Inclusive Energy Scapes

Regenerating the Rhenish Minescape towards an inclusive energy transition

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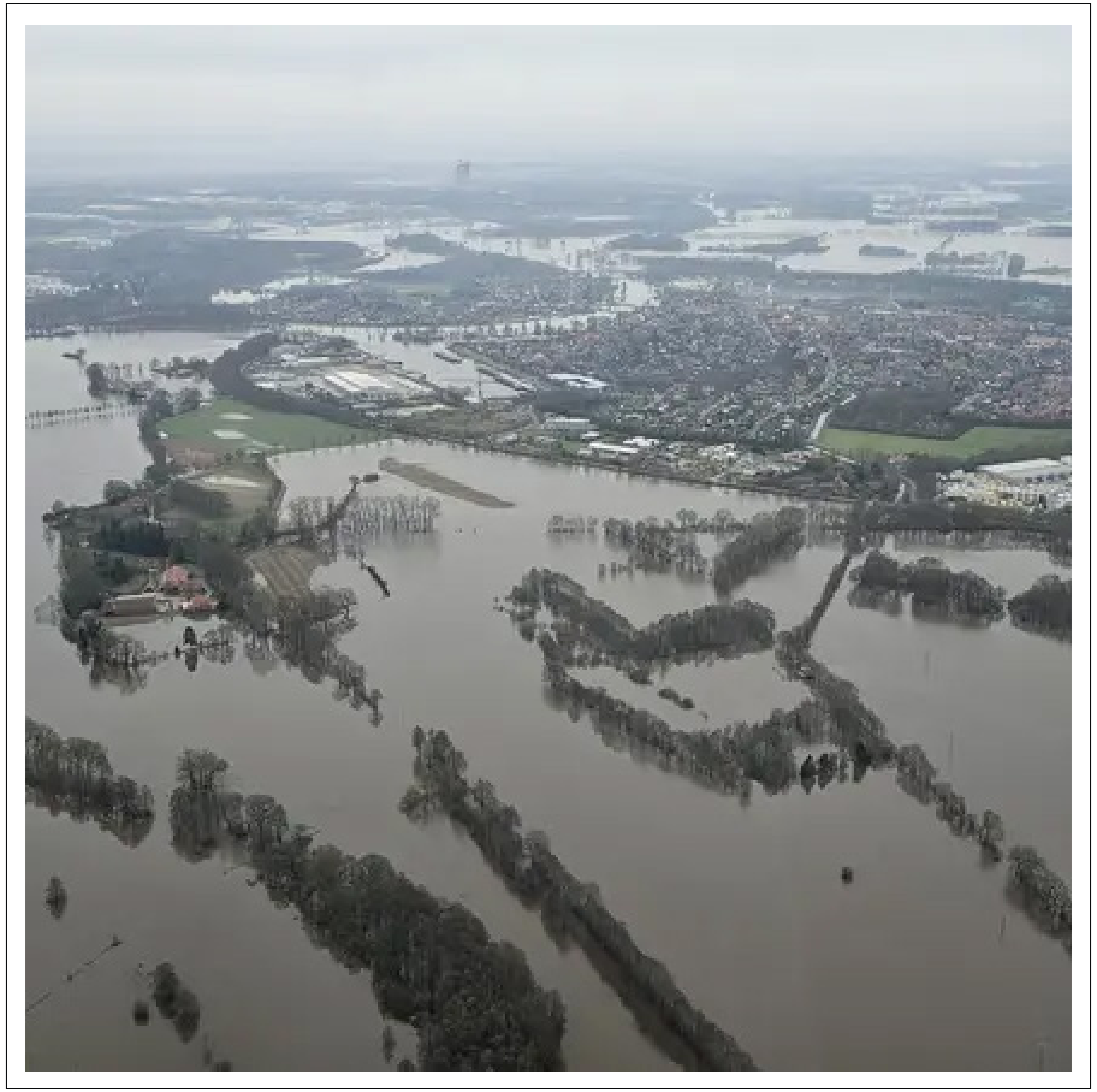
"Braunkohle-Tagebau" by Jürgen Spira, 2000

Depletion

Sergii Kharchenko/NurPhoto (2022),

Global instability



Climate change


Renewable energy

Based on Sijmons (2014)

Space

Arwyn Roberts (2015)

Resistance

Carolyn Cole/Los Angeles Times (n.d.)

Quality

I

Context

II

Systems

III

Landscapes

IV

Transitions

Content

Lignite

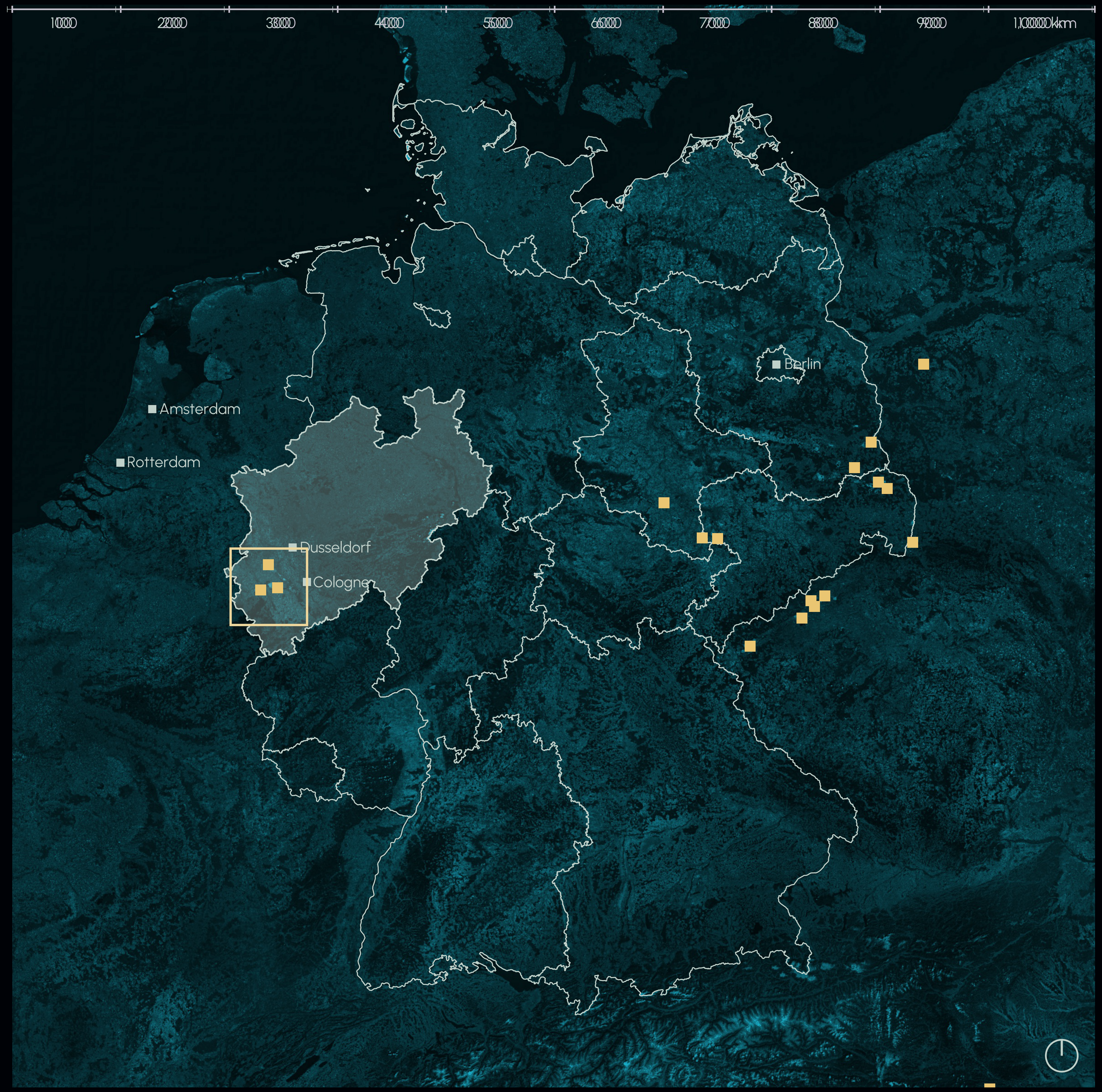
Future coal potential

Coal plant

Coal mine

Coal terminal

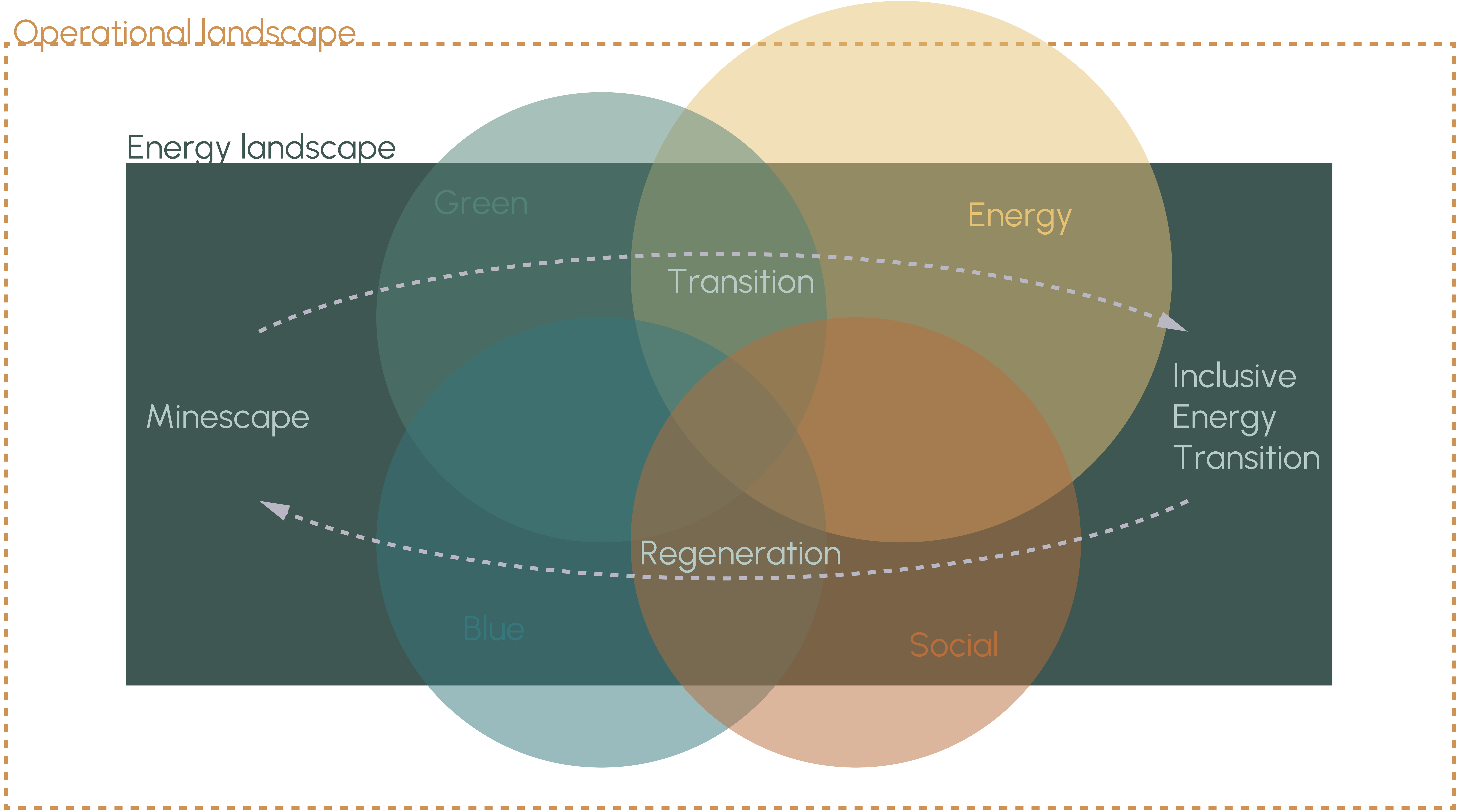
Lignite



Case study

Rhenish Lignite Mining Area

How to ***regenerate*** *through design the* ***minescape*** *of Rhenish Mining Area towards an* ***inclusive energy transition?***



