



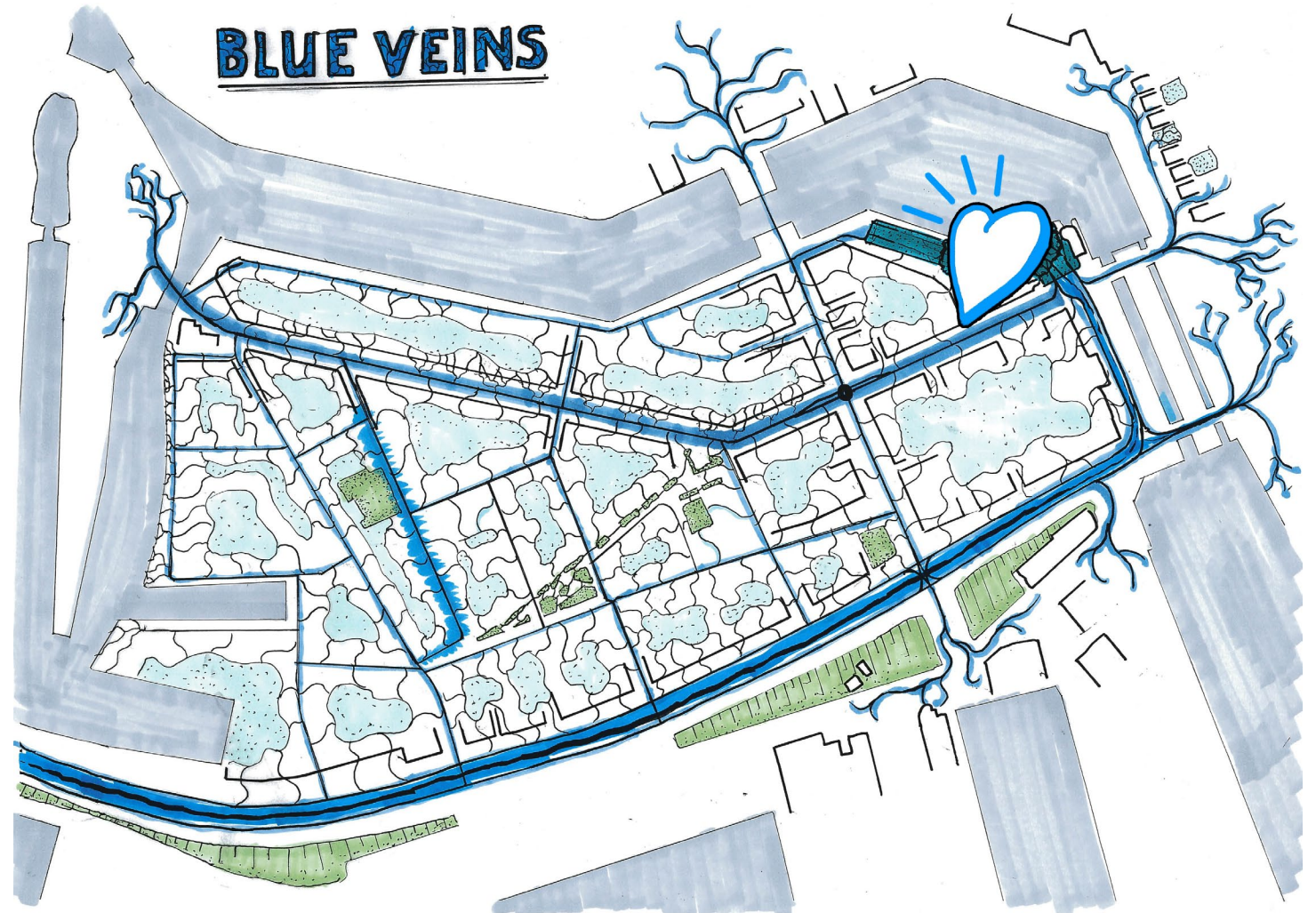
Blue Veins | Coolheart

Rotterdamse Academie van Bouwkunst
Tycho de Veld

Concept:
Pumping water through the neighbourhood to and from the pumping station

Interventions:

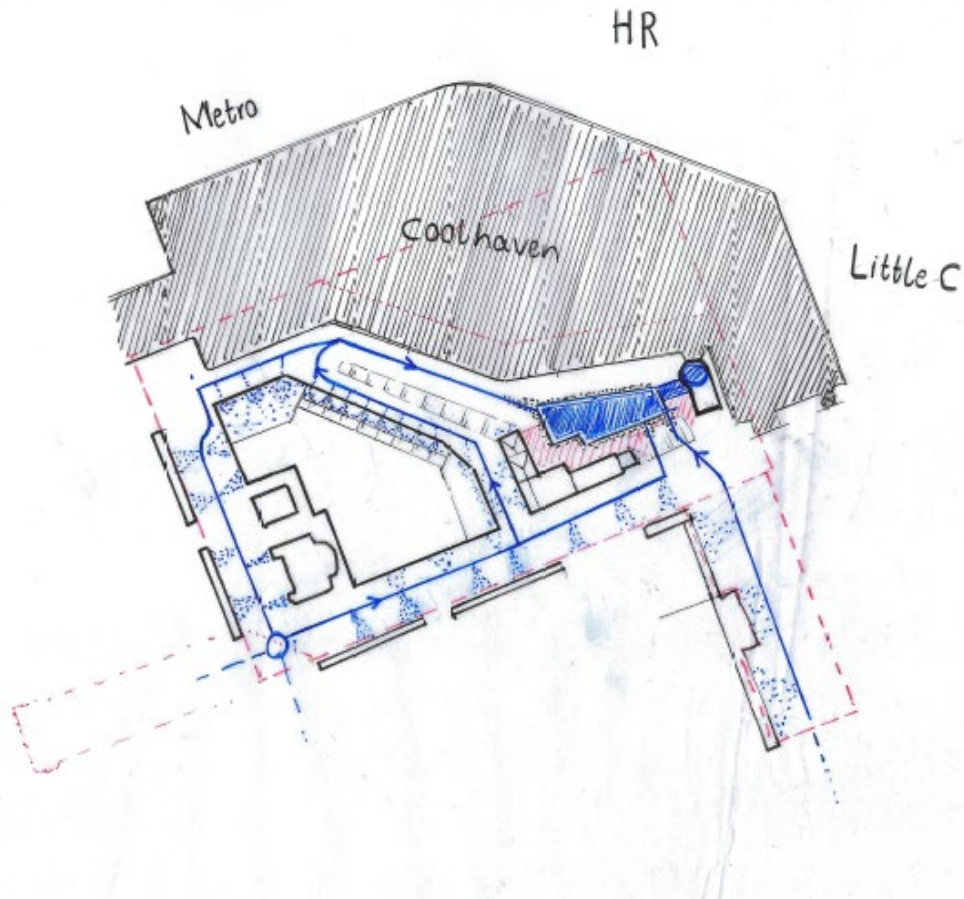
- Separating Rainwater & Greywater from Wastewater
- Creating “veins” that collect the Rainwater and are connected to the pumping station
- Storing and cleaning Rain- & Greywater near the pumping station
- Using the pumping station to pump back the water to the neighborhood for reuse



- **Watertask:** 18.000 m³
- **Inhabitants Delfshaven:** 7.380 people
<https://allecijfers.nl/buurt/delfshaven-rotterdam/>
- **Average water usage / person:** 134 l / day = 0,134 m³ / day
- **Average water usage Delfshaven:** 7.380 x 0,134 = **988,92 m³ / day**
- **Population equivalent (wastewater per persoon):** **1 PE = 150 l/day = 0,15 m³ / day**
- **Population equivalent Delfshaven:** **7.380 PE = 0,15 m³ x 7.380 = 1.107 m³ / d day**



The Heart of the Coolhaven

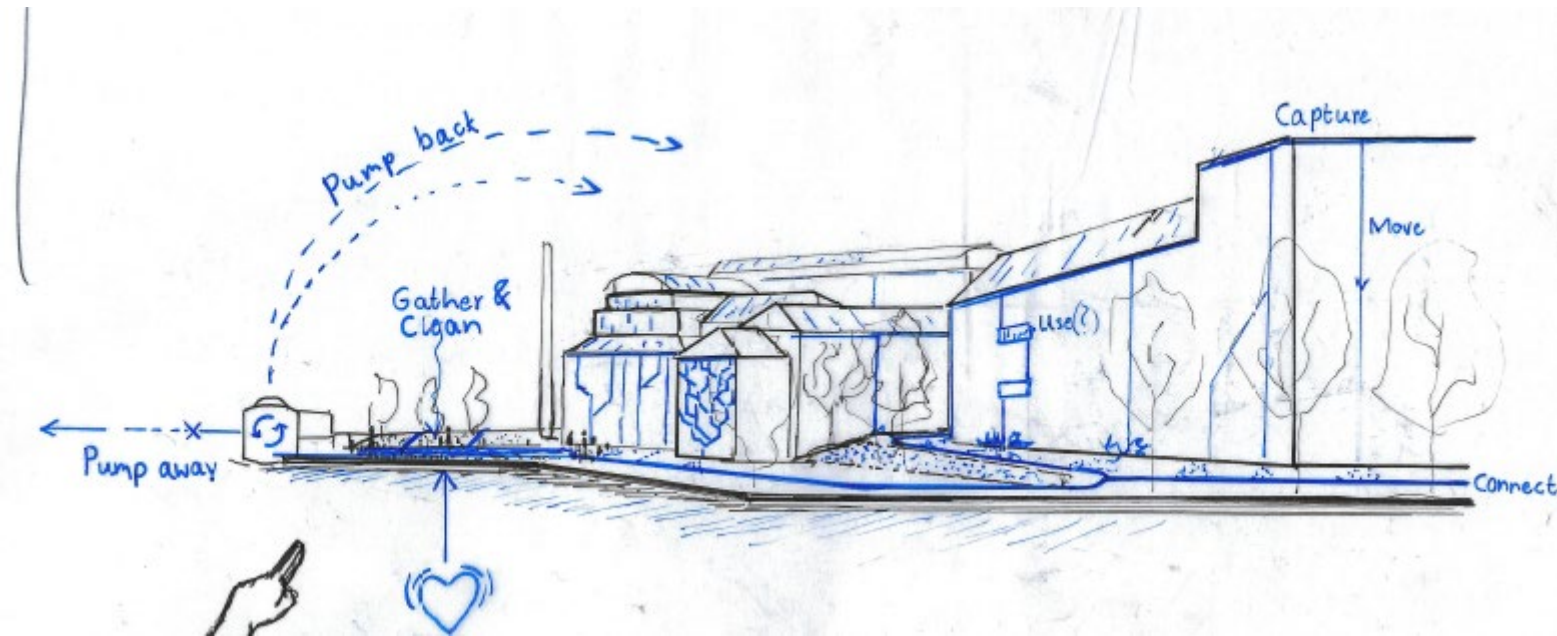


The Blue Veins concept disconnects rainwater from the drainage system in Delfshaven, allowing it to flow naturally, or artificially where needed, towards the neighbourhood's "heart" - the site of the Parksluizen pumping station.

