20020326, 0, 0, 12
260,20020327, 0, 0, 23
260,20020328, 0, 0, 25
260,20020329, 0, 0, 25
260,20020330, 0, 0, 13
260,20020331, 0, 0, 20
260,20020401, 0, 0, 24
260,20020402, 0, 0, 29
260,20020403, 0, 0, 32
260,20020404, 0, 0, 28
260,20020405, 0, 0, 29
260,20020406, 0, 0, 27
260,20020407, 0, 0, 28
260,20020408, 0, 0, 29
260,20020409, 2, 2, 13
260,20020410, 0, 0, 22
260,20020411, 0, 0, 17
260,20020412, 0, 0, 22
260,20020413, -1, -1, 14
260,20020414, 33, 8, 15
260,20020415, 83, 10, 4
260,20020416, 56, 8, 7
260,20020417, 27, 16, 9
260,20020418, -1, -1, 14
260,20020419, -1, -1, 21
260,20020420, 0, 0, 16
260,20020421, 0, 0, 31
260,20020422, 0, 0, 28
260,20020423, 0, 0, 30
260,20020424, 0, 0, 29
260,20020425, 0, 0, 20
260,20020426, 122, 32, 7
260,20020427, 1, 1, 20
260,20020428, 81, 16, 10
260,20020429, 21, 10, 17
260,20020430, 66, 26, 9
260,20020501, 18, 8, 27
260,20020502, 70, 38, 13
260,20020503, -1, -1, 29
260,20020504, -1, -1, 5
260,20020505, 64, 10, 5
260,20020506, 4, 3, 22
260,20020507, -1, -1, 40
260,20020508, 0, 0, 30
260,20020509, -1, -1, 29
260,20020510, -1, -1, 12
260,20020511, -1, -1, 7
260,20020512, -1, -1, 12
260,20020513, -1, -1, 39
260,20020514, 58, 21, 20
260,20020515, 0, 0, 34
260,20020516, 0, 0, 44
260,20020517, 0, 0, 45
260,20020518, 4, 4, 15
260,20020519, -1, -1, 31
260,20020520, 0, 0, 38
260,20020521, -1, -1, 39
260,20020522, 46, 10, 7
260,20020523, 0, 0, 34
260,20020524, 17, 8, 15
260,20020525, 5, 5, 29
260,20020526, 28, 19, 19
260,20020527, -1, -1, 30
260,20020528, -1, -1, 37
260,20020529, 40, 34, 25
260,20020530, -1, -1, 27
260,20020531, 0, 0, 34
260,20020601, 0, 0, 47
260,20020602, 0, 0, 48
260,20020603, 43, 41, 30
260,20020604, 1, 1, 42
260,20020605, 31, 12, 17
260,20020606, -1, -1, 23
260,20020607, -1, -1, 23
260,20020608, 0, 0, 36
260,20020609, 21, 18, 36
260,20020610, 112, 35, 16
260,20020611, 8, 7, 31
260,20020612, 208, 71, 16
260,20020613, 10, 5, 13
260,20020614, 66, 40, 24
260,20020615, 0, 0, 30
260,20020616, 20, 11, 22
260,20020617, 0, 0, 55
260,20020618, 16, 13, 42
260,20020619, -1, -1, 42
260,20020620, 264, 94, 10
260,20020621, 0, 0, 29
260,20020622, 8, 4, 29
260,20020623, 0, 0, 39
260,20020624, 0, 0, 43
260,20020625, 0, 0, 30
260,20020626, 0, 0, 37
260,20020627, -1, -1, 35
260,20020628, 41, 7, 23
260,20020629, 0, 0, 40
260,20020630, -1, -1, 18
260,20020701, 95, 47, 6
260,20020702, 28, 10, 23
260,20020703, 144, 23, 7
260,20020704, 27, 14, 38
260,20020705, -1, -1, 19
260,20020706, -1, -1, 20
260,20020707, 4, 3, 16
260,20020708, 0, 0, 40
260,20020709, 134, 96, 24
260,20020710, 35, 8, 10
260,20020711, -1, -1, 36
260,20020712, -1, -1, 26
260,20020713, 168, 118, 18
260,20020714, 0, 0, 37
260,20020715, 0, 0, 46
260,20020716, 0, 0, 42
260,20020717, 0, 0, 42
260,20020718, 0, 0, 37
260,20020719, 0, 0, 17
260,20020720, 64, 41, 36
260,20020721, 52, 29, 24
260,20020722, 0, 0, 33
260,20020723, 42, 15, 13
260,20020724, 1, 1, 29
260,20020725, 4, 3, 29
260,20020726, 11, 7, 34
260,20020727, 0, 0, 44
260,20020728, 0, 0, 49
260,20020729, 0, 0, 47
260,20020730, 159, 115, 46
260,20020731, 1, 1, 30
260,20020801, 72, 25, 8
260,20020802, 0, 0, 44
260,20020803, 140, 58, 15
260,20020804, 48, 29, 33
260,20020805, 143, 59, 16
260,20020806, 76, 24, 22
260,20020807, 249, 230, 24
260,20020808, 0, 0, 32
260,20020809, 17, 15, 28
260,20020810, -1, -1, 23
260,20020811, -1, -1, 26
260,20020812, -1, -1, 28
260,20020813, 0, 0, 38
260,20020814, 0, 0, 24
260,20020815, 0, 0, 40
260,20020816, 0, 0, 41
260,20020817, 0, 0, 42
260,20020818, 0, 0, 41

260,20020819, 16, 10, 26
260,20020820, 252, 167, 11
260,20020821, 15, 5, 9
260,20020822, 1, 1, 13
260,20020823, 0, 0, 19
260,20020824, 83, 36, 6
260,20020825, 1, 1, 30
260,20020826, 0, 0, 33
260,20020827, 0, 0, 21
260,20020828, 0, 0, 27
260,20020829, 0, 0, 28
260,20020830, 0, 0, 13
260,20020831, 8, 7, 17
260,20020901, -1, -1, 25
260,20020902, 0, 0, 32
260,20020903, 11, 7, 31
260,20020904, 0, 0, 29
260,20020905, 0, 0, 28
260,20020906, 0, 0, 15
260,20020907, 122, 54, 17
260,20020908, 66, 20, 17
260,20020909, 0, 0, 21
260,20020910, -1, -1, 8
260,20020911, 16, 12, 14
260,20020912, 0, 0, 33
260,20020913, 0, 0, 29
260,20020914, -1, -1, 12
260,20020915, 0, 0, 28
260,20020916, -1, -1, 18
260,20020917, -1, -1, 8
260,20020918, 0, 0, 10
260,20020919, 0, 0, 9
260,20020920, 0, 0, 15
260,20020921, 3, 3, 10
260,20020922, 38, 21, 21
260,20020923, 0, 0, 23
260,20020924, -1, -1, 23
260,20020925, 23, 21, 16
260,20020926, 43, 12, 10
260,20020927, 0, 0, 13
260,20020928, 0, 0, 11
260,20020929, 0, 0, 16
260,20020930, 0, 0, 21
260,20021001, 0, 0, 19
260,20021002, -1, -1, 14
260,20021003, 14, 7, 6
260,20021004, 0, 0, 15
260,20021005, 126, 36, 3
260,20021006, 11, 8, 15
260,20021007, 31, 8, 8
260,20021008, 0, 0, 17
260,20021009, 0, 0, 18
260,20021010, 0, 0, 16
260,20021011, 0, 0, 16
260,20021012, -1, -1, 6
260,20021013, -1, -1, 4
260,20021014, 117, 27, 2
260,20021015, -1, -1, 4
260,20021016, 6, 3, 7
260,20021017, 19, 7, 10
260,20021018, 44, 17, 7
260,20021019, 43, 19, 8
260,20021020, 21, 5, 10
260,20021021, 17, 9, 3
260,20021022, 22, 10, 5
260,20021023, 37, 22, 6
260,20021024, 2, 1, 11
260,20021025, 94, 69, 3
260,20021026, 24, 12, 6
260,20021027, 260, 58, 4
260,20021028, -1, -1, 12
260,20021029, 8, 6, 3
260,20021030, 12, 7, 10
260,20021031, 0, 0, 10
260,20021101, 41, 21, 2
260,20021102, 25, 16, 8
260,20021103, 119, 32, 7
260,20021104, 12, 8, 8
260,20021105, 0, 0, 7
260,20021106, 136, 34, 7
260,20021107, 56, 21, 4
260,20021108, 187, 31, 3
260,20021109, 1, 1, 7
260,20021110, 34, 15, 3
260,20021111, 6, 6, 6
260,20021112, 8, 5, 4
260,20021113, 50, 14, 3
260,20021114, 2, 1, 6
260,20021115, 0, 0, 5
260,20021116, 0, 0, 2
260,20021117, 1, 1, 4
260,20021118, 0, 0, 2
260,20021119, 0, 0, 2
260,20021120, 0, 0, 5
260,20021121, 4, 3, 2
260,20021122, 0, 0, 3
260,20021123, 33, 19, 6
260,20021124, 4, 4, 7
260,20021125, 59, 24, 1
260,20021126, 0, 0, 4
260,20021127, 0, 0, 5
260,20021128, 46, 14, 1
260,20021129, 3, 1, 1
260,20021130, 0, 0, 2
260,20021201, 77, 22, 2
260,20021202, 2, 1, 1
260,20021203, 0, 0, 2
260,20021204, 0, 0, 1
260,20021205, 0, 0, 3
260,20021206, -1, -1, 1
260,20021207, 1, 1, 1
260,20021208, 0, 0, 2
260,20021209, 0, 0, 3
260,20021210, 0, 0, 3
260,20021211, 0, 0, 3
260,20021212, 0, 0, 2
260,20021213, 2, 2, 2
260,20021214, 0, 0, 1
260,20021215, 47, 13, 2
260,20021216, 35, 15, 0
260,20021217, 0, 0, 0
260,20021218, 0, 0, 3
260,20021219, 0, 0, 3
260,20021220, 0, 0, 2
260,20021221, 0, 0, 1
260,20021222, 232, 30, 0
260,20021223, 10, 10, 1
260,20021224, 33, 12, 2
260,20021225, 6, 3, 2
260,20021226, 84, 27, 1
260,20021227, 92, 15, 1
260,20021228, 34, 14, 1
260,20021229, 179, 66, 1
260,20021230, 55, 16, 1
260,20021231, 0, 0, 3
260,20030101, 169, 34, 0
260,20030102, 189, 45, 1
260,20030103, 28, 15, 1
260,20030104, -1, -1, 2
260,20030105, 4, 2, 2
260,20030106, 9, 5, 3
260,20030107, -1, -1, 3
260,20030108, -1, -1, 2
260,20030109, 0, 0, 3
260,20030110, -1, -1, 3
260,20030111, 0, 0, 4
260,20030112, -1, -1, 3
260,20030113, 24, 12, 2
260,20030114, 2, 1, 2
260,20030115, 15, 12, 2
260,20030116, 0, 0, 5
260,20030117, 1, 1, 3
260,20030118, 2, 2, 1
260,20030119, 24, 8, 1
260,20030120, 35, 10, 2
260,20030121, 22, 14, 5
260,20030122, 34, 11, 0
260,20030123, 7, 6, 1
260,20030124, 0, 0, 6
260,20030125, 15, 8, 3
260,20030126, 23, 4, 2
260,20030127, 16, 13, 3
260,20030128, 49, 19, 3
260,20030129, 64, 12, 4
260,20030130, 34, 12, 3
260,20030131, -1, -1, 4
260,20030201, 52, 9, 2
260,20030202, 102, 52, 2
260,20030203, 35, 24, 4
260,20030204, 62, 15, 3
260,20030205, 9, 6, 7
260,20030206, 0, 0, 7
260,20030207, -1, -1, 2
260,20030208, 3, 1, 2
260,20030209, -1, -1, 2
260,20030210, 0, 0, 9
260,20030211, -1, -1, 1
260,20030212, -1, -1, 1
260,20030213, 0, 0, 9
260,20030214, 0, 0, 9
260,20030215, 0, 0, 1
260,20030216, 0, 0, 9
260,20030217, 0, 0, 9
260,20030218, 0, 0, 9
260,20030219, 0, 0, 10
260,20030220, 0, 0, 11
260,20030221, 0, 0, 11
260,20030222, 0, 0, 11
260,20030223, 0, 0, 12
260,20030224, 0, 0, 13
260,20030225, 0, 0, 13
260,20030226, 0, 0, 13
260,20030227, 0, 0, 13
260,20030228, 31, 21, 13
260,20030301, 2, 2, 14
260,20030302, 31, 13, 6
260,20030303, 0, 0, 11
260,20030304, 9, 5, 10
260,20030305, 3, 3, 6
260,20030306, 15, 9, 4
260,20030307, 9, 6, 10
260,20030308, 85, 17, 9
260,20030309, 6, 5, 12
260,20030310, 0, 0, 10
260,20030311, 72, 15, 2
260,20030312, 3, 2, 7
260,20030313, 0, 0, 18
260,20030314, 0, 0, 19
260,20030315, 0, 0, 19
260,20030316, 0, 0, 19
260,20030317, 0, 0, 16
260,20030318, 0, 0, 20
260,20030319, 0, 0, 14
260,20030320, 0, 0, 13
260,20030321, 0, 0, 20
260,20030322, 0, 0, 22
260,20030323, 0, 0, 23
260,20030324, 0, 0, 21
260,20030325, 0, 0, 18
260,20030326, 0, 0, 23
260,20030327, 0, 0, 19
260,20030328, 0, 0, 24
260,20030329, -1, -1, 9
260,20030330, 0, 0, 22
260,20030331, 0, 0, 20
260,20030401, 157, 39, 10
260,20030402, 36, 18, 13
260,20030403, -1, -1, 15
260,20030404, -1, -1, 9
260,20030405, -1, -1, 18
260,20030406, 0, 0, 16
260,20030407, 0, 0, 23
260,20030408, 0, 0, 18
260,20030409, 4, 4, 17

```
260,20030410,  -1,  -1,  15
260,20030411,   1,   1,  18
260,20030412,   0,   0,  26
260,20030413,   0,   0,  30
260,20030414,   0,   0,  33
260,20030415,   0,   0,  38
260,20030416,   0,   0,  37
260,20030417,   0,   0,  37
260,20030418,   0,   0,  34
260,20030419,  -1,  -1,  16
260,20030420,  -1,  -1,  31
260,20030421,  39,  21,  33
260,20030422,   1,   1,  32
260,20030423,   0,   0,  31
260,20030424,  -1,  -1,  34
260,20030425,  14,  14,  19
260,20030426, 119,  44,   6
260,20030427,   8,   6,  22
260,20030428,  11,   5,  20
260,20030429,  30,  17,  33
260,20030430,  42,  39,  10
260,20030501,   6,   5,  22
260,20030502,  92,  41,  19
260,20030503,  21,  16,  29
260,20030504,   0,   0,  43
260,20030505,  73,  16,   7
260,20030506,  36,  14,  20
260,20030507,   0,   0,  32
260,20030508,   8,   7,  31
260,20030509,  -1,  -1,  17
260,20030510,   0,   0,  34
260,20030511,  10,   8,  32
260,20030512, 115,  42,  17
260,20030513,  20,   9,  31
260,20030514,  10,   4,  22
260,20030515,  20,  11,  28
260,20030516,  -1,  -1,  33
260,20030517,  24,  11,  19
260,20030518,  32,  10,  21
260,20030519,  34,  13,  12
260,20030520, 224,  63,  16
260,20030521,  28,  25,  25
260,20030522,  30,   9,   7
260,20030523,  94,  17,  11
260,20030524,  24,  11,  10
260,20030525,  18,   7,  13
260,20030526,   0,   0,  36
260,20030527,   0,   0,  34
260,20030528,   0,   0,  33
260,20030529,   0,   0,  44
260,20030530,   0,   0,  49
260,20030531,   0,   0,  46
260,20030601,   0,   0,  47
260,20030602, 108, 106,  32
260,20030603,  -1,  -1,  34
260,20030604,  35,  35,  41
260,20030605,  -1,  -1,  34
260,20030606,   0,   0,  47
260,20030607,   0,   0,  45
260,20030608,  75,  38,  21
260,20030609,   0,   0,  44
260,20030610,  77,  77,  24
260,20030611,   0,   0,  42
260,20030612,  -1,  -1,  31
260,20030613,   0,   0,  44
260,20030614,   0,   0,  34
260,20030615,   0,   0,  48
260,20030616,   0,   0,  48
260,20030617,  13,   8,  34
260,20030618,  -1,  -1,  38
260,20030619,   2,   2,  11
260,20030620,   0,   0,  37
260,20030621,   0,   0,  38
260,20030622,   1,   1,  34
260,20030623,   2,   1,  33
260,20030624,   0,   0,  34
260,20030625,   0,   0,  40
260,20030626,   0,   0,  52
260,20030627,   0,   0,  45
260,20030628,  -1,  -1,  27
260,20030629,   0,   0,  43
260,20030630,  33,  15,  12
260,20030701,  41,  27,  29
260,20030702,  57,  18,  20
260,20030703,  51,  23,  25
260,20030704,   7,   4,  10
260,20030705,  -1,  -1,  17
260,20030706,   0,   0,  13
260,20030707,  -1,  -1,  31
260,20030708,  15,  15,  28
260,20030709,  -1,  -1,  41
260,20030710,   0,   0,  49
260,20030711,   0,   0,  37
260,20030712,   0,   0,  39
260,20030713,   0,   0,  51
260,20030714,   0,   0,  54
260,20030715,   0,   0,  55
260,20030716,  -1,  -1,  49
260,20030717,  85,  37,   9
260,20030718,   3,   3,  27
260,20030719,   0,   0,  51
260,20030720,   2,   1,  35
260,20030721,  -1,  -1,  44
260,20030722,   0,   0,  36
260,20030723,   0,   0,  36
260,20030724,   1,   1,  21
260,20030725,  17,   8,  30
260,20030726,  -1,  -1,  29
260,20030727,   6,   4,  28
260,20030728,   3,   3,  37
260,20030729,   0,   0,  34
260,20030730,  10,   7,  22
260,20030731,   0,   0,  42
260,20030801,   0,   0,  39
260,20030802,  -1,  -1,  32
260,20030803,   0,   0,  44
260,20030804,   0,   0,  45
260,20030805,   0,   0,  42
260,20030806,  -1,  -1,  43
260,20030807,   0,   0,  44
260,20030808,   0,   0,  37
260,20030809,   0,   0,  36
260,20030810,   0,   0,  36
260,20030811,   0,   0,  35
260,20030812,   0,   0,  41
260,20030813,   0,   0,  35
260,20030814,  -1,  -1,  40
260,20030815,   0,   0,  37
260,20030816,   0,   0,  30
260,20030817,   1,   1,  14
260,20030818,   5,   5,  20
260,20030819,   0,   0,  30
260,20030820,  -1,  -1,  30
260,20030821,   0,   0,  30
260,20030822,  -1,  -1,   7
260,20030823,  -1,  -1,  29
260,20030824,   0,   0,  12
260,20030825,   0,   0,  32
260,20030826,  -1,  -1,  30
260,20030827,   0,   0,  17
260,20030828,  14,  11,  15
260,20030829,  55,  11,  10
260,20030830,  -1,  -1,  28
260,20030831,  17,  10,  18
260,20030901,  11,   3,  22
260,20030902,   2,   2,  18
260,20030903,   0,   0,  24
260,20030904,   0,   0,  24
260,20030905,   0,   0,  28
260,20030906,  17,  12,  12
260,20030907,   0,   0,  15
260,20030908,  -1,  -1,  20
260,20030909,  30,  28,  15
260,20030910, 135,  31,   4
260,20030911,   0,   0,  17
260,20030912,   1,   1,   6
260,20030913,   0,   0,  26
260,20030914,   0,   0,  28
260,20030915,   0,   0,  24
260,20030916,   0,   0,  24
260,20030917,   0,   0,  26
260,20030918,   0,   0,  27
260,20030919,   0,   0,  21
260,20030920,   0,   0,  24
260,20030921,   0,   0,  25
260,20030922, 145,  84,  24
260,20030923, 120,  75,  12
260,20030924,  -1,  -1,  14
260,20030925,   0,   0,  22
260,20030926,   4,   3,  17
260,20030927,  -1,  -1,  18
260,20030928,  46,  15,   4
260,20030929,   5,   4,  15
260,20030930,   0,   0,  18
260,20031001,  38,  16,  14
260,20031002,   0,   0,   9
260,20031003,   8,   3,  12
260,20031004,  36,  16,  12
260,20031005,  34,  12,  15
260,20031006, 129,  34,   7
260,20031007, 228,  36,   6
260,20031008, 171,  73,   4
260,20031009,   3,   2,   6
260,20031010,  10,   5,  12
260,20031011,   0,   0,   6
260,20031012,   0,   0,  15
260,20031013,   0,   0,  11
260,20031014,   0,   0,  13
260,20031015,   0,   0,  15
260,20031016,   0,   0,  15
260,20031017,   0,   0,  14
260,20031018,   0,   0,  12
260,20031019,   0,   0,  12
260,20031020,  -1,  -1,   9
260,20031021,  -1,  -1,   4
260,20031022,   5,   5,   9
260,20031023,   0,   0,  11
260,20031024,  21,   8,   4
260,20031025,  91,  17,   5
260,20031026,   6,   3,   7
260,20031027,   0,   0,   9
260,20031028,   0,   0,   6
260,20031029,  -1,  -1,   8
260,20031030,   4,   4,   5
260,20031031,  59,  17,   4
260,20031101,   7,   5,   4
260,20031102,  28,  14,   4
260,20031103,  18,   7,   4
260,20031104,   0,   0,   8
260,20031105,   0,   0,  10
260,20031106,   0,   0,   9
260,20031107,   0,   0,   9
260,20031108,   0,   0,   8
260,20031109,  -1,  -1,   7
260,20031110,   0,   0,   6
260,20031111,   0,   0,   2
260,20031112,   6,   5,   4
260,20031113,   2,   1,   7
260,20031114,  -1,  -1,   2
260,20031115,   2,   2,   3
260,20031116,  50,   7,   1
260,20031117,  12,   3,   4
260,20031118,   9,   2,   1
260,20031119,   0,   0,   2
260,20031120,   3,   2,   1
260,20031121,  -1,  -1,   3
260,20031122,  15,   6,   3
260,20031123,  47,  33,   2
260,20031124, 151,  47,   1
260,20031125,   0,   0,   5
260,20031126,  15,   6,   2
```

