

Final Architecture Design Studio

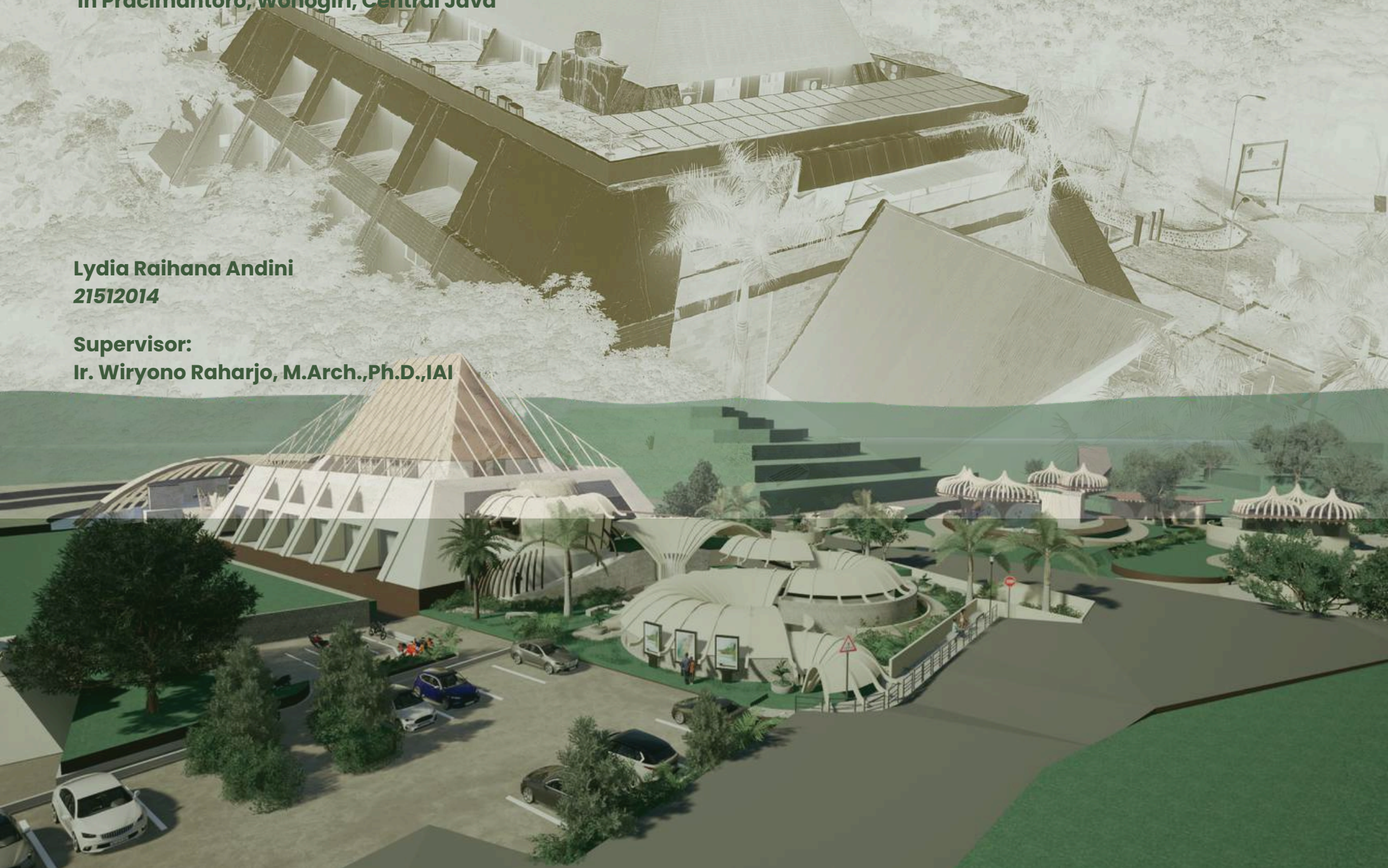


Revitalization of The Indonesia Karst Museum

Reviving Karst Narratives through the Storytelling Architecture and Adaptive Reuse Approach
In Pracimantoro, Wonogiri, Central Java

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UNIVERSITAS
ISLAM
INDONESIA

INTERNATIONAL UNDERGRADUATE PROGRAM IN ARCHITECTURE



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REVITALIZATION OF INDONESIAN KARST MUSEUM

REVITALISASI MUSEUM KARS INDONESIA

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STATEMENT OF AUTHENTICITY

I hereby declare that all parts of this work are my own, except where references are cited. No external assistance, either wholly or partially, has been involved in its creation. I also affirm that there is no conflict of intellectual ownership regarding this work; all ideas and writings contained herein are attributed to the main author and supervisor. The final results are submitted to the Department of Architecture, Universitas Islam Indonesia, for educational and publication purposes

Yogyakarta, August 15th 2025
Author



Lydia Rahana Andini



Validation Page

Final Architectural Design Studio entitled

REVITALIZATION OF INDONESIAN KARST MUSEUM

Reviving Karst Narratives through the Storytelling Architecture and Adaptive Reuse Approach

REVITALISASI MUSEUM KARS INDONESIA

Menghidupkan Narasi Kars melalui Arsitektur Cerita dan Pendekatan Penggunaan Kembali yang Adaptif

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Acknowledge by
Head of Undergraduate Program in Architecture



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PREFACE

The author expresses gratitude to the presence of God Almighty because of His grace and blessings, this architectural design report titled “Revitalization of Museum Karst Indonesia” has been completed successfully. This report is prepared as part of the academic process as well as documentation of the design ideas developed based on issues, potentials, and needs present at the site.

The purpose of this report is to explain the design process, the theoretical foundations, and the design approach, leading to the final results in the form of concepts and architectural designs. It is hoped that this report can serve as a source of understanding regarding the values, functions, and contributions that are intended to be achieved through this design work.

The author received considerable help, input, guidance, and support from various individuals during the preparation of this undergraduate final project. The author wishes to express their appreciation and gratitude to:

1. Allah SWT, for the help and blessing of Allah SWT, the author was able to complete this Bachelor's Final Project as hoped.
2. The author’s parents, Bapak Banu Muzafar Sunanto and Ibu Retno Puspito Rini, have fully supported with love and ensured that the work runs smoothly.
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8. Fellow friends, Diva, Jeni, Bocil, and Jopi, for their support, companionship, and presence throughout the challenging phases of the project.
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10. Friends from the Architecture Class of 2021, including Aye, Azka, Zidan, and others not mentioned individually, for their valuable views, ideas, suggestions, and support throughout the study.

TITLE CLARITY

TITLE

Revitalization of The Indonesia Karst Museum

EMPHASIS

This project focuses on the overall transformation of the Wonogiri Karst Museum through the integration of design that prioritizes user experience with architectural storytelling and adaptive reuse. This approach is designed to create a more interactive, engaging, and sustainable space, thereby increasing tourist attraction and providing a more satisfying experience for every visitor.

DEFINITION

REVITALIZATION	The process of making something grow, develop, or become successful again.
INDONESIA KARST MUSEUM	The museum is located in Wonogiri and has the concept of karst (natural rocks) as the main theme.
STORYTELLING ARCHITECTURE	The art of creating a narrative or a story that is reflected in the design of a building or a space.
USER EXPERIENCE	The feeling users experience when using a product, application, system, or service.
ADAPTIVE REUSE	The process where existing buildings are reused in a different capacity to their original purpose.

ABSTRACT

The Indonesia Karst Museum is one of the educational centers on the karst ecosystem that has high scientific and ecological value. However, in recent years, the museum has experienced a decline in the number of visitors due to a less attractive user experience. This results in the museum area facilities not functioning as they should. Conventional methods of presenting information make the museum feel static and less impressive to visitors. Therefore, a design approach is needed that can increase visitor engagement and experience in a more interactive and immersive way.

This study aims to revive the Indonesian Karst Museum through the integration of storytelling and an adaptive reuse approach. Those are applied to create an interactive, adaptive space that supports deeper visitor exploration. Meanwhile, adaptive reuse is applied to preserve the good elements but also increase the value of the building.

The methods used in this study include analysis of the existing conditions of the museum, literature studies related to user experience in educational spaces, and exploration of storytelling and adaptive reuse as a design approach. The results of this study are expected to produce a museum design concept that is not only more visually attractive, but also more functional and immersive, so as to increase visitor interest and involvement. Therefore, the Indonesia Karst Museum can once again function as an effective education center, while also becoming a more innovative and sustainable environmental conservation-based tourist attraction.

Keywords:

Adaptive-reuse, Karst Museum, Revitalization, Storytelling, User Experience, Education



ABSTRAK

Museum Karst Indonesia adalah salah satu pusat pendidikan tentang ekosistem karst yang memiliki nilai ilmiah dan ekologis yang tinggi. Namun, dalam beberapa tahun terakhir, museum ini mengalami penurunan jumlah pengunjung akibat pengalaman pengguna yang kurang menarik. Hal ini menyebabkan fasilitas area museum tidak berfungsi seperti seharusnya. Metode konvensional dalam menyajikan informasi membuat museum terasa statis dan kurang mengesankan bagi pengunjung. Oleh karena itu, diperlukan pendekatan desain yang dapat meningkatkan keterlibatan dan pengalaman pengunjung dengan cara yang lebih interaktif dan imersif.

Studi ini bertujuan untuk menghidupkan kembali Museum Karst Indonesia melalui integrasi storytelling dan pendekatan reuse adaptif. Pendekatan tersebut diterapkan untuk menciptakan ruang interaktif dan adaptif yang mendukung eksplorasi pengunjung yang lebih dalam. Sementara itu, reuse adaptif diterapkan untuk melestarikan elemen-elemen baik tetapi juga meningkatkan nilai bangunan.

Metode yang digunakan dalam studi ini meliputi analisis kondisi yang ada di museum, studi literatur terkait pengalaman pengguna di ruang pendidikan, serta eksplorasi storytelling dan penggunaan kembali yang adaptif sebagai pendekatan desain. Hasil dari studi ini diharapkan dapat menghasilkan konsep desain museum yang tidak hanya lebih menarik secara visual, tetapi juga lebih fungsional dan imersif, sehingga dapat meningkatkan minat dan keterlibatan pengunjung. Oleh karena itu, Museum Karst Indonesia dapat berfungsi kembali sebagai pusat pendidikan yang efektif, sekaligus menjadi daya tarik wisata berbasis konservasi lingkungan yang lebih inovatif dan berkelanjutan.

Keywords:

Adaptive-reuse, Karst Museum, Revitalization, Storytelling, User Experience, Education



LIST OF CONTENTS

DOCUMENT COMPLETENESS

0.1	Cover Page.....	
0.2	Title Page (2 language versions: Indonesian and English).....	
0.3	Approval Page.....	
0.4	Introduction Page.....	
0.5	Declaration of Originality.....	
0.6	Abstract with 2 language versions in Indonesian and English.....	
0.7	Table of Contents, List of Figures, List of Tables.....	

INTRODUCTION

		2
1.1	Design Premise.....	3
1.2	Project Title.....	4
1.3	Background.....	5
1.4	Design Problem Study.....	7
1.5	Problematique.....	15
1.6	Methodology.....	16
1.7	Design Constraints.....	17
1.8	Precedents.....	23

PROBLEM STUDY

		28
2.1	Study of Location, Site, and Context.....	29
2.2	Site Analysis.....	41
2.3	Study of Building Typology.....	53
2.4	Study of Design Approach.....	54
2.5	Process of Gathering Data.....	57
2.6	Existing Condition.....	58
2.7	Design Issues.....	64
2.8	Design Guidelines.....	76

DESIGN PROBLEM SOLVING

		80
3.1	User and Activity Flow Analysis.....	81
3.2	Karst Museum Programming.....	83
3.3	Design Concept.....	87
3.4	Initial Concept.....	88

LIST OF CONTENTS

ANALYSIS AND RESPOND	90
4.1 Room Arrangement.....	91
4.2 Zoning Alternatives.....	93
4.3 Design Exploration.....	95
DESIGN DESCRIPTION	104
5.1 Master plan.....	106
5.2 Entrance: Tembus Cave Zone.....	107
5.3 Main Museum Building.....	109
5.4 Parking Area.....	117
5.5 Water in Karst Zone.....	123
5.6 Karst Value Zone.....	129
EVALUATION & REFLECTION	138
6.1 Design brief notes.....	139
6.2 Comprehensive notes.....	140
6.3 Final defense notes.....	142
ATTACHMENT	
BIBLIOGRAPHY	



01 **INTRODUCTION**

DESIGN PREMISE

The revitalization of the Indonesian Karst Museum aims to transform a static museum into a dynamic educational space focused on user experience. Through the application of storytelling architecture, the layout and collections will be arranged narratively so that visitors can understand the process of karst formation, its ecological values, and its connections to the lives of the community. The optimization of facilities and improvements in circulation are carried out to create a clearer, more efficient, and immersive visit flow. Thus, this museum not only serves as a repository for collections but also as a center for education, conservation, and community empowerment in accordance with geopark principles.

PROJECT TITLE

Revitalization of Indonesian Karst Museum in Pracimantoro

Revitalization

Revitalization in the context of architecture is an effort to revive, enhance the quality, and optimize the functions of buildings or areas that have experienced a decline in condition, both physically, functionally, and in social-cultural value. This process is carried out by repairing, adjusting, and integrating new architectural elements without removing the identity, historical value, and original character of the building or area.

Karst

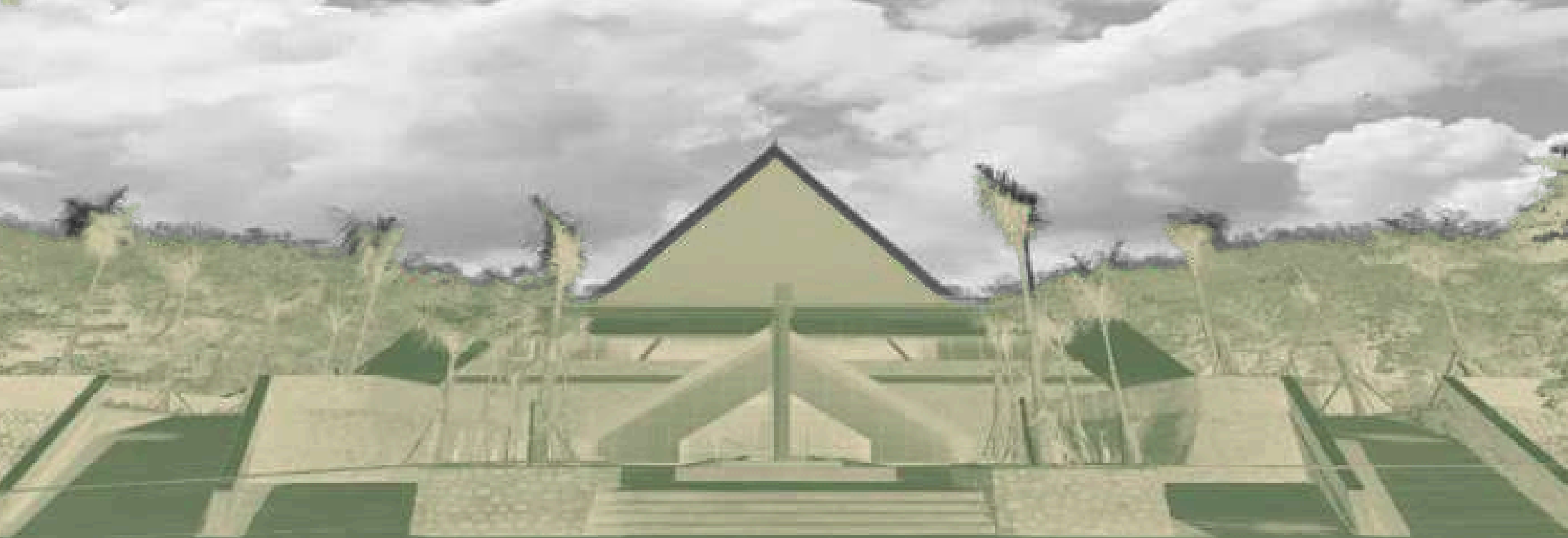
Karst is a landscape formed from the dissolution of carbonate rocks (such as limestone and dolomite) that occurs over a very long period. This geological process creates characteristic morphology in the form of caves, sinkholes, underground rivers, limestone hills, and unique barren landscapes. Karst areas hold significant value not only from a geological perspective but also from ecological, hydrological, archaeological, and cultural aspects. In the context of Indonesia, karst areas serve as water reserves, habitats for biodiversity, and living spaces for local communities that depend on their natural resources.

Museum

The museum is an institution that functions to collect, preserve, research, communicate, and exhibit both cultural and natural heritage, whether material or immaterial, for the purposes of education, research, and recreation for the community. In the context of the Indonesian Karst Museum, the museum not only serves as a storage and exhibition space for geological collections related to karst areas, but also acts as a medium for education, research, and a means of preserving knowledge about the geological, ecological, social, and cultural values inherent in karst landscapes. Therefore, the Karst Museum functions as a public learning space as well as a center for interpretation that connects the community with the natural wealth of Indonesia's karst.

Pracimantoro

Pracimantoro is a district in Wonogiri Regency, Central Java, which is known as the center of the Sewu Karst area that stretches to Pacitan (East Java) and Gunungkidul (Yogyakarta). This region has a distinct geological character of limestone hills, caves, and underground rivers, making it an important part of the world's geological heritage. In the context of revitalizing the Indonesian Karst Museum, Pracimantoro is considered strategic because of its location in the middle of the karst area, allowing the museum to serve as a center for education, research, and scientific tourism that represents the natural wealth, ecology, and culture of the Indonesian karst community.



BACKGROUND

The Indonesian Karst Museum is the only Karst Museum in Indonesia, which is the largest in all of ASEAN. This museum is located in the Gunung Sewu geopark area, precisely in Pracimantoro district, Wonogiri. The reason for its construction is because it is the middle point of the karst area which is spread between the gombong karst area until pacitan karst area. This museum was built as a geological education center. The museum has existed since 2009 when it was established by President Susilo Bambang Yudhoyono. Initially, the museum was under the management of the central government. But then it was donated to the Wonogiri regional government in 2022.

Many visitors expressed their opinions regarding the comfort while in the museum. The results of a study conducted by Anggraeni (2017) stated that 76% of tourists experienced discomfort in the use of facilities and services in museums were still inadequate. It includes the museum's spatial layout that does not meet the expectations of visitors and monotonous museum collection objects that make visitors bored and saturated. This is also evidenced by the duration of tourists who arrive, which are completed in less than 20 minutes. The unclear circulation also makes them more likely to read information boards randomly.

Karst areas have a strong narrative related to their natural processes. Starting from the process of formation, its ecological function, to the life of the people in it. The collection in the museum is too static and does not meet a narrative that it wants to tell. The placement of the collection is not sorted as a story process from start to finish. This makes the experience that users get less. The narrative related to the many types of rocks, karst elements, caves should be able to be used as inspiration for museums to be able to tell their own stories so that they are more immersive.

The abundance of facilities in the abandoned museum area is caused by the waste of functions that are not needed by the museum. The Gunung Sewu geopark area applies three main principles which are conservation, education, and community empowerment. However, the museum, which represents the karst area, has not optimally implemented these principles. This becomes the basis for the need for revitalization so that the museum can have an efficient function with a more engaging user experience.

Therefore, the collaboration between storytelling and adaptive reuse is expected to be a solution to museum revitalization. So that museums become more functioned and emotionally close for visitors. That way, a strong narrative will be owned by the museum and the experience that visitors get will be more imprinted.



Muhammad Usman

Local Guide · 26 reviews · 48 photos



★★★★★ 7 months ago

The place is actually very good for educating children about geology, but the place is quite quiet, maybe there's not enough promotion, there are also lots of caves to explore, maybe in the future several places can be repaired and upgraded so they can be busy again...



Julia Pertiwi

8 reviews · 5 photos



★★★★★ a month ago

The place is a bit damp and poorly maintained. Some air conditioners don't work. Hopefully more Indonesian people will visit the museum.



Endang Antarwati

Local Guide · 49 reviews · 156 photos



★★★★★ a year ago

The Kars Museum is located adjacent to the Gunung Sewu Geopark so the entire area is fairly large.

The museum is neat and tidy, cool because all the air conditioning is operating. The gallery is very educational, very suitable for study visits, both for student groups and the general public.

Unfortunately, during the 2.5 hours we were there, there were no other visitors.

Apart from going to the museum, take the time to explore several of the surrounding karst caves. Because at that time we brought the elderly and small children, so we only had time to visit Tembus Cave, which is well maintained.

Visited on
Weekend



Ilham Guntara

Local Guide · 226 reviews · 1,708 photos



★★★★★ 5 years ago

Emergency, the Karst Museum is now poorly maintained. Unlike 6 years ago when I came here it was still good. But now it looks poorly maintained. Some displays are broken, interactive screens don't work, and so on. It seems the government should pay attention. Actually this is a good museum and good prospects for educational tourism.

Translated by Google · [See original \(Indonesian\)](#)

WHAT THE VISITORS SAID



Slamet Sutono

Local Guide · 267 reviews · 556 photos

★★★☆☆ 3 years ago

1. Because it is in a karst area... it should be a special interest tourist attraction.

2. So that the existing infrastructure needs to be planned and not impressed as long as it is built

Translated by Google · [See original \(Indonesian\)](#)



andika rahmadi

Local Guide · 65 reviews · 133 photos



★★★★★ 2 years ago

The location is wide open... there must be connecting access between one location and another. I was also disappointed that I couldn't go to many of the cave locations because I had to track them and the distance was too far... maybe that's what makes visitors lazy and quiet... for the medicine museum disappointed maybe yes

Translated by Google · [See original \(Indonesian\)](#)

DESIGN PROBLEM STUDY

Project of City Branding in Wonogiri

Wonogiri as a Tourism City



Since 2023, the Wonogiri government has had a city branding project. It is no longer just the Gaplek city, but it aims to represent Wonogiri through its tourism potential. The Head of BAPPEDA, Heru Utomo, stated that previously, Wonogiri did not have a branding. According to him, Wonogiri lacks a unique regional identity that can attract people's attention. In fact, Wonogiri tends to be perceived as an area that is not potential to visit compared to other areas in Soloraya. However, its potential is quite extraordinary with the existence of reservoirs, mountains, sea, coffee, livestock, and others. Yet, it is only known as the Gaplek City or the Dry City.

Currently, the government is reviewing tourism, trade, industry, and even transportation. This has led to the creation of a city branding, namely Wonogiri, The Inspiring of Java. The government hopes that the city branding project can attract local and international visitors to come to Wonogiri, thereby positively impacting the residents' economy. The government is integrating tourist destinations and transportation. The regional secretary suggested that feeder transport should be provided for those arriving by train and bus.

Museum Karst Indonesia

Economic and Development Assistant of Wonogiri Regency, Fransiscus Xeverius Pranata, said that the tourism sector is the main focus in city branding Wonogiri because this region has very complete potential, ranging from mountain tourism, reservoir water, to beach resorts. This makes it the only area in Soloraya with complete tourist attraction potential.

"We have a complete offer, for highland tourism we have Bulukerto to Girimarto on the slopes of Lawu, there's also WGM, **as well as the Geopark Gunungsewu area**. And it should be noted that we also have an exotic beach in Paranggupito," said Pranata.

The Importance of
KARST ECOSYSTEM



In 1997, the World Commission on Protected Areas (WCPA) as a commission under the auspices of the International Union for Conservation of Nature (IUCN) has encouraged the protection of karst ecosystems around the world with several considerations. Considerations related to ecology are that karst is a habitat for rare flora and fauna; karst as an area of rare minerals (non-renewable) and has a unique landscape.

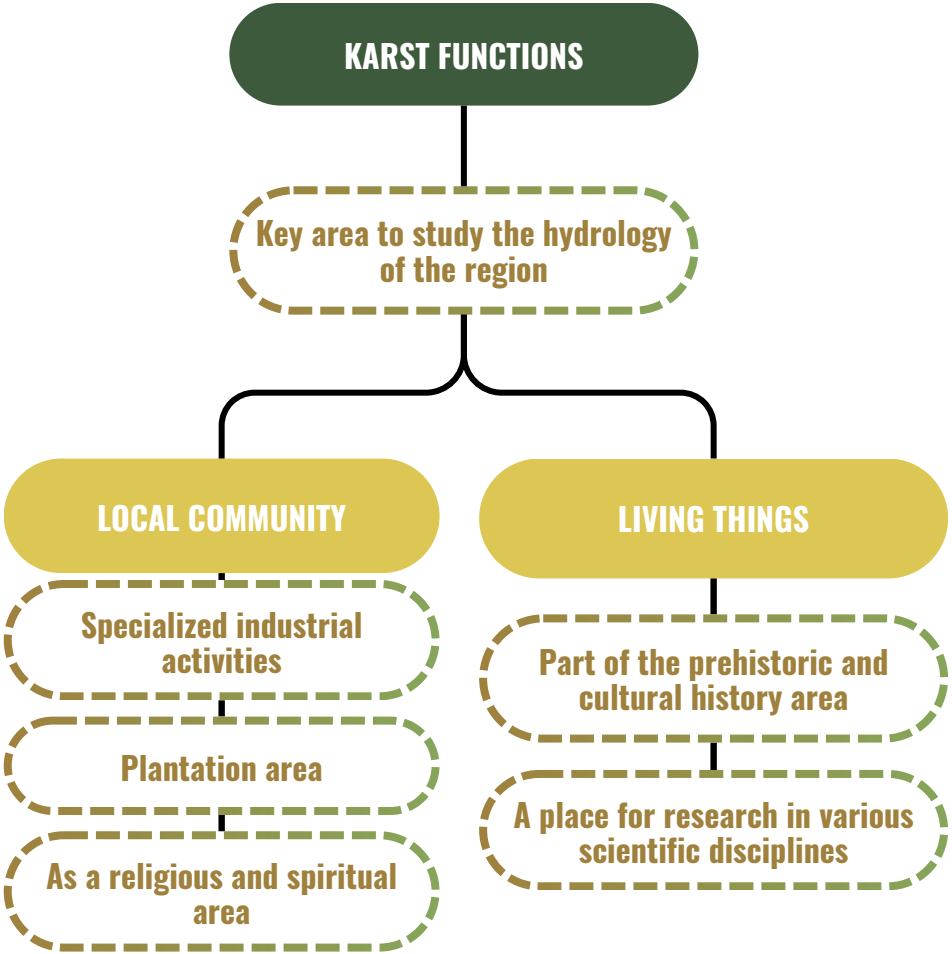
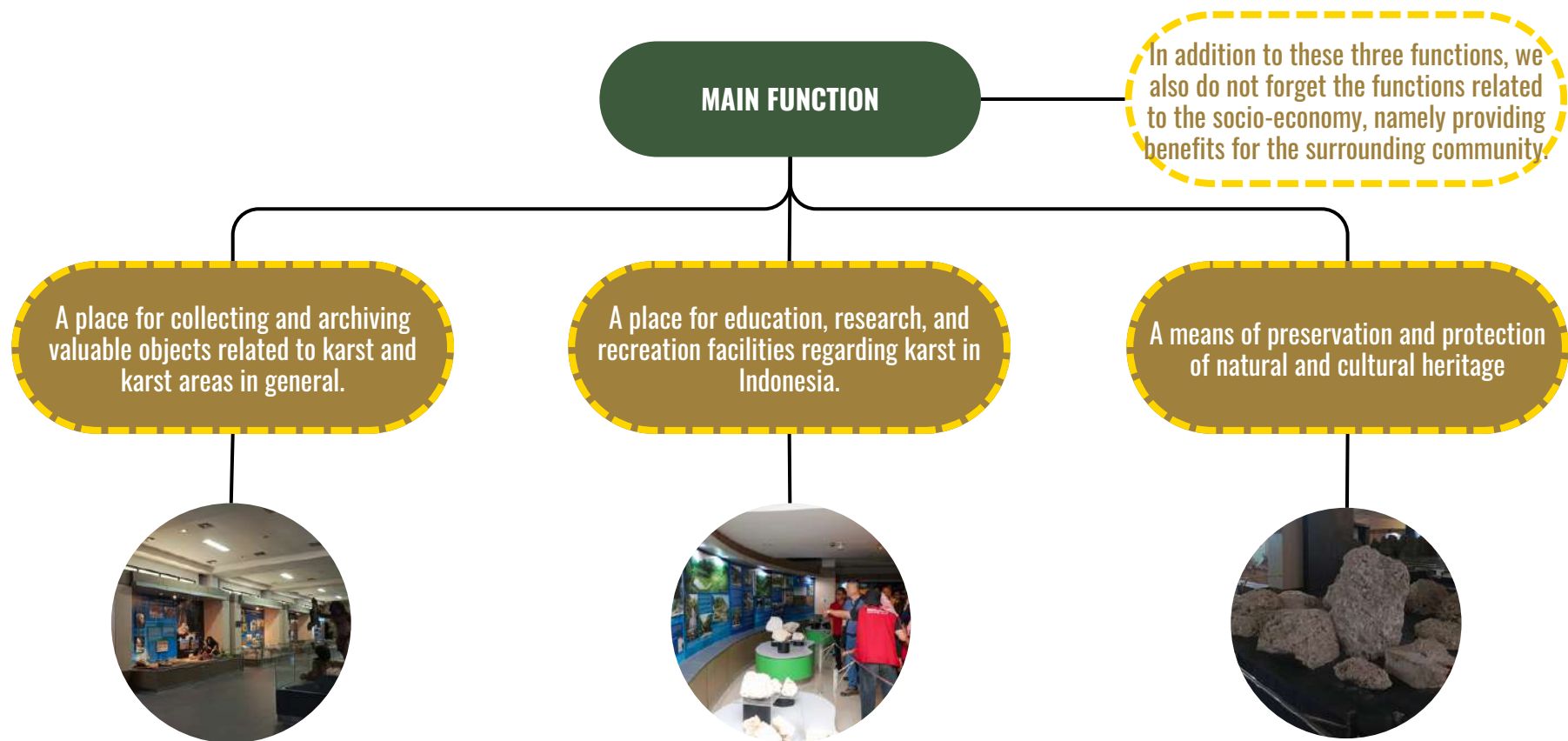


Diagram of The Importance on Karst Ecosystem
Source: Author



Zoning of
KARST MUSEUM AREA



EXISTING MUSEUM BUILDING

NON-ARCHITECTURAL ISSUES

SOCIAL

Lack of public interest in museums

Lack of involvement of local communities

ECONOMY

Dependence on government subsidies

Unfacilitated street vendors, abandoned canteens and souvenir shops

ECOLOGY

Museums are not yet completely environmentally friendly

Threat of damage to karst ecosystems

ARCHITECTURAL ISSUES

01

Visitor circulation is not optimal, the layout of the museum arrangement

02

Museums make less use of existing karst potencies as part of the exploration experience

03

Lack of experience

04

Many areas are abandoned and infrastructure is damaged

PROBLEMATIQUE

BACKGROUND

The Indonesian Karst Museum was established to educate visitors about Indonesia’s unique karst landscapes and their ecological significance. However, the lack of user experience is happened due to several reasons. Museums also lack the role of a space for the local community, even though museums have the potential to become a center for experimental karst education. The museum needs a revitalized approach to remain relevant, engaging, and increasing the experience.

GENERAL PROBLEM

The museum struggles with low visitor engagement, **passive learning experiences**. To revive it, immersive storytelling within the building must be integrated to enhance education, visitor experience, and related to the context.

SPECIFIC PROBLEMS

- 1.How to create an immersive and spatial experience through storytelling architecture?
- 2.How to reuse existing building elements in an adaptive way (adaptive reuse) without damaging the local context and identity?
- 3.How to design plots and showrooms that are able to raise karst narratives as important environmental and cultural issues?

GOALS

Improve **visitor experience** to be more functional, comfortable, and attractive to various groups of visitors.

Revitalize museum facilities through adapting the abandoned space into the part of museum narration.

Integrate **storytelling** to make the museum able to tell about karst ecosystem not in passive way.

Make the museum a more engaging and effective educational center in collaborating with the communities.



Mind Map Diagram
Source: Author

METHODOLOGY

Architectural Storytelling Approach

Architectural storytelling is an architectural design approach that uses space, form, materials, and visual elements to convey a certain narrative or meaning to its users. In short, it is a way to create buildings that are not just functional, but also tell a story such as about culture, history, identity, or a vision for the future through the experiences felt by people when they are in or looking at it.

Data Collection Method

Primary Data

Primary data was collected using field observation and interviews with the museum stakeholders. Primary data was collected in the form of existing sites and issues experienced by the karst museum area.

Secondary Data

Data collection is carried out through previously available sources, such as literature, archives, maps, photos, climate data, and previous study reports, to support contextual analysis and design.

Design Approach Method

The design approach is carried out after observation and literature review which then found the design problem. This design includes:

- 1 Designing the spatial layout, visitor flow, that encourage active participation, exploration, and immersive learning about karst landscapes.
- 2 Providing flexible areas for local community activities, temporary exhibitions, and workshops, so that the museum functions as a social space and a center for shared knowledge.
- 3 Using an architectural storytelling approach to build a narrative that flows from the geological, ecological, to the socio-cultural context of Indonesia's karst, so that visitors can connect emotionally.

Matrix of Design Thinking

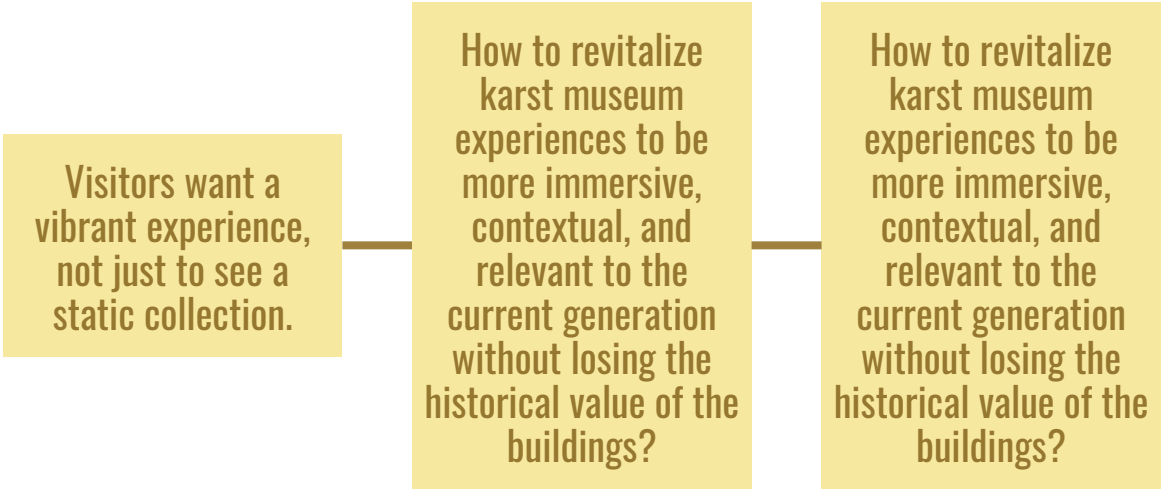
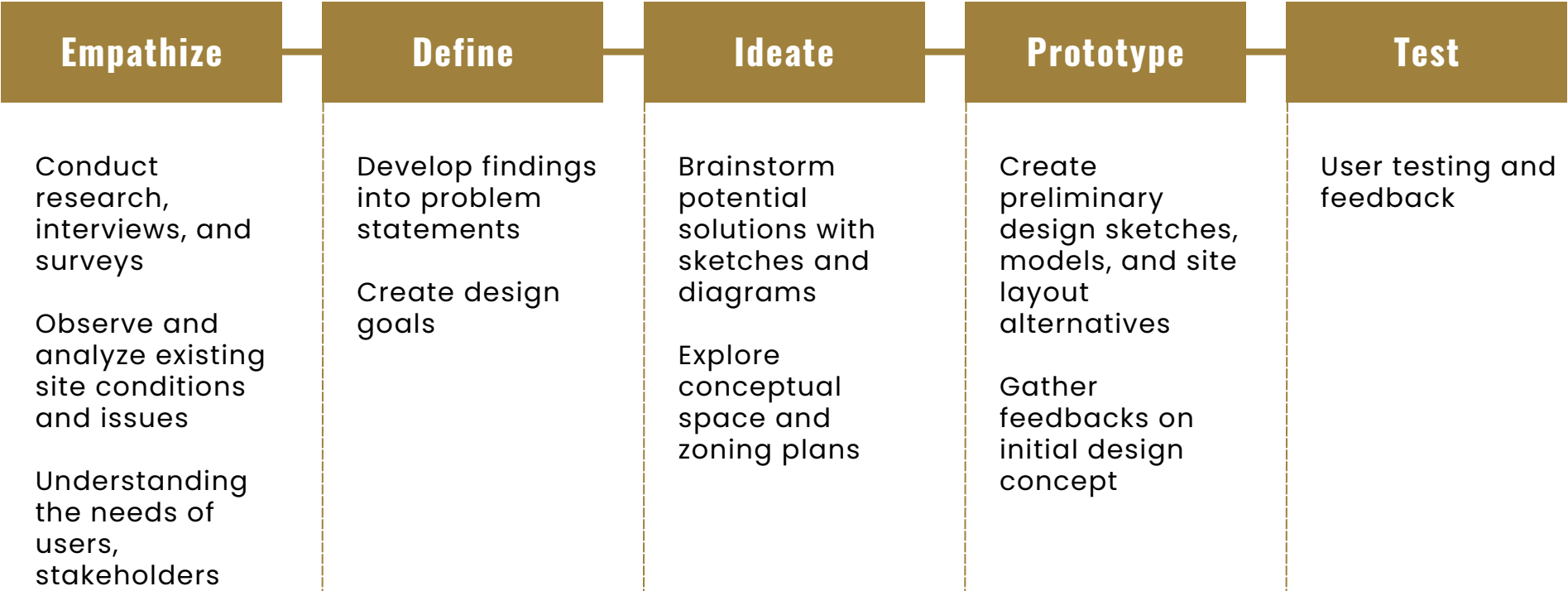
DESIGN CONSTRAINTS	RADICAL	SYMBOLIC	FORMAL	PRACTICAL
Regulator:	Maintaining the preservation of buildings in accordance with the regulations for the preservation of cultural heritage sites or geological areas (Geopark).	Buildings must continue to represent geological heritage and local identity.	The structure of the building must not be drastically changed, it must still comply with the original spatial layout and facade.	Accessibility, building security, and energy efficiency must meet national standards.
User: Local population, public users?	Desire for changes that create a more vibrant, educational, and relevant museum for the present time.	Hoping that the museum can raise awareness of the importance of karst areas and local culture.	Wanting clear navigation, comfortable space, and a layout that is not confusing.	Needs complete facilities: toilets, sitting area, children's education area, etc.
Client: BAPPEDA Wonogiri DISPORA	Want new branding and social-economic impact for the region, including tourist attraction.	Wanting the building to become a pride landmark of the region with educational and symbolic value.	Need a cost-effective design solution that still looks professional and modern.	Aiming for an increase in visitors and efficient long-term maintenance.
Designer: The Architect	Designing with an adaptive reuse approach and storytelling architecture to create meaningful transformation.	Designing spatial narrative elements and immersive experiences to depict Karst characters.	Redesigning zoning, circulation, and spatial structure to be more humane and to flow narratively.	Improving the dead space into functional space.

TABLE OF ABDUCTIVE REASONING

WHAT?	HOW?	VALUE
The museum does not attract visitors because the zoning is confusing and there is no strong narrative.	Redesigning zoning based on spatial storytelling that follows the sequence of Karst geological processes.	Enhancing understanding, experience, and educational appeal for visitors.
The lack of basic facilities (toilets, signage, seating areas) and low accessibility.	The addition of public facilities in an integrated manner and universal design.	Increasing comfort and inclusivity for all layers of society.
Visitor circulation is chaotic, there is no clear starting/ending point.	Designing a visitor flow based on a narrative with a clear 'entrance-experience-exit' system.	The visitor's experience becomes coherent, deep, and more memorable.
Ventilation and natural lighting are not optimal due to the old closed design.	Opening new ventilation points strategically and strengthening relationships with the surrounding karst landscape.	A healthier, brighter space that strengthens the relationship between the inside and outside of the building.
There are no social spaces that can accommodate community or educational activities.	Adding multifunctional public spaces (workshop room)	The museum becomes a center for community activities and active education, not just a passive space.
The museum is quiet with visitors, less relevant to the young generation.	Revitalization of space programs with an interactive and experience-based approach (experience-based museum design).	Engaging young generations and increasing community participation.

design method

DESIGN THINKING DIAGRAM



EXCELLENCY, ORIGINALITY, & NOVELTY

PROJECT TITLE	LESSON LEARNED	DIFFERENCE
The museum does not attract visitors because the zoning is confusing and there is no strong narrative.	Redesigning zoning based on spatial storytelling that follows the sequence of Karst geological processes.	Enhancing understanding, experience, and educational appeal for visitors.
The lack of basic facilities (toilets, signage, seating areas) and low accessibility.	The addition of public facilities in an integrated manner and universal design.	Increasing comfort and inclusivity for all layers of society.

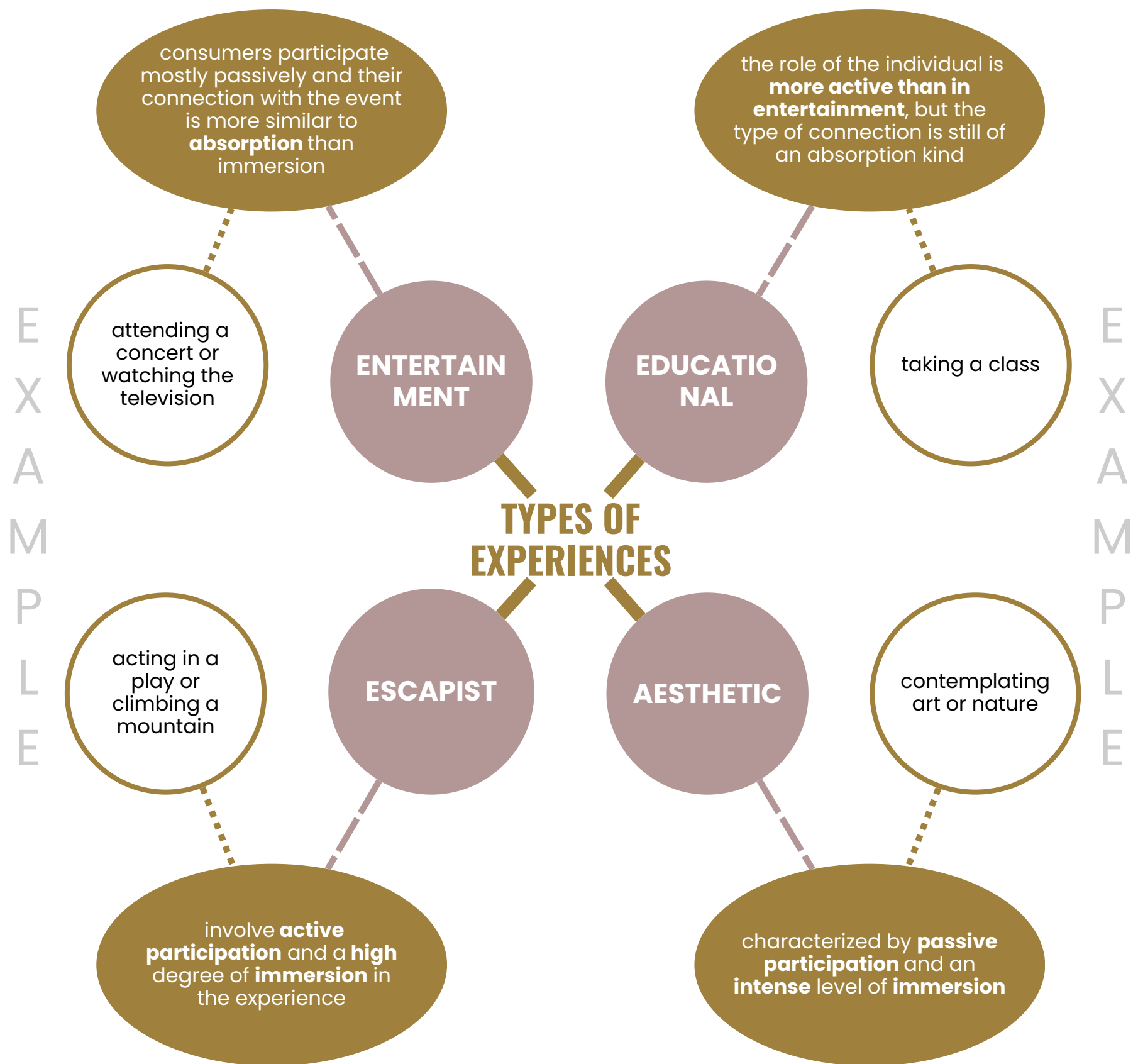


Diagram of Experience Types
Source: Vitiello (2017)

EXCELLENCY, ORIGINALITY, & NOVELTY

Principal from Handbook

Implementation for revitalization

Preserving geological heritage and karst features while raising public awareness

Turn technical information into an educational experience that is easy for the public to understand.

Explains the real benefits of karst areas for human life: clean water, biodiversity, microclimate regulation.

Involve the surrounding community in the preservation and management of kars.

- Present original objects or replicas of karst features (rocks, speleothem, dolina, polje) with an explanation of the importance of preservation.
- Create an educational zone about threats to kars (illegal mining, groundwater pollution, climate change).

- Design the narrative flow of the exhibition that starts from general phenomena and then enters into local specifics (for example: Kars Dunia → Kars Indonesia → Kars Wonogiri).
- Use interactive media: AR/VR, audio-visual, tactile maps, 3D models of caves.

- Creating an exhibition about karst as a water source (with real examples in Wonogiri or Pracimantoro).
- Provide a simulation experience of how karst ecosystems support agriculture or local life.

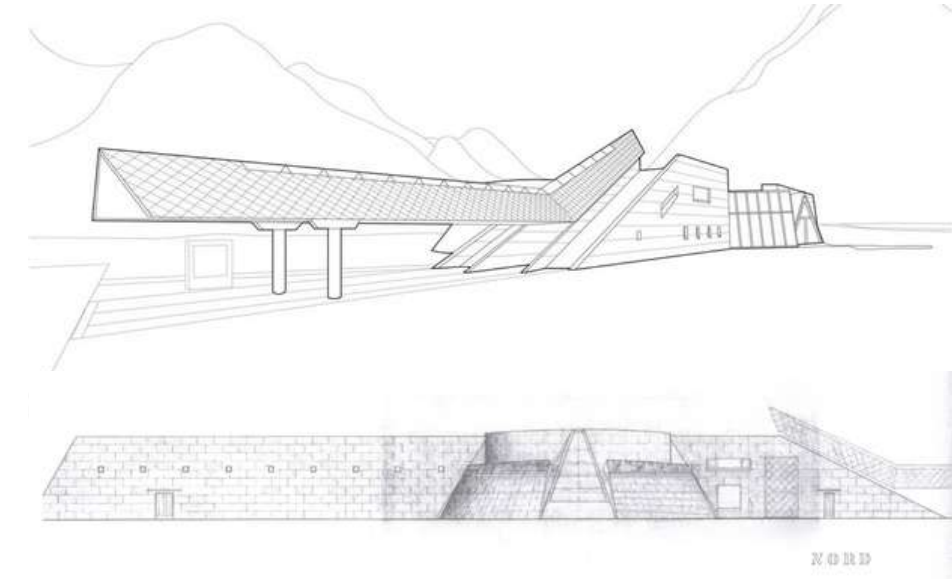
- Open a community space within the museum for discussions, workshops, or citizen exhibitions.
- Creating educational programs for local school children about the importance of kars.

Concept

The Norwegian Glacier Museum opened in 1991 with the aim of **collecting, developing and disseminating knowledge about glaciers and the climate**. The concept of the museum is to **convey the feeling of having been conceived by the glaciers that surround it and add to its history**. The sense of place and belonging are present as if through its access you enter the glacier and your ice envelops you. Critics of the Norwegian Glacier Museum say it looks like an air raid shelter or a military bunker, but architect Sverre Fehn selected the rugged gray concrete to harmonize with the mountains and glaciers of Fjaerland.

Spaces

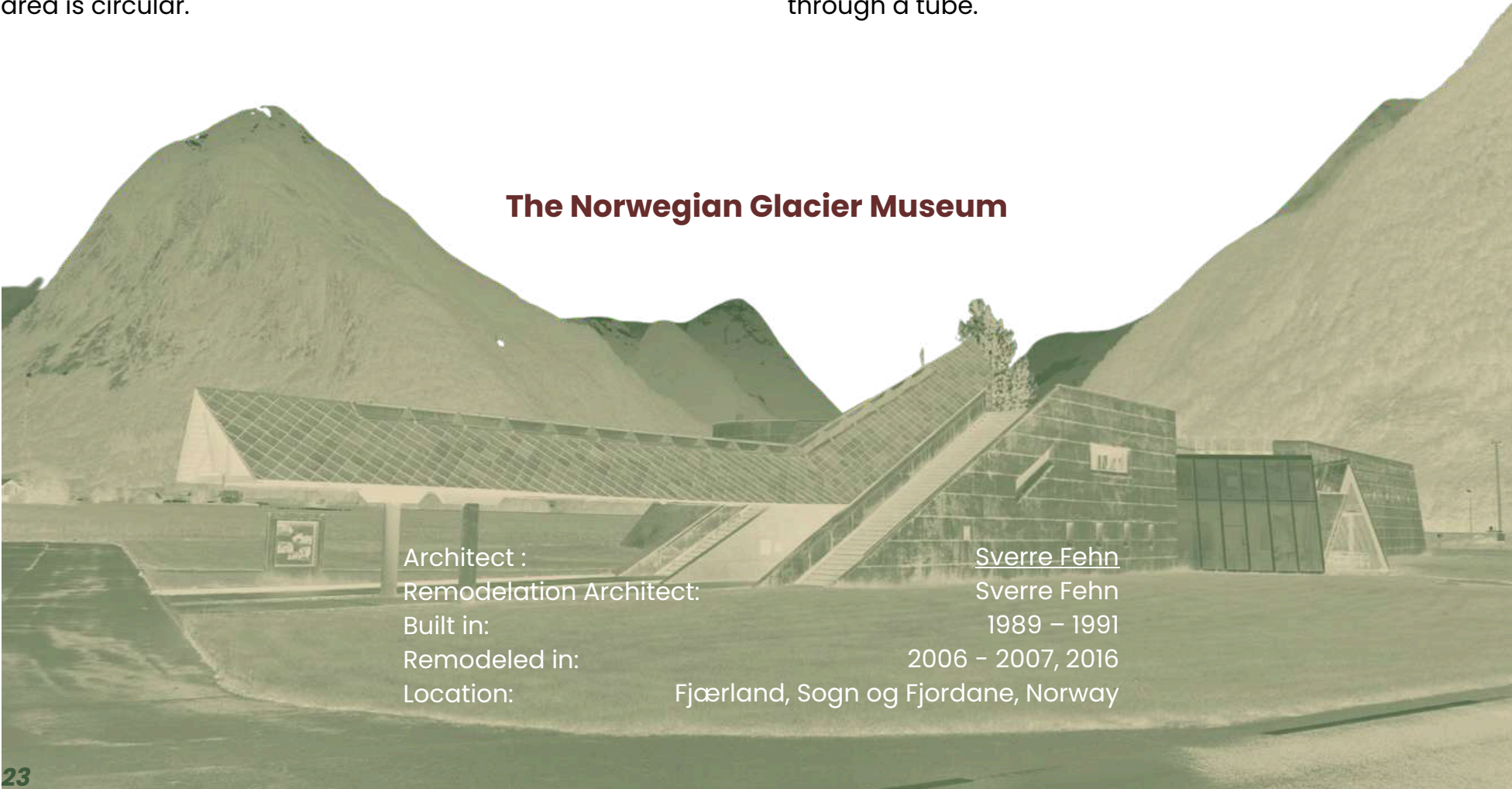
Fehn’s angular design for the museum maximizes space with geometric shapes such as the triangular entrance canopy or the stairs that lead to the rooftop gazebo. The long entrance takes the visitor to the indoor exhibition spaces or climbs the stairs to an outdoor observation platform. The canopy is triangular, while the exhibition area is circular.



