URBAN DREAMS
RURAL REALITIES

Global Housing

KASPER WILLEMSE

ABSTRACT

This graduation report presents the reserach and design for a rural settlement system in the Haor region of Bangladesh. This area exists of a unique ecosystem, that is vulnerable to frequent and long lasting flooding. The primary objective of this project is to create a safe and sustainable rural community that can provide residents with a rural place to stay. While also mitigating the effects of rapid urbanization. The rural community should gain economic opportunities for its residents, thereby preventing migration to urban slums and enhancing overall well-being.

The proposed settlement system consists of a network of interconnected elevated islands that offer protection from floods while maintaining accessibility between them. Each island is equipped with spaces that can be used for healthcare and education, ensuring these essential services can still be practiced even during future higher floods. The main island will have more services such as additional schools, healthcare facilities, markets and other public buildings. Secondary islands will focus more on residential areas, while special islands will be designated for markets and tourism. The design tries to improve resilience, for example by high building plinths and land reclamation for year-round agricultural activities.

Economic opportunities are enhanced through the creation of attractive communal spaces that encourage small businesses such as shops and tea stalls. The implementation of pro-poor tourism further enhances income generation options in the form of jobs as well as allowing residents to collectively host tourists and share the generated income. The development of community-led housing cooperatives further promotes social cohesion and economic stability, enabling even the poorest residents to participate in the community and be benefitted from it.

The report begins with an introduction to the challenges of urbanization, particularly in Bangladesh, followed by a concise contextual analysis covering ethnographic, environmental, and climatic data. An examination of the regional context and existing settlements provides insights for the design, which is then detailed from a macro to micro scale. The design process is elaborated from the regional plan to the layout of the main island, the configuration of clusters, and finally the individual units and construction details.

The results of this project include a layout of the interconnected islands on a regional scale. Which is then followed by a detailed layout of the main island with strategic placement of public facilities and residential clusters around shared courtyards. Roads are designed in a DNA-like pattern to control traffic flow and create vibrant neighborhoods with distinct public functions at key intersections. The introduction of renewable materials, such as bamboo, for construction and the establishment of resilient agricultural practices further contributes to the sustainability of the settlement.

In conclusion, this proposed settlement system addresses the challenges faced by rural communities, specific to the Haor region of Bangladesh. By incorporating economic and social initiatives into the design, the project aims to create a livible and resilient place to stay that can be used as a model for other regions worldwide facing similiar challenges.

Acknowledgments
I'd like to thank my tutors Dick van Gameren and Nelson Mota for their insightful feedback. I want to thank my mentors Mo Smit and Marina Tabassum for their guidance throughout this project. Special thanks to my main mentor: Rohan Varma, who has guided me closely throughout these ten months and help make my graduation possible. I'm also gratefull to my fellow students, as well as the students and teachers of SUST for making a field trip to Bangladesh possible. Finally I want to thank all the family and friends for their support and encouragement during my graduation project.

Urban Dreams, Rural Realities
Mitigating rural to urban migration through economic empowerment and flood resilience in the Haor region of Bangladesh.

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BACKGROUND

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In this first section you will find my research plan which gives a short introduction of the problem of urbanization both in general and site specific. In addition it provides some context to the project and its site.

BACKGROUND

INTRODUCTION

PEOPLE IN TRANSITION

Migration and Urbanization are two intertwined movements significantly influencing the shape of our world. In recent times there have been mass migrations from rural to urban areas, causing a shift of populations. As a result, cities worldwide have experienced a rapid growth that doesn't seem to end anytime soon (Ritchie, 2018). Both international and internal migration, from rural to urban areas, are mostly driven by the same array of factors. The leading incentives are mainly based on the prospect of better living standards. The expectation of many migrants is to find better employment opportunities in the city. Often hoping to escape extreme poverty. Others lost their current income source or their housing (due to environmental disasters). These problems occur worldwide and so as well in the case of Bangladesh (Uddin & Firoj, 2013).

Just as they expected, migrants from rural to urban areas often earn more than they did before. They also tend to earn more than people who decided to migrate from rural to other rural areas.

Thus migrating to the city, seemingly contributes to some of the desires of these people in transition. But even though the migrants gain a greater income, they also often gain more challenges. For example to save enough money for the rest of the family, migrants often cut on costs for their own nutrition, while working longer hours than the people in rural areas (Khan & Kraemer, 2013). Besides migrants usually end up in overcrowded inadequate housing and informal settlements in which they lack many of the desired (health) benefits of the city. This is mostly because the urban centers can't handle the rapid urbanization. Especially in developing countries, the fast migration influx results in bad living conditions and people staying stuck in poverty (Zurich, 2023).

LOCATION

BANGLADESH

Bangladesh, a country in South Asia bordered by India and Myanmar is home to many of these challenges. The country only exists since 1971. It was once part of British India until 1947, however due to Britain's post-Second World War struggles and lack of resources to govern British India, the British Raj, which had lasted for three hundred years, came to an end (Dalrymple, 2015). The escalating divide between Hindus and Muslims in the preceding decades made it difficult for the two religious groups to continue as a single nation. As a result, the Indian subcontinent was divided into two independent nations: India with a Hindu majority and Pakistan with a Muslim majority. The Partition led to a massive migration, with millions of Indian Muslims moving to Pakistan and Pakistani Hindus relocating to India. This was accompanied by widespread massacres and acts of violence, including sexual violence, in the border regions of Punjab and Bengal. Bengal was divided by the National Congress into Western Bengal, which joined India, and East Bengal, which became part of Pakistan and was later renamed East Pakistan (Van Schendel, 2009).

In the first general elections of Pakistan in December 1970, the Awami League, led by Sheikh Mujibur Rahman, emerged as the clear winner in East Pakistan, indicating the Bengali people's strong desire for autonomy. Despite this, the ruling authorities in West Pakistan were resistant to transferring power. On March 25, 1971, the Pakistan Army initiated Operation Searchlight, a military genocide to suppress the Bengali demands, sparking the Liberation War (Khanna, 2021). With assistance from India, the Mukti Bahini (freedom fighters) fought against the Pakistani military. On December 16, 1971, the Pakistan Army surrendered to the combined forces of the Indian military and the Mukti Bahini in Dhaka, signifying the independence of Bangladesh (Rahman, 2013).

Bangladesh its short existence as an independent nation comes from a turbelent history. Despite the independence the country continues to face deep-rooted difficulties including political instability and economic challenges.

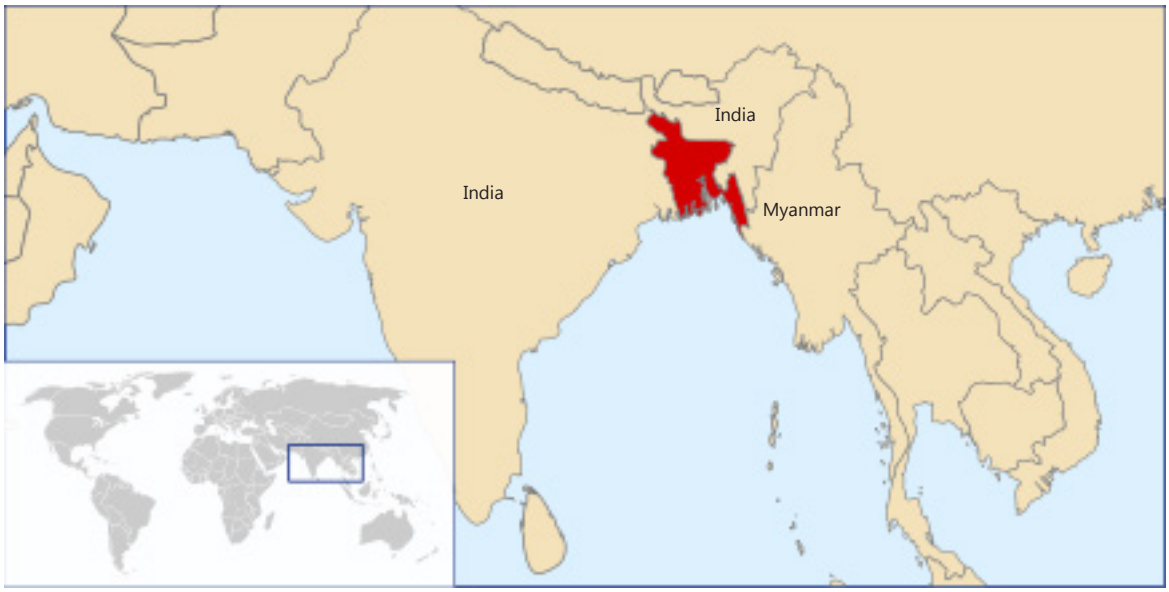


Figure 1: Location of Bangladesh (Source: "LocationBangladesh.svg," Wikipedia, 2024).

Figure 2: Divisions of BangladeshAdapted from Global housing booklet, Technische Universiteit Delft, 2023.

SYLHET

Sylhet, a region located in the northeastern region of Bangladesh, is a second-tier city that faces a variety of challenges caused by internal migration. The city and country are an example of the broader global narrative of people in transition. Sylhet and its region are seeing an influx of people due to internal migration. People who are misplaced due to climatic events caused by climate change, are seeking more stable environments. Simultaneously, a significant part of the population is drawn from rural to urban areas for the economic opportunities. Most of the migrants end up in slums with insufficient facilities for safety, shelter and nutrition (Khan et al., 2015).

The haor landscape located in the division Sylhet is one of these rural areas, that have seen many people migrate to the city Sylhet. It is a wetland ecosystem, where the land is constantly changing because of floods. The area that local communities use to build crops, are flooded for a period of seven months a year. This heavily influences the lifelyhoods of people, as during these seven months harvest stops and most of them depend on fishing for income (Habib & Rahman, 2022).

LOCAL PERSPECTIVE

During an interview me and a fellow student (Kasper Willemse & Veda Hepark) conducted in one of the villages of the Haor region, a local woman confirms that most people migrate to the city to enhance their livelihoods, as well as providing livelyhoods for their relatives staying in the rural area. The main reason she gives for the people migrating are the floodings, most people have no source of income for a total period of 7 months a year. A secondary reason caused by the floodings are loss or damage to current housing (Local Female respondent (figure 3), personal communication with translation aided by A.I. Toma, 2023).

Figure 3: Local Female Respondent, Veda Hepark, 2023

PROBLEM STATEMENT

Factors such as climate change, economic aspirations and the overall attraction of urban life have drawn a huge amount of people to cities worldwide. It is believed that in urban areas one out of three people live inside slums (Zurich, 2023). The problems that arise with this, aren't mere logistical but also bring about serious implications for the mental and general health of the migrants, an aspect that is mostly considered secondary. As the prospect of improving social and economic status is more important.

Urban areas struggle to accommodate the growing population. There is a surge in construction to provide housing for people in transition, often in the form of informal settlements. However, slums are often related to social problems, with high risk and vulnerability of mental illness (Khan et al., 2015; Khan & Kraemer, 2013). The prospect of better access to living necessities seem often less than expected, as housing, acces to education, sanitary conditions and access to healthcare are still lacking (Sherf-Ul-Alam et al., 2022). Within migrant groups, there is also a difference between migrants from rural to rural areas and migrants from rural to urban areas. With the rural to urban group being more prone to experience bad housing, bad mental and general health (Khan & Kraemer, 2013). Despite this, the greater percentage of people are migrating to urban areas. Therefore, it is important to understand and research the challenges and opportunities that come with the push and pull factors of migration and rural housing (within the context of Sylhet). The rapid urbanization caused by the migration is too much for cities to handle. While it simultaneously doesn't seem to improve the general health of the migrant themselves, at least for the first couple of years both worldwide as well as in Sylhet (Lu, 2010; A. Khan et al., 2015b).

The reason people still feel compelled to migrate from the rural areas to the city of Sylhet is because it does usually improve their social and economic status (Chowdhury et al., 2012). Although, understandably this is the main concern in times of extreme poverty, it also significantly influences the mental health of both the migrants (Khan & Kraemer, 2013) and the family they leave behind (Saha et al., 2019), despite the fact that it is in order to provide for them. Life in rural areas, albeit still harsh, appears to have the potential to be better than in the city. If it would be possible to reduce the need to migrate away to the city. Even though this is a challenging and sensitive subject, it also opens up the opportunity to explore potential design solutions in the rural areas.

By improving the rural areas through design, both the problem of the rapid urbanization as well as the (mental) health state of people in this predicament can be tackled. By creating a design for the rural communities, where the need to migrate away lessens, the cities can be somewhat relieved from the growing urbanization as well as keeping the people from the rural area in better mental and general health.

In order to form such a design, this research attempts to analyze the motivations behind migration to urban areas, identifying the current needs for the Haor region. Such as creating economic opportunities and ensuring the safety of the people by finding housing solutions more resistant to environmental events. Lastly it is important to find ways to cater in health and education services. Overall this research attempts to analyze and identify the factors that play a role in the motivations for leaving the rural areas, in order to provide a sustainable and secure design and managerably system for the rural communities so families can stay at their homes.

Rural

Figure 4: Situation Haor Region

The Haor region is a remote wetland, that is flooded every year during the monsoon period. During these floods the ground used for growing crops is not usuable, resulting in many of the man leaving to the city for work. Because of the remoteness basic life services aren't always nearby.

Floods

Lack of Services

Extreme Poverty

Urban

Figure 5: Situation Sylhet

Displaced people often go on to live in slums, like the one in figure 4. In contrary of what many people seek, there are still a lot of shortcomings. Altough making more money, they are often in bad mental and general health while still being deprived from basic necessities.

Bad Mental and general Health

Lack of Services

Overcrowding of Cities

RESEARCH QUESTION

Main Research Question:

"How can design contribute to the rural community of the Haor region, so that people do not feel compelled to migrate to the cities?"

SubQuestions:

A: "How and where can job opportunities be created in the Haor region of Sylhet?"

B: "What kind of housing could ensure safety (against the rising waters) in the Haor region of Sylhet?"

C: "How can access to essential services, including healthcare and education, be improved in the Haor region of Sylhet?"

The research will be conducted by the hand of the following research (sub-)questions.

The main research question: "How can design contribute to the rural community of the Haor region, so that people do not feel compelled to migrate to the cities?" In order to answer this research question, several aspects need to be researched.

First of all, it is necessary to create income generating opportunities in the rural areas. Finding work is the leading factor of migration in Bangladesh (Uddin & Firoj, 2013), the man of the family often leaves his family behind in order to provide income for the family. The departing from the family is often also one of the key factors for the declining mental health of the migrants (Lu, 2010). The problem of job opportunities will be looked into by the hand of the following sub question:

"How and where can job opportunities be created in the Haor region of Sylhet?"

After economic reasons, the main driver for people to migrate is loss of housing due to environmental events. People are afraid of the rising waters and rightfully so. In order to form a design solution that incorporates the safety against environmental issues, the following sub question emerges:

"What kind of housing could ensure safety (against the rising waters) in the Haor region of Sylhet?"

Finally the lack of access to certain important services such as health services and acces to education should be tackled to improve living conditions. Which will be covered by the last sub question:

"How can access to essential services, including healthcare and education, be improved in the Haor region of Sylhet?"

The hierarchy of these questions dipicted on the left page leading from A to C, is based on what are the most common causes for migration.

THEORETICAL FRAMEWORK

In this research, complex and sensitive subjects will be explored. In order to do this, an interdisciplinary approach will be used. Working with sociology, urban planning and architecture and combining these to form a solution. This multi-disciplinary base is essential for gaining a thorough understanding of the complex relationships between migration patterns and housing needs. The theoretical framework that will guide this research will make use of various concepts, theories and practices. The framework that will be studied, consists of the following important factors:

1. Push and pull factors in migration:
Migration is influenced by both push and pull factors. The push factors drive individuals away from their place of origin, for example extreme poverty or environmental displacement. The pull factors are what attract the migration to the new destinations, such as economic opportunities or better living standards (Krishnakumar & Indumathi, 2014). By considering these factors, the aim is to better understand the motivations behind internal migration from rural to urban areas in Bangladesh and Sylhet and the implactions this brings.

2. Current issues in the Haor region:
In order to create a design for the rural communities in the Haor region, it is necessary to identify current issues. Possible solutions in the form of design of managerable systems to tackle these problems can then be formulated. By catering to the needs of the communities in the Haor region, the need of migrating could be reduced.

3. Safe housing conditions:
The impact of environmental issues is apparent on the members of the rural areas in Bangladesh. Some people are afraid of the floods and a lot of people are displaced because of the raising water (Islam et al., 2022). Sustainable and resistant housing design solutions could secure people's homes and their feeling of safety.

4. Job opportunities:
The main reason people migrate from rural to urban areas, is to earn more (Hossain, 2001) often in order to provide for their families. To keep families together and reduce the migration stream to urban areas, solutions should be found in the form of creating income in the rural areas, in this case the Haor region.

5. Services:
General living conditions are often believed to be better in urban areas, due to access to health facilities and such. (Even though the migrants from rural to urban areas often showcase worse general health conditions than people in the rural areas (Khan et al, 2014)). Access to essential services such as healthcare and educational services should be integrated into a design, as well as waste management systems in order to create a truly sustainable design.

6. Adaptability:
To design a resilient community in the sense of safety, economic security and sustainability, an adaptable solution is needed. In order to keep people in the region instead of them migrating away the area should expandable, also rural to rural migrants could settle in such a community. In order to accommodate more people the design should incorporate this beforehand.

METHODS

The theoretical framework aims to identify all key factors included in the motivations to migrate away from rural areas. So that an attempt can be made to find a design solution, that ensures people don't feel the need to migrate away from their homes and families. These factors will be researched, using both quantitative and qualitative methods, including literature review, analysis, interviews and fieldwork. Which methods will be used to research each factor are depicted below.

A. Literature review
The literature review will be used to form a context for the research, building upon existing articles and reports about the subject. This literature review forms the foundation of our research and guides the further methods.

B. Case studies / References
In order to find potential design solutions, design approaches in similar areas will be examined. There will be looked at several solutions and systems and their benefits as well as their drawbacks.

C. Surveys / Interviews
Understanding the implications on (mental) health experiences of migrants in Sylhet will be done by building upon existing surveys in similar cases. Through the use of surveys, it is possible to gain a better understanding of the reasons people migrated to urban areas as well as how this has changed their life. Not only is this valuable to better understand why people migrated away from rural areas, but it also serves as a control research to see if the general findings through research are corresponding to the site of the assignment.

D. Analysis / Observations
To gain a better understanding of current housing situations in Sylhet and similar areas, the region will be researched. Firstly this will be done by data collection on reports and studies on similar settlements and projects. By examining existing data, it is attempted to find patterns. Secondly, we are able to gather data directly from the study area in Sylhet by analyzing the area and current housing settlements and their conditions through observations made through our fieldwork trip. Which we can use to test these patterns and if general beliefs about similiar areas also hold up in the Haor region.

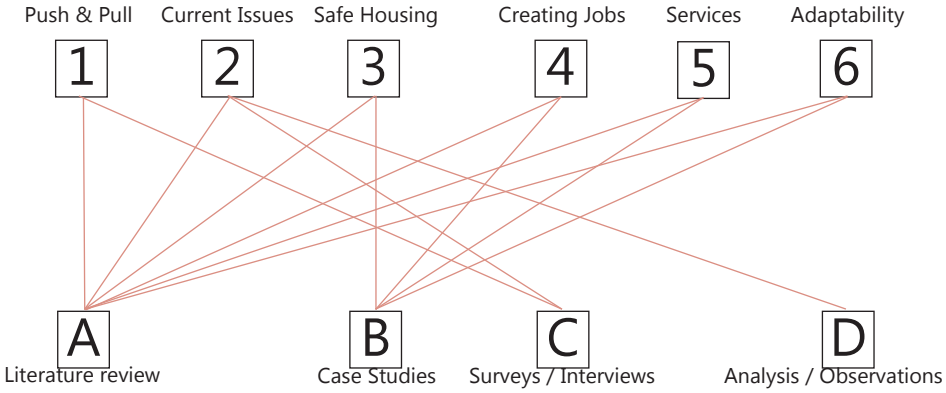


Figure 6: Haor Region During Monsoon

RELEVANCE

The research and design that will be conducted in the context of the Haor region in Sylhet, Bangladesh, is believed to be of relevance for a broader perspective. As the findings will hopefully be replicable in lesser and greater extent in similar other cases. By navigating the reasons people migrate away from the rural areas and finding design solutions to reduce these reasons, it is aimed to present findings that have a global relevance. In both keeping families together at their homes as well as relieving the cities from the rapid urbanization. The issues addressed transcend the borders of Sylhet and are faced by populations in transition around the world. A phenomenon that keeps increasing in our rapidly changing world. These transitions, that often carry promise of new opportunities, also bring along a lot of challenges including its influence on general and mental health. The specific research and design on the Haor region of Sylhet will be used to make broader statements about the problems that come with migration. By proposing a potential design and system for this specific site, it is attempted to tackle both general as specific problems. Every site has their own context that will influence both design and outcomes. This research in Sylhet aims to contribute to an expanding knowledge that can offer insights, design solutions and recommendations to address these challenges in a global context.

ANALYSIS

Global Housing: Architecture of Transition in the Bangladesh Delta

In this next section the context the problems and potentials of the site's region will be further explored on the basis of some concise analyses of multiple relevant subjects.

CONTEXTUAL ANALYSIS

INCOME OPPORTUNITIES

POTENTIAL

Youthfull demographic structure
Bangladesh its age demographic is predominately youthfull (PopulationPyramid.net, 2022). An average young composition of society holds significant potential for economic growth. On the same hand this also poses lots of problems, which are primarily evident in basic services such as healthcare and education (Voxco, 2022).

Employment
Bangladesh's economic landscape has altered much over the last decade, on a national level it has shifted from agriculture to the services sector (Statista, 2021). In rural areas, agriculture remains the primary occupation for both men and women. However, urban areas offer diverse economic opportunities, predominantly in sales-related occupations for men (Bangladesh Bureau of Statistics & World Bank, 2017).
In order to create a sustainable way of life in rural settings, there is need for new avenues of employment.

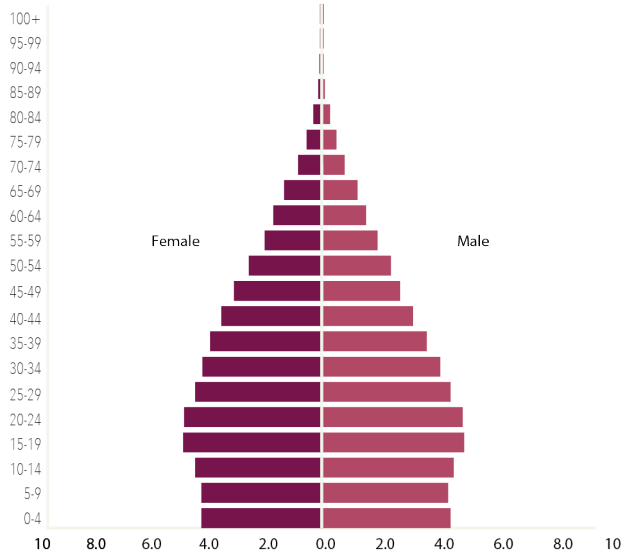


Figure 7: Age pyramid Bangladesh. Adapted from Global housing booklet (p. 146), Technische Universiteit Delft, 2023.

Figure 8: Interesting landscape Haor region in Sylhet.

PRO-POOR TOURISM

In the context of the project, the Haor region of Bangladesh presents a relatively untapped opportunity for generating income through tourism. The people working there now are mainly dependend on the area and it's resources. Most jobs are in farming or fishing. This area is situated in a unique wetland ecosystem with a rich biodiversity and beautifull landscapes. Here certainly lays the potential for eco-tourism that is beneficial to the local residents. Despite the unique and beautiful nature, tourism in the Haor region, just as in the rest of Bangladesh is very little (Haines, 2016). By developing tourism infrastructure that includes eco-friendly accommodations, guided tours, cultural experiences, and local crafts markets, the region can create new economic opportunities for its inhabitants (Ashley et al., 2007). Tourism would happen most during the unique monsoon periods. This is the period of time that currently sees many people migrating away for jobs. This way an income could be generated for the residents of the Haor during these periods. By implementing new job opportunities created by tourism, a lot less people will be forced to move to the cities in order to get a job, especially for the younger generations.

Figure 9: Sunset over the Haor region.

HOUSING

COMMUNITY

Bangladesh's social structre is centered around family. You have many families living together across multiple generations. In sylhet especially community based lifestyle is important.

In the existing settlements of the Haor region, however lack spaces to promote communities. There are few valuable open public spaces, or other places to get together, leading to people meeting eachother in the narrow roads between houses. There is a scattered layout of houses that are very densly placed together, leaving no room for shared courtyards or shared public spaces, which contribute to the feeling of being part of a community. (Sylhet Region Blogger, 2010)

Figure 10: Narrow street in Ratansree a Village in Rural Bangladesh. Sue Vern, 2023.

HOUSING TYPOLOGIES

1. Bengali Hut

Description: Bengali Huts are usually arranged around a central courtyard. Each hut consists of a single rectangular room, with walls made from woven bamboo, reed matting or mud on a bamboo or wooden framework.

Key Features:
Orientation: The huts are mainly orientated to the south for climate control, making use of naturual ventilation and avoiding cold north winds. The openings are placed on the east side to allow morning sunlight while avoiding warming up too much.
Thatched Roof: made from dried palm leaves, straw or other local materials.
Mud walls and foundation: constructed from a mixture of mud, clay and straw, applied to bamboo or woorden framework.
Single-Room Layout: One multipurpose living space for cooking, socializing and sleeping.
The design is sustainable and eco-friendly making use of local materials (Ul Haq, 1992).

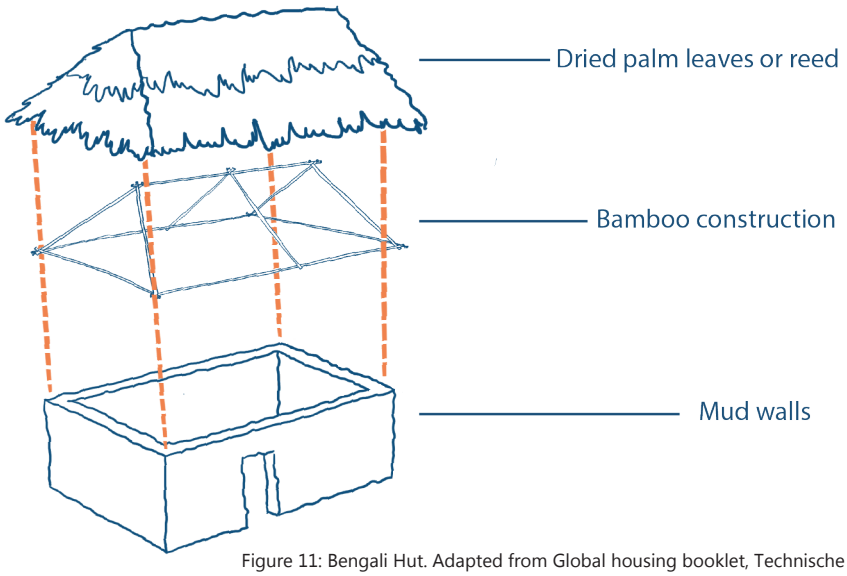


Figure 11: Bengali Hut. Adapted from Global housing booklet, Technische Universiteit Delft, 2023.

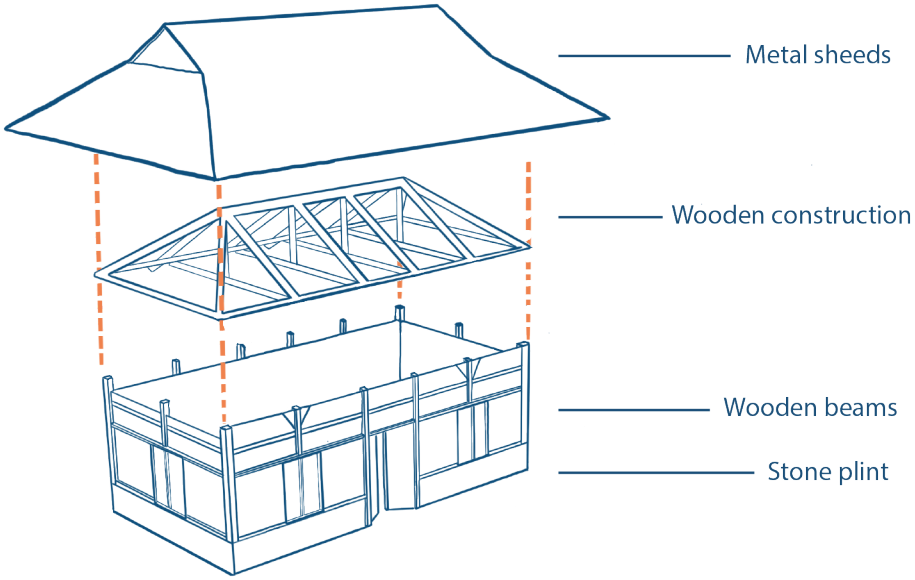


Figure 12: Ikra House. Adapted from Global housing booklet, Technische Universiteit Delft, 2023.

2. Ikra House

Description: The Ikra house is a well designed low tech house that withstands environmental challenges such as heavy rainfall and high humitidy. Mainly found in rural, low income environments.

Key Features:
Orienatation: No shared walls with other buildings/households. Building shape is mostly rectangular.
Pitched Roof:
Construction and material: One-story house with brick or stone plints. The structure consists of a bamboo or wooden framework. The walls are constructed of ikra reeds set within the framework and are covered with a mudding mixture or concrete on both sides (Kaushik & Ravindra Babu, 2012).

Figure 13: Local School in Haor region

SERVICES

EDUCATION

Bangladesh, although stated as one of the world's least-developed countries, has progressed a lot in recent years. Of these developments education has been one of the most noteworthy, which has seen a lot of improvement over the last two decades (United Nations Development, 2006). In the Haor region however, with its unique environment, still faces difficulties in the acces to basic services such as education. Particulary during floodings, or monsoon periods. The region doesn't necesarrily lack an amount of schools, but the accessibility can be an issue for surrounding settlements without their own schools. Because of this there is a seasonal inaccesibility in some places, that could obstruct regular education.

HEALTHCARE

Another basic service that experiences accesibility troubles is healthcare. Which lags behind national averages on several areas like skilled health personnel assist and infant mortality rates. This is also caused by the regions remote location, poverty and frequent migration, which al hinder healthcare and education development and access (Hiramoni, 2023).

> **More than 15 hundred students are studying in the School, come from surrounding villages. As there is no transportation facilities of school, students suffer a lot of trouble for coming to school. Ensuring hostel facilities will futher enchance the success of the school.**
>
> google review from
> [RTN Suman Ch Sarker], [2021]

The problem is not amount of schools in the region, but their accessibility during the periods when the waterlevels are high. The only way to reach them if you're not on the island itself is by boat.

CLIMATE & ENVIRONMENT

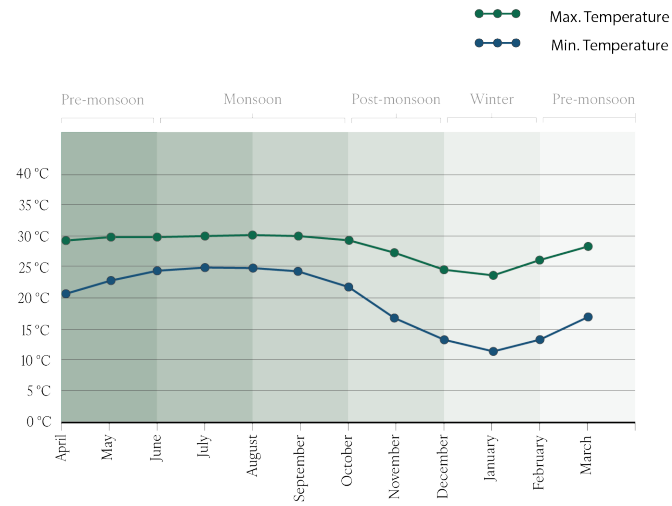


Figure 14: Temperature per Season Sylhet. Adapted from Global housing booklet, Technische Universiteit Delft, 2023.

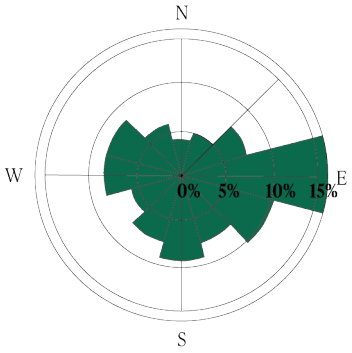


Figure 15: Windrose Sylhet. Adapted from Global housing booklet, Technische Universiteit Delft, 2023.

bronnen van booklet enzo bij halen

CLIMATE

Bangladesh has a sub-tropical humid climate that is characterized by its seasonal variation patterns of the pre-monsoon, monsoon and post-monsoon. Especially in the Haor region these seasonal changes heavily influence daily life, as monsoon periods flood most of the surrounding agriculture fields (Shahid, 2010). During floods the settlements are even more secluded, resulting in more difficult acces to basic necessities.

WEATHER

Temperature: During winters, temperatures can drop to a minimum of 11.3 degrees Celsius, while summers see highs of up to 30.3 degrees Celsius, indicating a significant temperature range throughout the year. (AccuWeather, n.d.)

Wind Patterns: In Sylhet wind comes mainly from the east as is shown in the windrose of figure 15.

Rainfall: Figure 16 shows Sylhet has an annual average of 2,200 mm rain. Design and planning must implement water management in the form of drainage systems and take into account flooding risks.

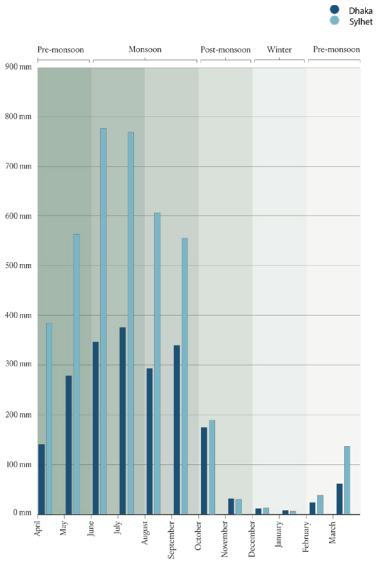


Figure 16: Rainfall Dhaka and Sylhet. Adapted from Global housing booklet, Technische Universiteit Delft, 2023.

Figure 17: Flooded Village in Sunamganj's Haor Area. (Dhaka Tribune, 2023).

FLOODING

Sylhet, and its haor region are located in one of the flood prone areas of bangladesh, especially during the monsoon season. The low laying terrain is often subject to long periods of being flooded, causing significant impact on life and economic opportunities. The floods are caused by heavy rainfall and river overflow which causes erosion of the settlements (Technische Universiteit Delft, 2023, p. 146).

During the monsoon periods which can last up to 8 months a year, the villages are often secluded from each other and are only reachable by boat. Roughly between 1 and 2 months a year there are floods, closing every village of from each other making everyone reliant on boats. During these time there is always the danger of flash floods, of which the consequences are dire as can be seen in figure 17 abvoe.

Because of these floods millions of people lose their homes and belongings. As well as thousands of hectares of agricultural land that get affected (Doctors Worldwide, 2022).

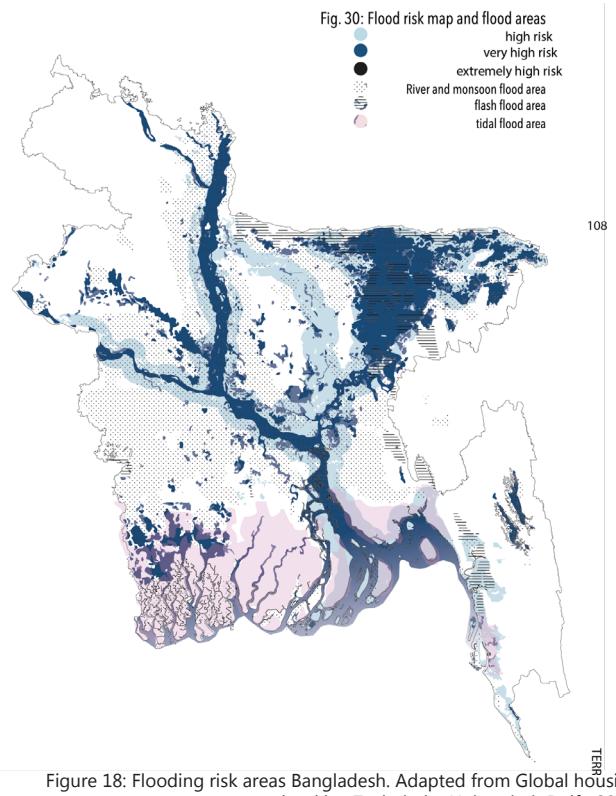


Figure 18: Flooding risk areas Bangladesh. Adapted from Global housing booklet, Technische Universiteit Delft, 2023.

CONCLUSION

In conclusion, there is an urgent need for safe and resilient housing in the haor region. Safe housing opportunities could provide life that continues during floods, complete with jobs, education and healthcare. Through urban planning of new settlements, communal spaces should be implemented, to foster a stronger sense of community. By integrating communal spaces, resilient settlement desing, environments can be created that support social and economic development throughout the year.

The Haor region of Bangladesh simultaneously poses an opportunity for pro-poor tourism development, which can provide job opportunities for the rural population and its youth. The Haor's unique ecosystem would be an intersting site for eco-friendly tourism. By integrating tourism within these new rural settlement desing, the area can become a more vibrant local economy. This will not only ensure income opportunites for the local residents but also a create more lively settlements while preserving the naturual and cultural heritage of the region.

Fig. 19 Unique Monsoon Landscape Haor Region

Fig 20. Guided Boat Tours. (Travel Mate, 2019)

Fig 21. Experience Local Life. (BanglaKids.cz, n.d.)