260,20031127, 0, 0, 2
260,20031128, 0, 0, 5
260,20031129, 14, 12, 3
260,20031130, 16, 5, 1
260,20031201, 58, 13, 2
260,20031202, 0, 0, 2
260,20031203, 0, 0, 2
260,20031204, 0, 0, 1
260,20031205, 0, 0, 1
260,20031206, 8, 5, 4
260,20031207, 0, 0, 4
260,20031208, 0, 0, 4
260,20031209, 0, 0, 4
260,20031210, 0, 0, 3
260,20031211, 42, 15, 1
260,20031212, 14, 6, 2
260,20031213, 233, 28, 0
260,20031214, 77, 20, 3
260,20031215, 19, 5, 3
260,20031216, -1, -1, 3
260,20031217, 0, 0, 4
260,20031218, 0, 0, 4
260,20031219, 0, 0, 1
260,20031220, 81, 27, 1
260,20031221, 72, 21, 2
260,20031222, 15, 11, 3
260,20031223, 61, 15, 0
260,20031224, -1, -1, 0
260,20031225, -1, -1, 1
260,20031226, -1, -1, 1
260,20031227, 11, 5, 4
260,20031228, 270, 60, 1
260,20031229, -1, -1, 2
260,20031230, -1, -1, 2
260,20031231, 0, 0, 1
260,20040101, 9, 2, 1
260,20040102, 0, 0, 4
260,20040103, 7, 7, 2
260,20040104, 12, 5, 2
260,20040105, 19, 7, 2
260,20040106, 30, 13, 0
260,20040107, 0, 0, 1
260,20040108, 46, 24, 1
260,20040109, 13, 6, 1
260,20040110, 0, 0, 3
260,20040111, 109, 27, 1
260,20040112, 27, 7, 1
260,20040113, 74, 24, 2
260,20040114, 93, 25, 1
260,20040115, 23, 12, 3
260,20040116, 148, 36, 1
260,20040117, 40, 26, 1
260,20040118, 0, 0, 6
260,20040119, 299, 32, 1
260,20040120, 6, 6, 3
260,20040121, 0, 0, 6
260,20040122, 1, 1, 1
260,20040123, 0, 0, 4
260,20040124, 44, 14, 1
260,20040125, -1, -1, 5
260,20040126, -1, -1, 2
260,20040127, -1, -1, 3
260,20040128, 57, 22, 4
260,20040129, 53, 19, 3
260,20040130, 0, 0, 3
260,20040131, 121, 23, 1
260,20040201, 102, 41, 6
260,20040202, 97, 22, 1
260,20040203, -1, -1, 5
260,20040204, 13, 7, 3
260,20040205, 68, 27, 2
260,20040206, 39, 23, 1
260,20040207, 80, 25, 4
260,20040208, 85, 18, 5
260,20040209, 19, 11, 5
260,20040210, 102, 17, 3
260,20040211, 13, 5, 3
260,20040212, 0, 0, 4
260,20040213, -1, -1, 3
260,20040214, -1, -1, 4
260,20040215, 0, 0, 4
260,20040216, 0, 0, 4
260,20040217, 2, 1, 4
260,20040218, 25, 10, 5
260,20040219, 0, 0, 9
260,20040220, 0, 0, 11
260,20040221, 0, 0, 4
260,20040222, -1, -1, 7
260,20040223, -1, -1, 10
260,20040224, 56, 10, 6
260,20040225, 24, 6, 7
260,20040226, 69, 25, 8
260,20040227, -1, -1, 3
260,20040228, 0, 0, 9
260,20040229, 0, 0, 11
260,20040301, 0, 0, 11
260,20040302, 0, 0, 9
260,20040303, 0, 0, 10
260,20040304, 0, 0, 9
260,20040305, 50, 18, 6
260,20040306, 11, 4, 5
260,20040307, 3, 2, 9
260,20040308, -1, -1, 11
260,20040309, -1, -1, 9
260,20040310, -1, -1, 2
260,20040311, -1, -1, 9
260,20040312, -1, -1, 9
260,20040313, 13, 5, 5
260,20040314, -1, -1, 12
260,20040315, 0, 0, 8
260,20040316, 0, 0, 7
260,20040317, 0, 0, 19
260,20040318, 29, 20, 8
260,20040319, 147, 51, 6
260,20040320, 70, 19, 2
260,20040321, 6, 3, 14
260,20040322, 81, 31, 11
260,20040323, -1, -1, 14
260,20040324, 2, 1, 8
260,20040325, 0, 0, 14
260,20040326, 8, 7, 12
260,20040327, 0, 0, 13
260,20040328, 0, 0, 18
260,20040329, 0, 0, 13
260,20040330, 0, 0, 27
260,20040331, 0, 0, 27
260,20040401, 0, 0, 26
260,20040402, -1, -1, 14
260,20040403, 6, 3, 11
260,20040404, 54, 31, 18
260,20040405, 30, 10, 13
260,20040406, 56, 17, 12
260,20040407, 57, 13, 15
260,20040408, 16, 5, 13
260,20040409, 0, 0, 8
260,20040410, 4, 3, 8
260,20040411, 5, 3, 10
260,20040412, 0, 0, 26
260,20040413, -1, -1, 16
260,20040414, 0, 0, 23
260,20040415, 0, 0, 28
260,20040416, 0, 0, 33
260,20040417, 5, 3, 28
260,20040418, 12, 9, 13
260,20040419, -1, -1, 14
260,20040420, 0, 0, 29
260,20040421, -1, -1, 21
260,20040422, 21, 20, 24
260,20040423, 0, 0, 33
260,20040424, -1, -1, 19
260,20040425, 0, 0, 31
260,20040426, 0, 0, 33
260,20040427, 0, 0, 32
260,20040428, 65, 58, 22
260,20040429, -1, -1, 16
260,20040430, -1, -1, 35
260,20040501, -1, -1, 22
260,20040502, 0, 0, 11
260,20040503, 2, 2, 34
260,20040504, 19, 4, 17
260,20040505, 0, 0, 27
260,20040506, 0, 0, 25
260,20040507, 119, 18, 6
260,20040508, -1, -1, 13
260,20040509, 3, 3, 27
260,20040510, -1, -1, 29
260,20040511, 0, 0, 23
260,20040512, 0, 0, 24
260,20040513, 0, 0, 20
260,20040514, 0, 0, 27
260,20040515, 0, 0, 41
260,20040516, 0, 0, 37
260,20040517, 0, 0, 37
260,20040518, 0, 0, 40
260,20040519, 0, 0, 42
260,20040520, -1, -1, 34
260,20040521, -1, -1, 28
260,20040522, 5, 4, 26
260,20040523, 4, 4, 38
260,20040524, 0, 0, 37
260,20040525, 1, 1, 23
260,20040526, 0, 0, 32
260,20040527, -1, -1, 16
260,20040528, 0, 0, 38
260,20040529, 0, 0, 45
260,20040530, 138, 50, 19
260,20040531, 21, 13, 29
260,20040601, 0, 0, 42
260,20040602, 74, 30, 7
260,20040603, 5, 4, 31
260,20040604, 61, 14, 13
260,20040605, -1, -1, 15
260,20040606, 0, 0, 32
260,20040607, 0, 0, 45
260,20040608, 0, 0, 50
260,20040609, 0, 0, 39
260,20040610, 12, 5, 22
260,20040611, 0, 0, 40
260,20040612, 46, 46, 28
260,20040613, -1, -1, 30
260,20040614, 0, 0, 36
260,20040615, 0, 0, 32
260,20040616, 0, 0, 32
260,20040617, 1, 1, 18
260,20040618, 44, 40, 22
260,20040619, 6, 2, 34
260,20040620, 23, 22, 32
260,20040621, 36, 17, 26
260,20040622, 2, 2, 31
260,20040623, 218, 38, 16
260,20040624, 136, 38, 16
260,20040625, 9, 2, 20
260,20040626, -1, -1, 33
260,20040627, 15, 13, 27
260,20040628, 0, 0, 38
260,20040629, 0, 0, 30
260,20040630, 4, 2, 29
260,20040701, 5, 5, 32
260,20040702, 139, 53, 25
260,20040703, 307, 168, 27
260,20040704, 16, 11, 18
260,20040705, 2, 2, 40
260,20040706, 0, 0, 45
260,20040707, 51, 31, 34
260,20040708, 77, 36, 29
260,20040709, 71, 38, 22
260,20040710, 22, 14, 41
260,20040711, 6, 5, 23
260,20040712, 135, 42, 15
260,20040713, 4, 4, 34
260,20040714, 43, 13, 19
260,20040715, -1, -1, 13
260,20040716, 2, 1, 17

```
260,20040717, 199, 113, 40
260,20040718, 19, 19, 16
260,20040719, 0, 0, 33
260,20040720, 26, 17, 19
260,20040721, -1, -1, 26
260,20040722, 0, 0, 43
260,20040723, 30, 15, 29
260,20040724, 0, 0, 37
260,20040725, 14, 4, 13
260,20040726, 53, 33, 40
260,20040727, 0, 0, 34
260,20040728, 0, 0, 27
260,20040729, 0, 0, 46
260,20040730, 0, 0, 42
260,20040731, 0, 0, 33
260,20040801, 0, 0, 33
260,20040802, 0, 0, 40
260,20040803, 0, 0, 45
260,20040804, 0, 0, 40
260,20040805, -1, -1, 36
260,20040806, 0, 0, 39
260,20040807, -1, -1, 28
260,20040808, 0, 0, 45
260,20040809, 0, 0, 46
260,20040810, 211, 135, 20
260,20040811, 36, 36, 34
260,20040812, 31, 17, 14
260,20040813, 287, 82, 11
260,20040814, 1, 1, 32
260,20040815, 26, 14, 33
260,20040816, 163, 89, 14
260,20040817, -1, -1, 34
260,20040818, 9, 9, 28
260,20040819, -1, -1, 24
260,20040820, 31, 12, 16
260,20040821, 15, 9, 18
260,20040822, 0, 0, 27
260,20040823, 4, 2, 23
260,20040824, 106, 28, 20
260,20040825, 71, 41, 22
260,20040826, 8, 4, 23
260,20040827, 85, 14, 4
260,20040828, 0, 0, 28
260,20040829, 2, 2, 19
260,20040830, 102, 50, 19
260,20040831, 84, 26, 20
260,20040901, 0, 0, 23
260,20040902, 0, 0, 32
260,20040903, 0, 0, 29
260,20040904, 0, 0, 31
260,20040905, 0, 0, 29
260,20040906, 0, 0, 33
260,20040907, 0, 0, 31
260,20040908, 0, 0, 31
260,20040909, 0, 0, 32
260,20040910, 4, 4, 29
260,20040911, 4, 2, 18
260,20040912, 2, 2, 23
260,20040913, 32, 12, 10
260,20040914, 13, 5, 21
260,20040915, 40, 13, 12
260,20040916, 0, 0, 20
260,20040917, -1, -1, 23
260,20040918, 6, 3, 13
260,20040919, -1, -1, 24
260,20040920, 18, 7, 3
260,20040921, 31, 16, 16
260,20040922, 226, 28, 5
260,20040923, 64, 17, 9
260,20040924, 69, 16, 14
260,20040925, 32, 12, 10
260,20040926, 0, 0, 16
260,20040927, 6, 6, 15
260,20040928, 68, 29, 6
260,20040929, 4, 2, 14
260,20040930, 3, 3, 9
260,20041001, 4, 3, 7
260,20041002, -1, -1, 16
260,20041003, 1, 1, 11
260,20041004, 29, 17, 8
260,20041005, -1, -1, 8
260,20041006, 65, 38, 14
260,20041007, 1, 1, 11
260,20041008, 5, 4, 9
260,20041009, 0, 0, 16
260,20041010, 0, 0, 17
260,20041011, 0, 0, 17
260,20041012, 0, 0, 14
260,20041013, 0, 0, 12
260,20041014, -1, -1, 7
260,20041015, 88, 40, 12
260,20041016, 2, 2, 3
260,20041017, -1, -1, 4
260,20041018, 27, 21, 8
260,20041019, 0, 0, 13
260,20041020, 78, 38, 2
260,20041021, 48, 33, 14
260,20041022, 0, 0, 13
260,20041023, 90, 20, 2
260,20041024, 12, 9, 4
260,20041025, 7, 7, 7
260,20041026, 0, 0, 8
260,20041027, 0, 0, 9
260,20041028, 20, 8, 4
260,20041029, -1, -1, 10
260,20041030, 2, 2, 10
260,20041031, 0, 0, 3
260,20041101, 0, 0, 4
260,20041102, 15, 7, 3
260,20041103, 27, 10, 3
260,20041104, 8, 8, 5
260,20041105, 4, 4, 6
260,20041106, 4, 3, 4
260,20041107, 0, 0, 6
260,20041108, -1, -1, 3
260,20041109, 0, 0, 7
260,20041110, 55, 13, 2
260,20041111, 0, 0, 4
260,20041112, 35, 19, 3
260,20041113, 27, 10, 6
260,20041114, 0, 0, 6
260,20041115, -1, -1, 1
260,20041116, 8, 4, 2
260,20041117, 86, 27, 2
260,20041118, 265, 29, 1
260,20041119, 58, 13, 3
260,20041120, 45, 16, 3
260,20041121, 21, 6, 3
260,20041122, 8, 4, 2
260,20041123, 3, 2, 5
260,20041124, 0, 0, 5
260,20041125, -1, -1, 2
260,20041126, 38, 14, 1
260,20041127, -1, -1, 2
260,20041128, 50, 12, 1
260,20041129, 0, 0, 1
260,20041130, 0, 0, 2
260,20041201, -1, -1, 0
260,20041202, 0, 0, 4
260,20041203, -1, -1, 2
260,20041204, 4, 3, 1
260,20041205, -1, -1, 1
260,20041206, 0, 0, 2
260,20041207, 0, 0, 1
260,20041208, 0, 0, 2
260,20041209, 0, 0, 1
260,20041210, 0, 0, 0
260,20041211, 0, 0, 1
260,20041212, 0, 0, 1
260,20041213, 0, 0, 0
260,20041214, 0, 0, 0
260,20041215, -1, -1, 1
260,20041216, 41, 17, 1
260,20041217, 96, 17, 1
260,20041218, 14, 12, 2
260,20041219, 0, 0, 4
260,20041220, 0, 0, 4
260,20041221, 0, 0, 2
260,20041222, 25, 6, 0
260,20041223, 4, 2, 2
260,20041224, 103, 30, 4
260,20041225, 32, 9, 3
260,20041226, 0, 0, 4
260,20041227, 0, 0, 4
260,20041228, 83, 13, 1
260,20041229, 27, 14, 4
260,20041230, 5, 2, 0
260,20041231, 29, 6, 1
260,20050101, 13, 6, 2
260,20050102, -1, -1, 2
260,20050103, 0, 0, 2
260,20050104, 16, 6, 1
260,20050105, 32, 15, 2
260,20050106, 3, 3, 5
260,20050107, -1, -1, 1
260,20050108, -1, -1, 3
260,20050109, 3, 2, 4
260,20050110, 19, 6, 4
260,20050111, 7, 5, 4
260,20050112, 3, 2, 5
260,20050113, 0, 0, 3
260,20050114, 1, 1, 5
260,20050115, 0, 0, 5
260,20050116, 0, 0, 5
260,20050117, 78, 19, 2
260,20050118, 105, 23, 2
260,20050119, 4, 3, 6
260,20050120, 116, 57, 2
260,20050121, 8, 4, 4
260,20050122, 9, 3, 5
260,20050123, 20, 9, 5
260,20050124, 10, 4, 5
260,20050125, 4, 2, 5
260,20050126, 0, 0, 6
260,20050127, 14, 5, 2
260,20050128, -1, -1, 2
260,20050129, 2, 1, 3
260,20050130, 11, 2, 3
260,20050131, 56, 10, 2
260,20050201, 4, 2, 4
260,20050202, 37, 8, 4
260,20050203, 4, 3, 5
260,20050204, 0, 0, 5
260,20050205, 0, 0, 7
260,20050206, 0, 0, 8
260,20050207, 0, 0, 7
260,20050208, 0, 0, 7
260,20050209, 2, 2, 6
260,20050210, 196, 30, 1
260,20050211, 23, 8, 5
260,20050212, 246, 47, 2
260,20050213, 104, 27, 4
260,20050214, 22, 10, 5
260,20050215, -1, -1, 3
260,20050216, 0, 0, 7
260,20050217, 0, 0, 4
260,20050218, 30, 17, 2
260,20050219, 43, 17, 7
260,20050220, 2, 1, 8
260,20050221, 7, 5, 6
260,20050222, 2, 1, 5
260,20050223, 3, 1, 3
260,20050224, 4, 4, 6
260,20050225, 0, 0, 7
260,20050226, 2, 1, 3
260,20050227, -1, -1, 9
260,20050228, 0, 0, 11
260,20050301, 20, 5, 3
260,20050302, 61, 9, 3
260,20050303, -1, -1, 4
260,20050304, 8, 2, 6
260,20050305, 13, 6, 5
260,20050306, 17, 8, 10
260,20050307, 18, 5, 7
```