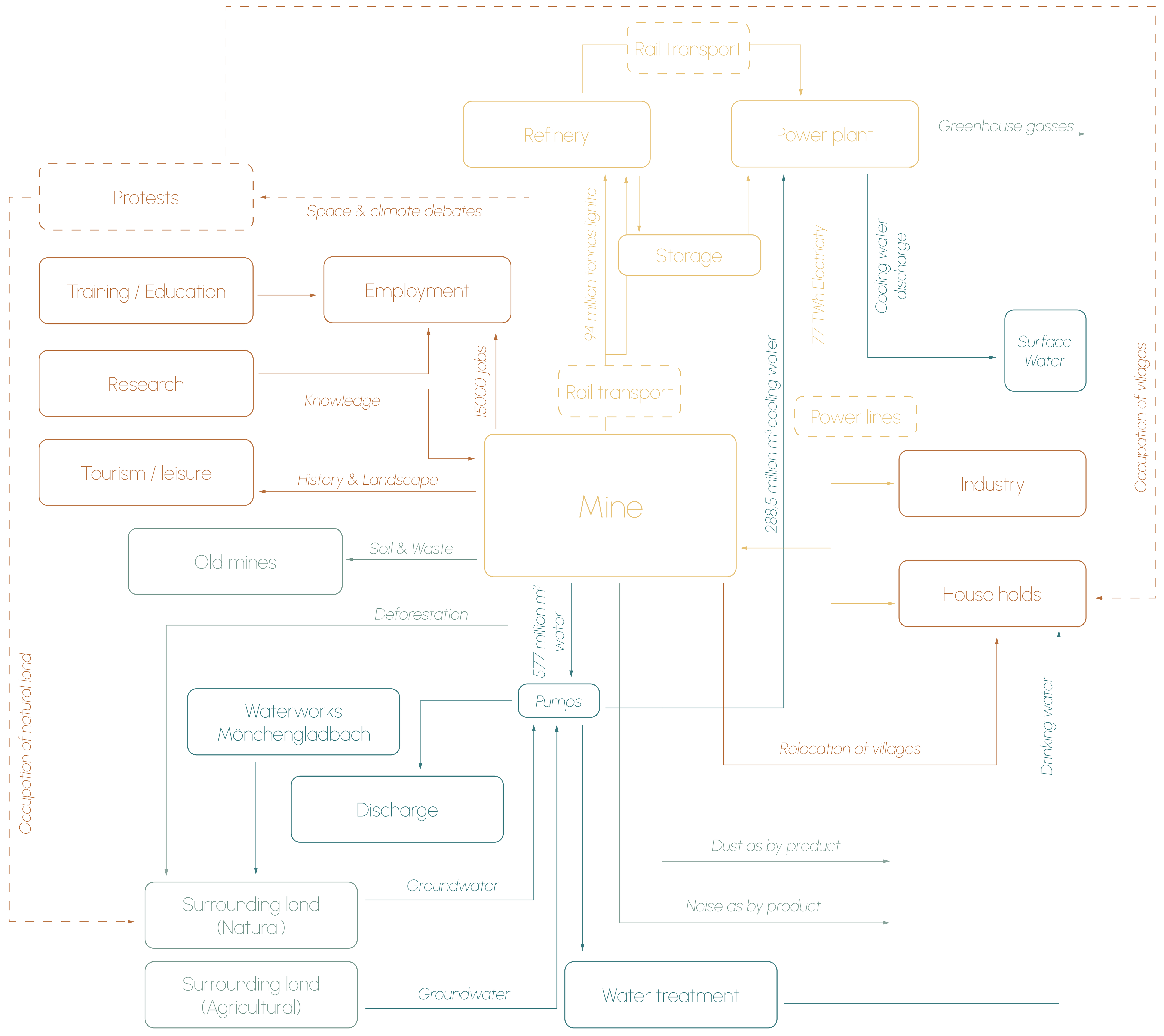
Conceptual framework

I
Context

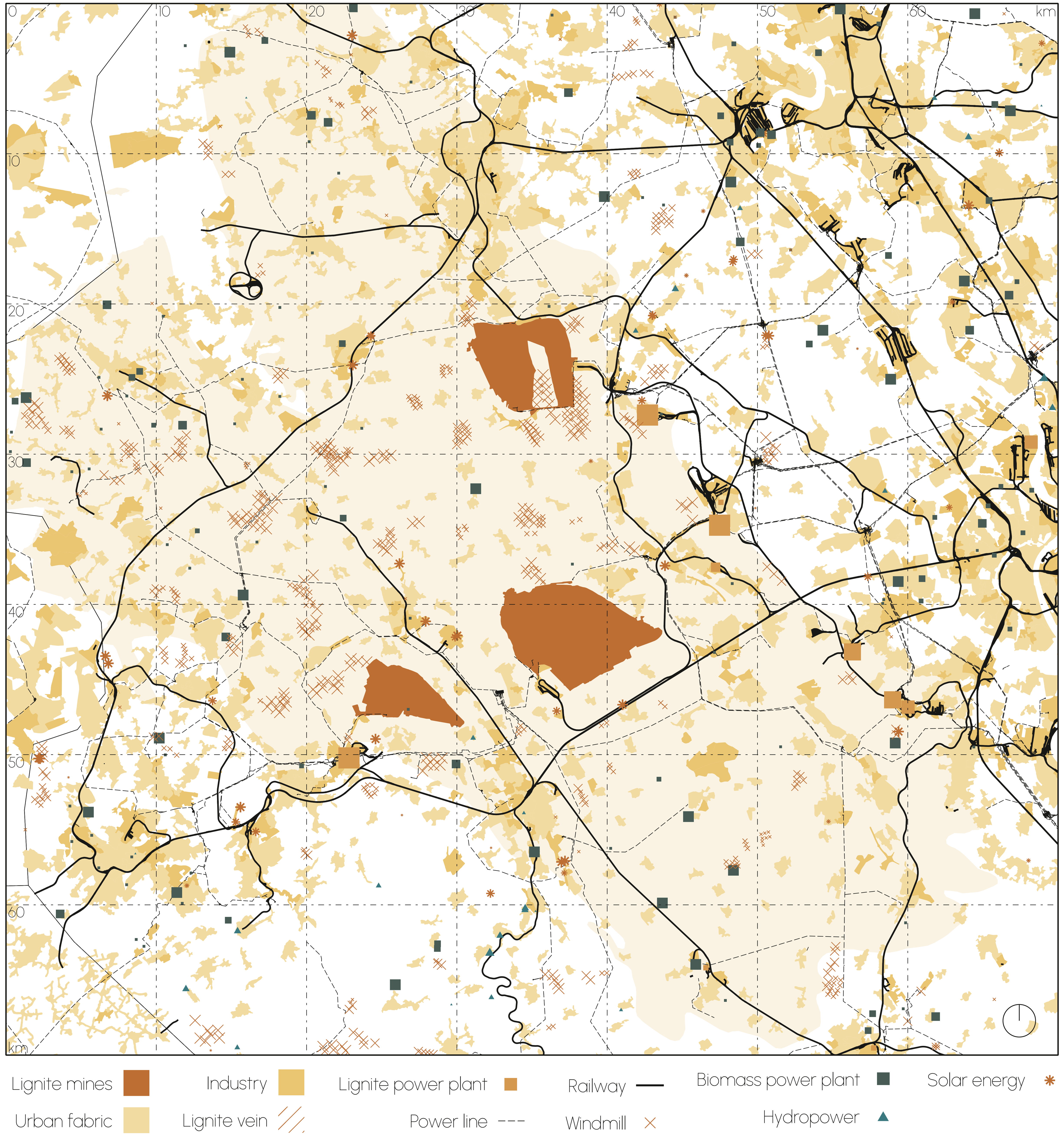
II
Systems

III
Landscapes

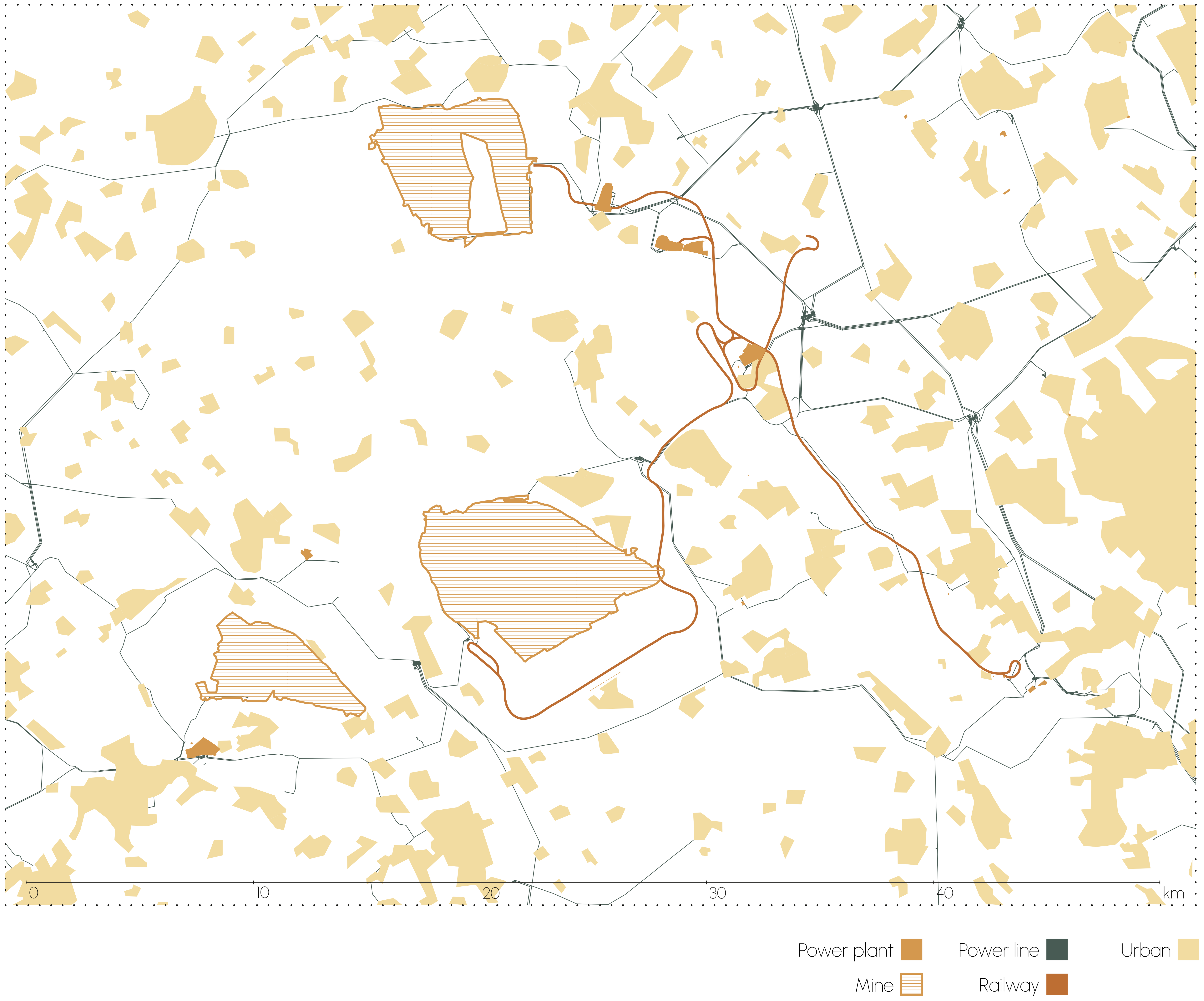
IV
Transitions



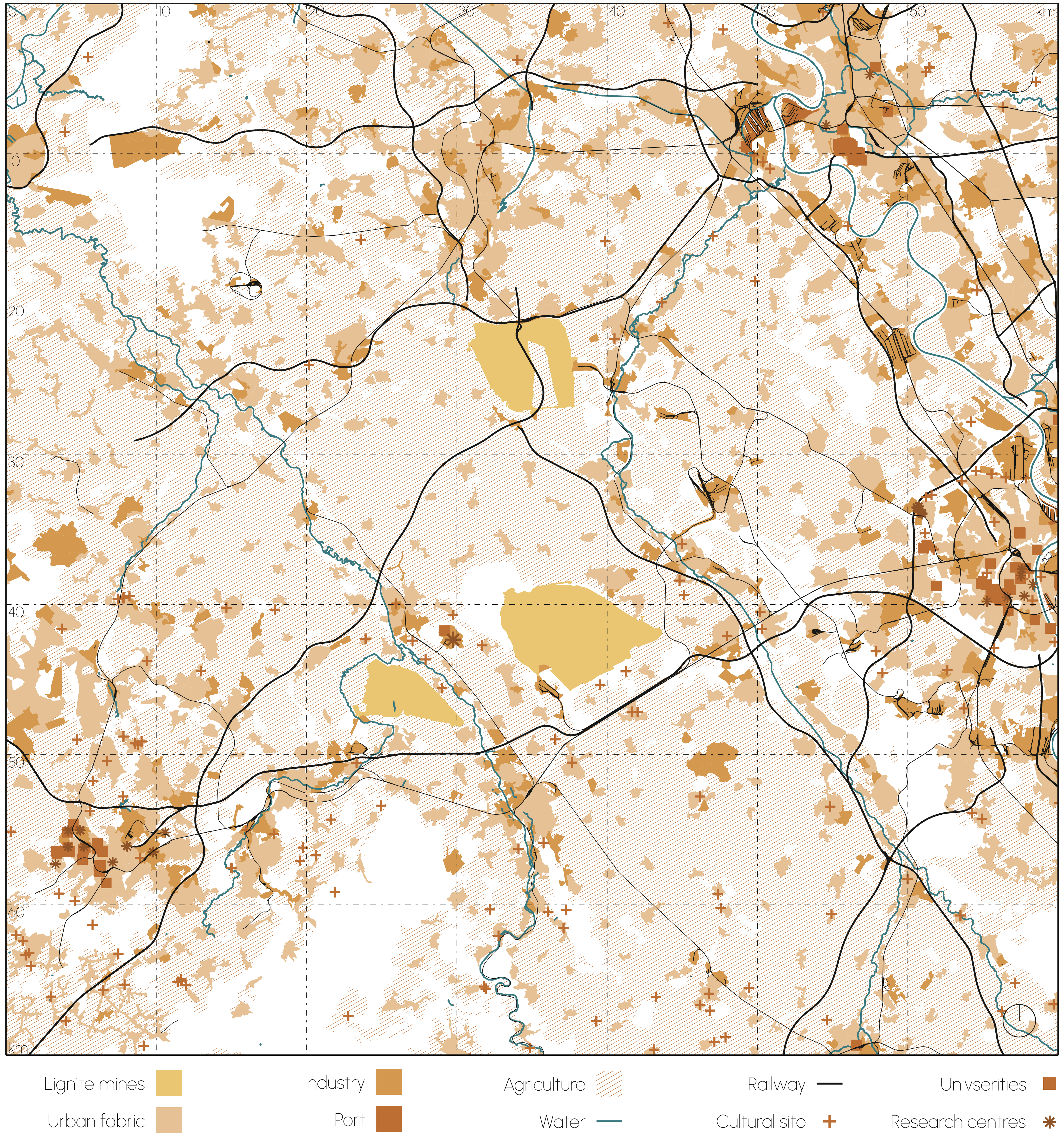
Minescape system



Energy system



Elements of the energy landscape



Social system

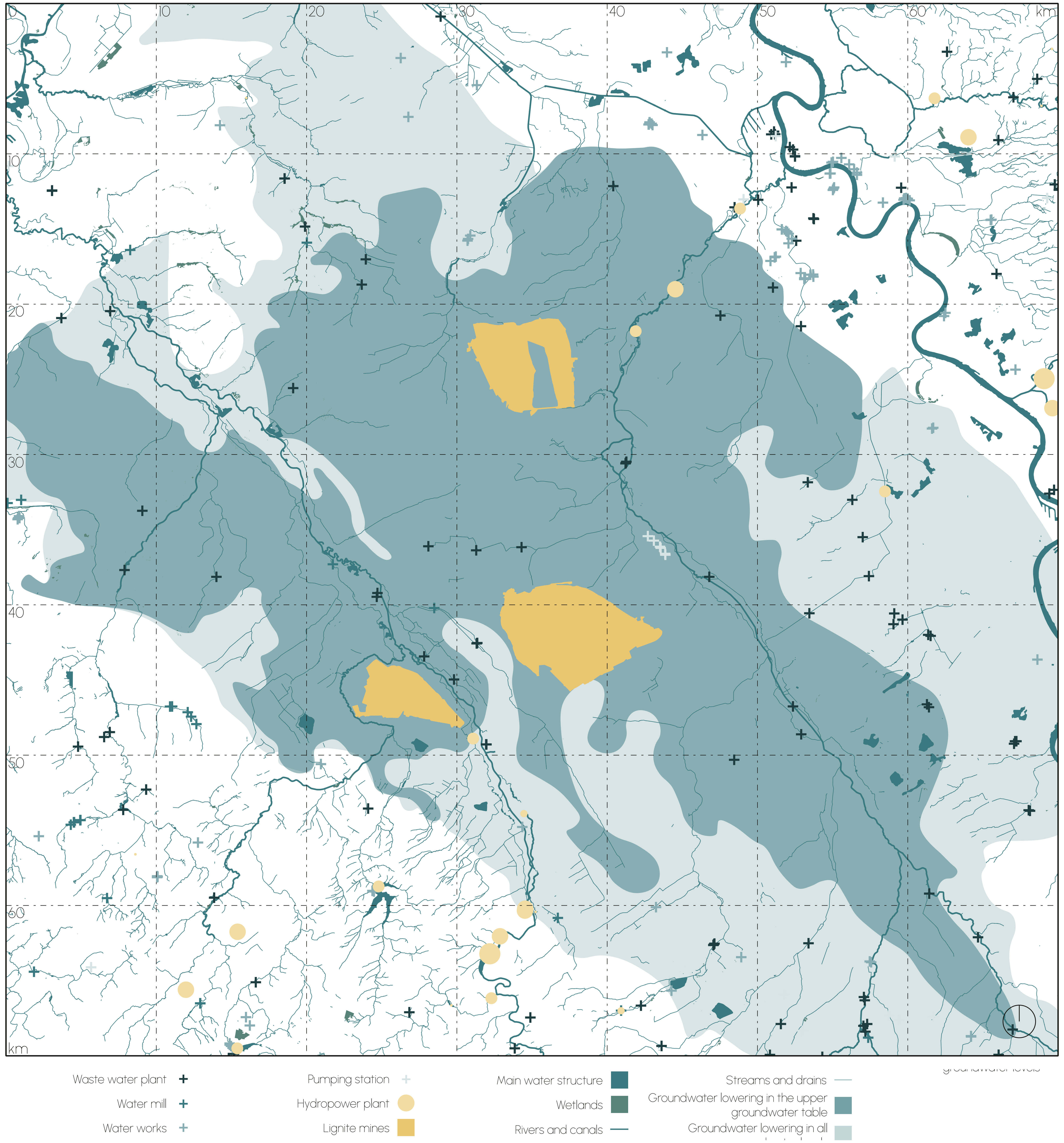




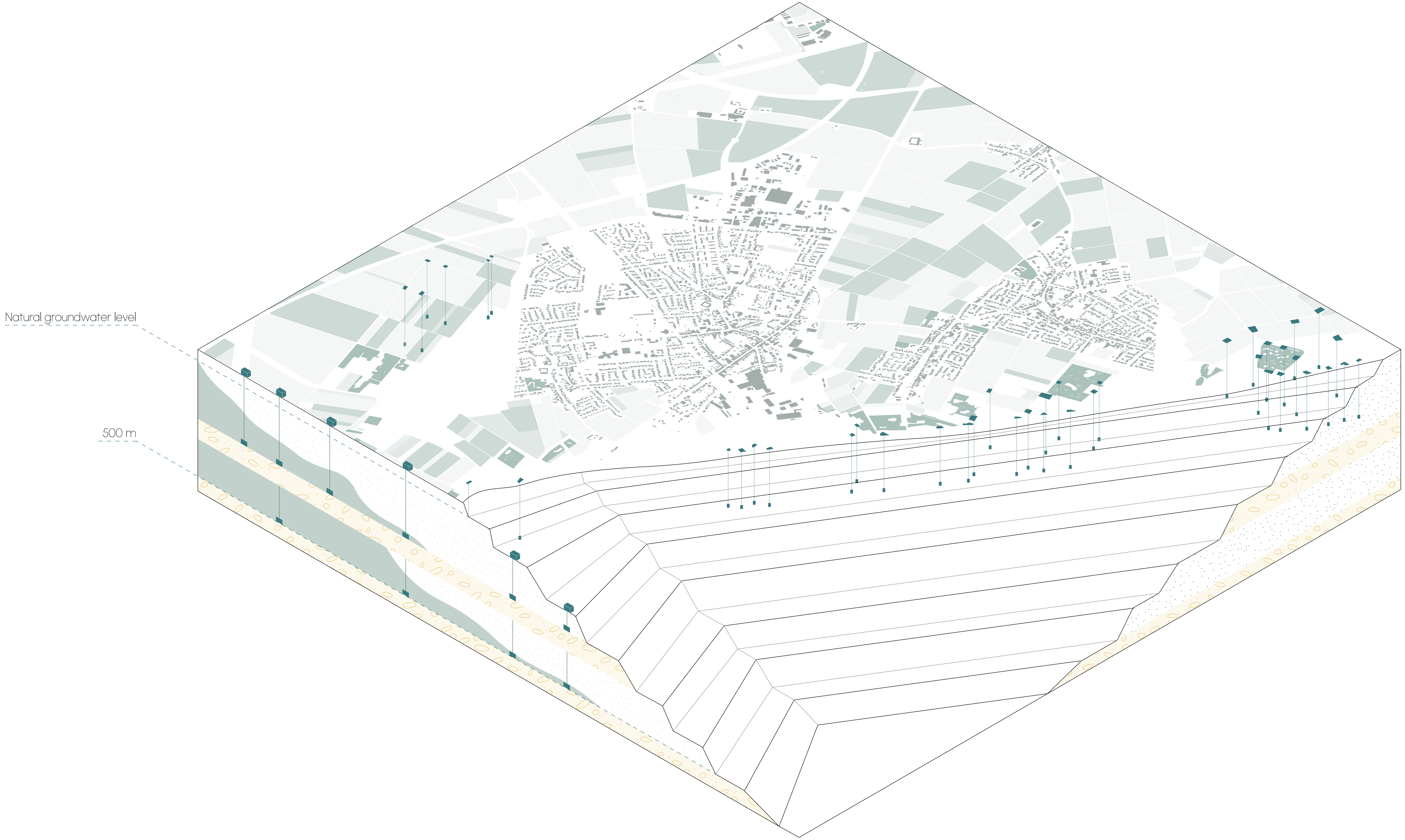




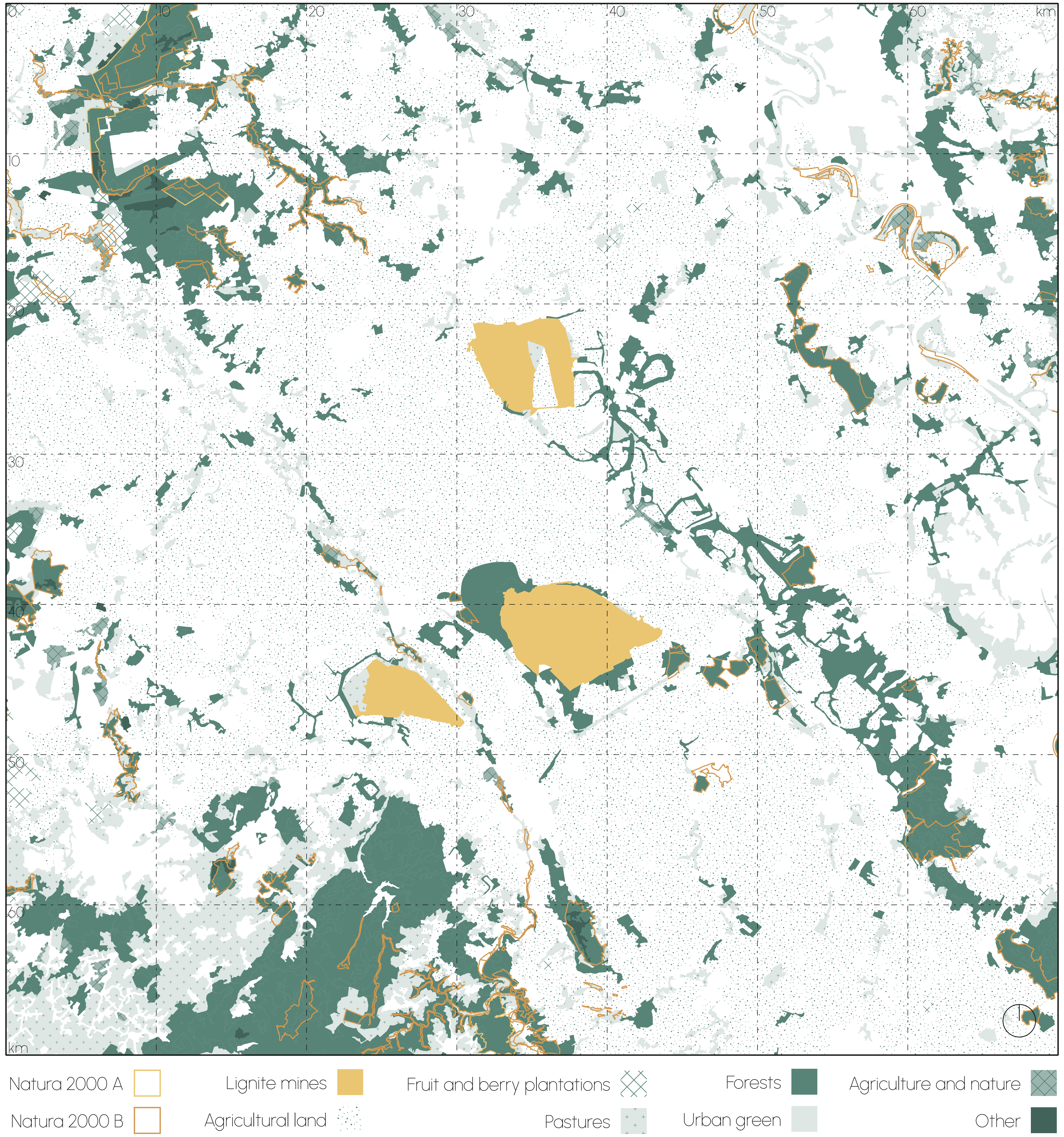
Resistance


0
10
20
30
40
50
60
km
Waste water plant
Water mill
Water works
Pumping station
Hydropower plant
Lignite mines
Main water structure
Wetlands
Rivers and canals
Streams and drains
Groundwater lowering in the upper groundwater table
Groundwater lowering in all

Blue system



Infrastructure



Green system


0
10
20
30
40
km
Soil heap (Overburden)
Pollution power plants
Definitive pollution
Active mine
Railways
Expected pollution regeneratted areas
Expected pollution mining

Pollution

Natural areas
Lignite mines
Villages
Agriculture
Railways
Research centre
Plants and Refineries
Closed mines
City
Pump
Research centre groundwater
Waterworks

System

I

Context

II

Systems

III

Landscapes

IV

Transitions

Landscape

Scarring


Landscape restoration

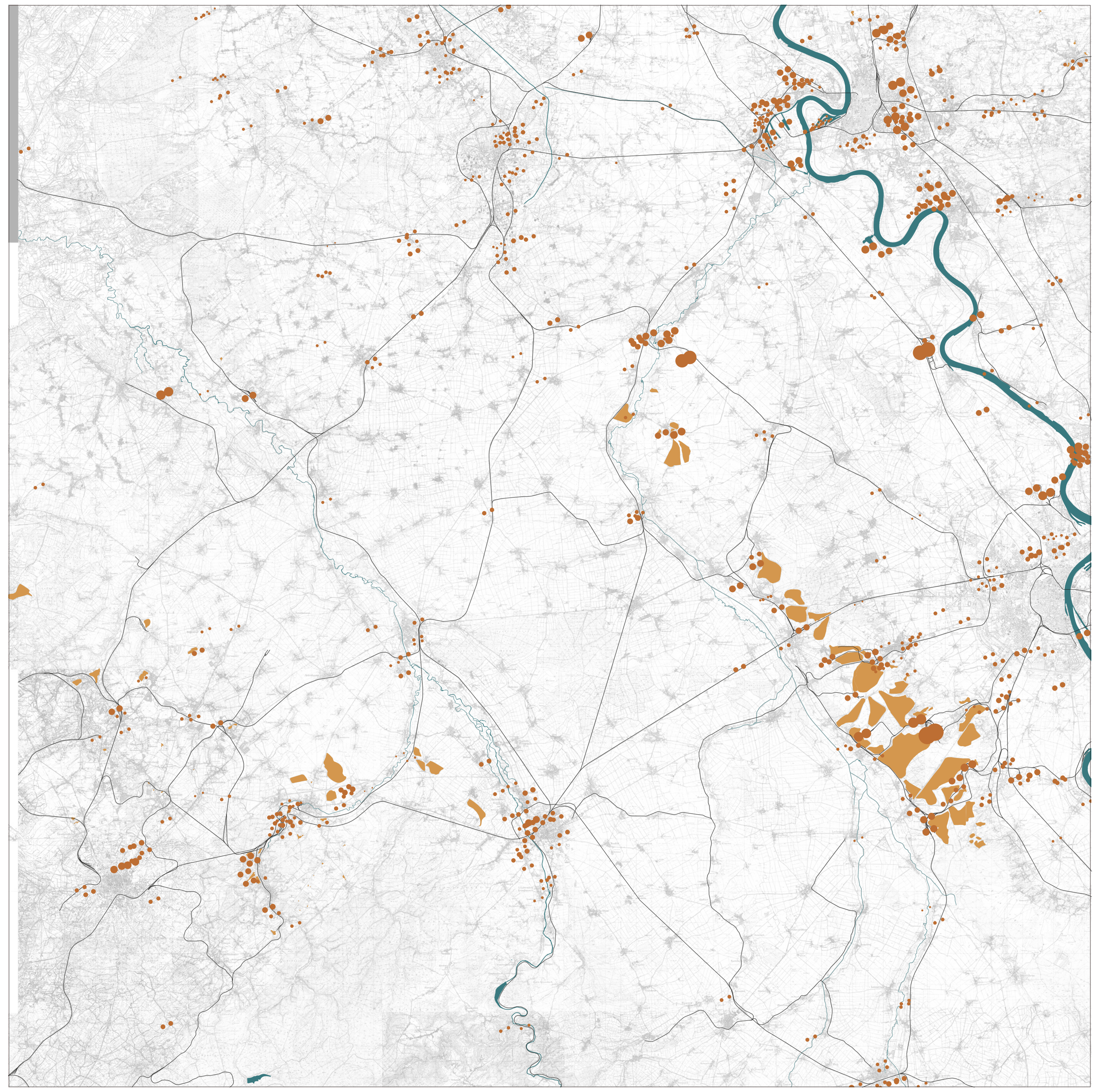
Infrastructural change

Vacancy

Soft Landscape

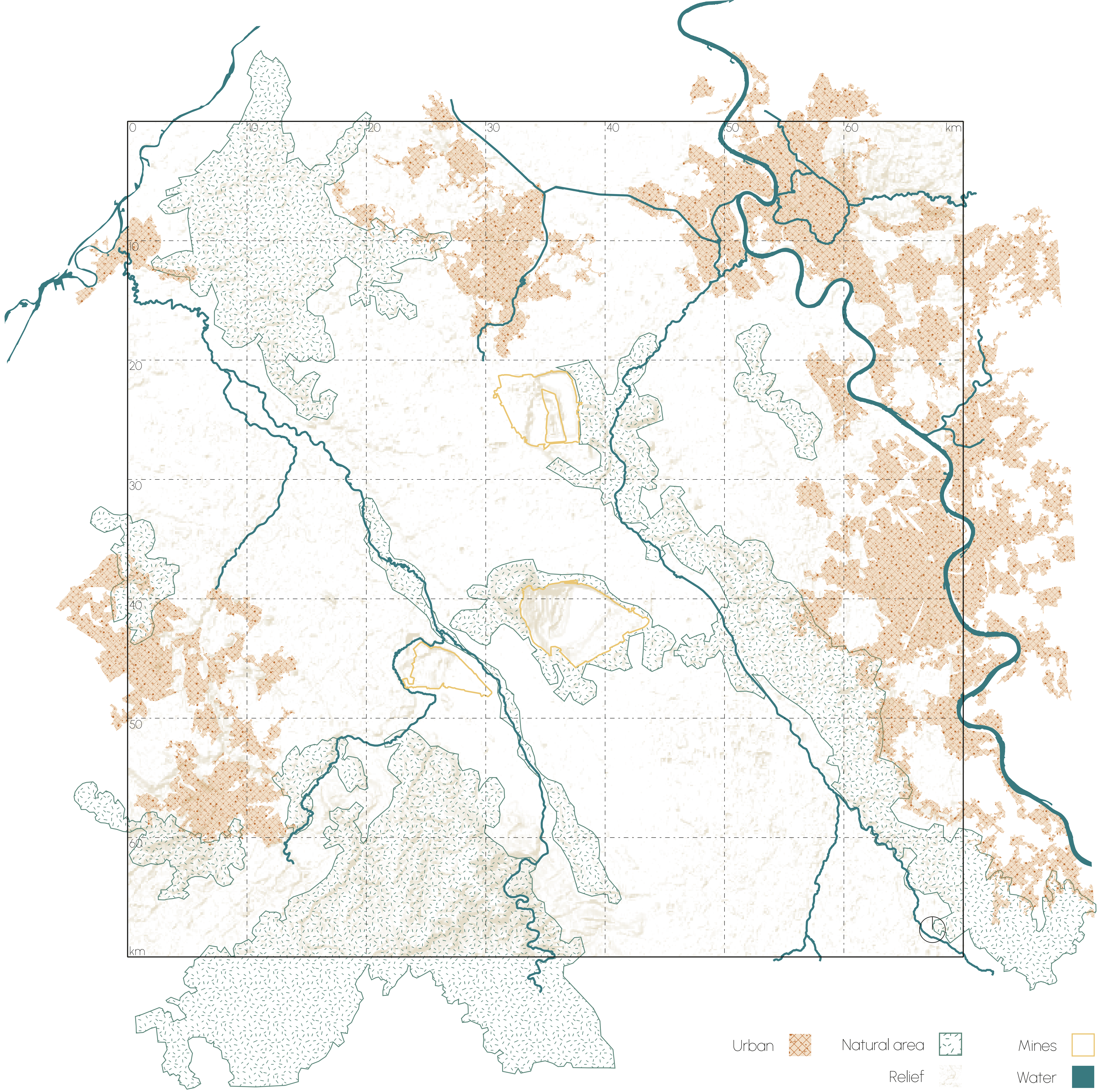
1836 - 1851

1891 - 1912



1936 - 1945

Historic overview



Characteristics

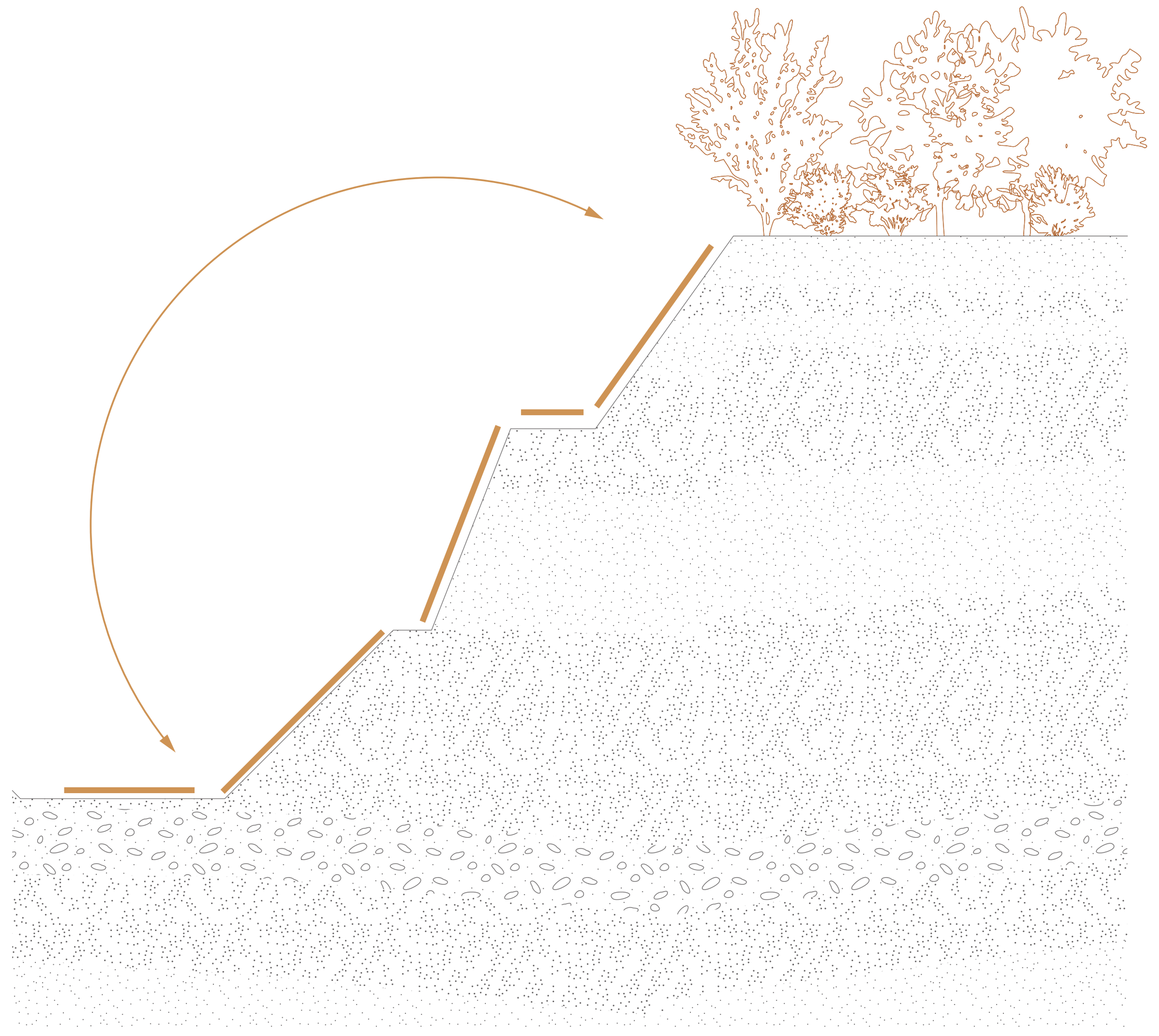
I	II	III	IV
Context	Systems	Landscapes	**Transitions**

Emscher landschaftspark - NatiSythen,
Berzdorfer See - Frank Vincentz, Tagebau Bergheim - Alexander Orth

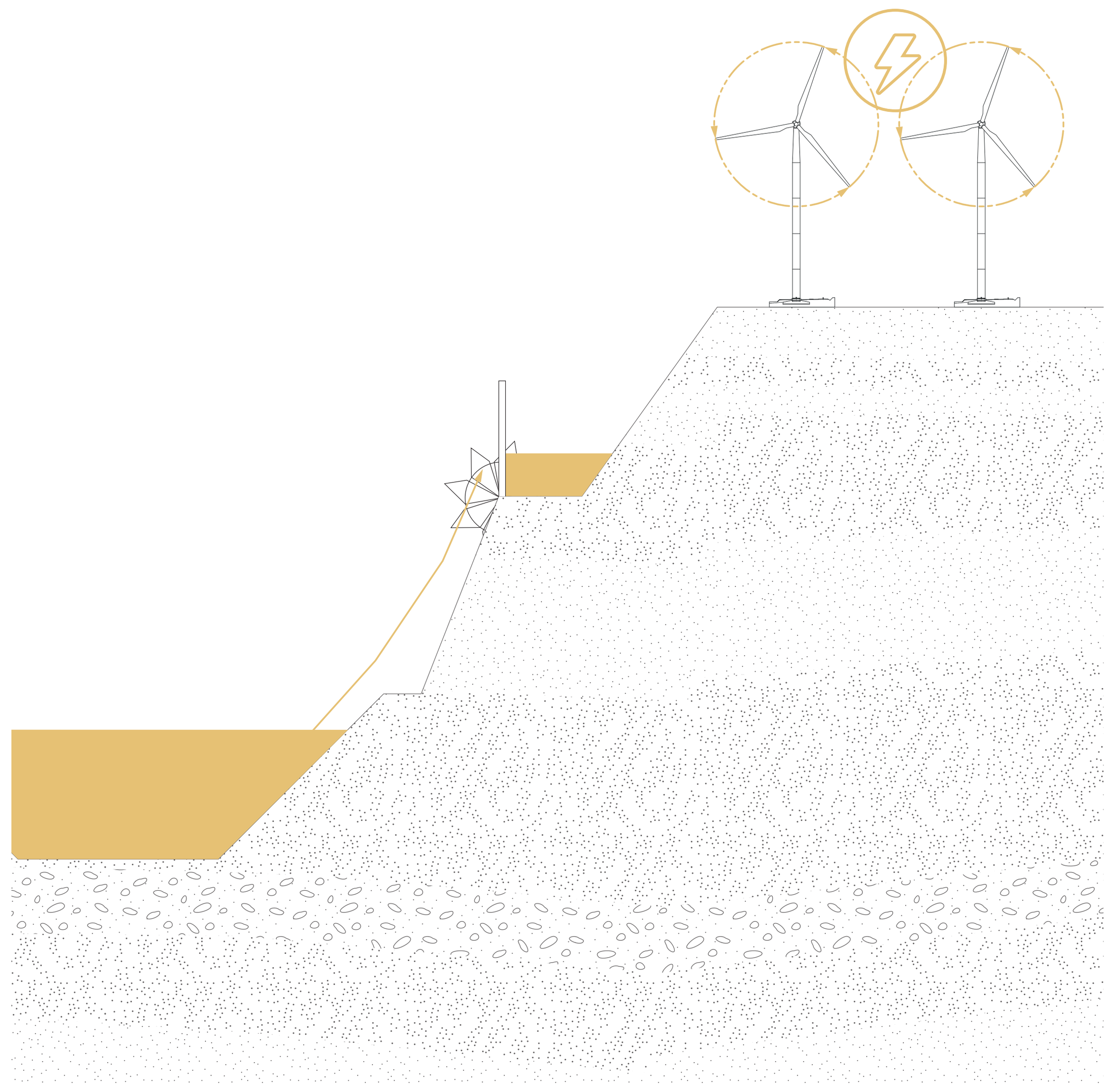
Transitions strategies

Energy transition as driver

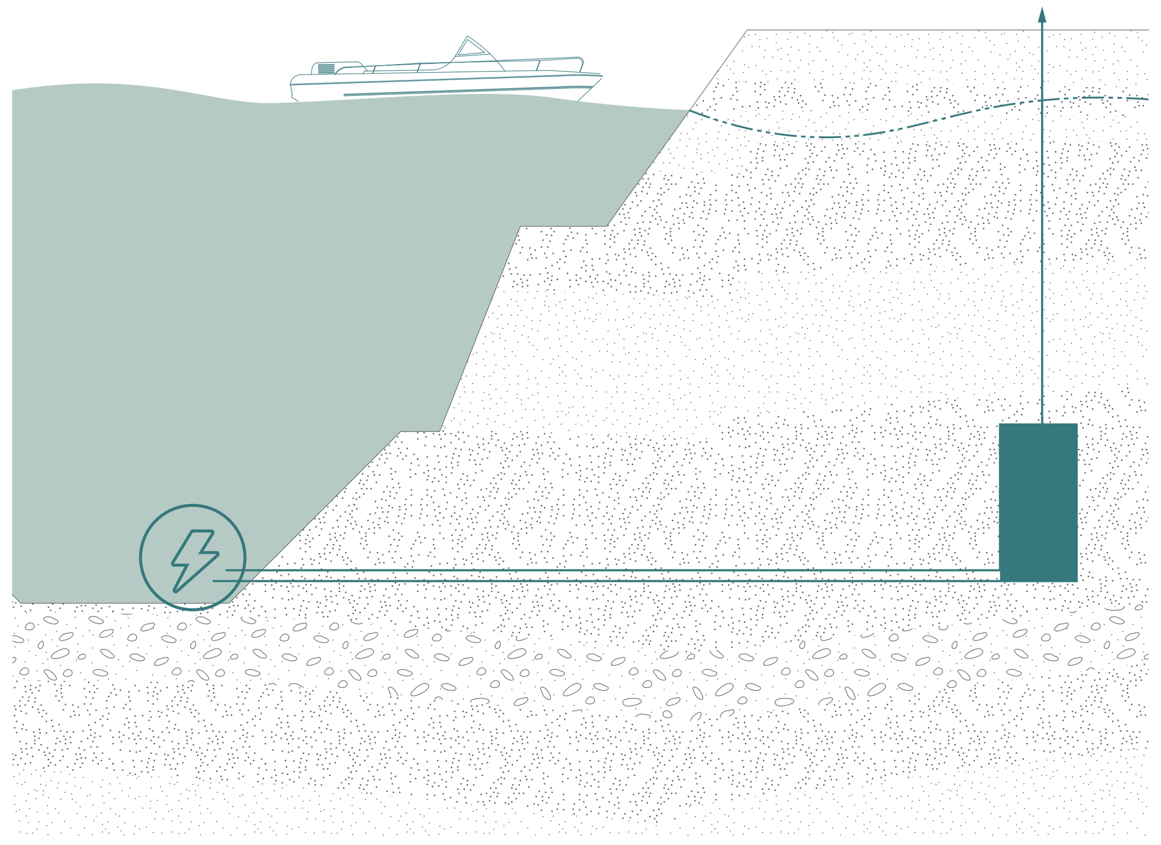
Spatial Vision municipality of Breda – (FABRICations, n.d.)



