

Ecosystem Employment in Jakarta, Indonesia

*Ecological Applications in
Urban Design*

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FOREWORD

Nature has a special knack for survival. After millennia of beating the odds against an inhospitable planet, many species have found clever ways to ensure self-preservation on an often inhospitable planet. By refining special skills and working alongside other members of the ecosystem, countless species have found a stable role in the landscape. As humans, we are no different. Developing human society in the cradle of our own environments, humans have found the ultimate way to not only survive, but thrive in our landscapes- by building cities. We eventually found that the strength in numbers and collective skills of our communities allowed us to no longer be dominated by the landscape, but rulers over it.

However, as our vast cities and domesticated landscapes have long-altered the self-regulating properties of local ecosystems, humans must once again adapt to an inhospitable environment as urban climate hazards such as flooding and the urban heat island effect threaten an ever growing population of urban inhabitants.

This project seeks to address these climate hazards by exploring one key nuance of urban ecology- that we humans

are acting members in the ecosystem, not a division from it. By allowing basic principles of ecology to guide the urban design process, we seek to employ the self-regulating and self-sustaining properties of the natural world into the built environment, thus reintroducing ecosystem services in a way that uplifts both human and nonhuman urban populations.

We will explore the concept of ecosystem service employment in human settlements by studying Jakarta, Indonesia- the world's second largest urban agglomeration, a complex landscape that faces many climate hazards that threaten life and livelihood to its urban citizens. As the city buckles under the pressure of land subsidence and other ecological challenges, we will explore the possibilities for regulative landscape as a tool for climate action. Is nature enough, then, to improve the landscape that now threatens many human settlements? By reestablishing our role in the ecosystem, can we find a way to in turn heal nature, with nature?



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CHAPTER 01 ECOLOGY IN THE CITY

THE QUALITIES OF THE ECOSYSTEM CAN BE A MAJOR ROLE IN ADDRESSING MANY CONCERNS THAT HUMANS FACE. ECOSYSTEM SERVICES ARE THE INHERENT BENEFITS THAT CAN HELP PEOPLE SOLVE MANY PROBLEMS WE FACE TODAY.

THE URBAN LANDSCAPE
Our Membership in the Ecosystem
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THE URBAN LANDSCAPE

An Introduction to Ecology in Human Settlements

I once lost an onion in the back of my cupboard. Months had passed before I finally noticed a thin green stem peeking up from behind boxes of pasta and potatoes. Though seemingly insignificant, this forgotten little onion had made the best out of an inhospitable situation. Chuckling to myself, I thought “life will always find a way”. This simple moment reminded me of the robustness of nature. In the face of insurmountable odds, the living inhabitants of our planet have developed many keen tools to survive and establish roles in an often unforgiving environment. From the basic cupboard onion searching for light, to the complex symbiotic networks of old-growth forests, life will always find a way to continue on, all as a union of co-survivors among inhospitable odds.

After thinking about this for a moment, I came to a realization- are we not the same? As humans, though often distanced from our wild habitats, we are still a part of this union of co-survivors. We are inherently connected to our landscape, the imprint of our neolithic ancestor’s ways of life still impacting the way in which we interact with the world and with each other. We evolved to ebb and flow with the landscape, following the migration of our food sources and developing survival techniques in extreme weather. This inherent ability to survive is what makes us *alive*, it’s what keeps us continuing on this often harsh planet.

In her beautifully-written book, *Tapestries of Life*, Dr. Anne Sverdup-Thygeson, a Norwegian biologist, sparked an change within my worldview. In her book, she establishes the notion that we as humans have never truly strayed from nature, for we utilize it every day in a myriad of different ways. From the buildings we live in, to the medicine we take in the morning, natural ingredients aid us in every moment of our lives. Yet in doing so, these endeavors to utilize nature have perhaps gone to far, bringing us into an Era of Anthropocene, where “human activity is now global and is the dominant cause of most contemporary environmental change. The impacts of human activity will probably be observable in the geological stratigraphic record for millions of years into the future” (Lewis, 2015). And now, in the plight of our own anthropologic progress, the survival of us and our nonhuman neighbors are at risk. As we have sought to ensure the survival and development of our own kind, we have developed a “paradox in our creative relationship with nature: we have made use of [nature], but our ability to exploit the benefits of nature also risks undermining the very foundation of our existence” (Sverdup-Thygeson, 2021).

Growing up in an age of constant technological development and scientific understanding, I was surrounded by the ideas that our survival depended on the discovery of new ideas and technologies. Now in the face of climate change, we must ensure our survival once more. Yet in thinking about Dr. Sverdup-Thygeson’s book, I am inspired by the idea that we can utilize nature to do just this. What if we can continue to do use nature as a tool, but in large scales? What

if we can shift our paradigms and think of nature as the ultimate healer of our planet? If ‘life always finds a way’, can we trust in it, can we employ it in our planning and design strategies to overcome the impacts of climate change? Can we then, with intentional planning and design, allow nature to heal nature?

OUR MEMBERSHIP IN THE ECOSYSTEM

In order to answer these questions, it is important to understand how we got to this point. Observing the intricacies of our world have lead to many inspired minds to do incredible things. In the world of urban design, I think of Jane Jacobs, who observed how modern urban development in her city was highly focused on efficiency and mass-production rather than meeting the social and safety needs in her neighborhood. Though not a technically-trained planner, her book *The Death and Life of Great American Cities* reasoned that planners should not cut out basic human needs in their neighborhood visions (Jacobs, 1961). Her writings from the mid-20th century have carried many generations of urbanists to be more people-focused, all because of her careful observations.

If we want to better understand how nature can help us, observing the intersection between ecology and the design of cities is vital in our journey. To brainstorm how nature can help solve our biggest problems we must first answer: who nature is, who we are, and how we come together.

“Hello, My Name is Nature”

If you really think about it, what is ‘nature’? At first glance it seems something quite obvious, but the definition is perhaps more unique to each person. I asked my friends from all around the world to share their own definitions and found that for some, it could be a *concept* of anything naturally-occurring- like mountains, plants, animals, and yes, even us humans. For others, it is be everything *but* us. It is the *physical place* outside our own human settlements, the wilderness, in essence. However, for the purposes of this book, more scientific terms will better compliment the ideas presented within.

Ecosystem vs. Habitat

The first important term we need is *habitat*, the unique places we physically live in. In my hometown, my habitat is the high-desert, located on the foothills of the Rocky Mountains. My current habitat is a temperate forest region on the fertile rolling hills of Skåne, Sweden. *Habitat* is a physical place with identifiable physical features and species unique to that place. The second important term is *ecosystem*. This is the combination of all forces that interact with each other, both living and nonliving. The *ecosystem* is essentially the complete biological experience, from before conception to decomposition. From microbes in the soil to the largest predator, and all of the forces that they interact with- the elements, geologic features, natural disasters, etc.- the



fig 1. each ecosystem actor has a role in the environment

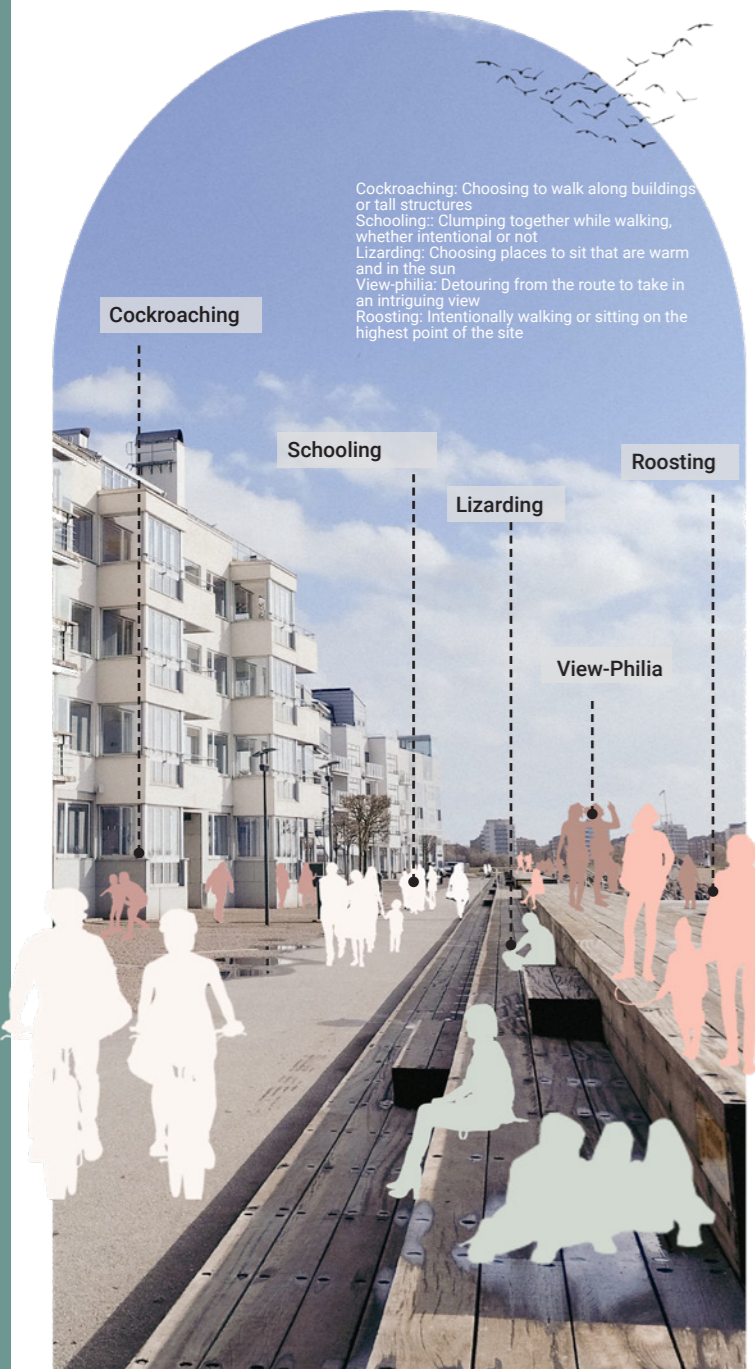


fig 2. human behavior still shows imprints of pre-urban life

ecosystem is the complete package that brings every living thing together under one umbrella.

Ecosystem Actors- The Union of Co-Survivors

An ecosystem isn't a 'system' without its working members. The next big word we need to understand is *ecosystem actor*. These are about what you would expect- the individual members living in a habitat. They have survived and evolved alongside us for millennia, all of us joined together in a union of co-survivors of an often harsh planet.

However in modern times, we in our cities easily become preoccupied in our human lives, filled with a multitude of people problems. But from this perspective- we are not an island, a detached observer within a landscape, but rather one important member of a very complex system.

EVALUATING OUR ROLE IN THE ECOSYSTEM

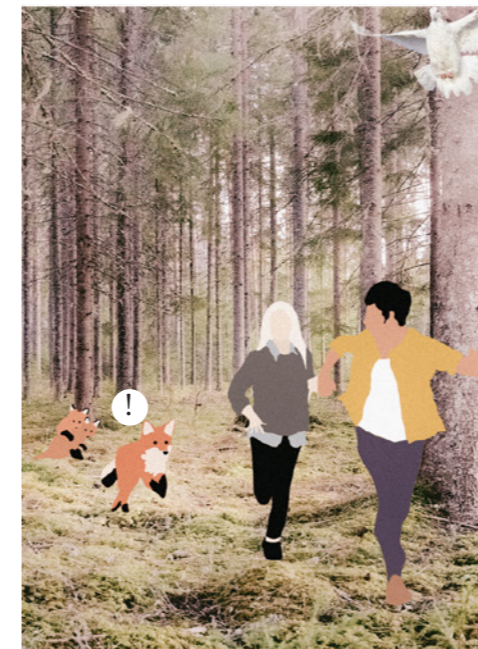
In 2019, a landscape architecture firm completed an observational study in New York, focusing on prominent human behaviors in public urban spaces. They noted behaviors (note fig. 2) such as: the Donut Effect, where people will sit on the edges of plazas, facing towards the center. Cockroaching, where people will choose to walk along walls or other hard edges rather than the middle of the plaza, or Crowding, where people were naturally drawn to walking in clumps if the chance arose (SWA, 2019). Why are we like this? Why do such actions come so naturally to us? Because that's how we survived in the wild. As an actor in our ecosystem, we developed these traits to make the best of our own situations. These behaviors became our own "life will always find a way" moment.

However, social studies around the world are exploring the relationship between people and planet, many of which are reporting "the connection of people to nature is decreasing more and more. This split between humans and nature can be seen as one of the reasons for our current environmental problems" (Kleepsies, 2021). For millennia we have ebbed and flowed with nature, but now, our very own division from the natural world could be the reason behind our many ecologic challenges in our settlements today. How then did humanity get to this point?

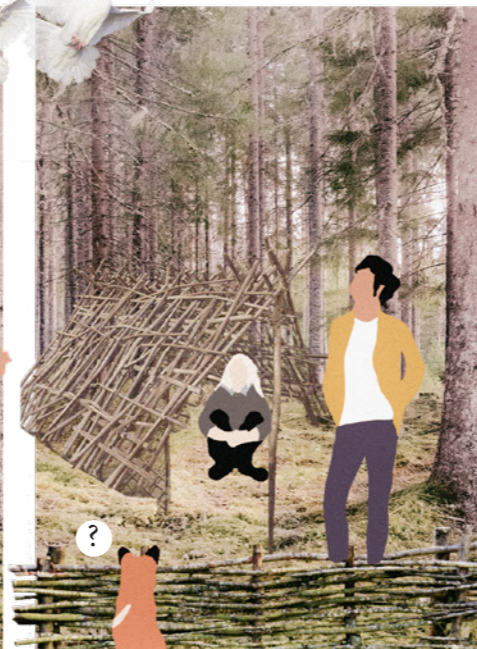
The Birth of the Urban Life- A Progression Since the Beginning of Us

My university professors always referred a progression of mankind and their relation to our environment. Whenever I think about our societal division with nature, I always think back to these lectures. It is important to note that this progression is not linear, we can very much switch from one phase to the other, or perform multiple stages simultaneously depending on the situation and community. Yet, this progression can help establish a context in understanding this relationship.

FEAR



ADAPTATION



AGGRESSION



STEWARDSHIP



Fear

For millennia we lived in a state of fear with the ecosystem. We were *in* nature, we were a *part* of it, and it very much dominated our quest for life. In many ways, we were equals with our nonhuman neighbors, simply fighting for survival. In this state of fear, humans learned that we were safer and stronger when we came together. In groups we could begin to shield ourselves from harsh elements and dangerous animals.

Adaptation

Yet, as we grew in larger numbers and built better tools, we were better able to adapt to the environment. We could live within a smaller margin of fear. By domesticating our human settlements, we decreased our vulnerability to the dangers of the wilderness outside. Though our ecological impact was small, we were beginning a legacy of distancing ourselves from our nonhuman neighbors, a legacy that eventually has faded our awareness of the natural world.

Aggression

With better technology and large populated cities, we were able to be in more control of our environment. Instead of being at the mercy of nature, we took an active role in shaping it. In our cities we have lost much of our natural spaces, which in turn have vastly decreased the biodiversity in cities, where only the most resilient species have been able to reside in our communities. We're looking at you, common pigeon.

Stewardship

Now, as we continue to grow in understanding in regards to our nonhuman neighbors, we are realizing their integral role in our own survival. For so long we have tried to distance ourselves from the ecosystem, but in so doing have made ourselves more vulnerable to large scale natural disasters. In the wake of climate change, mass extinctions, and ecological failures, many people are now working hard to undo these immense damages from our current ways of life.

EMPLOYING ECOSYSTEM SERVICES IN THE CITY

So then, what does this new age of stewardship look like? When experts discuss environmental stewardship, the terms ‘climate change’ and ‘sustainability’ are often thrown around. And important as these concepts are, they are just as abstract and up to interpretation as the concept of ‘nature’. Throughout my life, from hometown concerns to world stage politics, I have witnessed, with frustration, decisionmakers spending more time debating about the existence of these issues than the actual solutions. From my own observations, I’ve seen how hard it is for communities as a whole to face more abstract obstacles that are based on far-off predictions. We survived for millennia facing each obstacle as it came, long-term planning still may be a new skill we are developing. Sadly, this is the case for climate change and solutions to address it.

Our Neighbors Were Helping All Along

Since society is much better at handling pressing challenges that are rather visible and clearly achievable, thinking about climate change as a whole is so abstract and large-scale it is hard to think of a save-all solution.

That is why Dr. Sverdrup-Thygeson’s book shifted my view towards climate response. She introduces this somewhat new term called *ecosystem services*. These ‘‘ refer to living nature’s direct and indirect contributions to human existence and welfare. All the benefits that nature offers’’ (Sverdrup-Thygeson, 2021). It is a term to describe how ecosystem actors benefit people. Just like my little onion in the cupboard, ecosystem actors are extremely resilient. If ‘life will always find a way’, then why not utilize that power to address our big problems? In the planning and urban design world, we can employ local ecosystem actors to help us regulate and re-balance the ecosystems that we have damaged within our human settlements.

‘Employing’ ecosystem services in regional and local planning can be the beginning of communicating and implementing solutions that directly address the unique climate and ecological challenges that we are now facing. There are four ways in which these services can benefit people, and each can be applied within our cities:

Provisional Services

Provisional services are physical resources. We see them and hold them. These actors very easy to identify, like trees that provide the wood material for our houses, or vegetables we put in our soup. Provisional habitats are like an ‘‘apothecary, a place where we can pick up all kinds of products that we need: drinks, food, and fibre; fuels and active ingredients for industry; and raw materials for new medicine’’ (Sverdrup-Thygeson, 2021).

Supportive Services

These are the nonliving services that make life possible. Actors like the sun, moon, water. Life will always need these basic supportive services to exist. And with modern technology we have even learned how to harness the power of supportive services to benefit people even more, like solar power or river channelization to transport goods.

Regulative Services

Regulative services do just that, regulate the landscape. In this way, we can think of ‘‘nature as a trusty caretaker... Some of these functions are so fundamental to life on Earth that we could think of them as central strands in the very fabrics of life’’ (Sverdrup-Thygeson, 2021). One example could be how wetlands filter and hold stormwater and clean pollutants from the air.

Cultural Services

Because nature is a part of us, the lack of it can have a strong impact on psychological health and human lifestyles. In this, we think of ‘‘nature as a source of knowledge, beauty, identity, and experiences’’ (Sverdrup-Thygeson, 2021). We see examples of this as parks and trails for recreation, or even sacred places vital to spiritual or religious experience.

Towards a Future in Environmental Stewardship

Throughout our time in cities, we have pushed out many of the species and habitats that create a healthy ecosystem, creating *biologic deserts*. Cities are the most unbalanced ecosystems in the world because of this, and this subsequent imbalance has lead to many urban climate challenges that are impacting peoples lives and livelihoods every day. If life truly does always find a way, then setting up space for our nonhuman neighbors could very well be the way to establish the employment of ecosystem services to save our cities and ourselves in the process.



fig 4. examples of ecosystem services- scene of a natural area in Bali, Indonesia

A HIGH QUALITY ECOSYSTEM

The Building Blocks of a Healthy Habitat

OF HABITATS AND INHABITANTS

In order to employ ecosystem services we must have a healthy ecosystem, and in order to have a healthy ecosystem, urbanists, myself included, must learn how to implement high quality habitat in our urban spaces. This is the first step in changing biological deserts into welcoming oasis.

A habitat cannot simply be put together. Just because one plants a million trees does not mean they are making a meaningful impact in the natural world, especially if it is done incorrectly. Careful understanding and thought should go into the design of high-quality habitat to welcome new ecosystem actors. This is why a basic understanding of naturally occurring ecosystems is vital in the reintroduction or preservation of ecological services in our cities. Each ecosystem actor must have their basic needs met so that they can thrive and provide the benefits cities need. A happy and healthy ecosystem ensures that the ecosystems services employed are better able to self-regulate and self-sustain, meaning less maintenance and costs over time.

What Does a Healthy Habitat Need?

The study of urban ecology is still rather new, the term first coined in the 1930's. We as humans are just scratching the surface of our understanding of the anthropogenic ecosystem, of these large and small scale interrelations between species and the urban landscape. Designers and planners shouldn't be expected to know the complete depths of ecology in order to implement healthy habitats, but it is important to remember these three key ideas in planning these spaces:

1. Each species has a unique life cycle and habitat needs, from conception to death. If certain species are needed to achieve an ecosystem service, their habitat needs must be present.
2. An ecosystem is a complex web of many complimentary species and interconnected systems. A more complete system of many species will ensure a healthier and long-lived system.
3. Connecting these many species and systems are a series of different habitats. The more habitat typologies in a city, more ecosystem actors and their subsequent services will be naturally drawn to that area.



fig 5. the relationship between the monarch and milkweed



fig 6. an ecosystem is healthiest when a variety of species, niches, and habitats are present

Supporting the Life Cycle- From Conception to Decomposition

Every species has its own unique life cycle. Think of the Monarch Butterfly of the Americas, who has a special relationship with a particular plant species- the Milkweed (see fig 5). The Milkweed acts as a nursery, providing food and shelter to the young insect. When time comes for their great migration, they fly thousands of kilometers from Mexico and throughout the United States, only breeding and laying eggs on the beloved milkweed. Take away the Milkweed and there is no Monarch Butterfly. Those implementing urban habitat must remember the basic needs required to support all key species through all stages of life. Forget one aspect and that species may be lost to that area.

Balancing Biodiversity, Niches, and the Food Web

Building a rich catalog of species is also vital in a landscape, but there are many layers to it. To make it simple, one must balance high biodiversity, niches, and food webs. *Biodiversity* refers to the amount of species in a particular habitat. The higher the biodiversity number, the better. It means the entire system will be healthier and more resilient. But taking it another layer deeper, the *Niches*, or specific roles a species holds, is just as vital. A niche in a habitat could include seed-eaters, apex predators, cleaners, or decomposers- to name a few. A variety of niches ensures that the ecosystem is more well-rounded and better able to self-regulate, especially if the niches are filled by native species rather than invasive ones. One last step is a balancing the *Food Web*. This means everything from microbacteria to predators are present and populations are balanced. When members of every level of the food chain are present, populations will be more balanced and overpopulation is less likely to occur.

Implementing Wildlife Succession and Habitat Variety

Zooming out, a variety and appropriate transition of habitats is needed throughout a region. A planner must think of *Wildlife Succession*, which is the series of habitats within a larger region. Use my home town for example- Salt Lake City in the western United States. Situated between a large lake and a vast mountain range, my local high-desert region sees at least 4 different habitats within 20 linear kilometers (see fig 6). Each habitat and transition area hosts its own set of species, many who may even move between these spaces. This is also why continuous habitat connections are important throughout a city to allow the safe migration of species during different life cycles or seasonal movements.

PEOPLE AND PLANET

Real World Applications of Nature-Focused Design

THE NEED FOR HEALTHY HABITATS IN HUMAN SETTLEMENTS

So then, is it even possible to implement such complicated and nuanced spaces in our cities? Yes, and we have been for years. Now, as urbanists are discovering the benefits of urban ecology, many are building off of the idea that even though cities “only harbor a significant fraction of the world’s biodiversity, they can also be made more livable and resilient for people, plants, and animals through nature-friendly urban design” (San Francisco Estuary Institute, 2019). When we build up our nonhuman neighbors in urban settlements, we are not only re-establishing the vital systems we need in cities, but improving the urban experience and overall livability for people, too. Just as Jane Jacobs and other urbanists called for the improvement of human-centric design to make life better, nonhuman-centric design will only improve the functionality and pleasantness of our urban habitats.

Current Trends and Toward Urban Habitat

As urban design strategies and values shift in the wake of many environmental catastrophes around the world, designers and governments are changing their approach when it comes to prioritizing and valuing the presence of ecosystem services in their cities. A wave of architects, planners, urban designers, and decision makers are finding value in ecosystem services, many of which are focusing on the following trends:

Nature-Focused Design

Designers, planners, and governments are becoming more aware of the need for nature in cities. For example, the EU has recently passed legislation that requires many offices and government buildings to apply key sustainable practices, one of which is to build biodiversity in their new building projects.

Biomimicry, Rewilding, and Native Plantings

Many designers are finding inspiration from the wild world around them. By practicing biomimicry and rewilding, they are able to create beautiful landscapes that utilize native species, which in turn invite even more species.

Accessible Habitat

The shift to nature-centric design also pushes planners to make habitat more accessible for all ages and incomes. Green space has traditionally been a privilege for the upper classes, but now planners are beginning to push for equitable access to green space in urban areas.



fig 9. photograph inside the experiential destination The Cloud Forest Conservatory

EXAMPLES IN THE REAL WORLD

Throughout the world, designers and planners are already prioritizing strategies to explore the ideas of urban ecology and the application of biomimicry, rewilding, and high quality urban habitat. The following are examples of strategies and designs that architecture and planning firms from various regions are implementing to practice nature-focused design.

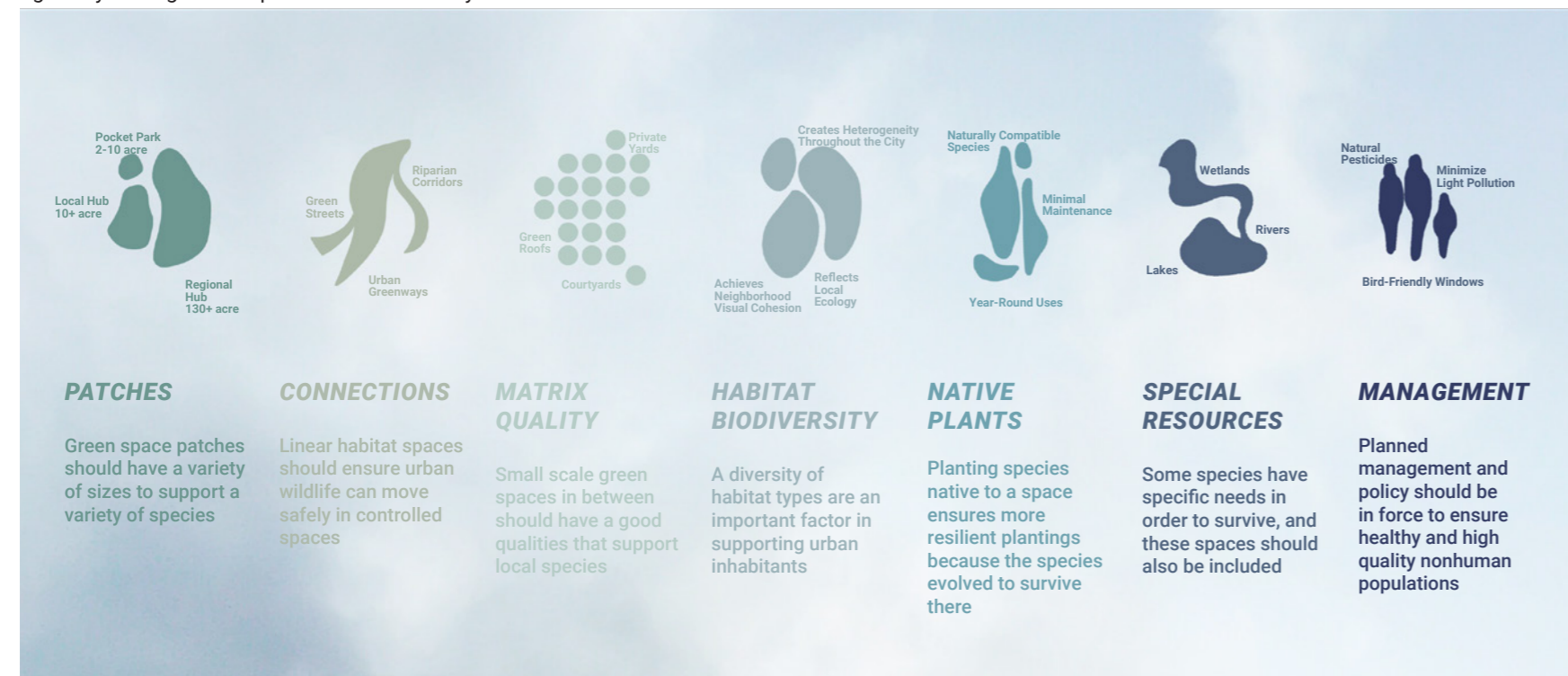
PROJECT HIGHLIGHT

The Cloud Forest Conservatory- Singapore

Primary Architect: Wilkinson Eyre Architects

The Cloud Forest Conservatory is an architectural masterpiece in the heart of Singapore. As an experiential destination site, the architects focused on how to create an “architectural icon, a horticultural attraction and a showcase for sustainable technology among the largest climate-controlled glasshouses in the world” (Wilkensen-Eyre) by taking the inspiration of the “maiden hair fungus, the mountain structure forms a lattice that...allows the opportunity to discover the unique biodiversity and geology of cloud forests” (Green Roofs). The greenhouse is not only important in its focus on education and biomimicry, but challenges the traditional ideas of the ‘garden city’. For, the “Bay South Garden is built on reclaimed land and, in the absence of a natural landscape, the conservatories are landmarks that prominently address both the bay and the skyscrapers of densely urban districts” (ArchDaily). As one of the main attractions of the city, it also shows the determination of the government to care for its nonhuman inhabitants, for public exposure leads to higher awareness and empathy.

fig 8. key strategies to implement "nature's city"



STRATEGY HIGHLIGHT

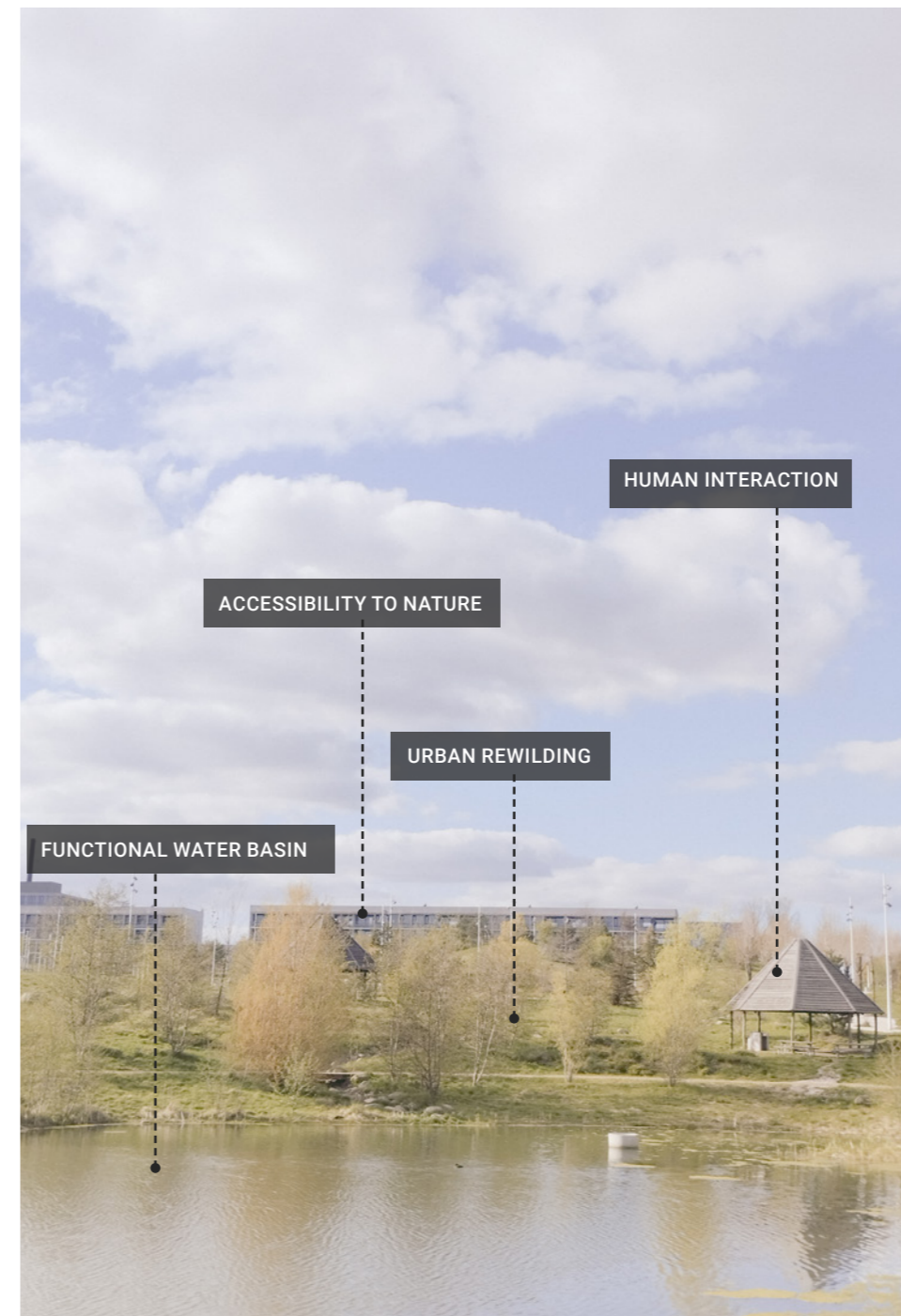
Making Nature's City

Published By: San Fransisco Estuary Institute

Noting that much of the research relating to urban ecology is scattered and largely inaccessible to urbanists, the San Francisco Estuary Institute created this booklet to synthesize research regarding urban ecology into a strategy that planners and conversationalists can use to implement healthy habitats in cities. Throughout the booklet, they defended the ideas that upgrading, expanding, and connecting habitats throughout a city should be a vital part of planning our settlements to meet the demands of the future (San Francisco Estuary Institute, 2019).

HIGH-QUALITY, ACCESSIBLE URBAN NATURE IS BEING INCREASINGLY RECOGNIZED AS CRITICAL TO HEALTHY AND EQUITABLE CITIES.

-UN HABITAT SYNOPSIS OF 'MAKING NATURE'S CITY'



Gellerup New Nature Park in Aarhus, Denmark reinvents urban green space

OFFICE HIGHLIGHT

SLA

Based In: Copenhagen, Denmark

SLA is a leading landscape architecture firm in Copenhagen that is striving to build a better understanding of the natural world and have developed a studio culture centered around the urban ecosystem. In an interview with Alexandra V. Hansen, head of Research and Development at SLA, I found many important applications in ecosystem employment and designing urban habitats.

SLA focuses on designing high quality habitats in urban settings. Teams extensively research and take site inventory to identify aspects of the natural environment that the firm can take into account on their project sites. By creating environmental baselines and goals, SLA works to build up ecological impact over time. For example, if more species are present than at the time of initial construction, it is considered a success as the landscape grows independently. Another important aspect of SLA is their research department, SLAB, which is an open research group that takes on different topics related to nature-focused design. SLA and SLAB prioritizes these interdisciplinary collaborations and conversations as they drive many of the design strategies and innovative ideas that the firm is developing. By focusing on these four key areas, SLA is making many breakthroughs in designing landscapes that serve both people and planet.

Biologic

A focus on the biological and ecological factors that are present, implementing a high quality habitat and maintaining ecosystem health.

Anthropologic

A focus on the human users of the site and their interactions with the landscape.

Economic

A focus on the economics of a site, and the financial impacts made by the variety of ecosystem services a site may offer.

Aesthetic

A focus on good design and the cultural ecosystem services that a landscape can offer.

REINTRODUCING SPECIES IN THE CITY

Establishing a Vision and Expectations

A VISION FOR SYMBIOTIC CITIES

Most designers and planners understand the need for natural areas in cities. However, just as Jane Jacobs observed the disconnect between the designer's desire for efficiency and the user's need for humanity in urban places, I am observing a nuance in this world of growing awareness towards nature-focused design and climate action.

Many times urbanists acknowledge that places should be sustainable and address climate change. They know that bringing nature into cities is key to addressing these issues, but many do not know, specifically, *why*. Many say that green is good, but exactly *how* does it help us? This thesis seeks to provide a concrete answer in how we as urbanists can put more intention into the natural spaces we design and plan for. Focusing on the potential for ecosystem services in a city gives specific goals and meaning to habitat space, it gives some answers to why it should exist and how it should be implemented.

Why- Rebalancing Systems, Regulating Landscapes, and Addressing Urban Issues

By designing habitat in cities we enable our human settlements to utilize ecosystem services. Many regulative services have been lost in dense urban areas because of the lack of natural ecosystems, and now many cities have minimal and unsuitable habitat space for nonhumans within our human communities. If we can see to it to provide habitat and reintroduce vital ecosystem actors (fig 10), many of the climatic hazards that we are now experiencing in this anthropogenic period can be addressed if we are intentional in our goals and ecosystem service employment.

How- Uplifting all Urban Inhabitants

By implementing high quality habitat, we begin a new chapter in our progression towards environmental stewardship. When we uplift our nonhuman urban inhabitants, we begin a symbiotic relationship. But we need to be intentional, we need to be direct, building a symbiotic city where we care for our fellow ecosystem actors and they in turn provide us benefits in the forms of ecosystem services- those provisional, regulative, and cultural benefits that we desperately need in our cities.

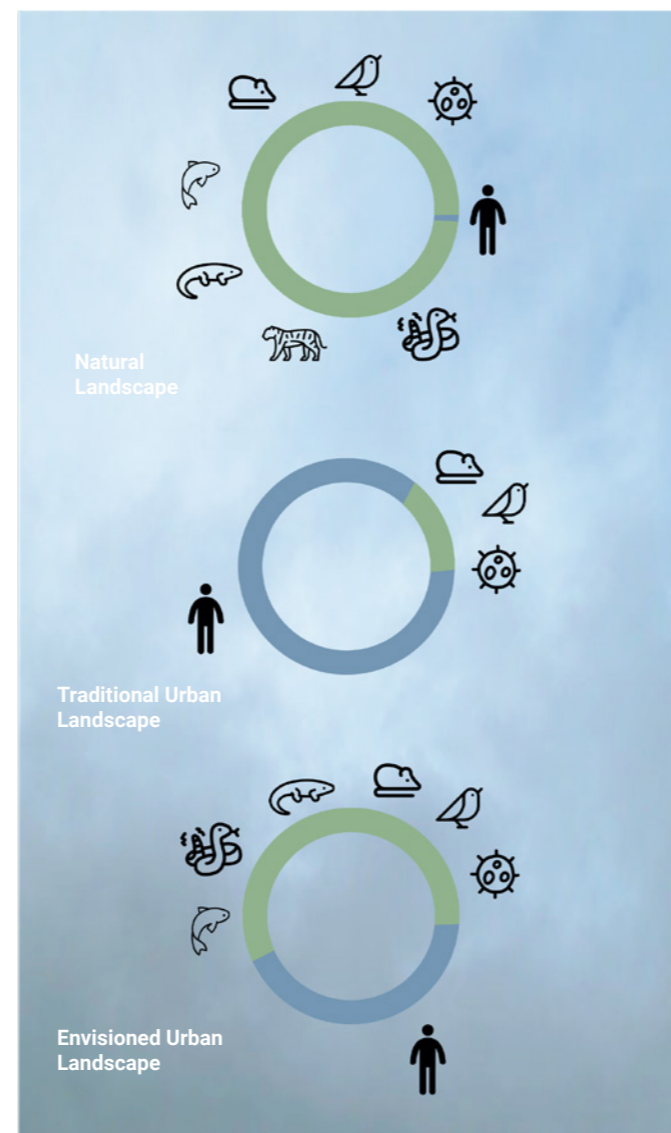


fig 10. the circle of wildlife balance



Establishing Expectations

Although the concepts of urban ecology and ecosystem services are still rather new, they provide many urbanists with the opportunity to explore the rich, interconnected world of our nonhuman neighbors in urban spaces. The purpose of this booklet is to explore one urban design strategy of ecosystem service employment in large urban areas. By constructing a general strategy and applying it to a real world city, I will explore the importance of habitat in cities as a viable response to many crisis that lay the wake of global climate change.

Establish a Strategy for Designers to Implement High Quality Habitat in Relation to Local Cultural and Geographic Needs

My main goal in this project is to develop a design strategy that any urbanist could follow- a game plan to observe and apply ecological benefits in human settlements. The strategy will begin with taking inventory of the local native habitats and people's relationship to them. Afterwards the urbanist can then implement designs and plans for habitats that reflect those observations.

Demonstrate How to Follow the Strategy in a Real-World City

The exploration and demonstration of urban ecosystem employment is an important step in communicating the viability of the thesis ideas. In a real-world city I will observe its ecosystem and the hazards that have come from large scale, rapid urbanization.

Develop a Prototype of a Neighborhood that Employs Ecosystem Services and It's Impact on Nonhuman and Human Residents

The final goal of this project is to develop a design that employs ecosystem services based on benchmarks and habitat implementation uniquely crafted for the city and sites chosen for design.

A GENERAL GUIDE FOR URBANISTS

Employing Ecosystem Services in Urban Areas

URBAN DESIGN STRATEGY

In order to employ specific ecosystem services in a city, the design and planning team must know how to successfully identify and implement appropriate habitat, have specific intentions and goals, and communicate these intentions in a way that decisionmakers and the public will want to support habitat and ecosystem actors for long term solutions.

This general strategy is meant as a guide for designers and conversationalists to begin the process of employing ecosystem services in their own designs and plans.

Step 1: Take Inventory of the Urban Ecosystem

IDENTIFY THE NATURAL HABITAT

Answer questions such as: What habitats does the city lie on, who are the ecosystem actors, what are the needs of these original actors. Answer the questions of what existed before the urban settlement, and what natural processes were at play when undisturbed. What processes are lacking, what processes are managed and cared for?

IDENTIFY THE EXISTING ELEMENTS OF THE URBAN ECOSYSTEM

Observe how: How does habitat present itself in the city? What areas have noticeably high levels of biodiversity, what areas have very low biodiversity? What is lacking in environmental health, what is working? Look into the three general categories of habitat space found in cities:

- The Gray: Developed Areas that are prominently human-centric
- The Blue: Areas of Water and riparian habitats, like wetlands
- The Green: Open space dominated by plants, like parks or farms

Step 2: Identify Needs to Address

IDENTIFY GOALS

Choose what needs ecosystem actors can supply. Here it is key to be specific, for this is the meat of the whole project. Refrain from conceptual ideas and look more at physical, visual issues that need to be addressed in the city. This could look like “implement wetland habitat to filter polluted water entering the city in river x” or “reconstruct mangrove forests on the coast to protect coastline properties from storm surge”. Identify the issue and how ecosystem actors and habitats can address them.

ANALYZE SPACE SUITABILITY

Identify how existing green, blue, and gray habitats can be improved to host appropriate ecosystem actors and habitats. If needed, seek out additional sites that would be suitable for ecosystem service employment.

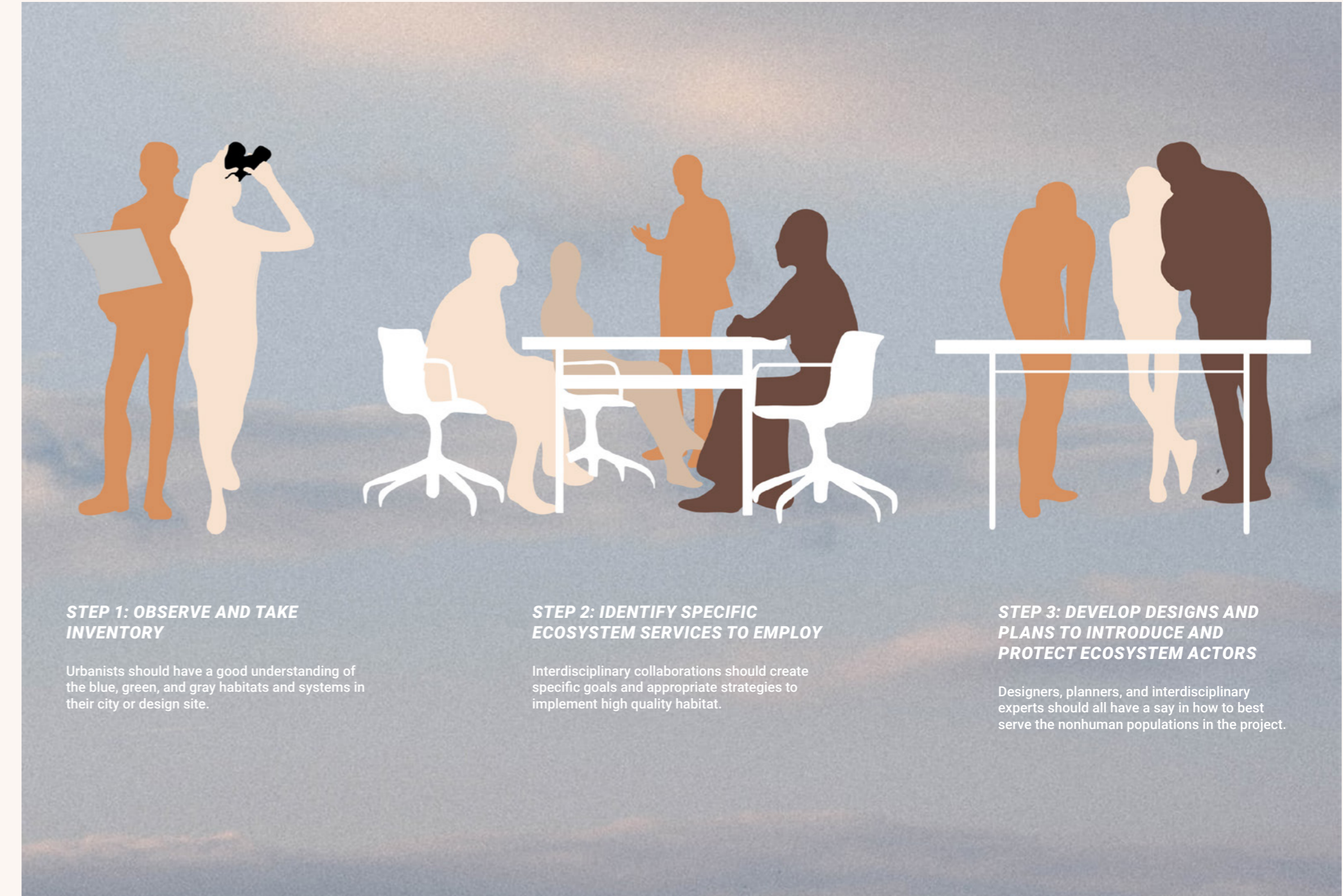
Step 3: Implement Habitat Space for Urban Communities, Both Human and Nonhuman

SYMBIOTIC DesignING AND PLANNING

Develop plans and design strategies that are driven by the findings of step 1, and meet the needs identified in step 2.

ENVIRONMENTAL STEWARDSHIP IN LEGISLATIVE POLICY

Ensure that habitat is well managed and protected in the form of urban planning policies and nonhuman-centric legislation that helps establish a foundation of ecosystem service work in the project area.





CHAPTER 02

THE RISE OF MEGACITIES

EXPANSIVE CITIES ARE POWERHOUSES OF ANTHROPOGENIC IMPACT ON THE LANDSCAPE. AS MORE CITIES CONTINUE TO GROW, MORE PEOPLE WILL BOTH IMPACT AND BE IMPACTED BY THESE URBAN LANDSCAPES.

EXTREME URBAN ECOSYSTEMS
An Urban Phenomena: Megacities
Rapid- Growth Trends

CHOOSING AN APPLICATION SITE
Applying Ecological
Understanding to Design
Introduction to Jakarta

EXTREME URBAN ECOSYSTEMS

The Migration to Cities at an Unprecedented Scale

AN URBAN PHENOMENA: MEGACITIES

In 2007, our global society passed a mark that we have never seen before. For the first time, more than half of us lived in cities (Ritchie, 2018). For millenia, we have worked in small groups to survive in our landscape, and for the fast few thousand years lived in a mix of small rural settlements, villages, and some taking to the larger cities. As cities grew and thus offered more work opportunities and access to trade and services, urban areas became much more incentivized to support the modern lifestyle.

However, the more people live in cities, the more the city tends to grow outward and the more natural land is developed. This poses a problem in the ecological world. As more land is human-dominated, other species are often pushed out- usually as a result of habitat loss or an active extermination. The loss of ecological assets is particularly important in our cities, for as nonhuman ecosystem actors are lost, so are the vital ecosystem services they provide, including the land's ability to self regulate and protect life from larger environmental threats.

The Mass Migration to Cities

However, there is a reason that humans move to cities. They are safer than the wild, have many more opportunities and provide unique social settings. The migration into cities will continue as long as these opportunities are present, and as local climates become much more extreme in the next few decades, many more people will be forced from rural areas into the cities. By 2050, nearly 70% of people will be living in urban areas (UN DESA, 2018).

The growth of cities is nothing new--urbanization has existed for millennia, but in its present form it functions as an accelerating aspect of the

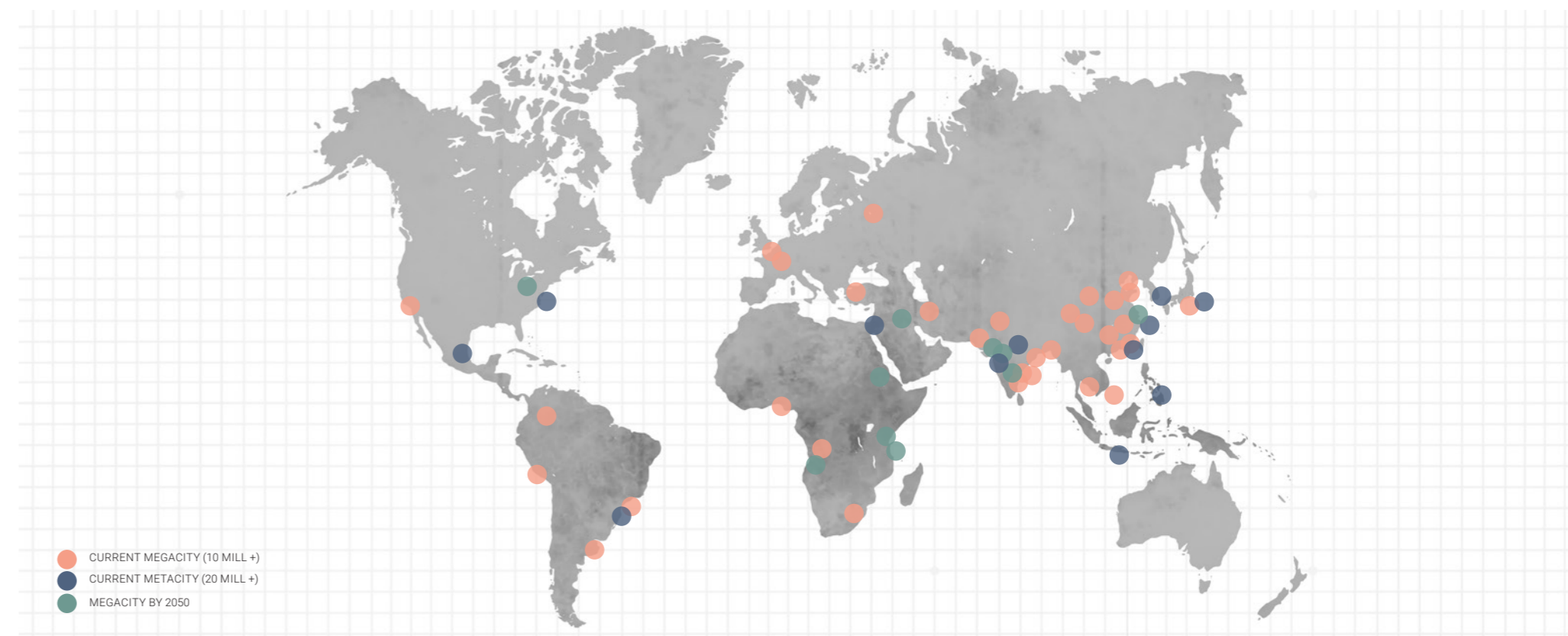
Anthropocene'' (DESA 2018). As more and more people migrate into the city, all together in one space, the anthropogenic impacts are compounded. To support large groups of people and large industries that often take up residence in large-scale human settlements, cities then become factories for large-scale anthropogenic activities that continue to grow as much as cities do. Already ``70% of global CO2 emissions from final energy use, but are disproportionately and increasingly exposed to the impacts of climate change'' (DESA 2018) and as more people move to urban centers, the environmental impact of cities will increase even more.

Cities continue to expand and densify- thus having a bigger impact on inner-city ecosystems and regional habitat health. This pattern of city expansion and migration becomes a rather nuanced phenomena- as our cities dominate the landscape in an effort to protect life and livelihood from the wild landscape, the risks of and vulnerability to much larger natural disasters increase even more. Because cities often lack healthy ratios of green and blue habitats, the physical landscape is not as capable as it could be to self-regulate and protect the area from large-scale climate threats. These issues become increasingly dire the larger and more dense the city.

The Definition of a Megacity

This migration into cities has created an even more interesting phenomena- the megacity, the world's largest human settlements and some of the most vulnerable places in the world in terms of climate hazards and natural disaster. Megacities are ``urban agglomerations with 10 million inhabitants or more'', giant megaliths of human life and anthropogenic impact. The first megacities popped up in the 1980's in an era of rapid growth and technological progress. At present, there are about 30 megacities around the world, and in recent years, humanity realized an even higher level of human settlement- the metacity- an urban agglomeration that supports 20 million

URBAN AREAS ABOVE 10 MILLION INHABITANTS



● CURRENT MEGACITY (10 MILL +)
● CURRENT METACITY (20 MILL +)
● MEGACITY BY 2050

NORTH AMERICA

MEXICO CITY, MEXICO 21,804,000
NEW YORK, USA 21,509,000
LOS ANGELES, USA 15,204,000

SOUTH AMERICA

SAO PAULO, BRAZIL 23,086,000
BUENOS AIRES, ARGENTINA 16,710,000
RIO DE JANEIRO, BRAZIL 12,592,000
LIMA, PERU 10,320,000
BOGOTA, COLUMBIA 10,085,000

AFRICA

CAIRO, EGYPT 20,296,000
LAGOS, NIGERIA 16,637,000
JOHANNESBURG, S. AFRICA 14,586,000
KINSHASA, DR CONGO 12,836,000

EUROPE

MOSCOW, RUSSIA 17,332,000
ISTANBUL, TURKEY 16,079,000
LONDON, UK 11,262,000
PARIS, FRANCE 11,060,000

ASIA

TOKYO, JAPAN 37,732,000
JAKARTA, INDONESIA 33,756,000
DELHI, INDIA 32,226,000
GUANGZHOU, CHINA 26,940,000
MUMBAI, INDIA 24,973,000
MANILA, PHILIPPINES 24,922,000
SHANGHAI, CHINA 24,073,000
SEOULE, S. KOREA 23,016,000
DHAKA, BANGLADESH 18,627,000
BEIJING, CHINA 18,522,000
KOLKATA, INDIA 18,502,000

BANGKOK, THAILAND 18,007,000
SHENZHEN, CHINA 17,619,000
KARACHI, PAKISTAN 15,738,000
BANGALORE, INDIA 15,386,000
HO CHI MINH, VIETNAM 15,136,000
OSAKA/KYOTO, JAPAN 15,126,000
CHENGDU, CHINA 14,645,000
TEHRAN, IRAN 14,148,000
CHENNAI, INDIA 12,395,000
XI'AN, CHINA 12,328,000
LAHORE, PAKISTAN 12,306,000
CHONGQING, CHINA 12,135,000
ZHENGZHOU, CHINA 10,959,000
DONGGUAN, CHINA 10,646,000
HYDERABAD, INDIA 10,494,000
TIANJIN, CHINA 10,368,000
WUHAN, CHINA 10,251,000

NEW MEGACITIES BY 2050

NORTH AMERICA
CHICAGO, USA

AFRICA

LUANDA, ANGOLA
DAR ES-SALAAM, TANZANIA
NAIROBI, KENYA
KHARTOUM, SUDAN

ASIA

AHMEDABAD, INDIA
NANJING, CHINA
PUNE, INDIA
SURAT, INDIA
BAGHDAD, IRAQ



fig 1. common characteristics of rapid-growth megacities

people or more. (DESA 2018). Mega- and meta- cities are one of mankind's largest achievements, the ability to build communities that can support millions of people in one place. In 1970, only 55 million people worldwide, or 1.5% of the world population, lived in megacities. In 2050, it is predicted that over 750 million people, or 8.8% of the population, will live in megacities (DESA 2018). Not only does this mean more people will be migrating into cities and increasing the physical and antropologic impact of cities, but much more people will be affected by the often vulnerable placement and disregulated ecosystems that often exist there.

The Impact of Megacities on the World Stage

Megacities are major factories of anthropogenic impact and how they affect the worldwide ecosystem. They have extremely large footprints and are often heavily dominated by manmade materials with insufficient natural areas. It take a lot to support this many people, for "the population consumes food and energy and produces waste in solid, liquid, and gaseous form in order to sustain themselves and pursue business activities such as manufacture or services" (Folberth 2015). Such consumption and waste has a significant impact on both the land and air, which has far reaching impacts on both the local and regional ecological health- including our own.

Megacities Are Important Urban Ecosystems

Megacities, often extending over many kilometers and dominated by hard materials like roads and buildings, create very unique ecosystems. Though they may be filled with people, nonhuman needs are rarely met- you might notice cities often have a few resilient species that take up majority of the nonhuman community- most often pigeons and rodents.

These altered ecosystems often house minimal habitat space, and those areas that are preserved often lack suitable resources that could support a healthy level of biodiversity. Subsequently, ecosystem services disappear in an unregulated environment and ecosystem hazards arise, like higher temperatures and a higher likelihood of flooding in storm events. The size of megacities also impact wildlife migration, where we often see 'unwelcomed' wild animals attempt movement across major streets or into human areas, more often than not resulting in harm to people or animal migrant. Oftentimes, simple and passive habitat space in cities can be a

powerful tool in not only providing a safe buffer between people and wildlife, but also aid in reintroducing the self-regulation of natural ecological systems and minimization of climate hazards like said flooding and heat exposure.

Megacities can be a greatly suitable space to implement habitat for targeted ecosystem services because they are both large and impactful. If simple solutions can affect millions of people, why not try?

RAPID-GROWTH TRENDS

It is important to realize that the more harmful attributes of megacities are not entirely because of poor planning or careless attitudes towards people and planet. Most mega- and meta- cities became 'mega' because of a phenomenon known as rapid-growth expansion. Over the last century, technologies and migration trends have largely contributed to the pressures of cities to grow farther out and build more densely.

Rapid-growth cities develop differently than slower growing cities because they lack the opportunity to exhibit organic long-term growth and planning. The high pressure to meet growth needs overrule many important aspects of careful and controlled city planning. This often ends up in densely packed, expansive cities with very little green space and community amenities.