260,20050308, 11, 2, 8
260,20050309, 3, 2, 7
260,20050310, 0, 0, 9
260,20050311, 43, 22, 2
260,20050312, 38, 17, 7
260,20050313, -1, -1, 11
260,20050314, 1, 1, 6
260,20050315, 0, 0, 15
260,20050316, 10, 5, 18
260,20050317, -1, -1, 7
260,20050318, -1, -1, 6
260,20050319, 1, 1, 5
260,20050320, 0, 0, 17
260,20050321, 0, 0, 22
260,20050322, 17, 9, 14
260,20050323, 0, 0, 23
260,20050324, 109, 56, 18
260,20050325, 2, 1, 12
260,20050326, 5, 4, 15
260,20050327, 106, 59, 11
260,20050328, -1, -1, 5
260,20050329, 0, 0, 10
260,20050330, 1, 1, 14
260,20050331, 14, 7, 23
260,20050401, 0, 0, 26
260,20050402, 0, 0, 29
260,20050403, 0, 0, 27
260,20050404, 30, 16, 20
260,20050405, 2, 2, 23
260,20050406, 15, 5, 12
260,20050407, 3, 2, 19
260,20050408, 73, 25, 13
260,20050409, 49, 18, 13
260,20050410, 14, 7, 14
260,20050411, 0, 0, 31
260,20050412, 0, 0, 24
260,20050413, 82, 15, 6
260,20050414, 23, 6, 15
260,20050415, -1, -1, 18
260,20050416, 46, 12, 4
260,20050417, 0, 0, 26
260,20050418, 14, 14, 16
260,20050419, 83, 19, 10
260,20050420, 26, 5, 16
260,20050421, 0, 0, 33
260,20050422, 0, 0, 32
260,20050423, 0, 0, 34
260,20050424, 0, 0, 28
260,20050425, 0, 0, 28
260,20050426, 53, 28, 12
260,20050427, 29, 13, 29
260,20050428, 3, 3, 24
260,20050429, 84, 22, 23
260,20050430, 0, 0, 15
260,20050501, -1, -1, 38
260,20050502, 30, 22, 12
260,20050503, 18, 12, 15
260,20050504, 2, 2, 8
260,20050505, 45, 23, 24
260,20050506, 2, 2, 26
260,20050507, 70, 47, 14
260,20050508, 20, 8, 25
260,20050509, 31, 18, 24
260,20050510, 3, 1, 23
260,20050511, 1, 1, 27
260,20050512, 0, 0, 33
260,20050513, 0, 0, 37
260,20050514, 0, 0, 38
260,20050515, 46, 11, 20
260,20050516, 10, 4, 15
260,20050517, 14, 10, 16
260,20050518, 0, 0, 30
260,20050519, 36, 22, 29
260,20050520, 22, 14, 25
260,20050521, 35, 22, 36
260,20050522, 19, 12, 39
260,20050523, 0, 0, 32
260,20050524, -1, -1, 18
260,20050525, 0, 0, 39
260,20050526, 0, 0, 44
260,20050527, 0, 0, 51
260,20050528, 0, 0, 47
260,20050529, 81, 42, 28
260,20050530, 55, 16, 10
260,20050531, 2, 2, 36
260,20050601, -1, -1, 39
260,20050602, 10, 3, 12
260,20050603, 77, 27, 28
260,20050604, 56, 31, 22
260,20050605, 11, 8, 21
260,20050606, -1, -1, 21
260,20050607, -1, -1, 24
260,20050608, 0, 0, 41
260,20050609, 0, 0, 40
260,20050610, -1, -1, 29
260,20050611, -1, -1, 26
260,20050612, 52, 30, 19
260,20050613, 2, 1, 32
260,20050614, 0, 0, 45
260,20050615, -1, -1, 36
260,20050616, -1, -1, 33
260,20050617, 1, 1, 16
260,20050618, 0, 0, 52
260,20050619, 0, 0, 57
260,20050620, 0, 0, 55
260,20050621, 0, 0, 45
260,20050622, 0, 0, 49
260,20050623, 0, 0, 54
260,20050624, 0, 0, 46
260,20050625, 28, 19, 17
260,20050626, 0, 0, 48
260,20050627, 0, 0, 50
260,20050628, 0, 0, 51
260,20050629, 108, 72, 33
260,20050630, 174, 94, 24
260,20050701, 2, 2, 25
260,20050702, 4, 4, 14
260,20050703, 0, 0, 38
260,20050704, 335, 169, 16
260,20050705, 4, 2, 23
260,20050706, 79, 38, 18
260,20050707, 0, 0, 30
260,20050708, 23, 10, 16
260,20050709, 0, 0, 35
260,20050710, 0, 0, 51
260,20050711, 0, 0, 40
260,20050712, 0, 0, 48
260,20050713, 0, 0, 48
260,20050714, 0, 0, 49
260,20050715, 0, 0, 36
260,20050716, 0, 0, 38
260,20050717, 0, 0, 29
260,20050718, 13, 11, 31
260,20050719, 23, 23, 29
260,20050720, 50, 27, 24
260,20050721, 1, 1, 11
260,20050722, 55, 31, 13
260,20050723, -1, -1, 22
260,20050724, 34, 12, 20
260,20050725, 136, 43, 16
260,20050726, 6, 6, 16
260,20050727, 41, 12, 14
260,20050728, 1, 1, 31
260,20050729, 205, 141, 25
260,20050730, 378, 296, 31
260,20050731, 195, 65, 10
260,20050801, 0, 0, 29
260,20050802, 0, 0, 36
260,20050803, 37, 19, 25
260,20050804, 0, 0, 40
260,20050805, 53, 12, 11
260,20050806, 17, 9, 26
260,20050807, 121, 24, 32
260,20050808, 35, 29, 25
260,20050809, 0, 0, 25
260,20050810, 1, 1, 25
260,20050811, 1, 1, 16
260,20050812, 400, 144, 13
260,20050813, 6, 4, 25
260,20050814, 126, 68, 23
260,20050815, 1, 1, 10
260,20050816, 0, 0, 32
260,20050817, 0, 0, 39
260,20050818, 0, 0, 39
260,20050819, 1, 1, 19
260,20050820, 9, 5, 11
260,20050821, 0, 0, 33
260,20050822, 0, 0, 22
260,20050823, 10, 5, 15
260,20050824, 8, 8, 26
260,20050825, 128, 24, 16
260,20050826, 2, 2, 26
260,20050827, -1, -1, 17
260,20050828, 0, 0, 34
260,20050829, 0, 0, 35
260,20050830, 0, 0, 36
260,20050831, 0, 0, 37
260,20050901, 3, 3, 15
260,20050902, 0, 0, 22
260,20050903, 0, 0, 24
260,20050904, 0, 0, 34
260,20050905, 0, 0, 35
260,20050906, 0, 0, 25
260,20050907, 0, 0, 27
260,20050908, 0, 0, 31
260,20050909, 4, 3, 20
260,20050910, 167, 134, 27
260,20050911, 45, 31, 7
260,20050912, 0, 0, 21
260,20050913, 0, 0, 26
260,20050914, 8, 3, 7
260,20050915, 171, 42, 6
260,20050916, 54, 13, 19
260,20050917, -1, -1, 21
260,20050918, 0, 0, 22
260,20050919, 0, 0, 24
260,20050920, 0, 0, 21
260,20050921, 0, 0, 23
260,20050922, 0, 0, 23
260,20050923, 0, 0, 22
260,20050924, 4, 4, 16
260,20050925, 1, 1, 14
260,20050926, 58, 45, 12
260,20050927, 5, 3, 5
260,20050928, 10, 5, 17
260,20050929, 51, 18, 14
260,20050930, 52, 22, 6
260,20051001, 40, 8, 15
260,20051002, 99, 36, 17
260,20051003, 0, 0, 16
260,20051004, 0, 0, 16
260,20051005, 0, 0, 16
260,20051006, 0, 0, 9
260,20051007, 0, 0, 17
260,20051008, 0, 0, 10
260,20051009, -1, -1, 8
260,20051010, 0, 0, 18
260,20051011, 0, 0, 17
260,20051012, 0, 0, 16
260,20051013, 0, 0, 16
260,20051014, 0, 0, 11
260,20051015, 0, 0, 15
260,20051016, 0, 0, 15
260,20051017, 0, 0, 15
260,20051018, 0, 0, 14
260,20051019, 19, 16, 3
260,20051020, 45, 17, 11
260,20051021, 65, 18, 3
260,20051022, -1, -1, 5
260,20051023, 58, 43, 7
260,20051024, 190, 30, 1
260,20051025, 45, 12, 3
260,20051026, 0, 0, 11
260,20051027, 0, 0, 13