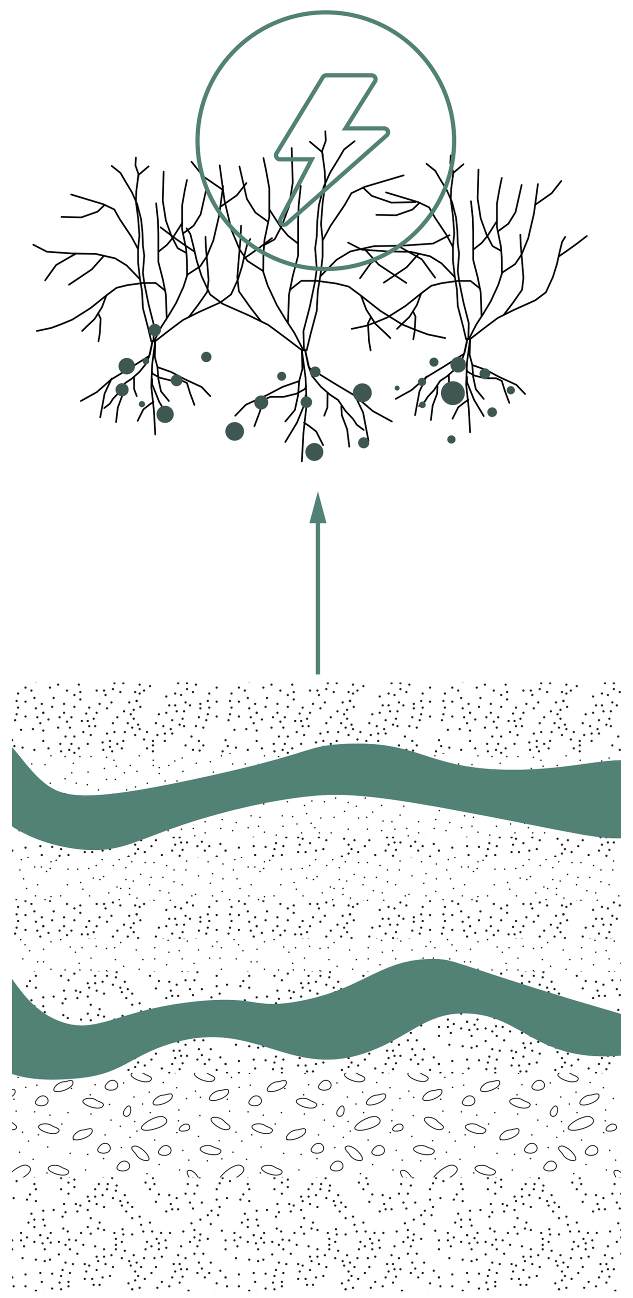
Solar



Wind



Aquathermal



Biomass

Possible scenarios

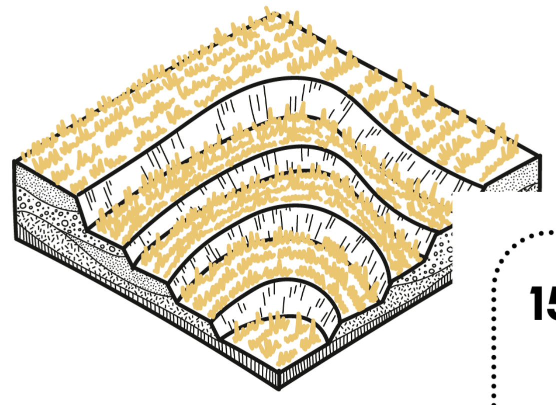
Living in the in-between

Wind, Water, Work

Productive Sees

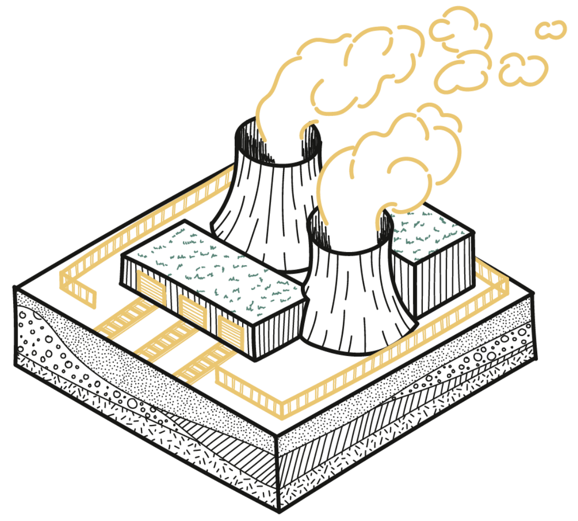
A Biodiverse Economy

1



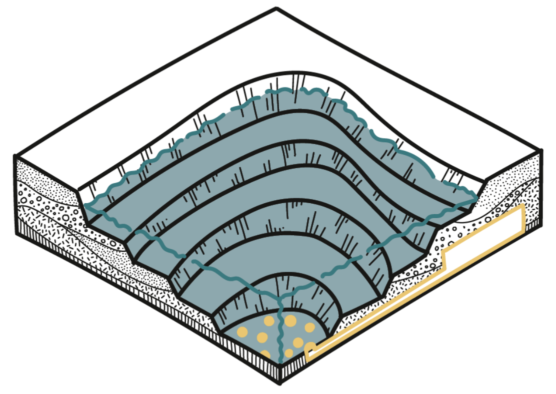
Biomass productic
- Growth of diverse plants in pit harvest to generate energy
- Generate employement fitting market
- Large green spaces with dive support ecosystems

15



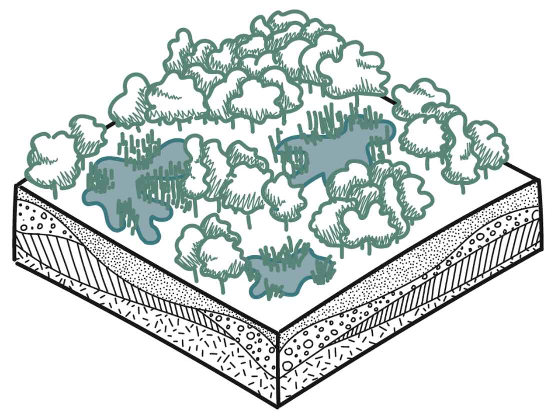
Retrofitting power plants
- Adapting power plants for biomass heat and electricity generation
- Alligns with alle existing infrastructure
- Burden for local residents remains
- Emplovement facility

4



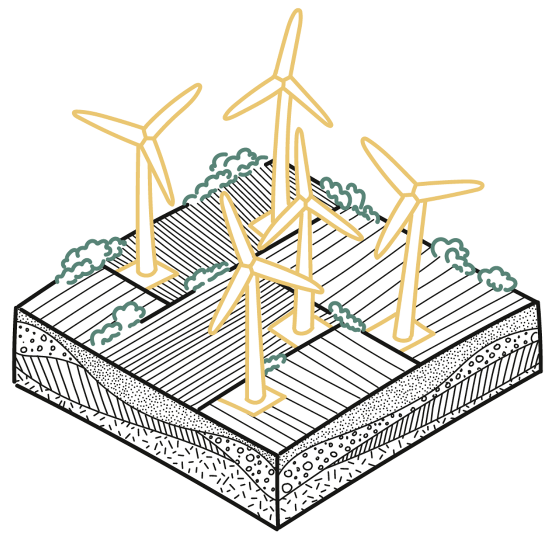
Aquathermal lakes
- Lakes created through water Rhine
- Closed at bottom to prevent groundwater seepage
- Extract heat in summer, store in soil, use in winter and reversed

7



Wetlands
- Raising of groundwater level
- Creating space for wetlands
- Allowing nature to recover
- Monitoring development ecosystem
- Protected and recreational space

8



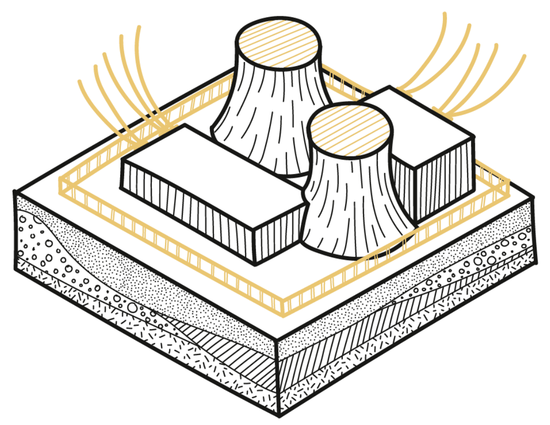
Windfields

eate windmills in agricultural areas
e rental system to create income for
rmers or local residents
e buffer zones for urban and natural
eas

2 3 5 6 9 10 11 12 13

Na G D

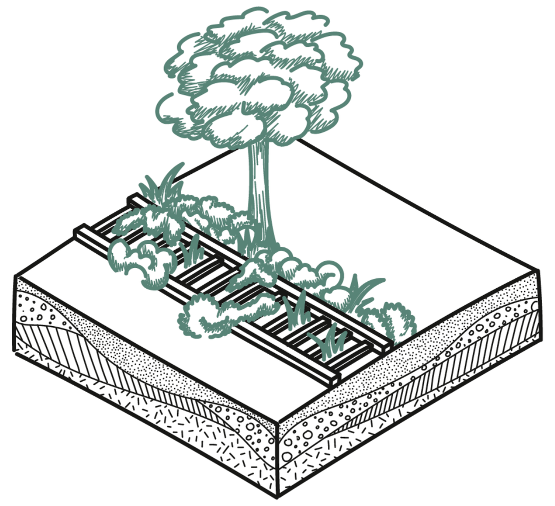
14



Power plants as battery
- Make use of the existing insulated and protected power plants
- Retrofit power plants to store batteries
- Low impact direct surroundings, high impact on rare metals minescapes

16 17 18 19 20 21 22 23 24 25

26

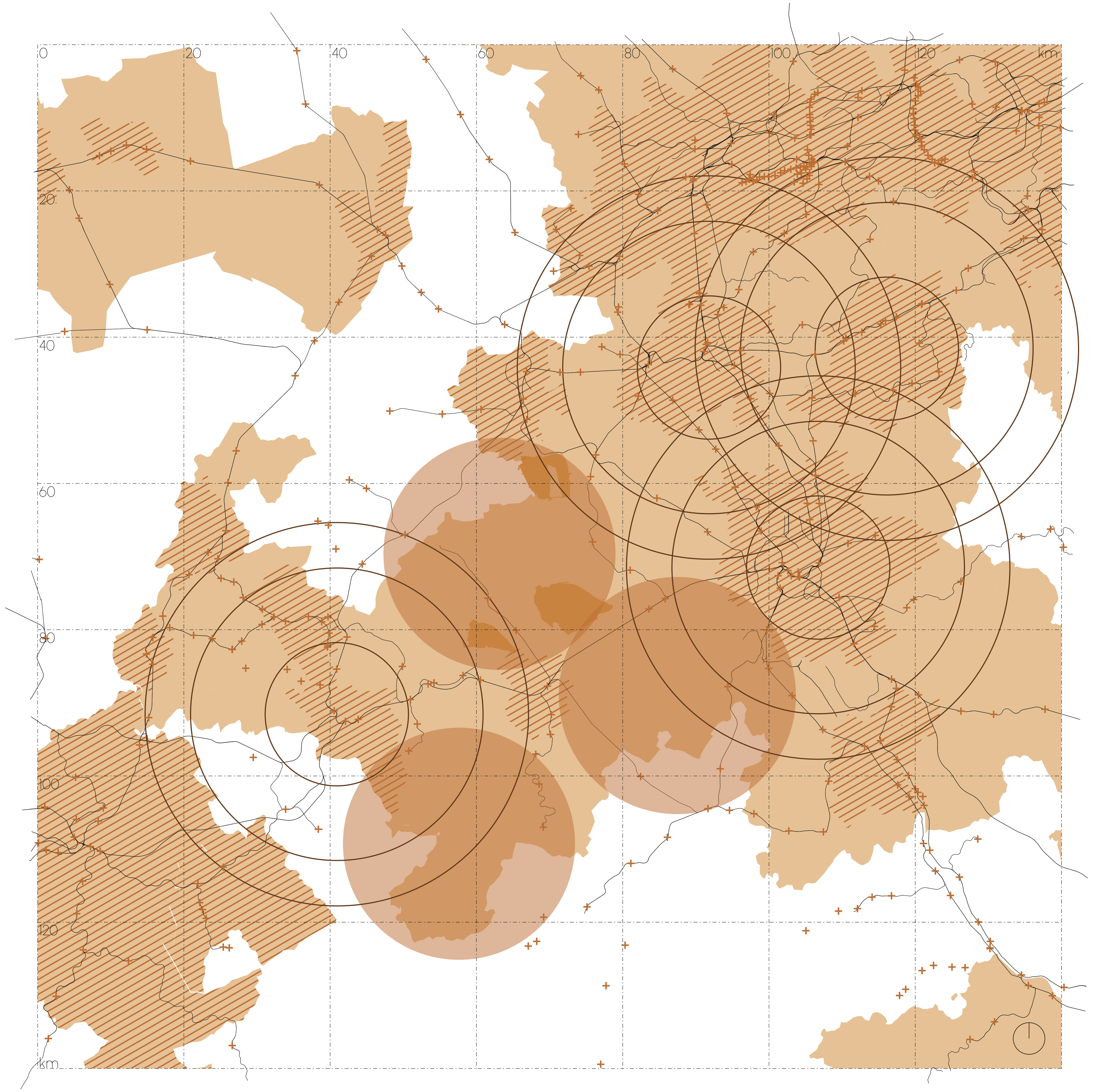


Ecological corridors
- Use of old transport corridors for nature
- Extend towards natural areas
- Can be open towards recreation

Design strategies

Living in the in-between

Spatial impact



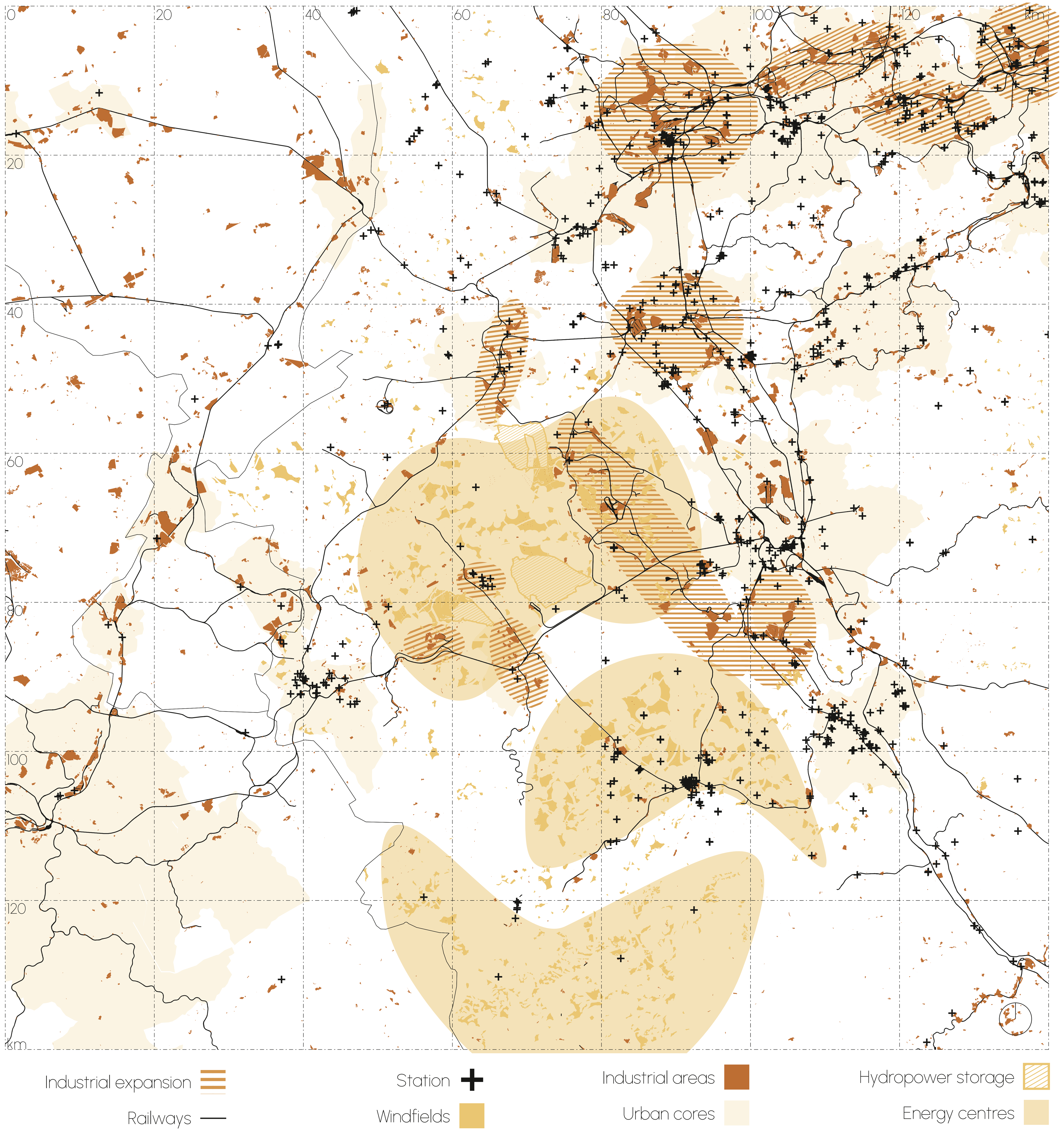
Urban centers
Railways
Station
Low connectivity
Commuting areas
Urban cores

Commute

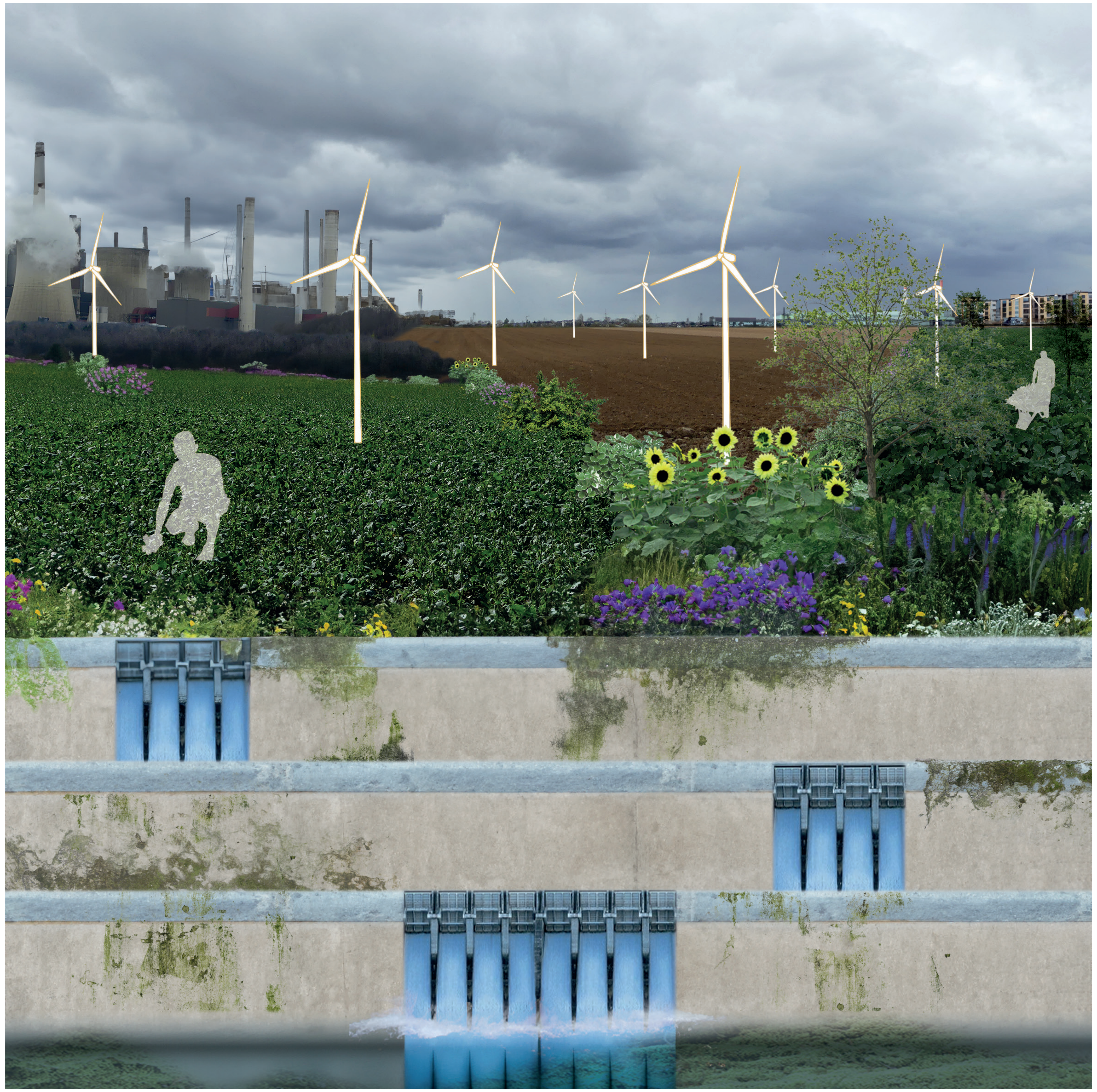
Living in the in-between

Wind, Water, Work

Spatial impact



Production network



Wind, Water, Work

Productive Sees

Spatial impact

Water treatment

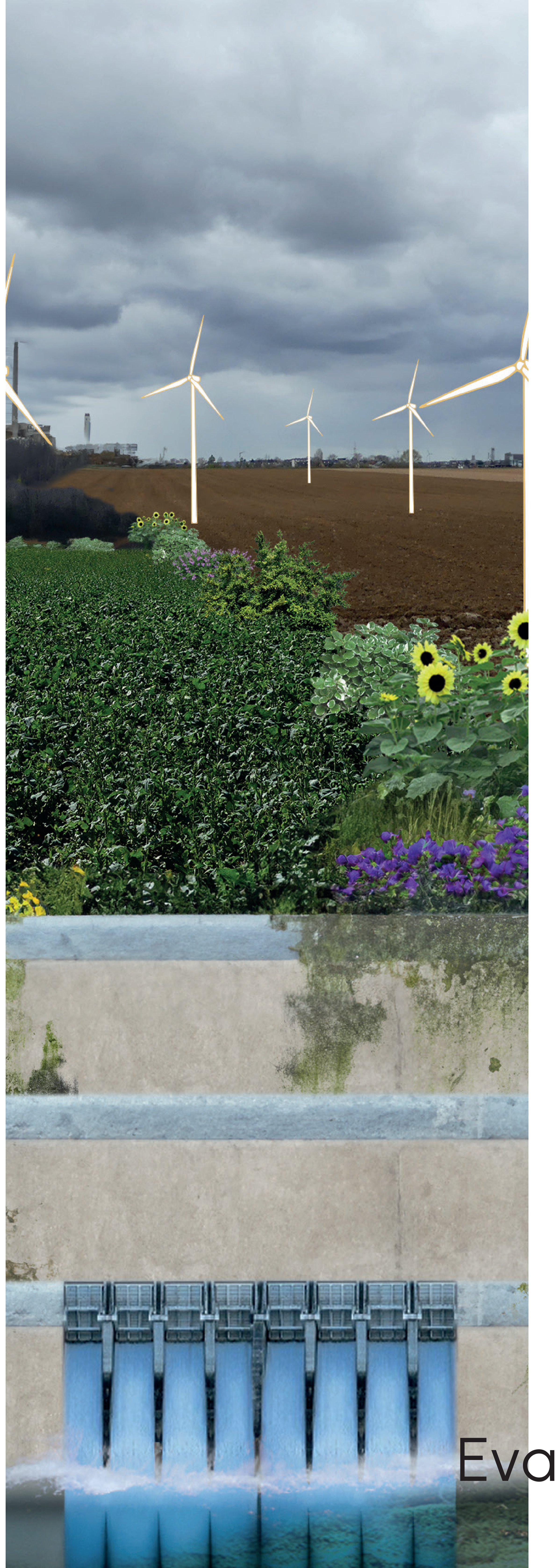
Productive Sees

A Biodiverse Economy

Spatial impact

Soil health

A Biodiverse Economy

Evaluation

Living in the in-between

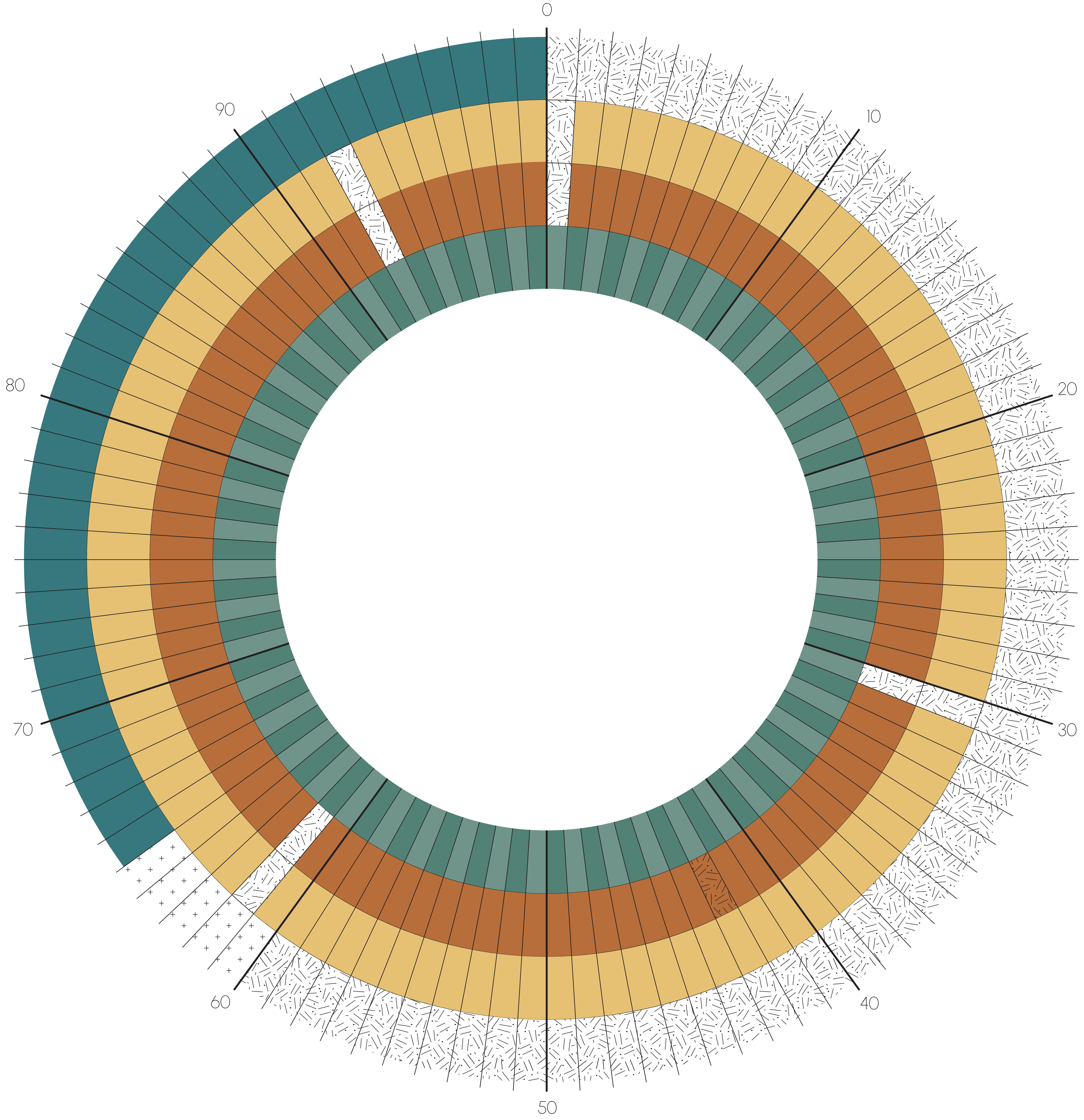
Wind, Water, Work

Productive Sees

A Biodiverse economy

Interscalar relations

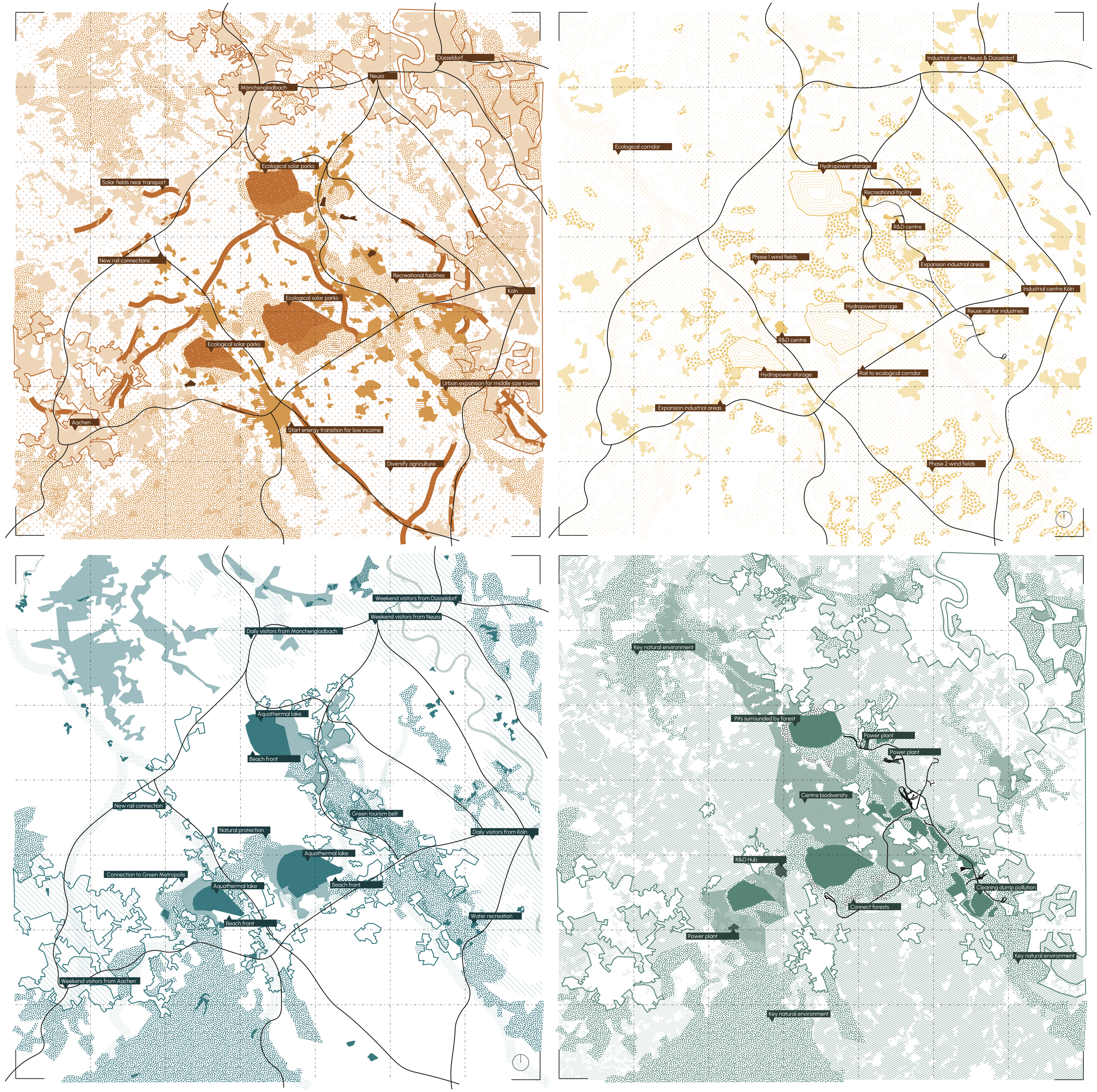
Production



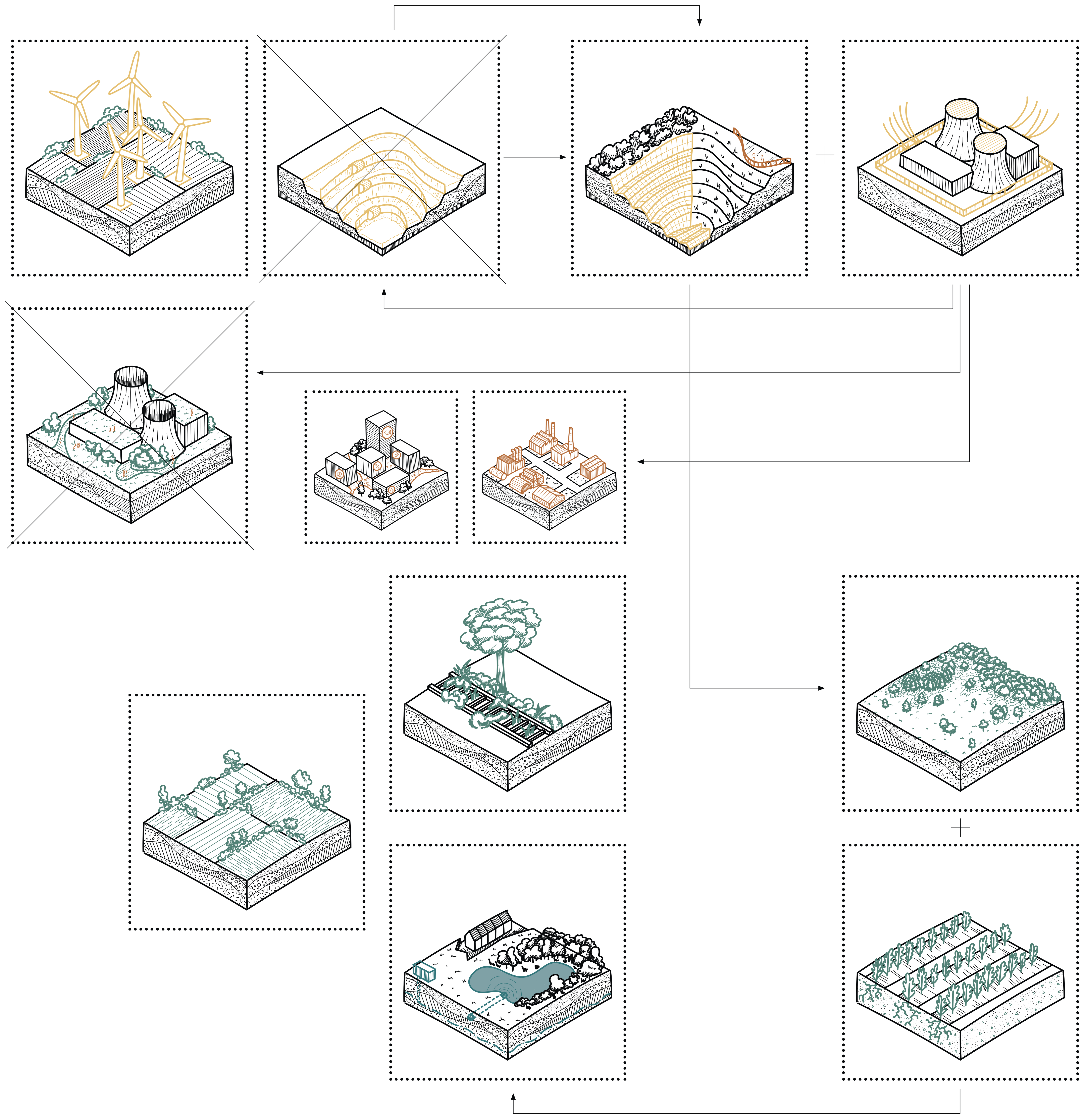
Lifespan


7
3
15
6
11
9
8
Living in the in-between
Wind, Water, Work
Productive Sees
A Biodiverse Economy