If global population growth follow the current trends and begins to flatten out, so will the growth of megacities. Even though the rate of worldwide city growth is slowly decreasing, the impact of previous rapid growth will continue to impact current and future inhabitants in these macro communities (DESA 2018). As many of the world's megacities are reaching more stable population rates and are now improving conditions in a post-growth period, ecosystem services can be an effective planning tool to ease many consequences of this expansion style. And for cities now that are facing rapid growth and/gaining megacity status in the next few decades, environmental quality should be a strongly protected element of the city in order to maintain landscape regulation and added protection from the climate crisis.

The Pressures of High Growth Rates

Often times rapid-growth megacities arise in the face of growth rates that

are at least 3% growth per year. Cities often must prioritize development of housing and the job market over most anything in order to support the added people living there.

Rapid growth is especially damaging to ecological systems because oftentimes cities must prioritize growth, and usually don't have time to create quality masterplans or follow now-arbitrary city plans. This growth often comes in different forms, depending on the location and qualities of the city.

Deforestation and Growth Outwards

The first option for cities is often outward growth, normally over wild landscapes like forests or grasslands or whatever the native habitat is. This takes out major areas of regulative habitat and the natural processes that support and protect life and thus become covered in hard materials.

Agricultural Conversion

Many times cities will develop over existing agricultural fields when forced to define new developable land. This not only decreases the amount of green space in an area, but also lowers food security of a city as it must rely more and more on imported produce rather than locally grown.

Urban Merging

Urban conglomerations can become so massive when multiple municipalities simultaneously growing together, creating one large urban area. This can minimize or even destroy natural connection routes that species use to migrate.

Land Locking

When cities run out of developable land, it leads to higher land prices and denser living situations. When cities cannot grow out they eventually begin to grow upwards. This can lower the desire to implement natural spaces because land is more valuable and landowners want to invest every amount of space they have in their favor, often the green is then considered 'dead space' and left out of plans.

How Does Rapid Growth Impact the Ecosystem?

Rapid growth often takes many environmental qualities out of cities as

meeting developmental needs are prioritized. This overall phenomenon has significant impacts the landscape's ability to "find a way". When green and blue habitats are overwhelmed by manmade development, ecosystem actors either cannot perform within their ecological niches or disappear entirely from the landscape. Other impacts of rapid and expansive growth can impact the landscape in the following ways:

Impermeability and an Altered Landscape

Manmade building materials, often impermeable, can impact many aspects of a landscape. Sunlight will reflect differently than natural materials do, resulting in warmer temperatures; rainfall is more concentrated to designated drainage areas, increasing the likelihood of flooding. Natural areas are concentrated in smaller areas, impacting nonhuman movement patterns and access to food and shelter.

Rapid Habitat Loss and Lack of Special Resources

With prioritized space for humans and less naturalized space for nonhuman actors, the natural ecosystem order is disrupted and nonhuman populations decrease as species are pushed out due to unsuitable habitat areas, which are often too few and few between.

Pollutants and Anthropogenic Impact

Manmade pollutants like fossil fuel emissions from factories and vehicles can impact many vital species who may be more sensitive to lower air and water qualities. Poor sanitation and littering can also be factors that push ecosystem actors out of an area, thus lowering overall biodiversity and nonhuman community health.

CHOOSING AN APPLICATION SITE

Introduction to Jakarta, Indonesia

APPLYING ECOLOGICAL UNDERSTANDING TO DESIGN AND URBAN PLANNING

This thesis project is an application of ecological principles that are understood in the modern day. In 2023, urban ecology and our understanding of urban nonhuman communities is still a young study area. Researchers and experts in the field are just beginning to understand the depths of the natural world in this way. By applying principles of urban ecology in terms of ecosystem services contributes to the conversation that nature has a vital role in human settlements and deserves protection and support by local governments and organizations.

The employment of ecosystem services can be seen as a city planning and design tool to better understand the role that our nonhuman neighbors have. By applying an understanding of basic ecological principles to the urban planning of habitat space, or in other words, urban vegetation and water systems, we are in turn creating a symbiotic relationship where urban society serves nature and nature in turn serves us. In Chapter 1, the progression of society and its relationship to the environment progresses from Fear, Adaptation, Aggression, and Stewardship. For so long our cities have been the macro-aggressor over the landscape, in turn becoming the factories of anthropogenic impact, emissions aiding in the trigger of the greenhouse effect and subsequent worldwide climate change. In the face of the global climate crisis, our cities have a choice to make, shall we allow extreme climate shifts make urban society vulnerable to nature again, or shall cities work with nature in a symbiotic way in order to undo the harm we have done, ushering an age of Stewardship. This project seeks the latter.

A Brief Look at Rapid Growth in Jakarta

To visualize these ideas of ecosystem employment in a real-world context, I will follow the general strategy introduced in Chapter 1 to a megacity I know well. Allow me to introduce the special region of Jakarta, Indonesia- the world's third largest urban area. The Jakarta urban area faced most of its rapid-growth in the 20th century and has since slowed as the main urban core has hit landlock. However, many climatic challenges impact the population now as the ecosystem has been drastically altered from the coastal tropics to a wide concrete landmass.

I personally chose this city because I already speak the language and have a basic understanding of the culture and lifestyle after living there many years ago. Compared to other suitable cities for this project, I decided it would be best to have at least a foundational understanding of the language and city before beginning a design proposal. In these next chapters, we will explore the nuances of Jakarta and its gray, blue, and green habitat within the vibrant metacity.





CHAPTER 03 SELAMAT DATANG KE JAKARTA

TRANSLATION: WELCOME TO JAKARTA

THE JAKARTA METACITY IS A COMBINATION OF MANY CITIES THAT TOGETHER MAKE UP 30 MILLION PEOPLE. AS CAPITAL, THE ARE ATTRACTS INDONESIAN FROM ALL ACROSS THE COUNTRY.

WELCOME TO INDONESIA
Selamat Datang- Welcome

WELCOME TO JAKARTA
Jakarta as Two Capitals

URBAN QUALITIES OF JAKARTA
Rapid Growth of Jakarta
Impacts of Rapid Growth
Action in Urban Design

WELCOME TO INDONESIA

Bumi Pertiwi- Land of Mother Earth

SELAMAT DATANG- WELCOME

Indonesia is an island archipelago located in Southeast Asia, in between continental Asia and Australia. The country boasts a strong cultural heritage with around 700 languages and 1,300 ethnic groups, each with a strong culture of cuisine, arts, language, and local traditions. Together, the archipelago was unified as an independent democratic nation in 1945 and after nearly 80 years, Indonesia has become one of the most influential nations in Asia, even the “fourth most populous nation in the world and 10th largest economy in terms of purchasing power parity” (World Bank, 2022).

Located along the equator, the fertile group of islands is not only a significant actor on the world stage in terms of economy and population, but also in the global ecosystem, representing “the third largest tropical rain forest in the world, and is home to the world’s largest tropical peat lands and mangrove forests. These natural resources store vast amounts of carbon that mitigate climate change impacts” (World Bank, 2022). The many ecoregions of Indonesia are vital in terms of large-scale climate regulation, making ecological preservation and conservation key in actions to address climate change and other environmental issues.

A Tropical Paradise of 17,000 Islands

As “the largest archipelago in the world to form a single state, Indonesia consists of five main islands and some 30 smaller archipelagos, totaling about 18,110 islands and islets of which about 6,000 are inhabited” (Indonesian Embassy). Located on the ring of fire, the island nation was born from the many volcanoes, many of which are still active today. Although the ever-present threats of eruptions, earthquakes, and tsunamis bring added risks to life and livelihood, the Indonesian people are strong and resilient. The 274,000,000 people of Indonesia, brought together in the unified language of

Bahasa Indonesia, still boast many strong cultures that have endured through centuries of Dutch colonization, devastating natural disasters, and political turmoil following independence. Traditional knowledge, cuisines, arts, and lifestyles continue to persevere and adapt as Indonesia moves into an age of rapid globalization and technological advancement.

Economy Driving By Provisional Ecosystem Services

Indonesia’s vital role as a regional and worldwide trade partner is no new feat. For centuries, ports throughout the archipelago have fueled commerce—from the days of merchant vessels to the current era of global shipping. Benefiting from the rich provisional ecosystem services like palm oil, coffee beans, and spices that brought traders from every corner of the Old World, Indonesia owes much of its success to its diverse palette of ecosystem services. Perhaps in this modern era, Indonesia is investing more in services and production manufacturing, the country’s relationship with the provisional benefits of nature will always be a part of its legacy.

A Bright Future for Indonesia

Since it’s independence in 1945, Indonesia has experienced many highs and lows. Though facing a variety of political and economic struggles during it’s first 75 years as an independent nation, the people of Indonesia have created a powerful country that is on route to becoming one of the biggest players on the world stage. Some even project that in the next century, Indonesia may become one the world’s next superpowers. Focusing on island connectivity and technological advancement, the future of Indonesia looks very bright. However, it is important to note that climate change is projected to impact Southeast Asia the fastest and hardest, and as many people live along the many coasts, Indonesia will need to make large scale actions to fortify its bright future ahead.

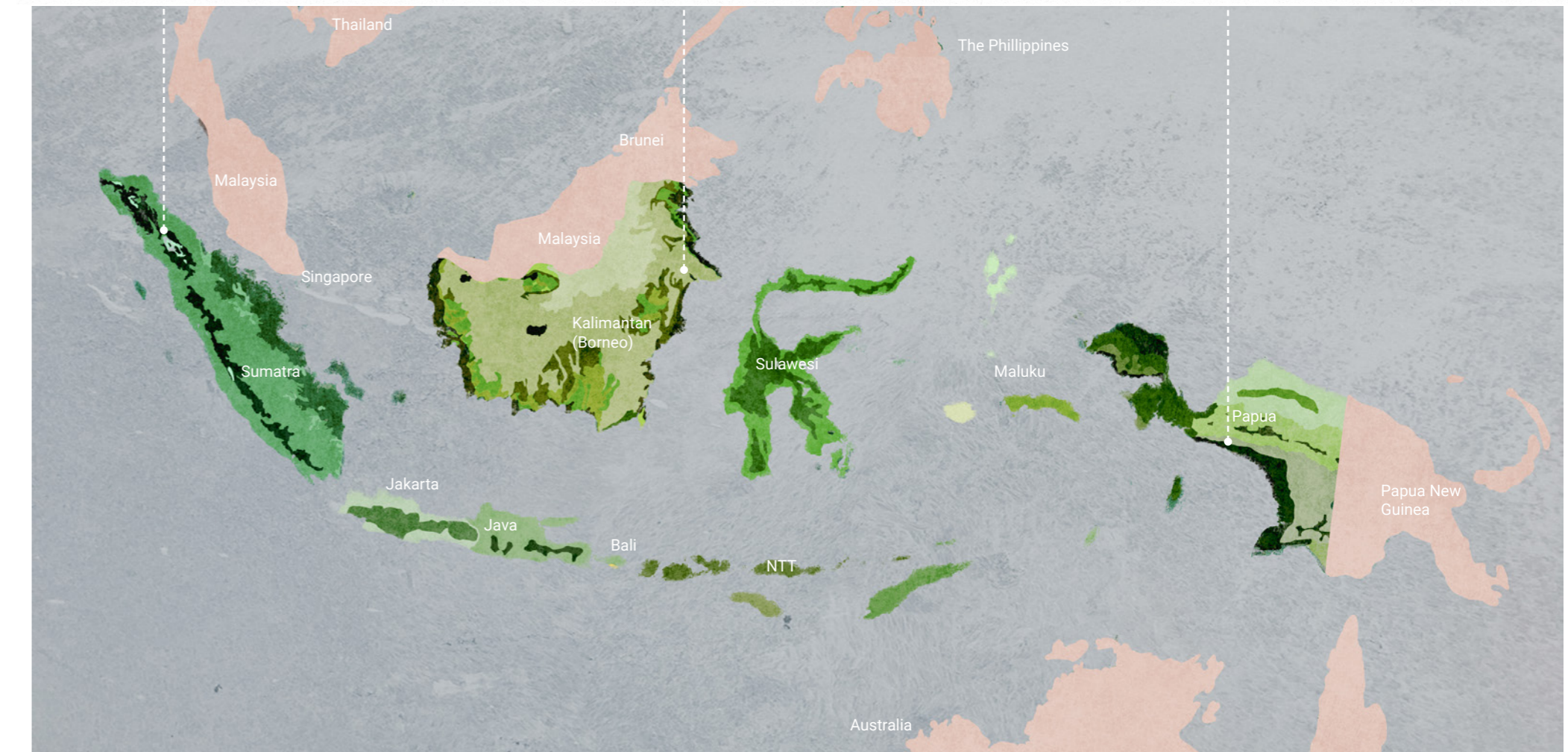
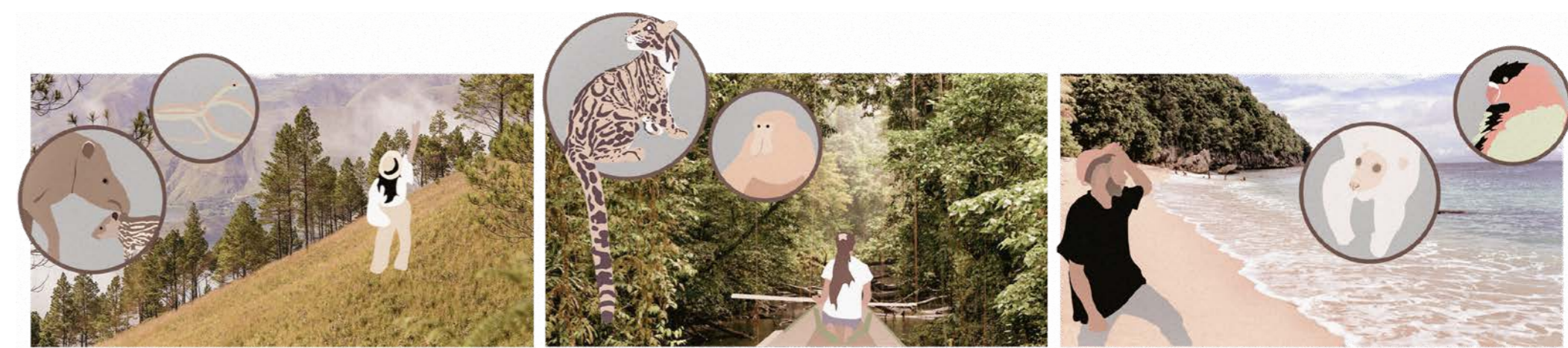


fig 1. map of Indonesia

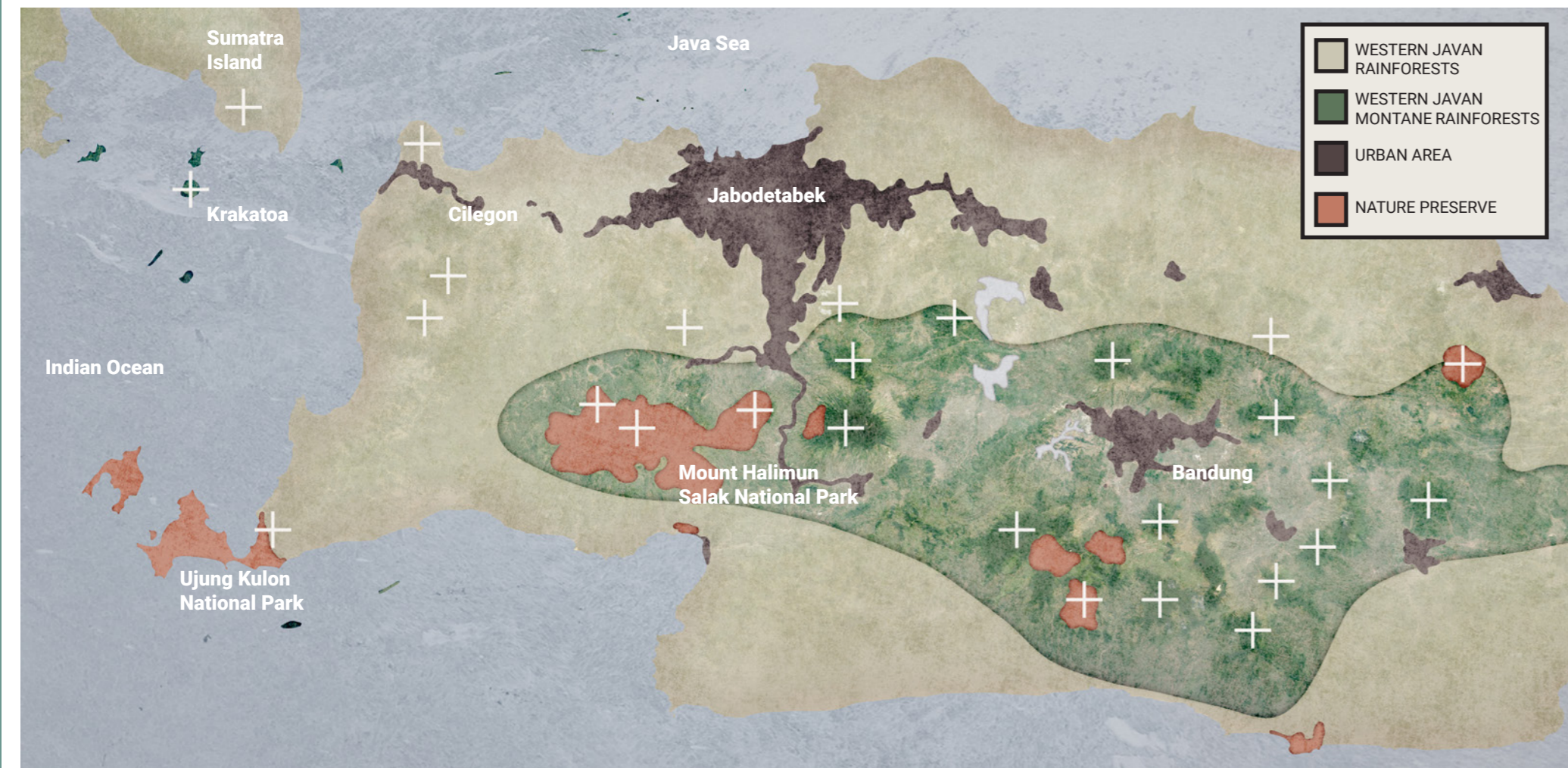


fig 2. map of western Java

WELCOME TO JAKARTA

The Big Durian- Southeast Asia's Economic Hub

INTRODUCTION TO JAKARTA

Jakarta, the most populated city in Indonesia, is also its capital. Combined with its nearby satellite cities, the overall urban agglomeration is known around the country as Jabodetabek (taking the first letters of each of the five municipalities- Jakarta, Bogor, Depok, Tangerang, and Bekasi). All together, this urban area makes up almost 34,000,000 million people, creating the second most populated urban area in the world.

For the future chapters of this book, I will focus on Jakarta itself, nuzzled in between its four neighbors. Jakarta alone is home to 10.5 million people and hosts many administrative offices, embassies, financial hubs, and business headquarters for both national and international companies. Jakarta is now an economic powerhouse in Southeast Asia and is on the route towards vast modernization of its city, focusing on new public transportation and smart city strategies to better connect and serve the people that live there.

Demographics

Many people have made the move to Jakarta because of the many opportunities it offers. Compared to other cities or small villages, Jakarta offers better jobs, better pay, and access to more services. Over the years, Jakarta has become a melting pot of cultures from every corner of the country, and even attracts foreign workers as well. Jakarta overall is a space that is more culturally and socioeconomically diverse than most anywhere else in Indonesia.

JAKARTA AS TWO CAPITALS

The Administrative Capital

Jakarta has been the capital of Indonesia since independence in 1945. Before that it was the headquarters for the Dutch colonizers known as Batavia, and even before then the head port city for the Sunda Empire. Jakarta has long been a magnet for foreign relations and is now home to embassies from all over the world. Many government offices and embassies dot the Central Jakarta region of the city.

The Stage for Political Expression

It is in this central region of Jakarta that many Indonesians come together in the form of political movements and demonstrations. These political practices are an important form of protest for the people of Indonesia to showcase their feelings towards certain laws or political movements and is a common occurrence in this area.

The Economic Capital

As the economic capital of Indonesia, the city has been given the nickname of 'The Big Durian' as a comparison to the Big Apple (the United State's economic capital). Jakarta is home to many business headquarters and financial offices. In the southern region of Jakarta is a district known as SCBD, is the financial district, and is home to many towering skyscrapers that make up the pronounced skyline of Jakarta. Here you will find many examples of state-of-the-art architecture and urban design practices in the city, for it is the window into the country for many important diplomats and leaders.

OBSERVATIONS OF A DESIGNER

In order to gain a more in-depth understanding of the city and center the ideas and proposals on personal observations, I spent two months living in the city and taking inventory of the many ways that Jakarta relates to nature and ecosystem services. Overall, I found four predominant characteristics of the city that are important for the reader to understand about this metacity.

The Concrete Jungle

Jakarta is a vastly covered in concrete and asphalt. During my time in the city, I noticed that these materials took up most of land cover. As a reliable building material that is helpful in keeping indoor temperatures cooler, houses are predominantly built from concrete. Impermeable materials also overwhelm open space as it is considered to maximize usable space for outdoor activities. Jakarta is 90% built up, leaving only 10% for undeveloped green spaces. This means it has great implications on the inner climate of the city, and is a major driver for hazards like flooding, land subsidence, and urban heating.

The City of Opportunity

Jakarta is considered one of the best places to live because of the higher pays and more economic and job opportunities despite it being more expensive. It is also more progressive and a better stage to practice more unconventional ideas and lifestyles. In the years of rapid growth, Jakarta grew at a minimum 3% rate from the 1950's to 1990, the fastest growth the city had

ever seen. Though growth has stabilized, the city continues to see a slow yet steady population rise every year. Many people are drawn to the opportunities and higher pays than most smaller cities and home villages can offer.

The City of Rivers

Located on the northern edge of the Java Island, many rivers meet the sea in this region. One of my first observations of this area was that there are canals everywhere. Some, vast rivers, and others only a meter or two wide. The canal system in Jakarta is extensive and very much a large part of how the city is designed and managed. The threat of flooding from these rivers during heavy rain storms is very real for many Jakartans, but I could see that the city is completing many projects are in the works to mitigate hazards while simultaneously implementing beautification projects that improve public perception.

The City of Traffic Jams

There is a famous phrase in Jakarta, "tua di jalan" or becoming 'old on the street'. Traffic jams are one of the biggest issues in Jakarta and a key feature that one must experience in order to truly experience the real Jakarta. Hours-long traffic jams are at their peaks in the mornings and evenings when workers travel between the satellite cities and Jakarta itself. After a while I gave up on travelling far distances because even short trips could take an entire day if the traffic was out of my favor. The city is making prioritizing efforts to address this issue, as it is one of the most prominent features of the post-rapid-growth metacity.



URBAN QUALITIES OF JAKARTA

The Age of Growth

THE RAPID GROWTH OF JAKARTA

Jakarta has had a long journey to the present day. From its designation as the young nation's capital in 1945 to these modern post-COVID days, Jakarta has faced an uphill battle in developing a resilient city that meet the present challenges of climate change and modern society. This is the journey of DKI Jakarta from birth to today.

Building from the Rubble of Colonization (1945)

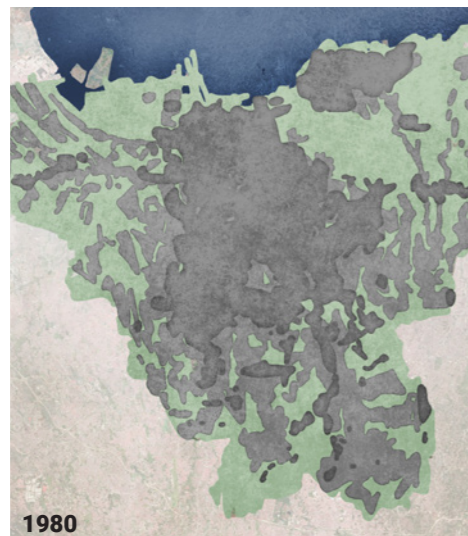
For centuries, Jakarta was under the name of Batavia, ruled heavily by the Dutch V.O.A trading company. Utilizing Dutch engineering techniques, the colonial urban planners brought European-style practices to Indonesia by channelizing many of the rivers and building streets and plazas. Once the Dutch lost power over the nation during the second world war, the Indonesian

government was left with a city based on its oppressive colonial imprint. For the 350 years under colonization, "the Dutch were able to separate groups on the basis of ethnic affiliation, religion, occupation or other characteristics" (Martinez, 2020) using canals and walls as a form of division and colonial control over the local residents.

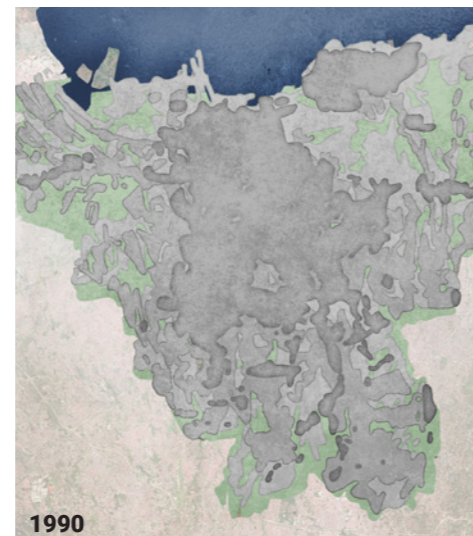
The new nation's leaders found that the vast European-style hardscape and channelization was not suitable for the tropical climate that experiences heavy rainfall and hot temperatures. Without the plans and management strategies that the Dutch failed to pass down to the newly independent country, the young Indonesian government struggled to maintain the vast infrastructure that their old colonizers had introduced in Batavia. Even to the present day, Jakarta continues to feel the negative impacts of this old infrastructure that now worsens flood vulnerability and congestion patterns.



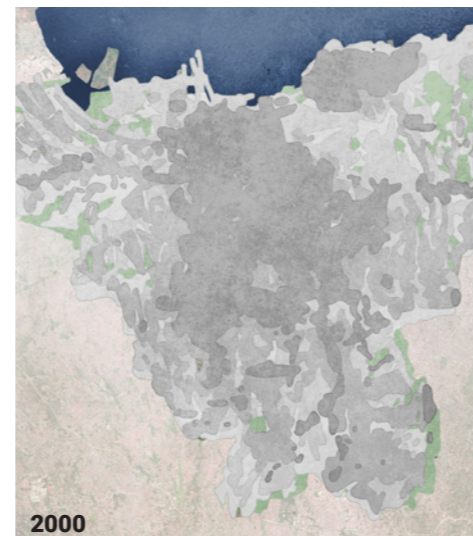
1970



1980



1990



2000

fig 3. physical footprint expansion of Jakarta, 1970-2000

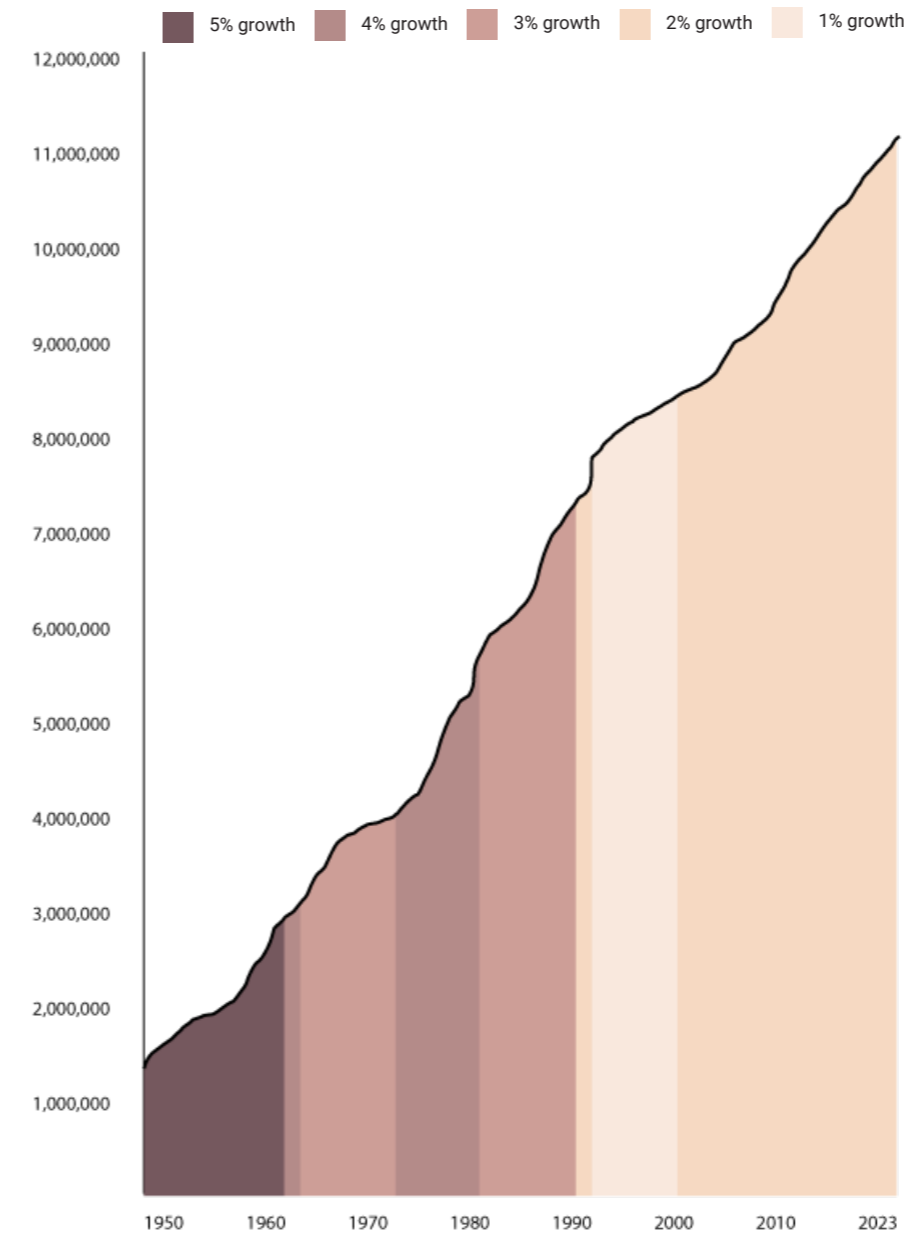


fig 3. population growth in numbers and growth rate 1950 - present

Sukarno Era (1945-1965)

After the Dutch left and Indonesians finally declared themselves independent on August 17, 1945, the government had many choices to make. President Sukarno, the first Indonesian democratic leader, had many ideas of what Indonesia should be, and made Jakarta the capital of the archipelago nation. "Imagining Jakarta as a showcase or 'portal of the country,' Sukarno envisaged the city as a stage upon which Western and Eastern traditions merge." (Martinez, 2020). The Sukarno era focused on bringing together the urban practices of the east and west, with the proclamation to become the 'beacon of emergent force', envisioning Indonesia's future as a powerful and significant nation on the world stage. It was in this period of fresh independence that brought millions of people to Jakarta with the population nearly tripling and a steady growth rate of at least 5% for about a decade. With the influence of communist Russia's support during this era, Jakarta began to flourish with expansive projects with heavy national iconography like the National Monument, Gelora Bung Sports Stadium, and a network of vast avenues and thoroughfares. Although the rapid growth of this era brought more people and economic backing to the city, vast areas of agricultural and natural lands were converted to keep up with the needs of the growing population.

Suharto Era (1965-1998)

In 1965, the U.S.-backed General Suharto led a coup that began a new era in both Indonesia and especially in the development of Jakarta. The Suharto era showed an iron fist on the people and the city. Unlike Indonesia's first president who focused on social monuments and community assets during a period of heavy population growth, Suharto "established a goal to differentiate rather than undertake new building projects. In his wish to distance the city from his predecessor, Suharto's new approach to Jakarta was to thwart direct participation by its citizens"

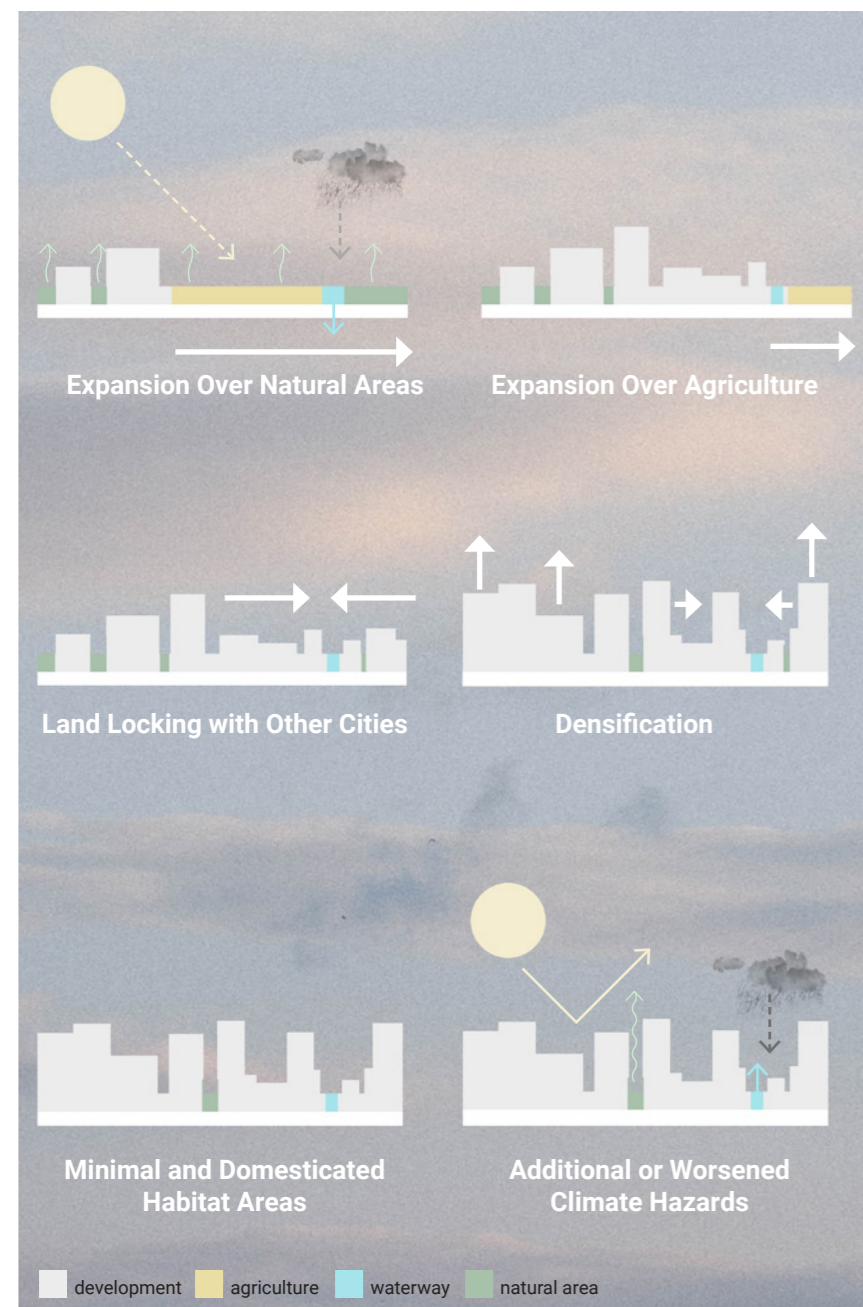


fig 4. progression of anthropogenic impact on local ecology

(Martinez, 2020). His iron-fist style of development pushed Jakarta into an expansive developmental boom with massive infrastructure projects like highways, the international airport, and the now/vital international sea port. However, his administration's focus on power and economic investments on the city inclined towards the upper classes and pushed for an era of vast political corruption. The late 1990's economic 'Krismon' led to financial and social chaos that stalled many city projects, marking the end of Suharto's reign as the longest-running president in Indonesia. At the end of Suharto's era, Jakarta was a much larger place, filled with high rise buildings and the iconic 'superblock', but lacking in public space, green space, and basic infrastructure for many of its residents.

The Modern Era

Today, as Jakarta takes place in an age of vast technological advancement and globalization, its placement on the world stage is vital to not only showcasing all that Indonesia has to offer, but must also meet the demands of a modern city in the face of climate change. In the 21st century, after building up after the years of rapid growth and political stresses, Jakarta has been focusing city planning on public transportation, flood mitigation, and building up the golden triangle, the financial district SCBD. "In different parts of the city, particularly in the central area, new office buildings, condominiums, and mega malls along with numerous small cities or enclaves, e.g. SCBD and the further expansion of Jakarta's Golden Triangle, emerged and transformed Jakarta's landscape" (Martinez, 2020). This new era for Jakarta is bright, but still much work needs to be done to continue improvements on climate action, social equity, and sufficient infrastructure.

THE IMPACTS OF RAPID-GROWTH

The rapid growth of Indonesia's first 30 years caused a significant expansion to occur. As millions migrated to the city in the wake of independence, Jakarta eventually merged with its satellite cities into the urban agglomeration Jabodetabek we know today. The rapid expansion was similar to other cities, in that much of the natural areas and agricultural lands were developed over to meet the needs of growth without much planning of habitat preservation.

Land Locking and its Challenges

Because DKI Jakarta has reached the boundaries of its city limits, the prices for land have skyrocketed. This has led to many people moving outwards into the satellite cities. Since the best jobs are in Jakarta and housing prices are lower in outlying Jabodetabek, congestion and traffic jams for these commutes have become a major issue within Jakarta. This has also created a challenge to densify and develop any available land left. 90% of the city has been developed, and this percentage could rise as the push for housing and economic growth pressures further development. This vast and dense development has created, then, an ecological desert in the city because so much of it is developed over, increasing the threat of flooding, minimizing regulative habitat, and increasing outside temperatures.

Minimal Habitat and its Challenges

Considering Jakarta is at present 90% developed, and only 10% of it is still green space, the existing habitat is not necessarily in good condition. As urban biodiversity is low, special resources are missing, and wide sections of urban hardscape make habitat hubs few and far between, the overall ecologic health and the landscape's ability to self-regulate is low. Often times, since waste and litter management currently lacking, plastics and other ecologically harmful waste often takes up existing habitat space as well, making it difficult for existing urban ecosystem actors to provide benefits. Because of the landscape's current qualities, oftentimes natural ecological systems become a threat rather than an asset. For example, the plentiful rainfall in the city should be a natural asset in providing water to the city and its residents, but because of channelization and land subsidence, water is a major threat to life and livelihood in Jakarta.

Ecological Failure and Climate Hazards

Because minimal and low quality habitat impact overall ecosystem service availability, we are seeing the effects of when an ecosystem is not balanced. Instead of seeing ecosystem services in the city, we are seeing ecological failure and its subsequent climate hazards. The next chapter will go more in depth with these specific hazards. Issues like flooding, land subsidence, and low air quality levels can be directly linked back to the interactions between human activity, city expansion, and nature degradation.





CHAPTER 04 THE FUTURE OF THE BIG DURIAN

THE 21ST CENTURY IN JAKARTA WILL BE A FORMATIVE ERA THAT WILL HAVE MAJOR IMPLICATIONS ON THE LIVEABILITY AND RESILIENCE OF THE COASTAL MEGACITY.

LOOKING FORWARD
The Future of Jakarta
Shifts in Urban Design Standards
Addressing Urban Health
Climate Hazards

LOOKING FORWARD

The Future of Jakarta in the 21st Century

THE FUTURE OF JAKARTA

Since the 2000's, Jakarta's growth rate has slowed to about 1% per year, and because much of land has already been built up, contemporary urban planning here focuses less on addressing rapid growth and instead on improving the urban qualities that were lost in the rapid-growth era of the 20th century and on taking climate action.

Because global climate change affects every regional differently, how Jakarta's climate will shift is unique to its physical location and the measures the city has implemented to address them. This is also largely dependent on the landscape's ability to self-regulate under the stresses of a more extreme climate. Current studies have predicted that Indonesia will face more extreme temperatures, raised sea levels, and more variable rainfalls. In addition, anthropogenic impacts from a vast, dense urban footprint compound the already stressed landscape in the face of local climate shifts. The World Bank has designated that Indonesia as a whole is "ranked 97nd out of 181 countries in the 2020 ND-GAIN Country Index....due to a combination of political, geographic, and social factors, Indonesia is recognized as vulnerable to climate change impacts" (World Bank Group, 2021). While the country as a whole is set in the middle of the list in terms of climate vulnerability, Jakarta itself faces many large-scale threats that may lead to widespread disaster in the upcoming decades.

SHIFTS IN URBAN DESIGN STANDARDS

Aware of the many needs of present-day Jakarta and the impacts of 20th century planning qualities, urban planners and designers are making strides in improving the city's ability to support itself and its people. As urbanists develop the city to meet the needs of modern life, there are already some

shifts that are currently underway throughout the city that seek to serve the people and improve the image of the city. In the coming decades, these shifts may be the beginning of a more resilient city that can continue to support people throughout this age of uncertainty we are all facing amidst climate change and worldwide tensions.

The Smart City

One major theme that the city proposes is the ideal of the 'smart city'. In other words, a more technically advanced city that utilizes technology in a variety of ways to support the functions of the city. As technological advances continue to improve at exponential rates, the reliance on technologies may be come the norm as Jakarta seeks a more modern approach to the city's future.

Alternative Transportation Choices

To combat the infamous traffic congestion, many new public transportation are already in the works. Over the next few decades, the city hopes to decrease the reliance on motorized vehicles through these lines that will better connect Jakarta with its satellite cities, easing the heavy traffic holds on the street. A new line of underground metro and a raised light rail system are near completion while existing commuter train and bus infrastructure is now under renovation. Recently the country's first Transportation Oriented Development center opened, bringing each form of public transportation together with a lifestyle center to orient people to alternative forms of commute. The city's push for public transportation hopes for improved air quality levels and eased congestion during commuting hours.

The Greening of Jakarta

On many large streets, the city is implementing more vegetation and improved walking routes. In just the last few years many new street renovations have begun to build friendlier streets to both people and nonhuman species. As this trend continues, it will be a great asset in implementing healthy habitats and regulative services throughout the city.

ADDRESSING URBAN HEALTH

Though much of the city in its current state is still reeling from a lack in suitable infrastructure and regulative ecosystem services, the city is seeking to improve infrastructure and density issues.

Infrastructure and Density

Jakarta is implementing many projects to improve access to basic infrastructure like piped water and safe walking paths. Because many instances of infrastructure were informalized in the rapid growth period, it has become a daily part of life in the city. It has been an uphill battle, but the future is bright as the city continues to develop and upgrade infrastructure to ease the burden of high density and vast socioeconomic gaps.

Sanitation and Pollution

Sanitation and pollution are also major issues in Jakarta today. Current air quality levels are this and they are predicted to be this if nothing happens. Water pollution is also an issue. River health levels are very low, and although the city is doing many river revitalization projects, the water ways are still very dirty and inhospitable for river species.

CLIMATE HAZARDS

Climate hazards are some of the greatest threats to Jakarta over the next century. These issues are so extreme that some have said if direct action is not made in the next 10 years, by 2050 much of the city will be unlivable. It is in this way that ecosystem services can be of greatest importance, since much of these challenges come from the lack of habitat space in the city.

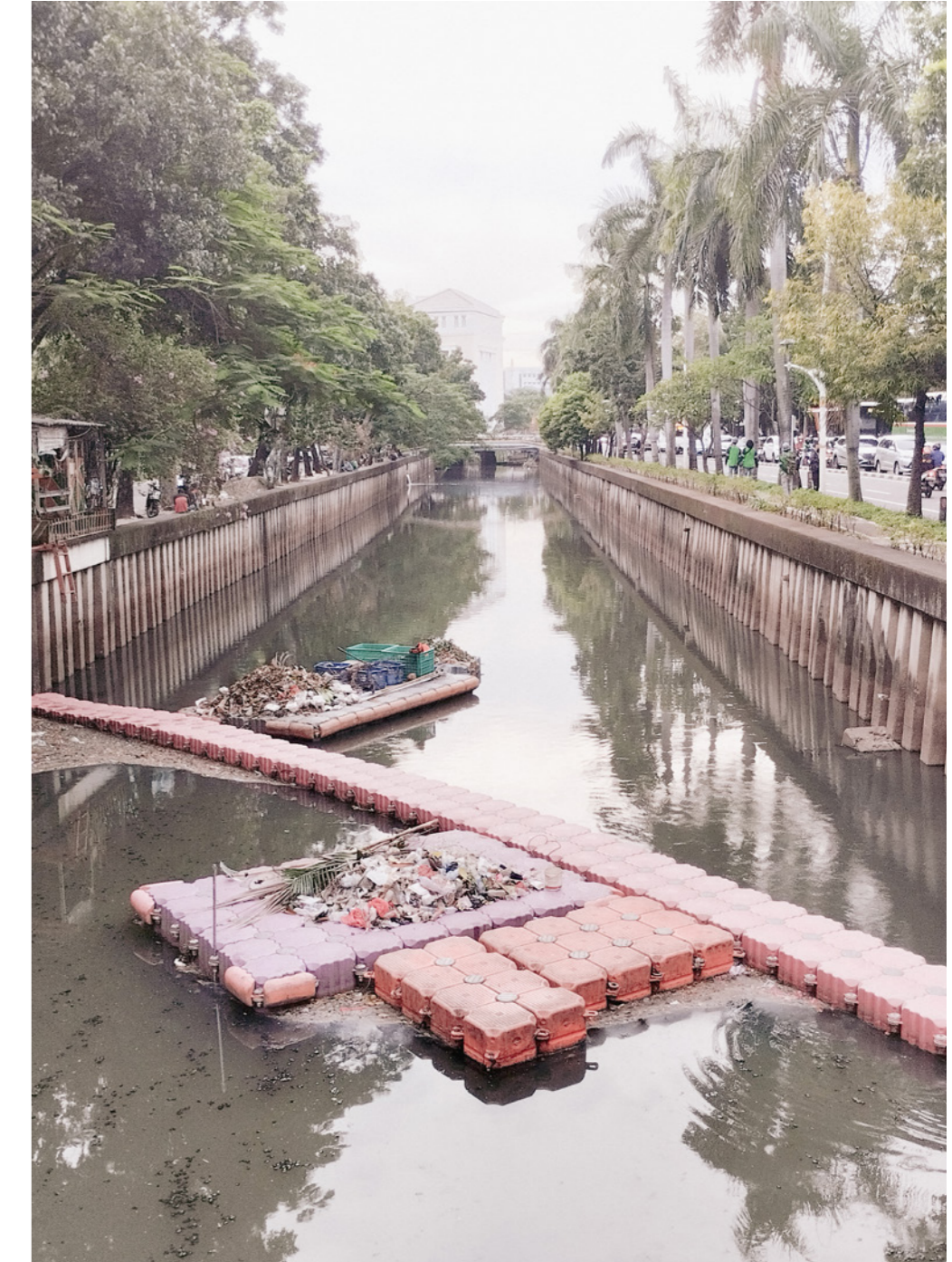


fig 1. population density by district

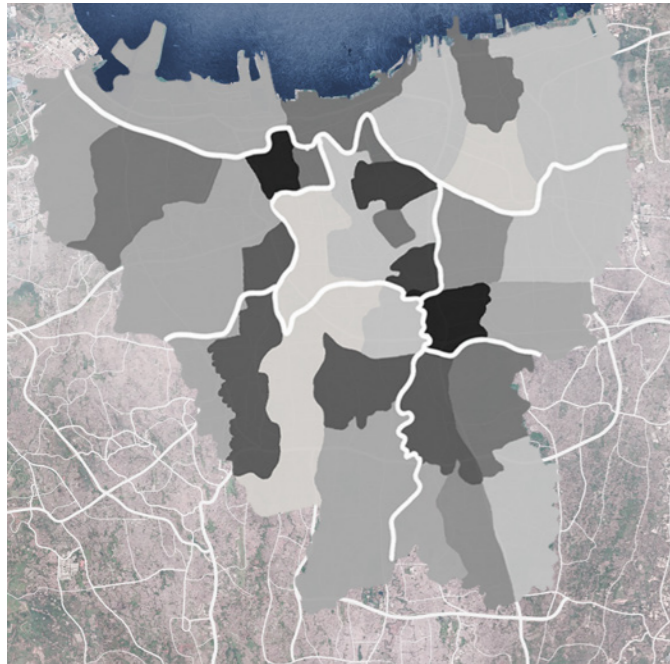


fig 2. urban temperatures

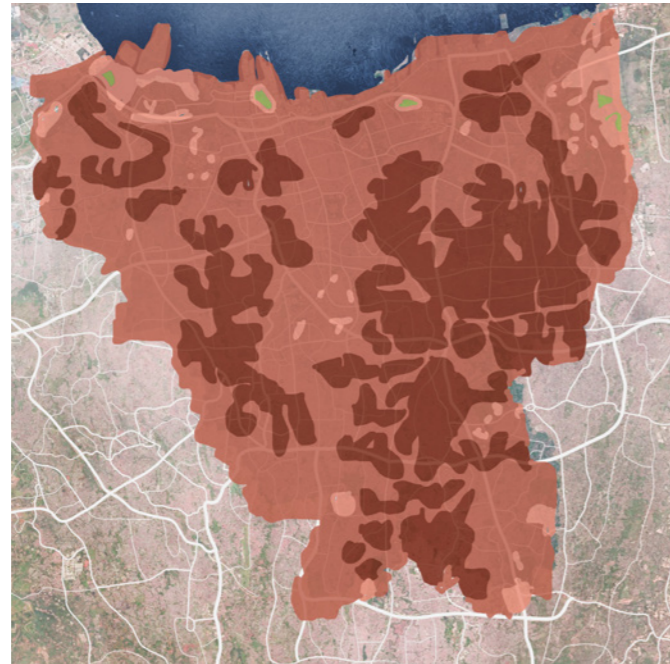


fig 3. land subsidence projects for 2025

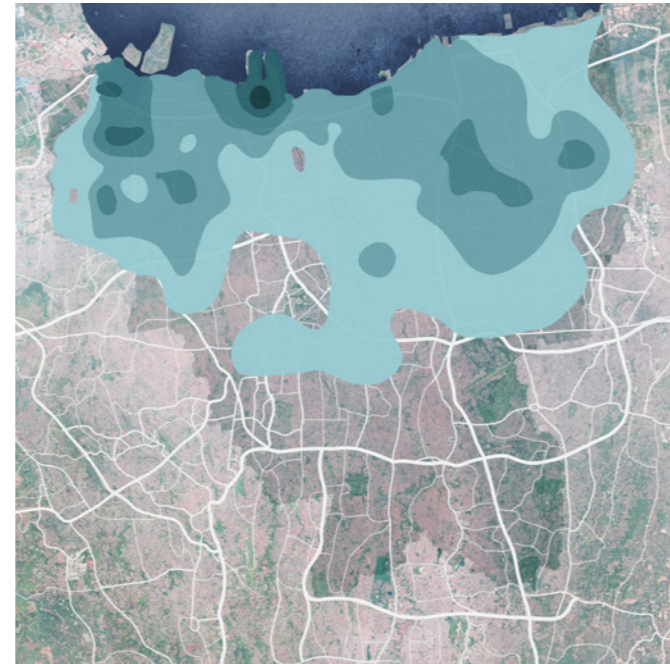
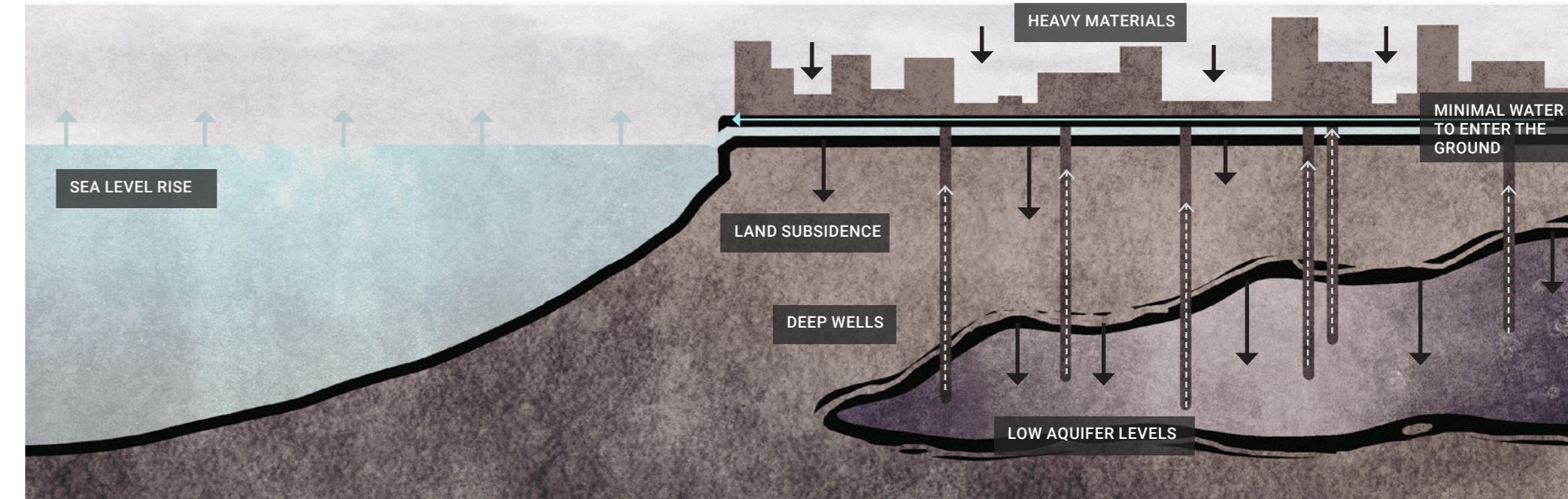


fig 4. land subsidence is a major threat that comes from anthropogenic activity



Issues Relating to Extreme Climate

Because of Jakarta's location, the climate is naturally very hot and humid, but with the impacts of anthropogenic changes on the landscape, the urban climate can become much more extreme. When large areas are covered in impermeable, manmade materials, a landscape can undergo the 'urban heat island effect'. Let's use an analogy. The urban heat island is a lot like heating up a wok or pan over a gas stove. If you turn on the stove, the wok isn't immediately warm- it takes a couple minutes. Over time the wok will become very hot, and after turning off the fire, you would need to wait quite a while before you're able to touch the wok again- it takes time for such a material to cool down. It takes time for the cool air around the wok to eventually bring it back to a normal temperature. Just like how a wok needs to cool down, cities work the same way. Every day the land goes through the same cycle. The sun acts like the fire below a wok. Naturally, it slowly heats up at sunrise and slowly cools down after sunset. However, large areas of manmade material, like cities, have a hard time cooling down. Because they are like giant woks made out of heavy manmade material that takes a long time to cool down, so long that it doesn't completely go back to normal by the morning. Large

areas of greenery like forests or farm fields are really good at cooling down the temperature at night, but because cities are dominated by buildings, there isn't much around to naturally cool off the land. So, because the city doesn't truly cool down, it becomes a place that is constantly warm. This makes living less comfortable, especially in a place that is already very warm, and also impacts the weather around the city. In Jakarta's case, the city has a very low percentage of green space, and this has a tremendous impact on how warm the city is, and can even be warmer than surrounding areas by a few degrees.

Issues Relating to Water

The greatest threat to Jakarta is water. It is because of water, that scientists and researchers have such a bleak prediction for Jakarta.

River Flooding

Flooding has been a major issue for Jakarta for a long time. Because of the channelization of rivers by the Dutch, the natural systems of the rivers in Jakarta are disrupted. In a natural system, when it rains heavily in the flood plain, the river usually has space to rise, the banks and space in the

flood plain acting as a sponge to hold in water as the river lowers after the storm. In an urban area, the river is only met with concrete and asphalt. Similar to a bath tub, the water will remain until a drain allows the water to move some place else. This is particularly dangerous for people because it can cause property damage, health issues, or even loss of life. As climate change impacts the severity of seasonal storms, it is very important that river flooding is mitigated.

Sea Level Rise

All over the world, sea level rise is a pressing issue. 90% of people that live in coastal regions are at risk to the sea level rising (DESA 2018). Jakarta is among those cities that will be affected, and as much of the northern parts of the city lie on the coast with little slope, much of the city, most prominently lower and middle income, will be at risk of this sea level rise as well.

Land Subsidence

Land Subsidence is a major issue because it is a direct correlation to human activity. Because of the informality of drinking water, many wells are dug to take water out of the aquifer. The stresses on the aquifer are even

compounded as much of the ground is impermeable, being covered by buildings and roads. Water is not able to accumulate and refill the aquifer. This has caused a phenomena called land subsidence, which is the lowering of the land because the ground water that stabilizes it is missing. Its like a book sitting on a water balloon. As the balloon loses water, the book will fall.

IBU KOTA NUSANTARA

The Administrative Shift Out of Jakarta

IBU KOTA// CAPITAL CITY

In the face of all of these challenges, the national government has recently made a decision to move the administrative capital out of Jakarta to a new region on the island of Kalimantan (Borneo).

Reasons why the Capital is Moving

The administration will soon leave Jakarta for a more central and more

environmentally stable area of the archipelago nation. Although the move has been desired for many decades, it is now a priority because of the predicted environmental hazards facing Jakarta. Other reasons are because it is a much more geologically stable area, much less vulnerable to earthquakes, tsunamis, and volcanoes. It is also more centrally located, providing more representation for all island regions, not just Java, the most represented group in the government and the island on which Jakarta resides. The capital will be built over an old palm oil field and masterplanned as a new blank canvas urban plan.



fig 5. the Indonesian capital will be moved to a masterplanned city on Borneo (East Kalimantan)



fig 6. visualization of Nusantara by competition-winning firm Urban+

What Will the New Capital Be Like

A few years ago, the Indonesian government opened a design competition for the new capital of Nusantara. The winning ideas of the contest were chosen and became the top urban design firms to lead the masterplan of the capital city concept. Now breaking ground, some of the plan includes:

Climate-Aware Design

A major focus of Nagara Rimba Nusa is to create comfortable spaces within the urban fabric. As the proposed city location is in a hot, and humid climate, the design focuses to create greenways to decrease urban heat island effect and prioritize active transport to limit pollution.

Walkability

Another foundation of the design is to create a walkable city by planning active transportation routes. This treatment seeks to decrease the need for motorized vehicles and make walking or biking more preferred.

Protected Landscapes

Because the city is to be proposed on old palm oil farms, this design seeks to reconstruct the lost landscapes by including wetland parks and habitat conservatories, as well as implementing biomimicked landscapes within the city.

Will this move impact Jakarta?

