SUMMARY

The project **“Cooling Havens: Water-Powered Neighborhood Cooling and Engagement Stations”** addresses the urban heat burden in Athens through the reintroduction of the water element into the urban landscape. The natural paleoenvironment of Attica once featured an extensive hydrographic network (Kifissos, Ilissos, Eridanos) that offered natural cooling. Rapid urbanization led to the systematic boxing (enclosure) of these rivers, resulting in the intensification of the urban heat island phenomenon and an increase in vulnerability to flood events.

The project aims at the **effort for partial restoration** of this balance and the **active mitigation of the impacts of the urban heat island**, drawing upon the rich mythological and cultural heritage of water in ancient Athens, while simultaneously functioning as a modern cooling mechanism and an educational platform. This holistic approach bridges the past with a sustainable, water-centric future for the city.

1. INTRODUCTION: THE HYDROCENTRIC REVIVAL OF ATHENS

The project "Cooling Havens: Water-Powered Neighborhood Cooling and Engagement Stations" in Athens is not just a modern response to the challenges of climate change and urban heat burden. It constitutes a deep revival of the city's lost relationship with the water element, drawing inspiration from its natural paleoenvironment and the intrinsic link between water and its cultural heritage.

1.1 The Natural Paleoenvironment: From Visible Streams to "Invisible" Waterways

Athens, today a densely built metropolis that often experiences extreme temperatures, once had a radically different natural paleoenvironment. The basin of Attica was previously crossed by an extensive hydrographic network, with the Kifissos, Ilissos, and Eridanos being the most significant rivers. These rivers were vital arteries that shaped the geomorphology of the area, irrigating fertile lands — such as the famous Attic Olive Grove — and offering natural coolness, directly influencing the city’s microclimate and making it much more sustainable.

The rapid urbanization of the 19th and 20th centuries, driven by the need to expand the road network and the pursuit of "modernization," led to the systematic enclosure of the rivers and streams, transforming them into "invisible" subterranean conduits. This intervention resulted in the loss of natural cooling, the intensification of the urban heat island phenomenon, and the increased vulnerability to flood events. The Cooling Stations aim, symbolically and functionally, to reintroduce the water element to the city's surface, reproducing the cooling effect of the rivers with modern means. It is an attempt to heal the trauma caused by the removal of water from the urban landscape.

1.2 Cultural Heritage: Water as the Soul of the Ancient City

Beyond its physical presence, water in ancient Athens was deeply connected to the city's cultural, mythological, and social life. This heritage is an invaluable asset for the Cooling Stations project. Rivers like the Kifissos were treated as deities, linked to myths, rituals, and sacred sites (such as Kallirhoe spring). Highlighting these narratives in the Cooling Stations transforms each installation into a place of collective memory.

The Cooling Stations, designed as "Engagement Stations," seek to revive the social function of the riverbanks by providing spaces for meeting, rest, and interaction, analogous to the ancient water sites. The reintroduction of water restores a morphological and aesthetic continuity with the ancient city.

1.3 The Holistic Approach of the Project: Bridging the Past and the Future

The "Water-Powered Neighborhood Cooling and Engagement Stations" represent a contemporary effort to bridge the natural and cultural past of Athens with a sustainable future. Through innovative water utilization techniques and the creation of new blue and green infrastructures, the project:

- Functions as a natural cooling mechanism, mitigating the effects of climate change.
- Acts as an educational platform, enhancing awareness about water resource management.
- Offers opportunities for citizen empowerment, cultivating environmental consciousness.

Emphasis is placed on reintegrating water into the urban fabric, making it a key element of public spaces and embedding a hydrocentric philosophy in urban planning. Through this holistic approach, the city can reclaim part of its lost identity and evolve into a cooler, greener, and more humane urban space.

2. GEOMORPHOLOGY, GEOLOGY, TECTONICS AND PALEOGEOGRAPHY OF THE KIFISSOS RIVER

The Kifissos River, with a name likely of Pelasgian origin suggesting its pre-Hellenic roots, is the largest river in Attica (27 km long), originating from Mounts Penteli and Parnitha and flowing into the Phaleron Bay. Its catchment area gathers the most significant percentage (67%) of the Attica basin's waters. In antiquity, the Kifissos was worshipped as a river deity, a symbol of fertility, hosting the Attic Olive Grove.