Viewpoint

The architect skillfully turns the roof of the museum into a public space, hinting at the idea that one “climbs the rock” to have a better view. The entry sequence resembles hiking on the glacier. You can take the stairs to the roof, the hike on the top of the glacier, or you can take a cave-like entrance to see the exhibits, walk below the glacier through a tube.

The Norwegian Glacier Museum



Architect :	Sverre Fehn
Remodelation Architect:	Sverre Fehn
Built in:	1989 – 1991
Remodeled in:	2006 – 2007, 2016
Location:	Fjaerland, Sogn og Fjordane, Norway

Historical Background

Vredeburg Fortress was originally built by the Dutch in 1760 as a military fort to monitor the activities of the Yogyakarta Palace. After the colonial period, the building was used as a headquarters for the Japanese military, and later for the Indonesian National Armed Forces (TNI). It was not until the 1980s that an initiative was proposed to convert **the fortress into a museum of national struggle**.

Adaptive Reuse Form

From Military Function → Educational & Cultural Function

- The military defense building has been repurposed into the Vredeburg Fortress Museum (officially opened in 1987), which showcases the history of the Indonesian struggle, particularly in Yogyakarta.

Preservation of Colonial Architecture

- Original architectural elements such as the fortress walls, gates, bastions, and barracks have been preserved.
- More changes were made to the interior, the addition of museum facilities (dioramas, exhibition rooms), and visitor facilities (toilets, multimedia rooms).

Principles of Revitalization that are Applied

Principle	Implementation
Conservation	The original building structure is preserved. Renovation follows the shape and materials that match the original.
New Functionality	Empty spaces are repurposed for diorama rooms, libraries, and performance spaces.
Historical Value	Historical narratives are curated to convey the values of the national struggle, not just colonial history.
Community involvement	The museum is now actively serving as a space for education, historical discussion, and local cultural activities.



General Information

Location: Banda Aceh, Indonesia
Architect: Ridwan Kamil (PT Urbane Indonesia)
Year Completed: 2009
Function: Memorial, disaster education, and disaster mitigation center



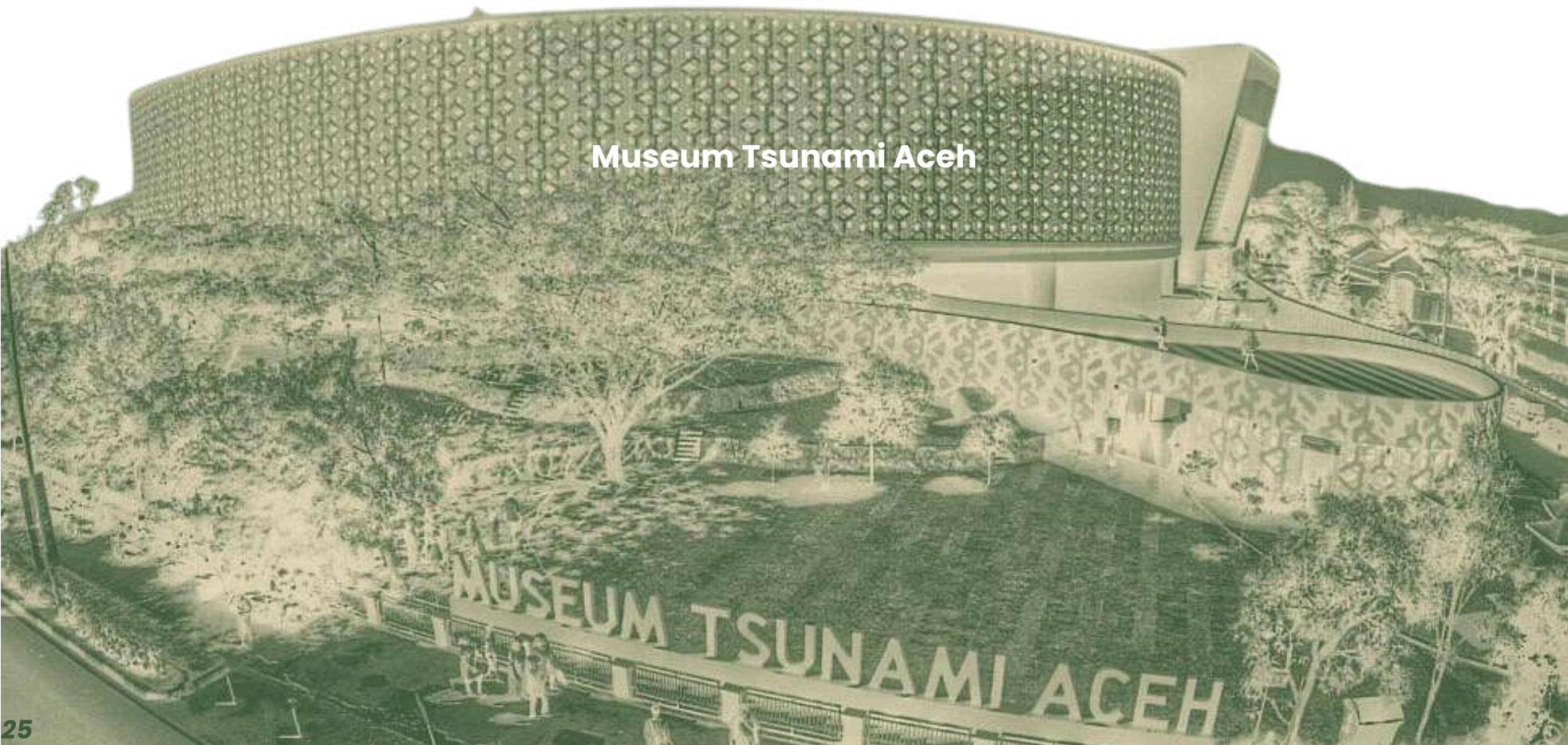
Design Concept and Narrative Value

This museum integrates the narrative of the tsunami tragedy from the beginning to the recovery process. Each room evokes a specific emotion, from the dark hallway (fear), the prayer room (reflection), to the hope room.

The Tsunami Museum serves dual functions: a monument + a disaster education space + community.

Principles of Revitalization that are Applied

Principle	Implementation
Spatial narrative	The tragedy-to-hope flow, geological-to-water solution flow.
Material symbolism	Water, light, dark to Karst stones, underground water, limestone
Visitor Immersion	Sensory, sound, atmosphere to Simulation of drought, rain, karst
Dual Function	Memorial & education to Museum & Innovation center
Dual Function	Revitalization of space with water technology & environmental education



Materiality Study

Glulam (glue-laminated timber) is laminated wood bonded with special waterproof adhesives. Structurally, glulam is more stable than solid wood because it has less shrinkage and expansion. Generally, it already uses waterproof adhesives (melamine-urea-formaldehyde or phenol-resorcinol) so that the joints do not easily come apart when exposed to moisture.

- Surface Layer Protection Glulam is given a protective finish (waterproof coating or sealant) so that water does not easily penetrate.
- Polyurethane paint, special exterior wood oil, or microporous coating can be added, which still allows the wood to 'breathe'.



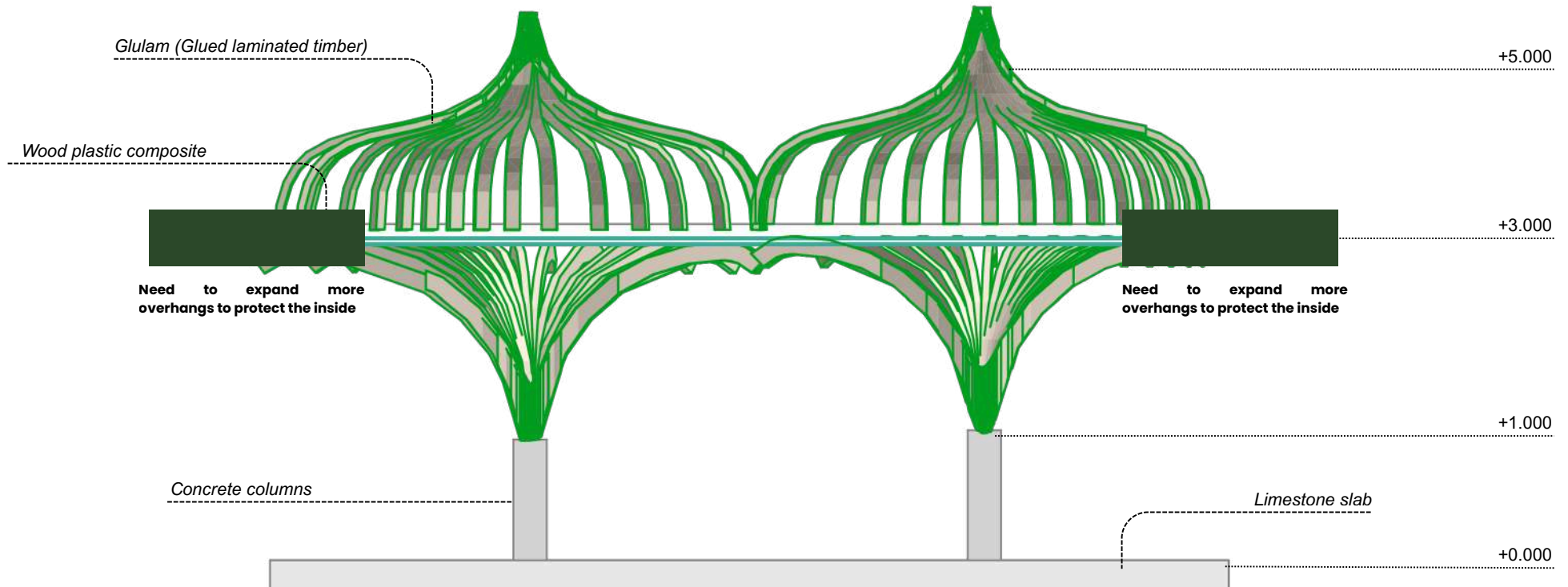
Construction Design Details

Glulam structures in outdoor areas should not be directly exposed to continuous rain. They are usually protected with roof overhangs, cladding, or canopies so that rainwater does not directly fall on the joints. The end grain of the wood should be covered or sealed, as this area is the most susceptible to water absorption.



Flooring alternative

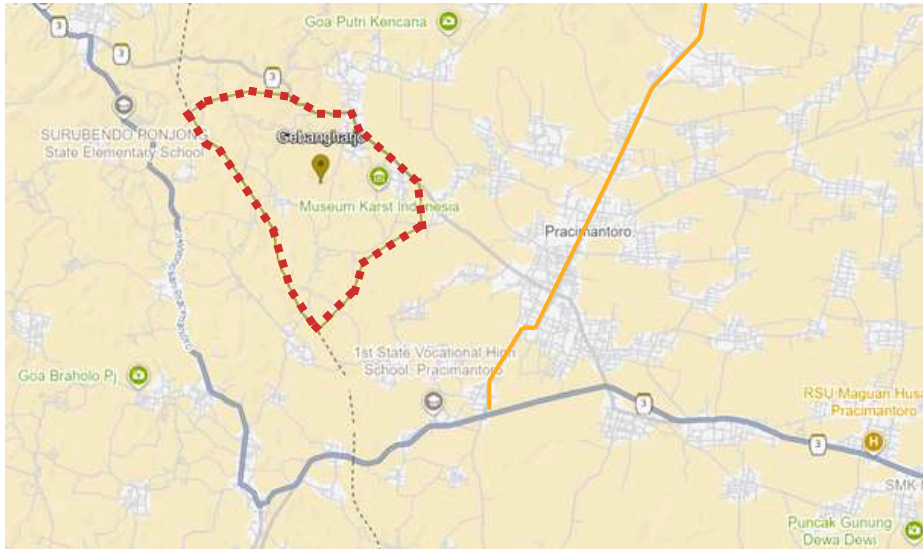
Previously, the floor was using wood plastic composite which is too thin for used for a floor. Another option might use bangkirai decking. It is quite strong and termite-resistant. It is suitable for semi-outdoor or outdoor flooring but still need to be protected. It still requires regular coating to prevent quick dulling or fine cracking.





02 **PROBLEM STUDY**

STUDY OF LOCATION, SITE, AND CONTEXT



It is located in Gebangharjo Village, Pracimantoro, Wonogiri, Central Java.

The main access is through the Wonosari–Pracimantoro national road.

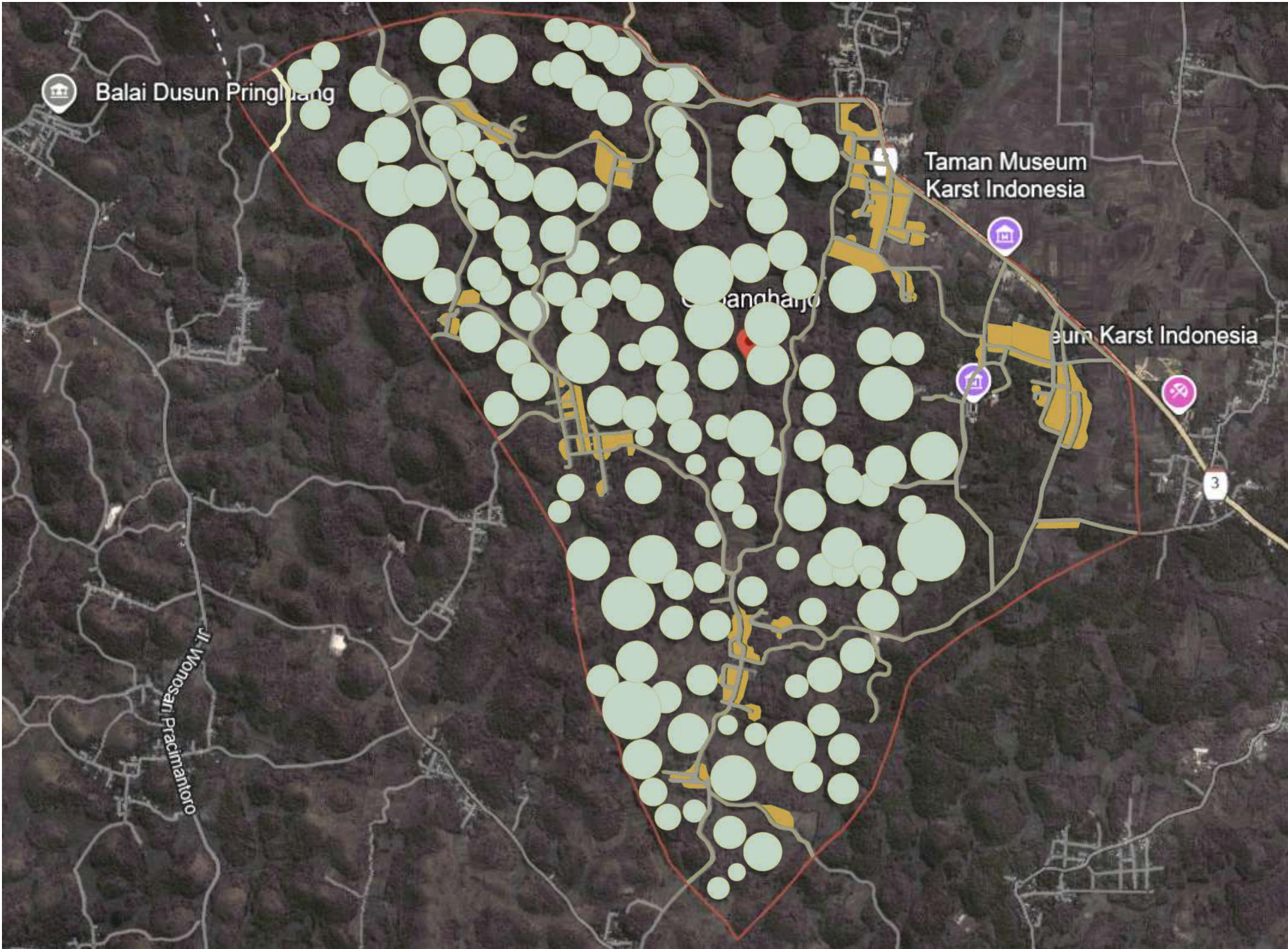
It is quite far from the city center or other public facilities.

Limited access to public transportation to the location.

Gebangharjo Village – Pracimantoro

Gebangharjo Village, located in Pracimantoro District, Wonogiri Regency, is a hilly area located in the Mount Sewu Karst area and is known as part of the UNESCO Global Geopark. Its geographical conditions, which are dominated by limestone, make this village prone to drought, but at the same time it holds unique geological wealth and natural resource potential. One of the main attractions is the existence of the Indonesian Karst Museum and natural caves such as Potro Bunder Cave and Translucent Cave, which have the potential to be developed as educational and adventure tourism destinations. In the agricultural sector, even though the land is less fertile, people still rely on crop cultivation such as corn, cassava, and beans, as well as goat and cattle farming as their main livelihood.

Macro Zoning

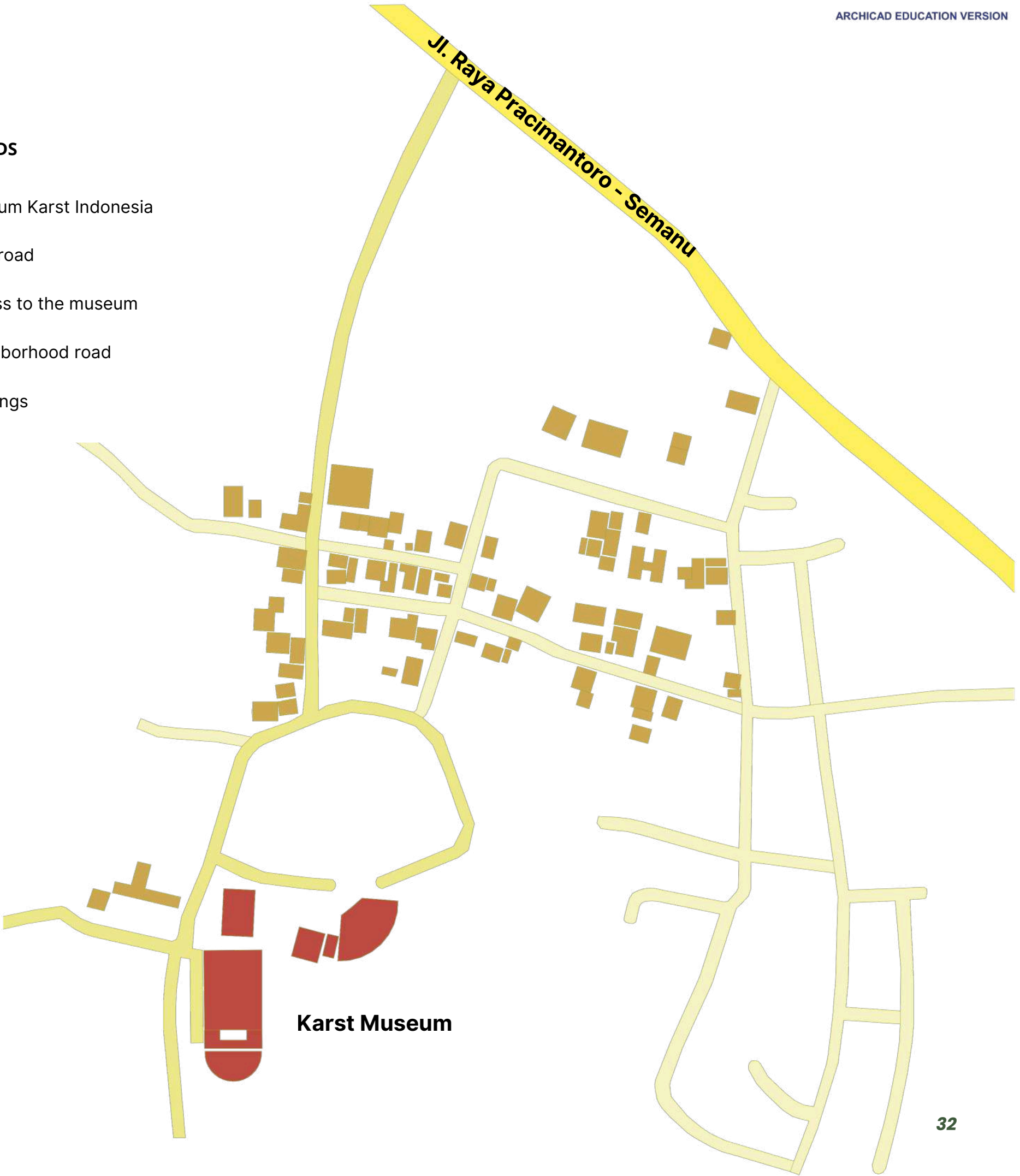


LEGENDS

-  Karst hills
-  Housings
-  Road access

LEGENDS

- Museum Karst Indonesia
- Main road
- Access to the museum
- Neighborhood road
- Housings



Macro Existing Analysis



Road

There are several types of roads in this area. The widest road is the provincial road, Jl. Semanu-Pracimantoro, which connects district between two different provinces which are Special Region of Yogyakarta and Central Java. There are also collector roads, local roads, and neighborhood roads.



Rice fields

In the area around the site, there are rice fields managed by the community in the government land. Rice is only planted once a year, usually during the rainy season—farmers utilize natural water from rainfall.



Seasonal river

In this village, there is a seasonal river which means the river only exists during the rainy season. This occurs due to high rainfall. In the dry season, the river dries up. This river is located on the west side of the karst museum, with its flow ending in the Sodong cave.



Settlement

The residential areas in this village are relatively scattered in one point. This is due to the topography that is full of karst hills. That makes the settlements built in the alley part of the area, not in the hill part because usually it is the preserved area.



Plantation

Plantation area is quite common in this area. Since the type of soil is dry due to the karst topography. The type of plants that usually grow do not need much water because the area is prone to drought during the dry season. Suitable plants such as cassava, sweet potatoes, and peanuts



Karst hills

This area is located in the Sewu mountains which is a karst nature reserve. Thus, its topography consists of karst hills and valleys. The soil tends to be dry and there are many limestone rocks. However, plants can still grow there. Some hills have caves as a result of thousands of years of karstification.

Accessibility Map

Interprovincial road



Semanu – Pracimantoro Road

Collector road



Pracimantoro Road

Local road



Nasional III Road

Neighborhood road

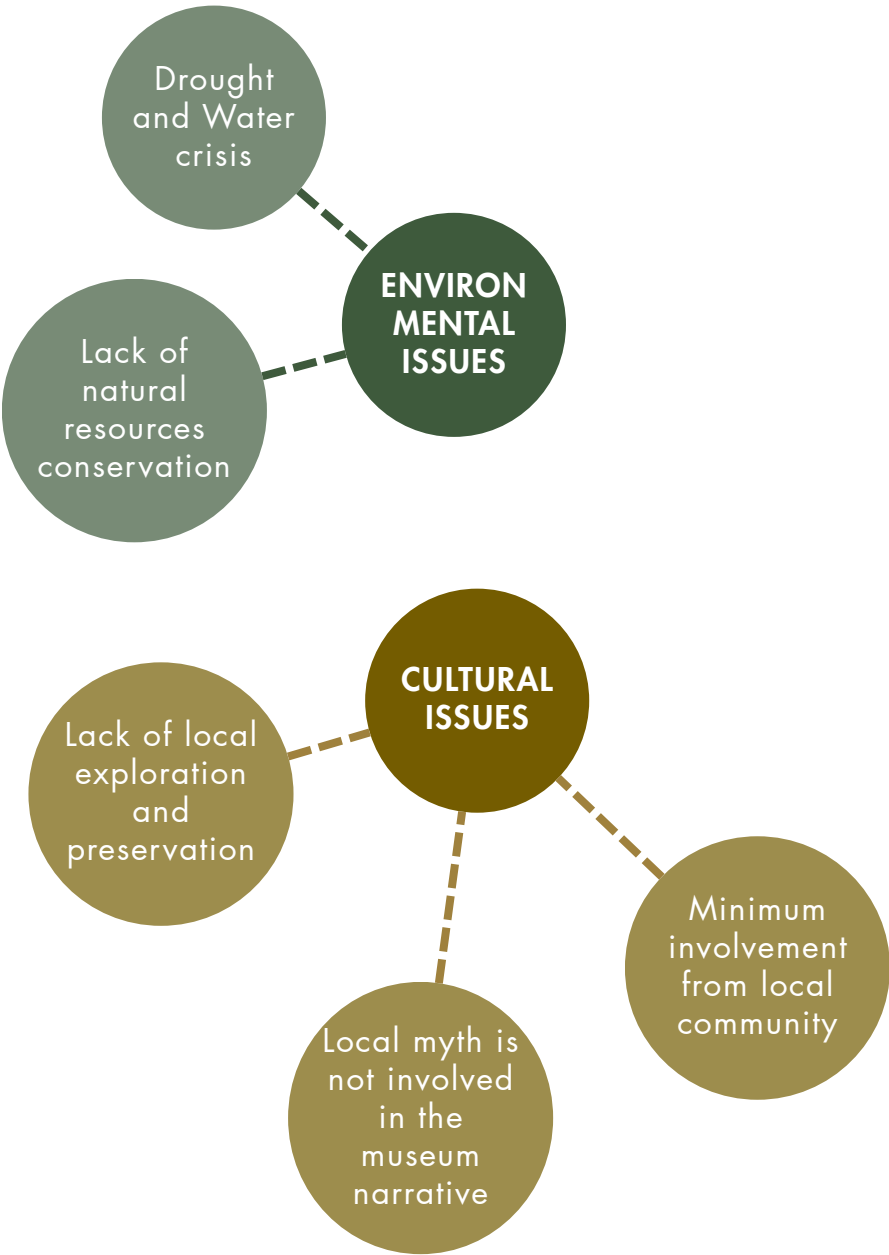


Local Pathway

Starting from Semanu District (Gunungkidul, DIY) heading to Pracimantoro (Wonogiri, Central Java), this stretch spans about 30 km, crossing the characteristic karst hills of the Sewu Mountains. The road's character is undulating, with steep climbs and descents, as well as sharp bends, especially after Bedoyo. The use of this road includes heavy vehicle traffic transporting limestone from karst mines.

Pracimantoro road connects Pracimantoro with surrounding districts such as Eromoko, Giritontro, and Wonogiri—playing a vital role as a primary access for transportation, economy (transportation of agricultural and mining products), as well as a link to administrative centers and local markets. The road serves the community, trucks, and buses; including heavy traffic from the limestone mining area.

SURROUNDING ISSUES



Some residents walk far to collect water from underground springs or caves.

The population finds it difficult to access water without deep drilling technology.

Water distribution is limited, relying on government assistance (water tanks).

Rainwater is not utilized optimally, causing water to flow directly into the underground cavities.

There are several buildings on the karst hill area, even though the top of the hill is the first surface that captures water before it enters the underground cavities, thus hindering the karstification process.

There is a story that can serve as a means to develop the museum zone.

Residents who directly experience living in karst have not been included.

SITE

GEOGRAPHIC LOCATION

Location

Located in Gebangharjo Village, Pracimantoro District, Wonogiri Regency, Central Java Province.

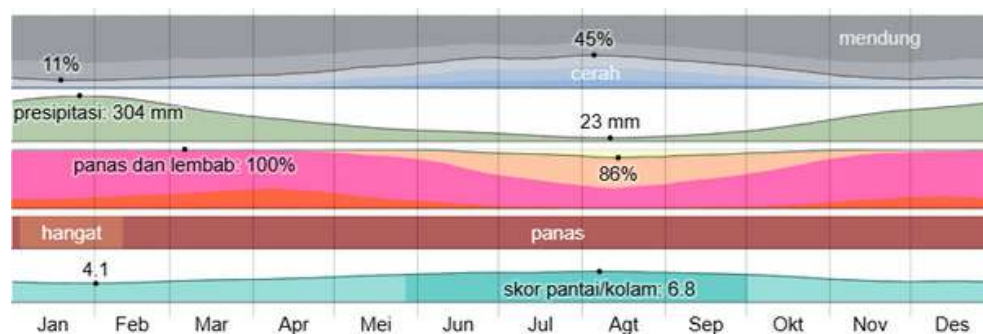
Physical Characteristics

The Indonesian Karst Museum area is located in the Sewu Mountains area which is a tropical karst area. The topography is hilly with a predominance of limestone rocks (karst) that form natural caves, steep cliffs, and less fertile soil.

Accessibility

The location is quite far from the center of Wonogiri (~40 km) and from Yogyakarta (~80 km), accessed via a winding but paved road route. There is no regular public transportation that goes directly to the museum.

CLIMATE



Climate Type

Tropical climate with a long pattern of dry seasons and uneven rainy seasons.

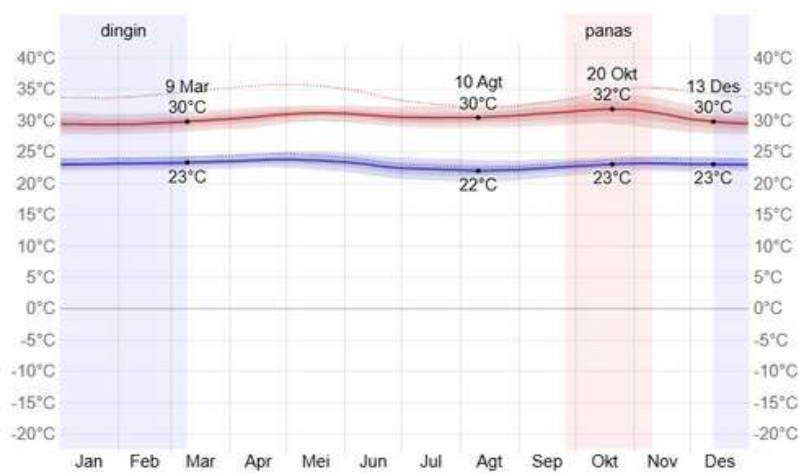
Drought Issue

This karst area is famous for its limited water resources due to the characteristics of soil that is unable to store water, so drought often occurs in the dry season.

SITE

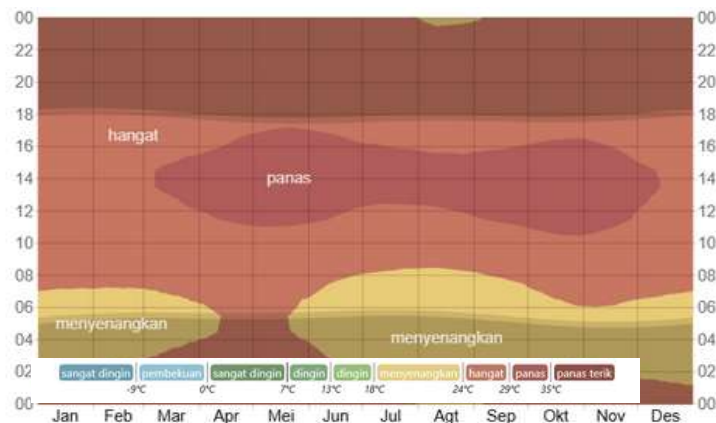
PRACIMANTORO, WONOGIRI

Average Temperature



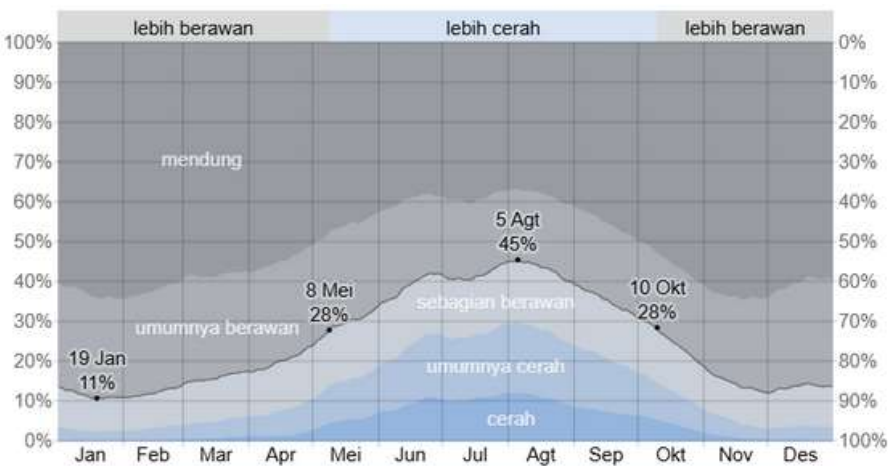
- Summer lasts for 1.5 months, from September 25 to November 10, with average daily highs above 31°C. The hottest month of the year in Wonogiri is May, with an average low of 31°C and a high of 24°C.
- Winter lasts for 2.9 months, from December 13 to March 9, with average daily highs below 30°C. The coldest month of the year in Wonogiri is August, with an average low of 22°C and a high of 31°C.

Average Hourly Temperature



Average temperature per hour, color-coded into the ribbon. The shaded layer indicates the civil night and dusk.

Cloud



The percentage of time spent in each cloud cover band, which is categorized according to the percentage of cloud-covered skies.

- In Wonogiri, the average percentage of cloud-covered skies experiences significant seasonal variations throughout the year.
- The period of sunnier weather every year in Wonogiri begins around May 8 and lasts for 5.0 months, ending around October 10.
- The sunniest month of the year in Wonogiri is August, where the average sky is clear, mostly sunny, or partly cloudy 43% of the time.
- This year's cloudier period begins around October 10 and lasts for 7.0 months, ending around May 8.
- The cloudiest month of the year in Wonogiri is January, with an average cloudy or mostly cloudy sky 88% of the time.

SITE

PRACIMANTORO, WONOGIRI

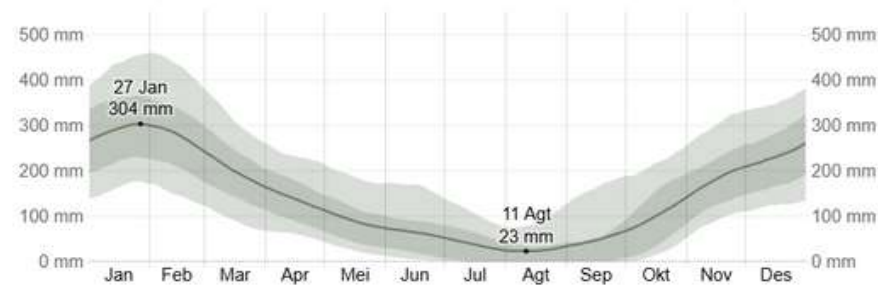
Precipitation



The percentage of days on which different types of precipitation are observed, excluding the number of traces: rain only, snow only, and mixed (both rain and snow fall on the same day).

- A wet day is a day with at least 1 millimeter of liquid rainfall or liquid equivalent. The chances of wet days in Wonogiri vary greatly throughout the year.
- The rainy season lasts 6.0 months, from October 27 to April 25, with more than 39% chance of days being rainy days. The month with the wettest day in Wonogiri is January, with an average rainfall of 20.9 days with at least 1 millimeter.
- The dry season lasts 6.0 months, from April 25 to October 27. The month with the least wet days in Wonogiri is August, with an average of 2.9 days with at least 1 millimeter of precipitation.
- Among wet days, we differentiate between days that experience rain only, snow alone, or a mixture of both. The month with the most rainy days in Wonogiri alone is January, with an average of 20.9 days. Based on this categorization, the most common form of precipitation throughout the year is rain, with the highest probability of 70% on February 1.

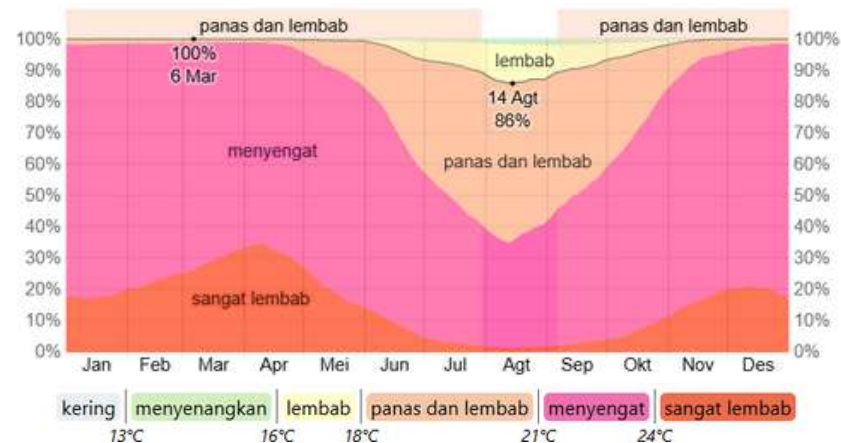
Rainfall



Average rainfall (solid line) accumulated over a 31-day sliding period centered on the day, with 25th to 75th percentile bands and 10th to 90th percentile bands. A thin dotted line is the corresponding average snowfall.

- To show the variation within months and not just the monthly totals, we show the precipitation accumulated over a shifting 31-day period centered around each day of the year. Wonogiri experiences extreme seasonal variations in monthly rainfall.
- Rainfall all year round in Wonogiri. The month with the most precipitation in Wonogiri is January, with an average rainfall of 294 millimeters.
- The month with the least precipitation in Wonogiri is August, with an average rainfall of 24 millimeters.

Humidity

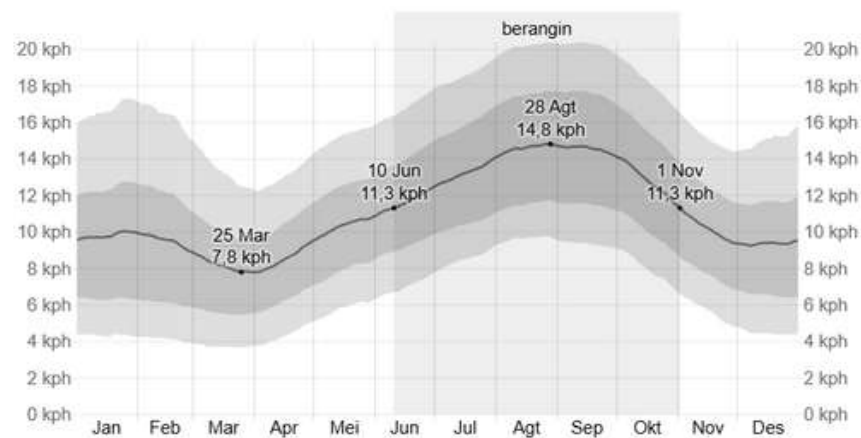


- Wonogiri experiences moderate seasonal variations in perceived humidity.
- The wetter and hotter period of the year lasts for 11 months, from September 6 to July 29, during which the comfort level is very humid and hot, stinging, or unpleasant at least 89% throughout the day. The month with the most humid and hot days in Wonogiri is March, with 31.0 humid and hot days or worse.
- The month with the least humidity and heat in Wonogiri is August, with 26.9 humid and hot days or worse.

SITE

PRACIMANTORO, WONOGIRI

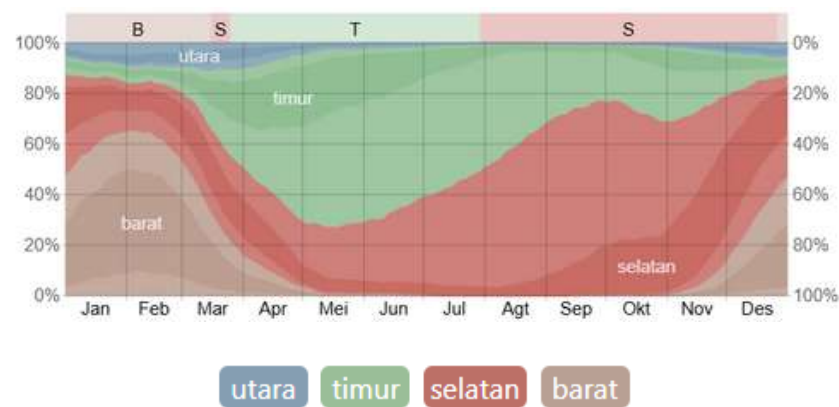
Wind



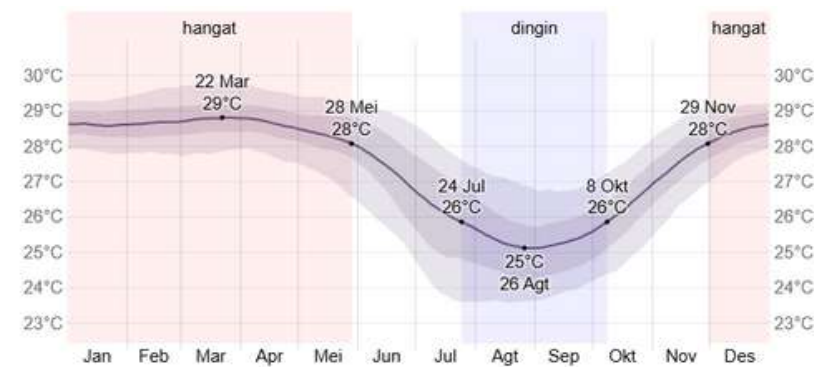
Average hourly wind speed is average (dark gray line), with bands of the 25th to 75th and 10th to 90th percentiles.

- The average hourly wind speed in Wonogiri experiences significant seasonal variations throughout the year.
- The windier period of the year lasts for 4.7 months, from June 10 to November 1, with an average wind speed of more than 11.3 kilometers per hour. The windiest month of the year in Wonogiri is August, with an average wind speed per hour of 14.6 kilometers per hour.
- The calmer wind period in the year lasts for 7.3 months, from November 1 to June 10. The least windy month of the year in Wonogiri is March, with an average wind speed per hour of 8.1 kilometers per hour.

Wind Direction



Water Temperature



Daily average water uhu (purple line), with 25th to 75th percentile and 10th to 90th percentile bands.

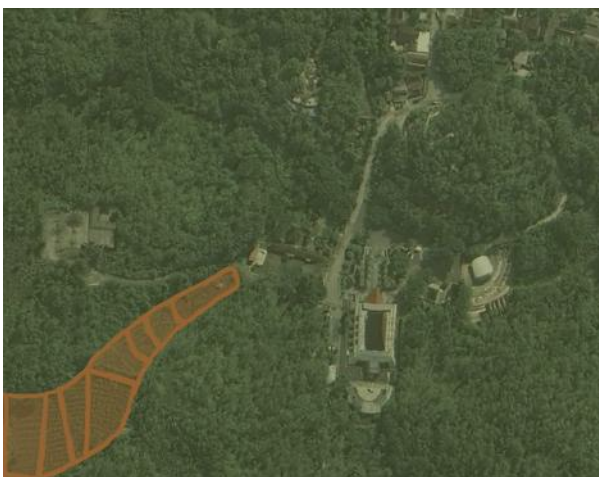
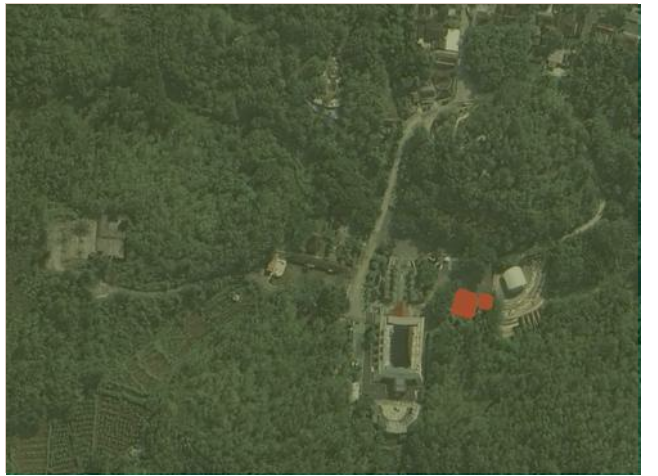
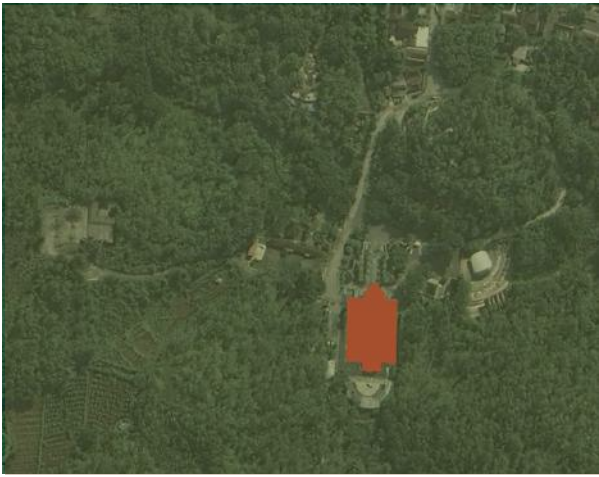
- Wonogiri is located near large bodies of water (e.g., oceans, seas, or large lakes). This section reports the average surface temperature of the large area of the water.
- The average water temperature experiences significant seasonal variations throughout the year.
- The time of year with warm water lasts for 6.0 months, from November 29 to May 28, with an average temperature above 28°C. The month of the year in Wonogiri with the warmest water is March, with an average temperature of 29°C.
- The time of year with cooler water lasts for 2.5 months, from July 24 to October 8, with average temperatures below 26°C. The month of the year in Wonogiri with the coldest water is August, with an average temperature of 25°C.



Existing Zoning of the Museum
Source: Author

Existing Zones

This project focuses on the overall transformation of the Wonogiri Karst Museum through the integration of design that prioritizes user experience with biomimicry architectural innovations. This approach is designed to create a more interactive, engaging, and sustainable space, thereby increasing tourist attraction and providing a more satisfying experience for every visitor.



-  Karst Museum
-  Settlements
-  Pura
-  Agricultural zone

- # Museum Zoning
-  Settlements
 -  Road access
 -  Karst museum area

The Museum Transformation

2011



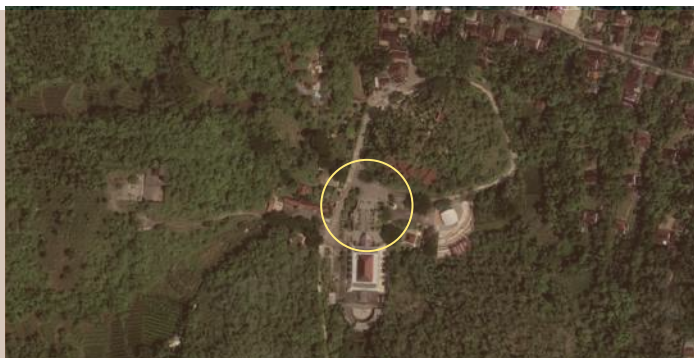
2013



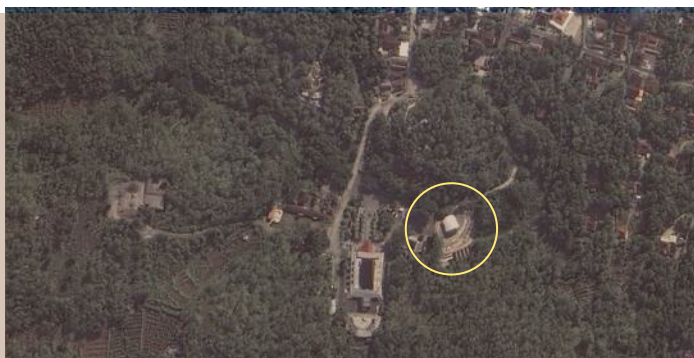
2017



2022



2023



The Indonesian karst museum located in Wonogiri has undergone changes with the addition of zoning. It has also experienced some expansion of the museum area. In 2011, it represented the establishment of the museum, which consisted only of the main museum building and facilities such as a mosque and toilets outside.

In 2013, a performance stage was added to the west side of the museum with a large courtyard. Then in 2017, an elongated building was added to serve as a transit area for a large scale of visitors in the same area as the stage built in 2013.

In 2022, there was a renovation of the front part of the main museum building. The entrance that was originally on the second floor was demolished and transformed into a garden on the ground floor. Furthermore, from 2023 until now, additional facilities in the form of a performance stage have been built on the east side of the museum.

The addition of stages and repetitive transit areas has caused the building to become stalled due to losing its functional value. A study by Tiesdell, Oc & Heath, Revitalizing Historic Urban Quarters, 1996 states that **too many zones with similar functions weaken the spatial narrative and reduce the vitality of an area.**

Local Stakeholder

The owner of the project is the local government of Wonogiri Regency. Meanwhile, the commissioner is the Office of Youth, Sports, and Tourism (DISPORA Wonogiri) because the fields of tourism and museum management are under their purview.

The revitalization of the Indonesian Karst Museum involves various local stakeholders in Wonogiri with complementary roles. The Wonogiri regional government, as the asset owner, acts as the primary decision-maker, while the Wonogiri Youth and Sports Office serves as the project manager and executor. On the other hand, the Pracimantoro community plays a crucial role as economic beneficiaries and guardians of local cultural identity. Academics and environmental communities contribute through research and sustainability inputs, and the tourism sector drives the economy around the museum. This relationship forms a collaboration between the government, community, academics, and the tourism sector for the success of the revitalization.



If examined further, museums actually have complex functions. Museums are also closely related to the preservation and inheritance of culture in people's lives so that museums are also considered as institutions for the storage, security, maintenance and preservation of human works, creations and karsa that contain wisdom values that can be used by the community as a symbol of the identity of local community life (Sarkowi, 2020).

