



THE URBAN OASIS

Get **COOL** – beat the urban heat

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1. Abstract

Driven by climate change and the Urban Heat Island (UHI) effect, the city of Athens is experiencing increasing heat stress due to its dense urban fabric and limited green space. This project responds to this challenge by exploring how architectural and landscape design can use natural elements, wind, shade, water, and thermal mass, to create passive cooling environments that also function as public and educational spaces.

The project focuses on the redevelopment of the former industrial “Pyrkal” site in Ymittos. An iterative design approach was used, combining 3D modelling with CFD wind simulations and solar analysis. The final design proposes a resilient public park with clusters of circular green spaces with drought-resistant vegetation to reduce water loss, combined with an urban ecology pavilion.

The pavilion incorporates thick concrete walls to increase thermal mass and improve thermal lag. With the help of these walls cool air is steered through the building to create cool spaces and cool its visitors down. Two reservoirs, one acting as a stormwater overflow, and one as a rainwater collector, support evaporative cooling. The collection of these systems stabilize temperatures in and around the building. Overall, the project shifts the idea of urban comfort from energy-intensive mechanical cooling toward passive, climate-responsive design, offering a scalable approach for improving microclimates in hot, dense urban areas.

2. Introduction

2.1 Problem statement

The climate in the city of Athens is, like many cities all over the world, being influenced by global warming. Temperatures are rising, and as a result cities are becoming hotter (Joint Research Centre 2024). The phenomenon called the “Urban Heat Island” (UHI), shows how cities are more affected by heat stress due to their large amount of people, infrastructure and “hard” materials (Pena Acosta 2023). The lack of nature and water gives the urban fabric little possibility to cool down during periods of high temperatures. This is also the case of Athens, one of the warmest cities in Europe (Schwingshackl et al. 2024). The higher temperatures result in a higher energy consumption (Howarth et al. 2023), impacts the health of residents negatively (WHO 2024) and creates a higher air pollution (Cardenas et al. 2024). These factors create an environment that impacts the economy by reducing business income during hot hours and causing employee discomfort (Kjellström et al. 2019).

The Greek government, and the city of Athens, are trying to fight the Urban Heat Island by applying Nature-based Solutions (NbS) in the city of Athens (‘Athens-Resilience-Strategy-English’, n.d.). The municipality of Athens is developing large areas along the coast and around historic monuments to include more space for nature (GTP 2025). Smaller initiatives, like the creation of so called “pocket parks” and “Adopt-A-Tree”, give local residents the opportunity to care for their environment and take away responsibility of the municipality (Gospodini 2024) (EIPA, n.d.). Initiatives like Adopt-A-Tree focus on preserving nature, as a lack of irrigation contributes significantly to the loss of green spaces in Athens (keptalkinggreece 2020).

The municipality needs to put time and money into the preservation of nature, but resources are limited and other aspects of nature, like fighting forest fires, are more important (City of Athens 2019).

The preservation of natural areas in the city is also being threatened by the development of buildings and infrastructure. The municipality of Athens wants to improve infrastructure, and developers want to create new buildings. As a result, these actions remove green spaces, trees, and natural elements from an already densely built urban fabric. An example of this is the development of a new metro station at Exarchia Square, where the creation of new public infrastructure led to protests from local communities that see their neighborhood being changed (Smith 2022). Promises by the municipality to replant the felled trees were not trusted by locals that see the historic plaza now being turned into a building site. This case illustrates the broader friction between Greek citizens and their authorities. While anti-government protests occur regularly for various reasons (Kitsantonis 2025), this specific conflict underscores a deep-seated public distrust in state institutions (OECD 2024).

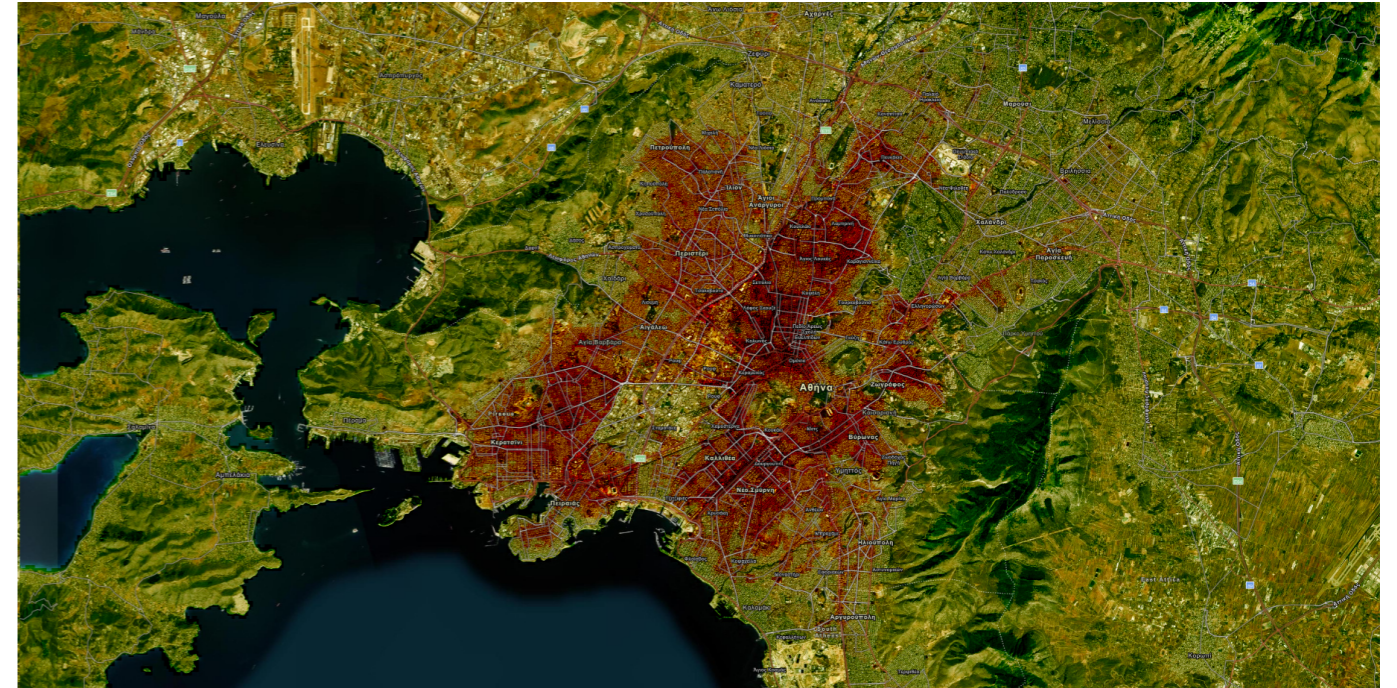


Fig. 2.1.1. Heat Risk Index 2023 Athens (By Pantazis Alexandros & Vlachou Eleni <https://storymaps.arcgis.com/stories/b37837ed9b544bf3b2e881171626dedf>)



Fig. 2.1.2. Pocket park in Athens



Fig. 2.1.4. “Athens is turning green, one neighborhood at a time” - Mayor Haris Doukas

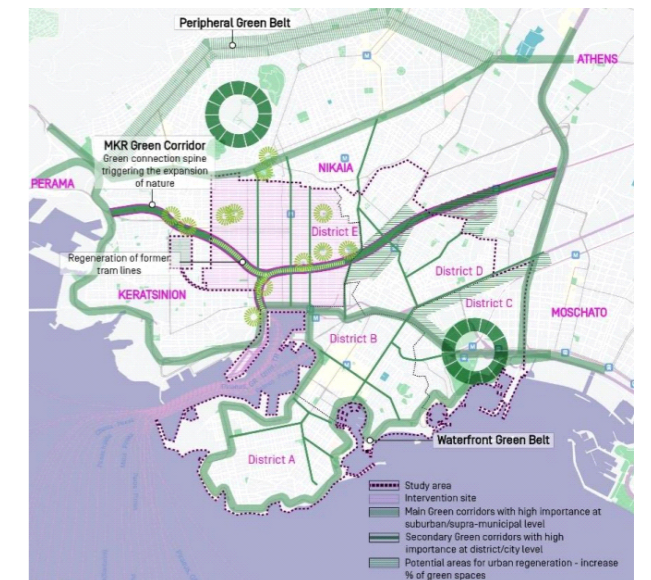


Fig. 2.1.3. Green corridors in Piraeus City

2.2 Relevance

The current policy of the municipality in Athens already tries to limit the heat stress in the densely built urban fabric (Municipality of Athens 2017). Habitants want to decrease the heat stress in their own environments, often by using nature-based solutions, and also see the value of nature in their environment (Paraskevopoulou et al. 2025). There are however few places in Athens where people can be informed about nature in urban areas, and escape the heat of the built fabric for a bit ('Athens', n.d.).

The new site and building will become a location where all ages can come to cool down and learn about urban ecology in different ways. The park will not only decrease heat stress in the direct surroundings, but become a link in a bigger system that aims to create cool spots in the city of Athens. The building itself is a central node in that system, showing how architecture can create cool spaces using natural media.



Fig. 2.2.1. Figure illustrating the new building as a central point in the ecological system of Athens.

2.3 Objective

The residents of Athens need a permanent location where they experience the possibilities for cooling in their city in an educational and recreational way. The creation of a new park and building in Athens are part of that solution. The park will focus on using nature-based solutions to create cooler spaces that can be preserved in the relatively dry Athens climate ('Nature-Based Solutions - Research and Innovation - European Commission' 2025). The building will showcase how natural media can be used to create cooler indoor- and outdoor places. It needs to become a link between urban ecology, local government and residents. The design needs to be adaptable to the challenging weather extremes in Athens ('2023 Was a Year of Multiple & Interrelated Negative Records for the Climate in Greece' 2024).

The project interests me because of the location of the project site. During my six years of studying and working in architecture, most of the projects have been situated in the northern parts of Europe. Creating cool spaces using nature-based solutions and natural media work differently in the southern European climate, and will give its challenges. Making a design that fits with the local environment, and becomes an enrichment to Athens.

2.4 Research questions

The main research question tries to encapsulate the buildings ideology:

How can a building in Athens let people experience cool places with their senses, while showing how ecology, residents, and city fabric can coexist?

I made the following sub questions to give a bit more direction to certain design requests:

How do nature-based solutions create sustainable cooling spots in a park in Athens?

How can natural media create cool spaces in and around the building?

How can the building create enjoyable places to cool down for all people that visit?

2.5 Scope

The building will be located at a current location of the Hellenic Defence Systems, also known as the “Pyrkal” site. This site in Ymittos (Athens, Greece) contains multiple industrial facilities and offices . The location is currently separated from its surroundings by a tall wall with barbed wire on top , to prevent people from seeing the inside and accessing the area. With a metro station, multiple bus stops, and a variety of stores, cafés, and sport close by, the site is well accessible with public transport and surrounded by social activities.

24 buildings, with a combined surface of 47.704 square meters, will be retained as they are marked as important for Greek industrial architectural heritage. 66 other buildings on the site, with a combined 68.500 square meters will be demolished due to their state and limited possibilities of reuse (Hellenic Republic ministry of national economy and finance 2024). The Pyrkal site is likely contaminated with dangerous materials, like heavy metals and chemicals, from the weapon production. To prevent contamination and hazardous situations, the contaminated matter will be replaced with new soil.

I have created a new masterplan for the site that contains the retained buildings, park, and the new pavilion for urban ecology. The building site is located on the topographically lower section of the site, in contact with the existing river that flows underground. The building’s program will consist of educational and recreational functions. It is important to note that the building will not only need to be welcoming to students and residents, but also to the public, as it is a public information centre for all ages. It will not be part of the Greek educational system, but will function as an ecological institution that informs the public about decreasing heat stress in the urban environment.



Fig. 2.5.1. Location of the Pyrkal site in Athens, Greece

2.6 Building program

The building program, as illustrated to the right, defines the functional organization of the new building. It is structured around four main programmatic themes:

Food

Auditorium

Educational

Entertainment

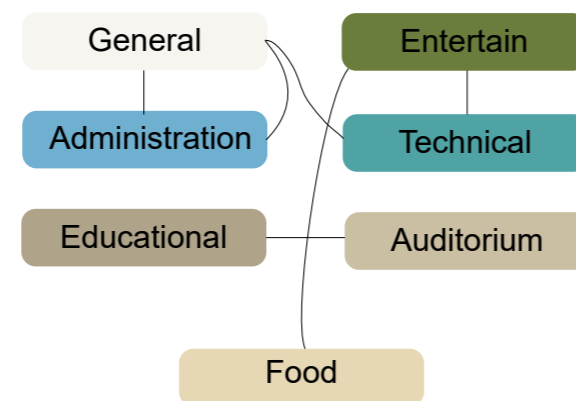
Together, these functions create a diverse and inclusive program that accommodates a wide range of users and age groups. Urban ecology centre is therefore a multi-functional public building, where learning, social interaction, and leisure are integrated into a single architectural framework.

General		08:00 - 23:00		Climate Atrium
Entrance	200	m²		
Waiting zone	1	30	m ²	
Bag/coat storage	1	20	m ²	
Circulation	1	150	m ²	
Reception	40	m²		
Reception desk	1	20	m ²	
Back office	1	20	m ²	
Restrooms	52	m²		
Male toilet	1	20	m ²	
Female toilet	1	25	m ²	
Accessible toilet	1	7	m ²	
Total	292	m²		

Food		07:00 - 21:00 / 23:00 late in case evening event		
Cafe indoor	120	m²		
Seating area	1	70	m ²	45-55 people
Service counter	1	15	m ²	
Display	1	10	m ²	
Workstation	1	10	m ²	
Circulation	1	15	m ²	
Terrace outdoor	300	m²		
Outdoor seating area	1	220	m ²	130-150 people
Outdoor service station	1	10	m ²	
Circulation	1	40	m ²	
Kitchen	50	m²		
Hot kitchen	1	20	m ²	
Cold kitchen	1	10	m ²	
Dishwashing	1	8	m ²	
Plating	1	6	m ²	
Circulation	1	6	m ²	
Storage	20	m²		
Dry storage	1	10	m ²	
Cold storage	1	6	m ²	
Cleaning storage	1	4	m ²	
Restrooms	30	m²		
Male toilets	1	10	m ²	
Female toilets	1	12	m ²	
Accessible toilet	1	8	m ²	
Waste management	15	m²		
Waste sorting	1	10	m ²	
Cleaning/wash area	1	5	m ²	
Service corridor	1	10	m²	
Total	545	m²		

Auditorium		09:00 - 23:00 in case of evening event		
Auditorium	238	m²		
Seating	1	165	m ²	150 people
Stage	1	45	m ²	
Control booth	1	8	m ²	
Circulation	1	20	m ²	
Backstage + storage	78	m²		
Dressing room	2	24	m ²	
Storage	1	20	m ²	
Technical room	1	8	m ²	
Service	1	10	m ²	
Circulation	1	16	m ²	
Total	316	m²		

Fig. 2.6.1. Building program



Educational		08:00 - 18:00		
Indoor classroom	180	m²		Fully openable connected to outside
Seating	3	90	m ²	75-90 students
Teaching	3	15	m ²	
Storage	3	15	m ²	
Circulation	3	60	m ²	
Outdoor classroom	80	m²		Shaded
Seating	2	50	m ²	40-60 students
Teaching	2	10	m ²	
Shade structure	2	20	m ²	
Workshop labs	200	m²		Water access
Workstation	2	100	m ²	50-60 students
Teaching	2	40	m ²	
Equipment	2	20	m ²	
Storage	2	10	m ²	
Circulation	2	30	m ²	
Outdoor children discovery space	120	m²		
Learning zone	1	60	m ²	
Sensory garden	1	25	m ²	
Exploration paths	1	20	m ²	
Seating	1	15	m ²	
Restrooms	30	m²		
Male toilets	1	10	m ²	
Female toilets	1	12	m ²	
Accessible toilet	1	8	m ²	
Circulation	60	m²		
Total	670	m²		

Entertain		08:00 - 21:00		
Changing	125	m²		open sunrise to sunset
Changing cabins	1	60	m ²	Connected to exterior
Lockers	1	30	m ²	14 units
Showers	1	35	m ²	180-220 lockets
Restroom	45	m²		Connected to exterior
Male toilet	1	15	m ²	
Female toilet	1	15	m ²	
Accessible toilet	1	15	m ²	
Sauna	1	70	m²	For winter usability of water
First aid	15	m²		Connected to exterior
Total	185	m²		

Administration		08:00 - 18:00		
Office	60	m²		5-10 person staff
Office	1	40	m ²	
Meeting room	1	20	m ²	
Staff lounge	90	m²		
Staff lounge	1	40	m ²	
Male toilet	1	10	m ²	
Female toilet	1	12	m ²	
Accessible toilet	1	8	m ²	
Circulation	1	20	m ²	
Total	150	m²		

Technical				
Mechanical rooms	1	250	m²	
Water systems	1	150	m ²	
Thermal storage	1	150	m ²	
General storage	1	100	m ²	
Total	650	m²		

3. Approach

3.1 Method

The location (Athens, Greece) was initially unfamiliar, so research was conducted into Greek culture and its relationship with nature. A combination of traditional search engines such as Google and AI tools like ChatGPT and Gemini was used to gather sources in both English and Greek. This provided insight not only into environmental data, but also public opinion and government policy.

A site visit provided valuable visual and sensory data about the project location, helping to better understand the character of the place. This included photographs and observations taken by students from the DDS Graduation Studio, shared through a Google Photos folder, as well as surveys completed on site on 26.11.2025. The collected information was organised into maps and reference lists to support the design process.

This site data was combined with analysis of current site conditions, the proposed Greek government masterplan, and studies of comparable parks to develop a new masterplan for the Pyrkal site. Key findings were documented through maps, sketches, and diagrams.

Personal experience with the design process has learned me that a combination of digital modelling and sketching works the best for me to come to a complete design. The accuracy of digital modelling allows me to create 3D-models in little time. Sketching using tracing paper over printed views, or in a sketchbook enables me to quickly draw options and visualize my ideas onto paper. According to research this method still allows to activate creativity (Donnici et al. 2025).

Computational Fluid Dynamics (CFD) was used as a design tool to test and refine airflow strategies for cooling within and around the building. The process helped to simulate how wind moves through the site, courtyards, and interior spaces, allowing the design to be evaluated beyond static diagrams and drawings.

The CFD analysis began with the development of a simplified digital model of the site and building massing. This model focused on the main spatial volumes and openings to ensure realistic wind behaviour. Prevailing wind directions were then applied as boundary conditions to simulate typical wind scenarios.

Different design iterations were tested to study how variations in building form, courtyard placement, and openings influenced airflow patterns. The simulations made it possible to identify areas of high wind speed, stagnant air zones, and effective ventilation paths. These results helped making decisions regarding placement of volumes, walls, and openings.

For the other important natural media, shade, I used a combination of calculations and built-in features of Revit. Results of these are angles of sun during different times of the year, and visuals in section showing shade.

For the water collection and rainfall mapping, I collected weather data from digital sources in an excel. Together with data from the site, heights and surfaces, these gave insight into the potential collection of rain during the year. Results of this are visually portrayed in graphs and lists.

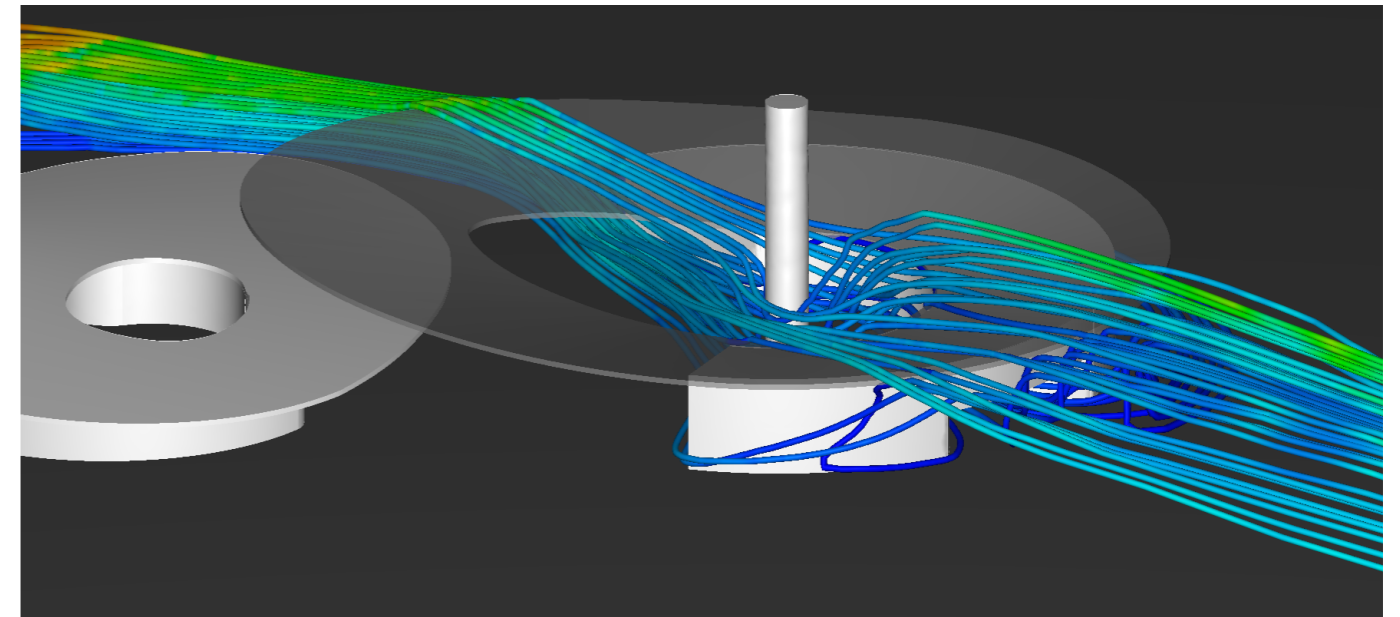


Fig. 3.1.1. Example of a Computer Fluid Simulation

3.2 Theoretical framework

As mentioned before, a lot of input of the site analysis comes from the surveys regarding sensory annotations that we as DDS-group did on 26.11.2025. The results of these surveys have been made visual by Marcel Janssens in QGIS maps, which are visible in Appendix C. The results show a high amount of noise, movement, and smell to the west of the site, which corresponds to the main road. I have also analysed the new master from the Greek government and other parks in- and outside of Athens (Appendix D). The new masterplan for the Pyrkal site gives some clear ideas about preservation of existing buildings, routing inside of the new area, but the functionality differs from my new masterplan. Detailed information regarding the state of current buildings, close-up photographs, and more detailed information about the site is not available due to the sensitive function that it currently houses. In this lack of knowledge certain assumptions will be made to cover the potential gap of knowledge that is there.

A map regarding soiltypes (Appendix E) and waterways gave insight into the existence of the river that is running below the site. Not a lot of information is available about the tunnels, besides some pictures from unspecified locations. Other analysed parks gave a clear idea about accessibility, routing and public safety. Especially the last aspect can be important for the creation of a well visited park. Further research about public safety in parks lead me to a document from the National Recreation and Park Association ('Park-Safety.Pdf', n.d.) where a set of factors is listed to enhance safety in parks. A compiled list of local flora and fauna gives a set of flora that can be placed on the site according to its needs. The new site design (Appendix H) Compiles the analysis of the existing site, the new masterplan, and ways to deal with nature-based solutions, into a new park that focusses on creating cool spaces.

Literature precedents regarding natural ways of cooling like "The Architecture of Natural Cooling" by Brian Ford show examples of evaporative cooling and its effect on the users. Research regarding natural based cooling and natural media (Appendix F). Has given certain parameters for the design of the park and the building. As the park is focused on using natural based cooling, in line with the municipality of Athens, the building design uses natural media as a way to create cool places for its visitors.

I have done extensive research in the way that water can be used as a media to create cool spaces. Due to the river running through the site, and the complicated relationship that Athens has with water, it forms a nontraditional way of cooling in the city of Athens. Research regarding water evaporation, history of the existing river, rainfall, and the usage of water evaporation as cooling, has been a pillar of the design development. (UNCCD, n.d.). Research shows that the amount of evaporation is multiple times higher compared to the rainfall. This results in dry summer months, where rain is barely falling, and evaporation is the highest.

Two windstudies of the site have been done before starting the design process, to give an insight into the windflows in the future site. These simulations show a corridor of higher windspeed being created in the middle of the site

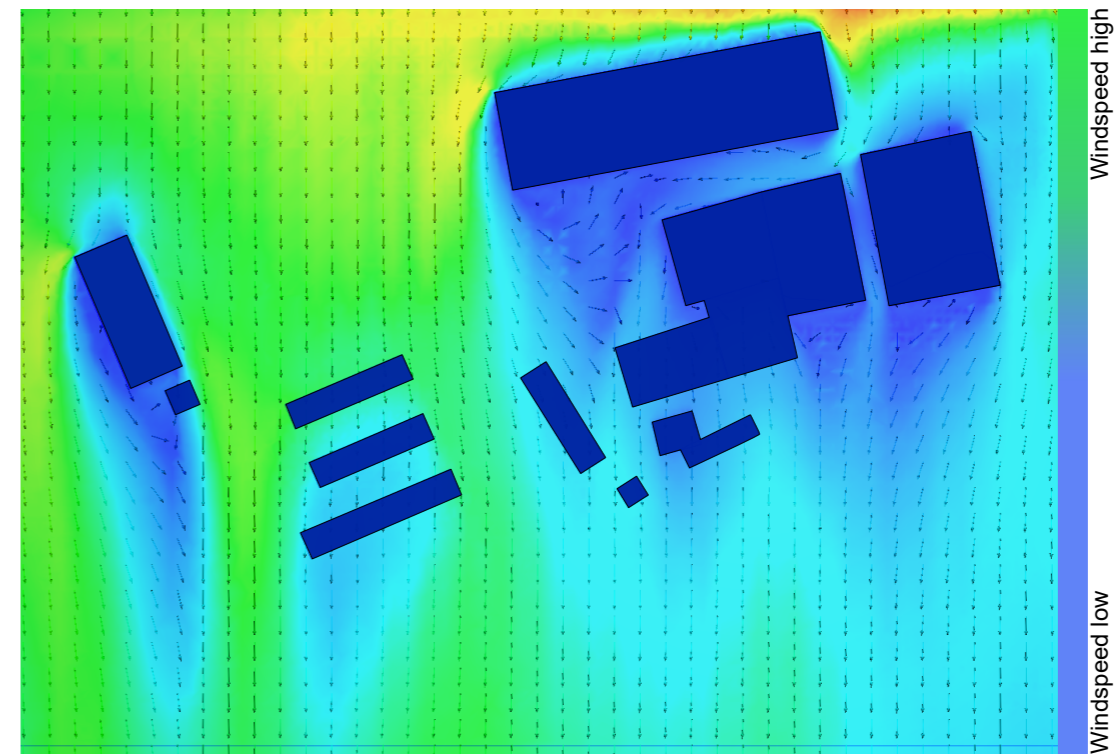


Fig. 3.2.1. CFD-simulation showing airflow on the site towards the new building

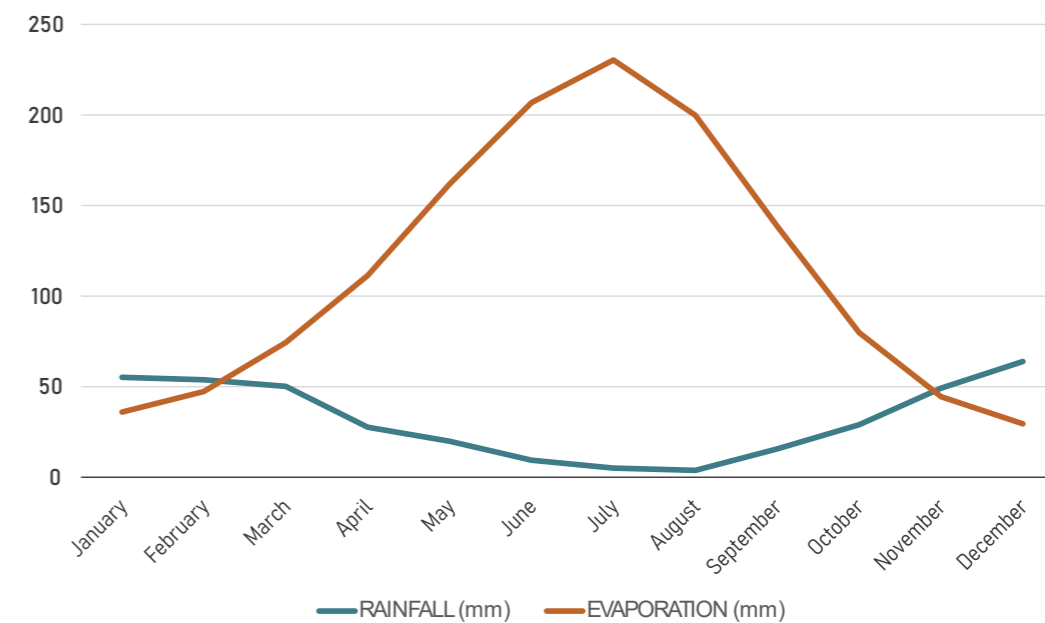


Fig. 3.2.2. Amounts of rainfall and evaporation per month in Athens, Greece

4. Results

4.1 Masterplan

The new masterplan evolves around the same concept as the building, creating spaces where people can cool down. The remaining industrial buildings will be connected by flowing pathways that go across the site. These flows follow the wind logic in a curved way and have a calming effect on its users. (Deng et al. 2024)

The road that dissects the sporting facilities from the site will be changed into a side road. Making traffic bend of before, to create a more safer passage between the facilities and the city. Sporters, students and other people can cross the road more safely to enjoy the park. Remaining traffic on the road consists of destination traffic to the underground parking or other facilities that are connected by the road.

The park incorporates a series of circular cooling spots enriched with diverse flora and vegetation. The circular form creates welcoming and accessible spaces that can be approached from different directions, encouraging movement and interaction throughout the park.



Fig. 4.1.1. New masterplan

4.1 Masterplan

The cooling circles have represented in the park with different sizes. The idea behind all of them comes down to the same concept, creating durable cooling spots using nature based solutions. Outer layer of trees acts as the wind barrier, while the inner part is focussed on water retention and storage. The idea is to create futureproof nature which can naturally expand towards the surroundings. Putting nature first and letting it progress in a way that is sustainable with limited irrigation, inspired by the green wall initiative (UNCCD, n.d.).

