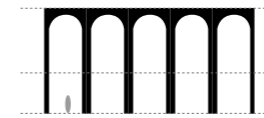


RUIN REUSE:
TRANSFORMING PISCINA MIRABILIS INTO MODERN SPA
THROUGH SENSORY HEALING DESIGN



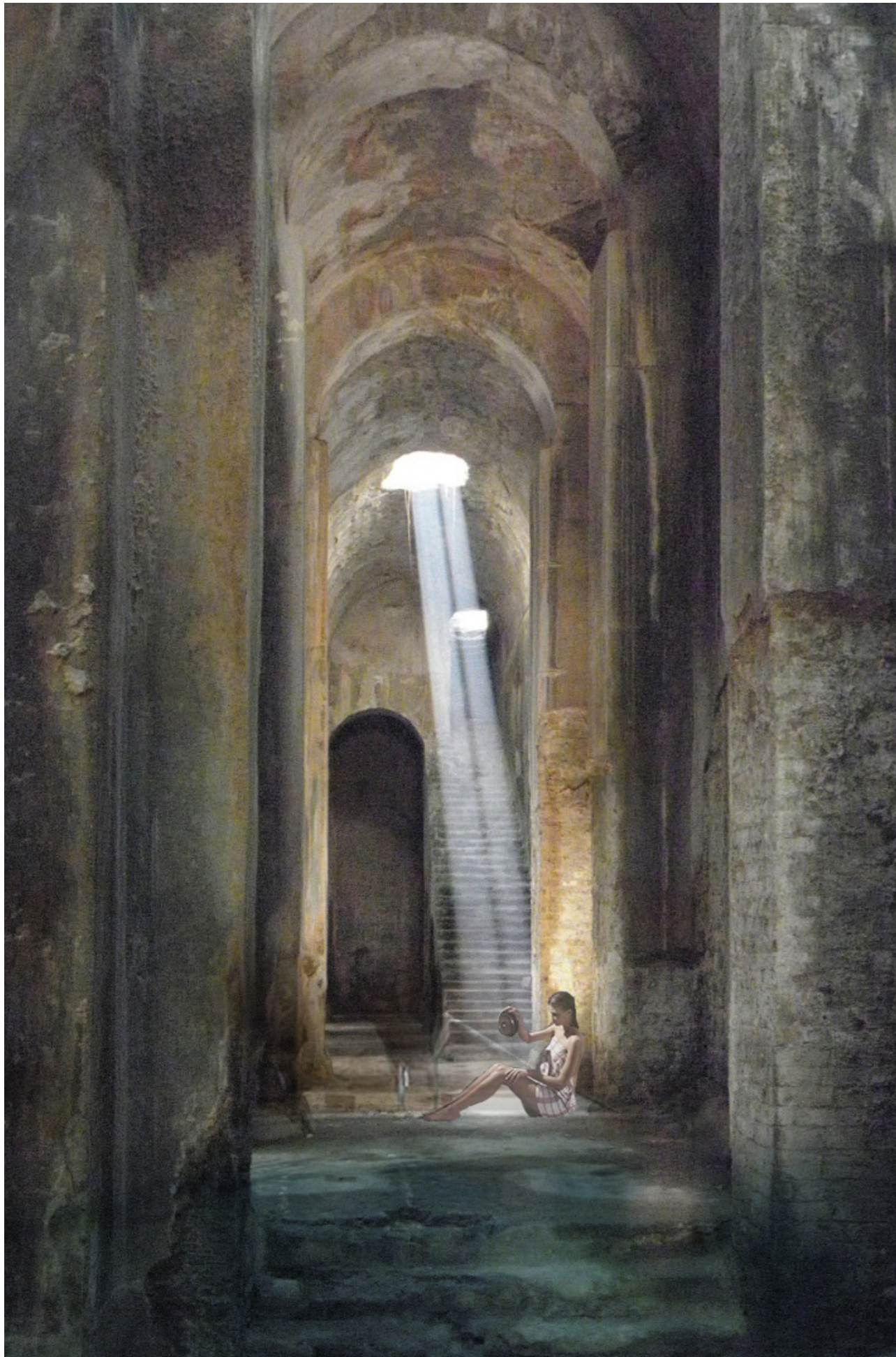
Jin Qian
Master thesis

Chalmers University of Technology
Architecture and Civil Engineering
Building Design and Transformation
Supervisor: Isabella Eriksson
Examiner: Mikael Ekegren



Within each crevice of stone and brick,
time quietly leaves its own stories.
And In this ancient building,
water is the narrative

ABSTRACT



Nowadays, the preservation and reuse of traditional cultural heritage has become an important issue. Some abandoned underground reservoirs, including Piscina Mirabilis, have become ruins in the city, and it is worthwhile to think about how to reuse this ancient and huge reservoir. Meanwhile, with the continuous development of the society, increasing pressure, depression and anxiety becoming common, people's demand for leisure and health is gradually increasing.

An abandoned underground reservoir is chosen as the object of study, and the study is aimed to rethink the potential use of this abandoned space through sensory healing design, to transform it into a spa space with unique sensory experience, to reactivate the function of the Spa as a community center, and to emphasize the importance of its health and social aspects.

The theoretical framework of the study is based on the concept of sensory healing, which emphasizes the stimulation of the five senses to reduce anxiety and promote physical and mental health. The design provides different experiences of water through space shaping that focuses on the human scale. Elements such as the reflection of sunlight, the flow of steam, the change in water temperature, and the sound of water droplets are introduced into the design to create a spa space that provides relaxation and healing. At the same time, the design starts from the perspective of ruins regeneration, thinking about how old spaces, materials and structures can adapt to new functions. Through the analysis of different spaces and functions, the original materials and structures are used, while matching new materials and structures are added. The structure forms a strong contrast between the old and the new, adds a sense of story to the space, and reactivates the space.

Keywords: Senses, Sensory healing, Contrast, Narrative, Materials, Structure

TABLE OF CONTENT

STUDENT BACKGROUND

2016-2021

Beijing jiaotong University
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2021-2024

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Residential healthcare - housing for seniors*

2022 Spring

Matter space structure 2

2022 Autumn

Aalto University
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Gmp architect
Internship

INTRODUCTION 06

Purpose/Aim 08

Thesis question 10

Theory and Method 12

Reference 16

SITE 22

Site 24

Original drawings 26

Site analysis 28

Reservior to spa 30

Materials 34

DESIGN PROPOSAL 36

Siteplan 38

Entrance 40

Old zone 42

New zone 44

Floorplan 46

Section 50

Skylight 52

View analysis 54

Pool types 58

Indoor water system 64

Ventilation 68

Materials 70

Details 72

DISCUSSION 78

BIBLIGRAPHY 80

INTRODUCTION

Purpose/Aim
Thesis question
Theory and Method
Reference



In contemporary society, the preservation and adaptive reuse of historical buildings have garnered increasing attention, reflecting a growing awareness of the intrinsic value of cultural heritage. This topic is particularly pertinent in the field of architecture, where architects are tasked with finding sustainable and meaningful ways to repurpose ancient ruins while respecting their historical significance.

The chosen topic delves into the intersection of cultural preservation and contemporary wellness practices. By exploring the transformation of Piscina Mirabilis, an Roman-era reservoir, into a modern spa facility, this research aims to show the possibilities of harmonizing ancient heritage with contemporary wellness practices. Moreover, it seeks to underscore the importance of preserving cultural heritage not merely as static relics of the past but as dynamic spaces that can continue to serve the needs of today's society.

Understanding how the integration of sensory-oriented spa experiences with historical ruins can contribute to the revitalization of cultural heritage sites is crucial for architects, urban planners, and policymakers alike. By revitalizing ancient structures in a manner that promotes wellness and cultural appreciation, this research endeavors to foster sustainable tourism, promote local economies, and enrich the overall quality of life for communities. Understanding how the integration of sensory-oriented spa experiences with historical ruins can contribute to the revitalization of cultural heritage sites is crucial for architects.

In summary, this research project is driven by the recognition of the intrinsic value of cultural heritage, the evolving societal needs for holistic wellness experiences. By investigating the transformation of Piscina Mirabilis into a modern spa facility, this study aims to contribute to the discourse on sustainable heritage conservation and the integration of wellness practices into the built environment.

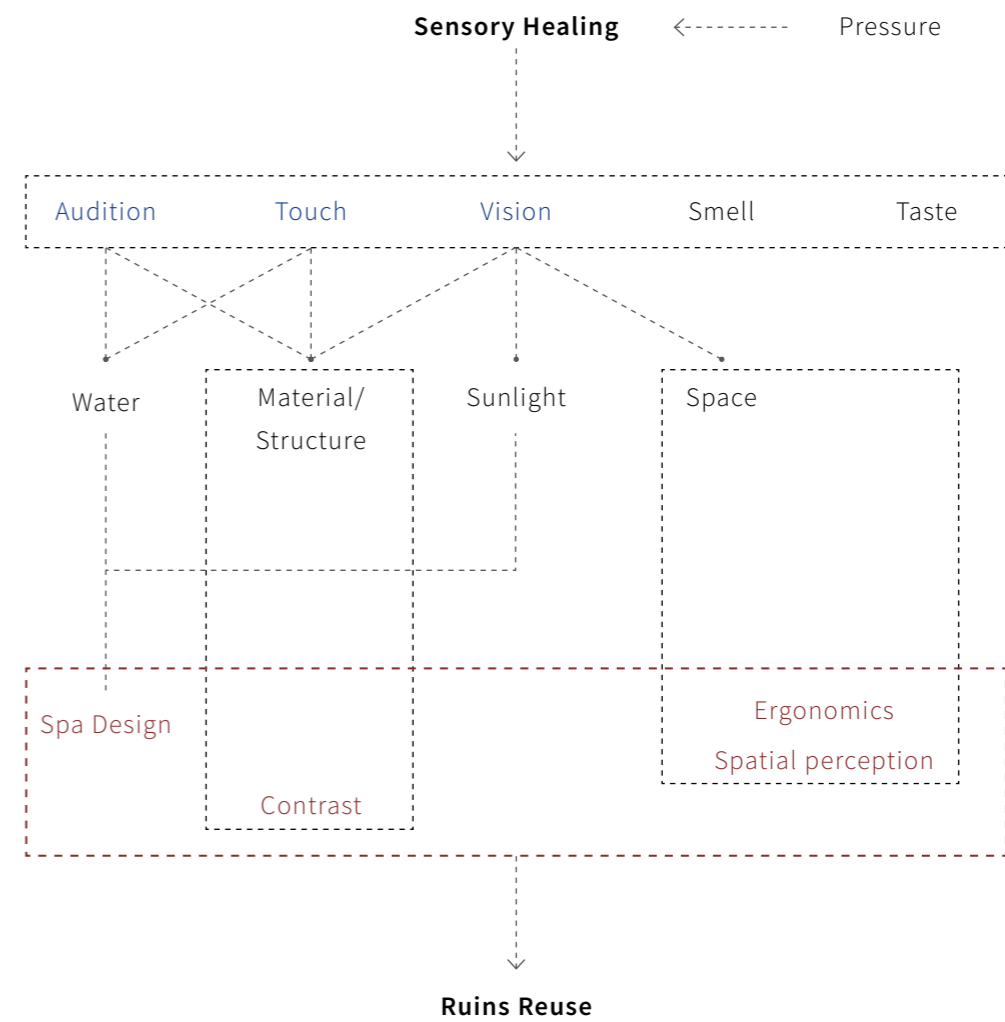
THESIS QUESTION

Main question

How can a spa based on sensory healing be designed and which elements needs to be considered?(the sunlight, the sound and the water temperature, the texture.....)

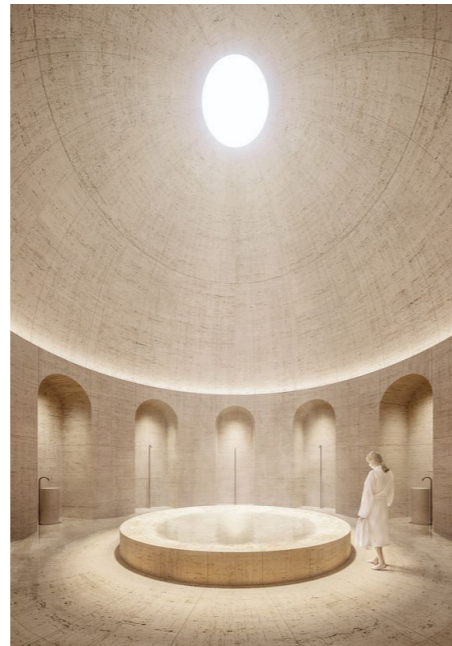
Sub question

When it comes to a renovation project, which do we need to consider more?





© archillect



Sunlight and bath



Sound of Water Droplets© Louis Isadore

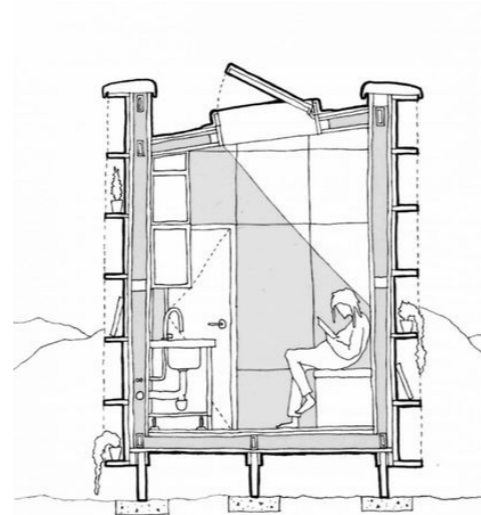
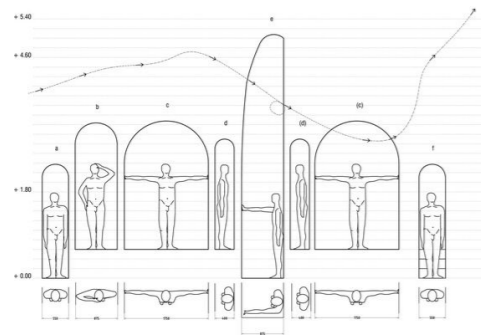


Sensory healing

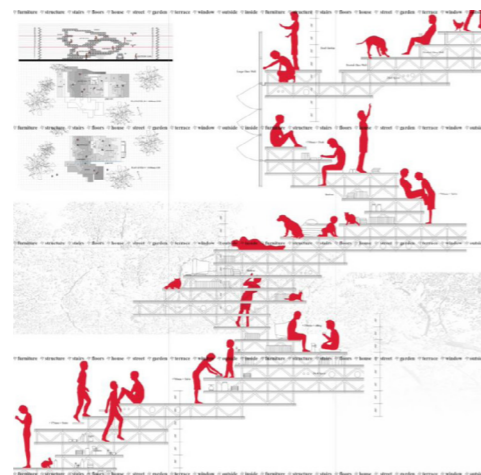
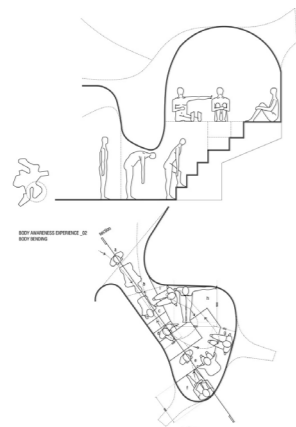
Sensory design is the orchestration of spatial stimuli in built environments, regulated to lift the quality of experience for the occupants they serve cumulatively. By taking an occupant-centered approach, therapeutic architecture further explains how it can be better attuned through sensory design for a healthier mind and body connection physiologically, cognitively, emotionally, behaviorally, and spiritually. The sensory design outline necessitates more as the built environment is assessed for the occupant's well-being and performance.

Five Senses

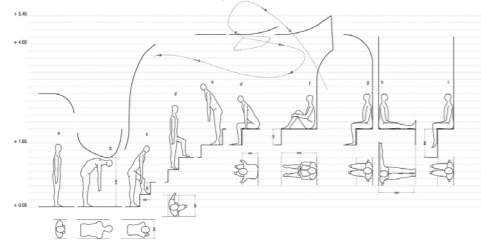
Architecture optimizes the healing process through the senses, presenting it unreliable that only vision reinforces the other senses. In 450 B.C, the Greek philosopher Protagoras noted this when he stated, "Human is nothing but a bundle of sensations." Senses, perceived as a whole, are an information-seeking system. They interact with, are stimulated by the environment, and transmit signals to and feature a different perception range. Touch, smell, and taste provide information exploring sensory design and its potential to heal within the paramount space around us. In contrast, vision and hearing can represent objects or events from greater distances.



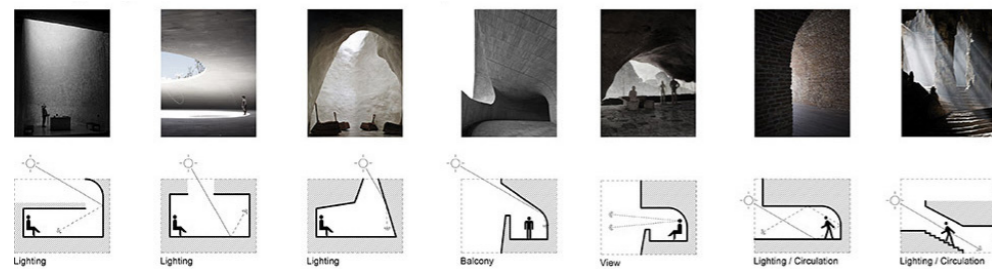
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Spatial perception

The perception of space, while primarily visual, is largely based on our relationship to scale. Our sense of scale is complemented by bodily sensations, primarily through tactile feedback. According to Alois Reger's theory and his model of aesthetics, there are three main scales at which we experience space:

- 1. **Small scale:** We can best understand complex curvilinear geometries.
- 1. **Medium scale:** We experience a part of an object at a time. Texture and clarity are important if the intent is for the user to understand the space or building as a whole. Curved forms are no longer effective because they are beyond the human body and we cannot form a complete mental map. Shadows and contrast become important when understanding objects in distant spaces.
- 1. **Large scale:** The ability to tactilely understand architectural objects disappears when experienced from a great distance. Simple forms and colors are paramount. We lack the optical skills to interpret complex forms, so high contrast forms or materials are important.

Ergonomics

Ergonomics is the process of designing or arranging workplaces, products and systems so that they fit the people who use them. While wellbeing and ergonomics refer to separate areas of health, they are also interconnected. For a start, poor ergonomics can lead to lowered wellbeing.

Preservation of the old items



© Peter Zumthor

Shelter for Roman Ruins

The tunnel continues on to a suspended light bridge overlooking and connecting the archeological excavations. The structure has an offset so it never touches the ruins directly. The slats in the facade are placed at an angle so that the excavations are protected from sun and rain without isolating them from their context. The slats in the facade are placed at an angle so that the excavations are protected from sun and rain without isolating them from their context. The construction solution optimizes material and function so that it feels as light as possible.



Cehgín Wine School

The main vault from the entrance is crossed over by a glass ramp that slopes gently down before leveling out to become a carpet of glass: a walkway that's transparent and colorless but full of fleeting reflections. Here almost everything new is hidden as much as possible. Raw steel and wood are very elemental materials that work well with the historic parts of the interior, respecting the handmade character and the patina of the time.



