LIVING LAKES

BACHELOR PROJECT

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2024

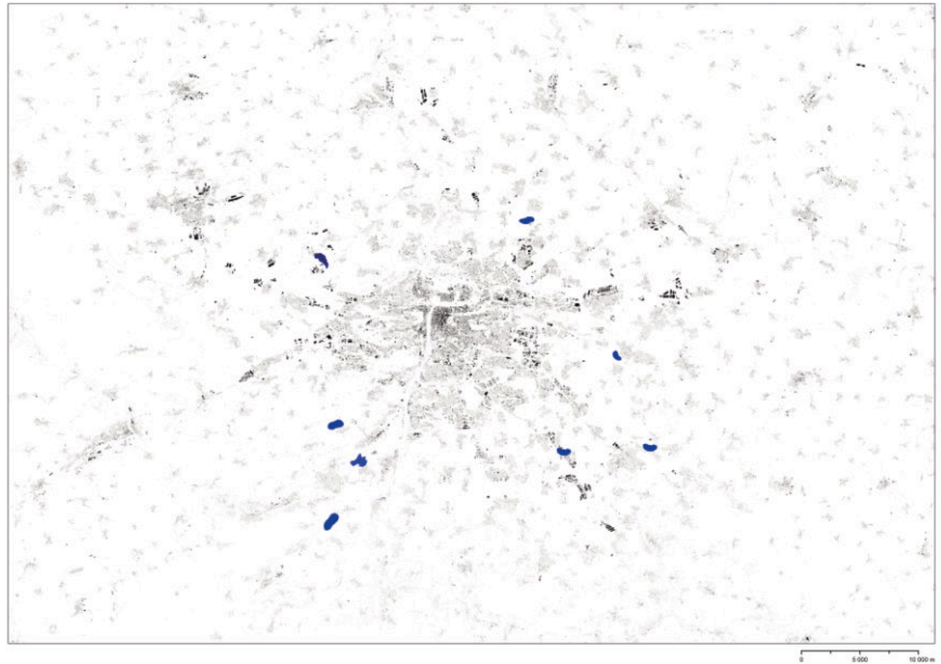
CONTENTS

INTRODUCTION

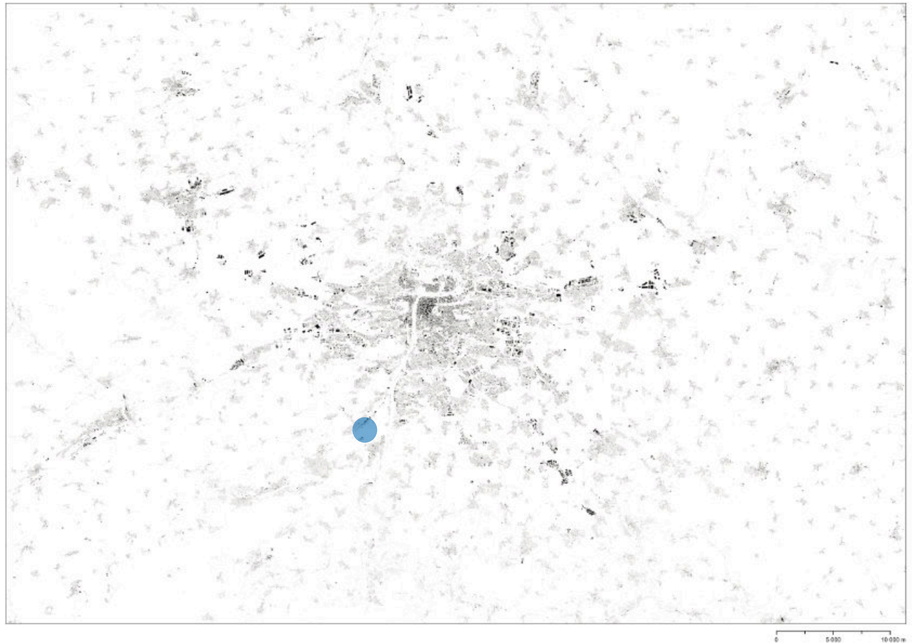
The studio brief calls for the creation of a visionary project depicting the future of Prague. The initial phase of the semester was focused on the analytical aspect, delving into old maps, junctions, the history of brownfields, and other relevant factors. Subsequently, the latter part of the semester was dedicated to the visionary component. Drawing inspiration from art, students were tasked with crafting innovative ideas that integrated insights gleaned from the analytical phase, all with the aim of enhancing the future landscape of Prague.

The project's overarching goal is to address a myriad of challenges through the strategic construction of new water reservoirs in the vicinity of Prague. The primary objective is to mitigate population density by dispersing inhabitants to less densely populated areas surrounding the city. This dispersion not only alleviates strain on existing infrastructure but also fosters balanced urban development. This integration not only enhances local food security but also supports economic sustainability within the region.

CITY SCALE IMPACT



PROJECT SITE LOCATON



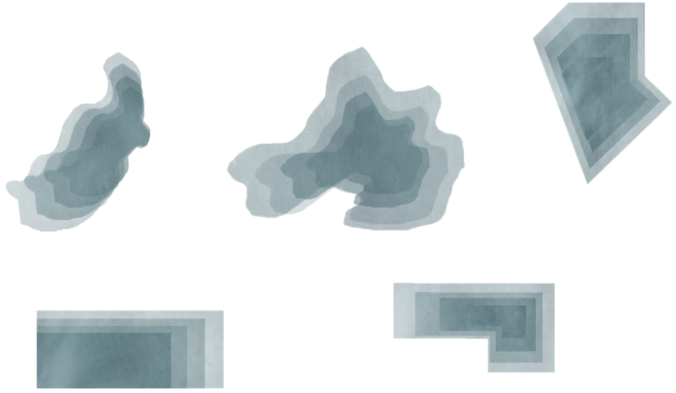
ART INSPIRATION

Georges Seurat's "A Sunday Afternoon on the Island of La Grande Jatte"

Seurat's masterpiece depicts a leisurely scene of people enjoying a tranquil Sunday afternoon by the water. The painting exudes a sense of serenity and contentment, capturing the idyllic atmosphere of leisure and relaxation. What stands out in Seurat's work is the communal enjoyment and connection to nature, particularly the serene presence of the water. Drawing upon this inspiration, the aim was to evoke a similar mood in the project, challenging the notion that enjoyment of the water should be limited to Sundays. Just as Seurat's subjects find joy and solace in their leisurely activities by the water, the project sought to create a living environment where residents could experience this sense of tranquility and connection with nature every day. By situating the reservoir at the heart of the development, it was intended to integrate the water into everyday life, inviting residents to embrace the waterfront as an integral part of their daily routine.

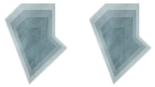
In contrast to Seurat's figurative style, the abstract compositions of Kazimir Malevich served as a source of inspiration for the formal design elements of the project. Malevich's work is characterized by its strict geometric forms, bold lines, and minimalist aesthetic. His art explores the concept of pure abstraction, emphasizing balance, harmony, and simplicity. Inspired by Malevich's disciplined approach to form and composition, there is similarly strict and edgy shape for the reservoir in the design. The reservoir's geometric silhouette, with its sharp angles and clean lines, reflects the influence of Malevich's abstract art. By embracing this minimalist aesthetic, the iam is to create a visually striking focal point within the development while also emphasizing the importance of balance and order in the urban landscape. Incorporating elements of both Seurat's tranquil scenes and Malevich's disciplined abstraction, the project seeks to create a harmonious and visually compelling environment that celebrates the beauty of nature while embracing the principles of modern design. By drawing upon these diverse artistic influences, the project aims to not only engage the senses but also spark contemplation and reflection on the relationship between art, nature, and urban living.

