Haringvlietdam, a beautiful operative landscape

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Fascination: Barnafoss Waterfall

BARNFOSS

BY JÓN R. HJÁLMARSSON

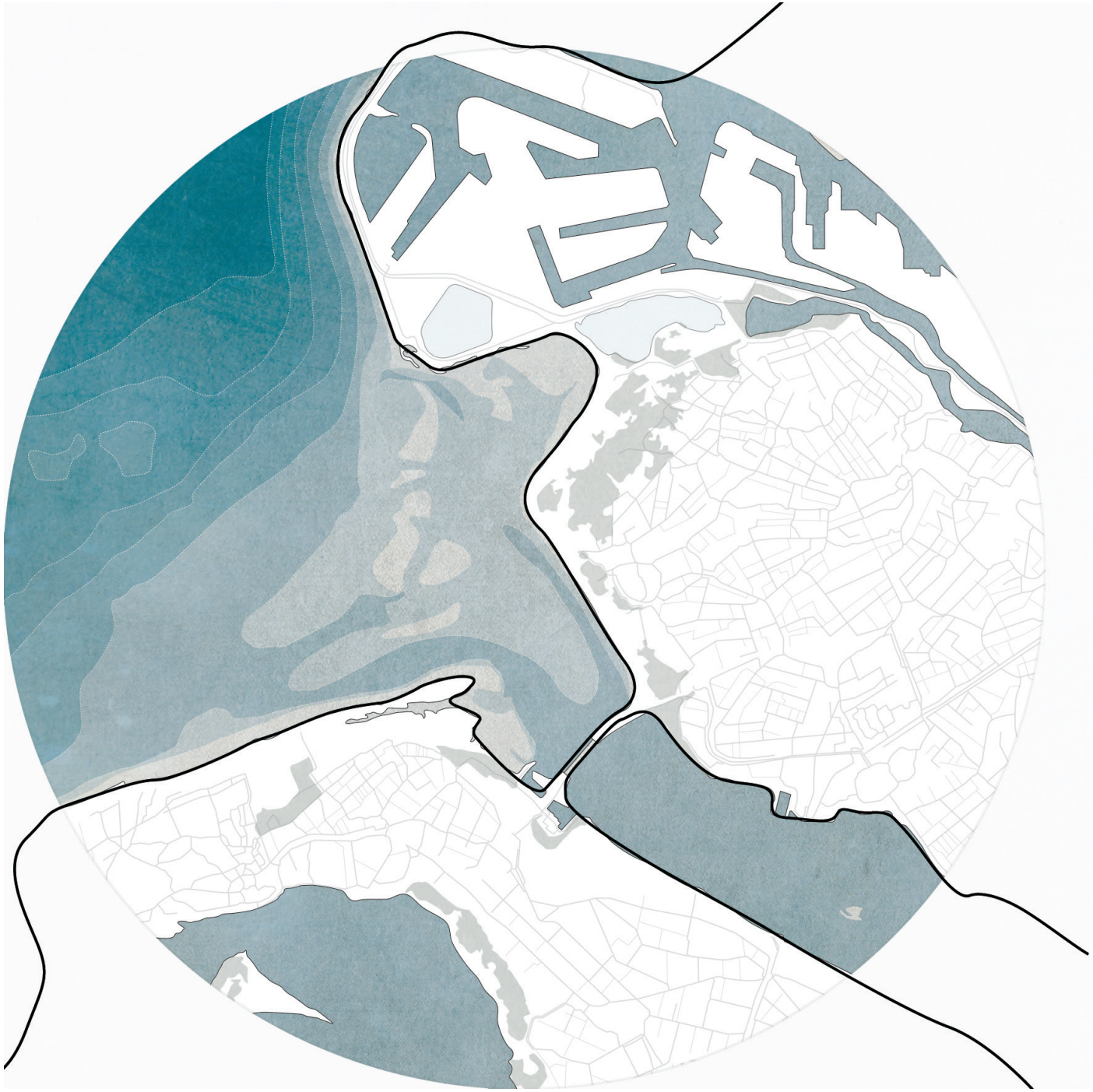
Once upon a time a wealthy woman lived at Hraunsás, and she had two young sons. One day she went with her entire household to church at Gilsbakki, north of the river, but both boys stayed behind. She told her sons to stay at home and not to stray from the house while she was away. But when everybody had gone, the boys grew bored and eventually decide to go after the others to church.

They walked down to the Hvítá river and soon reached the stone arch. The arch is said to have been rather narrow, with a long drop down to the river and the waterfall beneath. The boys were frightened and they held hands to cross the river. Things went well until they reached the stone arch and looked down into the maelstrom below. They grew so dizzy looking down into the eddies that they feel from the bridge in the river and drowned.

When the churchgoers returned home, the lads were nowhere to be found. Their mother ordered a search, but for a long time this was fruitless. Eventually she learned what had happened, for someone had seen the boys on their way to the river but had been too late to save them. The woman then grew very upset and angry, and she had the stone arch over the river broken down, saying that no one should cross it alive ever again. The waterfall has been identified with this event ever since, and is now known as Barnafoss, Children's Falls.

Elisa Vendramin, 2010

Digital collage
Artist: Elisa Vendramin
Source: http://www.elisavendramin.co.uk/Barnafoss



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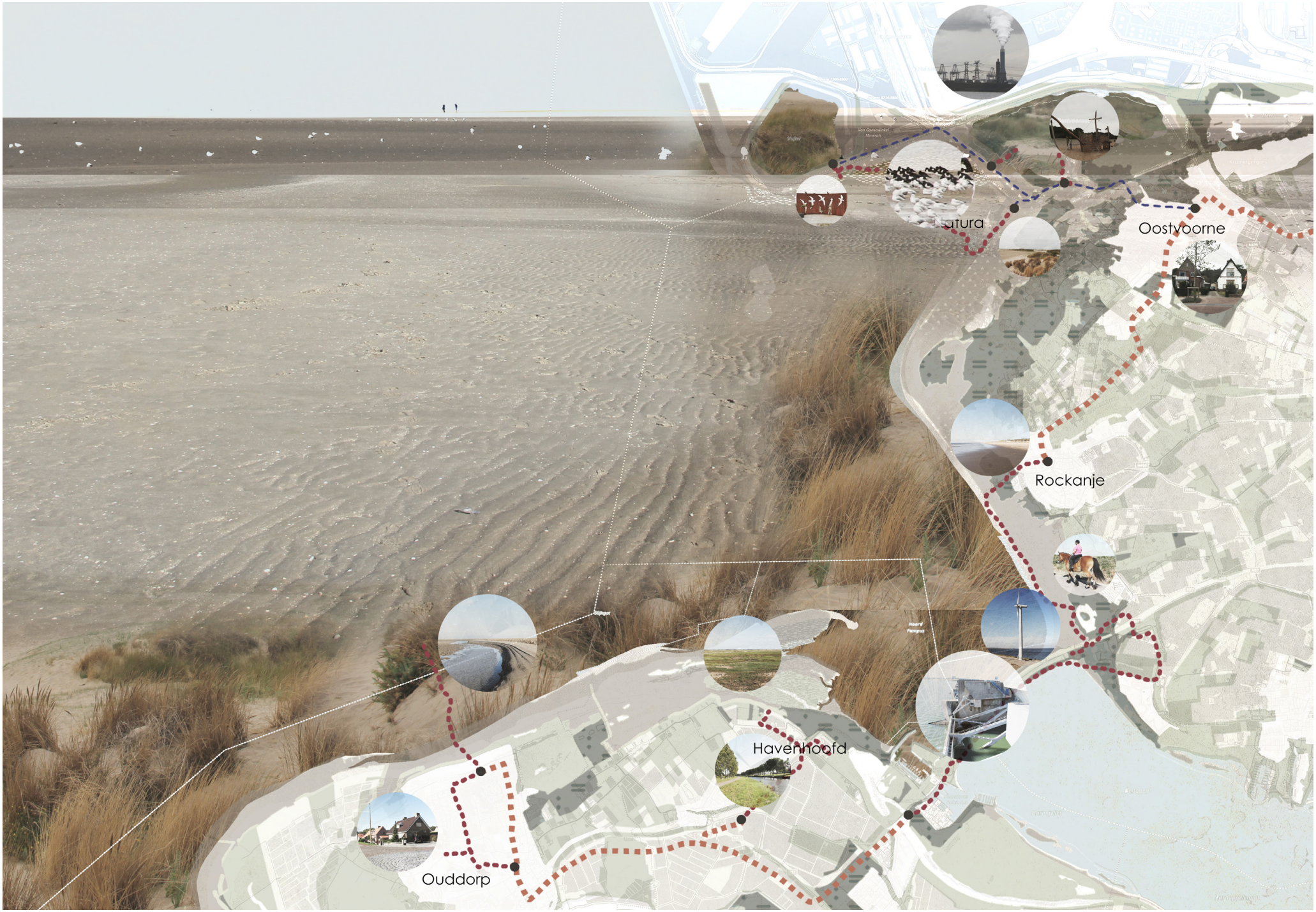

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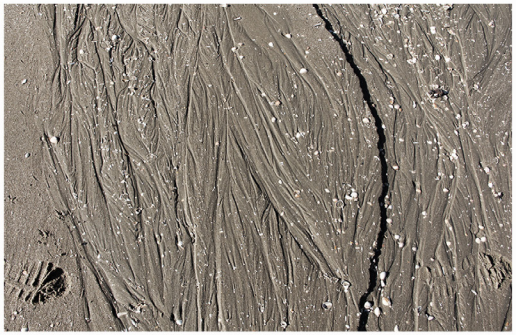
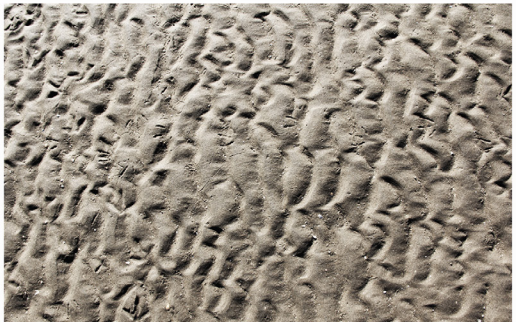
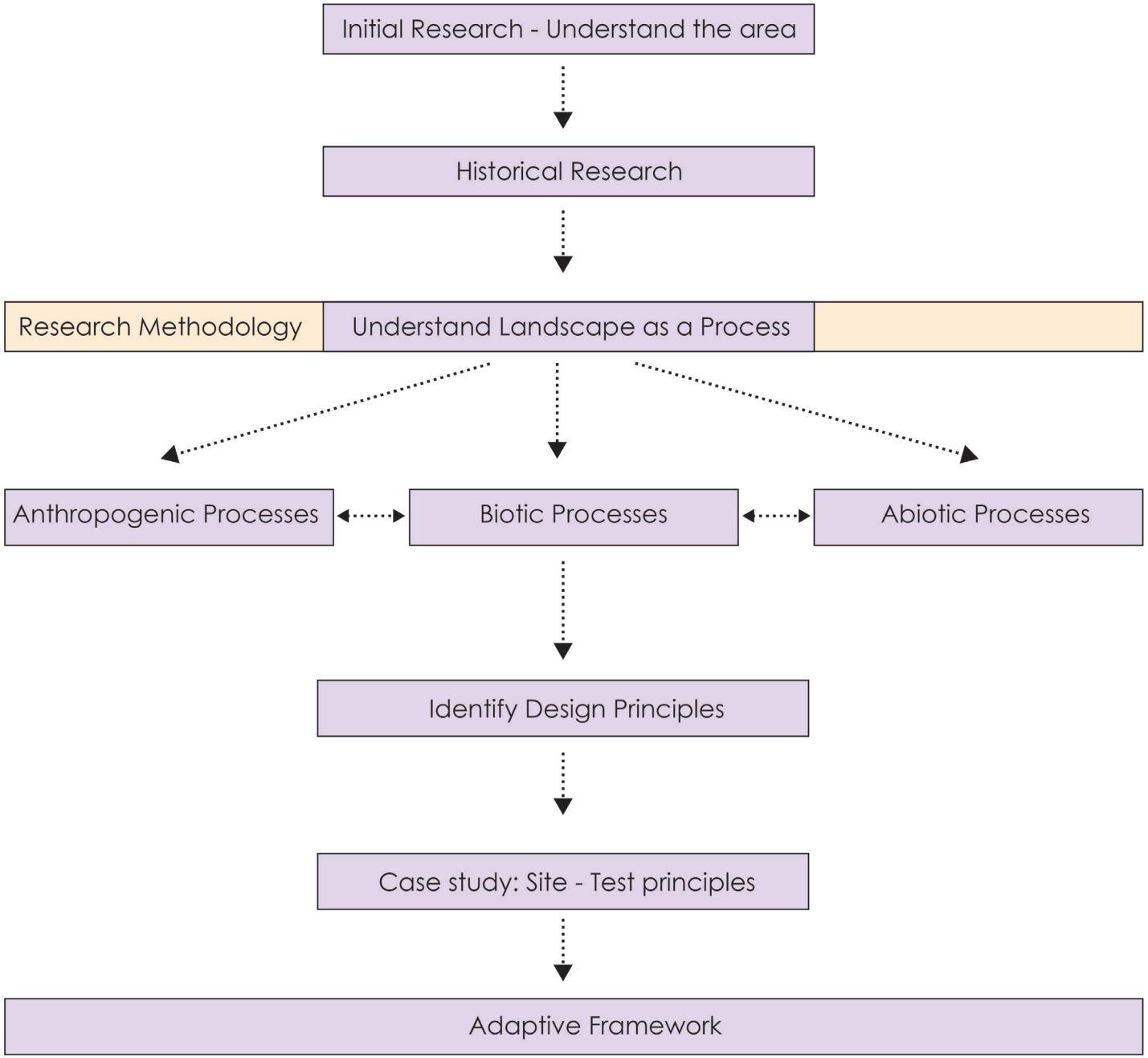