© INMAT Arquitectura

New structure



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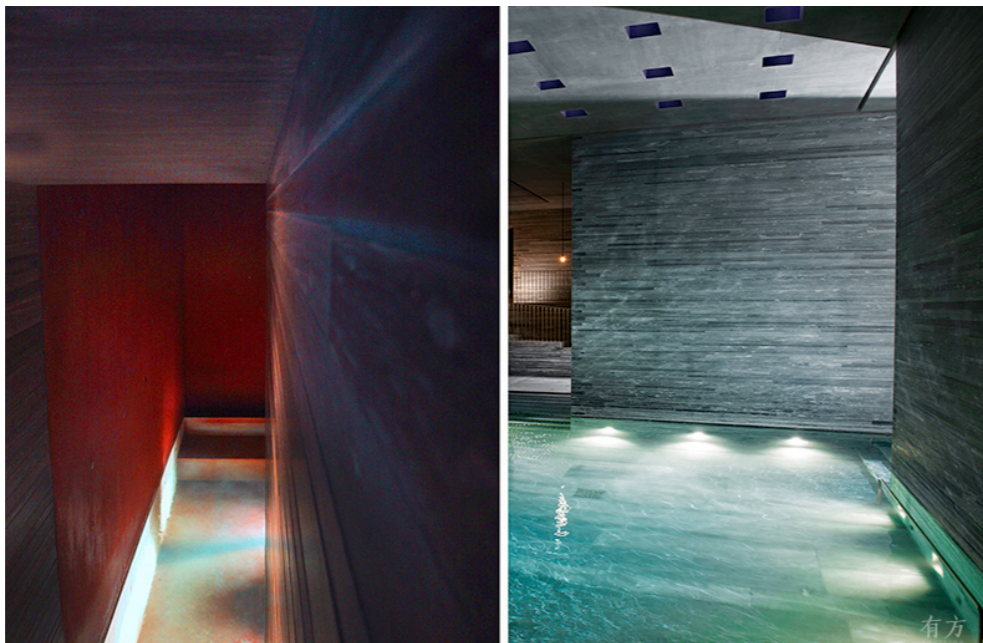
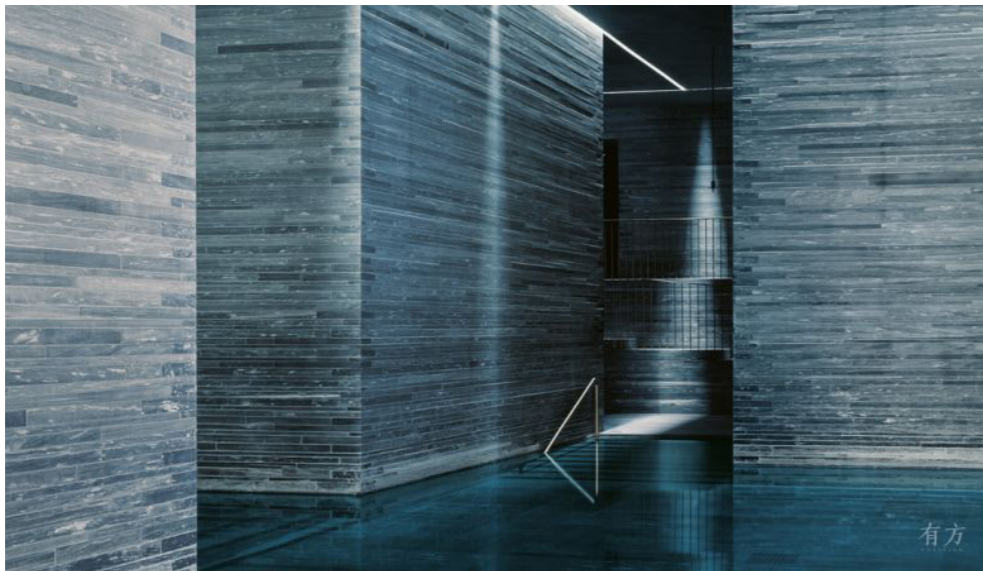
Restoration of Tossa Castle



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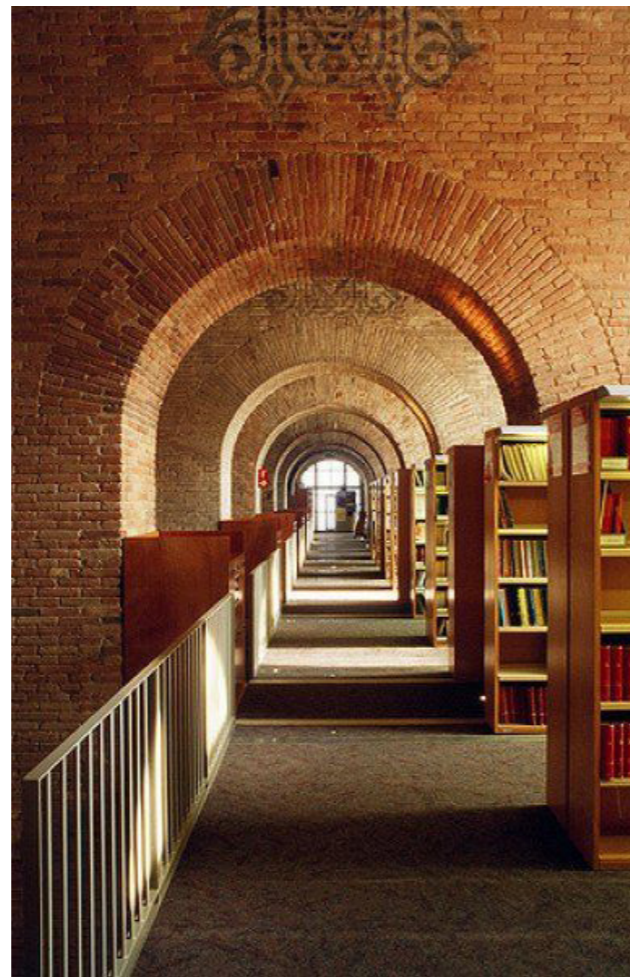
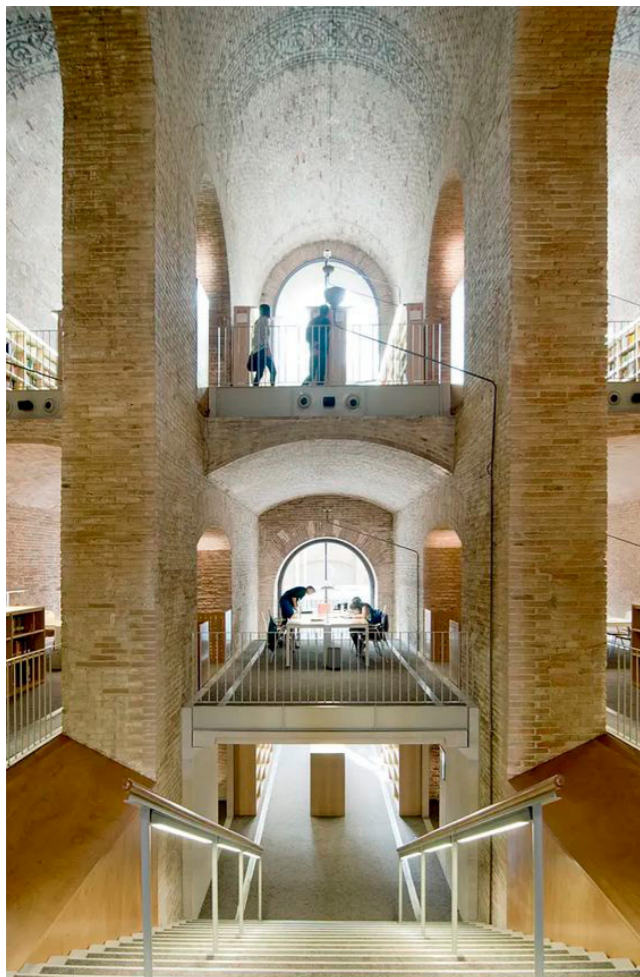
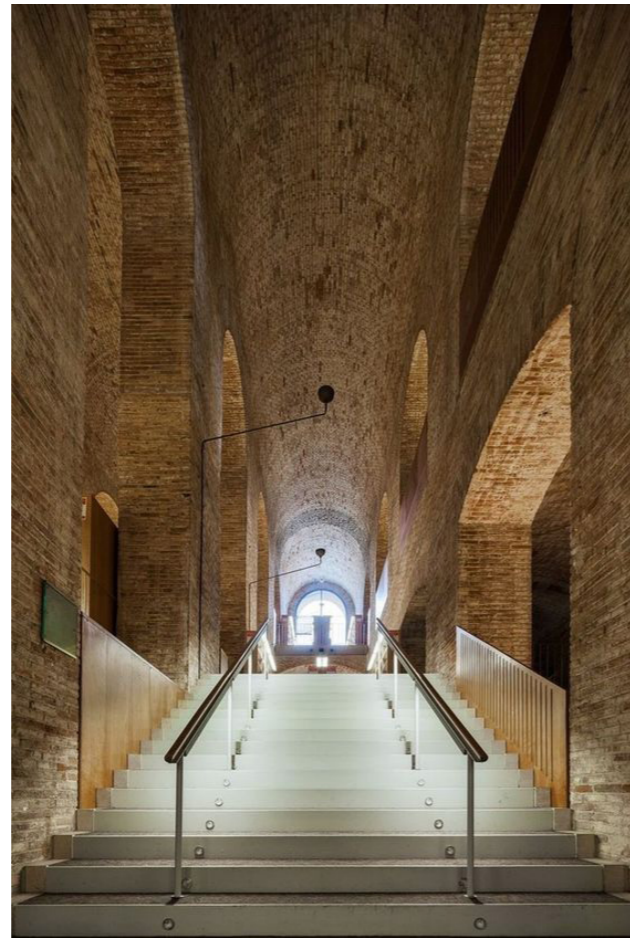
Ruins of Sandsfoot Castle

Addressing the historical problems of rock erosion and stone theft, the stone conservation work was carried out in lime mortars, with small scale reinforcement and supporting interventions to preserve the castle as it stands. The new walkway was designed to be a lightweight item sitting elegantly in the ruined castle at first floor level. This one touches the fabric of the castle in as few places as possible. Galvanized steel was chosen as a robust and economical material, both for the structure of the walkway and to form barriers to access the interior of the castle walls.



Therme Vals © Peter Zumthor

Rather than being placed into the mountain like a quarry, this work by Pavnem-to is an extension of the natural formations of the hot springs. The spring water reaches the surface through the gneiss geological formations and enters a man-made gneiss palace, where people can have different experiences of the spring water underground, indoors, and outdoors. So, before unfolding the story of the building, this building first tells the story of man's dialog with the geological formation. In a way, the geological feeling of Pemto determines the conceptual height of the whole building. Indoors, semi-outdoors, outdoors, simple height differences and water passages, all of which seem like very small architectural gestures today, make for a very rich architectural experience with the materials, water, light, temperature and fog. Enclosed architectural volumes wrap around pools of different functions and temperatures, the volumes hold up concrete floor slabs, and the overhangs of the floor slabs create shading. When the building is constructed further, the whole building is very complex in its handling of technical topics such as temperature differences, water, minerals, insulation, air conditioning and structural overhangs, all hidden inside the mega structure. The sequence of concrete pouring, the location of expansion joints, and the circulation of water are all taken into account in the overall design of the structure. From the space of this building we can see not only the Roman baths, but also the caves, the memory of the archaeological remains. The long, flat proportions of the gneiss is the material of the walls, layered with subtle variations in thickness, exaggerating the heaviness of the building in the space. Water and stone have formed a relationship that has accumulated over time in this building. The stone walls are gradually colored with traces of water, and the space is filled with the sound and smell of water.



The old water tank in Barcelona transformed into a Library © Josep Fontserè

Rather than being placed into the mountain like a quarry, this work by Pavnemto is an extension of the natural formations of the hot springs. The spring water reaches the surface through the gneiss geological formations and enters a man-made gneiss palace, where people can have different experiences of the spring water underground, indoors, and outdoors. So, before unfolding the story of the building, this building first tells the story of man's dialog with the geological formation. In a way, the geological feeling of Pemto determines the conceptual height of the whole building. Indoors, semi-outdoors, outdoors, simple height differences and water passages, all of which seem like very small architectural gestures today, make for a very rich architectural experience with the materials, water, light, temperature and fog. Enclosed architectural volumes wrap around pools of different functions and temperatures, the volumes hold up concrete floor slabs, and the overhangs of the floor slabs create shading. When the building is constructed further, the whole building is very complex in its handling of technical topics such as temperature differences, water, minerals, insulation, air conditioning and structural overhangs, all hidden inside the mega structure. The sequence of concrete pouring, the location of expansion joints, and the circulation of water are all taken into account in the overall design of the structure. From the space of this building we can see not only the Roman baths, but also the caves, the memory of the archaeological remains. The long, flat proportions of the gneiss is the material of the walls, layered with subtle variations in thickness, exaggerating the heaviness of the building in the space. Water and stone have formed a relationship that has accumulated over time in this building. The stone walls are gradually colored with traces of water, and the space is filled with the sound and smell of water.

SITE

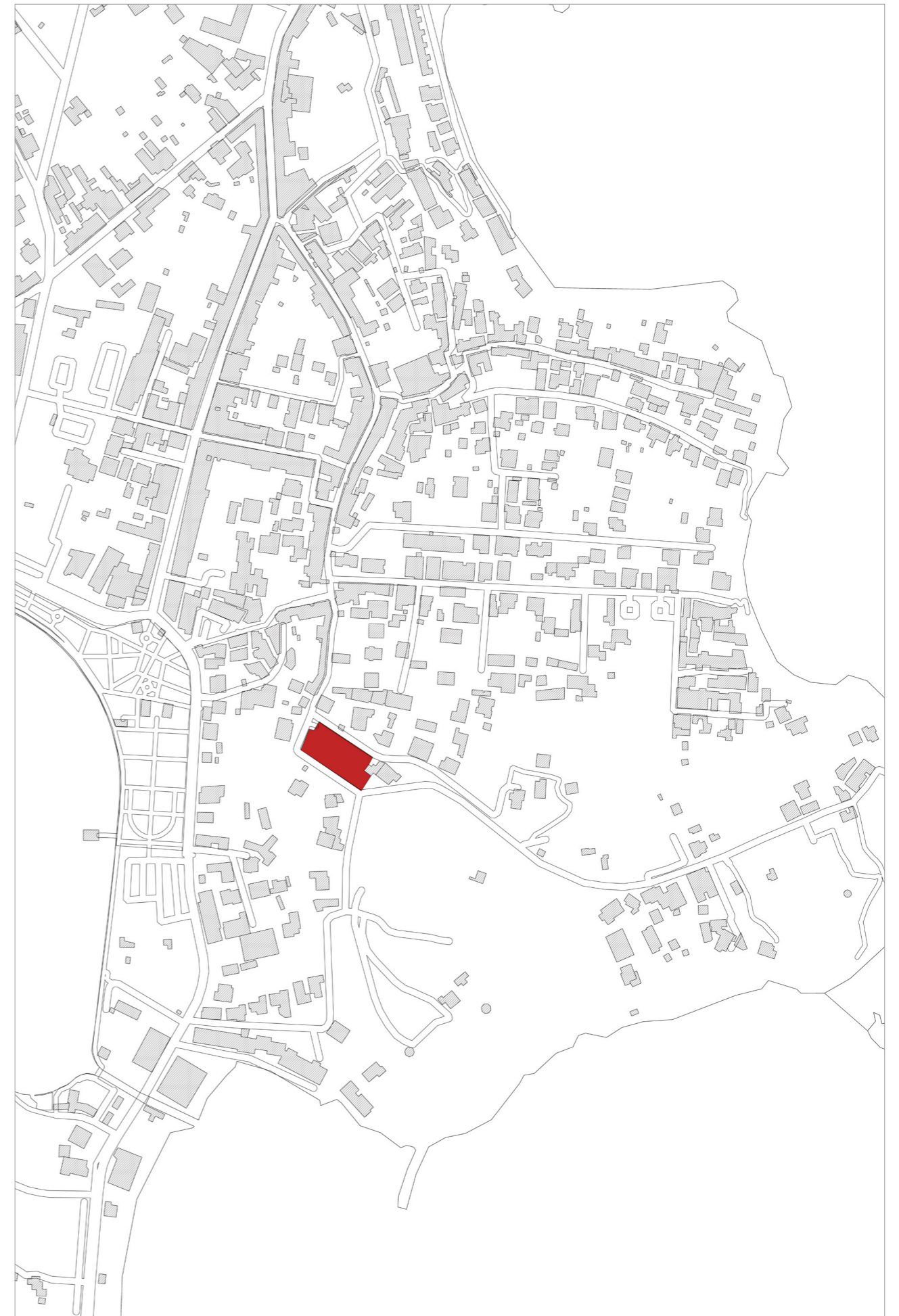
Site
Original drawings
Site analysis
Reservior to spa
Materials

SITE

The Piscina Mirabilis is located in the present day Municipality of Bacoli, in Miseno (the ancient Misenum), up the hill facing the sea in the bay of Naples. It is west of Naples in the area of the Phlegrean Fields, from the Greek word phlegràios which means '**burning**' because it is characterized by an intense volcanic activity that manifests itself with thermal springs, volcanic lakes, sulphate and numerous active volcanoes. It was realized during the Augustan Age.

