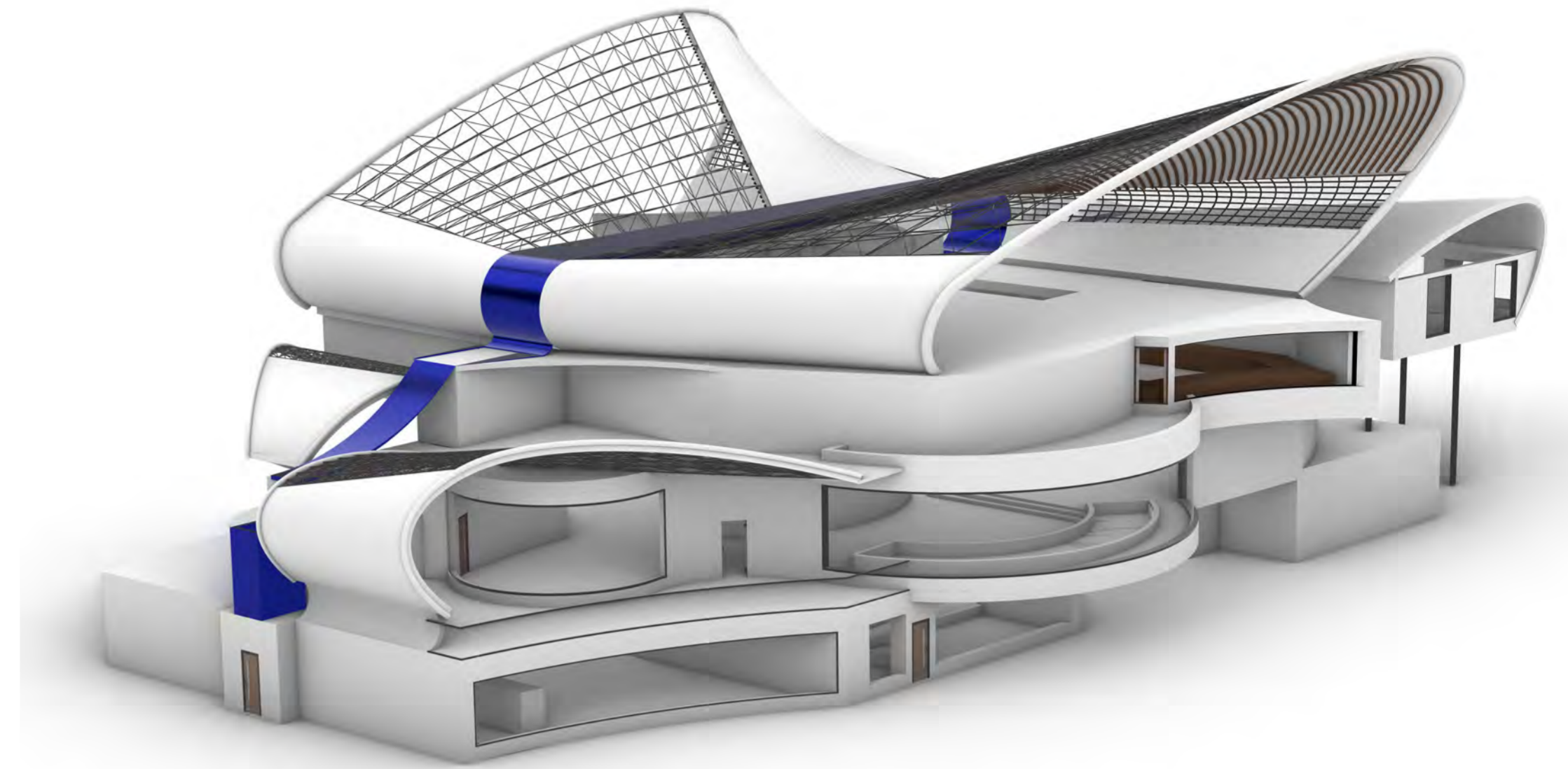


BRIEF

THE MUSEUM OF WATER

The Museum of Water in Copenhagen, is an educational and immersive building that explores the evolving relationship of people with water as a natural, cultural and environmental force. Copenhagen has always been shaped by water, serving as a source of trade, movement, identity and environmental vulnerability. The museum responds directly to this context by celebrating the ways water has influenced the city's development and daily life, while transforming learning into a direct experience, through a series of interactive and multisensory exhibitions. Through its exhibitions, the museum explores the significance of water in ecology, history, and culture, while also addressing the issue of climate change in a dramatic and impactful way. One of the key installations, a flooded apartment exhibition, aims to shock visitors by showing what everyday life could look like, if climate change continues unchecked. The Museum of Water's top floor aims to create a strong visual connection with the surrounding environment, through its glazed, fluid parametric roof and facade. Finally, the building itself becomes part of the exhibition narrative through its fluid shape, and the bioconcrete construction of numerous areas throughout the museum. This innovative material, uses water as a living and regenerative element which actively contributes to the maintenance of the structure, while also reinforcing the themes of sustainability and coexistence with the natural environment.



KEY FEATURES



FLUID SHAPE



WATER IS AN ACTIVE ELEMENT AIDING IN THE MUSEUM'S MAINTENANCE, NOT JUST A THEME



NATURAL LIGHT IS PRIORITISED IN BRIGHT AREAS OF THE MUSEUM. THE SHAPE OF THE BUILDING AIMS TO MAXIMISE DAYLIGHT WHEREVER NEEDED.



RAINWATER IS COLLECTED, STORED AND USED IN THE WATER EXHIBITIONS OF THE MUSEUM



LEARNING THROUGH INTERACTING WITH THE WATER

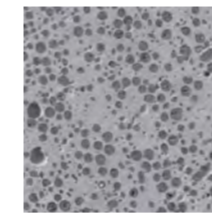
MATERIAL PALETTE

LOW-CARBON CONCRETE



Main Structure

BIOCONCRETE



Water Exhibitions

MARBLE



Interior Finish

RECYCLED ALUMINIUM



Window Frames, Rainwater Redirection System

RECYCLED STRUCTURAL STEEL



Space Truss Systems

FLOOR THEMATOLOGY

GROUND FLOOR



WATER AS EXPERIENCE

FIRST FLOOR



WATER AS A NATURAL ELEMENT

SECOND FLOOR

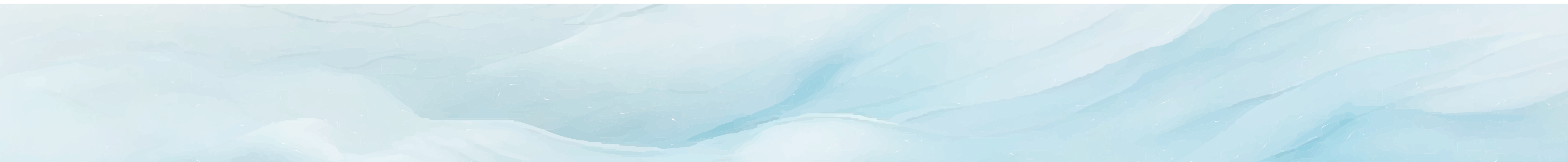


WATER AS A FORCE

THIRD FLOOR

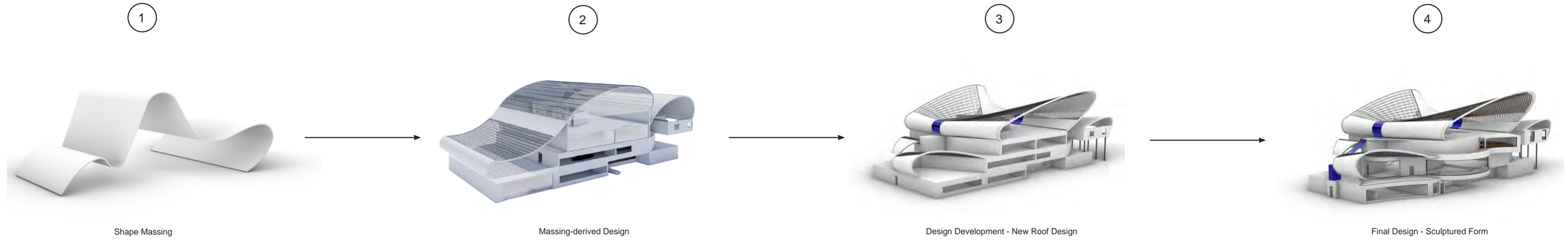


WATER AS PERSPECTIVE



DESIGN DEVELOPMENT

From the beginning, the design intent was to create a building which expressed a sense of fluidity. This was firstly explored through a fluid massing model, which evolved into a feasible building design. Then, the form of the building was further refined with the introduction of a dynamic roof design, and in the final stage with the introduction of sculptural projections which enhance the visual complexity and architectural character of the building.



SPATIAL SEQUENCE & CIRCULATION

03 THIRD FLOOR



- 13A. Traditional Ship Exhibition Top
- 17. Viewpoint

02 SECOND FLOOR



- 8. WC
- 13. Traditional Ship Exhibition
- 14. Interactive AR Storm Exhibition
- 15. AR Flooding Exhibition
- 16. Flooded Apartment Exhibition

01 FIRST FLOOR

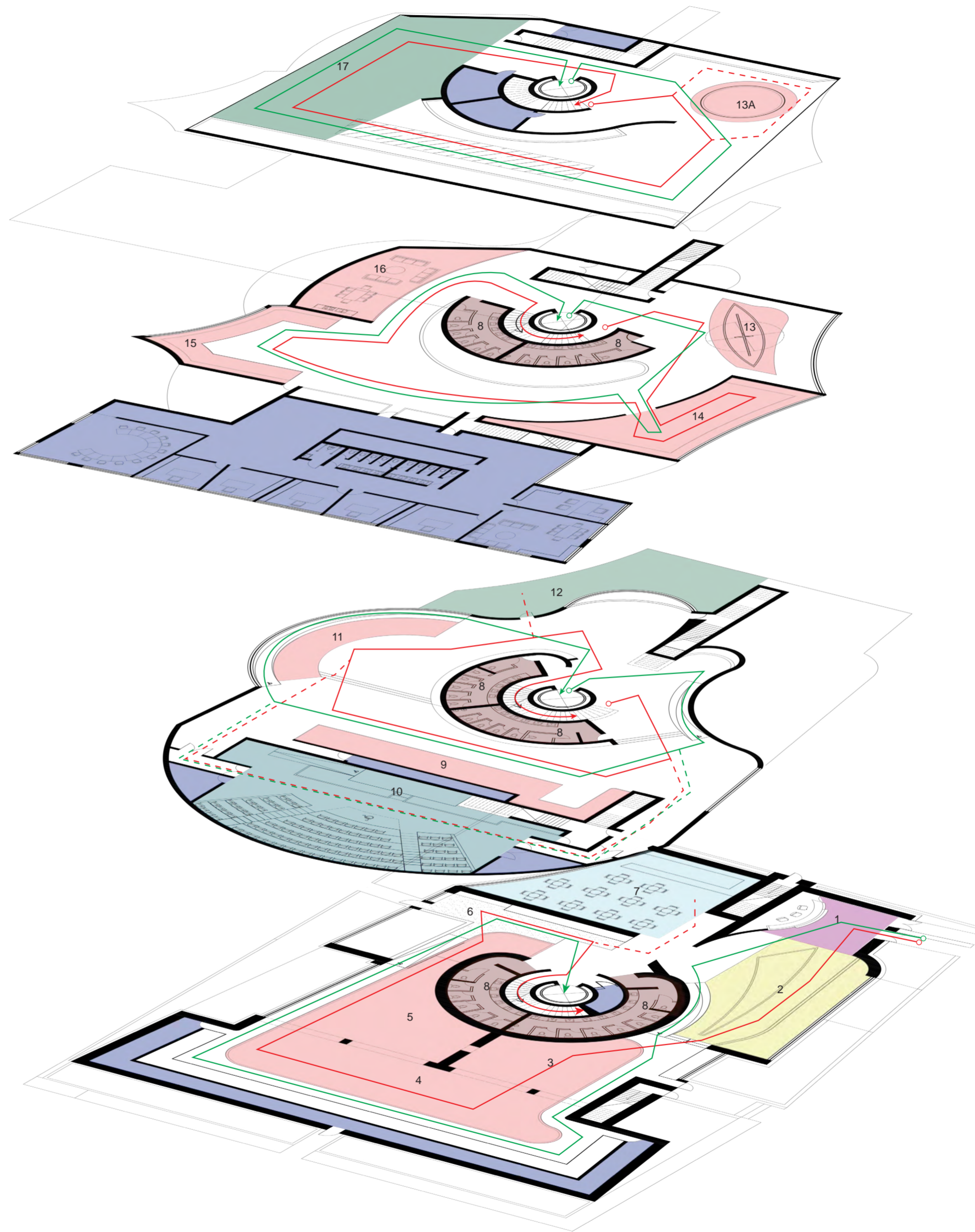


- 8. WC
- 9. Water Cycle Exhibition
- 10. Interactive Water Journey Exhibition
- 12. Balcony Viewpoint

00 GROUND FLOOR



- 1. Reception
- 2. Theme introduction Space
- 3. Flooded Room Introduction Space
- 4. Flooded Local Fish Exhibition
- 5. Flooded Rain Room
- 6. Drying Area
- 7. Cafe
- 8. WC



- Reception
- Theme Introduction Space
- Exhibition Spaces
- Staff-Only Areas
- Cafe
- WC
- Auditorium
- Viewpoint
- Visitor Route
- Accessible Route
- Secondary Visitor Route
- Secondary Accessible Route

PRECEDENTS

01

HARBIN OPERA HOUSE | MAD ARCHITECTS

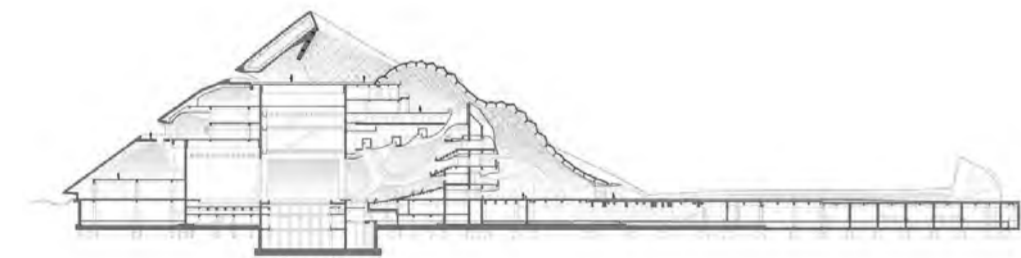
HARBIN, CHINA | 2015



FOCUS: FORM + RELATIONSHIP WITH LANDSCAPE

The building has a fluid and organic form which emerges from its landscape and is inspired by movement, wind and the natural forces present at the site