This heart can store up to 18.000 cubic meters of rainwater in its basins, where it undergoes cleaning and treatment processes. The treated water is then pumped back into the neighbourhood through the same pumping station, creating a closed-loop system that captures, cleans, and reuses rainwater locally.

By mimicking natural water cycles, Blue Veins reduces strain on traditional drainage infrastructure while promoting sustainable water management within the community.

Concept drawing of the system



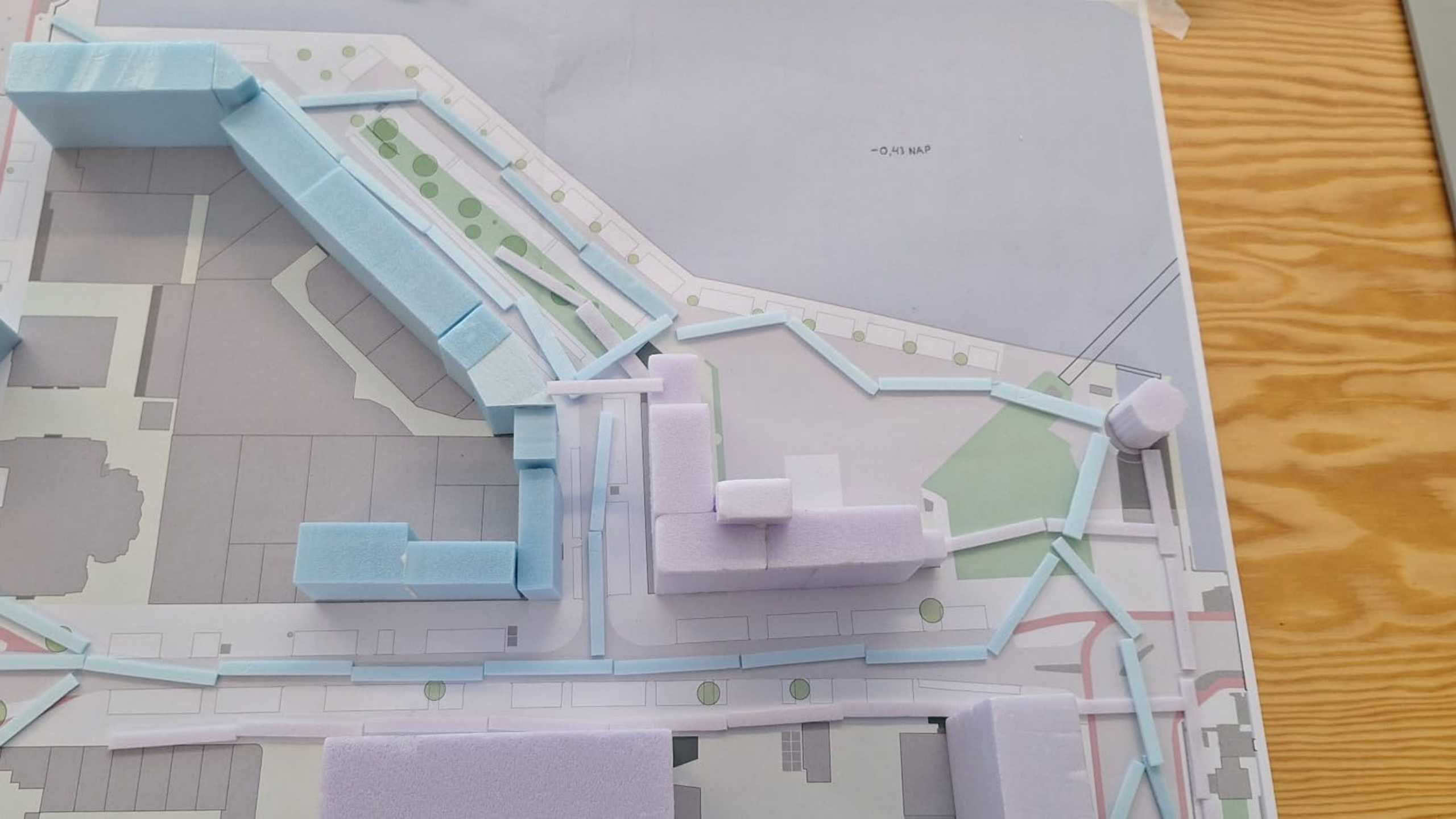


Model study

Getting a better understanding of the scale of the water task







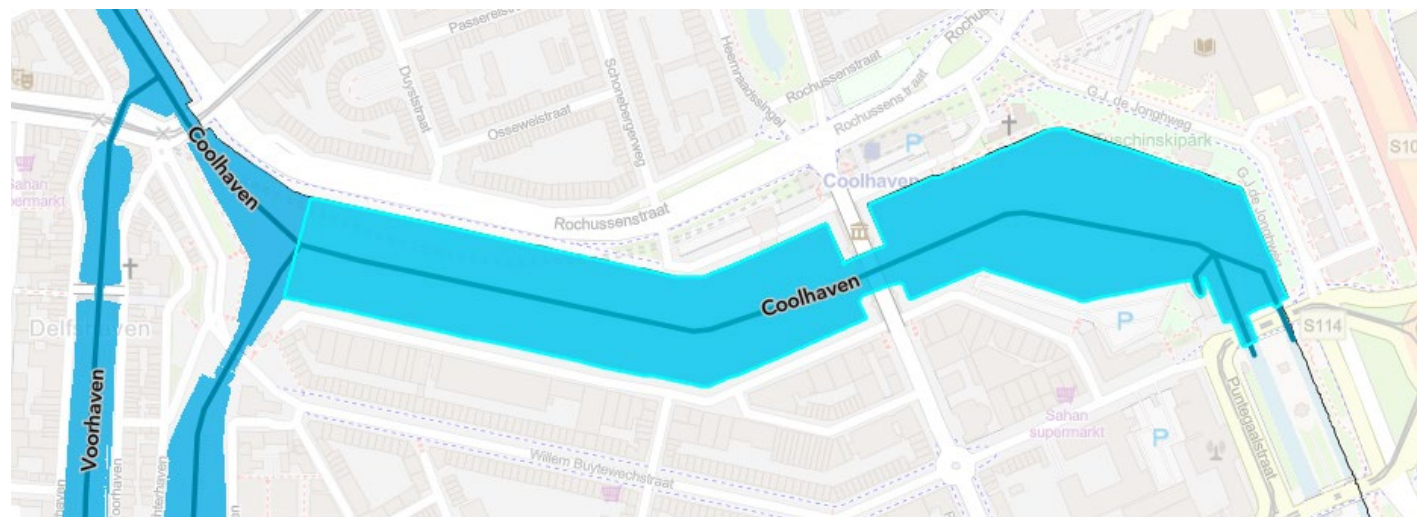
-0,43 NAP



Model 1: Water in the Public Open Space (Water Square)

- A Basin of 1 meter deep on all the current streets and parking spaces of the area
- A basin on the water of 2,5 meters deep.
 - **Statistics of the Coolhaven:**
 - NAP -0,43
 - Minimal Depth: 2,70 m
 - Maximum Depth: 3,20 m
 - Surface: 84.250, 4 m²
 - Minimum volume: 245.490,98 m³

“If you add the entirety of the water task (18.000 m³) to the open water of the Coolhaven, it’s water level would rise with 2 centimeters.”



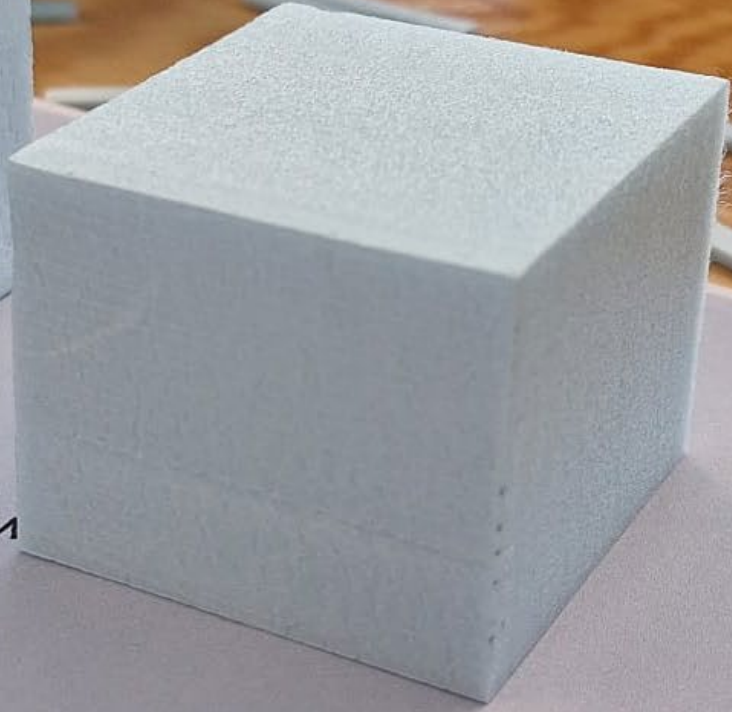
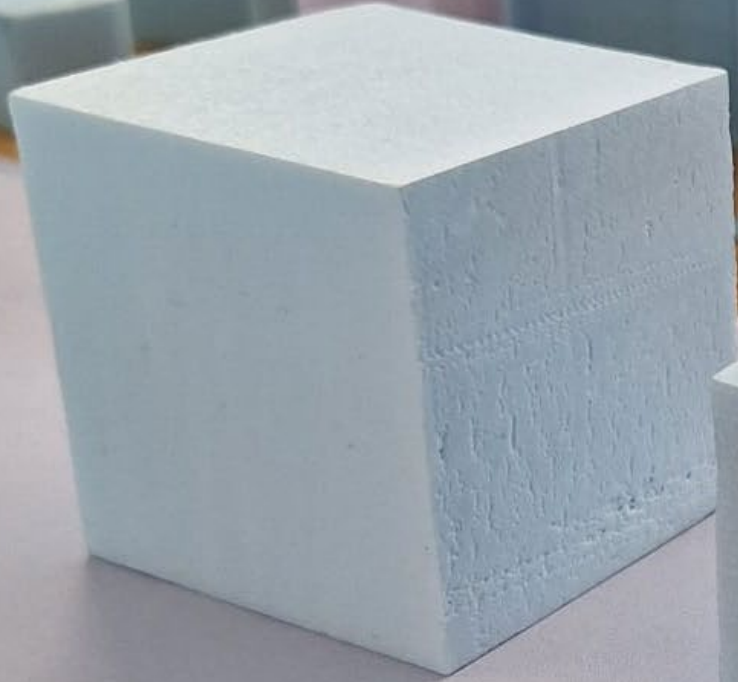


