Reimagining

urban waterfronts for resilience

RAMBØLL BOGL

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BOGL is an award-winning architecture studio specialising in landscape architecture and planning. The company helps shape the spaces around, between, and above our buildings and cities – connecting people and nature through thoughtful, sustainable designs. BOGL's 32 employees are situated in Copenhagen and Oslo.

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Preface

Since the dawn of time, life has flowed towards the water. Throughout history, people have gathered at the water's edge, drawn by its promise of connection and abundance. Over time, these waterfronts have evolved into vibrant centres of activity, commerce, and culture, shaping the way we live, trade, and come together.

During and after industrialisation, many waterfronts were hardened, polluted, and stripped of their natural character. For decades, they served industry rather than community, losing much of their ecological and social value. In recent years, however, cities have begun to rediscover their waterfronts as vital engines of economic and cultural renewal. Yet today, these same areas face new threats, most urgently from climate change and rising sea levels.

The time for traditional thinking has passed. What is needed now is bold, regenerative, and life-affirming action. Paradoxically, conventional methods of protecting nature at the waterfront can sometimes worsen the very climate impacts they aim to prevent. We are curious to explore this tension, by asking pivotal questions:

How can we create more, and better quality, nature in our cities, while shaping resilient, sustainable communities along our urban waterfronts? And can this very nature become our protection, helping to safeguard urban areas, rather than relying on ever more hardscapes?

We believe in asking questions, no matter how difficult they may seem, So, this publication should serve as a conversation starter. We invite urban planners,decisionmakers, citizens, and changemakers everywhere to rethink what is possible, and seek the most sustainable answers together.

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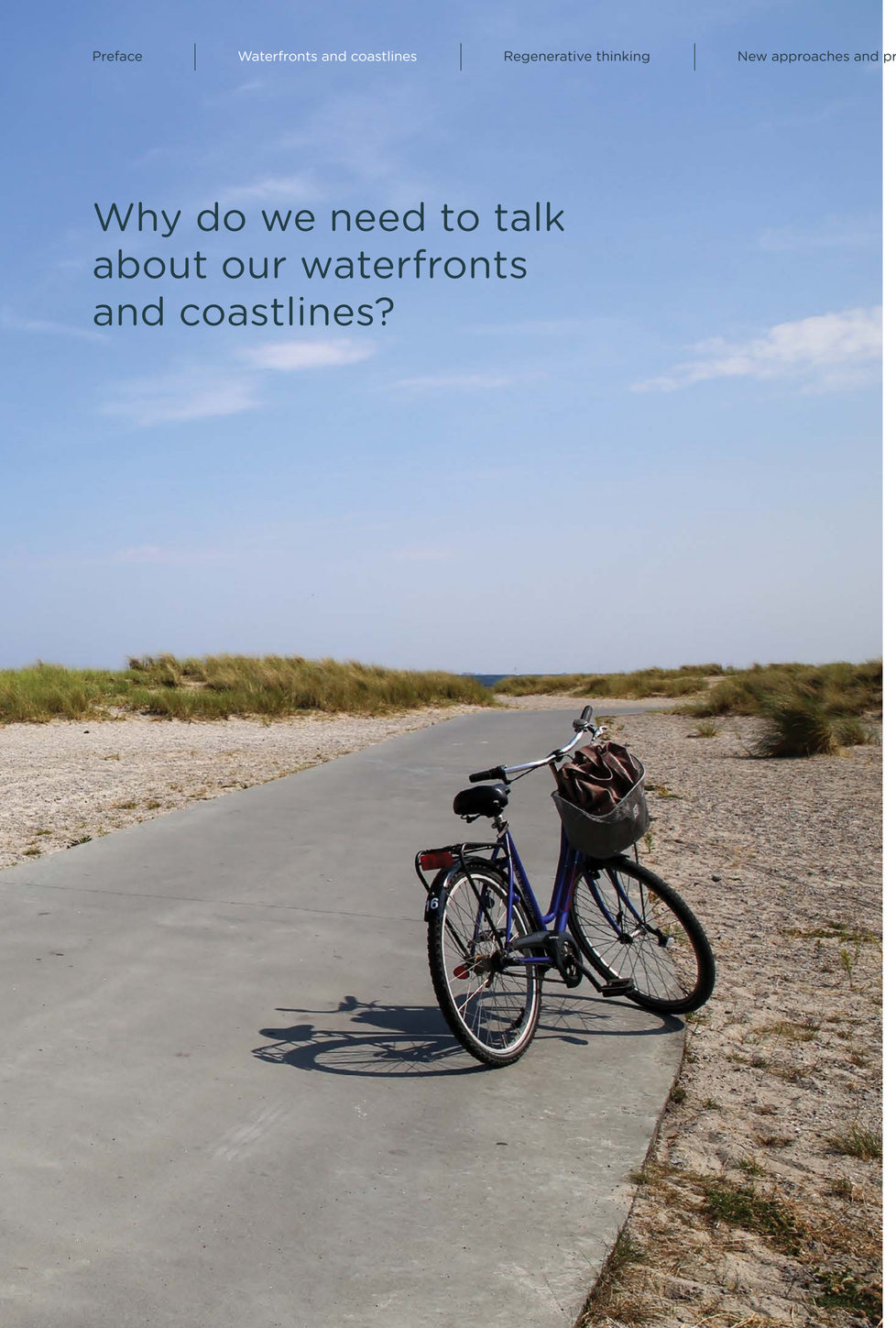


Why do we need to talk about our waterfronts and coastlines?

The bigger picture

For thousands of years, humans have built cities along rivers, coasts, and deltas, turning waterfronts into dense, industrialised urban centers. But today, three powerful forces demand a new mindset.

The message is clear: if we want to protect our cities and the ecosystems they depend on, we must rethink how we design, build, and live along our waterfronts.

01

Urban density is reaching critical levels

56% of the world's population – 4.4 billion inhabitants – live in cities. This trend is expected to continue, with the urban population more than doubling its current size by 2050, at which point nearly 7 of 10 people will live in cities (World Bank). Three billion people — about half of the world's population — live within 200 kilometres of a coastline. That figure is likely to double within a few years.

02

Biodiversity is in steep decline

The planet's natural capital and biodiversity are under unprecedented pressure. Coastal ecosystems are deteriorating rapidly, and wildlife populations have plummeted, with an average decline of 69% over the past 50 years (World Economic Forum).

03

The climate is changing rapidly

Coastal regions face intensifying threats: beach erosion, storm surges, flooding, hurricanes, and cyclones. Climate change is compounding these hazards. Sea levels are projected to rise 1.3 to 1.6 meters by 2100 (NASA), driven by melting ice caps, rising temperatures, and stronger storm systems (Frontiers).

Time-frame | Scale | Approach

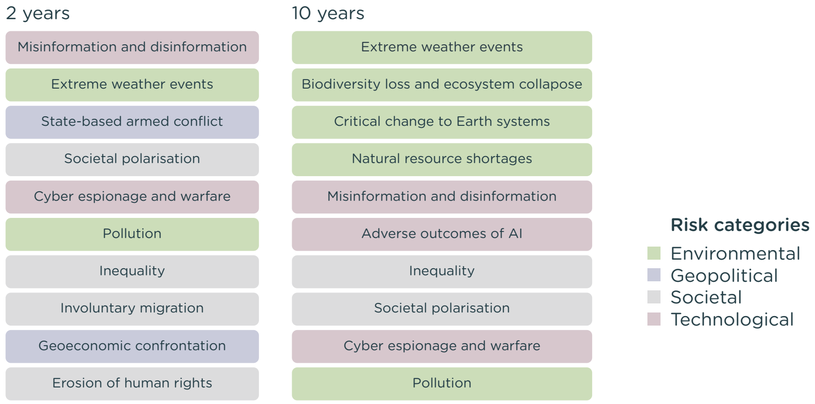
The foreseeable future - a thought exercise

When we plan cities, we aim to improve quality of life, designing infrastructure that addresses immediate needs like housing, transport, sanitation, and energy. And it is something we are good at. In just a few years, we can deliver innovative solutions to complex
societal challenges.

Interestingly, the systems we design often have a lifespan of 50 to 75 years, roughly the span of a human life. This timeframe feels familiar and tangible.. And it fits neatly within what we call the foreseeable future.

But the biggest challenges in our future are not geopolitical, societal, or technological, they are environmental, and so not so easily solved with conventional infrastructure.

Global risks ranked by severity over the short and long term



So we asked ourselves:

What if we expanded our perspective?

What if we designed beyond conventional project parameters, integrating more systems, more synergies, more layers of value?

That is what this project sets out to do.

To challenge assumptions. To spark new thinking. And to begin a conversation about how we can, and must, do better this time.

Time-frame | **Scale** | Approach

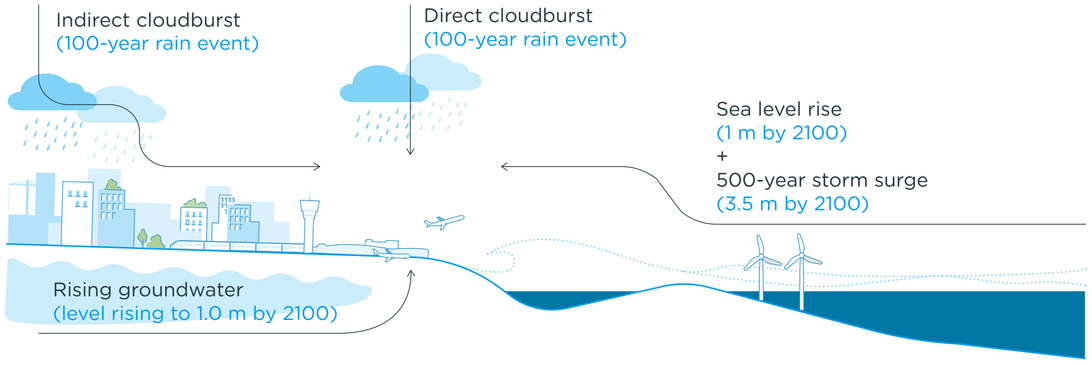
The coastal zone and a changing climate

Climate change is one of those intangible risks that we struggle to plan for. Some may consider it a hyperobject – a phenomenon so vast in scale and impact that it is difficult to fully grasp. When paired with the shifting needs and desires of society, long-term planning for coastal adaptation becomes even harder to comprehend – and act upon.

Historically, protecting cities from the sea has been an engineering challenge: think sea walls, dikes, and flood gates that were constructed to defend urban areas from storm surges and rising tides. However, in the face of a changing climate, the limits of this approach are becoming clear. We can now expect more water in our cities, coming from all directions, more often, and with greater force. At the same time, we're facing an equally urgent biodiversity crisis in our shallow coastal waters and urban green spaces.

So what do we do? Abandon the coast? Unlikely. We assume that we will continue living in cities like Copenhagen. That means protecting what matters: our homes, our infrastructure, our cultural heritage, and our sense of place.

But how? This is the complexity we must now embrace, as such problems have no simple solutions.



We invite you to shift the frame:

To see urban adaptation not just as defense, but as opportunity.

To explore approaches driven by ecological development, in harmony and reciprocity with human life.

This perspective opens up new pathways.

Not to control nature, but to coexist with it. To build coastal cities that are resilient, regenerative, and ready for an uncertain future.

Breaking the single-use habit

Over the past 150 years, global urbanisation and industrialisation have followed a clear pattern: single-use infrastructure. Cities were carved up into industrial zones, residential neighbourhoods, recreational areas, and farmland, each with its own clearly defined purpose.

At first glance, this seems logical and efficient. But in reality, it's deeply misaligned with how natural systems function, especially water. When places are misaligned with natural systems, they become vulnerable. By its constant and dynamic evolution, a natural ecosystem becomes resilient and responsive to diverse and changing challenges, and nature does not operate in silos.

Water flows freely, shaping ecosystems and connecting everything in its path, but traditional city planning has largely pushed water underground, into pipes, drains, and infrastructure networks, out of sight and disconnected from the urban experience.

Recently, we have seen a shift where a new wave of multi-use, integrated planning is emerging. One that brings water back into the urban landscape.

Nature-based solutions are transforming green spaces into active water systems.

Mixed-use districts are blending living, working, leisure, and even agriculture.

Ecological thinking is beginning to influence how we shape cities, from the ground up.

But this is only the beginning. To truly futureproof our urban environments, we need to take this integrated approach further. We have been inspired to explore regenerative thinking and regenerative planning and design processes.

Time-frame | Scale | **Approach**

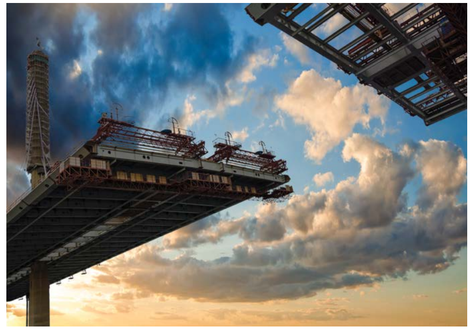
Nature as infrastructure

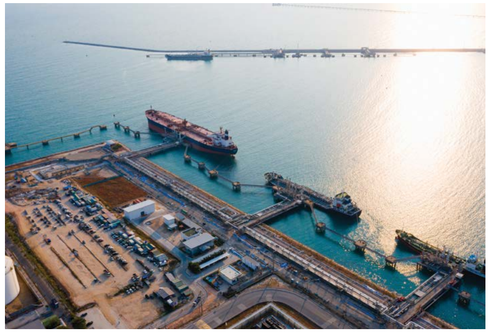
For centuries, humanity has poured ingenuity and resources into building infrastructure for diverse purposes: to connect us, to protect us, to power our lives, and to shape the places where we live, work, govern, play, and worship.