SHAPE OF RESERVOIR



The dimensions and form of the reservoir can vary widely, meticulously tailored to accommodate the specific plot size, the surrounding landscape, and the envisioned programs and facilities. This careful consideration ensures that the reservoir seamlessly integrates into its environment while fulfilling its multifaceted roles. Moreover, the design takes into account the anticipated resident population in the vicinity, with provisions made to meet their needs and enhance their quality of life. By customizing the dimensions and form of the reservoir to suit the unique characteristics of the site and the aspirations of the community, the project strives to create a harmonious and functional urban environment

IMPACT ON PRAGUE



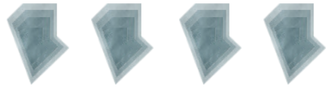
700 000 m2 reservoir x 2

Covers 20% of Trout export market

Produces 800 tones of salmon a year

Produces 500 tones of Carp a year

Provides 2 recreational beaches



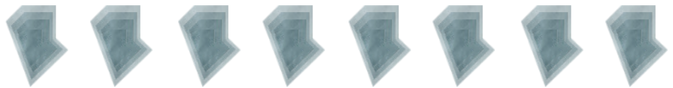
700 000 m2 reservoir x 4

Covers 40% of Trout export market

Produces 1600 tones of salmon a year

Produces1000 tones of Carp a year

Provides 4 recreational beaches



700 000 m2 reservoir x 8

Covers 80% of Trout export market

Produces 3200 tones of salmon a year

Produces 2000 tones of Carp a year

Provides 8 recreational beaches

WHY?

FISH FARMING

POPULATION DISTRIBUTION

COLLECTION OF WATER

NEW LIVING NEIGHBORHOODS

FLOOD PREVENTION

The integration of fish farming within the reservoir presents a sustainable solution to enhance local food production and economic resilience. By allocating a portion of the water surface for aquaculture, the project aims to cover the imported fish market of Czech republic. Addressing urban congestion in central Prague, the project emphasizes population dispersion to areas like Lipence. By providing attractive housing options, coupled with amenities and employment opportunities, the aim is to incentivize individuals and families to relocate. This approach not only supports the growth of unpopulated areas but also promotes balanced development across the city, relieving strain on infrastructure and enhancing overall livability. The project will implement innovative stormwater collection systems to capture and store rainwater. These systems will not only mitigate flood risks but also replenish groundwater resources and support ecosystem health. By harnessing natural processes, the development ensures the efficient use of water resources while safeguarding against flooding. Mixed-use developments will integrate residential, commercial, and recreational spaces, along with essential amenities such as schools and parks.

USERS

01 PEOPLE OF ALL AGES

The project is designed to be inclusive and accessible to people of all ages, catering to diverse needs and lifestyles. From young families to seniors, the development offers a range of amenities and services aimed at enhancing quality of life and promoting well-being. Whether enjoying waterfront activities, cultural events, or simply relaxing in green spaces, residents of all ages can find fulfillment and enjoyment within the community.

02 CHILDREN

For children, the project provides a nurturing and stimulating environment designed to support their growth and development. With a school and kindergarten integrated into the development, along with playgrounds, parks, and green spaces, children have access to quality education and ample opportunities for play, exploration, and socialization in a safe and enriching setting.

03 OFFICE WORKERS

For office workers, the project provides a dynamic and inspiring work environment that promotes productivity, collaboration, and innovation. With office spaces integrated into the development, along with coworking facilities, meeting rooms, and networking opportunities, professionals have access to modern and flexible workspaces that meet the demands of the modern workforce.

04 FISH FARMERS

The project offers opportunities for fish farmers to engage in sustainable aquaculture practices within the reservoir. With dedicated areas for fish farming, equipped with RAS systems and infrastructure, fish farmers have the resources and support needed to cultivate freshwater species in an environmentally friendly and economically viable manner. This integration of fish farming into the development not only contributes to local food production but also fosters economic resilience and community engagement.

05 WATER SPORT ENTHUSIASTS

For enthusiasts of water sports and outdoor activities, the project provides an exciting array of opportunities to indulge in their passion. With the expansive reservoir at their doorstep, residents can partake in thrilling water sports such as jet skiing, sailing, and wake surfing, enjoying the adrenaline rush of gliding across the water's surface. Additionally, the development offers facilities and amenities to support a healthy and active lifestyle, including waterfront promenades, jogging trails, and fitness zones.

AXONOMETRY

LOCATION

Locating a reservoir in Lipence offers several significant benefits, particularly in addressing the challenges faced by both the area and the wider city of Prague:

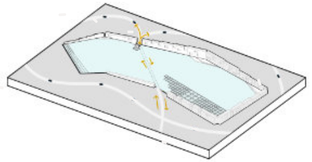
Flood Prevention: Lipence, situated in the southern part of Prague, is prone to flooding due to its lower elevation. By constructing a reservoir in this area, excess water can be effectively managed during periods of heavy rainfall or flooding events. The reservoir serves as a critical storage space, mitigating the risk of inundation and minimizing damage to surrounding infrastructure and communities.

Population Distribution: Lipence currently has relatively low population density compared to other parts of Prague. By establishing a reservoir and associated amenities in this area, the project can help redistribute population growth away from overcrowded urban centers. This not only alleviates pressure on existing infrastructure but also promotes more balanced development across the city, fostering sustainable urban expansion.

SITE DIAGRAMS

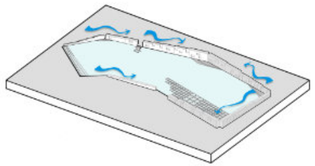
COMMUNICATION

The tonnel is made to connect the two roads under the water.



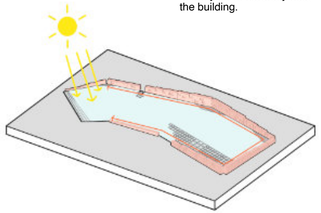
WIND

The height of the building is dictated by the wind direction to secure the inhabitants from the pure winds.



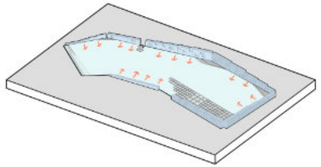
HEATING

The reflection of the sun is helpful during cooler season of the year to narurally heat the building.

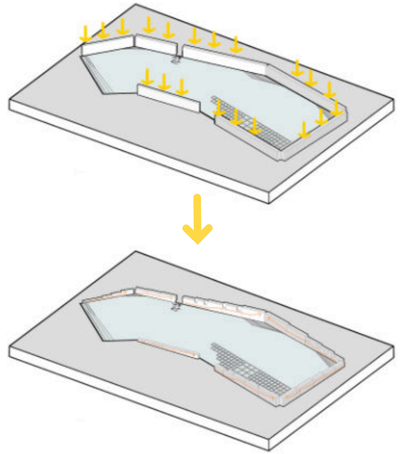


COOLING

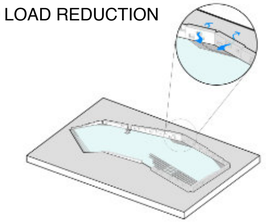
During the hot season, water is helping to cool down the building.



