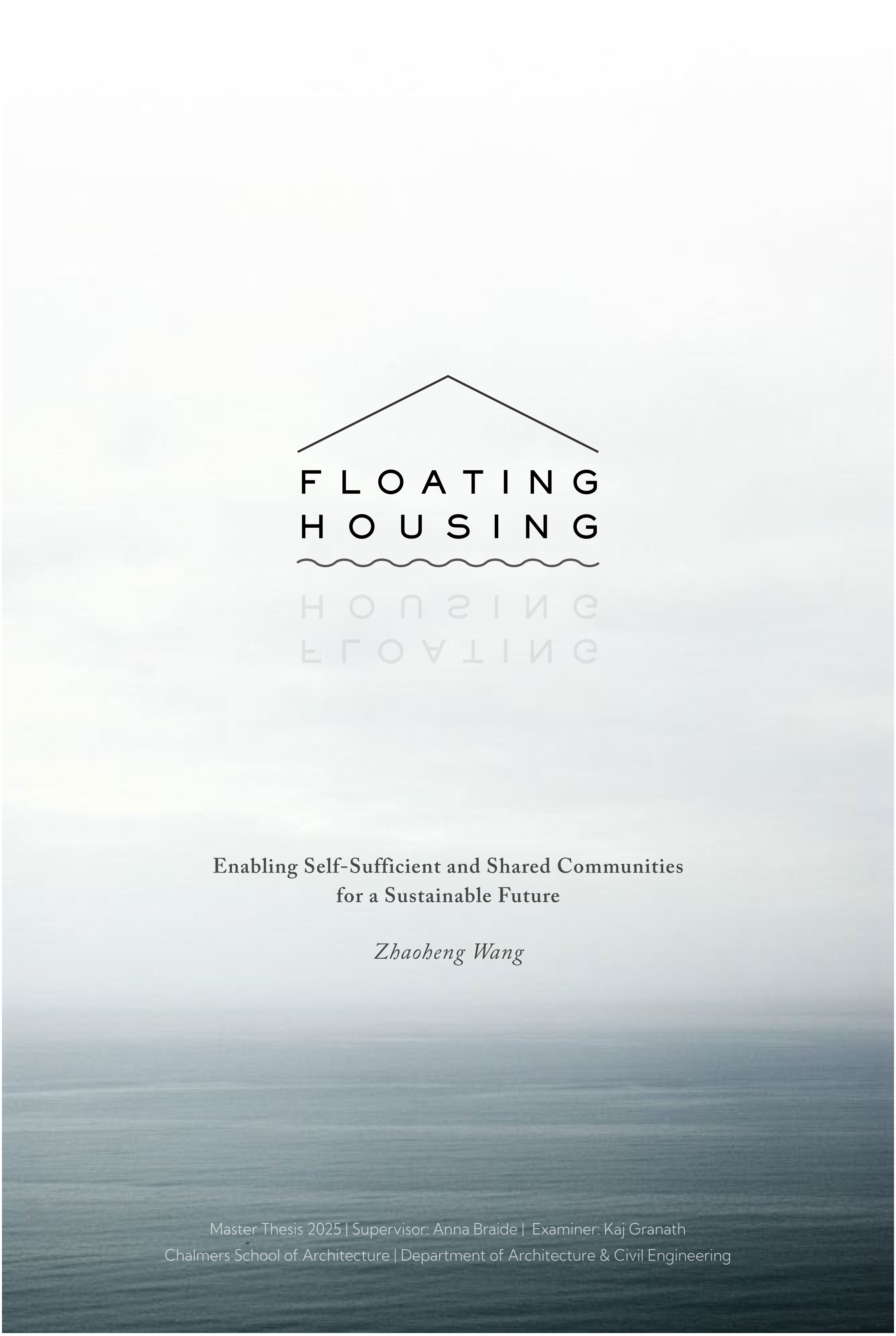


FLOATING HOUSING

Enabling Self-Sufficient and Shared Communities for a Sustainable Future

Zhaoheng Wang

Master Thesis 2025 | Supervisor: Anna Braide | Examiner: Kaj Granath
Chalmers School of Architecture | Department of Architecture & Civil Engineering

Master Thesis in Architecture and Urban Design
Architecture and Advanced Programmes | Spring 2025
Healthcare and Housing Architecture

Floating Housing: Enabling Self-Sufficient and Shared Communities for a Sustainable Future

Author: Zhaoheng Wang
Supervisor: Anna Braide
Examiner: Kaj Granath

Department of Architecture and Civil Engineering
Chalmers University of Technology
Gothenburg, Sweden 2025
www.chalmers.se

Abstract

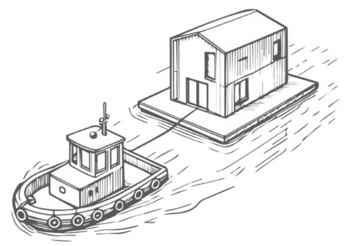
Under the influence of global climate change, rising sea levels and increasing flood risks present unprecedented challenges to cities worldwide. These environmental changes highlight the urgent need for cities to enhance their resilience. Floating housing, as a solution providing an innovative approach to adapting to water-based environments and offers a sustainable alternative to traditional urban living, has gained global attention. However, Sweden has been relatively slow in developing this field due to reasons including regulatory barriers and limited public awareness and has yet to establish mature floating community practices.

This study focuses on the Frihamnen area in Gothenburg, which has been undergoing the most significant transformation since its establishment in the 1920s. As part of the Älvstaden (River City) revitalization project, which aims to revitalize the city's waterfront and improve its sustainability. The need to reshape and reactivate the underutilized old harbor basin presents an opportunity to rethink the potential of floating housing in this context.This research proposes the creation of a floating community within the Norra Frihamnen harbor basin to address the demand for sustainable urban housing solutions.

The thesis examines the concepts of sharing communities and self-sufficiency strategies, explores how the spatial design of floating community can offer more soft values, enhance interaction among residents, improve living experiences, and contribute to a more inclusive, sustainable, and resilient form of water-based living.

The thesis ultimately presents a co-living floating community proposal in the Norra Frihamnen harbor basin. Through continuous iterative optimization and refinement, this design not only offers a new perspective on the Frihamnen revitalization but also explores how floating communities can serve as a catalyst for the symbiotic development of Gothenburg and its surrounding waters. Furthermore, the thesis emphasizes the importance of raising awareness and stimulating public discussions regarding floating housing in Sweden, aiming to increase understanding and acceptance of this housing type.

Keywords: *Floating housing, Shared community, Co-living design, Self-sufficiency, Harbor revitalization*



Student Background

2022.9 - 2025.6
Chalmers University of Technology | Sweden
M.Sc. Architecture And Urban Design

ARK263 Furture Visions for Healthcare and Housing
ARK132 Matter, Space, Structure

2024.9 - 2025.1
Lisbon School of Architecture | Portugal
Erasmus Exchange

2023.9 - 2024.6
C.F Møller Architects | Denmark
Architectural Internship

2017.9 - 2022.6
Zhejiang University | China
B. Architecture

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INTRODUCTION

Background

WHAT WE ARE FACING?

Approximately 40% of the world's population lives within 25 miles of coastlines that are predicted to be uninhabitable by 2100. With that knowledge, the United Nations' World Meteorological Organization warns about the urgency to protect communities from coastal hazards, such as erosion, waves and storm surges.

"When the City of Gothenburg plans for new construction, it must take rising water levels into account. Around 2030-40, more extensive flood protection needs to be in place." (Göteborgs Stad)

Climate issues are a constant focus in urban development. One of the biggest threats is intense cloudbursts, which can lead to flooding, and Sweden experiences these heavy downpours each year. Although Gothenburg has not been as severely affected as many other places, there is ongoing work to climate-proof the city. This includes mapping the impact of rainfall to facilitate smarter future construction and redevelopment of existing problem areas.

When sea levels rise, back pressure can occur in the canals and rivers that flow into the Göta River, which may lead to flooding in the city's low-lying areas.

RETREAT, DEFEND OR ATTACK?

Gothenburg is not the only city facing this dilemma, which is already a global crisis. Global warming in the 21st century might result in a rise in sea level which could overwhelm the measures every countries has taken to control floods. Some representative country like the Netherlands had proposed The Room for the River project allows for periodic flooding of indefensible lands. In such regions residents have been removed to higher ground, some of which has been raised above anticipated flood levels."

However some people suggested the opposite way to neither block floods nor move people away from flood-prone areas but to have them work or live on very large floating platform.

"If there are floods, it's expected that many people will move to higher ground. But the alternative is to stay close to coastal cities and explore expansion onto the water. If you consider that in the second half of the century, hundreds of millions of people will be displaced by sea level rise, we need to start now to increase the scale of floating developments." (De Graaf)

GLOBAL EFFORTS

The concept of the floating metropolis has lived as a science fiction concept ever since French author Jules Verne described them in his novel The Floating City in 1871. The development of floating communities has evolved from traditional water-based settlements in Asia, South America, and Africa, where people adapted to local water environments with simple, functional structures. In the 20th century, architects like Buckminster Fuller and Le Corbusier conceptualized futuristic floating cities to address urbanization and resource scarcity. The energy crisis of the 1970s prompted sustainable experiments with floating homes, especially in the Netherlands.

Today, with rising sea levels due to climate change, floating communities have gained prominence. Projects in Netherlands, Japan, and the U.S. exemplify modern, resilient designs using modular platforms, renewable energy, and eco-friendly materials. Future trends focus on smart systems, adaptable structures, and self-sufficient ecosystems, highlighting floating communities as a solution for sustainable urban living.

Floating communities are not only a response to climate change but also foster a unique community culture. In Belgrade, Serbia, for instance, floating structures known as splavs (rafts or barges) have transformed into vibrant social hubs. Each summer, locals and tourists alike gather at these floating bars, restaurants, shops, and nightclubs along the Danube rivers, creating a lively scene that's central to Belgrade's renowned nightlife. With over 600 floating homes and venues, splavs are a staple in Serbian culture, blending recreation, socialization, and a distinctive connection to the water. This example illustrates how floating communities can shape a city's identity and offer a dynamic lifestyle beyond the practicalities of climate adaptation.

These vivid case studies inspire us to envision floating communities as an essential urban spatial solution for waterfront cities. Floating housing is not merely a desperate response to climate change and natural disasters; it can also emerge as an innovative urban living space that harmoniously integrates cultural life and ecological environments. Amid the many benefits that floating communities offer, critical questions arise: How can we minimize their drawbacks? What strategies can we implement to create high-quality urban living spaces that are more attractive to residents? How can we design floating communities to become a core component of sustainable urban infrastructure? These are the challenges we need to explore further.

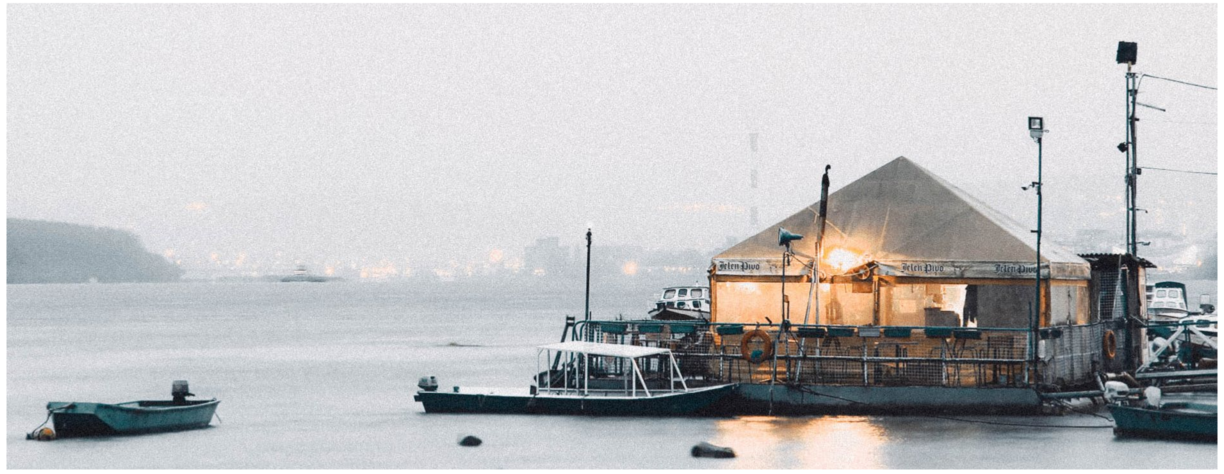


Fig. 1. Splav in Belgrade, Serbia (© Jerome Cid/Alamy)

Research Questions

How can floating housing implement self-sufficient and shared communities to promote sustainable and resilient living?

How can floating communities implement multi-level sharing strategies to optimize space and resources while facilitating shared spaces and social interaction through design?

How can floating agriculture be integrated into floating community to enhance self-sufficiency?

Why Researching the Integration of Floating Housing, Shared Communities, and Self-Sufficiency Matters?

The thesis argues that floating housing is an optimal platform for enabling self-sufficient communities and shared living.

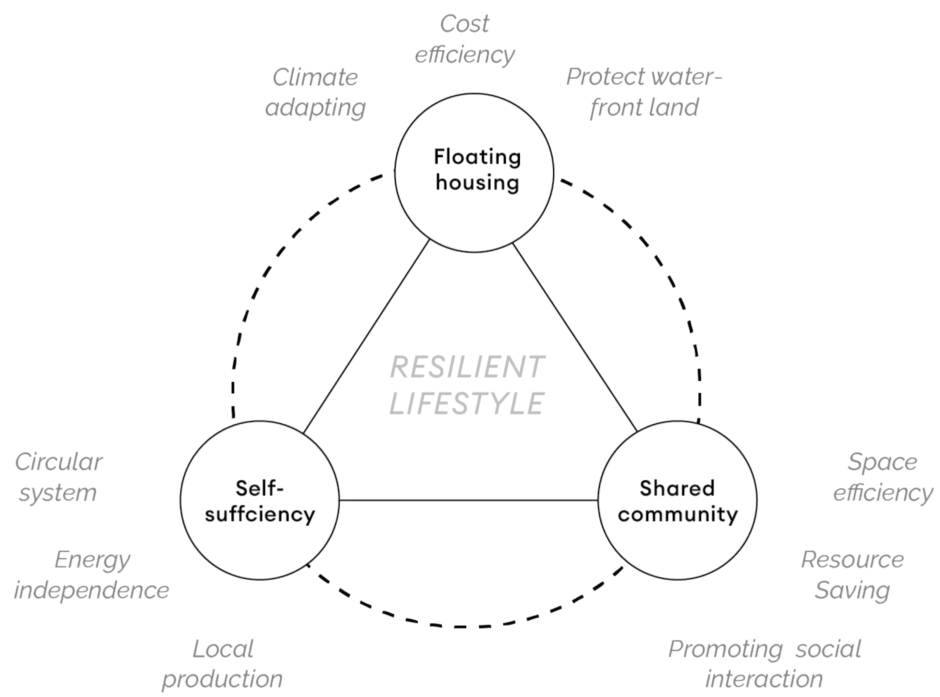
First, floating houses can easily access various renewable energy sources, as there are fewer physical barriers on water. Water-based homes have access to more solar and wind energy than land-based homes, and the hybrid energy model of solar and wind power is highly suitable.

When people transition from land to water living, the easily accessible supply chains and logistics on land become obstacles for floating houses. To address these issues and account for the possibility of being completely isolated during extreme conditions like severe weather or pandemic, establishing a self-sustaining community is essential to improve the ability to respond to environmental changes.

From a social perspective, floating housing communities encourage closer neighborly relationships due to controlled entry, a naturally enclosed environment, and increased familiarity among residents. The surrounding water limits uninvited access, fostering a sense of security, neighborhood trust, and community cohesion. These strong social connections serve as a foundation for developing a shared community economy. (Moon, C. 2015)

A well-designed floating community envisions:

Rainwater filtration for clean drinking water. Renewable energy like hybrid solar and wind power for energy independence. Circular farms utilizing soil-free vertical, or hydroponic systems for local food production. Circular waste management to minimize environmental impact. Shared transportation as primary mobility solutions. Eco-friendly materials like wood, clay, and limestone to reduce structural weight (IMM Cologne. 2022)



Methodology

This thesis follows a Research by Design methodology, where the design process and theoretical research are intertwined. The methodology consists of several interconnected stages: literature review, case studies, site analysis, iterative design process. These stages work together to inform and guide the design proposal, ensuring it is both contextually relevant and practically feasible.

THEORETICAL RESEARCH

A comprehensive literature review provides the foundation for understanding key concepts like floating housing, shared communities, and self-sufficiency. The review will include a range of sources such as academic papers, books, reports, as well as Swedish housing regulations, coastal protection laws, and urban planning in Gothenburg. The insights gathered will guide the design strategy while also fostering critical thinking and dialectical discussions, offering a framework aligned with the thesis goals.

CASE STUDIES

Case studies are used to analyze existing floating projects at varied scales with different insights: Global Scale provides broad solutions and innovative strategies. European Scale focuses on advanced projects and mature experiences.Swedish Scale examines local challenges, regulations, and context-specific solutions in Sweden.

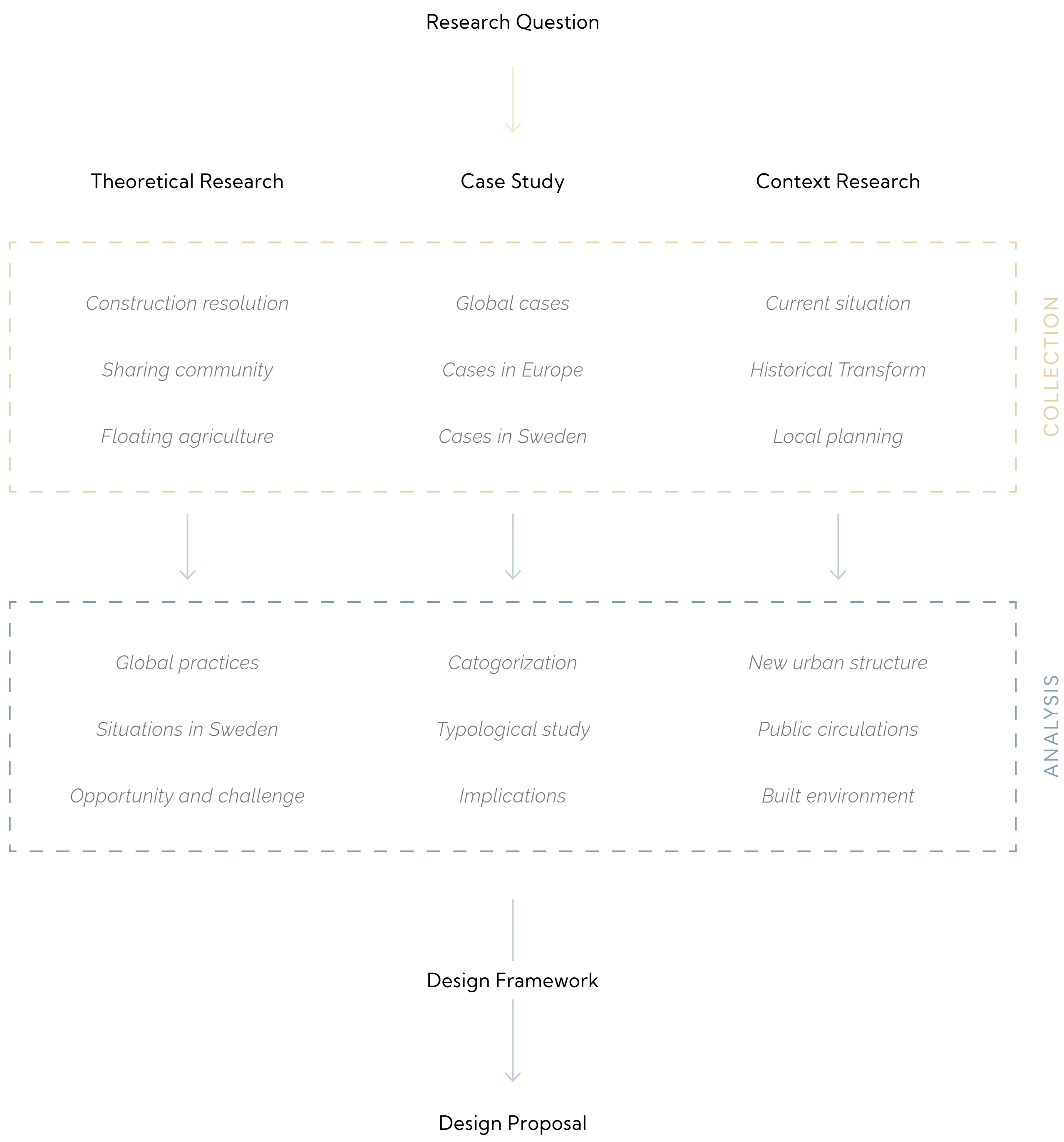
A comparative analysis method is used to evaluate, identifying common themes and differences. Additionally, categorization is applied to organize information based on environments, spatial layouts, and technical solutions, helping to highlight patterns and draw relevant conclusions for the design proposal.

CONTEXT RESEARCH

The thesis will take a broader urban perspective, through analysis of the Frihamnen including an examination of the site's historical development, current state, and future plans, focusing on the urban structure, activities, and circulation relevant to the project.

ITERATIVE DESIGN PROCESS

The design process will be iterative, allowing for continuous refinement and adjustment. Early-stage designs will be tested, evaluated, and revised through an ongoing process of reflection and feedback. As a novel form in Sweden, this will be an experimental and exploratory process. While embracing the potential for new solutions, the design will prioritize feasibility and practicality. The goal is to develop a constructive proposal that balances real-world challenges, while also raising public awareness and acceptance of floating housing.



Delimitations

The thesis focusing on the potential of floating communities in the context of the Frihamnen. It represents a more experimental exploration rather than a practical approach to addressing the current housing shortage in Gothenburg or Sweden. The following delimitations are established:

LOCAL DEVELOPMENT PLAN 2016
The research will not strictly adhere to the detailed and rigorous development plans set forth by Göteborgs Stad for the Frihamnen area. While these regulations will be taken into account, the focus of the research will be on exploring concepts rather than strictly comply to existing planning frameworks.

Research Scope and Delimitations

Will focus	*Floating Housing* *Self-sufficient Community* *Multi-level Sharing*
Will do	*Vertical Agriculture* *Urban Form and Typology* *Community-based Sharing* *Microclimate Shaping* *Water Responsive Spatial Design* *Modularity and Prefabrication*
Will not do	*Regulation and Legislation* *Housing type comparison* *Cost and Affordability* *Detail Technical Solutions*

Currently, the content of the local plan is primarily refered to the development strategy announced by Göteborgs Stad in 2015/2016. However, in practice, the detailed planning process has been paused. It will resume once the City Council reaches a decision on the economic direction for Frihamnen.