BUILDING SECTION



KEY COMPONENTS



Fluid Roof Design



Large + Open Public Spaces



Unique + Attractive Design



Relationship with landscape

02

VITRA DESIGN MUSEUM | FRANK GEHRY

WEIL AM RHEIN, GERMANY | 1989



FOCUS: SCULPTURAL IDENTITY

A bold and structural composition which expresses the museum as something much more than a building which houses artefacts; the building is an art piece as well (something worth exhibiting)

BUILDING PLANS



KEY COMPONENTS



Sculptural Building Form



Complex Geometry Adds Dynamism + Visual Interest



Architecture is a Landmark Within Its Context



Careful Shaping Controls Light + Shadow on Surfaces

03

BRITISH MUSEUM GREAT COURT ROOF

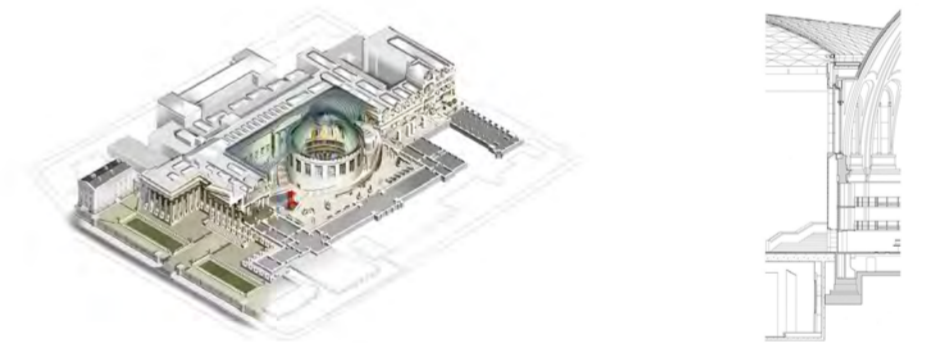
FOSTER + PARTNERS | LONDON, UK | 2000



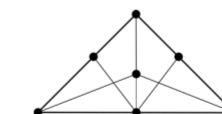
FOCUS: PARAMETRIC ROOF

The lightweight parametric roof which maximises daylight and openness and creates a remarkable and attractive public space.

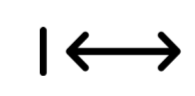
BUILDING SECTION + DETAIL



KEY COMPONENTS



Parametric Roof



Parametric Structure Achieves Long Spans with Minimal Support



Roof Design Allows Daylight to Enter the Building + Creates a Sense of Openness

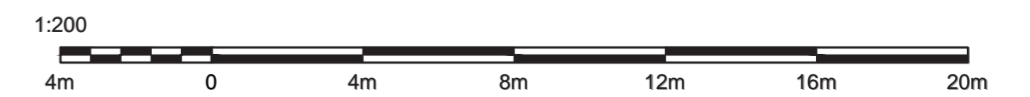
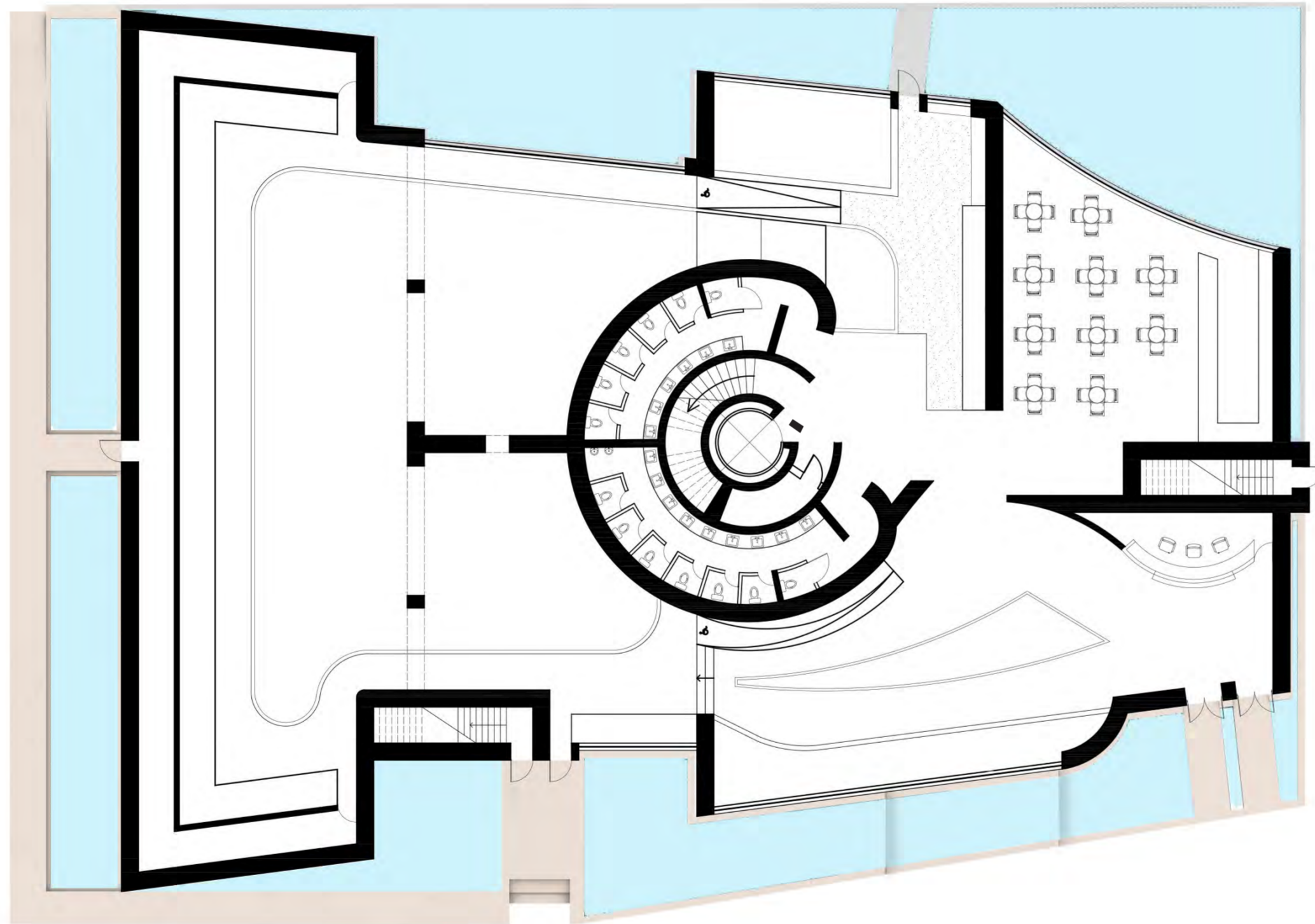