This concept for cooling circles is not only for the new masterplan, but could be applied in other places around Athens.

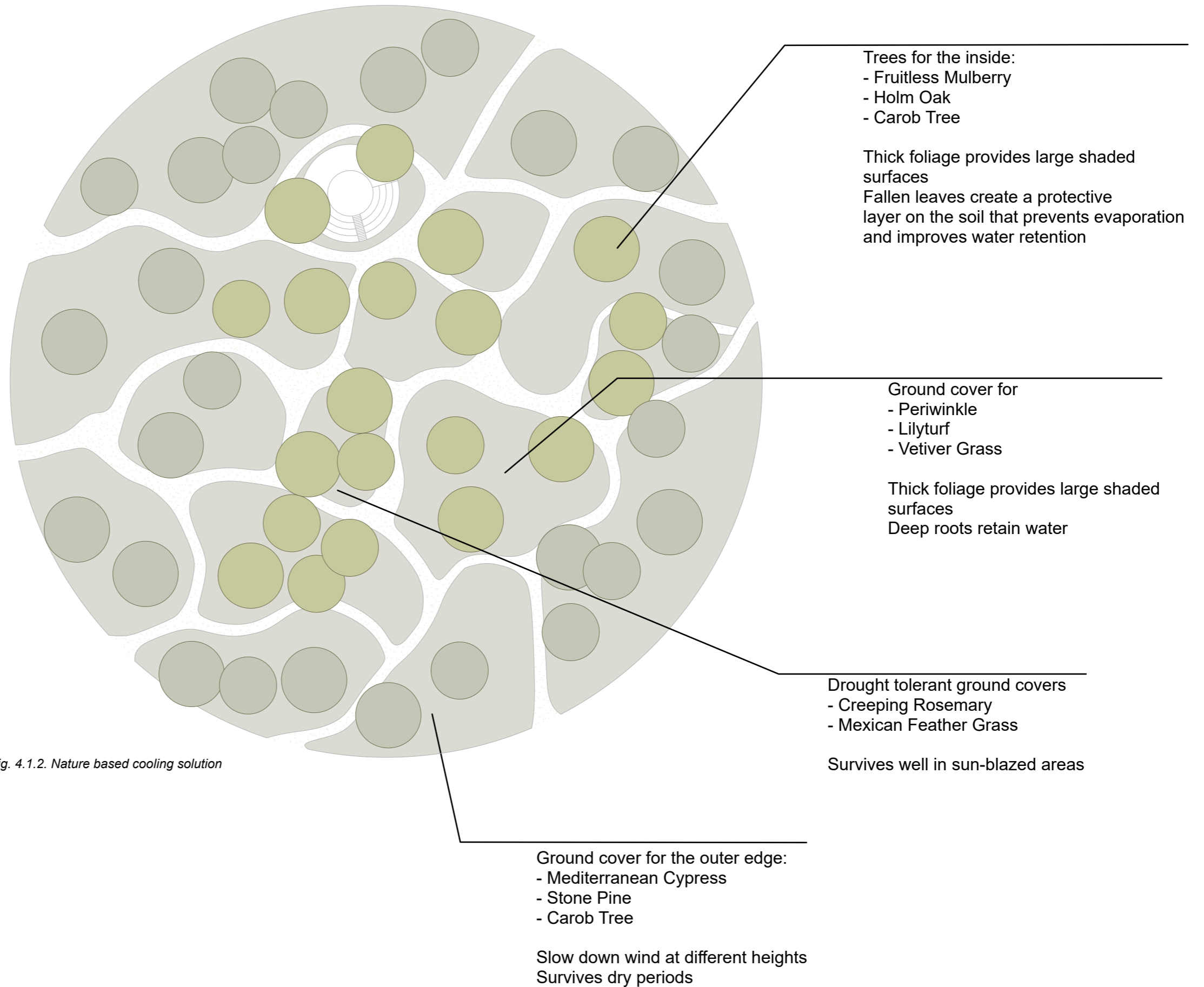


Fig. 4.1.2. Nature based cooling solution

4.1 Masterplan

The location of the new urban ecology pavilion has been planned according to the guiding themes of the building. The location is on the lower part of the site, making it possible to direct rainwater from rooftops higher to the central collection point. The location is not the lowest point of the site. That place, although being more beneficial for rainwater collection, was decentralized from other important routes and infrastructure. The current location makes the building a node in a bigger network of daily pedestrian routes, green infrastructure, and places it above the river that lies beneath the surface.

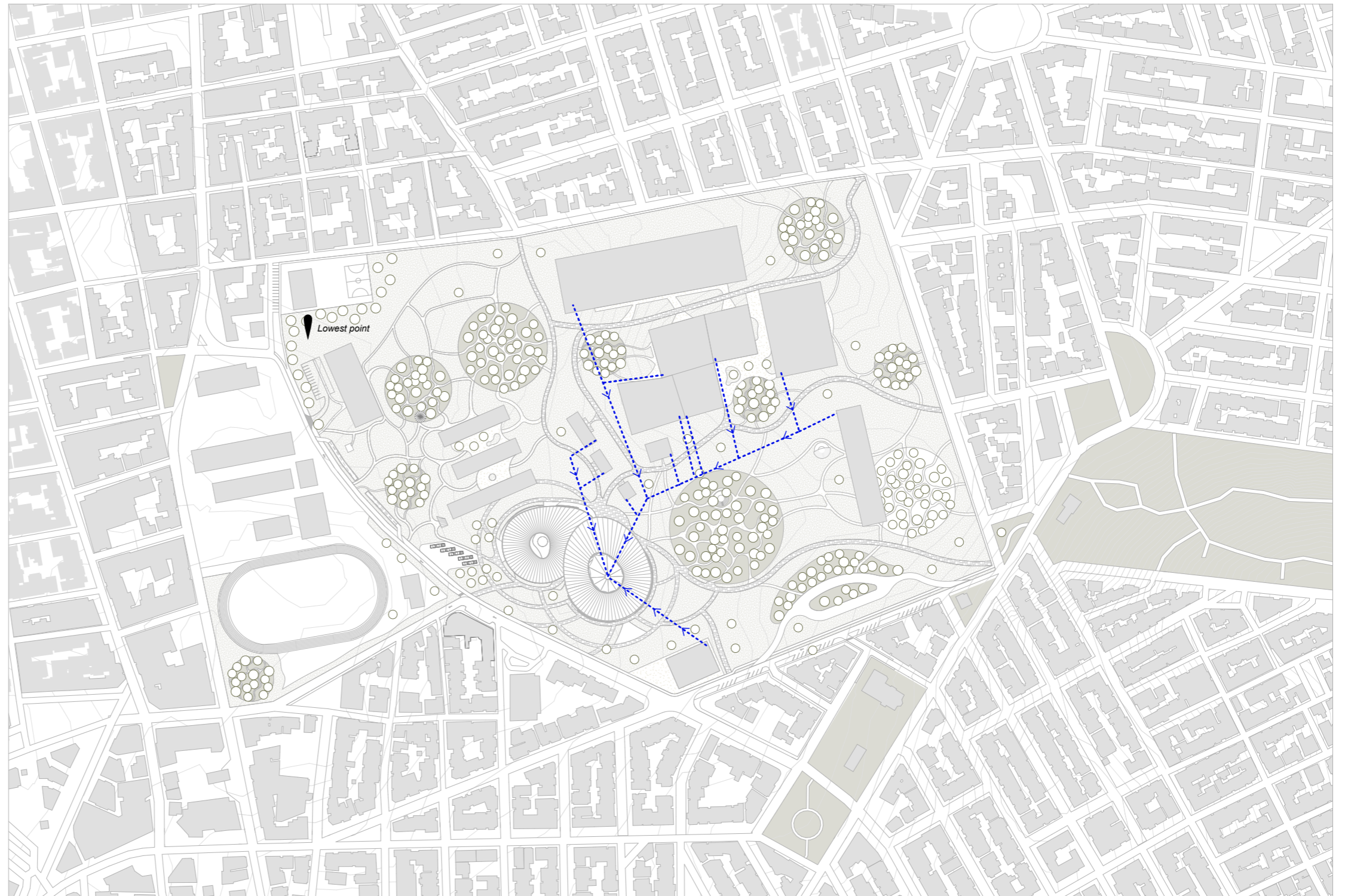


Fig. 4.1.3. Rainwater collection from neighbouring roofs

4.2 Building

The center for urban ecology itself consists of two water reservoirs. One reservoir is linked to the river that runs underground and functions as an overflow during periods of high rainfall, to release a bit of stress on the system and lower the chances of flooding in lower areas of Athens. During the winter months, the reservoir is designed to fill up to a predetermined maximum level, ensuring that excess water is safely contained and preventing flooding of the building.

Water is disappearing over time due to evaporation, cooling the direct surroundings while doing so. During summertime the place might be dry, giving more usable space to the functions surrounding it.

The second reservoir is aimed at collecting rainwater from roofs on the site. Collecting rainwater only from roofs, gives more control over the quantity and the quality of the water that will enter the reservoir. About 75% of the water that falls on the roof will reach the reservoir. The other 25% is lost in filters, evaporation, and splashing (Stormsaver 2026). The reservoir itself has a varying amount of water throughout the year. During wintertime, rainfall will fill up the reservoir to its maximum capacity.

During the drier months, water from the reservoir will gradually be lost through evaporation and will also be used for irrigation and cooling purposes, resulting in lower water levels. Based on the proposed evaporation-reducing design strategies, a cautious estimate suggests that evaporative water losses could be reduced by approximately 20% compared to a conventional open-water reservoir.

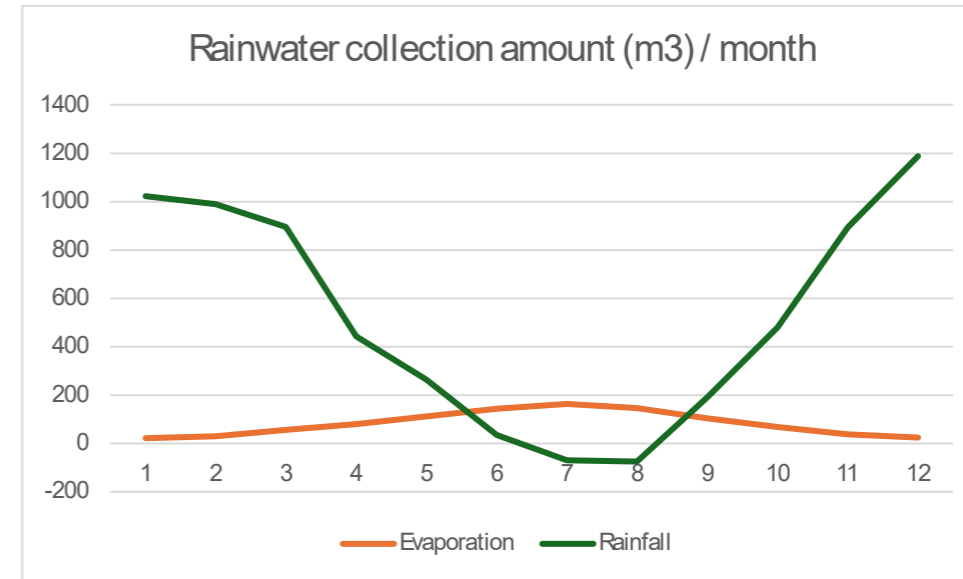


Fig. 4.1.4. Rainwater collection and evaporation of the reservoir

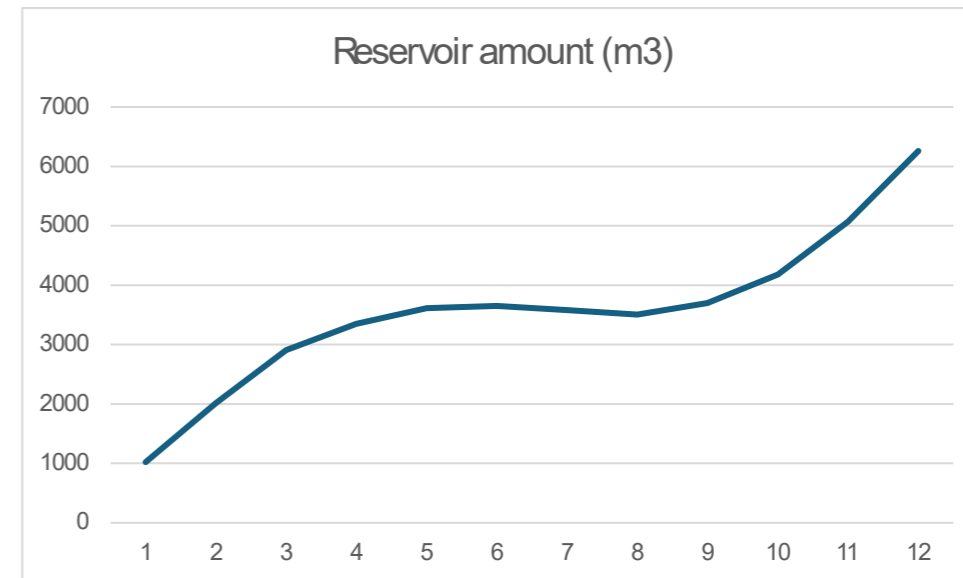


Fig. 4.1.5. Amount of water stored in the reservoir (=rain collection - evaporation)

4.2 Building

The first simulations for the building focussed on choosing a main shape for the design. Wind simulations show that corners create distortion of the wind, lowering the windspeed and disrupting the flow. For that reason the “avocado” shape has been chosen as the first shape of the building. It has a better flow of wind around the shape.

The position of the building was optimized while maintaining the design criteria outlined above. Several configurations of the primary volume were explored, with the aim of preserving airflow along both sides of the building. Allowing air to move freely around the volume increases air circulation and wind speeds within the surrounding space, contributing to a cooler and more comfortable microclimate.

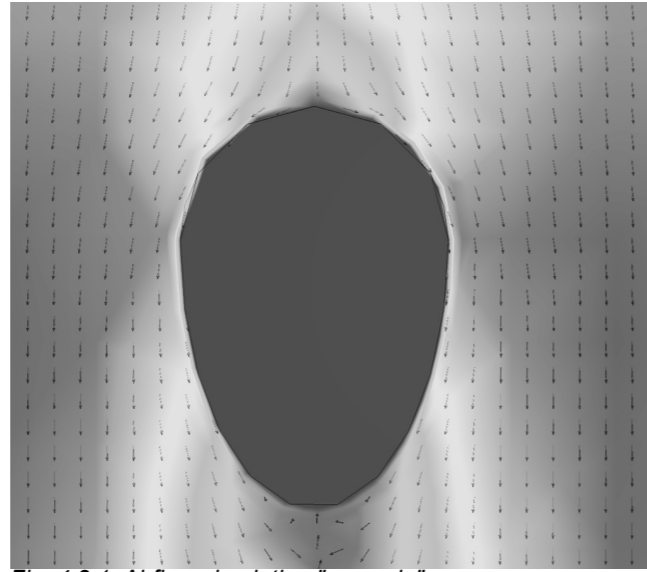


Fig. 4.2.1. Airflow simulation “avocado”

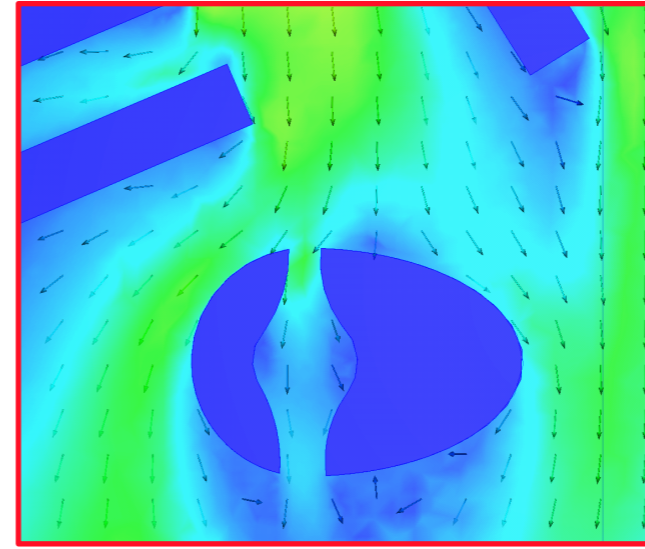


Fig. 4.2.2. Airflow simulation that limits flow right of the new volume

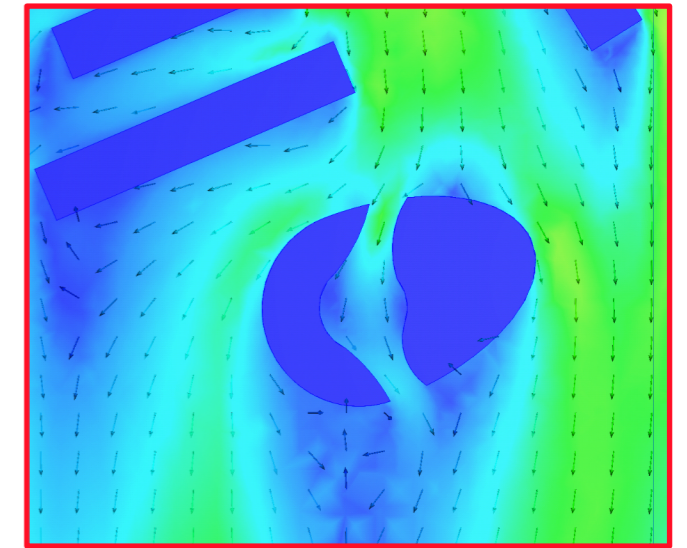


Fig. 4.2.3. Airflow simulation that limits flow left of the new volume

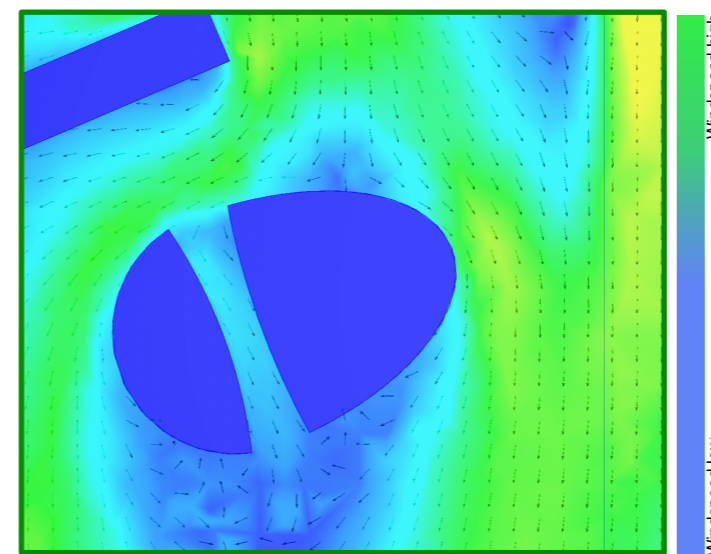


Fig. 4.2.4. Airflow simulation showing the new volume creating good airflow on both sides

4.2 Building

The second set of simulations decided the location of the second volume. The shape started as half a circle around the reservoir. Using the wind simulations I tried different positions relative to the other volume, with the goal to create a higher velocity of wind between both buildings.

The second goal was to prevent high wind velocity over the water reservoir, as this increases evaporation. One of the options was closing of the water with a movable canopy or wall. This directed more air between both buildings, creating a higher windspeed, which results in a higher sense of cooling.

A key aspect of the design is the visibility of the water as visitors move past the reservoir. As one of the project's defining features, the water is deliberately integrated into the experience of the landscape, remaining visible from key pathways and public spaces. This made it difficult to validate versions where the reservoir would be more closed off. In the end I chose a variant that is offset into the flow of air coming from the north. I created a rise in the terrain next to the reservoir, pushing air more up before it reaches the water. This results in a lower velocity of the air above the water, limiting evaporation through wind.

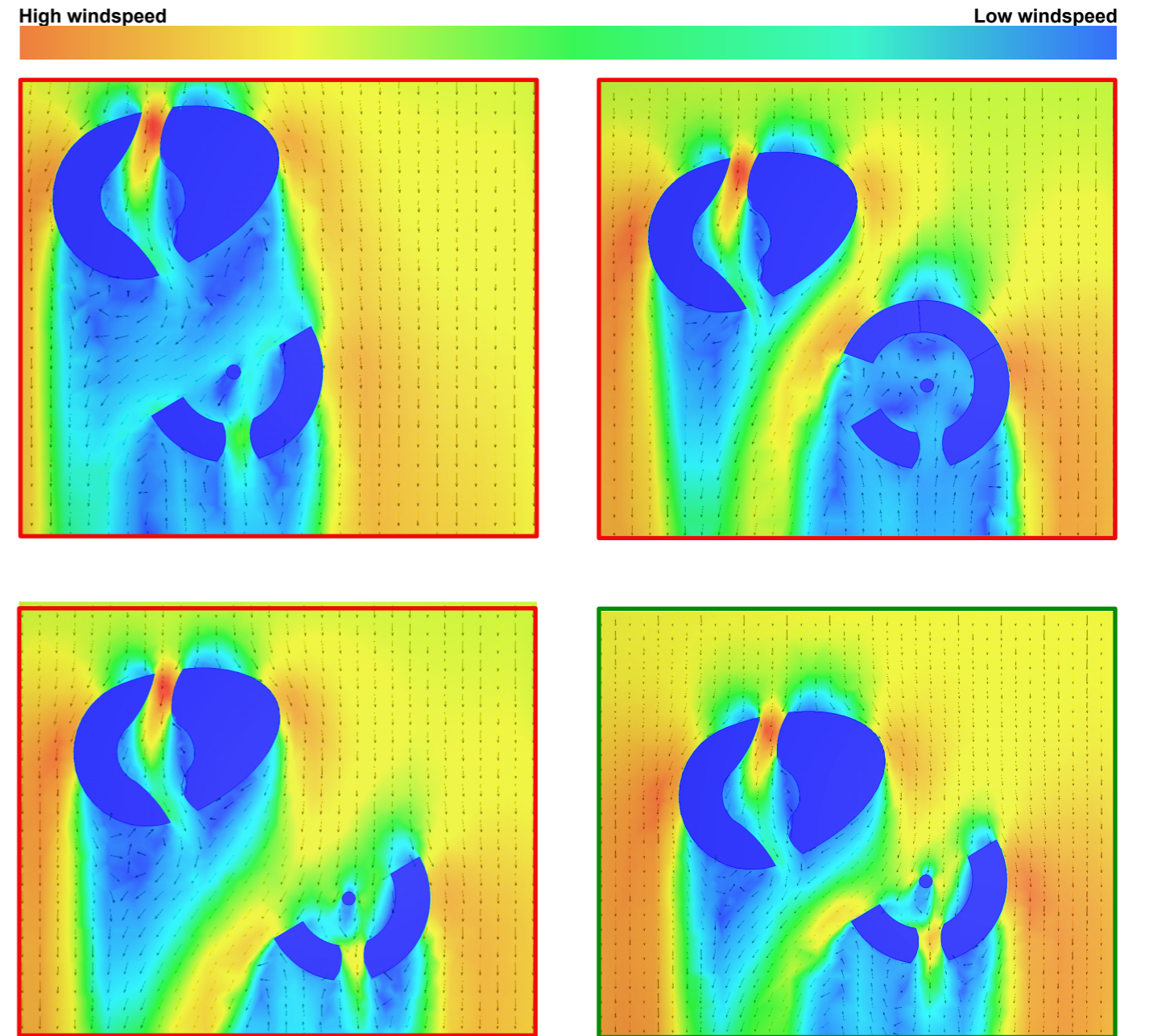


Fig. 4.2.5. Airflow simulation different windspeeds between two volumes

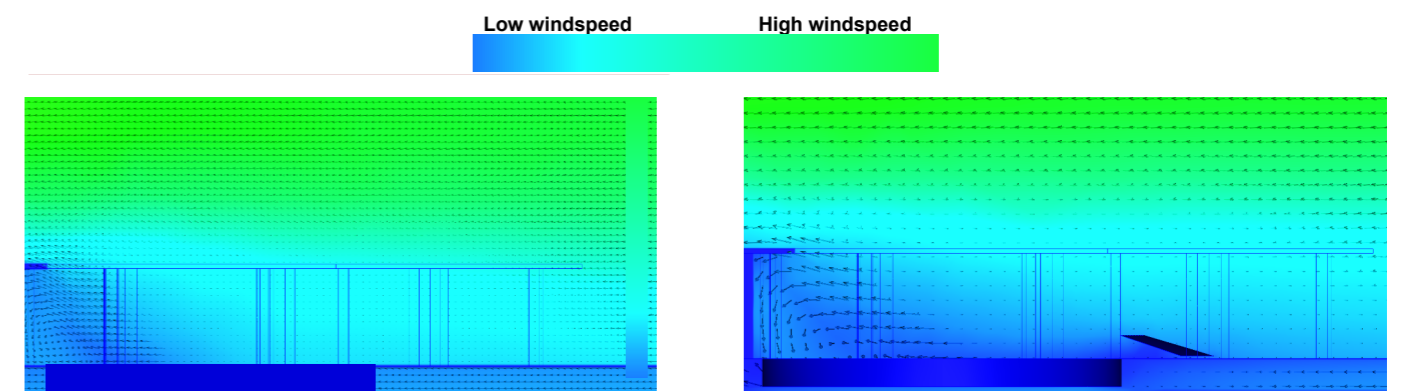


Fig. 4.2.6. Airflow simulation over waterreservoir without protection

Fig. 4.2.7. Airflow simulation over waterreservoir with protective elevation of 1.5m

4.2 Building

Both buildings are more closed on the south side. This side catches the most sun, which creates the highest possibility to warm up. The north side and inside of the buildings are more open, allowing daylight to enter. The roof also follows this methodology by being lower and having a bigger overhang on the south side, preventing sunrays to reach the façade. On the east- and westside. The roof comes up more, and is the overhang less big, allowing sunlight to enter during the intermediary and winter seasons, while still blocking it in the summer.

To create the layout of the walls, I used simulations to check for the best placement of the air guiding walls. What I looked for was a systematic approach that creates different kinds of airflow in and around the building. I chose the curved walls as a main walls to guide air, because they allow different options. When moved towards the outside, they catch more wind circling around the building. A higher velocity of wind is created on the inside, while the outside of the wall gets a lower windspeed.

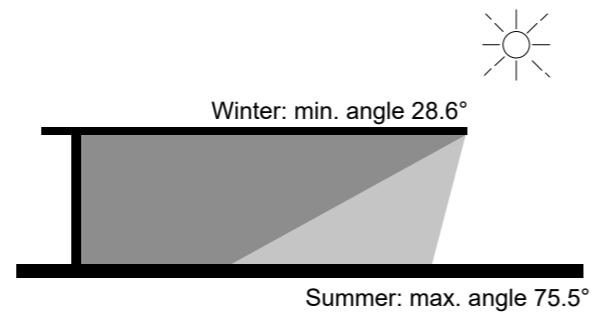


Fig. 4.2.9. Angle sun summer / winter

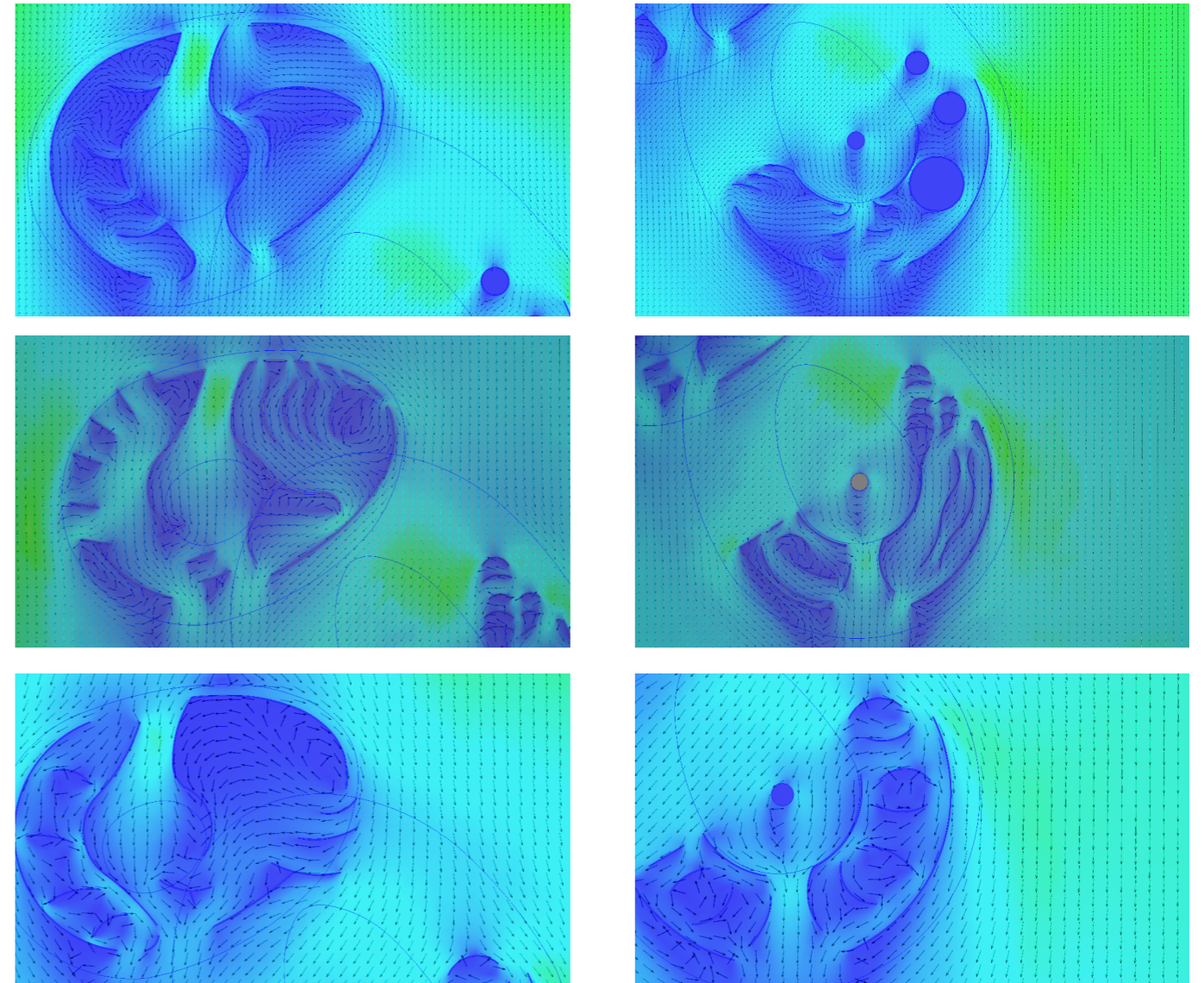


Fig. 4.2.8. Airflow simulation trying different types of walls and layouts

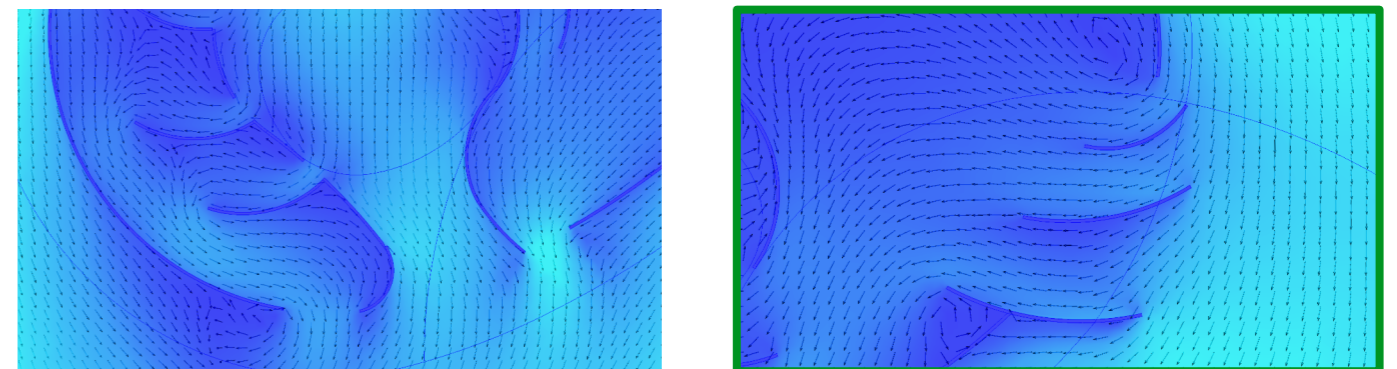


Fig. 4.2.9. Airflow simulation showing the possibilities to create different wind directions using curved walls

4.2 Building

The functions are arranged according to their specific spatial and environmental requirements. The educational spaces are located on the northern side of the building, allowing for large window openings and enhanced natural ventilation throughout the classrooms.

