PLAN B

“Future waterscapes”

Baan Taweel

P5 Presentation
17 January 2024

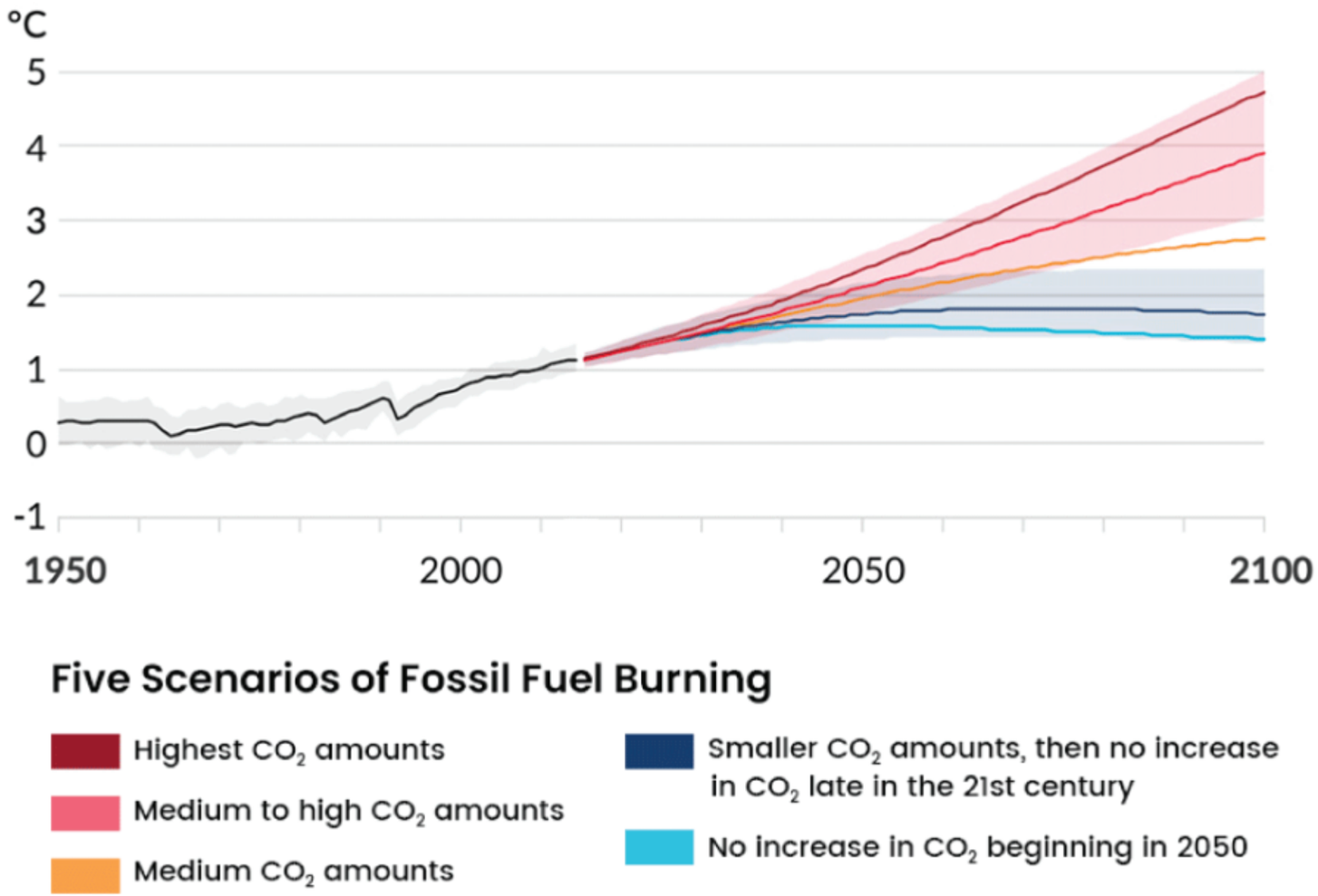
Architectural Engineering Graduation Studio
Delft University of Technology

Introduction

Problem statement

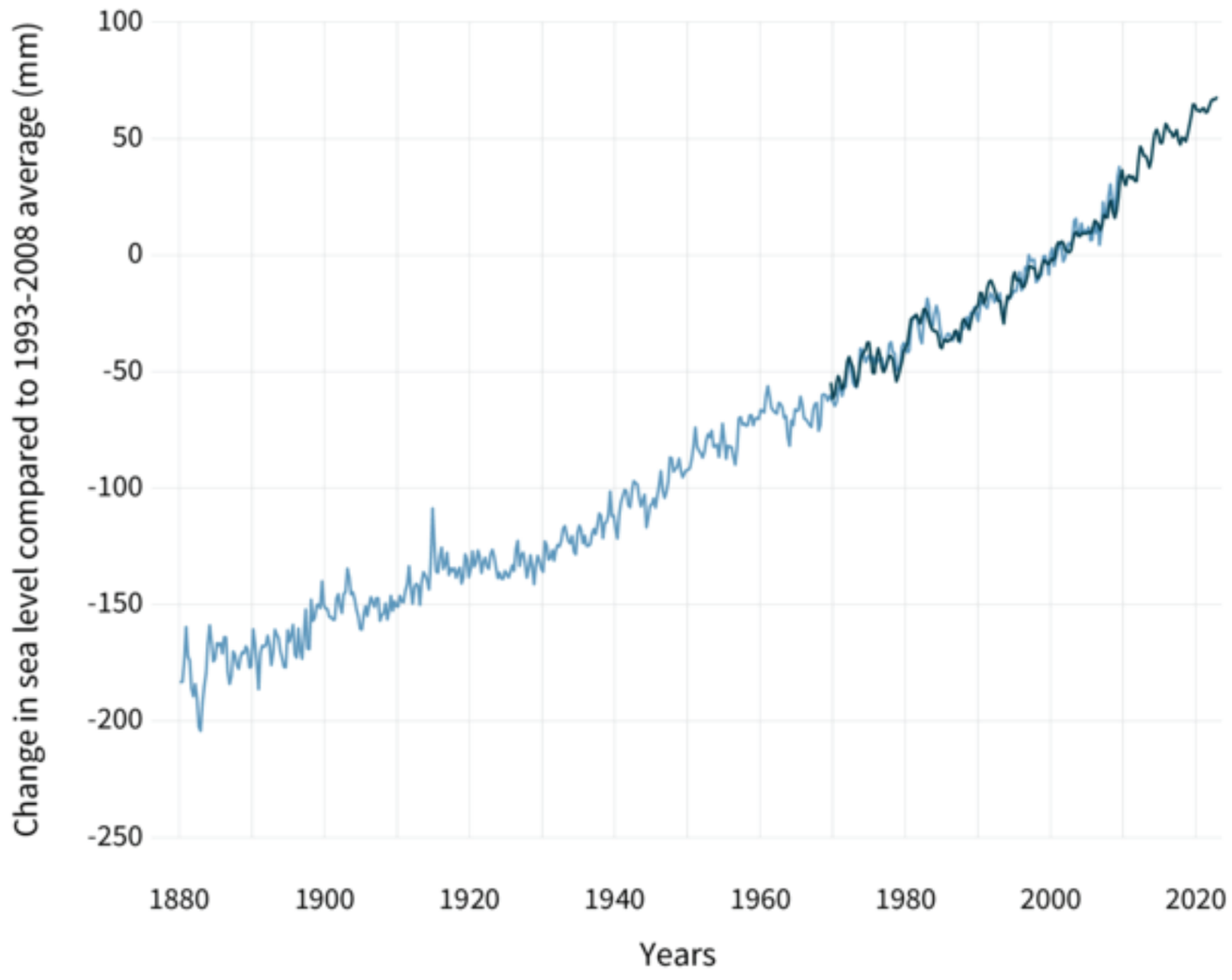
Objective/project aim

Projected Temperature Increase



Source: https://scied.ucar.edu/learning-zone/how-climate-works/why-earth-warming

Global sea level



Source: https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level

Current situation NL 2023

50 km

N

NL in 2050 without intervention

50 km

N

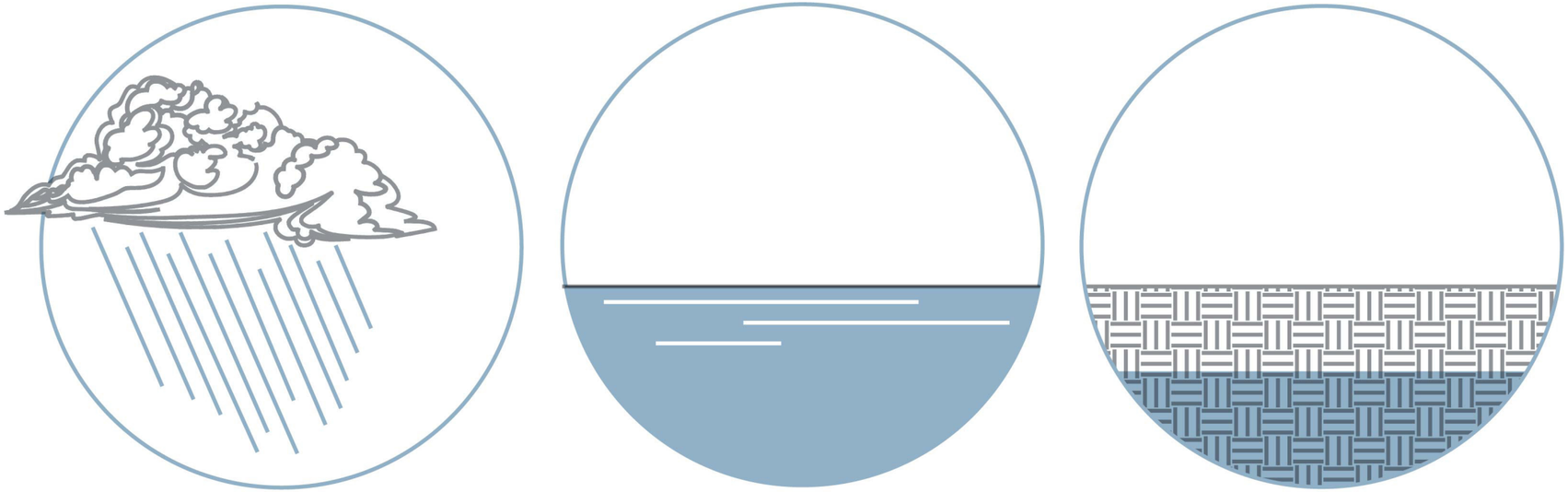
NL LOLA LANDSCAPES 2200

50 km

N

Hydrological system

Natural form



Rainwater

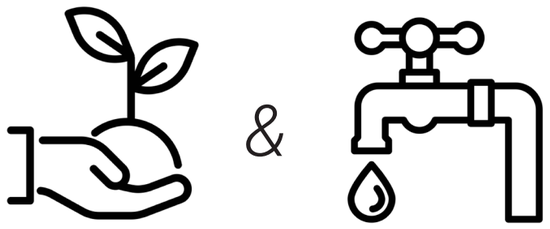
Surface water

Groundwater

Problem

The Netherlands (flooded scenario) --> *Sea water (salt) + River water (sweet) =* *Brackisch water*

Problem for ecology and drink water



Huge shortage of drinkwater

(Not only in the Netherlands)

INTERVIEW **HENK OVINK** SCHEIDEND WATERGEZANT

‘De wereld moet zich meer zorgen maken over zoet water’

Alles draait om water, zegt Henk Ovink, die na acht jaar afscheid heeft genomen als watergezant van Nederland. „We begrijpen water nog zo slecht.”

Door onze redacteur **Paul Luttikhuis** Foto’s **Cynthia van Elk**

Water is alles. Dat is de onontkoombare conclusie van een gesprek met Henk Ovink. Ruim acht jaar was hij de watergezant van Nederland. Een paar weken geleden nam hij afscheid. Hij is nog in New York om zijn laatste werkzaamheden af te ronden. Het is de stad waar hij van 2013 tot 2015 faam maakte als *‘Henk, the water guy’*, adviseur bij de wederopbouw na de verwoestende orkaan Sandy. En waar Nederland afgelopen maart samen met Tadzjikistan voor de Verenigde Naties een mondiale waterconferentie organiseerde, de grootste in veertig jaar. Die conferentie was de afsluiting van Ovinks gezantschap.

Water is alles. Henk Ovink zegt het letterlijk en, in een lang videogesprek vanuit een kantoor van de New York University waar hij betrokken is bij de organisatie Rebuild by Design, in allerlei variaties: water zit aan alles vast; als je water centraal stelt, moet iedereen een plek aan tafel; water is echt magisch; ik zeg altijd, water is een *‘solution space’*, een plek waar je oplossingen kunt vinden; water geeft altijd hoop.

> Dit is de kracht van water: het brengt alles en iedereen bij elkaar

Ovink weet ook wel dat zijn lofzang een keerzijde heeft. „We begrijpen water nog zo slecht”, legt hij uit. „Het gevolg is dat water destructiever wordt nu het klimaat verandert. Als er te veel is, kan water heel verwoestend zijn. Zoals onlangs in Libië. Een hele stad weggespoeld, duizenden mensen omgekomen. Drie jaar geleden gebeurde iets vergelijkbaars in Duitsland, België en Limburg. Niet in dezelfde omvang, maar die waterbom in onze omgeving veroorzaakte wel meer dan tweehonderd doden en heel veel schade, vooral in Duitsland.”

Hygiënische voorzieningen

Te veel water is gevaarlijk, te weinig water kan hele samenlevingen ontwrichten, vertelt Ovink. „Als er weinig water beschikbaar is, zijn het meestal vrouwen en kinderen die water moeten halen. Als scholen geen water hebben, hebben ze ook geen hygiënische voorzieningen. Voor meisjes die ongesteld zijn betekent het dat ze niet naar school kunnen. Dat is dus bijna één week per maand geen school. Ze kunnen er niks aan doen, maar het zet ze meteen op een enorme achterstand. Die vrouwen en die meisjes zíjn niet kwetsbaar. Nee, we máken ze kwetsbaar. We ondermijnen hun positie doordat we niet goed voor water zorgen.”

En dan is er nog de waterkwaliteit. „Vies water is nog steeds een van de grootste doodsoorzaken en veroorzakers van ernstige ziektes”, zegt Ovink. „Zeker onder kinderen. Baby’s die vies water drinken lopen groeistoornissen op die ze nooit meer inhalen. Als water van goede kwaliteit is, leg je de basis voor kinderen om zich te ontwikkelen. Als het slecht is, betekent dat niet een kansje minder. Voor hersenschade bestaat geen pilletje. Dan kun je het verder vergeten. Afgelopen met de groeispurt.”

Water als mensenrecht

Water vormt ook de basis van de economie. Of, zoals Ovink dat zegt: „Alles staat stil zonder water, of dat nou de meubelgigant is of de voedselindustrie.” En toch gaat de wereld er verkwistend mee om.

Langs de oever van het **sterk vervuilde Mambalam Kanaal in Chennai, India**. In de stad Chennai werkt Water as Leverage, een initiatief van Ovink, aan klimaat- en wateractie.

Henk *Ovink in Brooklyn* Bridge Park, New York. Ovink werkte eerder in de Hurricane Sandy Task Force aan wederopbouw van New York en een nieuwe Amerikaanse klimaataanpak.

Henk Ovink in gesprek met de Japanse delegatie tijdens de VN Water Conferentie 2023 in New York.

Ovink heeft daar wel een verklaring voor: „Water is geen grondstof, maar een mensenrecht, dat is in 2010 zelfs officieel door de VN vastgelegd. En het is hartstikke ingewikkeld een mensenrecht te beprijzen. Daardoor doen we ook in de economie alsof water geen prijs heeft. Ik was een keer op een forum waar een landbouwminister zei: ‘water is niet meer dan een distributieprobleem. Dus we hoeven alleen maar leidingen aan te leggen’. Dat kun je wel zeggen, maar als er geen water is, heb je niets aan de beste infrastructuur van de wereld.”

Het omgekeerde is natuurlijk ook waar, zegt Ovink. Hij noemt Tadzjikistan, de partner van Nederland bij de VN-waterconferentie, als voorbeeld. „Dat land zit op de bron van tweederde van al het zoetwater in Centraal-Azië. Tadzjikistan heeft een van de grootste gletsjercomplexen van de wereld. Ik heb daar gezwommen in een meer op 3.500 meter hoogte. Superkoud. Maar, o wat mooi. Dat water kun je gewoon drinken. Maar dat geldt niet voor het water dat in Tadzjikistan uit de kraan komt. Hun infrastructuur is niet betrouwbaar. Economie en samenleving zijn losgekoppeld van het belang van water.”

Dat geldt volgens Ovink niet alleen in Tadzjikistan. Ook elders wordt het belang van water onvoldoende onderkend. „Toen Europa door de oorlog in Oekraïne ineens geen gas meer kreeg uit Rusland, regelden we binnen een paar maanden andere energie. Kwetsbare mensen werden geholpen, niemand mocht eronder lijden, geld speelde geen rol. Die zomer was het extreem droog, ik denk al voor het vierde of vijfde jaar op rij. En wat zei Europa? Wilt u alstublieft uw zwembad niet vullen. Dan begrijp je niets van het belang van water. Zeker 25 procent van onze energievoorziening is direct afhankelijk van de beschikbaarheid van zoetwater!”

De wereld zou zich veel meer zorgen moeten maken over zoet water, vindt Ovink, misschien nog wel meer dan over zeespiegelstijging. „De zoetwatervoorziening neemt af. Doordat het grondwater wordt uitgeput en vervuild, doordat de gletsjers en de polen smelten. Alles wordt vies en zout. En intussen groeit de vraag naar water door bevolkingsgroei en economische ontwikkeling. Daarom hebben we de Global Commission on the Economics of Water opgezet, dat deze zomer haar eindrapport presenteert.” De Wereldbank verwacht dat de vraag naar water aan het einde van dit decennium 40 procent hoger ligt dan het aanbod, nu al leeft 10 procent van de wereldbevolking in gebieden met kritieke waterschaarste.

Rode draad

Henk Ovink is geen waterbouwkundige. „Ik ben niet in Delft opgeleid”, vertelt hij. Via kunst en wiskunde kwam hij uiteindelijk uit bij een studie architectuur. „Maar water loopt als een rode draad door alles wat ik heb gedaan. Mijn allereerste opdracht was, in 1990, voor een waterschap. Later was ik betrokken bij het ‘Ruimte voor de rivier’ programma. Pas geleidelijk ontstond het bewustzijn over het belang van water. En al ben ik nu geen watergezant meer, ik zal het thema zeker niet loslaten.”

Sterker nog, Ovink is kandidaat om voor de Verenigde Naties speciaal gezant voor water te worden. Een belangrijke conclusie van de waterconferentie dit voorjaar was dat zo’n gezant dringend nodig is om water hoger op de internationale agenda te krijgen. Al ruim voor die conferentie dienden zo’n honderdvijftig landen een officieel verzoek in bij secretaris-generaal António Guterres om een watergezant aan te stellen.

Ovink heeft officieel laten weten belangstelling te hebben voor de functie – al zou hij nog liever zien dat die gaat naar „een vrouw uit de Global South”. Maar mocht die niet op korte termijn te vinden zijn, dan is hij misschien wel de beste kandidaat. „Bij de VN gaan dit soort besluiten niet zo snel. Er zullen dus wel meer Henkjes zijn. Het gaat ook niet om mij, het gaat om water. Mijn grootste zorg is dat er een half jaar na de waterconferentie nog zo weinig met de aanbevelingen is gedaan.”

> Mijn grootste zorg is dat er sinds de VN-conferentie nog zo weinig is gedaan met de aanbevelingen

Met laarzen in de rivier

Diplomatie, hoe noodzakelijk ook, is uiteindelijk voor Ovink niet het belangrijkste. Van de concrete projecten heeft hij als watergezant toch het meest genoten. Projecten waarbij hij met laarzen aan in een rivier stond, dijken inspecteerde, lokale gemeenschappen adviseerde en samen nadacht over *Water as Leverage*, water als een ‘hefboom’ om een gemeenschap weerbaar te maken.

Ovink vertelt over zijn werk in Peru waar in 2016 en 2017 zware overstromingen waren. „El Niño regende helemaal leeg op de Andes. Rivieren werden moordmachines. Ze traden buiten hun oevers en zaaiden ellende. Meer dan 150.000 huizen werden verwoest. Er waren veel doden. Ik weet nog dat ik met de gouverneur van de provincie Piura in een helikopter over het getroffen gebied vloog. We kwamen bij een zwakke dijk die was doorgebroken, een groot landbouwgebied stond onder water. ‘Verschrikkelijk, we zullen een veel sterkere dijk moeten bouwen’, vond de gouverneur. Maar die zwakke dijk was de redding van het dorpje met 750 inwoners dat vier kilometer verderop lag en gespaard bleef.”

De Water as Leverage-projecten zijn kleiner en bedoeld om problemen te voorkomen. Zoals in Chennai in India, waar een school de verantwoordelijkheid kreeg voor zijn eigen waterbeheer. Het grondwater was er zout en vies, en dus niet te gebruiken. Gezamenlijk besloten ze iets te gaan doen wat ze vroeger altijd hadden gedaan: regenwater opvangen. Dat hielp tegen overstromingen, en het water was al relatief schoon. Verder werd ook het afvalwater niet meer zomaar geloosd, maar met bacteriën schoongemaakt en in een moeras teruggebracht. Het grondwaterpeil steeg en het water werd schoner. „Alles wordt nu gemonitord”, vertelt Ovink, die Chennai een paar weken geleden bezocht, trots. „Je kunt alles op je smartphone volgen, de hoeveelheid water en de kwaliteit. Het eigenaarschap van zo’n project ligt bij de school, bij de kinderen, de gemeenschap.”

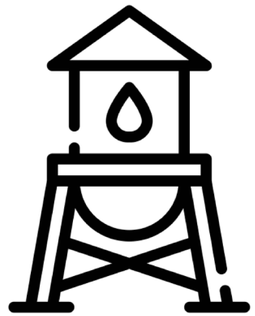
De problemen van water worden versterkt door klimaatverandering, zegt Ovink, maar als je „aan water gaat klussen”, zoals hij dat noemt, als je water gebruikt als organiserend principe, dan kan het je helpen om klimaatverandering binnen de perken te houden.

„Neem afvalzuiveringsinstallaties. Die hebben bij elkaar een grotere CO_2-voetafdruk dan de hele scheepvaartindustrie bij elkaar. En dan moet je bedenken dat de helft van de mensheid nog niet eens een toilet heeft”, zegt Ovink. „Stel je voor wat er kan gebeuren als je die installaties zou inzetten als nature-based duurzame machines, die helpen om het grondwater weer op peil te brengen, die energie leveren, die zorgen voor banen. Het kan, er is gemakkelijk een *business case* voor te maken. Je versterkt de waterbalans, zorgt voor een goede waterkwaliteit voor mens en natuur, verbetert de sanitaire voorzieningen, reduceert de uitstoot van broeikasgassen en draagt bij aan een duurzame en veilige leefomgeving. Dat is de kracht van water, het brengt alles en iedereen bij elkaar.”

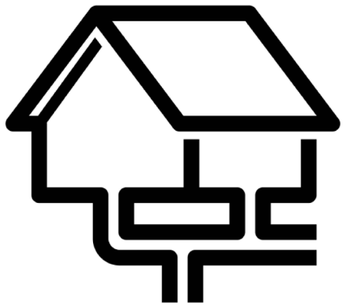
NRC - Water shortage

Opportunities

RIVM



Storing water



Separated sewer system

bufferzones in Natural Areas

Research

Statement + Question

Thematic Research Question

“How can we create spaces
that establish a serene interaction with the hydrological system, based on Traditional Ecological Knowledge?”

Mesopotamia

Deltaworks

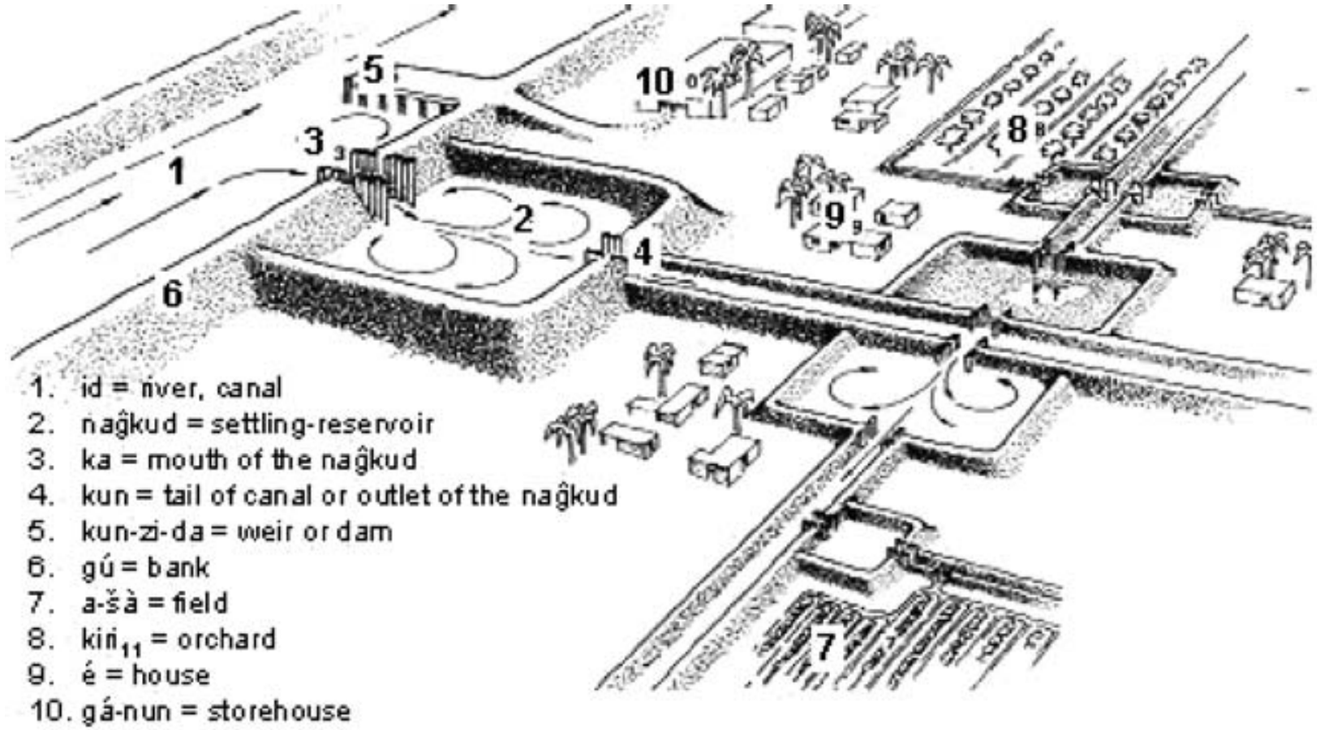
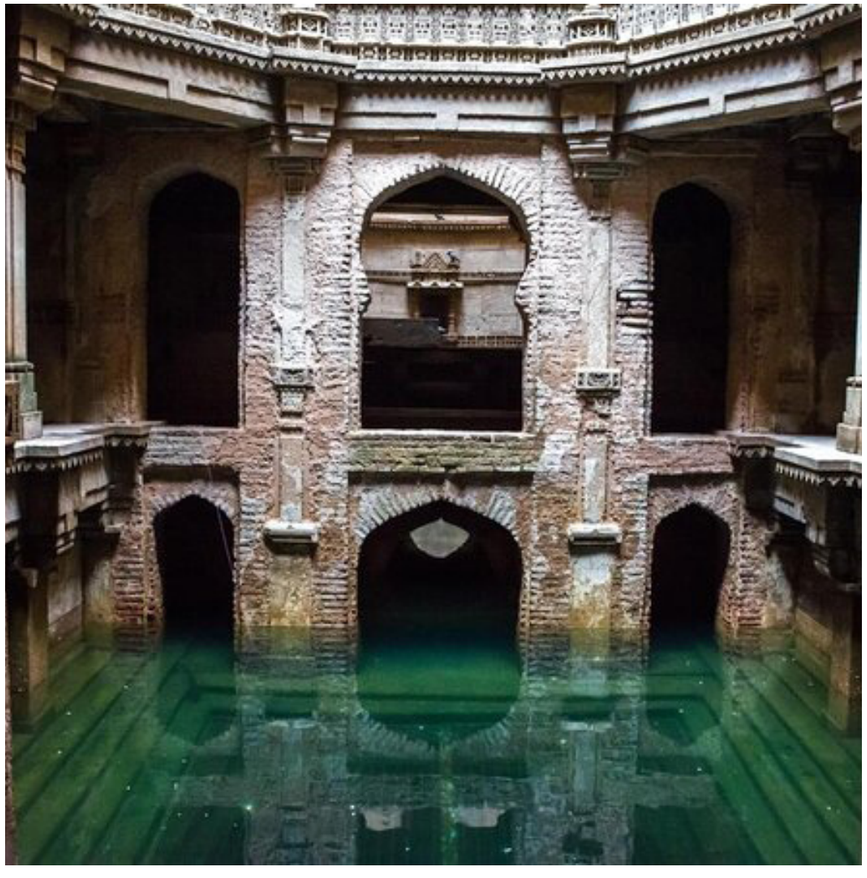


Fig. 2.14 The settling-reservoir (*nag-ku*$_5$) and complementary water-works, as reconstructed by Kang (1973) from the Ur III texts