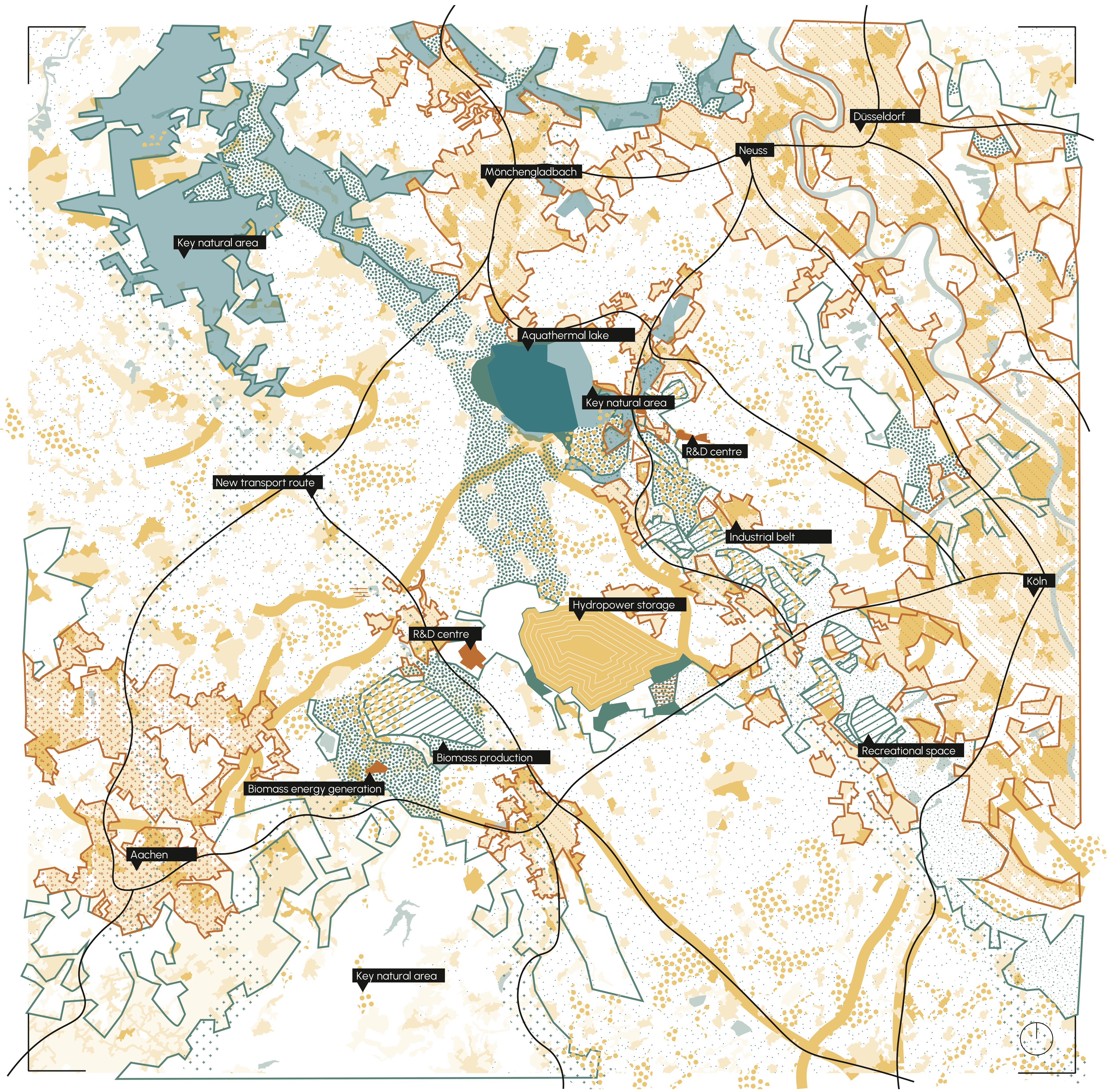
Evaluation



Limitations

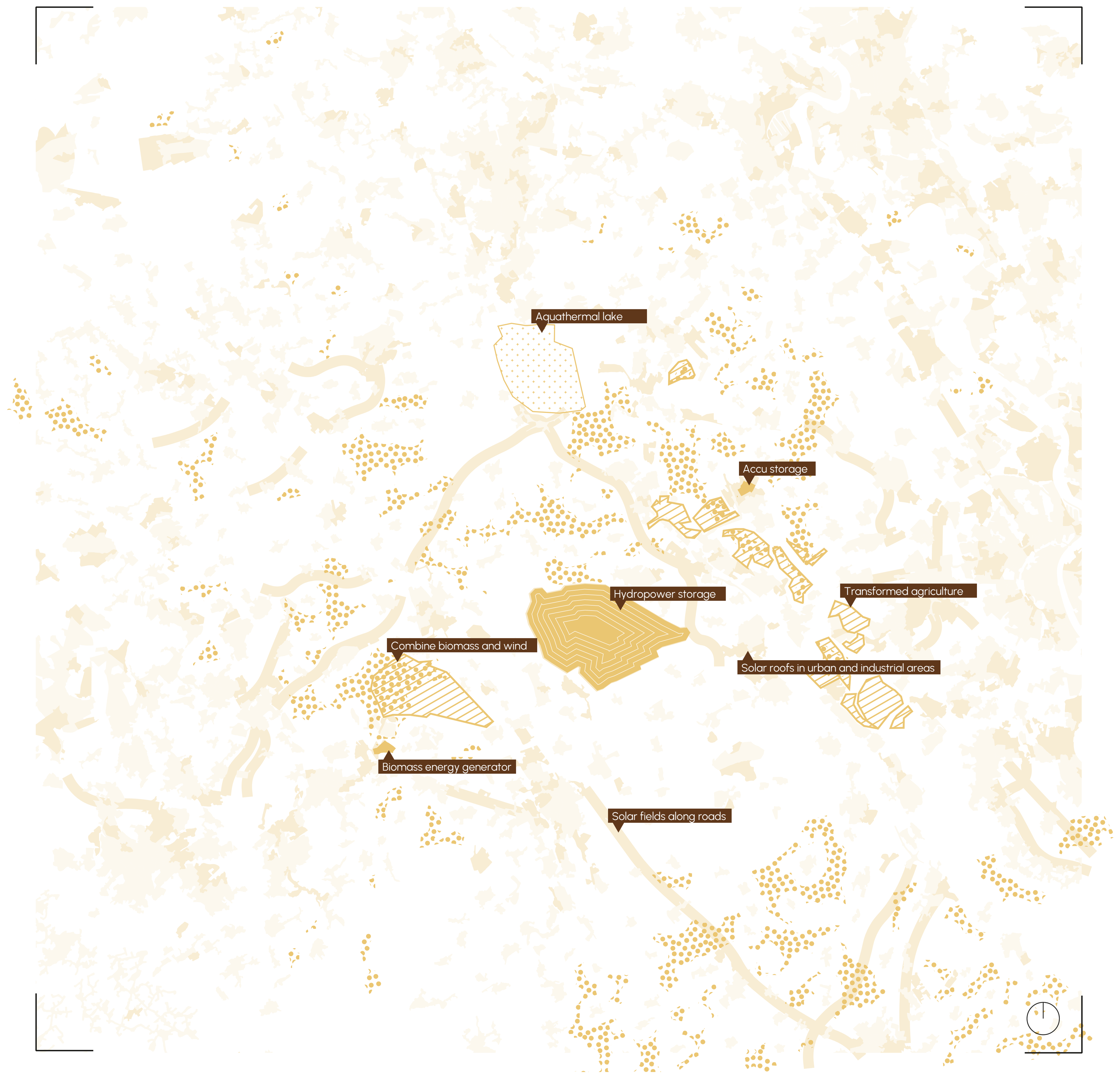


Strategizing

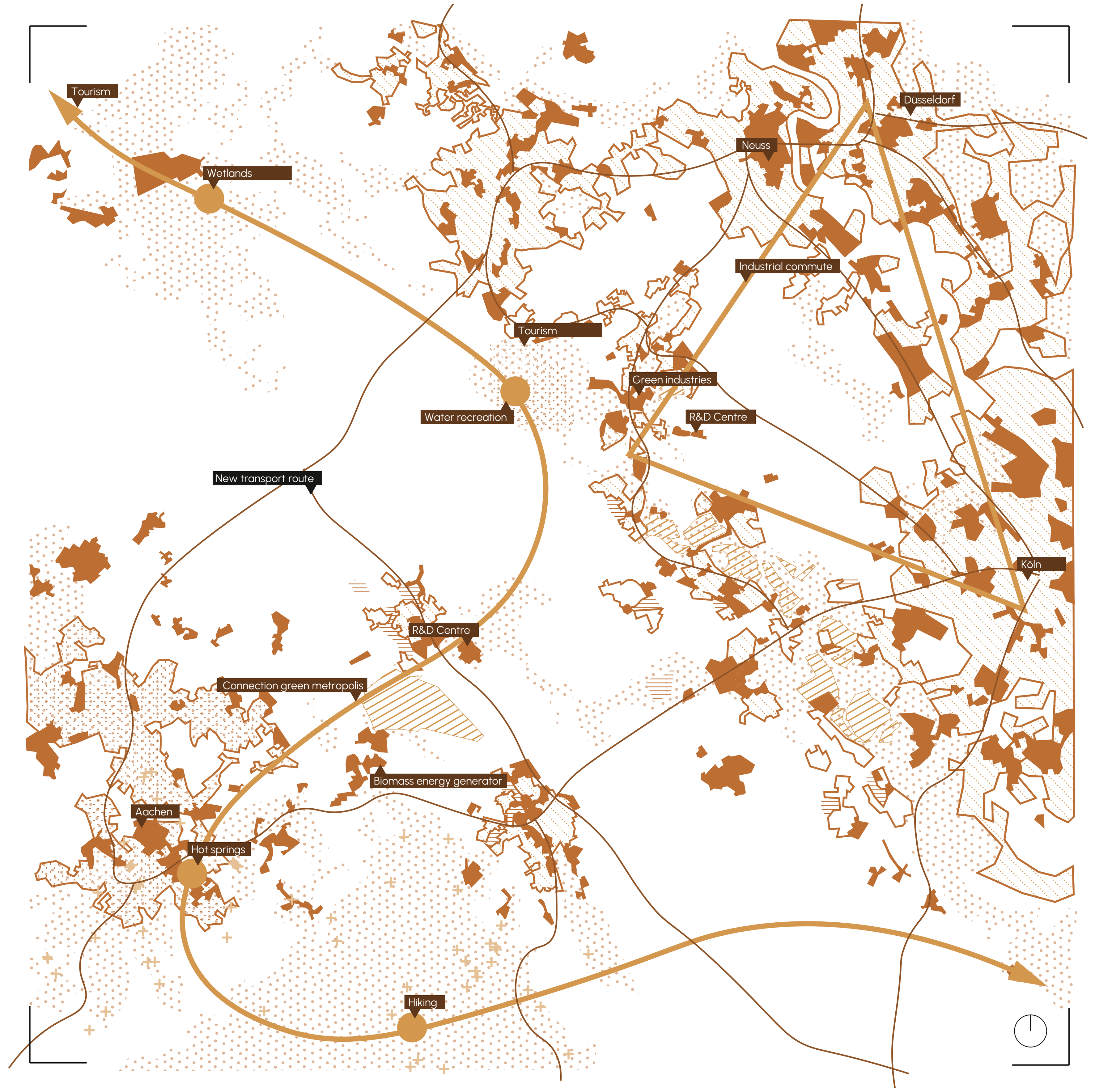


Train routes
Ecological corridors
New forests
Windfields
Key building complexes
Biomass production
Agriculture
Existing water bodies
Phytoremediation
Existing natural areas
New water bodies
Solar fields and Industrial areas
Wetlands
Diverse agricultural focus spaces
Solar energy in urban areas
Industrial cities
Industrial cities

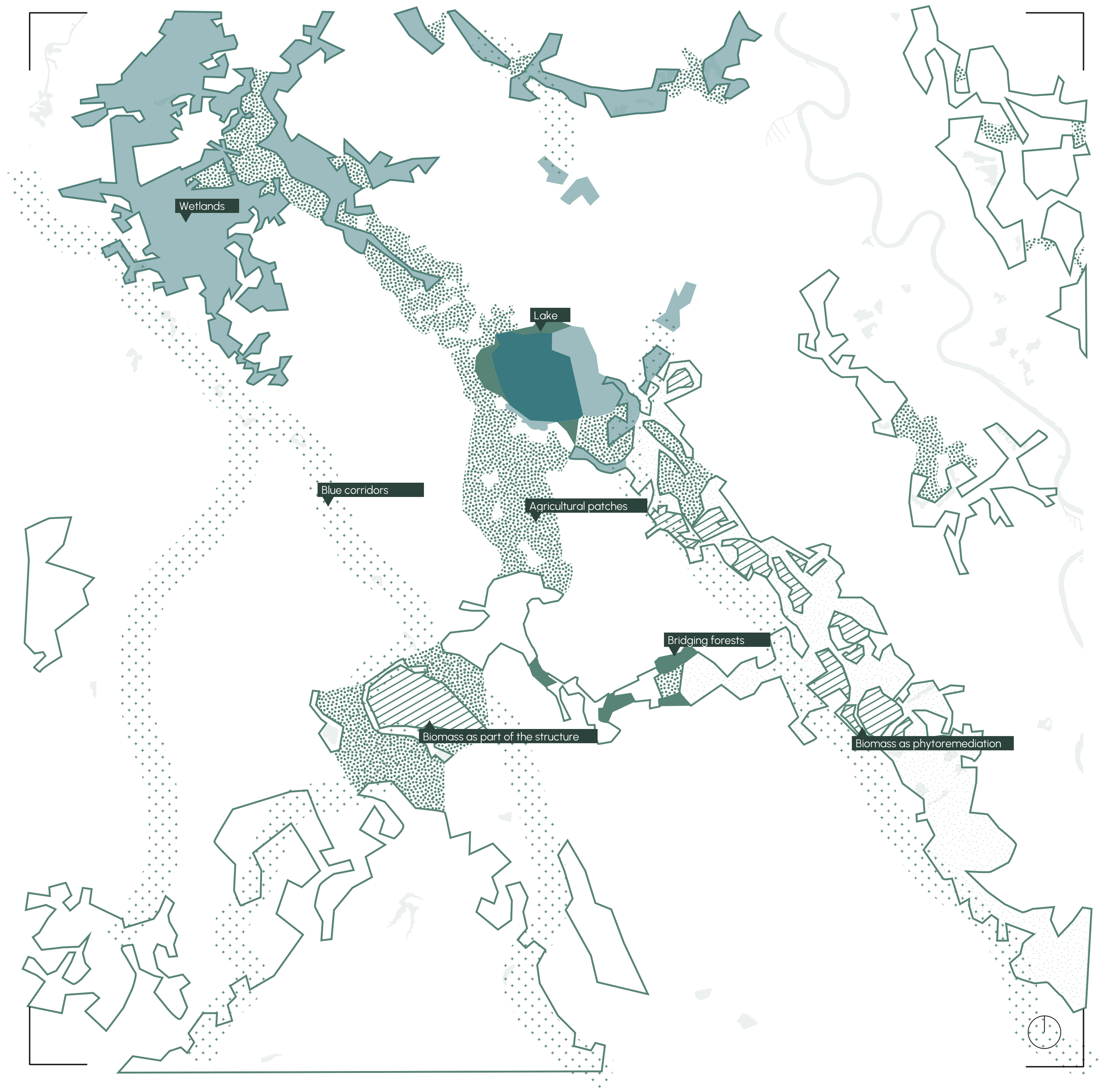
Strategy



Aquathermal lake
Accu storage
Hydropower storage
Transformed agriculture
Combine biomass and wind
Solar roofs in urban and industrial areas
Biomass energy generator
Solar fields along roads



Tourism
Wetlands
Düsseldorf
Neuss
Industrial commute
Tourism
Green industries
Water recreation
R&D Centre
New transport route
Köln
R&D Centre
Connection green metropolis
Biomass energy generator
Aachen
Hot springs
Hiking



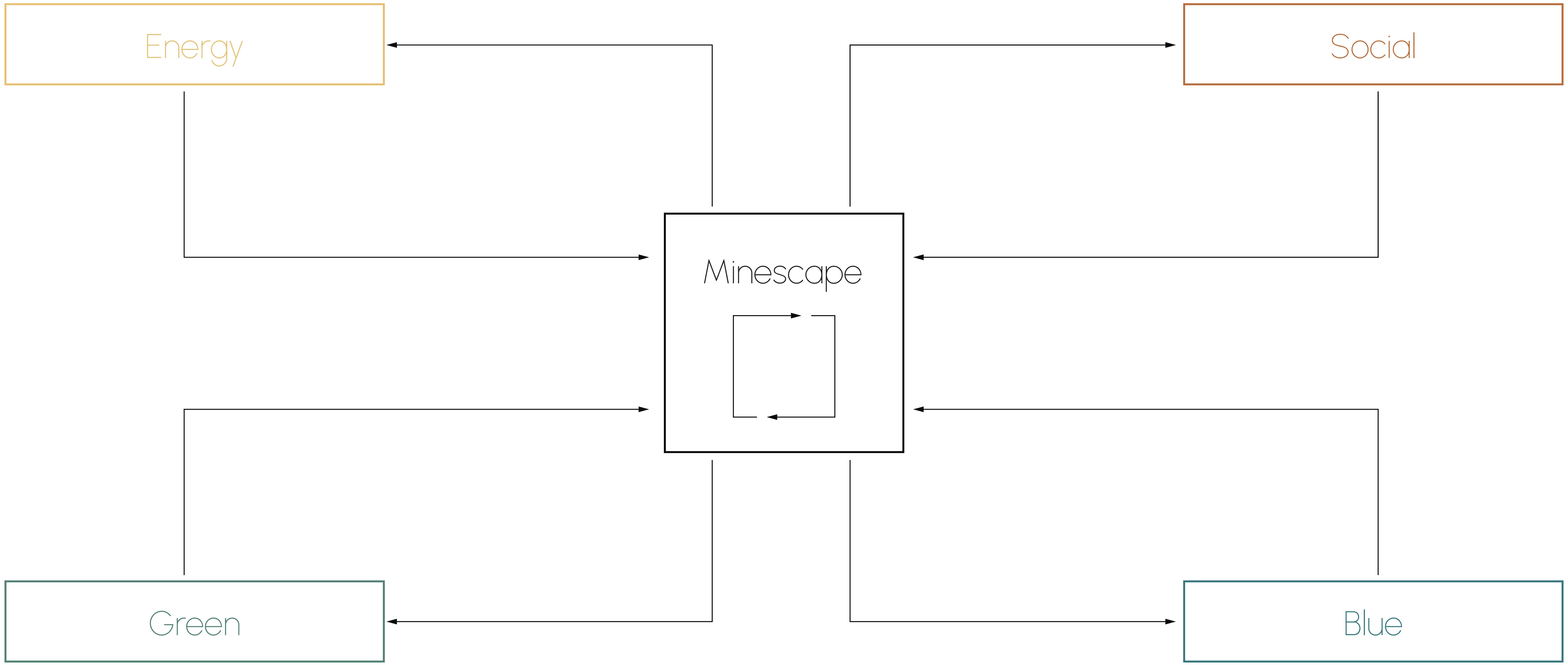
Wetlands
Lake
Blue corridors
Agricultural patches
Bridging forests
Biomass as part of the structure
Biomass as phytoremediation

Structures

How to ***regenerate*** *through design the* ***minescape*** *of Rhenish Mining Area towards an* ***inclusive energy transition?***

Conclusion

Energy density



Systemic interaction

Minescape vs footprint

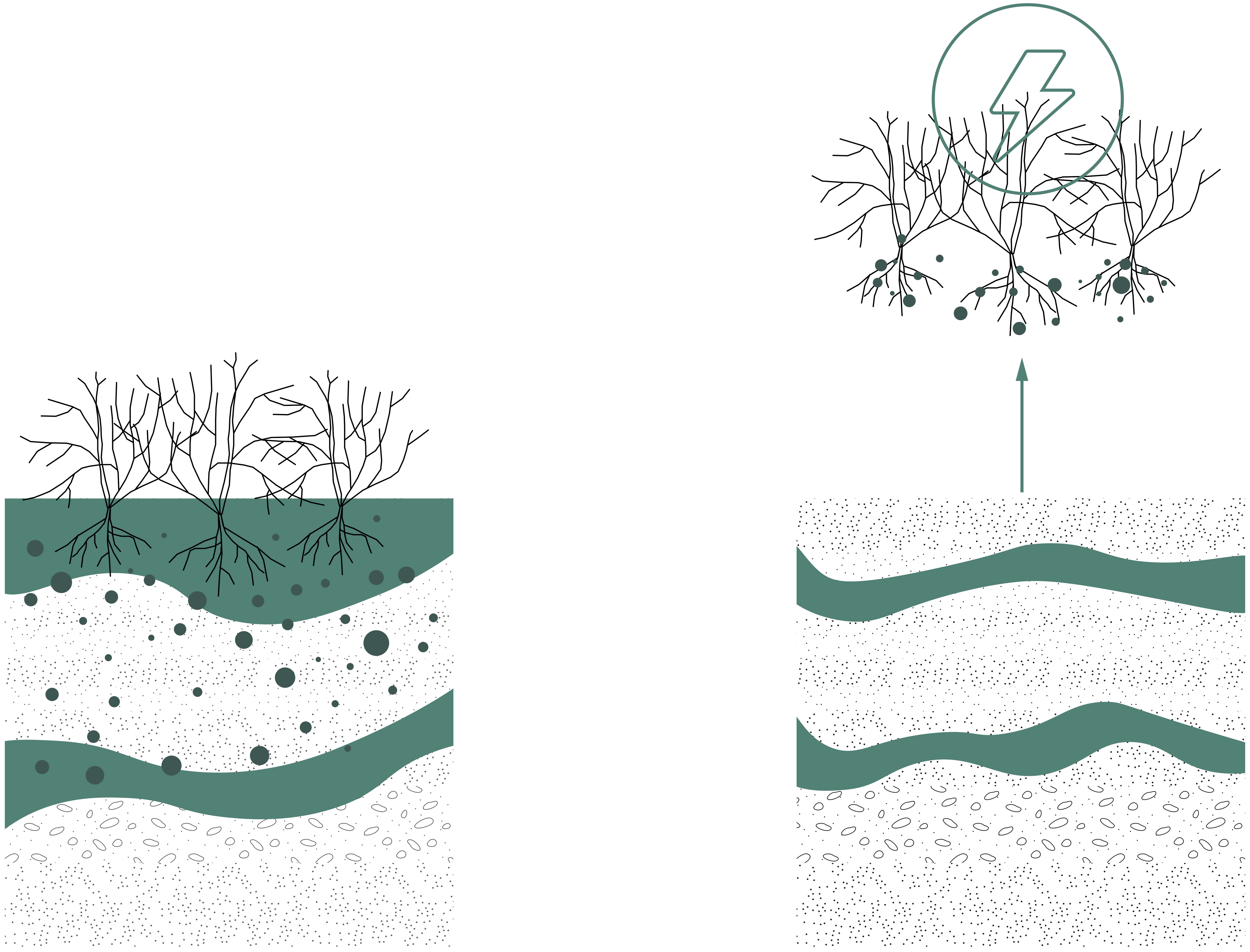
"Braunkohle-Tagebau" by Jürgen Spira, 2000

