
GUANABARA
BAY
BRAZIL

INTRO AND PARTNERS

GUANABARA BAY, BRAZIL

A spectacular city sprawled between mountains and sea, Rio de Janeiro's builtenvironment has been shaped through centuries of resource extraction, producingvarious forms of social and environmental degradation and inequities.

The Studio work was focused on Guanabara Bay, an area at Rio de Janeiro's core and borders, spatializing complex interplays of inter-municipal connection, infrastructural contestation, and socio-environmental recalibration. Once a pristine land and waterscape, Guanabara Bay is now heavily polluted. The species, including Dolphins, that have lived in the Bay for generations are now threatened, with some already extinct. The Bay is no longer a recreational asset to the residents of Rio like it used to be. Communities around the Bay are also suffering from pollution, waste and sewage disposal issues. In the wake of this legacy, while major Brazilian fossil fuel companies
are continuing to expand their extraction and exports, Rio's inhabitants are also beginning to construct robust cultural, economic, and political networks of solidarity, resistance and activism, demanding their right to a healthy environment to live in.

At the scale of the region, with growing global interest in Minas Gerais for mining minerals and lithium needed for green energy transition, Rio holds significant potential to redress sites of industrial exploitation and show ways that energy production andenvironmental protection do not have to be exclusive. At the scale of the planet, Brazil's position as a global leader in climate action, highlighted by its role as host of COP30 in the Amazon nearly 40 years after Rio's COP92, makes the nation, and Rio specifically, a critical site for confronting extractive histories and envisioning reparative futures.

Investigating these material heritages and historical narratives across diverse urban contexts, students worked in collaboration with local stakeholders to explore pathways for repair and regeneration. On the field visit to Rio, Columbia students and faculty engaged with their counterparts from the Universidade Federal do Rio de Janeiro. They also met with CTDUT Technology Research and Development, Transpetro Islands and Refineries, Experts from the Estaleiro Mau Shipyard, residents of Ilha de Concei o
and several local community groups. Student groups analyzed five sites in and around the Bay, paying special attention to the transformative impacts and potentials of Petrobras' oil infrastructure.

Considering the current situation and these practices, student explored the role that urban design and policy envisioning can play in shaping the future of energy, climate, and sustainable symbiosis between species (including humans) and nature.

FEDERAL UNIVERSITY OF RIO DE JANEIRO, FAU

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RIO SITE VISIT HOSTS

CTDUT - Technology Research and Development
Byron, Aldo Cesar Azevedo
Maria Elisa Silva

Transpetro Islands and Refineries
Jo o Luiz Lavoura Correa
Nadine Serra Soeiro Silveira
Felippe Thiago Camilo Reis

Estaleiro Mau Shipyard
Heitor Ciuffo Miro Arantes (CEO)
Ana Larronda Asti (Sub Secretary of Water Resources for the City of Rio)
Luciana Neves Lopes (Environmental Analyst for the Shipyard),
Alte. Walter Lucas da Silva (President of the Navy Technology Cluster)
Douglas Mendon a Soares (Safety Supervisor)

Ilha da Concei o
Nadia Coelho (Resident)
Lagoa Rodrigo de Freitas - Mangrove Restoration
Mario Moscatelli (Biologist)

Guanabara Bay - History and City
Bruno Amadei

Museum of Modern Art - Rio - Formas das guas
Paula Correa

SEMINAR SPEAKERS

Washington Fajardo, InterAmerican Development Bank
Tatiana Castelo Branco, Rio City Hall
Anne Heloise, Brazilian Center for Climate Justice
Thaynara Fernandes, Brazilian Center for Climate Justice
Maria Clara Salvador, Brazilian Center for Climate Justice
Thiago Soveral, World Bank
Ana Duran, Yale University
Martin Dietrich Brauch , Columbia Center for Sustainable Investment
Stephanie Smith, Industrial Mining Response Santa Cruz County
Rob Pitman, Natural Resource Governance Institute
Kira Akerman, Hollow Tree
Tori Bush, The Climate Museum
Priscila Coli, UC Berkeley
Ana Lucia Britto, UFRJ

LANDSCAPES OF REPAIR RIO ROUNDTABLE

Participants
Brazil Ministry for Environment and Climate Change
Casa Fluminense
Brazilian Center for Climate Justice
CEBRI (Centro Brasileiro de Rela es Internacionais)
Columbia University Center for Sustainable Investment
Columbia GSAPP Urban Design
Columbia, Climate School
Columbia University Rio Global Center
Instituto de Arquitetos do Brasil
Instituto Decodifica
Yakara'na and P.A
Rio City Hall - International Secretariat
Rio City Hall - Planning Secretariat
UFRJ, PROURB

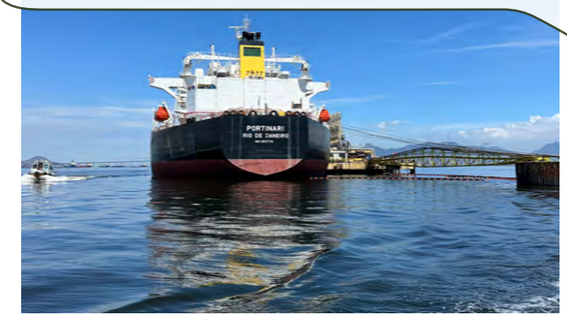
SITE VISIT DOCUMENTATION & AGENTS OF CHANGE

"We see the mobility system not just as a tool for efficiency but as a means to make the city healthier, more walkable and vibrant." - Students

"Dramatic change from self-sufficient fishing communities to struggling, polluted environments"

"People of Rio are living a drastically different reality – catastrophic events such as explosions, oilspills, severe storm surges, and flash floods are frequent and becoming more and more severe"
- REDUC Team

"The fishermen do not have far to look for the cause of their village's demise. They, too, know that the bay is not the problem but the consequence. The problem comes from the river".
- Gilson Alvarenga | Guanabara Bay fisherman of 30 years | NYC Times



ROUNDTABLE WORKSHOP

Earth Studio Roundtable as held on March 20th, 2025, at Instituto de Arquitetos do Brasil - Rio de Janeiro (IAB-RJ). This roundtable explored the relationship between existing petrochemical extraction and processing in the Guanabara Bay and its relationship to the energy landscapes of the future, resilience, and climate justice.

- Articulate the overlay between mitigation and adaptation in Brazil in advance of COP30
- Foster dialogue between students, faculty, policy makers, and the private sector
- Place corporate, policy, academic, and climate action in conversion to ground truth assumptions, particularly related to cities and the built environment
- Support on-ground planning and project efforts in Rio related to the Plan for Sustainable Development and Climate Action

STAKEHOLDER SPEAKERS AND PRESENTERS

DANIEL MANCEDO
RIO CITY HALL

L A REICHERT
CEBRI

KAYO MOURA
DECODIFICA

ARIANE EVALD
UFRJ

THAIS BATISTA
CEBRI

TATIANA C. BRANCO
RIO CITY HALL

ALEXANDRE PESSOA
UFRJ

THAYNARA FERNANDES
CBJC

MARTIN BRAUCH
COLUMBIA G. CENTER

TOM TREBAT
COLUMBIA G. CENTER

LARYSSA NUNES
COLUMBIA G. CENTER

ENERGY PAST AND PRESENT

MUNICIPAL POLICY AND REGIONAL CONTEXT

Despite Rio's ambitious climate commitments, including carbon neutrality by 2050 and a 20% GHG reduction target by 2028, a critical governance gap threatens progress. While Rio maintains a permanent environmental team and conducts annual GHG inventories, the discussion revealed that surrounding municipalities lack both technical capacity and integrated planning.

This fragmentation creates a patchwork of policies where the state of Rio and many municipalities operate without comprehensive environmental plans, inventories, or adaptation strategies.

This governance challenge is compounded by competing jurisdictions, with energy regulation divided across federal, state, and municipal levels. The resulting disconnect means that critical vulnerabilities—such as sea level rise affecting petrochemical infrastructure—remain unaddressed.

COMPETING PRIORITIES: BASIC NEEDS V. ENERGY TRANSITION

A fundamental tension emerged between long-term energy transition goals and immediate community needs. Brazil's structural issues often overshed the discussion of topics such as energy transition. This perspective was reinforced by community representatives who emphasized how energy (particularly gas) affects mobility, access, and daily life. The discussion revealed how extractive industries often control essential resources and the complex relationship between extraction, power, and basic services.

Brazil's energy context differs significantly from global norms. While energy typically dominates global emissions, in Brazil it comprises only 18%, with land use and forestry being the primary contributors. This creates a different calculus for transition priorities and timelines, especially given the economic importance of oil exports to Brazil's GDP and municipal economies.

NEW ENERGY FUTURES

"JUST TRANSITION" IN BRAZILIAN CONTEXT

The discussion challenged conventional understanding of just transition, with participants arguing that energy transition plans must include job creation strategies to be viable. This acknowledges the reality that in Brazil's economically vulnerable regions, environmental objectives cannot be separated from economic security.

The conversation expanded beyond employment to include community agency in decision-making. Participants emphasized that sustainable solutions must be developed collaboratively with affected communities rather than imposed from above, recognizing that marginalized communities need meaningful involvement for transitions to be both just and effective.

THE HIDDEN COSTS OF "CLEAN" ENERGY

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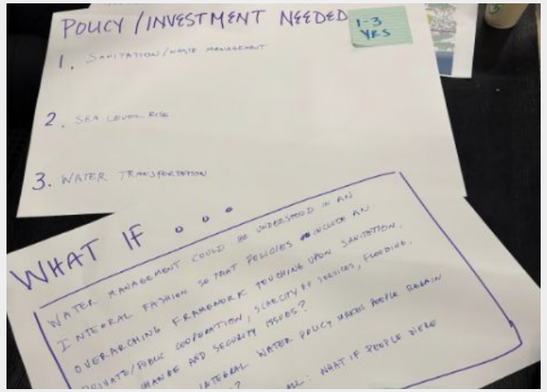
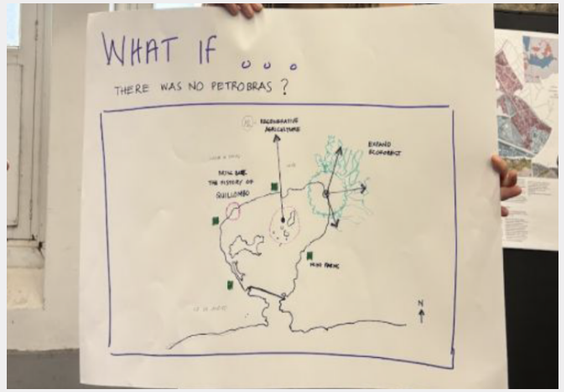
FINDINGS | DESIGN AND CLIMATE ACTION WORKSHOP

A design visioning workshop challenged participants to envision Guanabara Bay's future across different time frames. Groups tackled distinct temporal horizons that reflect climate change projections, political moments, as well as infrastructure and asset life cycles.

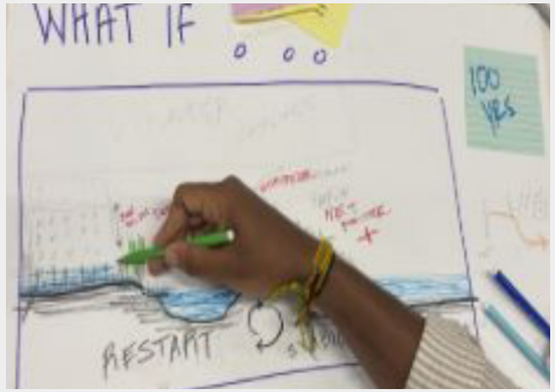


1 -3 YEARS
Leading up to COP30 and Brazil's National elections



20 YEARS
Petrochemical facility maintenance cycles

50 YEARS
Transition mineral supplies projected to have more than doubled and pre-salt oil supply is past peek



100 YEARS
100-year climate impacts of potentially surpassing 1.5 C average warming.

What if climate change and security considerations were addressed simultaneously?

- Sanitation/waste management, sea level rise adaptation, and water transportation systems.
- Integrated water management within an overarching framework that could coordinate policies across multiple dimensions—connecting sanitation infrastructure with climate change response, public-private cooperation, and security concerns.
- Water policy as a shaper of public trust in government and whether the voices most affected by environmental decisions are truly being heard in the lead-up to COP30 and Brazil's elections.

What if sea level rise and asset upgrades were used to cycle in regenerative systems and reduce risk?

- Regenerative agriculture, circularity/circular economy initiatives, and decentralization, with ecotourism as a comple mentary focus area.
- Reference the history of Quilombo communities and proposing to expand eco forests
- Model post-petroleum land use that can revitalize the bay's ecosystem and create sustainable economic alternatives.
- Prototype decentralized development models to transition petrochemical infrastructure to regenerative systems

"Most municipalities don't have technical knowledge or personnel to join projects and develop future solutions."

"The sea level rise is something not really taken into consideration for petrochemical industries."

"Where there's water, there's Petrobras."

Nature as Industry? What is oil could no longer be king in Rio's industrial economy?

- Acknowledges the dual challenges driving this future—energy transition and resource depletion
- Emphasize the importance of maintaining economic stability through a deliberate reimagining of how wealth is generated and distributed.
- Scale biodigesters and nature-based technologies, creating ecological edges around Governor's Island and developing a new EPA near UFRJ
- Invest in community education and workforce development

Radical Reimagining? What if we understood we were all one species that was only a small part of the ecosystem?

- Transformative "restart" built on principles of symbiosis, balance, and dynamic equilibrium between human systems and natural processes
- Adaptation structures with restored wetlands
- Policy frameworks are legally binding, environmental education becomes necessary
- Industries collaborate, and engineers work alongside social scientists.
- Human rights and basic needs guaranteed through nature-designed solutions.

"There's a lack of integration between environmental policies across the state, with each municipality operating independently."

"An energy transition plan without a job transition plan is not possible."

"The transition to electric vehicles and solar panels is creating new extraction frontiers in Brazil with impacts that disproportionately affect indigenous communities and biodiversity hotspots."