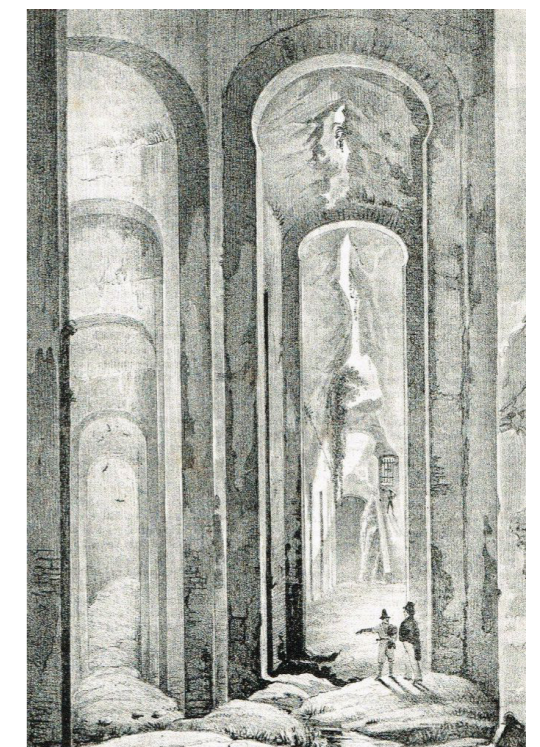
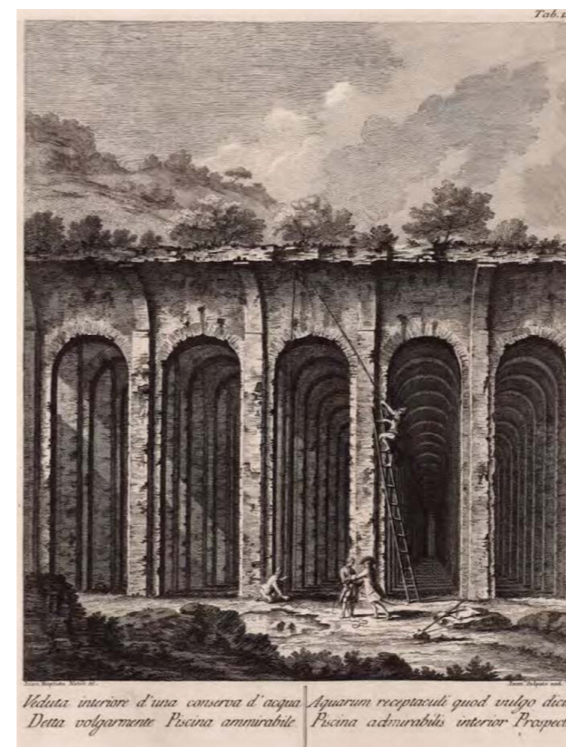
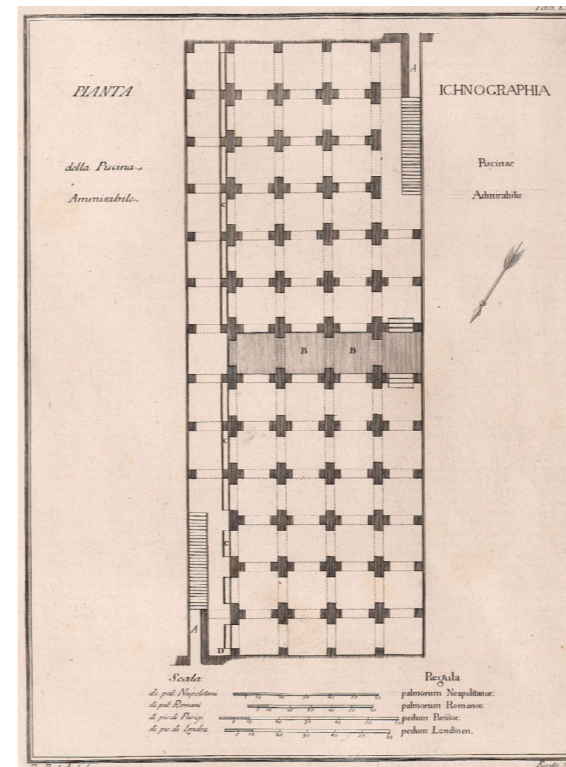
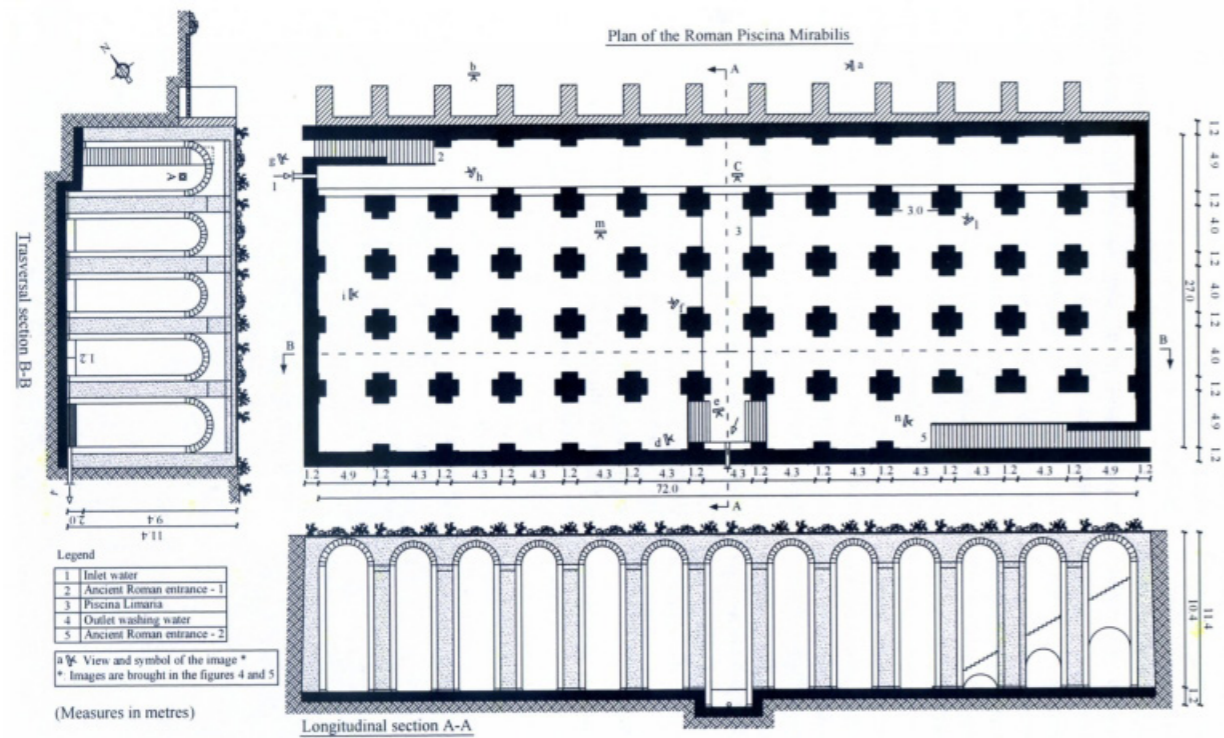
It is the largest surviving Roman cistern, built in the first century BC during the reign of Augustus. The cistern was part of the Roman aqueduct system, specifically designed to serve the Roman western imperial fleet stationed at Misenum.

Over the centuries, the Piscina Mirabilis fell into disuse and was partially forgotten until its rediscovery in more recent times.



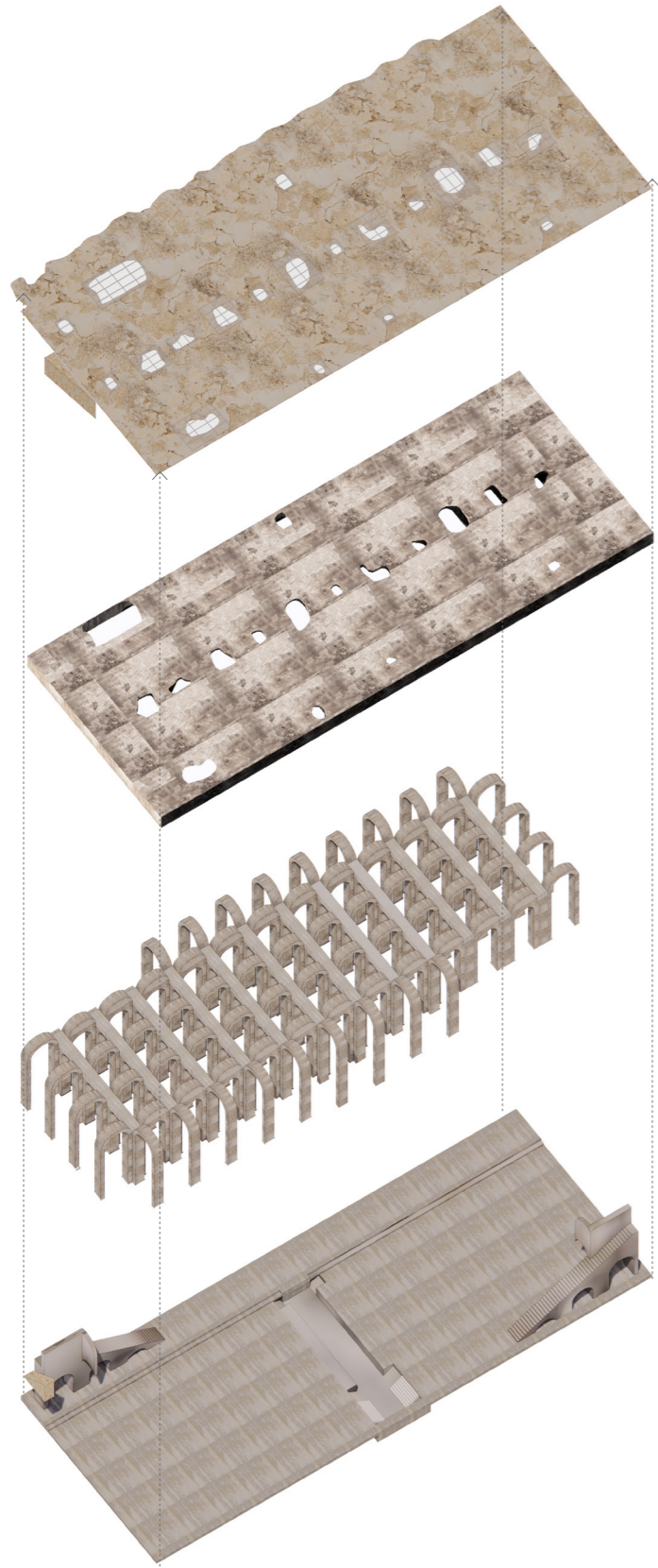
ORIGINAL DRAWINGS

The Piscina Mirabilis is a reservoir 72m long and 27m large. It is dug in a tufa hill and has two step entrances in the northwest, the Ancient Roman entrance and southeast corners. Forty-eight pillars, arranged on four rows serving as a support to the barrel vault, divide it into five principal aisles on the long sides and thirteen secondary aisles on the short sides.



SITE ANALYSIS

There is an entrance in the northwest corner and the southeast corner of the site. There is a staircase in the northwest corner leading to the roof. The height difference between the roads around the site and the building roof is 1 to 3 meters.

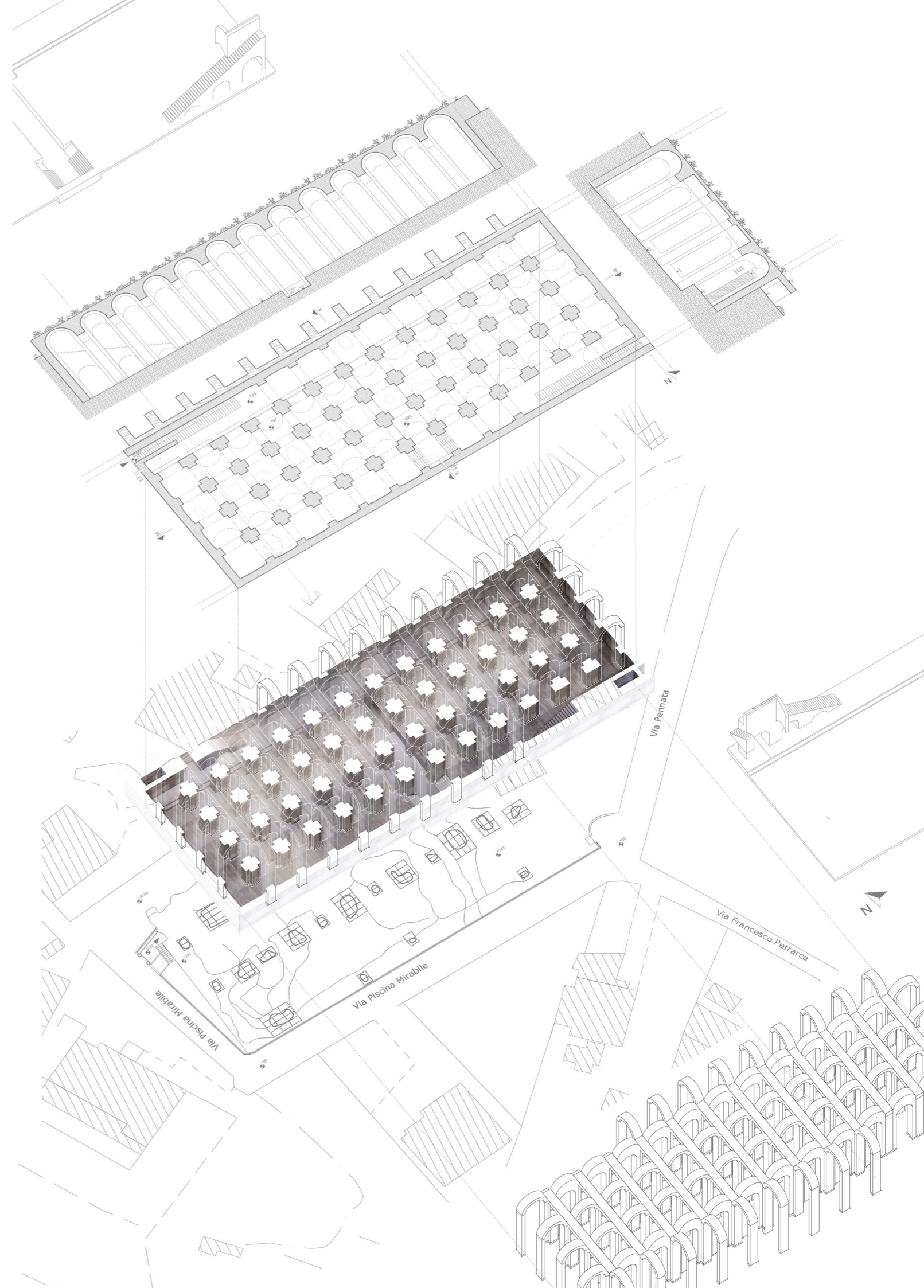


----- Roof and windows

----- Vaults

----- Structure

----- Stairs and basement



RESERVIOR TO SPA

Transforming *Piscina Mirabilis* into a modern spa spaces has multiple advantages:

- 1. Surrounding:** The natural environment of Campania and the beautiful landscape of Naples Bay provide an ideal environment for the spa;
- 2. Conditions:** *Piscina Mirabilis* itself is a huge pool that can be transformed as a natural hot spring water source. The area has strong volcanic activity. So the water in the underground reservoir may contain special minerals and unique temperatures, providing natural advantages for spa treatments;
- 3. Structure:** The architectural structure of the underground reservoir can be used, such as using natural caves and vaulted structures to create unique spa space;
- 4. Culture:** *Piscina Mirabilis* has a historical background from the ancient Roman period, adding unique historical and cultural elements to the spa. Integrating the spa and wellness center into this history provides guests with a unique cultural experience, combining traditional and modern spa concepts.

There are several potential items that could be made use of:

Pillar: There are many stone pillars inside the building, with some traces of water and time.

Skylight: There are several skylights on the roof, with sunlight shining down from above.

Stair: There are two stairs on the two sides of the building, which could be used as the entrances to the underground and another stairs to the roof.

Wall: Walls around the site can be used as guide walls for the main entrance.

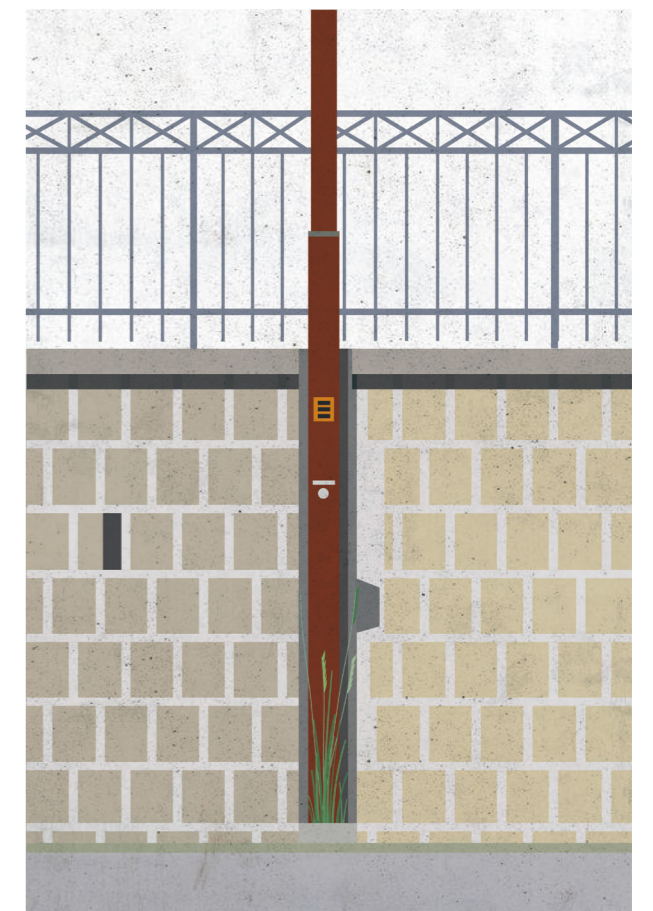
Pool: There is a basin of 1.10 m, probably a polishing pool.



Entrance



Wall





Skylight/Pillar



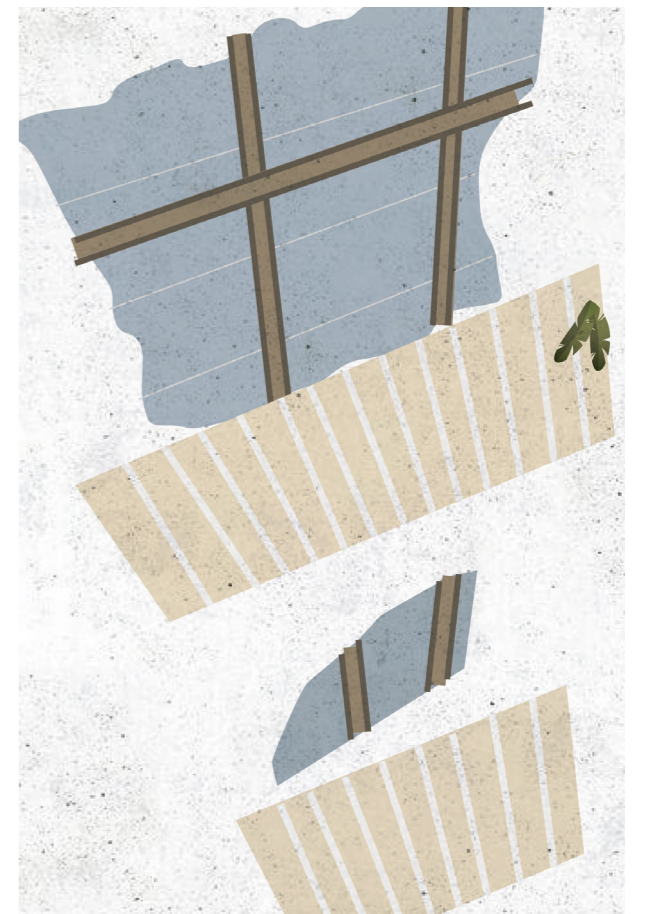
Pillar/Skylight/Stair



Pillar/Pool/Stair



Skylight



STRUCTURE/MATERIALS

The water coming from Serino flew into it near the northwest entrance.

Pillars: The side pillars are kiln-fired bricks and the central pillars are tufa used as a base material (widely present in the area of Campi Flegrei) – both covered with a waterproof layer of opus signinum (pounded terracotta).

