

Growing with Cooler Green

To create a climate mitigating city development strategy through forest urbanism

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P5 Presentation

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Urban Forestry Lan

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Second Mentor: Stefan van der Spek

Heat Wave

- High Temperatures are Shattering Records
- Wildfires are Raging
- Water is Becoming More Scarce
- Energy Demands are Creating an Awkward Situation
- Heatwaves are Complicated

39.5 °C

The highest temperature reached in the Netherlands in the summer of 2022

From June to August 2022, persistent heatwaves affected parts of Europe, causing evacuations and at least 26,000 heat-related deaths, making these heat waves the deadliest meteorological events in 2022. Experts predict that changes in the jet stream as a result of climate change will cause heatwaves with increasing frequency in Europe.



Climate Issue and Urban Heat Island

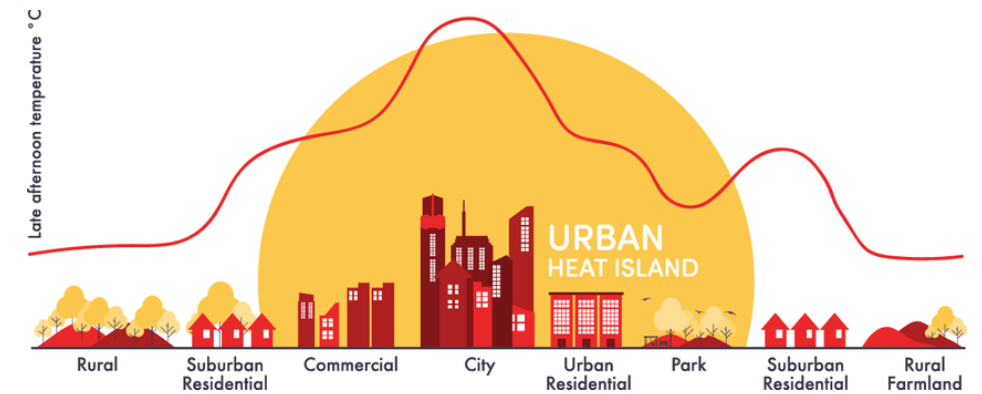
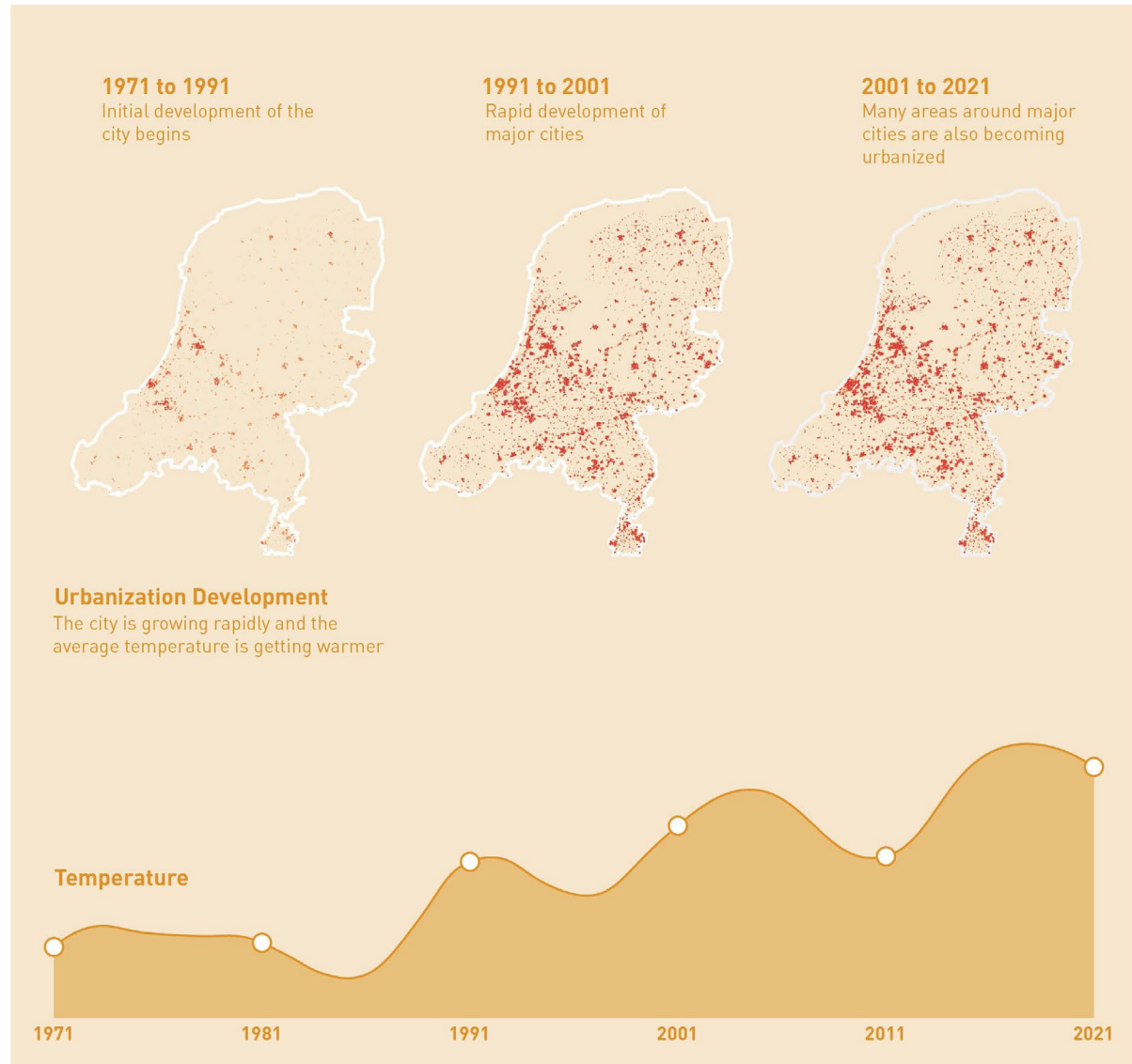
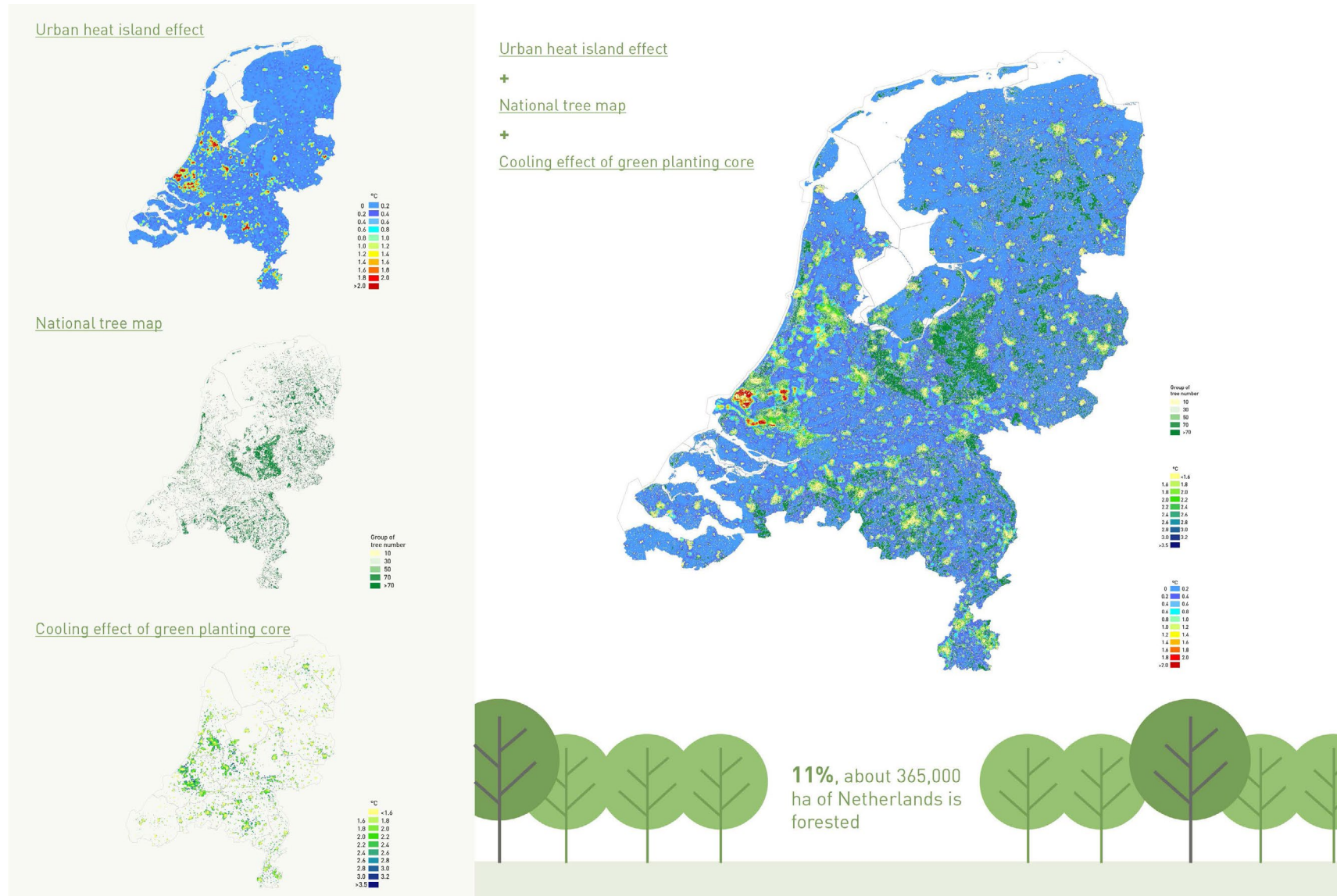


Figure is a courtesy from Kamyar Fuladlu

How to Reduce Urban Heat Island?



What Is Urban Forest?



How Tree Works in Reduce the Urban Surface Temperature

Lowering temperature



Green areas have lowered surface temperature than built areas

Max 7 °C

Urban wildlife habitat



Tree is a source of animal food

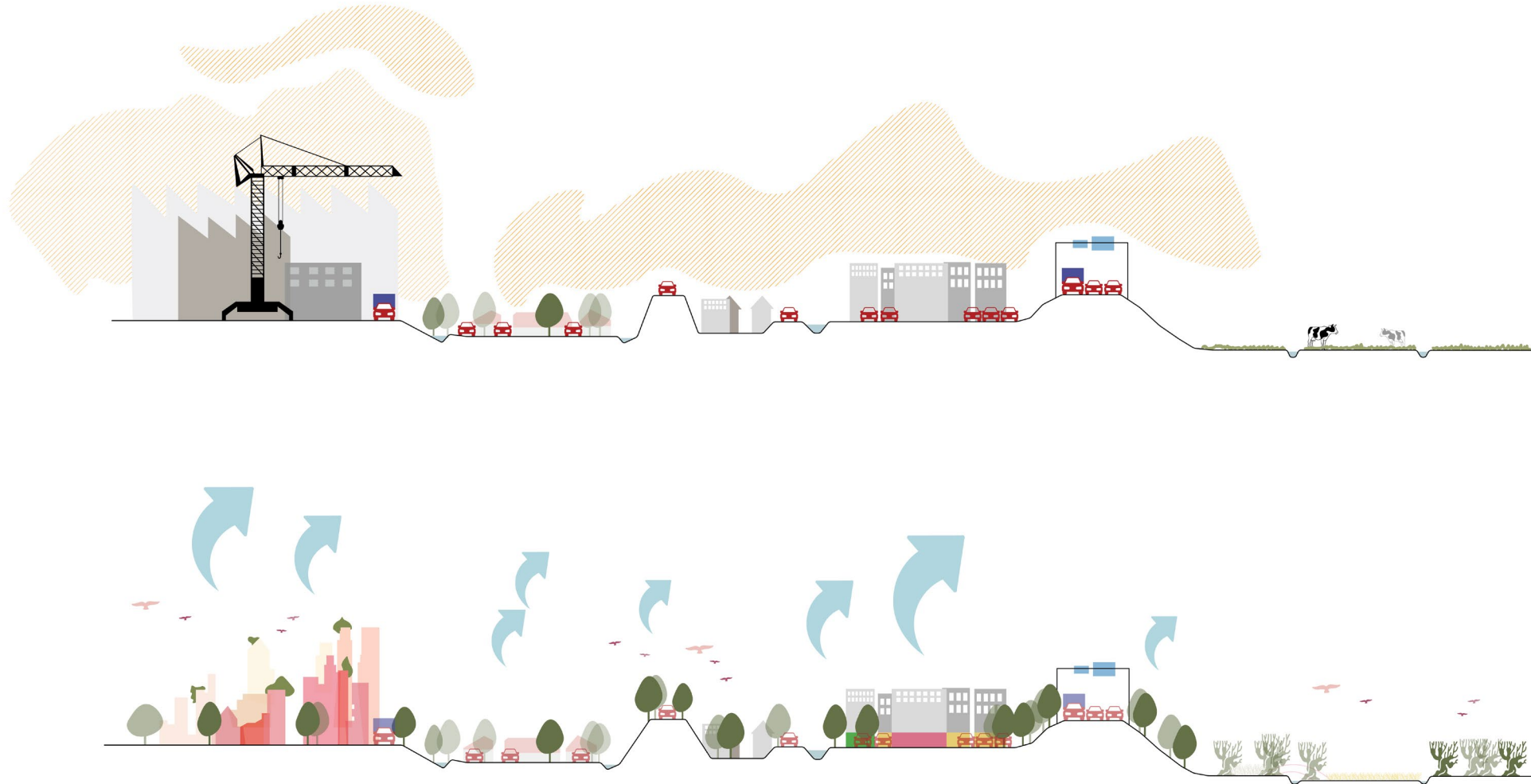
Filter air pollution



PM 2.5 Filter



How Urban Forest Solve the Urban Heat Island Problem?



Research Question

How to transform cities from utilizing cool forest features to becoming cities within cool forests while also improving the urban forest system to mitigate the urban heat island effect and enhance the living experience of the neighborhood?

Sub-question

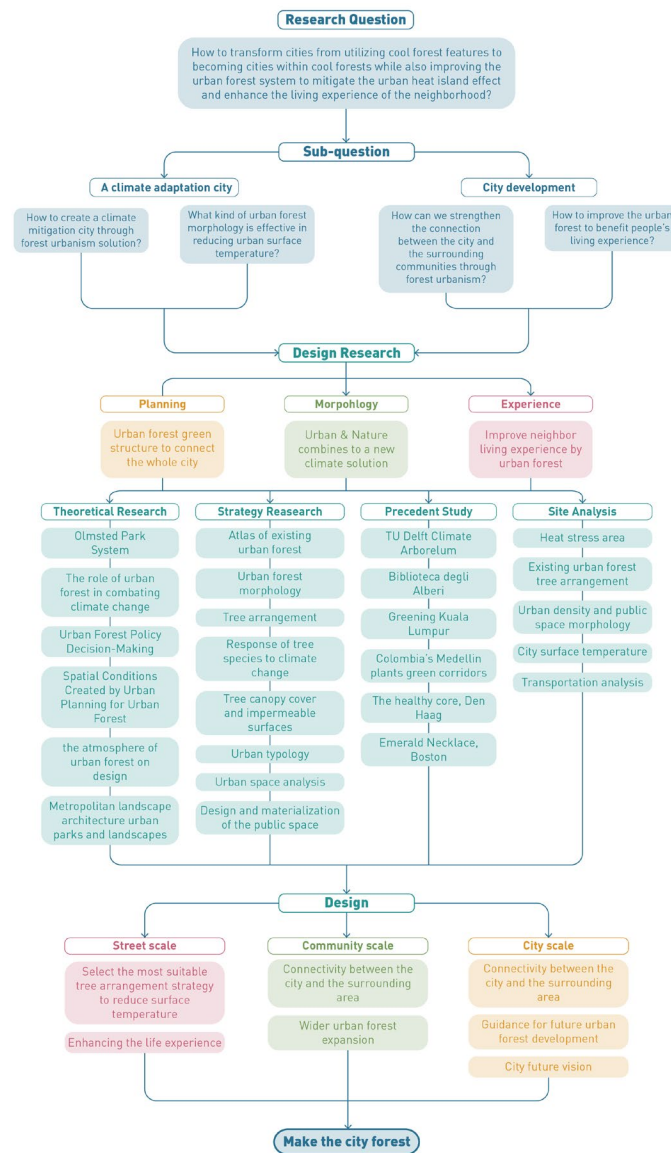
How to create a climate mitigation city through forest urbanism solution?

What kind of urban forest morphology is effective in reducing urban surface temperature?

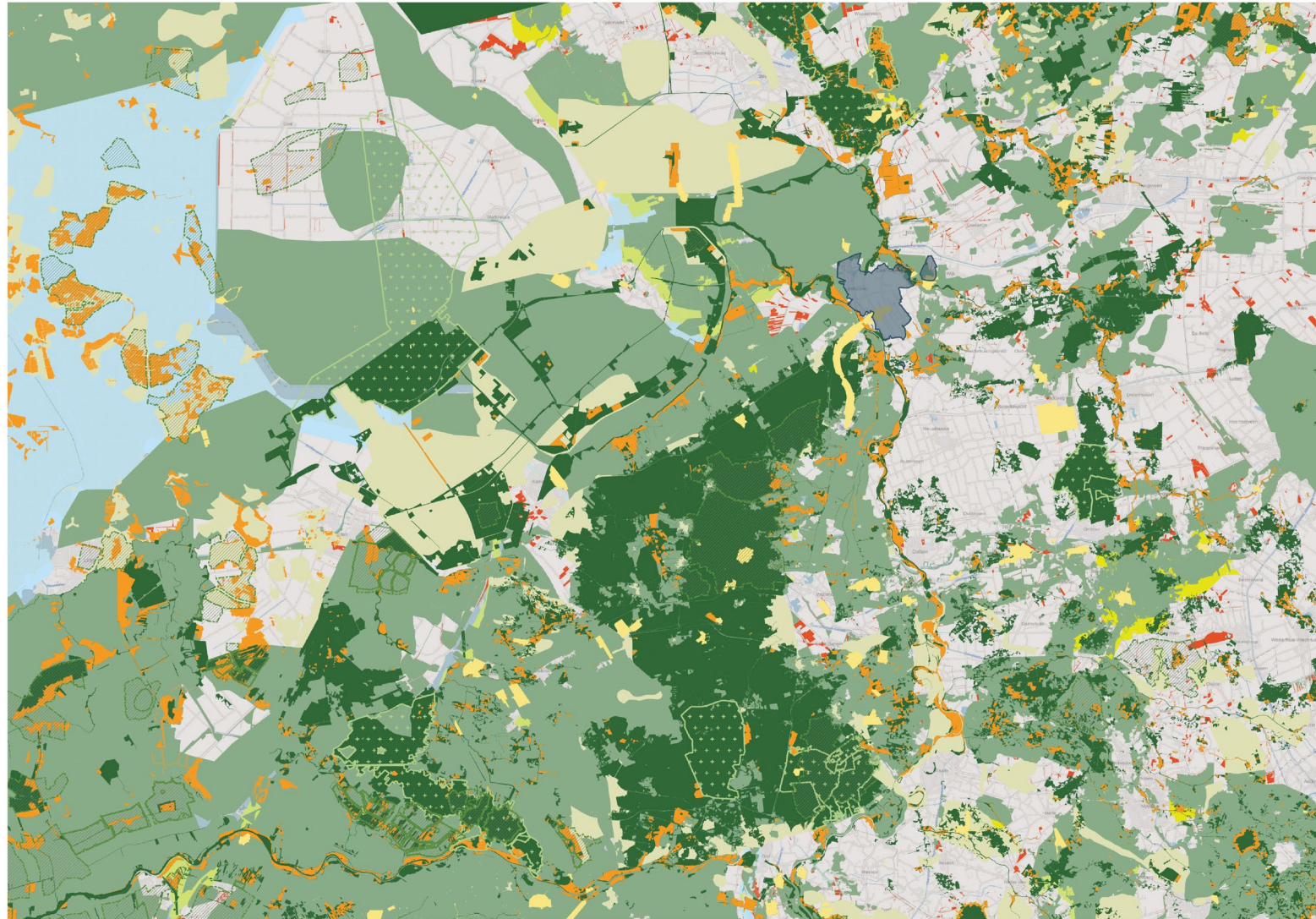
How can we strengthen the connection between the city and the surrounding communities through forest urbanism?

How to improve the urban forest to benefit people's living experience?