It is predicted that Jakarta will not actually be that impacted in the long run. Old embassies and government buildings can easily be retrofitted, and only like 3 million people are predicted to live in Nusantara, and that number can easily be replenished as people continue to migrate from villages and smaller cities to Jakarta.



CHAPTER 05 EMPLOYING ECOSYSTEM SERVICES

TO BEGIN TO FOLLOW THE GENERAL STRATEGY, FIRST WE MUST UNDERSTAND WHAT EXISTED IN JAKARTA BEFORE PEOPLE, AND WHAT QUALITIES SHOULD BE PRIORITIZED IN A DESIGN OR PLANNING PROPOSAL.

THE JAKARTA ECOSYSTEM
Jakarta Before People
The Metamorphosis of Jakarta
The Urban Landscape

DESIGN STRATEGY
Leaning into Existing Interactions
Defining Habitat Intentions
Habitat Succession in the City

**ECOSYSTEM SERVICE
EMPLOYMENT**
Regional Vision

THE JAKARTA ECOSYSTEM

What Was and What Remains

JAKARTA BEFORE PEOPLE

Situated on a key coast land opening to an important trade route, Jakarta has found its location a very important aspect of its success today. However, the location of Jakarta not only is important for the growth of the city in terms of economy, but the very landscape has shaped the entire urban agglomeration. In order for us to understand how Jakarta can utilize the ecosystem for a safer, more livable city, we need to understand what the ecosystem was here before people, and what has remained after rapid growth. First, let's look at climate to get an overall picture.

Hot and Humid Climate

The hot and humid climate allows for biodiversity to flourish. The temperature of 20 to 30 degrees Celsius year-round make it easy for species to thrive without needing to adapt to the different situations and threats that variant weather causes.

The Rainy and Dry Season

With a rainy and dry season, the landscape receives great amounts of water during one time of the year. This is why riparian areas are important because they act as sponges. Natural flooding also really helps bring water to places farther away from rivers. The rainy season is in the -ber months up to february, and the dry is march to august I think.

Shaped By the Landscape

It is important to look at where Jakarta is positioned. The location of Jakarta is very important and very much a product of a unique habitat that has had a significant impact on how the city formed and continues to function.

The Ring of Fire

On the global scale, Jakarta is in a very unstable place known as the Ring of Fire. Although this means that the area is more prone to volcanic activity, earthquakes, and subsequent tsunamis, the lava activity often creates fertile land and slopes that create rivers.

The Nearby Mountains

Jakarta itself is neighbors with a volcano named Mount Halimun-Salak. Another dormant volcano Pangrango also is nearby. These mountains play a significant role in bringing water and soil nutrients to the land below. It also means that rivers will go faster here because the lava rock and rapid slope towards the ocean.

Tropics on the Equator

The tropical habitat of the land between the mountains and the sea is a hub of biodiversity and many unique species.

A Delta of 13 Rivers

Located on the delta of 13 different rivers that meet the sea in this area, this means that there are many benefits of water, but also many hazards and harsh landscapes like mangroves and wetlands and flooding. Although these are very healthy and natural processes, they can be rather unfriendly to humans. The placement of Jakarta on this delta is a big reason

Jakarta Bay and Pulau Seribu

The coastline is protected by a bay. There are also a group of islands and coral reefs that also impact Jakarta in a more passive way.

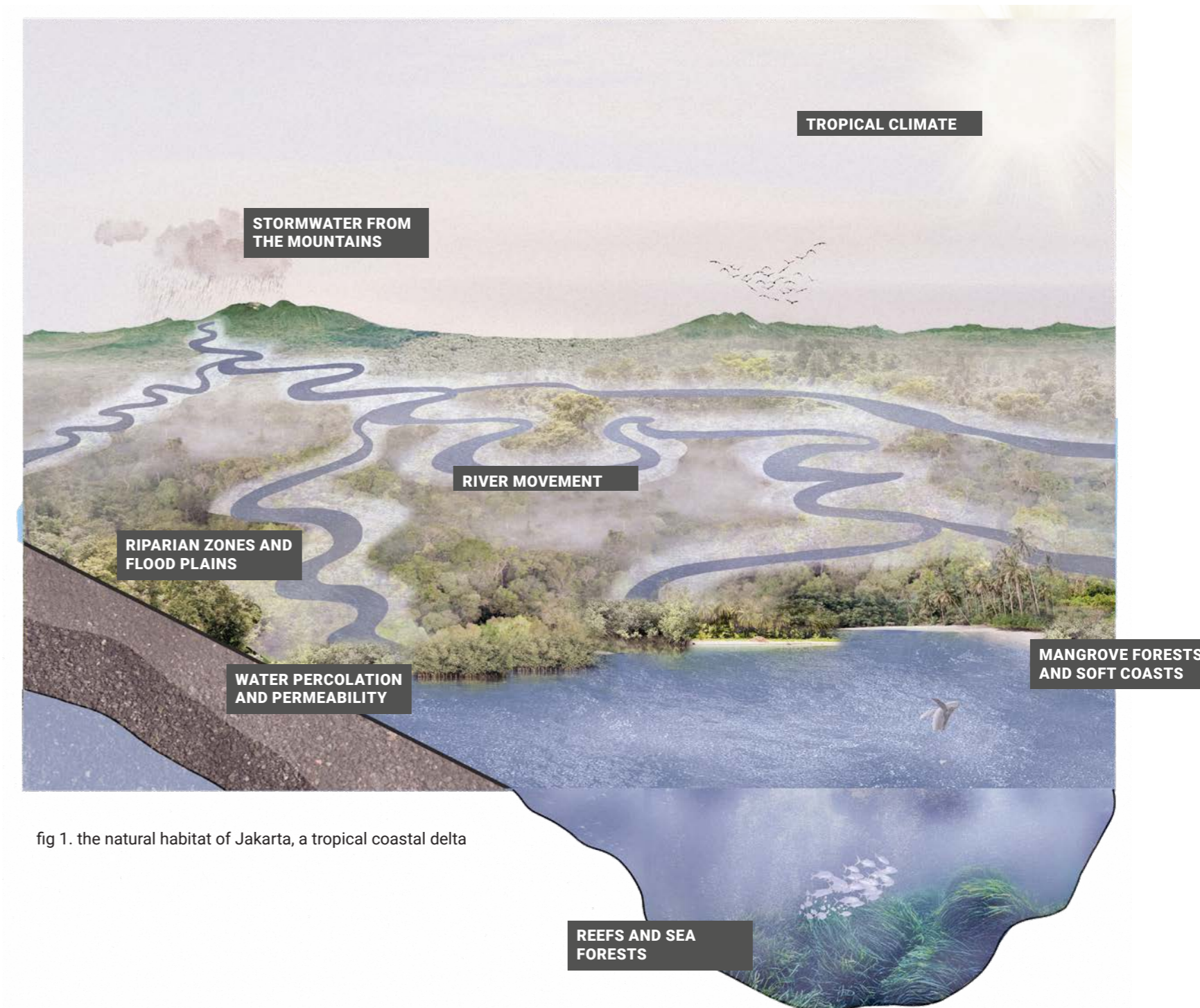


fig 1. the natural habitat of Jakarta, a tropical coastal delta

THE EVOLUTION OF JAKARTA, FROM PREHISTORY TO RECENT HISTORY



SUNDALAND

(18,000-5000 BCE)

For thousands of years, much of Indonesia was connected to mainland Asia due to lower sea levels. This allowed people and many species to migrate to the area- explaining why Indonesia is home to some of the highest biodiversity levels and earliest traces of hominids in the world.



THE BUNI PERIOD

(400 BCE-100 CE)

As cultures began to form, the Buni people found refuge in the region where Jakarta lies. Clay pots and other artifacts show that people here have long utilized ecosystem services.



THE SUNDA KINGDOM

(670-1579 CE)

Eventually the Sunda established a city in present day Jakarta known as Sunda Kelapa and began a long legacy of worldwide trade. The rich spices and other provisions brought traders from all over the Old World to the port city.



BATAVIA

(1619-1945)

The VOA Dutch traders colonized Indonesia and established a base in Batavia, present-day Jakarta. Dutch engineering and planning techniques still impact Jakarta today, such as river channelization and bridges.



THE SUKARNO ERA

(1945-1966)

After the second world war, Indonesia gained independence. In the first era of independent Jakarta, the new county's founders focused on modernization and large public amenities such as Monas and GBK- a large sports stadium. These spaces continue to be Jakarta's largest green spaces.



THE SUHARTO ERA

(1967-1998)

The Suharto era brought the greatest outward spread of Jakarta as the leader, President Suharto, had a grand vision for the city that revolved more around highways and city expansion.

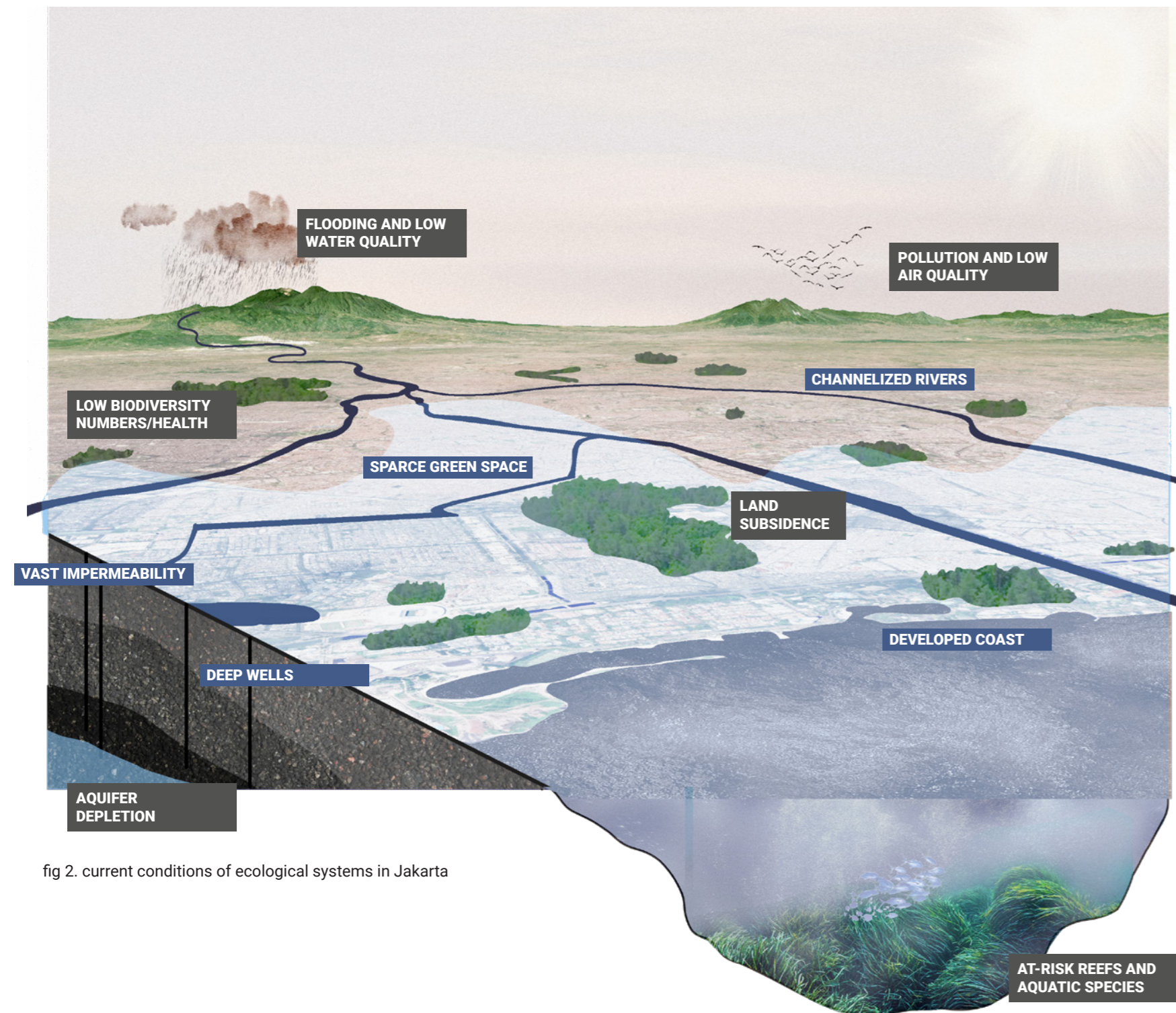


fig 2. current conditions of ecological systems in Jakarta



THE URBAN LANDSCAPE

In today's Jakarta, much of the native landscape has been lost due to the pressures to expand and densify in an age of rapid development and reconstruction after a long era of colonization. As we have talked about before, the lack of naturalized space has vastly impacted the landscape, causing many climate hazards that impact livability and leave's Jakarta vulnerable to more large-scale disasters like sea level rise and land subsidence. The lack of ecosystem services has wrought on an new age of ecosystem failure that is predicted to majorly impact the city, where much of it is predicted to be unlivable by the end of the century. Many studies suggest that action must be taken by 2050, and large-scale action should be completed by 2030 in order to address these issues. Jakarta is making many plans to address these issues, which we will talk about in the next few chapters, and I believe that the employment of ecosystem services as a city tool in tackling these issues can be another viable solution for the city.

ECOSYSTEM SERVICE EMPLOYMENT

An Open Call, Hiring All Ecosystem Services

Habitat space can be a valuable tool for the region in addressing a large variety of issues. It is important that we establish a vision for the area. Because of a far reaching footprint and minimal habitat space, Jakarta is facing many hazards that can be addressed through ecosystem service employment.

These climate issues come from the direct anthropogenic footprint on the Jakartan landscape, the vision that I have for this region is to focus on how to reintroduce natural systems in a way that brings those regulative, self-sustaining features back into the city. Remember, if “life always finds a way”, we can apply these resilient features into the city. Jakarta can find a way, and that way is by employing ecosystem services.

REGIONAL VISION

In order to heal nature with nature, we must first identify what is nature in the context of this project in this city specifically. After spending two months on site, I noticed that the application of nonhuman species was mostly for aesthetic purposes, like gardens or streetside plantings, or for thermal comfort such as shade, much like most other cities. I think if we focus our minds on these three definitions, we can be more intentional and direct in our use of ecosystem services. By answering the questions ‘what is habitat and what is it doing?’ we can begin to formulate a plan for ecosystem employment in Jakarta.

Habitat as Regulative Infrastructure

The most influential definition of habitat space in this context is habitat as a regulative system in the city. It should be seen as a vital program that the city cannot go without, similar to plumbing infrastructure or road networks. We

need to understand that the city cannot fully function without a functioning ecosystem. By shifting our view this way, we will put more emphasis on preserving existing natural space and expanding the spaces we already have.

Habitat as the Backdrop of the Urban Stage

From talking with many local Indonesians, I found that nature is seen differently than from the culture that I was raised in. There are still many superstitions and perhaps some may see it as a hindrance to modern development, some even have a negative view of nature in general. This was a bit of a culture shock for me as a designer and somewhat a new and exciting challenge to shift my own perceptions and such. In the case of Jakarta, I think it is best to think of natural elements as more of a background character on the urban stage here. Always present but rarely the focus. Habitat spaces should support the elements of living, working, and playing in the city.

Habitat as Application of Local Knowledge

The bridging component of the natural landscape and the social landscape is local knowledge that brings back our own knowledge from the days where we were more reliant and connected to natural systems. It brings back the localized adaptations and practices that we used in an age where we applied ecosystem services every day.

By fostering conversations between interdisciplinary groups by involving local experts and indigenous communities, the city can apply local knowledge of the natural and social systems in a way that uniquely fits Jakarta itself. Participative design is perhaps the most important aspect of this vision.

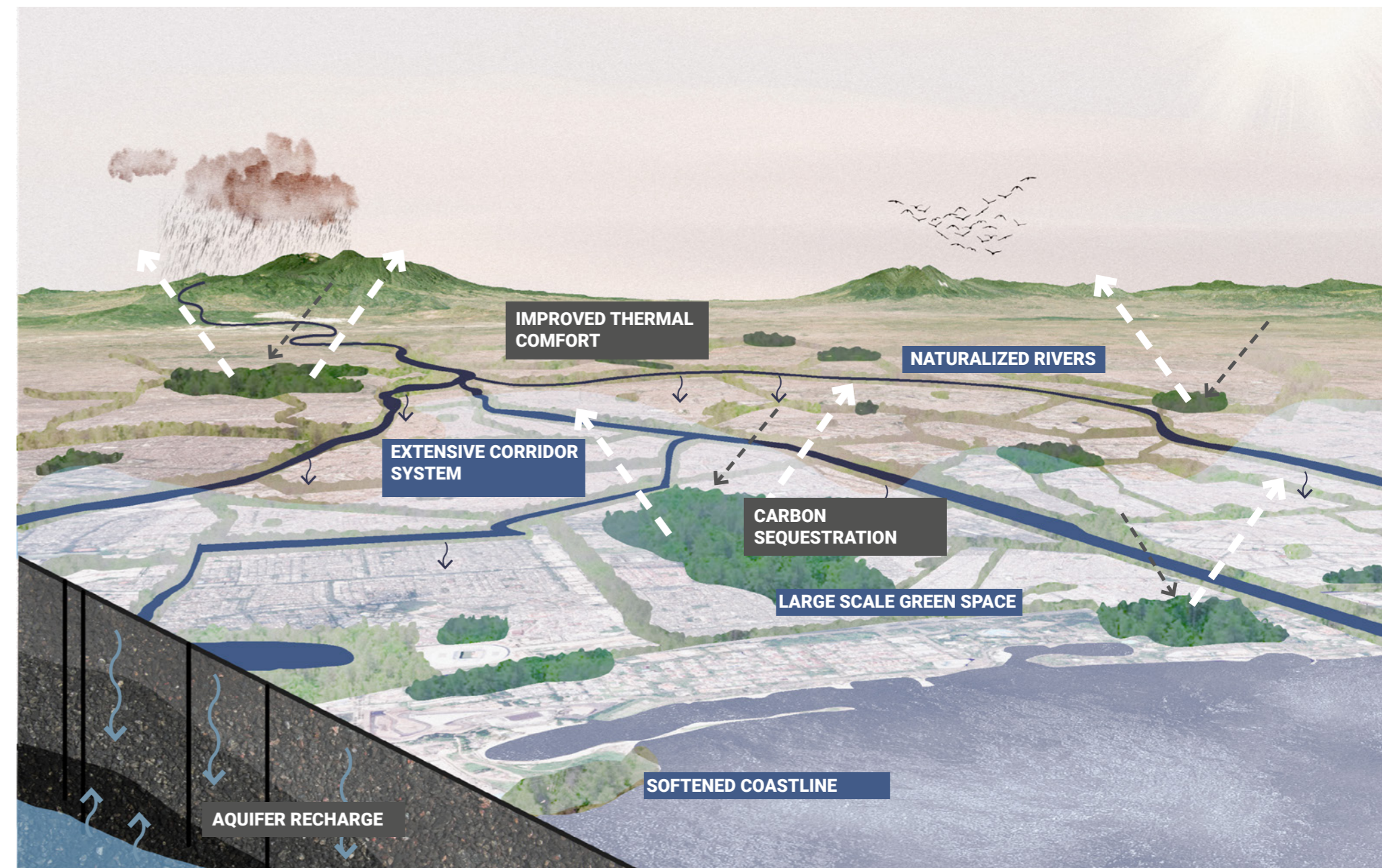


fig 3. a vision of Jakarta if it utilized ecologic infrastructure



Layer 1
The Functional Landscape

In designing, the first step in this progression is to establish the base habitat- identifying what type of habitat and ecosystem actors and services will be employed in the project site and establishing baselines to meet the needs of working ecosystem actors and to achieve the service needed.



Layer 2
Life and Livelihood

After a habitat has been conceptualized, programming that support's the needs of the city is next. Mainly, one should answer the question- "what does the city need in this area to support people's lifestyles and livelihoods?" Insert these needs without damaging the habitat. Make sure that the base habitat is actively supporting these needs.



Layer 3
Attraction and Interaction

Lastly, the life blood should come into the project. Does nature help support social life and urban activities? Is there a level of interaction that brings exposure to and attracts people back to nature?

DESIGN STRATEGY

Designing Habitat Based on Local Needs

LEANING INTO EXISTING INTERACTIONS

In addition to defining a regional vision for Jakarta, establishing a design strategy for the context of Jakarta is also in order. Every region has different values and priorities in regards to natural areas and outdoor space, so as a designer it is important to adjust the design process to meet the needs of the project's vision and local user interactions with said vision. After spending time in Jakarta and speaking with many residents there, I found that people are less interested in spending time in untamed natural spaces, sometimes because of superstitions, sometimes a negative perception regarding wild habitat and animals, and most commonly- uncomfortably hot and rainy weather. I found that activities that do occur outdoors, but mostly in the mornings and evenings. Usually neighbors will be socializing on the street, residents will be going to the morning market, or office workers would be having meal breaks or commuting to and from work.

Because the need to implement regulative ecosystem services is vital to the regional vision, but the pressure to maximize a plots usability and return on investment are prioritized, and the appeal for nature-focused venues is low, I needed to adjust my typical design approach to favor the local context here in Jakarta.

In terms of employing ecosystem services in a design proposal, I would need to maximize the habitat footprint, ensure the plot could appropriately support local lifestyles and livelihoods while simultaneously supporting the social and aesthetic layer that is infused in Indonesian society. Therefore, my design process moving forward will be to think of ecosystem employment in this order:

Layer 1- Establish Benchmarks and Design High Quality Habitat Space

Layer 2- Ensure Site Programs and Habitat Support Life and Livelihood Needs

Layer 3- Foster Attractive Habitat Spaces that Support Social Activities



DEFINING HABITAT INTENTIONS

As we learned in the first chapter, a variety of habitat types and sizes are required to propose a functional and healthy urban ecosystem. Each city will have its own needs, but for Jakarta, I have identified three categories of habitat that each have their own intention and role in the urban landscape.

Oasis- Large Scale Regulative Space

Hubs- Small Scale Biodiversity Centers

Connections- Continuous Habitat Corridors

HABITAT SUCCESSION IN THE CITY

The next step in our journey is to explore the different ways in which habitat is presented in cities- in the gray, blue, and green.

Gray Habitat- The Built Environment

Blue Habitat-Water Systems

Green Habitat- Large Scale Open Space

It is vital to look at all three of these to understand how Jakarta's current habitat system works, how people relate to habitat in these sectors, and what kind of habitat is suitable for these spaces. In these atlases of urban habitats, we can also begin to visualize the future of habitat space in Jakarta based off of observations and spatial analysis.

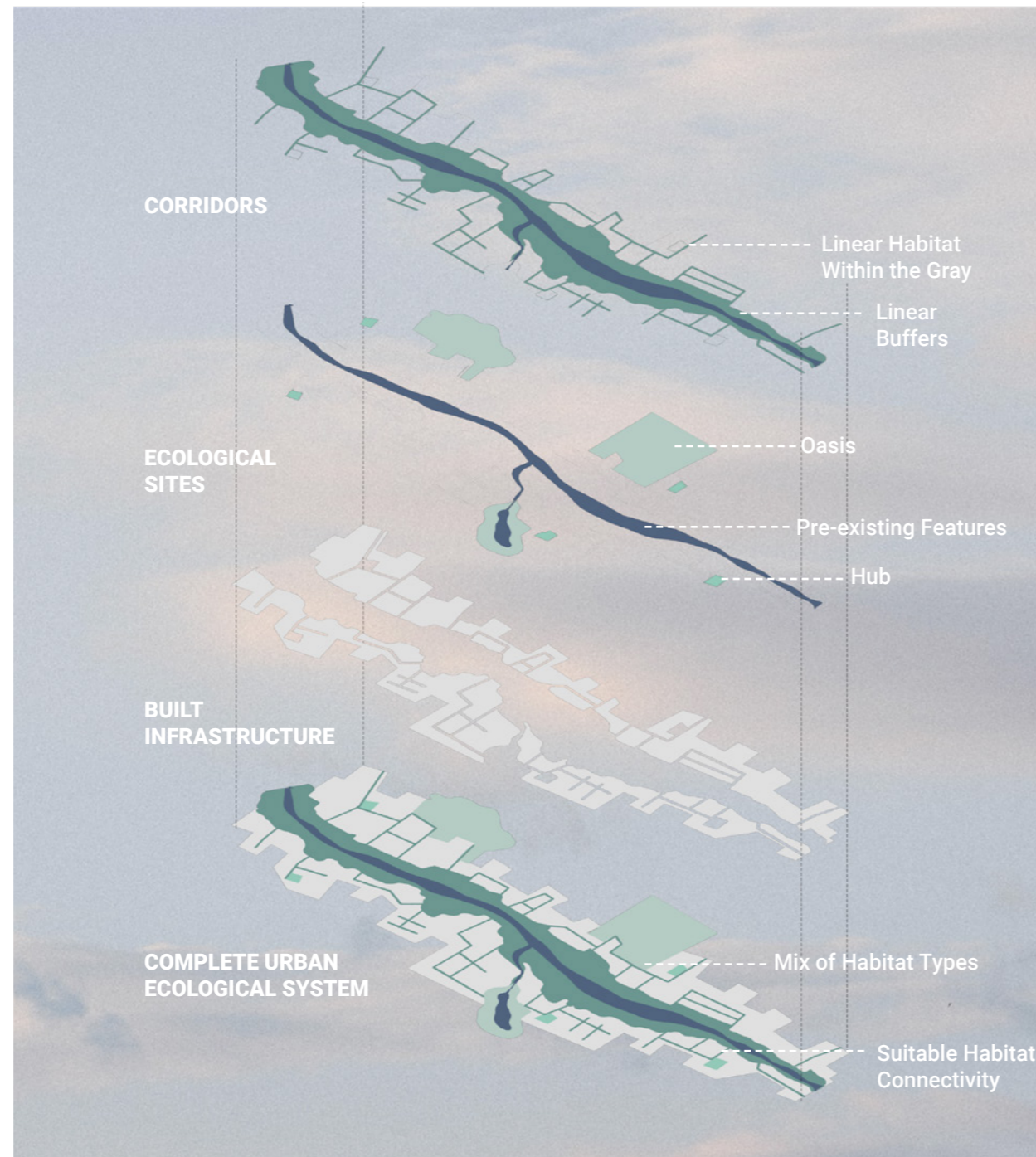


fig 4. habitat intentions within the city to mimic wildlife succession and reintroduce areas of high biodiversity

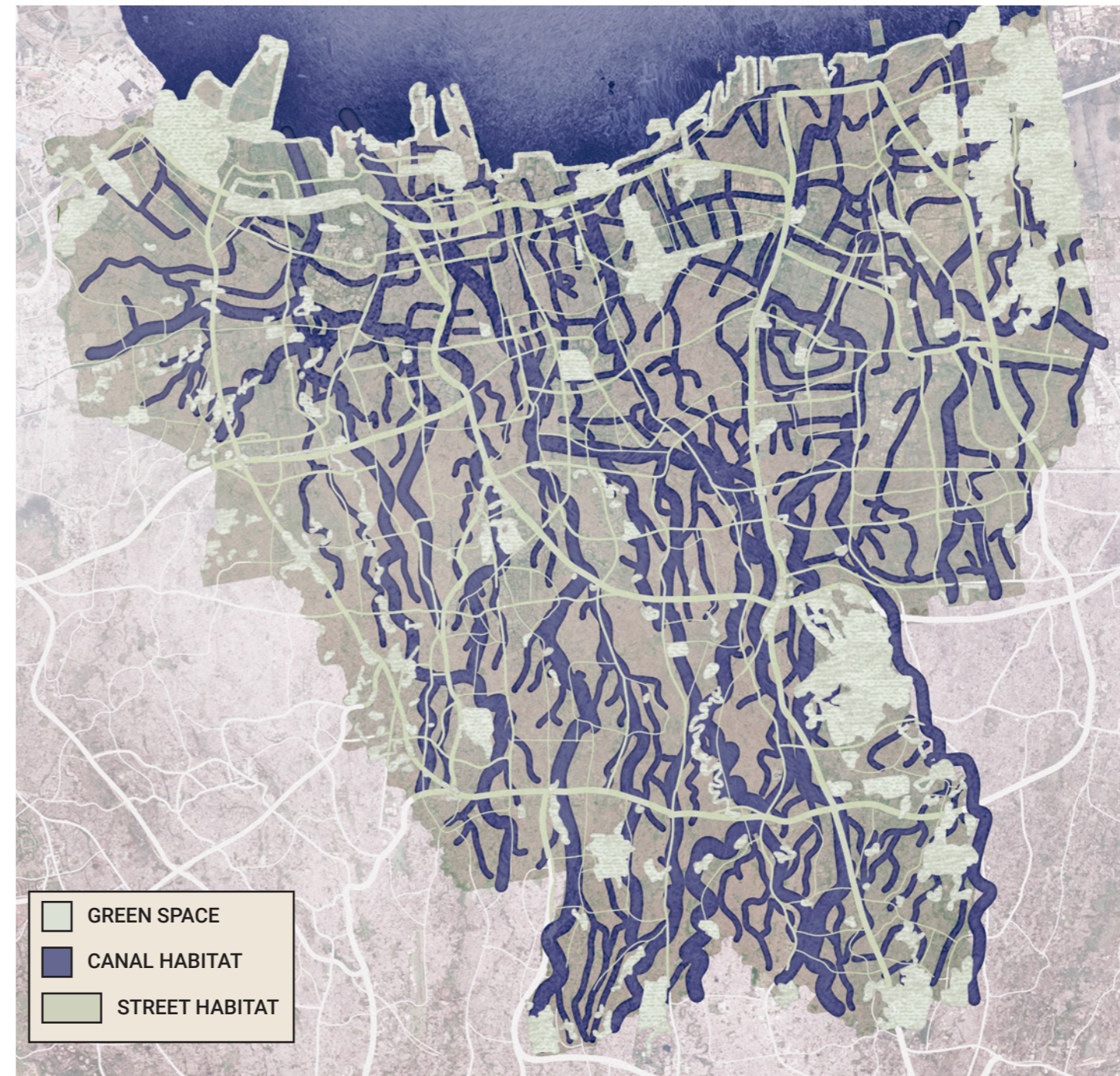


fig 5. a regional administration of habitat space in Jakarta

Oasis- 4 Hectares+

Large scale habitats that can house many species that may need more space from human interaction. These areas should be larger than 4 hectares and should be perceived and protected by the city as ecological infrastructure sites. These areas should have high levels of biodiversity and be given specific ecological functions, such as aquifer recharge sites or stormwater catchment basins.

Hubs- 1-4 Hectares

Hubs are smaller scale areas within the urban fabric that allow for more interaction between humans and nonhumans, they will usually come in the form of local parks and plazas up to 4 hectares large. These spaces should help foster habitat succession (the shifting from one habitat to another) and seasonal movements by providing shelter and other special resources that key species need to thrive in the city.

Connections- Linear Elements

Linear habitat elements are important in allowing for species to move throughout the city as well as providing equal access to habitat areas, so that one area is not drastically lacking compared to another one. Oftentimes these can be river systems or vegetated streetscapes.



CHAPTER 06

THE GRAY ATLAS

WITHIN THE GRAY ATLAS, WE WILL OBSERVE JAKARTA THROUGH THE DESIGNER'S EYE AND EXPLORE THE CHALLENGES AND OPPORTUNITIES WITHIN THE CITY IN TERMS OF HUMAN-DOMINATED LANDSCAPES.

THE GRAY ATLAS

- Introduction of the Gray
- A City of People
- A Designer's Observations

HABITAT IN THE GRAY

- Life Between Buildings
- Hardscape Habitat
- Rain Gardens and Drains
- Symbiotic Architecture

CHALLENGES IN THE URBAN LANDSCAPES

- Impacts on Urban Populations
- Current Trends

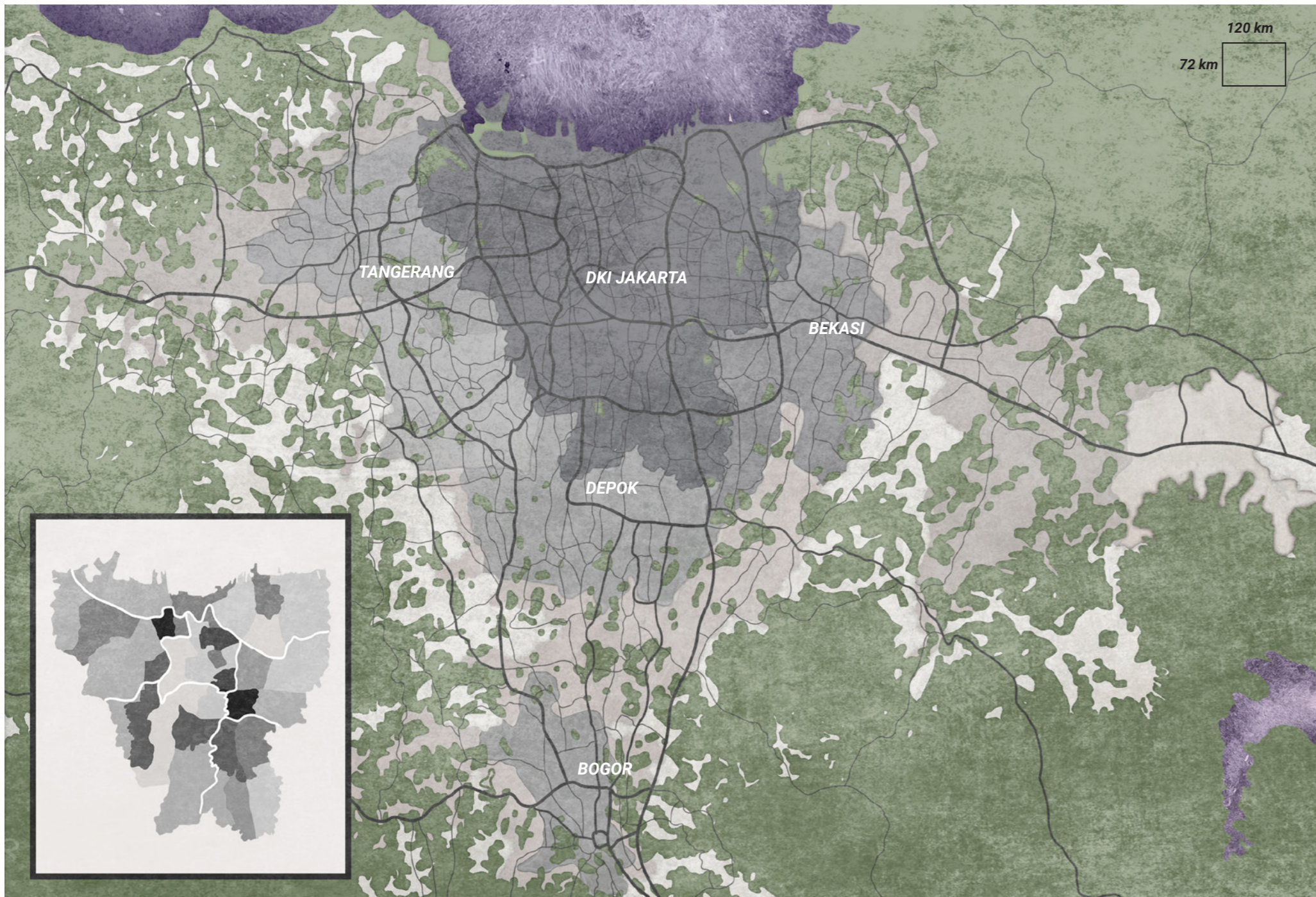


fig 1. regional urban footprint and population density in Jabodetabek

THE GRAY ATLAS

Taking Inventory of Human Settlements

INTRODUCTION TO THE ATLAS

Over the next few chapters, we will explore the different aspects of habitat and natural life within the urban fabric of Jakarta. By understanding the various nuances of natural spaces and people's connection to them, designers can better implement new habitat in a way that responds to and improves the current conditions and activities that occur in these spaces. The three main habitats- the Gray, or human-dominated surfaces and spaces, the Blue waterways, and the Green open areas, are the most prominent in Jakarta and will be observed over the following chapters. The findings will then guide the design of existing areas in the city to demonstrate how to implement Blue/Green/Gray habitat and develop ecosystem service infrastructure that can connect to the city-wide plan.

INTRODUCTION TO THE GRAY

The Gray refers to the developed spaces of a city, the areas that are predominantly manmade and landscapes are domesticated. In this chapter, we will be looking at how gray spaces show themselves in Jakarta and how people overall relate to them. We will then go into some of the issues that come from existing conditions, what Jakarta is currently doing to address them, and introduce a set of design tools that showcase how to implement habitat space in gray areas.

Prominent Paving Practices that Impact Habitat

Jakarta is 90% developed, and within this space much of the landmass is covered in impervious material. Materials such as asphalt and concrete often cover the space between buildings. Though this allows people to utilize the most space on the street level and minimizes weeds and overgrowth, it also has a great impact on nonhuman habitat and the regulative properties of the landscape. Because most space is set up to control the landscape, it disallows the natural growth patterns of flora and minimizes the amount of water that can enter the ground and trickle into the aquifer. Simple techniques like expanding existing planting beds, applying permeable paving materials, and naturalizing river bottoms can have a great impact on the landscape to regenerate many of its regulative properties without impacting common human activities and building practices.

FAST FIGURES FOR JAKARTA

661.5
KM² TOTAL AREA

10,560,000
POPULATION

15,978.2/KM²
POPULATION DENSITY

90%
TOTAL DEVELOPED AREA

595.35
KM² BUILT FOOTPRINT

7250
KM OF ROAD INFRASTRUCTURE

22,779,693
KM² OF ROAD FOOTPRINT

7%
MAJOR ROADS WITH SIDEWALKS



SCOREBOARD

A Designer's Personal Observations and Analysis of Gray Space in Jakarta, Indonesia

Habitat Quantity

Is there sufficient habitat space in the city?



Habitat Quality

Can existing habitat space support a variety of species?



Human Interaction

Are habitats accessible and welcoming to the public?



Symbiotic Exchanges

Do human systems impact ecological systems?



A CITY OF PEOPLE

A Designer's Analysis of Gray Systems in Jakarta

MAIN TAKEAWAYS

Overall the gray habitat of Jakarta is overwhelmingly large and has a negative impact on regulative systems and overall habitat health, but many opportunities lay in store for the city if it utilizes habitat in gray space.

Strengths

Many parts of the city are becoming greener as more landscaping is implemented on the street level, more parks and ecological areas are being developed to improve access to green spaces

Weaknesses

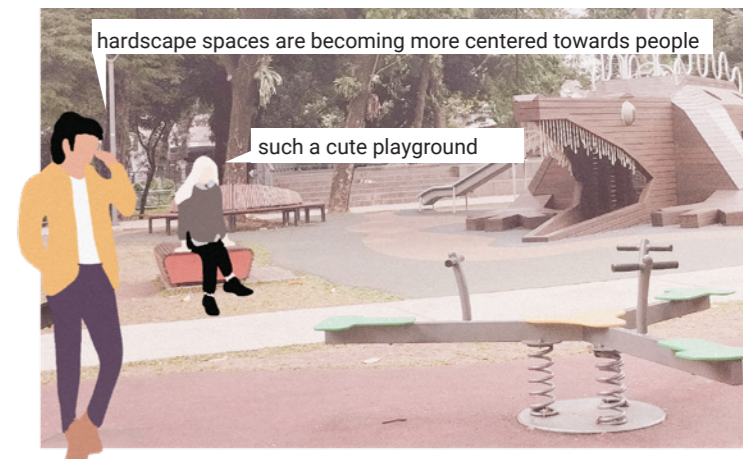
The city is overwhelmingly covered in hardscape materials, with only 10% of remaining undeveloped land.

Threats

The small amount of open space means that there are many dangerous hazards that come from a lack of regulative environment. Threats are so dire that much of the city will be unlivable if direct action is not taken quickly.

Opportunities

Habitat spaces can easily be implemented and expanded throughout the city, both on the plot level and at a systematic level. Basic changes in these areas can bring out a large impact.



A DESIGNER'S OBSERVATIONS

Beauty in Complexity

PEOPLE IN THE CITY

As a designer, I found Jakarta very interesting. The mixing of typologies and uses is very complex and nuanced, and although I was only there for two months, I was able to find some prominent categories to help describe the general feel of the city. Oftentimes spaces are not strictly divided by use or socioeconomic level. A high-rise building may be situated next to a park and informal settlement. It feels completely natural and I think that's the beauty of it. The complexity and seeming chaos all comes together into a beautiful cityscape that brings all socioeconomic levels together.



fig 2. typical streetscapes

THE IMPORTANCE OF THE STREET

Streets are an important part of the Jakartan experience. As many people commute into the city, commuters often take to the major street thoroughfares and toll roads. The major street typologies you will find in Jakarta are the residential gangs, which are narrow streets that connect residential plots. They are often places for preparing and selling food and other self-sold items. Many times gangs are closed off for events like community events and personal family events like funerals and weddings. Sometimes you may even find cultural and art performances. The gang is a unifier that brings the neighborhood together.

There are also artillery streets. Often you can find traveling vendors, performers, and other commercial activities along these thoroughfares. Perhaps the most popular are popup warungs, or tents for small-scale eateries. You can find anything from nasi goreng to beef rendang to snacks. Lining these streets are usually commercial stores and restaurants or service and business offices.

Many traffic jams occur on major streets as people funnel to them to go or return from work. Here, you will here the term 'tua di jalan', or growing old on the street. Toll roads are the fastest and largest streets in Jakarta. You must may to get on, but they are well located as there is an inner and outer ring around the city as well as connections to other satellite cities and further to other major cities on the island. Most personal drivers use cars or electric scooters, known as motors, which account for the majority of traffic on streets.

CHALLENGES IN THE URBAN LANDSCAPE

Impacts on Human and Nonhuman Populations

After many decades of rapid development and vast expansion, Jakarta has become a very complex example of the post-rapid growth metacity. Though the many complexities cannot be succinctly described in this booklet, following is a short compilation of some the major challenges in Jakarta's Gray, many that can be improved by ecosystem services.

Pressures on City Development

An Age After Rapid-Growth

At a time of slower growth, the city is now faced with the impacts of vast expansion and minimal planning oversight. This means that the city is now in an age to improve city conditions by meeting the needs of modern society.

Landlocking

Because Jakarta has developed up to its borders, the city will now need to balance any future growth by either densifying or developing what little open space it has left.

Pressures on People

The Choice Between High Prices or Long Commutes

The high density within Jakarta lowers standards of living for everyone in the Jabodetabek region. Those who live inside Jakarta must live in tighter quarters and smaller living spaces, which may have physical and mental health implications. This impacts commuters from the satellite cities because they must spend long hours in traffic jams, causing more exposure to the elements that are becoming even more extreme in recent years.

Low Air Quality

Many factories and motorized vehicles result in a very smoggy city. Air quality levels can become dangerous and impact the health of residents.

Socioeconomic Impacts on Greenspace Dispersement

The low access to green space in Jakarta can have an impact on mental health. Vast swathes of hardscape impact thermal comfort and exposure to the elements if there is not enough vegetation to offset it.

Pressures on Natural Systems

Expansive Impermeability

The almost completely covered landscape in impervious materials impacts how ecological systems operate. With the dominance of manmade materials, natural habitat spaces don't have enough space and water cannot enter the ground, impacting soil health and groundwater supplies.

Lacking Biodiversity and the Controlled Landscape

The existing green space on the majority of Jakarta streets are not large enough nor house a multitude of species. Landscapes are well managed but also highly controlled, impacting nature's natural ability to shift and change.

Impact on Hazard Resilience

The lacking amount of ecosystem actors and systems present in Jakarta disallows the landscape to soften exposure to the elements and provide shelter from climate hazards. The lack of ecosystem means a lack of regulation of the overall environment.

CURRENT TRENDS

How Designers and Planners are Addressing Climate Hazards

CURRENT PROJECTS UNDERWAY

Jakarta is in an important era of city development as the economy is growing and less pressures are from growth and rather towards the need to improve city infrastructure and respond to the challenges that have come from rapid growth. The following are some of the trends and practices in urban design and planning today.

The Push for Public Transportation

Expanding Lines and Developing New Modes

Many public transportation routes are being worked on. Presently, the first TOD is near completion, new underground metro phase 2 is under construction, and many bus stops are being renovated.

Even-Odd Number Days for Private Vehicles

Motorized vehicles are now put under a policy where each car can only drive on even or odd days depending on its license plate number. This is decreasing the amount of cars on the street and putting more priority on public transportation.

Marketing Campaigns for Public Transportation

Many marketing campaigns are underway to improve perceptions of public transportation and straying away from private vehicles to ease traffic tensions.

Street Upgrading

A Focus on Nonmotorized Vehicles

Many bike lanes and walkable sidewalks are being implemented on key routes in the city. This allows for safer active transportation.

Tree Cover and Planting Beds

The upgrading of streets also focuses on more planting beds and tree cover, both improving habitat conditions and allowing for more ecosystem services in the city.

Space for Informal Vending

Wider streets allow for informal vending space, thus contributing to raising exposure and incomes of individual vendors.

HABITAT IN THE GRAY

Strategies for Ecosystem Employment

LIFE BETWEEN BUILDINGS

Gray space doesn't have to be all business and function. It can also be the vibrant spaces that so many people need in Jakarta. To be realistic, the hot and humid climate naturally does not create a welcoming outdoor experience, but with the help of ecosystem actors, these vital social areas can become comfortable, safe, human-scale spaces that can support the urban stage.

Nature as Infrastructure

Vegetative cover can provide many benefits that don't have to be overtly focused on in the urban fabric. By bringing in human friendly species, natural elements can simultaneously regulate the landscape in a way that people may not be aware of but can still enjoy the benefits of.

Supporting Street Life

Providing shading and cooling elements can help improve the ability of the gray habitat to support traditional street life and strengthen these spaces as important elements in supporting the lives and livelihoods of Jakartans.

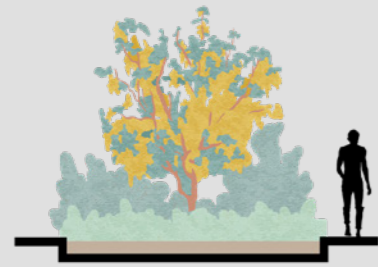
Improving the Outdoor Experience

By creating attractive and comfortable outdoors spaces, it is hoped that more people will be inspired to go out and enjoy all that the city has to offer. Habitat space can increase the aesthetic qualities and reduce unpleasant exposure to the elements.

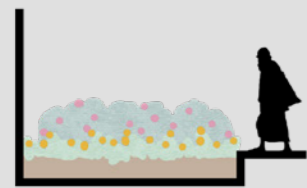


fig 5. visualizing a healthy habitat in human-dominated landscapes- i.e. the gray

FUNCTIONAL HABITAT



Layered Planting Beds



You-Pick Provisional Plants

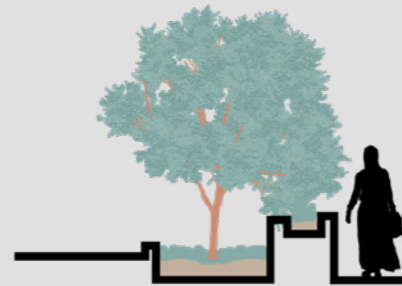


Permeable Paving Materials

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Shaded Circulation Structures



Street Buffers

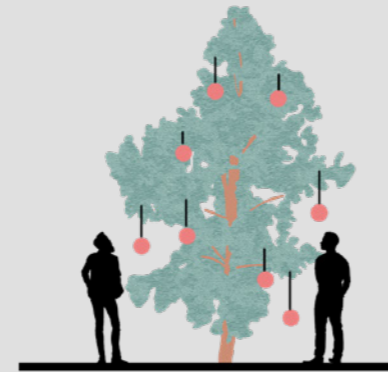


Covered Vendor Space

ATTRACTION // INTERACTION



Outdoor Furniture and Play



Nature As Art



Educational Elements

HARDSCAPE HABITATS

SUPPORTING THE BACKBONE OF URBAN LIFE

Streetscapes are among the most important social spaces in the city. Ecosystem services can be applied here to improve thermal comfort as well as provide connection.

Base Habitat- Connections and Territories

By upgrading and reintroducing habitats within gray space in Jakarta, species can have an expansive network the survive and even thrive in the urban context. This can have great impacts on the Jakartan regulative system.

Life and Livelihood- Support Movement and Commerce

These hardscape spaces can have great potential in supporting the movement and commerce often found in these areas. By providing shading and cooling, people can feel more comfortable in these outside environments that can often be harsh and exposed to the elements.

Attraction and Interaction- Welcoming Appropriation

More natural spaces allows for more passive areas that can easily be used according the passerby's needs. Planting beds can become hubs of informal selling, resting, or play. Interactive street activities can also motivate moments of education, contemplation, and attraction.

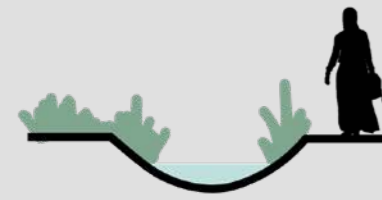


fig 6. applying the habitat toolbox in hardscaped spaces

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Altingia excelsa Rasmala tree Pohon rasmala	A popular and highly functional tree that has many aesthetic and provisional qualities, as well as a valuable member of the ecosystem	resistant to pests high conservation value traditional medicine beautiful bark	responsible planting
	Monoon longifolium False Ashoka Glodogan Tiang	narrow everygreen tree, often planted as street trees in Jakarta	wind break ornamental flowers wood production beneficial oil	no specific needs
	Casuarina equisetifolia Coastal she-oak Pohon Cemara Laut	a tree that usually grows neat the sea, often known for its ornamental qualities and dye component	shade increasing water content and soil structure wood	prefers sandy soils
	Cassia fistula Indian Laburnum Pohon Cassia	an ornamental tree known for its bright yellow flowers in late spring	medicinal pollination aesthetics	no specific needs
	Pometia pinnata Island Lychee Pohon Matoa	fruit tree with a popular fruit, grows rapidly	food medicinal properties wood	deep moist soils
	Filicium decipiens Fern Leaf Tree Kerai payung	ornamental tree known for its bark, popular fruit for birds	shade carbon sequestration pollution absorption branches as charcoal	should be planted near water sources

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Aeromys tephromelas Black Flying Squirrel Tupai terbang hitam	lives in tree hollows, adaptable to habitat loss, does well in urban areas	primary consumer, disperse seeds and fungi flower pollination	small social groups, prefers areas with sparse tree cover, nesting cavities for nocturnality
	Padda oryzivora Java Sparrow Gelatik Jawa	small bird known for living near rice paddies, has a distinct call, often makes nests in high trees and buildings, feeds on grains	seed dispersal, especially grains	endangered- requires protections
	Psilopogon armillaris Flame-fronted Barbet Cangkarang	a green songbird native to java and bali	primary consumer, seed dispersal	tree cover
	Lamprolepis leucosticta Java Tree Skink	a little known reptile that is native only to western java	pest control (insects)	no specific needs
	Calotes jubatus Maned Forest Lizard Bunglon Pohon	a small lizard that can change colors if it feels threatened, can live in urban areas, feeds on insects by waiting on the tops of trees	pest control secondary consumer	low bushes high trees

FUNCTIONAL HABITAT



Riparian Bio-Swells

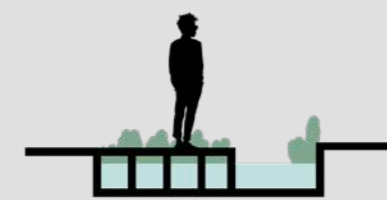


Green Drain Canal Covers

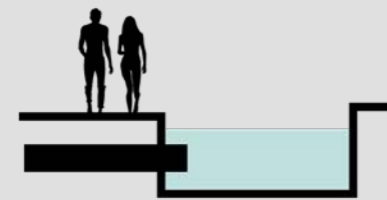


Semi-Covered Canal Habitats

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Canal Structures



Water Collection Points



Water Filtration Points

ATTRACTION // INTERACTION



Aesthetic Crossings



Natural Splashpads



Fountains

RAIN GARDENS AND DRAINAGE CANALS

WORKING WITH WATER

Rain Gardens can be a way to store and move water in urban areas in a way that is attractive and useful. Not only does it provide beauty and habitat in dry periods, but during storms it allows for a place to store water and decrease flooding issues on-site. Rain gardens can be used on plot levels or as neighborhood systems to manage storm flow, or as part of neighborhood or district plans for water management.

Base Habitat- Riparian Spaces

Riparian species can be a passive technique to filter and slow water, important aspects in urban sanitation and flood mitigation. Canal plantings can also create linear corridors that can support nonhuman populations that each have their own individual ecosystem services.

Life and Livelihood- Storm Protection




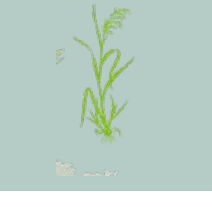
A major issue that affects many Jakartans is flooding. Rain gardens can provide on-site solutions that store and move water in a way that is easy to manage and self-regulating.

Attraction and Interaction- Attractive Gardens

Rain gardens can be beautiful places that can be the backdrop for taking pictures or for an evening stroll. Not only are they important functional spaces but also beautiful places that can bring the beautiful aspects of nature to people's doorstep.

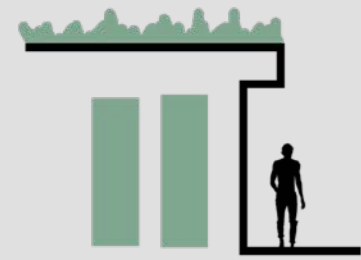


fig 7. applying the habitat toolbox in rain gardens and street drain canals

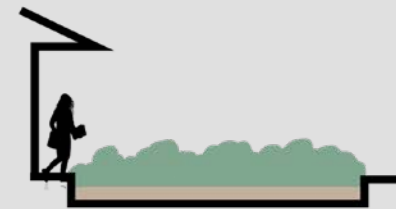
	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Hibiscus tiliaceus Sea Hibiscus Waru Laut	a flowering tree found near coastlines	firewood wood carvings and furniture tempeh fermentation tea from roots and bark	no specific needs
	Scirpus littoralis Bulrush Mendongan	grass-like perennial that lives in wet areas, it is very durable and can even grow in potholes and commonly along river banks	butterfly host plant water filtration erosion control herbal remedy	high water content
	Hydrilla verticillata Water Thyme Ganggang Rantai	an aquatic plant that lives in freshwaters but has a high resistance to salinity, must be careful not to allow it to overgrow	digestive benefits 'superfood' fish shelter/aquatic habitat	full water immersion
	Typha latifolia Broadleaf Cattail Tifa	common riparian plant found in wetlands and marshes	food medicinal uses bioremediation water filtration	freshwater no more than .8 m of water
	Vesicularia dubyana Java moss Ava mulut	a moss commonly used in aquariums, in the wild it lives on tree trunks, stones, and soil	water filtration aquatic shelter	moist areas
	Oryza sativa Rice Padi	the traditional rice plant	provisional uses	riparian spaces

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Ipomoea aquatica Water Spinach Kangkung	semi-aquatic vegetable, can grow easily near water sources with little care	provisional crop phytoremediation culinary uses medicinal properties	grows best in clay or marshy soils
	Ottelia alismoides Duck Lettuce Keladi Air	aquatic plant that usually grows in ponds, often harvested in the wild or crops	medicinal uses edible fruit and leaves water filtration	stagnant or slow moving channels
	Juncus effusus Soft Rush Sumpu	riparian plant that can be found around the world in a variety of different conditions	erosion control bank lining	not too wet
	Alcedo coerulescens Celulean Kingfisher Raja Udang Biru	a blue bird related to the common kingfisher, often found in streams and canals	ecosystem health indicator secondary consumer fish population control pest control	sandy banks for nesting
	Amyda cartilaginea Asiatic Softshell Turtle Bulus	a turtle species native to Southeast Asia that lives in wetlands and streams, it is omnivorous with a wide diet	pest control role as predator and prey	mud banks for nesting protections from trading
	Ictinogomphus decoratus Dragonfly	predatory insects that come in a variety of colors, particularly oranges and yellows in this variety	pollination pest control bioindicator prey to birds and fish	suitable air and water health

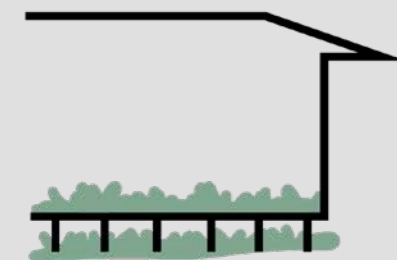
FUNCTIONAL HABITAT



Nonhuman Shelter

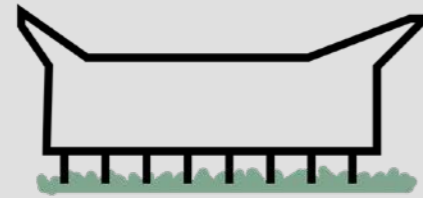


Anti-Pest Plantings



Animal-Friendly Architecture

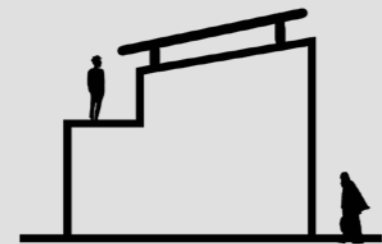
LIFE // LIVELIHOOD



Inspiration from Vernacular Design



Inspiration from Natural Materials

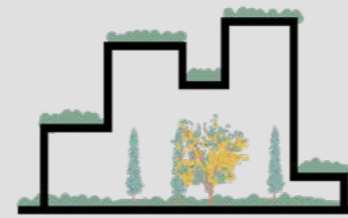


Renewable Energy Infrastructure

ATTRACTION // INTERACTION



Green and Natural Material Facades



Gardens and Green Roofs



Observation Decks

SYMBIOTIC ARCHITECTURE

ARCHITECTURE- ONE WITH NATURE

The ideas of symbiotic architecture are to apply ecosystem services and habitat space both existing buildings and proposed plans. A symbiotic building allows for habitat space on site and offers features that interact with and uplift nonhuman neighbors.

Base Habitat- Passive Building Management

Plantings can have a major impact on the cooling and maintenance of a building. Intentional planting choices can either repel harmful pests like termites and mosquitoes, or attract species that can improve household functions or predate on unwelcomed species.

Life and Livelihood- Cooling and Aesthetics

Plantings can have cooling properties that can help people to save money on their electricity and decrease their reliance on AC. Aesthetic planting choices can also aid in improving the attraction of a home or business.