260,20051028, 0, 0, 9
260,20051029, -1, -1, 9
260,20051030, -1, -1, 13
260,20051031, -1, -1, 10
260,20051101, 2, 2, 9
260,20051102, 62, 25, 2
260,20051103, -1, -1, 10
260,20051104, 1, 1, 4
260,20051105, -1, -1, 7
260,20051106, 10, 8, 9
260,20051107, 8, 5, 4
260,20051108, 0, 0, 8
260,20051109, -1, -1, 2
260,20051110, 13, 7, 4
260,20051111, 11, 3, 3
260,20051112, 23, 13, 4
260,20051113, 0, 0, 7
260,20051114, 0, 0, 7
260,20051115, 68, 14, 1
260,20051116, 110, 21, 4
260,20051117, 43, 8, 4
260,20051118, 3, 3, 6
260,20051119, 3, 3, 5
260,20051120, 3, 2, 2
260,20051121, 1, 1, 2
260,20051122, -1, -1, 2
260,20051123, 13, 5, 1
260,20051124, 127, 25, 1
260,20051125, 425, 52, 0
260,20051126, 9, 4, 1
260,20051127, 37, 18, 2
260,20051128, 0, 0, 4
260,20051129, 4, 4, 4
260,20051130, -1, -1, 3
260,20051201, 0, 0, 4
260,20051202, 1, 1, 2
260,20051203, 12, 4, 1
260,20051204, 47, 16, 3
260,20051205, 53, 14, 3
260,20051206, 7, 4, 2
260,20051207, 39, 11, 3
260,20051208, 0, 0, 4
260,20051209, 0, 0, 3
260,20051210, -1, -1, 2
260,20051211, -1, -1, 1
260,20051212, -1, -1, 3
260,20051213, -1, -1, 1
260,20051214, 12, 4, 4
260,20051215, 6, 4, 2
260,20051216, 136, 34, 2
260,20051217, 21, 11, 2
260,20051218, 18, 14, 3
260,20051219, 21, 6, 3
260,20051220, -1, -1, 1
260,20051221, 15, 6, 1
260,20051222, 18, 8, 2
260,20051223, -1, -1, 1
260,20051224, 0, 0, 2
260,20051225, 1, 1, 5
260,20051226, 25, 15, 3
260,20051227, 1, 1, 2
260,20051228, 0, 0, 3
260,20051229, -1, -1, 4
260,20051230, 111, 25, 2
260,20051231, 21, 9, 1
260,20060101, 0, 0, 1
260,20060102, -1, -1, 2
260,20060103, -1, -1, 4
260,20060104, -1, -1, 2
260,20060105, 0, 0, 1
260,20060106, 0, 0, 1
260,20060107, 0, 0, 4
260,20060108, 0, 0, 1
260,20060109, 0, 0, 4
260,20060110, 0, 0, 2
260,20060111, 47, 13, 0
260,20060112, 0, 0, 1
260,20060113, 0, 0, 4
260,20060114, 0, 0, 5
260,20060115, 0, 0, 4
260,20060116, 7, 5, 4
260,20060117, 49, 27, 1
260,20060118, 1, 1, 3
260,20060119, 13, 3, 1
260,20060120, 25, 18, 1
260,20060121, 4, 3, 3
260,20060122, 0, 0, 1
260,20060123, 0, 0, 5
260,20060124, 0, 0, 5
260,20060125, 5, 2, 3
260,20060126, -1, -1, 2
260,20060127, -1, -1, 1
260,20060128, 0, 0, 6
260,20060129, 0, 0, 7
260,20060130, 0, 0, 4
260,20060131, 0, 0, 6
260,20060201, -1, -1, 3
260,20060202, -1, -1, 1
260,20060203, 0, 0, 1
260,20060204, -1, -1, 3
260,20060205, 11, 3, 1
260,20060206, 3, 2, 1
260,20060207, 3, 1, 2
260,20060208, 134, 38, 5
260,20060209, 12, 6, 6
260,20060210, 4, 3, 1
260,20060211, -1, -1, 3
260,20060212, 50, 9, 2
260,20060213, 0, 0, 3
260,20060214, 4, 2, 4
260,20060215, 139, 30, 3
260,20060216, 46, 13, 4
260,20060217, 53, 17, 1
260,20060218, 3, 3, 5
260,20060219, -1, -1, 7
260,20060220, 0, 0, 2
260,20060221, 14, 4, 2
260,20060222, 0, 0, 1
260,20060223, 0, 0, 7
260,20060224, 0, 0, 10
260,20060225, 0, 0, 12
260,20060226, 0, 0, 9
260,20060227, 40, 10, 5
260,20060228, 72, 9, 6
260,20060301, 53, 20, 6
260,20060302, 33, 12, 11
260,20060303, 15, 12, 6
260,20060304, 14, 5, 10
260,20060305, 21, 5, 11
260,20060306, 55, 16, 13
260,20060307, 0, 0, 11
260,20060308, 190, 25, 2
260,20060309, 59, 14, 4
260,20060310, 67, 21, 4
260,20060311, 2, 2, 5
260,20060312, 0, 0, 13
260,20060313, 0, 0, 14
260,20060314, 0, 0, 12
260,20060315, 0, 0, 16
260,20060316, -1, -1, 3
260,20060317, 0, 0, 4
260,20060318, 0, 0, 14
260,20060319, 0, 0, 7
260,20060320, 0, 0, 14
260,20060321, 0, 0, 15
260,20060322, 0, 0, 13
260,20060323, 0, 0, 21
260,20060324, 15, 8, 8
260,20060325, 86, 33, 13
260,20060326, 193, 95, 17
260,20060327, 62, 49, 12
260,20060328, 1, 1, 19
260,20060329, 48, 15, 18
260,20060330, 113, 35, 12
260,20060331, 16, 5, 14
260,20060401, 1, 1, 19
260,20060402, 53, 16, 15
260,20060403, 22, 12, 15
260,20060404, 10, 7, 18
260,20060405, 0, 0, 21
260,20060406, -1, -1, 18
260,20060407, 7, 3, 19
260,20060408, 40, 34, 15
260,20060409, 0, 0, 26
260,20060410, -1, -1, 22
260,20060411, 24, 12, 14
260,20060412, 17, 7, 16
260,20060413, 79, 29, 11
260,20060414, 0, 0, 21
260,20060415, 39, 14, 13
260,20060416, 49, 16, 23
260,20060417, 10, 4, 28
260,20060418, 1, 1, 16
260,20060419, 0, 0, 15
260,20060420, 0, 0, 20
260,20060421, -1, -1, 22
260,20060422, -1, -1, 6
260,20060423, 7, 5, 18
260,20060424, -1, -1, 27
260,20060425, 0, 0, 31
260,20060426, 19, 17, 18
260,20060427, 0, 0, 30
260,20060428, -1, -1, 23
260,20060429, 5, 5, 21
260,20060430, 15, 8, 21
260,20060501, 37, 8, 11
260,20060502, 0, 0, 32
260,20060503, 0, 0, 36
260,20060504, 0, 0, 38
260,20060505, 0, 0, 38
260,20060506, 0, 0, 39
260,20060507, 0, 0, 33
260,20060508, 0, 0, 36
260,20060509, 0, 0, 40
260,20060510, 0, 0, 44
260,20060511, 0, 0, 45
260,20060512, 0, 0, 41
260,20060513, 0, 0, 35
260,20060514, 0, 0, 35
260,20060515, 4, 3, 25
260,20060516, 2, 2, 19
260,20060517, 17, 9, 29
260,20060518, 102, 42, 23
260,20060519, 76, 22, 10
260,20060520, 106, 22, 15
260,20060521, 58, 19, 17
260,20060522, 54, 34, 24
260,20060523, 38, 8, 22
260,20060524, 89, 36, 20
260,20060525, 38, 16, 13
260,20060526, 154, 24, 7
260,20060527, 45, 18, 7
260,20060528, 25, 24, 28
260,20060529, 30, 22, 31
260,20060530, 24, 9, 28
260,20060531, 3, 3, 13
260,20060601, 4, 1, 20
260,20060602, 0, 0, 40
260,20060603, 0, 0, 27
260,20060604, -1, -1, 35
260,20060605, -1, -1, 31
260,20060606, 0, 0, 39
260,20060607, 0, 0, 37
260,20060608, 0, 0, 49
260,20060609, 0, 0, 49
260,20060610, 0, 0, 53
260,20060611, 0, 0, 56
260,20060612, 0, 0, 57
260,20060613, 0, 0, 52
260,20060614, 48, 12, 14
260,20060615, 2, 1, 6
260,20060616, -1, -1, 38
260,20060617, 0, 0, 50
260,20060618, 0, 0, 42

260,20060619, 6, 6, 36
260,20060620, 0, 0, 34
260,20060621, 12, 5, 11
260,20060622, 1, 1, 19
260,20060623, 0, 0, 24
260,20060624, -1, -1, 42
260,20060625, 105, 40, 13
260,20060626, 2, 1, 8
260,20060627, -1, -1, 22
260,20060628, 0, 0, 41
260,20060629, 0, 0, 48
260,20060630, 0, 0, 45
260,20060701, 0, 0, 53
260,20060702, 0, 0, 53
260,20060703, 0, 0, 56
260,20060704, 0, 0, 53
260,20060705, 2, 2, 34
260,20060706, 5, 3, 44
260,20060707, 1, 1, 24
260,20060708, -1, -1, 31
260,20060709, 1, 1, 27
260,20060710, -1, -1, 41
260,20060711, 62, 42, 25
260,20060712, 0, 0, 50
260,20060713, 0, 0, 49
260,20060714, 0, 0, 49
260,20060715, 0, 0, 51
260,20060716, 0, 0, 54
260,20060717, 0, 0, 54
260,20060718, 0, 0, 53
260,20060719, 0, 0, 54
260,20060720, 0, 0, 44
260,20060721, 0, 0, 50
260,20060722, 4, 4, 29
260,20060723, 0, 0, 34
260,20060724, 0, 0, 39
260,20060725, 0, 0, 46
260,20060726, 0, 0, 46
260,20060727, -1, -1, 21
260,20060728, 11, 9, 29
260,20060729, 0, 0, 34
260,20060730, 64, 35, 20
260,20060731, -1, -1, 31
260,20060801, 148, 145, 18
260,20060802, 149, 37, 17
260,20060803, 79, 17, 17
260,20060804, 84, 37, 28
260,20060805, -1, -1, 41
260,20060806, 0, 0, 43
260,20060807, 3, 2, 26
260,20060808, -1, -1, 19
260,20060809, 31, 13, 12
260,20060810, 42, 22, 15
260,20060811, 252, 52, 11
260,20060812, 73, 17, 16
260,20060813, 0, 0, 34
260,20060814, 147, 37, 12
260,20060815, -1, -1, 15
260,20060816, 40, 28, 33
260,20060817, 0, 0, 23
260,20060818, 57, 32, 21
260,20060819, 32, 19, 32
260,20060820, 224, 73, 14
260,20060821, 90, 33, 20
260,20060822, -1, -1, 24
260,20060823, -1, -1, 29
260,20060824, 7, 3, 14
260,20060825, 3, 2, 20
260,20060826, 0, 0, 15
260,20060827, 40, 25, 22
260,20060828, 161, 54, 15
260,20060829, 70, 39, 22
260,20060830, 72, 29, 17
260,20060831, 1, 1, 8
260,20060901, -1, -1, 17
260,20060902, 3, 3, 13
260,20060903, 48, 24, 8
260,20060904, 0, 0, 25
260,20060905, -1, -1, 11
260,20060906, 0, 0, 31
260,20060907, 2, 2, 23
260,20060908, 0, 0, 27
260,20060909, 0, 0, 31
260,20060910, 0, 0, 31
260,20060911, 0, 0, 28
260,20060912, 0, 0, 30
260,20060913, 0, 0, 28
260,20060914, -1, -1, 26
260,20060915, 0, 0, 29
260,20060916, 0, 0, 25
260,20060917, 0, 0, 9
260,20060918, 7, 7, 10
260,20060919, 26, 13, 11
260,20060920, 0, 0, 26
260,20060921, 0, 0, 28
260,20060922, -1, -1, 23
260,20060923, -1, -1, 10
260,20060924, -1, -1, 15
260,20060925, -1, -1, 13
260,20060926, -1, -1, 10
260,20060927, 0, 0, 18
260,20060928, 0, 0, 16
260,20060929, 0, 0, 16
260,20060930, -1, -1, 20
260,20061001, 100, 62, 10
260,20061002, 229, 49, 6
260,20061003, 56, 33, 11
260,20061004, 115, 41, 13
260,20061005, 92, 19, 14
260,20061006, 90, 29, 3
260,20061007, 18, 8, 16
260,20061008, 0, 0, 10
260,20061009, -1, -1, 14
260,20061010, 1, 1, 8
260,20061011, 0, 0, 17
260,20061012, 0, 0, 7
260,20061013, -1, -1, 12
260,20061014, 0, 0, 11
260,20061015, 0, 0, 9
260,20061016, 0, 0, 15
260,20061017, 0, 0, 15
260,20061018, 10, 9, 6
260,20061019, 21, 17, 8
260,20061020, 1, 1, 7
260,20061021, 10, 6, 8
260,20061022, 61, 21, 6
260,20061023, 141, 60, 10
260,20061024, 93, 39, 6
260,20061025, 28, 28, 5
260,20061026, -1, -1, 9
260,20061027, -1, -1, 8
260,20061028, 6, 2, 4
260,20061029, 0, 0, 9
260,20061030, 0, 0, 8
260,20061031, 21, 9, 4
260,20061101, 25, 6, 8
260,20061102, 25, 5, 6
260,20061103, 2, 1, 5
260,20061104, -1, -1, 6
260,20061105, 0, 0, 3
260,20061106, 0, 0, 5
260,20061107, 0, 0, 2
260,20061108, 71, 37, 3
260,20061109, 2, 1, 8
260,20061110, 0, 0, 5
260,20061111, 225, 77, 4
260,20061112, 53, 11, 4
260,20061113, 46, 11, 3
260,20061114, 38, 21, 4
260,20061115, 4, 4, 4
260,20061116, 47, 8, 3
260,20061117, 0, 0, 7
260,20061118, 11, 7, 5
260,20061119, 22, 9, 2
260,20061120, 87, 15, 0
260,20061121, 51, 16, 3
260,20061122, 82, 25, 3
260,20061123, 88, 18, 1
260,20061124, 3, 1, 5
260,20061125, 43, 13, 2
260,20061126, 0, 0, 5
260,20061127, 0, 0, 5
260,20061128, -1, -1, 4
260,20061129, 0, 0, 6
260,20061130, 0, 0, 2
260,20061201, 1, 1, 3
260,20061202, 9, 4, 1
260,20061203, 132, 83, 1
260,20061204, 37, 10, 3
260,20061205, 47, 35, 1
260,20061206, 2, 1, 2
260,20061207, 156, 35, 0
260,20061208, 88, 13, 1
260,20061209, 2, 1, 5
260,20061210, -1, -1, 4
260,20061211, 51, 12, 0
260,20061212, 12, 4, 5
260,20061213, 5, 5, 2
260,20061214, 0, 0, 3
260,20061215, 0, 0, 2
260,20061216, 47, 15, 1
260,20061217, 5, 2, 3
260,20061218, 0, 0, 4
260,20061219, 0, 0, 3
260,20061220, 0, 0, 1
260,20061221, 0, 0, 1
260,20061222, 0, 0, 2
260,20061223, 0, 0, 1
260,20061224, -1, -1, 1
260,20061225, -1, -1, 1
260,20061226, -1, -1, 0
260,20061227, -1, -1, 0
260,20061228, 10, 3, 1
260,20061229, 2, 1, 4
260,20061230, 81, 17, 1
260,20061231, 63, 33, 2
260,20070101, 5, 2, 2
260,20070102, 58, 14, 2
260,20070103, 17, 5, 1
260,20070104, 23, 7, 2
260,20070105, 24, 9, 1
260,20070106, 124, 28, 2
260,20070107, 7, 3, 1
260,20070108, 85, 20, 4
260,20070109, -1, -1, 2
260,20070110, 55, 24, 1
260,20070111, 39, 10, 0
260,20070112, -1, -1, 2
260,20070113, 1, 1, 2
260,20070114, 8, 8, 6
260,20070115, 0, 0, 4
260,20070116, 6, 3, 1
260,20070117, 139, 80, 2
260,20070118, 248, 36, 1
260,20070119, 8, 2, 4
260,20070120, 38, 22, 2
260,20070121, 71, 45, 4
260,20070122, 24, 9, 4
260,20070123, 0, 0, 4
260,20070124, 0, 0, 4
260,20070125, 0, 0, 6
260,20070126, 34, 10, 1
260,20070127, 9, 4, 4
260,20070128, 10, 4, 1
260,20070129, 1, 1, 4
260,20070130, 0, 0, 3
260,20070131, 4, 1, 6
260,20070201, -1, -1, 2
260,20070202, 0, 0, 3
260,20070203, 0, 0, 8
260,20070204, 0, 0, 5
260,20070205, 2, 2, 3
260,20070206, 2, 2, 5