Site Analysis

Museum Karst Indonesia

Ticket Counter

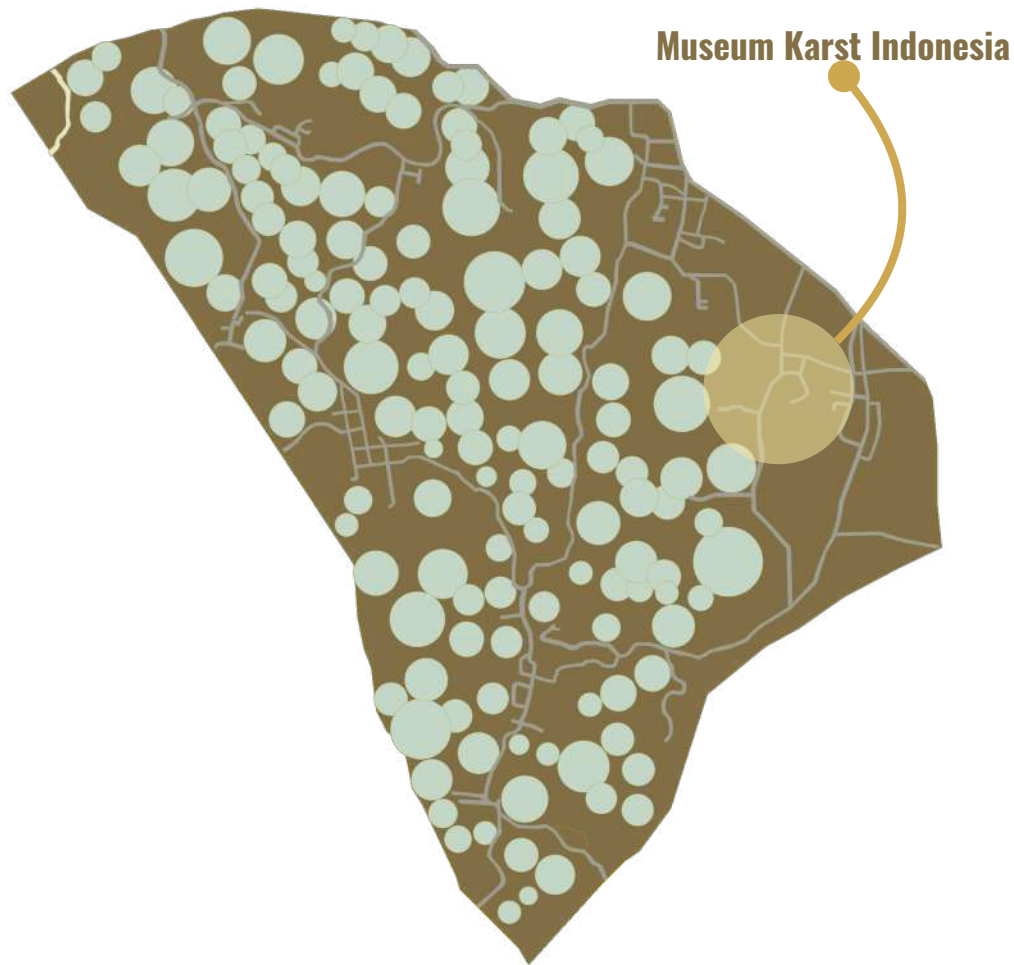
Park of Museum Karst Indonesia

Entrance

MAIN ROAD

MAIN ROAD

Topography of Karst Museum Area



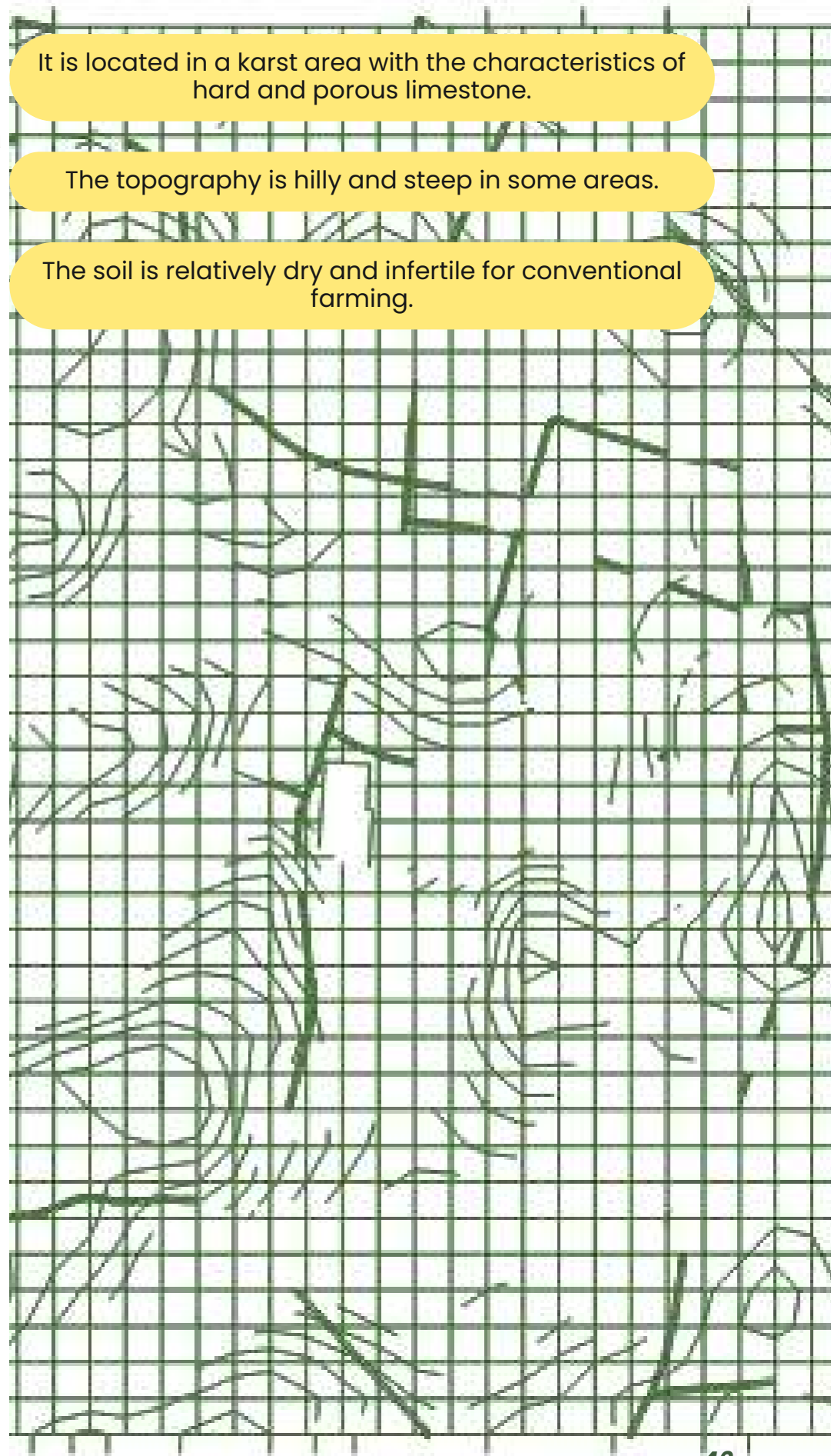
The topography of the Indonesian Karst Museum area, which is located in Gebangharjo Village, Pracimantoro District, Wonogiri Regency, has the characteristics of an undulating and steep hilly karst landscape. The contours of the land are uneven, consisting of limestone hills of varying elevations, creating slopes with moderate to steep slopes. Between these hills there are small basins (dolina) which are part of the drainage system typical of karst areas. The surface of the soil is generally rocky, with many limestone outcrops and very little fertile soil layer.

Because it is located in a tropical karst area, the area around the museum also shows karst phenomena such as rock cliffs, caves, ponor (water holes entering the ground), and conical hills. This kind of topography makes land use have to pay attention to natural contours, minimal surface water flow, and slope stability.

It is located in a karst area with the characteristics of hard and porous limestone.

The topography is hilly and steep in some areas.

The soil is relatively dry and infertile for conventional farming.





The topography of the Indonesian Karst Museum area, which is located in Gebangharjo Village, Pracimantoro District, Wonogiri Regency, has the characteristics of an undulating and steep hilly karst landscape. The contours of the land are uneven, consisting of limestone hills of varying elevations, creating slopes with moderate to steep slopes. Between these hills there are small basins (dolina) which are part of the drainage system typical of karst areas. The surface of the soil is generally rocky, with many limestone outcrops and very little fertile soil layer.

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SWOT ANALYSIS

STRENGTH

- 1.The Indonesian Karst Museum has an attraction because it displays the unique geological characteristics of the karst area that many other museums do not have.
- 2.Located directly in the Wonogiri karst area, making it relevant to the environmental context and direct education in the field.
- 3.Provides insight into the karst ecosystem, the importance of conservation, and geological phenomena, which are interesting for academics, tourists, and students.
- 4.(Can apply the concept of biomimicry by imitating the form and function of nature in the karst environment, so that it is more sustainable and harmonious with nature.)

WEAKNESS

- 1.Some existing facilities are damaged or less attractive to visitors, resulting in a less than comfortable experience.
- 2.Not utilizing interactive technology, augmented reality (AR), or digital experiences to enhance the appeal and educational experience.
- 3.Interior design and room layout are not fully support a comfortable and informative visitor flow.
- 4.Most visitors are academics and researchers, but less attractive to general tourists or families.

OPPORTUNITY

- 1.With the user experience design and biomimicry approach, museums can be more attractive and provide a more immersive experience.
- 2.The application of AR/VR, interactive multimedia, or digital education systems can increase the attractiveness of museums for various groups.
- 3.Museums can be developed into community centers for education and research and attract more tourists, thus having an impact on the local economy.
- 4.Can become educational centers on karst area conservation, in collaboration with academics, environmental organizations, or local communities.
- 5.The development of environmentally-based tourism with trekking, cave exploration, or other outdoor activities can increase the number of visitors.

THREATS

- 1.Without innovation in visitor experience, museums can become increasingly deserted as they become less attractive to younger generations and general tourists.
- 2.Uncontrolled human activities can damage karst areas, requiring an environmentally friendly design approach.
- 3.Renovation and revitalization require large investments, while government or sponsorship budgets can be limited.
- 4.Climate change can affect the condition of karst areas, including the risk of erosion, drought, or ecosystem degradation.

Surrounding Caves

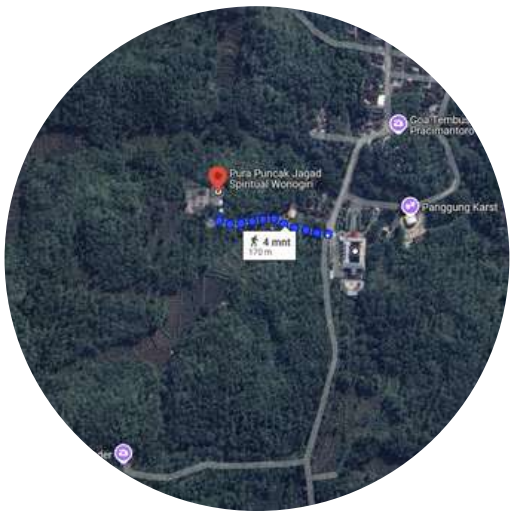


LEGENDS

- 1. Tembus cave
- 2. Sodong cave
- 3. Pura puncak jagad
- 4. Mrico cave
- 5. Potro bunder cave
- 6. Gilap cave

The integration of interactive museums and natural caves can provide a comprehensive educational experience for visitors. Visitors can learn geological theories and information in the museum, then directly observe karst phenomena in the field through exploration of the caves. This approach is in line with the concept of environmental education that emphasizes direct experience to increase ecological awareness.

Access to the museum area destination



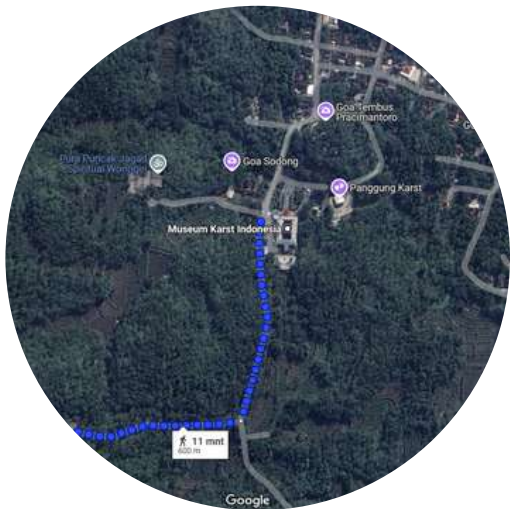
Pura Puncak Jagad



Tembus cave



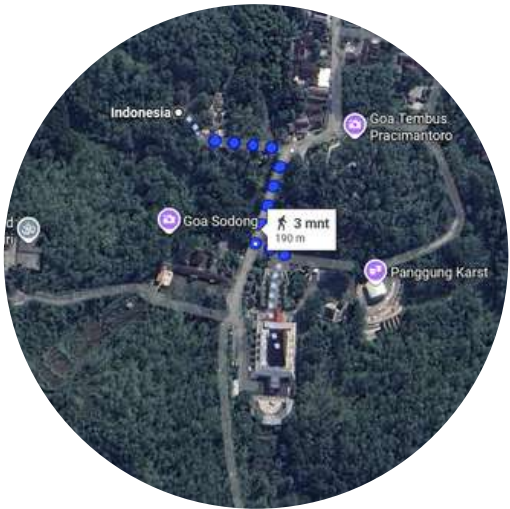
Sodong cave



Potro bunder cave



Luweng sapen



Mrico cave

Luweng Sapen: Water Source

Luweng Sapen, located in the Pracimantoro karst area of Wonogiri, is one of the **natural vertical holes** (luweng) used by the community as a source of clean water, especially during the dry season. The water extraction system in Luweng Sapen is quite unique and reflects the community's adaptation to the geological conditions of the karst region, which has limited surface water.

It cannot be visited generally because the water inside is used for the daily needs of the surrounding residents. In addition, due to its vertical shape, opening it to the public is very dangerous because it has a depth of 30 meters. Therefore, only certain people can maintain the cleanliness of the water.

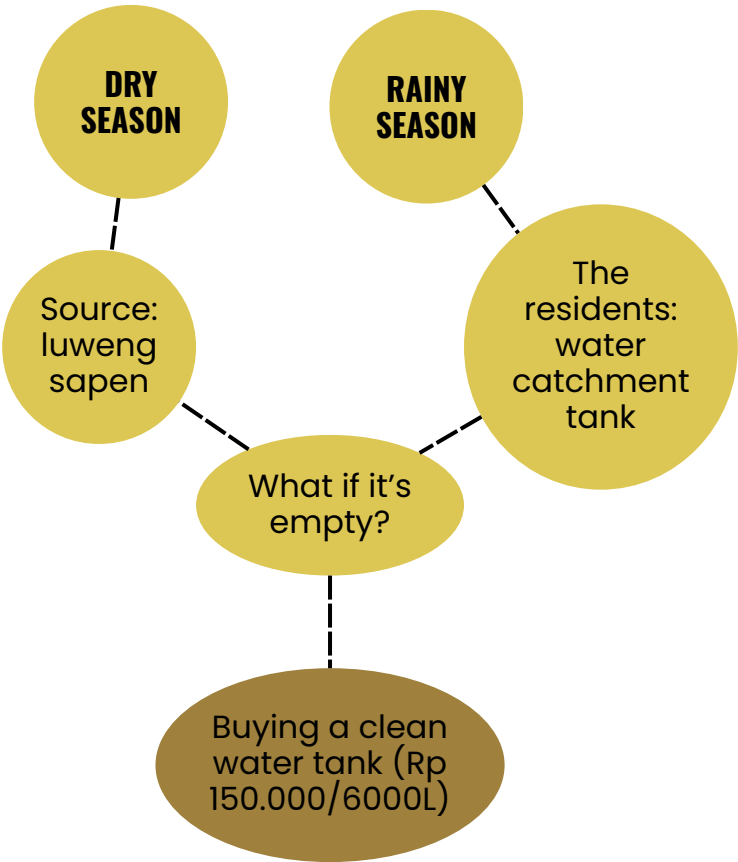


Traditional way with catrols and buckets

- 1. People descend the edge of the well (which is vertical and can be very deep), or lower a bucket using a rope and pulley.
- 2. Water is taken from the groundwater that is at the bottom of the well.
- 3. The person taking the water usually alternates due to the difficult and steep terrain.
- 4. This is done manually, without pumps, and heavily relies on the physical condition of the water fetcher.

Use of Water Pump

- 1. Some citizen initiatives or assistance from social organizations/universities have installed pipes and small water pumps.
- 2. Because of the difficult terrain and unstable geological conditions, these systems are not always permanent and often break down.



Water in Luweng Sapen is not always available throughout the year. It is only during the rainy season that a lot of water is collected, and it is still available at the beginning of the dry season. This makes the community have to manage the timing and turns of water collection.

WATER SOURCES AND SOIL IN KARST AREA

The dry karst physical environment is caused by the lack of surface water. Surface water from rainfall mostly seeps into the ground through cracks in the rocks. The water that seeps into the ground forms accumulations stored within cavity systems, rock fractures, and passageways. In some karst areas, large underground water reserves have the potential to become a source of groundwater. If that happens, then the dry physical appearance of the karst will only occur at the surface.

The emergence of groundwater in the form of springs is usually found in lower places, such as the slopes of hills and the bottoms of valleys. This emergence is caused by the interruption of the water-bearing layer (aquifer) by topography or geological structure (faults, fractures). Water from the ground often flows out through the openings of caves that have underground rivers within them. The groundwater arrangement system in karst areas is divided into dry zones, transitional zones, and saturated zones.

Soils resulting from the weathering of limestone are called terra-rossa. In most karst areas, the layer of terra-rossa is very thin, ranging from 20 cm to 100 cm. This reddish-brown to black soil is easily washed away by runoff rainwater, before eventually being deposited in lower-lying areas. Topographical depressions such as dolinas become one of the deposition sites, causing the shape of the depression to transform into a plain.

Local residents utilize the land for farming. To prevent soil erosion on the hillsides due to runoff water, they build a terrace system around the hill. These terraces, which are 50 cm to over 1 m high, are constructed from chunks of limestone. Another function of the land in the karst area is to absorb rainwater, so not all rainwater flows as runoff.

STUDY OF BUILDING TYPOLOGY

Museum Building

Introduction

The term museum is associated with scientific characteristics in addition to having fun (Indonesian Museum Directory, 2012 p. 16). According to Government Regulation No. 66 of 2015, museums are institutions that function to protect, develop, utilize collections, and communicate them to the public. In essence, museums are related to cultural heritage objects that are scientifically based. Museums are known as buildings that are used to store collections of cultural heritage objects that are of noble value and are considered worthy of saving.

Decree of the Minister of Culture and Tourism number: KM.33/PL.303/MKP 2004 concerning Museums chapter 1 article 1 (i) states that museums are institutions for the storage, security, and utilization of material objects as well as their nature and environment in order to support efforts to protect and preserve the nation's cultural wealth. The existence of museums is very important, especially in the world of education and history learning, both from the lowest to the highest level of education.

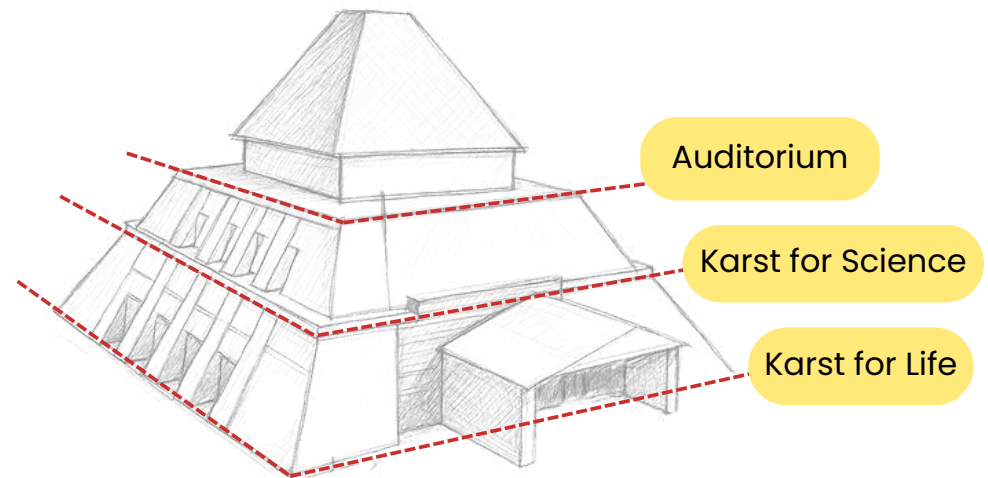
Type of Museums

Types of museums (according to Government Regulation No. 66 of 2015) and their main distinctions:

- General Museum – Collections in various fields of science (history, art, culture, science).
- Specialized Museum – Collections focused on a specific field/topic (for example, the Karst Museum focuses on karst geology).
- Site Museum – Located at the original site of the collection/remains, directly related to the history of the site.

Karst Museum Building

Each Floors Function



Function Typology

- **Education**

Provide information on karst geology, flora and fauna of karst areas, and the process of cave formation.

- **Cultural**

Stores a collection of artifacts and documentation of local culture that coexist with karst nature.

- **Recreation**

Informal visiting spaces for the general public, schools, and tourists.

Typology of Space

- **Exhibition Space** as display room for rock collections, cave dioramas, geological maps.
- **Audio Visual Room** as mini theater or presentation room.
- **Lobby and Reception**
- **Administration Room**
- **Collection Warehouse**
- **Garden** as an outdoor circulation area that blends in with karst nature.

Architectural Character

- Architectural styles tend to be conventional and less contextual to the character of karst areas.
- The use of materials does not reflect the local geological or natural narrative.
- Lack of integration between buildings and karst landscaping.

STUDY OF DESIGN APPROACH

Revitalization

Widjaja Martokusumo states that revitalization is an integrated effort to restore the vitality of underutilized or declining urban areas, considering social, cultural, economic, and environmental aspects. Danisworo (2002) defines revitalization as the effort to re-vitalize areas that were once vibrant but have declined, through an approach that recognizes and leverages the environmental potentials such as history, meaning, and place image.

According to Sujarto (2002), Revitalization is one approach to enhancing the vitality of an urban area, usually involving rearranging land use and buildings, renovating areas as well as existing buildings, so that their economic and social values can be improved and developed.

Revitalization is the activity of modifying an environment or cultural heritage object for new uses. What is meant by a more suitable function is a use that does not require drastic changes, or that only requires minimal impact (Burra Charter in Sidharta and Eko Budihardjo, 1989:11).

Eugène Viollet-le-Duc – Dictionary of French Architecture (1854–1868)

Viollet-le-Duc had a different approach to restoration. He argued that restoration is not merely about repairing, but about **returning a building to a complete state that may never have existed before**. "To restore a building is not to maintain it, repair it or remake it: it is to re-establish it in a complete state which may never have existed at any given moment." 5 His approach often involved adding new elements that harmonize with the original structure.

Christian Norberg-Schulz – Genius Loci: Towards a Phenomenology of Architecture (1979)

Norberg-Schulz introduces the concept of genius loci or 'spirit of the place', which refers to **the unique character of a place that must be preserved in architectural design**. He emphasizes the importance of understanding the physical and symbolic context of the environment in the design process: 'Genius loci represents the sense people have of a place, understood as the sum of all physical as well as symbolic values in nature and the human environment.'. This concept is relevant in revitalization as it helps maintain the identity and meaning of a place.

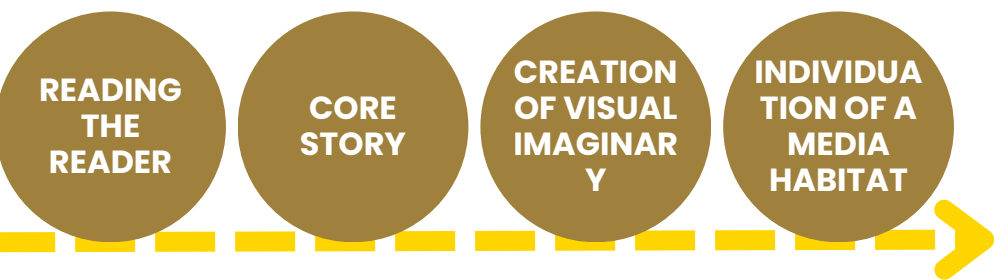
STUDY OF DESIGN APPROACH

Storytelling Definition

“Storytelling is the activity of telling or writing stories”.
The storytelling definition of Fontana, one of Italy’s most relevant experts in Corporate Storytelling. He defines storytelling as the activity of creating representations that can be textual, visual, sonorous, and perceptual

Storytelling Engineering

“An effective storytelling project, regardless its application area, is made up of four macro-steps: reading of the readers, definition of a core-story, creation of a visual imaginary and individuation of a media habitat (Fontana, 2016).



Techniques and Approaches in Architectural Storytelling

Narrative Structure

Constructing an architectural story with important elements such as protagonist (user), setting (context location), conflict (design challenges), and resolution (design solutions). This forms a cohesive conceptual framework for the design.

Visual Storytelling

Using rendering, diagrams, sketches, and digital animations to communicate the flow of spatial experiences emotionally and intuitively.

Contextual Integration

Combining historical, cultural, and local environmental contexts so that the design story is relevant and resonates with local values.

Balancing Functionality and Storytelling

Ensuring that narrative elements do not interfere with the main functions. The design approach should combine the aesthetics of the story with pragmatism and spatial effectiveness.

Adaptive reuse

The term museum is associated with scientific characteristics in addition to having fun (Indonesian Museum Directory, 2012 p. 16). According to Government Regulation No. 66 of 2015, museums are institutions that function to protect, develop, utilize collections, and communicate them to the public. In essence, museums are related to cultural heritage objects that are scientifically based. Museums are known as buildings that are used to store collections of cultural heritage objects that are of noble value and are considered worthy of saving.

Decree of the Minister of Culture and Tourism number: KM.33/PL.303/MKP 2004 concerning Museums chapter 1 article 1 (1) states that museums are institutions for the storage, security, and utilization of material objects as well as their nature and environment in order to support efforts to protect and preserve the nation's cultural wealth. The existence of museums is very important, especially in the world of education and history learning, both from the lowest to the highest level of education.

Adaptive reuse is an architectural strategy that focuses on repurposing old buildings for new functions without eliminating existing historical, architectural, or social values. The goals are: To extend the lifespan of buildings. To preserve local identity. To reduce construction waste and the costs of new construction. To provide functions that are more relevant to the current needs of the community.

Main Principles of Adaptive Reuse

- Preservation → preserving the important elements of old buildings.
- Intervention → adding or modifying spaces according to new functions.
- Integration → harmonizing old elements with new ones (old & new dialogue).
- Sustainability → efficient use of materials, energy, and space.

Approaches

a. Identification of Existing Values

1. Historical, cultural, and initial functional studies of the building.
2. Assessment of physical conditions (structural integrity, materials, utilities).
3. Identification of elements that must be preserved (façade, main structure, architectural details).

b. Analysis of New Programmatic Needs

1. Study of new user needs.
2. Adjustment of functions (e.g., warehouse → museum, factory → community center).
3. Establishing new zoning according to needs.

The adaptive reuse design approach in this project aims to preserve the historical value of the old building while providing a new function that is relevant to the needs of the community. The strategy is to maintain authentic architectural elements as identity, while integrating functional contemporary interventions.

Process of Gathering Data

Direct Observation in the Field

Objective

To directly observe the physical condition, visual aspects, circulation, ventilation, and atmosphere of the space.

Techniques

1. Field sketches & photography
2. Zoning mapping
3. Analysis of indoor and outdoor spaces
4. Recording user activities

Documentation & Archiving Study

Objective

To directly observe the physical condition, visual aspects, circulation, ventilation, and atmosphere of the space.

Source

1. Department of Tourism
2. Brochures, old maps, publications, or area maps

Semi-Structured Interview

Objective

Exploring the perceptions, obstacles, and aspirations of direct stakeholders.

Source

1. Department of Tourism
2. Brochures, old maps, publications, or area maps

User Experience Mapping

Objective

Analyzing the flow of visits and the emotional experiences of visitors.

Output

Visitor journey map: from entrance to exit, interesting/dull zones, time spent.

Method

Shadowing by following visitors

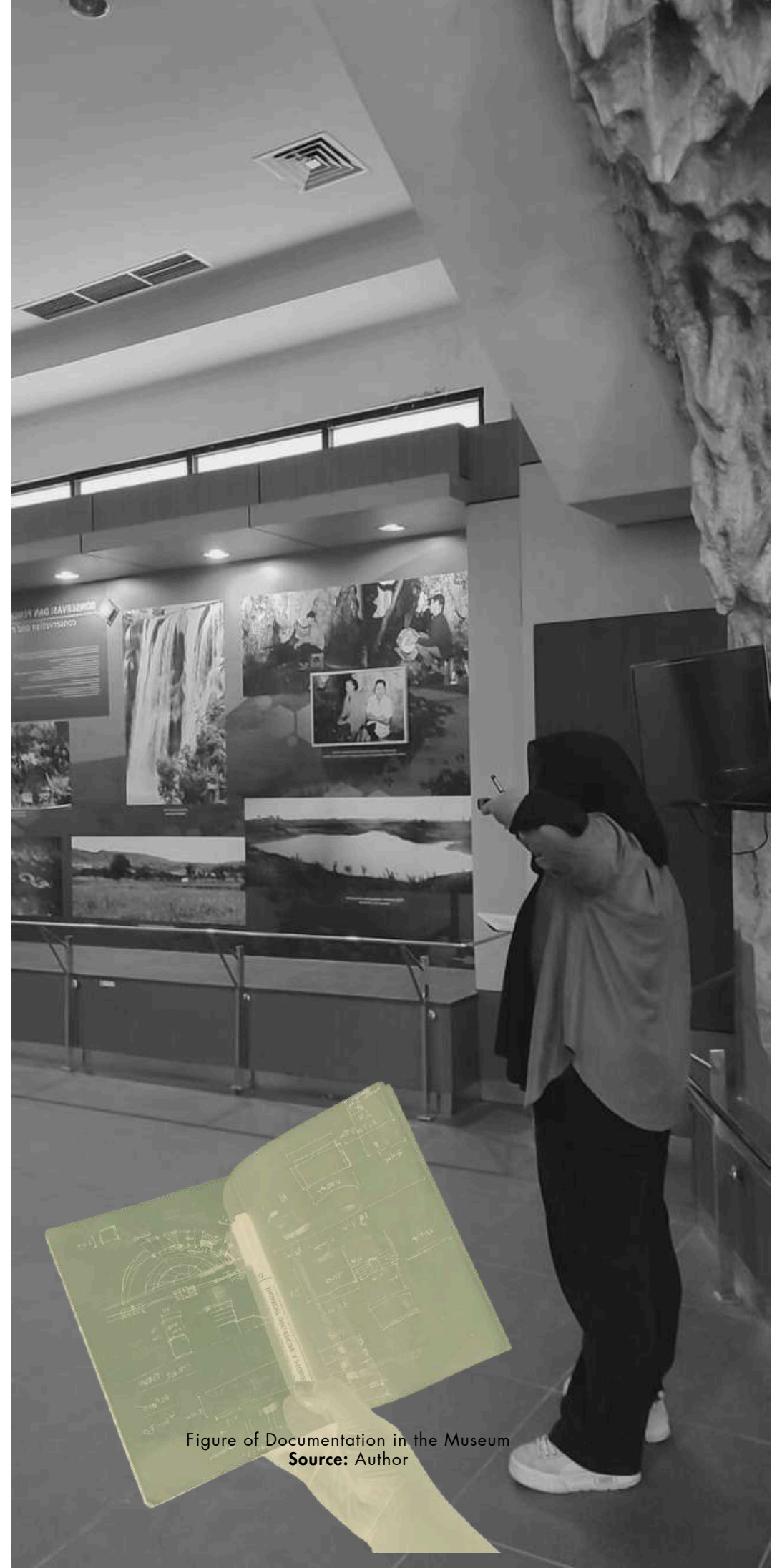


Figure of Documentation in the Museum
Source: Author



"Kalau saya ditanya potensi apa yang bisa digali buat menambah pengalaman pengunjung yang datang, mungkin terkait edukasi konservasi air ya Dik. Menurut saya, itu terasa kontekstual karena kars kan sebenarnya sumber penyimpanan cadangan air ya."

"If I were asked what potential could be explored to enhance the experience of visitors, it might be related to water conservation education. In my opinion, that feels contextual because karst is actually a source of water reservoir right."

"Museum ini dapat sumber air dari Luweng Sapen. Itu memang sumber air alami, yang diambil dari goa vertikal yang menyimpan air di bawah tanah. Jadi seperti sumur bor. Kita pakai air itu Mbak, termasuk warga desa sini. Kami juga kalau sedang musim hujan, biasanya nyimpan airnya itu, soalnya kan sulit ya di sini."

"This museum gets its water source from Luweng Sapen. It is indeed a natural water source, taken from a vertical cave that stores water underground. So it's like a borehole. We use that water, Mbak, including the residents in this village. We also usually store that water during the rainy season, because it is difficult here."

-Ari

"Saya itu sangat menyayangkan koleksi museum yang hilang. Banyak fasilitas rusak, atap bocor yang sampai sekarang nggak teratasi padahal sudah dibenerin beberapa kali, apalagi kalau hujan deres."

"I really regret the loss of museum collection. Many facilities are damaged, the roof leaks which still hasn't been fixed even though it has been repaired several times, especially when it rains heavily."

"Dulu sebelum tahun 2017 itu sebenarnya pintu masuk museum dibikin dari lantai 2 Mbak. Jadi masuknya lewat atas baru turun, penjelasannya juga urut dari sejarah karsnya dulu. Kalau sekarang karena udah diubah jadi taman ya lewat bawah, jadi urutannya nggak runtut seperti dulu."

"Before the year 2017, the museum entrance was actually started from the second floor. So people would enter from above and then descend, and the explanation would also follow the chronology of the karst history. Now, since it has been changed into a garden, you enter from below, so the order is not as sequential as before."

-Nining

Process of Design Planning

Needs and Design Objectives Analysis

Objective

Establishing the vision, mission, and design goals based on the analysis of existing conditions and stakeholder aspirations.

Techniques

1. Identifying the stakeholders (museum management, visitors, and local community.)
2. Determining the main objectives of design planning
 - revitalization of visitor experience
 - enhancement of accessibility
 - strengthening relationships with the surrounding environment

Data Collection and Field Observation

Objective

Gathering accurate information about the existing conditions of the museum and its environmental context.

Techniques

1. Direct observation of the museum space and its surrounding area
2. Documentation study (maps, archives, historical photos)
3. Interviews with relevant stakeholders
4. Visitor surveys (to obtain user experience feedback)

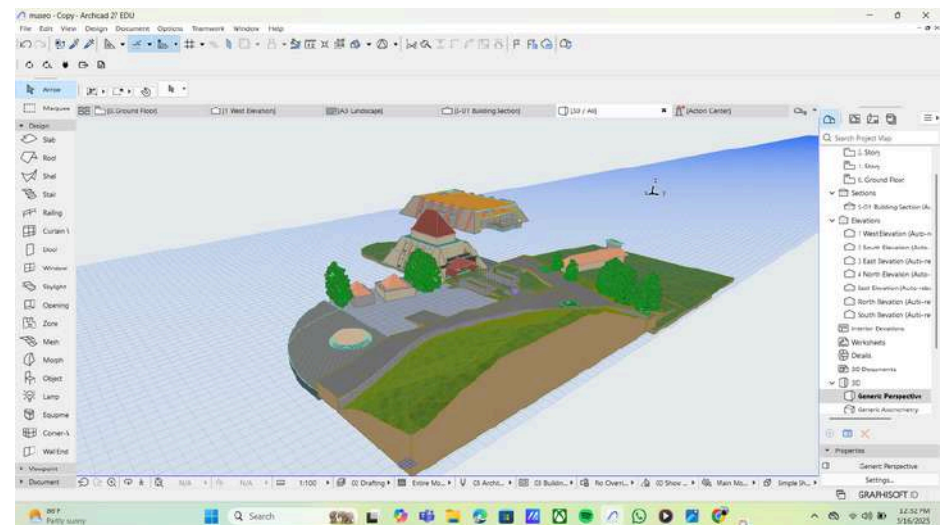




Figure of Observation
Source: Author

Data Collection of Existing Building

In the process of revitalizing a building, data on the existing conditions such as floor plans, structures, and the materials used are required. The challenge faced is obtaining the existing data of the current building. This is due to the lack of accessible building infrastructure data at the Tourism Office.

The solution is to carry out a combination of data collection through direct observation. This involves collecting data in the form of photos, videos, measurements, and analysis based on Google Earth.

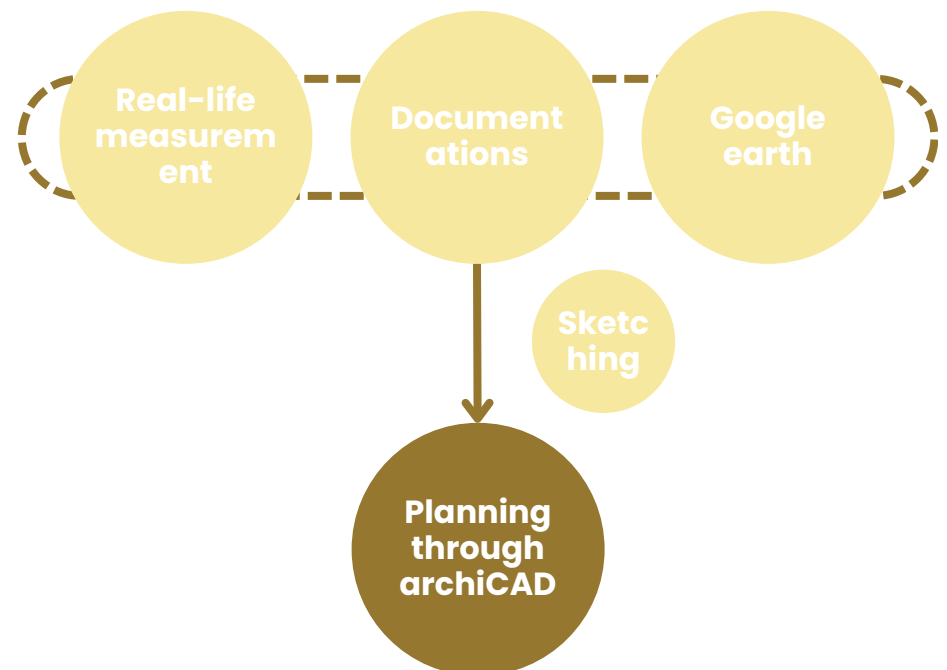


Diagram of Data Collection
Source: Author

Existing Building Facade & Exterior

The style used is modern tropical, which tries to adapt to the karst landscape. However, from an aesthetic perspective, the appearance of the building tends to be rigid and monumental, with a visual expression that is less grounded in the local context.

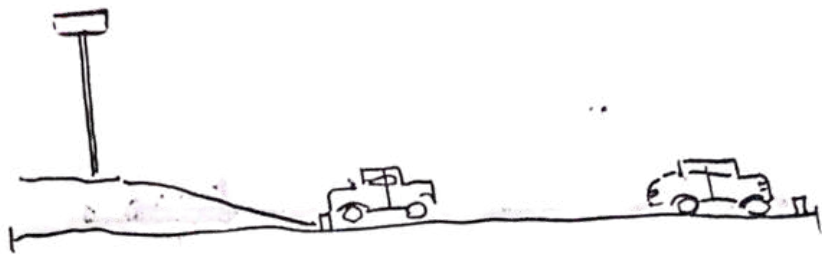


Bird Eye Perspective of Existing Museum
Source: Author

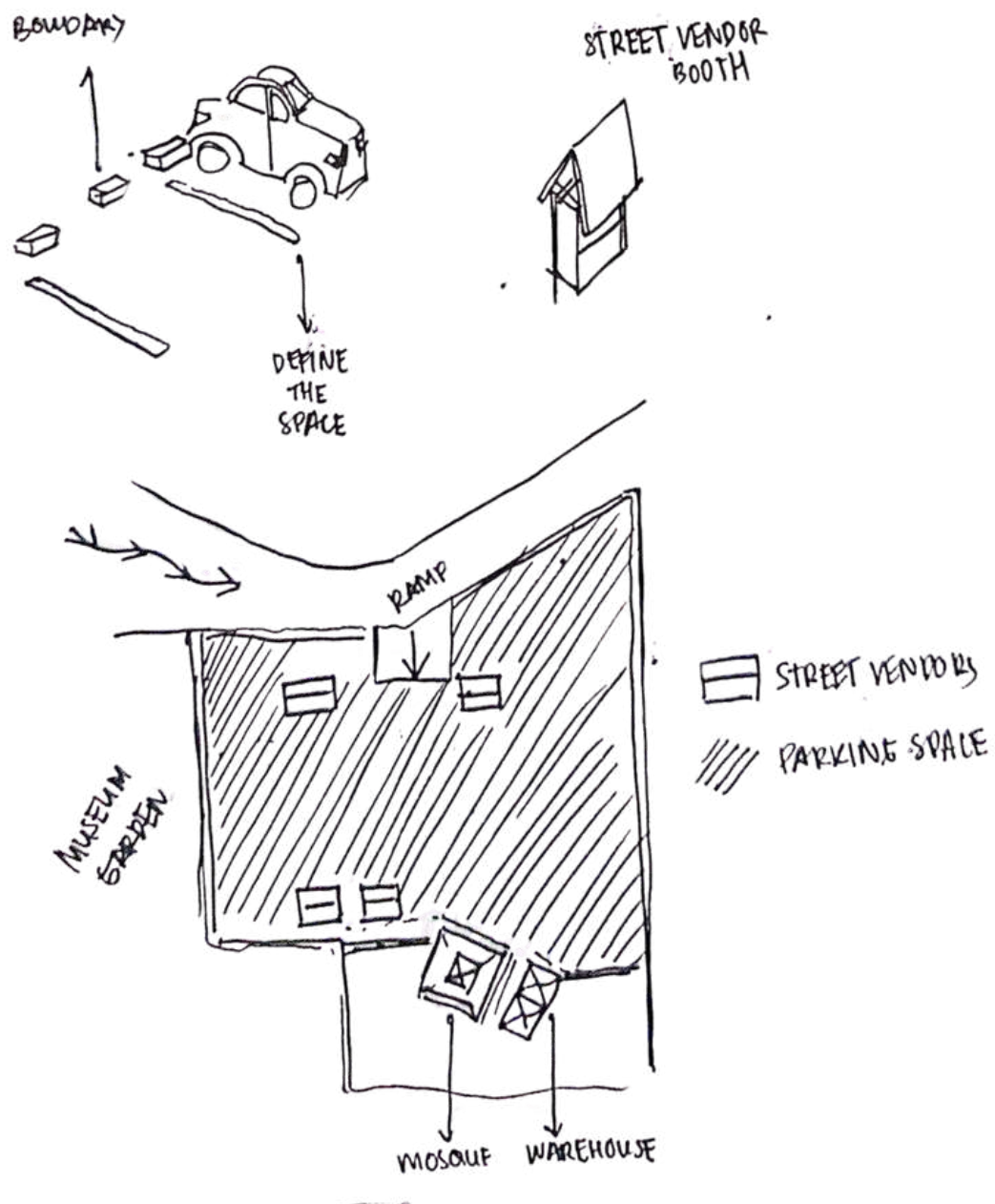
Design Issues

Parking Zone

PARKING ZONE



The parking lot is not defined whether it is for two-wheeled or four-wheeled vehicles.



There are no line markings related to the division for each vehicle, so visitors park as they please.

The poorly managed division of parking spaces allows street vendors to set up booths arbitrarily.

Sketch of Existing Parking Zone
Source: Author

Existing Building Lobby / Entrance

Location and Arrival Directions

1. The entrance area is located at the front side of the main building, facing the parking area.
2. There is no noticeable portal or gate marking the transition from the outside space to the inside of the museum building.
3. Visitor access from the parking lot to the entrance area has not been designed with a special pedestrian pathway or clear directional elements.

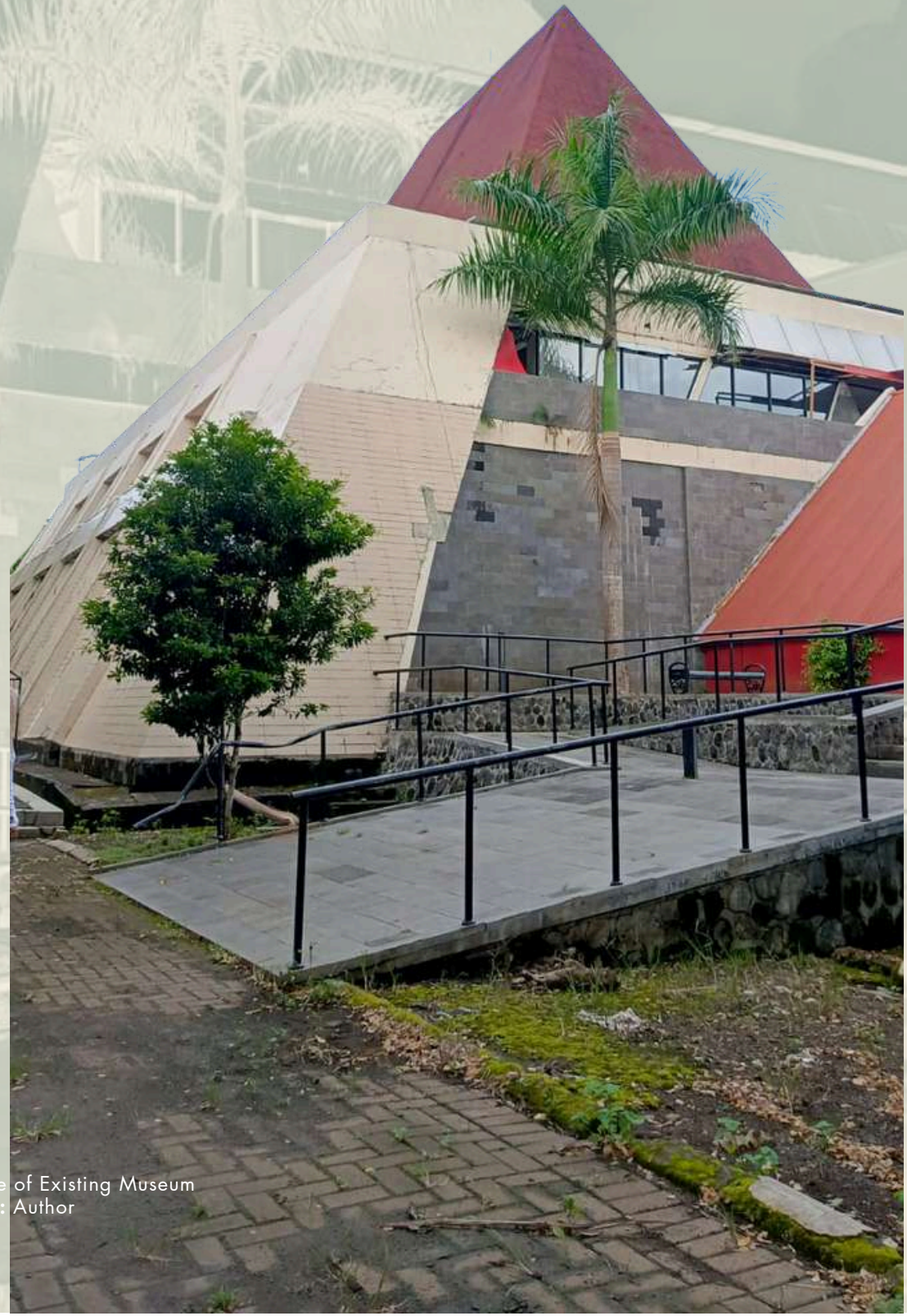


Transition Area (Front Page & Terrace)

1. The entrance terrace is quite spacious, consisting of a simple concrete plaza without shading elements or seating.
2. The surrounding landscape is minimally vegetated, making this area feel hot and dry during the day.
3. There are no artistic elements or outdoor installations that could attract visitors to stop or interact before entering.

Entrance & Facade

1. The main door consists of double openings with glass doors and a metal frame, but its size is not too large or monumental.
2. There is no canopy to protect the door area from heat or rain.
3. The front facade appears massive and monotonous, making the entrance less prominent from a distance.



Design Issues

Entrance Zone

The previous area was a park that was rarely used.

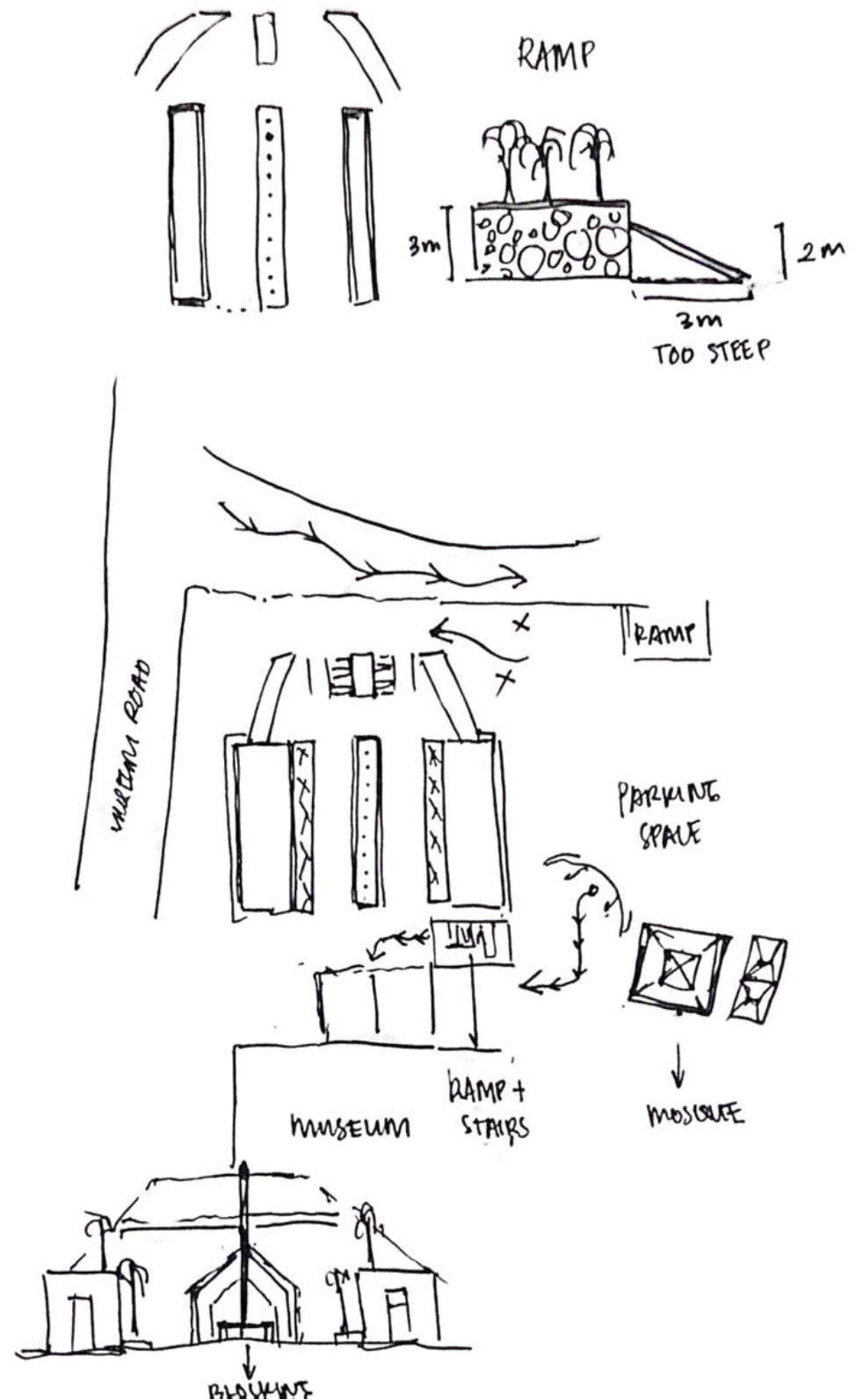
The cause is that visitors tend to enter through the ramp path that is visible from the parking area.