FORM DEVELOPMENT

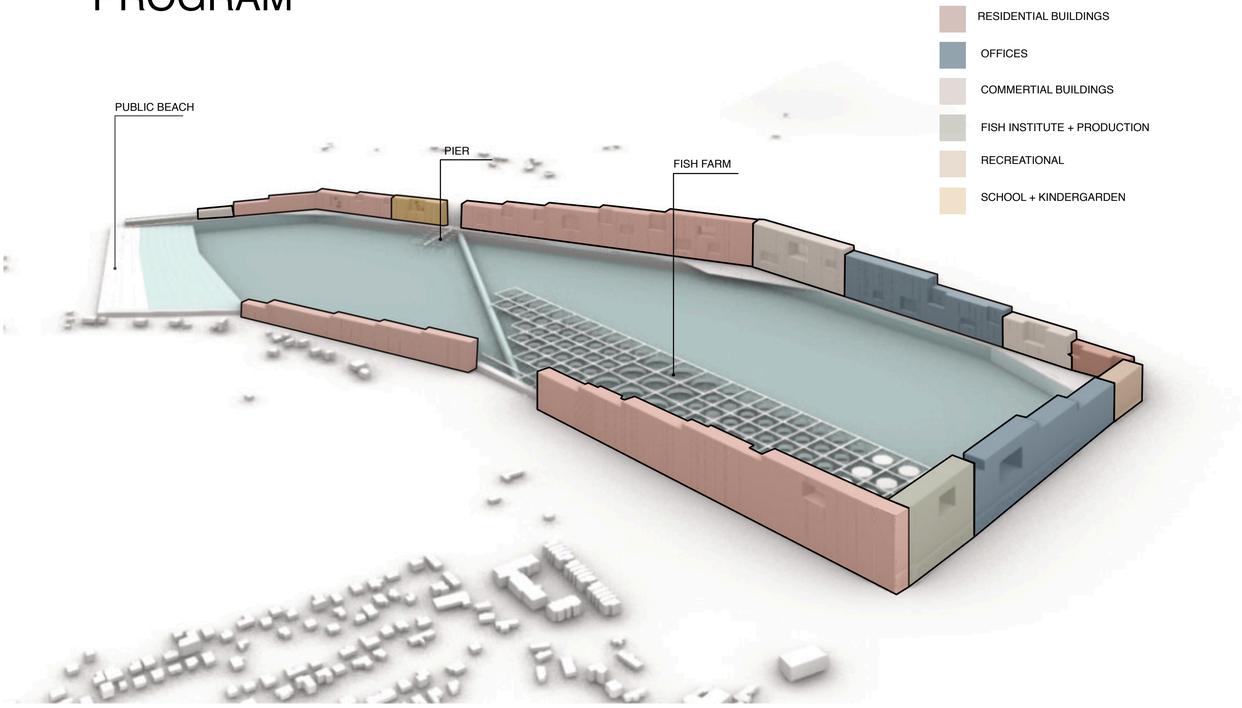


WIND LOAD REDUCTION



The holes through the the building are made the reduce the wind load and allow more sunlight in.

PROGRAM



Housing Units (60% of Massing):

- The majority of the development's massing is dedicated to residential buildings, providing diverse housing options for residents of all ages and lifestyles.

- From high-rise apartment complexes to townhouses and waterfront villas, the housing units offer modern amenities, green spaces, and panoramic views of the surrounding landscape.

Recreational Facilities (20% of Massing):

- Recreational amenities are thoughtfully incorporated throughout the development, offering opportunities for leisure and social engagement.

- Facilities may include playgrounds, swimming pools, fitness centers, shops, and community centers, catering to the diverse recreational needs of residents and promoting an active lifestyle.

Educational Institutions (5-10% of Massing):

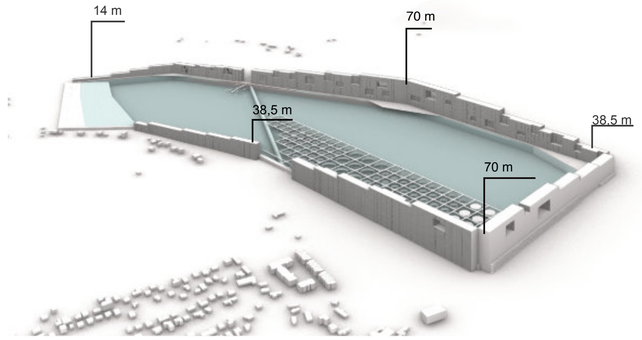
- Educational facilities, including schools and kindergartens, are integrated into the development to support the learning and development of children and adolescents.

Office Spaces (20% of Massing):

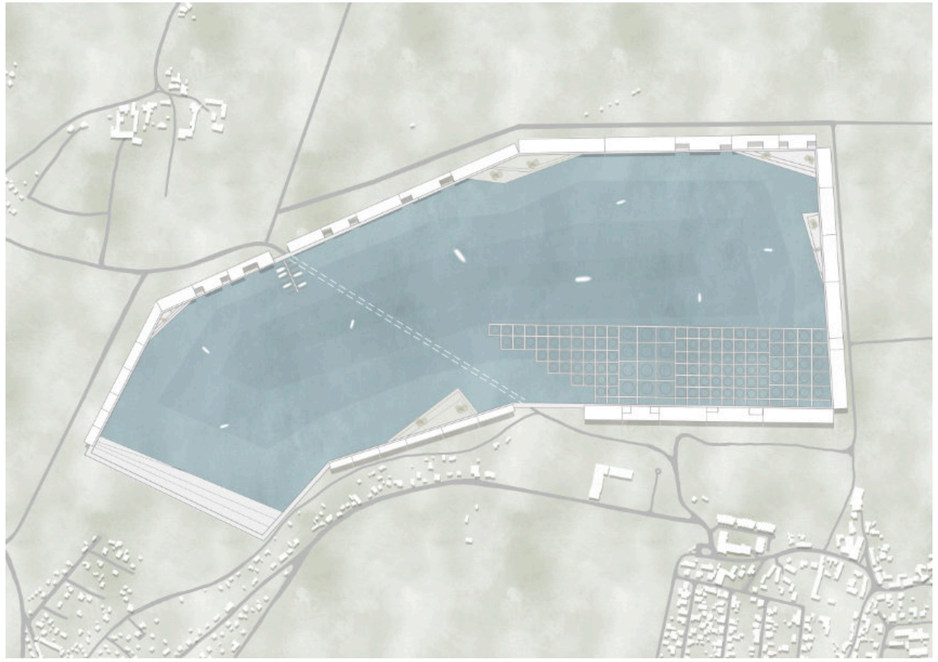
- Office buildings and commercial spaces are strategically located within the development, providing opportunities for businesses, startups, and professionals to thrive.

- Flexible office layouts, coworking spaces, and modern amenities are offered to support innovation, entrepreneurship, and economic growth.