ECONOMIC AND AFFORDABILITY
The economic viability and affordability of floating housing are recognized, and the issues related to cost measurement are awared. However, these aspects will not be explored in depth. The focus will remain on the unique benefits of floating communities as a solution, without delving into development costs or economic sustainability.

LEGAL VIABILITY
Floating housing in Sweden must comply with strict government coastal protection laws. While relevant legal provisions will be reviewed during the design phase, specific issues such as building permits will not be discussed in this study. Given the dynamic nature of the legal framework, the legal viability will be considered with a forward-looking perspective.

DETAIL CONSTRUCTION SOLUTION
Detailed technical methods of constructing floating housing will not be covered in this study. But basic solution would be proposed along with the design.

Theory

DEFINITION OF FLOATING HOUSING
Floating housing can be defined as a residential structure that floats on the water, utilizing a flotation system, materials, and design to adapt to fluctuating water levels, allowing it to remain stable and functional in various environmental conditions. (Endangsih & Ikaputra, 2020) These houses are securely moored in a fixed location, making them qualify as "permanent buildings" (Climate-adapt, 2016). They are equipped with essential utilities, either through direct connections to urban infrastructure or through self-sustaining systems. Typically found on lakes, seas, rivers, or coastal areas, floating houses adjust their position in response to water level changes, all while maintaining balance and stability. This type of housing clearly differs from amphibious and floatable houses which were built on land. (Moon. C, 2015)

STRUCTURE OF FLOATING HOUSING
Floating housing needs to consider load and stability. "In planning low-rise floating buildings, it is important to know that the total area available for floating buildings is estimated to be 50% of the floating structure." (Endangsih & Ikaputra, 2020) Forms of implementation are highly varied. The rise of floating housing is closely linked to houseboats, with wood being the primary choice. Later, in countries like the Netherlands, reinforced concrete became widely used, and was eventually replaced by a new system with a concrete exterior surrounding a polystyrene foam core.

Category	Resilient features
Natural disaster	*Buoyancy for the hydrological disaster and earthquakes*
Energy shortage	*Easy employment and potential use of diverse renewable energy*
Environmental damage	*Movability, long time usage, water cycle system and prefabrication & modular system*
Social problem	*Good natural environment, solid social spirit of strong unity sense of security*

Table 1. Resilient Features of Floating Housing (Based on Moon)

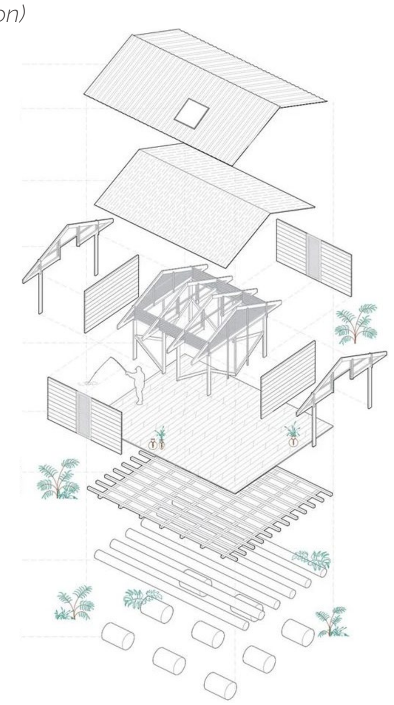


Fig. 2. Explosion of floating structure (© Natura Futura & Juan Carlos Bamba)

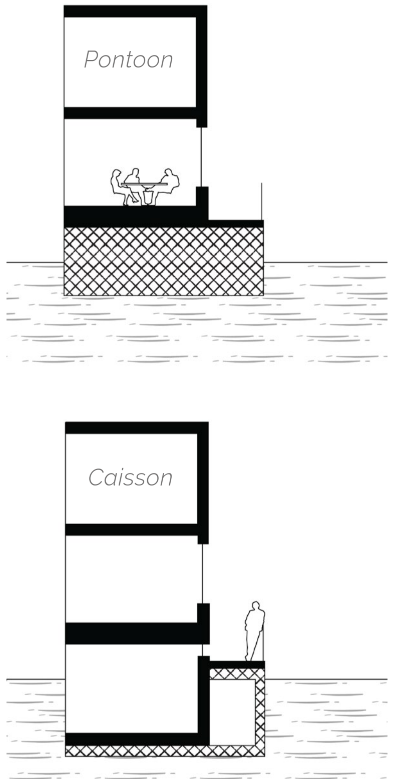


Fig. 3. Floating solutions (Based on aquavilla)

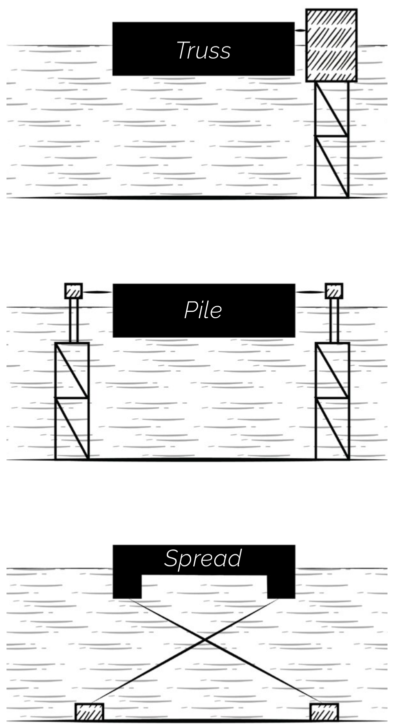


Fig. 4. Mooring solutions (Based on Endangsih & Ikaputra, 2020)

In Sweden, the construction of floating homes typically relies on two main technical solutions: caissons and pontoons, both of which serve as the base for the building. (Dumbuya & Eriksson, 2020) The house is constructed on top of these structures. Pontoon-based designs, being a more cost-effective solution, require all floors to be built above the water surface. In contrast, caisson-based designs allow for a floor to be constructed below the water surface, as the concrete slab is hollow. A caisson can be compared to a boat, as its floor is submerged, with the underwater space potentially used for storage or technical purposes. These caissons can also be pre-constructed on land before being floated into place. (Aqua Floating Group, 2020)

In addition to the floating structure itself, each floating structure requires a sufficiently rigid and strong mooring system. Basically, mooring systems come in the following variations: The truss mooring system secures the floating structure by attaching mooring lines to specific parts and can be connected via internal or external turrets. It is suitable for large-scale floating buildings but is significantly affected by waves. The pile mooring system uses pile foundations to stabilize the structure, with supporting poles enhancing stability, making it ideal for high-stability buildings. For example, the floating community in IJburg, Netherlands, adopts a combination of floating platforms and pile foundations. The Spread mooring system secures the floating structure with cables while maintaining a fixed heading direction, eliminating the need for swivel components. It is best suited for relatively calm waters, such as lakes or enclosed waterways. This system is the most flexible but is generally used for small-scale or temporary floating housing. (Endangsih & Ikaputra, 2020)

FLOATING HOUSING GLOBALLY

In the 20th century, Buckminster Fuller's Triton City and Kenzo Tange's vision of a floating metropolis in Tokyo Bay paved the way for modern concepts of floating cities. Although these utopian plans did not materialize, in 21st century we have seen a global resurgence of interest in floating housing.

The Dutch, with their extensive experience in water-based living, have taken the lead in implementing floating housing projects. Solutions like Waterbuurt and Schoonschip are already realized. They have set their sights on the core water areas of the city such as Maashaven, Rotterdam. "It is inner city harbours or industrial areas in decline that are being targeted for floating communities." (Rowsell, 2020)

Since floating houses have long been popular in the Netherlands, and Baca Architects have proposed a similar idea for the canals of London. In 2015, a Portuguese team named Friday SA demonstrated the feasibility of transporting prefabricated floating houses to lakes and waterways around the world. And in 2019 BIG has unveiled an ambitious floating city concept called Oceanix City, which is made up of modular hexagonal islands, can house up to 10,000 residents. The team plans to continue developing the prototype for Oceanix City and aims to launch it on the East River in New York. As a result, we also see many U.S. cities exploring alternative methods to strengthen vulnerable coastlines. Boston and Miami are taking measures to address flooding, while San Francisco tried to find solutions for protecting coastal areas from rising sea levels. (Dezeen, 2019)

Across Asia, Africa, and America more countries like Indonesia, Phillipines and Nigeria are engaging in related practices. The abundant rainfall and flood risks associated with the local climate have prompted people to learn how to live more effectively on the water. Maldives Floating City represents the vision of many island nations facing rising sea levels and coral reef protection. These marine projects are often combined with resorts, forming a new model for tourism development.

With the continuous efforts of architects worldwide, the feasibility of floating housing is gradually being validated. In the past, concerns were raised about the potential negative impact of floating housing on aquatic ecosystems. However, the reality is quite the opposite—floating structures may not only avoid harming the ecosystem but could also serve as new habitats for biological communities, contributing positively to aquatic environments. (Table 2, Lima and

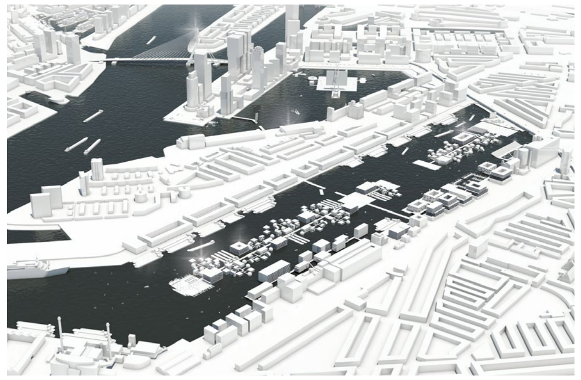


Fig. 5. Planning of Maashaven (© Goldsmith, 2012)

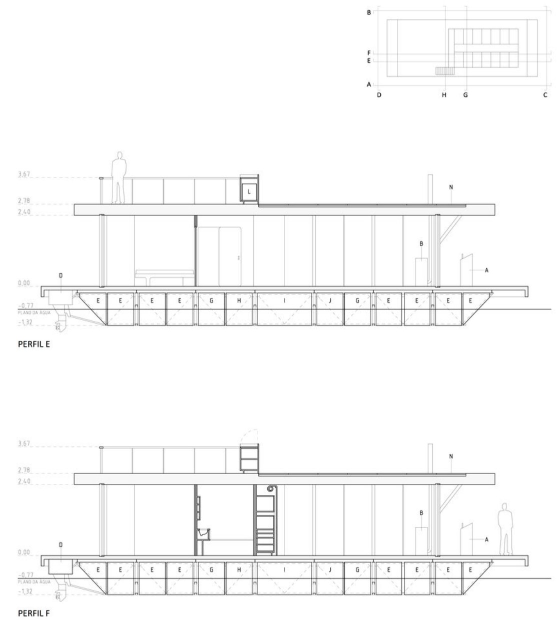


Fig. 6. Global Transport of Prefabricated Floating House (© Friday SA, 2015)

Fig. 7. Makoko in Nigeria (© Iwan Baan)

Impact	Consequences & Benefits
Air-water interactions	*Rainfall, oxygen diffusion, aquatic ecosystems, and evaporation*
Blocking of sunlight	*Disrupt phototrophic organisms, food chains, and lowering water temperature*
Wind & Hydro-dynamics	*Barriers alter wind and hydrodynamic patterns, may increase wind speed*
Maintenance	*Increases water turbidity and light penetration*
Attraction of birds	*Attract birds or insects*
Water quality & Ecology	*Provide large underwater surfaces for biofouling*

Table 2. Potential changes and consequences or benefits to aquatic systems (© Lima and Boogaard, 2020)

Fig. 8. Submersible barges can transport 2 floating houses directly from factory to site (© Aquavilla)

Boogaard, 2020)

Nevertheless, we cannot overlook the challenges that floating housing presents in practice. Compared to traditional land-based housing, the construction costs of floating houses are generally higher due to additional expenses required to accommodate water level fluctuations and ensure seamless connectivity with public infrastructure. For instance, in Amsterdam's IJburg Waterbuurt community, construction costs are 10% higher than those of comparable conventional housing. Additionally, the interior layout and furniture placement of floating houses must be meticulously designed and calculated. **Since even slight tilts on water surfaces can be amplified, any imbalance caused by design flaws must be carefully addressed.**

Despite these challenges, the development of floating housing still faces certain limitations. It demands highly stable water conditions, and while successful implementations have been achieved in calm inland waters, its viability in open seas remains to be fully tested. However, once structural stability against ocean currents and waves is ensured, floating housing at sea has the potential to become a promising and sustainable future living solution. (Climate-adapt, 2016)

FLOATING PRACTICES IN SWEDEN

Sweden has a long coastline of 3,218 km and more than 50,000 islands and lakes, providing vast potential for the development of floating housing. However, the development of floating housing has been extremely slow, primarily due to the following reasons:

From a legal view. Sweden's strict coastal protection legislation "Strandskydd " hindered developers, as it establishes protection zones around most water bodies, within a 100-meter range from the water's edge, where any construction are strictly limited. This is why floating housing is usually found in old marinas and shipyards. "In these areas, shipbuilding or port companies already own the property, making it easier to release the coastal protection." (Hakegård & Ljungström, 2022) Nevertheless, we have seen that during the writing of this thesis, the Klimat- och näringslivsdepartementet has initiated a proposal to relax the coastal protection zone restrictions, providing a more favorable environment for housing construction such as through exemptions. Therefore, in the changing legislative environment, floating housing will benefit from gradually relaxed regulations.

From a national perspective, **Sweden is not a society with a culture of living on water**. This is due to factors such as population density and privatization. In a country like Sweden, where about 87% of the population lives in cities occupying only 1.3% of the total land area, there seems little necessity or motivation for urban areas to encroach upon water bodies.

Moreover, the privatization of floating housing areas seems to inherently conflict with public accessibility to waterfronts found in the Planning and Building Act (PBL). "Another contradiction is how to make waterfronts more publicly accessible while simultaneously allowing space for private houses." (Storbjörk & Hjerpe, 2022) As, a result, When planning permanent housing on water, this often takes longer than housing on land. (Celsing & Durkin, 2020) To avoid these issues, the developer Aquavilla believes that on the contrary, **floating communities could provide the public with free access to the water and the water surface. (Aquavilla, 2023)** Therefore, from a design perspective, showcasing how floating housing projects can allow the public to benefit from the added value these projects bring, while balancing the Swedish people's preference for avoiding exposed living, is key to increasing public and governmental acceptance.

Today, the reality in Sweden is one of both opportunities and challenges. We can see active attempts from the private and legislative reforms, and apparently there will be greater potential in coastal areas in the future. This thesis aims to demonstrate through design by balancing accessibility and privacy, promote public discussion, increase public credibility and acceptance, and reveal its unique potential and adaptability in Sweden.

FLOATING AGRICULTURE

Floating agriculture is an innovative agricultural model that combines floating structures with advanced

Fig. 9. Marinstaden Nacka in Svindersviken (© Aquavilla)

Fig. 10. Kolkajen-Ropsten birdviews (© Adept & Madaworks, 2019)

STRENGTH	WEAKNESS
climate adaptation flexibility housing diversity land expand	*insufficient volume legally bound public and privacy*
OPPORTUNITIES	**THREATS**
developable space reform in legislation self-sufficiency living quality	*political support market appeal living tradition non-profitable*

Table 3. SWOT analysis of the practices of floating housing in Sweden

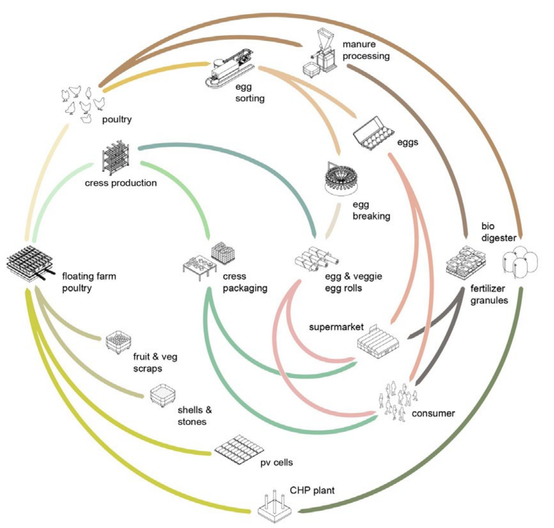


Fig. 11. Concept of circular agriculture principle (© Goldsmith, 2019)

Fig. 12. Sharing workshop (© McCormick & Charlotte, 2021)

Fig. 13. Sharing farming (© Svenska institutet)

vertical farming technologies to address challenges such as limited urban space, water scarcity, and climate change. Floating agriculture typically uses hydroponics and other soil-free farming techniques to reduce water usage and increase crop yield, while also incorporating circular agriculture principles. It can utilize food waste to feed animals and convert livestock manure into fertilizer or energy, promoting sustainable development.

An example is the Floating Farm in Rotterdam, operational since 2019, which produces dairy and grows vegetables using vertical farming systems. It feeds cows with local food waste and processes manure into pellets for sale, promoting urban circular agriculture. (Kang, 2024)

However, while the Floating Farm presents new ideas for urban food security, it faces high costs, technical dependencies, and long-term uncertainties related to urban planning and land use. Despite these challenges, floating agriculture holds significant potential in addressing climate change, promoting food self-sufficiency, and reducing food transportation costs. As technology advances and policies evolve, floating agriculture could become a key future direction for urban farming. (Dickinson, 2024)

SHARING COMMUNITY IN SWEDEN

Sharing communities have become an important solution to issues such as resource scarcity, environmental sustainability, and social isolation in modern society. In 2017, Sweden launched a 4-year national program to explore models of the sharing economy in Swedish cities. The practices of Sharing Cities Sweden included the implementation of sharing community in the Solberga in Stockholm. The activities include providing workshop facilities to support residents in woodworking, textile, and metalworking, and sharing handicraft knowledge through workshops; supporting residents in small-scale farming activities, starting from indoor planting and planting boxes to gradually expanding into outdoor cultivation, with growing interest and commitment over time, while harvest parties encourage residents to share; at the same time, the sharing of public and commercial spaces was explored, promoting the community to try various temporary activities, such as theater, workshops, indoor gardens, and cafes in the square. (De Jong & Fjellande, 2022)

MICRO-RESIDENTIAL

Private minimal / Shared maximal As urban facilities and service resources become more abundant, residential needs and lifestyles are undergoing transformation. In Sweden, nearly half of all households consist of single occupants—the highest proportion in the EU (Eurostat, 2022) —while rental prices are rising rapidly. These factors have driven the development of micro-residential strategies. Rather than merely reducing private living space, these strategies ensure appropriate living standards by optimizing shared facilities to compensate for spatial limitations while utilizing compact and efficient design to improve space utilization. Unlike earlier micro-living spaces, which had to accommodate various functions like living, dining, and entertainment within small interiors, leading to passive sharing, the new shared floating community implements an active sharing model through design strategies. Non-core living functions are simplified and transformed into contributions to the community's shared spaces. (Shu, 2024)

REFLECTION

Floating housing, floating agriculture, and shared communities are complementary solutions to address climate change, land scarcity, and resource shortages. Floating housing offers a response to rising water levels, but faces technological, legal, and cultural challenges in Sweden. Floating agriculture expands urban food production but struggles with cost and integration, while shared communities enhance resource sharing and social cohesion. However, the ideal vision of floating communities remains unachievable due to practical limitations.

The focus is on finding a delicate balance — idealism and reality, stability and flexibility, privacy and collectivity, and technology and social needs in design is complex. Future design should focus on overcoming these challenges and finding a viable path to creating sustainable and resilient floating communities.

Fig. 14. Sharing cultivation in Solberga (© De Jong & Fjellande, 2022)

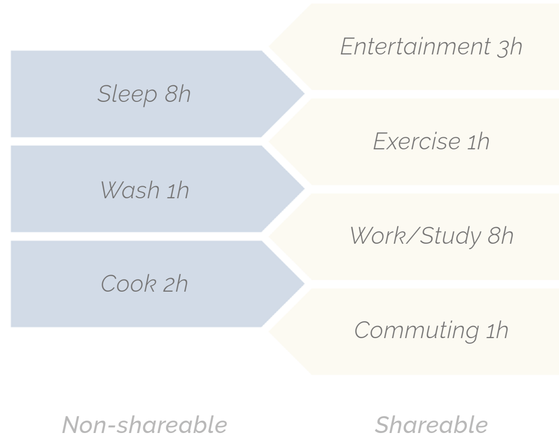


Fig. 15. More activities can be carried out in shared spaces in a daily life.

Case Study

SCHOONSCHIP | NETHERLANDS
SPACE&MATTER | 2008

This renowned neighbourhood was initiated and developed by a group of enthusiasts with a shared dream: to build a sustainable, close-knit community on the water. It consists of 30 water plots and is home to more than 100 residents. all 46 houses are unique since each household designed their own house with an architect of their choosing. Community members share nearly everything, including bikes, cars, and food bought from local farmers. Each building runs its own heat pump and devotes roughly a third of its roof to greenery and solar panels.

LAND ON WATER | DENMARK
MAST | 2003

MAST's Land on Water system offers a flexible approach to floating construction that can adapt to various uses, from homes to parks. Made of modular, recycled plastic containers that can be filled with locally sourced floatation materials like old fishing buoys, it promotes sustainability by reusing waste. Unlike traditional steel or concrete floats, these modules encourage biodiversity, providing habitats for marine life within their structures, supporting ecosystems while offering a sustainable alternative for building on water.

Fig. 16. Schoonschip (© Alan Jensen)

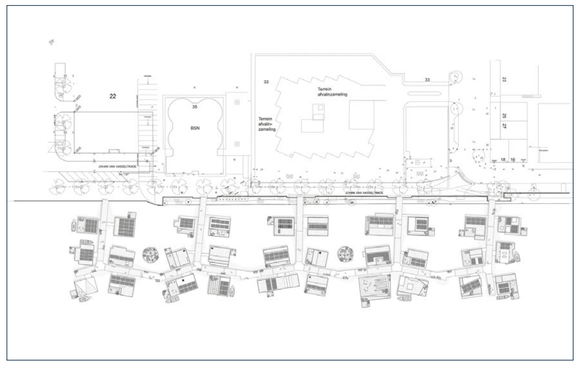


Fig. 17. Plan of Schoonschip (© Space&Matter, 2021)

URBAN RIGGER | DENMARK
BIG | 2016

A floating student housing project in Copenhagen's harbor, using stacked shipping containers to create low-cost, flood-resistant residences. Consisting of 9 containers the design forms a shared central garden, addressing the need for affordable housing in city centers. Urban Rigger demonstrates the potential of shipping containers as stackable, adaptable structures for cost-effective housing solutions, hinting at future possibilities like container skyscrapers to combat housing shortages.