There are no signs and circulation directing visitors to go through the front.

The park area with high elevation is abandoned because there are no facilities to stop for a moment, such as benches.

The ramp on the existing building is also too steep with a final height of 2 meters but the length of the ramp is only 3.4 meters.

The high lights along the park located in the middle obstruct the museum building, which diminishes the initial impression due to the poor visibility of the building.

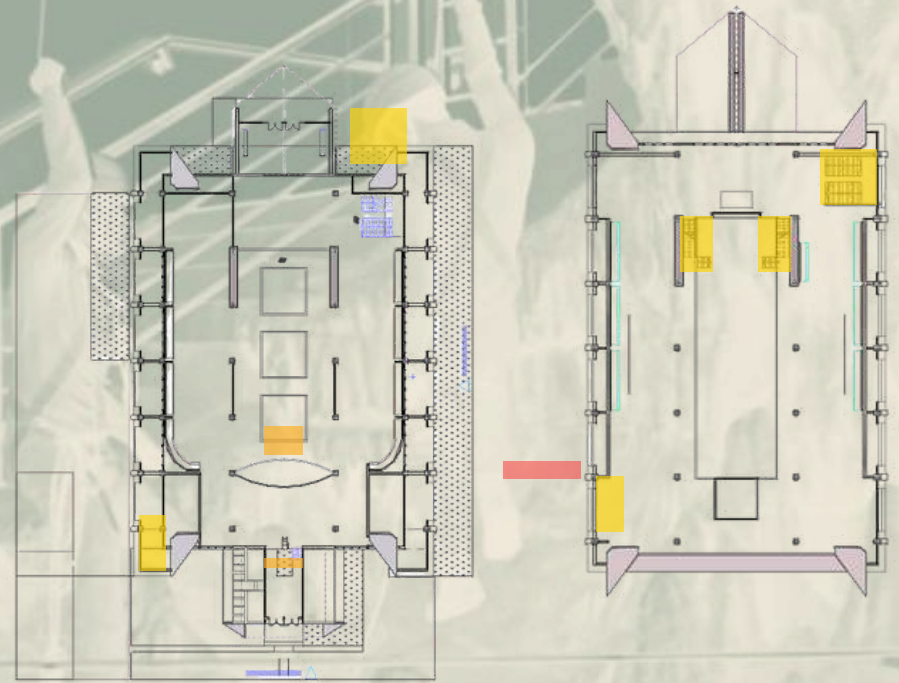


Existing Building Main Circulation

VERTICAL ACCESS

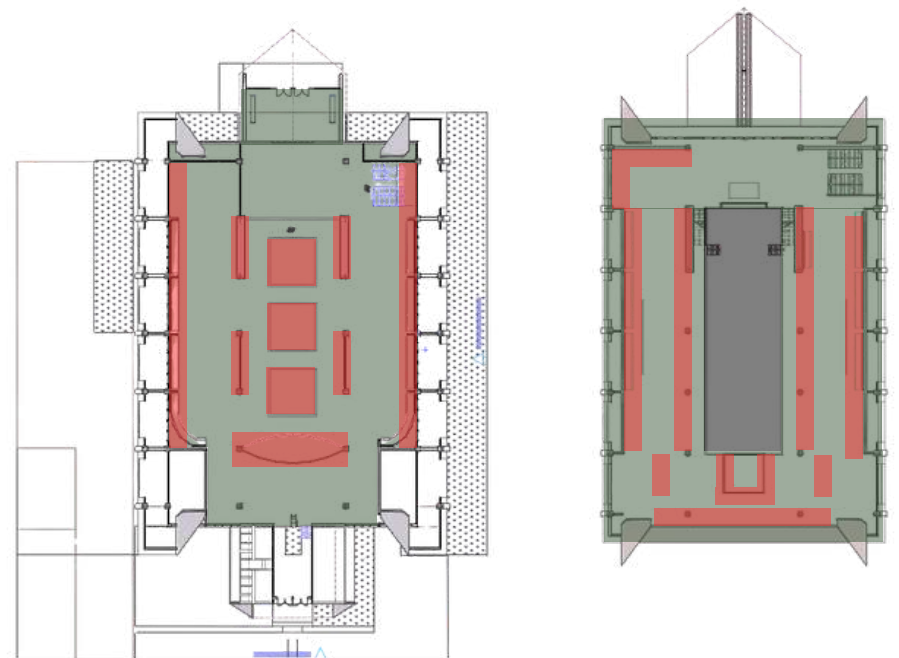
The museum consists of several levels, but vertical access such as stairs or ramps:

- Is not directly visible from the main circulation- Is less integrated into the narrative of the exhibition flow-
- Accessibility for disabled people is not optimal.



Vertical Access in The Museum
Source: Author

INTERACTION & STOP



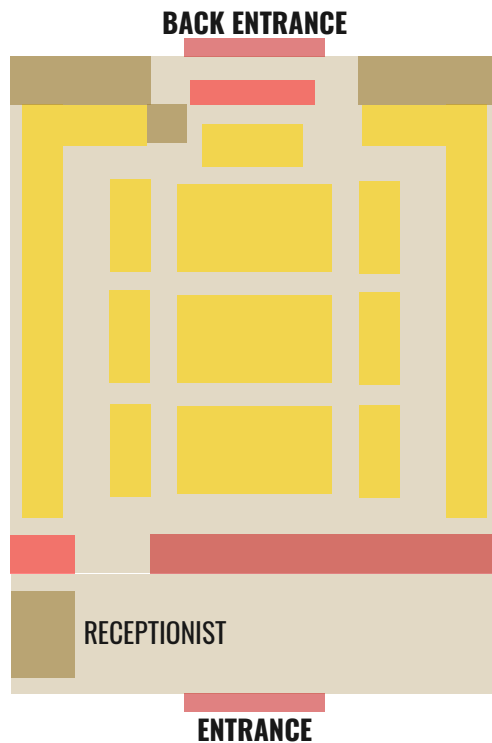
Exhibition Arrangement
Source: Author

1. There are almost no pocket spaces or pause points designed for:
 - Sitting, reading information, or resting
 - Engaging in interaction or group discussions
2. The circulation feels like it is continuously moving without moments of contemplation or deep engagement.

MUSEUM LAYOUT

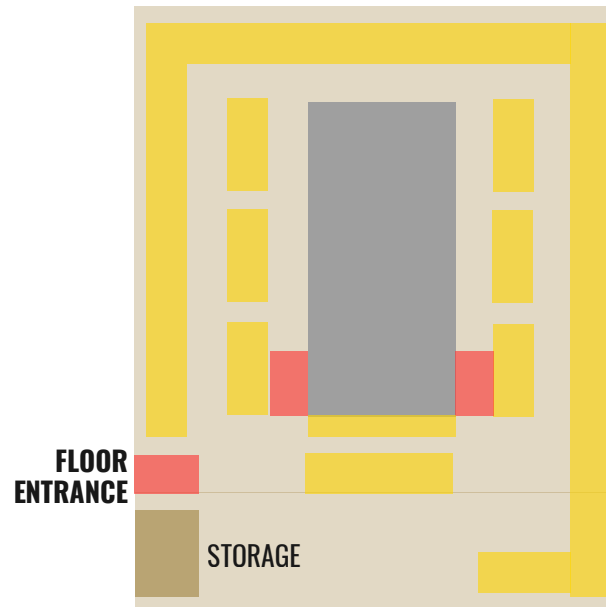
GROUND FLOOR

Karst for Life



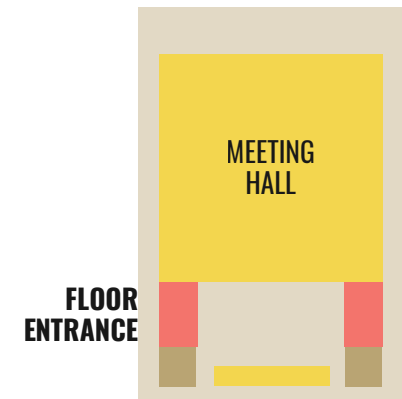
FIRST FLOOR

Karst for Knowledge



SECOND FLOOR

Auditorium



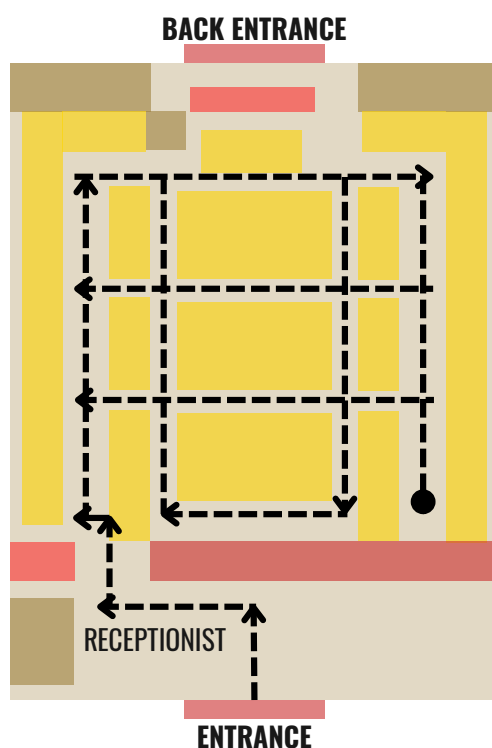
LEGENDS

- Display placement
- Partition
- Stairs
- Void
- Office or toilets

VISITOR CIRCULATION

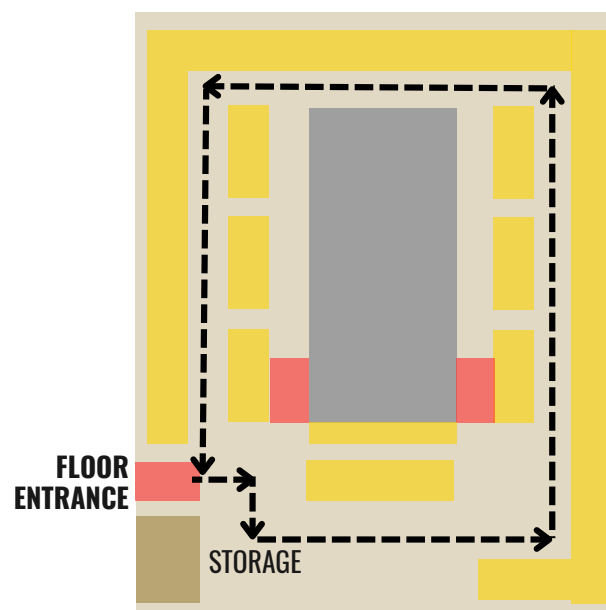
GROUND FLOOR

Karst for Life



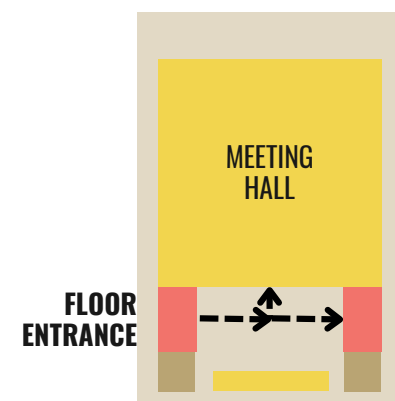
FIRST FLOOR

Karst for Knowledge



SECOND FLOOR

Auditorium

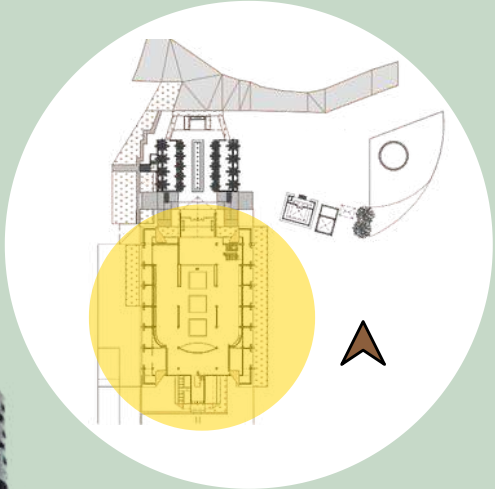


LEGENDS

- Display placement
- Partition
- Stairs
- Void
- Office or toilets

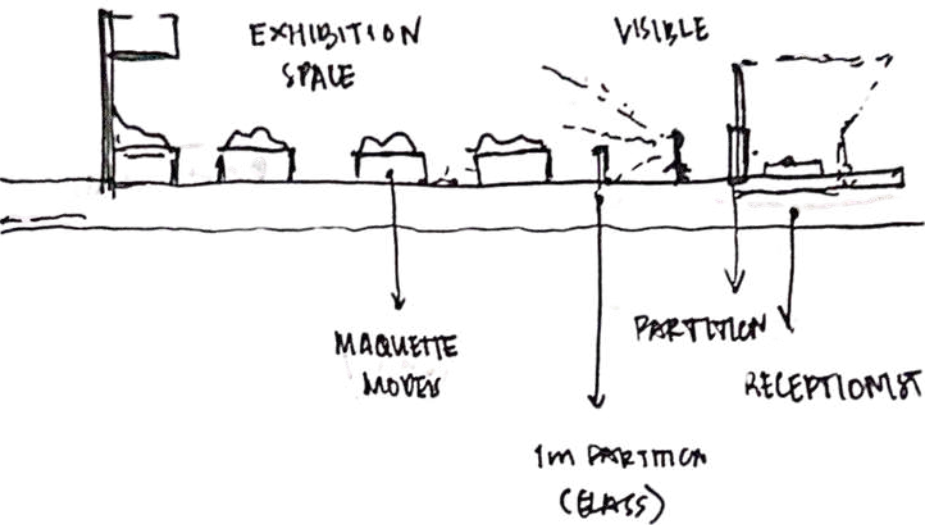
Source: Author

Existing Building
Museum

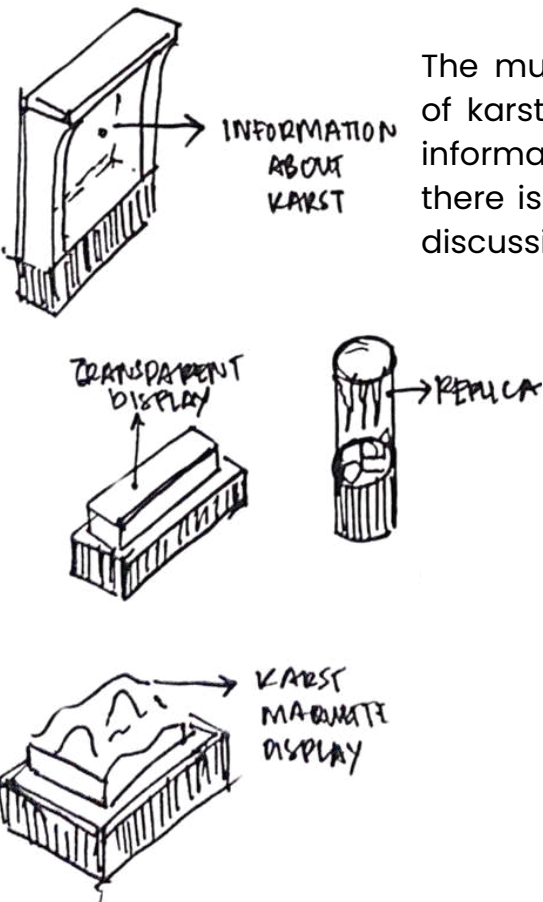


Design Issues Museum Building

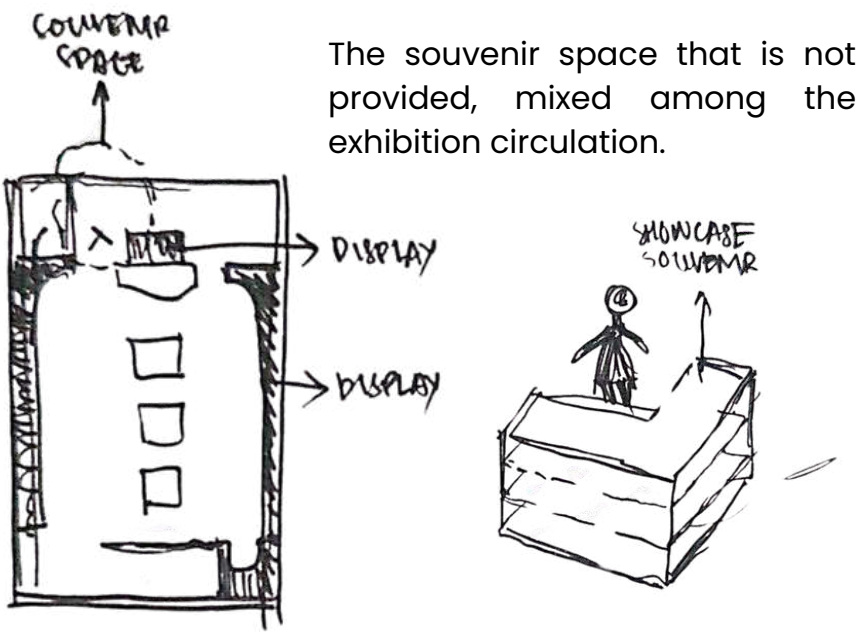
There is no symbolic nuance welcoming the visitors.



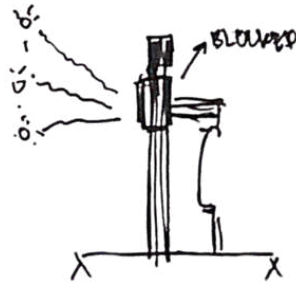
Upon entering the museum's reception area, visitors can directly see the inside of the exhibition.



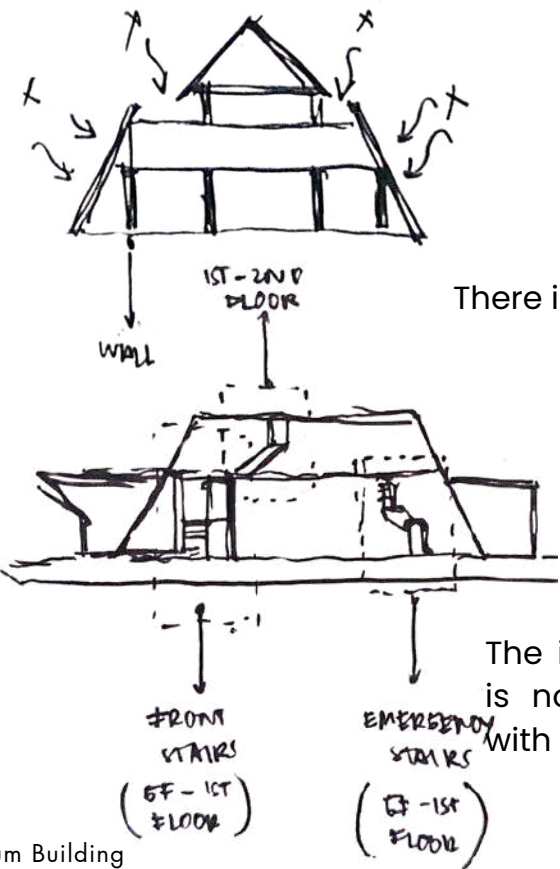
The museum, as a function of karst education, provides information boards, but there is no space for further discussion/study.



The souvenir space that is not provided, mixed among the exhibition circulation.



The natural light source on the first floor is obstructed by the exhibition board.



There is no natural lighting on the second floor.

There is no passive ventilation.

The interior of the museum is not accessible to users with disabilities.

Design Issues

Back of Museum

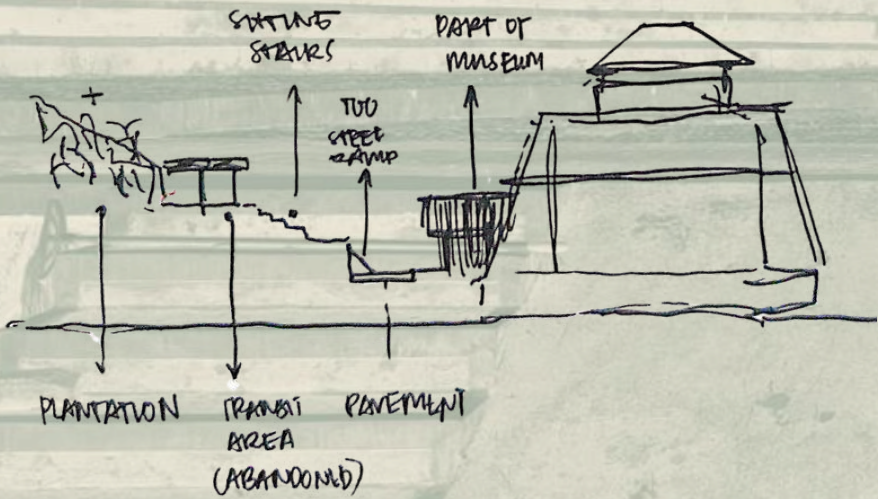


Figure of Museum Back
Source: Author

In the south of the museum building, there is an area with a higher elevation that used to serve as a transit area.

The ramp is 1 meter high but only 2 meters long, making it very steep.



The back section has an agricultural area that should be included in the museum's narrative, but there is no access.

The area has no correlation with the museum narrative or is of no significant function.



There are several spaces, but they are left unused as a storage for scrap that is not in use.



Raised hardscape that can be used for sitting and relaxing.

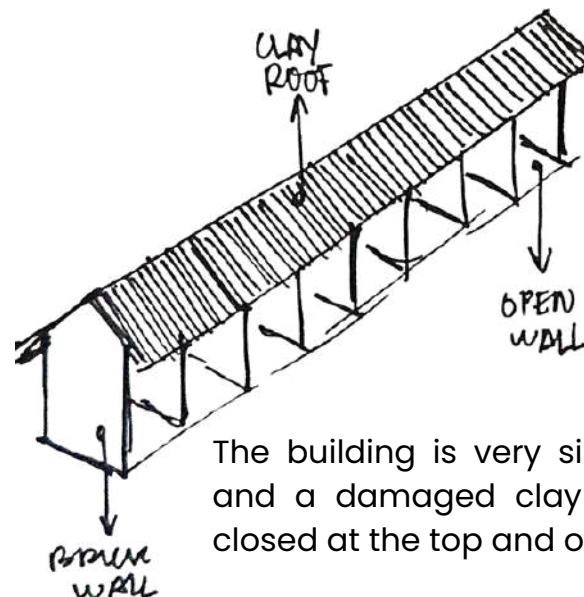
Design Issues West of Museum

There is a long abandoned facility.



In the west of the museum building, there is an area with a lower elevation that used to serve as a transit area. The area here has not been provided with ramp facilities.

The area has no correlation with the museum narrative or is of no significant function. Because it is not in good condition, the building is used by some residents to store their harvest.



The building is very simple with brick walls and a damaged clay roof. The building is closed at the top and open on the wall sides.

Analysis on Ideal Condition

Aspect	Existing Condition	Ideal Condition	Revitalization Strategy
Concept and Theme	Museum themes seem too passive and lack interactive experiences.	A theme that combines interactivity, education, and firsthand experience about the karst world.	Reorganizing the museum theme with more narrative architecture
Zoning and Visitor Circulation	The flow of visitors is not well structured. Some areas appear empty or not integrated.	A clearly structured flow, zones connected with a narrative theme.	Redesigning the visitor journey with clearer thematic zones.
Educational Space	There are no educational spaces, just a display containing monotonous information boards.	A structured and inspiring educational space.	Building a workshop space for geological exploration and a mini laboratory.
Visitor Involvement	Visitors are more passive, there is not much to do other than viewing the exhibitions.	Visitors are more actively engaged in experiences, such as mini cave exploration and water filtration simulations.	Creating interactive areas such as craftsmanship making, or virtual cave experiences.
Conservation and Environment	The limited green elements and open spaces, as well as the suboptimal maintenance of the collection.	Collection maintenance with a good conservation approach, green building, and nature integration.	Implementing the rainharvesting as a solution to water crisis.
Visitor Facilities	Some visitor facilities such as seating and signage are inadequate.	Comfortable visitor facilities, high accessibility, as well as interactive and rest areas.	Add comfortable break room facilities and accessible toilets.
Spatial Connectivity	The spaces feel separate and monotonous.	A space that is interconnected narratively and visually for a sustainable experience.	Making the one way circulation

Differences On Karst Museum

ASPECT	GENERAL MUSEUM	KARST MUSEUM
Function and Purpose	Displaying collections of art, history, culture or science in a neutral space.	Education about karst geology, the environment, water conservation, unique ecology, and local myths.
Exhibition Contents	Tend to be static, based on artifacts or historical narratives	Interactive and based on geospatial science, morpho-geology, rock dissolution processes, groundwater, etc.
Site Condition	Free, can be in urban areas	Integrated with karst areas, protected zones or geoheritage, such as in Wonogiri.
Structure and Material	Flexible, sometimes monumental or contemporary	Adaptive to geological conditions, does not damage karst landscape (light materials, minimal deep foundations)
Government Guidelines	Referring to the Minister of Education and Culture Regulation or Cultural Heritage Regulation	Must refer to: - Minister of Energy and Mineral Resources Regulation No. 17 of 2012 concerning Karst Landscape Areas - Law No. 11 of 2010 concerning Cultural Heritage - Regional Spatial Planning (RTRW) of the area
Zoning	Generally only public, exhibitions, & admin	Strict zoning is needed (protection zone, education zone, interpretation zone of myths/ecology)

Design Guidelines

Do & Don't

NO.	DO	SOURCE
1	Protect the core karst areas (caves, sinks, ponors, springs)	According to the Ministry of Energy and Mineral Resources Regulation No. 17 of 2012, karst core zones should not be built upon as they serve as natural water reservoirs and specific habitats.
2	Enhance visitor experience through interactive storytelling.	Supported by the Museum Revitalization Guidelines (Ministry of Education and Culture): educational and immersive spatial experiences increase visitor numbers.
3	Provide accessible pathways and facilities for people with disabilities.	According to SNI 03-1736-2000, museums must be friendly to all groups. Accessibility is an element of inclusion and legality.

NO.	DON'T	SOURCE
1	Uncovering the karst rock formation for building expansion	According to the Ministry of Energy and Mineral Resources Regulation No. 17 of 2012, karst core zones should not be built upon as they serve as natural water reservoirs and specific habitats.
2	Eliminating educational functions to become fully commercial (for example, malls)	Museums must continue to educate. A complete shift to commercial functions violates the purpose of establishment based on Presidential Instruction No. 16 of 2005.
3	Ignoring safety and evacuation standards	Contrary to the SNI 03-1745-2000 standards (fire protection), the museum must have active and passive safety systems.



These are images captured by drone from the height of 30 meters above the ground.

Real Situation of the Museum Area
Source: Author





Real Situation of Tembus cavea
Source: Author

The Legend of Goa Tembus:

An Ancestor's Heritage Guarded by the Supernatural Long ago, in the barren and limestone-hilled land of Pracimantoro, there lived an old sage named Ki Wono Dipo, a hermit known for his wisdom and supernatural powers. He was known to be able to read the direction of the wind, understand the sound of stones, and speak to nature. It is said that during his meditation, he often entered a very deep cave — which later became known as Goa Tembus. The villagers at that time believed that Goa Tembus was not just an ordinary cave, but a corridor that connected the human world and the supernatural realm. Ki Wono Dipo referred to the cave as the 'earth's light pathway', a place where humans could understand messages from their ancestors and the universe. However, not everyone was allowed to enter. Only those with pure hearts and no ill intentions could safely pass through its corridor.

A Curse for the Greedy

There is a story passed down orally about a greedy young man named Jagat who tried to enter the Tembus Cave to search for a 'magic stone' believed to bring wealth. He brought a knife, rope, and sack, intending to collect crystal stones inside the cave. However, when he went too deep, the passages of the cave changed shape, and he seemed to walk in an endless loop. The villagers found Jagat a few days later in a dazed condition outside the cave, his mouth mumbling unclear words. Since then, he has never been able to speak normally again and is considered to have his 'soul locked' by the mystical guardian of the Tembus Cave.

Since that incident, parents in the past have always warned: "Aja ngrogol panggonane lelembut, yen ora gelem ilang pikire." Don't disturb the place of the spirits, if you don't want to lose your mind.

This folklore also teaches that Goa Tembus is a symbol of the guardian of nature's balance. If humans are greedy and do not respect nature, then nature will close itself off. The cave will become a dead end for those with dark hearts, and it will only be 'penetrable' for those who come to learn and reflect. This story is still believed today, especially by the elderly community around Pracimantoro. They believe that Goa Tembus has a 'soul' and should not be regarded as a mere object.



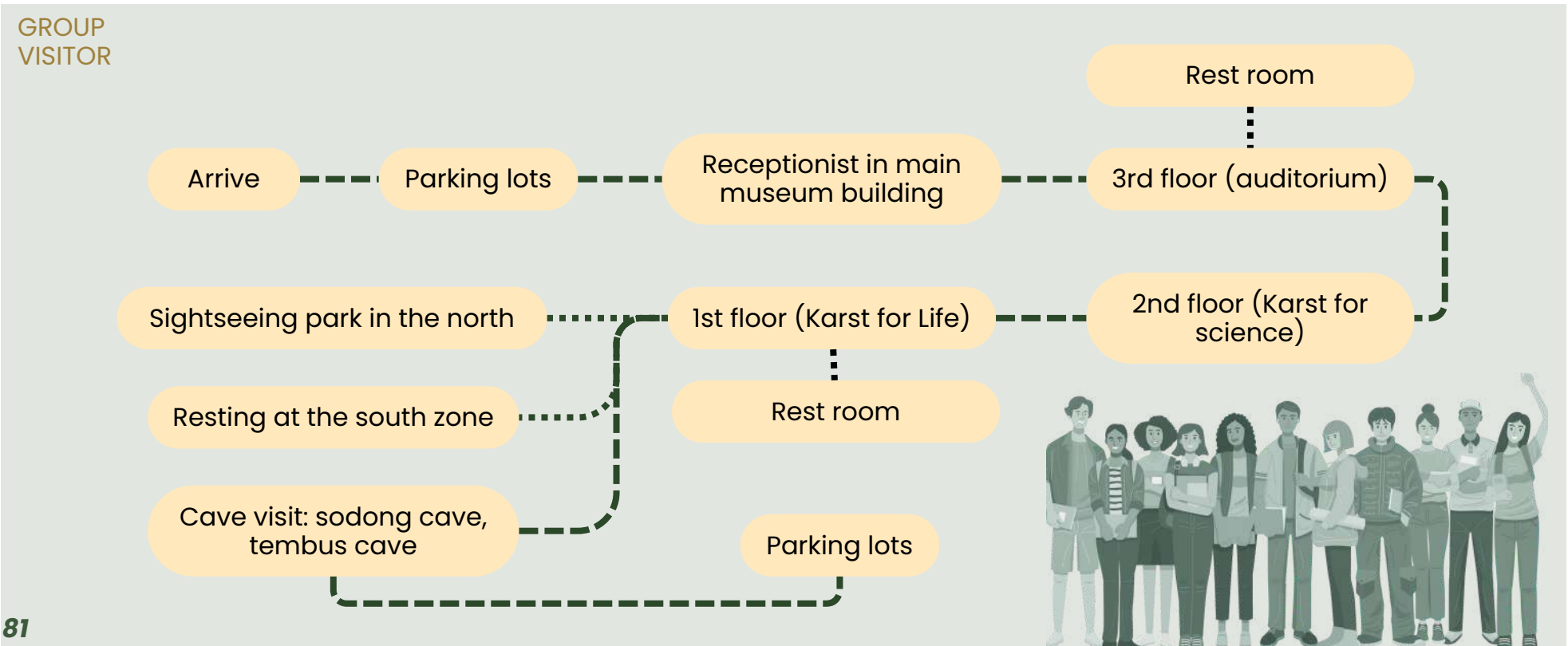
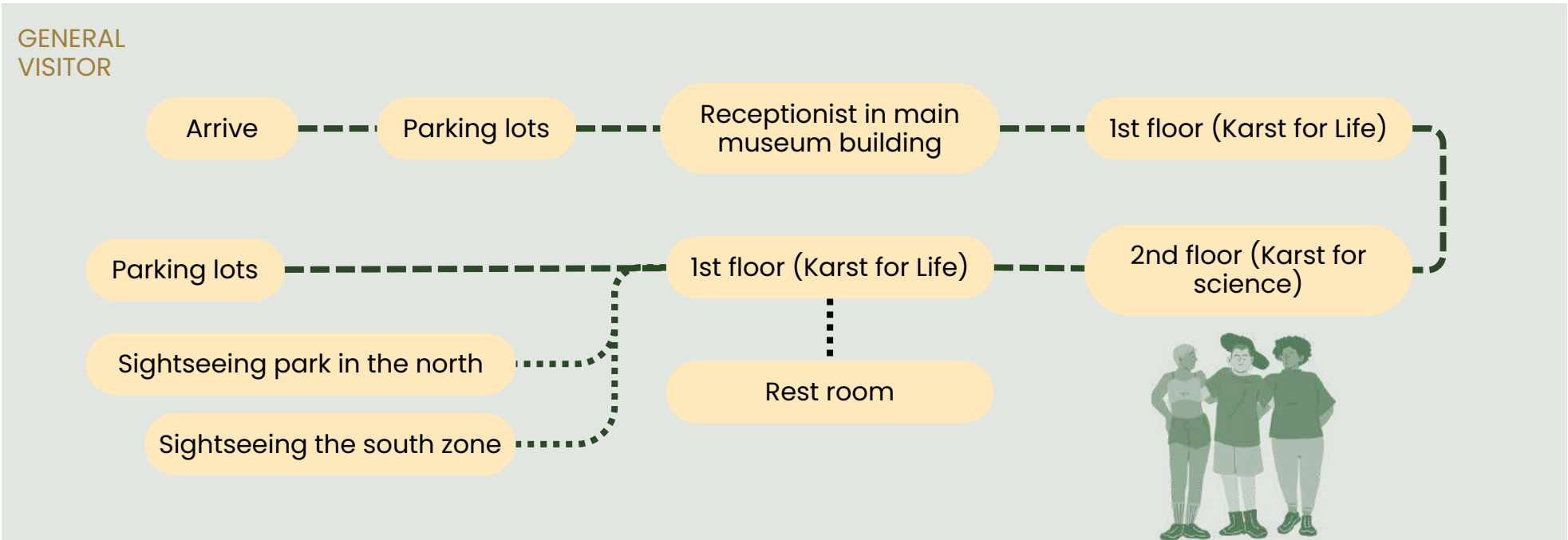
03

DESIGN PROBLEM SOLVING

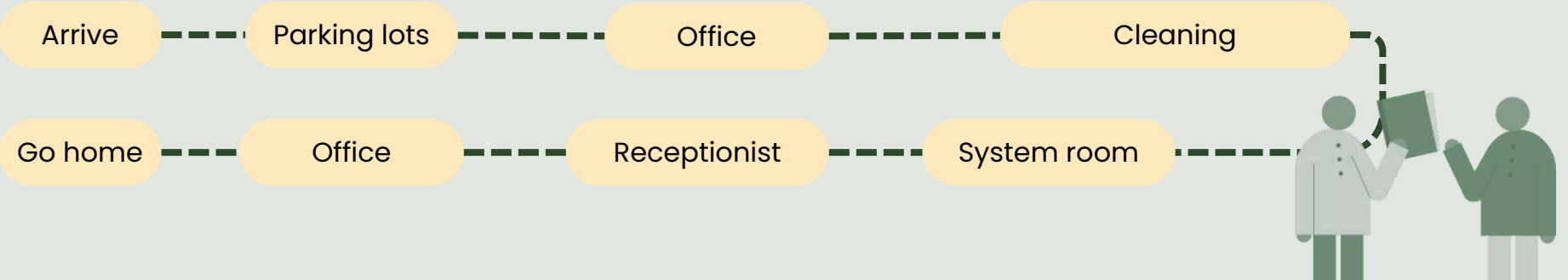
USER & ACTIVITY FLOW ANALYSIS

Based on User

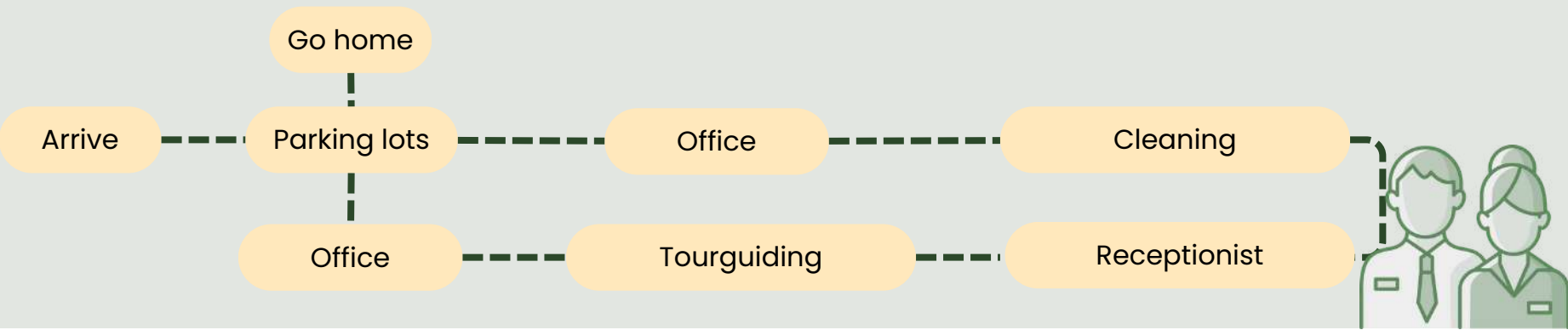
Museum themes seem too passive and lack interactive experiences.



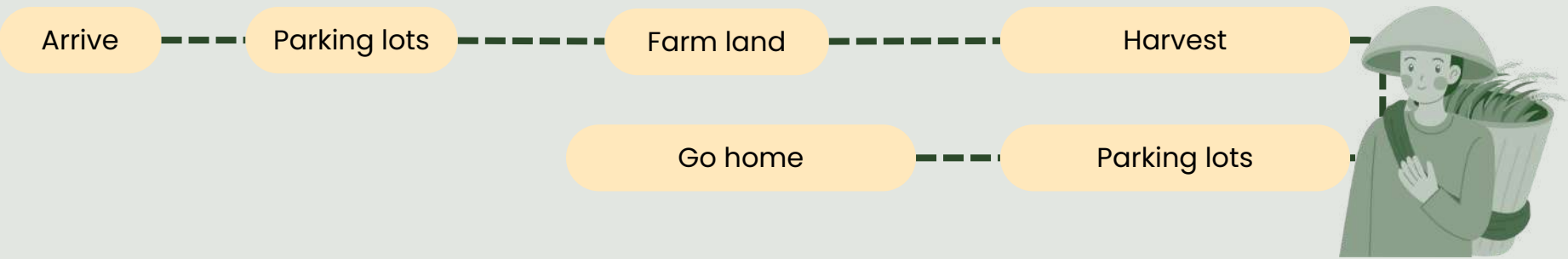
MANAGEMENT



STAFF



FARMER



No.	User	Activities	Room Requirement	Properties
1.	General Visitors (students, tourists, families)	• Buying tickets and orientation • Viewing permanent & temporary exhibitions • Watching educational films • Participating in interactive tours- Shopping & resting	• Entrance & ticketing area • Orientation space • Permanent & temporary exhibition gallery • Audio-visual room • Interactive zone • Museum shop & cafeteria	• Easy access • Clear circulation (visitation flow) • Comfortable & educational space • Child & family-friendly
2.	Children / Students	• Learning in an interactive way • Educational games • Participating in school programs	• Children’s corner • Interactive learning zone • Education workshop room	• Safe & enjoyable design • Attractive visuals • Interactive equipment
3.	Researchers & Academics	• Accessing data & literature • Researching collections & samples • Discussions & seminars	• Research library • Collection storage & preservation • Laboratory • Seminar room	• Calm & private • Temperature/humidity controlled (preservation) • Supporting technology facilities
4.	Local Community	• Attending cultural workshops • Showcasing local arts • Community discussions	• Community space • Workshop area • Outdoor plaza/amphitheater	• Flexible for various events • Community friendly • Supports social interaction
5..	Manager / Staff	• Museum administration • Collection management • Operations & maintenance	• Administration office • Staff room • Security & maintenance room • Storage/service area	• Limited access • Close to technical space • Efficient circulation

PUBLIC ZONE

Room	Function	Characteristic
Lobby & Orientation Space	Reception area, initial information, visitor orientation	Public, open, easy access, clear circulation, visually attractive
Permanent Exhibition Gallery	Displaying the permanent collection (geology, water, biodiversity, karst culture)	Educational, narrative, controlled lighting, immersive atmosphere, interactive display
Temporary Exhibition Gallery	Thematic exhibition according to certain events	Flexible, modular, easy to change layout, adaptive lighting
Audio Visual Room / Mini Theater	Screening films/visual education	Dark ambiance, good acoustic, comfortable seating, focused atmosphere
Children’s Corner / Education Room	Child education through play	Safe, fun, bright colors, child-friendly, flexible furniture
Museum Shop	Sales of souvenirs, books, local products	Public, attractive, close to the exit, smooth circulation
Cafeteria & Rest Area	Rest and meal place	Public, comfortable, natural lighting, supports relaxation
Mushola & Toilet	Worship and basic needs	Public, easily accessible, clean, neutral
Parking & Drop-off Area	Vehicle parking, bus transit area	Public, direct access, safe circulation, large capacity

Table of Karst Museum Programming
Source: Author

KARST MUSEUM PROGRAMMING

Based on Spatial Character

SEMI PUBLIC ZONE

Room	Function	Characteristic
Seminar / Conference Room	Discussions, workshops, academic presentations	Formal, flexible, good acoustic, layout easy to change
Community Space	Community meeting, community discussion	Communal, flexible, semi-public, supporting social interaction
Workshop Area	Cultural training, crafts, local products	Flexible, creative, open, productive atmosphere

PRIVATE ZONE

Room	Function	Characteristic
Research Library	Access to literature, research archives	Calm, formal, private, controlled natural lighting
Collection Storage & Preservation	Museum collection storage	Very private, controlled (RH/temp), safe, isolated from the public

SERVICE ZONE

Room	Function	Characteristic
Administration Office	Access to literature, research archives	Calm, formal, private, controlled natural lighting
Staff Room & Service Area	Museum collection storage	Very private, controlled (RH/temp), safe, isolated from the public
Security Room / Control Room	Security monitoring, CCTV	Private, safe, close to the entrance, limited access

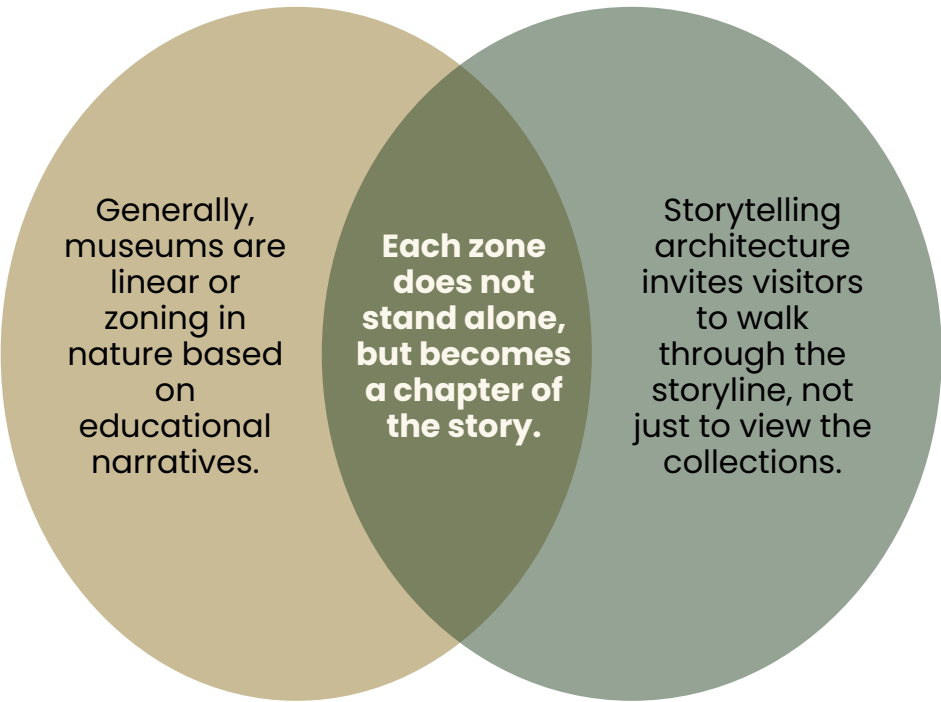
SERVICE ZONE

Room	Function	Characteristic
Outdoor Plaza / Amphitheater	Cultural performances, public events	Outdoor, open, communal, natural acoustics, flexible
Landscape & Outdoor Exhibition	Field education (rock garden, karst interpretation trail)	Outdoor, natural, educational, in harmony with the environment

DESIGN CONCEPT

Site Planning

Zoning arrangement characteristic



Typical Plan – Museum Karst

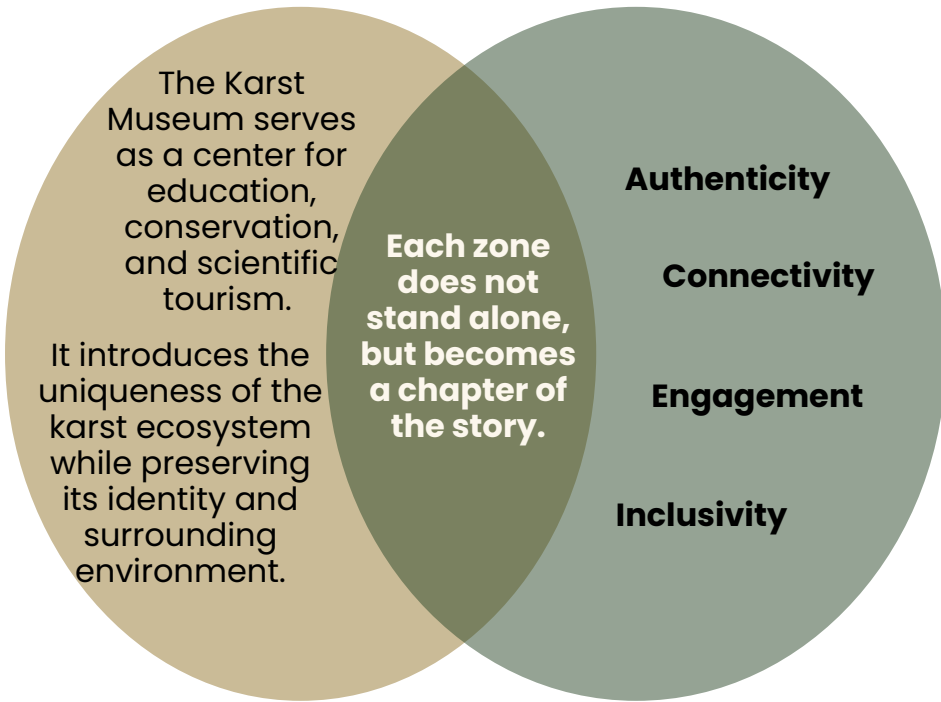
Storytelling Principle

In general, museums are organized either in a linear sequence or by zoning, depending on the educational flow that they want to build.

- **Linear plan** → visitors are directed to follow a sequential one-way path. Each space acts as a chapter in a story, forming a clear chronological or thematic storyline. Suitable for historical narratives, natural evolutions, or sequential tales.
- **Zoning plan** → the museum is divided into thematic zones or clusters. Visitors can choose their own route according to their interests, such as geology, flora-fauna, local culture, etc. Suitable for a more free and interactive experience.

Storytelling architecture transforms the museum experience from merely viewing collections into a narrative journey. Visitors are invited to traverse spaces arranged like chapters in a story, where each transition conveys a particular message, atmosphere, and meaning. In this way, the museum serves also as a medium that creates a deeper emotional and intellectual experience.

Spatial concept and architectural storytelling



Karst Museum Building

Storytelling Ethics

Ethics in Storytelling Architecture

1. **Authenticity** – the story being built based on the truth of history, culture, and local context.
2. **Connectivity** – the space must convey a narrative that can be understood and felt by visitors, not just a symbol.
3. **Engagement** – the design provides an immersive experience so that visitors feel connected to the story.
4. **Inclusivity** – the story presented is not exclusive but embraces diverse perspectives and audiences.

In essence, the ethics of storytelling architecture is to tell the space honestly, relevantly, and responsibly, while involving visitors in a meaningful experience.