Stepwells

India



The Netherlands & Indus Civilization

2050 CE *3000 BCE*

Drinkwatercrisis

Different ways of water-storage and distribution

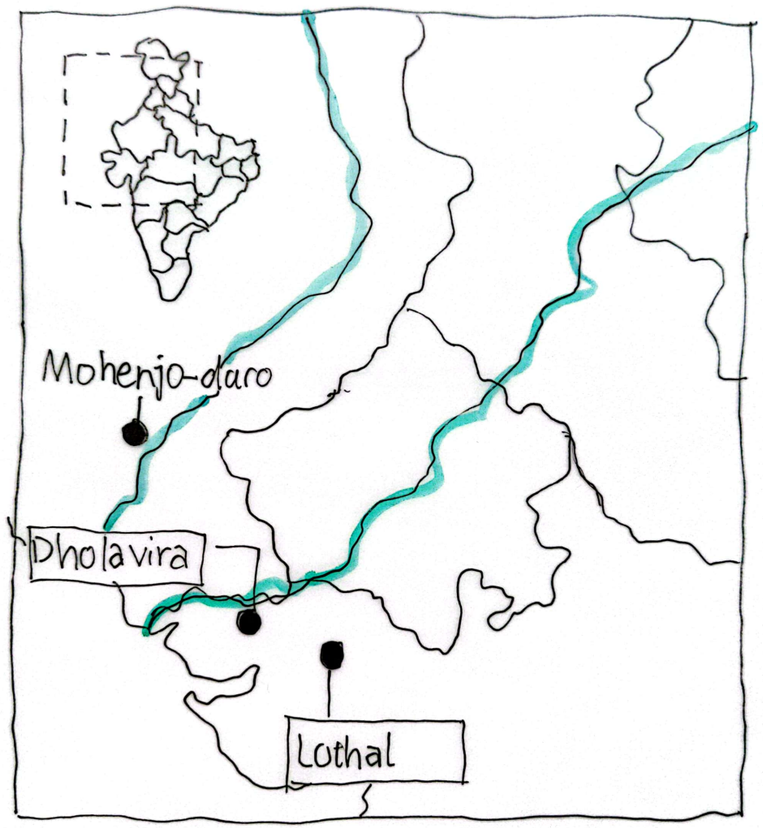
Dholavira

Lothal

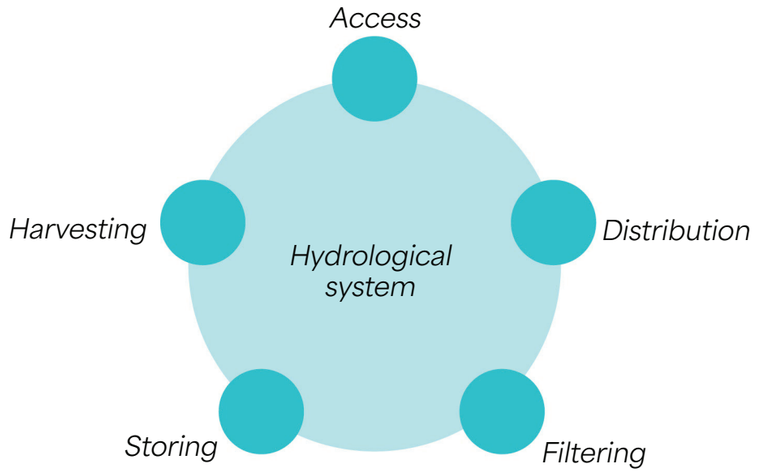
Mohenjo-Daro

Indus civilization

3000 BCE

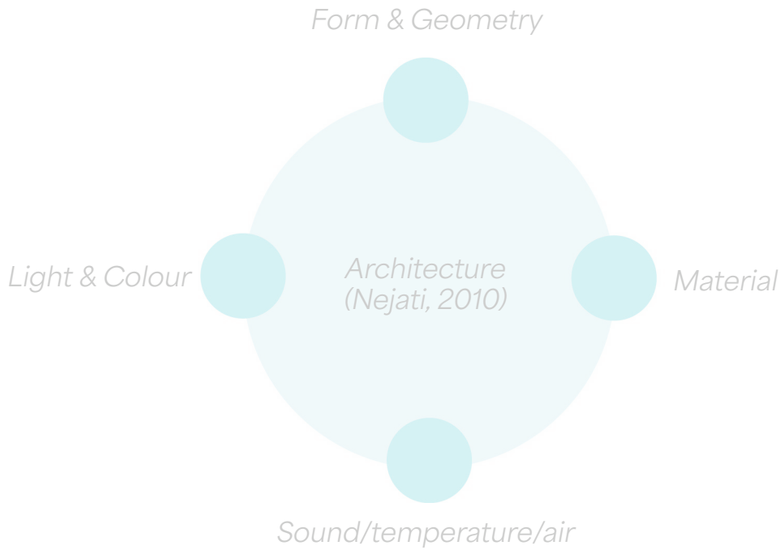


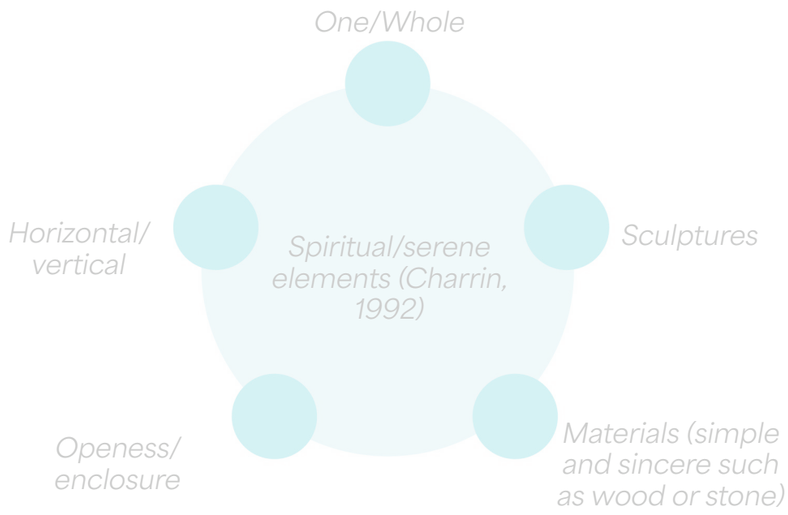
Source: Author 2023



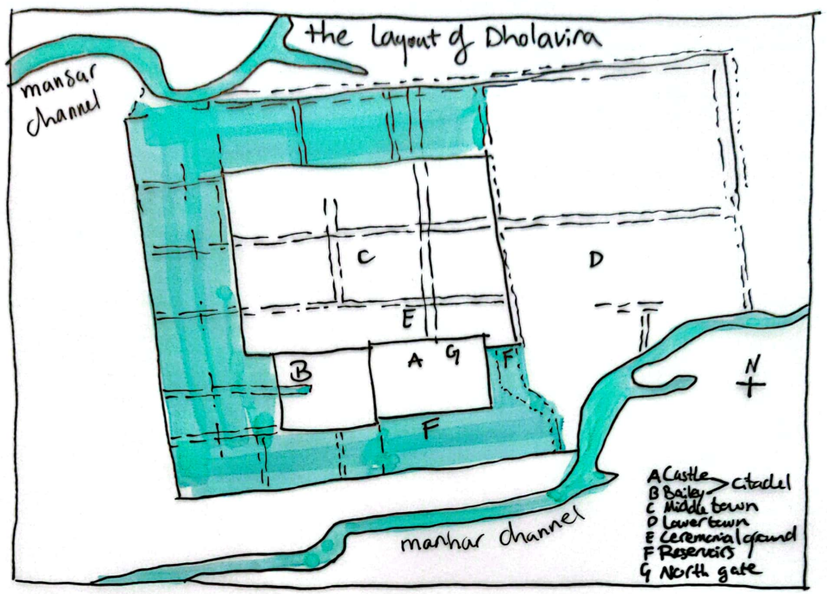
“Methodology”

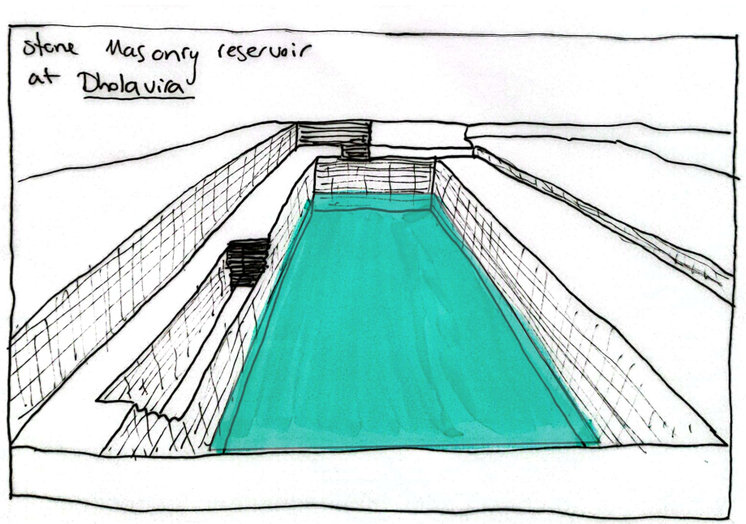
Case study analysis

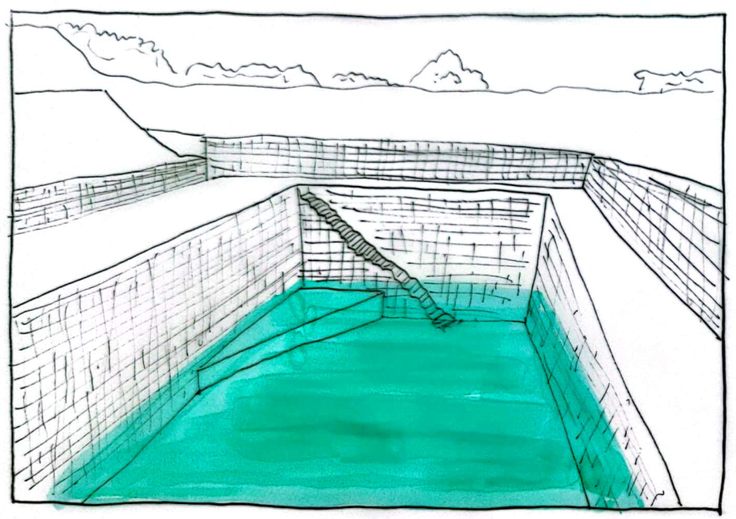


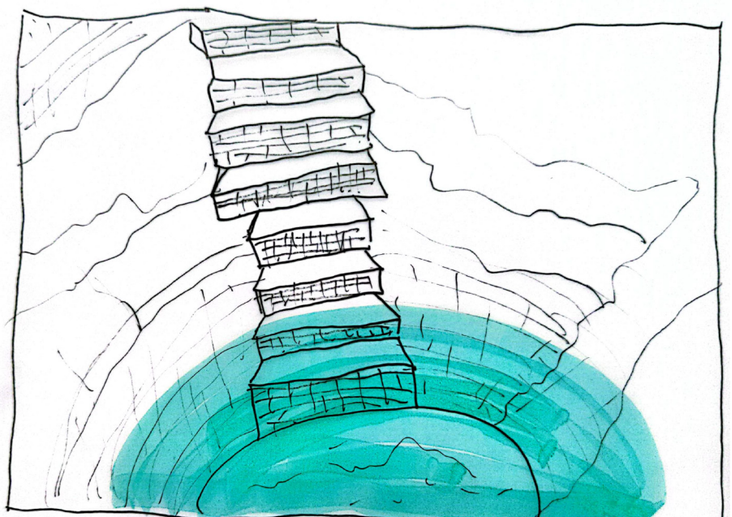


Dholvira

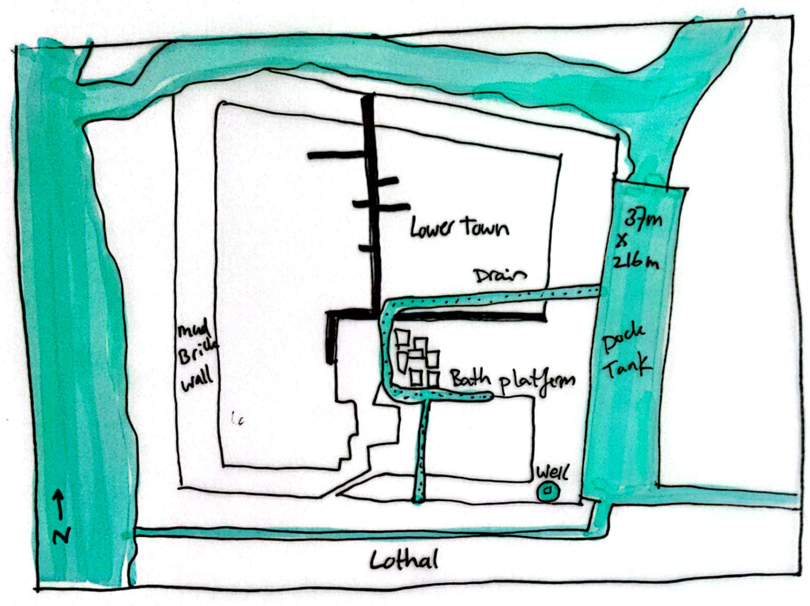

the layout of Dholavira
mansar channel
C
D
E
A
G
F
B
F
N
A Castle → Citadel
B Bailey
C Middle town
D Lower town
E Ceremonial ground
F Reservoirs
G North gate
manhar channel

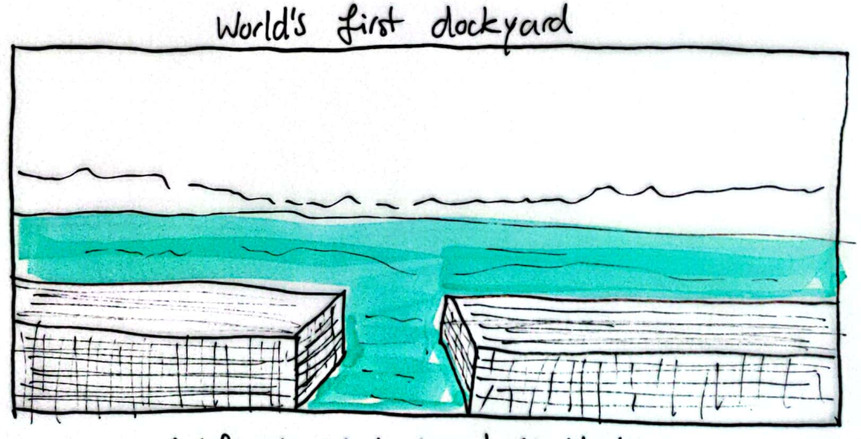

stone Masonry reservoir
at Dholavira





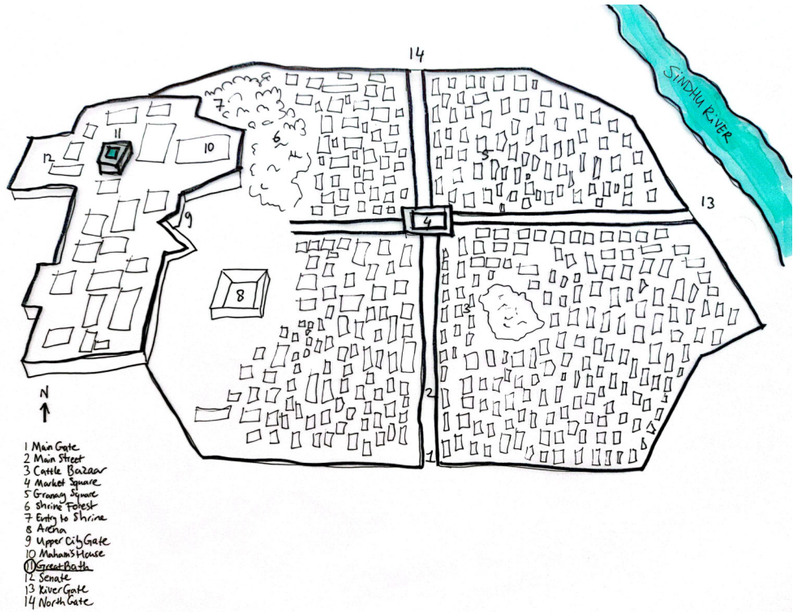
Lothal

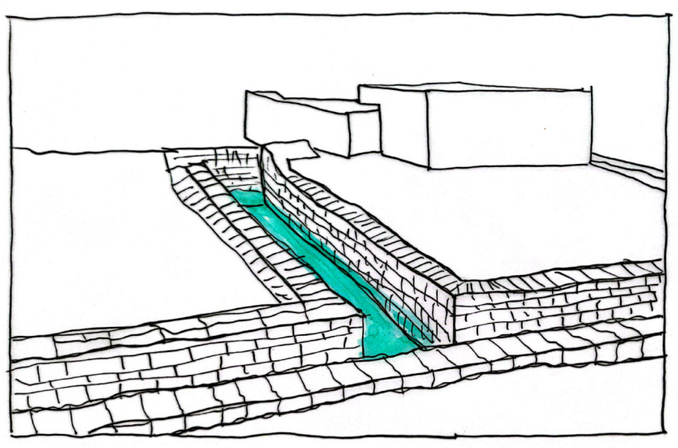


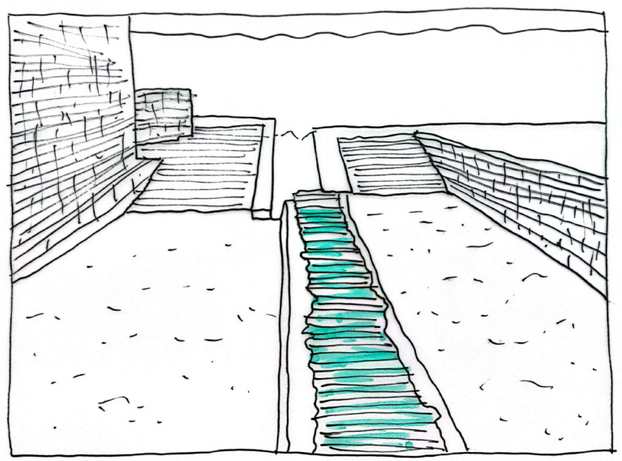


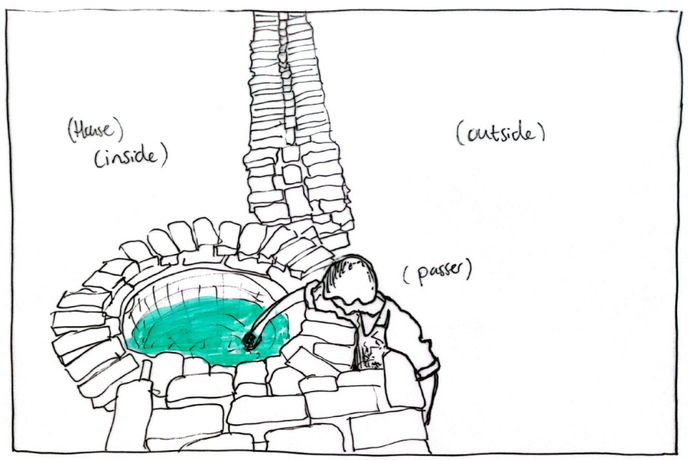
Artificial brick dockyard at Lothal

Mohenjo Daro

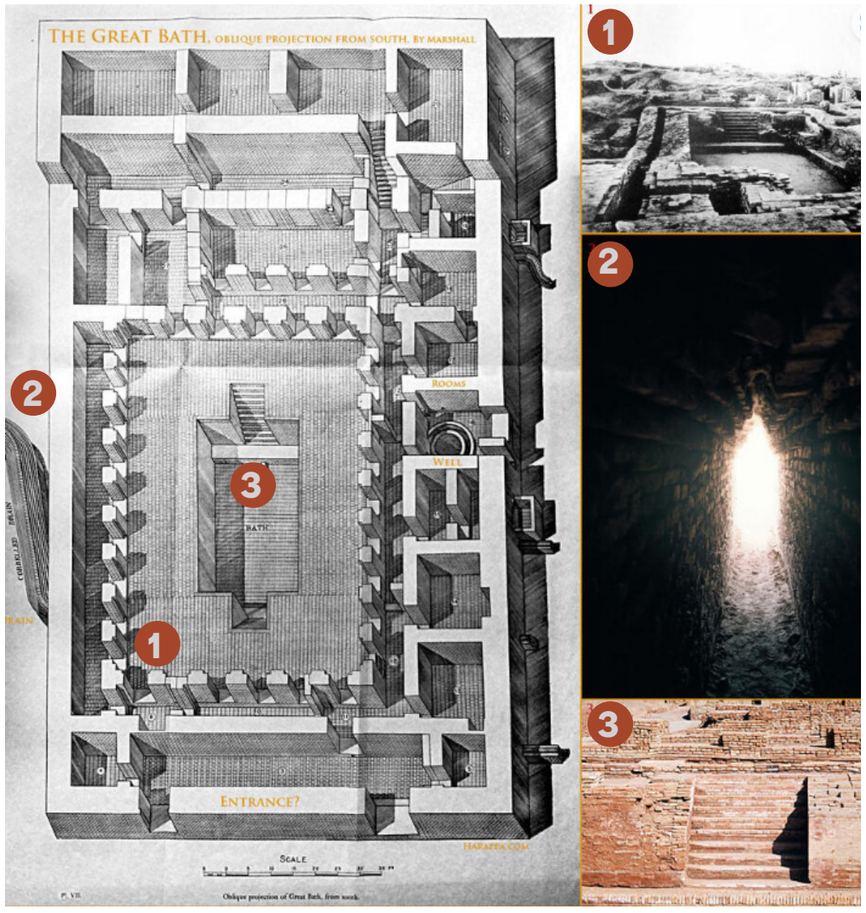








The Great Bath



1. Chand Baori

Figure 13

Information
9th Century
3500 Narrow steps
13 stories
30 m. deep
(deepest stepwell)

Architecture

When we examine its architectural form, we observe a unique inverse structure reminiscent of a Ziggurat, where the complex is excavated from the ground. Adding to its distinctive design, a subtle cantilever extends outward from the center of the complex.

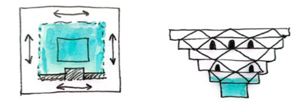
Shifting our focus to the internal environment, we discover that the presence of water creates a refreshing microclimate within. In fact, this microclimate can be remarkably cooler, with temperatures up to 9 degrees lower than the surrounding area. Moreover, this complex serves as a gathering place, particularly for women. The narrow steps, arranged meticulously in perfect symmetry, create a sense of a mystical labyrinth. The interplay of light and shadow further enhances its enigmatic ambiance.

Overall, this structure serves as a remarkable example of rock-cut architecture, showcasing its ingenuity and uniqueness (Perumal, 2022).

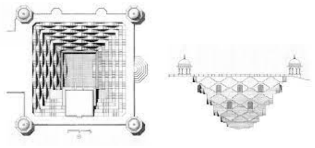
Spirituality/Serenity

This architectural structure exudes a strong sense of unity, harmoniously blending with its natural surroundings. Its design prominently incorporates horizontal elements, facilitating easy movement and navigation, while vertical elements beckon visitors to explore the depths of the well. The stepwell stands as an inclusive space, welcoming people from all walks of life. The choice of materials, particularly the combination of stone and wood, showcases an authentic and heartfelt approach to construction.

The meticulously symmetrical arrangement of the steps and the interplay of light and shadow create a captivating atmosphere that allows visitors to feel a deep connection with the water. It is an immersive experience that encourages a profound sense of oneness with the surroundings.



Analysis of Chand Baori. Source: the Author



Chand Baori plan. Source: Step well / Getrapt waterreservoir. HKB Stedenbouwkundigen. https://hkblabla.wordpress.com/2011/09/12/step-well-getrapt-waterreservoir/

2. Assi Khamba Ki Baori

Assi Khamba Ki Baori. Source: https://www.indiamike.com/india-images/pictures/assa-khamba-ki-baori

Figure 14

Information
1500 CE

Architecture

As we look into the Assi Khamba Baori we find this time a circular form with a promenade and colonnade on top. The amount of stairs used in here is very minimal. What we find is a temple on site attached to the complex. This complex was built for military purpose and was built in 5 days. It was used to store water but also for bathing.

Spirituality/Serenity

What we observe in this structure is a compelling circular arrangement, creating a sense of unity and coherence. The circular form enhances the overall harmony of the complex, symbolizing togetherness and interconnectedness. The presence of a long passage with a colonnade further enhances the visitor's experience, as it allows for the interplay of light and shadow, evoking a feeling of depth and intrigue.

Analysis of Assi Khamba Ki Baori. Source: the Author

3. Adi Kadi Vav

Adi Kadi Vav. Source: https://www.outlookindia.com/outlooktraveller/explore/story/69059/iconic-stepwells-of-gujarat

Figure 15

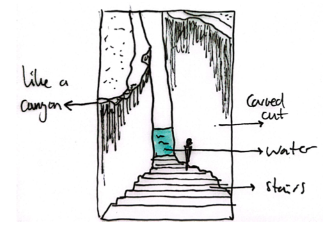
Information
319 BCE

Architecture

The well is strategically designed with five levels, adorned with intricately sculptured pillars and motifs. Stone ledges, open skies, and interconnected passageways at each level create a comfortable resting space, promote air circulation, and facilitate easy movement. The circular well shaft showcases captivating geometric designs, enhancing the visual appeal of the structure.

Spirituality/Serenity

The Adi Kadi Vav stands as one of the ancient stepwells, skillfully carved into the mountainside. This craftsmanship showcases the inherent beauty, simplicity, and authenticity of the rock material, creating a captivating interplay of light and shadows. The unique aspect lies in its resemblance to a natural fissure in the earth, from which water gracefully emerges, accessible to people through a series of stairs. The design emphasizes the significance of verticality while maintaining a harmonious integration with the surrounding natural environment.



Analysis of Adi Kadi Vav. Source: the Author

4. Baoli Ghaus Ali Shah

Baoli Ghaus Ali Shah. Source: https://haryanatourism.gov.in/Destination/baoli-ghaus-ali-shah

Figure 16

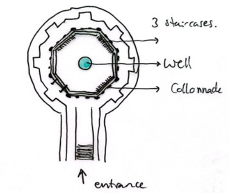
Information
18th Century
Purpose: Layover

Architecture

The Baoli Ghaus exhibits a captivating lower courtyard that imparts a sense of serenity and proportion, with the well taking center stage. The presence of a promenade and two staircases leading to lower levels, accompanied by comfortable seating areas, invites visitors to pause and indulge in the peaceful ambiance. The design of this courtyard stepwell incorporates an octagonal shape, adding to its aesthetic appeal and architectural intrigue.

Spirituality/Serenity

The octagonal courtyard design of this stepwell provides a distinct courtyard typology, creating an open and inviting atmosphere. The central area, with its well, allows for unobstructed views and freedom of movement around the surrounding colonnade. The presence of only three staircases contributes to a sense of intimacy within the stepwell. Access to the stepwell is facilitated by a long hallway that leads to the octagonal courtyard, adding a gradual and intriguing entry experience. The use of light materials enhances the overall feeling of lightness and adds to the intimate ambiance of the space.



Analysis of Baoli Ghaus Ali Shah. Source: the Author

5. Hampi Stepwell

Hampi Stepwell. Source: https://www.atlasobscura.com/places/stepped-tanks-pushkarani-hampi

Figure 17

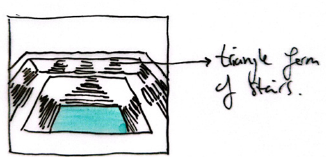
Information
13th century
Purpose: Worship

Architecture

The stepwell, with its square shape, was meticulously planned and constructed using a prefabricated method, a technique that was uncommon for its time in the early 13th century. This innovative approach, which gained popularity in the 19th century, allowed for faster construction compared to traditional methods. Interestingly, the sequential numbering of the stones during the dressing process was employed to ensure their precise placement within the stepwell. This efficient construction technique also enabled simultaneous construction of various sections of the stepwell, as evidenced by the removal of dressed stones from the site. The adaptation of this prefabricated approach during a time of war in the Vijayanagara empire highlights the remarkable engineering and planning skills of the builders.

Spirituality/Serenity

The Hampi stepwell presents a mesmerizing display of triangular staircases, forming an enchanting pattern that captures the eye. Located nearby is a square-shaped stepwell that invites visitors to approach it from any angle. This stepwell stands out for its artistic composition and playful orientation, creating a delightful atmosphere. The dynamic interplay of shapes and forms within the stepwell's design enhances its aesthetic allure, encouraging exploration and interaction from all directions. It is worth noting that this stepwell also serves as a place of worship, adding a spiritual dimension to its significance.



Analysis of Hampi Stepwell. Source: the Author

6. Rajon Ki Baoli

Rajon Ki Baoli. Source: https://www.foodravel.com/2020/12/22/rajon-ki-baoli-mehrauli/

Figure 18

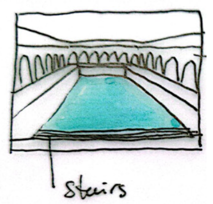
Information
1506 century

Architecture

The Rajon Ki Baoli showcases the use of a unique type of brick, where lime and brick powder were combined to serve as the binder. River sand was employed as the fine aggregate, while brick surkhi served as the coarse aggregate. This ingenious combination enabled the lime mortars to achieve a strength comparable to that of cement concrete, thanks to the enhanced pozzolanic reaction and the formation of additional Calcium silicate hydrate. The incorporation of brick powders as strength enhancers resulted in highly durable materials that could withstand environmental forces with resilience.

Spirituality/Serenity

The Rajon Ki Baoli features a rectangular shape with a lengthy colonnade at the ground level. When the stepwell is filled with water, it evokes a sense of a medieval courtyard, creating a charming ambiance. The colonnade extends even as one descends deeper into the stepwell, maintaining its continuity. The stepwell exhibits a pronounced verticality that encourages visitors to gaze into the distance, fostering a profound connection with nature. The materials used in its construction are humble and genuine, reflecting a simplicity that resonates with the surroundings. Access to the stepwell is granted through a long staircase on one side, guiding visitors on a gradual descent into its inviting depths.



Analysis of Rajon Ki Baoli. Source: the Author

7. Mata Bhavani Vav

Mata Bhavani Vav. Source: https://amdavadiheritage.wordpress.com/2018/12/02/mata-bhavani-stepwell-in-ahmedabad/

Figure 19

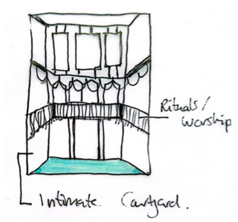
Information
11th Century
Purpose: Temple/worship

Architecture

The Mata Bhavani Vav serves multiple functions, primarily as a place of worship, rituals, and communal gatherings. Visitors have personalized this space by adorning the balustrades with vibrant, colorful cloths, adding a touch of individuality and cultural expression. The colonnade of the building follows a grid pattern, with each module measuring 2m x 2m, creating a sense of rhythm and order within the architectural composition.

Spirituality/Serenity

This space is designed with spirituality in mind. It features a cozy courtyard surrounded by colonnades and open on both sides. What makes it truly special is the personal touch added by people through sculptures and vibrant colors, creating a unique and individualized atmosphere. Additionally, the walls are adorned with candle holders, harmoniously bringing together elements of light, natural stone, water, air, and the play of light. The interplay of these elements enhances the beauty and serenity of the sculpture, making it a truly enchanting space.



Analysis of Mata Bhavani Vav. Source: the Author

8. Ujala Baoli

Ujala Baoli. Source: http://www.navrang-india.in/2019/09/ujala-baoli-near-mandu-madhya-pradesh.html

Figure 20

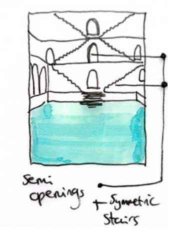
Information
15th Century

Architecture

The name Ujala signifies light, which perfectly contrasts with the conventional symmetry found in most stepwells. This baoli stands out with its eccentric design, featuring stairways that vary between direct and zigzagging paths. This unconventional arrangement adds a distinct and original touch to the structure.

Spirituality/Serenity

Although the approach may appear unconventional and the steps somewhat repetitive, when combined with the finely carved niches and arched chambers, the result is a truly sculptural experience. The shadowy arches, hint to some kind of mystery. The stairs lead the way towards the calm and inviting green water, inviting visitors to immerse themselves in its tranquility.



