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Museum of the Isthmus of Corinth – History with a View

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[redacted]

Abstract

The Corinth Canal is a narrow artificial waterway in Greece that separates the Peloponnese Peninsula from the Greek mainland, connecting the Ionian Sea with the Aegean Sea. The approximately 6.3 kilometers long Canal celebrated for its engineering brilliance of the 19th century, reflects humanity's ongoing interaction with nature, a story that has been unfolding since ancient times. However, the current infrastructure of the Canal is underdeveloped, offering tourists and visitors few opportunities to experience it directly due to the lack of viewpoints, cafes, and tourist information points or exhibition spaces. As a result, the technical achievement and significance of the Corinth Canal remain hidden from many. This project proposes an architectural design that integrates the Canal's historical narrative and its surroundings into a cohesive framework. The aim is to create a space where visitors can consciously appreciate the Canal's beauty and learn about its history. The proposal emphasizes sustainability, seeking to balance environmental concerns with social and economic considerations. By leveraging innovative technologies and adaptive reuse principles, the goal is to minimize environmental impact while maximizing the Canal's socio-economic benefits. The design includes an expansive museum complex that meticulously documents the history of the Isthmus and serves as a place for knowledge dissemination. An auditorium space is incorporated into the plan to accommodate educational seminars, lectures, and cultural events. The building is planned to be constructed underground, harmoniously integrated into the rocks of the Isthmus, and complemented by a cantilevered observation terrace with a cafe. These spaces will offer visitors a unique place for gathering and inspiration, nestled within the picturesque landscape of the Isthmus.

Kurzfassung

Der Kanal von Korinth ist ein schmaler, künstlicher Wasserweg in Griechenland, der die Peloponnes-Halbinsel vom griechischen Festland trennt und das Ionische Meer mit der Ägäis verbindet. Der etwa 6.3 Kilometer lange Kanal, der für seine ingenieurtechnische Brillanz des 19. Jahrhunderts gefeiert wird, spiegelt die fortwährende Interaktion des Menschen mit der Natur wider. Die aktuelle Infrastruktur des Kanals ist jedoch unzureichend und bietet Touristen und Besucher:innen kaum Möglichkeiten, ihn direkt zu erleben, da es an Aussichtspunkten, Cafés sowie an Ausstellungsräumen fehlt. Infolgedessen bleibt die technische und historische Bedeutung des Kanals von Korinth vielen verborgen. Ziel der vorliegenden Diplomarbeit ist es, einen Raum zu schaffen, in dem Besucher:innen bewusst die Schönheit des Kanals erleben und mehr über seine Geschichte erfahren können. Der Entwurf legt Wert auf Nachhaltigkeit mit dem Streben, ökologische Belange mit sozialen und wirtschaftlichen Überlegungen in Einklang zu bringen. Durch den Einsatz innovativer Technologien und der bewussten Nutzung von vorhandenen Ressourcen, sollen übermäßige Eingriffe in die Umwelt minimiert und gleichzeitig die sozioökonomischen Vorteile des Kanals maximiert werden. Das Design umfasst einen weitläufigen Museumskomplex, der die Geschichte des Isthmus detailliert dokumentiert und als Ort der Wissensvermittlung dient. Ein Auditorium ist im Enwurf integriert, um Raum für Bildungsseminare, Vorträge und kulturelle Veranstaltungen bieten zu können. Das Gebäude soll unterirdisch angelegt werden und sich harmonisch in die Felsen des Isthmus einfügen und durch eine auskragende Aussichtsterrasse mit einem Café ergänzt werden. Die Räumlichkeiten sollen den Besucher:innen einen einzigartigen Ort, eingebettet in die malerische Landschaft des Isthmus, als Quelle für Inspiration und zum bewussten Verweilen bieten.

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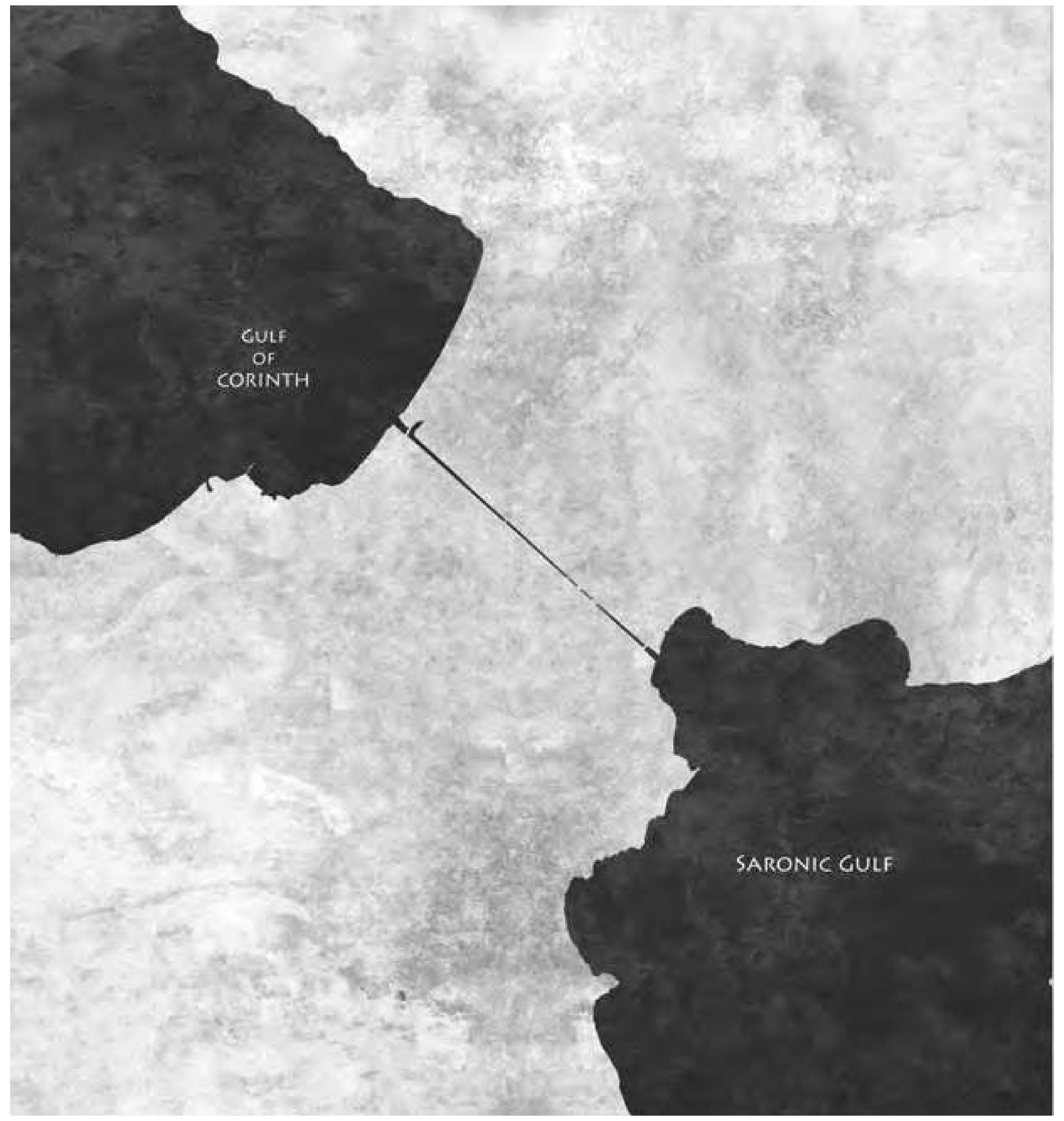
Introduction

The Isthmus of Corinth, positioned at a place of great geopolitical significance, served as the launching pad for one of humanity's greatest achievements: the Corinth Canal. This canal connects the Gulf of Corinth with the Saronic Gulf and now separates mainland Greece from the Peloponnese. The total length of the canal reaches 6,343 meters, of which 540 meters belong to the two ports at the entrance and exit of the canal. The bridge that connects the two land masses is situated 79 meters above sea level, while the width of the canal is 24.6 meters at the surface of the water and 21.3 meters at the bottom, which reaches a depth of 8.3 meters (Zakinthinou, 2017).

Homer's epithet "'Αφνειος Κόρινθος" was used to describe the fertile land of Corinth, which, since antiquity, has been a point of interest. The narrow strip of land, where the canal now flows and once connected the two lands, forced ships to circumnavigate the Peloponnese, risking the turbulent waters of Cape Maleas, thus bringing the Isthmus opening into debate, in order to facilitate a different route for vessels through a canal. The opening of the Corinth Canal marked significant changes in the maritime landscape of the 19th century. However, today, the canal plays a rather limited role compared to the past, as its width does not allow the passage of larger modern ships. Therefore, its use is primarily restricted to leisure boats, which benefit from avoiding the circumnavigation of the Peloponnese. This fact signals investment opportunities for this particular segment of navigation, making the Corinth Canal especially significant, once again (Thomas, 2022). However, the role of the Corinth Canal in modern navigation is not limited merely to the economic benefit and safety of the vessels that traverse it. Additionally, it stands as a living testimony to human ingenuity and technological advancement, as well as a beacon of culture whose light transcends through the centuries. Thus, the promotion of the Corinth Canal represents a minimal obligation to history and makes the present work inevitable.

Figure 1: Edited satellite images showing the location of the Isthmus in Greece



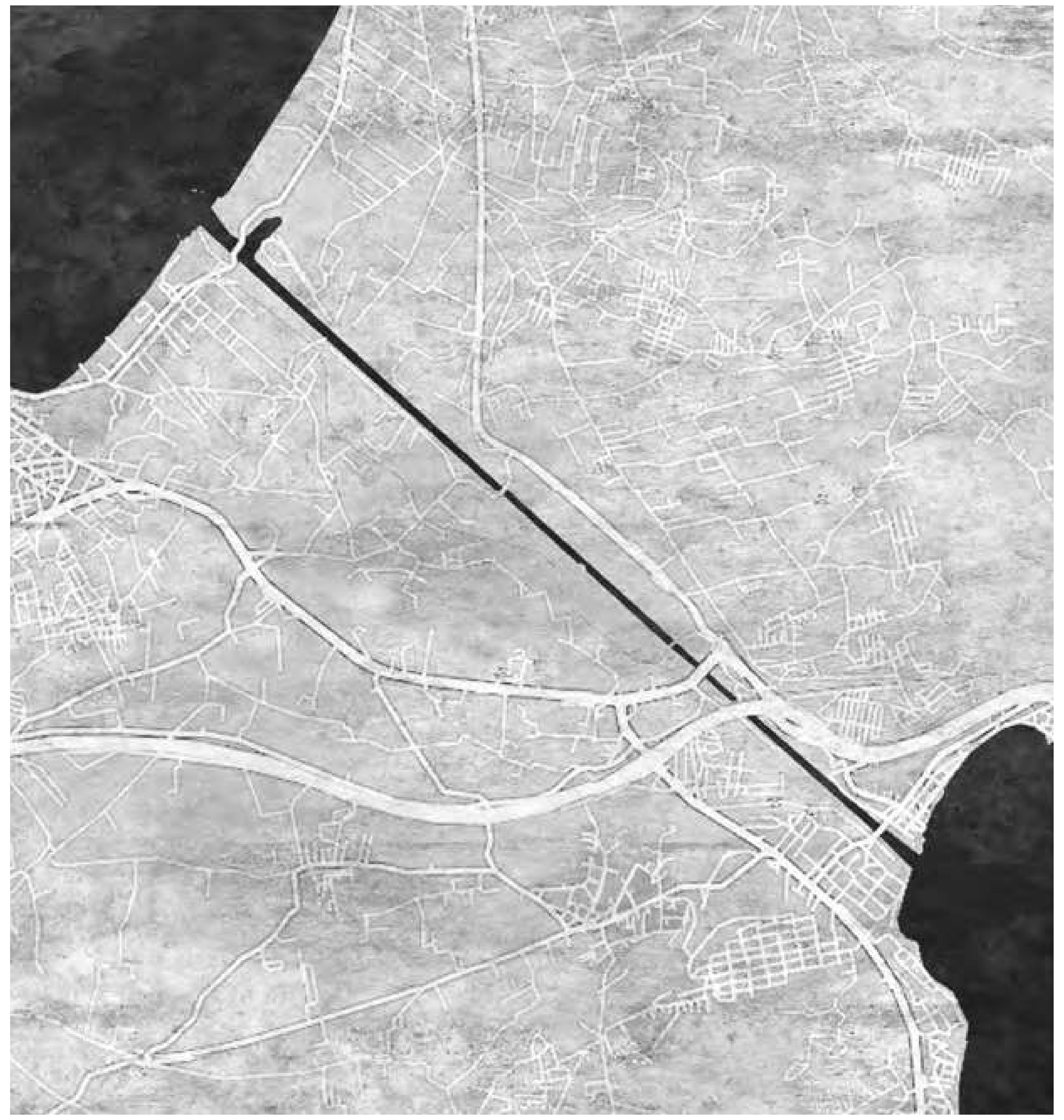


Figure 2: Boat driving through the Canal of Isthmus

The Isthmus of Corinth

The significance of the Isthmus's location appears to have been known in antiquity long before the Hellenistic period. According to one theory, Mycenaean findings attest to the presence of civilization in this area even before the 11th century BC. Additional evidence supporting this theory includes the vowel cluster -nth in the toponym "Corinth", indicating that the city's name dates back to pre-Hellenic times, long before the Achaean tribes migrated to Greece and brought the Greek language with them. On the other hand, the Dorian tribes, specifically the Megarians, who were settled in the area, also seem to have exerted their influence over the Isthmus, leading to military conflicts with the Corinthians (Hopper, 1955). Later, the Megara alliance with the city of Athens, initiates a rivalry between Corinthus and Athens, which soon resulted to the Peloponnesian war, in which none was found victorious. In their further armed conflict, Corinthus dominated with the neighborhood Megara land and established their presence on Isthmus. By the 7th century BC, the area was firmly under Corinthian control. The tyrant Periander had stationed fleets on both sides of the Isthmus to protect the city exploiting his strategic advantage. The "Examilion", the famous wall stretching six Roman miles (approximately 7 kilometers) along the Isthmus, was built for the same reasons of security and defence to potential invations, while the Acrocorinth, the rock towering 1.5 miles from Corinth, offered a panoramic view of both seas at the Isthmus's edges, providing the Corinthians the advantage of prevention of forecoming attacks by sea. All these factors suggest that the Isthmus was initially not a commercial passage open to all, but rather a strategic asset for Periander's protection of the city, shared only with his allies (Pettegrew, 2011).

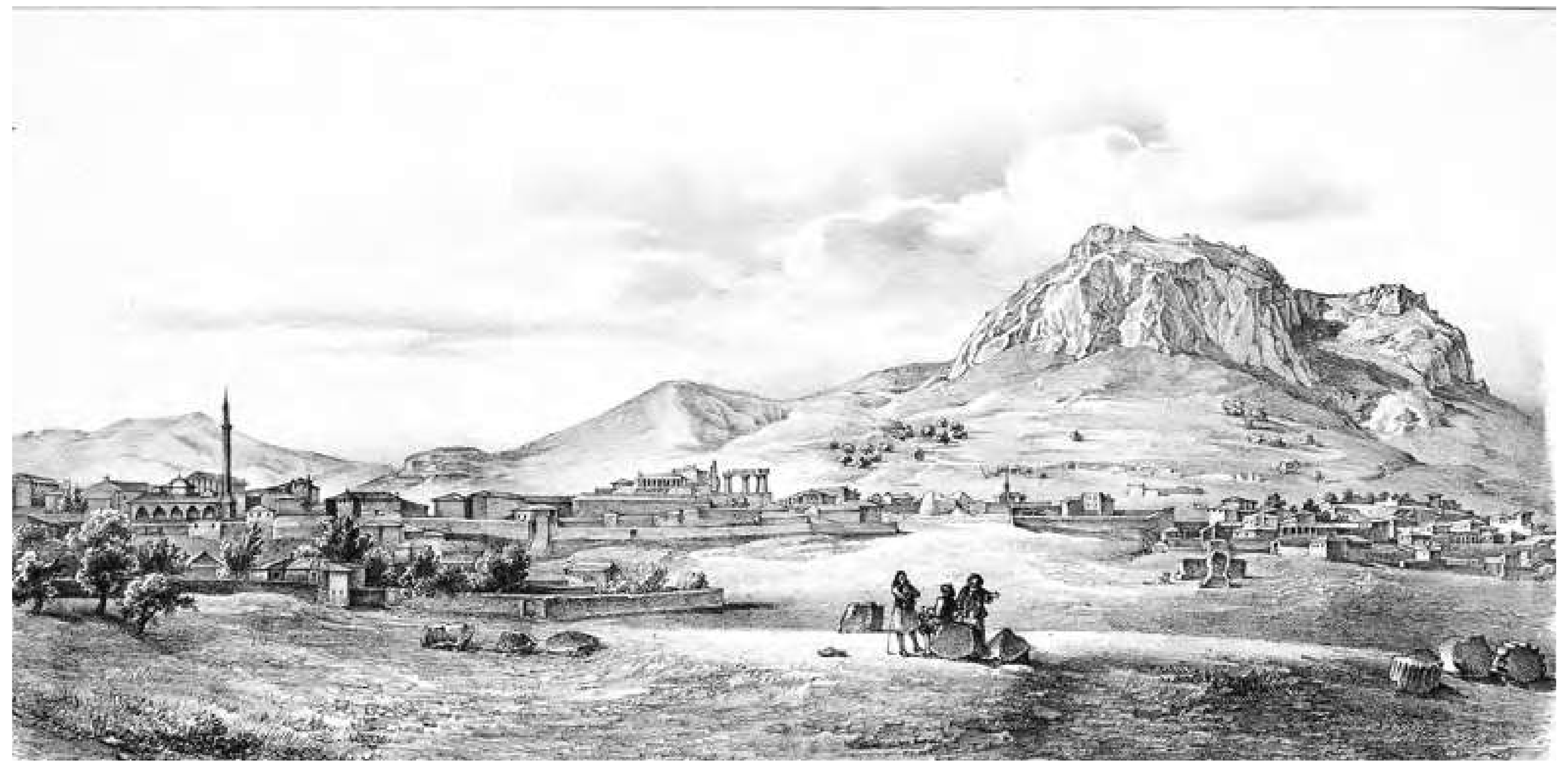


Figure 3: View of Ancient Corinth with Acrocorinth in the background

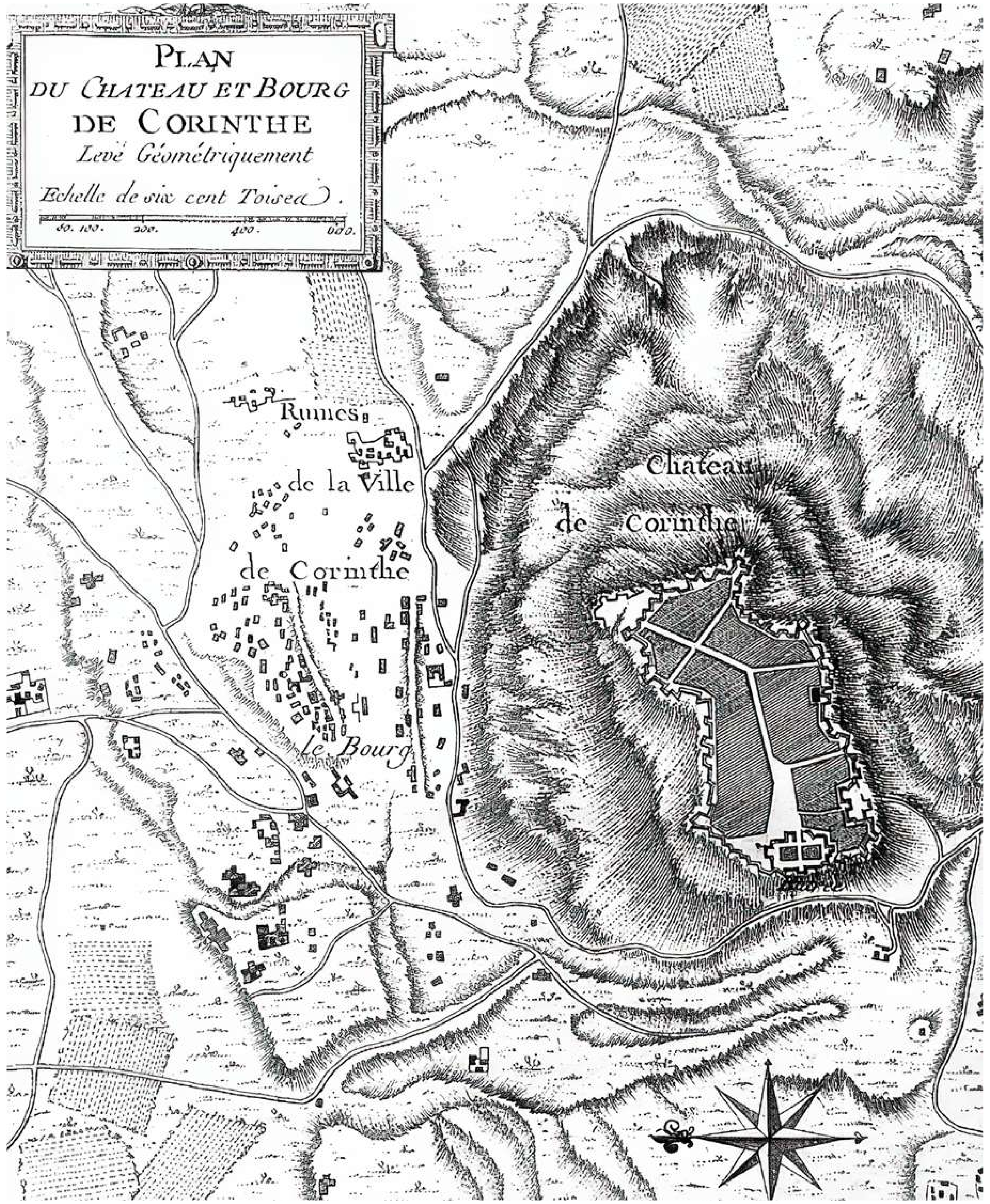


Figure 4: Map of ancient Corinth with Acrocorinth (1771)

Under Periander's leadership, Corinth became one of the wealthiest and most powerful city-states in Greece, thanks to his excellent governance and ambitious public works programs. He is often considered one of the Seven Sages of Greece, men of the 6th century BC who were renowned for centuries for their wisdom. The Isthmus of Corinth served also as a crucial hub for transportation and communication between the two major gulfs of Greece. The main feature in the area was the "diolkos", a road used for transporting ships from one gulf to the other. Despite the practical significance of the "diolkos", which was facilitated the transportation of ships from antiquity to the Roman period, the Canal and the attempts for its construction garnered greater literary attention as it became associated with prominent figures such as kings and emperors who expressed interest in its construction (Pettegrew D. , 2006).

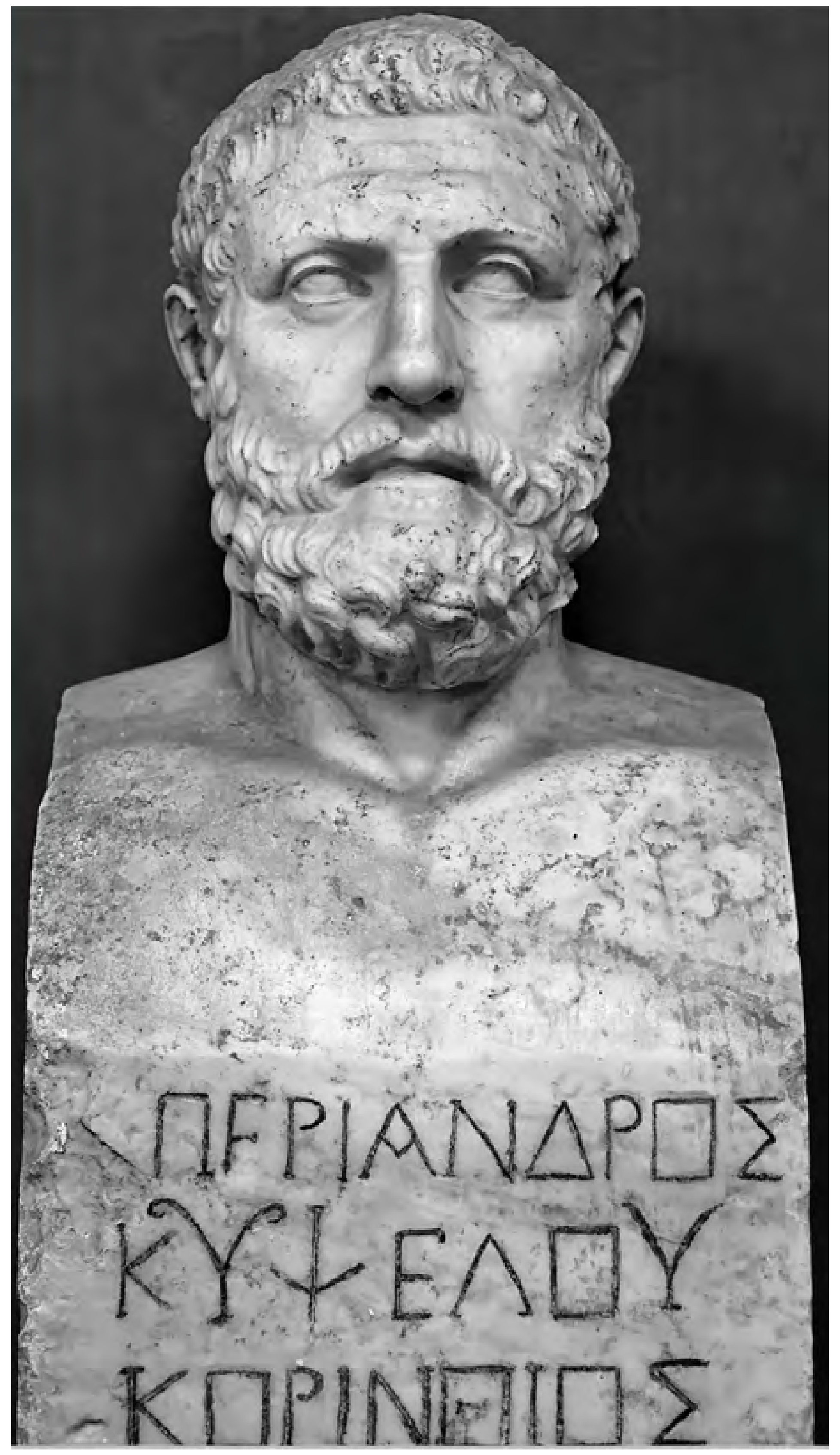


Figure 5: Periander, Roman copy after a Greek original of the 4th century BC, Vatican Museum

The Diolkos Passage

According to historical sources, the Diolkos, a paved trackway which allowed ships and their cargoes to be moved overland across the Isthmus, is characterized as the first overland “road” for the passage of ships and likely the earliest form of a railway in antiquity. Its construction is dated possibly to the period of the Corinthian tyrant Periander in the 6th century BCE. From a technical construction standpoint, the Diolkos took the form of a road paved with cobblestones cut from limestone. Its width ranged from 3.5 to 5 meters. In the middle, there were two parallel grooves, which were certainly not due to wear from the friction caused by the transportation of ships but were part of the construction. Their purpose was to protect against deviations at points of particular danger, such as turns.

