Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Gili Marae Hofland
Student number	4876091

Studio		
Name / Theme	Architectural Engineering	
Main mentor	Stephan Verkuijlen]	Architecture, Architectural Engineering + Technology, Architectural Technology
Second mentor	Nico Tillie	Architecture, Urbanism & Landscape Architecture
Third mentor	Paddy Tomessen	Architectural Engineering + Technology
Argumentation of choice of the studio	Water has been an element that has always intrigued me. In times of stress, I seek to go out to nature to find a place to relax. Mostly I can find myself along the coast to lose myself in staring away infinitely. During my travels, I have always visites coastal cities and love to see how people are enjoying the close connection to the waterside. In the nothern cities of Europe, like Denmark, Sweden and the Netherlands this connection to water is even more sensible. Water can both be seen as a technical and psychological design element, means of why it interests me so much. In the field of Architectural Engineering, you get the chance to discover your own fascination and combine it with a technical approach. During my studies, the focus had been on designing and the technical aspects were subject to the design process. Often technical solutions were integrated in the end, without fuly understanding the functionality or logic. When relating water to the Architectural Engineering Studio, it creates the possibility to research how water can be implemented in architectural designs and how we as humans can engage more with water. Moreover, as climate change effects are increasing, we get to deal with more water problems like riverine floodings and heavy rainfall, but also water scarcity. Can water be the visible triggering element that stimulates people to think of creative sustainable solutions, that lead to collective water management and the formation of communities?	

Graduation project	
Title of the graduation project	**ENGAGING WITH WATER** AN APPROACH ON HOW A SPONGE BUILDING AND SURROUNDING AREA CAN COMBAT WATER PROBLEMS, WHILE USING WATER AS CONNECTING BRIDGE BETWEEN NATURE, HUMANS AND BUILDINGS TO ENHANCE OUR WELL-BEING AND SIMULTANEOUSLY USE IT AS AN EXAMPLE ON HOW TO BECOME MORE SUSTAINABLE FOR COMMUNITIES AND OTHER STAKEHOLDERS
Goal	
Location:	Thames Ironworks, Tower Hamlets, London
The posed problem,	*"As climate change will have its effect on the frequency and intensity of rainfalls and the rising sea level, more interventions need to be taken to protect our cities from floods and droughts. Therefore, adjusting and transforming our current existing city structure to an inclusive water-retaining system city structure with a healthy living environment has to become a priority when shaping our future-proof city."* **Missing link of implementing natural water cycles in cities** In our current world we are experiencing accelerating climate changes. The effects of the changes are slowly, but surely becoming reality. On a large scale, we are dealing with high-risk flood areas, due to the rising sea level and heavy rainfalls, causing unpredictable floods (Hunt & Watkiss, 2010). Now, water gets two faces, since we need to protect our living environment from it, but we are also very dependent on it regarding our basic needs. Only, in the existing largely paved city structures not enough space is available to retain large amounts of natural water and therefore ask for transformation (Raes & Savolainen, 2023). The disconnection of humans and water is also sensible on a psychological level. In our current living environment, we have become used to living indoors, while this often leads to stress and depressions. Integrating water in designs can help solve the negative influence of living indoors as it has a positive effect on our health and can enhance our well-being on both a smaller indoor and larger urban scale. Studies have shown that the sound of water has a relaxing effect on people and can help to relieve stress and better our performance (Calabrese & Kellert, 2015). On a larger scale, water can be linked to our urban health (Angelakis, Koutsoyiannis, Tchobanoglous & Zarkadoulas, 2008; Arsénio et al., 2016). It is remarkable that we are not aware of the full potential and qualities water has to offer regarding our mental and physical health.

	Lack of sustainable awareness and social responsibility The lack of awareness regarding the effects of water on our health is a challenge for architects and designers as they must convince people of the positive effects of implementing water in designs. Worldwide actions are taken by the government, engineers, and designers to make cities adaptable to climate change. Only, among people there still is a lack of public knowledge and awareness of the necessity to become more sustainable regarding the water risks and health effects. Because if they are not directly threatened by floodings and water scarcity, why should they pay attention to it? Thereby, the consequences will mostly be carried by the elderly and low-income groups, or moreover the most vulnerable groups (IPCC, 2007). Activating other parties like investors and municipalities to participate in sustainable solutions is therefore of essential importance, as they have the money capacity to invest. The challenge is to stimulate the political will of stakeholders like investors and city planners to finance the sustainable solutions. The institutional capacity is there, and studies already developed design strategies to solve water and health problems, but they still need to be put into practice (Dickinson, 2022, 28:04). The adaptation of climate change therefore brings social, economic, and governmental challenges to raise social responsibility (Douglas et al., 2011). Lack of knowledge forms a barrier when it comes to the engagement of the public with climate change. Letting people engage can create understanding of the climate policies and interventions taken by the government but can also help to bond society. Besides, if a more sustainable and healthy living environment is the demand, then the potential solutions should be communicated in an easy-to-understand explanation for everyone (Buurman, Hoekstra, Van Ginkel, 2018).