Parametric Roof Adds Visual Interest

CONTEXTUAL AERIAL VIEW

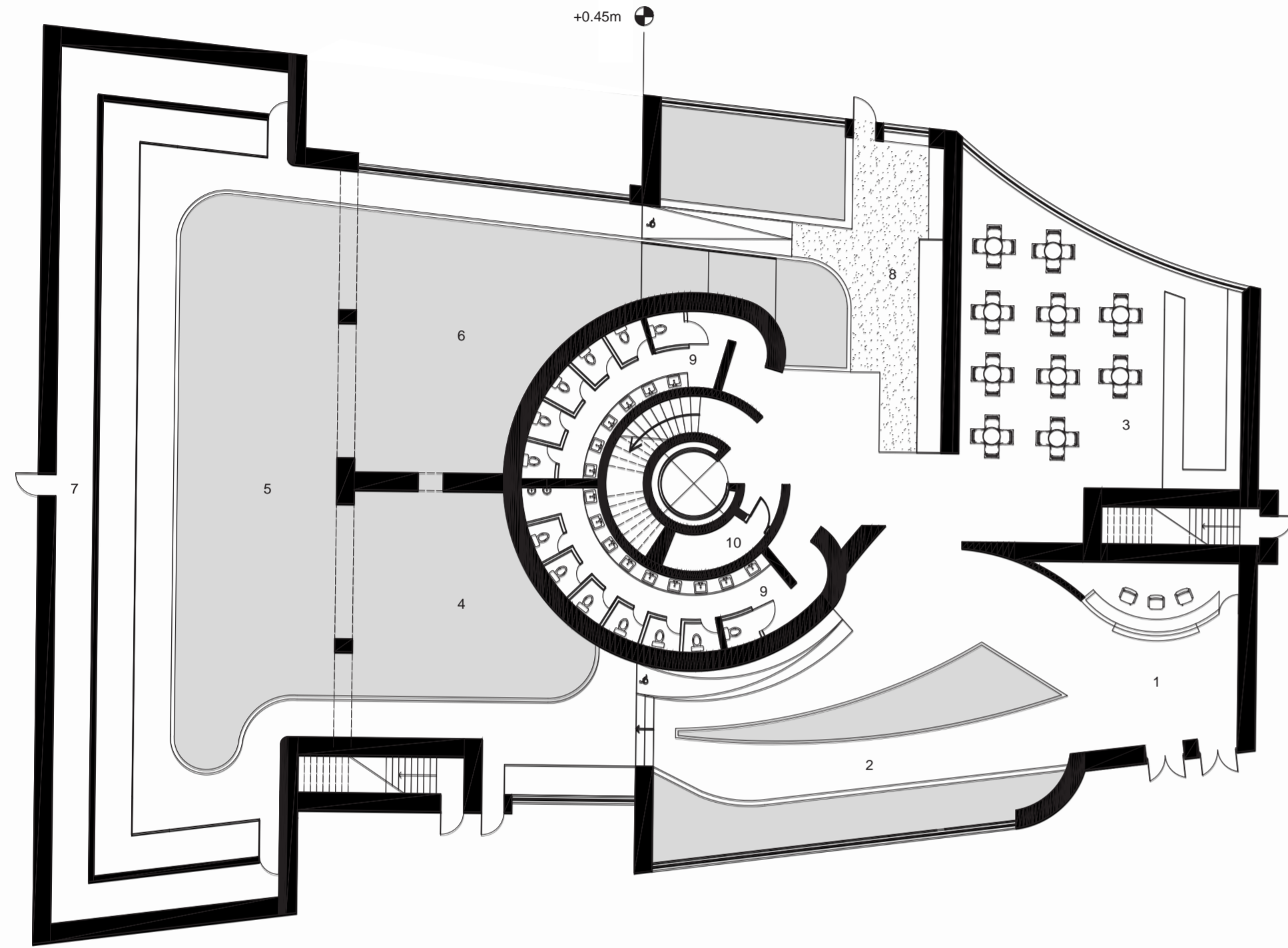


GROUND-FLOOR PLAN IN CONTEXT

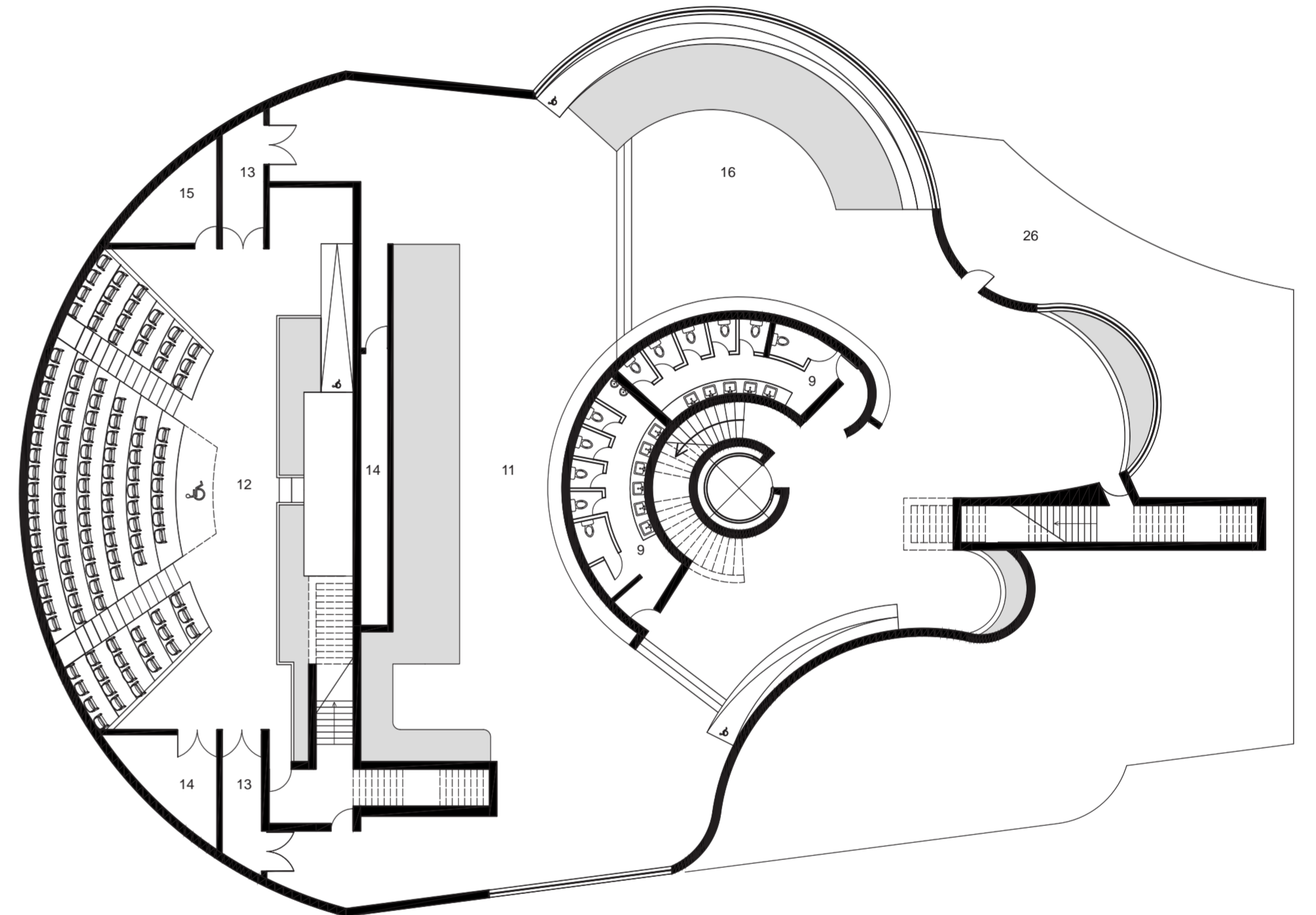


FLOOR PLANS

GROUND FLOOR



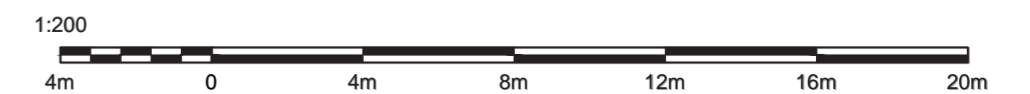
FIRST FLOOR



KEY

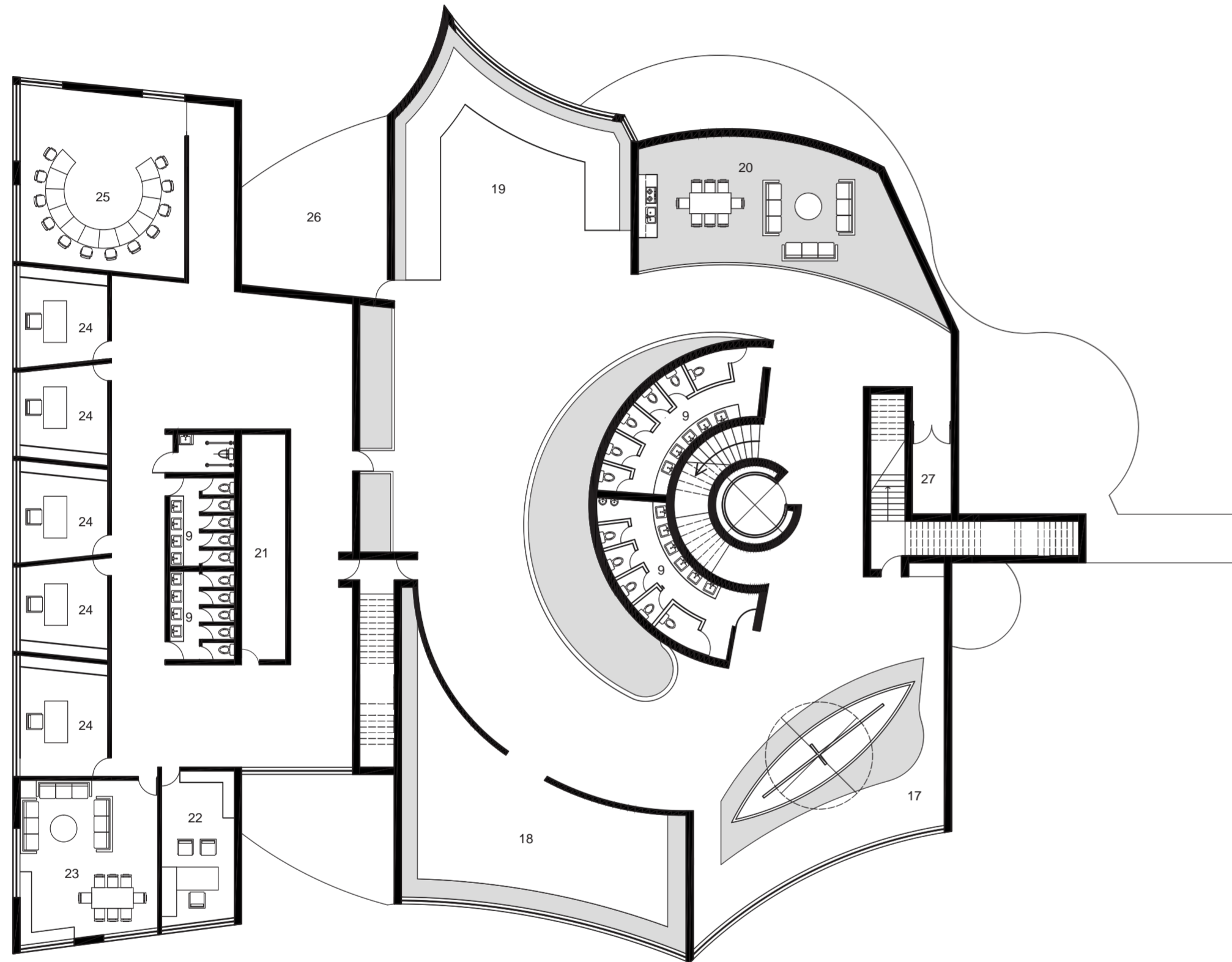
- | | |
|---|--|
| 1. Reception | 11. Water-cycle exhibition |
| 2. Theme introduction Space | 12. Auditorium |
| 3. Coffee shop | 13. Vestibule |
| 4. Flooded room introduction space | 14. Storage |
| 5. Flooded fish exhibition | 15. Mechanical & Electrical Room |
| 6. Flooded rain room | 16. Water Journey Interactive Exhibition |
| 7. Fish-tank maintenance room + storage | 26. Balcony - Viewpoint |
| 8. Drying area | ■ Water |
| 9. WC | |
| 10. Hydraulic elevator mechanical room | |

MUSEUM OF WATER



FLOOR PLANS

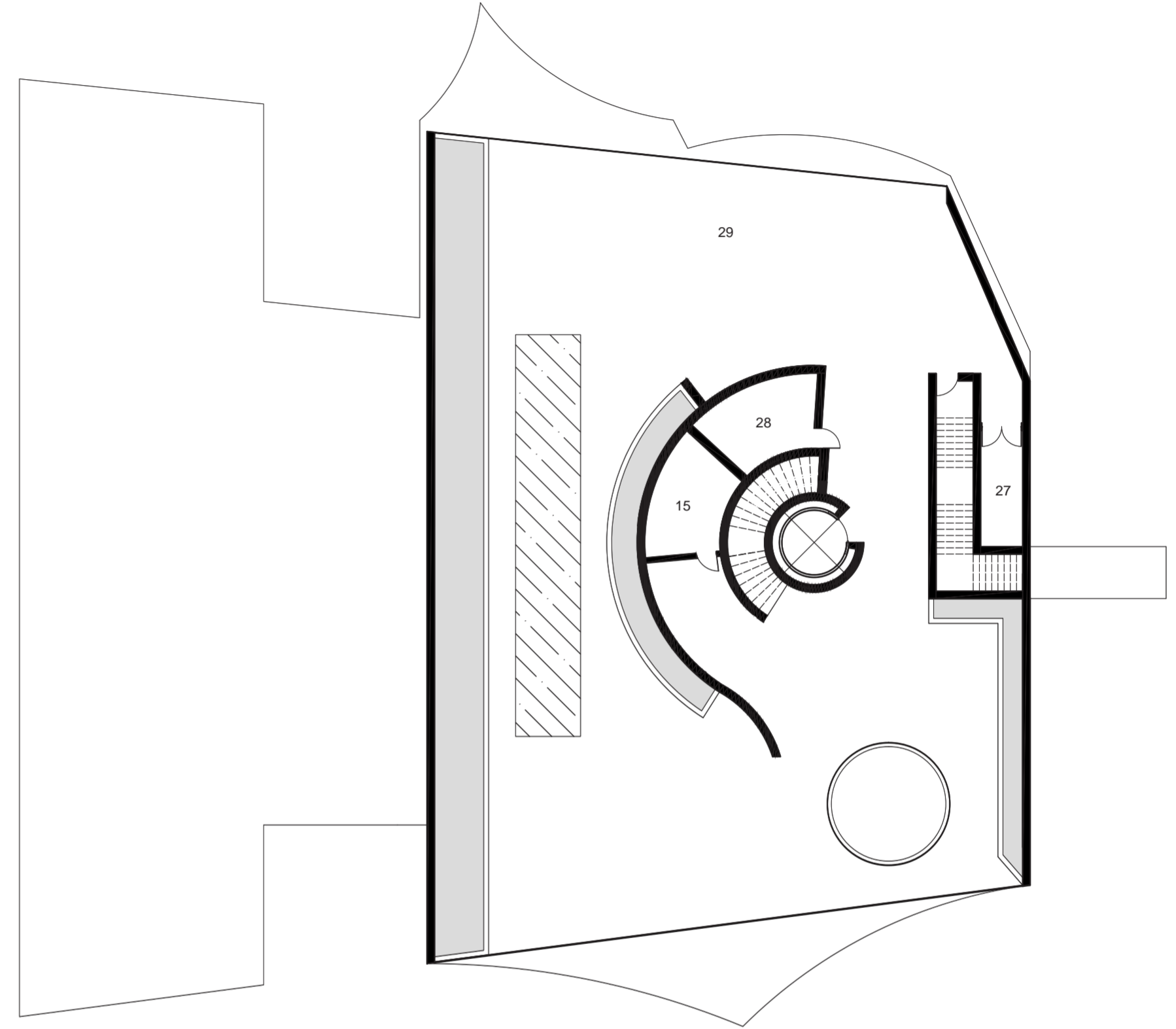
SECOND FLOOR



KEY

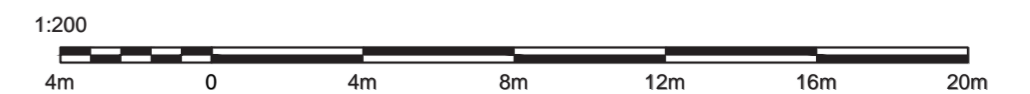
- | | |
|---|----------------------|
| 17. Trading / Shipping History Exhibition | 26. Balcony |
| 18. Interactive AR Storm Exhibition | 27. Water Plant Room |
| 19. Flooding Model Exhibition | Water |
| 20. Flooded Apartment Exhibition | |
| 21. Office Utility Room | |
| 22. Manager's Office | |
| 23. Employee Break Room | |
| 24. Office | |
| 25. Conference Room | |

THIRD FLOOR



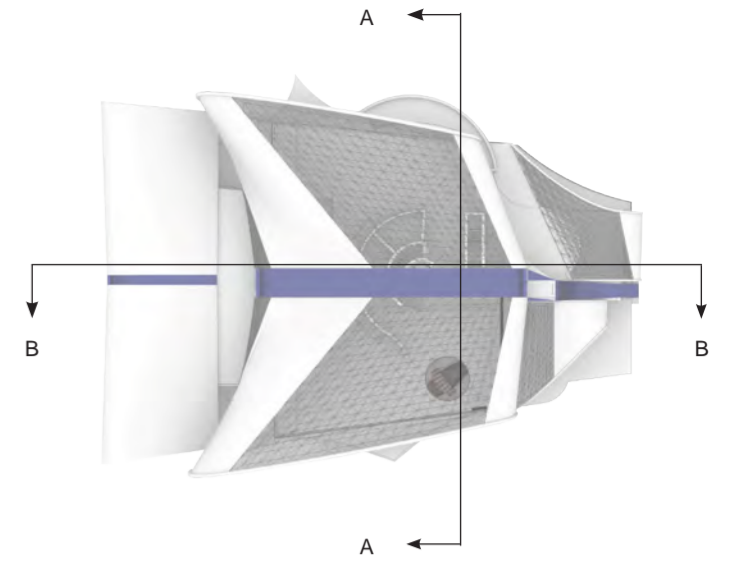
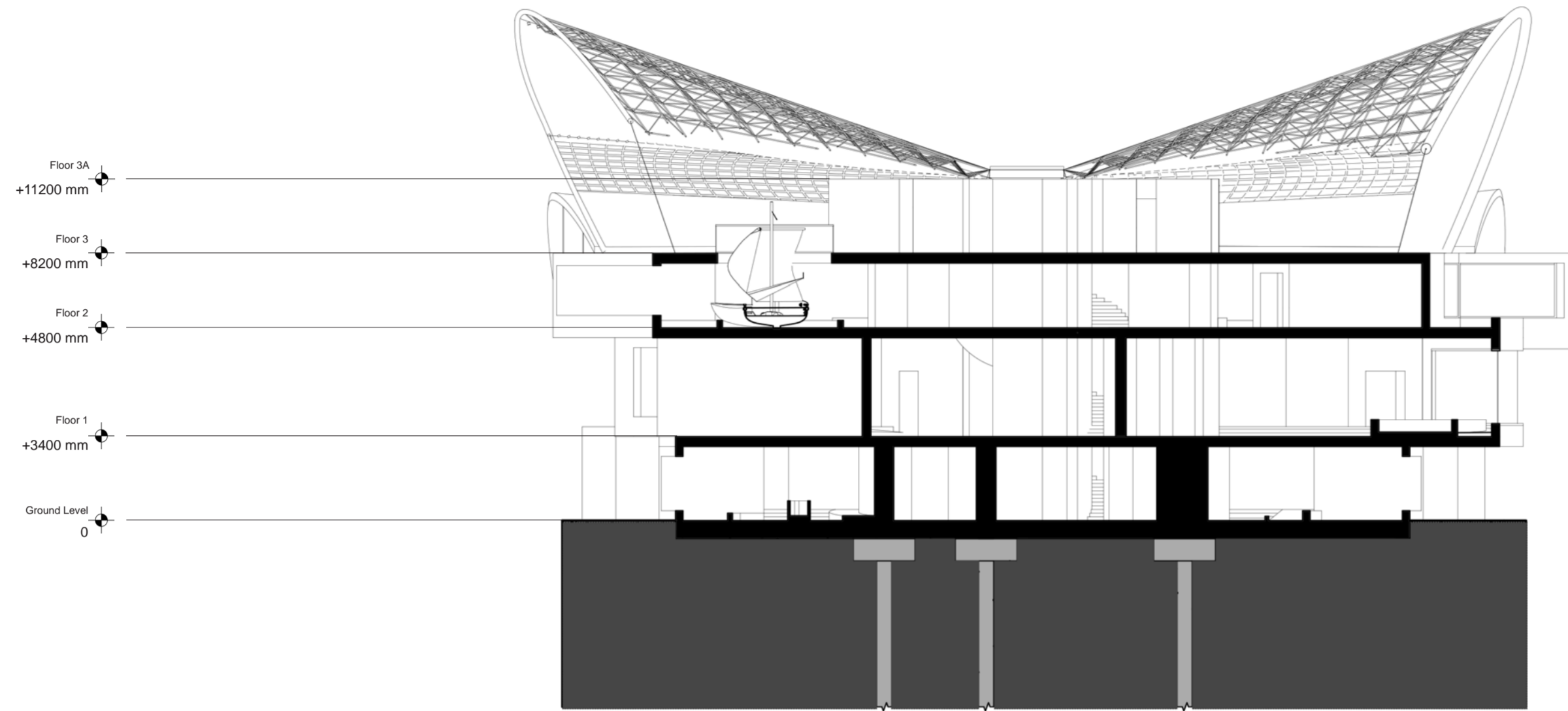
KEY