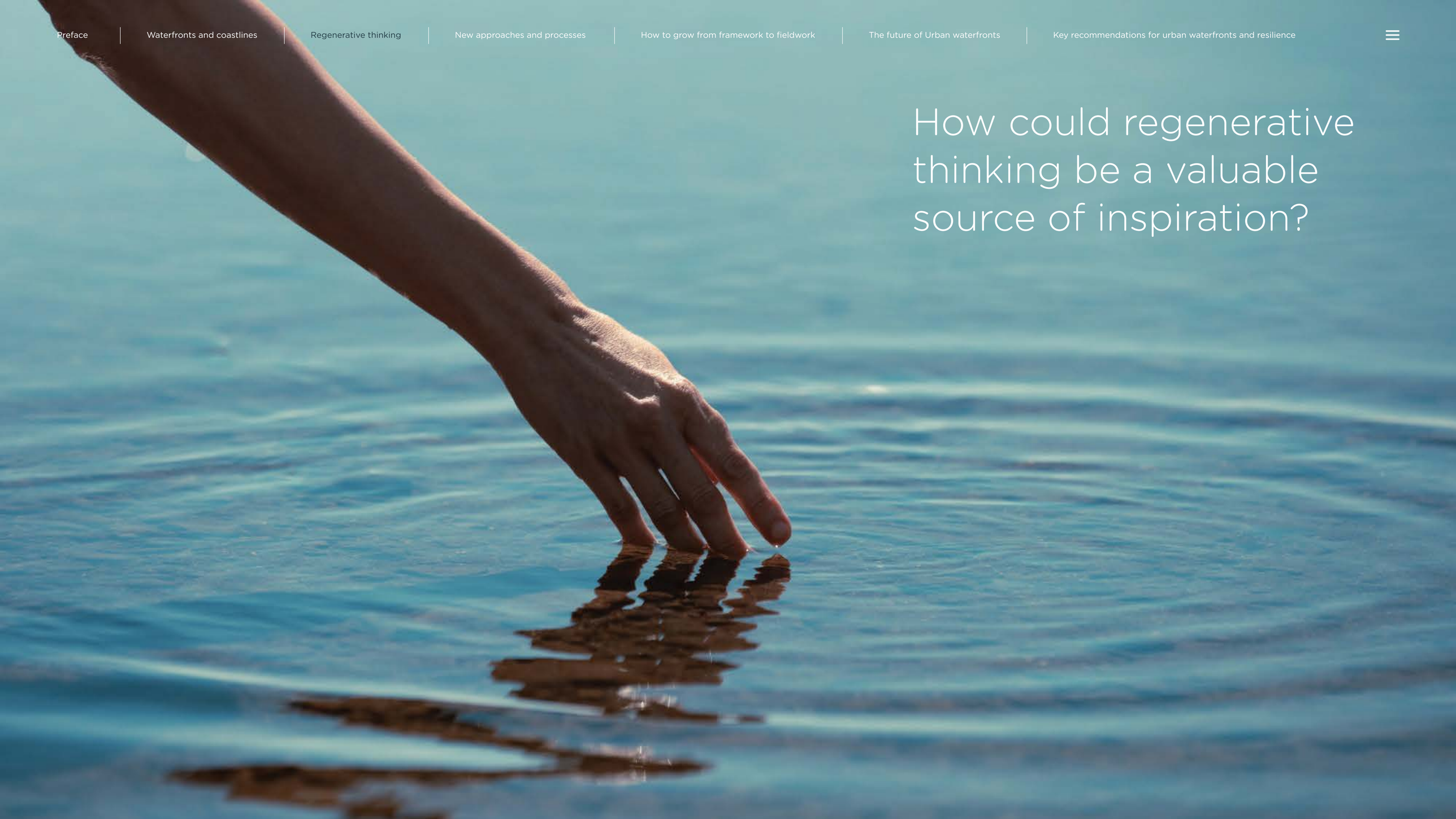
But what if we applied that same level of commitment to non-human nature?
Not nature as scenery or as a constraint, but nature as infrastructure.

Imagine investing in the living systems around us, in the flora, the fauna, the oceans and the land itself, with the same ambition and intentionality that we have brought to roads, power plants, and sea walls. What new possibilities could arise if we viewed ecosystem regeneration and coastal resilience as inseparable? What synergies might unfold if nature were not something to control, but something to design with?

Can nature protect us?
Not in the traditional sense. But with the right mindset, it can become a powerful ally.

How could regenerative thinking be a valuable source of inspiration?

A journey towards a thriving future

In the face of today's polycrisis of climate change, biodiversity loss, and social fragmentation, it is clear that business as usual is no longer viable.

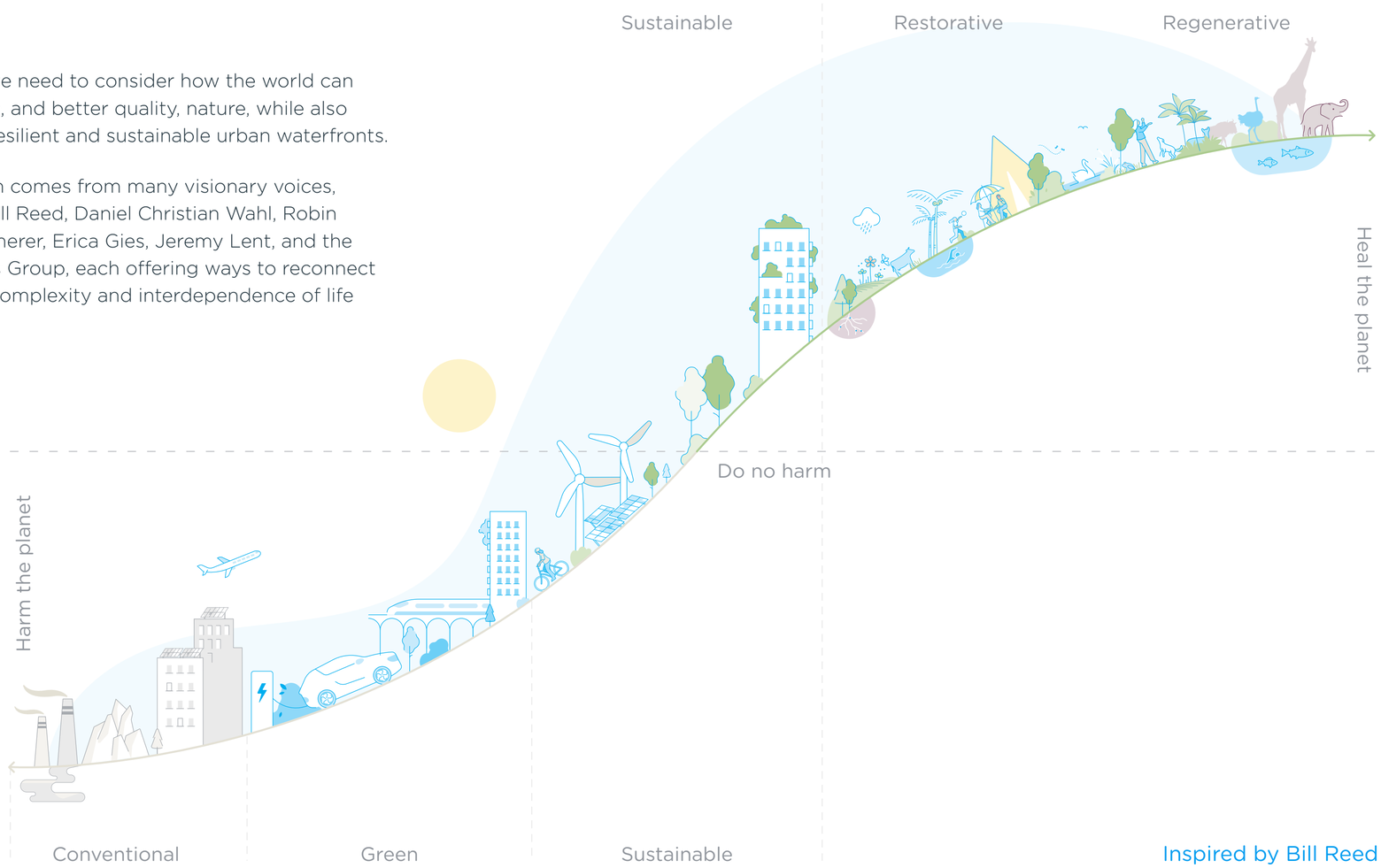
A regenerative paradigm invites us to go beyond incremental sustainability and reimagine how we create value, at the right scale and in the right relationship, with each other and the natural systems that sustain us. It is a fundamental rethinking of how we engage with the world, moving from extractive models to those that are life-affirming, systems-aware, and deeply connected to nature.

Thought leadership in this space means guiding bold transitions, shaping new narratives, and embedding regenerative principles into the very fabric of our strategies, cultures, and operations.

Regenerative thinking challenges us to move beyond the idea of simply "doing less harm."

Instead, we need to consider how the world can gain more, and better quality, nature, while also building resilient and sustainable urban waterfronts.

Inspiration comes from many visionary voices, such as Bill Reed, Daniel Christian Wahl, Robin Wall Kimmerer, Erica Gies, Jeremy Lent, and the Regenesis Group, each offering ways to reconnect with the complexity and interdependence of life on Earth.



Inspired by Bill Reed

Other decarbonisation options alone won't cut it

A regenerative future calls on us to rethink, redefine, and redesign how we work, relate, and imagine what is possible. At the heart of regenerative theory is an invitation not only to evolve our practices but also our language. After all, language shapes perception and is the architecture of thought. A regenerative vocabulary reorients our values, priorities, and relationships, enabling us to speak of vitality instead of scarcity, interdependence instead of control, and potential instead of extraction.

Through this shared language, regenerative futures are not just imagined but made possible. So, how can we shift the way we speak to shift the way we build, design, and care?

Key terms for a regenerative future

Interconnectedness

A recognition that nothing exists in isolation. All life is woven into nested, dynamic systems and flows of energy, that constantly shift and influence each other.

Living System

An open, self-organising system made up of all socio-ecological beings and communities. In living systems, the whole is always greater than the sum of its parts, and vitality emerges through relationships.

Complexity

The inherent unpredictability and relationships found within living systems. Rather than controlling it, we engage with its complexity by listening, sensing, and working with the whole system.

Eco-systemic

An understanding that we are part of a web of relations, both living and non-living, every entity playing a fundamental role in our collective community.

Power with

A shift from hierarchical "power over" models toward shared power, where leadership becomes relational and rooted in service, trust, and collaboration.

Essence

The unique qualities or energies that define a place, entity, or living system. Essence is felt and sensed, harnessed through imagining. It is key to making something what it truly 'is'.

Life affirming

It is a mindset and design philosophy, aligned with the cycles and generative forces of living systems. Supporting the cyclical and generative capacity of all living systems, it nurtures and activates the conditions conducive to life.

Place

More than a location, place is where the past, present, and future converge, where and complex relationships between living and non-living stakeholders create a unique story and vibrant presence.

Reciprocity

Going beyond transactional relationships, regeneration asks us to give more than we take and to co-create through care, generosity, and mutual investment in a thriving whole.

Past knowledge for future generations

Learning from ancestral wisdom, traditional ecologies, and the resilience of communities past, we aim to create thriving conditions to ensure life for tomorrow.

Sense of place

Sense of place provides the overarching context for any design or development process. It is not just about where a project happens, but how that place lives, breathes, and evolves. To design regeneratively, we must first come to know a place: its rhythms, patterns, capacities, and potential. At its core are three essential elements:

Sense: Places are living socio-ecological systems, shaped by people, species, landforms, and layered histories. To “sense” a place means to widen our lens, uncover its past, witness its present, and begin understanding its future potential.

Reconnect: Reconnection involves co-creating shared understanding, welcoming critique, and integrating many forms of expertise to guide development to a shared vision.

Evolve: The process generates integrated solutions that transform complex challenges into regenerative opportunities. They are not static, but living strategies, shaped by local context, responsive to change, and able to evolve over time. It ensures development is not only sustainable, but authentic and in harmony with the ecological and cultural fabric of place.

01

In harmony with nature

Regenerative thinking calls for a fundamental shift in how we see ourselves in the world, where we are not separate from nature, but part of nature.

This worldview challenges centuries of hierarchical thinking in which humans have been positioned above, and in control of, the natural world. We are not here to dominate, overpower, or manage nature, but to live in unity and treat it with humility, responsibility, and care. In this light, regenerative thinking becomes a process of co-evolution, creating built environments and human systems that restore harmony, foster reciprocity, and rebalance the relationship between people and planet.

It also calls us to ask deeper questions: Who and what thrives here? Who and what has been displaced, degraded, or lost? Just as the past 150 years brought forth monumental feats of engineering and infrastructure, we now imagine a future marked by equally ambitious projects of regeneration where we invest in the restoration of ecosystems, biodiversity, and the vitality of place.

02

Past knowledge

Throughout history, communities all over the world upheld deep-rooted traditions of living in balance with the land, guided by a sense of stewardship, reciprocity, and responsibility toward their environments. These cultural obligations reflect a profound awareness that humans are not owners of nature, but participants within it.

Recently, research has begun to validate that these time-tested systems of natural resource management are often more resilient, equitable, and effective than those developed through post-colonial economic and governance structures.

We are inspired by the idea that regenerative urbanism can draw strength from this wisdom. By turning to historical and ancestral knowledge systems as a foundation, we are offered a powerful opportunity to reshape sustainability, not as a set of metrics, but as an ethic of care that prioritises life, living systems, and long-term flourishing.