BREED INZETBAAR

VISSE & VISSER
• METEN • BOUWEN • BEGRIPPEN

0.00

MITSUBISHI PENCIL CO. LTD.
P101 00-000
BLACK



-0,43 N







Model 2: Water in one building

- One large building filled with water.
- For comparison, **the Coolbase project**: A residential building with around 60 apartments.
 - **Floorspace**: 6.000 m²
 - **Height**: 50 m
- **Rough calculation**: 6.000 m² x 3 m (typical floor-to-ceiling height) = 18.000 m³
([Water task: 18.000 m³](#))



60 woningen
75 % middenhuur
50 meter hoog



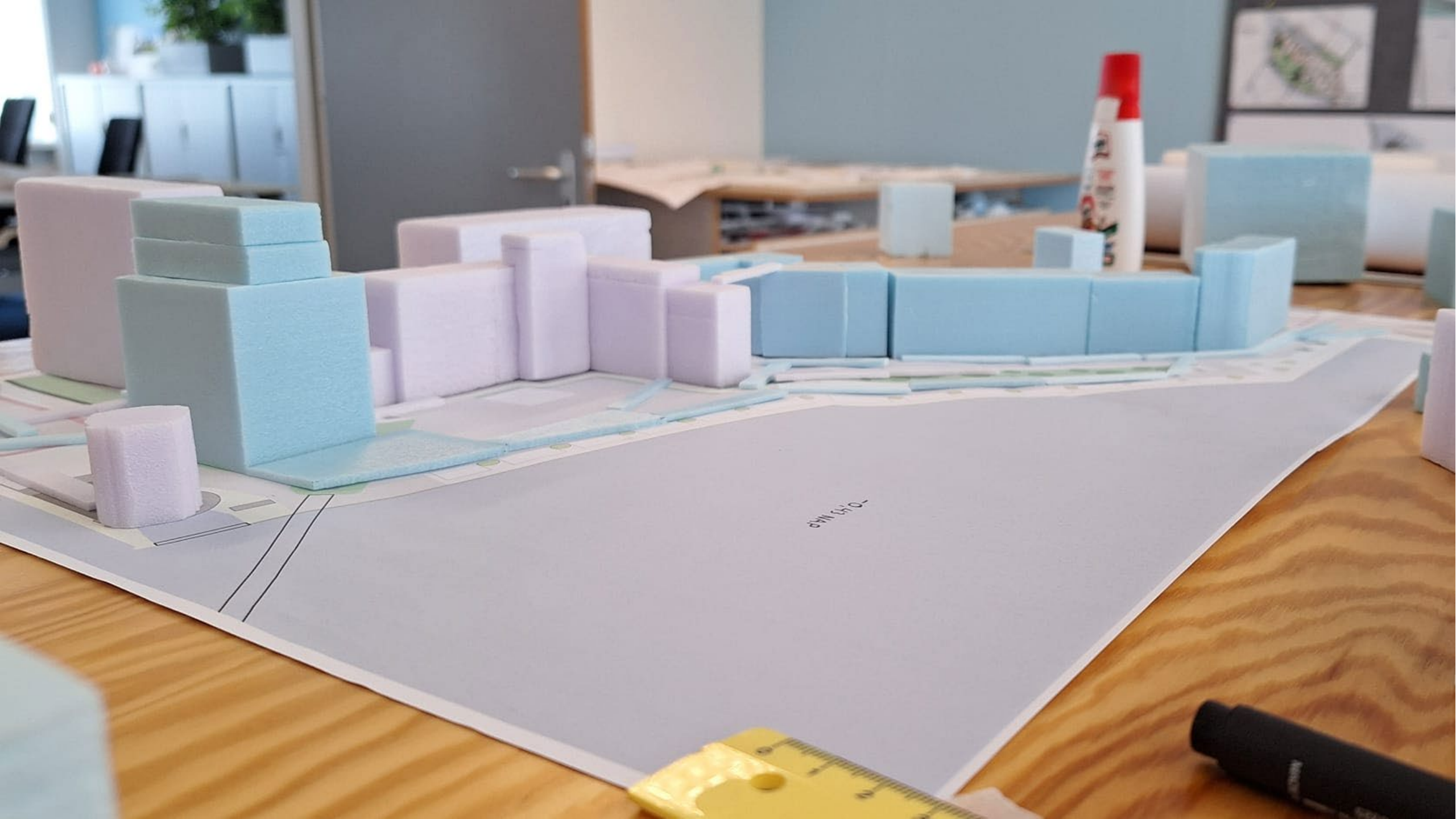
-0,43 NA



-0,43 NAP







01111111



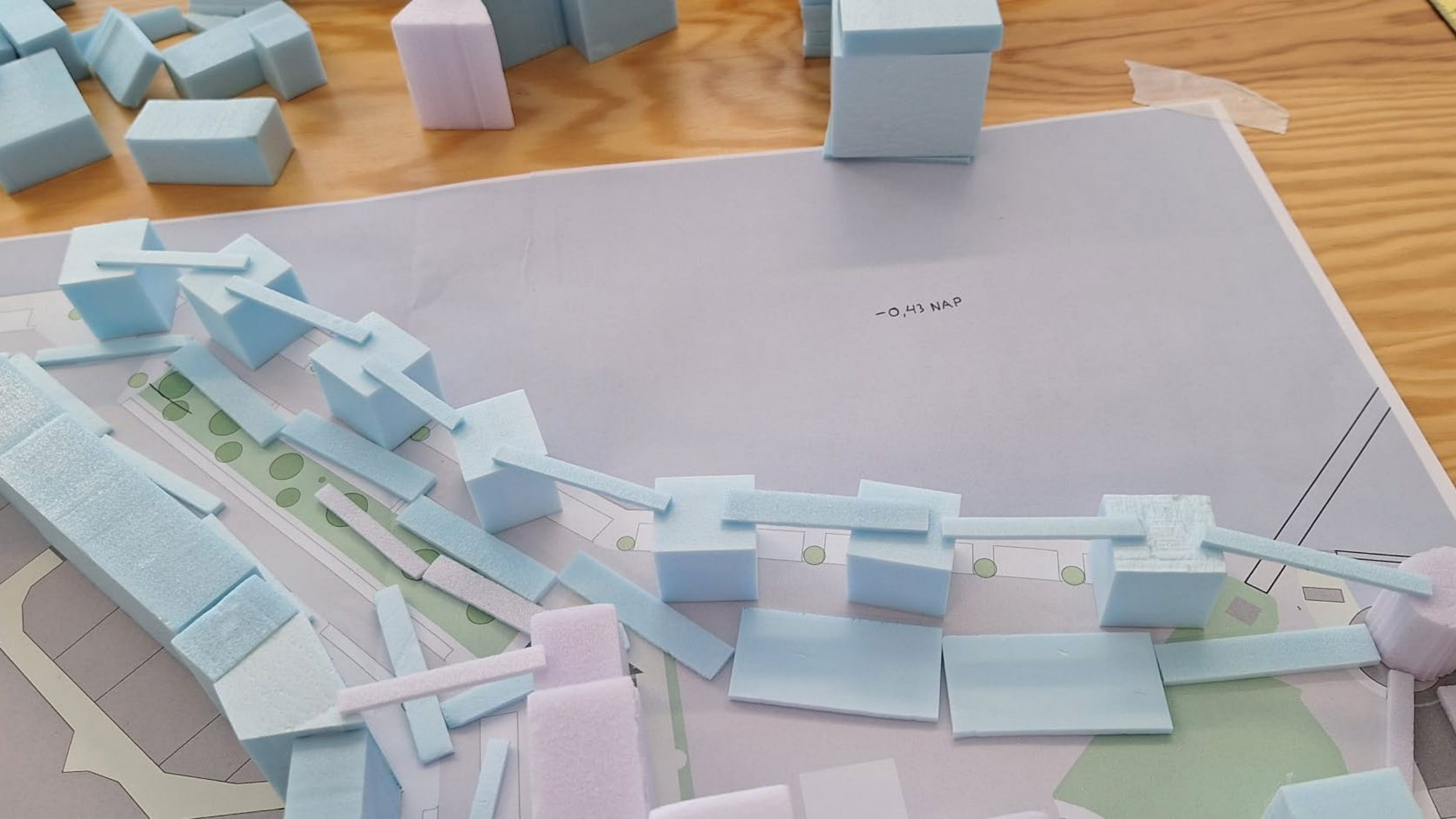
Model 3: Water in the Public Open Space + Multiple Smaller Watertanks

- Water reservoir park
- Adding recreational activities to a water reservoir
- Making use of the height differences of the area to store more water in the public space