Analysis of Ujala Baoli. Source: the Author

9. Dada Harir Vav

Dada Harir Vav. Source: https://thirdeyetraveller.com/dada-harir-stepwell-ahmedabad-bai-harir-vav/

Figure 21

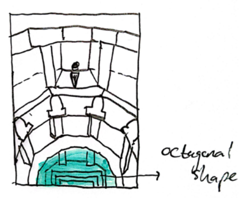
Information
1498 CE

Architecture

Constructed in sandstone, the Dada Harir stepwell is an impressive structure that delves five stories deep into the ground. Its octagonal shape at the top showcases intricate carvings and a multitude of pillars. Each floor offers ample space for gatherings and socializing. The stepwell was meticulously excavated to tap into groundwater at that particular level, taking into account the fluctuations in water levels throughout the year caused by seasonal rainfall. To ensure proper ventilation and illumination, the roofs of the various floors and the landing level feature large openings as air and light vents. One unique aspect is the presence of three staircases from the first-floor level that lead down to the water level, adding to the stepwell's distinctiveness.

Spirituality/Serenity

Within this hallowed and nurturing setting, we come across a splendid rest-house embraced by intricately carved and adorned walls. The serene atmosphere is further enriched by a flourishing grove of fruit trees, generously presenting their abundant fruits. Additionally, a well and a revitalizing pool of water are thoughtfully provided to cater to the needs of visitors. The architectural design, characterized by its octagonal layout, imparts a profound sense of intimacy, as if embracing and enveloping those within its space.



Analysis of Dada Harir Vav. Source: the Author

10. Rani Ki Vav

Rani Ki Vav. Source: https://whc.unesco.org/en/list/922/

Figure 22

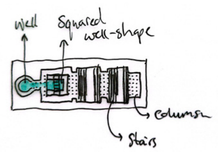
Information
1063 CE
Also known as the Queens stepwell

Architecture

The Rani Ki Vaav, known for its intricate and well-planned architecture, was primarily constructed using sandstone. The sandstone employed in its construction exhibited a creamy hue and was of sedimentary nature, featuring a range of grain sizes from fine to coarse. To ensure structural integrity and prevent any potential collapse, pillars, niches, and slabs were crafted from coarse-grained stone capable of bearing heavy loads. Finer grains were utilized for finishing touches and ornamental embellishments. In addition, stone wooden dowels were employed as joints to provide adhesion and stability to the structure.

Spirituality/Serenity

A lengthy vertical pathway leads us to the well, accompanied by four sections of colonnades. The vertical nature of this route acts as a guiding force, directing our movement and drawing us closer to the water. As we journey along this path, our focus becomes wholly absorbed by the structure, forging a deep sense of unity with the natural surroundings. Upon reaching the plateau adorned with colonnades, we are provided with a serene space for rest and introspection before continuing onward to the next flight of stairs. This remarkable structure seamlessly integrates with its environment, creating a profound sense of enclosure and oneness.



Analysis of Rani Ki Vav. Source: the Author

11. Modhera Sun Temple

Modhera Sun Temple. Source: Sun Temple Modhera - History, Architecture & Interesting Facts | T2B (taleof2backpackers.com)

Figure 23

Information
1026
Purpose: Worship of Sun and water

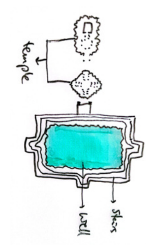
Well is 54 x 37 meters

Architecture

A magnificent flight of steps provides access to this sacred pool, which holds significant importance for ritual ablutions. The pool is meticulously crafted with a rectangular layout, featuring a series of platforms and terraces adorned with shrines of diverse sizes and shapes. Skilfully constructed small pyramidal stairways connect the terraces in staggered rows, while the presence of low semicircular steps (ardhachandra) on their landings adds an elegant touch to the architectural design.

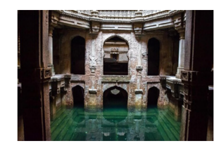
Spirituality/Serenity

A multitude of skilled artisans and sculptors poured their talent and craftsmanship into the creation of this magnificent structure. The significance of this site is exemplified by the presence of the king himself, who would visit to offer prayers to the sun. Not only did this complex serve as a stepwell, but it also functioned as a hub for music and dance performances. The harmonious rhythms, combined with the multiple layers of depth within the structure, including the temple at its center and the reflective waters, contribute to an atmosphere of profound spirituality. It truly is a place where various elements converge, creating a space that transcends the physical and reaches the realm of the divine.



Analysis of Modhera Sun Temple. Source: the Author

12. Adalaj Stepwell



Adalaj Stepwell. Source: https://ahmedabadtourism.in/adalaj-stepwell-ahmedabad

Figure 24

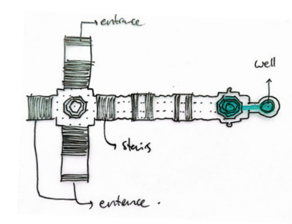
Information
1498 CE

Architecture

The remarkable structure was frequented by local residents for traditional rituals, adding to its cultural significance. Crafted from striking sandstone, the square stepped platform leads to a deep well below, symbolizing the vital role that stepwells played in providing water for drinking and household purposes in ancient times. Known as vav in Gujarati and baoli in Rajasthani, these architectural marvels are especially prevalent in the semi-arid regions of Gujarat. The water festival held at Adalaj drew numerous visitors, eager to witness captivating performances by renowned musicians, further adding to the allure of this remarkable site.

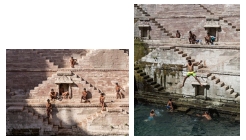
Spirituality/Serenity

As visitors descend the steps of this magnificent stepwell, they are transported back in time, surrounded by the awe-inspiring architecture and a serene ambiance. Exploring this historic monument is a captivating experience, especially for those who have a deep appreciation for the past. This remarkable five-storey stepwell holds great significance, not only for its architectural grandeur but also for the intricately engraved deities adorning its walls. It is believed that villagers flock to the stepwell to offer their prayers and seek blessings from these revered deities. At the entrance of the stepwell, a temple stands as a testament to the spiritual importance of this



Analysis of Adalaj Stepwell. Source: the Author

13. Toorji Ka Jhalra



Toorji Ka Jhalra. Source: https://kevinstandagephotography.wordpress.com/2017/03/21/toorji-ka-jhalra-jodhpur-step-well/

Figure 25

Information
1740 CE

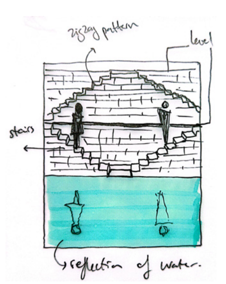
Architecture

During the excavation process, the depths of over two hundred feet revealed a hidden world of hand-carved wonders in Jodhpur's renowned rose-red sandstone. Among these treasures were exquisite carvings depicting dancing elephants, majestic medieval lions, and intricately designed cow water-spouts. The stepwell also featured niches that once housed long-forgotten deities, adding an air of mystery to the site.

Spirituality/Serenity

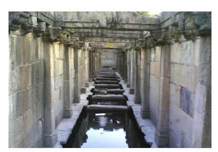
Within this complex, numerous square-carved openings adorn the staircases, offering a respite from the sunlight and providing a cool, shaded sanctuary for rest and prayer. These intricately crafted carvings not only serve a functional purpose but also contribute to the overall aesthetic appeal of the site.

The design of this complex fosters a sense of tranquility and togetherness, creating an enclosed space where people can gather and connect. It offers a serene environment for individuals to come together, reflect, and engage in communal activities. The combination of architectural elements, soothing surroundings, and the presence of water creates a harmonious atmosphere that encourages a sense of calm and unity among visitors.



Analysis of Toorji Ka Jhalra. Source: the Author

14. Geban Shah Vav



Geban Shah Vav. Source: https://champaner-pavagadh.blogspot.com/2007/12/gebanshahs-vav.html

Figure 26

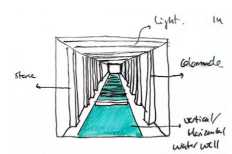
Information
16th Century
52 meters long

Architecture

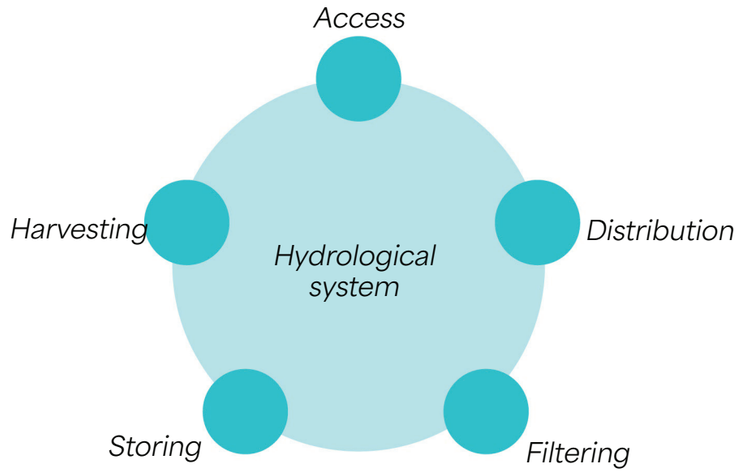
Despite its imposing size, the stepwell's design embraces simplicity and elegance, with minimal decorative elements and made out of sandstone. Platforms encircle the well shaft at each landing, offering convenient resting spots for those navigating the stairs. The stepwell played a crucial role as communal resources, providing vital water supplies to the surrounding areas. The ingenuity of the design relied on subsoil flow, utilizing the natural filtration properties of the soil to maintain the water's purity. This sustainable approach to water management not only demonstrates the builders' resourcefulness but also underscores their deep concern for the welfare of the community.

Spirituality/Serenity

The stepwell's entrance emanates an aura of understated refinement. It evokes the sensation of traversing a water pathway, with stones appearing to hover above the surface. The architectural design of the stepwell is marked by a captivating interplay between light and shadow, creating an aesthetically captivating spectacle. Crafted predominantly from stone, the structure imparts a feeling of enclosure, further enhancing the intimate atmosphere within.

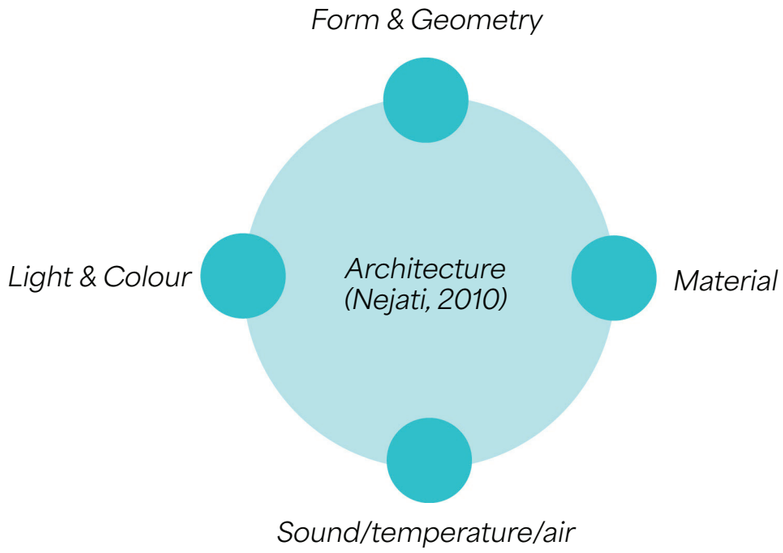


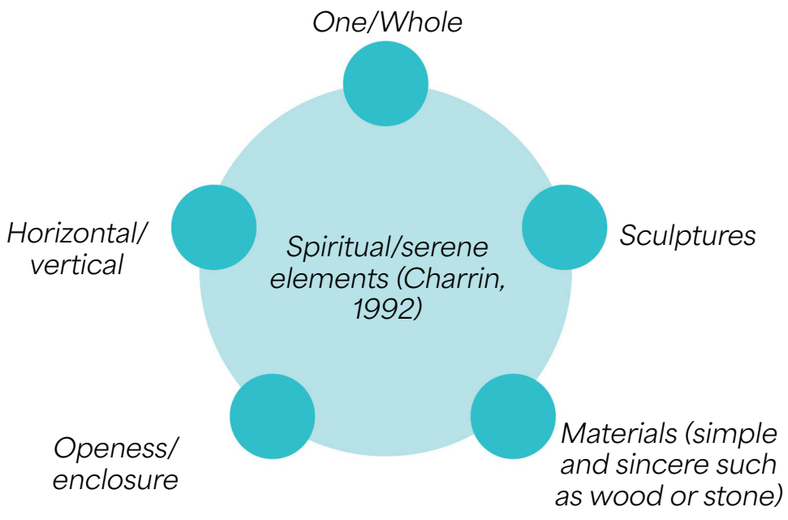
Analysis of Geban Shsh Vav. Source: the Author



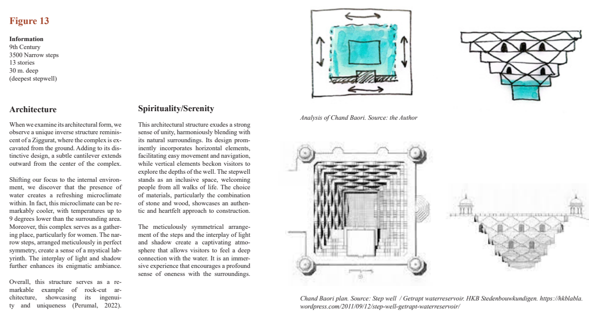
“Methodology”

Case study analysis

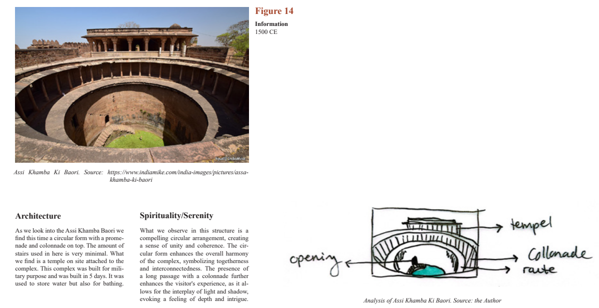




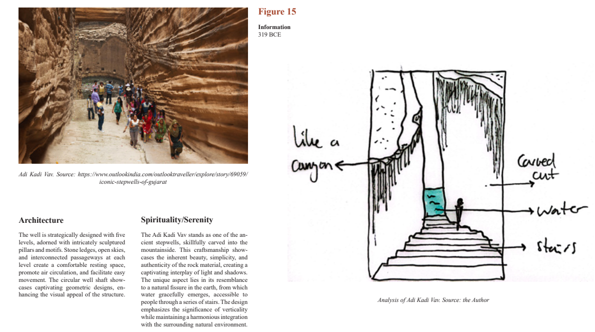
1. Chand Baori



2. Assi Khamba Ki Baori



3. Adi Kadi Vav



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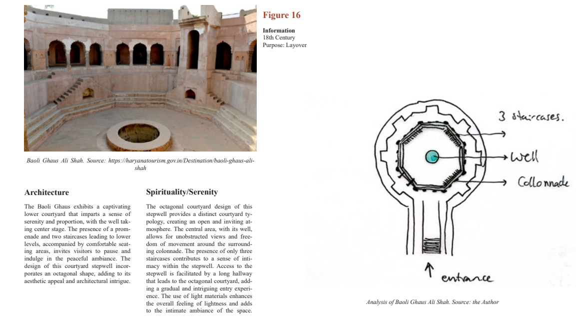

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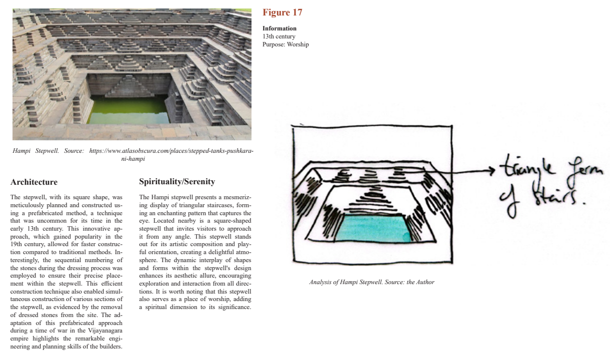
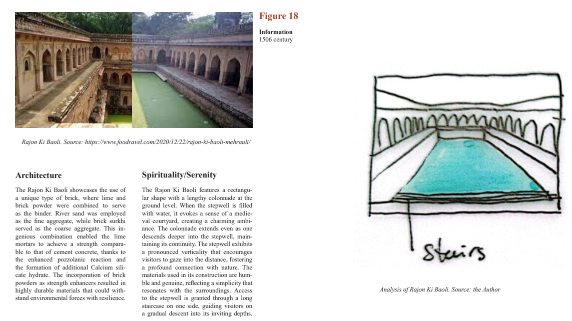
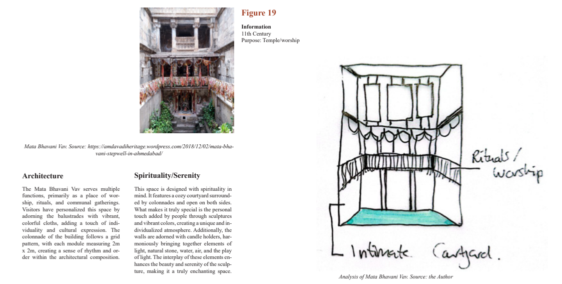


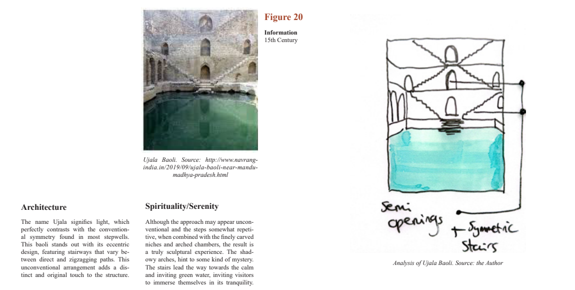
6. Rajon Ki Baoli



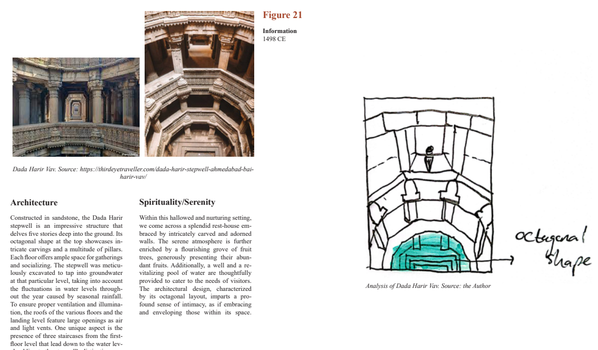
7. Mata Bhavani Vav



8. Ujala Baoli



9. Dada Harir Vav



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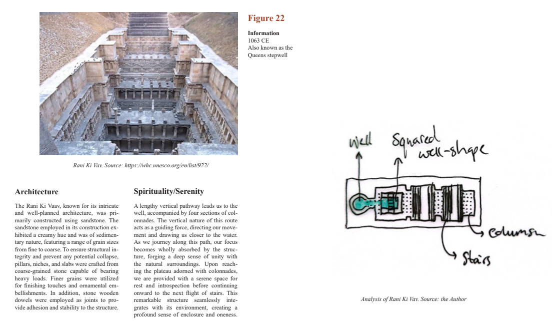
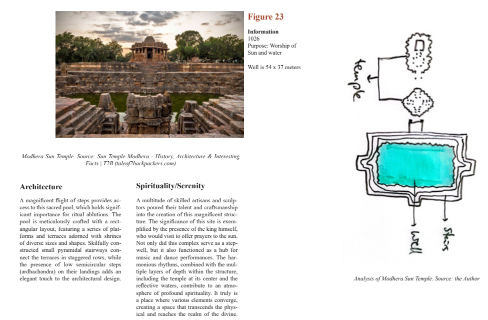
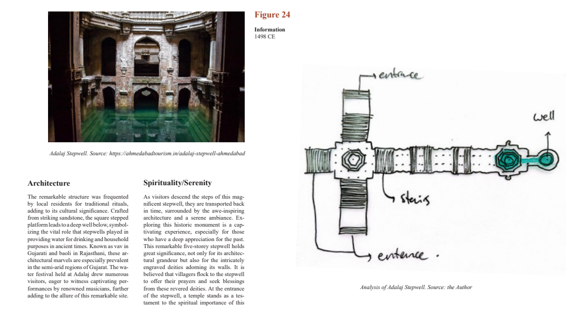


11. Modhera Sun Temple



12. Adalaj Stepwell



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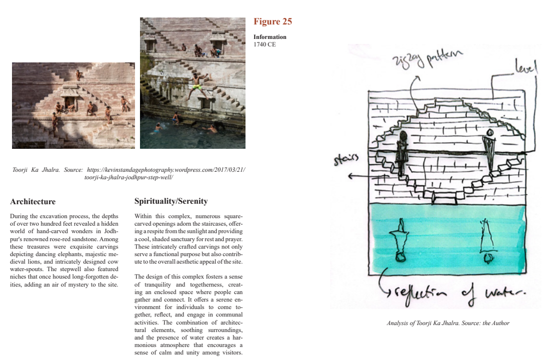

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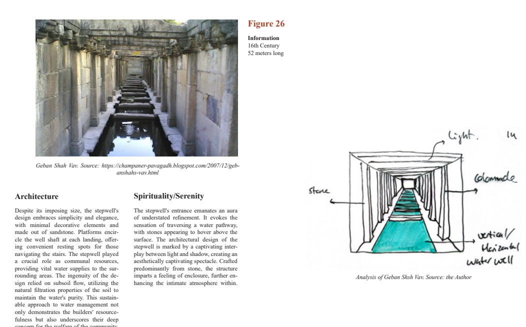

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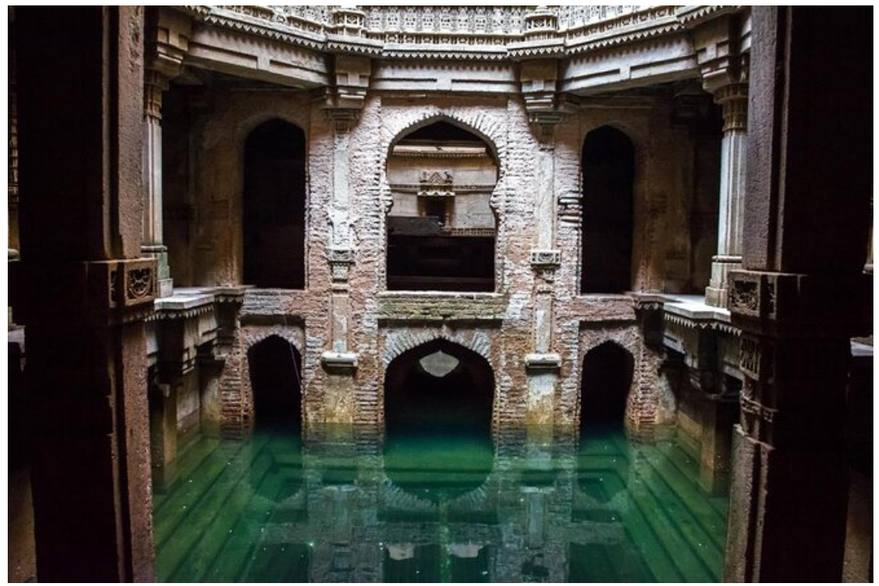

Adalaj Stepwell. Source: https://ahmedabadtourism.in/adalaj-stepwell-ahmedabad

Architecture

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Spirituality/Serenity

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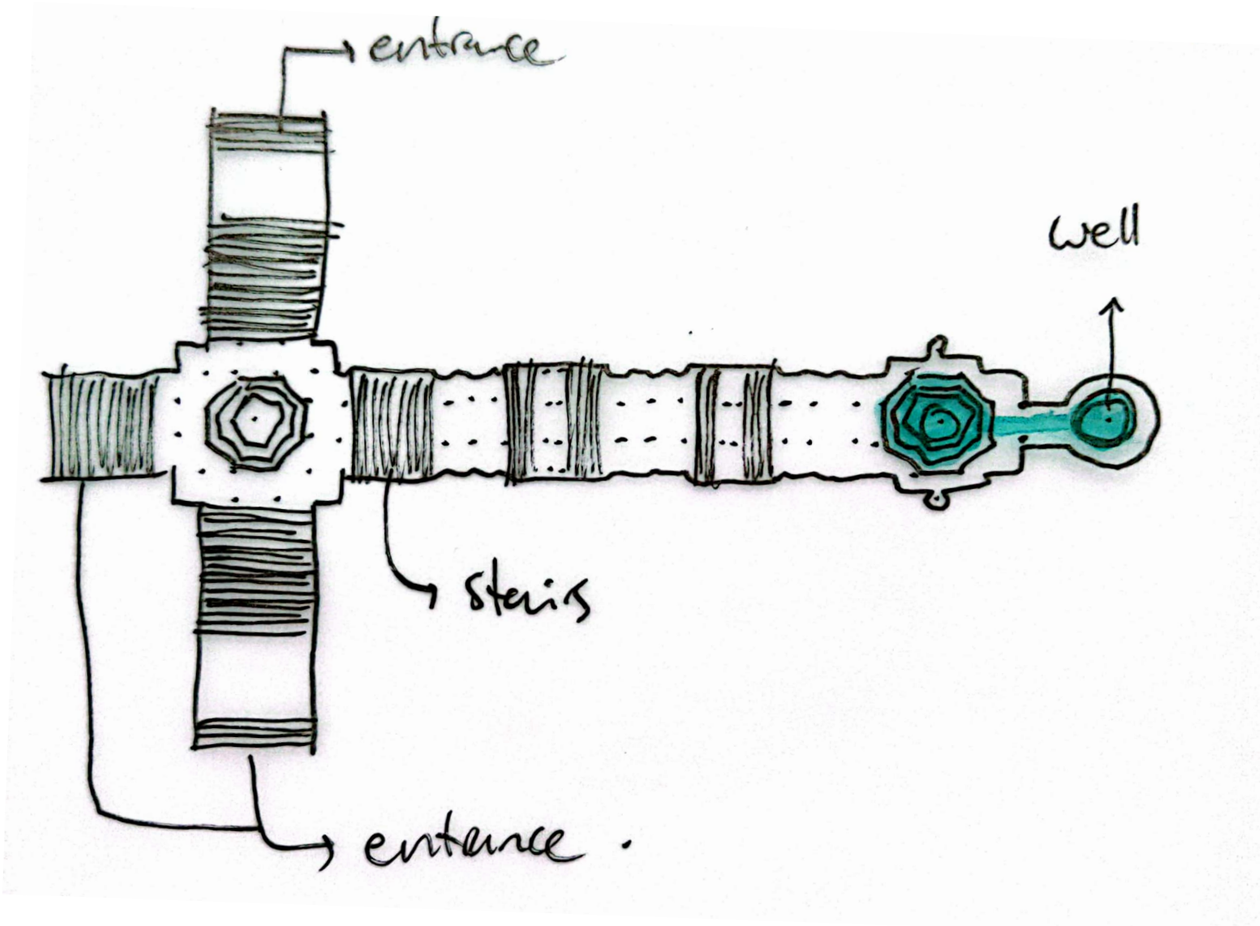
Figure 24

Information
1498 CE



Analysis of Adalaj Stepwell. Source: the Author

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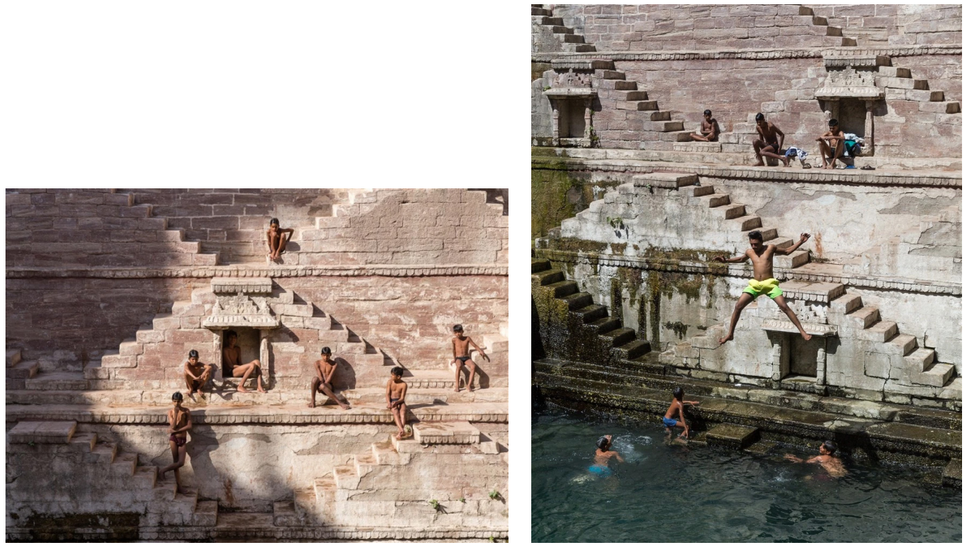


Figure 25

Information
1740 CE

Toorji Ka Jhalra. Source: https://kevinstandagephotography.wordpress.com/2017/03/21/toorji-ka-jhalra-jodhpur-step-well/

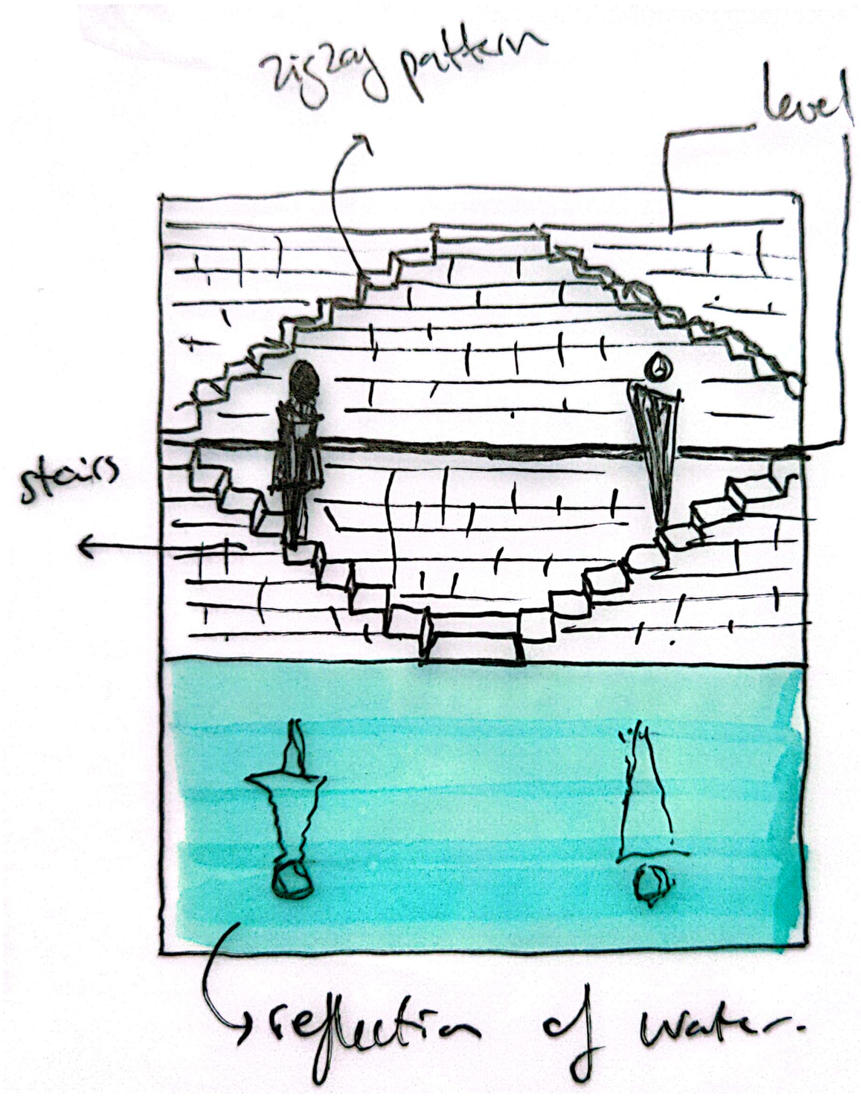
Architecture

During the excavation process, the depths of over two hundred feet revealed a hidden world of hand-carved wonders in Jodhpur's renowned rose-red sandstone. Among these treasures were exquisite carvings depicting dancing elephants, majestic medieval lions, and intricately designed cow water-spouts. The stepwell also featured niches that once housed long-forgotten deities, adding an air of mystery to the site.