The auditorium is a closed space on the east side. Having a lot of thermal mass to prevent heating up during hours of use. The outer wall also functions as a important guider of air.

The café is focused on the courtyard of the first building. This space can be used during drier times when it is more busy with clients. It has a continues airflow cooling the space down and has a mix of sun and shade, depending if you are below the roof or not.

The second building houses the office and entertainment. It has the big reservoir that collects rainwater and visitors can use to cool down. In the basement there is maintenance and service to make sure that the water has the needed quality. The main floor contains the entrance and first aid station, while the other parts of the floor are reserved for recreational functions such as changing rooms, showers, toilets, places to sit, and play.

During summertime everything can be opened to create a cooling airflow. During wintertime the building is closed, to keep the colder temperatures outside. The sauna can be used, in combination with the water, and certain areas can be closed of to house occasional meetings or other temporary functions.

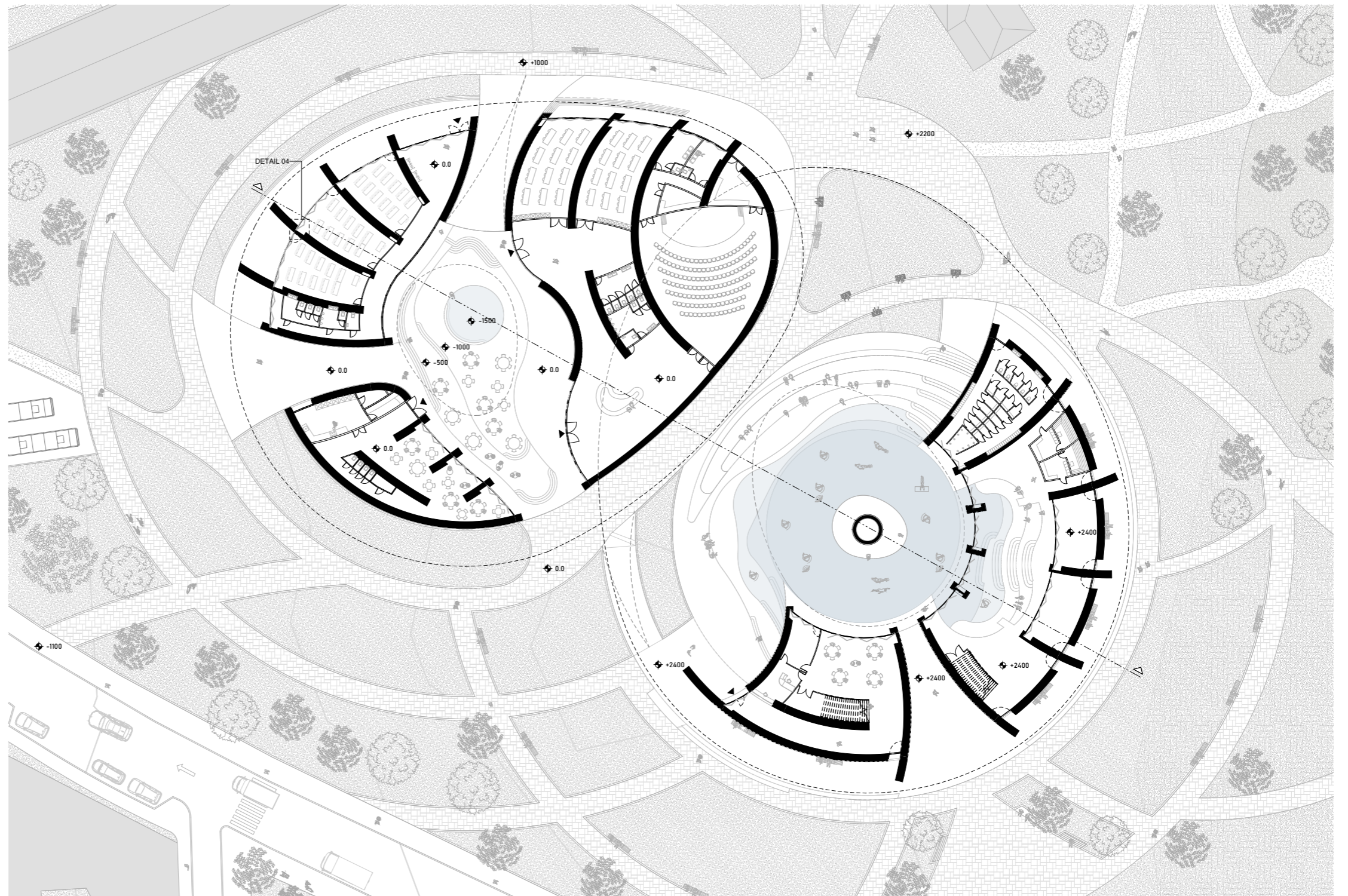


Fig. 4.2.10. Ground floor

4.2 Building

By constructing the curved walls from one-metre-thick concrete, significant thermal mass is introduced into the building. This increases thermal lag, as the walls are shielded from direct sunlight and have the opportunity to cool during the night, helping to stabilize indoor temperatures.

Inbetween the thermal mass are light façade structures in the form of closed walls, glass and retractable doors. The retractable doors can be opened fully, being detailed into the thick concrete, allowing wind to pass freely through the building.

The structure of the buildings consists of a continuous concrete footing, with concrete floors on top. The one meter thick walls form the structure of the top building, while the second building uses the central concrete chimney as a structural tower for the roof. Both roofs are made of glulam beams that span between an inner and outer ring

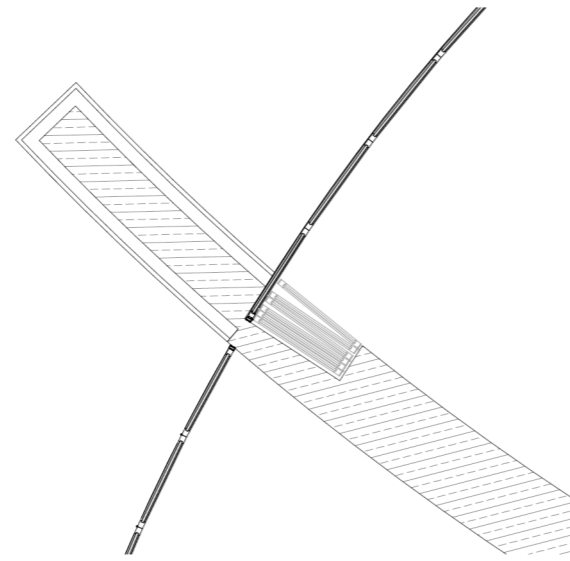


Fig. 4.2.11. Horizontal detail of retractable wall fitting into the concrete wall

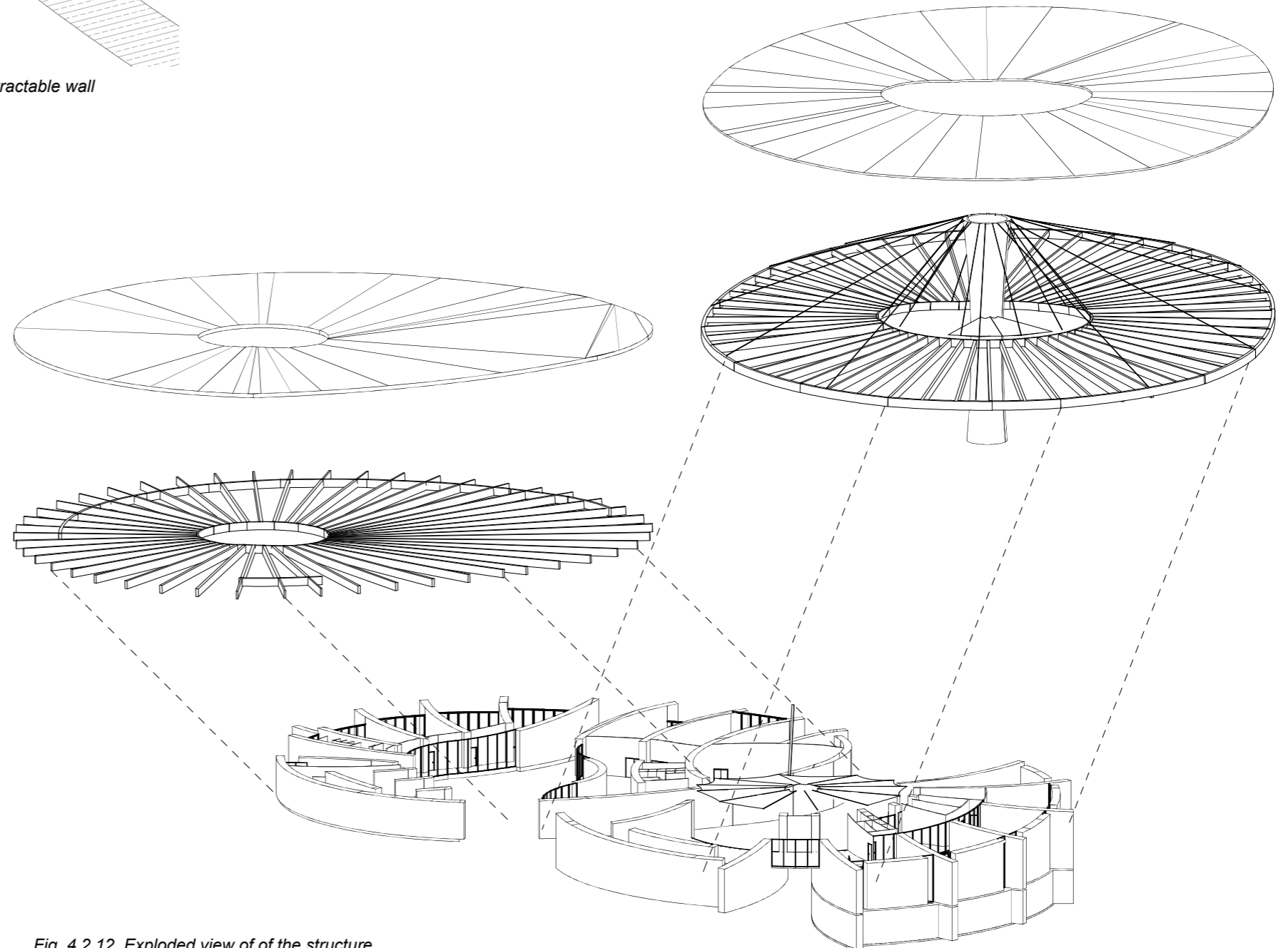


Fig. 4.2.12. Exploded view of of the structure

4.2 Building

The exterior walls of the building consists of a mix of glass and tiles. The tiled surfaces are easy to maintain in areas with significant water presence and feature a subtle gloss that reflects sunlight and shimmering water patterns, enhancing the visual connection to the landscape. The roof is finish with metal sheeting. Being exposed to the sun, this will heat up quickly to high temperatures, but also cool down quickly during the night. This material is also well suited for rainwater collection due to its fast runoff characteristics, effective debris shedding, and low risk of chemical leaching (Stormsaver, 2026).

The soffit is finished in wood, reinforcing the continuity between the interior wood aesthetic and the surrounding outdoor environment.



Fig. 4.2.13. Visualization of the exterior looking towards the classrooms



Fig. 4.2.14. Visualization of the overflow reservoir filled with water

5. Conclusion and discussion

5.1 Conclusion

The final design fulfils the ambitions that were established at the beginning of the project, although the outcome was sometimes different from what I had originally anticipated. My primary goal, to create a meaningful and engaging space within the city of Athens, has been achieved through the design of both the new masterplan and the building. The masterplan has evolved from a site-specific strategy into a broader methodology that could be applied throughout the city. This shift has strengthened the project's relevance beyond the immediate context and demonstrates its potential for wider implementation.

How do nature-based solutions create sustainable cooling spots in a park in Athens?

Nature-based solutions are not new to Athens. The city already hosts numerous initiatives that promote actions aimed at protecting, sustainably managing, and restoring natural ecosystems. Creating green spaces within the city is not the primary challenge; maintaining them in an environment that is often harsh for vegetation is.

The new park proposed in the masterplan is therefore not focused on maximizing the amount of flora, but on creating a resilient and future-proof landscape that depends as little as possible on human intervention. To achieve this, trees and vegetation are grouped into specific "Green Circles." These areas contain high-density planting, creating shaded and cooler microclimates within an otherwise hot urban environment.

The selection and placement of plant species are carefully adapted to local conditions, giving them the highest chance of survival. Drought-tolerant species are positioned along the outer edge of each Green Circle, where they act as a windbreak, reducing wind speeds and limiting evaporation. This protective layer helps shield the more sensitive vegetation located at the centre. The central zone contains species that improve soil quality, retain moisture more effectively, and produce leaf litter that forms a natural mulch layer, further reducing evaporation from the soil. Together, these measures create a more sustainable and self-sufficient park that provides shaded, cooler spaces for visitors while requiring minimal maintenance and resource input.

How can natural media create cool spaces in and around the building?

Natural media in this project consists of sun, shade, wind, water, and thermal mass. These elements work together to cool visitors and create the perception of a cooler environment.

Shade is used to block direct solar radiation, preventing surfaces and spaces from absorbing excess heat. By reducing solar gain, shaded areas remain more comfortable and can be used throughout the day, especially during warm periods.

Wind contributes to cooling in different ways. First, a continuous flow of air through spaces improves ventilation and provides fresh air. Second, moving air increases the evaporation of moisture from the skin, creating a cooling sensation. Wind also has a psychological effect, as people often associate breezes with freshness and lower temperatures.

Water enhances cooling through evaporation. Features such as fountains, misting elements, or shallow water surfaces can lower the surrounding air temperature while creating pleasant sensory experiences through sound, movement, and reflection.

Thermal mass helps regulate temperature by absorbing heat during warmer periods and releasing it slowly when temperatures decrease. Materials such as stone, concrete, or earth can therefore create stable and comfortable environments, particularly in shaded spaces.

Together, these natural media create a network of cool spaces in and around the building. By combining shade, airflow, water, and thermal mass, visitors experience both physical cooling and the perception of a cooler environment, making the building more comfortable and enjoyable during warm weather

How can the building create enjoyable places to cool down for all people that visit?

The building can create enjoyable places to cool down by integrating a variety of shaded, comfortable, and accessible spaces throughout the design. Rather than treating cooling as a purely technical function, the building can transform it into a social and sensory experience for all visitors.

Outdoor cooling areas can include trees, green roofs, planted courtyards, and shaded seating that reduce heat while providing attractive places to rest and gather. Water features such as misting elements, fountains, or shallow reflective pools can further improve thermal comfort and create a pleasant atmosphere.

By combining nature, shade, water, airflow, and social seating areas, the building becomes more than a refuge from heat, it becomes a welcoming destination where visitors can relax, interact, and enjoy the environment while staying comfortable.

5.2 Implication & recommendation

Its significance for the field of architecture lies in the shift from viewing thermal comfort as a technical requirement to understanding it as a design opportunity. The project shows how environmental performance and user experience can be combined, creating spaces that are both sustainable and enjoyable. Cooling is not hidden within building systems but becomes visible and experiential through spatial organization, material choices, and landscape design. Furthermore, the design highlights the importance of sensory experience in architecture. The perception of coolness is influenced not only by temperature but also by factors such as moving air, shade patterns, water, sound, and materiality. By engaging these elements, the project demonstrates how architecture can shape comfort through both physical and psychological means.

Accepting that there is no single perfect indoor temperature helps reduce reliance on energy-heavy cooling systems, especially during increasingly frequent heatwaves. Instead of strictly maintaining 19–26°C, short periods of higher temperatures can be tolerated through design.

Using natural media such as wind, shade, and thermal mass helps make spaces feel cooler by lowering perceived temperature rather than only the actual temperature. This shows how comfort can be achieved through environmental design instead of fully sealing buildings from their surroundings.

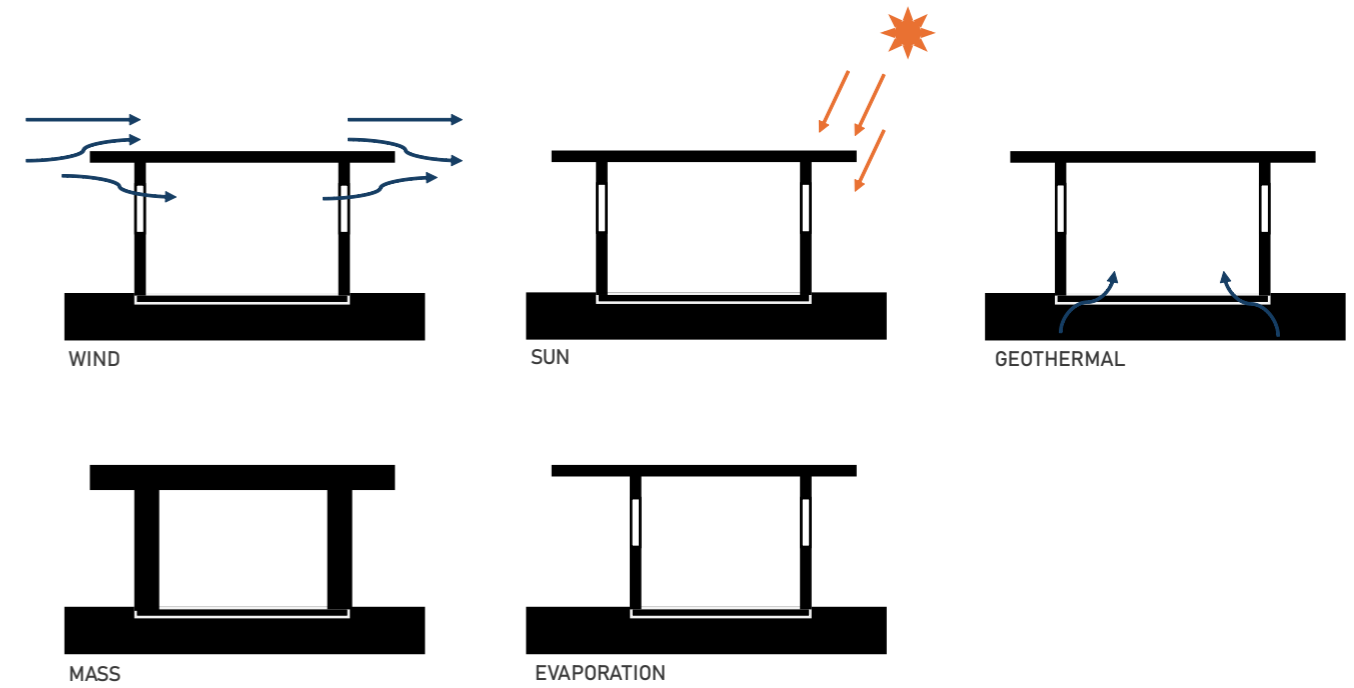


Fig. 5.2.1. Natural media in graphs

5.3 Reflection

The process of creating a design in a completely different climate has been more of a challenge than I originally anticipated. Finding usable data, drawings, and sources proved harder than expected. The lack of information, combined with the language barrier, made it difficult to conduct a good analysis of the location. The fact that this site was located just outside certain research areas commonly used in Athens, combined with the secrecy of it, did not make the analysis any easier. Certain aspects of this process could have been improved, particularly by making better use of AI-assisted searches for Greek sources, as these proved very helpful during the later stages of the project.

The design concept has evolved significantly A1 to A3. In the beginning I was focussed primarily on the use of nature and the connection humans have with it. Transitioning towards natural media was an important step in developing a more architecturally elaborate concept. Although this transition required additional time, the design process is rarely a straight path to the final result, I believe it contributed positively to the overall development and comprehension of the concept. Understanding nature within the city, as well as our role and position within nature, has given me a different perspective on the way I wanted to approach this design. The combination of nature-based solutions at the masterplan scale and natural media within the architectural design proved to be a successful and complementary approach.

Making the small maquettes during the first weeks as part of the design bootcamp was an enjoyable experience. Creating models for one another helped generate inspiration and encouraged the exchange of ideas between projects. After those initial weeks, feedback from classmates became an important part of the design development process. Different perspectives provided new insights and were particularly valuable when I felt stuck. Giving feedback to others was equally insightful. Taking a step away from my own design and brainstorming with fellow students offered a welcome change of focus and often helped me view my own project from a different perspective.

There was a lot of focus on the development of the masterplan during the early months of the project. The site contains the weapons factory that will largely be demolished. This meant a lot of new space has to be filled in. From the beginning this was known, but the projected extensiveness of the masterplan was limited. I reserved a few weeks for the development of the masterplan, before progressing to the building design. However the masterplan took more time than anticipated, and had to be revised multiple times. This pushed back my progress on the building design, as time had to be invested in the development of the site. The final masterplan came out more detailed than I had expected and has a strong link to the concept. This did however take away worktime from the architectural design, the main part of the project.

The use of the wind simulations was a good step towards the complete design. I helped a lot to have something to fall back on when choices had to be made regarding placement of walls or other design decisions. The combination of digital modelling, quick sketching and the digital simulations worked well to quickly produce variations. The order: model, simulate, sketch, model, simulate, decide, made it very clear to me what I was doing and also gave a great overview. The advantage of doing it digitally, making it easy scalable and adaptable in my central design, definitely helped improving the efficiency. A learning point was the preparation of the simulation models, and the visualization of the simulation results. In the begin I tried to simulate models with too much objects, resulting in long waiting times before the simulation was finished. The solution that I took for this was splitting the model into smaller parts, and not running the whole site through the simulation. These simulations are supposed to be quick, to make a decision on and continue, so splitting it into elements of the design helped achieving this. The second thing is the visualization. The results of the first visualizations were hard to read if there is not context. I could have started by creating a understandable end image, which I would use during the rest of the project.

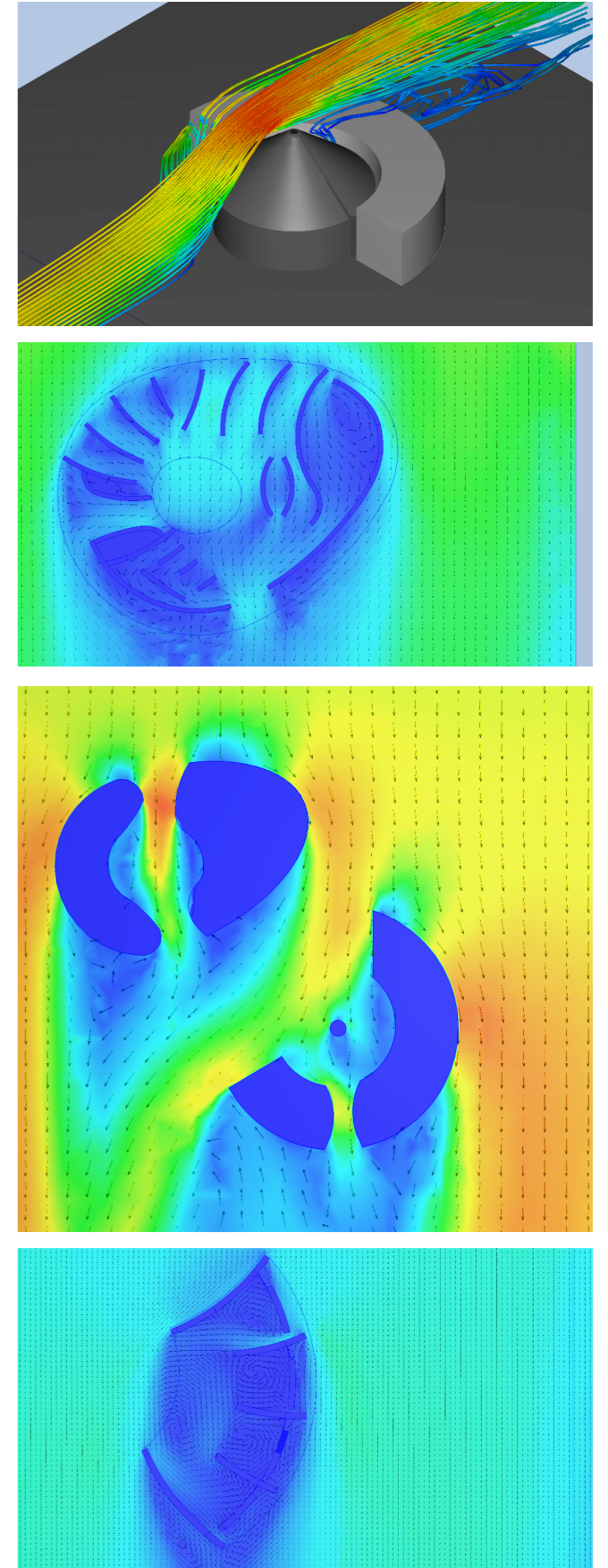


Fig. 5.3.1. Different visualization styles of wind simulations

6. Acknowledgements

I would like to express my gratitude to my two supervisors that helped me guide through this project. Their input and feedback helped to overcome challenges that I found on the way to my final design. Furthermore I would like to thank the other students of the Radical Institutions graduation studio. They have not only been a support for the progress of my project, but also mental support during the more difficult moments.

And finally I would like to thank my family and girlfriend for keeping up with me when I was not that "gezellig".