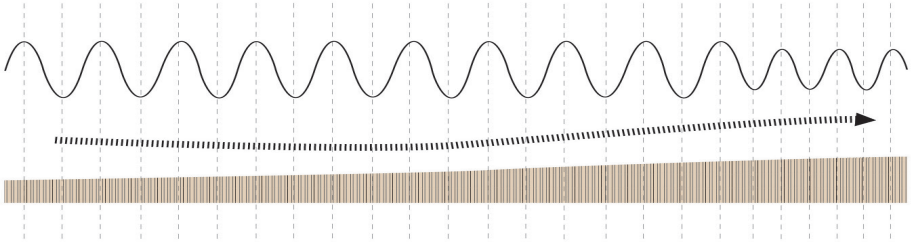
Problem Statment

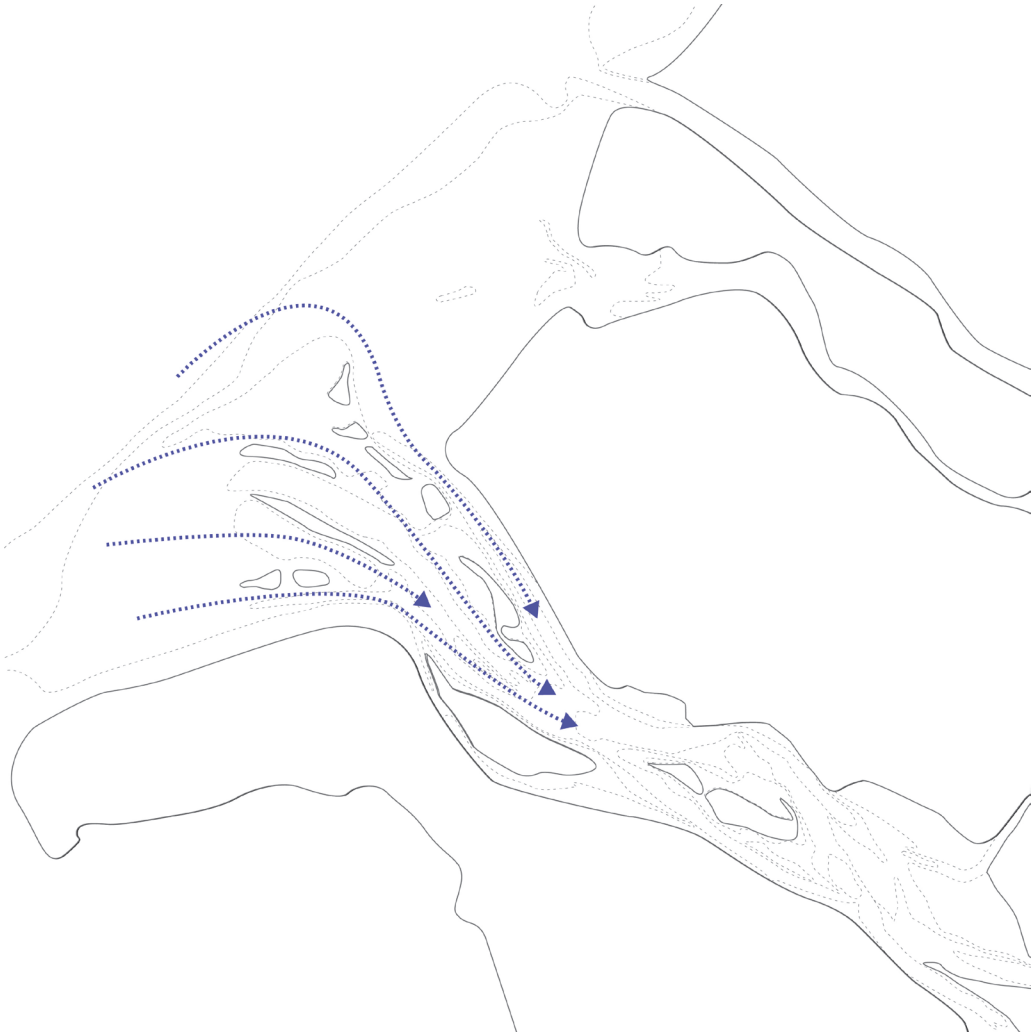
Research Methodology



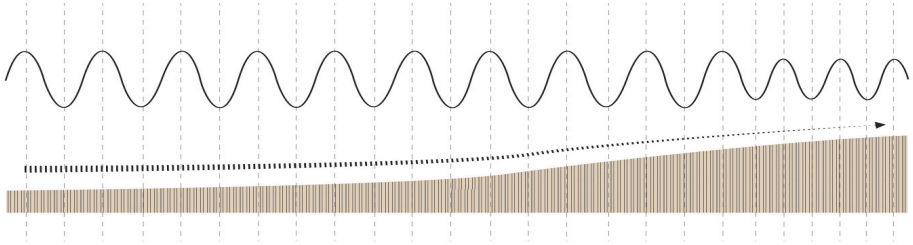
Historical Research Conclusions

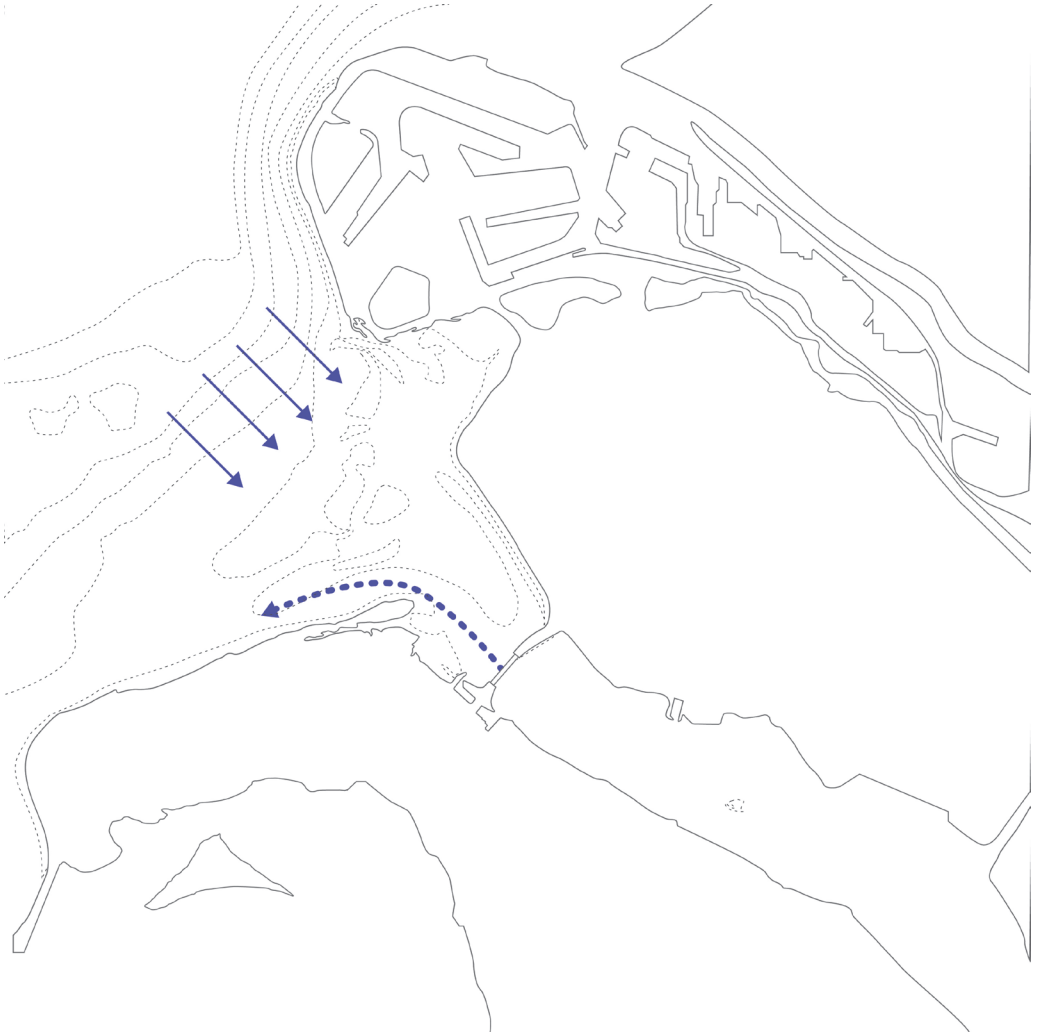
1950 - Tide dominated





2016 - Wave dominated

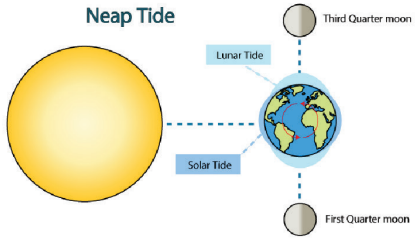


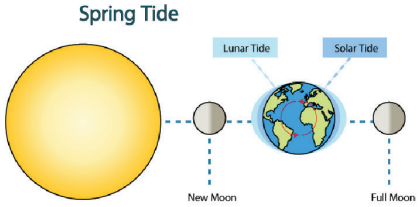


Research Abiotic Processes

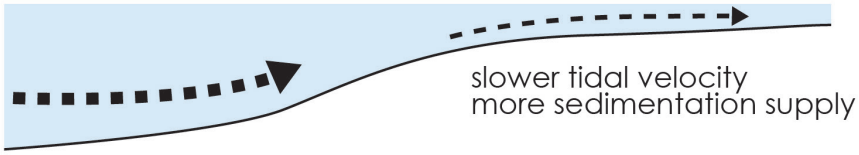
Tides:

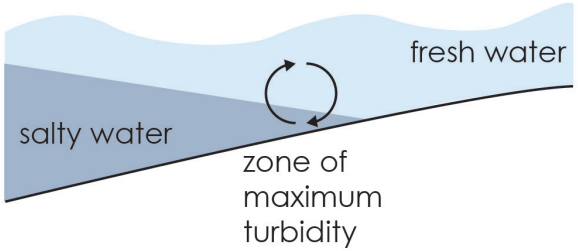
Tides are movements of the oceans set up by the gravitational effects of the moon and the sun in relation to the earth.Tidal currents transport sedimentation.





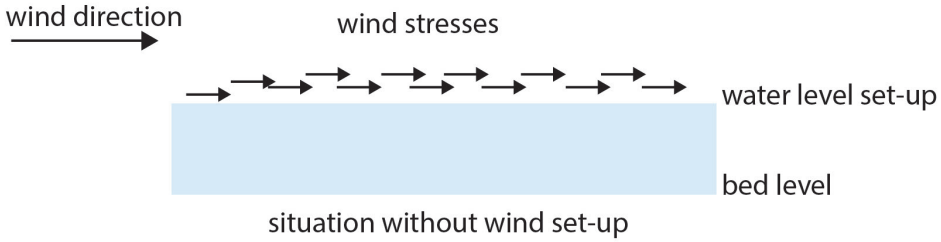
Tidal volume velocity depents on the depth and so the tidal volume is bigger where the bed level is deeper. If the water velocity becomes smaller then accretion of sediment will occur. When saltwater interacts with freshwater, there is maximum turbidity and more sediemtation occurs in the area.

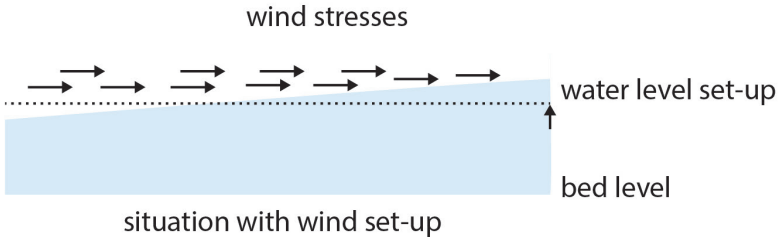




Wind:

If wind stresses are directed in a certain direction for a longer period, the generated stress cause water level set-up. The longer lenght over which the wind stress occur, the larger water level set-up (Distance = Velocity x Time). Haringvliet wind direction is from North West, this direction has a large fetch and the water level set-up can be up to 1.5m





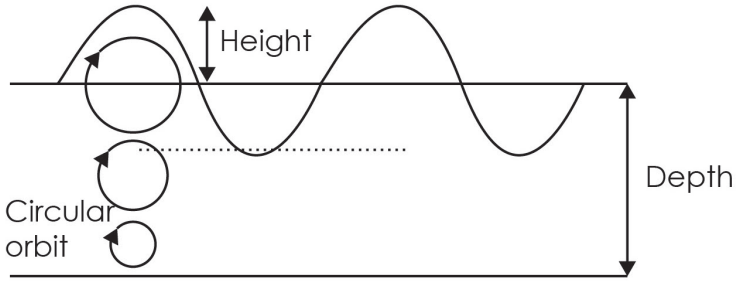
Storm surges:

Storm surges occur when strong onshore winds build up coastal water to an exceptionally high level for a few hours or days, and are most pronounced when they coincide with high spring tides.

Research Abiotic Processes

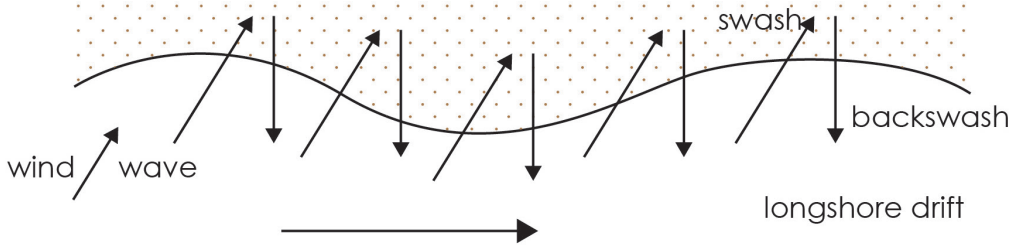
Waves:

Waves are generated offshore. When a wave reaches a heigh of equal to three quarters of the water depth the wave will break. During calm weather, large waves typically reach breaking depths far from the shoreline. During storm conditions, the elevated water level generated by storm surge allow waves to penetrate much closer to the shoreline. Moreover, due to the circular orbit process, waves carry sedimentation. Depending on the fast or slow energy, waves can be destructive or constructive.



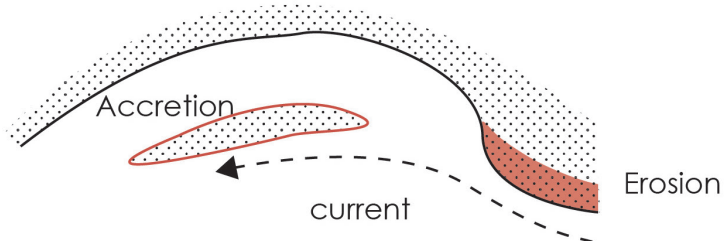
Longshore Drift:

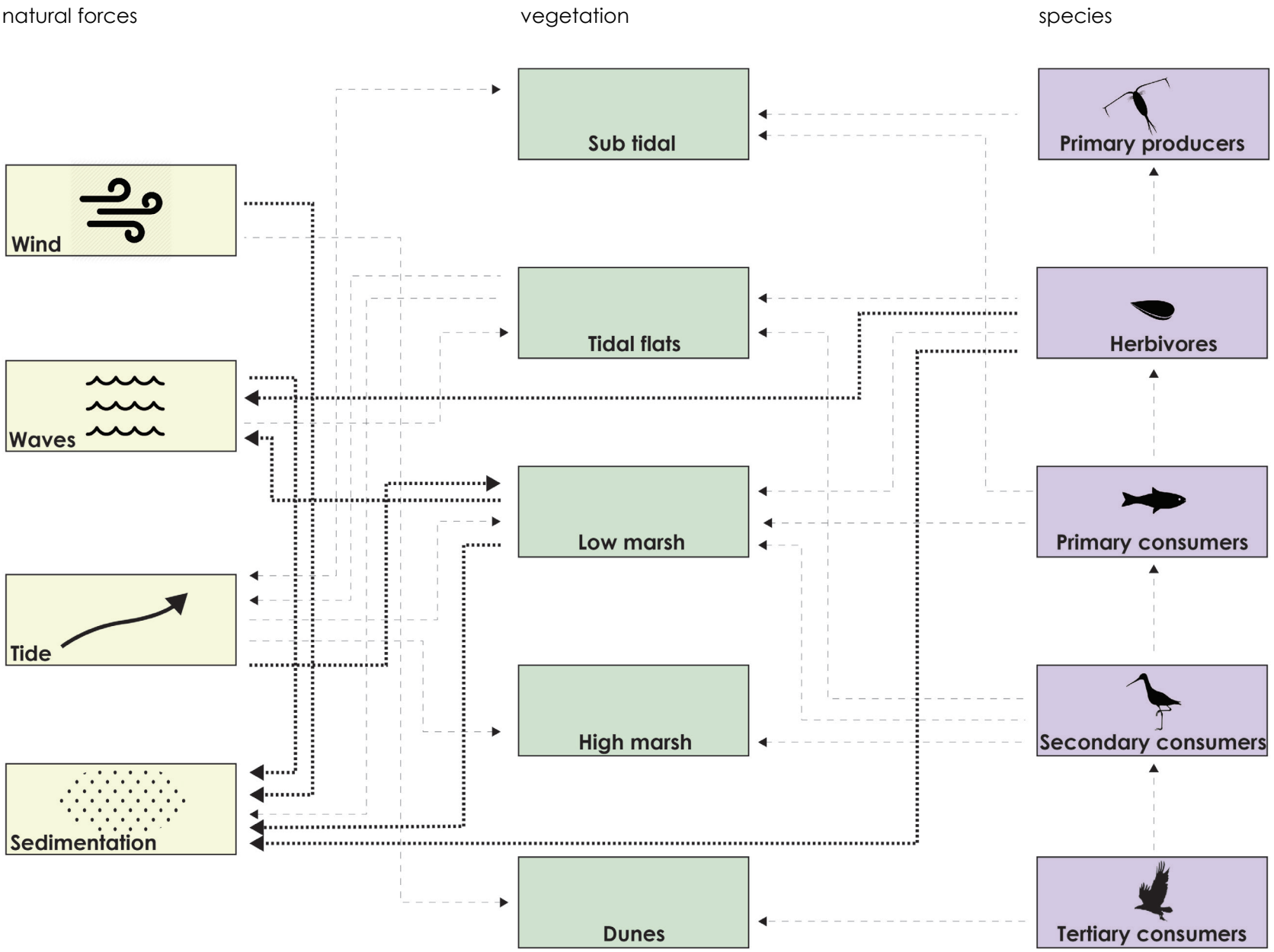
Waves approach the beach at an angle similar to the wind. With the swash and backwash, the material is transported along the beach in zigzag movement.



Sedimentation and Erosion:

There is a balance in the sedimentation process, which means that sediment is redistibuted from one area to an another. Wind, waves and tides could create the loss or transportation of sediments.