Attraction and Interaction- Home Gardening

Plantings can also allow for personal connections to the natural world. Through gardening and having plants nearby, one's mental health and comfortableness with plants can improve.



fig 8. applying the habitat toolbox in relation to architecture

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Anaphalis javanica Javanese edelweiss Edelweiss Jawa	flowering plant mainly found in the mountains of Java	host for Javan Whistling Rush	protection from picking
	Hoya	a tropical plant popular as a houseplant internationally but is native to Asia	air filtration flowers have healing properties for burns and insect bites	no specific needs
	Pteridophyta Ferns Pakis	the large variety of ferns grow well in humid and shaded areas. They are a great addition to as a residential ecosystem actor	chemical sequestration air filtration erosion control allergy reduction	well drained, moist soil
	Combretum indicum Rangoon Creeper	a vine with red clusters, popular for home plantings	ornamental seeds for parasite treatment fragrance privacy screen	cannot be grown indoors
	Cymbopogon nardus Citronella	a tropical plant that is often planted near windows and entrances to repel insect pests like flies and mosquitos	fly and mosquito repellent fragrance medicinal uses	no specific needs
	Apis mellifera Honey Bee Lebah	the typical honey bee. Can be a great asset to have near homes as pollinators for gardens	pollination biodiversity stabilization honey	places to build nests/hives

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Nisaetus bartelsi Javan hawk-eagle	indonesian emblem, symbol of garuda, buddhist symbolism as well	secondary consumer pest control	lays nests in high areas, ENDANGERED in need of protections, preference to Rasmala Trees
	Plexipus sp Jumping Spider Laba-laba	although spiders can be a menacing neighbor, allowing them to reside in developed areas has many ecological benefits	predation pest control food for larger predators garden maintenance	no specific needs
	Rousettus amplexicaudatus Geoffroy's rousette	bat species that are never far from human settlements, they live in large groups that roost together in the day, they often follow fruit seasons	pollination and movement of fruit seeds highly fertile guano	cavelike roosting spaces foraging sites of fruit

TAKEAWAYS

Habitat in the Gray

In the Gray, it is especially important to implement natural elements. In a city as large and as dense as Jakarta, Gray habitat is a vital component of improving the regulative properties of the landscape and outdoor conditions for urban populations.

The Vision for Gray Habitat in Jakarta

While the city is already making strides in implementing greener streets and public spaces, more can be done to maximize the impact that ecosystem services can have in Jakarta. By employing the design and planning strategies of this thesis in the Gray, the city can have a management plan to tackle many of the urban challenges it faces today. Through thoughtful design and planning, ecological features can once again regulate the landscape that improves the city in a large and meaningful way.

Functional Ecology in the City

Habitat in the Gray can allow for 'nature to find a way' once more. Through the implementation and design of natural areas intertwined into the urban fabric, a multitude of species can find ways to thrive and reintroduce ecosystem services that have been lost overtime.

Supporting the Human Population

A balanced landscape can have a myriad of positive effects on people and cities. More plantings means healthier air and water, cooler and less extreme weather, and fewer climate disasters to experience. When a landscape is safer, so are the people that live on it, and so are their lifestyles and livelihoods affected.

A More Aesthetic City

Greener cities are often seen as more beautiful and more welcoming to be in. As Jakarta implements more habitat in the Gray, more people will be

prompted to go outside, be active, and interact with the city. As the air and water is better filtered, people may feel safer to be outside. As the city cools and is more shaded, people may feel more comfortable to go out.

Benefits of Urban Gray Habitat

By designing and implementing high quality habitat in Jakarta, many ecosystem services will follow. As these benefits spread through the city, Jakarta will be better equipped to address and mitigate many climate hazards present today.

Stormwater Management

By expanding vegetated areas and tree cover, large storm events will have a less dire impact on the city and its inhabitants. As plantings slow rainfall and canal speeds, flooding will be less extreme. As more permeable spaces are introduced, more water can be held in the ground like a sponge, slowly percolating into the water table and aquifer.

Thermal Comfort and Improved Outdoor Experience

Shading and cooling are major needs in the city. Currently many of the walkways and outdoor spaces are exposed to the heat and elements. With a higher percentage of vegetation and canopy cover, the city will see a lowering of urban temperature and more enjoyable outdoor spaces.

Natural Corridors

Nonhuman ecosystem actors need space to move and migrate throughout Jakarta. By allowing more natural areas within the developed city, such as the streets, canals, and buildings, these actors will live a healthier life. When an ecosystem actor is able to thrive, and when the overall nonhuman population is healthy, they are able to give a more broad and productive palette of ecosystem services.





CHAPTER 07 THE BLUE ATLAS

WITHIN THE BLUE ATLAS, WE WILL OBSERVE JAKARTA THROUGH THE DESIGNER'S EYE AND EXPLORE THE CHALLENGES AND OPPORTUNITIES WITHIN THE CITY IN TERMS OF WATER SYSTEMS AND HABITATS FROM INLAND RIVERS TO THE COASTLINE AND JAKARTA BAY.

THE BLUE ATLAS

Introduction of the Blue
A City of Water
A Designer's Observations

HABITAT IN THE BLUE

Blue System as Major Corridors
Super Canals
Wetlands and Mangroves
Coastline and the Bay

CHALLENGES IN THE URBAN LANDSCAPES

Impacts on Urban Populations
Current Trends

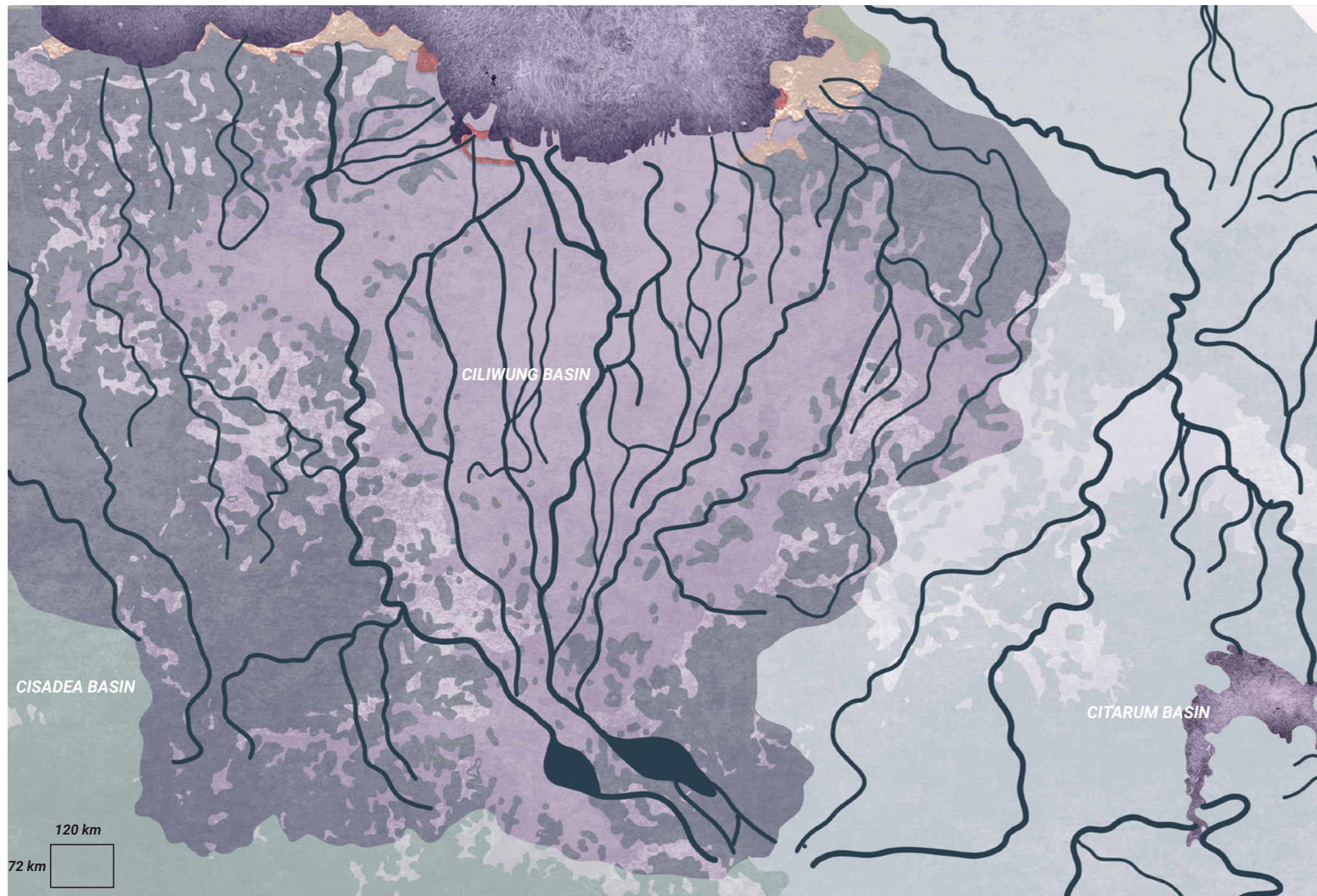


fig 1. regional watersheds and major rivers in the Jabodetabek region

THE BLUE ATLAS

Overview of Blue Systems in Jakarta

BLUE HABITAT

The Blue refers to water habitat in the city, the areas that are predominantly water. In this chapter, we will be looking at how blue spaces exist in Jakarta and how people relate to them. We will then go into some of the issues that come from existing conditions, what Jakarta is currently doing to address them, and introduce a set of design tools that showcase how to implement habitat space in blue areas.

Rivers

Channelized rivers are one of the most common things in Jakarta. As delta of 13 rivers that lead into the ocean, canals are on nearly every major street. Rivers are a great asset but many of them are low in quality, sanitation, and ecological health.

Reservoirs

Inner-city reservoirs act as water containment and diversions from rivers. These reservoirs are throughout the city, some of them closed off to the public, but a rising number are under revitalization projects to become more attractive and interactive with the urban population.

Coastline

Jakarta opens to Jakarta Bay on its northern border. A variety of urban typologies lie along this line, including lower-income neighborhoods, high-end apartment and hotel developments, mangroves, and attractions like a beach and amusement park.

The Ocean

Jakarta Bay and Pulau Seribu also are under the governance of Jakarta. The ocean brings many ecosystem services but also many threats as well. Pulau Seribu and its coral reefs are a major asset to Jakarta but are also at great risk and vulnerability due to sea level rise and ocean acidification.

FAST FIGURES

13
MAJOR RIVER PATHS

72
KM OF SHORELINE

1,492.6
MM TOTAL RAINFALL (2018)

111
RAINY DAYS PER YEAR

25 CM/YEAR
RATE OF SUBSIDENCE

6,693,949
M³ LEGAL GROUNDWATER OUTTAKE

64%
ESTIMATED GROUNDWATER DEPLETION

A DESIGNER'S OBSERVATIONS

The Deep Connection Between City and Water

THE CITY OF RIVERS

As a designer, I spent two months in Jakarta observing the water systems in the city and noting how people interacted with them. These are my main takeaways and understanding of the ecological systems relating to the blue.

Always Present, Yet Somehow Forgotten

Almost every street contains a river, however much of the time they are not accessible to people. In speaking with locals, I found that perceptions towards rivers are rather low, stating that rivers are often stinky and don't have a very positive reputation. Looking at reviews of public blue spaces, many times people's opinions were negative regarding these spaces because of the low water health and sanitation levels. Even on the streets, these spaces are often inaccessible to people.

Habitat of Concrete

Although much of the city is related to water, the actual habitat quality is not suitable for many species. Although I noted a few species in the rivers, like fish, waterfowl, and swimming snakes and lizards, the water is polluted and naturalized habitat is minimal. This means that a lot of minor improvements, however, can be made to upgrade water habitat in a meaningful way.

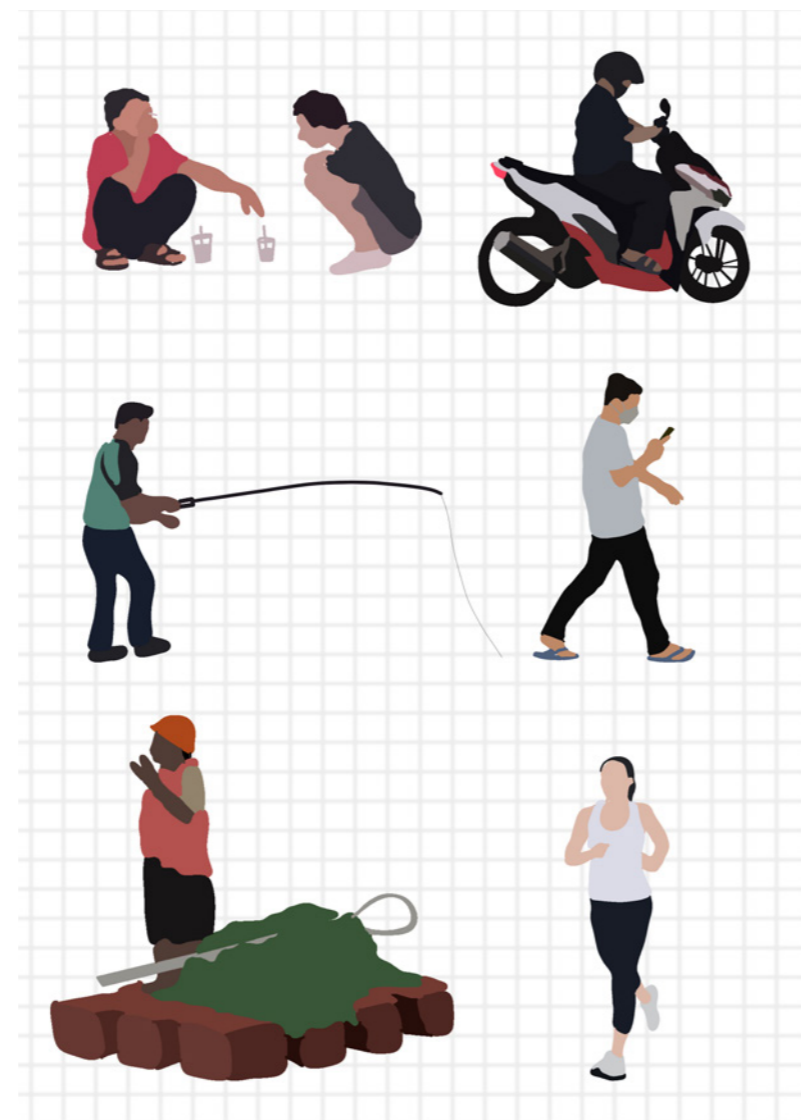


fig 2. prominent user types that interact with and near blue systems

CHALLENGES IN THE BLUE

Impacts on Water Habitats and Systems

After many decades of rapid development and vast expansion, Jakarta has become a very complex example of a post-rapid growth metacity. Though the many complexities cannot be succinctly described in this booklet, I have compiled a short list of some of the major challenges in Jakarta's Blue, mostly those that can be improved by ecosystem services.

Pressures on City Development

Stormwater Response and Flooding

Heavy storms and flooding are a major issue that both the government and locals struggle with. During the monsoon season, many people are affected by flooding and the damages that come with it.

Coastal Protections and Sea Level Rise

Sea level rise is a major threat as much of the city is flat and near sea level. Although this has not been a major issue in the past, as global sea level rise increases, much of the city will be at risk.

Aquifer Recharge and Land Subsidence

Perhaps that largest threat to Jakarta is land subsidence. As the aquifer below Jakarta is in a state of depletion, the land is lowering by many centimeters every year. This will have major implications on the city in the next few years, as many neighborhoods are already experiencing increased flooding on the coast due to this land subsidence.

Pressures on People

Access to Sanitary Water

Many people rely on privately sourced water because access to sanitary water is lacking. Because of this need, many people are left to supply themselves

with water from the aquifer below Jakarta, building deep wells. This, along with formal well digging, have a major impact on the aquifer.

Loss of Life and Livelihood- Vulnerability to Disaster

Flooding damage and dangers are a major risk to Jakartans. While many areas are implementing flood-preventative measures, many neighborhoods are still at risk of urban flooding.

Negative Views Towards Blue Spaces

A rather negative overall perception of blue systems in Jakarta mean that these spaces are not viewed as a commodity to its citizens. Having such a negative typology can impact a person's perception of the city overall and may affect quality of life.

Pressures on Natural Systems

Lacking Habitat Quality

The quality of blue areas are relatively low- discolored and unable to support many species. This can have impacts all throughout the city as what are natural oases are now ecological deserts.

Inability to Perform Natural Water Cycles

The imperviousness of the ground and close proximity of dense development near blue systems impact the landscape's natural ability to manage and self-regulate according to weather shifts.

Lack of Permeable Spaces

As much of the city is densely built and covered in impervious materials, water struggles to percolate into the water table and aquifer below the city. This can have devastating consequences in the short and long term.

HABITAT IN THE BLUE

Strategies for Ecosystem Employment

HEALING BLUE SYSTEMS

Blue infrastructure is an ever-important presence in Jakarta. Located on a delta river landscape that drains into the Jakarta Bay, addressing water is vital in understanding the city. Because much of the urban fabric is intertwined with canals and reservoirs, it proves a great potential to implement high quality habitat in these spaces. If rivers throughout Jakarta can be transformed into ecological corridors that both serve the human and nonhuman community, major ecosystem services can fuse its way throughout the city.

Functional Landscape

River revitalization can have a major impact on the city's ability to address flooding and water quality concerns, as well as support a great variety of species that can each supply their own ecosystem services.

Life and Livelihood

Clean, upgraded rivers can have many positive implications in the lives and livelihoods of Jakartans. By providing spaces that can support provisional activities, commerce, and transportation, waterways can be a major investment towards urban life in Jakarta.

Attraction and Interaction

Walkable promenades, ornamental plantings, and artistic implementations can bring a sense of attraction and interaction with the water systems in Jakarta. By creating exciting and beautiful river spaces, people's perceptions and interactions with blue infrastructure will improve.

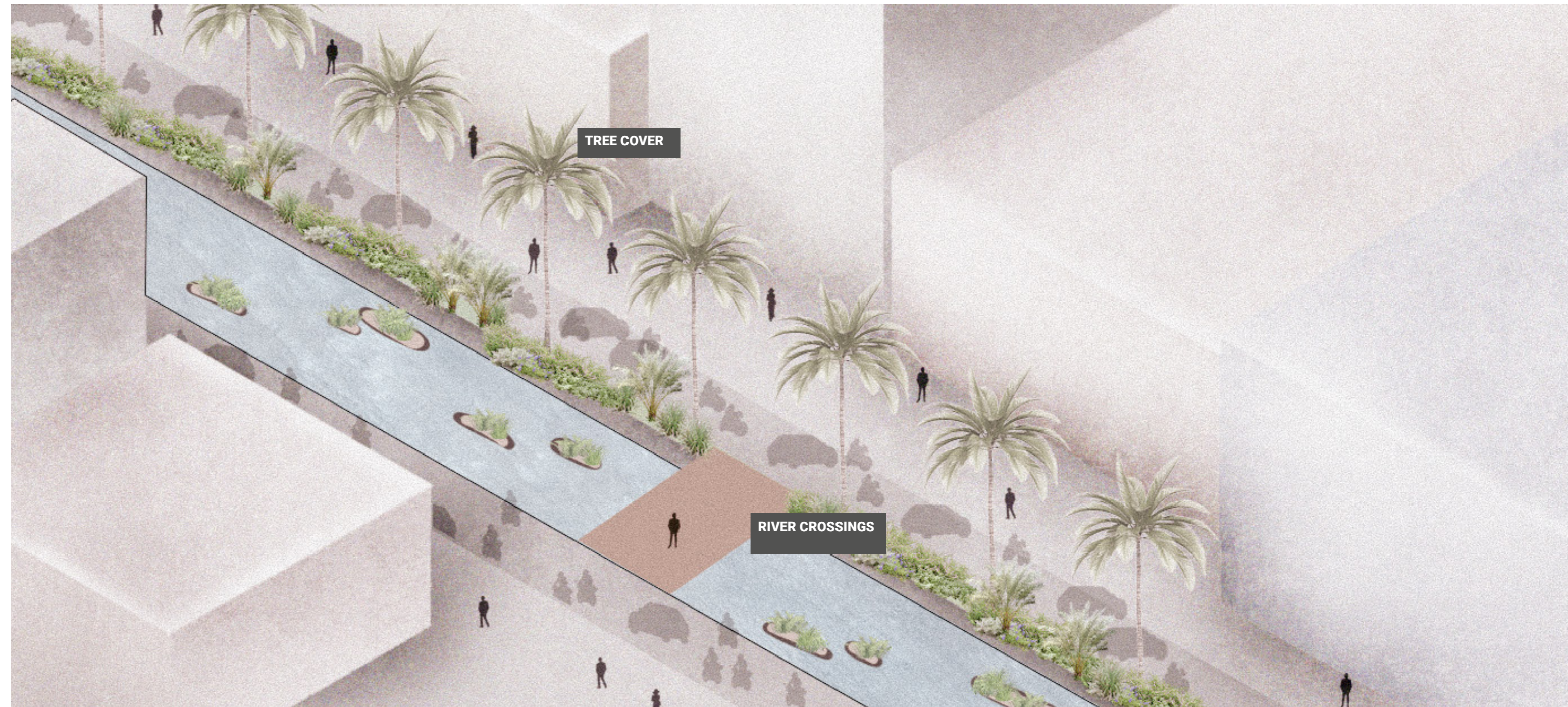
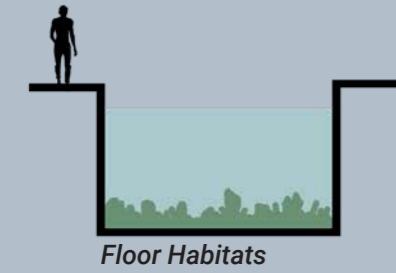
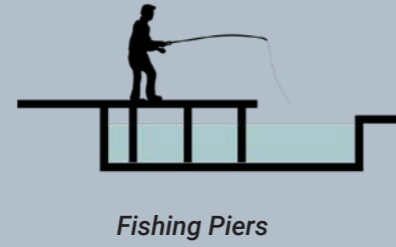


fig 6. a visualization of improving blue habitat to serve human and nonhuman users

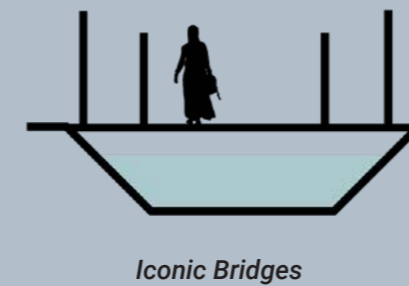
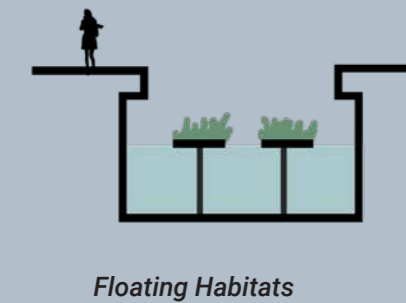
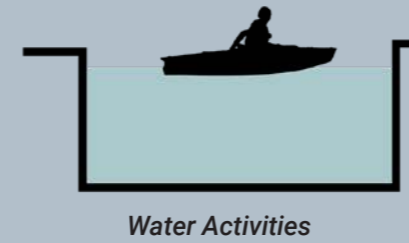
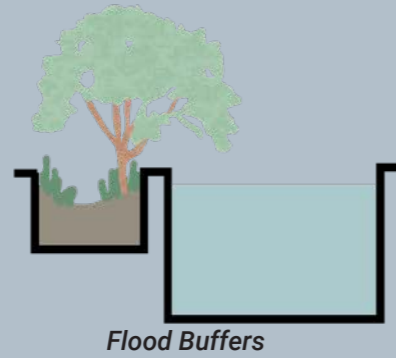
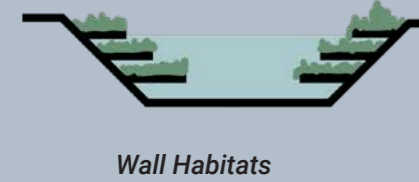
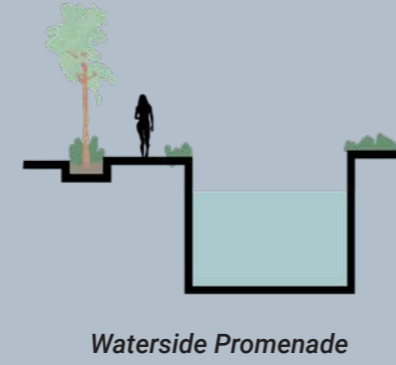
FUNCTIONAL HABITAT



LIFE // LIVELIHOOD



ATTRACTION // INTERACTION



SUPER CANALS

WORKING WITH WATER

Canals have large-scale potential in Jakarta. Because of the complex and far-reaching canal system, canals can be a major corridor system that connects the city-wide ecological system as a whole. Riverscapes can become habitat superhubs that support a large variety of species and ecosystem services.

Base Habitat- Reconstructed Rivers

Through thoughtful canal upgrading, canal sections can become major functional systems within the city. Plantings and other actions that mimic natural river systems can improve flooding danger and water quality.

Life and Livelihood- Slowing and Filtering

Through slowing and filtering water, canals can better support the lives and livelihoods of the nearby human population. With safer rivers, people can be able to use canals as assets rather than unsafe infrastructure.

Attraction and Interaction- Beautiful Experiences

By implementing attractive properties to rivers, locals can experience the true potential of canals and their aesthetic qualities in the urban setting. Once a large amount of river area is improved, many people can be in close proximity to positive blue experiences along the canal.



fig 7. applying the habitat toolbox in channelized rivers

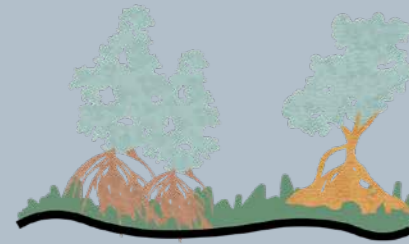
	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Blyxa echinosperma	aquatic plant popular in aquariums	water filtration aquatic habitat	prefers slow moving, shallow streams
	Ficus racemosa Cluster Fig Pohon Loa	a popular fruit tree, grows naturally along river banks, seen as an ornamental tree in parks	bark as medicinal remedy shade bank stabilization leaves provide mulch	no specific needs
	Nauclea orientalis Bur Tree Pohon Bangkal	riparian trees that thrive in flooded or moist places, grown for ornamental purposes, reportedly vulnerable to termites	edible fruit, popular with animals as well wood soil control	does best in riparian areas
	Cyperus iria Rice Flat Sedge Rumput Menderong	riparian plant that often grows in rice fields, can thrive well in urban areas	medicinal properties leaves for weaving insect host plant	no specific needs
	Eucheuma Sea Moss Rumput Laut	a sea weed with many uses, common around the tropics, important source of food and income	provisional activities food ecosystem stabilization	below the tide mark slow to moderate water flow
	Perna viridis Asian Green Mussel Kerang Hijau	a very economically important ecosystem actor, harvested for food market, however it is known to harbor toxins in harsh environments	ecoindicator provisional activities food water filtration	estuarine habitats

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Hampala macrolepidota Hampala Barb Hampala	somewhat large fish, abundant	secondary consumer traditional food	prefers running rivers and streams
	Puntius bramoides Ray-finned Fish Lawalak	makes up the majority of fish biomass in its range	popular food	breeds in floodplains, lives in running rivers and streams
	Clarias batrachus Catfish Ikan Lele	popular food fish around the world but comes from Asia, able to walk and wiggle on land to find food, has a thorn defense	popular food apex predator, must be careful in newly established areas	thrives in stagnant waters like muddy ponds or canals
	Aonyx cinerea Small Clawed Otter Sero Ambrang	common otter species that lives in streams and rivers near coastlines, they are one of the only otter species to utilize their hands	shellfish and crustacean population regulation pest management	dense foliage cover areas with muddy banks large social groups shellfish
	Anhinga melanogaster Darter Pecuk Ular Asia	water birds that enjoy a wide variety of habitats and ranges, but always stays close to water sources	predator of most small aquatic species- population regulation	water deep enough to dive and stand branches for preening protection from poaching
	Gymnothorax polyuranodon Tiger Eel Belut Moray	common eel found in southeast Asia, carnivorous- feeding only on fish and shrimp	population control secondary consumer	shallow waters shelter like rocks or plantings

FUNCTIONAL HABITAT



Tiered Pools



Urban Rewilding



Riparian Soils

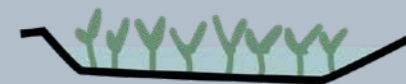
LIFE // LIVELIHOOD



Aquifer Drains



Stilted Buildings



Wetland Provisions

ATTRACTION // INTERACTION



Boardwalks



Wildlife Observation Spots



Art in the Landscape

WETLANDS AND MANGROVES

URBAN SPONGES

Wetlands and other riparian habitats can be a major asset to Jakarta as well. Wetlands have amazing properties that can improve urban climates, such as water filtration and retention, carbon sequestration, and urban cooling. Mangroves in particular are vital in coastal protection.

Base Habitat- Riparian Spaces

Riparian areas are very important spaces, and urban wetlands can be game changers in addressing the functional climate needs of a city. In Jakarta particularly, these spaces can be important areas for aquifer recharge and stormwater management.

Life and Livelihood- Storm Protection

As wetlands provide functional uses, the lives and livelihoods of Jakartans are also protected, as flood risk and sanitation threats are lowered.

Attraction and Interaction- Attractive Gardens

Urban wetlands are also known to be very beautiful places if designed correctly, bringing in new attractions throughout the city and increasing interaction and education about this type of habitat.

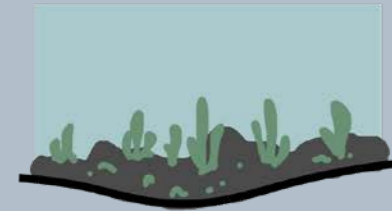


fig 8. applying the habitat toolbox in wetlands and mangroves

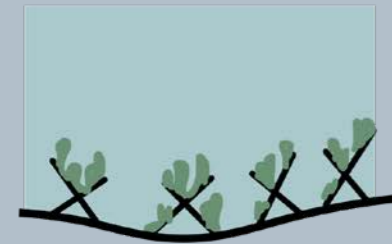
	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Rhizophora stylosa Spotted Mangrove Slindur	mangrove species found in muddy and sandy areas on the coast,	erosion control coastal protections medicinal properties	sandy beaches coral terraces
	Sonneratia alba Prapat	mangrove species in tidal creeks and sandy seashores	firewood edible leaves coastal protections building materials	brackish waters no freshwater
	Xylocarpus granatum Cannonball Mangrove Nyirih	mangrove species known for its wood and building properties	timber for boats coastal protections	sandy or muddy areas
	Rhizophora mucronata Loop-root Mangrove Bakau	mangrove species that grows near tidal areas in southeast Asia	fuel and charcoal tannin coastal protection	sandy or muddy areas
	Pluchea indica Indian Camphorweed Bluntas	this waterbound shrub is an important plant in mangrove areas by providing bird habitat and growing rapidly to establish habitat	animal shelter medicinal properties	no specific needs
	Acrostichum aureum Golden Leather Fern Warakas	a fern that lives in wetlands and other tropical riparian areas, it grows rapidly which may be beneficial in initial restoration projects	edible leaves thatching	swamp or marsh

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Lutrogale perspicillata Smooth Coated Otter	otter species endemic to south and southeast asia, does well in urban areas, holt does well in urban areas, holt alternatives	secondary consumer, fish population regulation,	freshwater and salt water coasts, does not like small streams and canals, only eats fish
	Varanus salvator Asian Water Monitor Biawak Air	Swimming lizard that lives in marshes and mangrove areas, world's second heaviest lizard, can do well in urban areas	apex predator population control	protection from poaching long stretches of water
	Pteropus vampyrus Large Flying Fox Kalong Besar	common bat species throughout Indonesia, one of the largest species in the world, they can fly up to 50 km to forage	primary consumer vast seed dispersal fruit pollination ecosystem superstar	large trees for roosting prefers undisturbed areas variety of fruit trees- foraging protection from poaching
	Centropus nigrorufus Javan Coucal Bubut Jawa	cukoo bird that enjoys life in mangroves and areas of brackish water	omnivorous- population regulation of small species	dense vegetation for foraging
	Mycteria cinerea Milky Stork Bangau Bluwok	found predominantly in coastal mangroves, they come together in breeding colonies every breeding season,	secondary consumer- population control of prawns and mudskippers	trees for shelter during high tide and breeding
	Glossogobius giurus Tank Gobi Nyereh	This small fish is found throughout the tropics and is a common tank fish but finds a home happily in wetlands and streams	food for secondary consumers keystone species for habitat restoration	no speciic needs

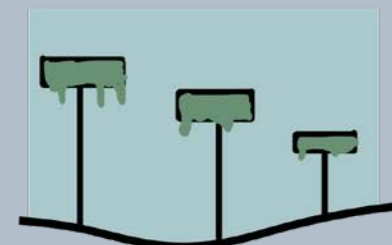
FUNCTIONAL HABITAT



Reconstructed Reefs



Artificial Habitats

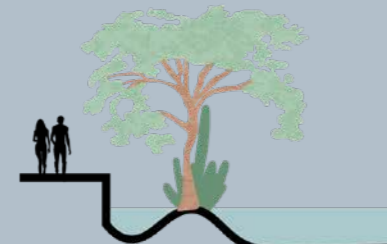


Shelter Cages

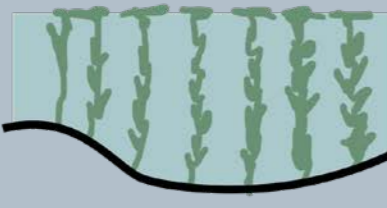
LIFE // LIVELIHOOD



Small Scale Docks and Piers



Coastline Flood Drainage



Localized Aquaculture

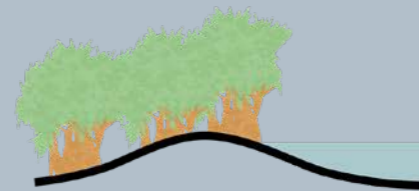
ATTRACTION // INTERACTION



Waterfront Destinations



Floating Architecture



Ecological Destinations

COASTLINE AND BAY

WORKING WITH WATER

The coastline is a very vulnerable place, especially in the face of threats like land subsidence, sea level rise, and erosion. Through the intentional planning of coastal ecosystem services and habitat, many of the threats can be at least lightened by the presence of natural areas.

Base Habitat- Natural Spaces

Riparian and aquatic species can be great assets in the improvement of coastal threats. Softened, or naturalized, coastlines can help protect against erosion and sea level rise, and improved underwater species can help protect against high waves and improve biodiversity and water sanitation.

Life and Livelihood- Protections and Provisions

Improving the bay and coastline have the potential of providing many jobs and protecting many homes. By improving aquatic species populations, more provisional activities can support the coastal inhabitants.

Attraction and Interaction- Water Activities

By improving the conditions along the coast, there are more opportunities to develop water-related activities and venues. Already much of the coast is being developed to support attraction, and more can be done to implement nature-driven attractive spaces.



fig 9. applying the habitat toolbox on the coastline and Jakarta Bay

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Enhalus acoroides Enhalus Lamun	aquatic flowering plant that are often found in sea meadows, though it flowers year-round. Flowering intensity is an indicator of sea temperatures.	vital aquatic habitat	no specific needs
	Thalassia hemprichii Pacific Turtlegrass Lamun	a hardy sea plant that can withstand the threats of ocean acidification and algal blooms.	slows wave velocity erosion control aquatic habitat	no specific needs
	Syringodium isotifolium Noodle Seagrass Lamun	aquatic flowering plant that makes up many sea meadows.	aquatic habitat edible	no specific needs
	Scleractinia Stony corals Karang Batu	marine animals that build a hard skeleton around themselves, much of coral reefs around the world mainly consist of this type of coral.	aquatic shelter coastal protections supports provisional fishing	shallow waters
	Sesuvium portulacastrum Shoreline Purslane Krokot Laut	a perennial flowering herb that is distributed in mangrove and other coastal areas.	cuisine seasoning bioremediation erosion control improves sand richness	beach dunes or brackish water conditions
	Lanea coromandelica Indian Ash Tree Pohon Kuda	a large coastal tree that ranges throughout Asia, known for its good wood properties.	wood edible shade	no specific needs

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Pandanus odoratissimus Fragrant Skrew-Pine Pandan Laut	coastal palm-like tree that occurs in high rainfall areas.	aromatic oil religious importance weaving material coastal protection	no specific needs
	Pandanus boninensis Skrew-Pine Pandan	coastal tree that grows above rocks.	edible fruit	consistently moist soils
	Charadrius javanicus Javan plover Cerek Jawa	A rare wading bird that lives on beaches primarily on Java island.	secondary consumer - crabs	sandy areas and mudflats protections from egg collecting
	Fregata andrewsi Christmas Frigatebird Cikalang Christmas	most of their life is spent on the sea, but noted many times in Jakarta, large size, known for stealing other birds' meals, 'the sea pirate'.	prominent sea predator population regulation bird watching key species	high trees for roosting and breeding species rehabilitation and conservation
	Leiognathus sp. Silverbelly Ikan Petek	oceanic fish found near coasts and estuaries that is an important economic driver, adults move in schools.	provisional	no specific needs
	Rastrelliger brachysoma Short Mackerel Kembung Perempuan	popular fish for eating, found in schools near coastlines.	provisional prey for predators	no specific needs

KEY TAKEAWAYS

Blue Spaces as Habitat Hubs

Blue systems are present throughout Jakarta, providing many opportunities to develop a large-scale habitat plan simply through improving the existing blue infrastructure.

The Vision for Blue Habitat in Jakarta

Water is among the largest threats to Jakarta, as well as most cities in the world. However, because of its existing river infrastructure, habitat improvements can be very beneficial and far-reaching.

A Functional Ecosystem

Creating a functional river plan that focuses on improving the habitat within the canals and other blue waterways can improve conditions relating to sanitation, flooding, and land subsidence.

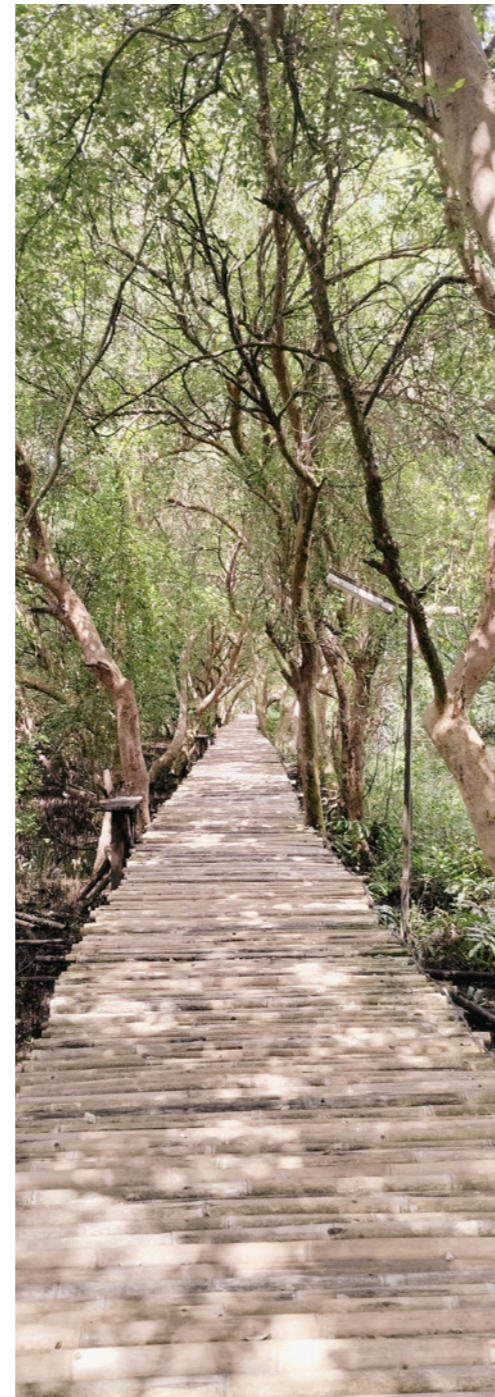
Protecting People, Protecting Jobs

Many people, offices, and stores lie near blue infrastructure. Through the improvement of these spaces, these people and their jobs can be further protected from the threats that water and storms cause on a regular basis. Improving this infrastructure can also facilitate new jobs and new connection routes.

Beautification and Raising Awareness

Through the beautification of water systems, more people will be drawn to these areas. Perceptions towards urban water spaces like the coast and rivers will improve. By attracting more people to spend time in blue spaces, awareness of water issues and ecosystem services will improve as well.





CHAPTER 08

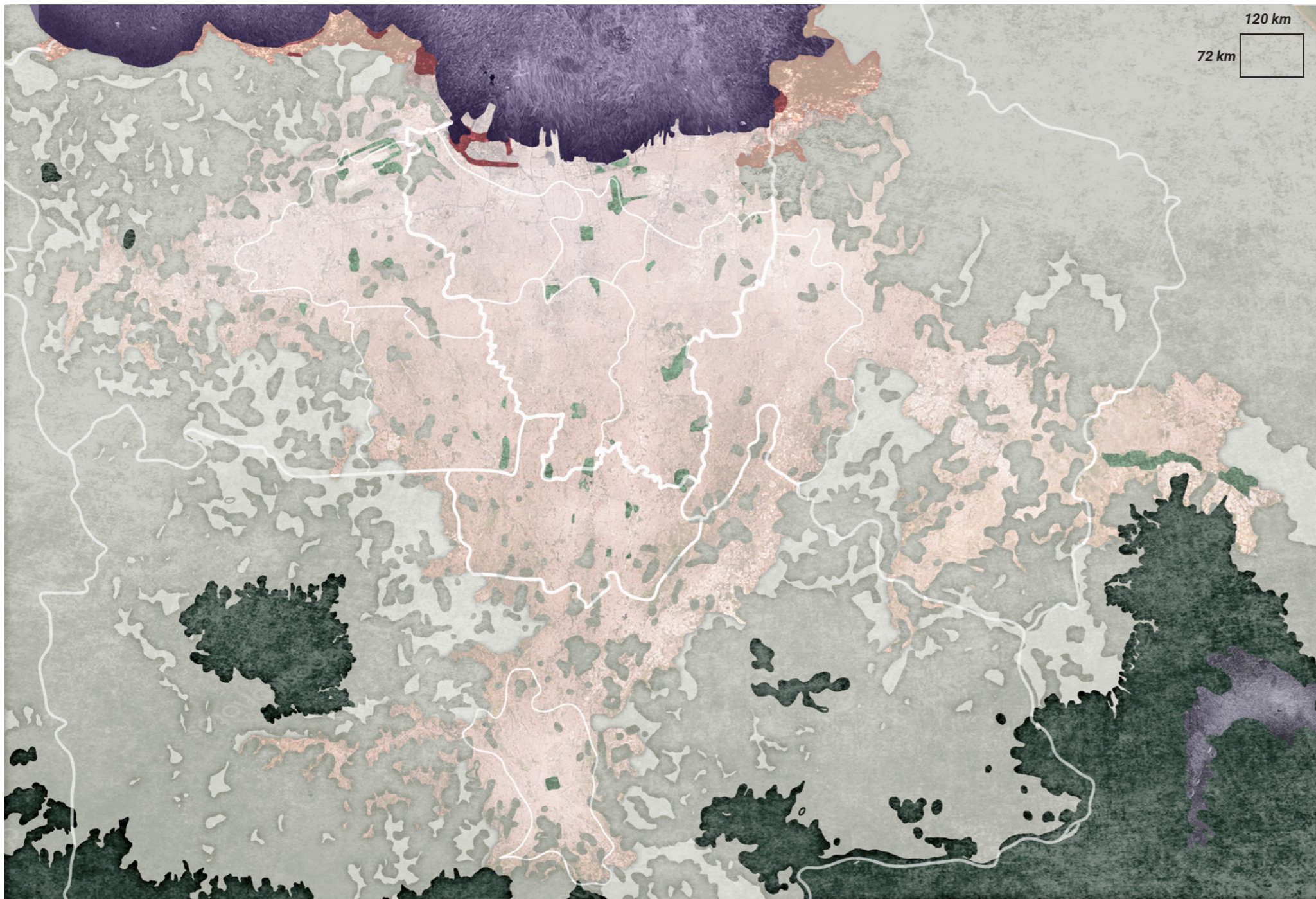
THE GREEN ATLAS

WITHIN THE BLUE ATLAS, WE WILL OBSERVE JAKARTA THROUGH THE DESIGNER'S EYE AND EXPLORE THE CHALLENGES AND OPPORTUNITIES WITHIN THE CITY IN TERMS OF LARGE-SCALE OPEN SPACES AND PARKS.

THE GREEN ATLAS
Introduction of the Green
The Potential of Green Space
A Designer's Observations

HABITAT IN THE GREEN
A Legacy of Co-Creation
Urban Forests
Agroforestry
Ornamental Gardens

CHALLENGES IN THE URBAN LANDSCAPES
Impacts on Urban Populations



THE GREEN ATLAS

Overview of Green Systems in Jakarta

GREEN HABITAT

The Green refers to green space in the city, the areas that are predominantly natural and permeable, as shown below. In this chapter, we will be looking at how green spaces are implemented in Jakarta and how people overall relate to them. We will then go into some of the issues that come from existing conditions, what Jakarta is currently doing to address them, and introduce a set of design tools that showcase how to implement habitat space in green areas.

Urban Forests

Many urban forests are scattered throughout the city. Many of them are only open on certain days or short hours, but nonetheless they are vital in protecting the habitat and conserving many ecosystem actors in the city. These spaces are well managed and also allow for small scale food services and vendors within or just outside forest walls.

Cemeteries

Cemeteries are major green spaces in the city. Oftentimes these are vast spaces and are all throughout the city and managed by a team of caretakers.

Public Parks and Monuments

Although few and far between, there are a variety of public parks and monuments in the city. Most notably is Monas and GBK, some of the largest green spaces in the city from the era of Sukarno. However, these largest spaces are actually rather empty, with only a few visitors during the day. Smaller parks usually always have at least a few people and support informal vending.

Sawah- Rice Fields

Sawah, or rice fields, are the most expansive agriculture in Java. Jakarta also has some, although more are found in the satellite cities.

FAST FIGURES

10%
UNDEVELOPED OPEN SPACE

66.15
KM² UNDEVELOPED OPEN SPACE

346.11
HA PROTECTED FOREST SPACE

787
AGRICULTURAL LAND



SCOREBOARD

A Designer's Personal Observations and Analysis of Green Space in Jakarta, Indonesia

Habitat Quantity

Is there sufficient habitat space in the city?

Available Space



Habitat Variety



Vegetative Cover



Connectivity



Habitat Quality

Can existing habitat space support a variety of species?

Flora Diversity



Fauna Diversity



Habitat Health



Species Health



Human Interaction

Are habitats accessible and welcoming to the public?

Public Perception



General Proximity



Habitat Aesthetics



Interaction Levels



Symbiotic Exchanges

Do human systems impact ecological systems?

Policy Protection



Direct Pollution



Ecologic Design



City Management



THE POTENTIAL OF GREEN

A Designer's Analysis of Green Systems in Jakarta

MAIN TAKEAWAYS

Overall, the undeveloped space within DKI Jakarta is staggeringly low, with only 10% of land undeveloped. However, as Jakarta now does not face rapid growth, there are many signs of higher quality green spaces in the city. While many of the largest green areas were built in the mid-20th century, a variety of eco parks and conservation areas have popped up in recent years and the trend is moving towards more green development in the future.

Strengths

Public green space is well managed and has daily caretakers.

Weaknesses

The green spaces are often in the most wealthy areas that can afford to implement what is considered 'dead space'. This makes regional habitat overall weaker because it is only sufficient in a few key areas spread sparsely throughout the city.

Threats

The lack of large scale green space in the city accounts for much of the lost ecological systems that allow the landscape to function. It affects biodiversity, city resilience, and urban life.

Opportunities

In existing undeveloped lands, habitat can be upgraded to meet a wide variety of needs of ecosystem actors. Large scale green space with high biodiversity can be one of Jakarta's key tools in addressing climate concerns.



A DESIGNER'S OBSERVATIONS

Interactions within Green Spaces

HABITAT IN A DOMESTICATED LANDSCAPE

90% of Jakarta land is developed by the heavy materials of concrete and asphalt. Although green space has become minimized, there is still hope as Jakarta puts more focus on green infrastructure in the upcoming decades.

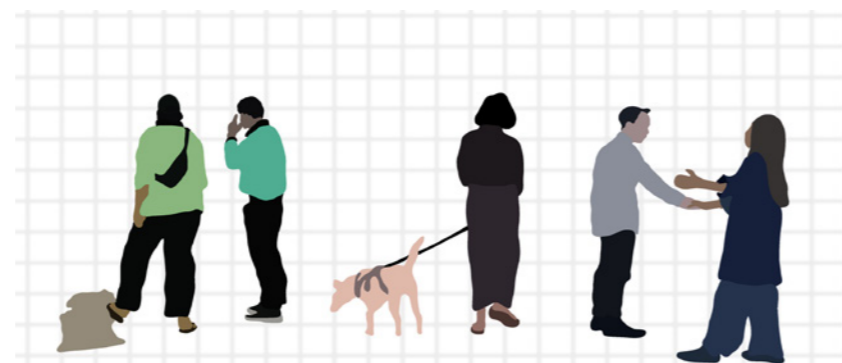
During my two months in Jakarta, I spent many days exploring the green spaces around the city. These are some of my most prominent observations.

A Growing Popularity in Green Spaces

More and more people are becoming interested in green space as more public green space projects make it more accessible and enjoyable. More and more people are coming in contact with parks and spending time in green areas. Although there is a bit of a cultural distancing from wild spaces, the mild urban parks allow for recreation and relaxation, a break from the hustle and bustle of the city.

A Liminal Period in Jakarta

Jakarta is in a transitional period when green infrastructure is becoming more commonplace. This will be important for Jakarta as it faces the many climate hazards in the next few decades. Many public spaces and streetscapes are under renovation to bring in more green infrastructure into the city.



A GRID OF COMMON ACTIVITIES IN GREEN SPACES



A BIOLOGICAL DESERT

Impacts of Limited Green Space

After many decades of rapid development and vast expansion, Jakarta has become a very complex example of a post-rapid growth metacity. Though the many complexities cannot be succinctly described in this booklet, the following is a short list of some of the major challenges in Jakarta's Green.

Pressures on City Development

Landlocking and Pressures to Develop

Because the city has reached landlock and prices are high, many developers and decisionmakers want to put more focus on the return on investment rather than implement green space, which is often thought of as dead space in this context. Because of this, green space has become a sign of wealth and prosperity for those that can afford green space in the city.

Urban Heat Island Effect

The minimal greenery and maximized manmade material causes the city overall to heat up, oftentimes the city is multiple degrees warmer than the less developed areas nearby.

Minimal Provisional Space and Food Vulnerability

Because little agricultural space exists within the city, much of Jakarta food providers must import products into the city. This increases vulnerability in times of disaster.

Pressures on People

Access to Green Space

Because there is such a dichotomy between green space and socioeconomic standing, there is also an inequality to green space accessibility. Richer areas experience the benefits of ecosystem services more than poorer areas.

Thermal Comfort

Urban Heat Island Effect also impacts the outdoor experience for people. This makes moving around outside less enjoyable, and incentivizes motorized transportation and spending time indoors.

Disconnect to Nature

The lack of green space disconnects people from nature. This is also a concern for traditional practices according to some, where much of the younger generations are losing touch with local and indigenous knowledge and values.

Pressures on Natural Systems

Low Biodiversity

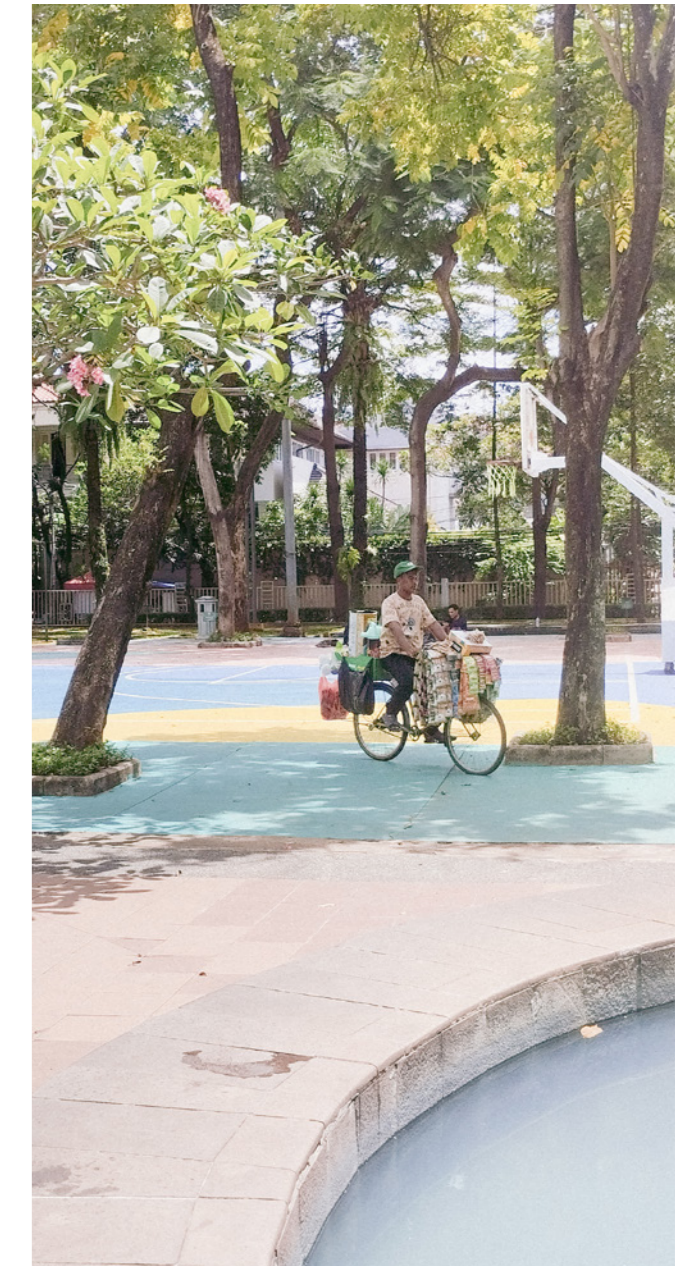
Minimal green space often means minimal biodiversity. This is concerning because the lower the biodiversity, the lower health of the entire population and overall ability of an ecosystem to provide services. Often it means the opposite, where the ecosystem then brings out more hazards than benefits.

Low Habitat Quality

While many green spaces are well managed, vital layers of habitat is missing. Oftentimes ground cover and shrub layers are not present. This may be related to aesthetics, cleanliness, and safety, but these layers are vital in a well-rounded habitat and can lead to a loss of key species that rely on a variety of planting layers.

Pollution and Close Proximity to People

The direct impact of the city and its pollution also has an impact on species. Many species cannot exist under the current conditions of a dense megacity, but careful planning later on can improve conditions and maximize the amount of species in the city.



HABITAT IN THE GREEN

Strategies for Ecosystem Employment

A LEGACY OF CO-CREATION

Large scale green space is vital in the success of a city and its ability to employ ecosystem services. A high quality urban green space meets the needs of its nonhuman community while also providing benefits to people.

Intentional Planning for High Biodiversity

By implementing principles of high quality habitat in large scale green spaces, we can begin to bring back the natural, regulative systems that the city needs in order to be a safe and resilient place and minimize climate impacts.

Spaces that Support Humans and Nonhumans

Green space can be a haven for humans and nonhumans alike. By planning ideal spaces for both in the same place, we can create a symbiotic space where nonhuman ecosystem actors can improve outdoor conditions for people and people can manage and protect habitat spaces.

A Focus on Old Knowledge

By applying traditional and indigenous practices and knowledge towards the design of green spaces, we can learn more about the nature world and about ourselves. As Jakarta is a city that brings people from all across the archipelago, green space can be a place to share and showcase ideas about nature.



HEAVY TREE CANOPY

ATTRACTIVE PATHS

FUNCTIONAL HABITAT



Biomimicry

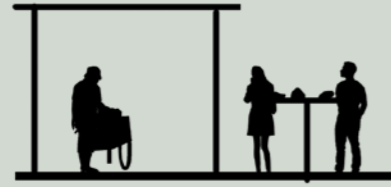


Reconstructed Forest Floor



Floodable Areas

LIFE // LIVELIHOOD



Vendor Zones



Provisional Zones



Habitat Management

ATTRACTION // INTERACTION



Nature Play



Event and Exhibition Space



Ecotourism Centers

URBAN FOREST

THE LUNGS OF JAKARTA

Urban forests are an important part of regulating the landscape as well as providing natural areas for people to go to escape the fast paced environment of the big city.

Base Habitat- Recreating the Forest

Urban forest areas should mimic the actual presence of a forest in the city, including the complex systems that exists there. By learning about local forests and bringing those features into the city, we are also recreating the benefits that those spaces can offer.

Life and Livelihood- Boosting Jobs

Urban forests can be a place that allows for more employment and commercial opportunities for local residents. By allowing for agriculture and ecological management, people can earn a living from the forest, as well as provide informal sector activities as well.

Attraction and Interaction- Ecological Destinations

Currently as large scale parks in Jakarta, urban forests can continue the legacy and add to an already strong presence by adding more attraction and interaction in new and existing urban forests.