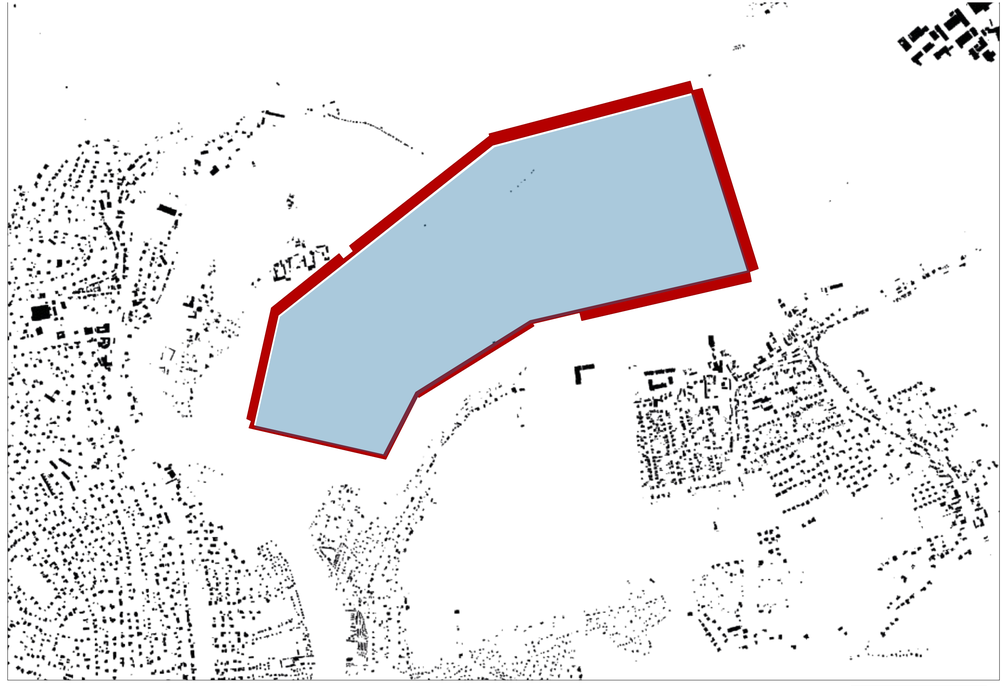
HEIGHTS



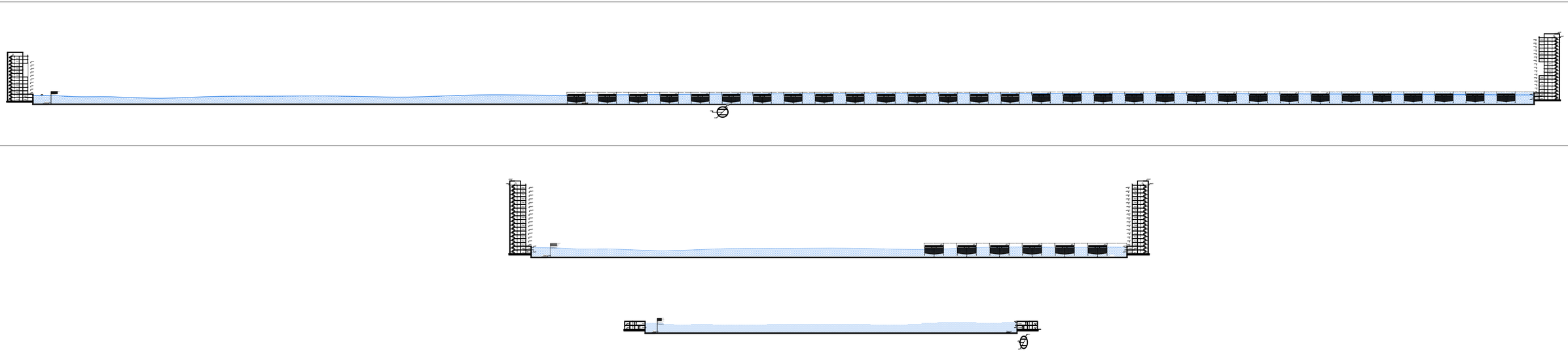
SITE PLAN



URBAN CONTEXT



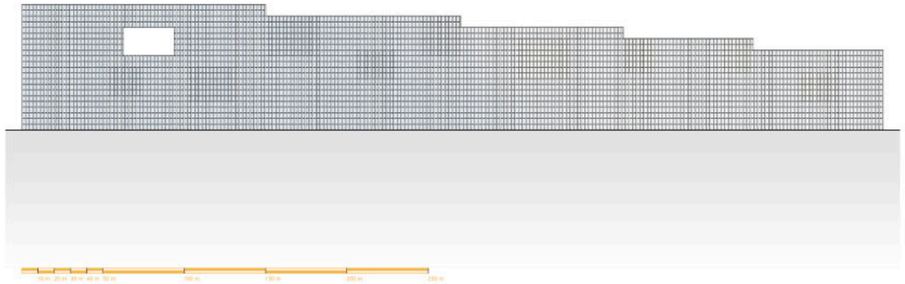
SECTIONS THROUGH RESERVOIR



RESIDENTIAL BLOCKS

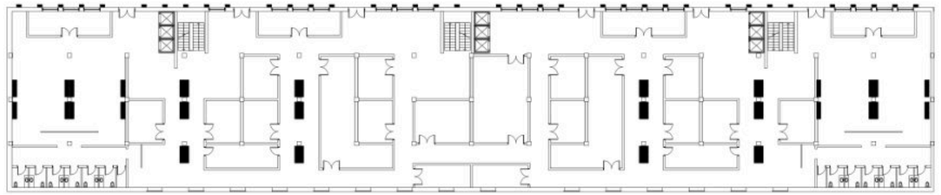
FRONT ELEVATION

REAR ELEVATION

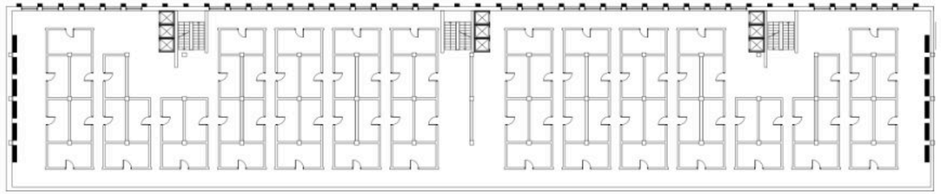


PLANS A

SECOND BASEMENT FLOOR



FIRST BASEMENT FLOOR



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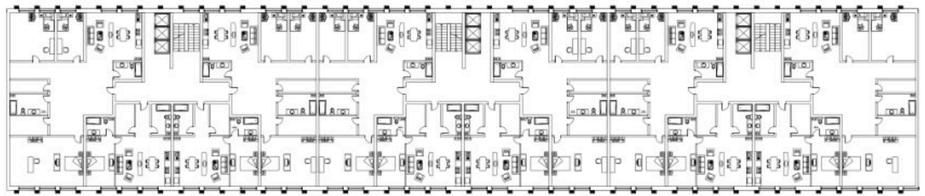
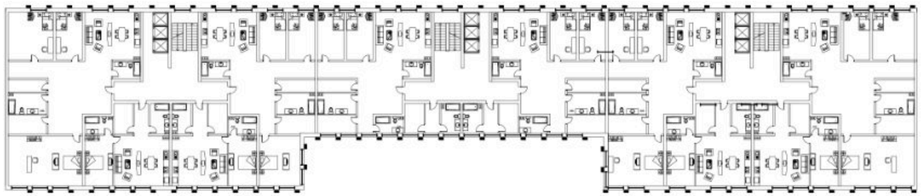
0.-6. FLOOR PLANS