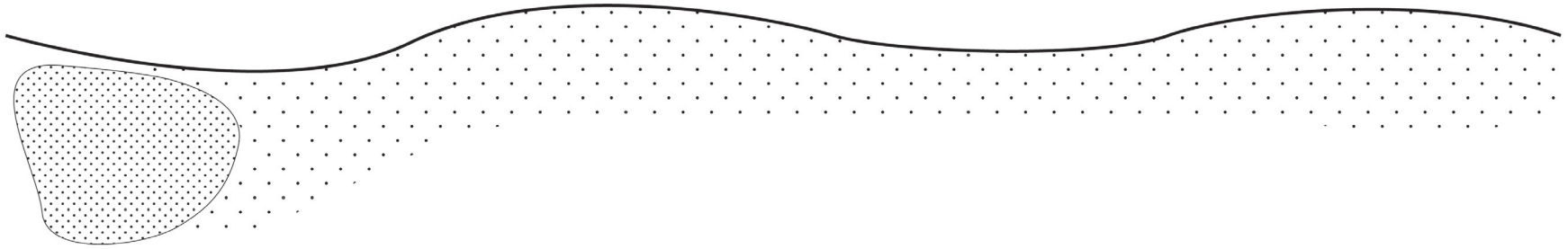



natural forces
vegetation
species
Sub tidal
Primary producers
Wind
Tidal flats
Herbivores
Waves
Low marsh
Primary consumers
Tide
High marsh
Secondary consumers
Sedimentation
Dunes
Tertiary consumers

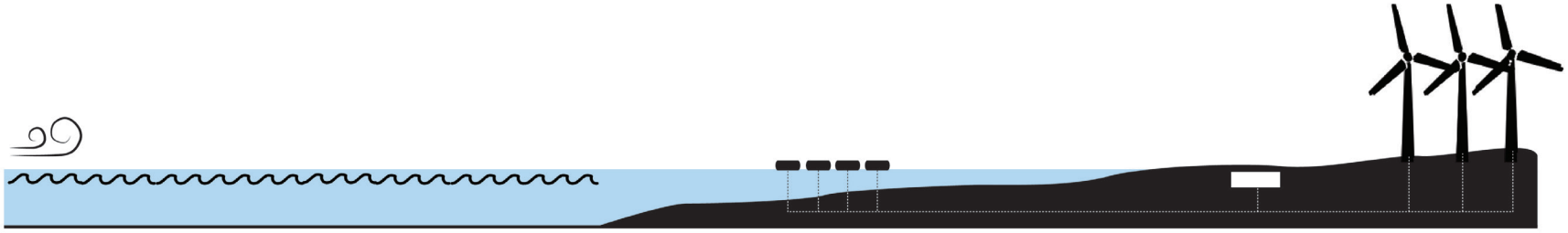
Research Abiotic and Biotic Processes

Principles:

A. Use the forces of tides and waves



Use the forces of tides and waves to redistibute sediment



Use wave and wind to produce energy

Use wave and wind to create soft foreshores or to new intertidal areas

Research Abiotic and Biotic Processes

Principles:

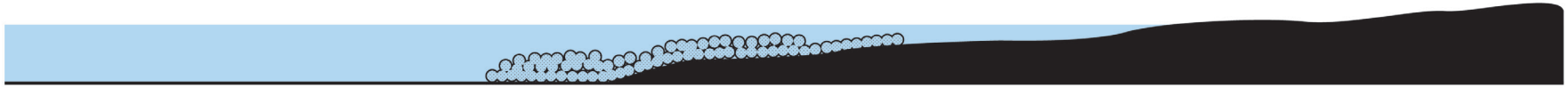
B. Use coastal vegetation as a coastal defence

Use nature stabilizers like salt marshes to prevent erosion

Use nature stabilizers like salt marshes to reduce wave energy

C. Use ecosystem engineer

Use oyster reefs for soil formation or enlarging intertidal areas



Use oyster reefs for maintaining intertidal areas (reduce wave energy)

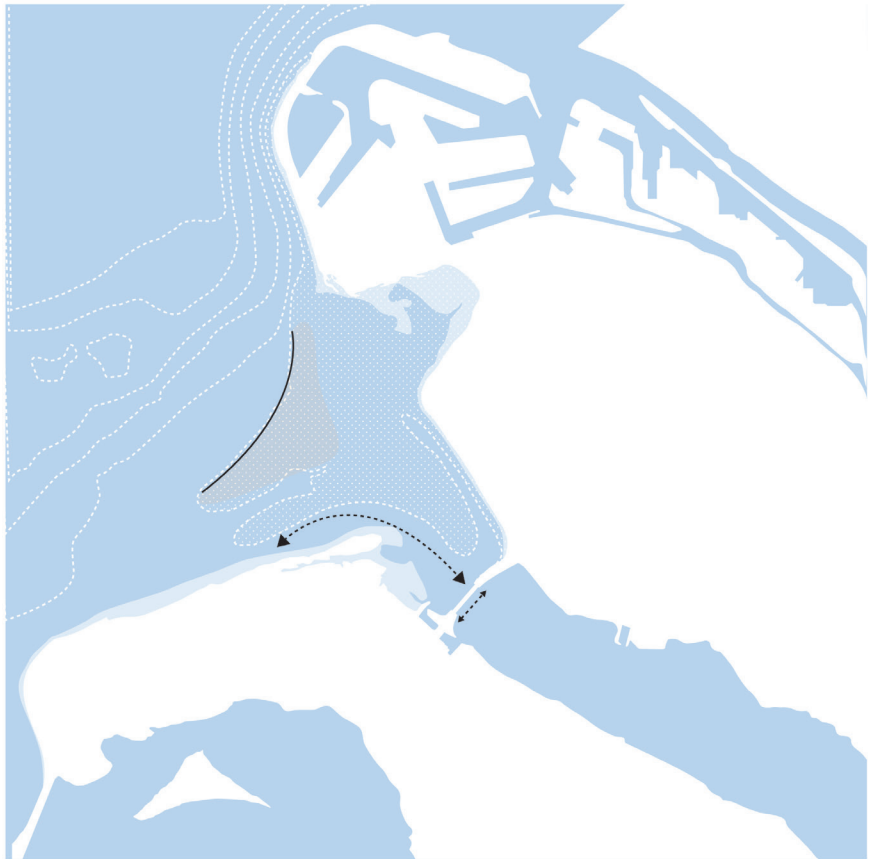
Principles

1. Creating the island before opening the dam

Areas endangered from erosion should be protected

2. Opening of the dam as a process

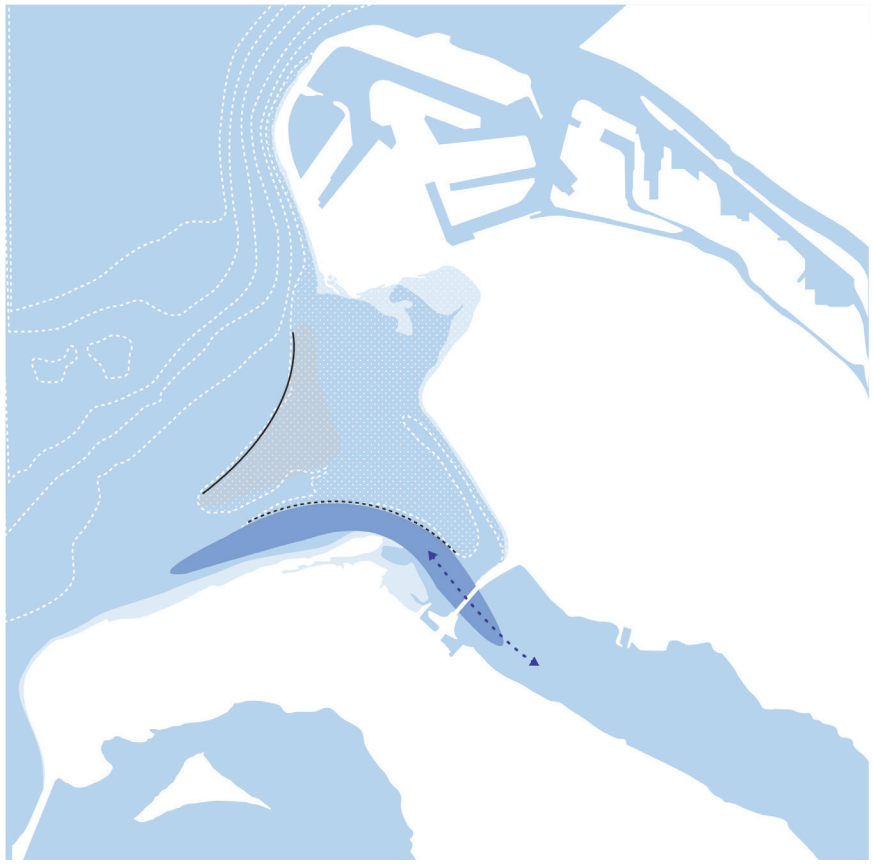
Dam should open slowly in order to understand the effects on the rest of the system.



Principles

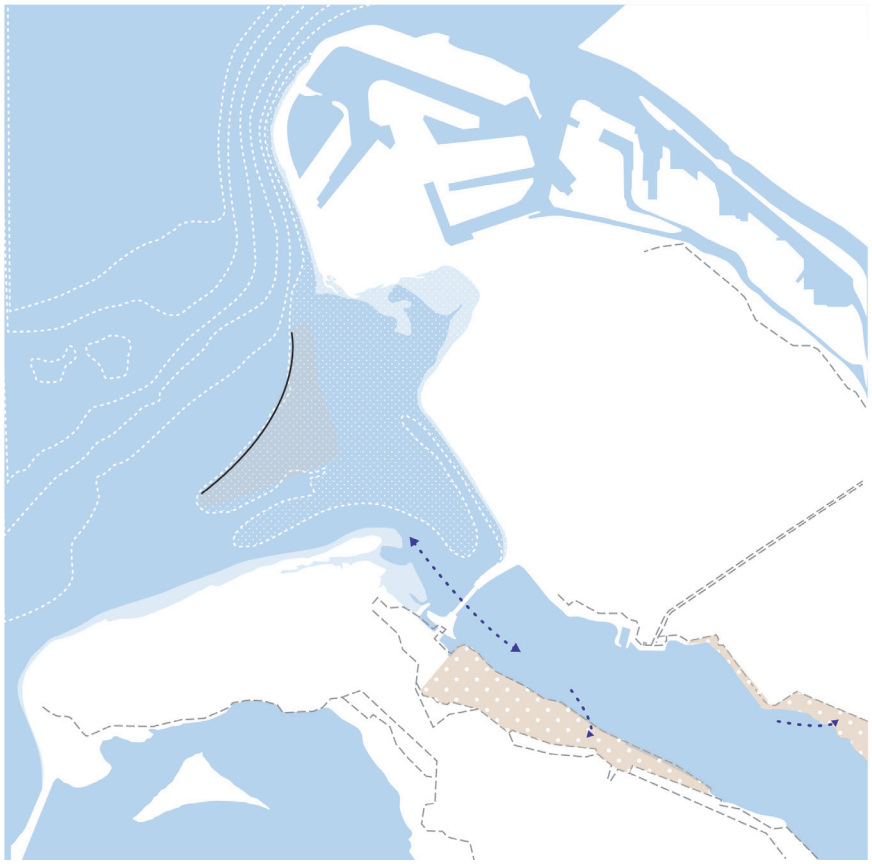
3. Control the water flow

By a deep channel or a dam



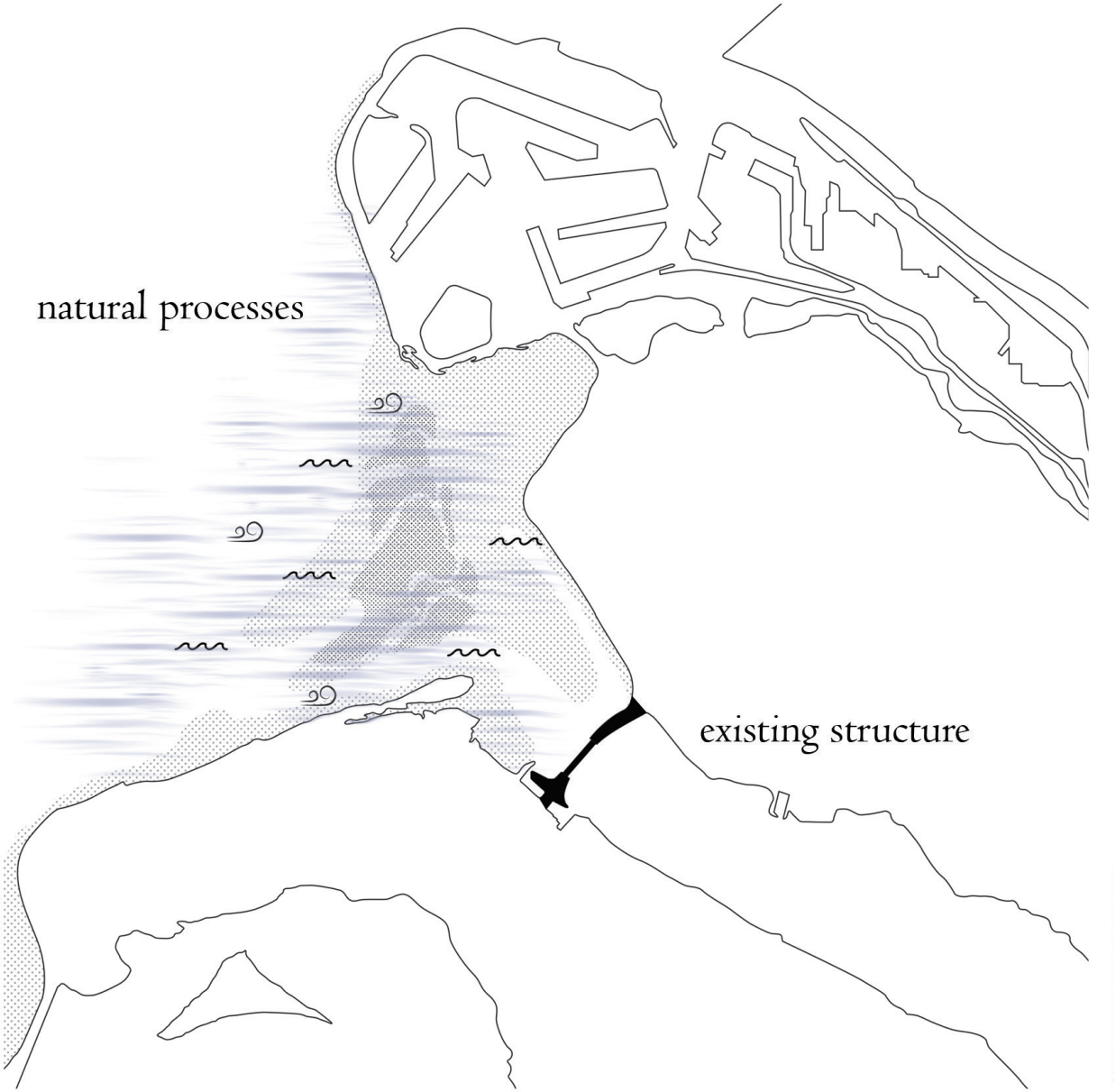
4. Creating new tidal areas by dike realignment

Use the zones between new and old dike as intermediate area. Once saltmarshes develop the vegetation will enhance sedimentation and the area will become higher. This will be able to grow with sea level rise.



Design Concept

Design Concept



Design Concept

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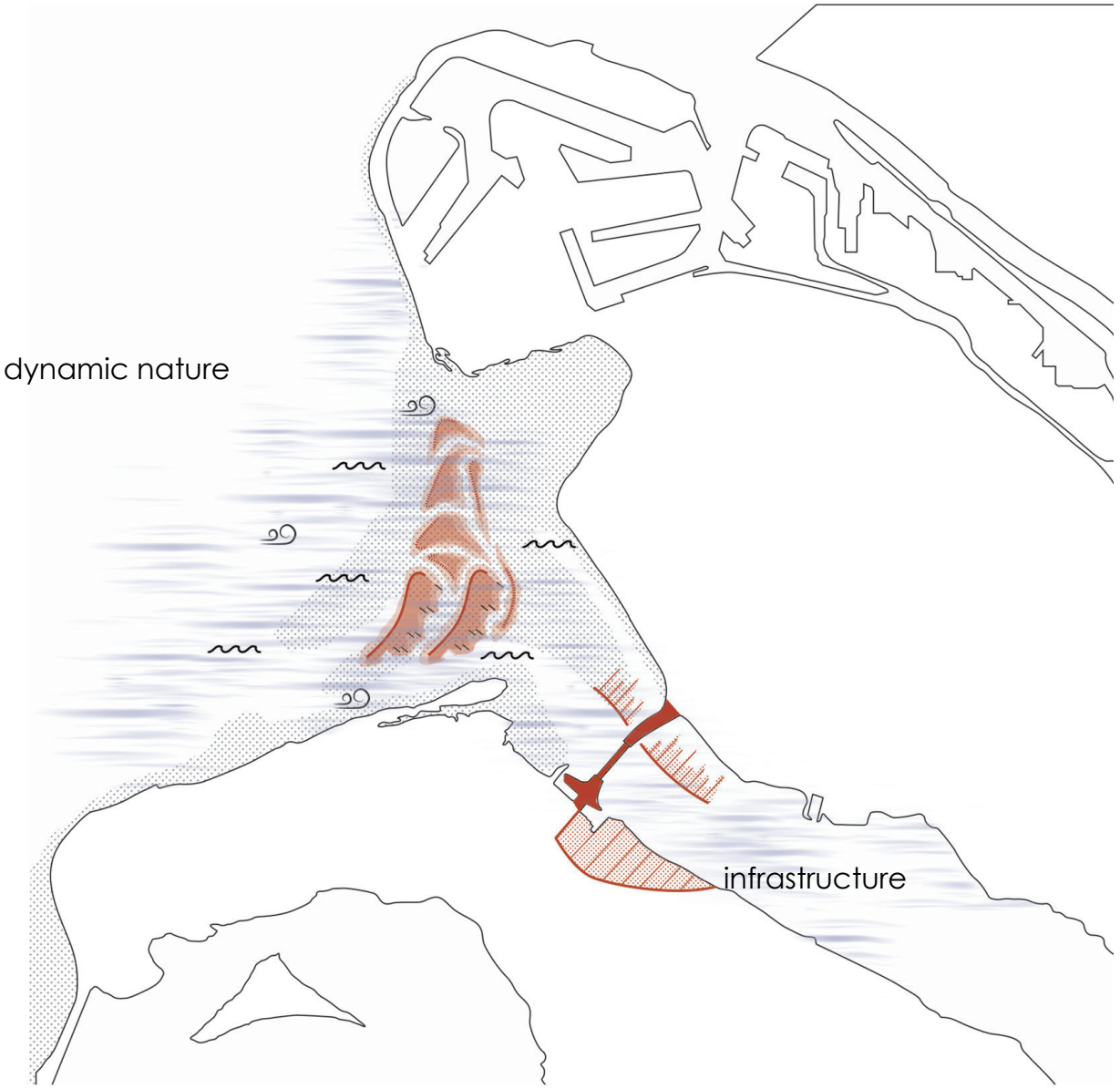