CLIMATE x DESIGN FRAMEWORK

GRAMACHO

Waste to Value:
Decentralizing Waste Management In Rio De Janeiro's Disputed Territories

REIMAGINE BRIDGING KNOWLEDGE AND FINANCE

REARTICULATE LABOR AS INFORMATION

REDUC

REDUC REDUX
Rethingking Energy: Decarbonizing & Uniting Communities

REPURPOSE LESS STRANDED, MORE ASSET

REINVENT PETROCHEMICAL TRANSFORMATION

Oil Archipelago

New Archipelago
A Vision For The Islands Of Gunabara Bay

RETHINK URBAN FOREST KNOWLEDGE

Ilha do Governador

Guanabara Bay: Ecotones of Repair
Multiplying, Diversifying & Complexifying The Edges

RETHYTHM POLICY AS ECOSYSTEMIC

RECIRCULATE ISLANDS AS CIRCULAR

Ilha da Conceição

From Wrecks To Wonders
Reclaiming Shorelines, Enriching Communities

RECLAIM CIRCULAR INCENTIVES

Downtown Niteroi

Connecting Niteroi: A Multiscalar Response
A New Urban Mobility Framework To Reduce Heat, CO2 Emissions & Social Fragmentation

REFRAME COLLABORATIVE KNOWLEDGE

REPARATE PROFIT AS A PLATFORM

Guia de Pacobaiba

Duque de Caxias

Ilha do Fundão

Centro

São Gonçalo

Estação Ecológica da Guanabara

Icaraí

Copacabana

Rocinha

Itaipuaçu

Guanabara Bay

N

Spacial Visions

Cimate Policy Provocations

UD Studio Sites

NITER I

GUANABARA BAY, BRAZIL

Spatial Visions

NITER I, BRAZIL

CONNECTING NITER I: A MULTISCALAR RESPONSE

A NEW URBAN MOBILITY FRAMEWORK TO REDUCE HEAT, CO2 EMISSIONS, AND SOCIAL FRAGMENTATION

Diana Cecilia Fernandez-Borunda
Yu Lin (Rachel) Hsu
Yujeong Rhee
Jinxian (Jessie) Yang

WHAT IF WE DON'T HAVE TO RELY ON CARS?

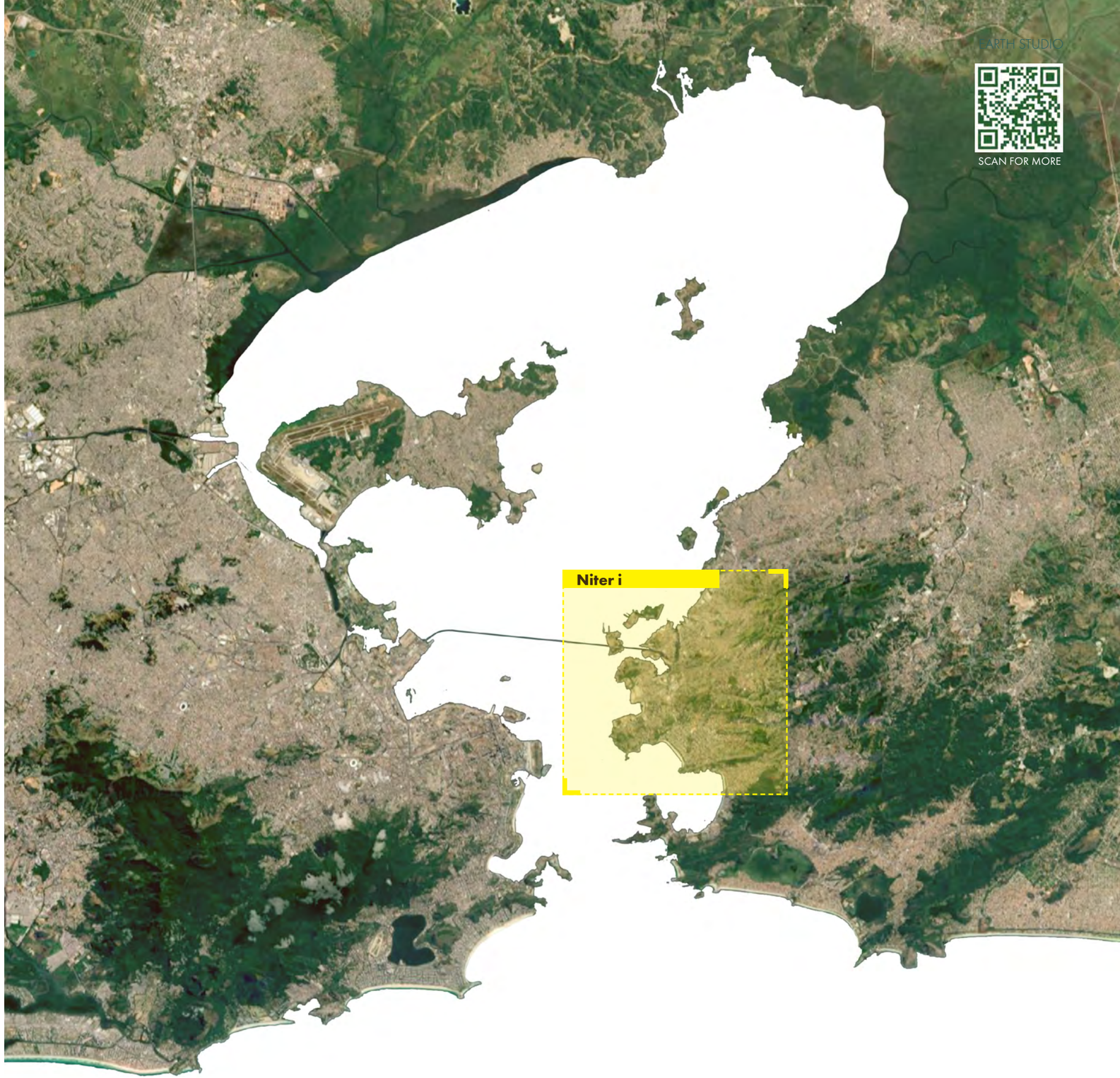
Niter i's urban expansion, catalyzed by its bridge to Rio de Janeiro, has stimulated rapid growth while deepening dependence on Rio's economy and transport.

This reliance has bred complex urban challenges: chronic congestion, heat islands, reduced walkability, and rising public health concerns.

Our project responds with multiscale solutions that include master planning, urban design, and architectural interventions to transform mobility networks and reinterpret infrastructure.

By shifting focus from car-based systems to integrated, mass transportation strategies, we aim to alleviate spatial discomfort and support a just transition to renewable energy.

This reimagined urban framework fosters autonomy, resilience, and a healthier, more connected Niter i.



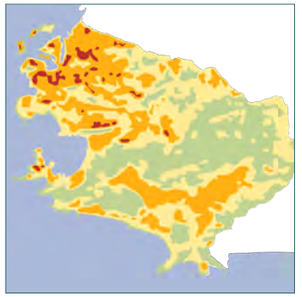
01 | Background

Before the Rio–Niter i Bridge was constructed, people had to either drive five hours from Rio to Niter i or take a 20-minute ferry ride. This led to the question: What if we could drive there in just 20 minutes? The Rio–Niter i Bridge was eventually completed in 1974.

This beginning also signaled Niter i's growing dependence on private cars and buses. The bridge accelerated the city's development, but the heavy reliance on private vehicles shaped an urban plan centered around cars. As a result, people lost their culture of walking and living actively in the streets.

02 | Design Strategies

Ferry usage decreased after the bridge constructed



The reliance on cars has led to urban heat island effect

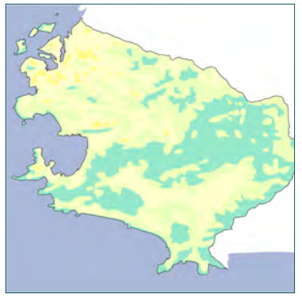
Some areas are not served by the bus system

By elevating the experience and increasing Ferry routes

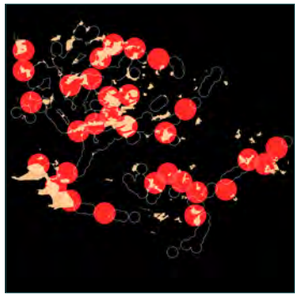
By redesigning the streets, replacing asphalt with green cover

By reimagining bus stop as unit of change

The goal is to maximize the opportunity to move, and minimize the need of moving



Walkable and livable streets to cool the city

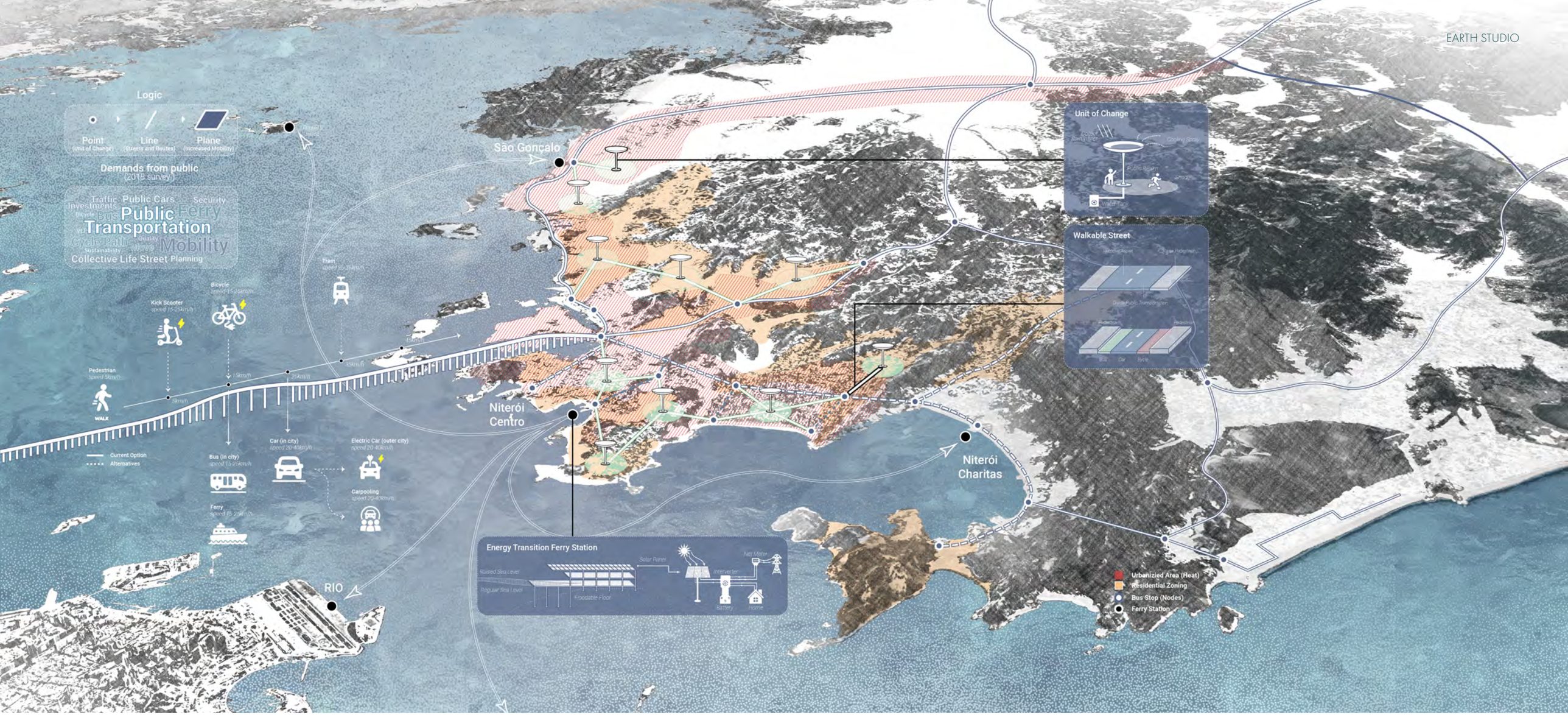


Attractive and multifunctional bus stops can serve more people

point

line

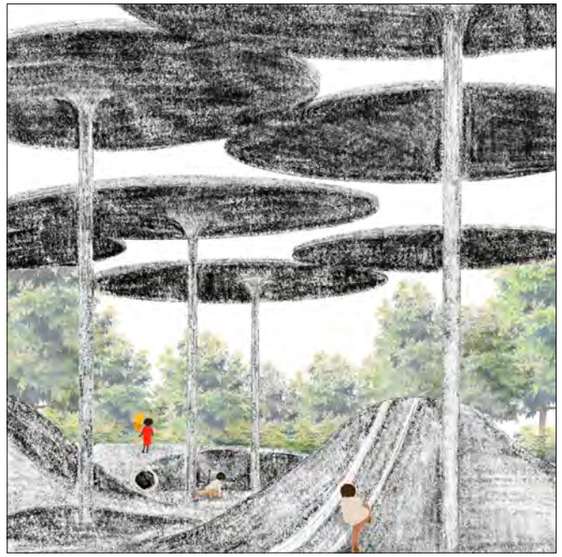
plane

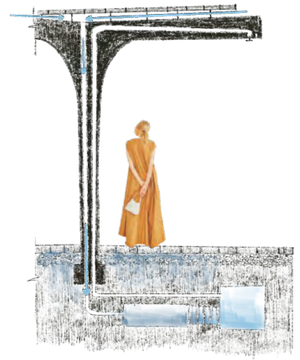


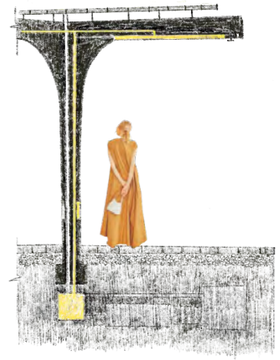
03| System Map and the New Street life

This system diagram illustrates how we plan to implement the previously mentioned strategies in the context of Niter i.

From umbrella-shaped bus stops to rethinking street layouts, adding new ferry routes, and elevating ferry stations, we propose multiscalar design strategies and thinking to push transportation beyond mere efficiency. By reducing car usage and turning streets into active parts of urban life, transportation can become a system for energy transition and contribute to mitigating the urban heat island effect.





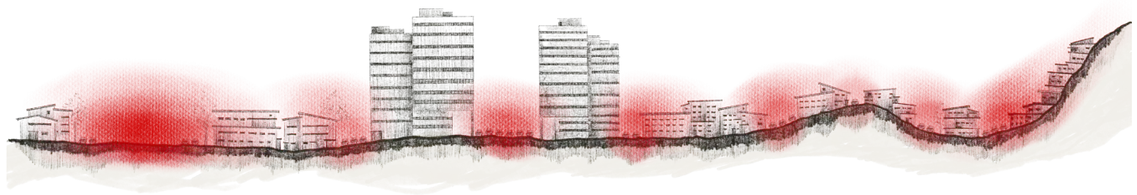


04| Unit of Change

As we walked through the streets of Niter i, the combination of intense sunlight, heat radiating from the asphalt, and lack of shade made the city feel much hotter than it actually was.

This experience shaped the core of our bus stop design, which prioritizes providing shade and thermal comfort. But beyond its basic function, we envision the bus stop as a multifunctional space—one that can serve as a small library, a playground, or a gathering spot for the community.