INITIAL CONCEPT

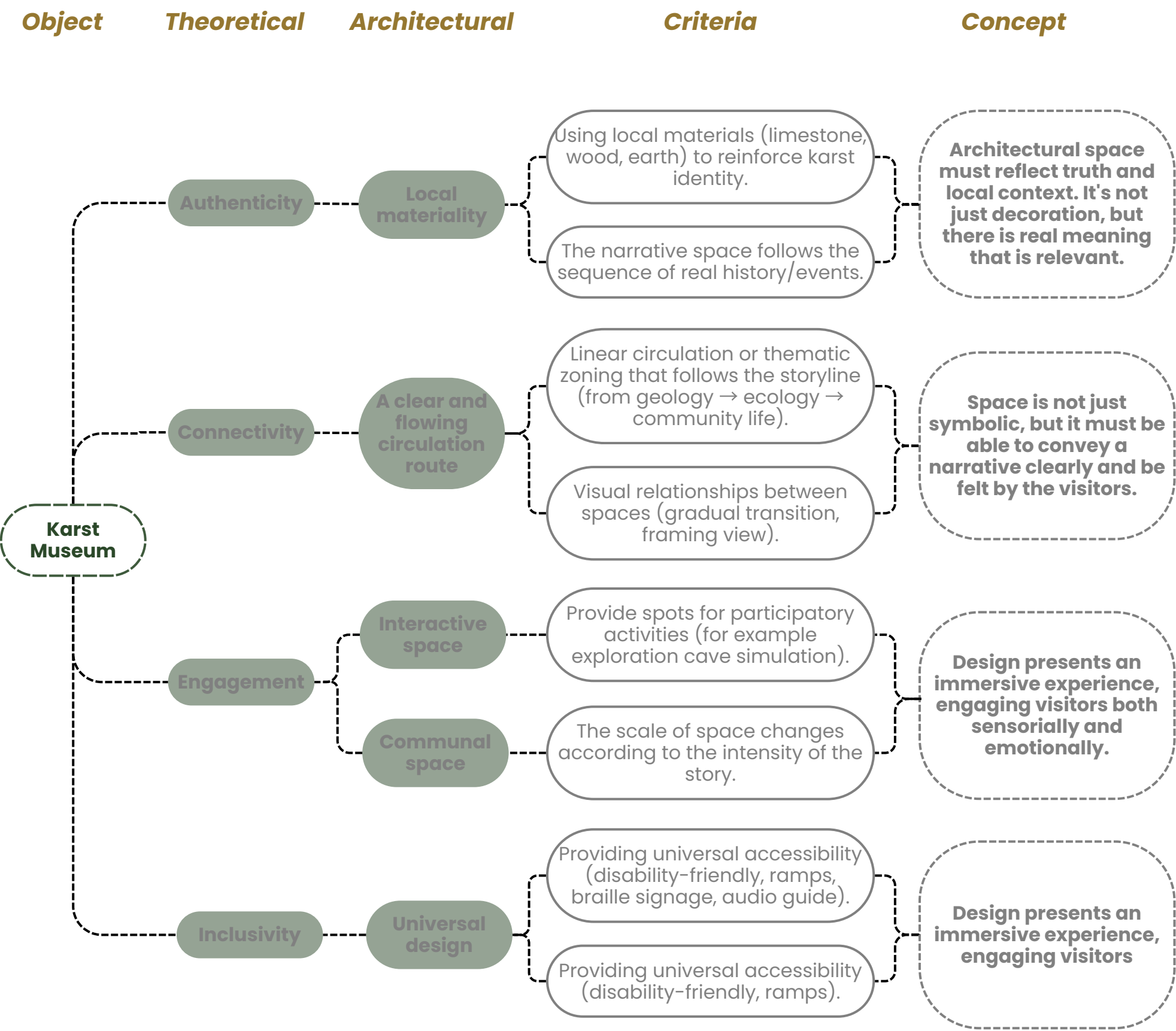


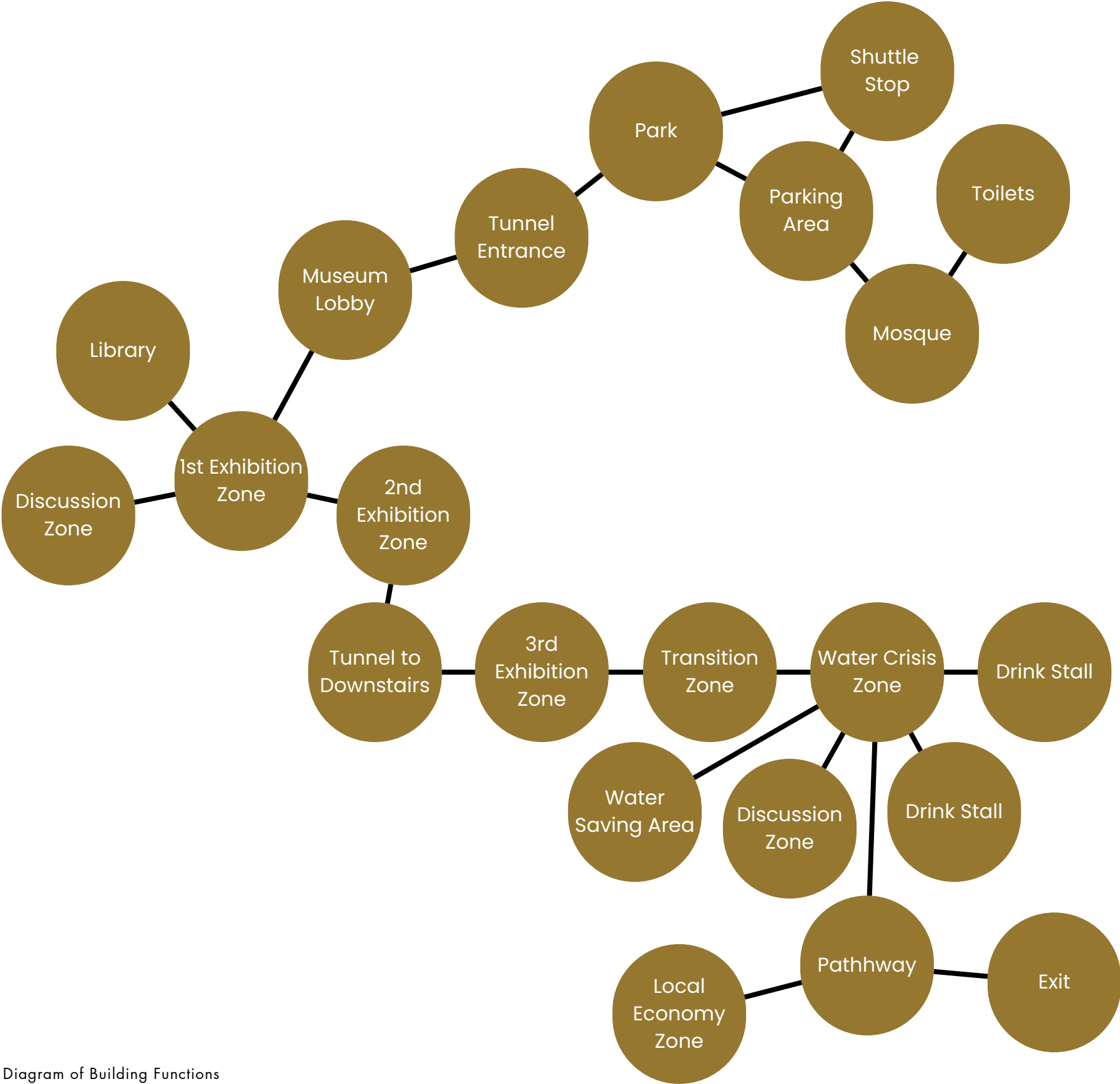
Diagram of Initial Concept
Source: Author



04

ANALYSIS AND RESPOND

Alternative – Room Arrangement

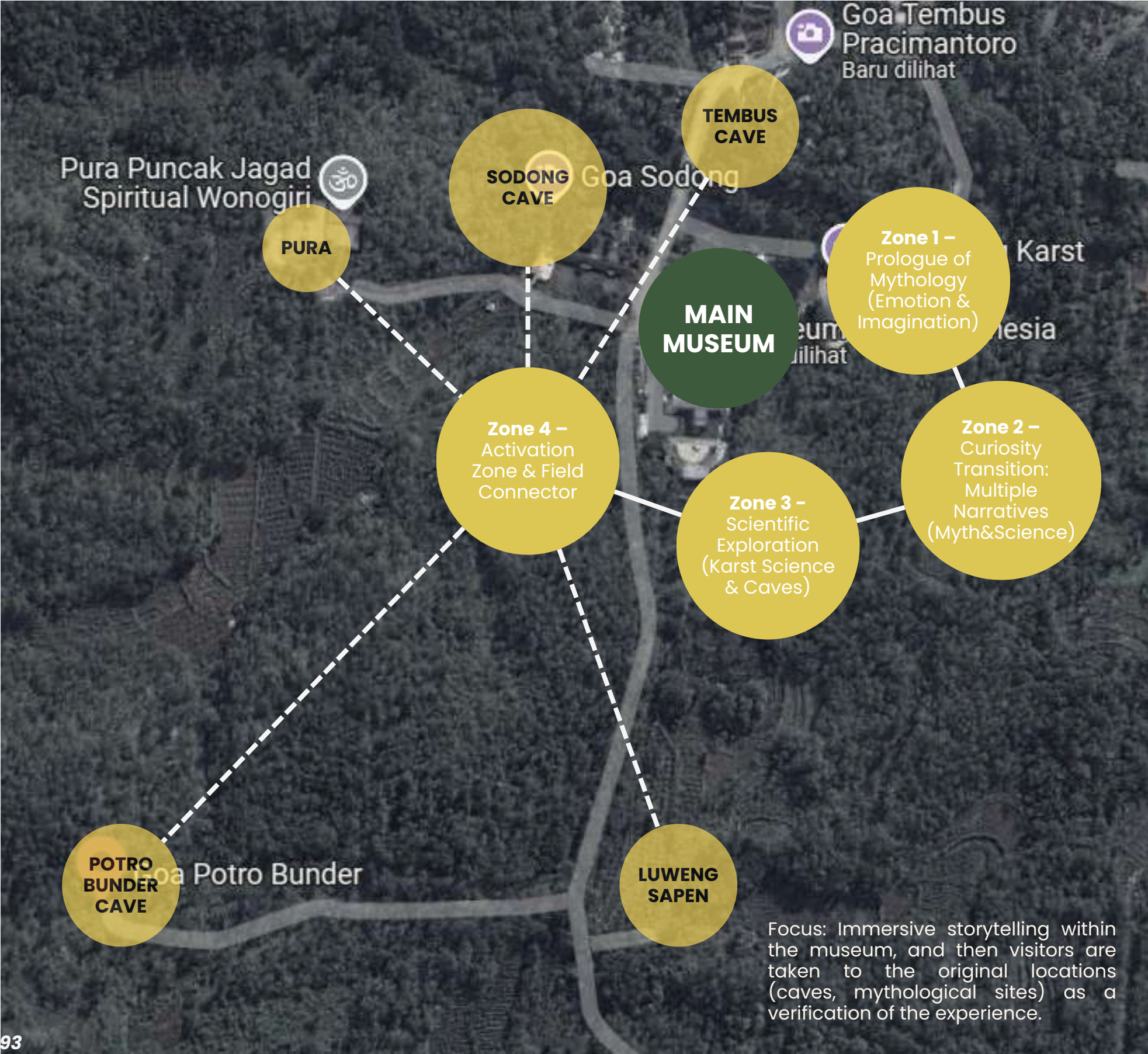


Bubble Diagram of Building Functions
Source: Author

1st ALTERNATIVE

Museum as the Main Narrative, Original Location as Validation

Zoning Concept

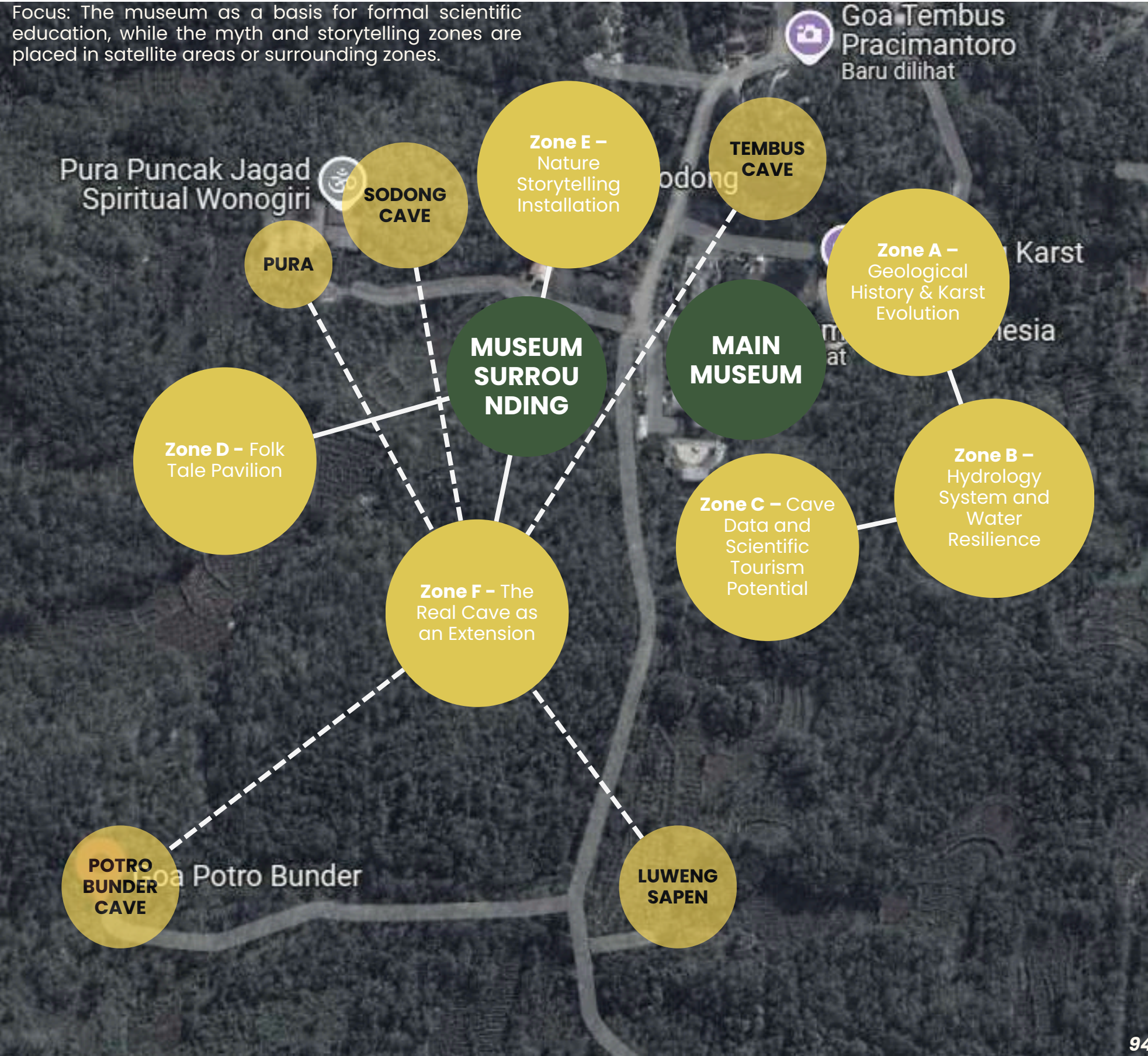


2nd ALTERNATIVE

Museum as a Science Center, Separated Zone for Myths (Thematic Segmentation)

Zoning Concept

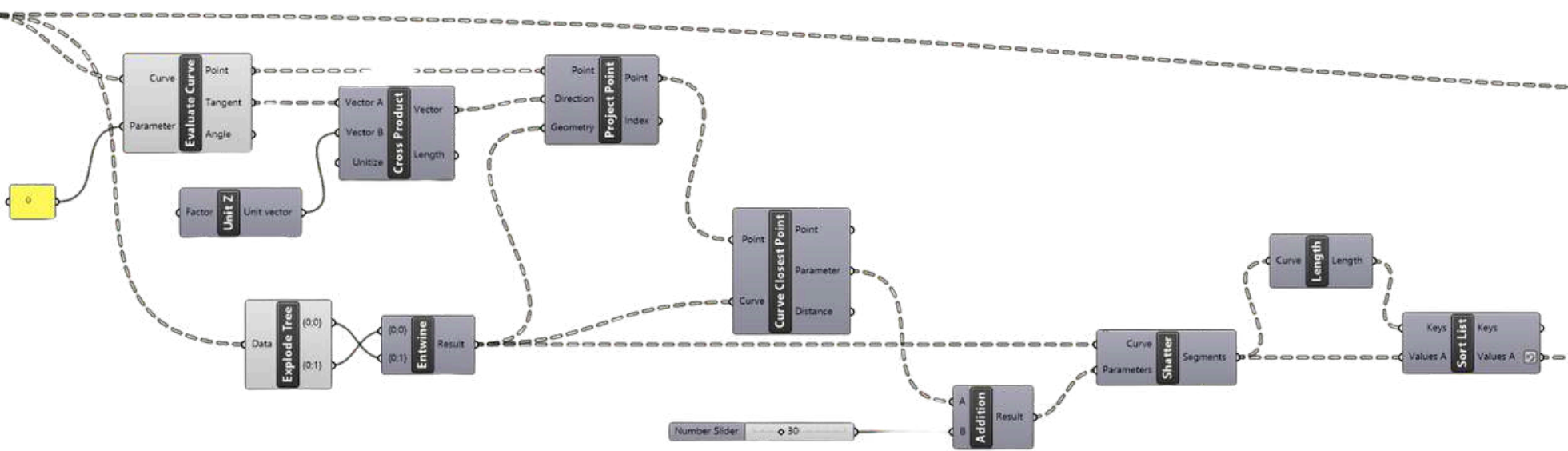
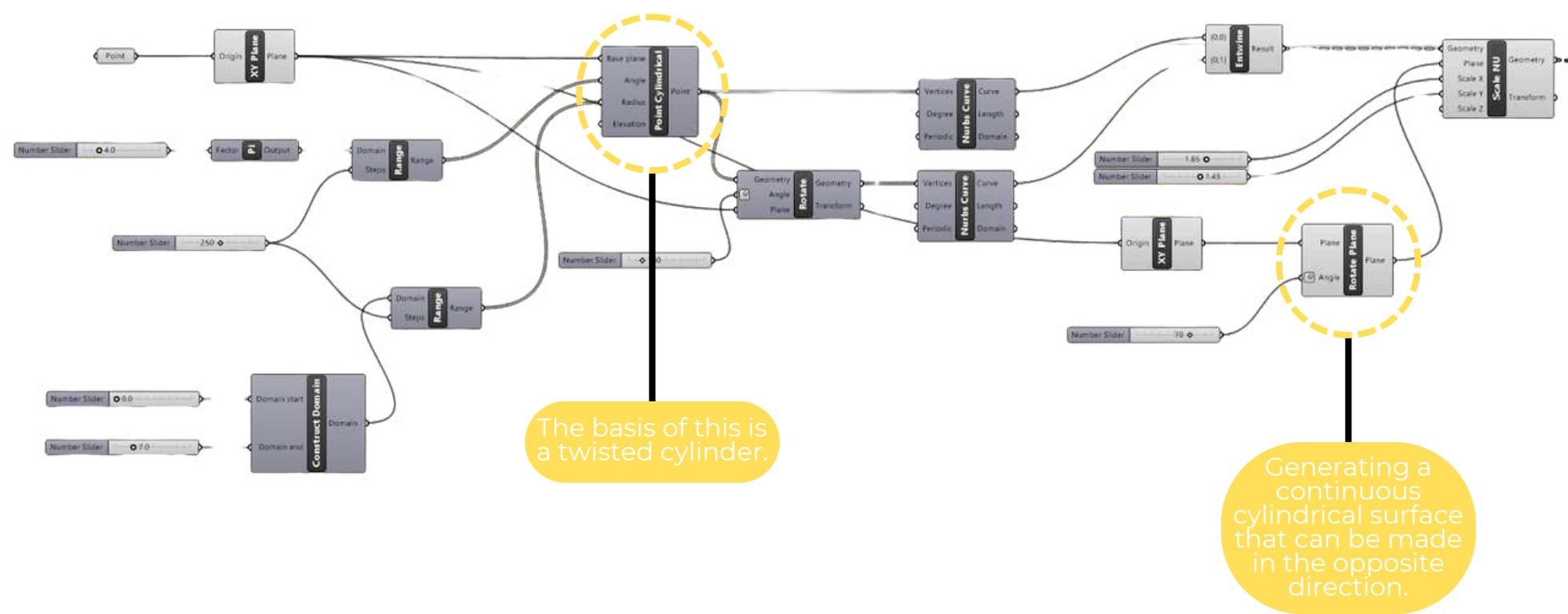
Focus: The museum as a basis for formal scientific education, while the myth and storytelling zones are placed in satellite areas or surrounding zones.

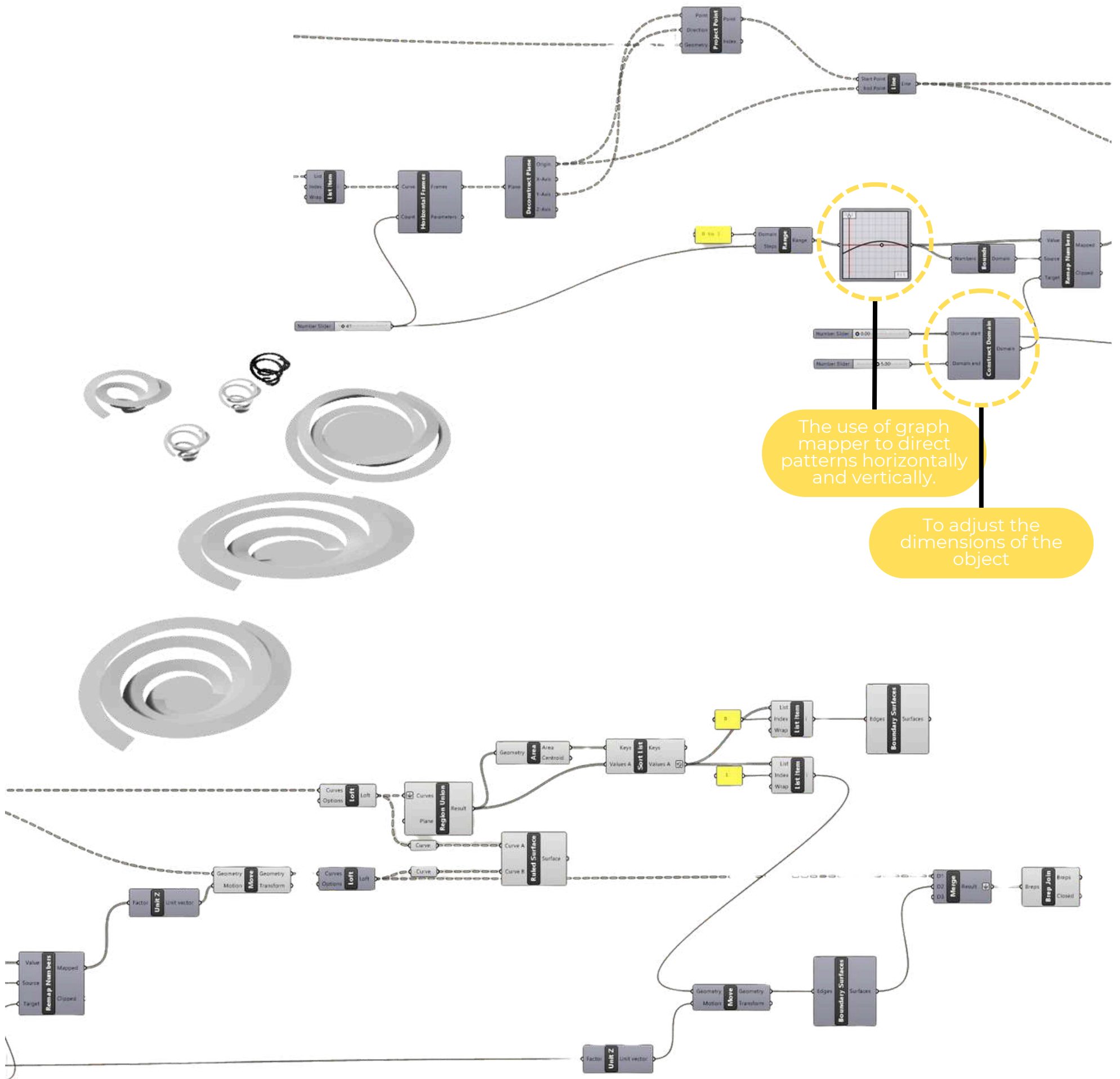


Site Exploration

WHY?

The exploration is conducted by adjusting the existing conditions which is curvy hardscape of the museum area buildings through PUFFERFISH PLUGIN. This plugin allows for the adjustment of the pavilion's diameter size, which initially aims to transform the space into a water crisis zone and conservation.





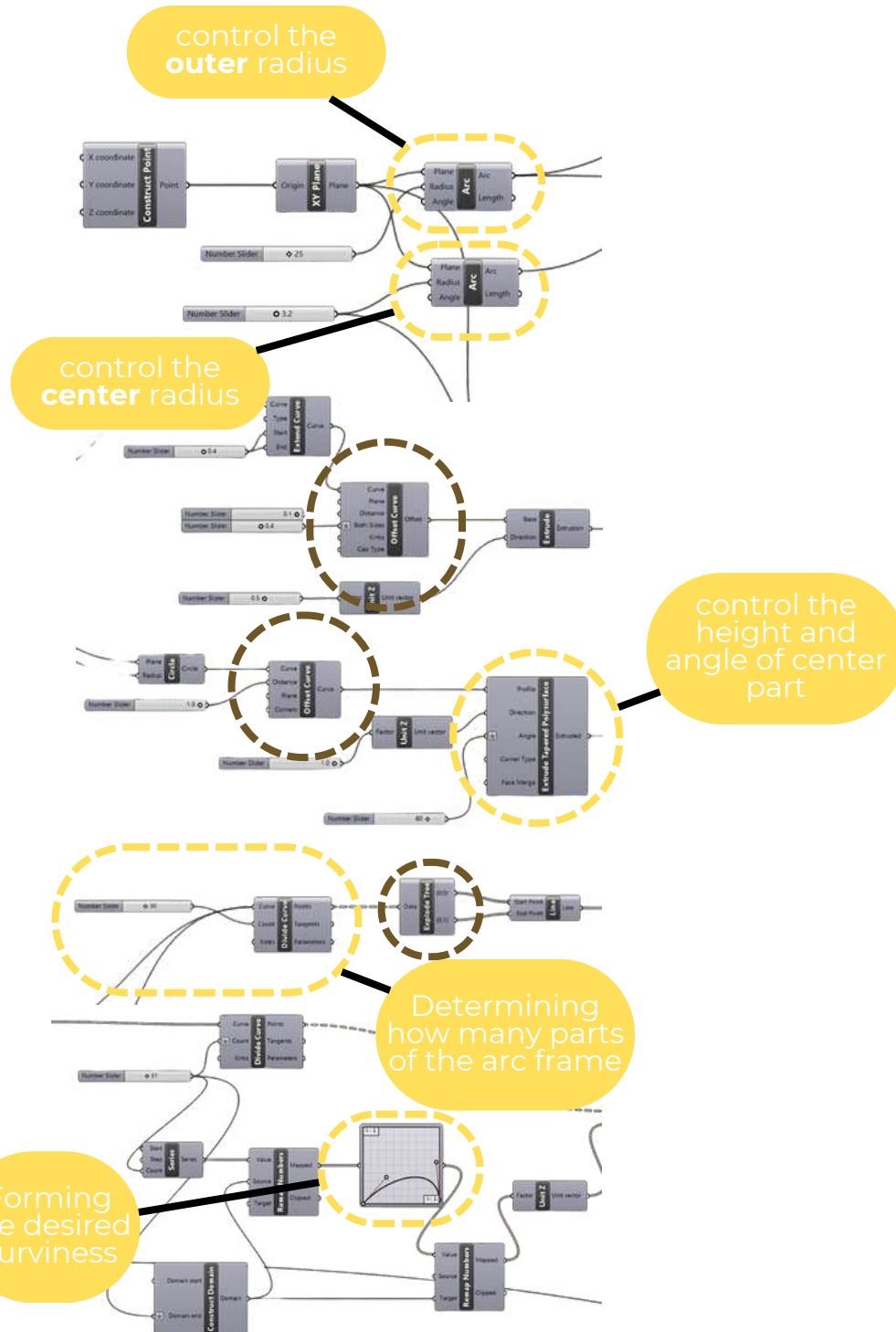
The use of graph mapper to direct patterns horizontally and vertically.

To adjust the dimensions of the object

Design Exploration

WHY?

The exploration is conducted by adjusting the existing conditions which is curvy hardscape of the museum area buildings through PUFFERFISH PLUGIN. This plugin allows for the adjustment of the pavilion's diameter size, which initially aims to transform the space into a water crisis zone and conservation.



HOW?

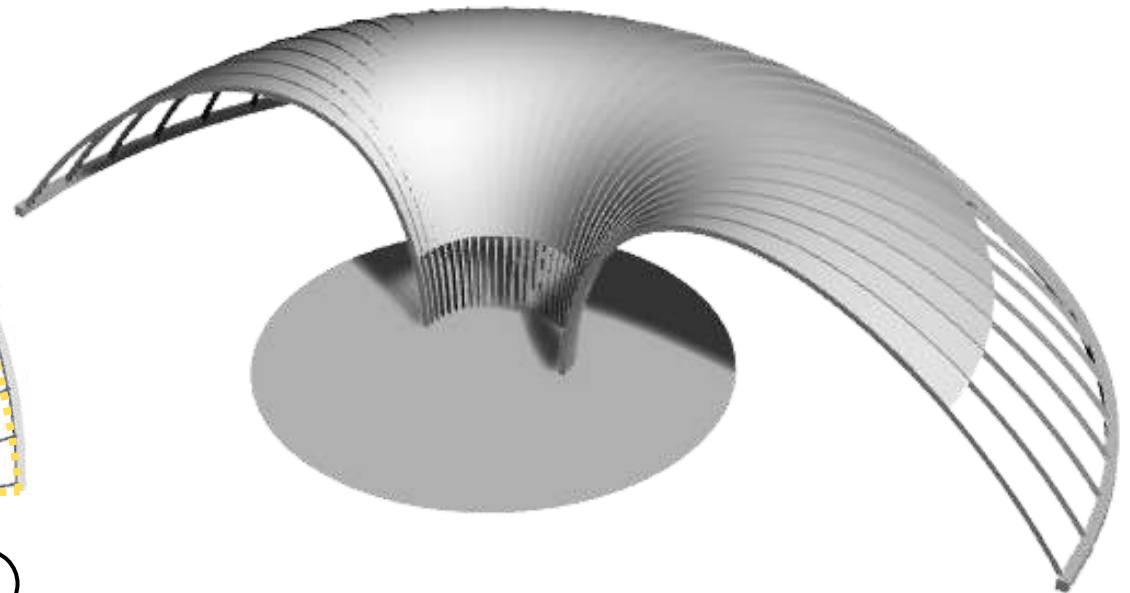
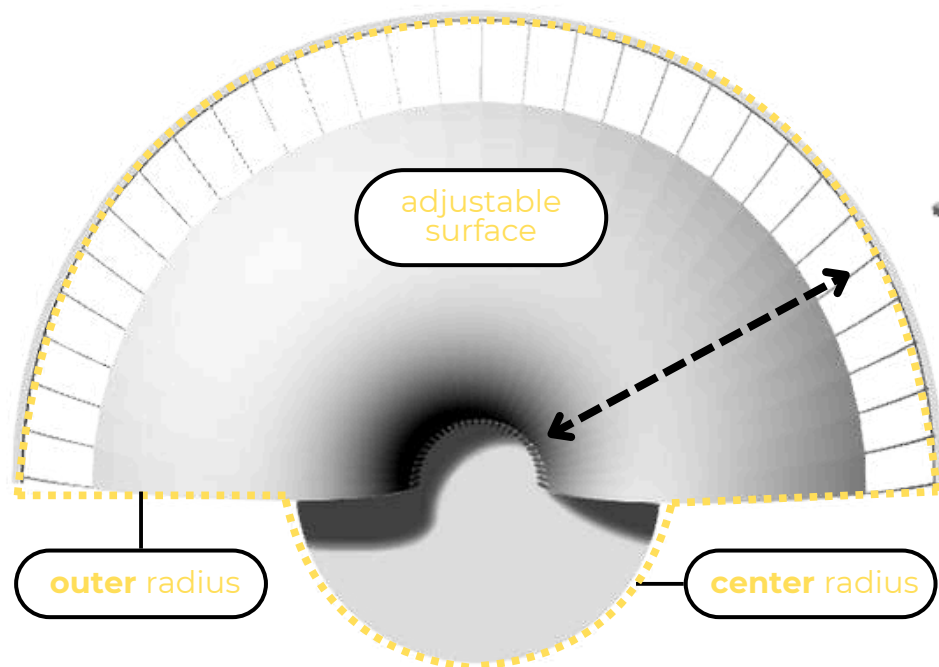
The base of this design is an **arc** to follow the existing hardscape conditions through **radius controller**.

Using an **offset curve** to ensure the position of the adaptive structure.

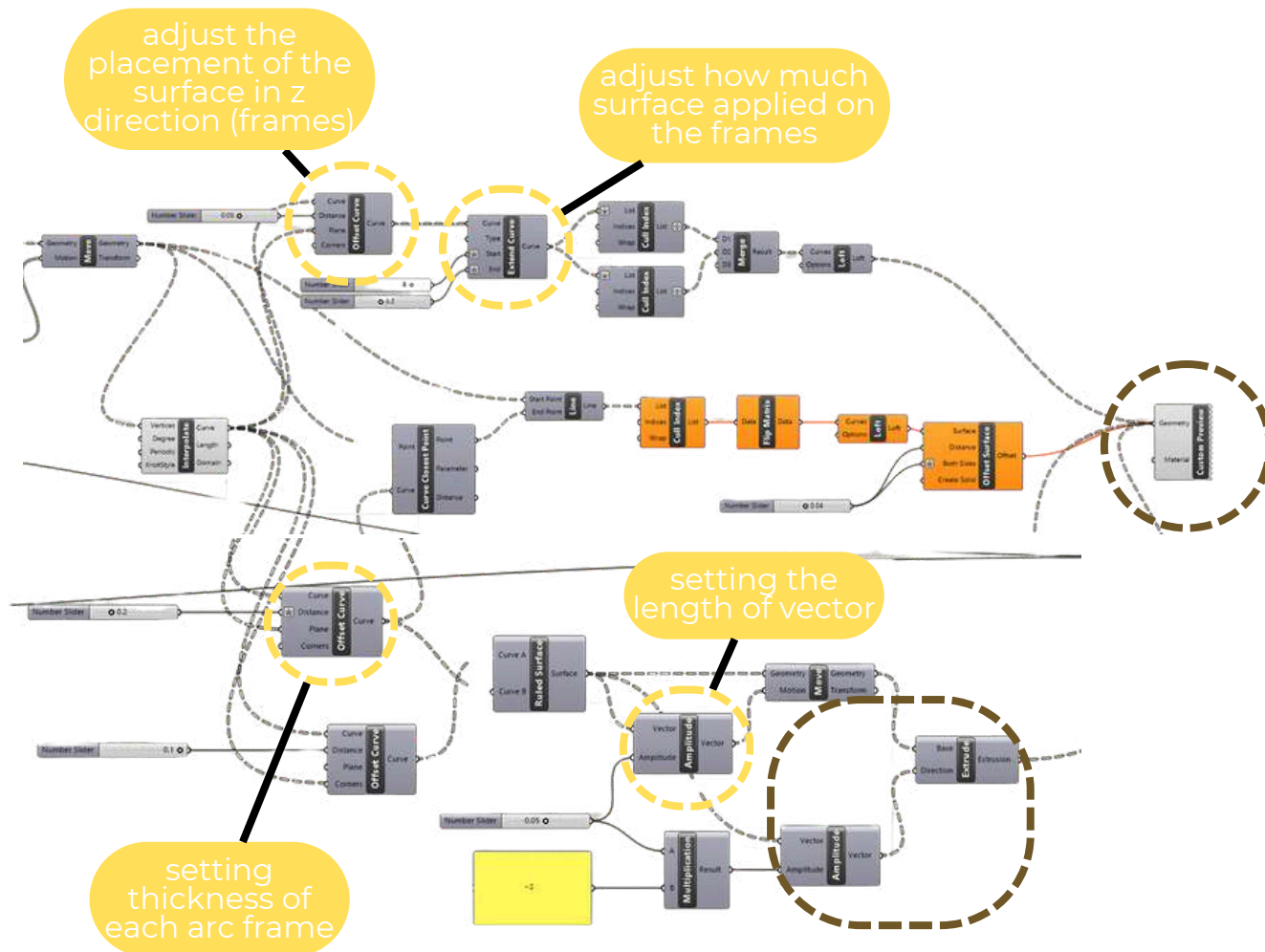
The height and angle can be adjusted.

Explode tree to extract all branches from all frames to become one unity.

Extracted branches are inputted together to be connected with the graph mapper that regulates the overall shape.



HOW?



Adding a surface that can be completely closed off or only the top part. Thus ensuring there is a part to capture and distribute water to the reservoir.

Setting the size of the arc frame with the finalization of the amplitude component after entering the numbers for the thickness and length of the frame, which is then extruded to the final geometry.

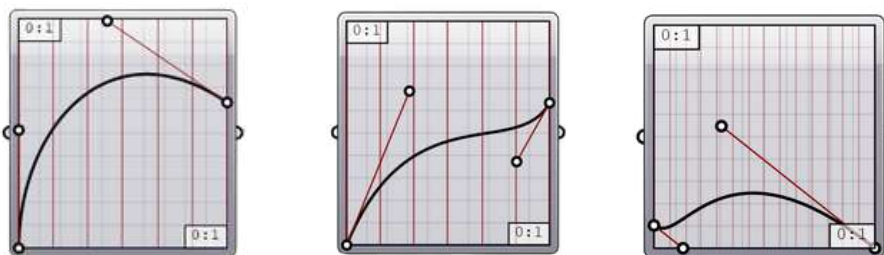
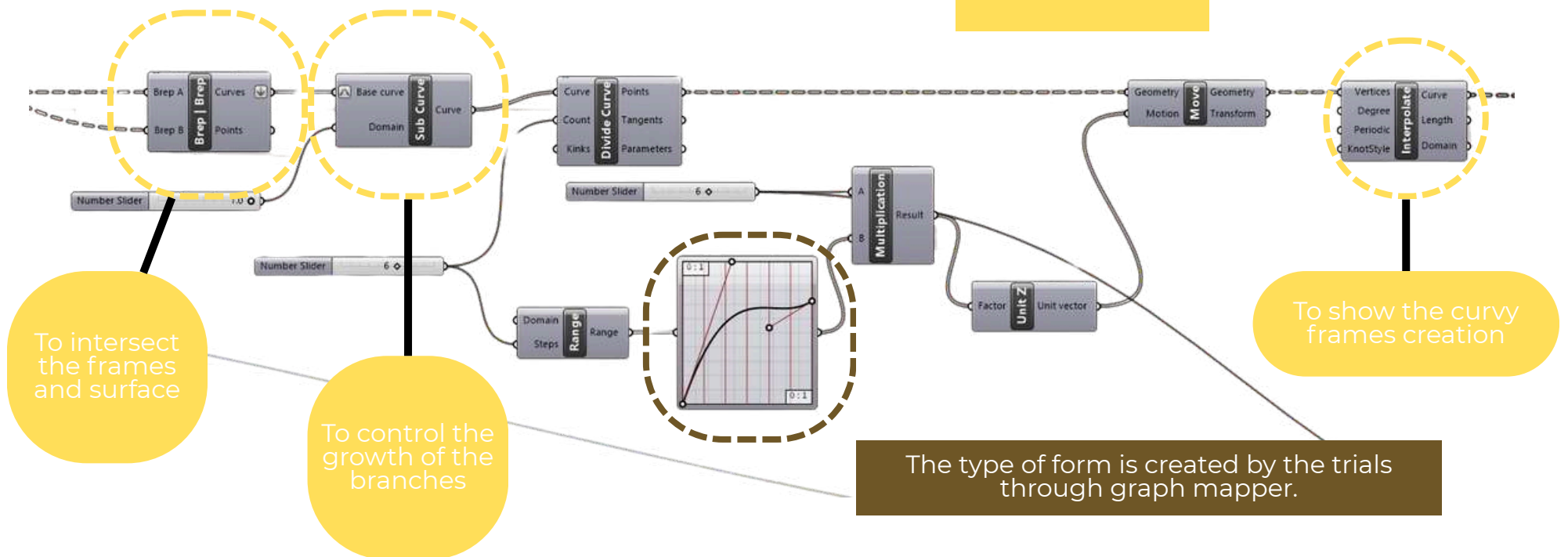
Design **Exploration**

Design **Exploration**

WHY?

This exploration arises from the need to enhance the experimentation of interior spaces and also to serve as a water catchment to increase innovation that can adapt to the existing museum building structure, so that the frames can rely on their loads to the structure.

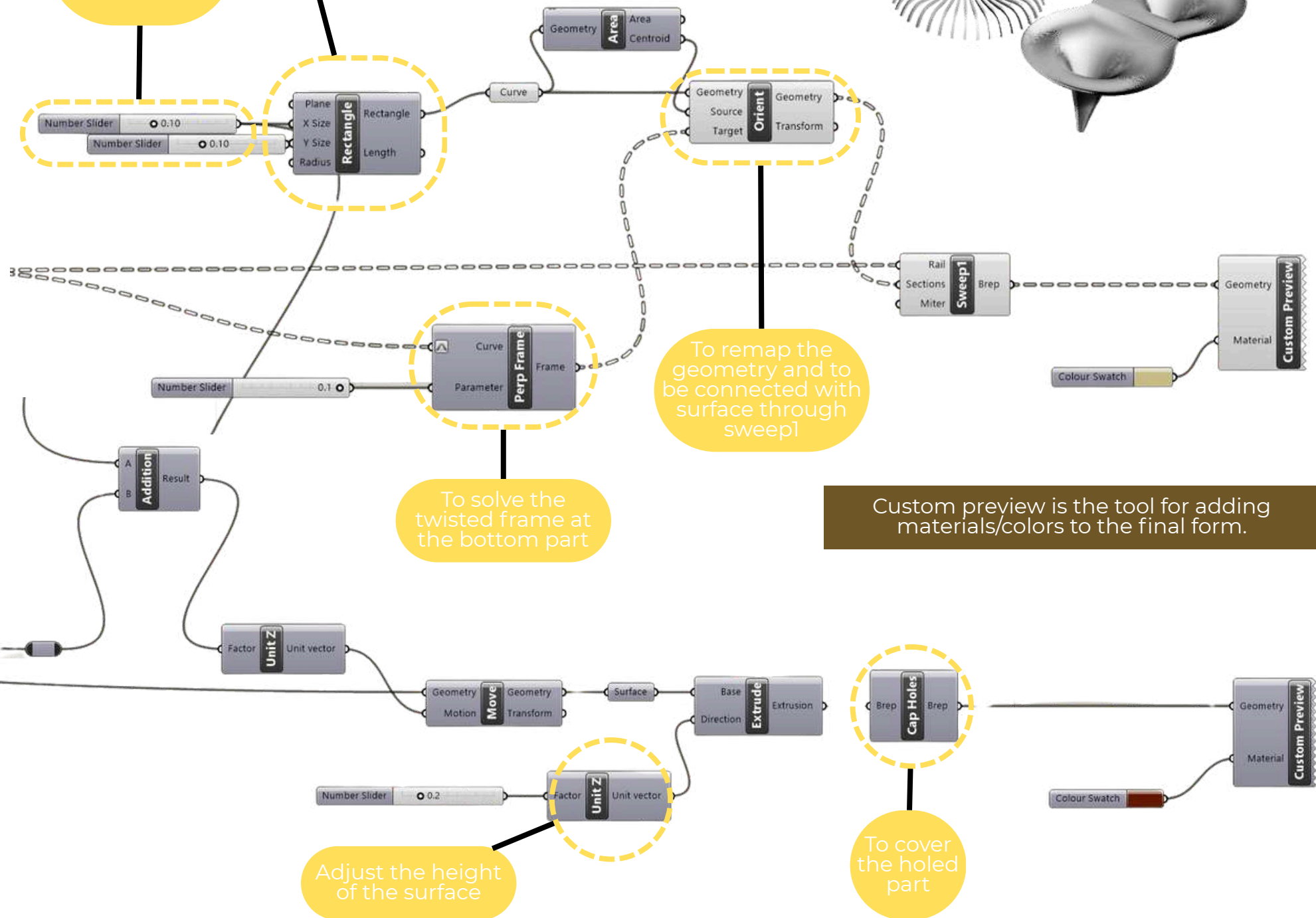
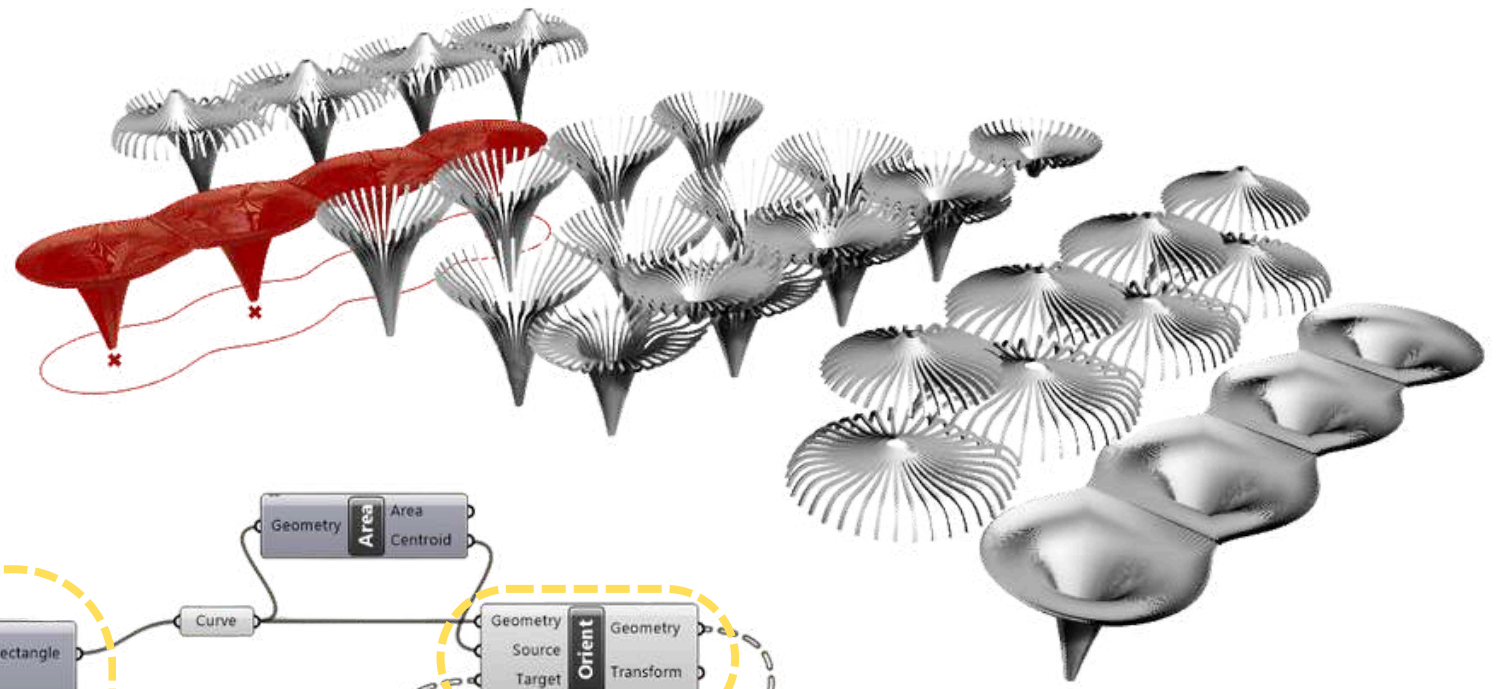
HOW?



GRAPH MAPPER to form the varied frames unity. This is to control the slopiness/curviness of the design. The length whether it will be hanging or step on the land can be done too.

Based frame is rectangular

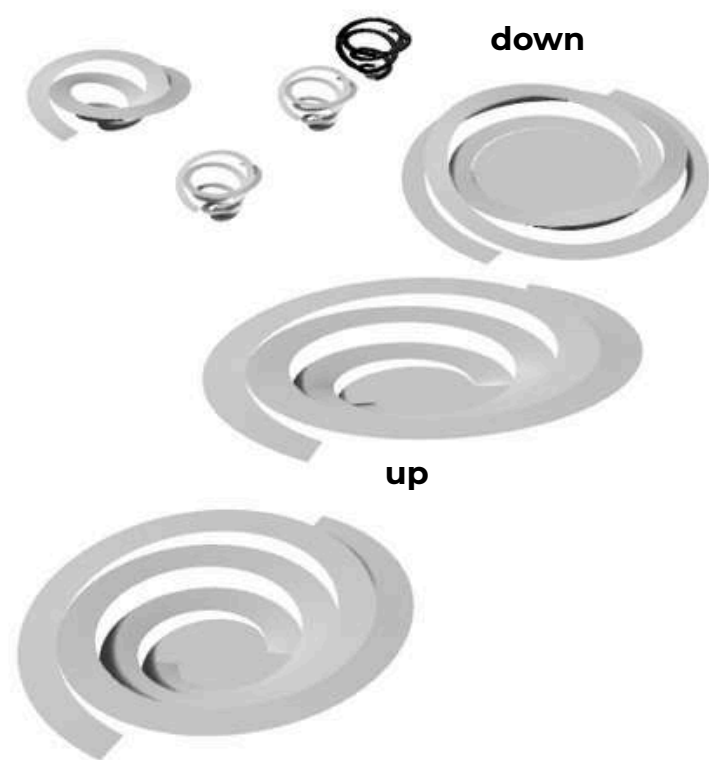
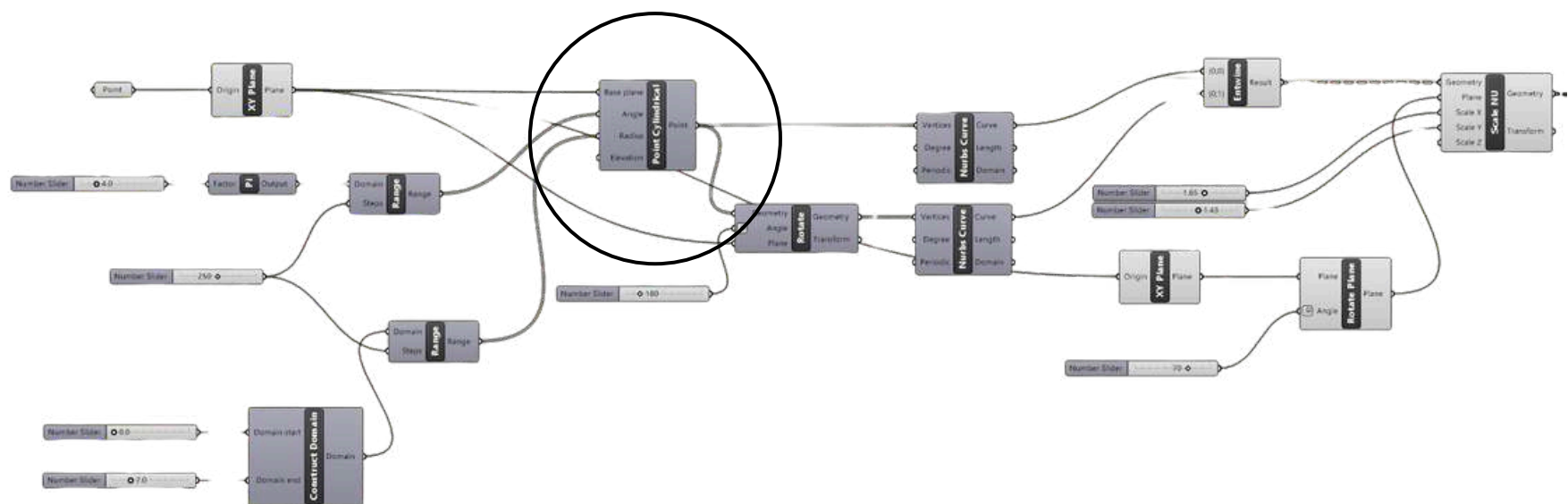
To adjust the size of the thickness and width of the frame



Site Planning Through

The intention is to purposing the journey for the visitors

The intention is to purposing the journey for the visitors



Integrating the site by creating continuity and flowing landscaping with cylindrical tools.

