AD6 - Summer term
2024

J. Wertig + J. Kopecký studio

Alžběta Pleyerová

Bachelor thesis

INSTITUTE OF AQUATIC BIOLOGY

ARCHIP
ARCHITECTURAL INSTITUTE IN PRAGUE

ANNOTATION

Branické ledárny Bachelor thesis is a complex architectural and urban study of the redevelopment of southwest part of the cadastral territory Prague 4, Braník. It strictly focuses on the area analysis and carefully repurposes new architectural and urban plan with respect to the spatial and functional relations in the transformed area including the new functional use of the industrial site of the former icehouse. This thesis designs the new conversion of Branické ledárny area in more detail including the design of the surrounding public spaces. The thesis proposes one of the possible solutions embracing the connection to the Vltava river with emphasis on river transportation, walkability and cycling activity throughout the area.

KEY WORDS

Branické ledárny, Akciové ledárny Braník, Prague, Czech Republic, Braník, Revitalisation, Conversion, Repurposing, Sustainability, Urbanism, Landscape, Public space, Pedestrian zone, Cycling zone, Boat transport, River transport, Aquarium, Faculty of aquatic Biology, Algae

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Academical year:	2023/2024
Name of Bachelor thesis:	Branické Ledárny

AFFIDAVIT

I honestly declare, that I developed my bachelor's thesis independently under the guidance of the supervisors of the bachelor's thesis. As the author of the mentioned bachelor's thesis, I further declare that I have not violated the copyrights of third parties in connection with its creation.

In Prague, 7.5.2024 Signature:

Contents

THE BRIEF

The Architectural Design Wertig - Kopecký studio operates through two distinct phases: the ANALYTICAL phase and the DESIGN phase, both integral to our projects.

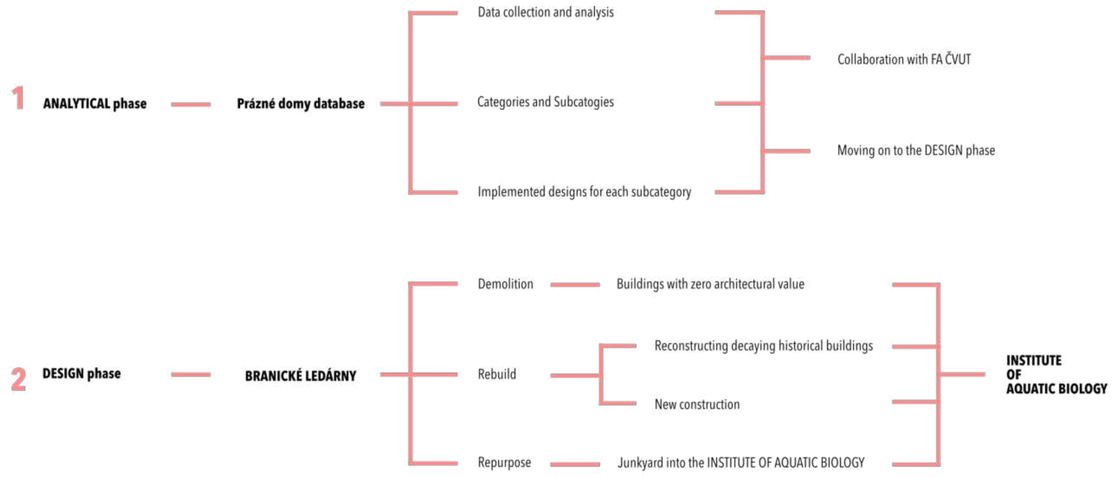
During the ANALYTICAL phase, our focus lies on the Prázné domy database, a non-profit organization dedicated to cataloging vacant buildings in the Czech Republic. Our primary attention has been on Prague, Czech Republic, which we divided into seven categories: Residential, Representational, Industrial, Public, Commercial, Military, and Transport. Students were organized into groups, each assigned to one of these categories. Within each group, attention turned to subcategories, detailing the number of empty buildings in each subcategory and the total count within the overarching category. This analytical phase provided crucial insights into Prague's vacant building landscape.

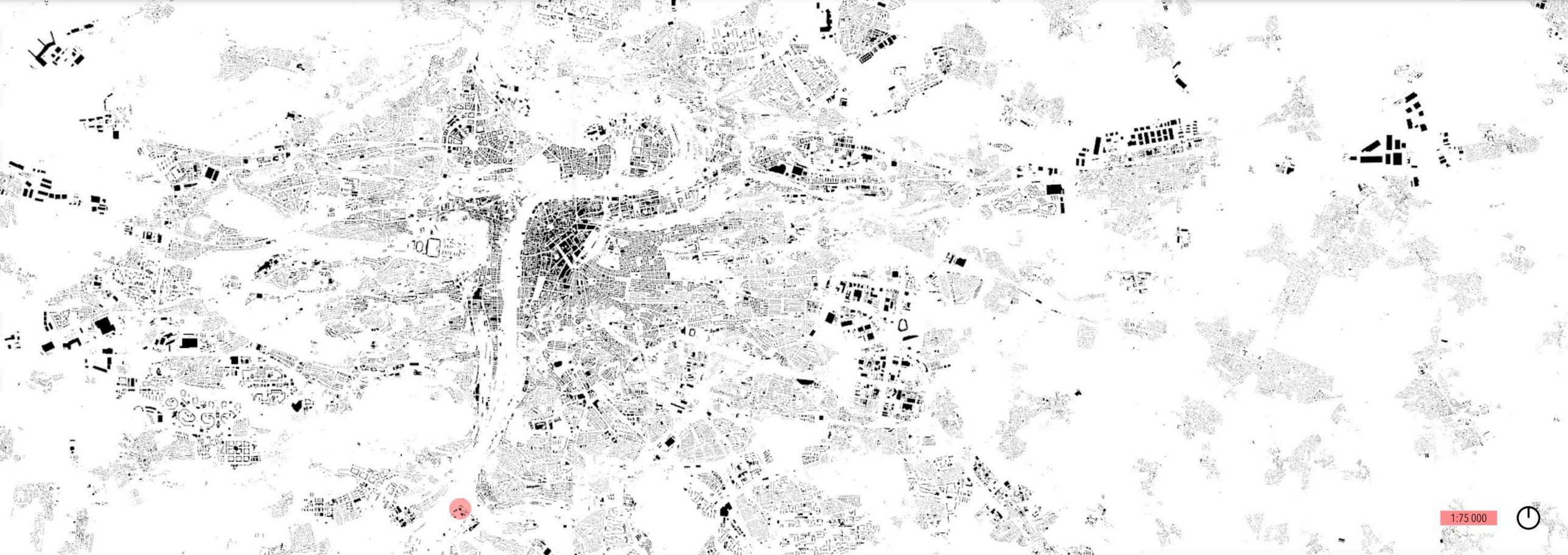
Subsequently, we transitioned to the DESIGN phase. Here, we selected sites from the categories identified during the ANALYTICAL phase. Working with these chosen sites, we deliberated whether to Rebuild, Demolish, or Repurpose them, shaping our design strategies accordingly.

THE MASTER PLAN - PROJECT INTRODUCTION

The Branické Ledárny Project is centered on the restoration and rejuvenation of a historically significant site located in Branik, Prague 4, Czech Republic. Situated on the grounds of the Akciové Ledárny, originally designed by J. Kovařovič in the Art Nouveau style between 1910 and 1920, this location holds immense cultural and historical value. Historically, it served as an ice storage facility, supplying
breweries, restaurants, and hospitals with ice harvested from the frozen Vltava river during winters prior to the construction of the Slapy dam. In line with the project's objectives, I proposed a strategy that prioritizes preservation over demolition. Given its status as one of the Czech Republic's pioneering structures to utilize reinforced concrete frames, the existing buildings remain structurally sound and resilient. My vision focuses on the renovation of the five buildings originally constructed by Kovařovič, repurposing them to house an Institute of Aquatic Biology. Additionally, I plan to construct two new buildings, harmonizing with the architectural style of their historic counterparts, to accommodate the expansion.

The revamped site will feature a Faculty of Aquatic Biology, a publicly accessible aquarium, laboratories equipped with fish reproduction and algae ponds, an educational library, cafeteria, student day room, and storage facilities. Furthermore, I am spearheading a comprehensive urban redevelopment plan encompassing a sprawling 30,000 square meters of green space, four new boat docks catering to small and larger vessels, and an extensive network of cycling paths. In essence, my project aims to introduce and promote interest in marine and aquatic biology within the Czech Republic. By providing state-of-the-art facilities for education and research, we aspire to engage students and the public alike while seamlessly integrating the Institute of Aquatic Biology into the cultural fabric of Prague. Moreover, the expansion of recreational areas and connectivity enhancements will enrich the community by fostering leisure activities and promoting environmental awareness.




1:75 000


Site location: Ledařská, 147 00, Praha 4
Coordinates: 50°01'58"N 14°24'16"E
Site area: 84 329 m²
1:10 000

SITE LOCATION

The site area is located in Braník, Prague 4, Czech Republic. Bounded from northeast and east by Modřanská arterial road, from south by U Ledáren street, from northwest by Strakonická highway. This is a very lucrative location right on the west and east bank of the Vltava River, which is unfortunately very neglected nowadays, despite the fact that it is in a very advantageous position towards Prague.

TERRAIN

Locality is mostly flat, terrain gets steeper right behind the Braník brewery which is not a part of the site. The only level barrier on the site is the tram body, which nowadays forms the border of the flood plain.

TRANSPORT INFRASTRUCTURE

Traffic service is provided by Modřanská street, which is an arterial road and to which a network of service roads is connected.
Municipal public transport services are provided by tram, bus and railway transport. Currently, the tram line is divided into two. The first track leads from the city centre to the level body and continues in the direction of Modřany (and vice versa). The second line runs along the body and ends with a turntable at Nádraží Braník, and from there it leads to the city centre again. There are currently two bus stops at Modřanská street, both are named as Pobřežní cesta and are leading towards Modřany and Smíchovské nádraží. Two railway lines pass through the territory. The first route Prague-Plzeň runs along the Branický bridge located near the site and does not have a stop in the area. The second line Prague-Čerčany, Dobříš (the so-called Posázavský Pacific) has a stop at the Prague-Braník train station. There is a dock for smaller boats in the Branické ledárny lagoon, located on Vltava river.

FUNCTIONAL USE OF THE SITE AND ITS SURROUNDINGS

Nowadays, the territory is not unified and the potential of this location is not fully utilized. This is mainly the historically significant area of Branické ledárny in contrast to uncoordinated low-rise buildings, mainly warehouses and workshops.
Part of the territory on the river bank is positively used. In the southern part there is a large sports complex with tennis and volleyball courts and a covered hall. Part of this area is the historically significant and reconstructed Vršovické vodarny pumping station. There is also a children's playground in the complex called HAMR.

Today, the Branické ledárny are being used in a dignified manner as warehouses, garages and workshops and the entire area is fenced and completely inaccessible to pedestrians. In the western part, there is also a horticulture (garden centre), which occupies a considerable area. In the eastern part, the largest area (almost a third of the territory) is occupied by the historically significant area of the Branické brewery. Today it is no longer fully utilized and brewing is carried out here in a limited quantity. The area is used more for small industrial production and storage. In the future, however, the full-scale restoration of brewing is being considered. There is also the already mentioned train station with historical buildings and small scattered buildings.
Currently, only the sports complex, which is widely used, the bike path along the Vltava River and the brewery ensure the attractiveness of the area.

QUALITIES OF THE AREA

+Area identity (Branické ledárny area, brewery, Braník train station, Vltava river, sports and recreational use)
+Cycling path alongside Vltava river
+Biocorridor, Greenery and Vltava river as a natural water source
+Easily accessible location - transportation infrastructure
+Potential use of site

SITE ANALYSIS

INEQUALITIES OF THE AREA

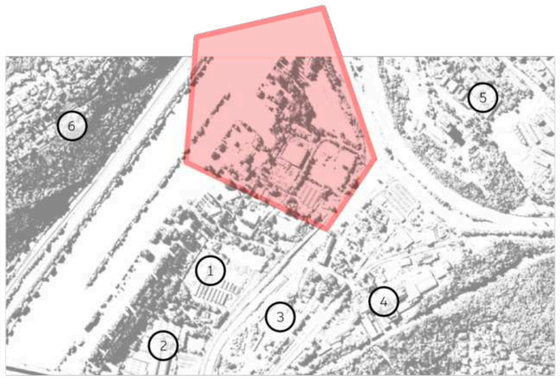
- Neglected cultural monument - Branické ledárny
- Unused potential of the territory
- Absence of concept
- Scattered structures with the function of warehouses and workshops (mostly for cars)
- Barrier territory - the busy modřanská street and the tram level body,
- Dead territory - people commute, there are no permanent residents

PLANNED USE OF THE AREA AND ITS SURROUNDINGS

In the Braník nádraží locality near the Branický bridge, a housing development and a tram transport construction are being prepared on a city plot with an area of approx. 25,000 m2. According to the current spatial plan, approximately 250 rental apartments, commercial and administrative premises and infrastructure for tram transport construction could be created here.
Currently, the stage of the project is at the preparatory work of the project and coordination between the Municipality of Hl. City of Prague, City District Prague 4 and Transport Company Hl. city of Prague. Everything is taking place with regard to the future development of tram lines. Construction will take place in two or three stages with a time estimate between 2023 and 2030. The new construction will also include a tram depot. There will be a new construction of metro D near the site.

Legend:

- Site
- 1 Horticulture
- 2 HAMR sports centre and playground
- 3 Branické nádraží / Braník train station
- 4 Braník brewery
- 5 Braník, Prague 4
- 6 Barrandov, Prague 5



Ledárny - side tunnel and entrance

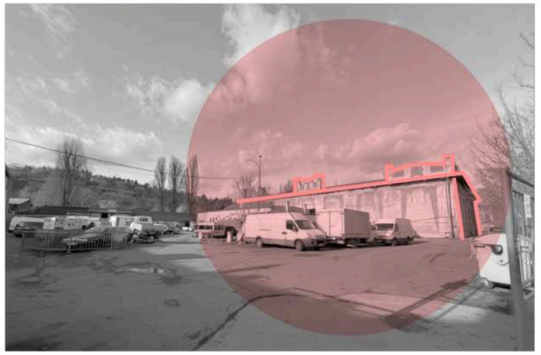
Ledárny - side entrance

Administration building - former manager's villa

Ledárny - elevator shafts for ice transportation

Administration building - former manager's villa

Preserved wall



Ledárny side view

Former stables for horses

Warehouses

Branické ledárny current summer open air concert stage

Former elevator buildings

Current site plan and situation

Site

Existing structure

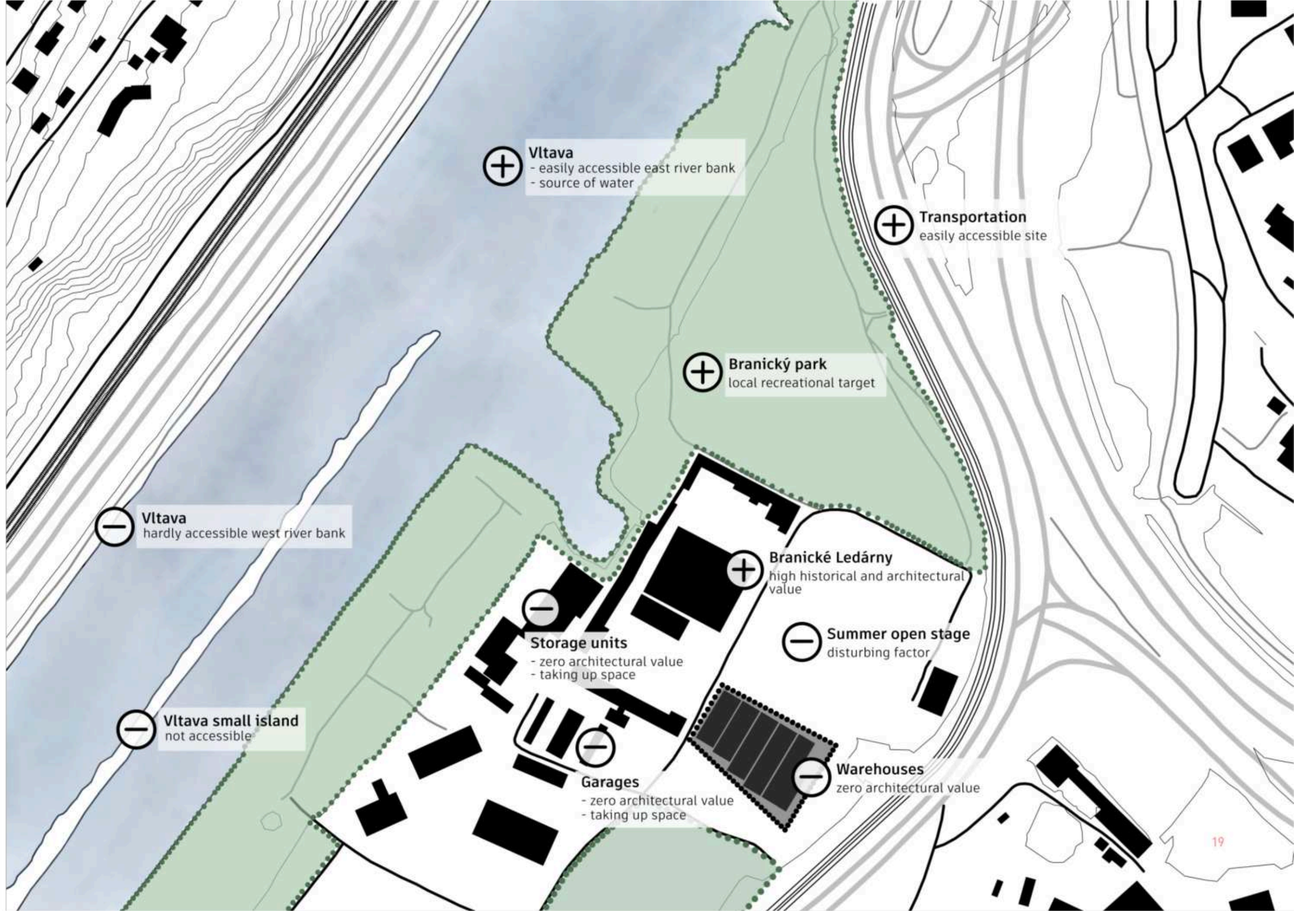
1:1500

Site qualities and inequalities

Site qualities

Site inequalities

1:1500



Accessibility and transportation

- Existing structure
- BUS Pobřežní cesta
- TRAM Pobřežní cesta
- TRAM rails
- Jižní spojka
- Modřanská
- Strakonická
- Barrandov bridge
- Local road
- Pathways
- TRAIN tracks

1:1500

Historically valuable structure

Historical structure

Existing structure

1:1500

Concept of demolishlion

Existing kept structure

Demolished structure

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Current public greenery areas

Current greenery

Demolished structure

Existing kept structure

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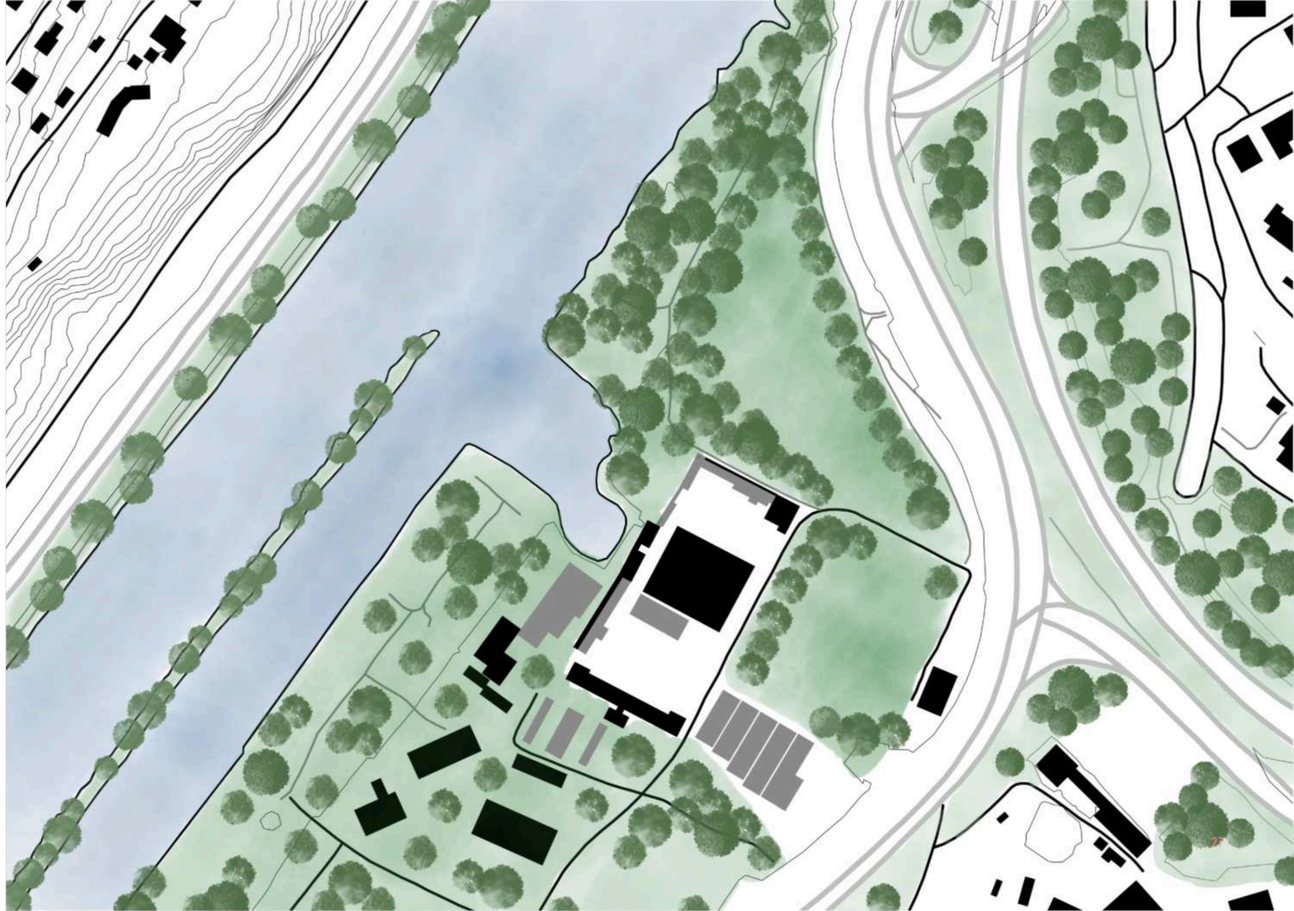


WHAT?