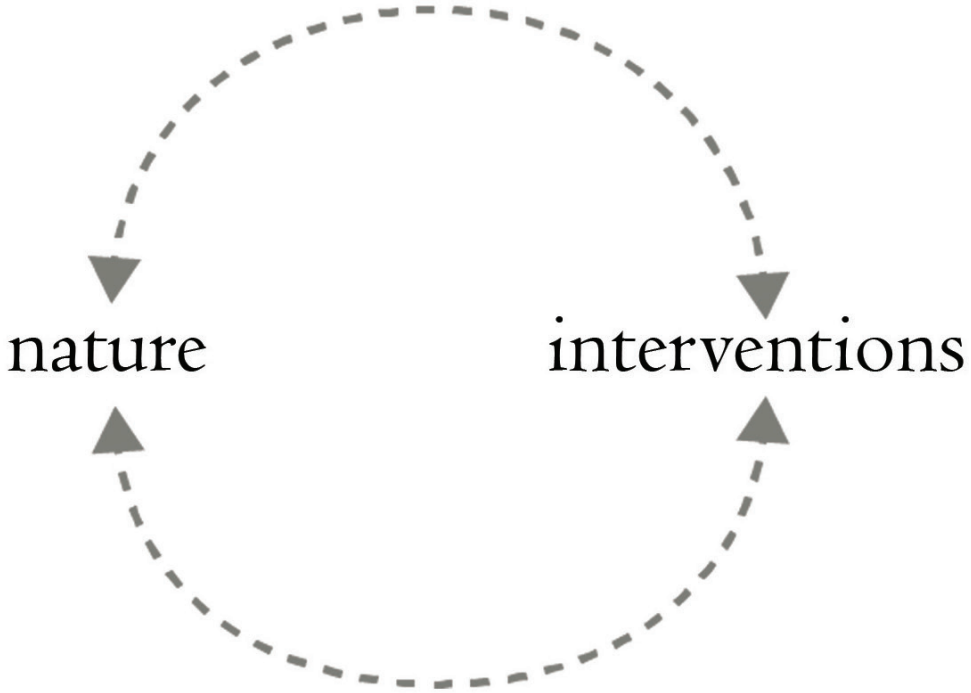
tourism

housing

experience

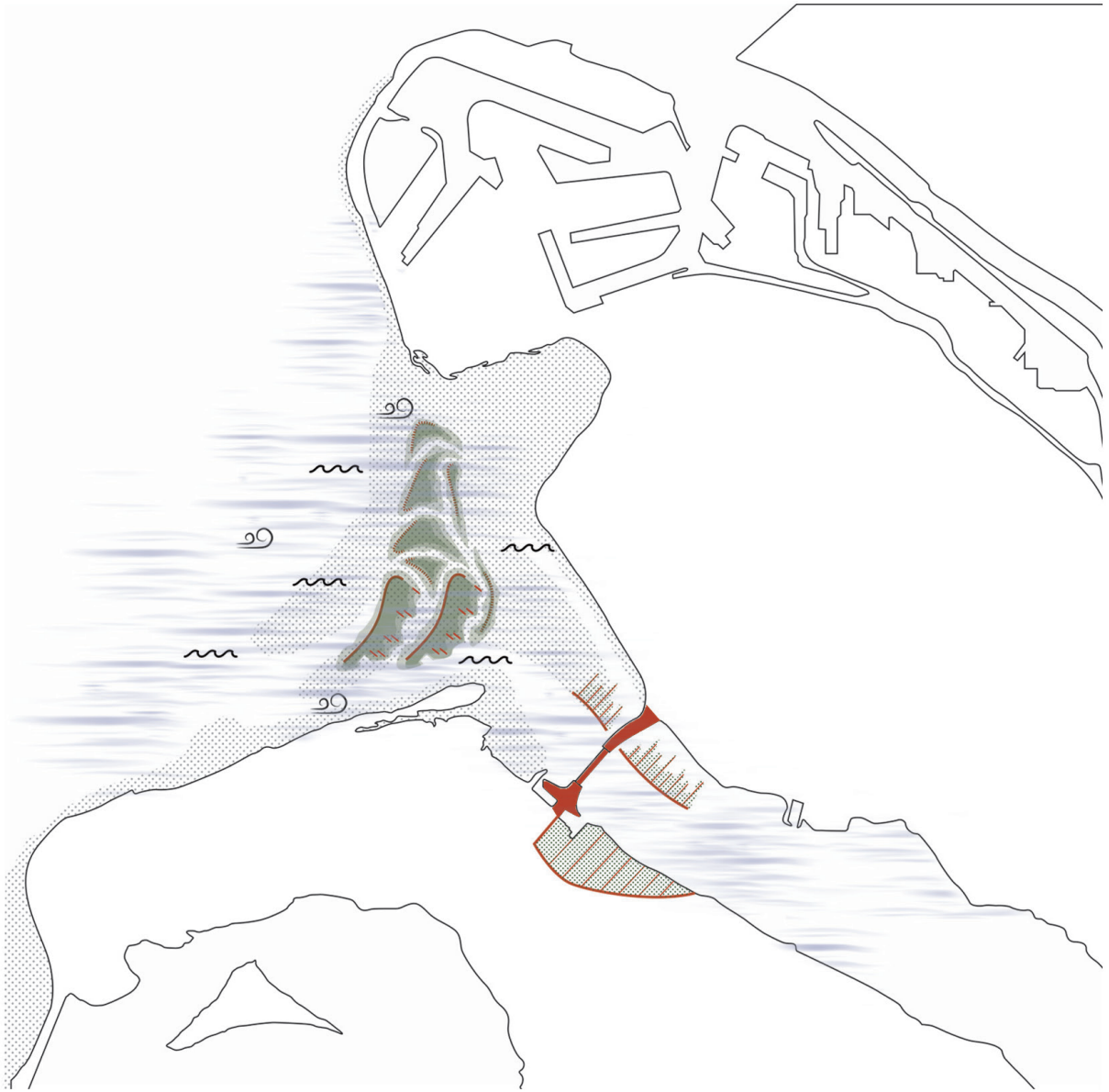
bivalve production

energy production

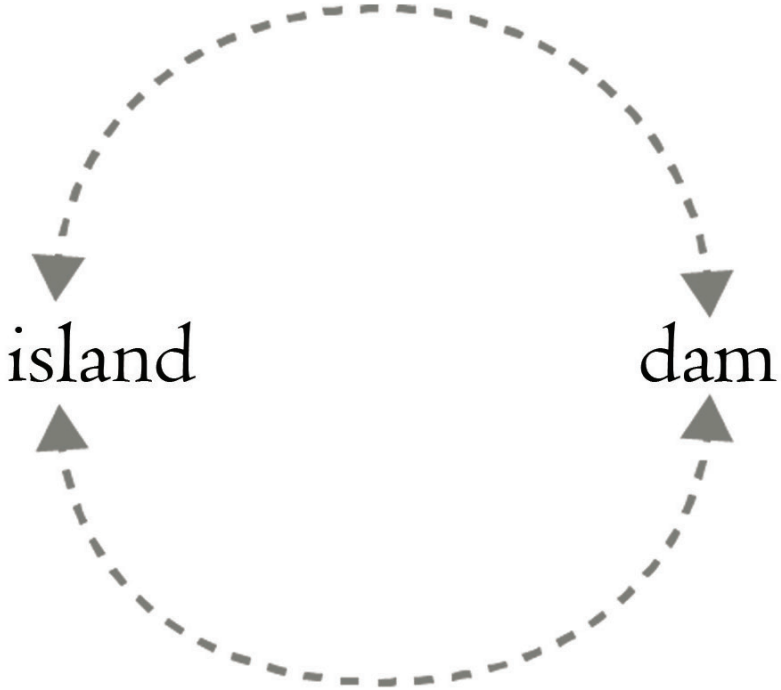


Dialogue

Design Concept



Design Concept



network - work one for the other

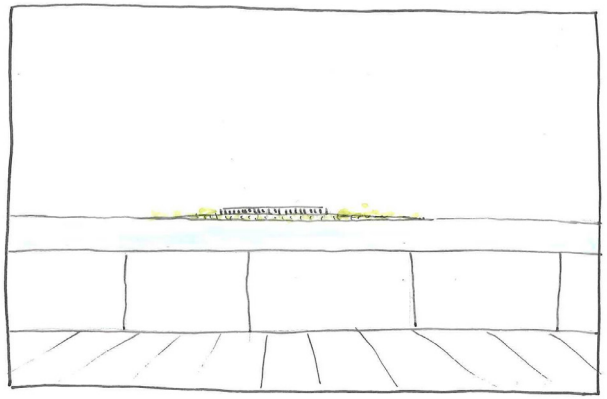
Timeline

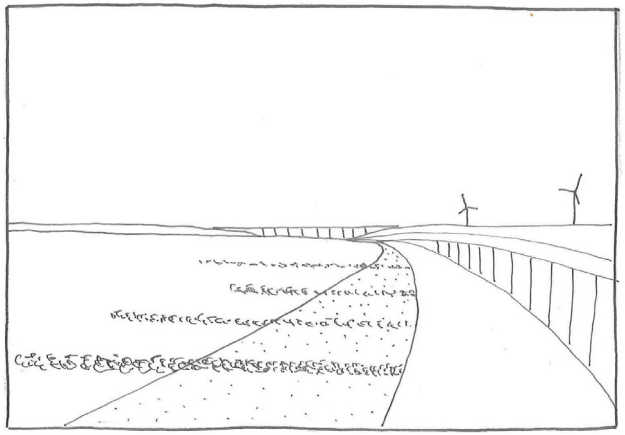
existing

Timeline

2017 intervene

Timeline

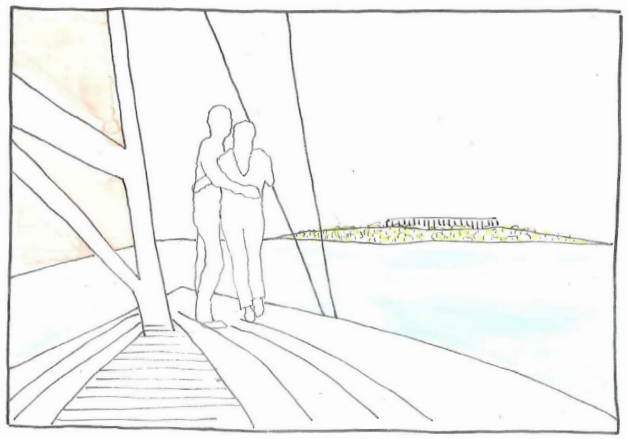




islands > attract people to the dam

2020 put landmark

Timeline



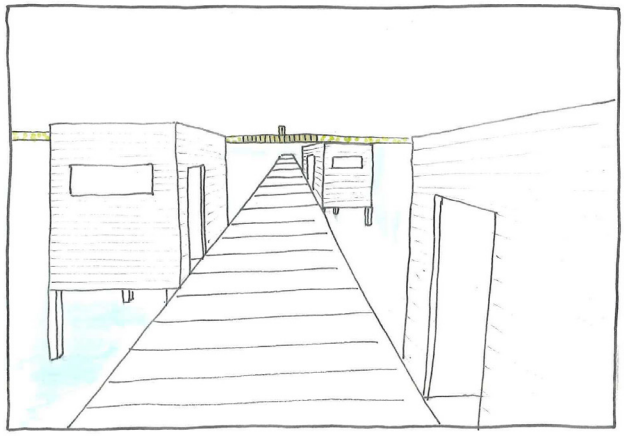
dam > boat connections to go to the islands

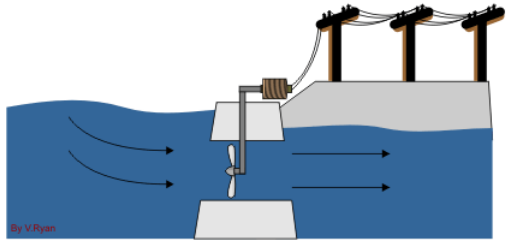
2021 people visit island

Timeline

2022 put units - open dam

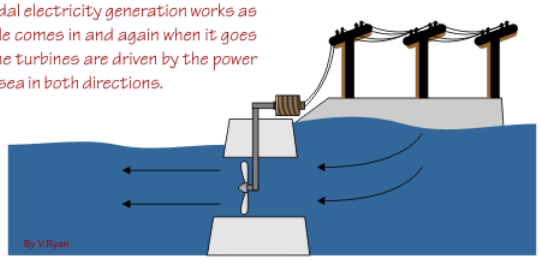
Timeline





TIDE COMING IN

This tidal electricity generation works as the tide comes in and again when it goes out. The turbines are driven by the power of the sea in both directions.