Tembus zone: applying exploration of caves obtained from the tunnel cave. The tunnel cave has a winding pattern like a snake from the entrance and then meets another cave entrance.

Back zone: continuity of the flowy landscaping as a transition to the water zone.

When wanting visitors to 'descend', the circulation of the cylinder can be adjusted to go down the space. If you want visitors to continue moving forward, it is continued with a winding forward pattern.

The pattern was then used as the basis for the placement of the building blocks.

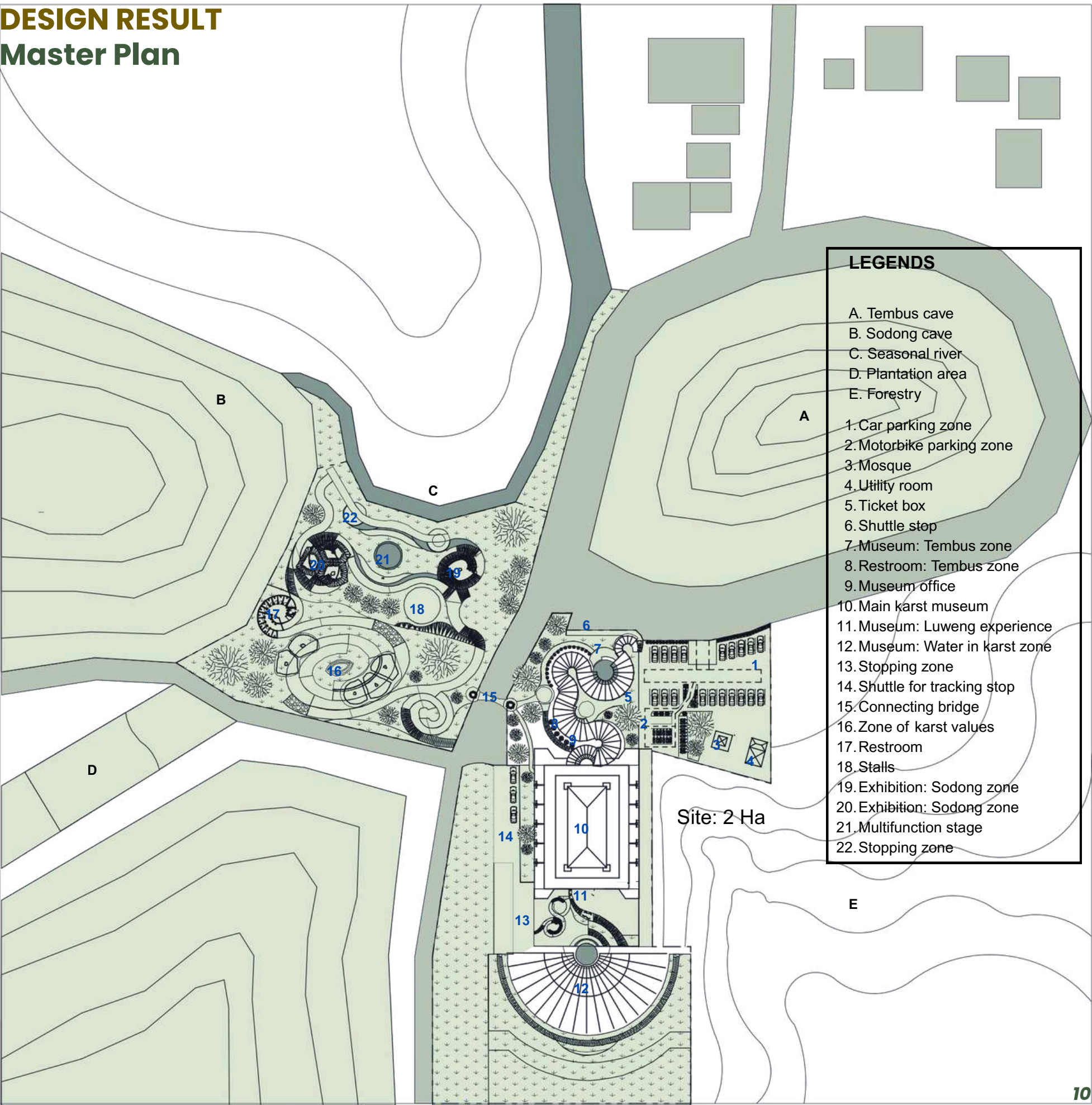


05

DESIGN DESCRIPTION

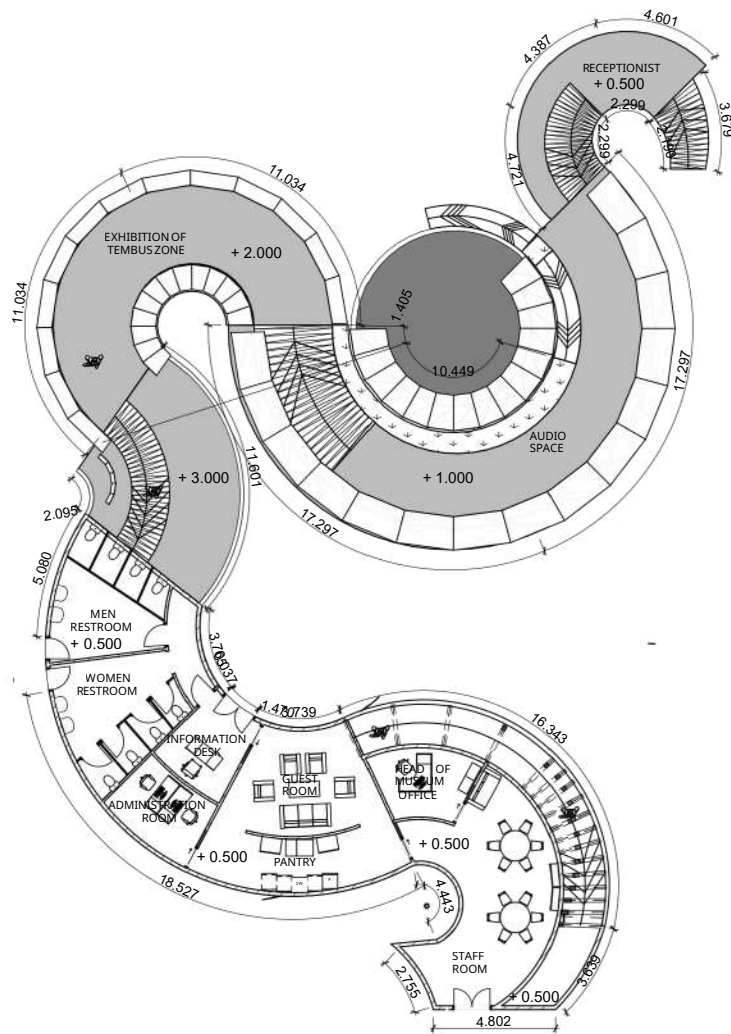


DESIGN RESULT
Master Plan

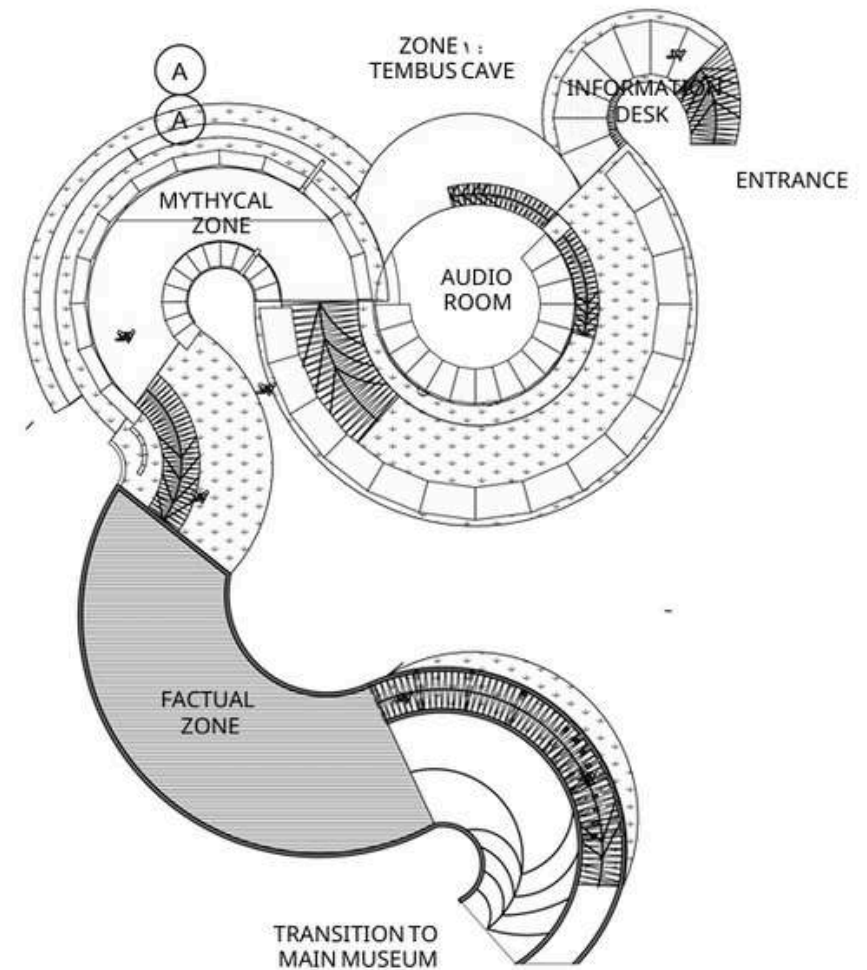


Entrance: Tembus Cave Zone

GF Plan



1st Floor Plan



The Penetrating Cave Zone is created as a narrative space that brings visitors to experience as if they are truly inside a cave. Its winding design incorporates the original cave narrative into it. The height is also variably arranged to create an uneven impression, reflecting the generally different elevations of caves.

Visitors are directed to walk through an increasingly ascending corridor, creating a dramatic spatial sensation. In the middle of the zone, there is a large space displaying an interactive multimedia installation about the myths and history of the Penetrating Cave.

Additionally, the sound of dripping water and an artificial meditation space are provided to enhance the sensation of the natural cave space while applying myths. There is a deceptive space designed to create an immersive experience of the myth of people trapped in evil. This zone is also designed inclusively, with accessibility paths that are friendly to all visitors, including those with disabilities.

Section



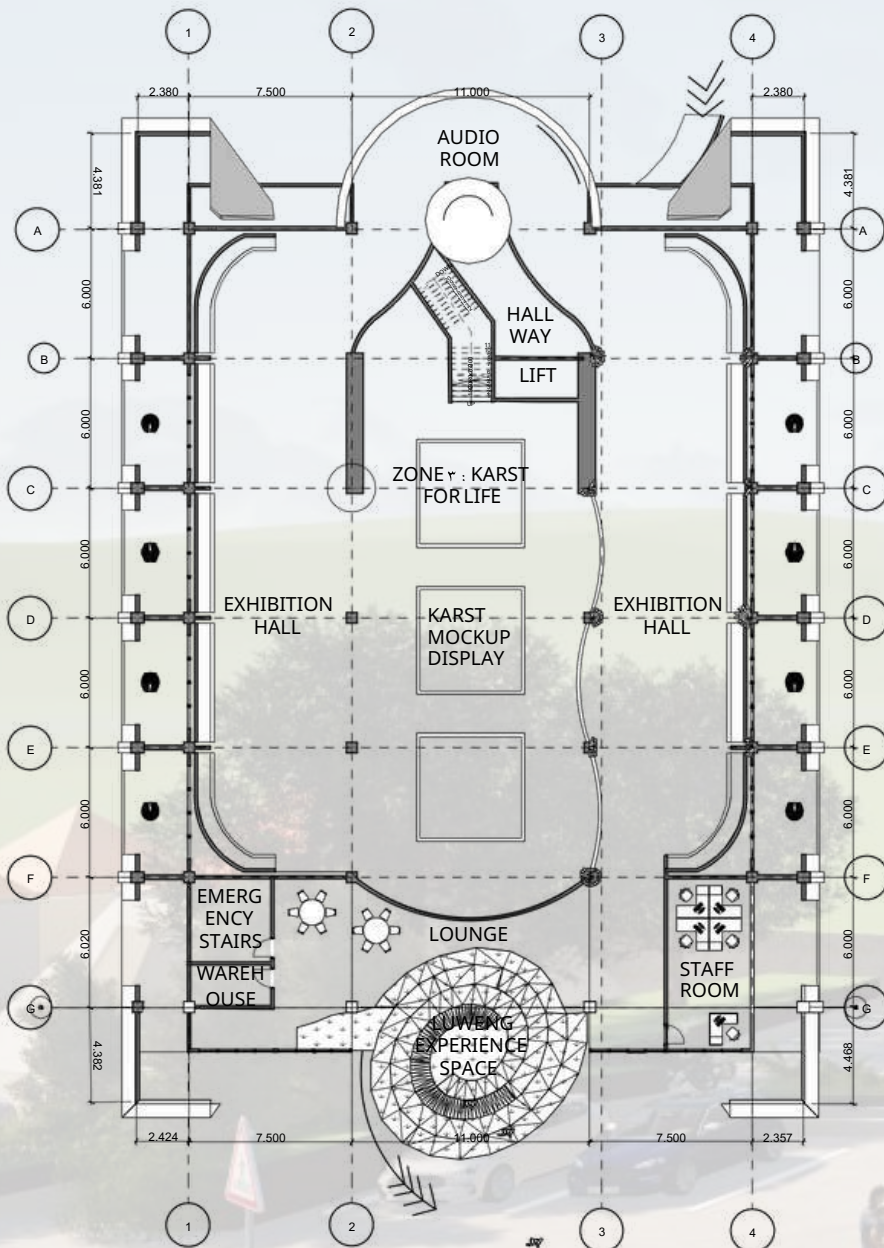
The drawing above illustrates how room locations have been strategically integrated based on varying levels of elevations. From the beginning of the entrance to the breakthrough zone, along the circulation, it always rises by 0.5 - 1 meter. This is intentional to create an experience for visitors in the exploration of the breakthrough cave zone. The elevated parts are built with limestone, which is then covered with surface material to ensure the path remains smooth. The zone serves as the beginning of the story that entices visitors to enter the next section.

The drawing above illustrates how room locations have been strategically integrated based on varying levels of elevations. From the beginning of the entrance to the breakthrough zone, along the circulation, it always rises by 0.5 - 1 meter. This is intentional to create an experience for visitors in the exploration of the breakthrough cave zone. The elevated parts are built with limestone, which is then covered with surface material to ensure the path remains smooth. The zone serves as the beginning of the story that entices visitors to enter the next section.

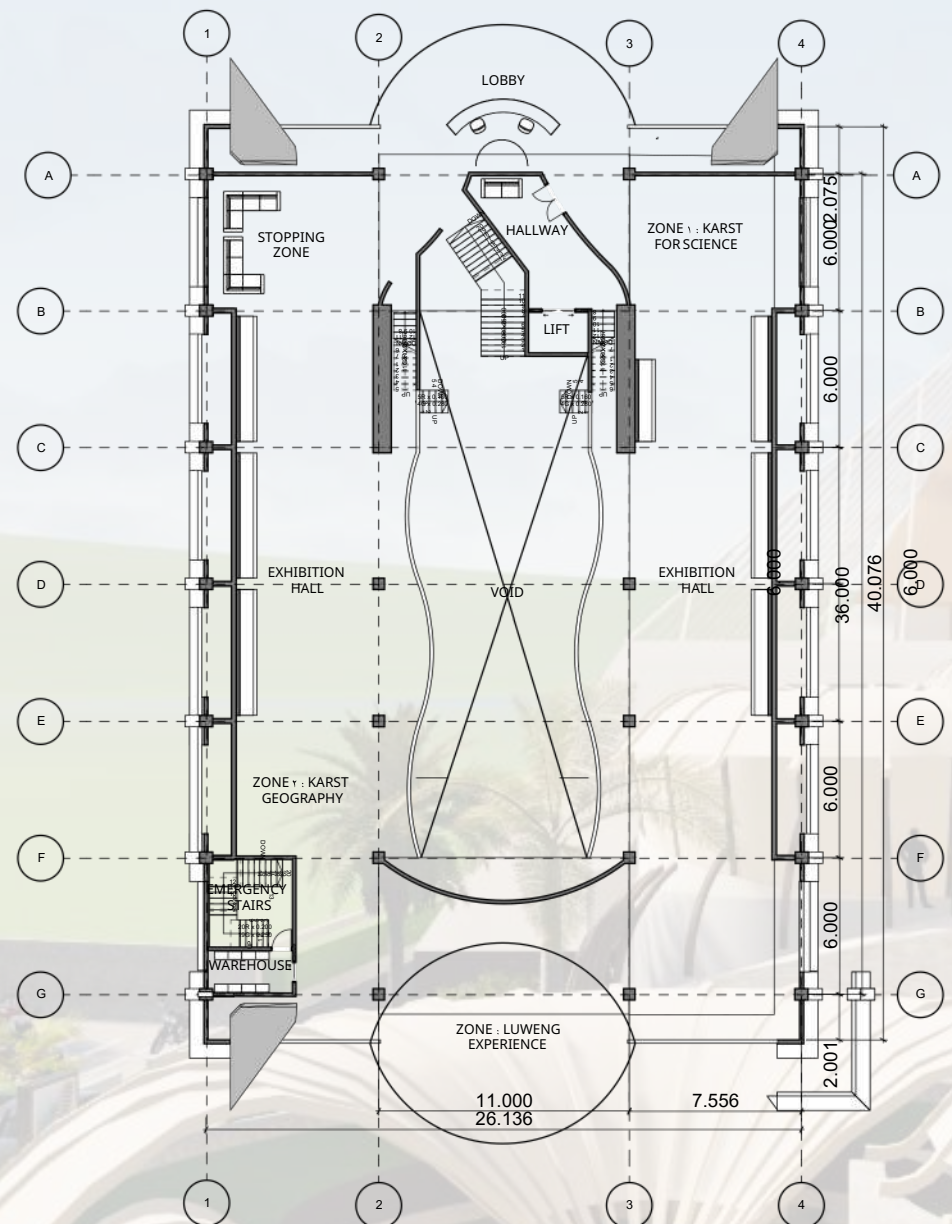


Main Museum Building

GF Plan



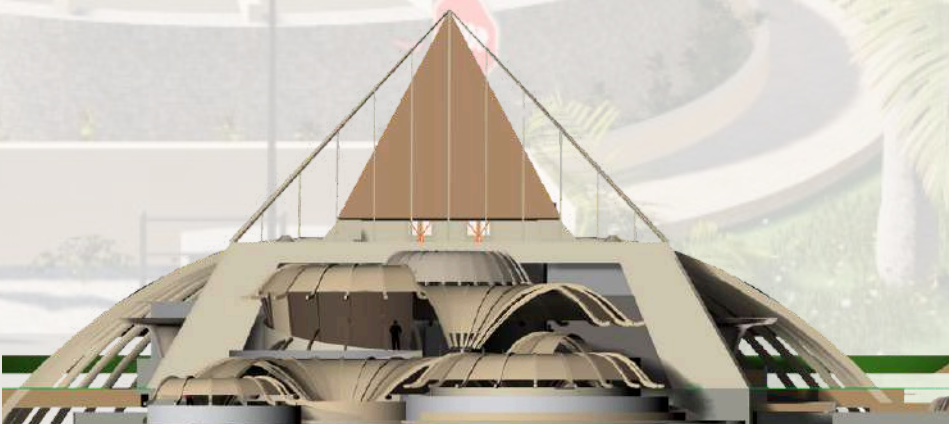
1st Floor Plan



Rendering



The drawing above illustrates how room locations have been strategically integrated based on varying levels of elevations. From the beginning of the entrance to the breakthrough zone, along the circulation, it always rises by 0.5 - 1 meter. This is intentional to create an experience for visitors in the exploration of the breakthrough cave zone. The elevated parts are built with limestone, which is then covered with surface material to ensure the path remains smooth. The zone serves as the beginning of the story that entices visitors to enter the next section.

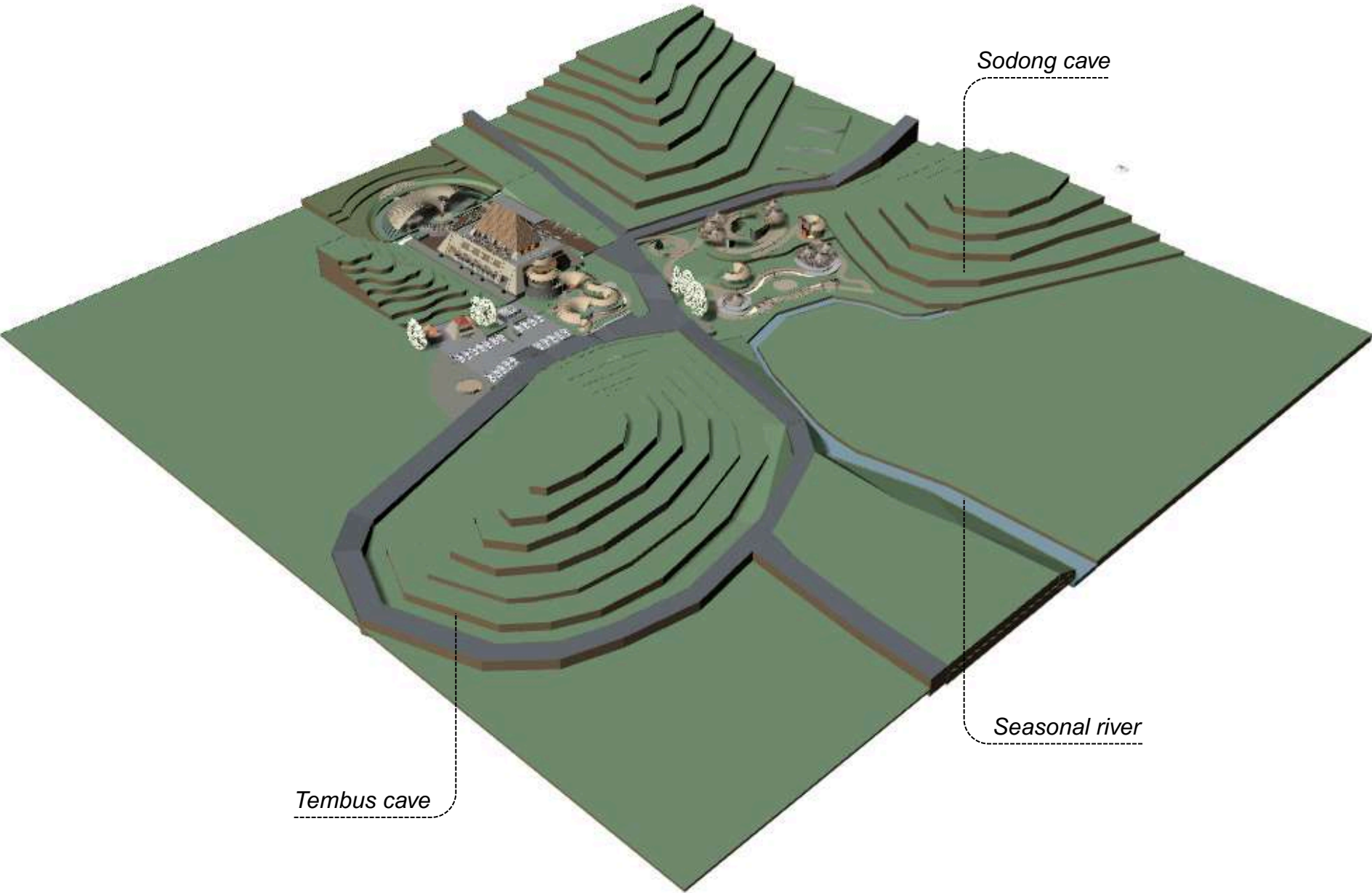


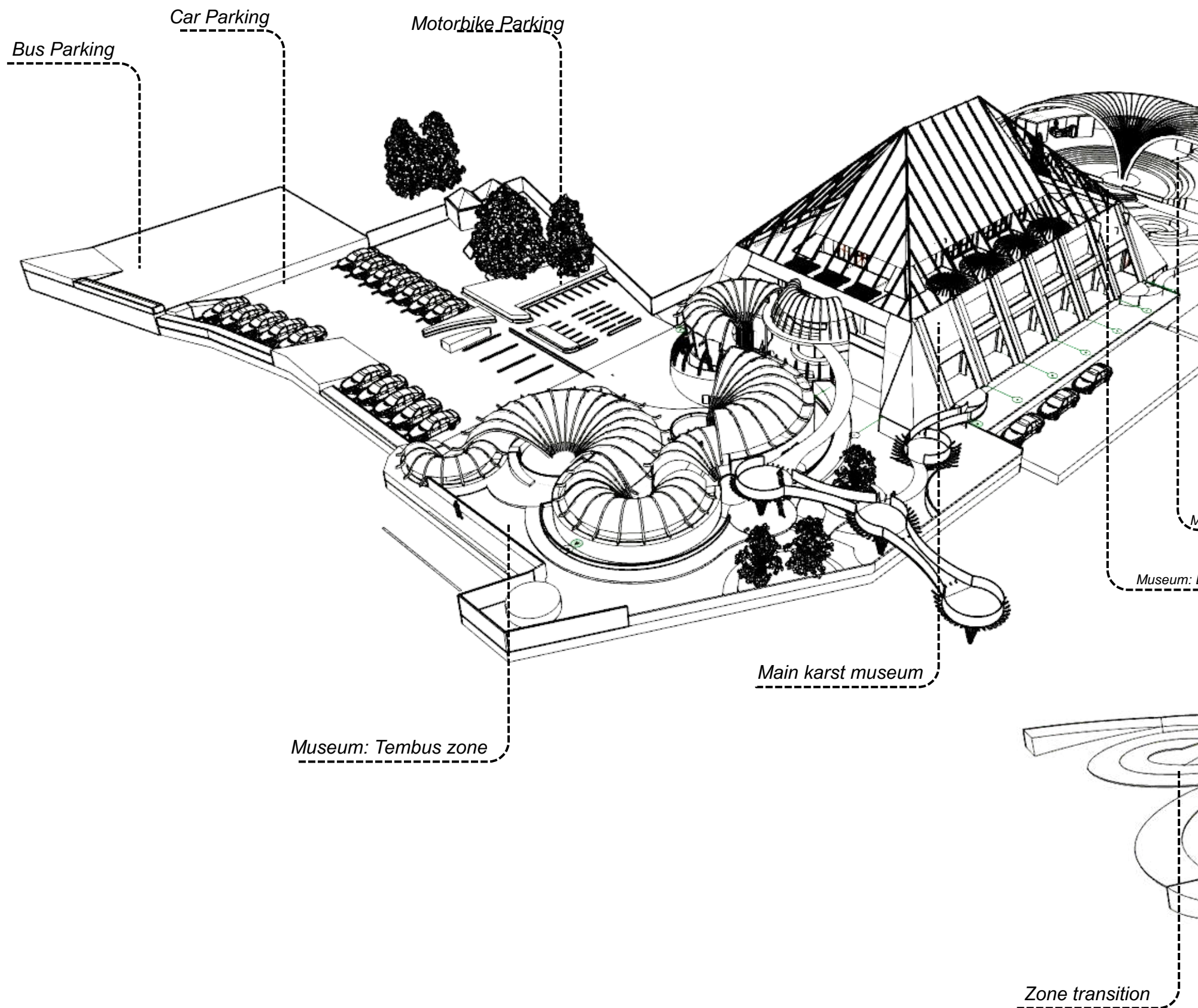
TOP VIEW



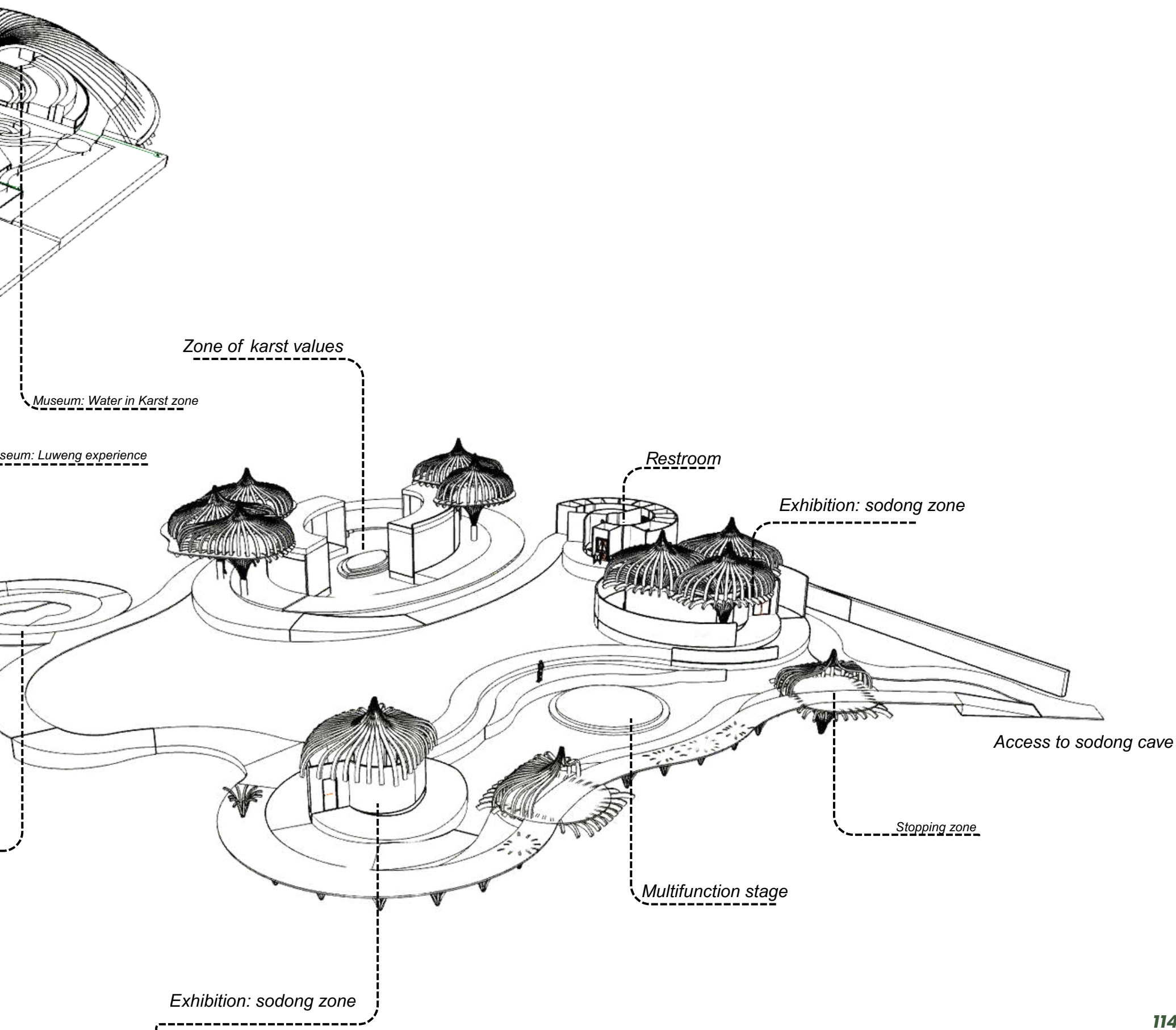
3D AXO

The area used is the same as the part of the museum from before. The area used is divided into two sections, namely east and west. The east zone is the zone that is part of the main museum where the main structure of the building is left intact.



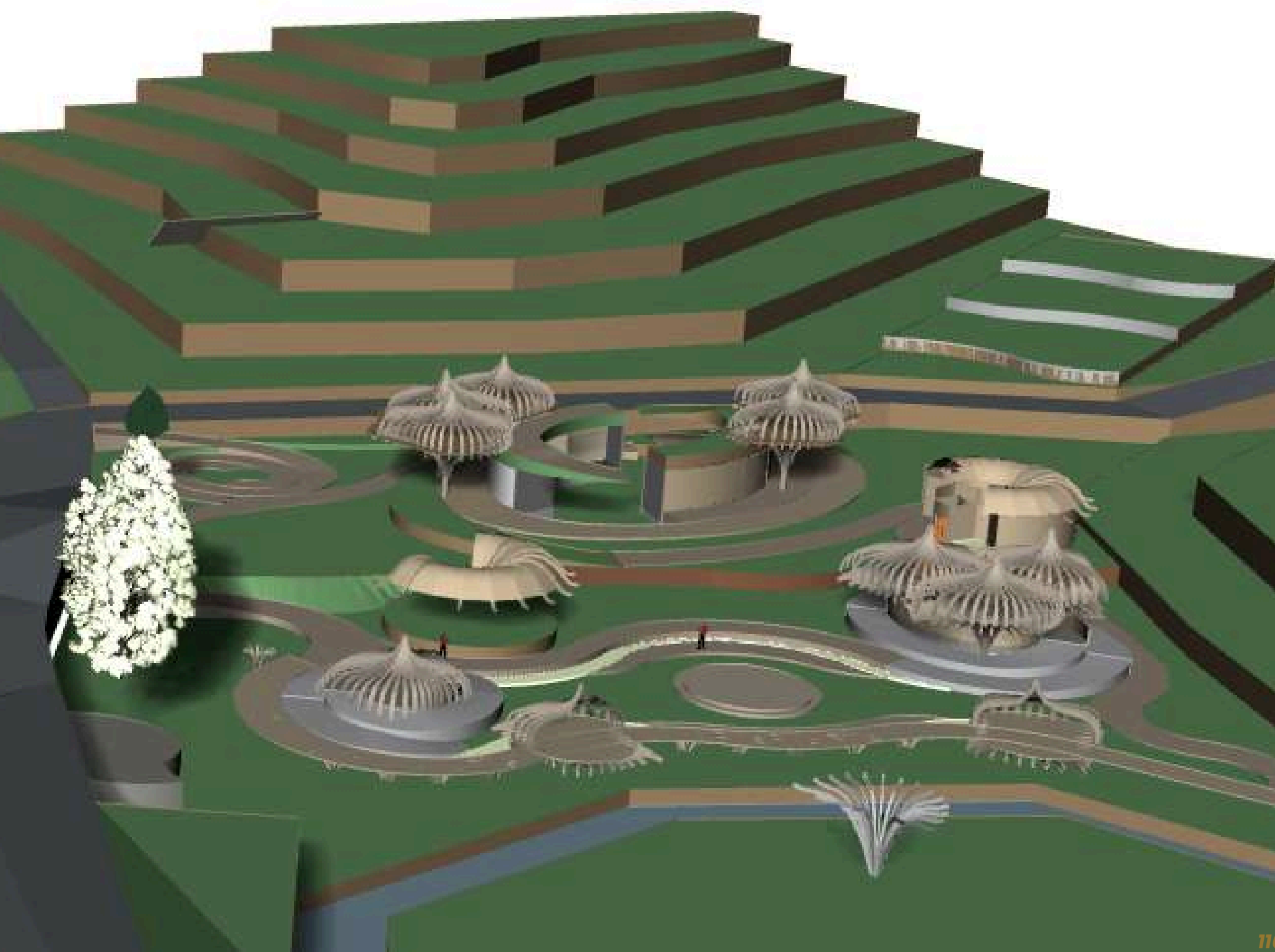


Museum Axonometry



PERSPECTIVE IMAGE

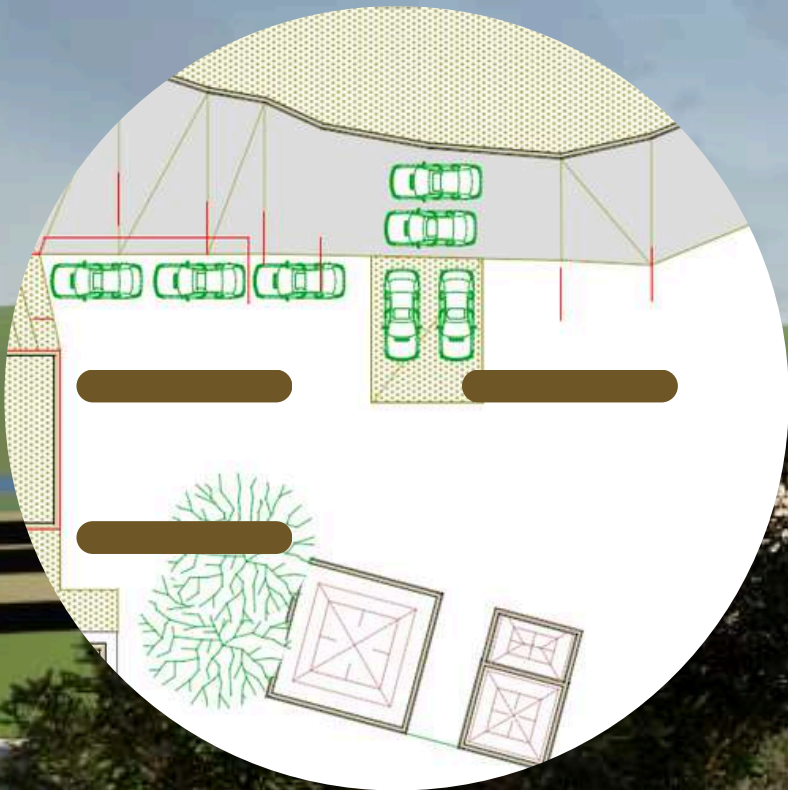




Revitalization of Parking Area

Capacity: 22 cars and 36 motorcycle

BEFORE



Lots of seller booth unfacilitated

No clear sign and placement for parking

Consist of pavement hardscape

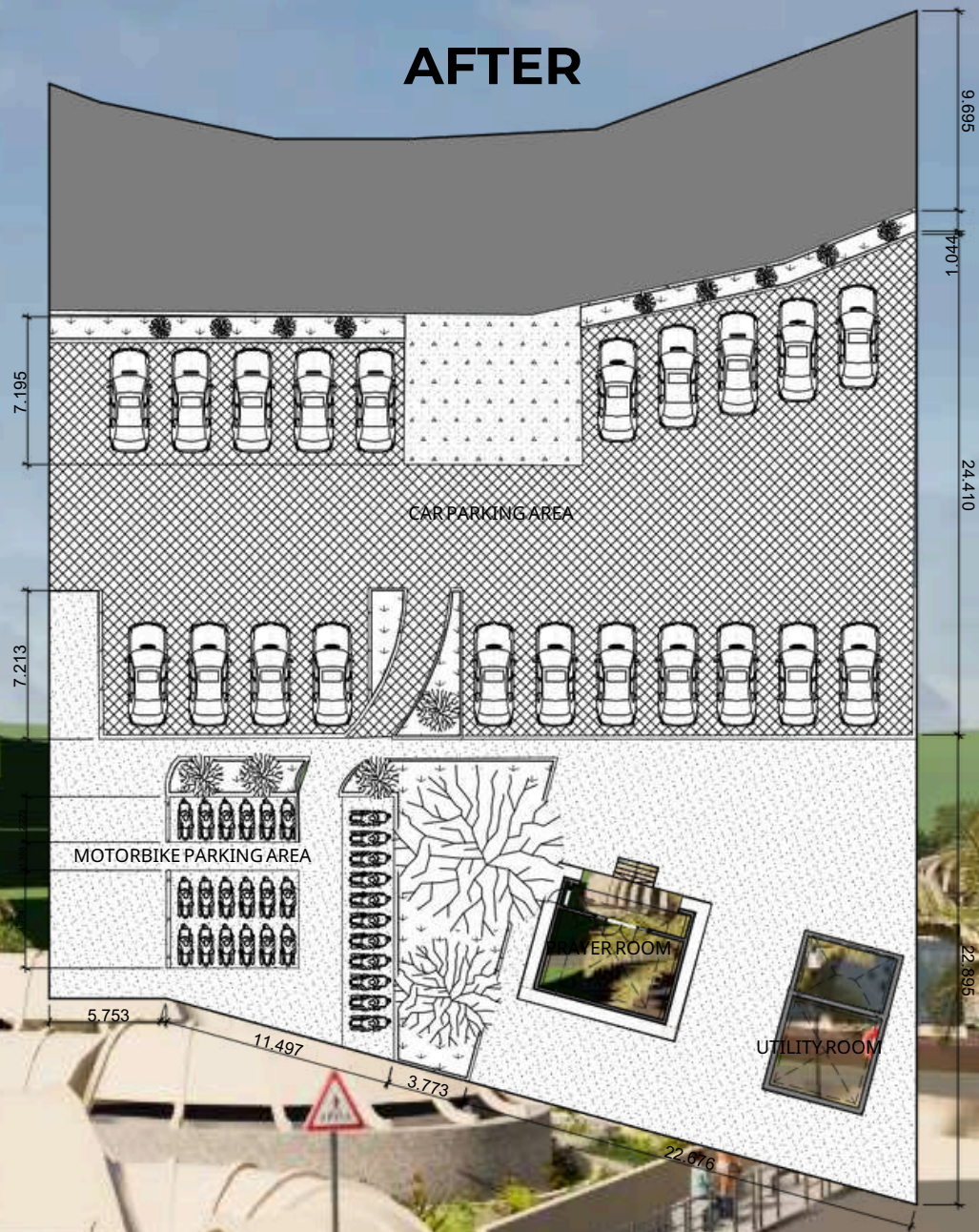
Adding motorbike parking at the west of the mosque

Neatly parked

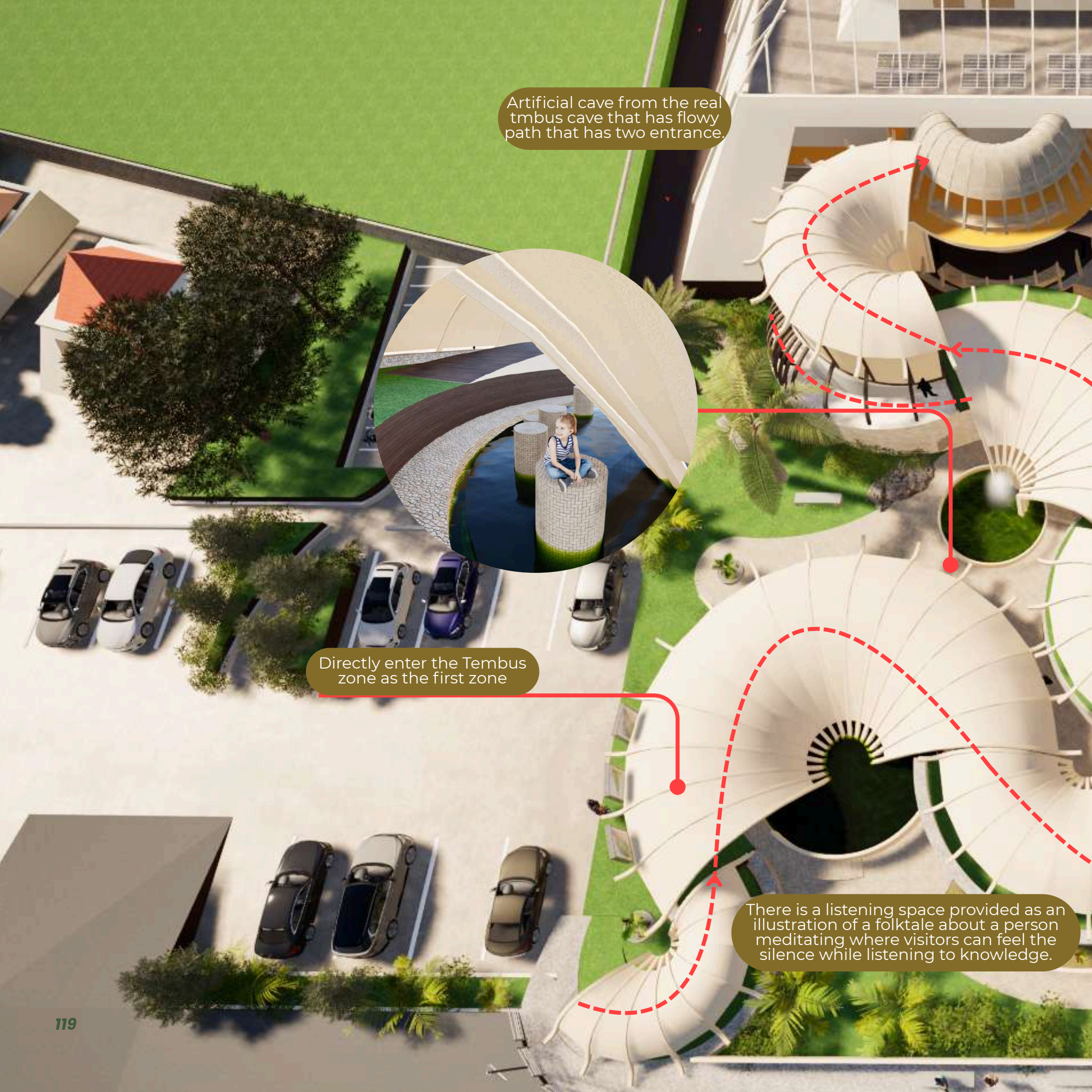
Greeneries

Replacing the seller booth that previously taking the parking space.

AFTER



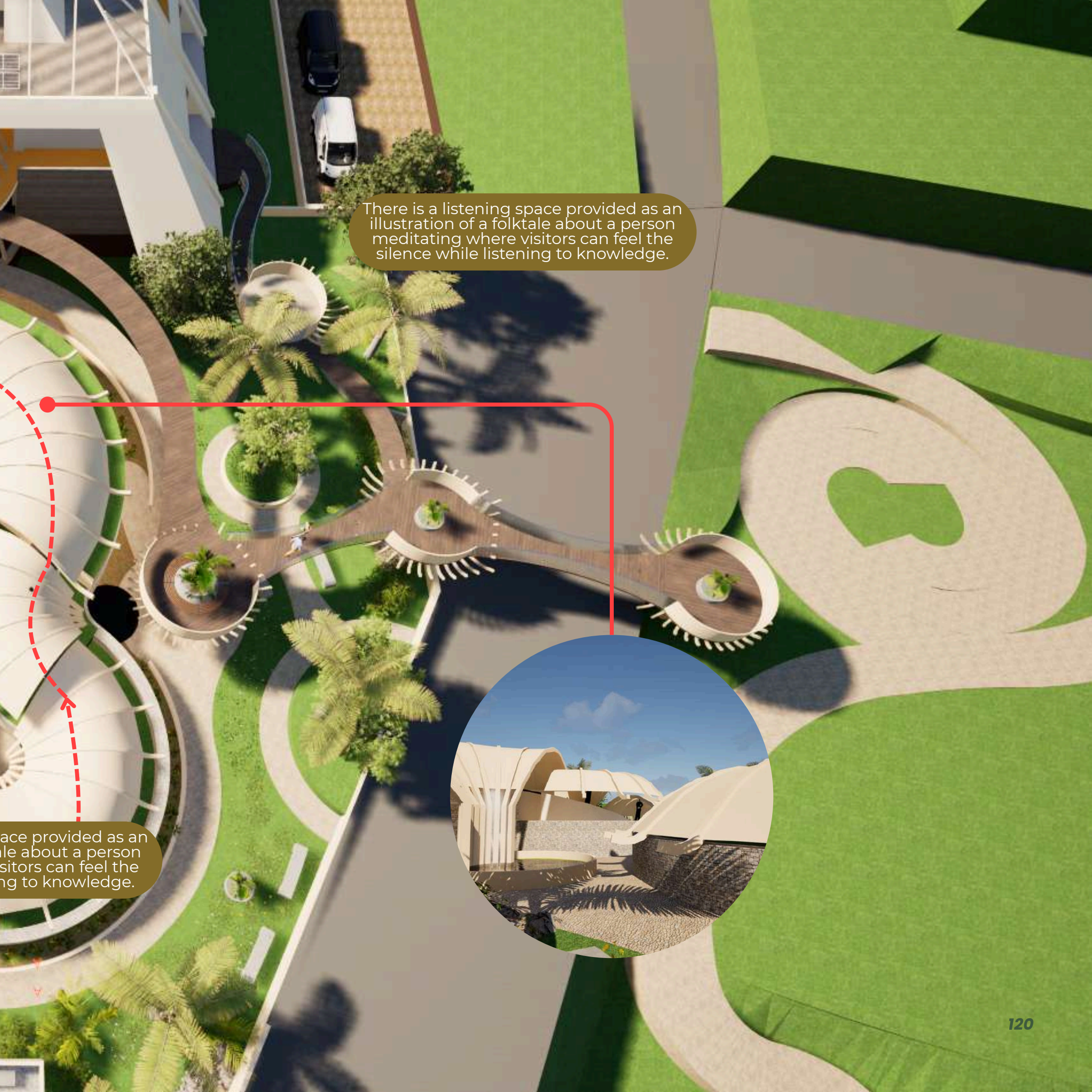
Space for the bus shuttle because the government plan to provide those to promote the city as tourism city.



Artificial cave from the real tmbus cave that has flowy path that has two entrance.

Directly enter the Tembus zone as the first zone

There is a listening space provided as an illustration of a folktale about a person meditating where visitors can feel the silence while listening to knowledge.



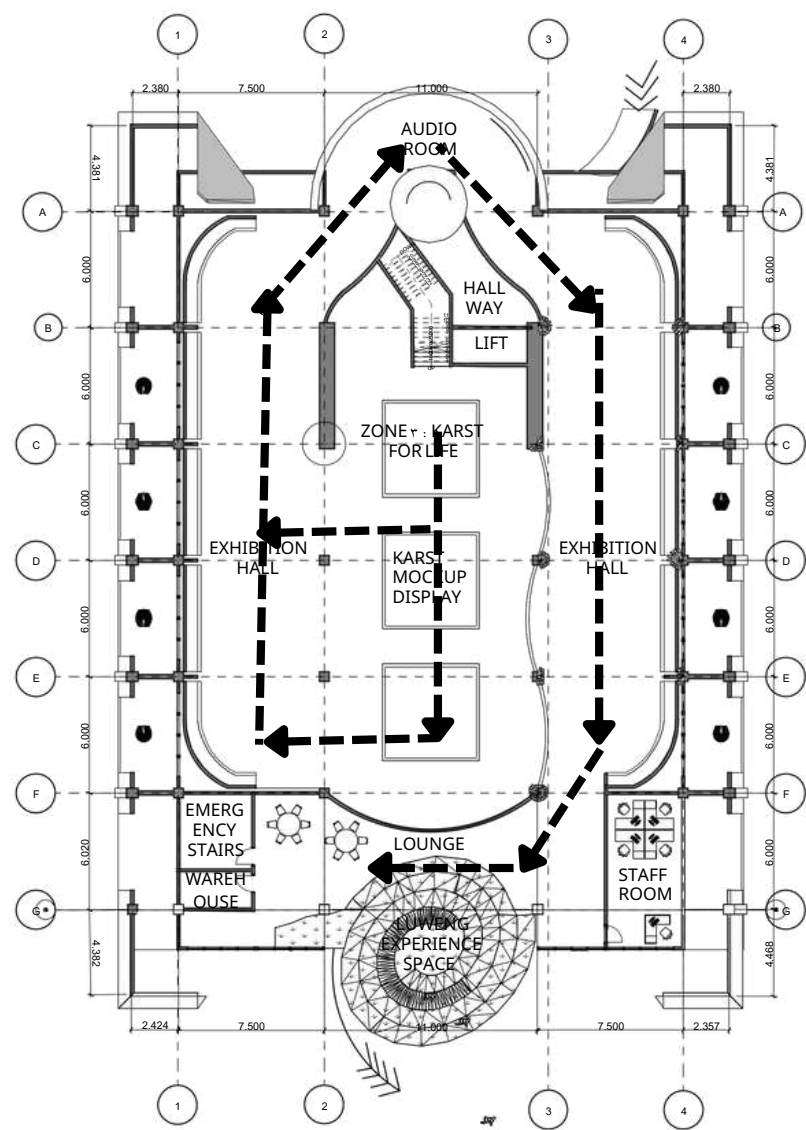
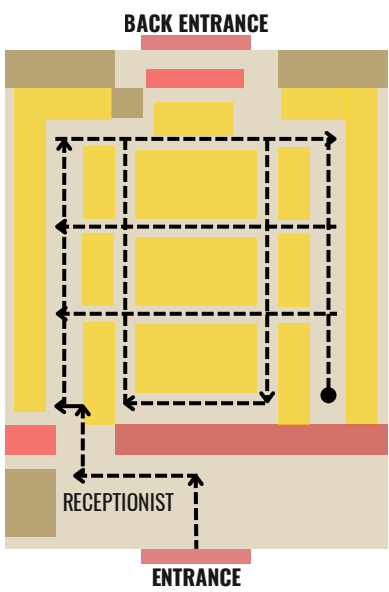
There is a listening space provided as an illustration of a folktale about a person meditating where visitors can feel the silence while listening to knowledge.