Insitute of Aquatic Biology

WHY?

- Entertainment
- Education
- Leisure

HOW?

- Reconstruction
- Renovation
- Revitalisation

SITE USERS

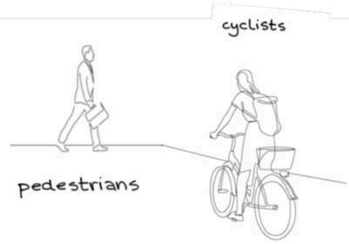
1 PRIVATE USERS

students + teachers

scientists

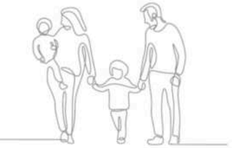
divers

PUBLIC USERS 2



cyclists

pedestrians



families with children

New designed site plan

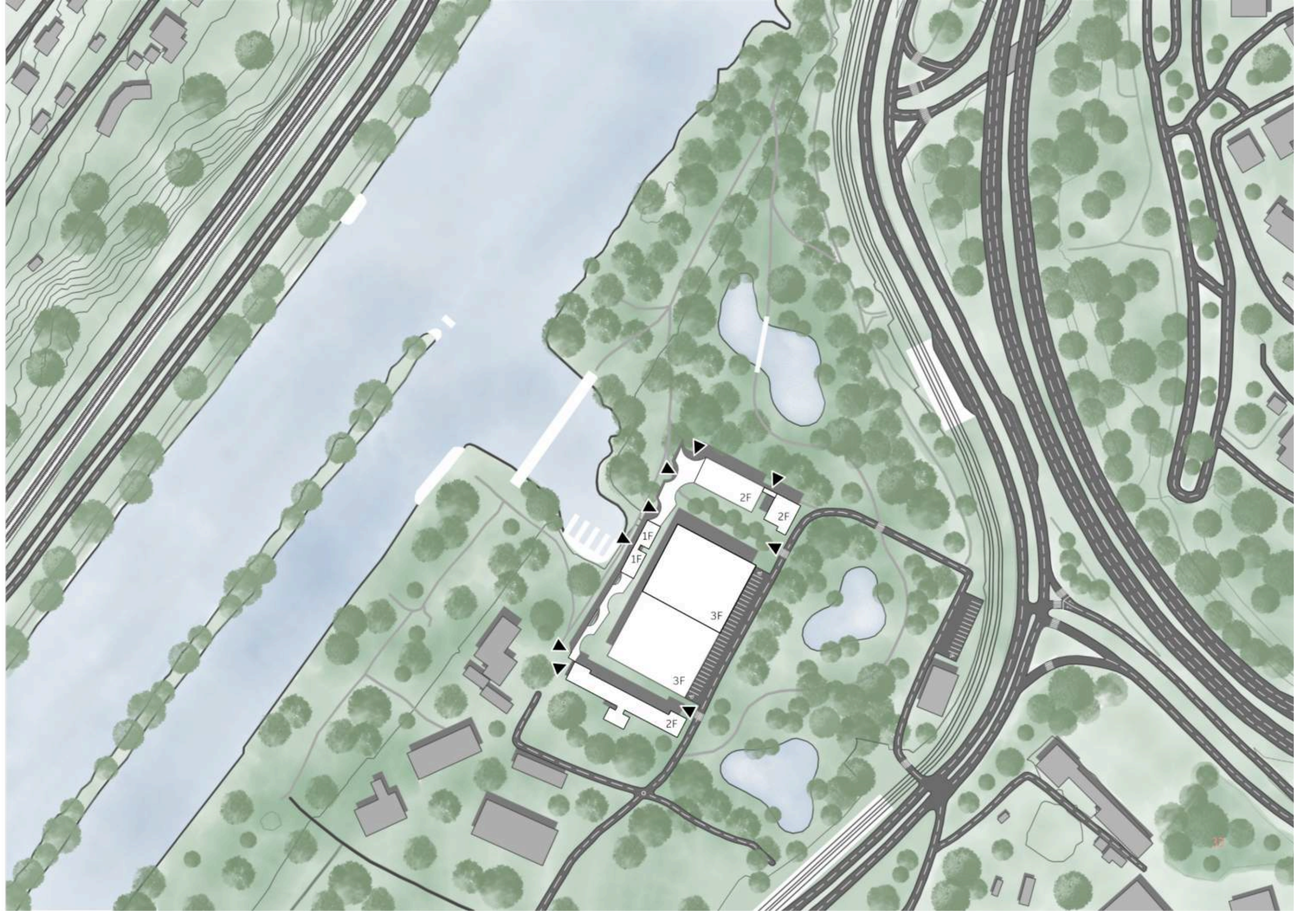
- Greenery
- Existing kept structure
- Newly built structure
- Water source
- Road

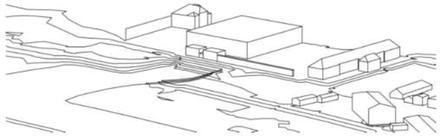
1:1500

Site entrances and floor count

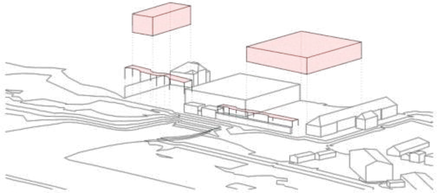
- Site entrances
- Greenery
- Site structures
- Water source
- Road

1:1500

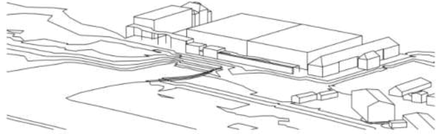




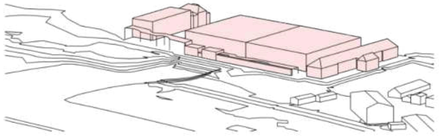
1 Current existing site



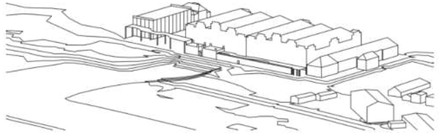
2 Massing



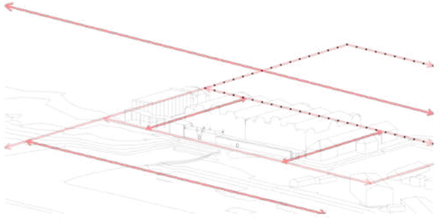
3 Massing



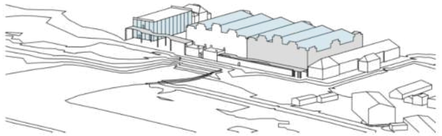
4 Modified area selection



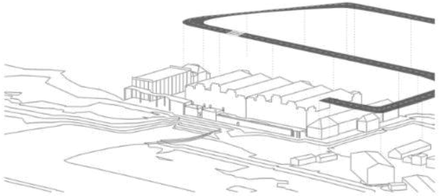
5 Simplification of Facades



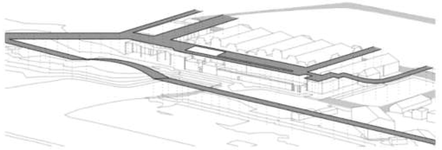
6 Area accessibility



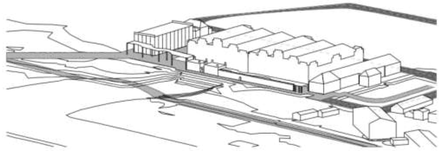
7 Building materials and entrances



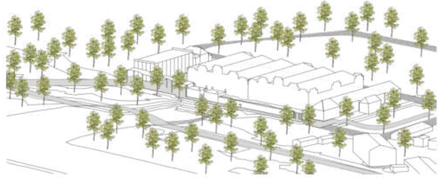
8 Road infrastructure



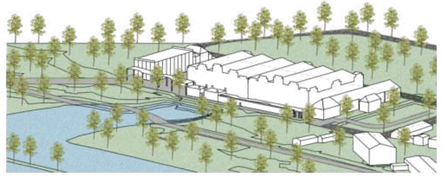
9 Paths and bridge



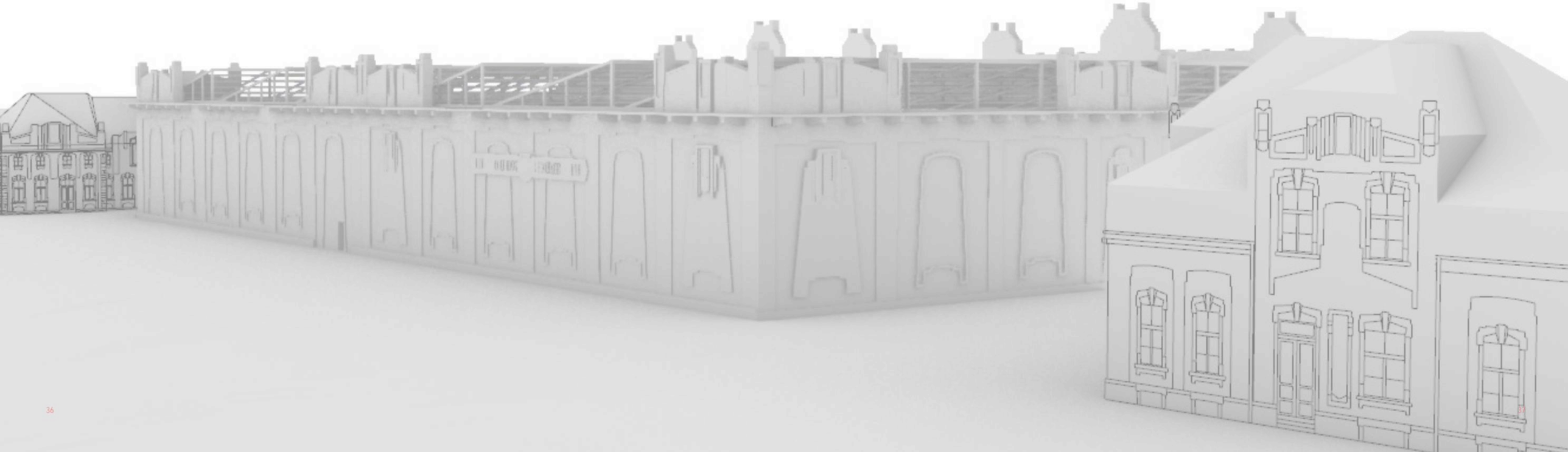
10 Urban scope

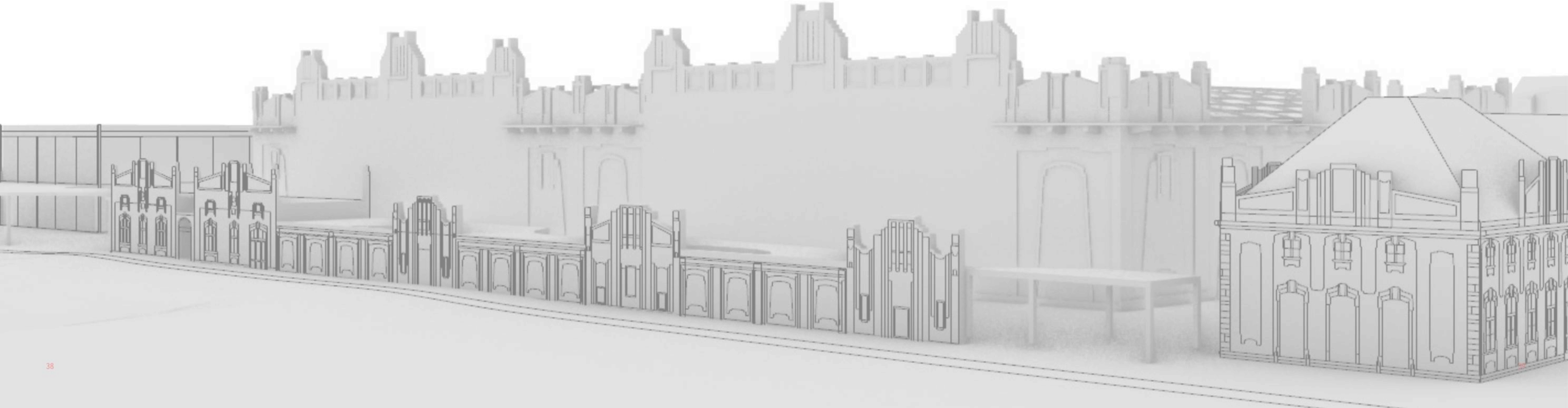


11 Landscaping



12 Landscape and Urban scope





The New Purpose

The proposed architectural plan for the Branické Ledárny project primarily revolves around the restoration and rejuvenation of the historic structures within the Branické Ledárny complex, which have fallen into disrepair over time. My proposal places emphasis on the demolition of buildings lacking architectural significance, such as derelict garages, aged storerooms, and warehouses. Depending on their locations, the vacant spaces left behind will either be reclaimed by nature, enhancing the surrounding greenery, or replaced with new structures aligned with the project's vision.

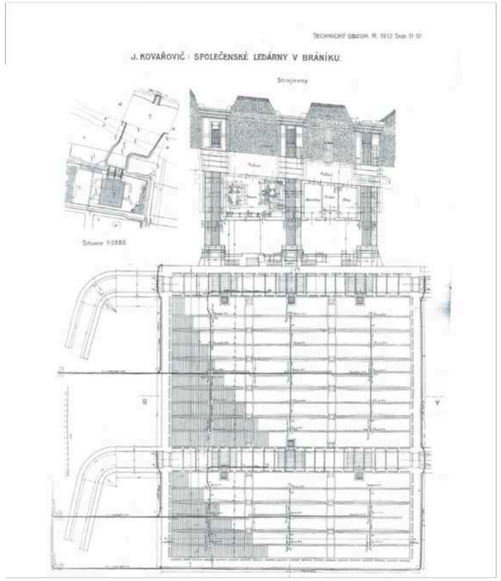
Presently, there exist five historically significant buildings dating back to 1910 within the Branické Ledárny complex. In my plan, these buildings will undergo repurposing, transforming them into the Institute of Aquatic Biology - Aquatic Research Centre, the Faculty of Aquatic Biology and Educational Library. Additionally, two new structures will be introduced: The Aquarium and Educational Hub, along with a Restaurant featuring a Student's Lounge. Through this initiative, my aim is to breathe new life and vitality into the once-forgotten Branické Ledárny complex.

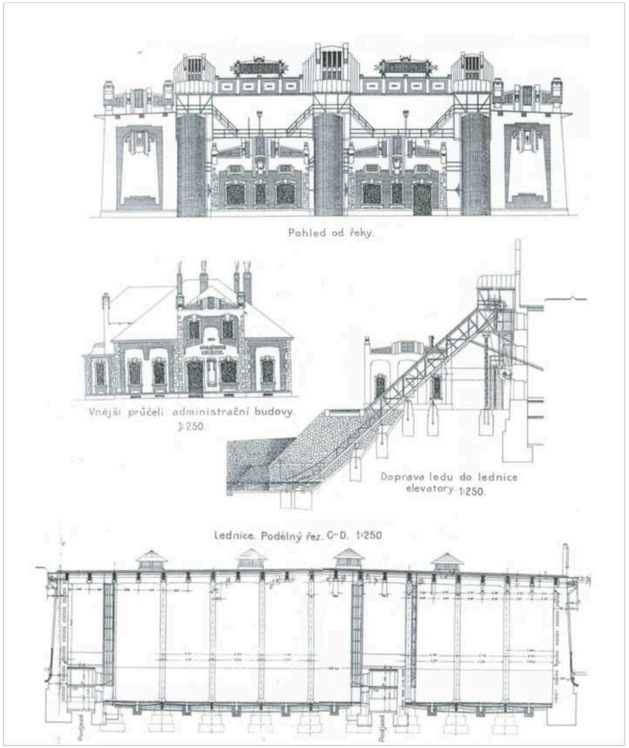
Art Nouveau reprinting into minimalism

Transitioning from Art Nouveau to a contemporary angle, the design approach for the two new buildings leans towards modernity, predominantly utilizing concrete and glass as primary materials. The intricate three-dimensional ornaments found on the original Branické Ledárny icehouse will be replicated onto the concrete façade of the new Branické Ledárny structure - the Aquarium and Educational Hub. Rather than employing overtly contemporary materials, which may clash with the historical context, the focus lies on echoing the existing patterns of the icehouse to create a harmonious blend of old and new.

This strategy not only ensures that the new buildings stand out but also maintains a sense of continuity and minimalism, paying homage to the historical roots of the complex. By reinterpreting the architectural motifs in a contemporary context, the project aims to preserve the essence of Branické Ledárny while ushering it into a new era of relevance and significance.

Architectural solution



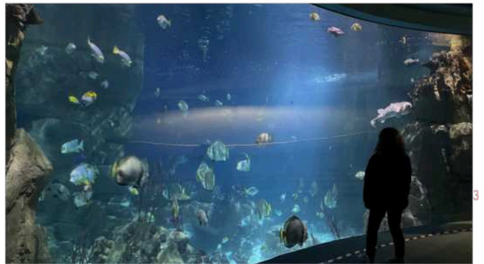


TECHNICAL DRAWINGS FROM J.KOVAŘOVIČ
The architect of Branické Ledárny 1910 complex

Plato Ostrava, Czech Republic

Seattle Aquarium, U.S.A

Plymouth Aquarium, U.K.



PROJECT INSPIRATIONS
Aquarium and new ledárny building renovation

Aquatic Biology laboratories

Location - Old ledárny

Size

6 864 m²

Floor count

3 floors

Building height

14m above ground, 19m with basement

Number of columns

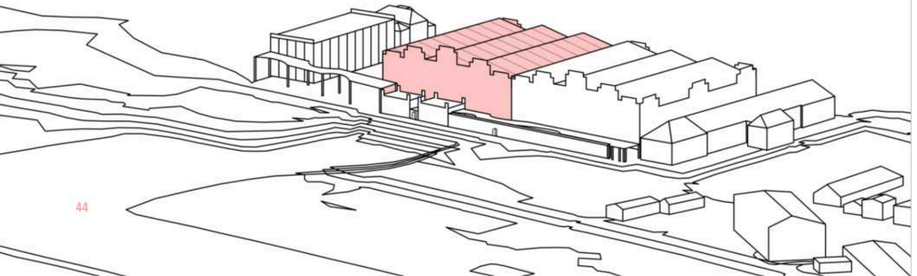
18 columns

Number of water tanks

58 quarantine and resarch fish tanks
4 fish reproduction tanks
2 algae tanks

Building function

- Research
- Fish reproduction
  (reintroduction to rivers)
- Algae reproduction
  (for Biofuel and medical purposes)
- Fish quarantine
  (Fish from the aquarium and Vltava)



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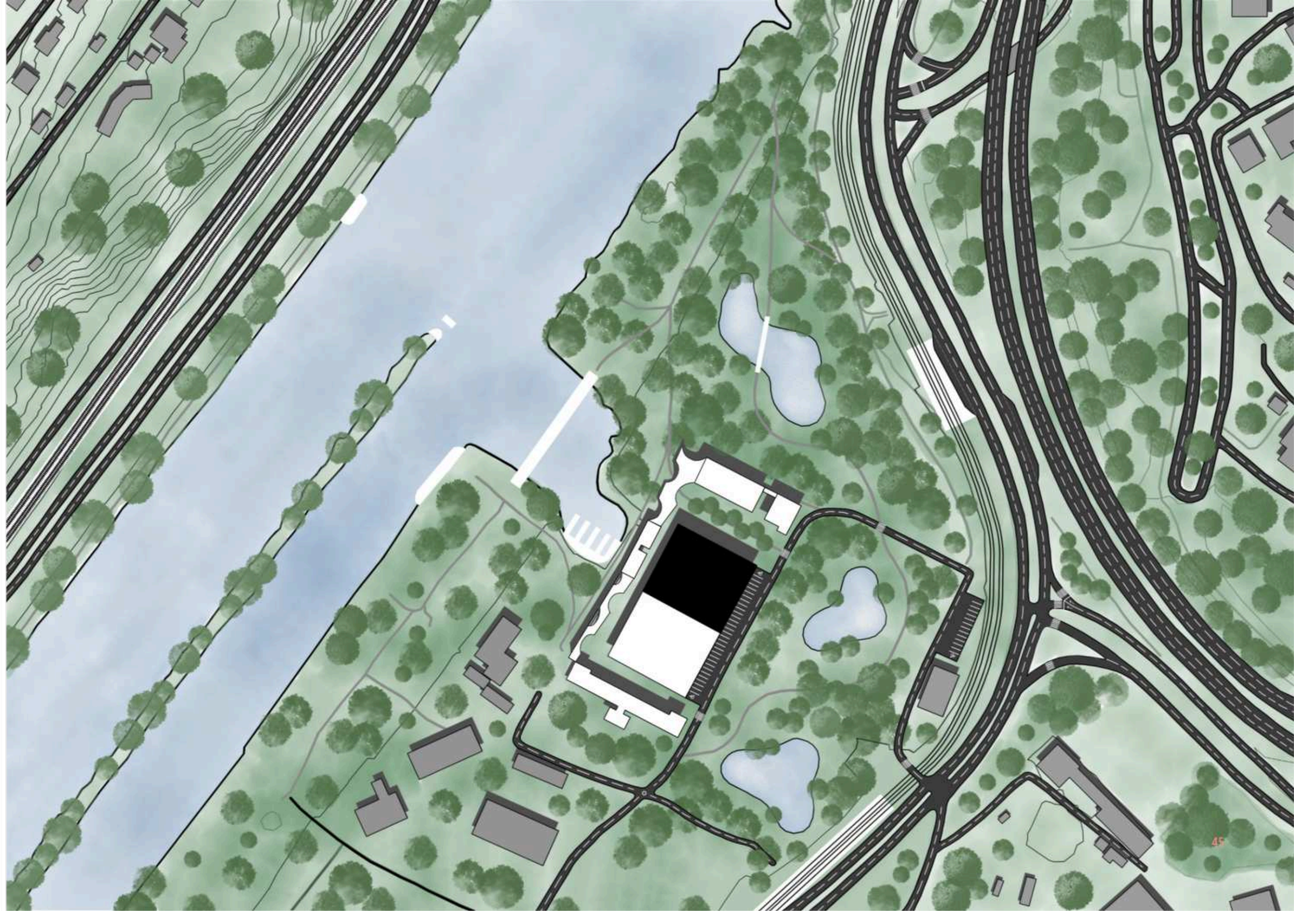