design assignment in which these result.	All these research inventories will be translated into a research design approach on an existing area with its own unique opportunities and challenges but is mainly suffering from high-water stress and heavy rainfalls. It should be an area that asks for transformation. The location of the example sponge building should be carefully considered, as the focus is placed on raising social awareness among residents, the municipality, investors, and the government. For example, a historical valued building could be used to create appreciation, since they are widely appreciated by all citizens. It reflects the memories and events of the past. A vacant building that is now left in despair, could be redeveloped to its original state and an even more vibrant area, which shows a visible change. The citizens then might appreciate its restoration which is an extra stimulating factor on why to maintain the building with collective water management. **Social engagement in raising sustainability awareness** To address the cruciality on why to become sustainable, water could be the key element to help and stimulate this process. The implementation of the natural water cycles in a building, leads to collective water management and helps to bond people. It might even help to form communities. Since climate change is impacting us all, communities are crucial to form collective solutions, as it can be used as a method to connect everyone and create a mutual feeling of responsibility. Moreover, in a community ideas and knowledge are shared, which also gives them a bigger voice in exchanging ideas, resulting in a bigger influence on policies and form an inspiration to others. Finally, the individual efforts have an increasing collective impact on multiple levels (Berting, 2023). Therefore, the buildings' main function will become a public function surrounded with more private spaces, such as different housing types. It will include educational activities to teach all stakeholders. The specific determination of the public function is part of the research tool and will be determined after a location analysis, to see what function the neighborhood is asking for. **Considerate architecture for community and nature** The aim of the design is to optimize the existing city structure regarding water conservation and revitalize the current living environment to a healthier habitat that benefits inhabitants on multiple aspects. The design is used as a translation tool to address communities on how to become sustainable on indoor and outdoor level. Surface water used in designs for example, functions as a water reservoir and cooling element for people. By using different design criteria that can be applied to each location with a unique approach, the research becomes generic but is still location specific. And since the existing areas that are facing floods and droughts are being transformed into interconnecting spheres of water retainment, a deeper connection to nature is created (ARUP, n.d.). Of course, different interventions need to be taken on different locations. The chosen location in London will be an example that will apply and test the guideline tool. In general, the thematic research is a research design tool to help understand natural water cycles and how

	to implement them in our society on a sustainable and social level leading to healthier cities. Overall, the building can help to reduce the risks of flooding by contributing to the regulation process of excess of water that cannot be absorbed by our nature. When implementing water systems in a building design, it becomes part of its environment. In general, more attention needs to be paid to water systems in cities to both regulate excess water and to enrich our environment to create a healthier living environment. The building functions as a sponge by releasing and collecting water when needed and therefore stimulates a closed water cycle, while it simultaneously improves a human's well-being when engaging with water. The desired design outcome is a visible, pleasant, and impactful example building that might help to activate citizens to want to participate in communities and think of sustainable solutions that enhance a pleasant living environment.

Process

Method description

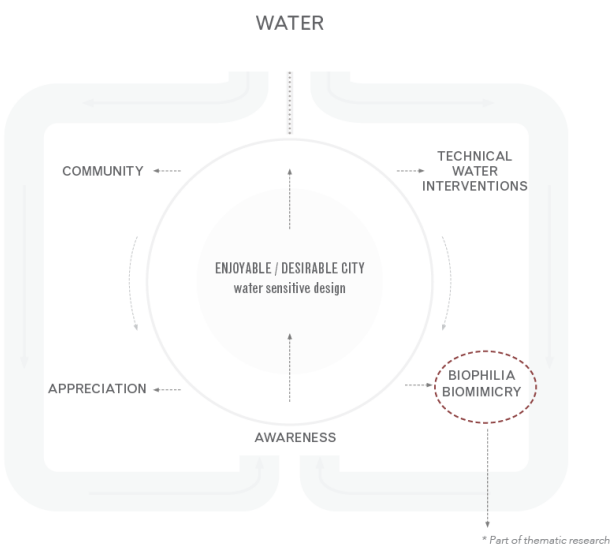
The goal of this research is to form a guideline for integrating water in a site-specific design approach that leads to more interaction and engagement of people with water by implementing water in designs on multiple scales. The first step is the understanding the natural water cycle, surface water flood-risks and flood-prone areas in the existing city structure using quantitative and qualitative data. Also, to map water design ambitions of municipality. Since the research will be a guideline for future projects, the chosen city of the design project (London) will form a base to see what kind of knowledge needs to be gathered to be able to form a guideline. On the landscape scale an overview and summary of what flood-risk maps are necessary to figure out problem areas that need attention will be made to see where oppurtunities of these areas lie regarding the regulating water systems.

The urban square scale should help understand and indicate what would be the best water intervention method to apply to a certain area. Is the area for example dealing with only flooding, so the water absorption quality needs to be improved? Or is the area also dealing with water scarcity and is it important to retain the water for a longer time period? The categorization and best-practise analysis should help forming this. The same goes for the indoor quailty using biomimicry and biophilia design translations. A categorization of the possible water interventions in the public sphere and building scale, such as streets, squares, playgrounds will be made. Final outcome will be an overview of best-practice project analysis (case-study).