	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Palaquium gutta Geta Karet Oblong	a tree with large orange fruit	Butterfly hostplant shade air filtration	no specific needs
	Ficus drupacea Ysore fig Ficus	large trees known for its bark and vines	medicinal fiber shade air filtration	requires a specific wasp for pollination
	Eucalyptus deglupta Rainbow Eucalyptus Pohon Pelangi	a colorfully-barked tree that grows tall, found throughout indonesia	pulpwood for paper aesthetic values wind control host tree for other plants	alkaline soils
	Tectona grandis Teak Pohon Jati	deciduous tree that is often found in forests of this region that can grow up to 40m	wood carbon sequestration medicinal properties soil stabilization	no specific needs
	Pterospermum javanicum Bayur Melerang	a medium growth tree that is evergreen	carpentry wood dyes for batik leaves as fertilizer soil and groundwater stabilization	no specific needs
	Dysoxylum parasiticum Yellow Mahogany	tall trees that are commonly found in javanese forests but are also popular in parks and gardens	shade aesthetic values wood	prefers acidic soils well drained soils

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Tragulus javanicus Java mouse-deer Pelanduk Jawa	deer the size of a rabbit, is a folivor that eats primarily shrubs and buds on the forest floor, like river banks and cliff faces, considered wise	primary consumer folklore character	dense undergrowth and shrubbery, social groups, territory space
	Rusa timorensis Javan Rusa Rusa Timor	endemic to java, protected species due to rapid decline, nocturnal and may graze during day	primary consumer, scat for soil health	small groups or pairs, feeds on grass leaves and fallen fruit
	Galeopterus variegatus Sunda Flying Squirrel Colugo	skillful climber and able to glide up to 100 m, very adaptable and can live in a variety of habitats, both domesticated and wild	primary consumer, pollination and scat seed dispersal	leaves high in tannin, heavy tree cover for foraging, cavities for nocturnality, high trees for protection
	Chalcidoidea Fig Wasps	the wasp family that spend larval stage in fig trees,. Wasps, though unpopular are important ecosystem acors	insect and pest population control pollination food- high in protein	presence of fig trees
	Gallus varius Green Junglefowl Ayam Hutan Hijau	a colorful fowl that is found in the forests of java. currently respration projects are common to increase the number of this endemic species	beautiful call seed dispersion pest management	shurrbery for shelter
	Dasia olivacea Olive Tree Skink Kadal Pohon Hijau	A lizard that spends its entire life in trees, this southeastasian reptile is considered very flexible and can live in a variety of habitats	secondary consumer pest control	undisturbed canopy territories

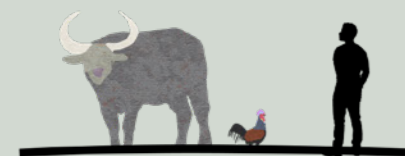
FUNCTIONAL HABITAT



Provisional Crops

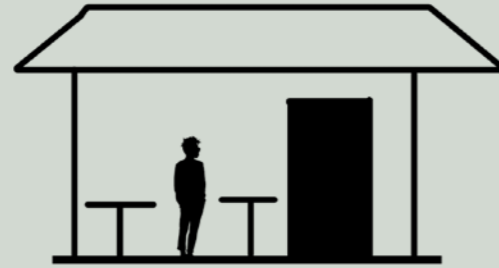


Pollinator Gardens



Domesticated Animals

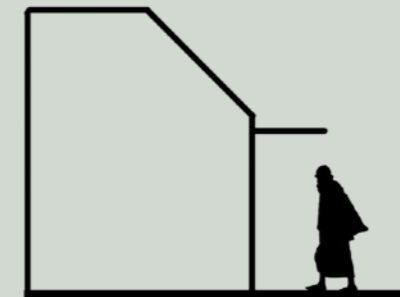
LIFE // LIVELIHOOD



Restaurants and Marketplaces



Productive Agroforestry



Caretaker/Workforce Housing

ATTRACTION // INTERACTION



Agritourism Activities



Traditional Agriculture Practices



Open Air Museum

AGROFORESTS

TRADITIONAL AGRICULTURAL PRACTICES

By learning about traditional and local practices in Indonesia, agroforestry sites in Jakarta can become important places of showcasing cultural practices as well as enjoying the benefits of high biodiversity areas.

Base Habitat- Circulative Gardening

With intentional planting choices and agricultural methods, the idea of circulative gardening can increase yields as well as increase biodiversity hubs in the area.

Life and Livelihood- Productive Habitat

By utilizing agroforestry and other traditional agricultural practices, this type of habitat can support livelihoods and increase food yields within the city, thus improving food security and access.

Attraction and Interaction- Learning Spaces

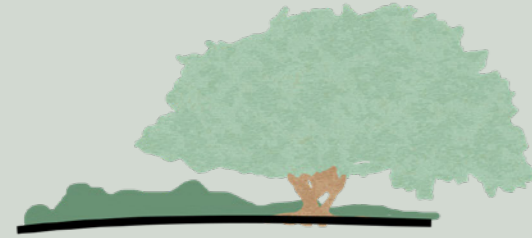
Agroforestry sites can include a layer of public interaction by opening these spaces as agrotourism and food tourism spaces. They can also help teach locals and tourists about traditional farming methods.



	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Salacca zalacca Snake Fruit Salak	floral emblem of Jakarta, popular fruit	edible fruit wine	no specific needs
	Cosmos caudatus King's Salad Kenikir	a beautiful flowering plant that is often used in cuisine, often as leaves in salad	edible supports pollinators potentially medicinal	no specific needs
	Canna discolor Brick Canna Ganyong	a lily species that is found in Indonesia, very popular in gardens	food for insects attracts pollinators insecticide if smoked phytoremediation	no specific needs
	Colocasia esculenta Taro Talas	a root vegetable, a very popular flavor in Asia, leaves and roots are utilized in many Indonesian dishes and snacks	edible	no specific needs
	Manihot esculenta Cassava Ubi Kayu	a popular crop used in a variety of dishes	edible biofuel animal feed	no specific needs
	Musa acuminata Banana Pisang	a fruit tree found throughout Indonesia, often planted in gardens and private plots	edible provisional activities	habitat needs

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Syzygium samarangense Javanese apple Jambu Semarang	a popular fruit tree that is often found in private gardens	fruit	no specific needs
	Mangifera foetida Mango Mangga	A delicious fruit that is popular as a snack in Indonesia	fruit butterfly host plant wood	no specific needs
	Gallus gallus domesticus Chicken Ayam	the domesticated chicken, one of the most common forms of meat in Indonesia, often found as personal pets here that live alongside humans	meat seed dispersal soil scratching soil fertilization	no specific needs
	Bubalus bubalis Water Buffalo Kerbau	a large black bovine that preferable lives near swamps or rivers	wetland management meat and dairy conservation grazing	moist areas
	Capra hircus Kacang goat Kambing	a local goat of Indonesia	weed control conservation grazing meat and dairy	social groups
	Anas platyrhynchos domesticus Duck Bebek	the typical domesticated duck, needs to live in social groups and access to water	meat seed dispersal soil scratching soil fertilization	social groups access to water

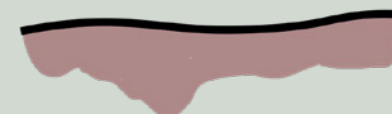
FUNCTIONAL HABITAT



Ornamental Plantings



Nonhuman Resources



High-Quality Soil

LIFE // LIVELIHOOD



Small Scale Business Space



Garden Allotments



Calm Paths

ATTRACTION // INTERACTION



Selfie Spots



Play and Sports



Eco Lawns

ORNAMENTAL GARDENS

BEAUTIFUL NATURE

Ornamental gardens in parks and private plots can add beauty and aesthetic qualities to neighborhoods in addition to increasing biodiversity and small scale habitat space.

Base Habitat- Nonhuman Homes

By focusing on the nonhuman needs in ornamental gardens, we are creating a personal connection between human individuals and their nonhuman neighbors.

Life and Livelihood- Productive Habitat

In ornamental parks, people can find refuge and beauty and a break from daily tasks and stresses. These spaces can also be stages for small scale businesses.

Attraction and Interaction- Learning Spaces

By providing an attractive place for outdoor recreation and social life, ornamental gardens can begin to heal the distance between people and nature in a vastly large city.



	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Jasminum sambac Arabian Jasmine Melati	national plant of indonesia	fragrance national emblem cultural symbolism jasmine tea	cannot handle cold temperatures
	Phalaenopsis amabilis Moon Orchid Anggrek Bulan	another national plant of indonesia, known for its beauty	national emblem ornamental qualities rarity	grows on trees high humidity free air movement ENDANGERED, illegal picking
	Ficus benjamina Weeping Fig Beringin	popular as a houseplant around the world, this tree native to southeast asia can grow large with fruits. It should be noted-shallow roots	butterfly host plant food for birds	no specific needs
	Magnolia x alba white jade orchid tree Cempaka Putih	a beautiful tree with large white flowers	ornamental fragrant flowers and oil shade butterfly host plant	drained soil nutrient-rich soil
	Cyrtostachys lakka Lipstick palm Palem Merah	beautiful red stocked palms, a popular ornamental plant. However, seeds are rare, makingt this a rather expensive plant	butterfly host plant aesthetic qualities	no specific needs
	Gigantochloa apus Tali Bamboo Bambu Tali	the most common form of bamboo	construction and furniture biomass energy high levels of oxygen production	sandy or clay soil

	NAME	DESCRIPTION	ECOSYSTEM SERVICES	SPECIAL NEEDS
	Manis javanica Pangolin Tenggiling Sunda	can live in a variety of habitats from gardens to forests to savannah,	eats termites and ants soil aeration from digging	lots of space- does not do well in captivity spaces Protection from poaching
	Martes flavigula Yellow-throated marten Musang	social mammal that is very cute, known for its yellow color	omnivorous- both primary and secondary consumer population management seed dispersal	a variety of food options like lizards, insects, fruits, and nuts
	Sundasciurus lowii Low's squirrel Bajing	resilient species that forages on the forest floor, although they can climb trees and build nests in shrubs	pest control- insects food for predators seed dispersal	smooth barked trees that flake easily trees high in tannin
	Acridotheres melanopterus black-winged myna Jalak Putih	bird that has a large range of habitats but does well in human-dominated areas, monogamous bird that travels in pairs	pest control seed dispersal	group roosting space protection from caged bird trade
	Lepidoptera Butterflies and moths Kupu-Kupu	since there are at least 2,000 species of lepidoptera in Indonesia, it is generalized in this list to include the properties of these actors together	pollination aesthetic qualities pest control	host plants
	Draco volans Common Flying Dragon Cekibar	a colorful lizards that glides in the tree canopy. It is considered to have aesthetic value while also being a member of the ecological system	aethetic value pest control- termites especially	tall and dense tree canopy

KEY TAKEAWAYS

Large-Scale Spaces with High Biodiversity

Green infrastructure in cities is vital in the journey to plan resilient, safe, and enjoyable human settlements. By planning green areas with intention, Jakarta can reap many benefits that come from large scale green space.

The Vision for Green Habitat in Jakarta

Jakarta is already on the track to implementing green spaces in many parts of the city, and by the intentional design of high quality habitat, Jakarta can maximize the impact that its green spaces can have as a tool for city management.

A Functional Ecosystem

By implementing principles of high quality habitat in large scale green spaces, we can begin to bring back the natural, regulative systems that the city needs in order to be a safe and resilient place and minimize climate impacts.

Welcoming Spaces for All Urban Inhabitants

Green space can be a haven for humans and nonhumans alike. By planning ideal spaces for both in the same place, we can create a symbiotic space where nonhuman ecosystem actors can improve outdoor conditions for people and people can manage and protect habitat spaces.

Reconnecting the People to the Land

By applying traditional and indigenous practices and knowledge towards the design of green spaces, we can learn more about the nature world and about ourselves. As Jakarta is a city that brings together people from all across the archipelago, green space can be a place to share and showcase ideas about nature to other groups and the younger generations.

Benefits of Urban Green Space

By designing and implementing high quality habitat in Jakarta, many ecosystem services will follow. Here are some of the key services that we could achieve in Jakarta through a functional green plan.

Urban Cooling

In order to offset the urban heat island effect, large green spaces are needed. This will in turn improve outdoor conditions and lower cooling costs and such.

Biodiversity Stabilization

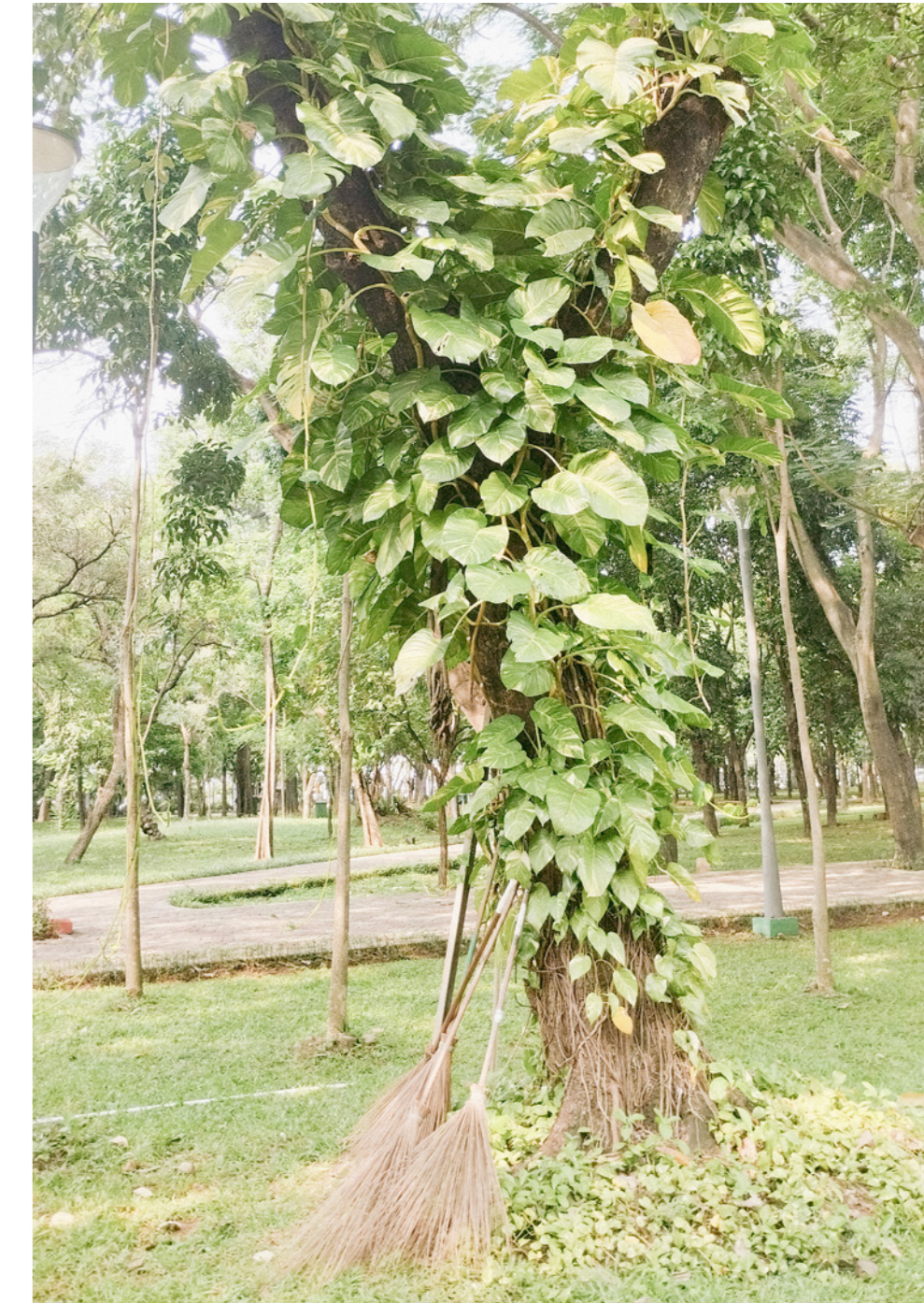
Large areas of naturalized space with a large variety of species will make Jakarta a biologic oasis. When ecology is balanced, many unintended benefits often come from the many ecosystem actors, like healthier and balanced populations.

Food Security

By bringing in more provisional sites like rice fields and other forms of agriculture, the city is not only bringing in more green space but also improving food security and proximity of healthy, natural foods.

Carbon Storage and Air Filtration

Large green areas are very good at taking in large amounts of carbon dioxide and other harmful pollutants that come from city life.





CHAPTER 09

THESIS APPLICATIONS

A SYNTHESIS OF THE GENERAL STRATEGY THUSFAR AND CONCLUSIONS THAT WILL GUIDE THE FUTURE DESIGN PROPOSAL OF EMPLOYING ECOSYSTEM SERVICES IN JAKARTA.

HEALING NATURE WITH NATURE
An Overview Thusfar
A Visual Overview of the Strategy

DESIGN APPLICATIONS
Introduction to the Design Sites

REGIONAL PLAN
Plan and Benchmarks
Expected Results
Ecosystem Service Employment

AT THE END OF THE DAY
Final Reflections

HEALING NATURE WITH NATURE

Functional Habitat to Address City Challenges

AN OVERVIEW THUSFAR

So far, we have come to explore and understand the urban challenges that press upon Jakarta. The significance of land subsidence and other climate hazards are a major threat that must be addressed in a large and impactful way.

Ecosystem Services

The altered urban landscape that Jakarta now sits upon adds pressure and vulnerability to many of its residents. Through the employment of ecosystem services, many of these climate hazards can be addressed in a way that can uplift both human and nonhuman communities in the region.

An Age of Anthropogenic and Climate Hazards

In an era where human activity has a major impact on natural landscapes and ecological systems, climate hazards abound as these systems are altered and deteriorated. In urban areas, landscapes are particularly vulnerable in their highly concentrated areas of development and manmade materials. This exposes even more people to the dangers of climate hazards and other urban challenges.

The Need for High Quality Habitat

High quality habitat refers to the design and implementation of reconstructed natural areas that apply ecological principles and a basic understanding of natural landscape systems. By implementing these types of spaces in cities, urban areas can reintroduce many of the naturally regulative properties that a landscape has lost due to urbanization.

Functional Landscape as City Infrastructure

Developing a city-wide plan to implement high quality habitat allows for a new layer of city management- natural regulation. Naturalized landscape then becomes a functional system that meets targeted services like stormwater management or urban air filtration.

Healing Nature with Nature

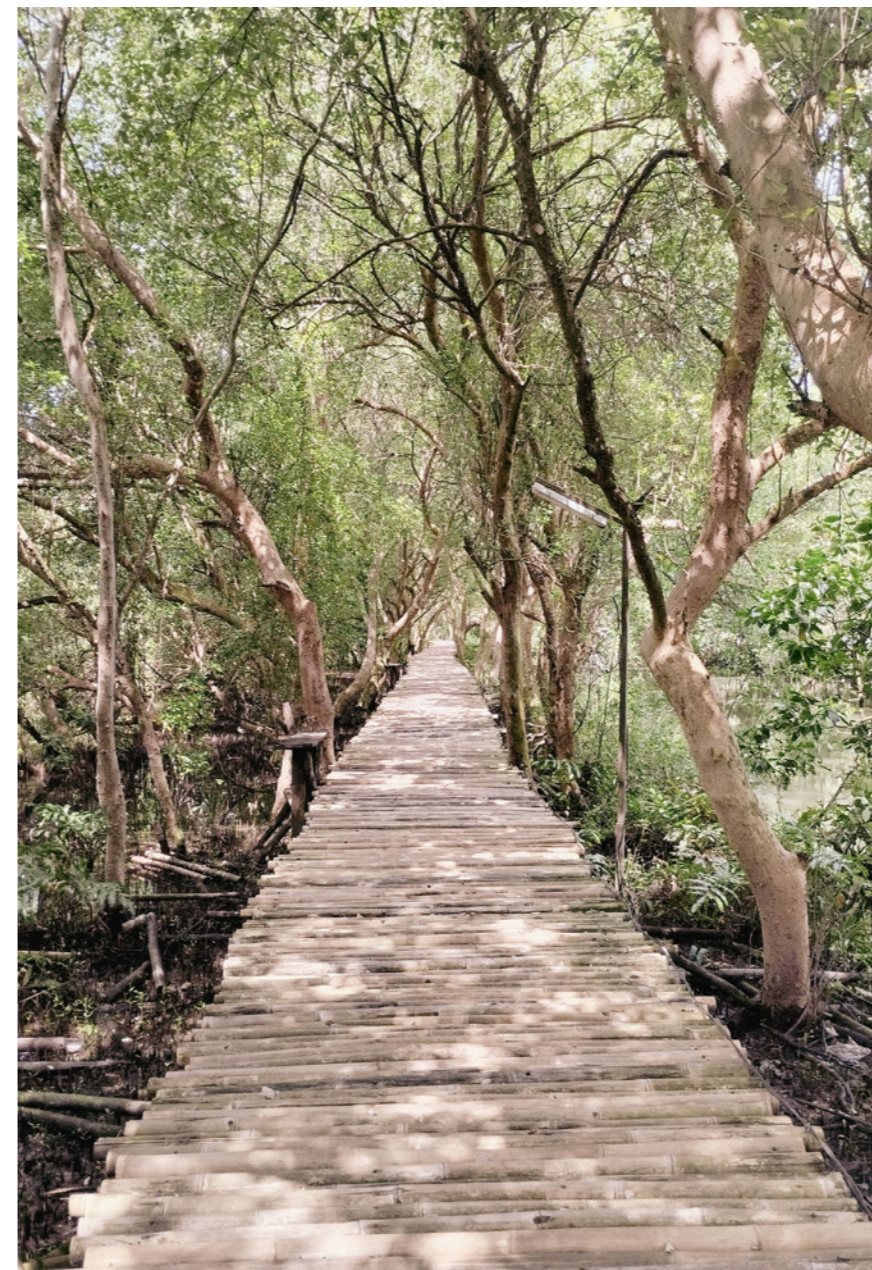
Many climate hazards come from an altered landscape, one that has lost its ability to self-regulate or perform natural systems that can ebb and flow with the changing climate. One could say that nature is a threat because nature is broken. The ideas of this thesis revolve around the idea that nature is extremely well adapted towards self-preservation and regeneration. Therefore, by reintroducing natural areas and natural systems in urban areas, the landscape will be better equipped to heal itself, a regeneration that will only help the human inhabitants living there.

Analyzing Habitat in Three Realms

A significant part in implementing the project's planning strategy is to take lengthy observations of the different habitat realms that exist throughout the urban area. Namely, the Gray-anthropocentric areas, the Blue- water dominated spaces, and the Green- large scale open space.

Habitat in the Gray

Within the Gray, we found that Jakarta is very dense and very developed- only 10% of the total land area in the city is undeveloped. Gray habitat is often lacking. Though well managed and maintained, habitat like street plantings and architecture often does not serve the ecology of the area. Because a



majority of the city is Gray, implementing high quality habitat here can have a major impact in restoring many ecological features and ecosystem services.

Habitat in the Blue

The overall quality of blue systems is low, with many blue areas highly polluted and unable to support life. However, because of the complex canal system interwoven throughout the city, utilizing waterways as habitat corridors can infuse the city with ecosystem services.

Habitat in the Green

Though only 10% of the city is Green, much of the areas are closed off to the public, with park space and natural areas scattered around the city. The Green can be developed by upgrading these habitats and expanding these spaces as much as possible.

The Symbiotic City

In following the planning strategy, many findings allowed for the production of different applications of ecological employment.

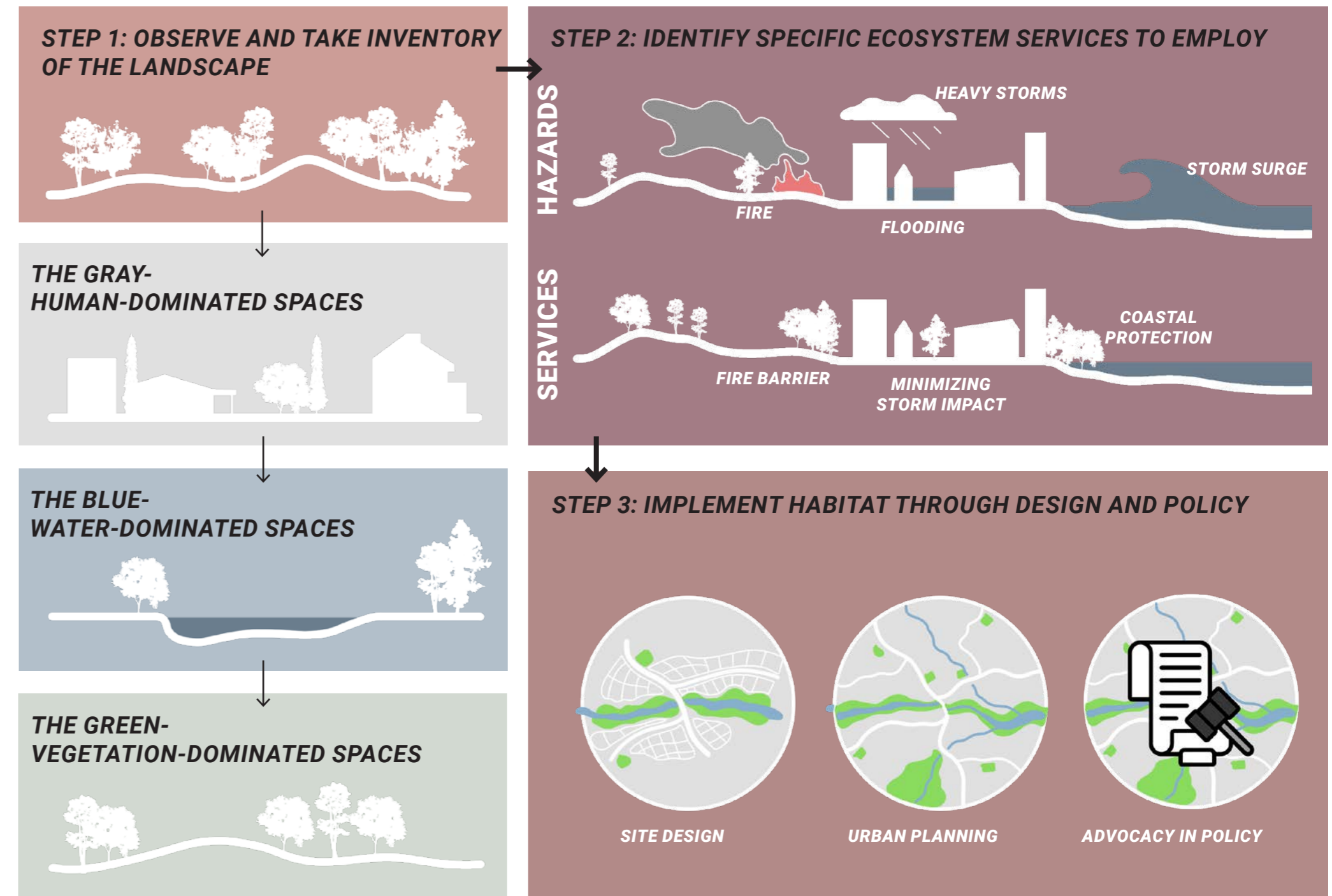
The City-Wide Strategy

A city-wide strategy was designed to utilize waterways and streetscapes as connecting habitat between a system of parks and other natural Green spaces throughout the city. This would allow for the urban ecosystem to flourish and bring many ecosystem services to Jakarta.

Habitat Design

After an observation period, a design strategy was created to prioritize functional landscape that can serve the lives and livelihoods of Jakarta citizens. The functional landscape could come in many different habitat typologies that each have their own function in serving the city's human and nonhuman inhabitants.

OVERVIEW OF THE GENERAL STRATEGY



ECOSYSTEM SERVICES

Manifesting the Impact of Ecological Urban Systems

A major component of the planning strategy is to plan the intended services that habitat will perform in a city, as well as hypothesize other secondhand consequences of the functional landscape.

CULTURAL SERVICES

Cultural services refer to the way in which natural areas impact our lives as humans, whether for personal enlightenment, religious significance, or improved mental health and lifestyles.

Equal Access to Green Space

As more habitat is implemented throughout the city, specifically through streetscapes and river channels, people will be in closer proximity to natural areas. It should be stressed that all areas of the city, not just the most affluent, should implement the plan for equitable impact both ecologically and socioeconomically.

Supporting Outdoor Social Life

An urban landscape that implements high quality habitat will be more shaded, have cooler temperatures, and improved thermal comfort. These factors all help to improve outdoor social life, especially on the streets.

Foster Nonmotorized Circulation

Providing safe buffers and help foster safer and more continuous circulation routes for nonmotorized transportation like biking and walking.

Indigenous Education and Ecological Literacy

Applying modern and traditional ecological practices can spread awareness about the ecosystem and indigenous values and knowledge, an important aspect of a city made up of many traditional cultural groups.

PROVISIONAL SERVICES

Provisional services refer to the ways in which natural elements can be used as ingredients or inspiration for innovation.

Food Security and Access to Nutritious Foods

By bringing in urban food resources it decreases the need to rely on food imports, thus decreasing pollution from transportation and vulnerability should disaster come. Provisional activities like farming, agroforestry, and fishing can help provide jobs in the city as well.

Vernacular Design and Ecologic Material

By finding inspiration from vernacular design and traditional building practices, new architecture in the city can utilize these methods and materials that respond well to the climate.

Renewable Energy Options

The future of Jakarta may find that renewable energy options are a viable way to utilize supportive services like the sun, tide, and river system.

REGULATIVE SERVICES

Carbon Sinks

A larger natural area will have a major impact on the city's ability to manage its carbon output. Areas with a heavy tree canopy, riparian areas like wetlands and mangroves, or the ocean are major carbon sinks. Expanding and upgrading these habitat can significantly help sequester carbon in Jakarta.

Urban Cooling

By expanding vegetative areas, maximizing tree cover to at least 40% total city cover, and utilizing cooler building materials, the city can experience cooler temperatures. This will have major implications on energy consumption as the reliance on AC will go down, and thermal comfort on the street level will also improve significantly.

Biodiversity Stabilization

With a functional habitat plan of hubs, oasis, and corridors throughout the city, nonhuman species will be able to thrive and reintroduce ecosystem services unique to each species. With more habitat space and habitat typologies, biodiversity levels will increase and yield healthier populations.

Pollutant Filtration

Vegetative cover is a vital component in pollutant filtration. With plantings that are key in phytoremediation, air filtration, and water filtration, the city can manage a passive yet very impactful pollution plan.

Aquifer Recharge

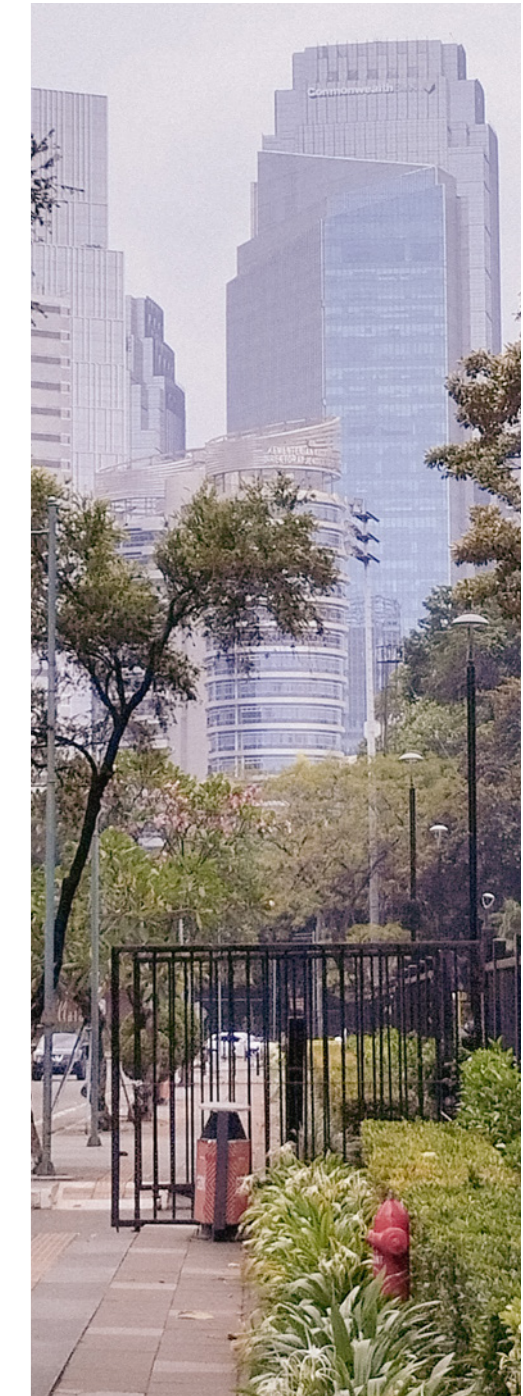
Because the depletion of the aquifer below Jakarta is a major threat that drives land subsidence and flooding, aquifer recharge could be a very viable solution in tackling this threat. Aquifer recharge can come slowly by opening the land and allowing water to percolate into the water table and aquifer. This can be done by increasing permeable surface area like permeable pavers, vegetative areas, or opening canal bottoms (though this does not percolate as fast as standing water). A faster alternative is to plan infill drains that can pump water into the aquifer from the ground level.

Coastal Protection

Coastal protections are extremely important in an age threatened by sea level rise. Softening coastal edges through plantings like mangroves and beaches can provide a safe buffer in between development and the threats of the sea. Improving the habitat below the bay through reconstructed reefs and sea meadows can also ease the impact of waves and rising seas.

Flood Mitigation

Much of Jakarta is prone to flooding due to heavy storms, land subsidence, or lacking stormwater management. Many ecological actions can be taken to address this. Increasing permeable spaces can act as a sponge, allowing water to enter the ground rather than rise into people's homes and workplaces. Plantings and naturalized rivers can slow river speeds during a storm and can hold more water in its banks. A heavier tree canopy also reduces the speed at which rain falls to the ground. A combination of vegetated areas, permeable materials, and naturalized rivers and coastal areas can all decrease the risk of flooding in Jakarta.



PROTECTING HABITAT

Actions to Support People and Planet



DEVELOPING POLICIES FOR SUSTAINED CHANGE

Just as design is an important factor in the employment of ecosystem services, policy and advocacy are vital in the lasting effects and implementation of the areas that provide them. The following are some ideas for policies and programs that will promote the further protections and development of high quality habitat in Jakarta.

BASELINE STANDARDS

Baseline Water Health Standards

Waterways need to have a baseline standard so that it does not impact the survival rates of aquatic ecosystem actors. Many local species cannot live in current river conditions. Water health and habitat health should be prioritized in future city projects. This will help improve river conditions, aesthetics, and sanitation issues.

Baseline Quantity for Urban Habitat

In order for an ecosystem to become functional and self-regulating, a certain amount of habitat is required to support a variety of species and ecosystem needs. Although this thesis does not have the data to suggest an appropriate quantitative baseline, a new study of Jakarta may suggest appropriate figures for ecosystem employment.

Baseline Quality for Urban Habitat

Habitat is itself a spectrum. Spaces that are designated as urban habitat should have sufficient biodiversity levels and many support many species. A baseline for biodiversity levels and each species' special resources should be prepared to ensure the needs of healthy biodiversity are met.

ECONOMIC DRIVERS

High-Income Company Green Plot Standards

Similar to other programs around the world, companies and developments at the highest economic brackets shall be required to meet certain quotas and benchmarks in both quality and quantity of habitat and vegetative spaces. This will help drive the implementation and protections of habitat areas in the city.

Mid to Low Income Company Habitat Incentives

Because of the high land prices, many lower bracket businesses are not able to afford the space nor maintenance of habitat space on their plots. Local grants and tax incentives can fuel the desire to implement habitat spaces in private areas, creating local hubs for ecosystem employment.

SOCIAL HABITAT

RT and RW Green Fund

Many neighborhoods are set up in a system known as RT's and RW's, managed by public members of the community. In this idea, RT's and RW's can apply for a Green Fund grant that allows for the funding of habitat upgrading within their neighborhood. This can foster a sense of ownership and personal connection to habitat spaces and develop neighborhood-scale habitat plans.

Social Project for Green Streets

City projects should continue to establish greener streets through the planting of trees and low-lying vegetation. These spaces should also foster social activities and nonmotorized movement.

Garden Exhibitions and Events

Events that support and educate about high-quality gardens and ecological literacy throughout the city, as well as resources to increase plantings throughout the city, like plant swaps or giveaways.



DESIGN APPLICATIONS

Exploring Ecosystem Employment in Jakarta

INTRODUCTION TO THE DESIGN SITES

For the remainder of the project, I will be focusing on the design aspect of ecosystem employment. During my time in Jakarta, I proposed two applications of high quality habitat in the more central part of the city.

While traditionally only one site is chosen for a project like this, there are very important reasons for selecting two separate sites in the city.

Developed vs. Undeveloped

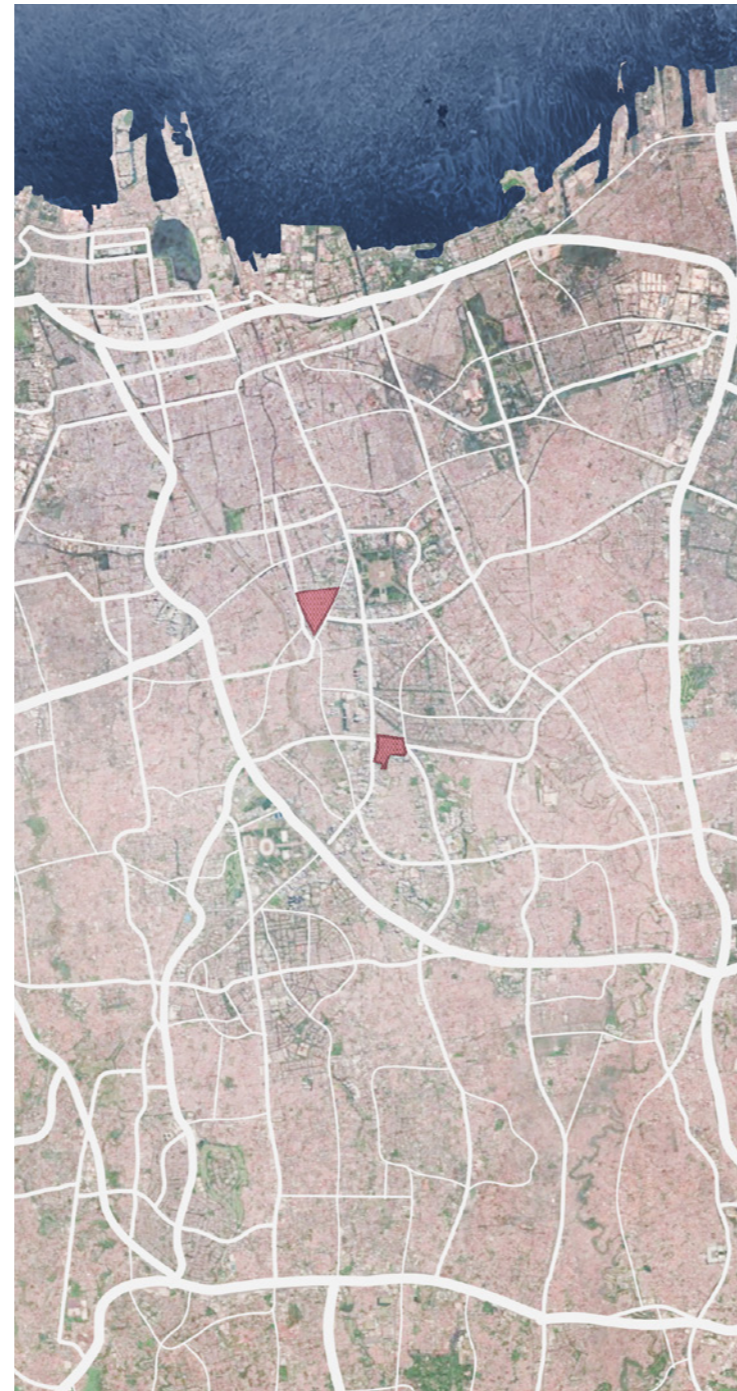
The main reason that the two sites were selected were because of the differing levels of development. Petojo Selatan is the northernmost site, heavily developed and near some of the most significant developments in the city, like the Merdeka Palace, National Monument, and National Museum. It is very representative of many Jakartan neighborhoods in typology, user types, and treatment of habitat. Setia Budi, on the other hand, is an undeveloped area at the opening of the financial district. It already has a high level of biodiversity and natural qualities compared to nearby neighborhoods, yet is at risk of development itself. Because of these differing typologies, it is important to study them both.

Characteristic Application vs. Unique Application

Because Petojo Selatan is a more characteristic neighborhood, it can easily become a model to imagine how the whole of Jakarta could look and feel like if it were to enlist in a city-wide ecology plan. However, Setia Budi would be a prime example of a unique application in unique circumstances. It is a highly valued land that must meet the needs of the city as well as preserve its existing natural qualities.

The Past vs. The Future

Overall, the two sites look at how to apply ecosystem employment in very different circumstances. Petojo Selatan seeks to apply habitat to past development, while Setia Budi attempts to preserve existing open space in connection to future developmental needs.



A LOOK INTO PETOJO SELATAN

Petojo Selatan is a neighborhood located centrally in Jakarta. Nestled between a variety of historically connected sites with many museums and showcases, this neighborhood is an important connection route for this part of the city. The design proposal for this neighborhood will focus on the little open space that exists and the usable spaces in between the dense development- streets and canals.



A LOOK INTO SETIA BUDI

Setia Budi is located in the heart of the financial capital of Southeast Asia- SCBD, the golden triangle. This area in southern Jakarta is filled with towers of extravagant offices and apartments. The site itself is undeveloped, but pressures to build this area are high as the nation's first Transit Oriented Development is built on its borders. This design will seek to develop this area and meet the local needs while maximizing and even improving the natural area still there.



CHAPTER 10 THE PERMEABLE CITY

TANAH ABANG IS A LONG-DEVELOPED AREA OF THE CITY IN THE MIDST OF MANY HISTORICALLY SIGNIFICANT SITES. THE PROPOSAL SEEKS TO EXPAND EXISTING HABITAT SPACE AND PERMEABLE PAVEMENTS TO MITIGATE FROM HAZARDS AND IMPROVE OUTDOOR COMFORT.

INVENTORY AND ANALYSIS

- First Impressions
- Tanah Abang as it is Now
- Analysis of Gray, Blue, and Green

PLAN DETAILS

- Permeable Streetscapes
- Canal Super Habitats
- Kebun Tanah Abang
- The Sink

DESIGN PROPOSAL

- Regional Plan
- Vision for Tanah Abang
- Masterplan

PETOJO SELATAN

TANAH ABANG
CENTRAL JAKARTA

58
HECTARES
1,213
PEOPLE/KM²
POPULATION DENSITY

BLUE STATS

4.21
% WATER COVER

24,624
M² WATER COVER

GREEN STATS

5.3
% VEGETATED AREA

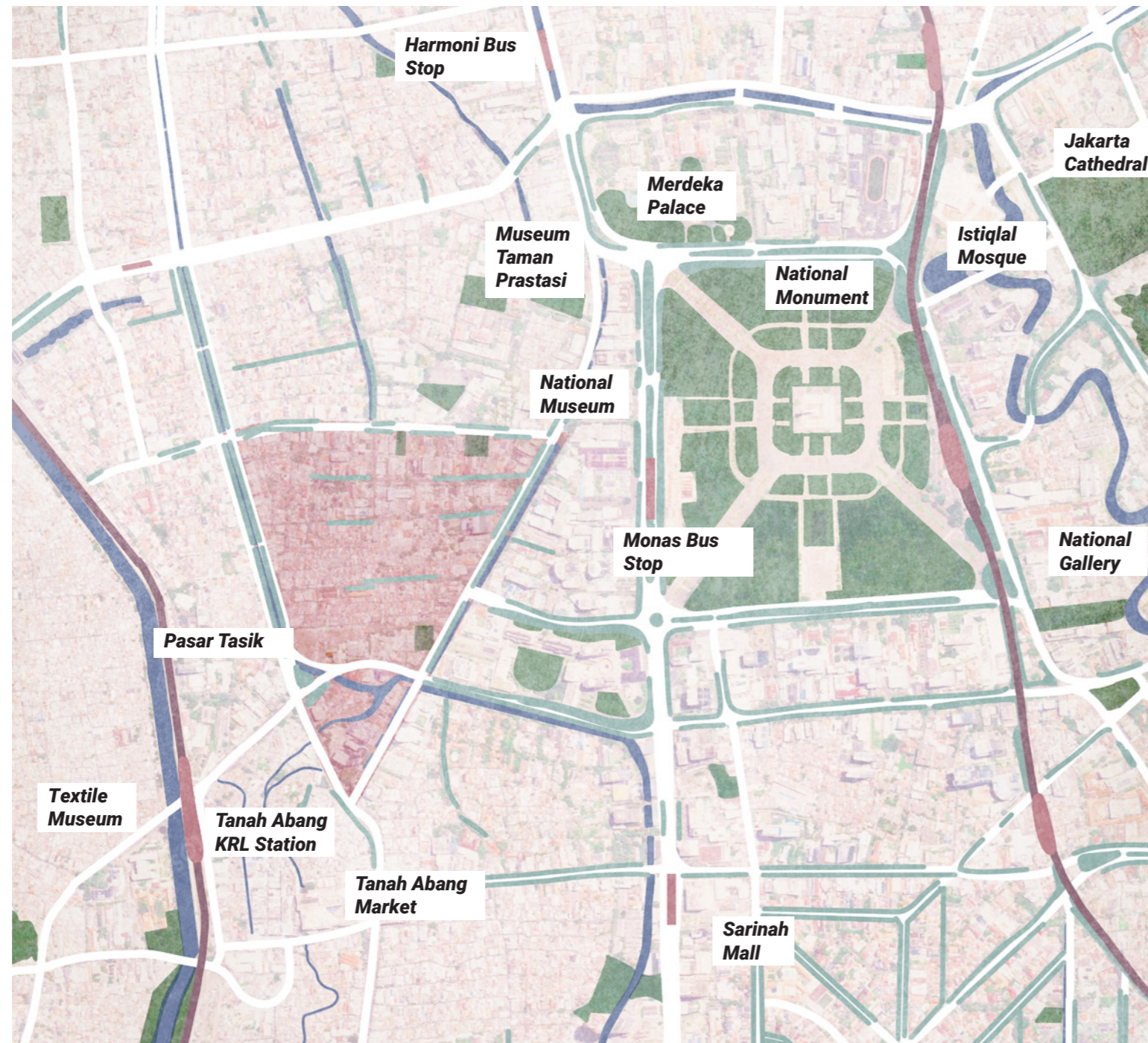
30,978
M² VEGETATED AREA

17
% TREE COVER

GRAY STATS

90.49
% DEVELOPED AREA

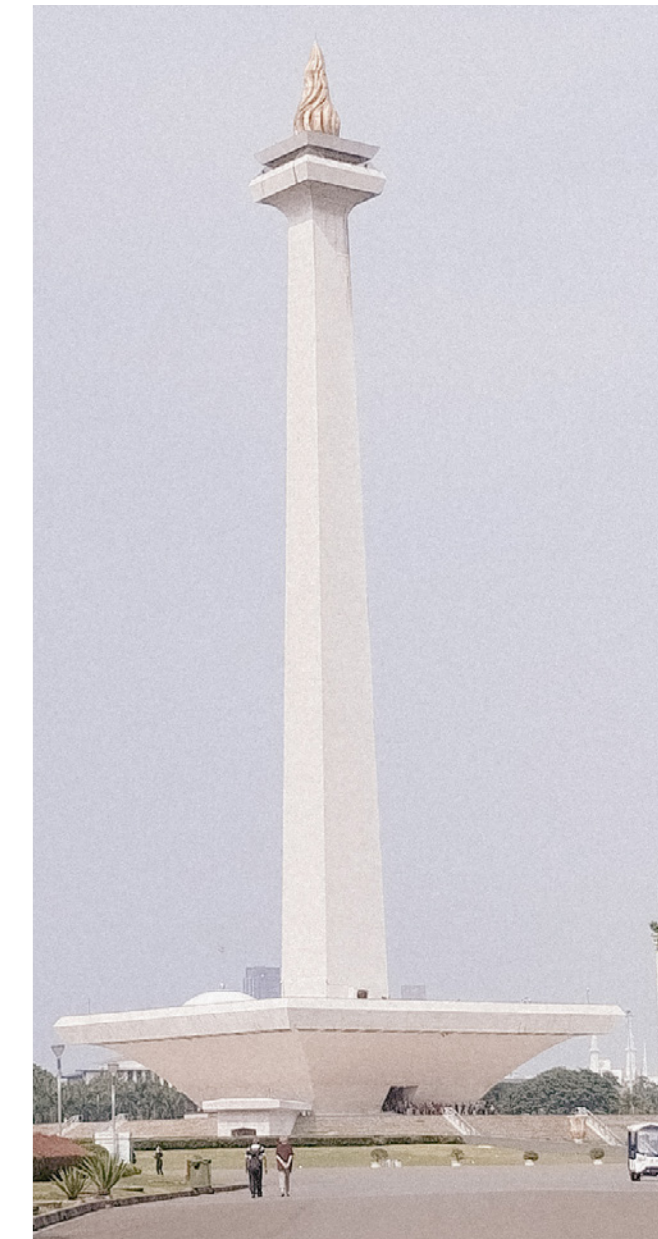
51,000
M² BUILT AREA



FIRST IMPRESSIONS

I first found this neighborhood by chance, when my bus was detoured due to construction on the main road. Driving by, I found many good opportunities that reflected what I wanted to show in this project. While the urban sense of place is similar to many other neighborhoods in Jakarta, the area was bordered on three side by rivers. I thought it would be a good showcase of what this design strategy could be in an already built, densely populated area. The area seems to already be in a state of transition, as many old, abandoned buildings sit side-by-side with high-end hotels and offices. Many areas are already beginning to implement more green space on street sides and neighborhood entrances. I think this could be a great way to see how to add functional habitat space within the confines of existing development. Is it possible to meet base habitat requirements without pushing existing users out?

In this neighborhood, I visualize the idea of 'The Permeable City', whereby I propose that maximizing the permeability of the outdoor space to improve the human experience outdoors, mitigate urban climate hazards like urban heat island, flooding, and lacking biodiversity by utilizing ecosystem services. I am choosing to focus on the outdoor spaces in this neighborhood because the streets in this neighborhood is the main stage for social connection. It is where people chat, eat, work, and enjoy their time after work. By improving outdoor life with the assistance of habitat space, it not only improves livability, but exposes people to the intricacies of urban ecology.



PETOJO SELATAN AS IT IS NOW

This neighborhood in Petojo Selatan is a beautifully vibrant community that is reminiscent of many Jakartan neighborhoods. Because the cities placement as a delta of 13 rivers, most neighborhoods interact or at least are in close proximity to blue infrastructure. The social streetscape and mixed urban landscape is also common for a majority of the region as well. That is why Petojo Selatan is such a good candidate for visualizing the employment of ecosystem services in Jakarta.

Overall, the neighborhood could be characterized by its diverse usability, vibrant social community, and location at the center of Jakarta's cultural and administrative district.

Diverse Neighborhood in Transition

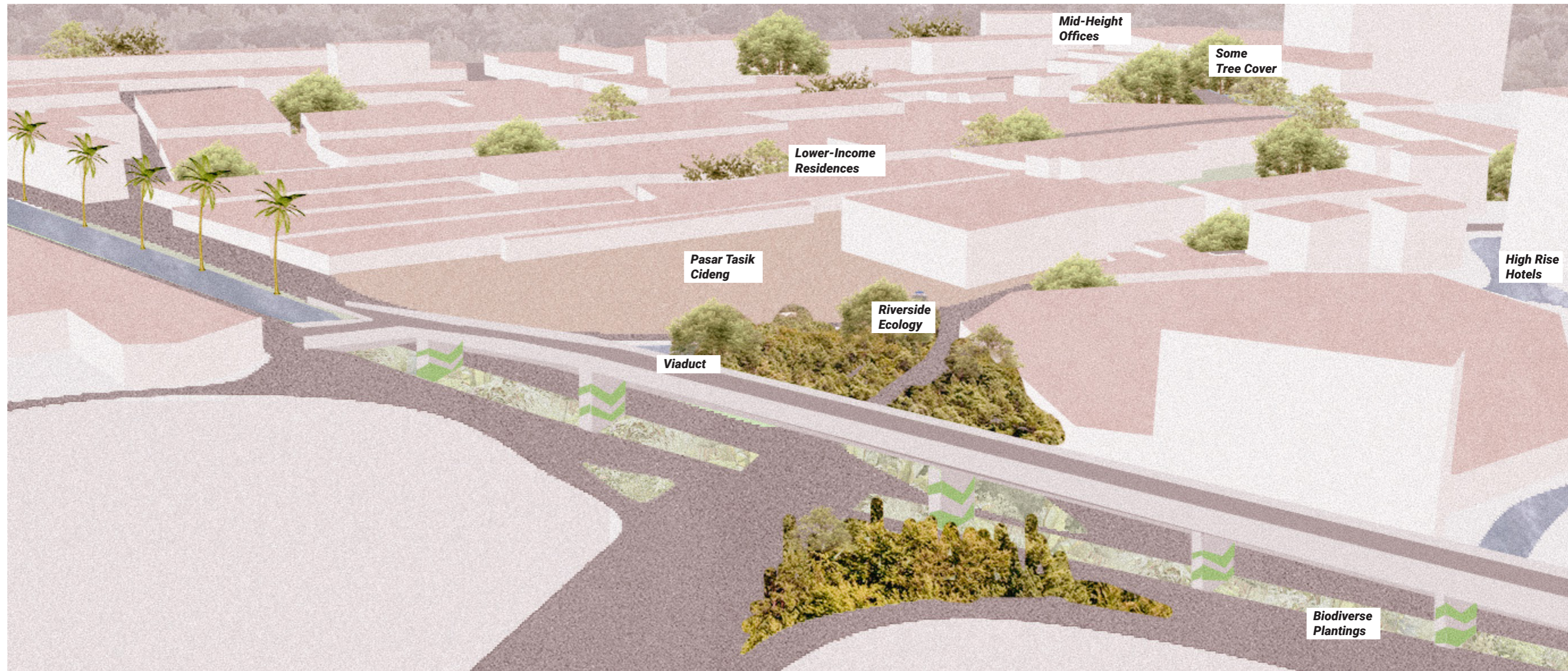
It is clear that the area is in a transition. Some plots are undeveloped, some abandoned, while next door there may be a high-end hotel or fancy office. Some places are safe to walk on while others are not. Some areas are very green while others are dominated by concrete. It is clear the city is actively working on developing this area to increase greenery and social assets.

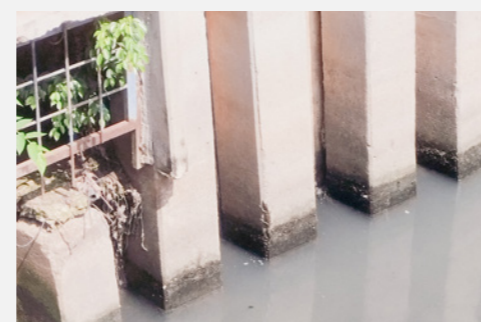
Vibrant Community

During my week's stay at a hotel within the neighborhood, many people remembered me and helped me find my way around if I got lost. Overall, I felt that the residents in Petojo Selatan were very kind and cheerful. The vibrancy of the area can truly be felt in the many different restaurants, vendor spaces, neighborhood gangs (residential alleys), and the streetside gazebos and benches that bring the people together.

A Historic Center

The neighborhood's location is very important to its identity. Located near some of the most major sites in Jakarta, like the National Monument (Monas), National Museum, and Pasar Tanah Abang- the largest textile trading market in Southeast Asia, this neighborhood is in the middle of it all.





ground textures

plant textures

building textures

etc.

LAND USE IN TANAH ABANG

A major reason this particular area in the Tanah Abang district was chosen was because it displays very prominent characteristics of many other neighborhoods in Jakarta. Oftentimes income levels and building typologies are dispersed and blended throughout the urban fabric. In the case of Petojo Selatan, as the area is in a transition period, upper end hotels and offices can be situated next to old abandoned commercial buildings or informal settlements. Most of the buildings in the neighborhood are private use, with little community amenities. However, social life is still strong here, as streetscapes are the backbone to urban connection. Overall, the proposal site is characterized by its human-scale streets, channelized rivers, and diverse urban typologies.

Riverscapes

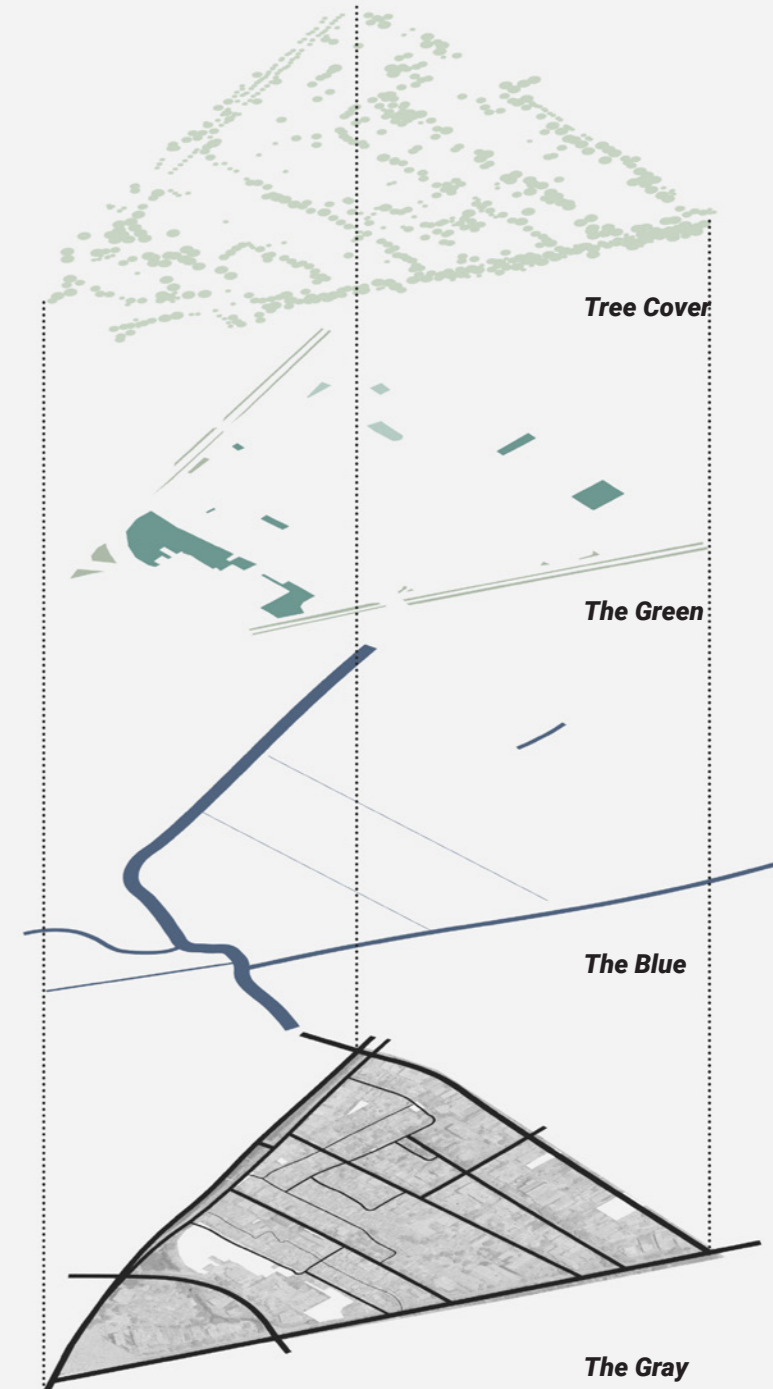
My first impression while taking the bus past Petojo Selatan was the many rivers that border the neighborhood- it is why I first considered this area. Many of the rivers are well landscaped on top, but the rivers themselves could use some upgrading. I noticed many instances of plastic waste and palpable odor along some stretches of the river. I also saw some lizards and snakes swimming in the murky water without any form of shelter or supporting resources.