Aquarium and educational hub

Location - New Ledárny

Size

6 864 m²

Floor count

3 floors

Building height

14m above ground, 19m with basement

Number of columns

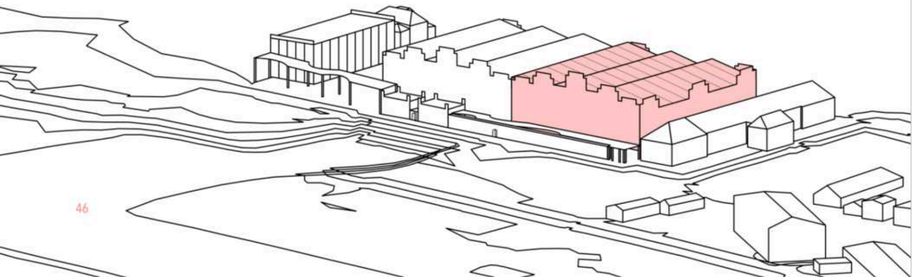
18 columns

Number of water tanks

3 circular big fish tanks
36 educational and research fish tanks
1 tunnel fish tank
7 medium sized fish tanks
7 educational fish and small animal tanks
7 Medusarium jellyfish tanks

Building function

- Recreation
- Education
- Attraction
- Fish quarantine
- Marine and Aquatic ecosystem conservation
- Diving
- Event organisation



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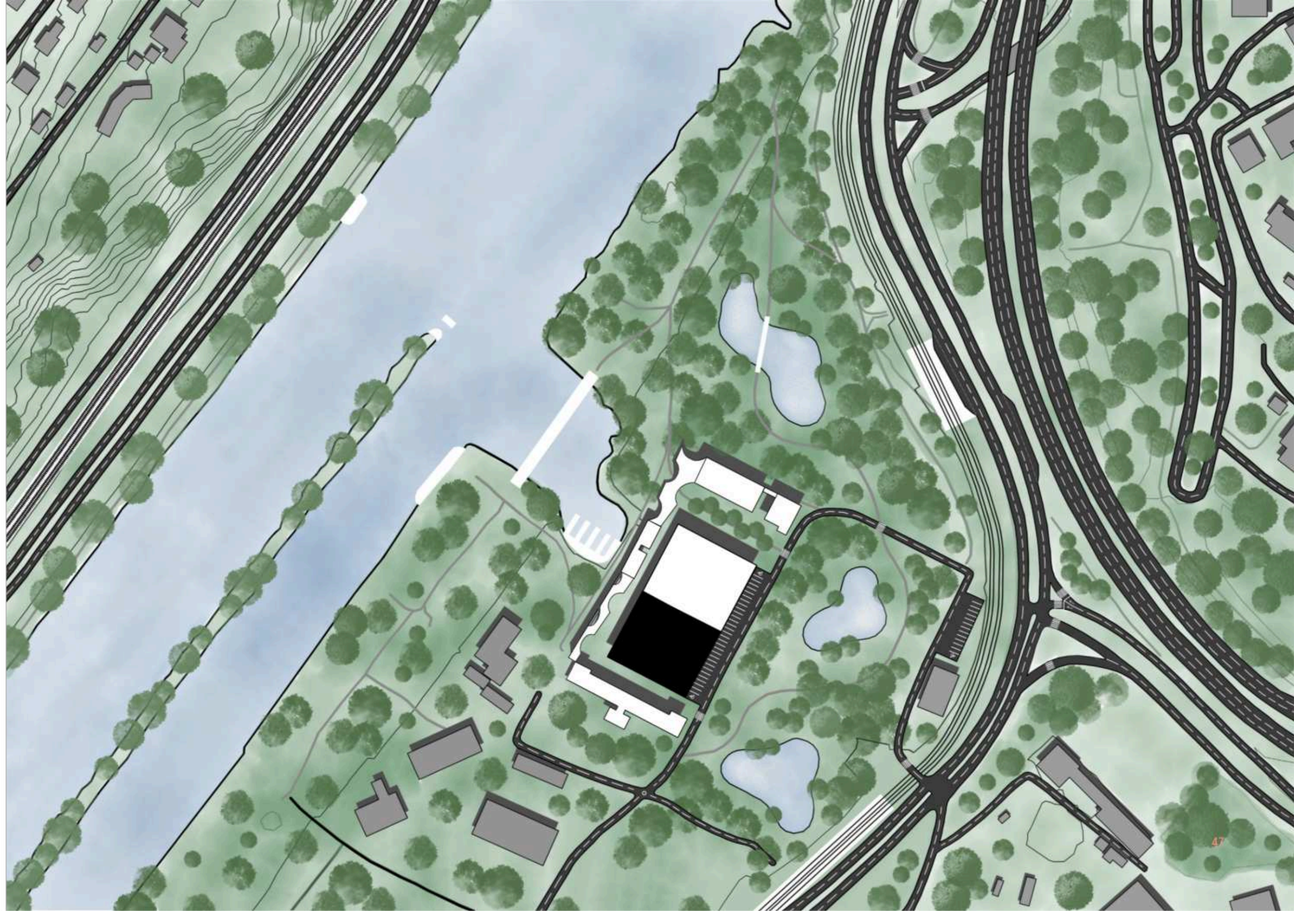


NEW LEDÁRNY - AQUARIUM AND EDUCATIONAL HUB

Private use

- 1.01 Auditorium
  Marine oasis tank 1
- 1.02 Education and research fish tanks
- 1.03 Women's bathroom
- 1.04 Men's bathroom
- 1.05 Educational zone
  Marine oasis tank 2
- 1.06 Technical room
- 1.07 Entrance corridor, stairs and elevator

OLD LEDÁRNY - AQUATIC BIOLOGY LABORATORIES

Private use

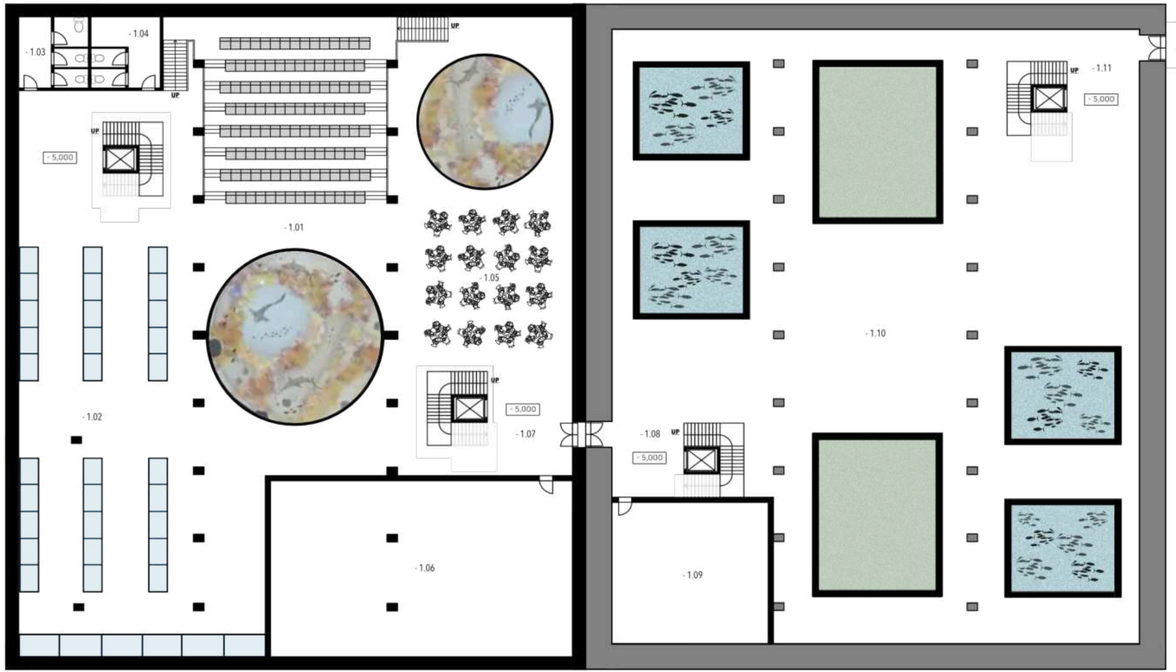
- 1.08 Entrance corridor, stairs and elevator
- 1.09 Technical room
- 1.10 Anchored fish and algae tanks
- 1.11 Main entrance, stairs and elevator
- 1.12 Main entrance ramp

Designed structure

Existing structure

0m 15m

- 1.FL 1:250



NEW LEDÁRNY - AQUARIUM AND EDUCATIONAL HUB

Public use

1.01	Main entrance
1.02	Reception desk
1.03	Men's bathroom
1.04	Bathroom for disabled
1.05	Women's bathroom
1.06	Cloak room
1.07	Marine gift shop
1.08	Lounge
1.09	Marine tunnel entrance
1.10	Marine tunnel exit
	Kelp forest tank 1
1.11	Emergency exit
1.12	Marine oasis tank 1
1.13	Stair and elevator corridor
	Coastal waters tank
1.14	Octopus adventure tank
1.15	Marine oasis tank 2
	Emergency exit
1.16	Aquatheater

OLD LEDÁRNY - AQUATIC BIOLOGY LABORATORIES

Private use

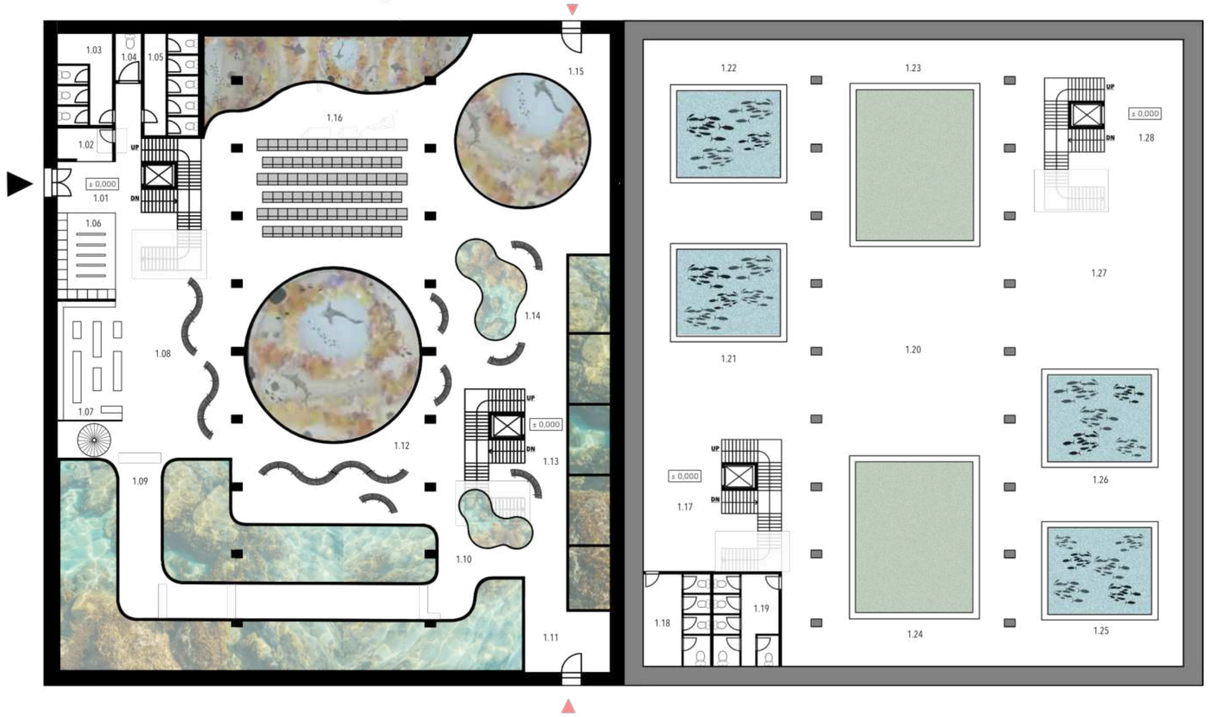
1.17	Stairs and elevator
1.18	Men's bathroom
1.19	Women's bathroom
1.20	Algae workspace
1.21	Fish reproduction tank 1
1.22	Fish reproduction tank 2
1.23	Algae tank 1
1.24	Algae tank 2
1.25	Fish reproduction tank 3
1.26	Fish reproduction tank 4
1.27	Workspace
1.28	Stairs and elevator

Designed structure

Existing structure

0m 15m

1.FL 1:250



NEW LEDÁRNY - AQUARIUM AND EDUCATIONAL HUB

Public use

2.01	Stairs and elevator
	Kelp forest tank 2
2.02	Medusarium - Jellyfish exhibition
2.03	Bathroom for disabled + baby changing room
2.04	Women's bathroom
2.05	Men's bathroom
2.06	Stairs and elevator, lounge corridor
2.07	PlayQuarium - Touch tanks
	Educational hub
2.08	Vltava ecosystem tank
2.09	Educational theatre

OLD LEDÁRNY - AQUATIC BIOLOGY LABORATORIES

Private use

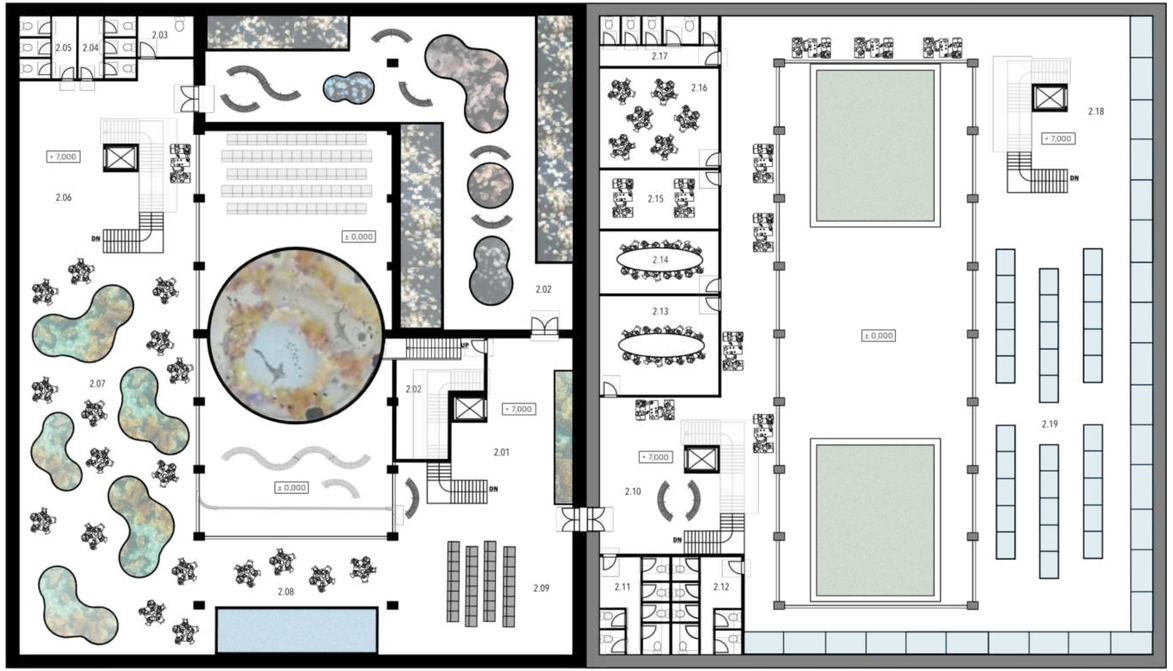
2.10	Stairs and elevator
	Lounge
2.11	Men's bathroom
2.12	Women's bathroom
2.13	Office room 1
2.14	Office room 2
2.15	Kitchenette
2.16	Office room 3
2.17	Bathroom
2.18	Stairs and elevator
2.19	Fish quarantine
	Workspace