It appears that ships were dragged on platforms by slaves, as no traces of animals or other machinery were found. For this passage, travelers paid exorbitant tolls, which were the main source of income for Corinth (Zakinthinou, 2017). Despite the numerous references to the Diolkos in ancient literature, there is a lack of detailed information regarding the transshipment of cargo. However, it is assumed that the cargo was unloaded and carried overland by animals, thus lightening the vessels using the Diolkos passage (Werner, 1997). This system of using the Diolkos to facilitate the passage of ships and cargo significantly enhanced Corinthian wealth and prosperity. The city benefited not only from the tolls collected but also from its advantageous position between the two gulfs, which established it as a significant trade center. Commodities from different sides of the sea converged at the Isthmus, creating a simplified logistic system. Though primitive, this system rendered Corinth a wealthy and prosperous city in the ancient world (Hopper, 1955).

Could these advancements in Corinth have inspired Periander to consider opening the passage and connecting the two seas? This is only an assumption. However, his vision was rejected by the Delphic Oracle on the grounds that “Poseidon has placed islands as he wished, wisely”, meaning that any attempt to open the Isthmus passage would suggest hubris. The hard rocks which prevented the opening, as well as other construction puzzles, were seen, or supported by the priest of the time to be, as evidence of Poseidon’s wrath for disputing his will, forcing Periander to abandon his plans in both a religious and political edge (CorinthCanal-SA).

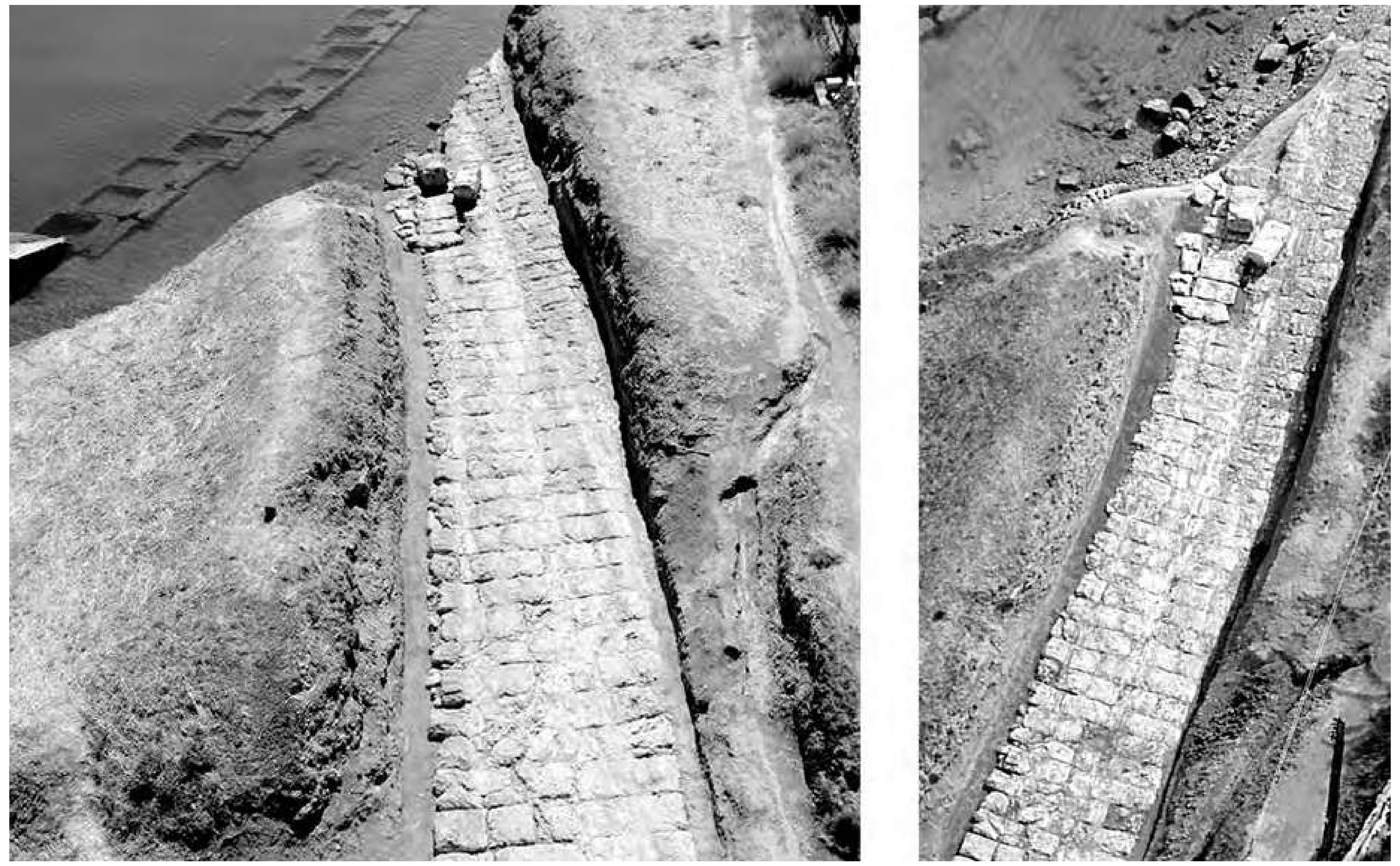


Figure 6: Remainings of the ancient diolkos in Poseidonia

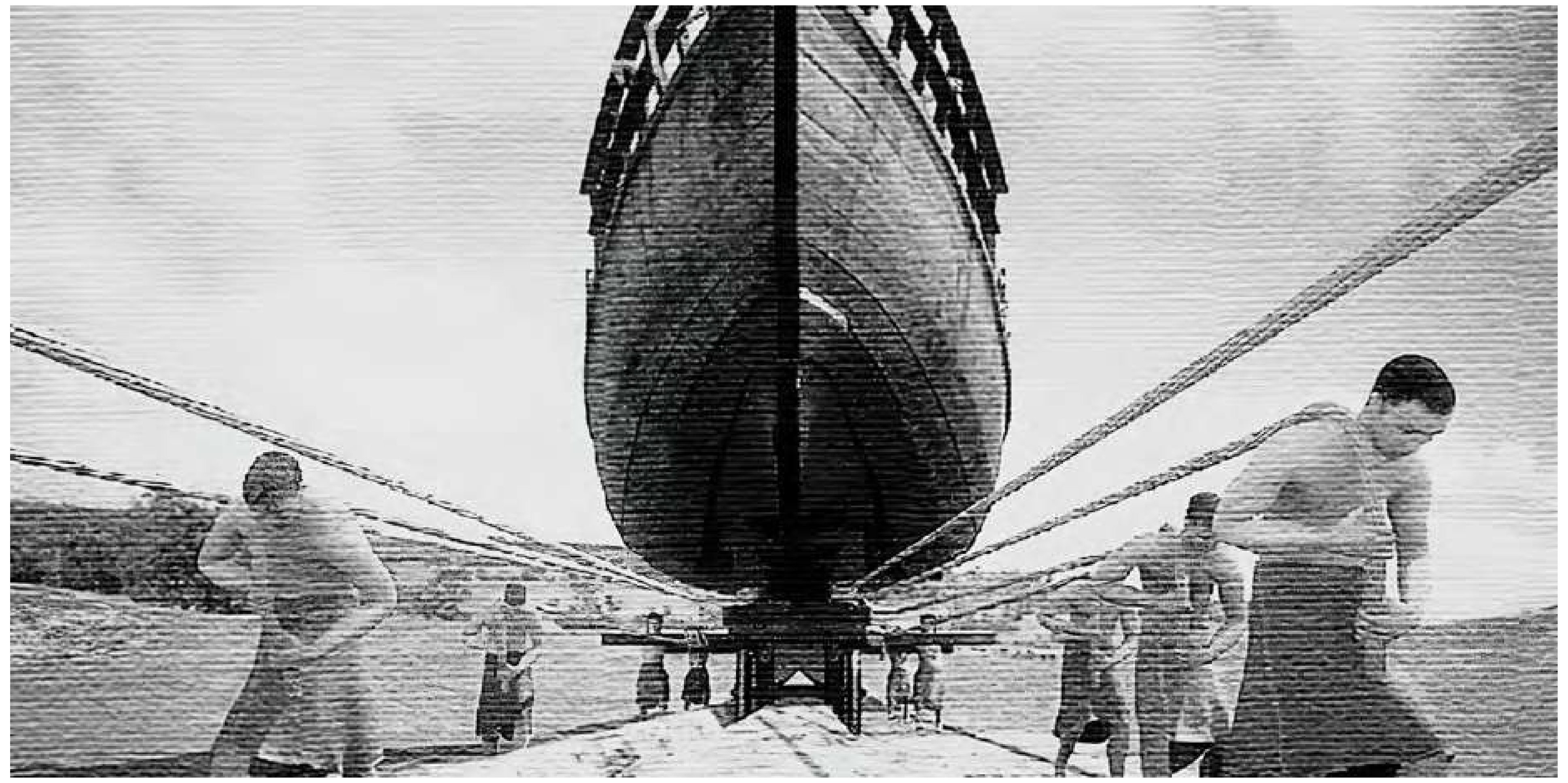


Figure 7: Depiction of ships being dragged on platforms by slaves on the diolkos road

4th century BC

The second attempt to open the canal and connect the two seas is attributed to Demetrius Poliorcetes in the 4th century B.C. Demetrius invited Egyptian architects to advise him accordingly; however, a misjudgment on their part prevented his plans. The Egyptians speculated that opening the canal would allow a massive flow of water from the Corinthian Gulf, which would drown Aegina, an island on the other side of the Isthmus in the Saronic Gulf (Werner, 1997). Over the centuries, the course of history reserved a different future for Corinth, which was determined by the expansion of the emerging Roman Empire. The dominance of Rome over Greek territories took place in the 2nd century B.C. and manifested itself with a mass slaughter of the

Figure 8: Demetrius Poliorcetes

In 44 B.C., Julius Caesar resettled Corinth with Roman veterans who were Hellenized and named Laus Iulia Corinthus. Under Roman rule, the city flourished again, gaining wealth and commercial power (Vasilas & Konstantogiannis , 2017). The significance of the Isthmus did not go unnoticed by a series of Roman emperors who devised plans for its canalization. Julius Caesar, Caligula, Gaius, and Hadrian each in turn drew up plans for the execution of the project (Papagianni, 2021). However, once again, the land of Poseidon thwarted their plans with a series of difficulties in executing the project, forcing them to abandon it, confirming the mysterious nature of the Isthmus to resist canalization (Pettegrew, 2006).

The geopolitical significance of the Isthmus of Corinth in antiquity was not limited to its military and commercial capabilities. The Isthmus was a crucial link between mainland Greece and the Peloponnese, allowing for the faster movement of troops and goods. This strategic position was further enhanced during the period of Roman rule when the Romans used Corinth as a central hub for managing their province in Greece.

67 AD

With Nero's ascension to the imperial throne in 67 AD, the most serious attempt to cut through the Isthmus began. During his visit to Greece, he participated in the major Isthmian Games, a renowned series of athletic competitions dedicated to god Posidon, where he conceived the idea of cutting through the Isthmus. He proclaimed the start of the works in a grand ceremony, chanting hymns to Amphitrite, the queen of the seas, Poseidon, and the local heroes Melicertes and Leucothea, honored particularly at the Isthmian Games. The emperor gave the signal for the commencement of the works by striking the ground with a golden pickaxe, while thousands of workers of various nationalities (Greeks, Romans, Jews) were lined up along the proposed canal route.

Figure 9: Head of Nero, Glyptothek, Munich

These workers, numbering over 6,000, were sent by Vespasian after the suppression of the revolt in Judea. Many of them were sold as slaves after the cessation of the works, while others may have been freed and settled in Corinth or became tenants of the land. Some worked in the mines of the area before their liberation.

The works began with great intensity under the supervision of Nero and his engineers. Two work fronts were created, one in the Corinthian Gulf and another in the Saronic Gulf. In total, over 2,000 meters of length, up to 60 meters wide, and with variable depths up to 20 meters were opened. Venetian plans from around 1687 suggest the existence of another trench, perpendicular to the main one at the Isthmus, and longer in length. During the final excavation of the canal in 1882, 26 wells of various sizes with a depth of about 20 meters were found, along with many trenches and backfills on both sides of the cut, placed during Nero's time. The reference to Nero's cut and wells is found in Curtius' book "Peloponnesus" (1852), but there is no mention of Diolkos (Papafotiou, 2010).

The works continued uninterrupted for two months under Nero’s supervision until he was urgently called back to Rome due to a revolt in the provinces of the empire leaded by Galbas. The project continued for some time under Vespasian’s supervision but was permanently halted after Nero’s assassination (Gallivan, 1973). The failed attempts at canalization highlight the resilience of the natural landscape and its connection to mythology, making the Isthmus a symbol of endurance and human ambition. Most individuals involved in the canal opening projects were depicted as ambitious and even excessive, expressing a desire to alter the natural world to facilitate maritime transportation. The literature of the time reflects the relationship between human endeavors and the natural environment, rendering the Isthmus a place with deep spiritual and historical roots and furthermore, the landscape’s sacred will to resist in becoming an island (Pettegrew, 2006).

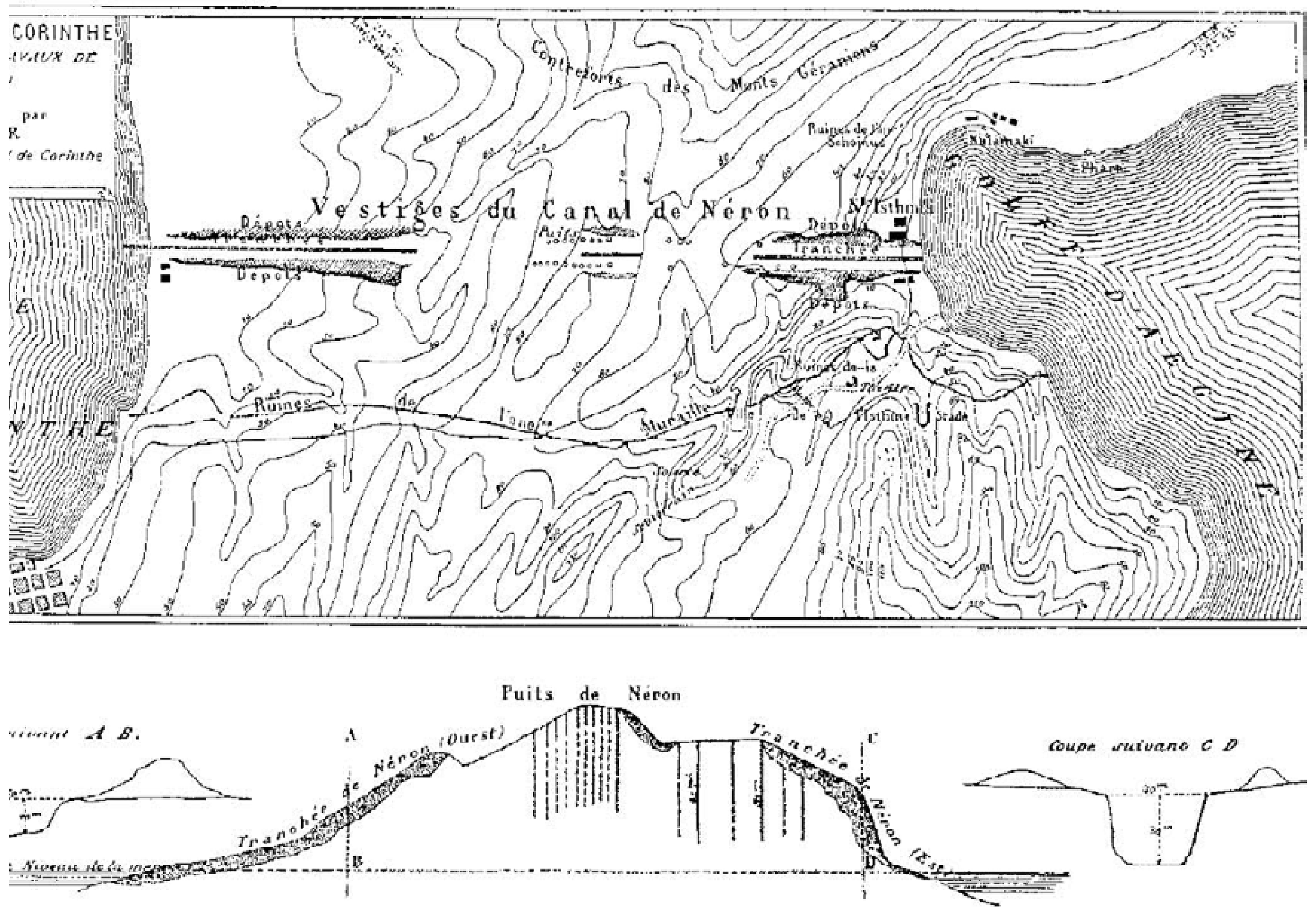


Figure 10: Remains of Nero’s Isthmus Canal in 1881

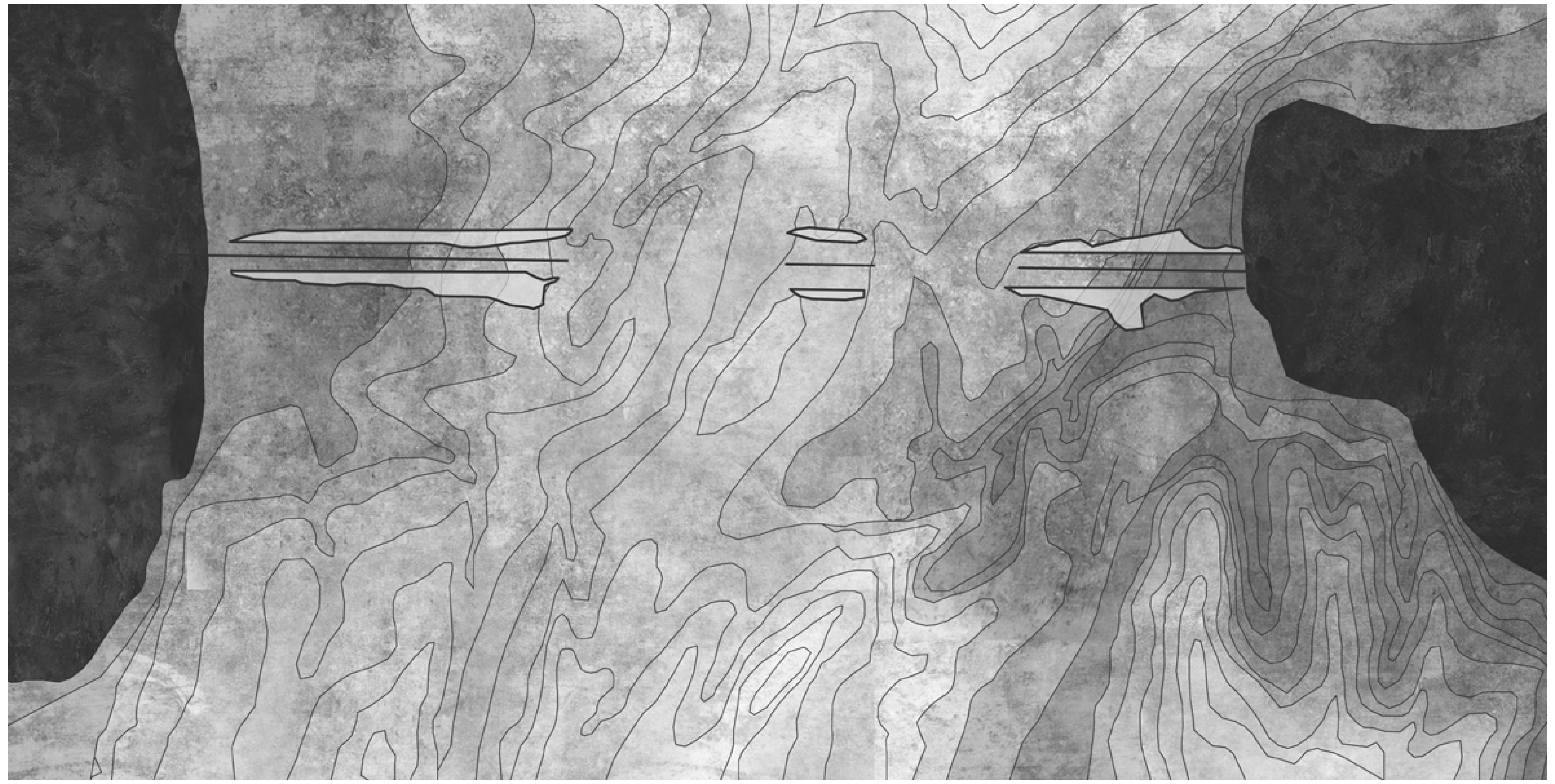


Figure 11: Redrawing of the map of the remains of Nero’s Isthmus Canal in 1881

The Drilling of Corinthus Canal in 19th Century

It was only in the 19th century that political developments in the newly established state under Ioannis Kapodistrias brought the opening of the canal back into discussions for the recovery of Greece as a free state. However, the 40,000,000 gold francs requested by the French engineer Virlet d'Aoust in 1830 was a prohibitive amount for Greece's economy at that time. The opening of the Suez Canal in 1869 revived the vision for the project in Corinth. Thus, the government of Zaimis, in the same year, created the institutional framework for a private company to undertake the construction of the canal. In 1870, the Greek government signed a contract with French entrepreneurs to complete the project, which, however, was not executed due to financial problems. Another attempt to start the construction of the Corinth Canal was made in 1882 with the consent of King George I and the arrangements of Prime Minister Charilaos Trikoupis. The Greek leadership entrusted the construction of the project to the Hungarian István Türr and the Hungarian engineer Béla Gerster, who had overseen the construction of the Franz Canal in Hungary. The project was halted once again due to Türr's bankruptcy, but the initial groundwork had already been laid, following the efforts of Nero almost 1800 years earlier. Finally, the Corinth Canal was completed in 1893 after 11 years, by the Greek Construction Company with the assistance of Andreas Syngros (Papagianni, 2021).

Figure 12: Charilaos Trikoupis

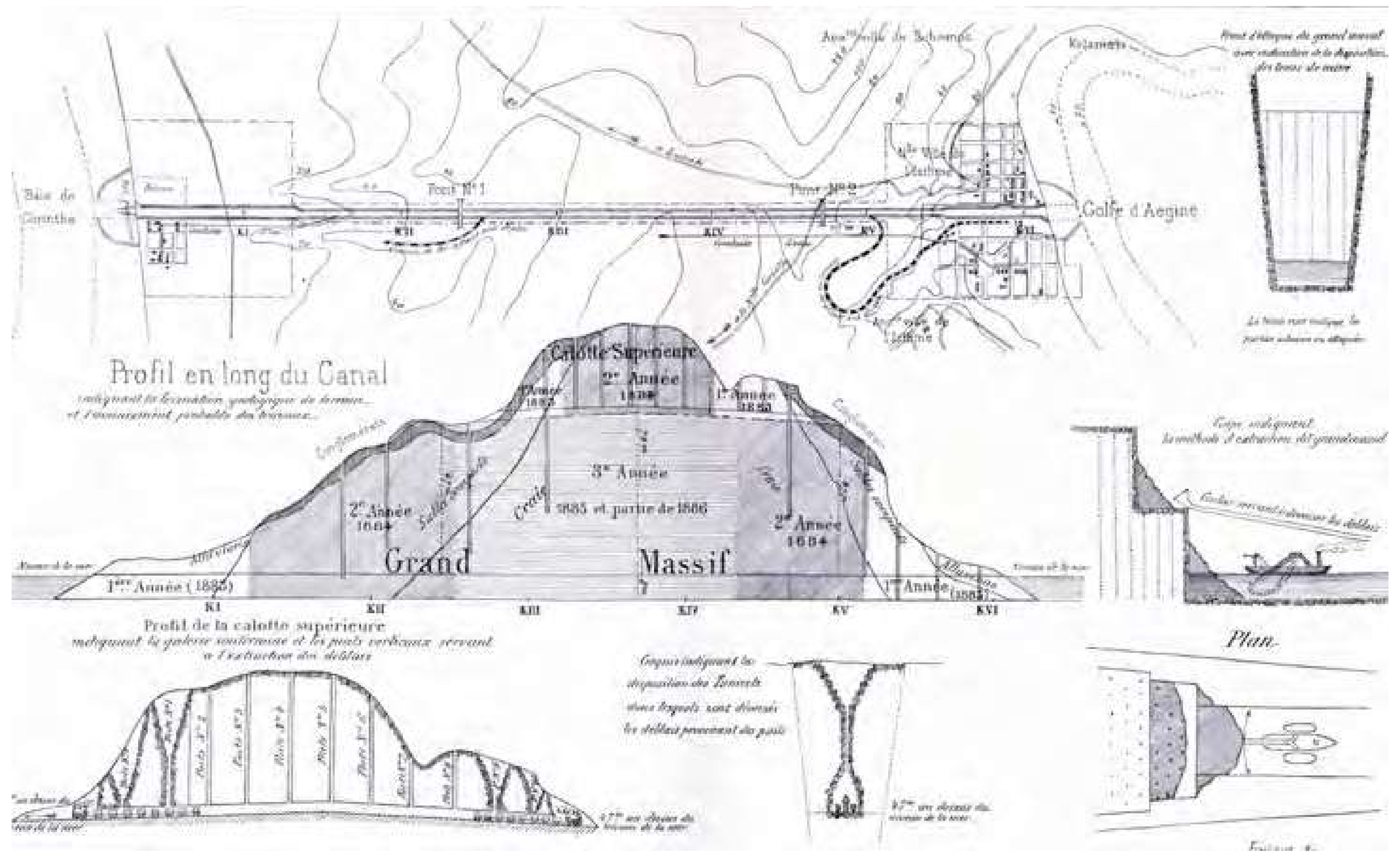


Figure 13: Isthmus Canal project plans of 1883

The Construction Process

The official inauguration took place on April 12, 1882, with a completion time of four years. The excavation employed the "Krauszer method", named after the Hungarian engineer who devised it. Digging commenced simultaneously from both ends of the Isthmus towards the center, with two main construction sites set up in a staggered manner across floors. Dredgers removed soil volumes simultaneously from the top and the bottom. Additionally, the "English method" or "piling method" was locally applied. The piling method, also known as pile-driving, is a construction technique used to create foundational support for structures like buildings, bridges, and retaining walls. It involves driving long, slender structural elements called piles deep into the ground to transfer the structural load to deeper, more stable soil or rock layers.Piles can be made of materials like concrete, steel, or wood, depending on the project's requirements and soil conditions. The process usually entails driving the piles into the ground using specialized equipment such as pile drivers, hydraulic hammers, or vibratory pile drivers. This method is commonly employed in areas with soft or unstable soil conditions where traditional shallow foundations may not offer adequate support. It helps distribute the structure's load over a larger area and provides resistance against lateral forces like wind or seismic activity. In essence, the piling method is crucial for ensuring the stability and durability of structures in challenging ground conditions. Eventually, both methods were abandoned in favor of the classic method of continuous construction sites, arranged in levels and soil categories. Excavated soil was transported using wagons pulled by steam engines (Papafotiou, 2010).