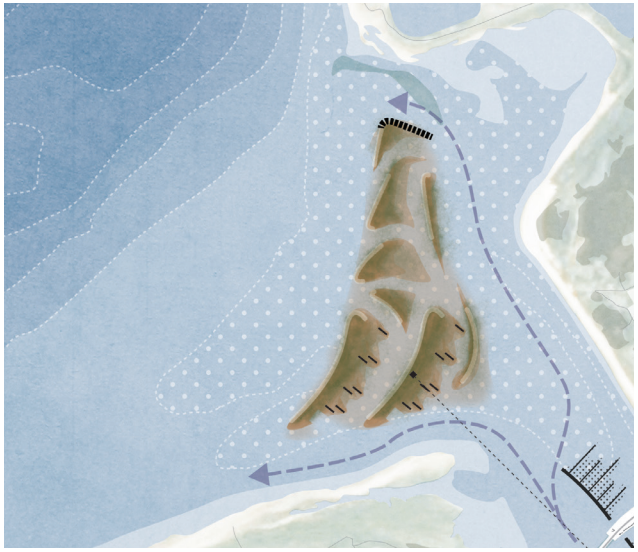


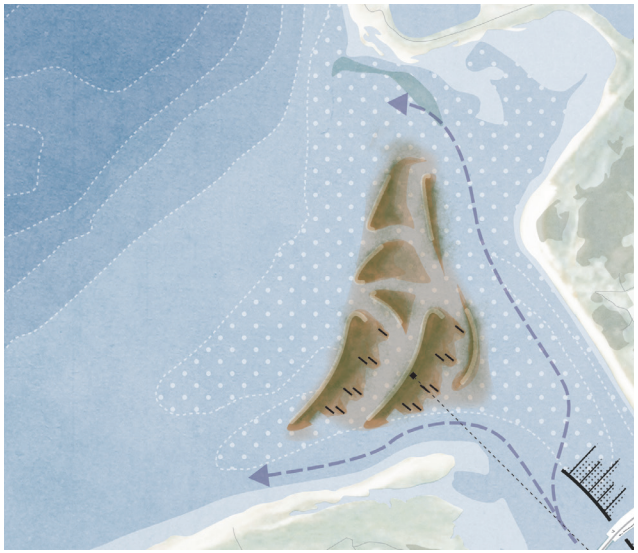
TIDE GOING OUT

dam > energy production to have electricity to the islands

2025 people stay on island

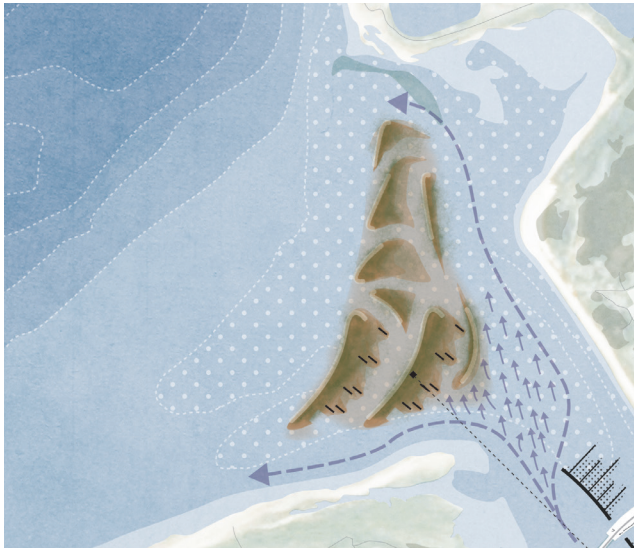
Timeline

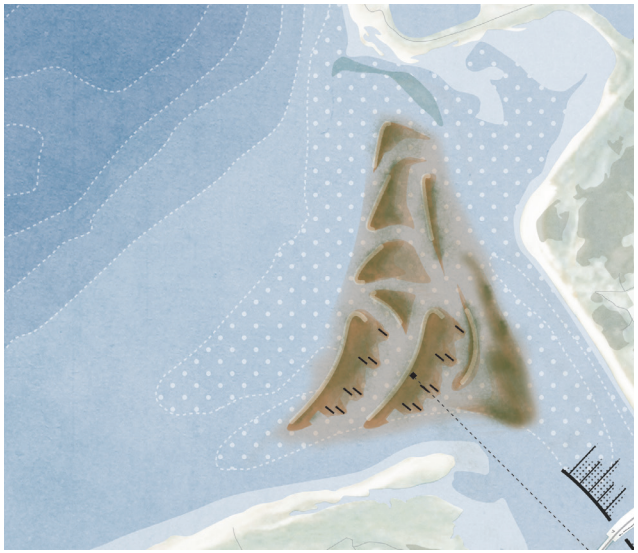




islands > protection from waves and storms

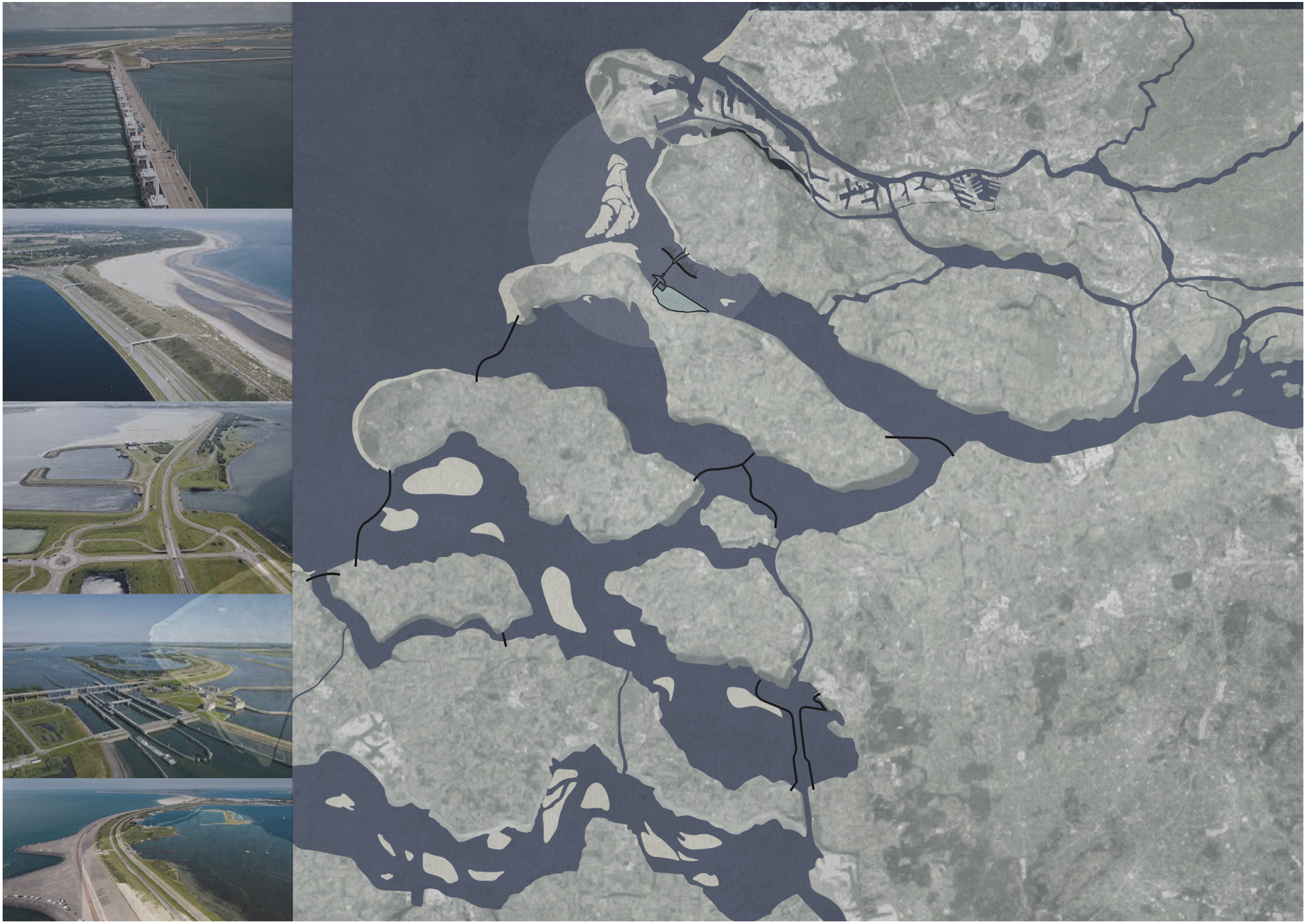
2030





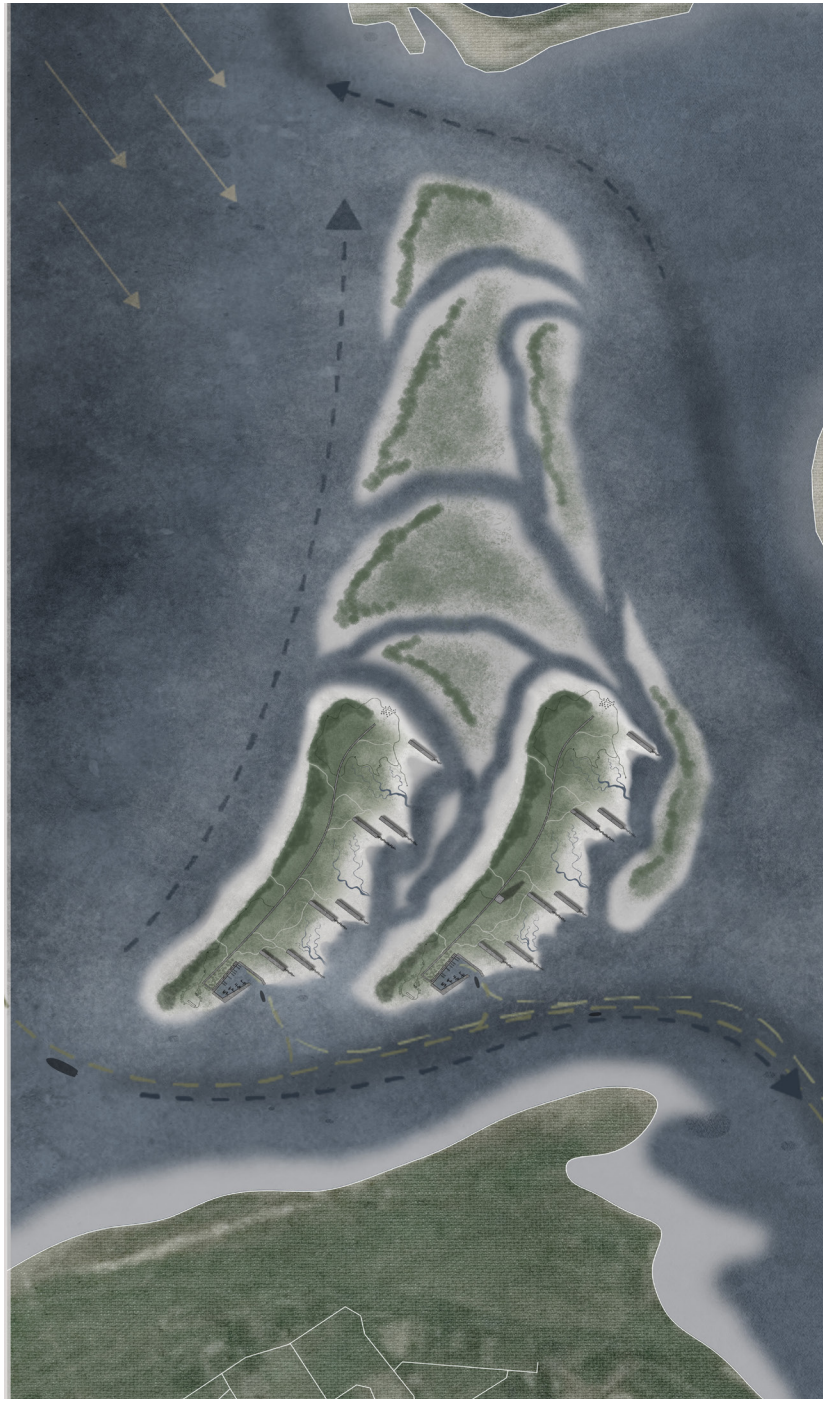
2050

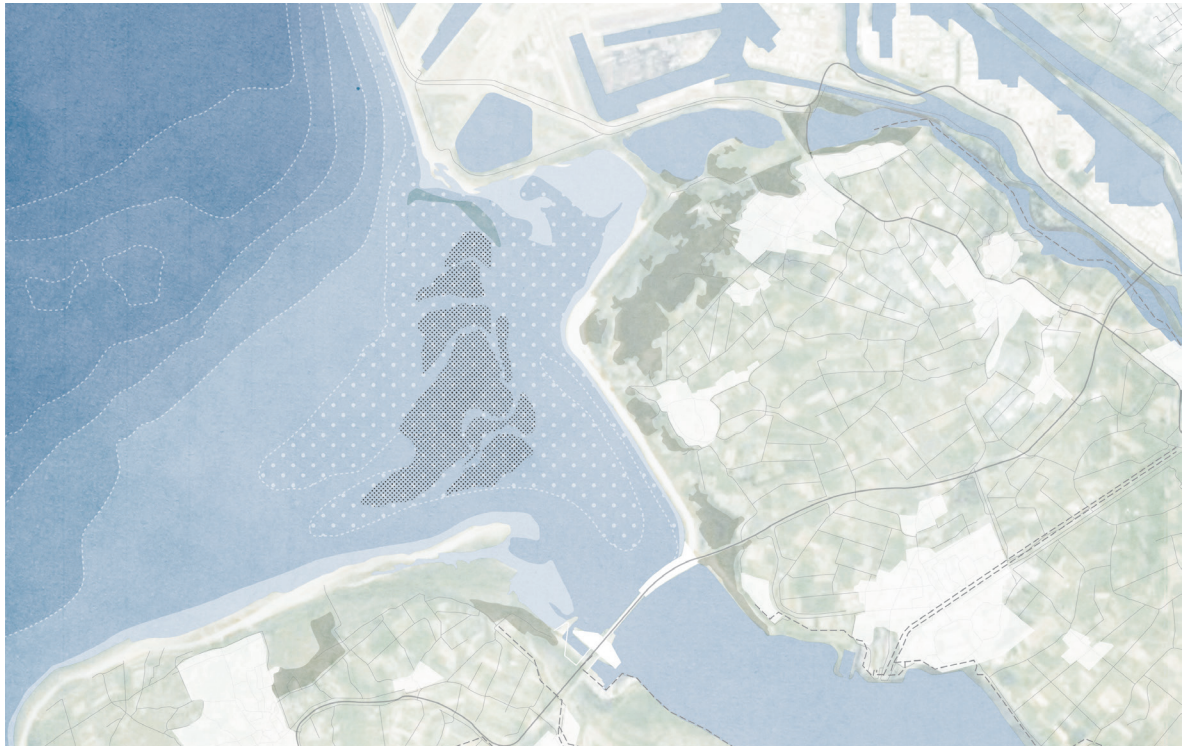
Regional Scale

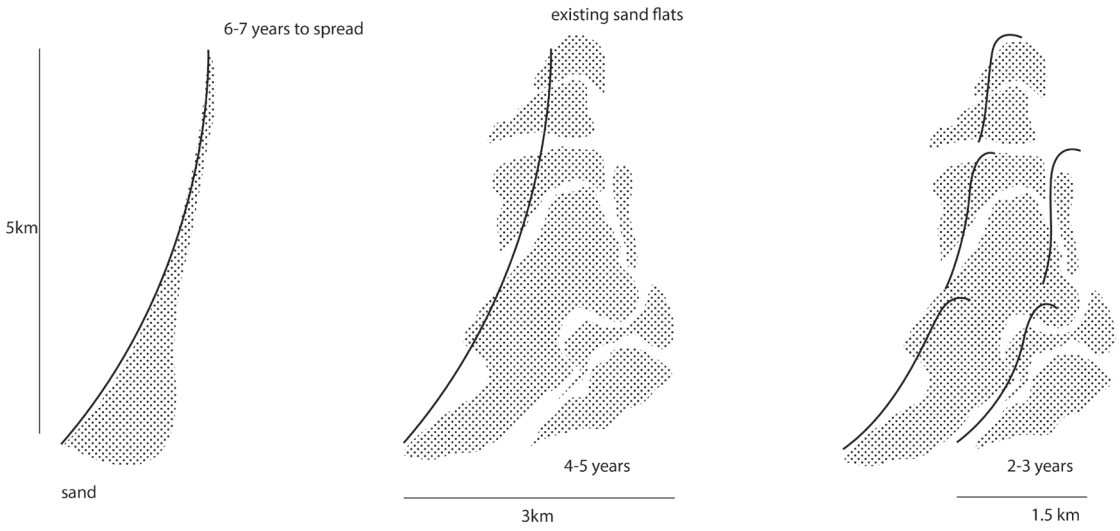


Masterplan

Barrier Island

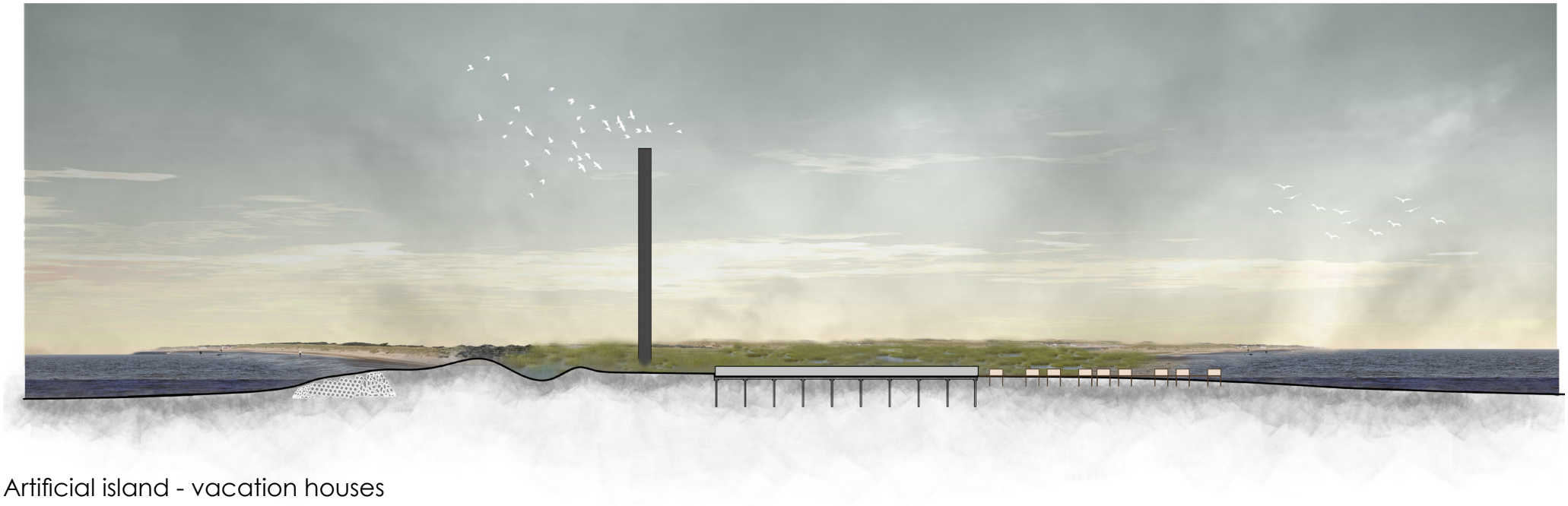