Spirituality/Serenity

Within this complex, numerous square-carved openings adorn the staircases, offering a respite from the sunlight and providing a cool, shaded sanctuary for rest and prayer. These intricately crafted carvings not only serve a functional purpose but also contribute to the overall aesthetic appeal of the site.

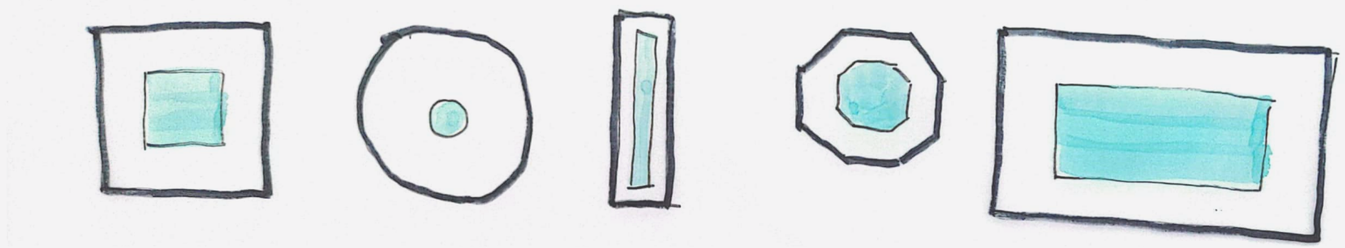
The design of this complex fosters a sense of tranquility and togetherness, creating an enclosed space where people can gather and connect. It offers a serene environment for individuals to come together, reflect, and engage in communal activities. The combination of architectural elements, soothing surroundings, and the presence of water creates a harmonious atmosphere that encourages a sense of calm and unity among visitors.



Analysis of Toorji Ka Jhalra. Source: the Author

Design conclusions from TEK - WELLS

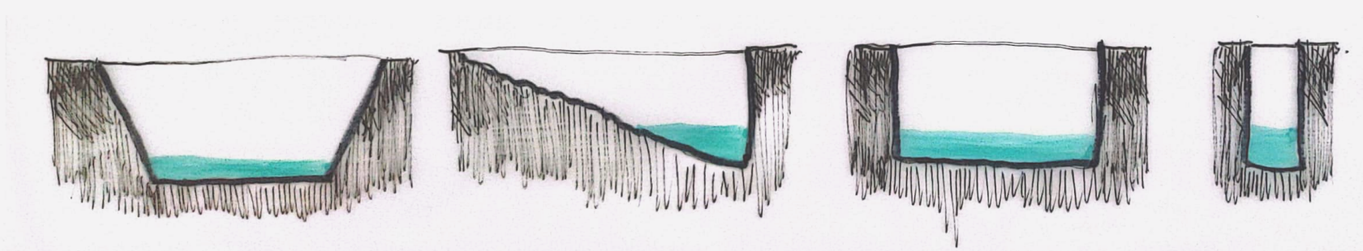
Form
The way people will follow the structure



Routing
(creating playfull shadows via Stairs & setbacks)

Collonade
A sense of embracement

Enclosed by earth
creating a cooler microclimate due to the presence of water



Design

Proposal

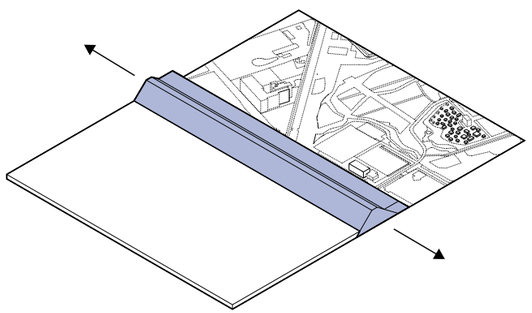
Design Question

“How can a building interact in a serene way with the hydrological system and simultaneously create visual awareness about climate change based on Traditional Ecological Knowledge for the Netherlands in 2050?”

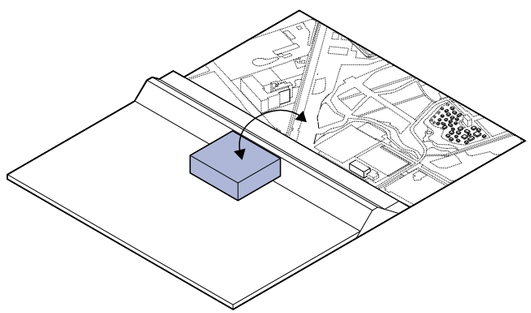
NL LOLA LANDSCAPES 2200

The Design Plan

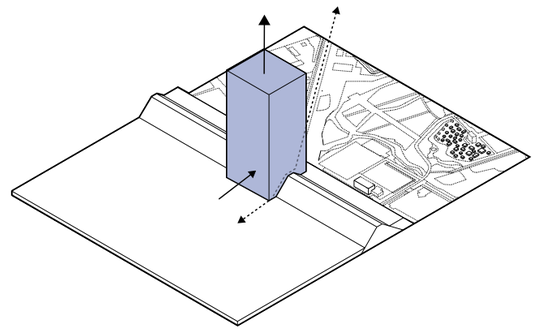
(Plan B)



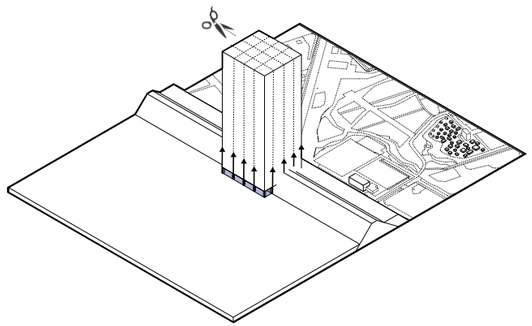
Mega-dyke around city (15 m + NAP)



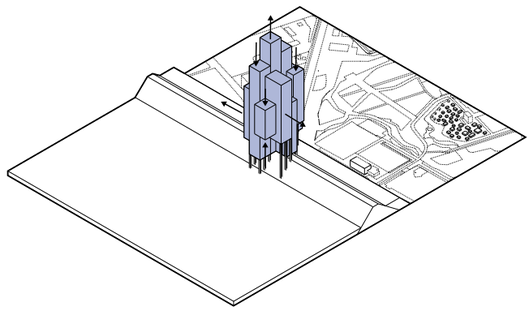
Expansion of city (outside Mega-dyke)



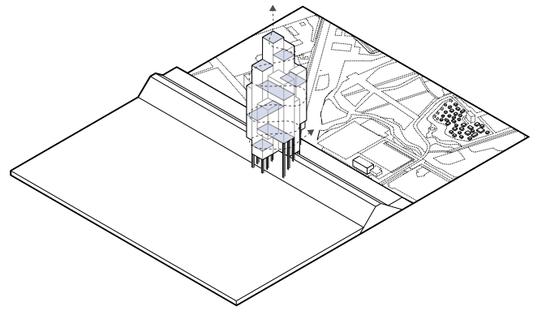
Building functions as hydraulic pump integrated in Dyke to keep the city of Delft dry. Thereby the building accomodates more dwellings in sq m.



Creating a robust structure as "drager" that is both durable for the long term and easily expandable. The structure is made from local harvested materials.



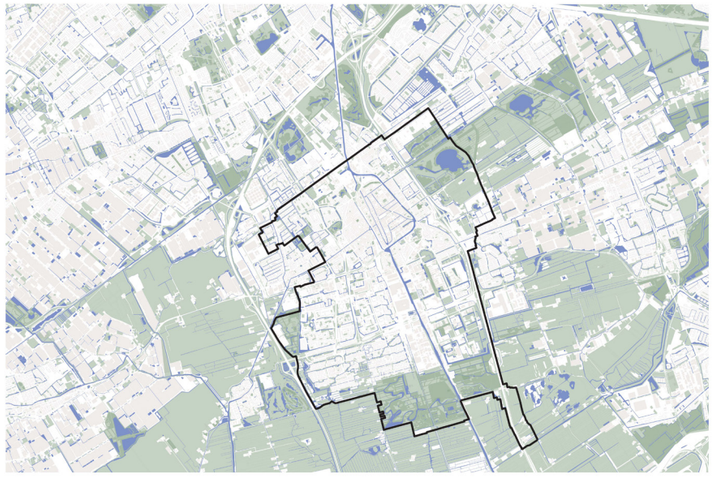
Increasing surface area to capture water and ensure sufficient daylight.view for the residences.



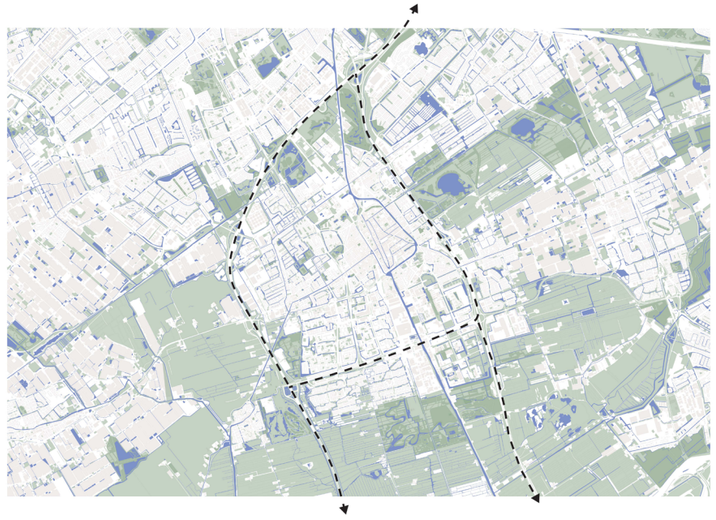
Intimate inner world filled with water features and a beautiful route through the building.

City of Delft +2050 CE

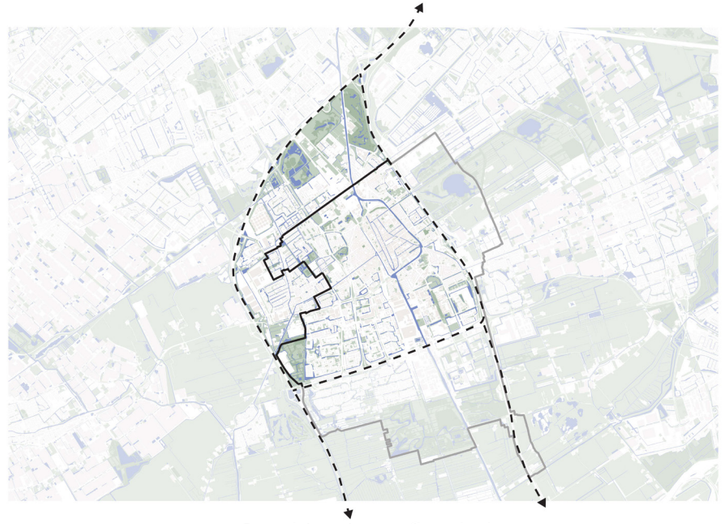
After 2050 CE



Delft - current situation



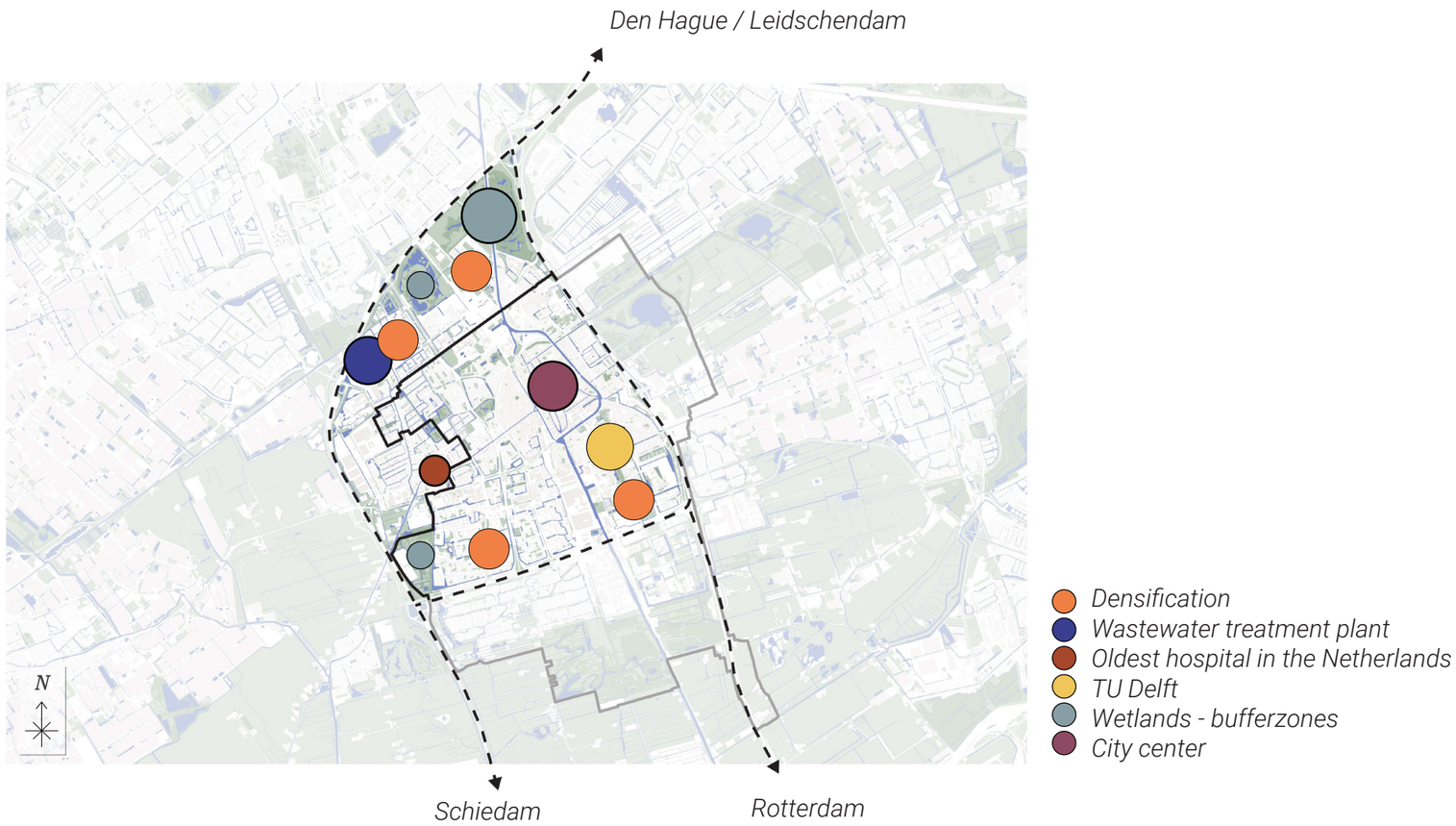
Old Dyke structure



Combination + flooded

Essential places

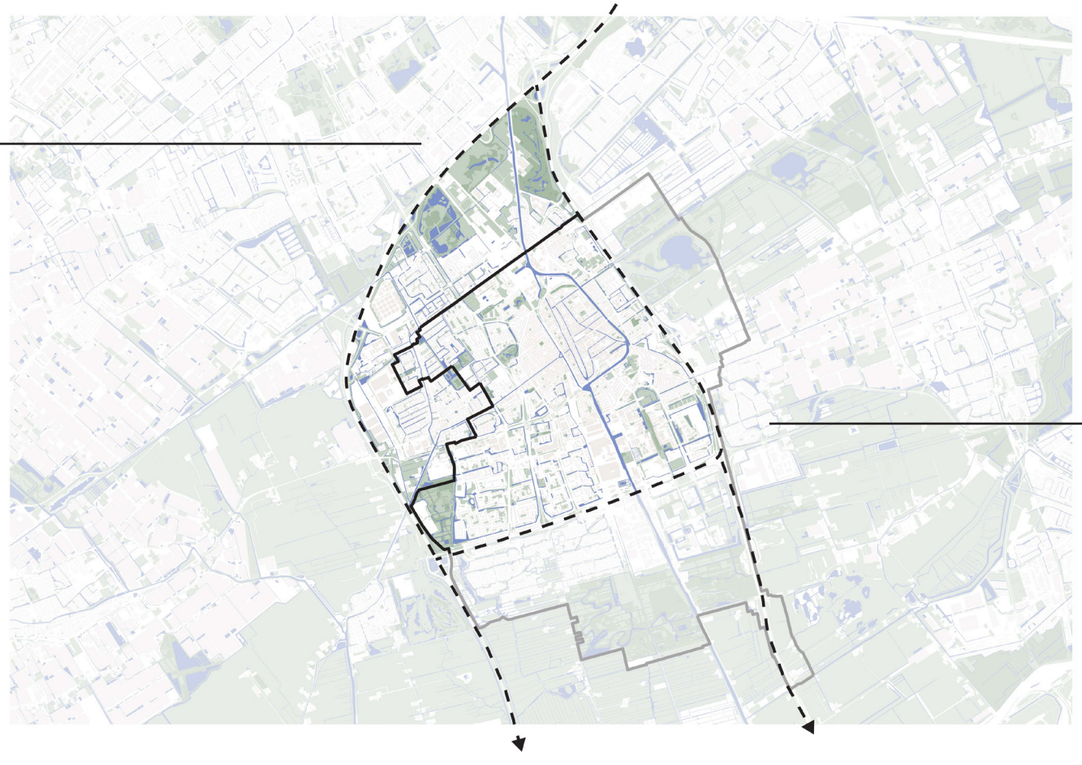
Urban densification



Area of 100.000 inhabitants
In need of 14.000+ dwellings

Harvesting materials

Brick, wood, concrete, glass, steel, clay

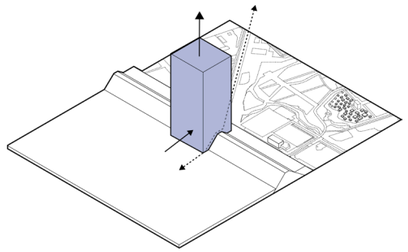


Hydraulic pump

Keeping area dry

Hydraulic pump

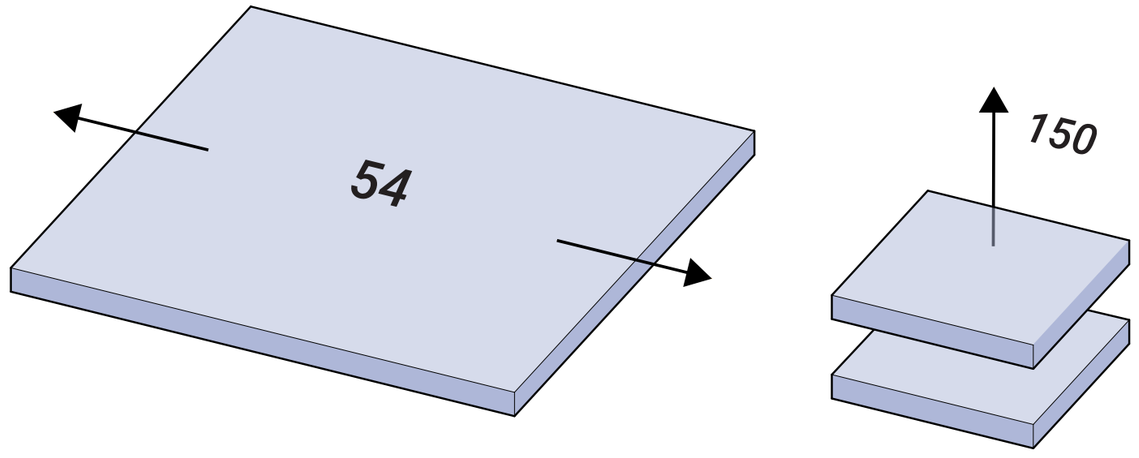
Accomodation inhabitants



Delft - 2253 dwellings in sq km.

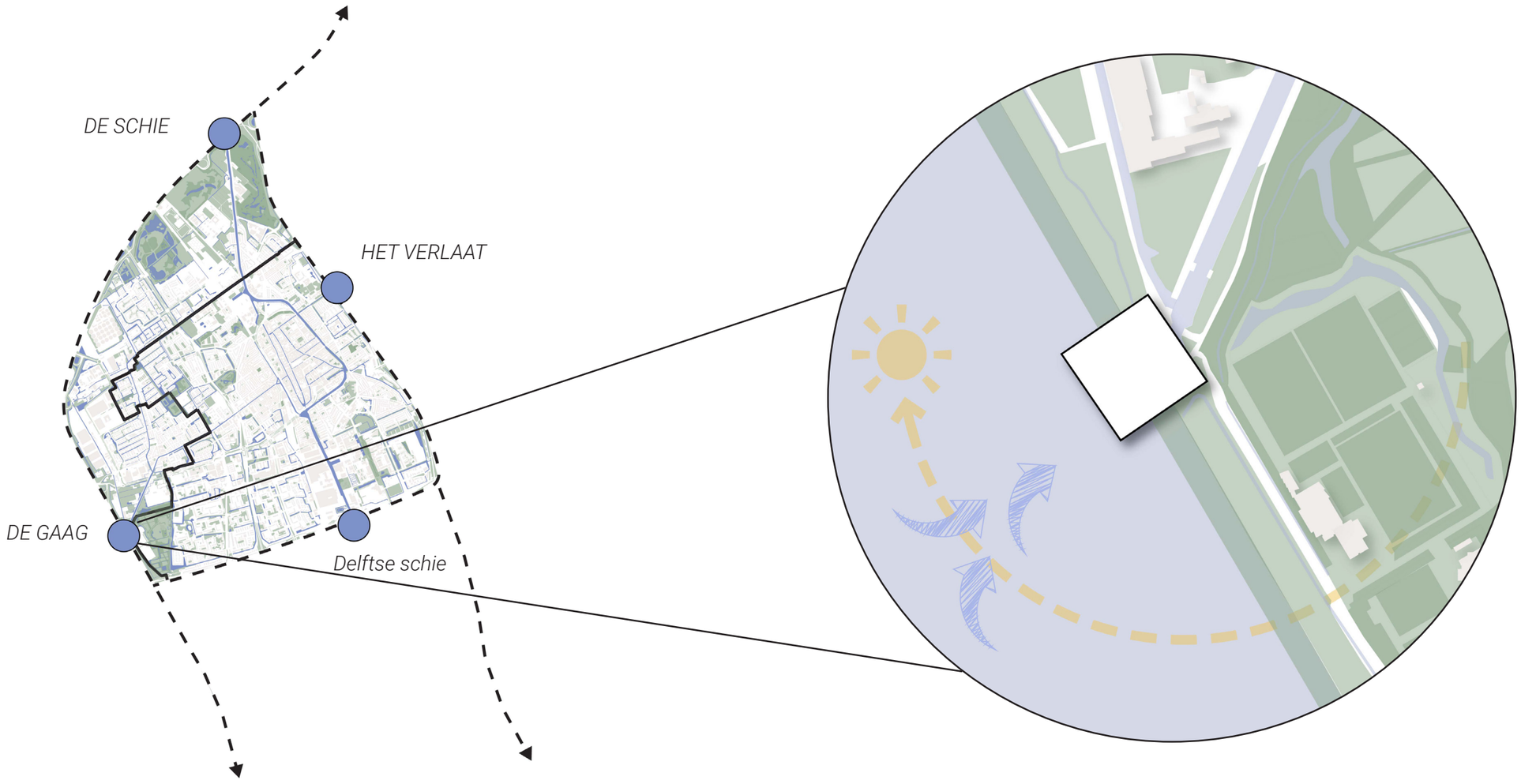
Area of 24.000 sq m. - 54 dwellings
In building 24.000 sq m. - 150 dwellings (15 floors)