Fig 22. Bazars with locally crafted goods. (NoYaBazar.xyz, n.d.)

RESEARCH

Global Housing: Architecture of Transition in the Bangladesh Delta

Inside the research section case studies will be examined with focus on courtyards on community spaces. This will be followed by research on the existing settlements of the region, giving insights in how the existing deals with these problems and what needs to be improved.

CASE STUDIES

HATHIGAON -
Rahul Mehrotra

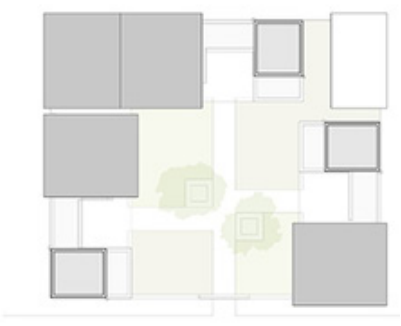


Fig 23. Hathigaon plans. (RMA Architects, 2011)

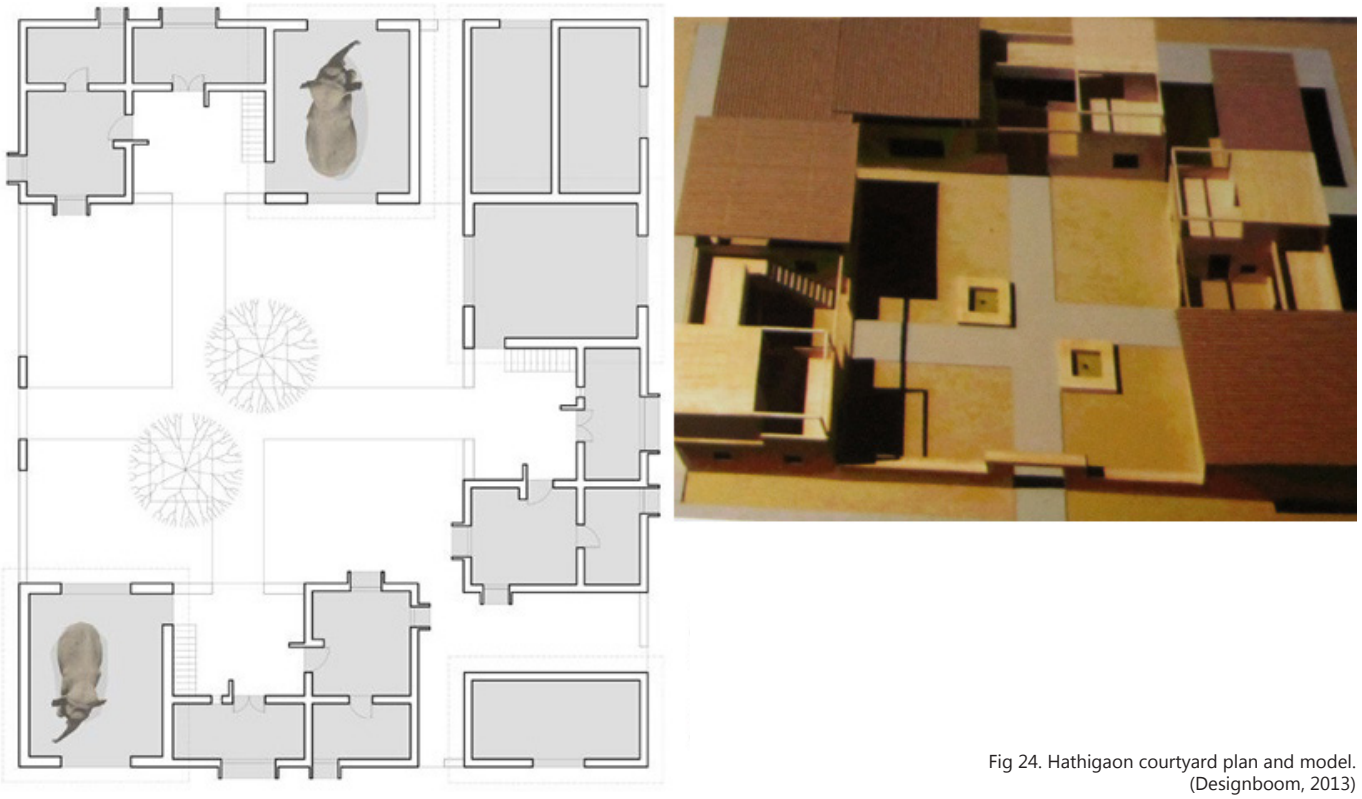


Fig 24. Hathigaon courtyard plan and model.
(Designboom, 2013)

Location:
Foothill of the Amber Palace and Fort near Jaipur, Rajasthan

Objective:
To create a sustainable living environment for mahouts (elephant caretakers) and their elephants, transforming a former sand quarry into a habitable and ecologically balanced community.

The Hathigaon project first focusses on structuring the landscape to form multiple waterbodies in order to harvest and use rainwater. The housing in this project is spread in to clusters centered around a central courtyard. The court-yards function as extra space, for the residents of these small low-income dwellings. The shared courtyards form a shared space with the goal of forming a sense of community among its residents (RMA Architects, 2018).

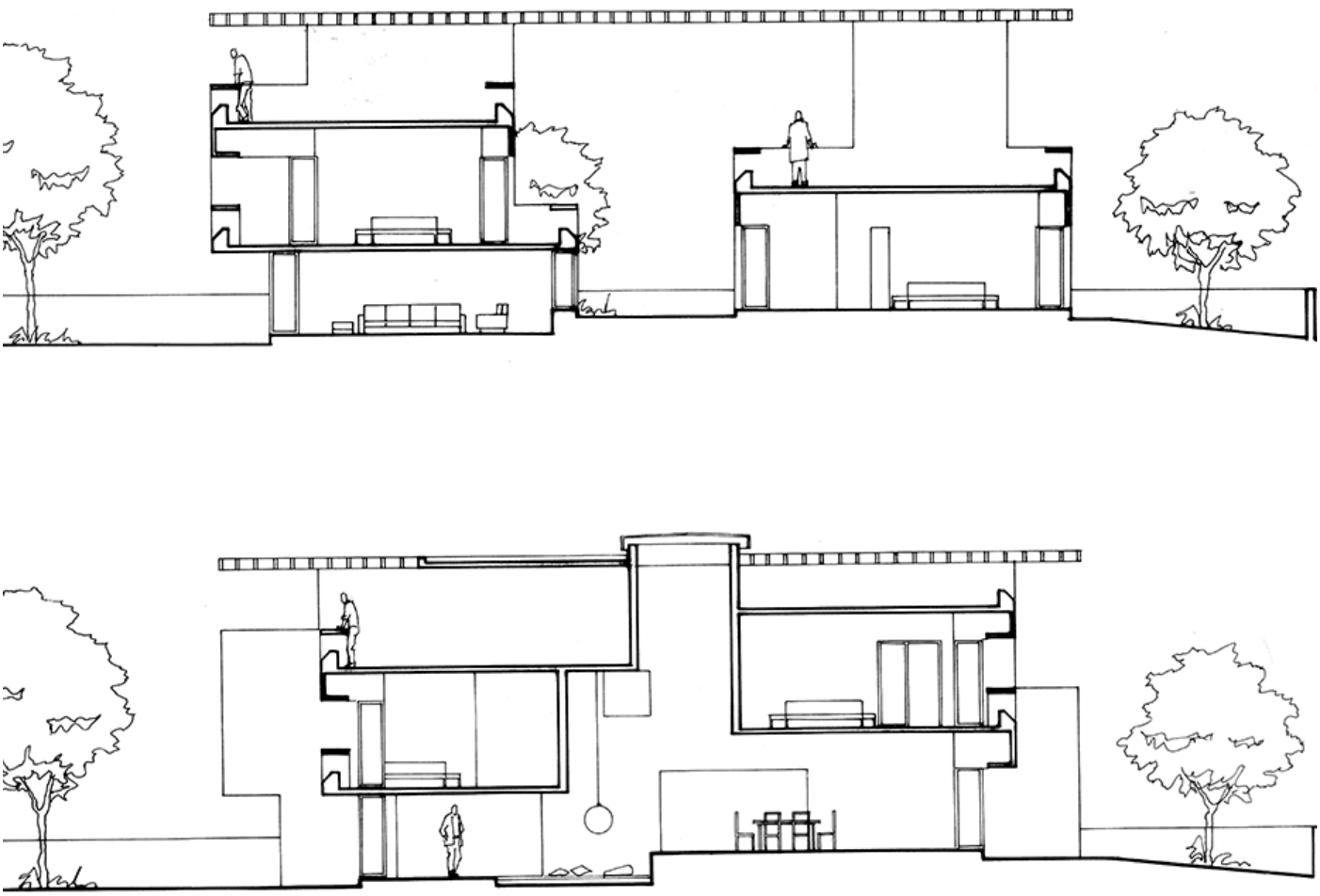


Fig 25. Sections Parekh House
(Charles Correa Foundation, 2022)

Parekh House - Charles Correa

Location:
Ahmedabad, Gujarat, India

Objective:
The project was to design a functional home that accommodates the needs of multigenerational families in a dense urban setting. The design aimed to provide a practical living space for the middle to lower class, covering both privacy and communal living spaces.

The Parekh House showcases a functional design within the culturally context of having a multigenerational home within economic realties for middle to low income housing (Athabasca University, n.d.).

Eventough it is a house design for low to middle income there is space for interesting architecture, allowing multiple possible interactions between floors.

Fig 26. Parekh House
(Charles Correa Foundation, 2022)

Previi Housing - Charles Correa

Fig 27. Community spine Previ Housing(Charles Correa Foundation, 2022)

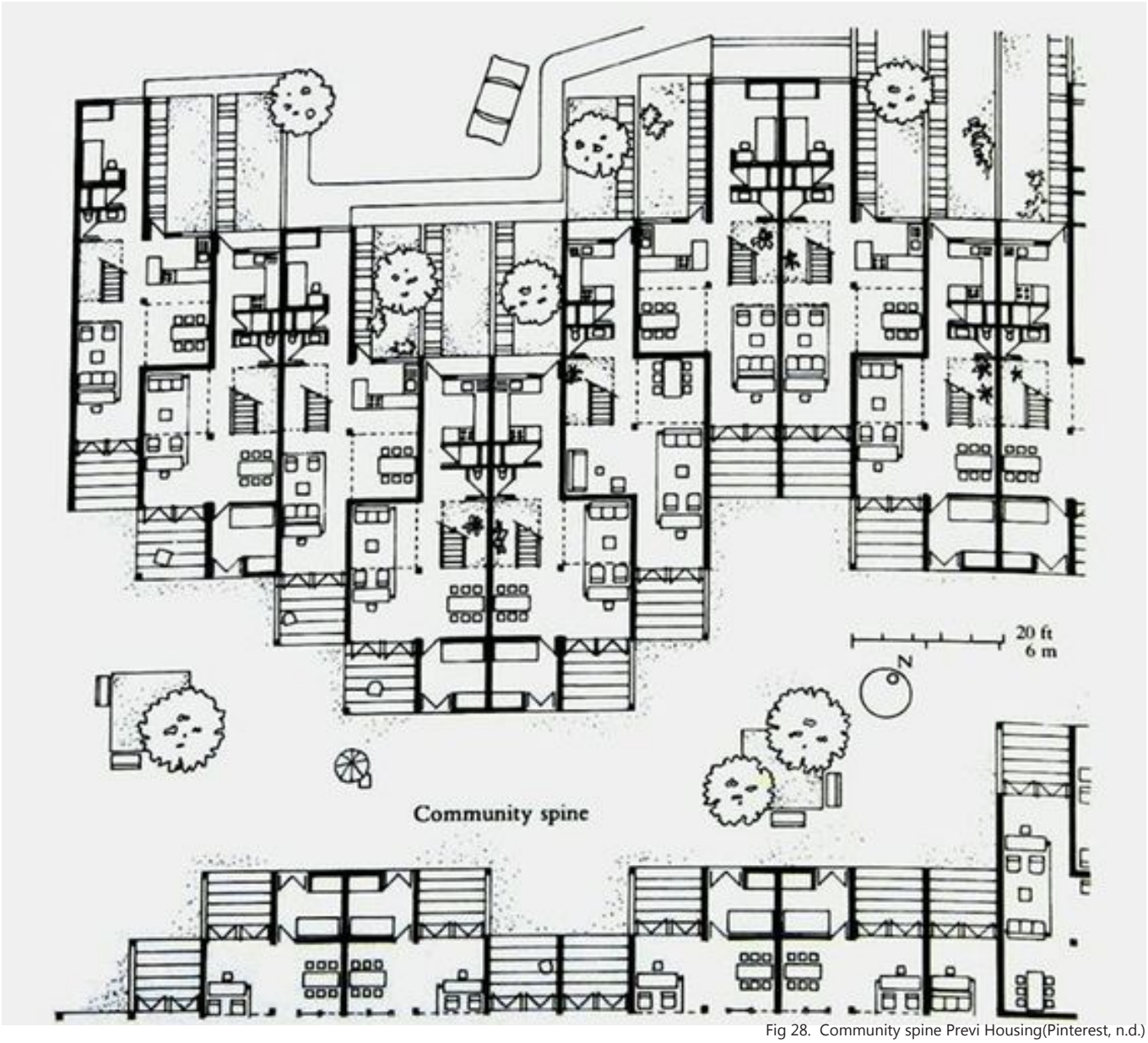


Fig 28. Community spine Previ Housing(Pinterest, n.d.)

Location:
Lima, Peru

Objective:
The objective of the PREVI (Proyecto Experimental de Vivienda) housing project was to create a housing complex that could accommodate large families, including multigenerational households.

All units have vehicular access from one end and a porch connecting to a community spine at the other, facilitating both private and communal interactions when entering your home. This layout fosters a strong sense of community through shared spaces, promoting social interaction and cohesion among its residents (Charles Correa Foundation, 2022).

TAHIRPUR REGION

Tahirpur is located in the northeastern part of Bangladesh, the site consists of the Haor wetlands. The site offers a unique setting for this community-focused project.

Context:
Tahirpur is characterized by its flat terrain and ecosystem, which includes expansive wetlands and seasonal water bodies. The region experiences distinct seasonal variations, which are of great influence on the settlements. The existing communities in Tahirpur are predominantly rural. Economically, the residents relies heavily on agriculture, particularly rice cultivation and fisheries supported by the haor wetlands.

Challenges and Opportunities:
While the region offers natural beauty and cultural richness, Tahirpur faces challenges such as infrastructure development andaccess to healthcare. These challenges present opportunities for innovative community-driven projects that enhance livelihoods while preserving its local charachter.

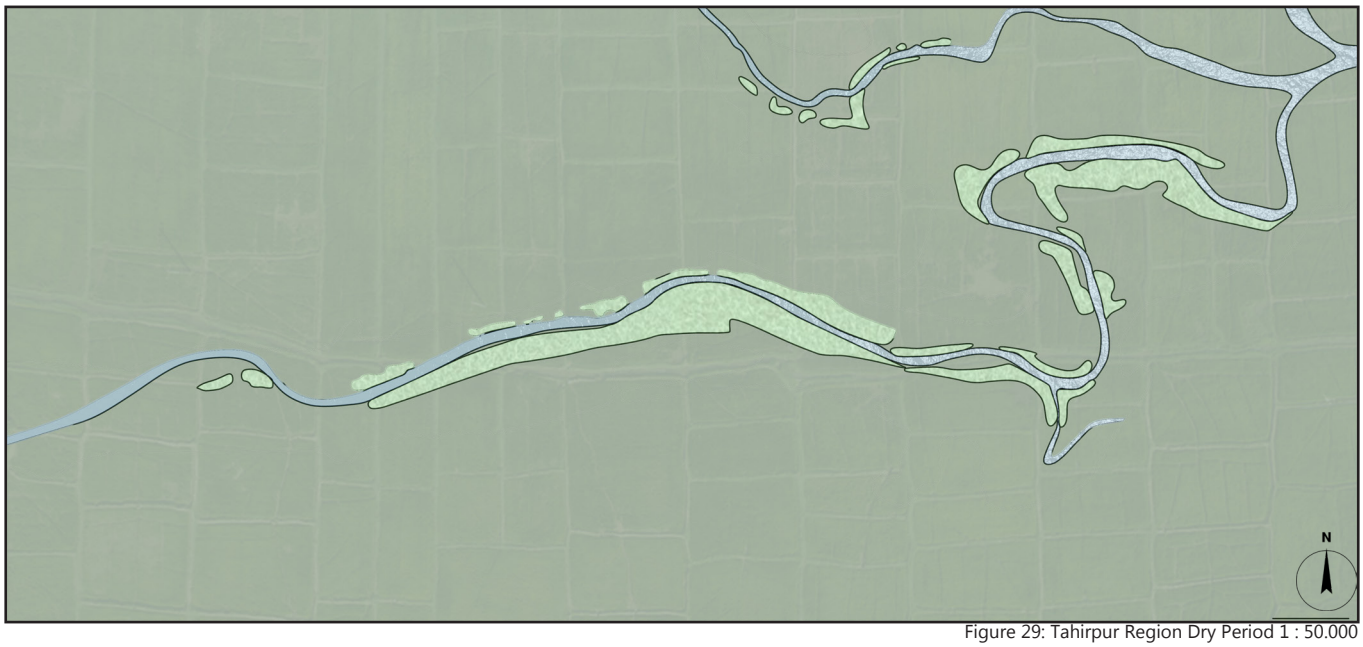


Figure 29: Tahirpur Region Dry Period 1 : 50.000

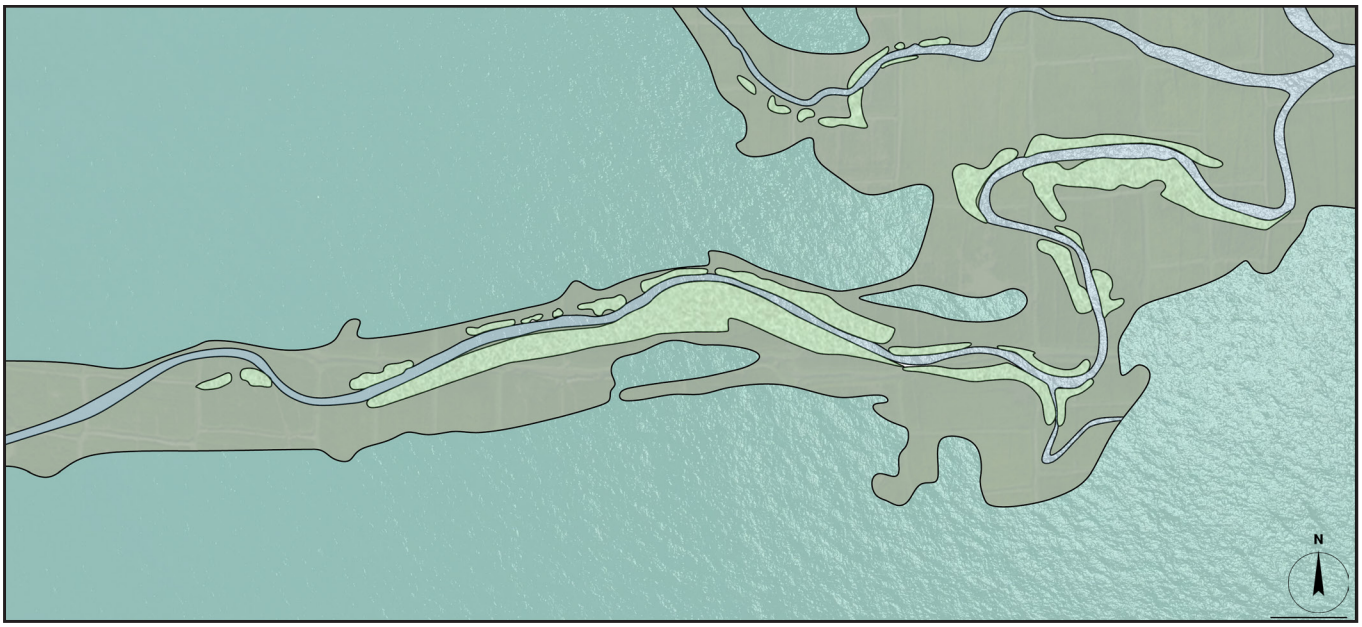


Figure 30: Tahirpur Region Monsoon Period 1 : 50.000

Monsoon Period

During the monsoon period (shown above in figure 30) the region completely changes. The most part of what are normally rice fields are submerged in the water, leaving minimal land above waterlevel among the elevated settlements. As this period can last up to eight months, it is evident that people who rely on income through rice cultivation need to find something else. A lot of the men seasonaly migrate to the city because of this. This means that a family can be seperated up to eight months a year because of this. During this period the fishermen of the village can obviously continue their work and so they stay at home also during the monsoon periods.

Flood

During Floods (shown in the picture below in figure 31), the little land around the elevated settlements that was left also gets submerged. Now the only form of transportation between the settlements is by boat. During this time the problem of acces to basic services becomes clear. During the dry period it looks like there are enough schools in the area. But during the floods every island should need at least some space to cater to these needs, to prevent the necessity of traveling over the water.

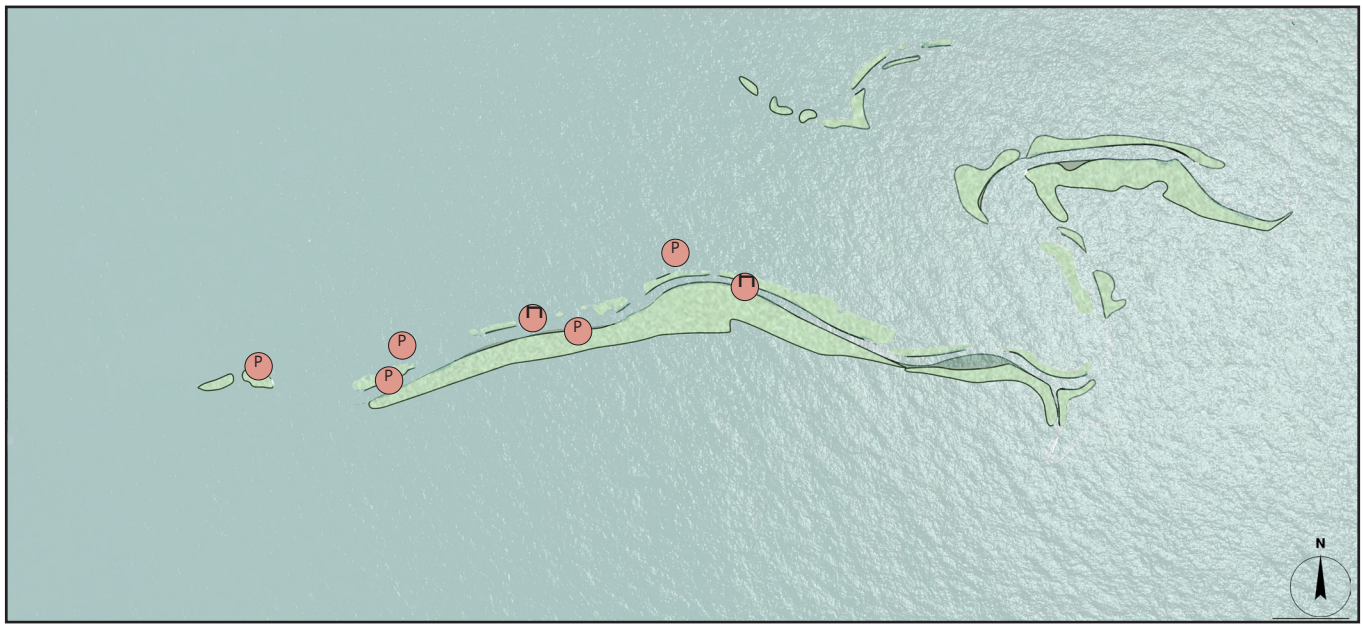


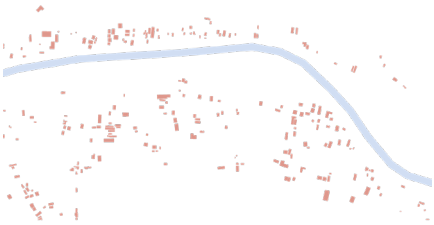
Figure 31: Tahirpur Region During Floods 1 : 50.000

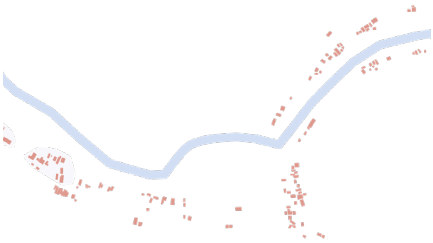
EXISTING SETTLEMENTS

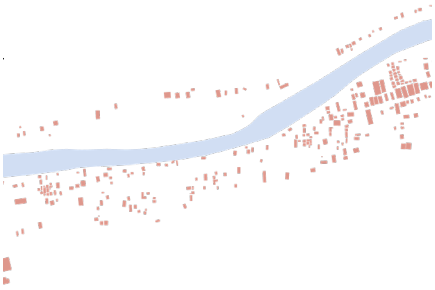
ANALYSIS

How do the existing settlements deal with the problems these changing waterlevels bring? And what other charasteristics do these settlements bring? This analysis will be used to on the one hand learn existing practices that help settlements exist in these areas, while on the other hand it can give a clear sight of what needs to be improved.

Figure 32: Settlements in Tahirpur region 1 : 50.000







CHICKSA

Area (ha): 36
Population: 3.692
Density (people/ha): 101,23
Average householdsize: 5,65

The region of Chicksa exists of two islands each on either side of the river. They both follow the flow of the river and are clearly structured around it.

JAMALGAR

Area (ha): 58
Population: 3.848
Density (people/ha): 66,34
Average householdsize: 5,19

Jamalgar exists of many smaller spread settlements. The small settlements are also all more or less following the naturual flow of the river. The density seems a little lower but this is can be explained by the spreading of the population over these multiple islands.

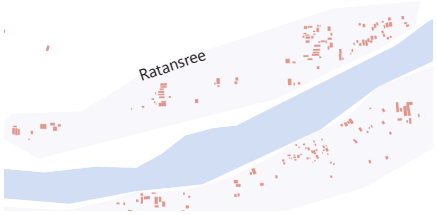
TAHIRPUR

Area (ha): 59,87
Population: 9.450
Density (people/ha): 157,84
Average householdsize: 5,61

Tahirpur is the biggest of the settlements in this area. It consists of one big island, that again follows the flow of the river. It serves as a kind of capital in the area, being home to the most amenities such as bazaars, high schools, post and police offices.

RATANSREE

Figure 33: Screenshot of Tahirpur Region from Google Maps.
from https://www.google.com/maps



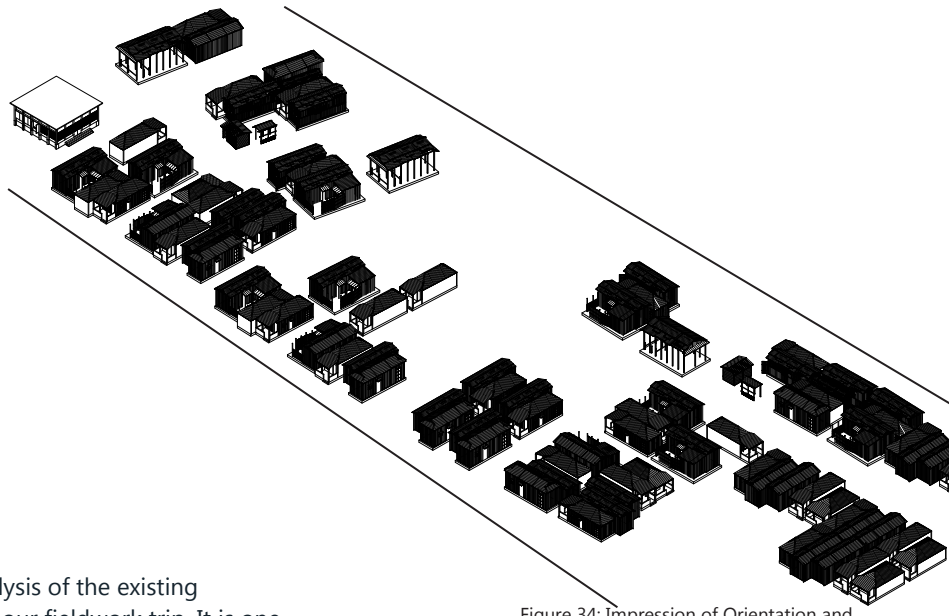


Figure 34: Impression of Orientation and Placement Housing in Ratansree

RATANSREE

Area (ha): 3,2
Population: 536
Density (people/ha): 167,5
Average householdsize: 2,39

Ratansree will be the main subject of further analysis of the existing settlments, as we have been able to go there for our fieldwork trip. It is one of the more densely populated places in the area, while having a lack of qualitative useable public spaces. The hiearchy of the settlement is in the form of a narrow central spine along which everything is concentrated. Circulation between houses is very narrow. Just like all the other islands the houses are orientated in a perpendicular fashion compared to the river.

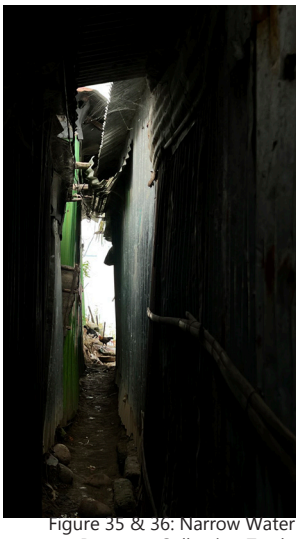


Figure 35 & 36: Narrow Water Passages Collecting Trash. Sue Vern, 2023.

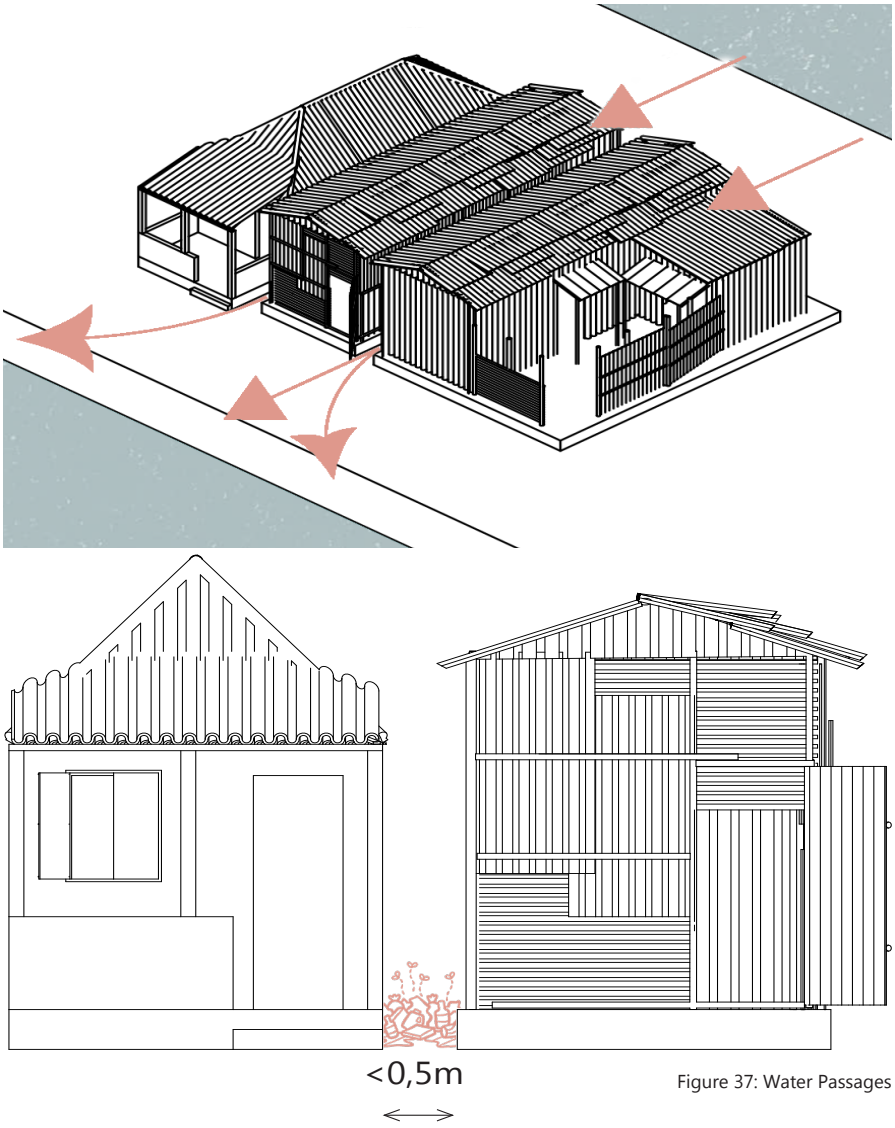
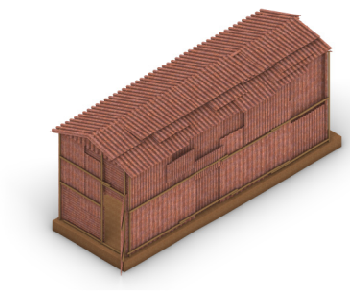


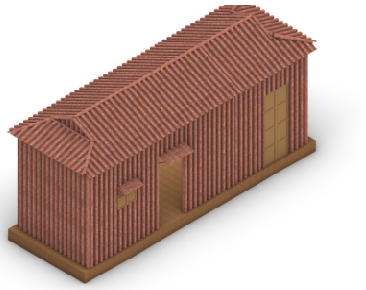
Figure 37: Water Passages

WATER PASSAGE

The perpendicular orientation of the houses isn't coincedental. The houses are following the waterway in case of floods to have minimal obstruction, letting the water pass over the island and into the river. To make this minimal obstruction possible, the houses leave space in between them instead of constructing adjacent housing. Altough necesarry, these water passages, now create sketchy areas that often attract trash. They are often less than half a meter in width but still used as ways of passage through the villages.

DWELLING

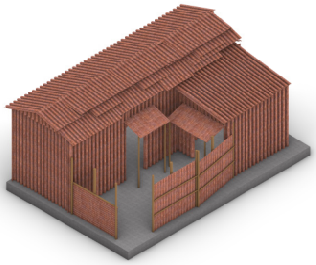


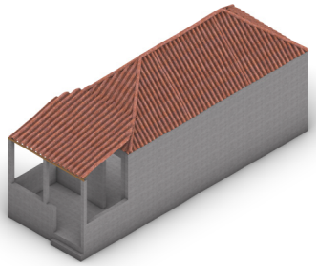


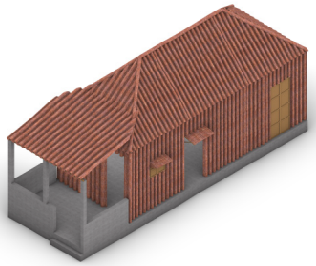
Traditional housing in the haor region of Bangladesh consists of some of the techniques and materials covered in the housing typologies. Often materials and techniques are combined based on what is locally available. Some of these encountered houses in Ratansree have been reconstructed for further analysis of the housing in the immediate vicinity of the site.

In Ratansree, the cgi sheet as a roofing and wall material reoccurs a lot. The sheets are cheap and relatively readily available. The encountered cgi sheets are often in a rusty state and sometimes multiple smaller parts of sheets are used together hold together by wooden or bamboo frames.

Some of the houses have a somewhat more constructed look, with whole pieces of cgi sheets and multiple openings in the form of doors and windows. Some of the housing plints consist only of earth and are thus vulnerable for floodings or heavy rainfalls.







Other plint styles that were present consisted of concrete slabs. These give more rigidy to the houses. As you can see in the example above houses often get expanded by just adding parts on to the house. These expansions are frequently used as stables for the kettle, which is often their most priced possesion, worth more than the house itself.

Some of the houses were almost fully part of concrete, only keeping the cgi sheets as roof material. Often these houses have a veranda towards the street site, as a transition space between the public and the private. Sometimes the cows are even kept on these small verandas.

There is not really a fixed typology, but rather a variety ranging from everything in between the most simple and the all concrete houses.