LYNETTEHOLMEN | DENMARK
MAST | 2024

A vision that expands Copenhagen. With the outermost rock reef set to be completed in 2026, off-site prefabricated floating buildings can be developed, saving costs associated with traditional land reclamation. These structures reduce CO2 emissions and land disturbance while allowing natural currents and habitats to thrive beneath them, enhancing community life and recreational access to the water. Moreover, These structures also provide climate adaptability, acting as protective barriers against storm surges caused by climate change.

FLOATING FARM | NETHERLANDS
GOLDSMITH | 2019

The first floating farm fully demonstrates its advantages in establishing a localized food supply chain, addressing land shortage, and enhancing public education. All outputs from the farm follow the principles of circularity. Solar energy and rainwater are collected to support the cows. The cows' feed comes from urban waste. At the same time, the waste produced by the cows is also integrated into the circular system. Manure is collected, processed, and sold as fertilizer to nourish urban parks and plants.

R-URBAN | FRANCE
ATELIER D'ARCHITECTURE AUTOGÉRÉE | 2014

R-Urban is a bottom-up urban resilience strategy that aims to strengthen local sustainability by establishing a network of citizen-operated facilities. The project includes three pilot units:

Fig. 18. Practices of Land on Water (© Mast, 2019)

Fig. 19. Land on Water modularity (© Mast, 2019)

Fig. 20. Urban Rigger (© Laurent de Carniere)

Fig. 21. Floating Lynetteholmen (© MAST, 2024)

Fig. 22. Floating Farm (© Ruben Dario Kleimeer)

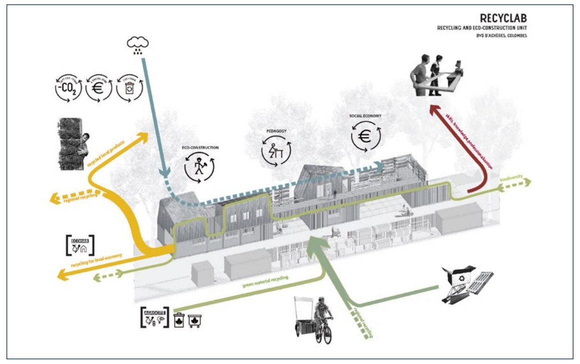


Fig. 23. "R-Urban": Network of Urban Commons (© AAA, 2014)

Fig. 24. The welcoming, human-scale pavillion of the AgroCite (© AAA, 2014)

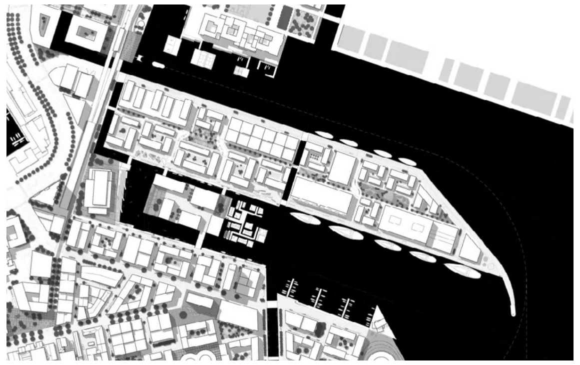


Fig. 25. Nordhavn plan diagram (© Cobe, 2014)

AgroCite – An urban agriculture hub featuring community gardens, experimental farms, and sustainable resource management facilities.

RecyLab – A green construction and recycling center focused on waste recovery and the production of eco-friendly building materials.

ECoHab – As an experimental project, its construction will involve self-building and on-site workshops, integrating shared spaces, water recycling, urban farming, and renewable energy.

NORDHAVN | DENMARK
COBE | 2008

The Nordhavn Project in Copenhagen is a large-scale urban development located in a former industrial harbor area, The first phase of the Inner Area plan divides buildings into smaller units, creating intimate urban spaces with close proximity to the water. This design not only fosters community interaction and engagement but also enhances livability and vibrancy through detailed street layouts and waterfront spaces. The transformation from the broader vision to specific design details ensures flexibility while meeting future development needs.

IJBURG | NETHERLANDS
MARLIES ROHMER | 2011

As the largest floating community in Europe. To highlight the water as a key feature and achieve high density, the floating houses are placed along jetties. The piers have public walkways, with a one-meter-wide water gap between each house and the jetty. The houses are connected to the jetties via movable gangways to accommodate water level changes. Each house is anchored by two diagonally positioned mooring poles for stability, with a sliding connection allowing vertical movement.

SPLAV IN BELGRADE | SERBIA

Belgrade's floating venues, known as splavs, are a key part of the city's nightlife and leisure culture. The term now refers to the numerous floating restaurants, bars, and clubs along the Sava and Danube rivers. Famous for their lively atmosphere, many splavs can accommodate hundreds of guests and remain open throughout the week. (Flohom, 2023)

KAMPUNG AYER | BRUNEI

Known as the "Venice of the East," Kampung Ayer is a historic stilt village in Bandar Seri Begawan. It blends traditional Malay water-based living with modern elements, featuring homes, schools, and mosques. While originally built with natural materials, parts have been modernized with government-constructed housing, balancing heritage and contemporary needs.

UROS | PERU

The Uros are a group of artificial floating islands on Lake Titicaca, built from totora reeds by the descendants of the Aymara people. These islands require constant maintenance as the reeds decay over time. Traditionally, residents relied on fishing and crafts, but tourism has become main source of income.

REFLECTION

These reference projects illustrate a broad range of approaches to floating living. Several shared qualities will inform the proposal:

Community-based development – (Schoonschip, R-Urban) These projects show that participatory, co-developed environments can enhance social cohesion and collective resilience. In the proposal, participatory planning is a core principle: residents are co-creators, involved in shaping shared spaces, defining communal functions, and contributing to the community's spatial identity.

Modularity and prefabrication – (Urban Rigger, Land on Water) The proposal adopts modular, prefabricated systems to enhance flexibility and scalability. Floating homes can be fully constructed and finished off-site before being transported to their final location.

Water-responsive spatial strategies – (Nordhavn) The proposal integrates architecture with water, balancing built and unbuilt space. Water is treated as both boundary and extension, enabling interaction and adaptability. The design responds to water's rhythms, supporting future growth and engagement with the natural environment.

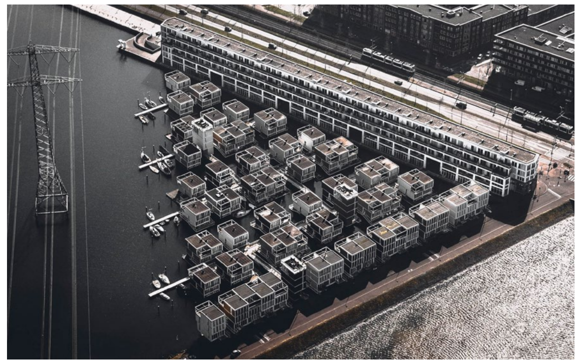


Fig. 26. The largest floating district in Europe (© Architectenbureau Marlies Rohmer, 2011)

Fig. 27. Houses are linked together in groups of 2 to 3 units (© Architectenbureau Marlies Rohmer, 2011)

Fig. 28. Traditional Malay house on water

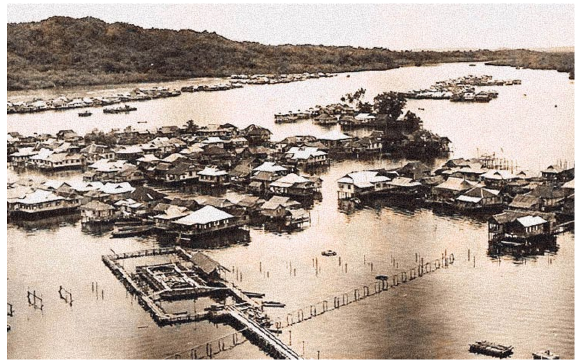
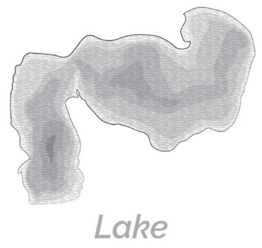


Fig. 29. Kampung Ayer in 1950s (© Blogspot)

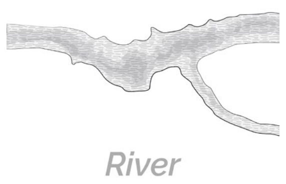
Typological Study

In this study, floating community cases are categorized based on several factors, including Location, Scale, Context, Type, Layout, and Public Access. The analysis emphasizes that the context—specifically the site conditions and hydrological environment—plays a critical role in shaping the community's layout, pattern, common space and entrance/exit design. Different environments bring unique opportunities and challenges, and thus, the design must adapt to the specific characteristics of the aquatic environment, such as water flow, space, and accessibility. By considering factors like the community's target users and intended functions, we can determine the most suitable design choices that align with both environmental conditions and the community's goals. This ensures that each floating community can thrive while responding effectively to its specific surroundings. To support this analysis, eight of the most representative and mature floating community cases, located in the Netherlands, Denmark, and the United States, have been selected.

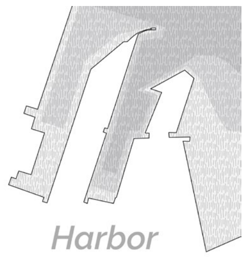
AQUATIC ENVIRONMENT



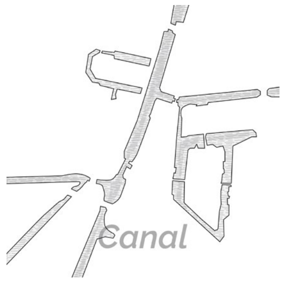
Lake
Strength: *calm water conditions provide stablity.*
Weakness: *often remote from city.*
Opportunity: *leisure and vacation communities communities.*
Threat: *seasonal water level changes and fluctuations.*



River
Strength: *easy access to urban infrastructure.*
Weakness: *limited stability.*
Opportunity: *transportation-based communities.*
Threat: *flooding risks and water level changes.*

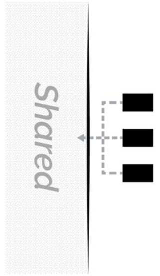


Harbor
Strength: *sheltered and calm waters*
Weakness: *conflict with busy industrial or commercial water traffic.*
Opportunity: *larger-scale communities.*
Threat: *limited infrastructure for residential use.*

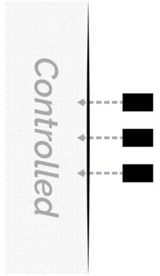


Canal
Strength: *controlled water levels provide stability.*
Weakness: *narrow channels limit space for expansion.*
Opportunity: *small, independent communities.*
Threat: *water pollution and limited growth due to space restrictions.*

PUBLIC ACCESS

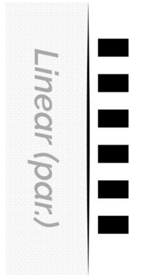


Shared Entrance
Pros: *open, low cost, promotes interaction and collaboration*
Cons: *less privacy and security*
Suitable for: *Larger, cost-effective communities near urban areas, ideal for renters, students, and young people seeking social interaction over privacy.*

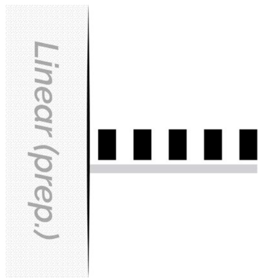


Controlled Entrance
Pros: *higher security, better privacy*
Cons: *less flexibility, higher cost, reduced community interaction*
Suitable for: *communities that prioritize privacy and security, ideal for families, professionals or vacation/leisure-oriented destinations.*

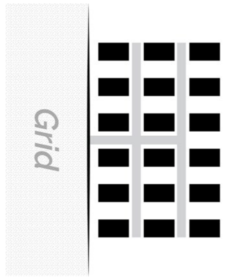
LAYOUT



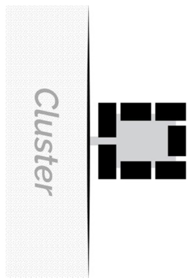
Linear (Parallel) Layout
Site: *coastlines, rivers, lakes, canals.*
Benefits: *individual waterfront space with privacy, scenic views.*
Suitable: *privacy-focused (families, professionals, vacationers).*
Weaknesses: *limit public access and common space, restricted further expansion.*



Linear (Perpendicular) Layout
Site: *coastlines, harbors, lakes.*
Benefits: *more public waterfront access, easy for docking, can base on existing marina to save costs.*
Suitable: *vacation communities need boat, or shared community.*
Weaknesses: *Limited privacy and common spaces.*

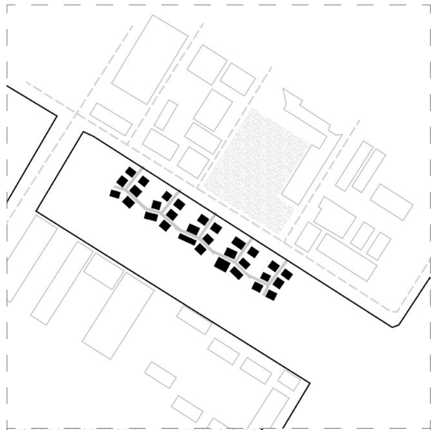


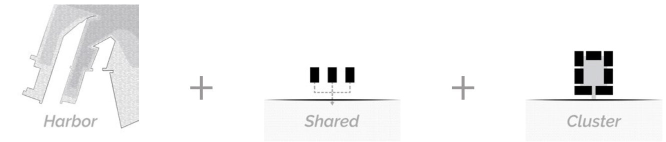
Grid Layout
Site: *coastlines, harbors, lakes.*
Benefits: *efficiency and organized infrastructure, easy to expand.*
Suitable: *mixed-use and large-scale communities.*
Weaknesses:*lack of privacy, overly structured, difficult to blend with natural surroundings.*



Cluster Layout
Site: *harbors, lakes.*
Benefits: *enhances interaction, common spaces for shared use.*
Suitable: *student, rental, co-living, or shared housing community.*
Weaknesses: *lack of connectivity between clusters, limited private space.*

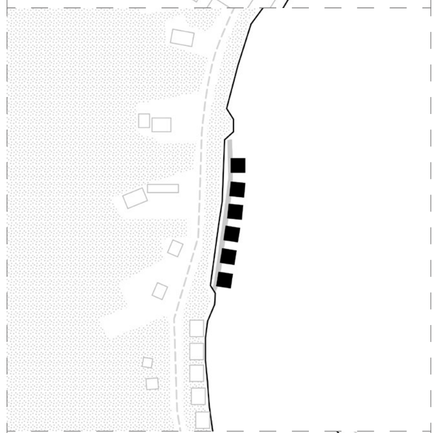
Typological Study Global

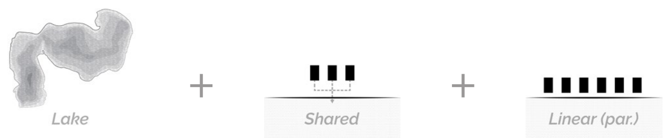




SCHOONSCHIP, NL

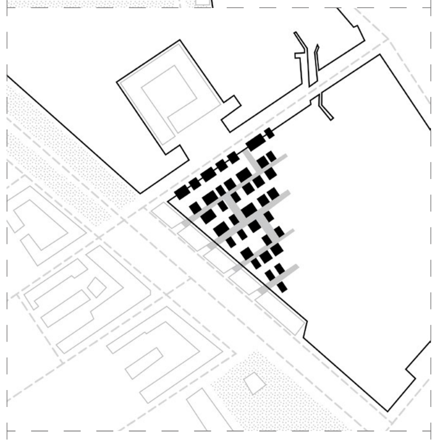
A floating residential community with 46 homes on 30 water plots, designed for a group of residents aiming for a sustainable and spontaneous lifestyle.

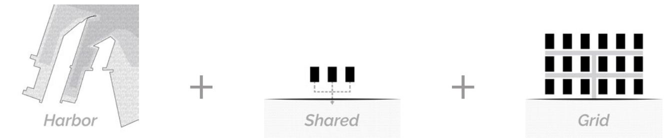




MAASBOMMEL, NL

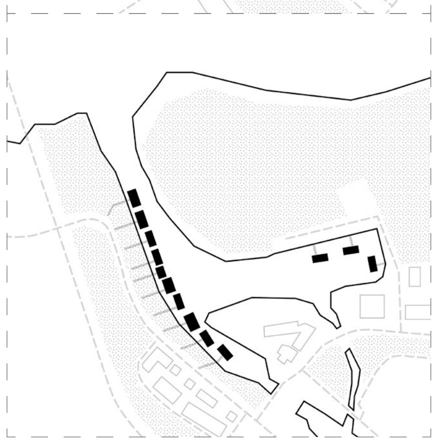
The first project in the Netherlands that incorporated amphibious housing and floating housing.

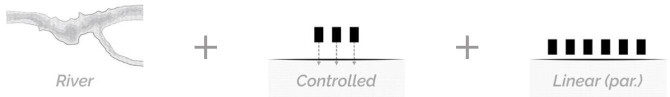




IJBURG, NL

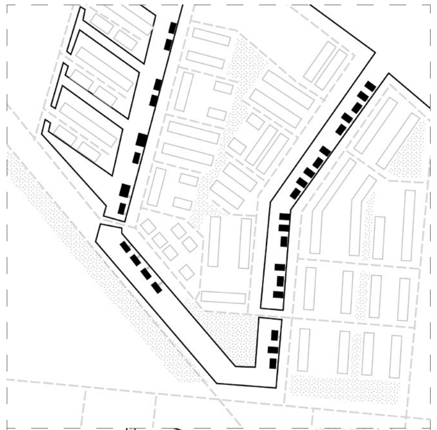
A large residential district development in eastern Amsterdam that includes floating homes as part of its waterfront development.

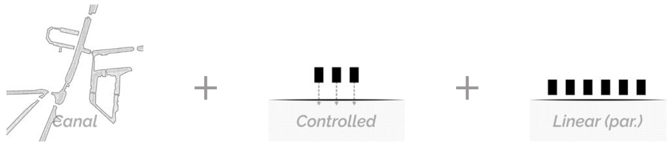




NIJMEGEN, NL

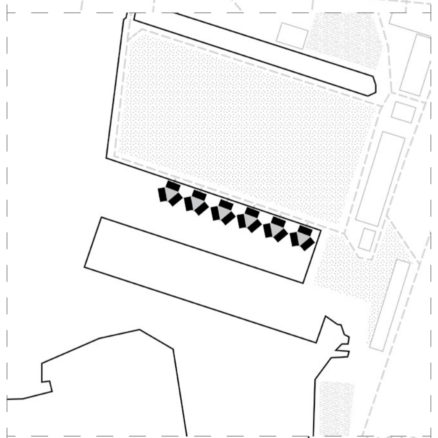
Nijmegen is located along the Waal River and has introduced floating homes to mitigate risks from fluctuating water levels and flooding.

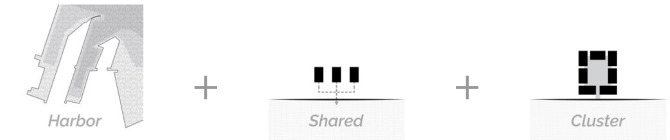




TERWIJDE, NL

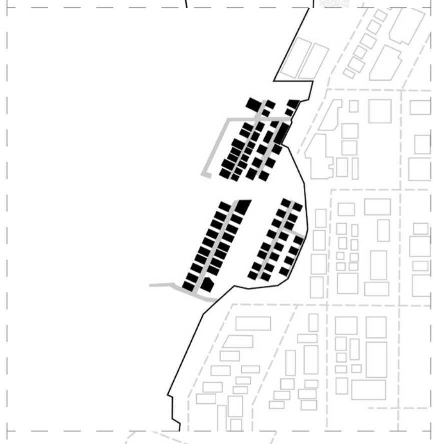
A residential area in Utrecht featuring floating homes integrated into the neighborhood's waterways.

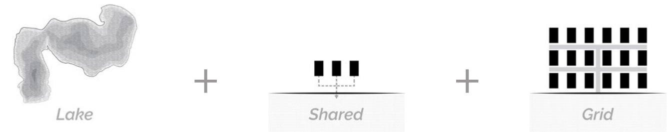




URBAN RIGGER, DK

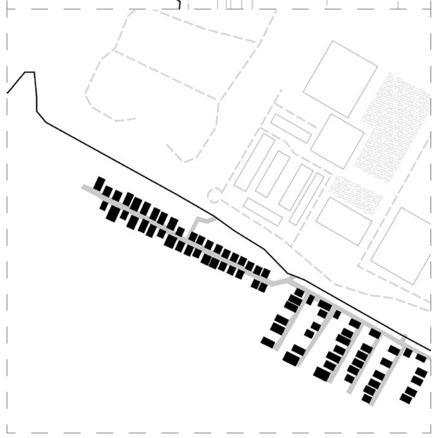
A floating student housing project in Copenhagen, made from repurposed shipping containers.

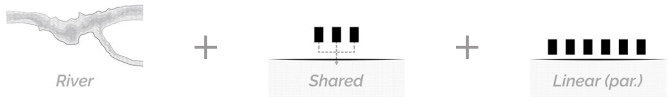




LAKE UNION, US

A floating home community in Seattle with a long history of waterfront living, where houseboats and floating residences have been a part of the area for decades.

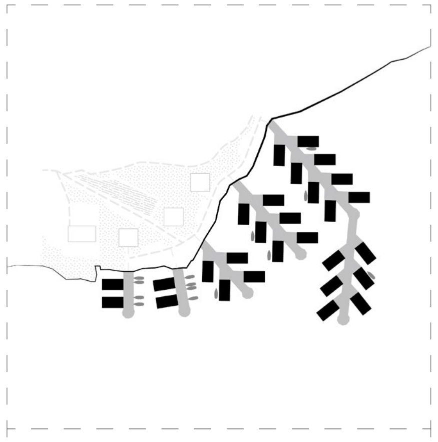


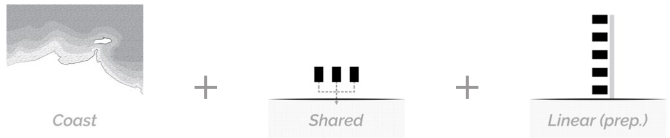


HAYDEN ISLAND, US

A residential area on the Columbia River with a long-established floating home community.