In transition

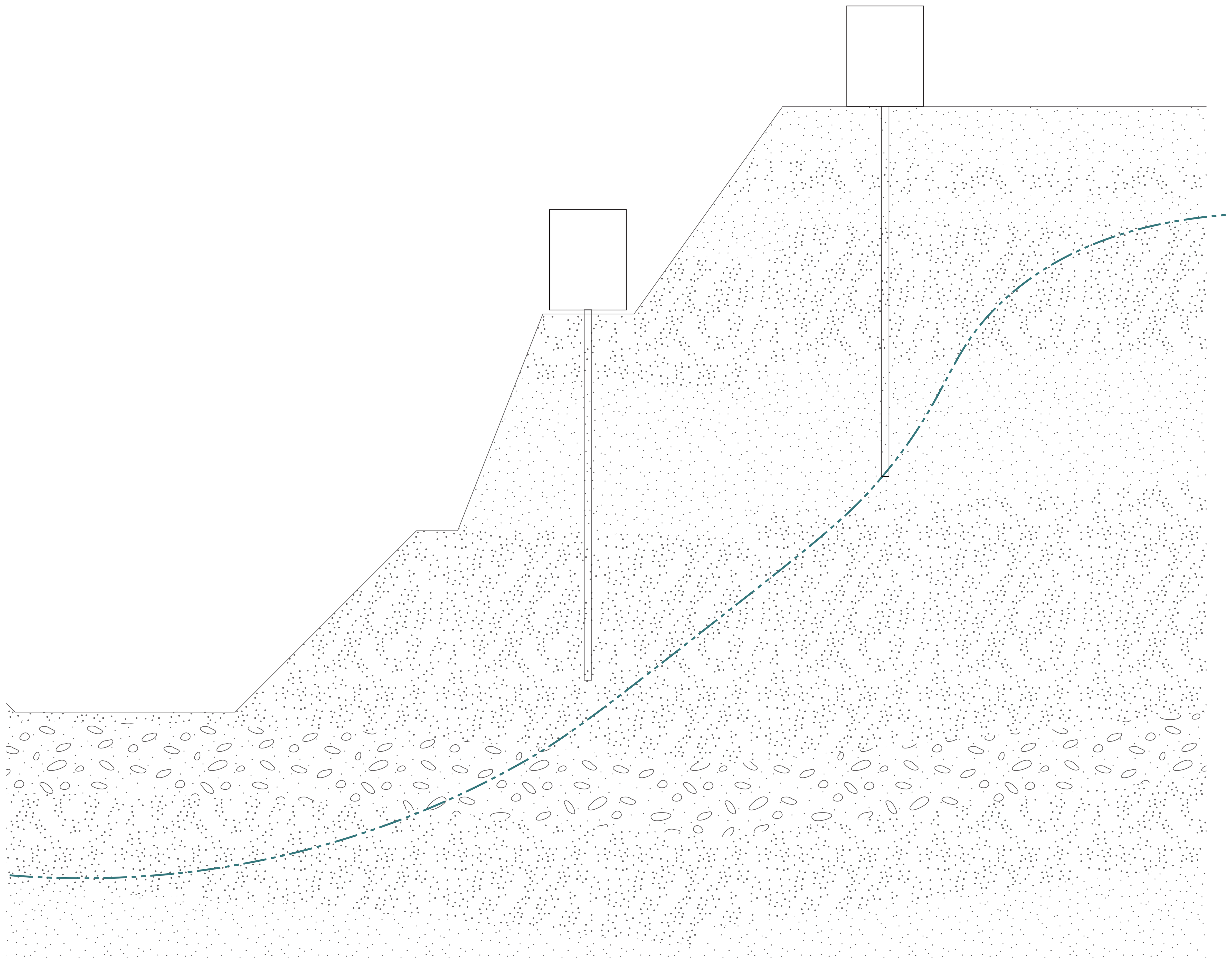
Urban development

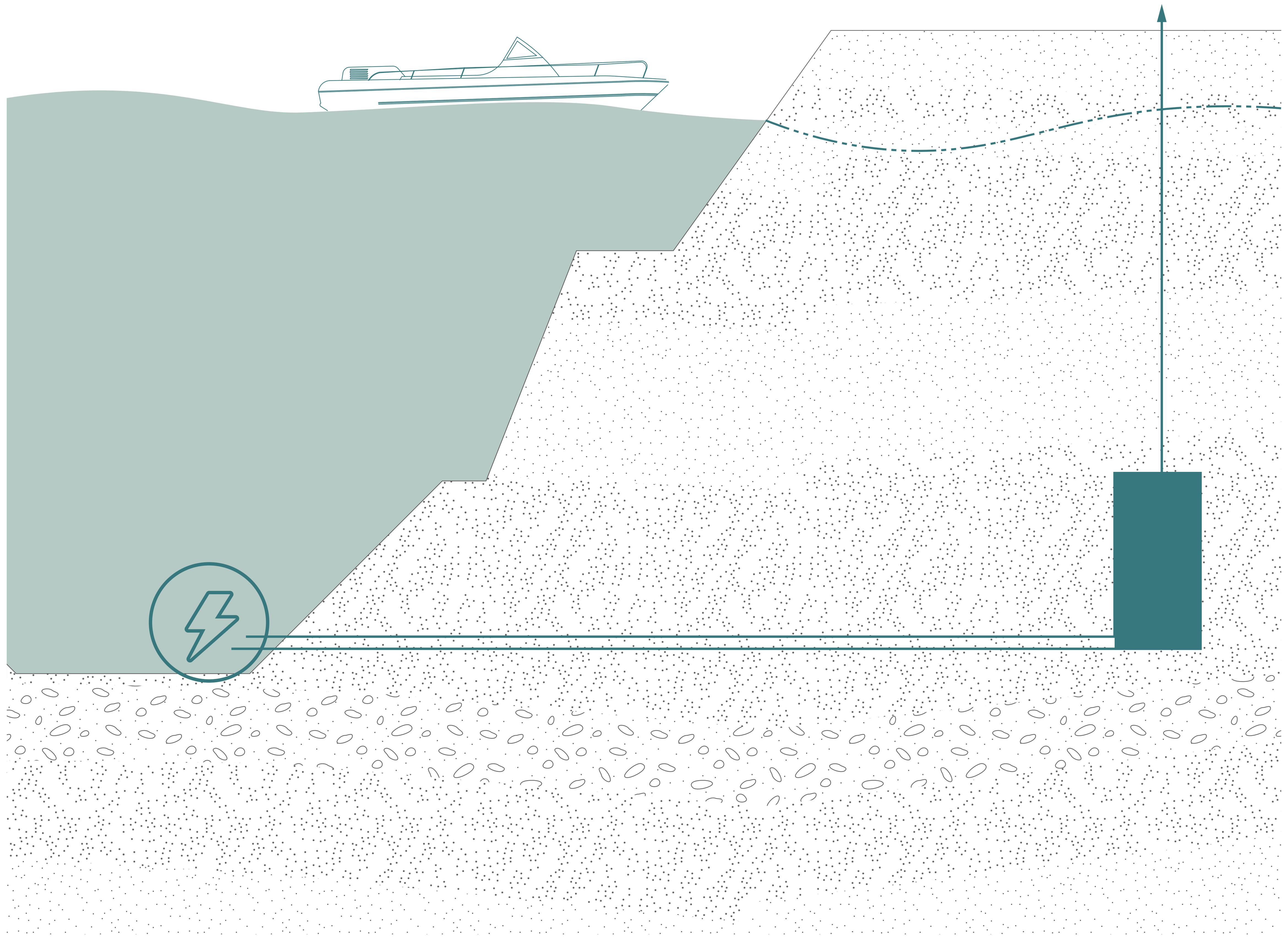

Heat generation from biomass.
Use extensive field of mine to generate winc energy
Extension terra Nova
Opening up the Research Centre
Enter
Water recreation
water levels will also be restored in gravel mines
Connection of green patches to restore ecology and maintain wind axis.

Content

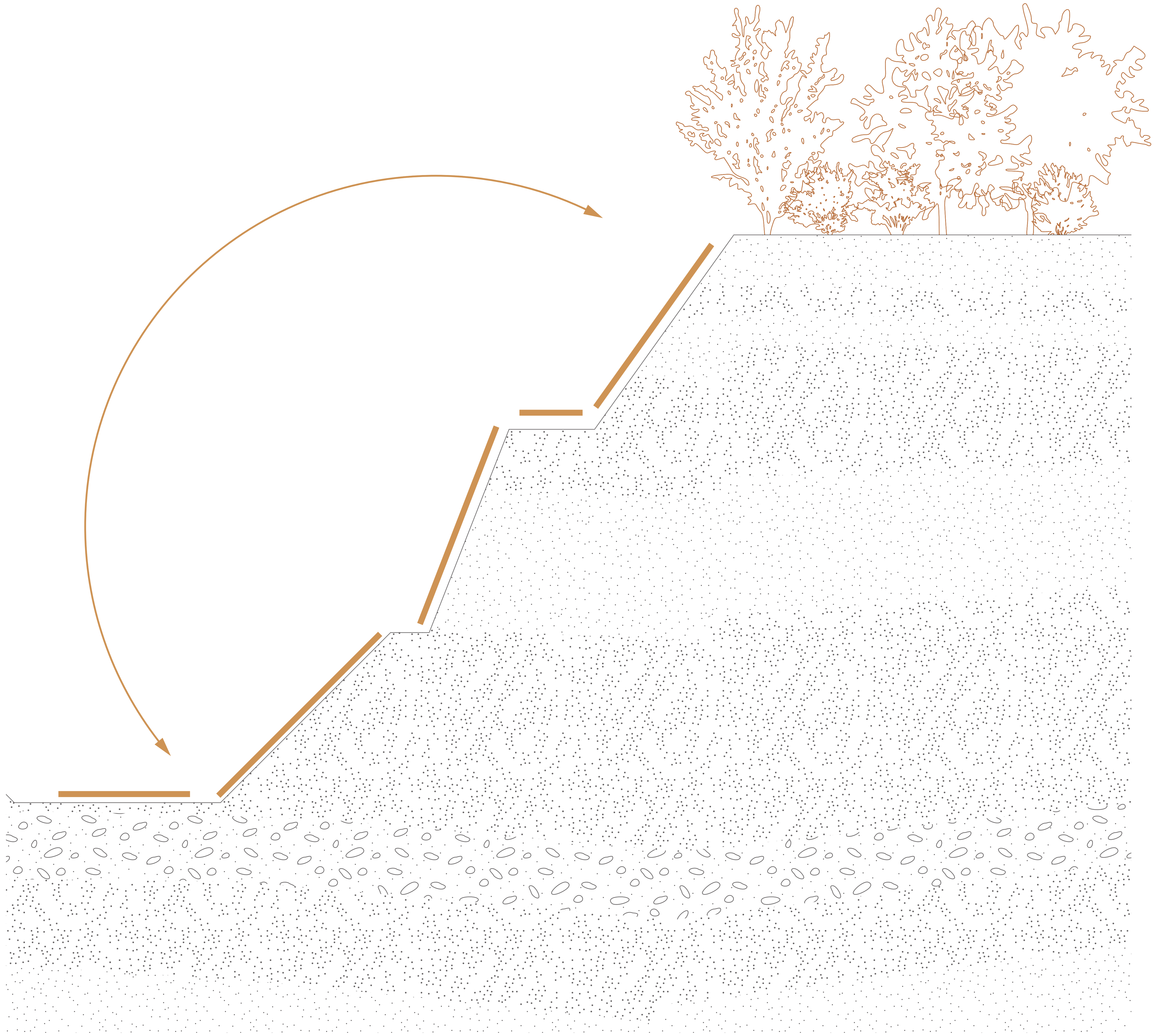


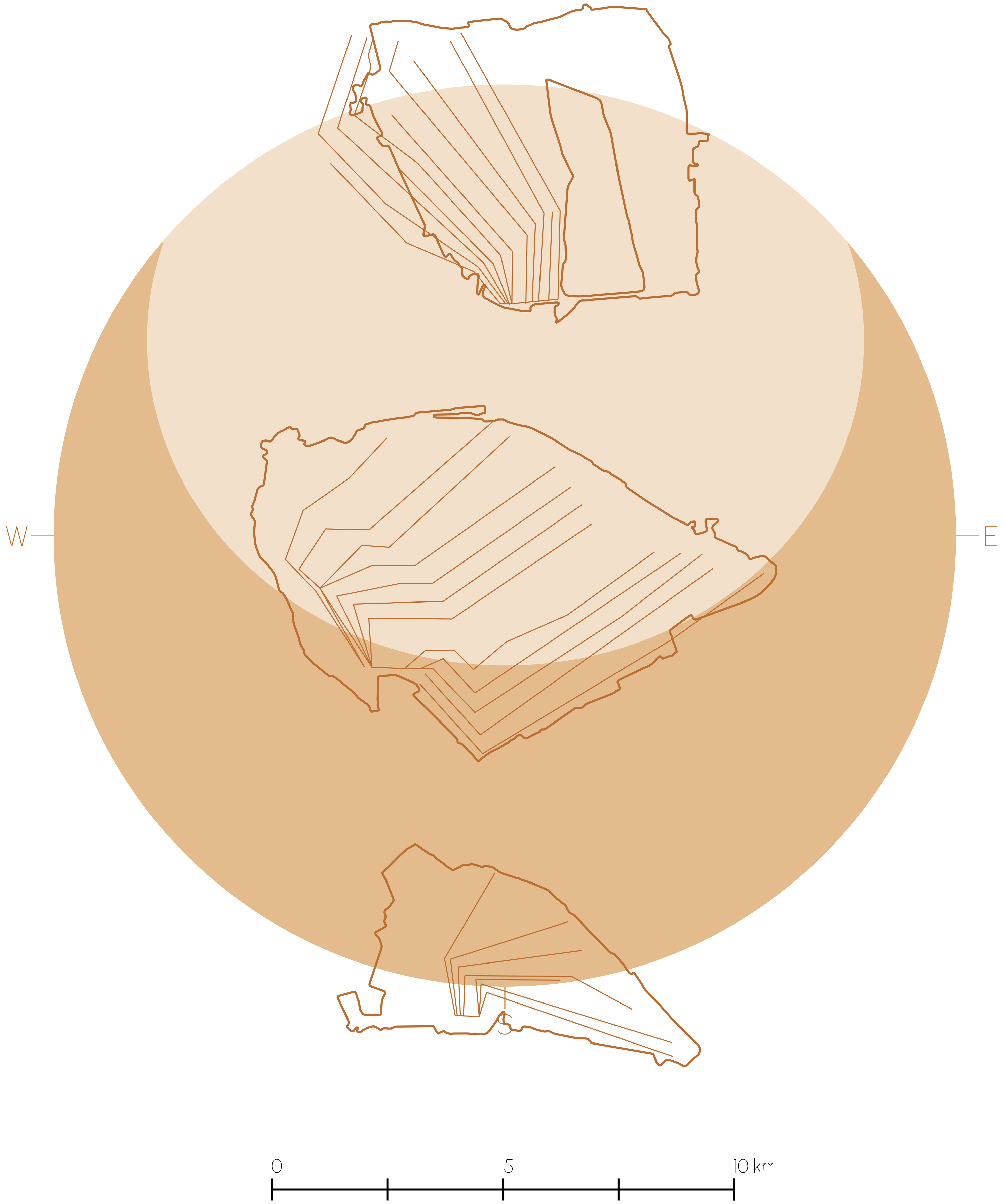
Biomass and phytoremediation





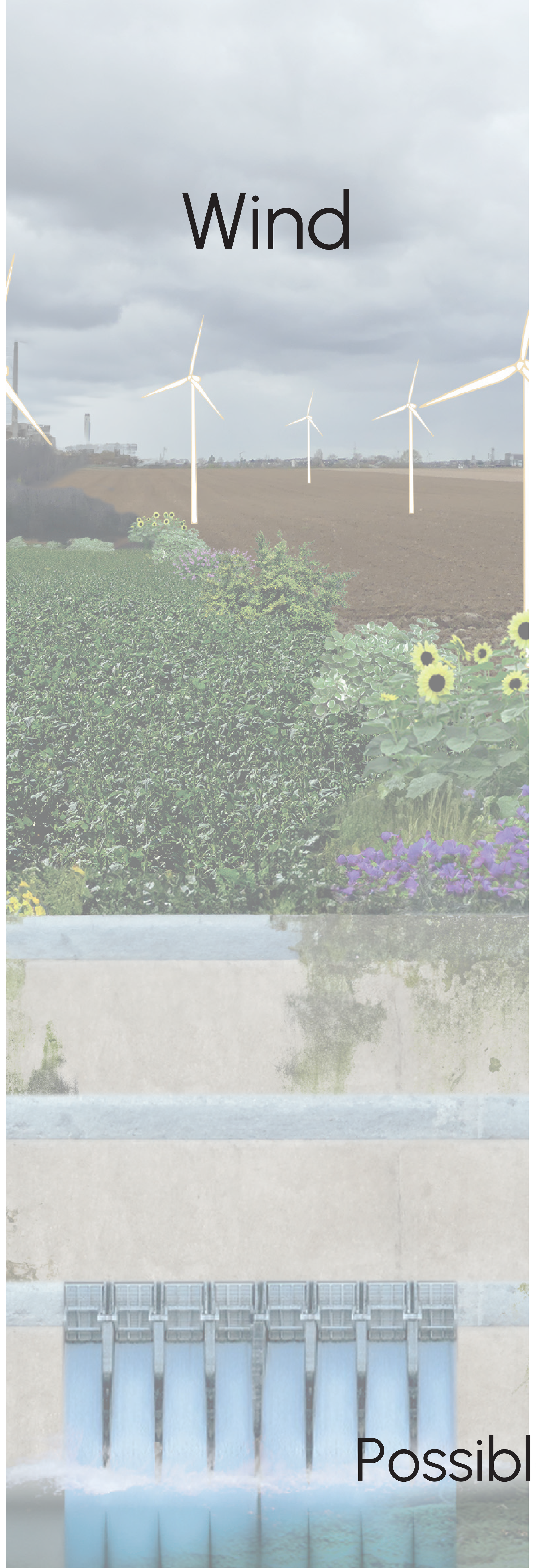
Groundwater level





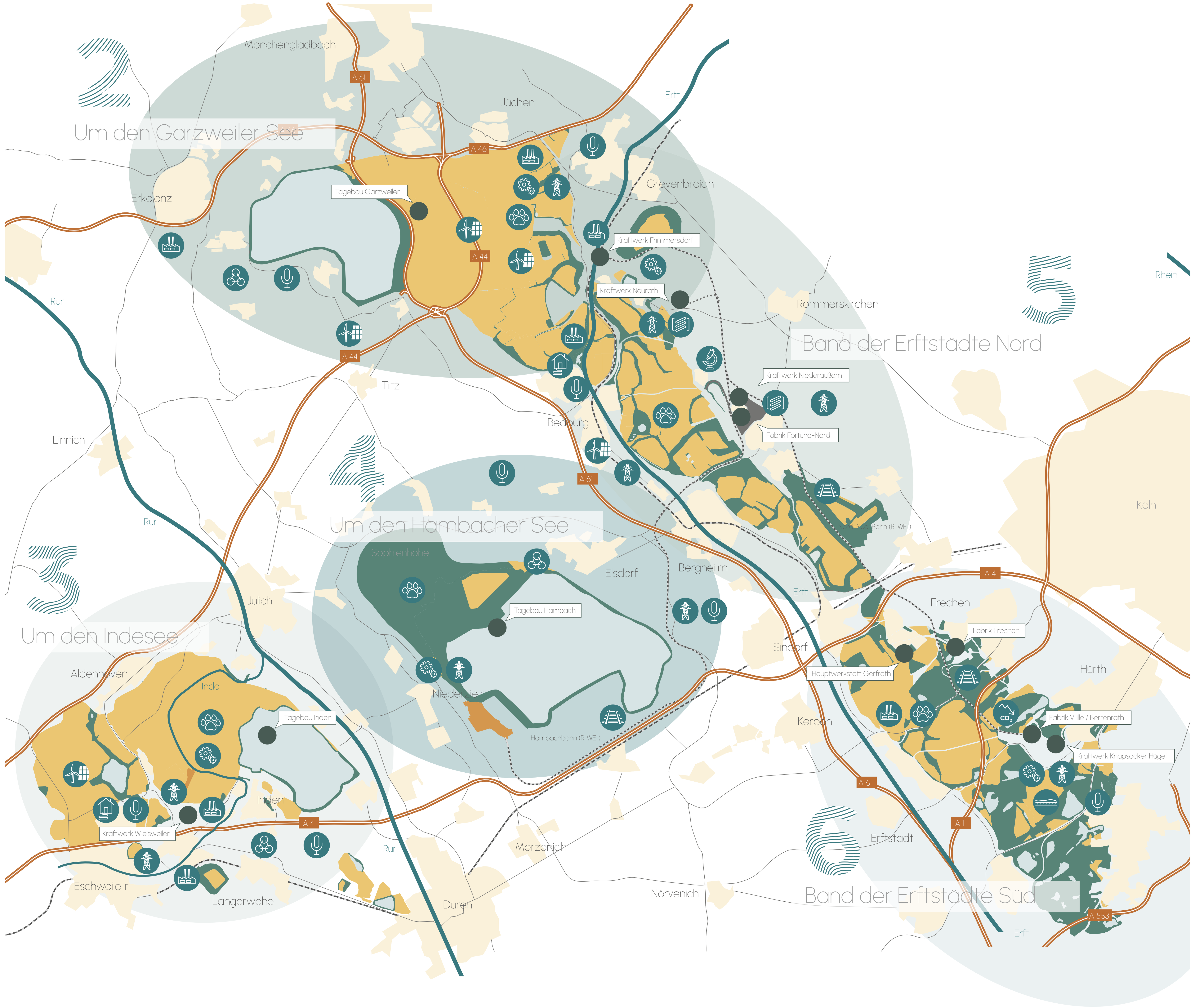
Mines and solar energy

Landscapes and storage



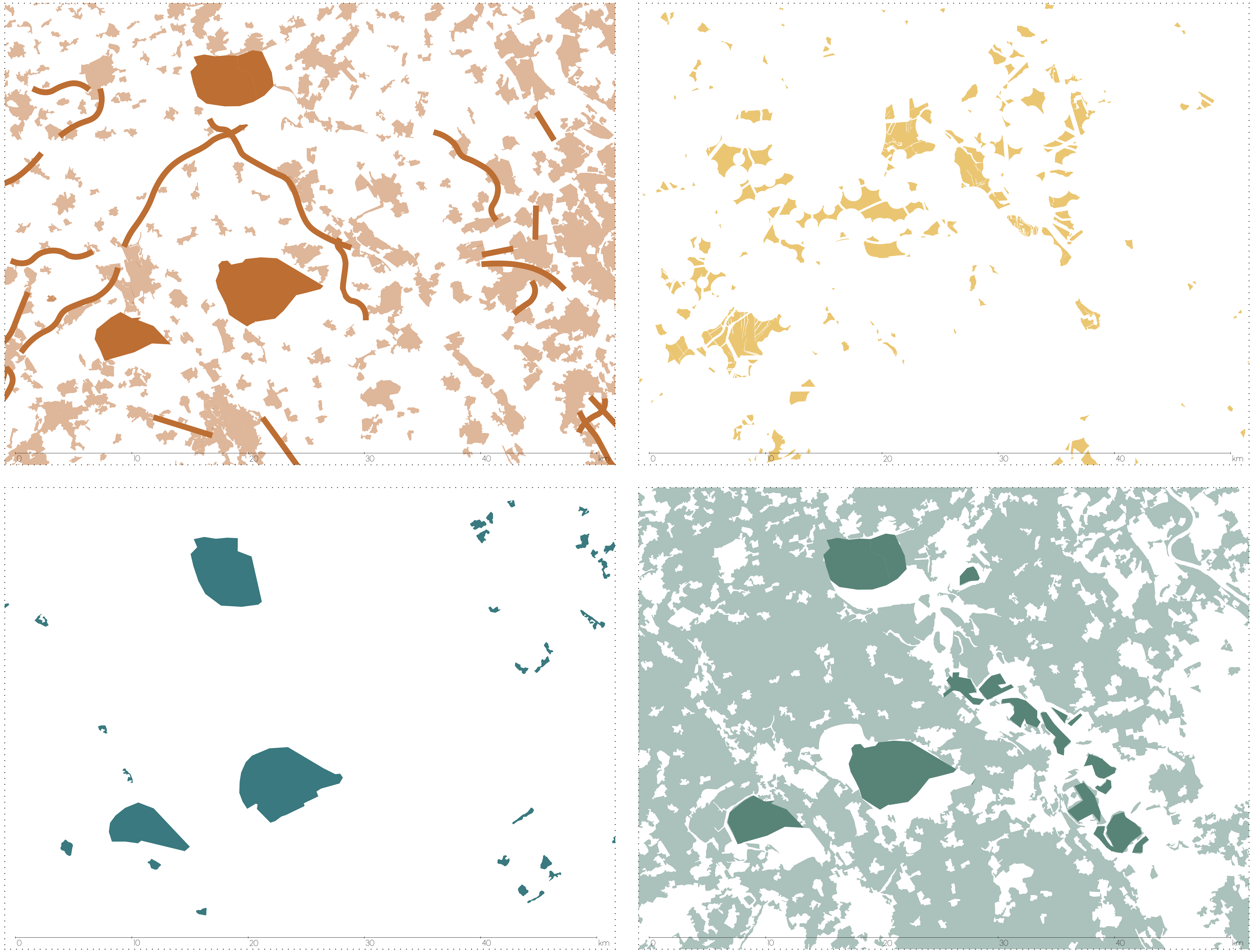
Possible scenarios

Production

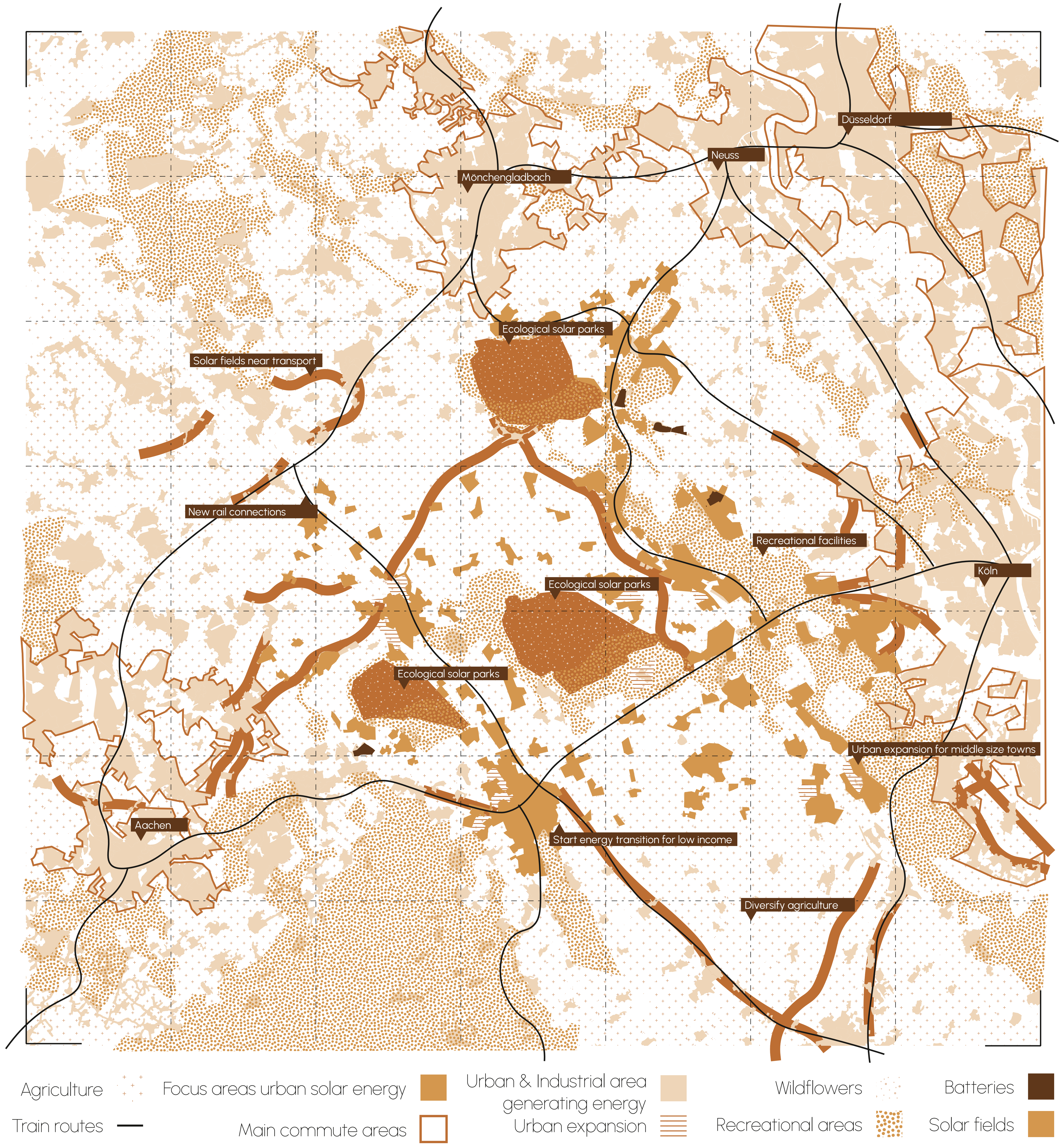


2
Um den Garzweiler See
Mönchengladbach
Jüchen
Erkelenz
Tagebau Garzweiler
Grevenbroich
Kraftwerk Frimmersdorf
Kraftwerk Neurath
Erft
Rommerskirchen
5
Band der Erftstädte Nord
Rhein
Kraftwerk Niederaußem
Fabrik Fortuna-Nord
Titz
Bedburg
Linnich
4
Um den Hambacher See
Sophienhöhe
Elsdorf
Bergheim
Tagebau Hambach
Köln
Frechen
Fabrik Frechen
Hürth
Jülich
3
Um den Indesee
Aldenhoven
Inde
Tagebau Inden
Hambachbahn (RWE)
Sindorf
Hauptwerkstatt Grefrath
Kerpen
Kraftwerk Knapsacker Hügel
Kraftwerk Weisweiler
Inden
Eschweiler
Langerwehe
Rur
Düren
Merzenich
Nörvenich
Erftstadt
6
Band der Erftstädte Süd
A 61
A 46
A 44
A 4
A 1