Figure 38: Reconstruction Ratansree Housing

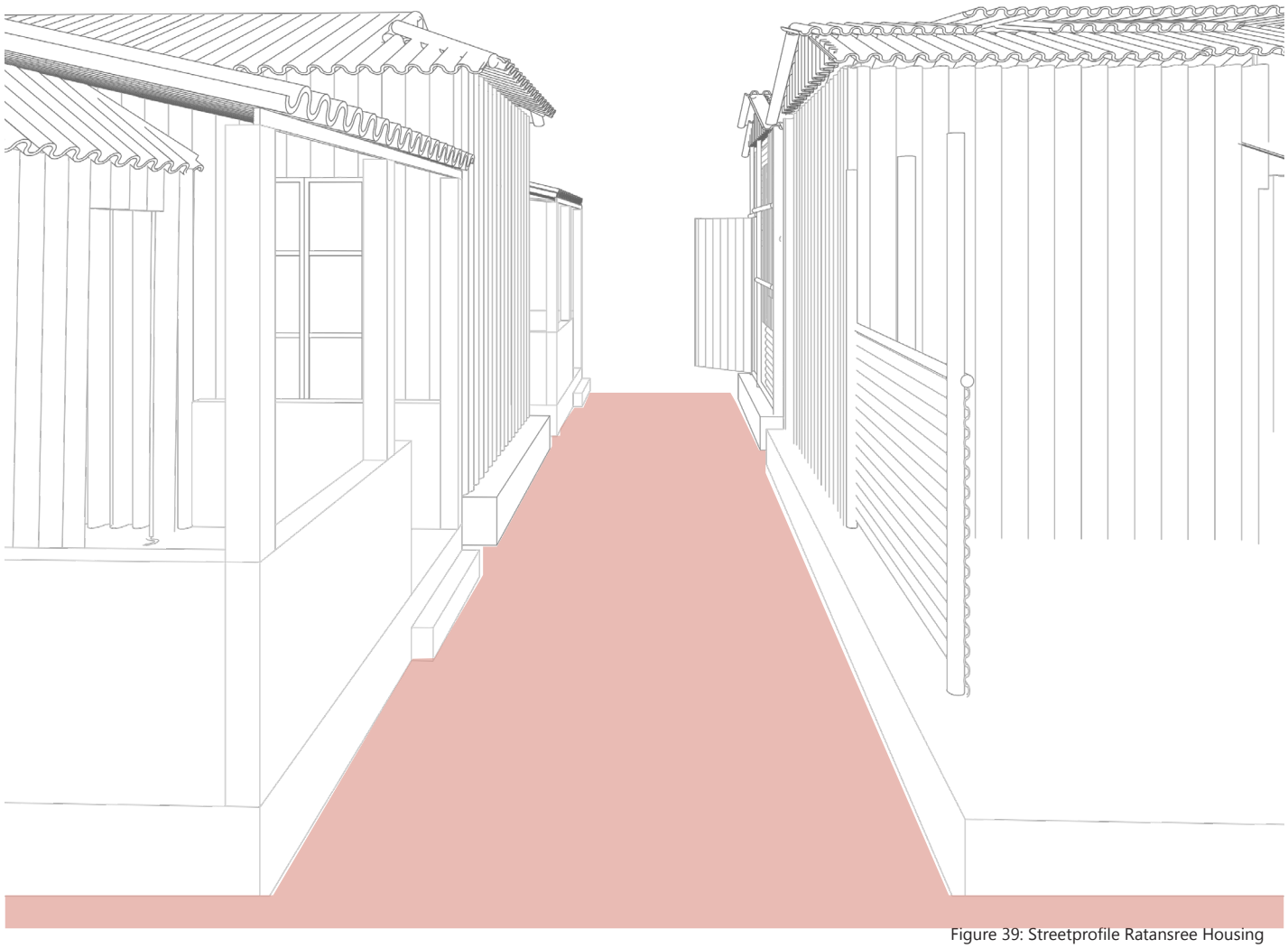


Figure 39: Streetprofile Ratansree Housing

The streetprofile in Ratansree was commonly pretty narrow, with multiple pedestrian routes through the villages where the houses opposite of eachother were not further than 2 meters aparts, as depicted above in figure 40. There was only one stone pedestrain road, the rest was without any structured design, simply a path on the bare ground. While the density rate of Ratansree is relatively not that high, it does feel really high. The houses are very closely packed together. The minimal seperation between the dwellings and the lack of communal spaces contribute to a sense of isolation among the residents.

There is not much room for public shared spaces other than the narrow routes, as a route with pedestrian traffic and being just bare ground, it is not an ideal space for neighbors to meet and interact with each other. Let alone qualitative spaces for the children to play, or community activities to take place. The street profiles highlight the need for a urban design that incorporates elements that encourage social interaction and promote community cohesion, which are vital for the overall well-being of the residents.

Figure 40: Streetprofile Ratansree Housing

PROJECT SITE

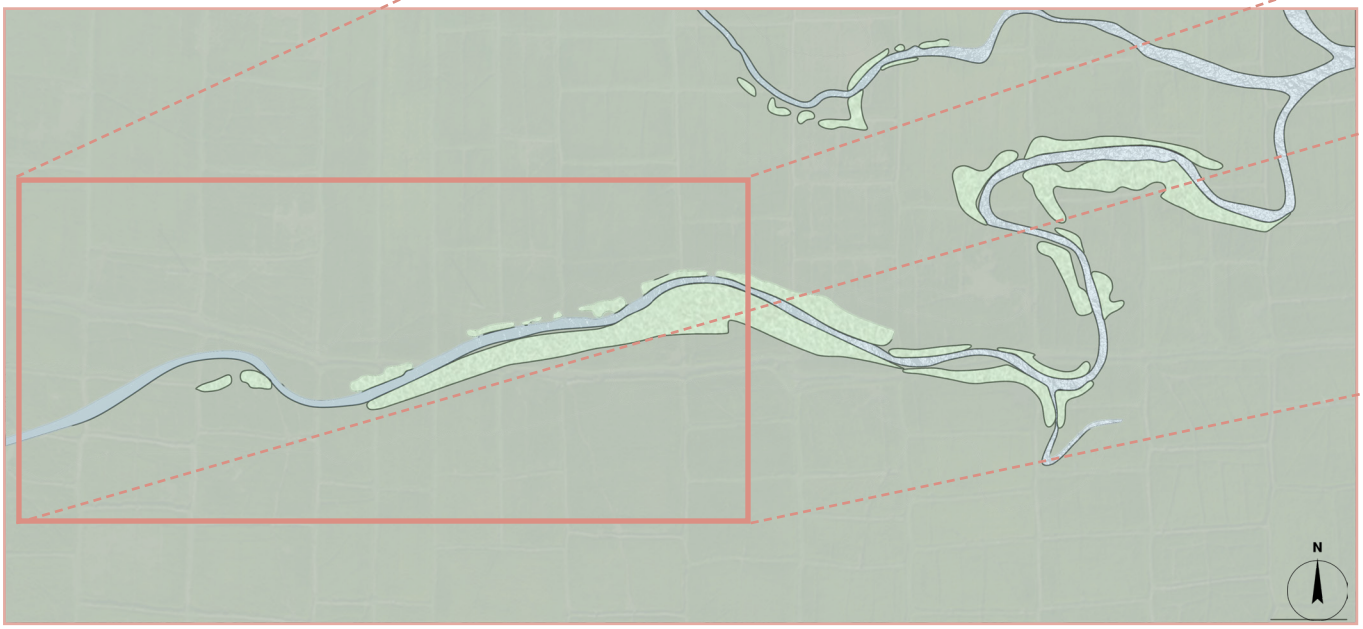


Figure 41: Site in tahirpurregion 1 : 50.000

The project's site is located at the left side of the tahirpur region around the river where it makes a curvature. Just as the existing elements the new proposed elements (highlighted in figure 43 on the right page) follow the naturual flow of the river. In this more zoomed in map of the site, we see the same seasonal differences. With again the problems of accesibility.

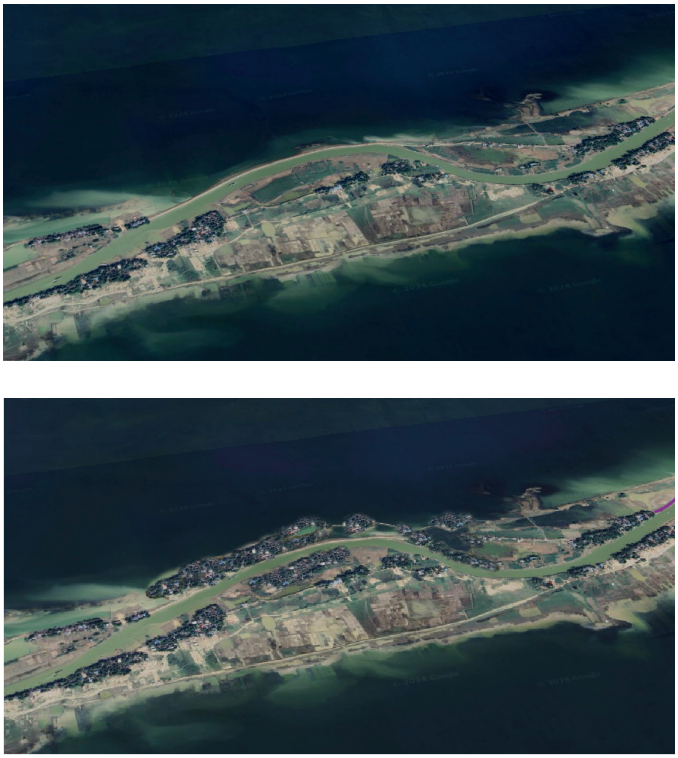


Figure 42: Current View from Above and View from Above Proposed Situation

Figure 43 : Proposed Settlements in Site During Dry period, Monsoon period and during Floods 1 : 25.000

DESIGN PRINCIPLES

Global Housing: Architecture of Transition in the Bangladesh Delta

The design principles are based on all the prior discussed work. In this section you find the fundamentals of the project's design and how it will be managed.

OBJECTIVES

GOALS & METHODS

The main objective is to design a settlement system that provides year round certainty of a sufficient living standard. In this case that means being less effected by the seasonal changes in water levels. Having such a resilient base to form communities would mitigate (seasonal) migration to urban areas. In order to create and sustain a resilient rural commmunity in the Haor region of Bangladesh, there need to be improvements in multiple regions. A key focus is generating income opportunities. Pro-poor tourism could prove to be beneficial for the area. A small island is designated as tourist centre during high season and additionally residents can host visitors and share the income generated. This also brings about a lot of job opportunites for example in the form of guided tours or selling crafted goods. The design will include lively hotspots where people can open shops, eateries, and small businesses, creating vibrant community hubs and ensuring year-round income-generating options for the residents.

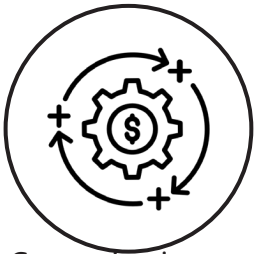
Building resilience is another important aspect. The project will introduce reclamed land between the elevated islands and roads, for year round agricultural activities as well as growing bamboo as renewable building material. This approach ensures a steady supply of building materials and food, enhancing the community's self-sufficiency. Furthermore, the settlement's elevated islands will provide safe living environments, protecting residents from the dangers of flooding.

Ensuring access to essential services is also a critical part of this project. The design maintains connectivity between the islands even during normal floods. Additionally, each island will be equipped with flexible spaces that can be repurposed for basic services such as healthcare and education in emergencies, ensuring that residents always have access to these critical services, even if the water levels rise even more unexpectedly in the future.

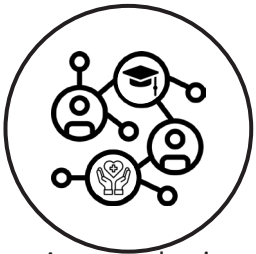
Creating a strong community is integral to the project's success. This will be achieved by forming cooperative organizations, encouraging residents to work together, build together, and own resources collectively. These cooperatives will promote social cohesion and economic stability, providing even the poorest members with opportunities to participate and benefit. The community-led approach will empower residents, fostering a sense of ownership and shared responsibility.

Moreover, local communities will be actively involved in the construction process. The project will also focus on infrastructure development, ensuring that each island is self-sufficient with necessary facilities for healthcare, education, and markets.

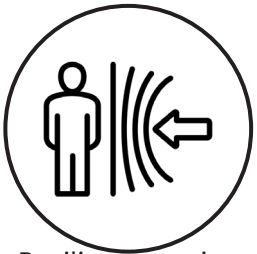
By following these methods, the project aims to create a safe, economically viable, socially cohesive, and environmentally sustainable rural settlement system in the Haor region of Bangladesh. These strategic approaches ensure that the community can withstand environmental challenges while promoting economic and social well-being.



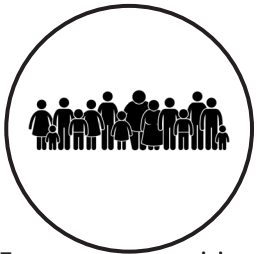
Generating income



Acces to basic services



Resilience against floods



Foster communities

PROGRAM OF REQUIREMENTS

Safety and Resilience
Elevated Structures: Design buildings and infrastructure on raised plinths to protect against flooding.
High Islands: Ensure islands are sufficiently elevated to remain safe from rising water levels.
Durable Materials: Use resilient construction materials and techniques to withstand environmental challenges.

Economic Opportunities
Pro-Poor Tourism: Develop designated islands for tourism, enabling residents to host visitors and share income.
Commercial Hotspots: Create lively areas with shops, eateries, and small businesses to generate year-round income.
Agricultural Land: Reclaim land for the cultivation of renewable resources like bamboo and year-round farming activities.

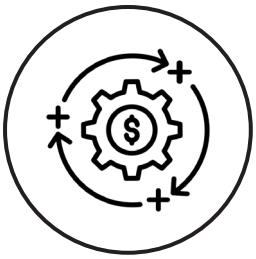
Social Cohesion and Community Building
Cooperative Organizations: Form community cooperatives to encourage collective ownership, resource sharing, and decision-making.
Community Spaces: Design central courtyards and communal areas to foster social interactions and a strong sense of community.
Construction Involvement: Engage local residents in the building process to enhance skills, create jobs, and ensure cultural appropriateness.

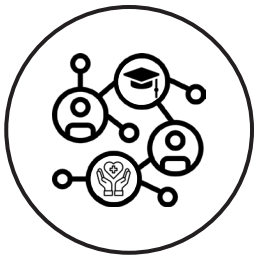
Accessibility and Connectivity
Interconnected Road Network: Implement a DNA-like road pattern to ensure smooth traffic flow and connectivity between islands.
Flexible Emergency Spaces: Equip each island with adaptable spaces for essential services such as healthcare and education in emergencies.

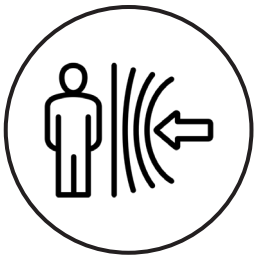
Essential Services and Infrastructure
Healthcare Facilities: Provide each island with accessible healthcare services, ensuring all residents can receive medical attention when needed.
Educational Institutions: Establish schools on each island to guarantee that education remains uninterrupted.
Markets and Shops: Create market spaces and shops to support local commerce and provide residents with necessary goods.
Water and Sanitation: Ensure the availability of clean water and effective sanitation systems, including septic tanks and helophyte filters, across all islands.
Energy Supply: Implement sustainable energy solutions to power the settlement.

Environmental Sustainability
Local Materials: Utilize locally sourced, renewable materials for construction to promote sustainability.
Green Spaces: Integrate parks and green areas into the settlement design to enhance environmental quality and provide recreational spaces.
Agricultural Practices: Develop sustainable farming practices to ensure food security and ecological balance.

Water Management
Septic Tanks: Implement septic tanks to manage waste and protect water quality.
Helophyte Filters: Use helophyte filters to naturally purify wastewater.
Lakes and Water Bodies: Incorporate lakes and other water bodies within the settlements to manage excess water and enhance the local ecosystem.
Stormwater Management: Develop systems to effectively manage stormwater, preventing flooding and ensuring water quality.


Generating income


Acces to basic services


Resilience against floods


Foster communities

TARGET GROUPS

Target Groups and Their Needs

The rural settlement project in the Haor region of Bangladesh aims to cater to a diverse range of target groups, each with unique needs and challenges. The following outlines the key target groups and how the project addresses their specific requirements:

Local Farmers and Agricultural Workers
Needs: Stability in income, protection from flooding, and access to fertile land.
Project Response: The project includes reclaimed agricultural land for year-round farming and the cultivation of renewable resources like bamboo. Elevated islands and resilient structures protect homes and farms from flooding, ensuring a stable environment for agricultural activities.

Small Business Owners and Entrepreneurs
Needs: Opportunities to start and sustain businesses, access to markets and customers.
Project Response: The design incorporates lively commercial hotspots where residents can open shops, eateries, and small businesses. Designated market islands and spaces for pro-poor tourism provide continuous economic opportunities and access to a steady stream of customers.

Families and Children
Needs: Safe living environments, access to education, healthcare, and recreational spaces.
Project Response: Each island is equipped with healthcare facilities, educational institutions, and flexible emergency spaces to ensure these services remain available during adverse conditions. Green spaces and community courtyards provide safe and enjoyable areas for families and children to gather and play.

Elderly and Vulnerable Populations
Needs: Easy access to healthcare, safe and accessible living conditions, and social support.
Project Response: Healthcare services are available on each island, with flexible spaces to ensure continuous access. The interconnected road network and public transport links make it easy for elderly and vulnerable populations to access essential services and participate in community life.

The Poorest and Most Marginalized
Needs: Affordable housing, opportunities for employment and social inclusion.
Project Response: The project promotes cooperative organizations, allowing residents to collectively own, manage, and benefit from community resources. This approach provides even the poorest members with opportunities for employment, housing, and participation in decision-making processes, fostering social inclusion and economic stability.

Tourists and Visitors
Needs: Attractive and engaging destinations, opportunities to experience local culture, and sustainable tourism options.
Project Response: Designated tourism islands with well-developed amenities offer tourists a unique and engaging experience. Pro-poor tourism initiatives ensure that the benefits of tourism are shared with the local community, supporting economic development while preserving local culture.

Local Artisans and Craftspeople
Needs: Opportunities to produce and sell crafts, access to markets and resources.
Project Response: Market spaces and commercial hotspots provide local artisans and craftspeople with platforms to sell their products. The use of local materials like bamboo in construction also supports local crafts and industries, providing additional income opportunities.


Residents


Jobs


Visitors

MANAGERIAL STRATEGY

Housing

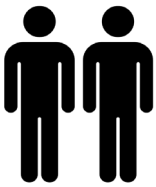
Primary stakeholders

PUBLIC SECTOR

Government
Developer of the project. Provides the urban design and building plans for the two housing cluster types. Develops the infrastructure.

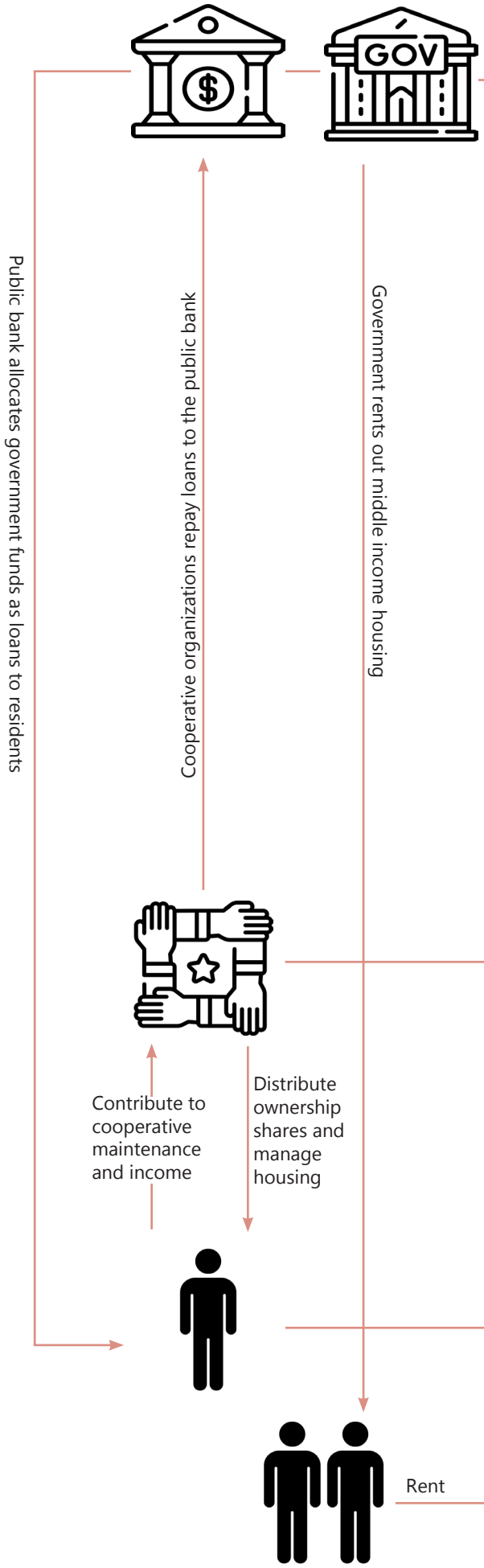
Public bank
The government provides small interest loans to individuals through the public bank.

RESIDENTS



Middle income Households
In the middle-income cluster, households rent their homes from the government.

Low income Cooperative organizations
In the low-income cluster, The residents use their loans to form small cooperative housing organizations.



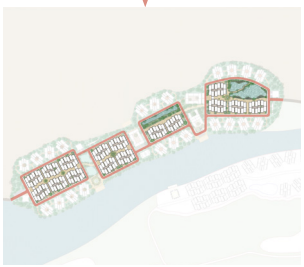
Settlement

Develops

Government

At the settlement level, the government is the key in the development and management of the community. They are responsible for designing the urban plan, including the zoning and sector divisions, ensuring that the settlement is well-organized and sustainable, leaving enough valuable free space. The government also develops and maintains the infrastructure, such as roads, utilities, and public facilities, to support the residents' needs. Additionally, they manage the overall administration to foster economic opportunities, social cohesion, and environmental sustainability.

Zone

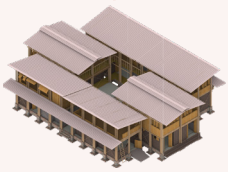


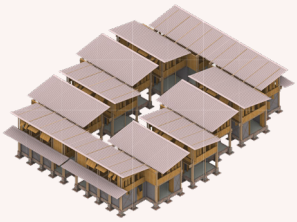
Government

At the zone level, the government is responsible for dividing the zones into low-income and middle-income housing areas. The middle-income housing is strategically placed between the vehicular roads and community spines, ensuring high visibility and both vehicular and foot traffic, which is beneficial for residents who open small shops and businesses. This placement helps foster economic activity and vibrant community life.

The low-income housing zones are situated closer to the water, with more green spaces interspersed between the homes. This layout provides a more serene and natural living environment, offering residents access to open areas for recreation. The thoughtful zoning ensures that each income group has an environment tailored to their needs, promoting both economic viability and quality of life.

Cluster





Residents

In low-income clusters, cooperative housing groups own and manage the housing. These groups are responsible for building and maintaining the clusters, sharing both costs and income from hosting tourists. They also have shared facilities like stables and storage spaces, promoting resource sharing and community support.

In the middle-income clusters, residents rent their homes from the government, fostering a more individualistic approach to housing. These residents are encouraged to open small shops and businesses within their clusters, providing opportunities to generate income and stimulate local economic activity. The middle-income clusters are designed to support entrepreneurial initiatives.

Unit

Low-Income Cluster Units

In the low-income clusters, the cluster is shared among the cooperative housing group, but each resident has individual ownership of their specific unit. The cost for each resident is proportional to the size of their unit compared to the entire cluster. While ownership is collective, residents have the freedom to modify and personalize their own units as they see fit.

Middle-Income Cluster Units

In the middle-income clusters, residents rent their units from the government. These units come with two floors, where only the outer walls on the ground floor and the bathroom are fixed structures. Residents have the flexibility to design and arrange the rest of the space according to their needs. The top floor can be left open as a terrace or enclosed to create additional rooms or any mix of open and enclosed.

COST RECOVERY

Government

For the government to sustain and further develop the rural settlement system, implementing effective cost recovery strategies is essential. These strategies ensure that the significant investments made in infrastructure, housing, and community services can be maintained and expanded over time. By generating revenue through various methods, the government can continue to support the community's growth and resilience. Below are the key cost recovery approaches employed at different levels of the settlement.To ensure the feasibility of the project, the density of the new settlements is to be increased compared to the existing settlements. To do this, while also maintaining enough space for public functions and open green spaces, all clusters are elevated to have a first floor. Effectively increasing the GSI while maintaining a low FSI.

Regional Level
At the regional plan level, the government employs several strategies to recover costs
associated with the development of the rural settlement system.

Tourism Development
The government develops a small island specifically designed for tourism. This island is sold to a pro-poor tourism organization, which manages and promotes tourism activities that benefit the local community. Additionally, the government generates revenue through tourism taxes collected from visitors, providing a steady stream of income to support further development and maintenance efforts.

Reclaimed Agricultural Land
The government rents out reclaimed land to local farmers, creating a sustainable source of income. By leasing these spaces to farmers, the government ensures that the land is utilized effectively for agricultural production, contributing to food security and economic resilience within the region. A significant portion of this reclaimed land is dedicated to bamboo farming, which serves as a renewable resource as essential building material for the settlements. The rental income from these agricultural plots helps offset the initial costs of land reclamation and infrastructure development.

Cluster level
At the cluster level, the government recovers costs primarily through renting and selling properties. In middle-income clusters, rental income from residents helps cover the initial infrastructure and development expenses. This consistent revenue stream is crucial for maintaining and improving the settlement. Additionally, the government sells properties, particularly in attractive areas, to generate significant funds. By also selling or leasing commercial spaces within the clusters, the government fosters local businesses and economic activity. This balanced approach of renting and selling ensures that the settlement remains financially sustainable and vibrant.

COST RECOVERY

Residents

Residents
The new settlement systems offer significantly more job opportunities for all residents. With the establishment of more commercial hotspots and public functions, residents can find employment in various sectors. The increased focus on tourism also creates numerous job opportunities, from hosting tourists to selling local crafts and services.

General Economic Opportunities
Middle-income residents can now set up small shops, cafes, and local businesses, fostering economic activity through community commerce. The development of public functions such as schools, healthcare facilities, and communal spaces also generates new jobs in maintenance, service provision, and management roles. The flourishing tourism sector provides additional income opportunities, with residents earning money by offering accommodations, guiding services, and showcasing local crafts to visitors.

Specific Opportunities for Low-Income Housing
In low-income clusters, residents can earn income by hosting tourists or visitors within their cooperative housing organizations. This includes activities like subleasing spaces or organizing community events that attract visitors.

Specific Opportunities for Middle-Income Housing
For middle-income residents, their housing units within the clusters serve as a versatile mix of living and commercial spaces. They can run shops, cafes, or restaurants from their homes, integrating business and residential life seamlessly. This mixed-use approach not only provides a steady income stream but also enhances the vibrancy and economic stability of the community.

These diverse income streams, coupled with home-based businesses like tailoring and crafts, highlight the potential for robust economic growth and community empowerment in the Haor region's new settlements. Bamboo farming initiatives and agricultural activities in green spaces further support sustainable development and job creation, enriching the local economic landscape.

MASTERPLAN

Global Housing: Architecture of Transition in the Bangladesh Delta

The design of the rural settlement system in the Haor region of Bangladesh aims to create a safe, sustainable, and economically viable community in flood-prone areas.

REGIONAL

Regional Concept
The proposed settlement system in the Hoar region of Bangladesh, is designed to form a network of interconnected islands. These islands all have different functions, to stimulate economic, social, and environmental sustainability.

Main Island
The main island is the "hub" of the settlement, as is hosts essential services and facilities like schools, healthcare centers, markets, and offices. This island is also the primary residential and commercial area. The diverse housing options and public spaces encourage interaction between the residents and stimulate economic activity.

Secondary Islands
The secondary islands are primarily focused on providing housing for the low- and middle-income residents. These islands are designed to support the main island, by offering additional housing and local amenities (such as small shops, cafes and community centers). The secondary islands are well connected to the main island, to ensure easy acces to the services and facilities of the main island.

Specific Function Islands
Some islands have specialized functions to stimulate the overall economic resilience of the settlement. One of these islands is designed as a bazaar area, where the local farmers, artisans and merchants can sell their products. Another island is developed as a tourism hub, by providing accommodations, restaurants, and attractions to highlight the regions natural beauty and strong cultural heritage. These islands provide job opportunities and attract visitors, which will boost the local economy.

Reclaimed Land
Reclaimed land plays a crucial role in the settlement system, used primarily for bamboo farming and other agricultural activities. Bamboo serves as a renewable building material, supporting local construction and reducing dependence on external resources. The agricultural activities on reclaimed land ensure food security and create additional income streams for the residents.

Phasing of the Project

The implementation of the settlement system follows a phased approach to ensure sustainable development and effective resource utilization:

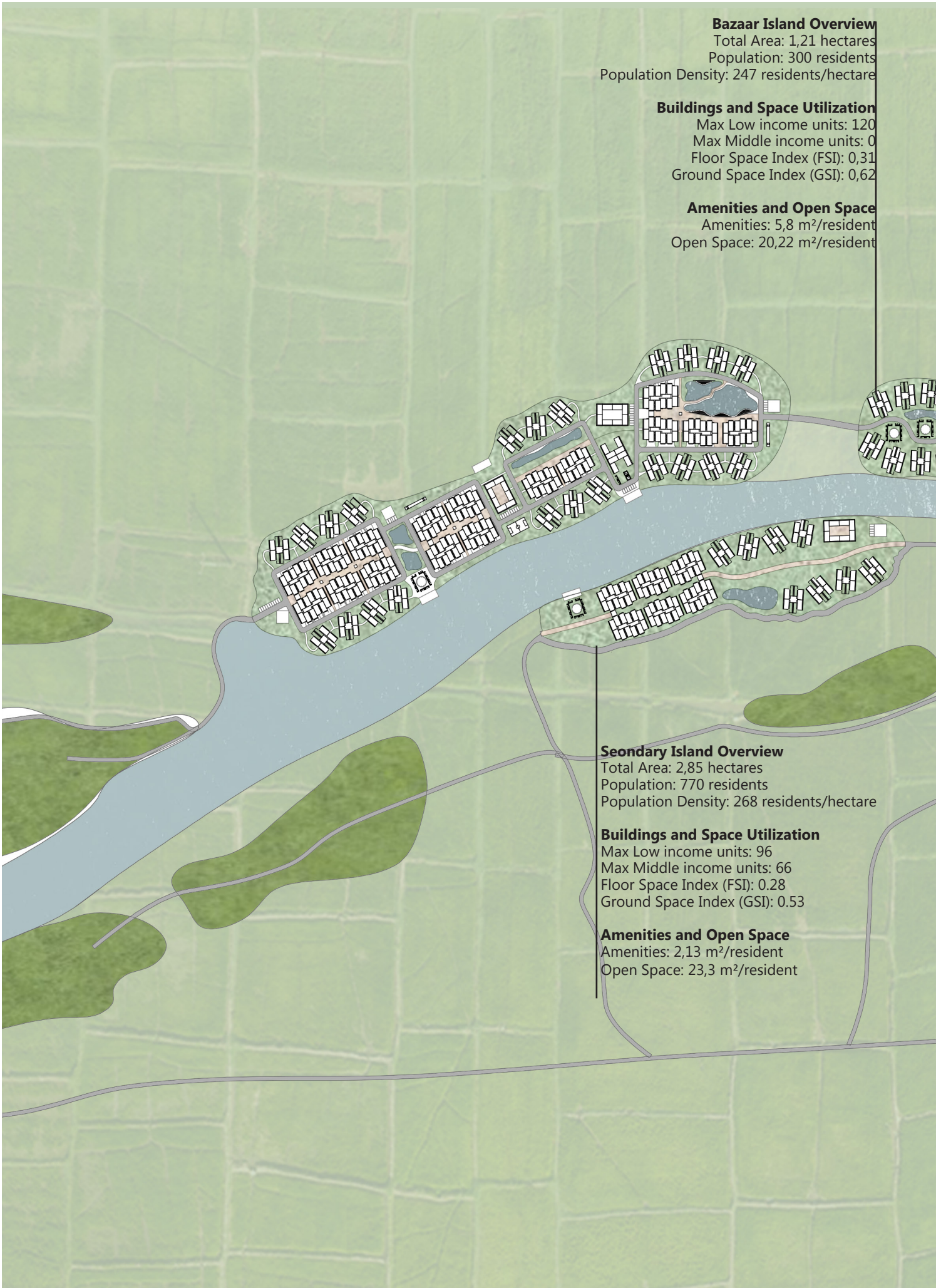
Phase 1: Development of the Main Island and Reclaimed Land
The project begins with the development of the main island, focusing on constructing essential services, housing, and infrastructure. Simultaneously, efforts are made to reclaim land for bamboo farming and other agricultural purposes. Establishing the main island and agricultural base first ensures that residents have access to essential services and food security from the outset.

Phase 2: Expansion to Secondary Islands
Once the main island is operational, the project expands to the secondary islands. These islands will be developed with a mix of low and middle-income housing, small businesses, and community centers. The connections between the main and secondary islands will be established, ensuring seamless access to services and economic opportunities.

Phase 3: Development of Specific Function Islands
The next phase focuses on developing the specific function islands. The bazaar island will be established as a central marketplace for local goods, while the tourism island will be developed with facilities and attractions to draw visitors. These islands will be crucial for boosting the local economy through trade and tourism.

Phase 4: Expansion Under the River
Finally, the project will expand to the islands under the river, which will be developed as the settlement grows. These islands will provide additional space for residential and commercial activities, ensuring the settlement can accommodate future population growth and economic development.

Through this phased approach, the project ensures a balanced and sustainable development, creating a resilient and thriving community in the Haor region.



Bazaar Island Overview
Total Area: 1,21 hectares
Population: 300 residents
Population Density: 247 residents/hectare

Buildings and Space Utilization
Max Low income units: 120
Max Middle income units: 0
Floor Space Index (FSI): 0,31
Ground Space Index (GSI): 0,62

Amenities and Open Space
Amenities: 5,8 m²/resident
Open Space: 20,22 m²/resident

Seondary Island Overview
Total Area: 2,85 hectares
Population: 770 residents
Population Density: 268 residents/hectare

Buildings and Space Utilization
Max Low income units: 96
Max Middle income units: 66
Floor Space Index (FSI): 0.28
Ground Space Index (GSI): 0.53

Amenities and Open Space
Amenities: 2,13 m²/resident
Open Space: 23,3 m²/resident

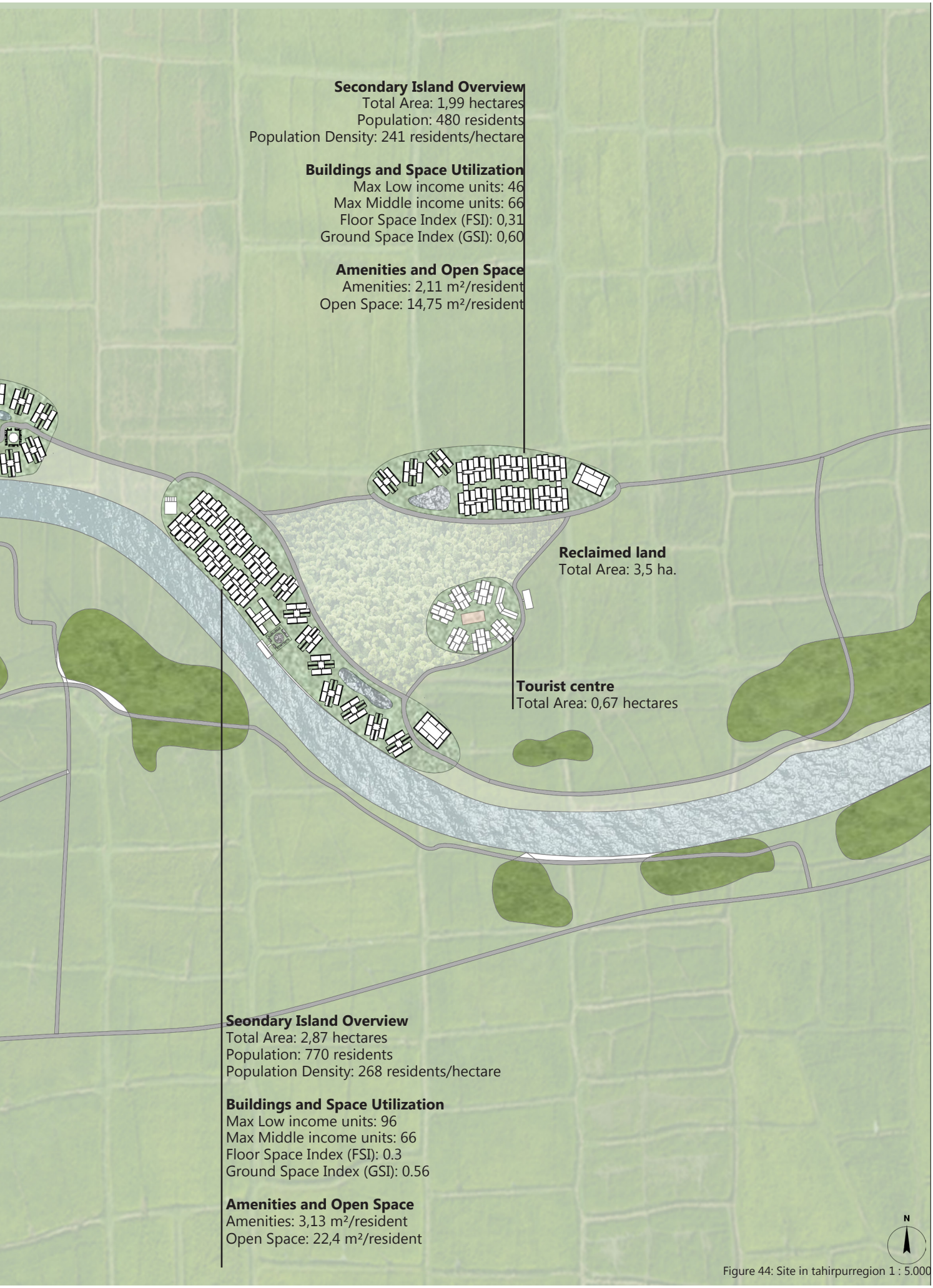


Figure 44: Site in tahirpurregion 1 : 5.000

RECLAIMED LAND

Reclaimed Land
Reclaimed land is a crucial component of the new settlement system in the Haor region of Bangladesh. This land is primarily used for agricultural activities, including bamboo farming, which supports the sustainability and resilience of the community.

Agricultural Activities
The reclaimed land is utilized for various agricultural purposes, with a significant focus on bamboo farming. Bamboo is chosen for its fast growth rate, resilience, and versatility as a building material. This renewable resource helps reduce dependence on external materials, supporting local construction and providing a sustainable source of income for the community. In addition to bamboo, other crops can be grown to ensure food security and generate income throughout the year. These agricultural activities not only supply the community with essential resources but also create job opportunities for residents.

Economic Benefits
The reclaimed land contributes to the economic stability of the settlement by generating revenue through agricultural production. The government leases plots of this land to local farmers, who can grow bamboo and other crops. This rental income helps recover the costs associated with land reclamation and infrastructure development. Additionally, the agricultural products, particularly bamboo, can be sold within the local market or to external buyers, further boosting the community's income.