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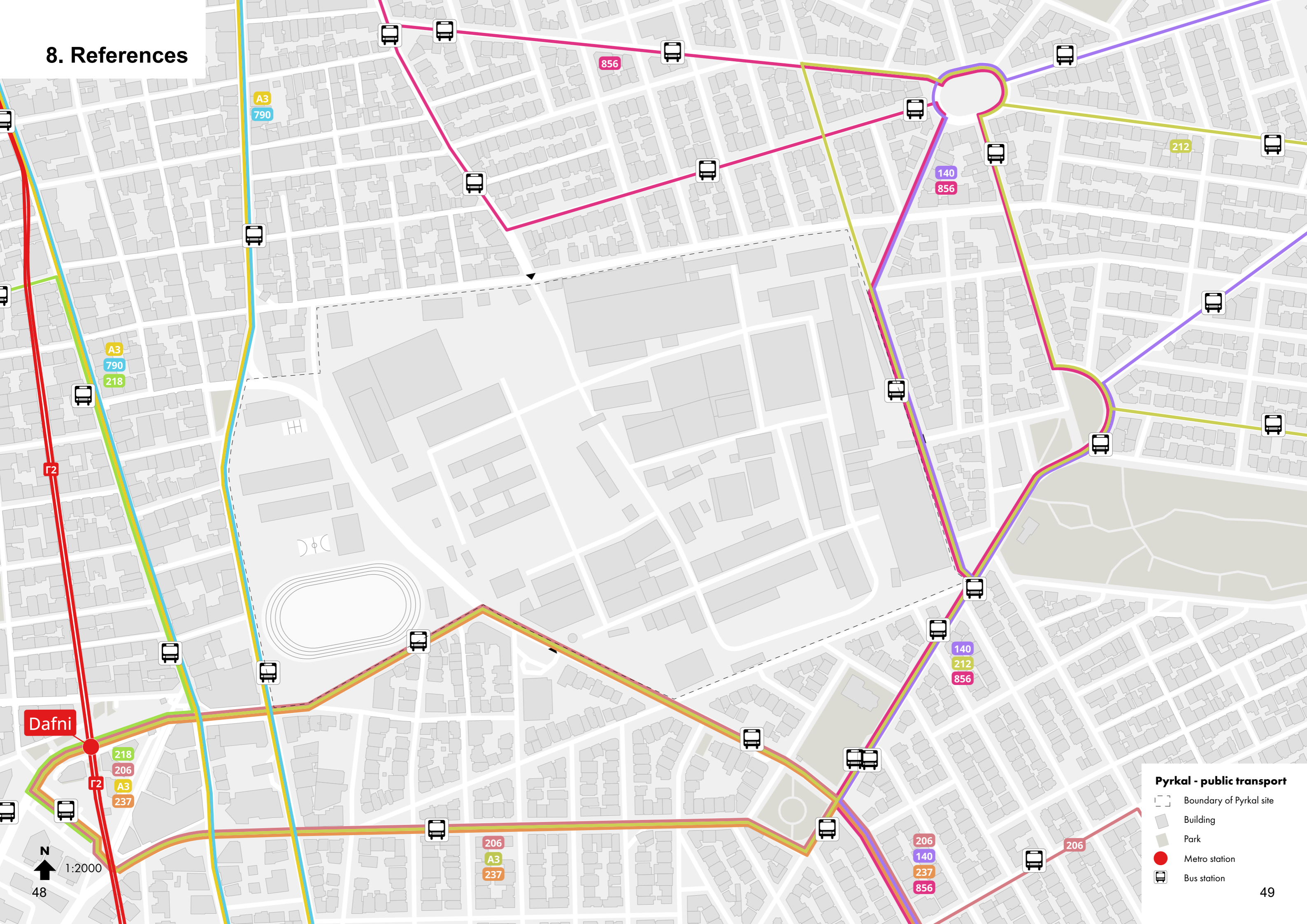
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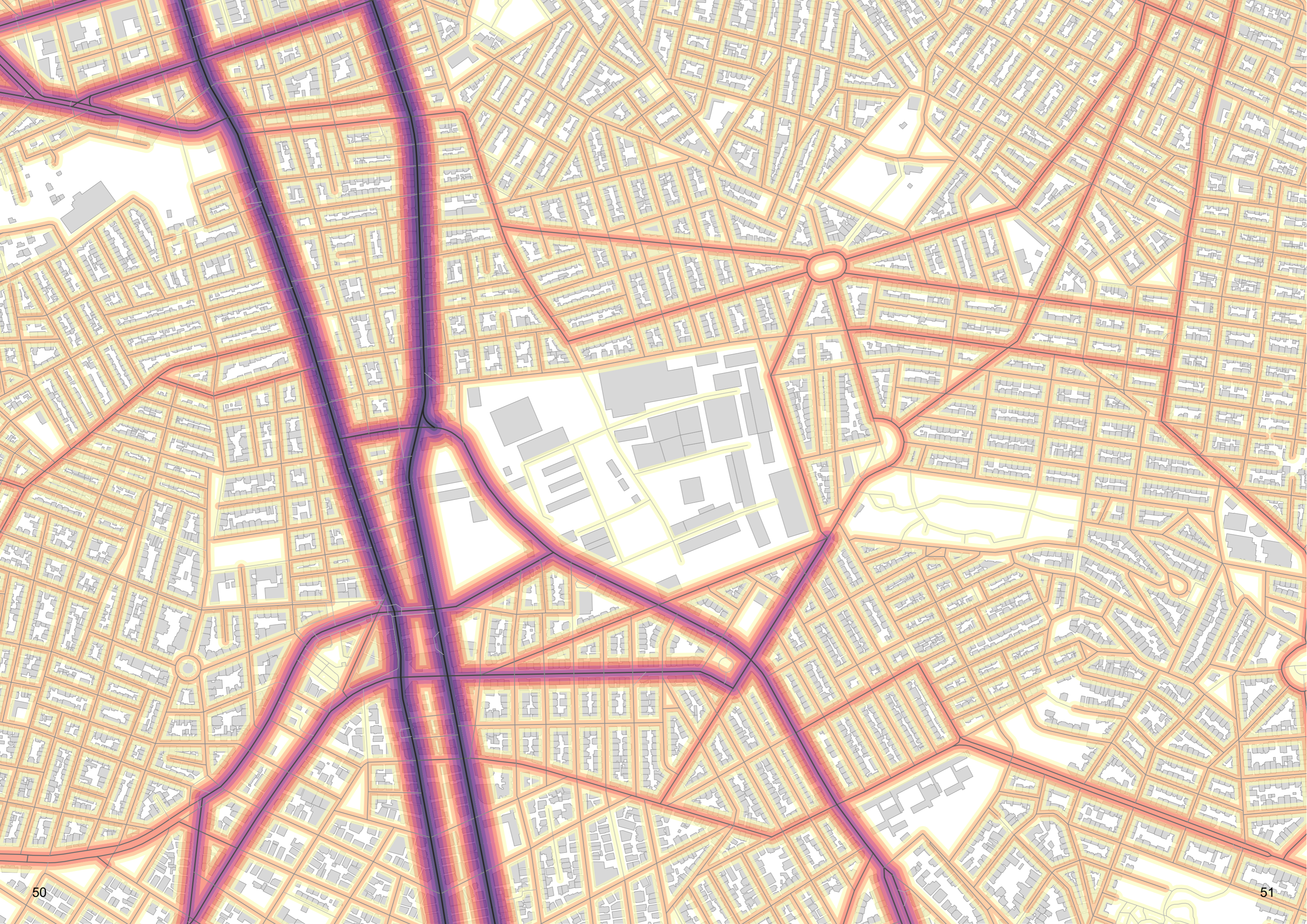
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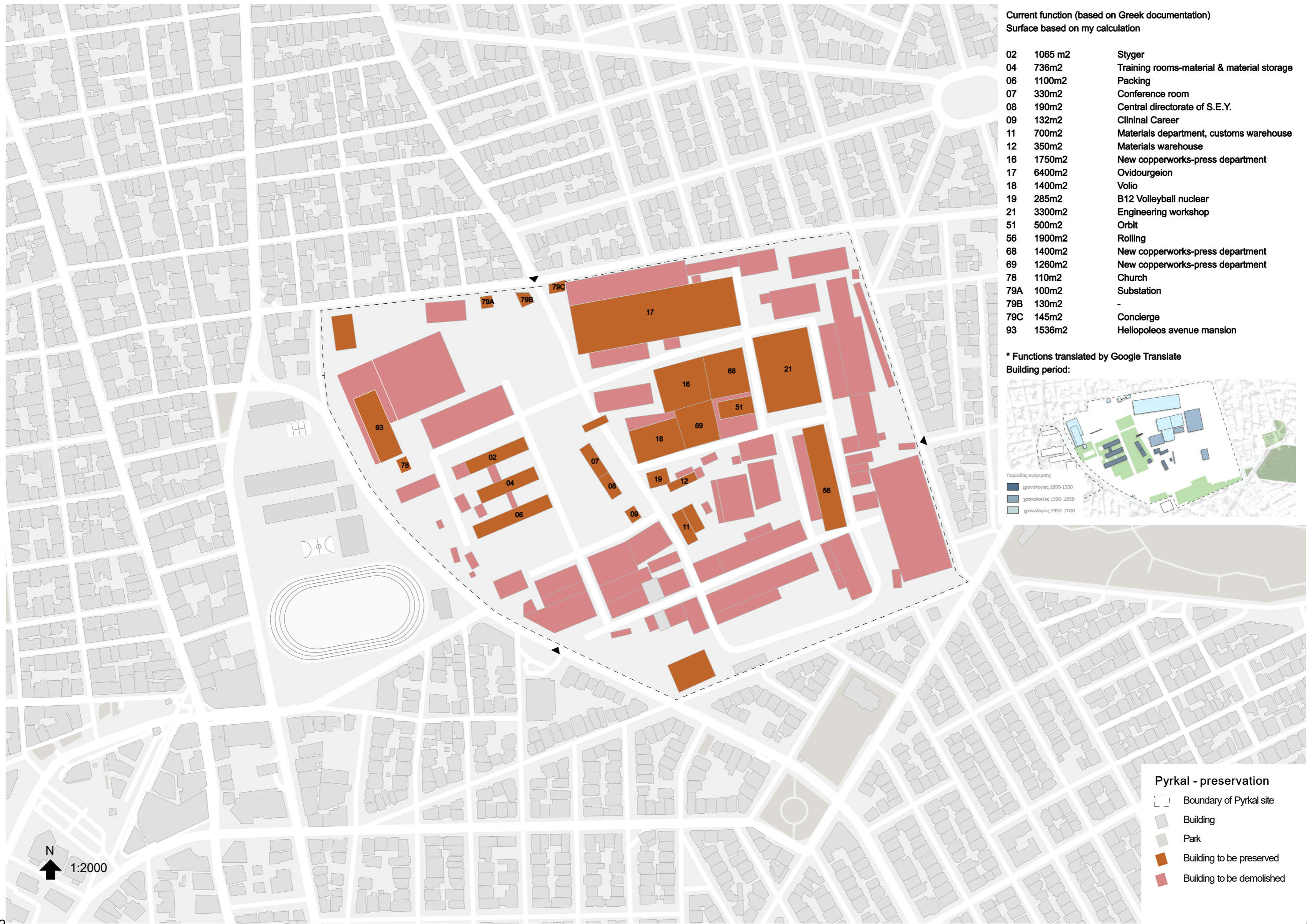
8. References



Pyrkal - public transport

- Boundary of Pyrkal site
- Building
- Park
- Metro station
- Bus station





Current function (based on Greek documentation)
Surface based on my calculation

02	1065 m2	Styger
04	736m2	Training rooms-material & material storage
06	1100m2	Packing
07	330m2	Conference room
08	190m2	Central directorate of S.E.Y.
09	132m2	Clininal Career
11	700m2	Materials department, customs warehouse
12	350m2	Materials warehouse
16	1750m2	New copperworks-press department
17	6400m2	Ovidourgeion
18	1400m2	Volio
19	285m2	B12 Volleyball nuclear
21	3300m2	Engineering workshop
51	500m2	Orbit
56	1900m2	Rolling
68	1400m2	New copperworks-press department
69	1260m2	New copperworks-press department
78	110m2	Church
79A	100m2	Substation
79B	130m2	-
79C	145m2	Concierge
93	1536m2	Heliopoleos avenue mansion

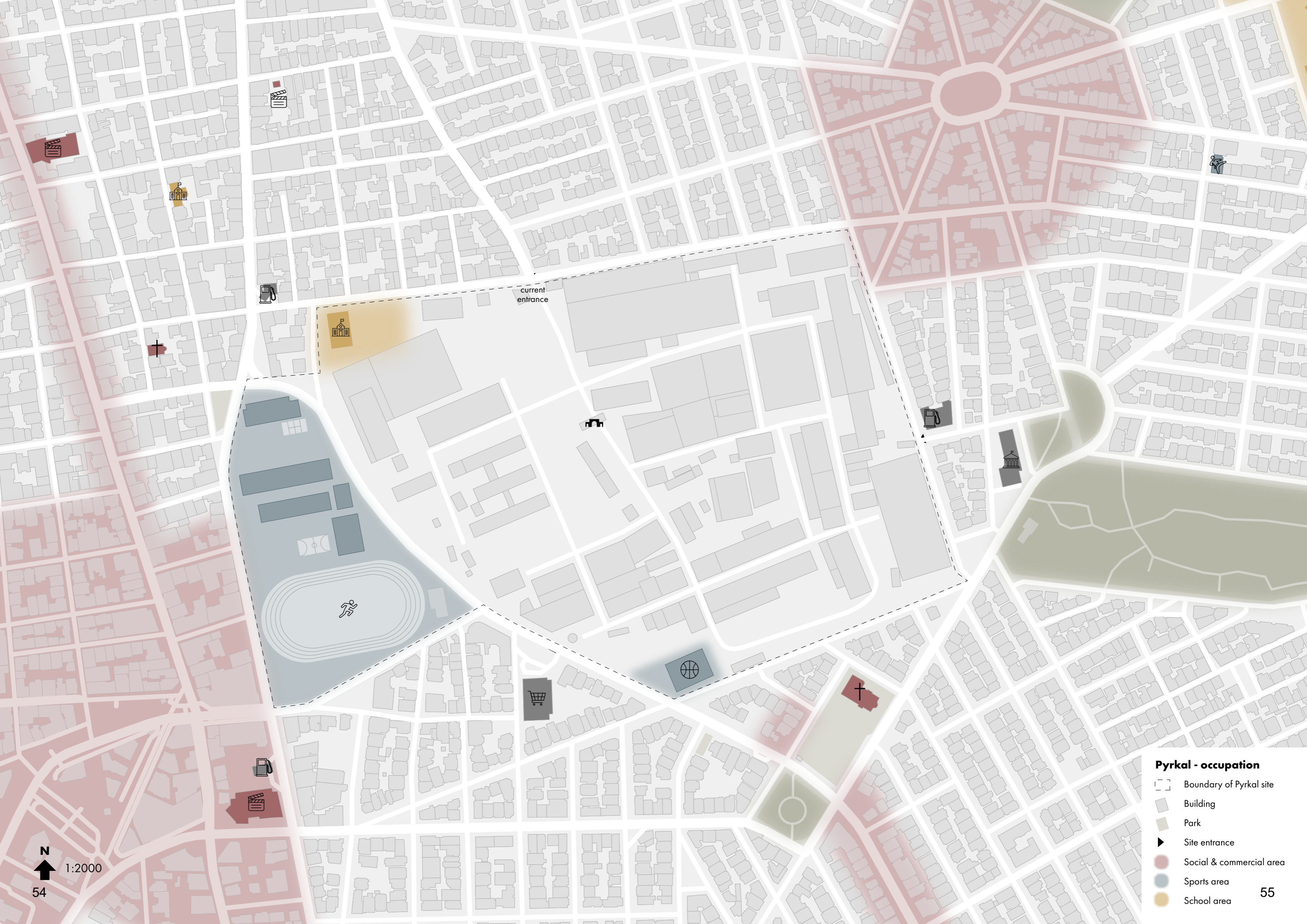
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Building period:










Pyrkal - preservation

- Boundary of Pyrkal site
- Building
- Park
- Building to be preserved
- Building to be demolished

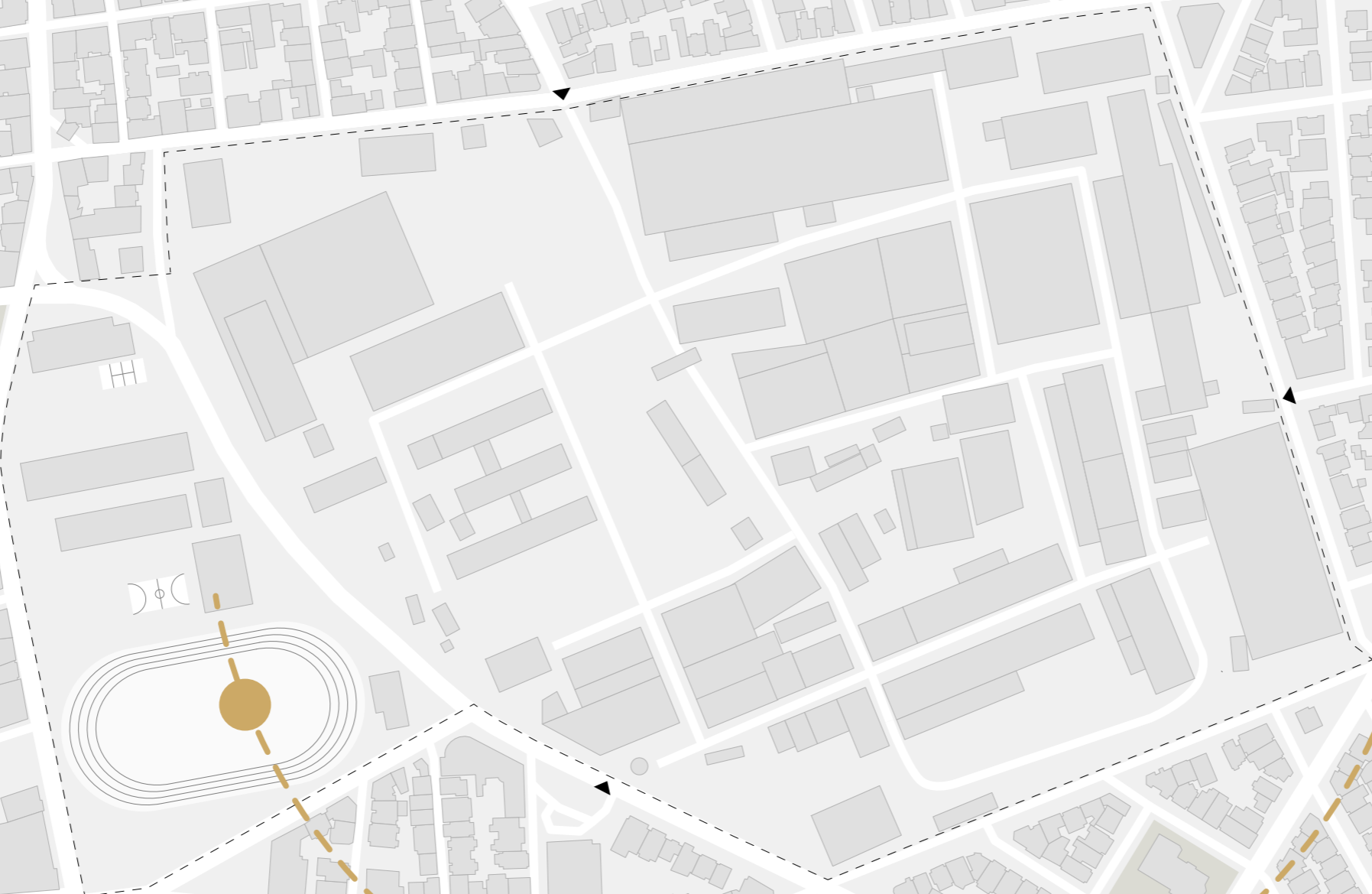
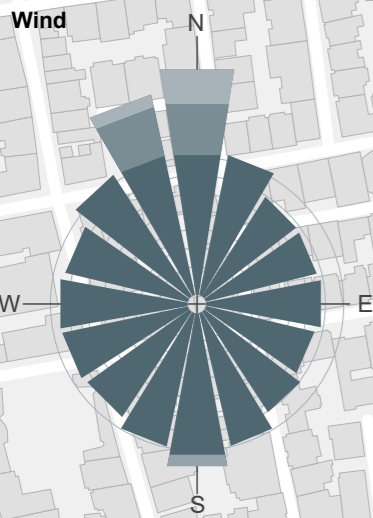
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current entrance




- Pyrkal - occupation**
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 -  Park
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 -  Social & commercial area
 -  Sports area
 -  School area

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Summer

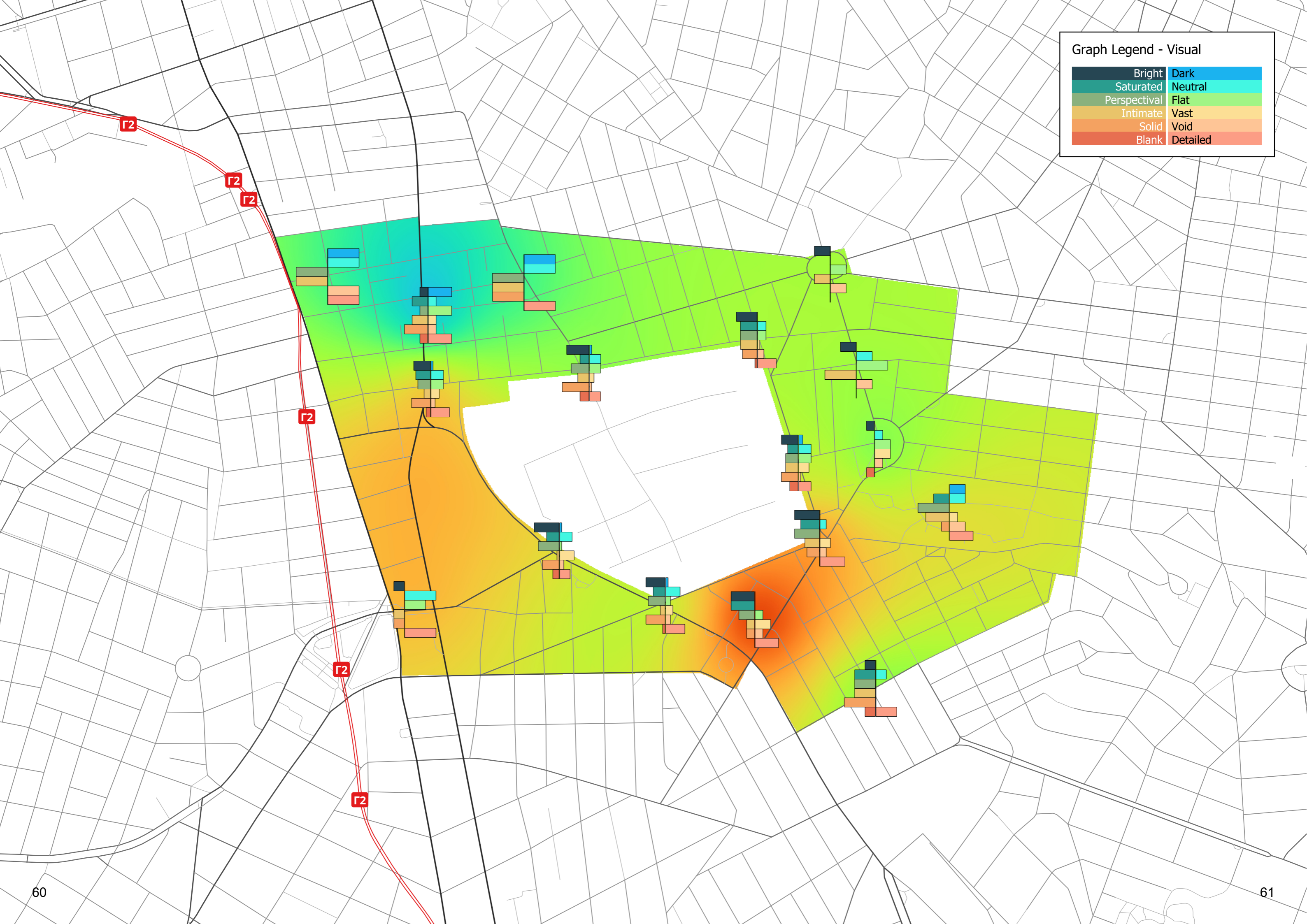
Winter

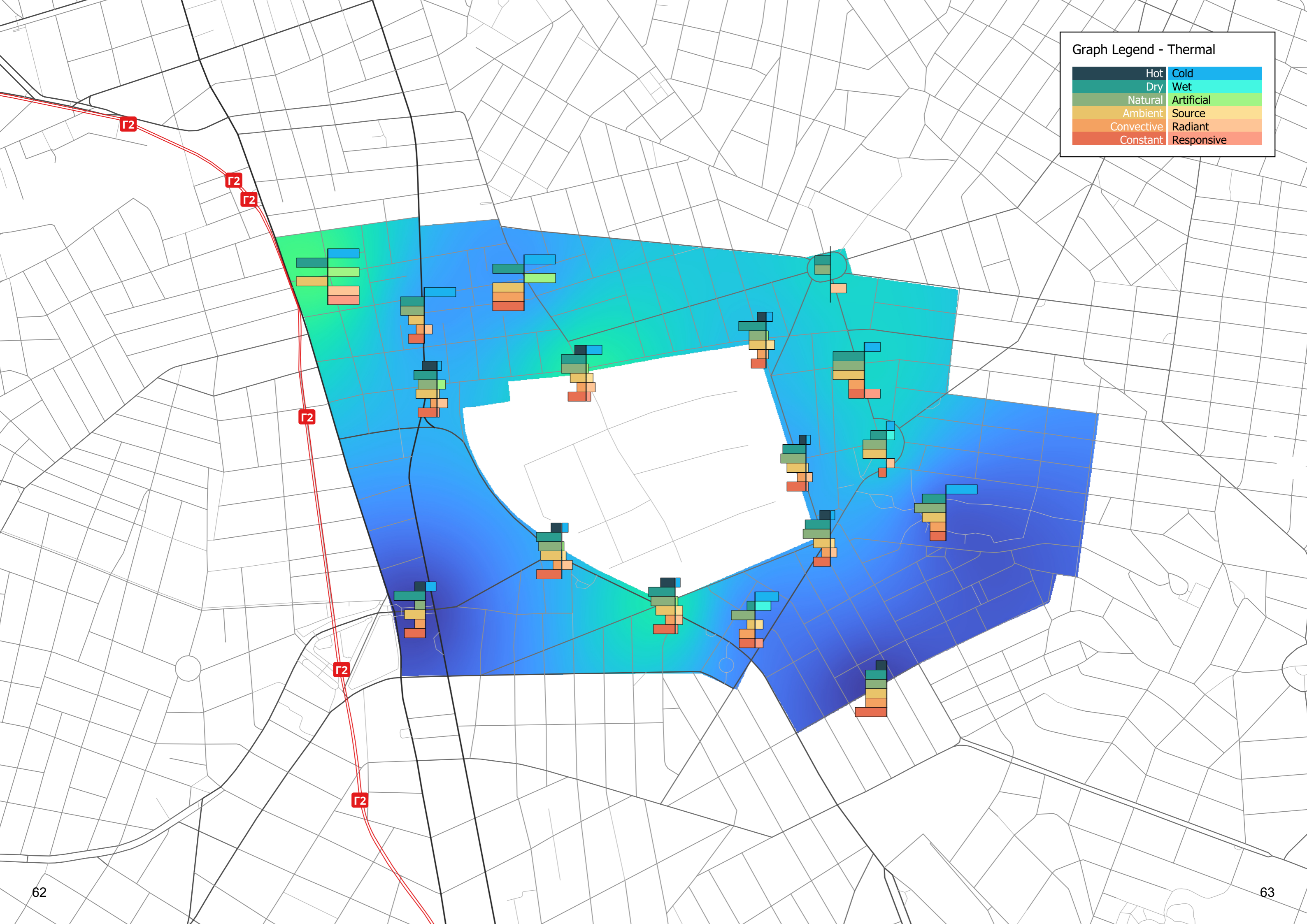
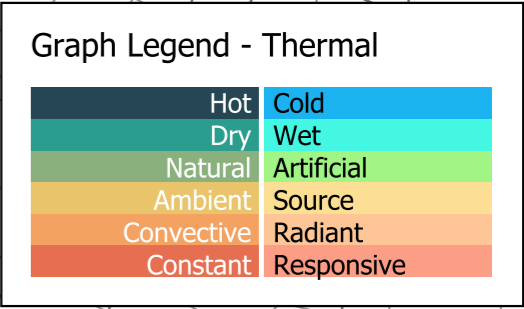
- Pyrkal - climate**
-  Boundary of Pyrkal site
 -  Building
 -  Park

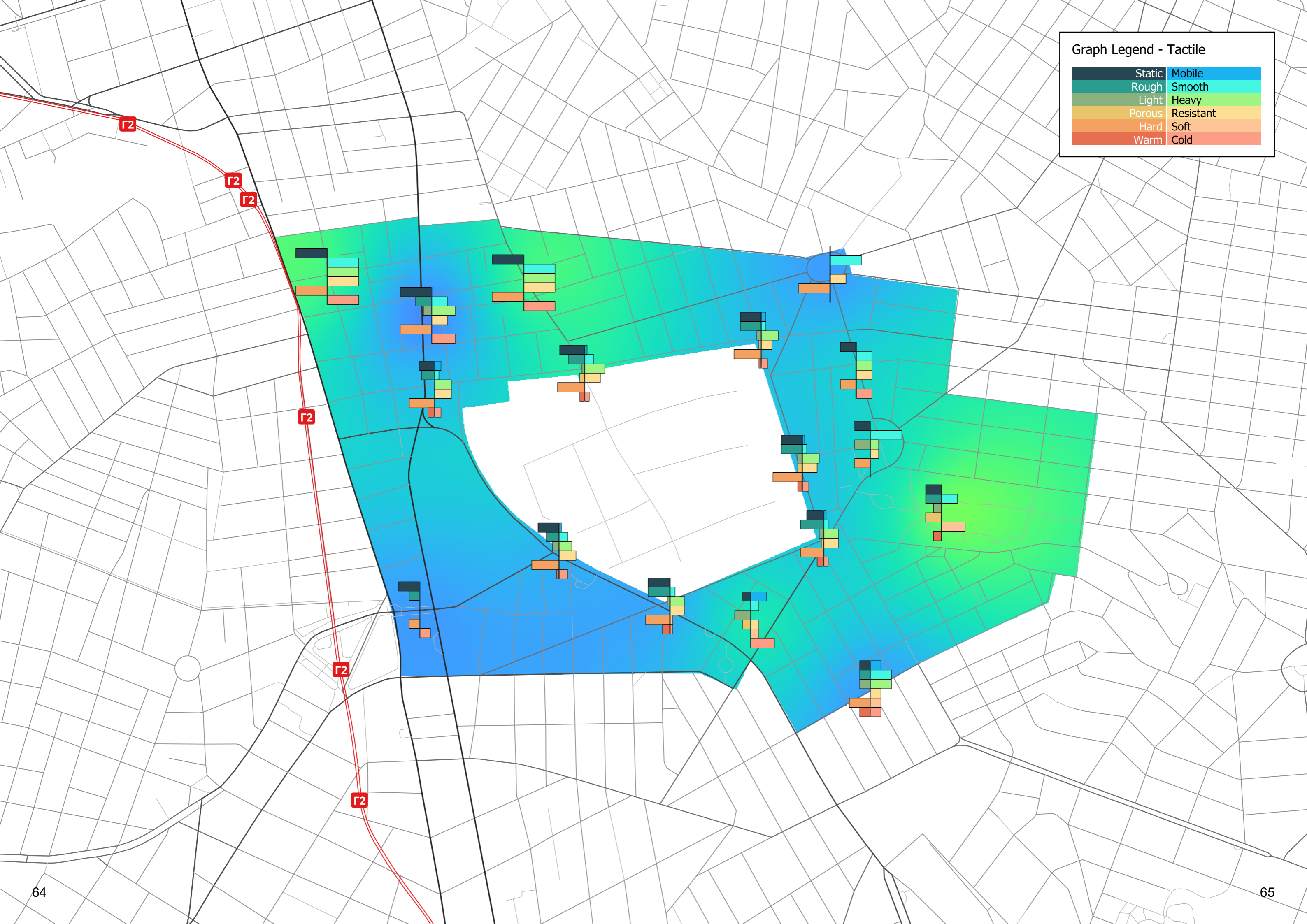


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Saturated	Neutral
Perspectival	Flat
Intimate	Vast
Solid	Void
Blank	Detailed