Figure 14: Transporting mud out of the canal

Figure 15: Digging out to about half of the total height (at about 1885)

The inauguration of the works for the Corinth Canal was initially scheduled to take place after four years. However, due to insufficient knowledge about the soil composition, unexpected geological discoveries were made during the excavations, forcing engineers to seek alternative solutions as the planned methods and equipment proved inadequate. Despite the delays, the excavation pace was so rapid that the project could have been inaugurated by 1891. However, reports from technical leaders raised the issue of additional excavation to strengthen the canal walls, causing further delays. The excavation work employed 1800 workers in 4 sectors, including Greeks, Italians, Montenegrins, etc. The number of workers fluctuated due to epidemics and labor accidents. Many accidents occurred during the loading and unloading of wagons, as well as due to landslides and derailments. Many workers lost their lives or were seriously injured during the works. The equipment used included both floating and land-based machinery. By 1887, 37 kilometers of railway lines, 16 steam engines, and 665 wagons for transporting excavation material had been installed (Zakinthinou, 2017).

Figure 16: Digging the Corinth Canal

Figure 17: Digging the Corinth Canal

The Isthmus Infrastructures

The Isthmus of Corinth plays a pivot role in Greece's transportation system, connecting parts of the country and is connected to both sides by a total of six bridges: two road bridges, two railway bridges, and two submerged bridges, at both entrances of the canal, which suffer from lack of maintenance and insufficient studies to re-enforce them. One of the Corinth Canal's bridges, faces multiple challenges due to the geological substrate of the area. Besides the geological and geotechnical properties of the soil and substrate, the region is also susceptible to earthquakes, justifying increased scrutiny in designing and analyzing the bridge's stability. Taking into account the dual challenge of seismic activity and geological substrate, the need for soil stability analyses, was already emphasized in the previous century, revealing the necessity for reinforcement measures such as the installation of vertical arrays of concrete. Additionally, monitoring the movements of geological structures and analyzing seismic impact can reveal new significant indicators regarding risk assessment and the implementation of preventive measures. With continuous monitoring and careful management, the goal is to maintain the bridge under adverse conditions, enhancing its safety and protecting the structure from the impacts of the natural environment (Christulas, Kalteziotis, & Tiambaos, 1984).

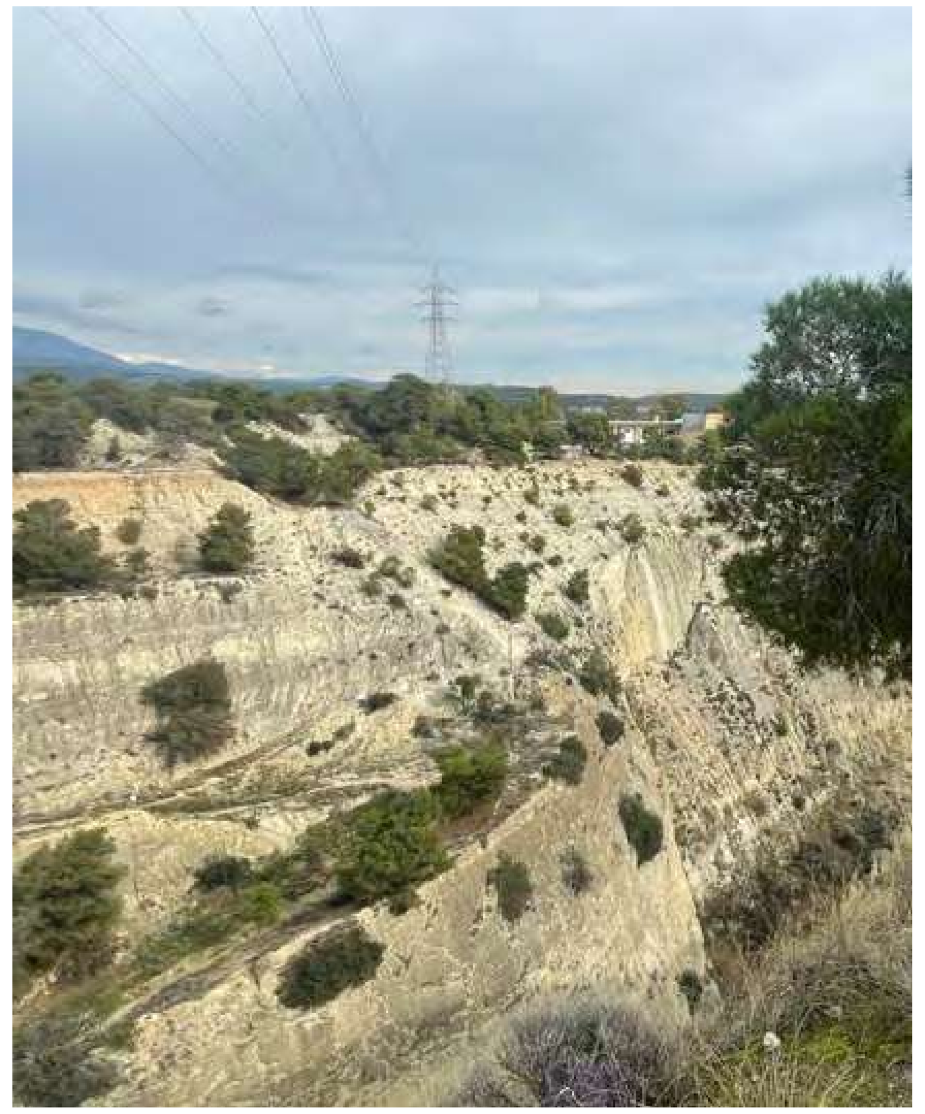
Geological Challenges and Restoration Efforts of the Corinth Canal

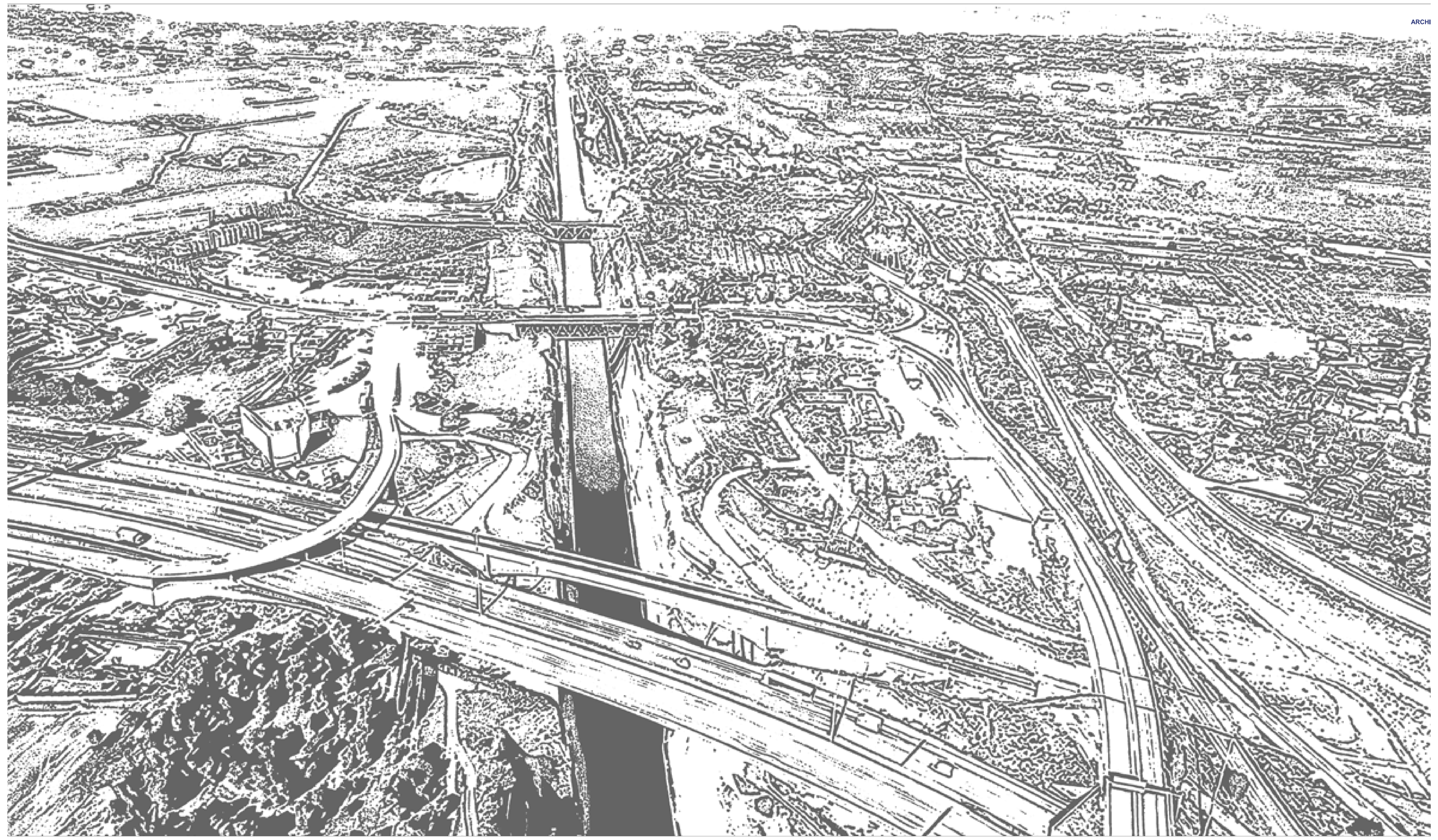
The Corinth area is part of the Sub geotectonic zone and contains rock formations from different geological epochs, including limestones from the Paleozoic and Mesozoic periods as well as Neogene marls and marly limestones. The Canal faces frequent landslides due to the geological composition of the soil in the area. Landslides emerged in 2018 and worsened in 2021, necessitating urgent interventions for passage safety. The restoration project, announced by the Greek Government along with a 9 000 000 euros support budget, includes geotechnical monitoring and addressing potential new issues, along with proposed measures for environmental protection and the development of multipurpose projects (Papagianni, 2021). By 2024, although safety issues are detected and addressed, the restoration project still follows a slowpace,holding incompatible with the increasing necessities for maintenance and restoration, and even bigger deviation from a successful developmental plan for the wider area.

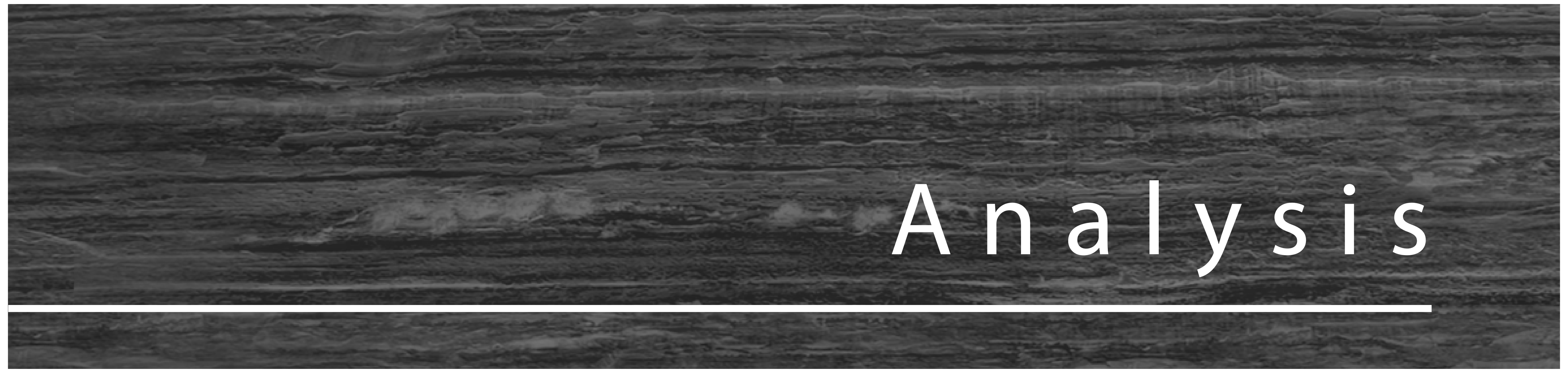
The Contemporary Isthmus Canal Operation

Today the Canal is managed by the Corinth Canal Company (A.E.DI.K.), which is responsible for its maintenance and holds the exploitation rights. The daily crossings through the Corinth Canal are supported by the seven pilot boats of A.E.DI.K. The company is continuously designing new services for cost and course calculation of the vessels, taking advantage of the opportunities provided by digital technologies (CorinthCanal-SA). Despite handling more than 12,000 ships annually, A.E.DI.K. still struggles to secure the necessary funds and overcome financial hardship. However, the historical value of the Corinth Canal represents a national cultural asset capable of generating returns on investment. Indeed, Isthmus has concentrated the interest of numerus studies which attempt to propose sufficient developmental plans and exploit opportunities, not only centered to the main concern of navigation, but tourism attraction as well. The current project attempts to suggest a project which will highlight the cultural heritance of the Isthmus and will open a view to the past, across the centuries in order to attract more visitors to witness the majesty of human spirit and creativity (A.E.DI.K).

Visiting the Isthmus of Corinth







Analysis

Sectional Analysis of the Corinth Canal

Infrastructure

Land Use

Sectional Analysis of the Corinth Canal (See pp. 36-37)

Multiple successive cuts were made along the length of the Isthmus, providing an opportunity for reflection on the concept of scale. The dramatic verticality of Isthmus juxtaposed with its narrowness creates an almost canyon-like experience, which is rare in man-made structures. The Canal, a large-scale engineering project, stretches 6,346 meters in length. For this particular project understanding the Canal's dimensions is important. Its very narrow width of 24 meters, compared to its considerable height of 80 meters at the top of the Canal, creates a dramatic landscape that challenges and invites engagement with its dimensions. An interesting aspect of this location is how its proportions are constantly changing as the cross-section of the canal varies along its length. On the map, one can observe the most characteristic cross-sections. The width remains relatively constant, in contrast to the height, which peaks around the middle of the Canal and diminishes to zero at its ends.

Infrastructure (See pp. 38-39)

The Canal, as a significant transportation hub, is characterized by the presence of major road arteries that dramatically impact its appearance. There is a clear effort to bridge the two sides with a robust road network featuring transverse connections. However, the secondary network, which links these arteries and, consequently, the two ends of the Canal, exhibits significant gaps. The two settlements of Poseidonia and Isthmia at either end of the Canal are not directly connected. Furthermore, the creation of the "Olympia Odos" motorway has altered the relationship of passing travelers with the Canal. This high-speed motorway does not offer opportunities for stopping or even visual contact with this remarkable engineering feat. In contrast, the bridge of the old national road serves as the primary stopping point for the Canal, with a narrow pedestrian strip beside the roadway.

Land Use (See pp. 40-41)

It is evident that residential areas are sparsely distributed, featuring a somewhat relaxed and unstructured layout. This suggests that the region is sparsely populated, with homes spread out rather than clustered. Recreational facilities tend to be concentrated along major thoroughfares; especially along the old national road. The absence of cohesive urban planning is apparent, resulting in a patchwork of development. This uncoordinated approach has led to a mix of building types and uses, with no clear zoning or organization. The lack of cultural amenities is particularly striking, given the Canal's historical and engineering significance. This deficiency undermines the Canal's potential as a landmark that could educate and engage the public about its historical and contemporary importance.

In addition to the disorganized residential and recreational uses, there are also facilities that seem out of place within the Canal's environment. For example, the presence of a sewage treatment plant on the Peloponnese side and an engineer corps camp on the mainland Greece side are incongruous with the Canal's character. These industrial and military uses detract from the aesthetic and historical value of the area. Overall, the land use around the Corinth Canal lacks complementary coherence. This disjointed development pattern fails to take advantage of the Canal's potential as a unifying element in the landscape. By not integrating residential, recreational, cultural, and industrial uses in a thoughtful manner, the area misses out on creating a harmonious and functional environment. To improve this situation, a comprehensive urban planning strategy is needed. Such a strategy should focus on integrating diverse land uses in a way that enhances the Canal's significance. Introducing cultural and educational facilities could celebrate the Canal's history and role in modern infrastructure. Better connectivity between residential areas and recreational spaces would create a more cohesive community.

Sectional Analysis of the Corinth Canal

Site Plan of Isthmus 1 : 20 000

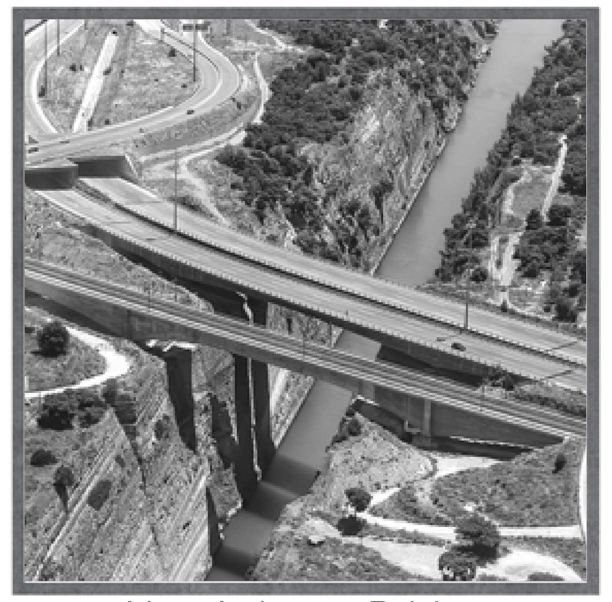
Infrastructure

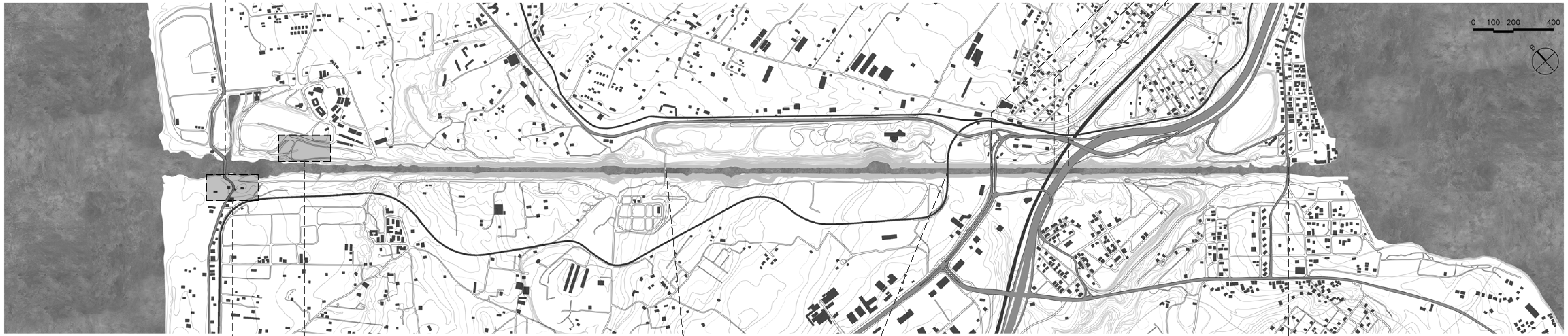
Site Plan of Isthmus 1 : 20 000


West Submersible Bridge of Corinth's Isthmus


Old national road Bridge

New Isthmus Railway Bridge (Proastiakos)


New Isthmus Bridge (Olympic Highway)



Ancient Diolkos (limestone pathway)

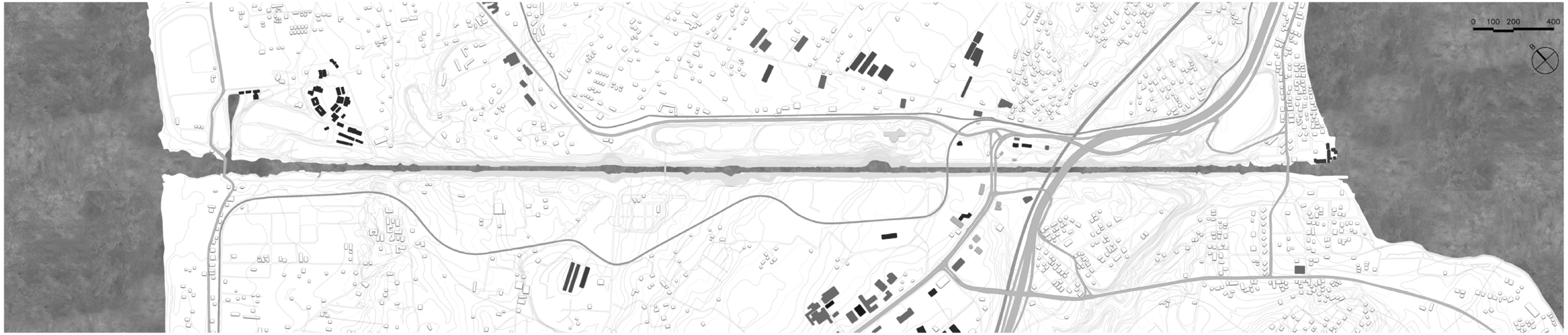
Isthmus Sewage Transport Bridge

Old Isthmus Railway Bridge (inactive)

Submersible Bridge of Corinth's Isthmus

Land Use

Site Plan of Isthmus 1 : 20 000



RESIDENTIAL

SERVICE

LEISURE

COMMERCE

PRODUCTION

SPECIAL USES

Building site

Underground Building Structures

The Choice of Location

Selecting the Southern Cliff

Underground Building Structures

The majority of the project is envisioned to be subterranean. This decision is firstly inspired by the foundational concept of the Isthmus project, which heavily relied on excavation efforts. The intention is also to design a building that merges with the natural rock formations, allowing the Isthmus to take center stage. Creating an immersive experience for visitors, where they feel intimately connected to the cliff, involves more than just observation from above. It's about fostering a sense of being within the cliff, evoking a cave-like ambiance that encourages visitors to explore the rock formations of the Isthmus up close. Positioning the building at a lower ground level, the architecture frames a view encompassing the opposing cliff wall, the expansive sky, and the waters of the Canal below.

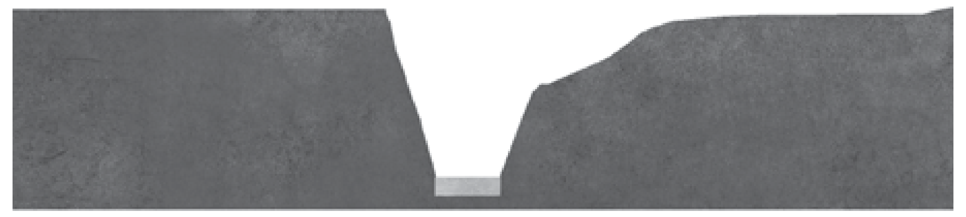
Furthermore, in response to the challenge of global warming, subterranean construction emerges as a strategic choice for the majority of the project, driven by a commitment to sustainability and environmental responsibility. Harnessing the earth's natural insulation, the architectural design maintains thermal stability within the built environment, effectively minimizing reliance on mechanical climate control systems. This approach not only reduces energy inefficiencies inherent in traditional HVAC systems, but also aligns with the imperative to mitigate climate change.