Environmental Resilience
Reclaiming land for agriculture also enhances the environmental resilience of the settlement. By converting previously unused or flood-prone areas into productive land, the community reduces its vulnerability to flooding and other environmental challenges.

Figure 45: Reclaimed Land 1 : 5.000

MAIN SETTLEMENT

The Main Settlement
The main settlement is the cornerstone of the new settlement system in the Haor region of Bangladesh. As the first developed island, it serves as the blueprint for the subsequent expansion and development of the entire settlement system. This primary island is designed to be the heart of the community, providing a robust foundation for growth and sustainability.

Central Hub of Activity
The main settlement is the central hub of the region, boasting the highest concentration of amenities and services. It features essential facilities such as schools, healthcare centers, markets, administrative offices, and community spaces. These amenities are crucial for attracting residents and fostering a vibrant community life. The presence of these services ensures that the main settlement is a thriving center of activity, drawing people from surrounding areas for education, healthcare, commerce, and social interactions.

Model for Future Development
As the first island to be developed, the main settlement sets the standard for the rest of the settlement system. It demonstrates the principles of sustainable design, community integration, and economic resilience that will be replicated in the subsequent islands. The success and functionality of this main settlement will serve as a model, guiding the development of secondary and specific function islands in the region.

Figure 46: Main Settlement 1 : 2.000

Economic and Social Engine

The main settlement acts as the economic and social engine of the entire system. Its diverse range of amenities and services supports a wide array of economic activities, from small businesses and markets to tourism and public services. This variety of opportunities attracts residents and promotes economic growth. The bustling center of the main settlement helps create a lively atmosphere, fostering a sense of community and belonging among residents.

Phased Expansion

The development of the main settlement marks the beginning of a phased approach to building the entire settlement system. After establishing the main settlement, the project will gradually expand to secondary islands, which will provide additional residential and commercial spaces. These secondary islands will be closely connected to the main settlement, ensuring that residents have access to its amenities and services. Specific function islands, such as those dedicated to bazaars and tourism, will be developed in later phases, enhancing the region's economic diversity and resilience.

Foundation for Sustainable Growth

By focusing on the main settlement first, the project ensures that the essential infrastructure and community services are in place, creating a stable foundation for sustainable growth. The lessons learned and successes achieved in the main settlement will inform the development of the rest of the system, ensuring a cohesive and well-integrated regional plan. This strategic approach guarantees that the entire settlement system grows in a balanced and sustainable manner, meeting the needs of the community while promoting long-term resilience and prosperity.

Figure 47: Main During Flood

WATER MANAGEMENT

Effective water management is crucial in the Haor region of Bangladesh. The new settlement system incorporates multiple practices to ensure the community remains safe and resilient against current and future water-related challenges.

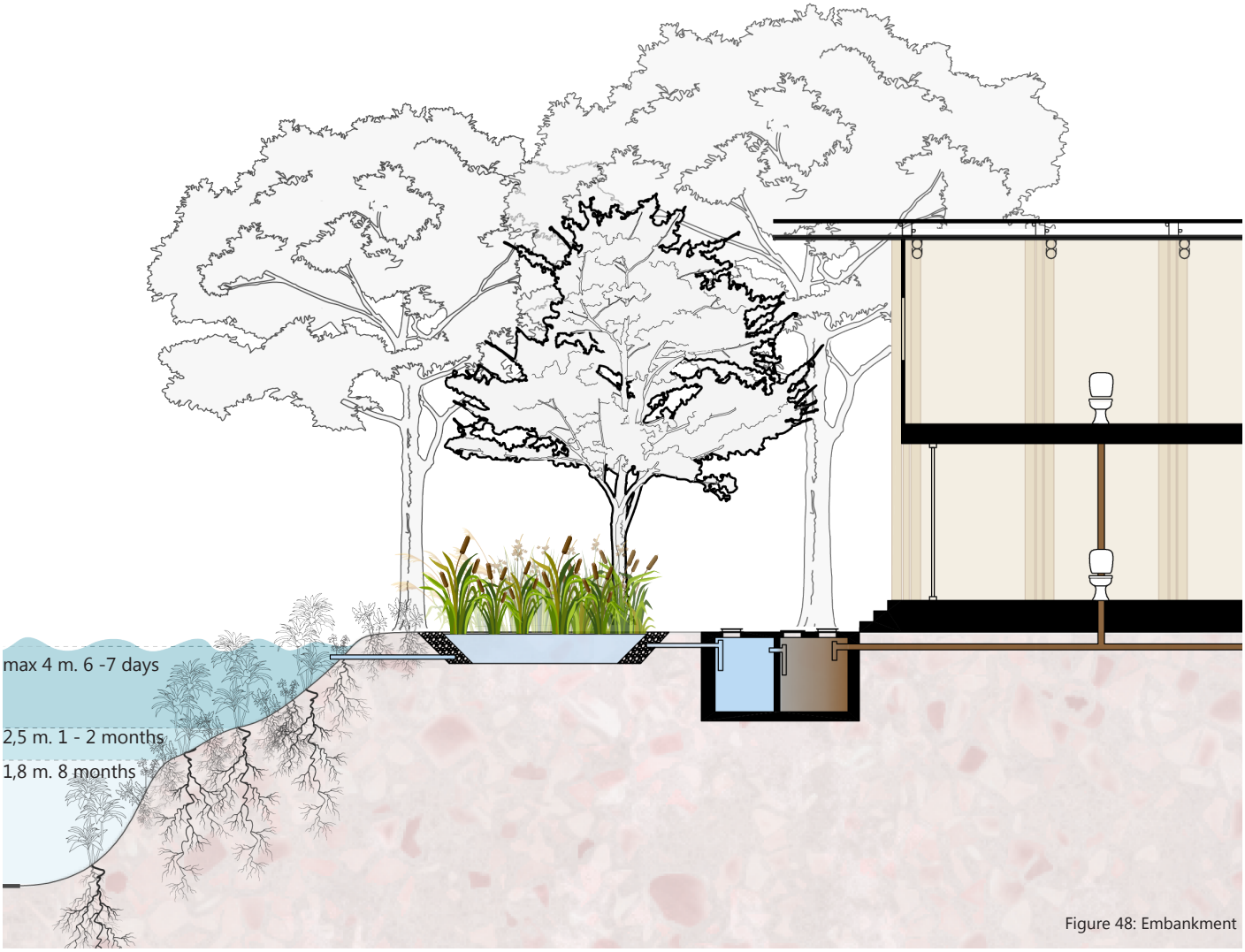


Figure 48: Embankment

Flood Protection

The settlement is designed with a high embankment, built to withstand current flood levels and anticipated future rises in water levels. The embankment is reinforced with vetiver grass, known for its deep root system that helps prevent soil erosion. Additionally, bamboo cribs are used to stabilize the embankment structure further. To enhance stability, numerous trees are planted along the embankment, their root systems providing additional support and reducing the risk of collapse.et faccaboria dent ent fugita denisci rehendi doluptatecto corepud andande lectate ctusdae.

Building Resilience

To prepare for potential future increases in flood levels, buildings within the settlement are constructed with heightened plinths, ensuring that even if water levels rise beyond current expectations, the structures remain above water. This proactive measure is crucial for maintaining the integrity and safety of the community in the face of extreme weather events.

Wastewater Management

The settlement employs a robust wastewater management system to ensure clean and safe water. Dirty water from the houses is directed through a series of septic tanks and helophyte filters.

Houses near the embankment

Wastewater from houses located on the sides of the settlement flows into septic tanks, where solid waste is separated. The effluent then passes through helophyte filters, which use aquatic plants to further purify the water. After filtration, the cleaned water is released back into the river or surrounding wetlands.

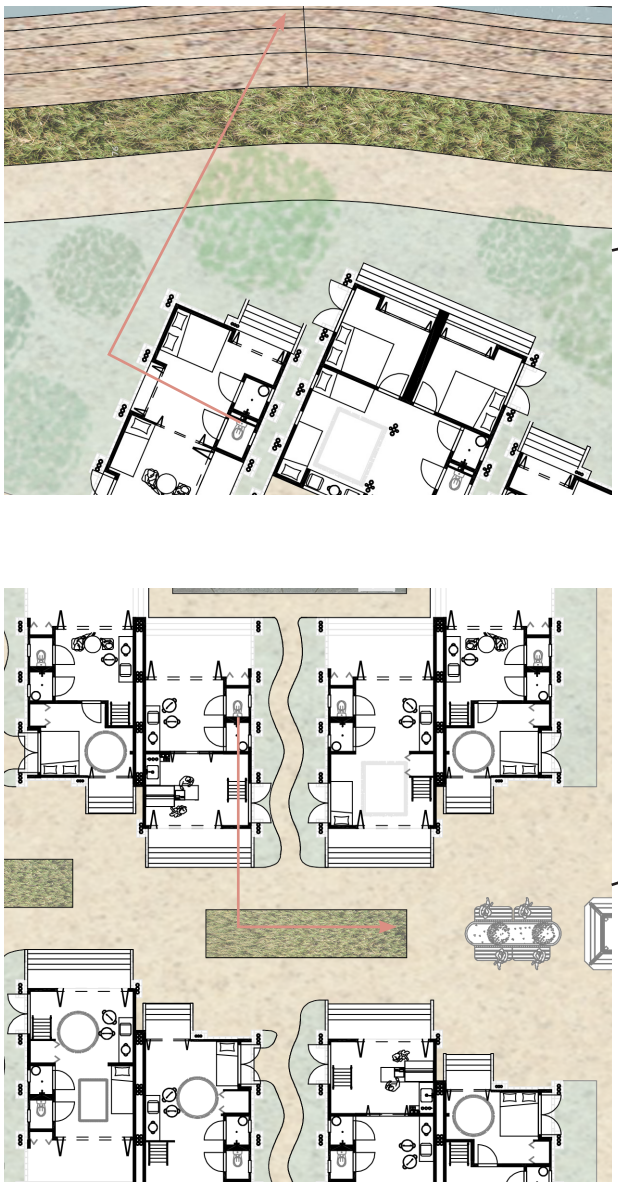


Figure 49: helofyte filters in plan

WASTE
WATER

Middle Houses: Wastewater from houses in the middle of the settlement follows a similar process but is directed into nearby lakes after passing through the septic tanks and helophyte filters. These lakes serve as natural reservoirs for treated water, supporting local ecosystems and providing additional water storage.

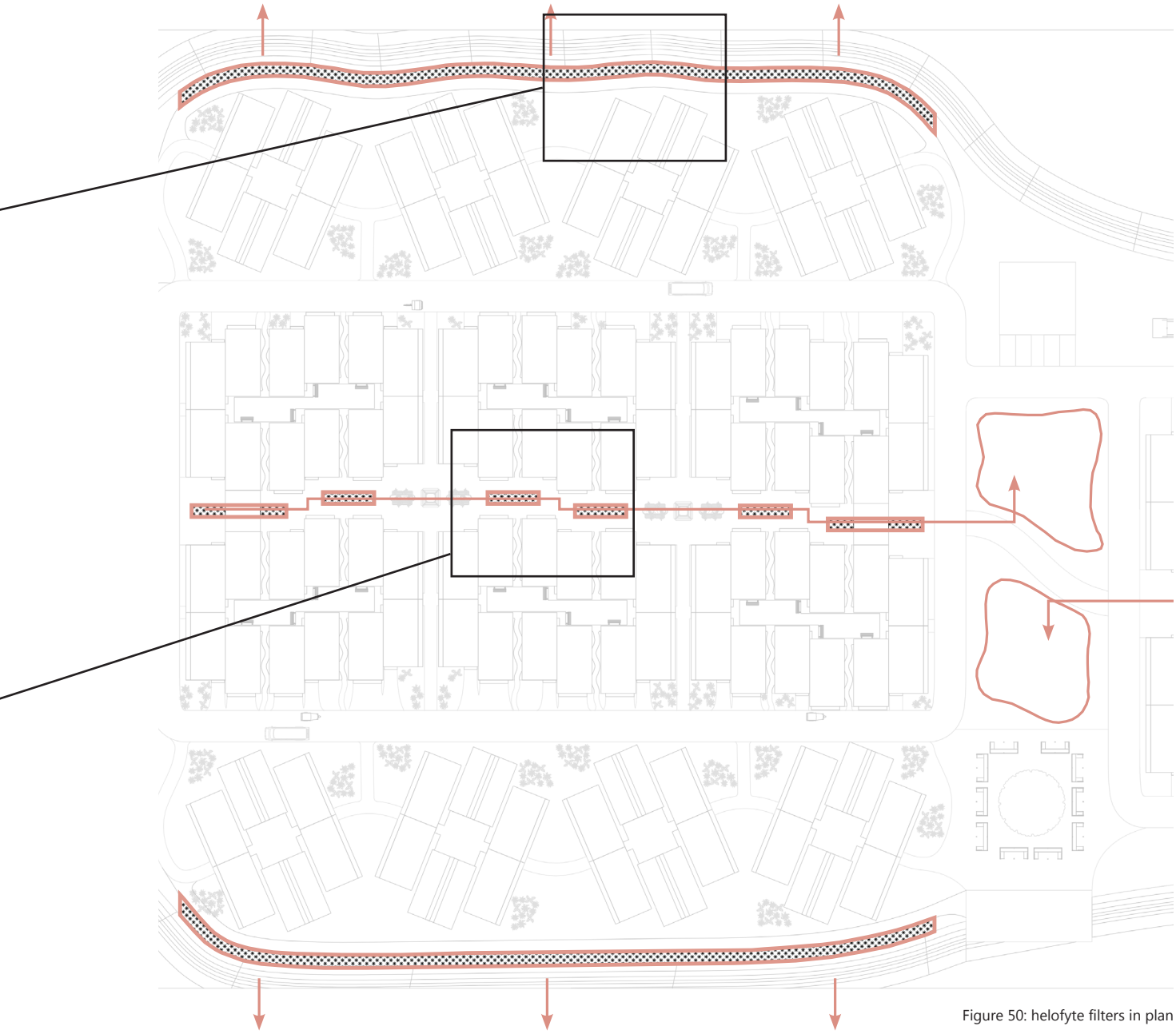


Figure 50: helofyte filters in plan

Rainwater Management
Excess rainwater is managed through a carefully designed drainage system that directs water either into the lakes or back into the river or wetlands. This system ensures that rainwater is effectively channeled away from residential and commercial areas, preventing flooding within the settlement. The lakes, integrated into the settlement plan, play a dual role: they collect and store excess rainwater and treated wastewater, maintaining the overall balance of the water system.

Sustainable Water Bodies
The water bodies within the settlement, including the lakes and wetlands, are integral to the water management strategy. They act as natural filtration systems, enhance local biodiversity, and provide recreational and aesthetic value to the community. The strategic placement and use of these water bodies ensure that the settlement can sustainably manage its water resources while also creating a pleasant living environment for residents.

Conclusion
The comprehensive water management system in the Haor region's new settlement ensures resilience against flooding, effective wastewater treatment, and sustainable use of natural water bodies. By combining traditional and innovative techniques, the settlement is well-equipped to handle current water challenges and adapt to future changes, promoting a safe and sustainable community.

ZONES

MIDDLE INCOME CLUSTERS

The vehicular circulation of the settlment is split and joined somewhat like a dna strand. This controls the traffic to pass at lower speeds. This also creates various zones within the plan. Zones within the vehicular road gain lot of visibility and traffic. The middle income clusters have moment on one side because of the vehicular route and inbetween because of a community spine, making sure that shops started within these regions get enough people passing by.

LOW INCOME CLUSTER

The low income clusters are zoned on the outside of the roads. With more focus being on the open space, creating places where neighbors can meet and interact. These clusters are a little more calm, perfect for hosting tourists.

PUBLIC FUNCTIONS

The zones with public amenities like schools, healthcare facilities mosques and bigger stores, are located where the road joins together. These arised nodes form the hotspots of the island.

Figure 51: Zoning Through Split Vehicular Road

SECTORS

The zones indicate the type of building it houses, you have the middle income, the low income and the public building zones. The islands is also horizontally divided by sectors you pass through from left to right or from right to left when you travel through this settlement. These sectors alternate from public functions, in which there is no dwelling units, and sectors that are mainly focussed on dwelling but have some mixed use units present. In the following section the sectors will be covered in more detail from east to west.

Figure 52: Sectors Main Island

ENTRANCE

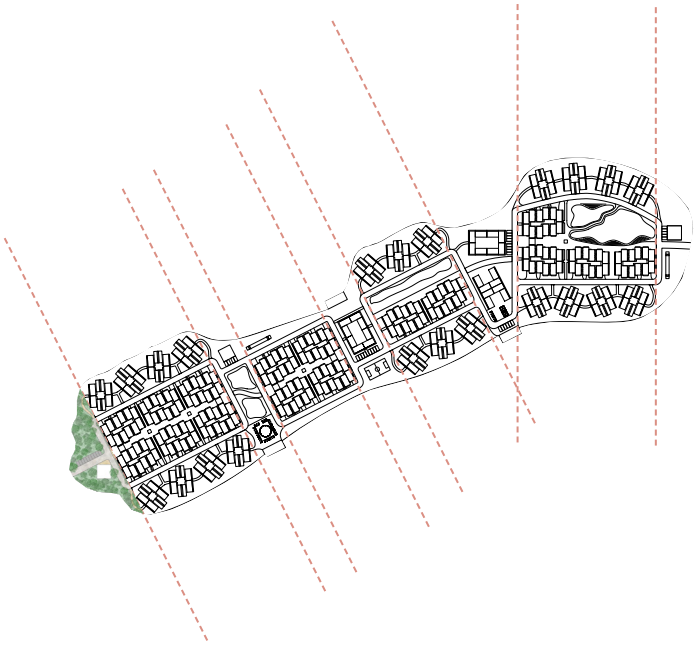
Entering the main settlement
As you approach the settlement sytem from the west, you enter via the main settlement. This is a welcoming entrance that sets the tone for the entire settlement system. This sector, designed to be a peaceful and inviting gateway, offers a calm atmosphere fitting the settlements.

A Place of Religion and Community
The first notable feature is the mosque, which is very important as the communities in this region are primarily muslim. It serves as a central point for daily prayers, fostering a sense of unity and belonging among residents. Besides this mosque you find a playground, which provides a safe and vibrant space for children to play and socialize and for their parents to meet, adding to the communal spirit of the sector.

Convenient Transportation
For those entering the settlement without own transport, there are rickshaws stationed at the beginning of this island. This ensures easy and efficient access to other parts of the settlement, making it a practical starting point for residents and visitors alike.

Open space
One of the most important featurues is the open green space. Areas with trees and greenery add to the calmth and opennes of the masterplan. Benches and seating areas are thoughtfully placed next to the embankment, providing peaceful spots for people to relax, enjoy the view, and engage in quiet reflection.

Figure 53: Sector 1 - Entrance 1 : 500



Sector 1

Scale: **1 : 500**

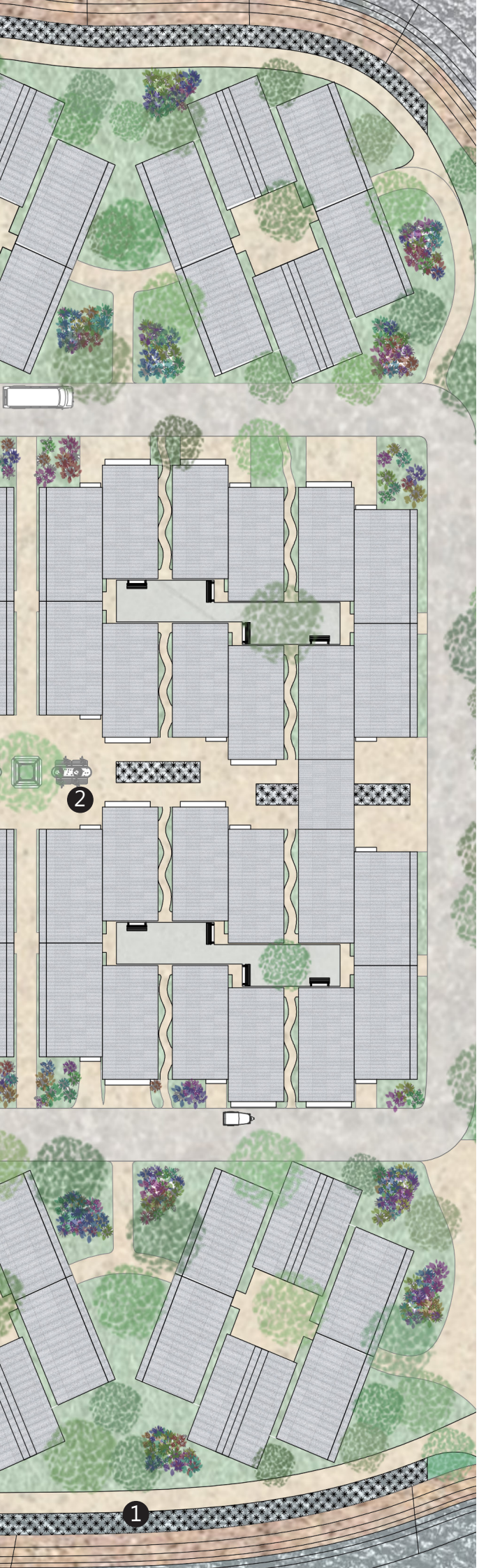
Orientation:

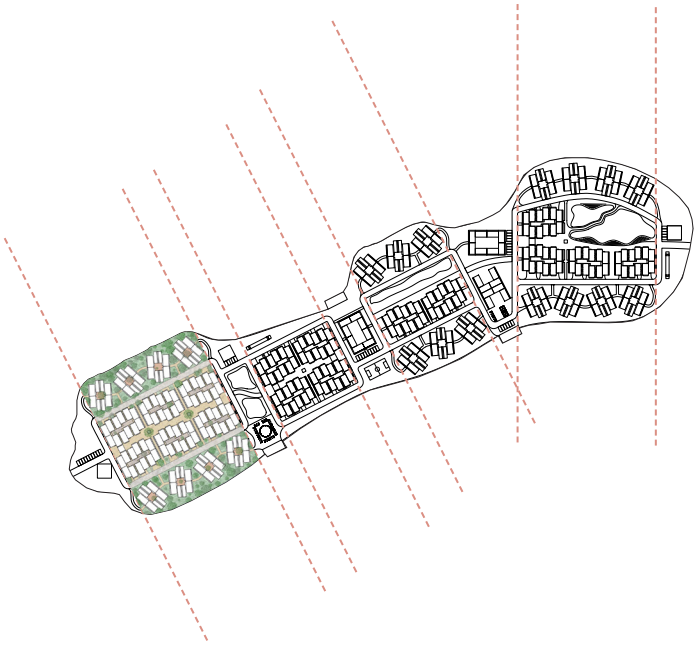
A Serene Introduction

The thoughtful design of this sector, with its emphasis on open space, greenery, and communal facilities, creates a impactfull introduction to the settlement. As the gateway to the community, this sector showcases the balance between liveliness and calming open space of the settlements, creating hotspots where people can meet with eachother without being overcrowded.

1. **Mosque**
2. **Playground**
3. **Embankment Seating Area**
4. **Parking**
5. **Rickshaw stand**

Figure 54: Sector 2 1 : 500





Sector 2

Scale: **1 : 500**

Orientation:

Dwelling

From the calm entrance you follow up in the most dense dwelling sector. The vehicular road splits up creating the low income zones to the middle and the middle income zones through the central spine of the island. This spine functions as a community spine, offering pedestrians a calmer and greener route that functions independent off the vehicular traffic. The community spine gives the pedestrians the opportunity to continue through island in a welcoming way.

1. **Helofyte filter**
2. **Community spine**
3. **Split vehicular road**
4. **Low income housing cluster**
5. **Middle income housing cluster**

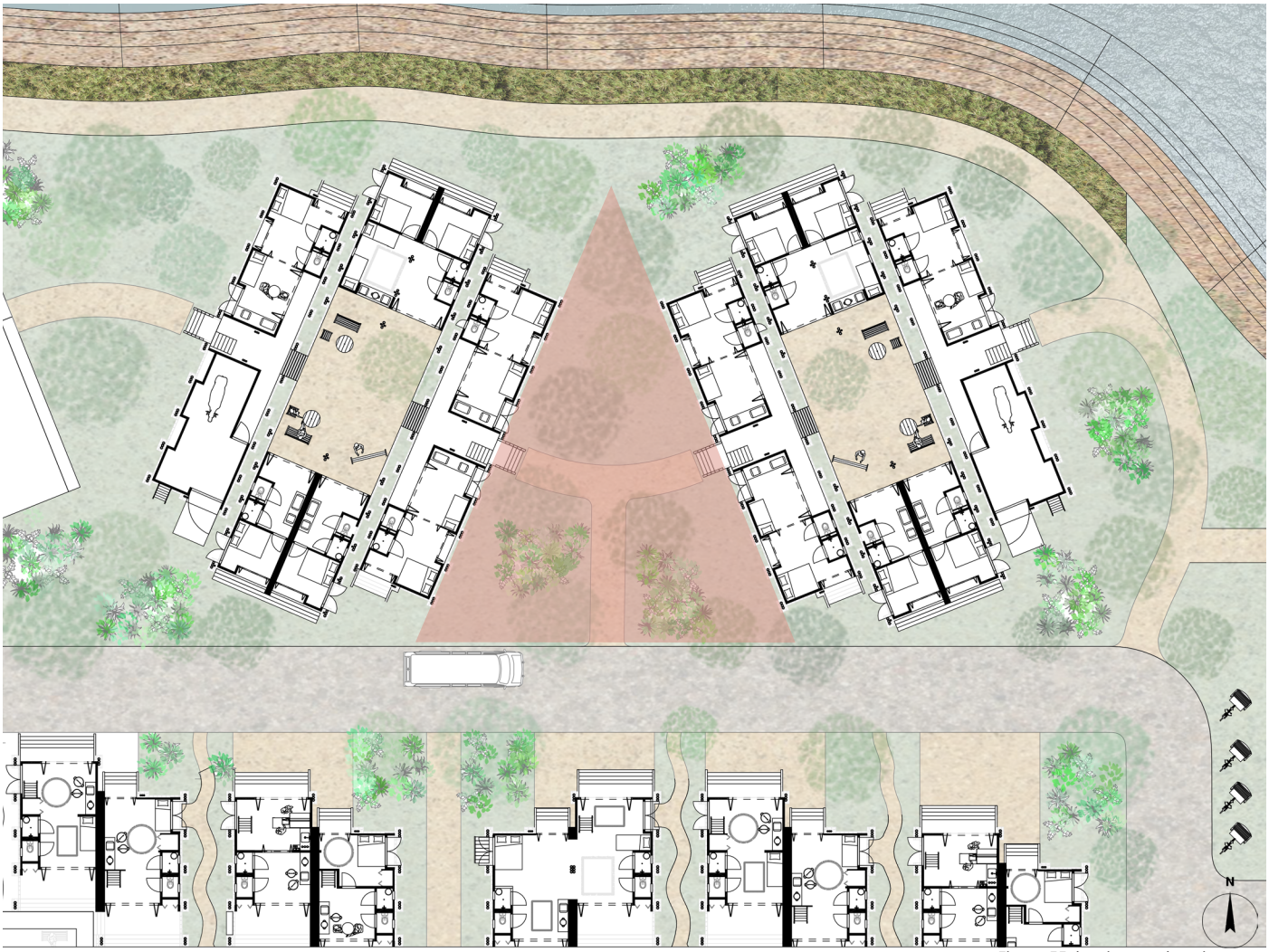


Figure 55: low income housing zone

COMMUNAL AREAS

Community spaces

Both the low income cluster and the middle income cluster type offer valuable community spaces, that arise from the placement of the clusters. The low housing types are positioned in a interchanging diagonally twisted manner so that two clusters always have a open space connecting the cluster alternatively to the front or the back. From these spaces you enter the cluster or you walk from one cluster to the other. With the clusters offering seating areas alongside the buildings these areas open up the opportunity for people to meet and interact, children from both clusters have the chance to play here.

Figure 56 & 57: Impression low income housing zone

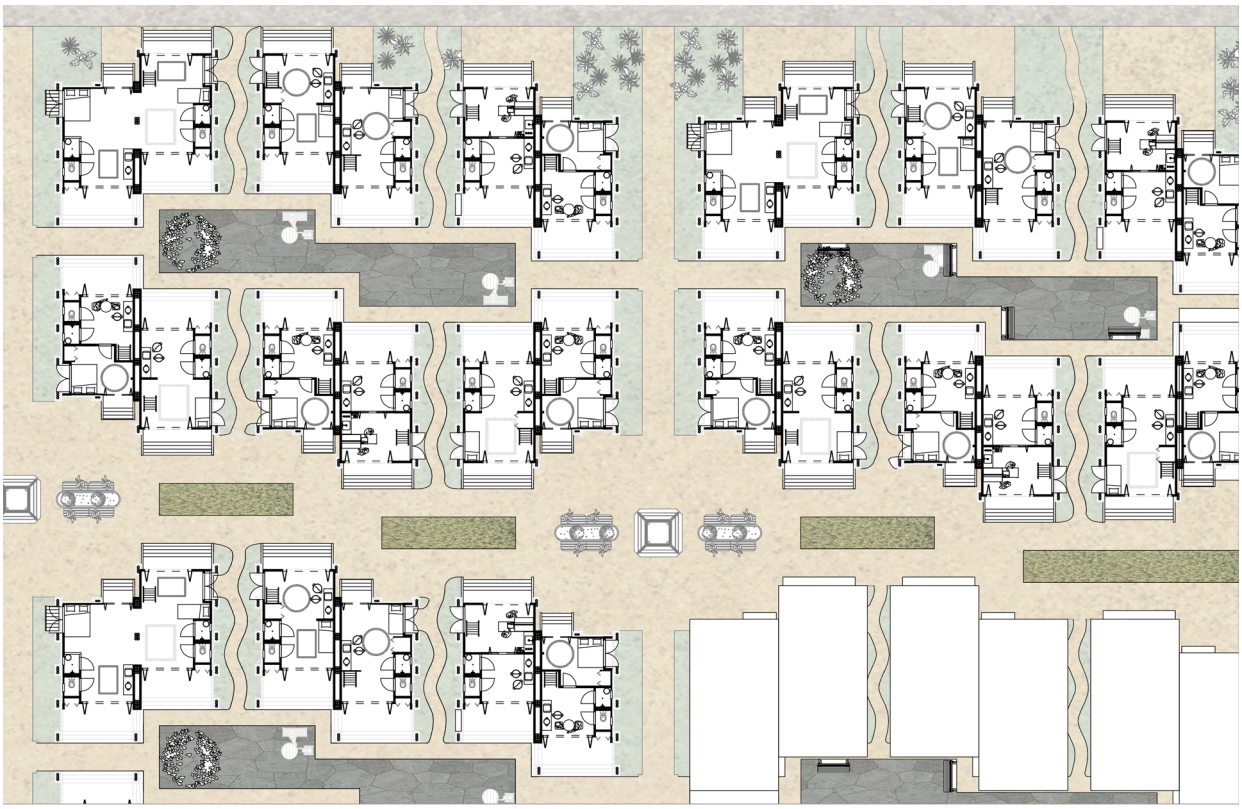


Figure 58: Community spine

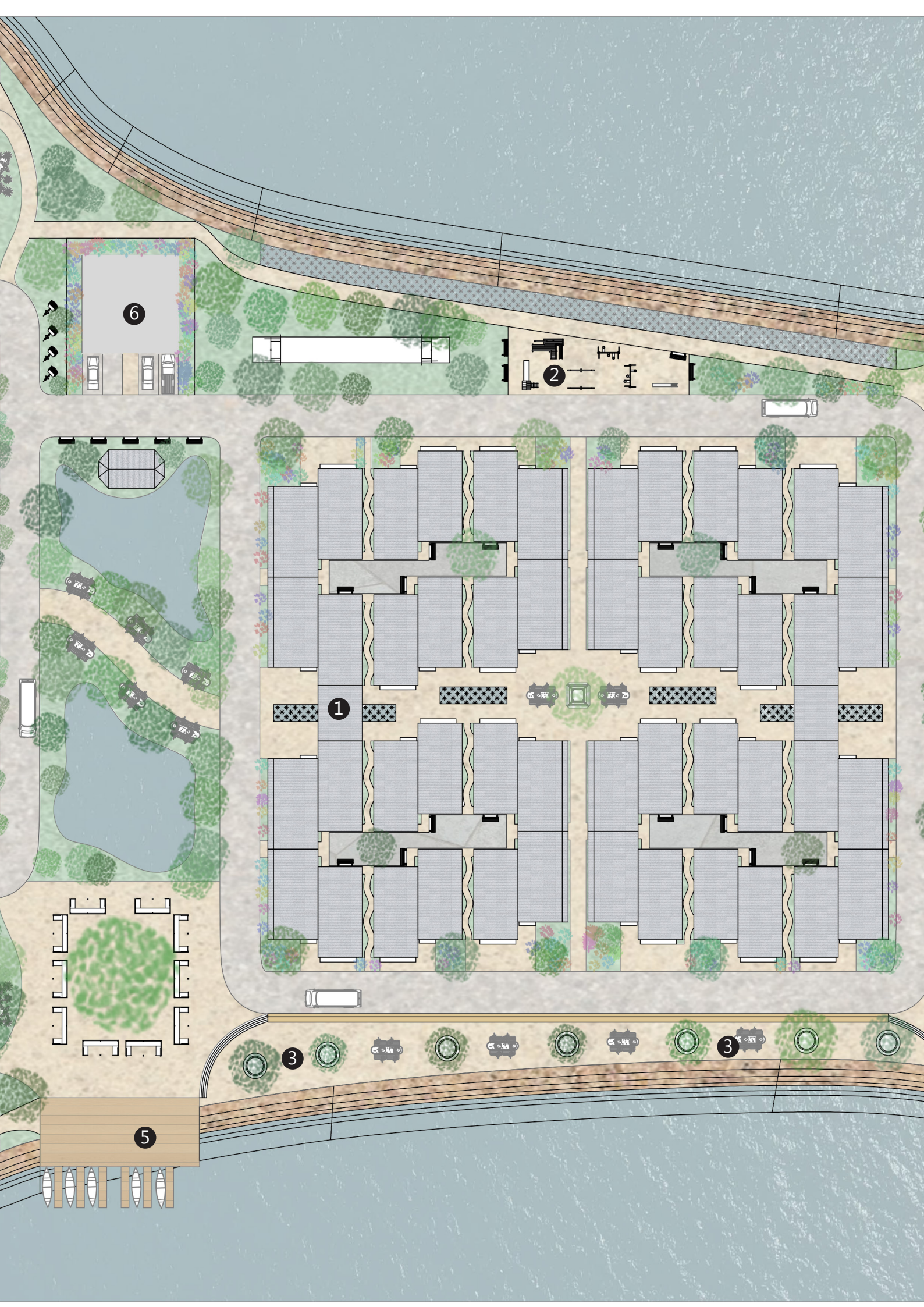
COMMUNITY SPINE

Community spaces

Between the middle income clusters, the community spine is formed. A pedestrian route through the dwelling clusters. The zig zag placing of the clusters and the units in the clusters make this an interesting route through the settlements. The clusters can be entered from this community spine giving the residents the option to enter from the vehicular road or from the more interactive backside, where the interaction of people is encouraged.

Figure 59: Community spine

Figure 60: Community spine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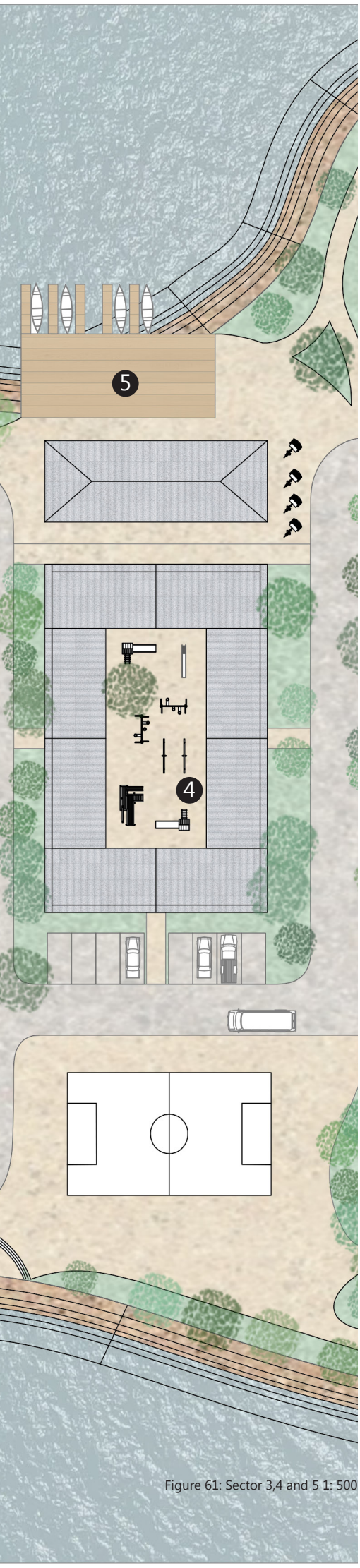


Figure 61: Sector 3,4 and 5 1: 500

Sector 3, 4 , 5

Scale: **1 : 500**

Orientation:

After the first dwelling sector you enter a smaller public sector that is very open. From the dock on the river side it is almost completely open up till the end on the wetland side, where the vehiclar road crossed the long open space, which is followed up by a city hall. From this you enter the second dwelling sector which only consists of a middle income zone. From the path through the lakes and park you can again follow a community spine, which is entered through a gate that often acompanies this community spine. Along the riverbank is a long stretched out seating area, where people can come together after work.