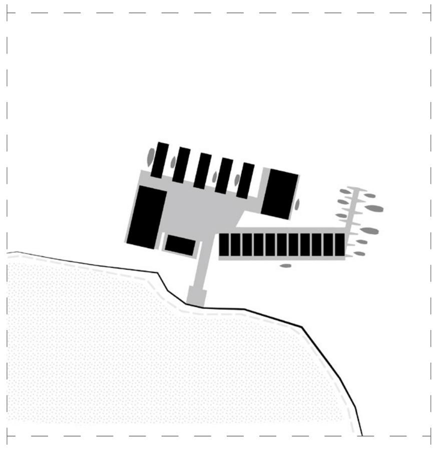
Typological Study Sweden

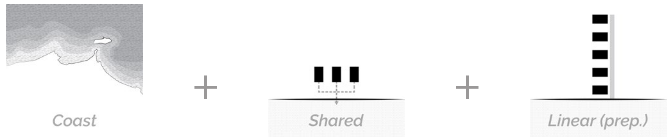




AQUAVILLA*

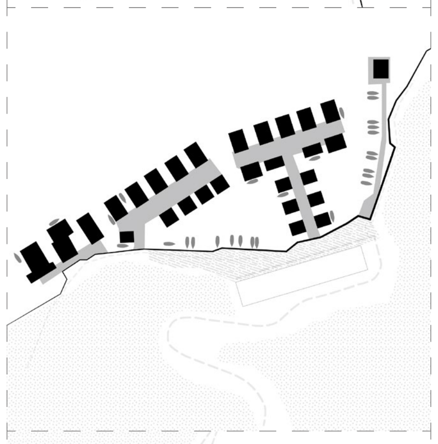
AquaVilla combines prefabricated floating houses and floating piers to create a modular, adaptive, and sustainable waterfront community.

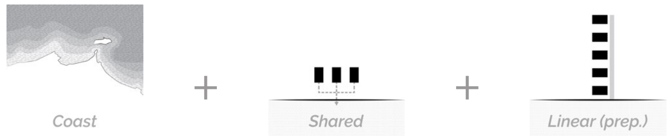




SÖDRA KAJEN*, SUNDSVALL

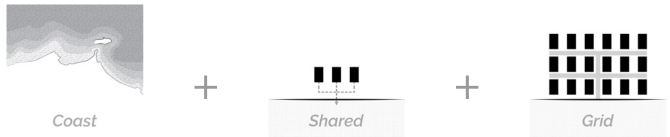
Designed by IMORGON Innovation, the floating quarter in Sundsvall will feature 25 homes and apartments along Södrakajen, got approved in 2022.





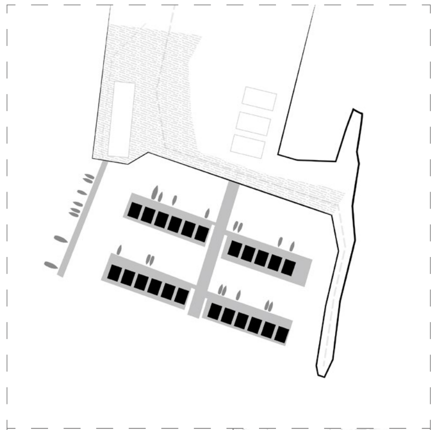
MARINSTADEN NACKA, STOCKHOLM

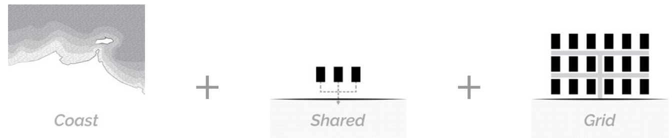
Originally planned with 65 homes, the project was taken over by AquaVilla after the developer's bankruptcy, and they are now constructing 14 new "Sjövillor" designed for long-term use.



PAMPAS MARINA, SOLNA

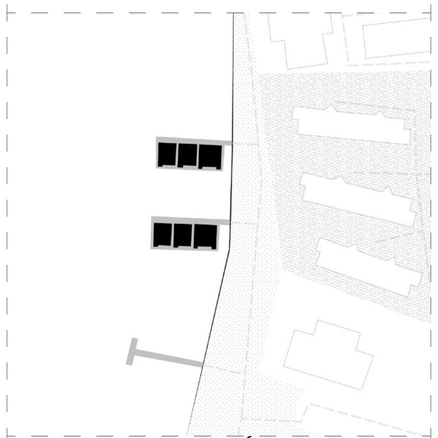
The first in Sweden to offer permanent floating homes with legal registration, featuring 25 floating villas developed by AquaVilla in 2002.

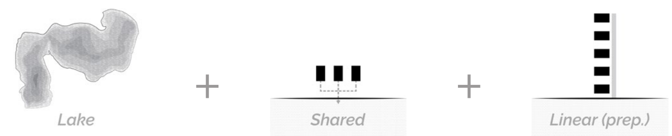




SUNNANÅ HAMN, MELLERUD

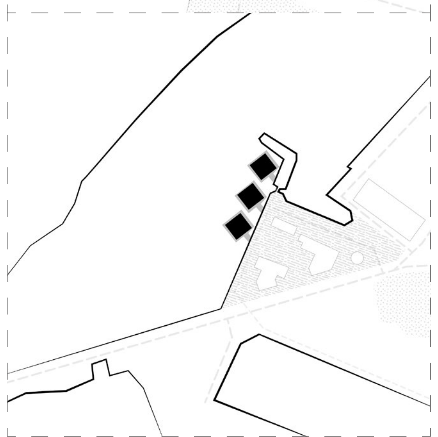
In the 1990s, the idea of creating attractive waterfront housing led to the development of Sjöbodarna, with a plan in 2004 that included 48 floating sheds, developed by Frykvalla Förvaltning AB.

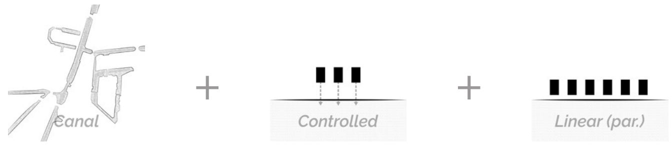




SJÖGÅNGEN, KARLSTAD

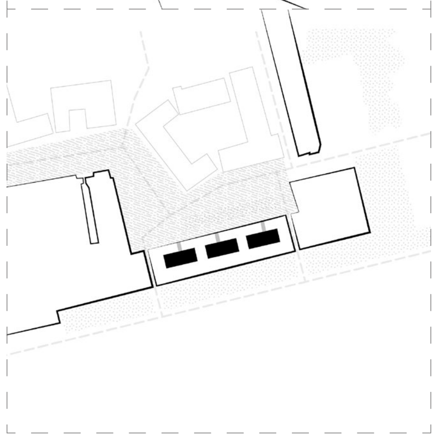
Sjögången is a floating rental housing project in Karlstad, initiated by the public housing company KBAB after the 2000 Glafsfjorden flood. It is the only publicly driven Swedish initiative explicitly addressing climate risk.

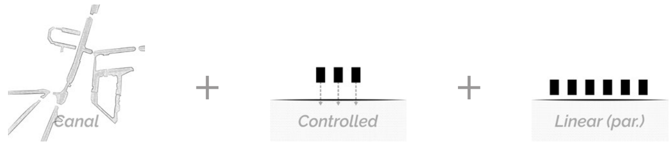




SJÖVILLAN, KALMAR

Three floating villas in Kalmar offers luxurious living with 178 square meters of space, two stories, sauna, a large rooftop terrace, and a private boat dock, all with stunning water views.

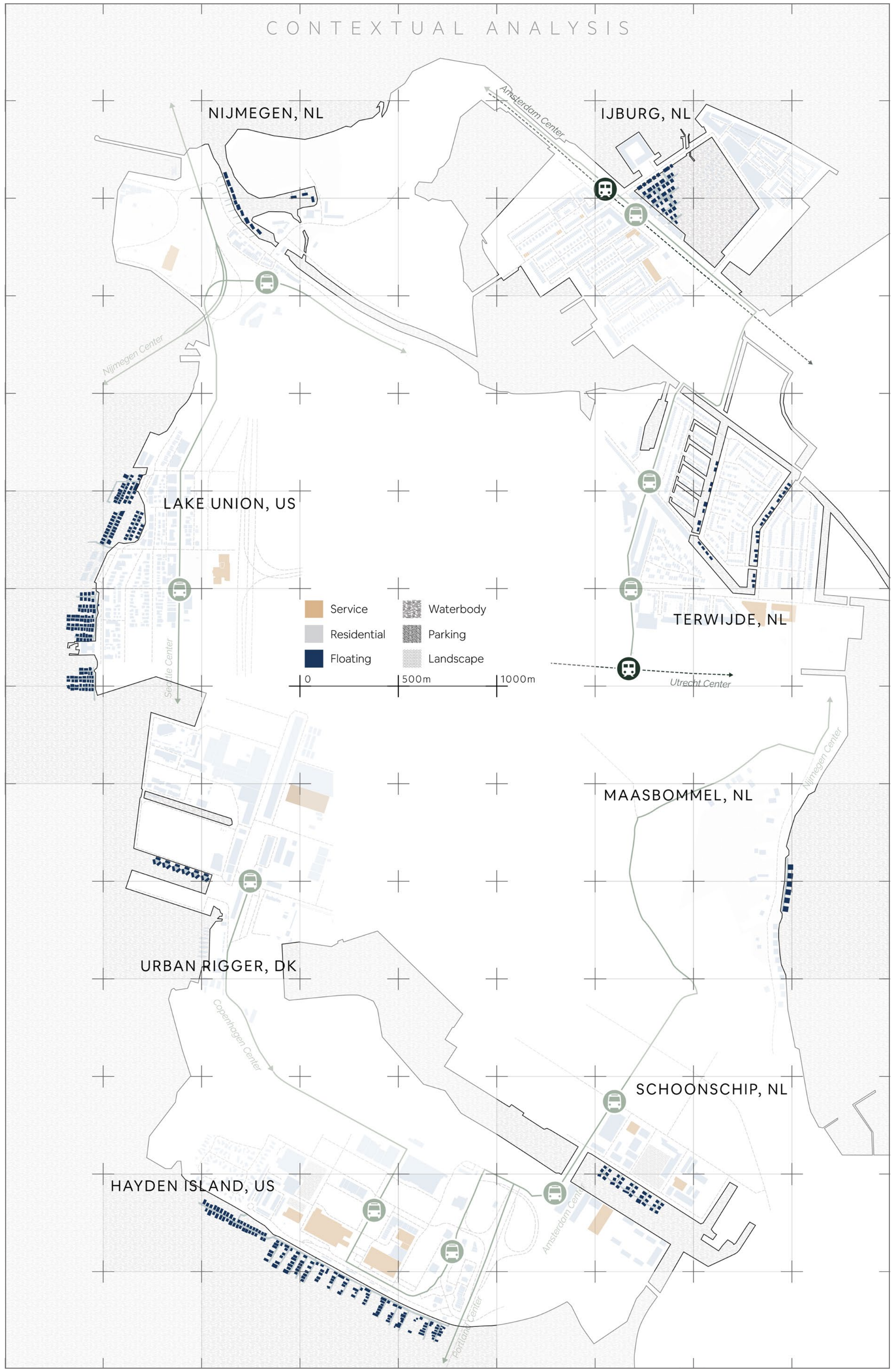




VÄSTRA HAMNEN, MALMÖ

The "Serenissima" houseboat in Västra Hamnen features a bohemian design with a tranquil atmosphere, offering sea views, a spacious deck, and cozy interiors.

*All project names with * are planned but not yet built.*



Typological Analysis

REFLECTION ON TECHNICAL SOLUTION

Across existing floating communities, concrete pontoons paired with pile mooring are the most common solution—suitable for calm waters like lakes, rivers, and sheltered harbors, with relatively simple hydrological conditions. These systems provide stable support for permanent residences and allow for modular prefabrication and easy on-site assembly. In contrast, more complex environments like oceans or coastlines require robust systems such as truss mooring. Spread mooring, however, while low-cost, offers limited stability and is generally suited for temporary or small-scale floating uses.

REFLECTION ON TYPOLOGY

The typological comparison shows that there is no one-size-fits-all model for floating communities. Instead, each case is shaped by its specific context—target users, urban conditions, and community goals. The design logic reflects a response to local needs and environmental constraints.

For harbor-based, medium-scale developments, a collective, clustered model proves particularly relevant. The clustered row house typology supports modular growth, flexible organization, and scalable infrastructure. The study reinforces the importance of context-responsive and goal-oriented design.

COMMUNITY	MOORING	CONSTRUCTION
Schoonschip	*Pile + Spread mooring system*	*Concrete caissons*
Ijburg	*Pile mooring system*	*Concrete caissons*
Nijmegen	*Pile mooring system*	*Concrete caissons*
Maasbommel	*Pile mooring system*	*Concrete pontoons*
Terwijde	*Pile mooring system*	*Concrete pontoons*
Urban Rigger	*Pile + Spread mooring system*	*Concrete pontoons*
Lake Union	*Pile mooring system*	*Concrete pontoons*
Hayden Island	*Pile mooring system*	*Concrete pontoons*

Table 5. Construction Solutions Categorization of Typical Floating Communities in Europe and America

COMMUNITY	LOCATION	SCALE	CONTEXT	TYPE	LAYOUT	ACCESS
Schoonschip	*NL*	*Medium (30+)*	*Harbor*	*Collective*	*Cluster*	*Shared*
Ijburg	*NL*	*Large (100+)*	*Lagoon*	*Collective*	*Grid*	*Shared*
Nijmegen	*NL*	*Small (10-20)*	*River*	*Independent*	*Linear (Parallel)*	*Controlled*
Maasbommel	*NL*	*Small (10-20)*	*River*	*Independent*	*Linear (Parallel)*	*Shared*
Terwijde	*NL*	*Medium (30+)*	*Canal*	*Independent*	*Linear (Parallel)*	*Controlled*
Urban Rigger	*DK*	*Medium (20+)*	*Harbor*	*Collective*	*Cluster*	*Shared*
Lake Union	*US*	*Large (100+)*	*Lake*	*Independent*	*Grid*	*Shared*
Hayden Island	*US*	*Medium (30+)*	*River*	*Independent*	*Linear (Perp.)*	*Shared*

Table 6. Categorization of Typical Floating Communities in Europe and America

CONTEXT

CONTEXT

Site

Frihamnen, located on the northern bank of the Göta River on Hisingen, extends from the Hisingsbron bridge to Lindholmen. As part of the larger Älvstaden development project, Frihamnen plays a key role in reshaping the future relationship between Gothenburg and the water. The vision for Frihamnen is to transform the area into an extension of the city center, aiming to create a variety of housing options, meeting places, and better connections.

The vision for Frihamnen is to develop the area into an extension of the city center. We aim to create a variety of housing options and meeting places. With the new Hisingsbron bridge and ferries Frihamnen will connect the city. (Göteborgs Stad)

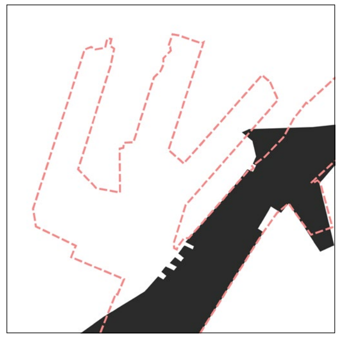
The industrial character of Frihamnen is fading, and the traces of its previous uses, along with vast undefined spaces, make the area highly potential as a showcase for an inclusive future urban life. The heritage of the industrial harbor consists of a series of massive buildings, man-made spaces, and a fragile balance between concrete and water. Transforming the harbor basin into a hub for cultural and civic life, or as an experimental floating housing testing ground, or achieving a delicate balance between the two, will prompt us to rethink new areas of use and types of experiences. The development plans of this area include a variety of housing options, businesses, and a new park by the water. In the future, around 17,000 people are expected to live here, with an equal number working there.

Another crucial issue for the future Frihamnen urban life is the three wide harbor basins. Earlier in the planning, it was assumed that these basins would remain and that buildings would be placed on the piers. However, building over parts of the basins would create far better conditions for connecting city streets. Without these streets, there is a risk that city life will not extend onto the piers. (Göteborgs-Posten)

Based on the vision for the future development of the Frihamnen area, particularly the three harbor basins, and in alignment with Gothenburg's broader developing goals, the thesis will focus on exploring the potential of floating communities which could play a key role in transforming the harbor basins while re-establishing a new connection between the piers. During the rehabilitation of the old harbor area, this approach could help patch the gaps in the future urban fabric and frameworks. In line with the vision for Frihamnen's development, this could truly extend urban life into the pier area.

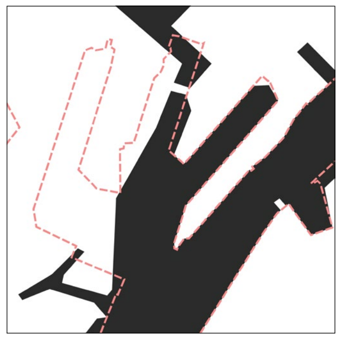
Fig. 30. Historical Plan of Frihamnen in 1820, 1860, 1890, 1921 (© SWECO).

Historical Transformation



1910

Fig. 31. Frihamnen from Kvarnberget, ca. 1920 (Photo From Göteborg 1860-1950)



1920

Since the establishment of Gothenburg, the port, shipyards, and shipbuilding industry have primarily been concentrated in the Masthugget and Majorna areas. In the early 19th century, after the city's defensive fortifications were demolished, Gothenburg gained new opportunities to expand its port.

With the opening of the first Hisingsbron bridge in 1874, the Lundbyvassen area was prioritized for development, and the canal and port at the mouth of Kvillebäcken began construction to serve new industries on Hisingen. Dock facilities were also built along the Göta River, with Gullbergskajen completed in 1872.

In 1897, Gothenburg initiated a study for a new deep-water port, which included a free port. The winning design in the 1903 competition proposed widening the river channel and constructing larger harbor basins. In 1906, Gothenburg incorporated the entire Lundby parish into the city, which brought new opportunities for social planning and construction on Hisingen. At the same time, the concept of a new port facility, the Centralhamn, began to take shape.

The Frihamnen began in 1914. However, the progress was slow due to the WWI, which caused costs to rise. It wasn't until August 31, 1922, that the port was inaugurated by Crown Prince Gustaf Adolf. The port reached a depth of 9m, equipped with warehouses, and railway tracks were laid on both sides of the dock. Gothenburg's city shipyard was also established here.

In the 1940s, the port underwent modernization to accommodate larger vessels. In the 1930s, Frihamnen built modern, efficient port warehouses and began receiving banana ships and other freighters. A new dock was added in the new port basin.

In the 1960s, Gothenburg planned a large-scale expansion of the harbor. A new port basin, Lundbyhamnen, was excavated to the north of Frihamnen and completed in 1951, with further expansion in 1960. During this period, Frihamnen and Lundbyhamnen were extremely busy with traffic.

In the 1980s, the shipbuilding crisis led to the idea of redeveloping the old shipbuilding and harbor areas into new urban areas. Frihamnen remained an active port until 2000, when the banana import business was terminated, marking the end of a legendary port operation. With Sweden's entry into the European Union in 1994, the free port function was gradually phased out.

In the 2000s, planning work for the "Centrala Älvstaden" vision began, with the Frihamnen area included as a central part of the plan. Large and unconventional cultural events were held in former industrial areas.

CONCLUSION

By drawing on the historical development of Frihamnen, the floating housing project can seamlessly integrate into the area's urban transformation process. As part of Gothenburg's transition from an industrial port to a livable urban area, floating housing not only preserves the openness and adaptability of the waterfront space but also responds to the modern city's demand for sustainable living, becoming an innovative practice of water-based living.

Fig. 32. Frihamnen in 1935 (© G. AB Flygtrafik Bengtsfors)

1940

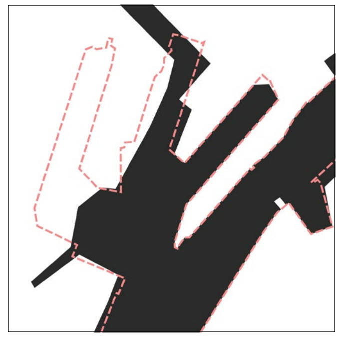


Fig. 33. Frihamnen in 2016 (© Göteborg stad)

1960

Harbor Basin

Current State

What's happening?

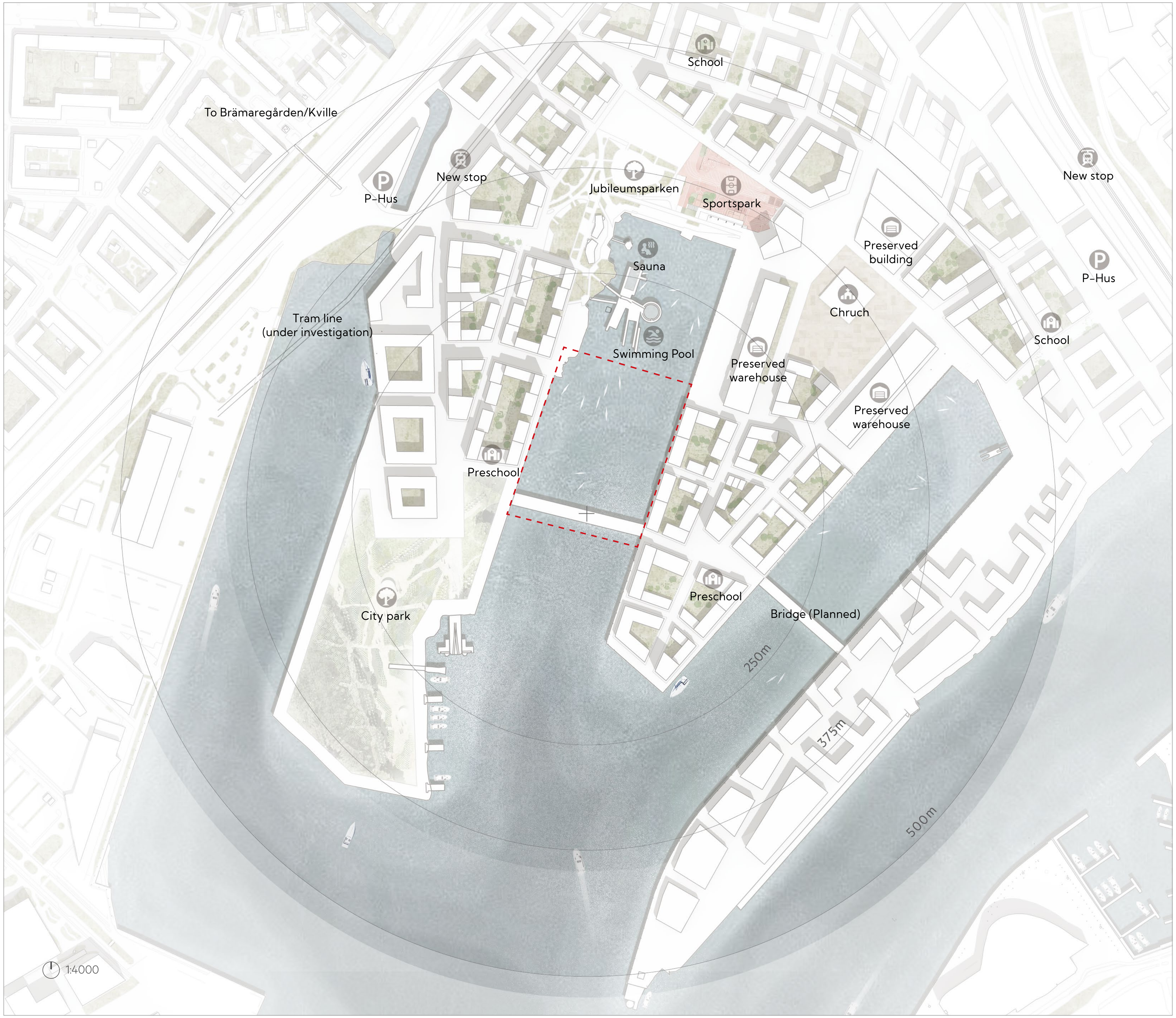
The "Detailed Plan for Frihamnen Phase 1," published by Gothenburg in 2016, aims to transform the harbor area into a multifunctional and mixed-use urban space.