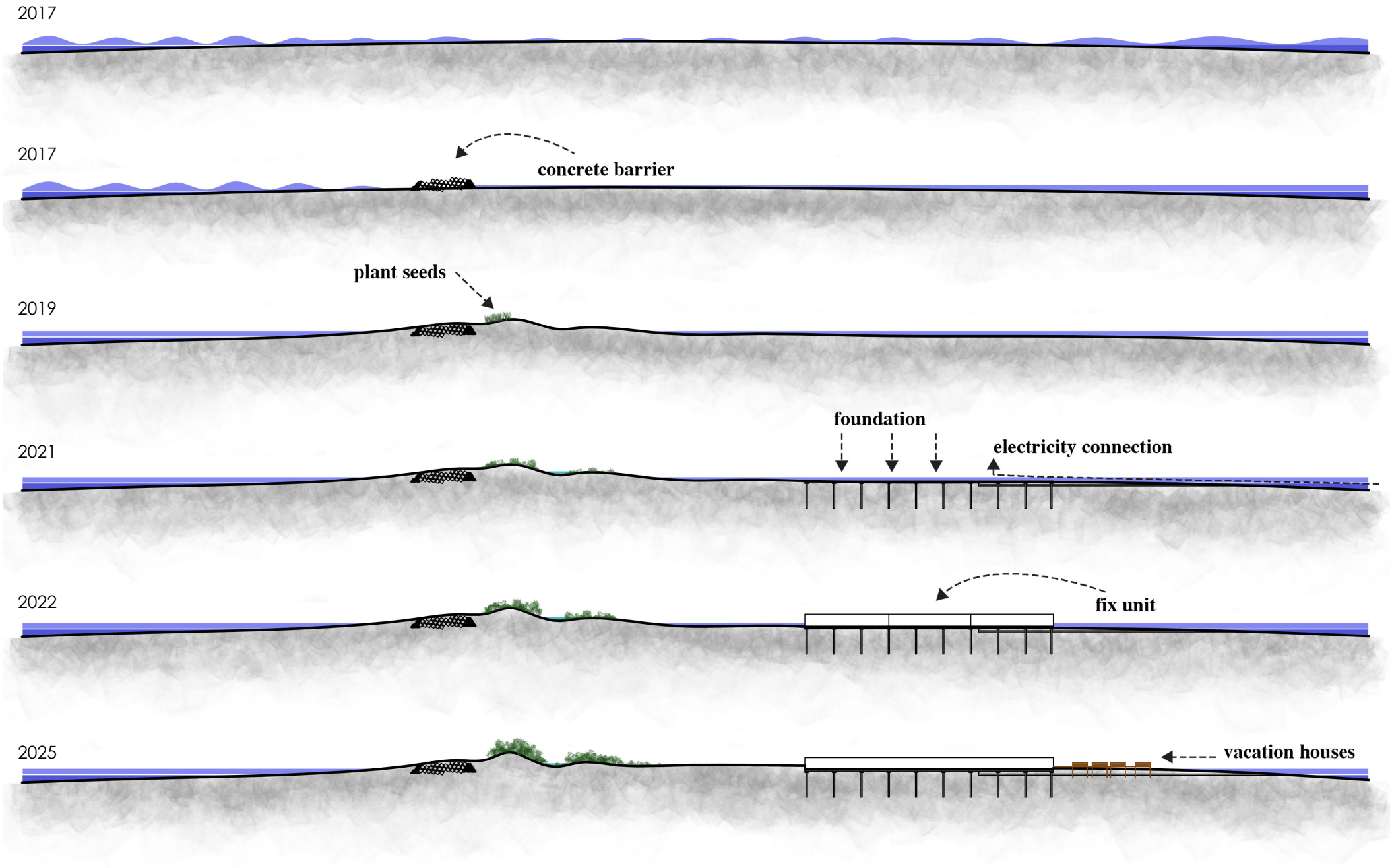
Two types of islands

Dynamic island for ecosystems

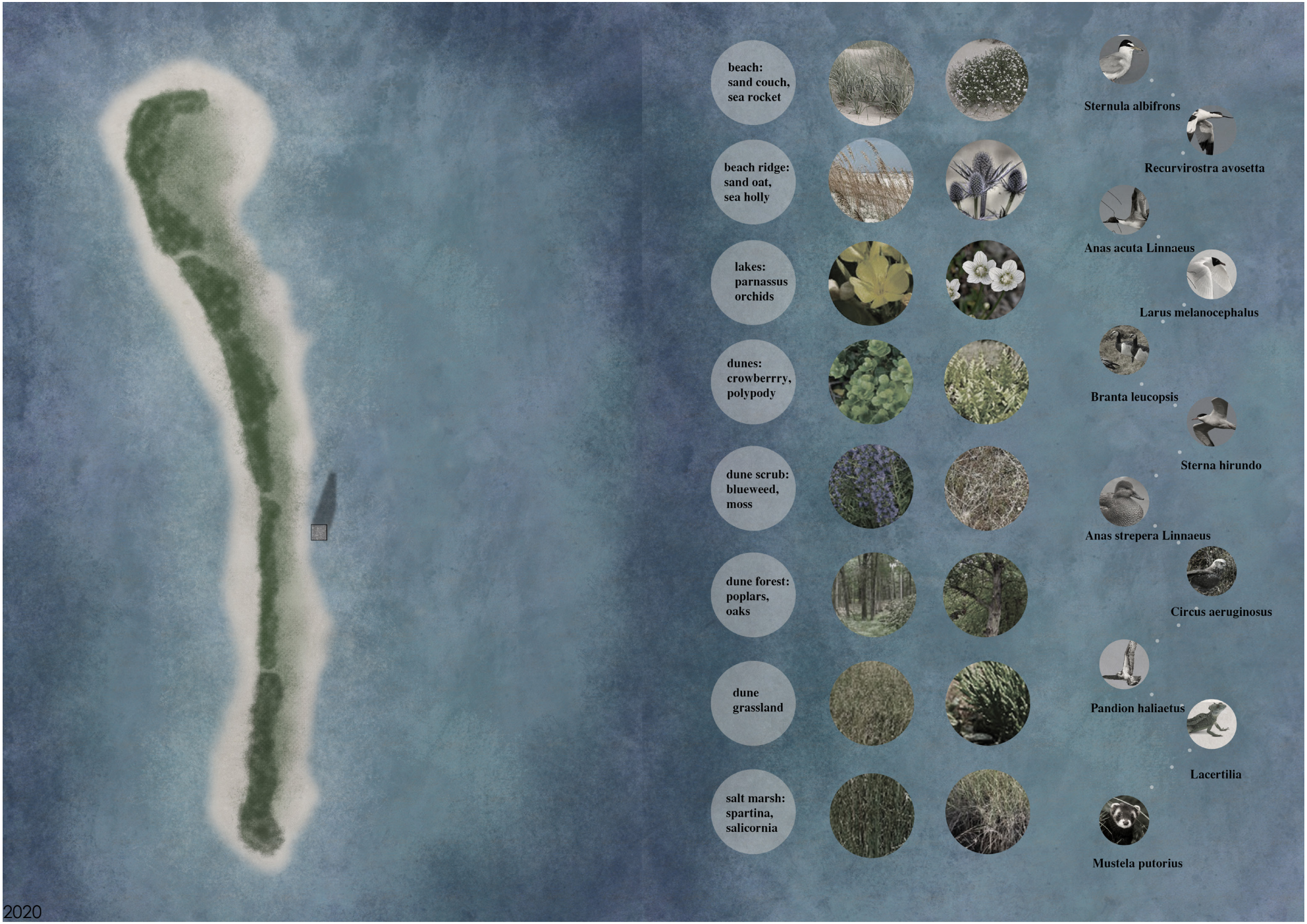


Artificial island - vacation houses

Artificial island development



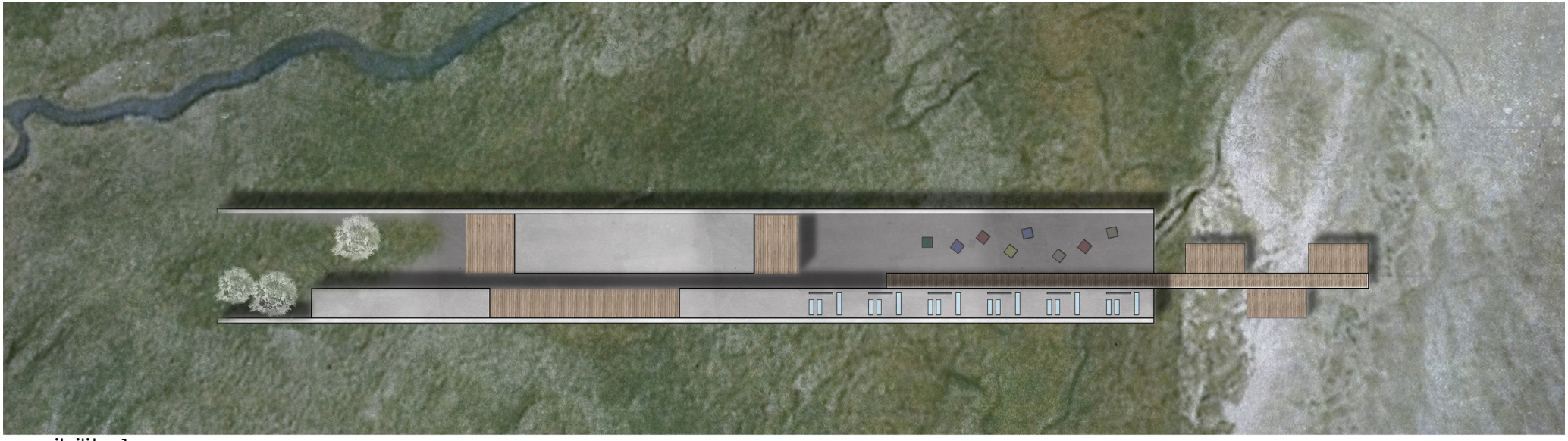
Artificial island development



Artificial island development

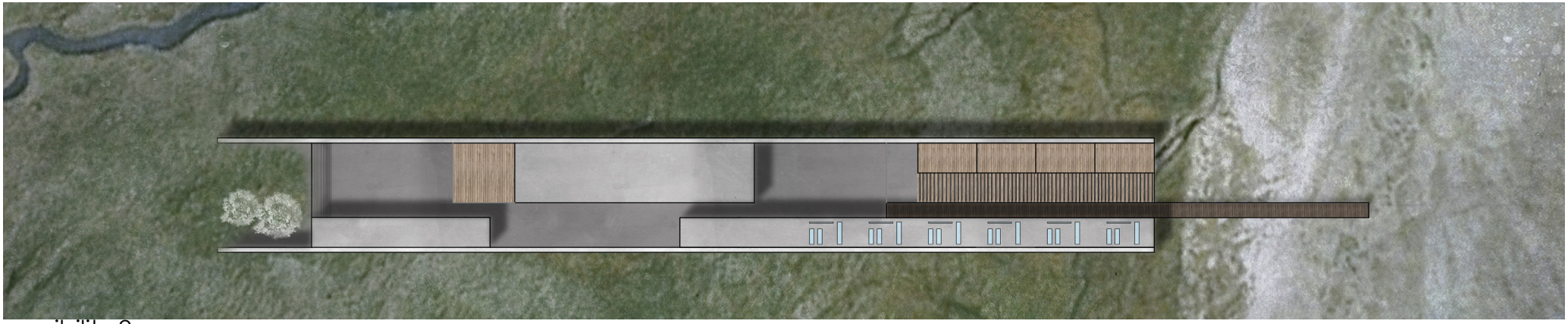
Artificial island development

basic unit

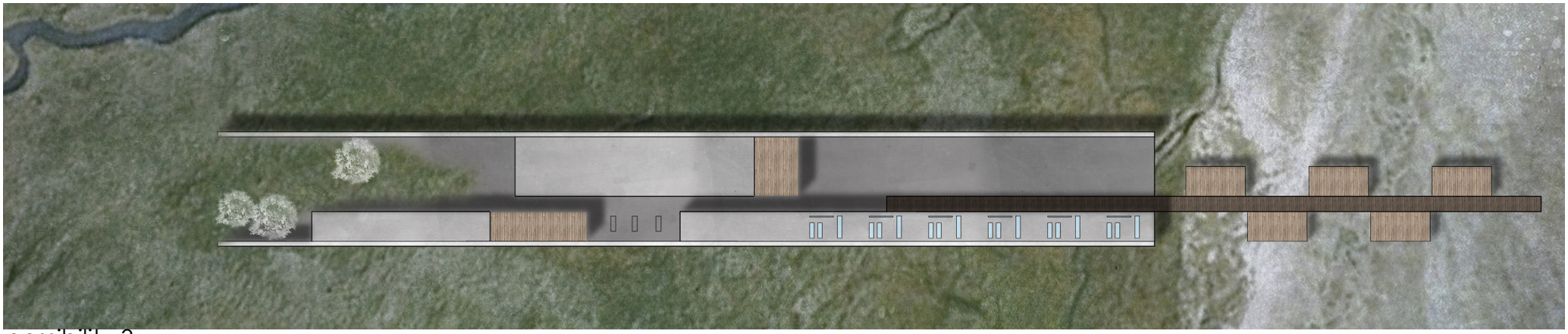


possibility 1

Unit



possibility 2

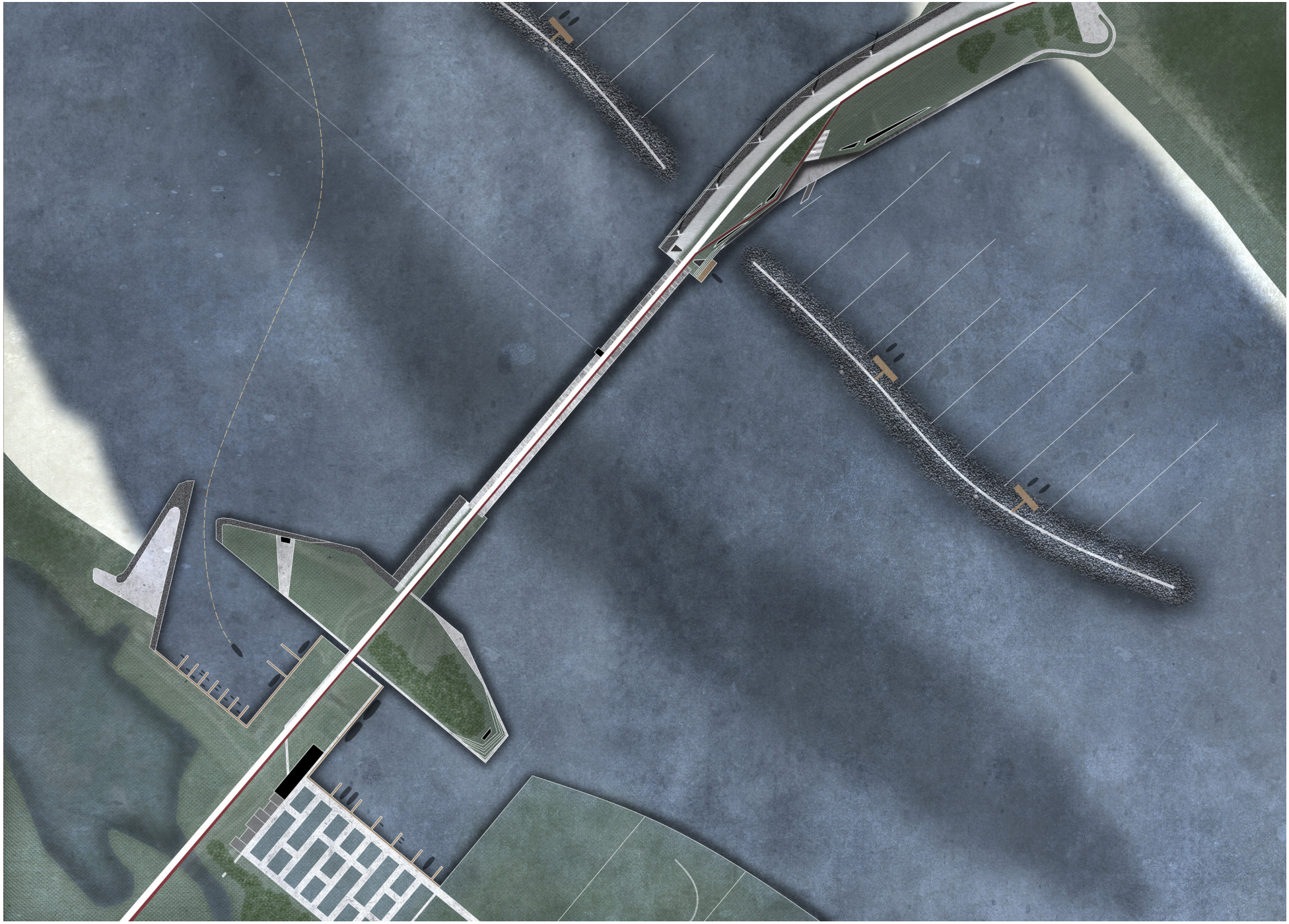


possibility 3

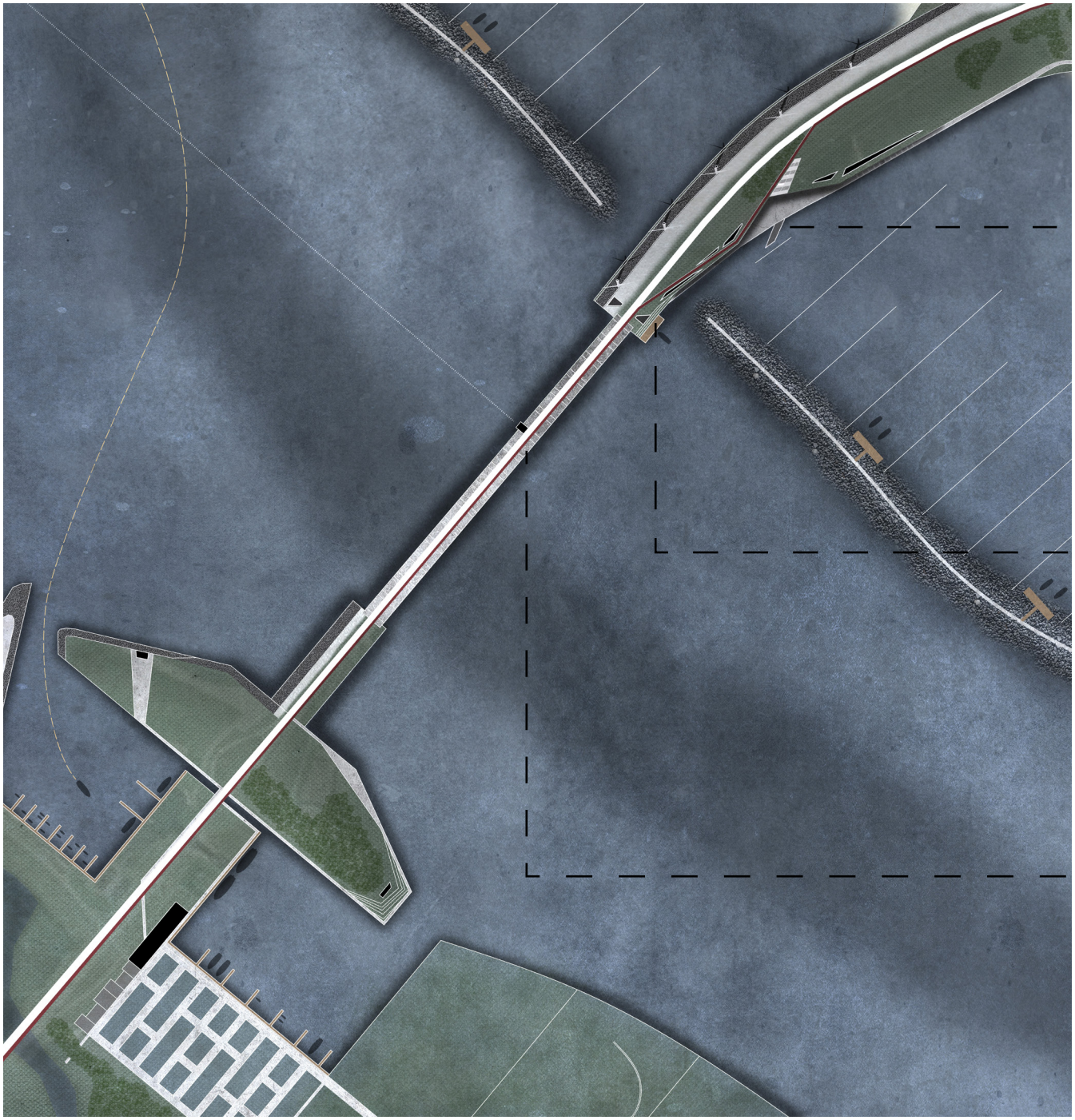