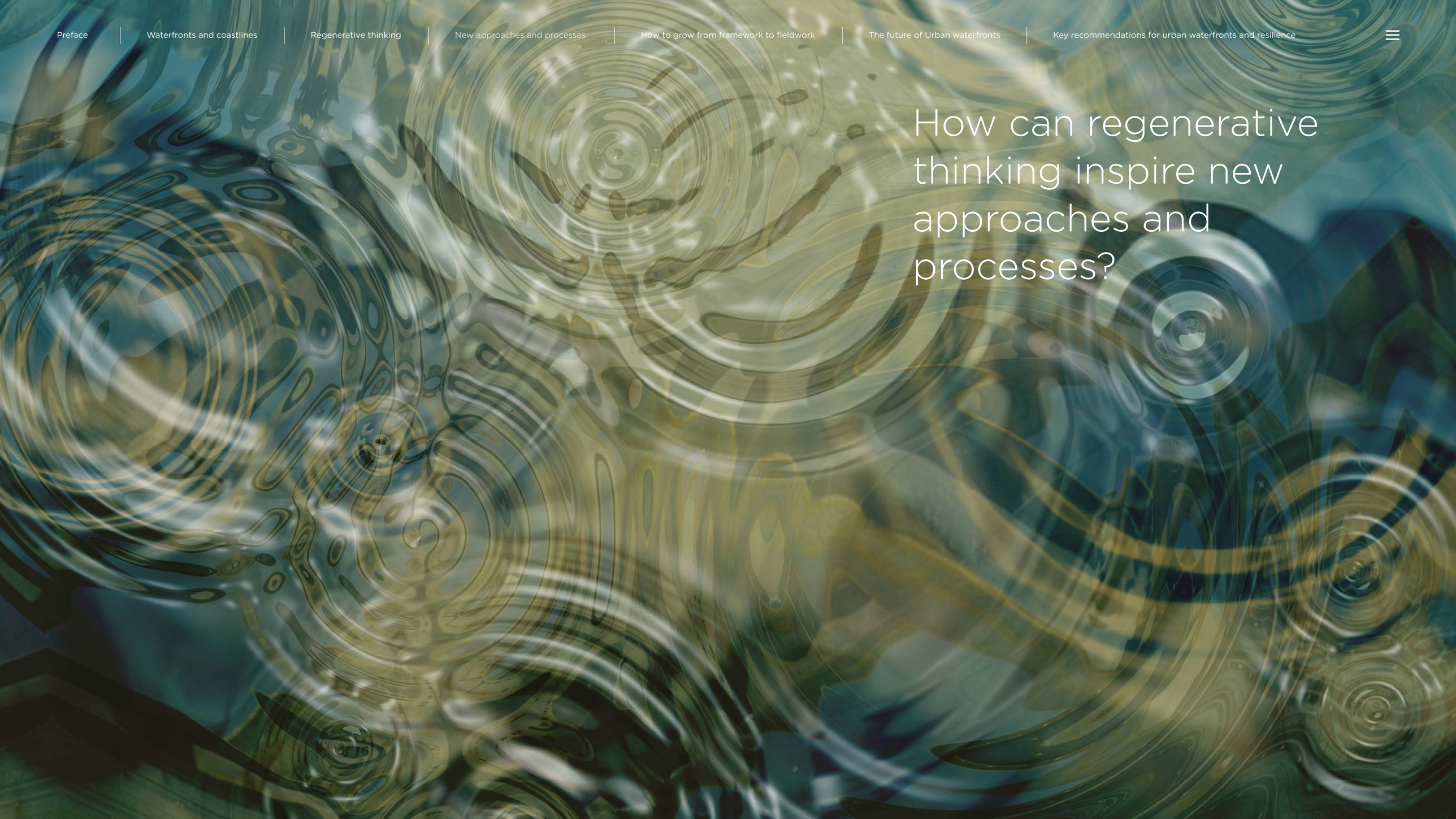
03

This approach calls on us to:

- act as agents of change rooted in place,
- engage with our communities and bioregions,
- work at the right scale, honour the stories, insights, and practicesthat came before us.

It invites us into a mindset of sensing what is alive and emerging in a place while also releasing outdated systems and beliefs. From this openness, new possibilities for a regenerative future can take root.

In doing so, we build not only a better “now,” but also a resilient, life-affirming world for generations yet to come.



How can regenerative thinking inspire new approaches and processes?

Regenerative guiding principles

We are inspired by regenerative theory and the evolving language that supports it. To guide our journey into this paradigm, we have developed four foundational principles, our “Four Cs”. They act as navigation points, helping us continuously ask the right questions, evolve our methods, and shape projects that are aligned with the rhythms and potential of the living world.

Community

Nurture ecosystems

We strive to understand the complexity of being part of and intervening within living systems. That is why we approach community not just as people, but as an ecosystem of relationships. We relearn what it means to be in partnership, expanding our view to include all forms of life and the environments that sustain them. And together, we nurture vibrant, diverse ecosystems of connection. At the heart of our approach is a commitment to activating a culture of “power with” rather than ”power over,” in all our relationships.

Creativity

Co-evolve conditions

We aspire to create life-affirming ripples, together, and with the wisdom of water. In a regenerative paradigm, creativity means designing for co-evolving conditions rather than fixed outcomes, because we believe that life itself creates the conditions for more life.

For us, co-creation begins with deep collective awareness of place, essence, and potential. We unlock this awareness through presencing, by honouring indigenous wisdom, and by practicing the art of letting go so that new possibilities may emerge.

We reintroduce nature into our language, our processes, and our designs
to rebalance and reconnect. We share and test our technical insights openly, acknowledging that growth depends on our willingness to explore. Here, failure becomes fertile ground, and an opportunity to compost, reorganise,
and learn anew.

Courage

Start differently

Starting differently means more than breaking with tradition. It means reimagining what is possible. We challenge assumptions, and aim for outcomes that align more deeply with the needs of our living systems.

It takes courage to start differently and question what has always been done.
It also takes curiosity, a willingness to listen, to learn, and to be transformed in the process. We recognise that much of our current work still struggles to meet the needs of the complex systems we serve. That is why we increasingly challenge the brief, to intervene in right relation and at the right scale.

Care

Revitalise essence

We honour the legacy that makes us who we are. Grounded in our values and
beliefs, we act with integrity and authenticity. United by our water hearts,
we steward life-affirming principles and care deeply for every place our work touches.

We choose our partners and projects with intention, guided by reciprocity.
We seek out synergies between lasting positive impact and healthy financials.
And we diversify our portfolio by prioritising relationships rooted in trust, shared purpose, and regenerative potential.

The way to get there matters

Creating more, and better, nature alongside resilient and sustainable societies in urban waterfronts is a vital aspiration. Yet, achieving this is far from straightforward. So, what could a process grounded in sense, reconnect, and evolve, inspired by regenerative principles, and initiated early and at a strategic level, look like? What elements, steps, and iterative loops could it include?

We have developed a take on a regenerative procedural approach to urban waterfront resilience. Use it for inspiration, but please do not see it as a one-size-fits-all diagram. In fact, the circular, adaptive, and relational dynamics between the individual steps may be more important than the steps themselves.

Past and present

This phase focuses on sensing and studying the specific place in depth. Stakeholders – human, nonhuman, and even nonliving – are identified, explored, and actively engaged to expand the understanding of place.

Present and future

Here, visions, desired impacts, resilience goals, guiding principles, and design criteria are co-developed, tested, and agreed upon through inclusive dialogue.

Resilience strategies

This is the stage where resilient strategies are conceived and refined, where ideas take form, and design elements begin to emerge.

Exploration and gathering of best practices

A mapping of present and future conditions occurs here, informing the development and testing of site-specific resilience typologies.

Site-specific

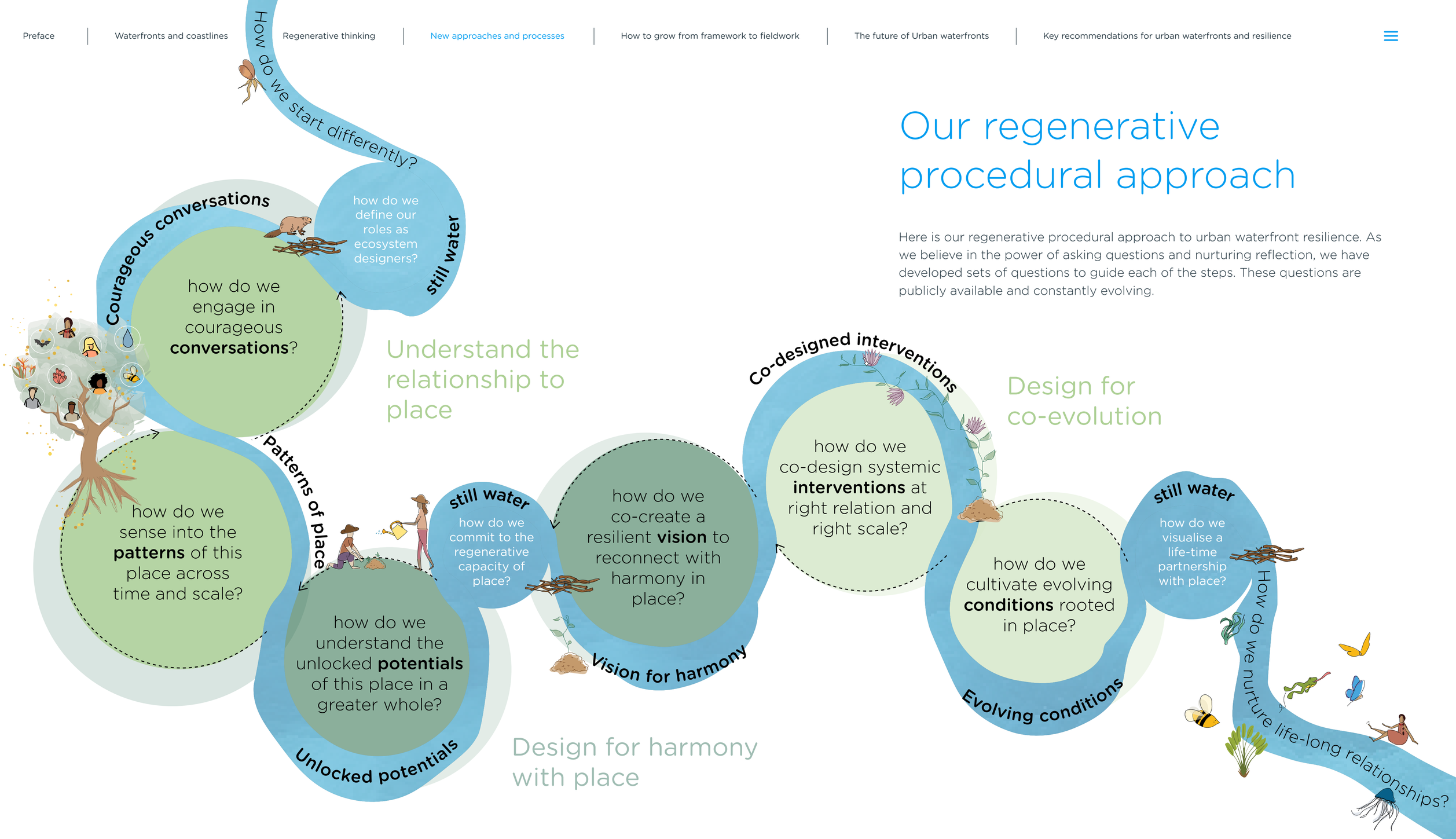
This phase involves creating, visualising, and evaluating design alternatives rooted in the unique context, needs, and regenerative potential of the site.

Finish differently

Instead of closing the process with static conclusions, this phase embraces dynamic adaptive planning. It also includes co-creating a business case that reflects not just economic value, but also long-term social and environmental sustainability

Our regenerative procedural approach

Here is our regenerative procedural approach to urban waterfront resilience. As we believe in the power of asking questions and nurturing reflection, we have developed sets of questions to guide each of the steps. These questions are publicly available and constantly evolving.



How can we go from framework to fieldwork?

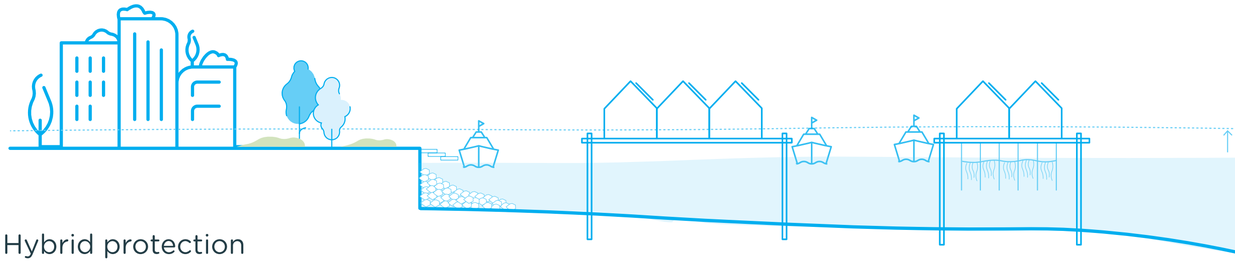
From framework to fieldwork: Baseline approaches for coastal flooding

While these guiding principles support more sustainable projects, coastal initiatives must first confront the practical challenge of fluctuating water levels. The following baseline approaches show how early-phase thinking can translate into resilient spatial strategies at the waterfront

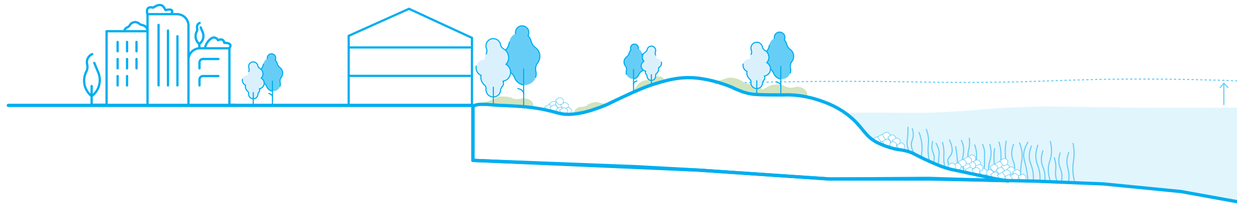
An early-phase approach to urban coastal resilience offers far more than protection from rising seas. When grounded in openness and inclusion, it becomes a powerful opportunity to unlock integrated, regenerative planning, connecting people, place, and the living systems we depend on. Coastal resilience is not just about keeping the water out. It is about letting new possibilities in.

> The key to success is to make the right combination and reach the right level of detailing!