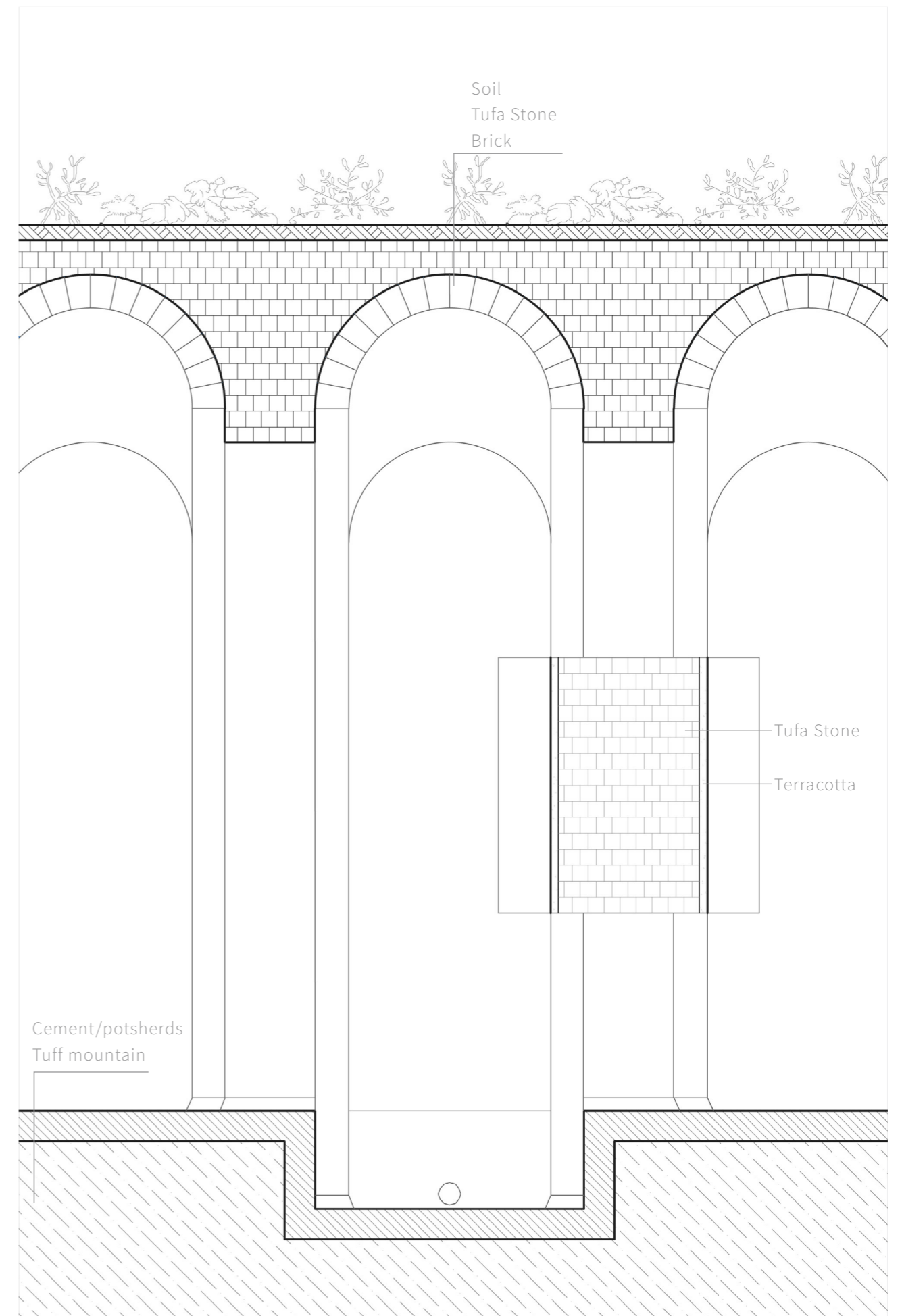
Floor: The floor is waterproof cement mixed with potsherds then polished.

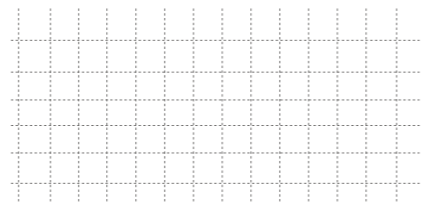
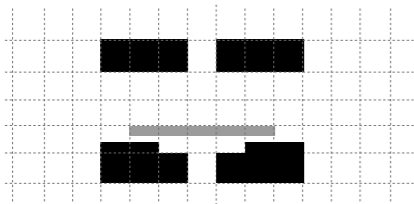
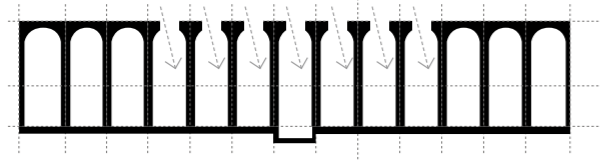
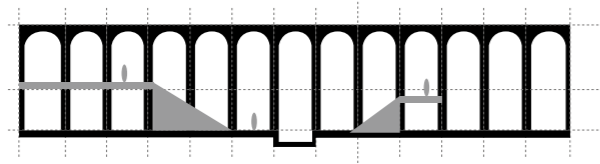
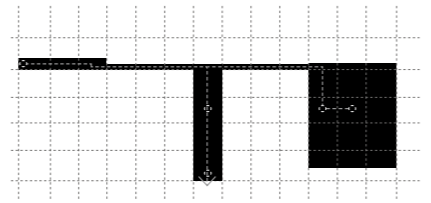
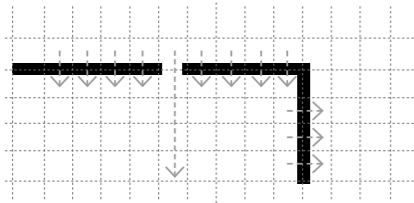
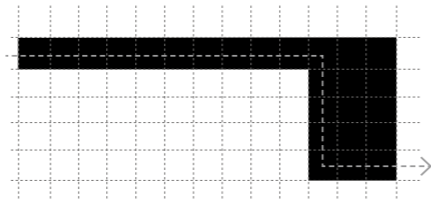
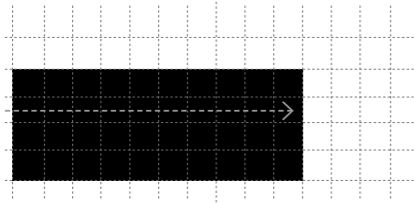
Walls: The long walls were realized in opus reticulatum (reticular work) with brick bonding courses. The Piscina is embedded in the surrounding volcanic tuff on three sides. On the fourth, northeast side there is a retaining wall supported externally by large buttresses.

Roof: The Piscina has a brick-vaulted roof to prevent evaporation and there are a number of holes, now covered, in it.

There is a basin of 1.10 m, probably a polishing pool, that is a waste-bath for the maintenance of the reservoir, in the floor of the nave. There is a ditch in the centre with a drainage hole at the south end.

Along the north-west external side, in the course of the first century A.D. twelve vault-covered little rooms in opus reticulatum with angular brick bonding courses were added.

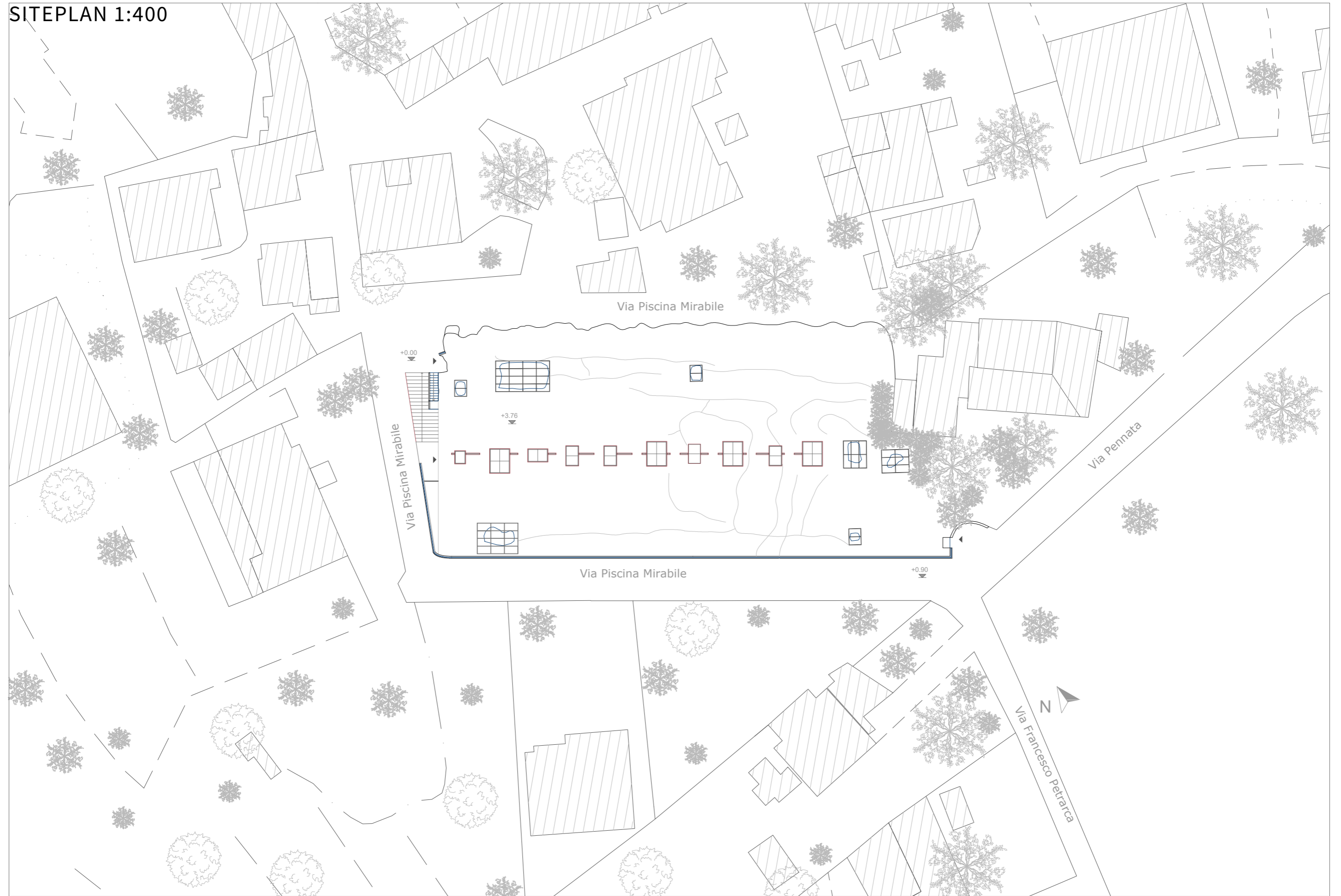




DESIGN PROPOSAL

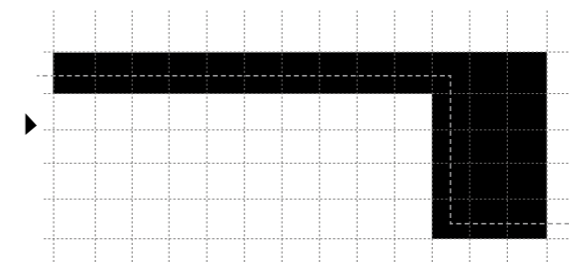
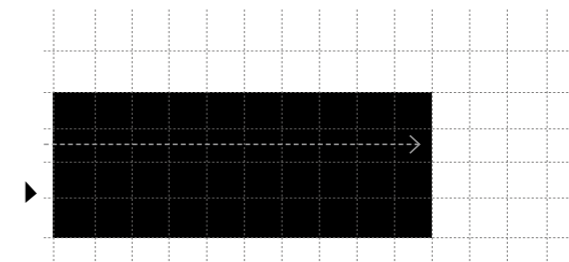
- Siteplan
- Entrance
- Old zone
- New zone
- Floorplan
- Section
- Skylight
- View analysis
- Pool types
- Indoor water system
- Ventilation
- Materials
- Details

SITEPLAN 1:400



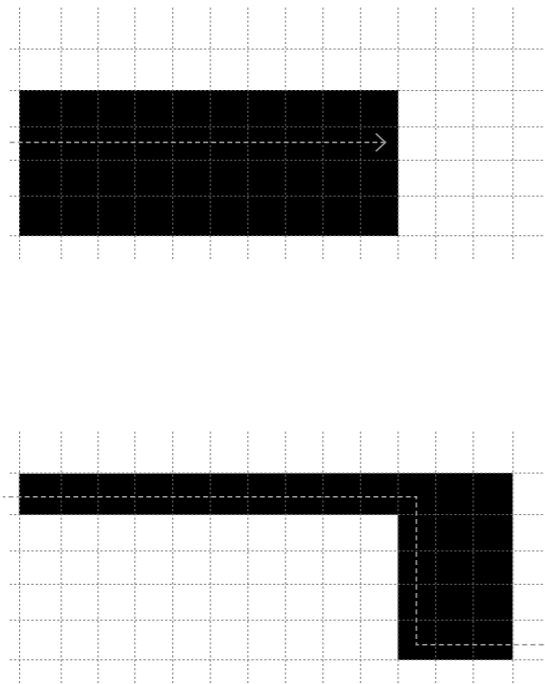


ENTRANCE



The main entrance of the building divides the flow of people into three parts: The original entrance is retained as the entrance for the visiting; the staircase leading to the roof is also retained; the entrance to the spa is reached through the new downward stairs. The building also provides an accessible entrance at ground level next to the main entrance.

OLD ZONE



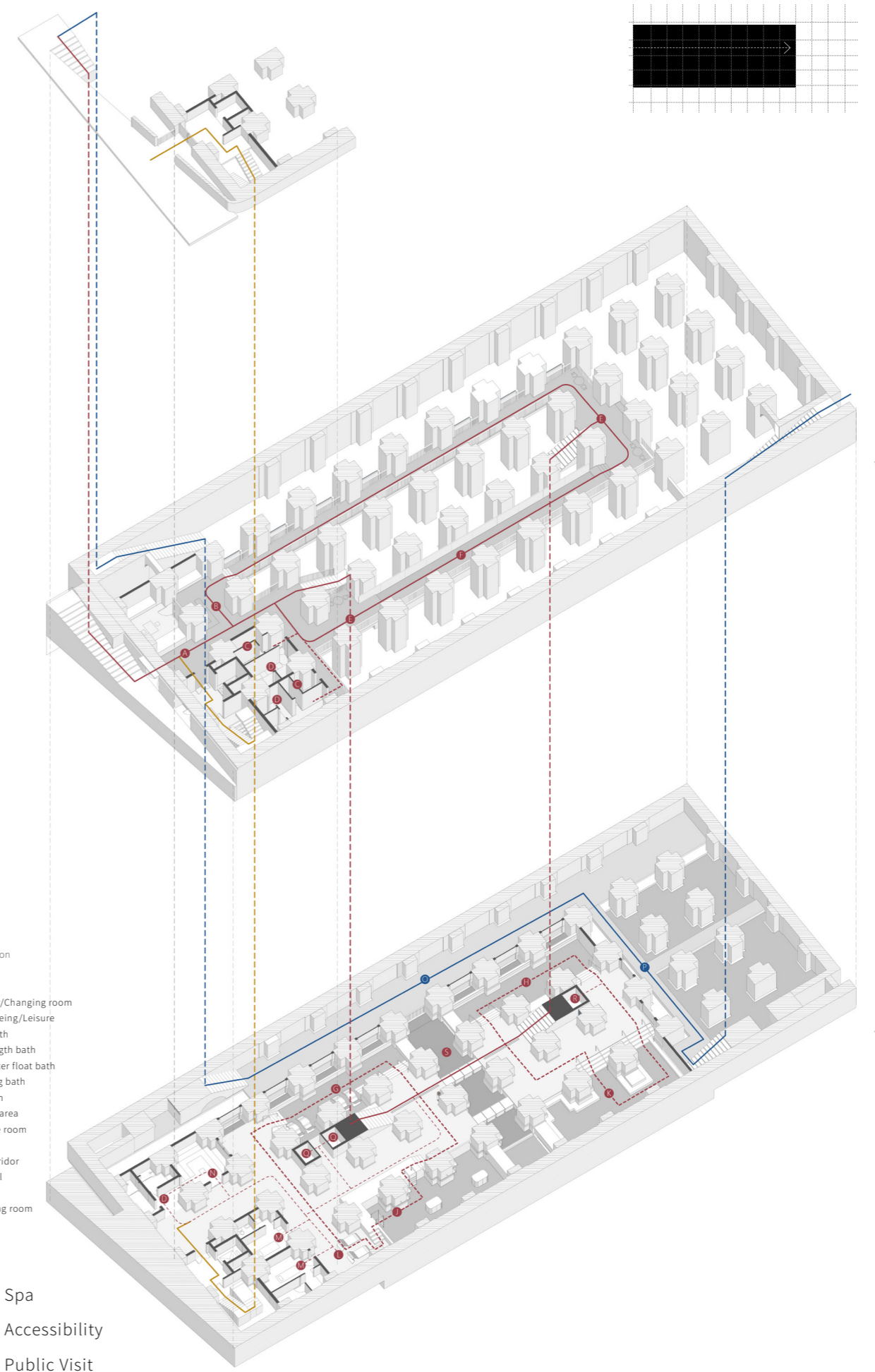
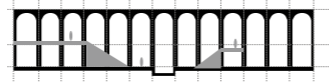
The space is divided into two zones, old one and new one.

Old zone: The status will be preserved. The existing two stairs will be used as the entrances to invite public to enter in. The underground space and the roof will be open to public even they don't use the spa.

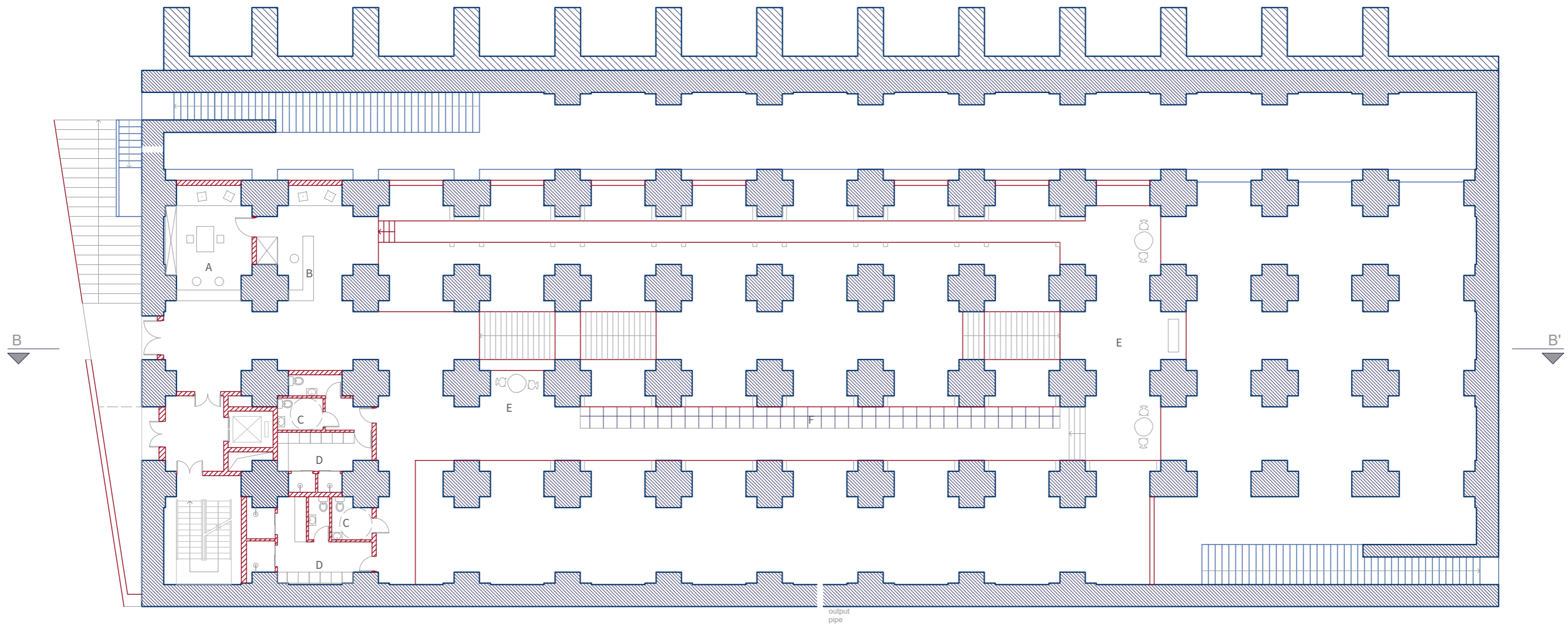
New zone: Spa.