-0.41 NAP



-0,43 NAP

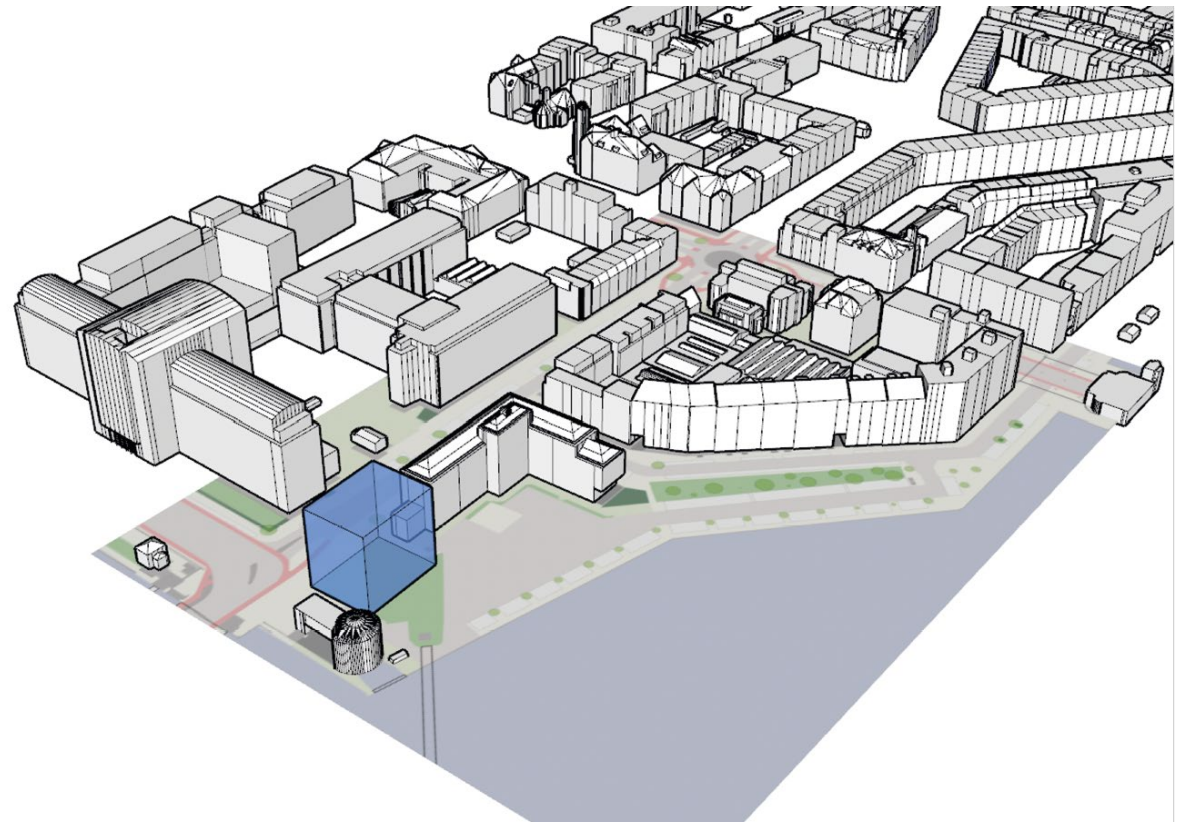
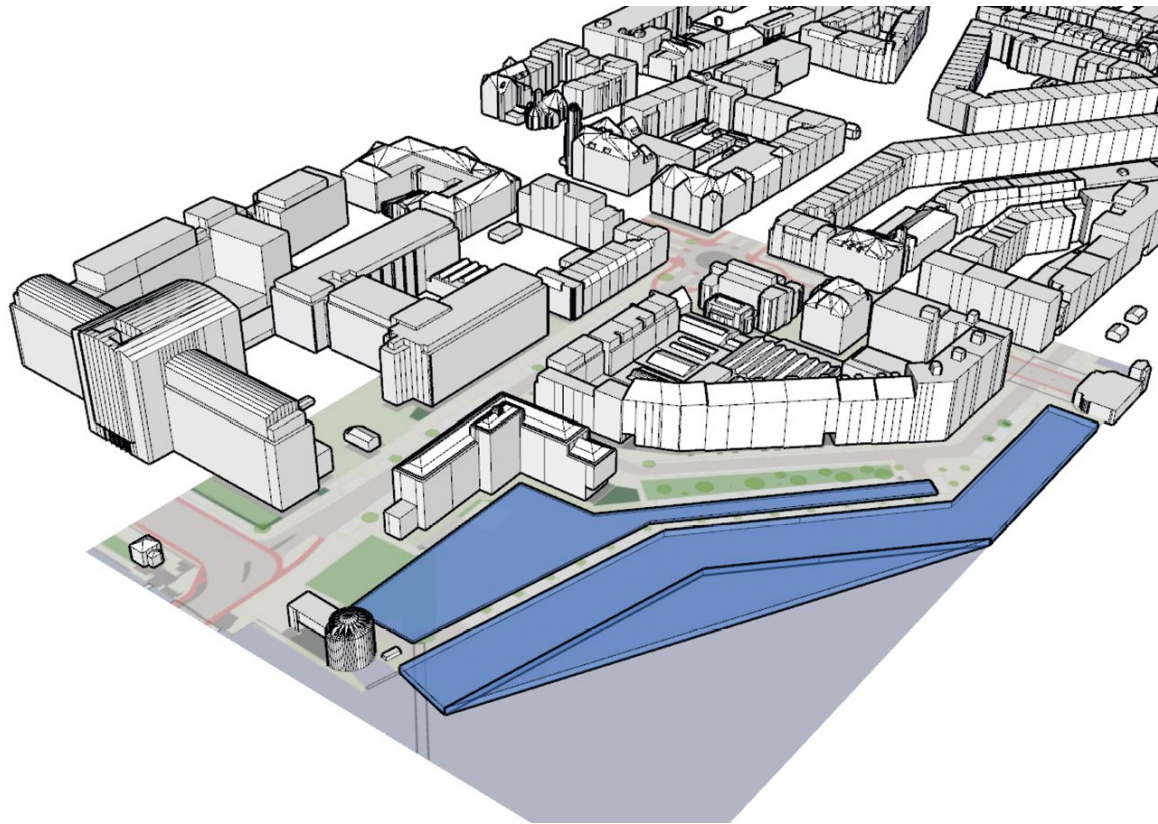


Before



After

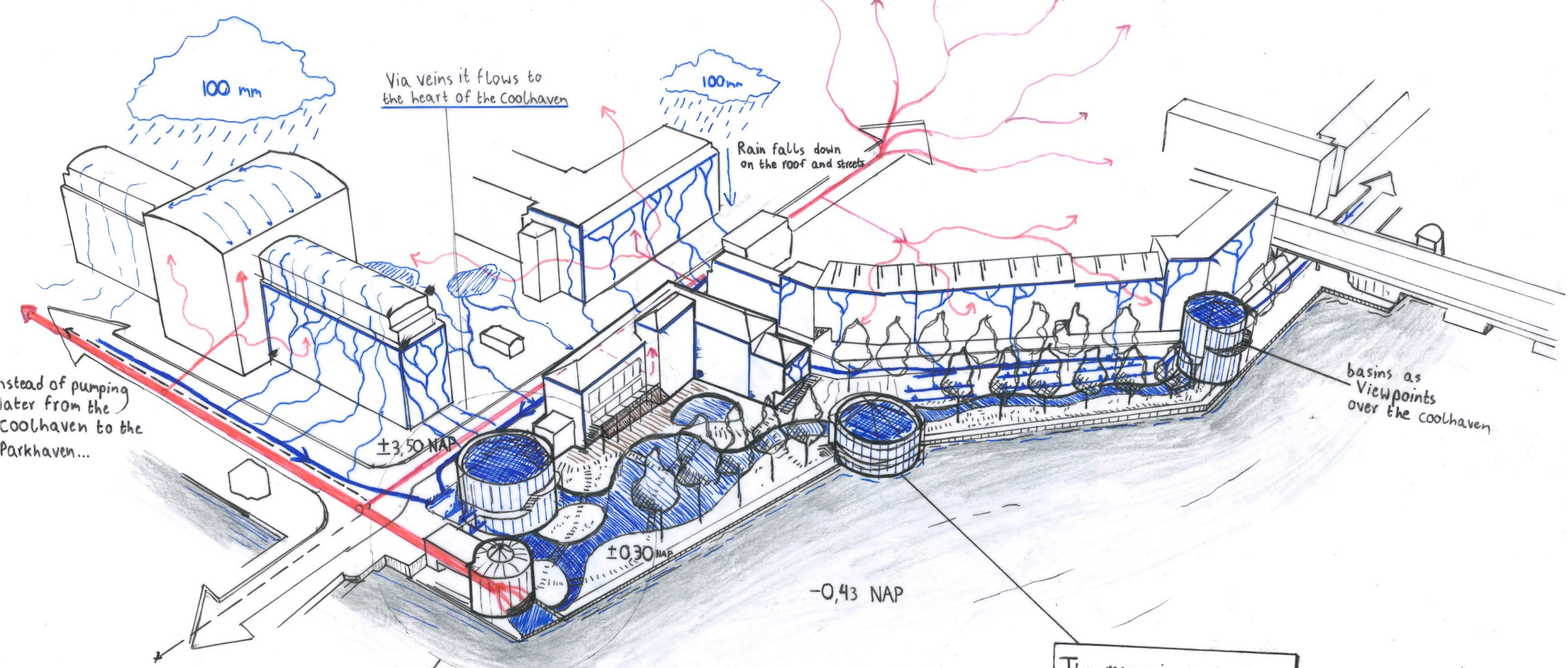
Further Exploration, Inspiration & Design



Blue Veins & The Coolheart

- Creating a water reservoir park
- Realizing a water cleaning and storage system that is connected to the pumping station
- Make use of the height differences in the area, combined with multiple water tanks to store the water
- Add recreational and cultural value to the site with Water as the main theme





Via veins it flows to the heart of the Coolhaven

Rain falls down on the roof and streets

Instead of pumping water from the Coolhaven to the Parkhaven...