Methodology



Zwolle landscape potential



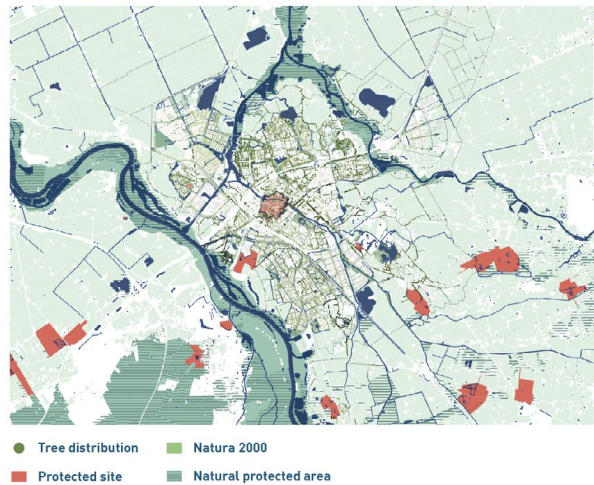
Urban Forest History & Development Process

Tree Cover Loss in Netherlands



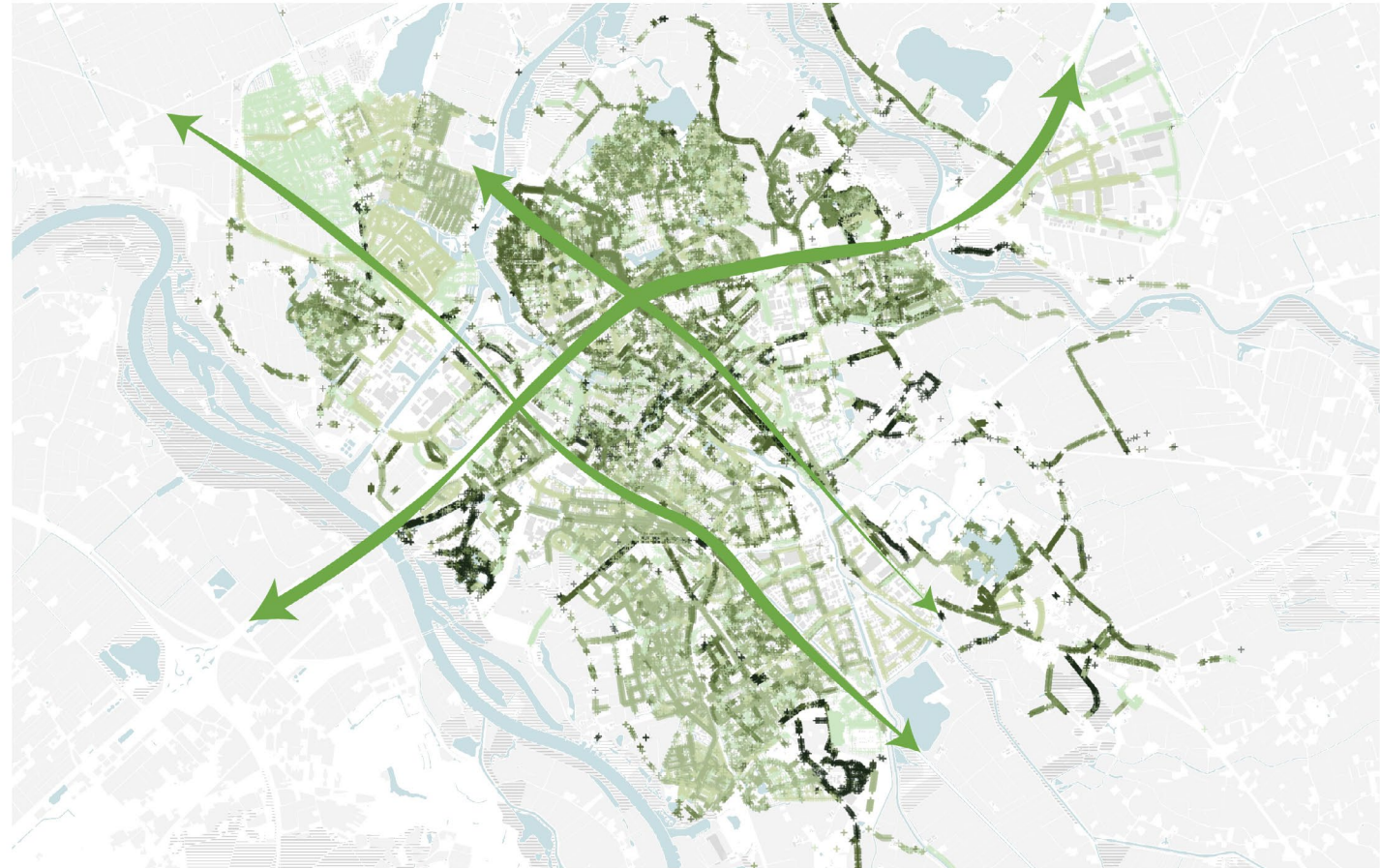
From 2001 to 2021, Netherlands lost **29.1kha** of tree cover, equivalent to a **4.9%** decrease in tree cover since 2000.

Current Landscape Potential



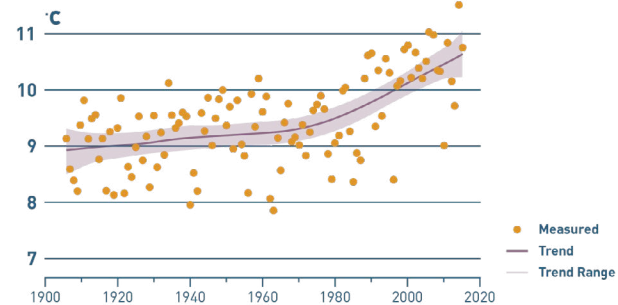
The Urban Tree Planting Map

The year of planting

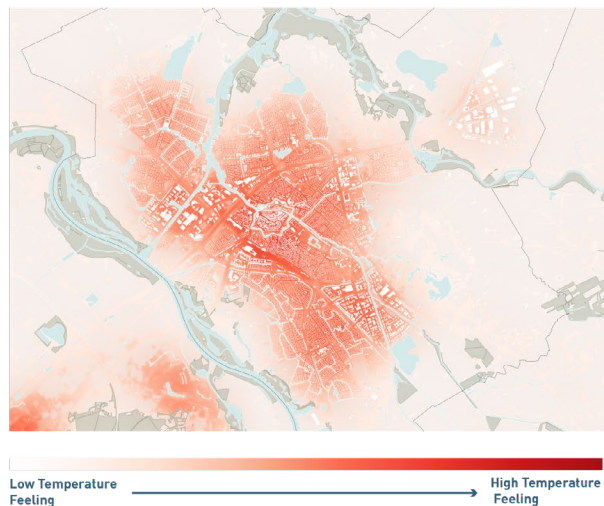


Urban Building Expansion Map & Heat Street Area

Average Temperature in the Zwolle



How Warm Feel in Zwolle?



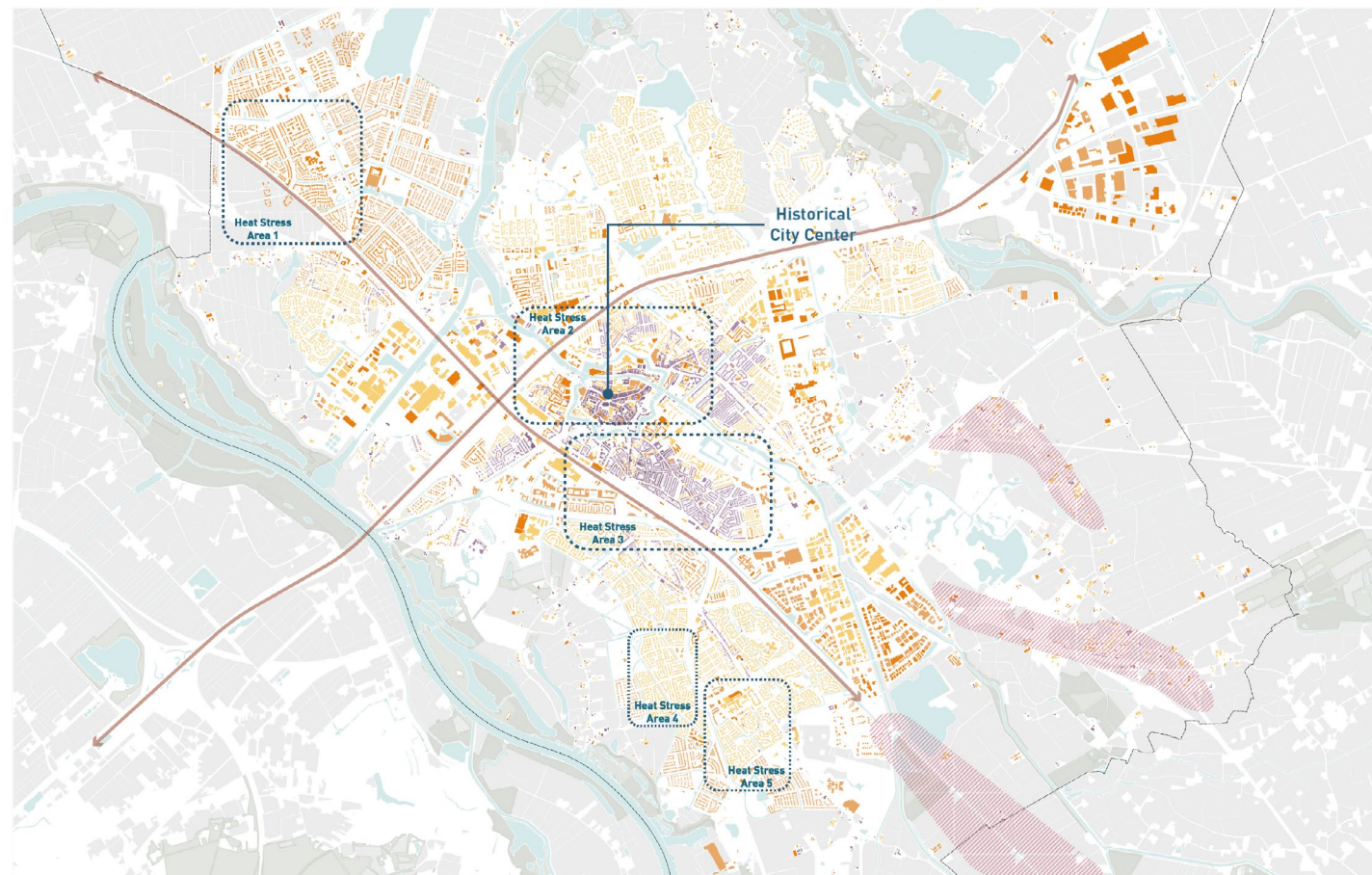
The Urban Expansion (Architecture Development)

Urban Build-up Area

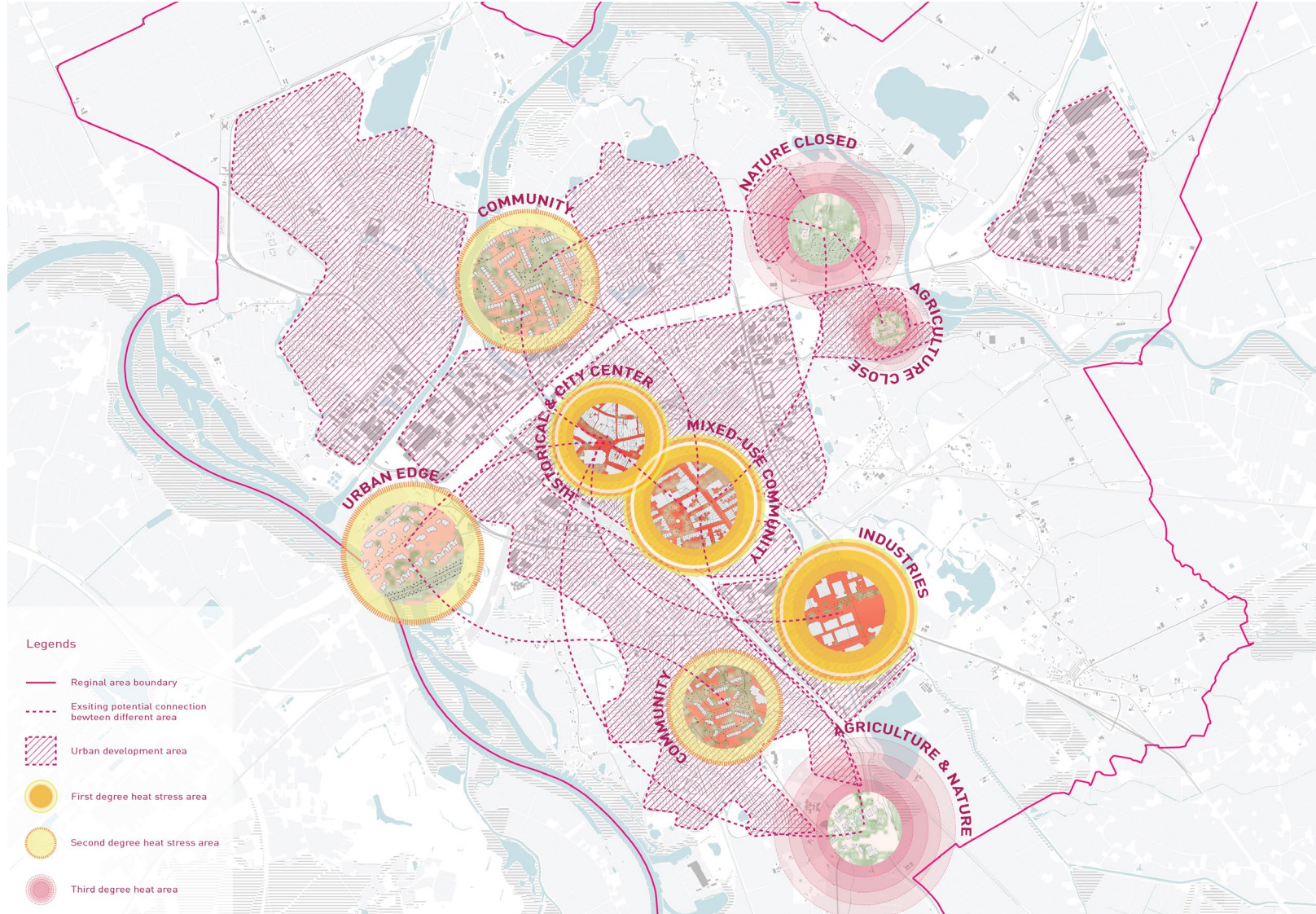


↔ Main Transportation Way

Future Possible Develop Area



Research Site Selection



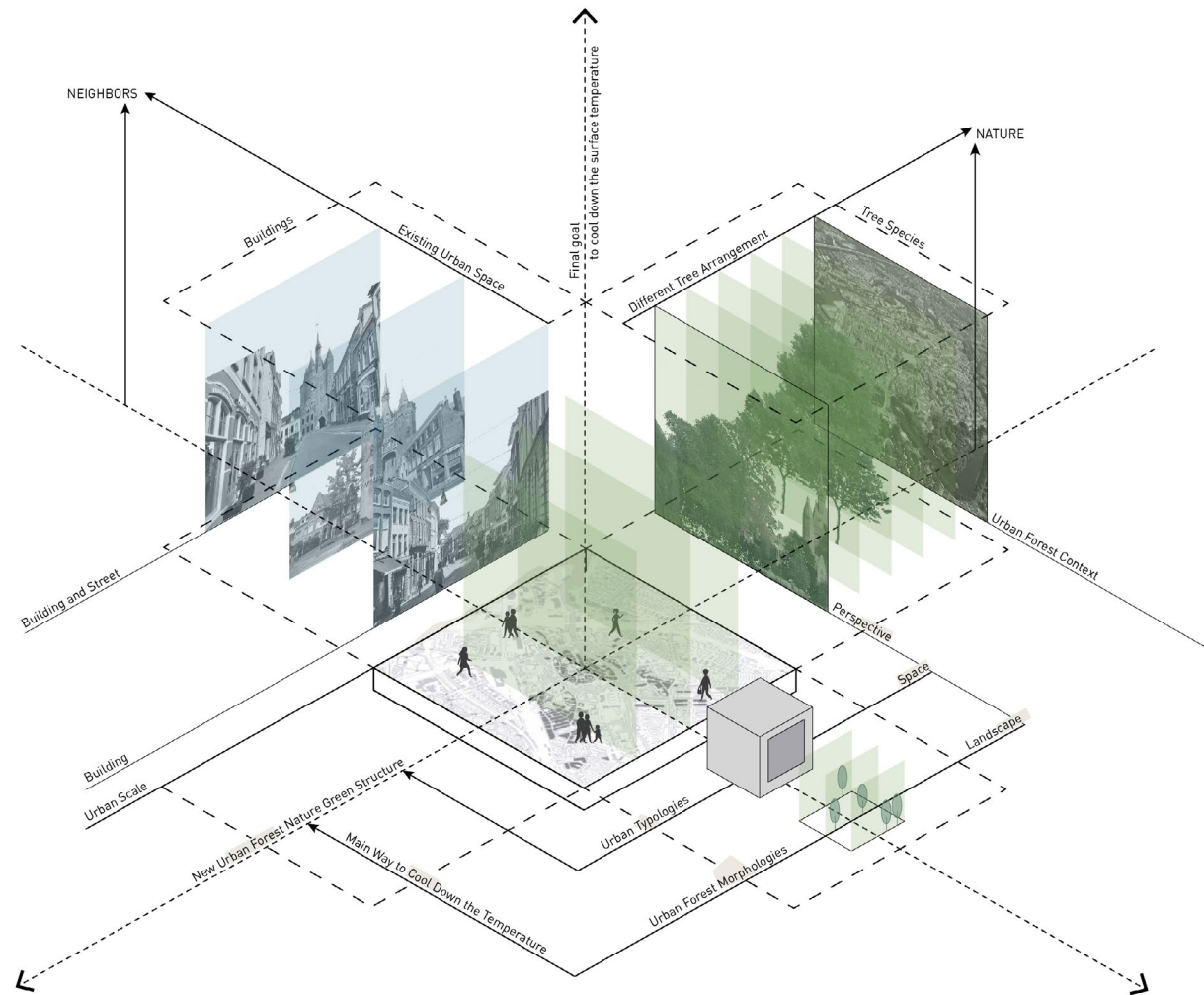
Surface
Ground
Temperature



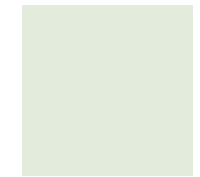
High

Low

Research Introduction



Urban Layer



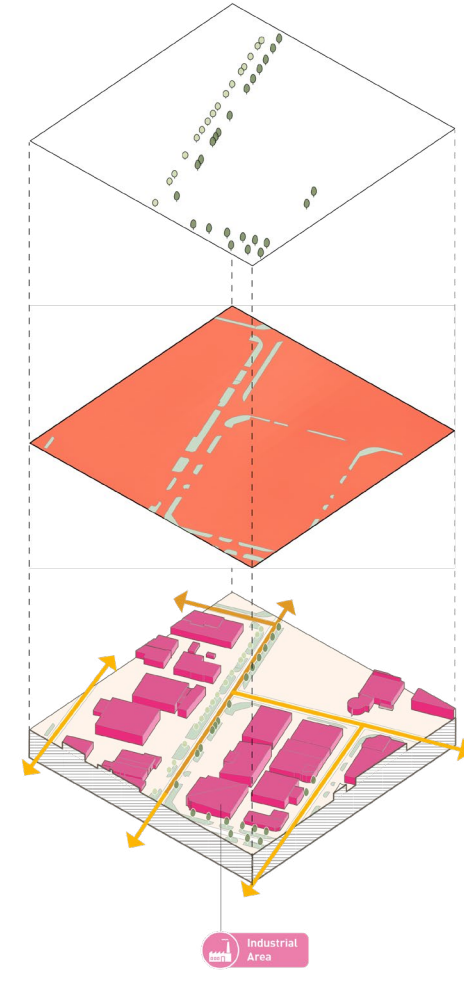
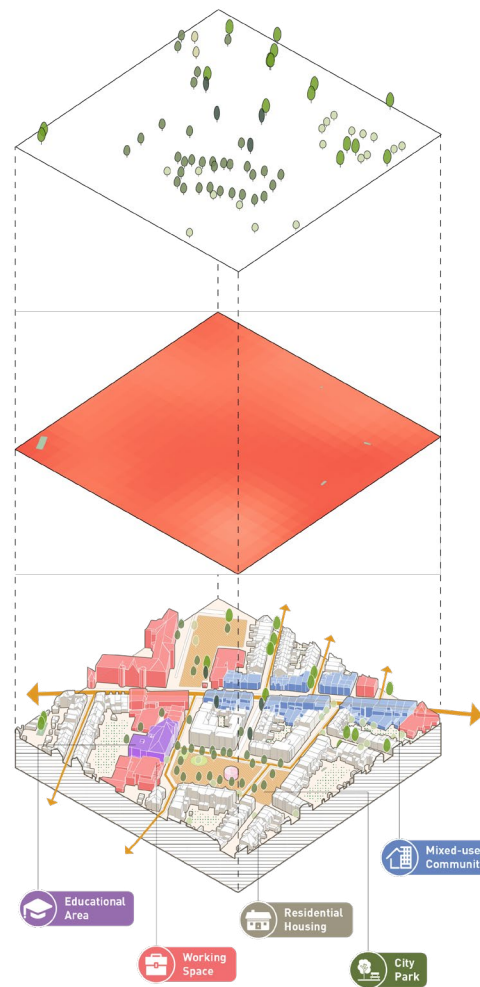
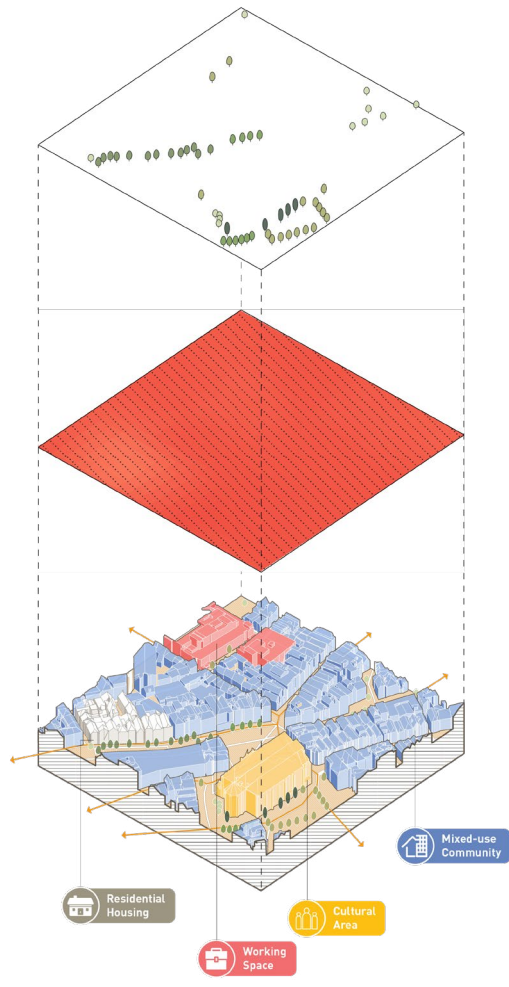
Landscape Layer