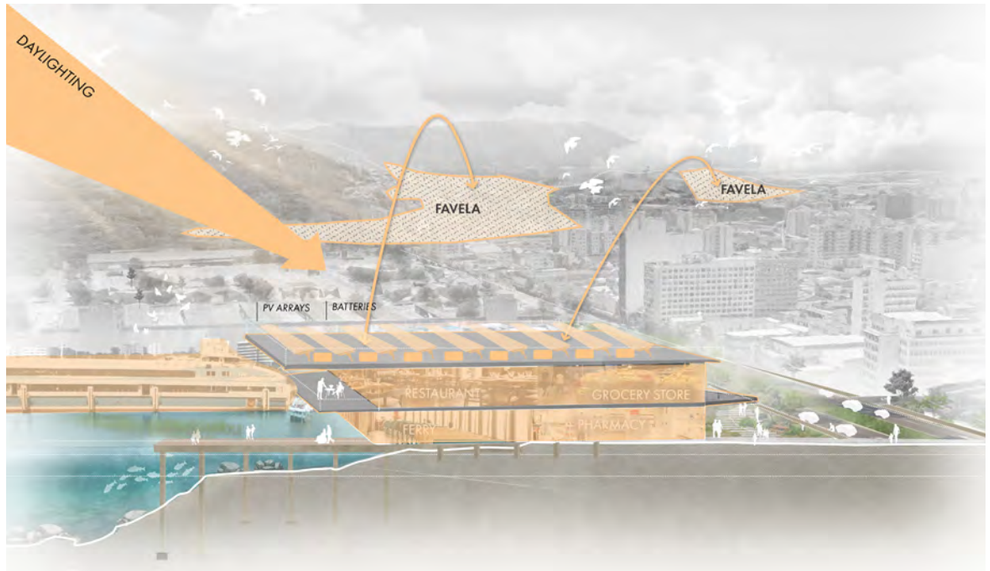
It is also designed to collect rainwater for cooling sprays during hot days and harness solar energy to power lighting, making it both climate-responsive and socially inclusive.



05| Walkable Streets

We envision the streets of Niter i not just as corridors for vehicles, but as active and inclusive urban spaces that support everyday life. To achieve this, we propose reducing the amount of asphalt-covered surfaces, increasing green coverage to improve environmental quality, and integrating public transportation systems powered by clean energy.

Our goal is to transform the street into a space centered around people rather than cars. By prioritizing pedestrians, greenery, and sustainable mobility, we aim to create a healthier and more livable city. Streets should serve as places for community interaction, leisure, and daily activities, instead of functioning solely as routes for traffic.

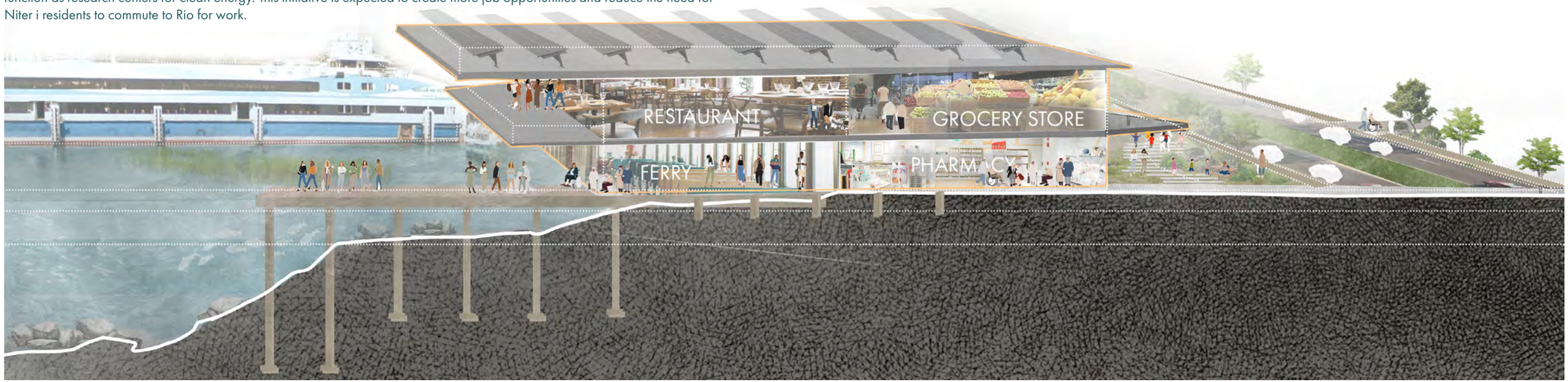


06| Ferry Station

Our design concept for the ferry system is: "Maximize the opportunity to move, and minimize the need to move."

Ferries are more eco-friendly and ferry stations can be closer to communitites. In addition to expanding ferry routes, we aim to enhance the functionality of ferry stations by integrating services such as pharmacies, grocery stores, and cafes. By making ferry stations a part of everyday urban life, we hope to encourage more residents to use the ferry.

Furthermore, the ferry stations will serve as key hubs for the energy transition. They will not only collect renewable energy but also function as research centers for clean energy. This initiative is expected to create more job opportunities and reduce the need for Niter i residents to commute to Rio for work.



SARAPU

GUANABARA BAY, BRAZIL

Spatial Visions

SARAPU RIVER, RIO DE JANEIRO

WASTE TO VALUE

DECENTRALIZING WASTE MANAGEMENT IN RIO DE JANEIRO'S DISPUTED TERRITORIES

Bria Miller / Dolyagritt Wonggom / Tzu-Yu Jason Huang/ Xinyu Zhang

WHAT IF WE DESIGNED AN URBAN FRAMEWORK THAT HELPED FACILITATE MULTILATERAL EFFORTS TO ADDRESS RIO'S WASTE CHALLENGE, USING THE SARAPUI RIVER AS A PILOT?

Rio de Janeiro's waste crisis is defined by the hyperaccumulation of waste in landfills and waterways, intensified by a hybrid system of governance in which militia control coexists with the state. These armed territorial groups shape everyday life by seizing land and monopolizing essential services such as water, cooking gas, and internet access.

Waste to Value moves from top-down models of waste management, instead proposing a neighborhoodbased, decentralized, and malleable urban strategy that reimagines waste as the engine for social, economic, and environmental transformation. By empowering people to serve as the infrastructure of this alternative system, the project builds collective capacity to challenge extractive powers and reclaim agency and stewardship over their lived environment.

Using the Sarapu River as a pilot site, its design adapts to local power dynamics, employing varying degrees of visibility and embeddedness depending on the intensity of territorial control in neighborhoods along the river.

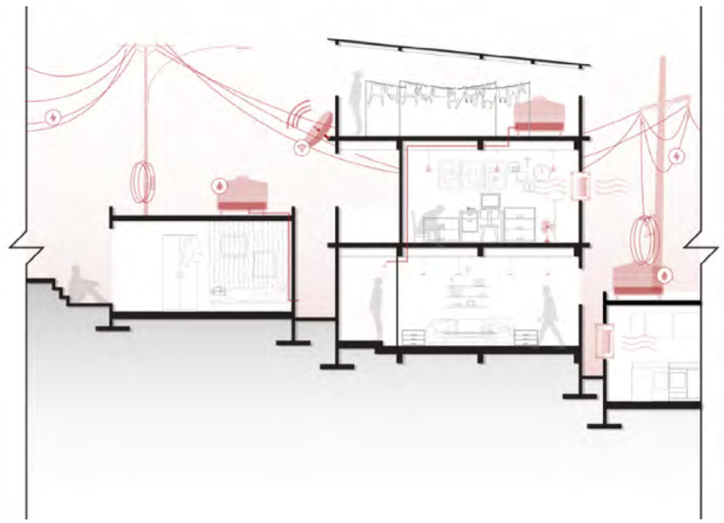
01 | Mapping Power and Pollution

02 | Lived Experiences

Militia control may be invisible to outsiders, but for many, it shapes daily life. This proposal centers the lived experiences of those in contested territories, examining how these forces impact urban space and quality of life.

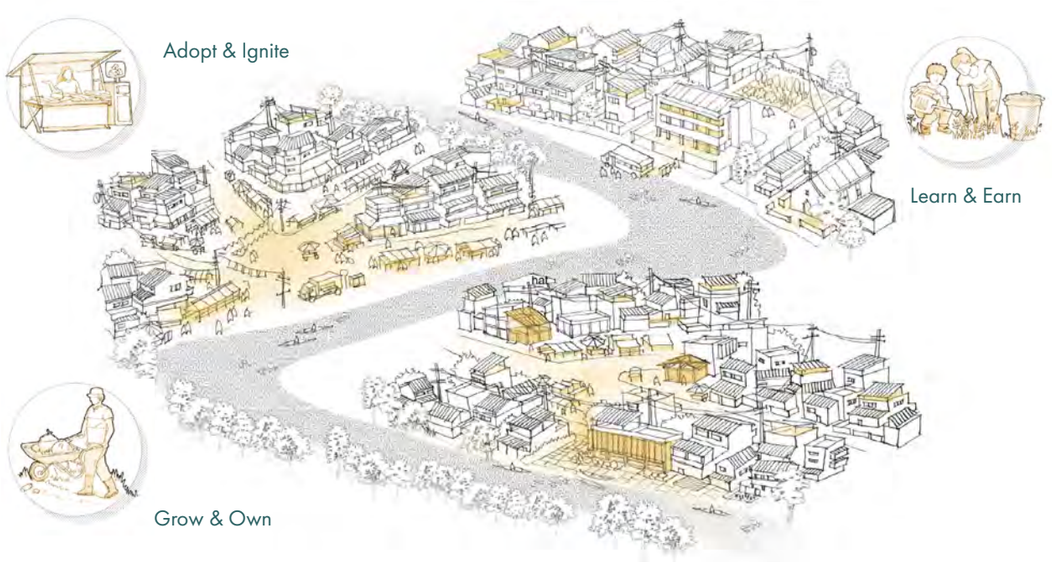
03 | History of Ecotones

Map shows snapshot of GIF which animates how territorial boundaries are not fixed, but rather fluid, necistating an approach that deploys varying levels of visibility and degree of fluidy as bournaries are constantly negotiated and in flux.



04 | Under the Veil

The section highlights the pervasiveness of militia control over critical infrastructure such as electricity, water, internet, and cooking gas.



01 | A Multi-Scalar and Multilateral Framework

02 | Building Power at the Household Scale

03 |Neighborhood Activation

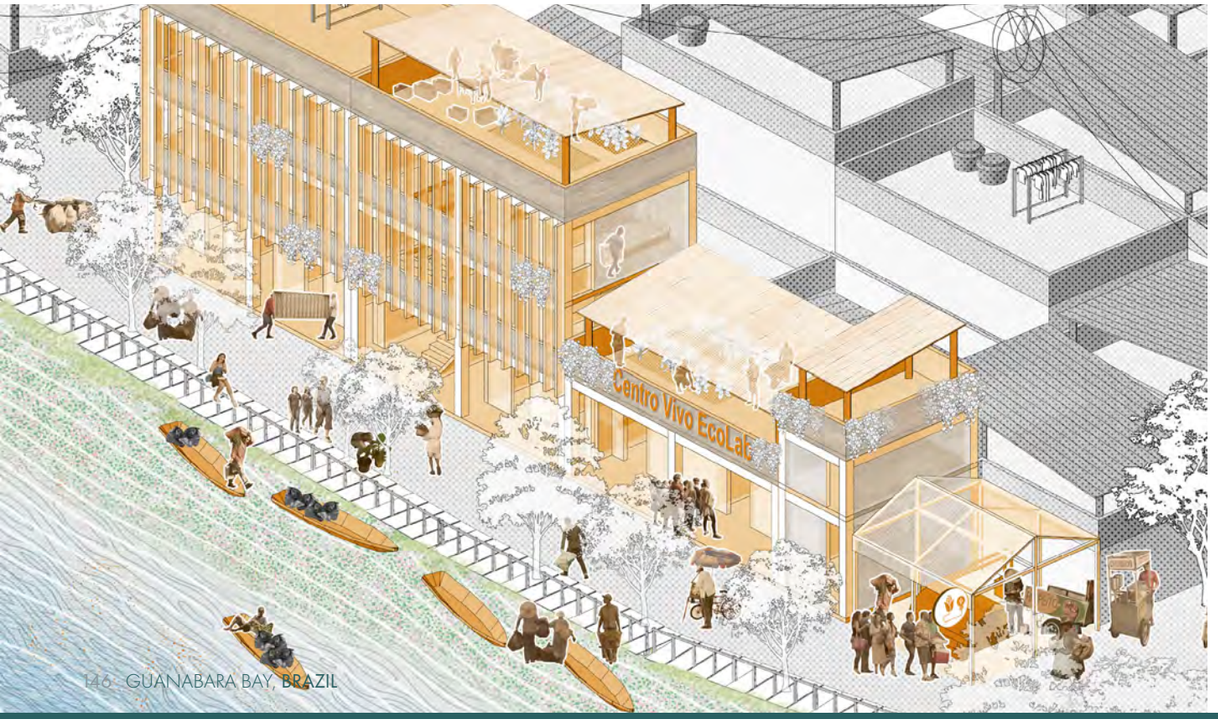
01 |Commercial Corridor as Catalyst

01 | Community Kitchen

One of three pillars in our “Green Waste Ecosytem”scenario, a community kitchen fosters a neighborhood-scale food economy and showcases the value ofrepurposing organic waste into local, healthy food options.

02 | Training Center

Another pillar of the “Green Waste Ecosystem,” the training center offers workshops, tools, and community space to anchor sustainable initiatives in the neighborhood. It connects directly with the EcoLab Residency Center (pictured below), a year-round program supporting river clean-up efforts.