Designed structure

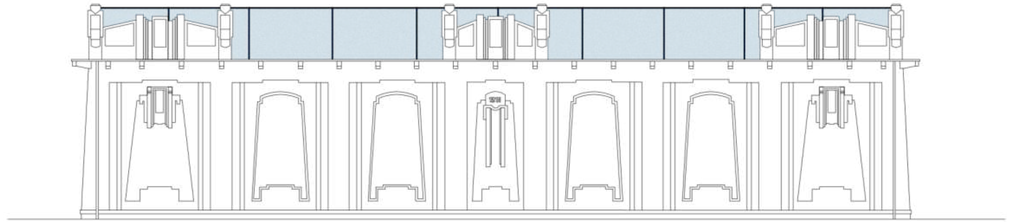
Existing structure

0m 15m

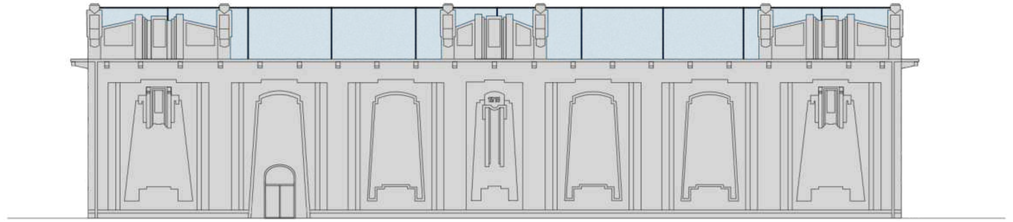
2.FL 1:250



North elevation



South elevation



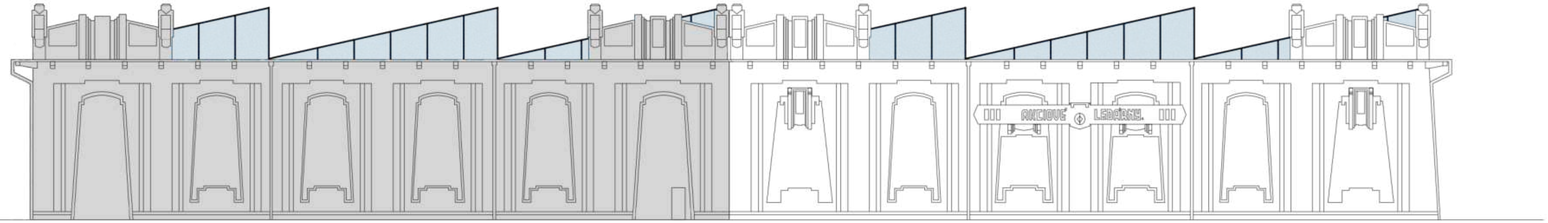
Glass

Concrete

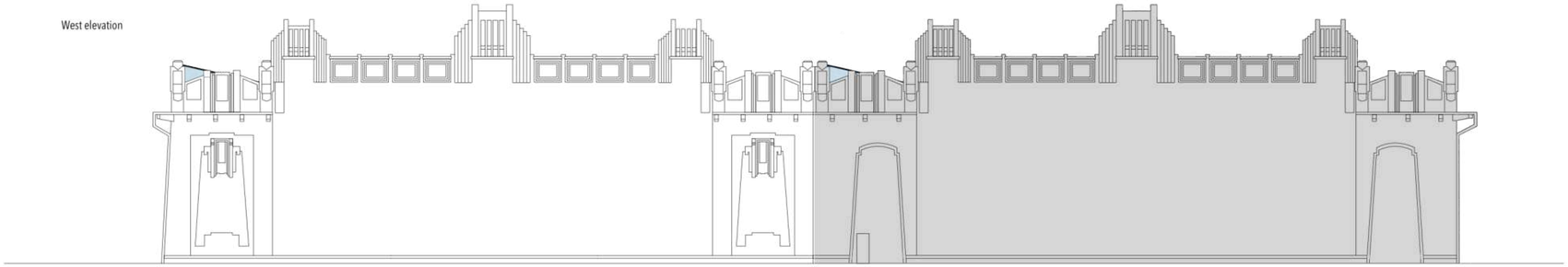
0m 15m

1:200

East elevation



West elevation

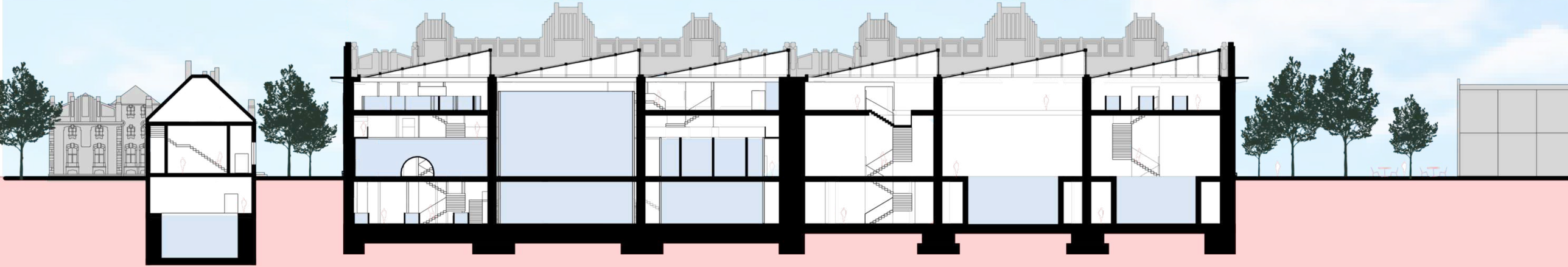


Glass

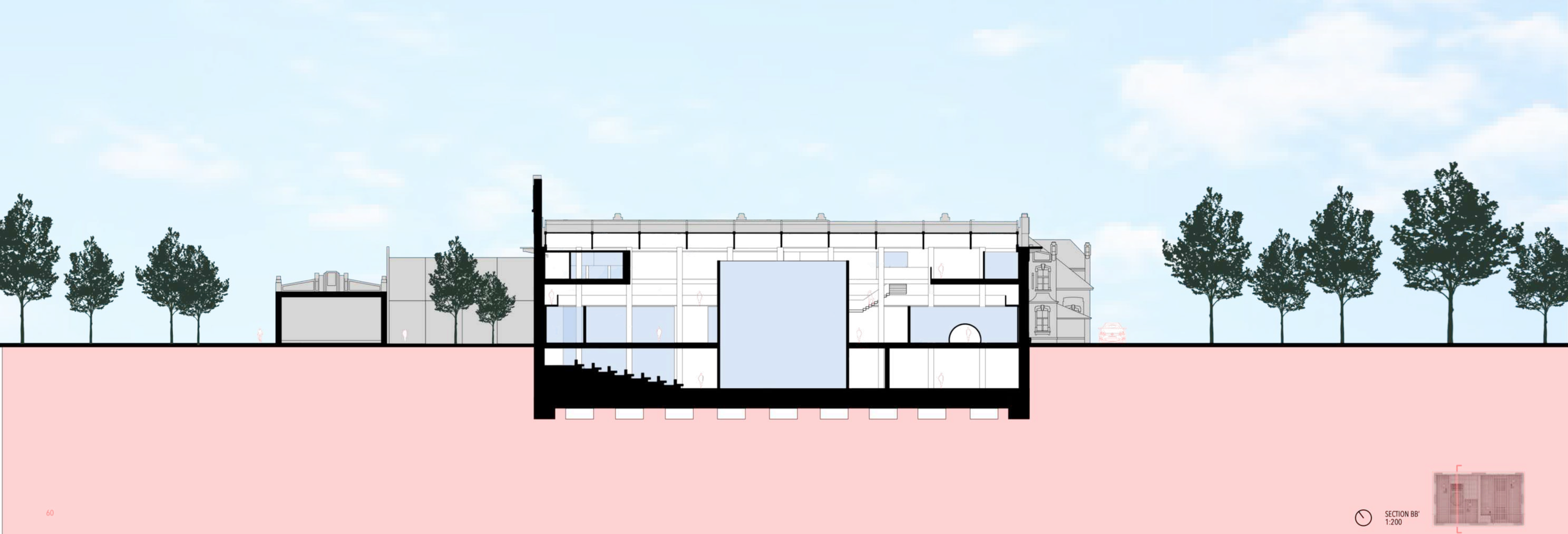
Concrete

0m 15m

1:200



EAST SECTION AA'
1:200

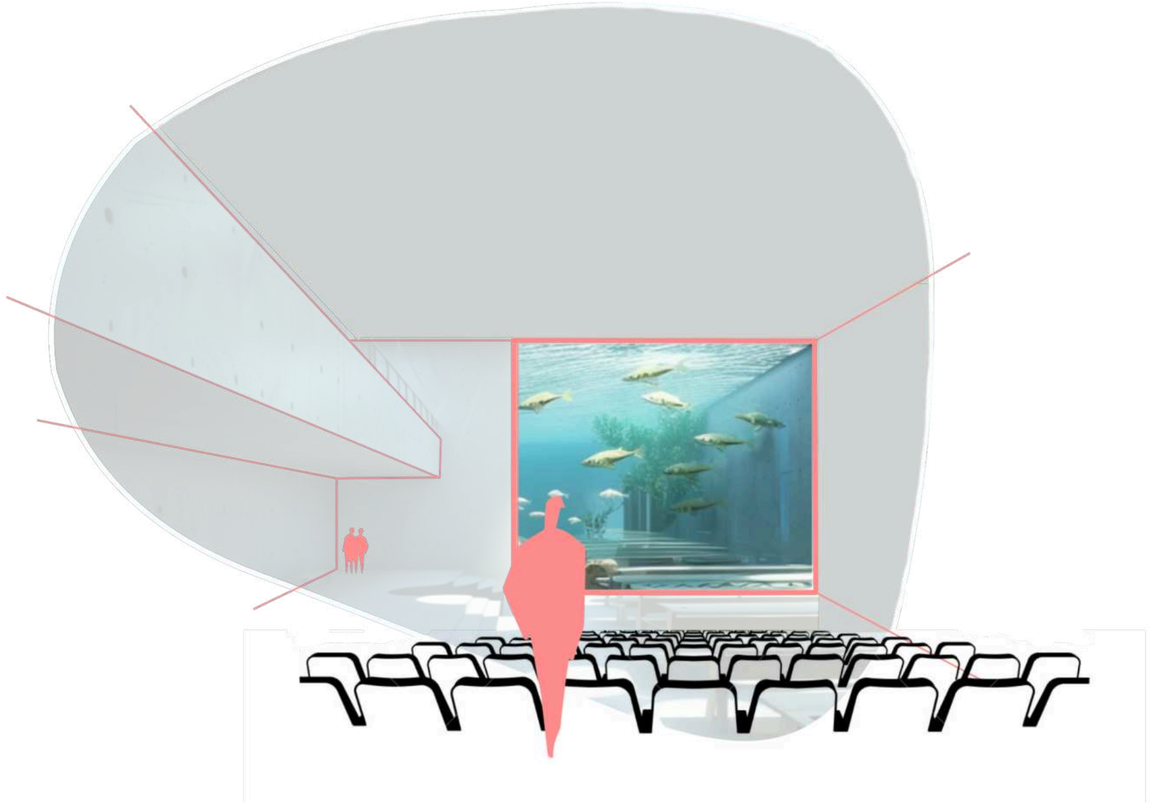


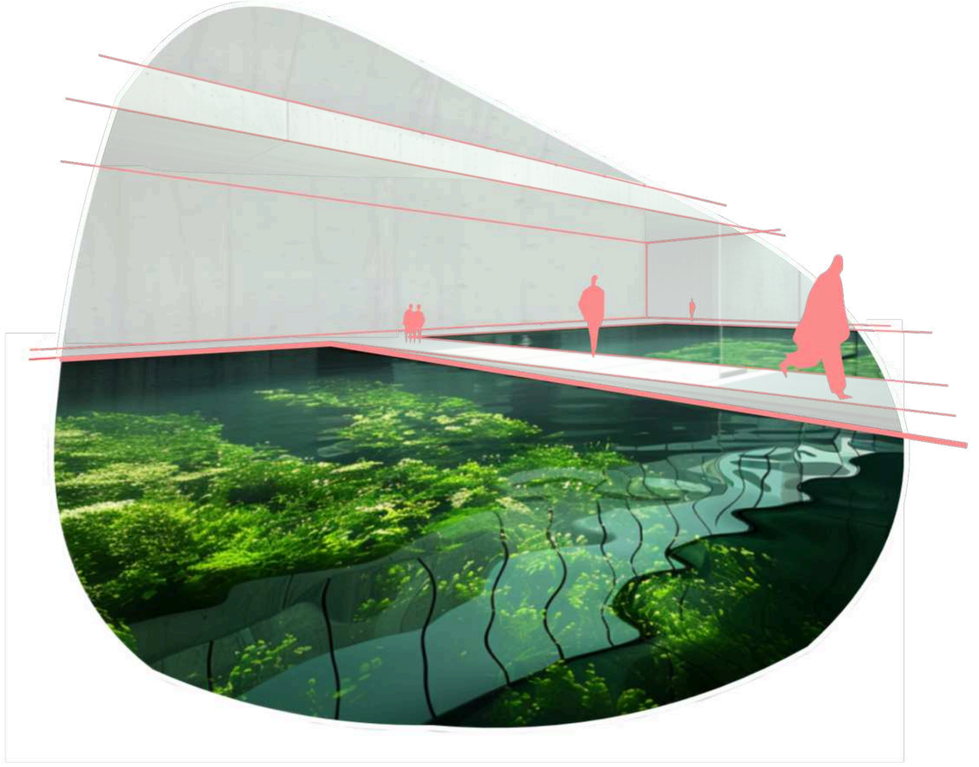
SECTION BB'
1:200

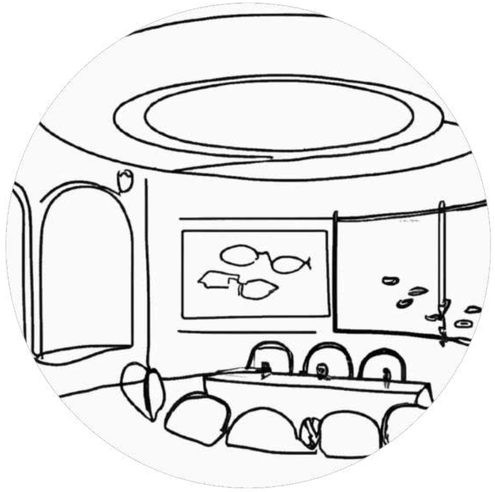
The structural columns of Branické Ledárny

The historical ice storage building of Branické Ledárny is quipped with 18 load-bearing columns supporting the weight of to roof and transporting forces into the stepped foundations.

In the new Branické Ledárny building - Aquarium and Educational Hub - I decided to use the same column pattern and implemented it in the design of the Aquarium. That makes 36 load-bearing columns for both buildings combined that are holding the new designed saw tooth roof and new designed floor slabs.



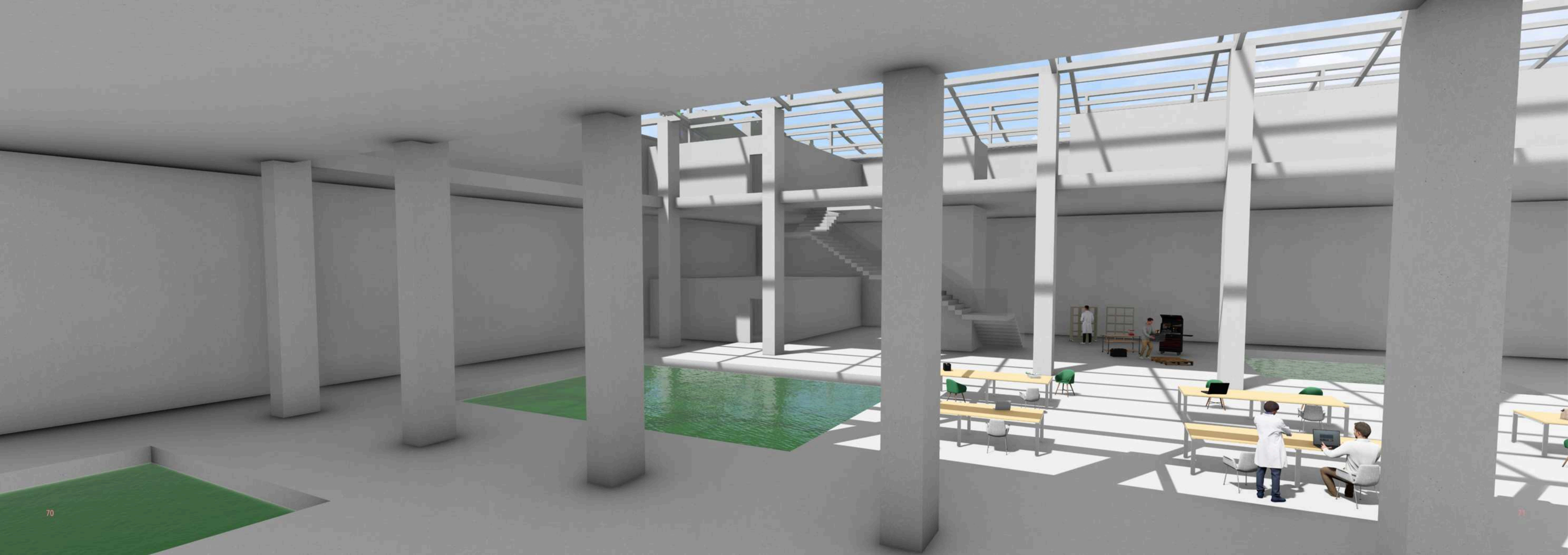


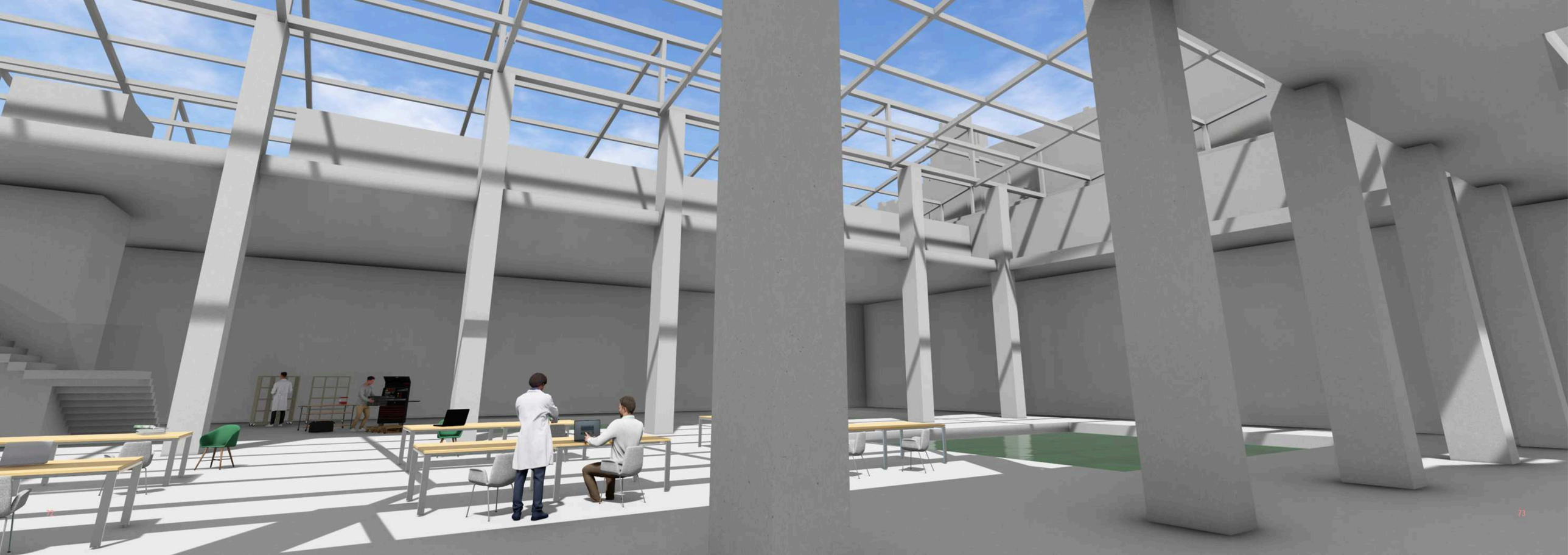


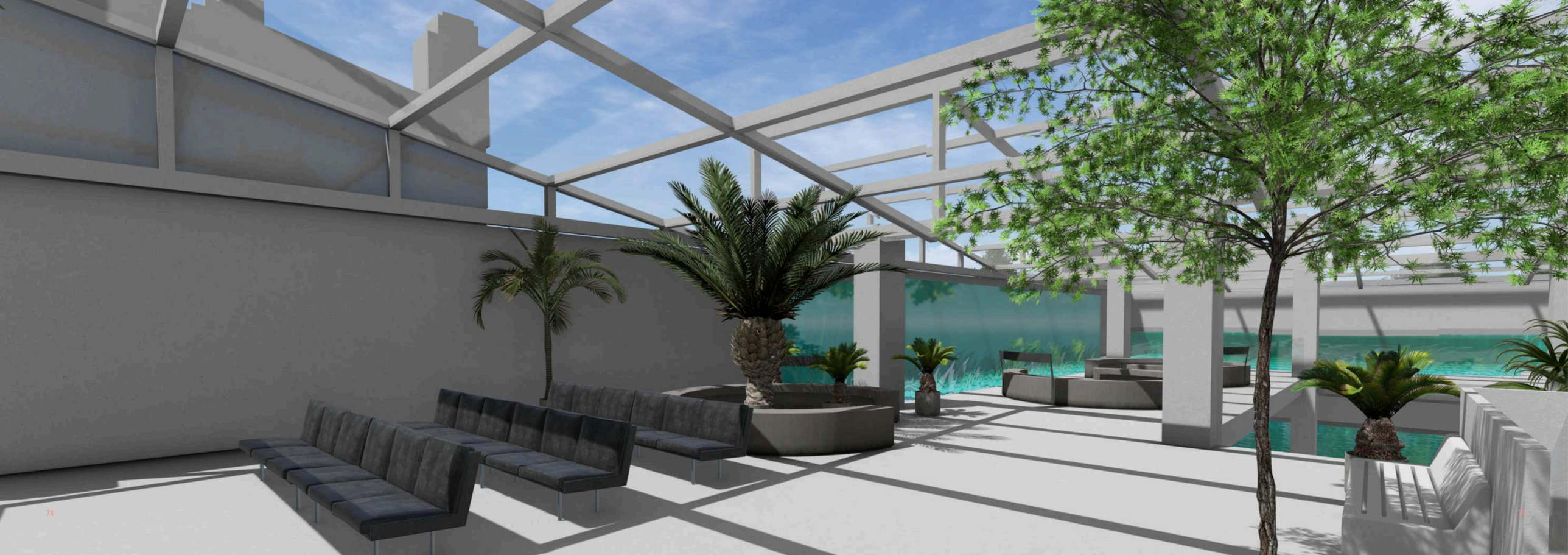
Live music concerts, Classical music concerts

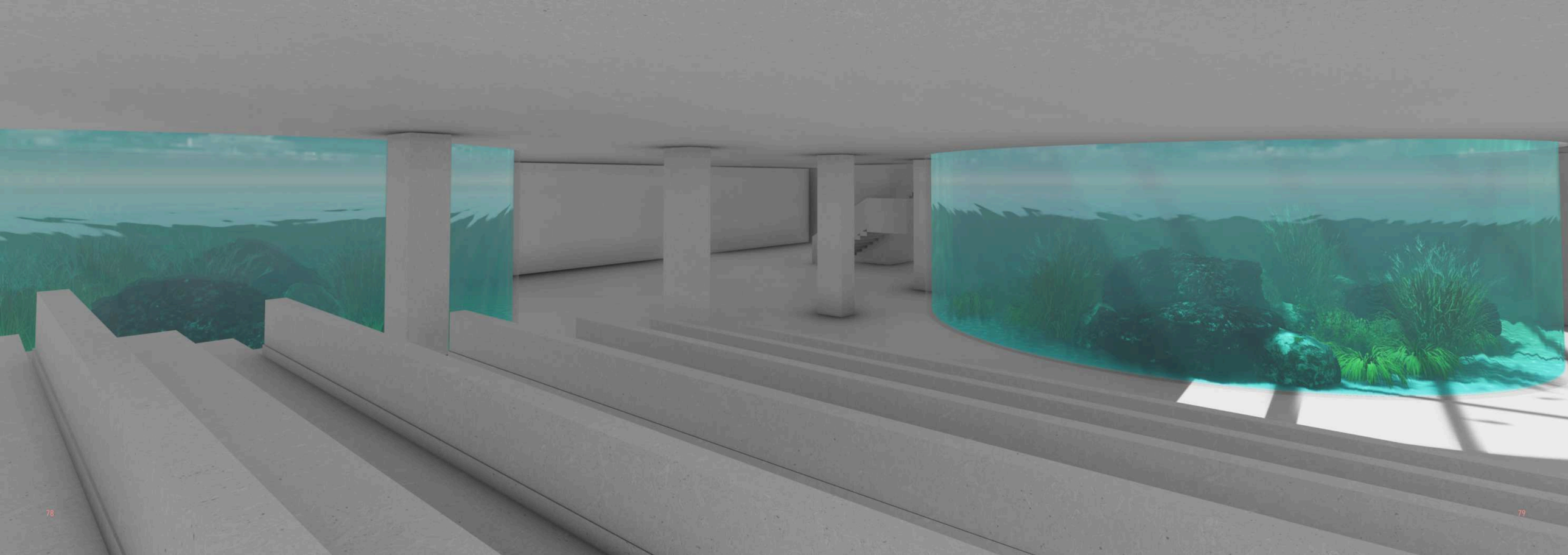
Weddings, Celebrations and Family events

Theatre performances, Public and private events, Cultural events









Faculty of Aquatic Biology

Location - former horse stables

Size

4 742 m²

Floor count

3 floors

Building height

10.9m above ground, 15.9 m with basement

Building function

- Education
- Diving

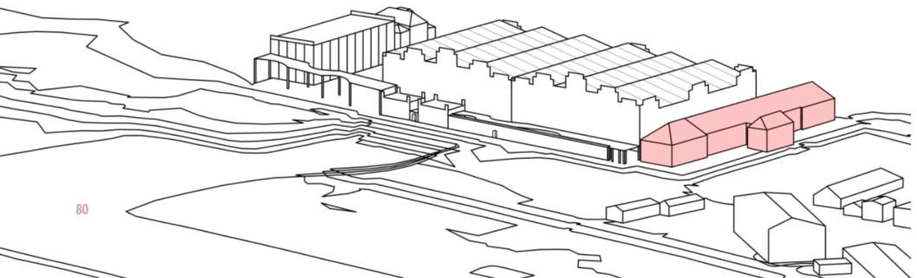
Educational program

- Bachelor's program 3 years

- Master's program 2 years

Approximate number of students

120 - 140 students



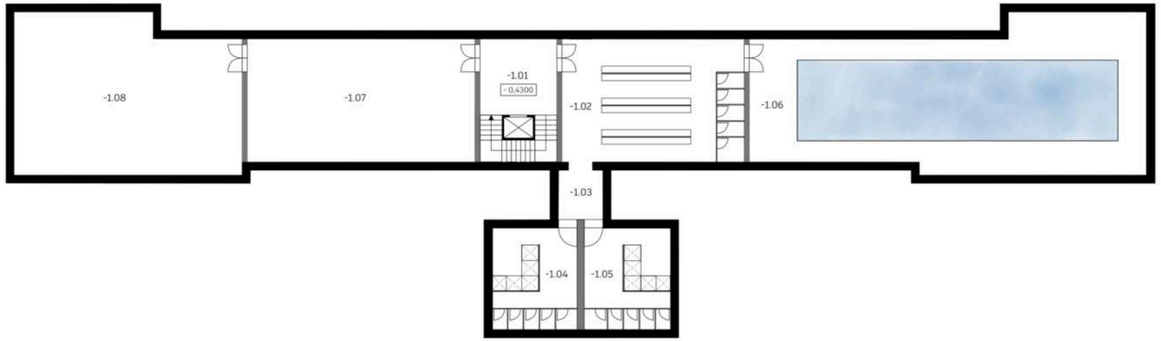
1:1500

- 1.01 Corridor
- 1.02 Changing room and locker room
- 1.03 Bathroom corridor
- 1.04 Women's bathroom and showers
- 1.05 Men's bathroom and showers
- 1.06 Diving pool
- 1.07 Storage room
- 1.08 Technical room