Streetscapes

When I first arrived on the site to explore, I quickly found that the streets are a major part of the neighborhood. Compared to other neighborhoods I walked through, the residents here were very friendly and open, often striking conversation with me or saying hello as I walked by. In the cooler mornings and evenings, so many people are out socializing. I saw many instances of street vendors and kaki lima (portable food vendors who travel around selling street food), as well as neighbors chatting. I even saw an evening exercise class taking over a small stretch of streetscape. Like anywhere, outdoor temperatures make street life less comfortable, but ecosystem services can be a great asset to the community by enhancing thermal comfort and improving overall conditions here.

Mixed Typologies

The variety in building types and urban typologies make this neighborhood a vibrant and diverse space. It means that many different type of people and urban uses are present in the neighborhood. In terms of the proposal, it means that a large variety of ecological tools can be also be installed in a diverse and vibrant way.



GRAY ANALYSIS

STRENGTHS

High variety in building uses and types
 Social space with many user activities, high sense of community
 Already some parks and streetside plantings
 Typical neighborhood, good for showcasing this project

WEAKNESSES

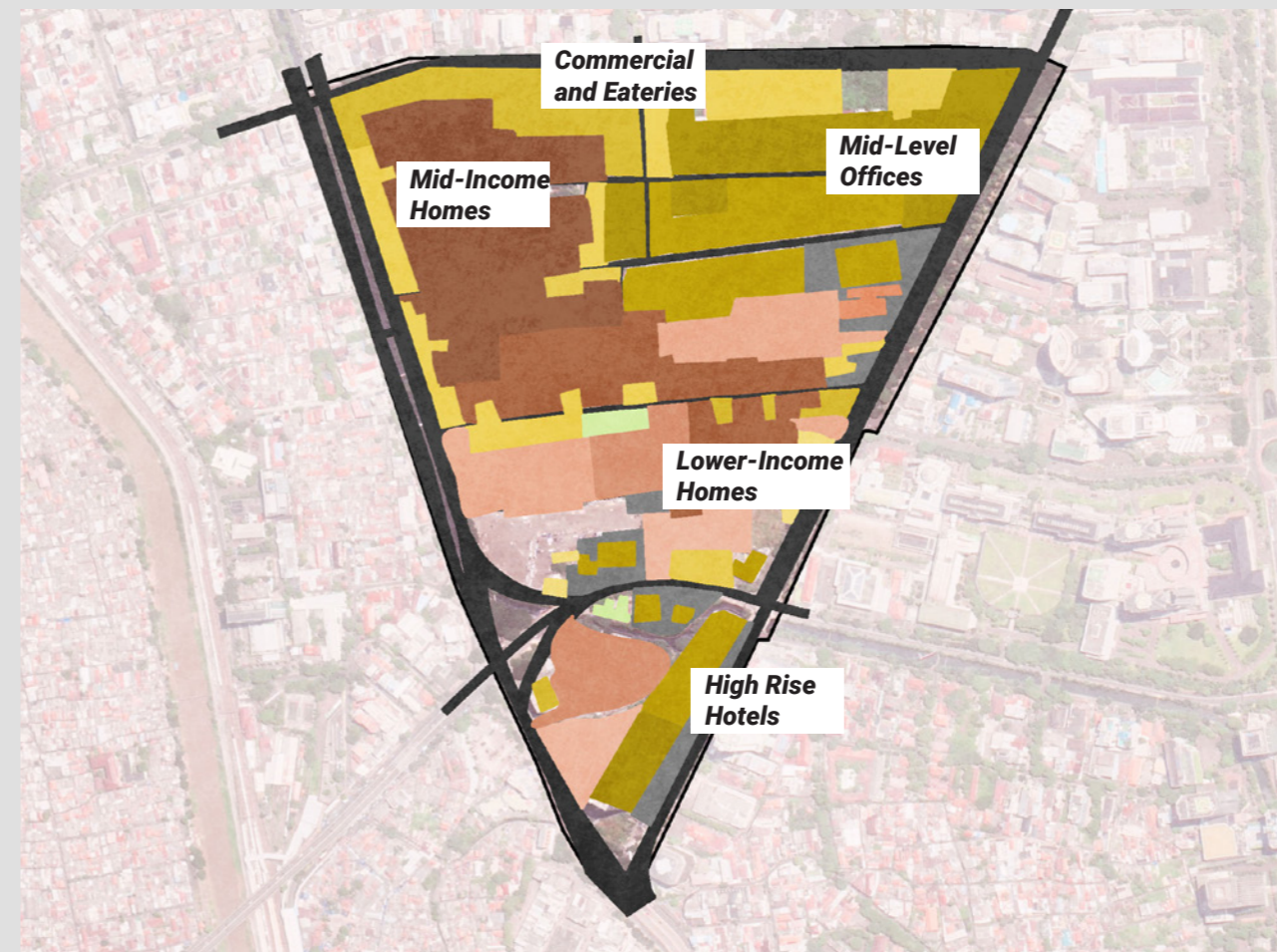
High level of impermeability
 Bordering streets have high traffic and low walkability
 Not a lot of room for expanding habitat, heavily densified

OPPORTUNITIES

Bordered by rivers, can naturalize or construct habitat here
 Can easily transition to permeable materials
 Southern area relatively undeveloped, can be used for habitat area
 Some small plots undeveloped

THREATS

Cement plant in the south may be polluting noise and emissions
 Impermeability impacts climate hazards like flooding and heat



TAKING INVENTORY OF THE GRAY

Petojo Selatan has many strengths as a friendly neighborhood in the center of Jakarta. With many building types and uses, people from many social backgrounds mix in one space. It is a great site to experiment with the design strategy because it shows characteristics that many other neighborhoods in Jakarta exhibit.

STREETSCAPES ARE MAJOR SOCIAL STAGES

Street scapes are a vital space for people. Many people use the neighborhood streets as places to socialize, eat, and enjoy the cooler evenings after work. Even major streets are important because motorists spend a lot of time out in traffic jams. Perhaps not many people use streets for pedestrian activity at present, but that could be attributed to the lack in continuous paths and difficulty crossing busy streets, even at intersections.

BLUE ANALYSIS

STRENGTHS

Area is already starting to implementing plantings along channels
Farther along the west river, there is a flood management door
Already some parks and tree cover to improve storm management

WEAKNESSES

City culture regarding rivers, seen as stinky and unsanitary
Some river areas and neighborhood canals are heavy in plastic waste

OPPORTUNITIES

Three distinct river areas to explore habitat strategy
Rivers here can be good for pedestrian circulation
Utilize blue areas to tackle hazards like heat stress and

THREATS

High levels of gray water and waste water drained into rivers
High levels of impermeability increase flood risk



TAKING INVENTORY OF THE BLUE

Rivers are a major structural element that shapes the neighborhood. As this area of Jakarta has less than a 1% slope, the rivers here are slow moving, but can become flooding hazards in the face of heavy rainfall.

Impermeability has a major impact on the site, everything goes to the rivers, draining through the streetside canals. Much like most of the blue system in Jakarta, the rivers are not places that attract much attention, often seen for their pollution and smell. However, it is clear that the city has put a lot of work in to the beautification of the rivers on the street level. Tree alle's and planting buffers aid in improving aesthetics, but presently do little to improve the habitat space and quality of the rivers. Some litter collection stations and

These rivers can be better integrated into the outdoor human experience as well as provide habitat. Higher percentage of permeable land and natural stormwater management through habitat installation in these rivers can decrease flood risk, improve river aesthetics and water health, all while providing natural shelter and food supply to urban ecosystem actors.



GREEN ANALYSIS

STRENGTHS

Already some well-managed green space
Rivers have nice planting buffers
Some parks are already built

WEAKNESSES

Relatively low percentage of habitat
Green spaces are too minimal and far apart
Street trees have very small openings
Some green space is still impermeable

OPPORTUNITIES

Utilizing a plant palette that discourages pests
Expanding existing streetside planting beds
Revitalizing existing open space as habitat hubs/large scale open space

THREATS

Lack of permeability can cause heat stress and flood risk
No filtering for stormwater runoff



TAKING INVENTORY OF THE GREEN

Green space is not a major feature within the neighborhood, but on the major streets there are many places with street trees. There are also signs of change, as the landscaping at the bus stop and at the interchange leading to the Tanah Abang Market are very nice and taken care of. There are some small parks and play areas that are well utilized by children around the neighborhood.

The largest green spaces in the neighborhood are undeveloped plots, but these are few and far between. The largest open space is at the southern tip where Pasar Tasik, a weekly market takes place. This market is lively and large, but the site is only in use two mornings a week. These undeveloped spaces can be havens for biodiversity and nature-driven development. The market space can be upgraded to act as a functional landscape site in addition to large events.

THE PERMEABLE CITY

A Vision for the Site

PETOJO SELATAN REENVISIONED

Petojo Selatan is a beautifully vibrant and diverse neighborhood in the center of Jakarta, nearby many historically significant sites. In applying the design strategy for this neighborhood, I found the need to address main concerns that relate to the human scale. To me, Petojo Selatan feels like a small town inside a giant city. My vision for Petojo Selatan is to continue to support human-scale activities through the use of habitat.

Functional Landscape: Permeability and Vegetative Cover

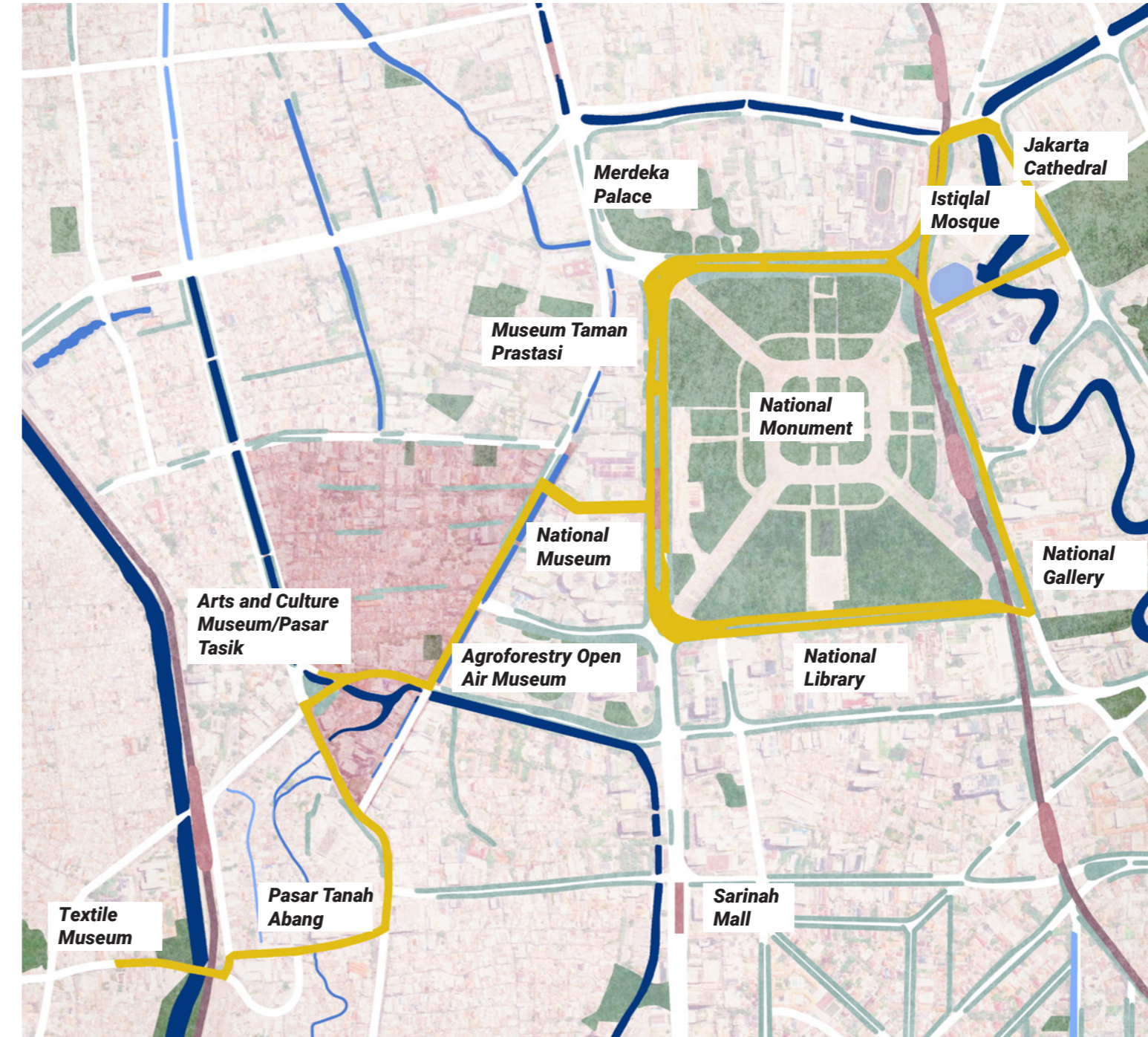
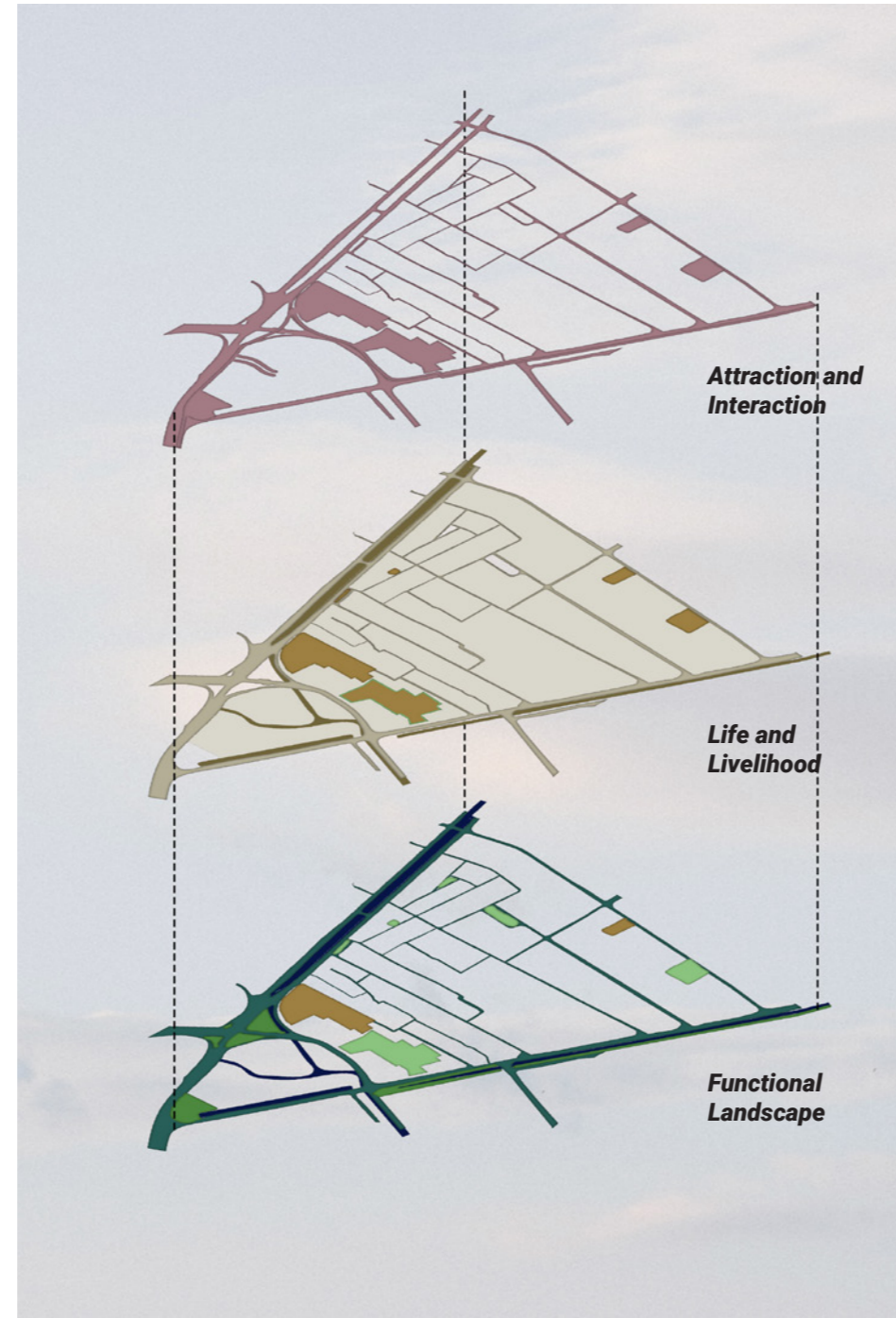
The prominent functions of the proposed plan for Petojo Selatan is to utilize functional landscape to ease the physical footprint manmade materials. As much of the land is covered in pavements and buildings, providing spaces for water to enter the ground and increasing vegetative cover throughout, the city can even use highly-developed spaces for ecosystem employment.

Life and Livelihood: Supporting the Existing Vibrancy

Habitat space can become a prominent feature of this gray-heavy neighborhood. By focusing on the streetscapes, habitat can aid in improving thermal comfort and decrease exposure to the elements. Green space can add to the vibrancy and sense of community to the area with an emphasis on community participation in planning and implementation.

Attraction and Interaction: Habitat as Education Space

Because this neighborhood is in a hotspot area for cultural and national museums, green areas here can also have educative aspects as a way of educating about local practices and ecologic literacy.



DISTRICT STRATEGIES

The Permeable City will be an important site in the regional strategy as a neighborhood that flagships many of the ideas of ecosystem employment. The following are some ways that the site can further connect to the city within a regional scale:

Museum Walk

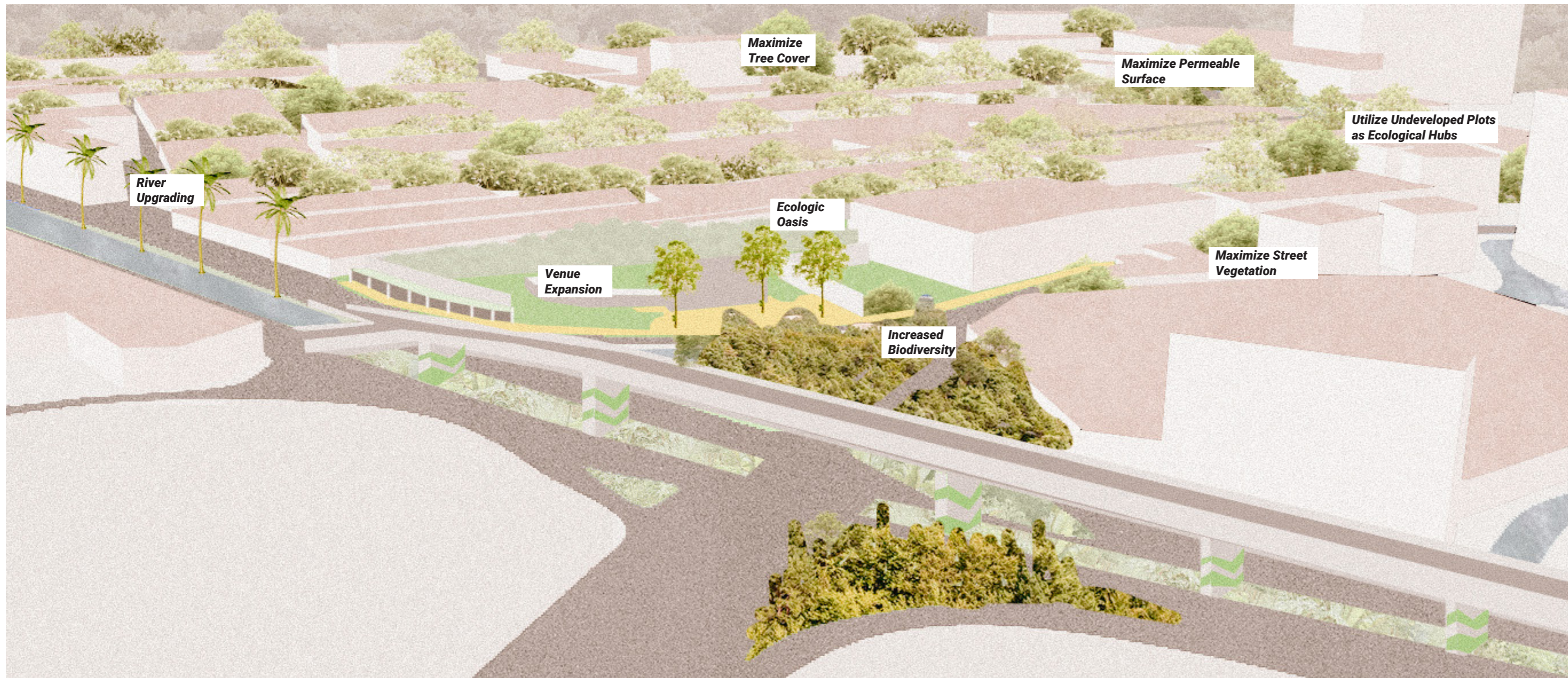
A museum walk with educative signing and distinct visual language will allow for locals and tourists interested in the history of Jakarta to learn about different aspects of the country. Petojo Selatan will be along this route and house a few museums as well.

Blue River Upgrading

Housing many upgraded rivers, the new plan for Petojo Selatan will be a section for multiple rivers in expanding river habitat and providing more interaction along the rivers' edges.

Neighborhood Habitat Fund

This neighborhood can be the first of many neighborhoods that can apply for funding to implement habitat at the community level.



PETOJO SELATAN: THE PERMEABLE CITY

Here is the first introduction to the design and vision for Petojo Selatan: The Permeable City. By applying some of the general toolbox items as well as localized ideas, The Permeable City envisions a city that addresses its heavy ecological footprint by reducing impervious materials and improving streetside conditions with the aid of vegetation.

Maximize Permeable Surfaces

Much of the city's hazards come from a high level of impermeability. By utilizing more permeable pavements and designated water basins, the neighborhood and city overall can become less vulnerable to the threats of flooding and urban heat island effect.

Expand and Upgrade Existing Habitats

By expanding plantings areas, habitable areas can easily be created in spaces that are already rarely used. In gray areas, it is important social street spaces are softened through vegetation and human-scale spaces that are supported by habitat space. Blue infrastructure can easily implement constructed habitats that can help water-based ecosystem actors to thrive. Green spaces can be improved with a wider planting palette and a variety of planting layers. Well-managed landscape in Petojo Selatan can both contribute to local needs of thermal comfort and improved outdoor experience as well as to the larger city-wide employment of ecosystem actors.

Introduce Habitat as a Foundation for Social Urban Life

Habitat spaces can become a foundational part of the social stage in Petojo Selatan. By providing more shade and recreational space, landscaped areas can become a part of the human-scale social spaces in the neighborhood. Increased outdoor programming can also add a diversity in functions so that more age groups can enjoy outdoor areas.

PETOJO SELATAN THE PERMEABLE CITY

51,070 M²
VEGETATED AREA

8%
VEGETATION TOTAL AREA

60%
TREE COVER

5.3%
PERMEABLE SURFACE
(BEFORE)

14.9 %
PERMEABLE SURFACE
(AFTER)

94.7%
IMPERMEABLE SURFACE
(BEFORE)

85.1 %
IMPERMEABLE SURFACE
(AFTER)

MASTER PLAN

The Permeable City explores how an already established old neighborhood can implement habitat by maximizing permeable, planted openings and introducing high levels of permeable materials.

1 FLEXIBLE HALL

A lifted open air building for futsal and assemblies in the day. But it is built over shaded microclimate, so it can be naturally cooling while maximizing vegetative cover and habitat space.

2 THE COFFEE BEAN

A local coffee brewing site that includes remote working space and meeting areas. On site ate a variety of pavilions among an ornamental garden.

3 CIDENG RIVER HABITAT

A major river upgrading section that introduces more crossings and riverside activities. Vegetative cover and riverside tree canopies, as well as reconstructed river habitat allows for a biodiversity superhub.

4 POCKET PARK

A small park at the southernmost tip of the neighborhood allows for recreation for nearby residents. The ecosystem services of pocket parks act as ecosystem hubs that allow for foraging and shelter for ecosystem actors.

5 KEBUN TANAH ABANG

Kebun Tanah Abang is an agroforestry showcase and interactive experience that teaches about urban permaculture. A mixed eatery highlights plant-based cuisines and drinks from around the archipelago.

6 CILIWUNG-CIDENG

This area of blue section runs tightly through residential and commercial space. It focuses on slowing and filtering water in a way that is aesthetic and useful for local residents.

7 THE SINK- ARTS CENTER/PASAR TASIK

The Sink is a wetland filter for an aquifer recharge drain. It also acts as an arts education center, as well as some space for the existing textile pop-up market, Pasar Tasik.

8 MUSEUM WALK

A museum walk brings visitors through the neighborhood on a route that passes by many culturally and historically important sites.

9 STORYTIME WALK

The habitat and riverside promenade included educational signage and artistic installations that tell a variety of stories about Indonesian history and folklore. Also along the museum walk.





This species can do very well in urban areas, allowing for minimal management of this ecosystem actor

Black Flying Squirrels forage from nearby food, thereby dispersing fungi and seeds

Aeromys tephromelas
Black Flying Squirrel
Tupai Terbang Hitam

HABITABLE STREETS

Creating Linear Habitat To Support Urban Life



Street Plantings



Social Spaces

5,351	57	15	9,631
LENGTH (M) OF CONVERTED STREET	STREET TREE COVER TOTAL (%)	BENCHMARK VEGETATED AREA (%)	CONVERTED PERMEABLE AREA (M ²)

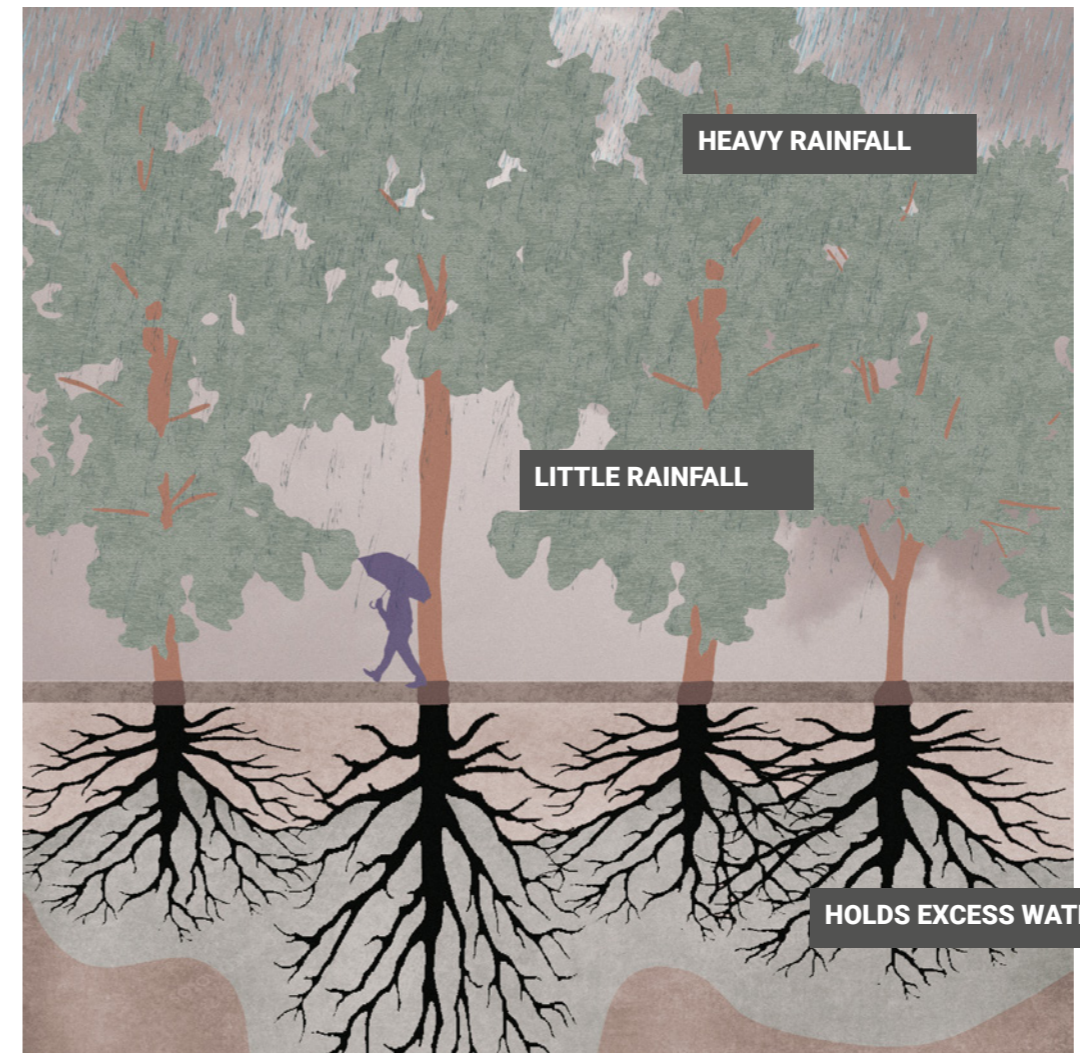


ENVISION THE STREETScape

Streetscapes in Petojo Selatan can become linear spaces that not only promote welcoming corridors for nonhuman residents but also improve existing outdoor human activity and protect from harsh weather and climate hazards.



plantings can aid in the betterment of outdoor experience



ECOSYSTEM SERVICE HIGHLIGHT
VEGETATIVE COVER AS STORM MITIGATION

Having a variety of vegetation can be an easy way to ease the impacts of storm events. A mix of plant heights and leaf textures slow down rainfall so that it does not all hit the surface at once, and the root systems create spongelike spaces that hold water. Simple and cheap solutions like this can create passive but very powerful solutions to protect people and property from flooding.



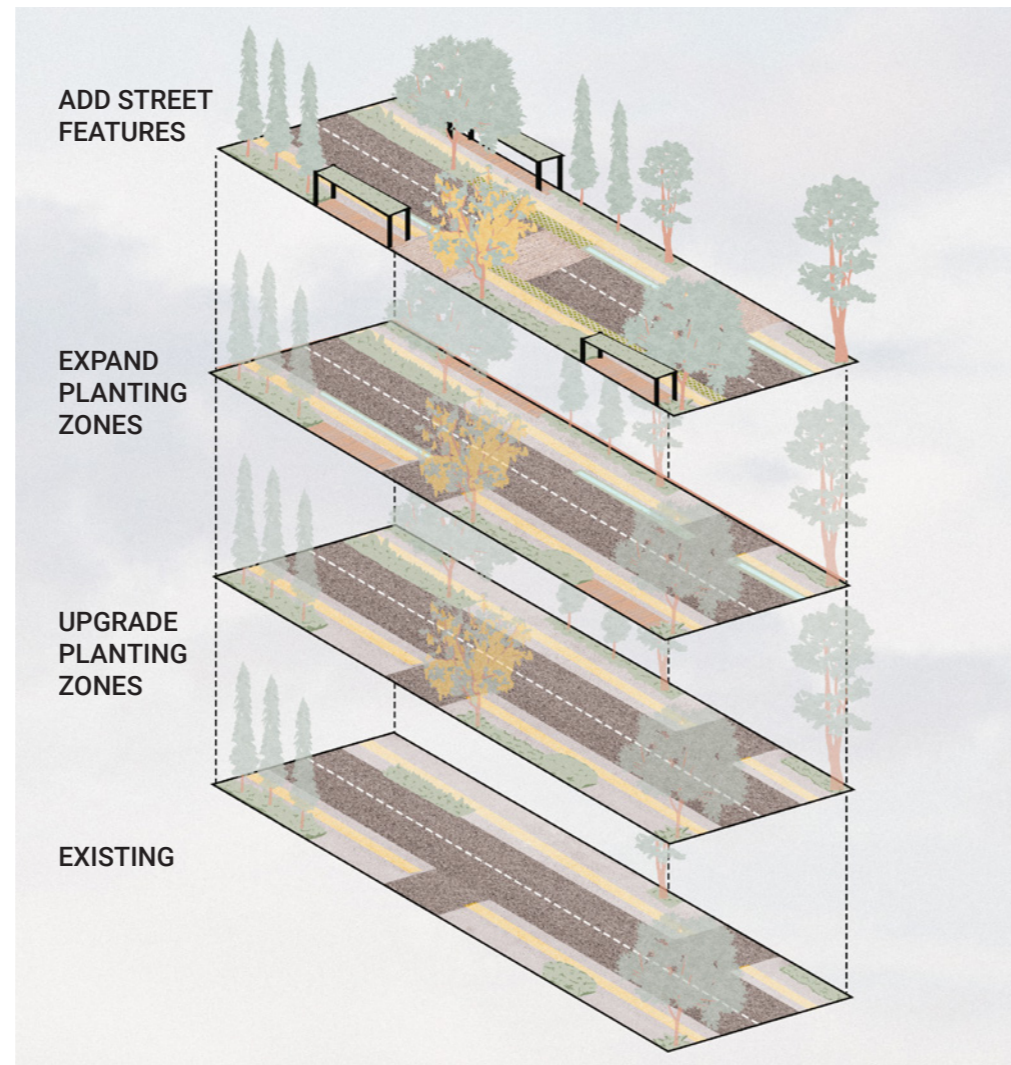
THE GREEN GANG

'Gangs' are narrow residential streets that are often vibrant social spaces. The many street activities can be supported by ecosystem services that protect from sun exposure and aid in calming the effects of rainfall. By expanding existing habitat space and increasing permeable surface area, these streetscapes can better support the many people who live in this neighborhood.



CONNECTING STREETS AND HABITATS

The arterial and main streets in Petojo Selatan provide quick routes for motorists to access the many shops, restaurants, and government offices that reside within the neighborhood. While the streets are often used for vending space as employees take their breaks, much of the streetside spaces and bumpouts are unused. These unused spaces can provide habitat space that can be more beneficial to the community.



STRATEGY APPLICATIONS

EXPAND, UPGRADE, AND CONNECT

Tanah Abang already has many planting beds. However, these spaces are often very small, sometimes only allowing openings for tree trunks. By expanding these beds in unused hardscape spaces, upgrading habitat health by introducing a larger palette of species, and decreasing the spacing between beds can create healthy corridors that can serve many species, who can in turn enable more ecosystem services in the area.

NO PLANTINGS



EXISTING HARDSCAPE PULLBACKS

Most buildings on the arterial streets are built many meters behind the main Right-of-Way. These hardscape spaces are often unused except for parking. These areas can be a great space to explore urban habitat and on-site ecosystem services.

AESTHETIC PLANTS



EXPANDING HABITAT INWARDS

By adding more vegetative cover, a rain garden, and permeable hardscape materials, this space can be retrofitted to become an active participant in localized ecosystem services, allowing for higher biodiversity, cooler microclimate temperature, and water management- all without altering the existing needs.



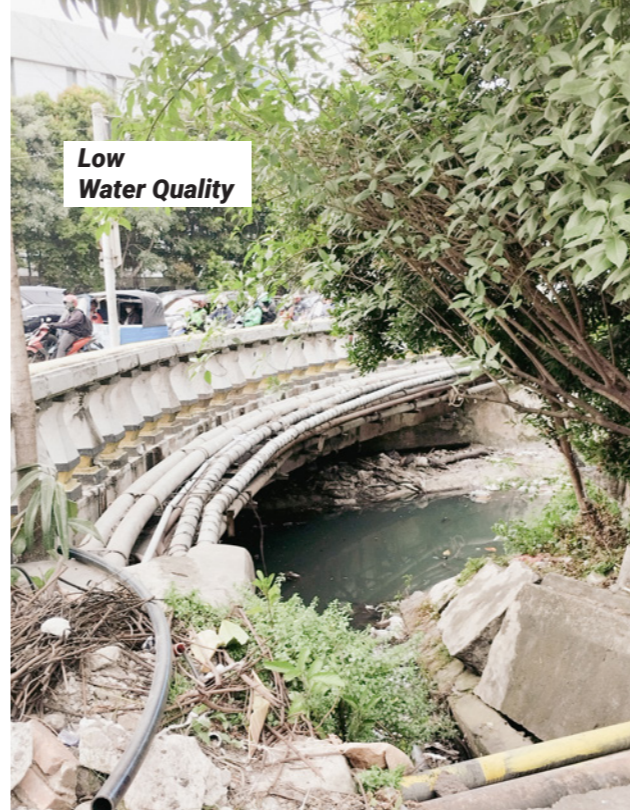
Darters are secondary consumers, meaning they feed off of other animals. They can be a great actor to control certain unwanted urban species and pests

Darters can do well in urban areas, but always stay close to the water. They need branches for preening

Aninga melanogaster
Darter
Pecuk Ular Asia

RIVER HABITATS

Biodiversity Super Connectors



A VISION FOR RIVERSCAPES

The canals bordering the neighborhood can be major biodiversity corridors for many species in Central Jakarta. Plantings and other habitat structures can foster healthier species, improved water quality, and slow river flow in the event of heavy rainfall.

2,464	12,320	600	1,200
LENGTH OF CONVERTED RIVER (M)	CANAL BED VEGETATION (M ²)	ADDED PEDESTRIAN WAYS (M)	CONVERTED PERMEABLE AREA (M ²)



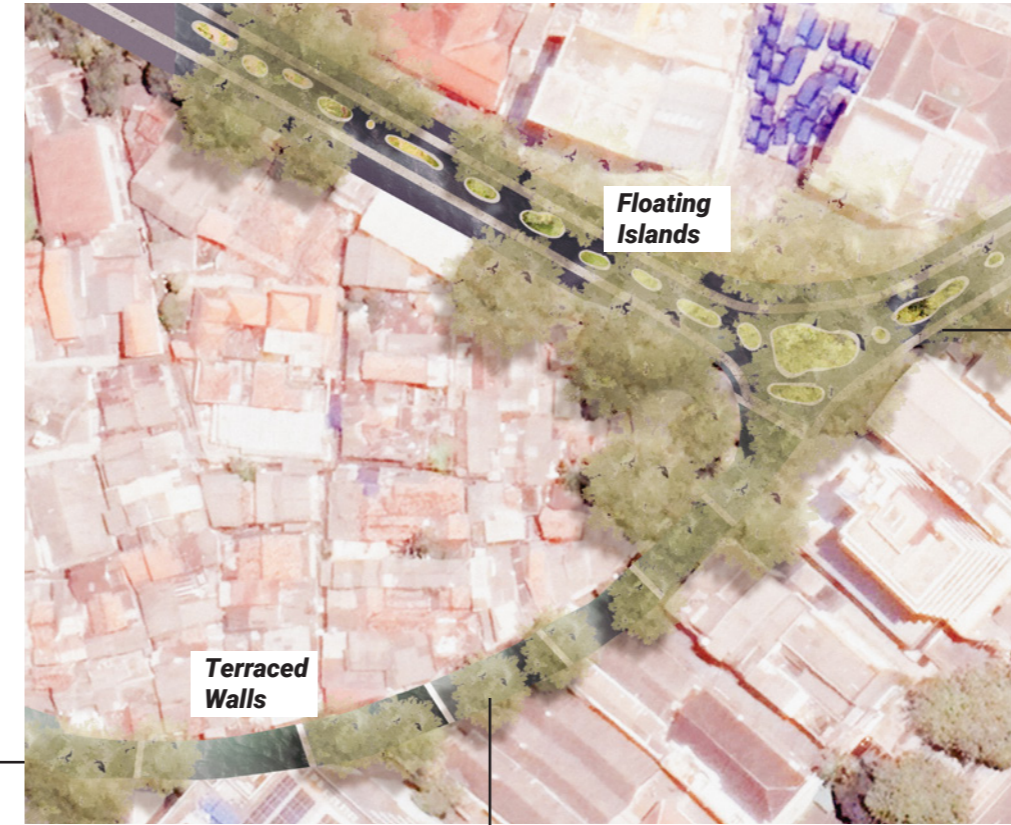
HABITAT HUB

Terraced canal sections can slow water and mimic the attributes of marshes. These wetland patches can become major filtration areas that purify the water for better health on-site and down stream. These areas also can slow water in the case of heavy rainfall which can help with flooding.



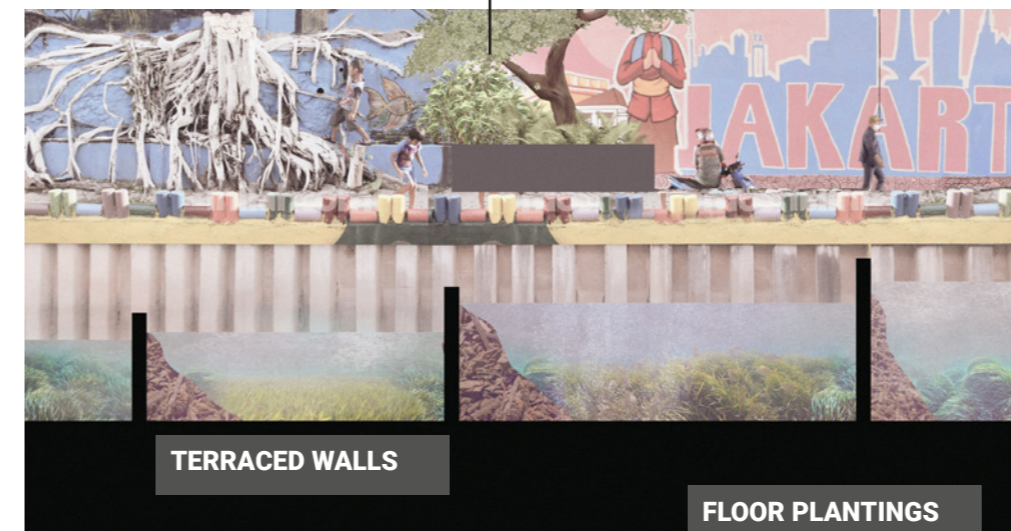
TERRACED WALLS

NATURALIZED RIVER



Floating Islands

Terraced Walls



TERRACED WALLS

FLOOR PLANTINGS



ISLAND PLANTINGS

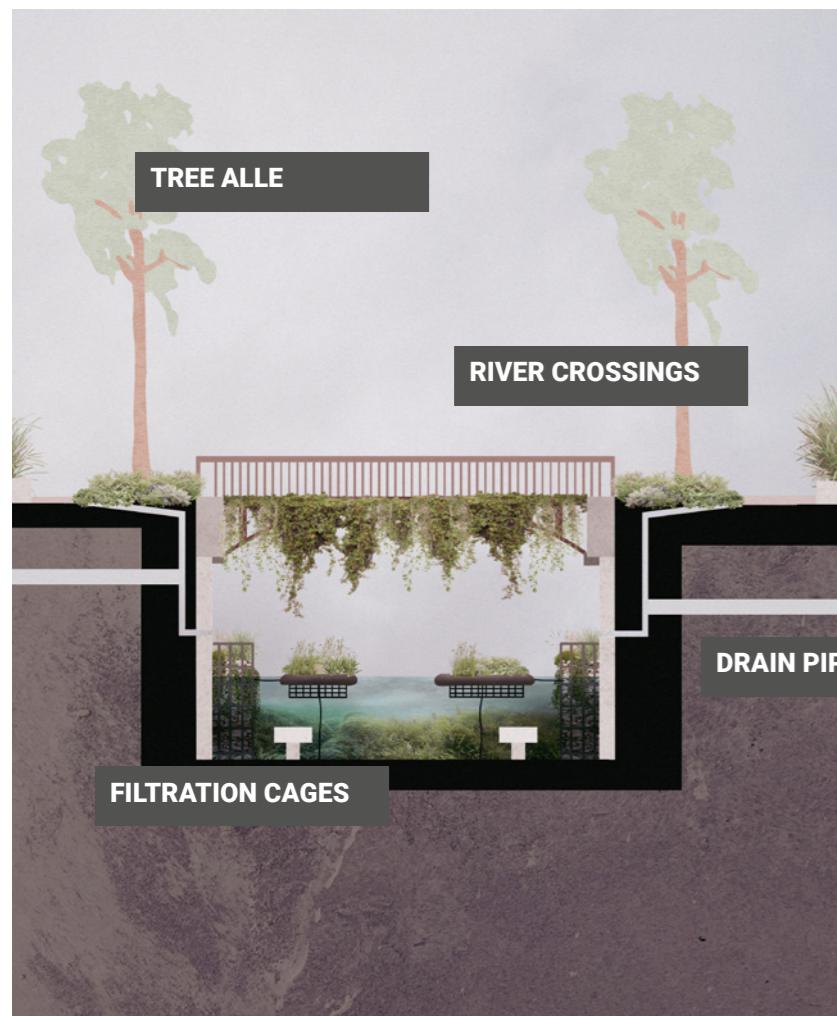
FLOATING DEVICE

MOLUSK CAGE

ROOT SHELTER

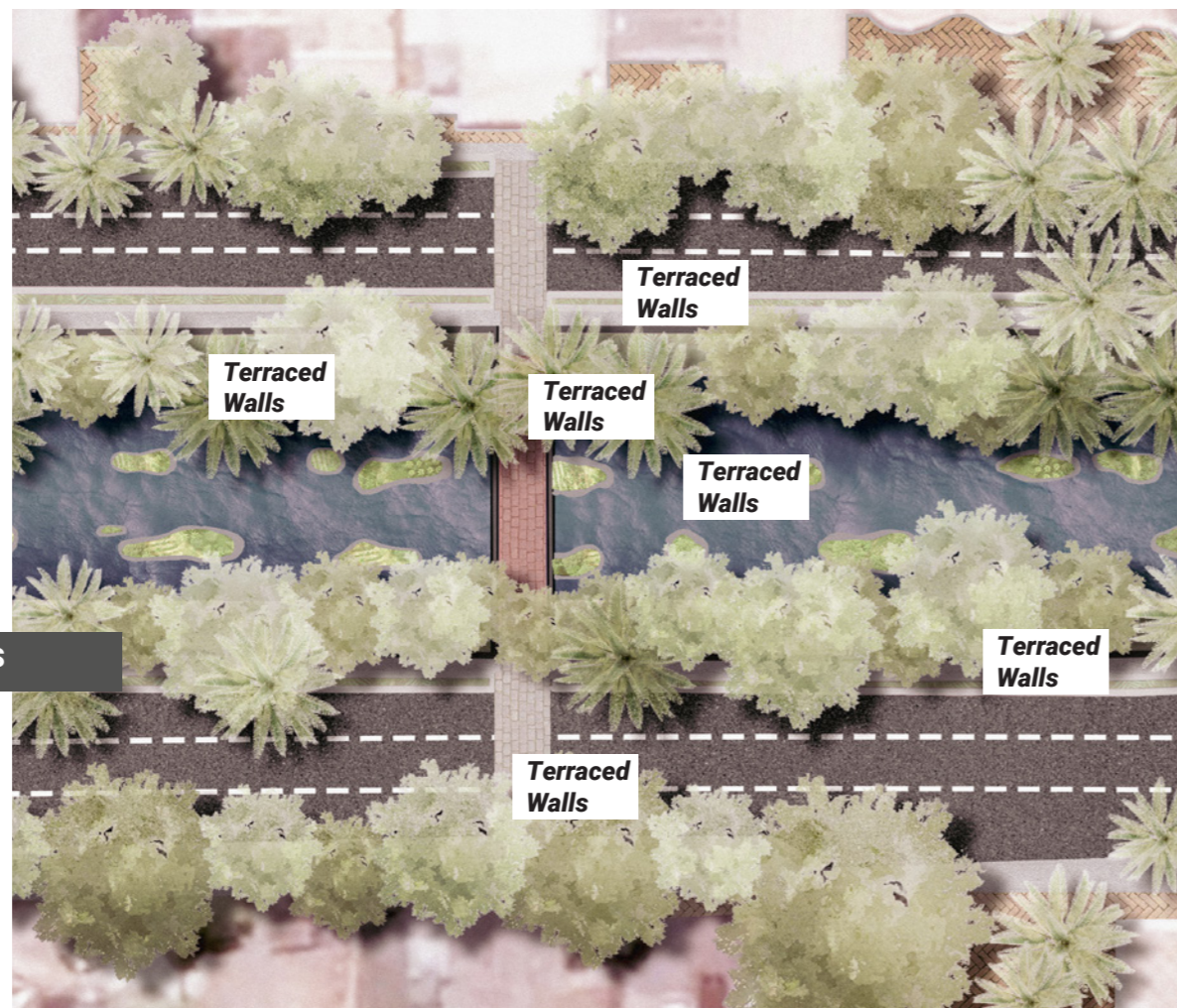
SOFT RIVER BOTTOM

TETHER



Vegetation as Sanitation Control

A variety of plantings and vegetation structures can allow for more filtration and phytoremediation within and nearby the river section. This can improve water and air conditions in a passive way that requires little management.



River Integration in a Social Streetscape

This section of the river can be more integrated into the urban activities that occur here. Overall the walkability on this street is low but by including riverside walkways, road and river crossings, and expanded vegetative cover, the river can foster more outdoor activities.



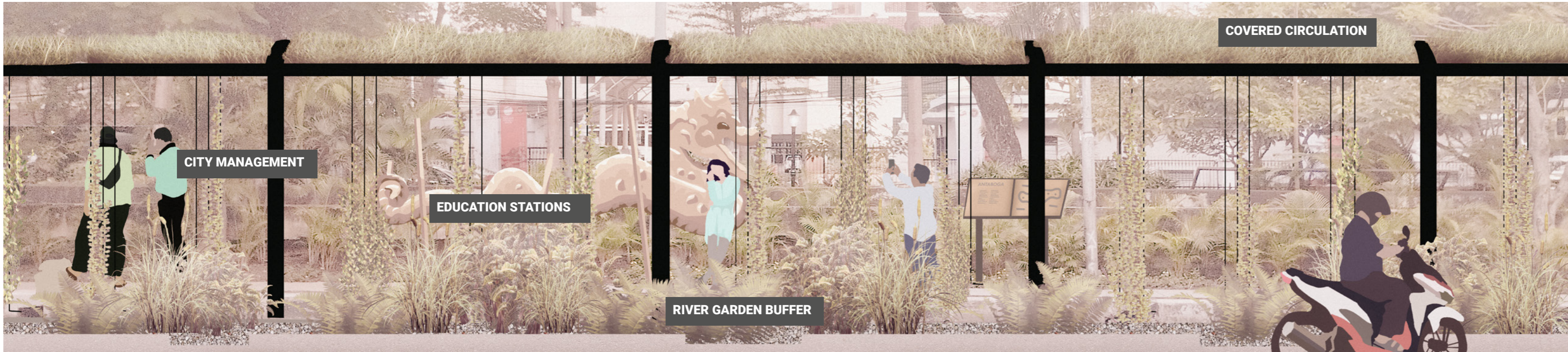
THE CIDENG CANAL

The section of the Cideng River is a calm canal situated as the buffer of a major road. Although the edges are beautifully landscaped with an all of palms, the canal is overall disconnected from human interaction, water quality is low and polluted, and riparian species have no habitat space to enjoy. The fish, lizards, and snakes swimming there had no shelter or natural spaces to rest or eat.

Simple Habitat Solutions

Passive habitat installation like filtration cages, floating islands, and riverside vegetation can provide valuable habitat space not only for ecosystem actors, but can create cleaner and more aesthetic riverscapes.

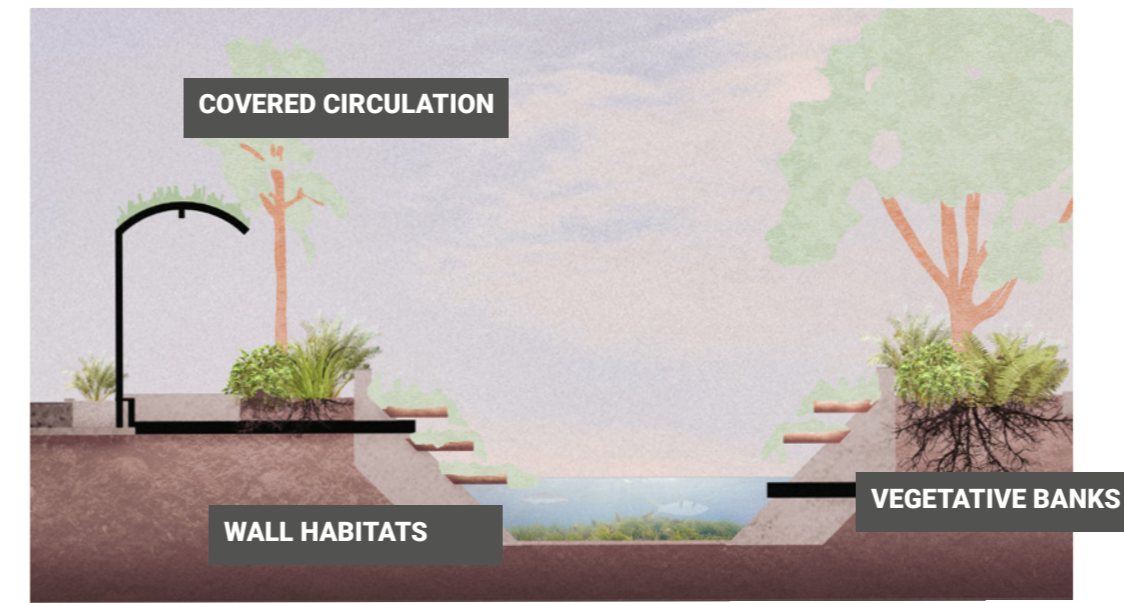
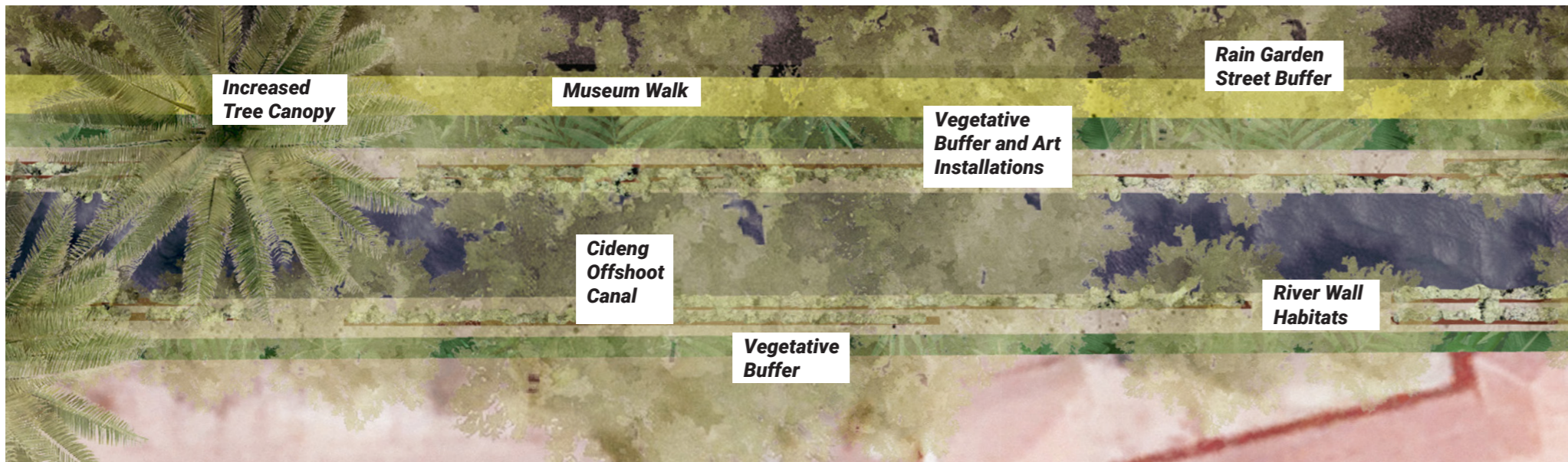




AN EDUCATIVE RIVERFRONT

The Cideng canal section that runs east of the neighborhood has the great opportunity to blend urban walkability, education, and ecosystem employment. As much of this river section coincides with the Museum Walk, connecting Kebun Tanah Abang and the National Museum, artistic installations and educational signage takes passerby through a variety of folklore and historical stories from throughout the archipelago.

A blend of planting beds, rain gardens, and covered walkways help in cooling the area, creating a walkway made for pedestrians and ecosystem actors alike.





Ducks need a broad social group and are often herded in domestic situations

Duck groups can be great ecosystem actors in that they can improve soil quality, manage pests, and fertilize plants.

Anas platyrhynchos domesticus
Duck
Bebek

KEBUN TANAH ABANG

Agroforestry and Adaptation



Undeveloped Plot



View from the Street

9,940	12	80	10,000
PRODUCTIVE AGRICULTURE (M ²)	WORKFORCE HOUSING UNITS	TOTAL TREE COVER (%)	TOTAL PERMEABLE AREA (M ²)



A VISION OF OPEN AIR LEARNING

Kebun Tanah Abang brings elements of Sunda and Javanese traditional agroforestry practices to install a high biodiversity hub as well as connect to the Museum Walk route in a food museum that brings cuisines from around the archipelago.

LESSONS FROM THE PAST, LESSONS FOR THE FUTURE

The park highlights a circular agriculture practice and teaches how urban agriculture can meet traditional agricultural practices.