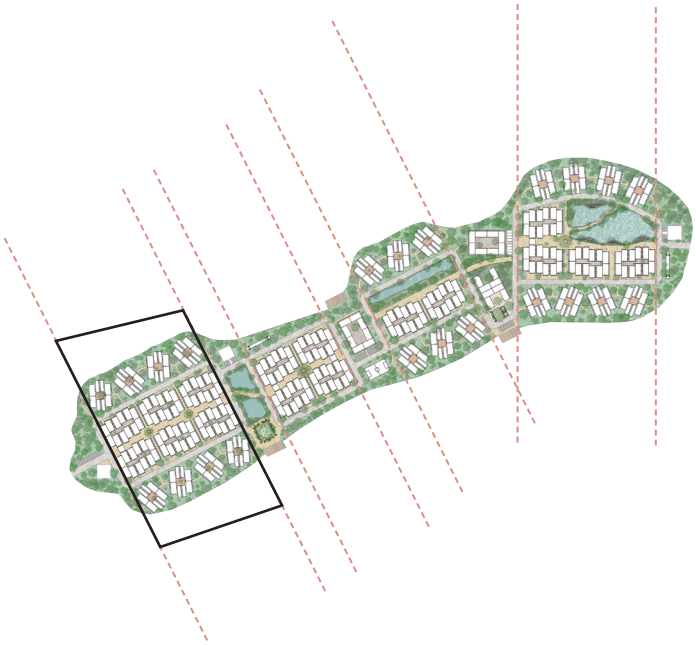
1. **"Gate"to community spine**
2. **Playground**
3. **Embankment Seating Area**
4. **Elemantary school**
5. **Dock**
6. **City hall**

ENTRANCE
COMMUNITY SPINE

The community spine offers a unique pedestrian route to every dwelling sector. The spine slightly differs in appearance in every sector, but is mostly accompanied by an entrance gate. This gate functions as the transition between the more busy vehicular road and the calm spine. The community spine and its gate follow the principle of compression and release, where one follows the more narrow spine which is entered of exited by the even more narrow gate before being released in to the more open areas again.

Figure 62: Gate to Community Spine

Figure 63: Sector 6



Sector 6

Scale: **1 : 500**

Orientation:

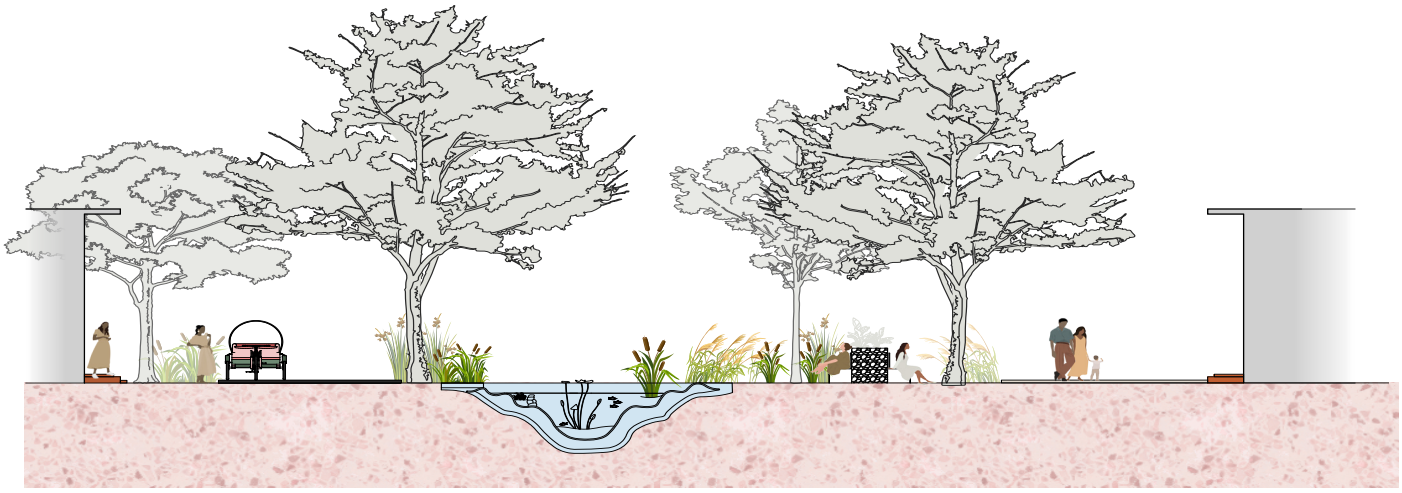
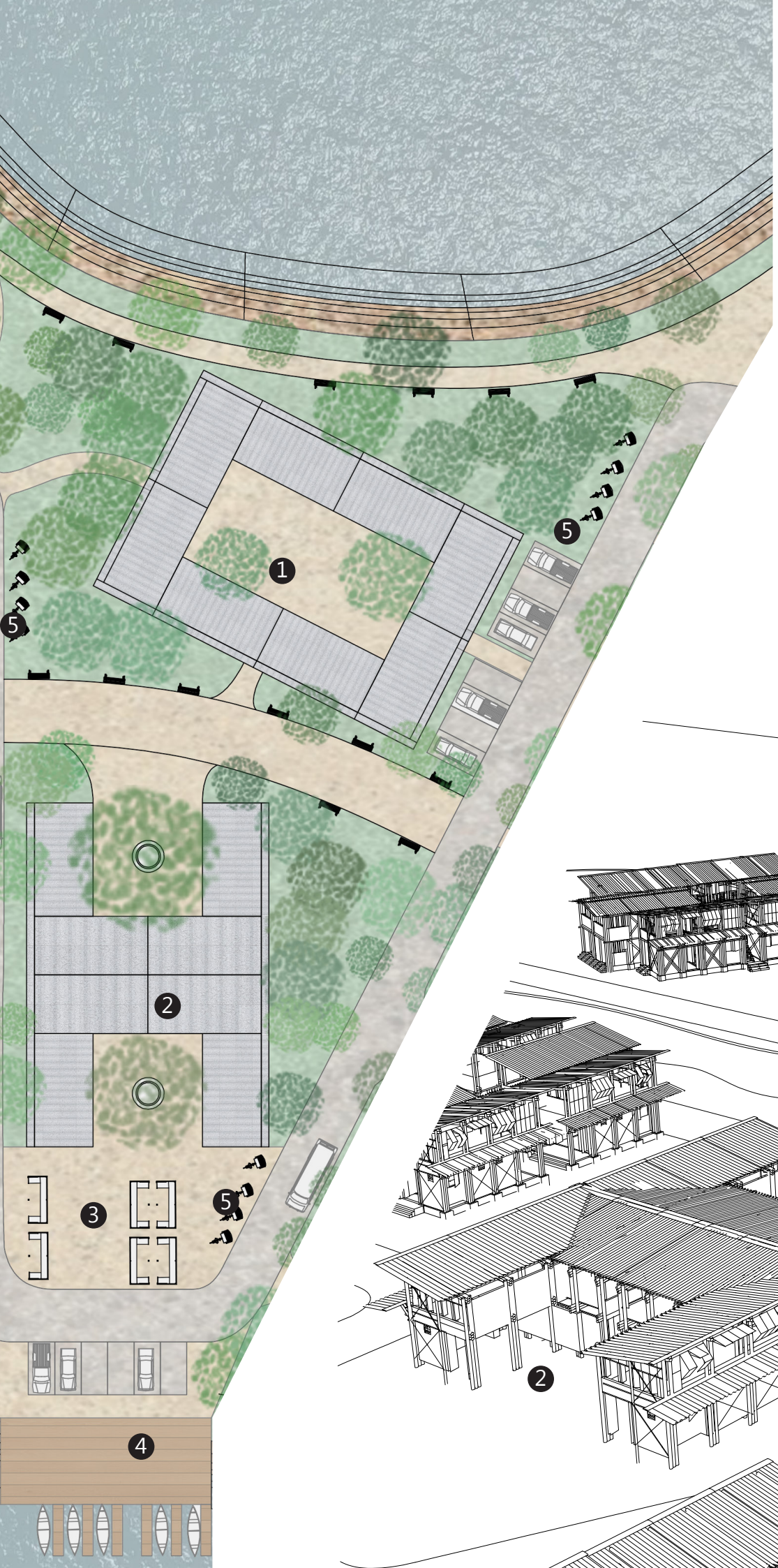
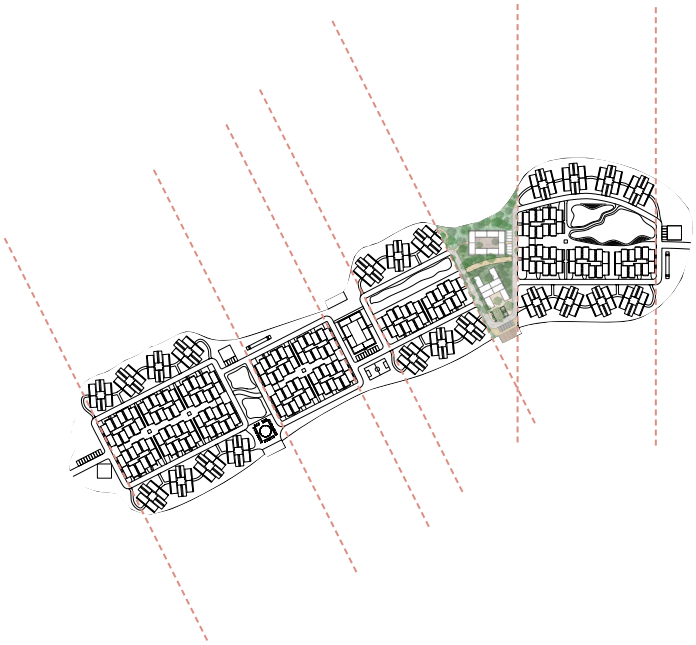


Figure 64: Streetprofile Sector 6

Sector 6 follows a more open plan, where the pedestrian route follows along one of the settlements lakes. By having more variation in the possible pedestrian routes, the plan is more inviting to walk through the settlement, rather than taking the vehicular road.


1
2
3
4
5
5
5

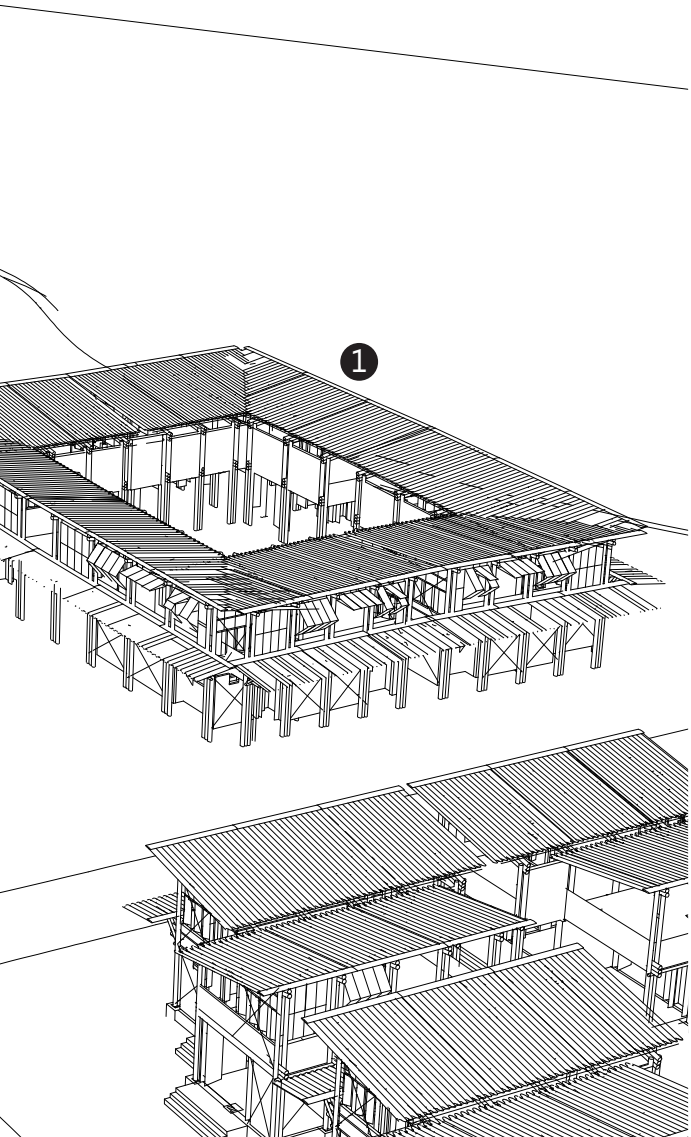
2



Sector 7

Scale: **1 : 500**

Orientation:

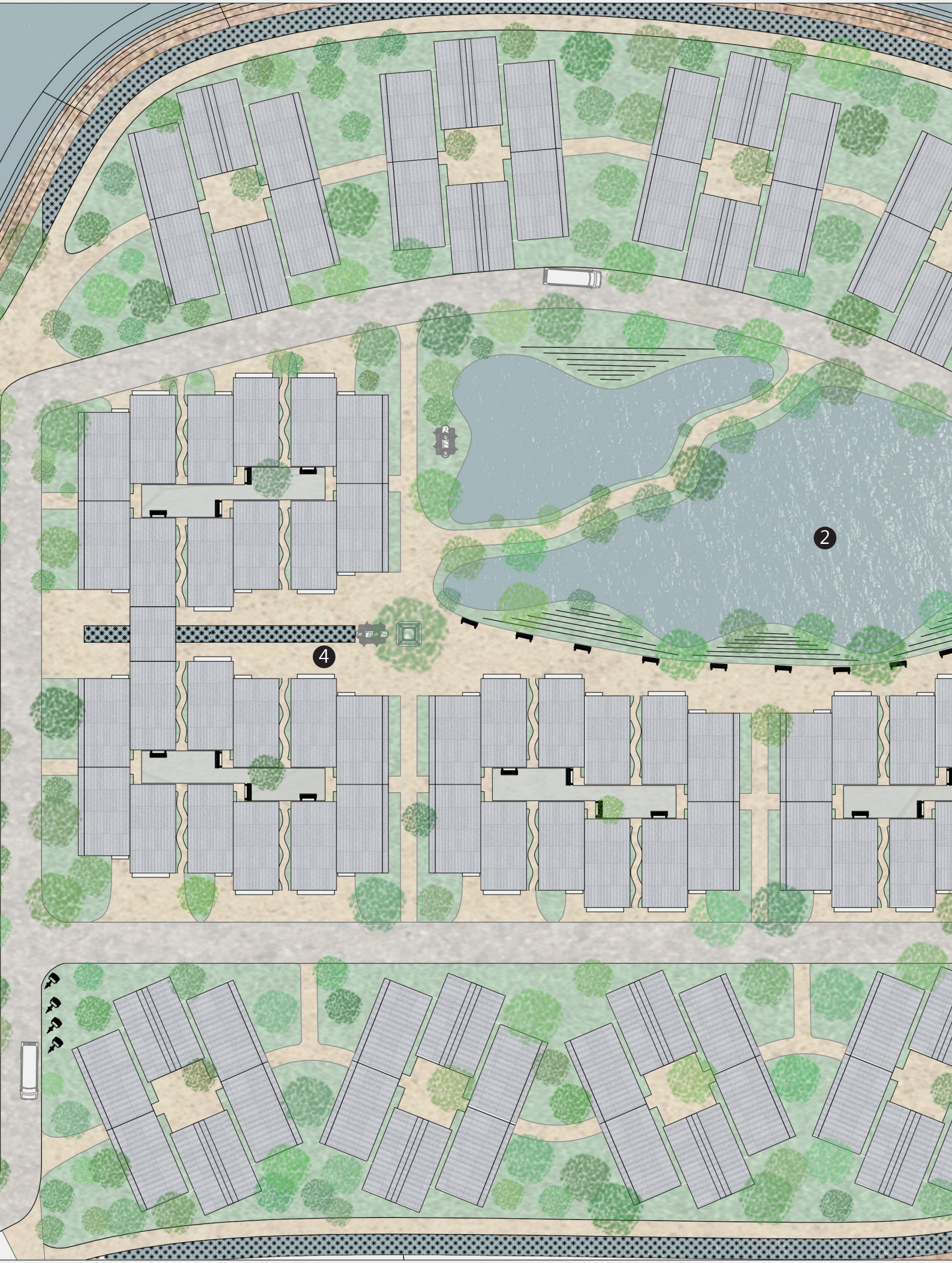


The public sector 7, connects the two differently orientated parts of the settlement. This creates an interesting area compared to the other sectors, as this is the only sector that does not follow perpendicular axis. This opens up this public sector more than the others. This sector really functions as the public centre of the whole settlement system. Here you can find a highschool, healthcare facilities and multiple shops. This space is also adjacent to one of the docks as this will be one of the most visited areas. Which is also apparent because of the many rickshaws.

1. **High school**
2. **Community hub**
3. **Market stalls**
4. **Dock**
5. **Rickshaw stand**

Figure 65: Sector 7

Figure 66: Impression Central Hub Sector 7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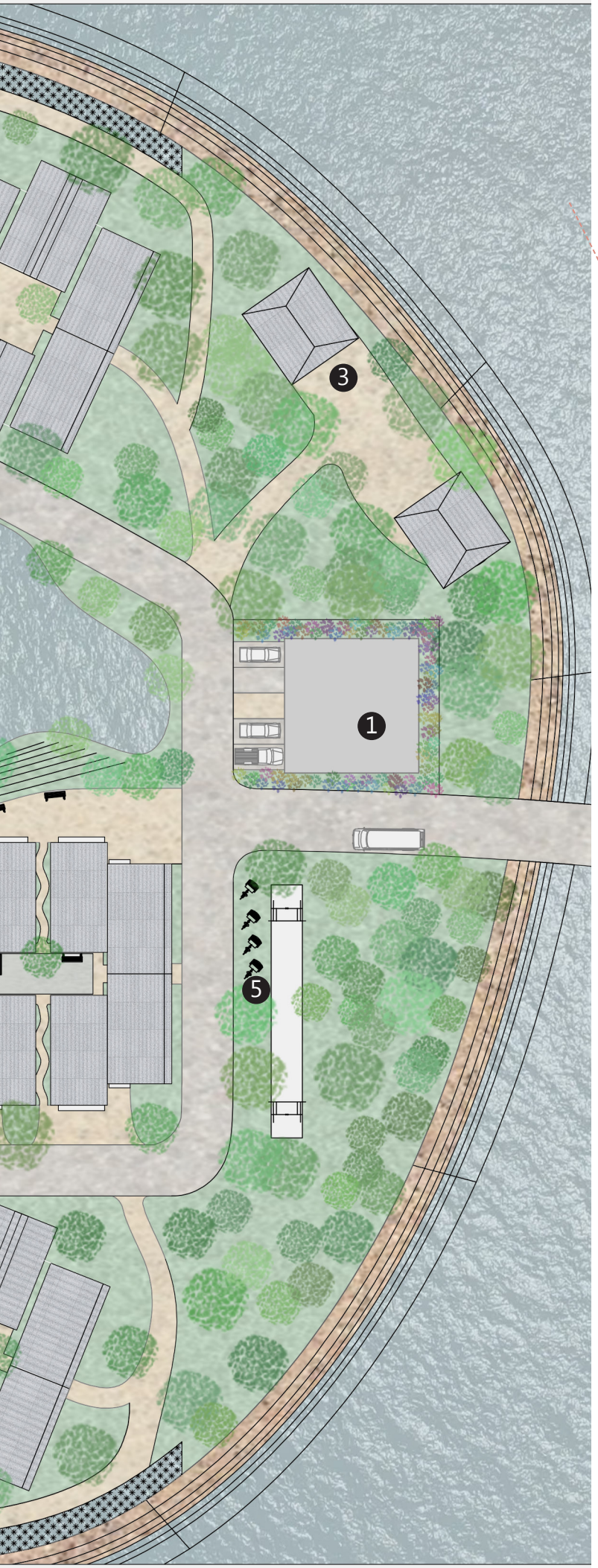
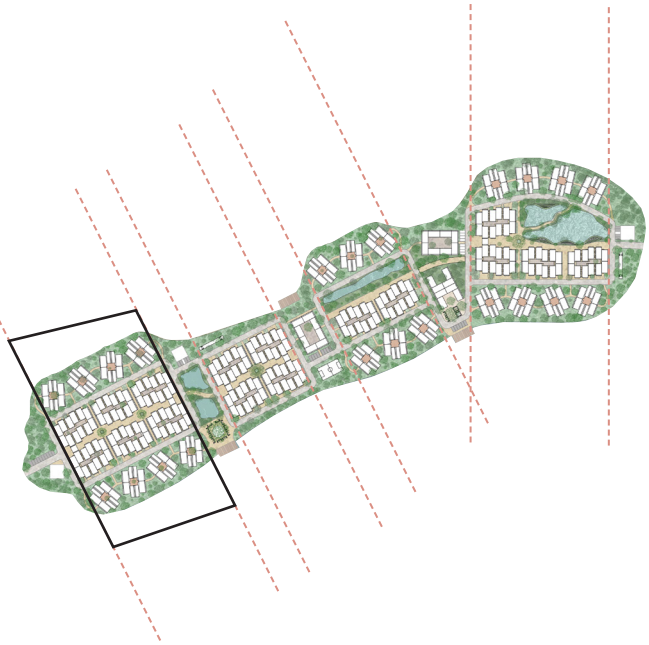




Sector 8, 9

Scale: **1 : 500**

Orientation:

The exit of the island, or the entrance also starts with a mosque before being welcomed by the biggest lake of the settlement. This again welcomes the visitor with qualitative open spaces, that attract live, both for the local community as for tourists.

1. **Mosque**
2. **Big lake**
3. **pavillions**
4. **Community spine**
5. **Rickshaw stand & cricket pitch**

Figure 67: Sector 8 & 9

Figure 68: Impression Entrance Sector 9

CLUSTERS

Global Housing: Architecture of Transition in the Bangladesh Delta

In this section both the cluster types will be discussed along side each other. Examining the different type of units within these clusters.

Figure 69: Impression Embankment Seating

LOW INCOME CLUSTER

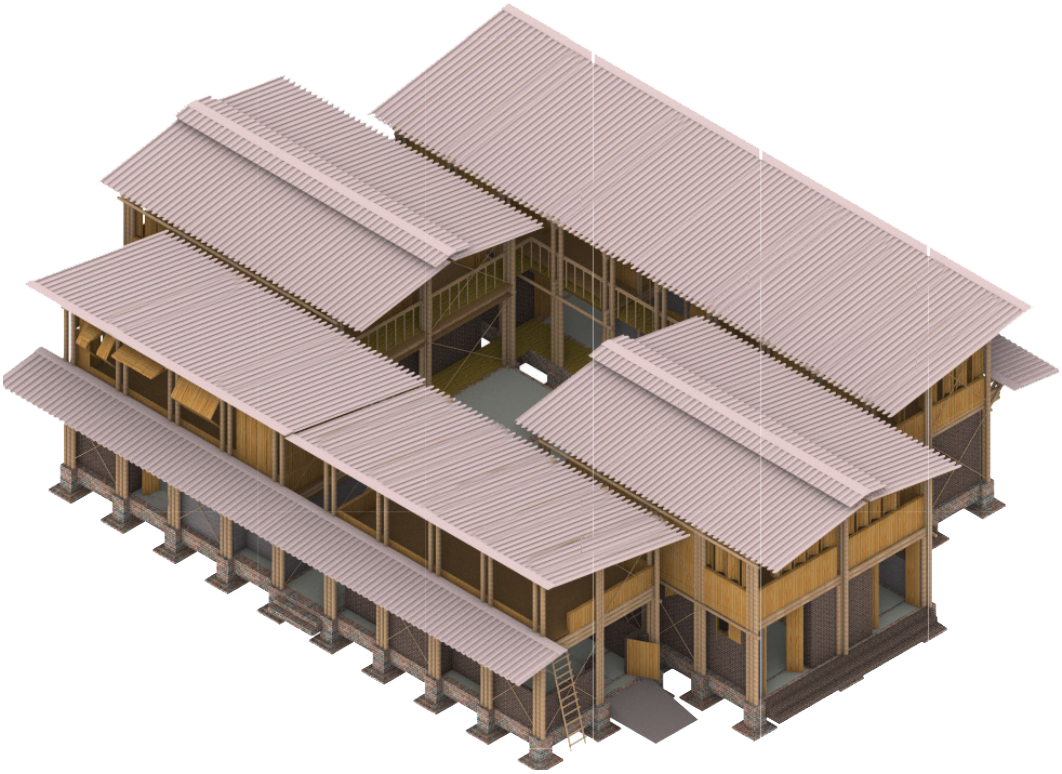


Figure 70: Axo Low Income Cluster

MIDDLE INCOME CLUSTER

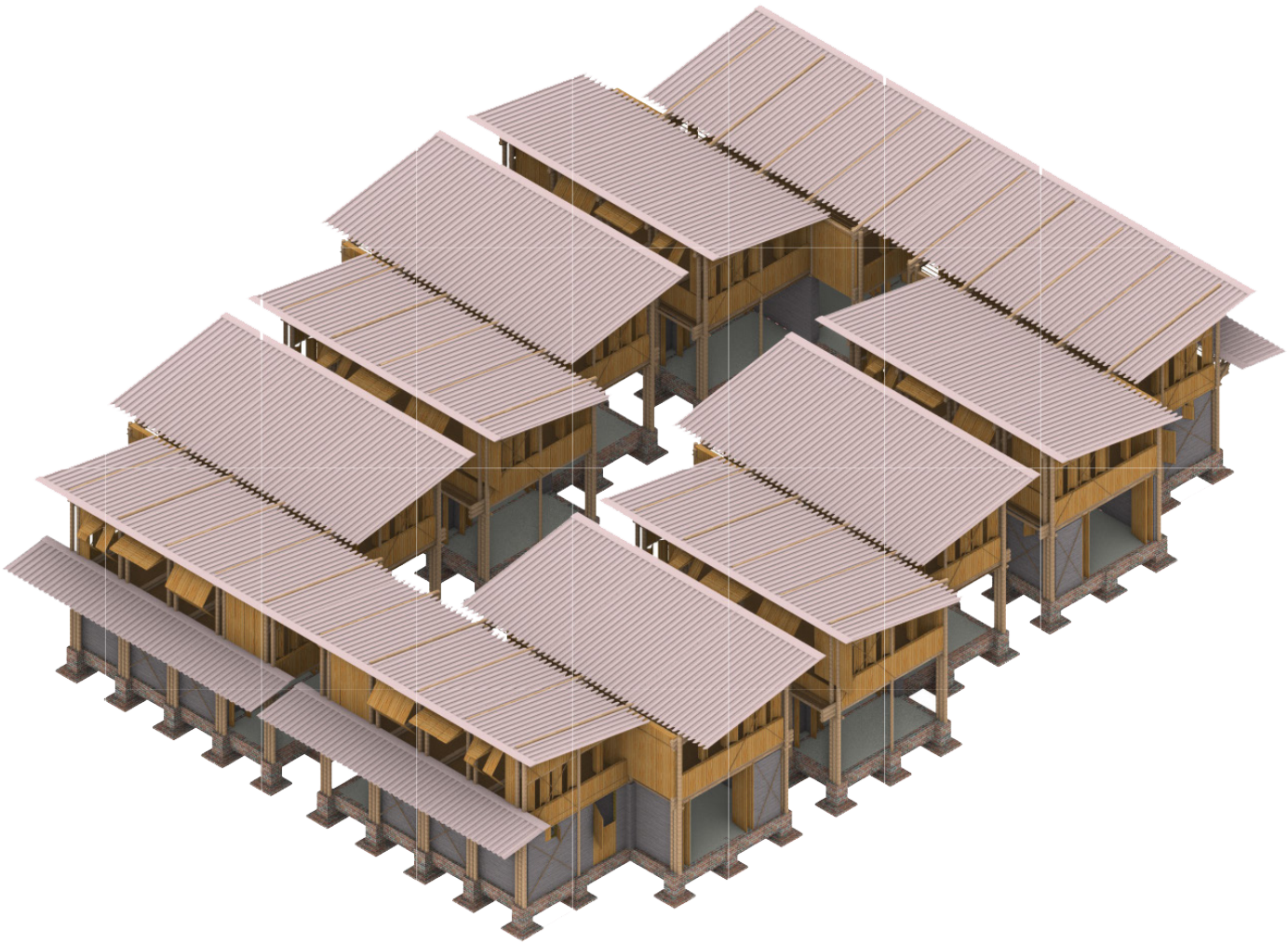
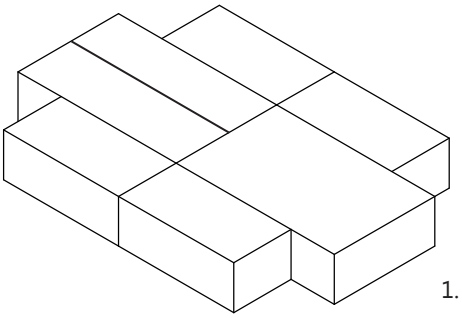
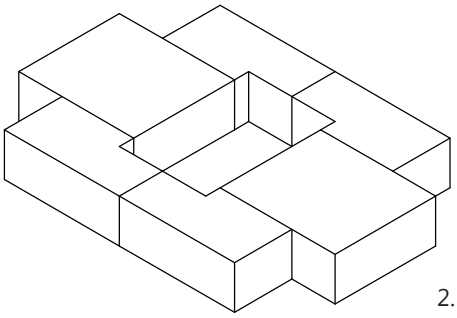


Figure 71: Axo Middle Income Cluster

LOW INCOME CLUSTER


1.

The low income cluster is the smaller of the two clusters, with a groundlfoor area of around 375 m2. The cluster consists of 12 units, varying in size. These units can house up to 40 residents, who share a courtyard of ca. 75 m2.

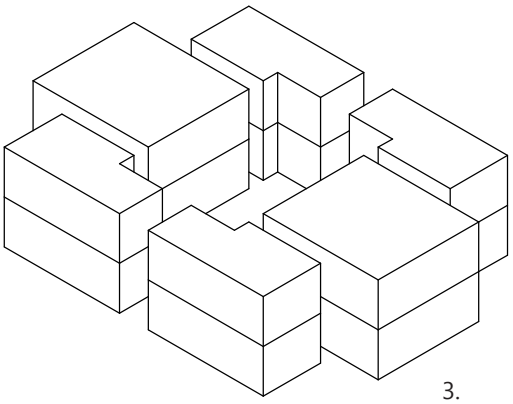

2.

1. The cluster is based around units varying in size, in order to be able to house different household sizes.

2. These units are orientated around a central shared courtyard.

3. In order to house more people while also maintaining enough open space throughout the settlement a first floor is added. In order to accomodate the possibility that in the future, floods could also pose a threat to this community the use of water passages can also be found back in these clusters. Altough being bigger so these can be regulary kept clean.

4. The roofs of the units connect the cluster together as a whole.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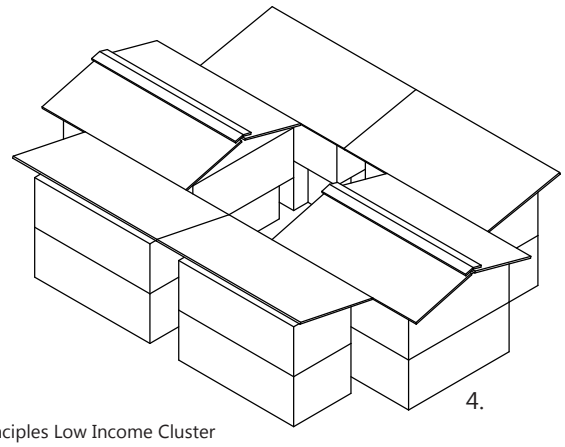
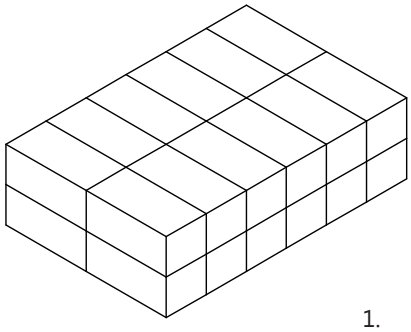

4.

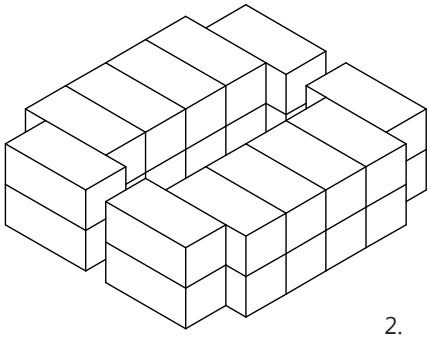
Figure 72: Design Principles Low Income Cluster

MIDDLE INCOME CLUSTER



1.

The middle cluster consists of 11 units, all consisting of 2 floors. With a ground area of around 750 m2 it is around twice as big as the lower income cluster, while housing up to 60 residents.

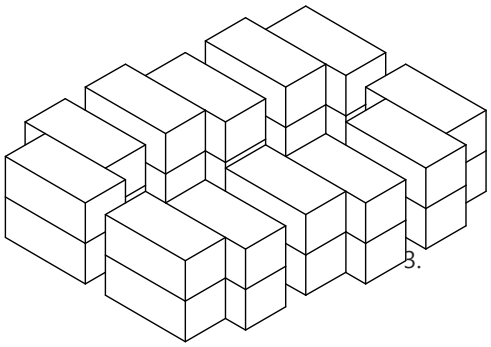


2.

1. The cluster consists of all equally sized units spreading across two floors, with the option to have a double unit.

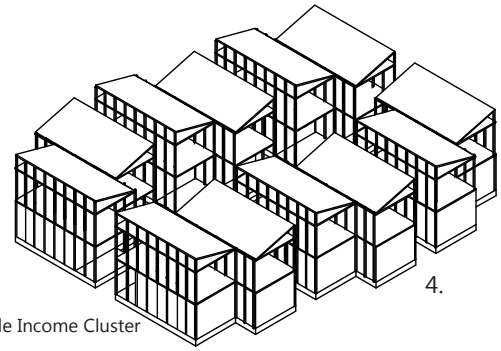
2. These units are orientated around a central shared courtyard.

3. The units are placed in a zigzag pattern, to give a more interesting spatial quality to both the shared courtyard as well the main roads going along it. In this cluster the water passage also plays a big role, stretched out even further these passage even form a qualitative role as entry point to the cluster. Spreading 2 meters wide, and being accompanied by pushed back seating areas in the facade, this opens up extra space where people can sit together after a day of work or read a book.



3.

4. The roofs of the units connect the cluster together as a whole.



4.

Figure 73: Design Principles Middle Income Cluster

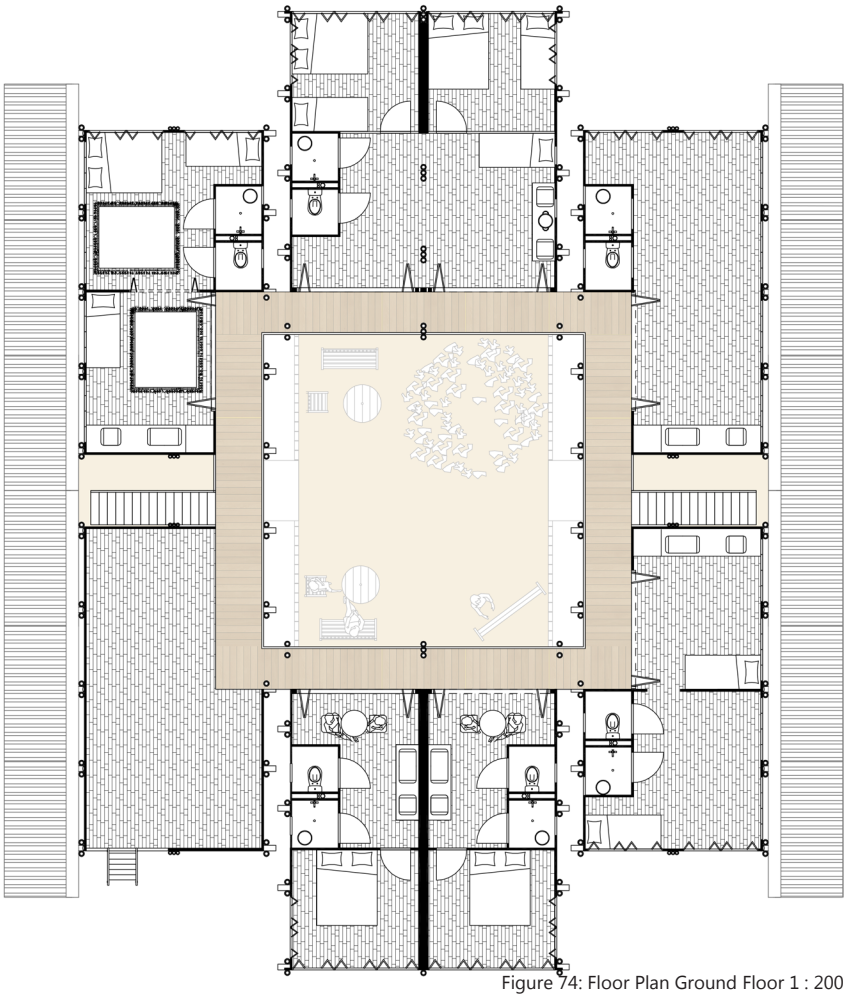


Figure 74: Floor Plan Ground Floor 1 : 200

Low Income cluster

All the units on both the ground floor as the first floor are centered around the shared courtyard from which you enter your home. The units on the ground floor, can also be entered and exited from the back or the side, giving the possiblity to completely open up and ventilate the house. The upper story units can only be entered by the shared first floor walkway which can be entered by the stairs on the side. The upper floor units have the possiblity to open up the horizontal and vertical shutters, giving the possibity to have the whole facade opened up as well. One of the ground floor units can be used as a shared stable with the unit above it as a shared storage. In cases of emergencies or rising floods this open unit space can also be used as room for education or healthcare per cluster if needed. The units consist of small, medium and big size and are shown in the appendix on units.