Existing structure

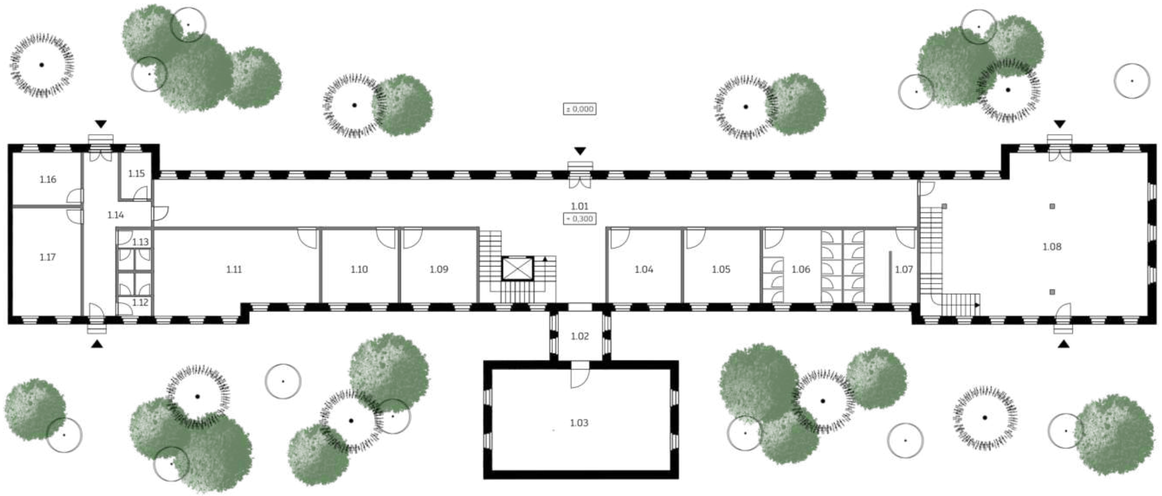
Designed structure

Diving pool



0m 15m

-1.FL 1:200



0m 15m

1.FL 1:200

1.01	Main entrance and study corridor
1.02	Auditorium corridor
1.03	Auditorium 1
1.04	Lecture room 0.1
1.05	Lecture room 0.2
1.06	Women's bathroom
1.07	Men's bathroom
1.08	Auditorium 2
1.09	Directors office
1.10	Office
1.11	Lecture room 0.3
1.12	Women's bathroom
1.13	Men's bathroom
1.14	Left wing corridor
1.15	Maintanance room
1.16	Office
1.17	Lecture room 0.4

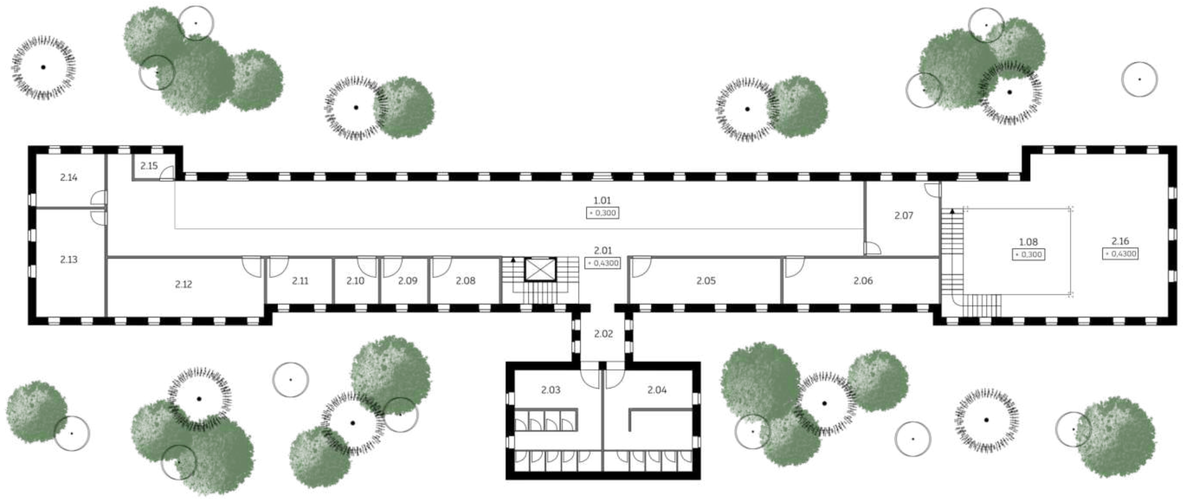
Existing structure

Designed structure

2.01	Corridor
2.02	Bathroom corridor
2.03	Women's bathroom
2.04	Men's bathroom
2.05	Lecture room 0.5
2.06	Lecture room 0.6
2.07	Technical room
2.08	Office
2.09	Office
2.10	Office
2.11	Office
2.12	Lecture room 0.7
2.13	Lecture room 0.8
2.14	Office
2.15	Maintanance room
2.16	Auditorium extension

Existing structure

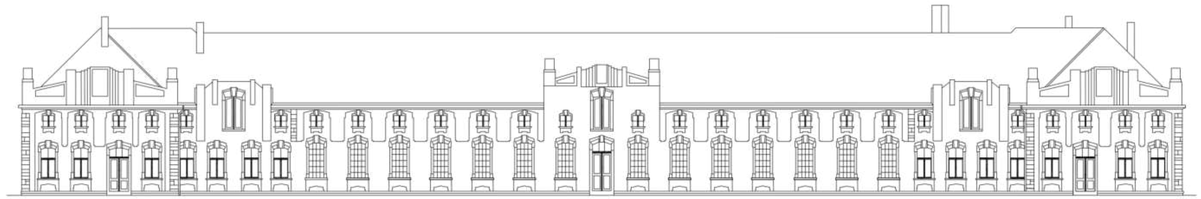
Designed structure



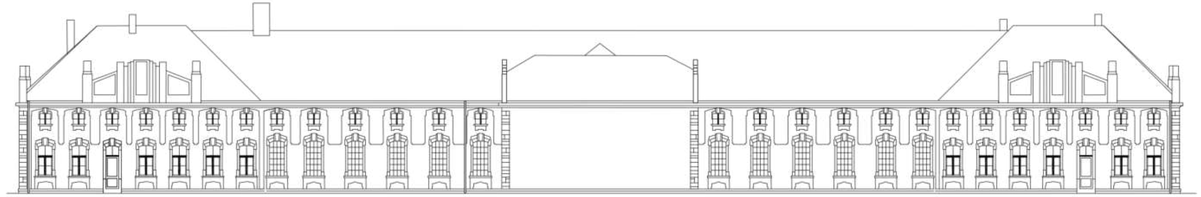
0m 15m

2.FL 1:200

North elevation



West elevation



East elevation

South elevation

0m 15m

1:200

Library, restaurant and student lounge

Location

Size

3 400 m²

Floor count

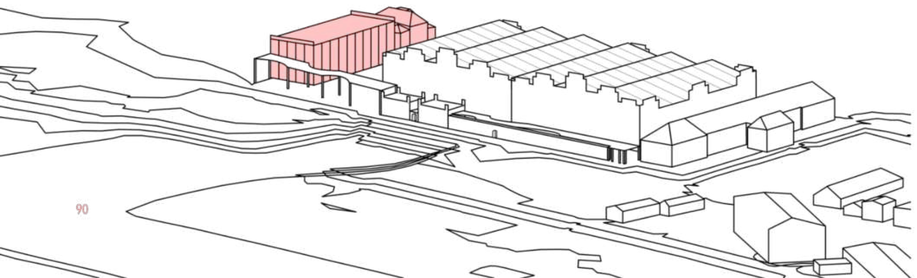
3 floors

Buildings height

Library 12m
Restaurant, lounge 9.6m

Buildings function

- Education library
- Restaurant and café
- Student's day room - lounge
- Student's cafeteria



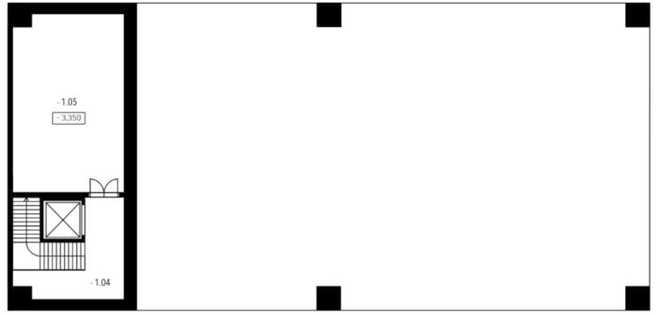
1:1500

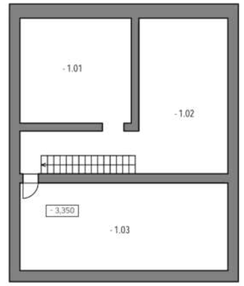
- 1.01 Technical room
- 1.02 Main corridor and archive 1
- 1.03 Archive 2

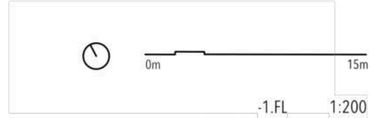
- 1.04 Corridor
- 1.05 Technical room

Designed structure

Existing structure



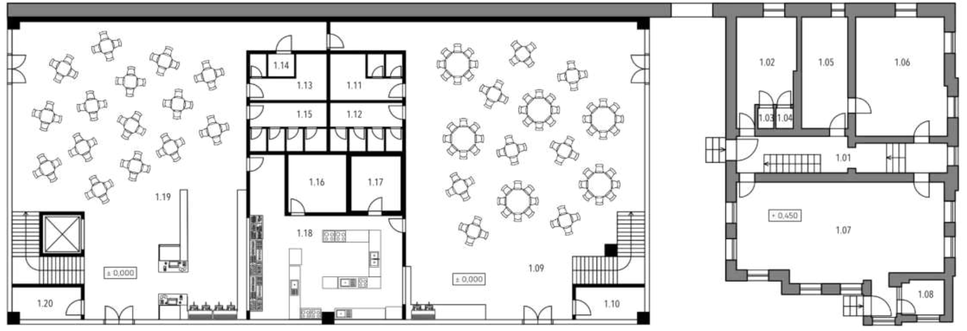


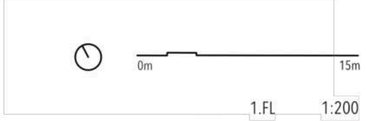


1.01	Corridor
1.02	Study room
1.03	Bathroom 1
1.04	Bathroom 2
1.05	Library 1
1.06	Library 2
1.07	Library 3
1.08	Reception
1.09	Student's cafeteria
1.10	Maintenance
1.11	Men's bathroom
1.12	Women's bathroom
1.13	Men's bathroom
1.14	Bathroom for disabled
1.15	Women's bathroom
1.16	Kitchen storage
1.17	Freezer
1.18	Kitchen and buffet
1.19	Restaurant and café
1.20	Maintenance

Designed structure

Existing structure





2.01 Restaurant and café

2.02 Maintanance

2.03 Bathroom for disabled

2.04 Men's bathroom

2.05 Women's bathroom

2.06 Men's bathroom

2.07 Women's bathroom

2.08 Student's study room and lounge

2.09 Maintanance

2.10 Corridor

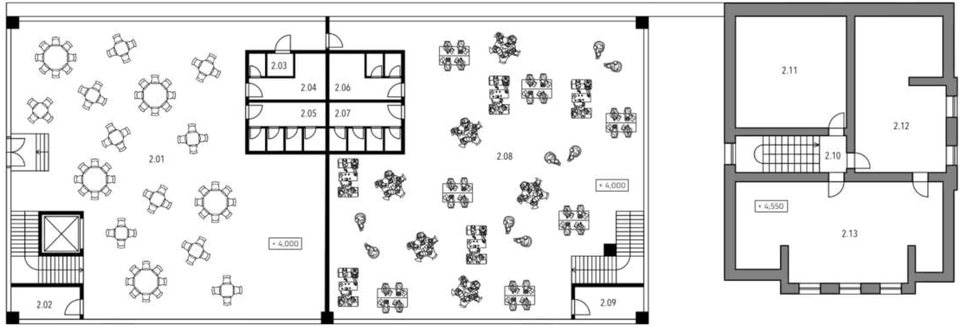
2.11 Library 4

2.12 Library 5

2.13 Library 6 and study room

Designed structure

Existing structure

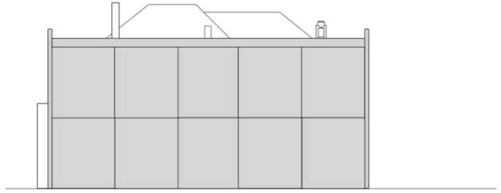


0m 15m

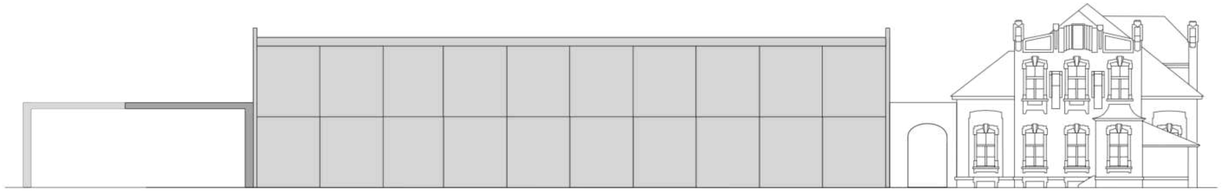
2.FL 1:200

North elevation

West elevation



East elevation

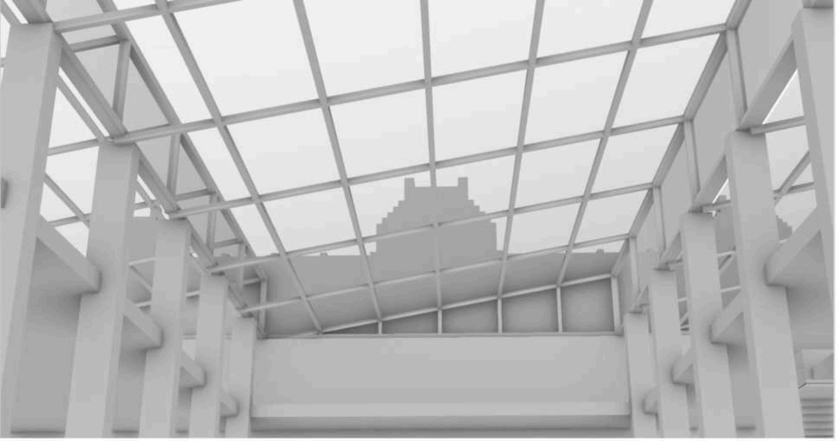


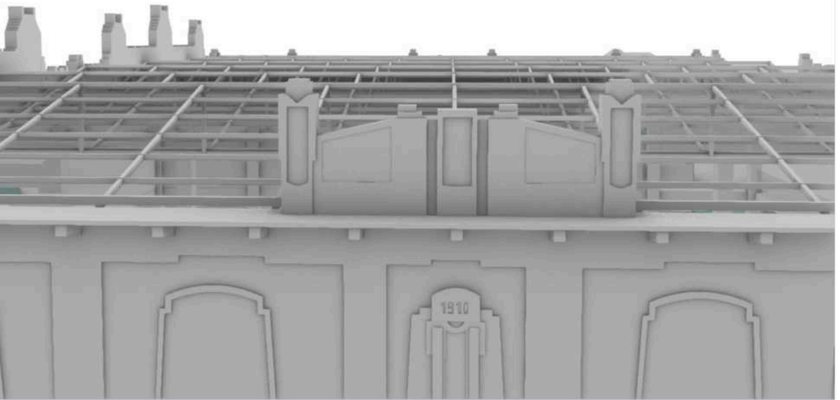
South elevation

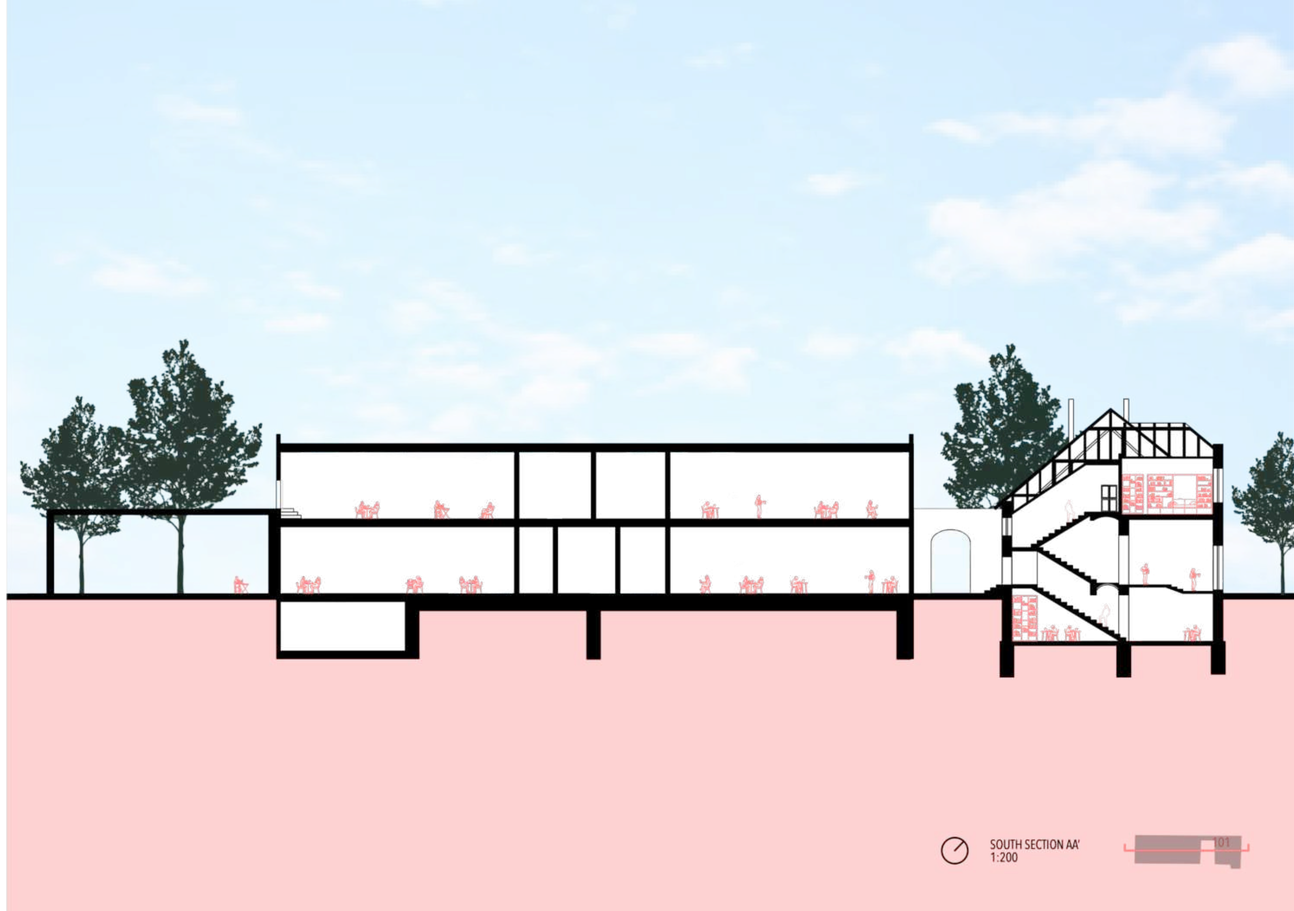
Designed structure

0m 15m

1:200

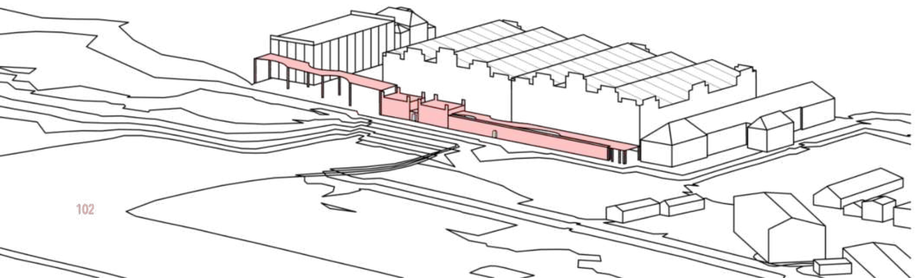






SOUTH SECTION AA'
1:200

0 1 2 3 4 5 10 m



Storage units and active roof

Location

Storage units size

628 m²

Storage units floor count

1 floor

Storage units height

7.6m

Storage units function

- Storage for docks and boats
- Storage for Faculty

Rooftop 1 size

Rooftop 1height

5.5m

Rooftop 1 function

- Publicly accessed green roof
- Extension of Restaurant

Rooftop 2 size

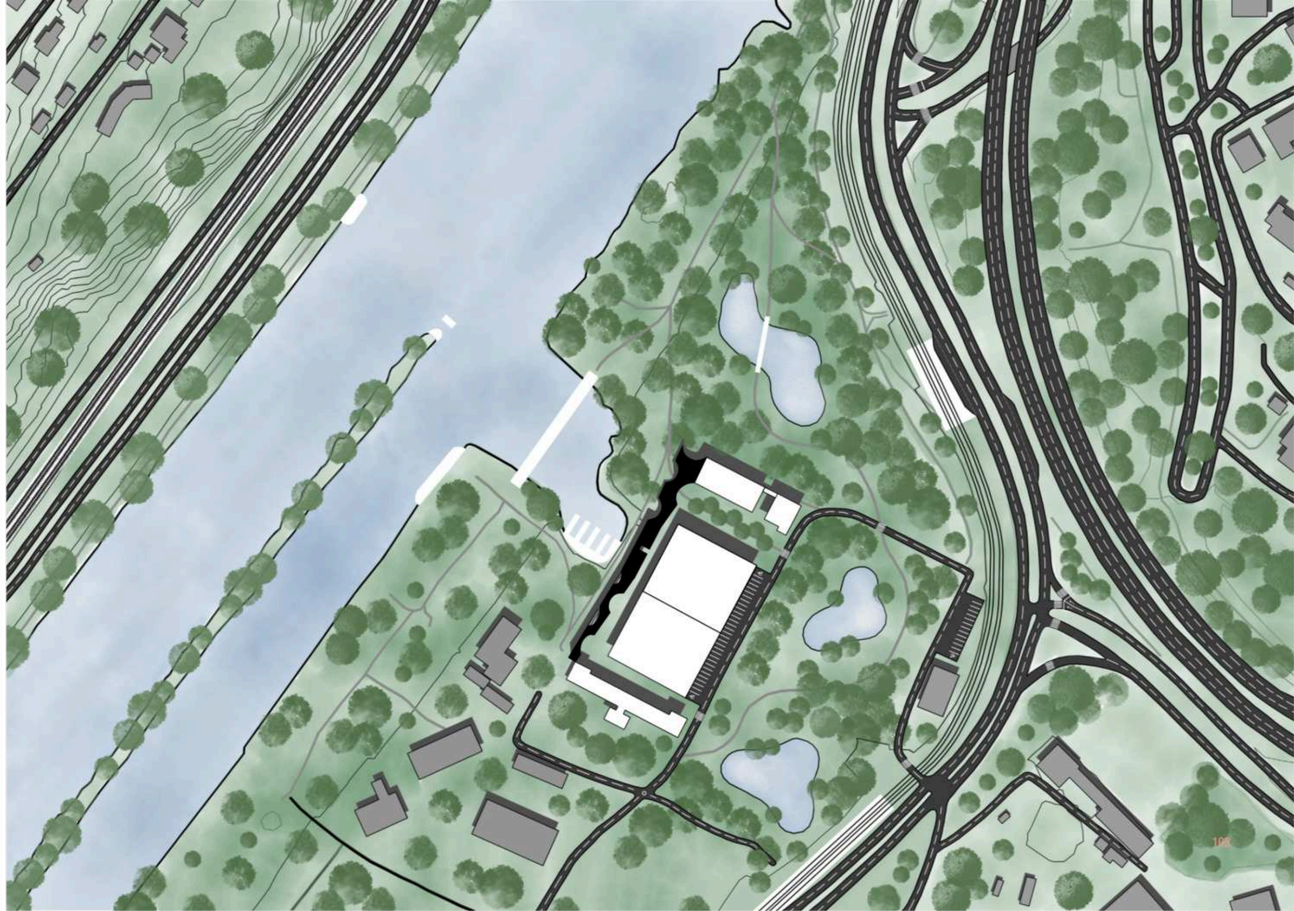
Rooftop 2 height

3.4m

Rooftop 2 function

- Algae biophotovoltaic panels

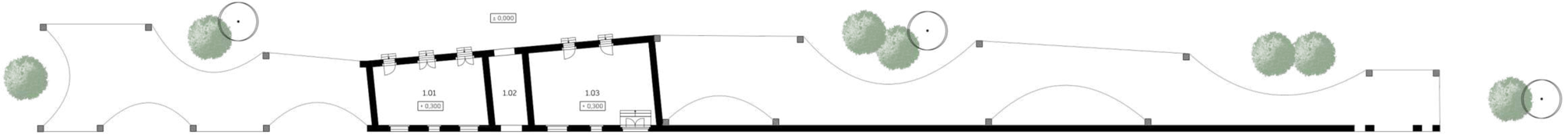
1:1500



1.01 Faculty of Aquatic Biology storage

1.02 Site entrance corridor

1.02 Dock storage

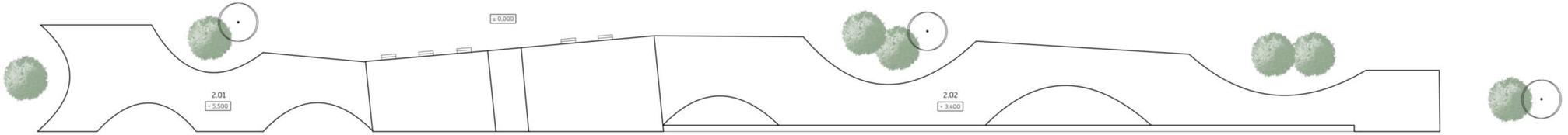


0m 15m

1.FL 1:200

2.01 Walkable roof (accessed by the restaurant)

2.02 Algae panel roof



0m 15m

2.FL 1:200

West elevation

East elevation

1:200


AKCIOVÉ
LEDÁRNY.