ILHA DO GOVERNADOR

GUANABARA BAY, BRAZIL

Spatial Visions

RIO DE JANEIRO, BRAZIL

GUANABARA BAY: ECOTONES OF REPAIR

MULTIPLYING, DIVERSIFYING AND COMPLEXIFYING THE EDGES

Octave Bourgeois / Yasmina Hamdan / Megan Haralovich / Penny Lee

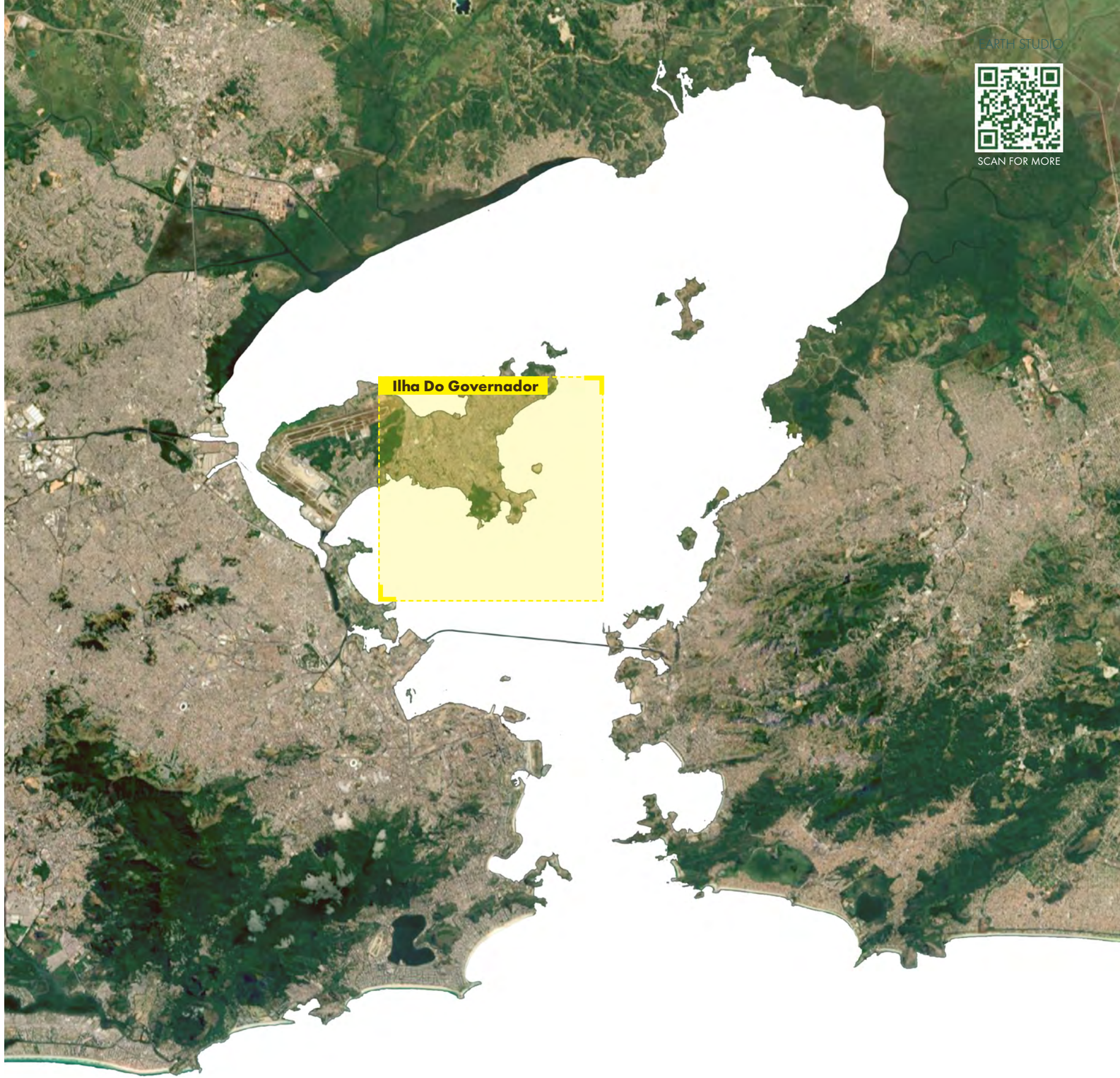
WHAT IFWE RESTORE, MULTIPLY, AND DIVERSIFY THE ECOTONES TO REPAIR THE BAY?

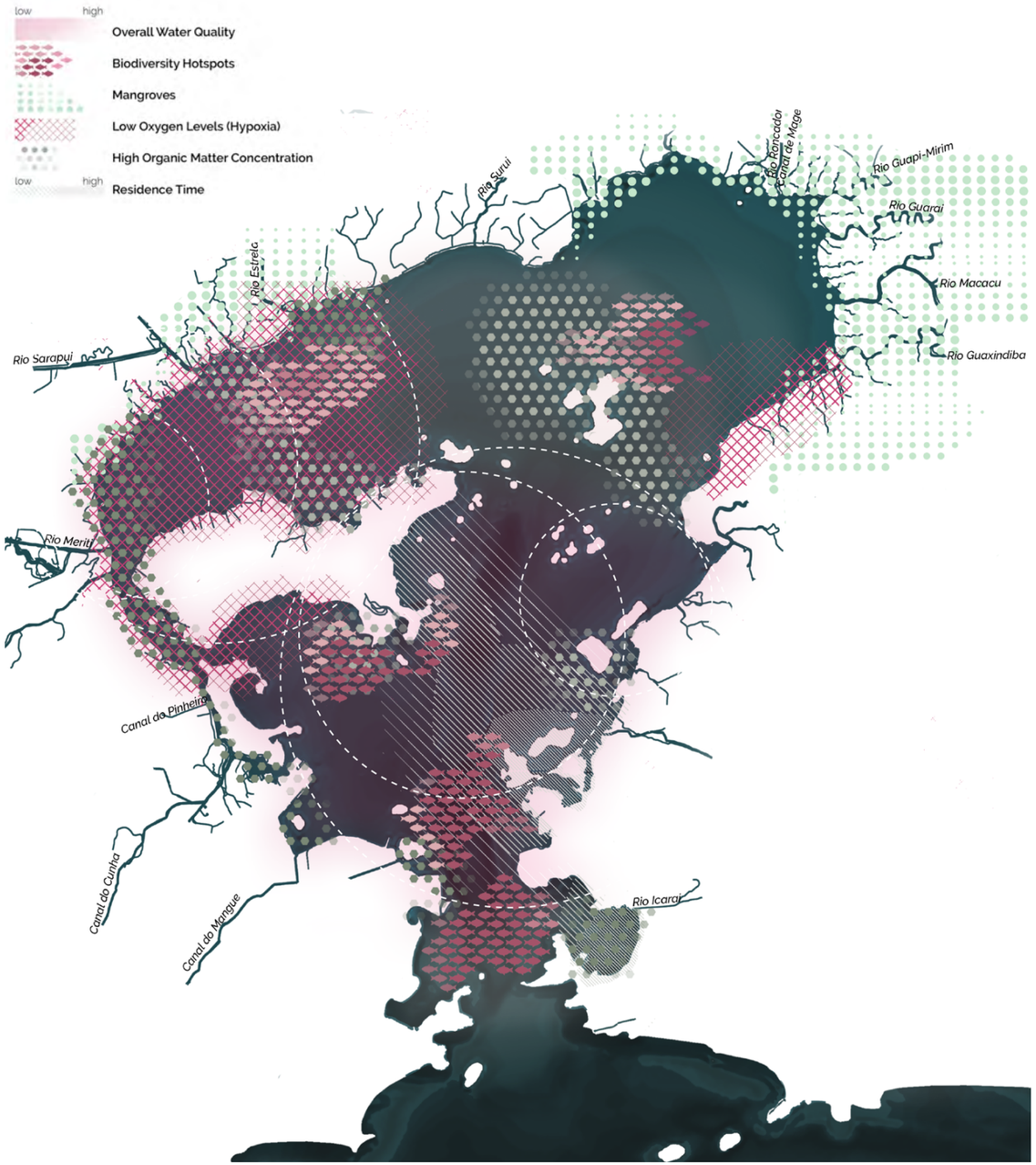
Guanabara Bay faces ecosystem collapse. Historically, it was surrounded by diverse ecotones between urban, aquatic, and terrestrial ecosystems that supported a web of biodiversity, economy, and social infrastructure.

Ecotones are transitional zones between two distinct ecosystems or biological communities, where blurred edges create overlaps. This in between space always holds more biodiversity than either of the adjacent ecosystems. However, the elimination of these ecotones, replaced by hard edges, sewage, garbage, and the oil industry, has stripped the Bay of its sustainability.

Ecotones of Repair boldly proposes to multiply and diversify the ecotones of Guanabara Bay to multiply and diversify its ecosystems, economy, and social relationships. The initiative includes constructing a range of ecotones, focusing on the critical urban-water ecotone through vegetated edges, deconstructed hard barriers, green energy infrastructure, habitat creation, green infrastructure jobs, fishing industry restoration, and ecotourism, where species and nature

co-design the future of Guanabara Bay.

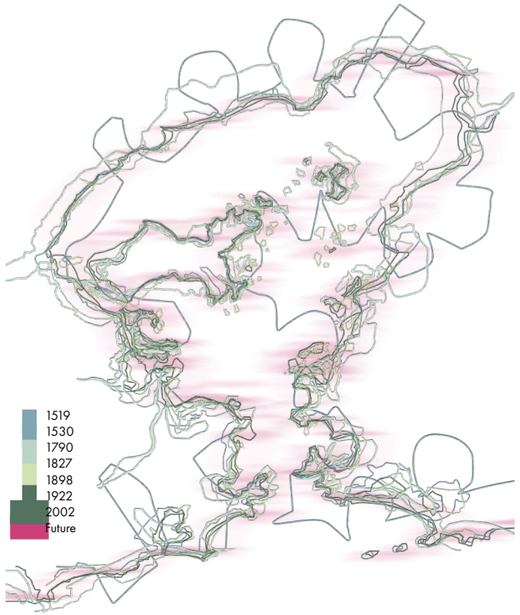




01 | Around Ilha Do Governador, water quality is extremely poor due to high pollution, and slow circulation.

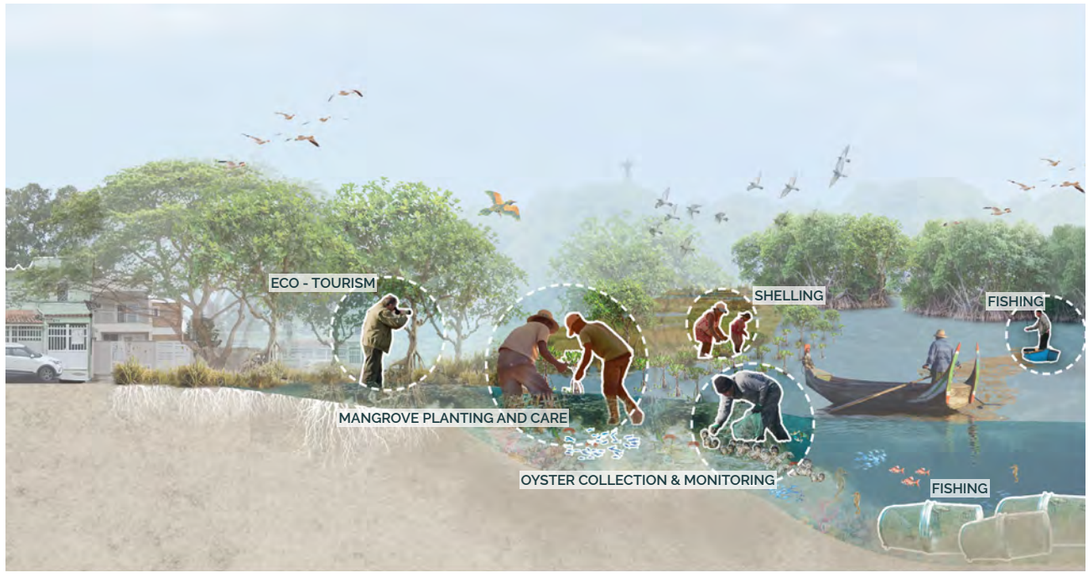
02 | Current Edge Condition

Guanabara Bay is currently shaped by hard edges and lines. Humans have long reshaped these shifting ecotones through dismantling of mountains infill and dredging.



03 | History of Ecotones

Previously, human and non-human species once coexisted along Guanabara Bay's ecotones through shared practices like fishing and leisure. However, urban development has disrupted this balance, replacing vibrant natural edges with hardened infrastructure and leading to significant ecological degradation.

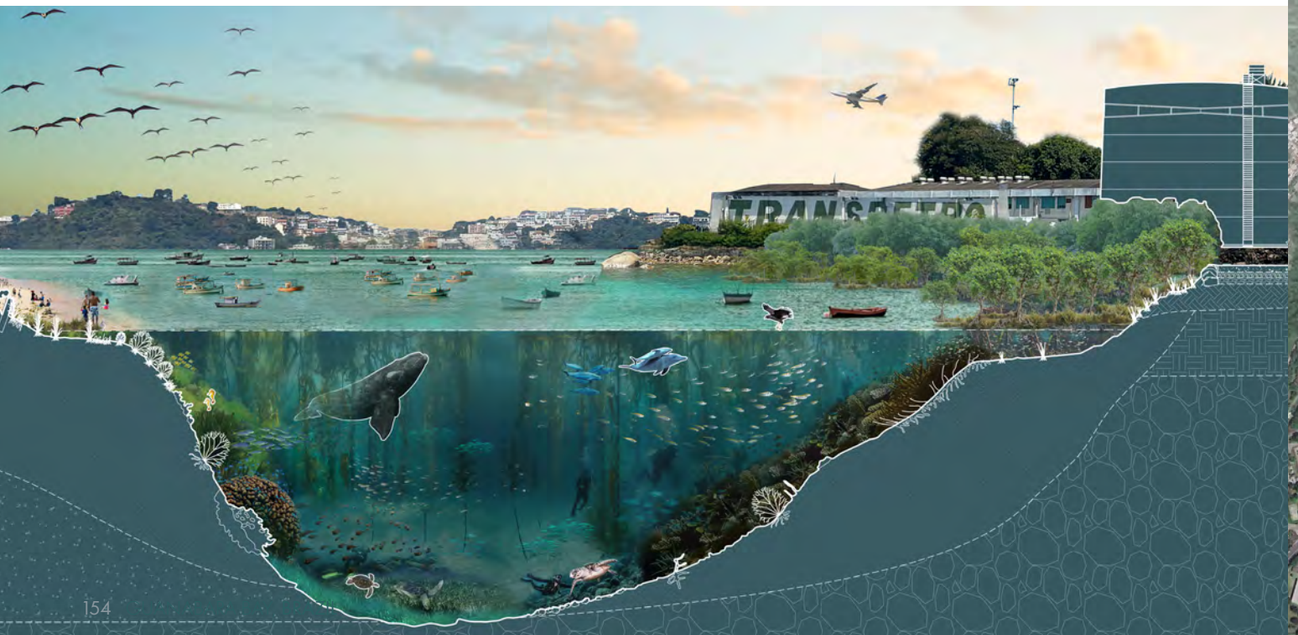


04 | Regenerative Timeline

From 2025 to 2075, Guanabara Bay can gradually transform through the restoration of soft edges and natural habitats. As ecotone revival continues into 2090, the bay will be surrounded by community parks, green infrastructure jobs, and the return of migratory species, ultimately shaping a resilient and co-designed future by 2150.

05 | Collaborative Stewardship

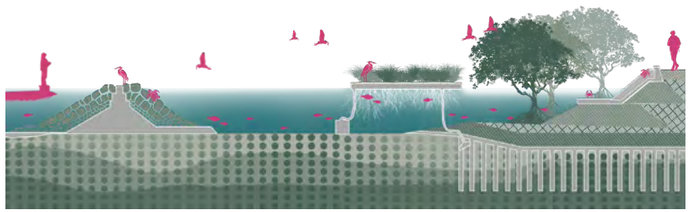
The restoration of Guanabara Bay depends on active collaboration among stakeholders. There are currently massive efforts occurring in the bay to restore ecotones. This project aims to play a part in this effort through collaboration of community, organizations, species, and policy initiatives.



06 | Boto Cinza Inlet

Named after the native dolphin species, the project seeks to revive biodiversity and reconnect low, medium, and high-income communities currently separated by infrastructure.