MIXED-USE

The plan emphasizes the principle of "mixed use," ensuring that functions such as residential, commercial, office, and cultural facilities, are concentrated within the area. From low-rise to high-rise buildings, from affordable rental apartments to expensive apartments, and from free activities to commercial, parks, green spaces, and courtyards will be shared for schools, housing, and rainwater management.

URBAN SCALE

The urban scale focuses on the flexibility. From "compact" to "open" spatial layouts, the design of Frihamnen maintains functional density while providing flexible changes in spatial scale. Lower buildings are typically constructed along the piers, gradually increasing in height toward the northeast to create better microclimate conditions. Higher and denser buildings will be constructed along public transport corridors to ensure the comfort of public spaces and residential areas.



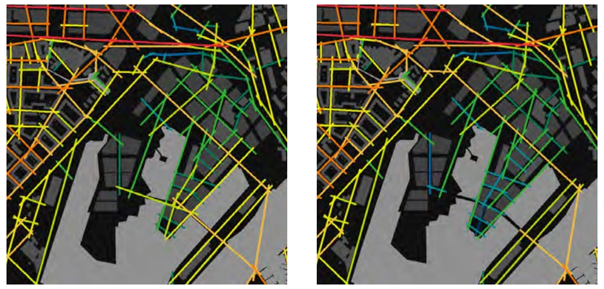


Fig. 34. Accessibility prediction with the proposed bridge in the Frihamnen basin (© Spacescape, 2015)

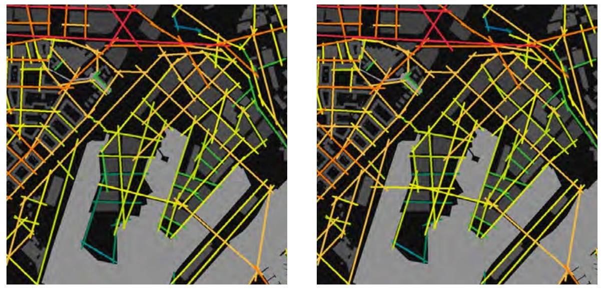


Fig. 35. Accessibility prediction with the proposed bridge in the Lunbyhamnen basin (© Spacescape, 2015)

Transportation & Urban Structure

Currently, Frihamnen is spatially isolated from the city due to the presence of harbor facilities and the basins, unclear pedestrian and bicycle paths, and the three long piers without connecting bridges.

URBAN STRUCTURE

According to the urban structure analysis of Frihamnen proposed by Spacescape in 2015, it is evident that building connecting bridges over the harbor basins, particularly two links between Bananpiren, Norra Frihamnspiren, and Kvillepiren, is crucial for internal traffic connectivity within Frihamnen (Figure 27). In contrast, the bridge over Lundbyhamnen does not significantly impact traffic within Frihamnen or its adjacent areas (Figure 28).

Based on the above analysis, integrating the floating community with bridges connecting the piers would not only enhance the overall accessibility of the harbor area but also better concentrate foot traffic around the basins. This aligns with the urban planning vision of creating a public waterfront area while strengthening the sense and memory of the harbor.

TRANSPORTATION

In terms of transportation design, Frihamnen prioritizes the integration of shared transportation systems, particularly low-carbon options such as electric/shared bicycles and shared cars. The urban street design will be optimized to prioritize walking and cycling. The transportation network will ensure that residents can easily access both public transport and cycling facilities.

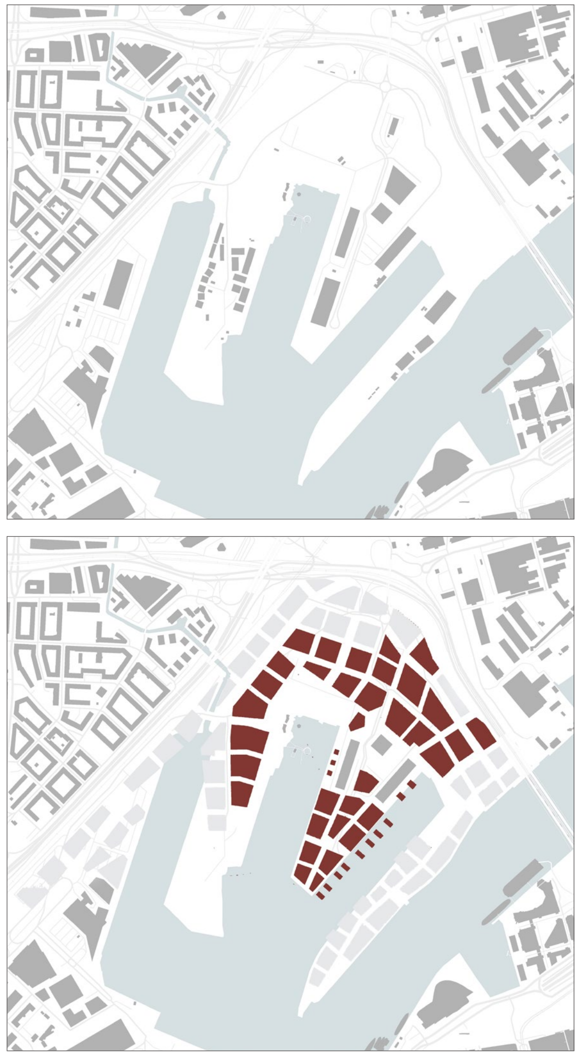


Fig. 36. Current urban structure (top) and planned future urban structure (bottom)

For cycling, dedicated cycling paths and bike-sharing stations will be incorporated into the design, encouraging a sustainable and healthy mode of transportation. The goal is to make cycling a convenient and accessible option for residents and visitors alike.

For public transportation, hubs will be strategically located at key transportation nodes within the area. The objective is for residents and businesses to be within 200 meters of public transportation services, equivalent to a 2-minute walk. This high accessibility to efficient public transport will reduce the reliance on private car ownership, which is expected to remain low in the area.

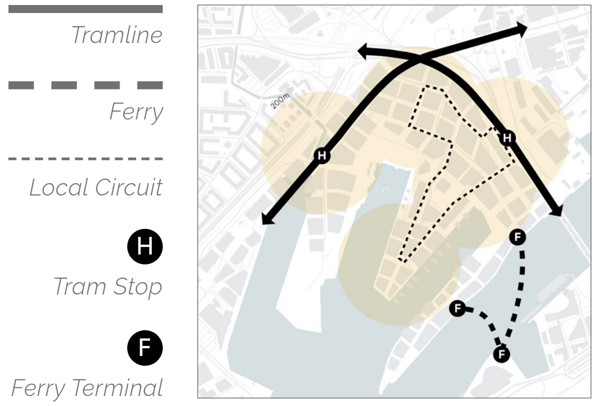


Fig. 37. Public transportation

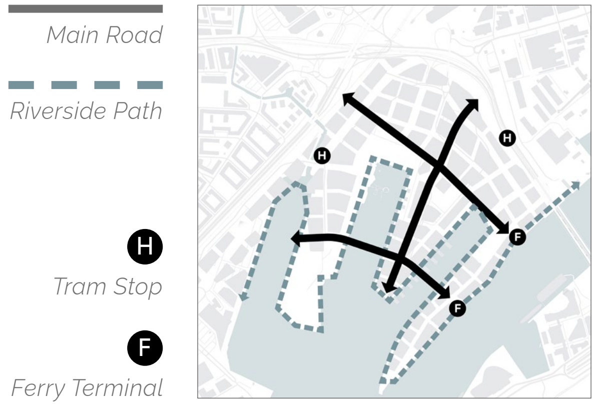


Fig. 38. Main street and Riverside

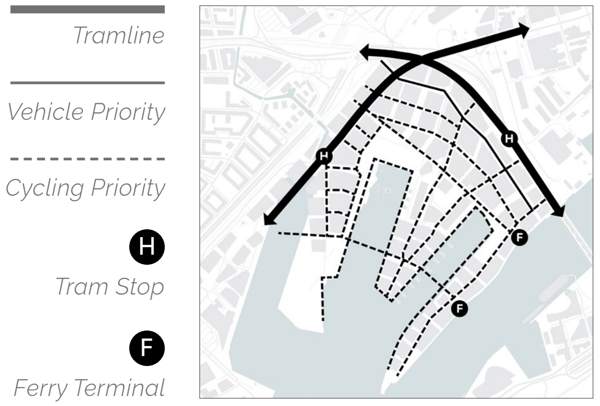


Fig. 39. People/Bike Priority Road

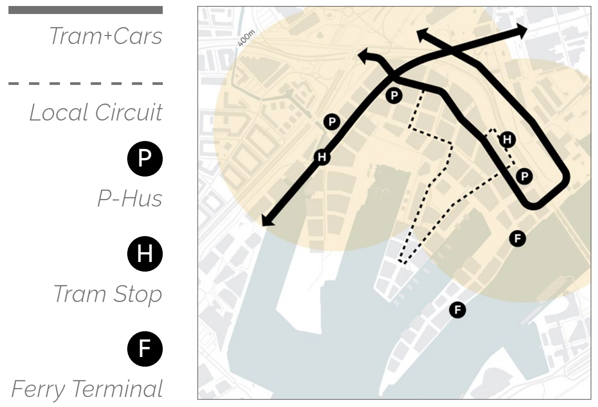


Fig. 40. Park and ride

Fig. 41. Funtional Zoning (Left), Blue paths (Mid) and Urban connections (Right). (© Göteborg stad, 2016)

Public Service & Circulation

The 5-minute walking radius centered around the northern harbor basin of Frihamnen connects almost all public activity facilities and spaces on piers.

HAMNENPARKEN

Open-air swimming pool, public sauna, and bathing facilities at the northern end of the basin reshape the relationship between citizens and water. The Harbour Pool will create a clean swimming area through a floating structure, realizing the "river bathing" concept. Although swimming directly in the river is currently not possible due to pollution, this pool will serve as a prototype for Gothenburg's "water park" and lay the foundation for future pool developments.

JUBLIEUMSPARKEN

The park aims to provide citizens with a platform to freely create various activities and projects. During this process, a special focus was given to creating a "self-service space," where the government provides tools and frameworks to allow people to engage in the creation, craftsmanship and management of public spaces.

INDOOR AND OUTDOOR

The ground-level buildings of Frihamnen, including Magasin113 and Frihamnskyrkan, will be viewed as part of the public space extension. These buildings will offer various functional spaces, including flexible offices, art centers, cafes, tourist information, shops, restaurants, and cultural centers. They will encourage the extension of activities from the exterior piers into the building.

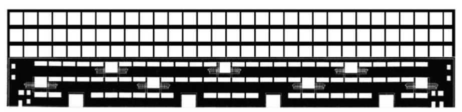
FLOATING COMMUNITY

The proposed floating community will be integrated with the walkway connecting the three piers, acting as a shared central space that will link all public activities across the piers and extend further into the basins. It is expected to incorporate greenhouse and urban farming components, which were initially planned but not realized, while also accommodating the self-sustaining agricultural experiments and public greenhouse.

Built Environment

In the development plan for Frihamnen, there are plans to preserve three old warehouses located on Norra Frihamnenspiren, which were industrial buildings constructed between the 1930s and 1960s. Currently, the renovation project for these warehouses is in the competition stage, but actual construction is still some time away. In the process of building the new floating community, respecting the materials and colors of these historical buildings and preserving the architectural heritage of Frihamnen is a key consideration. This approach ensures that the new buildings will integrate with the historical environment and architectural characteristics, preserving the unique charm of the past while modernizing the area.

① MAGASIN 113



Status: Not yet started
Designed by: MVRDV
Material: Bricks, Concrete, Wood
Programmes: Mixed Use, Offices, Commercial, Cultural

Fig. 42. Visualization for transformation of Magasin 113 (© MVRDV, 2019)

② FRIHAMNEN 16

Status: Existing Building, to be preserved?
Designed by: N/A
Material: Bricks, Concrete
Programmes: Mixed Use, School, Commercial, Offices

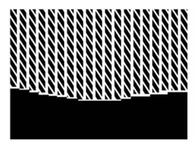
Fig. 44. Frihamnen 16

③ FRIHAMNEN 12

Status: Existing Building, to be preserved?
Designed by: N/A
Material: Bricks
Programmes: Industrial

Fig. 45. Frihamnen 12

④ FRIHAMNSKYRKAN



Status: Finished
Designed by: Elding Oscarson
Material: Stone, Steel
Programmes: Religious Use

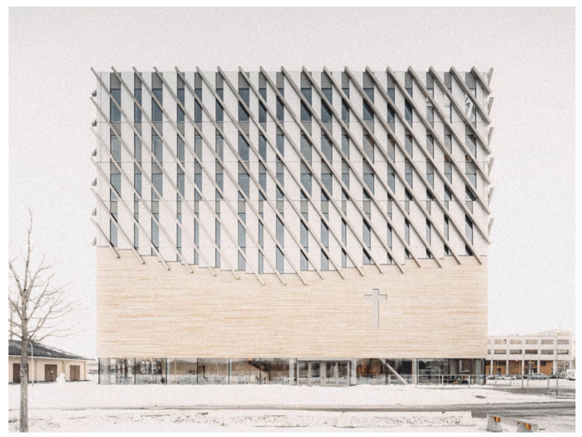


Fig. 43. West Facade of Frihamnskyrkan (© Johan Dehlin)

P R O P O S A L

P R O P O S A L

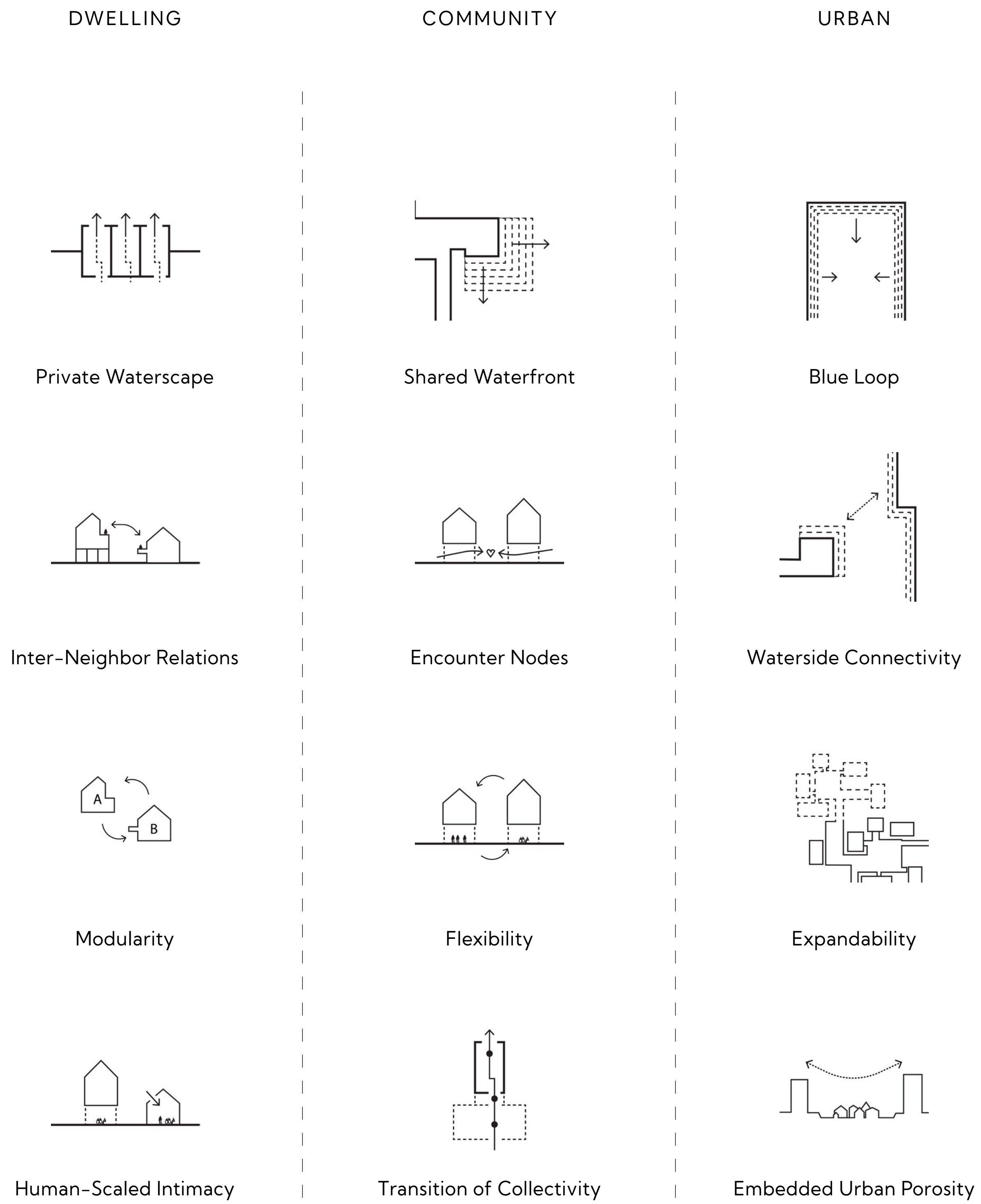
Programme and Framework

SCALE & DENSITY
Number of housing units: 40–50 row houses
Floors per unit: 2–3 stories
Residents per unit: 2–6 people
Total population: 100–300 people

HOUSING TYPOLOGIES
Co-Houses: (~60% of total)
Private Houses: (~40% of total)

TARGET RESIDENTS
The target households of this floating community include **shared** (Multiple unrelated individuals), **compact** (Nuclear family), and **multigenerational households**. It attracts long-term, flexible, and short-term residents, as well as middle-income groups and co-living advocates who prioritize shared resources and community engagement.

People who are environmentally conscious
People escaping high-density urban living
People fond of water-based living
...



A Fully Shared Floating Community

I. DWELLING SHARING

The lowest Level of Sharing — the focus of sharing is on individuals or small groups living within the same residence.

Sharing Inside House

Shared spaces like the entrance, kitchen, bathroom, living room, and waterfront deck optimize space use while fostering small-scale social interaction.

Sharing Between Houses

Clusters of houses share outdoor terraces, communal gardens, storage, and docks, enhancing resource efficiency and a sense of community.

CATEGORY	INSIDE THE HOUSE	BETWEEN HOUSES
Flexible Boundaries	*Living rooms, Dining rooms, Remote working spaces, Co-working corner*	*Optional shared areas (front yard, BBQ area, drying area)*
Utility Sharing	*Shared kitchen, Balcony/Patio, Laundry, Storage*	*Shared tools, EV/Boats charging, Recreational and sports*
Resource Sharing	*Waste recycling, Appliances and furnitures, Second-hands*	*Solar power, Rainwater collection, Heating and hot water, Boat sharing, Carpooling*
Information Sharing	*Skills exchange, Event organization, Social and networking*	*Community log, Resident council, Participatory decision-making*

Table 7. Sharing Strategies in Minimum Sharing Levels (Inside and between houses)

II. COMMUNITY SHARING

This level of sharing goes beyond individual households or small groups, focusing on spaces that are shared by the entire floating community.

Shared Public Spaces

Ground-floor spaces serve as cafés, study rooms, workshops, laundries, or shops.

Shared Cultivation

A community-managed floating farm uses food waste for cultivation, creating a circular economy. Produce can be consumed locally or sold externally.

Shared Transportation

Shared bicycles, EVs, small boats, etc., reduce the need for private vehicles.

PRIVATE SHARING

Share inside houses *(Kitchen, living room, terraces...)*

Share between houses *(Shared storage, communal gardens, laundries...)*

Share information *(Skills, tools, and information...)*

COMMUNITY SHARING

Share public spaces *(Cafés, workshops, activity areas...)*

Sharing transportation *(Boats, parking spaces, shared bikes...)*

Sharing cultivation *(Floating farms, rooftop gardens...)*

CITY SHARING

Share resources *(Shops, weekend markets ...)*

Enhancing connectivity *(Pedestrian paths, waterfront access...)*

Integrate ecology *(Floating wetlands, Sub-merged habitats...)*

III. CITY SHARING

As part of the city, the boundaries between the community and the city, with features that are open to the city, allowing interaction, connection and sharing between the community and the outside city.

Shared Resources and Productions

Float farms function as shared spaces for residents and city dwellers to get education, grow, harvest, and trade crops, supporting the circular economy.

Public Shops and Weekend Markets

City-facing shops and weekend markets sell community-produced goods, including handicrafts, food, and ecological products, fostering economic interaction.