Urbanistic scope

The proposed urbanistic plan primarily emphasizes enhancing the site's accessibility, introducing new pedestrian and cycling path extensions. These improvements now enable visitors to fully access the Branické Ledárny complex, which was previously inaccessible. The reintroduction of these pathways includes the construction of two new pedestrian and cycling bridges: one spanning the Vltava river lagoon on the west side of the Vltava river bank, and another bridge spanning the newly reintroduced pond in the currently inaccessible park.

Additionally, a new extension of the main road is proposed, facilitating easy and quick access from Modřanská road to the site. Furthermore, the project incorporates the installation of four new boat docks, reviving river transportation at Branické Ledárny. This initiative not only ensures comfortable travel between the Vltava west and east river banks and provides access to the Branický island but also rekindles the nostalgic essence of river transportation at the site.

Landscape scope - Landscope

A paramount emphasis within the project lies in the landscape component, aimed at reintroducing and enlarging public green areas. Through the strategic removal of buildings devoid of architectural merit within the earmarked zone for park expansion, a substantial parcel measuring 32,481 m² is seamlessly integrated into the landscape, offering the public increased access to lush green spaces.

Furthermore, in an effort to enrich the ecological diversity and aesthetic appeal of the parks, the incorporation of water elements has been meticulously planned. Three tranquil ponds have been meticulously designed to not only serve as serene habitats for Koi carp, small fauna, and ornamental flora but also to function as captivating outdoor showcases for the Aquarium. These ponds, adorned with vibrant aquatic life and verdant foliage, provide visitors with a harmonious blend of natural beauty and educational opportunities, enhancing the overall experience of the park.

16 589 m2 area of new greenery extension

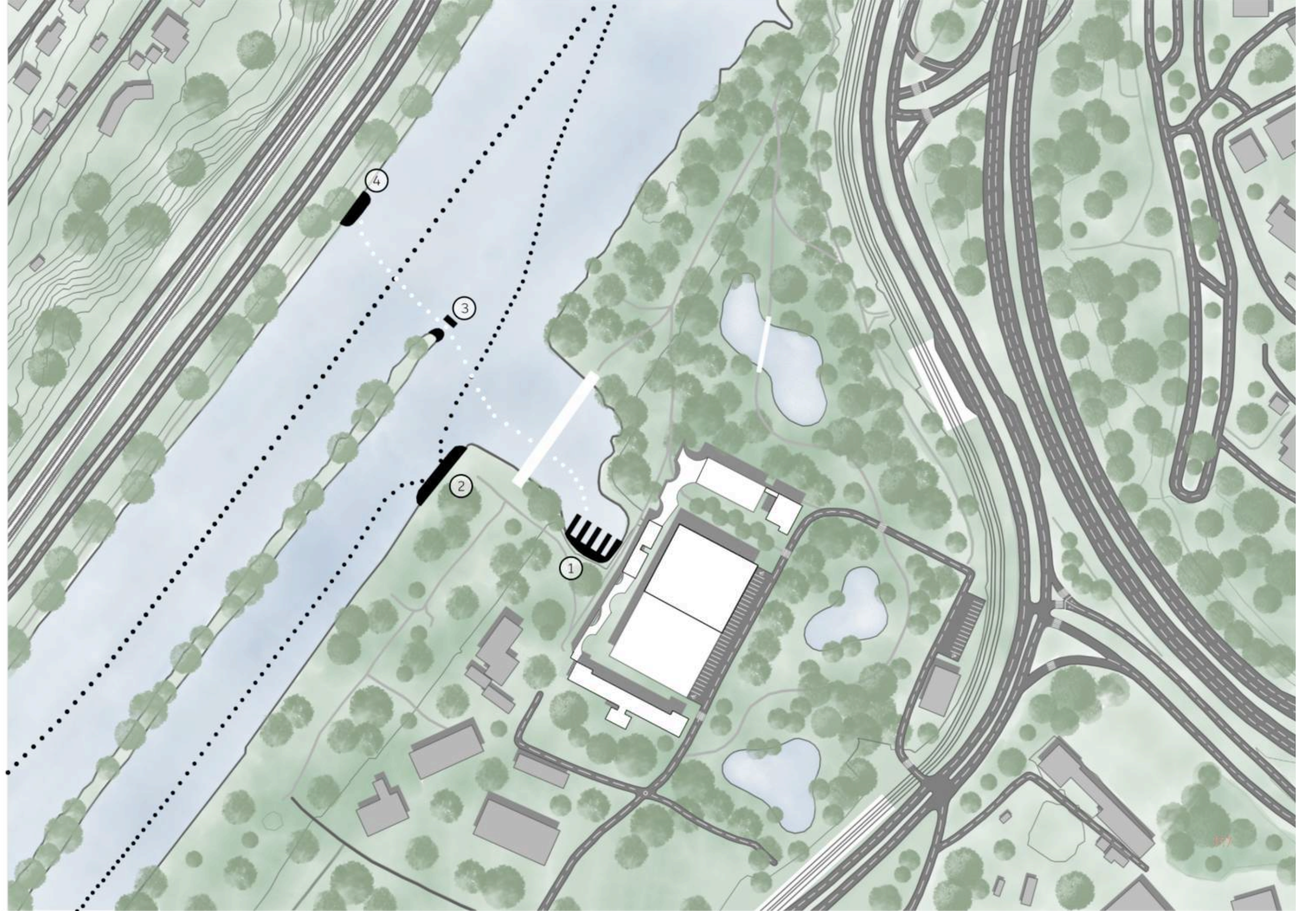
15 892 m2 area of new greenery extension

Urbanistic solution

Docks and river transportation

- Boat docks
- Main boat and ferry route
- New conveyence route
- 1 Branické ledárny dock 1
- 2 Branické ledárny ferry dock 2
- 3 Ledárenská proudnice dock 3
- 4 Barrandov dock 4

1:1500



Pedestrian zone improvement

Pedestrian zone

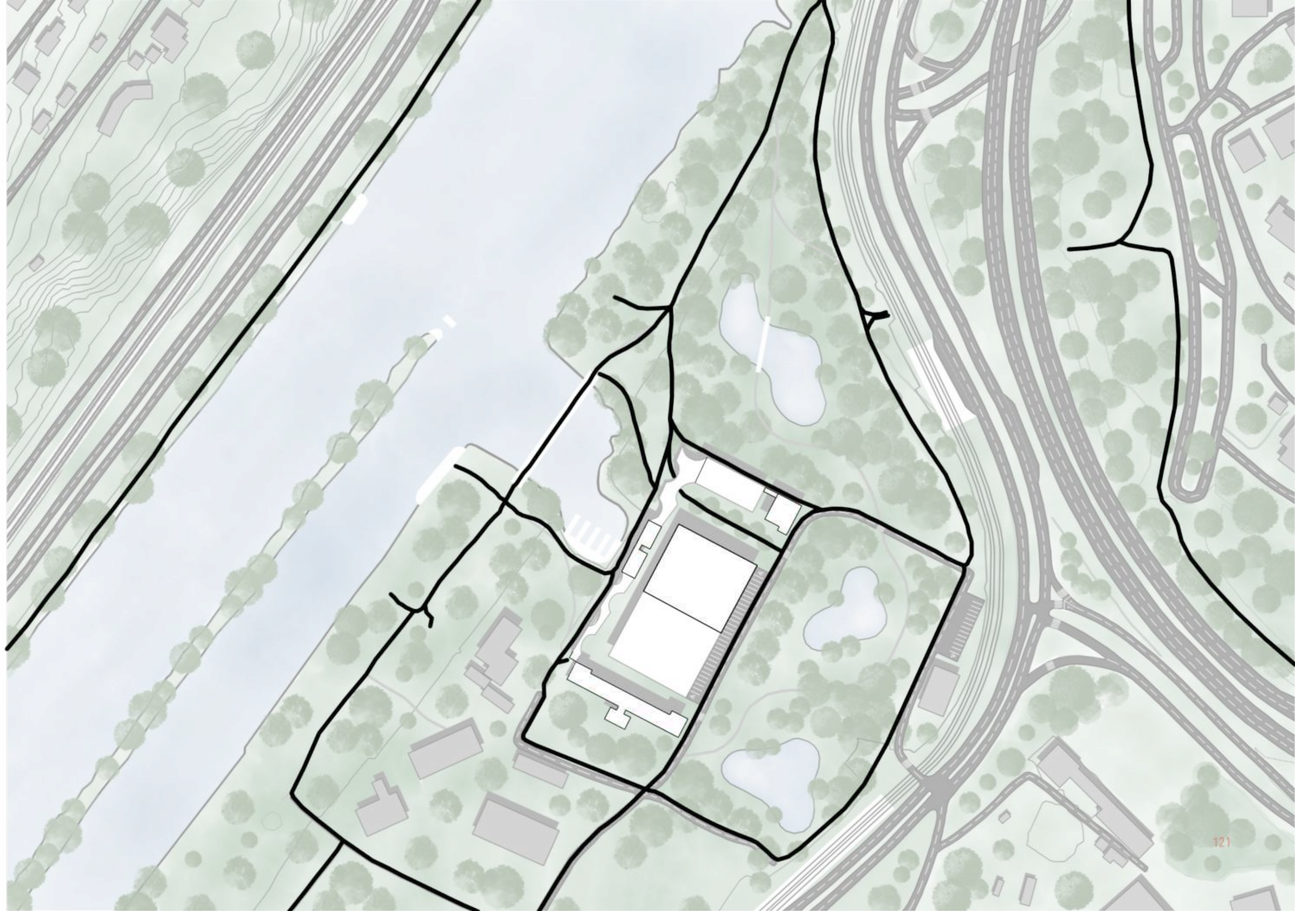
Pedestrian and cycling bridges

1:1500

Cycling improvement

Cycling path

1:1500



Public greenery extension

- Freshwater ponds
- Greenery
- A - Park A - ornamental garden 1
- B - Park B - ornamental garden 2
- 1 - Koi carp pond 1
- 2 - Koi carp pond 2
- 3 - Frog and ornamental plant pond 3

1:1500

Asphalt - road

Threshing floor - small paths

Seamless asphalt - biking paths

Ornamental grass - unpaved surfaces

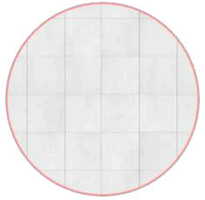
Waste bins - mmcité Crystal CS330

Tree grids - mmcité Arbottura ARTC381

Benches - mmcité Lago LAG311

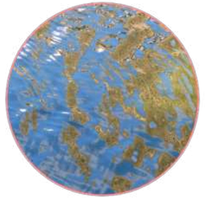
Water fountain - mmcité Hydro HD410

Concrete pavement



Limestone slab - paths and pavements

Water - ponds



Grass - unpaved surfaces

Bike stands - mmcité Lotlimit SL505

Benches - mmcité Blocksolar LQS110

Benches - mmcité Woody LWD110

Picnic table - mmcité Blocq LBQ960

Tilia cordata

Quercus cerris

Carpinus caroliniana

Acer japonicum

Juniper - shrub

Paeonia

Thuja occidentalis

Pennisetum

Ginkgo biloba

Salix babylonica

Fraxinus excelsior

Platanus acerifolia

Magnolia soulangeana

Rhododendron hybridum

Cosmos

Nymphaeceae

PROJECT APPENDIX

Cover Report, Technical Report

CONTENTS

1 Introduction

1.1 Purpose of the buildings

Both the new designed buildings and preserved repurposed buildings are strategically aligned to promote awareness and appreciation for aquatic biology and its critical significance. These new and revitalized structures serve as vibrant hubs, engaging communities and visitors alike in the exploration of aquatic ecosystems and the imperative role they play in sustaining life on our planet. In essence, the transformation of these repurposed buildings transcends mere architectural restoration; it embodies a profound commitment to cultivating a deeper connection with the watery realms that sustain life on Earth. Through education, exploration, and innovation, this visionary initiative seeks to ignite a ripple effect of awareness and advocacy, ensuring that the importance of aquatic biology resonates far and wide, for generations to come.

1.2 Project identification data

1.2.1 Project name

Branické Ledárny

1.2.2 Location

Ledařská, Praha 4, Braník

50°01'58"N 14°24'16"E

The site area is located in Braník, Prague 4, Czech Republic. Bounded from northeast and east by Modřanská arterial road, from south by U Ledáren street, from northwest by Strakonická highway. This is a very lucrative location right on the west and east bank of the Vltava River, which is unfortunately very neglected nowadays, despite the fact that it is in a very advantageous position towards Prague.

1.2.3 Building typology

Semi - public, educational, institutional, recreational

Institute of Aquatic Biology research laboratories

Aquarium

Faculty of aquatic Biology

Educational library

Restaurant

Cafeteria

Student's lounge and day room

1.2.4 Context of the site

Braník, situated in Prague 4, Czech Republic, lies to the south of the city along the eastern bank of the Vltava river. Brink has approximately about 18,000 residents, and gained recognition in the year 1008. Historically renowned for its brewery - Branický pivovar, operations ceased in 2002. Braník shares borders with Malá Chuchle and Hlubočepy to the west, Podolí to the north, Krč to the east, and Lhotka and Hodkovičky to the south.

1.2.5 Site

The size of the site is 84 500 square meters excluding the Vltava river part of the site, which will be used for docks and river transportation.

1.2.6 History of site

The Branické Ledárny, erected between 1910 and 1920, emerged from the collaborative vision of architect Josef Kovařovič and the construction firm Nekvasil. Situated along the eastern banks of the Vltava River, these structures served a vital function as ice storage facilities and an ice production plant. Throughout the seasons, ice was meticulously harvested from the river, stored within the Ledárny, and subsequently distributed to hospitals, restaurants, and the nearby Braník brewery, sustaining various industries and enterprises. However, the advent of modern advancements, notably the construction of the Slapy dam and the widespread adoption of refrigeration technology, heralded a transformative shift in the landscape. With the Vltava River no longer succumbing to the winter freeze and the widespread availability of refrigerated storage solutions, the traditional role of the Ledárny became obsolete. Consequently, these once bustling hubs of ice commerce found themselves relegated to the annals of history, their purpose supplanted by the march of progress.

1.2.7 Accessibility

Traffic service is provided by Modřanská street, which is an arterial road and to which a network of service roads is connected. Municipal public transport services are provided by tram, bus and railway transport Currently, the tram line is divided into two. The first track leads from the city centre to thelevel body and continues in the direction of Modřany (and vice versa). The second line runs along the body and ends with a turntable at Nádraží Braník, and from there it leads to the city centre again. There are currently two bus stops at Modřanská street, both are named as Pobřežní cesta and are leading towards Modřany and Smíchovské nádraží. Two railway lines pass through the territory. The first route Prague-Plzeň runs along the Branický bridge located near the site and does not have a stop in the area. The second line Prague-Čerčany, Dobříš (the so-called Posázavský Pacific) has a stop at the Prague-Braník train station. There is a dock for smaller boats in the Branické ledárny lagoon, located on Vltava river.

1.2.8 Built - up volume

There are seven buildings in total on the selected site, two of which are newly designed buildings with new materials (mainly concrete), and five of which are old buildings that were once part of the now-lost Branické Ledárny ice plant. The height of the buildings ranges from one to three floors above ground, with a maximum height of 14 meters. The buildings are closely located next to each other, ensuring comfortable walking circulation throughout the site.

1.2.9 Urban plan

A comprehensive urban development plan is underway for Braník, encompassing various enhancements to infrastructure and accessibility. Firstly, an extension of the existing road network will facilitate smoother traffic flow and provide a vital connection to the main road artery. Additionally, ample parking spaces will be designated to accommodate the growing needs of residents and visitors alike. To promote sustainable transportation, a pedestrian and cycling bridge will be erected, bridging the previously disjointed waterfront path. This bridge will seamlessly integrate the east and west sides of the Vltava river bank, further augmented by the introduction of boat travel options, including the creation of several boat docks. This initiative aims to alleviate accessibility challenges on the west side and Branický island. Furthermore, the implementation of pedestrian and cycling paths will ensure a comfortable and safe circulation around the area, transforming it from its current state of inaccessibility. As part of this revitalization effort, buildings lacking architectural significance will be selectively demolished, as indicated in the site analysis maps. This holistic approach seeks to enhance both functionality and aesthetic appeal, fostering a vibrant and interconnected community in Braník.

1.2.10 Landscape

The terrain is mostly flat, it gets steeper right behind the Braník brewery which is not a part of the site. The only level barrier on the site is the tram body, which nowadays forms the border of the flood plain. My project focuses on 32 000 square meters of new reintroduced greenery which will be divided into two main parks altogether with three newly created ponds with fish and water plants. An addition of pedestrian and cycling paths will ensure a comfortable circulation around the site.

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2 Structure

2.1 Foundations

A series of stepped footings connected to columns above the foundation level are incorporated in the foundations of the Old and New Ledárny buildings. Stepped foundations, also known as tiered or stepped footings, are a structural solution employed in areas with uneven terrain or soil conditions. They involve a series of horizontal platforms, each at a different elevation, which support the weight of the building above. These stepped configurations help distribute the load evenly across the ground, reducing the risk of settlement or instability. Stepped foundations are particularly useful in regions prone to soil movement or where the ground slopes significantly (the placement of Ledárny buildings 4.09m above Vltava river level), providing stability and ensuring the structural integrity of the building. They require careful planning and engineering to accommodate the specific site conditions and building requirements.

2.2 Bearing structures

2.2.1 Vertical bearing structures

The 500mm reinforced concrete load-bearing walls function as robust foundation elements, efficiently distributing loads and supporting both vertical and horizontal forces within the buildings. By incorporating reinforced concrete, an additional layer of resilience is imparted, strengthening the walls against external pressures and potential stressors. These strategically positioned load-bearing walls form a cohesive and interconnected network throughout the buildings, enhancing overall stability. Their substantial thickness and reinforced composition not only provide essential support but also bolster the building's ability to withstand dynamic forces such as wind, seismic activity, and other environmental factors. Beyond their structural role, these load-bearing walls also contribute to spatial planning, defining the layout and functionality of interior spaces. A series of structural columns are strategically incorporated throughout both the Old and New Ledárny buildings, effectively transferring loads to the foundations. More detailed information about the column system can be found in Chapter 2.2.3, dedicated to the column and beam system.

2.2.2 Horizontal bearing structures

Within the architectural framework of this project, the horizontal bearing structures are meticulously crafted from in-situ cast reinforced concrete slabs. This deliberate choice in construction methodology underscores a commitment to both structural integrity and long-lasting durability. Renowned for its exceptional load-bearing capacity and adaptability, reinforced concrete serves as the cornerstone of the buildings' robust structural framework. By opting for reinforced concrete, the project not only ensures the reliable support of the architectural elements but also reinforces the resilience and longevity of the overall structure. This strategic decision reflects a comprehensive approach to construction, where careful consideration is given to both functional requirements and long-term sustainability.

2.2.3 Column and beam system

In both the New and Old Ledárny buildings, an array of load-bearing reinforced concrete columns serves as indispensable components, crucial to the load-bearing structural framework. These columns play a pivotal role in transferring loads into the foundations, ensuring the robust support necessary for the buildings' stability. Moreover, they provide essential anchorage for the stainless steel beam construction, which forms the framework for the distinctive sawtooth roof design, imparting both structural strength and architectural character. Complementing these load-bearing columns are two horizontal bearing reinforced concrete slabs, intricately interconnected with the columns. This integration enhances overall stability and facilitates the efficient transfer of horizontal loads, thereby optimizing the structural performance of the buildings. Through this cohesive system, the flow of forces is effectively managed, contributing to a harmonious distribution of loads throughout the structures.
Each building boasts a set of nine columns, totaling eighteen structural columns across both the Old and New Ledárny buildings. These columns, measuring 60x80cm in size, are meticulously designed to withstand the demands of the structure while ensuring optimal support and load-bearing capacity. In essence, these reinforced concrete columns epitomize the resilience and reliability inherent in modern construction practices, embodying the fusion of functionality and structural elegance.