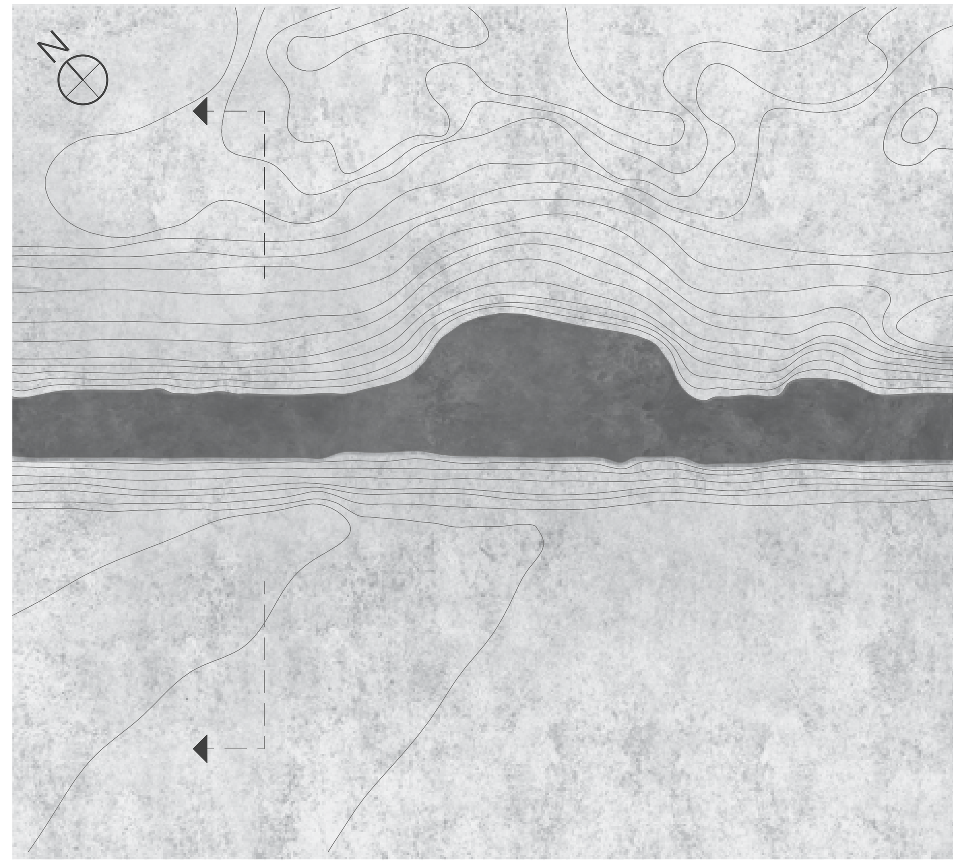
Figure 18: Sky

Figure 19: Artificial waterway of canal

Figure 20: Stone layers of the Isthmus

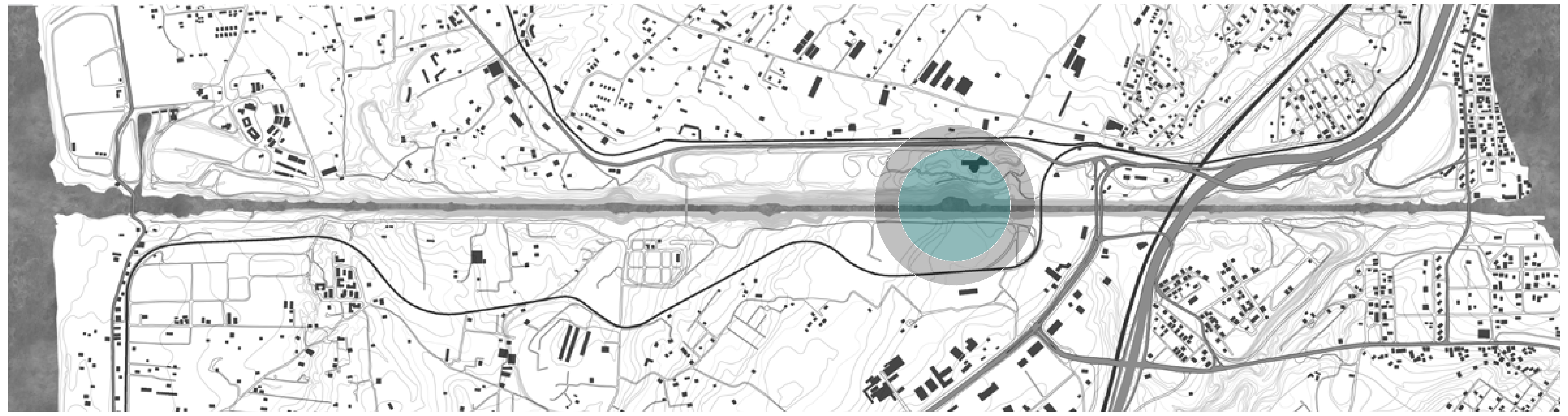
The Choice of Location



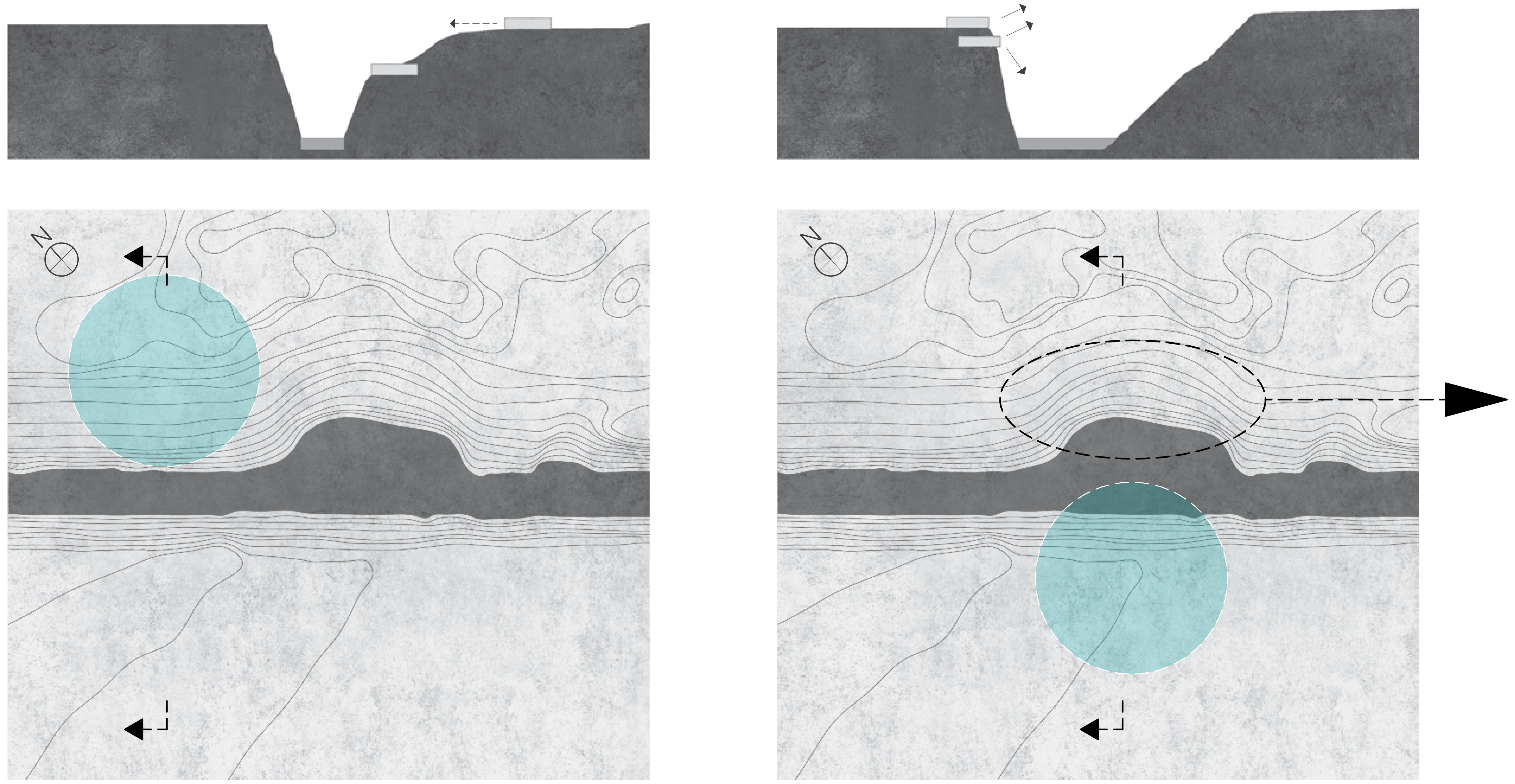


Regarding the selection of an appropriate building plot, several factors have been taken into account. Foremost, among the project's priorities was ensuring fast and convenient access from both sides of the Isthmus. This goal is achieved by the strategic placement of the building near the 'Olympia Odos' motorway and the bus station, offering accessibility to visitors with or without personal vehicles.

Moreover, through an initial examination of the area's geographical features and the determination of cliff wall heights along the Isthmus's entirety, it became apparent that the central juncture of the Canal, rising to approximately 80 meters, boasts the highest elevation in comparison to its outer ends. This significant elevation in the Canal's midpoint, coupled with the desire to showcase the Canal's dimensions and height solidifies the middle as the ideal site for the building. Additionally, this position allows for a view in both directions along the length of the Canal, providing a comprehensive experience of the Canal landscape.



Selecting the Southern Cliff



Following the determination of the central position for the building site along the Canal's longitudinal axis, a thorough assessment and analysis of both sides of the Canal ensued to define the precise location for the project. Initially, erecting the building on the northeast side of the cliff was considered, but ultimately the advantages of the southwest side prevailed. Choosing the northeast side would have compromised the view of the length of the Canal due to its sloping terrain. An alternative option was to place the building closer to the middle of the Isthmus. However, access to the building complex would not be ideal. Additionally, the potential extension of certain building parts, such as a terrace or an observation point over the Canal, might have posed issues, such as presenting challenges for passing ships due to their considerable height.

Figure 21: View into the canal of the Isthmus

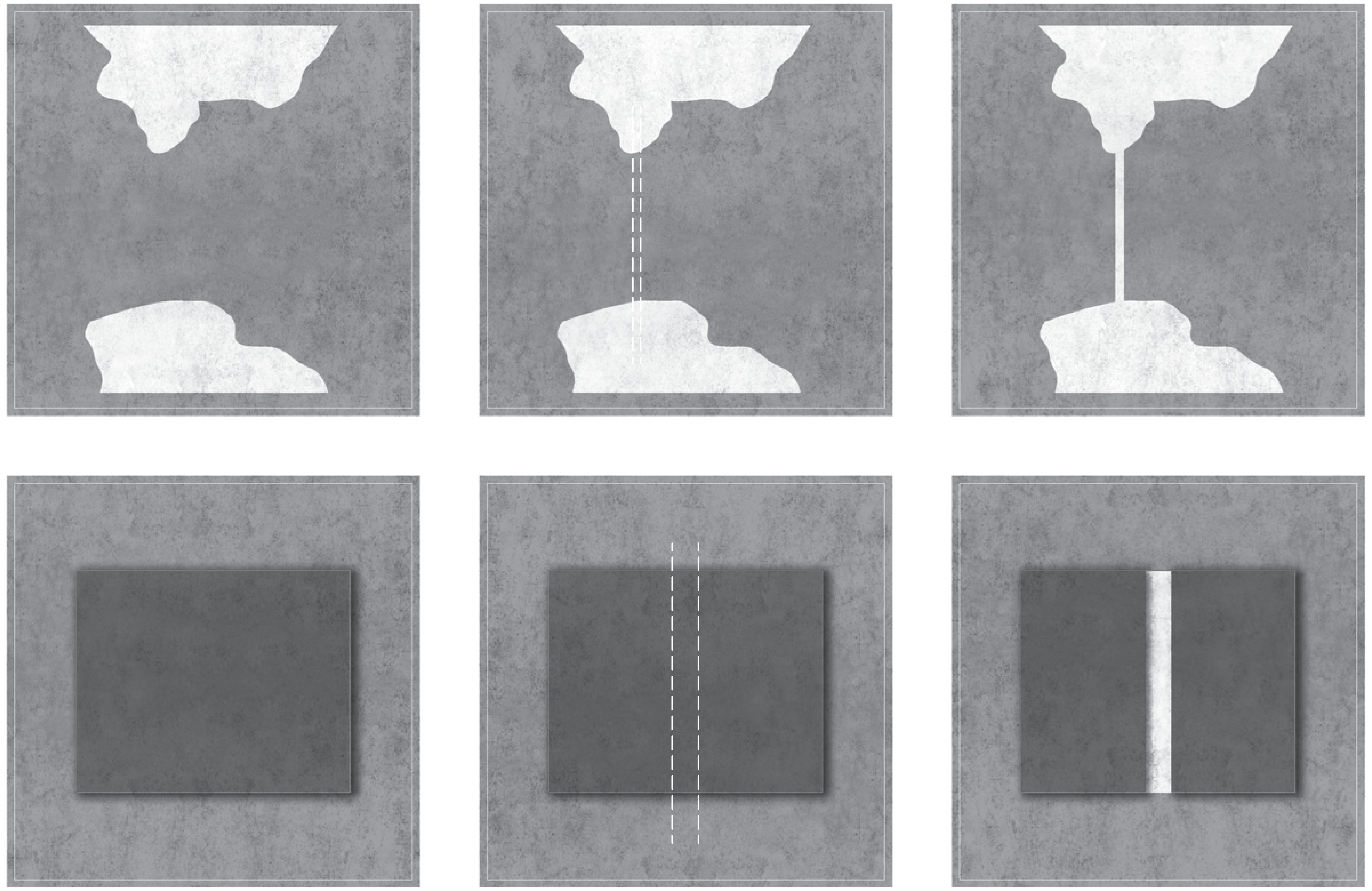
Figure 22: View of the north-east canal site

The southern cliff of the Canal presents at its midpoint a combination of heightened elevation and steep terrain. This vantage point not only grants visitors an enhanced panoramic view to the length of the Canal and to the indentation on the opposing slope, but also ensures convenient accessibility. Moreover, it provides the benefit of a northeast-facing terrace. Given Greece's typical strong sunlight and accompanying heat, the northeast orientation of the terrace mitigates direct midday heat and intense afternoon sun, ensuring comfort for the visitors throughout the day. Also, the facing slope of the Isthmus basks in a warm glow while in the evening light.

Bird's-Eye View of the Architectural Proposal on the Isthmus of Corinth

Main Concept

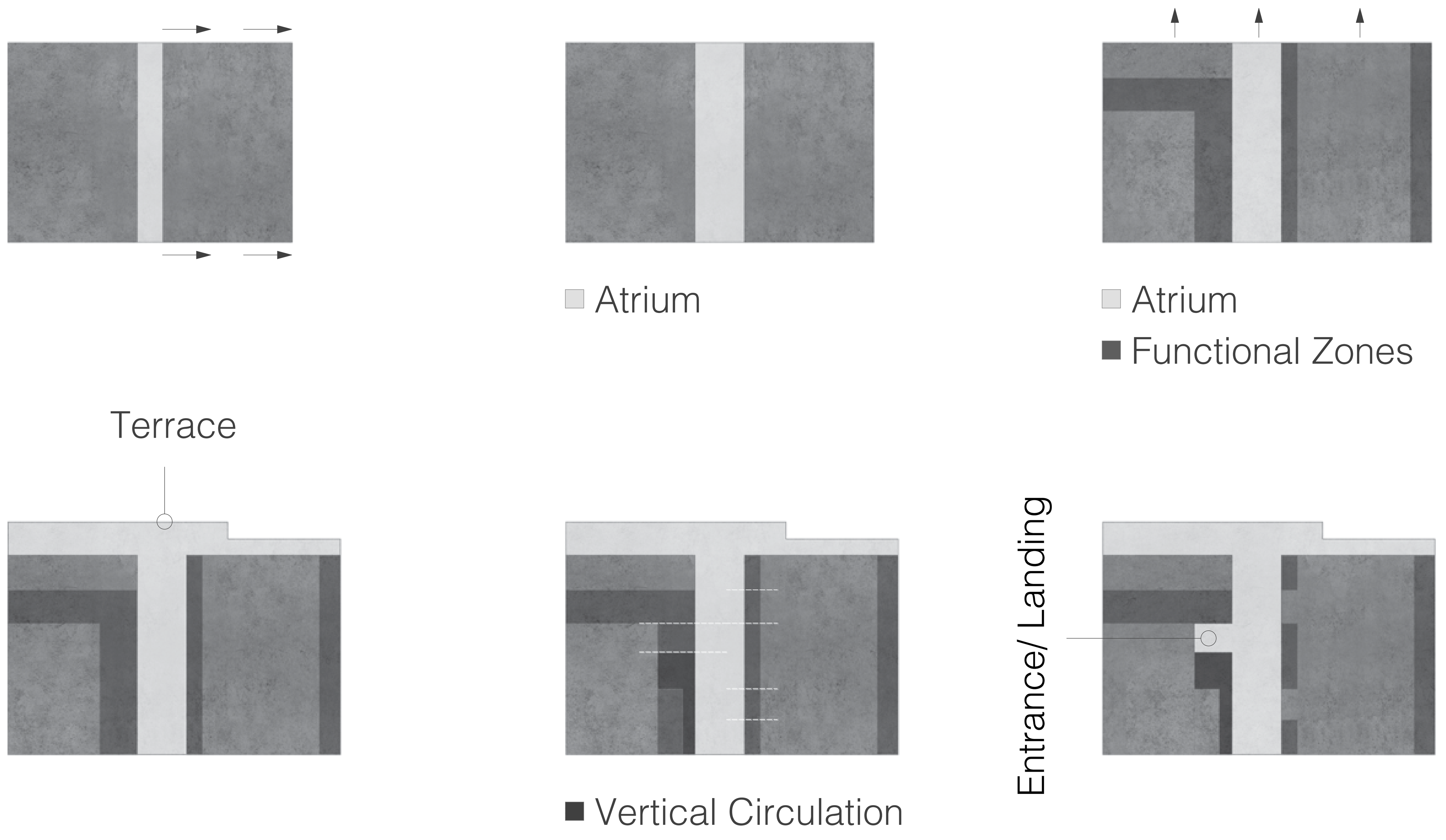
Concept Development



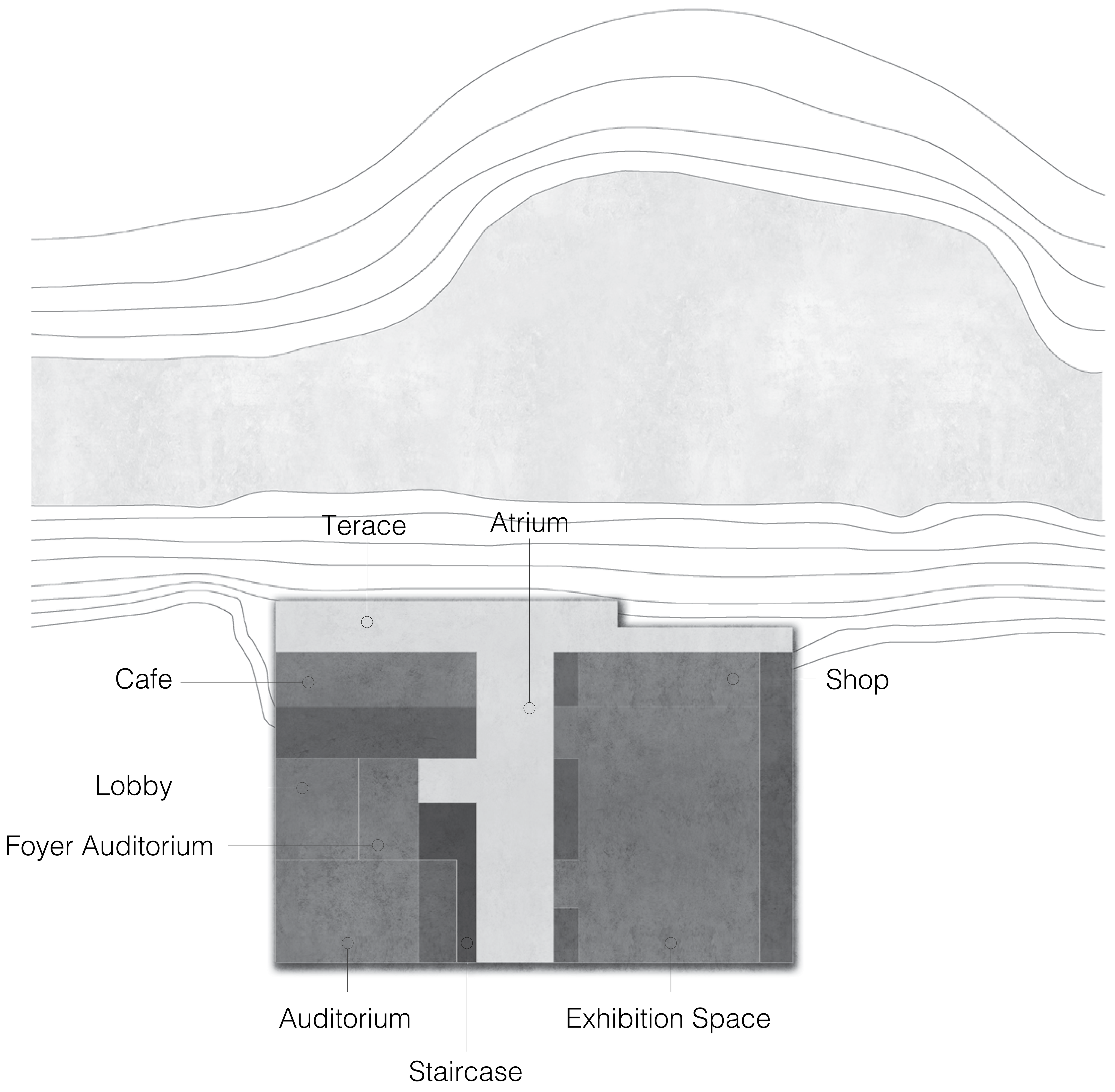
The architectural concept of the building is inspired by the formation of the Isthmus Canal. Mirroring the Canal's transformative process of carving through the land, filling with water, and reshaping the landscape, the design aims to embody this dynamic by incorporating a division in the building complex that echoes the Isthmus, thereby sculpting its unique identity within the building.

Figure 23: Shipping in the canal of Isthmus

Spatial Organisation



The division within the building expands, creating a spacious atrium, which serves as the central hub of the project and the initial point of encounter for visitors. Surrounding the atrium, a diverse array of spaces unfolds, comprising of a museum, a boutique, a café, and an auditorium complete with a lobby and a foyer.



Inspirations

Figure 24: Proposed design for the National Archaeological Museum, Kengo Kuma, Athens, 2024

Figure 25: Extension of Kunsthaus Zürich, David Chipperfield Architects, Zurich, 2020

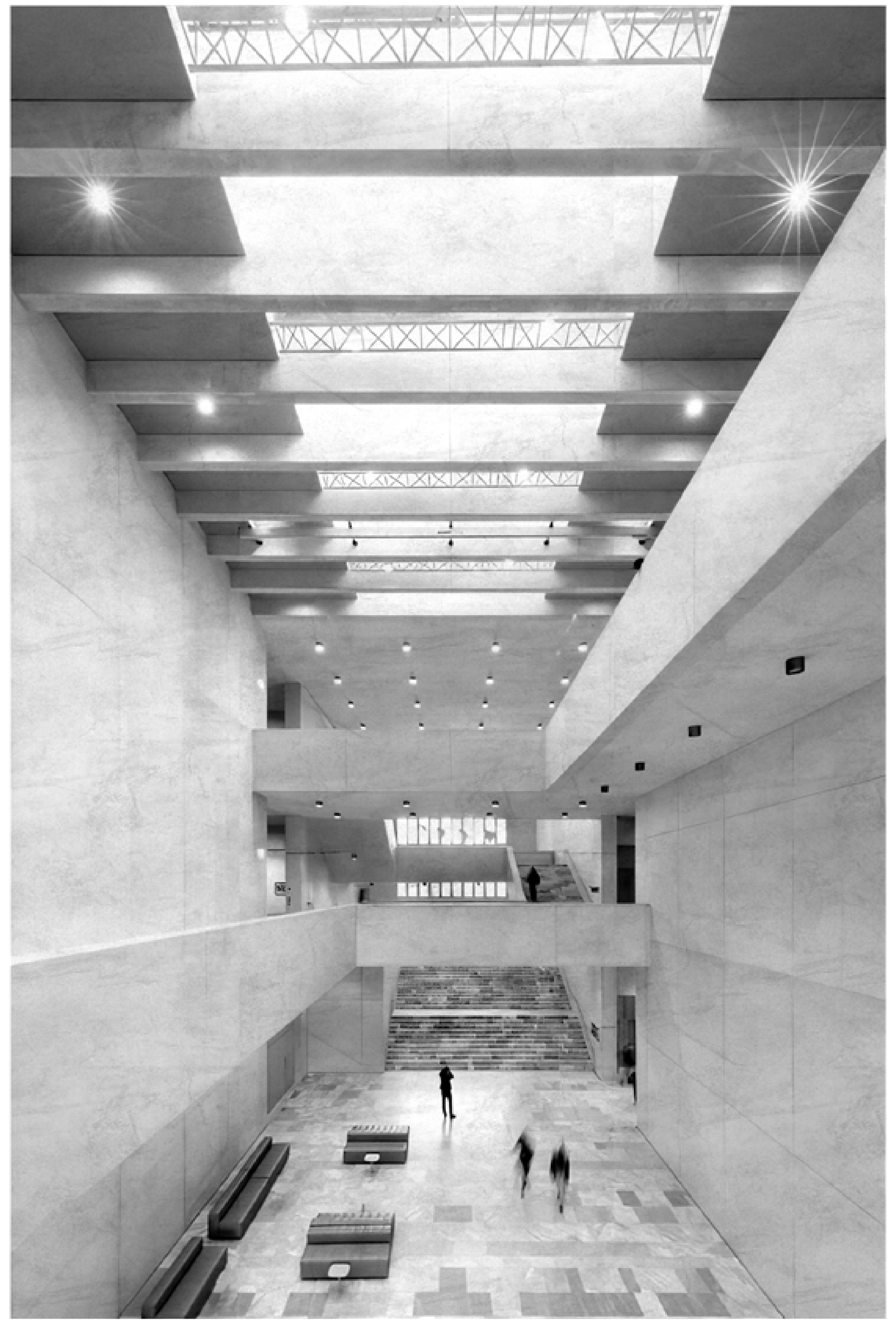


Figure 26: Extension of Kunsthaus Zürich, David Chipperfield Architects, Zurich, 2020

Figure 27: Staircase in the Old Pinakothek of Modern Art, Hans Döllgast, Munich

Figure 28: Yad Vashem Museum, Moshe Safdie, Israel

Project Description

The primary idea of this project is to achieve a simple and clear spatial conceptualization that addresses formal criteria while fulfilling various functions. Inspired by renowned examples such as the extension of the Kunsthaus Zürich by David Chipperfield, the Yad Vashem Museum by Moshe Safdie in Israel, and the reconstruction of the Alte Pinakothek by Hans Döllgast in Munich, the design aims to create a cohesive and functional space that respects its context by being in harmony with the surrounding environment.

The design incorporates three underground levels that blend into the natural topography of the Isthmus and ensure a harmonious integration with the landscape. A ground-level parking area has been strategically positioned, in a distance from the building. This deliberate segregation aids in abating noise and pollution emissions in the vicinity of the structure and ensures the preservation of an unobstructed environment directly surrounding the edifice, free from vehicular intrusion.

The journey begins as visitors traverse the path that gradually leads them towards the intended destination. A straight staircase guides them into the deep, underground level of the building. A spacious hall, the atrium, doubles as an open gallery, where various sculptures and models depicting the Isthmus are exhibited along its length, and extends to a terrace that runs parallel to the Canal and is partially cantilevered from the Isthmus's rocks. Part of the terrace serves as a viewpoint, offering visitors a clear view of the Isthmus, while another section is designated as a cafe area. An opening of small width floods the atrium with natural light from above, reminiscent of the dividing line of the Isthmus. During rainfall, water descends from this aperture into a water basin, and then flows through concealed pipes beneath the floor, returning to the Isthmus.

The museum's foyer is located within the atrium, while the enclosed section houses a shop and a double-height exhibition space. The exhibition space is characterized by oversized columns, which through their design and materials mimic natural rock formations. In the double-height area of the museum, a narrow elongated section is divided into two levels.

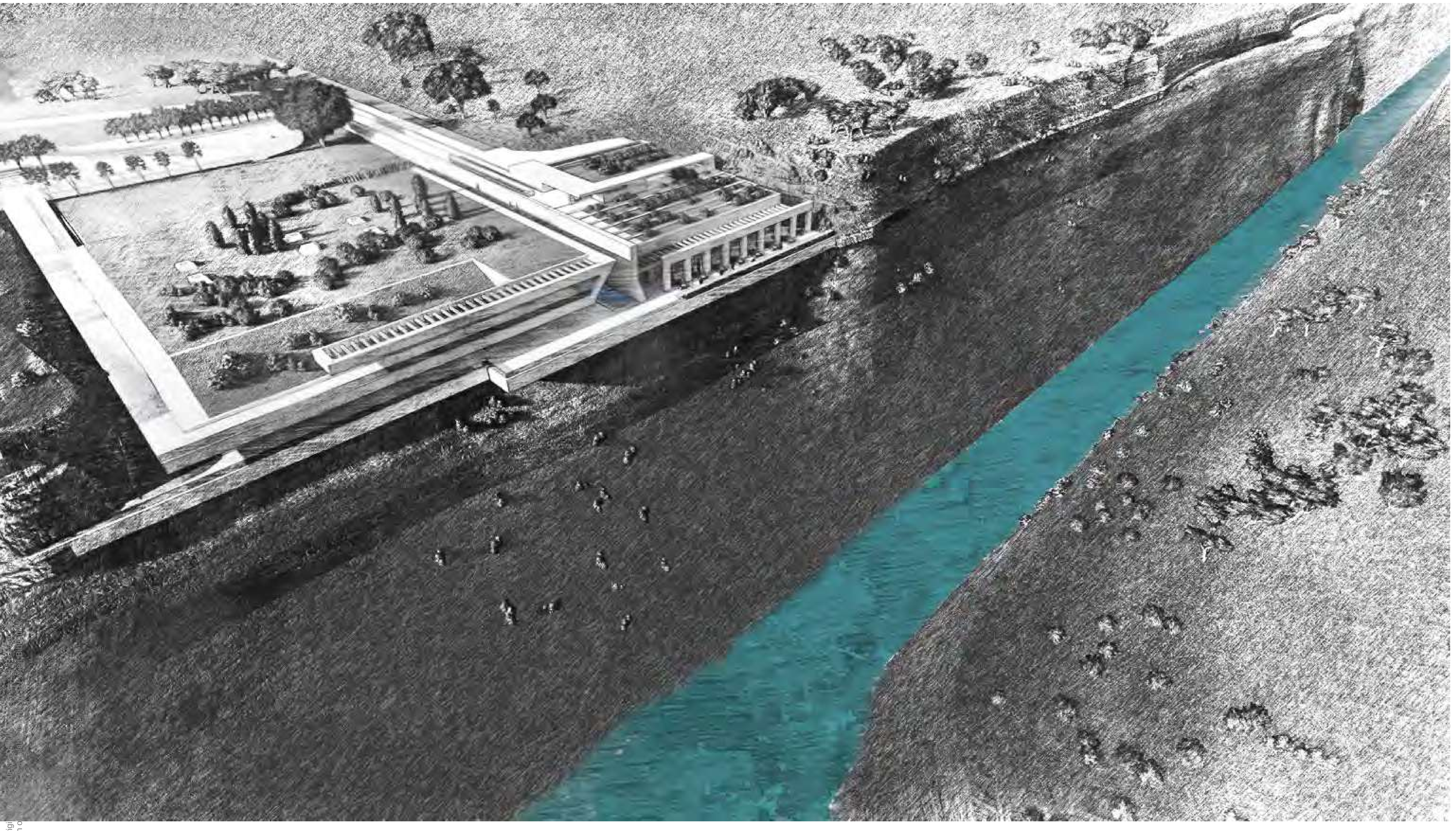
The upper part is utilized for temporary exhibitions. At the end of the exhibition, a terrace provides space for visitors to relax and enjoy views of the surrounding environment and also serves as a shelter for the lower level. Additionally, the terrace connects to the exterior space via which the administrative area can be accessed. The administrative area features its own entrance and outdoor space.