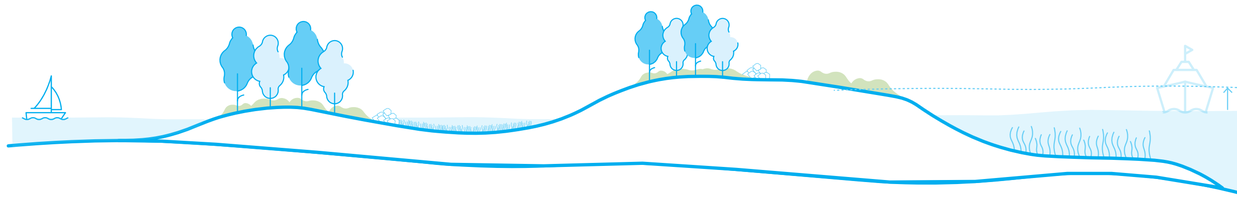
Living with water



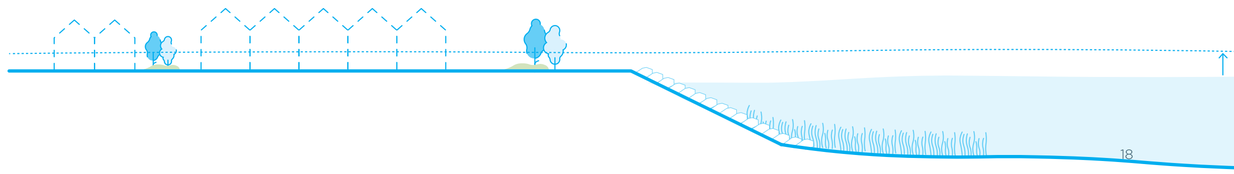
Hybrid protection



Protect with nature



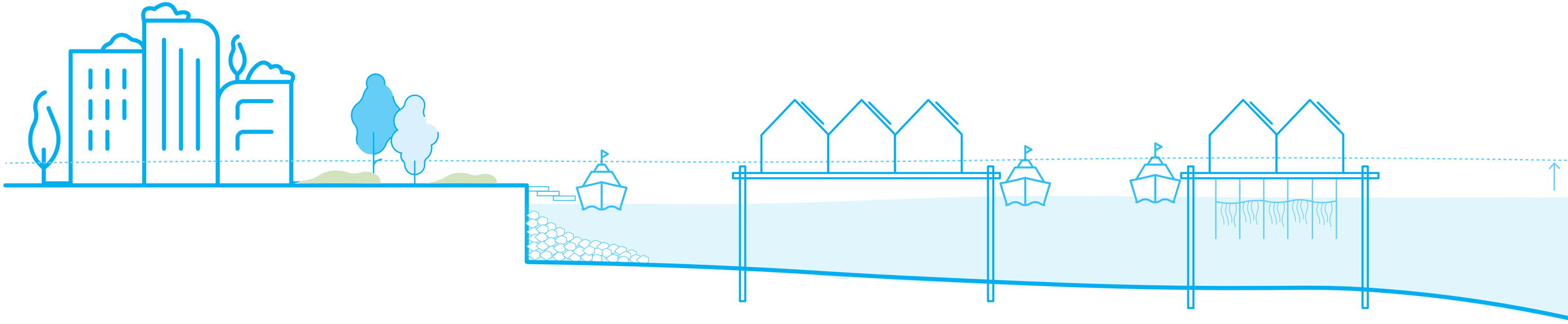
Managed retreat



Living with water

Testing adaptive urban forms

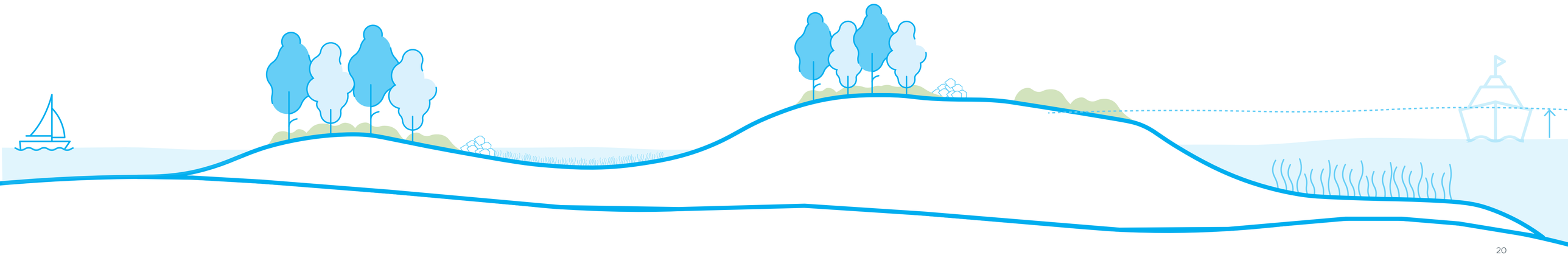
This strategy explores how cities can embrace water, not just resist it. Instead of designing urban areas to keep flooding out, we ask how the built environment can adapt and respond. Adaptive urban forms, such as floodable ground floors, stilted structures, floating homes, terraced landscapes, and elevated walkways, allow for a more fluid and flexible relationship with water. These forms accommodate sea-level rise, storm surges, and cloudbursts by integrating periodic flooding into the fabric of daily urban life, transforming disruption into design.



Protect with nature

Nature as infrastructure

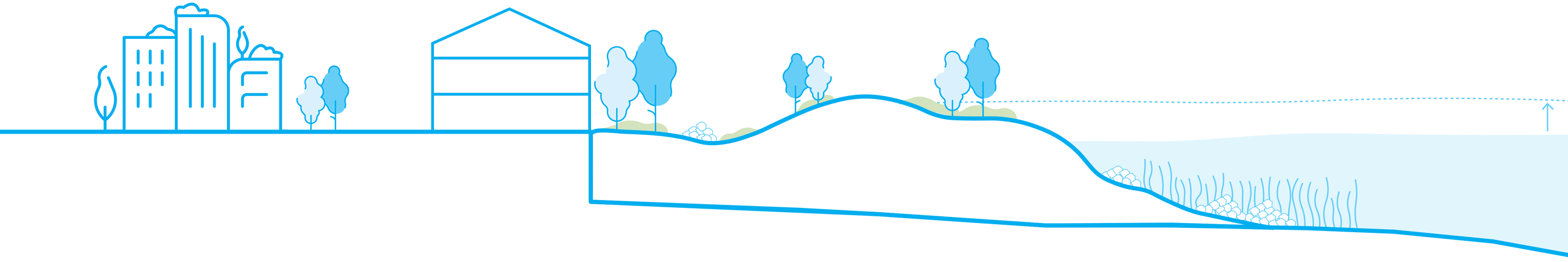
This strategy proposes nature-based, or ”new nature”, landscape interventions beyond the immediate coastline, such as barrier islands or constructed landforms that function like dikes. These coastal features serve not only as buffers that protect the inner urban edge, but also as vibrant ecological and recreational assets. Designed with diverse topographies, wetlands, lagoons, and nature reserves in mind, they offer long-term, flexible protection while enabling habitat regeneration and public enjoyment. By restoring or building offshore ecosystems, cities can strengthen their coastal resilience through solutions that are as life-affirming as they are protective.



Hybrid protection

City as a coastal zone

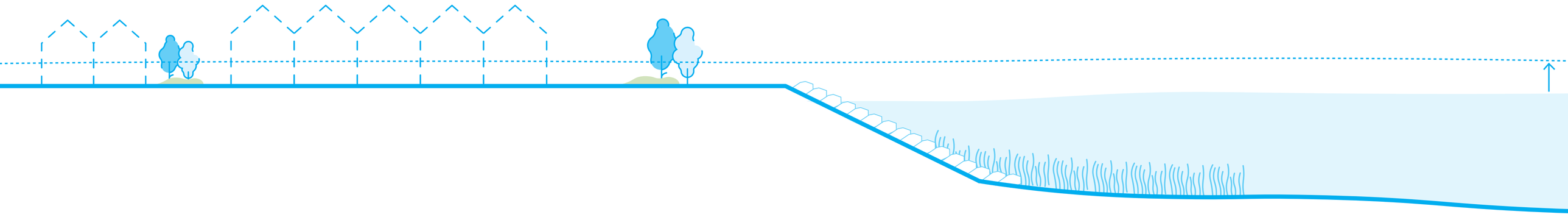
Hybrid protection combines engineered infrastructure with ecological systems to create multifunctional, resilient coastal edges. This might include integrating protective dikes or levees with living shorelines, restored vegetation, and layered public spaces. Existing landmarks, industrial structures, and waterfront infrastructure can be repurposed to preserve cultural identity while also reinforcing coastal protection. The result is a robust urban margin that is not only protective, but also accessible, biodiverse, and meaningful to local communities.



Managed retreat

Let nature reclaim

Where exposure and risk are too great, managed retreat becomes a strategic response. This approach involves the gradual withdrawal from highly vulnerable coastal zones and the repurposing of land for climate-adaptive functions, such as wetland restoration, floodplains, or carbon sinks. Although politically and logistically challenging, managed retreat must be seen as a long-term, planned transition. Rather than framing it as a loss, it should be embraced as a forward-looking investment in public safety, ecological regeneration, and sustainable land use.



Our three aspirations for urban waterfront resiliency

Once coastal protection strategies are selected, we must go further, inviting open, unrestricted collaboration to explore what more these projects can offer. Regenerative and holistic planning cannot emerge in isolation. It requires the space and the mindset to imagine layered benefits that extend beyond defense.

We have grouped these into three aspirations:

CLIMATE-RESILIENT

Assessing the human cost of protective measures against potential damages is key to safeguarding our fragile urban infrastructure. This means assessing the human and environmental costs of inaction, and integrating adaptive solutions not only for coastal flooding, but also for interconnected challenges such as heavy rainfall, urban heat, and drought.

01

RESOURCE-BALANCED

Coastal protection often requires substantial resources, with environmental costs that span the full project life cycle. A regenerative approach emphasises long-term thinking and circular practices: reusing and repurposing materials, prioritising local sourcing, and integrating opportunities for co-benefits such as energy generation, food production, and water purification.

02

NATURE-POSITIVE

Coastal resilience long predates human settlement, but today faces threats like biodiversity loss and ecosystem collapse. Protection should not only prioritise nature-based solutions, but aim to establish new-resilient and biodiverse ecosystems, consciously managed to adapt to climate risks and guard against invasive species.

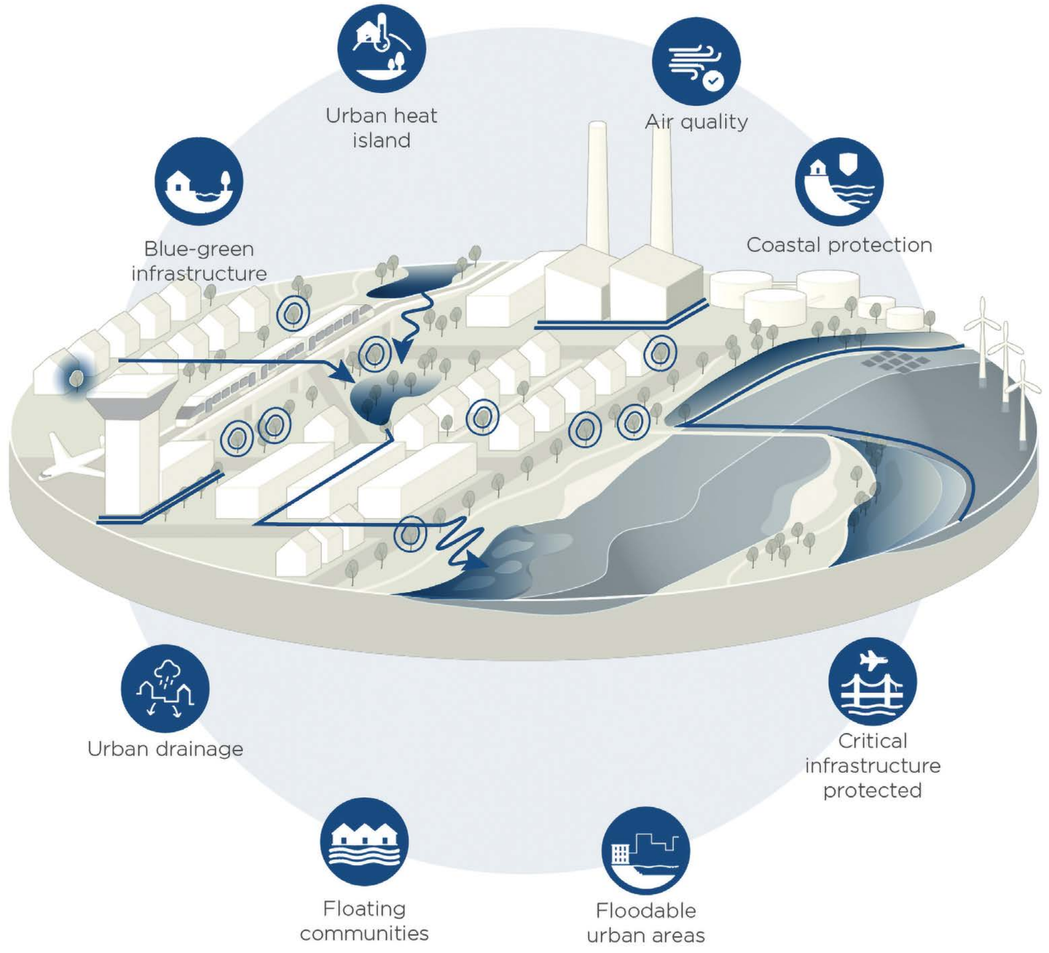
03

Climate resilient

Extreme weather events, from coastal storm surges and sea-level rise to cloudbursts and heatwaves, are among the most significant global risks we face. And with climate change accelerating, these events are projected to become more frequent, more severe, and more unpredictable.

Our urban areas must adapt. Resilience is not only about protection, it is about shifting our mindset to embrace systems thinking and integrated responses. This means planning for multifunctional spaces that can flood safely, embedding nature-based solutions into urban fabric, and reimagining how we live alongside an increasingly extreme climate.

Adaptation is not a one-time fit, but a continuous process of learning, designing, and evolving with our environments.

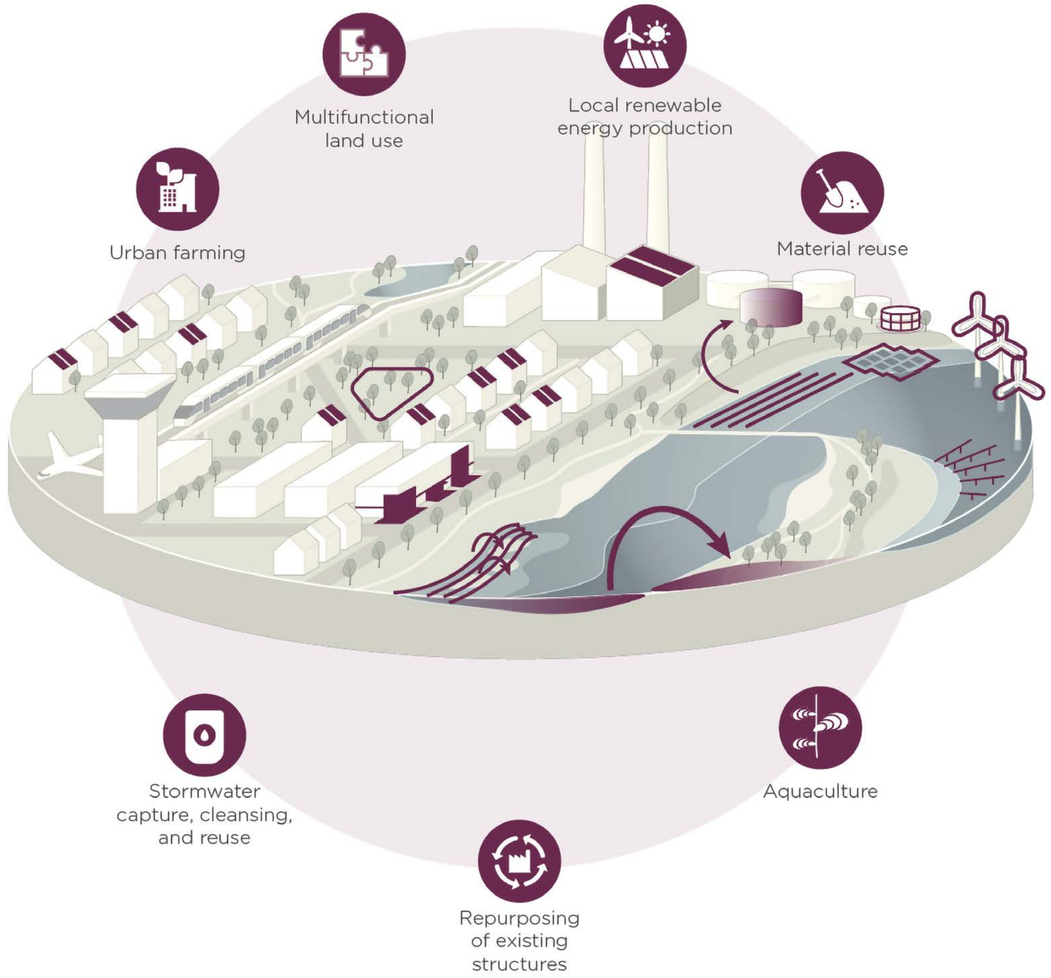


Resource balanced

Building climate protection infrastructure is essential, but it must be done with care and responsibility.