Space provided as an illustration of a folktale about a person meditating where visitors can feel the silence while listening to knowledge.



Revitalization of The Main Museum

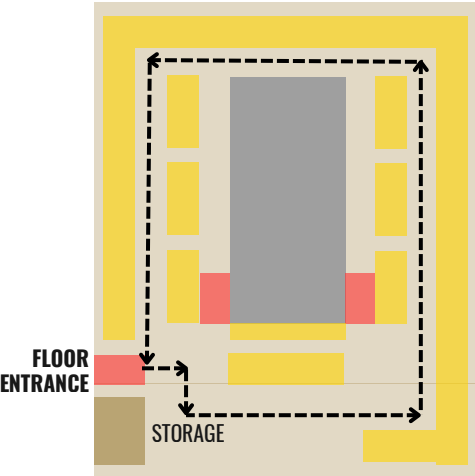
GROUND FLOOR Karst for Life



GROUND FLOOR PLAN

FIRST FLOOR

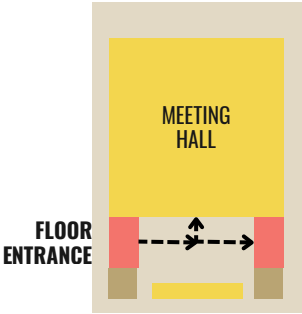
Karst for Knowledge



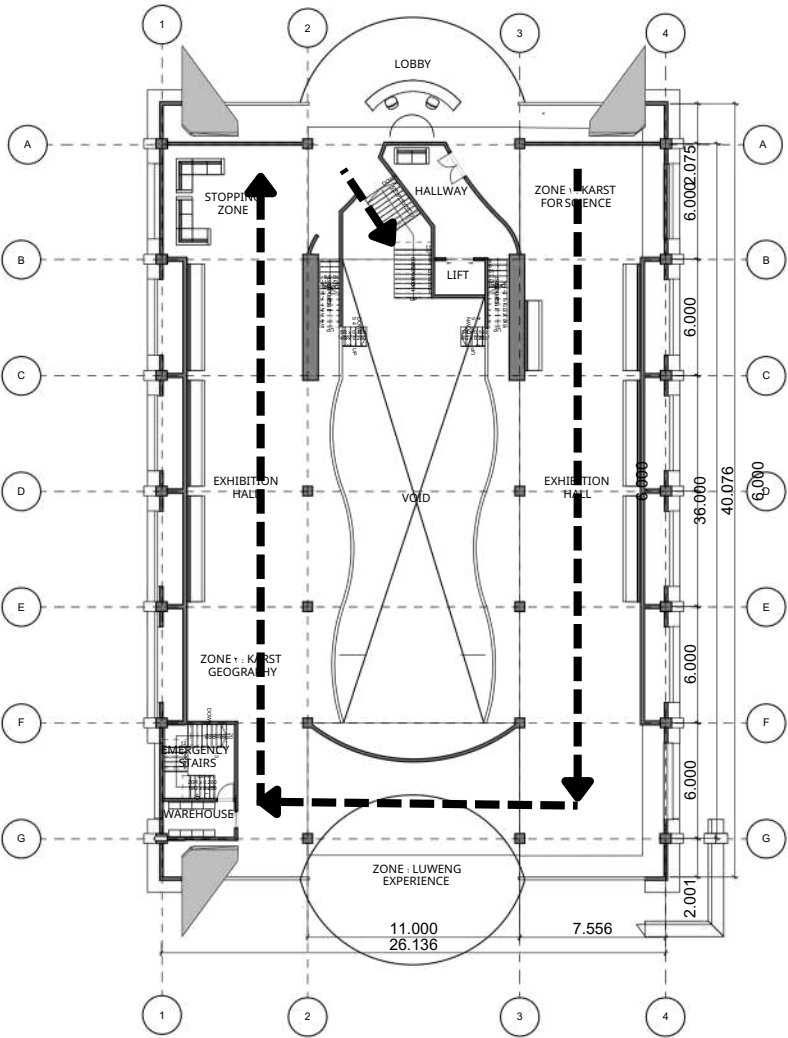
Source: Author

SECOND FLOOR

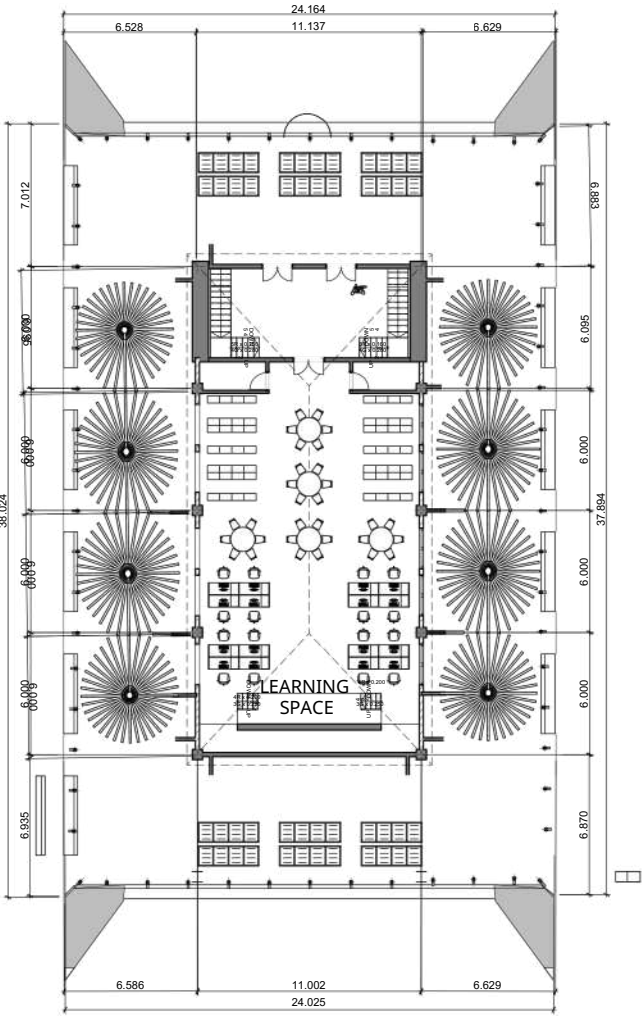
Auditorium



- LEGENDS
- Display placement
 - Partition
 - Stairs
 - Void
 - Office or toilets



FIRST FLOOR PLAN



SECOND FLOOR PLAN

Revitalization of Museum

Water in Karst Zone

Luweng experience zone



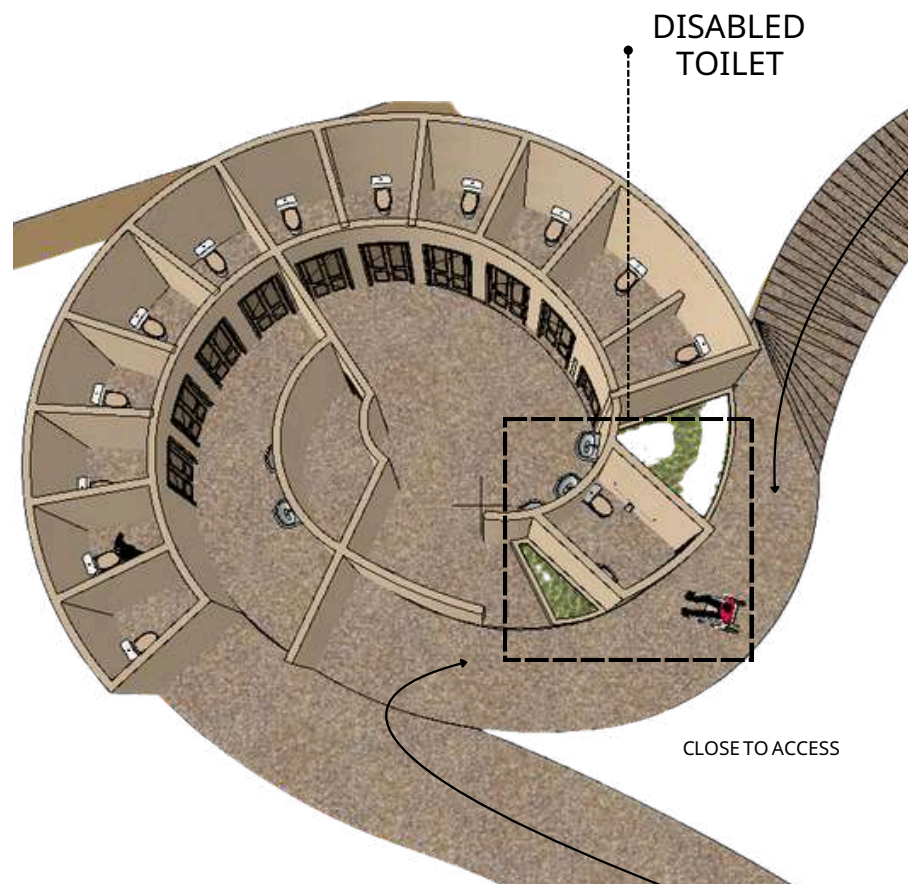
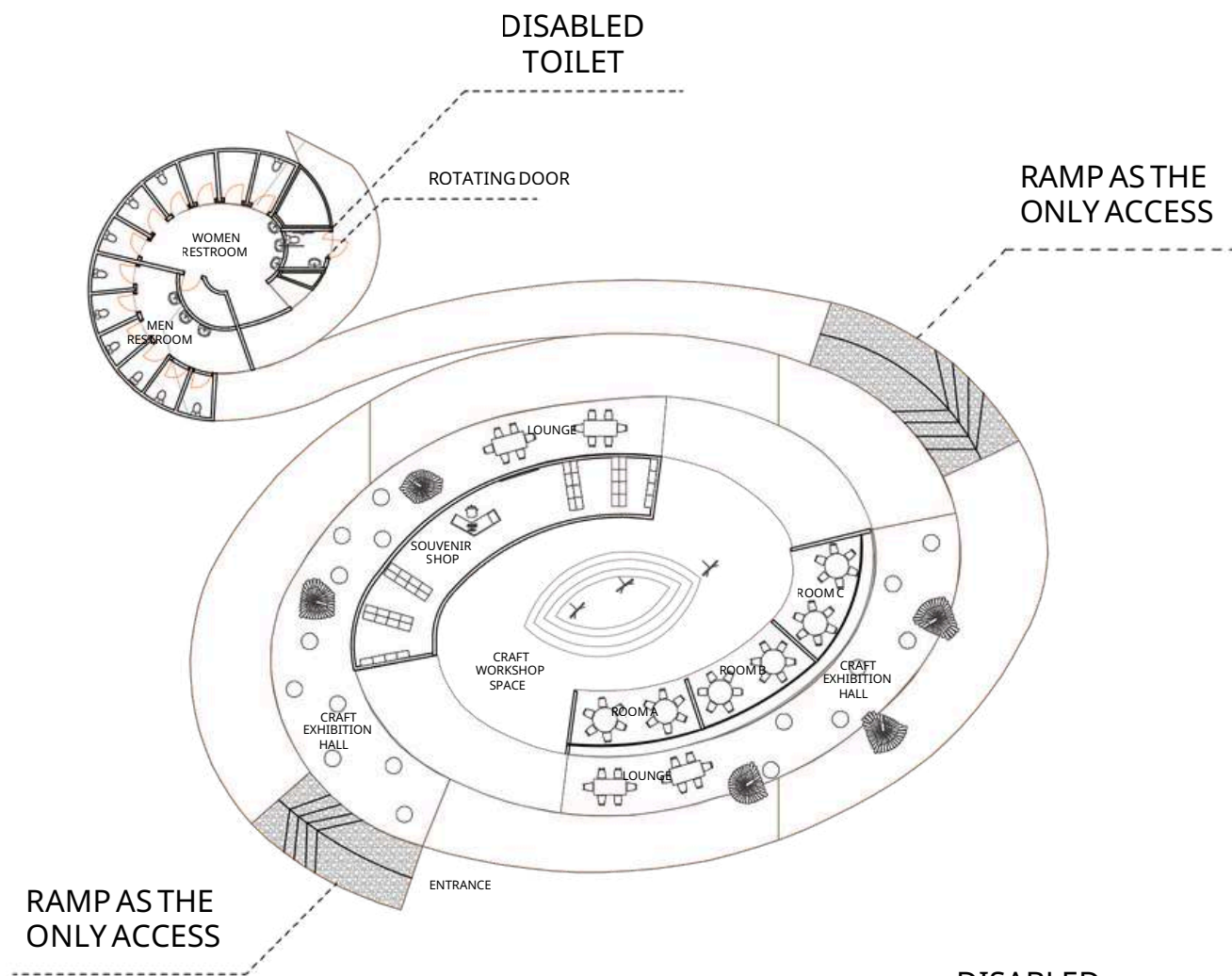
The experimental zone of sensation enters the vertical cave where there is a little water underneath.

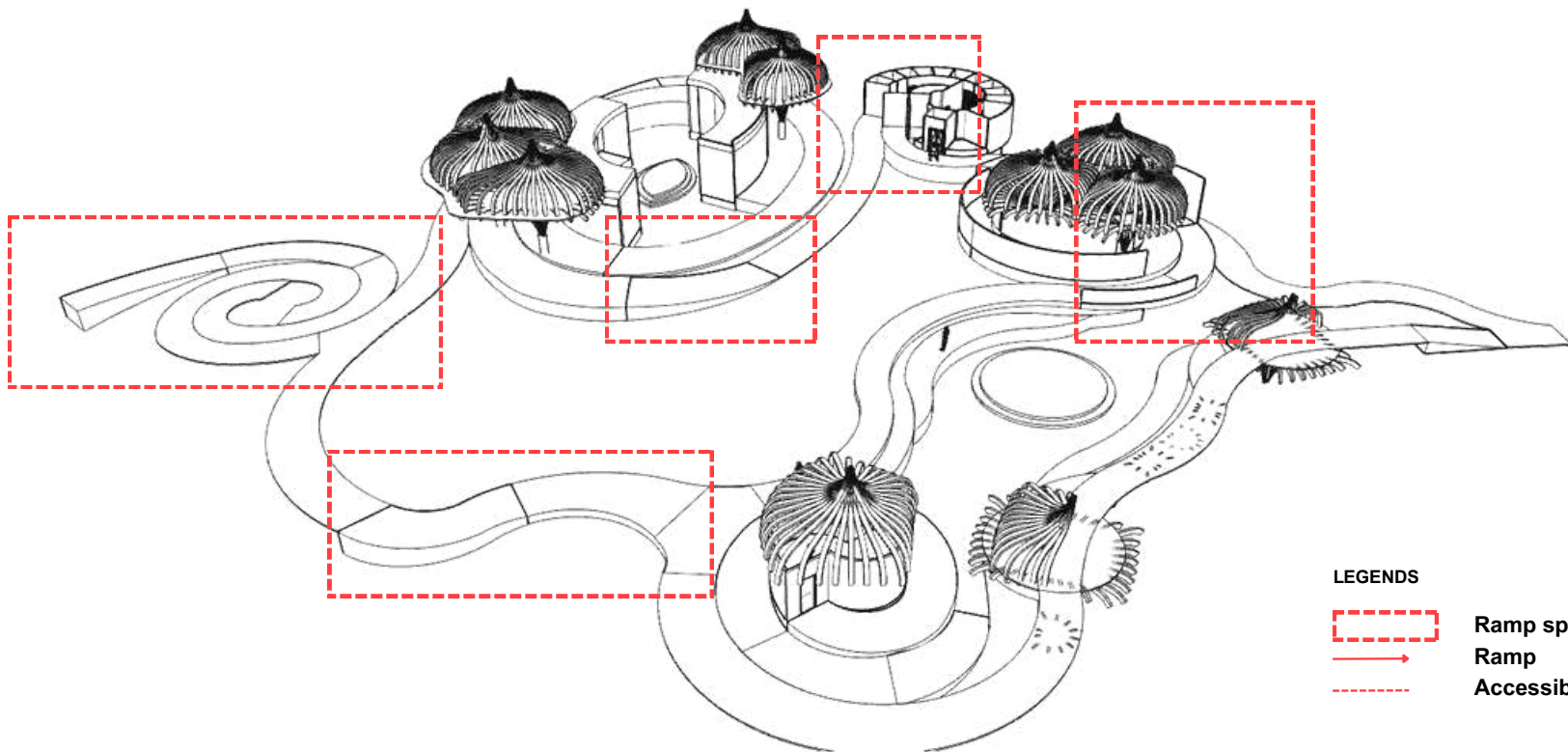
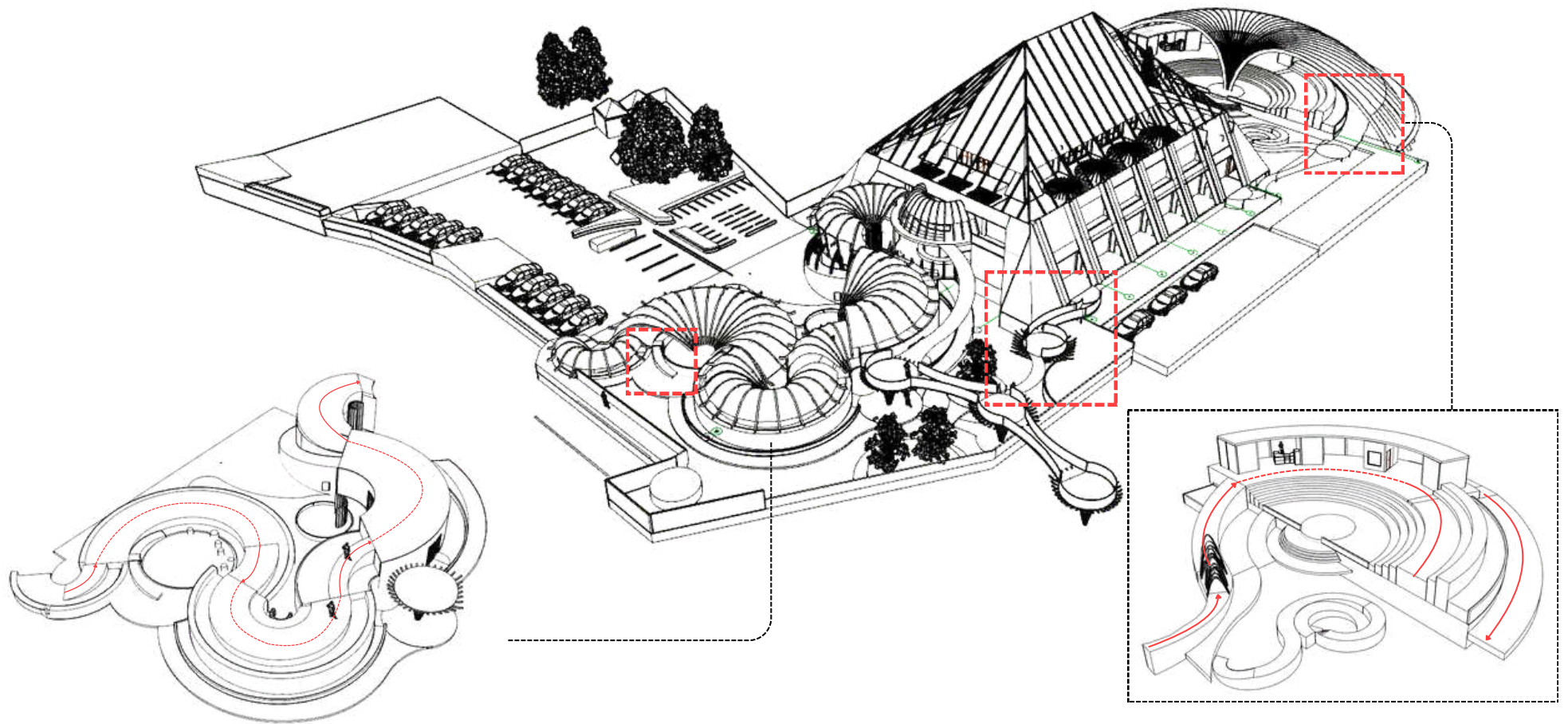
as a storytelling depiction of Luweng Sape which illustrates a narrow vertical cave at the bottom of which there is water to depict how difficult it is for the residents there to collect water.

An architectural rendering of a modern building with a curved wooden roof. The roof is made of many wooden beams that curve upwards and outwards, creating a large, open space underneath. Below the roof, there is a landscaped garden with a small stream, a paved path, and a circular green area. The background shows a green hill and a blue sky with clouds.

Previously abandoned warehouse into the exhibition about water in karst area

This area has an elevation of the land that is 1-2 meters higher. Behind it is a plantation, so to enhance the escapist experience for visitors, a connecting element between the museum and the garden has been added.





LEGENDS



Ramp spots
Ramp
Accessible area

An architectural rendering of a modern landscape. In the foreground, a large, stylized tree with green leaves and a thick trunk stands on the left. A wide, light-colored path leads towards a series of white, curved, tunnel-like structures that form a bridge. Two people are walking on the bridge. The background features rolling green hills under a blue sky with scattered white clouds. The overall design is clean and modern, with a focus on natural elements and flowing lines.

Connecting bridge between the east and west zone



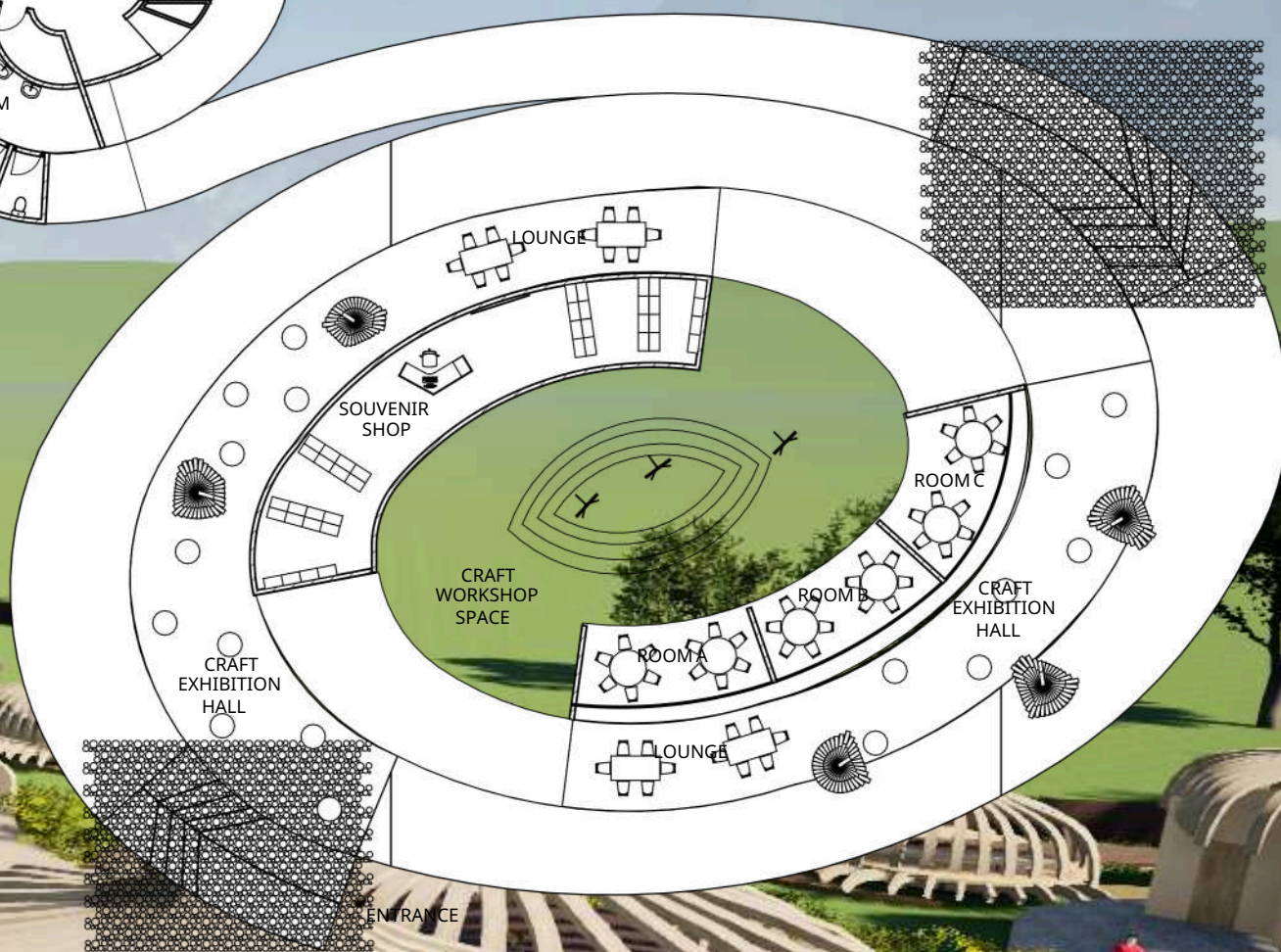
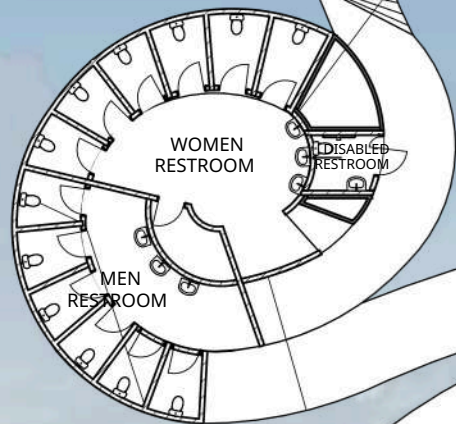
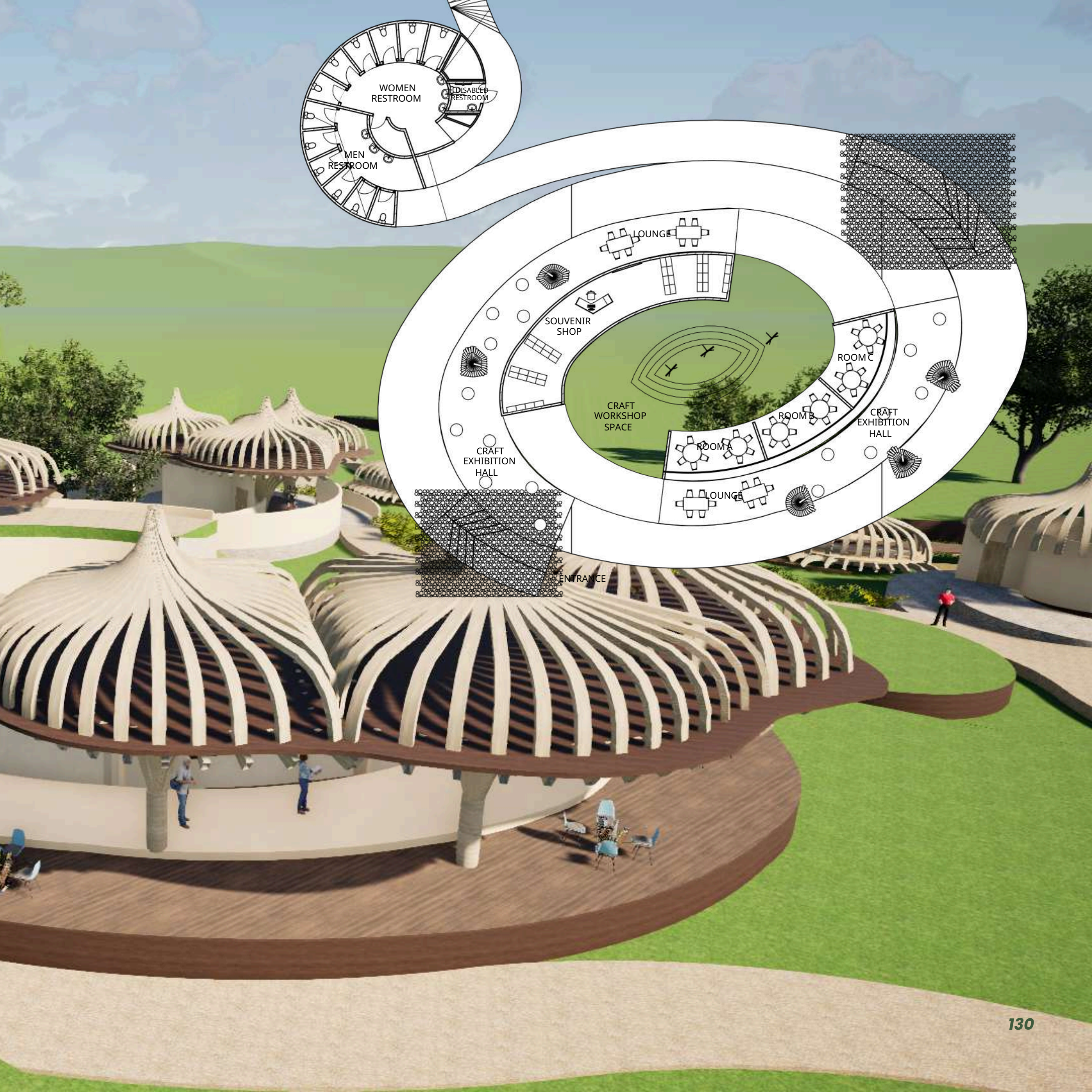
The cause for the establishment of the bridge is to respond to the roads around the museum that are often used by locals for farming.

Revitalization of Museum **Karst Value Zone**

Workshop room and souvenir rooms

Souvenir room that previously only placed
randomly inside the main museum

Exhibition about things the karst produce like
interior purpose or crafts.





A place to relax and respect the seasonal river and stopping zone

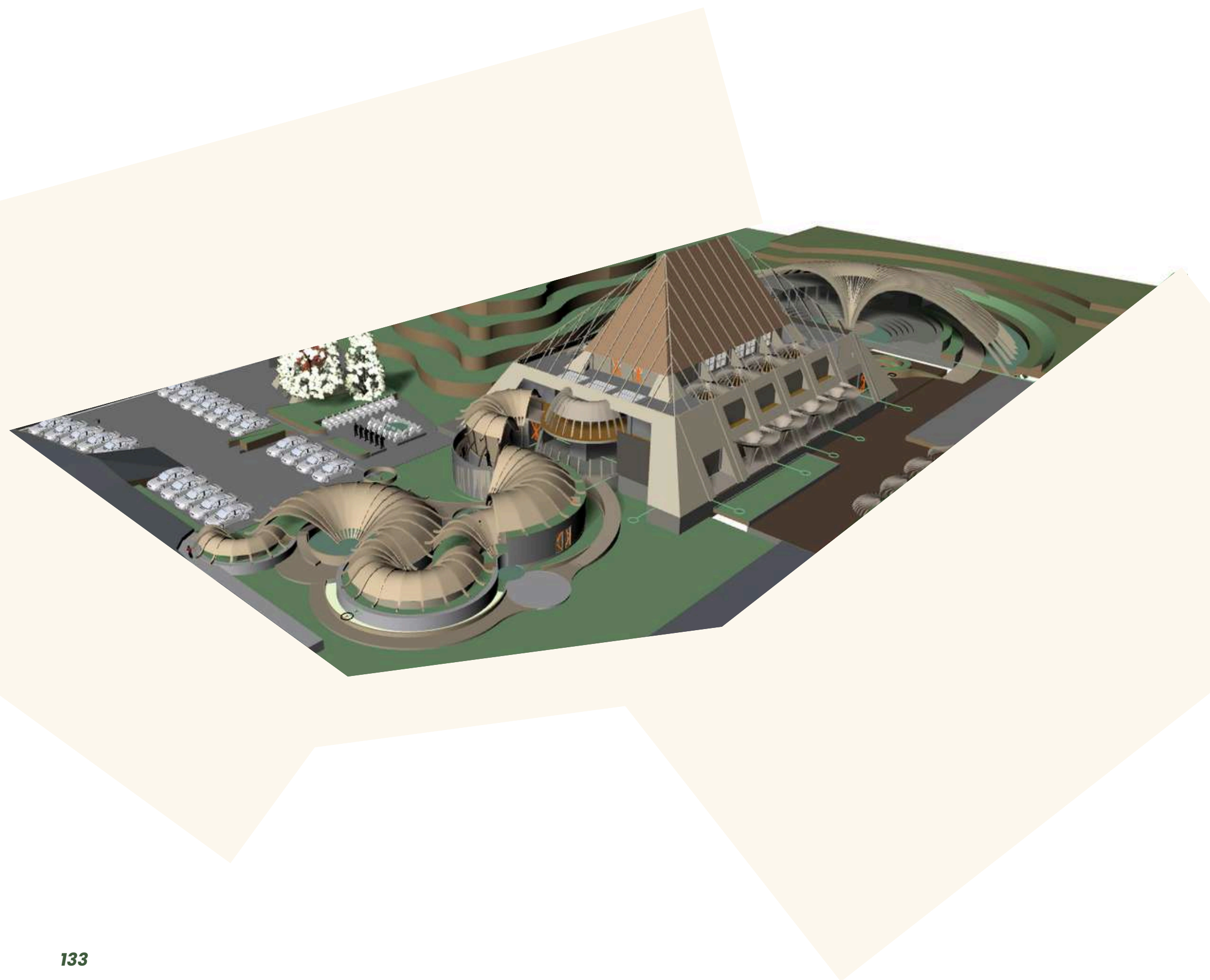
Exhibition about sodong cave



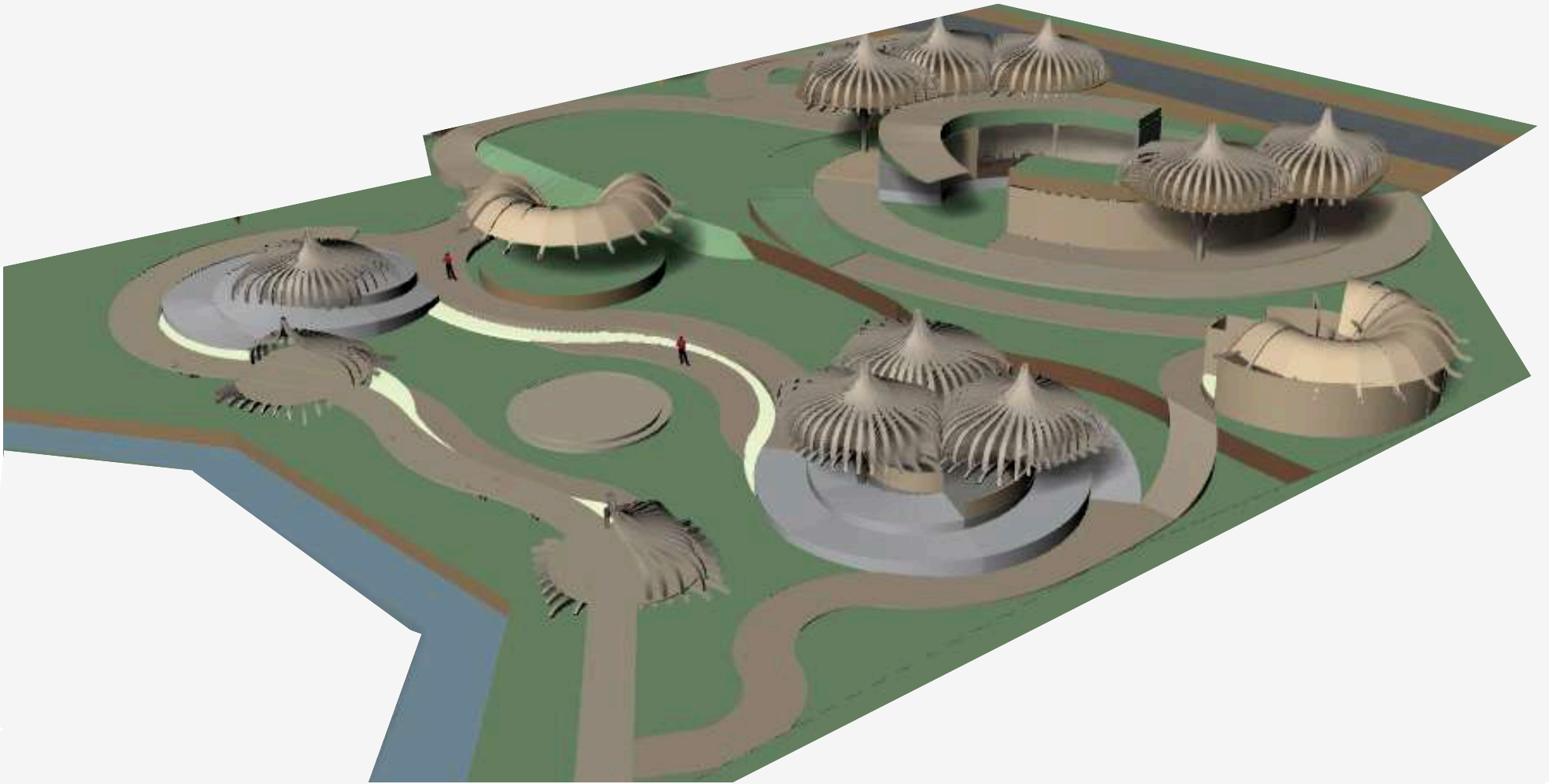
The path that directs visitors to visit the real site of the Sodong cave.

Exhibition about sodong cave

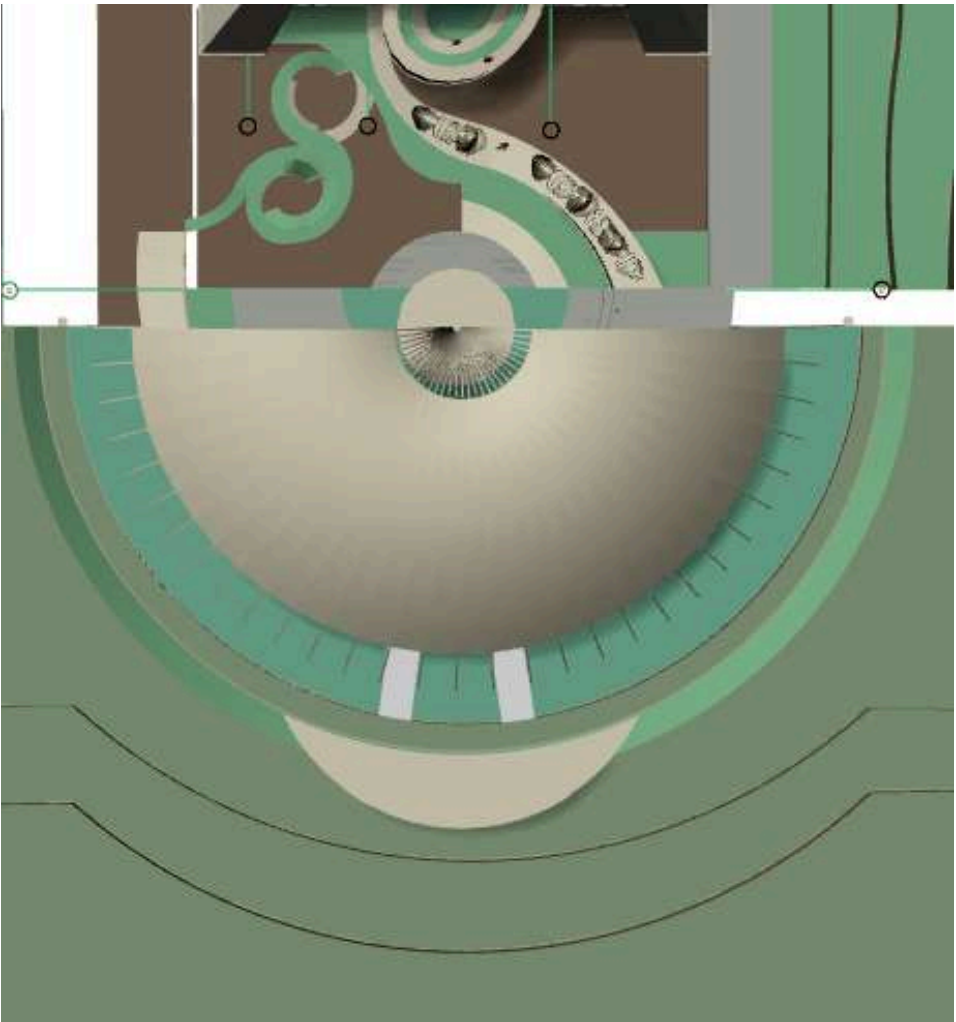
MAIN ZONE PERSPECTIVA



WEST ZONE PERSPECTIVA



MAIN ZONE TOP VIEW



WEST ZONE TOP VIEW





06

EVALUATION & REFLECTION

1	The reason for “redesigning” the museum	The reason for the redesign/revitalization was the large amount of dead space, damaged, and neglected facilities in the main museum and the surrounding area. The museum, which serves as the largest in ASEAN, still lacks in the user experience it provides. However, there is potential for incorporating the museum's narrative into the karst landscape of the area.	Page 13
2	The reason for choosing biomimicry as an approach	The biomimicry approach was dropped because it was deemed inconsistent with the intended goal of revitalization. Therefore, it was replaced with an architectural storytelling approach.	Page 55-56

1	The owner and commissioner of the project	The owner of the project is the local government of Wonogiri Regency. Meanwhile, the commissioner is the Office of Youth, Sports, and Tourism (DISPORA Wonogiri) because the fields of tourism and museum management are under their purview.	Page 44
2	The relationship with the local stakeholders in Wonogiri	The revitalization of the Indonesian Karst Museum involves various local stakeholders in Wonogiri with complementary roles. The Wonogiri regional government, as the asset owner, acts as the primary decision-maker, while the Wonogiri Youth and Sports Office serves as the project manager and executor. On the other hand, the Pracimantoro community plays a crucial role as economic beneficiaries and guardians of local cultural identity. Academics and environmental communities contribute through research and sustainability inputs, while MSMEs and the tourism sector drive the economy around the museum. This relationship forms a collaboration between the government, community, academics, and the tourism sector for the success of the revitalization.	Page 44

3	Design challenges of the project and the proposed design solutions	The revitalization of the Indonesian Karst Museum faces several challenges, including a decrease in visitor numbers, outdated facilities, a lack of narrative and storytelling in exhibitions, and limited accessibility. To address these challenges, a revitalization design is proposed through the reinforcement of the storytelling architecture concept that organizes the spatial flow based on geological and cultural narratives. In addition, improving accessibility for all segments of society and providing social-educational spaces for the community is an important part of the design solution.	Page 88
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1st Jury: Prof. Dr.-Ing. Ir. Ar. Ilya Fadjar Maharika, MA., IAI.

COMPREHENSIVE

1	You need to enhance the parametric design into not only symmetrical	The parametric design is first used to create the zoning, flow, or site planning. It uses the tool of a cylinder that can be adjusted in the way of vertically or horizontally. So that it creates a more dynamic and flowy path and helps create the building for the zone. Another tool being used to create more cave-like (stalagmite, stalaktite) by pufferfish to integrate all of the buildings.	Page 119
2	You can play with the height difference of the cave to reflect the cave thing into the design in order to gain experience	The design already plays with different heights, especially the tembus cave zone, as the first step of the museum. It shows the elevation to imitate the feel of going to the cave, and the design is mostly in the form of curvy lines of different widths and heights.	Page 107
3	STORYTELLING: Gaining experience might be from the connection to a local myth surrounding the museum.	Several mythological stories around the area were found. For example, in the Tembus Cave, there are tales of a princess who ran away and also of a hermit who inhabited it. In the Luweng Sapen, there are also stories about the many supernatural beings that make the area forbidden to enter. Some of these stories are expressed in designs, namely in the Tembus Cave Zone and the Luweng Experience Zone.	Page 78

4	Need more precedent studies on museum	The precedent museums that apply storytelling architecture are The Norwegian Glacier Museum and the Aceh Tsunami Museum, both of which are located in Indonesia. This museum integrates the narrative of the tsunami tragedy from the beginning to the recovery process. Each room evokes a specific emotion, from the dark hallway (fear), the prayer room (reflection), to the hope room. The Norwegian Glacier Museum opened in 1991 with the aim of collecting, developing and disseminating knowledge about glaciers and the climate. The concept of the museum is to convey the feeling of having been conceived by the glaciers that surround it and add to its history.	Page 23-25
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2nd Jury: Dr. Ar. Yulianto Purwono Prihatmaji, S.T., M.T., IPM., IAI.

COMPREHENSIVE

1	Show the storytelling implemented in the design (story for each zoning).	Some of the storytelling is applied to several zones. The zones are the Tembus cave zone, the Luweng experience zone, and the Sodong cave zone. Each zone has an attraction of different stories that happened back in the past/legends/myths. It is applied to the design.	Page 146
2	Provide do and don't about the design project + Design guidelines from the government	The guidelines are mostly found in the government regulations on building in the karst areas. Also, the museum stakeholders are those who told or guided what the design should be.	Page 76
3	Environmental and cultural issues	The main environmental issue is drought in the karst. So during the dry season, they tend to rely on government assistance. The cultural issue is minimal involvement from the local community, and the local myth is not involved in the museum narrative.	Page 35

4	Design alternatives and design process	The alternative is to explore parametric designs that can produce new forms according to the site.	Page 93-100
5	Connection of the problem formulation with the design implementations	The problem formulation raised is the lack of experience with space and damaged facilities that can lead to a lack of visitor interest, even though the government plans to do city branding for Wonogiri as a tourism city, where the karst museum is one of the potential. Therefore, in the design implementation, a spatial narrative based on storytelling is presented to make the visit flow more engaging and to incorporate existing legend stories into the design.	Page 7
6	Explain the design concept and criteria	The space is not just symbolic, but it must be able to convey a narrative clearly and be felt by the visitors.	Page 88

1st Jury: Prof. Dr.-Ing. Ir. Ar. Ilya Fadjar Maharika, MA., IAI.

FINAL DEFENSE

1	You need to show clearer dimensions, especially if you have different heights in the floor elevation.	There are different floor levels in the Tembus Cave Zone. The elevation difference increases as visitors follow the existing circulation. Transitions to higher levels are connected by ramps.	Page 107
2	You forgot the ramp notation on a certain part. Please show it in the drawing so it's clear.	The ramp notation not shown in the image is the beginning of the Tembus Cave Zone. Therefore, it needs to be shown on the floor plan.	Page 107

3	The room in the karst value zone is still lacking functionality.	The upper floor of the Karst Value Zone is intended to be a space for discussions and storage of seasonal collections by stone craftsmen. Therefore, continuous access with a ramp design is required for visitors.	Page 88
4	Try to find another material option for the floor in the karst value zone.	Previously, the floor was using wood plastic composite which is too thin for used for a floor. Another option might use bangkirai decking. It is quite strong and termite-resistant. It is suitable for semi-outdoor or outdoor flooring but still need to be protected. It still requires regular coating to prevent quick dulling or fine cracking.	Page 26

2nd Jury: Dr. Ar. Yulianto Purwono Prihatmaji, S.T., M.T., IPM., IAI.

FINAL DEFENSE

1	Chronological order of the circulation	The circulation consists of several zones. However, in its design, visitors are guided through the same path. It starts from the first zone, which is the cave zone, serving as an introduction (initial explanation about karst). From there, visitors are directed into the main museum through the entrance on the first floor. Then, visitors are guided to the lower floor to explore the science of karst. The next zone is the Luweng Experience Zone, where visitors can have the experience of entering a luweng as a water source for the communities living in karst areas. After that, visitors are directed into the water in the karst zone. There will be a resting area for visitors before moving to the next zone, which is the karst value zone. Finally, the last section is the Sodong Cave Zone, which depicts life in the past that occurred in the Sodong Cave.	Page 142
2	The booth for the workshop and how to search for which community will sell in the souvenir shops	Previously, the souvenir shop was only manifested in one space containing two display cases showcasing stone crafts. It consisted of only one kiosk and was a consignment from artisans from Pacitan. From there, the estimate arose that the souvenir shop would be managed by the museum. However, the providers are artisans from the karst area who want to leave their work at the museum to be sold or displayed.	Page 141

3	The design indicates adaptive reuse	The part of the building that applies adaptive reuse is in the water in the karst zone. This section was previously a gathering place that then became a warehouse and was abandoned. This area consists of a high arrangement of concrete slabs that are elevated. The story that wants to be conveyed in broad terms is the sequence about karst, interspersed with some narratives in each zone.	Page 143-145
4	How to make sure the structure survives in the rain	If using glulam remains, the glulam structure is still safe in rain if: using waterproof adhesive, given a protective coating, construction details protect from direct exposure, joints are protected, and water drainage is good.	Page 26

The booth for the workshop and how to search for which community will sell in the souvenir shops

F&B stalls

Previously, many residents of Gebangharjo village sold food in the vehicle parking area. There were 6 stalls in total, all managed by village residents. The stalls were simple in design and only sold food and drinks.

Referring from there, the determination of the number of stalls is made. They are relocated to a new zone, namely the karst values zone.

Workshop in Karst values zone

The workshop available focuses on crafting with limestone. Limestone that can be made into jewelry as well as decorations or building materials like vents. In this zone, there is a space provided to hold workshops during certain events or on weekends.

Referring to that, the museum collaborates with local artisans to regularly contribute to organizing workshops.

Souvenir shop

Previously, the souvenir shop was only manifested in one space containing two display cases showcasing stone crafts. It consisted of only one kiosk and was a consignment from artisans from Pacitan.