1 New Sediment Island Formation



2 Energy Transformation to BioFuel

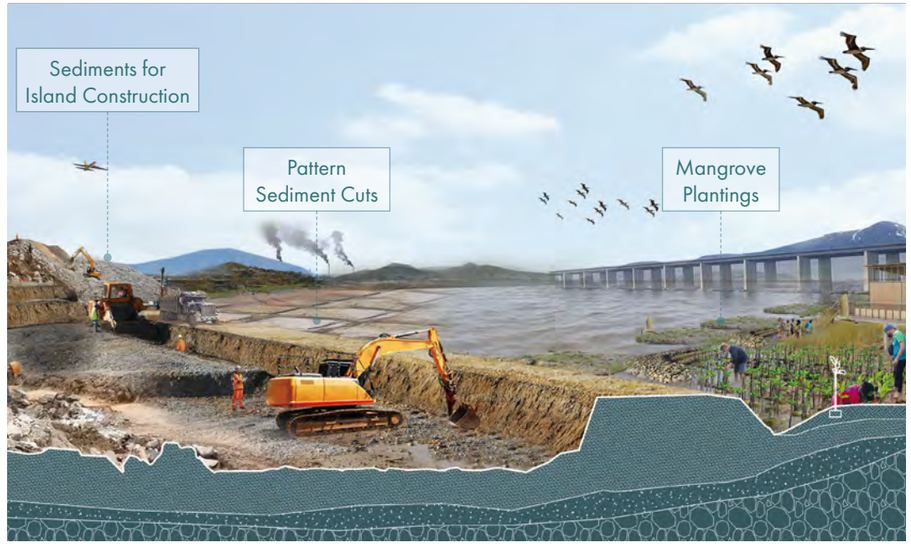
3 Connection to Water

4 Inlet and New Island Formation

5 Deconstructed Edges and Oyster Reefs

6 Mangrove Nursery and Fisher Economy

07 | Ecotone Typologies



08 | Recreation - Water Ecotone:
First Phase of Inlet Ecotone Construction (yr 2030)

09 | Residential - Water Ecotone:
Recreational Amenities and The Urban - Water Ecotone are Formed

10 | Re-Forestation - Water Ecotone: Water Energy, Erosion, Dispersal, and Decay Shape the Inlet


REDUC
GUANABARA BAY, BRAZIL
Spatial Visions

REDUC, BRAZIL

REDUC REDUX

RETHINKING ENERGY: DECARBONIZING & UNITING COMMUNITIES

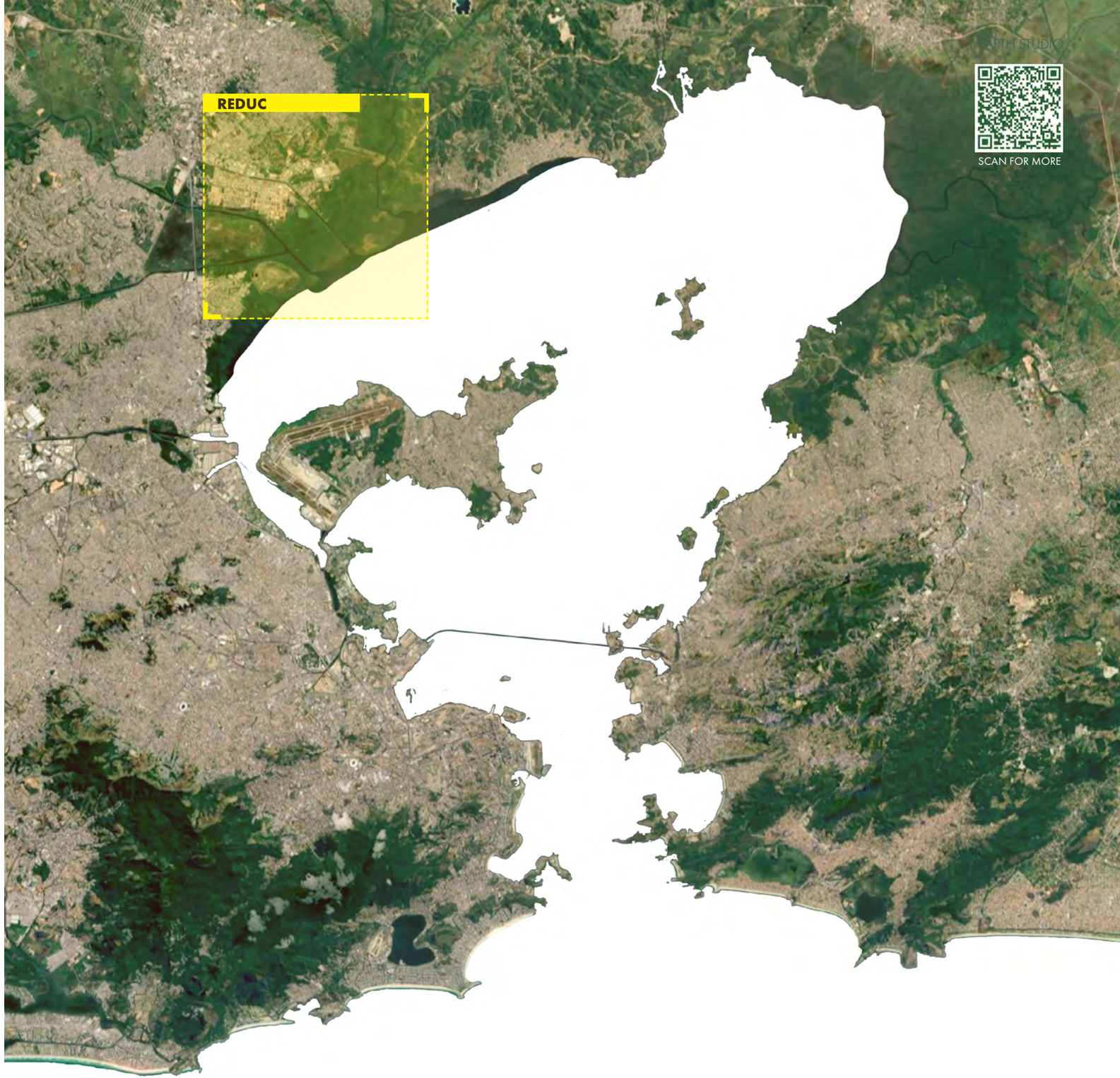
He Dong / Chunyuan Hu / Wentong Huang / Jahlik Parkes

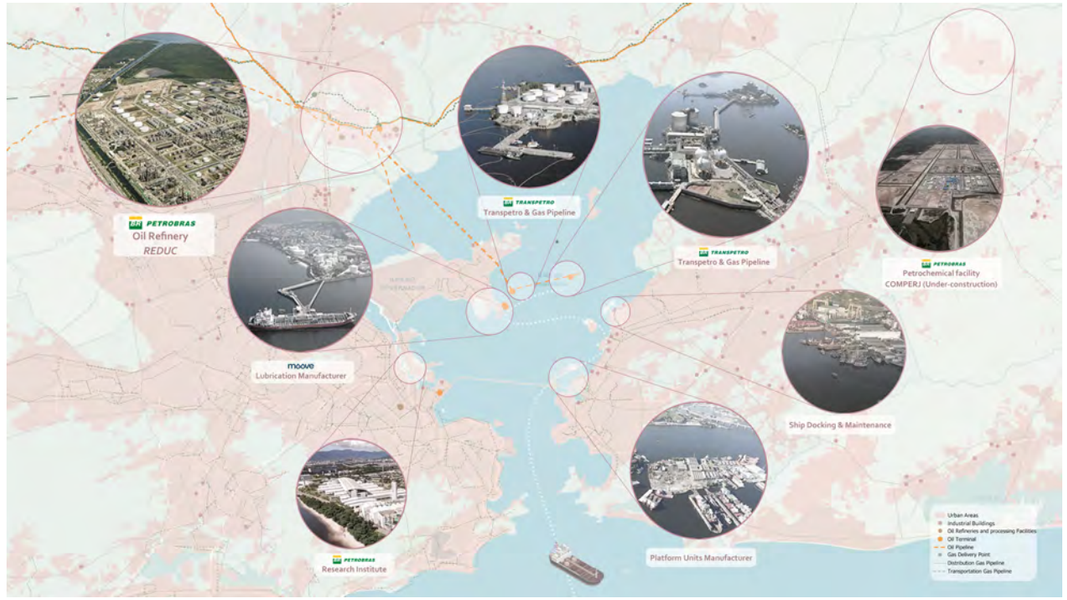
WHAT IF PETROBRAS TOOK THE LEAD IN BRAZIL'S CLEAN ENERGY TRANSITION BY TRANSFORMING GUANABARA BAY INTO A GLOBAL MODEL FOR SUSTAINABLE INNOVATION?

With the REDUC site—projected to be mostly underwater by 2050 and at high risk of catastrophic events like major oil spills and industrial fires—the need for transformation is urgent. Designating REDUC (Refinaria de Duque de Caxias) as first step would allow Petrobras to prioritize decarbonization and safety by replacing fossil fuel operations with renewable energy solutions while preemptively addressing critical environmental vulnerabilities.

However, within this fragility lies a powerful opportunity: to transform REDUC from a symbol of extraction into a beacon of regeneration. The most flood-prone zones can be carefully decommissioned, giving way to healing through soil restoration, reforestation, and flood-able landscapes. These renewed spaces would welcome community use, offering access to nature and the water's edge. At the core, REDUC can shift toward innovation, repurposing industrial remnants to power clean energy futures. With bold investment in hydrogen, micro algae farms, and bio-energy, REDUC could seed a new era rooted in resilience, equity, and Rio's leadership in a post-carbon world.

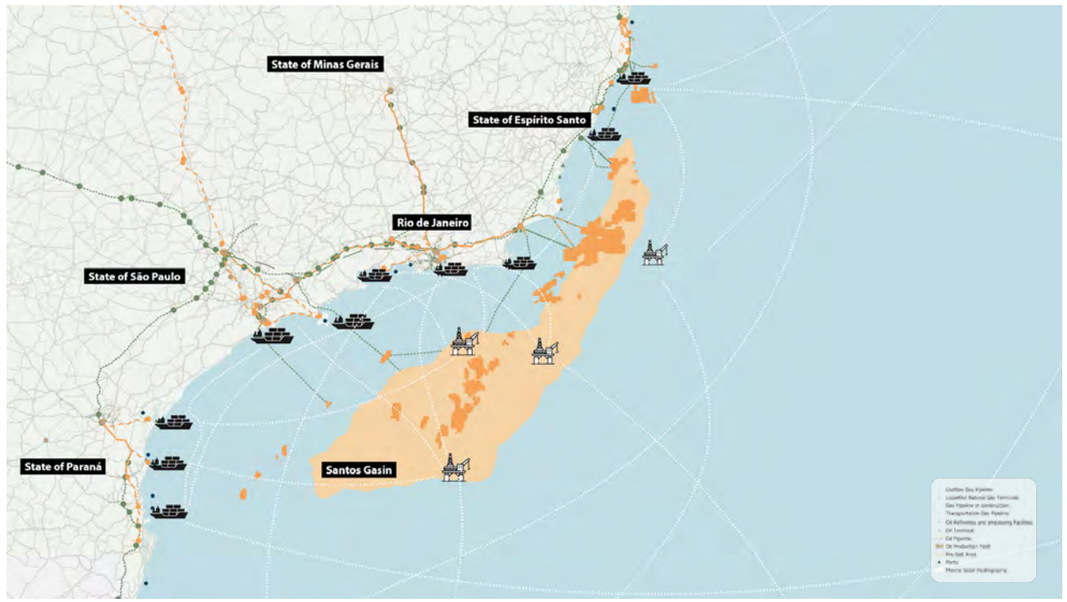
By reimagining REDUC not as a relic of the past, but as a seedbed for regenerative futures, Petrobras has the power to lead by example, demonstrating that the transition to clean energy is not only necessary for safety and sustainability but also an unparalleled opportunity for economic resilience, social equity, and environmental justice.





01 | Oil Industry Network in Guanabara Bay

REDUC is one of the most critical assets in Petrobras' refining network and a cornerstone of the Guanabara Bay area and Brazil's national energy infrastructure, accounting for 12% of Brazil's total refining capacity.



02 | Brazilian Oil Industry Network

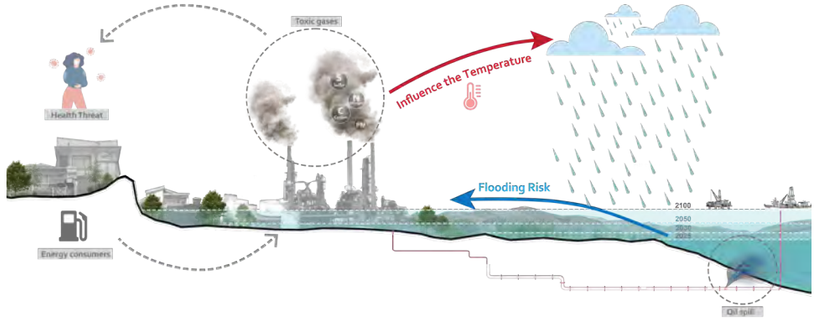
Elements of the oil infrastructure in the Bay are connected to a larger infrastructure that stretches via pipes throughout the country and across Brazilian borders.

03 | Oil Refinery Site

The REDUC oil refinery is composed of large crude oil storage tanks, where the raw oil undergoes multi-stage distillation and refining through a series of processing units. The output is converted into more than 50 different petroleum-based products, stored in smaller tanks and distributed to households and industries.

04 | Flooding Risk

Flooding poses a major challenge. By 2050, nearly 50% of REDUC oil refinery is at risk, and projections for 2100 show almost the entire site underwater. Our site is located adjacent to the waterways feeding the bay, increasing the threat to bay ecosystems. The cause and effect relationship pollution has on severe rainfall and sea-level rise have needs to be understood and designed for.