The geological structure of the Kifissos basin is critical for understanding its hydrogeology and flood phenomena. The basin was primarily formed by formations of the Pelagonian Zone. The main geological formations are:

1. **Jurassic Unit of "Schists-Cherts"**: Includes schists, clays, marls, and sandstones, often alternating with ophiolites. These rocks are generally impermeable and form the basement of the aquifer.
2. **"Athens Schists" (Upper Cretaceous - Paleocene)**: Consist of flysch and marls. Due to their low permeability, they act as aquitards, restricting the downward movement of water.

Newer formations covering the basement include:

- **Quaternary Deposits (Holocene Alluvial)**: Composed of sand, gravel, and pebbles. This is the most important aquifer in the basin, as it has high permeability and is the main source of groundwater in the area.
- **Neogene / Upper Miocene Deposits**: Lacustrine and fluvio-lacustrine deposits.

The current form of the Kifissos River and its basin is the result of Neo-Alpine tectonic processes.

- **Orogenesis**: Paleozoic and Neo-Alpine orogenies caused extensive folding and the creation of the Attica mountain ranges (Penteli, Parnitha).
- **Fault Zones**: The basin is crossed by two main fault zones that control the hydrography:
    - **NNE-SSW Fault**: Divides the basin: to the west, the Alpine basement has subsided, creating a tectonic trench (**graben**) filled with alluvial deposits, which forms the main flow zone of the Kifissos. To the east, the basement has been uplifted, forming a tectonic ridge (**horst**).

- **WNW-ESE Fault**: Controls the flow of groundwater and determined the river's course locally.

The paleo-geographic evolution of the Kifissos basin spans over 300 million years. The basin emerged during the Upper Miocene (10 – 6 million years ago), with the creation of lakes and lagoons within the tectonic trench. The Kifissos River, in its unified form, was created during the Middle Pleistocene (approximately 781,000 – 126,000 years ago), as a result of tectonic activity and climatic changes that allowed the connection of the isolated northern and southern hydrographic networks and the drainage of the pre-existing lacustrine systems, with the waters finding their final outlet into the Saronic Gulf. The Holocene period led to the current appearance of the basin, with an asymmetrical hydrographic network that maintains its original direction, draining into the Saronic Gulf.

3. THE ILISSOS AND ERIDANOS RIVERS

The Ilissos, one of the three historic rivers of Athens, originates from Mount Hymettus and flows southwest for about 10 kilometers. Its basin consists of schists, limestones, and flysch. The mountainous mass of Hymettus (marble and schist) feeds the river. The Ilissos is a seasonal river (**torrential**), its flow directly dependent on rainfall and subterranean runoff. Like the Kifissos, the Ilissos was sacred and often mentioned by ancient philosophers, underscoring its cultural significance.

The Eridanos is a smaller, but historically important, river originating from Lycabettus or Strefi Hill. Its riverbed is structured by loose sediments (marls and flysch), making it vulnerable to erosion and interventions. Its flow is now intensely controlled and channeled through underground conduits due to urbanization. Its ancient course is now visible only through excavations, such as in the Ancient Agora and Kerameikos, where it functioned as a natural boundary.

4. ANTHROPOGENIC INTERVENTIONS AND URBAN TRANSFORMATION

The uncontrolled urban development since 1834 led to a drastic alteration of the hydrographic network. It is estimated that approximately **850 km** of streams have been covered or filled in the last 75 years (out of over 700 streams, fewer than 50 remain today). The covering of streams and the impermeability of the ground (by asphalt and construction) increase the **runoff coefficient**, resulting in a faster and larger volume flow of rainwater into the central conduit and significantly increasing the risk and frequency of flood phenomena in the plain area.

The main regulation project took place ahead of the 2004 Olympic Games, during which approximately **13 kilometers** of the Kifissos riverbed were enclosed in a closed concrete conduit, upon which the Kifissou Avenue was constructed. While the project aimed at flood mitigation, it led to the destruction of riparian habitats, the alteration of the microclimate, and the perpetuation of pollution.

In the Ilissos and Eridanos, interventions resulted in their complete covering. The replacement of the green, wet surface with impermeable materials increased the absorption of solar radiation and reduced evapotranspiration. This shift in energy balance intensified the **Urban Heat Island (UHI)** phenomenon.

Of interest is the complex system of the **Hadrianic Aqueduct** (120-140 A.D.), which ingeniously utilized the groundwater potential of the river basin to supply Athens with water. Modern interventions have severed the connection between the urban fabric and the once visible and worshipped rivers, turning them into "invisible" underground channels.