The social building scale focusses on understanding the effects and symbolism of biomimicry and biophilia to visuale possible intervention methods by applying and combining the collected literature. The different effects water can have will be analysed here, to categorize water pattern types applicable in different kinds of environments. In this stadium the landscape and urban square scale will also be involved to determine challenging areas. If for example a vacant historic site is chosen, are there water risks within the neighborhood? And have the municipality already invested in water interventions close-by? Therefore, it is a constant process of reflecting on the different scales. This switchting between scales will also play a prominent role in the design process.

Literature and general practical preference

A literature analysis will be made of already developed strategies trying to invite water in our cities, like the City Water Resilience Approach (CWRA) and Design With Water 2.0 approach by Arup (Simpkins, 2024) (Appendix B, B1 and B2), the Long-term Initiatives for Flood-risk Environments (LiFE) (Barker & Coutts, 2016) (Appendix C, C1), and Healthy Water Cities by SWECO (Raes, S. & Savolainen, T. 2021) (Appendix D). Arup and SWECO are both engineering companies, focusing on informing stakeholders about the technical design solutions to cope with floodings. Meanwhile, the LiFE strategy is a complete approach that also focusses on the social influence water interventions can have. The LiFE approach divides four different scales where water interventions can be applied to, which are the region, city, neighbourhood and building scale to show how water in design be introduced instead of relying on the traditional flood defenses, which can be overwhelming (Appendix C2). A balanced approach emerges when the policy and frameworks are adjusted to the scalar approach (Barker & Coutts, 2016). During this research, three scales will be divided, which are the landscape water cycle scale, urban square scale, and social building scale. They form the base of the guideline, that could be used for design approaches to better cope with the complexity of developing water sensitive projects. The framework will also be tested according to literature research about the effects of water on our well-being to test the project's successes. The challenge becomes more approachable and manageable when dividing different steps during the design process. Like understanding the natural water cycle, while also relating it to water interaction and social responsibility (figure 3). Each city deals with its own conditions and characteristics. Therefore, the chosen site needs to be linked to its surroundings to understand the challenges of the area, like flood risks, to be able to develop a design approach. (Barker & Coutts, 2016).



The landscape scale is the first step of the guideline, which is a general, governmental based data collection about the water flood defences and water problems the chosen city is dealing with on macro level to understand the natural water cycle of the city. The second step is the urban square scale, which looks more detailed into water sensitive design strategies and technical solution studies through an inventory catalogue of best-practice examples applicable in the public sphere and buildings. On a micro level, which will be the third step, the social building scale focusses on the positive health effect of water on our well-being and how to create positive interaction with

water to develop understanding and awareness through quantitative literature studies and case-studies. The scales are interconnected to one another. An integrated approach rises when water systems are understood on all three levels. This research therefore focusses on the practical side of the implementation of water. Each subject contains a few sub-questions that help translate technical knowledge into a research and design approach. The following chapter is divided according the three scales, whereby the first part consists of a literature study about what flood risks the city is dealing with and the corresponding flood risk plans of the municipality to tackle the problems. The second part will be a best-practice analysis and inventory using qualitative literature, combined with quantitative literature about the implementation of water systems in designs. The last part discusses the implementation of interactive water interventions with technical water systems to create multiple benefits for both combatting flood risks and enhancing the human well-being.

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

First, the graduation topic focusses on implementing water into our buildings to create water sensitive designs, which is something that should get more attention regarding the future of our city and the climate change. The studio focusses on technical research combined with an architectural design. Water is a technical topic, that can be applied in building in an aesthetic way, combining and integrating the two different research topics. The master track is Architecture, focussing on creating new architecture. Since the graduation topic is about creating new design approaches for the future it is relevant for the way we design nowadays. It also requires an integration of landscape and architecture, which then fits in the overall approach of MSc AUBS Master's programme.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

Considerate architecture for community and nature

The aim of the design is to optimize the existing city structure regarding water conservation and revitalize the current living environment to a healthier habitat that benefits inhabitants on multiple aspects. The design is used as a translation tool to address communities on how to become sustainable on indoor and outdoor level. Surface water used in designs for example, functions as a water reservoir and cooling element for people. By using different design criteria that can be applied to each location with a unique approach, the research becomes generic but is still location specific. And since the existing areas that are facing floods and droughts are being transformed into interconnecting spheres of water retainment, a deeper connection to nature is created (ARUP, n.d.). Of course, different interventions need to be taken on different locations. The chosen location in London will be an example that will apply and test the guideline tool. In general, the thematic research is a research design tool to help understand natural water cycles and how to implement them in our society on a sustainable and social level leading to healthier cities. Whilst the media mostly informs us on the disastrous events happening around the world regarding the climate change with people dying from the inevitable devastation of settlements and nature, this will make it seem as if acting upon the climate change is of no importance anymore. Seemingly makes it even feel there is no possibility in saving the planet anymore. Focus on the small

sustainable improvements to better our environment is therefore important as it brings a more positive glance of the future. It encourages people to think of creative outcomes mentions Harald Dunnink in an interview with Berting (2023).