From there, the estimate arose that the souvenir shop would be managed by the museum. However, the providers are artisans from the karst area who want to leave their work at the museum to be sold or displayed.



Hadi Sutrisno, Natural Stone Craftsman (Jasper and Agate)	Walyono, Obsidian Stone Craftsman
- Based in Sejati Village, Giriwoyo District, Wonogiri. - Processing natural stones such as Jasper (including red Jasper) which is part of karst or limestone rocks that undergo a waterproofing process (silicification), into accessories, garden ornaments, or interior decorations. - Although not explicitly referred to as regular "limestone," he uses materials that indeed originate from limestone formations. https://batuakikpedia.blogspot.com/2014/12/pengrajin-batu-akik-di-pactan-dan.html?	- Location: Sejati Village or Wates Environment, Giriwoyo Subdistrict, Giriwoyo District, Wonogiri. - Product: Processing obsidian stone (a type of natural synthetic stone, not limestone), polished into gemstones in oval, cube, diamond, pendant shapes, etc., which are then exported to Sweden and Germany. (Sonoradetikcom Suara Merdeka Solo.)

Chronological order of the circulation is not yet clear



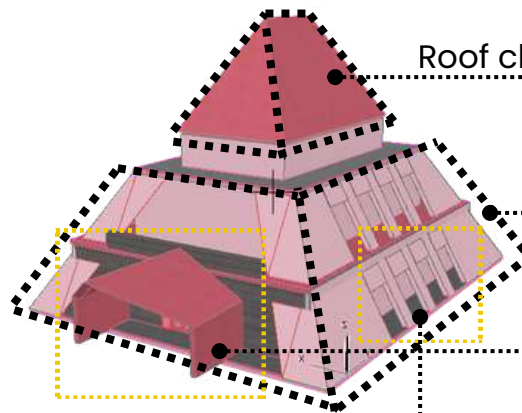
The circulation consists of several zones. However, in its design, visitors are guided through the same path.

- 1 It starts from the first zone, which is the cave zone, serving as an introduction (initial explanation about karst).
- 2 From there, visitors are directed into the main museum through the entrance on the first floor. Then, visitors are guided to the lower floor to explore the science of karst.
- 3 The next zone is the Luweng Experience Zone, where visitors can have the experience of entering a luweng as a water source for the communities living in karst areas.
- 4 After that, visitors are directed into the water in the karst zone.
- 5 Bridge
- 6 There will be a resting area for visitors before moving to
- 7 The next zone, which is the karst value zone.
- 8 Sodong Cave Zone, which depicts life in the past that occurred in the Sodong Cave.
- 9 Resting area + view for seasonal river
- 10 Stalls

The design indicates adaptive reuse

1

The part of the building that applies adaptive reuse is in the **main museum**. The main structure of the building is preserved, and nothing is destroyed. The reason is the original structure of the museum represents the **historical traces** of the development of the first museum about the karst areas in Indonesia and ASEAN. If the structure is completely altered, then its authenticity and historical identity will be lost.



Before

Roof characteristic: limasan and surrounding karst characteristic.

being kept

Pyramid-like shaped building, tried to imitate the karst type found in Wonogiri.

being kept

Galvalum canopy that is being removed to connect the main museum and the new tembus cave zone.

changed01

It was an empty space, only an ornament, yet when totaled the area covers 30 sqm.

changed02

The transition from the tembus zone for the main museum

changed01

Utilize into hallway by cutting the wall following the shape as an circulation way to connect the water zone and the bridge

changed02

Additional platform for the start and end of the transition hallway.

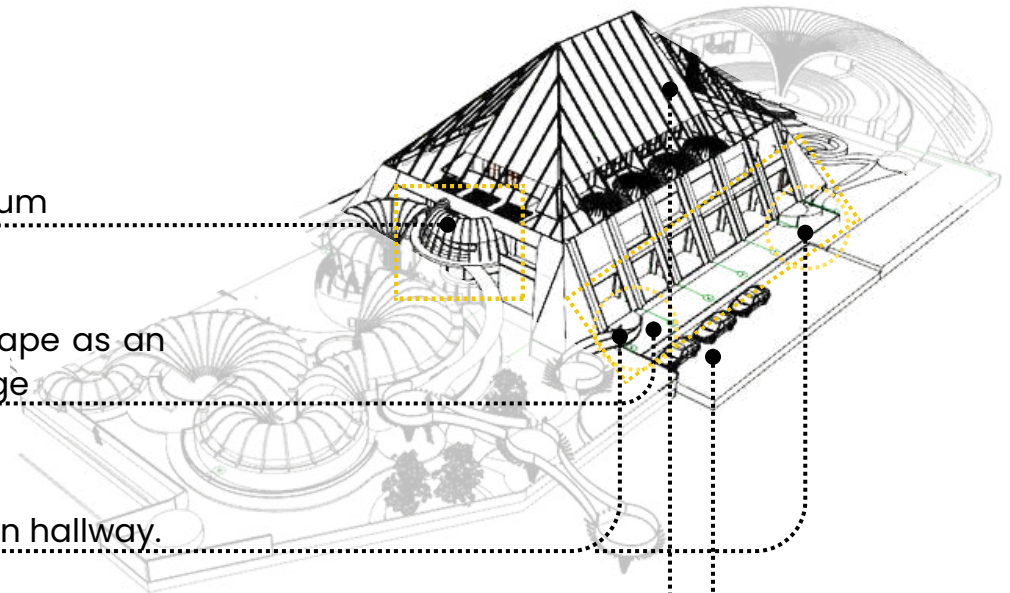
changed03

Previously, it was just an empty pavement hardscape turned into the tracking shuttle point.

changed04

Add-on steel frames and steel mesh for outer roofing to create the feel of preserved building.

changed04



After

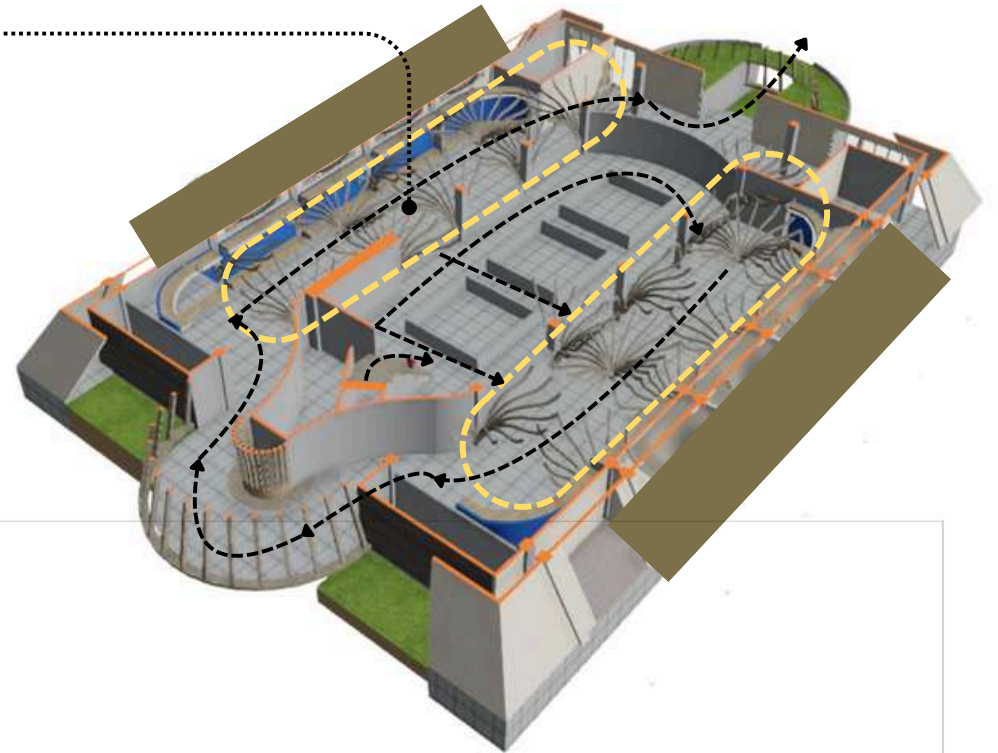
EXHIBITION WITH PARAMETRIC ORNAMENT SPACE

add on

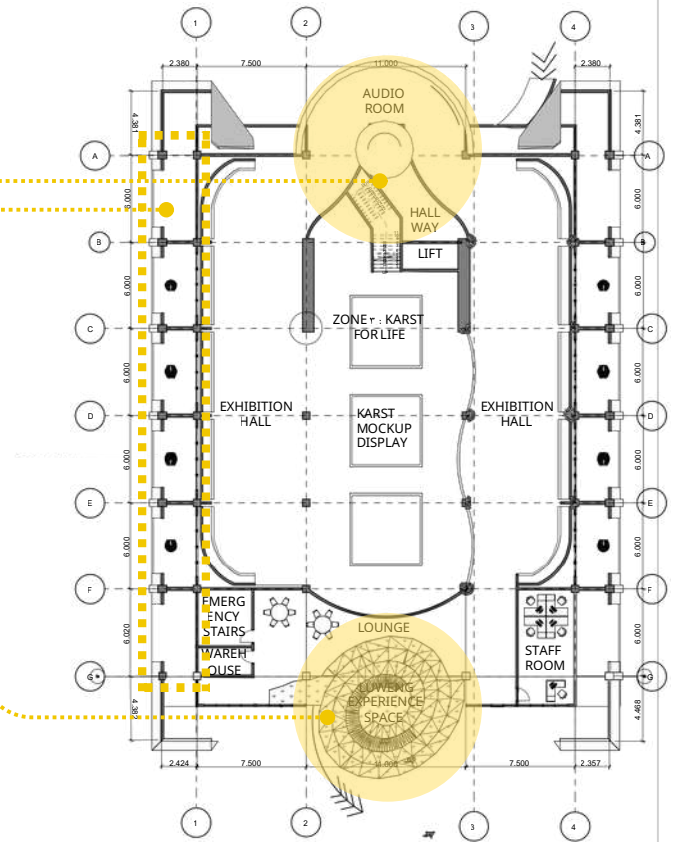
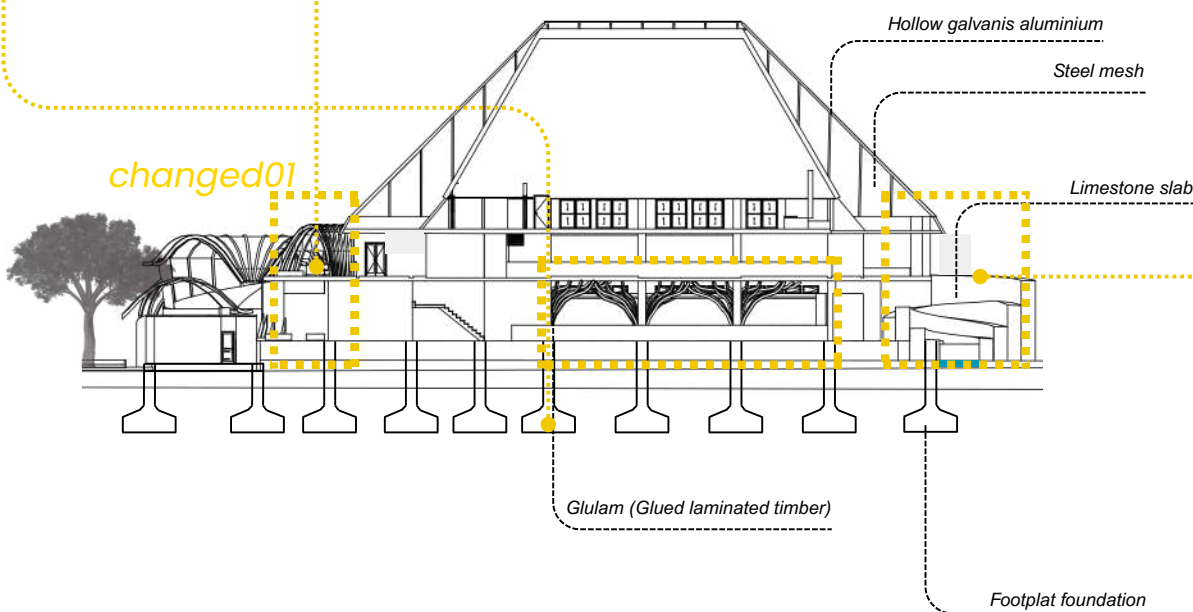


The curved frames are interconnected with joints so that they support each other.

The design is elongated and located on the ceiling, which is arranged with a parametric design resembling the karstification shape found in caves.

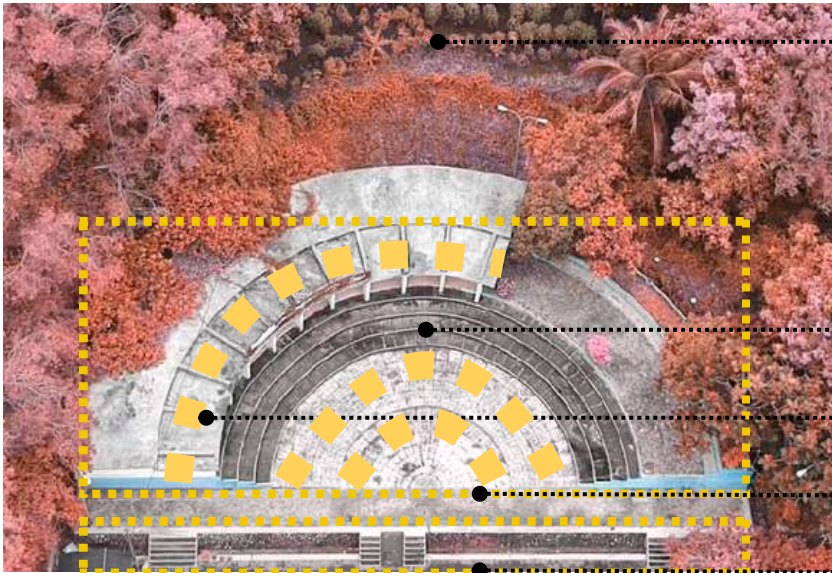


Additional platform for the start and end of the transition hallway.



The design indicates adaptive reuse

2 The part of the building that applies adaptive reuse is in the **water in karst zone**. This section was previously a gathering place that then became a warehouse and was abandoned. This area consists of a high arrangement of concrete slabs that are elevated.



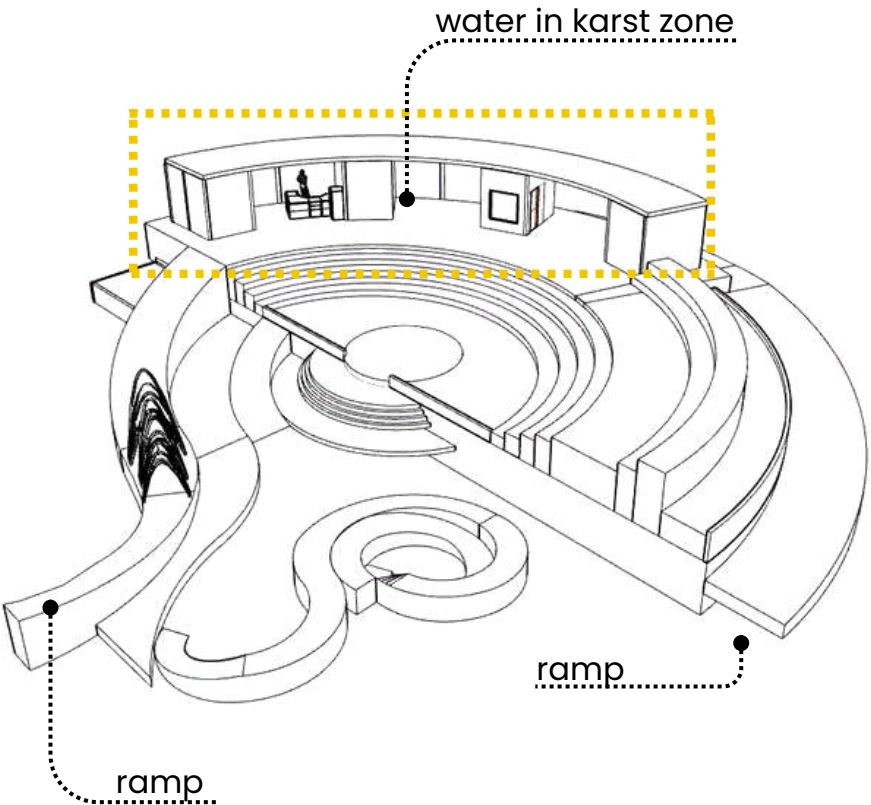
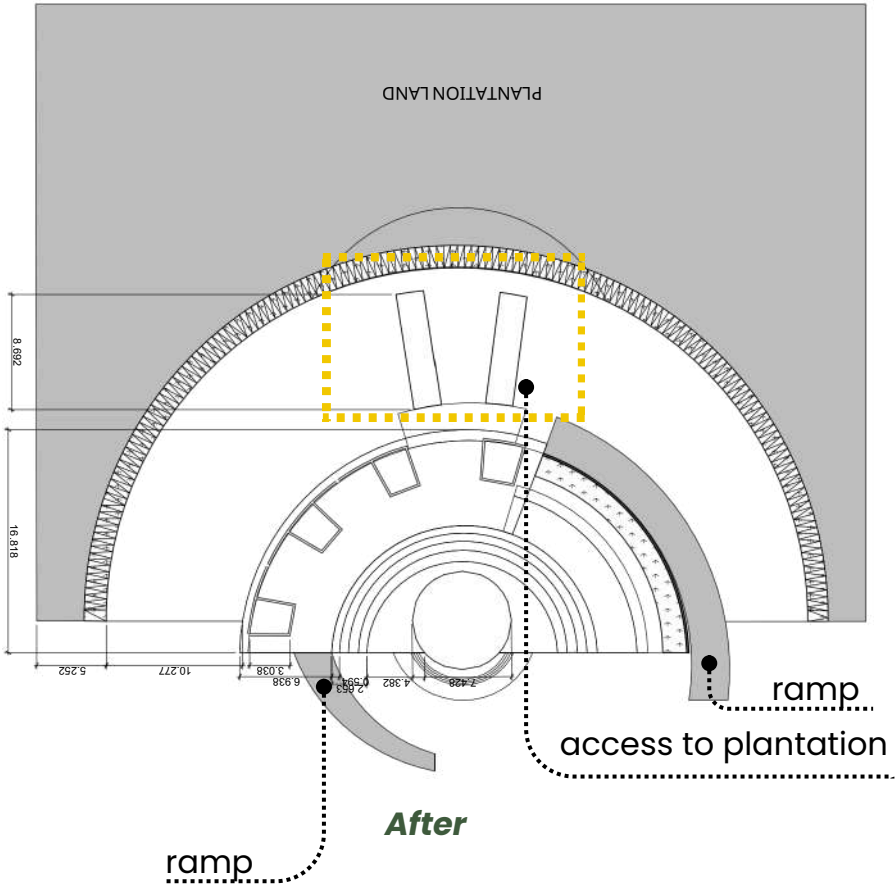
Before

Existing cassava plantation land

previously a gathering place
being kept

abandoned place, all rooms utilized as warehouse
being kept

empty space
changed
stairs access
changed

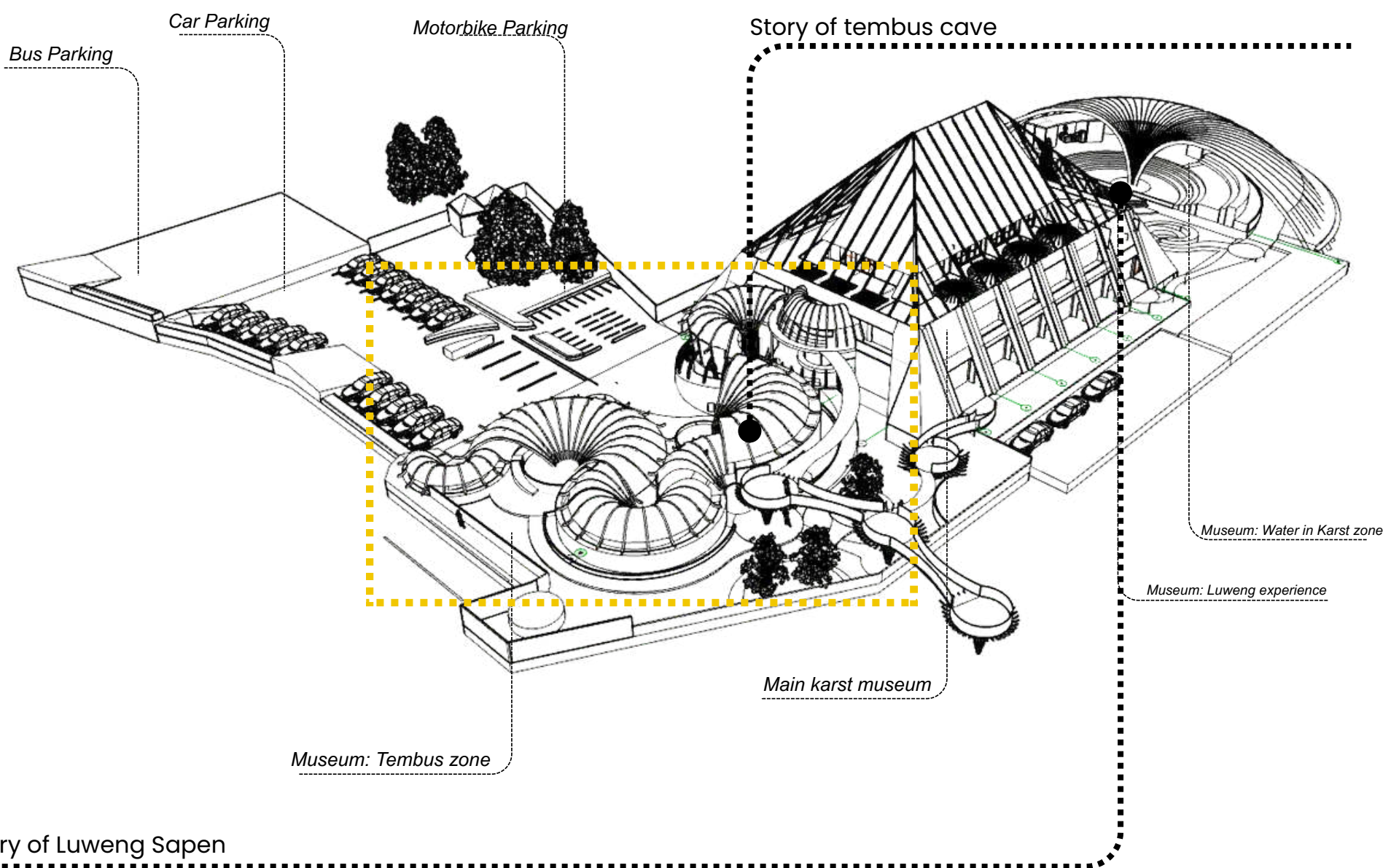


The design indicates storytelling

3

The story that wants to be conveyed in broad terms is the sequence about karst, interspersed with some narratives in each zone.

The pattern follows the circulation of the cave which is winding. Then in the element inside, a water kola is provided where there is a story about a hermit who meditated there on the rocks, so a stone seating area is added in the design for visitors to stop and listen to the narration.



Story of Luweng Sapen

It also tells the myth of the spirit guardian, so the design depicts it sinking further in. And the water that is only a little to illustrate how highly water is respected because it is considered sacred.

Buildings that use cylindrical elements in a descending and winding manner show how in the original cave it becomes narrower.

ATTACHMENT



MAQUETTE 1X1m

REVITALIZATION OF THE INDONESIA KARST MUSEUM

in Pracimantoro, Wonogiri, Central Java, Indonesia

The Rio de Janeiro Museum is one of the oldest and most important in South America. Officially designated as a geological heritage by UNESCO, this museum is located in a coastal area spanning 16 hectares. Year after year, the museum has expanded its zones outside of the museum. However, the role of its function as a HQ is raised. Some facilities have become more functional spaces that have been neglected. Therefore, this revitalization aims to enhance the visitor experience and to let some of the zones that have been built to revive the narrative of a lost museum. Revitalization is carried out by adding several existing buildings to function as new zones, while focusing on enhancing the visitor experience based on architectural storytelling from the existing surroundings.

PROBLEMATIQUE

图 1-1-1 中国人口年龄构成

The Indonesian Rural Museum was established to educate visitors about Indonesia's unique rural landscapes and their ecological significance. However, the lack of user experience is reported due to several reasons. Museums play the role of a space for the local community, even though museums have the potential to become a center for experiential and education. The museum needs a revitalized approach to remain relevant, engaging, and environmentally responsible.

GENERAL PROBLEM

The museum struggles with low visitor engagement, **passive learning experiences**. To revitalize, interactive exhibit, immersive storytelling within the building must be integrated to enhance education, visitor experience, and environmental conservation.

SPECIFIC PROBLEMS

1. How to create an immersive and interactive space experience through storytelling architecture?
2. How to reuse existing building elements in an adaptive way (adaptive reuse) without damaging the local culture and identity?
3. How to design plots and programmes that are able to relate local narratives as inspirational, environmental and cultural landscape?

360.1

improve **visitor experience** to be more functional, comfortable, and attractive to various groups of visitors.

Revitalize museum facilities through adapting the abandoned space into the part of museum corridor.

Integrate **storytelling** to make the museum able to tell about forest ecosystem not in passive way.

Make the museum a more engaging and effective educational center in collaborating with the communities.

DESIGN STUDY

DESIGN CONCEPT

DESIGN FEST

Matrix of Design Thinking

DESIGN CONSTRAINTS	EMERGENCY	EMERGENCY	EMERGENCY	EMERGENCY
Requirement:	Maintaining the preservation of buildings in accordance with the regulations for the preservation of cultural heritage sites or geopedic areas (Europe)	Buildings must be equipped geopedic heritage value identify.	The structure of the building must not be altered even if it must not comply with the original specified layout and structure.	Accessibility, building must meet the required standards.
Use: local population, public use	Locate for change that create a more vibrant, educational, and social museum for the present time.	Noting that the museum will raise awareness of the importance of natural areas and local culture.	Warning clear, flexible, comfortable, spacious, and layout that is not confusing.	Needs complete facilities for learning, storage, and education area, etc.
Other: social workers, citizens	Want new branding and social-economic impact for the region, including total renovation.	Wanting the building to become a place that break out of the traditional architectural symbolic value.	Need a cost-effective design solution that is both professional and modern.	Aiming for an increase in visitors and effective long-term sustainability.
Steps: The project	Engaging with an independent organization and consulting	Designing space renovation elements and innovative design elements (Architect's aspect)	Designing zoning, circulation, and spatial operations to be more functional and to be more sustainable.	Improving space facilities and natural ventilation, adding multifunctional facilities space.

Table of Contents
v

Abductive Reasoning

Initiative	Impact	Value
The museum exhibits art objects visitors have contributed to, is surprising and there is no strong narrative	Developing visiting based on spatial story telling that follows the sequence of discovery of processes	Enhancing understanding, experience and educational support for visitors
The lack of basic facilities (toilets, changing room) and no accessibility	The addition of public facilities on an integrated manner and structural design	Increasing comfort and usability for all types of visitors
Visitor circulation is chaotic, there is no clear starting/ending point	Developing visitor flow based on a combination with a clear 'intention' - experience and end - system	The visitor's experience becomes different, easier and more memorable
Utilization and lighting design are not optimal due to the old closed design	Spreading more traditional public programs and arranging temporary exhibitions with more surrounding environments	A healthier, brighter space that strengthens the relationship between the inside and outside of the building
There are too social spaces that are uncomfortable community or educational activities	Adding multi-functional public spaces (workshop area)	The main hall becomes a center for community activities and active education, not just a passive space
The museum is quiet with visitors, less relevant to the younger generation	Revitalization of space programs with an interactive and experience-based approach (Creative Zone - based on museum design)	Engaging visiting generation and re-creating community participation

Table of Relative Endoring
Source: Author

Design Thinking Diagram

Empathize	Define	Ideate	Prototype	Test
Conduct research, interviews, surveys	Develop findings, problem statements	Generate potential solution with sketches and diagrams	Create preliminary design sketches, models, and wire board alternatives	Iterative testing and feedback
Observe and analyze existing use conditions and issues	Craft design goals	Explore conceptual space and identify needs	Develop feedback on initial design concepts	
Understanding the needs of users, stakeholders				
		How to maintain best museum experience to be more innovative, contextual, and relevant to the current generation without losing the historical value of the buildings?	How to maintain best museum experience to be more innovative, contextual, and relevant to the current generation without losing the historical value of the buildings?	
	Visitors want a vibrant experience, not just to see a static collection			

Design thinking program

Analysis on Ideal Condition

Agents	Collating Condition	Media Condition	Regulating Entity
Concept and Theme	Museum themes: seem to possess unshakable, inflexible experiences.	A theme that combines interactivity, education, and firsthand experience about the real world.	Biologizing the museum theme with more narrative architecture
 zoning and Visitor Division	The flow of visitors is not well structured. Some areas appear empty or not frequented.	A clearly structured flow, zones connected with a narrative theme.	Deepening the visitor journey with clear thematic zones
Exhibition Types	There are no educational spaces, just a display containing traditional information boards.	A structured and inspiring educational space.	Building a workshop space for geological explanation and a mini laboratory.
Visitor Investment	Visitors are more passive. There is a lot much to do other than viewing the exhibitions.	Visitors are more actively engaged in experiences, such as mini rock exploration and water filtration simulation.	Creating interactive zones such as understanding making of water used as experience.
Conservation and Environment	The linked green elements are open spaces or wetland the subterranean maintenance office collection.	Collection maintenance with good conservation practice, green building and sustainable integration.	Implementing the current existing as a sustainable with ethics.
Visitor Facilities	Some visitor facilities such as seating and signage are inadequate.	Comfortable visitor facilities, high accessibility, or well-ventilated and street.	Add comfortable break room facilities and accessible toilets.
Spatial Sustainability	The spaces feel separate and monotonous.	A space that is interconnected narratively and visually for a sustainable experience.	Making the one city attraction



Existing Zones

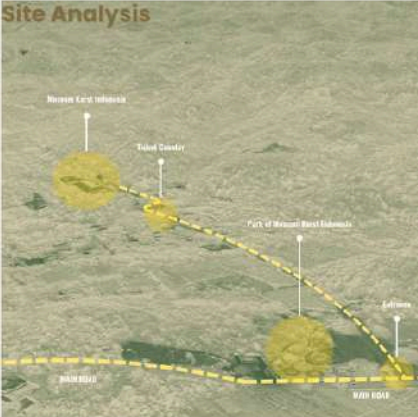
This project focuses on the overall transformation of the Karst Museum through the integration of design that prioritizes user experience with contemporary architectural innovations. This approach is designed to create a more interactive, engaging, and sustainable space, thereby increasing tourist attraction and providing a more satisfying experience for every visitor.



Museum Zoning

Legend:

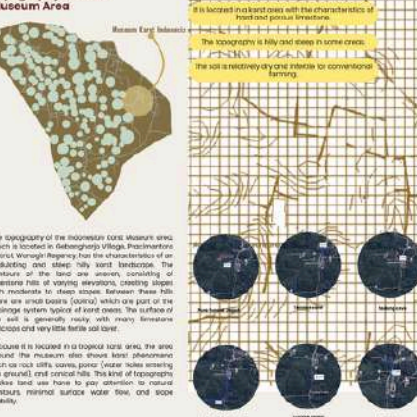
- Karst Museum
- Settlements
- Pura
- Agricultural zone
- Settlements
- Road access
- Karst museum area



Site Analysis

Legend:

- Ruas Karst Indonesia
- Tekong Center
- Part of Museum Karst Indonesia
- Settlements
- Ruas Karst Indonesia



Topography of Karst Museum Area

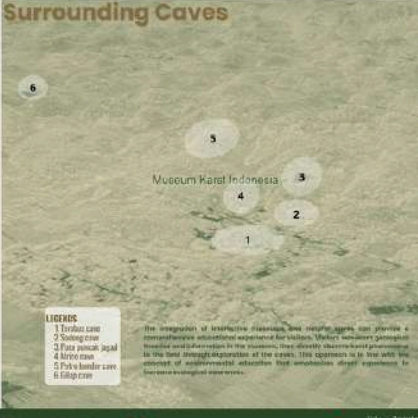
It is located in a karst area with the characteristics of karst and porous limestone.

The topography is hilly and steep in some areas.

The soil is relatively dry and suitable for conventional farming.

Legend:

- Settlements
- Ruas Karst Indonesia
- Settlements
- Ruas Karst Indonesia



Surrounding Caves

Legend:

- 1. Tunnel cave
- 2. Soling cave
- 3. Pura cave
- 4. Karst cave
- 5. Pura karst cave
- 6. Soling cave



Design Guidelines Do & Don't

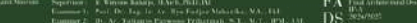
NO.	DO	SOURCE
1	Protect the karst cave and caves (karst, karst, karst)	According to the Ministry of Energy and Mineral Resources Regulation No. 17 of 2012, karst cave zones should not be built upon as they serve as natural water reservoirs and specific habitats.
2	Enhance visitor experience through interactive storytelling	Supported by the Museum Rehabilitation Guidelines Ministry of Education and Culture, educational and interactive spatial experiences increase visitor numbers.
3	Provide accessible entrance and facilities for people with disabilities	According to SNI 03-1735-2010, museums must be friendly to all groups. Accessibility is an element of inclusion and equality.

NO.	DON'T	SOURCE
1	Overlooking the karst cave formation for building expansion	According to the Ministry of Energy and Mineral Resources Regulation No. 17 of 2012, karst cave zones should not be built upon as they serve as natural water reservoirs and specific habitats.
2	Eliminating educational functions to become fully commercial (for example, malls)	Museums must continue to educate, despite the shift to commercial functions, to maintain the purpose of education based on Presidential Instruction No. 16 of 2005.
3	Ignoring safety and conservation standards	Contrary to the SNI 03-1735-2010 standards, the protection of the museum must have active and passive safety systems.



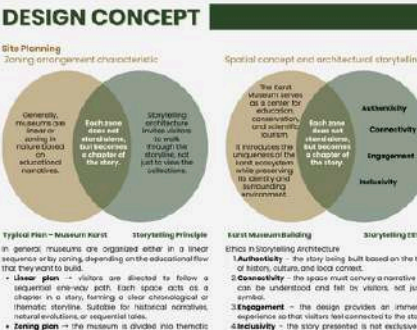
Legend:

- 1. Tunnel cave
- 2. Soling cave
- 3. Pura cave
- 4. Karst cave
- 5. Pura karst cave
- 6. Soling cave



Legend:

- 1. Tunnel cave
- 2. Soling cave
- 3. Pura cave
- 4. Karst cave
- 5. Pura karst cave
- 6. Soling cave

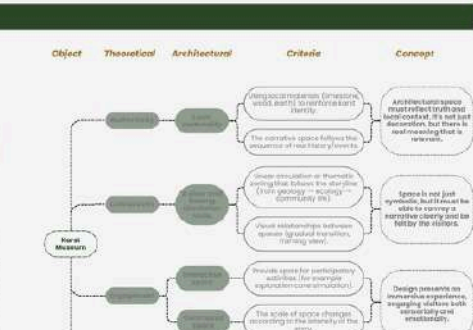


DESIGN CONCEPT

Site Planning

Spatial concept and architectural storytelling

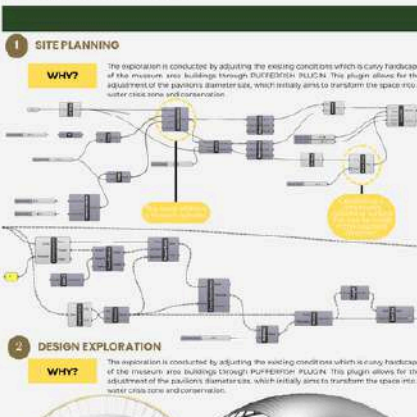
Object Theoretical Architectural Criteria Concept



Site Planning

Spatial concept and architectural storytelling

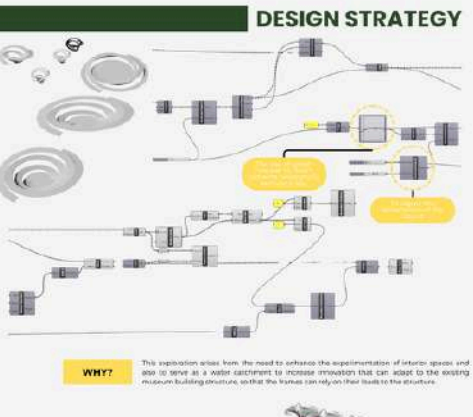
Object Theoretical Architectural Criteria Concept



1 SITE PLANNING

WHY?

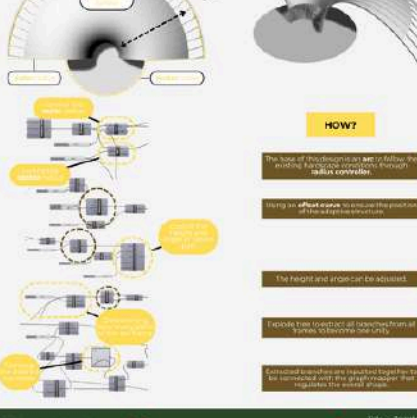
The exploration is conducted by adjusting the existing conditions which is early landscape of the museum area buildings through PUEKING PLUG. This plug allows for the adjustment of the building's diameter size, which initially aims to transform the space into a water cave zone and conservation.



2 DESIGN EXPLORATION

WHY?

This exploration arises from the need to enhance the experiential of interior spaces and also to serve as a water cave zone to increase innovation that can adapt to the existing museum building structure, so that the karst cave can rely on its built-in structure.



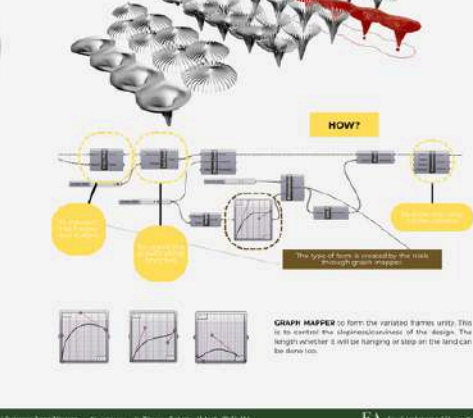
HOW?

The type of structure is an early landscape of the museum area buildings through PUEKING PLUG. This plug allows for the adjustment of the building's diameter size, which initially aims to transform the space into a water cave zone and conservation.

The height and angle can be adjusted.

Exclude the structure all connections of the structure.

Exclude the structure all connections of the structure.



HOW?

The type of structure is an early landscape of the museum area buildings through PUEKING PLUG. This plug allows for the adjustment of the building's diameter size, which initially aims to transform the space into a water cave zone and conservation.

The height and angle can be adjusted.

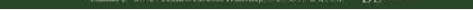
Exclude the structure all connections of the structure.

Exclude the structure all connections of the structure.



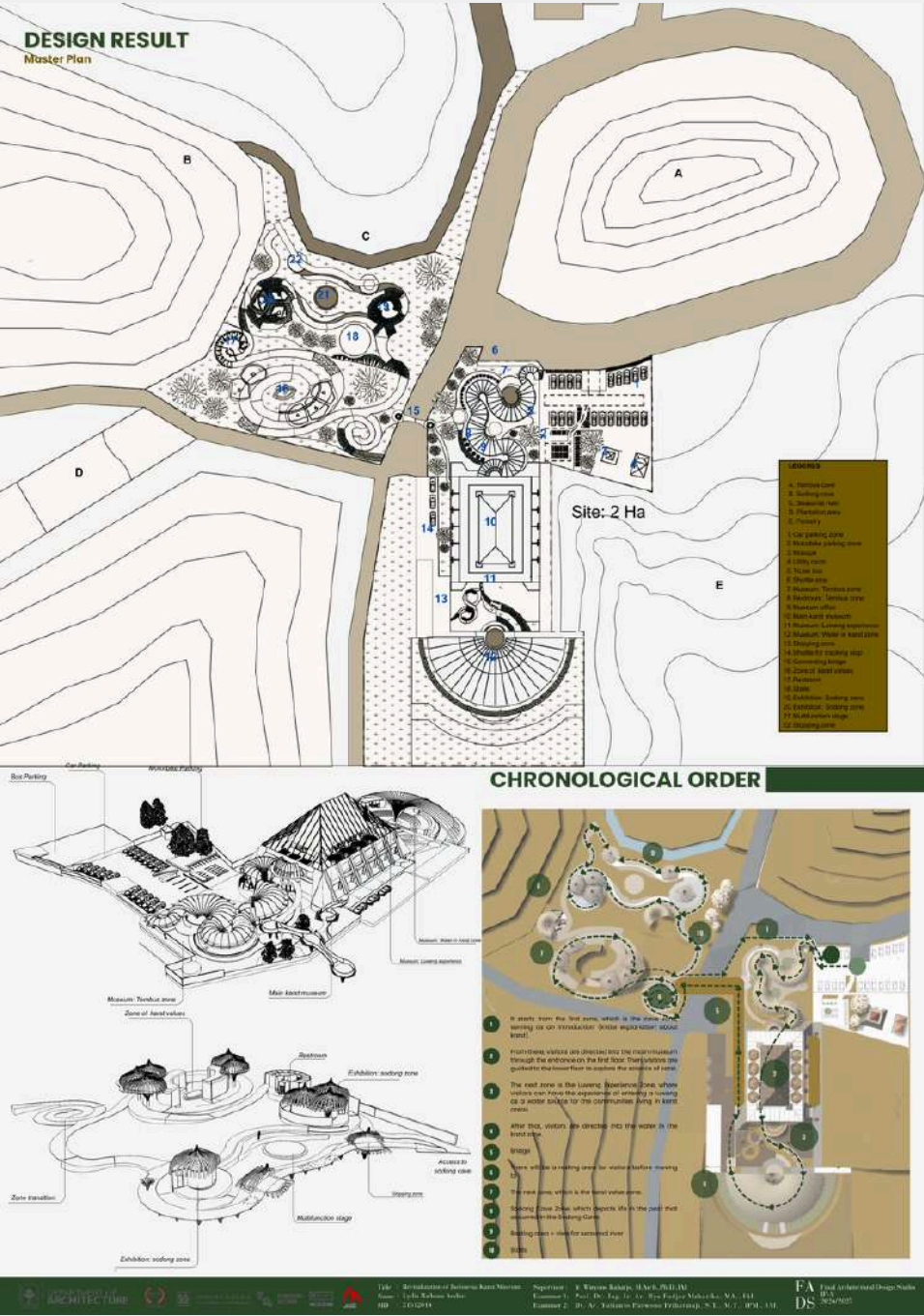
Legend:

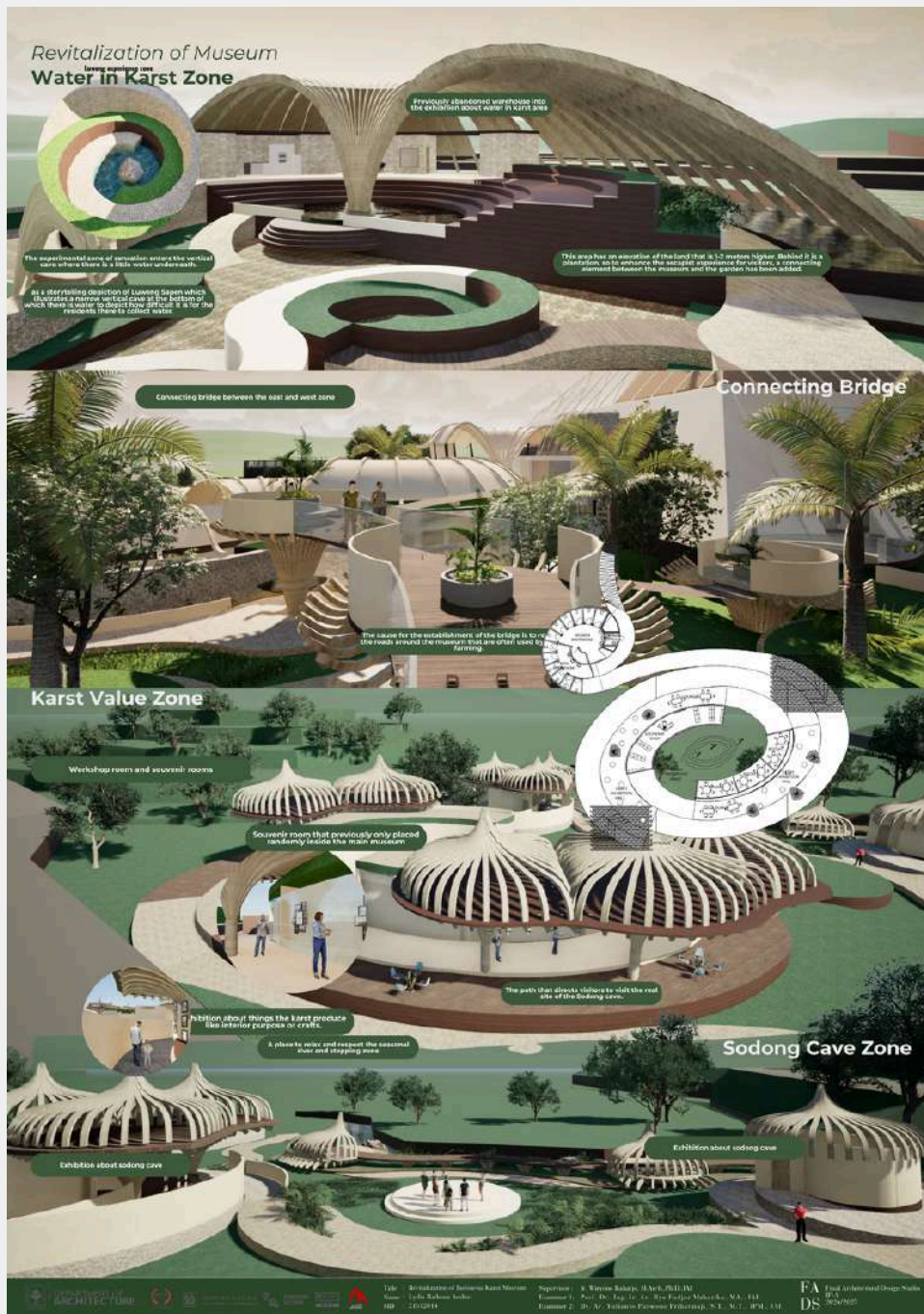
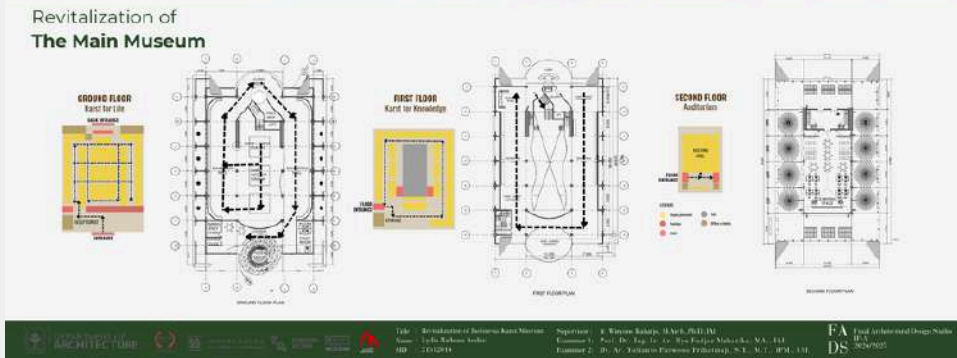
- 1. Tunnel cave
- 2. Soling cave
- 3. Pura cave
- 4. Karst cave
- 5. Pura karst cave
- 6. Soling cave



Legend:

- 1. Tunnel cave
- 2. Soling cave
- 3. Pura cave
- 4. Karst cave
- 5. Pura karst cave
- 6. Soling cave







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Bismillaahirrahmaanirrahiim

Assalamualaikum Wr. Wb.

Dengan ini, menerangkan Bahwa:

Nama : Lydia Raihana Andini
Nomor Mahasiswa : 21512014
Pembimbing : Ir. Wiryono Raharjo, M.Arch., Ph.D., IAI
Fakultas / Prodi : Teknik Sipil dan Perencanaan/ Arsitektur
Judul Karya Ilmiah : Revitalization of The Indonesia Karst Museum

Karya ilmiah yang bersangkutan di atas telah melalui proses cek plagiasi menggunakan **Turnitin** dengan hasil kemiripan (*similarity*) sebesar **5 (Lima) %**.

Demikian Surat Keterangan ini dibuat untuk dapat dipergunakan sebagaimana mestinya.

Wassalamualaikum Wr. Wb.

Yogyakarta, 8/12/2025

Direktur



Muhammad Jamil, SIP.

BIBLIOGRAPHY

Kunardi, D. (2018). Dampak perkembangan kawasan wisata Museum Karst Indonesia terhadap kondisi lingkungan di Dusun Mudal, Desa Gebangharjo, Kecamatan Pracimantoro, Kabupaten Wonogiri [Master's thesis, Universitas Gadjah Mada]. UGM Repository. It also tells the myth of the spirit guardian, so the design depicts it sinking further in. And the water that is only a little to illustrate how highly water is respected because it is considered sacred.

Amelia, D.F. 2016. Upaya Pemerintah Indonesia menjadikan Kawasan gunung Sewu sebagai UNESCO Global Geopark Network (GGN) Tahun 2013-2015. JOM FISIP Vol. 3 No. 2: 1-14.

Ford, D. and Williams, P. 1992. Karst Geomorphology and Hydrology. Chapman and Hall : London.

Rohani, E.D. 2013. Optimalisasi Potensi Museum Karst dalam rangka meningkatkan Pengembangan Wisata Pendidikan di Kawasan Karst Pracimantoro. Universitas Gadjah Mada: <http://etd.repository.ugm.ac.id>.

Soehardinata, P. N., & Winata, S. (2022). Penerapan pengalaman ruang (user experience) sebagai media baru dalam perancangan living museum di Pasar Ikan, Jakarta Utara. Jurnal Arsitektur, (Tanggal masuk: 14-07-2022, revisi: 14-08-2022, diterima: 03-09-2022). Universitas Tarumanagara.

Buildings Department. (2019). Practice guidebook on compliance with building safety and health requirements under the Buildings Ordinance for adaptive re-use of and alteration and addition works to heritage buildings (2019 ed.). Hong Kong: Buildings Department.

Kementerian Energi dan Sumber Daya Mineral Republik Indonesia. (2012). Peraturan Menteri Energi dan Sumber Daya Mineral Republik Indonesia Nomor 17 Tahun 2012 tentang Penetapan Kawasan Bentang Alam Karst. Jakarta: Kementerian ESDM.

Pemerintah Kabupaten Wonogiri. (2020). Peraturan Daerah Kabupaten Wonogiri Nomor 2 Tahun 2020 tentang Rencana Tata Ruang Wilayah Kabupaten Wonogiri Tahun 2020-2040. Wonogiri: Pemerintah Kabupaten Wonogiri.



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