- | |
|----------------------------------|
| 15. Mechanical & Electrical Room |
| 27. Water Plant Room |
| 28. Server Room |
| 29. Viewpoint |
| Water |

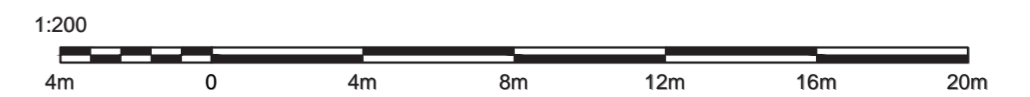
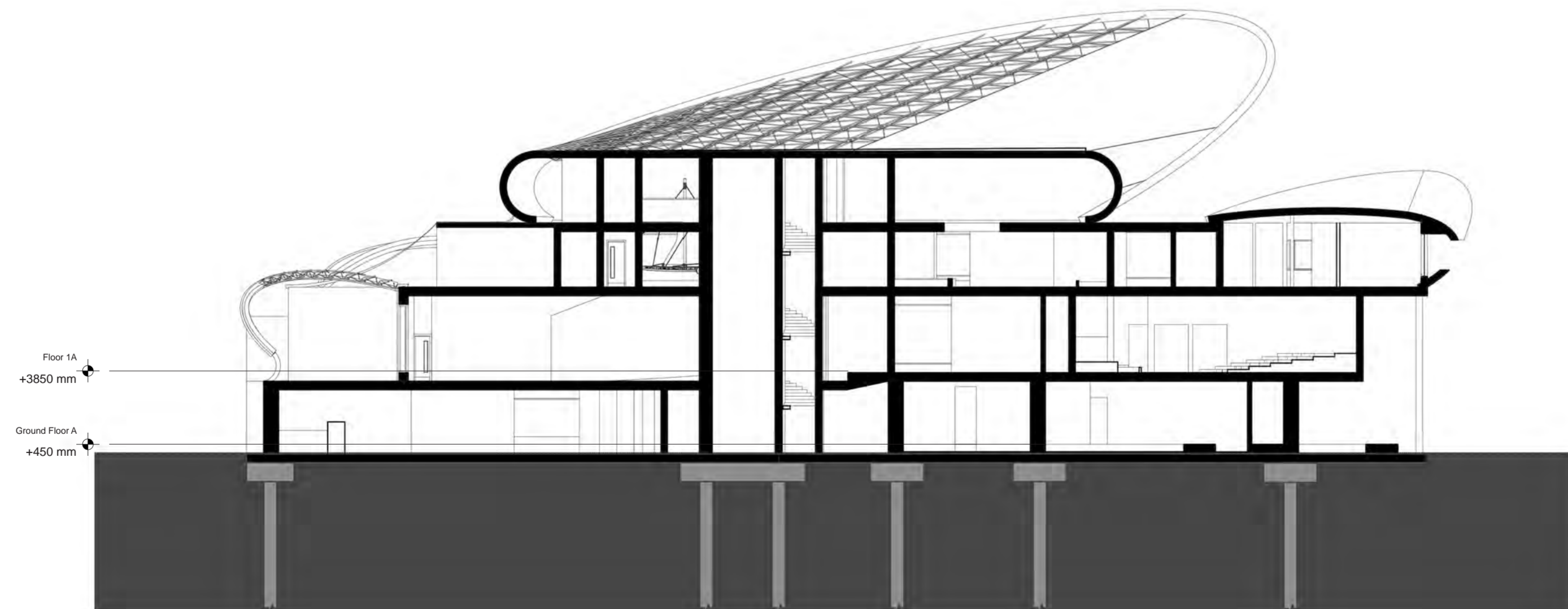


SECTIONS

SECTION AA - TRANSVERSE SECTION

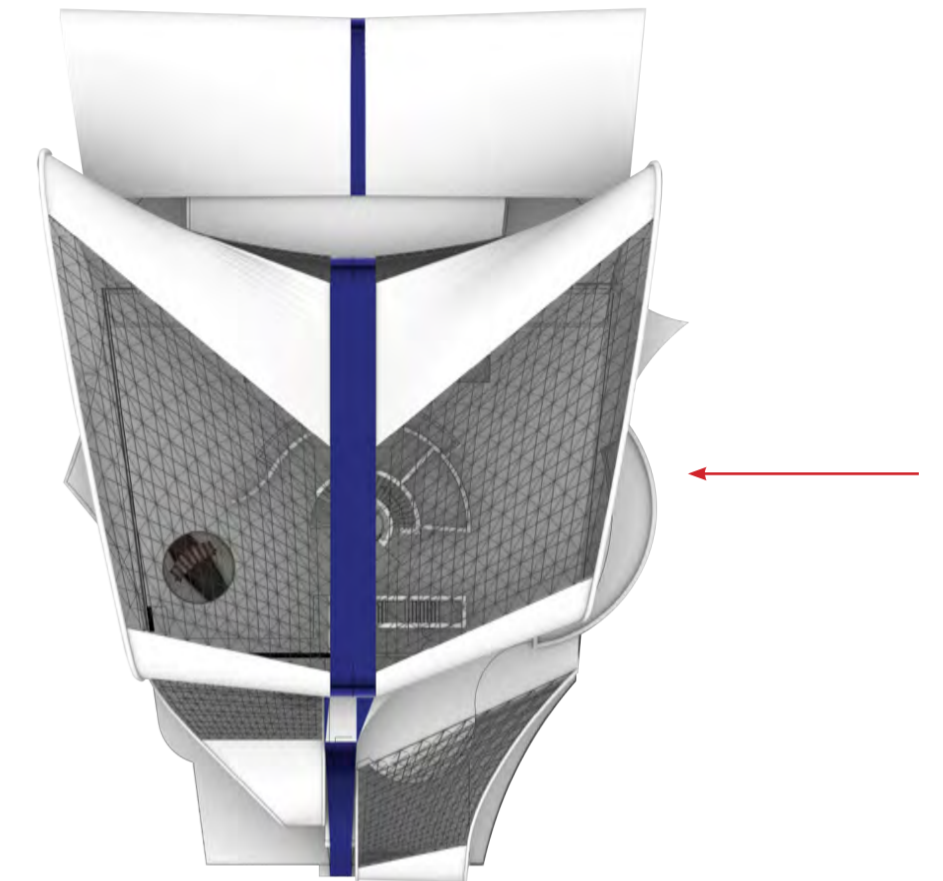


SECTION BB - LONGITUDINAL SECTION

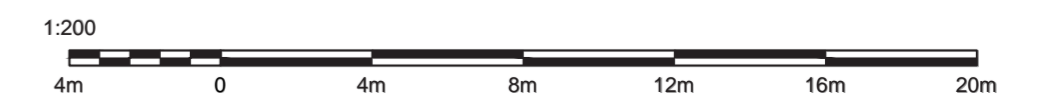
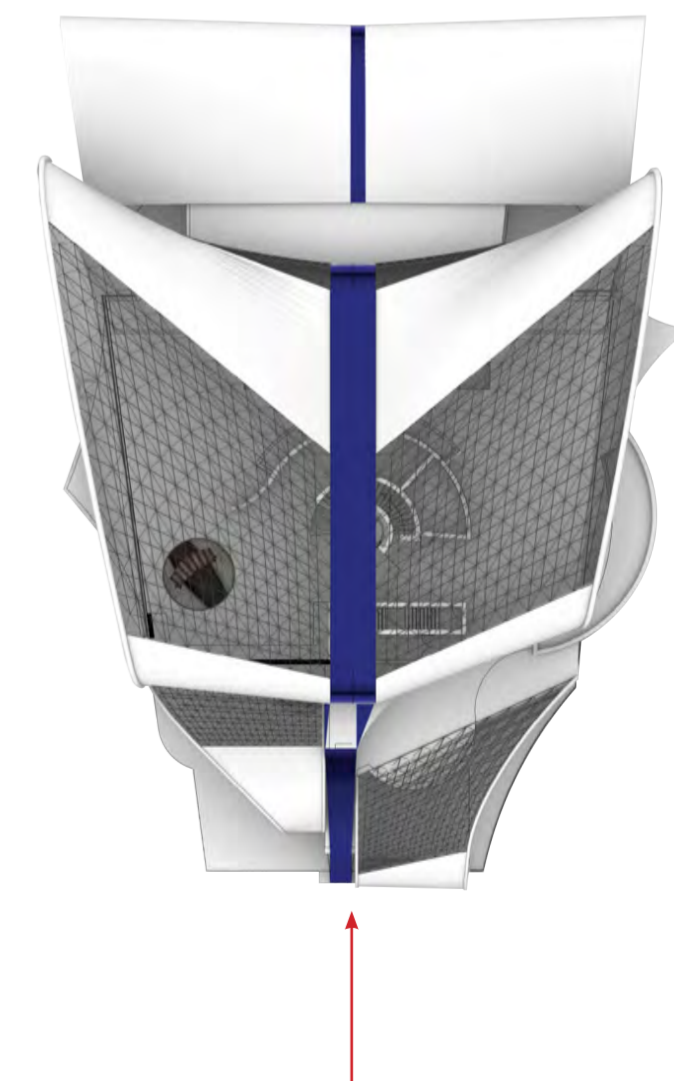
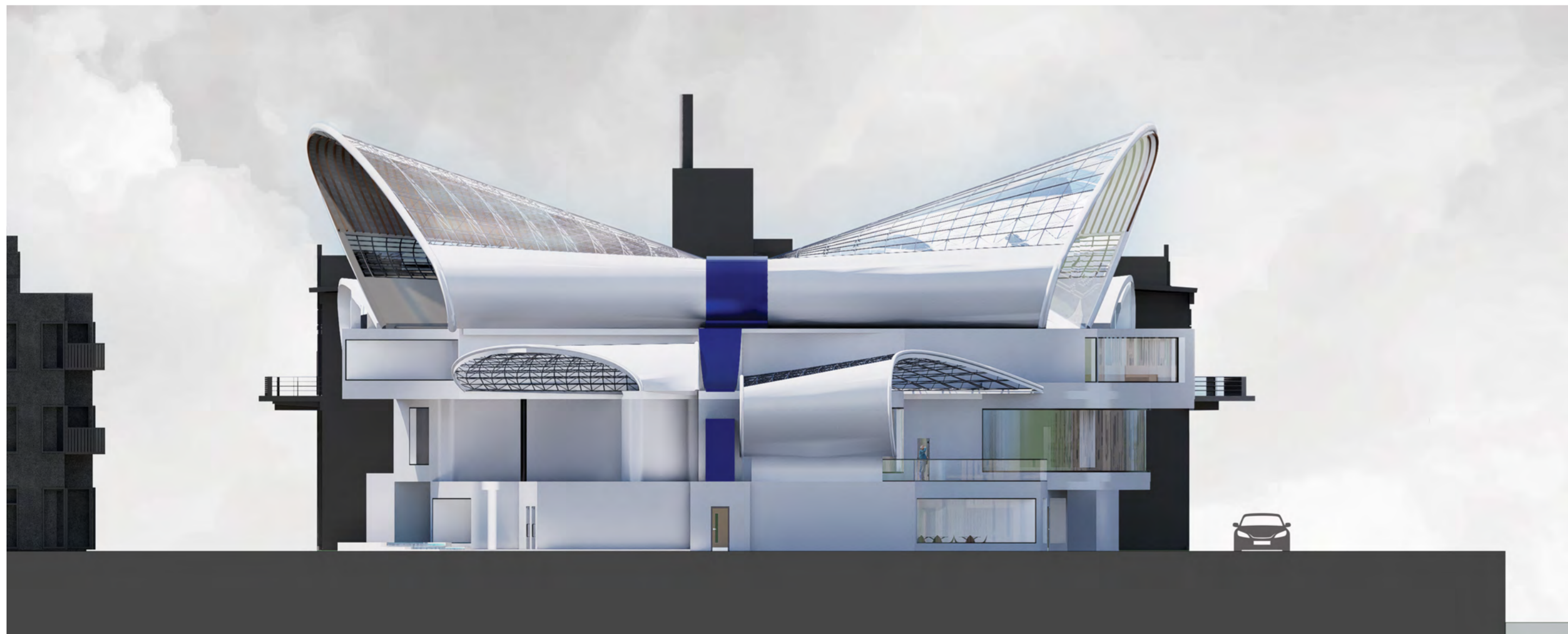