The cafe, positioned on the opposite side of the atrium, provides seating for over 170 guests, boasting both indoor and outdoor dining areas. The outside space evokes the ambiance of a Greek stoa, characterized by two rows of columns merging the interior and exterior space. Glass openings afford glimpses of the natural geological formations of the Isthmus, an experience akin to peering into a cave. Along the edge of the terrace, an elongated high table offers prime vantage points. Behind the bar of the café, there are storage rooms, guest restrooms, a preparation area, and a kitchen, capable of accommodating the needs of auditorium guests if necessary.

The auditorium, capable of accommodating 270 visitors, boasts its own foyer and a lobby area for intermissions. The concrete walls of the auditorium main room are covered with marl stone, a material that is to be found in the excavation area and that creates the feeling of being inside a real cave. Extending to the lower basement level, this level also houses a second entrance for the auditorium, as well green rooms for the speakers and various other facilities including storage rooms and technical rooms.

The building features a green roof, incorporating a diverse range of plant species for both ecological benefits and aesthetic enhancement. Adjacent to the lifts facilitating the access of guests to the ground level, a final stepped terrace offers visitors a last opportunity to take in the landscape before leaving the premises.

Bird's-Eye View Perspective of the Architectural Proposal



Concept Insights

Materiality

Atrium

Exhibition Space

Café

Materiality

inspired by the stonelayers from the Isthmus

Figure 29: The figures 29, 30, 31, and 32 show different stone layers of the Isthmus

Figure 30

Figure 31

Figure 32

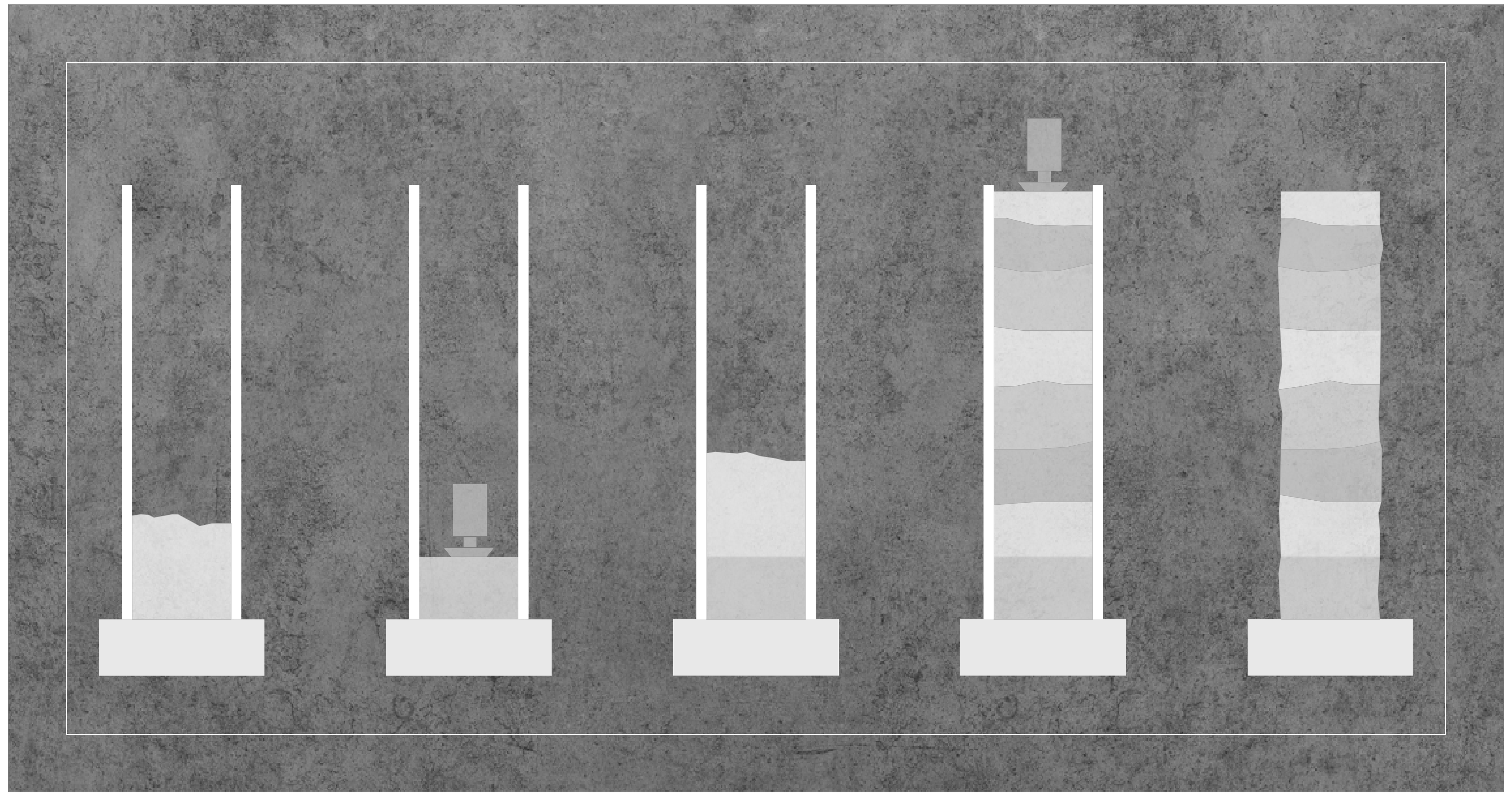
Rammed Earth Concrete

Inspired by the layers of the Isthmus, rammed earth concrete is intended for use as both a structural component and a decorative cladding element. To produce this concrete, a stiff, moist mixture of soil, sand, gravel, and cement is poured into a mold and rammed until the surface becomes compact and homogenous and a layer of moisture appears on it. To be more specific, it is a moisture film that appears on the mixture, signaling readiness for the next layer (Ciancio & Beckett, 2013).

The result is a resilient and enduring material that not only offers aesthetic appeal but also boasts resistance to cracking and deformation. This construction material is crafted using locally-sourced rock materials, promoting sustainable and efficient resource utilization while bolstering the local economy.

The unique aesthetic of rammed earth concrete evokes the imagery of archaic sedimentary layers, enhancing its allure as a building material. The intense compression during production yields sturdy structures, ideal for monolithic constructions that promise longevity. Moreover, the material emphasizes a horizontal character and serves as a tribute to natural rock formations.

Rammed Earth Concrete



Step 1 Step 2 Step 3 Step 4

Step 1: Plywood formwork filled with layer of moist earth mix (concrete, gravel, sand, clay, ...)
Step 2: Earth layer compacted using pneumatic backfill tamper
Step 3: Next layer added and process repeated
Step 4: Additional layers of moist earth are added and compressed
Step 5: Once dry, the formwork is removed to reveal the rammed earth wall

Figure 33: Gallery of mantinum intervention, Antoine Dufour architectes and Buzzo Spinelli Architecture, 2020

Figure 34: Gallery of mantinum intervention, Antoine Dufour architectes and Buzzo Spinelli Architecture, 2020

Figure 35: Vigna Maggiore – In a dialouge with earth, Julien Kerdraon and David Giancatarina, 2019

Figure 36: Rammed earth wall

Marl

Marl emerges as a compelling substance, characterized by its earthy composition abundant in carbonate minerals, clay, and silt. Under the influence of water and the presence of organic matter like algae, marl undergoes a transformative process, solidifying into what is known as marlstone—a sturdy and versatile rock formation (Boggs, 2006).

The material is sourced from the uppermost strata along the longitudinal axis at the middle of the Isthmus, where the architectural complex will be built.

It will be used as a foundational element for the fundamental structure of the building, as a supplementary cementitious material (SCM) in cement formulations, but also as a key component in the interior aesthetics of the interior space (Bahhou et al., 2021). It is used for enveloping columns and adorning wall surfaces within the auditorium space, reflecting the natural stone structure of the Isthmus.

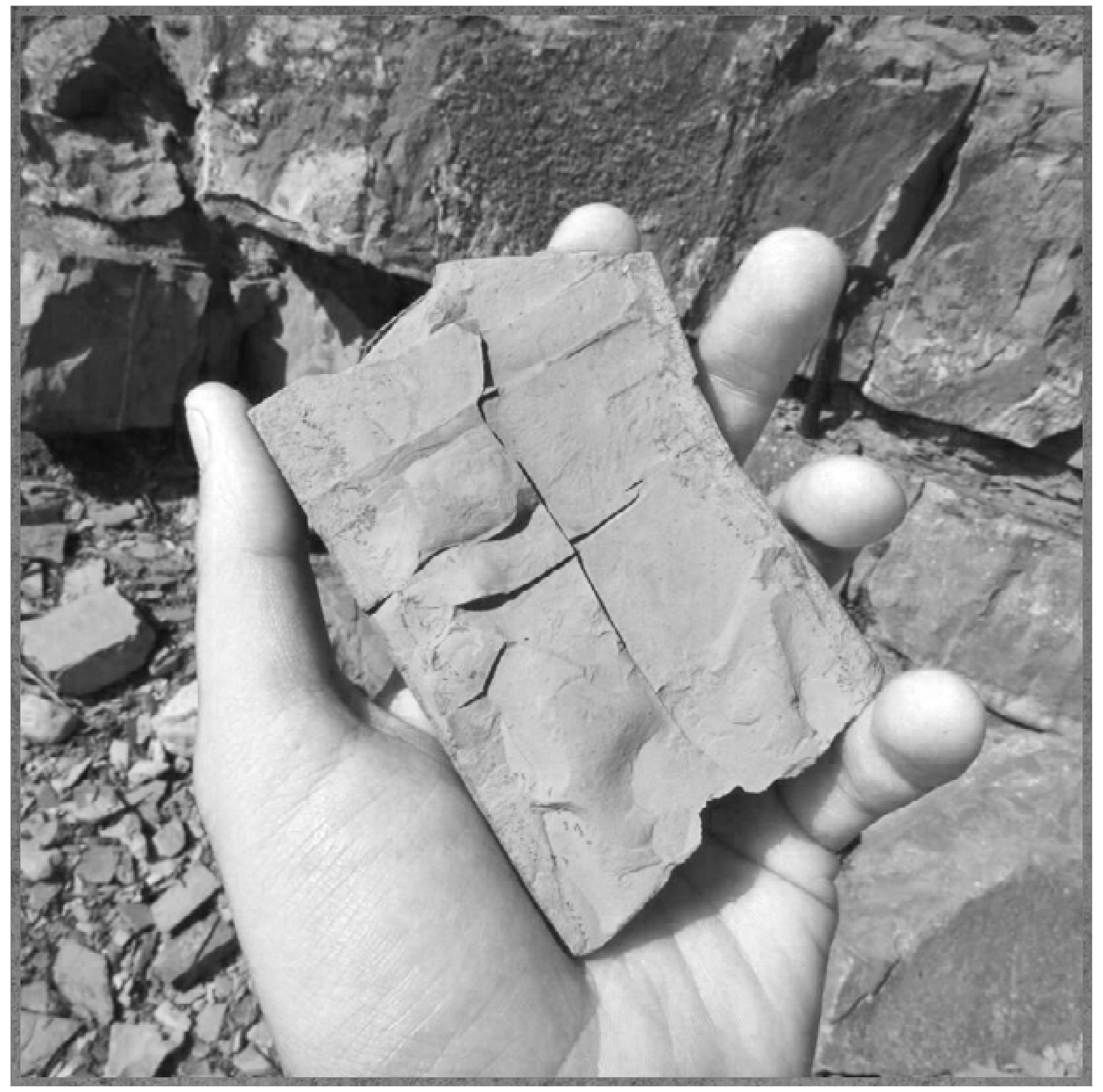


Figure 37: Piece of Marl

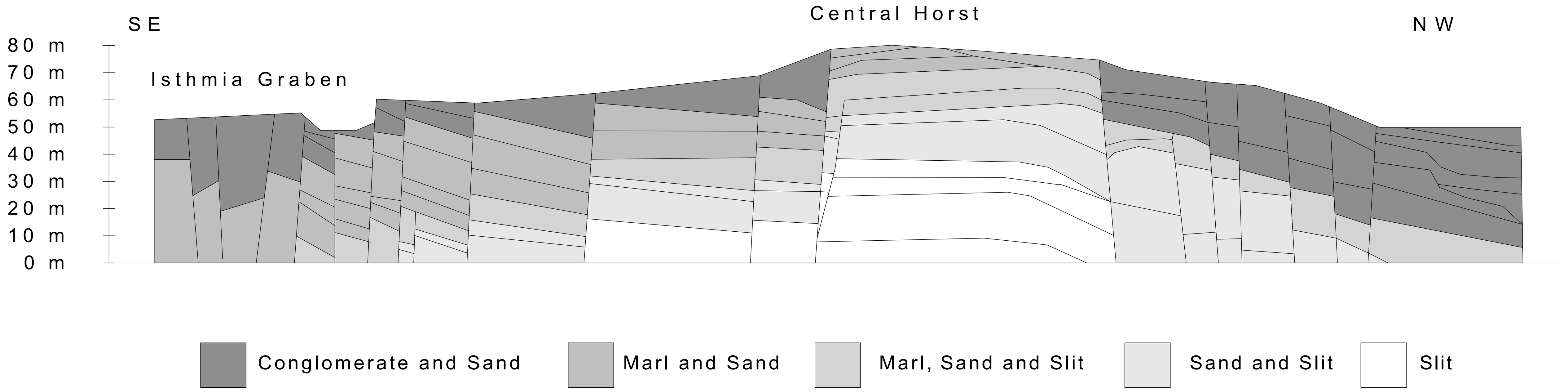


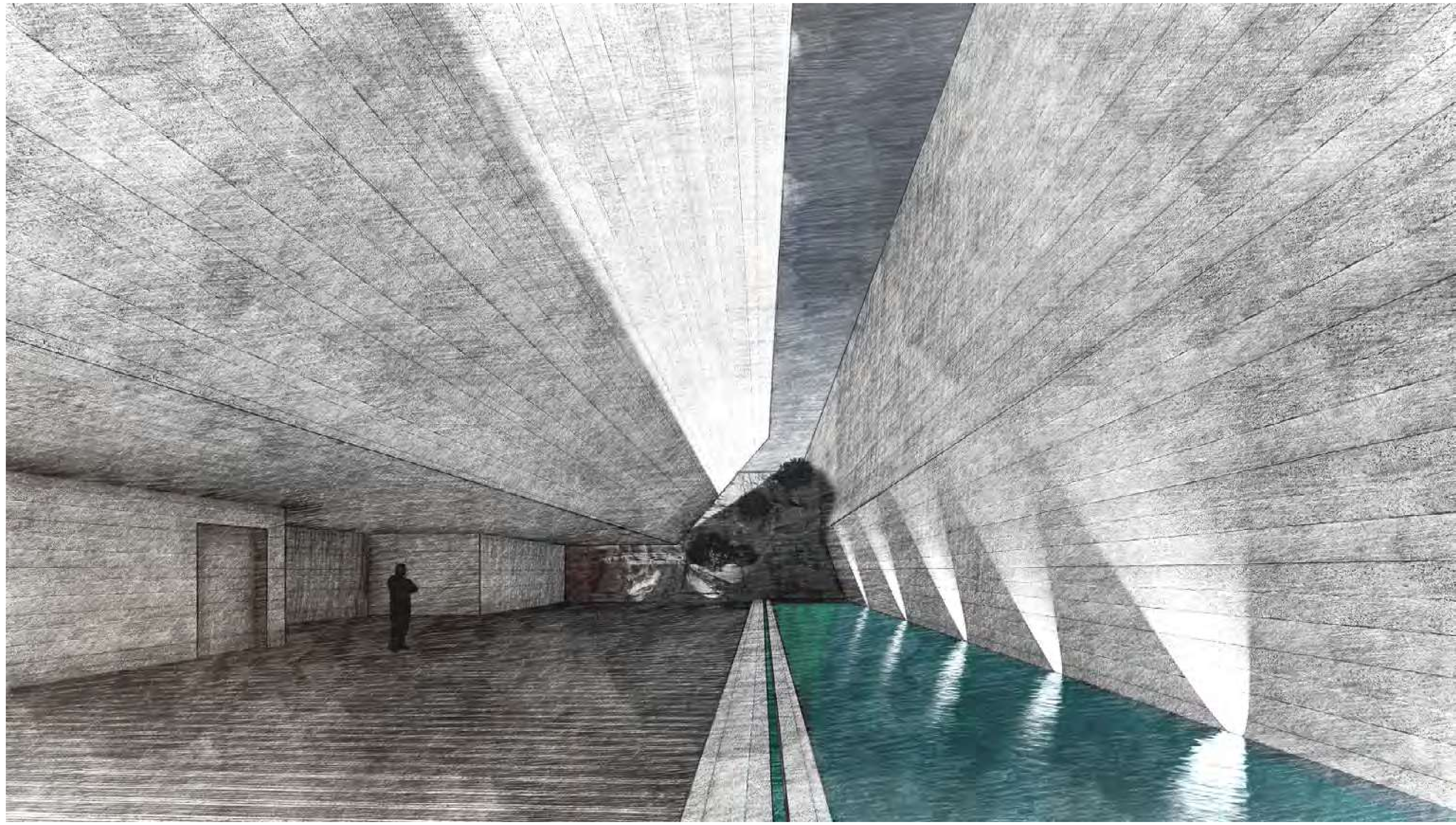
Figure 38: Division of the stratal units into five tectonostratigraphic units of the Canal of the Isthmus