A resource-balanced approach aims to minimise the carbon footprint through reuse, repurposing, local sourcing, and the use of low-carbon materials. It also recognises that, with thoughtful planning, resilient landscapes can give back. By integrating energy and food production, as well as systems like water harvesting, infrastructure can move beyond protection to actively contribute to a more regenerative and self-sustaining urban future.

Long-term thinking is essential, enabling material efficiency through project synergies and laying the groundwork for productive, circular landscapes.



Nature positive

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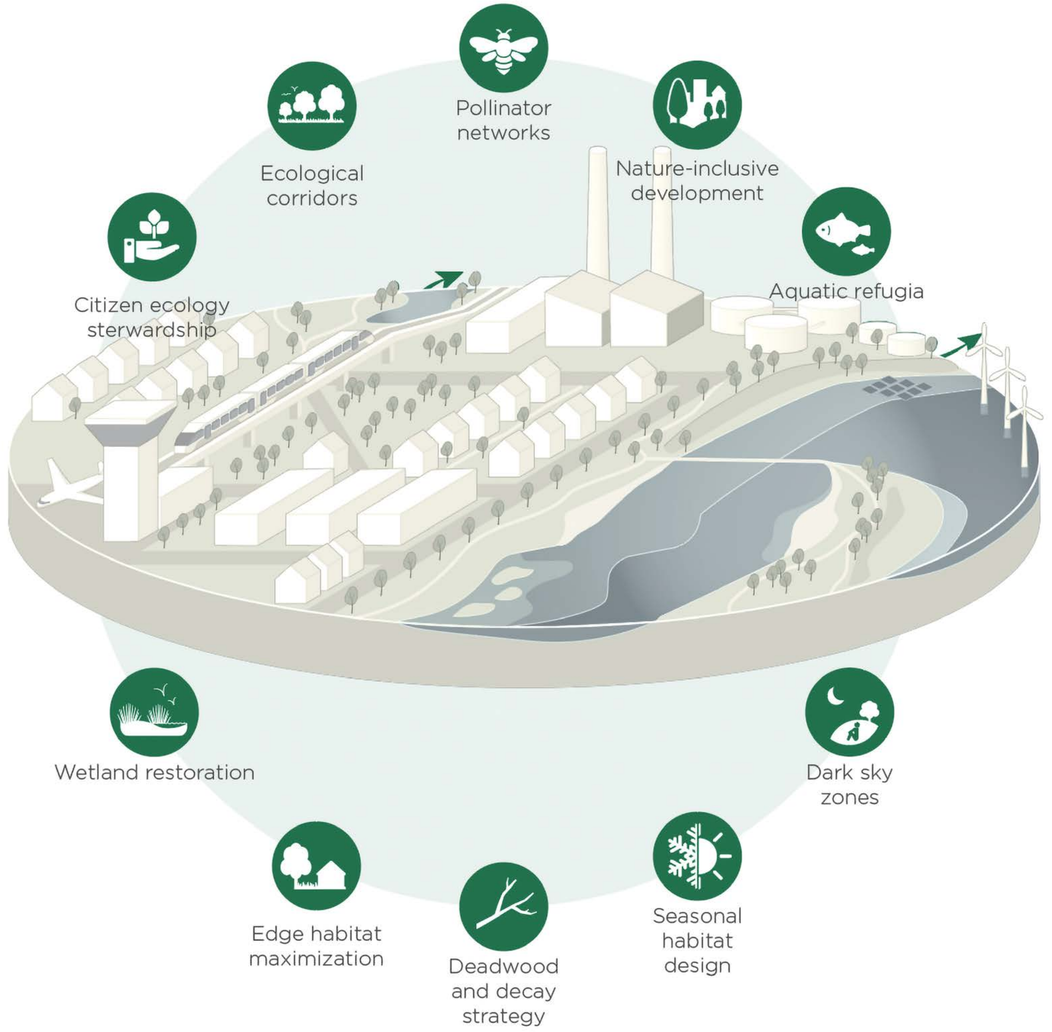
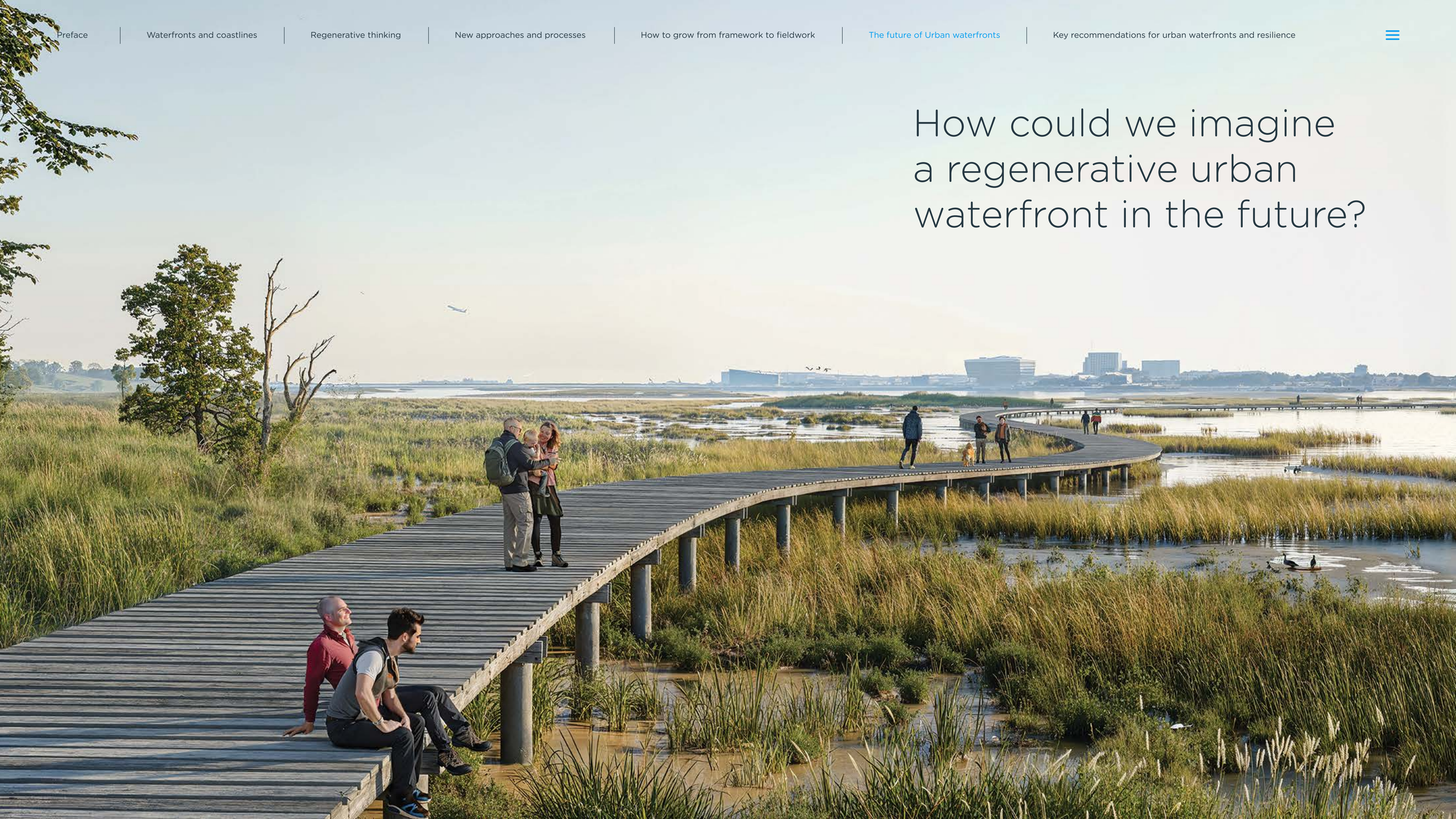


How could we imagine a regenerative urban waterfront in the future?



We have now seen how a regenerative mindset can guide us toward life-affirming and resilient urban waterfronts, and how this shift calls for new processes and ways of working. But what does such a future actually look like on the ground?

What does it mean, in practical and physical terms, to create an urban waterfront where both human and non-human nature not only coexist, but flourish and regenerate together? Which conditions, interventions, mechanisms, and spatial qualities will shape the resilient waterfronts we aspire to bring to life?

From spring to autumn 2024, a joint team from Ramboll and BOGL took on the challenge of envisioning what a truly resilient and regenerative urban waterfront could look like. Over the six month period, the team developed a bold, integrated design for a pivotal coastal stretch, one highly vulnerable to sea-level rise and extreme storm surges.

Applying regenerative thinking: A case study in Copenhagen

To bring this thinking to life, we selected Copenhagen, Denmark, as our case study-offering a lens through which to imagine an alternative future. Like many global coastal cities, Copenhagen is a low-lying, densely built environment where urban life meets the sea at a fragile coastal edge. Historically shaped by land reclamation, the city has steadily extended into the sea to support growing urban needs and enrich the lives of residents and visitors alike.

In this thought exercise, we turn our attention to the eastern coast of Amager, a large island situated just south of Copenhagen's city centre. With an average elevation of just two metres above sea level, Amager is particularly exposed to the long-term impacts of climate change, including sea-level rise and storm surge. Its diverse urban fabric, ranging from housing and critical infrastructure to cultural heritage sites, recreation areas, and protected natural landscapes, makes Amager a compelling and valuable case study for exploring regenerative urban coastal futures.

The physical area and key focus points

Located along the eastern coastline of Amager, Copenhagen's urban and industrial waterfront faces the Øresund Strait, a body of water that forms the Danish–Swedish border. This coastal stretch is increasingly vulnerable to sea-level rise and storm surges. According to recent projections, water levels along Amager's east coast could rise from the 3.4 meter level in 2023 to 3.9 meters by 2075 and up to 4.5 meters by 2125 during extreme storm-surge events. To protect the current land, infrastructure, and buildings over the next century, a minimum protection level of 4.5 meters will be required.

One of the most vulnerable areas in such a scenario is the nearby island of Saltholm, located just east of Amager. If a severe storm surge of this magnitude occurs, Saltholm could be almost completely submerged. At 16 km2, Saltholm is Denmark's 21st largest island and a critical nature reserve. It is home to a large number of nesting wild birds and features an extensive salt marsh in its southern region, protected under the Ramsar Convention. The entire island and its surrounding waters are designated as a nature reserve by the European Union and recognized as an Important Bird Area (IBA) by BirdLife International.

Guided by a holistic approach rooted in regenerative thinking, and shaped through early-phase, high-level, and inclusive collaboration, the team identified three key focus areas to protect, restore, and regenerate:

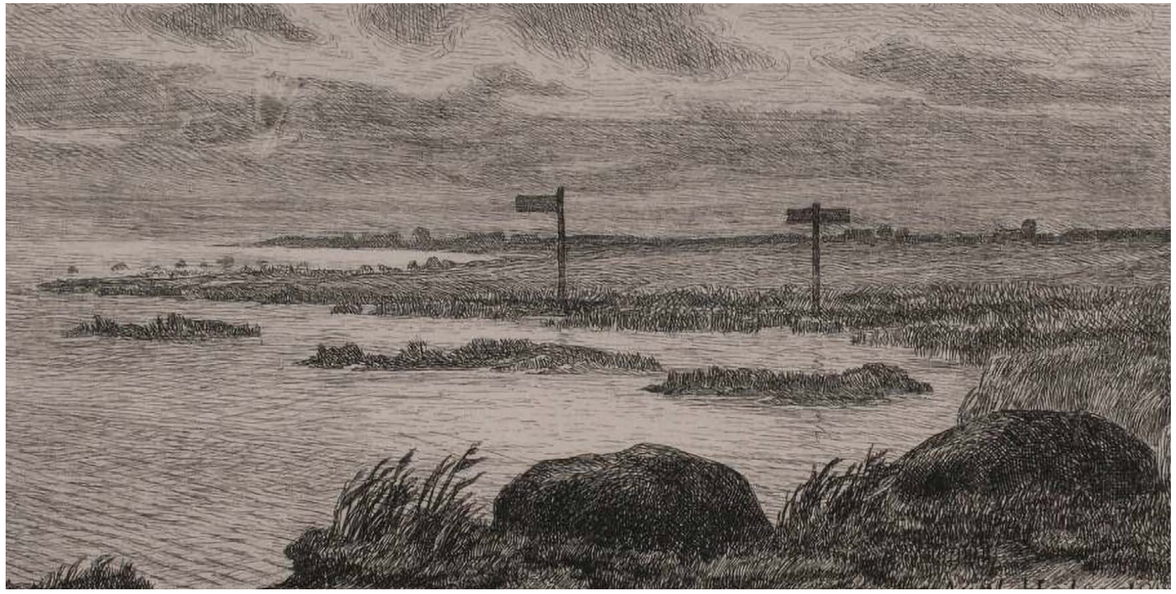
- Non-human parts of nature
- Critical infrastructure and important technical facilities
- Human urban life

Amager: An island shaped by intervention

The island of Amager, as we know it today, is a product of centuries of human intervention and transformation. Much of its current landscape, areas like Vestamager, Amager Strandpark, Christianshavn, Kraftværkshalvøen, and Prøvestenen, have been artificially constructed or significantly altered through extensive land reclamation and coastal adaptation.