ELEVATIONS

NORTH-EAST ELEVATION

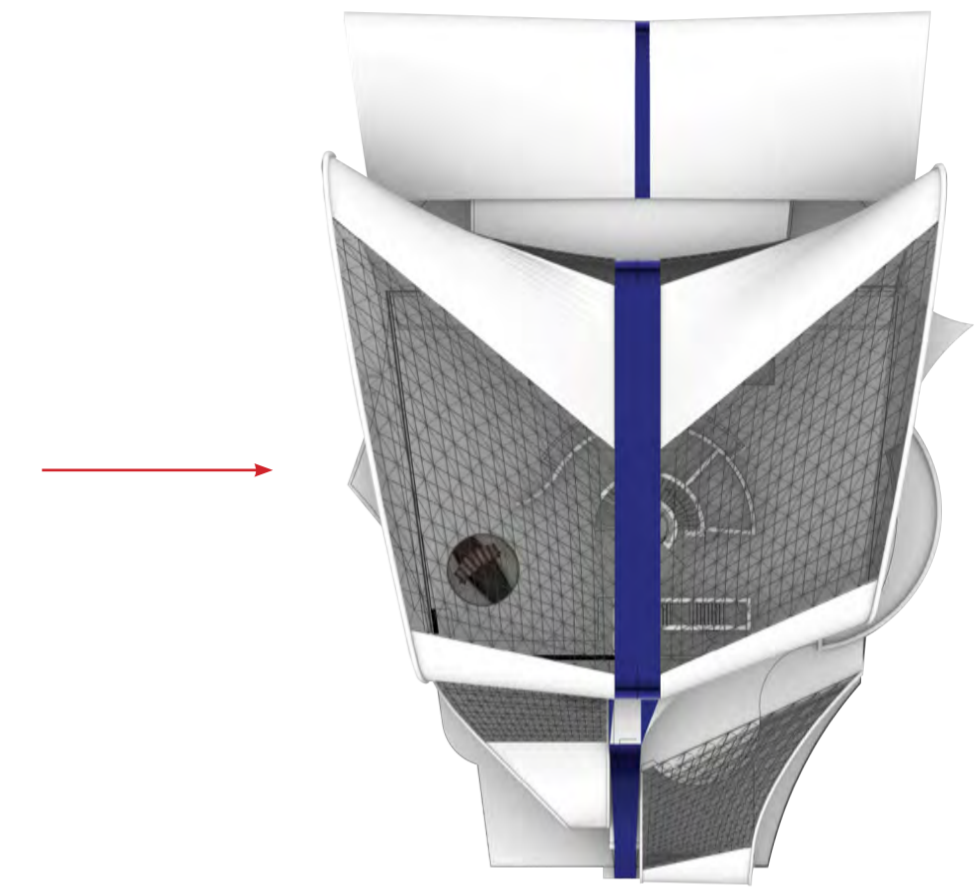
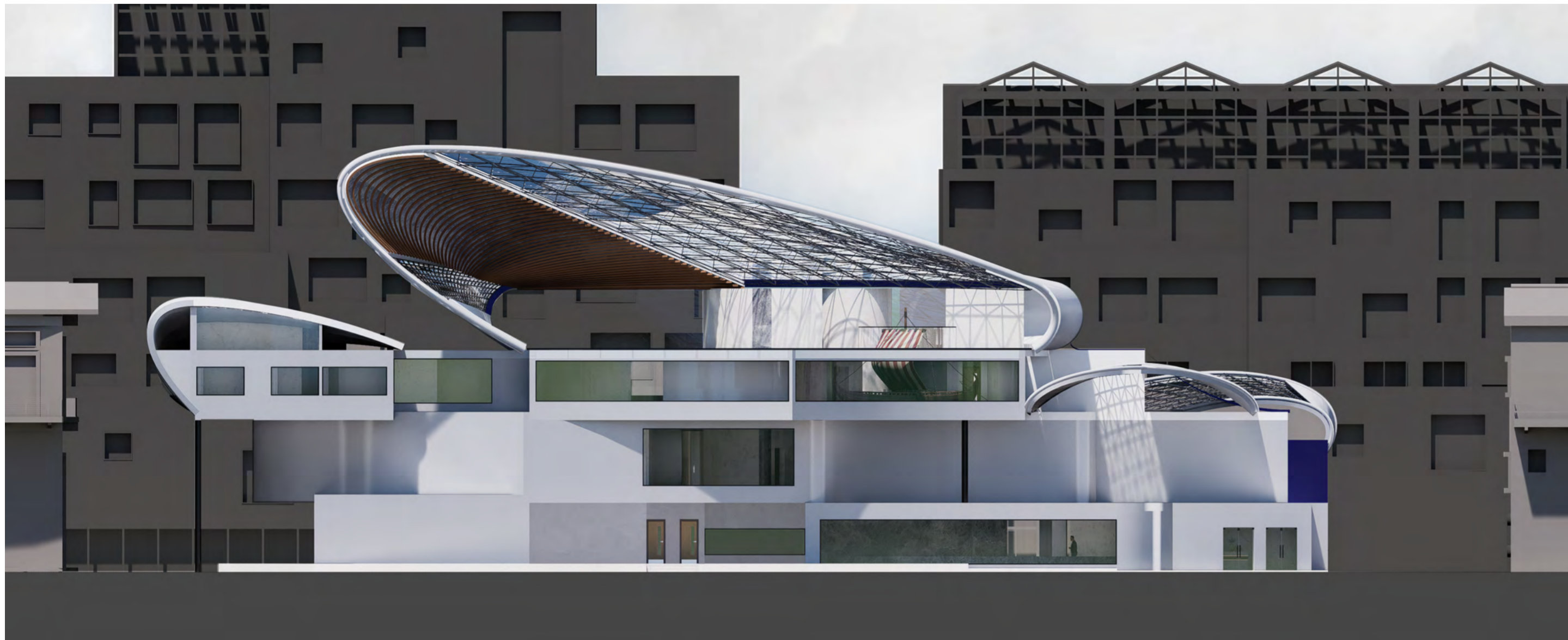


SOUTH-EAST ELEVATION

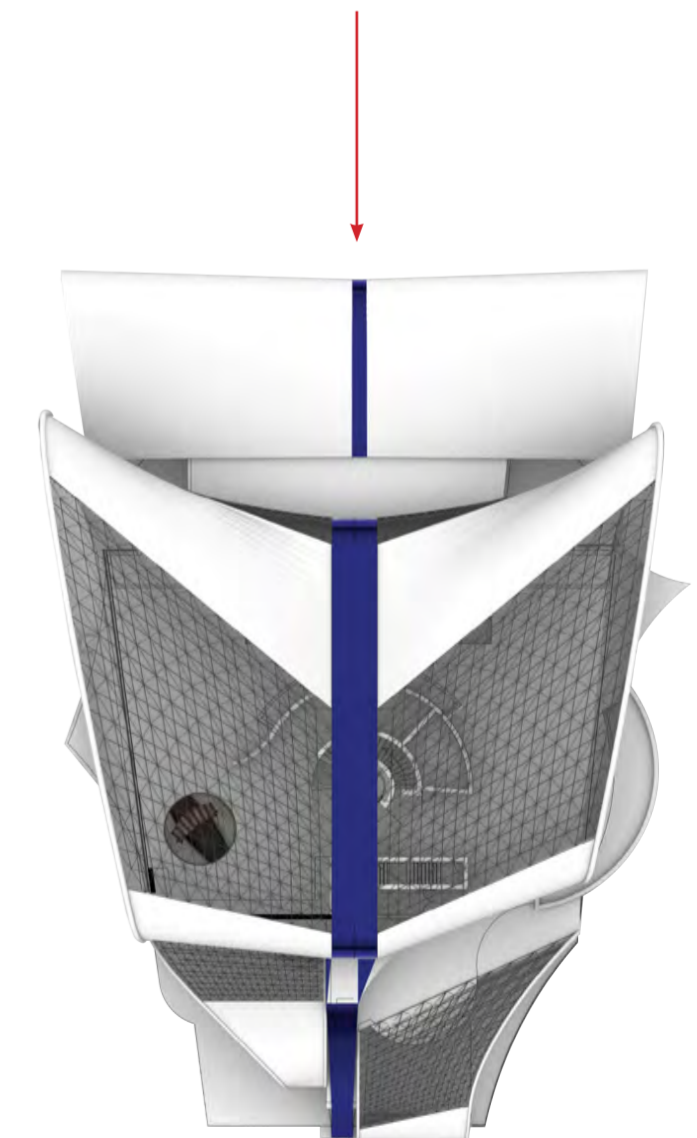
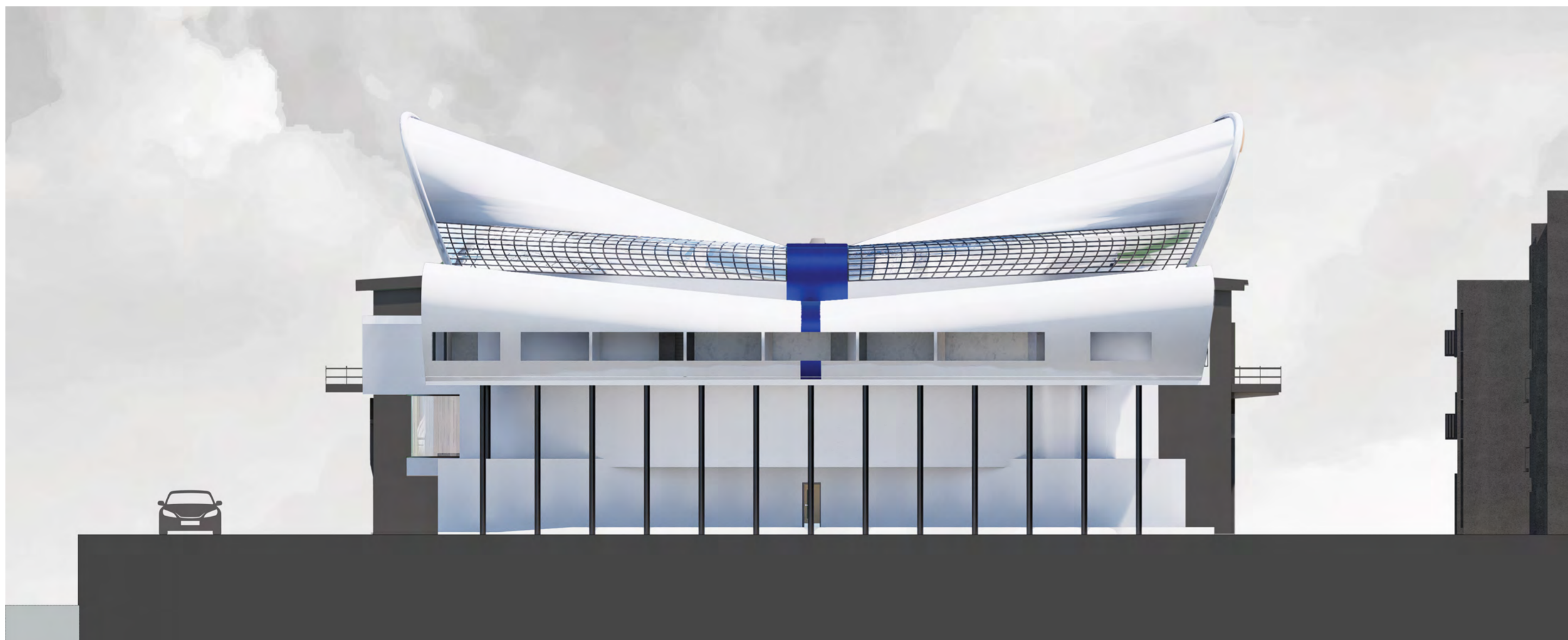


ELEVATIONS

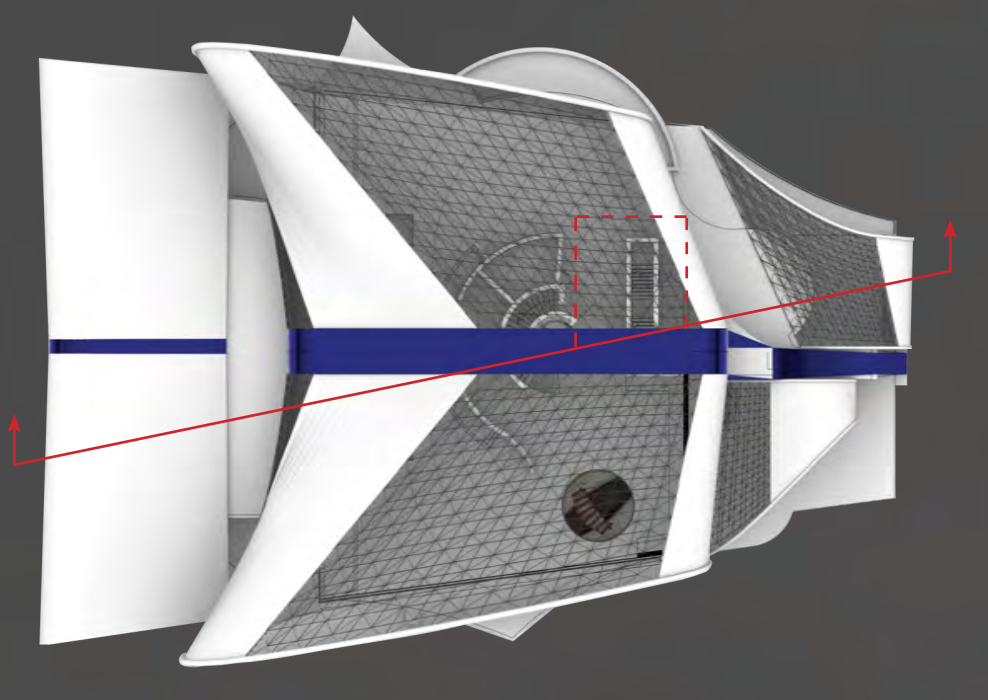
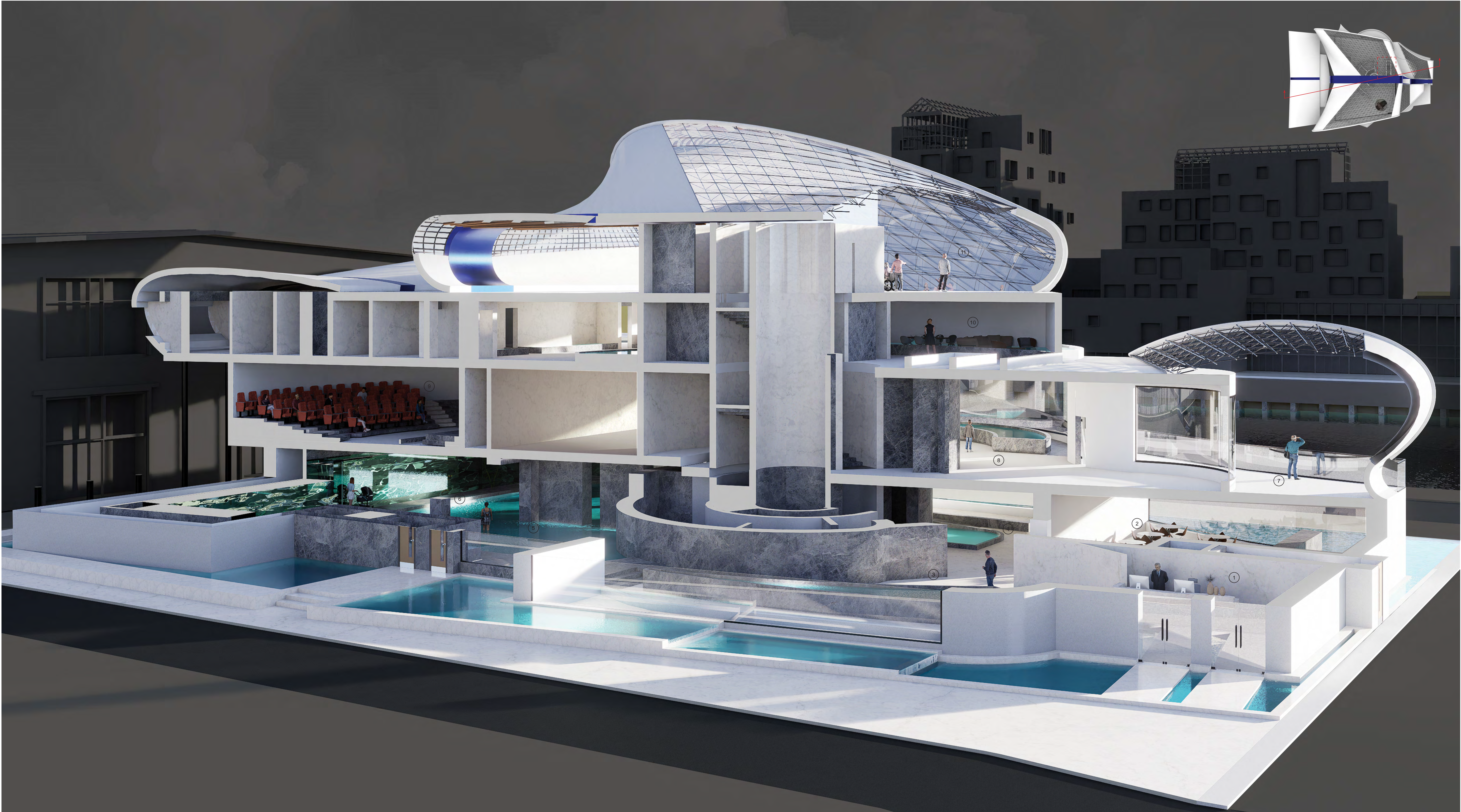
SOUTH-WEST ELEVATION