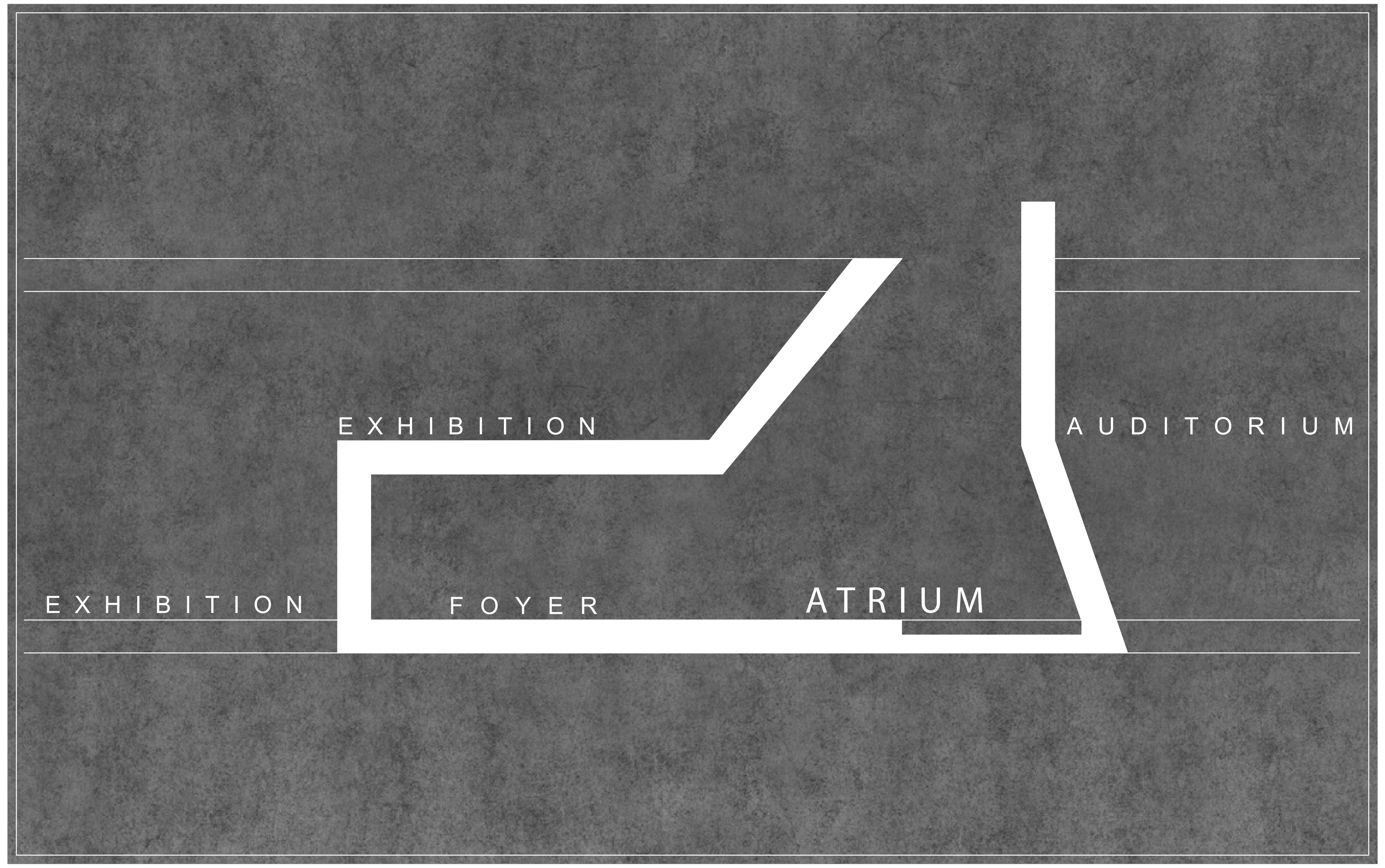
Figure 39: Marlstone

Figure 40: Marlstone quarry

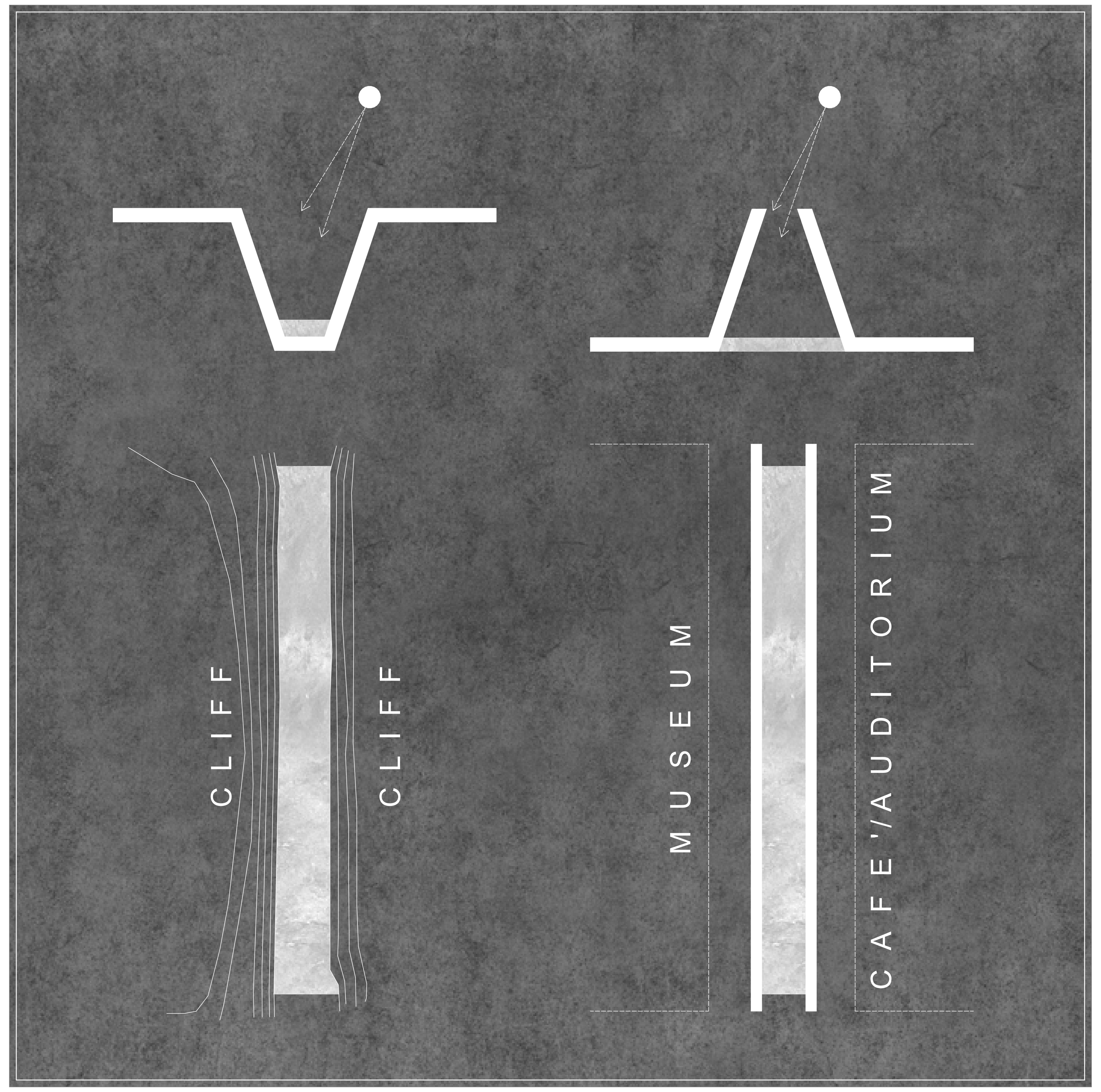
Figure 41: Marlstone quarry

Atrium

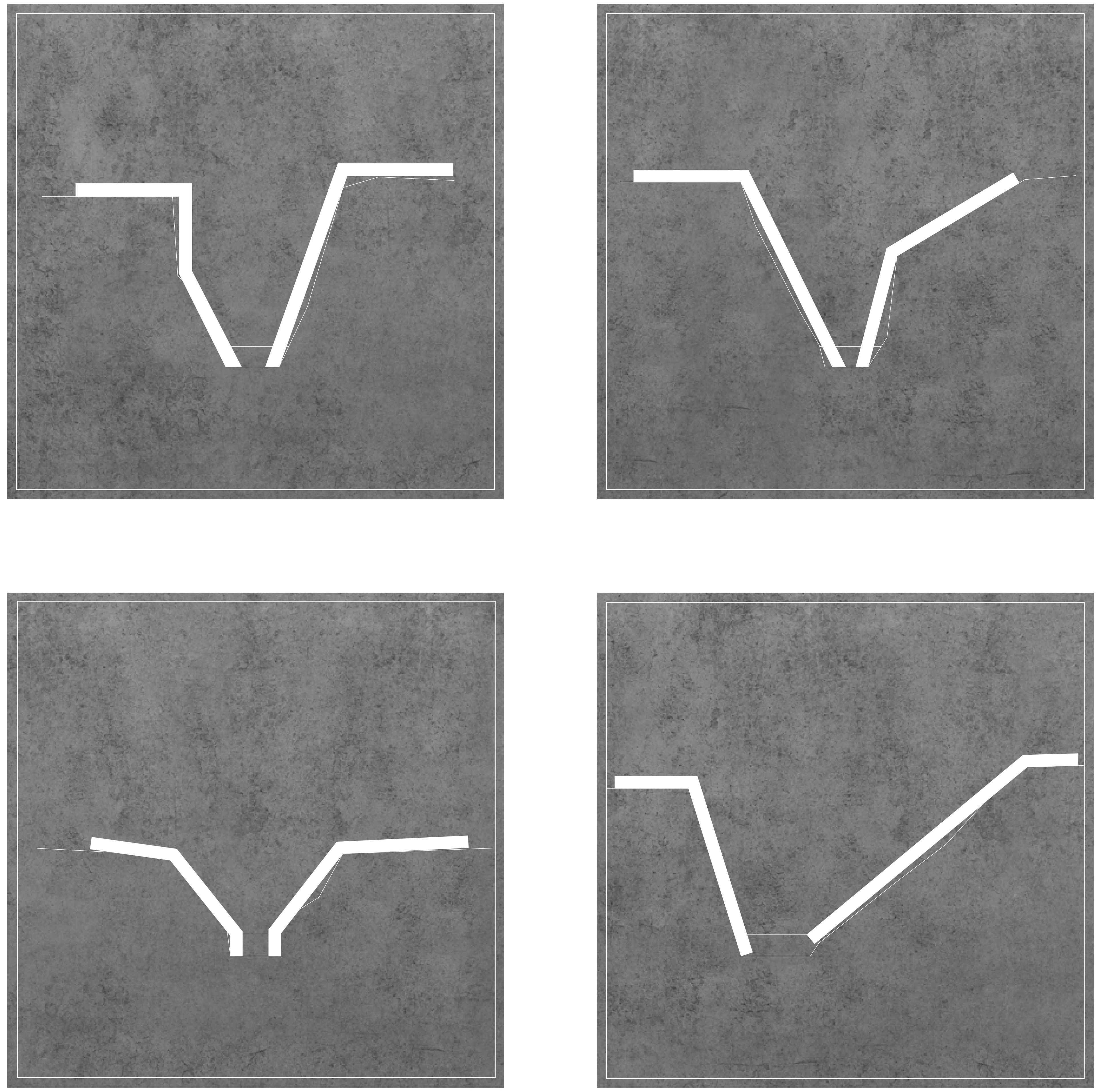




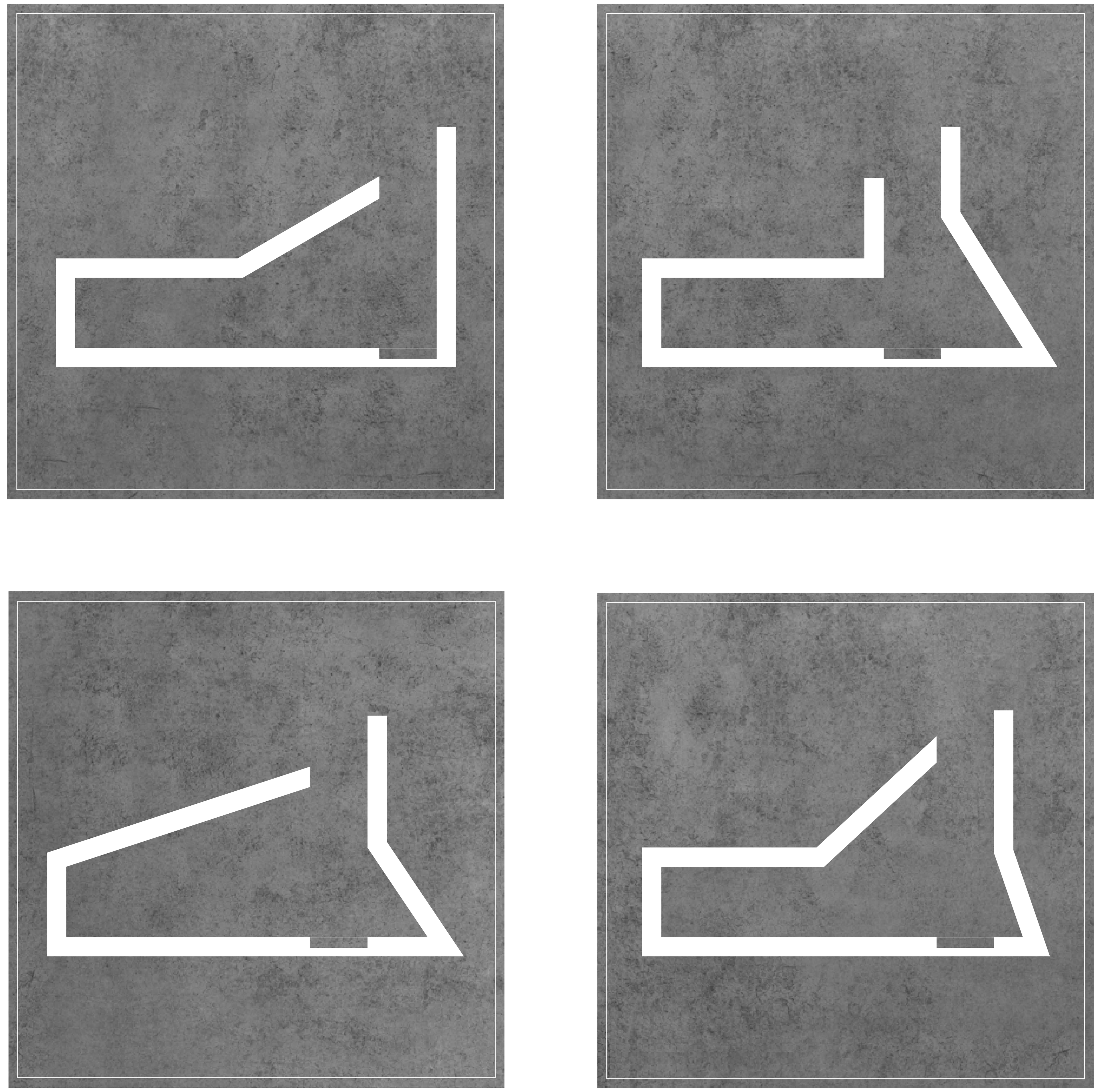
Enclosed by towering slanted walls, the atrium fosters an inviting and dynamic ambiance. Within this central space, visitors' attention is drawn in one direction, their gaze wandering across the opposing cliff of the Isthmus. At the opposite end of the atrium, the original rock inside the Isthmus is revealed. Formed over millions of years, this natural rock formation imbues the space and highlights the site's rich history and geological heritage. Inspired by the heterogeneous structure of the Canal with its diverse topographies, the walls of the atrium are intended to eschew strict parallel or vertical alignments and are instead characterized by sloping angles. These inclined walls open upward to a longitudinal opening, allowing sunlight to penetrate and creating a unique lighting ambiance within the interior space. This slit-like opening, when viewed from above, evokes the resemblance of the Isthmus Canal.



Water, as a significant component of the Isthmus, is embraced indoors in the form of a decorative water feature. Serving as a reflective element, it fosters a calming and delightful atmosphere while simultaneously acting as an aesthetically pleasing visual focal point that defines the impact and spatial experience of the atrium. During rainfalls, water becomes an additional acoustic medium, generating an enjoyable and engaging sound backdrop.

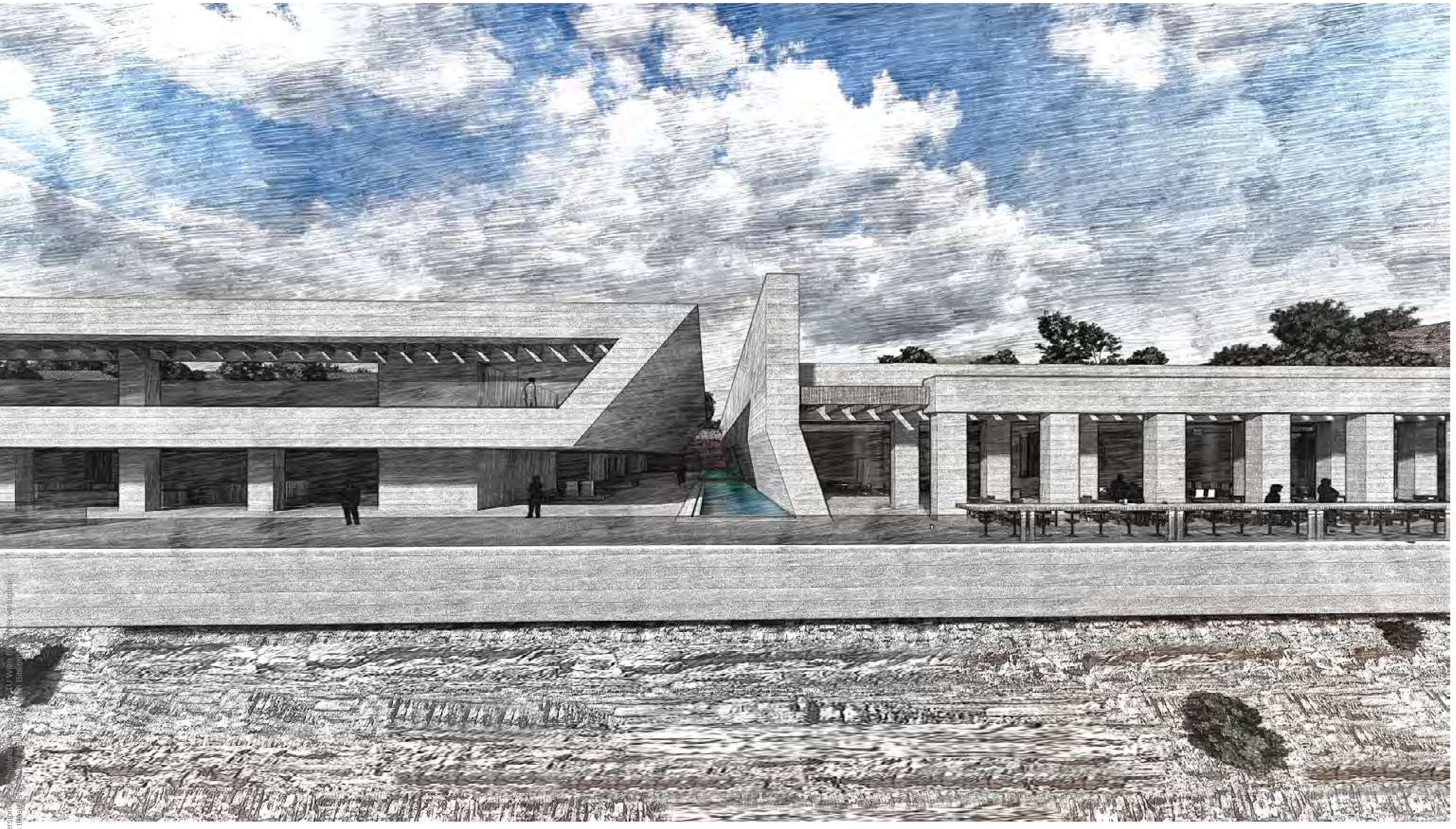


Sections in several parts of the Isthmus which showcase different variations of its topography



Based on the multiple cross-sectional cuts of the Isthmus, various designs were made with different variations of shapes and angles for the walls of the atrium.

Front View Perspective

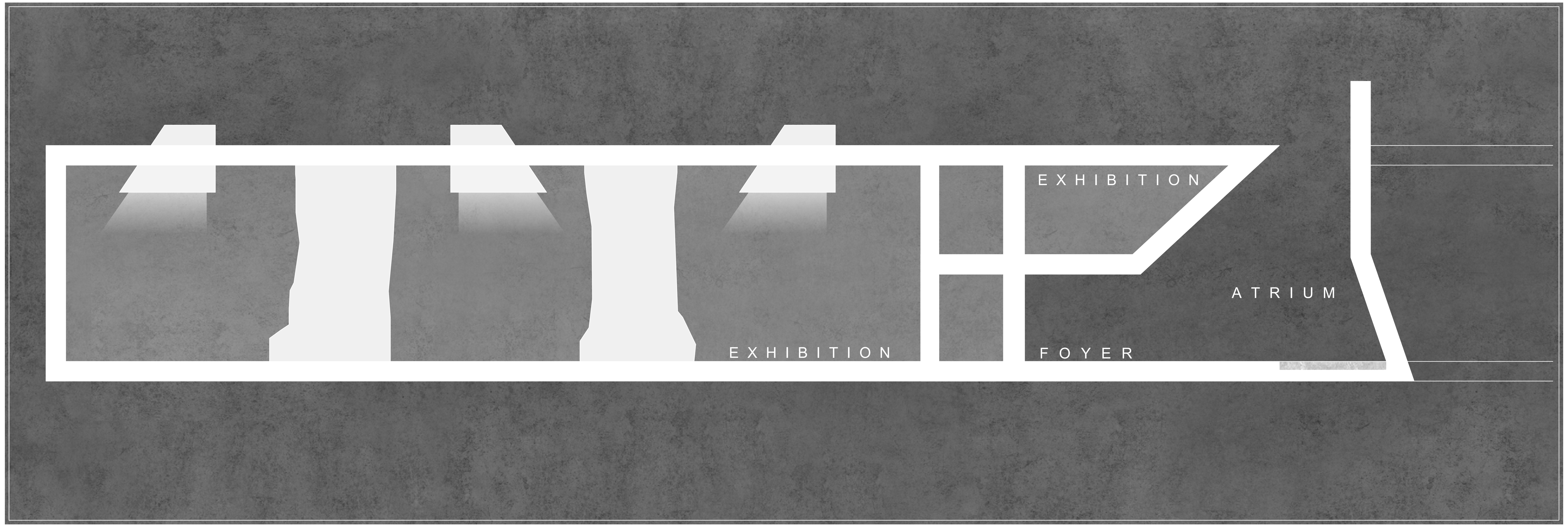


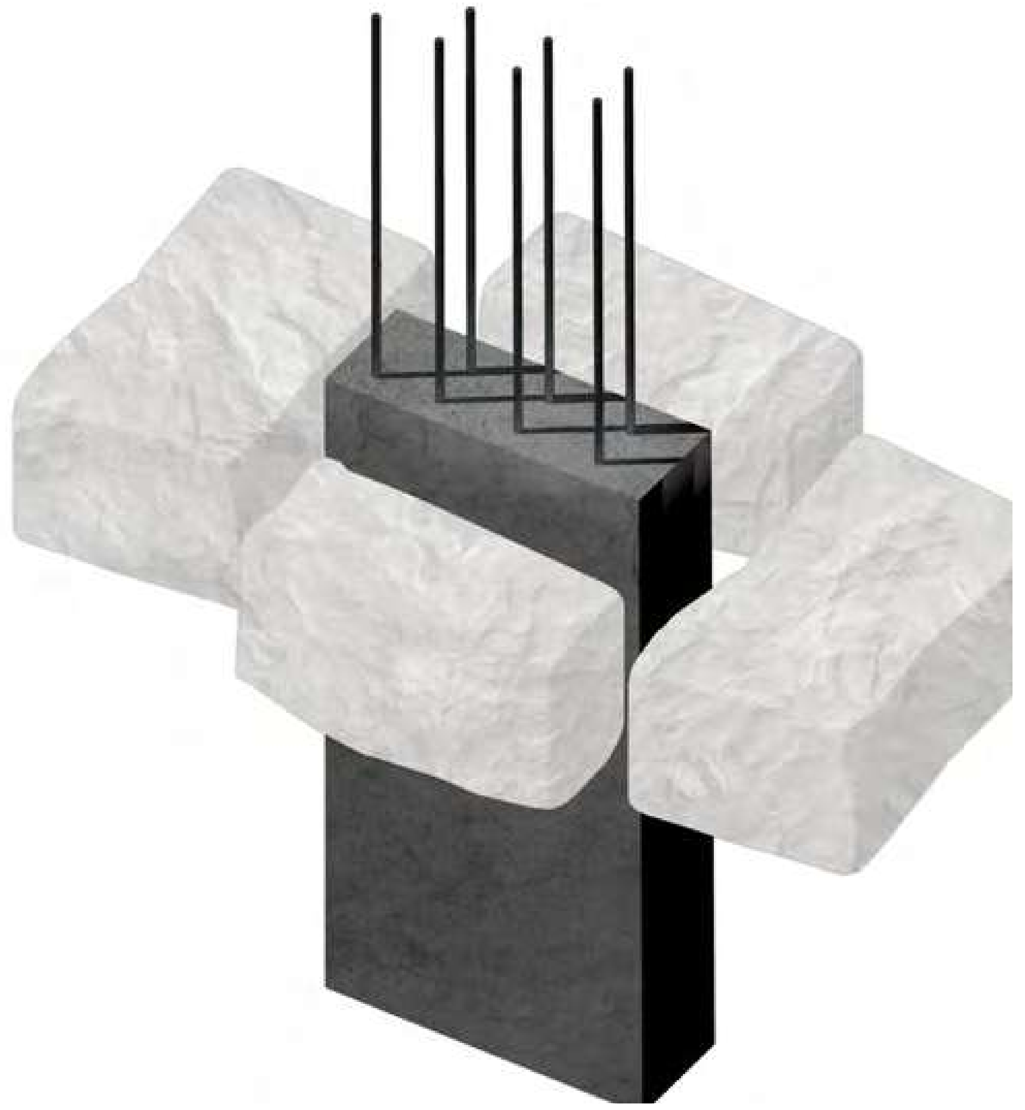
Exhibition Space

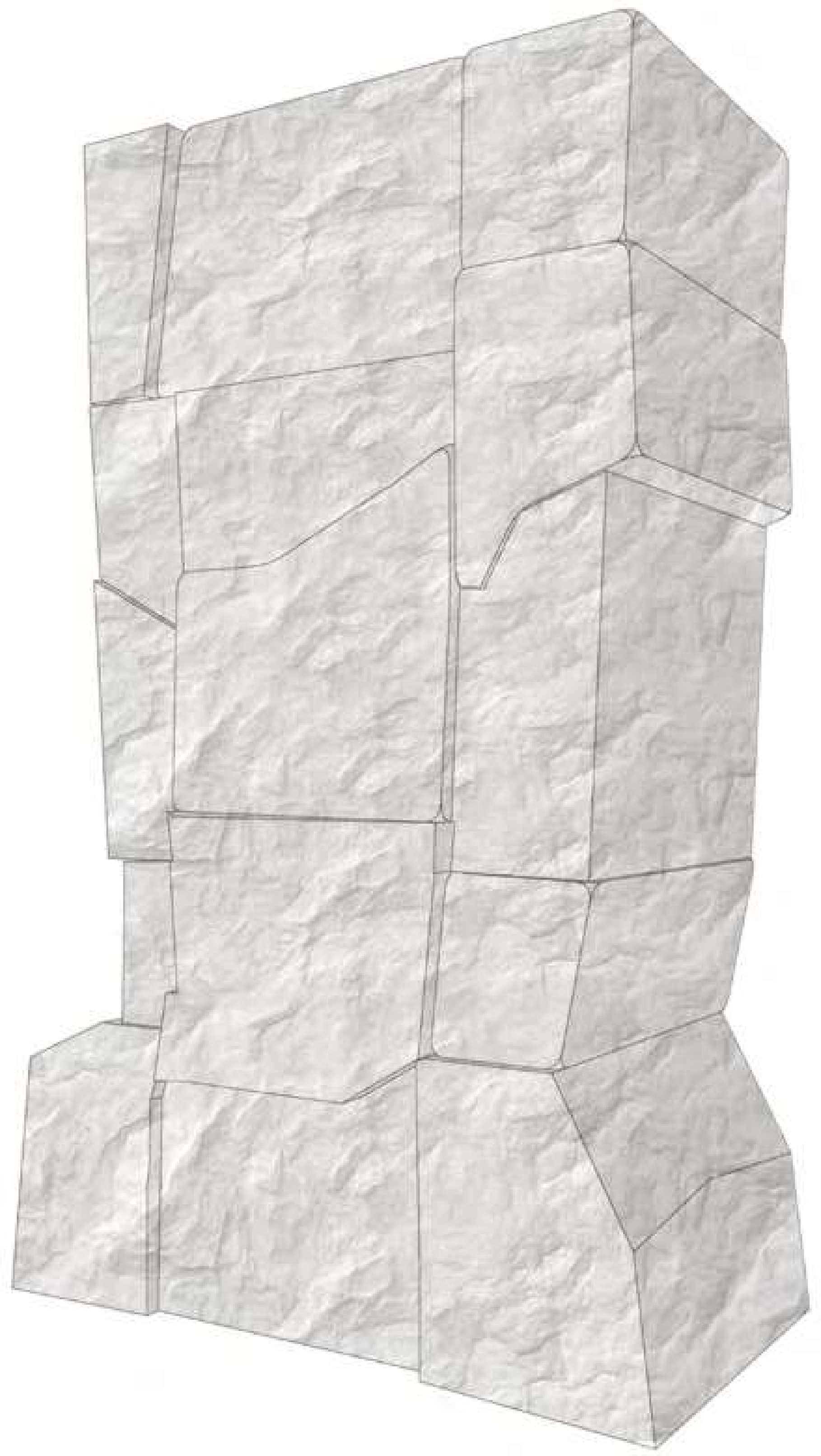
On the southeast side of the building complex lies the exhibition area. The ceiling of this lofty space is supported by columns whose exterior is covered by marl, a material found in the Isthmus, effectively echoing the original geological formations.

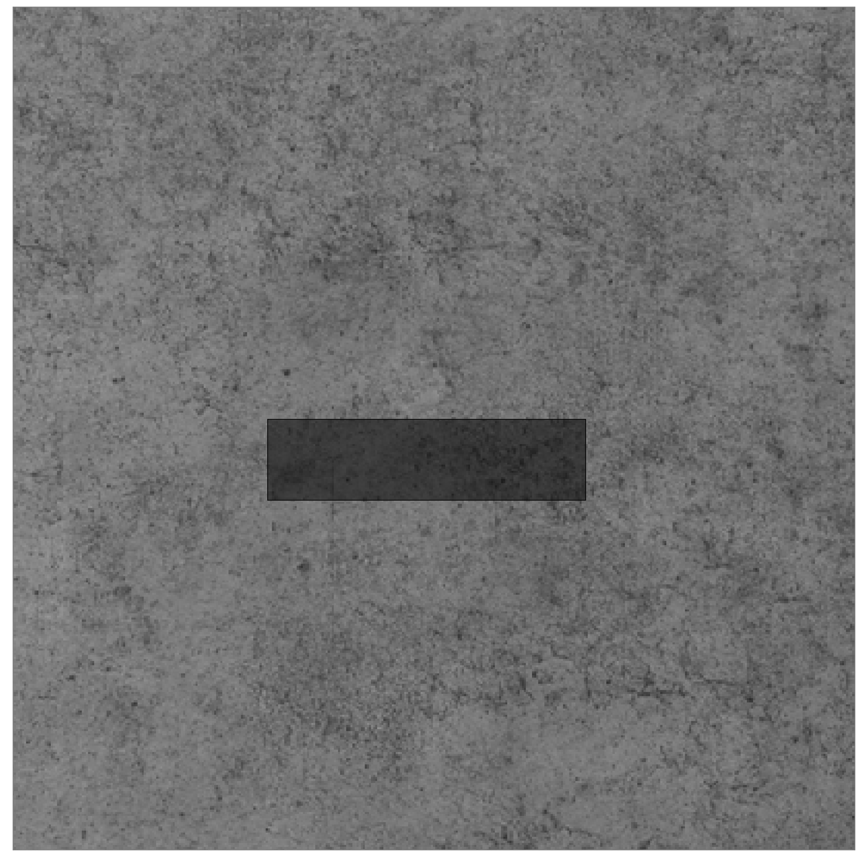
The columns in the exhibition space present themselves in diverse and individual forms, akin to those found in the Chipperfield Cava Arcari project. Their externally heterogeneous design and generous dimensions lend a unique aesthetic presence to the visual appearance, while internally they are reinforced concrete columns that ensure structural support.

Consciously enveloped in darkness, the exhibition area creates an atmospheric ambiance pierced by individual spotlights. The sole natural light source is provided by light shafts. Small openings at the top allow daylight to filter into the space and establish a subtle connection to the outside world. The sloping wall of the atrium creates an additional space intended for temporary exhibitions.