section

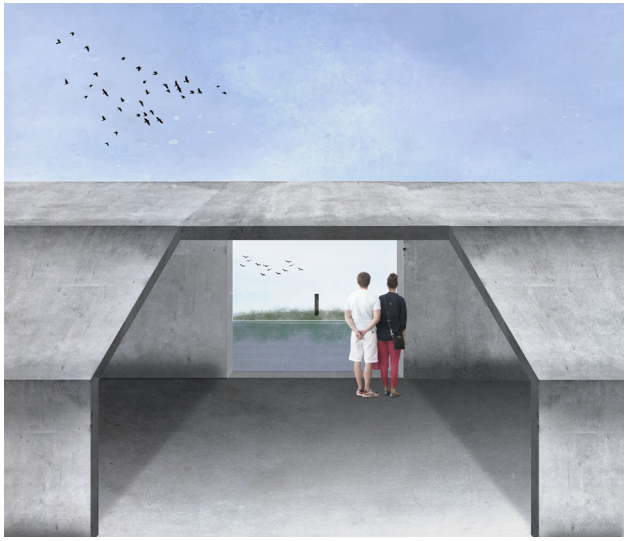
Unit

Dam



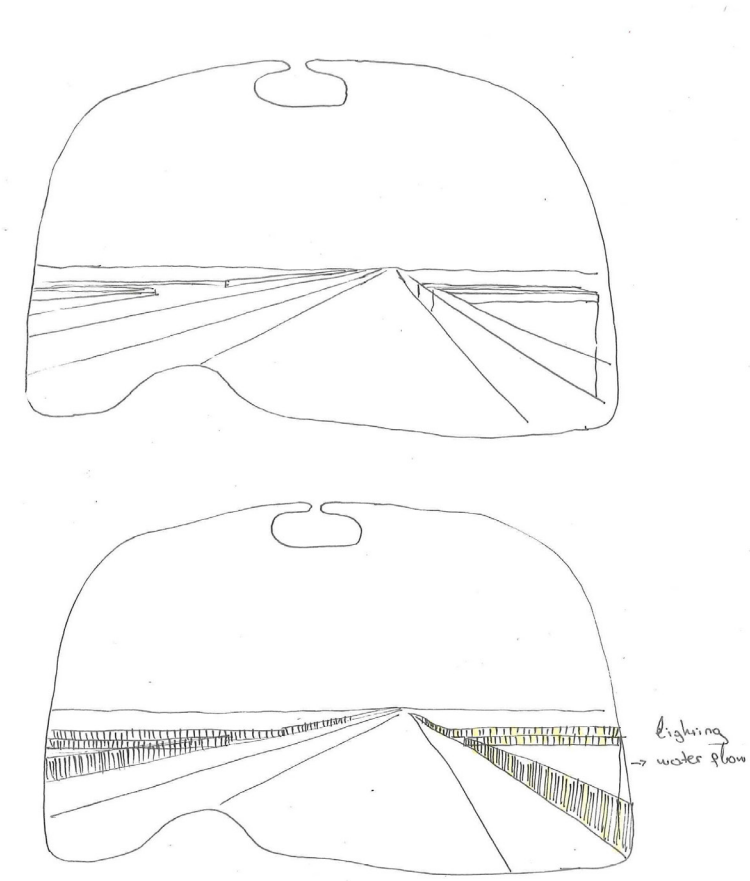
Dam





Dam

Opening of the gates:
People should be aware of the natural processes and how the area is slowly transformed



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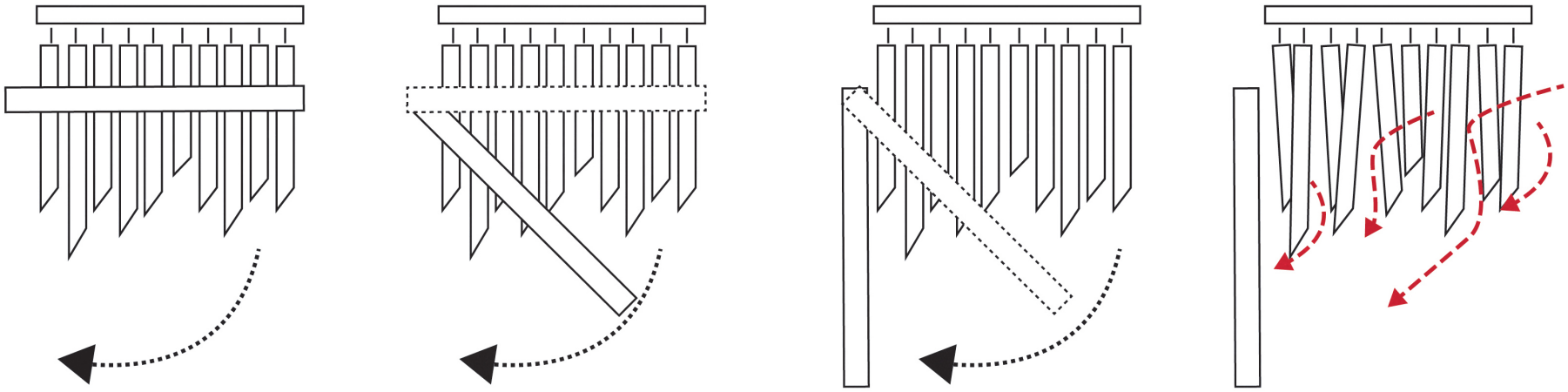
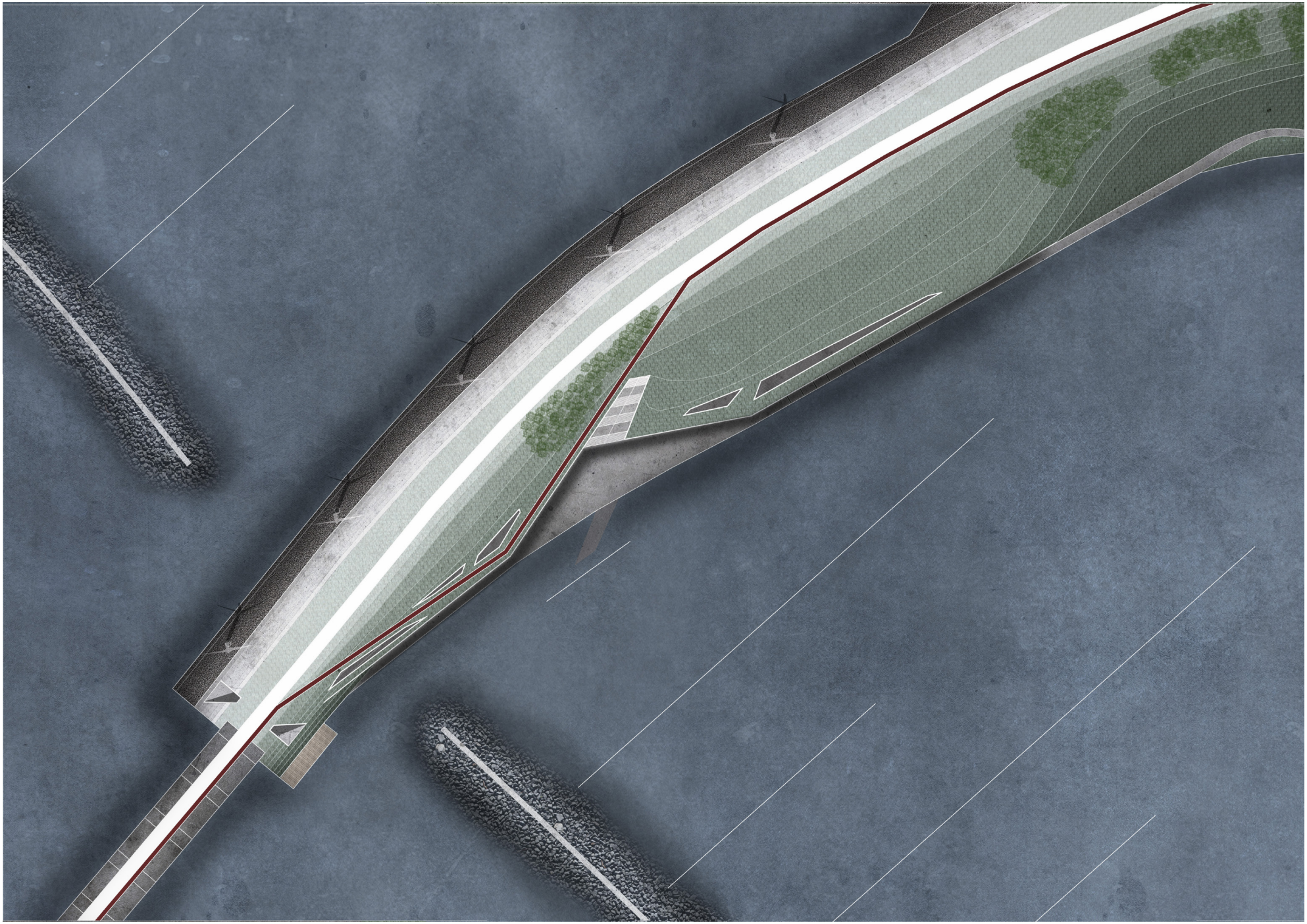


Dam

Dam

Dam



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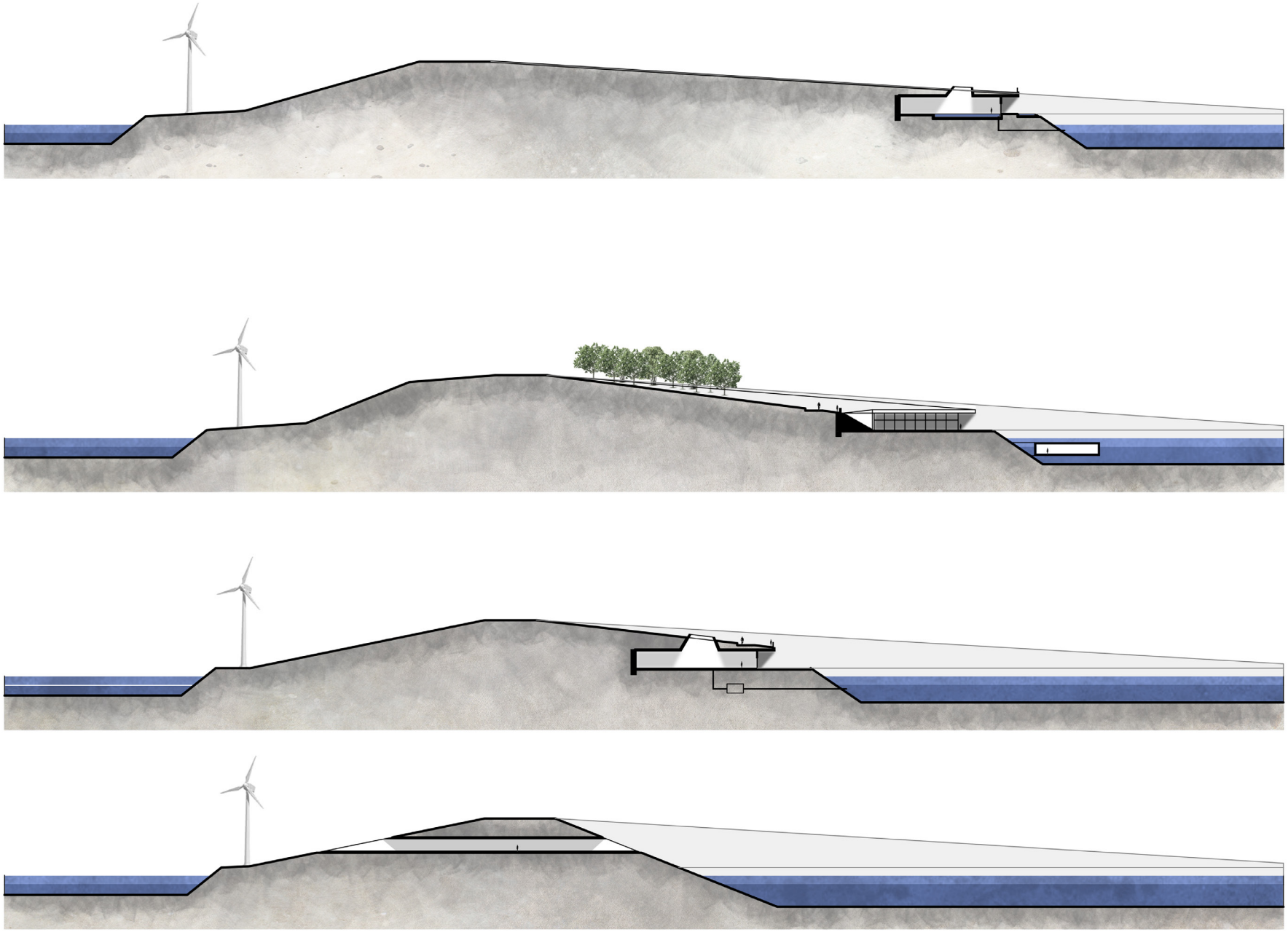

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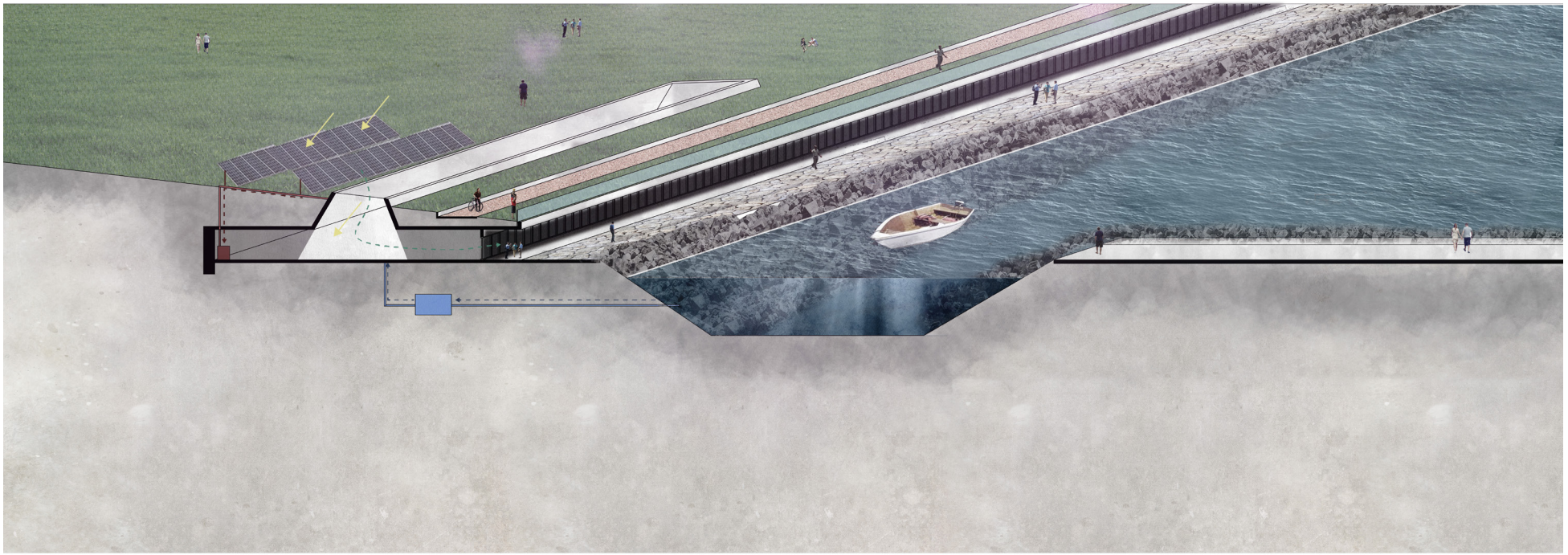