NORTH-WEST ELEVATION



1:200
4m 0 4m 8m 12m 16m 20m



KEY

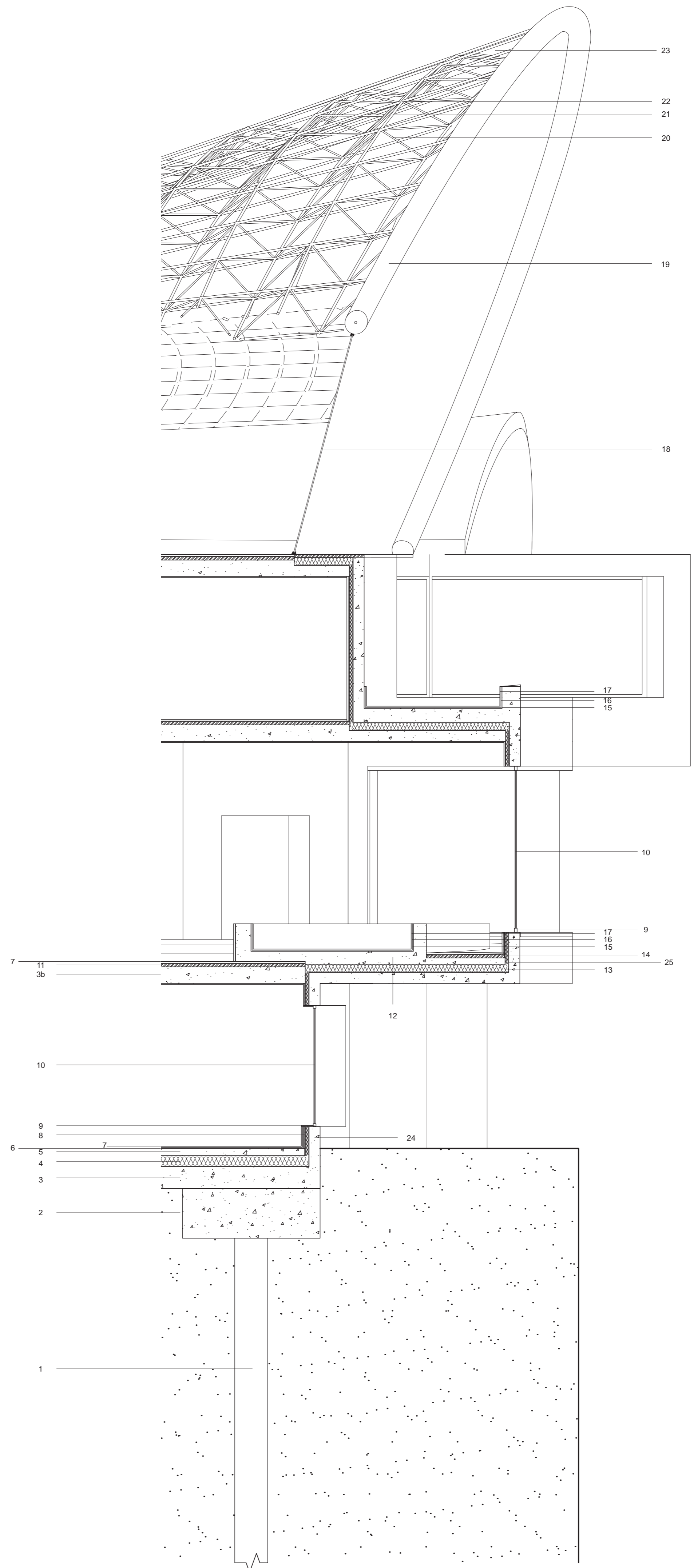
- 1. Reception
- 2. Museum Cafe
- 3. Theme Introduction Space
- 4. Drying Area
- 5. Flooded Room Exhibition - Introduction
- 6. Flooded Room Local Fish Exhibition
- 7. Balcony - Floor 1 Viewpoint
- 8. Water's Journey - Interactive Exhibition
- 9. Auditorium
- 10. Flooded Apartment Exhibition
- 11. Rooftop Viewpoint

IEWS



BAY STUDY

This Bay Study Page Shows a part of the South-East facade, and includes the foundation, the projections of the facade, the water collection structure and the parametric roof structure.



KEY

- | | | | | | |
|------------------------------------|-----------------------------|--------------------------------------|--|--|----------------------------|
| 1. 15m span foundation pile | 5. Concrete Slab | 10. Double-Glazed Window | 15. 20mm Thickness Aluminium Tank | 20. Space Truss Support Components | 25. Waterproofing Membrane |
| 2. Concrete Pile cap | 6. 10mm Marble Adhesive | 11. 60mm Concrete Screed | 16. 10mm Waterproof Liner | 21. Space Truss Main Frame | |
| 3. 400mm Structural Concrete Slab | 7. 30mm Marble Finish | 12. 200mm concrete slab extension | 17. 20mm Marble Finish | 22. Aluminium Space Truss Ball Joint | |
| 3b. 300mm Structural Concrete Slab | 8. 70mm Rockwool Insulation | 13. 150mm Rockwool Insulation | 18. High Performance Glazing | 23. High Performance Glass Panel Infills | |
| 4. 200mm XPS Foundation Insulation | 9. Aluminium Window Frame | 14. 70mm High-Performance Insulation | 19. 200mm Thickness Glazing Support Pipe | 24. 200mm External Concrete Wall | |

0 1:50 2.5m

STRUCTURAL STRATEGY

The Museum of Water's structural strategy is driven by performance, durability and sustainability. The hybrid system combining low-carbon concrete, bioconcrete and steel, provides a resilient and efficient structure which supports the museum's form while also enhancing the connection of people with the exhibitions and surrounding landscape, where necessary.

STRUCTURAL OVERVIEW



Low carbon concrete provides durable and thermally stable mass with reduced embodied carbon



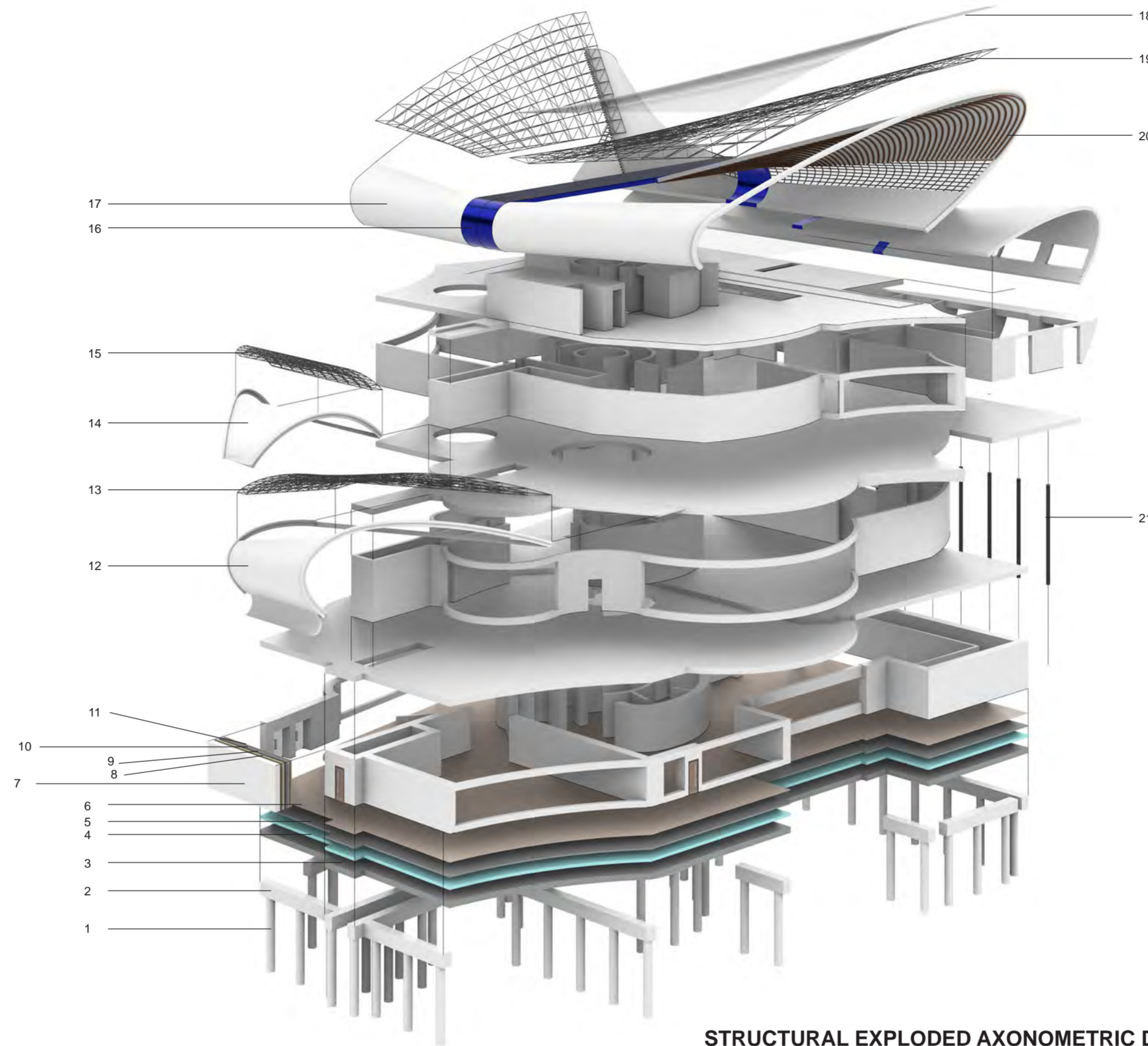
Bioconcrete's interaction with water, promotes self-healing and enhances ecological value



Steel space truss supporting the glazed parametric roof, allowing a much lighter structure, longer spans and much more natural light entering the building.



The building's structure is designed with long term durability in mind.



STRUCTURAL EXPLODED AXONOMETRIC DIAGRAM

KEY

- | | | | | | |
|-----------------------------|-----------------------------|----------------------------|------------------------------------|-------------------------------------|------------------------------|
| 1. Concrete Pile Foundation | 5. Concrete Floor Screed | 9. Concrete Wall Screed | 13. Canopy Steel Space Truss | 17. Curved Concrete Roof Wall | 21. Supporting Steel Pillars |
| 2. Pile Caps | 6. Marble Floor Finish | 10. Marble Adhesive | 14. Small Curved Concrete Canopy | 18. High Performance Roof Glazing | |
| 3. Structural Concrete Slab | 7. Reinforced Concrete Wall | 11. Marble Wall Finish | 15. Small Canopy Steel Space Truss | 19. Roof Steel Space Truss System | |
| 4. XPS Insulation | 8. Rockwool Insulation | 12. Curved Concrete Canopy | 16. Roof Structural Steel Element | 20. Flooded room introduction space | |

MATERIAL STRATEGY

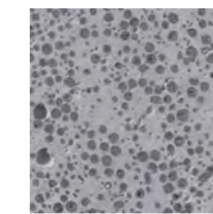
LOW-CARBON CONCRETE



-Significantly lower CO2 emissions compared to traditional concrete, while also maintaining its structural performance (compressive strength, fire resistance and longevity)

-Incorporates recycled or supplementary materials (such as fly ash), reducing resource extraction and supporting circular construction practices

BIOCONCRETE



-Low-Carbon Reinforced Concrete containing living bacteria that promote self-healing when they interact with water (through the production of limestone)

-Ideal for use in water features and exposed surfaces

STEEL SPACE TRUSS SYSTEM

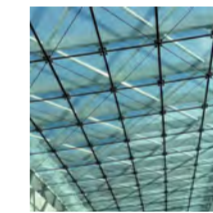


-High strength to weight ratio for long spans

-Precision fabrication for complex geometry

-Fully recyclable

ROOF GLAZING



-High performance glazing to enhance natural daylight, comfort and connection with the surrounding environment

-Reduced reliance on artificial lighting

SUSTAINABILITY



Low carbon concrete and bioconcrete minimise environmental impact

RESILIENCE & DURABILITY



The Museum's structure is strong and robust, combining cores, load bearing walls and a 15m deep concrete pile foundation

RESILIENCE & DURABILITY



Bioconcrete creates an extra layer of connection between the building and its thematology, with the water acting as a functional agent within the structure, rather than just a theme

STRUCTURAL PRINCIPLES

COMPONENT	MATERIAL SYSTEM
STABILITY SYSTEM	Reinforced concrete walls and cores
FLOOR SLABS	Reinforced concrete slab
WALL INSULATION	Rockwool insulation
FOUNDATION	Concrete raft and piles system
FOUNDATION INSULATION	XPS Insulation
WATER EXHIBITION WALLS	Bioconcrete structure
ROOF	Steel space truss system + Glazing

FIRE STRATEGY

The Museum of Water's fire strategy has been designed in accordance with Approved Document B, in order to ensure a safe escape for everyone in case of emergency. Additionally, the main materials used in the construction of the museum are non-combustible -concrete, steel, glass- have been used in order to prevent fire spreading.