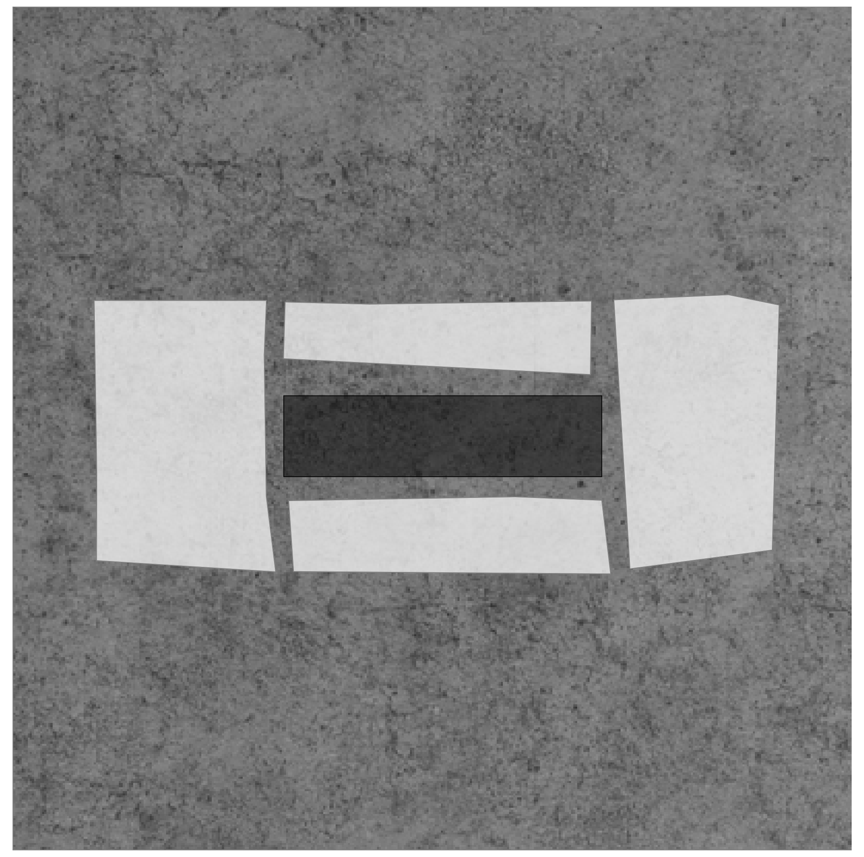




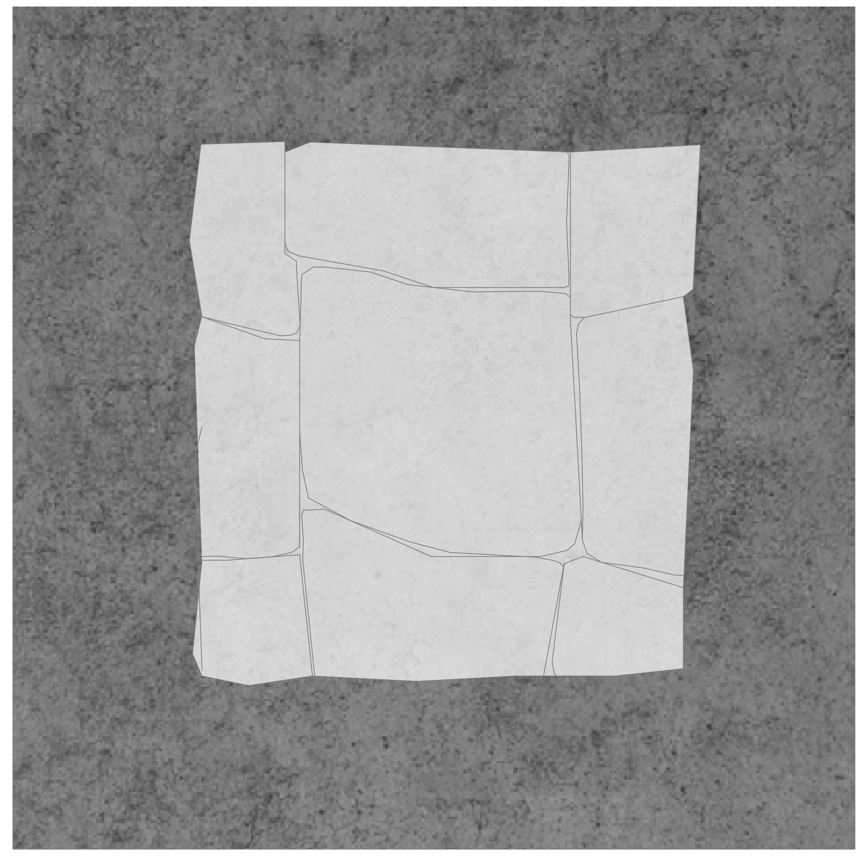




Reinforced concrete columns serve as the inner core of the pillars, helping them fulfill their structural support function.



The reinforced concrete columns are enveloped in marl, which is an excavation material sourced from the Isthmus.



Detailed view of a marl-encased column with a heterogeneous surface and varying plate sizes.

Overall view of a column adorned with marl casing.

Inspirations

Figure 42: Cava Arcari, David Chipperfields Architects, Vicenza, 2018

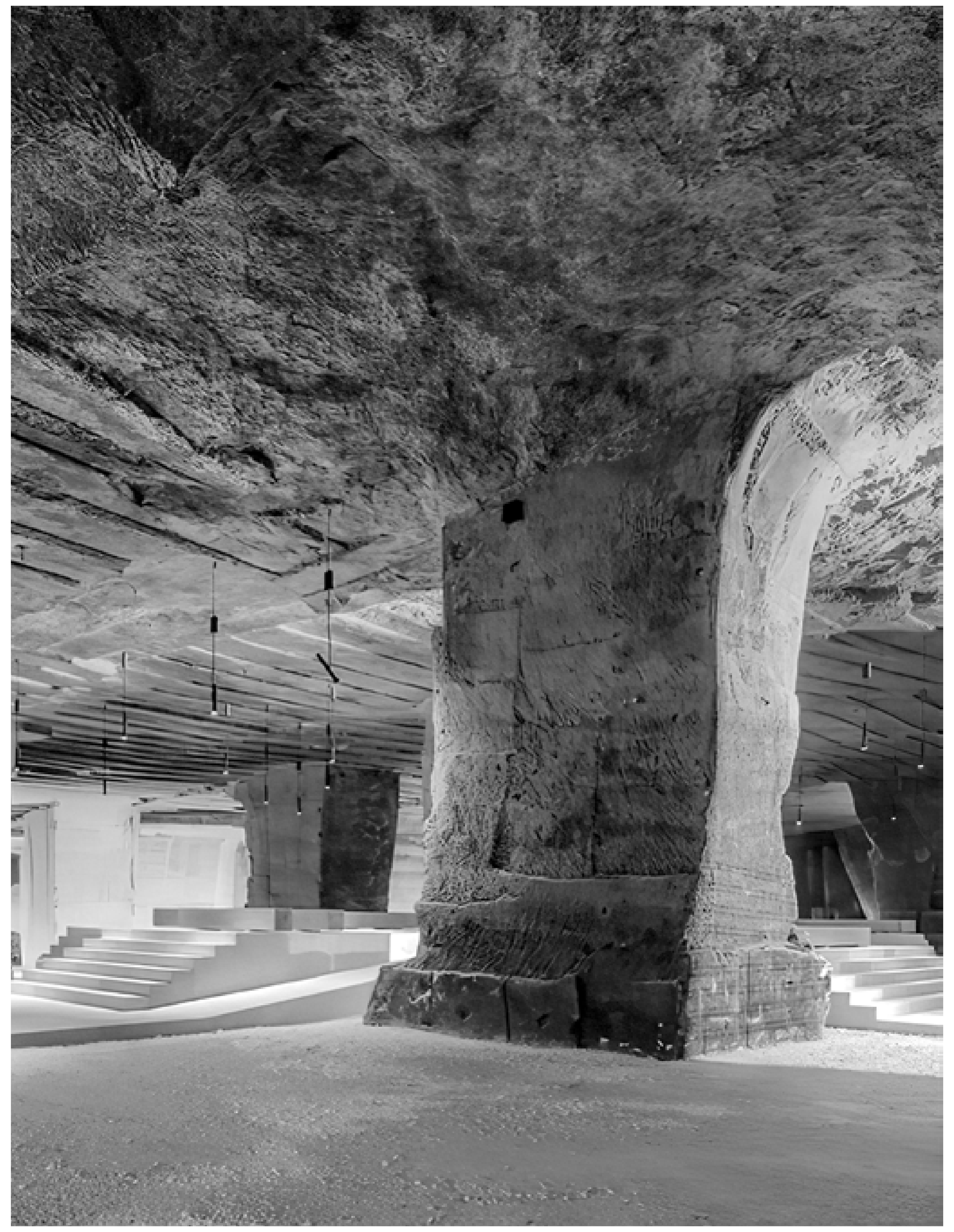


Figure 43: Cava Arcari, David Chipperfields Architects, Vicenza, 2018

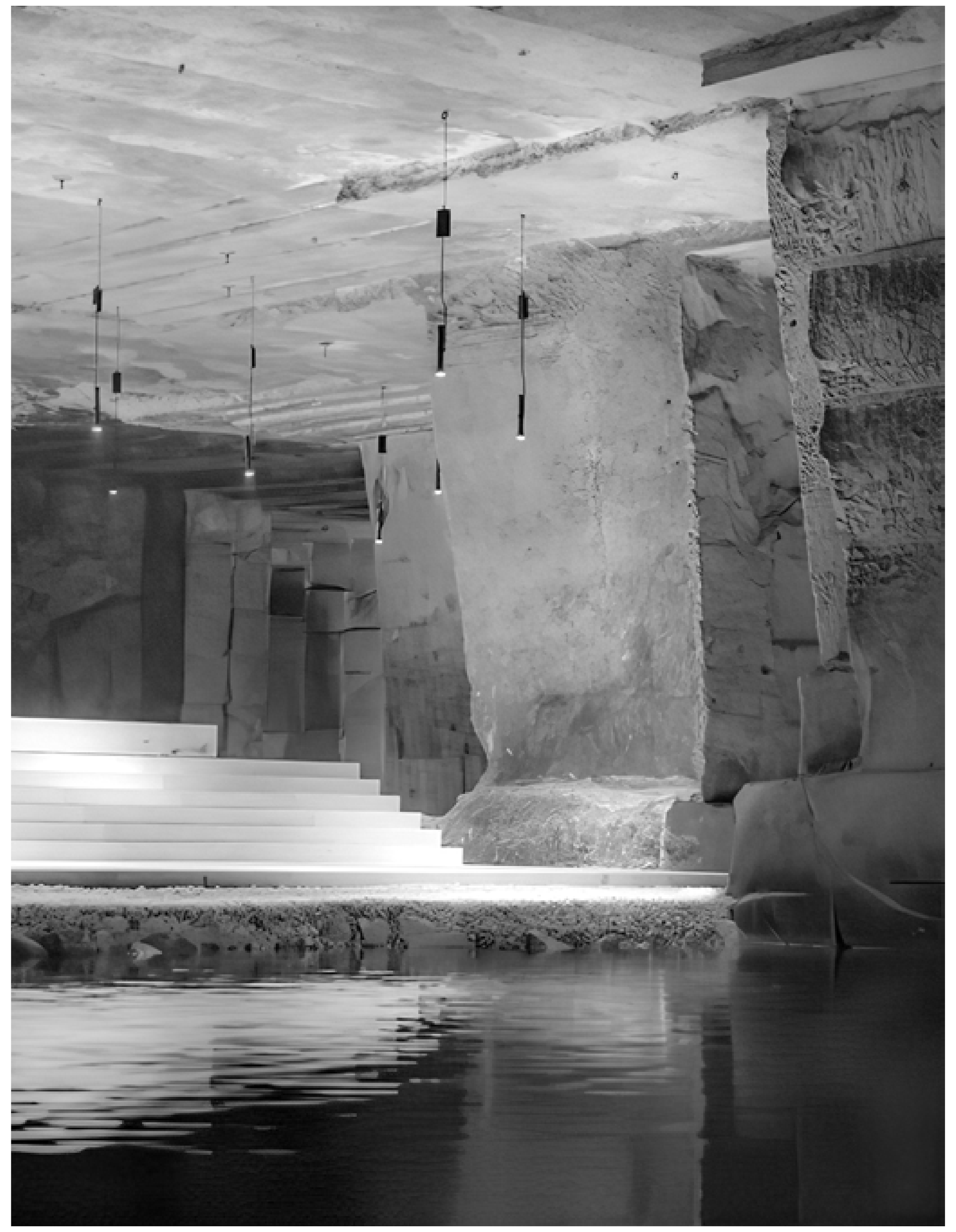
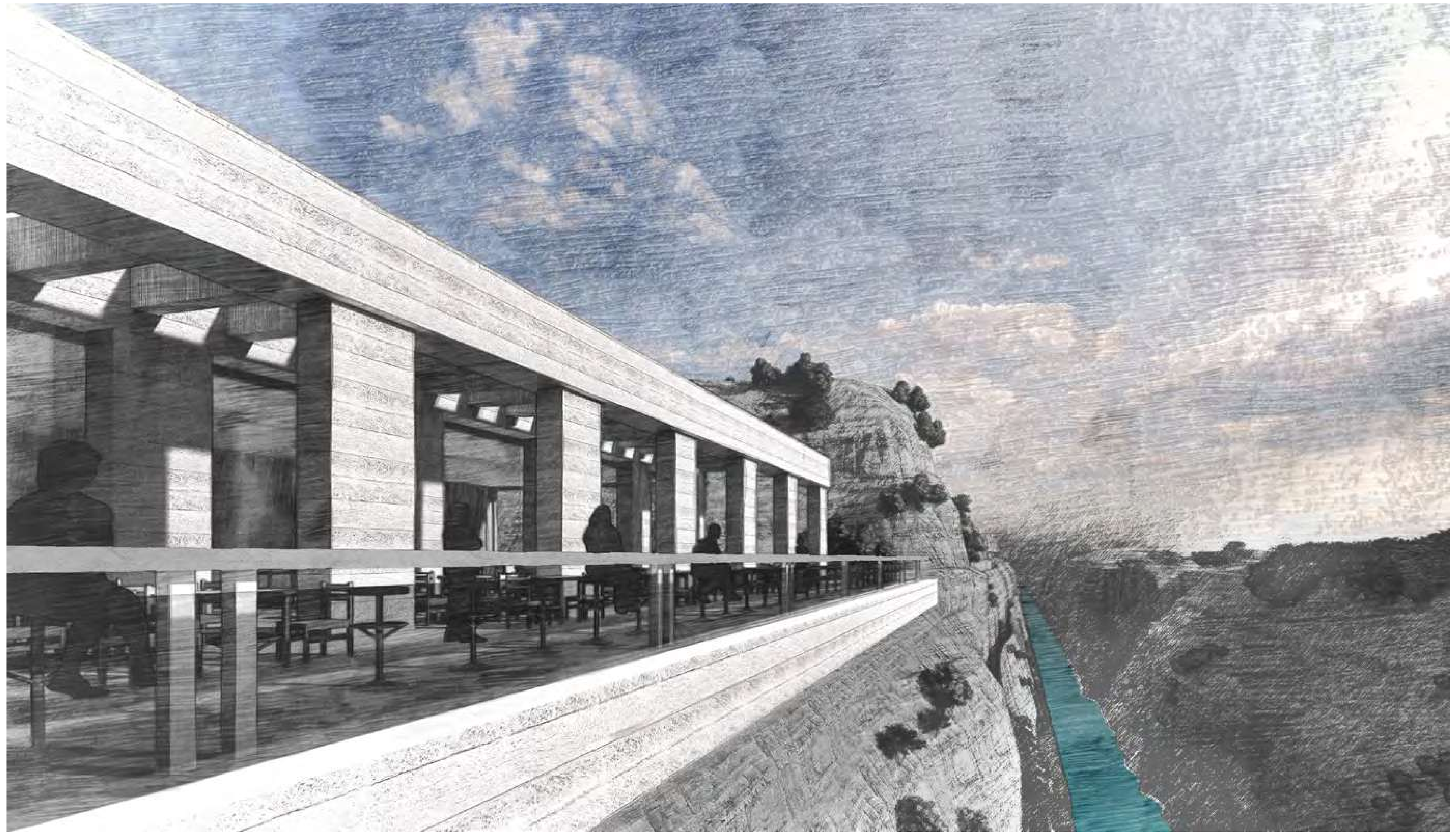


Figure 44: Cava Arcari, David Chipperfields Architects, Vicenza, 2018

Café



Architectural Drawings

1: Building complex
2: New road to the building complex
3: Old national road

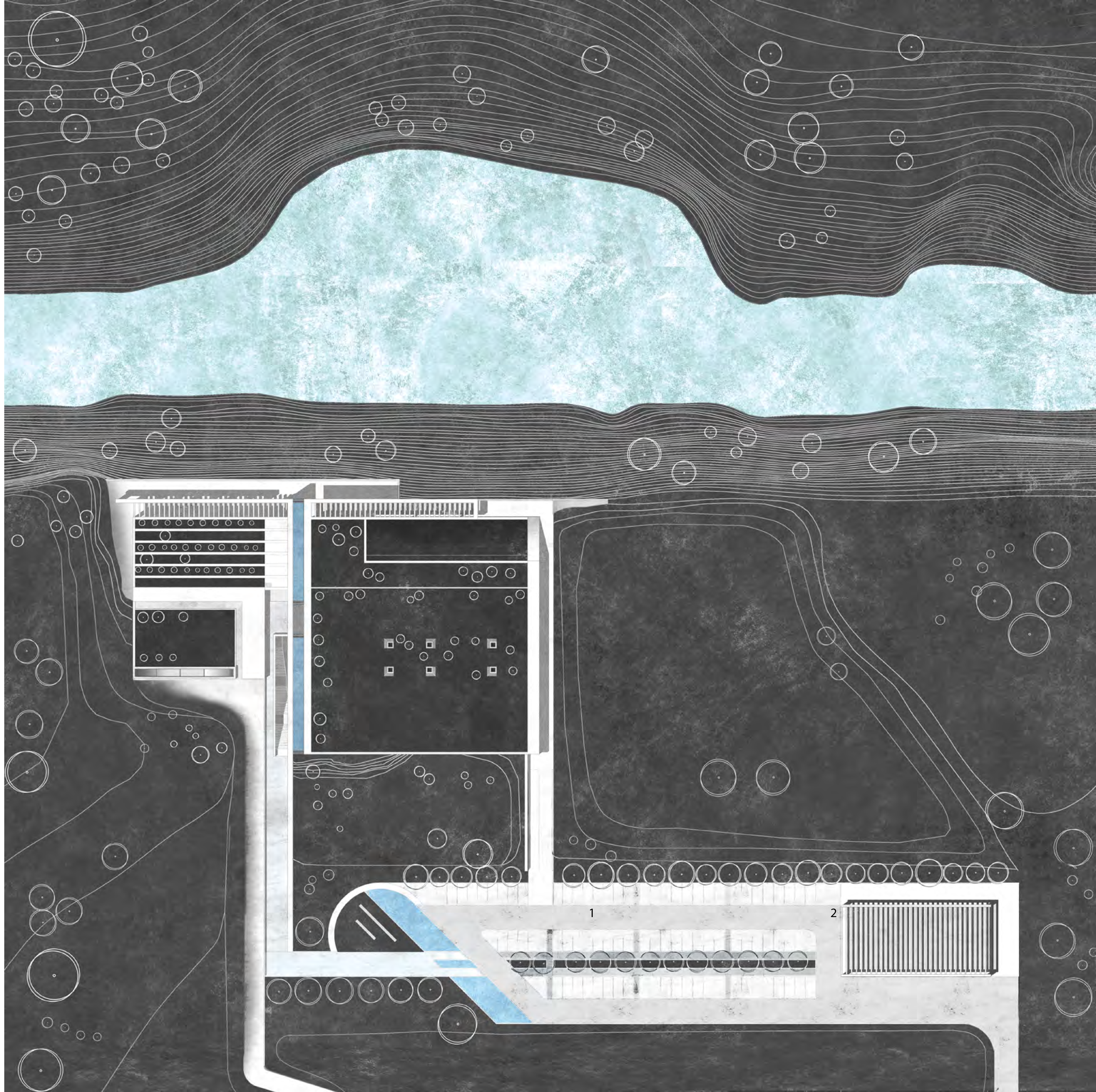
Site plan

Scale 1:4000

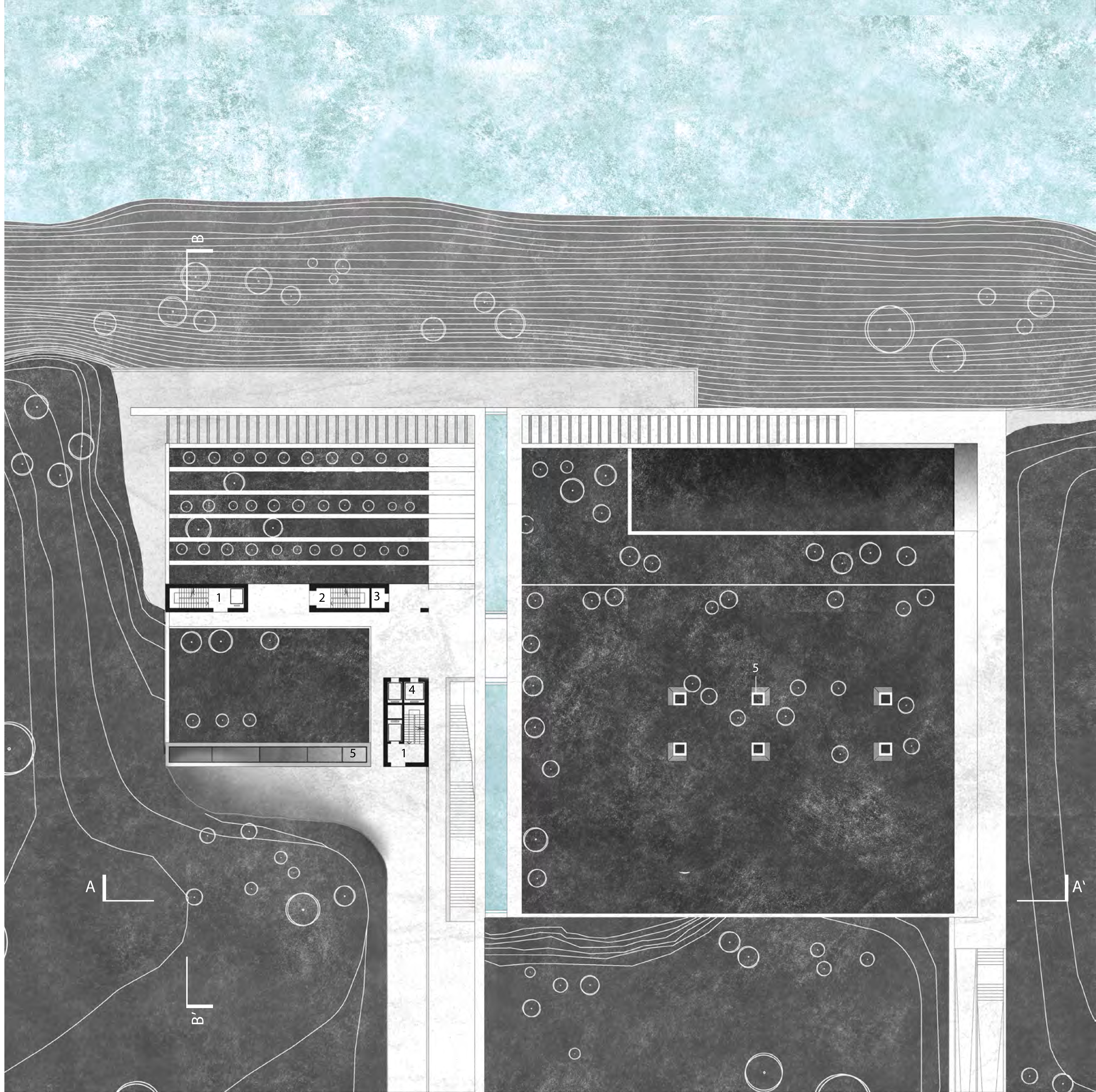
1: Parking lots
2: Covered parking lots for buses

Site plan

Scale 1:1000



1: Service staircase and elevator
2: Service staircase
3: Storage room
4: Public elevator
5: Light shafts



Floor plan - building utilities

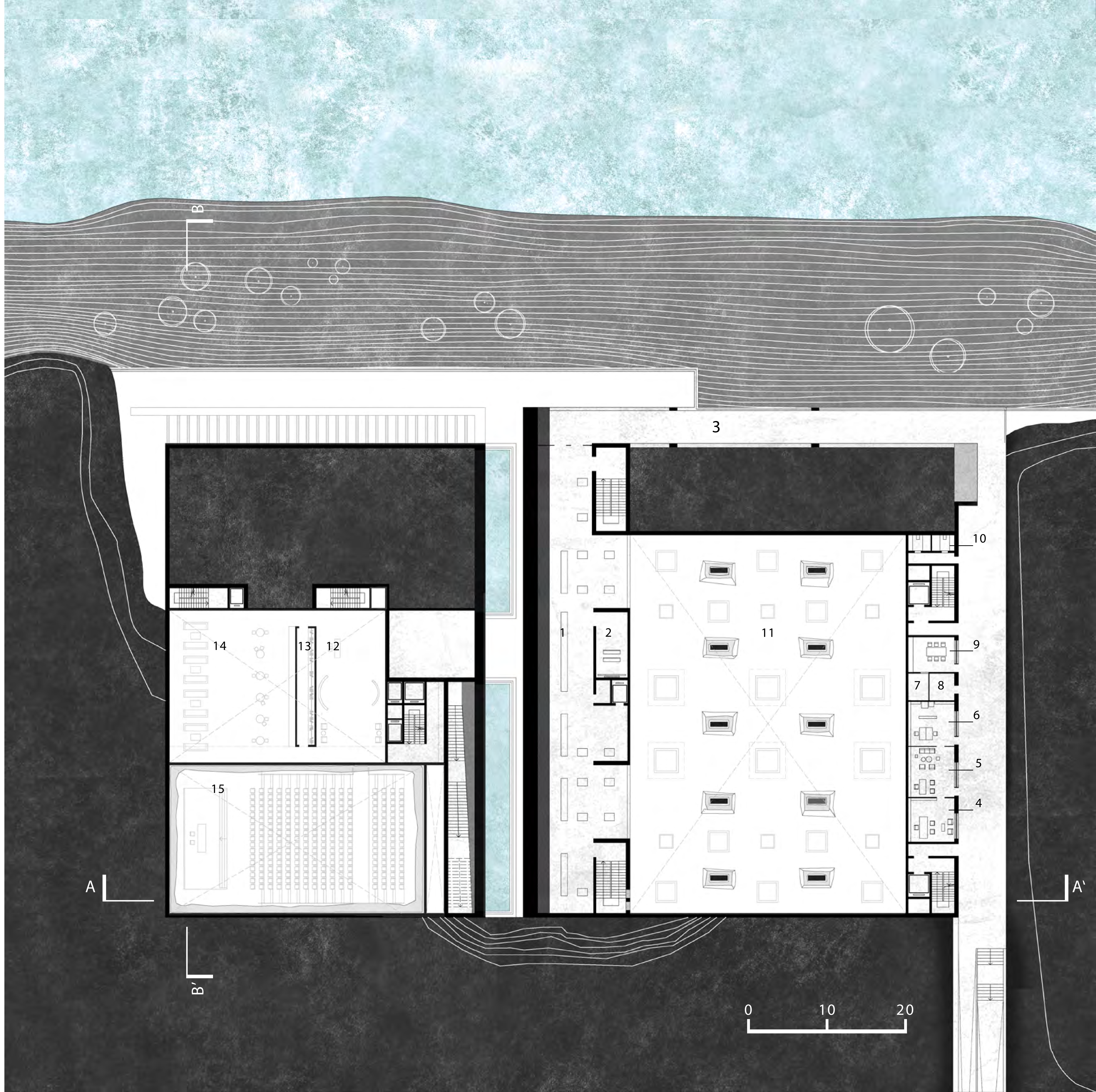
Scale 1:500

First floor (level-1)

Primary spaces	m^2
1: Temporary exhibition space	430.70
2: Media room	32.70
3: Terrace	
Administration	154.89
4: Director’s office	31.70
5: Secretary’s office	35.35
6: Administration office	31.64
7: Storage room	7.75
8: Trash room	10.25
9: Kitchen and breakarea	27.30
10: Toilet facilities	10.90

Main floor (level -2)

11: Exhibition space
12: Foyer
13: Cloakroom
14: Lobby
15: Auditorium



First floor (level -1)