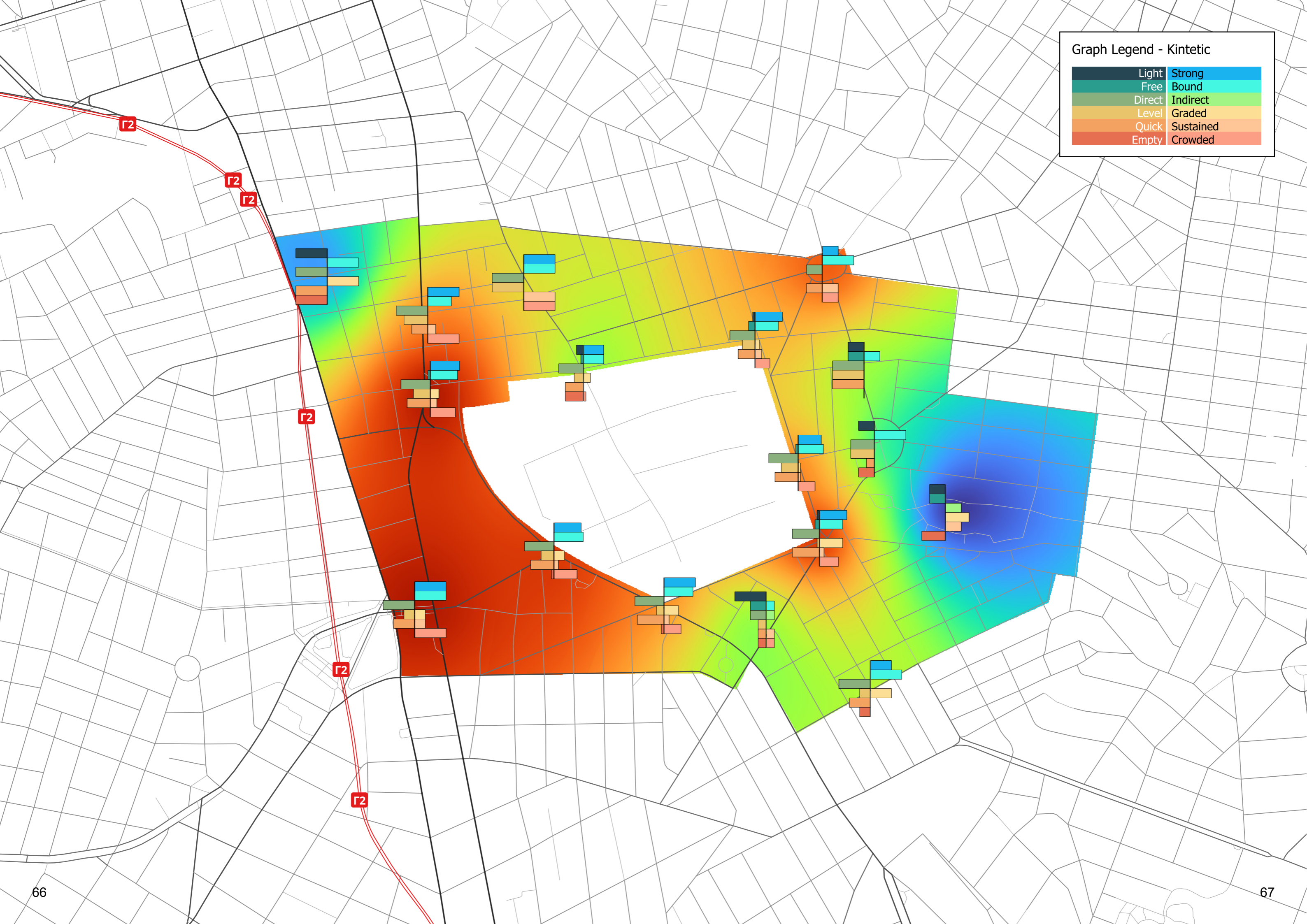


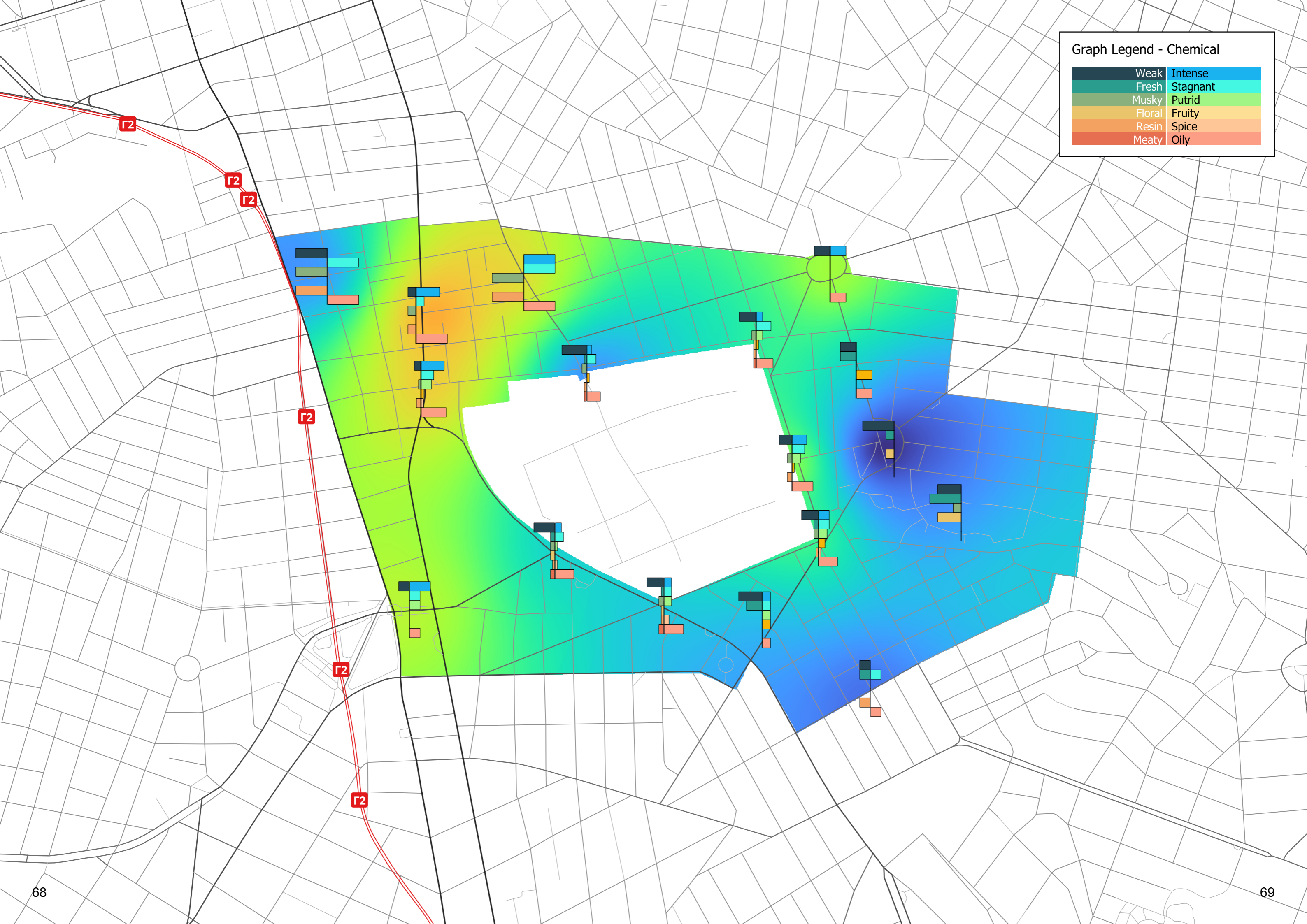
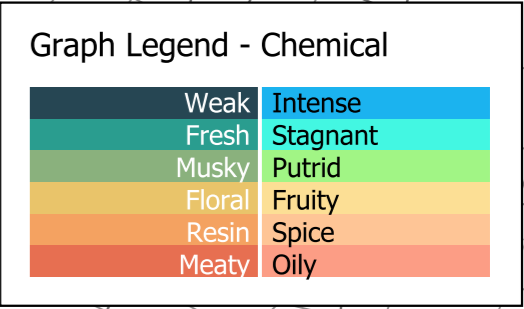




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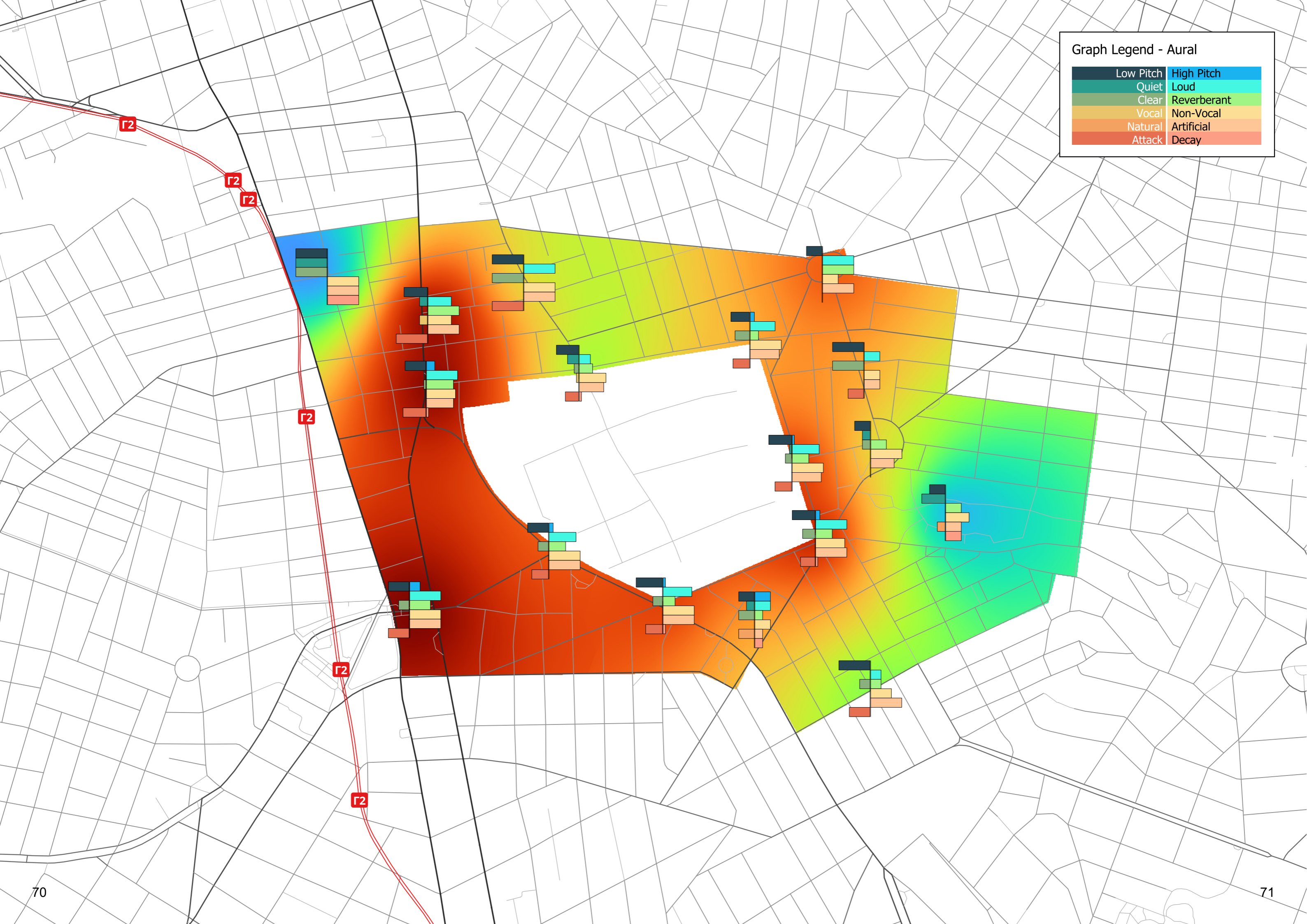
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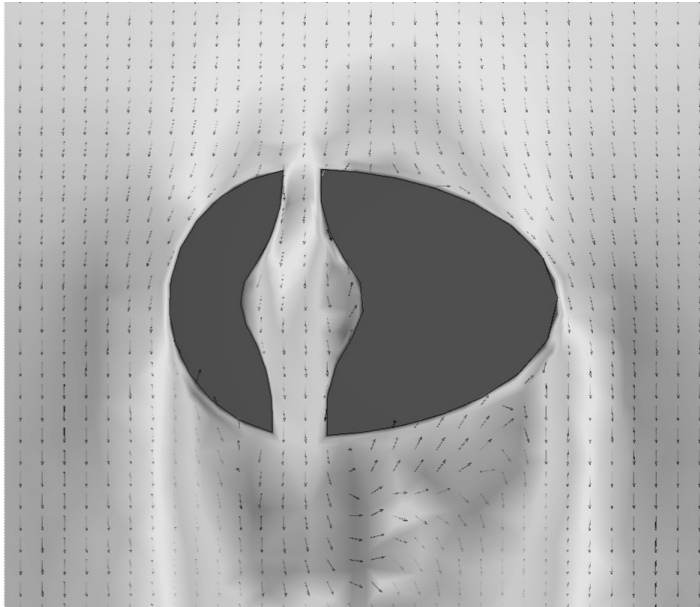
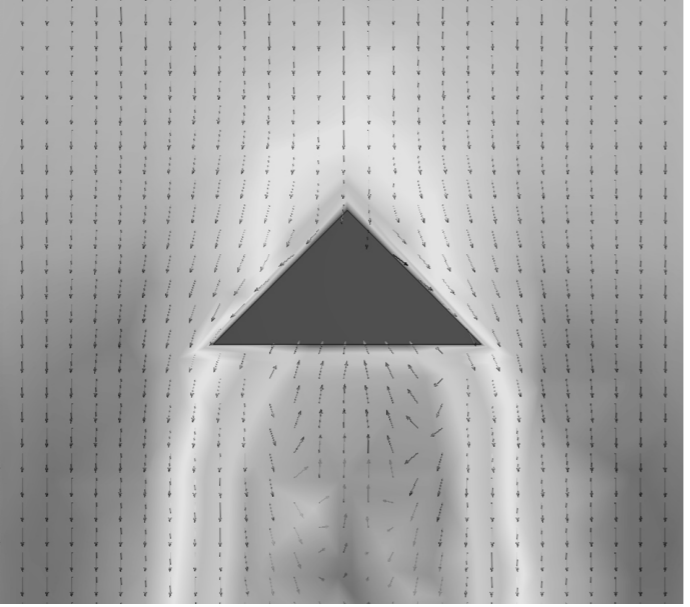
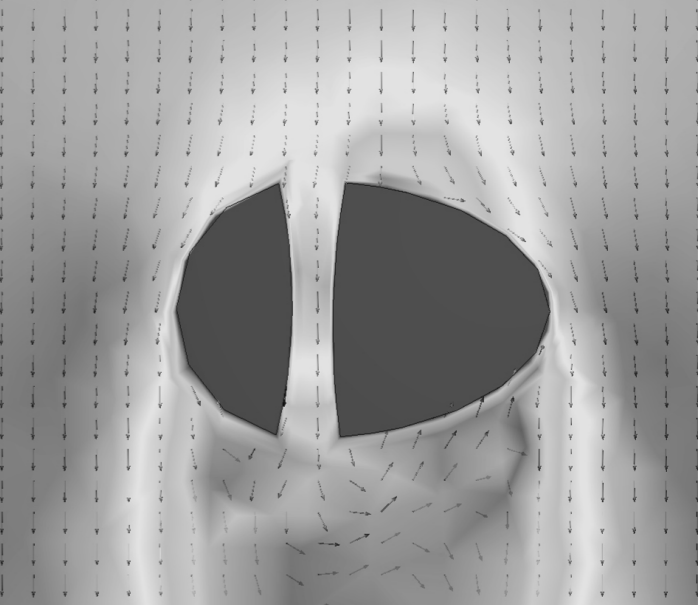
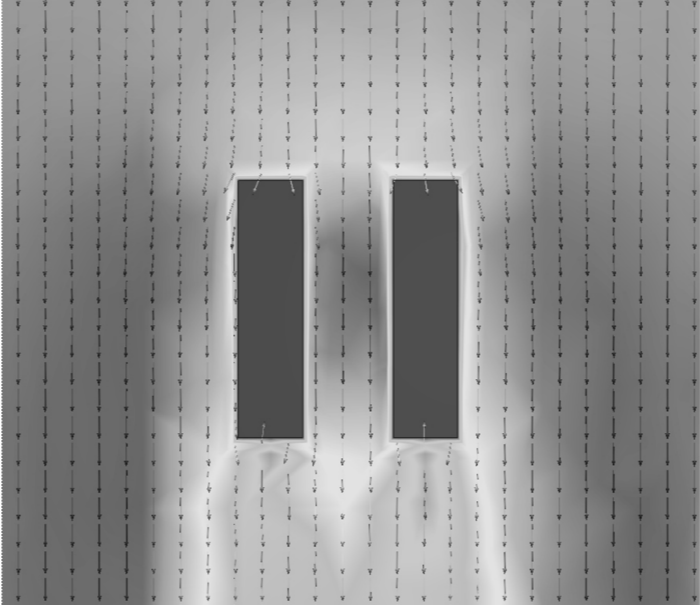
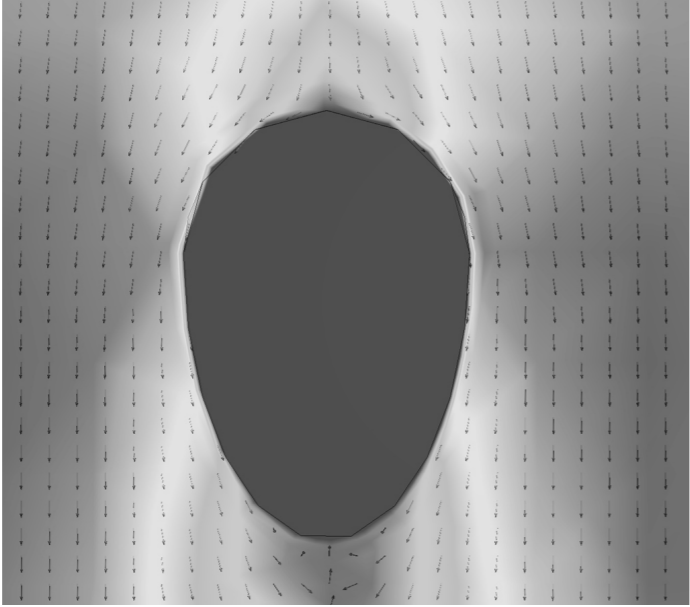
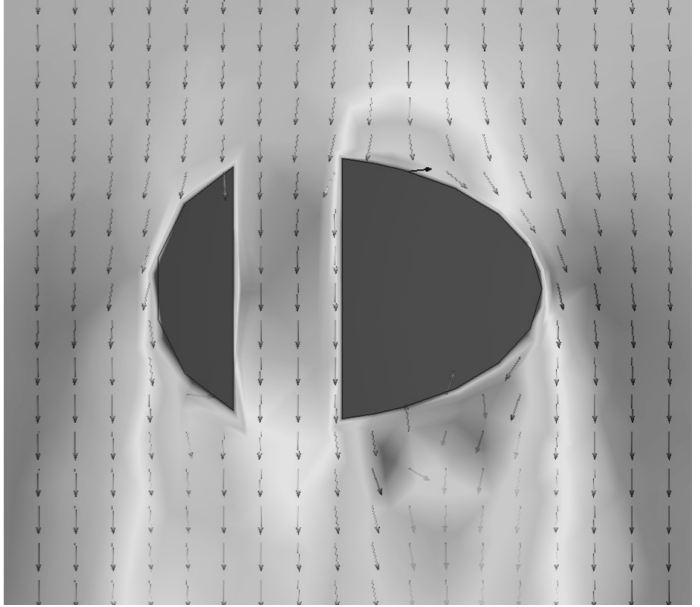
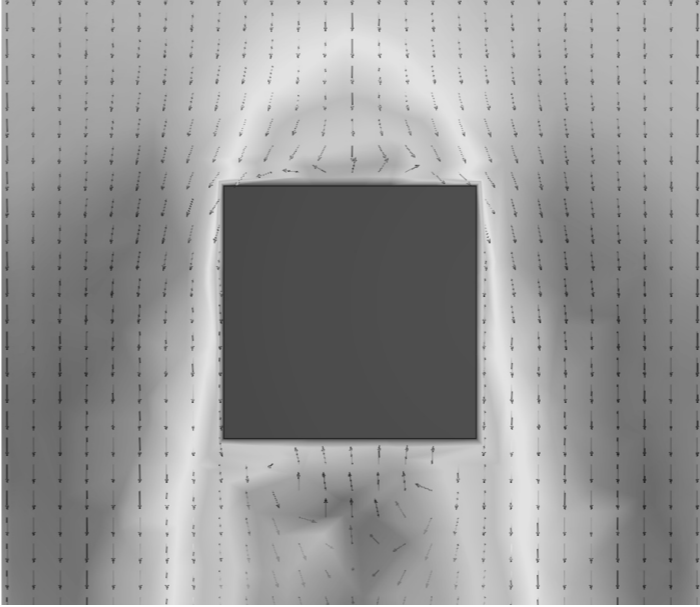
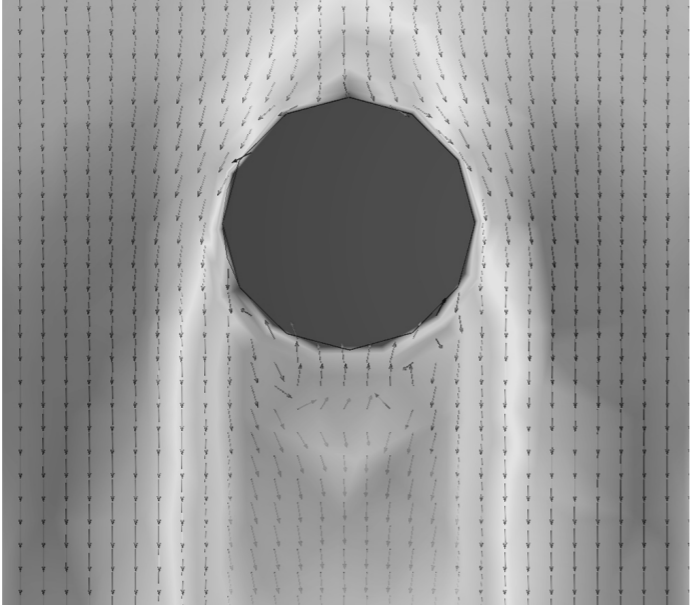


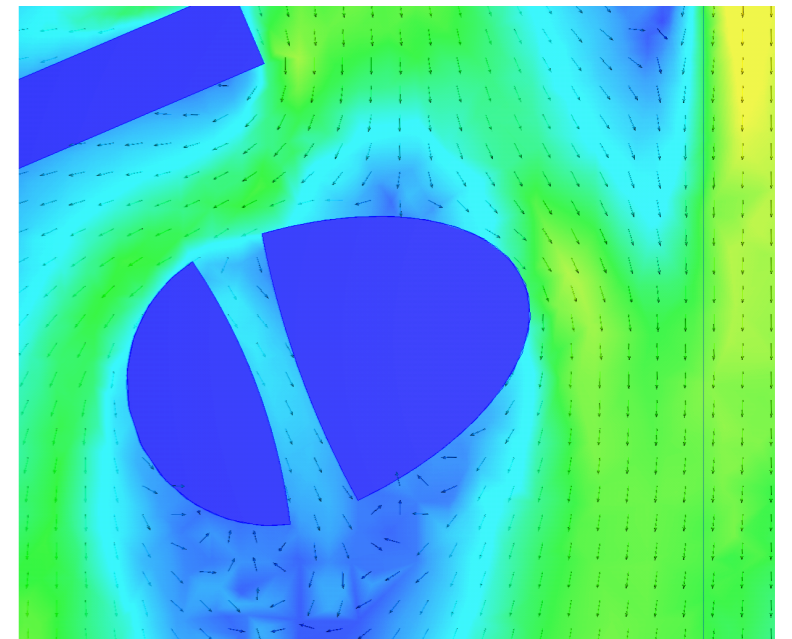
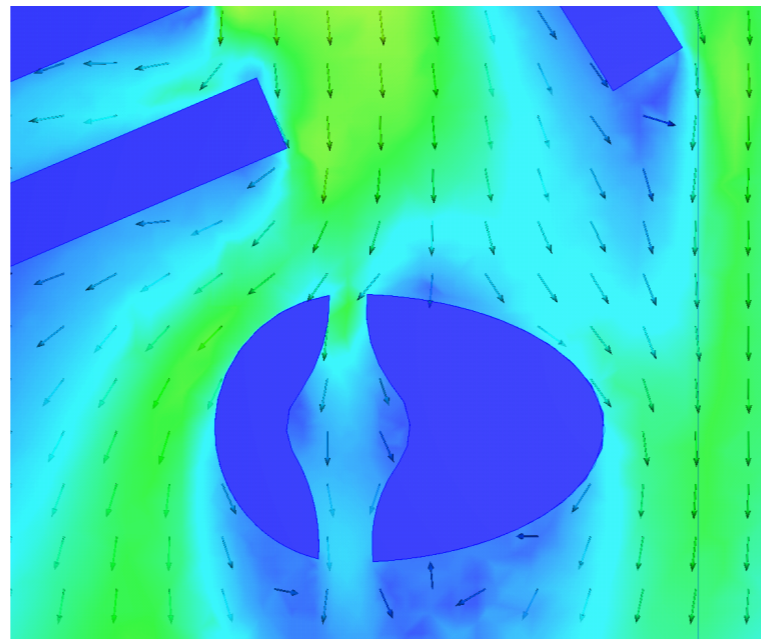
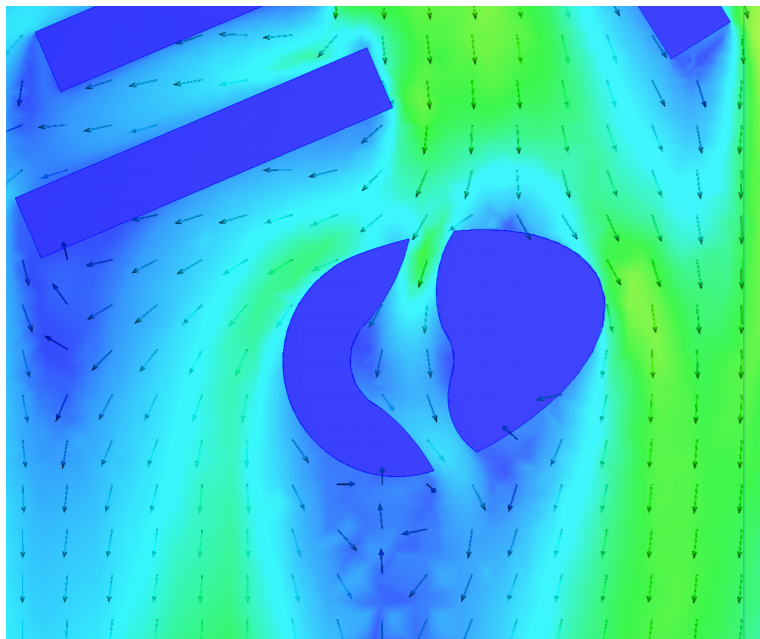
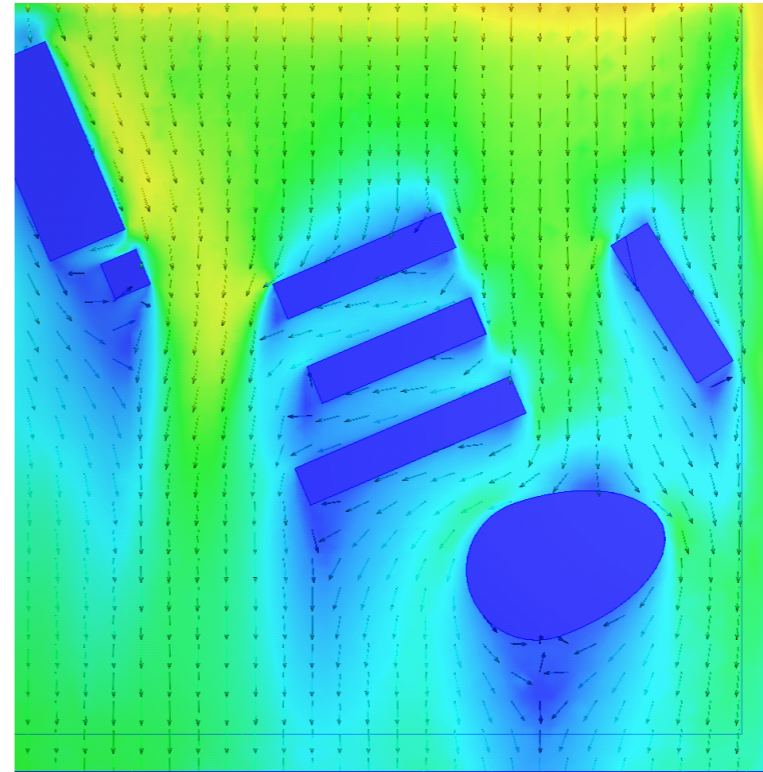
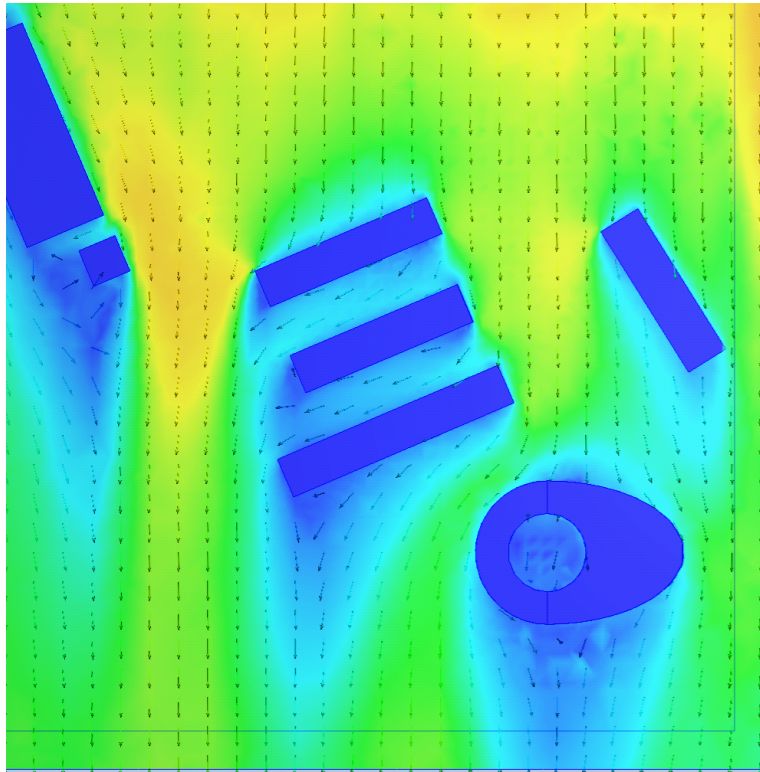
Graph Legend - Aural