Research Result

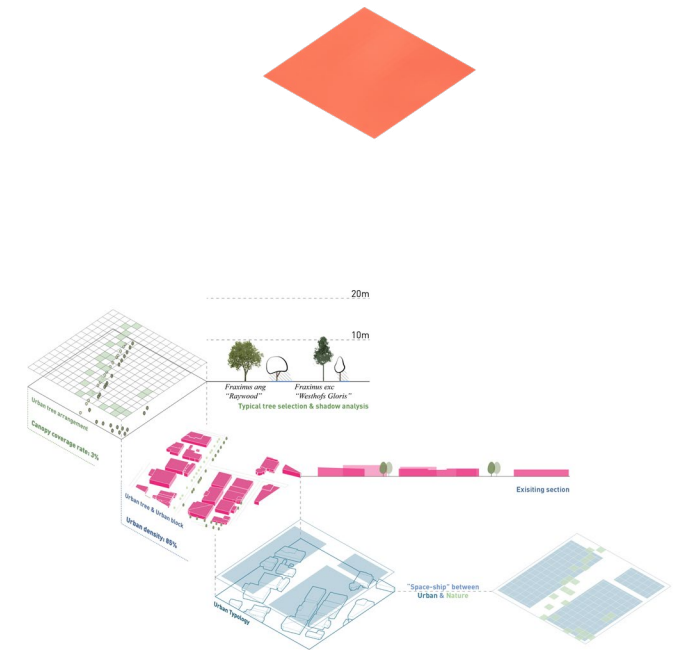
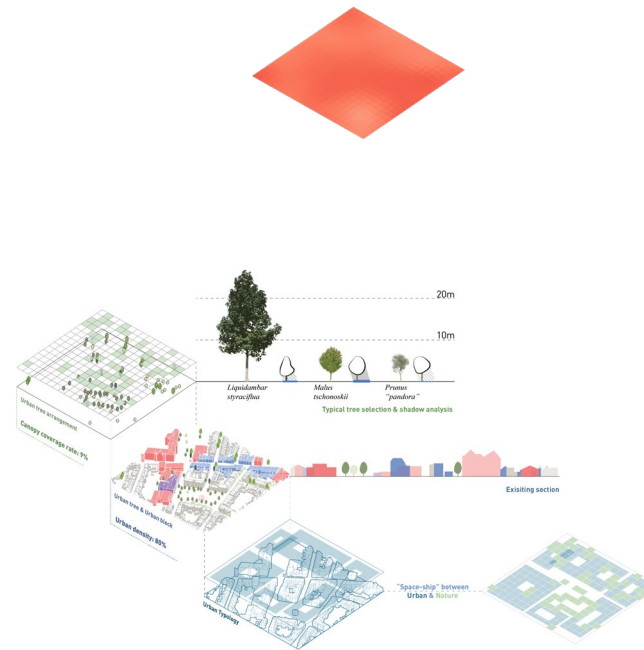
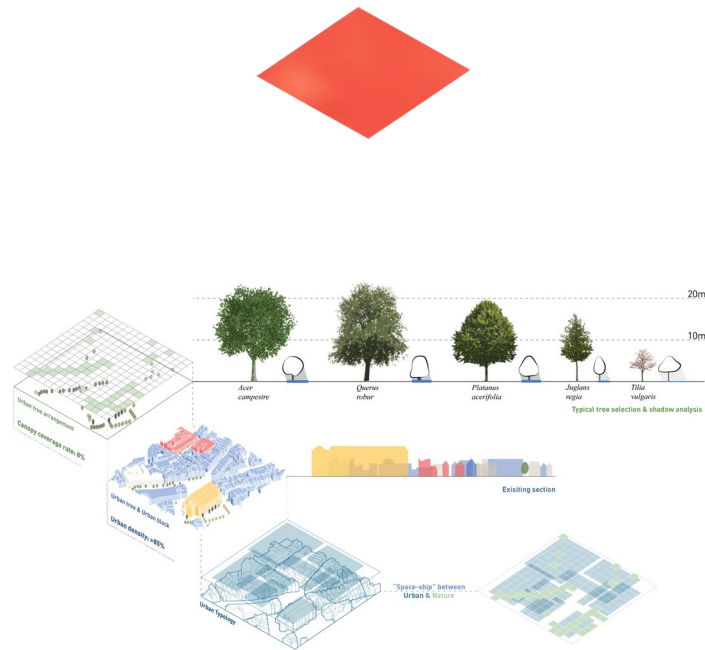
Existing Typology Research

First Group: Extreme High Temperature Area



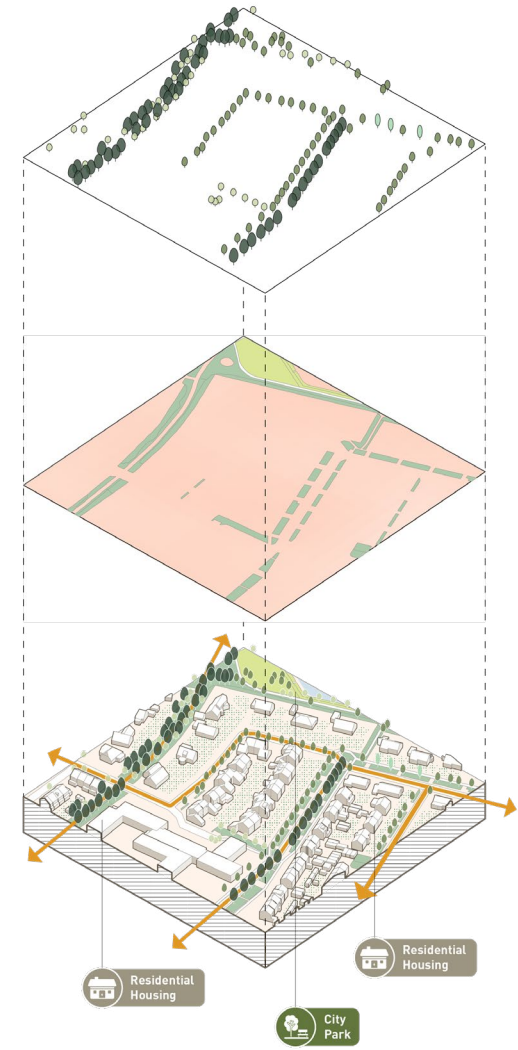
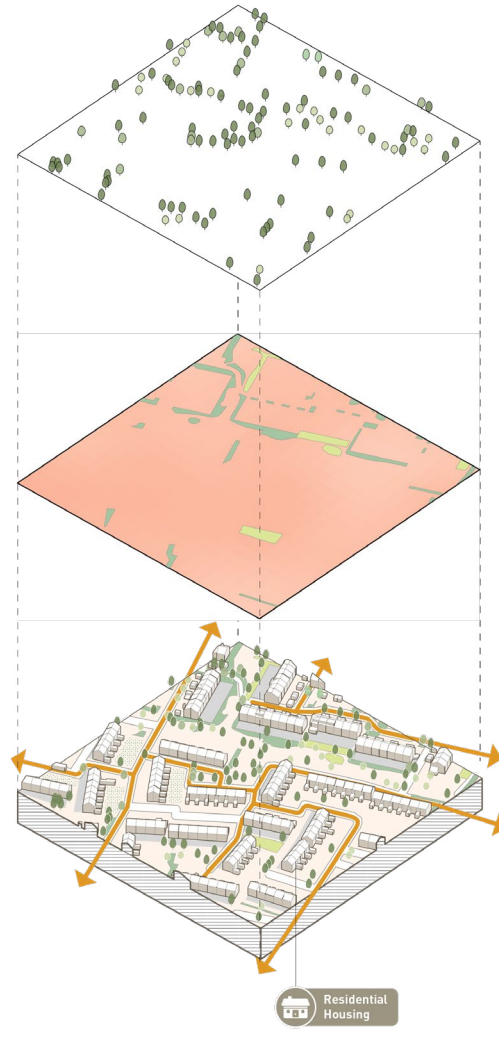
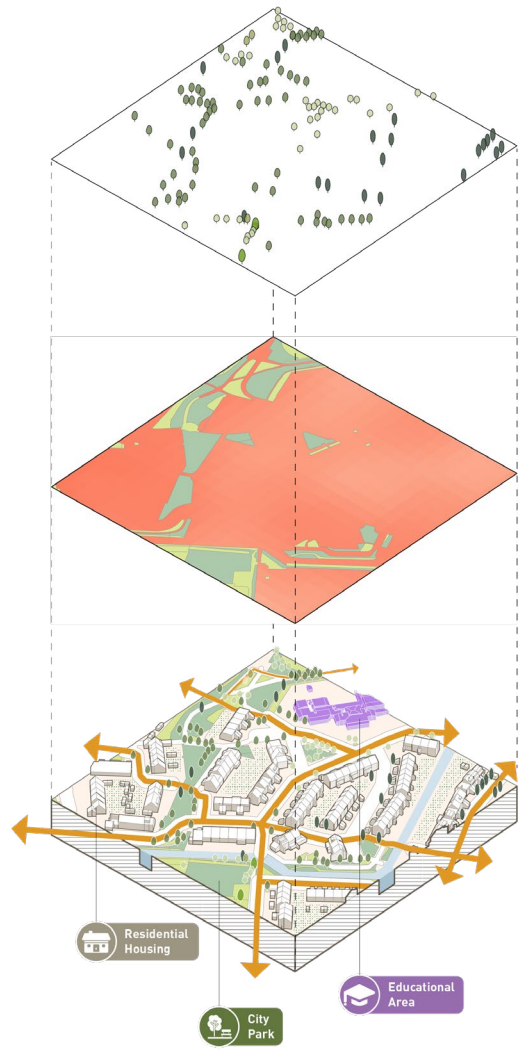
Existing Typology Research

First Group: Extreme High Temperature Area



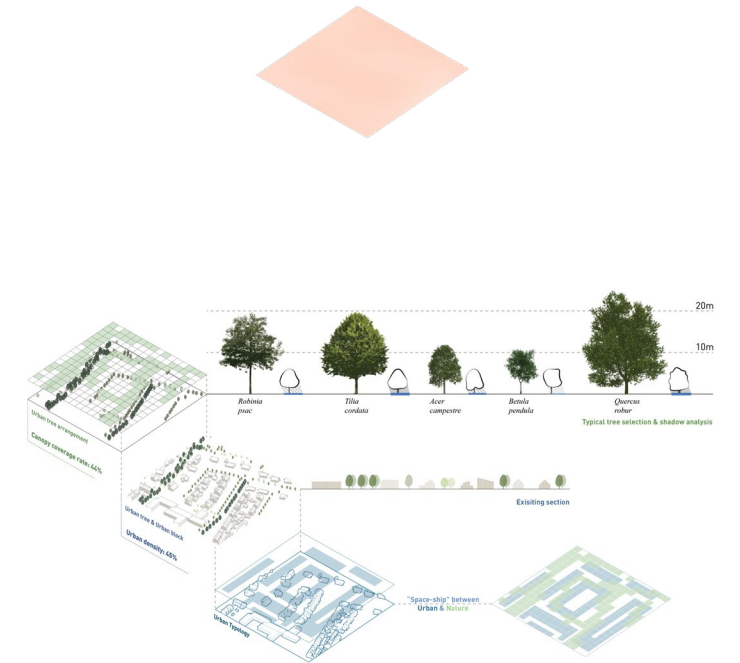
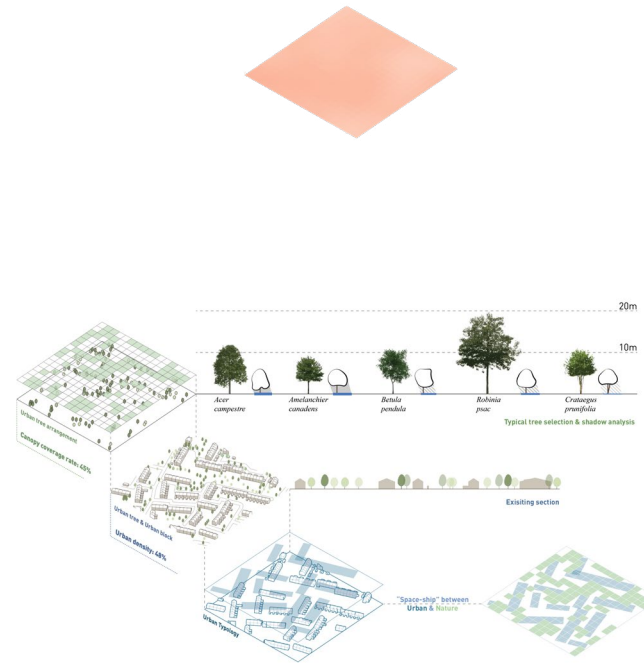
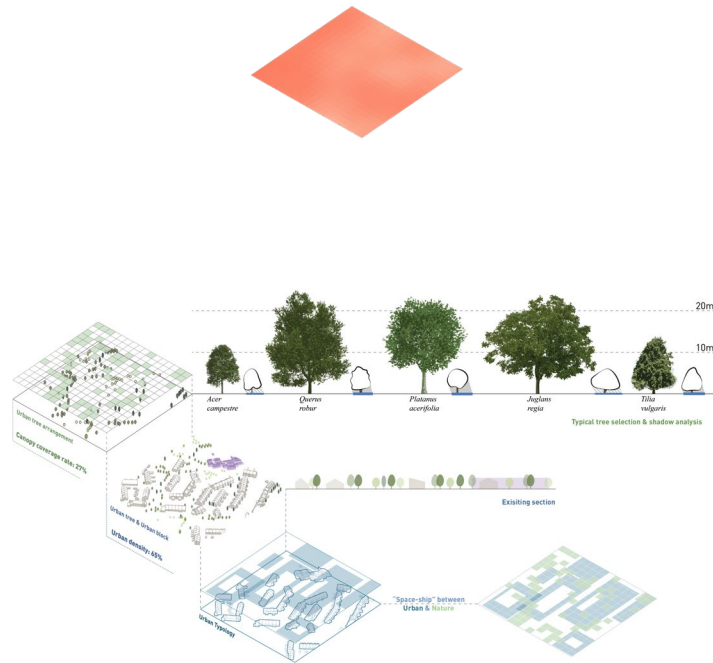
Existing Typology Research

Second Group: High Temperature Area



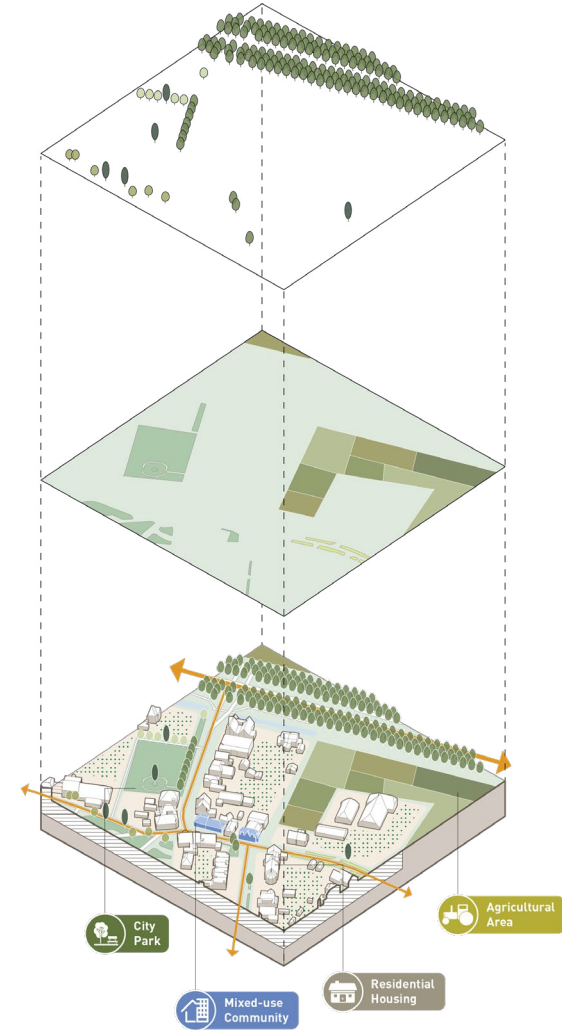
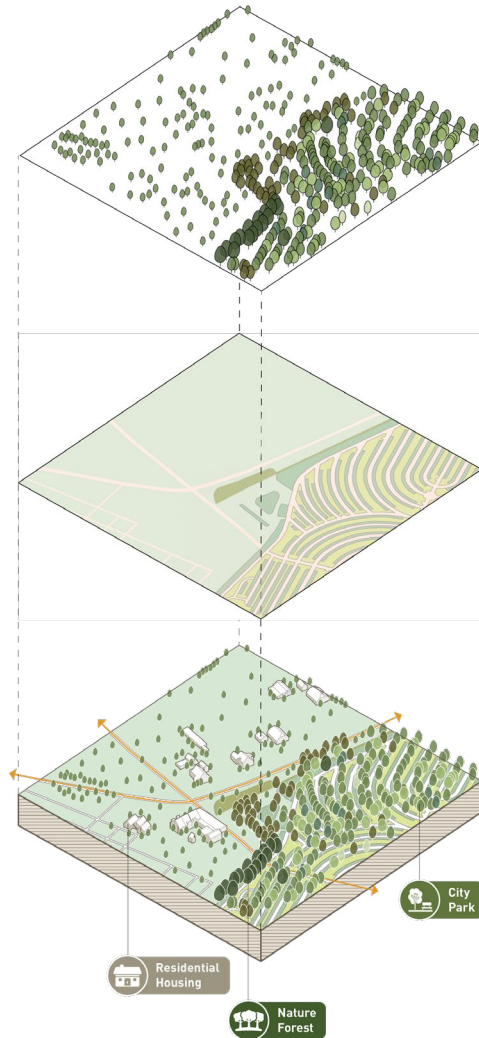
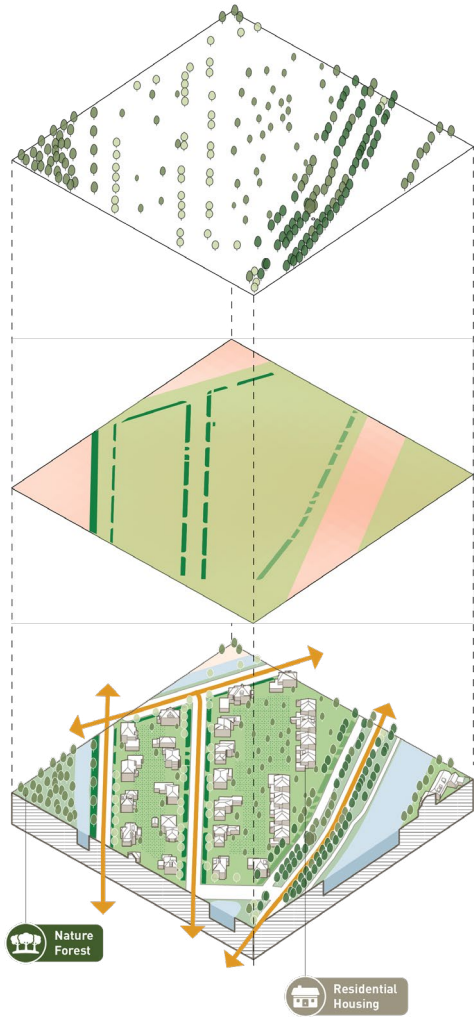
Existing Typology Research