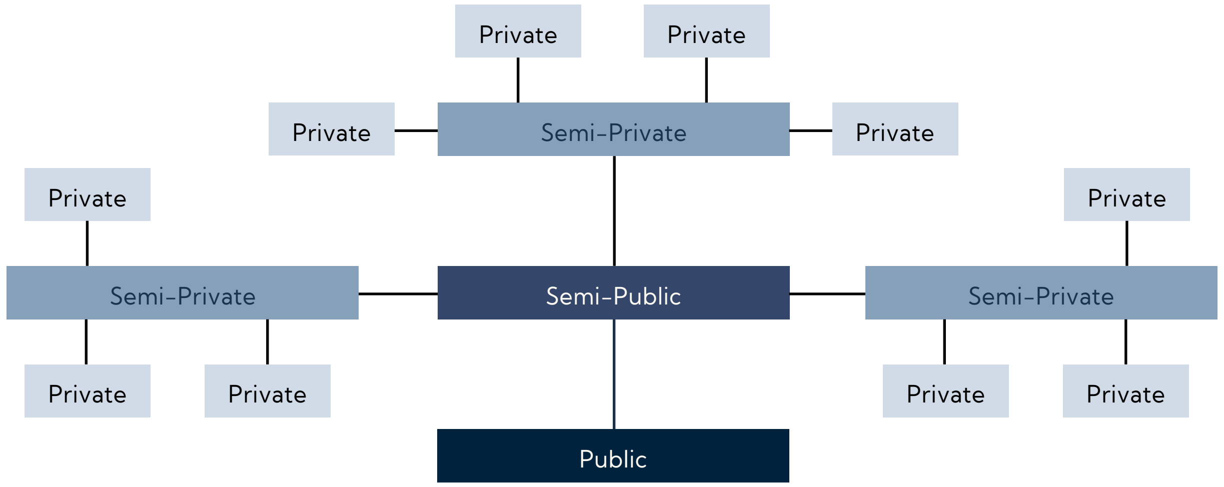
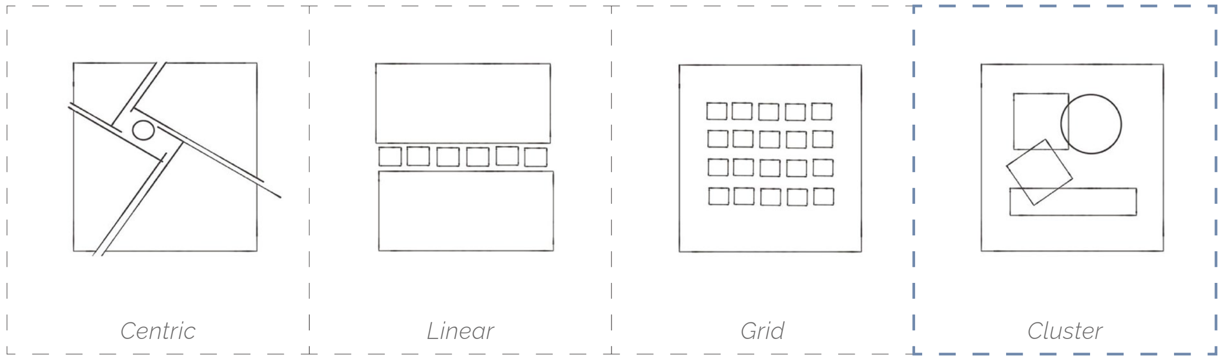


Fig. 46. Redrawn sketch; 'Defensible Space', (O. Newman, 1972)

Spatial Organization

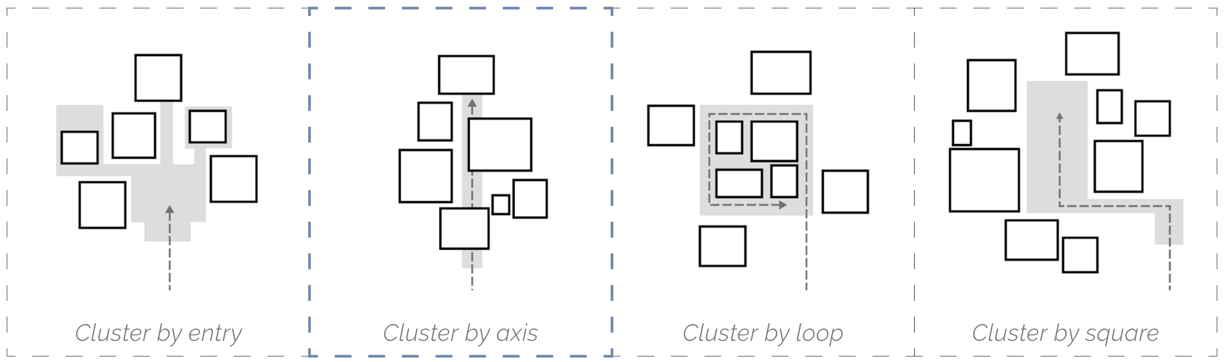
Spaces with varying degrees of privacy provide different environments for various activities and social relationships. The transition from public to private space is constrained by different boundaries and rules. Private and semi-private spaces offer a sense of security and enhance a feeling of belonging by distinguishing them from easily accessible public areas. The definition of semi-public space is somewhat ambiguous, typically referring to open areas that have a certain degree of privacy but are still broadly accessible, with less obvious boundaries. Such spaces are particularly important in residential areas, where visual connections enhance a sense of responsibility and control over the space. (Gehl, 2006)

Semi-public spaces, activities, and outdoor resting areas should be located in front of buildings and around entrance areas to facilitate access and avoid unnecessary barriers. Proper spatial layout not only provides opportunities for daily activities but also allows people to observe neighborhood activities, which can stimulate more social interactions. Transitional spaces between buildings, such as porches or front yards, also play a role in connecting different levels of privacy while encouraging neighborhood interaction. Ultimately, it's important to recognize that providing opportunities for observation can also inspire more active social engagement, not just the chance to participate in activities.



PROTOTYPES

The four common spatial prototypes in architectural theory—centric, linear, grid, and cluster—each shape the user experience in distinct ways (Ching, 2014; Unwin, 2020). Centric centers around a dominant space. Linear follows a defined axis, guiding movement in a directional flow. Grid provides a systematic, modular layout. Cluster, which groups spaces based on social or functional relationships, is most aligned with the vision of a shared community, promoting interaction, flexibility, and organic growth.

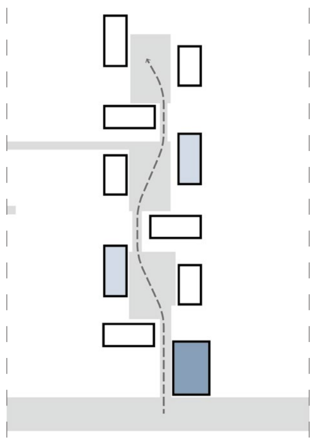


CLUSTERING

In the spatial organization of floating community residences, Cluster is prioritized for its excellent social attributes. Simply choosing Cluster forms based on entrance or axis is too one-sided. Instead, a flexible combination of square, loop, axis, and entry can better meet design needs. This combination balances social interaction with privacy, while ensuring connectivity and flow within the space. When applied to harbor redevelopment, the linear grouping along an axis suits best the harbor basin profile.

Iteration of Spatial Organization

Platforms | Private House | Social House | Public Space | <-- Local Path



Courtyard linkage

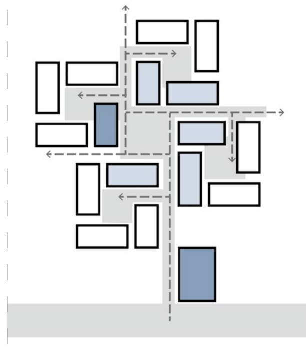
A. COURTYARD LINKAGE
The main path connects semi-private courtyards, creating a network of a series of small, interactive spaces.

Pros: *Strong community feel, active social spaces, expandable for future growth.*
Cons: *Less privacy, needs buffer zones.*

Secondary access

B. SECONDARY ACCESS
The main path remains independent, with smaller secondary paths that lead to individual courtyards. This creates a more segmented community layout.

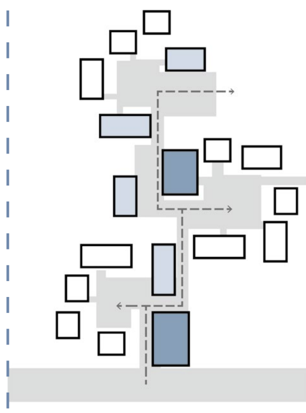
Pros: *Better privacy, clear group structure, expandable for future growth.*
Cons: *Empty main path with limited space, weaker community interaction.*



Central square

C. CENTRAL SQUARE
The community is organized around a central public square or hub, with groups of homes surrounding it. This central space serves as the focal point for semi-public activities.

Pros: *Strong community cohesion, centralized public activity.*
Cons: *Compact layout, constrain openness of floating homes near center, not easily expandable.*



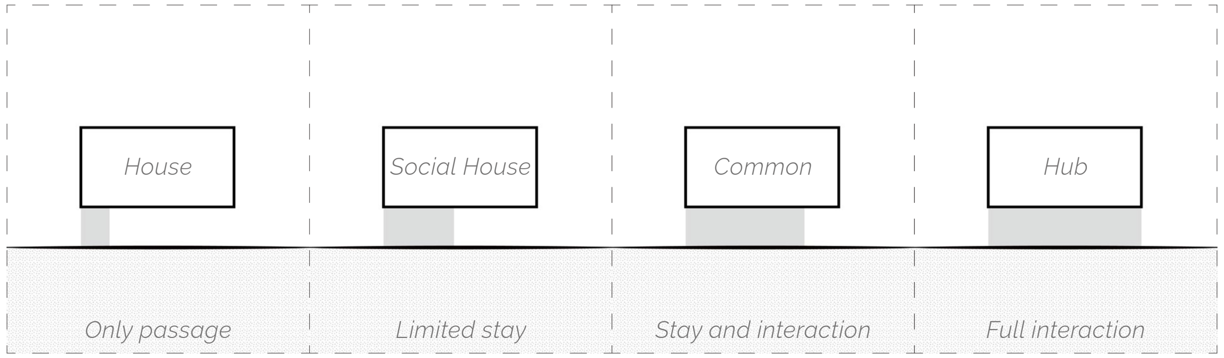
Organic flow

D. ORGANIC FLOW
The community layout is less rigid, with floating platforms and small bridges connecting clusters of homes in a more loose, organic, fluid way. There is no strict hierarchy of main paths or secondary routes.

Pros: *Flexible, balances privacy and community feel, better fluidity, expandable for future growth.*
Cons: *Less clear circulation, needs wayfinding.*

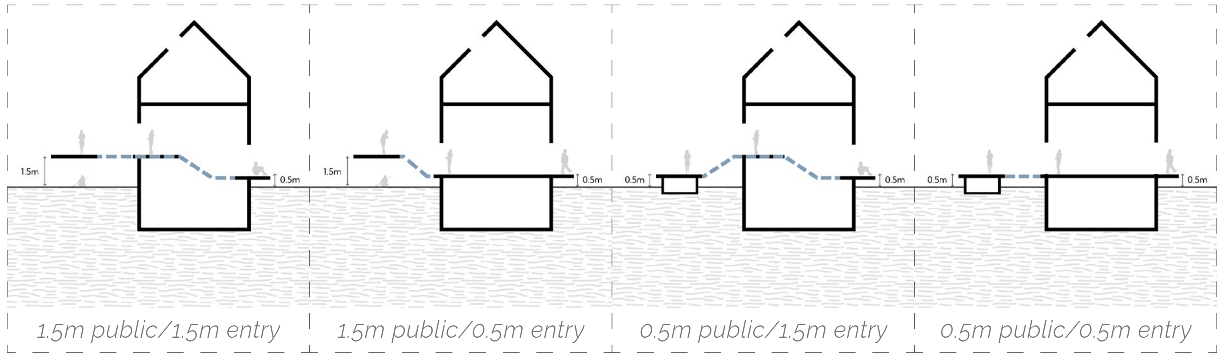
REFLECTION
The fourth alternative, with its flexible and naturally flowing layout, was adopted as the main approach. It balances privacy and social interaction through social nodes along courtyards and pathways, while allowing future expansion to support resilience and adaptation. Key strengths from other alternatives were also integrated to enrich the overall design.

Transition



ENTRANCE AND JETTY

The classification of entrance spaces and jettys reflects varying levels of engagement and interaction, guiding design based on user behavior. These spaces range from primarily for movement with minimal interaction, to areas that allow brief stops, to spaces that encourage people to pause and engage socially, and finally to areas designed for prolonged interaction and active social engagement. This hierarchy helps in designing entrance spaces that align with social dynamics and desired functions.



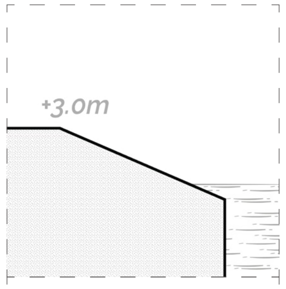
SPATIAL SEPARATION

In the community, the height of public passages and house entrances is crucial as it determines the transition from semi-private to private spaces. Boundaries at different privacy levels require appropriate layering. The natural characteristics of floating structures can be utilized to use water as a boundary for separation, while creating intimate spaces that are visually or functionally connected at the semi-private boundary.

To avoid a sense of insecurity from being monitored and the potential for observation from more private spaces, house entrances should be elevated to a height equal to or higher than the public passageways. However, accessibility for people with disabilities needs to be considered in the design. For residences specifically designed for people with disabilities, avoiding height differences between the public platform and the housing is a priority factor.

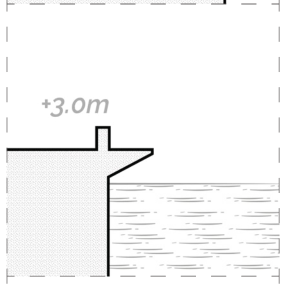
PIERS AND QUAYS

The piers in Frihamnen were put into use in 1922. These piers are supported by wooden piles and concrete piles. In the design of the floating community, the pier structure connecting to the floating structures will be reconsidered. According to the 2014 Tyréns report on the construction of the Frihamnen piers and Ramboll's hydrodynamics and flood analysis, the flood protection height along the riverbank is set at 3.0m. Considering the public functions and ecological protection of the riverbank, three structural forms are defined as follows.



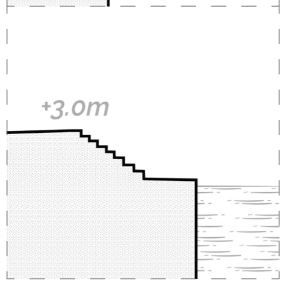
Embankment

It is a barrier in the form of a slope to create a protection, preventing floodwater from entering the protected area via the ramp.



Quayside

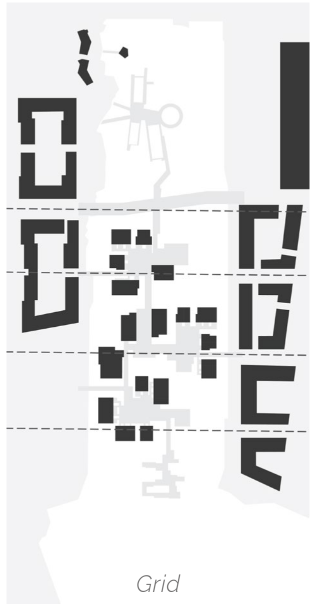
It places the flood protection facilities directly along the quay edge (kajkant), creating a physical barrier without occupying too much of the public activity space on the quay.

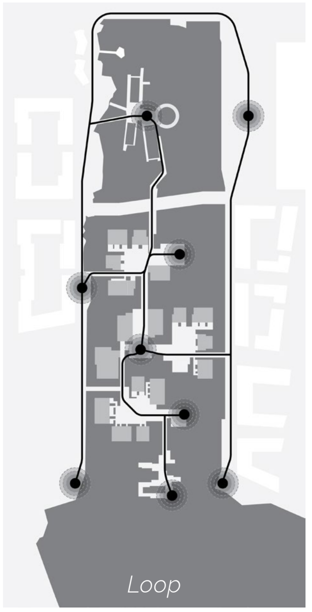


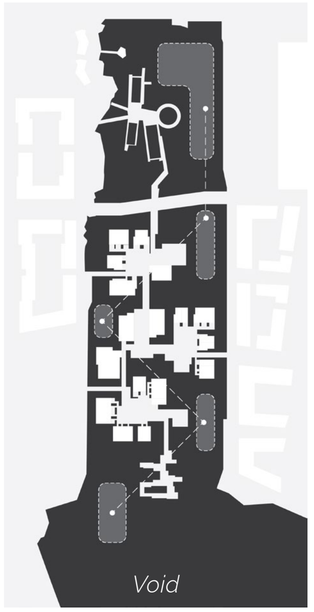
Floodable

In some areas, temporary flooding is allowed, and these areas may become part of a natural wetland or a lower waterfront promenade, connected to higher levels through a terrace.

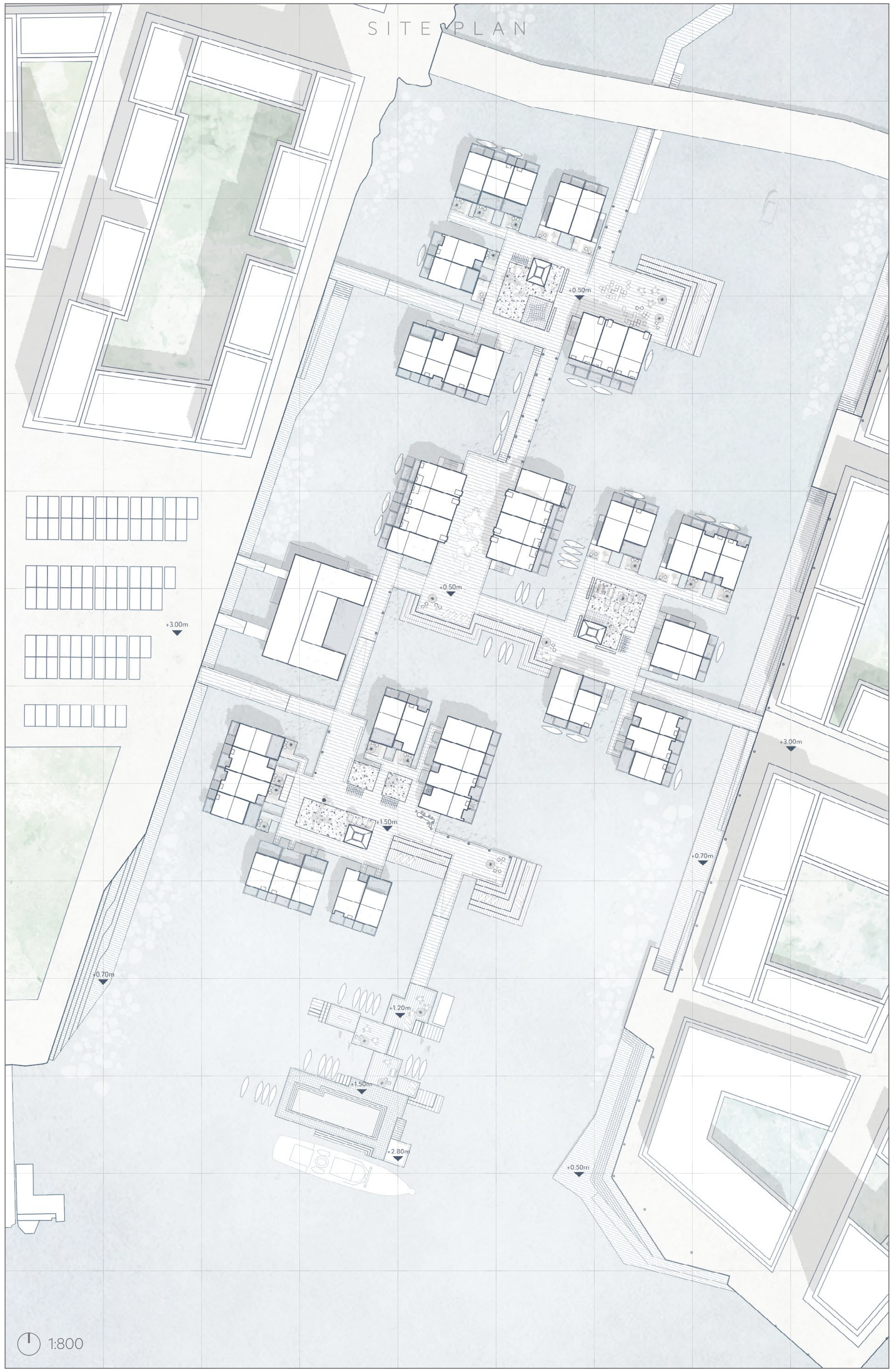
Master Plan

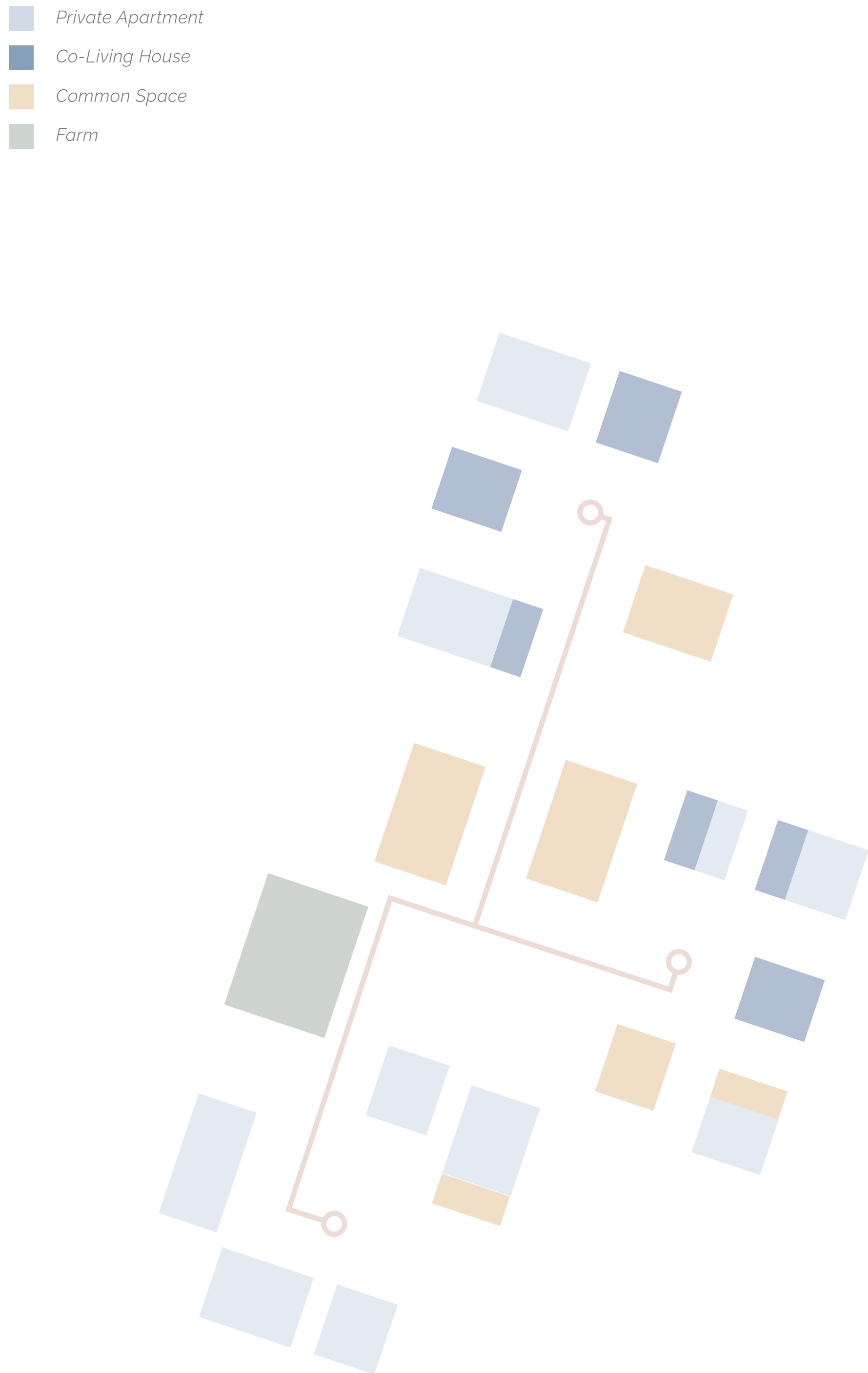






In quiet dialogue with the urban fabric, the floating village embraces the scale of city blocks, grounding itself in familiar proportions to resonate with the rhythms of contemporary life. Along the water's edge, the path becomes more than a line of clarity—it offers moments of pause, reflection, and leisure. Blue Loop forms a soft mobility network, gracefully connecting the islands into a seamless urban tapestry. Water itself is envisioned as a dynamic and reflective medium—a fluid ground that not only supports floating architecture but also enriches its spatial and sensory experience.