Permaculture and Education

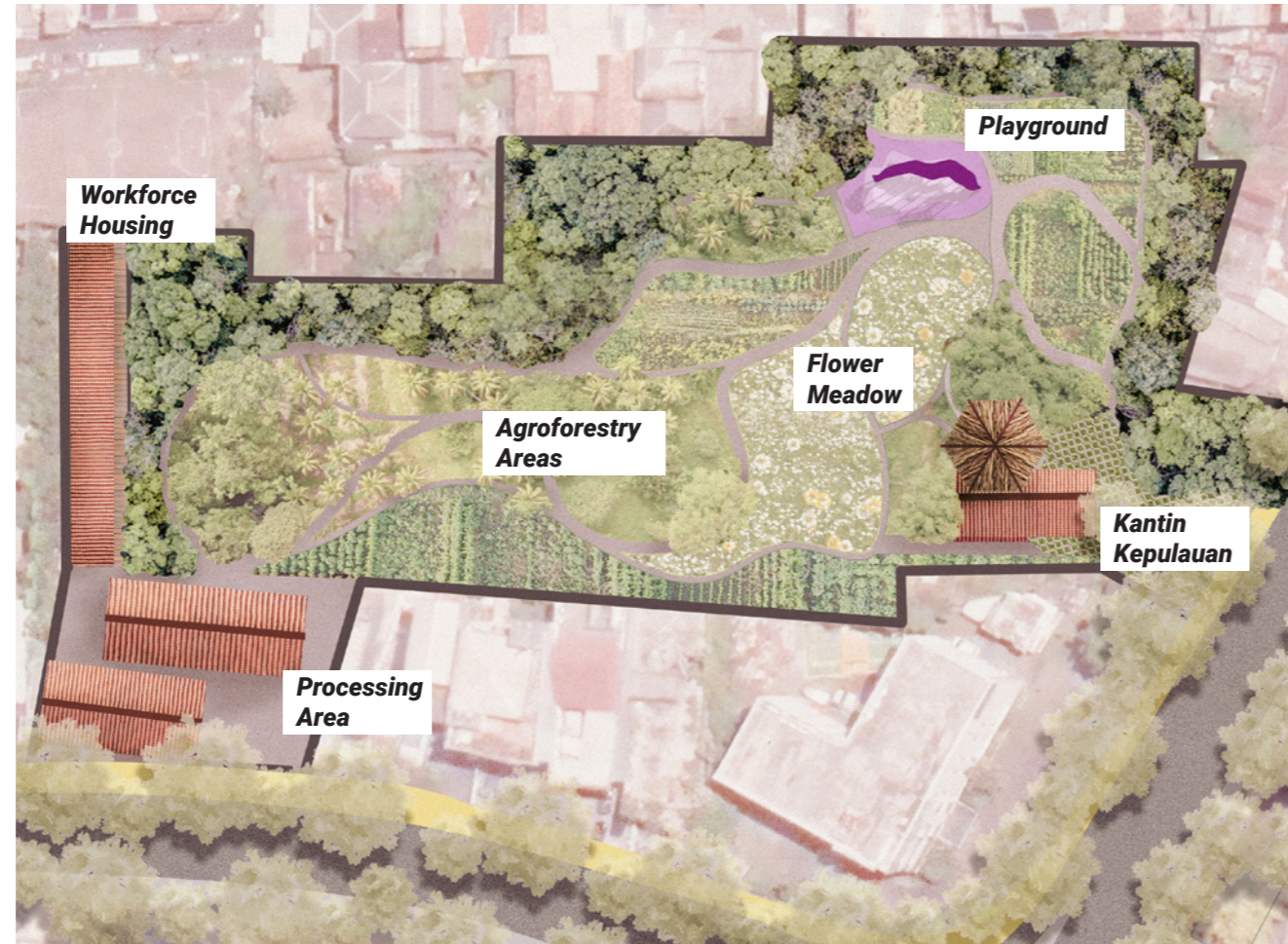
The park highlights a circular agriculture practice and teaches how urban agriculture can meet traditional agricultural practices.

Indonesian Cuisine Tour

A food hall utilizes the crops on-site and showcases foods and drinks from around the archipelago.

An Attractive Habitat Area

Not only is this an attractive place for humans, but also serves as a large-scale habitat zone to employ ecosystem services.



PHASING FOR FUTURE PLANNING



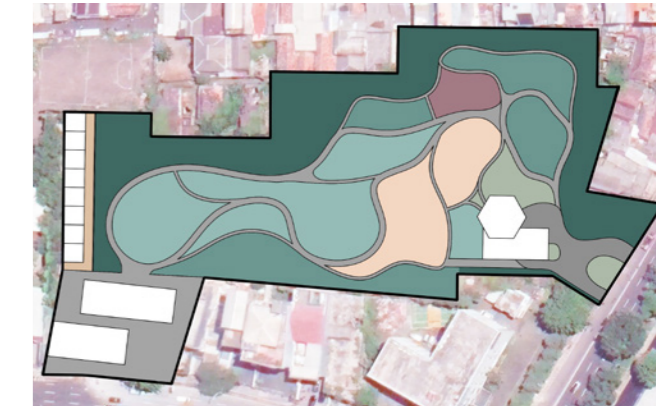
Phase 1

The current undeveloped plot introduces the foodhall Kantin Kepulauan and some agroforestry productive spaces. The existing cement plant to the west continues with work as usual.



Phase 2

After the cement plant ceases business eventually, the plot can expand. Over an extended period, phytoremediation plantings and modern engineering techniques can improve the soil conditions to a healthy level.



Phase 3

Once the soil has reached a level safe for human consumption plantings, the rest of the site can install traditional agroforestry techniques and complete remaining infrastructure and development.



KANTIN KEPULAUAN

Kantin Kepulauan is a food hall-style eatery that introduces cuisines and drinks from every corner of the island nation. Plant-based products especially will be highlighted to educate and spread awareness about the highly varied palette of produce and recipes. Produce from the agroforestry garden can even provide the ingredients for these recipes.

PERMACULTURE AS EDUCATION RENDERING

The park overall will act as an open air museum, with many different educational materials throughout the garden. Insights into the ecologic, cultural, and historic significance of traditional agricultural practices connect the garden to the larger museum walk that weaves itself throughout the area.



AGROFORESTRY AND ECOSYSTEM SERVICES

Although agriculture in today's sense brings images of monocultures and the pushing out of native species, traditional Sundanese agroforestry practices bring provisional, regulative, and cultural ecosystem services together in one location. Based on the basic principles of the *Pekarangan*, or "A traditional system located in the village that provides both subsistence and commercial

products and serves multiple functions by simultaneously combining agricultural crops with tree crops and animals" (Marten 1986).

In the larger ecological system throughout Jakarta, this site can act as an ecological hub that both preserves domestic heritage species as well as provide habitat space for wild passerby. The high levels of biodiversity and vegetative cover allow for increased permeable surface and subsequent flood mitigation, and urban cooling.



This species of otter is often found in urban areas of Southeast Asia, they live in social groups.

Otters are great secondary consumers that can help control aquatic populations.



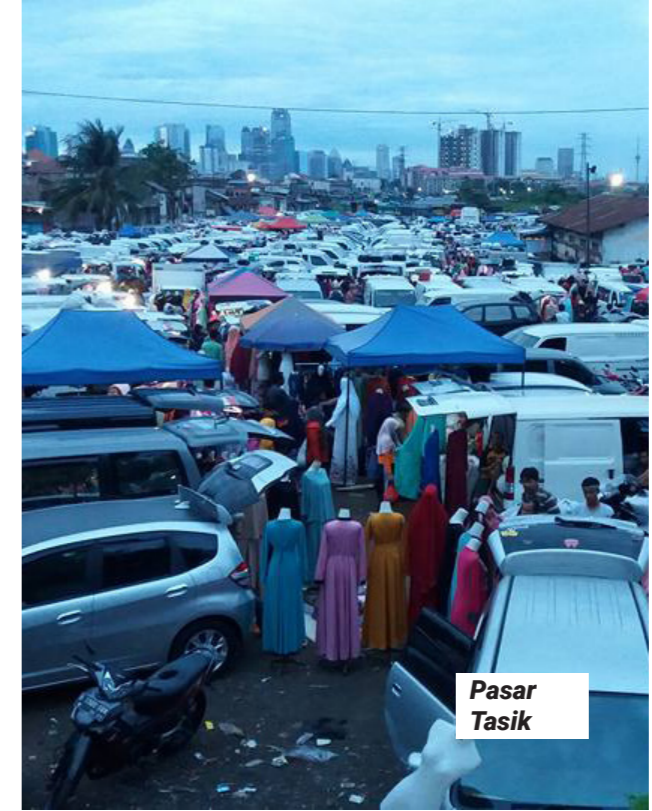
Lutrogale perspicillata
Smooth Coated Otter

THE SINK

Arts Center Meets Aquifer Recharge



Within
Pasar Tasik



Pasar
Tasik



THE SINK, CONNECTING CULTURE AND ECOLOGIC REGULATION

The Sink is located on the existing site of Pasar Tasik, a weekly textile market whose land lays barren the remaining five days of the week. The vision for this site is to introduce ecosystem employment while resonating to the existing site activities and the area's strong ties to the arts and culture- namely the nearby Pasar Tanah Abang, Textile Museum, and Sarinah Mall, a nearby department store that sells Indonesian-made products and cuisines.

12,231	X M2	315	17
VEGETATED AREA (M ²)	WATER BASIN FILL (M ²)	MARKET CAPACITY (VANS #)	VENDED STANDS

Aquifer Recharge Site

Perhaps the most prominent impact of The Permeable City is its potential to improve groundwater supplies and contribute to aquifer recharge- allowing for water to enter the ground rather than diverted to the ocean through the canal system. However, a system of inject wells throughout the city can speed up the process and perhaps keep up with current aquifer depletion rate. The Sink's primary function is to act as a filtration area that cleans the water before being re-established into the aquifer via a filtered inject well.

Wetland Park

The urban wetland serves many functions in terms of ecosystem services and local asset. Wetlands help to store, an important feature to have in a highly impervious area threatened by flooding. Wetlands also have many filtration qualities, both improving surface and groundwater health as well as carbon sequestration and air filtration. Wetland parks can also be designed in an attractive way that brings visitors.

Indonesian Arts Center

In relation to the many other arts-related venues nearby, The Sink brings a cultural layer to the site by developing an arts center where visitors can learn about the history and significance of the many arts throughout the archipelago, including music, dance, textile, and more. Visitors can become involved through educational exhibits, crafts, music and dance performances, and seminars. Outside, visitors can also take a calm walk through the bamboo garden where a variety of artistic installations wait to be discovered.

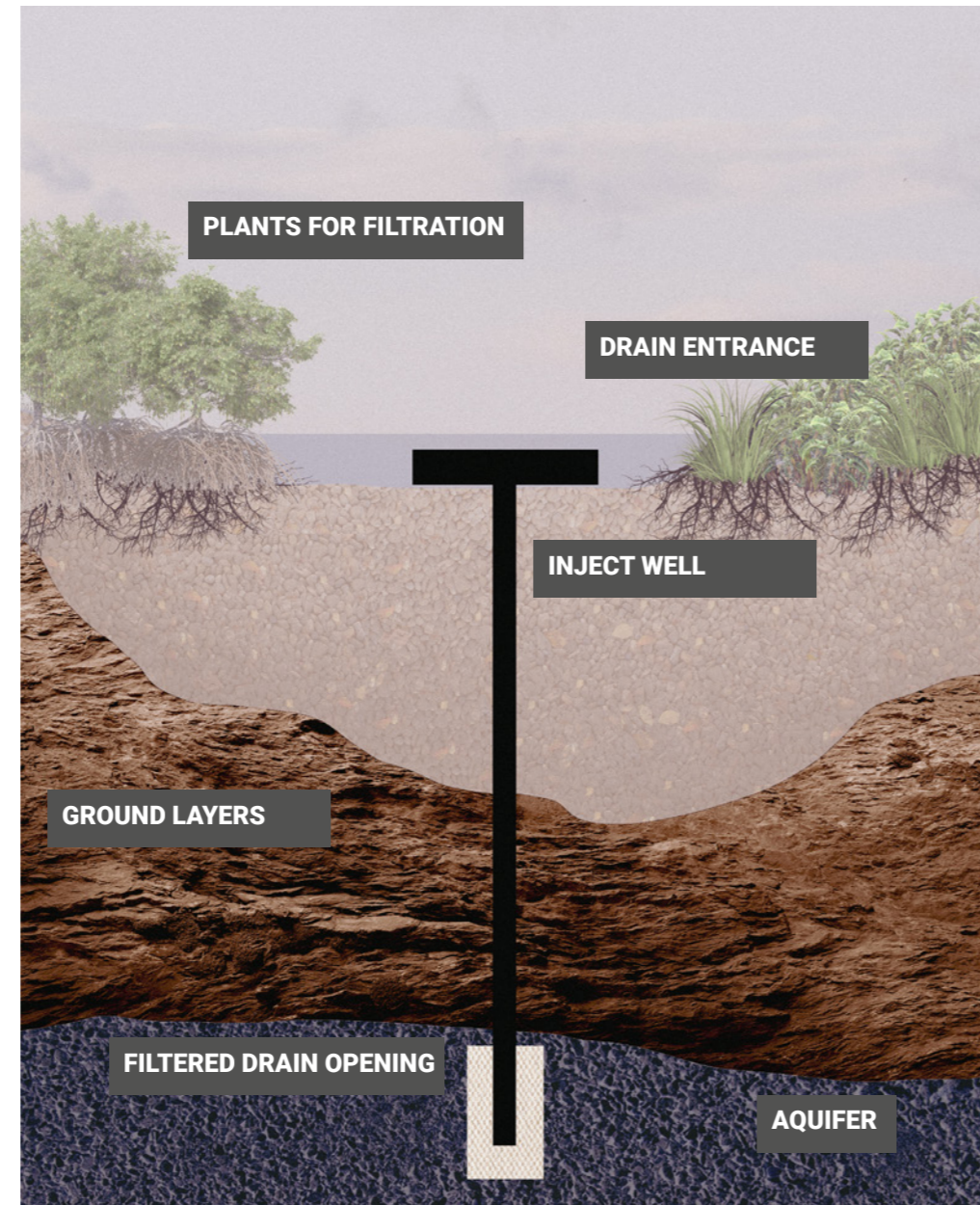


fig 1. the functional properties of The Sink are to hold stormwater and to filter and replenish water supplies for aquifer recharge through the installation of an inject well.

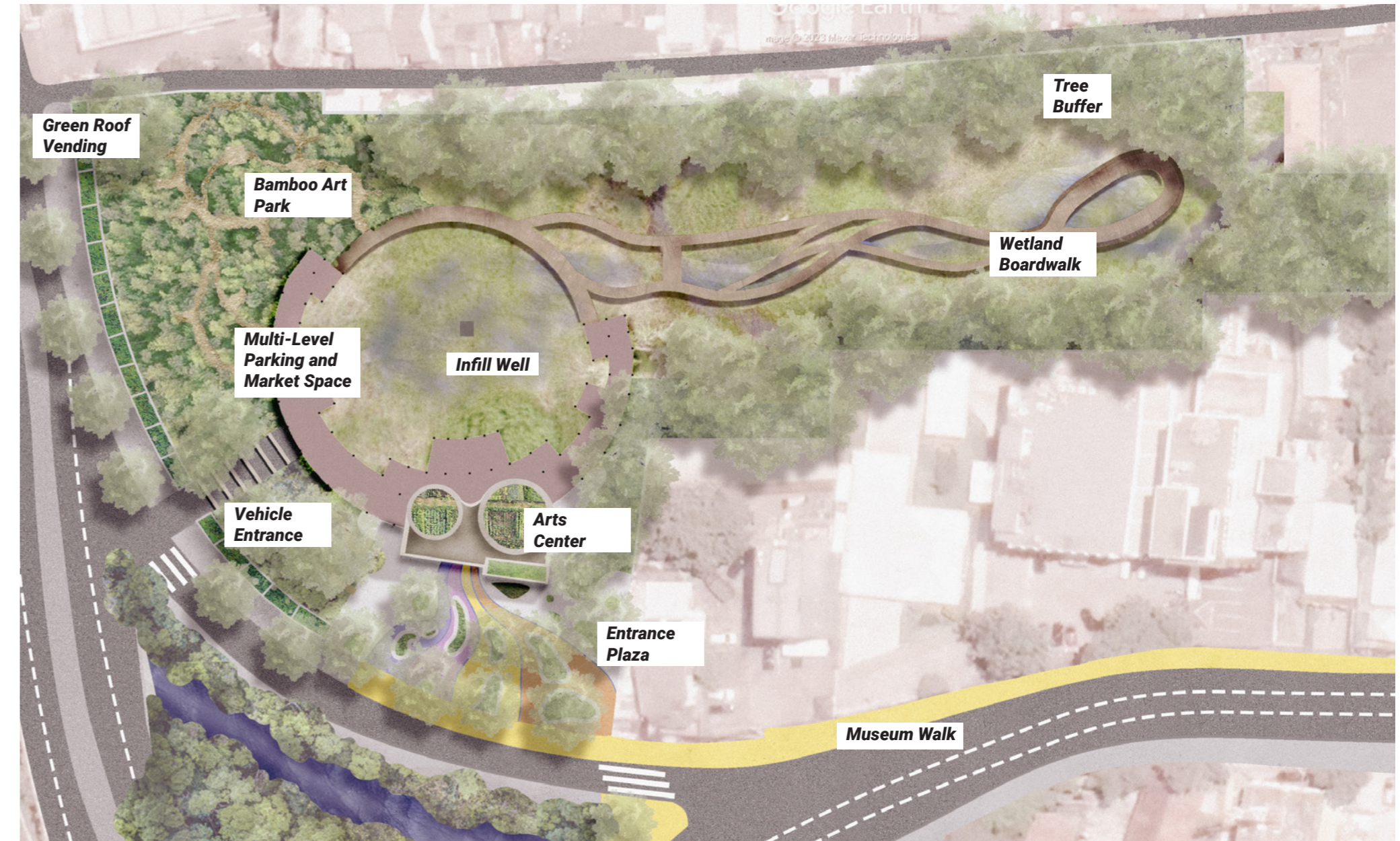
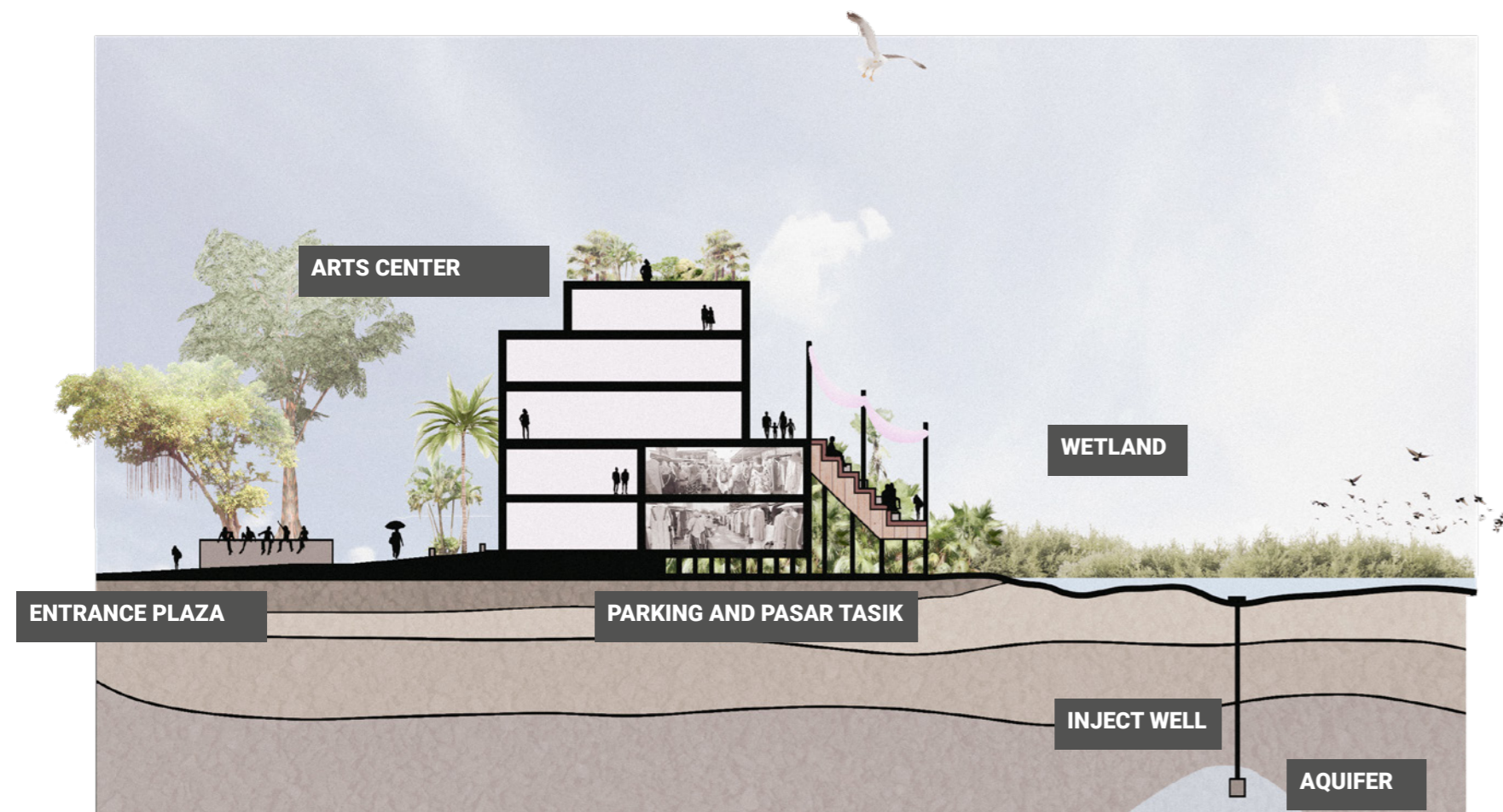


fig 2. The Sink connects to a larger system of educational venues that will guide visitors through different aspects of Indonesian culture and history

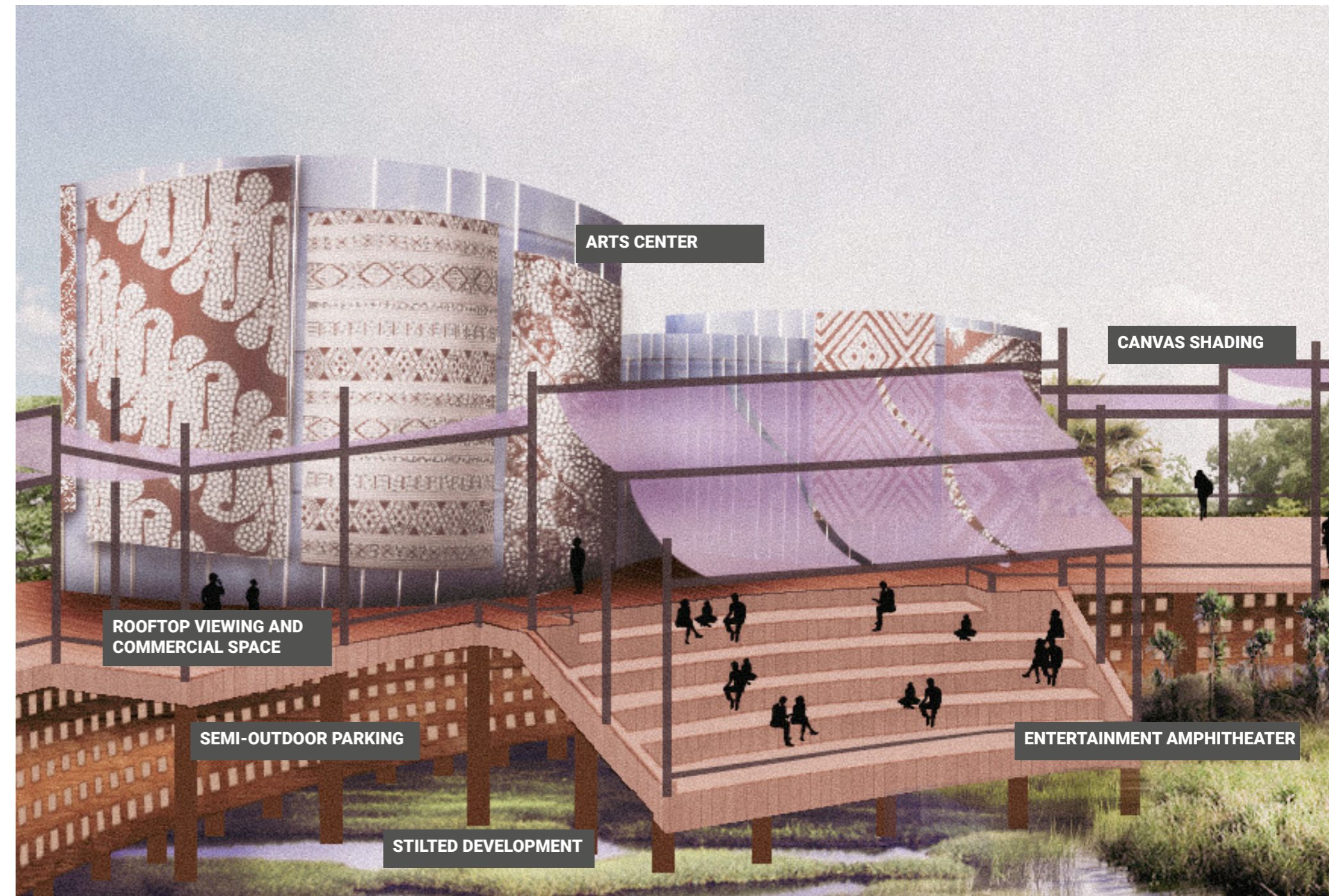
SECTIONS



SUPPORTING ECOSYSTEM, COMMERCE, AND EDUCATION

This site focuses on education about arts like batik and other Indonesian arts, and supporting small-scale sellers in the market below. Expanding the market area and schedule to every day can allow for a larger variety and quantity of vendors. The pasar will be a big shaded area that also acts

as a cooling space e that can support the existing textile market, cultural performances, or exhibitions that center on the arts.





CHAPTER 11

DUKUH ATAS

AIR

THE DUKUH ATAS SITE IS AN UNDEVELOPED PLOT SITUATED NEXT TO INDONESIA'S FIRST EVER TRANSIT-ORIENTED DEVELOPMENT. DUKUH ATAS AIR SEEKS TO EXPLORE HOW TO RETHINK STANDARD DEVELOPMENT PATTERS BY MAXIMIZING PRESERVED HABITAT WHILE STILL MEETING THE NEEDS OF AN ADVANCING AREA.

INVENTORY AND ANALYSIS

First Impressions
Dukuh Atas as it is Now
Analysis of Gray, Blue, and Green

PLAN DETAILS

Promenade Ciliwung
Symbiotic Towers
Wild Jakarta
Dukuh Terapung

DESIGN PROPOSAL

Regional Plan
Vision for Dukuh Atas
Masterplan

SITE 2

DUKUH ATAS
SOUTH JAKARTA

18
HECTARES

BLUE STATS

34
% WATER AREA

61482
M2 WATER AREA

GREEN STATS

55
% PERMEABLE AREA

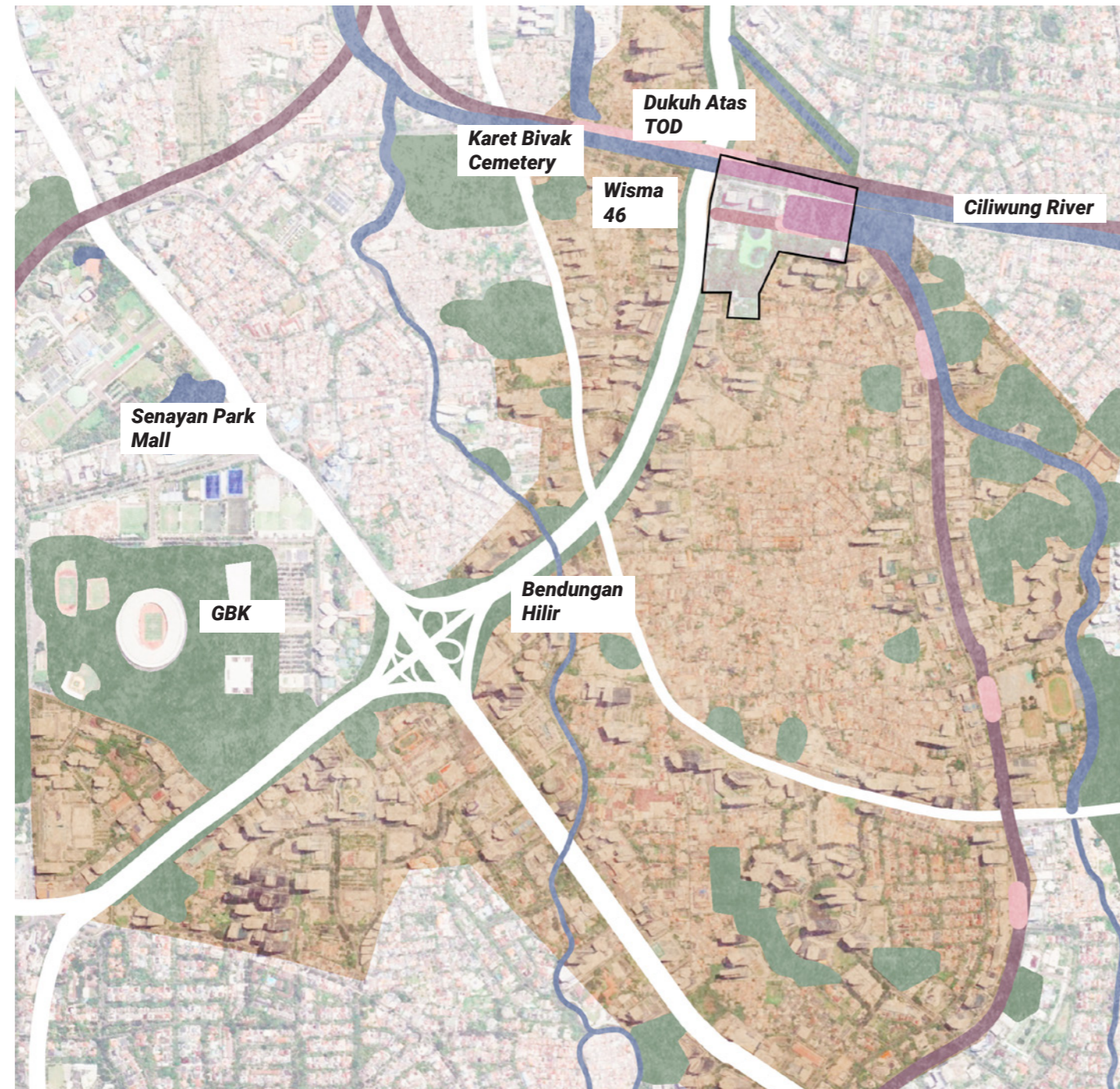
98,232
M2 PERMEABLE AREA

53
% TREE COVER

GRAY STATS

34
% DEVELOPED AREA

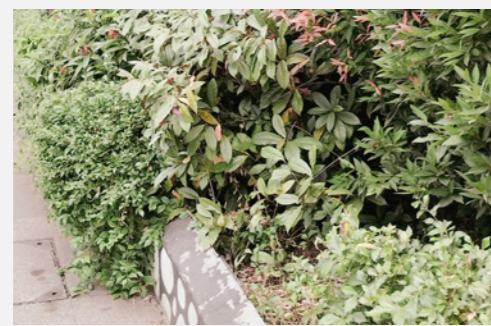
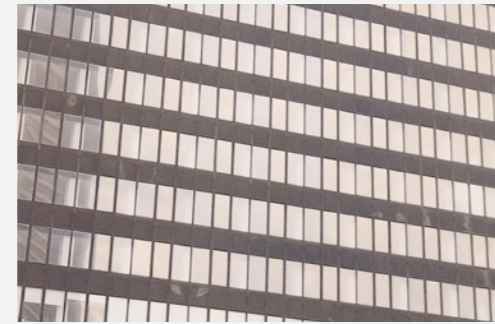
61,891
M2 DEVELOPED AREA



I also found Duku Atas by accident. One Sunday I went to meet an old friend. I had planned to ride the bus there, but because it was car-free day on Sudirman Street, the major connecting street near my accommodation, I had no choice but to walk most of the way there. In reality it was only an hour walk, but in the hot midday weather I became very tired and weathered down. Instead of walking back home in the heat, I decided to take a cab. On my way home, I noticed a large undeveloped plot of land next to a large reservoir. It instantly sparked my interest and I decided to look into the area more. I found that this area was not too far from where I was staying, so after visiting again, I knew that this site would be a really interesting exercise in exploring how a very desirable area can be built up to meet the needs of a growing high-rise district while still balancing and improving the natural areas.

I expected that this area would become a very important space in regards to transportation connections, as the Duku Atas LRT raised rail station is near completion as well as an upgraded Transjakarta stop. Across the river is also the central Sudirman train station that connects to the airport in the west and Bekasi in the east. Located at the entrance to Jakarta's financial district, this space will prove very dynamic in terms of land value. Because of this, I explored ways to preserve green space in a very profitable way, as developers are very keen to utilize every meter of land to maximize its return of investment. The area is now planned to become a central T.O.D. Or 'transit oriented development' that is already in the beginning stages of development with streetside landscaping and a skatepark. I think this site will be a very interesting and challenging site to explore the ideas of utilizing ecosystem services to not only improve regional conditions, but site-specific habitat upgrading and outdoor thermal comfort.





ground textures

plant textures

building textures

etc.

THE PROPOSED DUKUH ATAS TOD

On and near the site, it is clear that the area is in the midst of a turning point, with a mixture of undeveloped land, low-rise residential neighborhoods, and luxury high rises. It is clear that this area will continue to densify as the TOD expands and attracts more development.

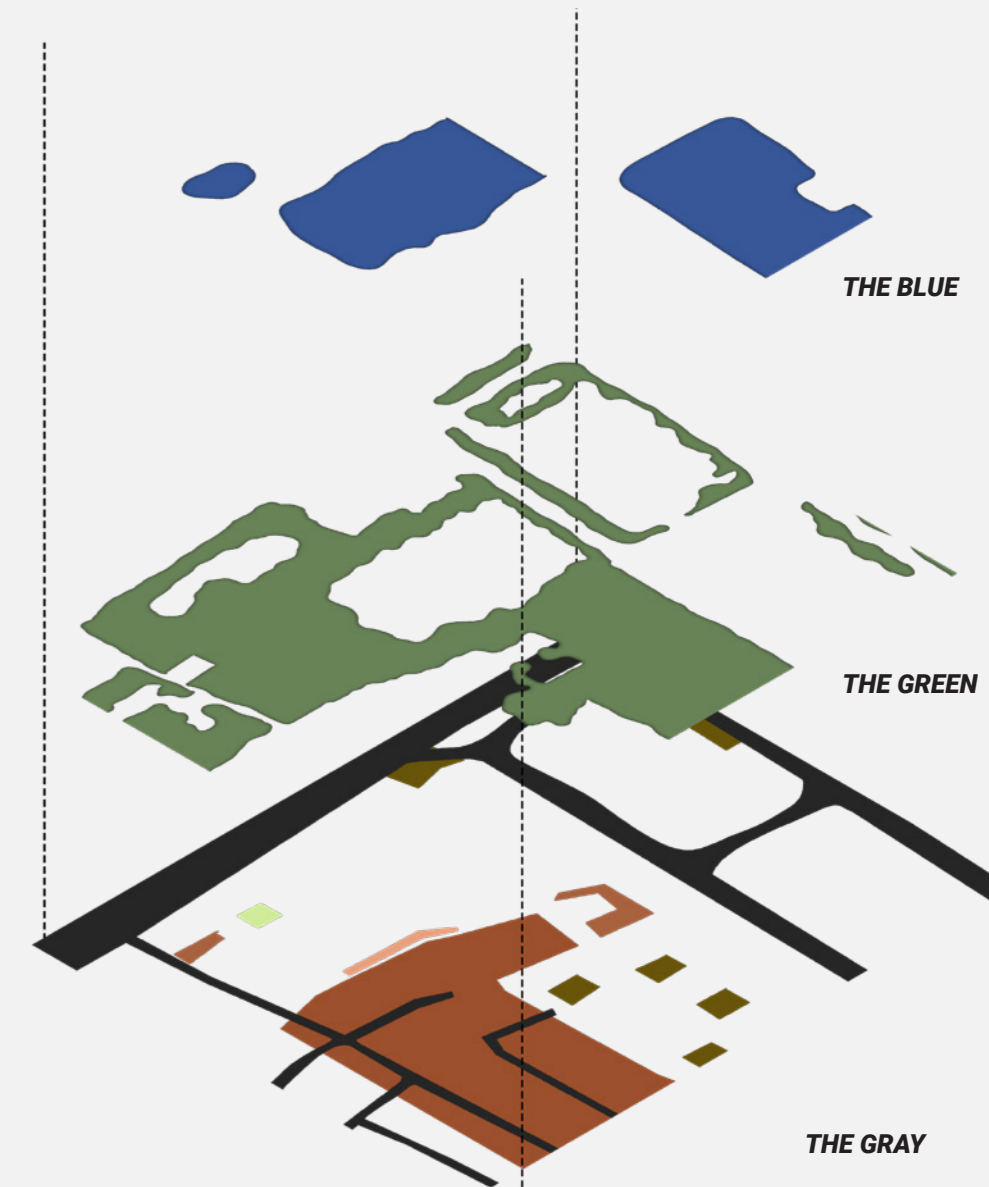
The Dukuh Atas TOD is the proposed urban design master plan for the area. Although I will not be refering much to this project in my personal design proposal, I think it is important to analyze this plan in order to understand what is most prioritized for this site and what the city and developers envision this area to be.

SUNGAI CILIWUNG// THE CILIWUNG RIVER

The Ciliwung River is a major river that flows through Jakarta, with headwaters starting at Mount Pangrango to the south. On this stretch of the canal, the edges host a wide planting buffer with mature trees, parts of it meeting the river in a more natural slope. Here it is rather wide and moves quickly compared to other rivers nearby. The river banks on site can be an intersting place on-site to explore combining water with urban development, such as architecture that serves both aquatic life below the water and human life above the bank.

Mature Treescape

An important aspect here is the large swathes of mature green space. Although more can be done to upgrade this land to employ ecosystem services.



DUKUH ATAS AS IT IS NOW

Dukuh Atas is an important area that can be utilized as an ecosystem service hub. Because of its vast undeveloped size, this area is already an oasis for many species in the city. I noted many types of birds and tree species here.

Undeveloped Green Area

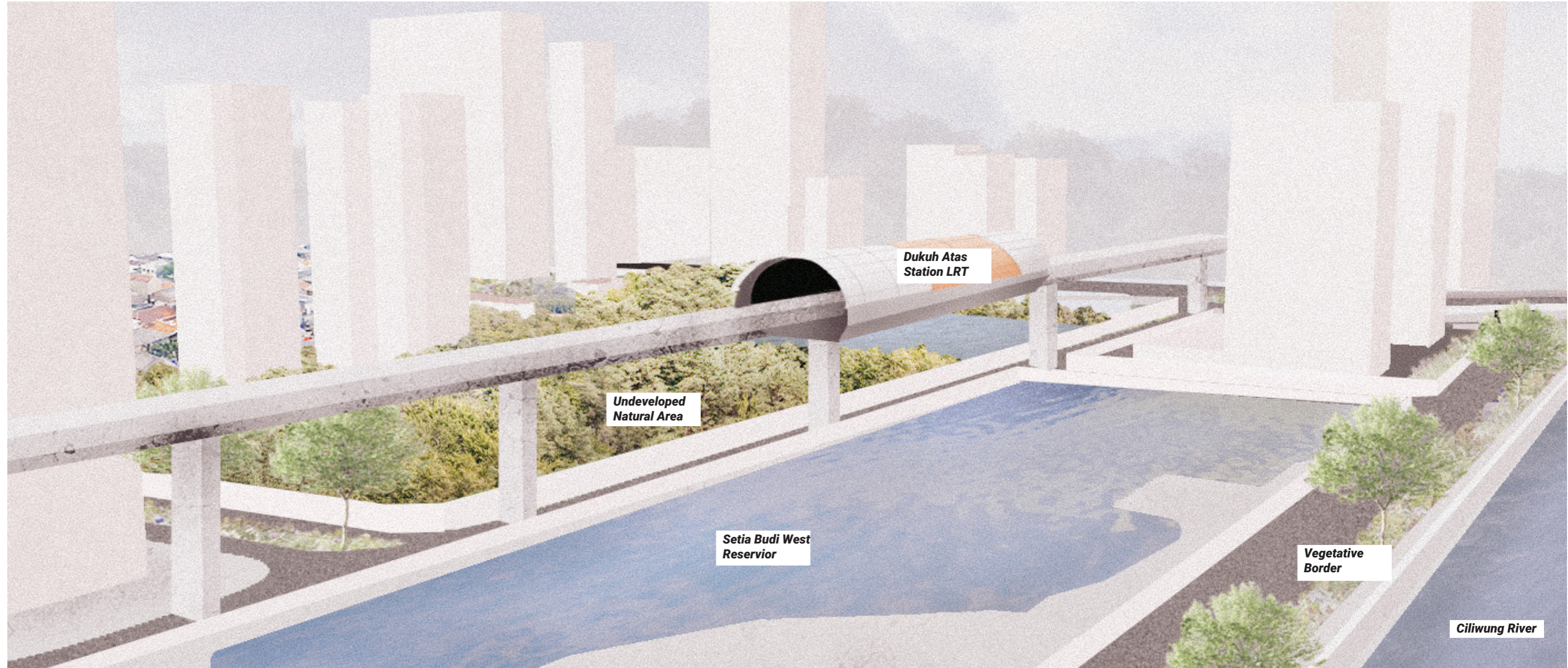
As an undeveloped space in its current condition, the site has attracted a variety of flora and fauna. Many different tree species fill the area creating a dense canopy, though lacking in floor vegetation. However, many bird and insect species were found, especially around the natural pools of water that have come from depressions in the ground. For now, this remaining bit of naturalized area has become an ecological oasis at the center of the city.

Center of Transportation

Located at the Dukuh Atas TOD, transportation is a key feature of the site. Bordered by the LRT rail and Dukuh Atas LRT station, major bus lines that stop at the Dukuh Atas bus station, and close connections to the Sudirman commuter train stop and MRT underground rail stop, millions of commuters will pass by this area each year. As the TOD is nearing completion in the coming years, more and more people will frequent the area. However now, foot traffic remains calm for most parts of the day.

High Value Development Area

Because of the size and location of the Setia Budi site, it is clear that this area will soon be developed, most likely following the current developmental trends to maximize the built footprint of the site. Because the value and potential of the area, this project will keep in mind the high urban value of the area. Urban activities and needs should be present on the site while natural areas should be preserved and maximized.



GRAY ANALYSIS

STRENGTHS

Undeveloped land has many mature trees
The river side has heavy tree cover
Jalan Sudirman already has strong landscaping and walkability

WEAKNESSES

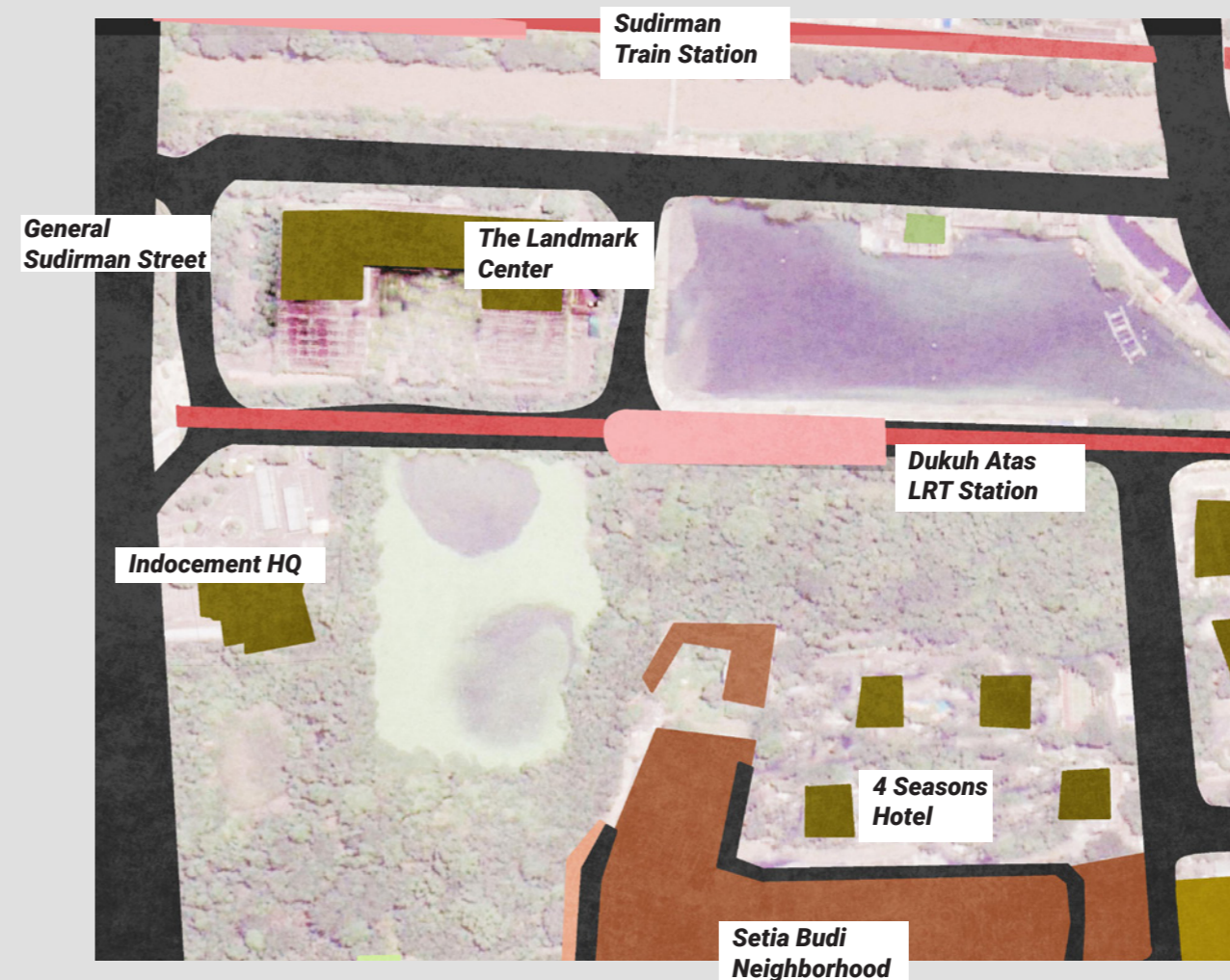
The pond may need some improvements to make it safe to live near
River is not very clean, low biodiversity

OPPORTUNITIES

Undeveloped, so it is essentially a blank canvas development
Many transit connections bring many opportunities for a TOD
This development can be a showroom for alternative building materials

THREATS

The land might need some engineering processes to make buildable
Land prices could make it hard to make a case for 'dead' space
The river is fast moving so could bring flood risk



DEVELOPMENT AT A TURNING POINT

Dukuh Atas is an undeveloped area in the rapidly modernizing area in South Jakarta known as SCBD, the Sudirman Central Business District. SCBD is a growing high-rise area, the financial powerhouse that makes Jakarta the largest economy in Southeast Asia. It is one of the most desired and expensive areas to develop, with many notable high-end hotels and offices surrounding the Dukuh Atas site itself. In true Jakartan fashion, however, a blend of income types and urban typologies surround the design area.

In this design proposal, it will be an interesting exercise in exploring how to meet the needs of both preservation and revitalization of existing undeveloped habitat with the needs and goals of a thriving, modernizing, and densifying financial district.



BLUE ANALYSIS

STRENGTHS

Many types of water collection and movement
 Already some revitalization projects
 Undeveloped area good for habitat preservation and water buffer

WEAKNESSES

Water pollution is still in need of improvement
 Lack of ecosystem actors and friendly habitat
 Heavy channelization impacts river's natural path

OPPORTUNITIES

Utilize the overall undeveloped land as a flood overflow area
 Waterfront developments to increase exposure and enjoy blue space
 Appropriate space for a wetland filter and aquifer recharge drain

THREATS

Stagnant ponds may be hubs for pests that can bring illness
 Water health is still rather unsanitary with plastic waste
 Flood risk for new developments near water
 River speed is rather high



TAKING INVENTORY OF THE BLUE

A main characterizing feature of Dukuh Atas is its expansive blue space. This gives many opportunities for water-oriented development, but can also pose some risks if not properly managed, such as flooding damage and water-related disservices like smell, illness, and pests if it remains stagnant. Overall the development should center on its connection to the water.

The existing contours of the site have established informal ponds. This has attracted small urban wildlife like swallows, though the ponds are not managed so the water health may not be ideal for development. These low areas should be revitalized for intentional habitat space that can both serve future human and nonhuman users.

WADUK SETIA BUDI BARAT// SETIA BUDI RESERVOIR- WEST

On and near the design site are a series of reservoirs. The westernmost reservoir has been undergoing a revitalization process that will provide more public waterfront space. This will be important for the future of this area in both habitat expansion and social exposure to urban blue infrastructure.

GREEN ANALYSIS

STRENGTHS

Undeveloped area
Many mature trees
Public transportation hub will decrease traffic on-site

WEAKNESSES

Street traffic and noise
A lack of high biodiversity
Much of the area close to Sudirman is cleared
Palm plantation in center, needs to be revitalized

OPPORTUNITIES

Habitat upgrading and expansion
Can create large scale green spaces
Blank canvas allows for maximizing habitat

THREATS

Green space perceptions by developers
Possible attraction of pests and other unwanted fauna



TAKING INVENTORY OF THE GREEN

The fact that this highly-central area is still undeveloped is a perfect opportunity to treat this site as a relatively blank canvas to showcase how new development can not only minimize impact on a more naturalized habitat but how development can actually work with the local ecology in a symbiotic relationship between urban human and nonhuman inhabitants.

Riverside Buffer

Along the Ciliwung River, a buffer of mature trees buffer the river from the bordering urban development and train tracks. This space is not available for public access and is blocked off by high concrete walls.

Streetside Plantings and Formal Landscaping

Several areas exhibit well-managed formal plantings, most prominently along Jalan Sudirman and the TOD, as well as within the private hotel and office plots.

DUKUH ATAS AIR

A Vision for the Site

DUKUH ATAS REENVISIONED: DUKUH ATAS AIR

The challenges of the site are what make it such an interesting project. As the current conditions of the Setia Budi should be preserved as much as possible, the needs of a rapidly modernizing and urbanizing area are still required to ensure the longevity of new development.

The Functional Landscape: A Naturalized Footprint

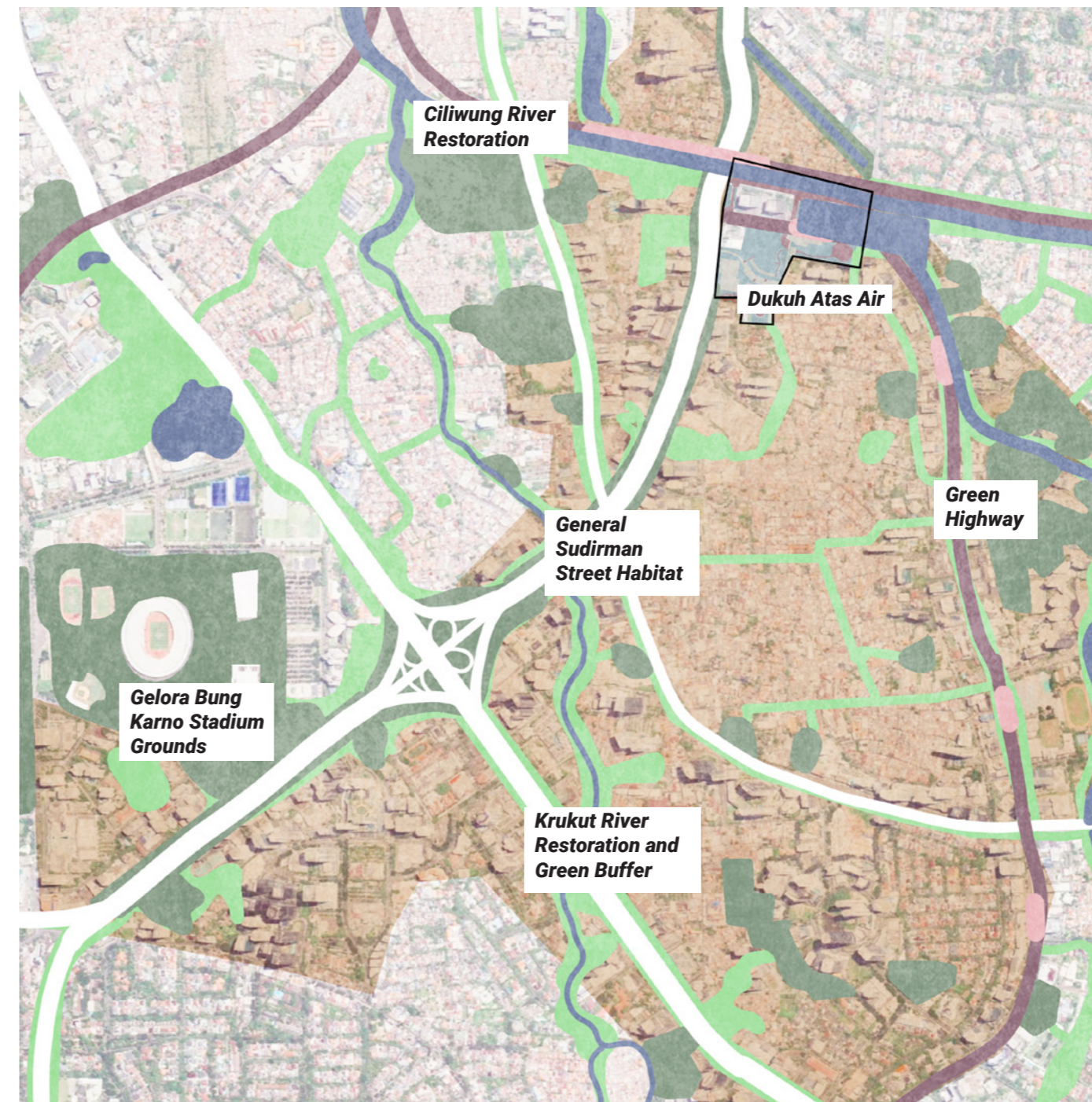
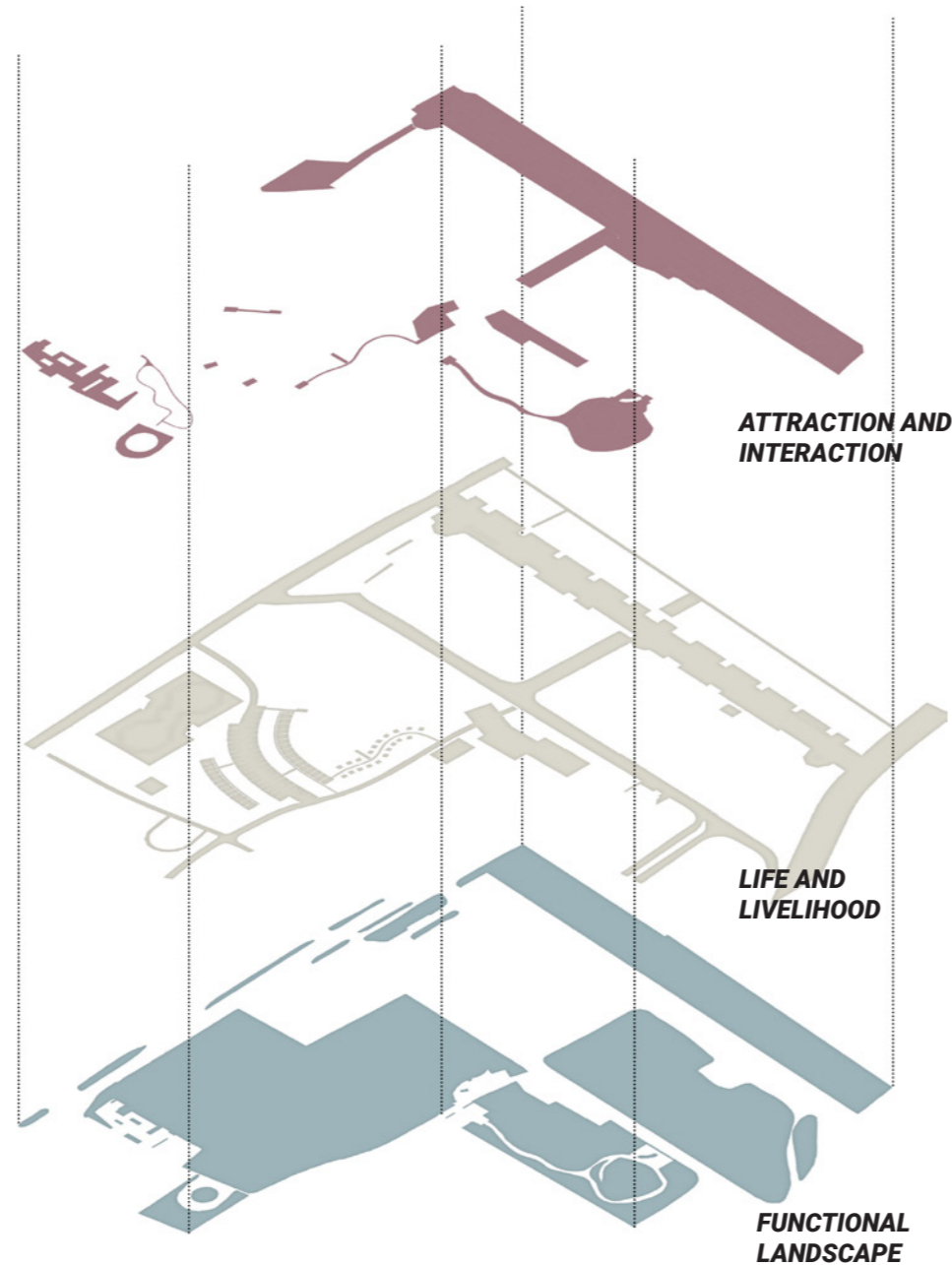
The base landscape of the site will be primarily focused on preserving or upgrading the current natural areas. By stiling many buildings, much of the vegetation can remain and new development can both minimize anthropogenic impacts on the landscape and benefit from the ecosystem services that will be maintained on site.

Life and Livelihood: The Urban Lifestyle

Many of the proposed buildings seek to connect to the growing urban lifestyle of the area, connecting directly to the demand for business space, respond to the housing need, and provide urban assets built upon the TOD.

Attraction and Interaction: Creating Destinations

Each new design proposal for this area implements a certain level of interaction with nature as a destination. From formal parks on the ground to exciting towers above, access to the natural world is possible at every turn.



DISTRICT STRATEGIES

Dukuh Atas Air focuses on preserving the existing ecological assets on the site, but also connects to the city-wide strategy in many ways, becoming an ecological oasis in the heart of the financial district.