Second Group: High Temperature Area



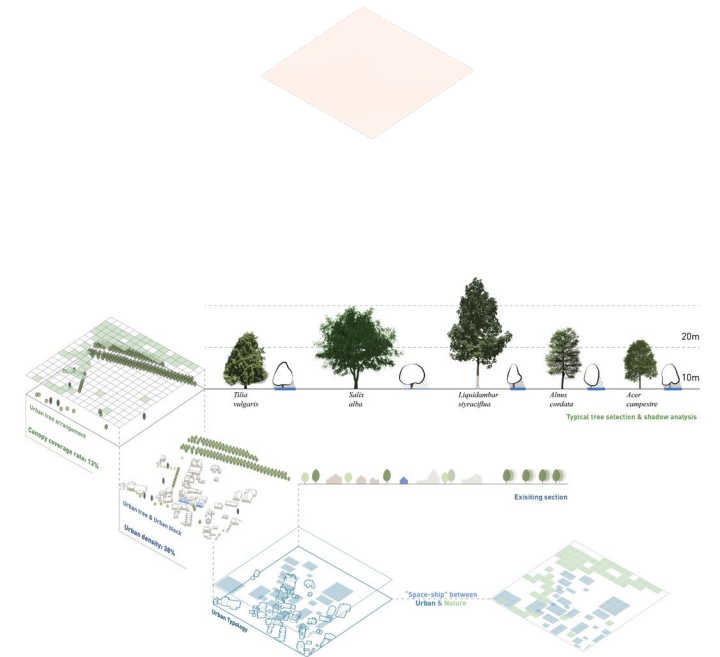
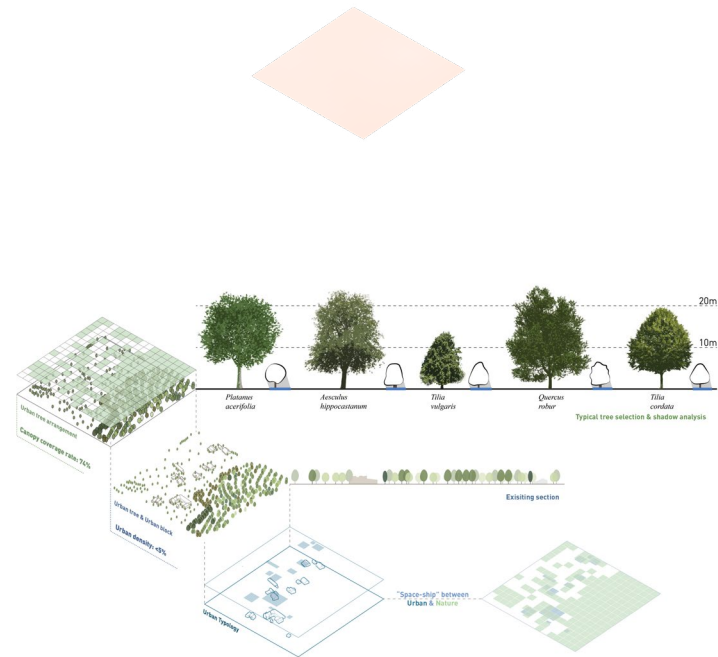
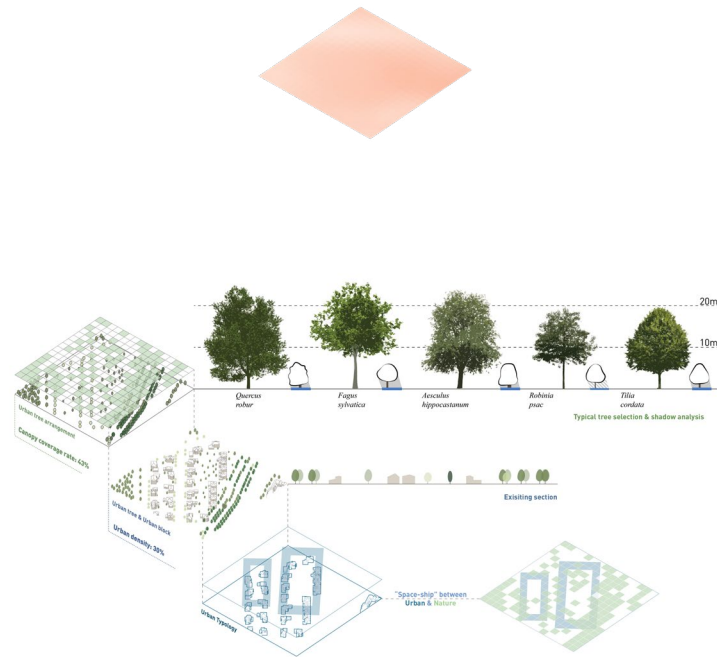
Existing Typology Research

Third Group: Low Temperature Area

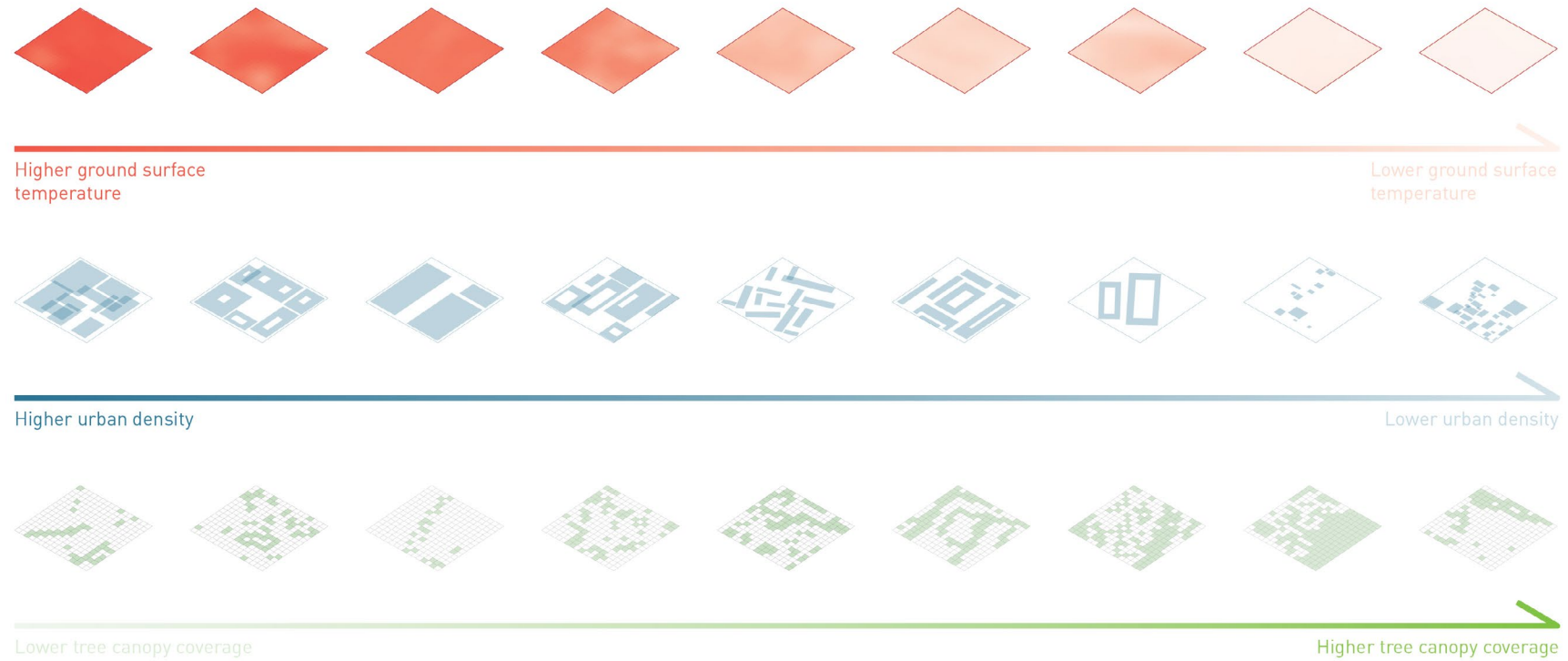


Existing Typology Research

Third Group: Low Temperature Area



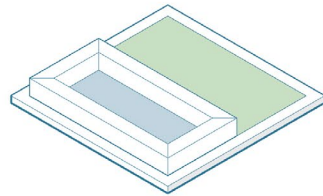
Research Conclusion



Research Result 1: Landscape & Urban Relationship

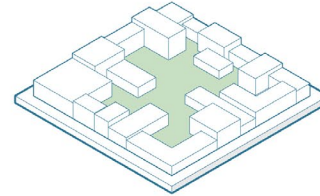
01

Large open green



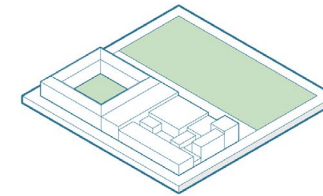
02

Center core green



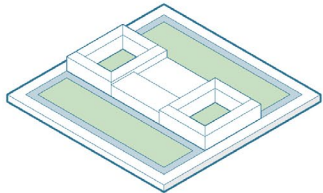
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Open and dotted green combination



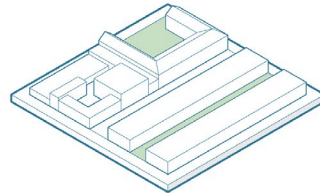
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Street and community interaction



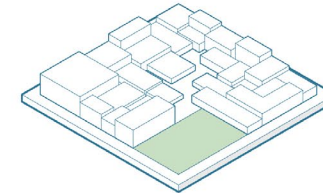
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Decentralized interlaced



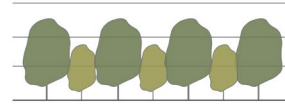
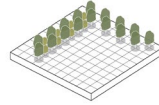
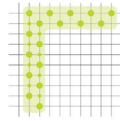
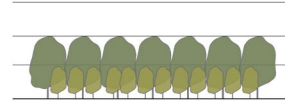
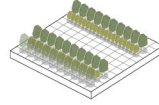
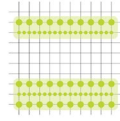
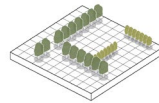
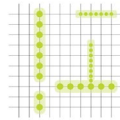
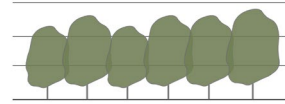
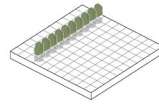
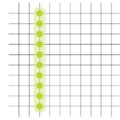
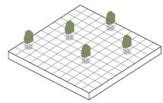
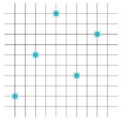
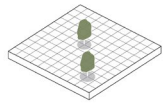
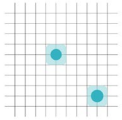
06

neighborhood green node creation

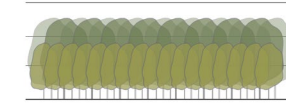
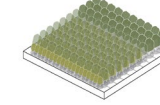
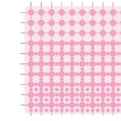
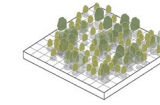
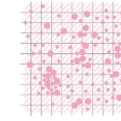
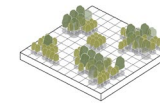
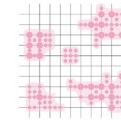
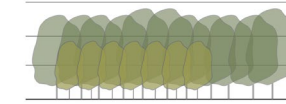
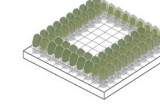
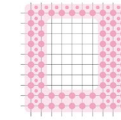


Research Result 2: Tree Arrangement

Point



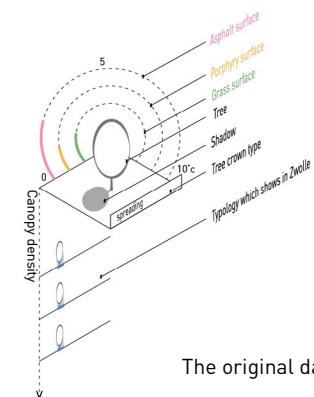
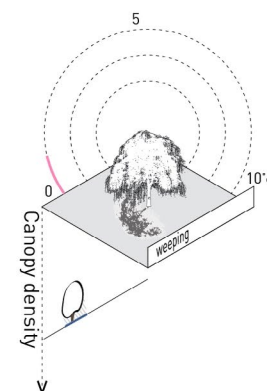
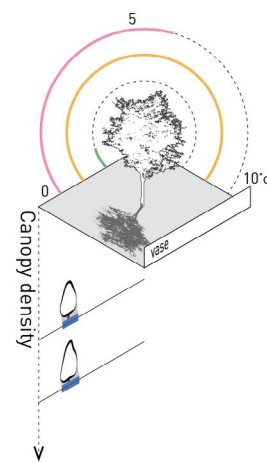
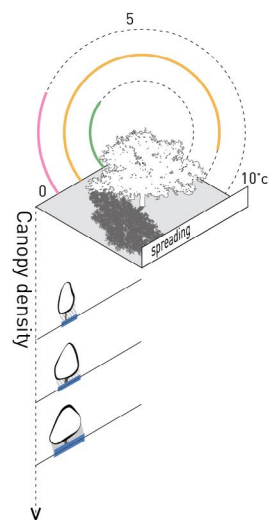
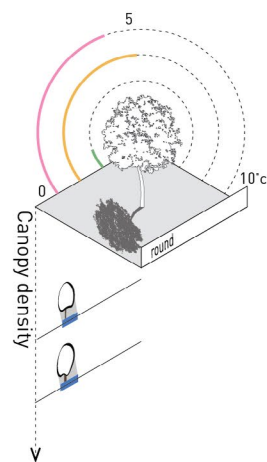
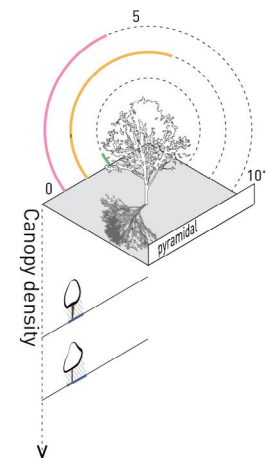
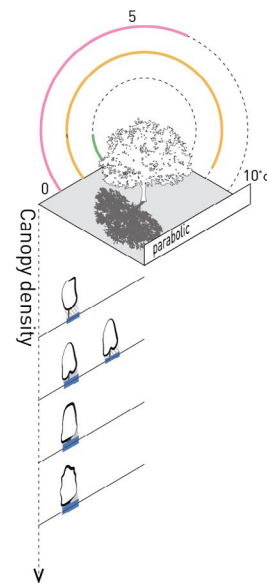
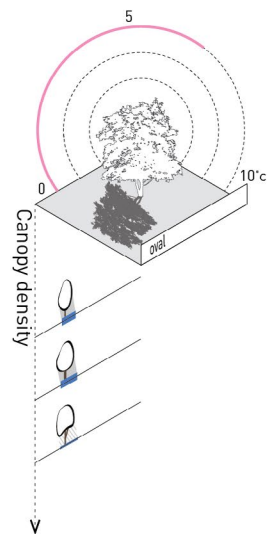
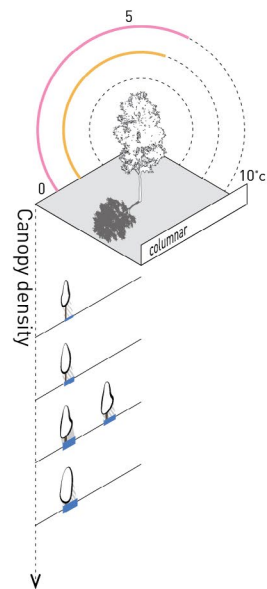
Linear



Group

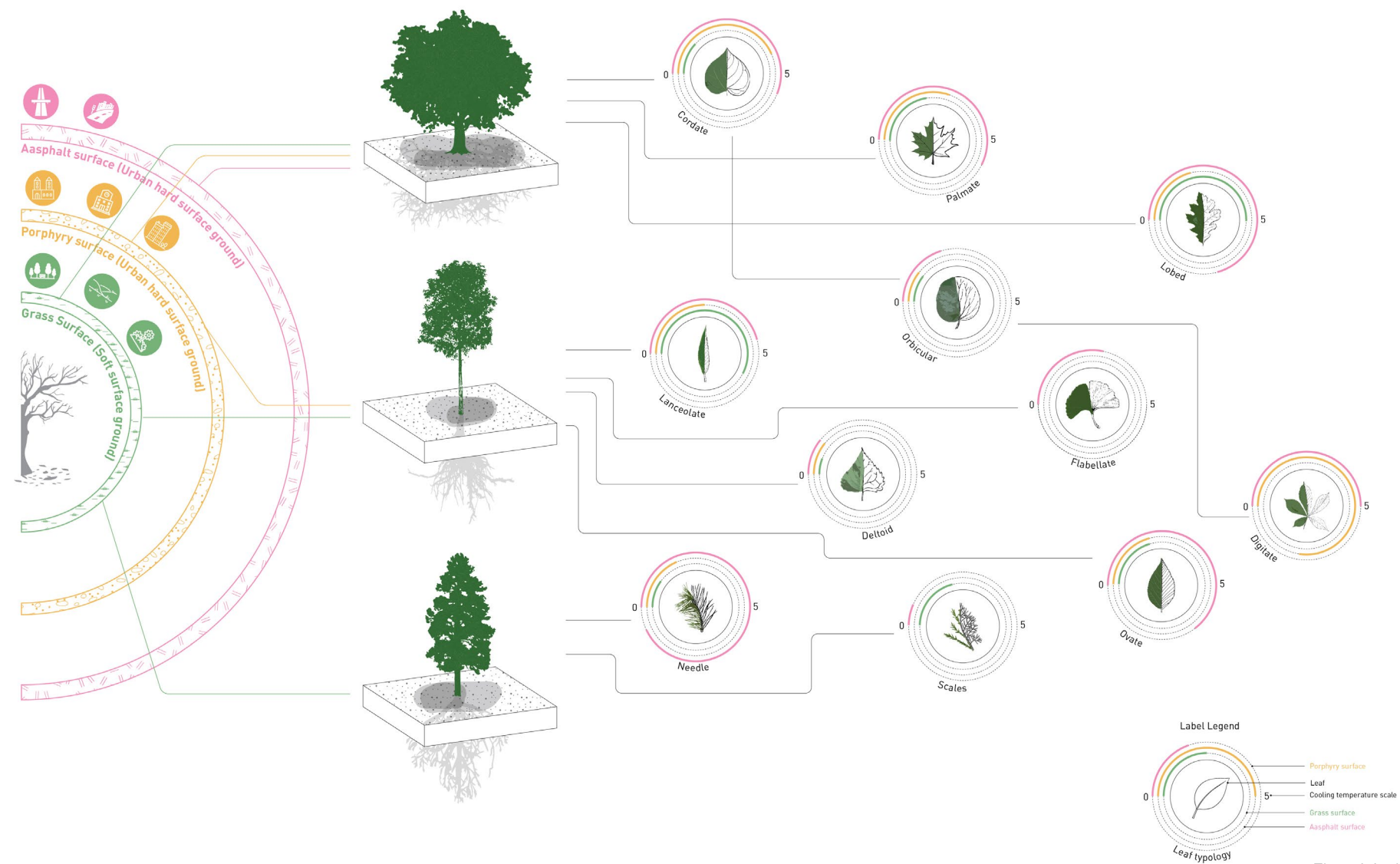
Research Result 3: Tree Selection

Tree Crown



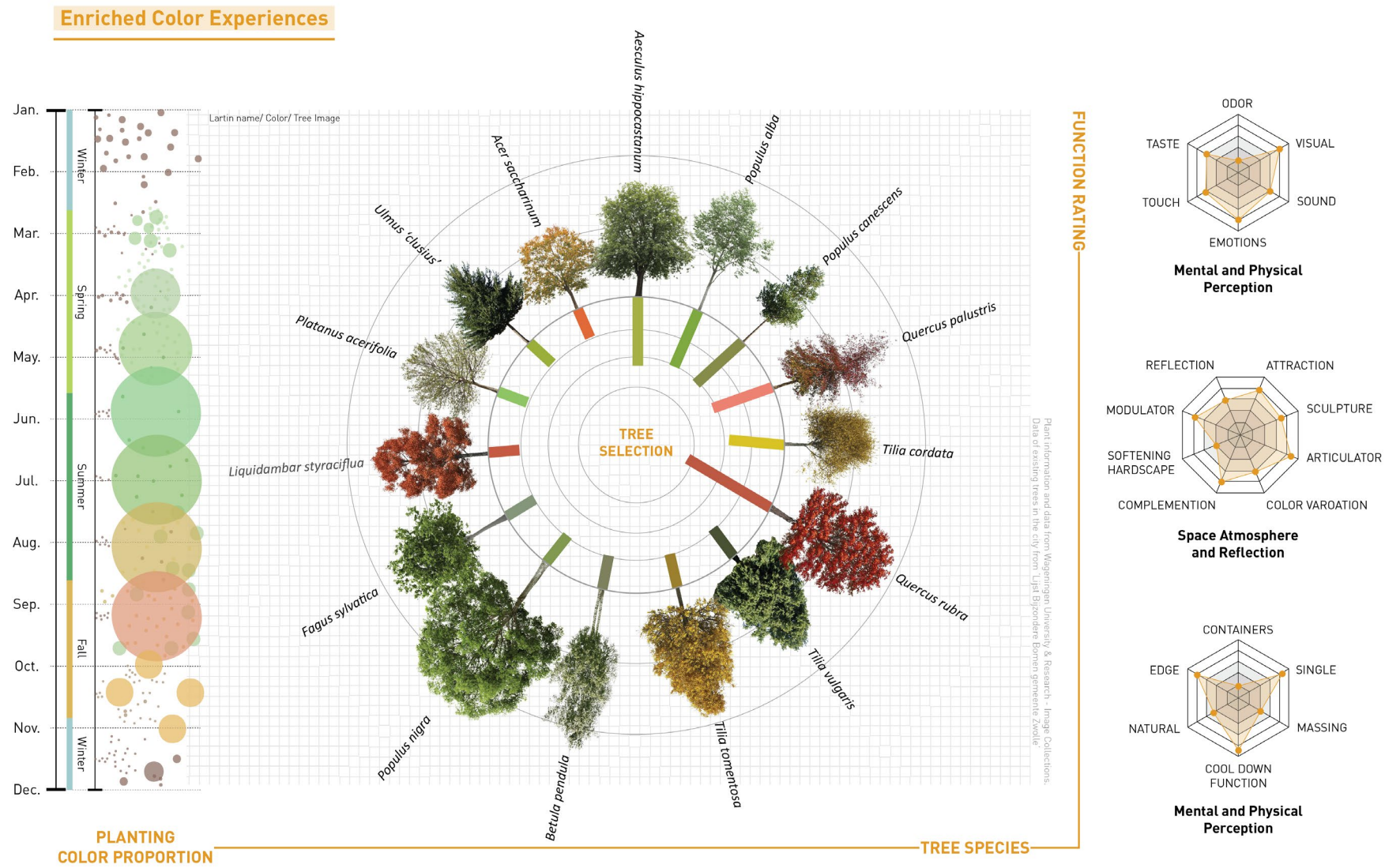
The original data [Speak et al., 2020]