260,20070207, -1, -1, 6
260,20070208, 52, 16, 1
260,20070209, -1, -1, 3
260,20070210, 36, 12, 2
260,20070211, 107, 22, 3
260,20070212, 79, 15, 4
260,20070213, 15, 4, 4
260,20070214, 77, 13, 2
260,20070215, 0, 0, 11
260,20070216, 0, 0, 9
260,20070217, 0, 0, 8
260,20070218, 0, 0, 3
260,20070219, -1, -1, 5
260,20070220, -1, -1, 8
260,20070221, 15, 6, 3
260,20070222, 3, 3, 9
260,20070223, 9, 5, 6
260,20070224, 44, 14, 6
260,20070225, 98, 18, 2
260,20070226, 9, 3, 3
260,20070227, 93, 18, 3
260,20070228, 38, 19, 7
260,20070301, 161, 67, 10
260,20070302, 17, 12, 6
260,20070303, 111, 20, 5
260,20070304, -1, -1, 8
260,20070305, 113, 68, 12
260,20070306, 162, 18, 2
260,20070307, 22, 8, 6
260,20070308, 0, 0, 15
260,20070309, 52, 24, 4
260,20070310, 0, 0, 14
260,20070311, 0, 0, 13
260,20070312, 0, 0, 20
260,20070313, 0, 0, 15
260,20070314, 0, 0, 11
260,20070315, 0, 0, 17
260,20070316, -1, -1, 8
260,20070317, 2, 2, 9
260,20070318, 122, 22, 12
260,20070319, 44, 19, 9
260,20070320, 20, 12, 12
260,20070321, 22, 19, 8
260,20070322, 0, 0, 17
260,20070323, -1, -1, 5
260,20070324, -1, -1, 8
260,20070325, 0, 0, 19
260,20070326, 0, 0, 25
260,20070327, 0, 0, 25
260,20070328, 0, 0, 25
260,20070329, -1, -1, 11
260,20070330, -1, -1, 16
260,20070331, 0, 0, 23
260,20070401, 0, 0, 28
260,20070402, 0, 0, 26
260,20070403, 3, 2, 9
260,20070404, 0, 0, 26
260,20070405, 0, 0, 24
260,20070406, 0, 0, 26
260,20070407, -1, -1, 19
260,20070408, 0, 0, 28
260,20070409, 0, 0, 27
260,20070410, 0, 0, 19
260,20070411, 0, 0, 24
260,20070412, 0, 0, 31
260,20070413, 0, 0, 26
260,20070414, 0, 0, 35
260,20070415, 0, 0, 38
260,20070416, 0, 0, 35
260,20070417, 0, 0, 22
260,20070418, 0, 0, 22
260,20070419, 0, 0, 33
260,20070420, 0, 0, 28
260,20070421, 0, 0, 30
260,20070422, 0, 0, 35
260,20070423, 0, 0, 29
260,20070424, 0, 0, 24
260,20070425, 0, 0, 32
260,20070426, 0, 0, 32
260,20070427, 0, 0, 41
260,20070428, 0, 0, 41
260,20070429, 0, 0, 40
260,20070430, 0, 0, 42
260,20070501, 0, 0, 42
260,20070502, 0, 0, 42
260,20070503, 0, 0, 36
260,20070504, 0, 0, 38
260,20070505, 0, 0, 39
260,20070506, -1, -1, 24
260,20070507, 409, 89, 4
260,20070508, 156, 64, 22
260,20070509, 42, 21, 23
260,20070510, 127, 44, 23
260,20070511, 137, 32, 14
260,20070512, 34, 13, 20
260,20070513, -1, -1, 22
260,20070514, 22, 12, 15
260,20070515, 3, 3, 32
260,20070516, 88, 31, 30
260,20070517, 22, 6, 25
260,20070518, 0, 0, 31
260,20070519, -1, -1, 40
260,20070520, 33, 9, 28
260,20070521, -1, -1, 17
260,20070522, 1, 1, 13
260,20070523, 0, 0, 46
260,20070524, 0, 0, 48
260,20070525, 0, 0, 40
260,20070526, 14, 8, 20
260,20070527, 184, 102, 19
260,20070528, 14, 11, 14
260,20070529, 27, 14, 13
260,20070530, -1, -1, 41
260,20070531, 66, 33, 23
260,20070601, 0, 0, 31
260,20070602, 0, 0, 45
260,20070603, 0, 0, 33
260,20070604, 0, 0, 41
260,20070605, 0, 0, 35
260,20070606, -1, -1, 34
260,20070607, 0, 0, 44
260,20070608, 13, 13, 41
260,20070609, 26, 16, 18
260,20070610, 141, 123, 27
260,20070611, 0, 0, 36
260,20070612, 4, 4, 9
260,20070613, 0, 0, 26
260,20070614, 125, 79, 25
260,20070615, 6, 4, 25
260,20070616, 17, 10, 26
260,20070617, 3, 3, 22
260,20070618, 67, 13, 20
260,20070619, 0, 0, 51
260,20070620, 12, 7, 38
260,20070621, 66, 47, 17
260,20070622, 68, 45, 28
260,20070623, 141, 33, 28
260,20070624, 55, 27, 24
260,20070625, 31, 11, 22
260,20070626, 24, 7, 18
260,20070627, 24, 7, 33
260,20070628, 14, 7, 44
260,20070629, 40, 20, 11
260,20070630, 24, 24, 22
260,20070701, 78, 41, 33
260,20070702, 103, 48, 30
260,20070703, 9, 2, 20
260,20070704, 269, 51, 16
260,20070705, 274, 118, 28
260,20070706, 35, 24, 8
260,20070707, -1, -1, 32
260,20070708, 7, 7, 32
260,20070709, 2, 2, 32
260,20070710, -1, -1, 30
260,20070711, 33, 31, 16
260,20070712, 6, 2, 18
260,20070713, 0, 0, 28
260,20070714, -1, -1, 32
260,20070715, -1, -1, 27
260,20070716, 39, 26, 31
260,20070717, 4, 4, 39
260,20070718, -1, -1, 33
260,20070719, 0, 0, 41
260,20070720, 67, 30, 13
260,20070721, -1, -1, 43
260,20070722, 112, 52, 26
260,20070723, 96, 36, 15
260,20070724, 43, 39, 27
260,20070725, -1, -1, 39
260,20070726, 105, 70, 16
260,20070727, 0, 0, 40
260,20070728, 129, 57, 29
260,20070729, 177, 55, 22
260,20070730, 18, 6, 34
260,20070731, -1, -1, 31
260,20070801, 0, 0, 42
260,20070802, 0, 0, 24
260,20070803, 0, 0, 33
260,20070804, 0, 0, 46
260,20070805, 0, 0, 48
260,20070806, 3, 3, 33
260,20070807, -1, -1, 18
260,20070808, 3, 3, 22
260,20070809, 16, 5, 5
260,20070810, 0, 0, 21
260,20070811, 0, 0, 36
260,20070812, 31, 30, 30
260,20070813, 0, 0, 32
260,20070814, 76, 68, 31
260,20070815, 43, 12, 26
260,20070816, 92, 39, 26
260,20070817, 45, 27, 22
260,20070818, -1, -1, 29
260,20070819, -1, -1, 28
260,20070820, 39, 37, 19
260,20070821, 40, 17, 21
260,20070822, -1, -1, 21
260,20070823, 9, 8, 17
260,20070824, 0, 0, 30
260,20070825, 0, 0, 34
260,20070826, 0, 0, 30
260,20070827, 0, 0, 27
260,20070828, 0, 0, 24
260,20070829, 0, 0, 27
260,20070830, 1, 1, 16
260,20070831, 24, 16, 10
260,20070901, -1, -1, 18
260,20070902, 60, 44, 18
260,20070903, 141, 79, 24
260,20070904, 20, 14, 26
260,20070905, 17, 4, 7
260,20070906, -1, -1, 19
260,20070907, -1, -1, 23
260,20070908, 11, 9, 10
260,20070909, -1, -1, 15
260,20070910, 187, 162, 13
260,20070911, 3, 3, 17
260,20070912, 0, 0, 15
260,20070913, 0, 0, 16
260,20070914, 2, 2, 15
260,20070915, 0, 0, 24
260,20070916, 0, 0, 24
260,20070917, 103, 30, 5
260,20070918, 36, 23, 18
260,20070919, 3, 3, 15
260,20070920, 58, 49, 7
260,20070921, -1, -1, 14
260,20070922, 0, 0, 11
260,20070923, 0, 0, 23
260,20070924, 31, 17, 9
260,20070925, 143, 53, 12
260,20070926, 21, 5, 8
260,20070927, -1, -1, 19
260,20070928, 82, 35, 11

260,20070929, 48, 16, 3
260,20070930, 2, 2, 11
260,20071001, -1, -1, 5
260,20071002, 0, 0, 8
260,20071003, 112, 45, 3
260,20071004, -1, -1, 9
260,20071005, 0, 0, 11
260,20071006, 0, 0, 19
260,20071007, 0, 0, 17
260,20071008, 0, 0, 10
260,20071009, 6, 3, 10
260,20071010, 0, 0, 13
260,20071011, 0, 0, 14
260,20071012, 0, 0, 11
260,20071013, 0, 0, 16
260,20071014, 0, 0, 17
260,20071015, 0, 0, 13
260,20071016, 0, 0, 15
260,20071017, 75, 33, 3
260,20071018, 5, 2, 11
260,20071019, 2, 2, 7
260,20071020, 0, 0, 12
260,20071021, 3, 2, 7
260,20071022, 0, 0, 12
260,20071023, 0, 0, 12
260,20071024, 0, 0, 6
260,20071025, 0, 0, 3
260,20071026, 0, 0, 4
260,20071027, 0, 0, 3
260,20071028, 18, 10, 6
260,20071029, 58, 9, 1
260,20071030, 40, 23, 7
260,20071031, 0, 0, 6
260,20071101, 0, 0, 4
260,20071102, 2, 1, 2
260,20071103, 5, 2, 3
260,20071104, -1, -1, 4
260,20071105, 60, 37, 4
260,20071106, 14, 5, 7
260,20071107, 8, 4, 2
260,20071108, 77, 25, 4
260,20071109, 77, 17, 4
260,20071110, 115, 36, 5
260,20071111, 45, 37, 5
260,20071112, 5, 4, 5
260,20071113, 8, 4, 1
260,20071114, 1, 1, 6
260,20071115, 0, 0, 6
260,20071116, 0, 0, 3
260,20071117, 0, 0, 5
260,20071118, 0, 0, 6
260,20071119, 10, 8, 3
260,20071120, 6, 2, 4
260,20071121, 7, 4, 1
260,20071122, 0, 0, 6
260,20071123, 10, 5, 3
260,20071124, 13, 8, 3
260,20071125, 23, 8, 3
260,20071126, 2, 2, 4
260,20071127, 0, 0, 3
260,20071128, 2, 1, 1
260,20071129, 26, 12, 1
260,20071130, 67, 30, 1
260,20071201, 26, 9, 5
260,20071202, 130, 35, 1
260,20071203, 56, 19, 4
260,20071204, 6, 2, 2
260,20071205, 24, 8, 1
260,20071206, 239, 63, 1
260,20071207, 71, 30, 3
260,20071208, 108, 27, 3
260,20071209, 51, 11, 5
260,20071210, 1, 1, 3
260,20071211, -1, -1, 4
260,20071212, 0, 0, 1
260,20071213, 0, 0, 2
260,20071214, 0, 0, 3
260,20071215, 0, 0, 2
260,20071216, 0, 0, 4
260,20071217, 0, 0, 1
260,20071218, 0, 0, 3
260,20071219, 0, 0, 4
260,20071220, -1, -1, 1
260,20071221, -1, -1, 1
260,20071222, -1, -1, 4
260,20071223, -1, -1, 3
260,20071224, 0, 0, 1
260,20071225, 7, 6, 2
260,20071226, -1, -1, 2
260,20071227, 0, 0, 1
260,20071228, 0, 0, 2
260,20071229, 28, 7, 4
260,20071230, 3, 1, 3
260,20071231, 15, 6, 2
260,20080101, 0, 0, 2
260,20080102, 0, 0, 4
260,20080103, 1, 1, 2
260,20080104, 4, 3, 1
260,20080105, 87, 16, 2
260,20080106, 14, 13, 5
260,20080107, 54, 21, 3
260,20080108, 0, 0, 2
260,20080109, 12, 6, 3
260,20080110, 28, 9, 3
260,20080111, 126, 26, 2
260,20080112, 5, 3, 3
260,20080113, 3, 2, 3
260,20080114, 1, 1, 3
260,20080115, 82, 17, 1
260,20080116, -1, -1, 4
260,20080117, 39, 18, 1
260,20080118, 100, 27, 1
260,20080119, 147, 36, 1
260,20080120, 17, 3, 1
260,20080121, 113, 24, 1
260,20080122, 9, 7, 6
260,20080123, 9, 5, 1
260,20080124, 20, 8, 1
260,20080125, 0, 0, 4
260,20080126, 0, 0, 6
260,20080127, 1, 1, 4
260,20080128, 0, 0, 3
260,20080129, 0, 0, 2
260,20080130, 36, 12, 3
260,20080131, 55, 23, 2
260,20080201, 9, 6, 5
260,20080202, 78, 40, 7
260,20080203, -1, -1, 6
260,20080204, 2, 2, 3
260,20080205, 54, 8, 1
260,20080206, 13, 9, 2
260,20080207, -1, -1, 5
260,20080208, 0, 0, 10
260,20080209, 0, 0, 10
260,20080210, 0, 0, 10
260,20080211, 0, 0, 10
260,20080212, 0, 0, 10
260,20080213, 0, 0, 2
260,20080214, 0, 0, 2
260,20080215, 0, 0, 11
260,20080216, 0, 0, 10
260,20080217, 0, 0, 10
260,20080218, 0, 0, 9
260,20080219, 0, 0, 3
260,20080220, 0, 0, 5
260,20080221, 9, 9, 3
260,20080222, 3, 2, 3
260,20080223, 0, 0, 5
260,20080224, 49, 35, 7
260,20080225, 18, 14, 12
260,20080226, 61, 21, 4
260,20080227, 0, 0, 12
260,20080228, 0, 0, 9
260,20080229, 96, 26, 8
260,20080301, 19, 16, 10
260,20080302, 2, 2, 13
260,20080303, -1, -1, 12
260,20080304, 35, 14, 12
260,20080305, 1, 1, 13
260,20080306, 10, 5, 2
260,20080307, 6, 3, 5
260,20080308, -1, -1, 10
260,20080309, 57, 12, 4
260,20080310, 26, 10, 4
260,20080311, 68, 13, 8
260,20080312, 19, 7, 4
260,20080313, -1, -1, 12
260,20080314, -1, -1, 17
260,20080315, 0, 0, 11
260,20080316, 141, 31, 3
260,20080317, 2, 1, 9
260,20080318, 5, 2, 14
260,20080319, 10, 5, 15
260,20080320, 214, 36, 8
260,20080321, 88, 23, 7
260,20080322, 2, 1, 6
260,20080323, 32, 11, 12
260,20080324, 70, 20, 13
260,20080325, 39, 8, 12
260,20080326, 10, 3, 6
260,20080327, -1, -1, 9
260,20080328, 36, 14, 11
260,20080329, 5, 5, 19
260,20080330, 18, 9, 6
260,20080331, 4, 3, 13
260,20080401, 34, 15, 9
260,20080402, 3, 1, 11
260,20080403, 2, 1, 11
260,20080404, -1, -1, 9
260,20080405, 140, 31, 7
260,20080406, 1, 1, 19
260,20080407, -1, -1, 18
260,20080408, -1, -1, 16
260,20080409, 0, 0, 26
260,20080410, 0, 0, 19
260,20080411, 0, 0, 23
260,20080412, 4, 4, 17
260,20080413, -1, -1, 20
260,20080414, 0, 0, 16
260,20080415, 7, 3, 20
260,20080416, 0, 0, 15
260,20080417, 0, 0, 23
260,20080418, 0, 0, 25
260,20080419, 2, 2, 21
260,20080420, 0, 0, 32
260,20080421, 0, 0, 35
260,20080422, 0, 0, 33
260,20080423, 68, 16, 25
260,20080424, 14, 10, 19
260,20080425, 0, 0, 25
260,20080426, -1, -1, 32
260,20080427, 0, 0, 30
260,20080428, 19, 8, 10
260,20080429, 45, 18, 22
260,20080430, -1, -1, 19
260,20080501, 2, 2, 24
260,20080502, -1, -1, 28
260,20080503, 0, 0, 35
260,20080504, 0, 0, 42
260,20080505, 0, 0, 44
260,20080506, 0, 0, 37
260,20080507, 0, 0, 44
260,20080508, 0, 0, 46
260,20080509, 0, 0, 47
260,20080510, 0, 0, 47
260,20080511, 0, 0, 48
260,20080512, 0, 0, 43
260,20080513, 0, 0, 37
260,20080514, 0, 0, 44
260,20080515, 28, 27, 25
260,20080516, 71, 33, 7
260,20080517, 53, 18, 7
260,20080518, 0, 0, 29