The series of maps below illustrate how Amager's coastline has changed over time due to these interventions. The final map presents a sobering future scenario: an unprepared and maladapted Amager overwhelmed by a combination of rising sea levels and a major storm surge event, highlighting the urgent need for resilient and regenerative planning.

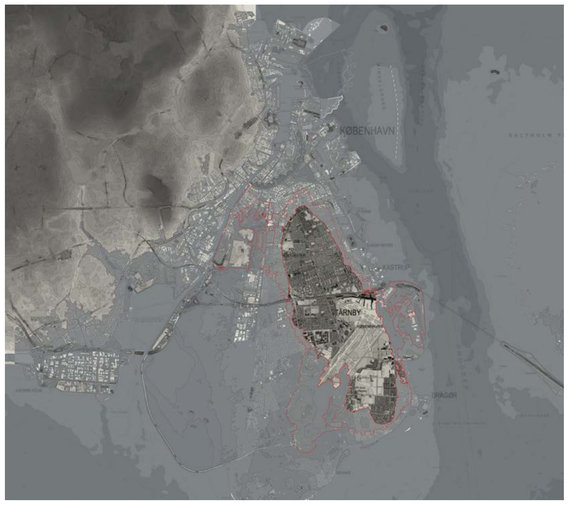
Together, Saltholm and Amager represent a fragile yet vital part of the larger ecological system, providing habitats that support biodiversity on a national and European scale. If resilience planning does not include and prioritise these landscapes, much of this natural wealth may be lost.



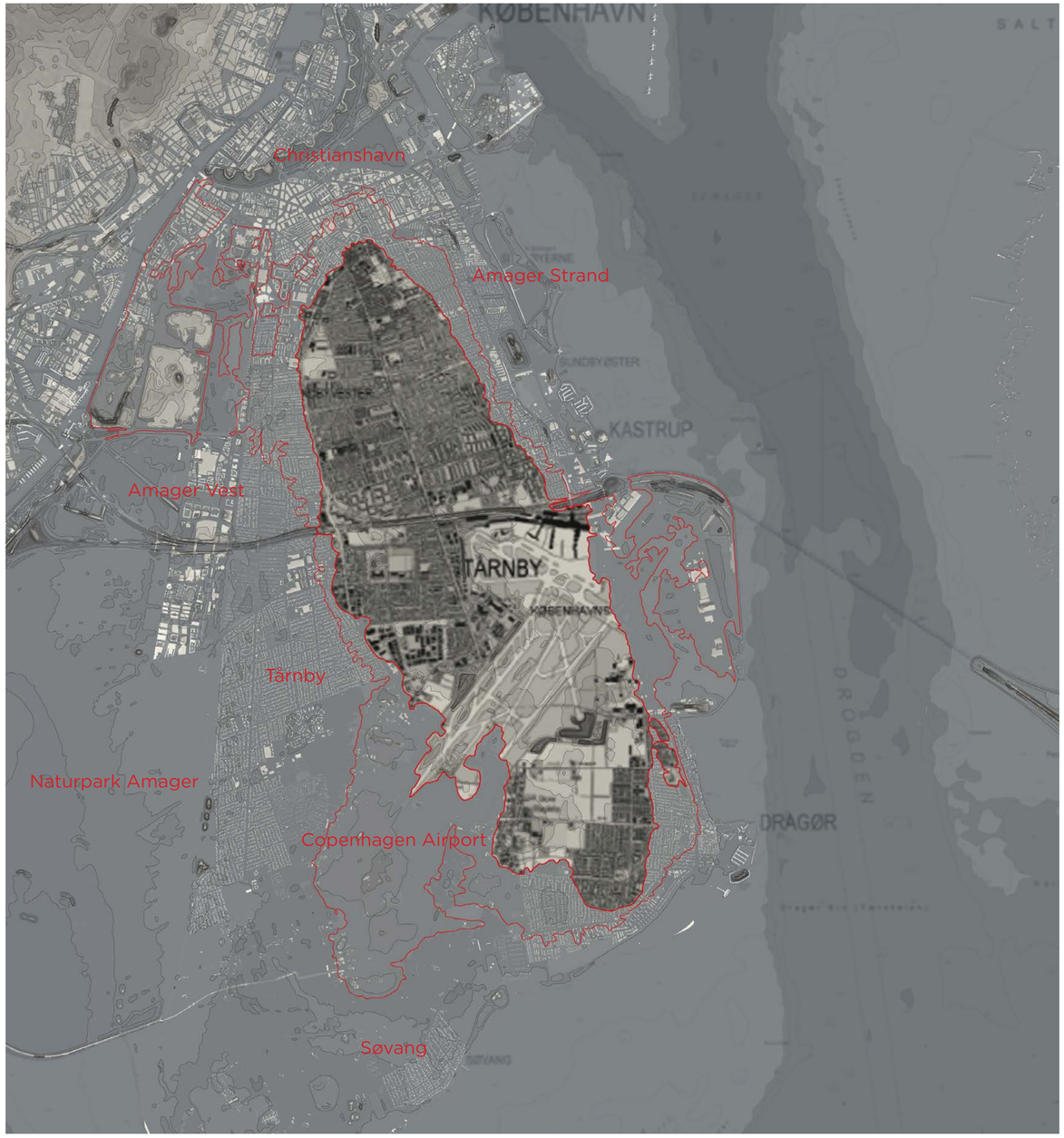
Amager, 1677

Amager, 1768

Amager, 2012



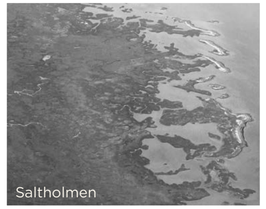
Amager in the future?



What will be lost if the status quo remains?

If no adaptive measures are taken, a storm surge of +4.5 meters, projected as a realistic future scenario, would inundate large parts of Amager. Critical infrastructure, residential neighborhoods, cultural landmarks, and vital natural habitats would be severely affected or lost.

Non-human nature


Saltholmen


Dragør Lagoon


Sandbanks and salt meadows

Human urban life


Housing


Cultural heritage


Recreation spaces

Critical infrastructure and important technical facilities


Copenhagen Airport


M1 and M2 metro lines


Amagerforbrænding

Non-human parts of nature

The two islands, Saltholm and Amager, host an incredible and sometimes overlooked wealth of natural life. Saltholm, covering 18 square kilometres, is a low-lying island of chalk meadowlands and coastal grasslands. Its vegetation is dominated by hardy species such as motherwort, henbane, blue iris and chickweed.

The island serves as Denmark's largest grazing area for geese, with around 7,000 visiting each summer. It also supports a large seasonal population of juvenile swans, some 3,500 in the summer and 2,000 more in winter. Autumn and early spring bring flocks of 10,000 to 12,000 ducks, while the island is also home to Europe's largest breeding colony of eiders. Each spring, up to 15,000 eiders live on the island, with around half that number hatched there every year.

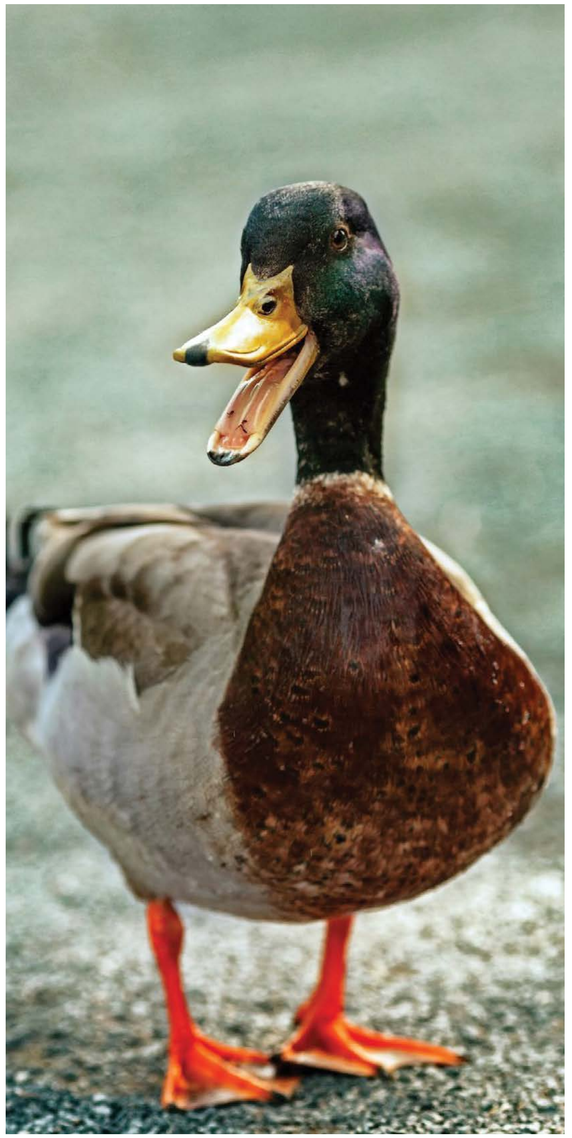
Just west of Saltholm, the much larger island of Amager spans 96 square kilometres and encompasses a diverse patchwork of urban and natural environments.

Its western areas include extensive wetlands designated as Natura 2000 sites, home to species such as marsh harriers, Eurasian curlews, pintails, dunlins, Arctic terns, and short-eared owls, many of them critically endangered. In winter, the area becomes a sanctuary for tufted ducks, goosanders, smew, and mute swans.

The latter, Denmark's national bird, gathers here in remarkable numbers, with nearly one-third of the national population wintering in and around Amager.

The island Saltholm covers 18 square kilometres

Saltholm has rich vegetation



10,000–12,000 ducks breed and graze on Saltholm

The natural rhythms of the area are shaped not only by wild birds but also by large grazing animals. In summer, Vestamager becomes a shifting landscape maintained by over a thousand heifers, calves, and bullocks, which help keep the vegetation in check.

A population of wild fallow deer also roams the area, managed to match the land's capacity. In the midst of this ecosystem lies 'Pinseskoven', the only large birch forest in Denmark. It is a rare, self-sustaining woodland that plays an important role in supporting both plant and animal life in the region.

'Pinseskoven' on Amager is the only large birch forest in Denmark.

Around 3,500 juvenile swans live on Saltholm in the summer

Human urban life

The development of Amager, and not least the area in scope, encompasses a long historical process, from agricultural land and royal estates to industrialization and recent population growth, driven by metro construction and new housing developments. The island has undergone a major transformation into an attractive residential area with a growing number of inhabitants, while preserving green spaces and developing cultural offerings. Since the mid-1990s, large parts of Amager have been characterized by extensive construction and infrastructure projects, most of which have been initiated based on a political desire to make Copenhagen – and thus Amager – a powerhouse in the Øresund region.

Ørestad is being developed in a vast natural area (Amager Fælled and Kalvebod Fælled), while other projects are situated on former industrial sites. Examples include the urban development area Kastrup East near Amager Strand as well as commercial and residential constructions at Amager Boulevard and Islands Brygge. Over the past 10-15 years, Amager has largely merged with Copenhagen and has therefore, alongside the rest of the city, undergone a general revitalization. The need for cultural activities and recreational areas has been addressed, for instance, in the Holmbladsgade district, Amager Strandpark, and the harbor park at Islands Brygge. Inviting cafés are emerging everywhere, and the vibrant city life creates an attractive balance between metropolitan living and unique nature.

Amager beach park hosts many beach guests and outdoor enthusiasts every year.

Kastrup Sea pool is a free bathing establishment constructed in the form of a conch shell

Streets like Amagerbrogade and Holmbladsgade host vibrant urban life

Residential and commercial high-rise buildings constitute an evolving skyline

Critical infrastructure and important technical facilities

Amager, and particularly the area in scope, is home to a concentration of technical and critical infrastructure that plays a vital role not just locally, but regionally and nationally.

The Copenhagen Metro, a light rapid transit system, serves 360,000 passengers each day and 120 million annually. Fourteen of its stations are located on Amager, making the island a central transit hub for the capital. Another landmark facility is Copenhill, the iconic waste-to-energy plant. More than just another incineration plant, it is a striking symbol of urban multifunctionality: a resource-handling centre, a provider of combined heat and power, and a public recreation facility with a ski slope on its roof. Every year, Copenhill processes approximately 400,000 tons of municipal solid waste, converting it into energy and district heating for the city.

The island is also home to Copenhagen Airport, Scandinavia's largest and the busiest airport in Northern Europe, serving more than 30 million passengers each year. To the north lies Prøvestenen, an industrial harbour and logistics hub that plays a crucial role in the movement of energy supplies and building materials into Copenhagen, feeding the ongoing development of the metropolitan region. Close by lies Lynetten, Denmarks's largest wastewater treatment plant that serves the central Copenhagen as well as several surrounding suburbs.