Leaf Shape

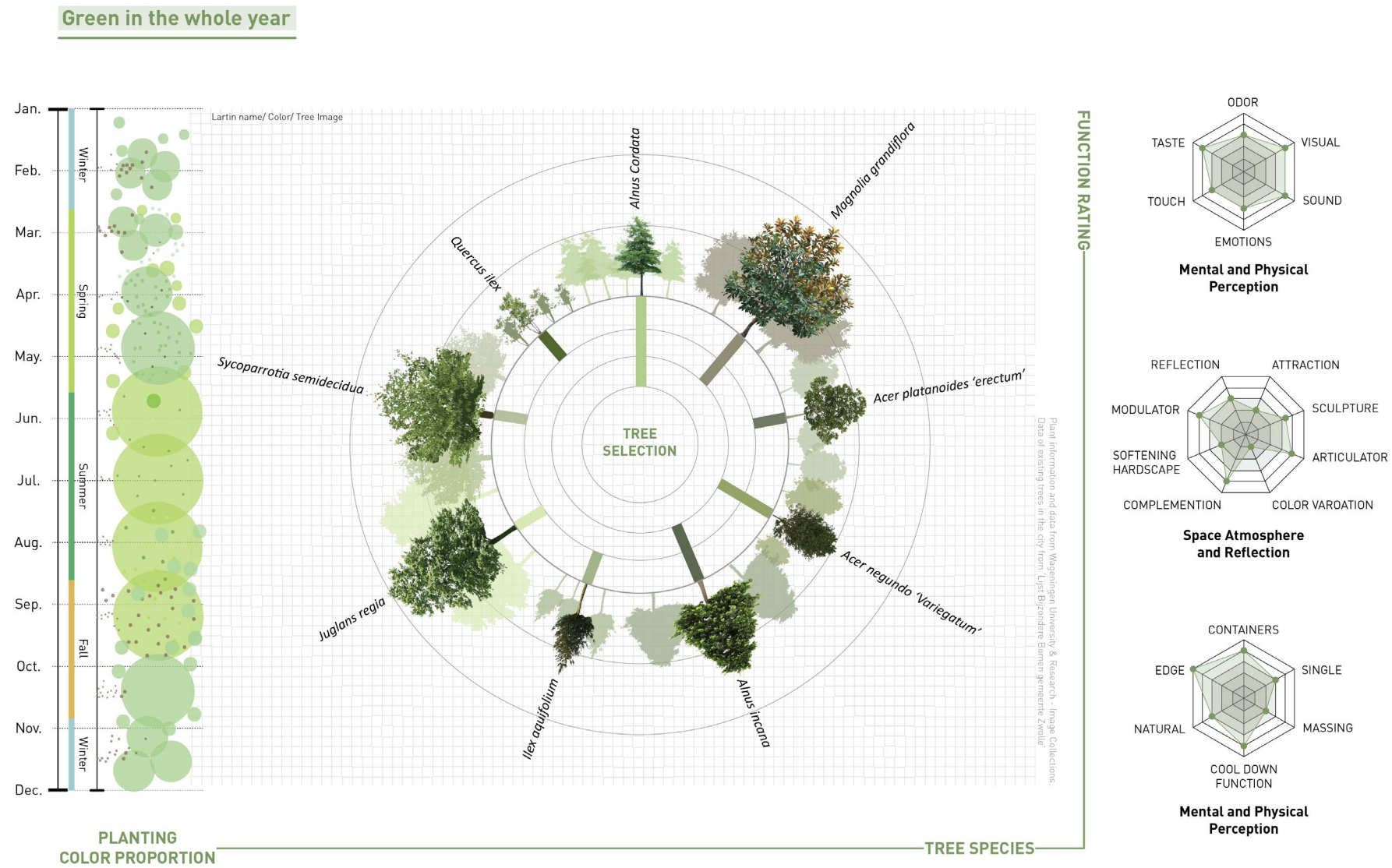


The original data [Speak et al., 2020]