basins as viewpoints over the Coolhaven

±3.50 NAP

±0.30 NAP

-0.43 NAP

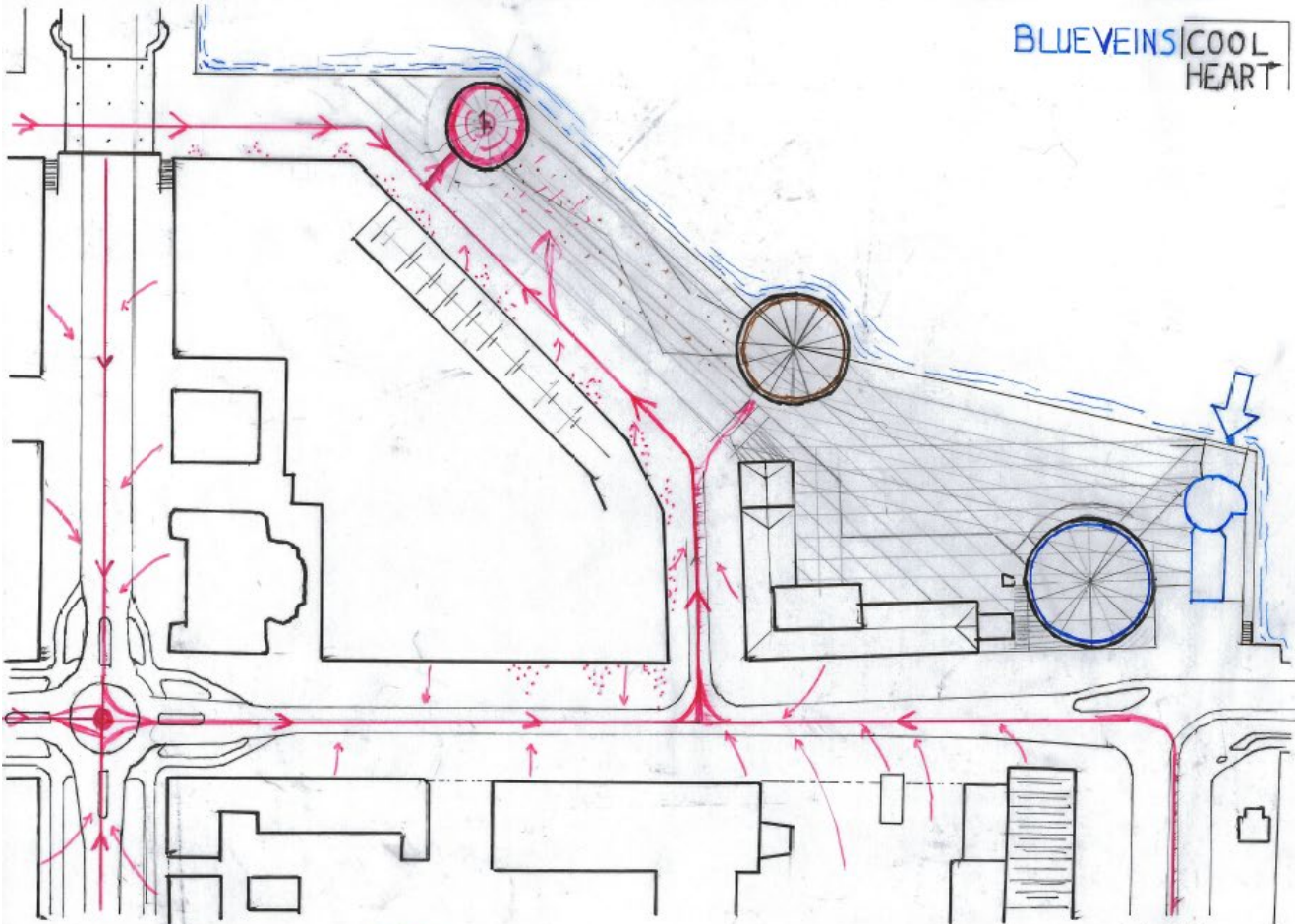
The reservoir park stores up to 18.015 m³ water

Coolheart
Pumps 1.200 m³/min

It takes 15 minutes for the pumping station to pump away the watertask

BLUEVEINS COOL HEART

Water task:
• 18.000 m³ Water (Rain)



During Heavy Rain



Pumping Station pumps water from the Coolhaven to the Parkhaven

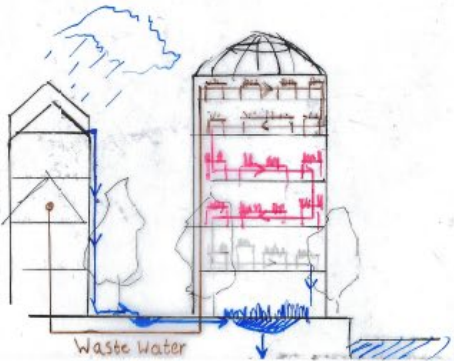
During Dry periods

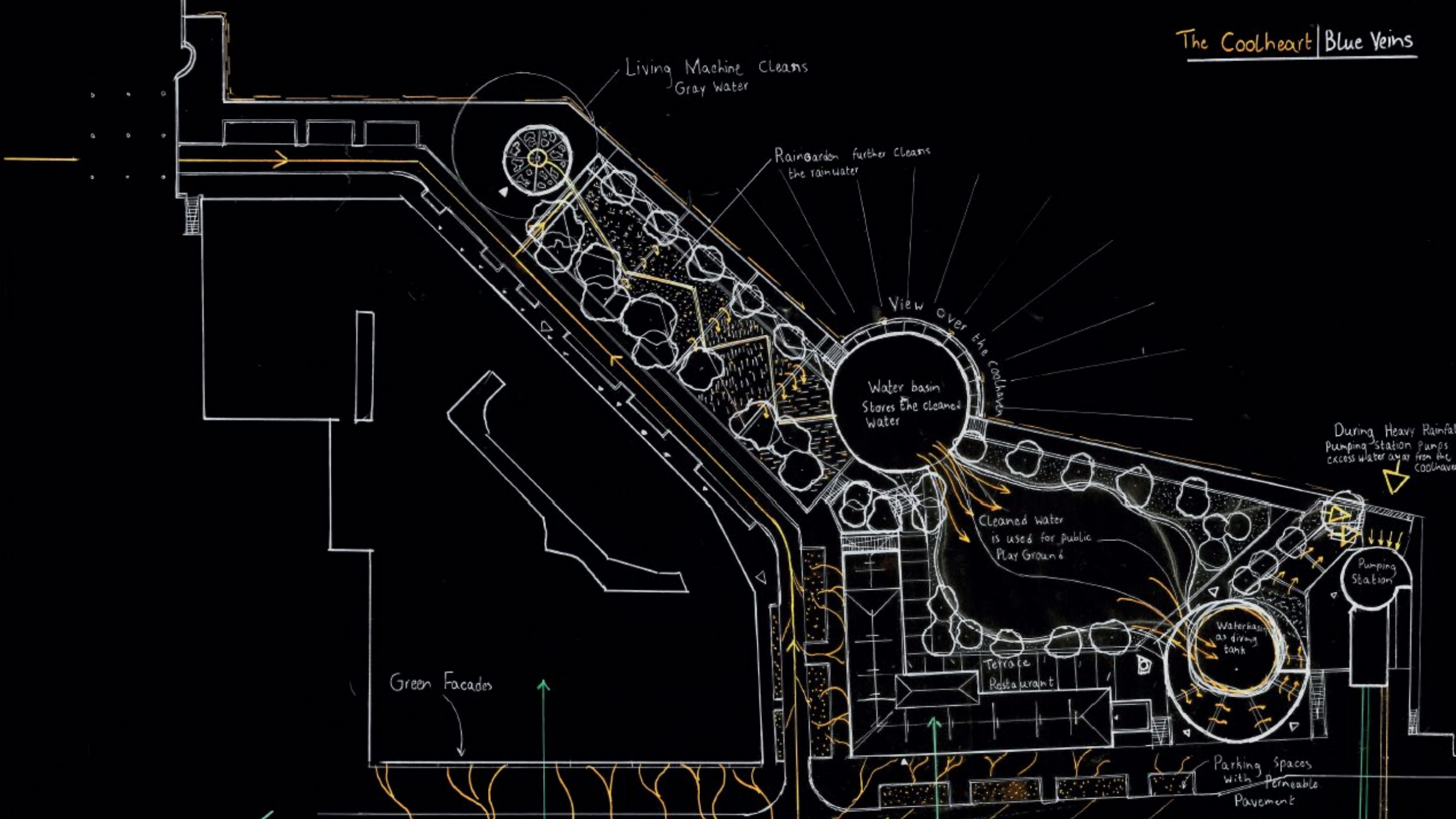


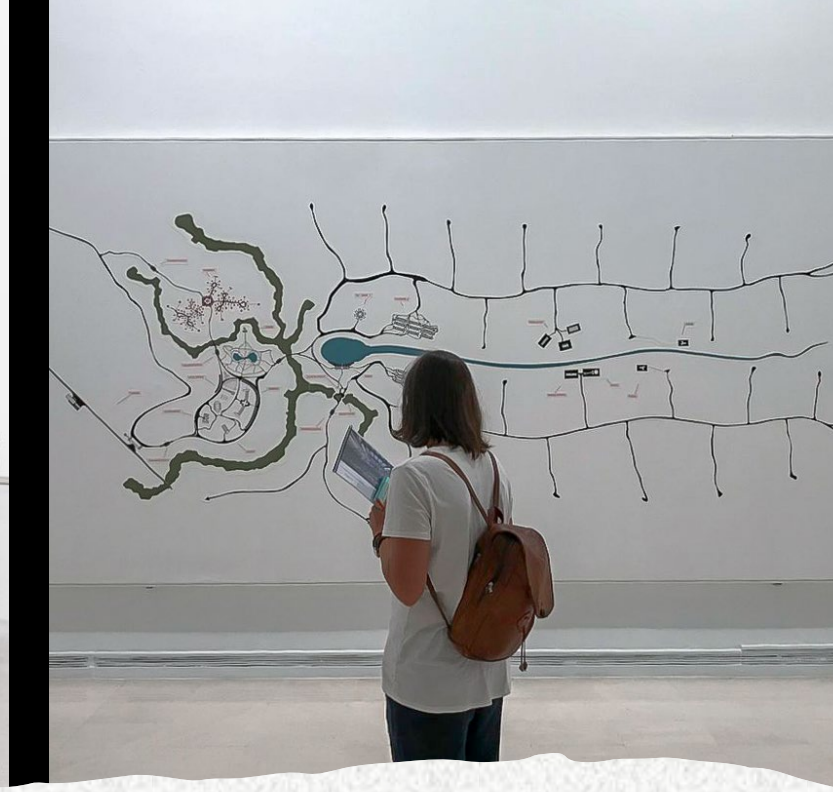
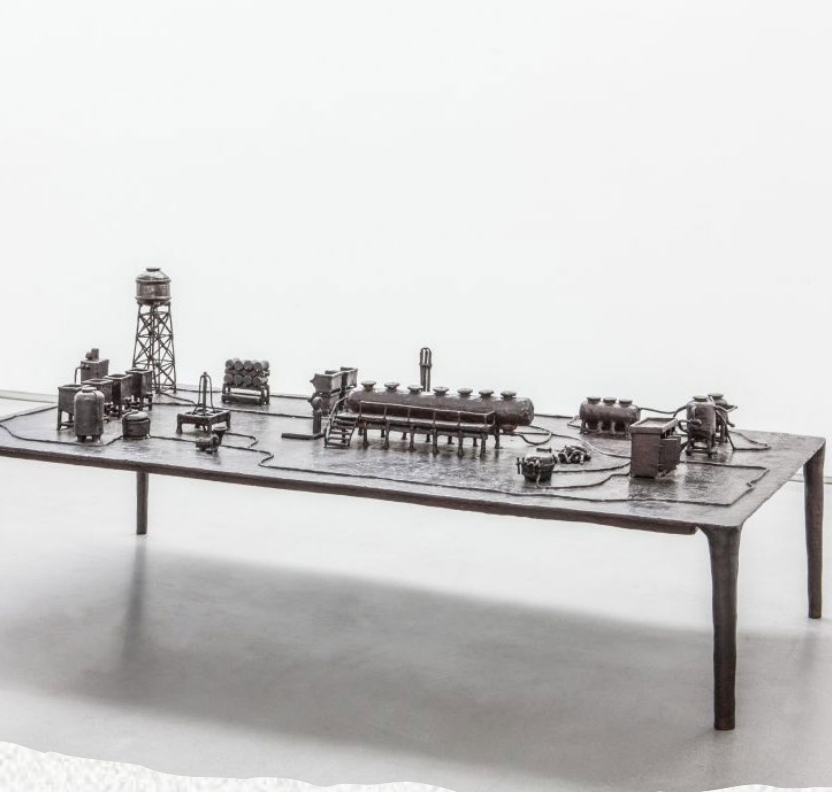
Pumping Station pumps water from the Park back into the neighbourhood

1:1000
0 10 20 30

1.