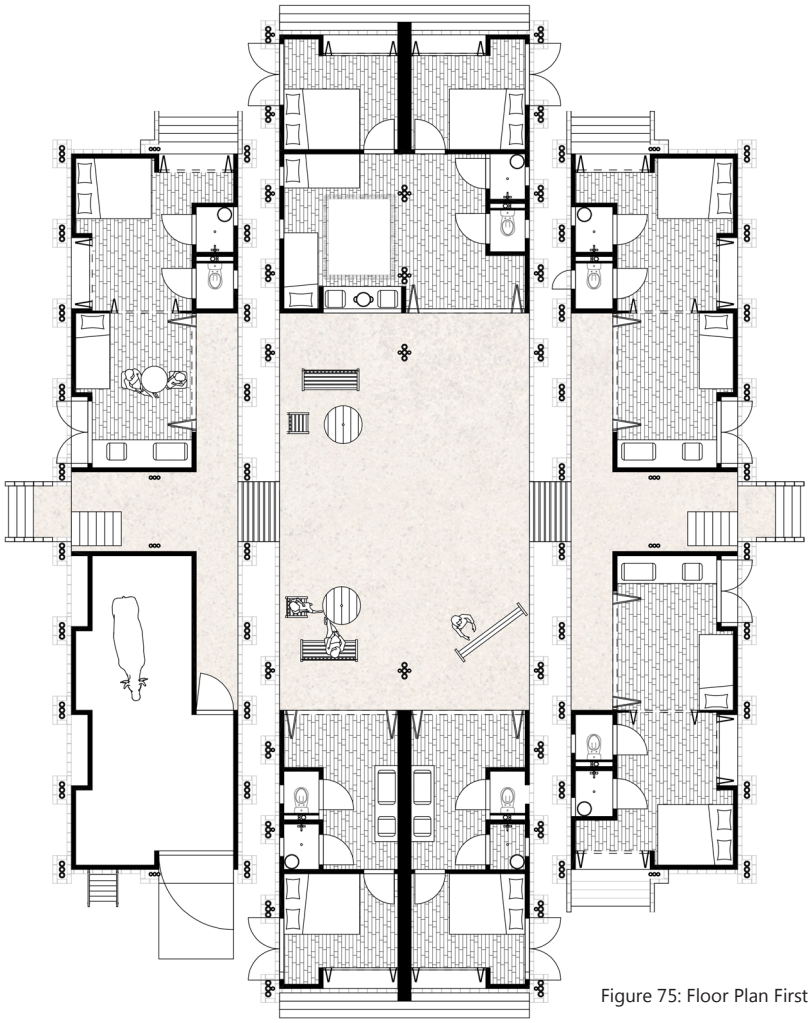


Figure 75: Floor Plan First Floor 1 : 200

Middle income cluster

The middle income cluster also has two enterable sides to the units. One towards the central courtyard and one towards the road it is connected too. Shops or restaurants in the mixed use units are positioned towards the road site in order to attract tension with bypassers. The top floor uses the same shutters as the low income clusters making it also possible to open up whole facades in order to ventilate. There are regular dwelling units, mixed units for example for shops and dwelling and double units, these are highlighted in the unit appendix.

Figure 76: Floor Plan Ground Floor 1 : 200

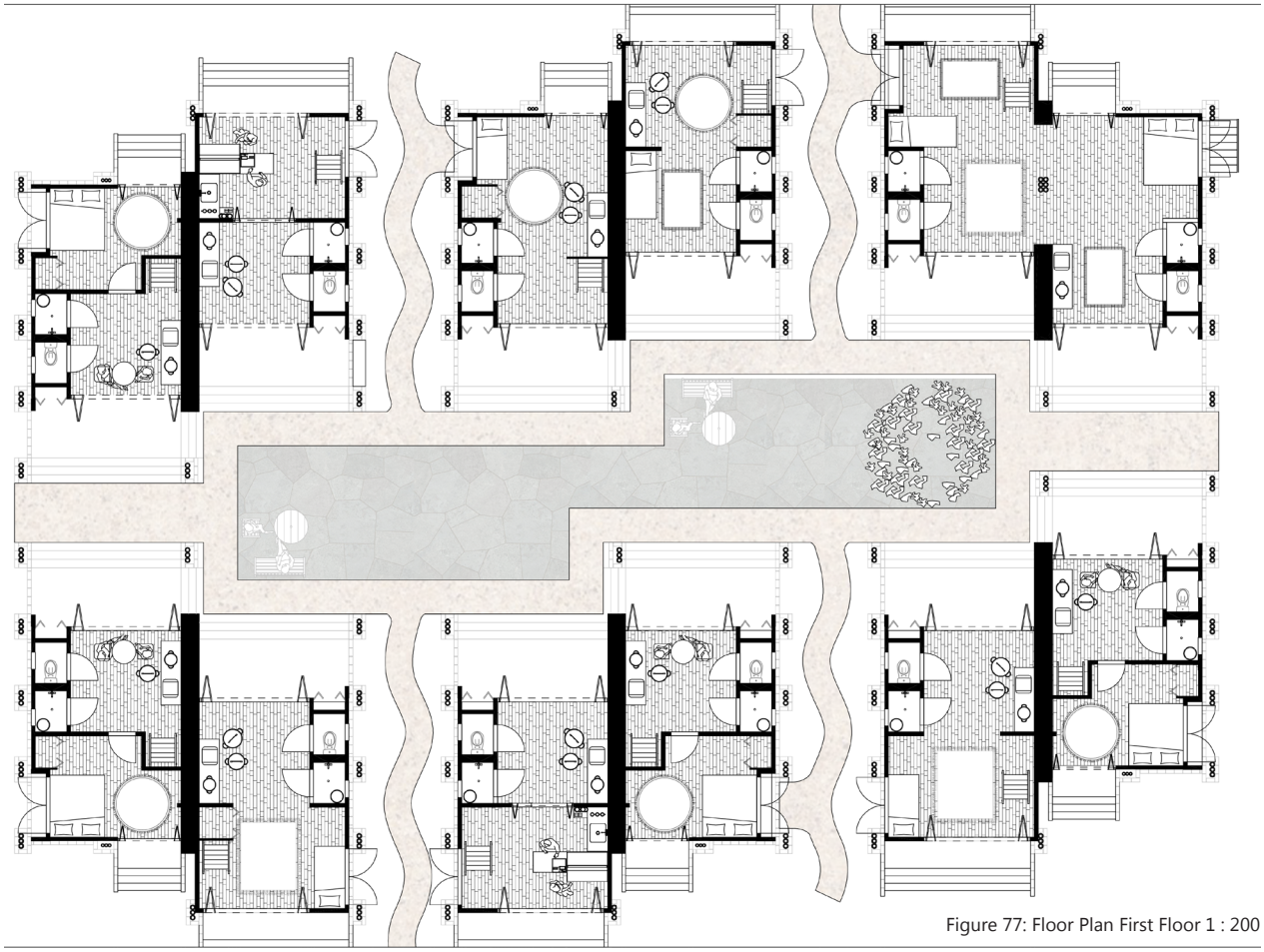


Figure 77: Floor Plan First Floor 1 : 200

Figure 78: Entrance Low Income Cluster

From the main vehicular road, you take a secondary path that runs through the zone where the low income clusters are located. These secondary roads run through the central courtyards of the clusters and thus form a semi-private route. From this entrance, you can also take the stairs to the first floor. The ground floor units are more opened up to the inside of the cluster, to have more connection with the courtyard while being more shut out from the outside world. These clusters do however have some, pushed back features in the facade where people can sit and relax, fostering the possibility to have meaningfull conections with people entering the cluster or with the people from the cluster opposite to you. The first floor units open up more towards the outside, giving a nice architectural and spatial quality facing outwards, towards bypassers and the rest of the settlement.

Figure 79: Entrance Middle Income Cluster

The middle income units can be entered from both the roads, as well from the shared courtyard. The shared courtyard can be entered from every side. The initial water passages are so wide that these form entrances to the clusters, big enough for people to walk past eachother and interact, even offering seating spaces.

Figure 80: Shared Courtyard Low Income Cluster

The central courtyard is the vocal point of the low income cluster. All units are orientated around it, fostering a strong sense of community along the shared owners. The residents form a cooperative organization for the costs and maintenance of the clusters. Also sharing the potentially generated income by housing tourists. The hosted tourists can really experience the strong sense of community in these courtyards, the children of different households can interact with eachother on a daily basis fostering strong friendships. The courtyard also gives the women of the community a semi-private space to come together.

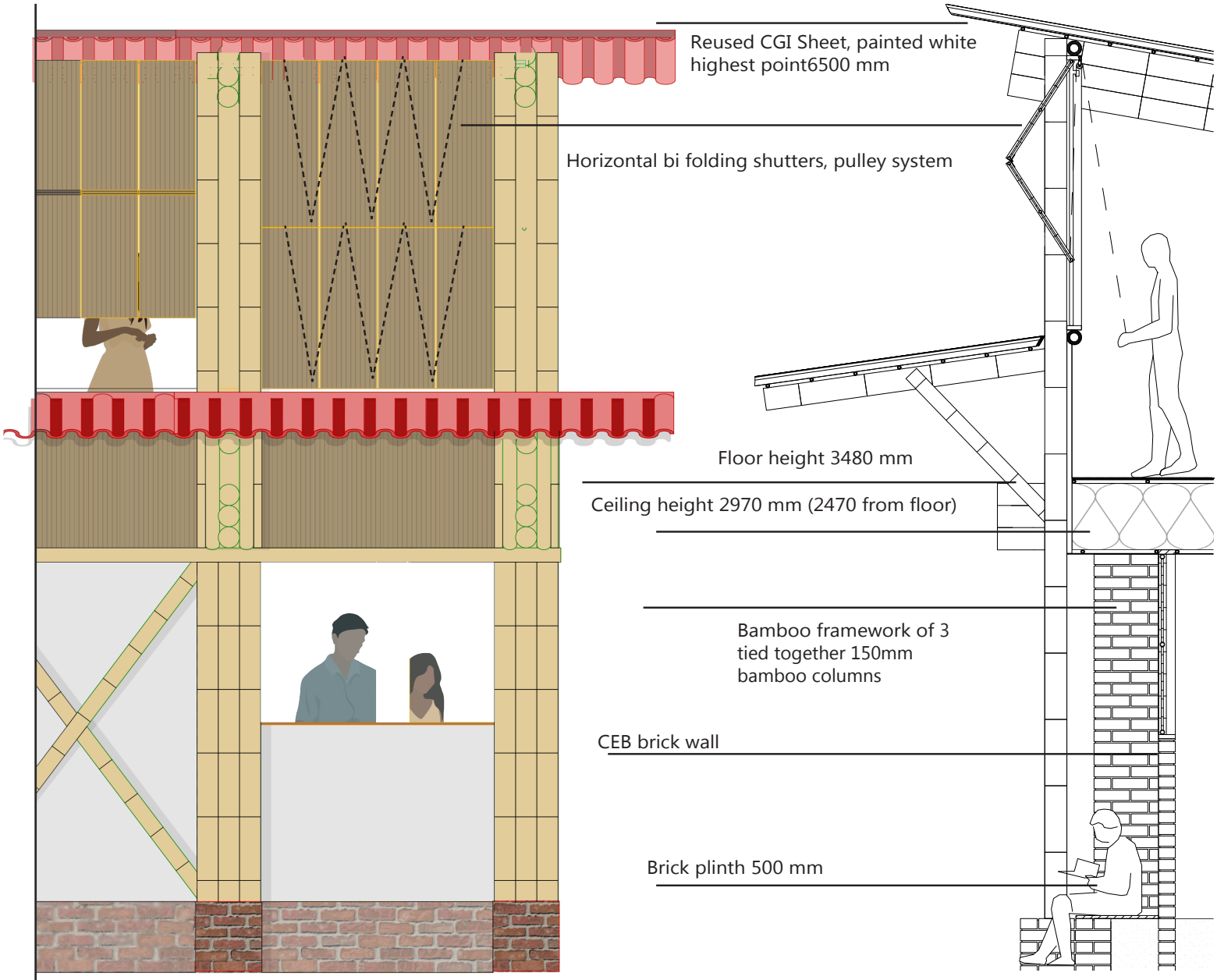
Figure 81: Shared Courtyard Middle Income Cluster

The units of the middle income clusters are a little less orientated towards eachother than the low income clusters, giving a little more of an individual quality to the seperate units. Each unit nevertheless is connected to the central courtyard and has an adjacent outdoor space, in this courtyard the same principles follow, hoping to build strong communities because of these semi- private shared spaces.

BUILDING TECHNOLOGY

Global Housing: Architecture of Transition in the Bangladesh Delta

The building technology section delves into the used construction methods and materials. It provides a detailed look at how these building technologies contribute to the overall resilience of the settlement while promoting economic and social well-being.



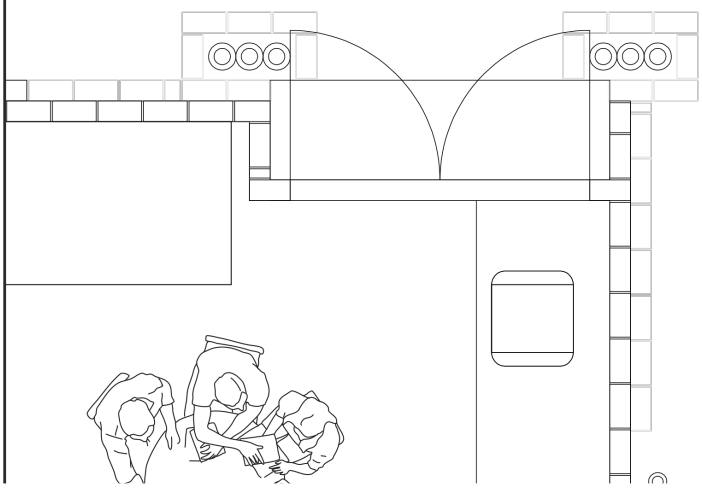


Figure 82: Facade Fragment 1 : 20

MATERIALS

USE

The use of materials is based on being able to work with local materials that can be assembled on site as much as possible.

CGI Sheet

Cgi sheet is a common found roof material in this area. The cgi sheets are locally sourced and upscaled by painting them white. Enlonging the lifespan while also reflecting more sunlight.

Bamboo

Bamboo is grown on the reclaimed land in the regional plan. Renewing the main constructural material of the plans.

CEB

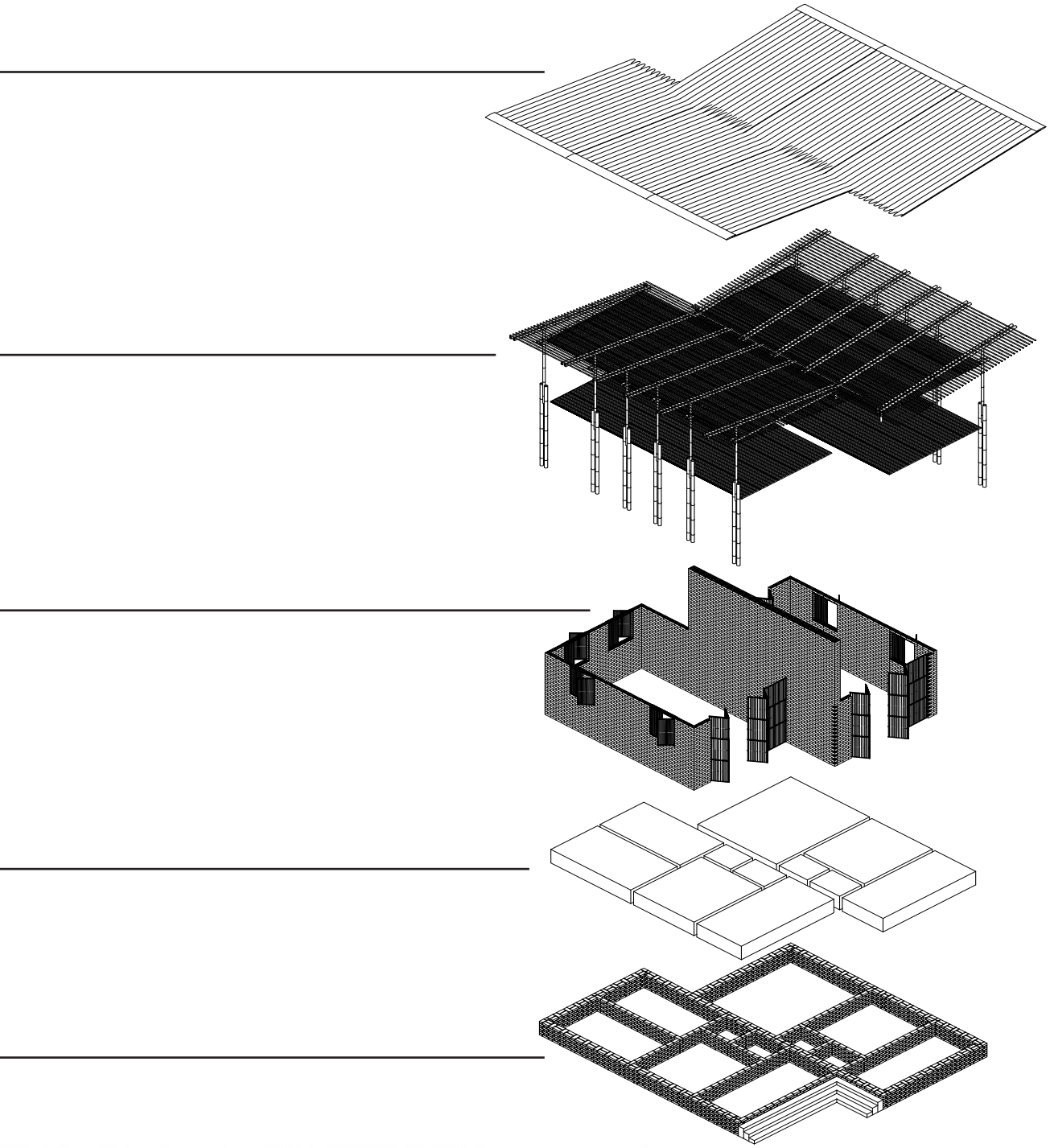
Just above ground on top of the building plinth, the houses use CEB bricks instead of normal bricks as they can be made on site from locally sourced soil, being more sustainable and cost effective.

Sand cement mix

The ground floor is made up of a sand cement mix hold together by a brick perimter wall. upscaling the traditional method of building plinths.

Brick

On the ground floor normal brick is used as this is more water resistant in case of



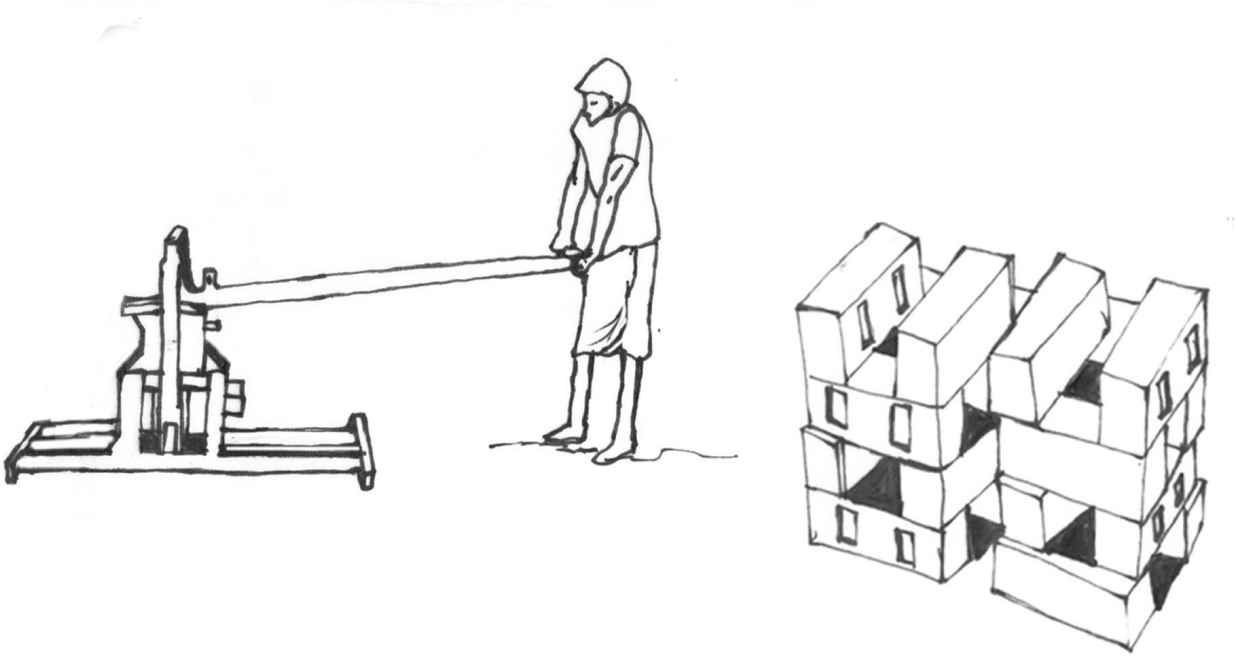
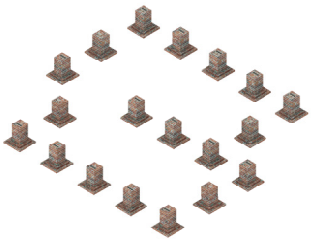
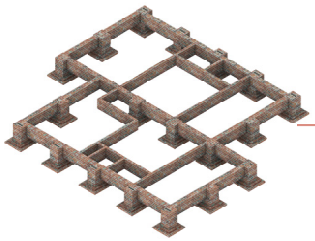


Figure 83: building Materials

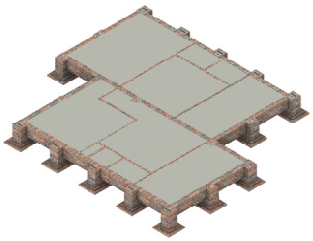
CONSTRUCTION ORDER



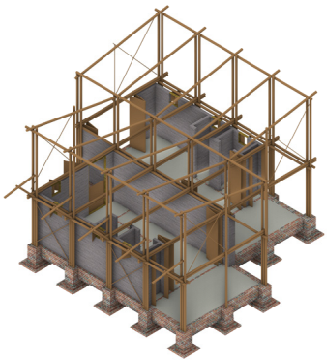
Brick step foundation



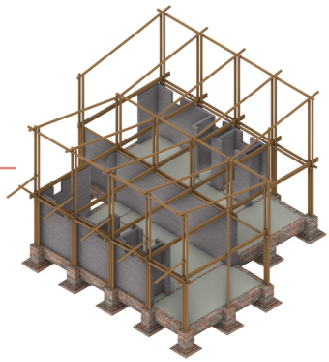
Brick perimeter wall



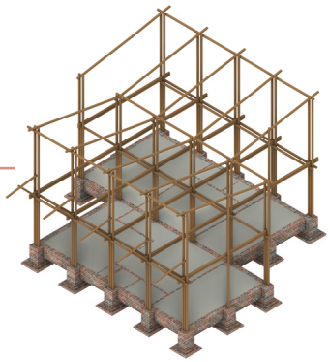
Sand cement filling



Bamboo doors and windows

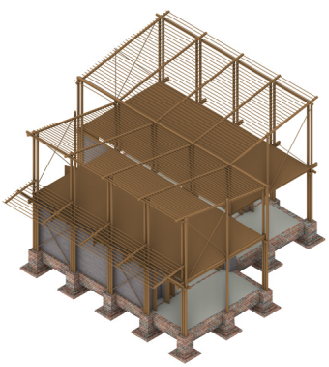


CEB walls ground floor

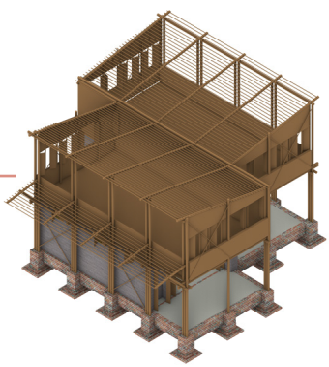


Bamboo construction frame

Bamboo joists and floors



Bamboo walls first floor



Cgi sheets painted white

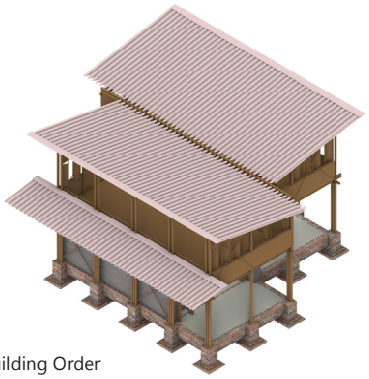


Figure 84: Building Order

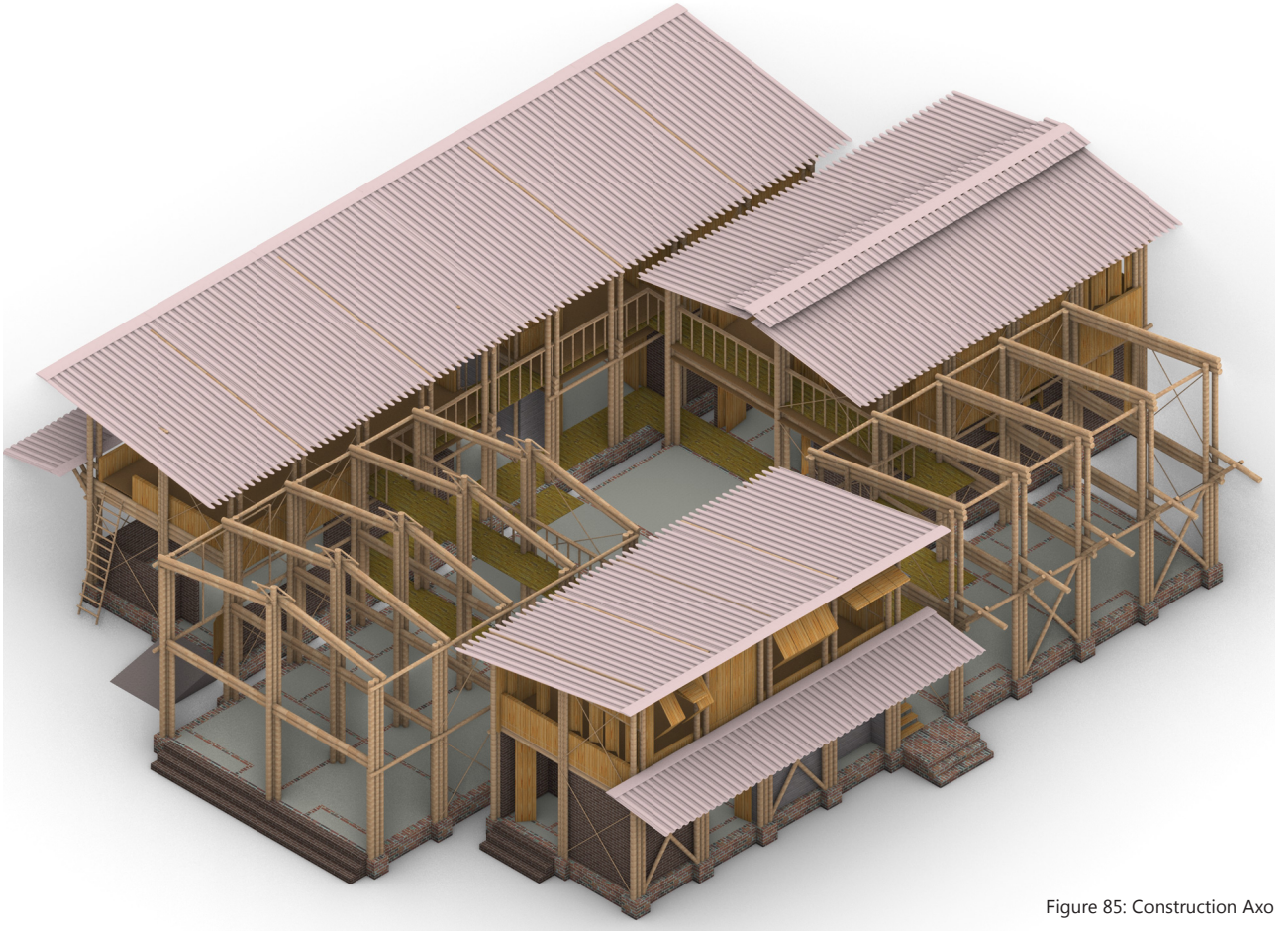
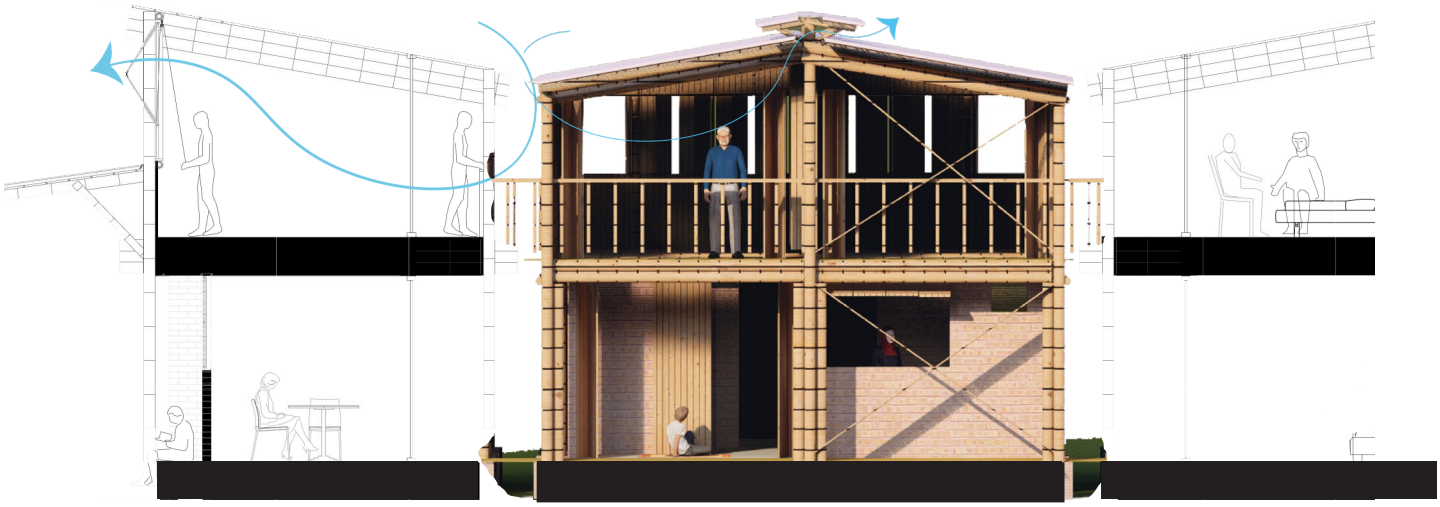


Figure 85: Construction Axo

The construction of both clusters are very similar, so that the same building principles can be repeated. In order to make the building process easier and so that multiple parts can be prefabricated on site. It starts with a brick step foundation on the points where the bamboo columns are in the plan. Three bamboo columns with a diameter each of 150 mm are tied together and anchored in the foundation by filling it with sand cement mix. The details can be found in the detail appendix. The ground floor consists of sand cement mix, kept in place and protected from water by a brick perimter wall. This filling and perimter wall form the building plinth. The ground floor is more rigid and heavy because of the CEB bricks, that are kept safe from water because of the plinth and overhang of the roofs. The CEB walls keep themselves up. The exterior bamboo framework bears the load of the bamboo floor, the cgi sheet roofs and the bamboo walls on the first floor.

All building is done by the hand off easy to follow guidelines, with most importantly all bamboo connections.

Figure 86: Bamboo Connections



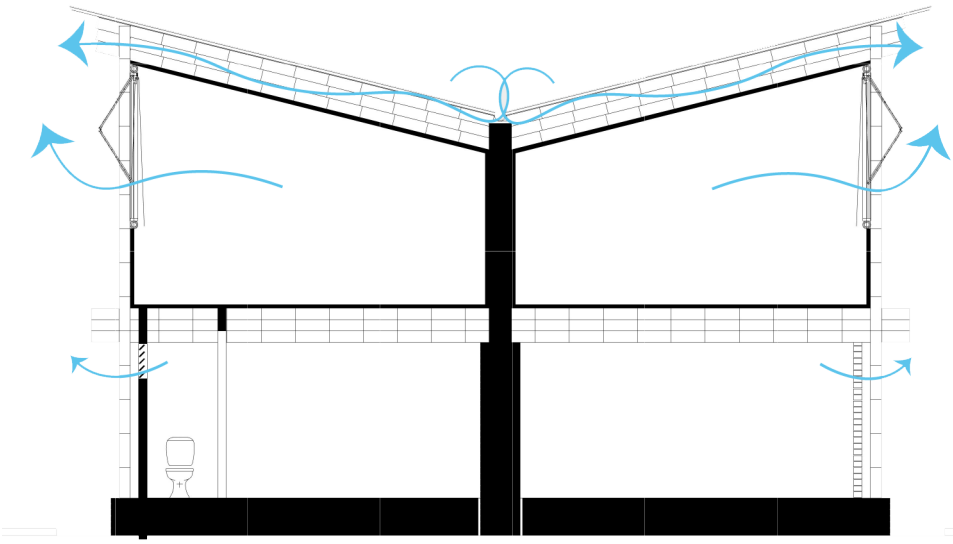


Figure 87: Ventilation

Ventilation of Cluster Types

Low-Income Clusters

Low-income clusters are designed with an emphasis on natural ventilation to ensure a comfortable living environment. The houses are constructed to be open on multiple sides, allowing for cross-ventilation that promotes airflow throughout the units. This design helps to maintain a cool indoor temperature.

Middle-Income Clusters

Similar to the low-income clusters, the middle-income clusters are also designed to maximize natural ventilation. The units in these clusters can be opened on multiple sides, enabling cross-ventilation and maintaining a pleasant indoor climate. Roof openings are also incorporated into these houses to facilitate the escape of hot air and improve overall air circulation. Detailed illustrations of these roof ventilation systems are provided in the appendix.

REFLECTION

Global Housing: Architecture of Transition in the Bangladesh Delta

1. Introduction

Why did I chose the graduation topic of global housing: people in transition?
During my studies in the field of Architecture, Urbanism and Building Sciences my interest has always gone to designing for people in special circumstances. This could be due to the special conditions of the site, such as a remote small island (Saba) that is often targeted by extreme weather conditions, as was the context of a prior assignment I finished during the Masters AUBS. Or this could mean designing with special conditions in mind for dwelling with regards to health and care, as would've been the case for my second choice of graduation topic. For my first choice, I kept within the field of dwelling with the Graduation topic of global housing. The site's context was one I wasn't familiar with, which intrigued me to learn more about it. Situated in the Sylhet division of Bangladesh, this site's region concerns many relevant issues of broader global context.

In this reflection I will briefly describe the graduation topic and its relations to my master track A: Architecture and my master Program MSc AUBS (Architecture, Urbanism and Building Sciences). Furthermore, I Will discuss the relation between research and design and how these have influenced each other throughout the project. Additionally, I will look back at how my way of working has influenced the project and it's trajectory. Finally, I will evaluate the academic and societal implications of my graduation project and the transferability of its results.

2. Graduation Topic

The graduation topic's main theme and focus are people in transition, with in this case in the context of Sylhet a region in Bangladesh. The biggest city of this region, also called Sylhet, is subject to rapid urbanization. This is happening due to an array of factors such as the expectance of migrants to find better economic opportunities within the city, as well as people being forced to move due to events happening by climate change. This vast stream of migration towards urban areas, sees a societal shift from by origin mainly rural settlements to an increasingly more urban concentrated population. These shifts bring with them unique problems in the different contexts from rural to urban locations, from which you were free to choose between an urban site, peri-urban site as well as a site in the rural area. The main interest I started out with was the mental well-being of the migrants and then in particular the implications of the migration itself and the newly found living conditions in the city had on these people. Thus, I initially wanted to design within the urban context, mitigating the negative effects migration has had on the migrants through design of a settlement for these people in transition. After having had the chance to visit these several areas in Bangladesh, I changed my approach. The haor region in Bangladesh is home to many smaller and bigger rural settlements in a very unique situation. It is situated in a wetland ecosystem, with many parts of the land flooded for larger periods of the year. This unique environment inspired me to focus on designing a resilient settlement system in the haor region of Bangladesh, instead of trying to solve the problem of the rapid urbanization in the urban areas of Sylhet. This way people are not as compelled to migrate to the cities.
How does this relate to the master track Architecture? As is stated in the description of the master track architecture: "Teaching encourages students to develop creative and innovative building projects that use design as a means to deal with the technical, social and spatial challenges encountered in the built environment." In this specific case the project aims to tackle the problems migration brings, on the one hand mitigating the cities from this stream of newcomers, while on the other hand creating a place in rural areas where families can stay together without having to sacrifice economic opportunities. By designing a settlement system in the rural haor area in Bangladesh, this social approach is taken carefully into account. Simultaneously taking spatial challenges in regard, creating meaningful spaces that foster a sense of community, while at the same time increasing the density to ensure a realistic result. Besides, a low-tech approach is kept in mind to tackle the availability to construct the new dwellings on site and in a manner that is appropriate to its context.

3. Approach

How does this relate to the master programme MSc AUBS?

The research and design focusses not only on the architectural scale but incorporates much of the urban planning and landscape scale as well. The aim of my project was to design a feasible and sustainable settlement system for in the rural area. This has been done through various scales ranging from regional, to settlement, to sectors, to clusters and finally to unit scale. This assures a multi-disciplinary approach that incorporates all tracks in the master program. From building technology in the creating of low tech comfortable and sustainable housing. To urban planning in the creating of systematic masterplans on settlement scale to ensure a sustainable live in these areas. As well as landscape architecture in creating new islands for the settlements in this unique wetland ecosystem. While making sure the project is feasible through thinking of a managerial strategy. And of course through architecture, designing dwellings in clusters that provide a comforting livelihood for its residents. This integrative design approach through multiple scales and disciplinaries provides a solid foundation to develop a cohesive and sustainable design.