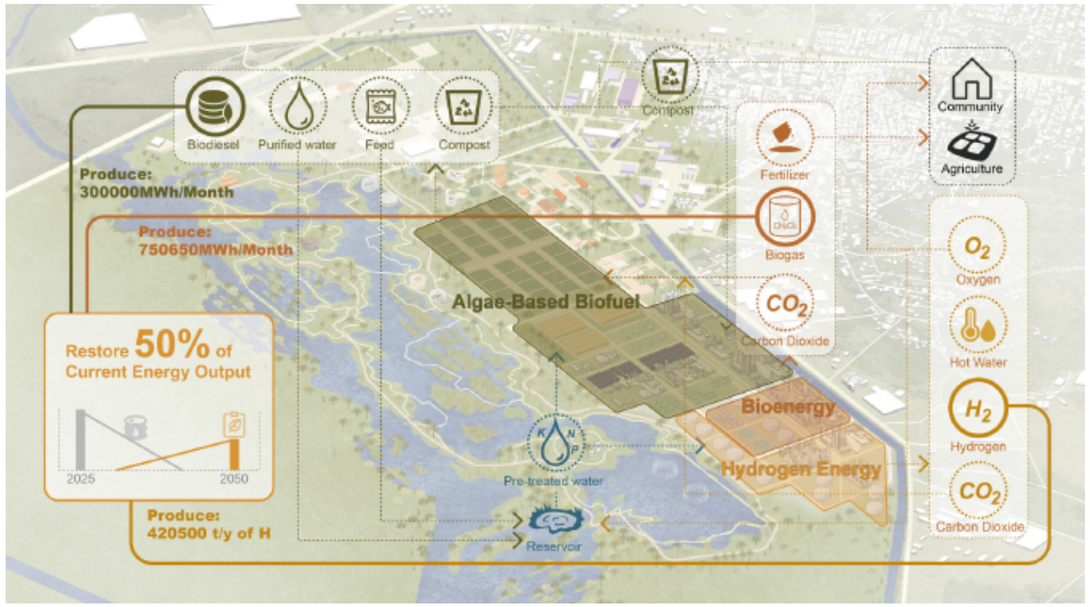


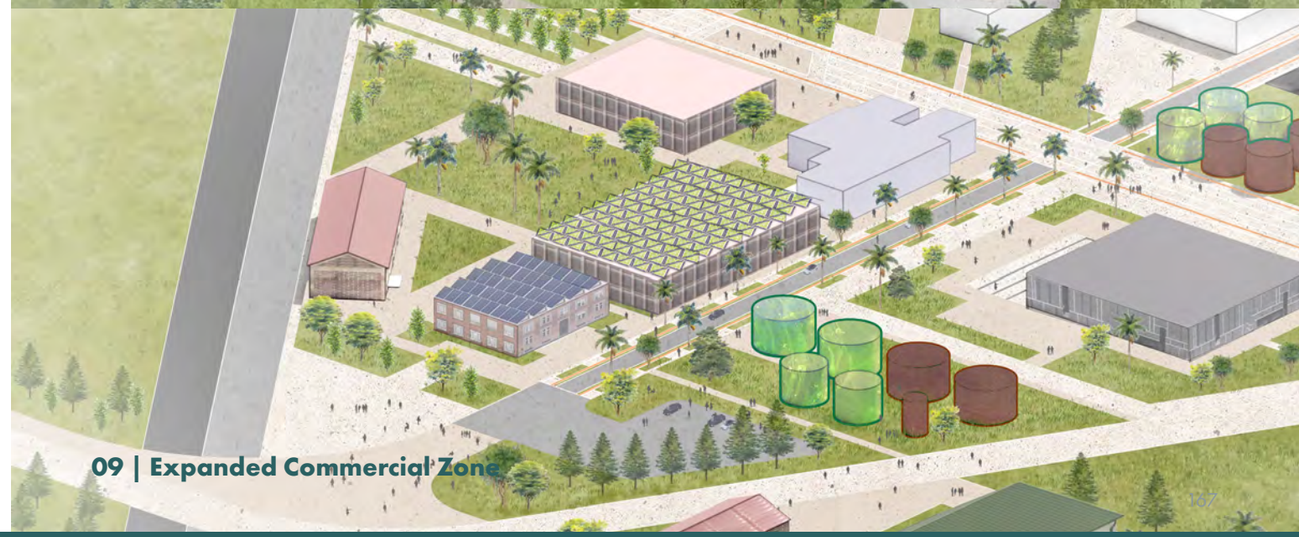
05 | Strategy

By 2100, the area can evolve into a global model of green energy-producing, and community-centered ecological hub fully integrated with its environment and resilient to future climate challenges. This proposal is a long-term phased development plan, integrating water restoration, ecological regeneration, renewable energy system, environmental education, and community-based economic models to ensure a sustainable and inclusive transformation.

06 | Renewable Energy Transition

Looking ahead, with advancements in green technologies, we envision the former refinery structures being repurposed into micro-algae biofuel farms, bio-digester facilities, and hydrogen energy production plants. Together, these systems can restore 50% of REDUC's original output by 2050 while advancing circular, community-integrated energy production.





11 | Visitor Center

12 | Community Activities

13 | Breaking the "Wall"

ILHA DA CONCEIÇÃO

GUANABARA BAY, BRAZIL

Spatial Visions

ILHA DA CONCEI O, BRAZIL

FROM WRECKS TO WONDERS

RECLAIMING SHORELINES, ENRICHING COMMUNITIES

Hongxiang Wang, Karunia Ayu, Tianqi Zhao

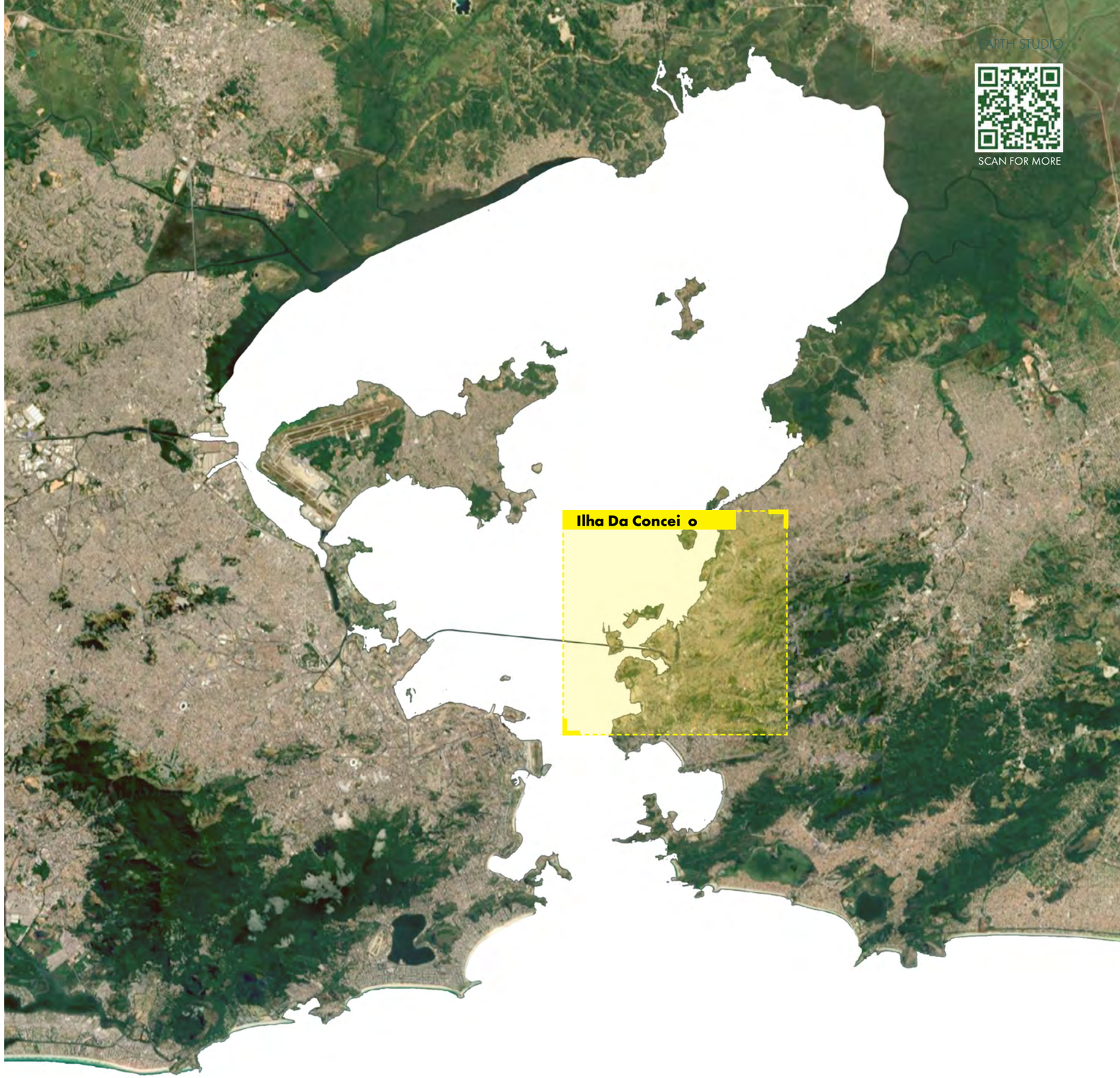
WHAT IF THE WATERWAY IS REOPENED, BRINGING COMMUNITY ACTIVITIES TO ITS SHORES, AND REVITALIZING THE ECONOMY AND INDUSTRY ALONG THE BANKS?

In the past, the island of Ilha da Concei o was composed of three separate islets located within Guanabara Bay. The construction of Niter i's port and the later Rio–Niter i Bridge, which was driven by the expanding oil industry, filled in the channels that separated the two islands. This effectively annexed the islands to the city while also obstructing the natural flow of water. In addition to the accumulation of derelict ships, this land reclamation has caused the accumulation of wastewater and industrial runoff, which has resulted in the transformation of once clean currents into polluted pools of stagnant water.

The shoreline is now dominated by industrial activity, which has cut off communities from the water and undermined both the quality of the fish catch and traditional ways of making a living, where previously local fishers used to thrive in this area.

The 'what if' scenario that we have envisioned involves reestablishing water circulation without displacing any industry. By relocating factories to nearby locations and innovatively repurposing vessels that have been abandoned, we can bring back a canal that is cleaner and flows more freely. Residents of Ilha da Concei o and Niter i would be brought together through the creation of new public spaces along its banks. These spaces would serve as natural filtration zones and social connectors.

What is the end result? improved water quality, revitalized community fishing, and parks along the water's edge that serve the communities. The ways that industry, ecology, and community can coexist in harmony would be demonstrated by the fact that improved access to the bay would stimulate the creation of jobs, broaden access to goods and services, and supporting local economic growth.



01 | 1930

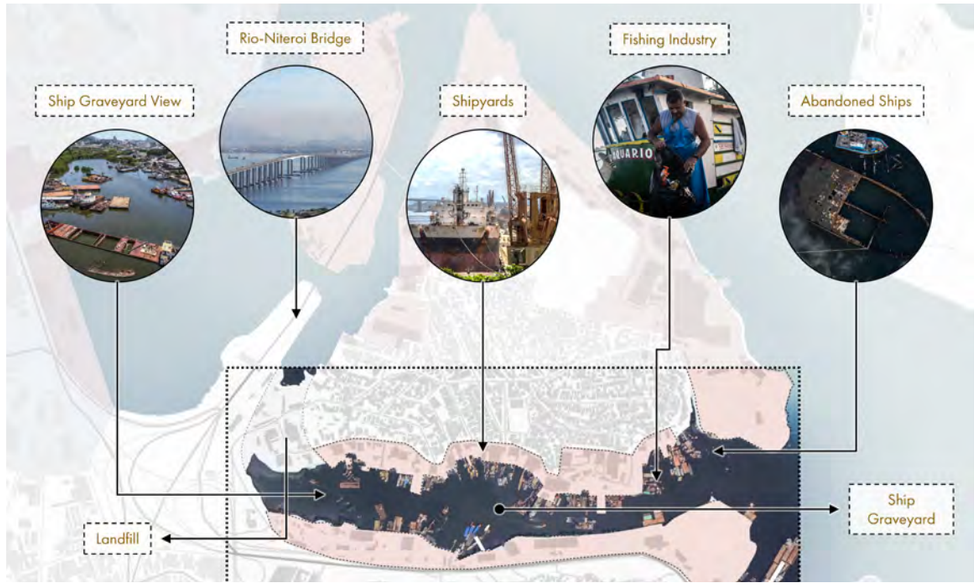
Ilha da Concei o started its modernization process, and the population began to grow. Some industrial activities also started to develop around that time. However, back then, the water was clean since it flowed naturally, and the residents could freely enjoy the island's beaches.

02 | 1970

To make way for Rio-Niter i Bridge construction, the island was "attached" to the city of Niter i by infill. The pollution problem started to happen as the waterway was blocked, making the water stagnant.

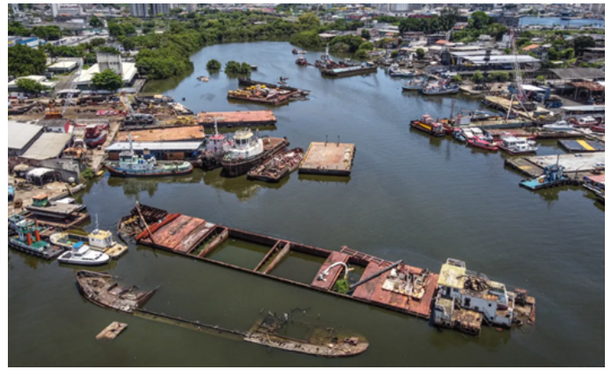
03 | Now

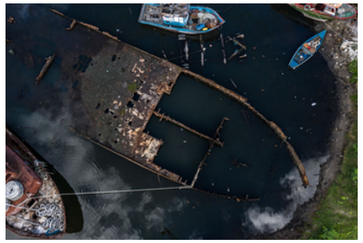
Since then, all problems have become visible over time. The stagnant water makes the water chanel the 'back of the house' where vessels are abandoned without regulation. Coupled with dense shipbuilding activity it has led to not only serious water pollution issues, but the declining economy and public health issues as well.

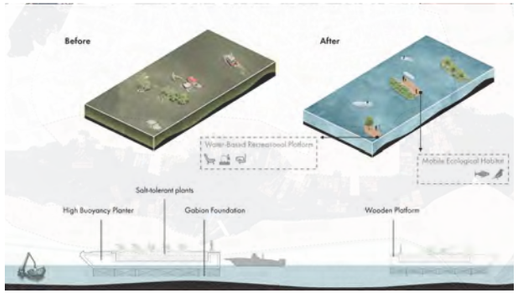


03 | Existing Condition

Encircled with dense industry activities, this water body gradually became a large ship graveyard in the entire Guanabara Bay.

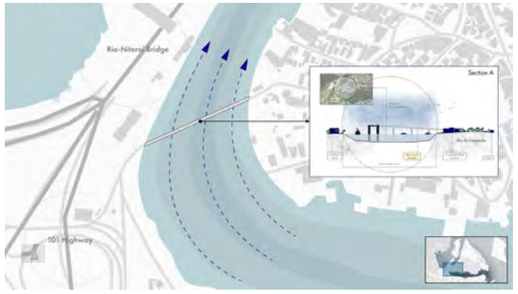






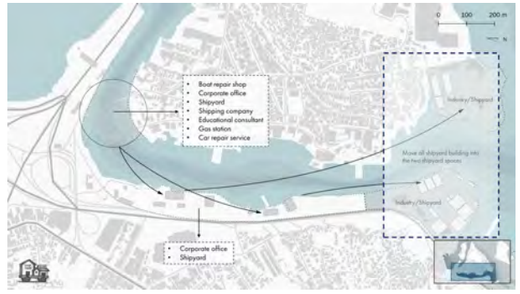
04 | Use Abandoned Ships to Enhance Ecosystem

Acknowledge and leverage existing potential to enhance biodiversity.



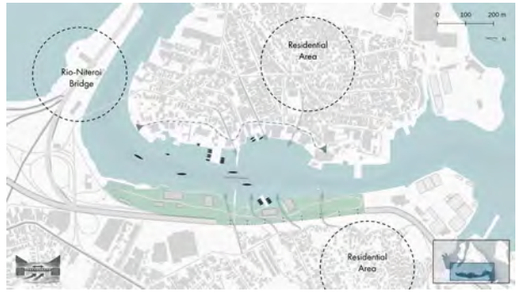
05 | Reopen The Waterway

Reestablish tidal flow, reduce water stagnation, eliminate pollution.