NEW ZONE - SPA



FLOORPLAN 2 1:200

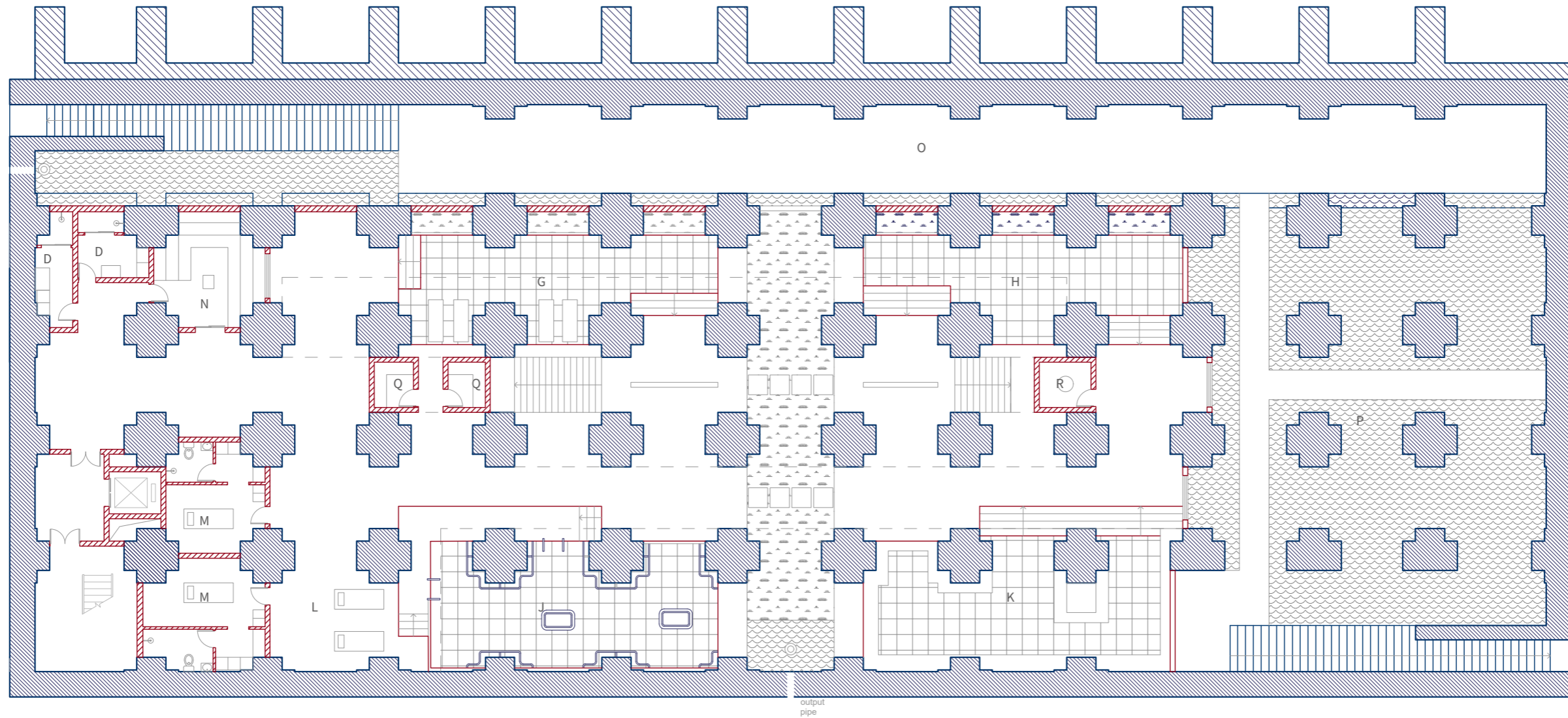


- A Reception
- B Bar
- C Toilet
- D Shower/Changing room
- E Sightseeing/Leisure
- F Foot bath

- G Full-length bath
- H Salt water float bath
- J Standing bath
- K Sitz bath
- L Waiting area
- M Massage room

- M Sauna
- O Old corridor
- P Old pool
- Q Sweat
- R Sounding room
- S Plants

FLOORPLAN 1 1:200

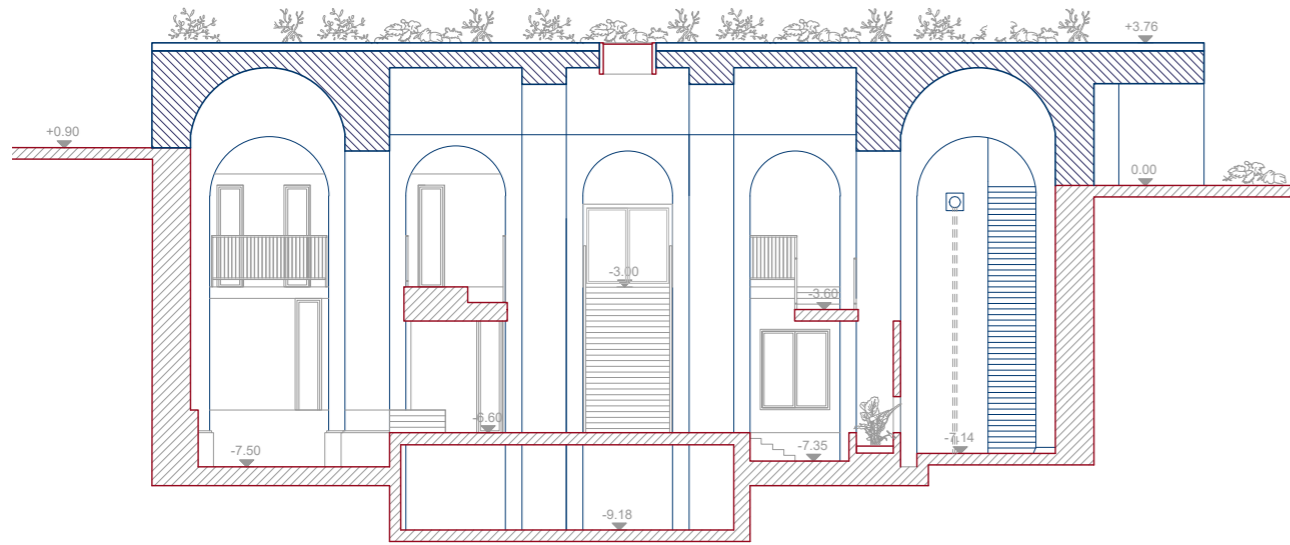


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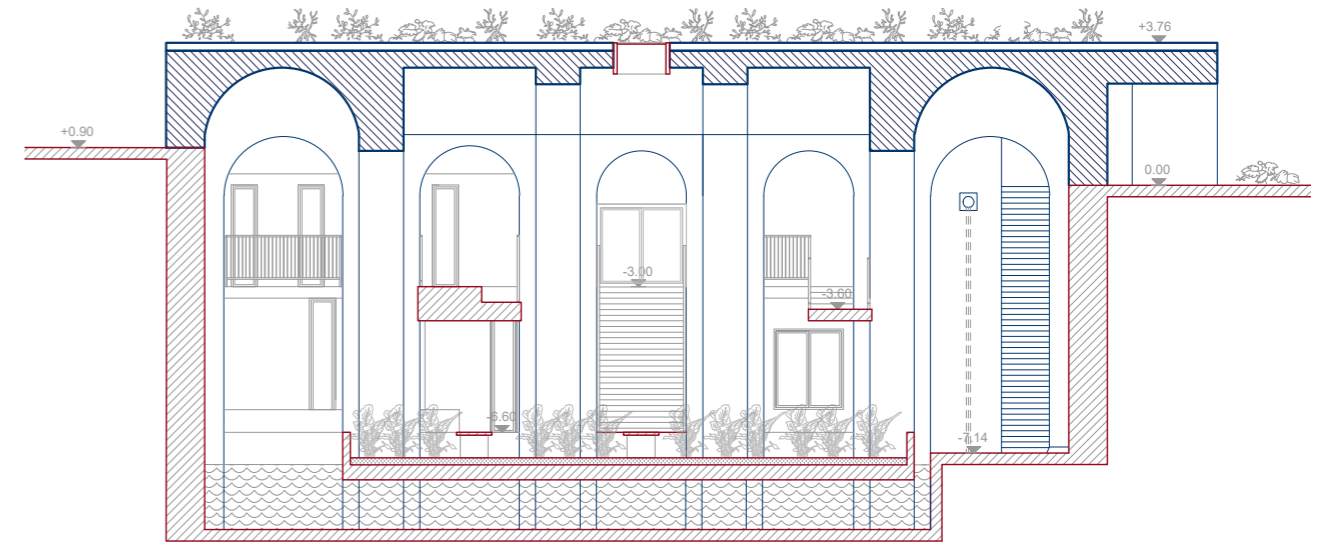
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- L Waiting area
- M Massage room

- M Sauna
- O Old corridor
- P Old pool
- Q Sweat
- R Sounding room
- S Plants

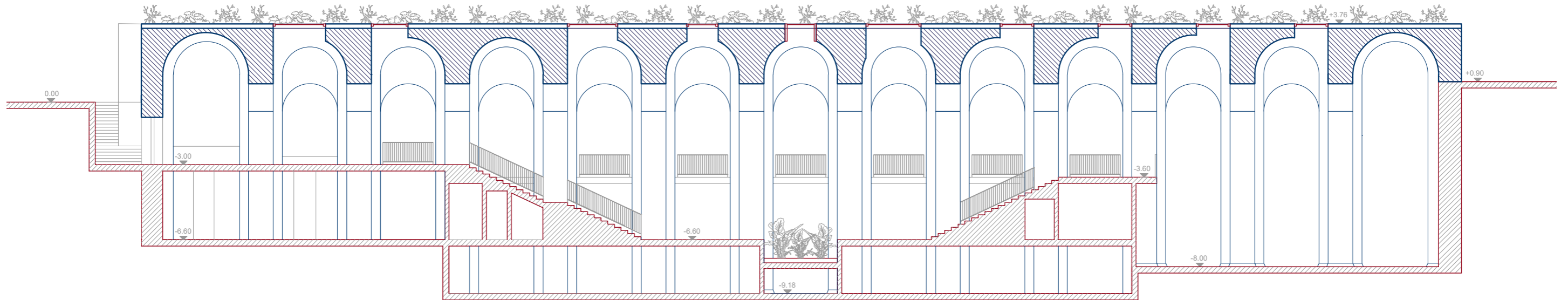
SECTION 1:200



SECTION A-A 1:200



SECTION B-B 1:200

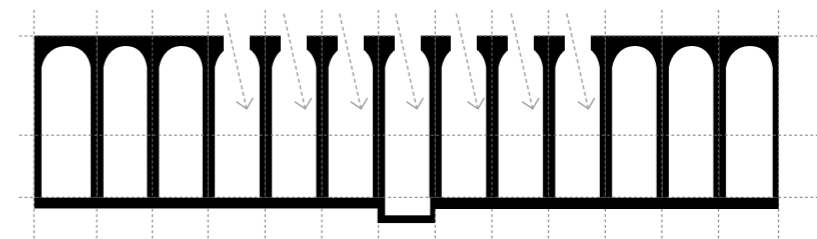


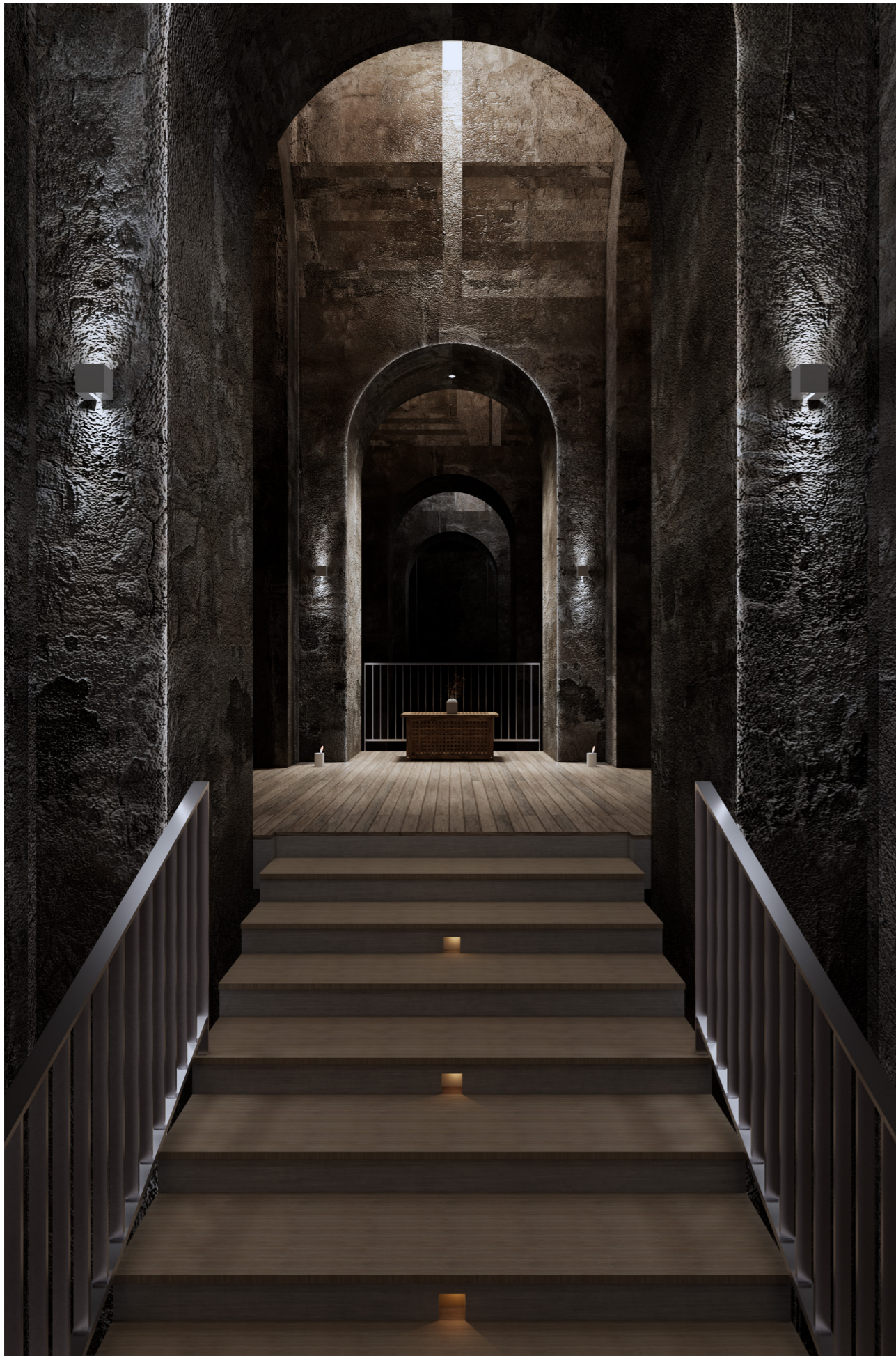
SECTION C-C 1:200

SKYLIGHT

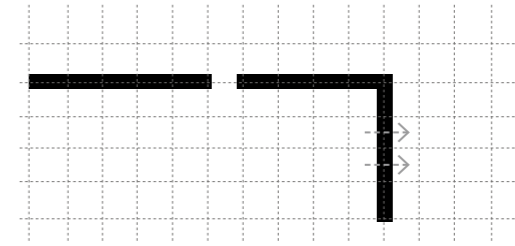


Skylights on the roof are designed to maximize the entry of natural light, forming changing light and shadow throughout the day. At the same time, with the interaction of indoor lights, water and plants, different atmospheres can be created