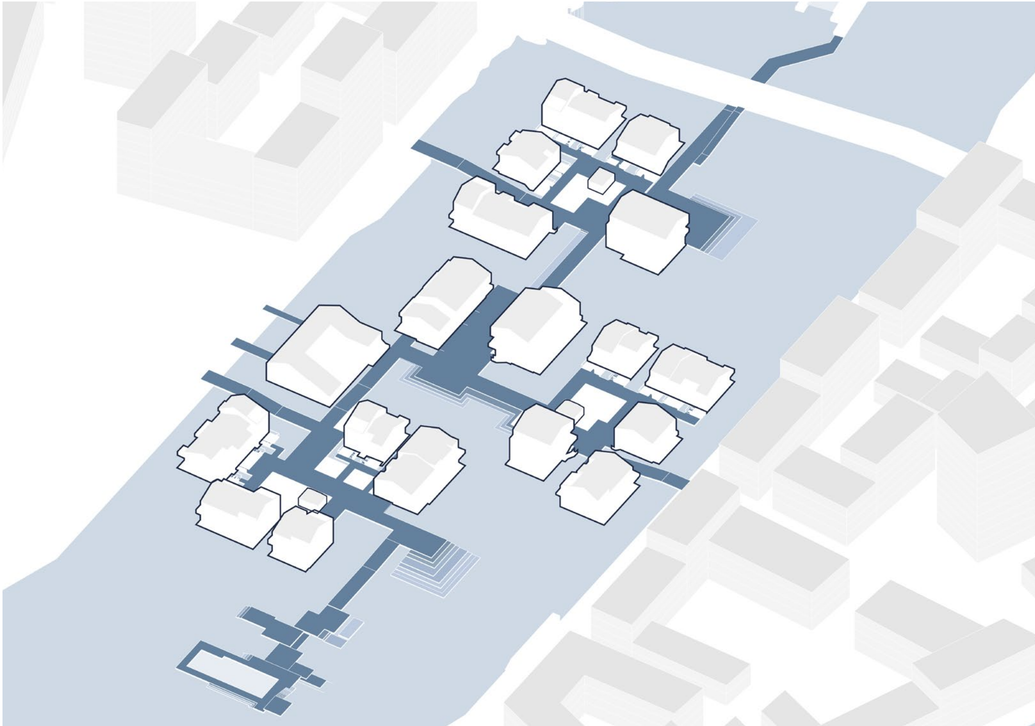


FUNCTIONAL ZONING

Each of the three clusters has a independent shared communal space, while nodes for larger community activities are arranged along the circulation linking the all clusters.

MICROCLIMATE

The terraces formed through courtyards and architectural volume cuts optimize the microclimate and enhance neighborhood interaction.



WATERFRONT ACTIVATION

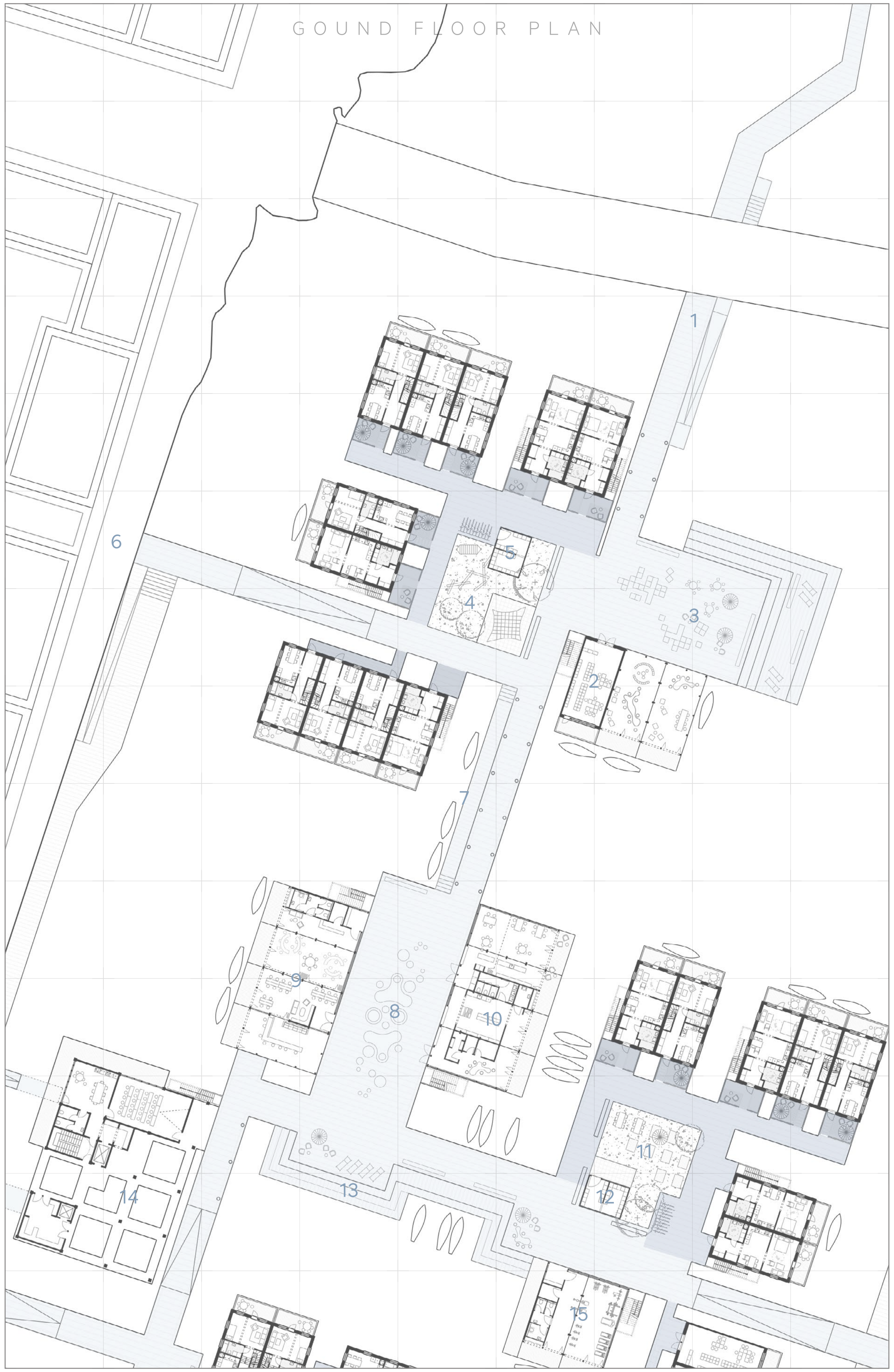
The waterfront platforms, featuring steps that gently slope towards the water, are shaped by tidal and seasonal changes, defining the deck's form.

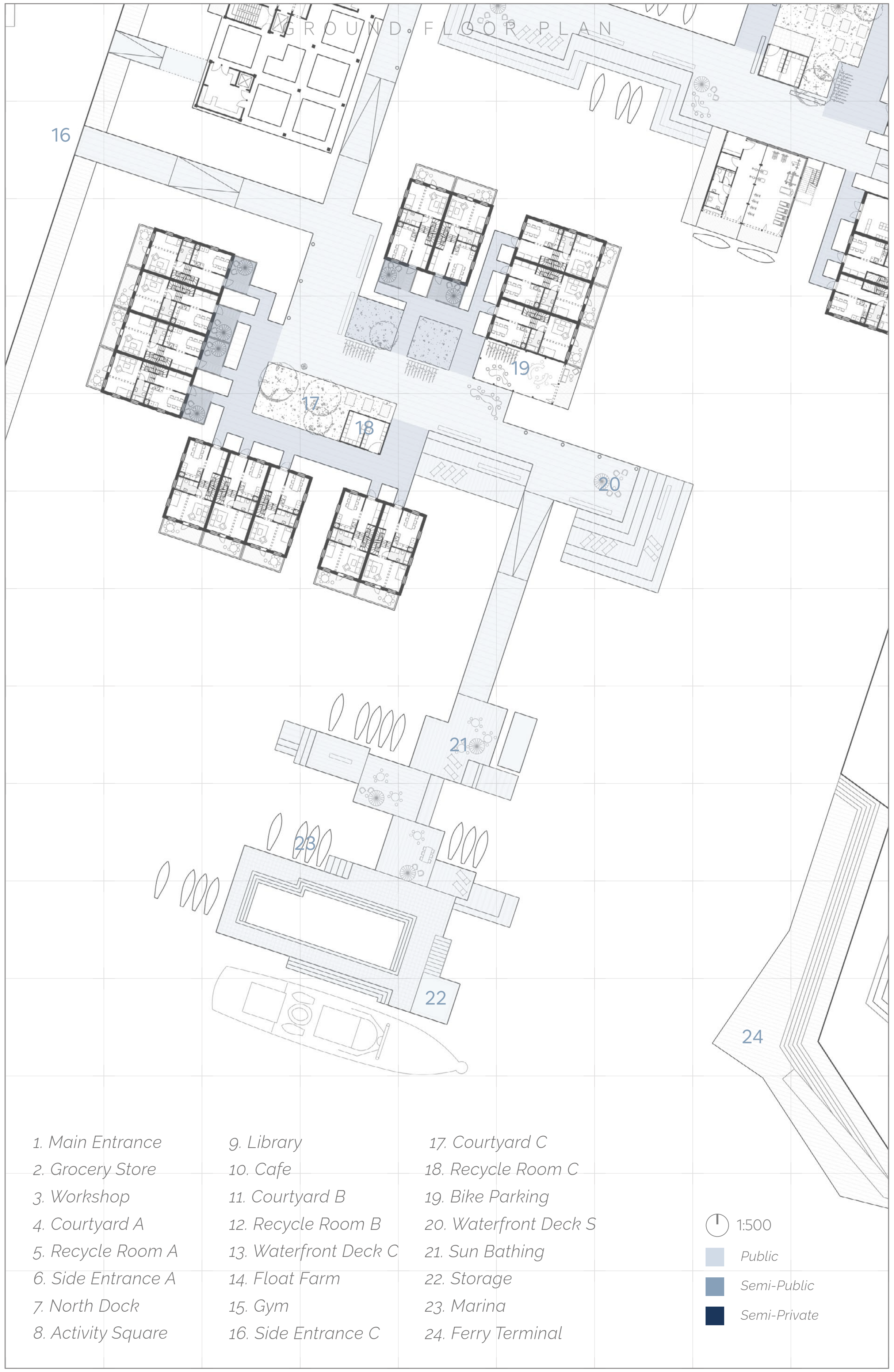
URBAN CONNECTION

The public deck links a series of public spaces, squares, and waterfront platforms along a continuous line, seamlessly integrating with the urban street network.

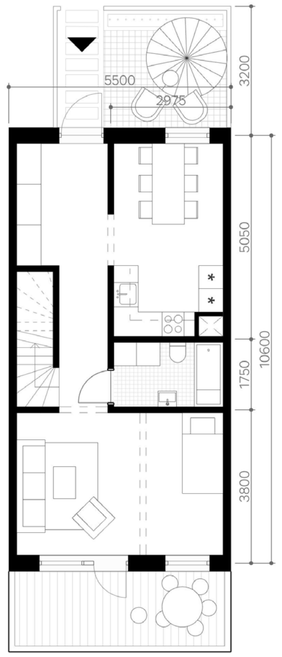
SHARING SPACES

The community's shared spaces are distributed across various clusters and public squares, seamlessly integrated throughout the entire area.

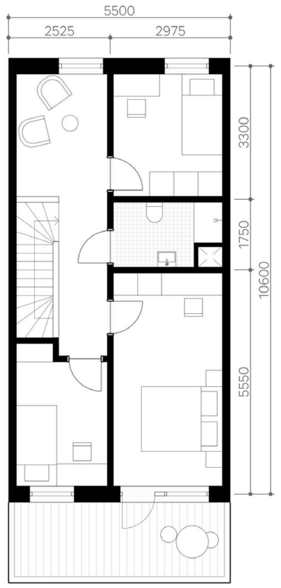

GOUND FLOOR PLAN
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15


GROUND FLOOR PLAN
16
17
18
19
20
21
22
23
24
1. Main Entrance
2. Grocery Store
3. Workshop
4. Courtyard A
5. Recycle Room A
6. Side Entrance A
7. North Dock
8. Activity Square
9. Library
10. Cafe
11. Courtyard B
12. Recycle Room B
13. Waterfront Deck C
14. Float Farm
15. Gym
16. Side Entrance C
17. Courtyard C
18. Recycle Room C
19. Bike Parking
20. Waterfront Deck S
21. Sun Bathing
22. Storage
23. Marina
24. Ferry Terminal
1:500
Public
Semi-Public
Semi-Private

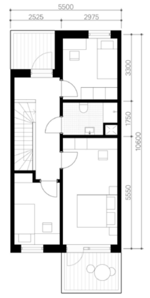
Housing Typology



GF PLAN 1:200



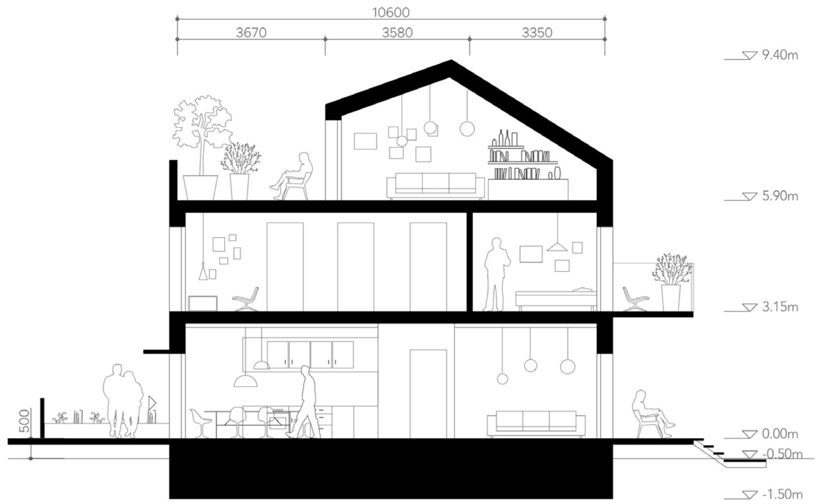
1F PLAN 1:200



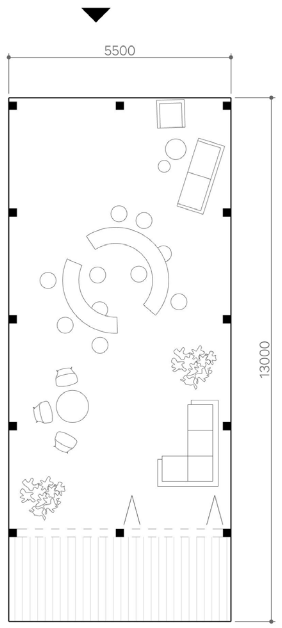
MODULE 2

MODULE 3

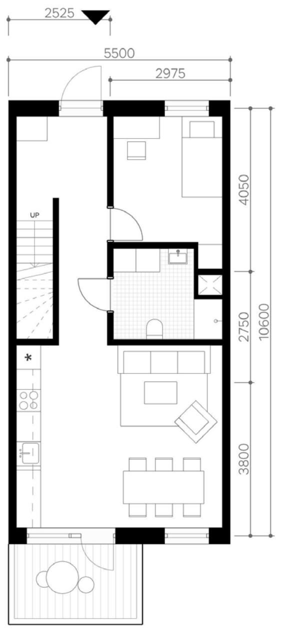
TYPE P1
Pontoon, Opt.1
Dimension: 5500*11000
Levels: 2
Area: 95-140m²



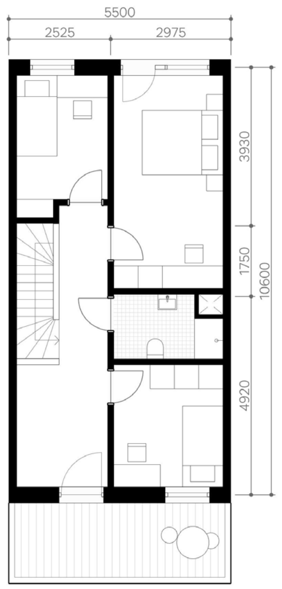
SECTION 1:200



GF PLAN 1:200



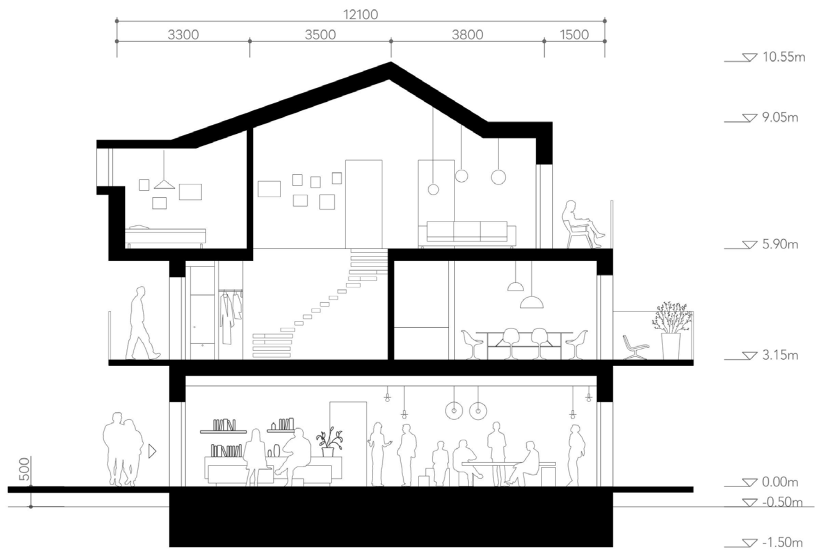
1F PLAN 1:200



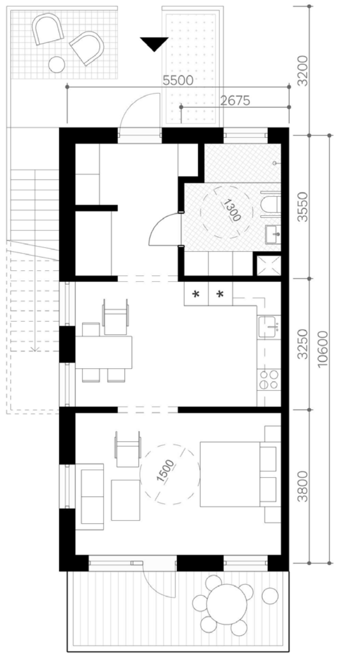
2F PLAN 1:200

TYPE P2
Pontoon, Opt.2
Dimension: 5500*12500
Levels: 3
Area: 180m²

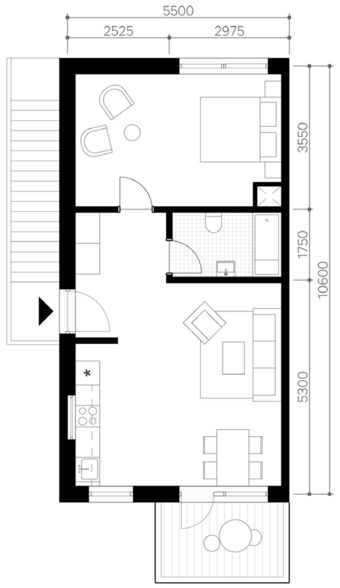
GF Can be bars, cafés, study rooms, workshops, shops, etc.