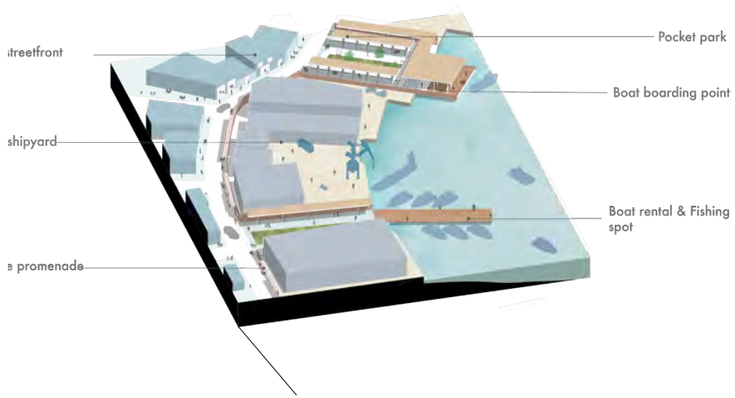
06 | Reconfigure Building Zones

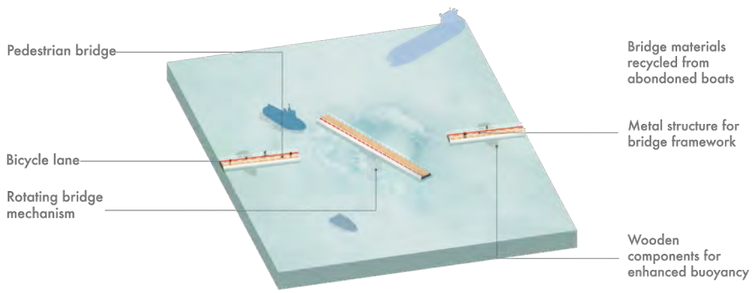
Relocate commercial activities and stimulate the econonomy by diversifying businesses.

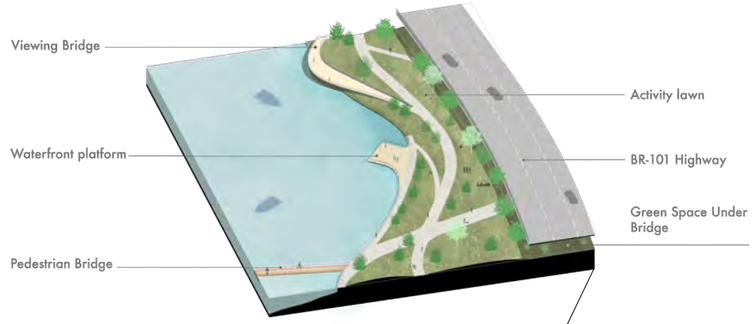


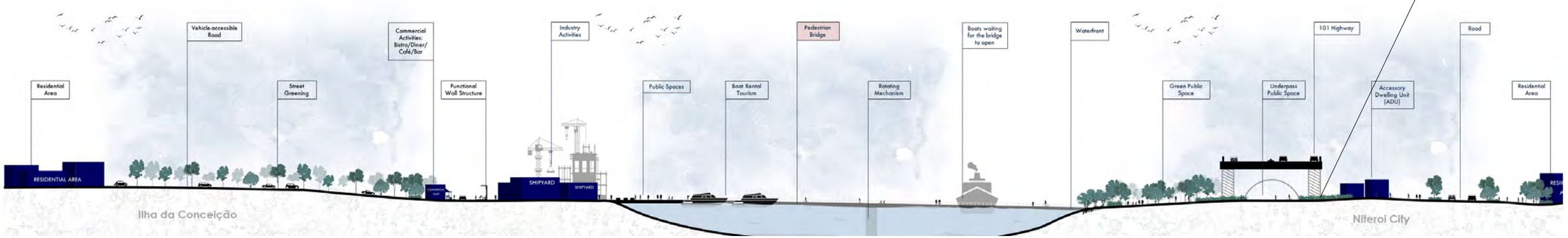
07 | Open Land-Water Connection

Foster community engagement, supports local business and cultivates waterfront identity.









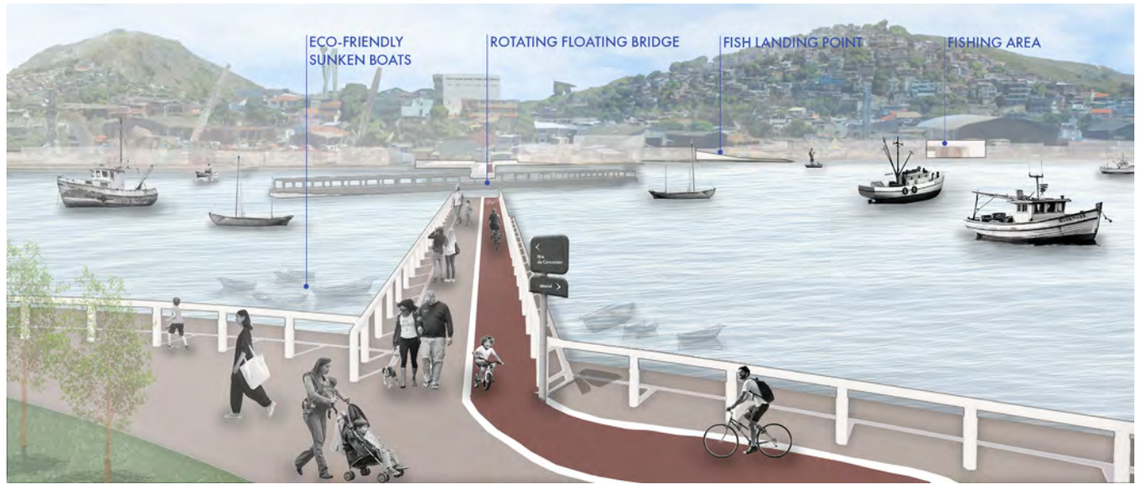
08 | Ilha da Concei o - Niter i Section

09 | Boat Rental and Fishing Spot

Providing the community with public spaces. While repurporsing some of the vacant unused shipyards, this public space will be a new asset for generating new economy, adding new stormwater catchment, and engaging the community.

10 | New Street Front Stores

Reimagining the once a fragmenting wall for public activities. This allows the remaining industry to still have privacy and give this wall a new function for public goods.

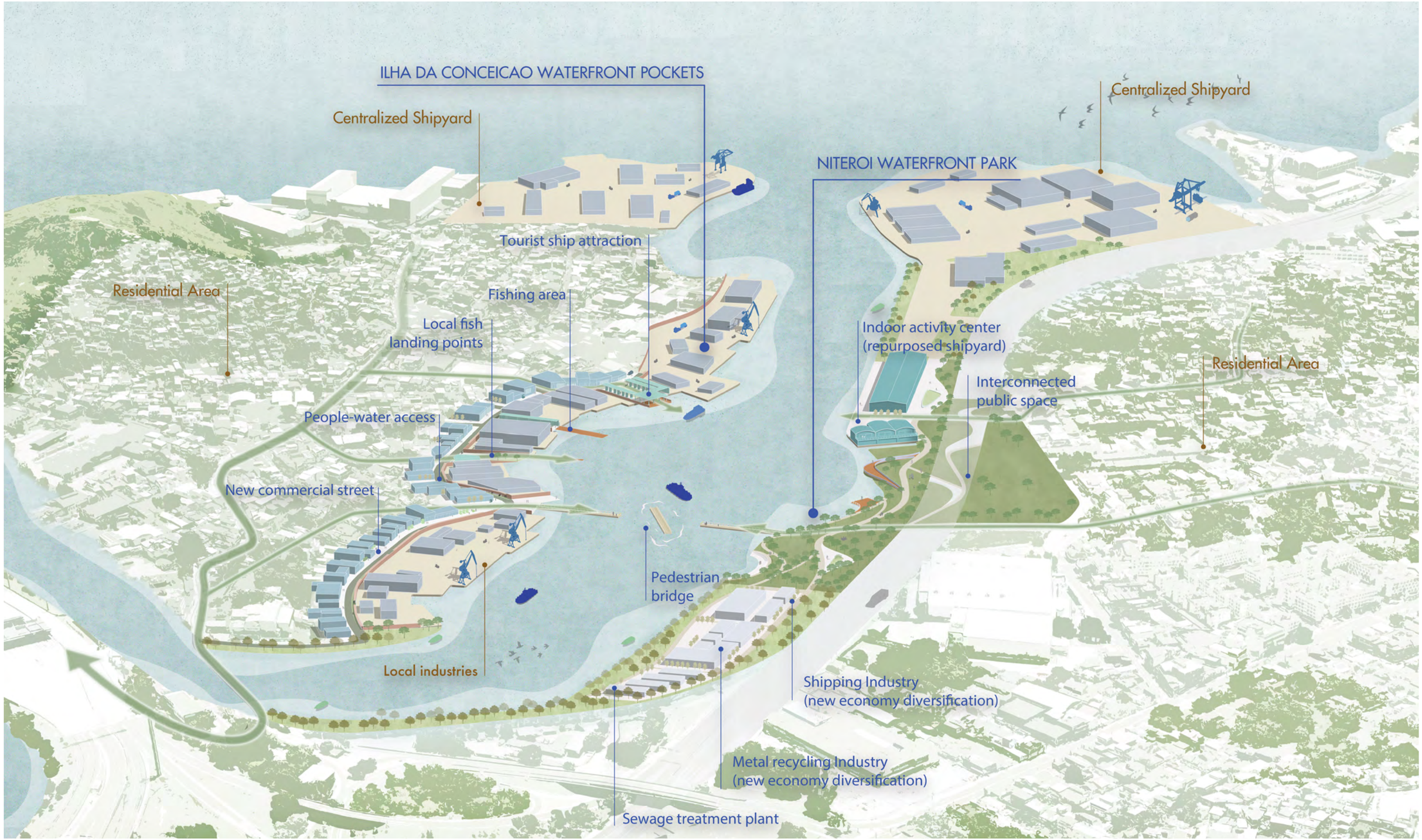


11 | Pedestrian Bridge

Connecting the two waterfronts, provide new access to get in and out of the island.

12 | Underpass Green Space

Large public green park will connect residential areas with the water. This proposal aims to reactivate the dead space under the highway with additional natural water filtering features in the waterfront.


ILHA DA CONCEICAO WATERFRONT POCKETS
Centralized Shipyard
Tourist ship attraction
Residential Area
Fishing area
Local fish
landing points
People-water access
New commercial street
Local industries
Pedestrian
bridge
NITEROI WATERFRONT PARK
Centralized Shipyard
Indoor activity center
(repurposed shipyard)
Interconnected
public space
Residential Area
Shipping Industry
(new economy diversification)
Metal recycling Industry
(new economy diversification)
Sewage treatment plant

ARCHIPELAGO

GUANABARA BAY, BRAZIL

Spatial Visions

GUANABARA BAY, BRAZIL

THE NEW ARCHIPELAGO

A VISION FOR THE ISLANDS OF GUANABARA BAY

Guo Xiu / Yikai Zhang / Ziheng Zhou

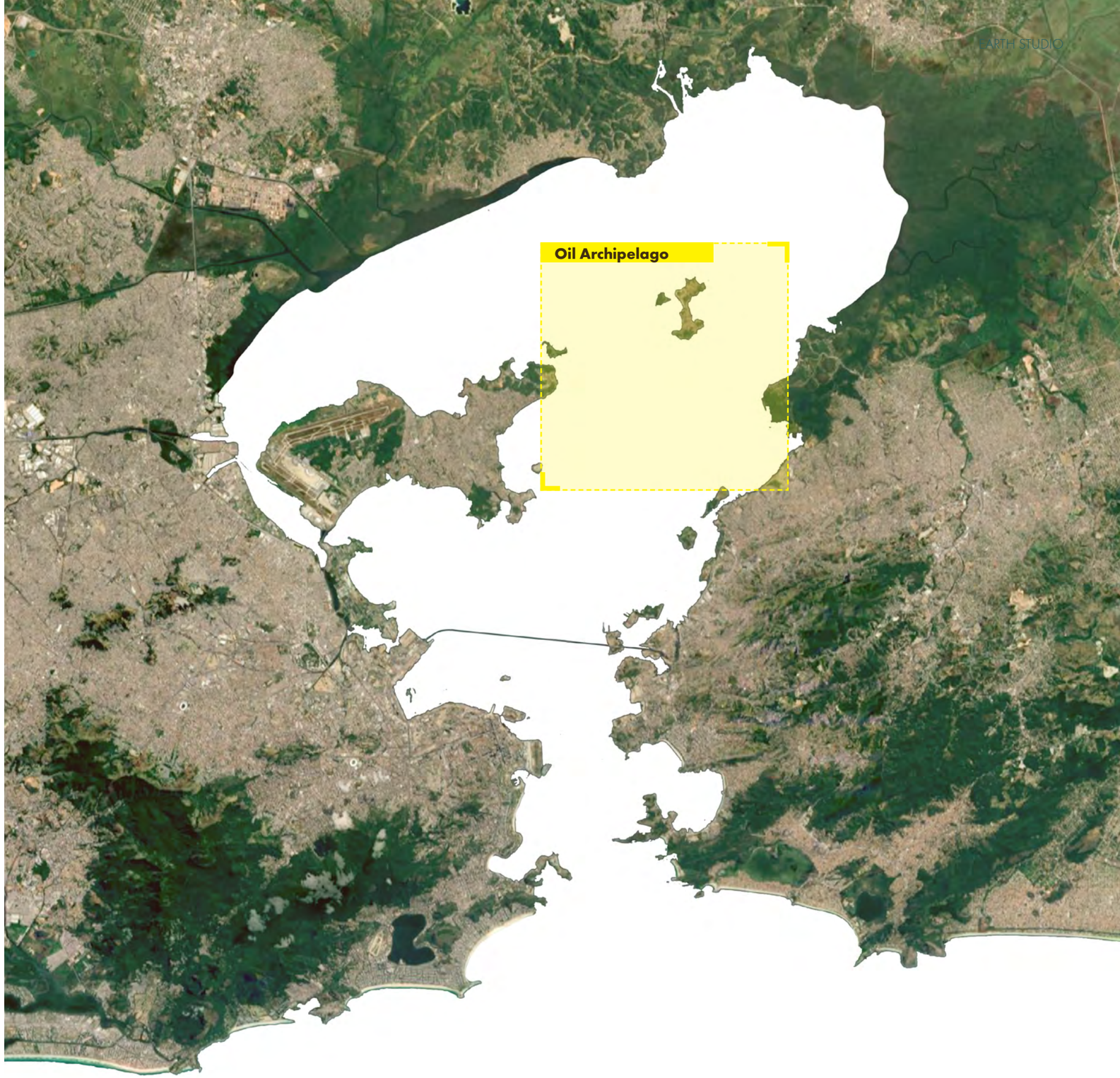
WHAT IF WE RETHINK THE ARCHIPELAGO AS AN URBAN SYSTEM TO ENHANCE ECOLOGICAL, SOCIAL, AND ECONOMIC VALUES OF THE GUANABARA BAY?