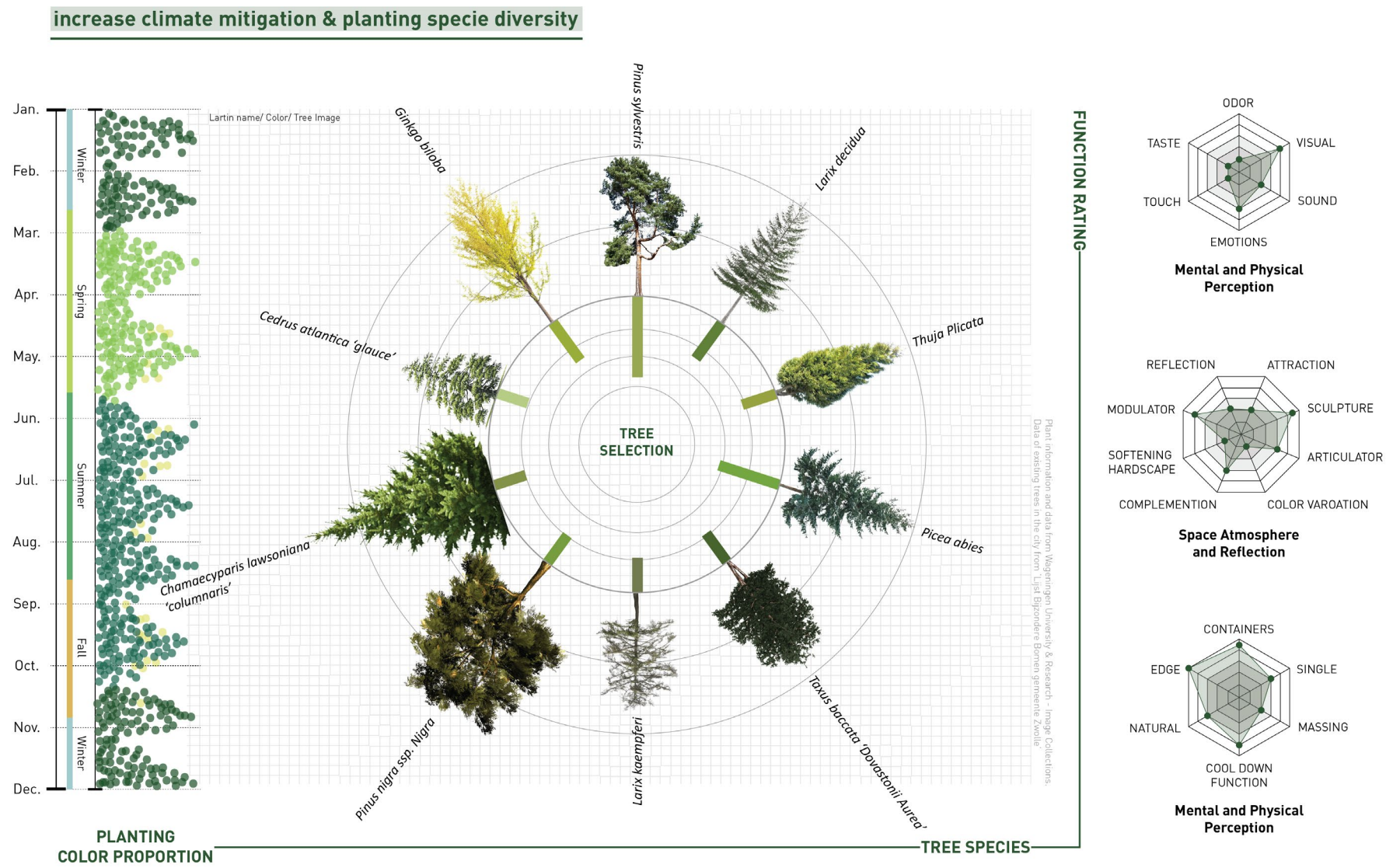
Detail
Planting
Selection



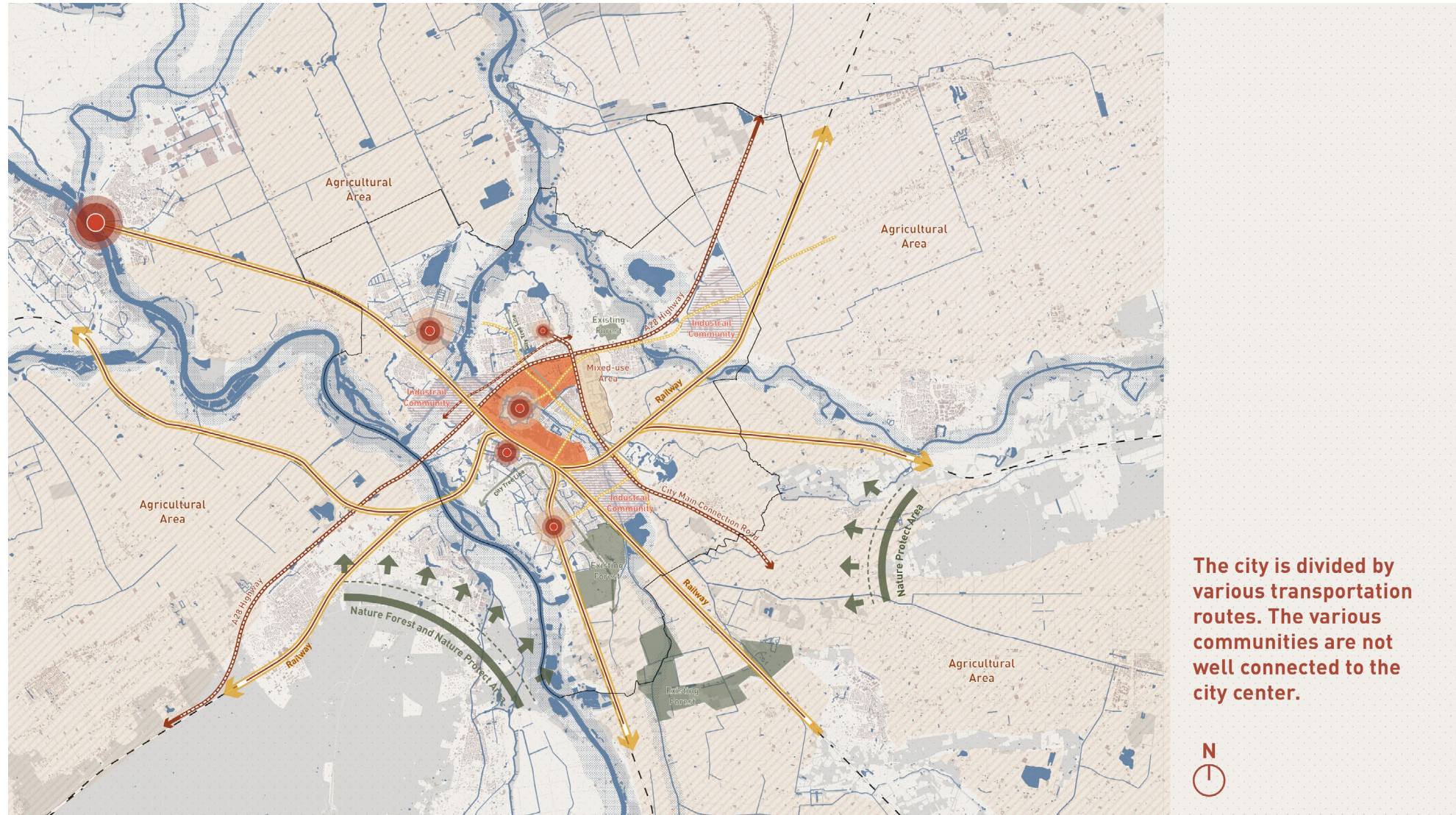
Detail
Planting
Selection



Detail
Planting
Selection

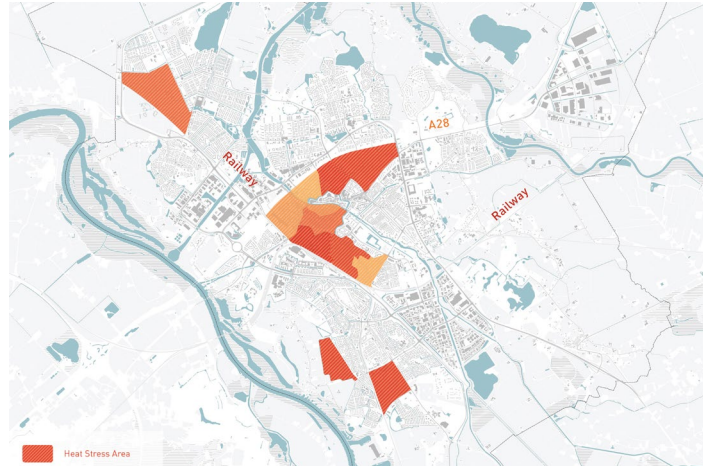


Regional Scale Analysis

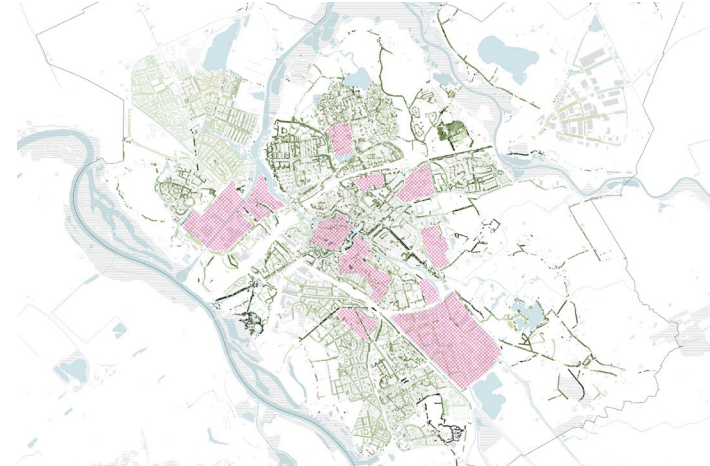


Understanding Where Urban Forest Needs

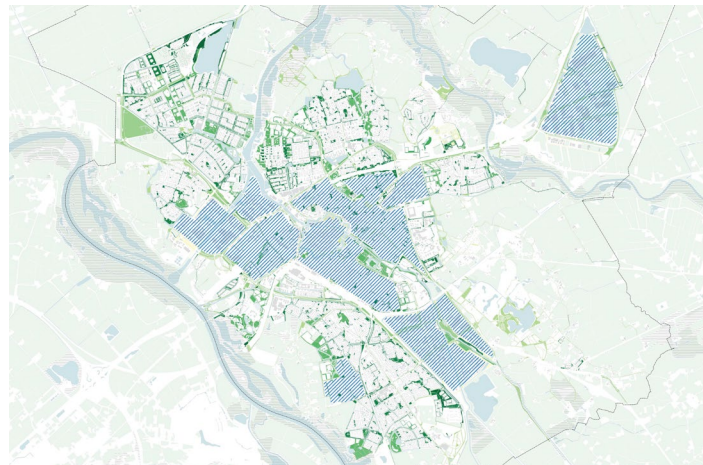
Heat stress area



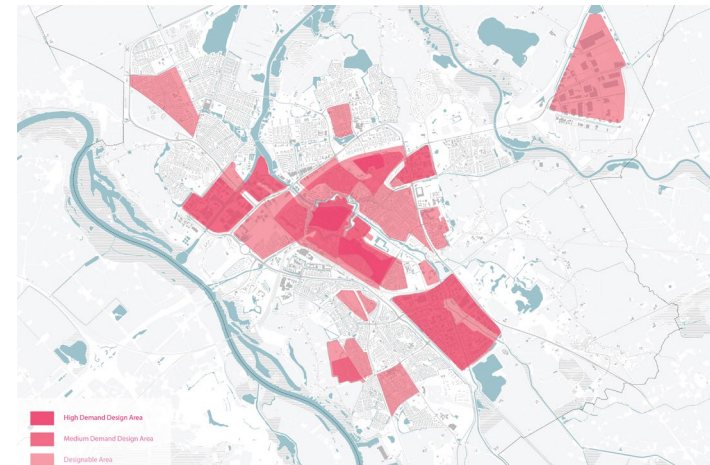
High density built-up

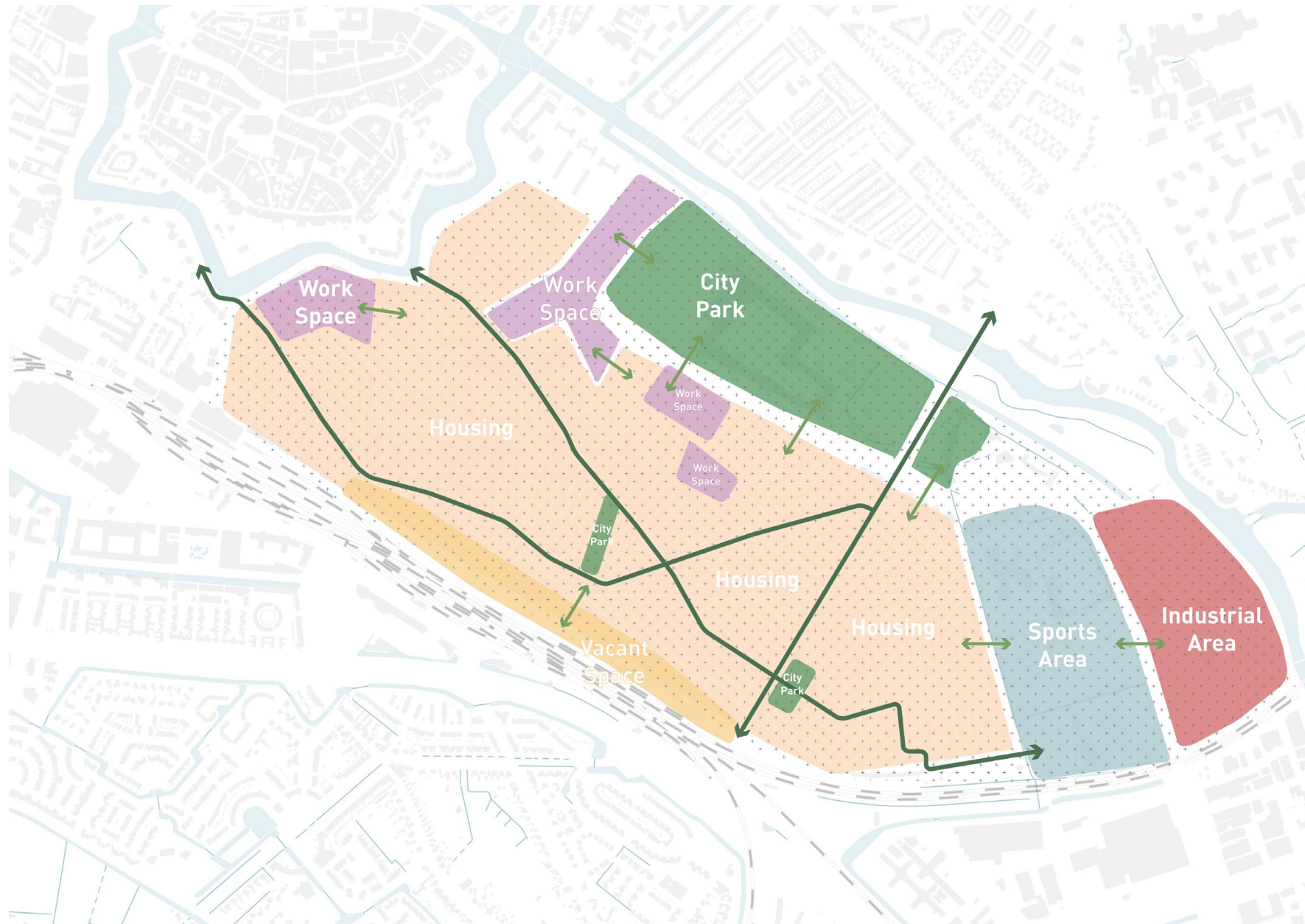


Lack of tree

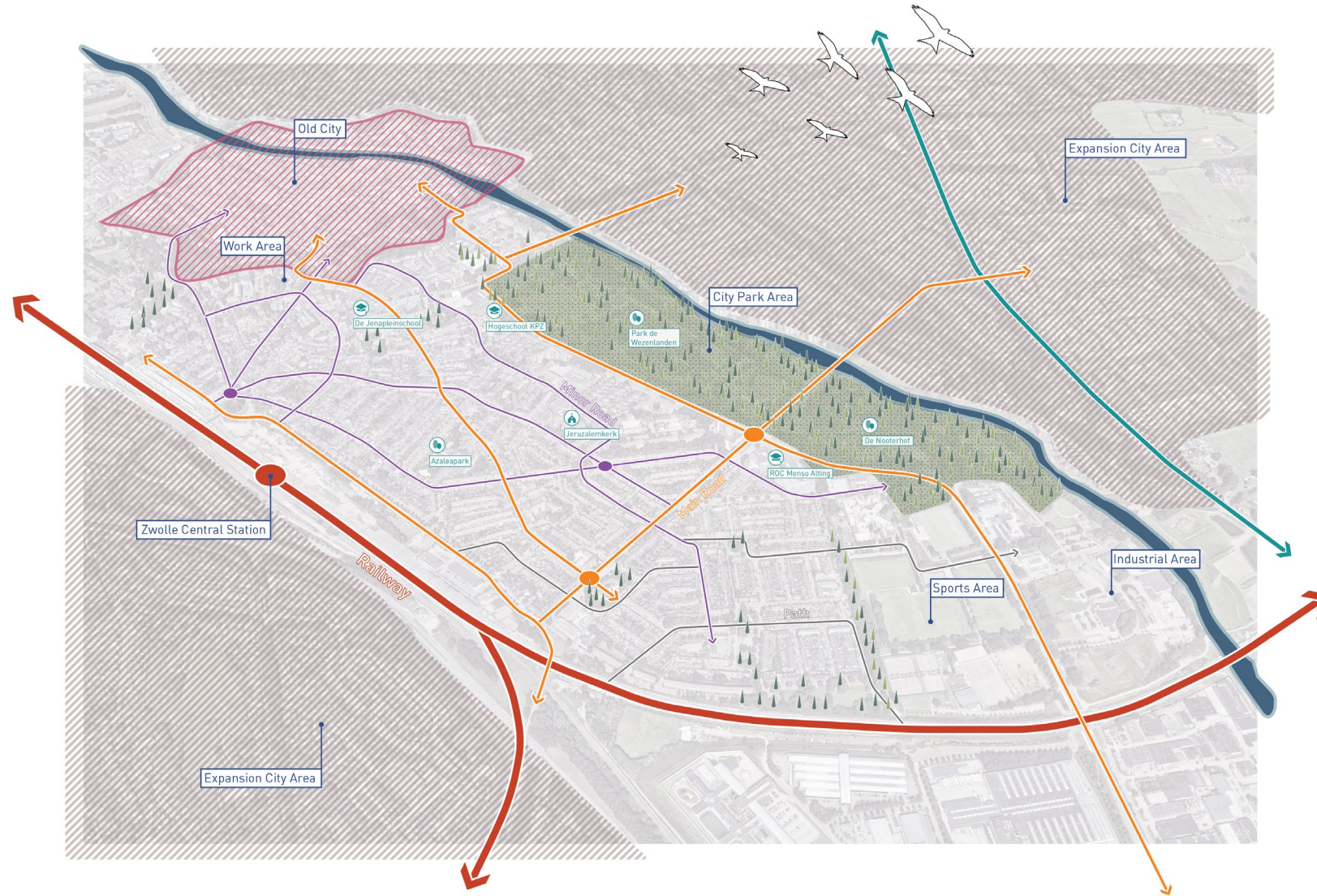


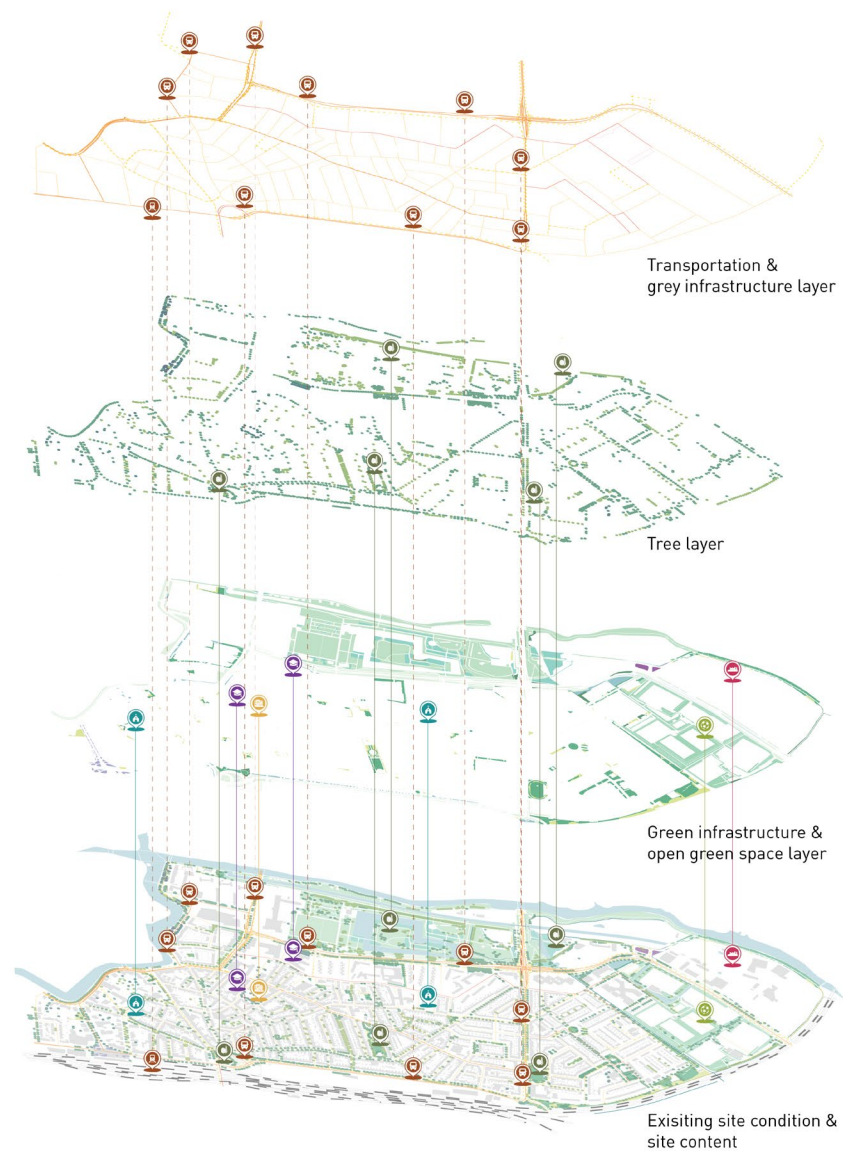
Overlap result





Site Analysis





LEGENDS

Existing road condition

- Street Level 1
- Street Level 2
- Street Level 3
- Street Level 4
- Bike Lane

Existing tree distribution (Planting year)

- 1827 - 1899
- 1900 - 1949
- 1950 - 1999
- 2000-2023

Existing planting area

- Companies and industry
- Cemetery
- Inner city
- Outside area
- Main green areas
- High-quality office facilities
- Park
- Sport
- Mall
- Residential area, offices and schools

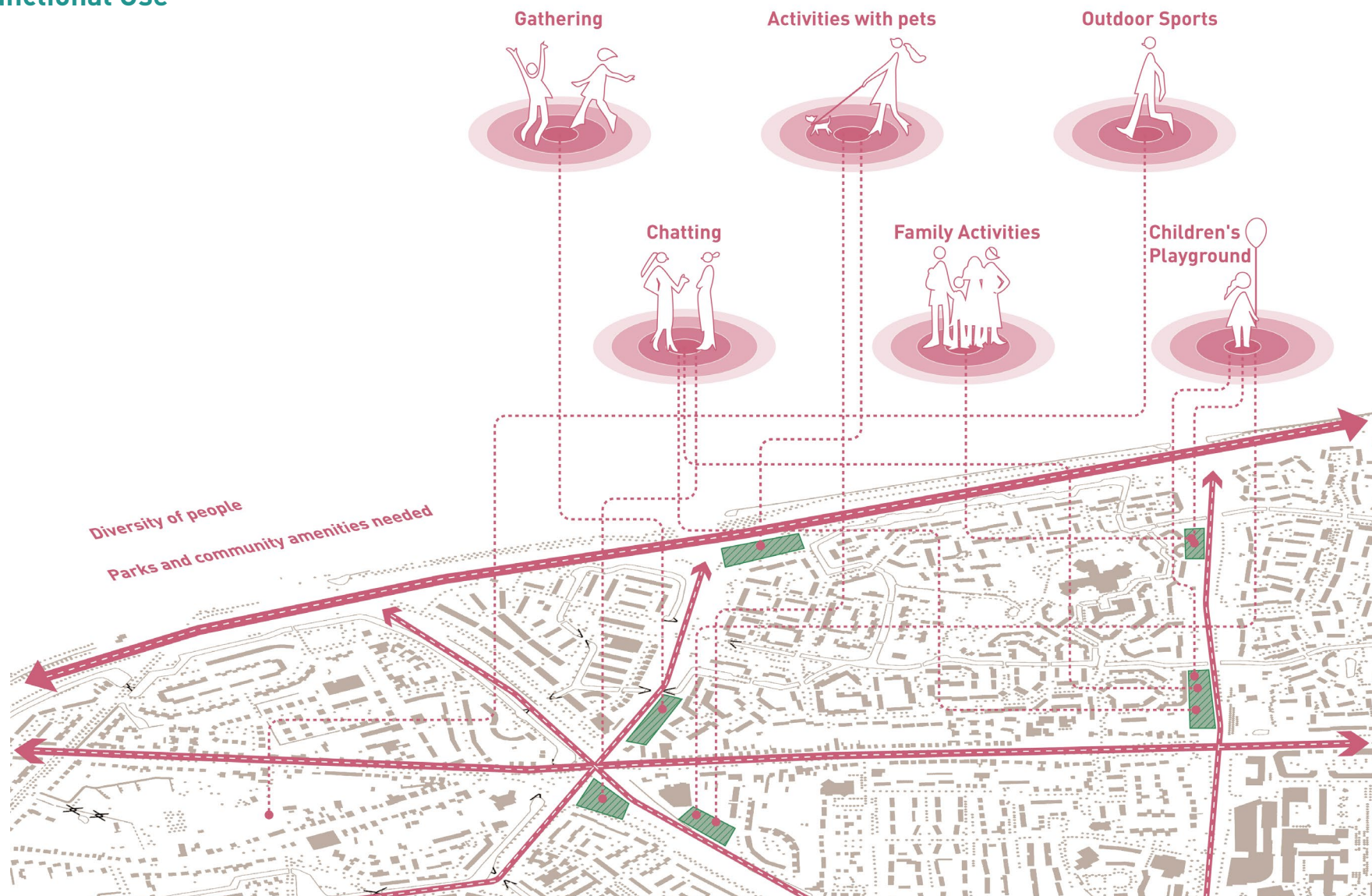
Existing grassland area

- Companies and industry
- Cemetery
- Inner city
- Outside area
- Main green areas
- High-quality office facilities
- Park
- Sport
- Mall
- Residential area, offices and schools

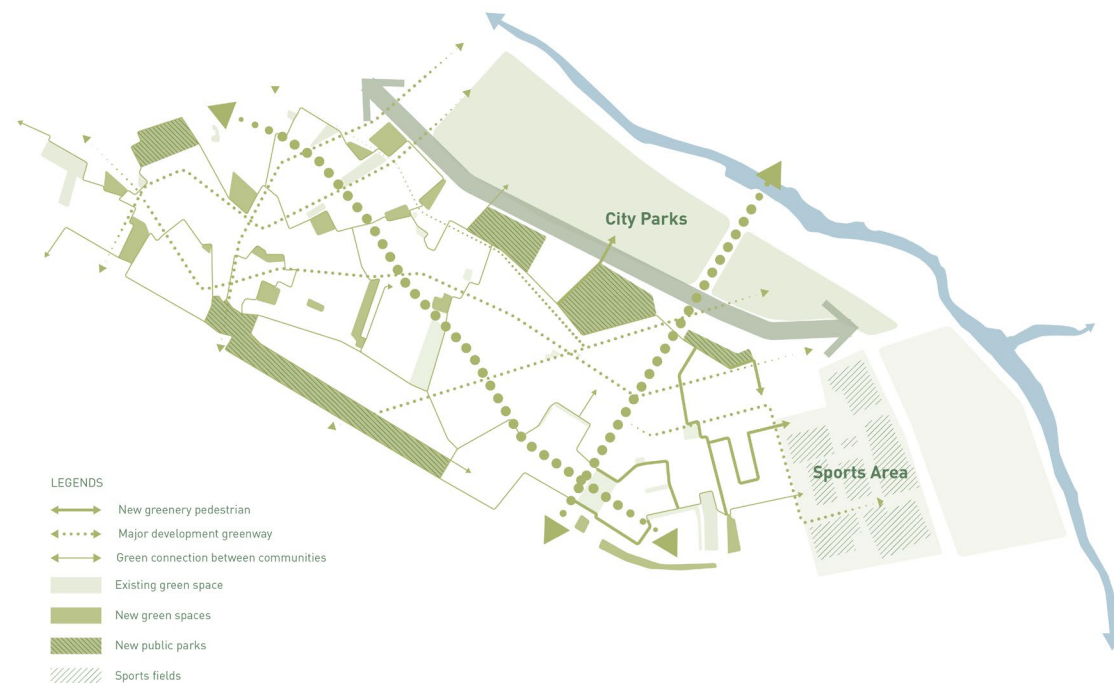
Existing site content

- Industrial area
- Sports area
- City park
- Bus stop/station
- Church / Cultural area
- School / campus
- City plaza
- Train station

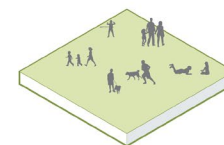
Site Exsiting Functional Use



Design Strategy 1: Green Loop

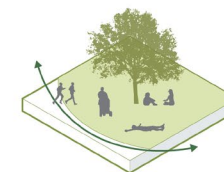


Activity space/
social hub



G1. Large open green spaces

Impact: €



G2. Optimization of hard-surfaced parking lots

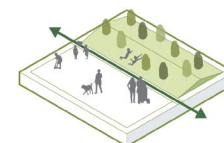
Impact: €



G3. Pollinator gardens

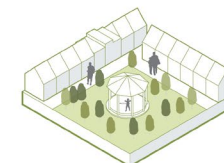
Impact: € €

Leisure/relax
space



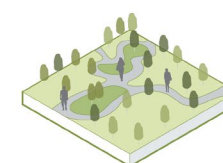
G4. Plaza and parks

Impact: €



G5. City plazas

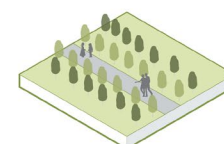
Impact: €



G6. Enriched circulation parks

Impact: € €

Nature
atmosphere



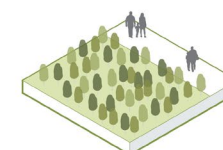
G7. Straight line urban forest

Impact: €



G8. Multi-experience urban forest parks

Impact: € €



G9. Large group of tree near urban area

Impact: € €

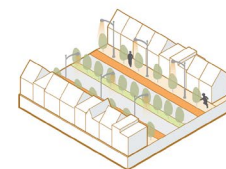


Existing green loop

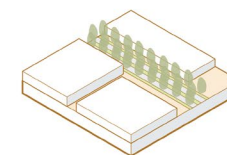
Design Strategy 2: Transportation & Circulation



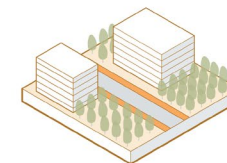
Street



C1. Trees along the road



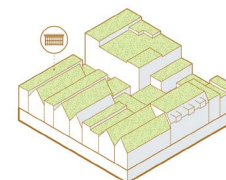
C2. Adding more green to industrial areas



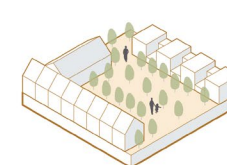
C3. Urban forest group near the high building density area



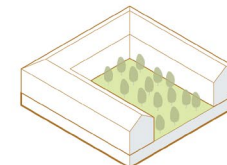
Community/ residential



C4. Green roofs/green facades



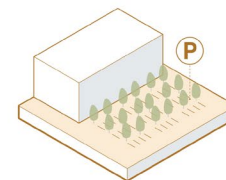
C5. Adding more green to community area



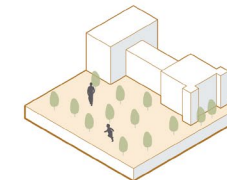
C6. Open the closed residential 'circle'



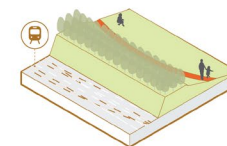
Mixed-use



C7. Optimization of hard-surfaced parking lots



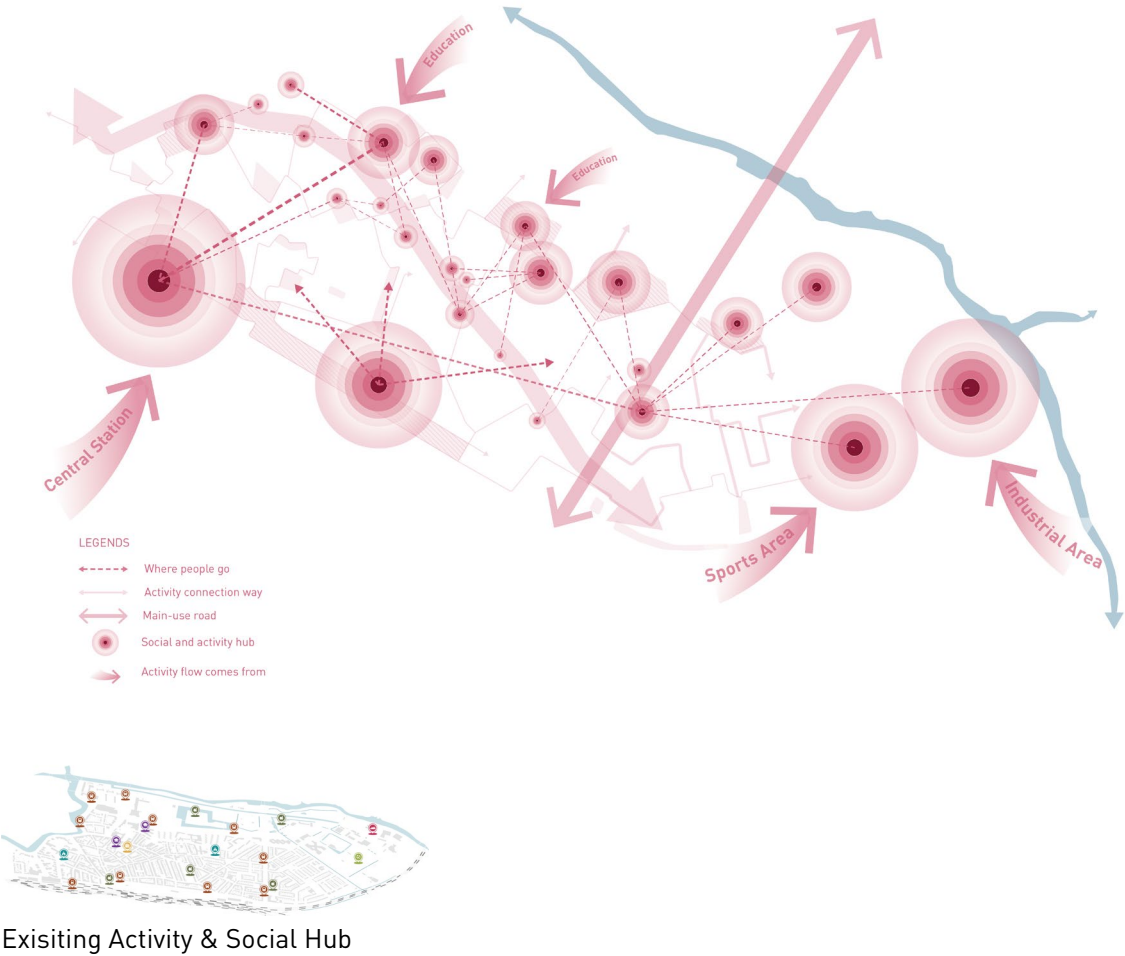
C8. Trees in front of the large building



C9. Large trees isolate the railroad



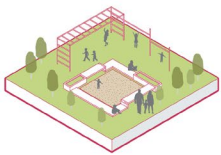
Design Strategy 3: Activity & Social Hub