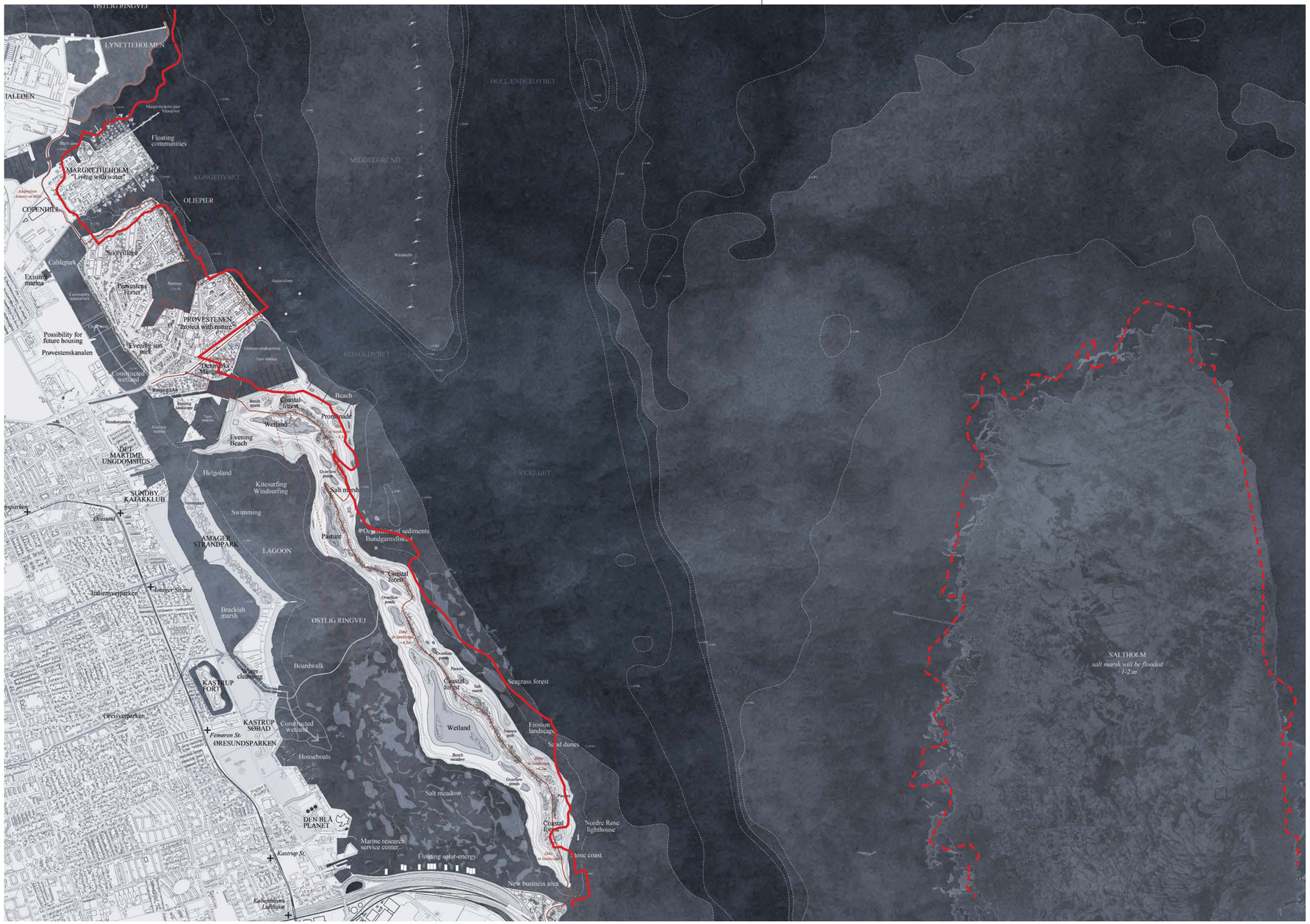
Treating wastewater from both industrial and municipal sources, Lynetten serves a population equivalent of
1.1 million people and handles around 3.2 million litres of wastewater every day.

Together, these facilities represent the backbone of Copenhagen's urban metabolism. Their exposure to climate risks such as sea-level rise and storm surge underscores the urgency of integrating resilient strategies into coastal planning, not only to protect human life, but to safeguard the systems that sustain it.

The Copenhagen Metro is a light rapid transit system in Copenhagen that serves 360,000 people daily

Streets like Amagerbrogade and Holmbladsgade host vibrant urban life

Copenhill is a combined heat and power waste-to-energy plant



The aspiration of this project is twofold: to reimagine and recreate natural habitats that are at risk of disappearing in a changing climate, and to adapt the island of Amager to the long-term realities of rising sea levels and increasingly frequent storm surge events. Rather than choosing between nature and protection, the project seeks to integrate the two, and to shape a future where ecological regeneration and urban climate adaptation go hand in hand.

CLIMATE-RESILIENT

RESOURCE-BALANCED

NATURE-POSITIVE


Climate-resilient
Flood-resilient building typologies: floating houses, houses on stilts, raised walkways, terraced landscapes
"Danish mangrove" tidal barrier woodland
New barrier island with a 4.5m high storm surge protection line

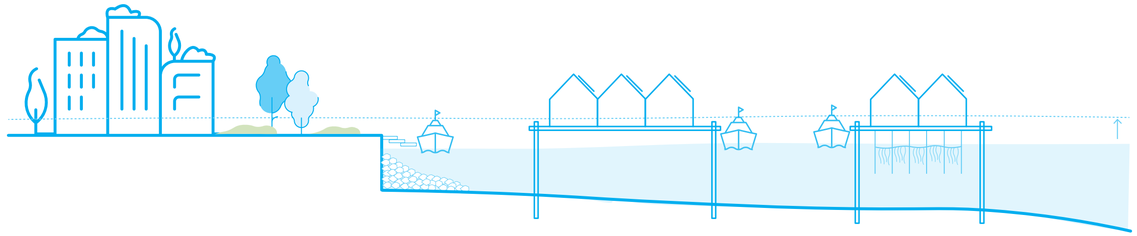

Resource-balanced
Repurposed industrial structures and sustainable materials (e.g. compacted sand)
Marine food production (e.g. seaweed, mussels, oysters, scallops, floating farms)
To minimize the use of soil and prioritize environmentally sensitive approaches, the design is confined to a seawater depth of 10 meters
Local renewable energy production - floating solar panels
Surplus soil from the planned Østlig Ringvej could be used for the new landscape, minimising resource extraction, transport, and emmissions


Nature-positive
"Danish mangrove" tidal barrier woodland
Wetland
Pasture
Salt marsh and overflow ponds
Lagoon
Constructed wetland
Freshwater ponds
Seagrass meadow
Salt meadow
Coastal forest
Beach meadow
Sand dunes
Rocky shore
To compensate for habitat loss, new nature is created.
The new barrier island has a varied topography and creates a landscape of many biodiverse ecosystems - both on land and in the shallows.

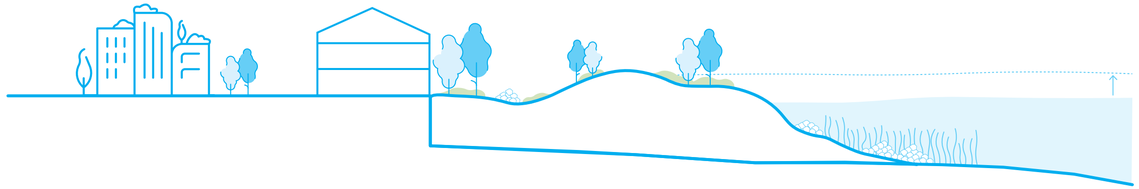
Four strategies

What happens when we start working with the three aspirations of being climate- resilient, resource-balanced and nature-positive in a specific context? How can we best protect infrastructure, technical facilities, and human liveability while nurturing nature and giving water the space needed? We sugggest following four strategies that can be applied at different places and combined in various ways:

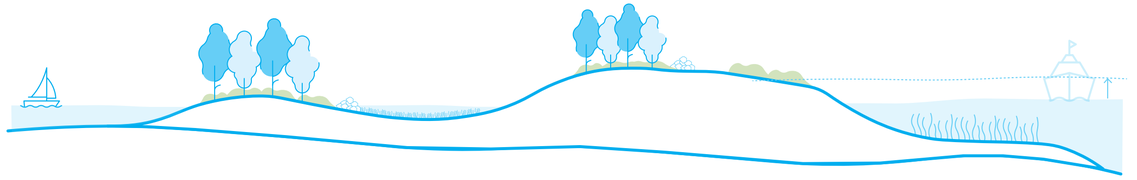
Living with water



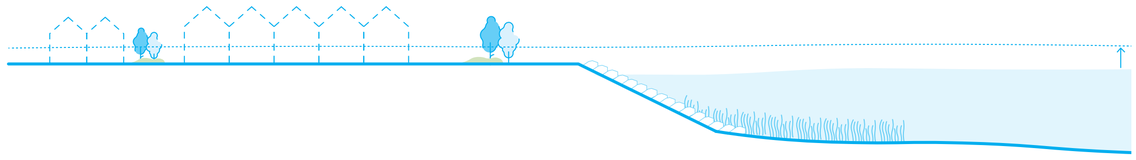
Hybrid protection



Protect with nature



Managed retreat



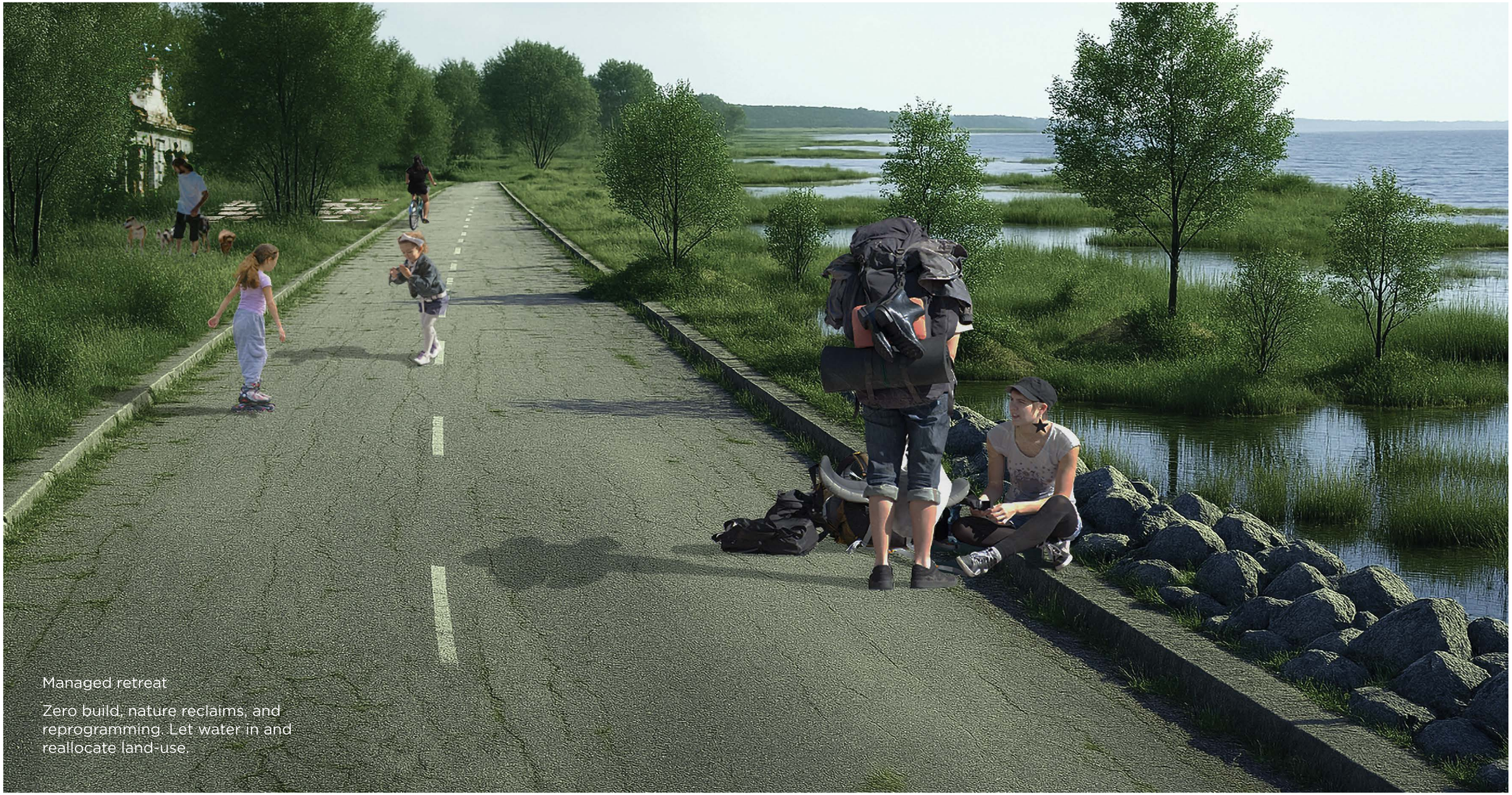
Different strategies for different parts of the area

Living with water

Floating communities, smart structures, and adaptive reuse. It's all about adaptability, flexibility, and creativity.


Hybrid protection
Bio-based materials, productive landscapes, and space for nature. Protect with care and cleverness.


Protect with nature
Ecology stewardship and new habitats and microclimates. Protect in life-giving ways.



Managed retreat

Zero build, nature reclaims, and reprogramming. Let water in and reallocate land-use.

Living with water

SMART STRUCTURES

New buildings on stilts or designed with floodable first floor, making them resilient to extreme flooding events. This would require new approaches to streetscapes perhaps supplemented with elevated walkways.

ECOLOGICAL CORRIDORS

Blue-green infrastructure creates connected corridors not only for water but also wildlife. Focusing on establishing generous blue-green networks makes the area more resilient while also increasing biodiversity.

PRESERVATION

Maintaining the existing waterfront and not establishing a protection barrier such as a dike, preserves the ecology that has established today, and provides variation to the other strategies along this coast.

LOW-IMPACT CONSTRUCTION

Keeping new buildings limited in their size reduces load, and therefore need for heavy construction materials. Light-weight, bio-based materials that can absorb and store CO_2 can be more feasibly supports on stilts.

CLEAN WATER

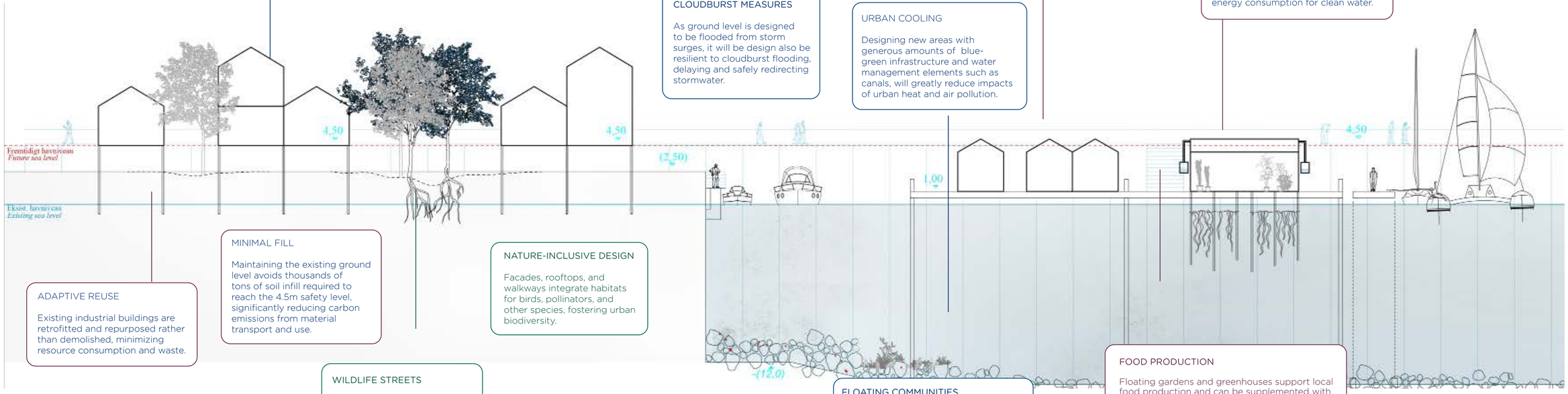
Harvesting rainwater and innovative greenhouse sills that desalinate seawater for re-use, especially during heatwaves, can make a big difference during drought, but also reduces daily energy consumption for clean water.