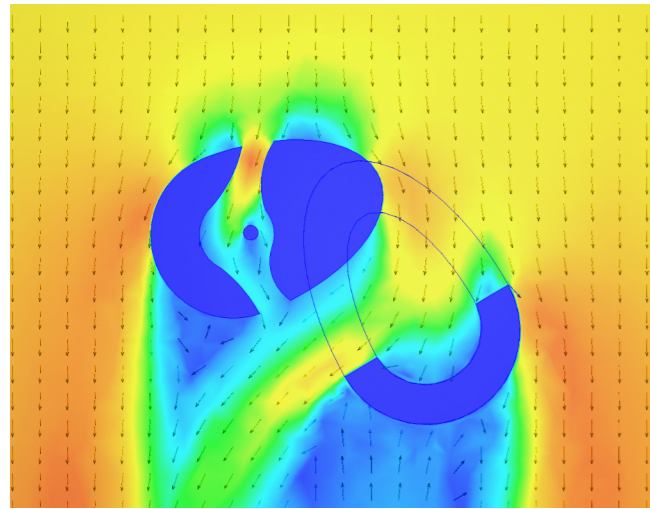
Low Pitch	High Pitch
Quiet	Loud
Clear	Reverberant
Vocal	Non-Vocal
Natural	Artificial
Attack	Decay



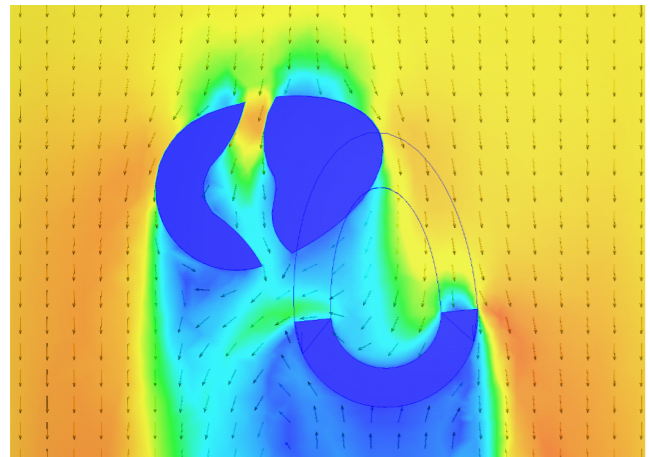
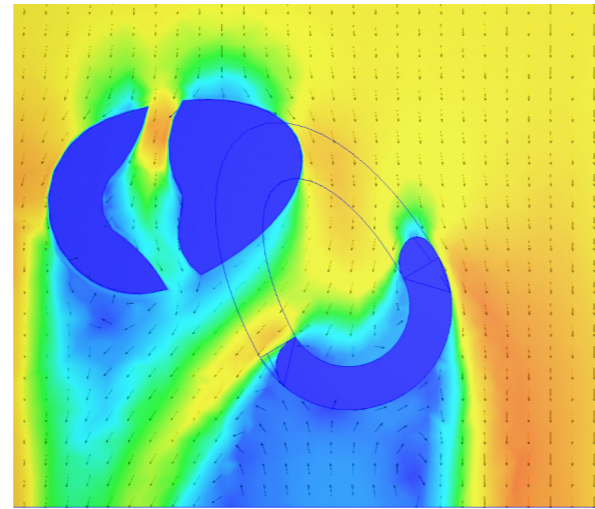
Wind simulation



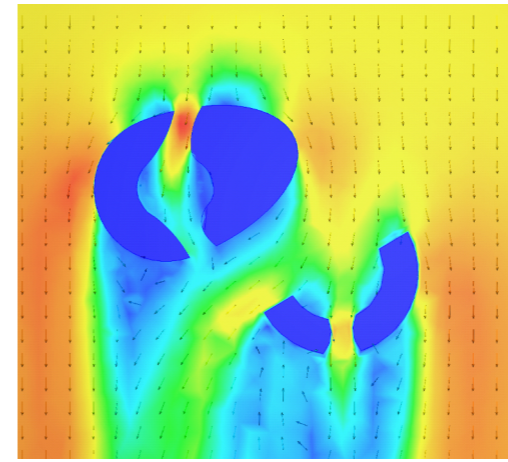




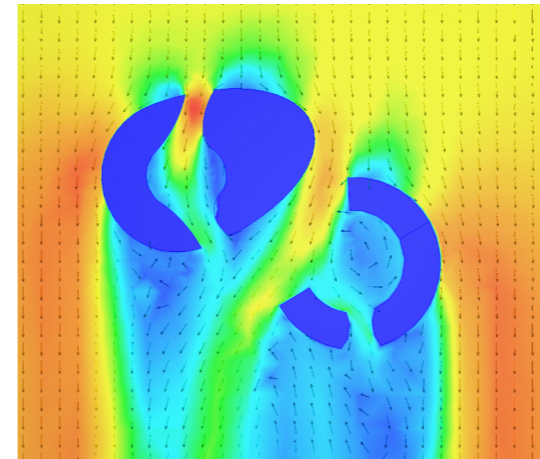
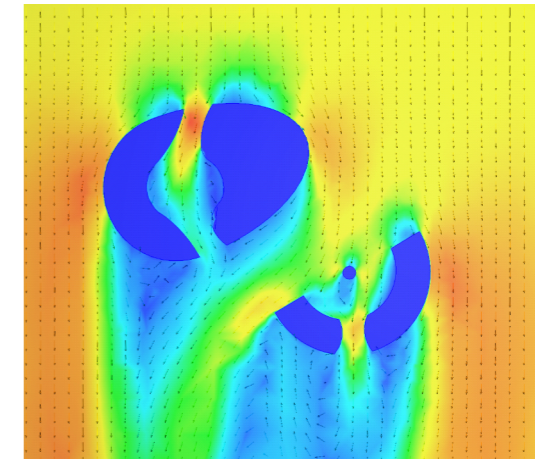
Bent edge allows air to curve more around the building, preventing turbulence



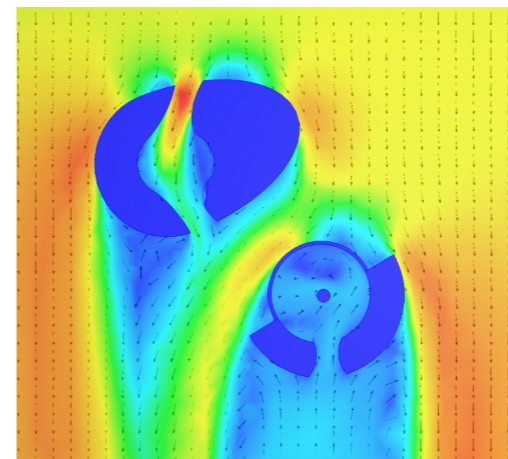
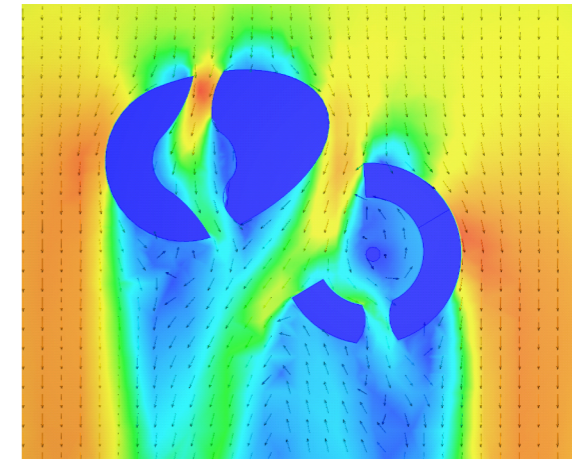
Second volume only creates airflow inbetween both volumes, when placed a certain amount into the airflow



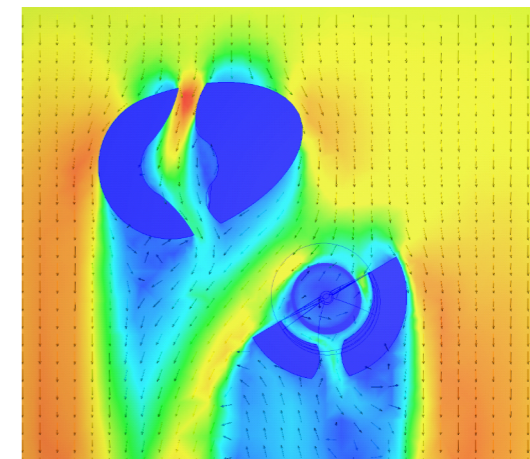
The opening in the second volume creates a new strong flow of wind. Placing a vertical volume, pushes this flow of air more to the sides where there used to be less wind

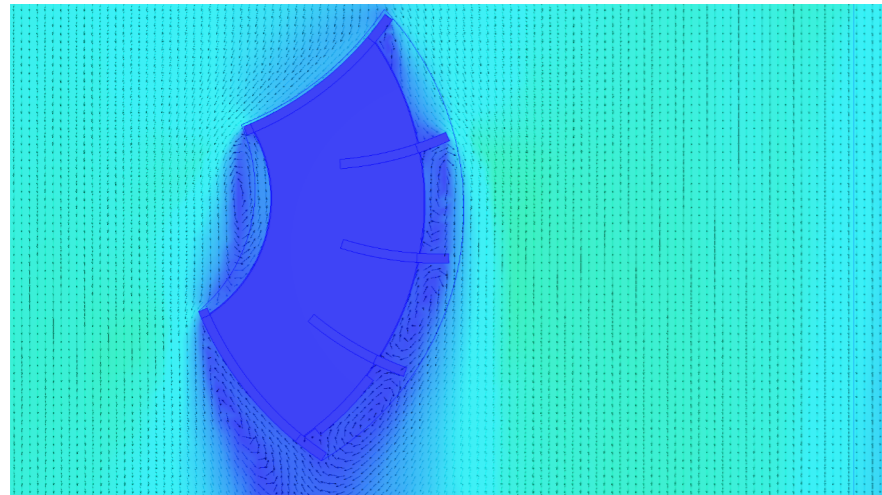


Adding an extra wall, decreasing the gap between both volumes, increases the windspeed. The airflow created with the new opening disappears. Placing a vertical volume, pushes this flow of air more to the sides, but also creates a larger surface of low windspeed.

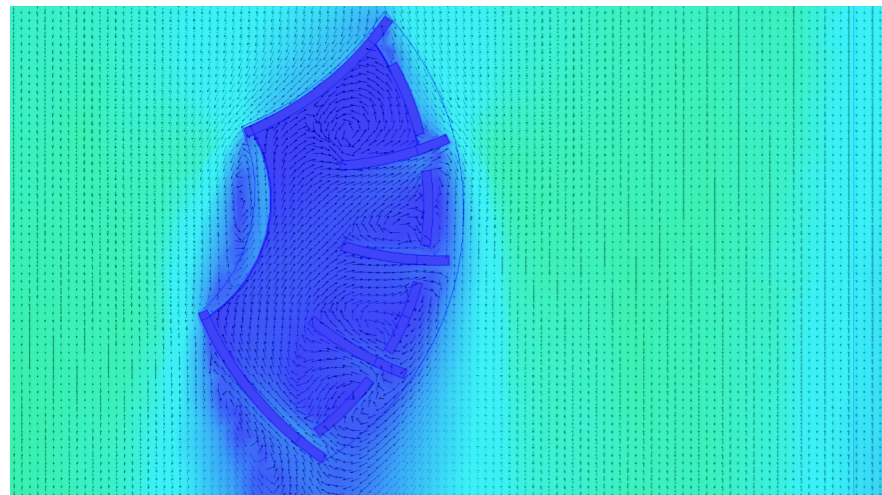


Decreasing the thickness off the wall creates more space between both volumes, lowering airspeed. The wind is guided way more around the building when the wall is closed, and a circle is formed.

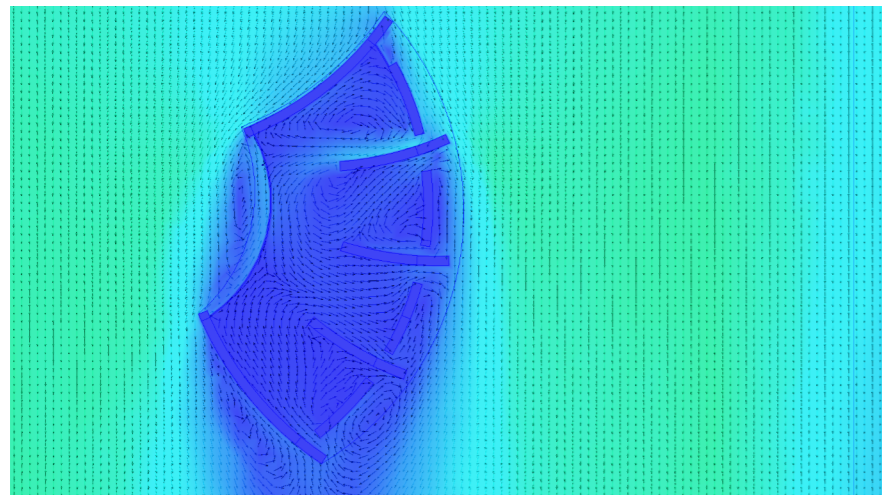




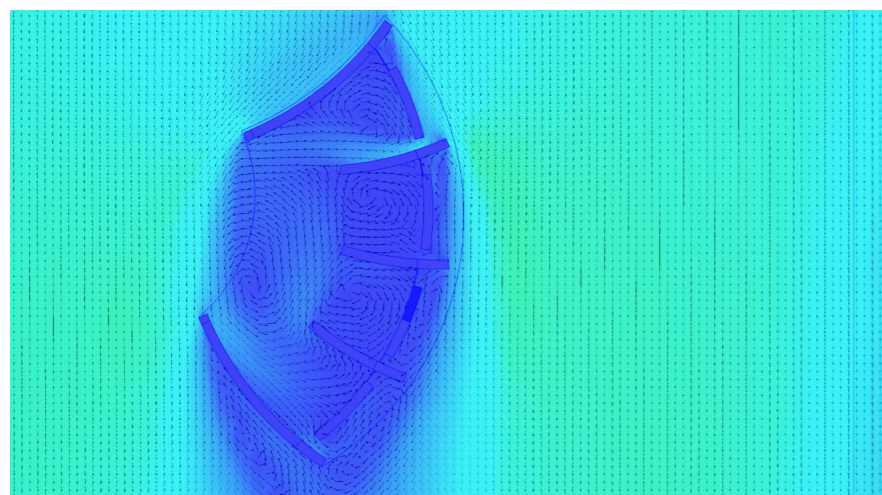
Everything closed, turbulence between the ribs on the outer side



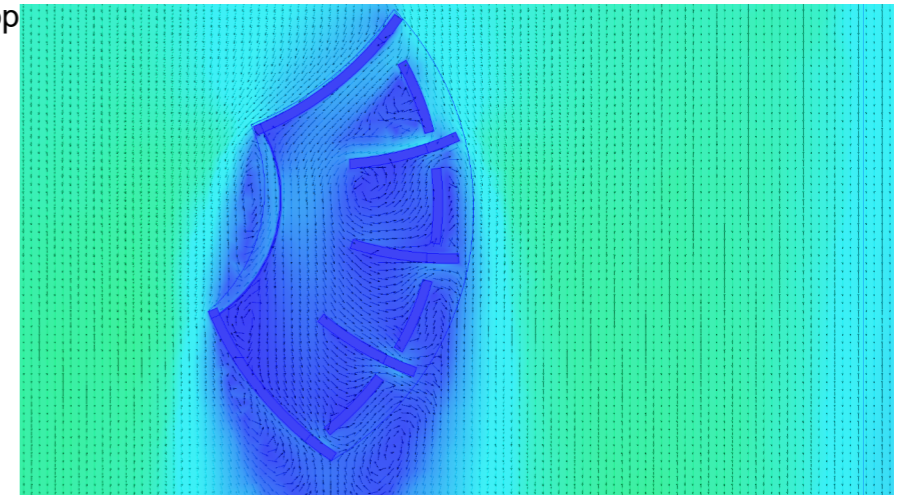
When the top is closed, less air enters



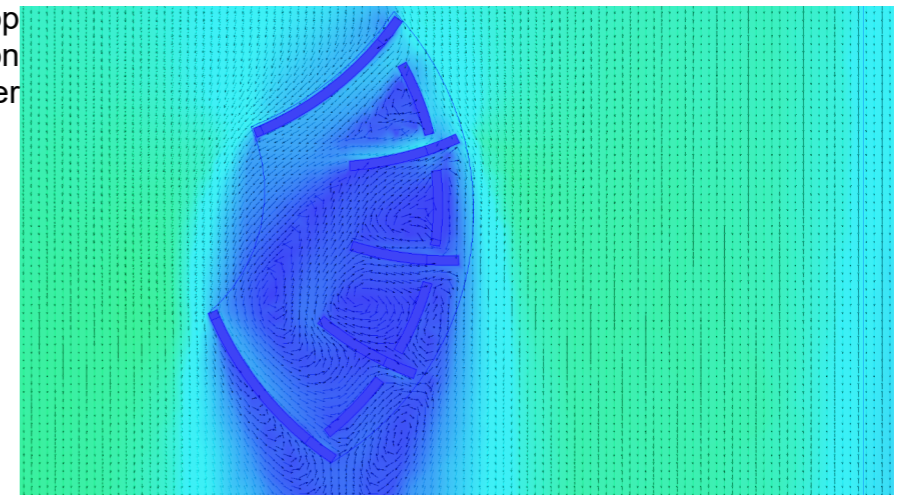
Top is open, lots of air enters the space, indicating that the top entry has the highest influence of the four



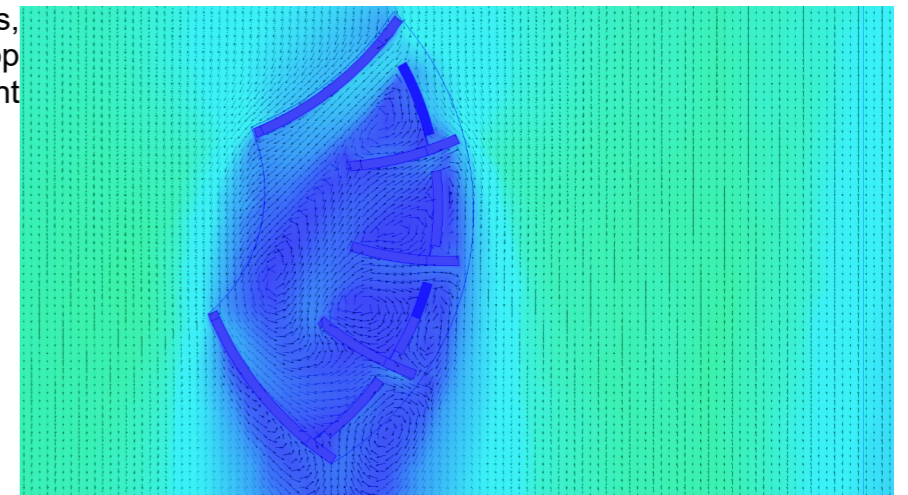
Low windspeed in the middle two parts, as wind travels from top to bottom.



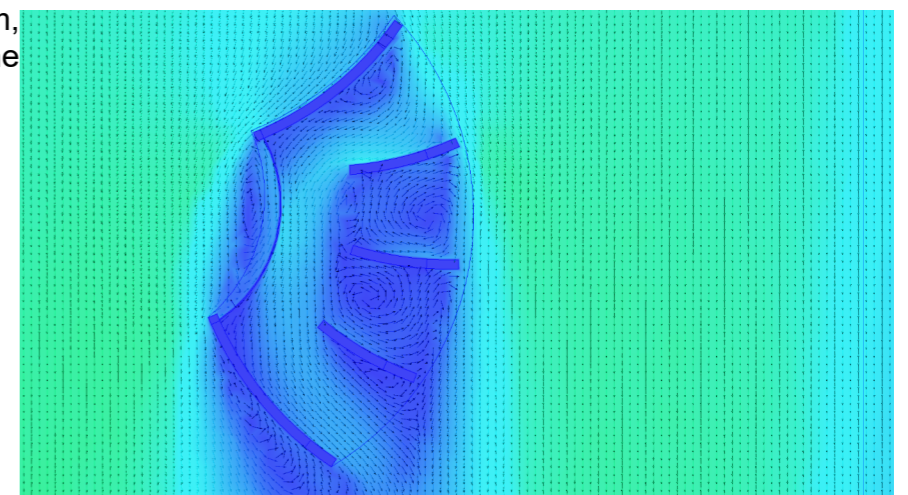
High airflow on both side of the top opening.



High airflow on both side of the top opening, but also higher flow on the bottom towards the lower opening.

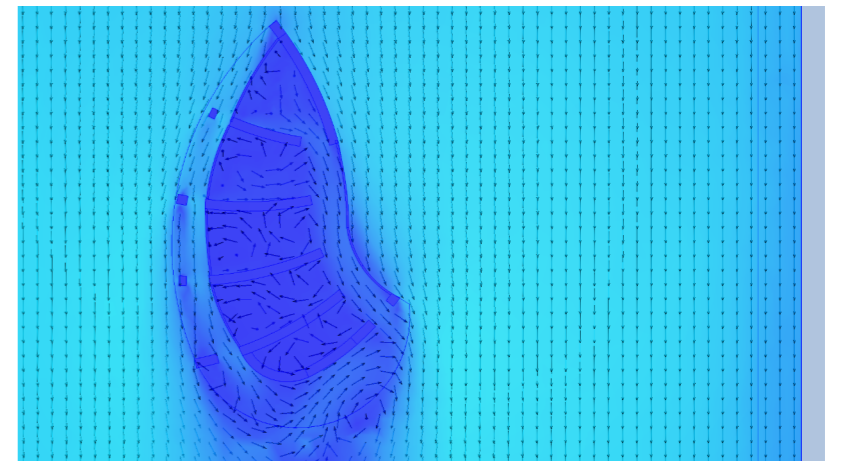
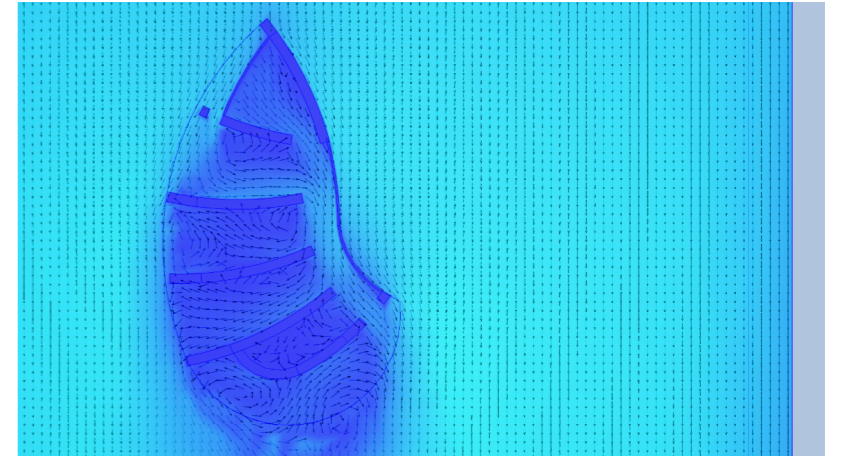
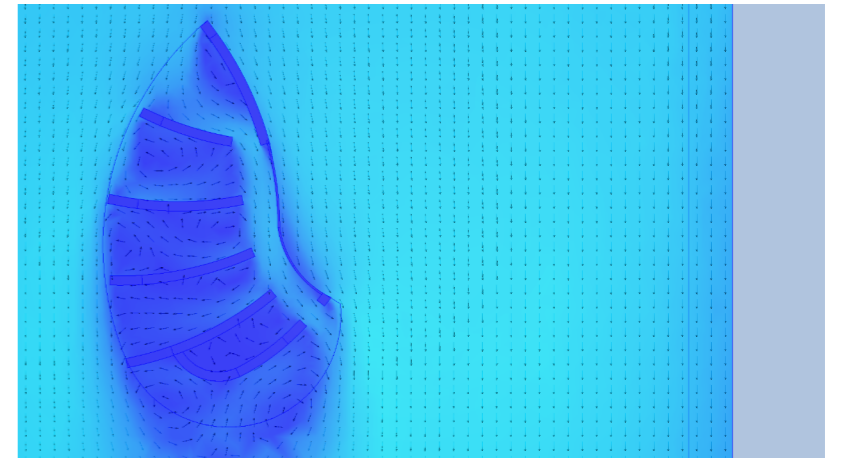
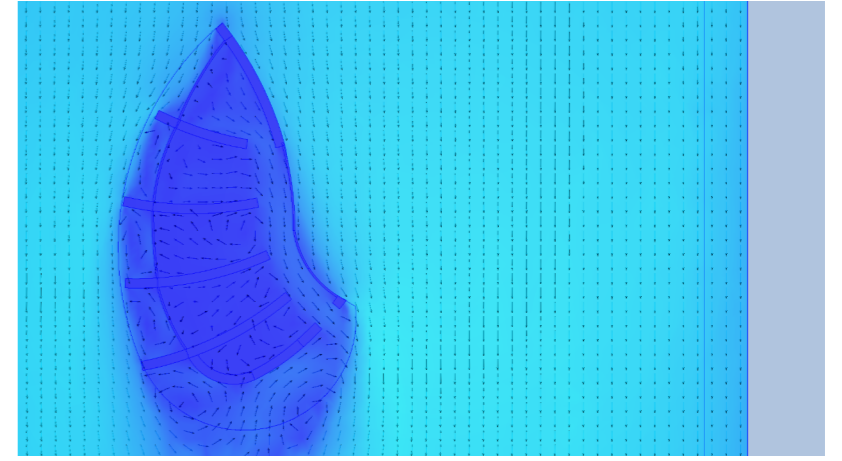
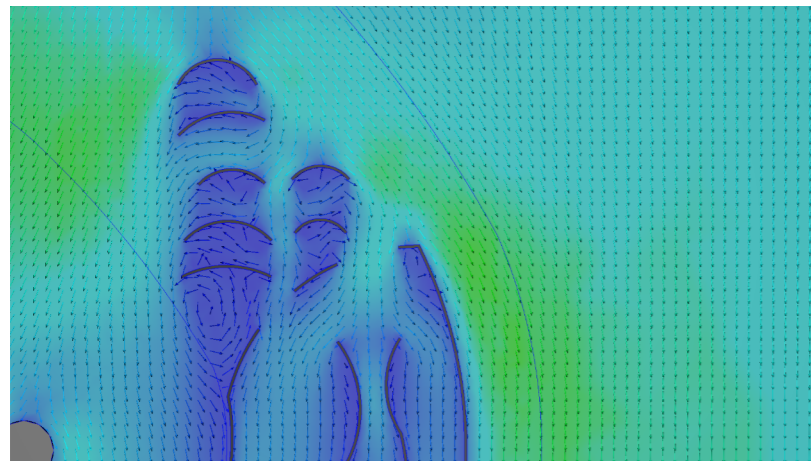
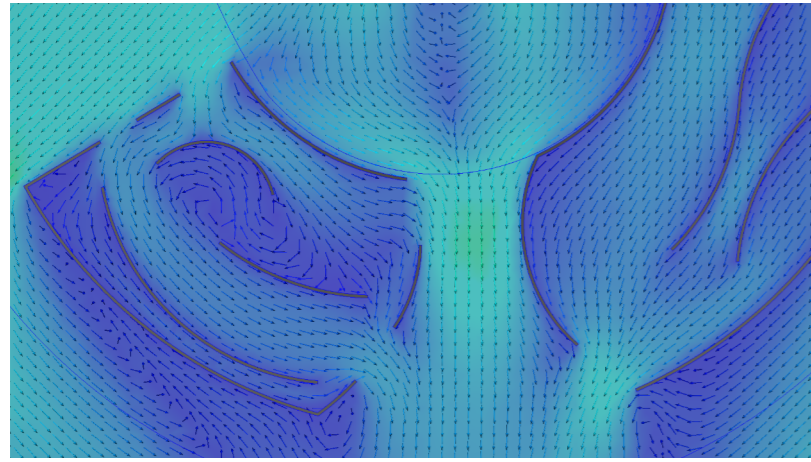
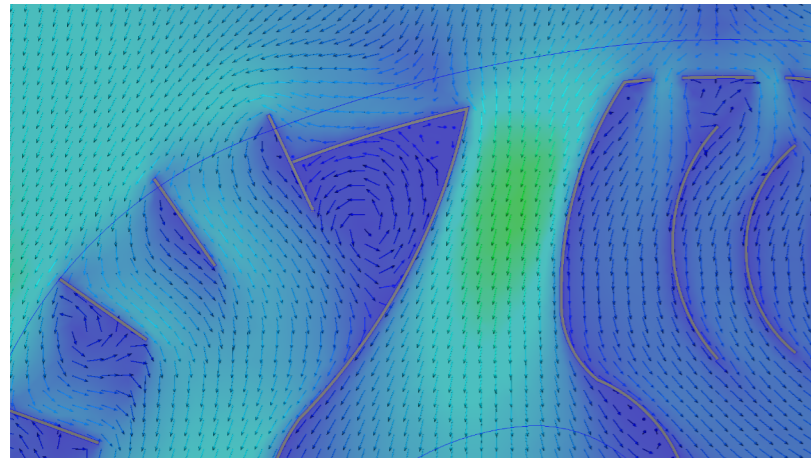
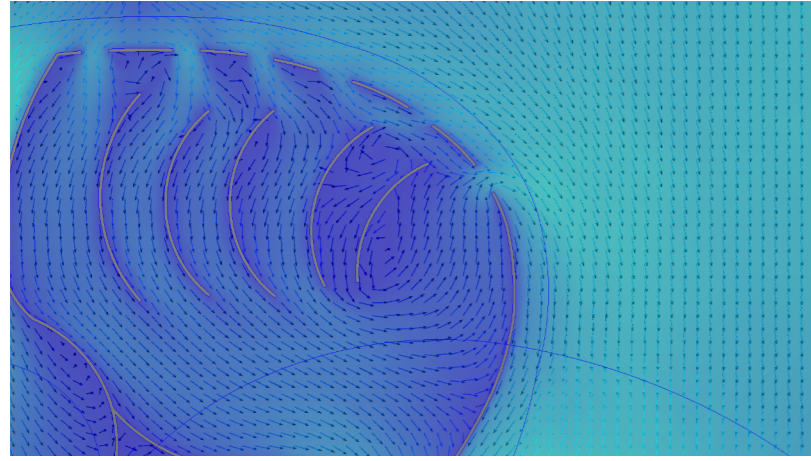


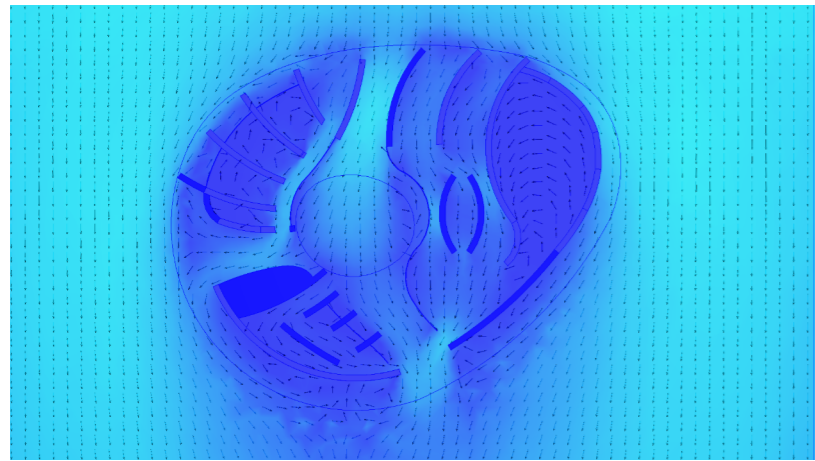
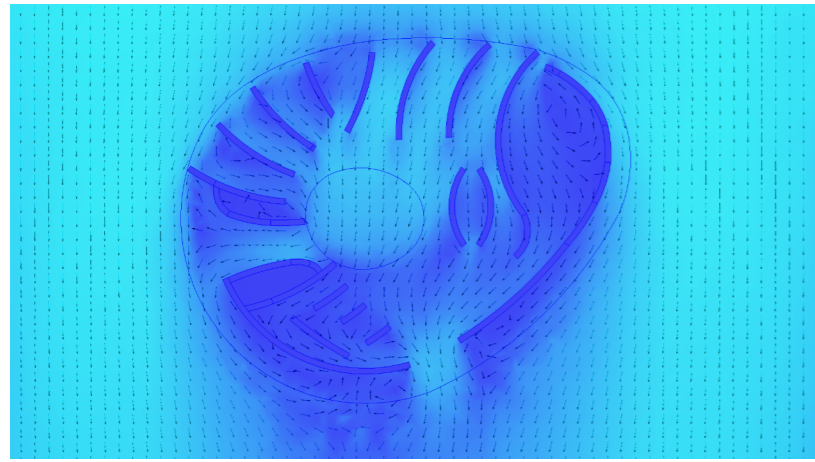
Turning winds in multiple places, mainly less airflow through the top opening, compared the the variant above.