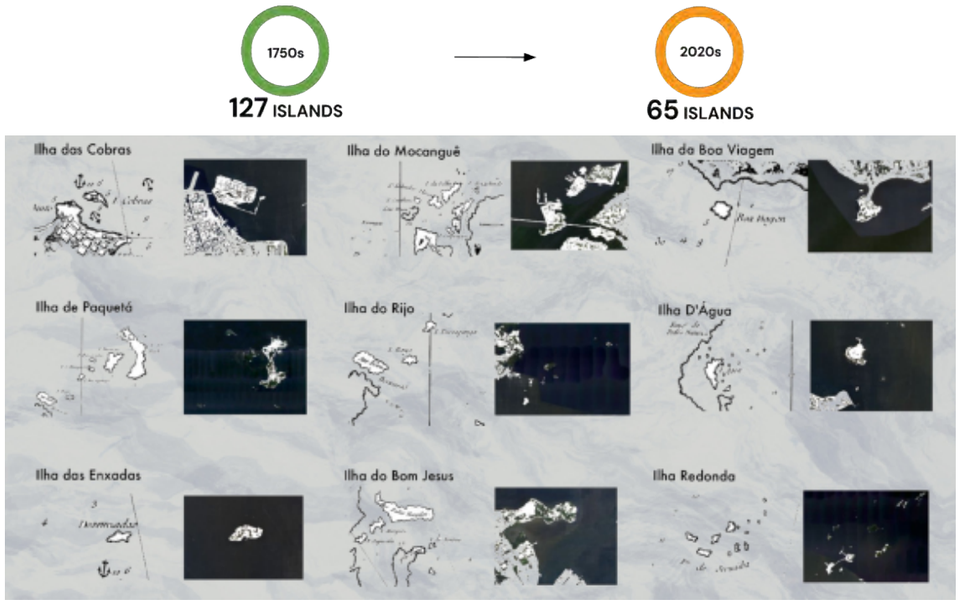
We redefine archipelago as not just a set of physically stationary islands, but also including all ecological, social, and economic activities related to it.

Our project aims to redefine and redesign the archipelago at Guanabara Bay, creating urban systems that will enhance it's ecological, social, and economic value.

In the short term, it is feasible to create public access to these oil islands, and gradually add renewable energy facilities to the oil rigs. With purifying, utilizing, and strengthening the reef area, we propose creating education and leisure spaces that urban residents can use. Furthermore, this project will enable the Bay to contribute to the future energy trasition.

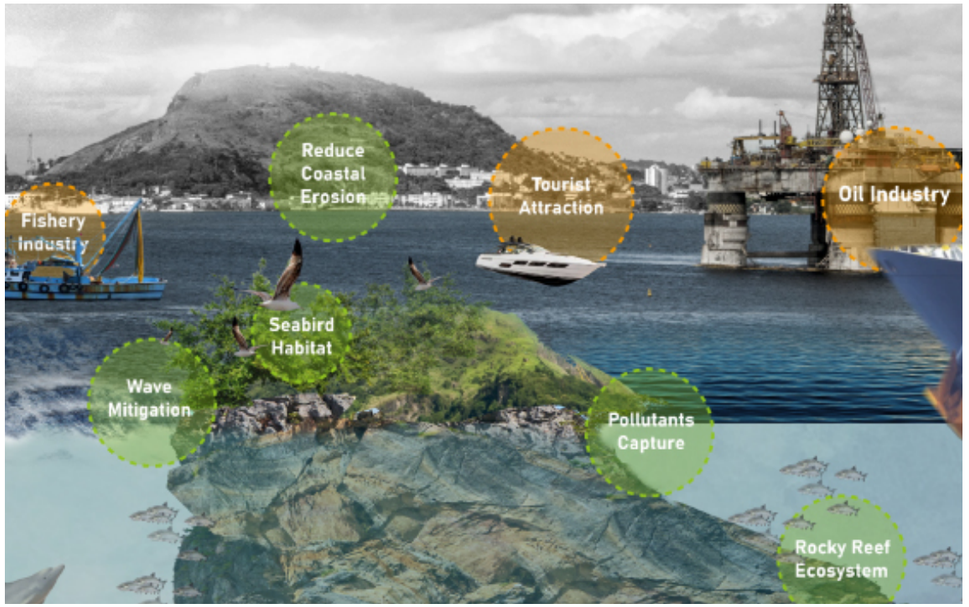
In the long run, a post industrial park, a floating walkway,and mobile urban spaces created by transforming supertankers will emerge and the archipelago will truly become a civic assets.





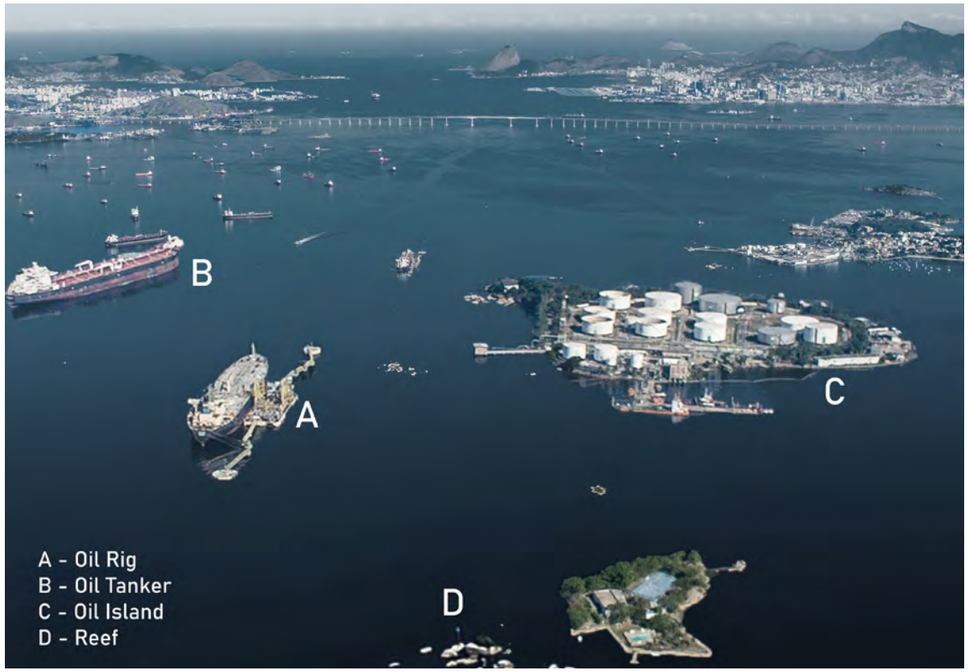
01 | Changes In Islands Over The Past 200 Years

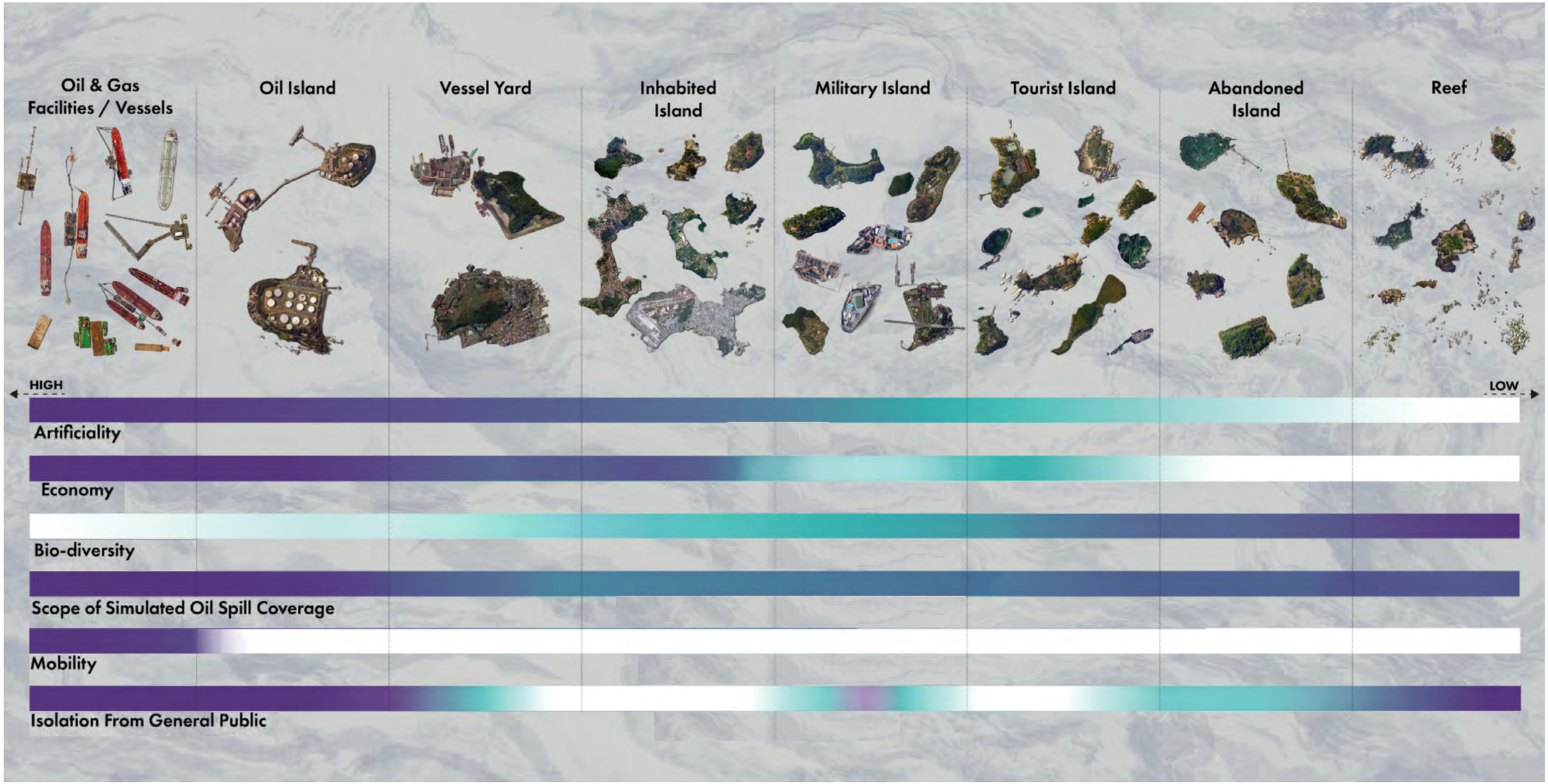
Guanabara Bay was once an island-studded and vibrant tropical Bay. However, sea level rise, coastal erosion, and human activities have led to a 50% reduction in the number of islands.



03 | Values Of The Archipelago In Guanabara Bay

The islands of Guanabara Bay are rich in economic, ecological, and social values. However, there are conflicts between these values, such as the oil industry has dealt a blow to fisheries and ecosystems while contributing to the economy.





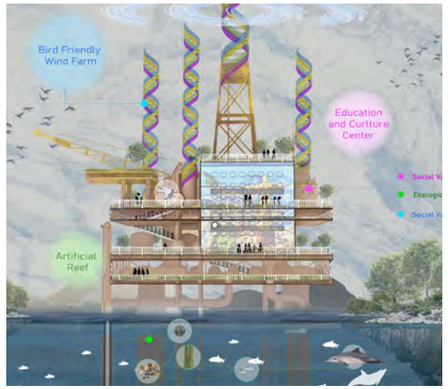
05 | Island Typologies And Analysis

The analysis of these island types indicates that the higher the degree of artificialization of the islands, the higher their economic value, but lower their ecological value.

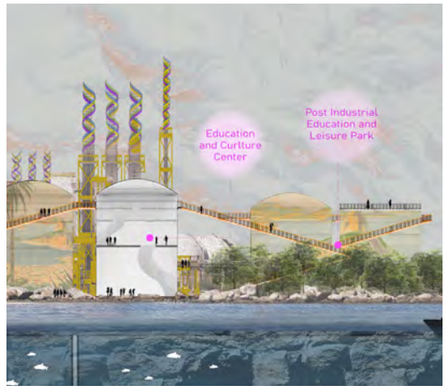
Although the oil industry in Guanabara Bay has made significant economic contributions, it has also caused serious damage to the ecosystem. The negative impact of oil spills, low biodiversity, and busy oil tankers on underwater life is sufficient evidence of this.

A more important conclusion is that the higher the artificialization of the island type, the higher the degree of isolation it has. The highest artificial island types lack public access, such as to oil facilities, ships, and oil islands. Guanabara Bay is not short of tourists and vitality, but these islands are like forbidden zones, lacking public access and social attributes.

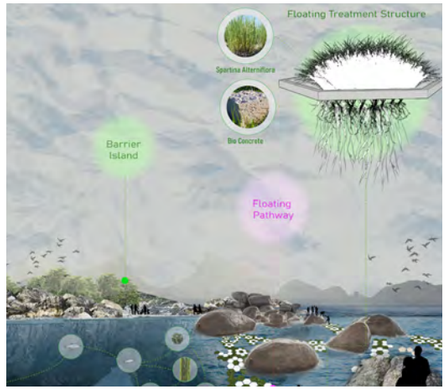
Therefore, this project aims to enhance the public access, energy producing potential, economic, ecological, and social values of different island types based on their characteristics.



06 | Proposed Oil Rig Site

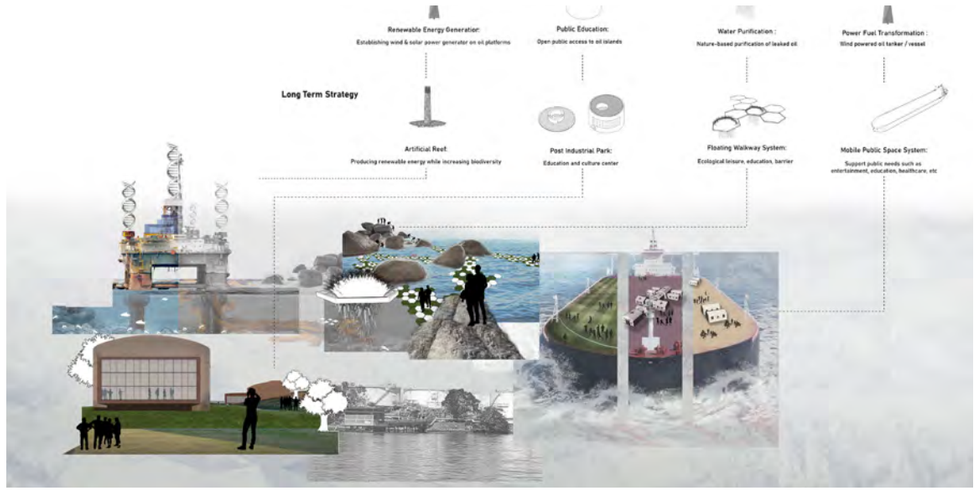


07 | Proposed Oil Island



08 | Proposed Reef Site

09 | Proposed Mobile Public Space



10 | Post Industrial Park At Oil Island

11 | Energy Education Center

12 | Floating Pathway In Reef Zone

13 | Archipelago As Urban Networks