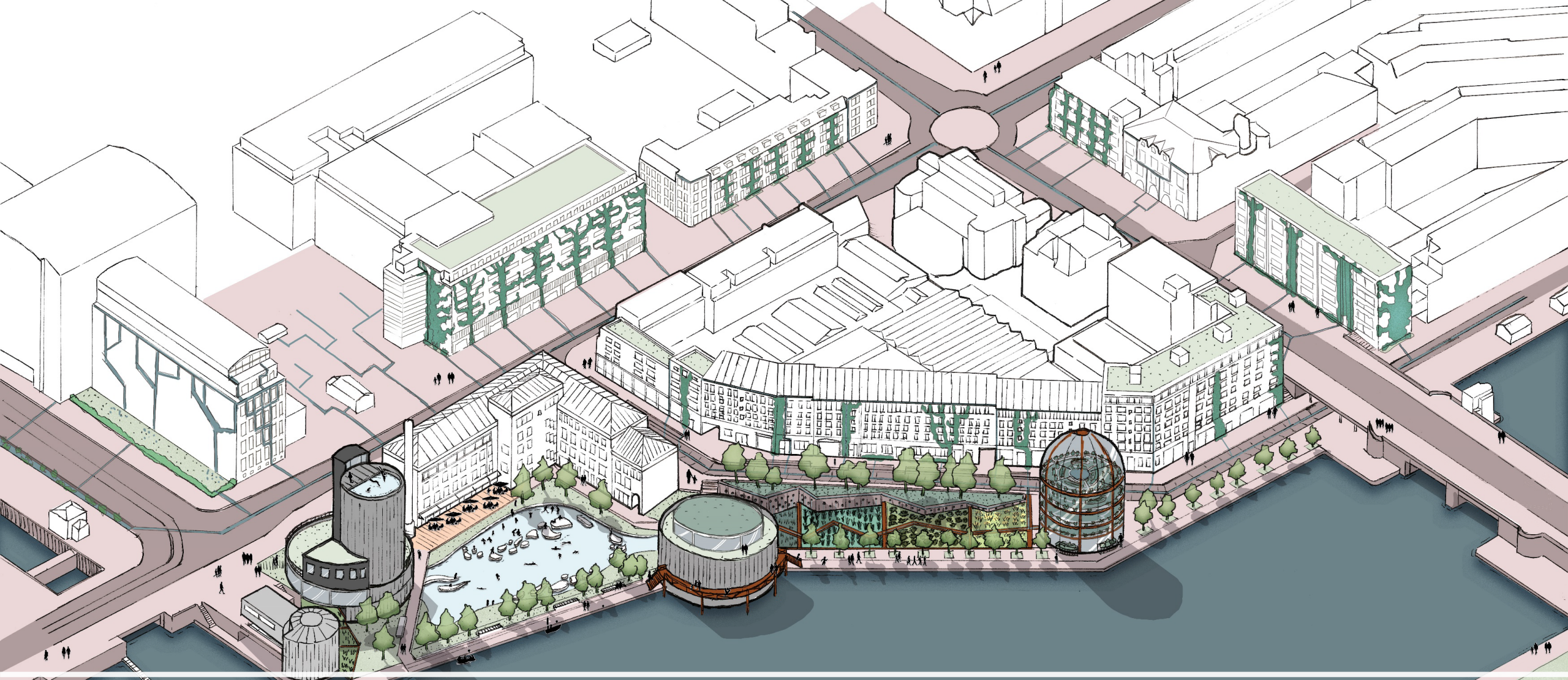






Inspiration Final Model

- **References:** Joep van Lieshout
- Focus on the workings of the **Blue Veins** system



The Heart of the Coolhaven



A water cleaning and storing system, consisting of tanks and places:

- Living Machine to thoroughly clean greywater.
- Constructed Wetland to further clean the grey- and rainwater entering the system.
- A cultural water tank to store water. Furthermore, this tank serves as a watchpoint over the Coolhaven and has an exhibition room to explain the system.
- An open water basin for storing clean water, where people can play with the water. The basin lies near the terrace of The Machinist restaurant, making it an excellent place to meet others.
- A recreational water tank to store water. The tall, smaller basin can be used as a diving tank, adding a sport-element to the system. Within the larger basin, water gets cleaned for a last time before transported to the pumping station.
- The already existing pumping station gets the additional purpose to pump the cleaned water back into the neighborhood of the Coolhaven.



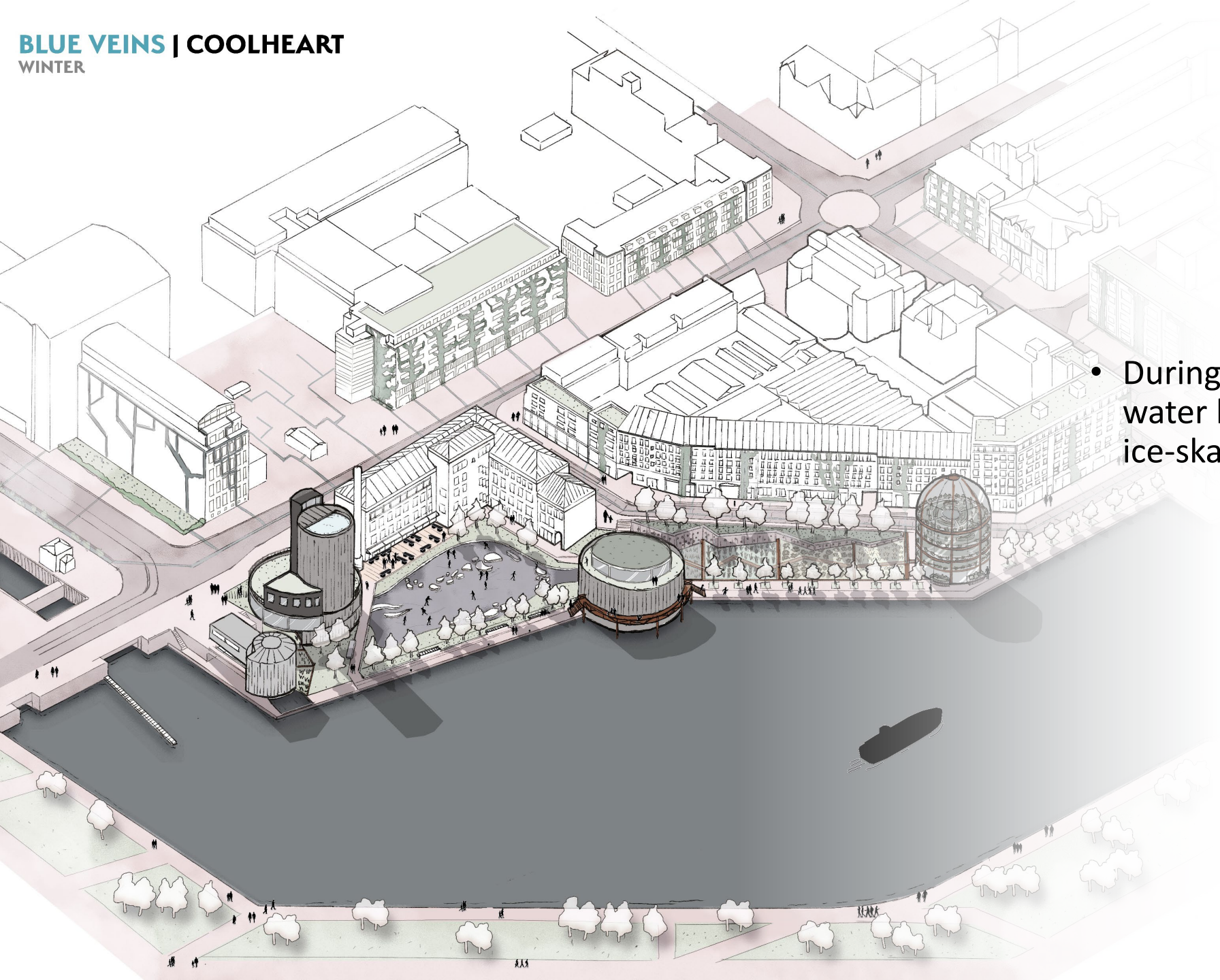
Living Machine

- Via a series of tanks and reactors greywater from the neighborhood is cleaned within the building. Every level represents a part of the cleaning process, using diverse communities of living organisms like bacteria, algae, plants, trees, snails, and fish to break down organic matter and remove nutrients from the greywater.
 - **Anaerobic Reactor:** Pretreats high-strength greywater and removes phosphorus biologically. Afterwards, water is pumped up to the top of the living machine
 - **Anoxic Reactor:** Pretreats and removes nitrogen via denitrification.
 - **Closed Aerobic Reactor:** First aerated stage with biofilter to treat high-strength greywater and remove odors.
 - **Open Aerobic Reactor I:** Plants convert organic contaminants to bacterial biomass in these aerated tanks.
 - **Open Aerobic Reactors II-IV:** Consecutive aerated stages where nitrification occurs and higher organisms, such as fish, further purify the water.
 - **Clarifier:** Bacterial biomass is separated, with a portion recycled and the rest removed as sludge.
- **The Living Machine** and the **Constructed Wetland** can clean up to **3.400 PE** of the **7.380 PE** total of the Delfhaven Neighbourhood. So around half of the greywater of the area can be cleaned within the Coolheart System.