FIRE STRATEGY OVERVIEW



Safe means of escape for the museum's occupants (Adequate and enclosed fire protected staircases)



Quick and easy escape from all floors












Emergency suction pump draining water from flooded room, to make escape safer

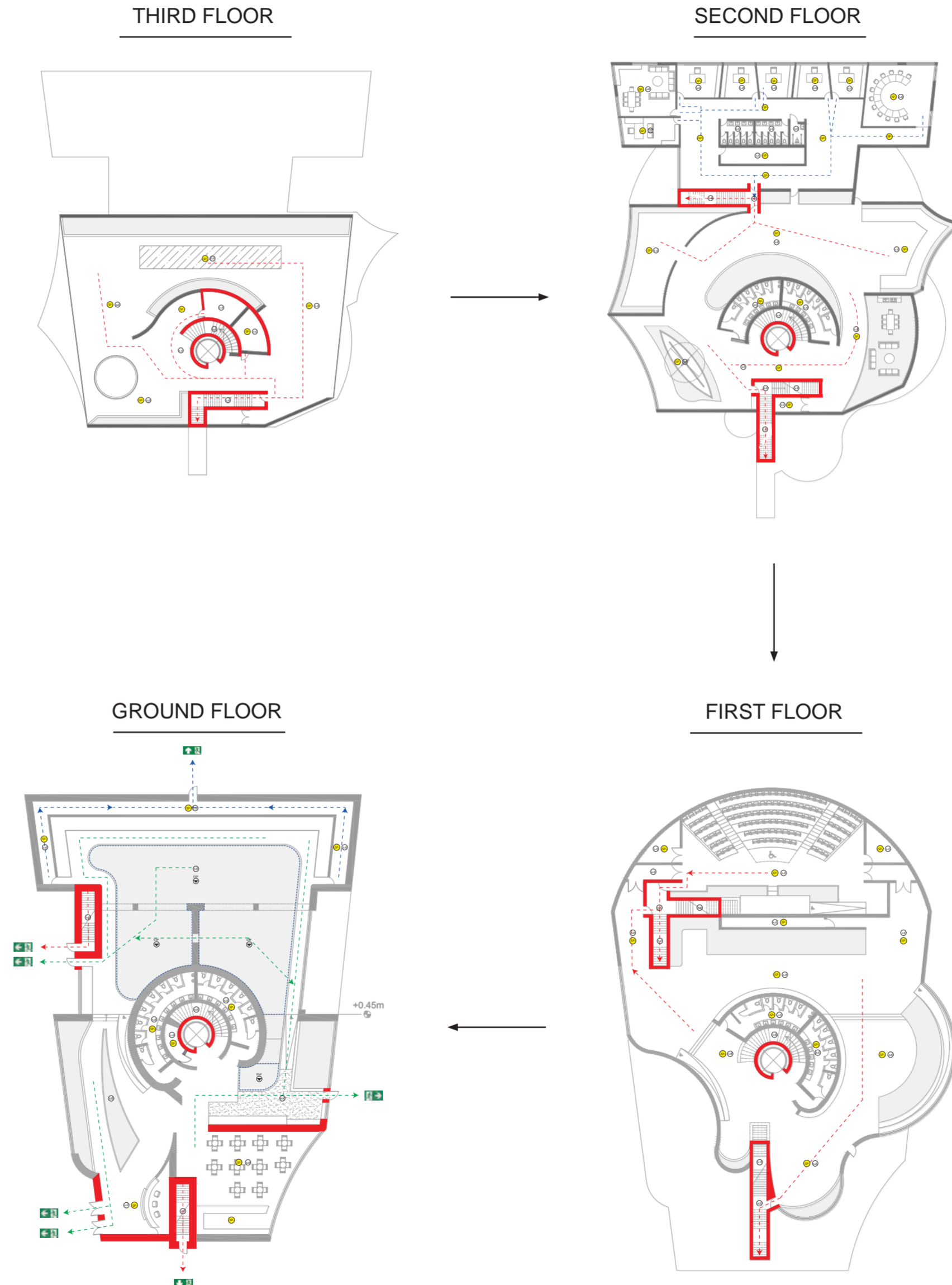


Early detection and warning through smoke detector systems

FIRE STRATEGY PLAN KEY

-  90-minute fire protected wall
-  120-minute fire protected wall
-  Area equipped with emergency water drainage + anti-slip floor
-  Ground Floor Escape Routes
-  Upper Floor Escape Routes
-  Staff-Only Escape Routes
-  Smoke Detector
-  Sprinkler System
-  Emergency Water Suction Pump

FIRE STRATEGY PLANS



FIRE STRATEGY REGULATIONS



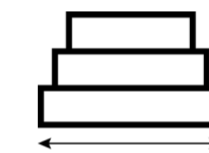
PROTECTED STAIRCASES

All fire escape staircases must be enclosed and protected from fire and smoke, by construction with a minimum fire resistance of 30 minutes (ALL ESCAPE STAIRCASES ARE ENCLOSED IN 120 MINUTE FIRE RESISTANT CONSTRUCTION)



RISERS & GOINGS

Maximum riser: 190 mm (180mm)
Minimum going: 250mm (250mm)



STAIRCASE WIDTH

The minimum width of a staircase should be 1000 mm to allow safe escape (1500 mm)



EASE OF ESCAPE

There should be more than one fire exits in high occupancy floors and escape routes should be clear and protected (All floors except F3 have 2 or more fire escape staircases. The top floor has a low occupancy so a 2nd escape route is not necessary)



SPRINKLER SYSTEM

An automatic sprinkler system is required throughout the building, covering the entire building and especially high fire-risk areas (Sprinklers have been added in the entire building, including exhibition spaces, storage rooms, M&E rooms, the cafe, etc.)



FIRE DETECTION SYSTEM

An automatic fire detection and alarm system with smoke detectors is required throughout the building including exhibition spaces, circulation areas, storage rooms and any other high risk areas (Fire detectors have been added in all required areas)

ENVIRONMENTAL STRATEGY

The Museum of Water's environmental strategy has been developed to maximise daylighting wherever light is necessary, exploit rainwater by collecting it and using it strategically for the museum's water exhibitions, and reduce embodied carbon through the use of sustainable materials.

ENVIRONMENTAL STRATEGY OVERVIEW



Sculpted Form Maximises Sunlight Entering the Building



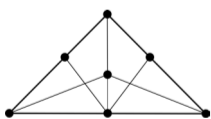
Low carbon concrete provides durable and thermally stable mass with reduced embodied carbon



Bioconcrete's interaction with water, promotes self-healing and enhances ecological value

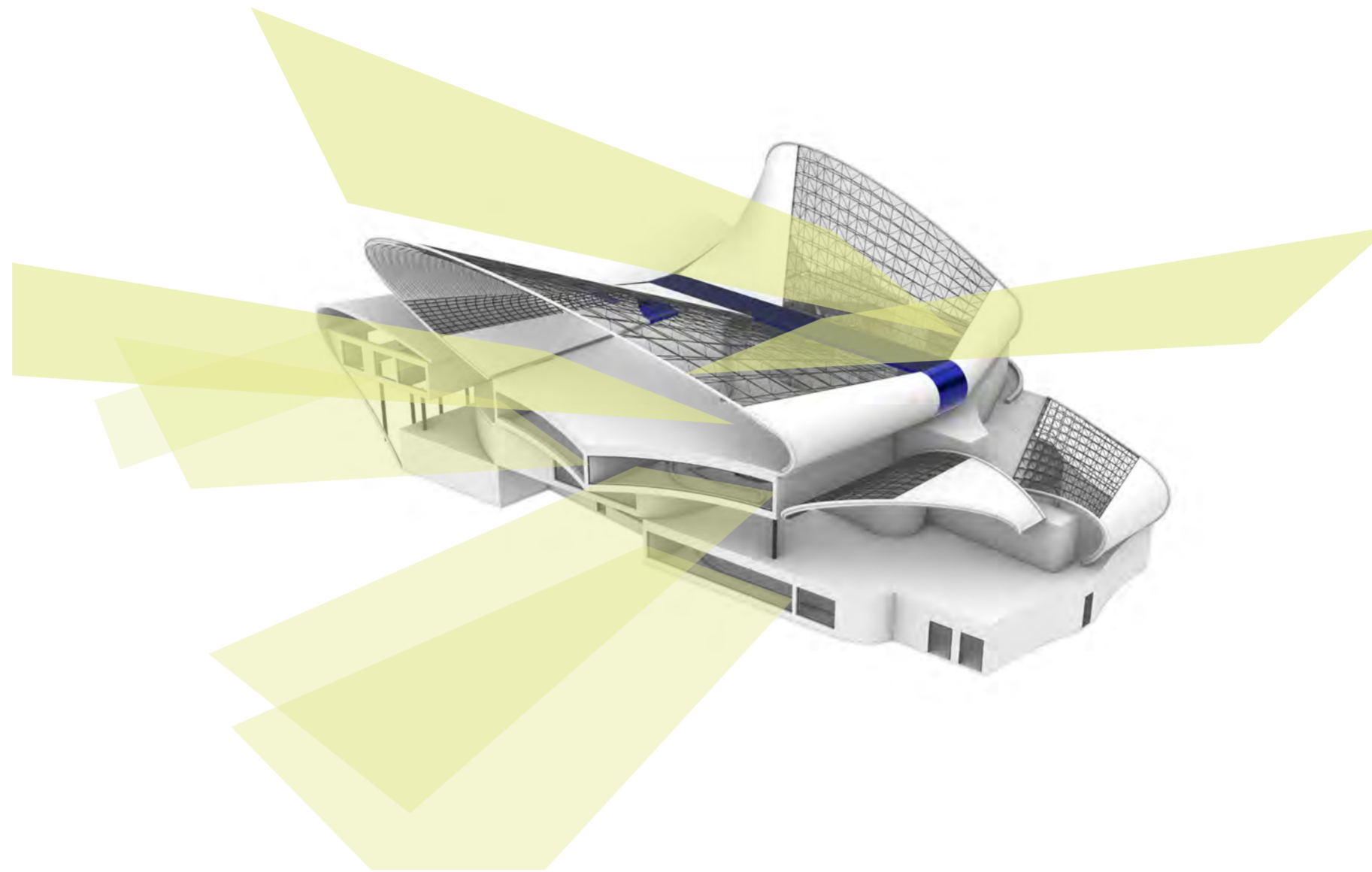


Rainwater is redirected and collected to be used in the water exhibitions of the museum

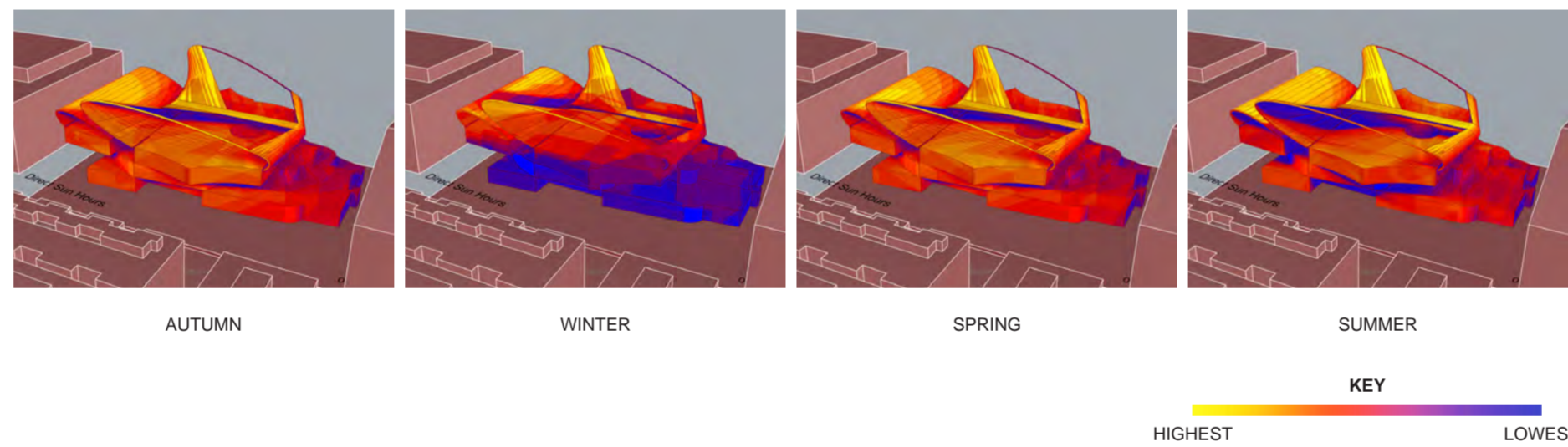


Parametric Roof Maximises Daylight Entering the Building

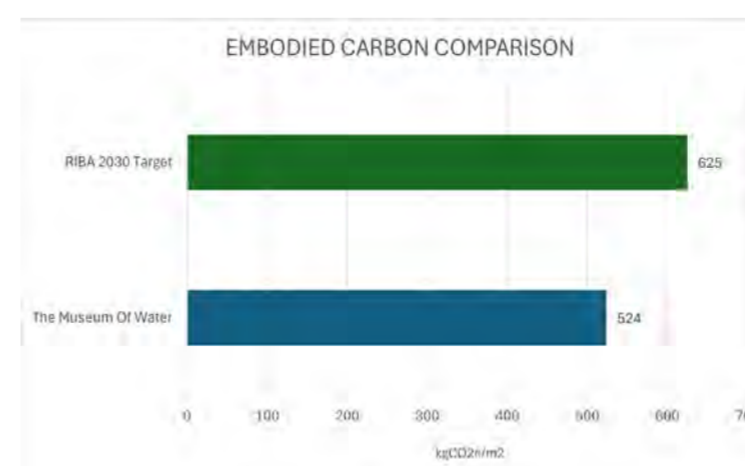
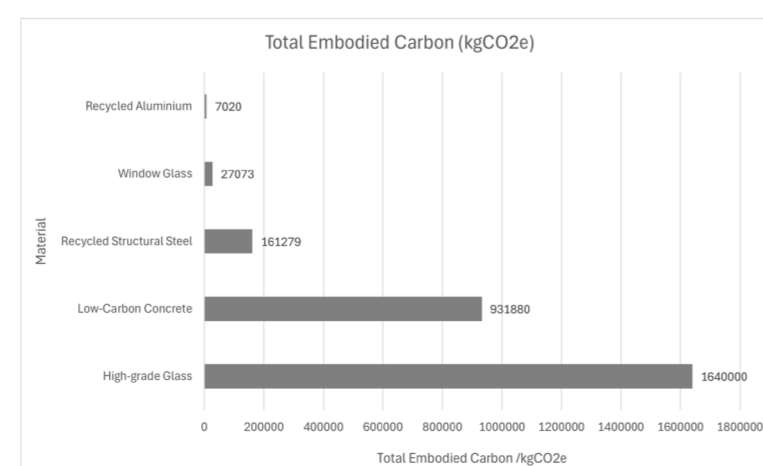
SUNLIGHT ENTERING BUILDING