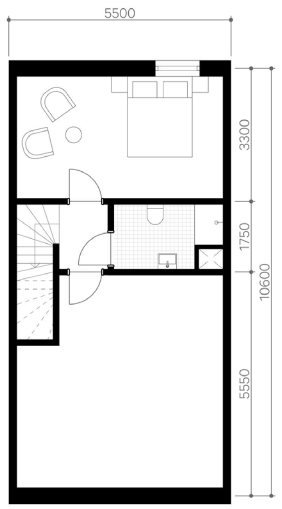
SECTION 1:200



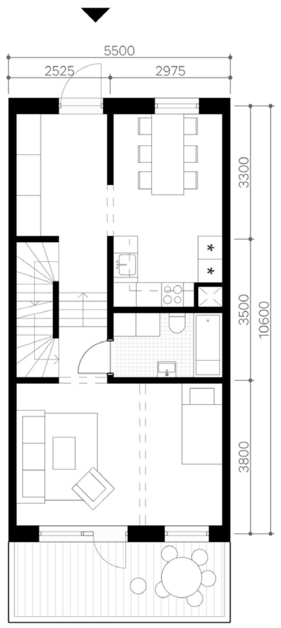
GF PLAN 1:200



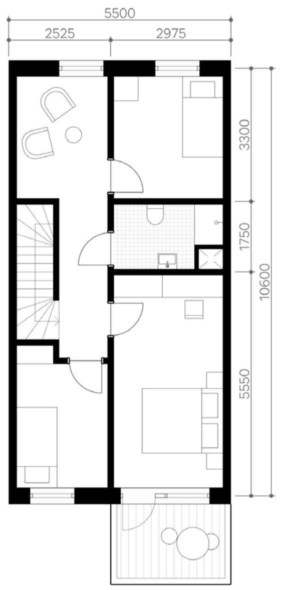
1F PLAN 1:200



B1 PLAN 1:200



GF PLAN 1:200



1F PLAN 1:200

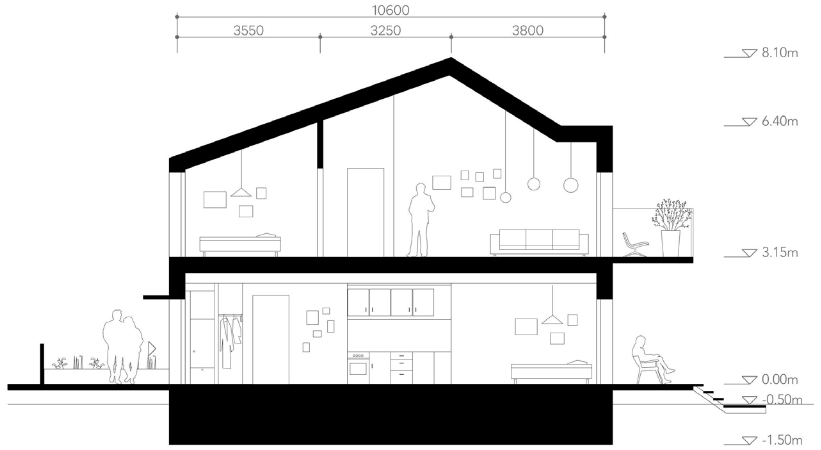
TYPE P3

Pontoon, Opt.3

Dimension: 5500*11000

Levels: 2

Area: 110m²



SECTION 1:200

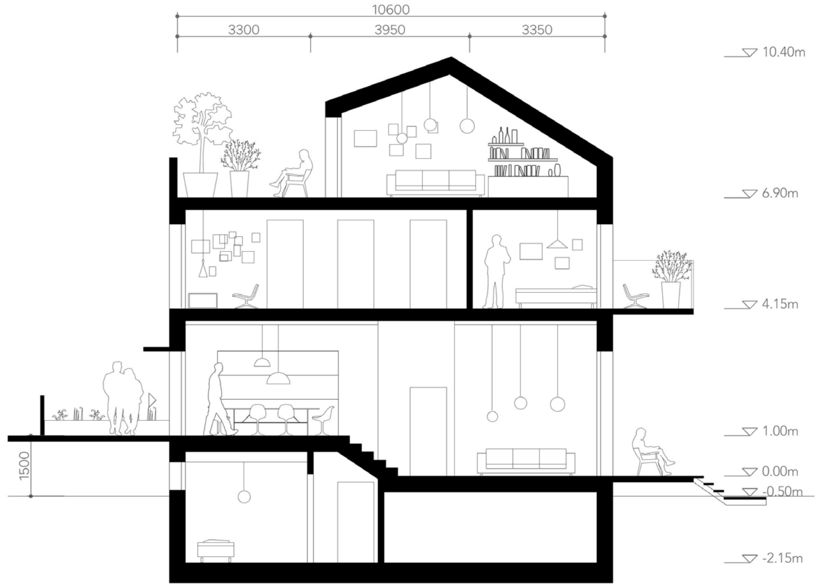
TYPE C1

Caisson, Opt.1

Dimension: 5500*11000

Levels: 3

Area: 190m²



SECTION 1:200

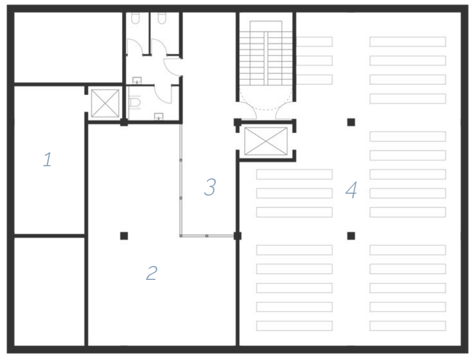
LIVING ROOM

The common living room on the first level faces the water, allowing residents to interact with the water through the waterfront while enjoying full privacy.

KITCHEN AND DINING ROOM

The private apartments have excellent views of the kitchen and dining room, and each has a generous 2 meters deep cantilevered balcony.

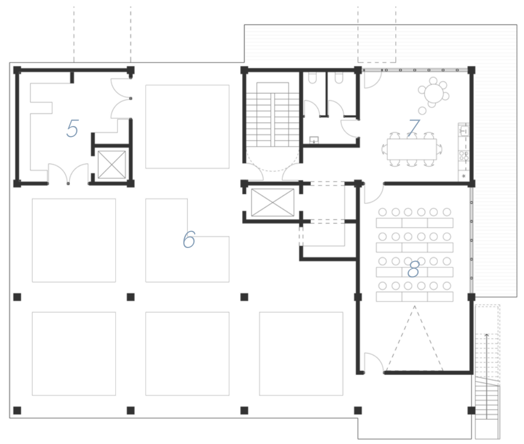
Float Farm



B1 PLAN 1:400

UNDERWATER LEVEL

1. Technical Room
2. Process Room
3. Viewing Gallery
4. Hydroponic



1F PLAN 1:400

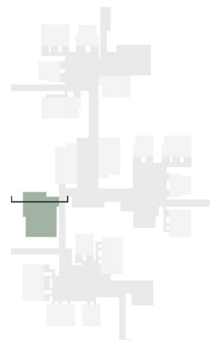
ENTRY LEVEL

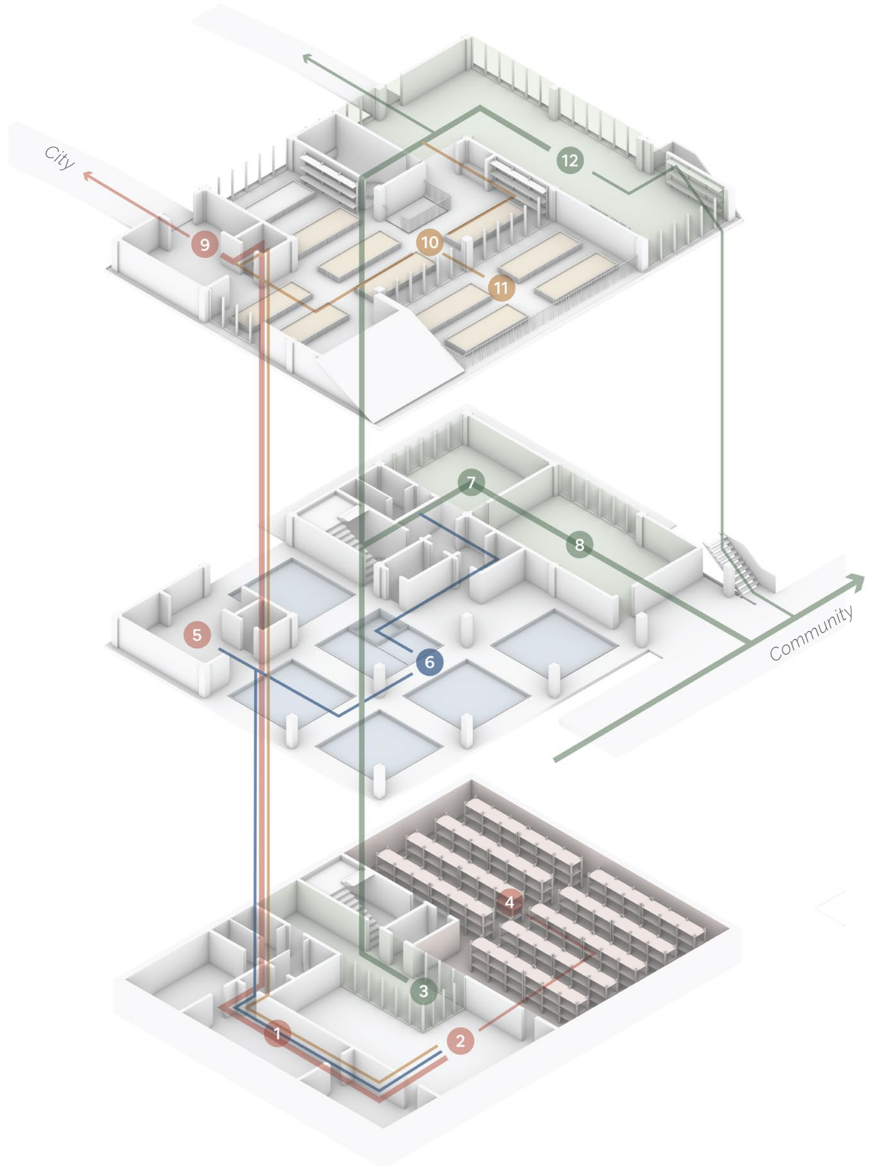
5. Handling Room
6. Fishponds
7. Kitchen
8. Education Room

2F PLAN 1:400

SECOND LEVEL

9. Receiving Room
10. Green House
11. Green Terrace
12. Farm Shop





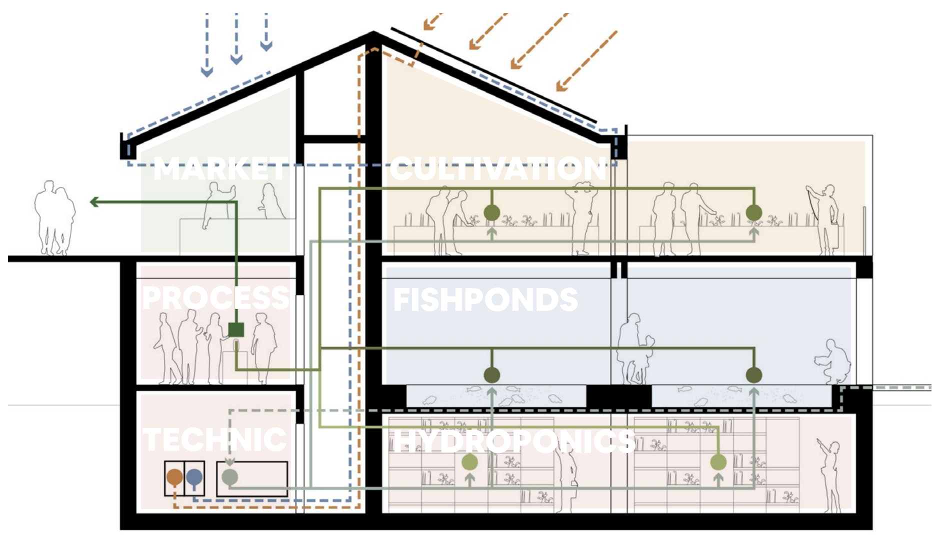
CIRCUALTION AXO

Visitors

Hydroponic
Cultivation
Education
Aquatic
Process Flow
Cultication Flow
Visit Flow
Aquatic Flow

Products

Rainwater Harvest
Solar Energy
Manure from Community
Hydroponic Vegetables
Fish Products
Crops
Food



SECTION 1:200

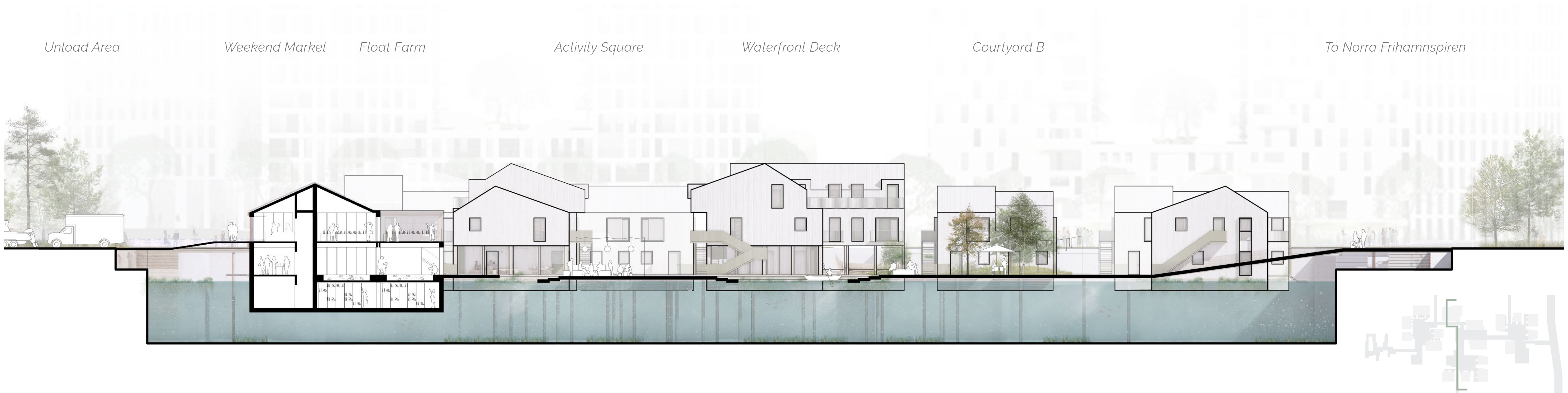
GREENHOUSE

Greenhouse provides controlled environments for year-round cultivation, supporting the farm's food production and research activities.

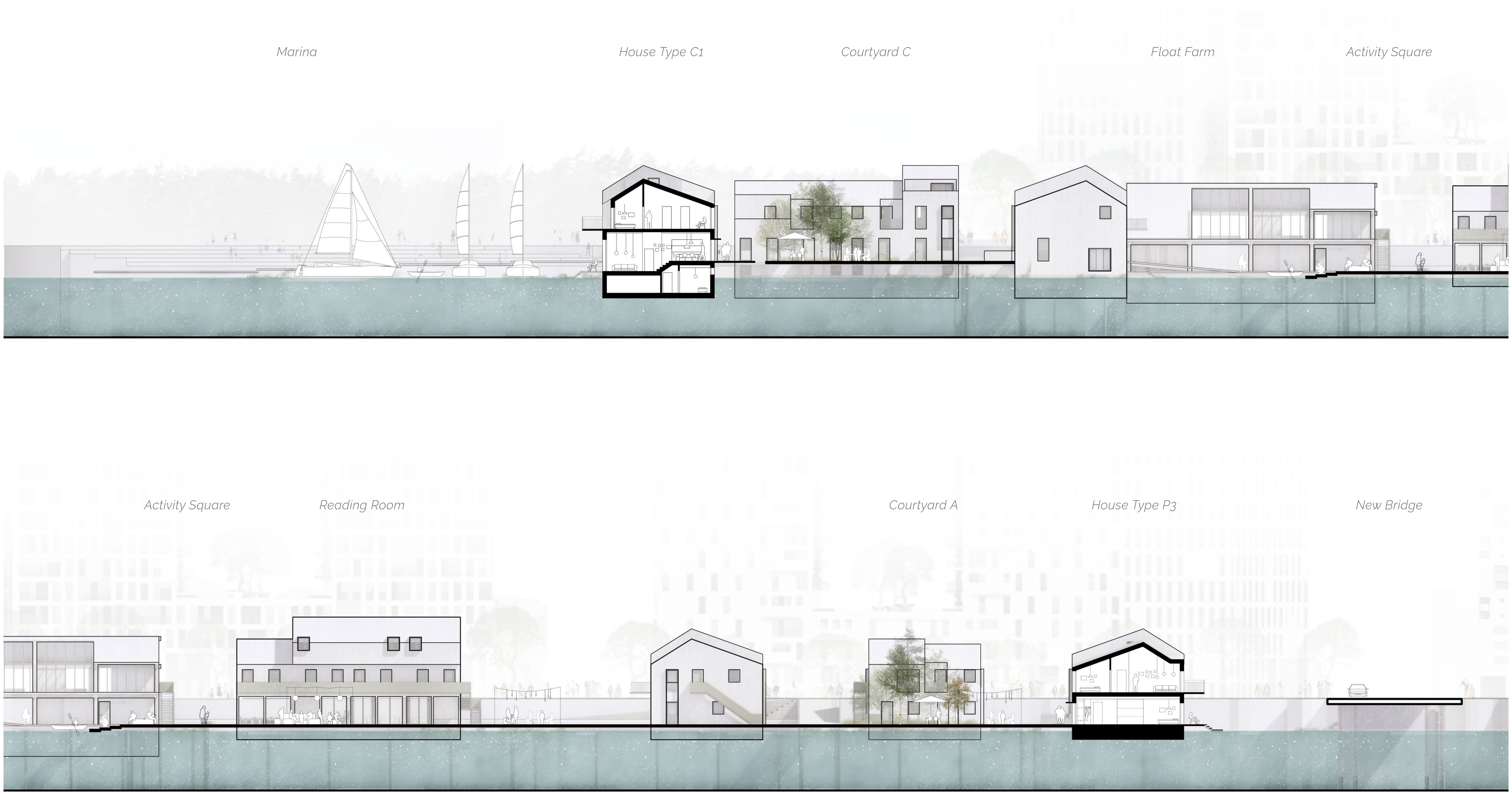
FISHPOND

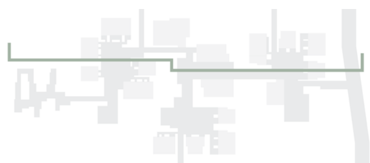
The water-level layer includes fishponds for small-scale ecological cultivation and aquaculture facilities for small-scale fish and seafood production.

SECTION A 1:400



SECTION B 1:400





SECTION C 1:400

WORKSHOP

Shared workshop fosters resident collaboration through co-building of spaces and shared tools and resources, cultivating a closely connected leisure lifestyle.

READING ROOM

The elevated reading space turns the undercroft into a quiet, open spot by the water, offering shade and inviting residents to pause, connect, and unwind.


WEEKEND MARKET
On weekends, the parking area transforms into a temporary market where residents sell products from the community.
COURTYARD A
The cluster is connected to the Kvillespiren on western side of the basin, and extends northward to the public swimming pool.
MARINA
The marina supports waterfront residents with boats, offering docking and storage, especially in winter when boats are not in use.
CRAFT DECK
It holds events for residents to engage in hands-on activities like boat building and other crafts.
FERRY TERMINAL
A ferry terminal, providing fast daily commuting across the river.
COURTYARD C
The cluster consists of a series of floating houses based on the caisson type, located adjacent to the floating farm.
COURTYARD B
The cluster is connected to the eastern side of the harbor basin, Norra Frihamnenspiren.

DISCUSSION

DISCUSSION

REVIEW

This project explores floating housing as a resilient strategy in response to climate change and the post-industrial transformation of harbor areas. The core design challenge lies in how to integrate residential units, infrastructure, and shared spaces on water while ensuring structural stability and spatial continuity. The project adopts a cluster-based layout system to enhance the community's social potential and responds to the site's narrow harbor basin by introducing an axial system that balances the low-density floating settlement with the high-density urban renewal blocks, thereby negotiating openness, privacy, and circulation.

How can floating housing implement self-sufficient and shared communities to promote sustainable and resilient living?

To address this question, the research was conducted across three sections: theory, case studies, and site analysis. The findings inform the design, resulting in a floating community proposal that combines spatial strategy and social potential.

Theoretical research focused on the structural logic of floating housing, spatial mechanisms of shared communities, and systems for water-based agriculture, building a foundational theoretical framework. Case studies examined global projects, with an emphasis on European and Swedish cases, to extract applicable strategies. Site analysis investigated the characteristics of the harbor site to ground the design in a realistic context.

The design adopts modular and flexible spatial organization strategies that embed a multi-level sharing concept. Inspired by Jan Gehl's theories of "life between buildings", the design enhances neighborhood interaction. The final proposal responds to issues of sustainability, spatial organization, and shared systems, demonstrating the potential of floating housing to address climate change and urban waterfront transformation.

CHALLENGES

A major challenge in the project lies in reconciling accessibility requirements with the lightweight construction necessary for floating structures. While features such as elevators and accessible bedrooms are essential for inclusive design, they typically involve heavier elements that may compromise the stability of floating platforms and increase construction costs. To address this, the design introduces fully independent ground-floor accessible units, eliminating the need for heavy vertical circulation systems. Moreover, the shared ground-floor spaces are conceived with flexibility in mind, allowing for future adaptation into accessible bedrooms when needed. This strategy ensures that accessibility is achieved without undermining structural integrity, offering a responsive solution that accommodates both technical constraints and user needs.

The ambition to create a self-sufficient community through systems such as rainwater harvesting, waste recycling, and ecological materials was central to the design vision. However, due to limited time and resources, the technical detailing and feasibility planning of these systems within the housing units remained underdeveloped. In response, the project places emphasis on the floating farm as a core element of the self-sufficiency strategy. By integrating hydroponics, aquaculture, and planting into a closed-loop system, the farm becomes a functional and spatial anchor that not only supports sustainable resource use but also strengthens the social and ecological dimensions of the shared community. This pragmatic shift grounds the self-sufficiency concept in a tangible and scalable component of the overall design.

REFLECTION

A persistent challenge throughout the design process has been achieving a balance between publicness and privacy—particularly within the Swedish cultural and legal context, where strict coastal protection regulations and a strong emphasis on personal privacy shape expectations for residential environments. The design seeks to mediate this tension by introducing semi-public and semi-private spatial layouts and shared nodes that encourage neighborhood interaction. However, the water-facing façades remain visually and spatially exposed to the surrounding urban context, revealing a tension between residents' desire for seclusion and the requirement for public access to waterfronts. Moving forward, future design improvement ought to develop more nuanced strategies for spatial transitions and boundary management. This includes refining thresholds, façade treatments, and shared edge conditions in ways that respect privacy while maintaining the openness and fluidity necessary for vibrant, accessible public spaces. Addressing this challenge is essential to advancing socially resilient and culturally appropriate floating communities in Sweden.

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Literature
Planning Documents
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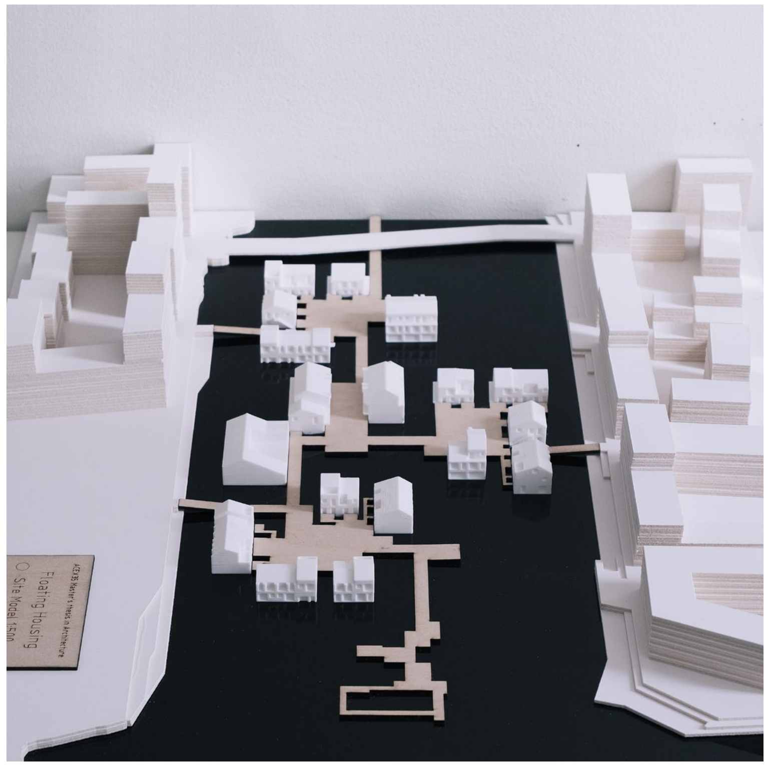

I would like to express my heartfelt gratitude to my supervisor, Anna, for her invaluable guidance, to my examiner, Kaj, for his insightful feedback, to my family for their constant support, and to my friends for their encouragement throughout this journey.

FLOATING HOUSING
Enabling Self-Sufficient and Shared Communities
for a Sustainable Future

Zhaoheng Wang | Master Thesis 2025