Jakarta's Green Lung

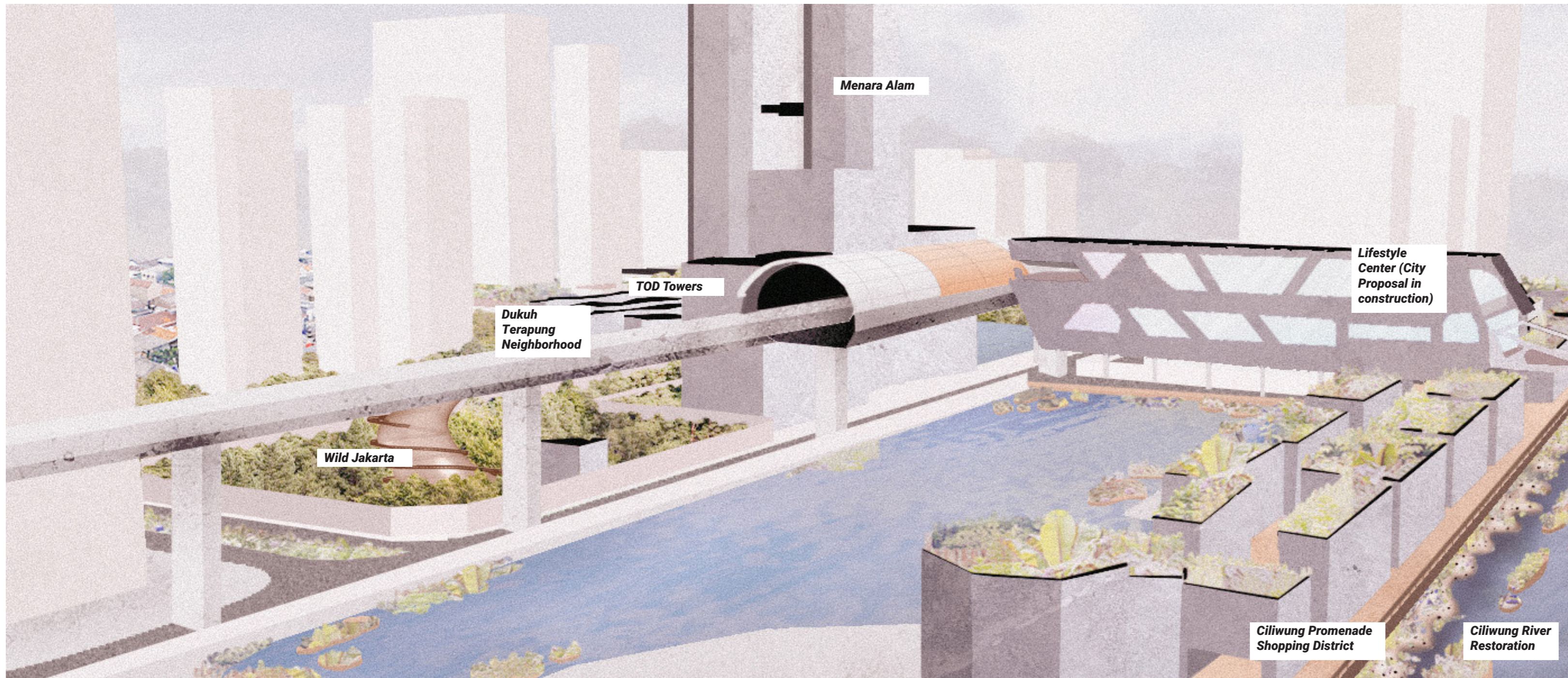
Within this district of the city, many large scale green spaces already exist and can be upgraded to support more species and outdoor activities. This system can create an expansive green lung in the financial district of Jakarta.

Golden Triangle Green Initiative

To connect to the proposed policies of chapter 9, the Golden Triangle of Jakarta, or the financial district, can require certain qualities and quantities of habitat in the existing and future development.

Linear Corridors

Streetscapes and riverscapes in this area can provide valuable ecological assets into SCBD. Already many streetscapes here have begun a green transformation, but a city-led campaign for ecosystem employment in these spaces can support many ecosystem actors and services.



DUKUH ATAS RE-ENVISIONED: DUKUH ATAS AIR

Dukuh Atas in Indonesian means the ‘upper hamlet’, however, the title for this proposal, Dukuh Atas Air, means ‘hamlet above water’. The vision for this neighborhood is to build up a new area while minimizing its impact on the landscape. In order to do this, I proposed that a majority of the new architecture be stilted above the landscape, allowing for free movement of land-bound species and expansion of vegetative cover. The focus on water and its connection to development on this site is key.

Flagship for Symbiotic Architecture

Development in Dukuh Atas Air seeks to create a symbiotic relationship with the ecosystem around it. By not only minimizing its physical footprint, key habitat resources will be provided by the building itself, including garden roofs, reconstructed habitat connected to the buildings, and nesting sites.

Rewilding Area

Although much of the area already consists of tree coverage, much more can be done to rewild the area and bring even more ecological features that are inspired from the natural landscape that Jakarta sits on. These features like higher biodiversity levels, forest floors, and natural river filtration zones will attract even more ecosystem employment for the site and city area overall.

Allow for Development to Float Above Land

By stiling or building development above, not only is vegetation and nonhuman species given more space to flourish in the area, but more area will become a safe area for flood overflow and water movement. This will decrease the risk for the local residents and even improve natural water cycles on the landscape by reintroducing a natural system that was lost overtime through urbanization.

**DUKUH ATAS
DUKUH ATAS AIR**

93,889 M²
VEGETATED AREA

52%
VEGETATED AREA

45%
TREE COVER

79%
PERMEABLE SURFACE

21 %
IMPERMEABLE SURFACE

191
COMMERCIAL UNITS

635
RESIDENTIAL UNITS

18,6558 M²
PUBLIC SPACE

MASTER PLAN

Dukuh Atas Air proposes an urban habitat that seeks to balance the needs of a rapidly modernizing area with habitat preservation.

1 WILD JAKARTA

An urban wildlife rehabilitation allotment, Wild Jakarta acts as a quiet area that provides service to animals set to return to the wild. The allotment maintains a wild atmosphere to maximize habitat and biodiversity on the site.

2 RIVERFRONT DEVELOPMENT

Not only does this riverfront development bring more exposure to the river, but below the water line implements a linear underwater structure 'fish hotel' to provide shelter and safe spaces for underwater flora and fauna.

3 DUKUH ATAS STATION TOD TOWERS

Three ecological towers create a strong destination point as the opening to the new LRT station but still contributing heavily to carbon sequestration.

4 MENARA ALAM

These two towers that face Jalan Sudirman and also act as carbon sequestration towers, with exciting ecosystem immersive experiences on the top levels.

5 MASJID PARK

A long thin park terraces down towards the Masjid, providing a relaxing passive park that also provides a diverse planting palette to meet the needs of many different ecosystem actors.

6 HOUSING

A low-rise waterfront village explores the topic of human scale ecological design that interacts and responds to changing water levels. The housing development is proposed as a social housing development.

7 PONDSIDE HUTS

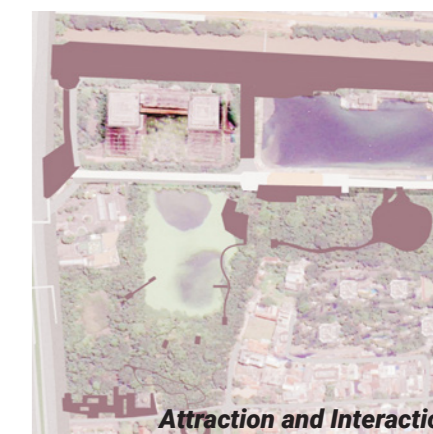
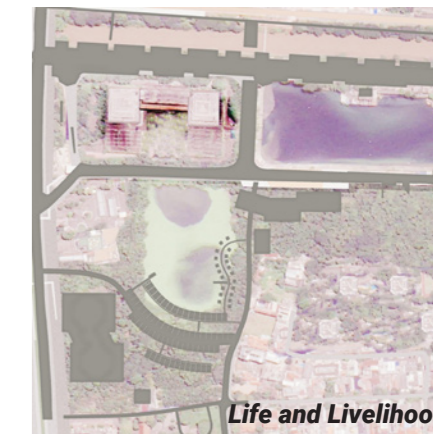
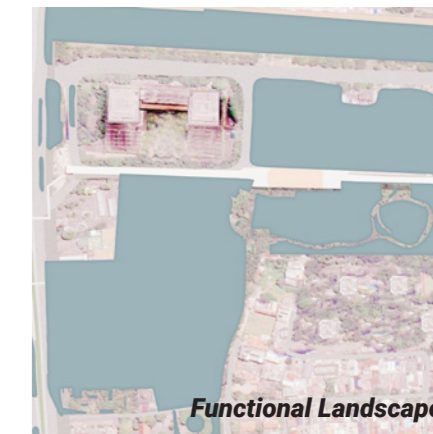
Opportunities for tourism are provided by a row on pondside cabins for short term accommodation. These can prove useful for business trips or for international tourists seeking a more wild side of Indonesia within Jakarta.

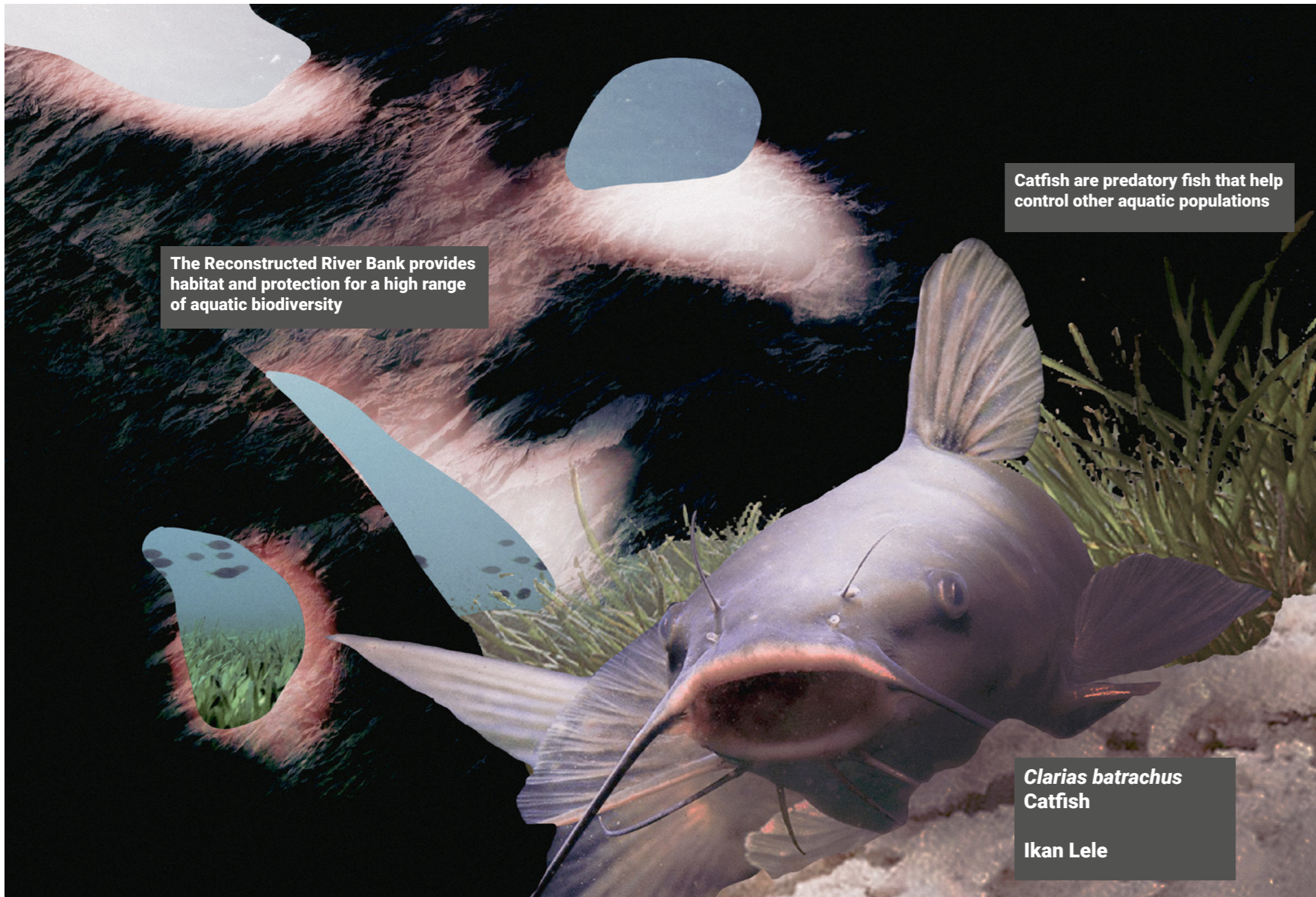
8 SMALL VENDOR AREAS

A small vendor area for food and drinks allows for a concentrated space to enjoy lunch or dinner after work, and provides jobs for local small scale business owners.

9 URBAN AGROFOREST

An urban agroforest nestles in behind the mosque and village. Allowing for recreation and agrotourism as well as providing localized food sources in the Setia Budi neighborhood.





The Reconstructed River Bank provides habitat and protection for a high range of aquatic biodiversity

Catfish are predatory fish that help control other aquatic populations

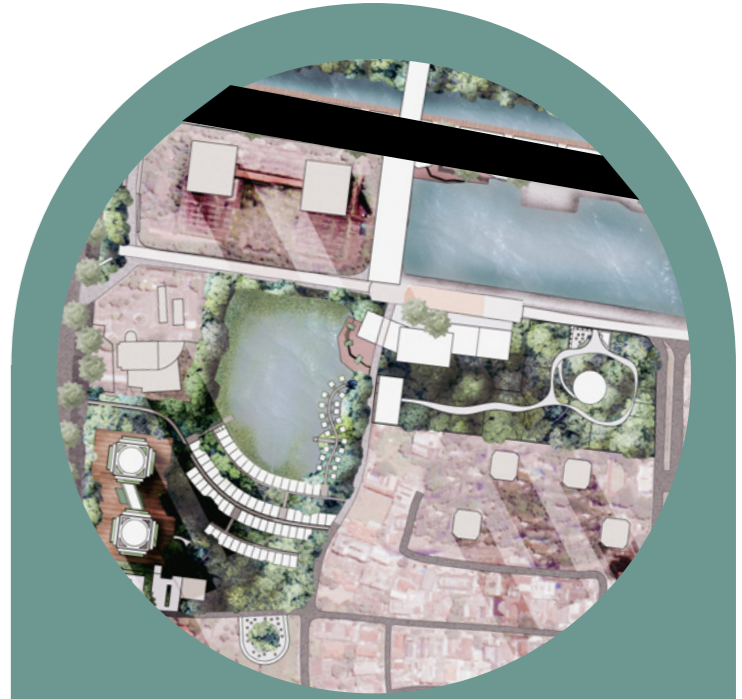
Clarias batrachus
Catfish
Ikan Lele

PROMENADE CILIWUNG

A Symbiotic Structure

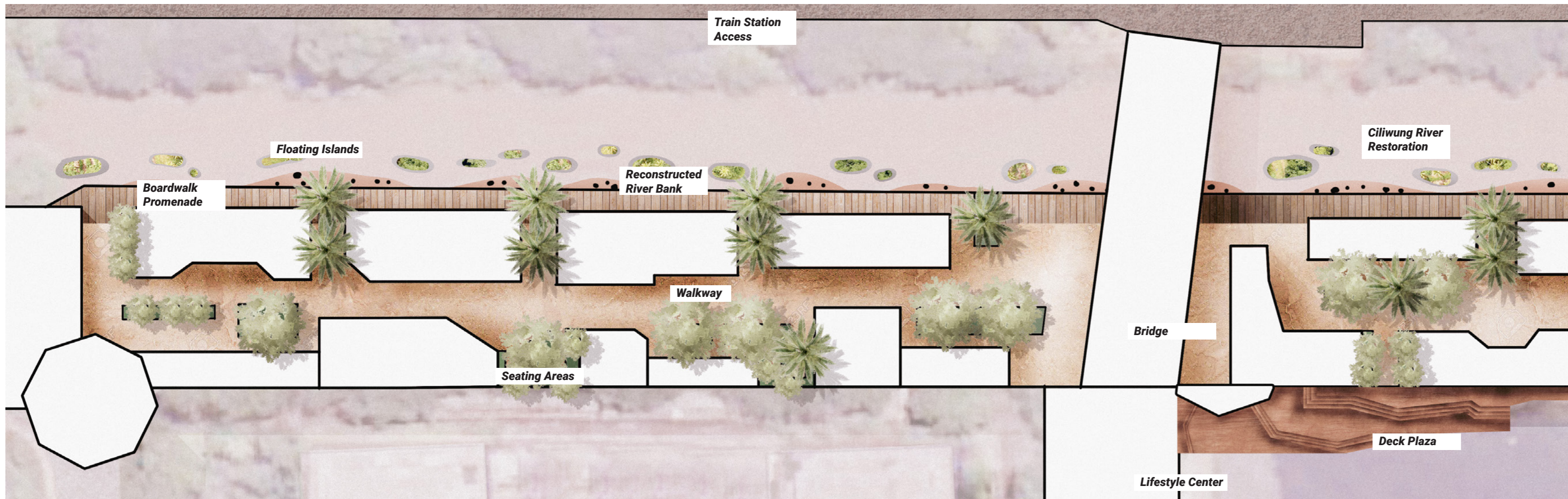


17857 VEGETATED AREA (M ²)	175 RESIDENTIAL UNITS	75 COMMERICAL UNITS	540 TUNNEL LENGTH (M)
---	------------------------------------	----------------------------------	------------------------------------



A SYMBIOTIC DEVELOPMENT

Located on riverside road, Promenade Ciliwung brings a new definition to riverside development in Jakarta. By building up and over the road, connecting and actively interacting with the bordering river and reservoir, architecture becomes a part of the landscape.



ABOVE THE WATER, BELOW THE BANKS

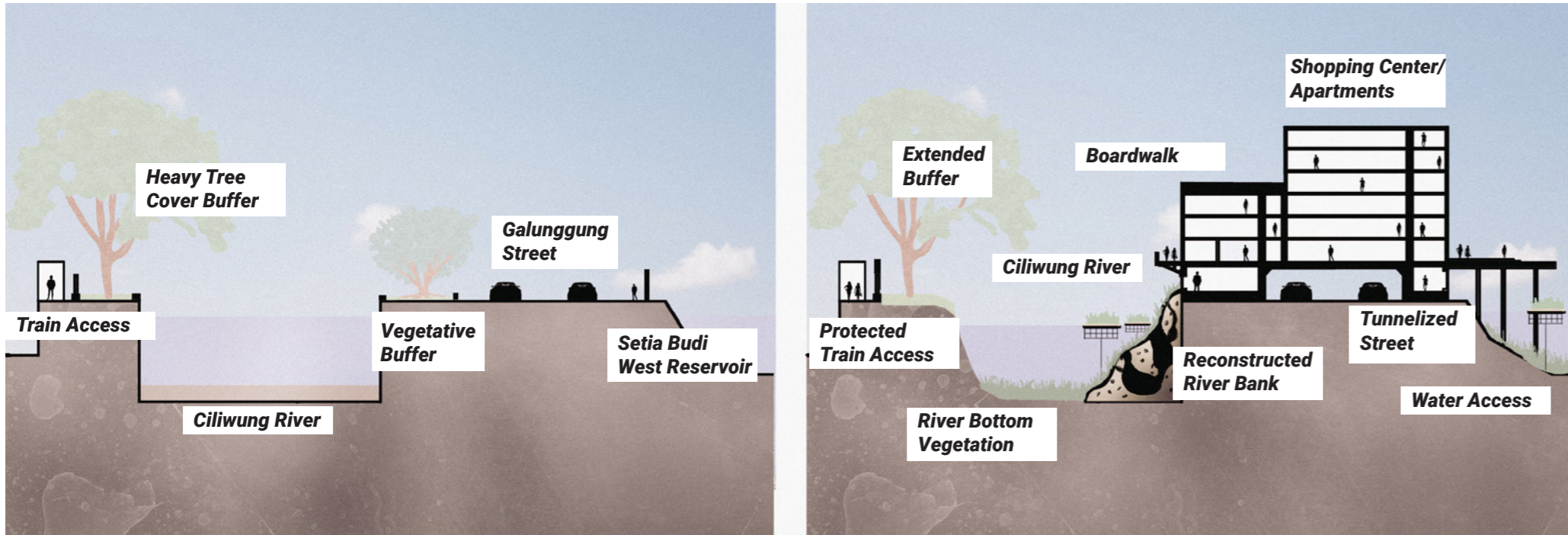
This development sees architecture as human-focused and nonhuman focused at the same time. By bringing these two worlds together to co-create an urban environment that helps all urban inhabitants to thrive on this section of the river, Promenade Ciliwung seeks to create a symbiotic relationship between development and ecosystem actors.

Aquatic Shelter

Constructed river habitat supports underwater flora and fauna. In the Reconstructed river bank that provides habitat and shelter for aquatic species, and floating islands that allow for shelter and places of rest, ecosystem actors will be supported and better able to provide ecosystem services for the people who live near the promenade.

River Filtration and Slowing

Through the Reconstructed River Bank, floating islands, and reintroduced river floor vegetation, the water will undergo filtration and drag, making the river run slower through the area, making the river safer for people.



APPRECIATING THE CILIWUNG RIVER

The riverfront development seeks to put more attention on the river Ciliwung instead of putting its back to it. Oftentime rivers are put behind walls or in the middle of streets which creates a distinct barrier between development and water. This often is for flood protection, but it also distances people from the wonderful ecosystem services that rivers can offer. After all, Jakarta is the city of rivers.





This predatory bird can be an urban asset through pest control and its attractive qualities

Javan Hawk-Eagles are the national emblem

Nisaetus bartelsi
Javan hawk-eagle
Elang Jawa

SYMBIOTIC TOWERS

A New Landmark in Jakarta



Already Clearcut



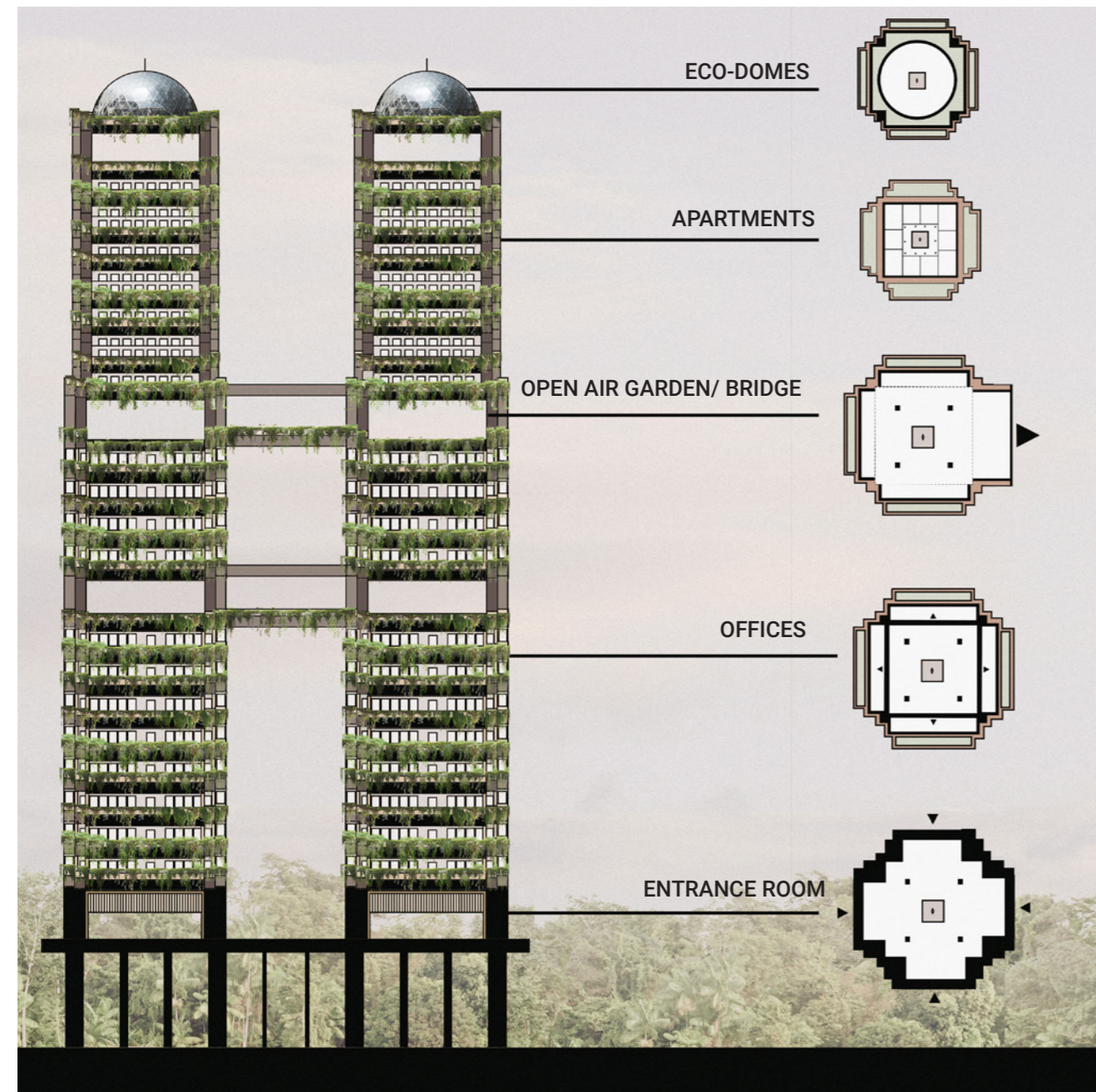
Existing Mature Trees

6,302	400	74	183+125
VEGETATED AREA (M ²)	RESIDENTIAL UNITS	COMMERICAL UNITS	BUILDING HEIGHTS (M)

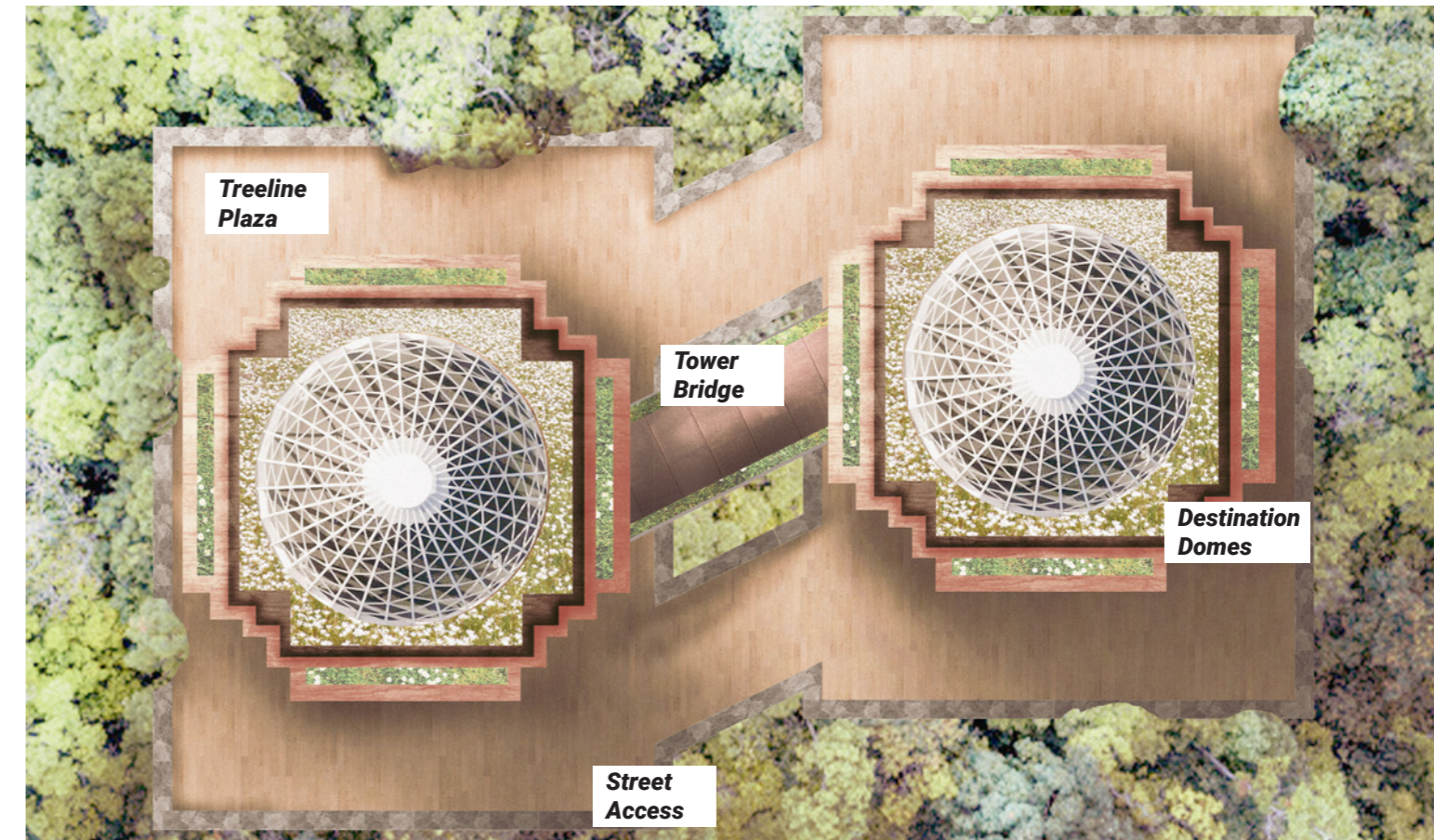


ARCHITECTURE FOR THE FUTURE

A variety of towers are proposed to increase the usability of the site while minimizing the built footprint on the site. However, not only are these towers built on stilts to minimize built footprint, but the structures above seek to provide habitat space and special resources for many species to enjoy.

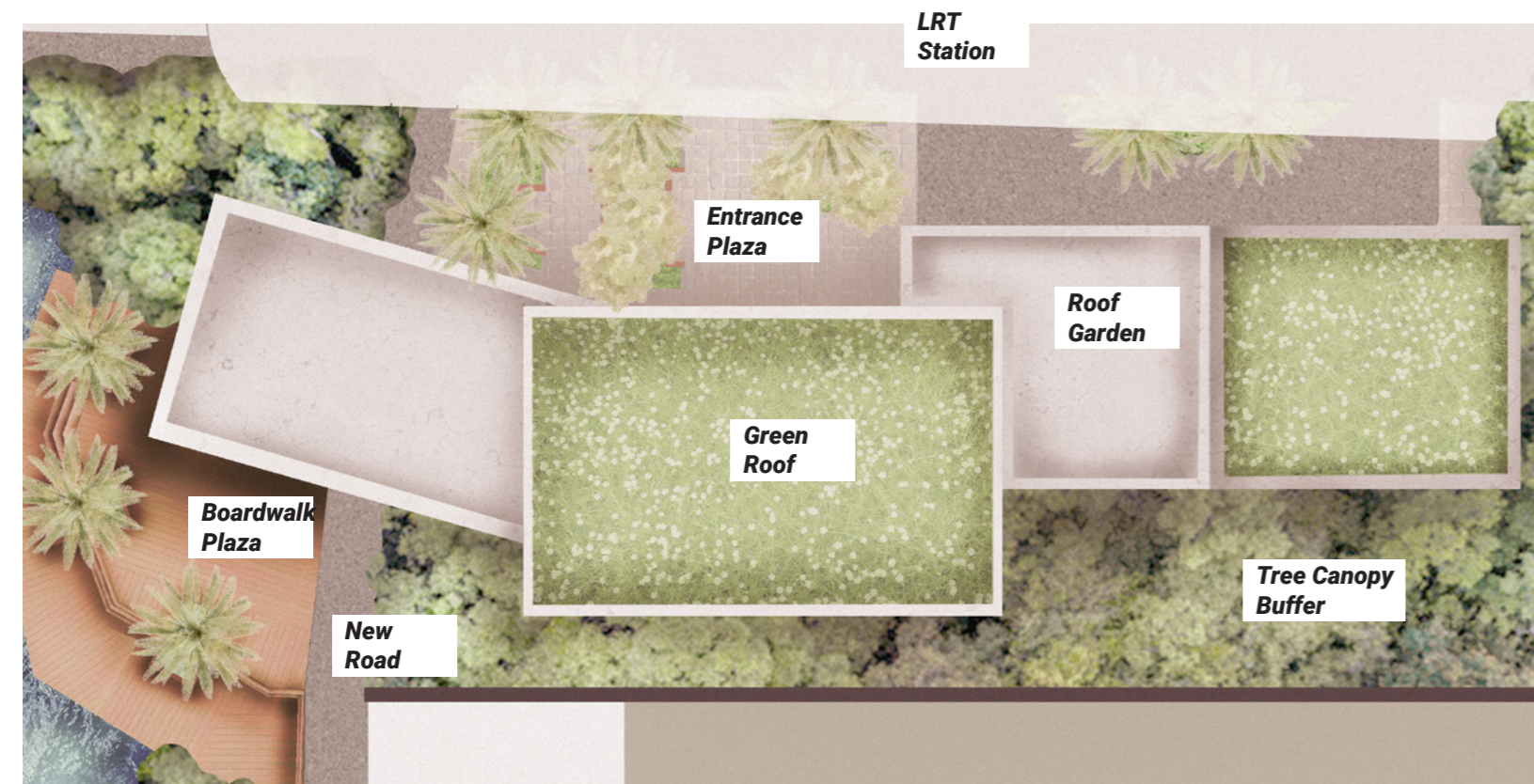


Menara Alam, meaning the Tower of Nature, seeks to provide working space and residential space for human users, but in implementing vegetative habitat on every level, allows for the habitat and ecosystem employment.



MENARA ALAM- Nature Tower

Tiered gardens at different levels of the tower allow for habitat and ecosystem actors to provide services vertically, maximizing the site's ability to employ its positive impact in as little square meters as possible (on the ground level).



Dukuh Atas Towers

The Dukuh Atas Towers are envisioned as a mixed use space that can connect directly to the TOD and many transportation routes connected to the site. By stiling the building above ground level, the building can be passively cooled, provide more vegetative space, and even connect a new road underneath.





Flying Dragons prefer to live in tall and dense tree canopies

These reptiles enjoy eating insects known as pests to people, particularly termites, which would be an asset to have in developed areas

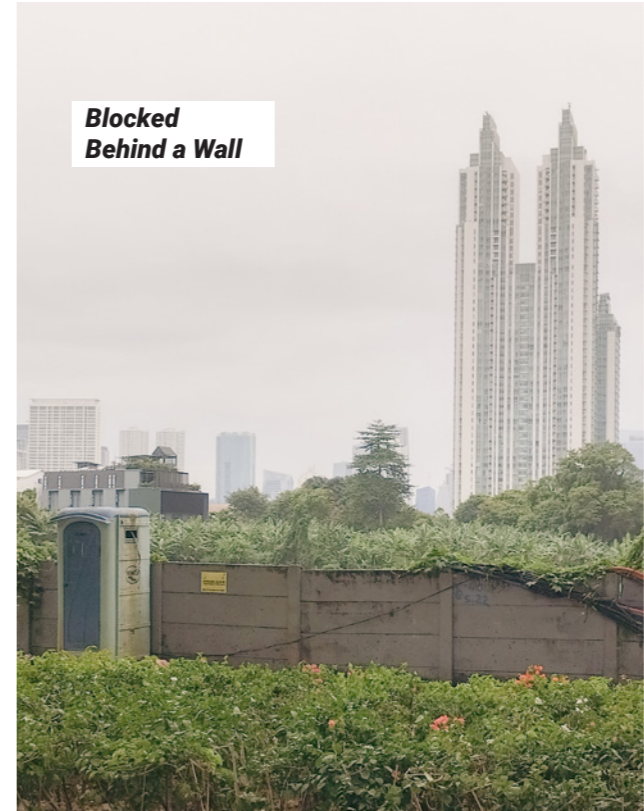
Draco volans
Common Flying Dragon
Cekibar

WILD JAKARTA

An Urban Home for Wildlife

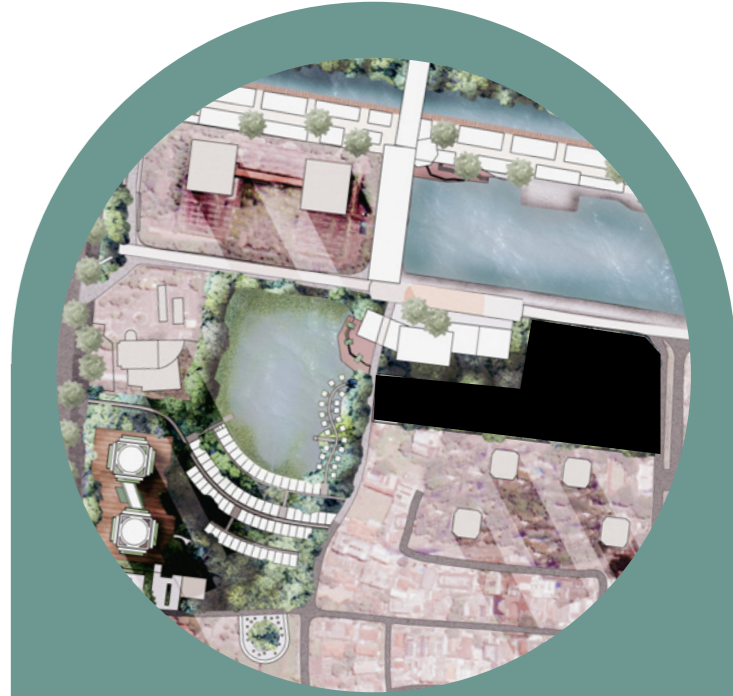


Near the LRT Line



Blocked Behind a Wall

15,276	80	9	4,092
VEGETATED AREA (M ²)	TREE COVER (%)	ANIMAL ENCLOSURES	BUILT FOOTPRINT (M ²)



A BIT OF WILD IN THE CITY

Wild Jakarta seeks to explore how to preserve large scale green space while responding to the financial concerns to support the site. In this design proposal, green space is preserved by developing an NGO wildlife rehabilitation center that will also act as an attraction for guests.



URBAN WILDLIFE REHABILITATION

The main function of the design is to provide enclosures for wildlife rehabilitation. These areas are intended to mimic the surroundings of the natural Indonesian landscape to aid in the rehabilitation of the animals.

EXISTING CONDITIONS



ADDED LAYERS AND TOPOGRAPHY

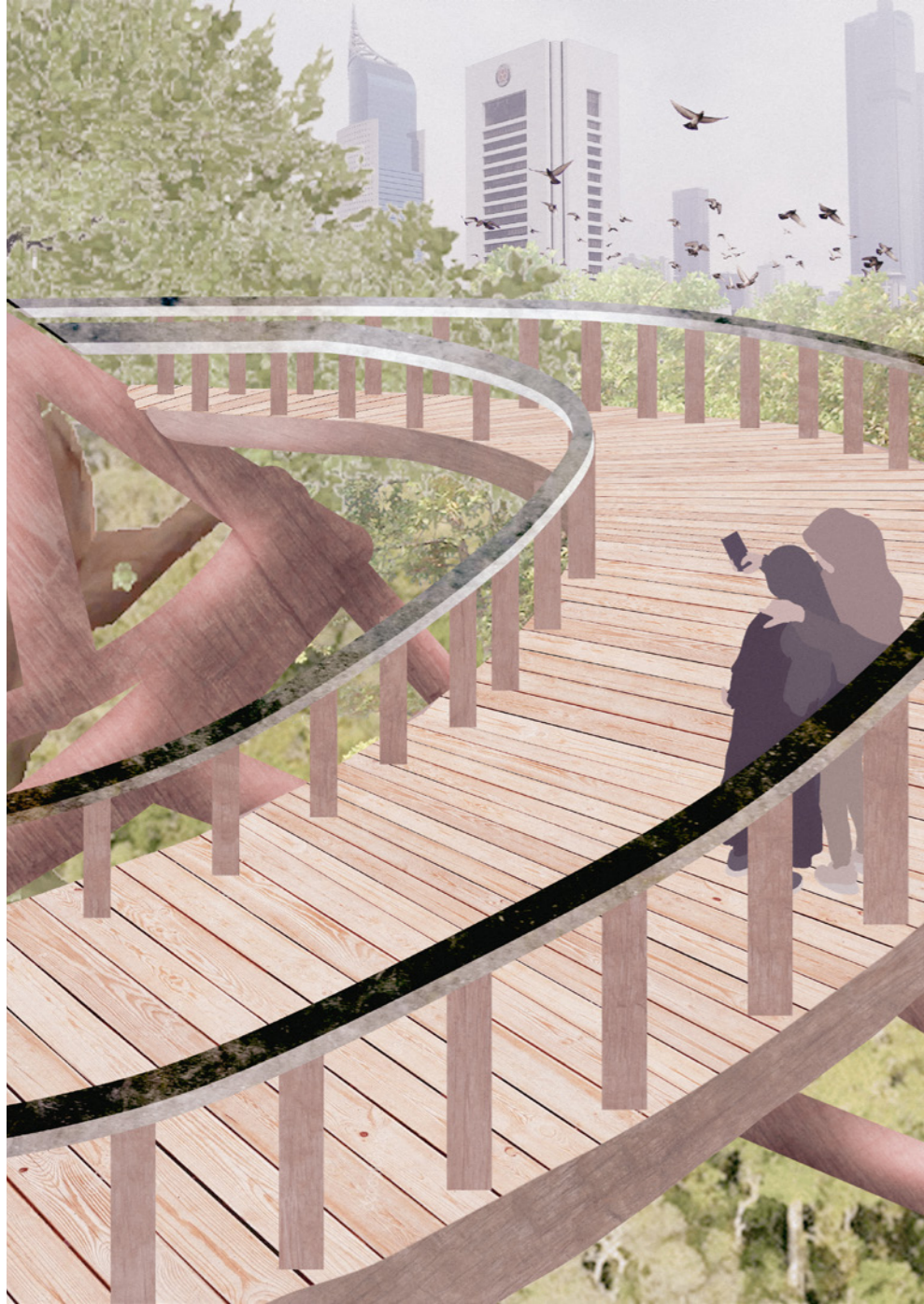


NONHUMAN RESOURCES



UPGRADING URBAN HABITAT

Although the existing habitat is already a thick canopy and already a great asset in terms of habitat and ecosystem employment, adding more vertical layers of vegetation and nonhuman resources can improve the habitat's quality even more.

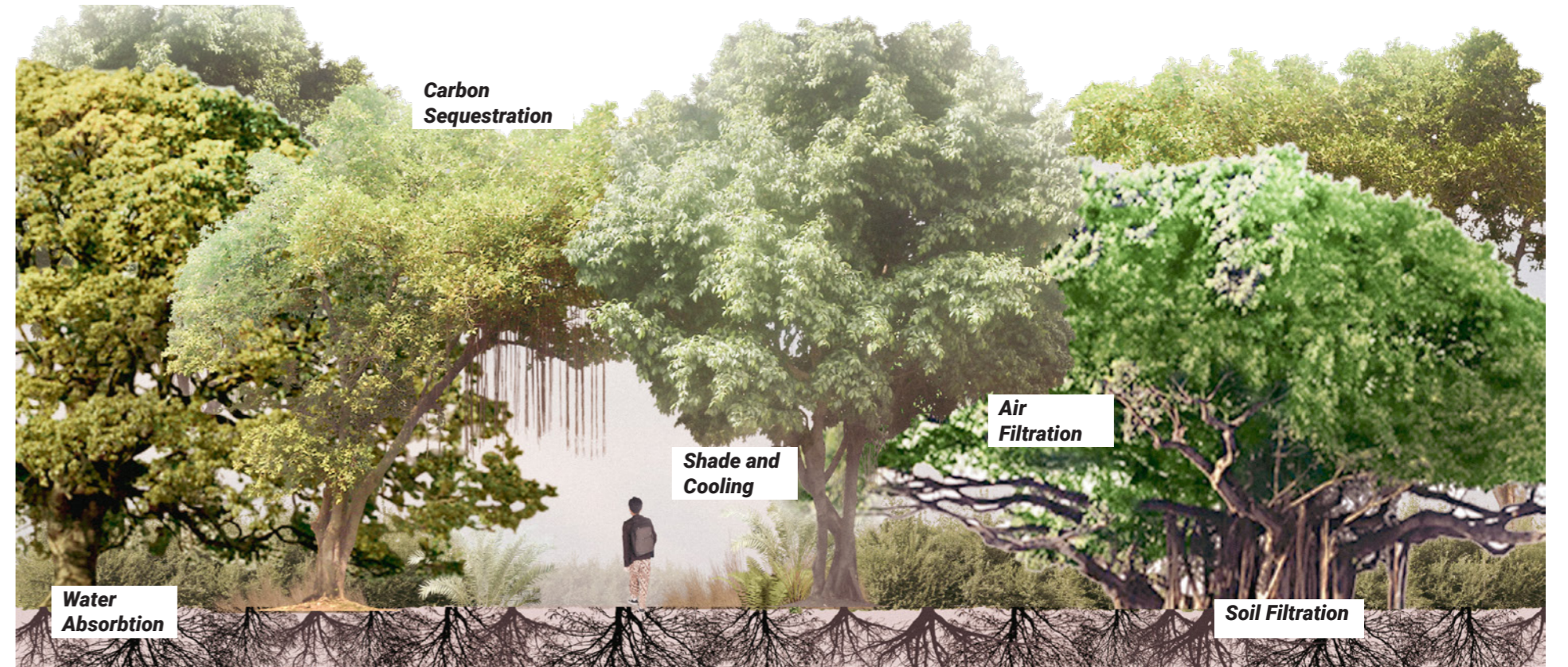


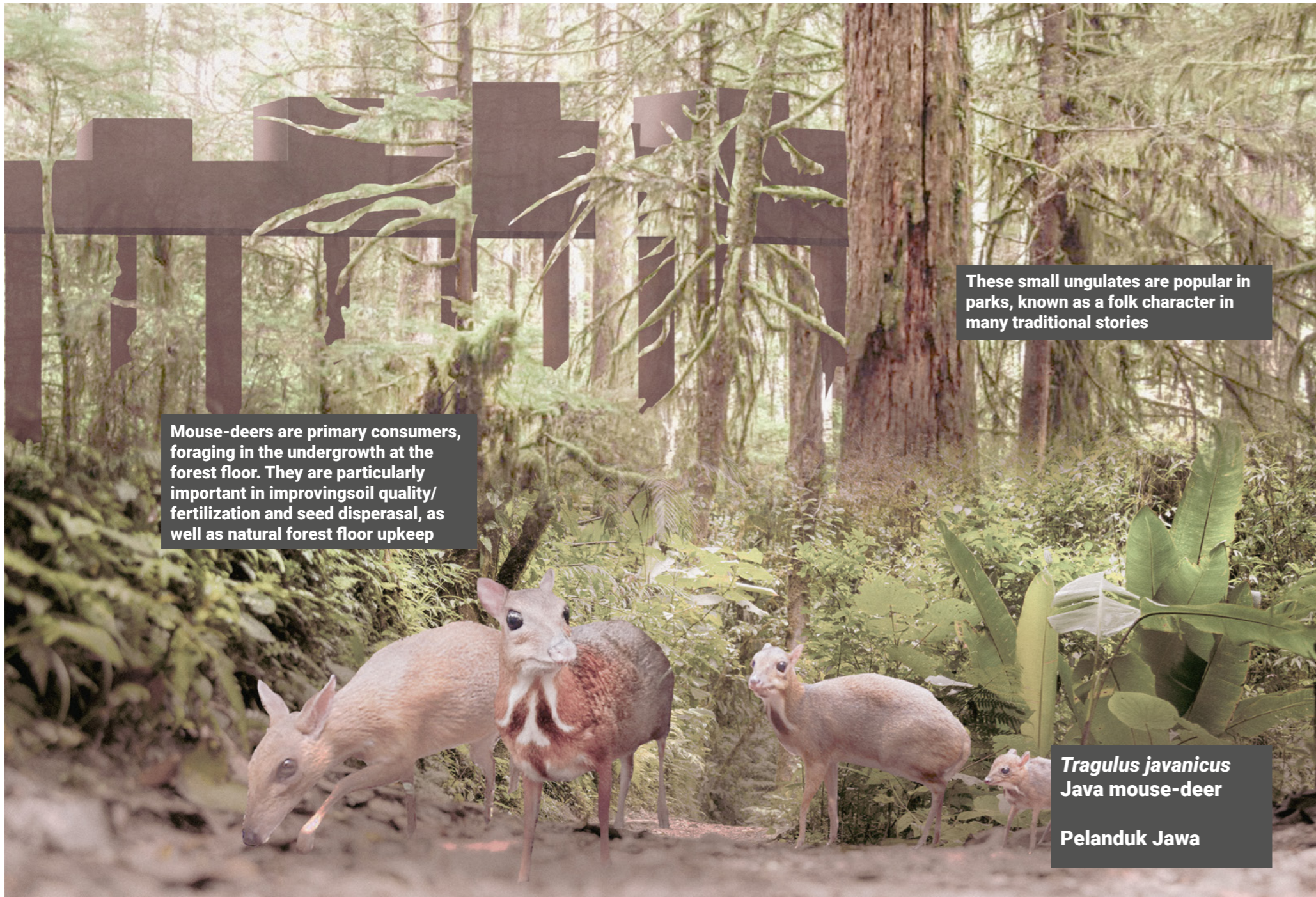
JAKARTA'S HIDDEN GEM

This attraction located in the corner of the masterplan is intended to limit the noise pollution and give some distance from the busy roads to both ease stress on the enclosed wildlife and for a more personal, intimate experience between visitors and the natural features of the park.

HIGH BIODIVERSITY AREA

Because the area's preserved and even upgraded ecological features are present and well-managed on this site, the high biodiversity area will actually be a great asset to the larger urban landscape as its cooling and filtration properties will impact the site and abroad.





Mouse-deers are primary consumers, foraging in the undergrowth at the forest floor. They are particularly important in improving soil quality/fertilization and seed dispersal, as well as natural forest floor upkeep

These small ungulates are popular in parks, known as a folk character in many traditional stories

Tragulus javanicus
Java mouse-deer
Pelanduk Jawa

DUKUH TERAPUNG

A Floating Social Housing Neighborhood

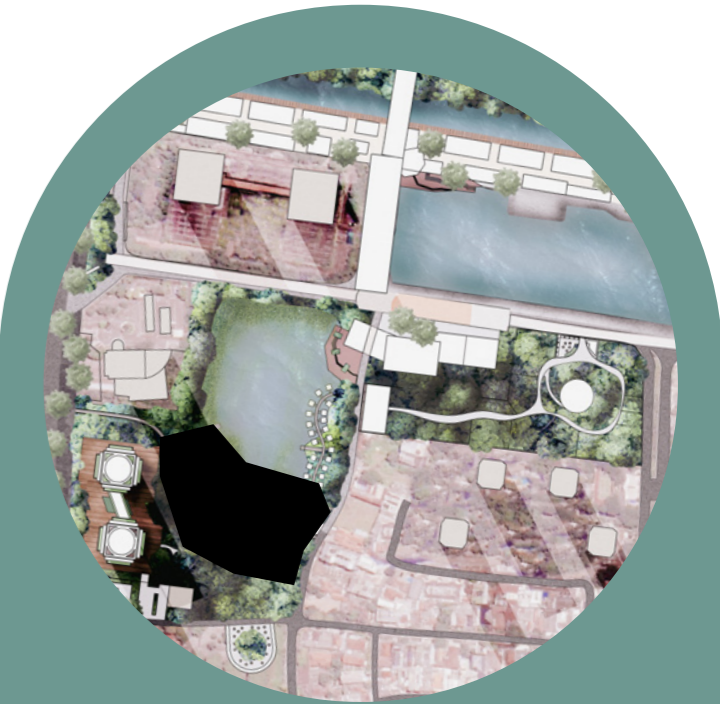


Already-Dense Vegetation



Natural Ponds

15,243 VEGETATED AREA (M ²)	60 RESIDENTIAL UNITS	12 COMMERCIAL UNITS	400 BUILT FOOFPRIENT (M ²)
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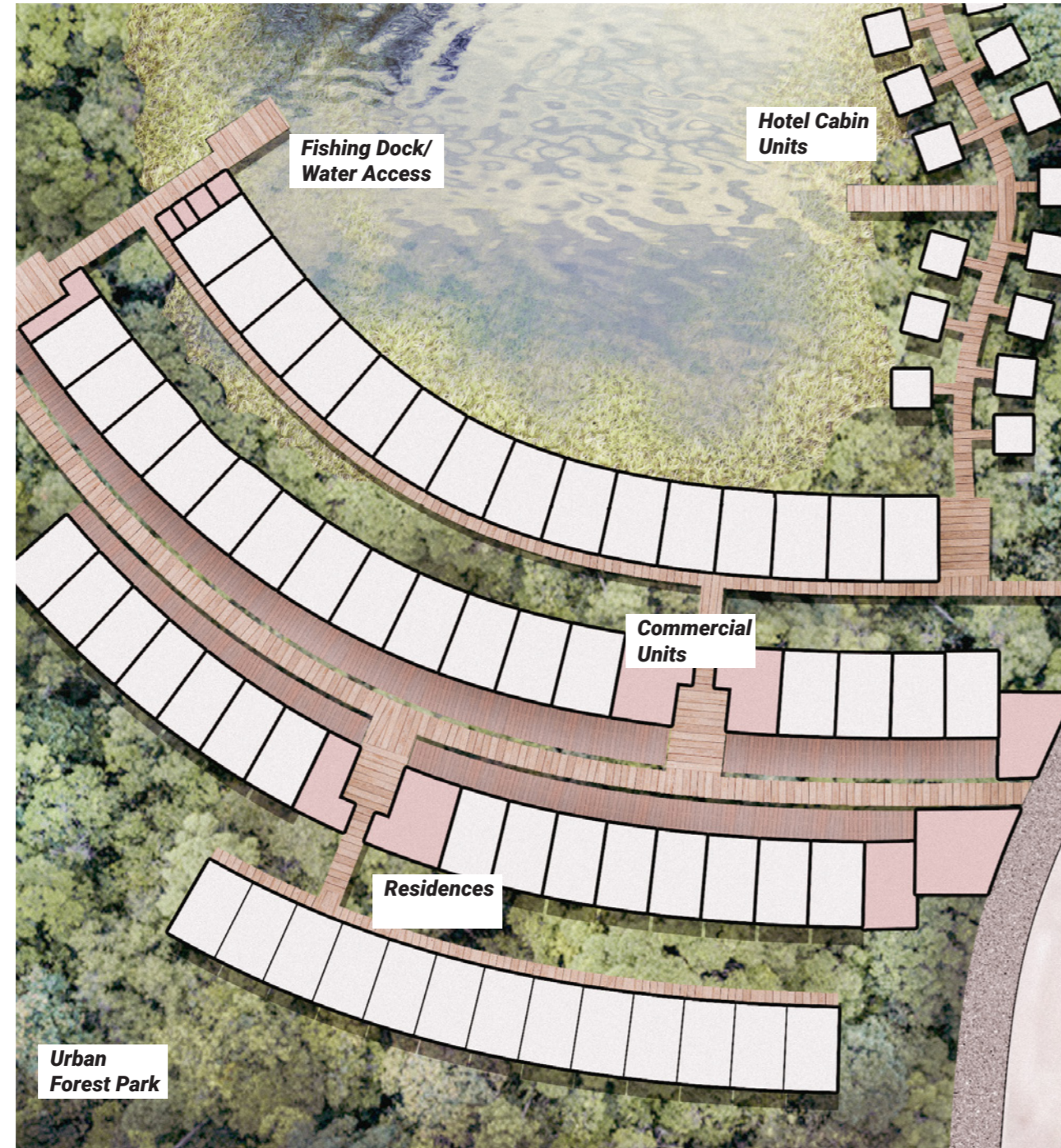


THE VILLAGE ABOVE THE WATER

Dukuh Terapung, or the floating hamlet, is a small residential area that connects to the existing residential area to the southeast of the design area. Built into the tree canopy on stilts, the area embraces the natural landscape and acts as a part of it.

HOUSING WORKING TOGETHER WITH THE LOCAL ECOLOGY

This develop seeks to use the climate as an asset that can support livelihoods as well as provide much-needed housing at the heart of the financial district. More natural materials are chosen to provide more individuality to each home as well as decrease the material impact on the land, On site water collection and solar panels reduce bills for residents and extra power can be used for other areas of the neighborhood.



ECOSYSTEM SERVICES AIDING HOME LIFE

Utilizing the elements of ecosystem services aid the lifestyles and urban experience for residents in the neighborhood. The building along an east-west orientation aid in wind tunneling, shading, and natural cooling.

Stilts are great asset for underneath cooling and flood management, and boardwalk plantings can filter water before entering ground. This will aid

street activities like playing, seating and socializing, vending, exercising, and just hanging out outdoors, a popular activity in the evening.



CHAPTER 12

PROLOGUE

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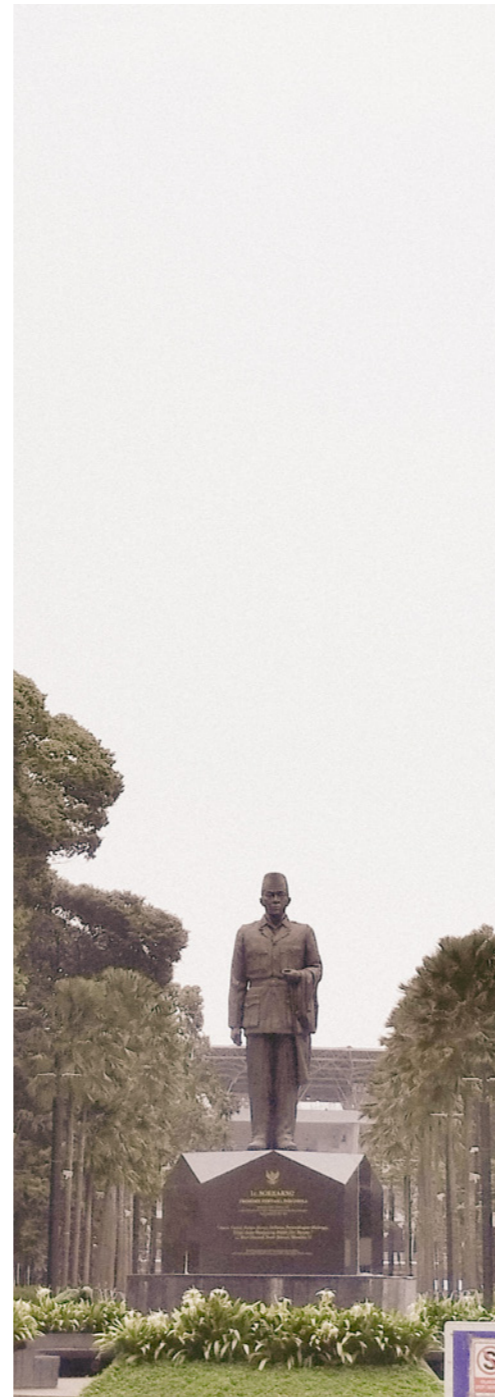
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