DAILY SUNLIGHT EXPOSURE

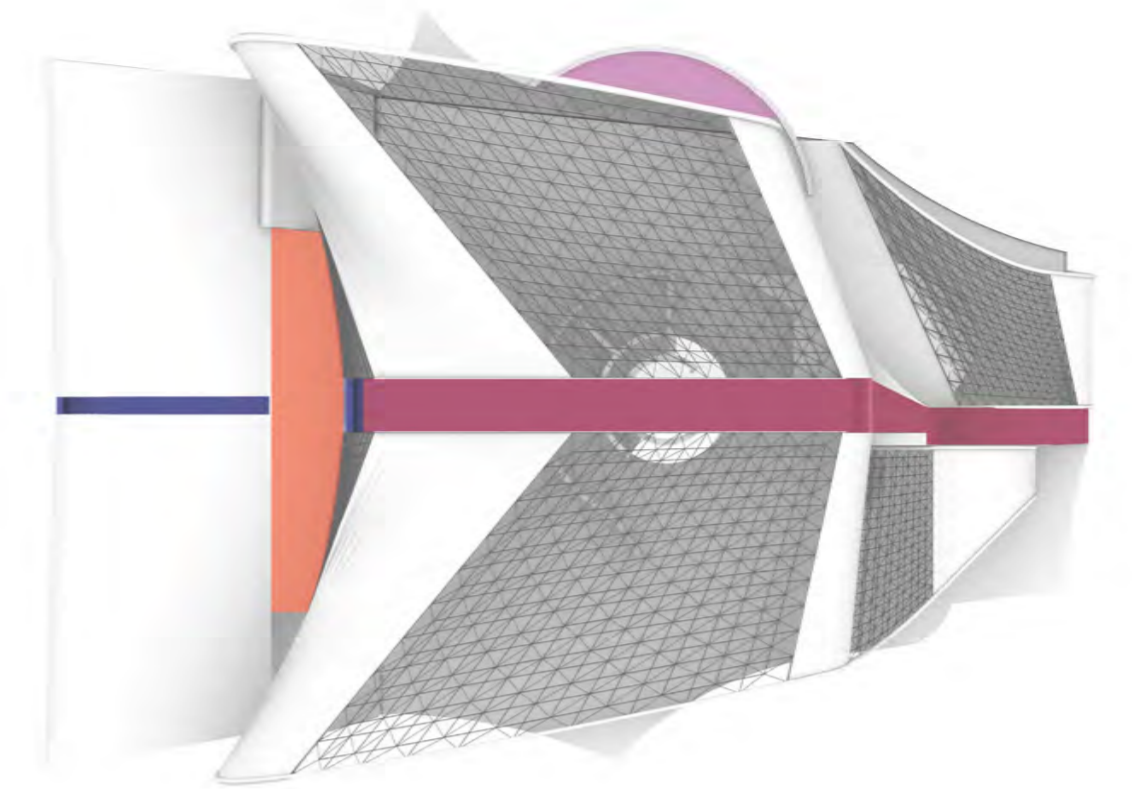


EMBODIED CARBON



16.2% Below the RIBA 2030 Embodied Carbon Target

RAINWATER



STRATEGY 1: WATER REDIRECTING SYSTEM LEADING TO A RAINWATER COLLECTION TANK.

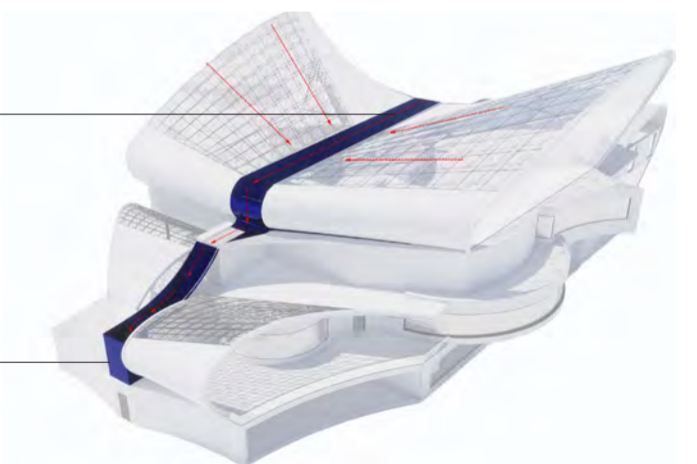
STRATEGY 2: WATER COLLECTING AREA, WITH DRAIN PROVIDING WATER TO THE WATER PLANT ROOM STORAGE.

STRATEGY 2: DRAIN WHICH MOVES WATER TO THE WATER PLANT ROOM STORAGE.

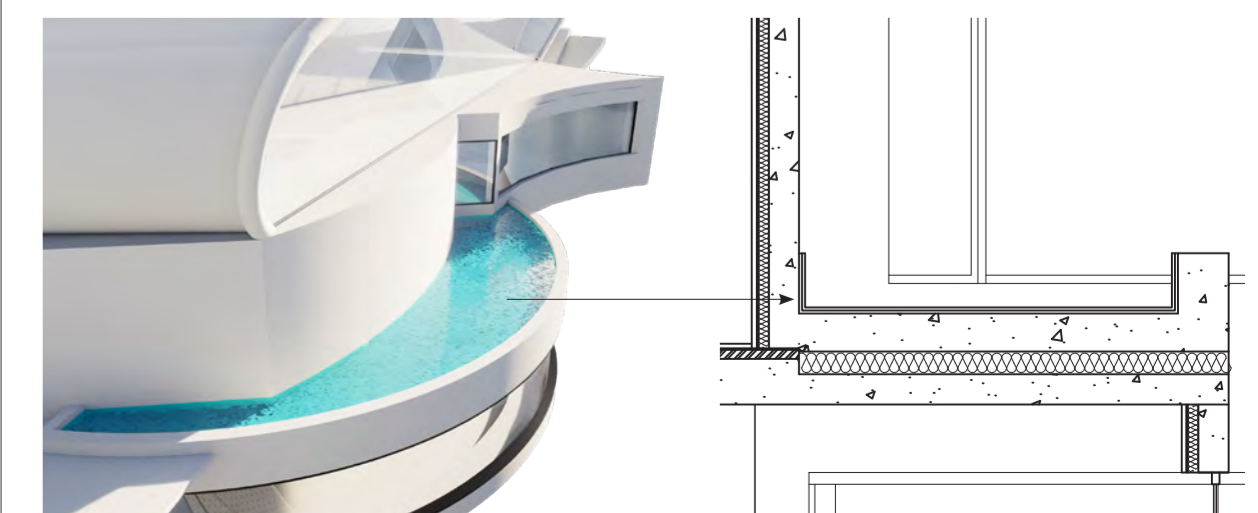
STRATEGY 1

Sloped Guiding Compartment

12t Rainwater Collection Tank



STRATEGY 2



LANDSCAPE STRATEGY

PRECEDENT

FOUNDATION LOUIS VUITTON | FRANK GEHRY

PARIS, FRANCE | 2014



FOCUS: WATER FEATURE LANDSCAPE

The Water Landscape Feature of the Foundation Louis Vuitton in Paris, France extends the fluid architecture of the building into the surrounding site. The water element creates a calm and immersive foreground which enhances light and movement while also guiding circulation and framing views of the building.

KEY COMPONENTS



Reflective Water Surfaces
Create Reflections Which
Enhance the Architectural
Form

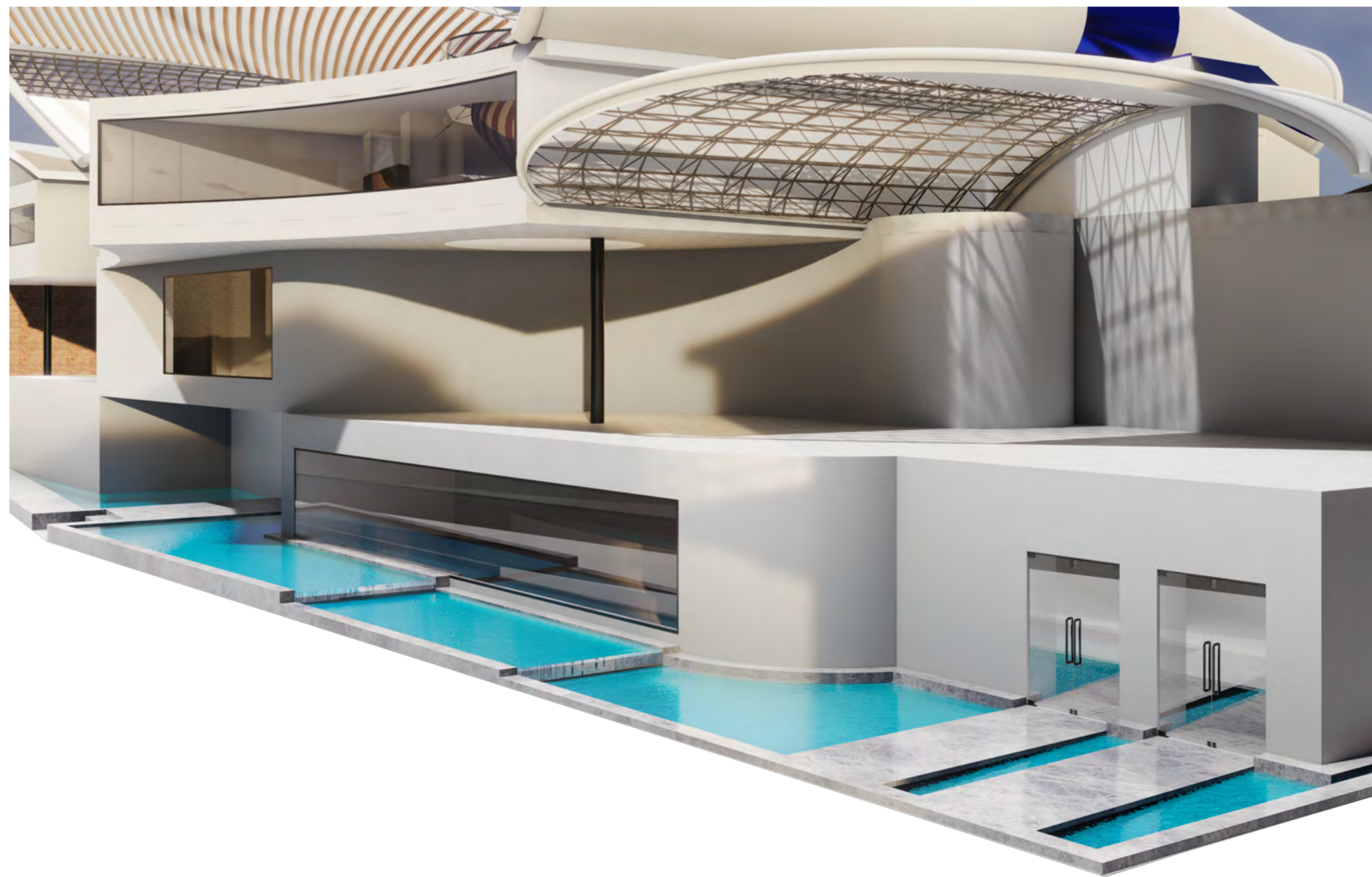
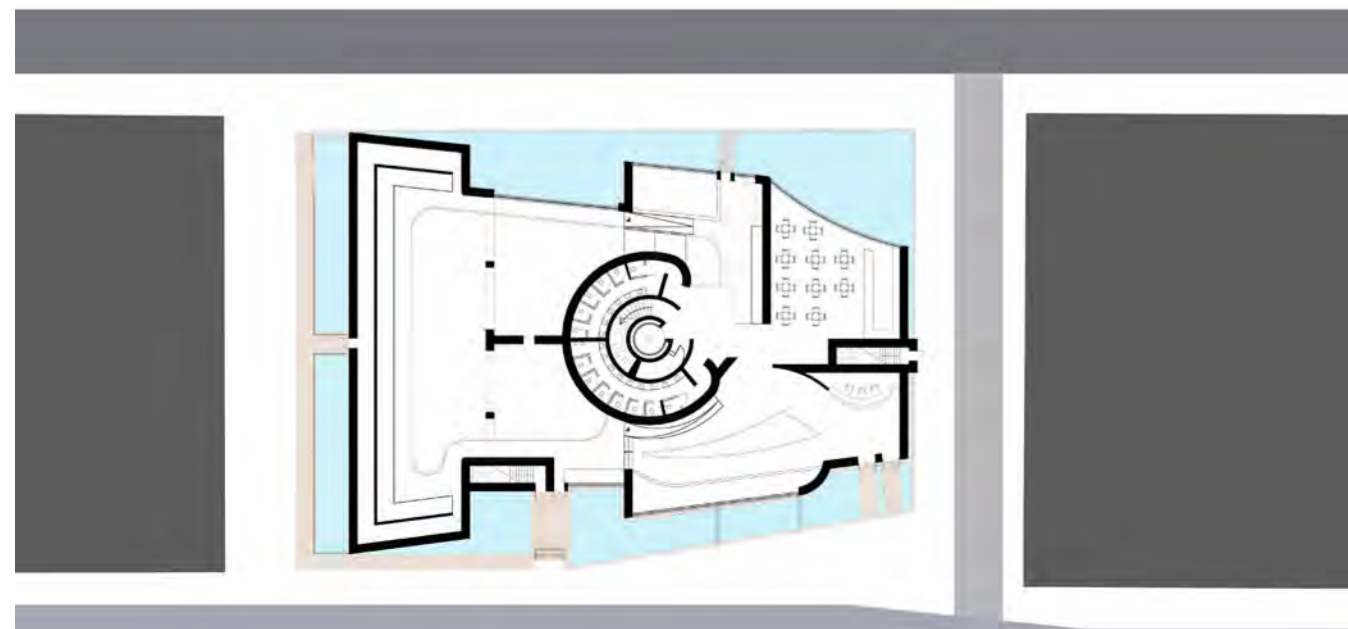


Immersive Sensory
Experience for the
Public



Water Features
soften Transition
Between Built Form
and Landscape

PLAN DIAGRAM



MODEL