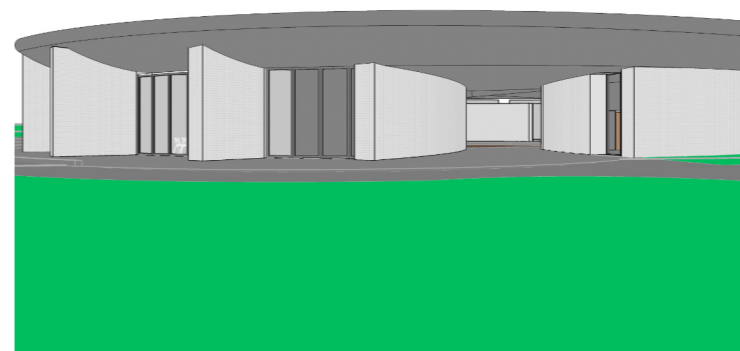
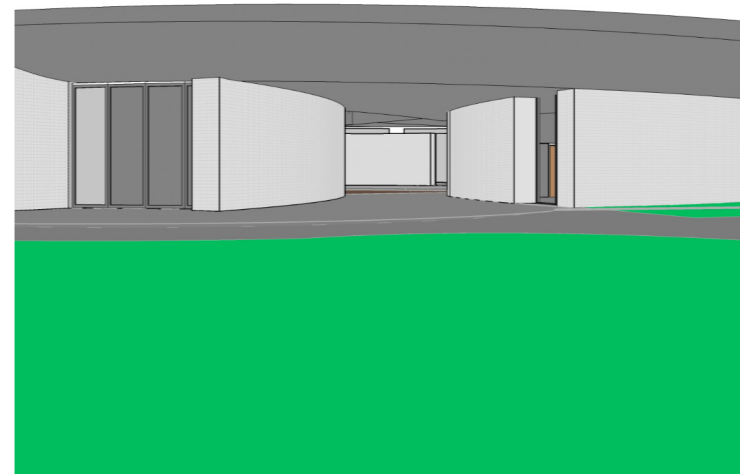
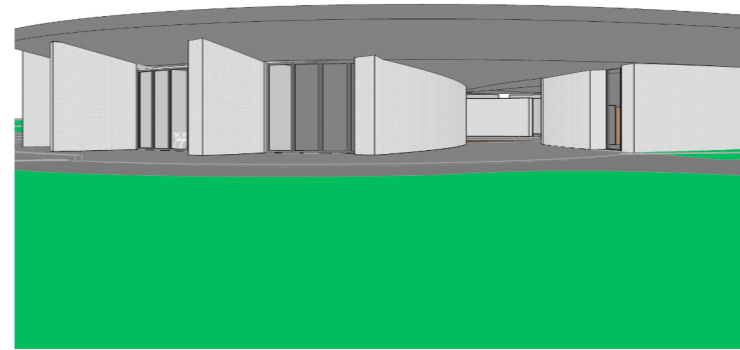
High airflow from top to bottom, while there are turning winds in the middle sections

Airflow simulations collective





Visualization roof edge



Masterplan analysis



Park analysis

Alsos of Nea Smyrni - Athens, Greece



Size: +/- 5.0 ha
Open: 06:00 - 23:00

Main functions:

- Cafe
- Open-air Theater (on the square)
- Outdoor Gym



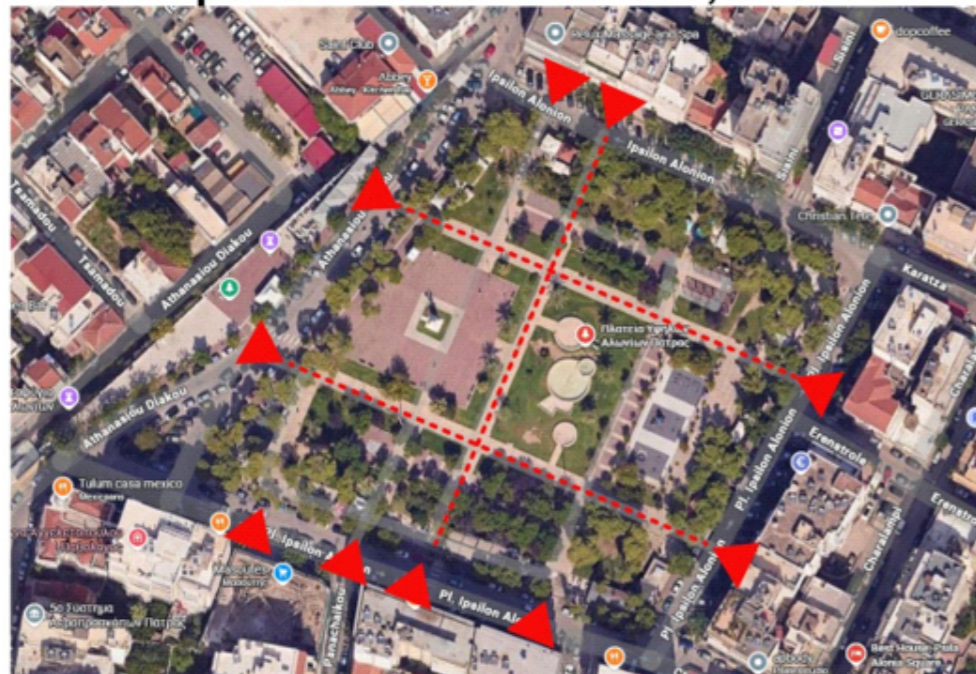
<https://www.google.com/maps>

This park is considered safe, but is closed during the night.
People advise it as a location to go for a run or to go with kids. The park is recently renovated

https://www.reddit.com/r/greece/comments/xutbill/can_you_recommend_me_some_safe_places_for_my/
<https://www.nou pou.gr/newsroom/aitodioikisi/xekinise-i-anaplasti-ton-paidikon-xaron-sto-alsos-neas-smimis/>

▲ Entrance
- - - Main path

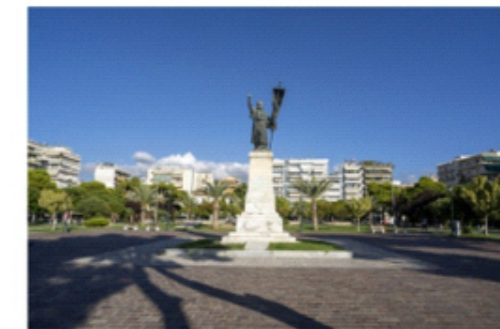
Plateia Ypsilōn Aloniōn - Athens, Greece



Size: +/- 1.4 ha
Open: 24/7
General police control

Main functions:

- Cafe
- Open-air Theater (on the square)



<https://olympianland.gr/en/listing/psila-alonia-square>

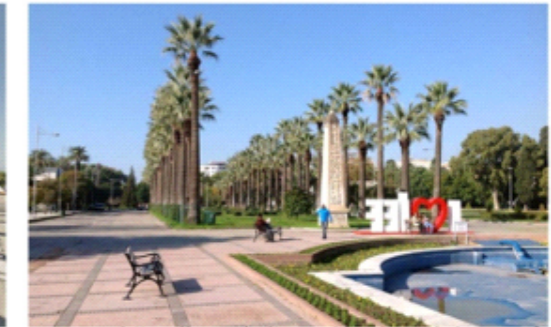
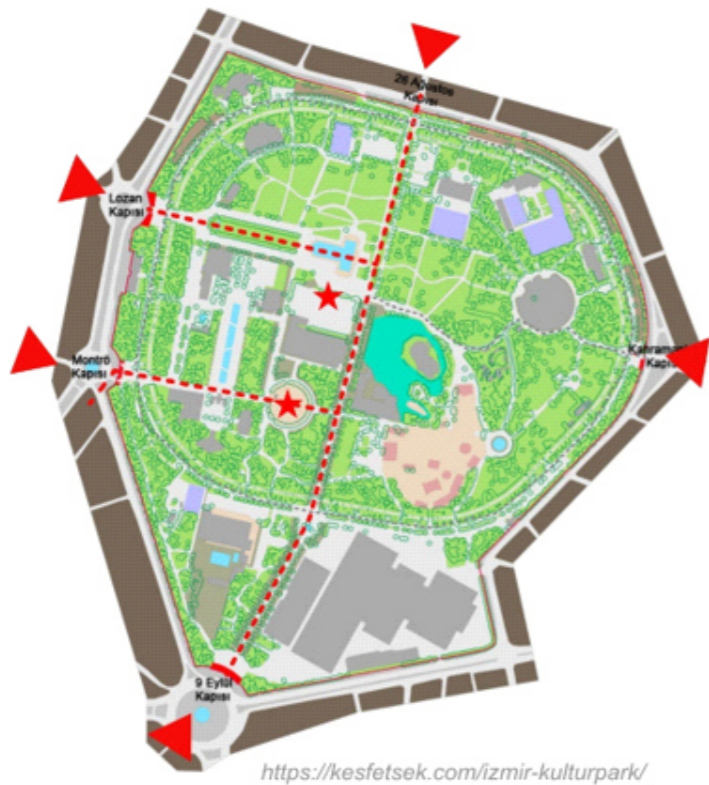
This small square/park is lately facing problems regarding criminality and drug users
https://www.oparlapias.gr/2025/06/y_01028259174.html

These problems have happened in the past, as a news article in 2014 mentioned that residents do not feel safe around the unwell lit square.

<https://www.patrasevents.gr/article/126665-patra-katantia-i-plateia-ton-ipsilon-alonion-ti-anaferoun-oi-katoikoi-se-epistoli-tous>

Park analysis

Kültürpark - Izmir, Turkey

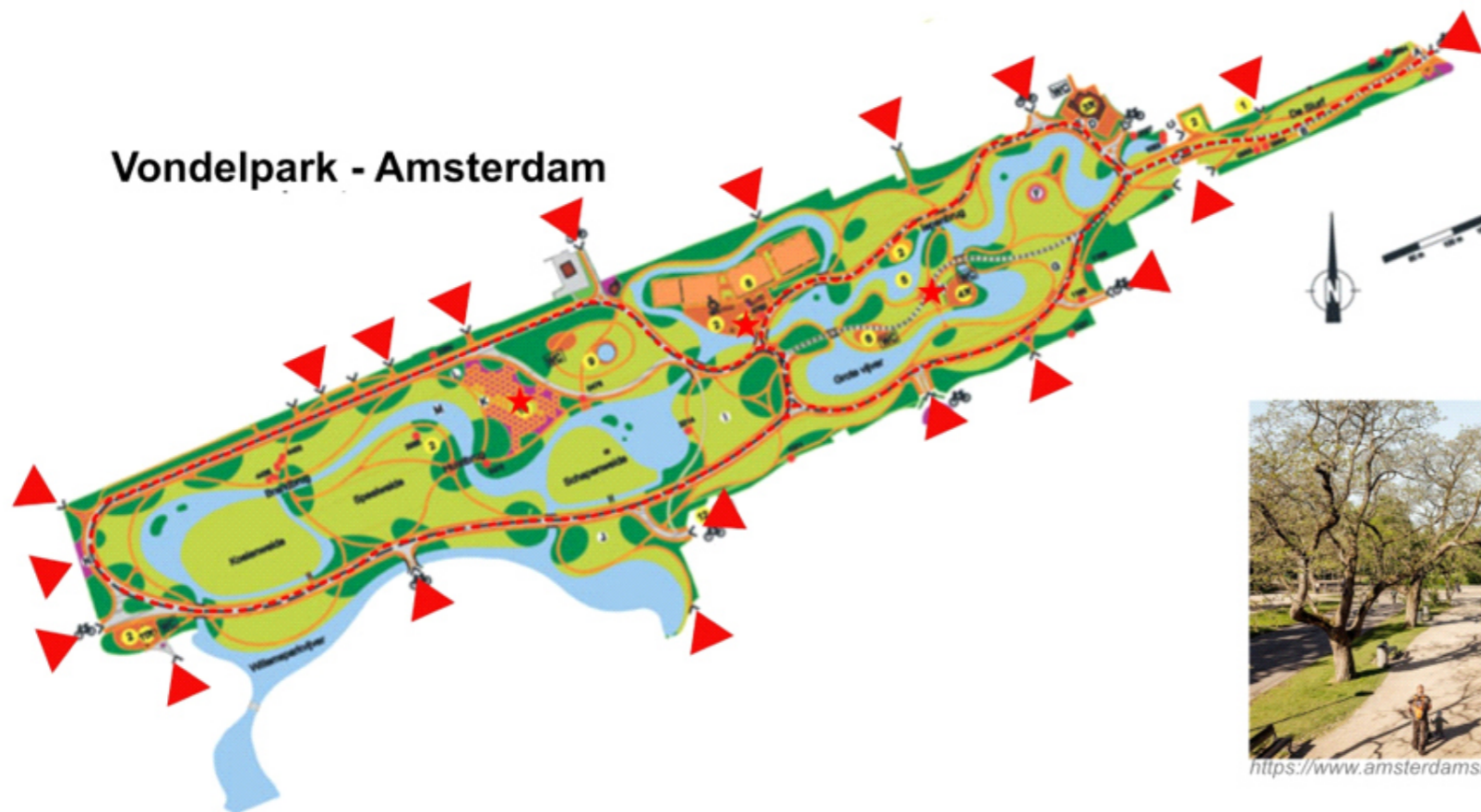


Size: +/- 42 ha
 Open: 24/7
 A special police unit maintains order in the park
 Main functions:

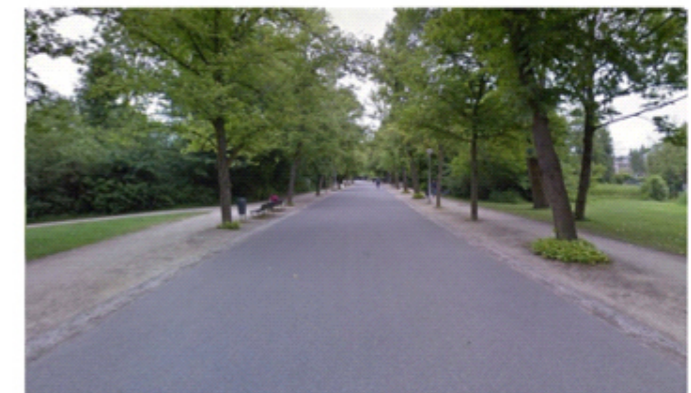
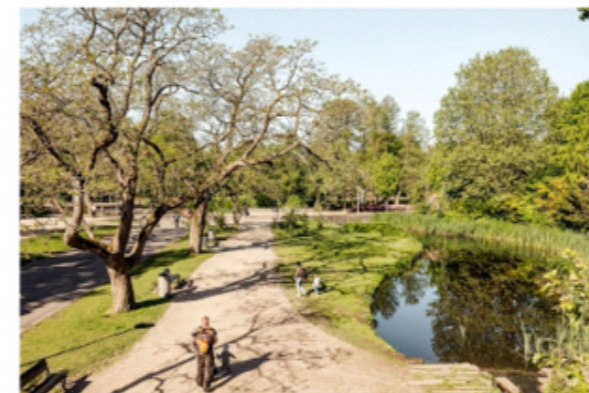
- | | |
|---------------------|-----------------|
| Restaurant/cafe | Parachute tower |
| Artcentre | Mosque |
| Tennisclub | Swimming pool |
| Casino | Museum |
| Veterinary practice | Exhibition |

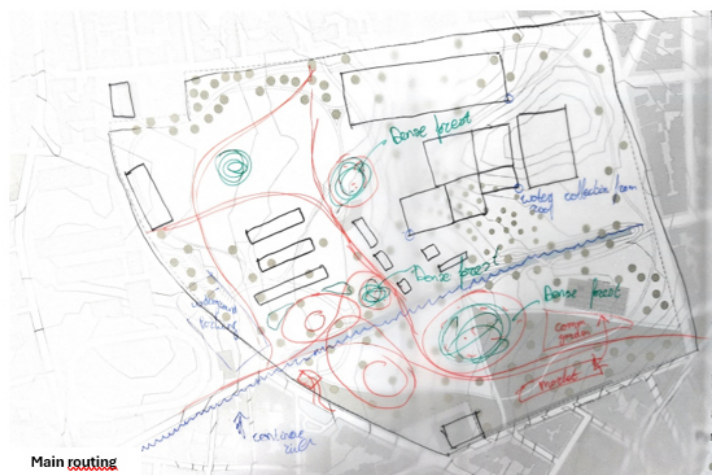
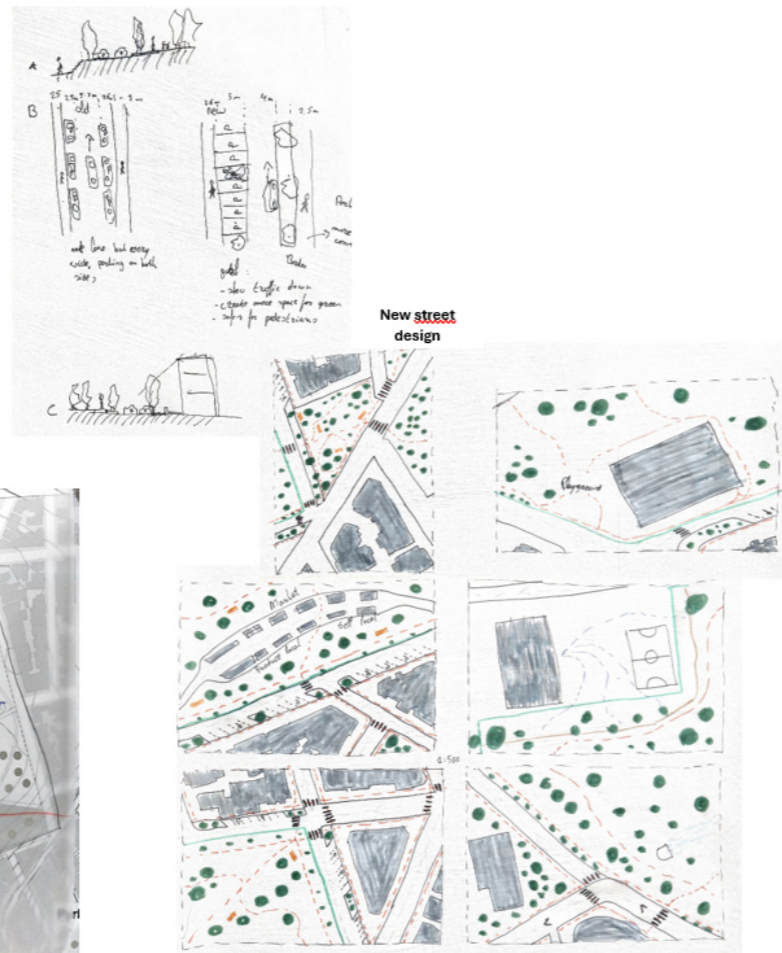
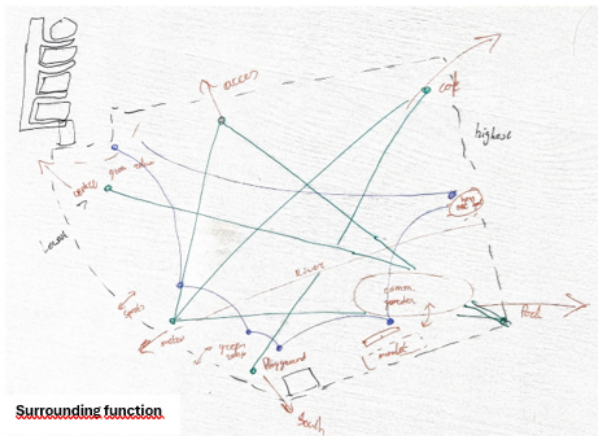
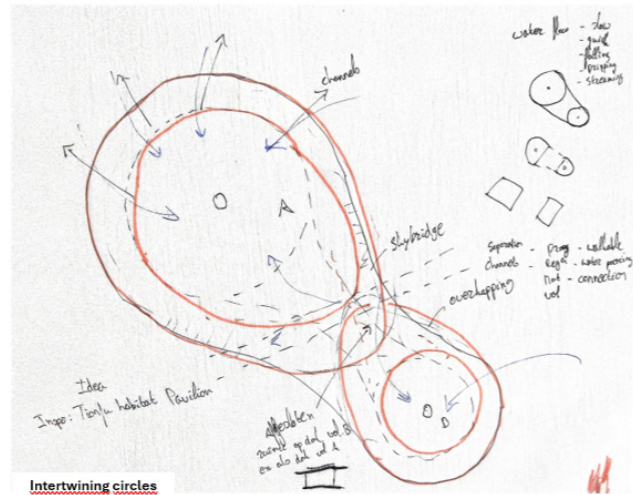
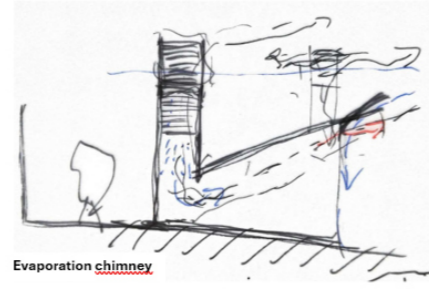
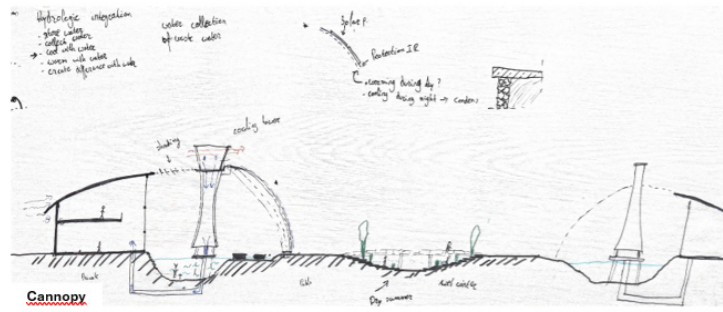
-  Entrance
-  Square
-  Main path
-  Smaller path

Vondelpark - Amsterdam



Size: +/- 47 ha
 Open: 24/7
 General police control
 Main functions:
 Cafe
 Open-air Theater





Environmental Education Centre Sluňákov
 Architect: Projekt1 Architekti
 Year: 17.1.2007
 Location: Skrběšská 669/70, Horka nad Moravou, Czech Republic
 Size: 1586 m²
 Floors: 2
 Function: Education, Exhibition, Cafe, Hostel
 Prominent material: Wood

24.4%	15.0%	14.4%	13.3%	7.8%	7.1%	4.3%
				7.2%	6.5%	

Ecology Center "Haff Remich"
 Architect: Valentiny HVP Architects
 Year: 2016
 Location: Remerschen, Luxembourg
 Size: 11-1800 m²
 Floors: 3
 Function: Exhibition, Education
 Prominent material: Wood
 *Building size is an estimation

70.8%	12.9%	4.8%	2.4%
	5.2%	3.9%	

Nueva School Science and Environmental Center
 Architect: Ledy Maytum Stacy Architects
 Year: 2021
 Location: Hillsborough, California, United States
 Size: 1078 m²
 Floors: 2
 Function: Education
 Prominent material: Wood

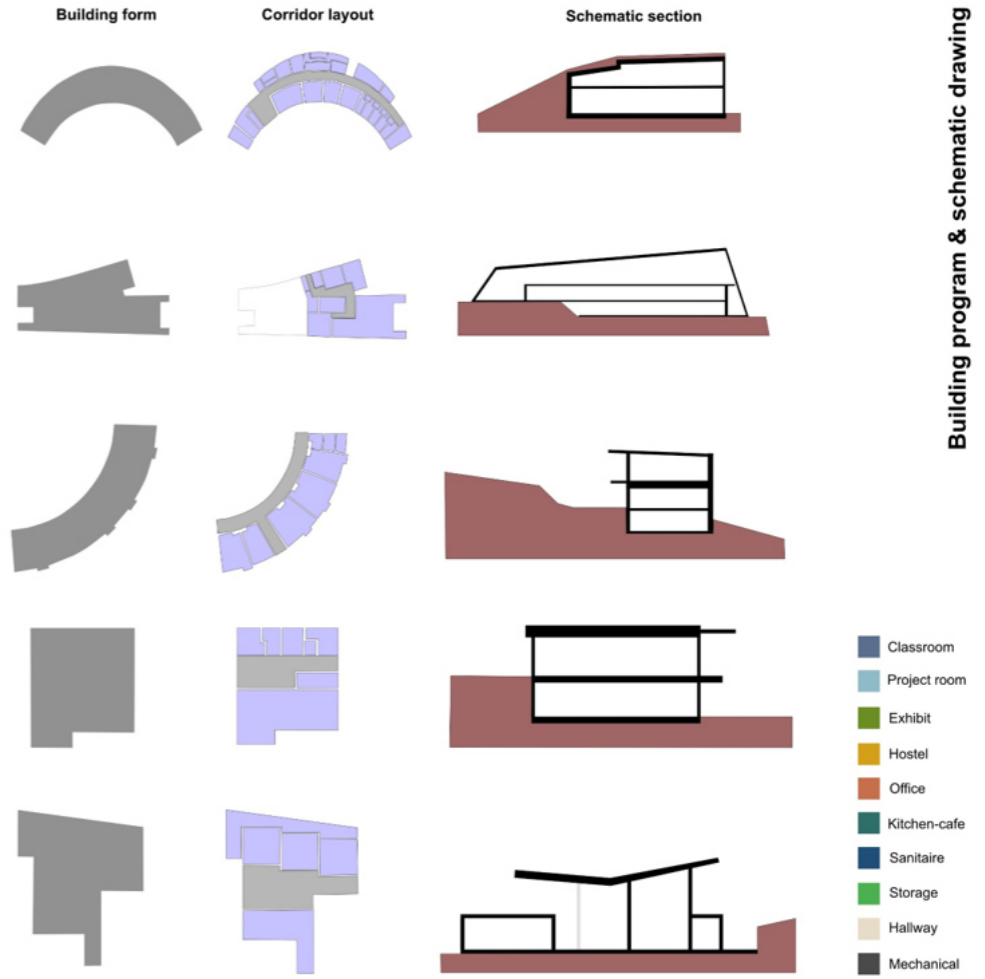
49.9%	29.3%	7.9%	4.6%
		4.9%	3.4%

Centre for Urban Ecology, Humber College
 Architect: Taylor Hazel Architects
 Year: 2007
 Location: 205 Humber College Blvd., Toronto, Canada
 Size: 416 m²
 Floors: 2
 Function: Education
 Prominent material: Glass