Moreover, the multi-disciplinary approach, was also apparent in the forms of research: here a combination of quantitative and qualitative research ensured an adaptive approach to the project. As stated before, the initial incentive was to tackle the mental health problem of rural to urban migrants, based on quantitative data gathered through literature. After having had the opportunity to go on a fieldwork trip, to conduct qualitative research on site through the form of observation and interviews, I gained a better understanding of the context of the project and shifted from the urban to rural site through newfound potentials.

4. Value

Academic and societal value

By having such a multidisciplinary approach, the project contributes to this work of field by proposing a rural settlement system, that not only mitigates cities from the problems posed by urbanization, but also ensures a better livelihood for people in transition. Not only do some people in this case not need to migrate away, this could also be an option for rural to rural migrants who seem to be in a lot better mental and general health than the rural to urban migrants. These settlements recommend a system of cooperating settlements each with their own characteristics. Incorporating meaningful public (green) spaces and buildings while increasing the density to attract more live and business opportunities to these areas. All the while creating dwelling in which the residents can comfortably live and be part of a community.

Ethical aspects

The topic of this project is sensitive because it covers real problems of real people. One of the ethical aspects I faced within the project was this involvement of real people for a project that is not going to be realized. During the fieldwork trip we got the chance to speak with several of these people, both in rural and urban areas. Which on the one hand was really valuable for the project, but on the other hand I couldn't help but feel as if I was making false promises. In no way did we let it seem that these projects were going to be executed for real. But it did showcase some form of privilege, being able to use other people their problems as a "fictional" project. Now of course it can be argued you need to learn about these kinds of projects in some way to be able to really help in the future, and by taking this course people will be motivated to take on these kind of projects in the future. So, while I wish we could have done more for the people we visited, the fieldwork trip was really valuable for truly understanding the situation and wanting to make a difference through the project now and in the future.

5. Methodology

Although the specific design is mainly site specific, the methodologies used to create this settlement system are not bound to this specific site and can be transferred to other rural settlements around the world facing similar problems. Methodologies, like a system of settlements that strengthen each other with their own characteristics, such as settlements mainly dedicated to dwelling (while ensuring every settlement has some form of amenities), having a main island, that houses the most diverse form of amenities as a sort of center of the system. And having settlements with more specific focusses such as bazaar or tourism orientated, ensuring more economic opportunities through the system. Or on more urban planning scale, the division of roads and the division of public to private areas, and lastly the forming of the cluster to foster communities inside these settlements. Therefore, the methodologies proposed in this project can be transferred to other context which makes it very valuable.

6. Personal workflow and Process improvement

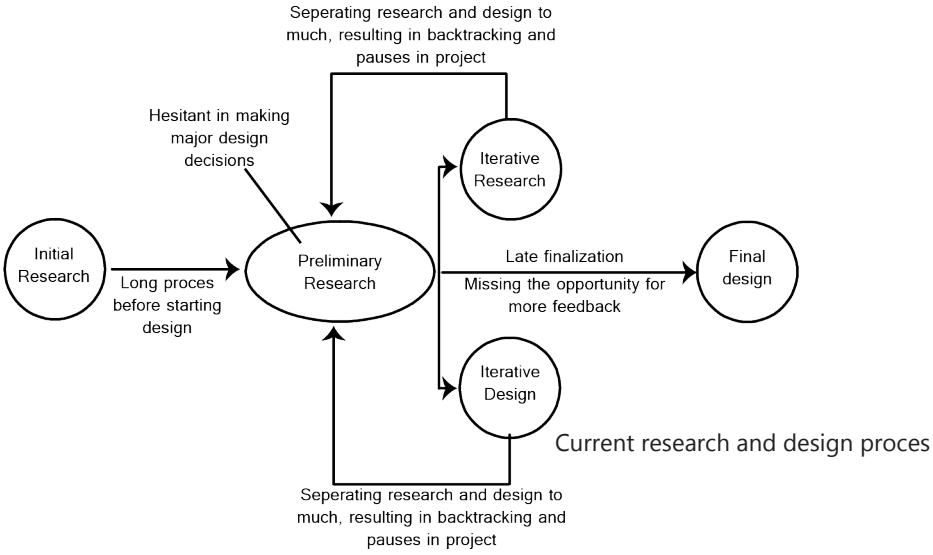
In which aspects can I still improve, based on the process of the project?

At the beginning of the project, you start with doing research to gain an understanding of the site. You need to understand its special and social context before you know what to design. But eventually you also need to start designing to know what to research. I think that is a part where I can still learn, the designing and researching is an interwoven process. The two are interconnected and are supposed to influence each other. I believe I can improve on this within my progress. Sometimes I separate the two too much, causing my progression to slow down as is shown in figure x. In the beginning I'm too afraid to start designing without having done enough research, which slows down the designing process. Then when the designing eventually starts, you are going to find new directions to research nevertheless. Through designing you're going to find new problems you have to solve. So, by doing the two more simultaneously, I believe I could have had a more continuous process, instead of sometimes needing to take a step back before going forward again. Although I do think it is not completely inevitable to sometimes have to take a step back when designing, I still think this is an important aspect to take with me during the rest of the duration of this project as well as future projects. So that I can improve my designs. The proces would than look a little more circular and continious as is shown in figure x.

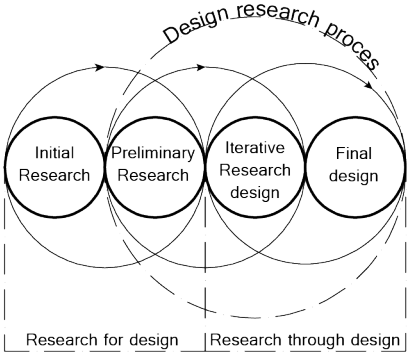
Through research you do not only find solutions but also the incentives for the problems you want to solve. In that sense the research first leads to the problem statement(s) and with it forms the design principles you want to take into account during your project. Through further research you try to find solutions to the envisioned problems as well as newly encountered problems during designing. The final design is backed by the outcomes of the research that has accompanied the design throughout the whole trajectory of the project. The project would develop better by, from now on, making sure the research and design flow over in to each other more.

I think the approach of my project, on the one hand created an interesting design direction of creating a new island settlement system for in the haor region of Bangladesh. I think there was a clear problem statement and clear vision of what needed to be tackled. On the other hand however, I feel like my methodology and methods could have been more elaborated, creating a smoother start. Which I was confronted with during the p2, where I had to retake the presentations. This can also be explained by another problem I have run into more often. Sometimes I get too scared to decide on design choices or showcase my work during regular feedback sessions. While I did spend a lot of time thinking and working on the project, I then sometimes have little to show for it. Which can result in getting less feedback. During the presentation I have got no choice to showcase everything I got and this is usually where most of the discussion about the project takes place for me. Optimally you would want this discussion to happen during the regular feedback sessions so you can be well prepared for the Formal presentations. This is also what happened in the P2, the discussion happened, and there was a big leap from the P2 to the retake of the P2. I run into yet the same problem during the P3. When I get the feedback, I take this in consideration and translate this into the design, by altering the design so it complies with the expectations. I believe I sufficiently use the feedback I get in order to improve my design, but I do sometimes place myself in a position where the teachers can't give me enough feedback, so that some flaws in the project are not timely noted.

What I've learned from this as well as my own work is that I need to be less afraid to design, I can be hesitant with making design choices. While in the end, the designing itself can lead the way. Additionally, the discussion formed by new design choices (even when poorly designed) can further develop the project. Moving forward I should be less afraid to make decisions and showcasing my work throughout the project, starting the discussion instead of passively waiting. I'm refining the project so that it incorporates more of my design without shunning to much away from my own vision. Looking back at this project I have faced some difficulties but mostly, I learned to make faster decisions and use that to further develop the design. In the future I hope to incorporate what I have learned by taking the following points into account: Be less afraid to design and discuss the design and have a smoother flow between research and design.



Current research and design proces



Prefered research and design proces

Figure 88: design process

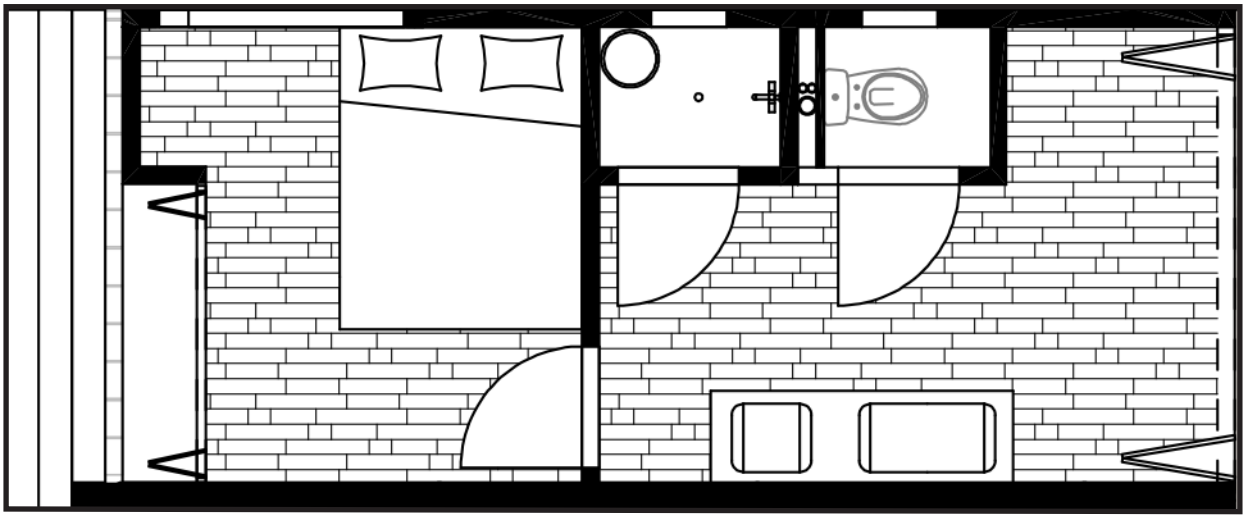
7. Own questions

Finally for my two formulated reflection questions which relate to the content of my work I ask myself:
"Which setbacks during the project, helped make the (end) result better?"
Throughout the feedback sessions, I often noticed that sometimes a design choice felt clear for me without showcasing directly why this choice was made. By repeatedly running into this problem, I will be sure to showcase the motivation behind certain choices. This will enable me to better defend the project as well as improve the presentations.

"What successful aspects of the project will I take with me?"
One of the things I really learned during this project is, to analyze and compare the new proposed design with the existing context. So, rather than just analyze the existing context on the good and bad things that are used as basis to form a new design, keep comparing it throughout the way in order to evaluate the project, and if its keeping to defined design principles.

APPENDIX A:
UNITS

In this section a short overview is given of all the individual units. Starting with the low income clusters, followed up by the middle income clusters.



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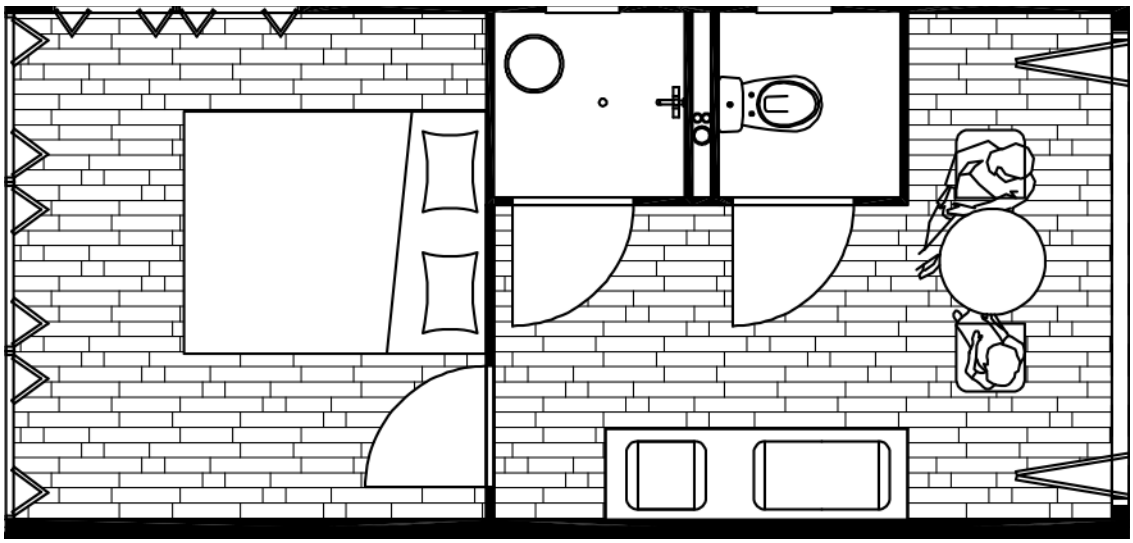
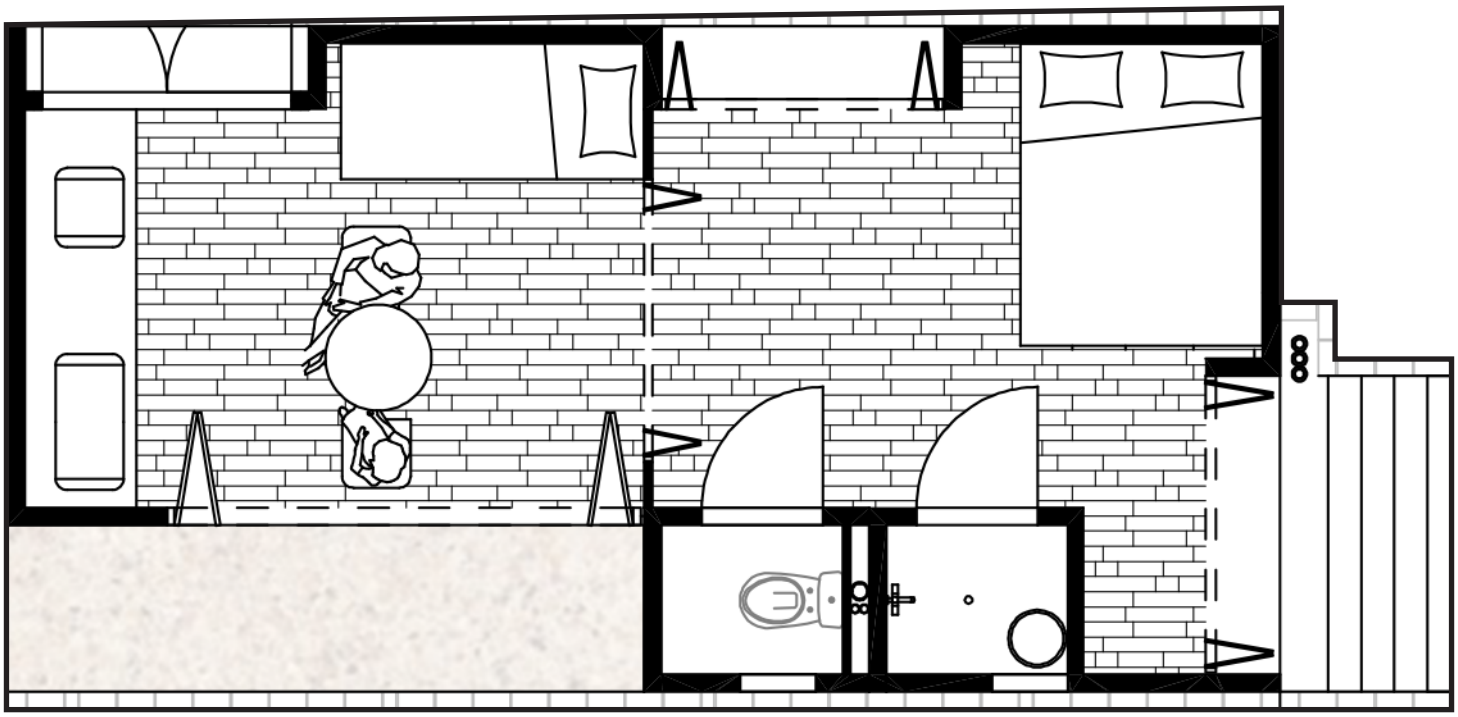


1F

Small unit

Area (m2):	**23**
Household size:	**1 - 2**



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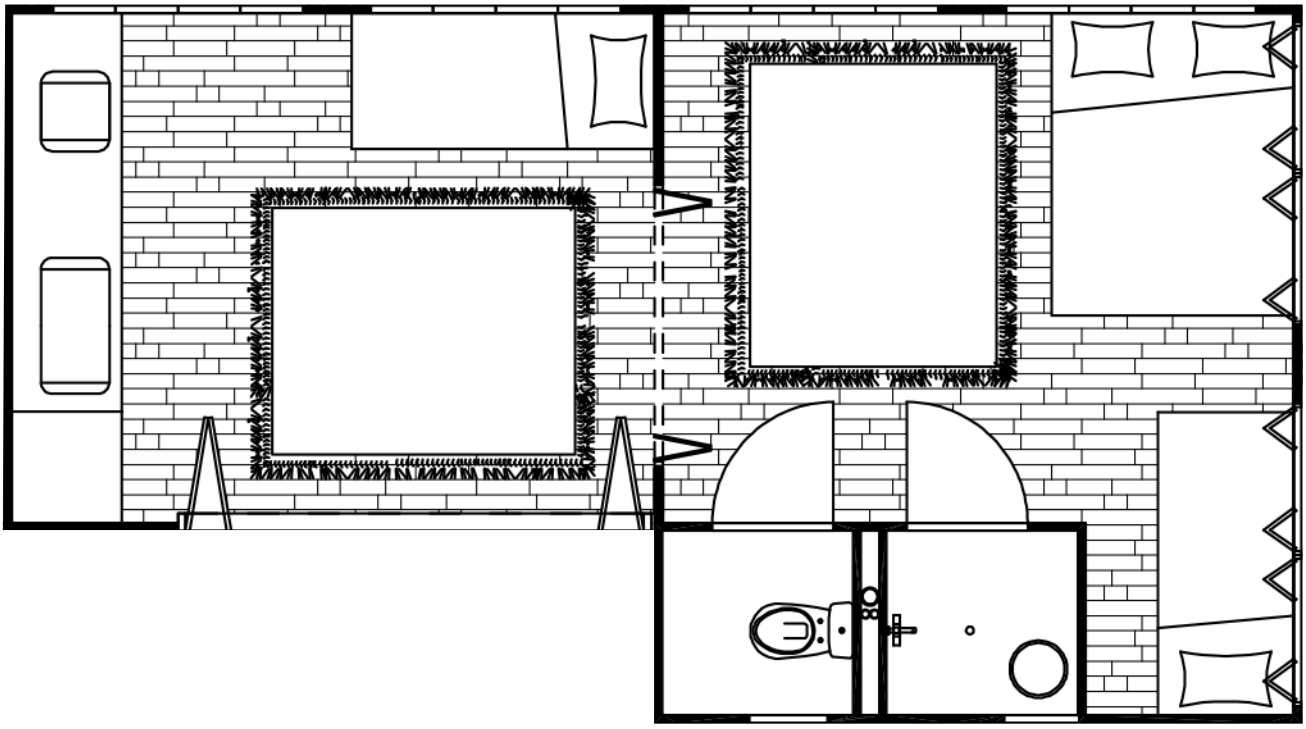
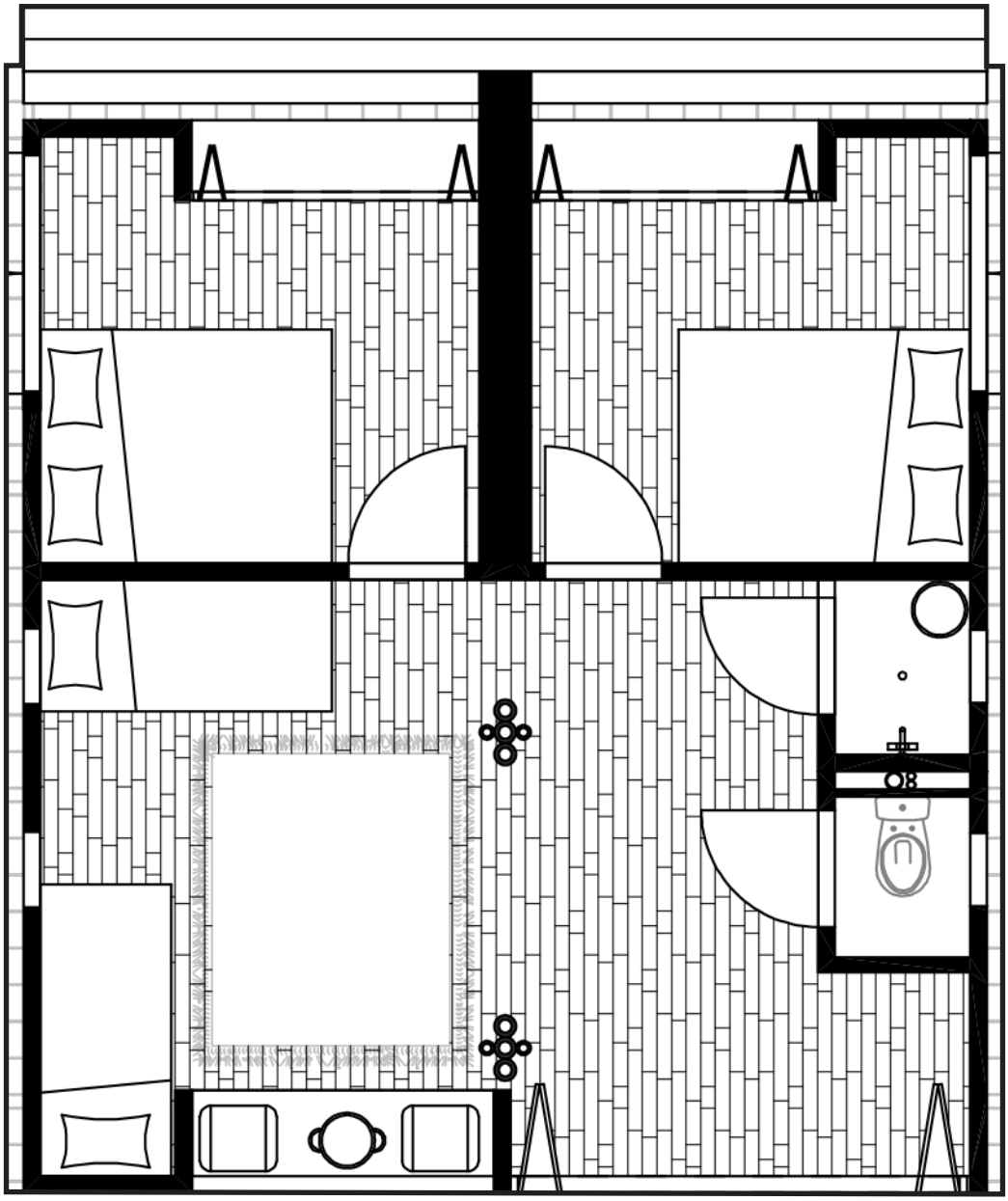


1F

Medium unit

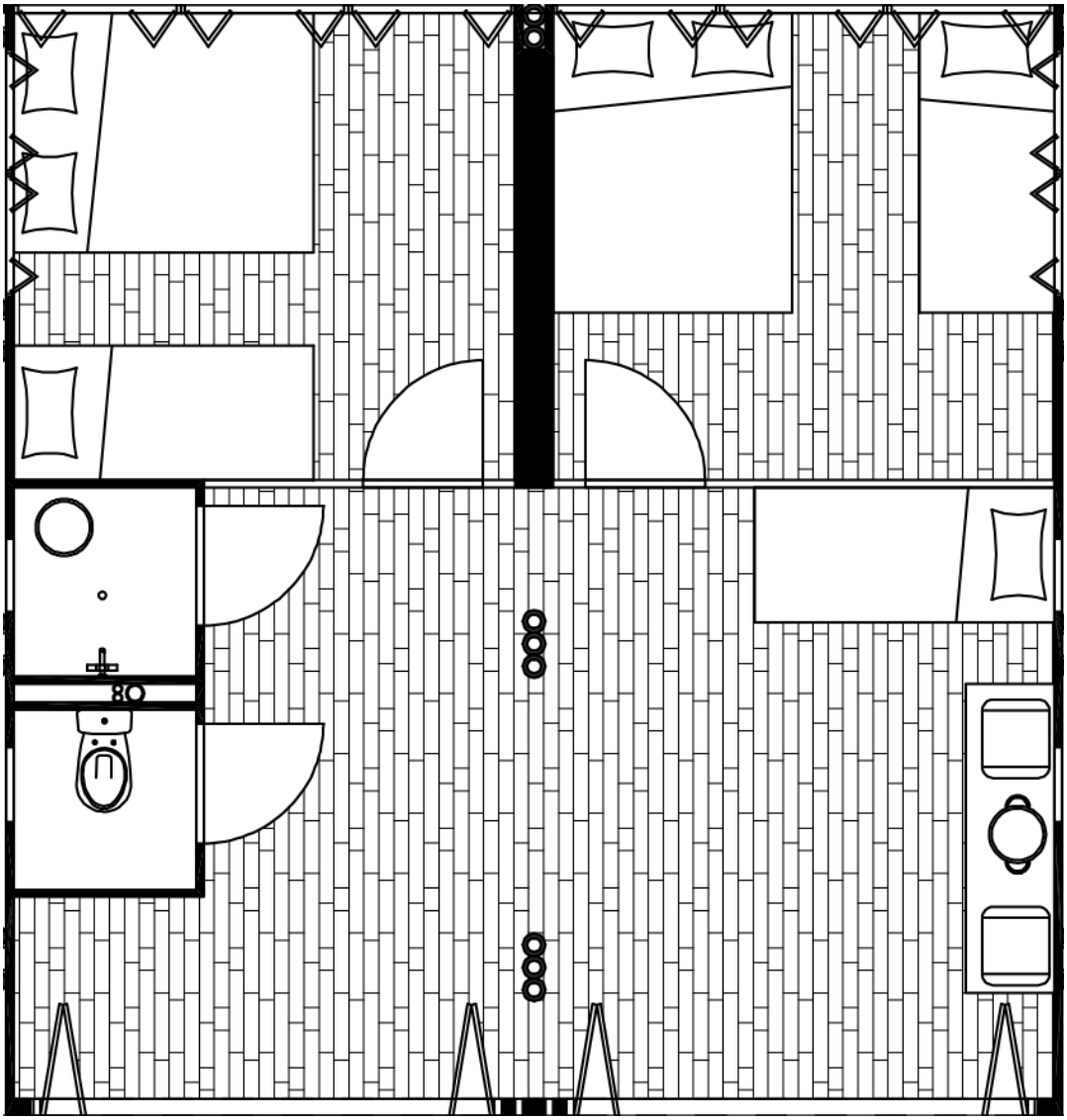
Area (m2):	**34**
Household size:	**3 - 4**



GF

Big unit

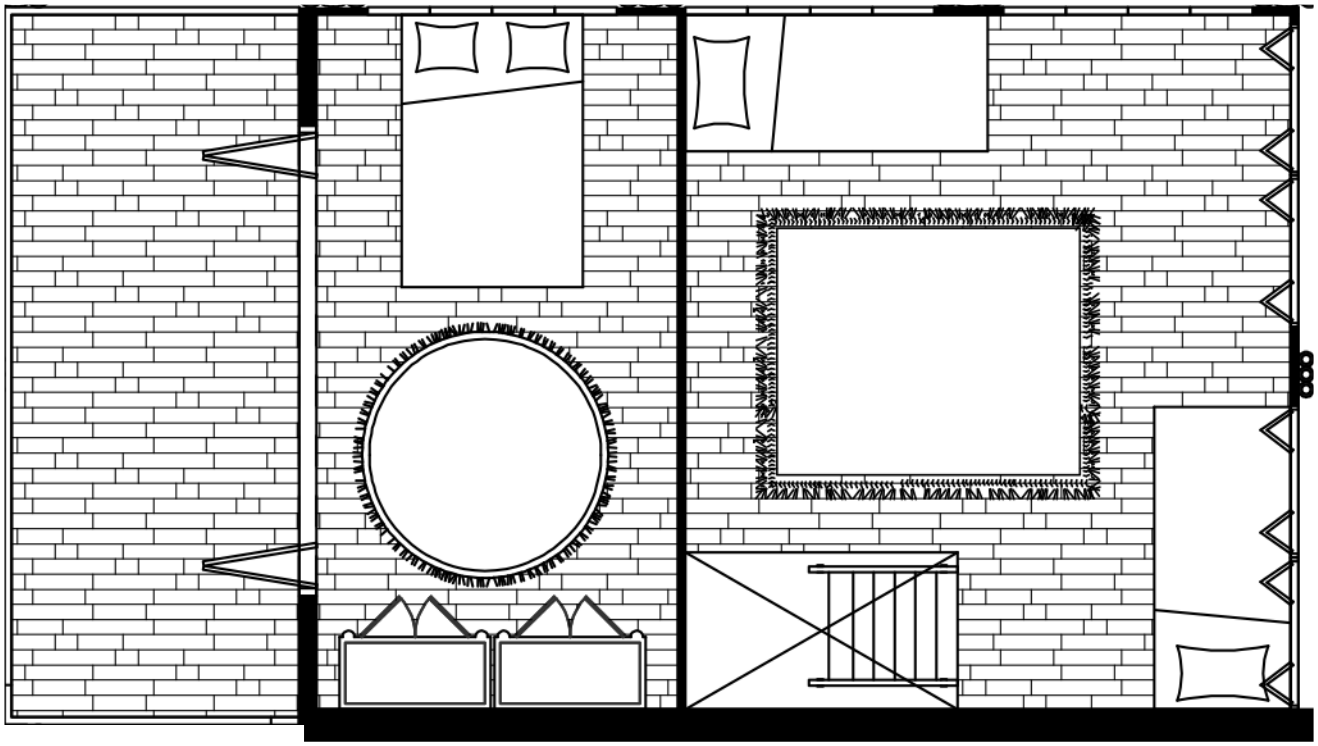
Area (m2):	**45**
Household size:	**6 - 7**



1F

Big unit

Area (m2):	**45**
Household size:	**6 - 7**



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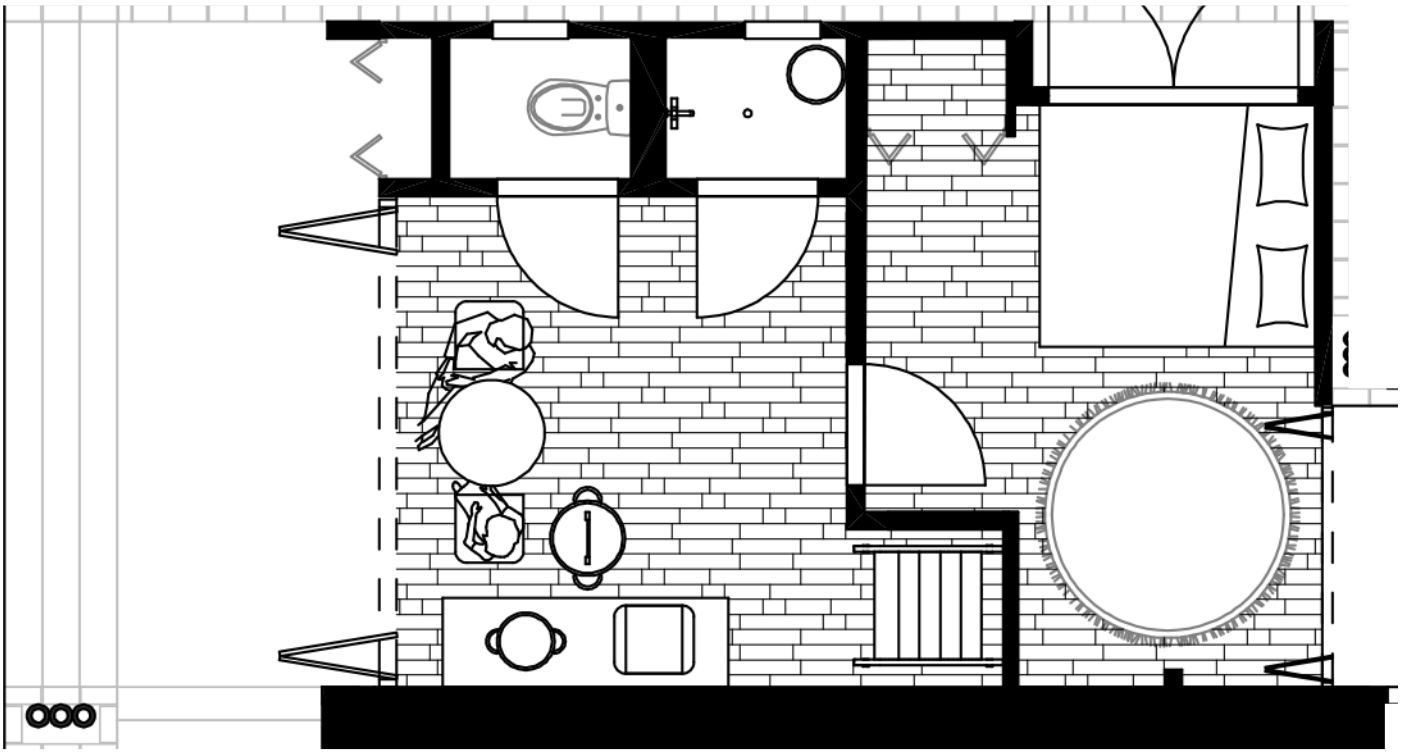
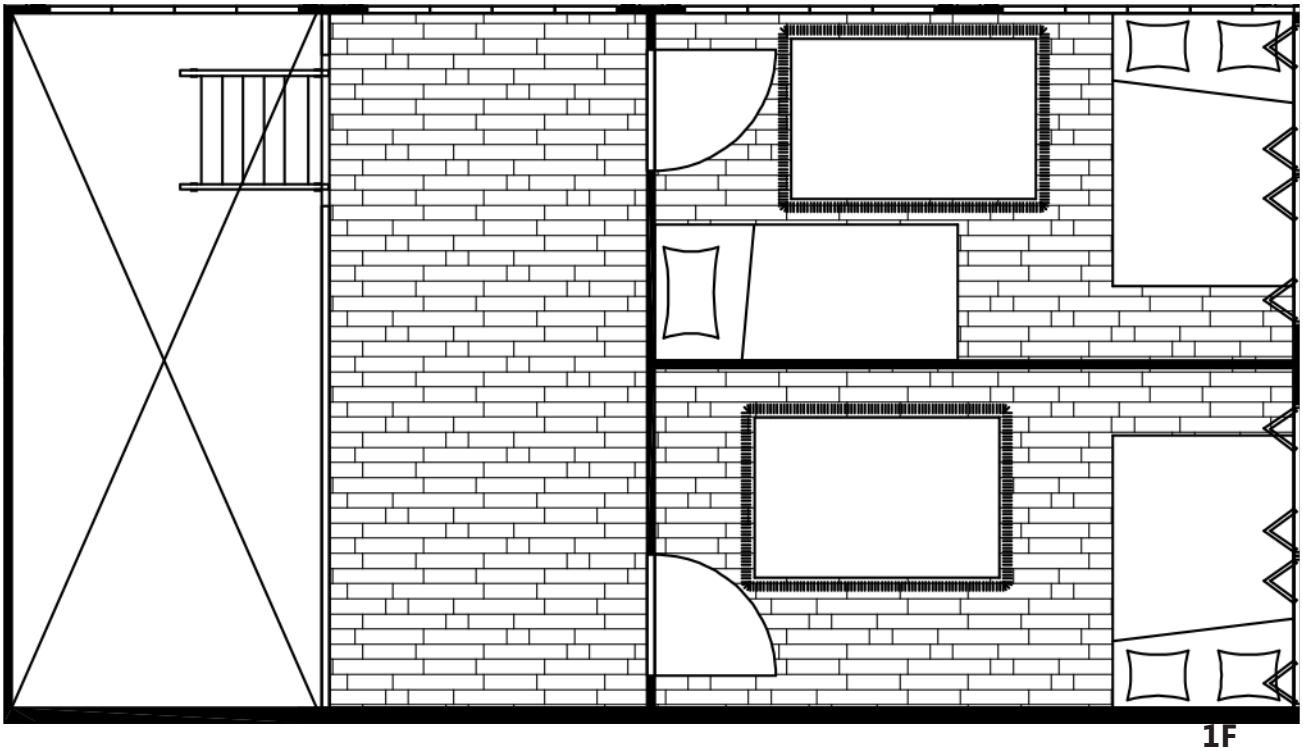
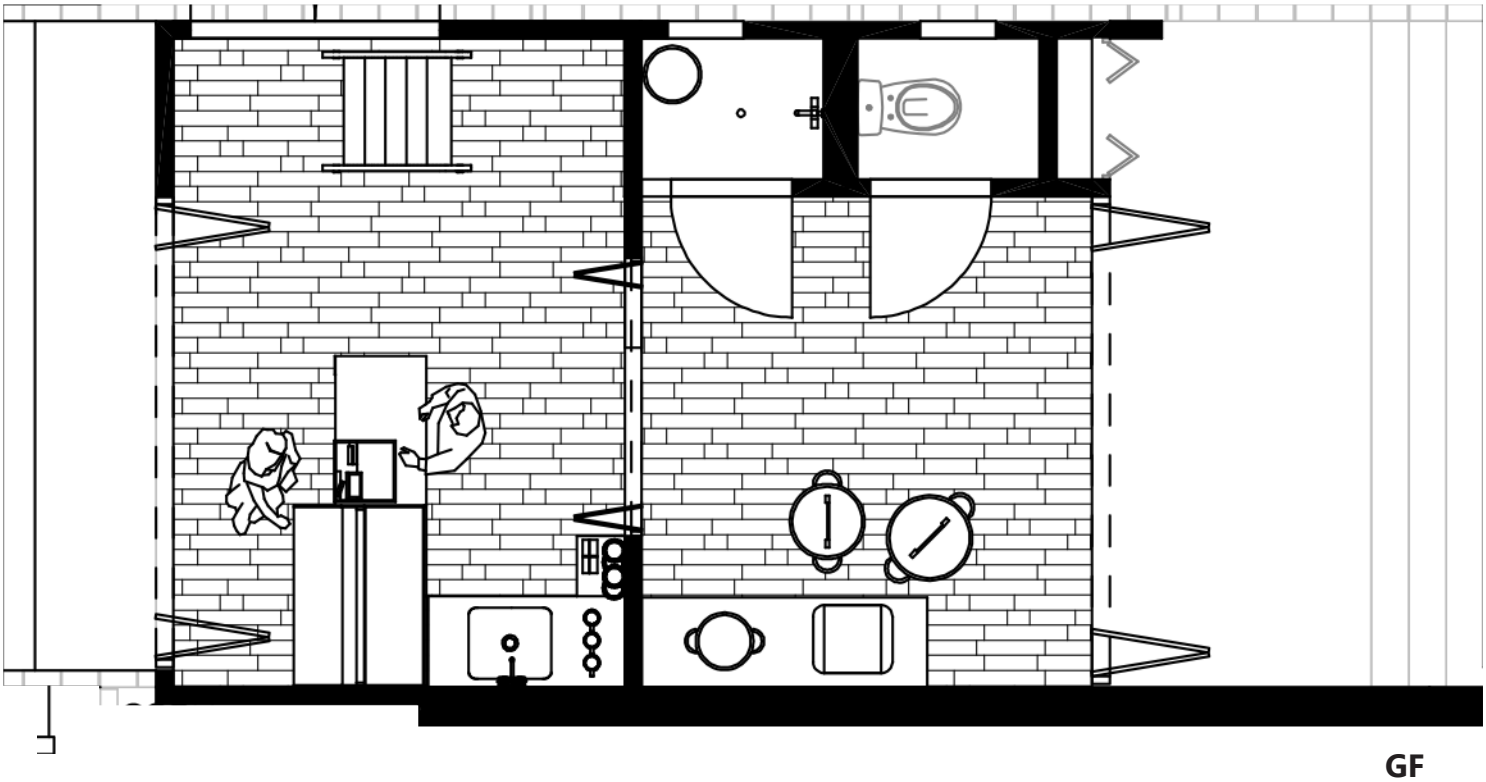