260,20080519, 5, 3, 21
260,20080520, 0, 0, 40
260,20080521, 0, 0, 37
260,20080522, 0, 0, 35
260,20080523, 0, 0, 37
260,20080524, 0, 0, 43
260,20080525, 14, 7, 14
260,20080526, 14, 5, 13
260,20080527, 1, 1, 26
260,20080528, 3, 3, 30
260,20080529, 53, 22, 16
260,20080530, 6, 3, 16
260,20080531, 77, 44, 31
260,20080601, 1, 1, 20
260,20080602, 196, 111, 41
260,20080603, 25, 13, 28
260,20080604, 0, 0, 22
260,20080605, -1, -1, 9
260,20080606, 0, 0, 44
260,20080607, 0, 0, 33
260,20080608, 0, 0, 46
260,20080609, 0, 0, 52
260,20080610, 0, 0, 46
260,20080611, 0, 0, 36
260,20080612, 66, 61, 12
260,20080613, -1, -1, 28
260,20080614, 24, 18, 18
260,20080615, 7, 4, 30
260,20080616, 0, 0, 37
260,20080617, 0, 0, 47
260,20080618, 0, 0, 37
260,20080619, 14, 5, 25
260,20080620, 0, 0, 31
260,20080621, 0, 0, 35
260,20080622, 0, 0, 34
260,20080623, 0, 0, 32
260,20080624, 0, 0, 47
260,20080625, 0, 0, 38
260,20080626, 0, 0, 45
260,20080627, 32, 16, 41
260,20080628, 32, 13, 26
260,20080629, 0, 0, 31
260,20080630, 0, 0, 37
260,20080701, 0, 0, 53
260,20080702, 33, 20, 33
260,20080703, 8, 2, 13
260,20080704, 0, 0, 46
260,20080705, 4, 2, 33
260,20080706, 32, 24, 31
260,20080707, 96, 46, 23
260,20080708, 183, 42, 20
260,20080709, 117, 27, 24
260,20080710, 67, 13, 10
260,20080711, 37, 17, 25
260,20080712, 42, 24, 30
260,20080713, 2, 2, 33
260,20080714, 0, 0, 40
260,20080715, 1, 1, 12
260,20080716, 4, 4, 35
260,20080717, 70, 26, 11
260,20080718, 8, 3, 17
260,20080719, 131, 35, 18
260,20080720, 43, 13, 24
260,20080721, 89, 20, 11
260,20080722, 1, 1, 34
260,20080723, 0, 0, 29
260,20080724, 0, 0, 50
260,20080725, 0, 0, 42
260,20080726, 274, 223, 28
260,20080727, 0, 0, 45
260,20080728, 8, 3, 31
260,20080729, 18, 18, 27
260,20080730, 0, 0, 33
260,20080731, 0, 0, 44
260,20080801, 97, 53, 35
260,20080802, 11, 5, 32
260,20080803, 87, 45, 14
260,20080804, 33, 33, 32
260,20080805, 2, 2, 31
260,20080806, 2, 1, 38
260,20080807, 127, 25, 14
260,20080808, 104, 71, 22
260,20080809, 10, 5, 32
260,20080810, 24, 14, 25
260,20080811, -1, -1, 18
260,20080812, 22, 9, 24
260,20080813, 35, 25, 25
260,20080814, 1, 1, 26
260,20080815, 40, 40, 31
260,20080816, 0, 0, 36
260,20080817, 90, 41, 16
260,20080818, 132, 41, 10
260,20080819, 45, 26, 21
260,20080820, 57, 20, 14
260,20080821, 18, 16, 20
260,20080822, 64, 35, 9
260,20080823, 132, 55, 28
260,20080824, 3, 2, 17
260,20080825, -1, -1, 27
260,20080826, -1, -1, 6
260,20080827, 1, 1, 6
260,20080828, 0, 0, 9
260,20080829, 0, 0, 26
260,20080830, 0, 0, 37
260,20080831, -1, -1, 34
260,20080901, -1, -1, 21
260,20080902, 75, 32, 9
260,20080903, 2, 2, 12
260,20080904, 0, 0, 23
260,20080905, 42, 16, 12
260,20080906, 6, 6, 18
260,20080907, 66, 24, 8
260,20080908, 67, 22, 11
260,20080909, 29, 25, 30
260,20080910, 0, 0, 21
260,20080911, 51, 51, 26
260,20080912, 375, 140, 6
260,20080913, 9, 4, 11
260,20080914, 0, 0, 25
260,20080915, 0, 0, 18
260,20080916, 0, 0, 12
260,20080917, 0, 0, 13
260,20080918, 0, 0, 23
260,20080919, 0, 0, 20
260,20080920, 0, 0, 23
260,20080921, 0, 0, 16
260,20080922, -1, -1, 15
260,20080923, 18, 9, 6
260,20080924, -1, -1, 9
260,20080925, 0, 0, 22
260,20080926, 0, 0, 21
260,20080927, 0, 0, 21
260,20080928, 2, 2, 18
260,20080929, 42, 13, 10
260,20080930, 216, 24, 5
260,20081001, 183, 40, 11
260,20081002, 128, 43, 12
260,20081003, 29, 19, 17
260,20081004, 8, 4, 11
260,20081005, 186, 17, 2
260,20081006, -1, -1, 6
260,20081007, 1, 1, 8
260,20081008, 11, 4, 9
260,20081009, 0, 0, 13
260,20081010, 0, 0, 15
260,20081011, 0, 0, 16
260,20081012, 0, 0, 10
260,20081013, -1, -1, 15
260,20081014, -1, -1, 13
260,20081015, 54, 25, 3
260,20081016, 50, 39, 9
260,20081017, 14, 5, 10
260,20081018, 0, 0, 10
260,20081019, 0, 0, 9
260,20081020, -1, -1, 14
260,20081021, 82, 21, 7
260,20081022, 0, 0, 9
260,20081023, 0, 0, 12
260,20081024, 55, 18, 2
260,20081025, 0, 0, 12
260,20081026, 99, 25, 1
260,20081027, -1, -1, 10
260,20081028, 15, 6, 5
260,20081029, 0, 0, 6
260,20081030, -1, -1, 5
260,20081031, 0, 0, 6
260,20081101, 32, 16, 2
260,20081102, -1, -1, 7
260,20081103, -1, -1, 1
260,20081104, 0, 0, 4
260,20081105, 5, 2, 1
260,20081106, 1, 1, 6
260,20081107, 5, 3, 7
260,20081108, -1, -1, 9
260,20081109, 50, 21, 6
260,20081110, 170, 70, 3
260,20081111, 184, 39, 4
260,20081112, 7, 5, 4
260,20081113, 1, 1, 7
260,20081114, 8, 1, 1
260,20081115, 30, 11, 2
260,20081116, -1, -1, 3
260,20081117, 1, 1, 5
260,20081118, 13, 5, 2
260,20081119, 0, 0, 3
260,20081120, 56, 16, 3
260,20081121, 94, 28, 4
260,20081122, 79, 47, 4
260,20081123, 35, 7, 2
260,20081124, 39, 12, 3
260,20081125, 2, 2, 4
260,20081126, 7, 3, 2
260,20081127, -1, -1, 1
260,20081128, 0, 0, 1
260,20081129, 2, 2, 3
260,20081130, 84, 26, 1
260,20081201, -1, -1, 2
260,20081202, 51, 25, 3
260,20081203, 12, 11, 3
260,20081204, 38, 14, 1
260,20081205, -1, -1, 2
260,20081206, 4, 2, 4
260,20081207, -1, -1, 5
260,20081208, 0, 0, 2
260,20081209, 26, 10, 1
260,20081210, 28, 14, 4
260,20081211, 2, 2, 1
260,20081212, 0, 0, 3
260,20081213, 0, 0, 4
260,20081214, 0, 0, 2
260,20081215, 0, 0, 1
260,20081216, 0, 0, 1
260,20081217, -1, -1, 2
260,20081218, -1, -1, 1
260,20081219, 55, 21, 4
260,20081220, 9, 5, 1
260,20081221, 11, 6, 1
260,20081222, 6, 4, 3
260,20081223, -1, -1, 2
260,20081224, 1, 1, 1
260,20081225, 0, 0, 2
260,20081226, 0, 0, 4
260,20081227, 0, 0, 4
260,20081228, 0, 0, 4
260,20081229, 0, 0, 3
260,20081230, 0, 0, 4
260,20081231, -1, -1, 2
260,20090101, 0, 0, 1
260,20090102, 5, 5, 1
260,20090103, -1, -1, 1
260,20090104, 40, 7, 1
260,20090105, 21, 8, 3
260,20090106, 0, 0, 4
260,20090107, 2, 1, 2