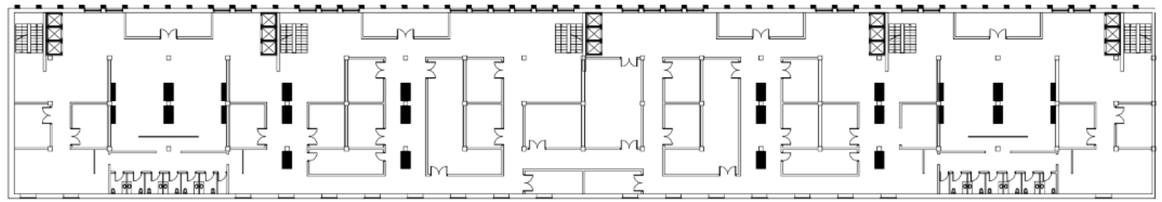


7. - 15. FLOOR PLANS

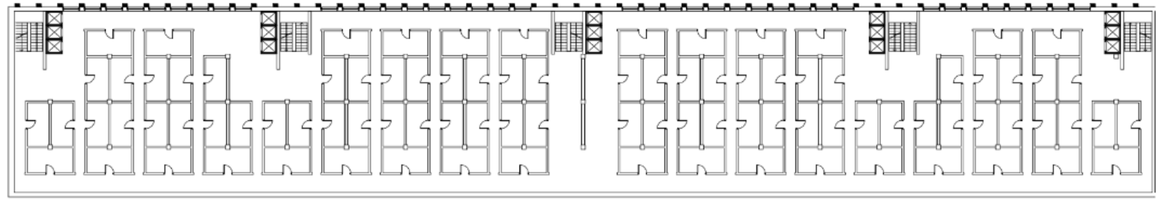


PLANS B

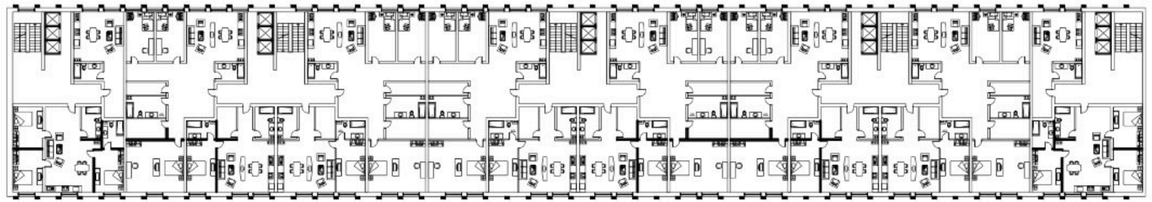
SECOND BASEMENT FLOOR PLAN



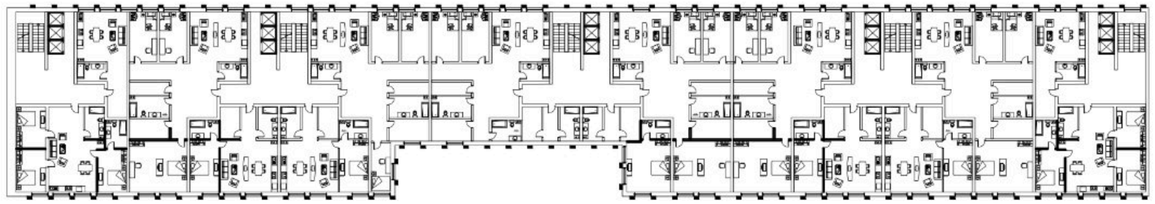
FIRST BASEMENT FLOOR PLAN



0.-6. FLOOR PLANS



7.- 11. FLOOR PLANS



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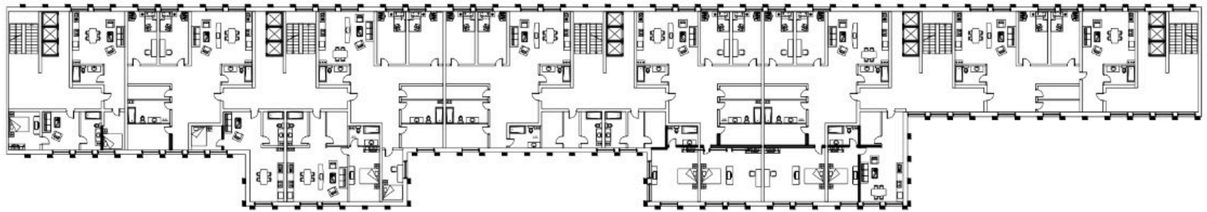
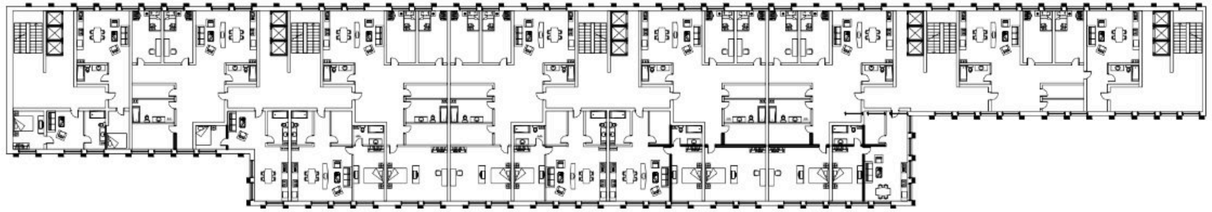
11. FLOOR PLAN



12. - 17. FLOOR PLAN



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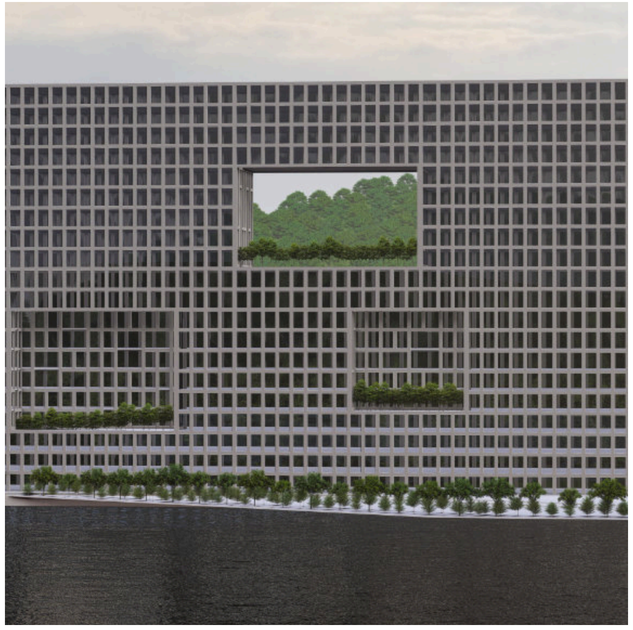
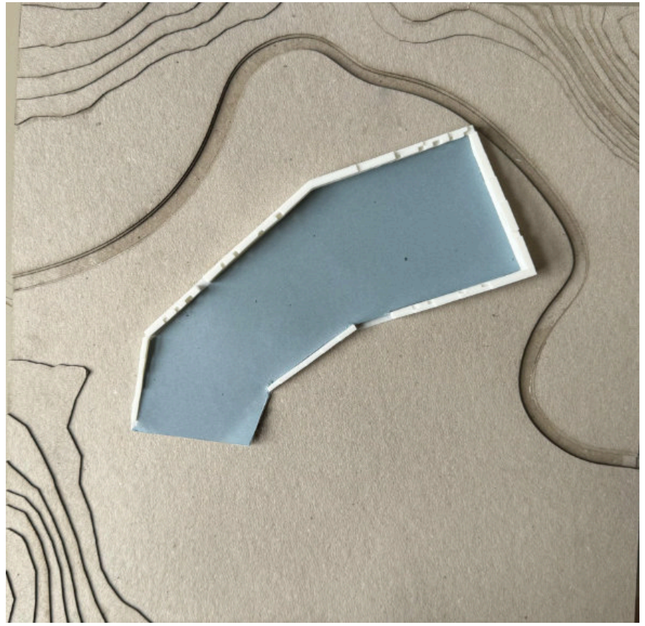
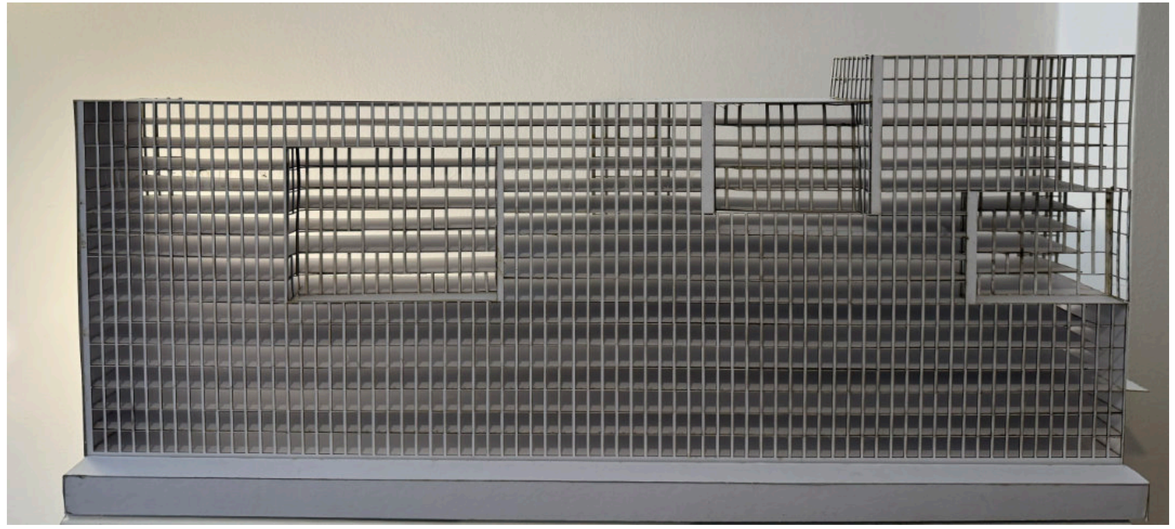
VISUALIZATIONS