Housing 3 times more people



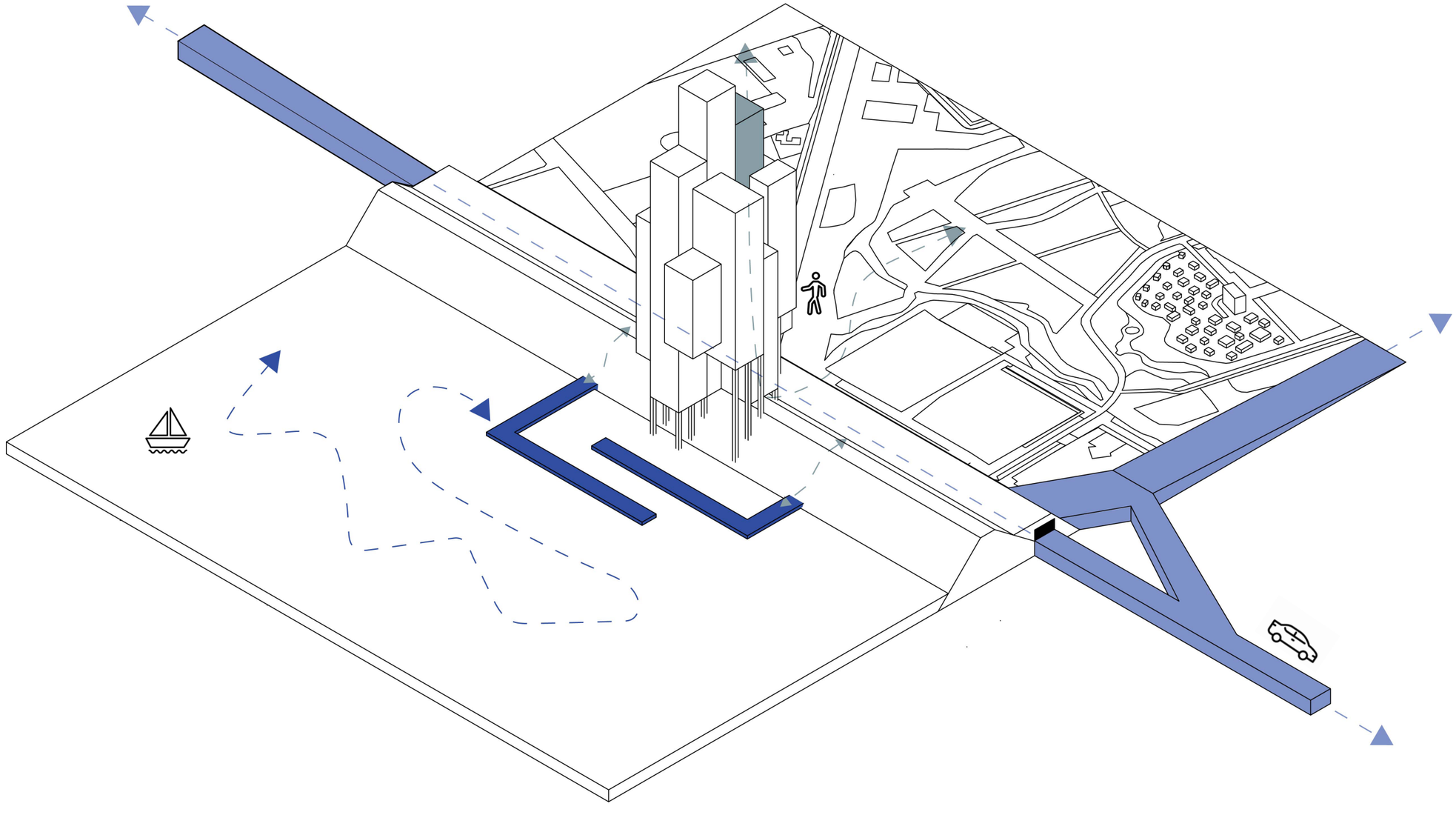
Site analysis

Sun / wind diagram



Building Access

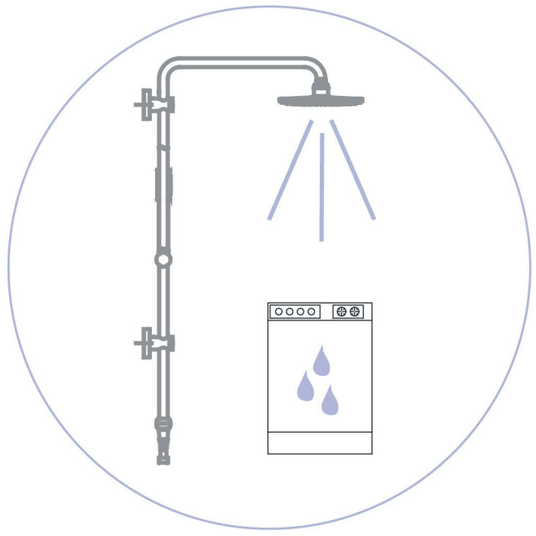
Marine - car - pedestrians



Hydrological system

Artificial form

Drinkwater

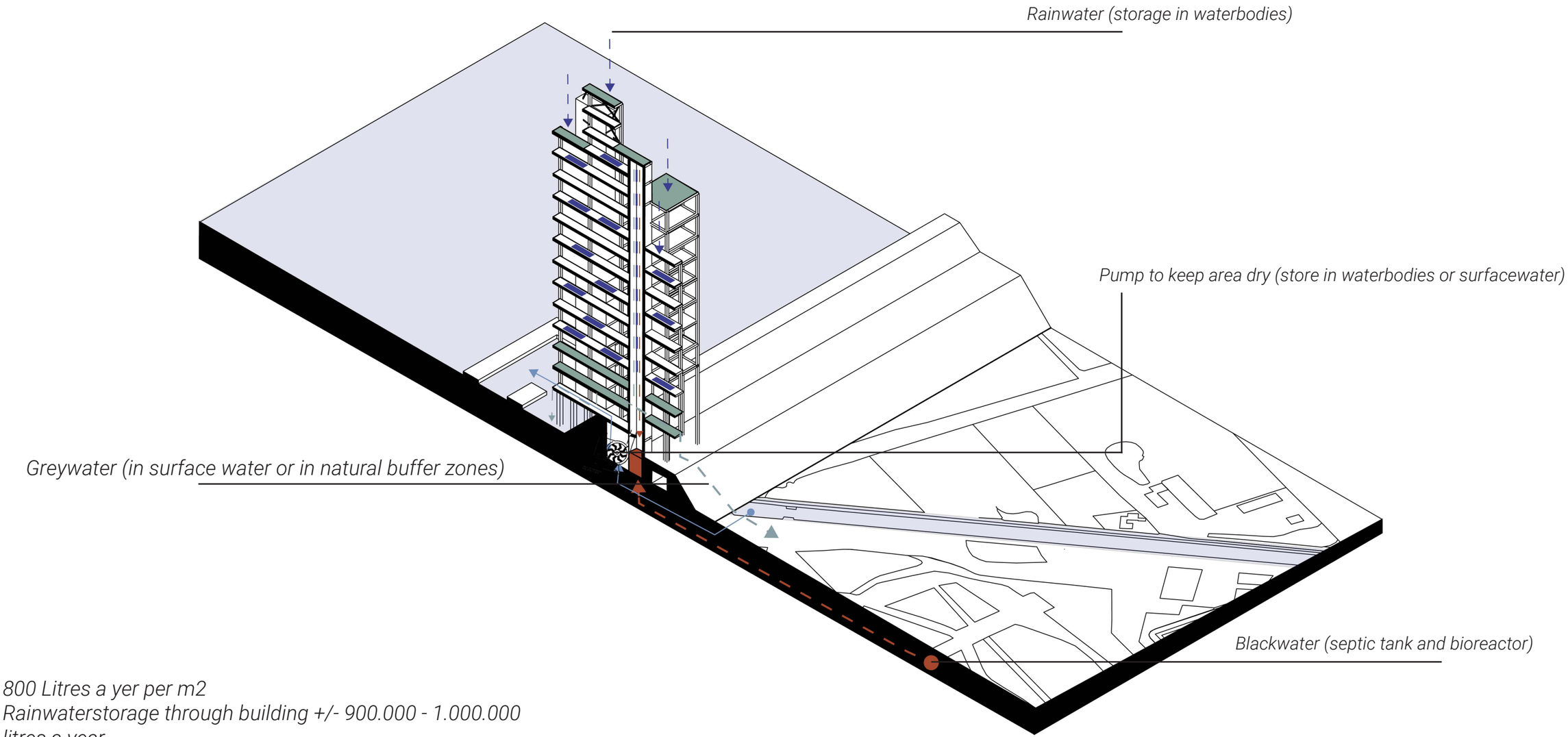


Greywater

Blackwater

Water distribution

Separated system



800 Litres a yer per m2
Rainwaterstorage through building +/- 900.000 - 1.000.000 litres a year

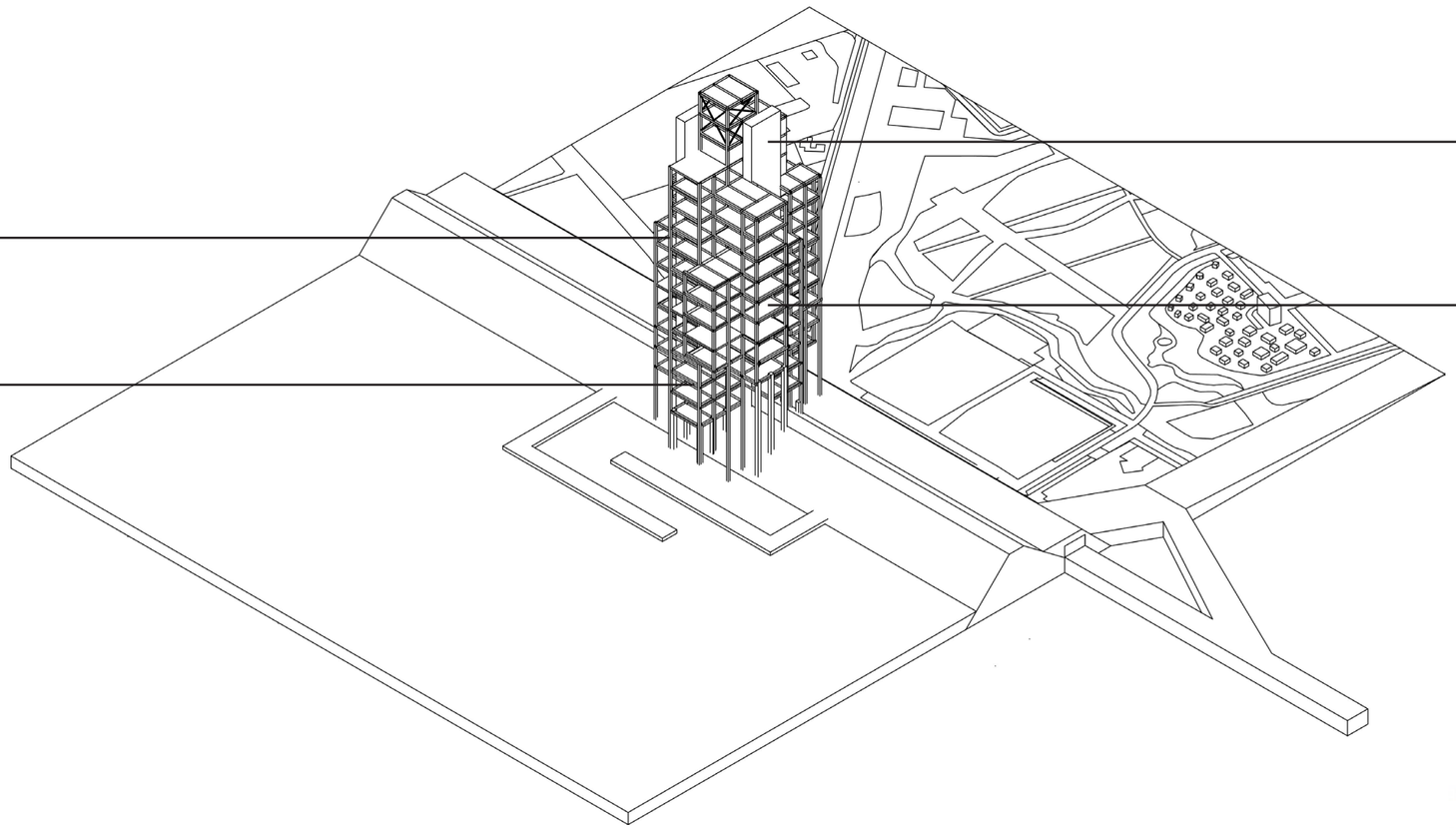
New situation

Placing building on site

Scale 1:2500

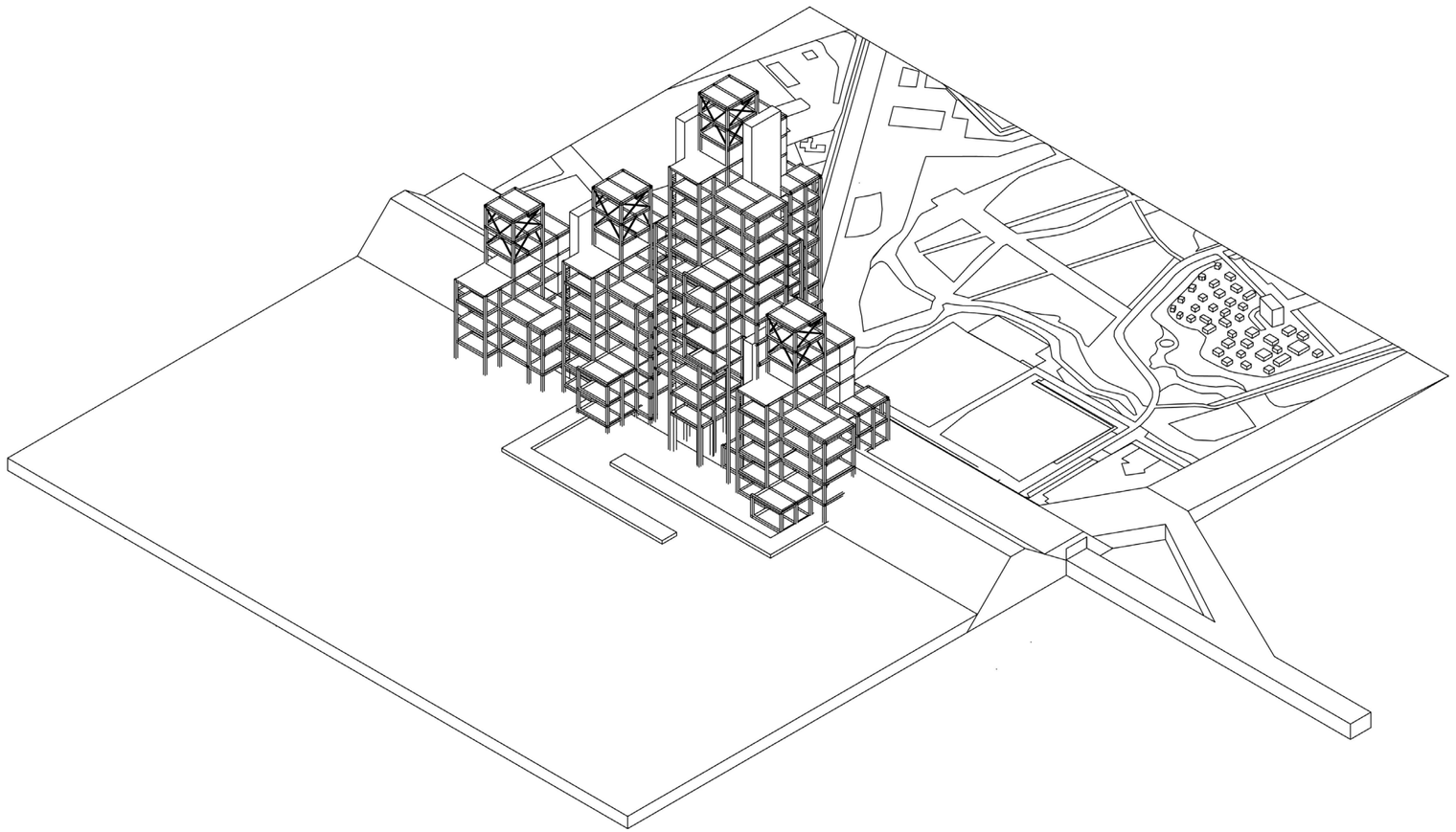
The structure

Construction based on Habraken theory “drager” - Grid 10x5 m



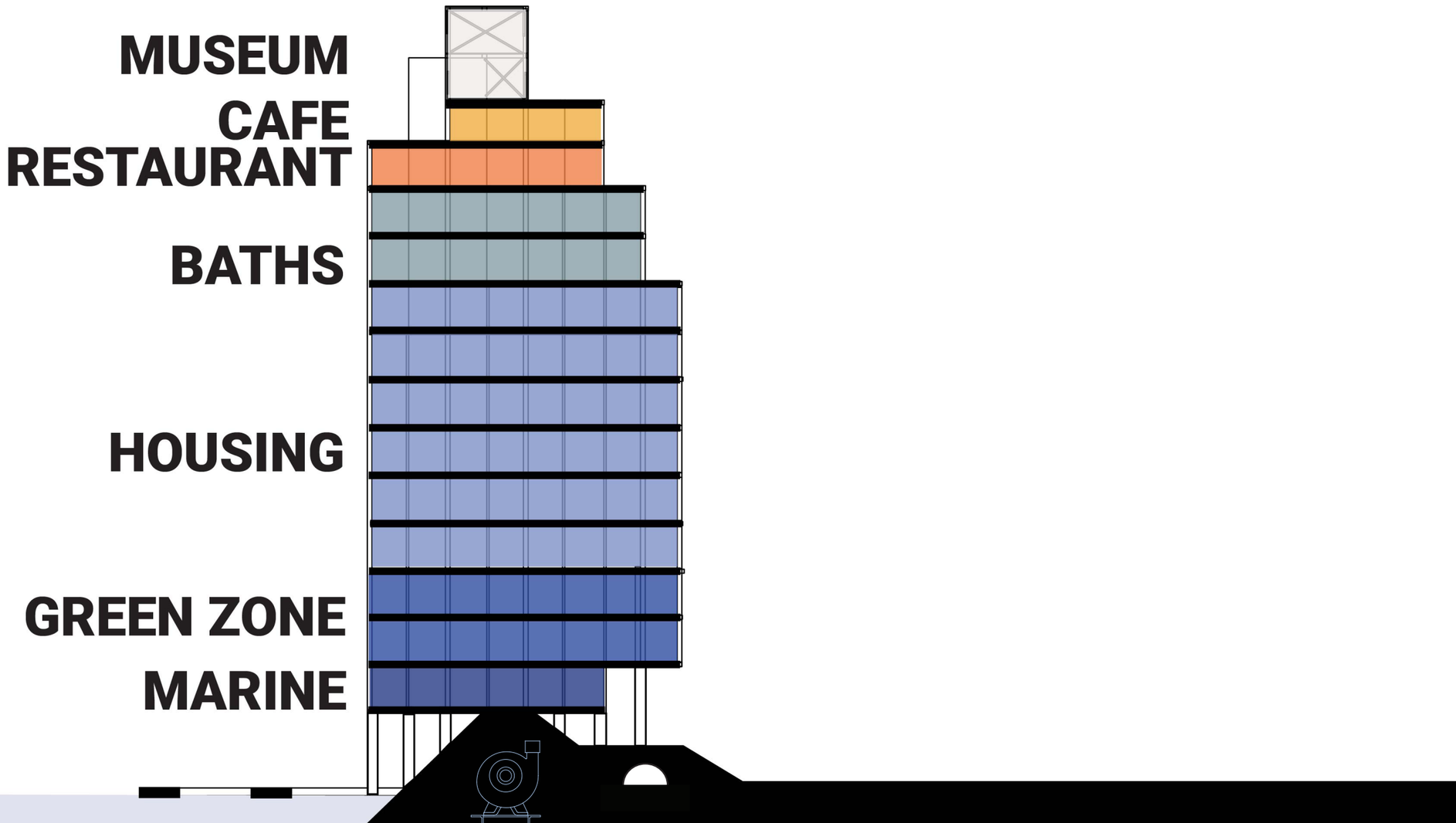
Future waterscapes

Flexible structure



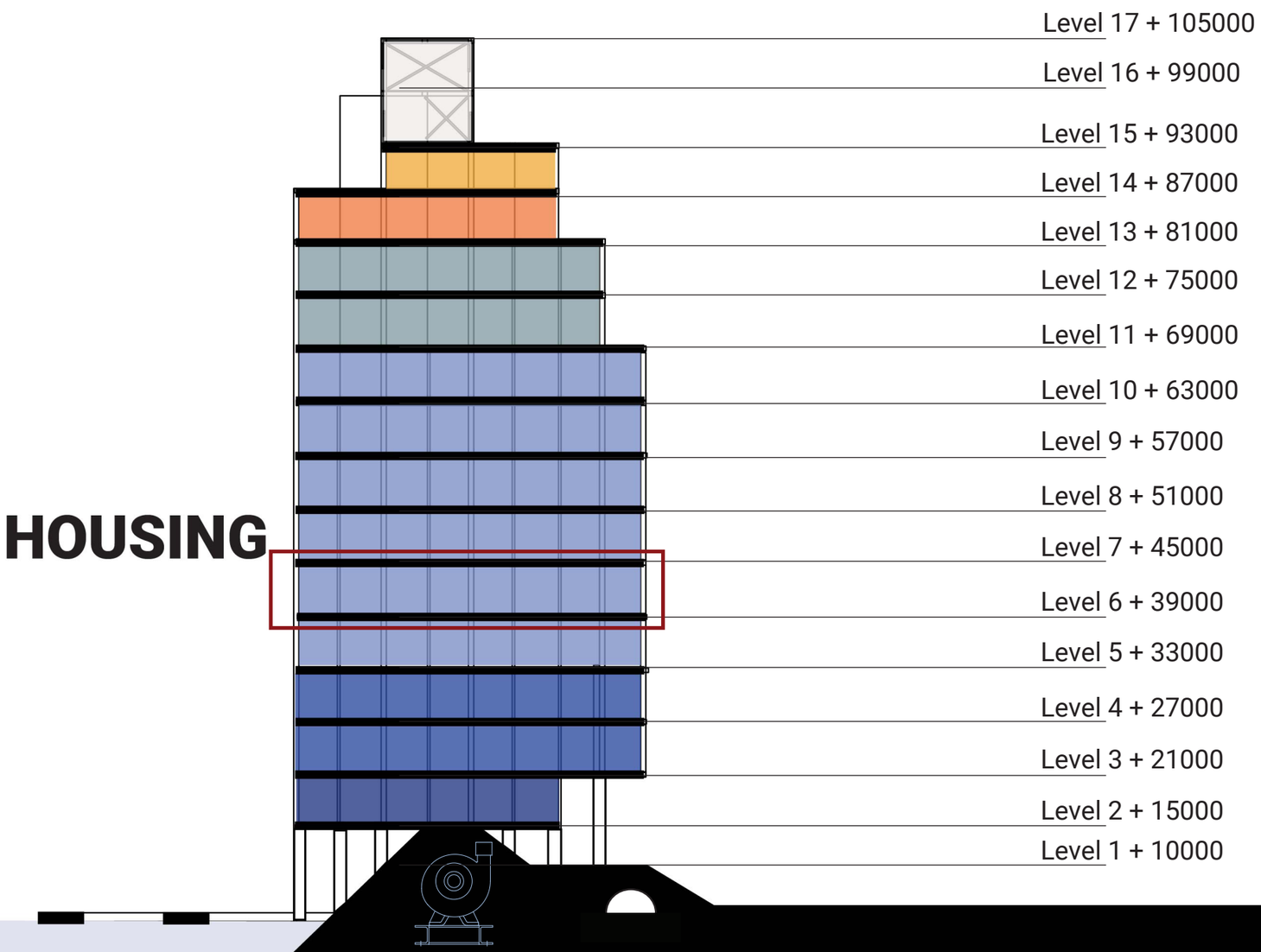
The Program

PLAN B



Housing morfology

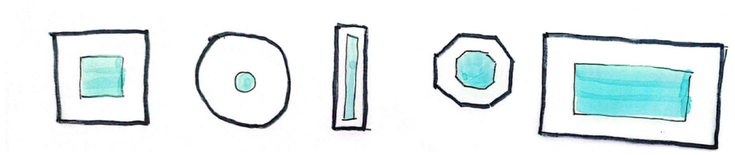
Level 6-7



Principle Floorplan

Based on TEK design-guides of stepwells

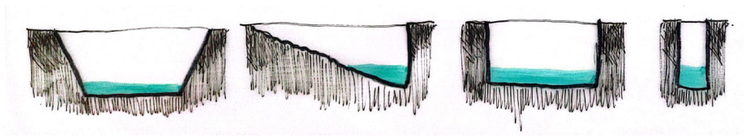
Form
The way people will follow the structure

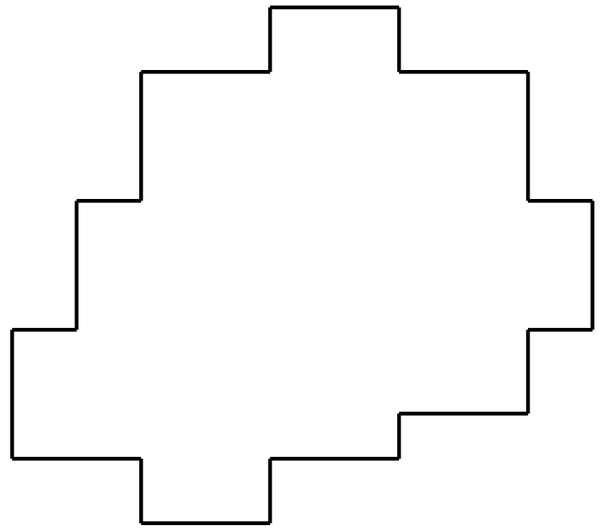


Routing
(creating playfull shadows via Stairs & setbacks)

Collonade
A sense of embracement

Enclosed by earth
creating a cooler microclimate due to the presence of water

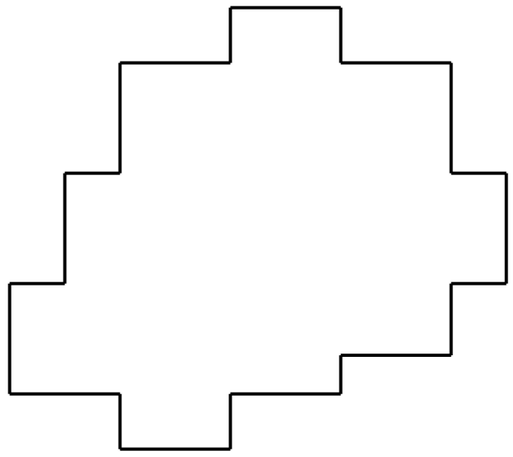




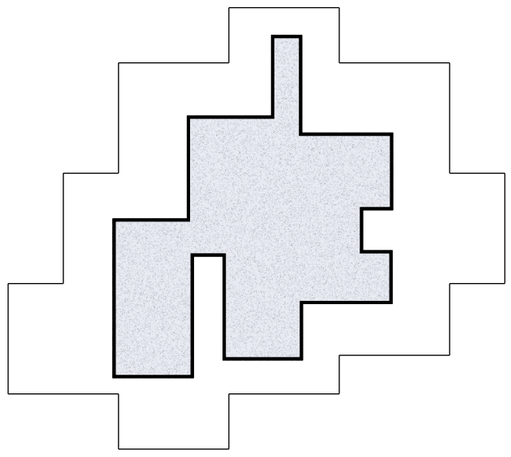
Level 6

Principle Floorplan

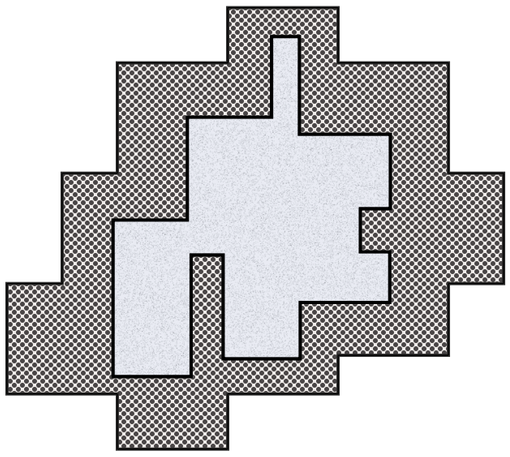
Based on TEK design-guides of stepwells



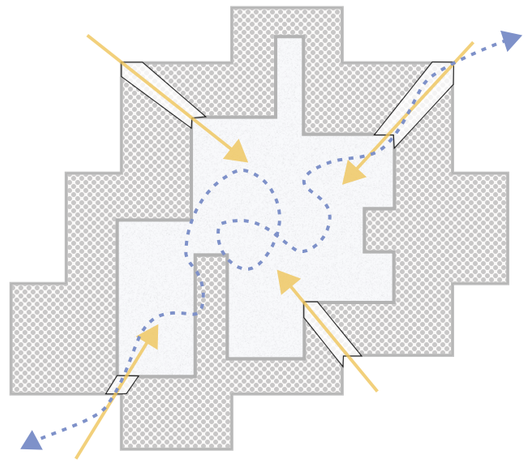
Level 6



Waterbody



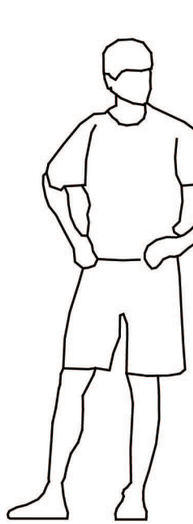
Dwellings

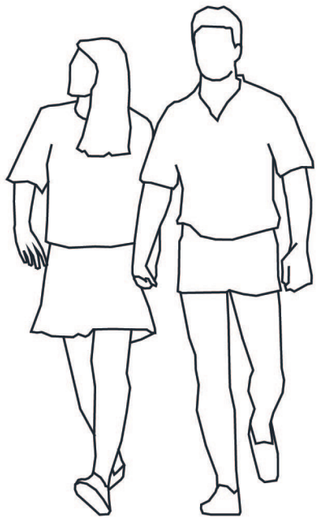


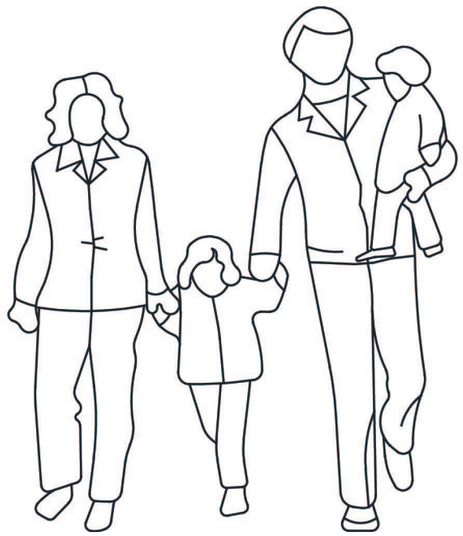
Microclimate

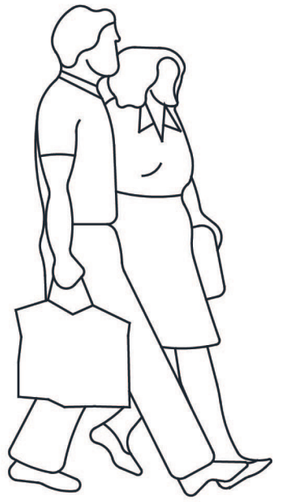
For “Whom?”

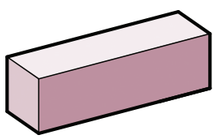
Residents (Visitors)