260,20090108, -1, -1, 1
260,20090109, -1, -1, 3
260,20090110, 0, 0, 4
260,20090111, 0, 0, 5
260,20090112, 24, 10, 3
260,20090113, 40, 8, 1
260,20090114, -1, -1, 3
260,20090115, 0, 0, 5
260,20090116, -1, -1, 2
260,20090117, 7, 3, 1
260,20090118, 54, 29, 1
260,20090119, 41, 10, 1
260,20090120, 9, 4, 4
260,20090121, 0, 0, 3
260,20090122, 68, 14, 1
260,20090123, 226, 31, 1
260,20090124, -1, -1, 3
260,20090125, 0, 0, 5
260,20090126, 0, 0, 5
260,20090127, 0, 0, 5
260,20090128, 0, 0, 6
260,20090129, 0, 0, 7
260,20090130, 0, 0, 7
260,20090131, 0, 0, 7
260,20090201, -1, -1, 5
260,20090202, -1, -1, 2
260,20090203, 24, 7, 1
260,20090204, -1, -1, 1
260,20090205, 30, 15, 3
260,20090206, -1, -1, 6
260,20090207, 30, 15, 4
260,20090208, 17, 7, 5
260,20090209, 98, 32, 2
260,20090210, 82, 16, 1
260,20090211, 23, 18, 5
260,20090212, 5, 5, 8
260,20090213, 23, 12, 2
260,20090214, 0, 0, 8
260,20090215, 33, 11, 3
260,20090216, 59, 9, 5
260,20090217, 38, 8, 2
260,20090218, 0, 0, 7
260,20090219, 10, 3, 2
260,20090220, 6, 2, 3
260,20090221, 0, 0, 5
260,20090222, 5, 2, 4
260,20090223, 7, 4, 5
260,20090224, 0, 0, 4
260,20090225, 6, 4, 3
260,20090226, 16, 7, 8
260,20090227, 34, 7, 3
260,20090228, 5, 2, 5
260,20090301, 5, 4, 9
260,20090302, 0, 0, 7
260,20090303, -1, -1, 4
260,20090304, 1, 1, 3
260,20090305, 3, 1, 7
260,20090306, 4, 2, 8
260,20090307, 2, 2, 11
260,20090308, 68, 26, 14
260,20090309, 3, 1, 4
260,20090310, 49, 15, 3
260,20090311, -1, -1, 13
260,20090312, 29, 14, 3
260,20090313, 0, 0, 14
260,20090314, 16, 7, 7
260,20090315, 0, 0, 10
260,20090316, 0, 0, 10
260,20090317, 0, 0, 18
260,20090318, 0, 0, 15
260,20090319, 0, 0, 18
260,20090320, 0, 0, 20
260,20090321, 0, 0, 20
260,20090322, -1, -1, 16
260,20090323, 58, 28, 6
260,20090324, 8, 5, 17
260,20090325, 87, 22, 9
260,20090326, 48, 9, 4
260,20090327, 13, 8, 14
260,20090328, 88, 26, 10
260,20090329, -1, -1, 13
260,20090330, 0, 0, 20
260,20090331, 0, 0, 24
260,20090401, 0, 0, 25
260,20090402, 0, 0, 28
260,20090403, 0, 0, 27
260,20090404, 0, 0, 7
260,20090405, 0, 0, 17
260,20090406, 0, 0, 25
260,20090407, -1, -1, 8
260,20090408, 22, 11, 9
260,20090409, 1, 1, 11
260,20090410, 2, 2, 30
260,20090411, 2, 1, 22
260,20090412, 58, 44, 18
260,20090413, 0, 0, 28
260,20090414, 0, 0, 28
260,20090415, -1, -1, 34
260,20090416, 3, 1, 19
260,20090417, 23, 7, 23
260,20090418, 0, 0, 35
260,20090419, 0, 0, 25
260,20090420, 0, 0, 34
260,20090421, 0, 0, 36
260,20090422, 0, 0, 34
260,20090423, 0, 0, 26
260,20090424, 0, 0, 36
260,20090425, -1, -1, 29
260,20090426, 28, 12, 17
260,20090427, 44, 16, 23
260,20090428, 16, 5, 9
260,20090429, 0, 0, 23
260,20090430, 0, 0, 33
260,20090501, 0, 0, 34
260,20090502, 0, 0, 25
260,20090503, 4, 2, 17
260,20090504, 6, 5, 28
260,20090505, 81, 13, 9
260,20090506, 37, 11, 11
260,20090507, 0, 0, 20
260,20090508, 15, 14, 24
260,20090509, 0, 0, 30
260,20090510, 0, 0, 40
260,20090511, 0, 0, 36
260,20090512, 0, 0, 35
260,20090513, -1, -1, 35
260,20090514, 23, 17, 24
260,20090515, 89, 28, 10
260,20090516, 2, 1, 24
260,20090517, 128, 50, 16
260,20090518, -1, -1, 33
260,20090519, 0, 0, 28
260,20090520, 0, 0, 37
260,20090521, 0, 0, 30
260,20090522, 6, 3, 38
260,20090523, -1, -1, 37
260,20090524, 0, 0, 47
260,20090525, 1, 1, 39
260,20090526, 256, 234, 12
260,20090527, 2, 1, 21
260,20090528, 0, 0, 34
260,20090529, 0, 0, 49
260,20090530, 0, 0, 48
260,20090531, 0, 0, 43
260,20090601, 0, 0, 47
260,20090602, 0, 0, 48
260,20090603, 0, 0, 27
260,20090604, 2, 2, 21
260,20090605, 1, 1, 19
260,20090606, 0, 0, 26
260,20090607, 109, 54, 16
260,20090608, 1, 1, 34
260,20090609, 99, 45, 27
260,20090610, 66, 21, 23
260,20090611, 103, 24, 24
260,20090612, 0, 0, 44
260,20090613, 0, 0, 43
260,20090614, 41, 15, 19
260,20090615, 12, 12, 23
260,20090616, 59, 31, 31
260,20090617, 3, 2, 42
260,20090618, 1, 1, 38
260,20090619, 2, 2, 36
260,20090620, 2, 2, 28
260,20090621, 2, 2, 34
260,20090622, -1, -1, 32
260,20090623, 0, 0, 47
260,20090624, 0, 0, 48
260,20090625, 0, 0, 46
260,20090626, 18, 18, 33
260,20090627, 0, 0, 25
260,20090628, 12, 11, 23
260,20090629, 0, 0, 45
260,20090630, 0, 0, 51
260,20090701, 0, 0, 48
260,20090702, 0, 0, 43
260,20090703, 0, 0, 45
260,20090704, 0, 0, 47
260,20090705, -1, -1, 38
260,20090706, 17, 17, 37
260,20090707, 192, 94, 21
260,20090708, 51, 20, 26
260,20090709, -1, -1, 23
260,20090710, 41, 14, 18
260,20090711, -1, -1, 36
260,20090712, 65, 23, 17
260,20090713, 0, 0, 35
260,20090714, -1, -1, 37
260,20090715, 3, 3, 43
260,20090716, 0, 0, 46
260,20090717, 77, 46, 35
260,20090718, 41, 14, 18
260,20090719, 83, 46, 28
260,20090720, 15, 9, 35
260,20090721, 95, 68, 33
260,20090722, 120, 69, 29
260,20090723, 43, 32, 17
260,20090724, 57, 20, 25
260,20090725, -1, -1, 36
260,20090726, -1, -1, 38
260,20090727, 5, 4, 28
260,20090728, 2, 2, 29
260,20090729, 117, 117, 28
260,20090730, 47, 24, 32
260,20090731, 0, 0, 37
260,20090801, -1, -1, 38
260,20090802, 99, 53, 15
260,20090803, 0, 0, 34
260,20090804, 0, 0, 45
260,20090805, 0, 0, 42
260,20090806, 0, 0, 45
260,20090807, 0, 0, 34
260,20090808, 0, 0, 27
260,20090809, 0, 0, 23
260,20090810, 11, 4, 35
260,20090811, 51, 42, 24
260,20090812, 49, 19, 14
260,20090813, 0, 0, 29
260,20090814, 0, 0, 30
260,20090815, 0, 0, 42
260,20090816, 0, 0, 32
260,20090817, 0, 0, 25
260,20090818, 0, 0, 33
260,20090819, 0, 0, 39
260,20090820, 14, 13, 35
260,20090821, 0, 0, 28
260,20090822, 0, 0, 30
260,20090823, 0, 0, 38
260,20090824, -1, -1, 37
260,20090825, 20, 6, 11
260,20090826, 0, 0, 29
260,20090827, -1, -1, 18

```
260,20090828, 215, 120, 26
260,20090829, 10, 7, 30
260,20090830, -1, -1, 15
260,20090831, 0, 0, 29
260,20090901, 13, 7, 12
260,20090902, 9, 5, 24
260,20090903, 67, 16, 14
260,20090904, 175, 42, 19
260,20090905, 13, 13, 24
260,20090906, -1, -1, 14
260,20090907, -1, -1, 28
260,20090908, 0, 0, 32
260,20090909, -1, -1, 12
260,20090910, -1, -1, 25
260,20090911, 0, 0, 18
260,20090912, -1, -1, 23
260,20090913, 3, 3, 14
260,20090914, -1, -1, 20
260,20090915, 32, 10, 6
260,20090916, 0, 0, 18
260,20090917, 0, 0, 23
260,20090918, 0, 0, 26
260,20090919, 0, 0, 22
260,20090920, 0, 0, 16
260,20090921, 0, 0, 21
260,20090922, 0, 0, 21
260,20090923, -1, -1, 17
260,20090924, 0, 0, 20
260,20090925, 0, 0, 9
260,20090926, 0, 0, 20
260,20090927, 0, 0, 18
260,20090928, -1, -1, 11
260,20090929, 8, 6, 6
260,20090930, 15, 4, 5
260,20091001, 53, 46, 8
260,20091002, -1, -1, 6
260,20091003, 48, 44, 5
260,20091004, -1, -1, 15
260,20091005, 30, 12, 4
260,20091006, 54, 36, 7
260,20091007, 156, 41, 6
260,20091008, 113, 45, 14
260,20091009, 99, 49, 17
260,20091010, 20, 6, 7
260,20091011, 161, 132, 5
260,20091012, 10, 7, 14
260,20091013, 0, 0, 15
260,20091014, 0, 0, 12
260,20091015, 0, 0, 14
260,20091016, 31, 7, 10
260,20091017, -1, -1, 13
260,20091018, 0, 0, 10
260,20091019, 0, 0, 6
260,20091020, 0, 0, 12
260,20091021, -1, -1, 10
260,20091022, 17, 7, 3
260,20091023, 0, 0, 10
260,20091024, 72, 21, 3
260,20091025, -1, -1, 10
260,20091026, 34, 8, 3
260,20091027, 0, 0, 8
260,20091028, 0, 0, 11
260,20091029, 0, 0, 6
260,20091030, 0, 0, 7
260,20091031, 0, 0, 7
260,20091101, 143, 44, 3
260,20091102, 2, 2, 6
260,20091103, 60, 12, 4
260,20091104, 28, 10, 4
260,20091105, 114, 50, 3
260,20091106, 7, 7, 3
260,20091107, 44, 12, 2
260,20091108, 0, 0, 8
260,20091109, -1, -1, 3
260,20091110, 35, 12, 2
260,20091111, -1, -1, 2
260,20091112, 18, 12, 4
260,20091113, 18, 8, 2
260,20091114, 21, 10, 5
260,20091115, 63, 31, 2
260,20091116, 7, 5, 2
260,20091117, 0, 0, 4
260,20091118, 15, 11, 1
260,20091119, 0, 0, 7
260,20091120, 44, 15, 5
260,20091121, 8, 3, 7
260,20091122, 59, 21, 5
260,20091123, 190, 49, 2
260,20091124, 9, 6, 2
260,20091125, 31, 22, 1
260,20091126, 104, 50, 2
260,20091127, 56, 23, 4
260,20091128, 112, 33, 2
260,20091129, 12, 5, 1
260,20091130, 0, 0, 3
260,20091201, 3, 3, 4
260,20091202, 29, 10, 1
260,20091203, 61, 19, 1
260,20091204, 67, 20, 1
260,20091205, 68, 19, 1
260,20091206, 64, 23, 1
260,20091207, -1, -1, 3
260,20091208, 24, 5, 3
260,20091209, 28, 8, 1
260,20091210, 61, 27, 2
260,20091211, -1, -1, 2
260,20091212, 0, 0, 4
260,20091213, 0, 0, 3
260,20091214, 0, 0, 1
260,20091215, 0, 0, 5
260,20091216, -1, -1, 2
260,20091217, 38, 12, 1
260,20091218, -1, -1, 3
260,20091219, 5, 3, 2
260,20091220, 84, 16, 1
260,20091221, 16, 5, 2
260,20091222, 17, 7, 2
260,20091223, 0, 0, 2
260,20091224, 18, 18, 3
260,20091225, 150, 20, 1
260,20091226, -1, -1, 4
260,20091227, 39, 10, 2
260,20091228, -1, -1, 4
260,20091229, 55, 22, 2
260,20091230, 17, 4, 0
260,20091231, -1, -1, 1
260,20100101, -1, -1, 3
260,20100102, 1, 1, 1
260,20100103, 0, 0, 4
260,20100104, -1, -1, 2
260,20100105, 9, 8, 3
260,20100106, 1, 1, 4
260,20100107, -1, -1, 4
260,20100108, 0, 0, 2
260,20100109, 10, 3, 2
260,20100110, 11, 3, 2
260,20100111, -1, -1, 1
260,20100112, -1, -1, 2
260,20100113, -1, -1, 2
260,20100114, 0, 0, 4
260,20100115, 0, 0, 1
260,20100116, 77, 21, 2
260,20100117, 14, 7, 2
260,20100118, 12, 5, 1
260,20100119, 3, 2, 2
260,20100120, -1, -1, 5
260,20100121, -1, -1, 2
260,20100122, 0, 0, 5
260,20100123, 50, 9, 2
260,20100124, 11, 5, 1
260,20100125, 0, 0, 1
260,20100126, 0, 0, 5
260,20100127, 39, 15, 2
260,20100128, 13, 10, 4
260,20100129, 85, 12, 1
260,20100130, 75, 28, 8
260,20100131, 1, 1, 6
260,20100201, 31, 10, 4
260,20100202, 182, 34, 1
260,20100203, 3, 2, 7
260,20100204, 23, 8, 3
260,20100205, 11, 3, 2
260,20100206, -1, -1, 3
260,20100207, 0, 0, 2
260,20100208, 0, 0, 4
260,20100209, -1, -1, 5
260,20100210, 17, 7, 4
260,20100211, -1, -1, 6
260,20100212, 0, 0, 9
260,20100213, -1, -1, 2
260,20100214, 5, 1, 2
260,20100215, 5, 1, 5
260,20100216, 1, 1, 4
260,20100217, 1, 1, 6
260,20100218, 7, 3, 3
260,20100219, 2, 2, 2
260,20100220, 2, 1, 7
260,20100221, 39, 15, 3
260,20100222, 131, 15, 2
260,20100223, 5, 3, 6
260,20100224, 18, 6, 5
260,20100225, 53, 15, 4
260,20100226, 11, 7, 4
260,20100227, 21, 11, 5
260,20100228, 202, 31, 2
260,20100301, 27, 8, 9
260,20100302, 0, 0, 9
260,20100303, 0, 0, 12
260,20100304, 0, 0, 13
260,20100305, 56, 17, 8
260,20100306, 2, 2, 14
260,20100307, 0, 0, 14
260,20100308, 9, 2, 5
260,20100309, 0, 0, 15
260,20100310, 0, 0, 15
260,20100311, -1, -1, 8
260,20100312, -1, -1, 6
260,20100313, 1, 1, 7
260,20100314, -1, -1, 8
260,20100315, 101, 19, 7
260,20100316, 2, 2, 11
260,20100317, 0, 0, 17
260,20100318, 0, 0, 17
260,20100319, 26, 13, 5
260,20100320, 205, 91, 6
260,20100321, 3, 2, 16
260,20100322, -1, -1, 14
260,20100323, -1, -1, 22
260,20100324, 0, 0, 16
260,20100325, 7, 6, 23
260,20100326, 15, 11, 8
260,20100327, 6, 5, 14
260,20100328, 4, 4, 12
260,20100329, 32, 10, 14
260,20100330, 29, 12, 7
260,20100331, 21, 7, 11
260,20100401, 30, 7, 16
260,20100402, 15, 15, 22
260,20100403, 86, 20, 9
260,20100404, 36, 9, 9
260,20100405, -1, -1, 16
260,20100406, 0, 0, 29
260,20100407, 2, 2, 25
260,20100408, 10, 3, 18
260,20100409, 0, 0, 29
260,20100410, 0, 0, 24
260,20100411, 0, 0, 11
260,20100412, 0, 0, 25
260,20100413, 0, 0, 28
260,20100414, 0, 0, 25
260,20100415, 0, 0, 30
260,20100416, 0, 0, 18
260,20100417, 0, 0, 31
260,20100418, 0, 0, 32
```