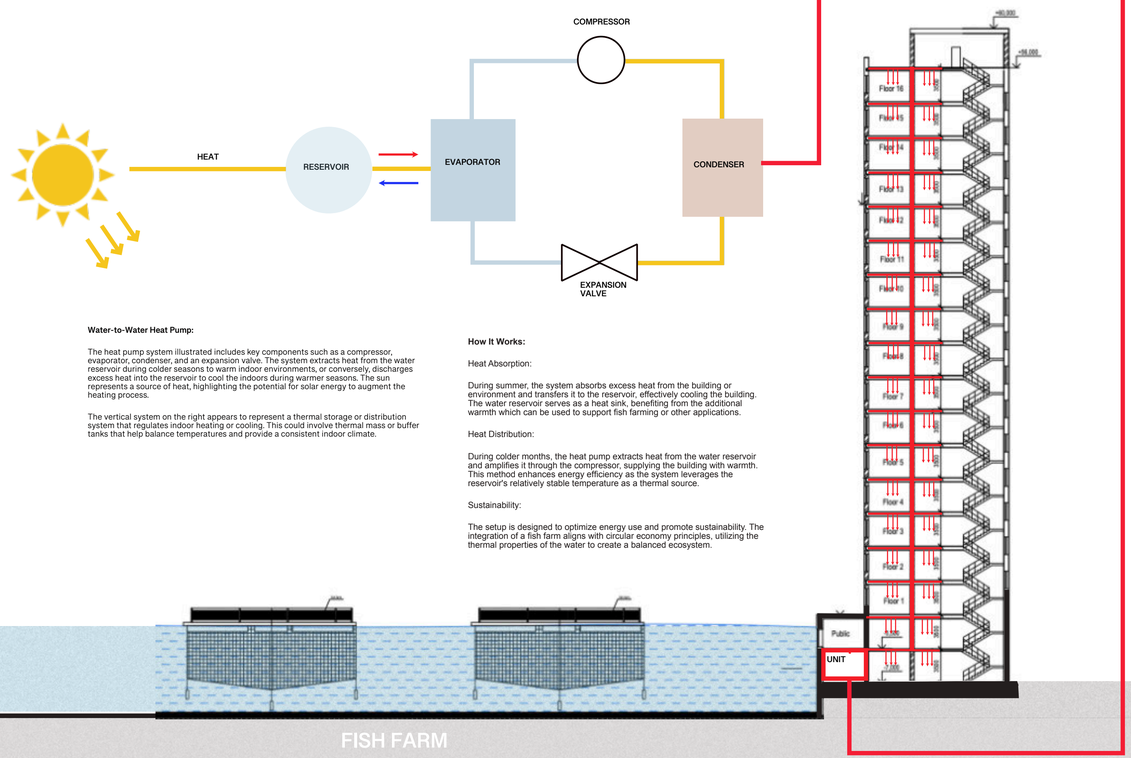


PHYSICAL MODELS





WATER TO WATER SOURCE HEAT PUMP



Water-to-Water Heat Pump:

The heat pump system illustrated includes key components such as a compressor, evaporator, condenser, and an expansion valve. The system extracts heat from the water reservoir during colder seasons to warm indoor environments, or conversely, discharges excess heat into the reservoir to cool the indoors during warmer seasons. The sun represents a source of heat, highlighting the potential for solar energy to augment the heating process.

The vertical system on the right appears to represent a thermal storage or distribution system that regulates indoor heating or cooling. This could involve thermal mass or buffer tanks that help balance temperatures and provide a consistent indoor climate.

How It Works:

Heat Absorption:

During summer, the system absorbs excess heat from the building or environment and transfers it to the reservoir, effectively cooling the building. The water reservoir serves as a heat sink, benefiting from the additional warmth which can be used to support fish farming or other applications.

Heat Distribution:

During colder months, the heat pump extracts heat from the water reservoir and amplifies it through the compressor, supplying the building with warmth. This method enhances energy efficiency as the system leverages the reservoir's relatively stable temperature as a thermal source.

Sustainability:

The setup is designed to optimize energy use and promote sustainability. The integration of a fish farm aligns with circular economy principles, utilizing the thermal properties of the water to create a balanced ecosystem.

WATER MANAGEMENT

Rainwater Collection:

The building includes a rainwater collection system at the top, which is ldesigned to capture and store rainwater for various uses, such as irrigation, flushing toilets, or providing water to the fish farm.

Water Storage:

"Main Water Cistern" and "Water Filtration" are used for storing collected water and purifying it before use, respectively. The system use a central water supply as a backup or for purposes where purified rainwater is insufficient.

Vertical Piping:

The diagram shows vertical piping running alongside the building's floors, facilitating the distribution of water. The fish farm section is depicted below the building, and the water for the fish farm is likely managed through the water management system. The fish farm could benefit from the rainwater collection system, providing a sustainable source of water.

Description

The water management system depicted in the image integrates several key elements:

Rainwater Harvesting:

The system collects rainwater from the rooftop of the building, utilizing it for various non-potable uses. This is an effective way to reduce the reliance on the central water supply and promote water conservation.