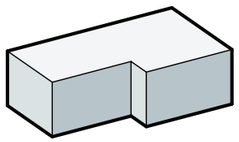




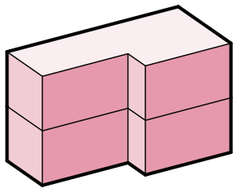




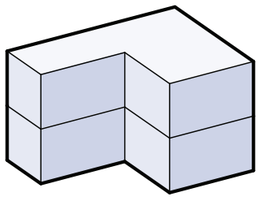
Type A - 30 m2



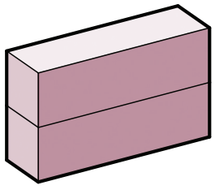
Type D - 50 m2



Type B2 - 80 m2



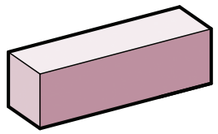
Type E2 - 120m2



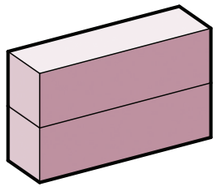
Type A2 - 60 m2

Mass placing

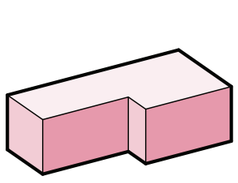
10 dwellings --> 30/40 people



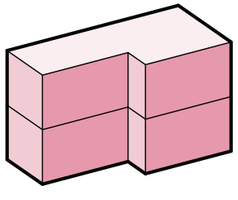
Type A - 30 m2



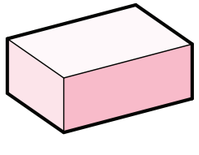
Type A2 - 60 m2



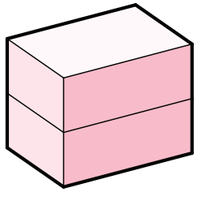
Type B - 40 m2



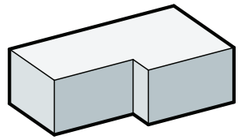
Type B2 - 80 m2



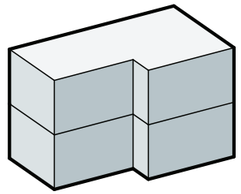
Type C - 40 m2



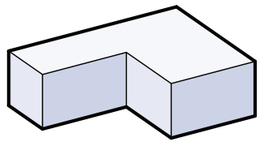
Type C2 - 80 m2



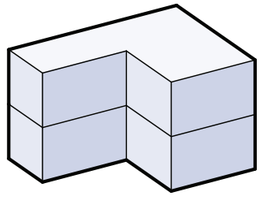
Type D - 50 m2



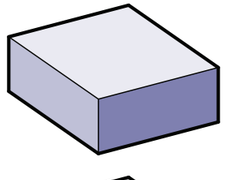
Type D2 - 100 m2



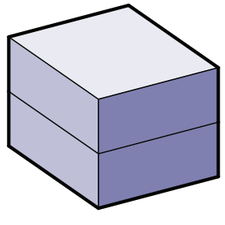
Type E - 60 m2



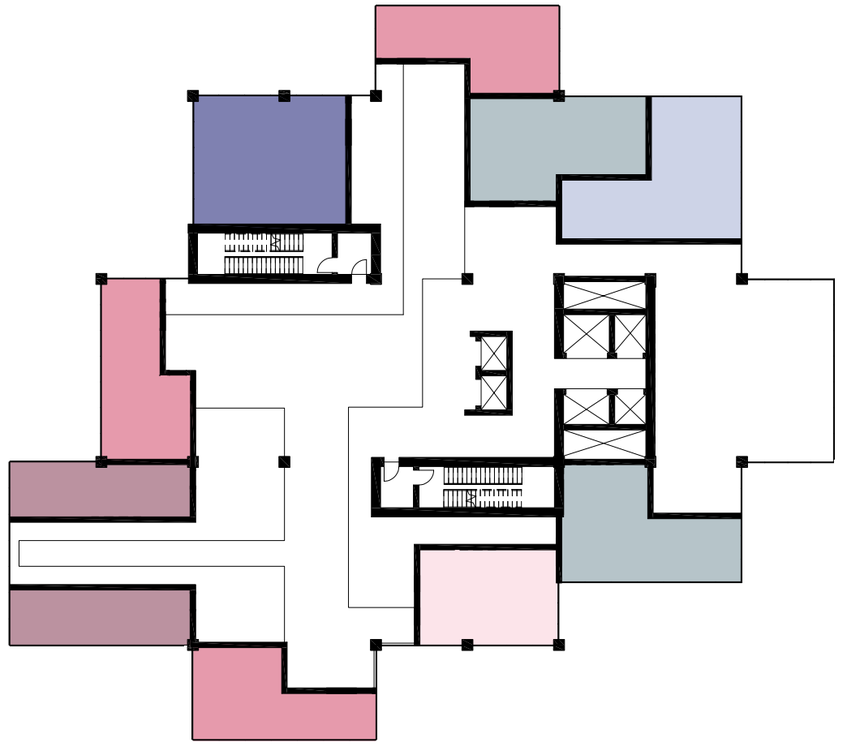
Type E2 - 120m2



Type F - 60 m2

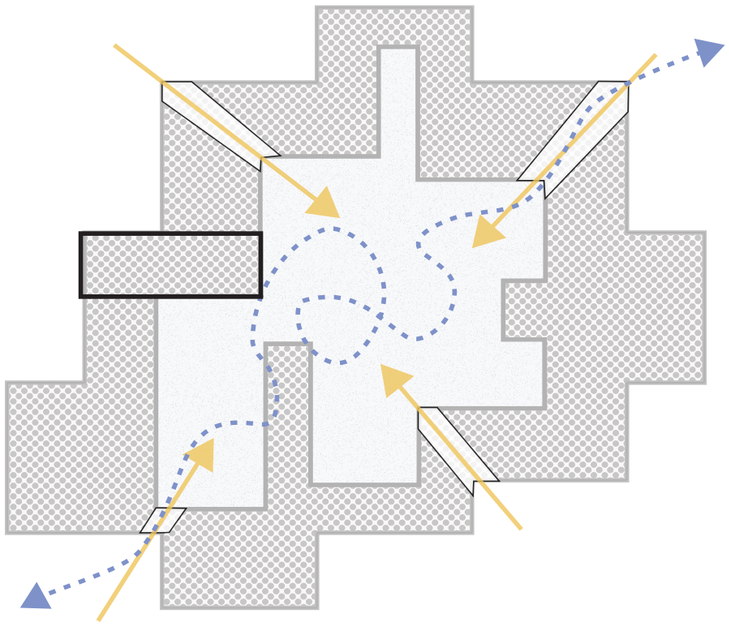


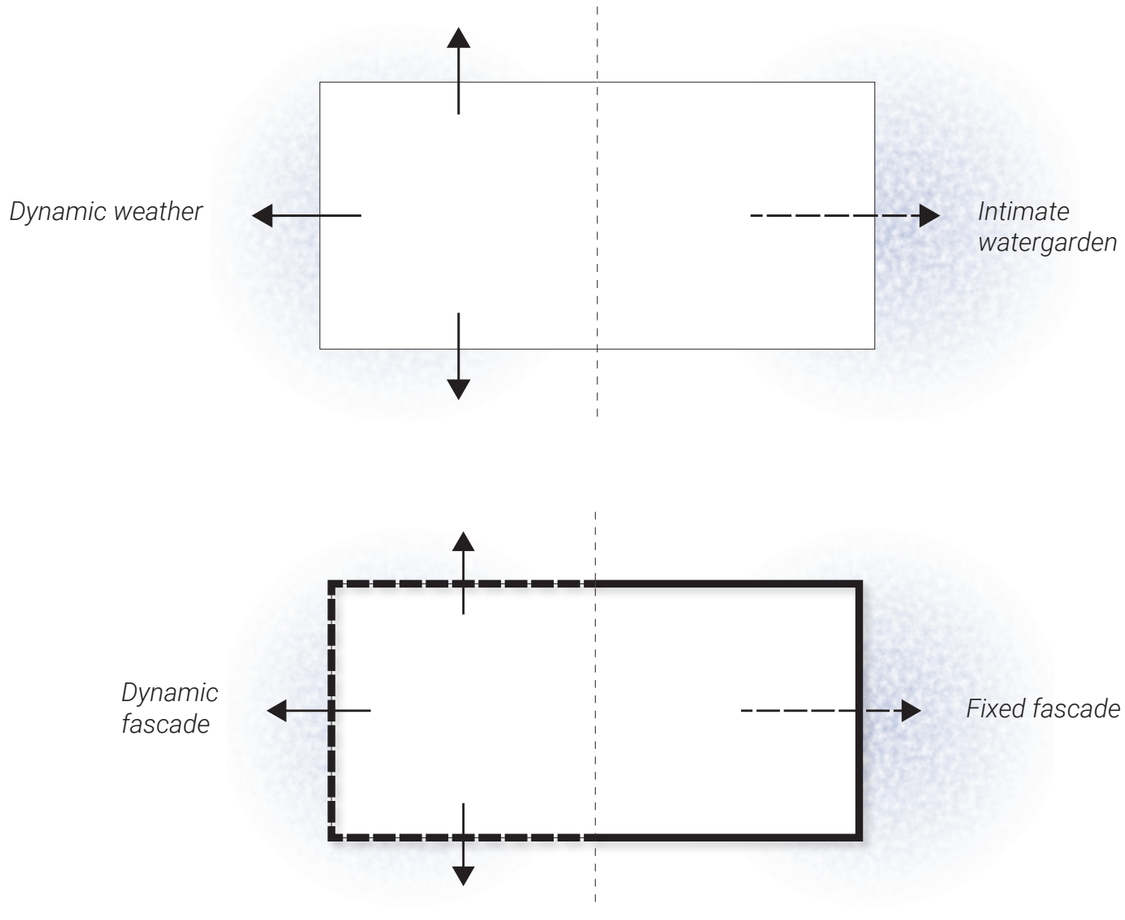
Type F2 - 120 m2



Principle Dwelling

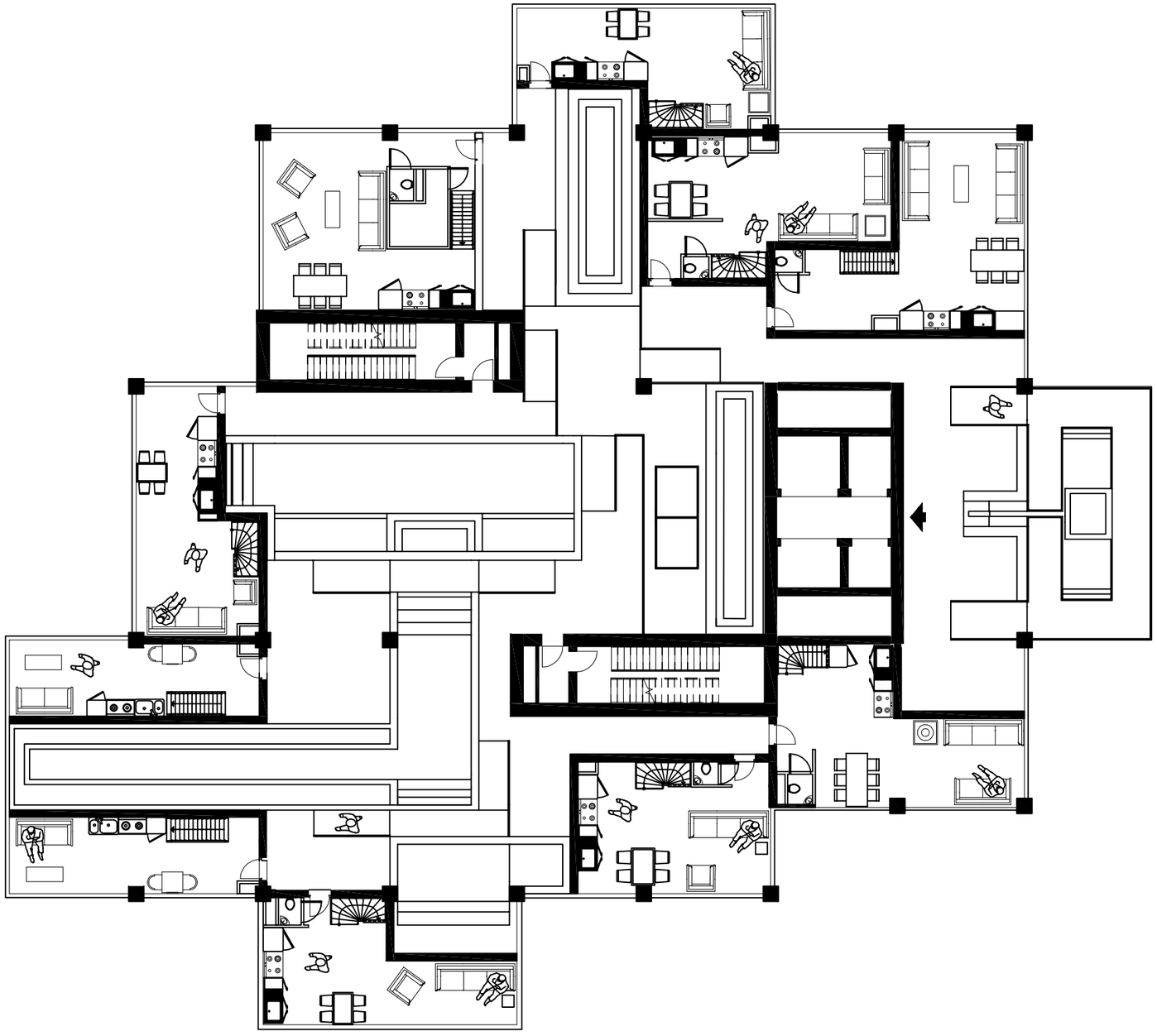
“Best of both worlds”





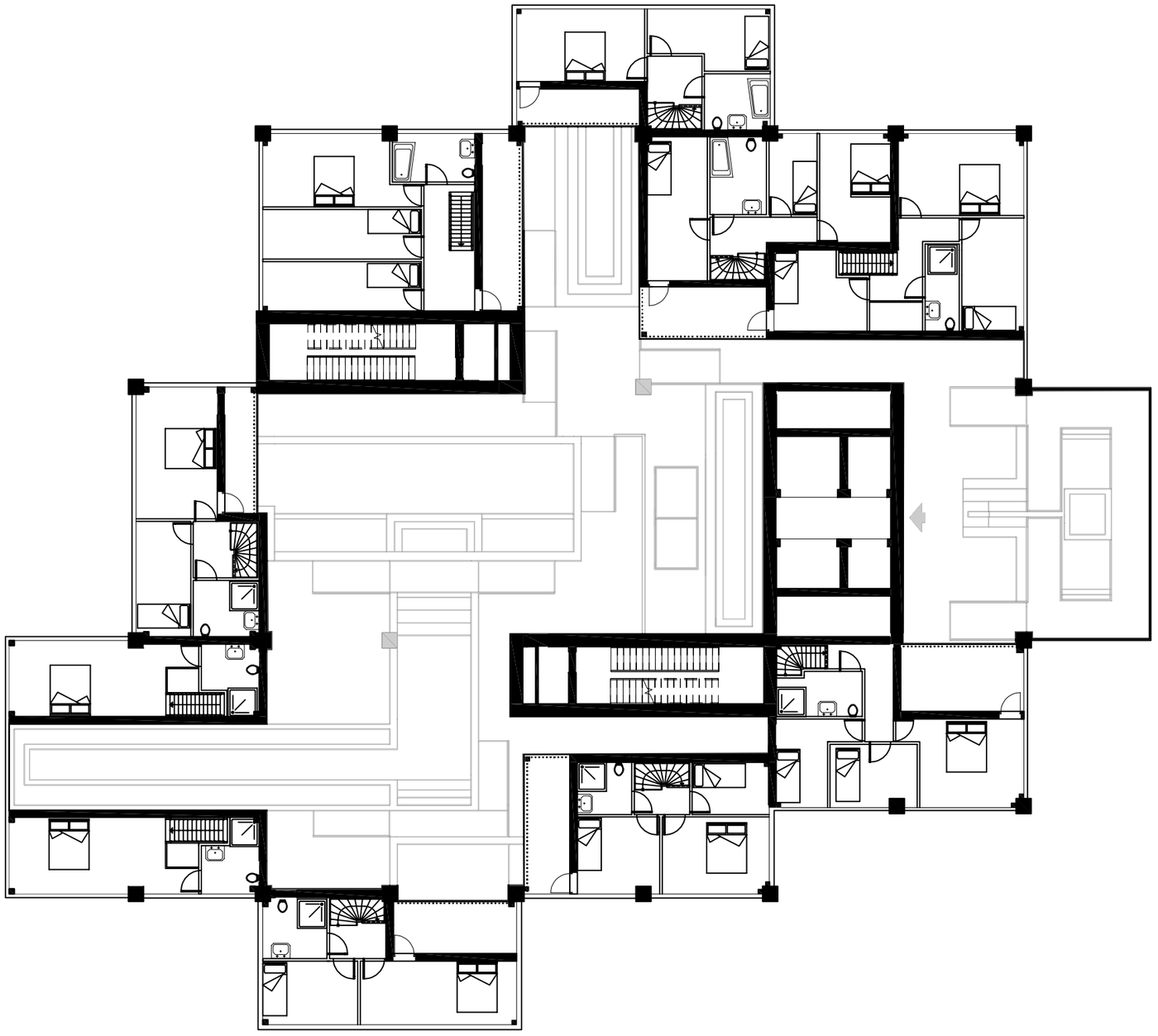
Level 6

scale 1:200



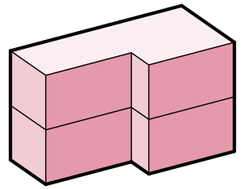
Level 6’