Different basins / different roles

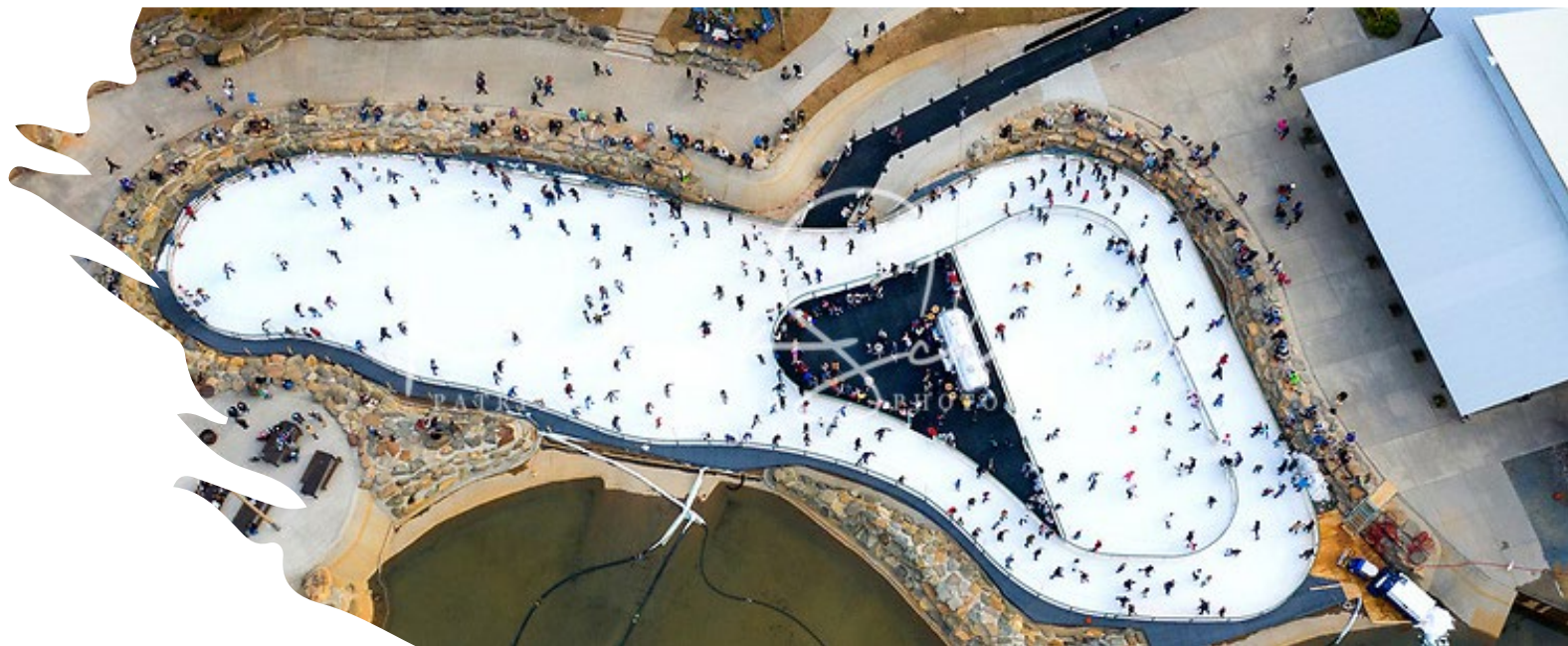
The basins each have their own role to play within the Coolheart System. Besides storing and cleaning, they also offer something to the public. Think about a diving center, water playground for kids or even a exhibition room with view over the entire Coolhaven.

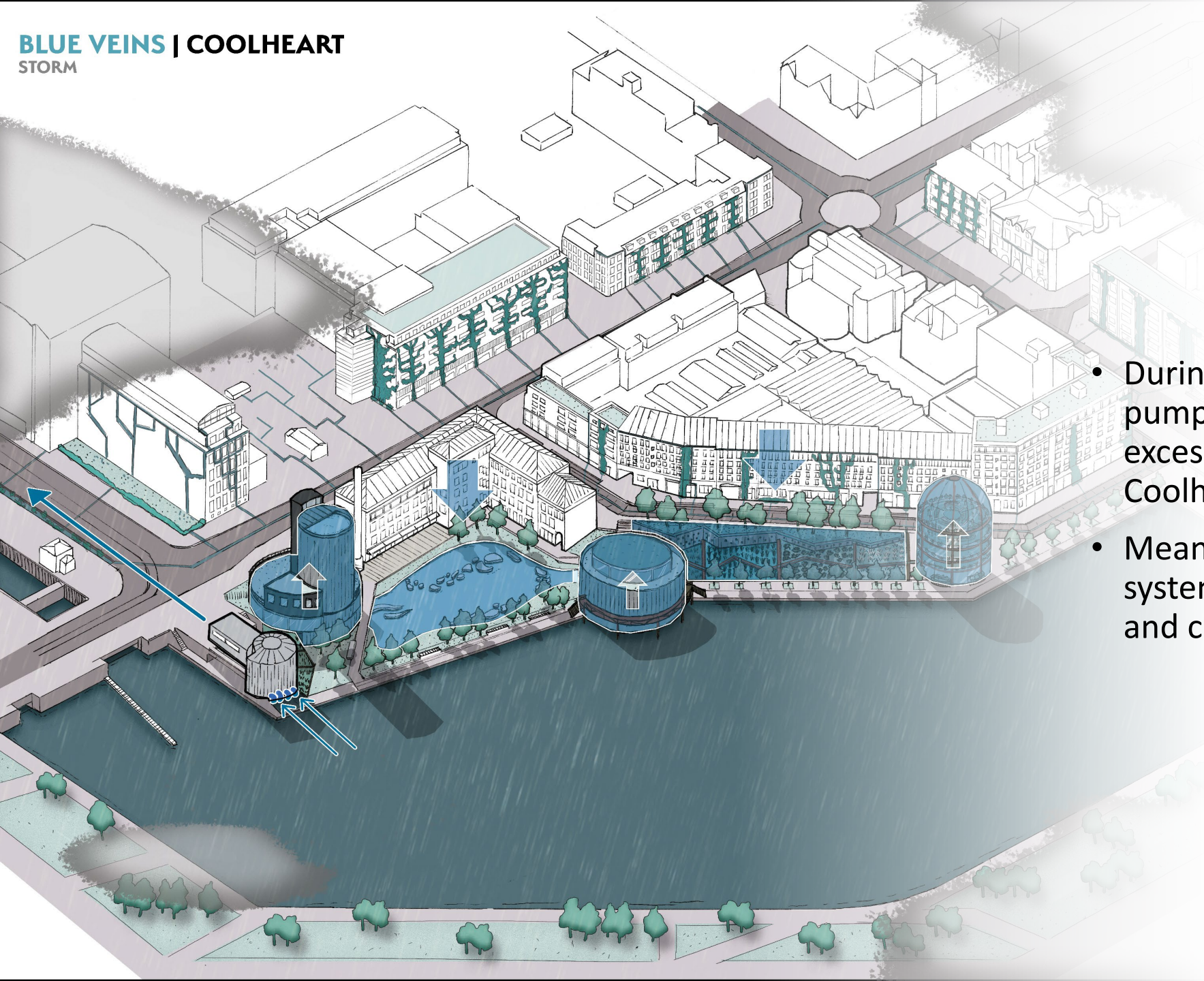


- During the winter, the open water basin could be used as an ice-skating track.

During the Winter

- The use of the Cultural Tank could vary per season or period. For example, during drier periods, the empty tanks could be used as interesting exhibition rooms or art galleries.
- During winter, the open water basin transforms into an ice-skating rink. The Machinist's terrace enhances this experience, offering a cozy gathering spot with refreshments and warm beverages.
- The Coolheart system becomes an integral part of the larger waterfront and completes the Coolhaven walkway while introducing a new experiential element to the area.