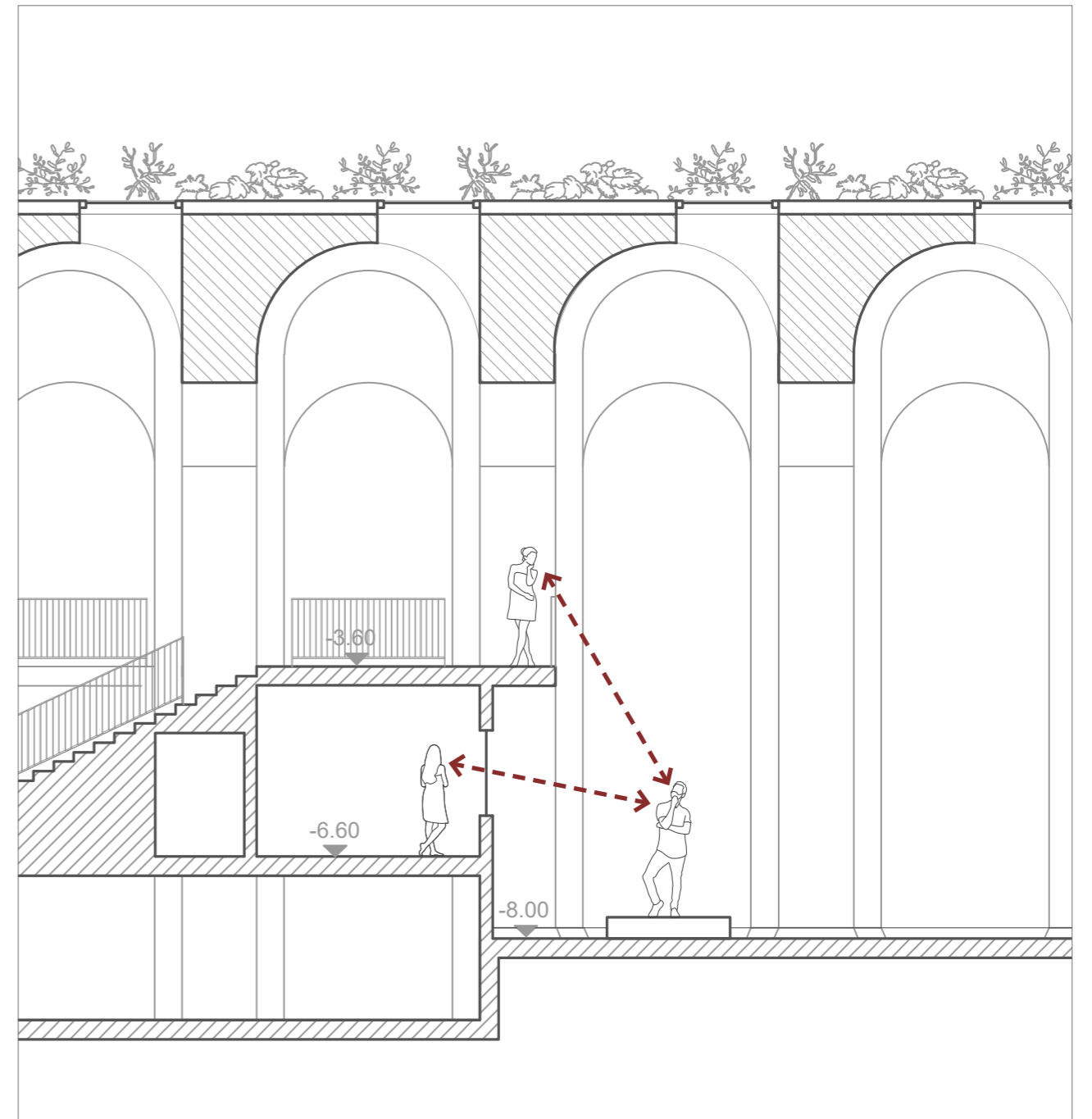




VIEW ANALYSIS

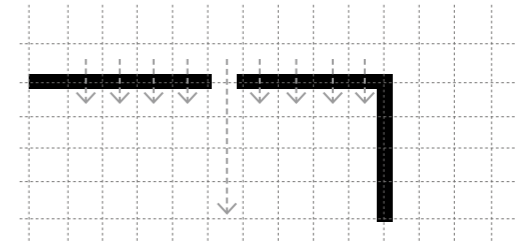


SECTION 1:100

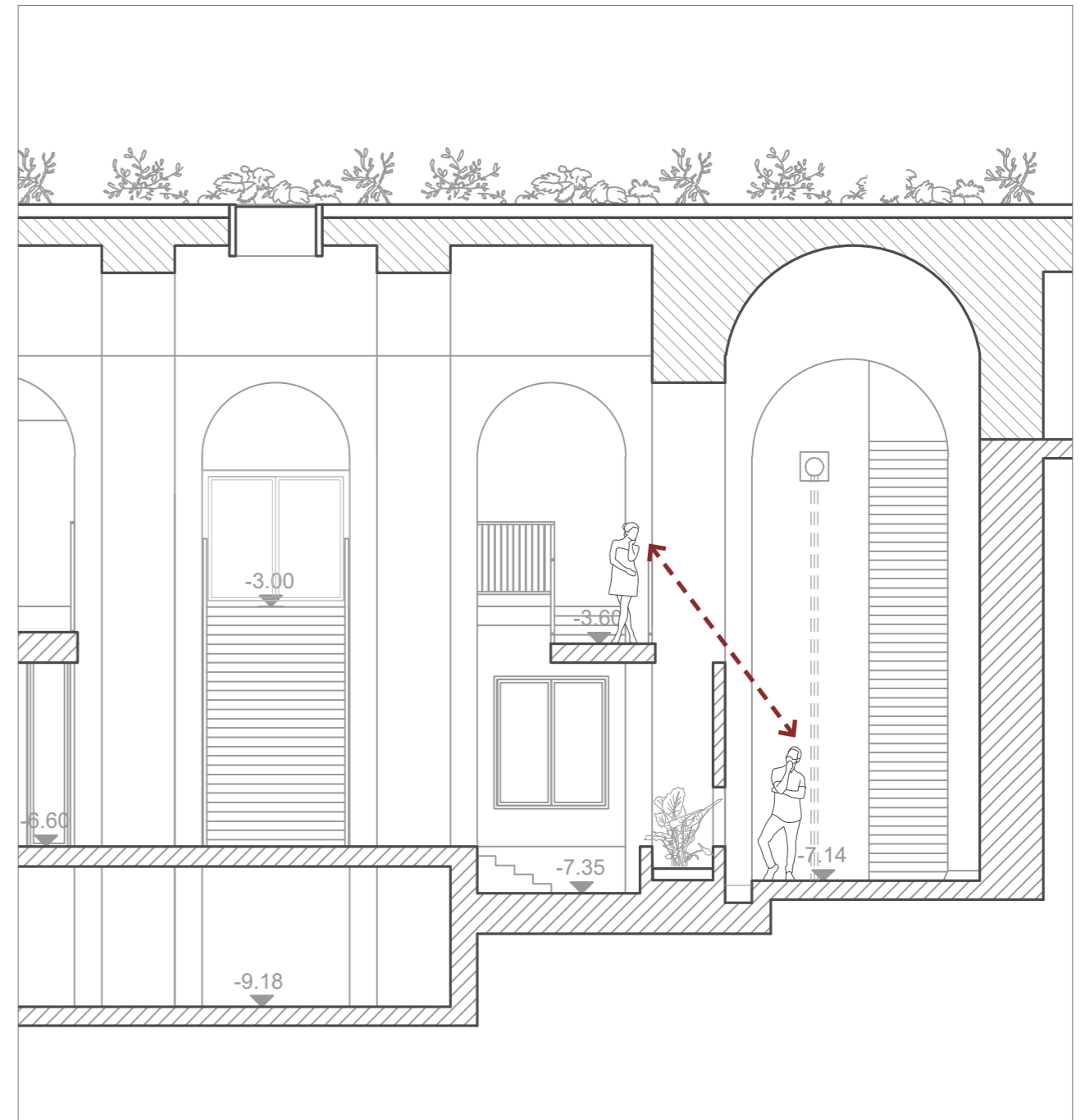




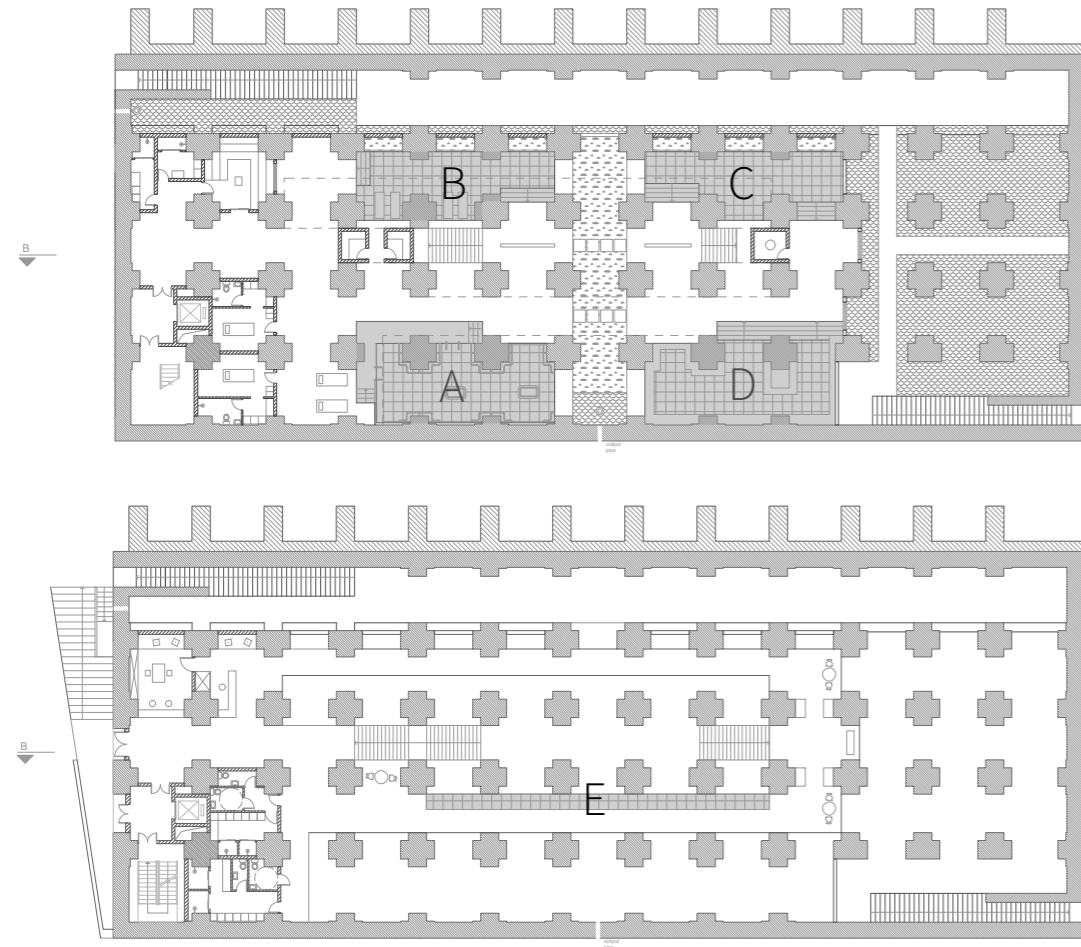
VIEW ANALYSIS



SECTION 1:100

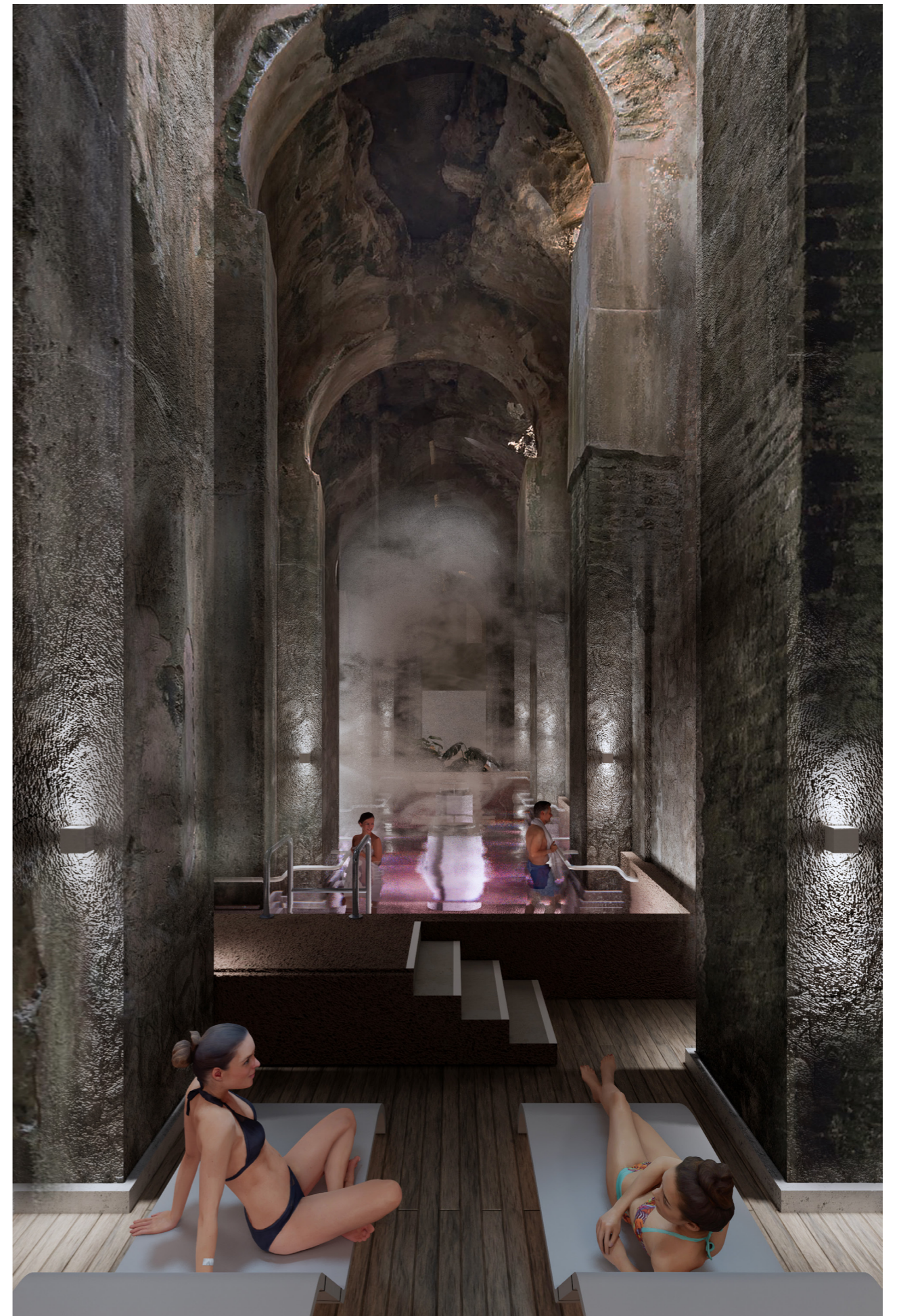
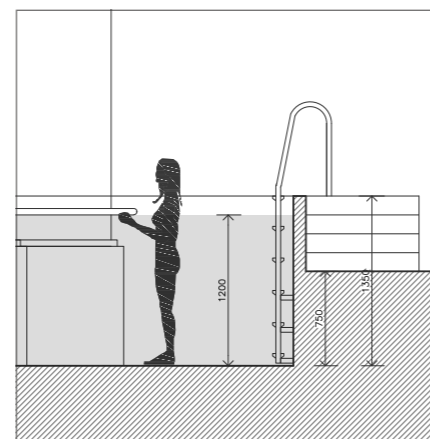
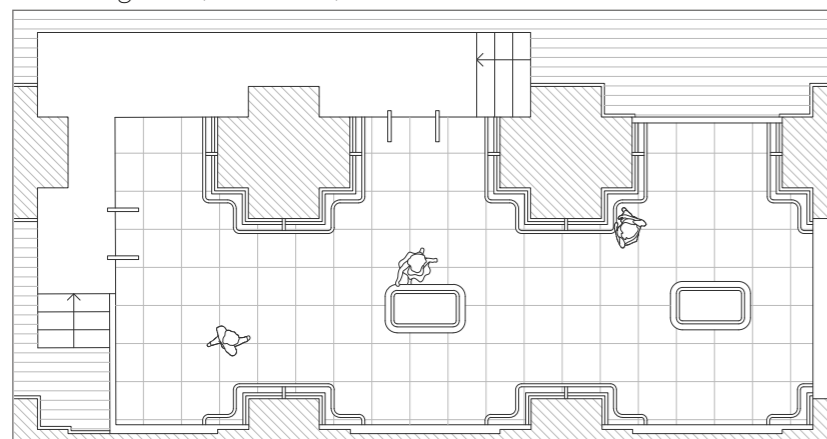
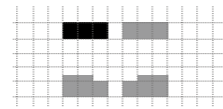


POOL TYPES

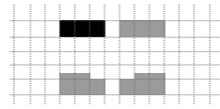


POOL A

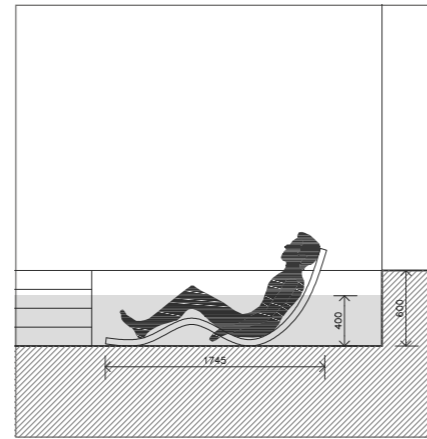
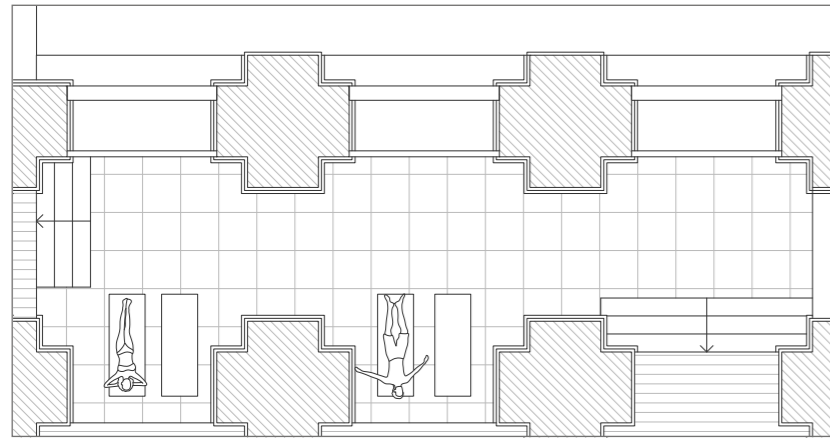
Standing bath, 1200mm, 37-40°C



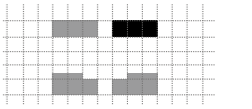
POOL B



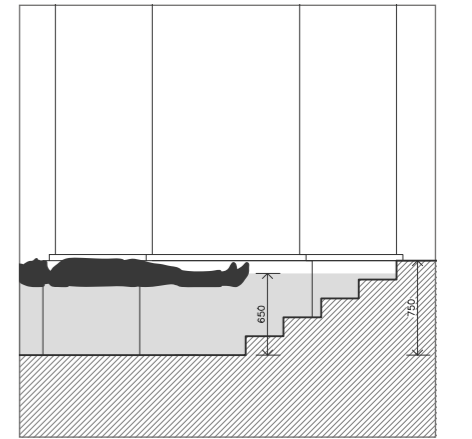
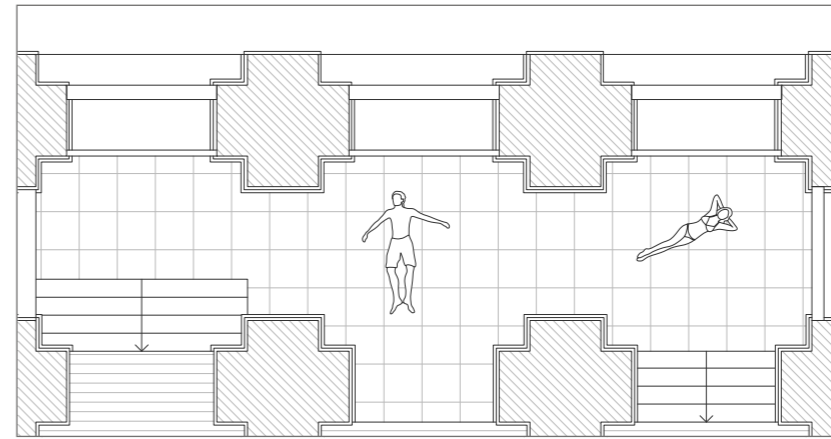
Full-length bath, 400mm, 40°C



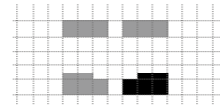
POOL C



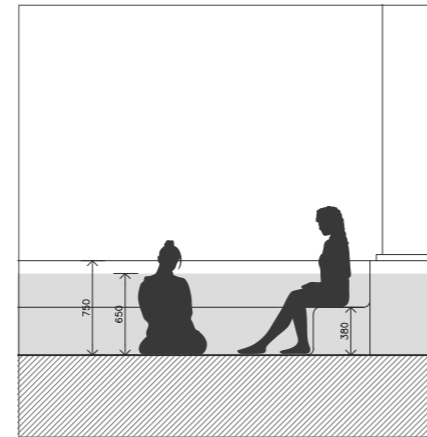
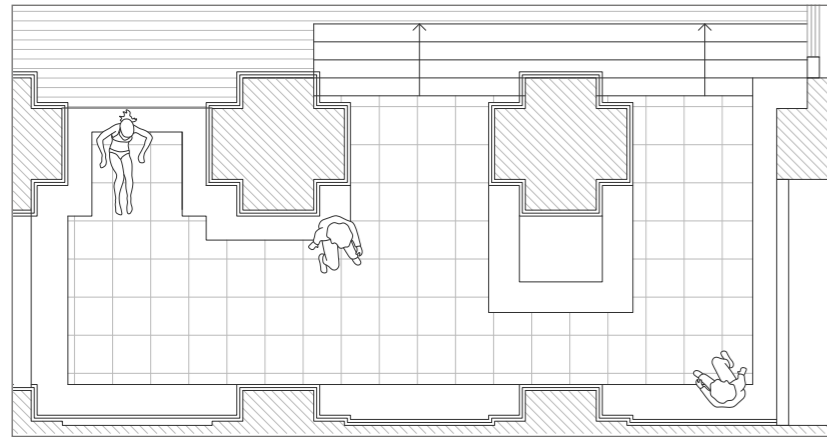
Salt water float bath, 650mm, 35°C