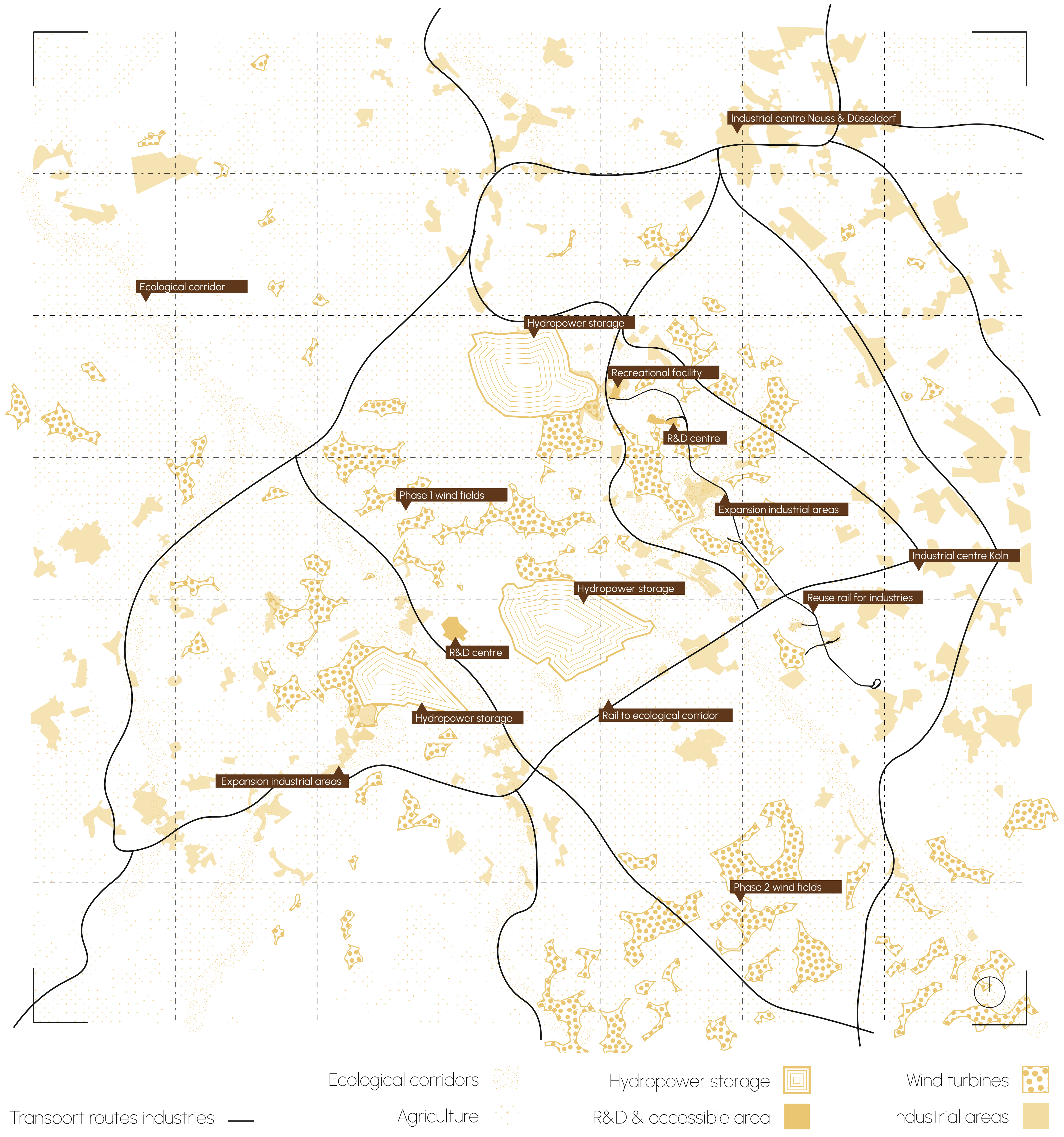
RWE plans



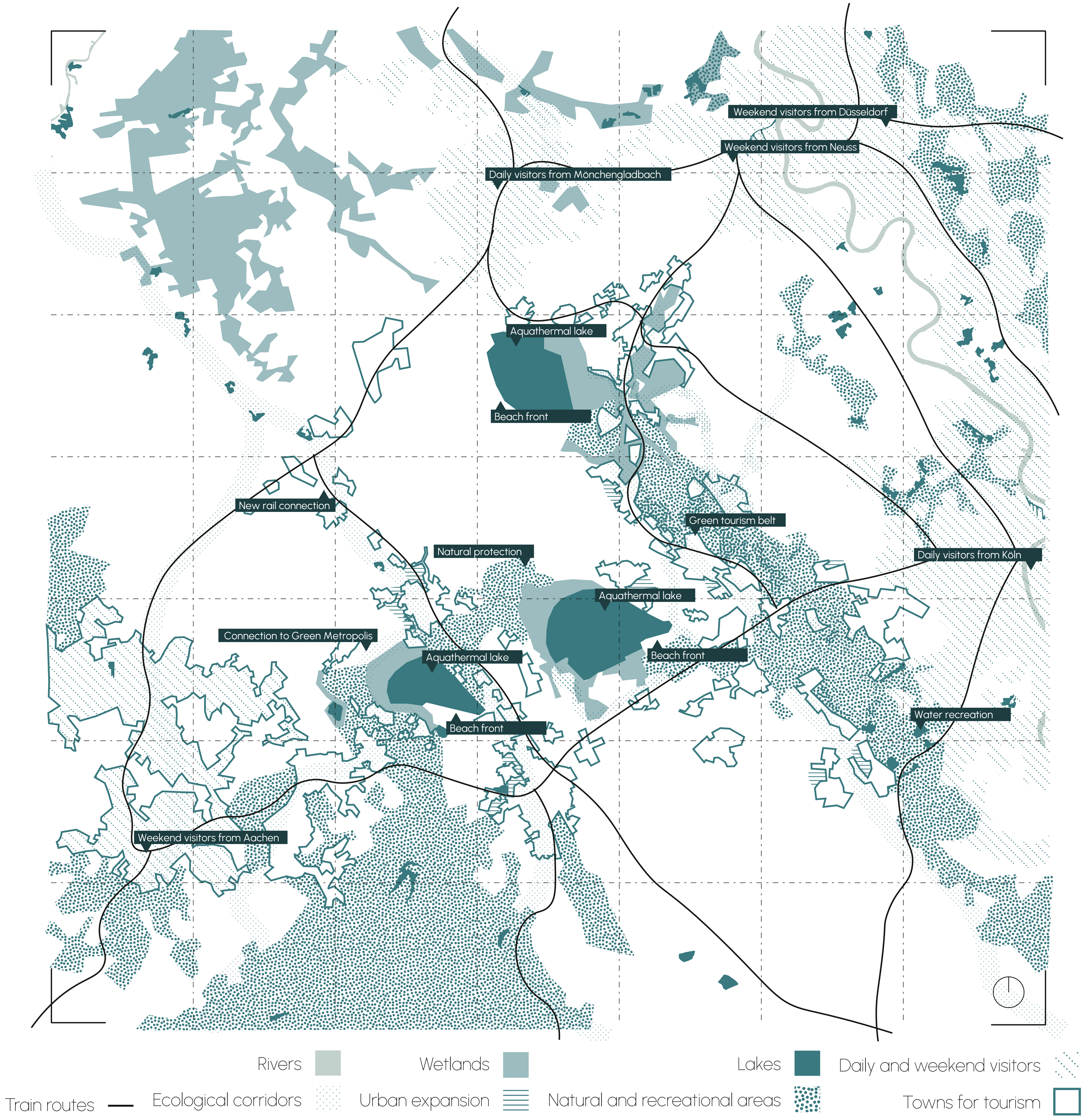
Spatial demand



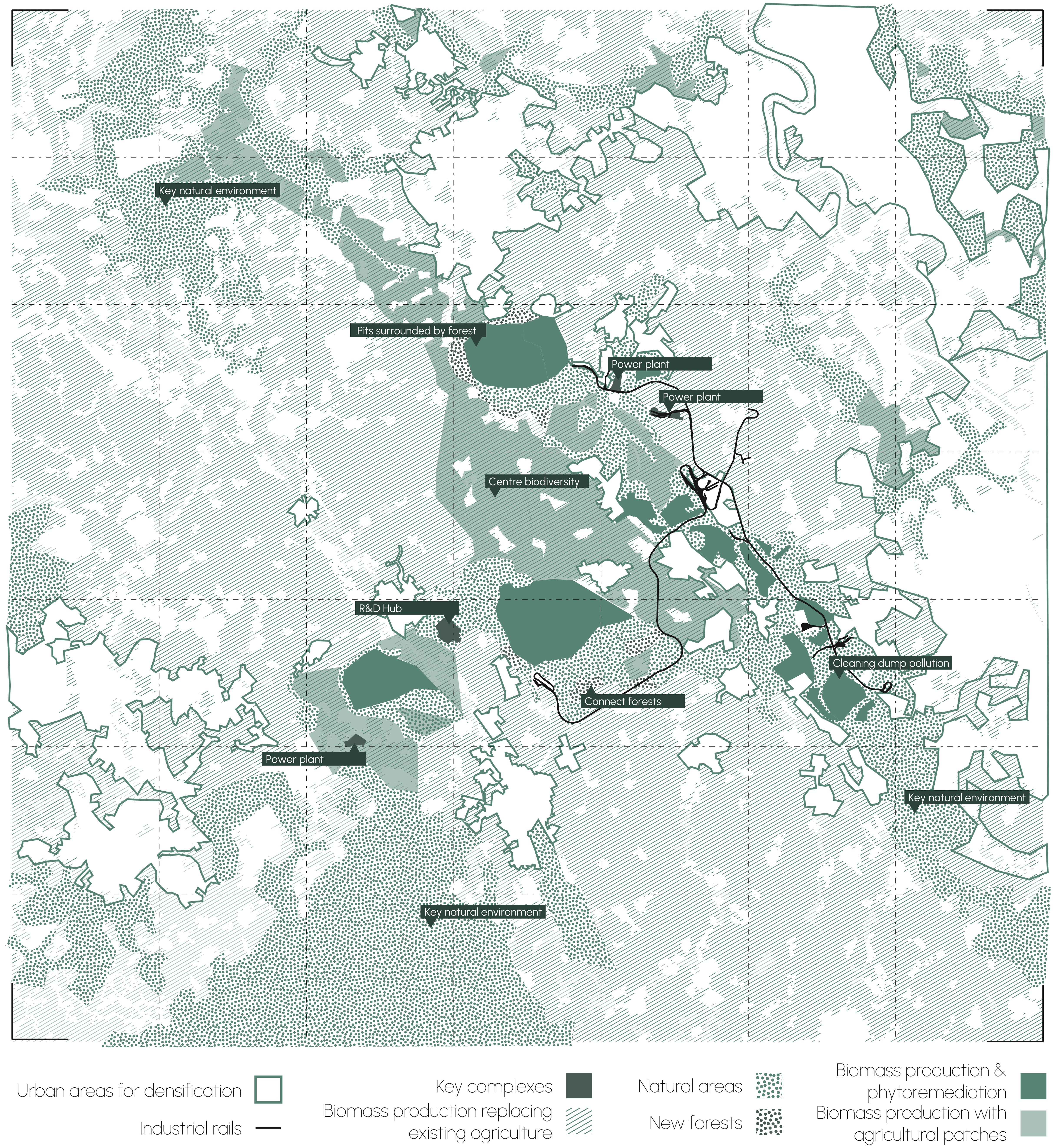
Regional strategy



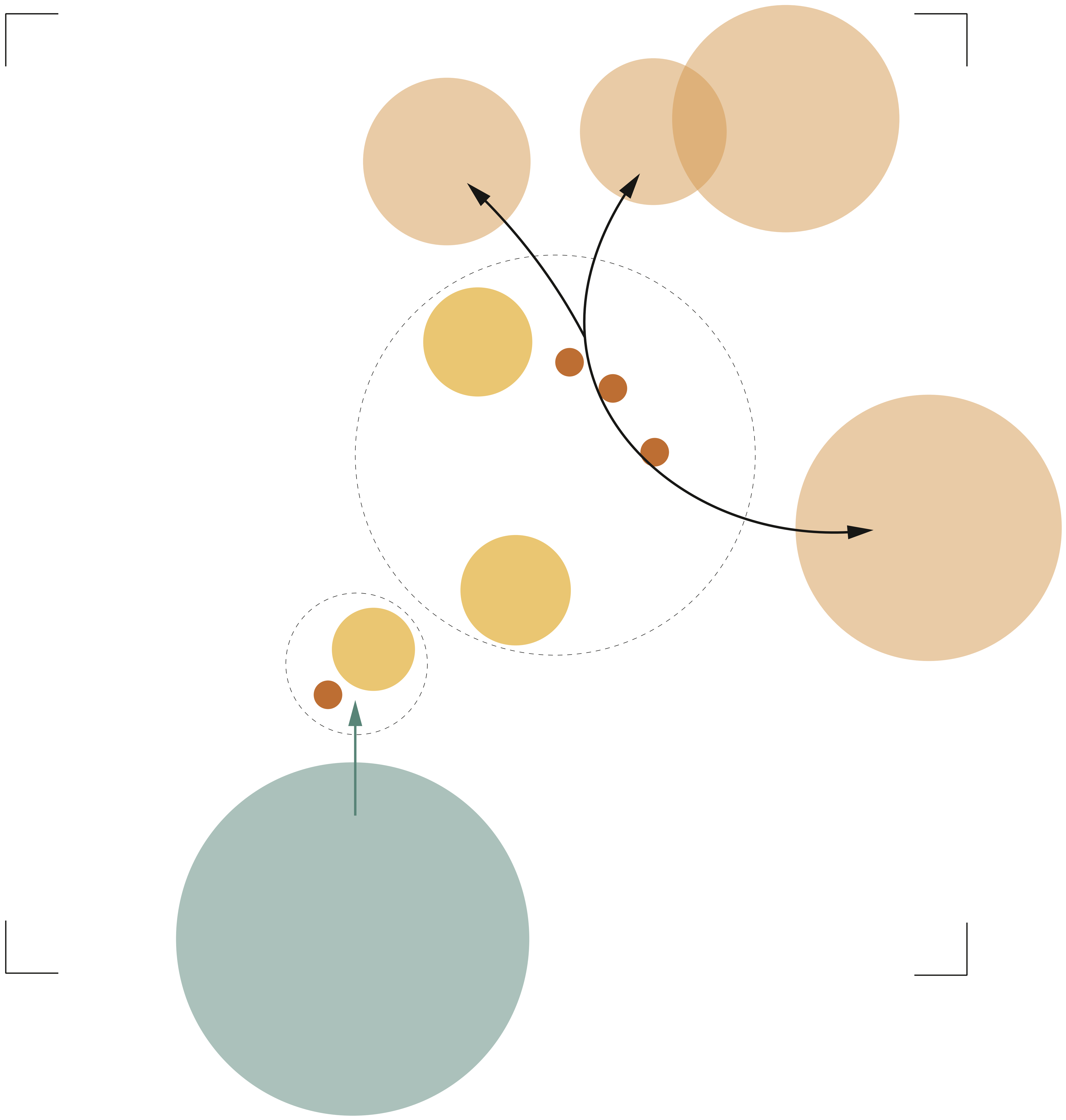
Regional strategy



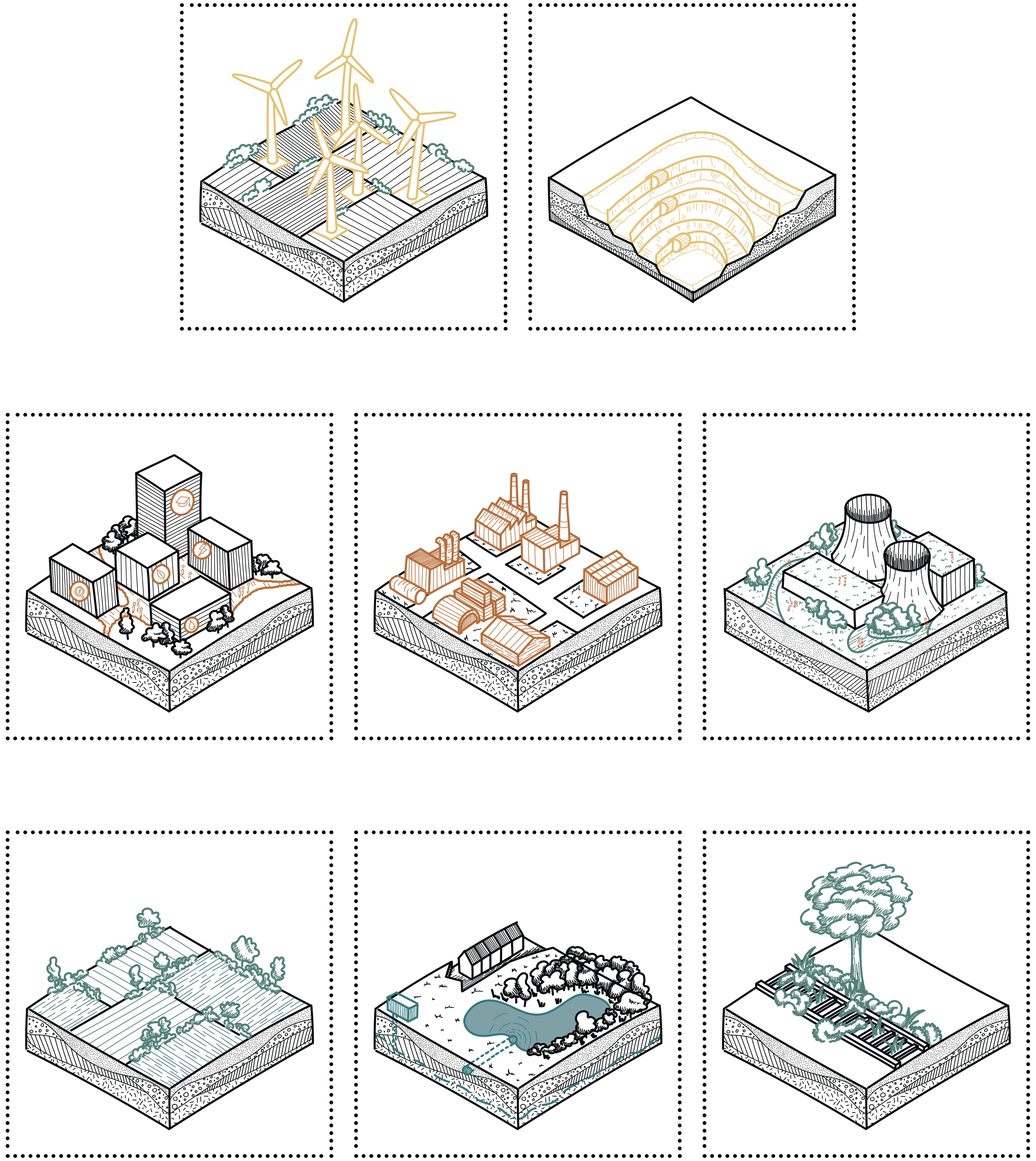
Regional strategy



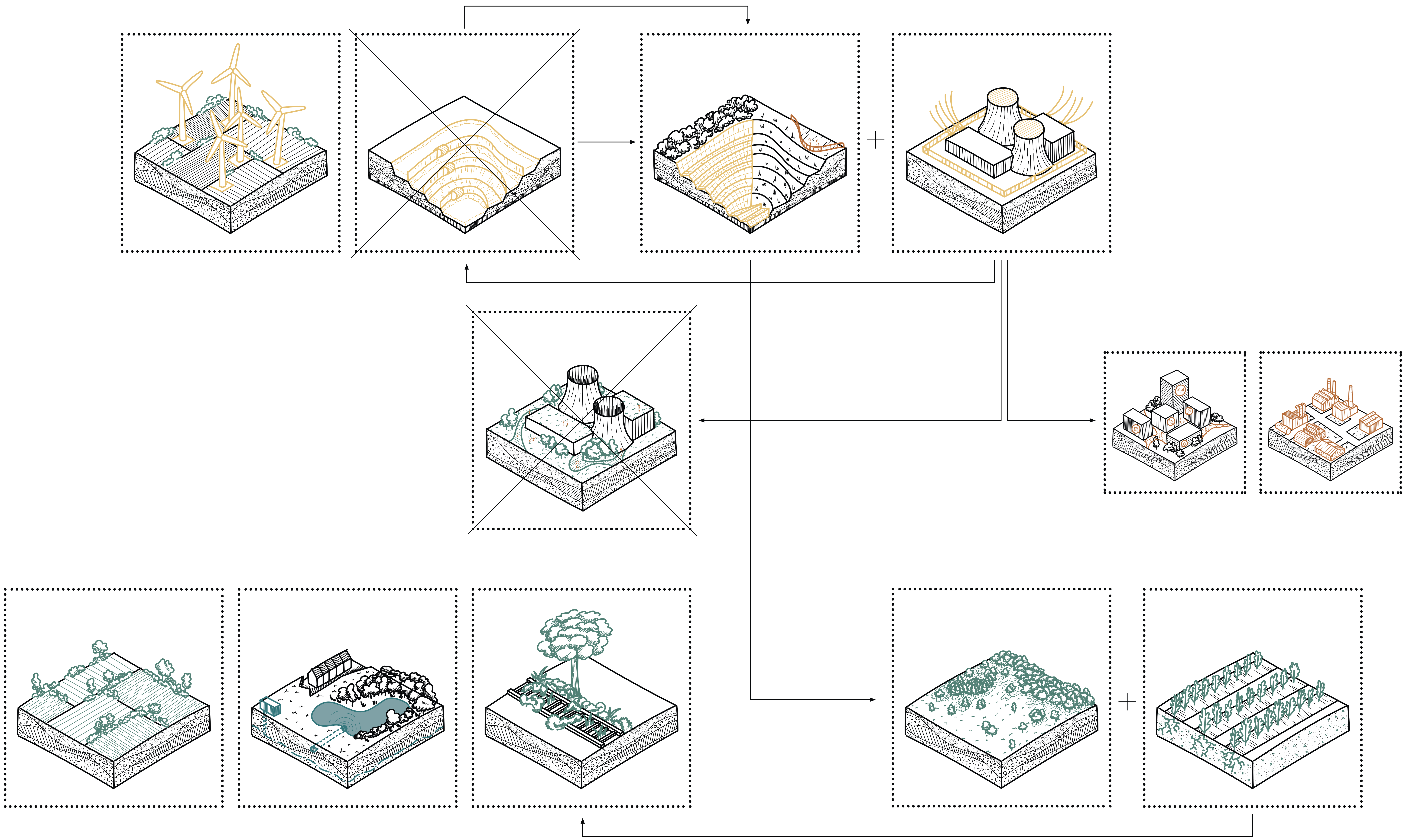
Regional strategy



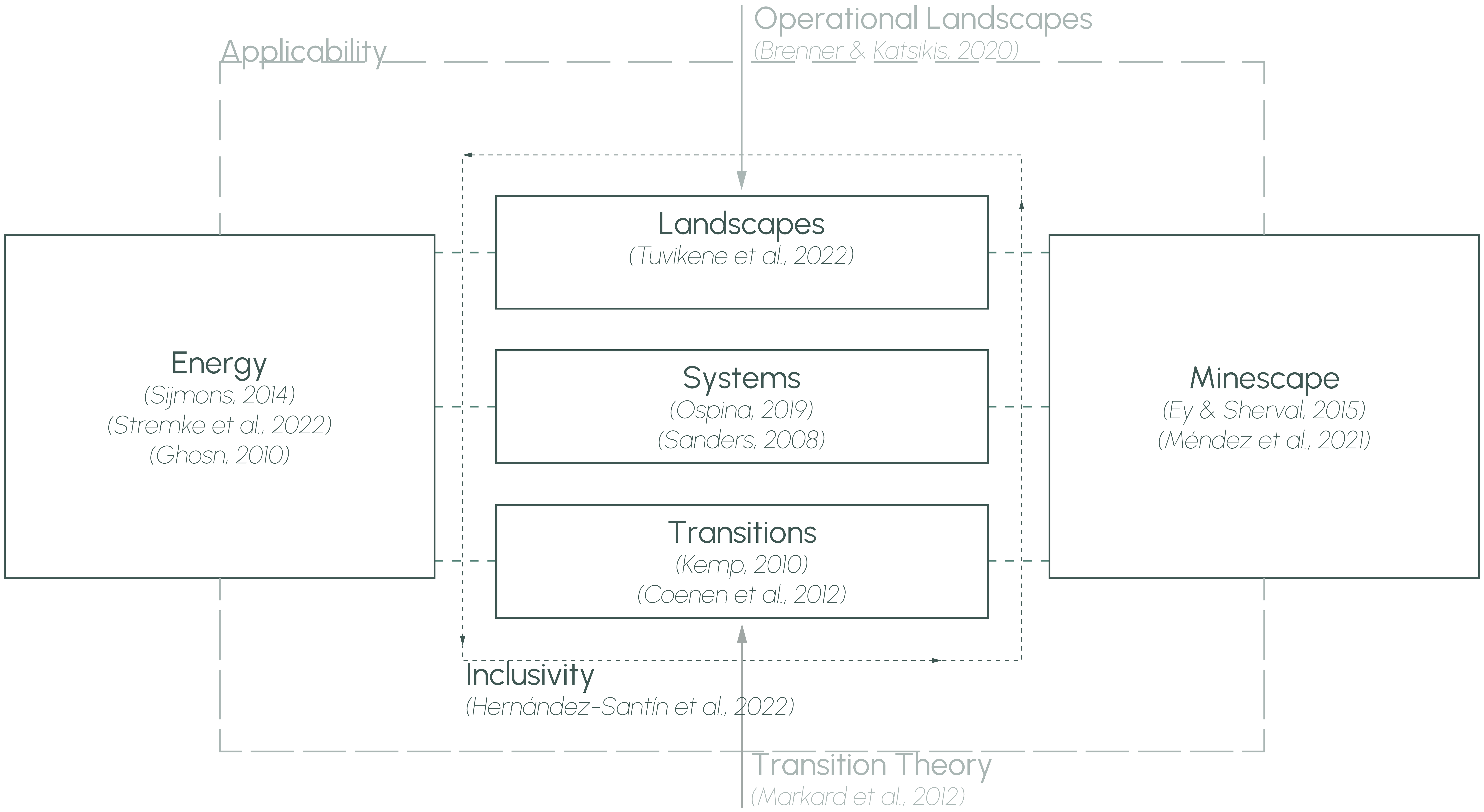
Future role mines



Practical implementation



Practical implementation

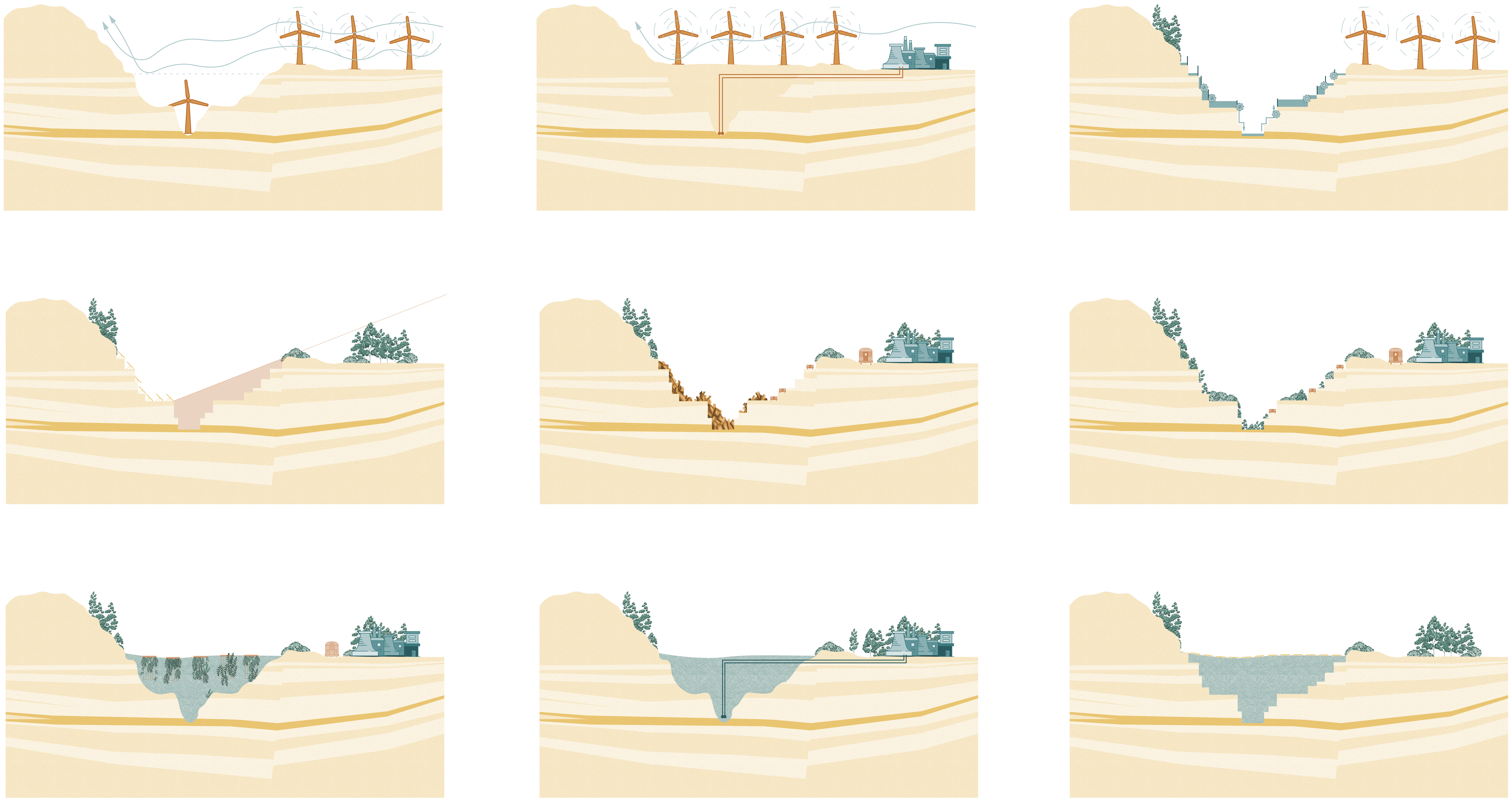


Theorethical framework

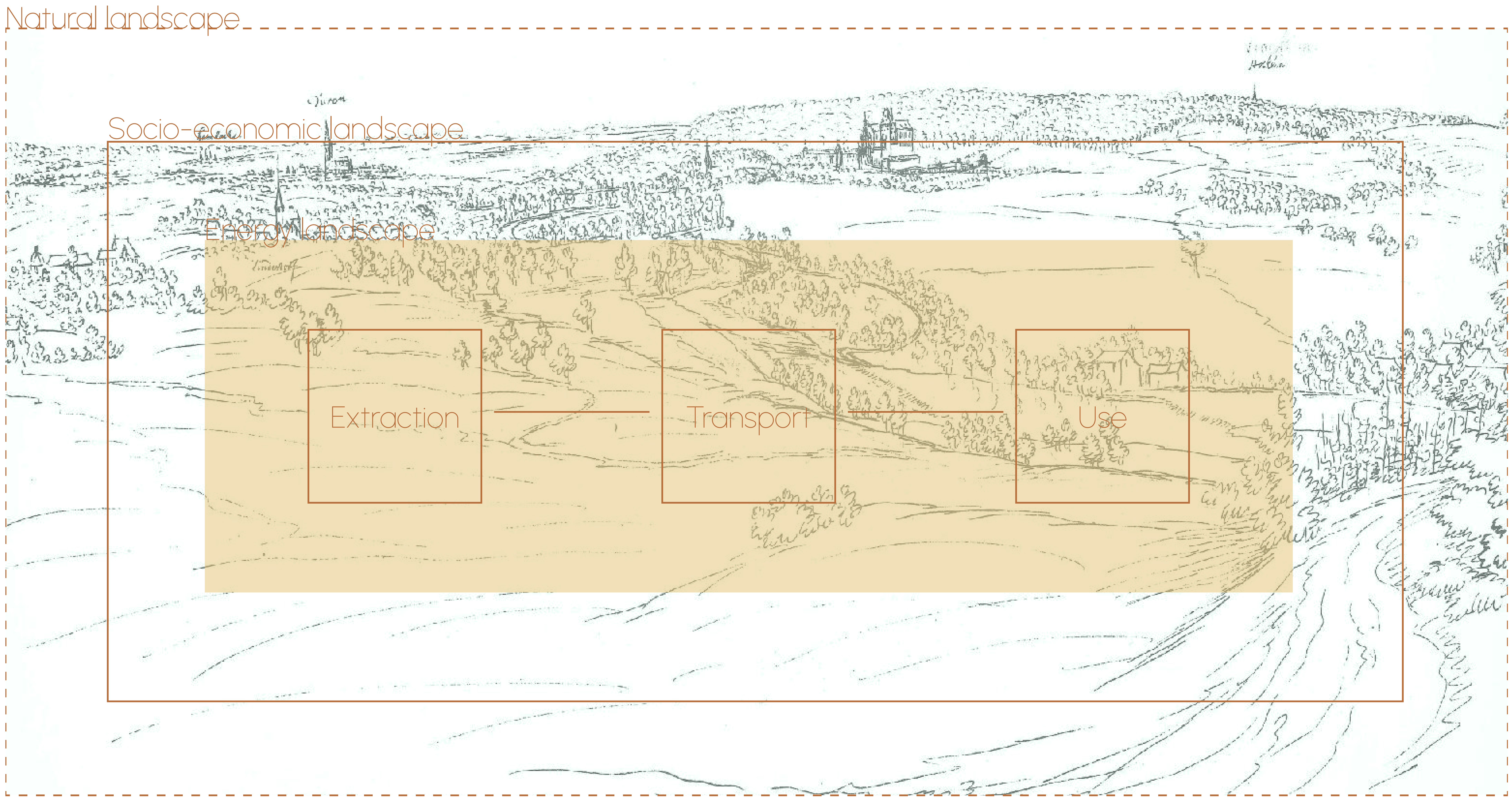
	Problematisation & Framing	Theorethical Framework	Systems	Landscapes	Transitions	Conclusion & Reflection
What is an inclusive energy transition?	Cause and problems Policy framework Global and European	Energy systems Energy landscapes Systemic thinking	What is the energy system (in Germany)? In what system will the energy transition take place?	What are the qualities of the landscape for an energy transition? What do energyscapes look like and how are they experienced?	What is the energy and spatial demand? How can the energy transition be shaped inclusively? What types of energy production can be implemented?	
How can minescapes be regenerated?	Problems of the minescape Reasons for the transition	Minescapes Regeneration Operational landscapes	What are the systems of the minescape? What are the possibilities and problems the systems have for the transition?	What defines the minescape of Rhineland mining district? How is the minescape experienced?	What are examples of the regeneration of minescapes?	
How to create an inclusive energy transition from a societal and environmental perspective?		Transition theory Inclusion	What are the socio-economic systems of the Rhineland mining district? What are the green and blue systems of the Rhinland mining district?	What are the socio-economic aspects of the landscape? What is the historical transtion of the landscape?	How can the minescape be transformed into an inclusive energyscape? How will the green, blue, energy and social systems be transformed through these interventions?	