Community activity space



A1. Neighborhood parks



A2. Children play areas



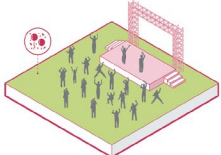
A3. Dog parks/pet friendly parks



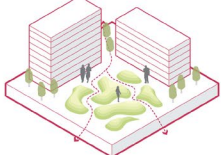
Open public activity space



A4. Gathering spaces/parks



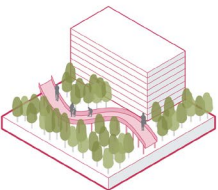
A5. Event/celebration plaza



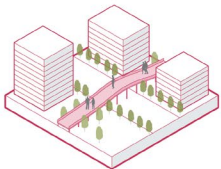
A6. Parks inspired from regional landscape



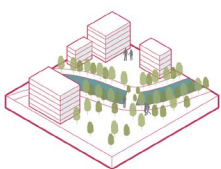
City connection



A7. Bridges connect with different function area



A8. Bridges over traffic



A9. Connection to the city center



Overall Framework



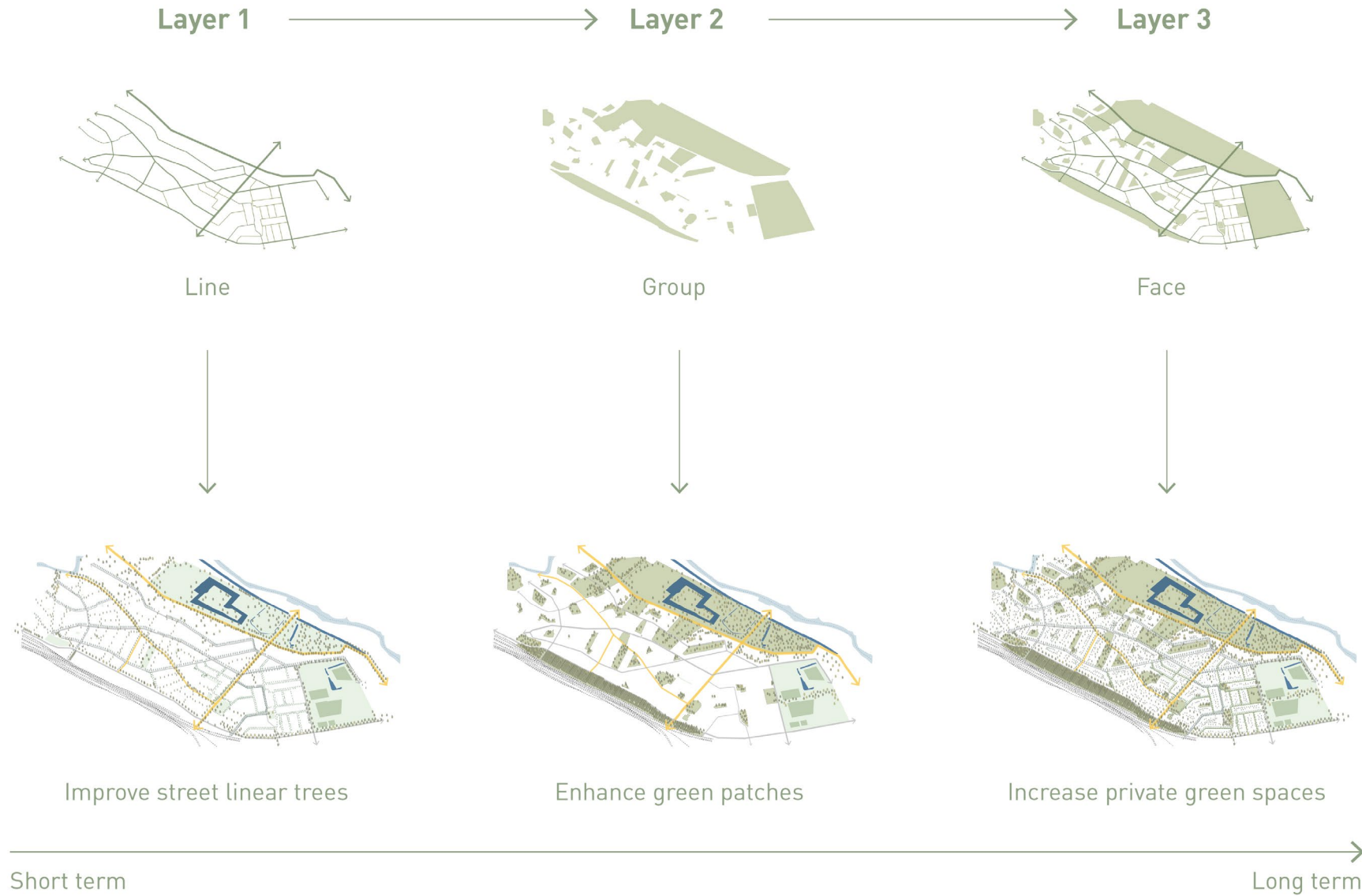
Site Existing Condition



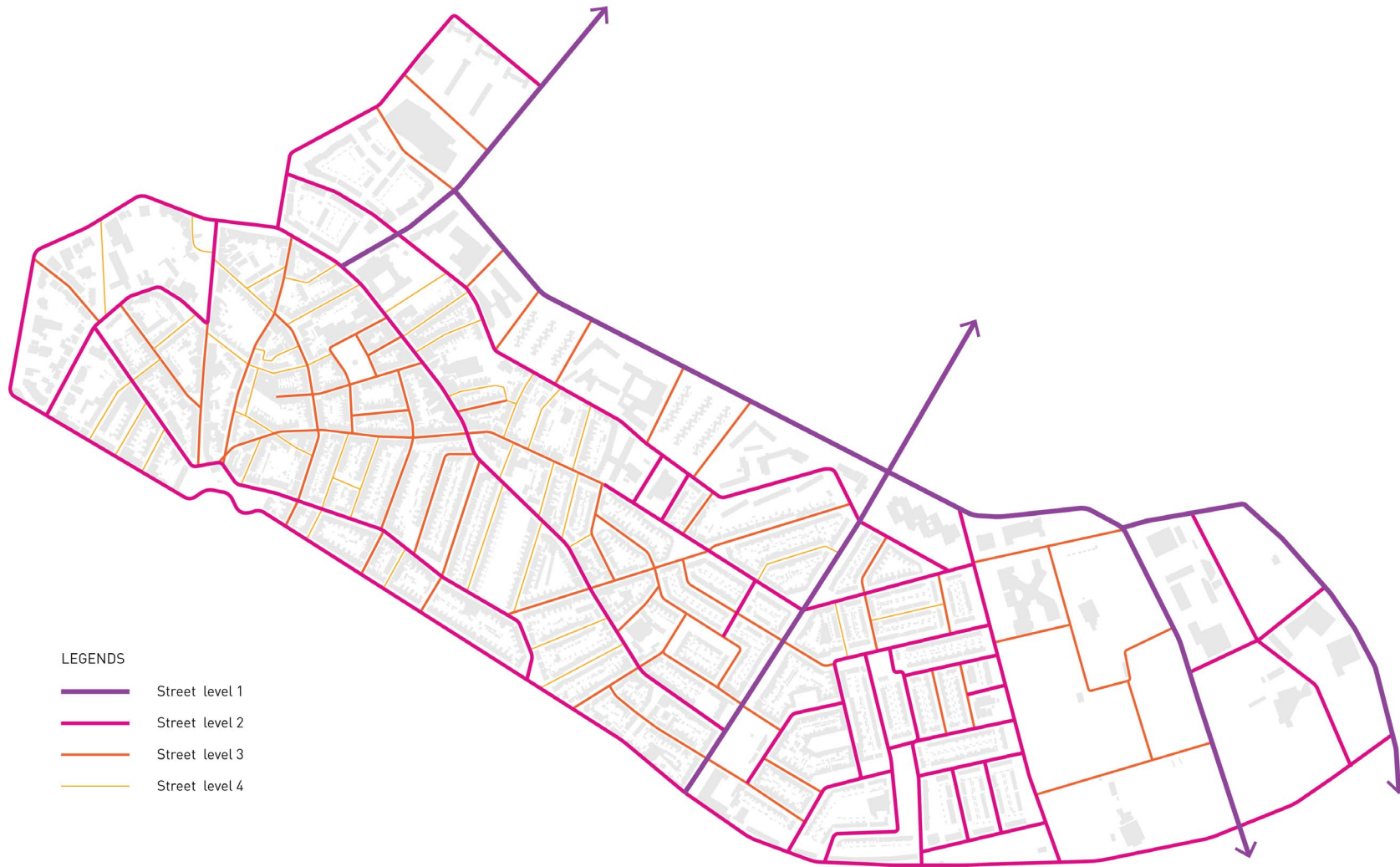
Future Urban Forest Development Vision



Design Layers



Design Layer 1: Line



Land use



Educational Area



Cultural Area



Mixed-use Community



City Park



Nature Forest



Agricultural Area



Industrial Area



Residential Housing

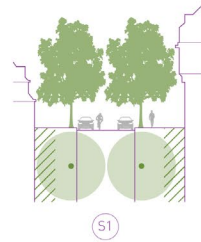


Working Space

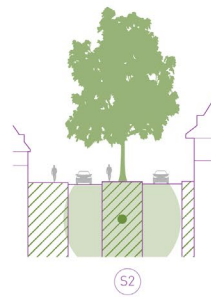
Street level

Level 1 street width
> 20mLevel 2 street width
14.5m - 20mLevel 3 street width
8.5m - 14.5mLevel 4 street width
< 8.5m