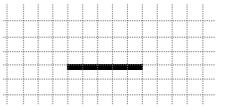
POOL D



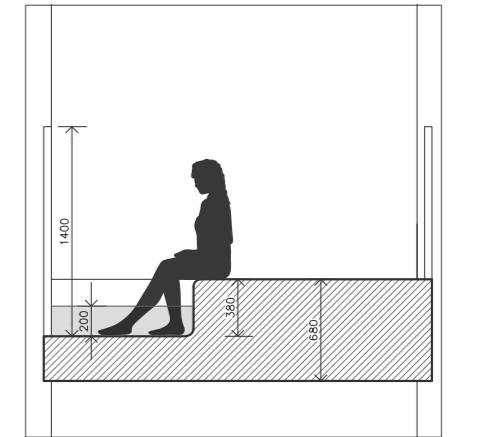
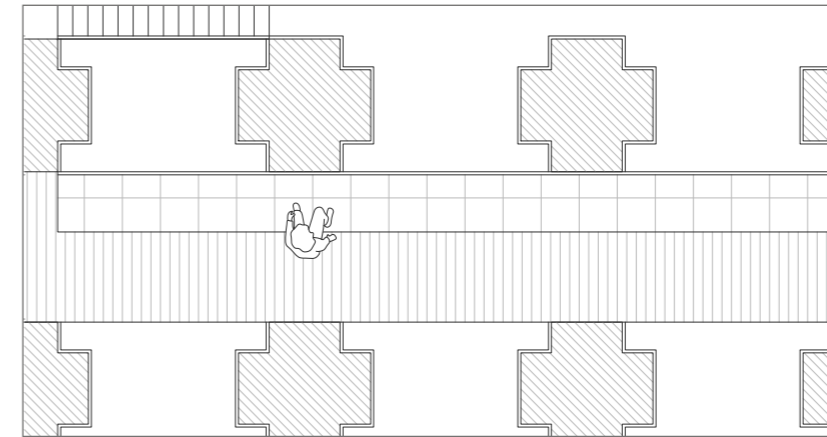
Sitz bath, 650mm, 37-40°C



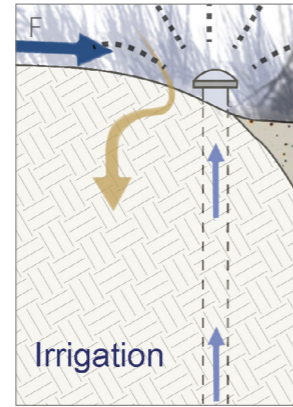
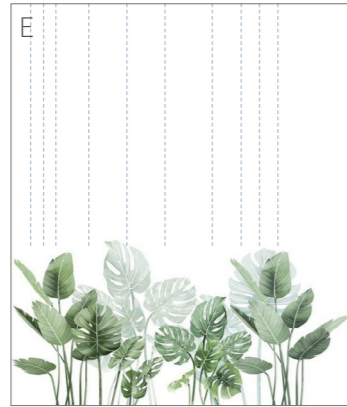
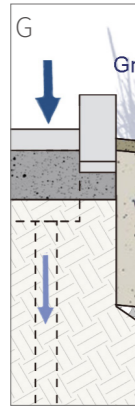
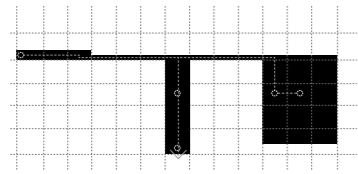
POOL E



Foot bath, 200mm, 42°C

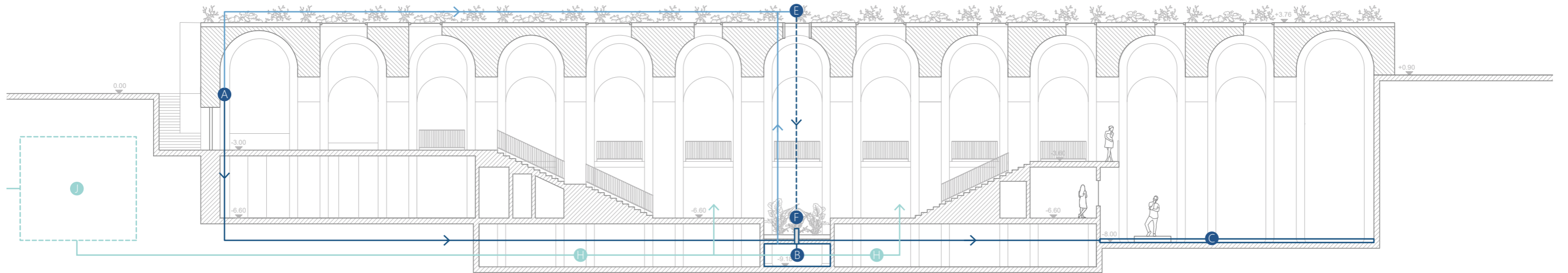
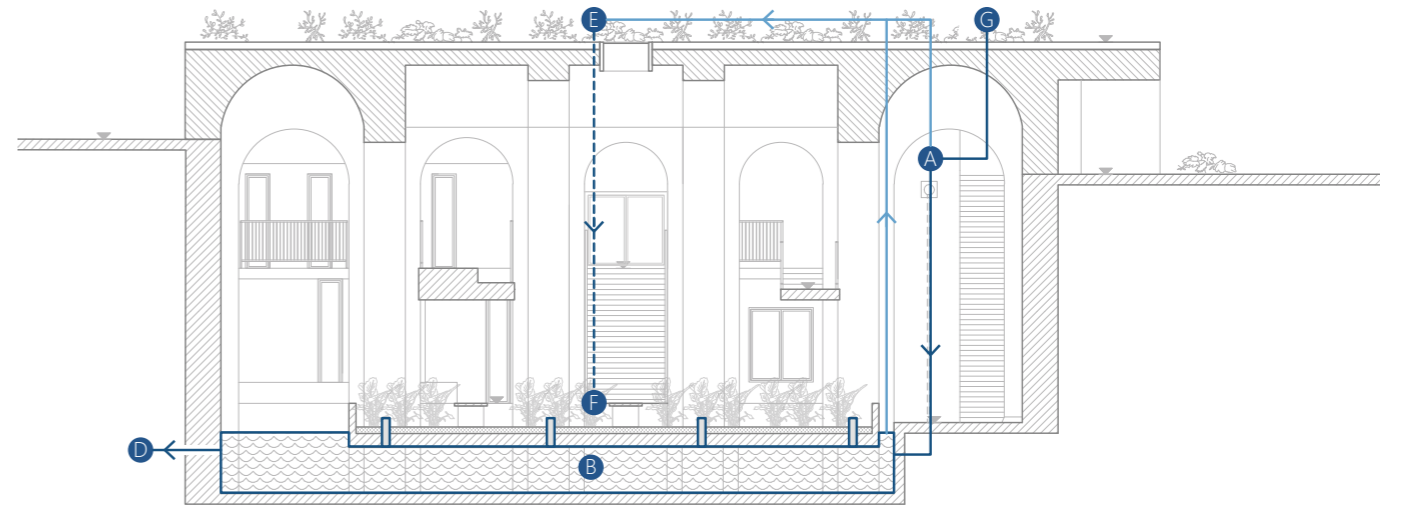


WATER SYSTEM



- A Input pipe(existing)
- B Rainwater storage tank
- C Old pool
- D Output pipe(existing)
- E Droplets device
- F Plants irrigation
- G Rainwater collection
- H Heating machine
- J Bath water storage tank

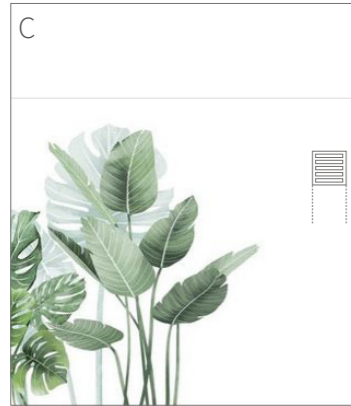
- Rainwater system
- Extra water system(no rain)
- Bath water system



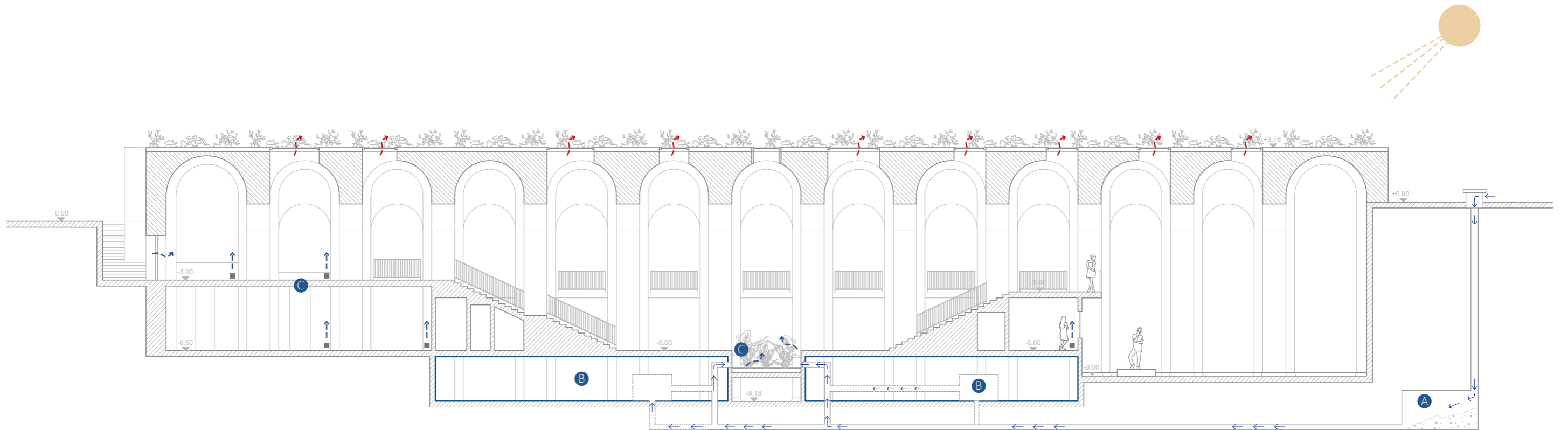
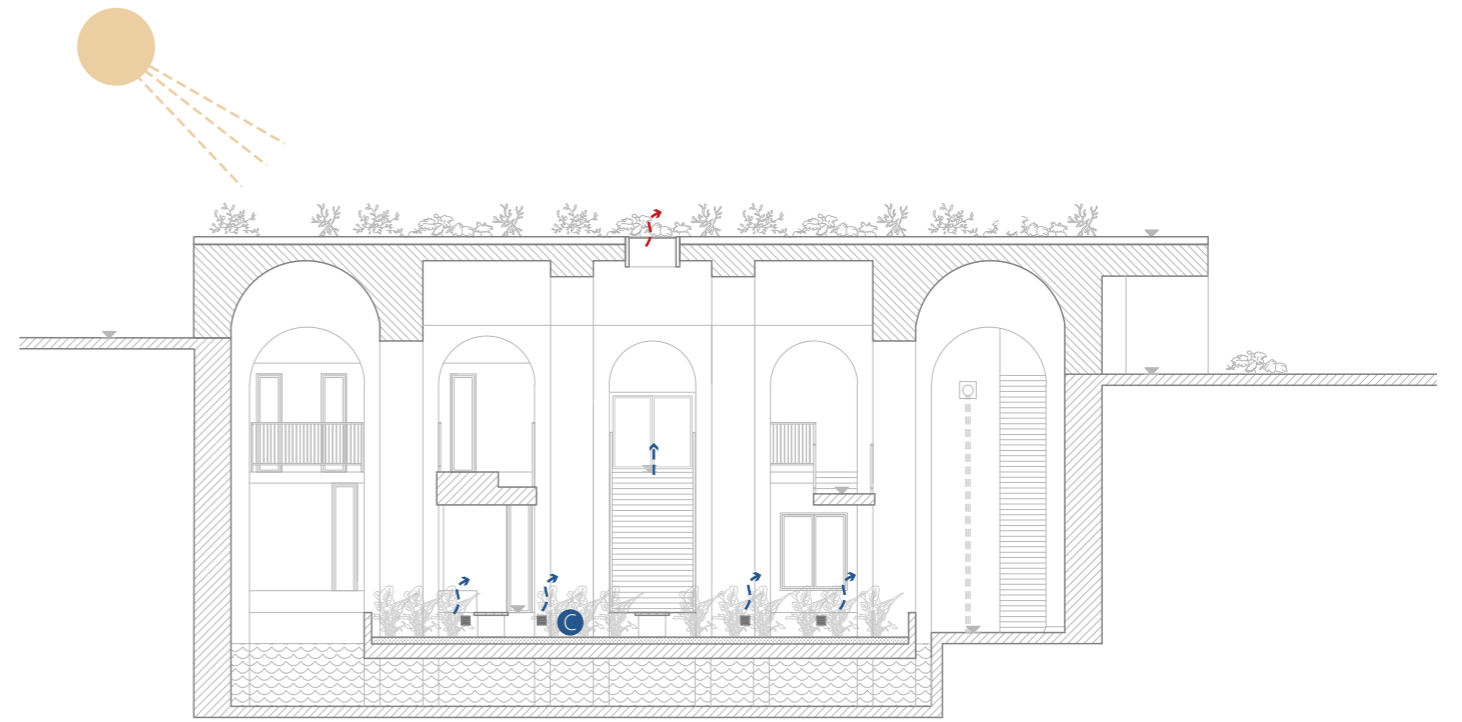
Water droplets fall from the sun
and collide with the water in the pool to create a unique sound



VENTILATION



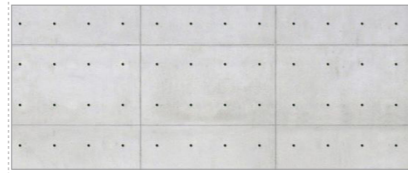
- A Pebble bed
- B Supply fans
- C Vents



MATERIALS



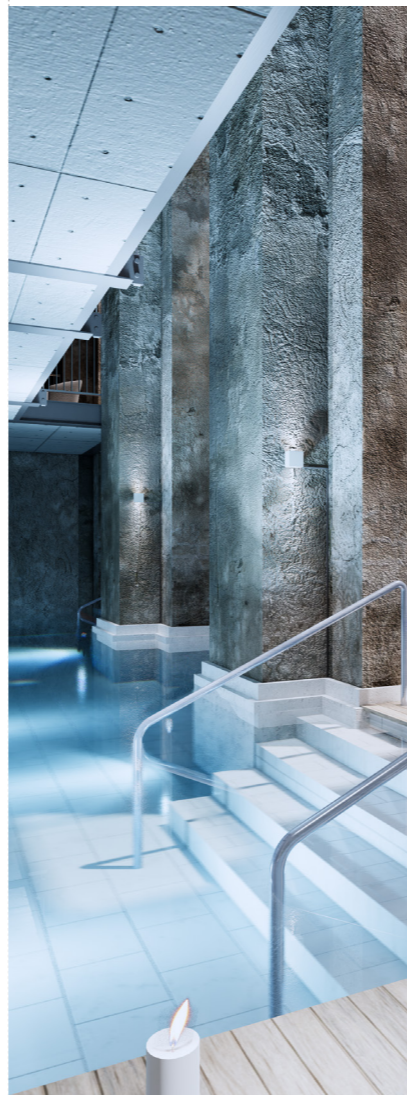
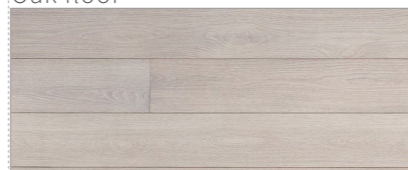
Steel