260,20100419, 0, 0, 28
260,20100420, -1, -1, 27
260,20100421, -1, -1, 22
260,20100422, -1, -1, 21
260,20100423, 0, 0, 33
260,20100424, 0, 0, 33
260,20100425, 1, 1, 27
260,20100426, 0, 0, 26
260,20100427, 0, 0, 28
260,20100428, 0, 0, 34
260,20100429, 62, 33, 33
260,20100430, 66, 41, 15
260,20100501, 61, 30, 15
260,20100502, 183, 32, 3
260,20100503, 74, 12, 4
260,20100504, 0, 0, 27
260,20100505, 0, 0, 23
260,20100506, 0, 0, 30
260,20100507, 4, 2, 10
260,20100508, 1, 1, 6
260,20100509, 0, 0, 16
260,20100510, -1, -1, 17
260,20100511, 75, 13, 16
260,20100512, 87, 17, 8
260,20100513, 15, 4, 7
260,20100514, 0, 0, 18
260,20100515, 0, 0, 25
260,20100516, -1, -1, 30
260,20100517, 7, 4, 30
260,20100518, 0, 0, 34
260,20100519, 0, 0, 43
260,20100520, 0, 0, 44
260,20100521, 0, 0, 36
260,20100522, 0, 0, 45
260,20100523, 0, 0, 46
260,20100524, 0, 0, 44
260,20100525, 0, 0, 41
260,20100526, -1, -1, 15
260,20100527, 7, 4, 19
260,20100528, 0, 0, 40
260,20100529, 34, 13, 31
260,20100530, 112, 29, 13
260,20100531, -1, -1, 17
260,20100601, 0, 0, 28
260,20100602, 0, 0, 49
260,20100603, 0, 0, 50
260,20100604, 0, 0, 51
260,20100605, 0, 0, 50
260,20100606, 11, 7, 24
260,20100607, 0, 0, 23
260,20100608, 129, 68, 23
260,20100609, 18, 4, 16
260,20100610, 16, 9, 13
260,20100611, -1, -1, 12
260,20100612, 0, 0, 38
260,20100613, 0, 0, 22
260,20100614, 0, 0, 46
260,20100615, 0, 0, 40
260,20100616, 0, 0, 49
260,20100617, 0, 0, 49
260,20100618, -1, -1, 14
260,20100619, 5, 2, 28
260,20100620, -1, -1, 16
260,20100621, 0, 0, 44
260,20100622, 0, 0, 45
260,20100623, 0, 0, 51
260,20100624, 0, 0, 48
260,20100625, 0, 0, 51
260,20100626, 0, 0, 52
260,20100627, 0, 0, 53
260,20100628, 0, 0, 50
260,20100629, 3, 2, 42
260,20100630, 0, 0, 43
260,20100701, 0, 0, 43
260,20100702, 0, 0, 50
260,20100703, 55, 44, 28
260,20100704, 0, 0, 49
260,20100705, -1, -1, 36
260,20100706, 0, 0, 39
260,20100707, 0, 0, 44
260,20100708, 0, 0, 48
260,20100709, 0, 0, 46
260,20100710, 296, 195, 48
260,20100711, 18, 15, 46
260,20100712, 25, 15, 31
260,20100713, 0, 0, 33
260,20100714, 150, 99, 41
260,20100715, -1, -1, 31
260,20100716, 21, 19, 28
260,20100717, 12, 6, 35
260,20100718, 0, 0, 45
260,20100719, 0, 0, 50
260,20100720, 0, 0, 44
260,20100721, -1, -1, 29
260,20100722, 6, 6, 29
260,20100723, -1, -1, 32
260,20100724, 0, 0, 46
260,20100725, 12, 5, 19
260,20100726, 61, 24, 22
260,20100727, 15, 11, 25
260,20100728, 81, 66, 37
260,20100729, 10, 6, 29
260,20100730, -1, -1, 39
260,20100731, 10, 6, 13
260,20100801, 1, 1, 23
260,20100802, 26, 20, 14
260,20100803, 0, 0, 41
260,20100804, 32, 26, 15
260,20100805, 1, 1, 24
260,20100806, 0, 0, 38
260,20100807, 25, 11, 12
260,20100808, 6, 3, 22
260,20100809, 14, 14, 30
260,20100810, 20, 17, 19
260,20100811, 6, 4, 34
260,20100812, 5, 5, 18
260,20100813, 0, 0, 33
260,20100814, 0, 0, 34
260,20100815, 189, 59, 20
260,20100816, 35, 23, 21
260,20100817, 7, 4, 5
260,20100818, 27, 23, 21
260,20100819, -1, -1, 23
260,20100820, 0, 0, 38
260,20100821, 0, 0, 23
260,20100822, -1, -1, 19
260,20100823, 132, 70, 16
260,20100824, 20, 13, 30
260,20100825, 64, 23, 24
260,20100826, 506, 130, 6
260,20100827, 30, 12, 12
260,20100828, 56, 22, 23
260,20100829, 256, 64, 12
260,20100830, 95, 25, 24
260,20100831, 0, 0, 24
260,20100901, 0, 0, 20
260,20100902, -1, -1, 17
260,20100903, 0, 0, 25
260,20100904, 0, 0, 28
260,20100905, 0, 0, 27
260,20100906, 0, 0, 31
260,20100907, 121, 65, 5
260,20100908, 42, 18, 10
260,20100909, -1, -1, 22
260,20100910, 13, 12, 9
260,20100911, 0, 0, 28
260,20100912, 8, 4, 11
260,20100913, 1, 1, 20
260,20100914, 219, 64, 3
260,20100915, 66, 48, 23
260,20100916, 63, 16, 14
260,20100917, 27, 7, 15
260,20100918, -1, -1, 18
260,20100919, -1, -1, 9
260,20100920, -1, -1, 11
260,20100921, 0, 0, 14
260,20100922, 0, 0, 23
260,20100923, 226, 171, 15
260,20100924, 11, 7, 13
260,20100925, 8, 8, 19
260,20100926, 0, 0, 11
260,20100927, 55, 11, 2
260,20100928, 1, 1, 6
260,20100929, 0, 0, 18
260,20100930, 42, 10, 4
260,20101001, 42, 22, 19
260,20101002, 78, 29, 9
260,20101003, 0, 0, 20
260,20101004, 0, 0, 14
260,20101005, 0, 0, 10
260,20101006, 17, 6, 7
260,20101007, 0, 0, 9
260,20101008, 0, 0, 7
260,20101009, 0, 0, 18
260,20101010, 0, 0, 18
260,20101011, 0, 0, 18
260,20101012, 0, 0, 13
260,20101013, 0, 0, 7
260,20101014, -1, -1, 5
260,20101015, 92, 20, 5
260,20101016, -1, -1, 8
260,20101017, 0, 0, 12
260,20101018, 10, 10, 10
260,20101019, 324, 91, 8
260,20101020, 122, 24, 8
260,20101021, 6, 4, 12
260,20101022, -1, -1, 8
260,20101023, 60, 15, 2
260,20101024, 41, 14, 10
260,20101025, -1, -1, 10
260,20101026, 12, 9, 5
260,20101027, 66, 26, 2
260,20101028, -1, -1, 3
260,20101029, 0, 0, 6
260,20101030, 3, 3, 4
260,20101031, 9, 4, 5
260,20101101, 0, 0, 2
260,20101102, 7, 3, 2
260,20101103, 58, 13, 7
260,20101104, -1, -1, 2
260,20101105, 205, 85, 1
260,20101106, 111, 29, 4
260,20101107, 62, 22, 4
260,20101108, 3, 3, 4
260,20101109, 26, 6, 2
260,20101110, 92, 36, 4
260,20101111, 129, 63, 1
260,20101112, 43, 10, 4
260,20101113, 13, 4, 3
260,20101114, 58, 10, 2
260,20101115, -1, -1, 4
260,20101116, 0, 0, 5
260,20101117, -1, -1, 2
260,20101118, -1, -1, 3
260,20101119, 9, 8, 3
260,20101120, 0, 0, 5
260,20101121, 0, 0, 5
260,20101122, 0, 0, 3
260,20101123, -1, -1, 4
260,20101124, -1, -1, 4
260,20101125, -1, -1, 3
260,20101126, 0, 0, 4
260,20101127, 1, 1, 1
260,20101128, 0, 0, 5
260,20101129, 17, 8, 0
260,20101130, -1, -1, 2
260,20101201, -1, -1, 2
260,20101202, 14, 3, 1
260,20101203, 4, 2, 2
260,20101204, 44, 7, 1
260,20101205, 28, 10, 3
260,20101206, 0, 0, 2
260,20101207, 0, 0, 2
260,20101208, -1, -1, 1

260,20101209, 25, 10, 3
260,20101210, 1, 1, 1
260,20101211, 4, 3, 1
260,20101212, 8, 6, 2
260,20101213, 1, 1, 1
260,20101214, 0, 0, 1
260,20101215, 21, 14, 2
260,20101216, 124, 30, 0
260,20101217, 24, 8, 1
260,20101218, 36, 22, 2
260,20101219, 64, 29, 1
260,20101220, -1, -1, 2
260,20101221, 1, 1, 1
260,20101222, -1, -1, 1
260,20101223, 5, 2, 1
260,20101224, 0, 0, 2
260,20101225, 1, 1, 3
260,20101226, 18, 8, 3
260,20101227, 0, 0, 1
260,20101228, 1, 1, 1
260,20101229, -1, -1, 2
260,20101230, 0, 0, 3
260,20101231, 7, 2, 1
260,20110101, 6, 3, 2
260,20110102, -1, -1, 4
260,20110103, 1, 1, 3
260,20110104, -1, -1, 3
260,20110105, 5, 4, 4
260,20110106, 155, 29, 1
260,20110107, 5, 2, 1
260,20110108, 48, 20, 2
260,20110109, 0, 0, 4
260,20110110, 0, 0, 5
260,20110111, 21, 10, 1
260,20110112, 105, 13, 1
260,20110113, 125, 21, 1
260,20110114, 193, 33, 1
260,20110115, -1, -1, 1
260,20110116, 0, 0, 4
260,20110117, 5, 3, 1
260,20110118, 108, 51, 2
260,20110119, 16, 14, 3
260,20110120, -1, -1, 6
260,20110121, -1, -1, 2
260,20110122, 3, 2, 2
260,20110123, 3, 2, 1
260,20110124, 14, 4, 2
260,20110125, 54, 19, 5
260,20110126, -1, -1, 3
260,20110127, 0, 0, 6
260,20110128, 0, 0, 6
260,20110129, 0, 0, 7
260,20110130, 0, 0, 2
260,20110131, 0, 0, 2
260,20110201, 9, 8, 1
260,20110202, 12, 12, 1
260,20110203, 20, 17, 6
260,20110204, 6, 2, 1
260,20110205, 0, 0, 3
260,20110206, 0, 0, 3
260,20110207, 0, 0, 6
260,20110208, 0, 0, 9
260,20110209, 0, 0, 8
260,20110210, 91, 22, 4
260,20110211, 21, 6, 2
260,20110212, 124, 35, 2
260,20110213, 0, 0, 5
260,20110214, 11, 5, 3
260,20110215, 6, 6, 8
260,20110216, 2, 2, 10
260,20110217, 0, 0, 11
260,20110218, 0, 0, 1
260,20110219, 0, 0, 5
260,20110220, 0, 0, 6
260,20110221, 0, 0, 9
260,20110222, 0, 0, 9
260,20110223, 38, 9, 4
260,20110224, 13, 7, 2
260,20110225, 1, 1, 2
260,20110226, 68, 21, 3
260,20110227, 196, 22, 2
260,20110228, 14, 8, 1
260,20110301, 0, 0, 4
260,20110302, 0, 0, 13
260,20110303, 0, 0, 12
260,20110304, 0, 0, 13
260,20110305, 0, 0, 4
260,20110306, 0, 0, 13
260,20110307, 0, 0, 15
260,20110308, 0, 0, 17
260,20110309, 12, 9, 7
260,20110310, 1, 1, 4
260,20110311, -1, -1, 14
260,20110312, -1, -1, 14
260,20110313, 13, 6, 7
260,20110314, 29, 15, 9
260,20110315, 0, 0, 17
260,20110316, 0, 0, 15
260,20110317, -1, -1, 5
260,20110318, 113, 42, 6
260,20110319, 0, 0, 19
260,20110320, 0, 0, 18
260,20110321, 0, 0, 20
260,20110322, 0, 0, 20
260,20110323, 0, 0, 20
260,20110324, 0, 0, 23
260,20110325, 0, 0, 18
260,20110326, -1, -1, 8
260,20110327, 0, 0, 23
260,20110328, 0, 0, 13
260,20110329, 0, 0, 23
260,20110330, 18, 15, 11
260,20110331, 55, 16, 5
260,20110401, 0, 0, 9
260,20110402, 1, 1, 26
260,20110403, 15, 10, 13
260,20110404, 0, 0, 19
260,20110405, -1, -1, 6
260,20110406, 0, 0, 19
260,20110407, 0, 0, 19
260,20110408, 0, 0, 27
260,20110409, 0, 0, 28
260,20110410, 0, 0, 29
260,20110411, 49, 21, 29
260,20110412, 7, 3, 21
260,20110413, 0, 0, 23
260,20110414, 0, 0, 11
260,20110415, 0, 0, 28
260,20110416, -1, -1, 19
260,20110417, 0, 0, 21
260,20110418, 0, 0, 33
260,20110419, 0, 0, 35
260,20110420, 0, 0, 36
260,20110421, 0, 0, 35
260,20110422, 0, 0, 33
260,20110423, 0, 0, 38
260,20110424, 0, 0, 34
260,20110425, 0, 0, 40
260,20110426, 0, 0, 34
260,20110427, -1, -1, 25
260,20110428, 10, 9, 25
260,20110429, -1, -1, 33
260,20110430, 0, 0, 38
260,20110501, 0, 0, 40
260,20110502, 0, 0, 36
260,20110503, 0, 0, 37
260,20110504, 0, 0, 28
260,20110505, 0, 0, 35
260,20110506, 0, 0, 35
260,20110507, 0, 0, 41
260,20110508, -1, -1, 37
260,20110509, 4, 3, 20
260,20110510, 49, 41, 25
260,20110511, 0, 0, 40
260,20110512, 0, 0, 28
260,20110513, 0, 0, 29
260,20110514, -1, -1, 33
260,20110515, 22, 15, 28
260,20110516, 50, 16, 9
260,20110517, 5, 4, 16
260,20110518, 0, 0, 14
260,20110519, 13, 4, 16
260,20110520, 0, 0, 38
260,20110521, 0, 0, 44
260,20110522, 73, 31, 23
260,20110523, 0, 0, 44
260,20110524, 0, 0, 43
260,20110525, 0, 0, 45
260,20110526, 28, 21, 19
260,20110527, 18, 16, 25
260,20110528, 8, 5, 21
260,20110529, -1, -1, 23
260,20110530, 1, 1, 47
260,20110531, 34, 13, 18
260,20110601, 0, 0, 48
260,20110602, 0, 0, 48
260,20110603, 0, 0, 49
260,20110604, 0, 0, 49
260,20110605, 20, 12, 23
260,20110606, 74, 37, 16
260,20110607, 33, 17, 29
260,20110608, 21, 7, 31
260,20110609, 1, 1, 33
260,20110610, 45, 28, 27
260,20110611, 53, 35, 29
260,20110612, -1, -1, 38
260,20110613, 17, 11, 16
260,20110614, 0, 0, 42
260,20110615, 1, 1, 25
260,20110616, 249, 43, 12
260,20110617, 33, 21, 25
260,20110618, 130, 48, 22
260,20110619, 64, 23, 17
260,20110620, -1, -1, 36
260,20110621, 10, 5, 23
260,20110622, 2, 2, 16
260,20110623, 25, 24, 30
260,20110624, 4, 3, 30
260,20110625, 51, 8, 7
260,20110626, 1, 1, 39
260,20110627, 0, 0, 56
260,20110628, 288, 217, 37
260,20110629, 22, 22, 27
260,20110630, 0, 0, 42
260,20110701, 15, 5, 33
260,20110702, 0, 0, 25
260,20110703, 0, 0, 43
260,20110704, 0, 0, 44
260,20110705, 0, 0, 48
260,20110706, 9, 9, 29
260,20110707, 0, 0, 33
260,20110708, -1, -1, 32
260,20110709, 49, 23, 25
260,20110710, 0, 0, 41
260,20110711, 0, 0, 37
260,20110712, 589, 275, 30
260,20110713, 43, 6, 7
260,20110714, 475, 75, 5
260,20110715, 20, 14, 44
260,20110716, 148, 38, 16

Calculation of water requirements according to climate change

G

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Precipitation	75.57	69.96	56.89	32.97	65.04	58.8	100.62	102.46	76.69	74.79
Evapotranspiration	8.96	15.25	38.08	70.34	88.45	102.1	101.96	82.59	54.47	30.55
Eva-Pre	-66.61	-54.71	-18.81	37.37	23.41	43.3	1.34	-19.87	-22.22	-44.24

G+

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Precipitation (-10%)	66	61.13	49.71	28.81	56.84	51.38	87.92	89.53	67.28	65.35
Evapotranspiration (+8%)	9.4	15.99	39.93	73.75	92.74	107.06	106.91	86.59	57.11	32.03
Eva-Pre	-56.6	-45.14	-9.78	44.94	35.9	55.68	18.99	-2.94	-10.17	-33.32

W

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Precipitation (+6%)	77.77	72	58.54	33.93	66.94	60.52	103.55	105.45	78.93	76.97
Evapotranspiration (+7%)	9.31	15.49	39.56	74.14	91.88	106.07	105.92	85.79	56.58	31.74
Eva-Pre	-68.46	-56.51	-18.98	40.21	24.94	45.55	2.37	-19.66	-22.35	-45.23

W+

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Precipitation (-19%)	59.43	55.02	44.74	25.93	51.15	46.24	79.13	80.58	60.31	58.81
Evapotranspiration (+15%)	10	17.03	42.52	78.53	98.75	114	113.84	92.21	60.81	34.11
Eva-Pre	-49.43	-37.99	-2.22	52.6	47.6	67.76	34.71	11.63	0.5	-24.7