Research frame

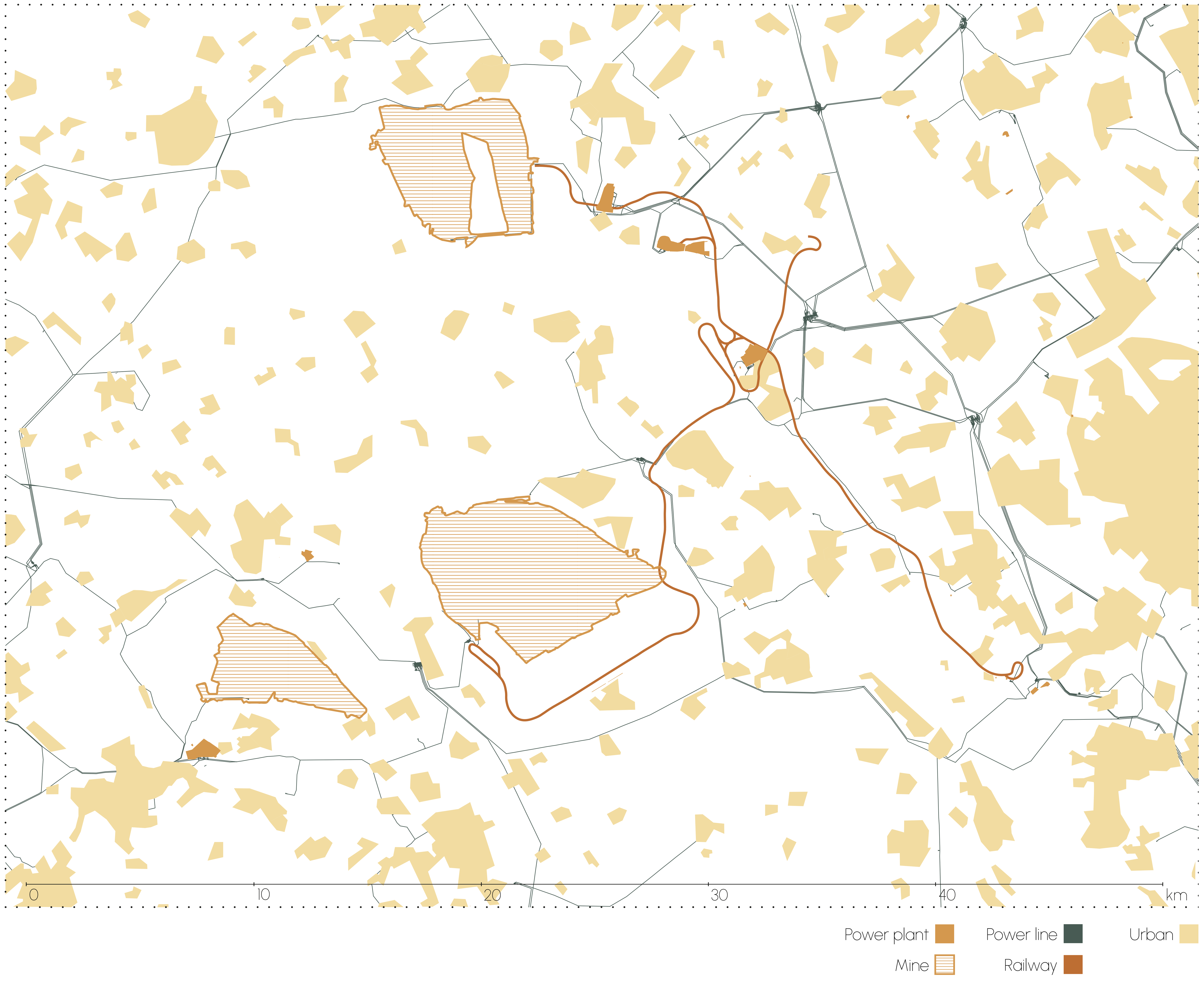
Spatial demand



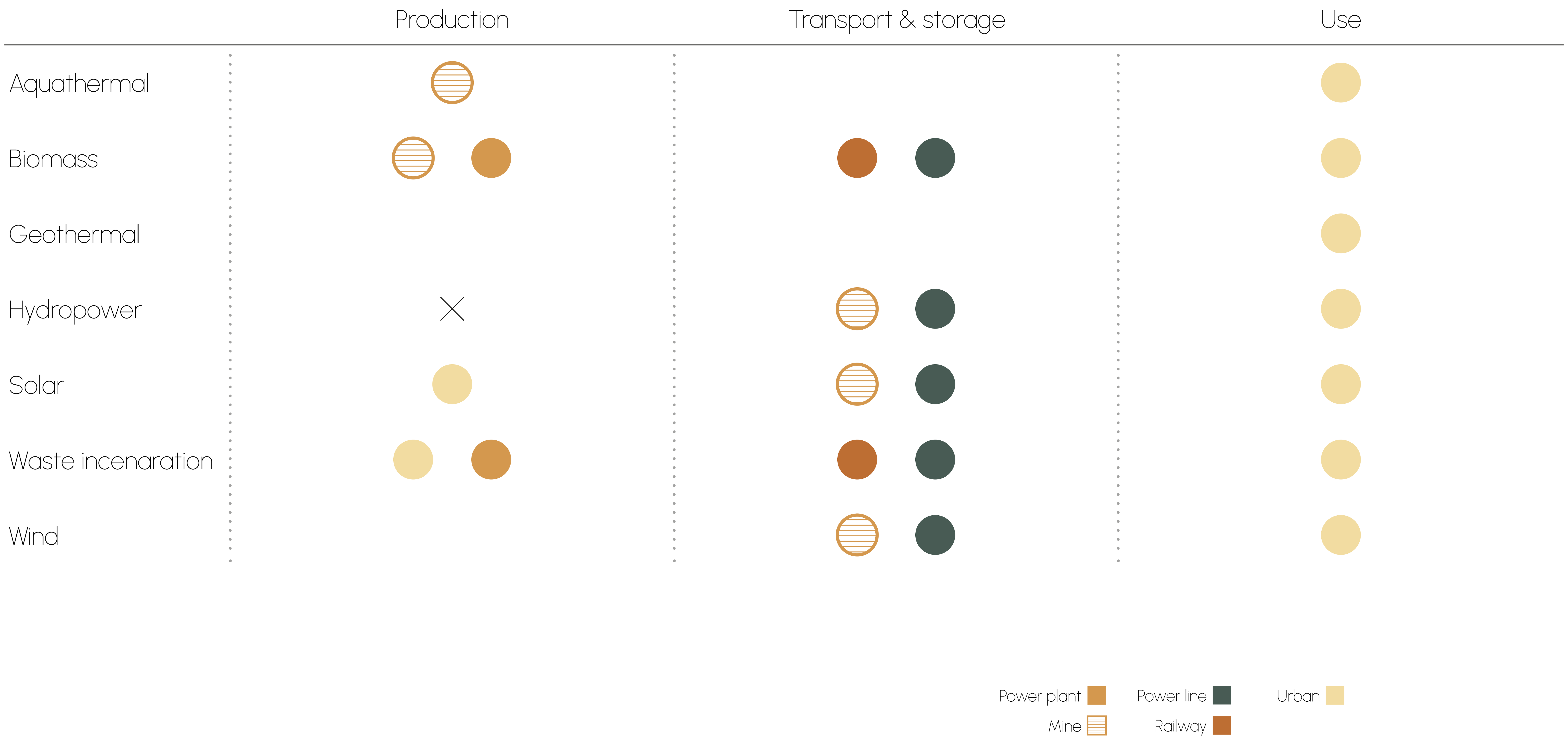
Landscape potentials



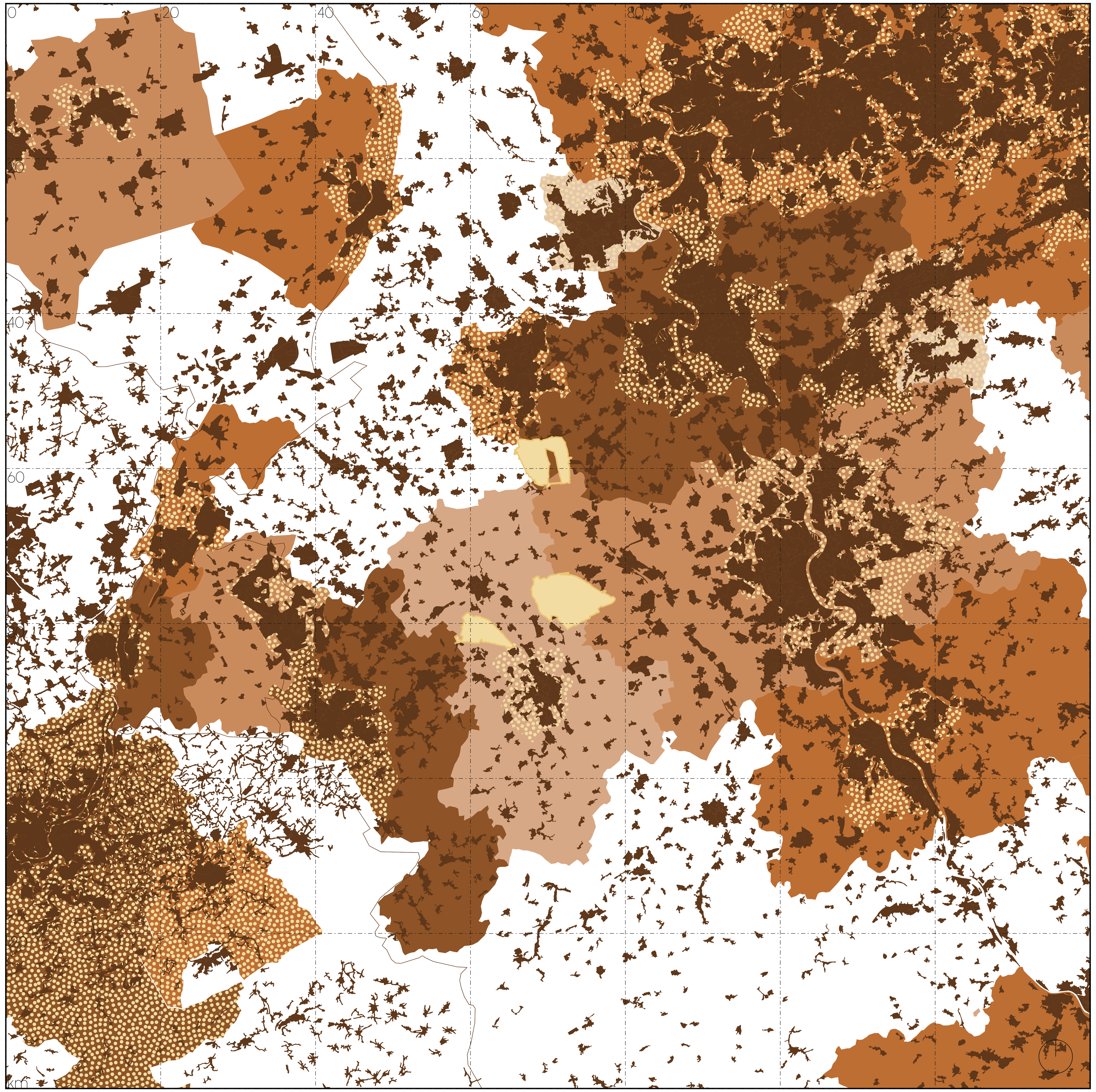
Energy landscapes



Elements of the Energy Landscape

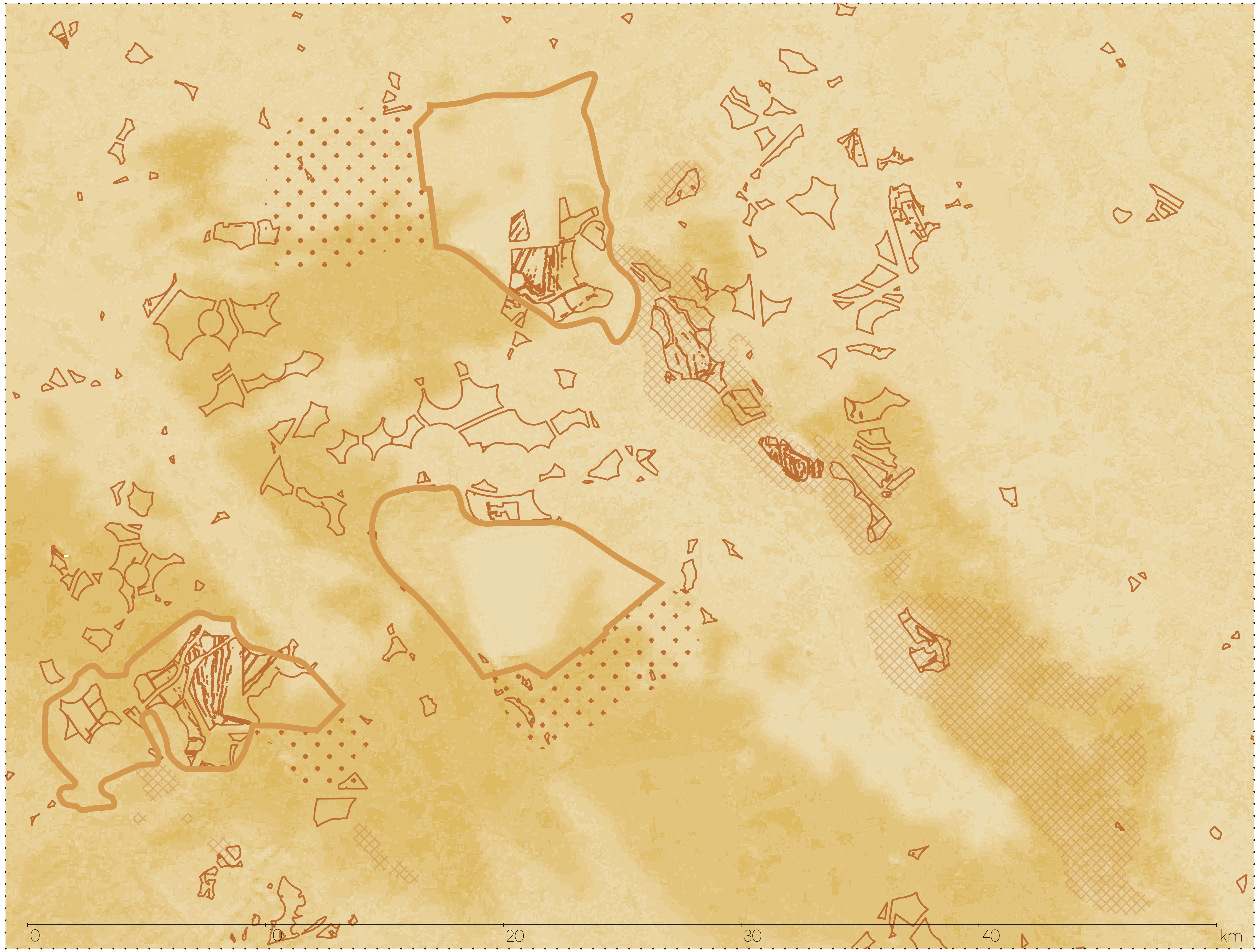

Production
Transport & storage
Use
Aquathermal
Biomass
Geothermal
Hydropower
Solar
Waste incenaration
Wind
Power plant
Mine
Power line
Railway
Urban

Projection

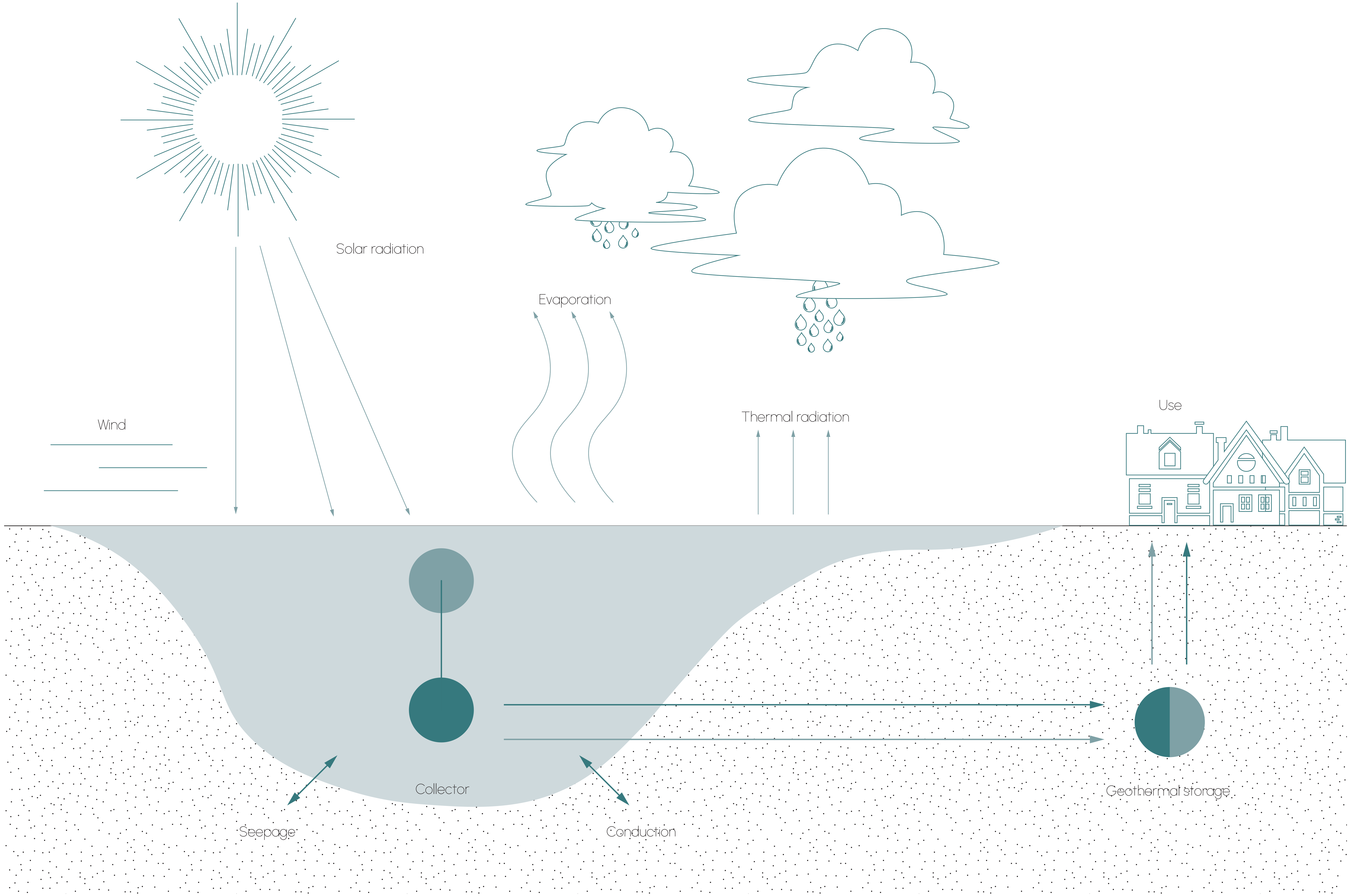


Mineral extraction sites
Commute district
Urban area
Urban core

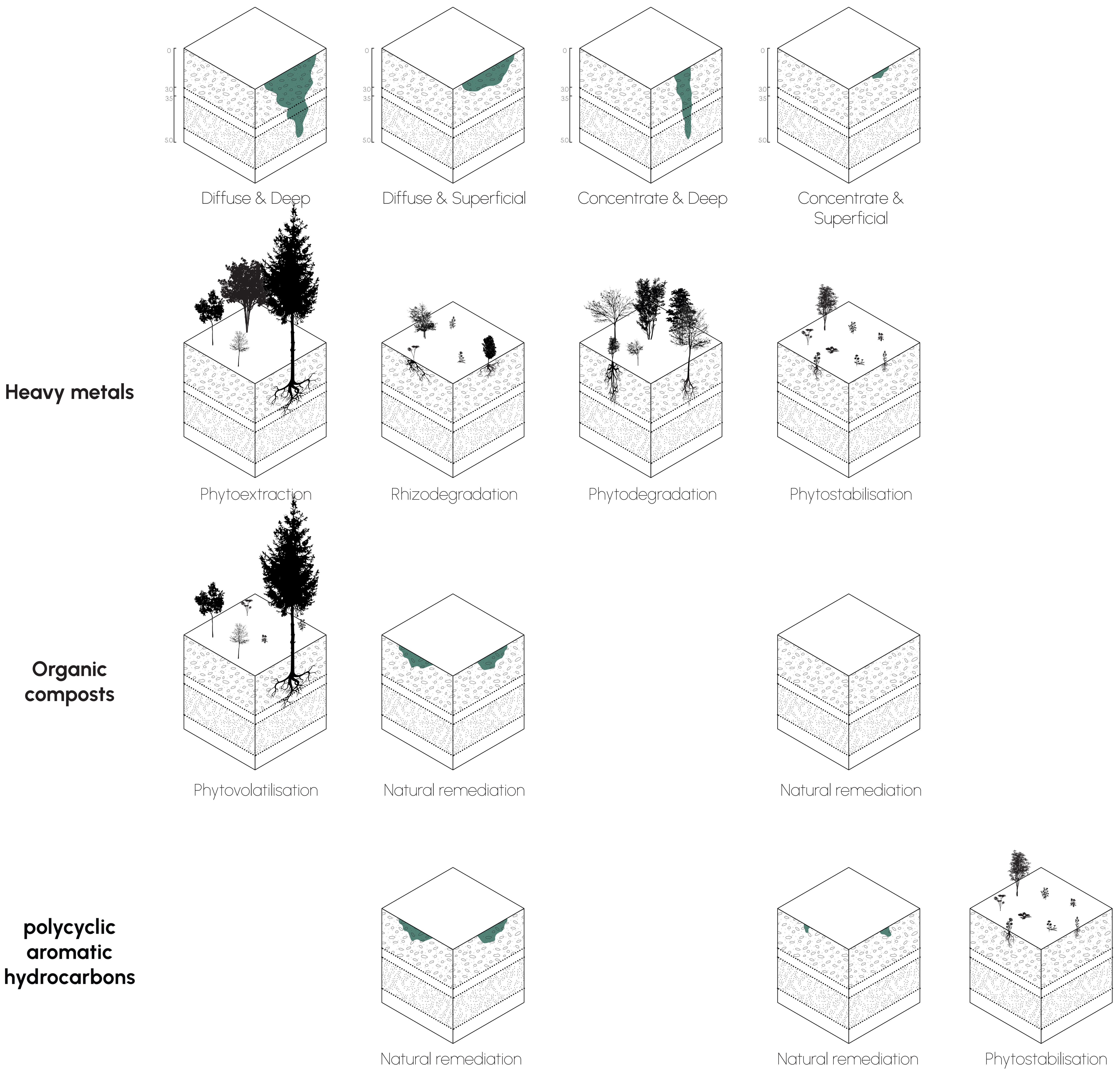
Commute



Possibilities



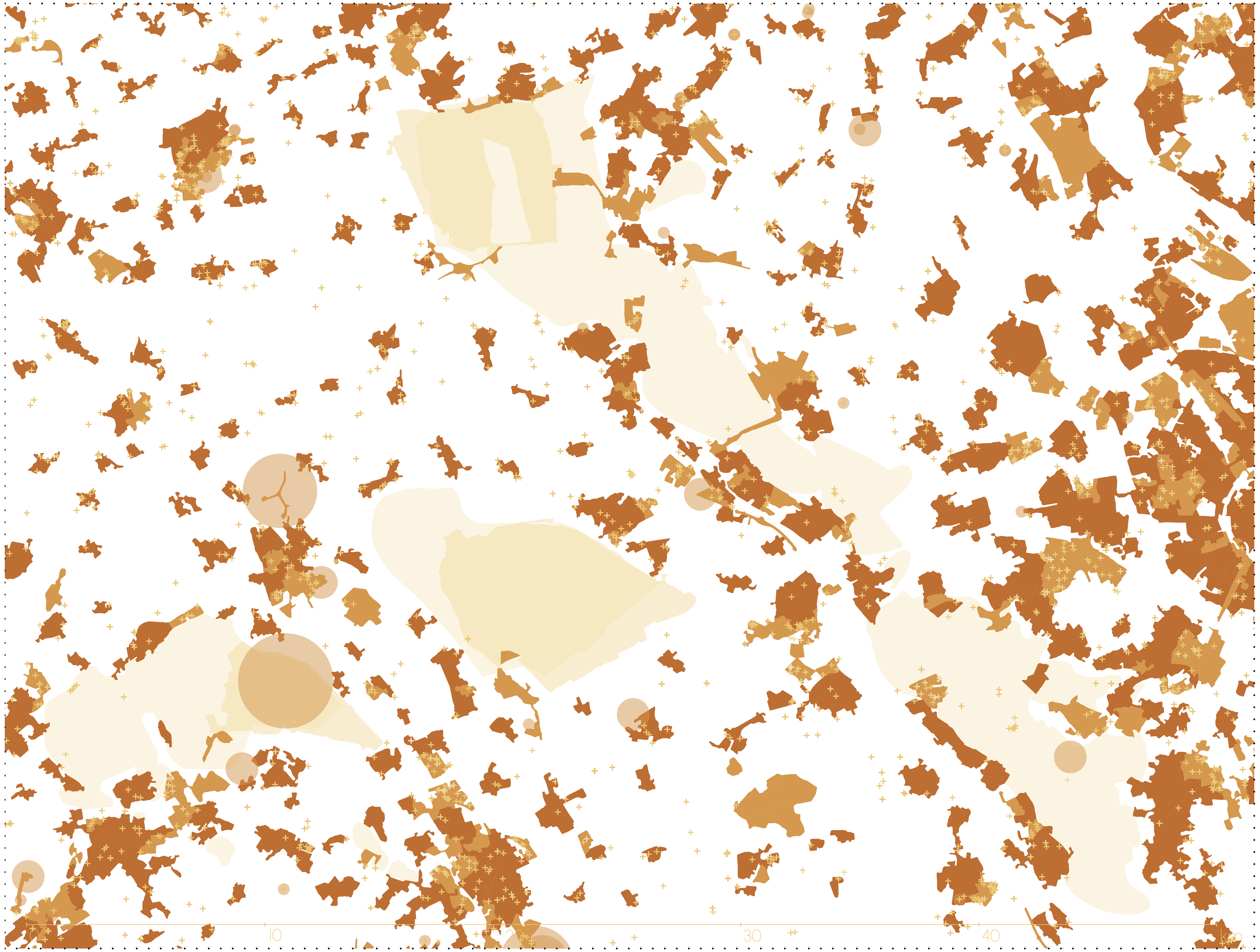
Aquathermal production



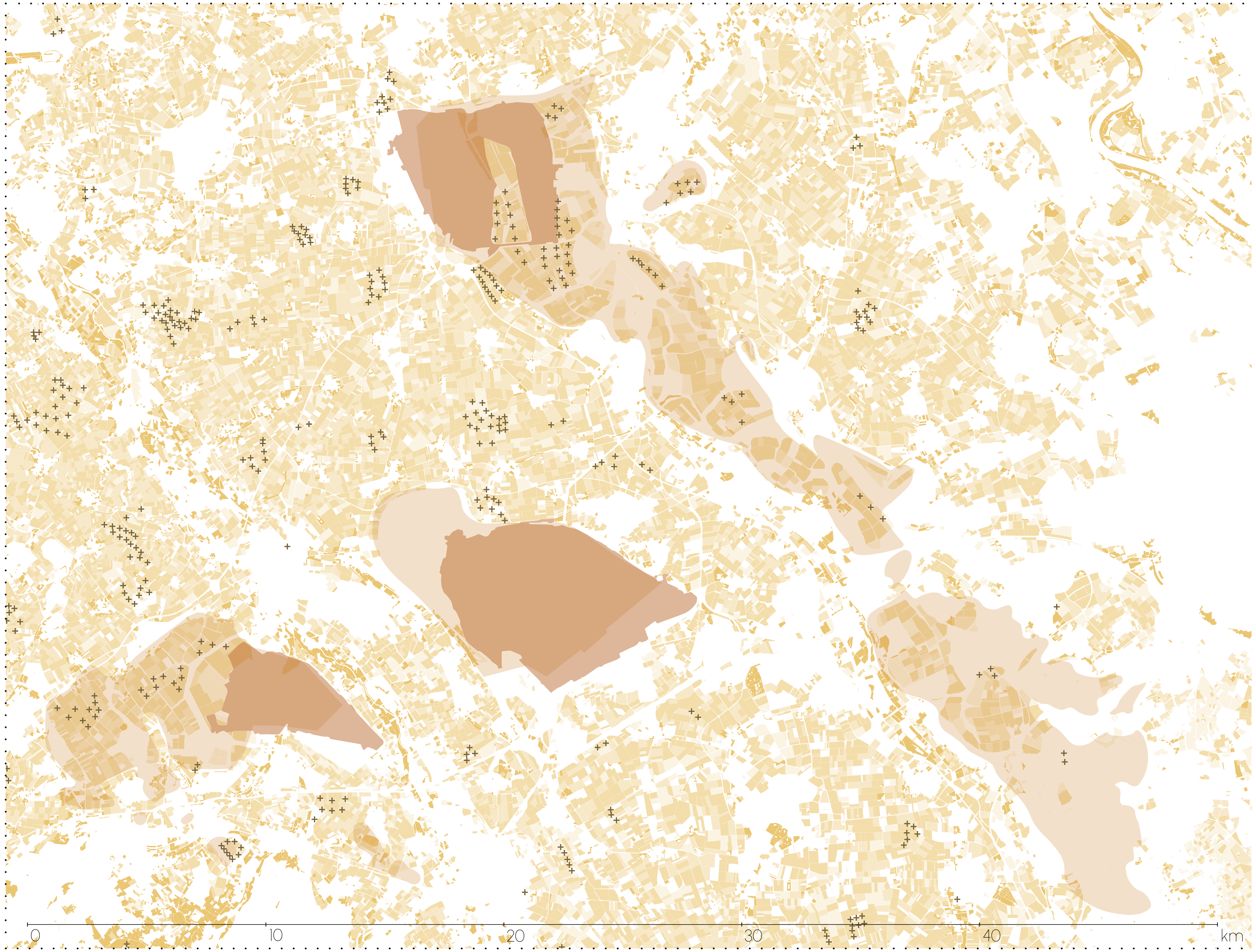
Phytoremediation

(Tamiazzo, 2015)