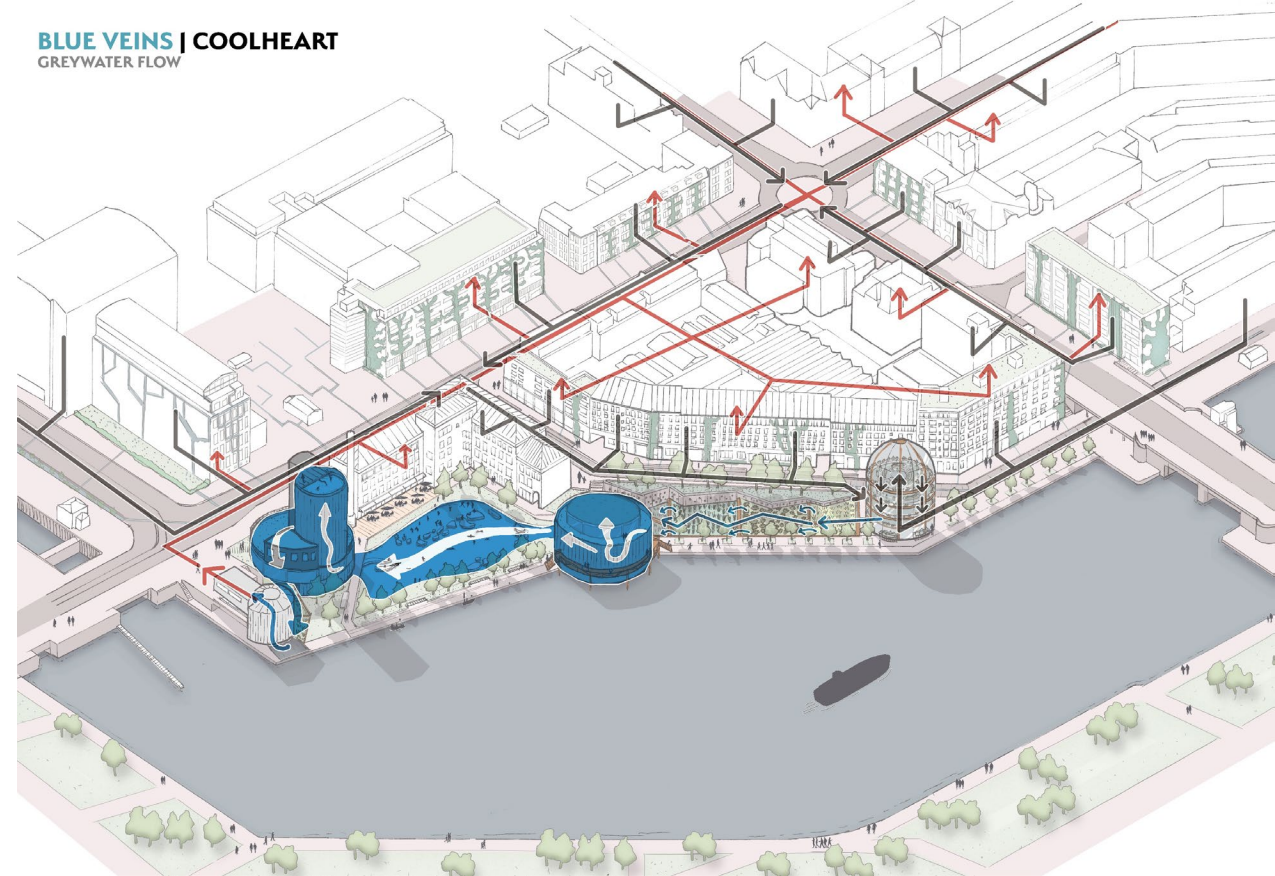
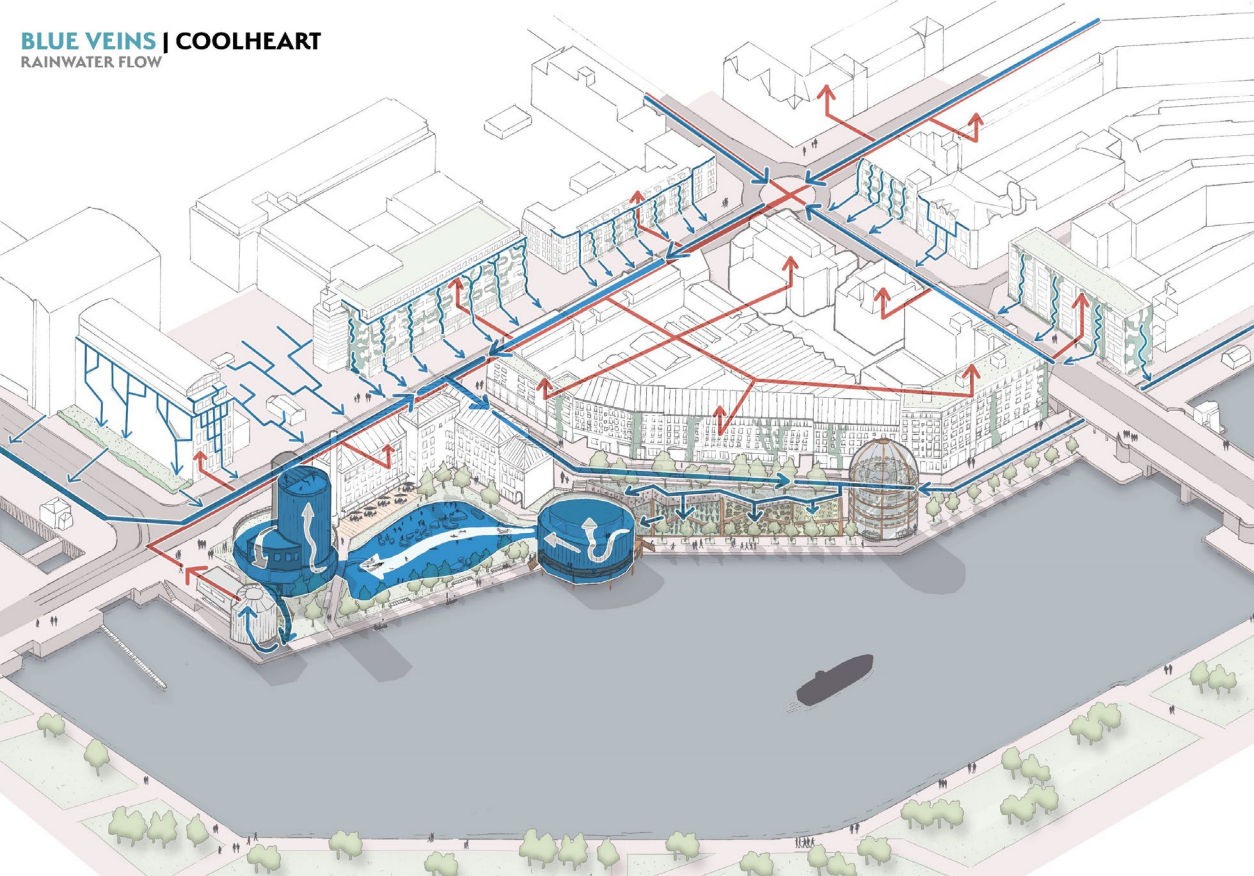




- During heavy rainfall, the pumping station is used to pump excess water away from the Coolhaven to the Parkhaven.
- Meanwhile, the Coolheart-system acts as a water buffer and can store up to 18.000 m³

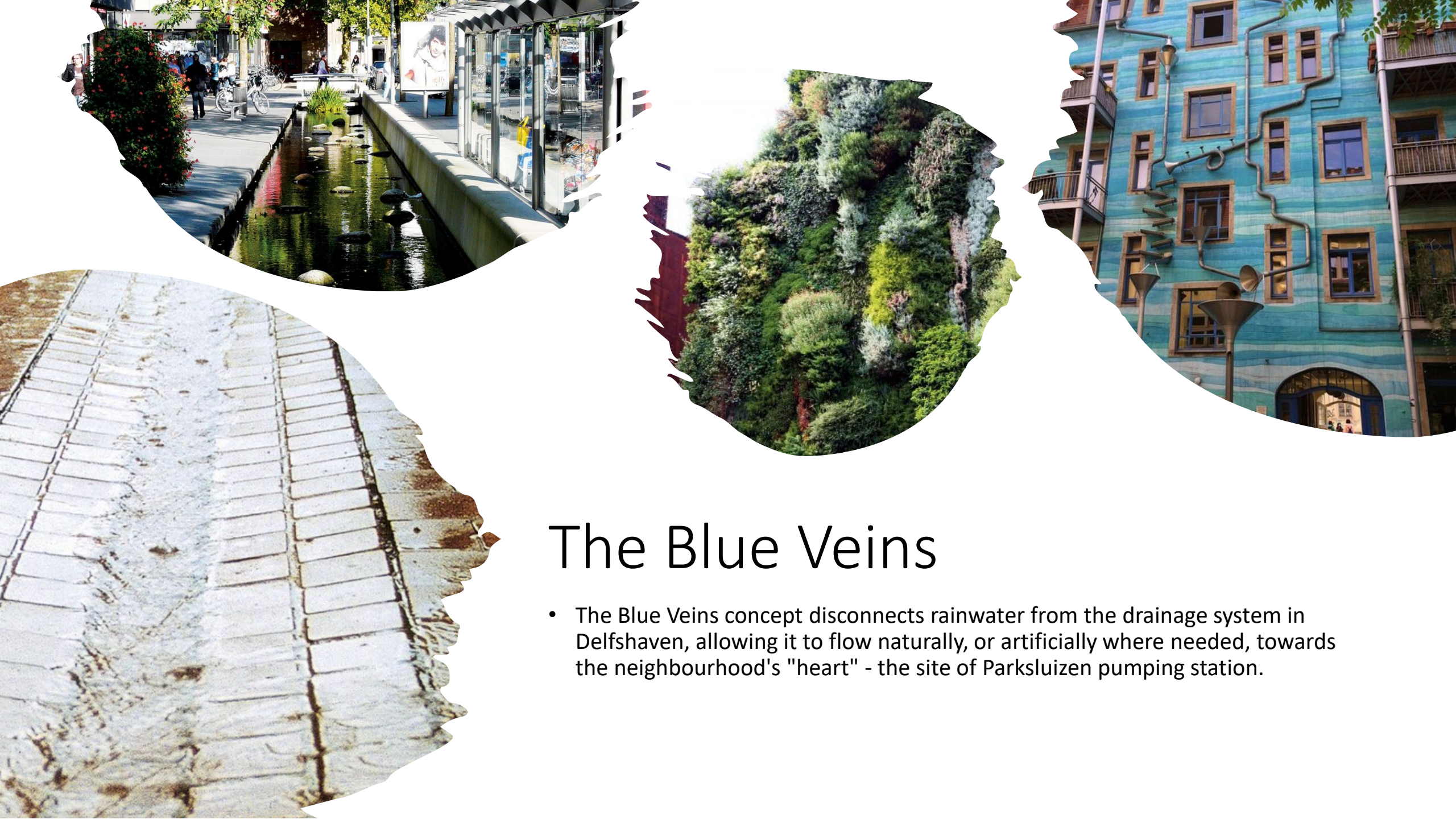


- At the pumping station, two distinct worlds converge. During heavy rainfall, the park reservoir fills with water, while simultaneously, the pumping station diverts water from the Coolhaven to the Parkhaven. The Coolhaven's water level is maintained at a constant -0.43 NAP.
- The pumping station's powerful force transfers 1.200 cubic meters of water per minute towards the Parkhaven, which has an open connection with the Maas river.
- In drier periods, the water stored in the Coolheart system undergoes purification processes before being pumped back into the neighborhood via the same pumping station. This retained water is held in various silos and a water park, which form part of a larger integrated water purification system.
- Harnessing its immense capacity of 1.200 cubic meters per minute, the pumping station can completely empty the entire park reservoir within a mere 15 minutes.



Rainwater & Greywater each go their separate way towards the Coolheart-System:

- Via Blue Veins, water is captured and directed to the constructed wetland. Here it gets mixed with the cleaned greywater and is further cleaned, stored and used within the system.
- Greywater moves through underground pipes to the living machine with the Coolheart-system. There it is thoroughly cleaned within the building and released into the wetland for further cleaning.



The Blue Veins

- The Blue Veins concept disconnects rainwater from the drainage system in Delfshaven, allowing it to flow naturally, or artificially where needed, towards the neighbourhood's "heart" - the site of Parksluizen pumping station.