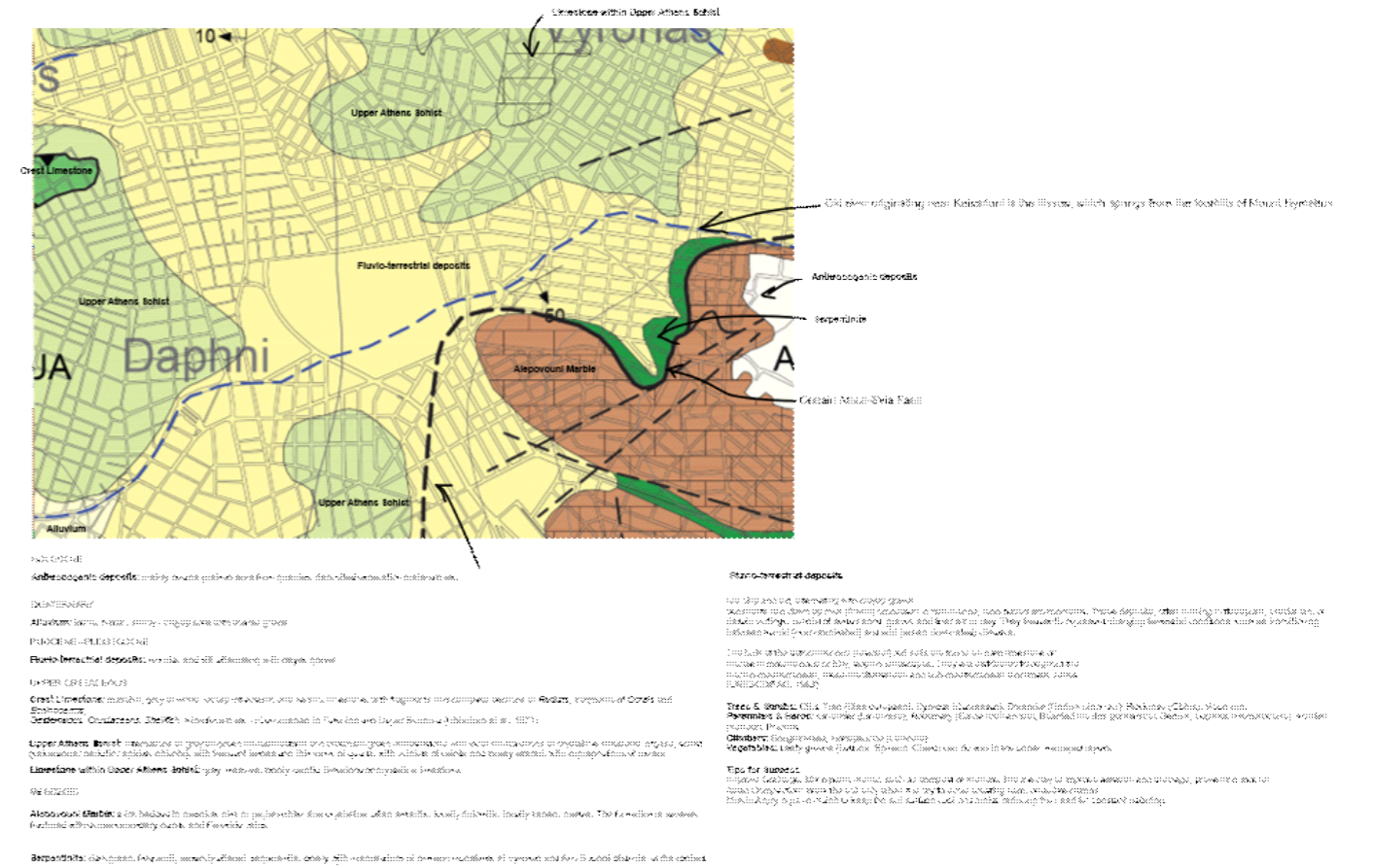
44.3%	30.8%	7.8%	6.6%
		7.6%	2.9%

Environmental Nature Center and Preschool
 Architect: LPA
 Year: 2019
 Location: Newport Beach, California, United States
 Size: 836 m²
 Floors: 1
 Function: Education
 Prominent material: Wood

53.7%	15.7%	9.1%	0.2%	1.2%	7.7%	3.9%
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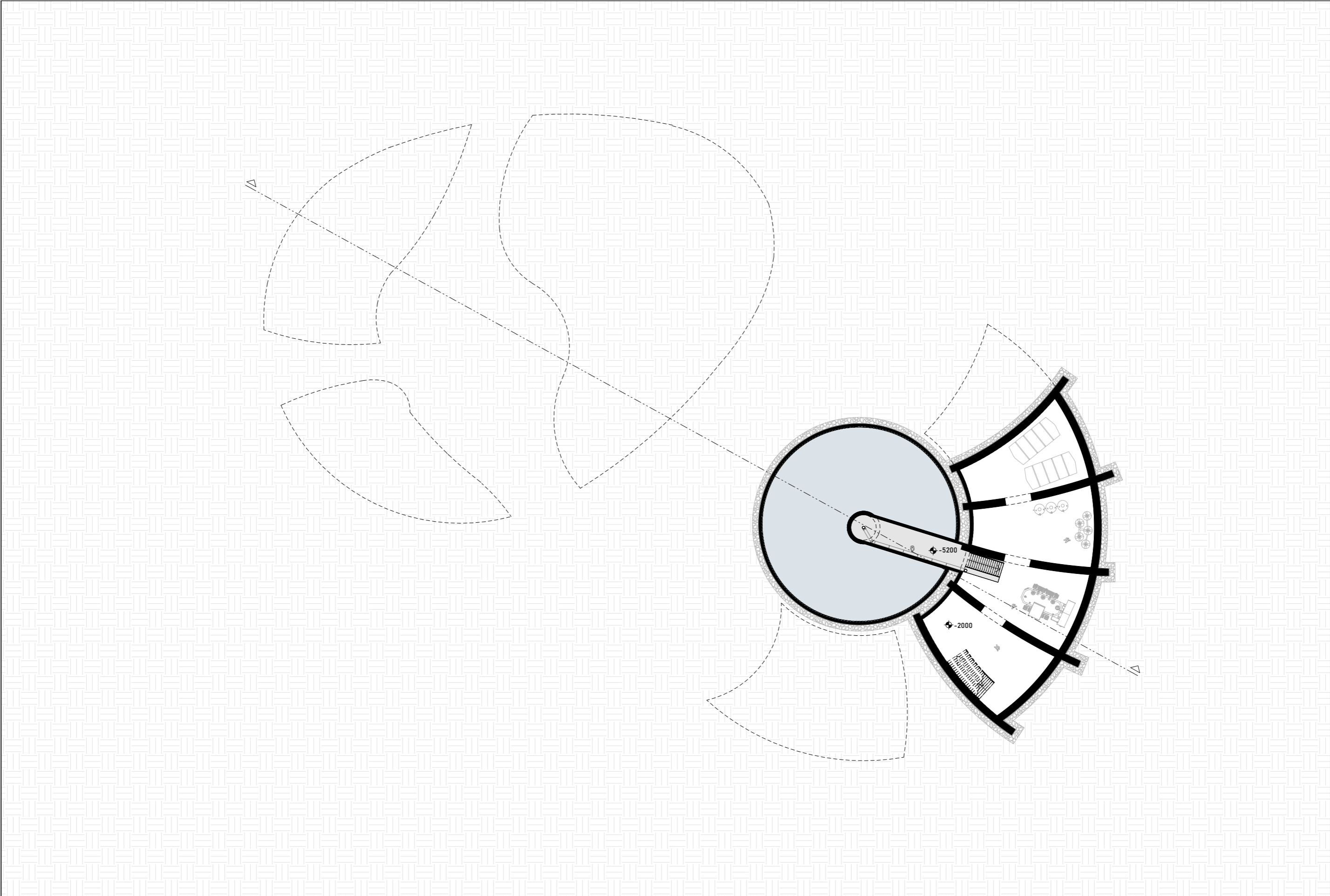
Soil type Pyrkal site



Site 1:4000



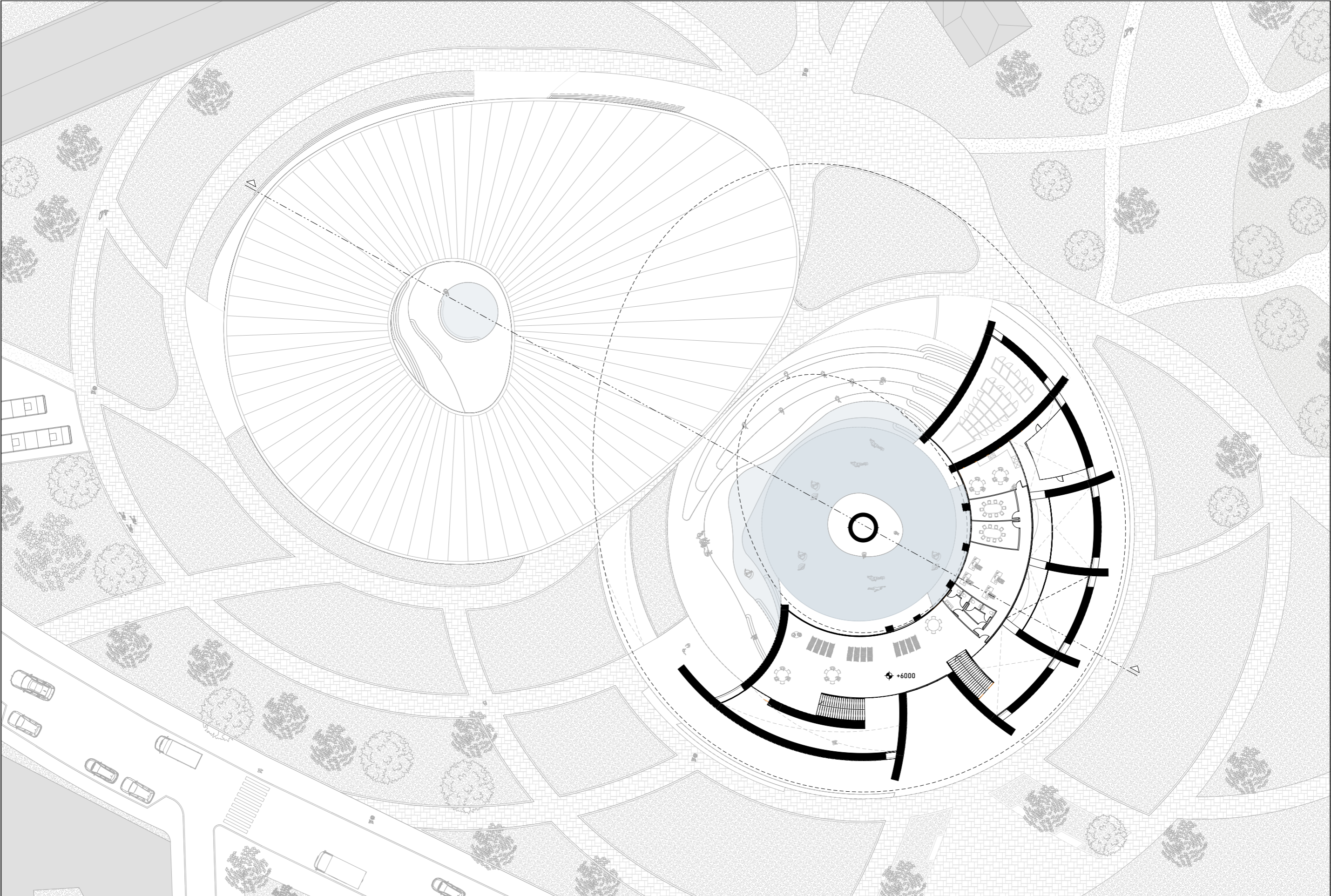
Basement 1:666



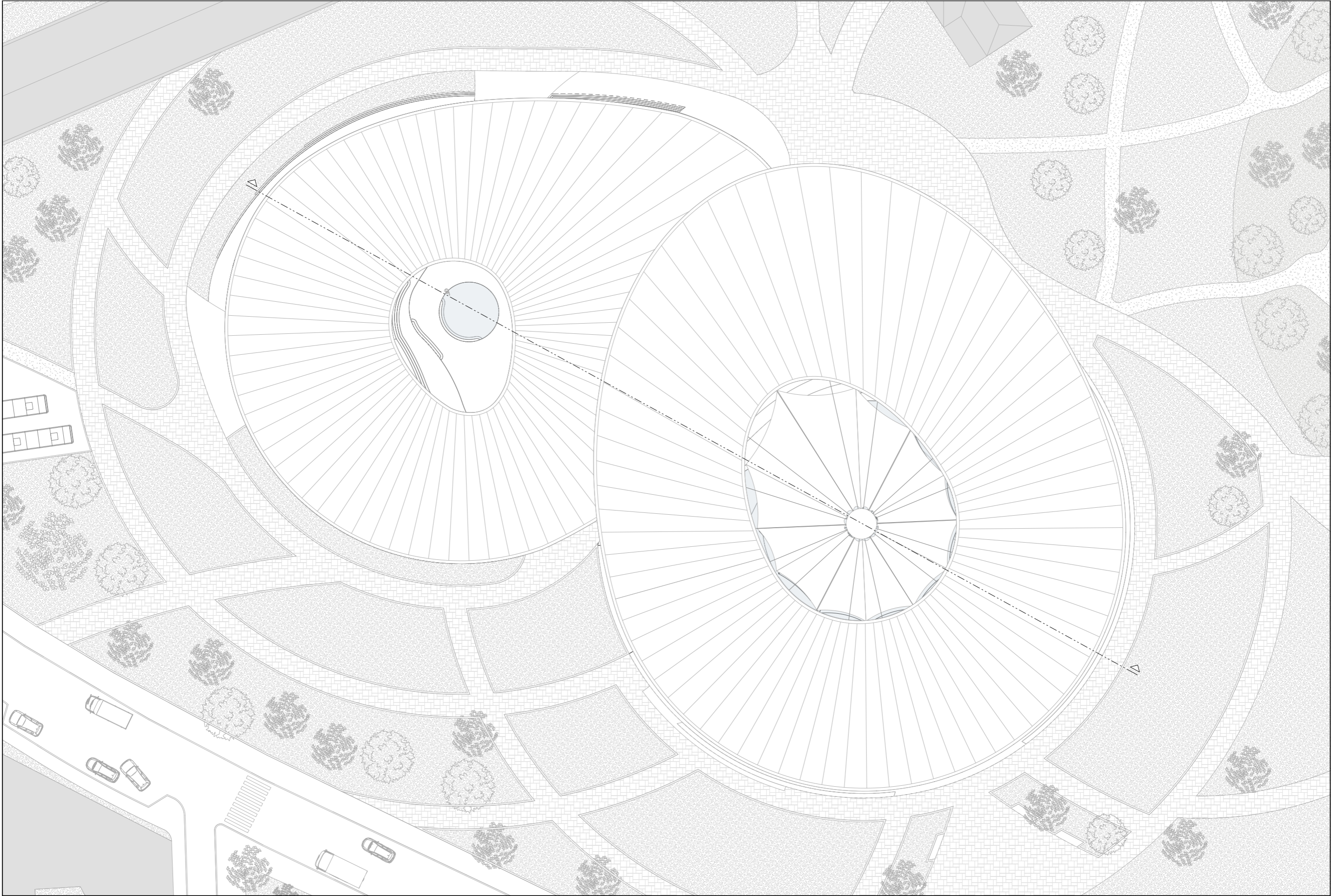
Ground floor 1:666



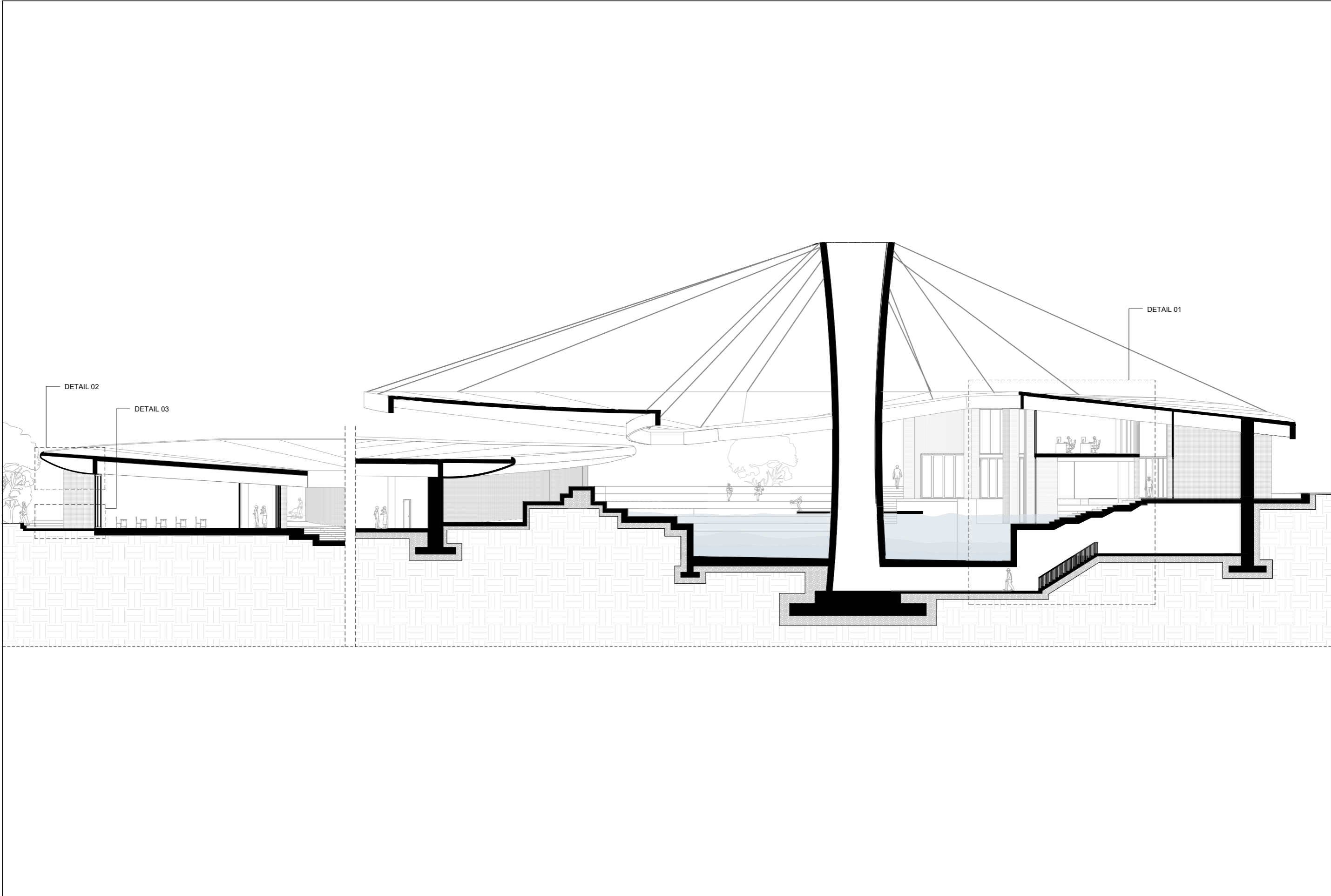
First floor 1:666



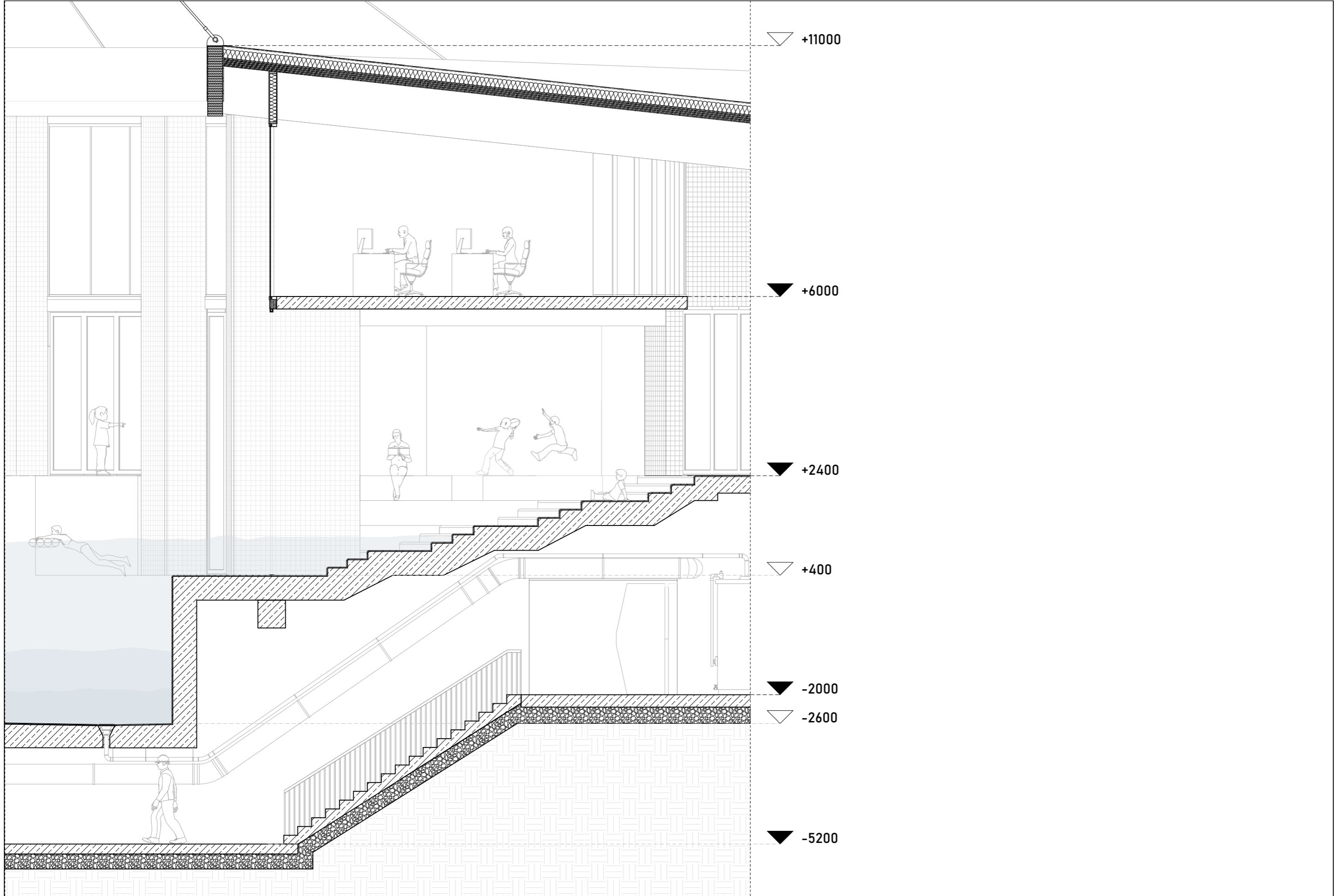
Roof 1:666



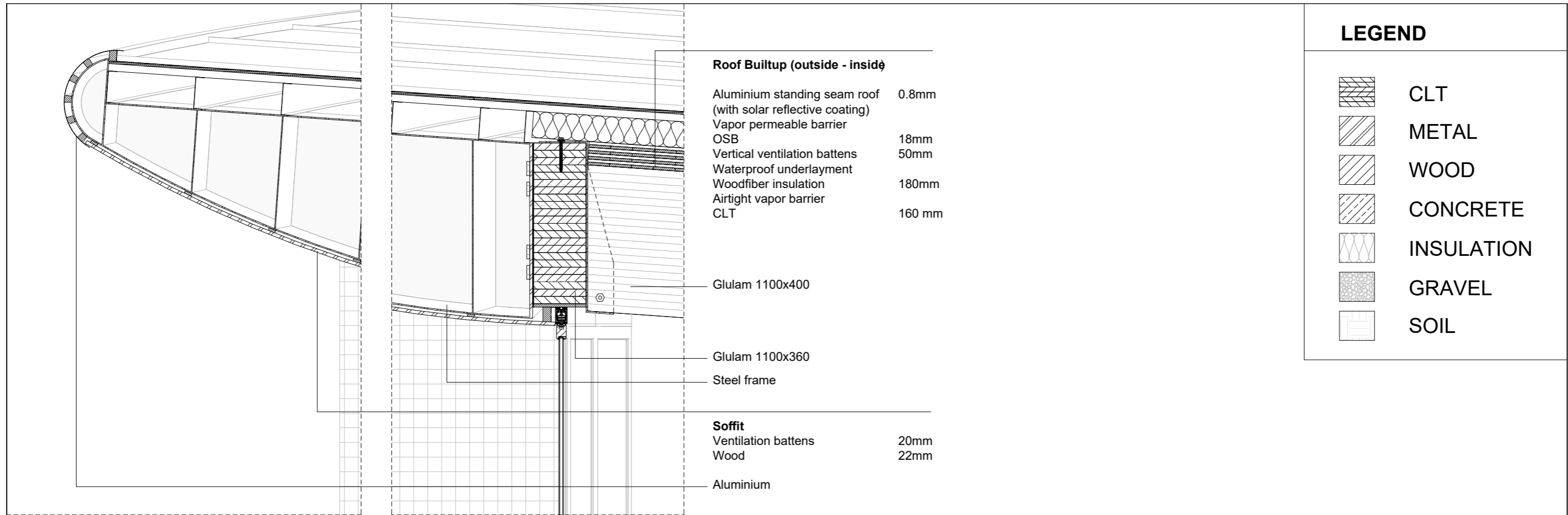
Section 1:666










Detail 01 1:100



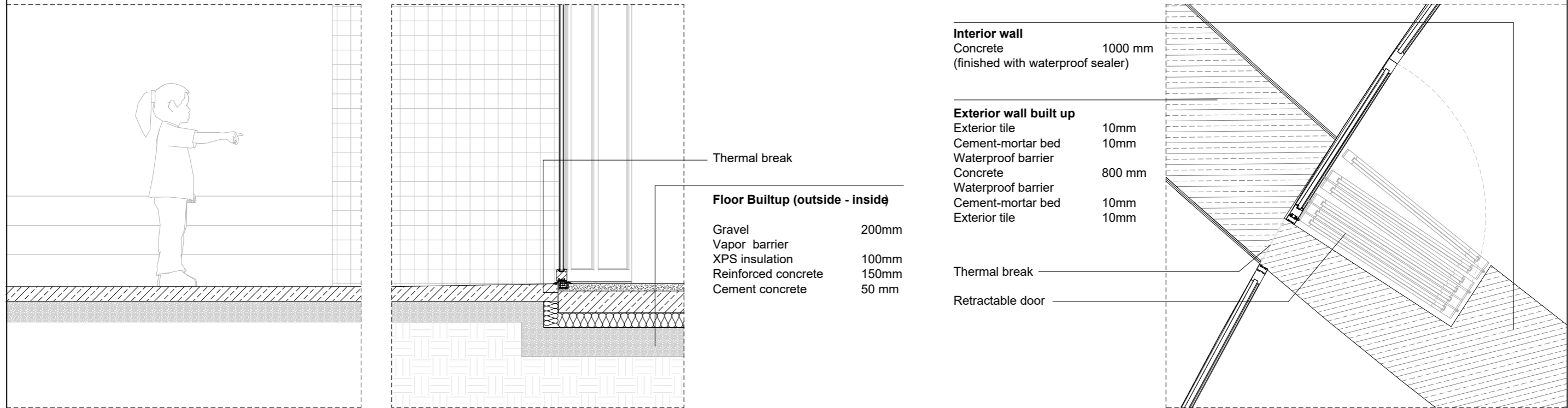
Detail 02-04 1:40



LEGEND

-  CLT
-  METAL
-  WOOD
-  CONCRETE
-  INSULATION
-  GRAVEL
-  SOIL

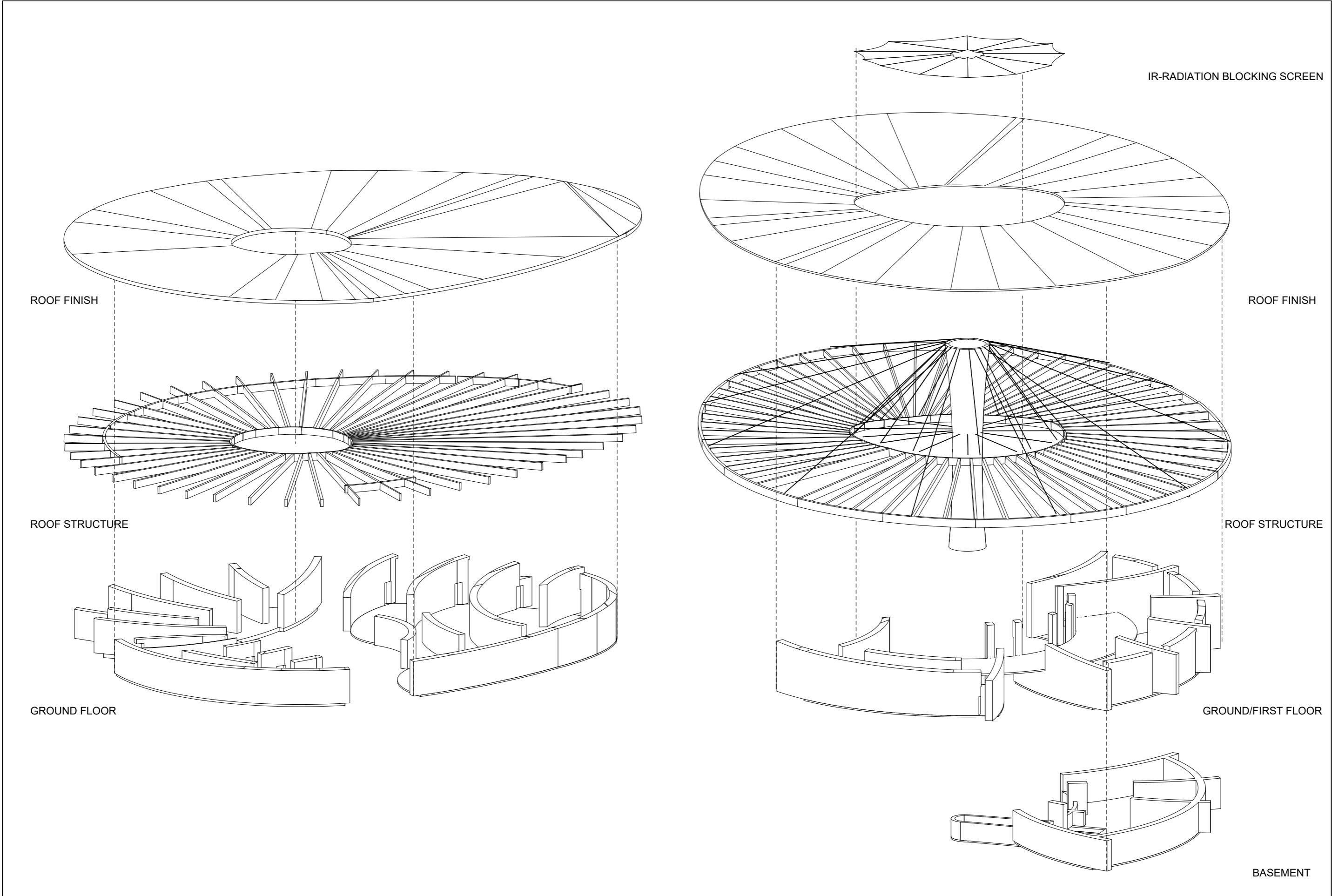
Detail 02



Detail 03

Detail 01

Axonometrie 1:666



visualization



WATER RESERVOIR SWIMMING



OVERFLOW RESERVOIR DAYTIME



ENTRANCE TOWARDS SCHOOL / CAFE



OVERFLOW RESERVOIR NIGHTTIME