Concrete



Oak floor



Ceramic tile



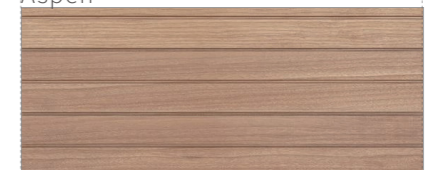
Volcanic rock

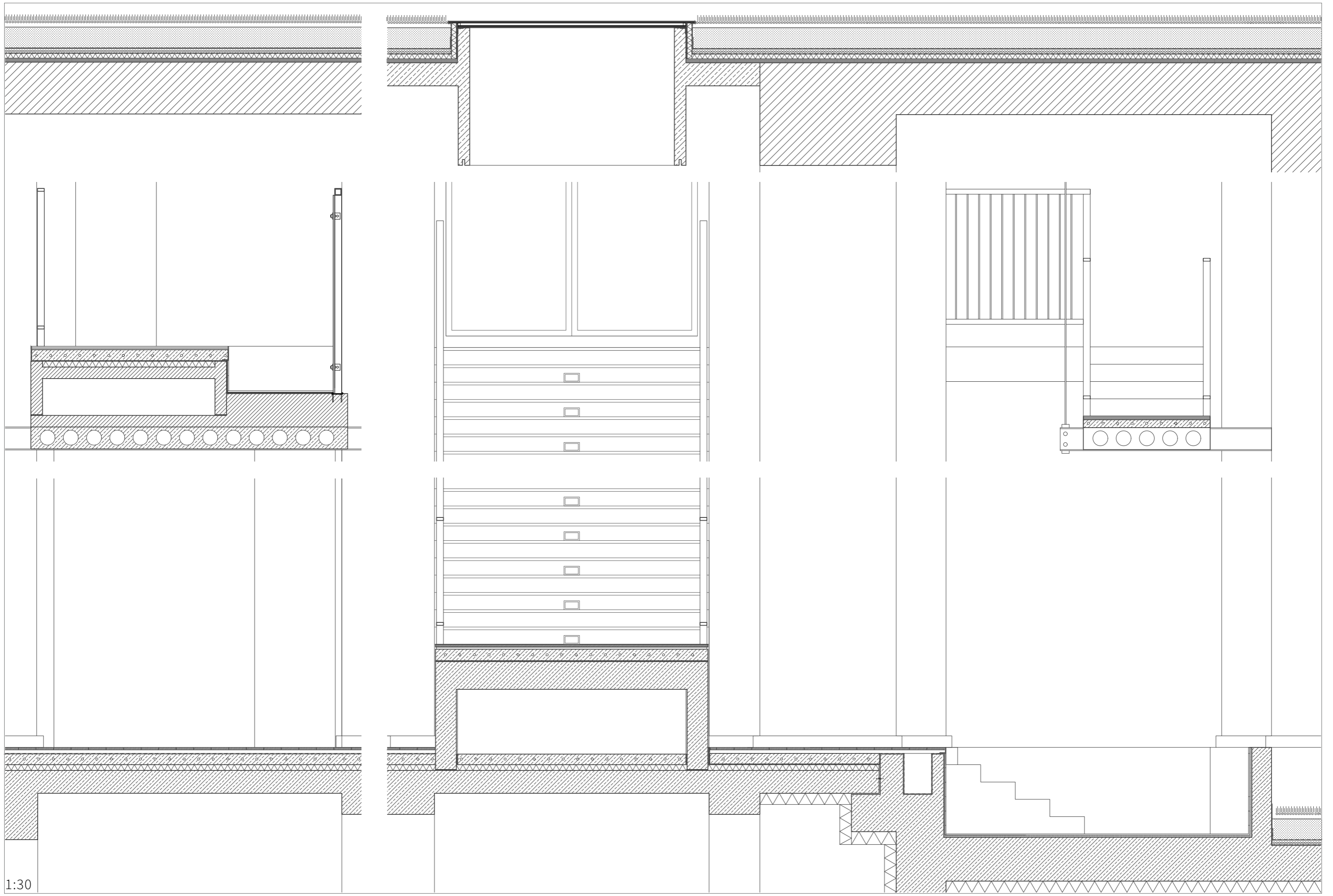


Oak cladding

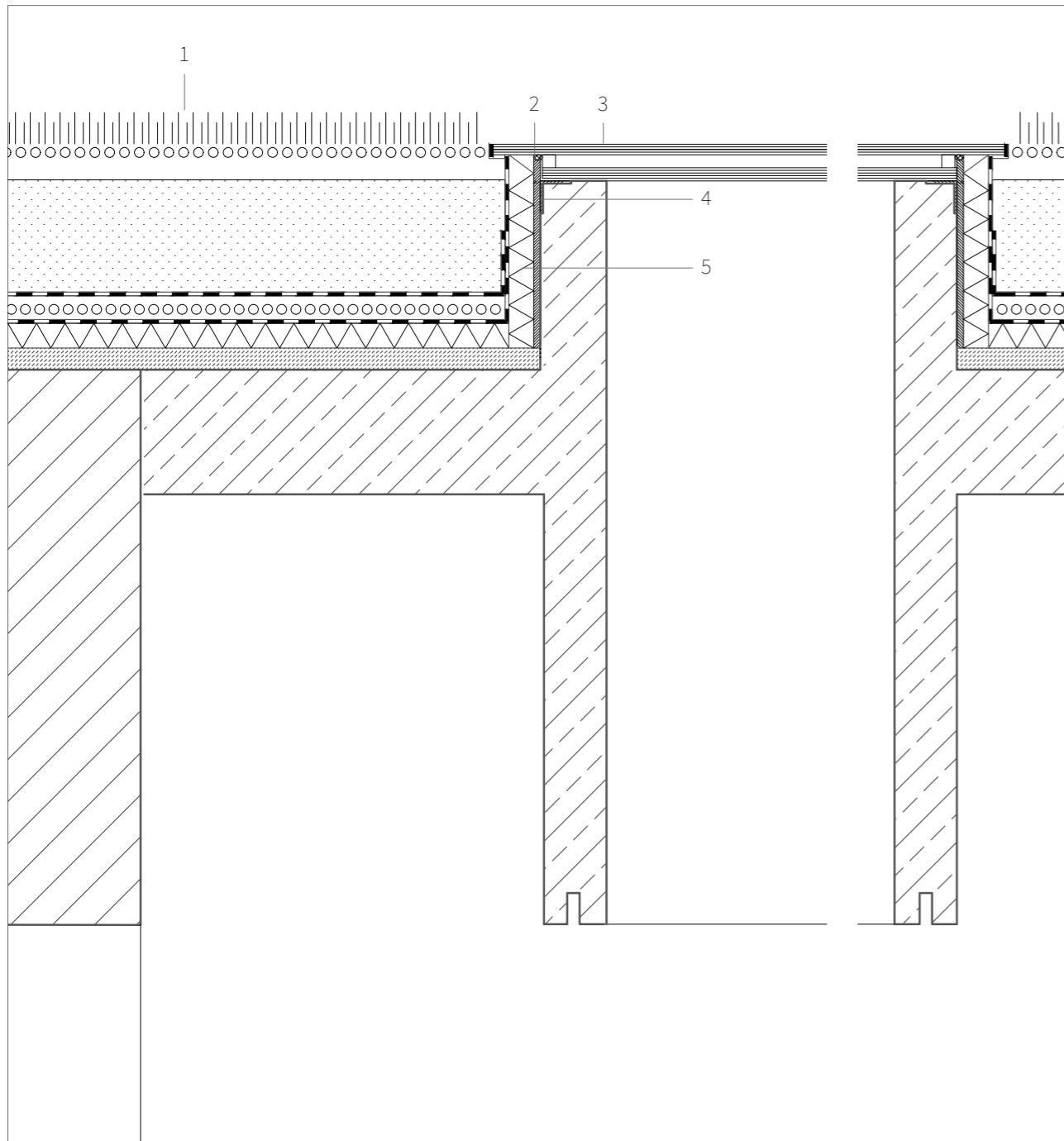


Aspen



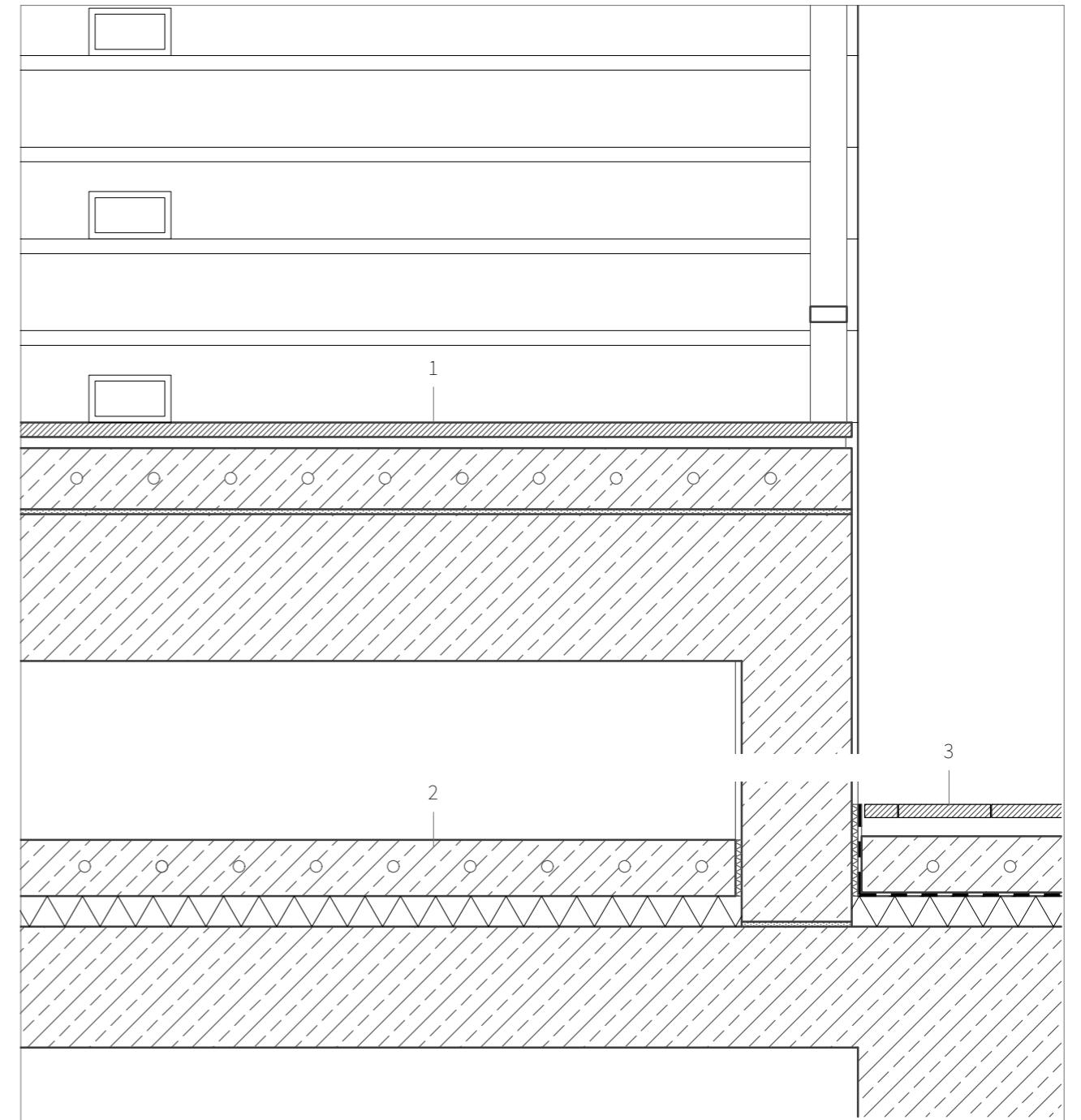


1:30



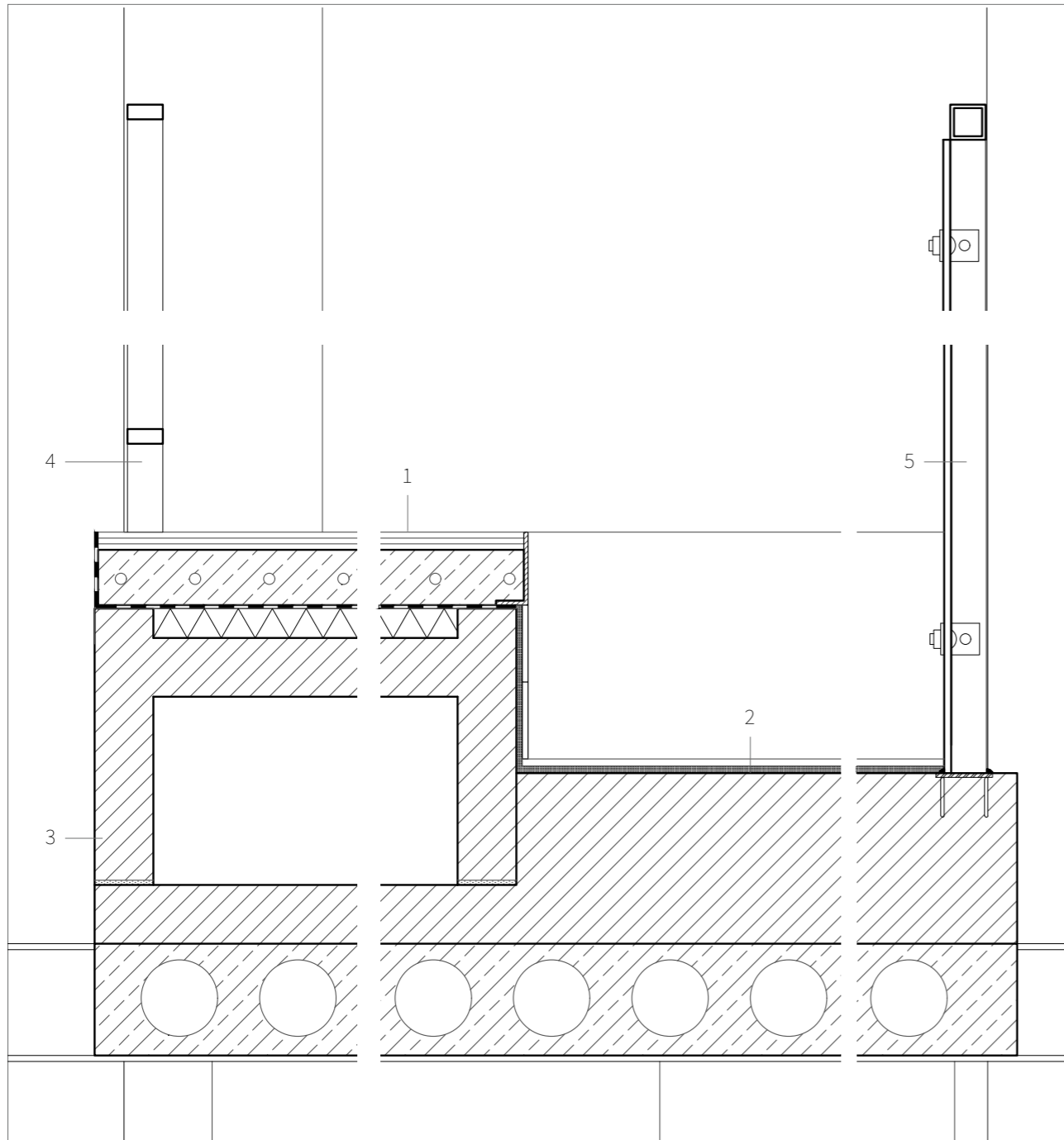
Roof Detail 1:10

- | | |
|--|--|
| <p>1 Flat roof/park:
meadow planting
180 mm vegetation layer
polyester filter membrane
approx. 20 mm fine gravel
polyester seal sheeting
35 mm thermal insulation laid in aluminium profile
30 mm screed to falls
250 mm reinf.-concrete floor</p> <p>2 seal, neoprene profile</p> | <p>3 skylight:
double glazing:
2*8 mm lam. safety glass
+ 20 mm cavity
+ 2*8 mm laminated safety glass with solar coating;
U value = 2.0 W/m²K₄</p> <p>4 support, 50/50 mm steel angle</p> <p>5 35 mm thermal insulation frame, 480/8 mm steel plate</p> |
|--|--|



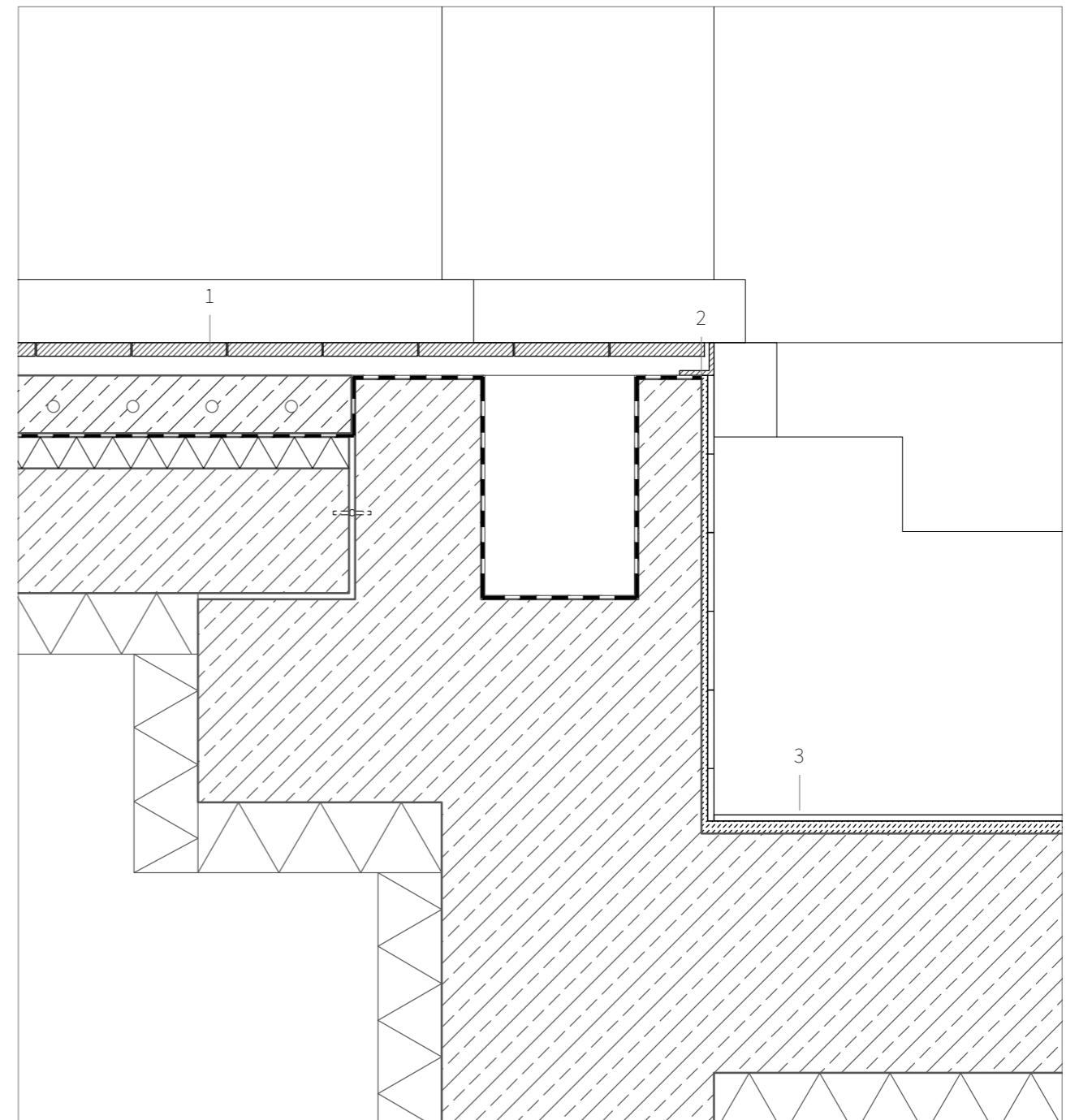
Stair Detail 1:10

- | | |
|---|---|
| <p>1 24 mm stained oak
100 mm concrete screed, reinforced, with underfloor heating, trowelled
15 mm bed of mortar
230 mm reinforced concrete</p> <p>2 100 mm concrete screed, reinforced, with underfloor heating, trowelled
60 mm thermal insulation</p> | <p>3 200 mm reinforced concrete
22/150 mm wood floor boards
50/50 mm wood blocking
100 mm concrete screed, reinforced, with underfloor heating, trowelled
sealant layer
60 mm thermal insulation
250 mm reinforced concrete</p> |
|---|---|



Pool Detail 1:10

- | | |
|--|--|
| <p>1 125/30 mm oak boarding
100 mm concrete screed, reinforced,
with underfloor heating, trowelled
sealant layer
60 mm thermal insulation
100mm reinforced concrete
void as duct for water supply pipes
300 mm reinforced concrete</p> | <p>2 ceramic tile
20 mm screed to falls
300 mm cement screed
200 mm prestressed hollow-core
floor planks</p> <p>3 8 mm sheet steel</p> <p>4 60/20/3 mm RHS galvanized steel handrail</p> <p>5 8 mm lam. safety glass</p> |
|--|--|



Pool Detail 1:10

- | | |
|---|---|
| <p>1 22/150 mm oak floor boards
50/50 mm wood blocking
100 mm concrete screed, reinforced,
with underfloor heating, trowelled
sealant layer
60 mm thermal insulation
250 mm reinforced concrete
100 mm thermal insulation</p> | <p>2 55/50 mm steel L-profile</p> <p>3 10mm ceramic tile
20 mm screed to falls
370 mm reinforced concrete
100 mm thermal insulation</p> |
|---|---|

DISCUSSION

The project first analyzed the historical background and original structural characteristics of the building, especially its connection with water, which helped me determine to transform it into a modern spa. The main focus of the renovation of the old building is how to deal with the new and old parts. The project maximizes the use of existing elements on the site and selects sensory therapy as the central theory for renovation.

There were many difficulties in the process. There were very few materials in the original reservoir. The specific structural drawings of the original materials and structures were drawn based on the thesis and some descriptions on the website; the selection of new structures and materials; the introduction of roof skylights and artificial light sources; the building is an underground space, how to smoothly introduce people into the building, that is, the entrance design; how to deal with the relationship with water, the depth, temperature and sound of the water need to be considered.

The space and streamline design also underwent a lot of changes after the mid critic. How to retain the original spatial scale has become a topic of concern after the mid-term. The functional area requires that the building cannot have only one floor, and there must be a two-story space. However, dividing the space directly into two floors will inevitably affect people's perception of the original space, so how to minimize its impact on the space when there is a partial second floor has become the focus. At the same time, the barrier-free design of the building also needs to be taken into consideration.

Due to the arch structure of the building itself, it is not very suitable for laser cutting, which increases the difficulty of model making. After discussion, it was decided to use 3D printing to make a cross-sectional model, and at the same time make a partial slightly larger scale model to show the space.

In the final critic, I received a lot of opinions from different directions and made some changes to the details. The distinction between the new and old parts in the technical drawings; the choice of materials; the structure and details of the second-floor bridge, the choice of lighting colors, etc.



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Examiner: Mikael Ekegren

MPARC-ACEX35

Building Design and Transformation