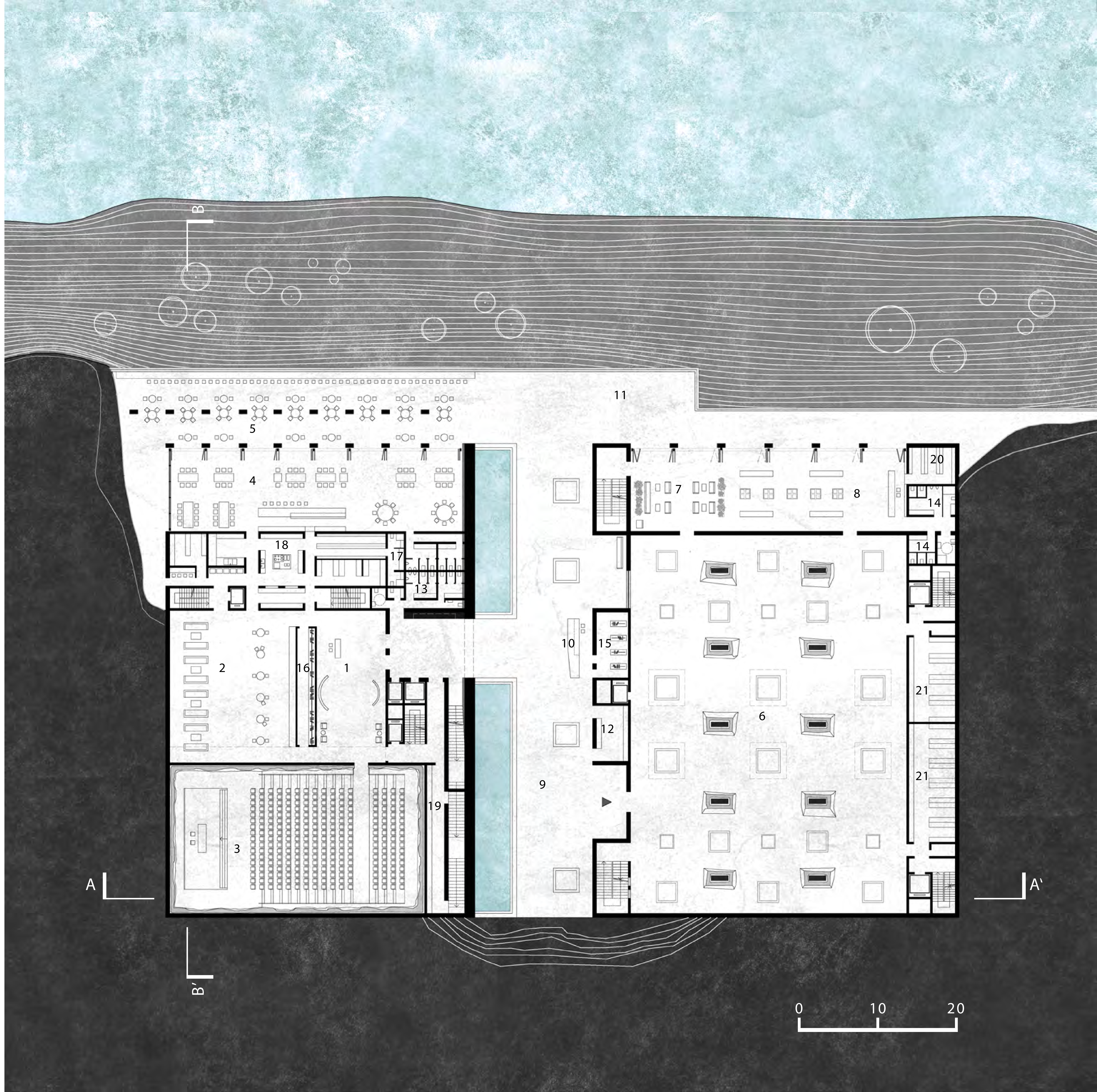
Scale 1:500

Primary spaces	m²
1: Foyer	173.00
2: Lobby	305.60
3: Auditorium	606.00
4: Café seating area	360.30
5: Terrace Café	474.50
6: Permanent exhibition	1 608.60
7: Lounge area	135.10
8: Museum shop	235.00
9: Atrium	
10: Ticketing area	
11: Terrace-View point	

Secondary spaces	m²
12: Lockers	26.40
13: Toilet facilities public	78.76
14: Toilet facilities public	40.30
15: Cloakroom museum	31.60
16. Cloakroom auditorium	38.60
17: Staff facilities (dressing room, WC)	13.00
18: Café secondary spaces	202.10
Glassware and dish storage	26.20
Cooling room	18.60
Freezer	9.25
Preparation area	24.70
Kitchen	23.60
Dishwashing area	18.90
Garbage room	5.80
Food storage room	17.80
Staff break area	7.00
Circulation area	50.25
19: Storage room	44.00
20: Storage room for shop	25.90
21: Storage room	143.00

Main floor (level -2)

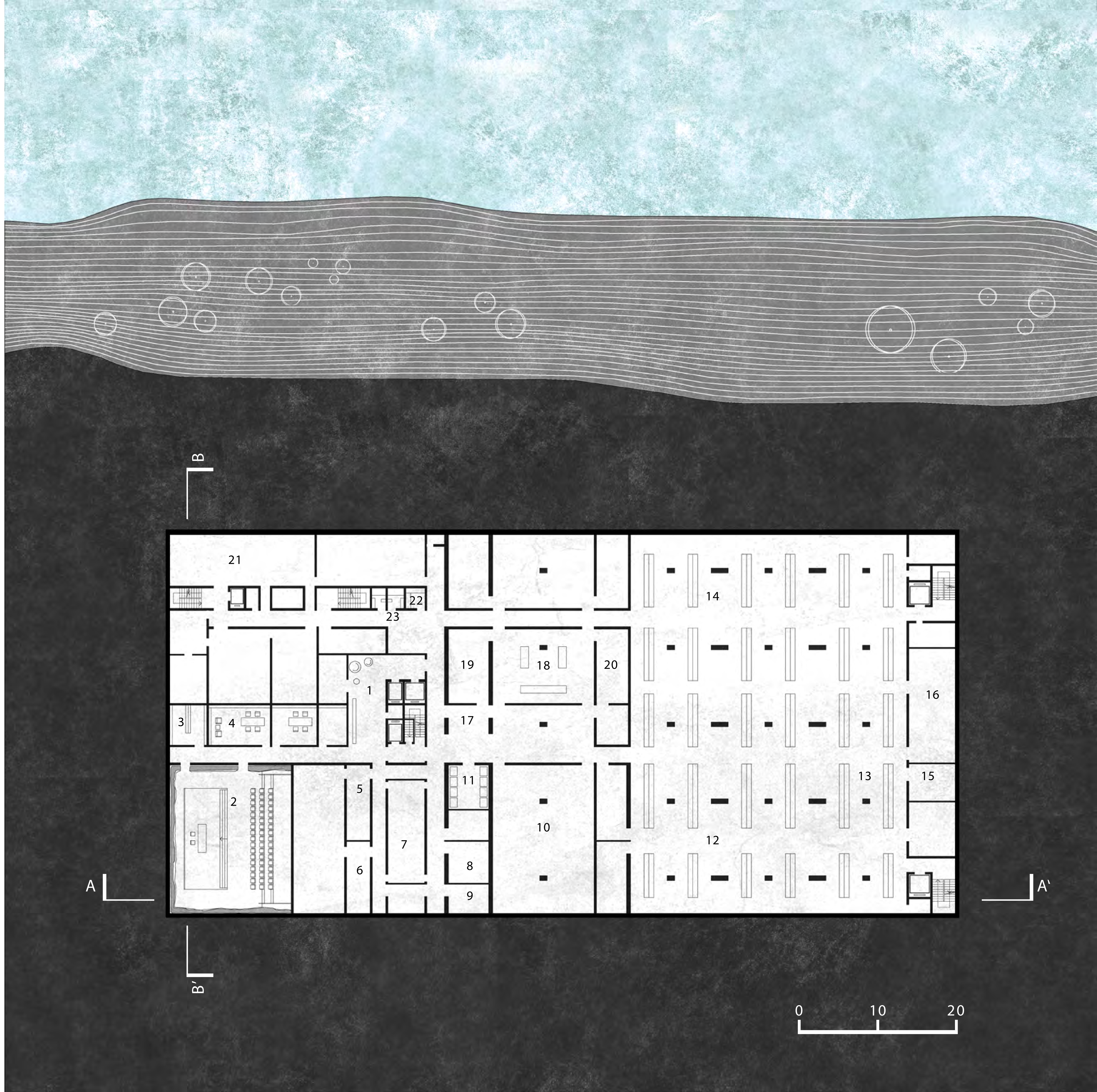
Scale 1:500



	m²
Lower level (level -3)	4.465
1: Public entrance hall	68.27
2: Auditorium (partly visible on plan)	276.90
3: Archive	23.60
4: Green room	69.80
5: Lighting control room	27.06
6: Cable management room	25.60
7: Equipment maintenance room	58.70
8: Climate control room	27.30
9: Ventilation room	17.26
10: Technical room	231.80
11: Garbage room	30.40
12: Storage management	370.00
13: Collections storage	289.80
14: Depot (museum)	955.00
15: Utility closet	26.00
16: Storage room for shop	89.46
17: Receiving and unpacking area	123.80
18: Restoration room	116.80
19: Material storage	46.14
20: Equipment storage	36.18
21: Cafe / Restaurant storage	224.00
22. Coffee Station	7.30
23. Staff restroom	9.90
Remaining roooms with	740.00
Circulation area	573.40

Lower level (level -3)

Scale 1:500



Ceiling hights

Main Exhibition Space: 7.20 m

Temporary Exhibition Space: 2.80 m

Museum Shop: 3.00 m

Auditorium: 10.50 m

Cafe: 4.40 m

Administration: 2.80 m

Lowest floor level -3: 2.45 m

Section AA'

Scale 1:500

Section AA′

Scale 1:250

Ceiling hights

Main Exhibition Space: 7.20 m

Temporary Exhibition Space: 2.80 m

Museum Shop: 3.00 m

Auditorium: 10.50 m

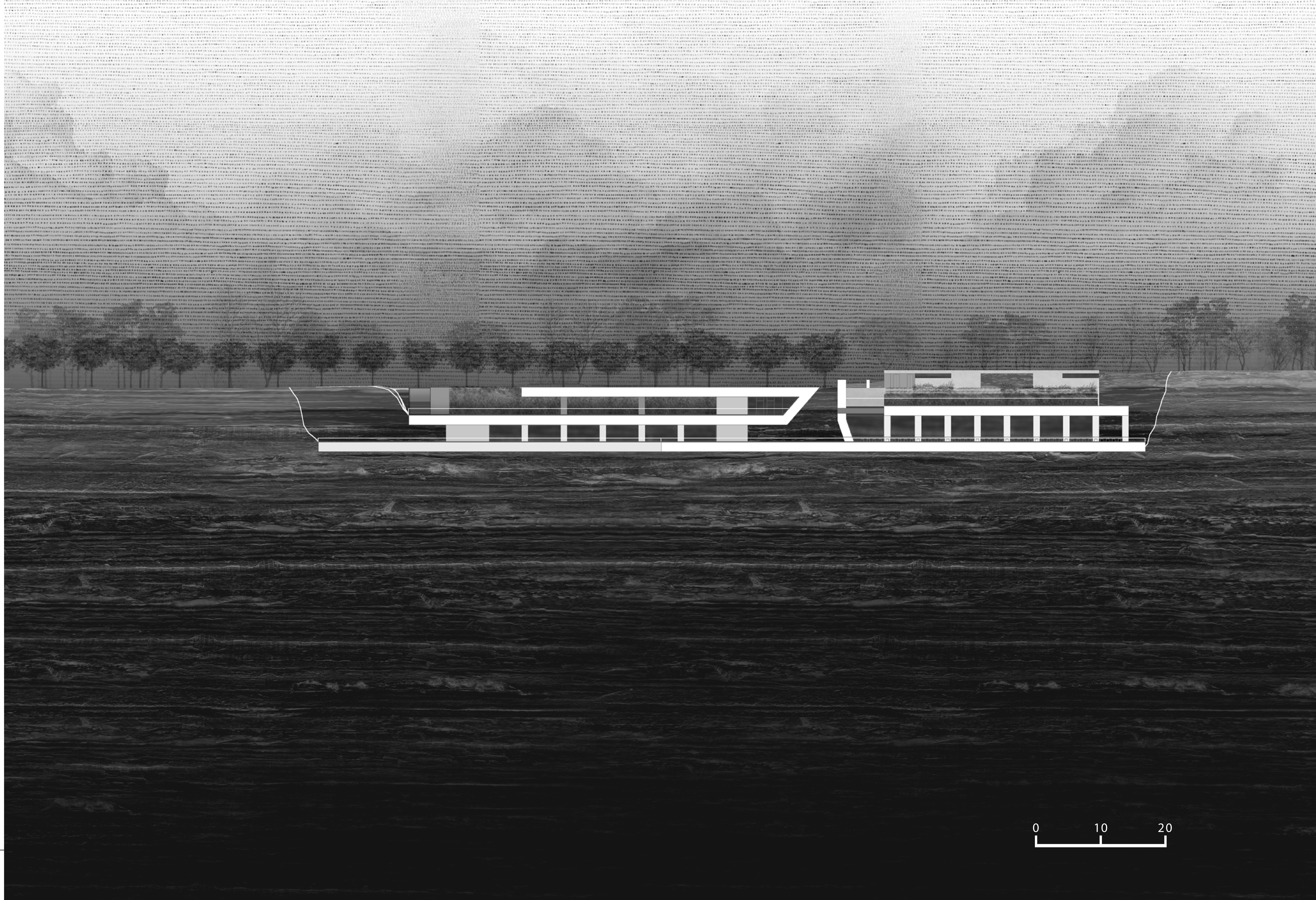
Cafe: 4.40 m

Administration: 2.80 m

Lowest floor level -3: 2.45 m

Section BB'

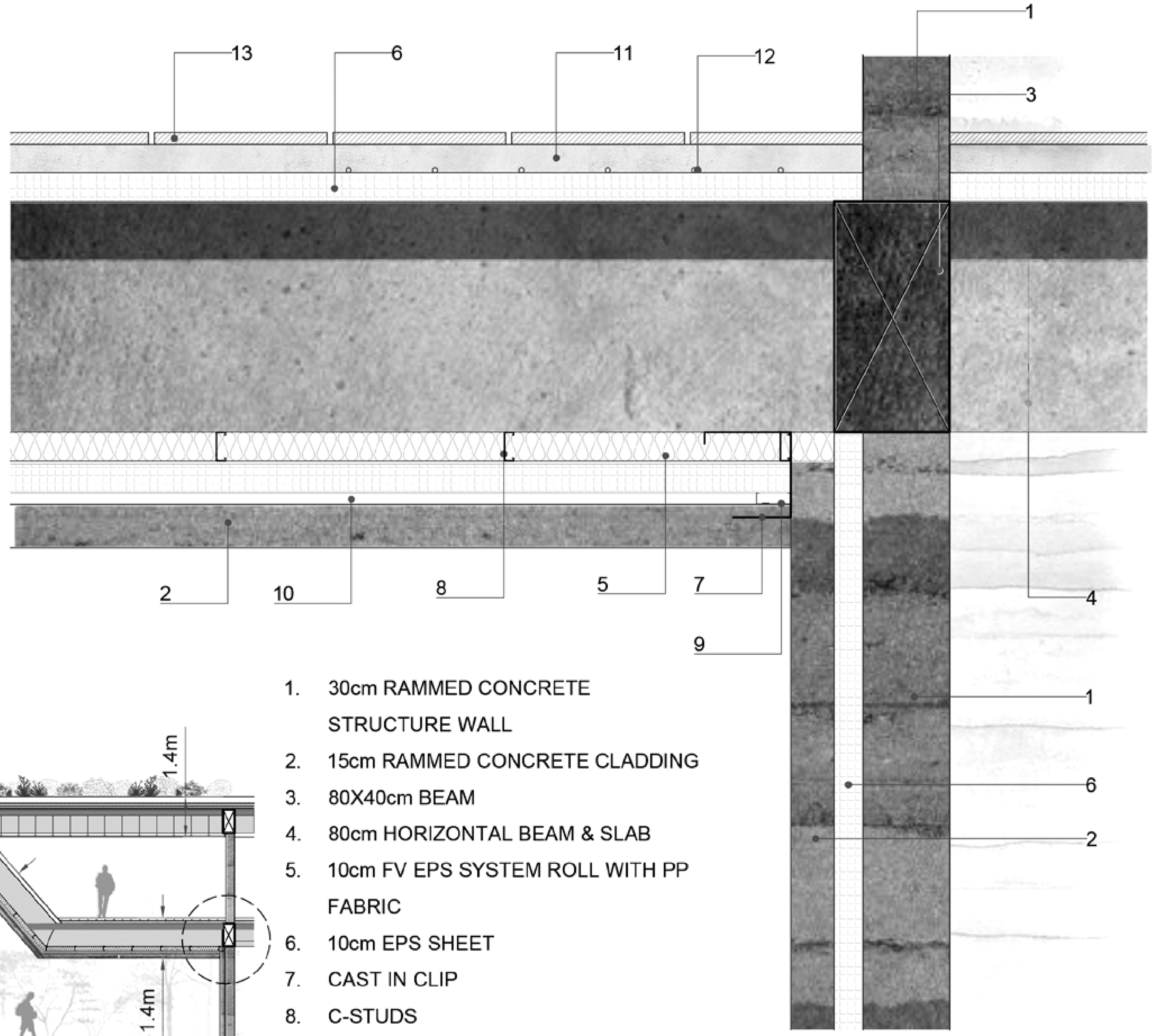
Scale 1:500

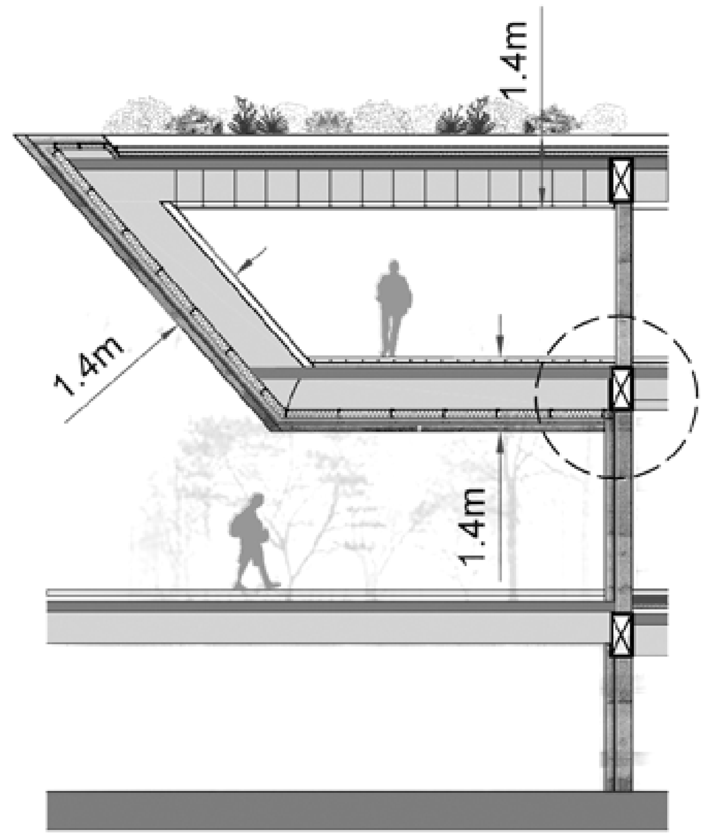


Front View

Scale 1:500

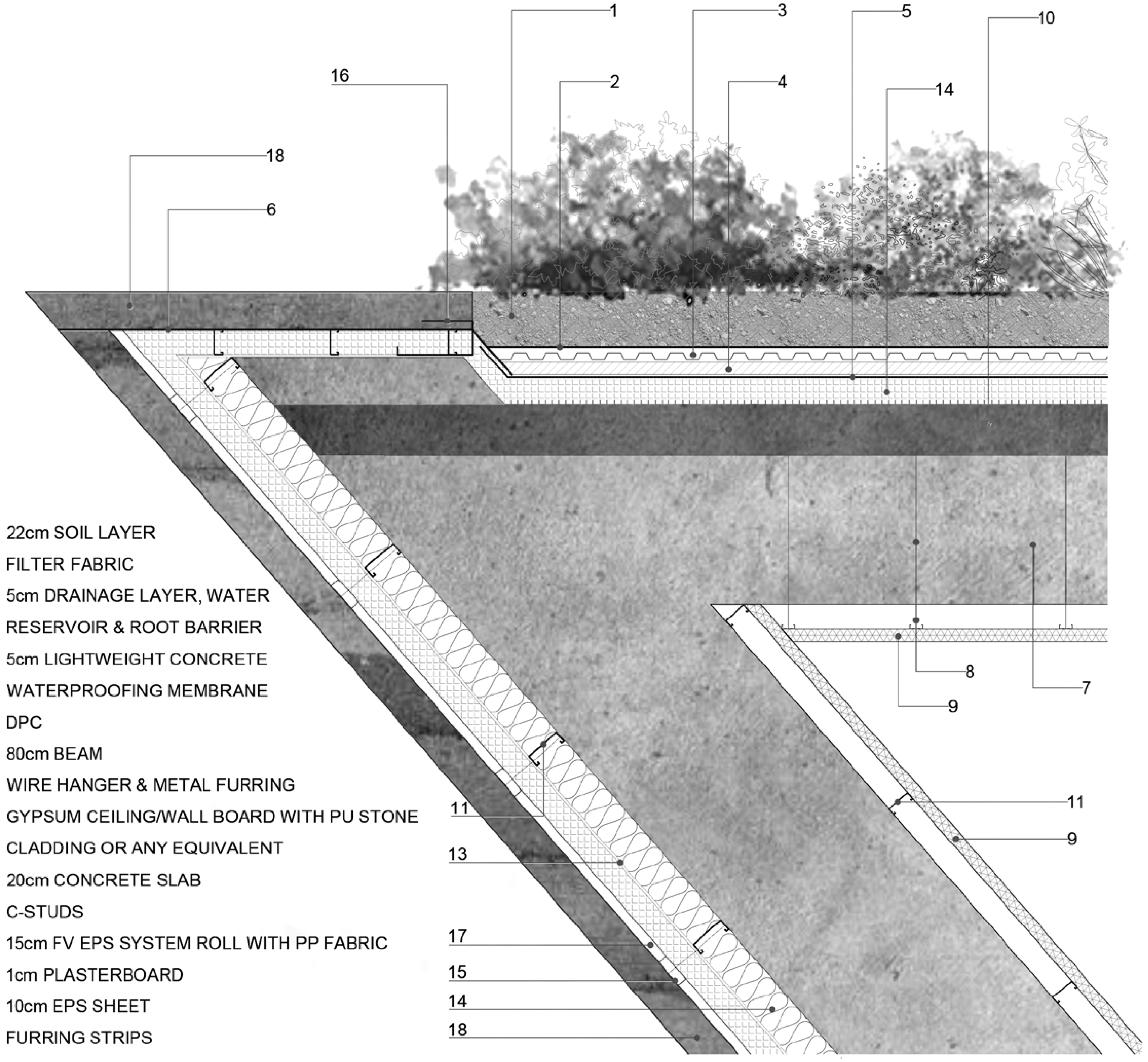
Details





1. 30cm RAMMED CONCRETE STRUCTURE WALL
2. 15cm RAMMED CONCRETE CLADDING
3. 80X40cm BEAM
4. 80cm HORIZONTAL BEAM & SLAB
5. 10cm FV EPS SYSTEM ROLL WITH PP FABRIC
6. 10cm EPS SHEET
7. CAST IN CLIP
8. C-STUDS
9. FURRING STRIPS
10. AIR CAVITY
11. 10cm CEMENT SCREED
12. 15mm Ø HEATING PIPE WITH TACKER CLIP FOR PIPE FASTENING
13. NATURAL STONE TILES

FLOOR AND WALL DETAILS 1:20



1. 22cm SOIL LAYER
2. FILTER FABRIC
3. 5cm DRAINAGE LAYER, WATER RESERVOIR & ROOT BARRIER
4. 5cm LIGHTWEIGHT CONCRETE
5. WATERPROOFING MEMBRANE
6. DPC
7. 80cm BEAM
8. WIRE HANGER & METAL FURRING
9. GYPSUM CEILING/WALL BOARD WITH PU STONE CLADDING OR ANY EQUIVALENT
10. 20cm CONCRETE SLAB
11. C-STUDS
12. 15cm FV EPS SYSTEM ROLL WITH PP FABRIC
13. 1cm PLASTERBOARD
14. 10cm EPS SHEET
15. FURRING STRIPS
16. CAST IN CLIP
17. AIR CAVITY
18. 15cm RAMMED CONCRETE CLADDING

ROOF AND WALL DETAILS 1:20

Exterior Perspective of the Building Complex

Perspective of Atrium

Bird’s-Eye View of the Architectural Proposal on the Isthmus of Corinth

Literature

Bahhou, A., Taha, Y., Khessaimi, Y. E., Hakkou, R., Tagnit-Hamou, A., & Benzaazoua, M. (2021). Using calcined marls as non-common supplementary cementitious materials—a critical review. Minerals, 11(517).

Boggs, S. (2006). Principles of sedimentology and stratigraphy (4th ed.). Pearson Prentice Hall. p. 172. ISBN 0131547283.

Christulas, S., Kalteziotis, N., & Tiambaos, G. (1984). Geotechnical Problems in a Bridge over Corinth Canal. First International Conference on Case (σσ. 849-854). Missuri University of Science and Technology.

Ciancio, D., & Beckett, C. (2013, August). Rammed earth: An overview of a sustainable construction material. In Proceedings of the Third International Conference on Sustainable Construction Materials and Technologies, Kyoto, Japan (pp. 18-21).

Corinth Canal Company (A.E.DI.K.). (n.d.). The history of the canal. Retrieved from https://corinthcanal.com/the-canal/the-history-of-the-canal/?lang=en

CorinthCanal-SA. (n.d.). The beginning. Retrieved from https://corinthcanal.com/

Gallivan , P. (1973). Nero's Liberation of Greece. Hermes, 101(2), 230-234. Retrieved from https://www.jstor.org/stable/4475791

Hopper, R. (1955). Ancient Corinth. Greece & Rome, 2(1), 2-15. Retrieved from https://sci-hub.se/https://www.jstor.org/stable/642202

Papafotiou, A. (2010). The Isthmus Canal : A miracle of Technology of 19th century. Lecture in TEE Peloponnisou. TEE Peloponnisou.

Papagianni, A. (2021). Isthmus of Corinth: A Historical Overviiea and Prospects of Development. Master Thesis Dissertation. Macedonian Academy of Commercial Navy.

Pettegrew , D. (2006). Corinth on the Isthmus : Studies of the End of an ancient landscape. Dissertation. University of Ohio.

Pettegrew, D. (2011). The Diolkos of Corinth. American Journal of Arcaeology, 115(4), σσ. 549-574.

Thomas, P. (2022). Investment Breaths New Live into Corinth Canal. Marine Traffic Blog. Retrieved from https://www.marinetraffic.com/blog/investment-breathes-new-life-into-corinth-canal/

Vasilas, V., & Konstantogiannis, M. (2017). Corinthus. University of Piraeus.

Werner , W. (1997). The Largest Ship trackway in Ancient Times : The Diolkos od the Isthmus of Korinthus. International Journal of Nautical Archaeology, 26(2). 98-119.

Zakinthinou, M. (2017). Between the Boundary and the Excavation: A Geopolitical Composition in the Corinth Canal. National Metsovio University Greece.

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