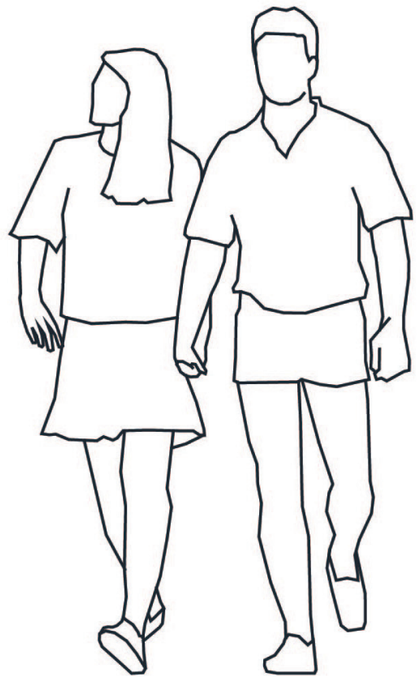
scale 1:200

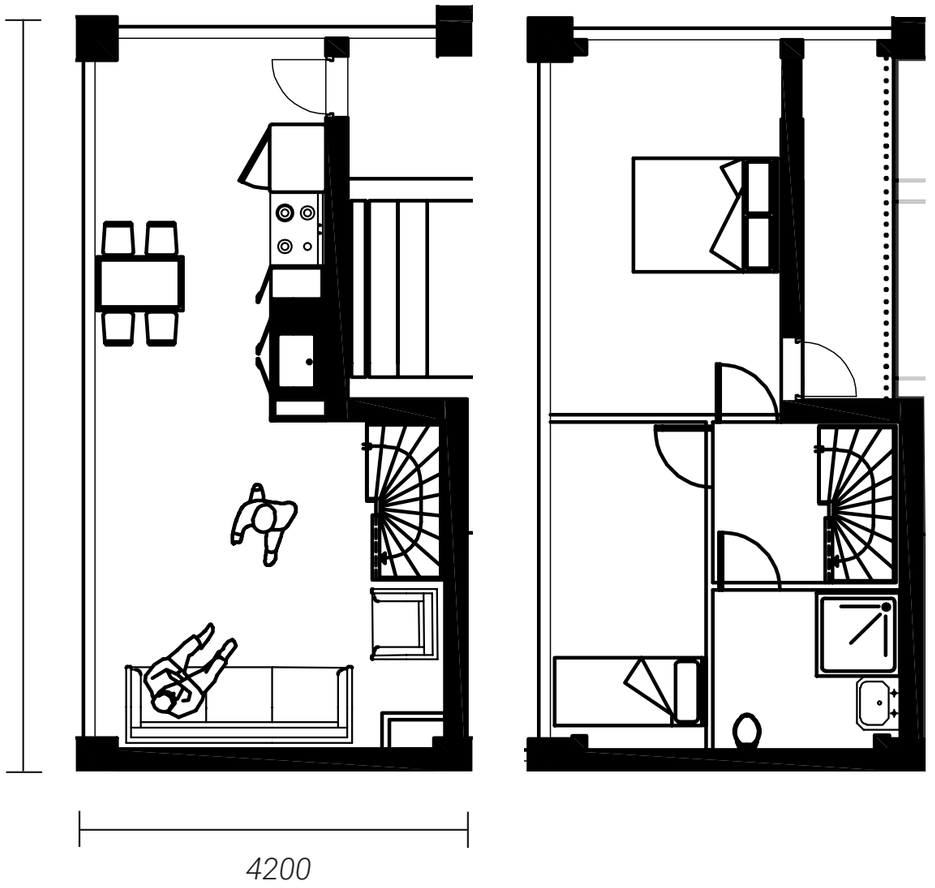


Type B2

80 m2 - double height - couple starting family

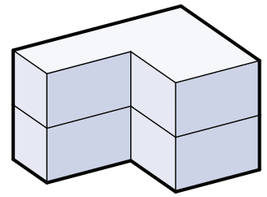


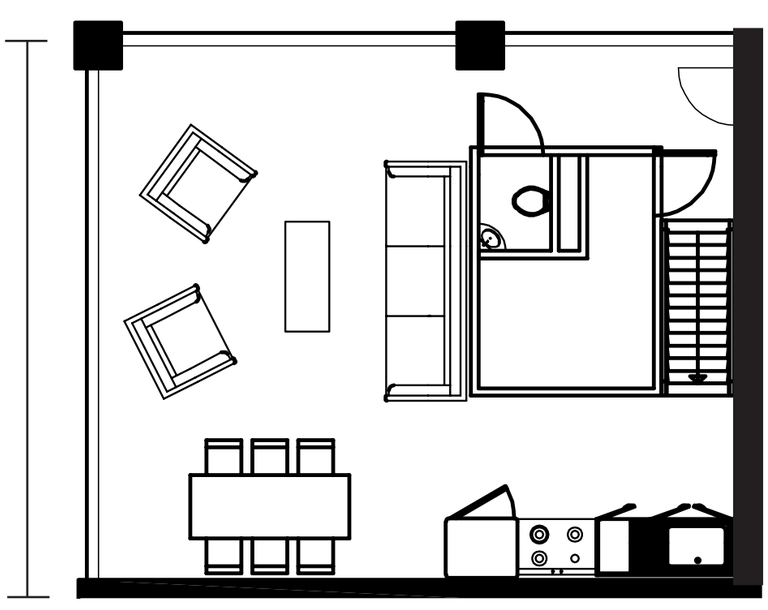


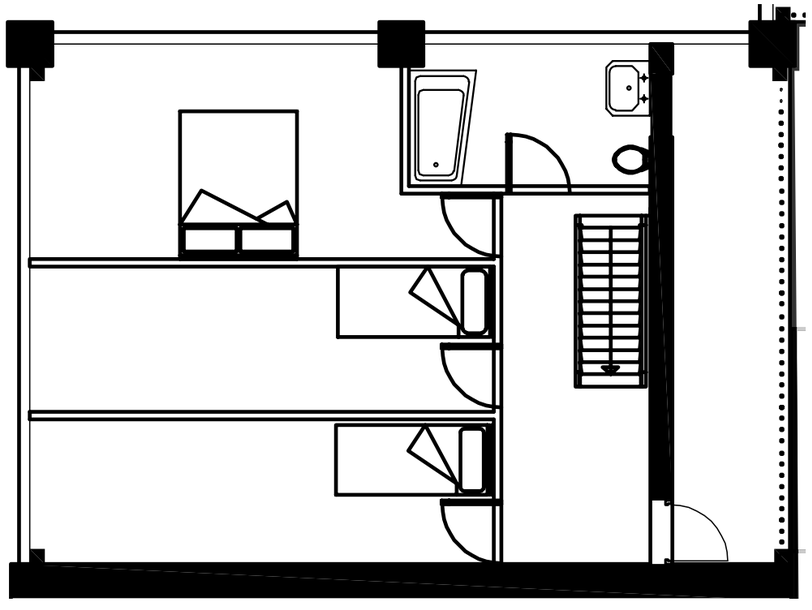


Type F2

12 m2 - double height - Family

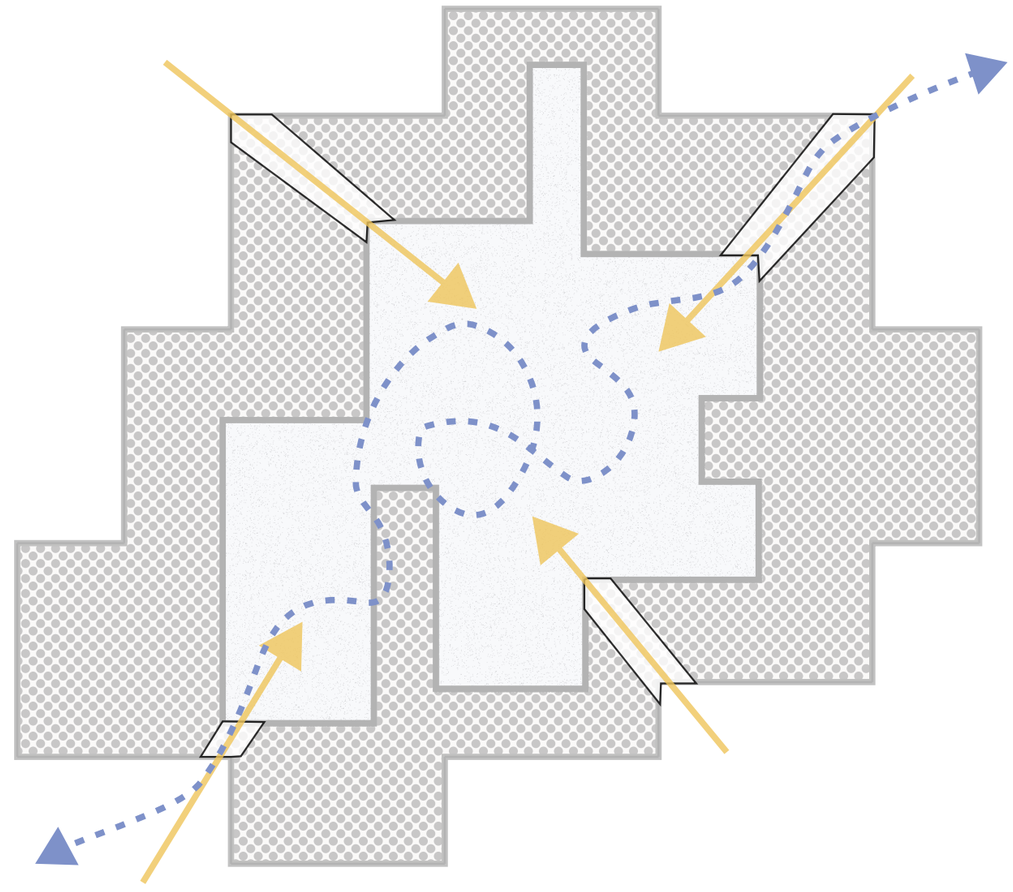






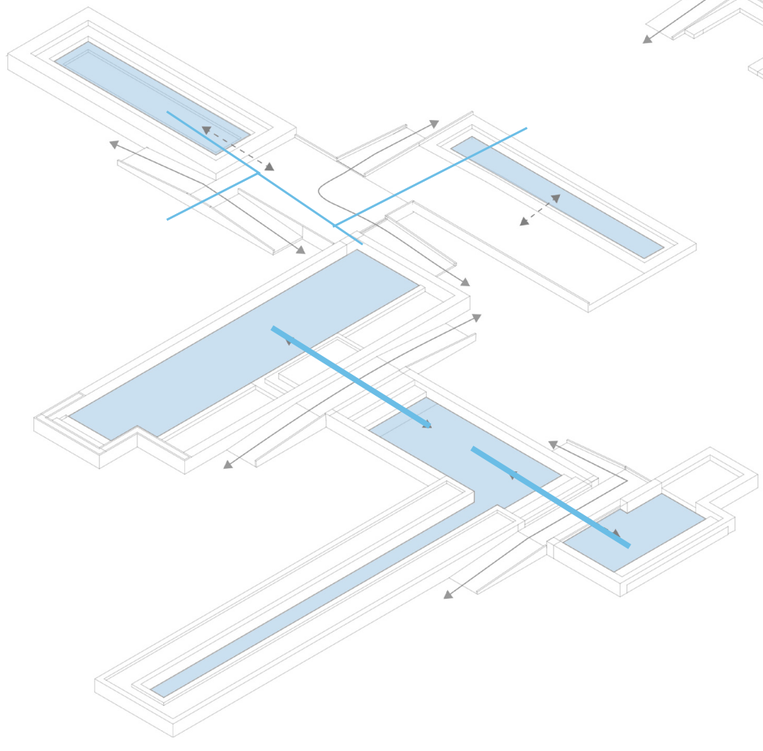
Microclimate

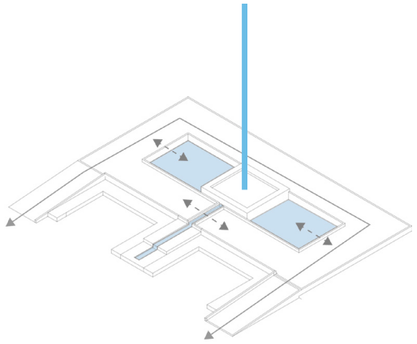
Daylight and ventilation

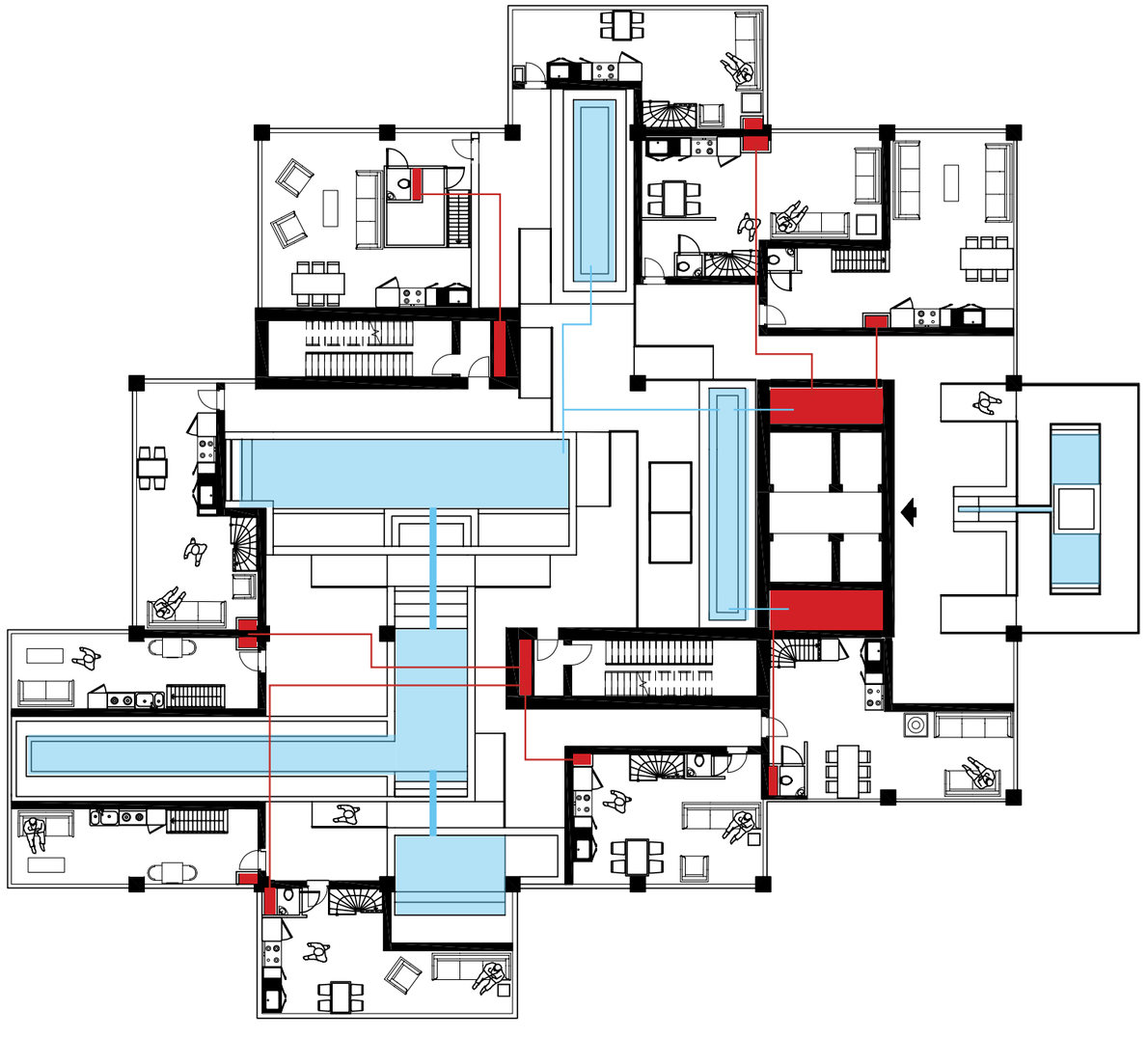


Waterdistribution

Rainwater, Greywater and Blackwater

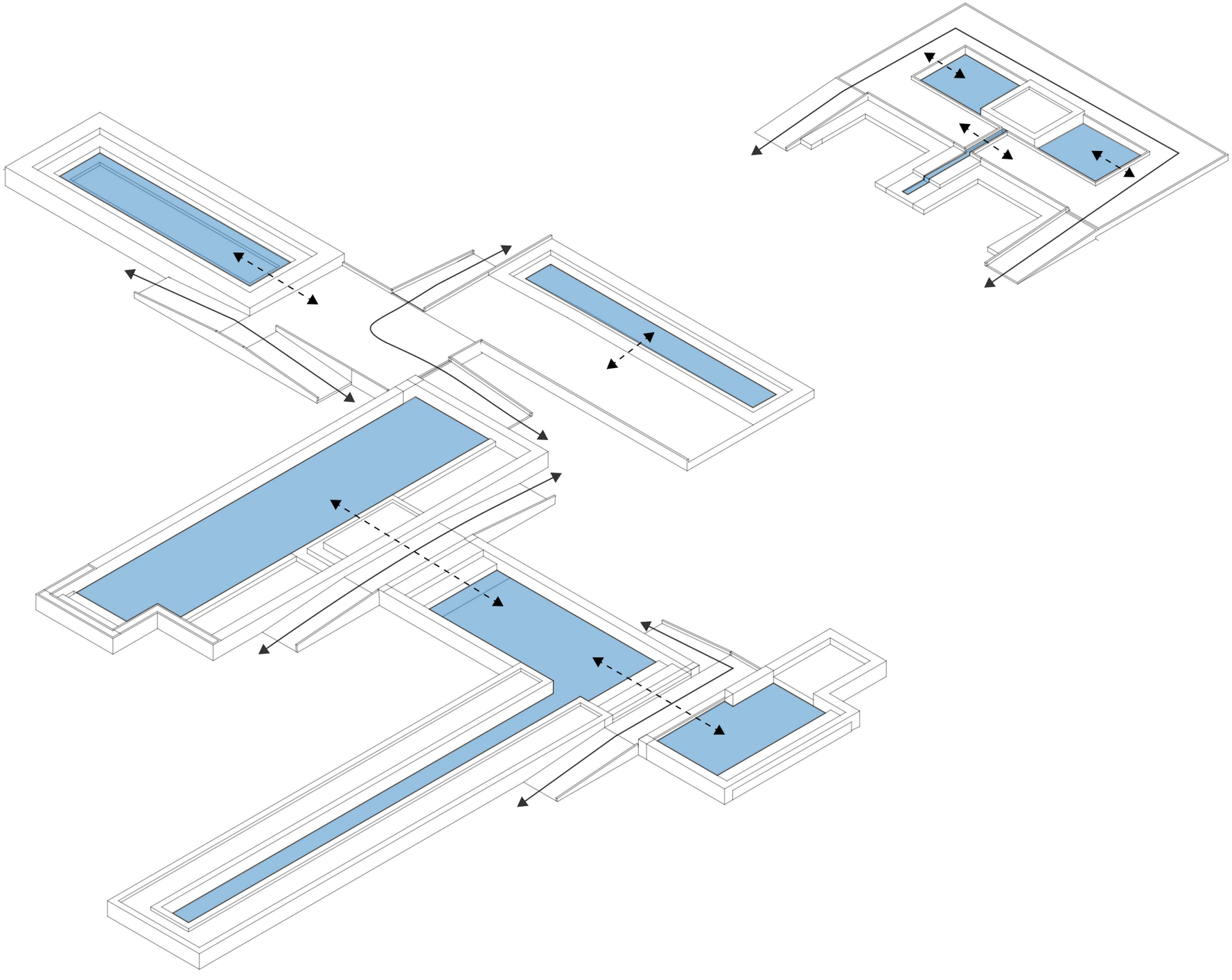




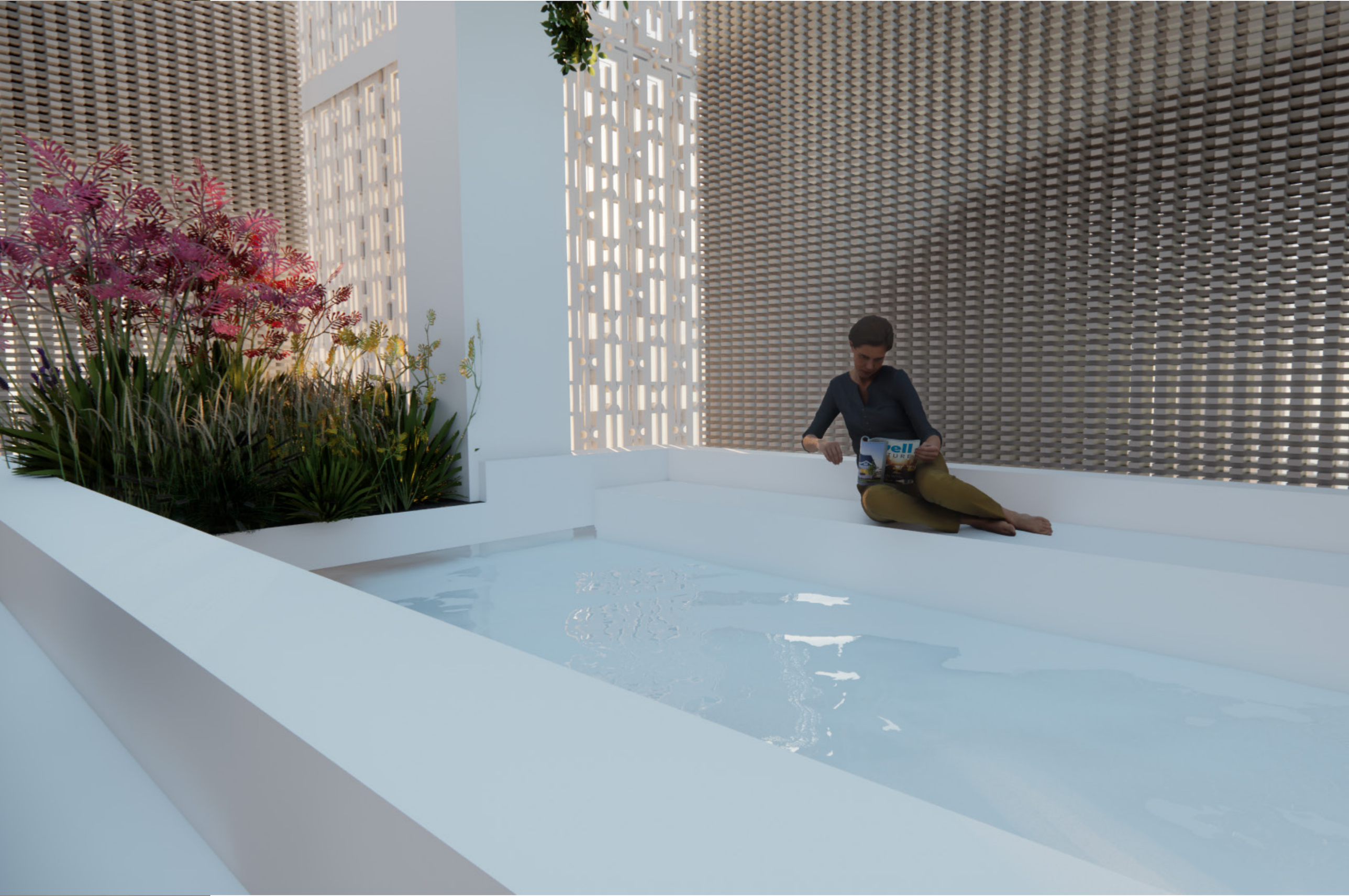


Routing

With slopes

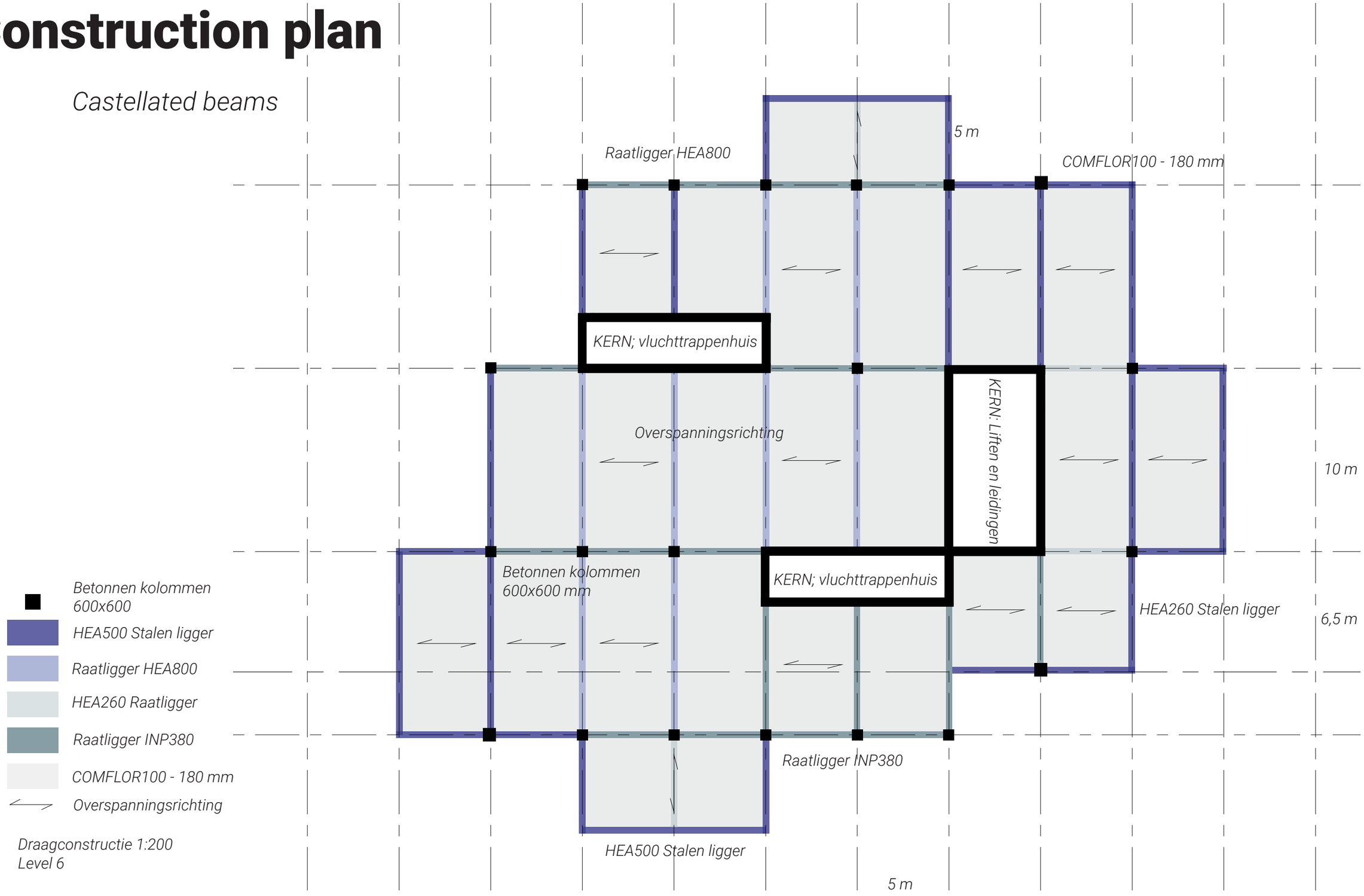


Between 22.000-40.000 litres



Construction plan

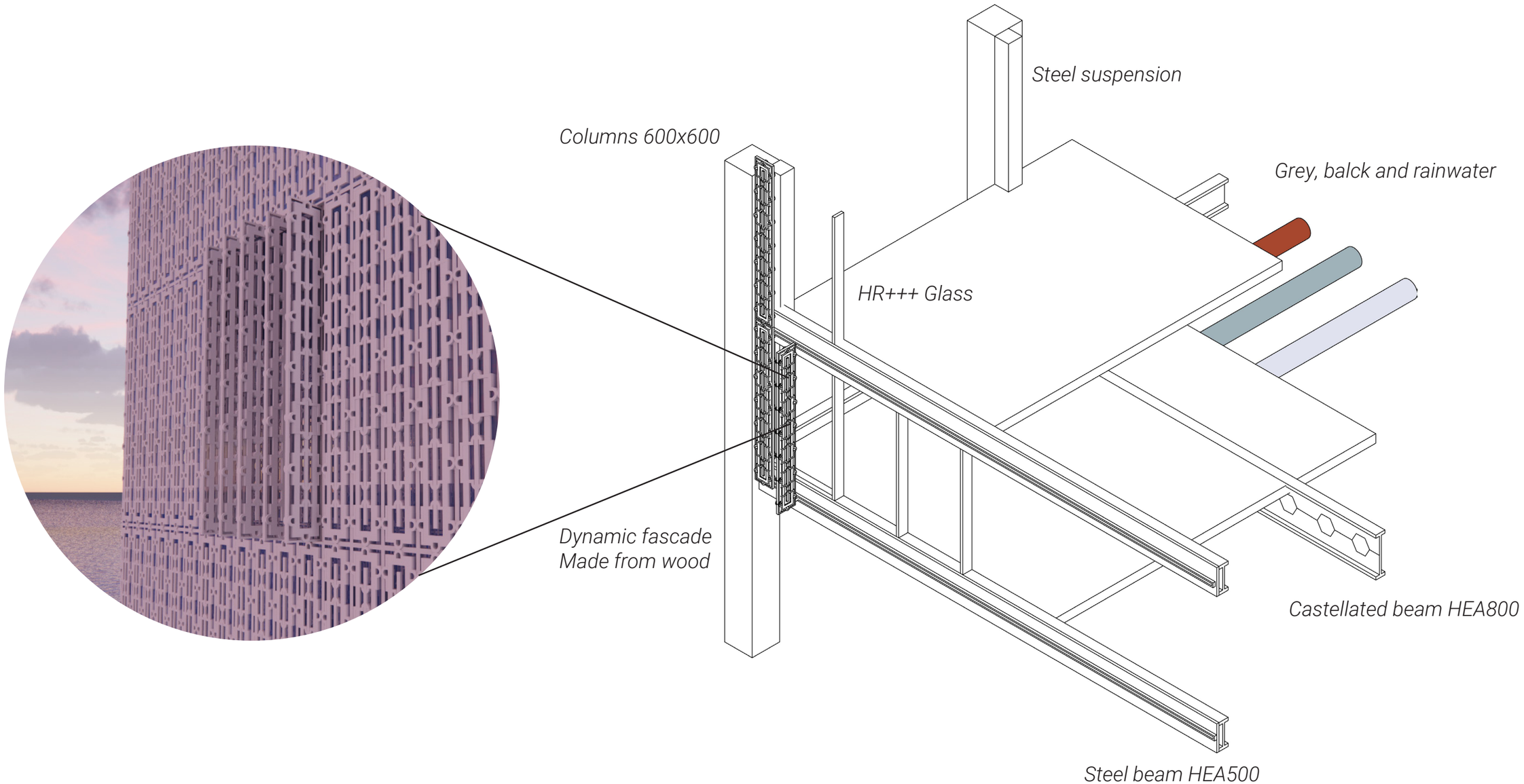
Castellated beams



Draagconstructie 1:200
Level 6

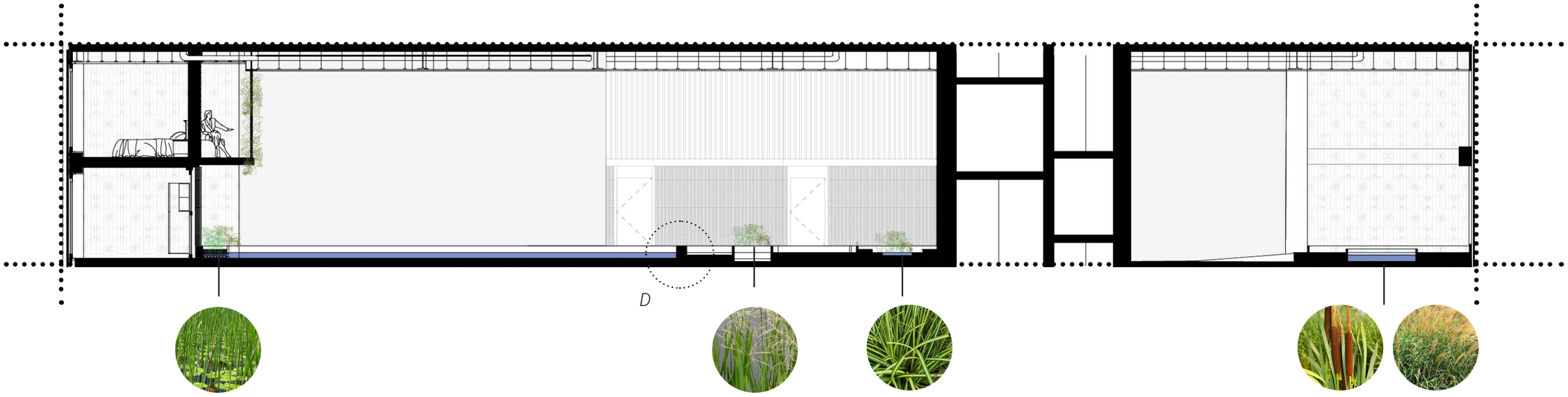
3D construction principle

Rainwater, Greywater and Blackwater



Waterfiltering

Helophytefilters



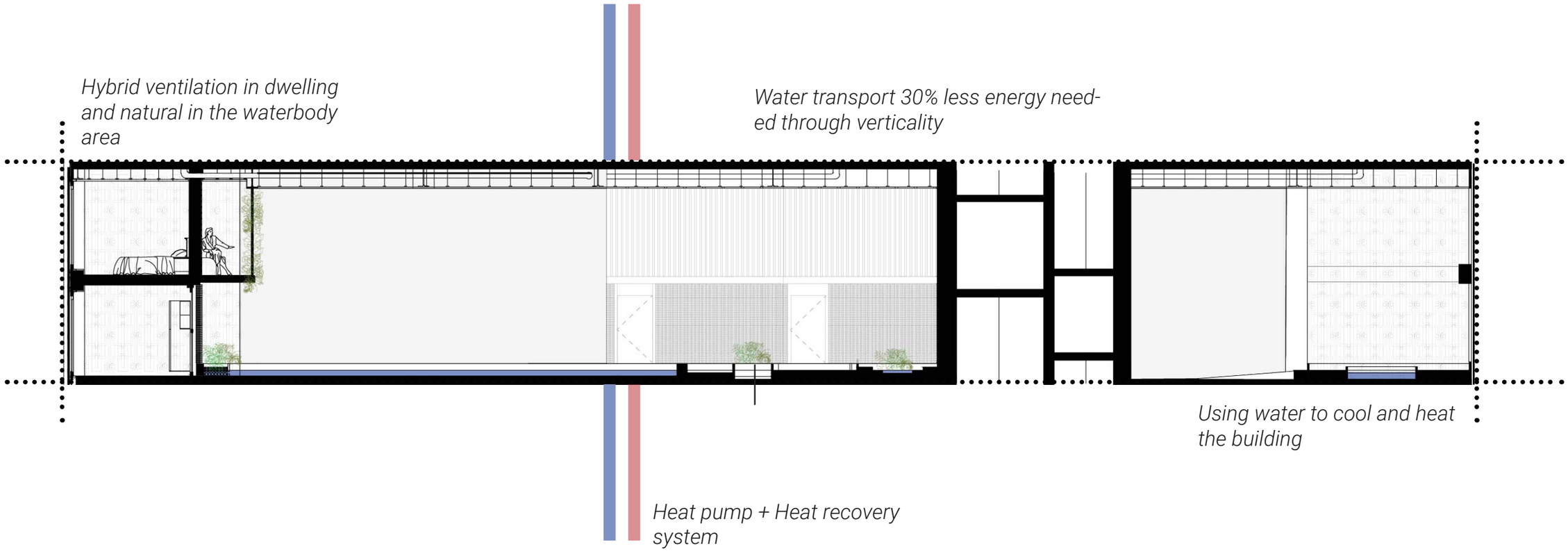
Section 1:200
Level 6

WINTER/SUMMER SITUATION

Water + wind

Hybrid ventilation in dwelling and natural in the waterbody area

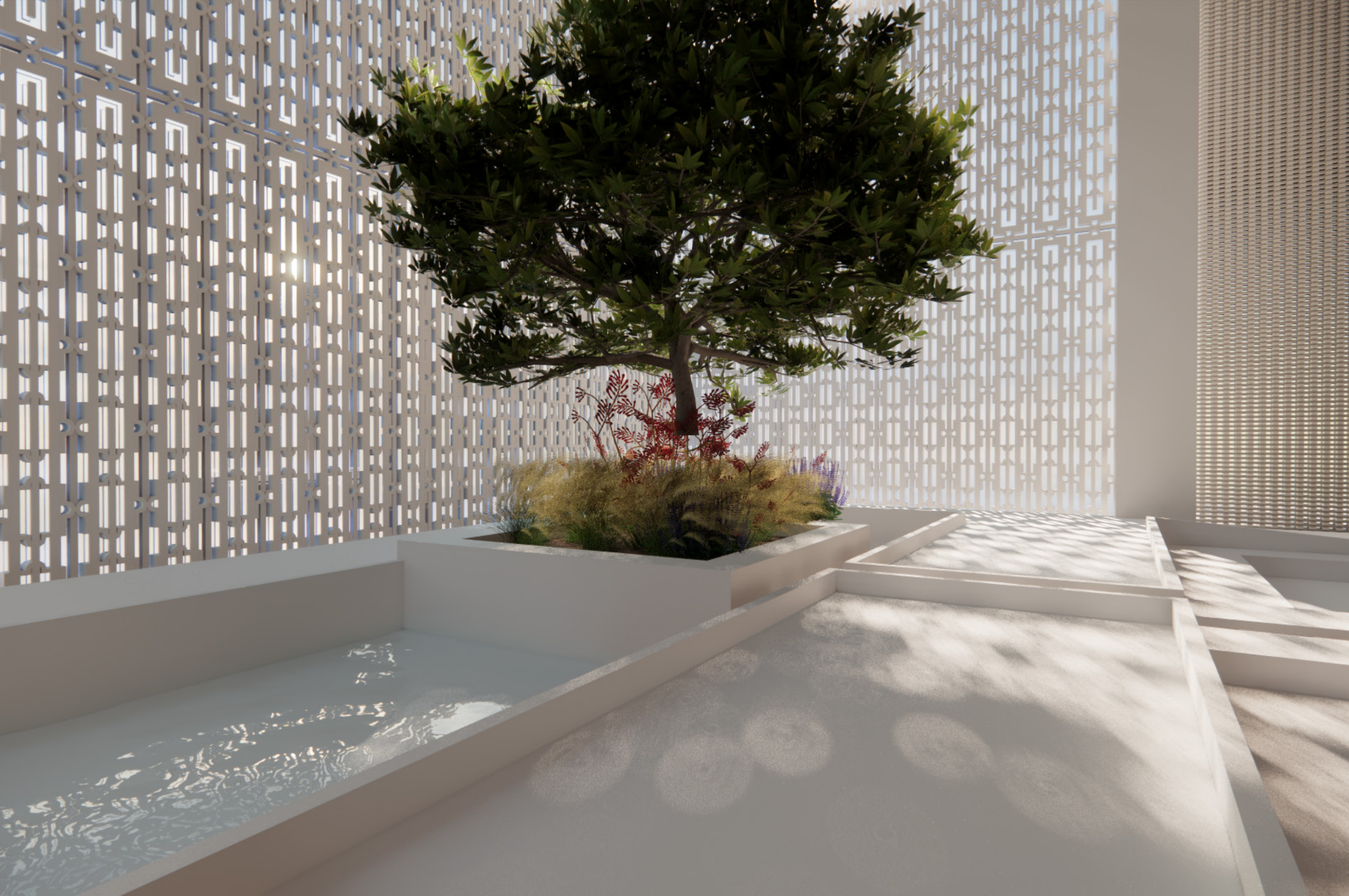
Water transport 30% less energy needed through verticality