GF

	Regular unit
Area (m2):	**70**
Household size:	**6**



1F



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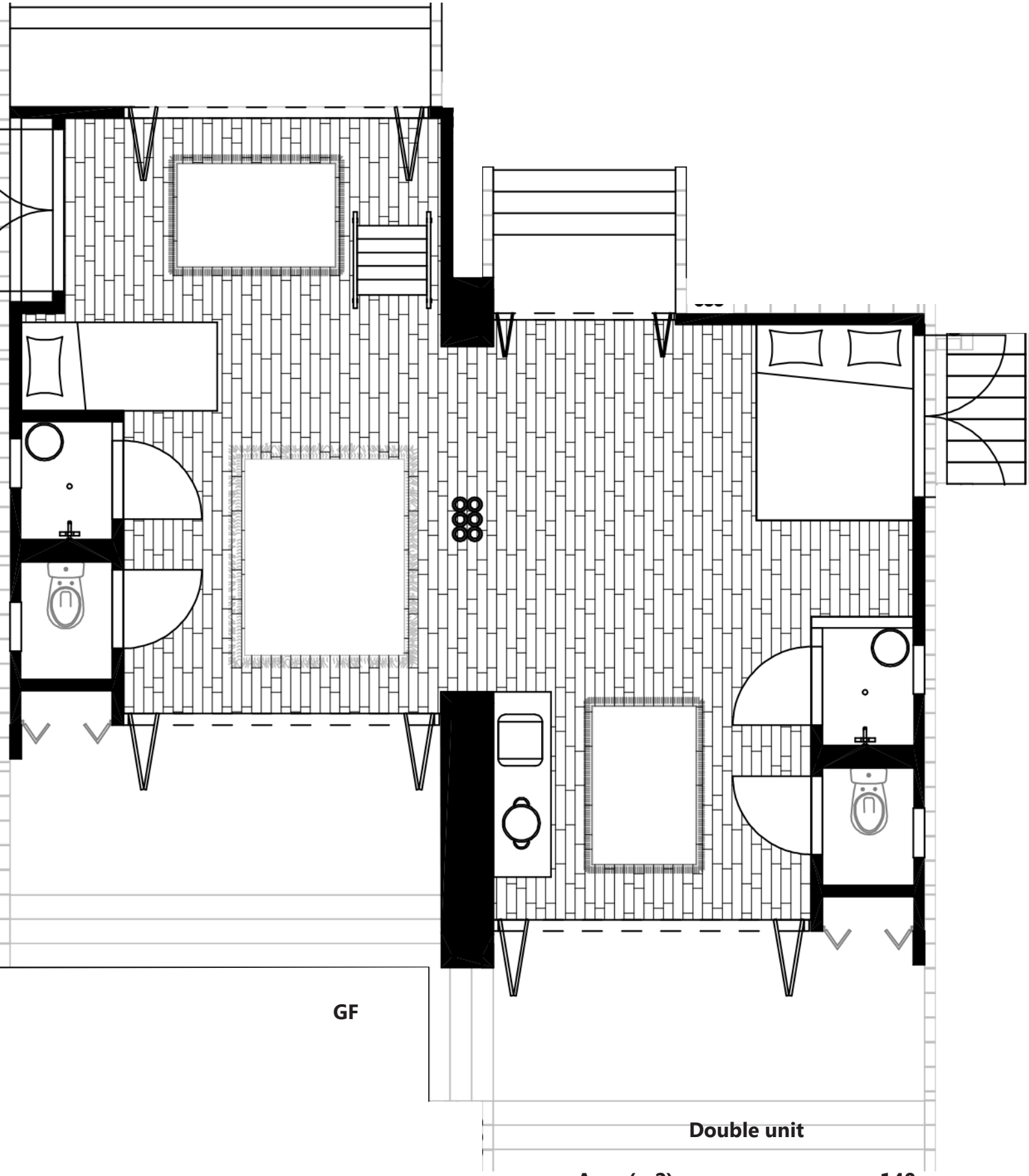
Mixed unit

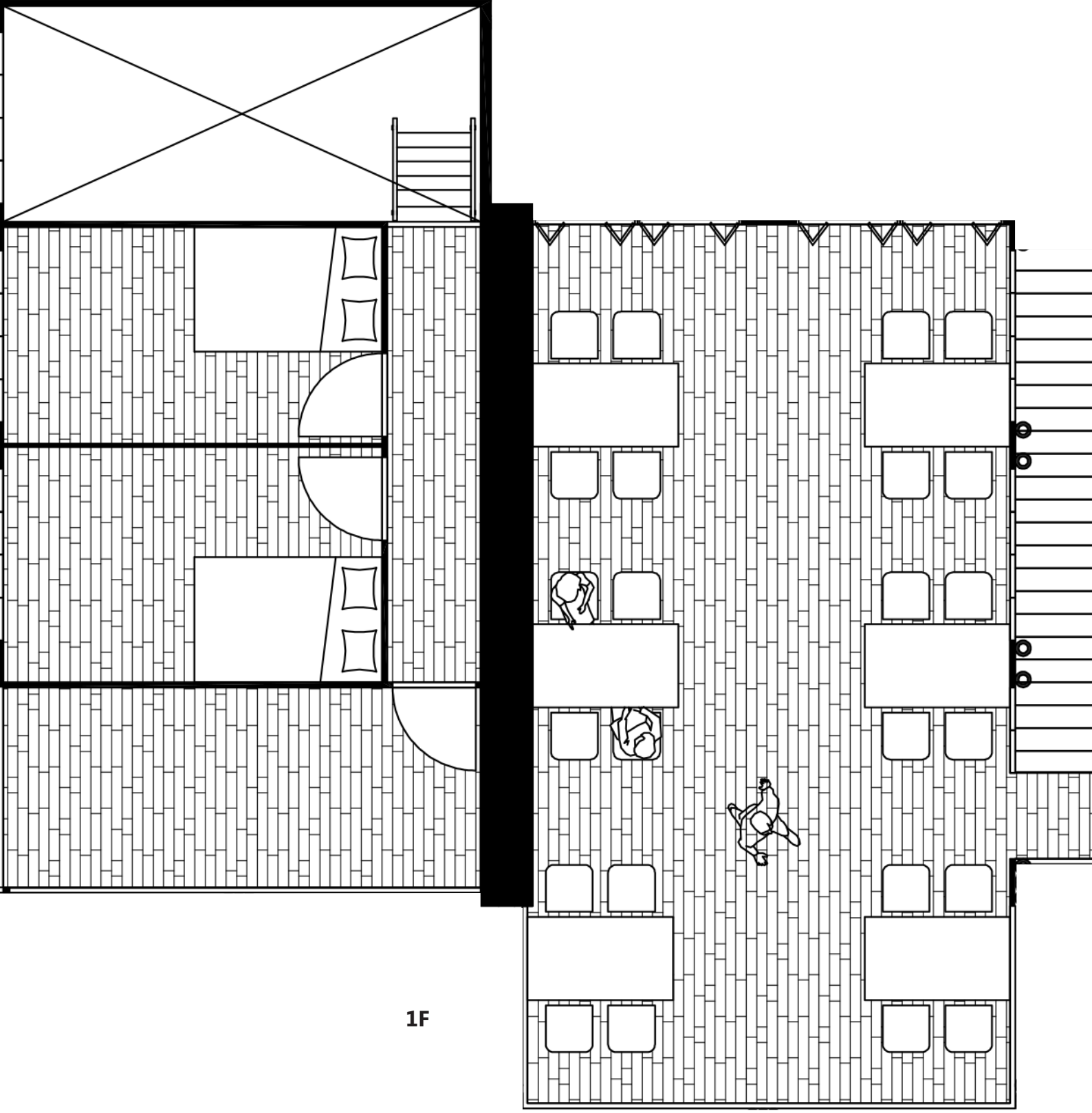
Area (m2):	**70**
Household size:	**4 - 5**



GF

Double unit

Area (m2):	**140**
Household size:	**6 - 14**



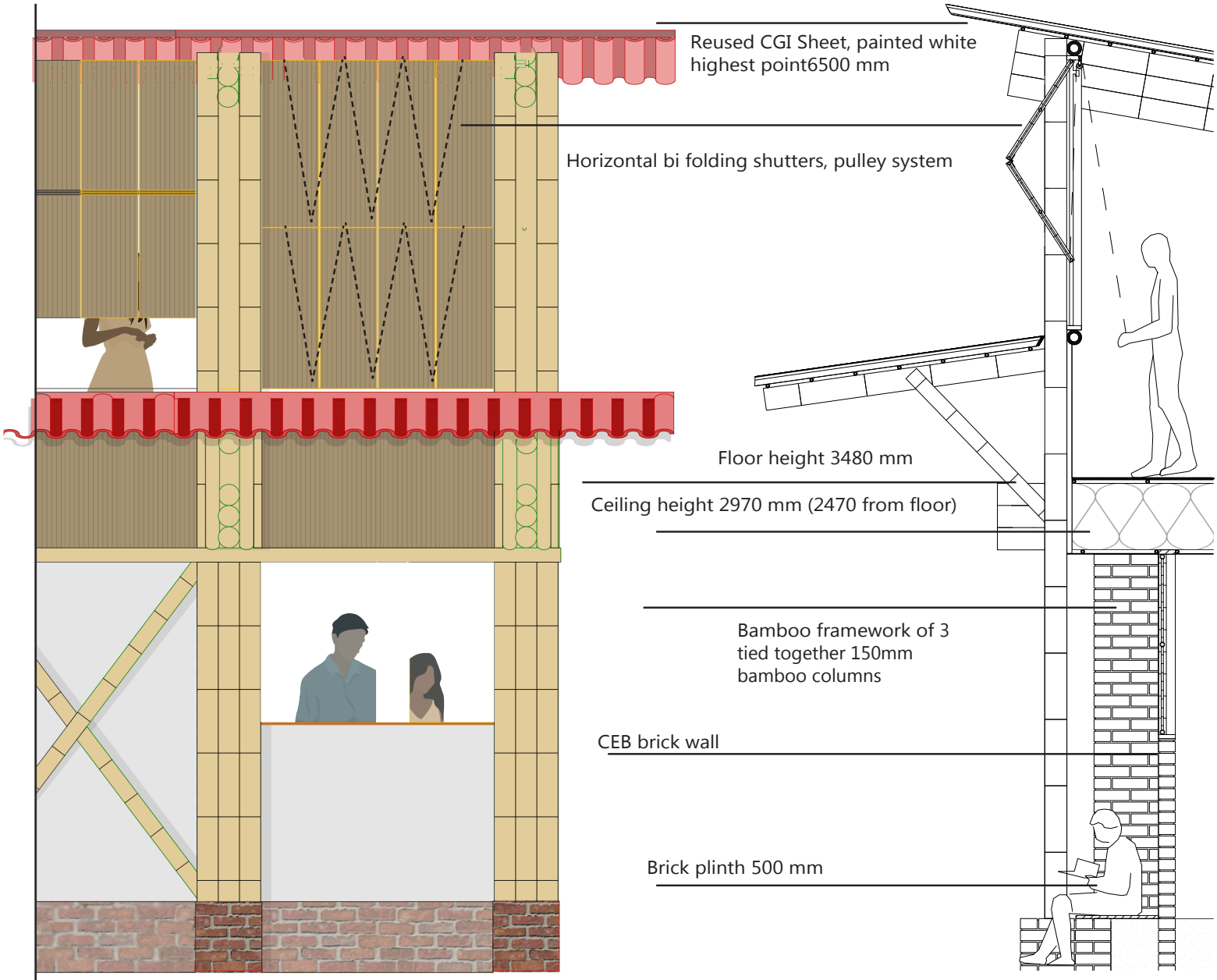
1F

Double unit

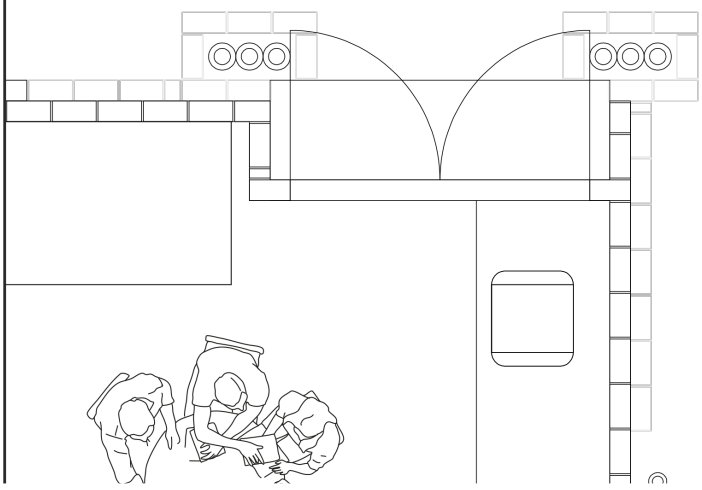
Area (m2): **140**

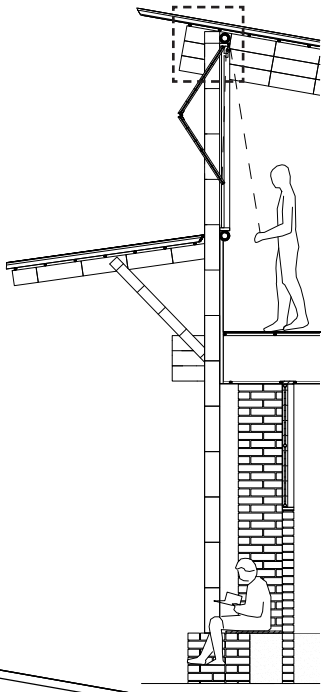
Household size: **6 - 14**

APPENDIX B:
DETAILS



Cement sand mix 1 / 4





Reused cgi sheets painted white, depth 18 mm, Slope 15 degrees

Bamboo joists 25 mm, spaced 300 mm

150

150

150

Three tied together bamboo trusses

100 mm bamboo truss

Wooden lintel 30 mm

Pulley

Horizontal bi-folding bamboo shutters 35 mm

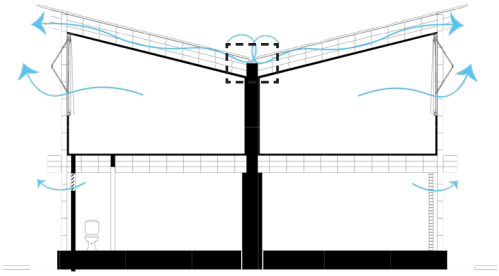
Iron hinge 3mm

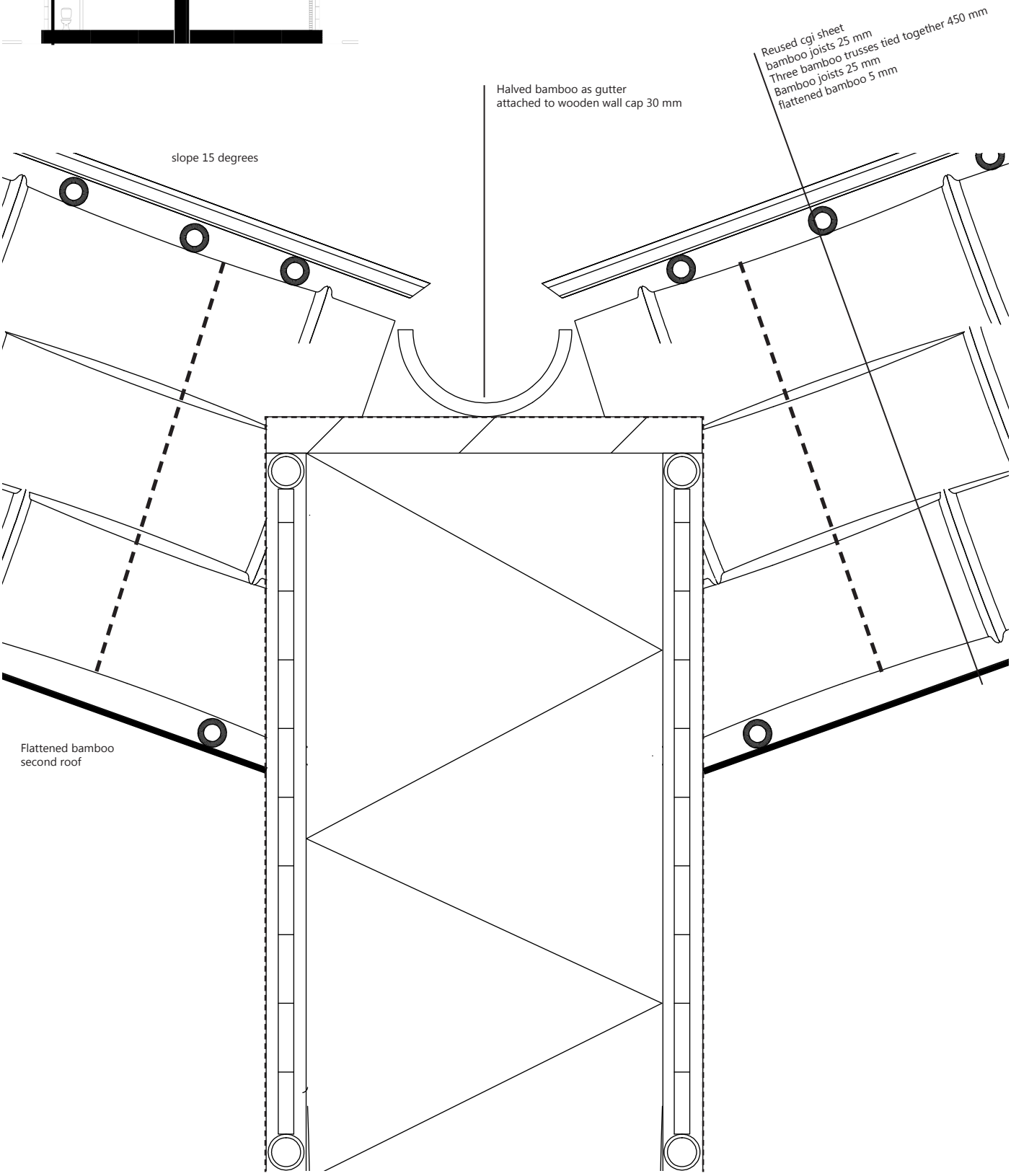
150

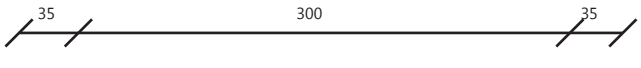
20

25

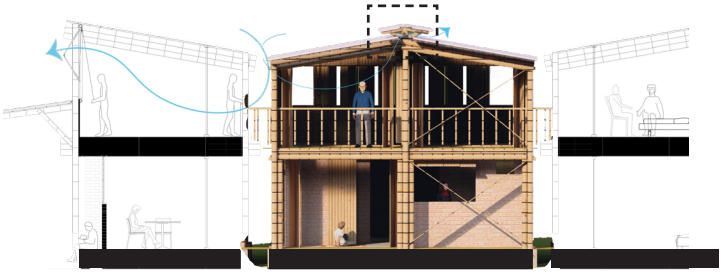
55

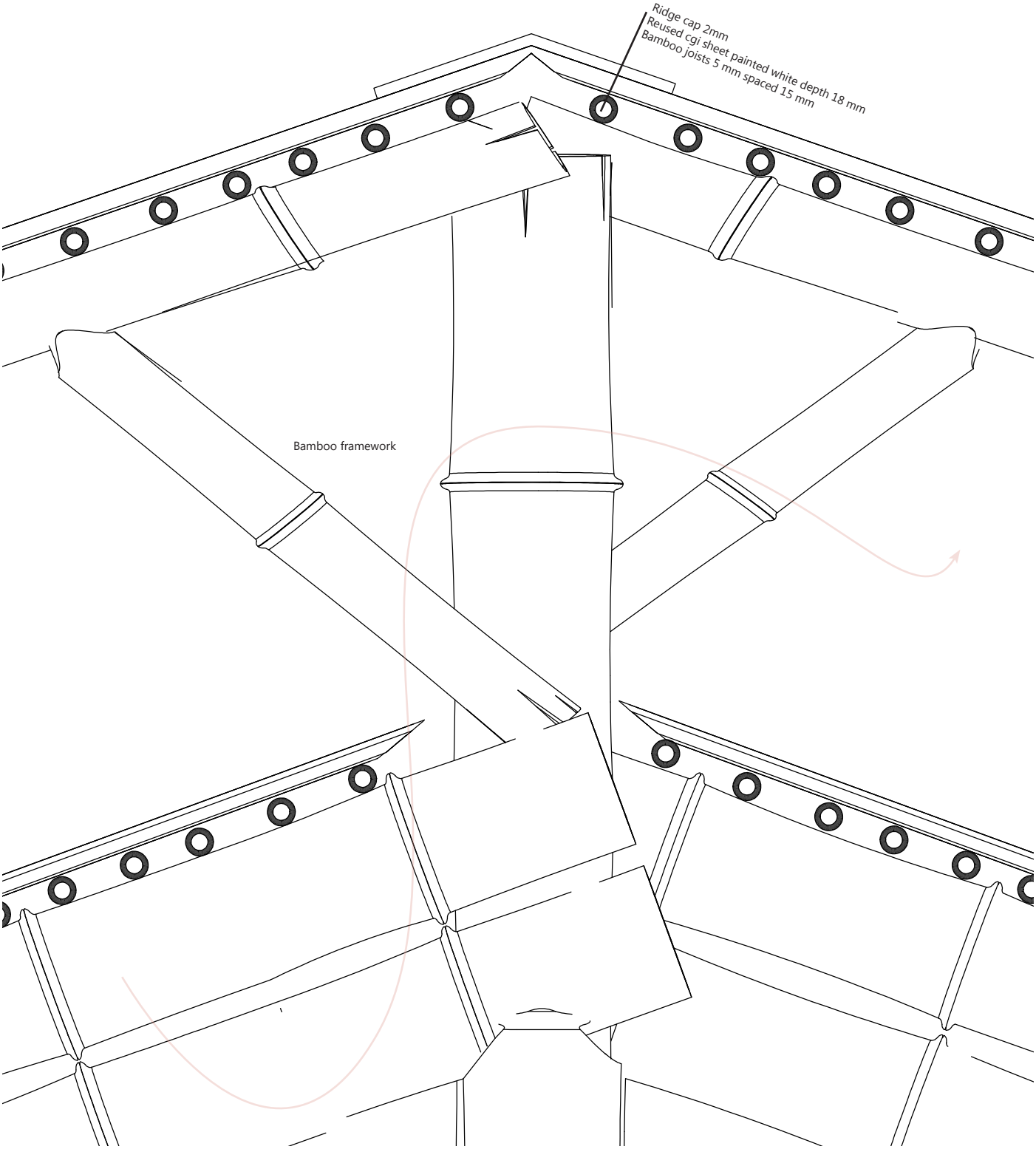


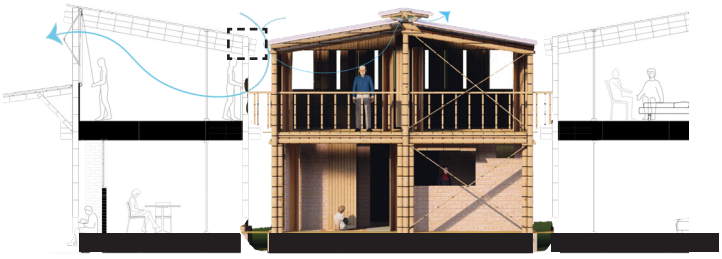


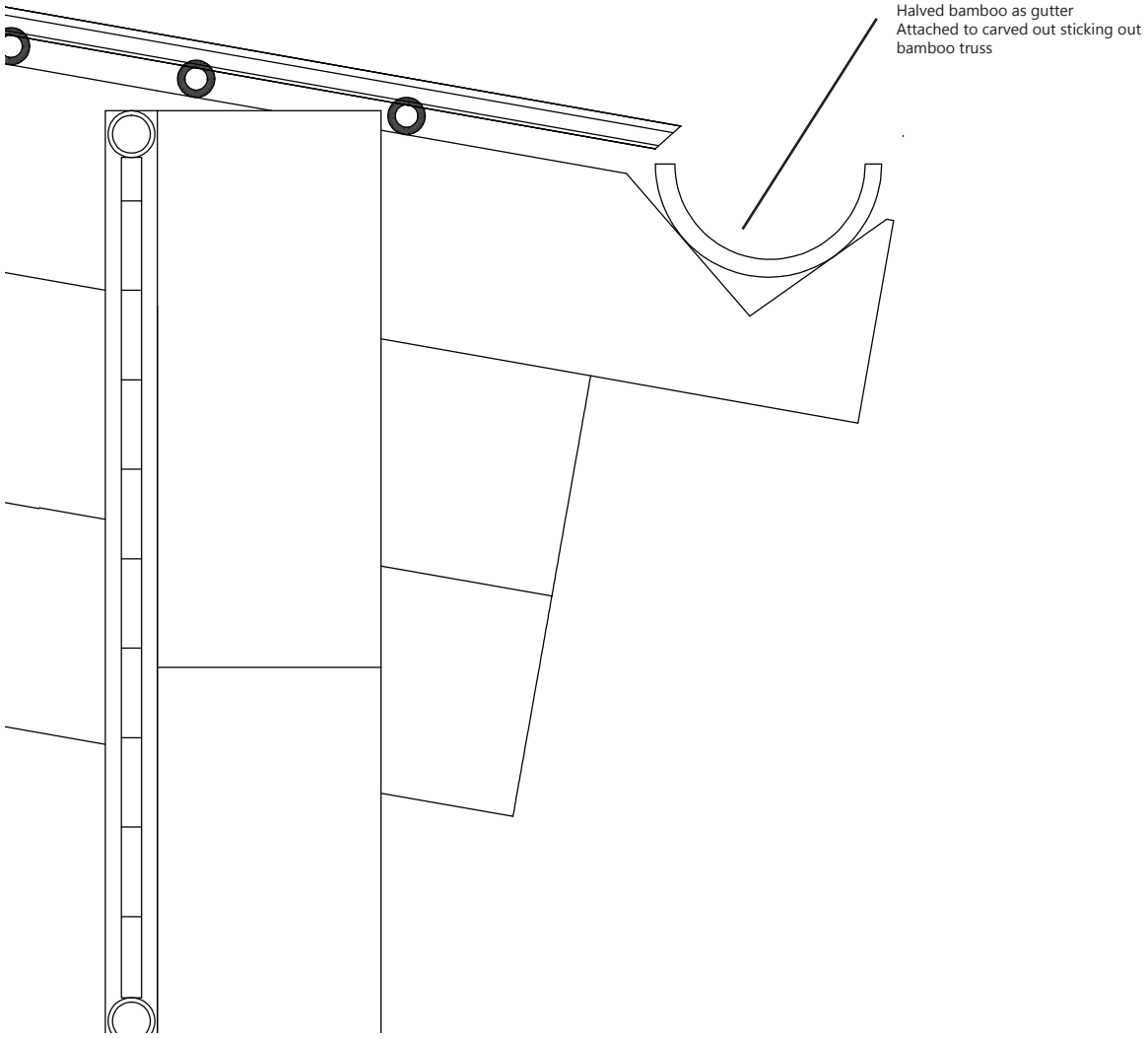


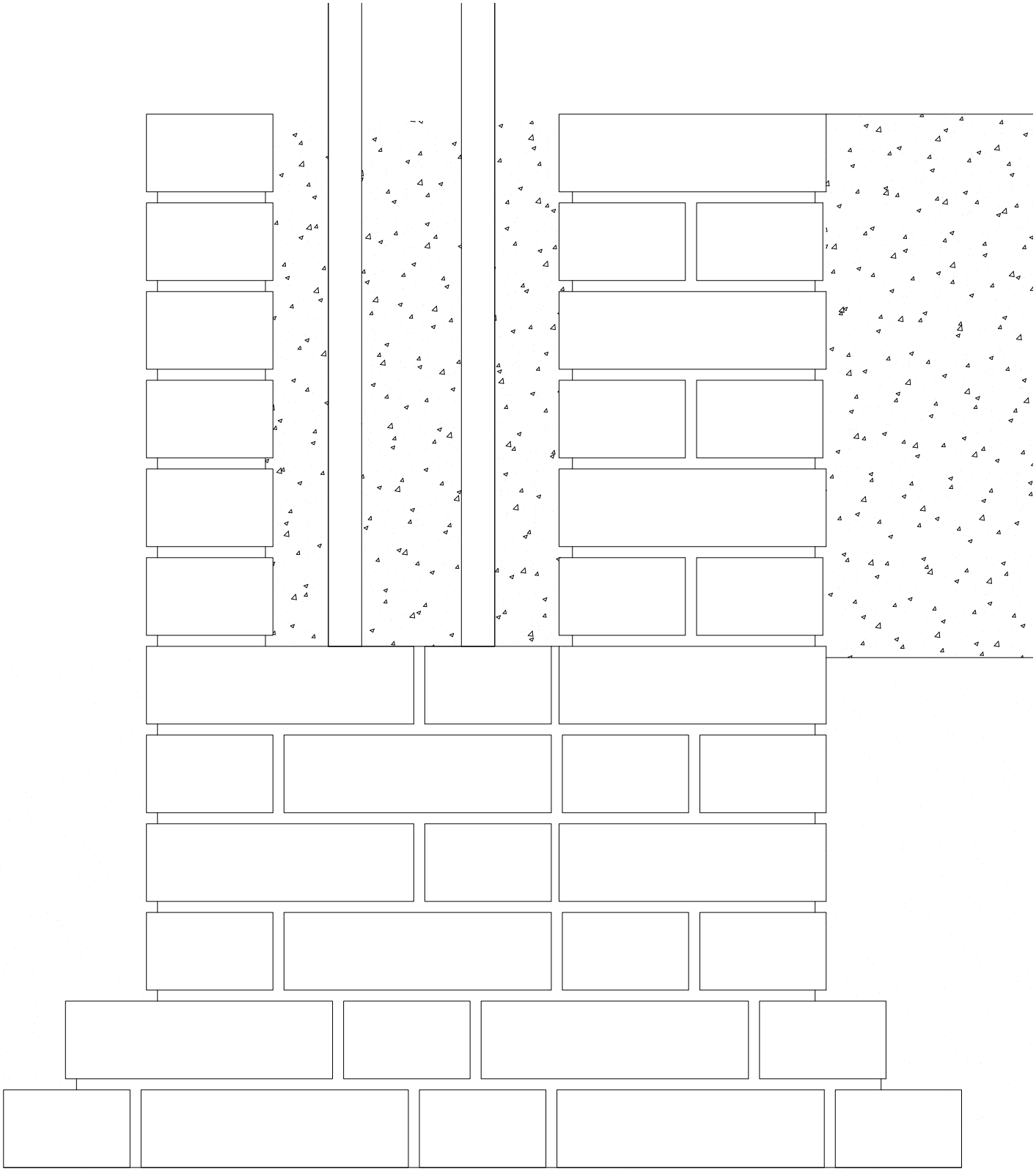
House dividing wall
plaster
35 mm bamboo mat wall
300 mm straw insulation
35 mm bamboo mat wall
plaster

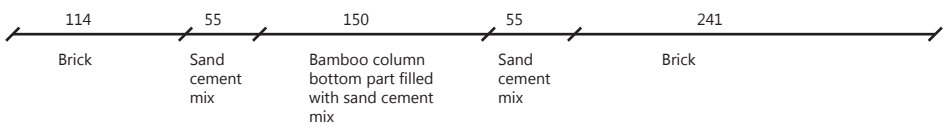


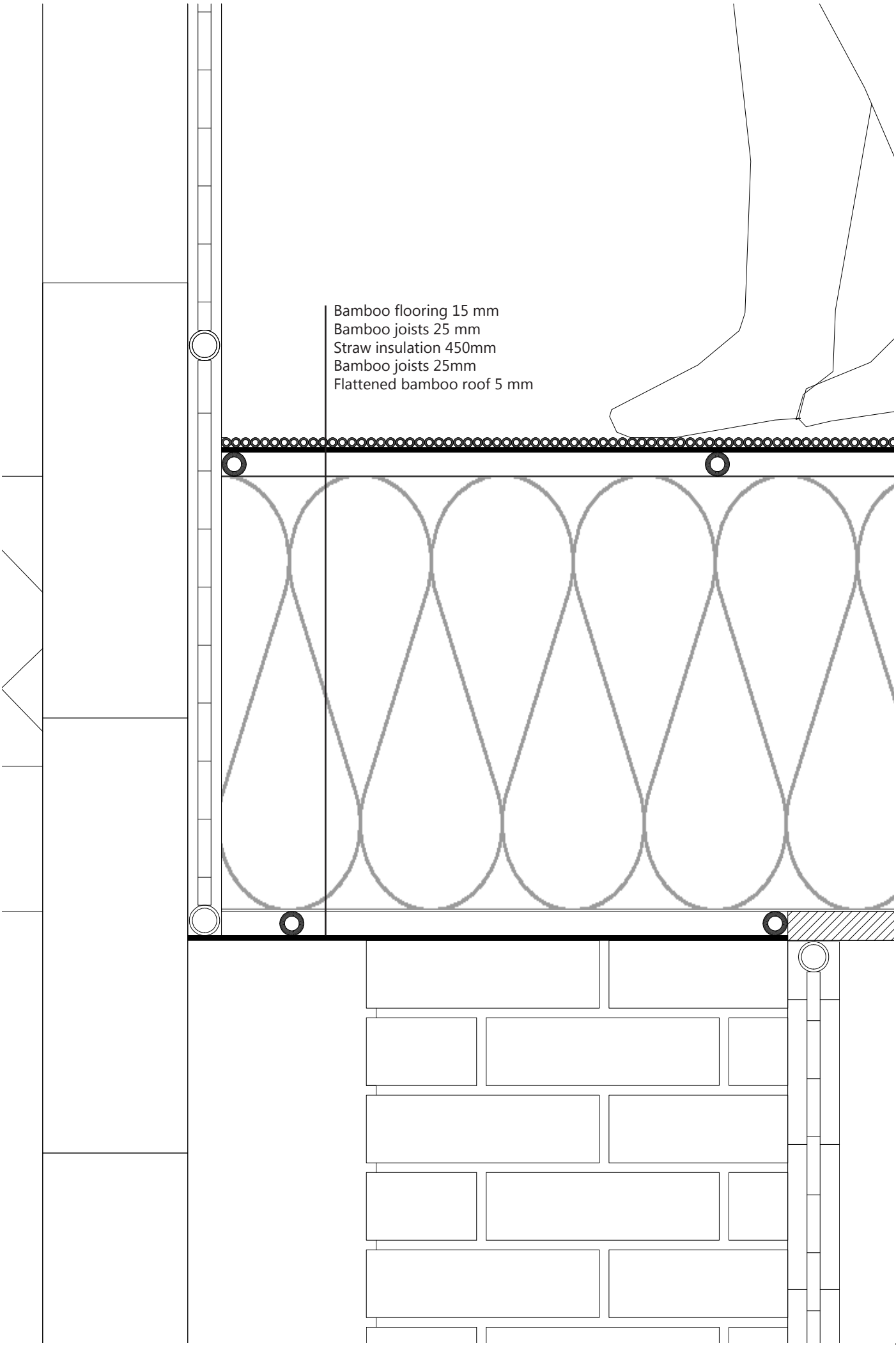

Ridge cap 2mm
Reused cgi sheet painted white depth 18 mm
Bamboo joists 5 mm spaced 15 mm
Bamboo framework




Halved bamboo as gutter
Attached to carved out sticking out
bamboo truss




114
55
150
55
241
Brick
Sand cement mix
Bamboo column bottom part filled with sand cement mix
Sand cement mix
Brick



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