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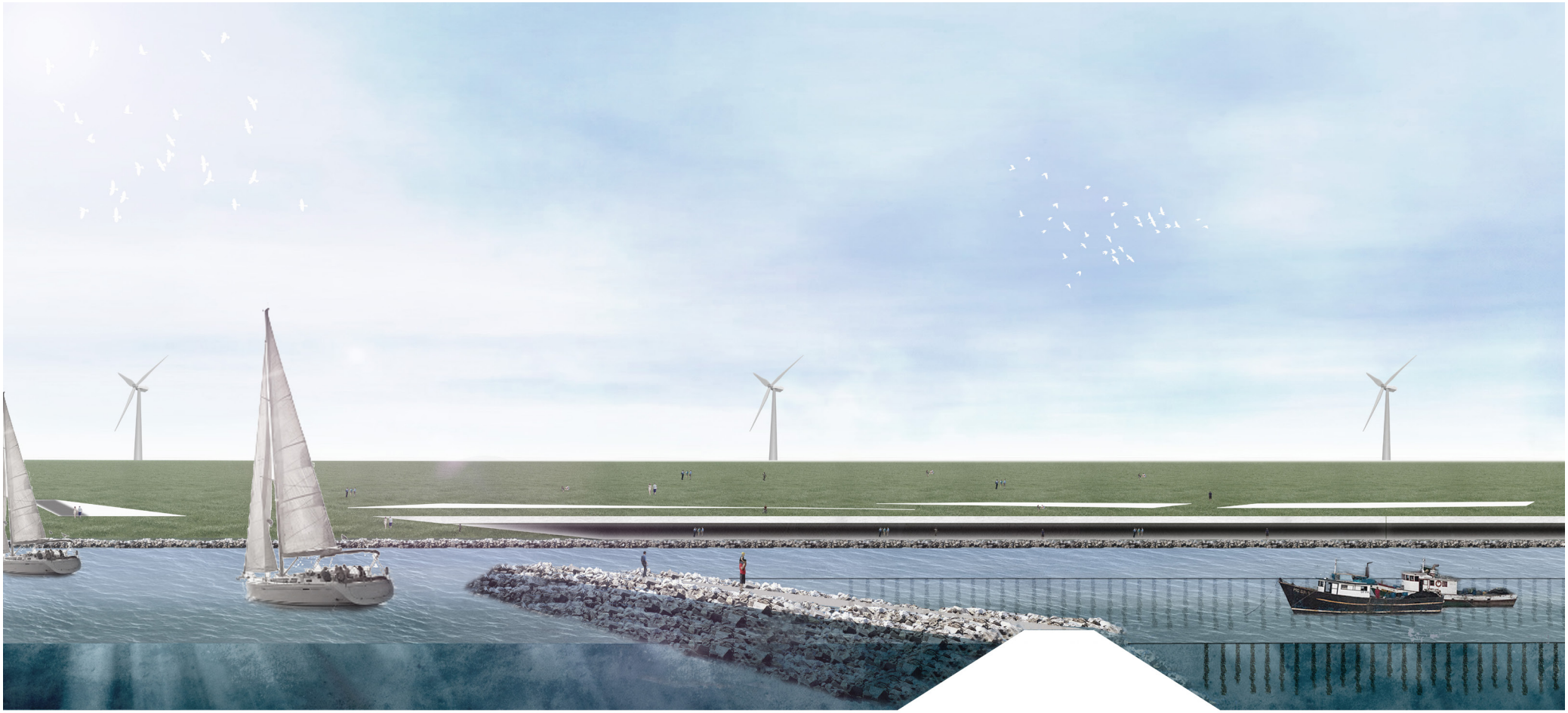

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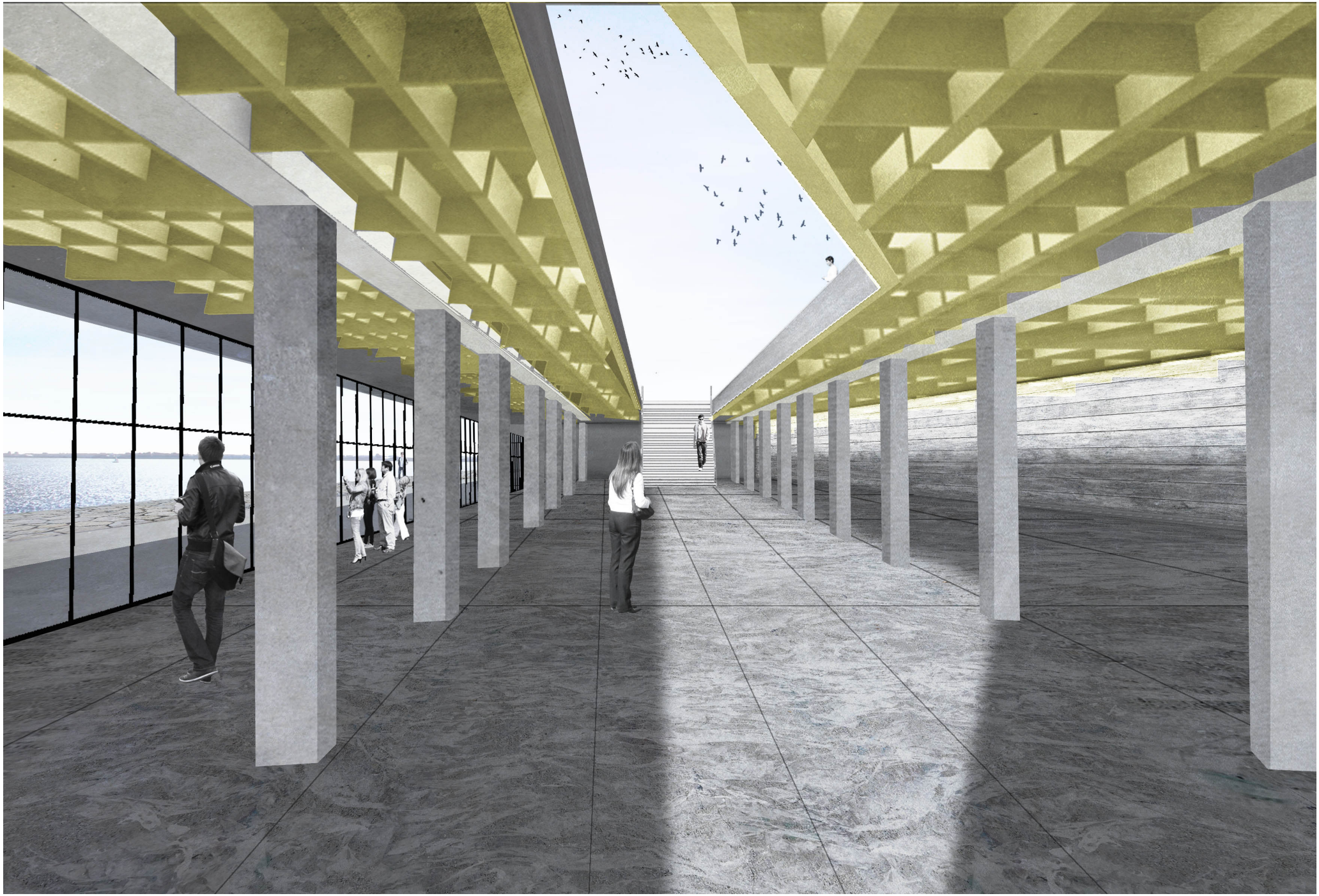
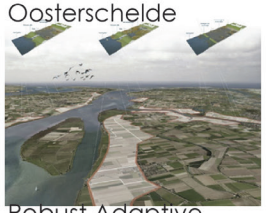


video

Precedents study

Sand motor

Oyster dam
Oosterschelde

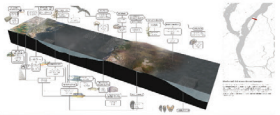


Robust Adaptive
Framework-Haringvliet

west 8 - Blue dunes

Posad
Ijmeer Markermeer

Maasvlakte 2



Garza and Thomas
de-Damming the Dutch
Delta

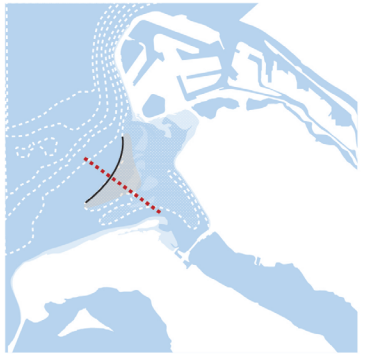
CAU + ZUS + URBANISTEN
New Meadowlands

Scape - Living breakwaters

Vista - Marker Wadden

Precedents study

Design Principles: Barrier Island



Existing Situation with tidal flats

Soft solutions

+ ecology + use natural processes − takes time

Sand nourishment

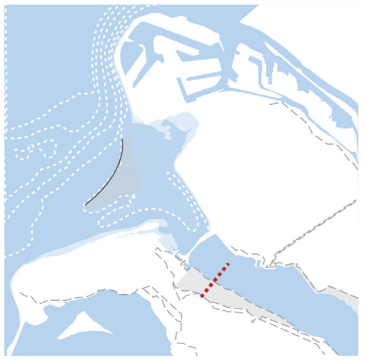
+ less time + use the sand from draining the channels − ecology

Combination of Soft and Hard solutions

+ less time − expensive

Precedents study

Design Principles: Creation of new intertidal zones

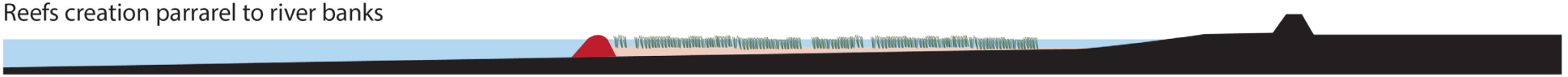


Existing Situation

Dike realignment

+ marsh vegetation + sedimentation + buffer + oyster - mussel production

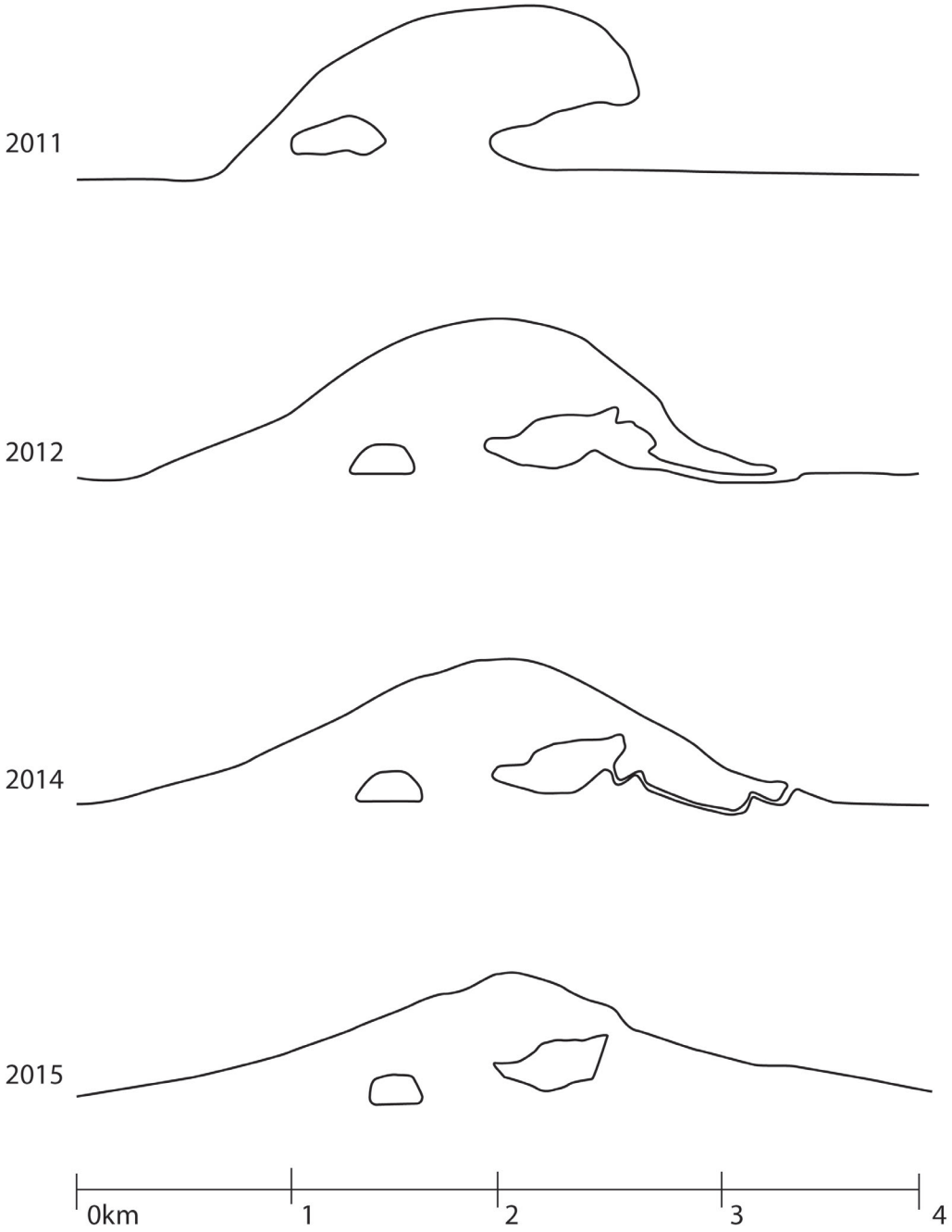
Reefs creation parrarel to river banks



+ marsh vegetation + sedimentation + ecology + recreation

Reefs creation vertical to river banks

Sand Motor Study



18.7 million m3 of sand
4 months to bring the sand

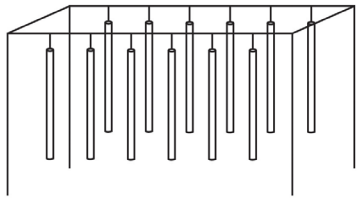
The predicted bed developments have actually occured but morphological changes were faster that predicted.

After 4 years the sand body protruded 260 metres less into the sea and the stretch of coast that has been extended seaward has become 2.2 kilometres longer.

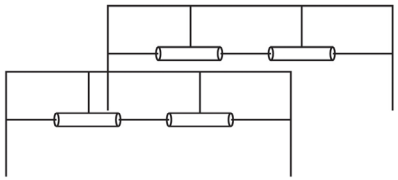
Storms in December 2013 and July 2015. storm moves as much sand as would hed been moved in four months.

Haringvlietdam: Production Dam

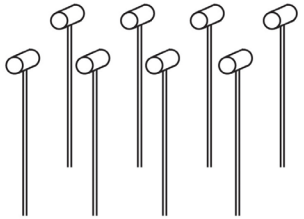
Bivalve Production



ropes

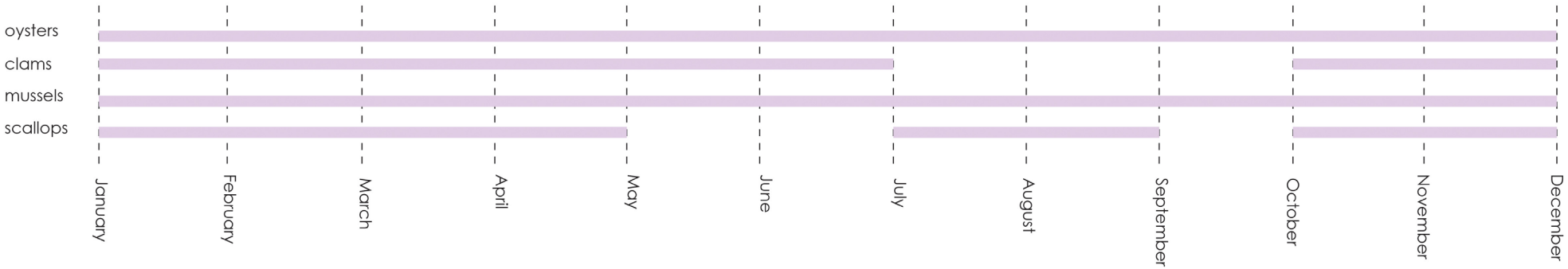


nets



boxes

Bivalve Seasonality



Oyster Production Study

Oysters reproduce in the summer months.

The larvae go to the bottom and search for something to attach themselves to. Ships have to spread empty mussels shelfs.

Ships do small circles to spread them evenly to the plot, to create a bed of mussel shelfs. A lot of oysters will attach themselves to the mussel shelfs.

One year later all the mussels shelfs with tiny oysters are brought out of the water and redistributed in a different plot. By doing that, mussels shelfs break apart, creating more room for oysters to grow.

After 3 years, the oysters are big enough for consumption.

Oysters are brought in Yerseke. They are full of sand. They put the oysters in oyster wells where the oysters perch themselves in a week.

Once they have been purified, they are removed from the pools and cleaned on at a time. After they are sorted by weight and return to the pools to recuperate.

The oyster wells are cleaned daily with the help of tidal cycles. When the tide goes out the sluice gates are open. In that way the sand that has been removed from the oysters get out. When the tide comes back, the oyster wells are full back again with water.

European flat oyster

Pacific oyster

)

Mussel Production Study

Mussels produce eggs in the spring

In the water look for something to attach themselves to.

Grow to 2-3 cm. The ropes are pulled out of the water.

Seed is removed and planted to grow into market size.

Plant mussels on plots that they can grow further.