Moreover, the structural integrity and durability of the sawtooth glazed roof are further reinforced by a combination of stainless steel beams and reinforced concrete beams. These meticulously engineered elements play a pivotal role in supporting and securing the roof in place, effectively distributing loads and enhancing overall structural stability. The stainless steel beams, renowned for their strength and corrosion resistance, provide crucial reinforcement, while the reinforced concrete beams offer additional support, ensuring the roof withstands the rigors of environmental factors and maintains its structural integrity over time.

2.3 Thermal and acoustic insulation

In order to improve thermal and acoustic insulation within the buildings, a combination of cork insulation, already utilized in the site's historical structures, and mineral wool insulation is strategically installed within the cavities between the exterior exposed concrete masonry wall and the interior concrete finish. This selection of insulation guarantees superior thermal, sound, and fire control properties. Mineral wool, capable of withstanding temperatures exceeding 1000 degrees Celsius, is particularly well-suited for fire protection. Additionally, mineral wool boasts an environmentally friendly composition, comprising 70% recycled materials, and offers a higher R-value per inch compared to alternative insulation materials.

2.4 Doors

Recognizing the fundamental importance of doors in enabling accessibility and seamlessly connecting exterior and interior spaces within the project, meticulous attention was devoted to the design of each door category. For the main entrance doors, situated at the project's exterior, aluminum double-sided triple glazing doors were selected to enhance accessibility and provide heightened comfort. Meanwhile, a series of emergency fire exit doors, strategically integrated into both the New and Old Ledárny buildings, serve as essential fireproofing components, ensuring a cohesive and secure design approach across the entirety of the project. This thoughtful selection and implementation of door designs not only prioritize functionality but also contribute to the overall safety and coherence of the architectural vision.

2.5 Windows

Double glazed window panes integrated into both the New and Old Ledárny buildings serve a dual purpose as integral components of the sawtooth roof, allowing direct sunlight to illuminate the interior spaces. Each roof window features a sophisticated double-pane design, meticulously sealed with a metal spacer, desiccant, primary sealant of butyl, secondary sealant of urethane, and an edge seal, housing a shading system between the panes for enhanced thermal control. An automatic shading system positioned between the glazed panes requires zero maintenance and effectively mitigates heat gain, reducing the Solar Gain Coefficient to less than 12%. Furthermore, the window panes are securely sealed to both the edge seal and the aluminum window frame, ensuring optimal performance and durability.

In addition to the roof windows, an existing series of double glazing windows adorns the adjacent buildings to the New and Old Ledárny structures, maintaining architectural cohesion and enhancing energy efficiency.

A novel structure housing the restaurant and student's lounge showcases a contemporary approach with triple glazed window aluminum frames, complemented by an external shading system. This integration of modernity not only enhances the aesthetic appeal of the site but also underscores a commitment to sustainable design principles.

2.6 Built interior

The interior design of the Old and New Ledárny buildings, housing the Aquarium and Institute of Aquatic Biology research hub, is meticulously crafted to cater to a diverse range of functions and activities. Within these expansive spaces, glazed curtain walls not only delineate various areas but also infuse the interiors with natural light, creating a vibrant and inviting atmosphere. The layout encompasses versatile spaces such as workspaces, a gift shop, reception and cloakroom facilities, restrooms, corridors, technical and maintenance rooms, and ample open areas designated for numerous fish tanks and algae tanks. Spanning an impressive size of 6,864m² each and spanning three floors, both buildings prioritize a seamless and comfortable circulation throughout, ensuring accessibility and ease of movement for occupants.

The Faculty of Aquatic Biology, occupying three floors with a total area of 4,742m², is designed to accommodate the specific needs of academic and research activities. Lecture rooms are thoughtfully arranged to promote engagement and interaction, while corridors provide efficient connectivity between different spaces. The building also houses offices for faculty members, technical and maintenance facilities, a dedicated diving pool area, and two well-equipped auditoriums, enhancing the learning and research experience for students and scholars alike.

Furthermore, the Educational Library and Restaurant complex spans three floors, boasting a generous size of 3,400m². Alongside essential technical and maintenance rooms, the facility features a fully equipped kitchen, restrooms, and spacious corridors facilitating seamless movement. The expansive ground floor encompasses versatile spaces serving as a restaurant, student cafeteria, reception area and library rooms, while the upper levels house a students' lounge, library rooms. The basement encompasses an archive and a technical rooms. This multifunctional setup not only caters to the academic and research needs of the institution but also provides a welcoming environment for relaxation, study, and social interaction.

2.7 Accessibility

Access to each floor is facilitated by a combination of staircases and elevators meticulously integrated into the design. The elevators are purposefully engineered to cater to a specific capacity of visitors and users, prioritizing comfortable accessibility for individuals with disabilities and those navigating with strollers. Meanwhile, the staircases are carefully constructed with a comfortable riser height of 180mm and a generous thread width typically measuring 1.8m, ensuring ease of use for all occupants. To further enhance safety and convenience, landings are incorporated as resting points between flights, accommodating the height of each floor seamlessly. Additionally, each staircase is adorned with glazed railings, providing both aesthetic appeal and enhanced visibility. With these thoughtful features in place, each building on the site is meticulously designed to be barrier-free, fostering inclusivity and accessibility for all.

2.8 Interior finishes

Historical buildings:

Plaster, Painted surfaces, Tiles (in restrooms), Concrete, Polished concrete

New constructed buildings:

Concrete, Polished concrete, Tiles (in restrooms)

2.9 Exterior finishes and Facade

Historical buildings:

Brickwork as structural walls - plaster finish, slate roof covering, historical ornaments made out of bricks and plaster finish

New constructed buildings:

Reinforced concrete structural walls - Exposed concrete finish, glazed roof, transformation of historical ornaments made out of concrete

2.10 Roofing system

There are two sets of sawtooth roofs covering the new and old Branické Ledárny buildings, each featuring three "teeth" comprising ridge and dual pitches, totaling six sets of ridge and dual-pitch roof structures for both buildings. The dimensions of one set of ridge and dual-pitch roof structure are 14.6m horizontally (from pitch to pitch), 3m vertically (from ridge to pitch), and 14.9m diagonally (from pitch to ridge). Vertical and diagonal window frames are supported by reinforced concrete beams serving as their structural elements. The structure is horizontally reinforced by stainless steel beams positioned beneath each vertical section of the sawtooth roof. The historical buildings are usually supported by roof trusses and beams made out of structural timber, with a slate roof cover as an exterior roof finish.

3 M.E.P.

3.1 Water management

Prague 4 boasts an extensive and interconnected water management infrastructure, seamlessly linked with the municipal water mains and sewage system. This sophisticated network ensures a reliable and consistent supply of clean, potable water to meet the diverse needs of site users.

At the core of this water management system is a meticulous process of sourcing water from the Vltava river. This water undergoes thorough filtration before being distributed throughout the HVAC (Heating, Ventilation, and Cooling) system. Here, it plays a multifaceted role in cooling, heating, and ventilating the buildings, contributing to enhanced comfort and energy efficiency (for further details, refer to section 3.2 Heating, Ventilation, and Cooling). Additionally, within the technical rooms, meticulous records are maintained to monitor the usage of water for fish tanks and algae tanks, ensuring efficient and sustainable management of aquatic ecosystems within the facility.

Moreover, the water management system extends beyond mere distribution, incorporating innovative strategies for water reuse and conservation. Excess water from the fish tanks and surplus Vltava river water can be filtered and repurposed for various applications. For instance, it can be utilized for water flushing in restrooms, reducing overall water consumption and promoting eco-friendly practices. Furthermore, in the restaurant and cafeteria areas, this reclaimed water can be employed for dishwasher use, minimizing water wastage and enhancing operational sustainability.

By integrating advanced water management techniques and prioritizing resource efficiency, Prague 4 demonstrates a commitment to environmental stewardship and sustainable development. This comprehensive approach not only ensures a reliable supply of clean water but also minimizes waste and promotes responsible water usage throughout the facility.

3.2 Heating, ventilation and cooling

The proposed HVAC (Heating, Ventilation, and Air Conditioning) system presents an innovative approach to climate control, drawing upon the abundant resource of fresh water from the nearby Vltava river. This sustainable solution begins with the filtration of river water, which is then directed through a water-to-air heat exchanger. Here, the water acts as a heat transfer medium, effectively cooling or warming the fresh outside air that circulates through the system. Should additional heating be required, supplementary heat can be introduced to the air within the exchange process.

The conditioned air, now at the desired temperature, is distributed throughout the building via industrial ventilation ducts, ensuring a comfortable indoor environment for occupants. Meanwhile, a separate duct system efficiently removes stale air from the building, preventing the accumulation of pollutants and ensuring optimal air quality. Notably, the warmth contained in the exhaust air is captured and transferred to the incoming fresh air through an air-to-air heat exchanger, maximizing energy efficiency and minimizing waste.

Remarkably, this system offers three essential functionalities–ventilation, cooling, and warming–using only two industrial-sized air duct systems, streamlining operation and maintenance while maximizing efficiency.

The strategic placement of the HVAC system in the basement's technical room ensures convenient access for maintenance and servicing, facilitating efficient operation and upkeep.

Furthermore, the site benefits from natural cooling provided by the adjacent parks with abundant trees, serving as a natural source of shade and temperature regulation. Additionally, the proximity of the Vltava river bank further contributes to the cooling effect, creating a harmonious synergy between nature and technology in maintaining optimal comfort within the built environment.

3.3 Electricity

The seamless integration of the building's electrical system into the existing electric grid on the site is a testament to the meticulous planning and implementation of modern infrastructure. At the heart of this system lies the primary electricity switchboard, strategically positioned within the technical rooms situated in the basements. Serving as the central hub for managing the building's electrical distribution, this switchboard facilitates efficient and reliable power supply to all areas of the structure.

Through careful coordination with the site's electric grid, the building's electrical system seamlessly synchronizes with the broader network, ensuring uninterrupted power flow and optimal performance. The strategic placement of the primary switchboard in the basements not only maximizes space utilization but also enhances accessibility for maintenance and operational purposes.

Furthermore, the integration of advanced technologies and safety features enhances the resilience and efficiency of the electrical system. From circuit breakers to surge protectors, every component is meticulously selected and installed to meet the highest standards of reliability and safety.

3.4 Fire protection

A meticulous focus on fire protection stands as a cornerstone in the design and construction of the project. Mineral wool, meticulously integrated into the structure, serves a multifaceted role, providing not only thermal and acoustic insulation but also commendable fireproofing properties. This deliberate selection enhances the overall safety features of the buildings, ensuring resilience against fire hazards.

In addition to structural reinforcements, both the New and Old Ledárny buildings are equipped with emergency fire exit doors on the ground floor, strategically positioned to facilitate swift and safe evacuation during fire emergencies. Furthermore, the design of the stairs is thoughtfully crafted to prioritize ease of accessibility and enable rapid evacuation, should the need arise.

These proactive measures collectively underscore a robust commitment to fire safety, placing the well-being and security of the building's users, occupants, and property at the forefront of the project's priorities. By integrating comprehensive fire protection measures into the design and construction process, the project ensures a resilient and secure environment for all stakeholders involved.

Additionally, the interior structures are passively fire protected, applying a certification listed fireproofing system to certain structures that allows them to have a fire-resistance rating. There are sets of applications listed: Structural steel fireproofing to keep below critical temperature of 540 degrees Celsius. Electrical circuit fireproofing to keep electrical circuits below 140 degrees Celsius and concrete fire proofing coating.

4 Sustainability

Algae bio-photovoltaic panels:

In a bold stride towards sustainability, Branik's infrastructure has been revolutionized with innovative features aimed at mitigating environmental impact and championing renewable energy sources. Among these pioneering advancements are the integration of algae energy-generating bio-panels into building exteriors, harnessing the natural power of photosynthesis to generate clean energy. These biophotovoltaic (BPV) algae panels represent cutting-edge solar technology, utilizing living microorganisms like algae to convert sunlight into electricity through photosynthesis.

The process is ingeniously orchestrated: when sunlight interacts with the algae, a cascade of reactions ensues, breaking down water into protons (H+), electrons, and oxygen. These components are vital for the algae's growth, facilitating the conversion of carbon dioxide and other inorganic substances into essential carbohydrates and proteins. The BPV algae panels capitalize on this phenomenon by employing a specialized setup with two electrode-containing chambers separated by a membrane, allowing only protons to pass through. Electrons generated during photosynthesis traverse through an external circuit, where they reunite with protons and oxygen at the cathode, forming water. The resultant current in the external circuit effectively powers electronic devices.

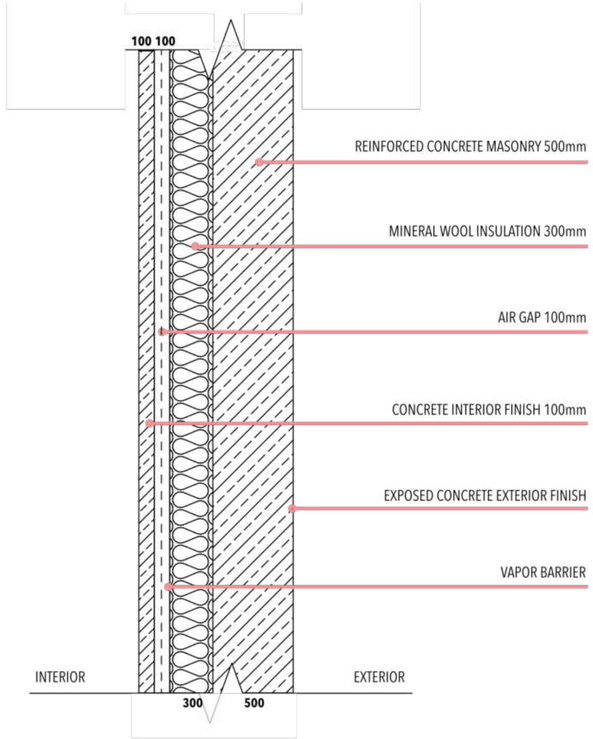
Notably, these panels serve a dual purpose, actively reducing carbon emissions by absorbing CO2 from various sources, enriching water with select algae strains, and catalyzing photosynthesis with sunlight to produce oxygen and increase biomass. The increased availability of sunlight expedites algae growth, effectively sequestering approximately two pounds of carbon dioxide per pound of algae.

Furthermore, when integrated into building rooftops, these panels provide shade and mitigate air conditioning energy consumption during summers. The biomass yielded by the algae can be harvested and processed into eco-friendly biofuels like biodiesel or biogas, presenting a sustainable energy source and a potential export commodity. Alternatively, it can be harnessed within the complex itself, for applications such as boat transport, aligning with the project's vision for comprehensive sustainability.

Moreover, the utilization of algae cultivated in dedicated ponds at the Ledárny facility serves a myriad of purposes, spanning from biofuel production to the creation of natural fertilizers, food products, and health supplements. This holistic approach not only diminishes the carbon footprint but also underscores a steadfast dedication to sustainable practices and environmental stewardship.

Vltava river water filtration used in HVAC system:

Complementing these groundbreaking initiatives is a sophisticated cooling system that taps into the natural resources of the Vltava river. Water sourced from the river undergoes meticulous filtration before being circulated throughout the premises, delivering efficient cooling for the buildings while minimizing energy consumption. Furthermore, a centralized HVAC air system incorporates state-of-the-art heat recuperation technology via heat exchangers, optimizing energy efficiency throughout the facility (for further details, refer to section 3.2 Heating, Ventilation, and Cooling). This integrated approach to harnessing renewable energy sources and enhancing energy efficiency exemplifies Branik's commitment to pioneering sustainability practices and fostering a greener future.



The selected material for the masonry is 500mm casted-in-situ thick reinforced concrete. This thickness is chosen because the reinforced concrete masonry not only provides structural support but also functions as an exterior finish, serving as a decorative facade adorned with three-dimensional Art Nouveau ornaments for the building.

Branické Ledárny technical drawing

Layer composition - load-bearing wall

1:20

There are two sets of sawtooth roofs covering the new and old Branické Ledárny buildings, each featuring three "teeth" comprising ridge and dual pitches, totaling six sets of ridge and dual-pitch roof structures for both buildings.

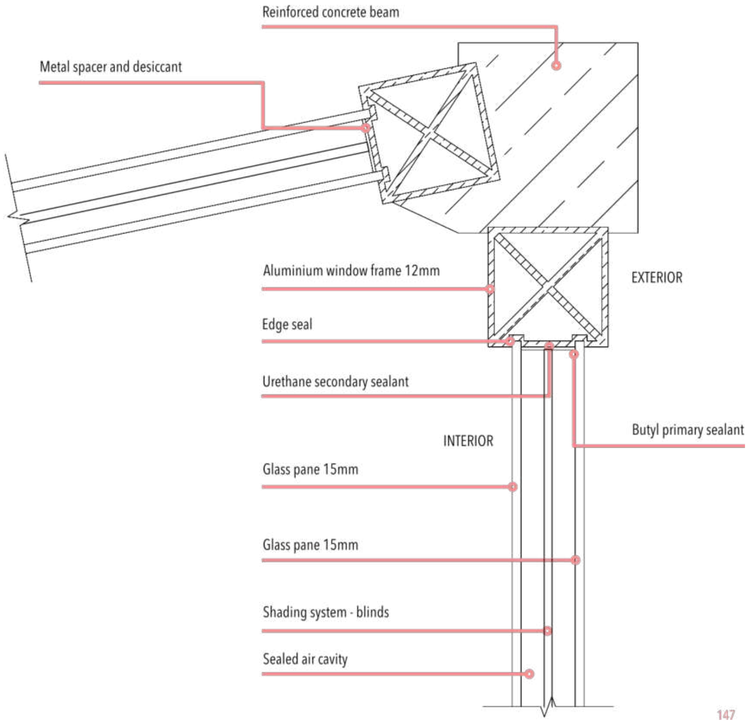
The dimensions of one set of ridge and dual-pitch roof structure are 14.6m horizontally (from pitch to pitch), 3m vertically (from ridge to pitch), and 14.9m diagonally (from pitch to ridge).

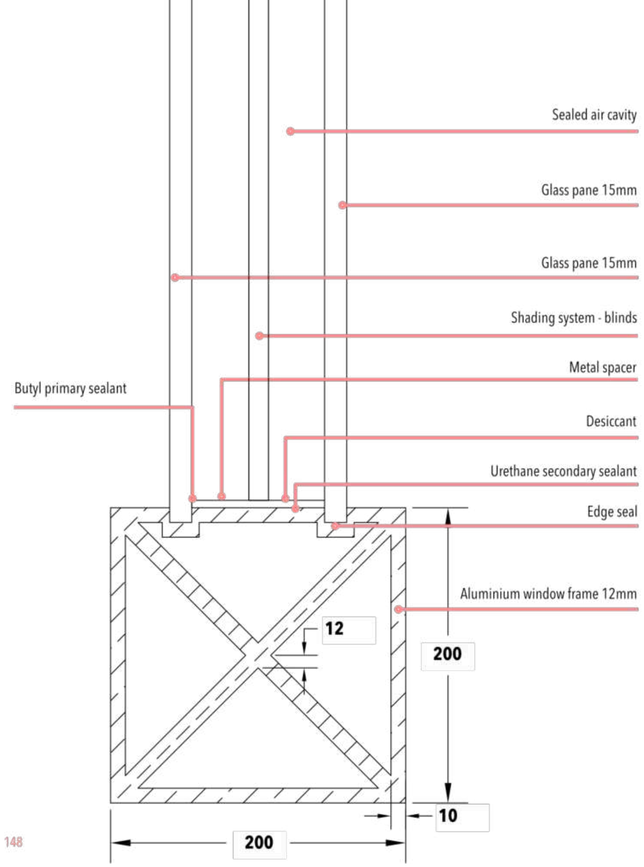
Visible are the vertical and diagonal window frames, supported by reinforced concrete beams serving as their structural elements. These beams support the vertical, horizontal, and diagonal aluminum window frames. The structure is horizontally reinforced by stainless steel beams positioned beneath each vertical section of the sawtooth roof.

1:5

Branické Ledárny technical drawing

Saw tooth roof section - Roof window detail 1





Branické Ledárny technical drawing

Saw tooth roof section - Roof window detail 2

1:2

The roof window features a double-pane design, sealed with a metal spacer, desiccant, primary sealant of butyl, secondary sealant of urethane, and an edge seal, housing a shading system between the panes.

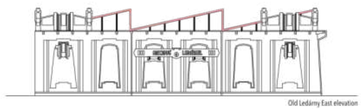
This design ensures that the blinds between the panes require zero maintenance and effectively block a significant amount of heat from entering the building, reducing the Solar Gain Coefficient to less than 12%. Additionally, the window panes are securely sealed to both the edge seal and the aluminum window frame.

1:100

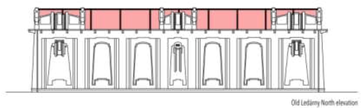
Branické Ledárny technical drawing

Saw tooth roof top view

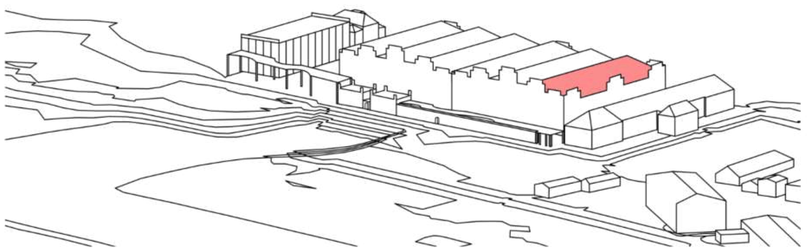
As previously stated, the sawtooth roof comprises three components: vertical, horizontal, and diagonal. The diagonal section of the glazed sawtooth roof is divided into ten segments, each with an aluminum frame intersection. This section contains a total of 60 windows measuring 4.6x2.35m, resulting in 360 window panes for the entire diagonal portion of the roof.