Using water to cool and heat the building

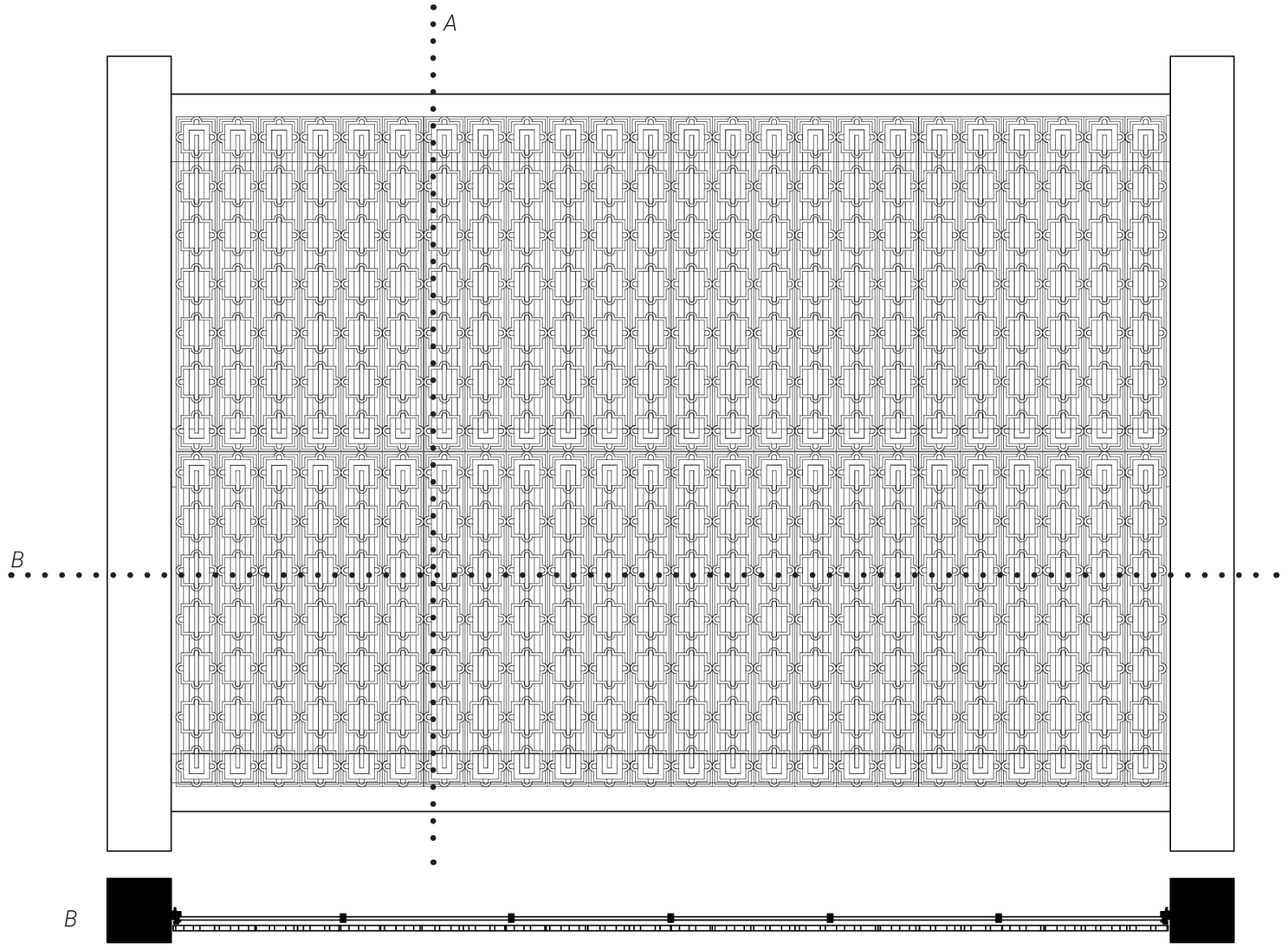
Heat pump + Heat recovery system

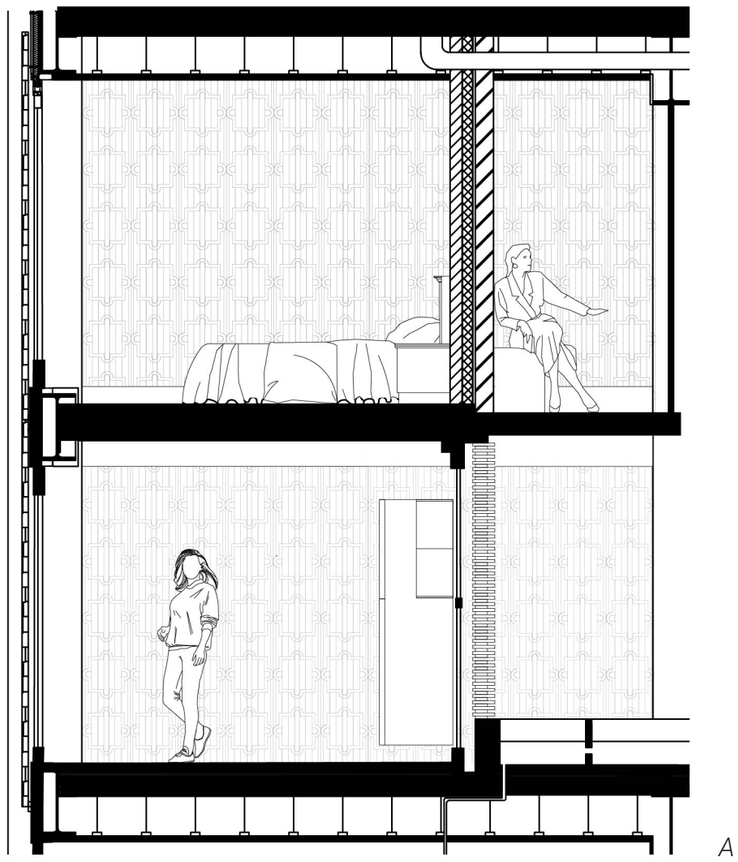
Section 1:200
Level 6



Building technology

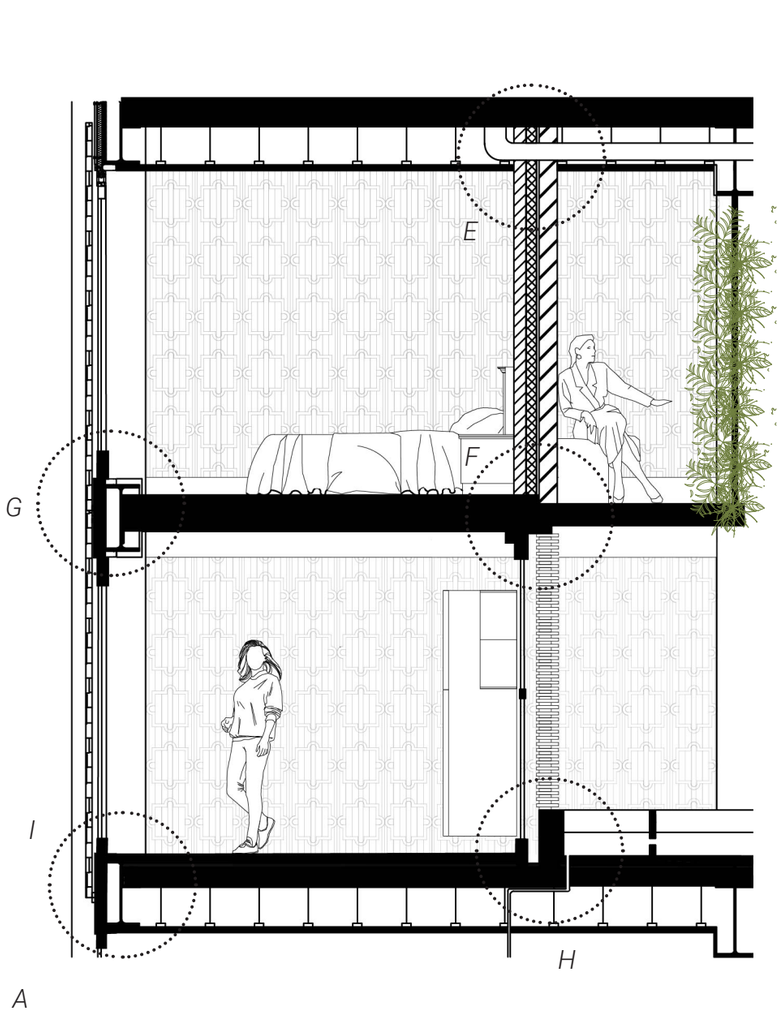
Fascade 1 - 1:50

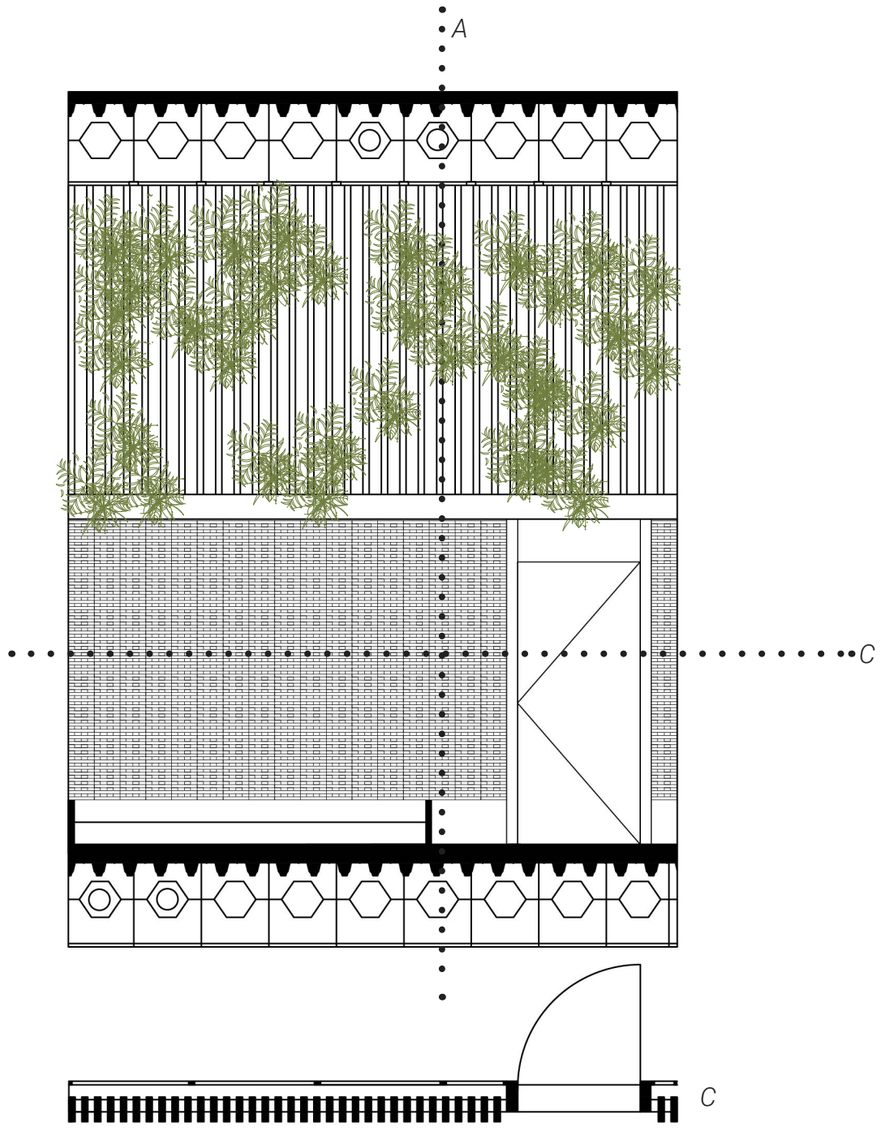




Building Technology

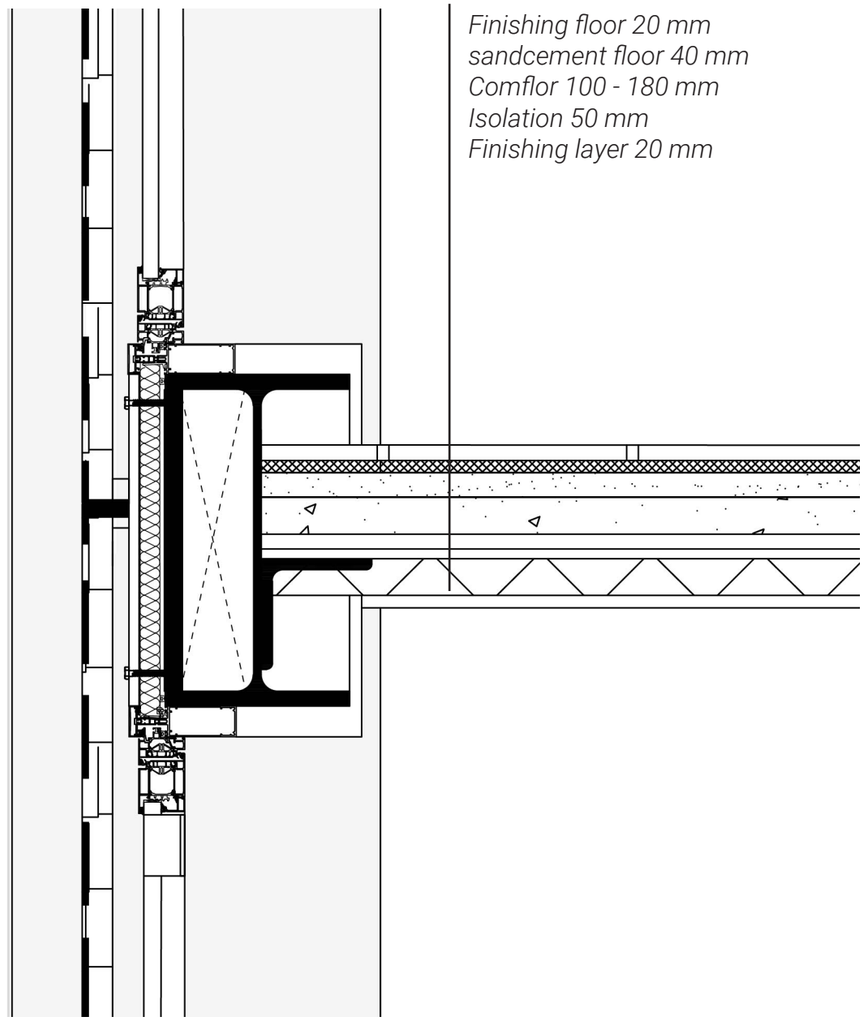
Fascade 2 - 1:50





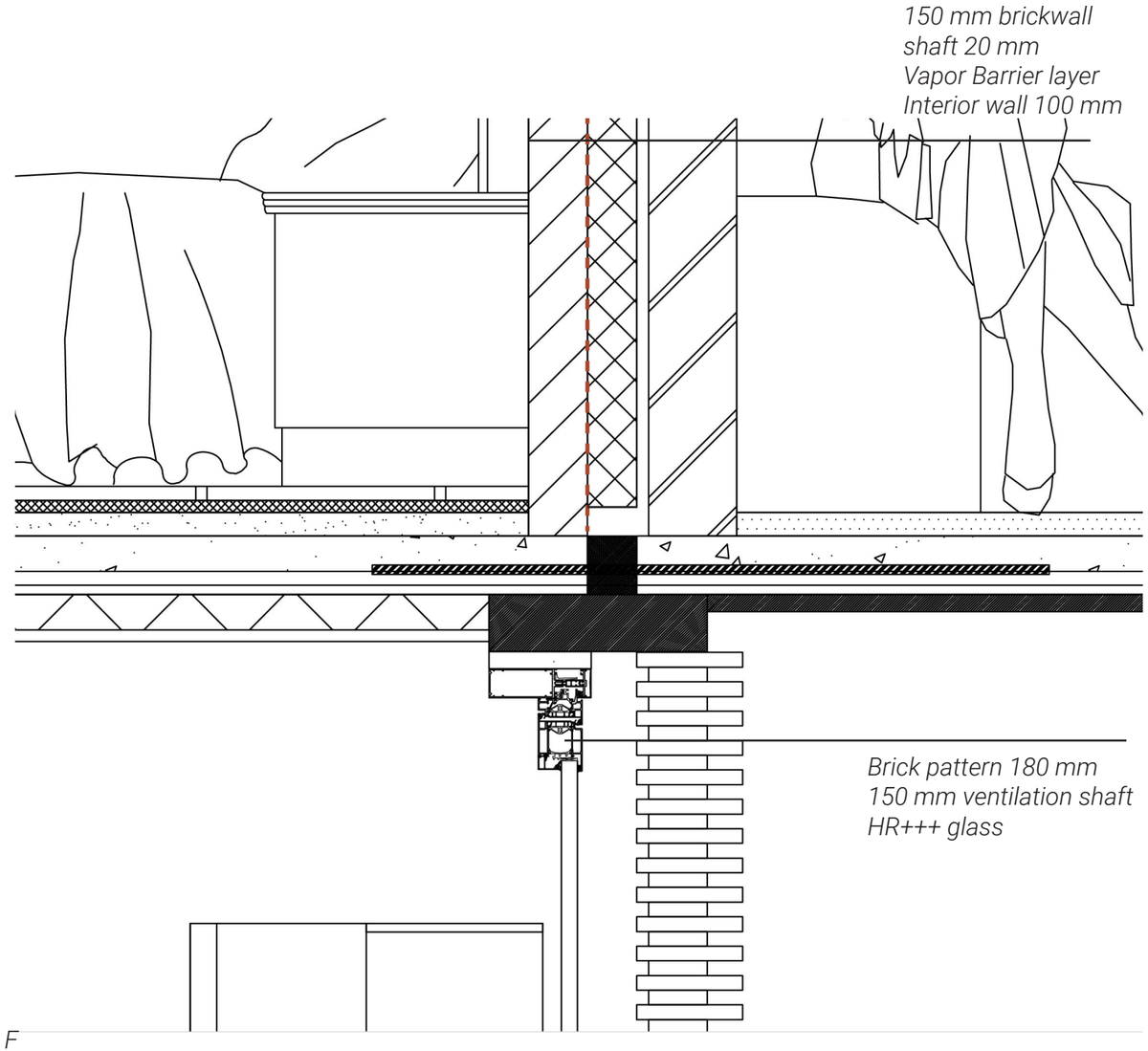
Building Technology

Details - 1:10



Finishing floor 20 mm
sandcement floor 40 mm
Comflor 100 - 180 mm
Isolation 50 mm
Finishing layer 20 mm

G



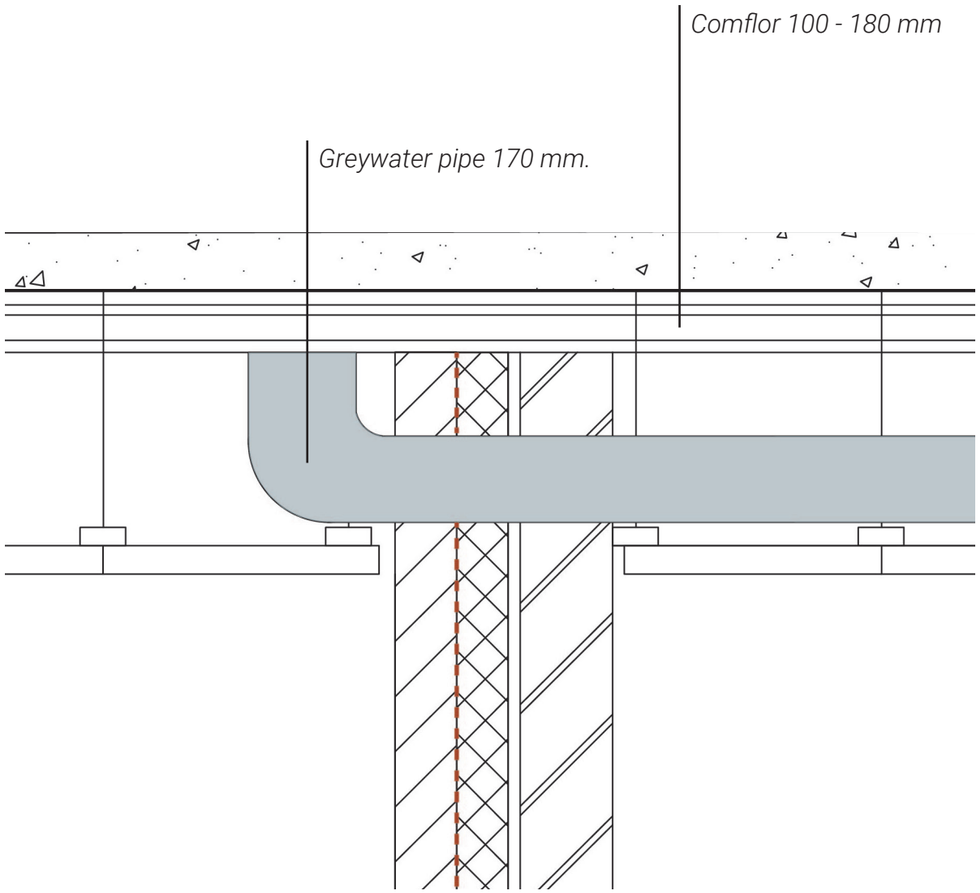
150 mm brickwall
shaft 20 mm
Vapor Barrier layer
Interior wall 100 mm

Brick pattern 180 mm
150 mm ventilation shaft
HR+++ glass

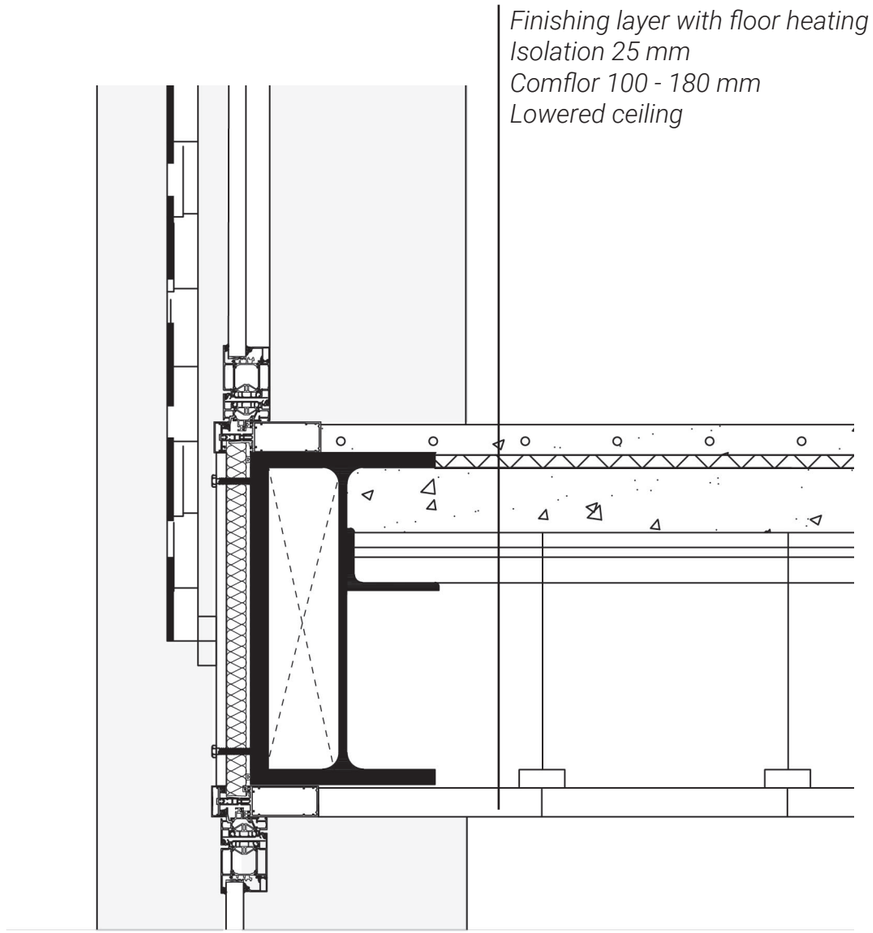
F

Building Technology

Details - 1:10



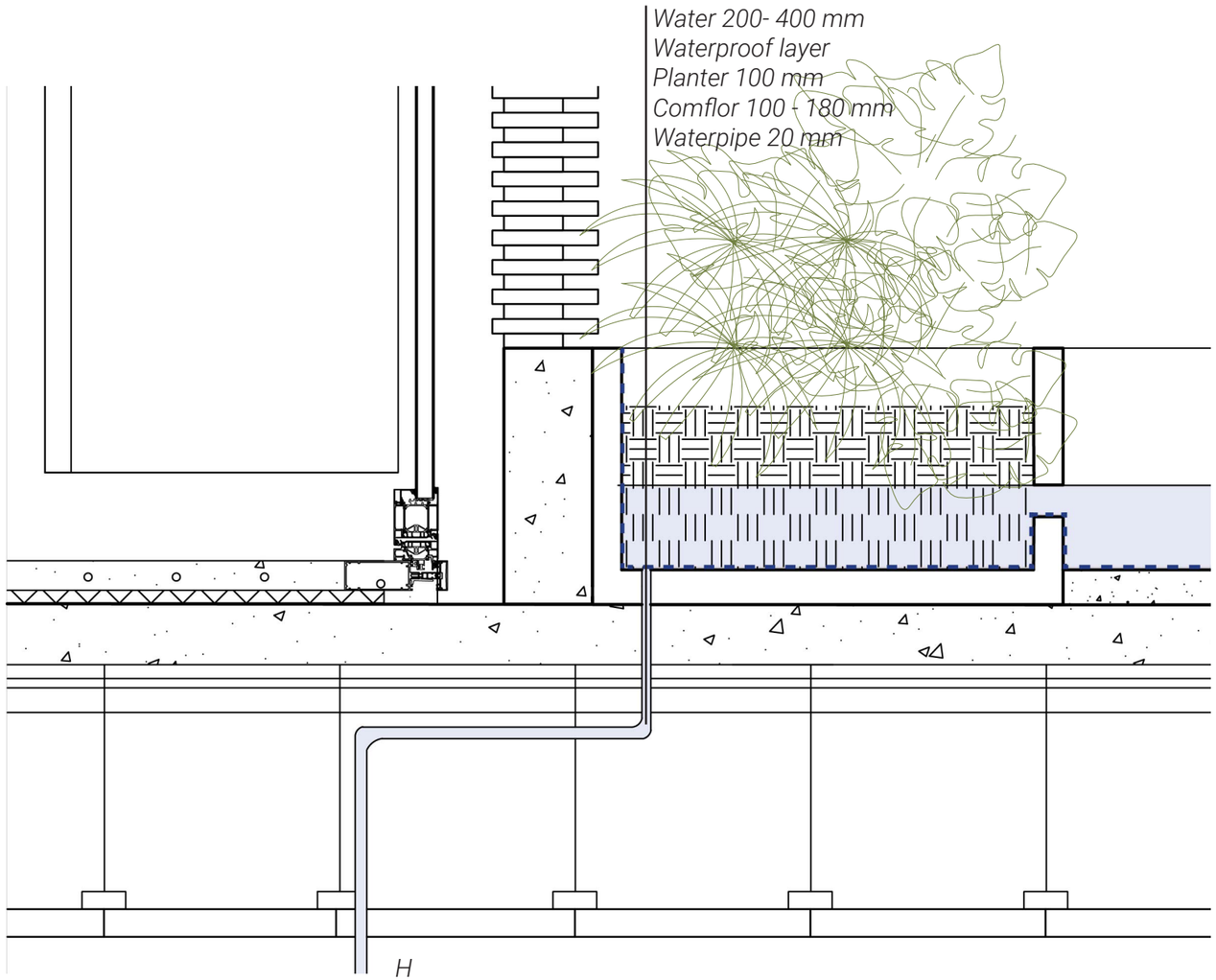
E

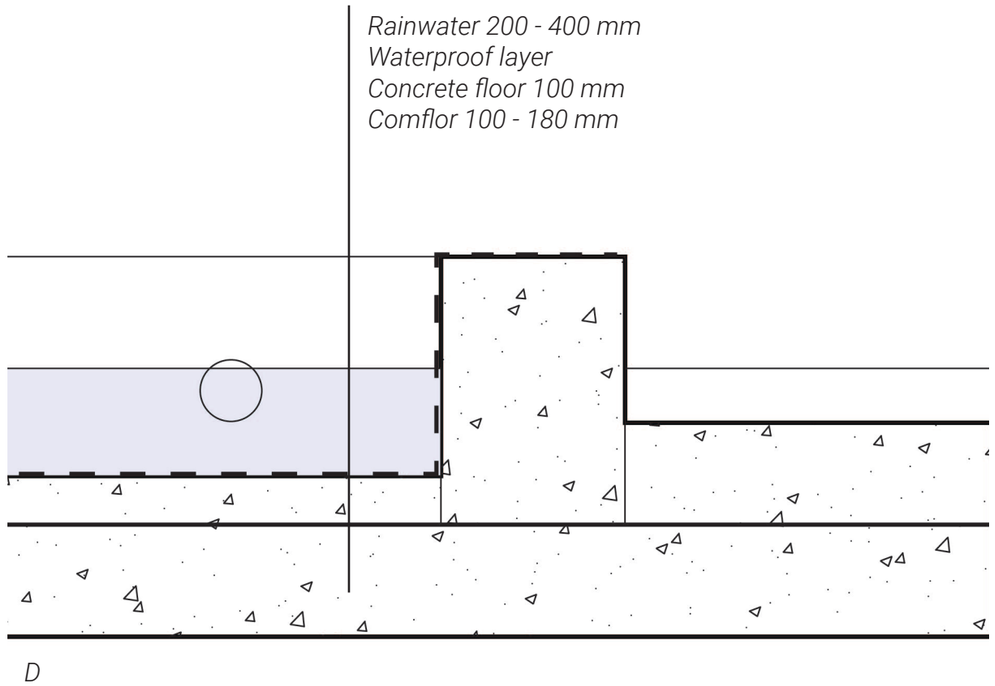


I

Building Technology

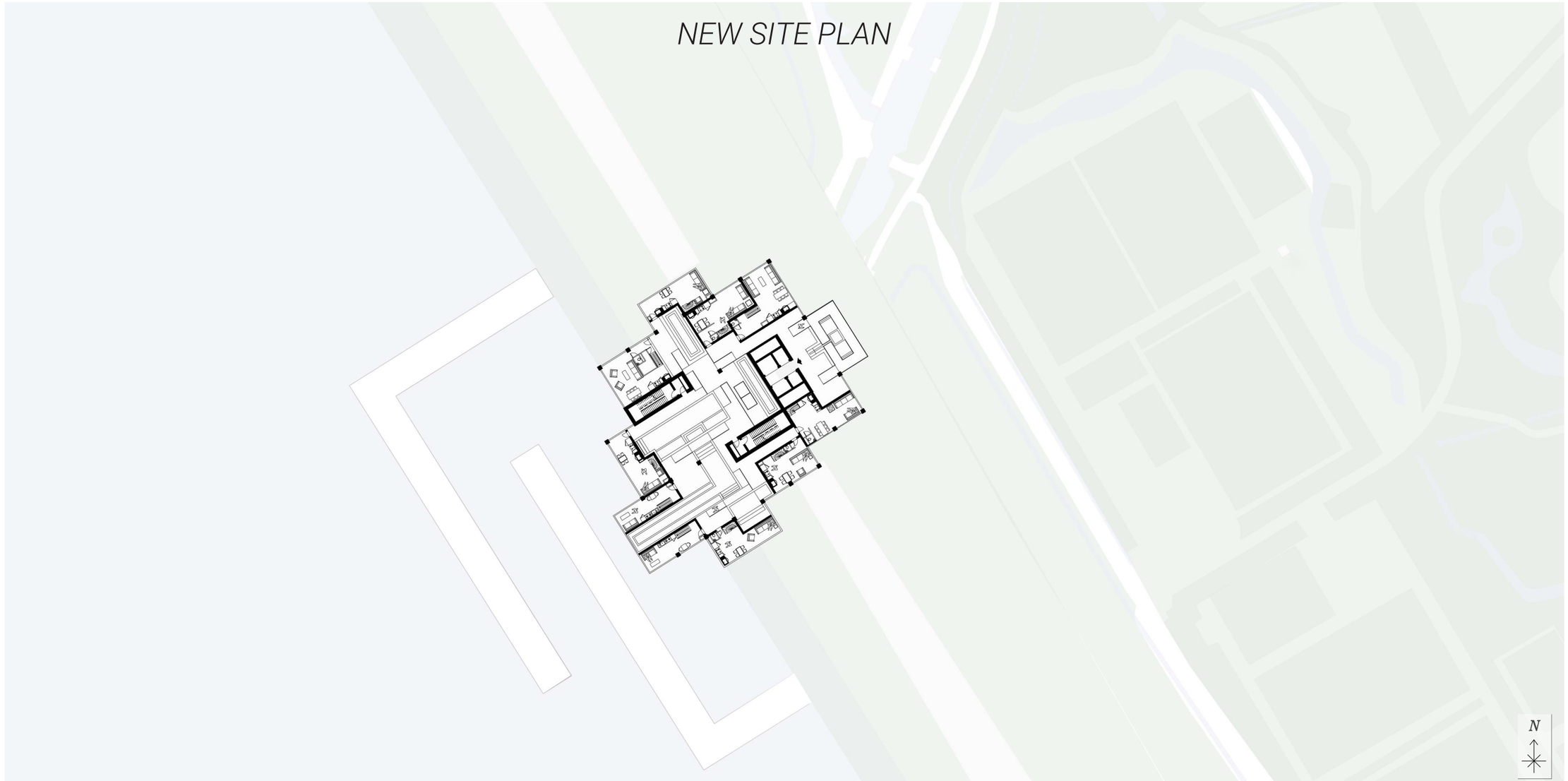
Details - 1:10





PLAN B

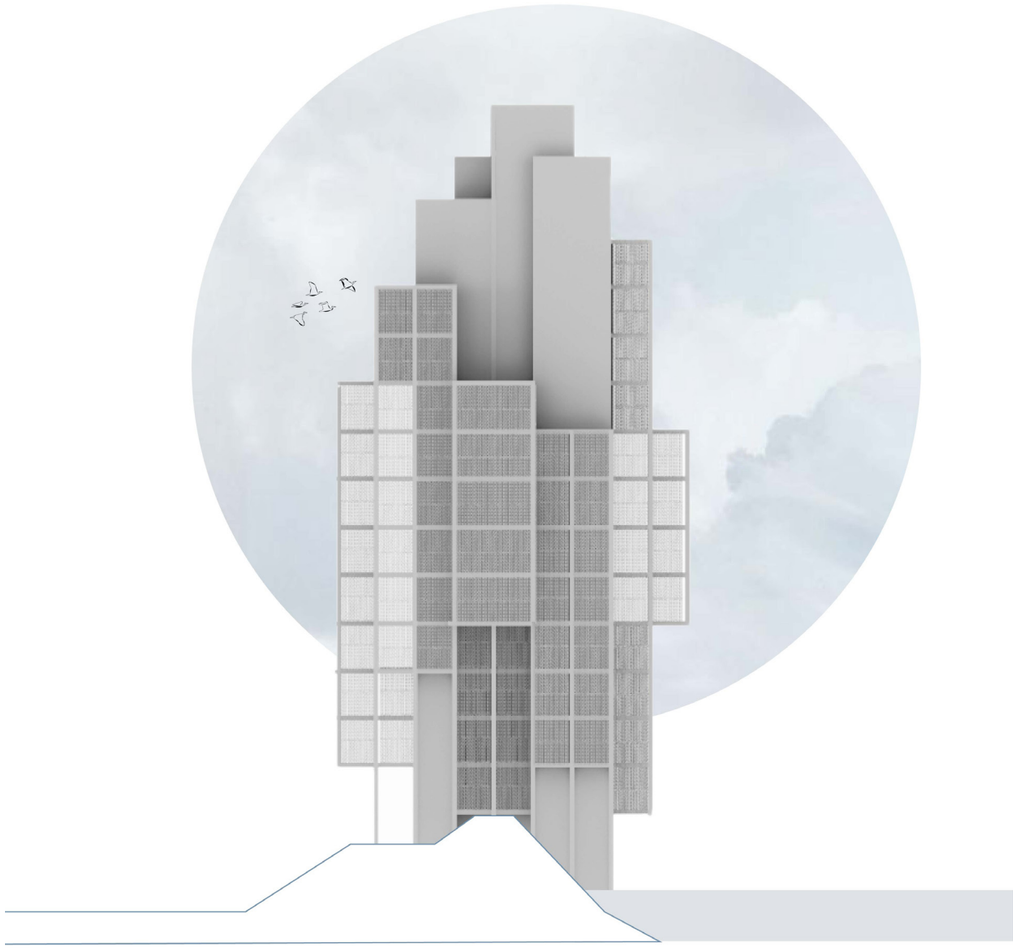
NEW SITE PLAN



Building - Plan B - Level 6
Scale: 1:2500

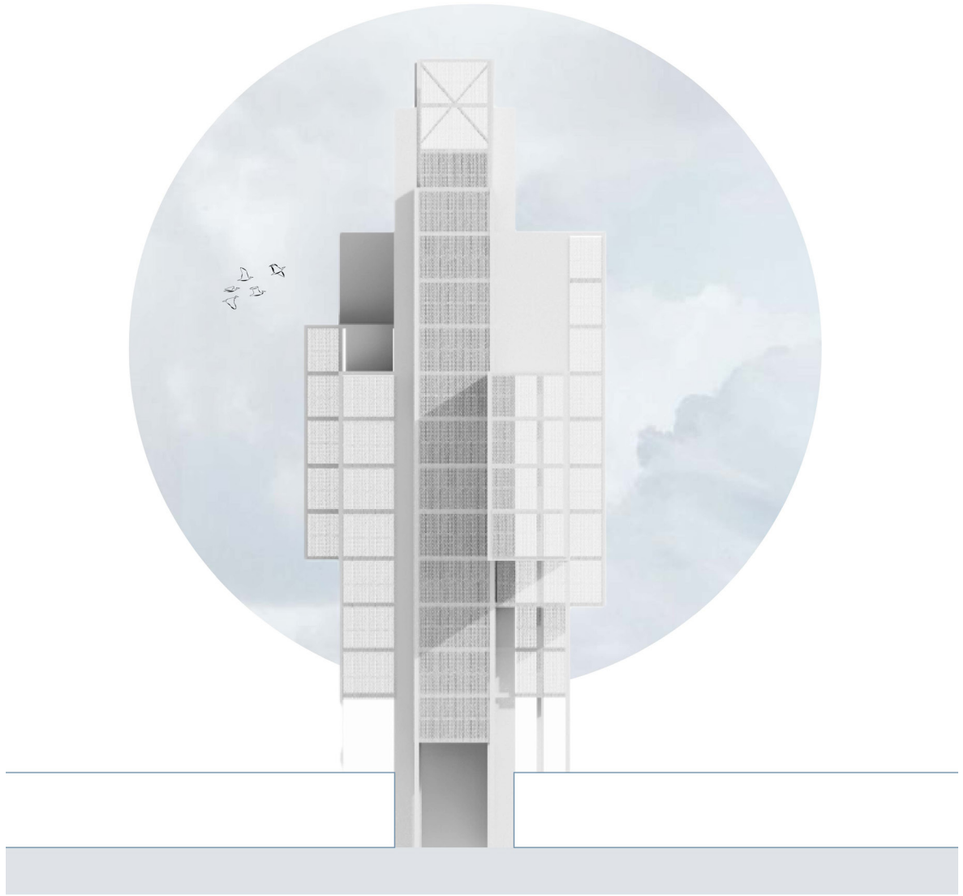
Elevations

South-east fascade



Northwest fascade

Elevations



Southwest fascade

North-east fascade

Thank you!

Questions?