Pollution



Symbiotic relation solar, shade and urban



Symbiotic relation wind, height and agriculture

Based on: Sim, Y. S., RüFenacht, D., & Chaudhry, S. (2022).
from https://topalovic.arch.ethz.ch/Courses/Student-Projects/HS22-Brown-Coal

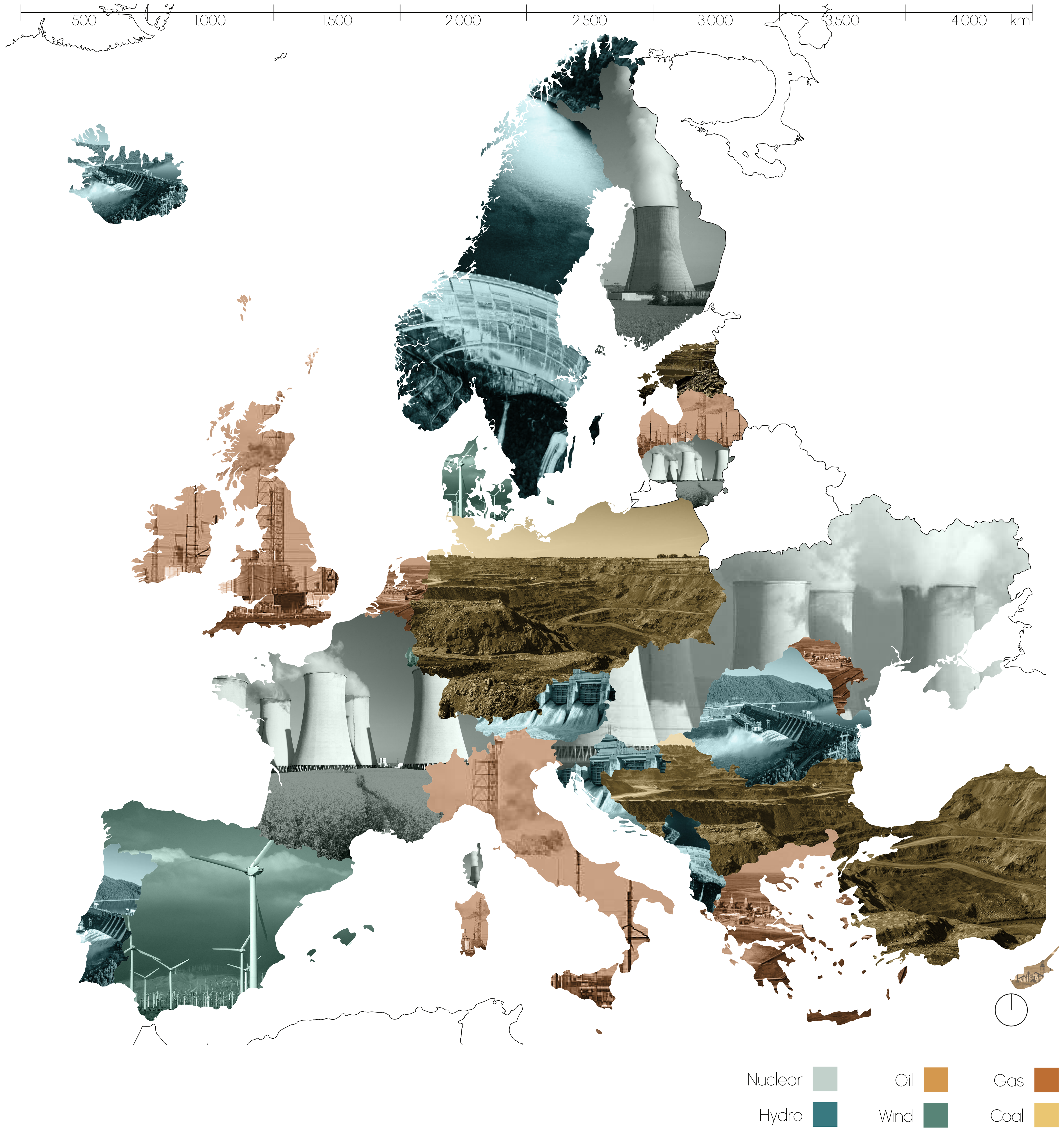
Lignite

Abandoned scape

Historic scape

Energy scape

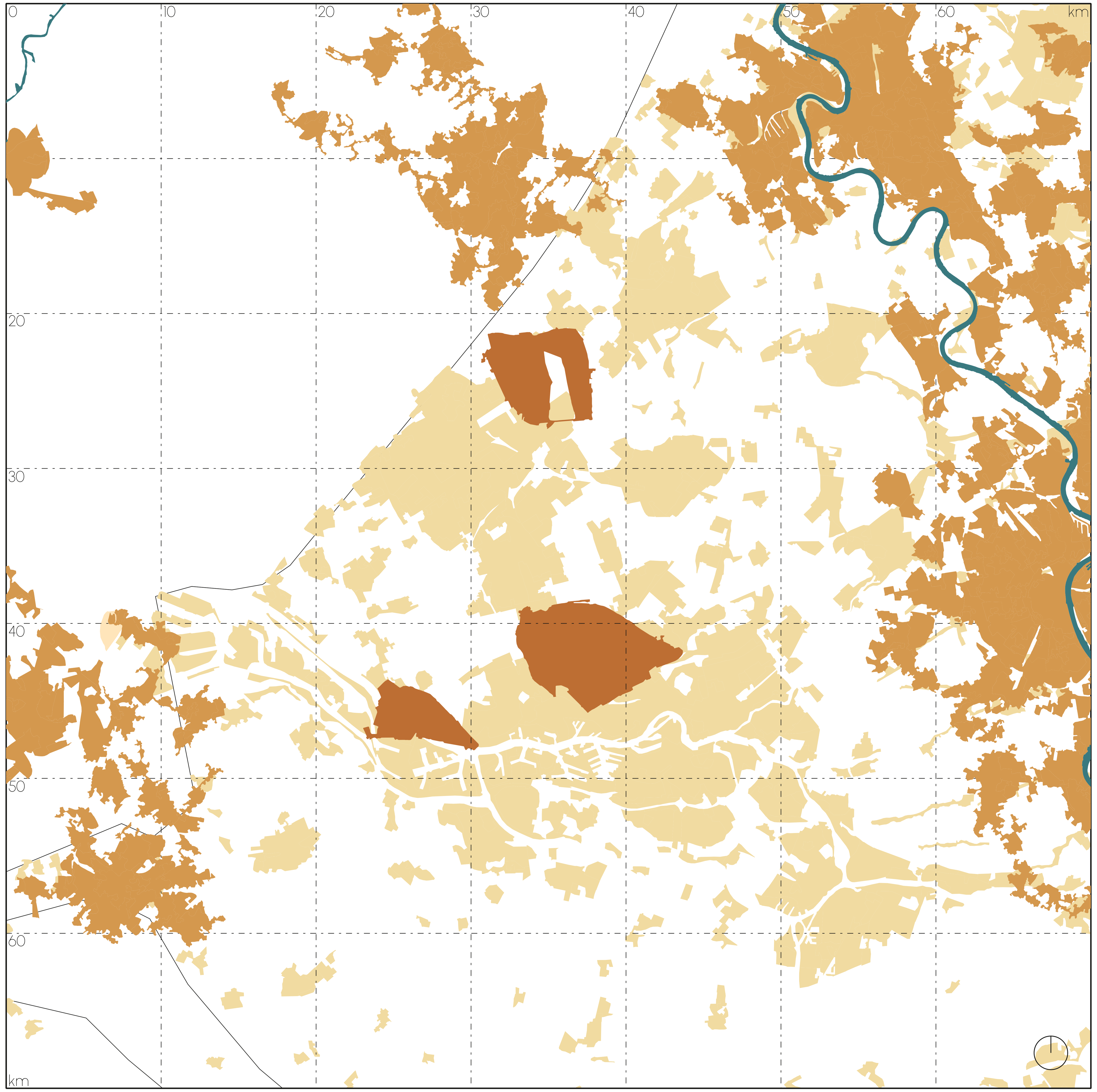
Inclusive scape



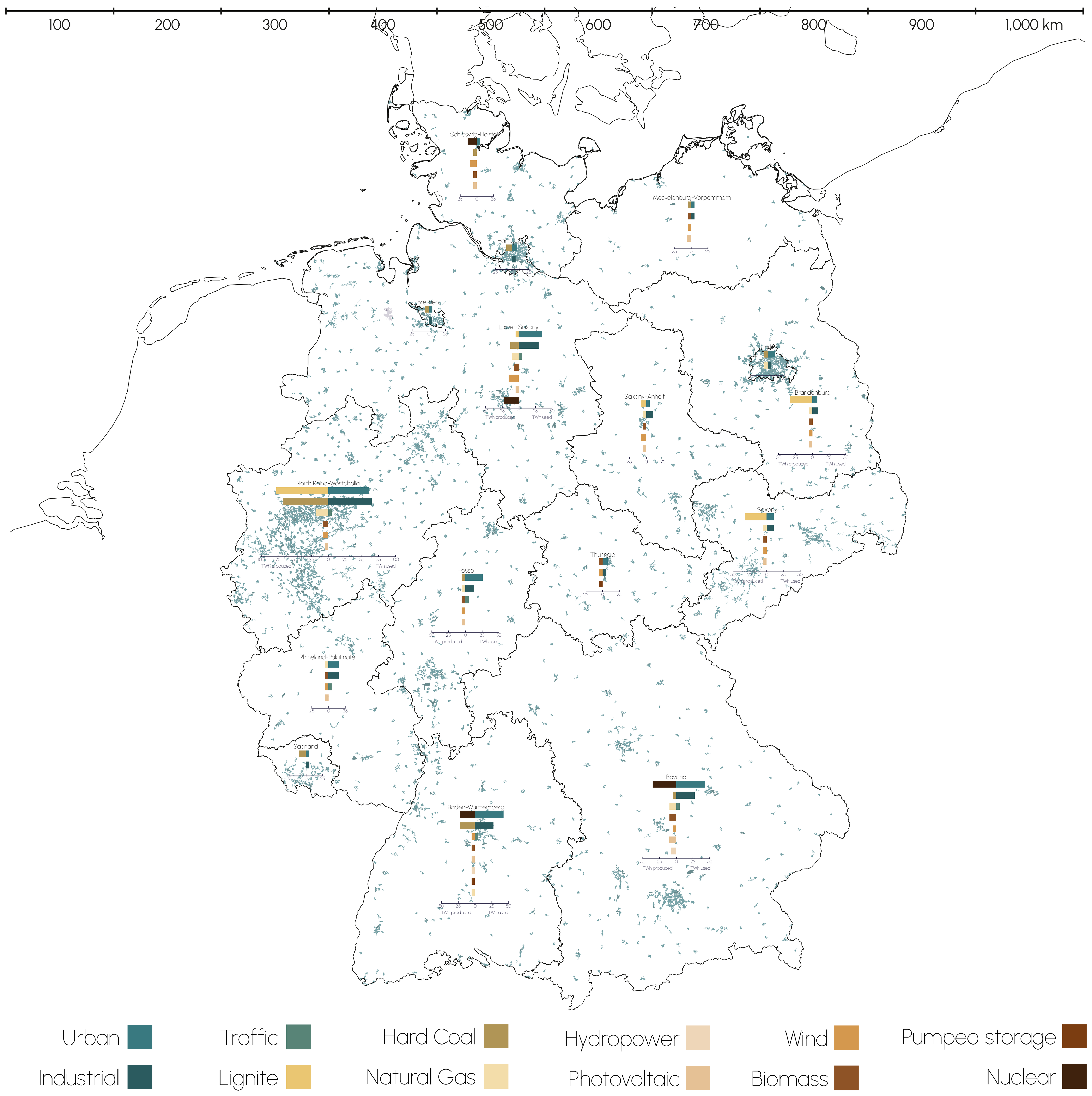
Energy landscapes of Europe


Production in million tonnes
0
4
8
12
16
20
24
28
32
36
40
44
100
200
300
400
500
Jänschwalde
Nochten
Reichwalde
Profen
Vereinigten
Schleenhain
Welzow-Süd
Inden
19 million tonnes
230 m deep
17 km²
Garzweiler
35 million tonnes
210 m deep
48 km²
Hambach
40 million tonnes
450 m deep
85 km²
Depth in meters

Scale mines

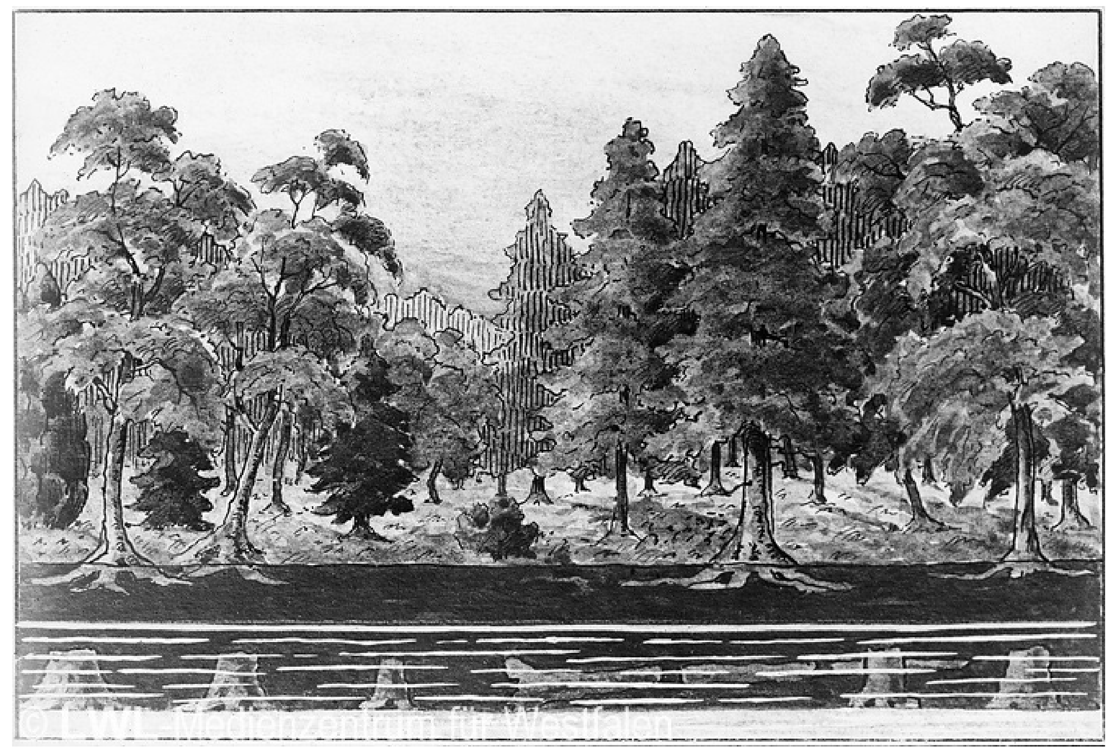


Scale minescape



Energy distribution

Timeline of Lignite



Spira (2000), Wolter (ca. 1925b), LWL-Medienzentrum für Westfalen (1920), Chatard (2017-2023), Wolter (ca. 1925b) Schlösser (2019)

Interpretations

Unknown artist (ca. 1700), Kraus (1832) and unknown artist (1839)

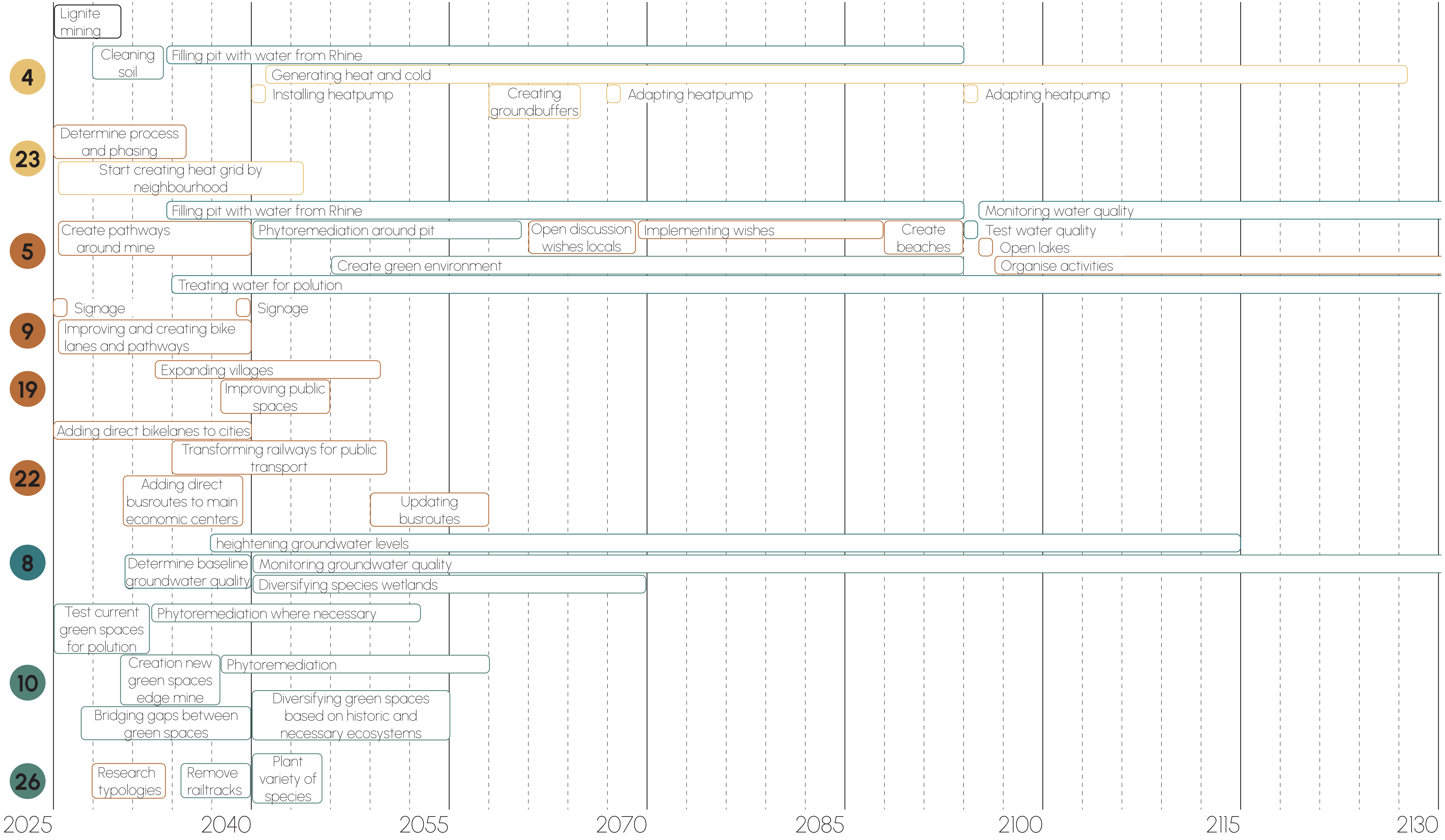
Landscape

Lignite mining
Maintenance of green space
2
Retraining program mining sector
Replacement panels
Production solar energy
Production solar energy
Retrofitting vacant power plants
14
Retrofitting vacant power plants
Cleaning soil
Placement solar panels buildings
Replacement solar panels buildings
18
Subsidies solar panels
Create policies and guides
Connnection buildings to grid and batteries
Expansion of electricity grid
24
Removal of railways
Creation of ecological corridor
Signage
Signage
9
Improving and creating bike lanes and pathways
Expanding villages
19
Improving public spaces
Adding direct bikelanes to cities
22
Transforming railways for public transport
Adding direct busroutes to main economic centers
Updating busroutes
Pumping of groundwater
6
Change ownership system
Expand and maintain system
baseline measurement
Measure impact
Measure impact
Measure impact
Measure impact
Measure impact
Create policies and guides
Research effect and improve nationwide strategies
12
Create biodiverse edges
Maintenance by farmers and municipality

Phasing


3
8
16
17
21
6
12
26
Lignite mining
Temporal battery installations in power plants
Design and research battery
Creation of waterbasins and power installations
Filling installation with water from Rhine
Start battery usage
Creation windfields
Replacement
Loan system farmers
Research new windfield possibilities
Cleaning of power plant areas
Spaces for energy history of area and energy transition exhibition
Creation of green spaces
Retrofitting for starter companies
Organising of (outdoor) activities
Connection to R&D center
Attract companies
Expand industrial areas at power plants
Create policies and guides
Monitor environmental impact
Opening up of R&D center
Expansion R&D center
Specialisation: energy, water, ecology
Attract and integrate with starter R&D companies
Pumping of groundwater
Change ownership system
Expand and maintain system
baseline measurement
Measure impact
Measure impact
Measure impact
Measure impact
Measure impact
Create policies and guides
Research effect and improve nationwide strategies
Create biodiverse edges
Maintenance by farmers and municipality
Diversify agriculture production
Help maintain diverse production through local markets and policies
Research typologies
Remove railtracks
Plant variety of species
2025
2030
2035
2040
2045
2050
2055
2060

Phasing

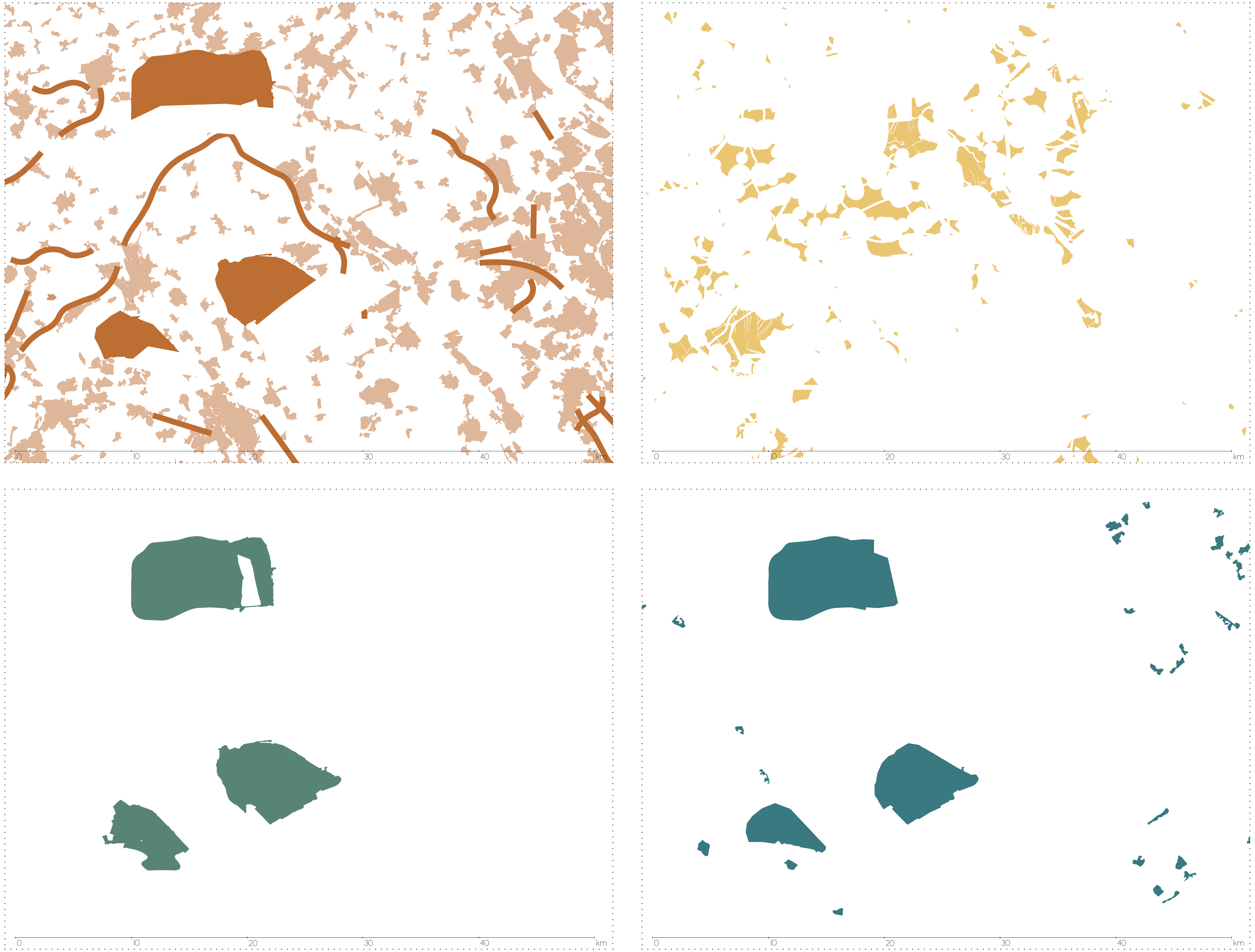


Lignite mining
4
Cleaning soil
Filling pit with water from Rhine
Generating heat and cold
Installing heatpump
Creating groundbuffers
Adapting heatpump
Adapting heatpump
23
Determine process and phasing
Start creating heat grid by neighbourhood
5
Filling pit with water from Rhine
Monitoring water quality
Create pathways around mine
Phytoremediation around pit
Open discussion wishes locals
Implementing wishes
Create beaches
Test water quality
Open lakes
Create green environment
Organise activities
Treating water for polution
9
Signage
Signage
Improving and creating bike lanes and pathways
19
Expanding villages
Improving public spaces
22
Adding direct bikelanes to cities
Transforming railways for public transport
Adding direct busroutes to main economic centers
Updating busroutes
8
heightening groundwater levels
Determine baseline groundwater quality
Monitoring groundwater quality
Diversifying species wetlands
10
Test current green spaces for polution
Phytoremediation where necessary
Creation new green spaces edge mine
Phytoremediation
Bridging gaps between green spaces
Diversifying green spaces based on historic and necessary ecosystems
26
Research typologies
Remove railtracks
Plant variety of species
2025
2040
2055
2070
2085
2100
2115
2130

Phasing


Lignite mining
1
Test soil pollution
Determine planting patterns
Adapt mine infrastructure
Biomass production
15
Determine retrofitting process
Retrofitting for biomass heat generation
Energy production from biomass
23
Determine process and phasing
Start creating heat grid by neighbourhood
25
Retrofitting for biomass transport
Usage
Change to electrical system
11
Collect urban biowaste in existing biomass power plants
Change collection urban waste to new power plants
Start collecting natural waste for new power plants
Educate on biomass usage (school trips, clear transport vehicles)
Motivate farmers for biomass produciton (subisidies, policies)
Collect agricultural biowaste in existing biomass power plants
Change collection agricultural waste to new power plants
20
Determine possible densificaiton areas
Densifying from city centers
Implementing green urban spaces
Evaluate population growth and needs
Densifying from city centers
Implementing green urban spaces
21
Opening up of R&D center
Expansion R&D center
Specialisation: energy, water, ecology
Attract and integrate with starter R&D companies
6
Pumping of groundwater
Change ownership system
baseline measurement
Measure impact
Expand and maintain system
Measure impact
Measure impact
Measure impact
Measure impact
10
Test current green spaces for polution
Phytoremediation where necessary
Creation new green spaces edge mine
Phytoremediation
Bridging gaps between green spaces
Diversifying green spaces based on historic and necessary ecosystems
13
Test all power plants, mines and recultivated areas for pollution
Phytoremediation mines
Phytoremediation recultivated areas
Phytoremediation power plants, where possible
2025
2030
2035
2040
2045
2050
2055
2060

Phasing



Production space

Soft Landscape