Water Storage and Filtration:

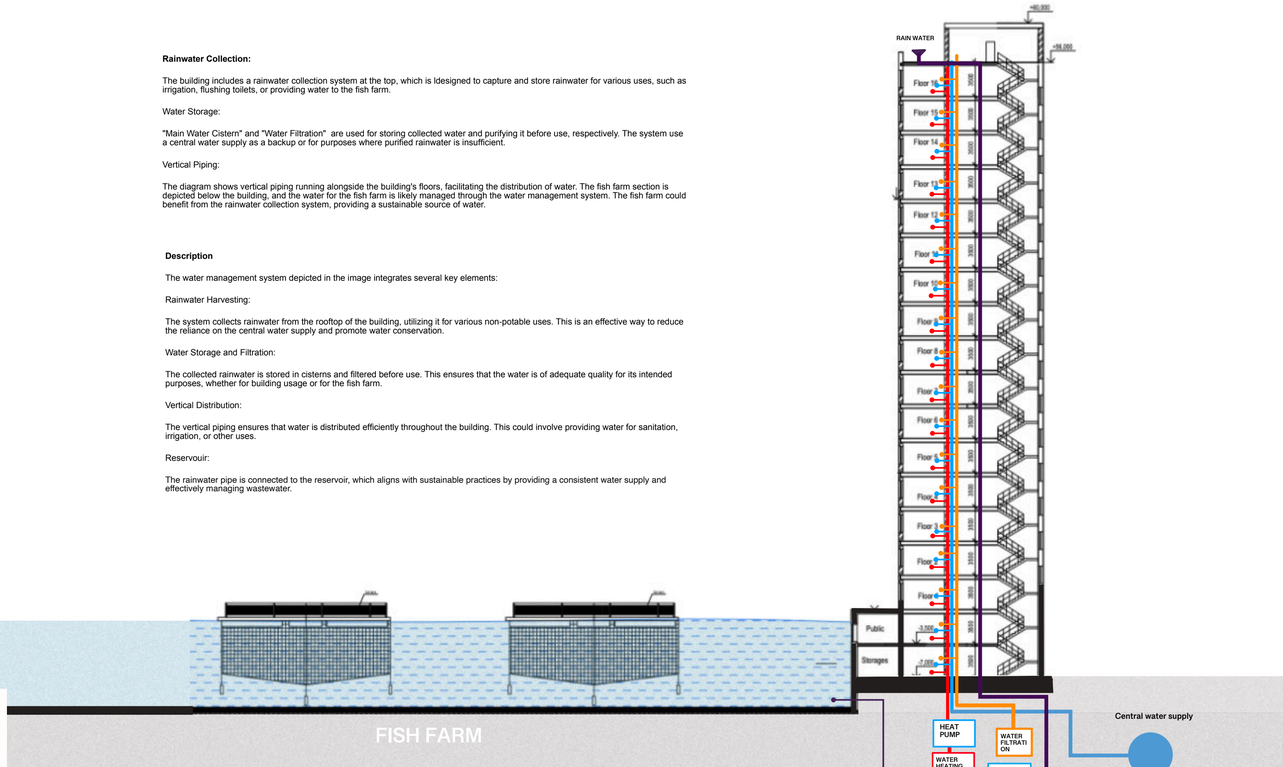
The collected rainwater is stored in cisterns and filtered before use. This ensures that the water is of adequate quality for its intended purposes, whether for building usage or for the fish farm.

Vertical Distribution:

The vertical piping ensures that water is distributed efficiently throughout the building. This could involve providing water for sanitation, irrigation, or other uses.

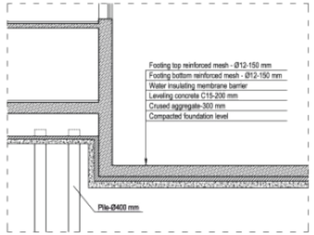
Reservouir:

The rainwater pipe is connected to the reservoir, which aligns with sustainable practices by providing a consistent water supply and effectively managing wastewater.

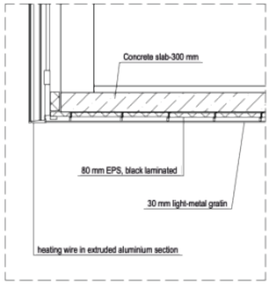


DETAILS

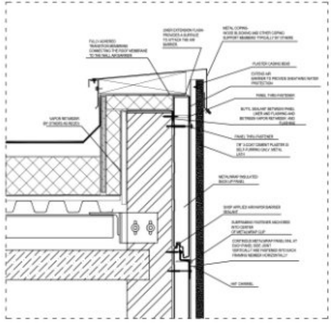
RESERVOUIR FOUNDATION DETAIL



FLOOR AND WALL DETAIL



PARAPET WALL AND ROOF DETAIL



TECHNICAL REPORT

1. Studio brief

The studio brief calls for the creation of a visionary project depicting the future of Prague. The initial phase of the semester focused on the analytical aspect, delving into old maps, junctions, the history of brownfields, and other relevant factors. Subsequently, the latter part of the semester was dedicated to the visionary component. Drawing inspiration from art, students were tasked with crafting innovative ideas that integrated insights gleaned from the analytical phase, all with the aim of enhancing the future landscape of Prague.

2. Purpose of the project

The project's overarching goal is to address a myriad of challenges through the strategic construction of new water reservoirs in the vicinity of Prague. The primary objective is to mitigate population density by dispersing inhabitants to less densely populated areas surrounding the city. This dispersion not only alleviates strain on existing infrastructure but also fosters balanced urban development.

Additionally, the project aims to serve as a proactive measure against floods by creating storage reservoirs capable of accommodating excess water during periods of heightened risk. The reservoirs can serve as a reliable water source, supporting the local farms during dry periods and helping to maintain consistent soil moisture levels.

Furthermore, the Czech Republic fish market would be expanded by implementing innovative fish farming systems within the reservoirs. Since, most of the fish in Czech republic is being imported this integration not only enhances local food security but also supports economic sustainability within the region.

Another key facet of the project involves the establishment of recreational public spaces within Prague. By incorporating public beaches along the reservoirs shores, the initiative enhances the quality of life for city residents while fostering community engagement with natural amenities.

Lastly, the project endeavors to create new living neighborhoods that encompass residential, commercial, educational, and recreational facilities. This holistic approach to urban planning promotes vibrant, inclusive communities that cater to diverse needs and lifestyles, thereby enriching the fabric of Prague's urban landscape.

3. Strategies

Strategies of the implementing reservoirs

Fish Farming:

- The integration of fish farming within the reservoir presents a sustainable solution to enhance local food production and economic resilience. By allocating a portion of the water surface for aquaculture, the project aims to diversify the local economy and provide a renewable food source.

Population Distribution:

- Addressing urban congestion in central Prague, the project emphasizes population dispersion to areas like Lipence. By providing attractive housing options, coupled with amenities and employment opportunities, the aim is to incentivize individuals and families to relocate. This approach not only supports the growth of Lipence but also promotes balanced development across the city, relieving strain on infrastructure and enhancing overall livability.

Collection of Water:

- Effective water management is critical for sustainable development, particularly in flood-prone areas like Lipence. The project will implement innovative stormwater collection systems to capture and store rainwater. These systems will not only mitigate flood risks but also replenish groundwater resources and support ecosystem health. By harnessing natural processes, the development ensures the efficient use of water resources while safeguarding against flooding.

New Living Neighborhoods:

- The creation of new living neighborhoods in Lipence aims to foster vibrant, inclusive communities that prioritize sustainability and quality of life. Mixed-use developments will integrate residential, commercial, and recreational spaces, along with essential amenities such as schools and parks.

Flood Prevention:

- Proactive flood prevention measures are integral to the resilience of the Lipence development. As the Lipence is a quite low area, the implementation of the water reservoir will help to control the water level in case of emergency.

.4. Impact on Prague

- Market Impact: At the moment 90% of the trout market in Czech republic is being imported. The increase in the number of reservoirs has a direct impact on Prague's share of the trout export market, with potential increases from 20% to 80%. This suggests a significant enhancement in local fishery production and could lead to economic growth in the fishing industry within Prague.