CLOUDBURST MEASURES

As ground level is designed to be flooded from storm surges, it will be design also be resilient to cloudburst flooding, delaying and safely redirecting stormwater.

URBAN COOLING

Designing new areas with generous amounts of blue-green infrastructure and water management elements such as canals, will greatly reduce impacts of urban heat and air pollution.



ADAPTIVE REUSE

Existing industrial buildings are retrofitted and repurposed rather than demolished, minimizing resource consumption and waste.

MINIMAL FILL

Maintaining the existing ground level avoids thousands of tons of soil infill required to reach the 4.5m safety level, significantly reducing carbon emissions from material transport and use.

NATURE-INCLUSIVE DESIGN

Facades, rooftops, and walkways integrate habitats for birds, pollinators, and other species, fostering urban biodiversity.

WILDLIFE STREETS

With buildings on stilts, there will be a lot of shelters spaces under these buildings that is less usable. These shaded area become microhabitats for urban nature.

FLOATING COMMUNITIES

Floating homes, houseboats and platforms rise with water levels, ensuring communities can stay safe and functional during extreme weather. Platforms can even have hinged bridges for emergency vehicular access.

FOOD PRODUCTION

Floating gardens and greenhouses support local food production and can be supplemented with underwater gardens that utilize aquaculture.

Hybrid protection

NATURE-INCLUSIVE DESIGN

Facades, rooftops, and walkways integrate habitats for birds, pollinators, and other species, fostering urban biodiversity.

BUILDING-BASED PROTECTION

Existing and new buildings along the waterfront can become the 4.5m protection line if reinforced correctly, instead of just having a wall.

DETENTION PARK

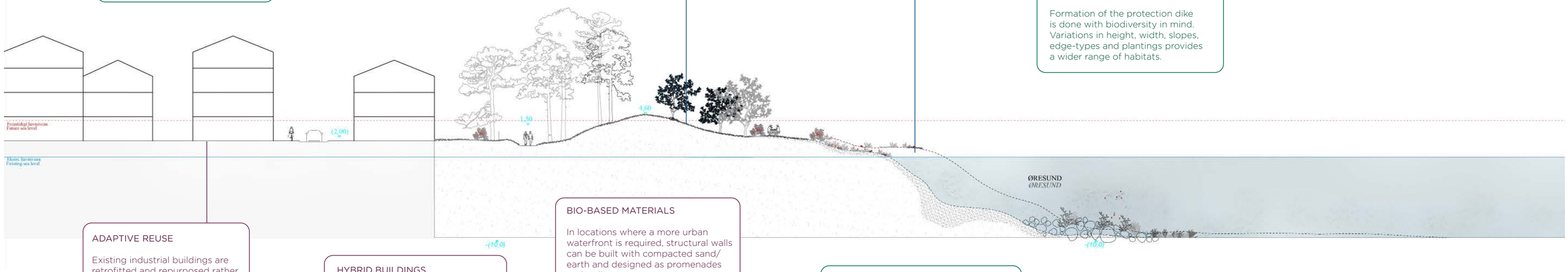
The protection barrier restricts discharge of stormwater during heavy downpour, so the nature-based area is designed to include a lowered park area to serve as a detention basin.

NATURE-BASED PROTECTION

A multifunctional dike (4.5m protection level) integrated into the existing bulkhead, designed as both a space for recreation and nature.

SPACE FOR NATURE

Formation of the protection dike is done with biodiversity in mind. Variations in height, width, slopes, edge-types and plantings provides a wider range of habitats.



ADAPTIVE REUSE

Existing industrial buildings are retrofitted and repurposed rather than demolished, minimizing resource consumption and waste.

HYBRID BUILDINGS

Barrier buildings can be designed to interact with the waterfront rather than obstruct it, such as accessible green roofs connecting directly to the parkscape.

BIO-BASED MATERIALS

In locations where a more urban waterfront is required, structural walls can be built with compacted sand/ earth and designed as promenades and walkways.

LARGE-SCALE NATURE CORRIDORS

The hybrid protection measure prioritizes on a nature-based dike solution, establishing a long, connected, green waterfront allowing species to traverse long stretches within nature areas.

PRODUCTIVE LANDSCAPES

A gradually sloping coastline provides opportunity for shallow water aquaculture, such as farming seaweed, which can be used for food or biogas production.

Protect with nature

DETENTION LAGOON

The existing waterfront becomes a large lagoon and wetland, able to detail vast volumes of stormwater during extreme rain events.

MICROCLIMATE

Amager's coastline, like many coastal areas, has stronger winds than inland areas. The barrier island with dense vegetation will reduce high wind speeds along the existing waterfront for a more hospitable microclimate.

ECOLOGICAL STEWARDSHIP

Design and management of new nature areas is important due to changing climate and invasive species. Engaging with local citizens and organizations will connect people with the nature area in a meaningful way while also ensure long-term ecological health.

BARRIER ISLAND FOR NATURE

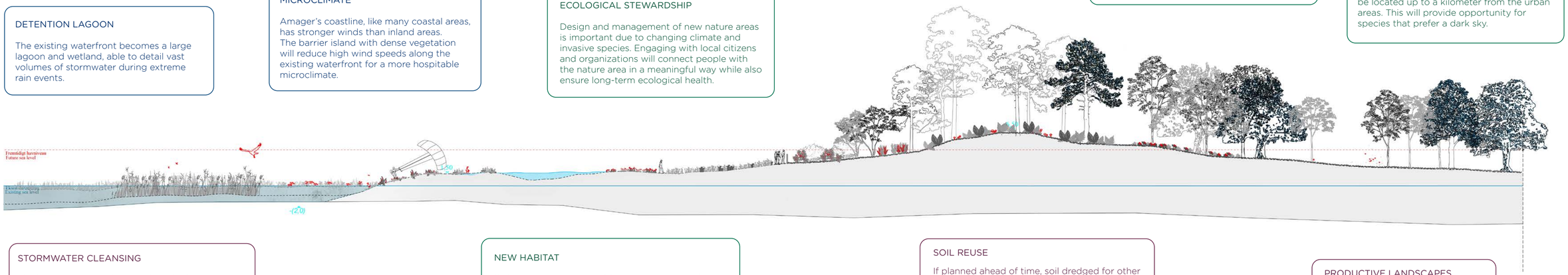
An alterative to the 4.5m waterfront barrier such as a seawall or dike. This solution has a much higher initial resource requirement but is robust and long lasting without impacting Copenhagen's existing waterfront.

LARGE SCALE NATURE

The large barrier island is dedicated to nature, with very limited access to people. The design of it should encourage diverse habitats with variation in terrain, ponds, dunes, forests, and meadows, supporting as wide a range of species as possible.

DARK SKY ZONE

Artificial light from urban areas has an adverse effect on many species. The barrier island will have no artificial lighting, and will be located up to a kilometer from the urban areas. This will provide opportunity for species that prefer a dark sky.



STORMWATER CLEANSING

The large constructed wetlands in the lagoon can receive local stormwater, removing pollutants before they reach the sea. Doing this locally greatly reduces energy consumption normally required in cleaning this water in wastewater treatment plants.

NEW HABITAT

Saltholmen nearby is host to a huge number of rare and endangered species, but with at barely 1m above sea-level, it will be greatly impacted by sea-level rise and climate change. This barrier island should aim to mimic many of the nature types found on Saltholmen to provide habitat for these species.

SOIL REUSE

If planned ahead of time, soil dredged for other projects such as Østlig Ringvej Tunnel can be repurposed locally. Projects like this can contribute up to 3 million cubic meters of soil towards this barrier island.

PRODUCTIVE LANDSCAPES

The vast area of the barrier island provides huge swathes of both shallow and deeper waters that can contribute to food and energy production through aquaculture.

Managed retreat

ZERO BUILD

There is no significant construction or resource cost, only the cost of relocating critical infrastructure.

REPROGRAM

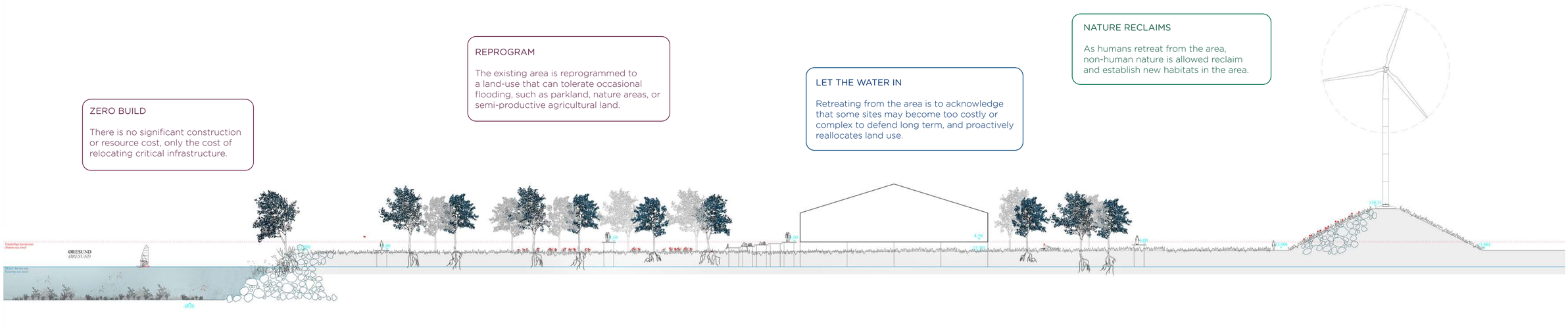
The existing area is reprogrammed to a land-use that can tolerate occasional flooding, such as parkland, nature areas, or semi-productive agricultural land.

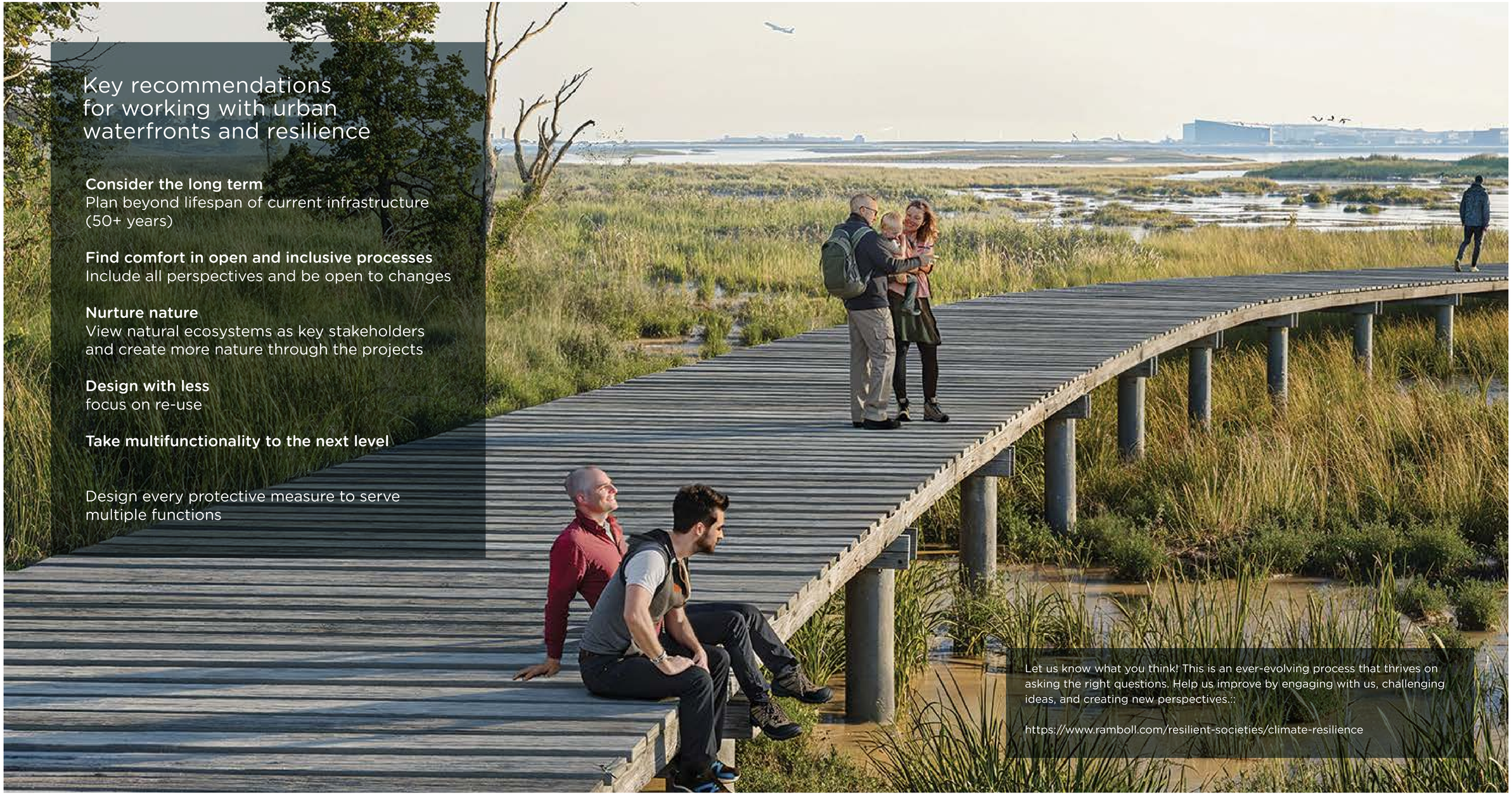
LET THE WATER IN

Retreating from the area is to acknowledge that some sites may become too costly or complex to defend long term, and proactively reallocates land use.

NATURE RECLAIMS

As humans retreat from the area, non-human nature is allowed reclaim and establish new habitats in the area.





Key recommendations for working with urban waterfronts and resilience

Consider the long term
Plan beyond lifespan of current infrastructure (50+ years)

Find comfort in open and inclusive processes
Include all perspectives and be open to changes

Nurture nature
View natural ecosystems as key stakeholders and create more nature through the projects

Design with less
focus on re-use

Take multifunctionality to the next level

Design every protective measure to serve multiple functions

Let us know what you think! This is an ever-evolving process that thrives on asking the right questions. Help us improve by engaging with us, challenging ideas, and creating new perspectives.::

https://www.ramboll.com/resilient-societies/climate-resilience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