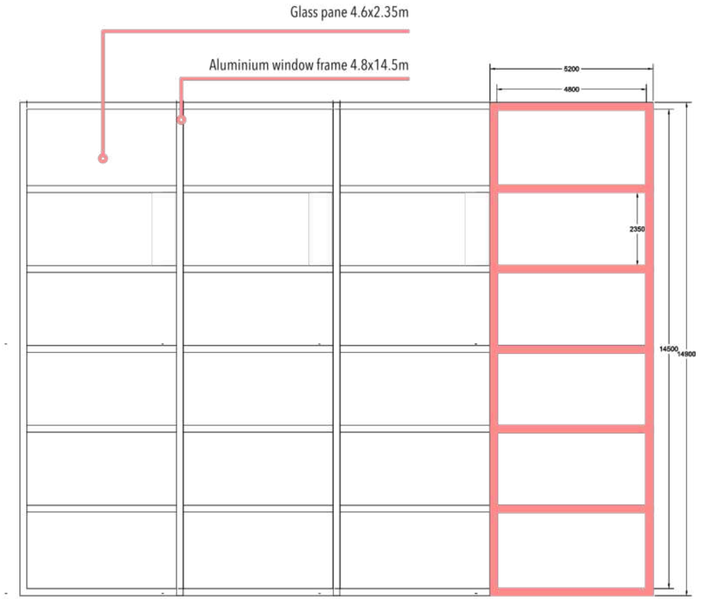


Old Ledárny East elevation



Old Ledárny North elevation





10x frames with 6 window panes = 1x diagonal part of saw tooth roof

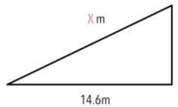
60x frames with 360 window panes = 6x diagonal parts = whole saw tooth roof

Load-bearing structures calculation

COLUMN STABILITY CALCULATION - OLD LEDÁRNY (Institute of Aquatic Biology)

1 Roof area calculation

Designed roof shape: Saw tooth



$X = \sqrt{3^2 + 14.6^2}$

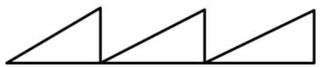
X = 14.9m

14.9 + 3 = 17.9m

17.9 + 3 = 53.7m

53.7 x 52 = 2792.4 m²

Roof area = 2792.4 m²



2 Roof weigh calculation

A) Weight of double pane per m²:

1 window pane:

2.35 x 4.6 = 10.81 m²

(10.81 x 0.015) x 2 = **0.32 m² of glass per pane**

B) Weight of glass on the roof:

3 x 10 x 6 x 810.75 = **145 635kg**

C) Weight of aluminium per panel:

10mm thick aluminium per panel

Aluminium weight per m³ = 2710 kg/m³

2(0.15 x 0.01 + 0.2 x 0.01) = 0.007 m³

2(0.007 x 14.5 + 0.007 x 4.6) = 0.27 m³

5(0.007 x 4.6) = 0.16 m³

0.27 m³ + 0.16 m³ = 0.43 m³

Aluminium per frame = 0.43 m³

Aluminium per roof = 6.45 m³

Aluminium per roof = 17 480 kg

D) Weight of stainless steel (in between window assemblies)

0.2 x 0.001 = 0.0002 m²

0.0002 x 14.9 = 0.003

0.0002 x 5.2 = 0.001

(0.001 x 0.003) x 2 = 0.008 m³

0.008 x 4 sides = 0.032 m³

Stainless steel per m³ = 7500 kg/m³

Stainless steel per frame = 240 kg

Stainless steel weight for the whole roof = 3600 kg

E) Weight of roof concrete beams

Weight of concrete = 2300 kg/m³

0.3m x 0.6m x 52m = 9.36 m³ per beam

3 beams x 9.36 m³ = 28 m³

Beams weight per roof = 64 585 kg

F) Roof weight

167 015 kg slanted roof + 200 420 kg vertical roof part

Whole roof weight = 265 005 kg

3 COLUMN STABILITY

Total weight of the roof = 265 005 kg

Total roof area = 2792.4 m²

Area supported by one column = 67.65 m²

67.65/2792.4 = 0.024 percentage of roof supported by one column

265 005 x 0.024 = 6360 kg supported by each column

Snow load calculation:

67.65 x 125 kg = 8456 kg snow load

6630kg supported by each column + 8456 kg snow load = 14 816 kg

14 816 kg + 10% error margin = 16 296 kg

Weight supported by each column = 16 296 kg

Weight supported by each column = 159 830 N

4 Weight of floor slabs

Reinforced concrete 30cm thick floor slabs

Weight of concrete per m³ = 2300 kg/m³

67.65 m² x 0.3 = 20.3 m³

20.3 m³ x 2300 kg = 46 690 kg

Live load = 3000 kg/m²

3000 kg/m² x 67.65 m² = 60 900 kg

46 690 kg x 60 900 kg = 107 590 kg per 1 floor

(107 590 kg x 2) + 265 005 kg = 480 200 kg carried by three parts of one column

Weight supported by each column = 480 200 kg

Weight supported by each column = 4 710 762 N

Result Summary

Name	Minimum	Maximum
Safety Factor		
Safety Factor (Per Body)	3.412	9.244
Stress		
von Mises	3.786 MPa	10.258 MPa
1st Principal	-2.292 MPa	0.365 MPa
3rd Principal	-10.257 MPa	-5.048 MPa
Normal XX	-2.343 MPa	0.361 MPa
Normal YY	-2.313 MPa	0.34 MPa
Normal ZZ	-10.168 MPa	-5.048 MPa
Shear XY	-0.246 MPa	0.232 MPa
Shear YZ	-0.878 MPa	0.881 MPa
Shear ZX	-0.777 MPa	0.788 MPa
Displacement		
Total	0.00 mm	1.725 mm
X	-0.023 mm	0.023 mm
Y	-0.026 mm	0.027 mm
Z	-1.725 mm	0.00 mm
Reaction Force		
Total	0.00 N	1.451E+06 N
X	-133963.83 N	134635.36 N
Y	-115171.44 N	116538.11 N
Z	0.00 N	1.451E+06 N
Strain		
Equivalent	1.203E-04	2.815E-04
1st Principal	0.00	7.677E-05
3rd Principal	-3.308E-04	-1.473E-04
Normal XX	0.00	7.451E-05
Normal YY	0.00	7.239E-05
Normal ZZ	-3.308E-04	-1.473E-04
Shear XY	-1.914E-05	1.804E-05
Shear YZ	-6.832E-05	6.859E-05
Shear ZX	-6.046E-05	6.134E-05
Contact Force		
Total	0.00 N	0.00 N
X	0.00 N	0.00 N
Y	0.00 N	0.00 N
Z	0.00 N	0.00 N

Calculation conclusion

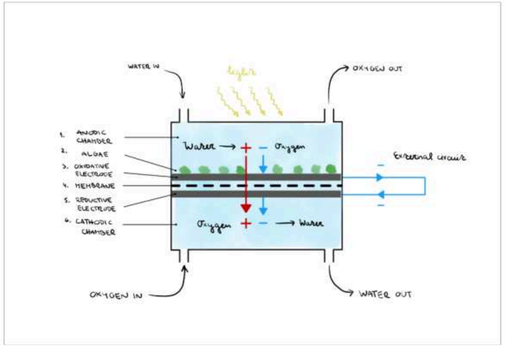
The columns are able to support the weight of the new roof structure and new constructed two floors with its previously designed dimensions of 60x80 cm. Calculations have been provided with only the calculation of concrete column without reinforcement, therefore the added reinforcement in the concrete column makes the column stronger to withstand the vertical loads.

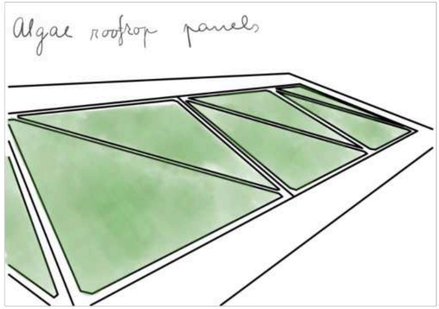
Bio photovoltaic panels - Algae solar system

Biophotovoltaic (BPV) algae panels are innovative solar technologies harnessing the power of living microorganisms like algae to generate electricity through photosynthesis. When light interacts with the algae, a cascade of reactions occurs, breaking down water into protons (H+), electrons, and oxygen. These components are essential for the algae's growth, aiding in the conversion of carbon dioxide and other inorganic substances into carbohydrates and proteins. BPV algae panels leverage this process by utilizing a setup with two electrode-containing chambers separated by a membrane, permitting only protons to pass through. Electrons produced during photosynthesis travel through an external circuit, where they recombine with protons and oxygen at the cathode, forming water. The resulting current in the external circuit can power electronic devices effectively.

Crucially, these panels play a dual role in reducing carbon emissions by absorbing CO2 from various sources, enriching water with selected algae strains, and catalyzing photosynthesis with sunlight to produce oxygen and increase biomass. Greater sunlight availability accelerates algae growth, effectively sequestering approximately two pounds of carbon dioxide per pound of algae.

Furthermore, these panels, when integrated into building rooftops, provide shade and reduce air conditioning energy consumption during summers. The biomass generated by the algae can be harvested and processed into biofuels like biodiesel or biogas, serving both as a sustainable energy source and a potential export commodity. Alternatively, it can be utilized within the complex itself, for applications such as boat transport, as envisioned in my project.

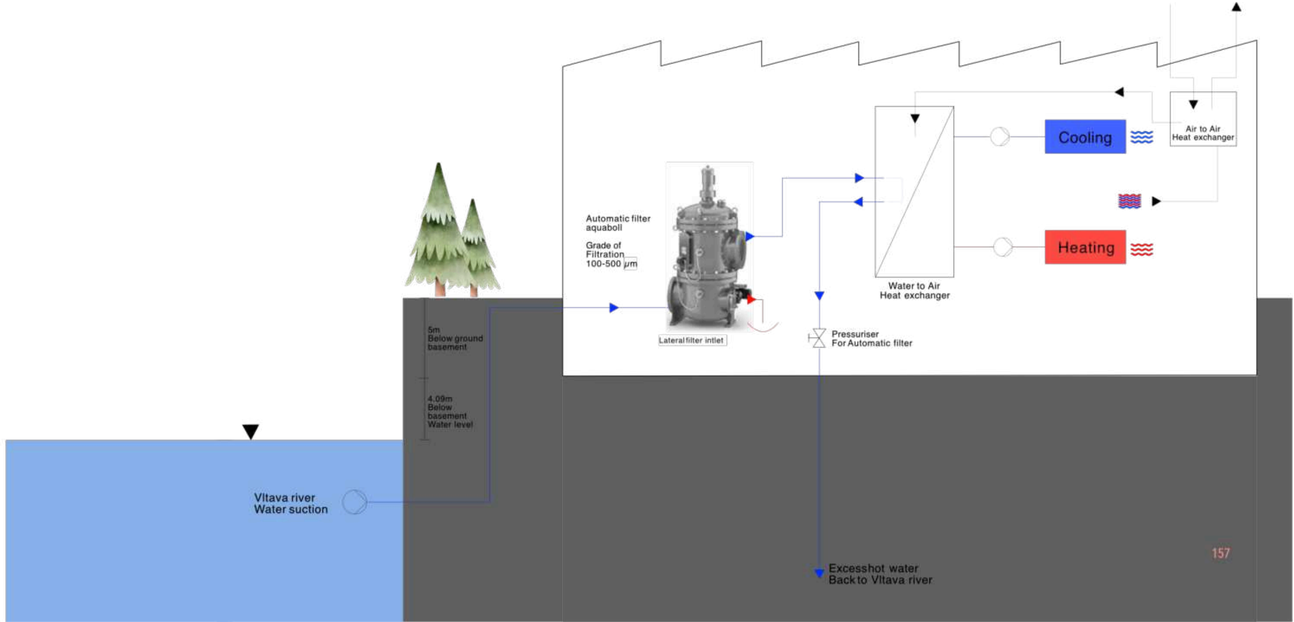




Vltava river water filtration and proposed HVAC system

Proposed HVAC system (Heating, Cooling and Air conditioning) aims at an idea of using fresh water from nearby Vltava river. Water is filtered and ran through a water to air heat exchanger before being flushed back to the river. Fresh outside air runs through the heat exchange effectively cooling it or warming it. Additional heat can be applied to the air in this system if necessary. The fresh warm or cooled air is then distributed throughout the building via industrial ventilation ducts. Old air is pumped out of the building through a different duct system. The warmth of the exhaust air is transferred to the fresh incoming air through an air to air heat exchanger before being released outside for extra efficiency.

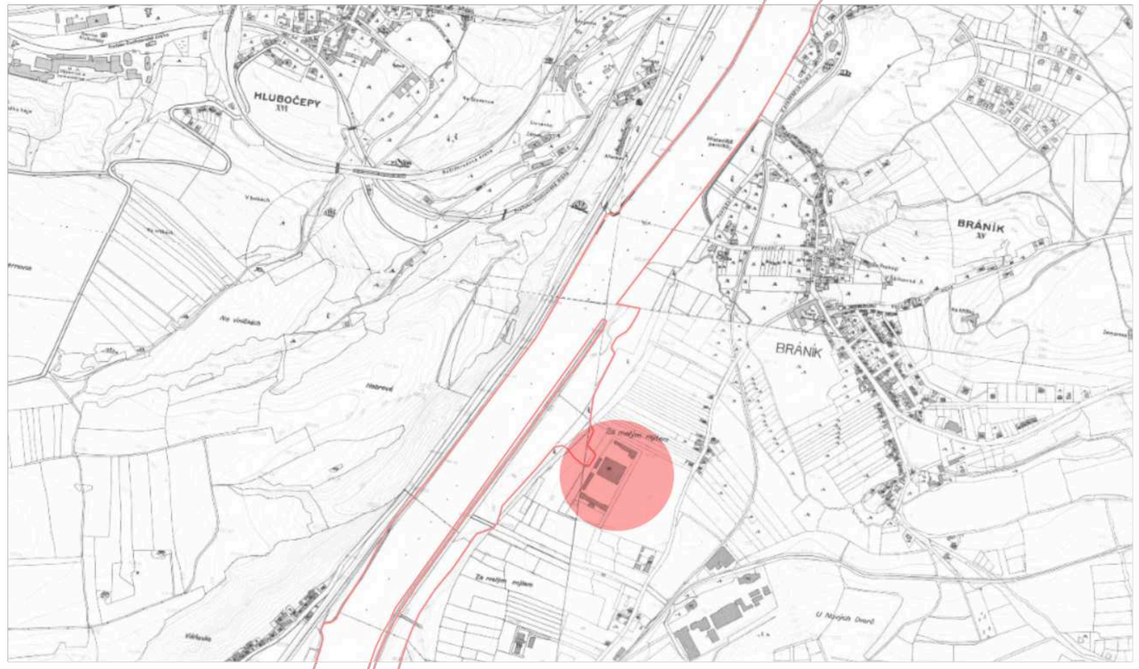
This system offers 3 functionalities using only two industrial sized air duct systems: ventilation, cooling and warming.



Site history and maps

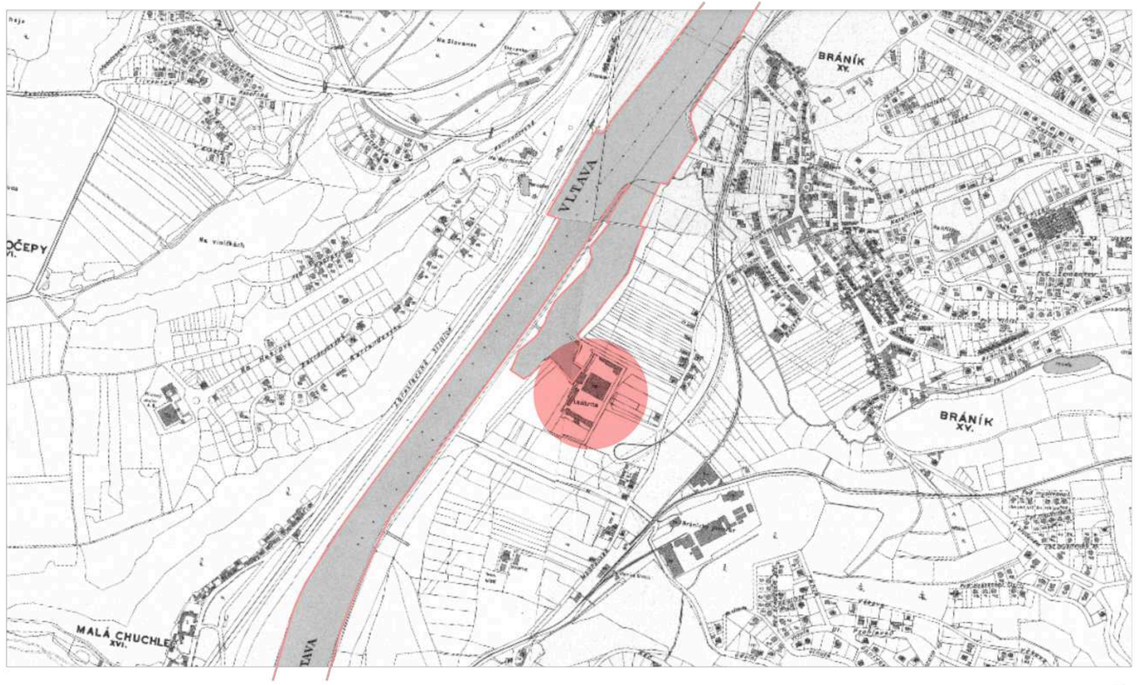
1909-1914 Orientační plán Prahy / 1909-1914 Orientational plan of Prague

1:10 000



1920-1924 Výškopis / 1920-1924 elevation chart

1:10 000



1938 Orientační plán Prahy / 1938 Orientational plan of Prague

1:10 000

1944 Plán Prahy / 1944 Plan of Prague

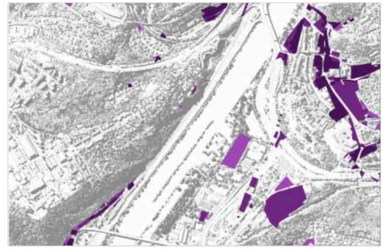
1:10 000

Digital technical map

1:1000

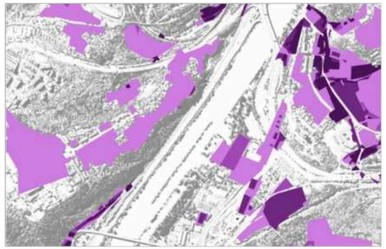
Built-up area of Braník and surroundings until 1840

Built up area of Braník and surroundings until 1880

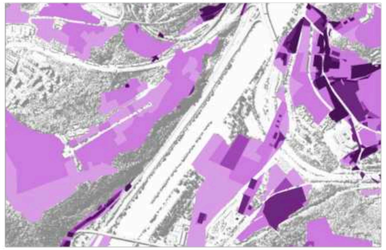


Built up area of Braník and surroundings until 1920

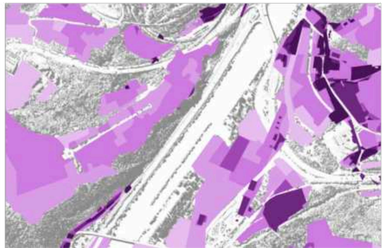
Built up area of Braník and surroundings until 1950



Built up area of Braník and surroundings until 1970



Built up area of Braník and surroundings until 1990



SITE HISTORY AND TECHNICAL DETAILS

The Art Nouveau buildings of the Branické ledárny complex in Prague 4 are characterized by valuable architectural decoration and an impressive urban design. The Ledárny (icehouse) building is also a unique technical monument. In its impressive indoor interior, ice that was mined in the winter months from the surface of the Vltava River was stored there. During the whole year, ice was used for cooling in food warehouses throughout Prague. However, in recent decades, the buildings do not serve their original purpose and their maintenance is neglected. Currently, the structures are already seriously damaged and effective steps must be taken to save them as soon as possible. In particular, however, it is necessary to prevent plans for far-reaching reconstructions that could lead to the destruction of the monument.

Before the end of the 20th century, the construction of a new road section (a new route of the road and a tram body) from Braník to Modřany along the Vltava temporarily revealed a view of the historical site of the former Braník ice factories, which for many years were covered by a thicket of uncultivated overgrown greenery. Now it is growing back. The disused building complex is falling into disrepair after it was stripped of its original function in 1954. The original largest "refrigerator" in Prague then served as a potato warehouse and gradually for other temporary and inappropriate purposes. It is slowly turning into a ruin together with the economic and administrative buildings.

The Branické ledárny parlors were built by the Vltava bay in the years 1909–1911 according to the project of the architect Josef Kovařovič by the Karlín construction company Nekvasil. They replaced the original wooden buildings of the Ledárny parlors on the island of Štvanice. One of the coldest places on the banks of the Vltava was chosen as the construction site for the construction of the Ledárny parlors. Long-term statistics of the current Meteorological Institute confirm that the annual temperature in this basin is 3° C lower than in places just a few hundred meters further in both directions. The dominant building is its own refrigerator, the exterior of which is characterized by a balanced art nouveau decor. The load-bearing structure of the interior belongs to the early realizations of reinforced concrete construction in the Czech republic. The interior has the layout of a three-nave hall with an area of 52x43.9 m and a height of 14 m. The middle field has a span of 15 m. The columns have dimensions of 60x80 cm. They carry the ceiling reinforced with seemingly subtle ribs with ramps. In reality, however, they are 80 cm high beams hidden by the soffit. A prismatic building with an articulated attic and gables reminiscent of the entrance pylon of Egyptian temples with its beveled walls and reinforced corners, a separate climate unit whose ventilation and thermal insulation enabled year-round storage of ice mined from the Vltava river. The thick perimeter walls contained an air gap that, along with the cork lining, kept the temperature low. The insulation function was also fulfilled by the double-skinned ceiling structure. The floors were covered with wooden beam grates. The bottom of the refrigerator is situated 4.09 m above the river level.

The administration of the Ledárny parlors was located in the villa located at the northern border of the area. Other buildings in a unified architectural concept contained stables for 120 horses with a hayloft in the attic, a forge, a wheelhouse, warehouses for storing ice-making equipment, a coal shed and woodsheds. The ice-makers carved the ice from the frozen surface of the Vltava and brought it closer to the lagoon in front of the ice-house with long poles. From there it was raised by three paternoster elevators. The fridge was usually filled for 38 days. Inside, the pieces of ice melted into a monolithic block, from which blocks were then carved throughout the year, which were delivered on horse-drawn carriages to Prague inns, cafes, butchers, pastry shops and hospitals...

The unique structure, despite some technical shortcomings, caused mainly by the limited experience of the implementers with ice operation, served its purpose until 1954, when the Slapy dam was built. From this time on, the Vltava practically does not freeze over the winter. The function of the Branické ledárny parlor was replaced by the production of artificial ice and a refrigerator. The reinforced concrete structure of the central hall is largely affected by corrosion, aggravated by the chemical products of putrefactive processes and acidic fumes from the potatoes that have been stored there for years. Damage to the steel armature and roof structure was discovered by a structural engineer as early as 1965. The cultured external appearance was spared major changes despite signs of aging and neglected maintenance.

After a delay of more than ten years, the ice houses were also discovered by the state preservation service (Národní památkový ústav), which tried to declare at least part of the area as a cultural monument. It was building No. 238, a former administrative building.