- Production Capacity: There is a clear linear correlation between the number of reservoirs and the production tonnage of trout, salmon and carp. This could positively influence the local economy by increasing supply for domestic consumption and export, potentially leading to job creation and technological investment in aquaculture.

- Recreational Opportunities: The provision of recreational beaches could offer social and health benefits by promoting outdoor activities and potentially increasing tourism. With more reservoirs, there are more opportunities for recreational areas, which can enhance the quality of life for residents and attractiveness for visitors.

4.3. Typology

Building Type: Integrated Waterfront Development

Description:

The integrated waterfront development encapsulates a harmonious blend of residential commercial, educational, and recreational facilities surrounding a central reservoir in Lipence, Prague. This complex embraces the natural beauty of the water while fostering a vibrant community environment.

Key Features:

Fish Farming Facilities (40% of Water):

- Aquaculture infrastructure is strategically positioned within the reservoir, utilizing 40% of its water surface area for sustainable fish farming practices.

- Modern RAS systems are integrated to produse diverse fish species, that are popular in Czech republic and around Eupore.

Housing Units (60% of Massing):

- The majority of the development's massing is dedicated to residential buildings, providing diverse housing options for residents of all ages and lifestyles.

.Recreational Facilities (20% of Massing):

- Recreational amenities are thoughtfully incorporated throughout the development, offering opportunities for leisure and social engagement.

- Facilities may include shops, malls, playgrounds, swimming pools, fitness centers, shops, and community centers, catering to the diverse recreational needs of residents and promoting an active lifestyle.

Educational Institutions (5-10% of Massing):

- Educational facilities, including school and kindergarten, are integrated into the development to support the learning and development of children.

Office Spaces (20% of Massing):

- Office buildings and commercial spaces are strategically located within the development, providing opportunities for businesses, startups, and professionals to thrive.

- Flexible office layouts, coworking spaces, and modern amenities are offered to support innovation, entrepreneurship, and economic growth.

Water Sports Facilities (10% of Water):

- Waterfront facilities are dedicated to water sports and recreational activities, catering to enthusiasts of sailing, kayaking, paddleboarding, and more.

- Marina infrastructure, boat ramps, and waterfront promenades enhance accessibility and enjoyment of water-based recreation for residents and visitors alike.

Public Beach Area (10% of Water):

- A designated public beach area is created along the reservoir's shoreline, providing a scenic and inviting space for relaxation and socializing.

- Amenities such as beach volleyball courts, picnic areas, and concession stands enhance the recreational experience and foster a sense of community.

6. Structure

The building is constructed using a concrete frame structure, a common approach in modern construction that offers several benefits such as strength, durability, and flexibility. The structure involves vertical columns and horizontal beams made of reinforced concrete, creating a skeleton that supports the building.

Key Structural Features:

Holes for Wind Load Reduction

The building is designed with strategically placed holes to minimize wind load. By incorporating these openings, the building reduces the pressure exerted by strong winds, enhancing stability and safety during adverse weather conditions. This design choice helps to prevent excessive lateral forces, which can cause structural issues.

Extrusions for Sunlight Access

To maximize natural light, the building features extrusions that direct sunlight into interior spaces. These protrusions are designed to enhance the quality of indoor lighting, reduce energy consumption for artificial lighting, and create a more pleasant environment for occupants.

Submerged Floors and Wall Thickness

The first two floors of the building are situated below water level, requiring special consideration for structural integrity. The walls of these submerged floors are 510 mm thick, providing the necessary strength to withstand water pressure. This thickness ensures that the building can resist the hydrostatic forces exerted by the surrounding water, preventing leaks and structural damage.

Pile Foundation

The building's foundation rests on piles, which are long, slender columns driven deep into the ground to support the structure. This pile foundation is particularly effective in distributing the building's load across stable soil layers or bedrock, enhancing the overall stability of the building. This foundation type is ideal for situations where the surface soil is not strong enough to bear the building's weight.

7. Materials

Green Concrete for the Facade

Implementing green concrete for the building facade it provides structural strength while promoting sustainability. This material reduces the carbon footprint associated with concrete production and often features improved thermal properties, contributing to energy efficiency.

High-Performance Glass

High-performance glass is a key material in modern sustainable architecture. It provides excellent insulation, reduces heat transfer, and enhances energy efficiency. This type of glass typically features special coatings or layers to reflect or absorb specific wavelengths of light, minimizing heat gain or loss. By incorporating high-performance glass, the building benefits from natural light while maintaining a comfortable indoor environment and reducing reliance on artificial heating or cooling.

Concrete Frame

The concrete frame is the backbone of the building's structure. Reinforced concrete offers exceptional strength and durability, capable of withstanding various loads and stresses. This material is highly fire-resistant and provides excellent thermal mass, which helps regulate indoor temperatures.

8. Sustainability

Sustainable Features

Water-to-Water Heating Pump System

The water-to-water heating pump system in your project is a highly efficient means of temperature control that aligns with sustainable building practices. This system utilizes water as both a heat source and a heat sink, depending on the season:

Heating Efficiency

- During colder seasons, the system extracts heat from a water source and uses it to warm the building. This process is more energy-efficient than conventional heating methods because it leverages existing thermal energy rather than generating new heat.

Cooling Efficiency

- In warmer months, the system operates in reverse, transferring heat from the building to the water source. This process provides effective cooling while utilizing less energy than traditional air conditioning..

Water Management Solutions

Rainwater Harvesting

- The building features a rainwater harvesting system that collects and stores rainwater for various uses, such as irrigation, toilet flushing, or supporting the fish farm. This reduces reliance on municipal water supplies and promotes water conservation.

Water Filtration

- The harvested rainwater is filtered and treated to ensure it meets the necessary standards for its intended uses. This sustainable practice ensures water is used efficiently and safely.

Fish Farming

- The water management system supports a fish farm, contributing to sustainable food production. The fish farm benefits from the building's water management solutions, creating a closed-loop system that reduces waste and enhances resource efficiency.

Energy Efficiency and Design

Thermal Insulation

- The thick walls of the submerged floors provide effective thermal insulation, maintaining stable indoor temperatures and reducing energy consumption for heating and cooling.

Green concrete implimentation

- Green concrete is a form of eco-friendly concrete that is manufactured using waste or residual materials from different industries, and requires less amount of energy for production. Compared to traditional concrete, it produces less carbon dioxide, and is considered cheap and more durable. Implementation of this type of concrete aims to make project more sustainable.

9. Conclusion

The "Living Lakes" project envisions a transformative future for Prague, centered around sustainable urban development that addresses key challenges while enhancing the quality of life for residents. Through careful analysis and innovative thinking, the project integrates diverse elements to achieve a holistic vision.

Strategic implementation of new water reservoirs near Prague serves multiple objectives, from bolstering the trout export market to offering diverse recreational opportunities. The project's strategies, such as fish farming, population distribution, water collection, new neighborhoods, and flood prevention, align with a sustainable approach to urban development.

Material choices, such as green concrete for the facade, high-performance glass, and a concrete frame, underscore the project's commitment to sustainability. Sustainable features like the water-to-water heating pump system, water management solutions, and energy efficiency measures further highlight the project's environmental focus.

In summary, the "Living Lakes" project presents a visionary future for Prague that balances economic growth, environmental stewardship, and social well-being. It serves as a model for sustainable urban living, addressing key challenges while enhancing the city's landscape.