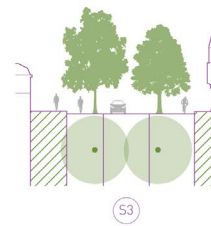
Street design planting principles



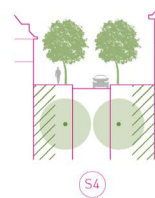
S1



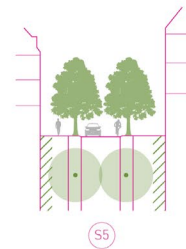
S2



S3



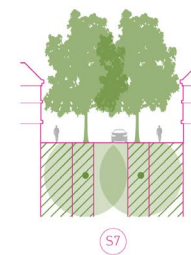
S4



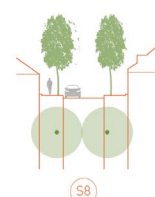
S5



S6



S7



S8



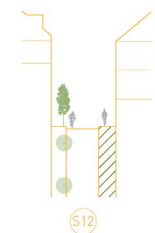
S9



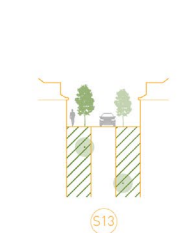
S10



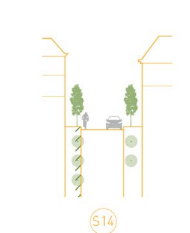
S11



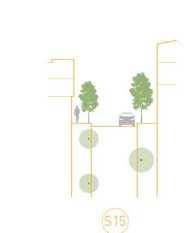
S12



S13

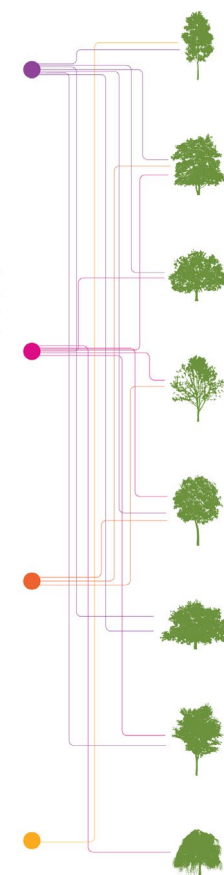


S14

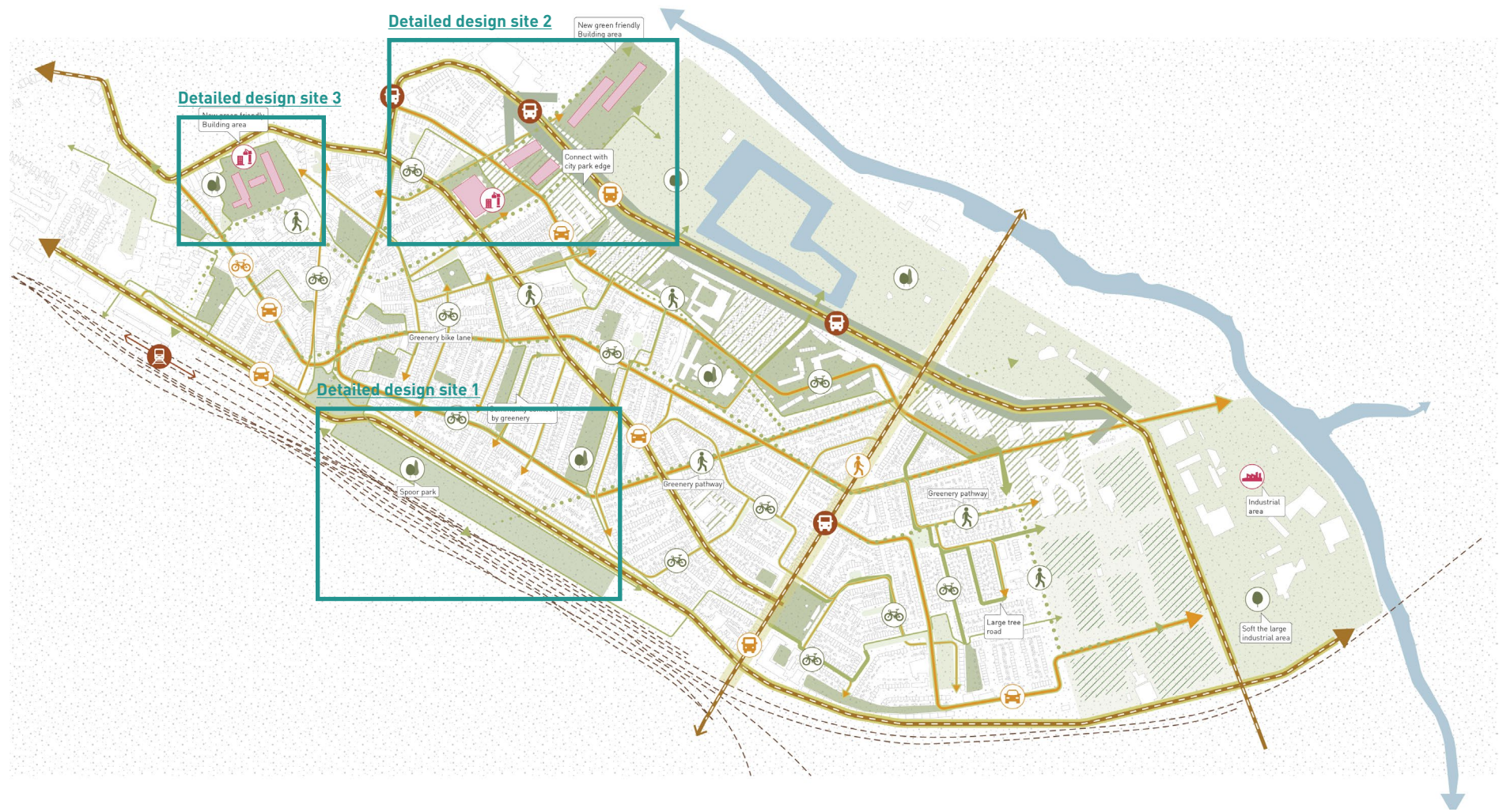


S15

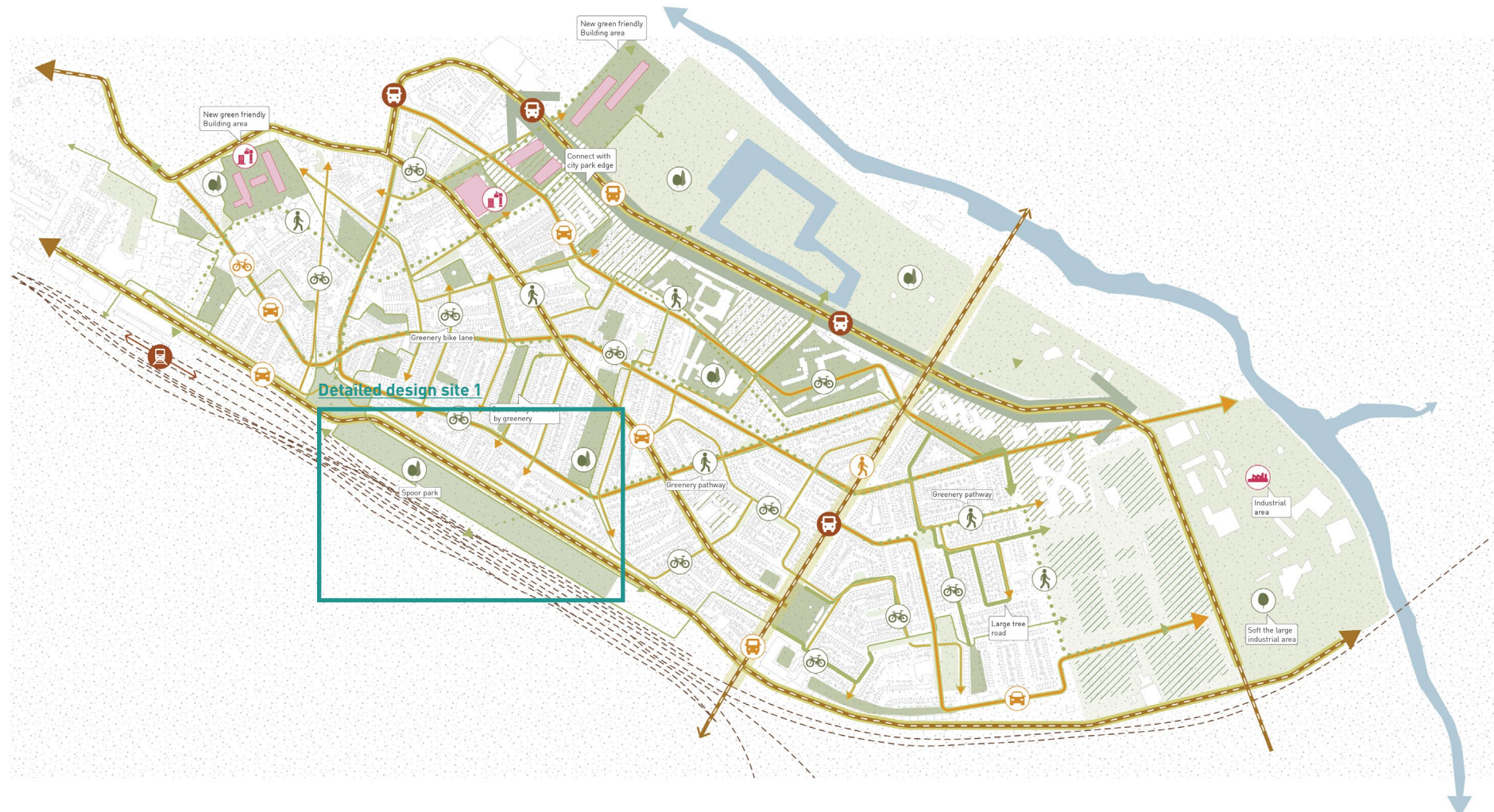
Tree crown selection



Design Layer 1+ 2 + 3: Line+ Group + Face



Design Layer 1+ 2 + 3: Line+ Group + Face



Detailed Design 1: Spoor Park

Site Analysis



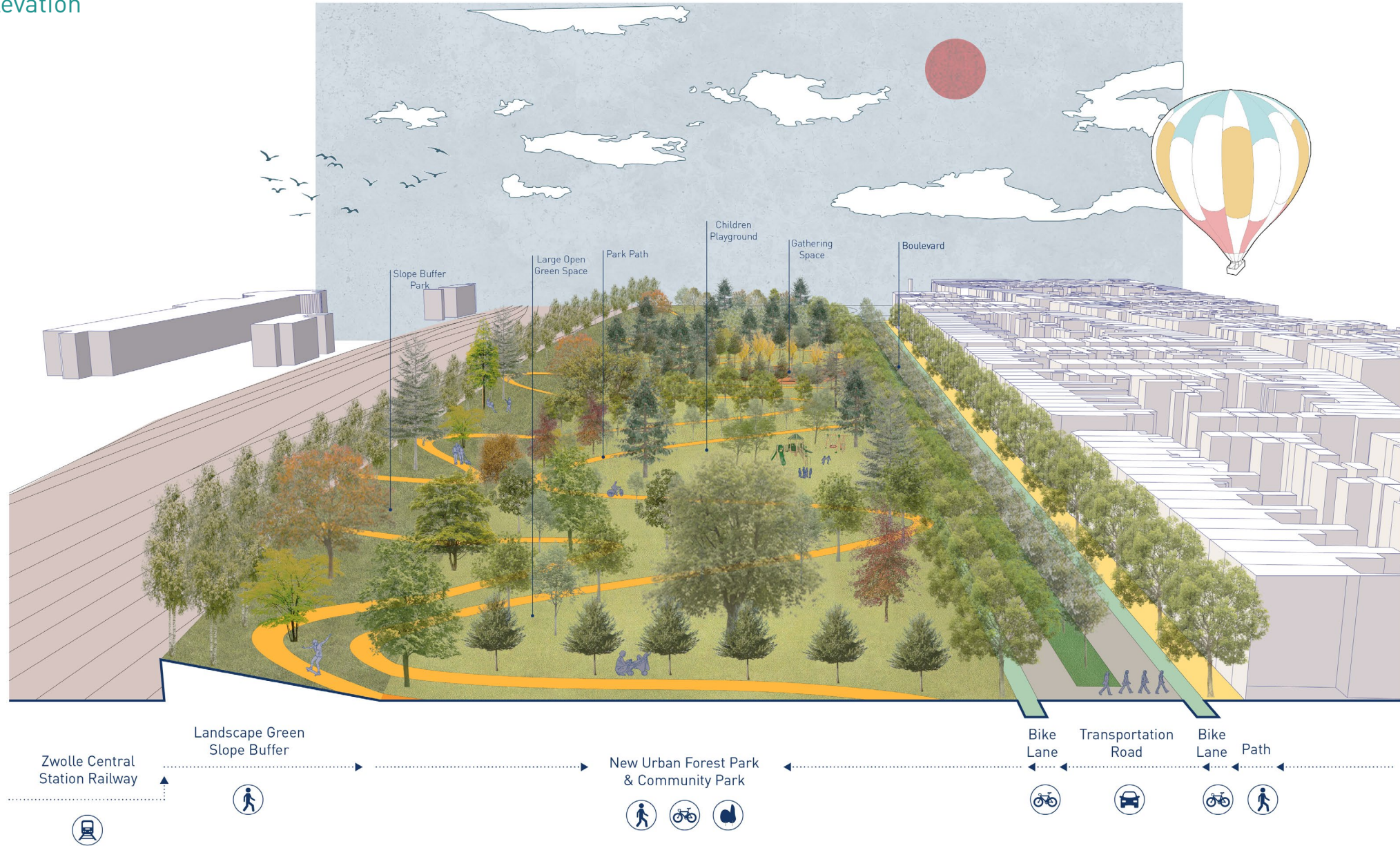
Design Concept & Process



Masterplan



Section Elevation



Planting Plan/Design



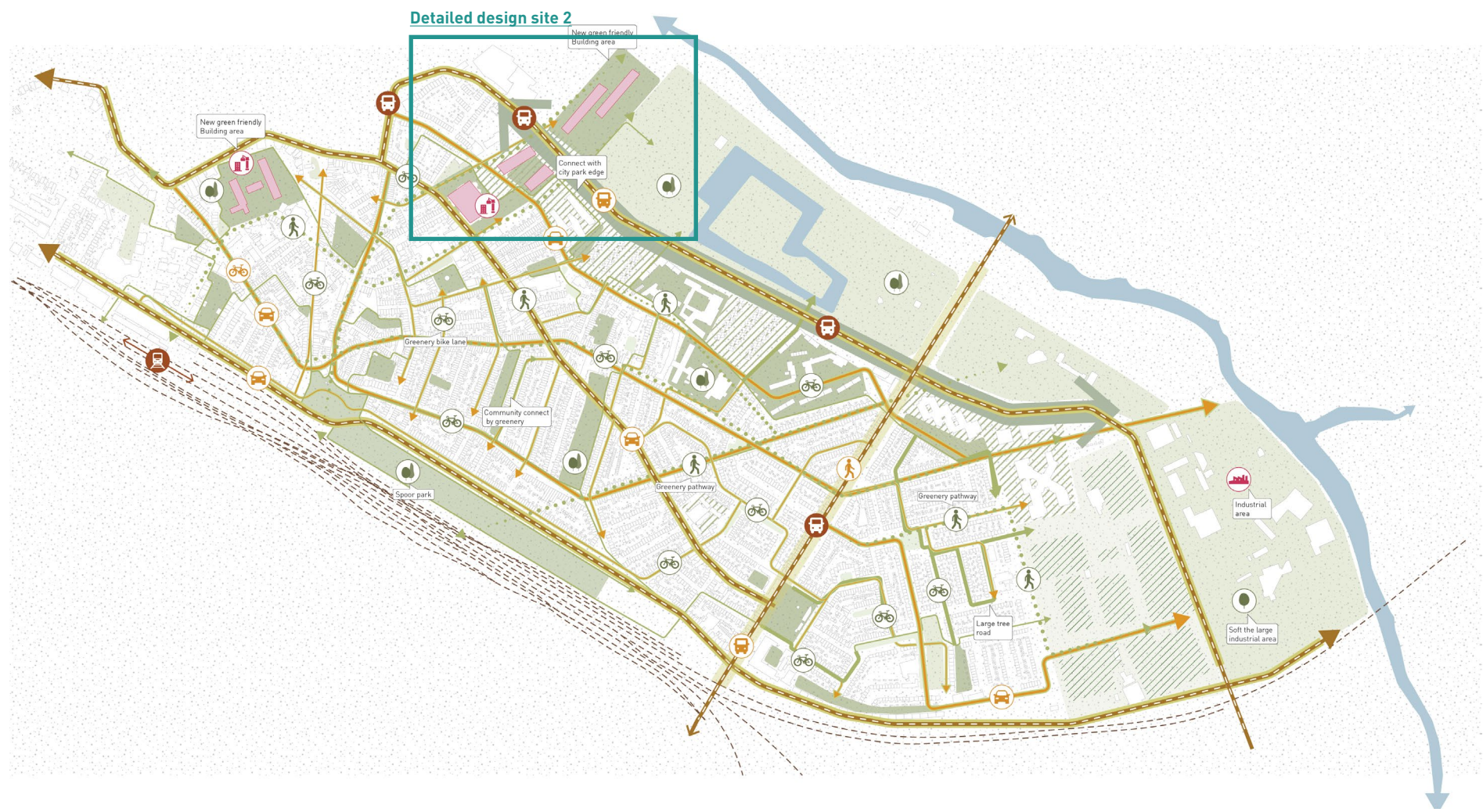
Perspective



The Relationship Between Tree & Street

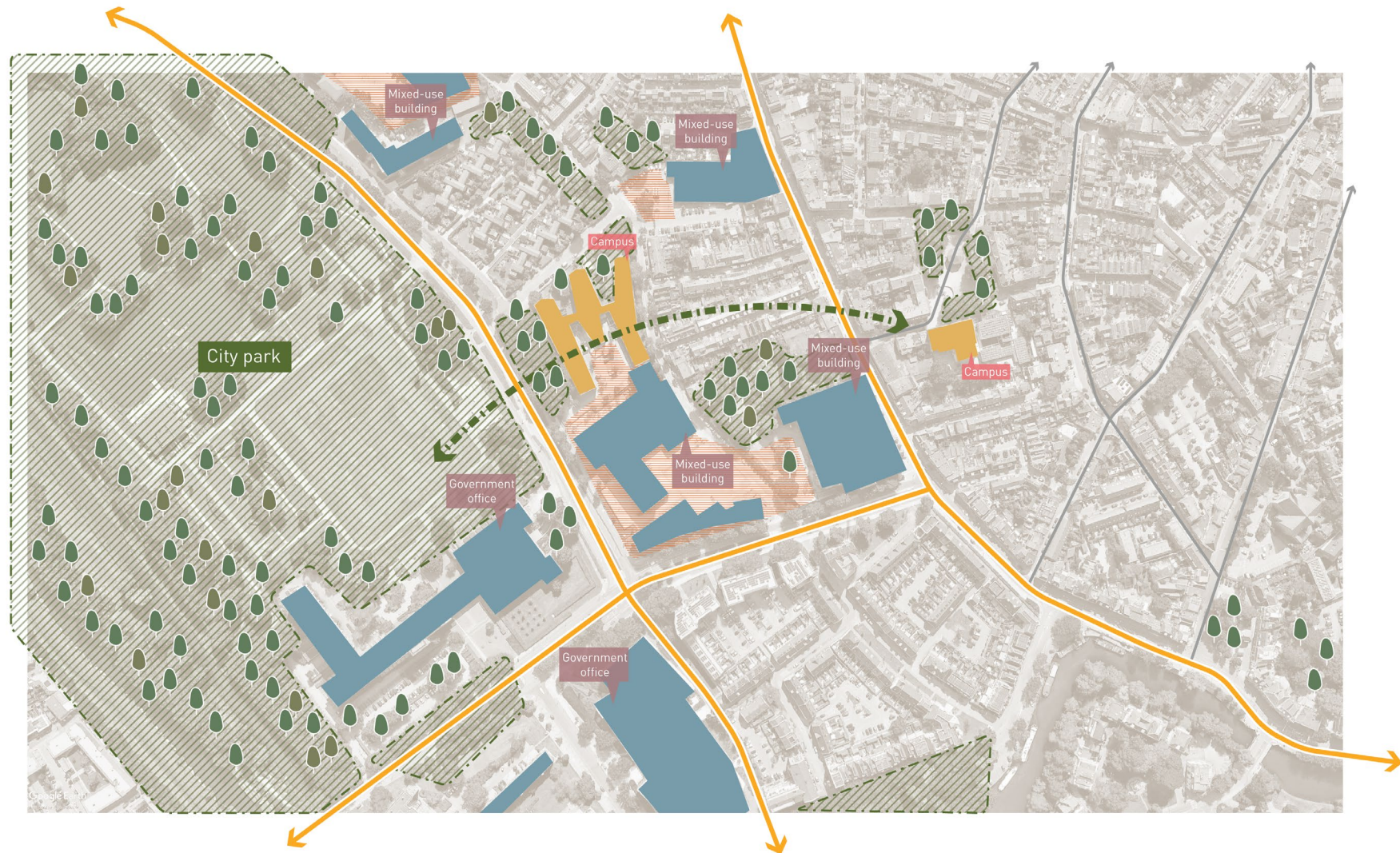


Design Layer 1+ 2 + 3: Line+ Group + Face

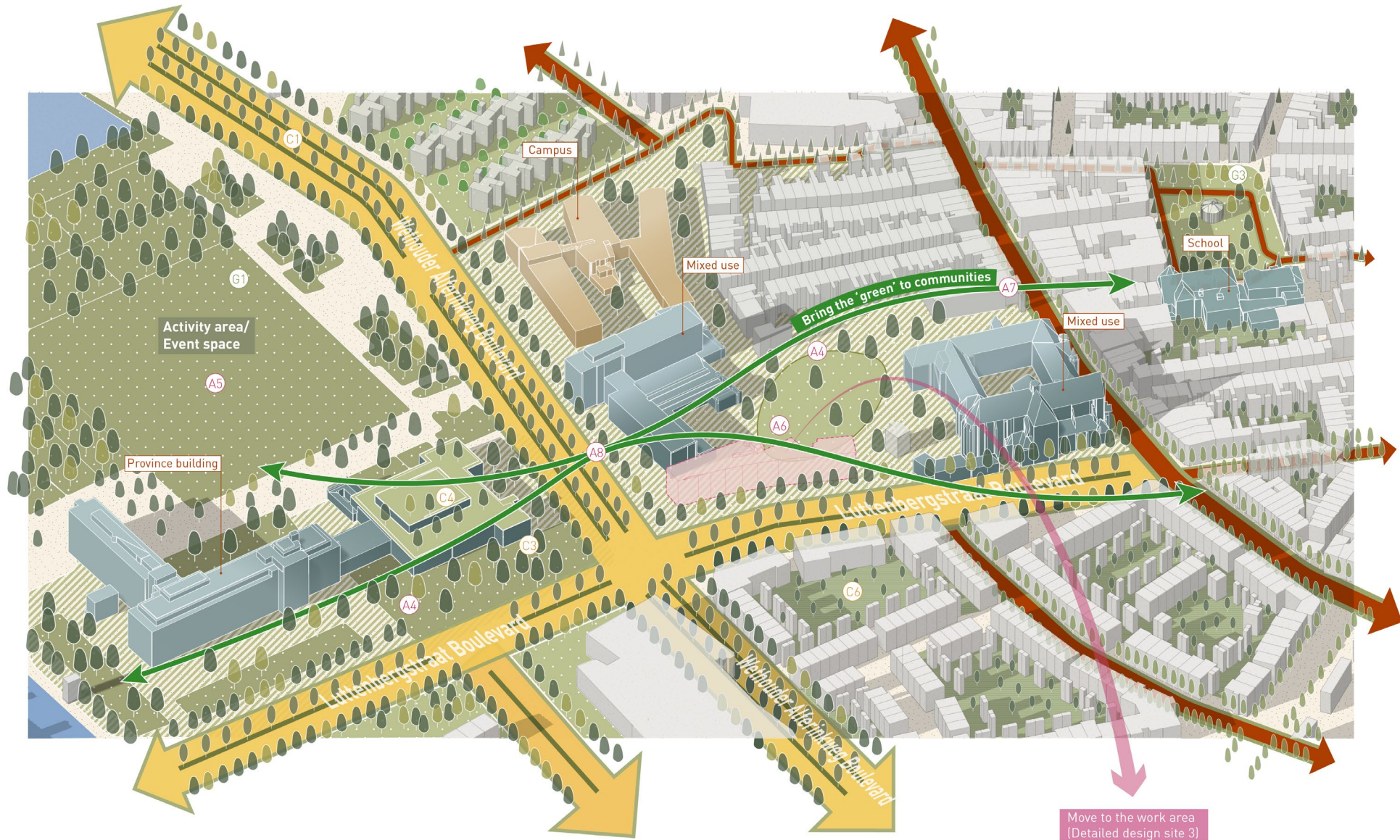


Detailed Design 2

Site Analysis



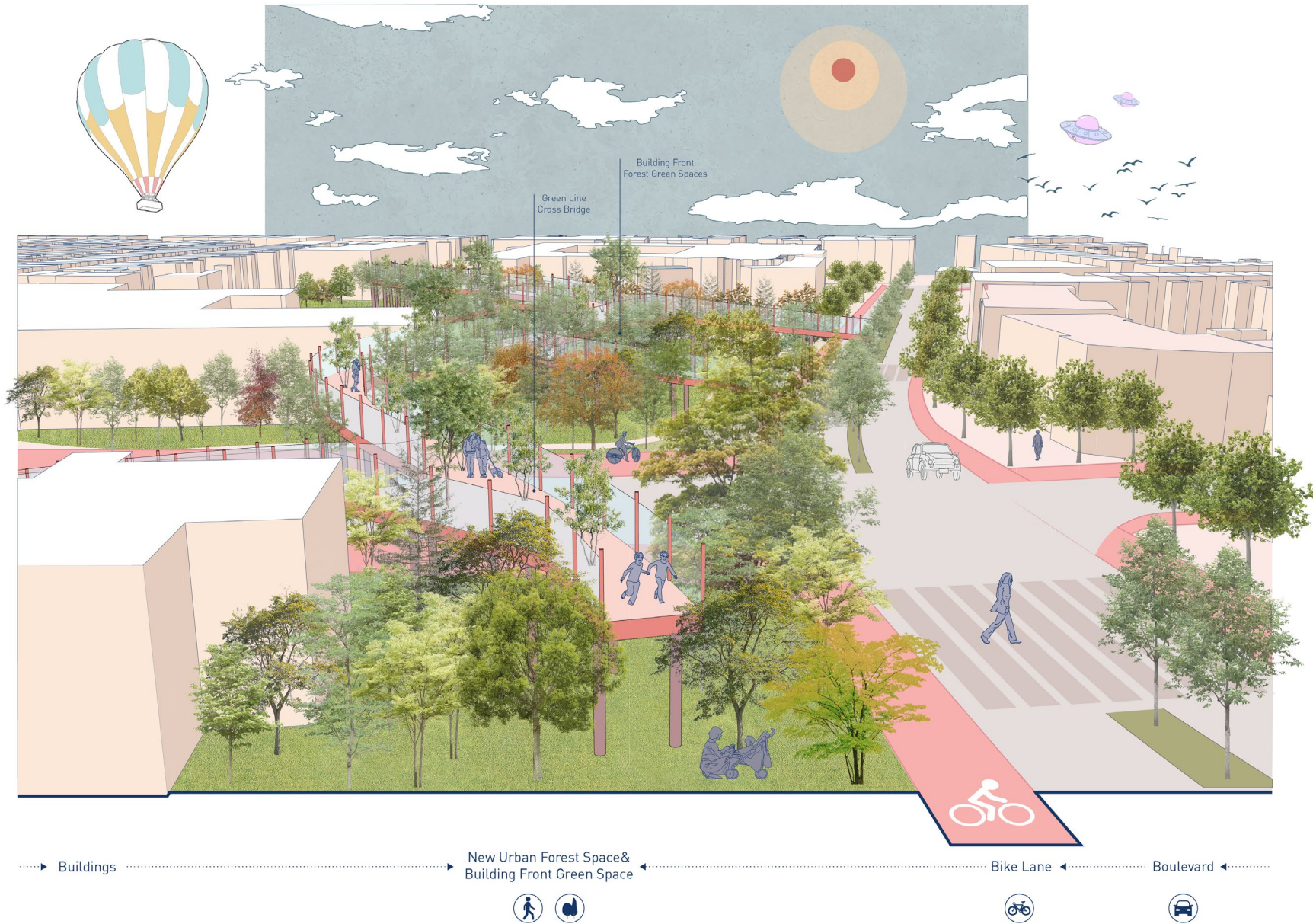
Design Concept & Process



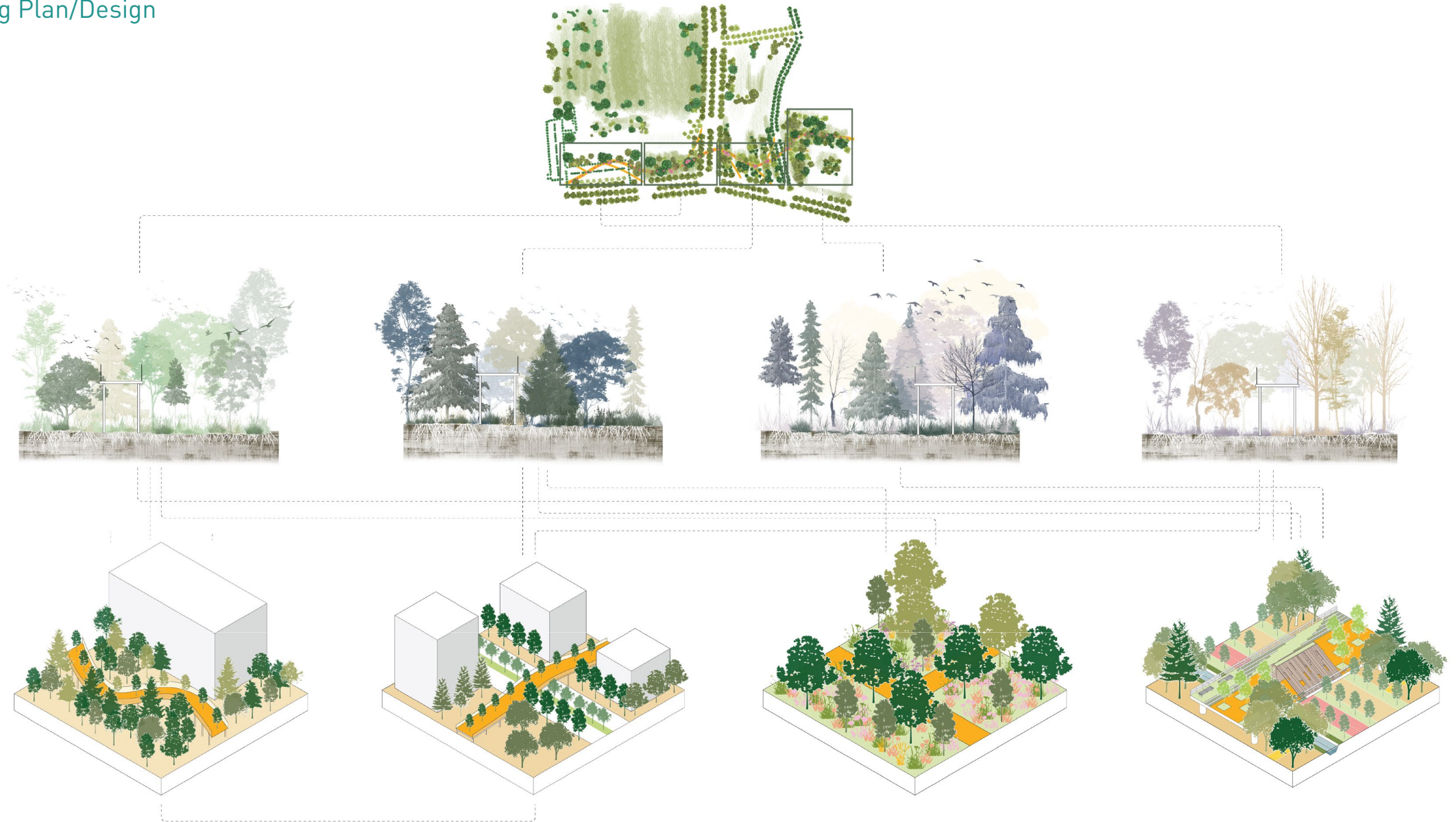
Masterplan



Section Elevation



Planting Plan/Design



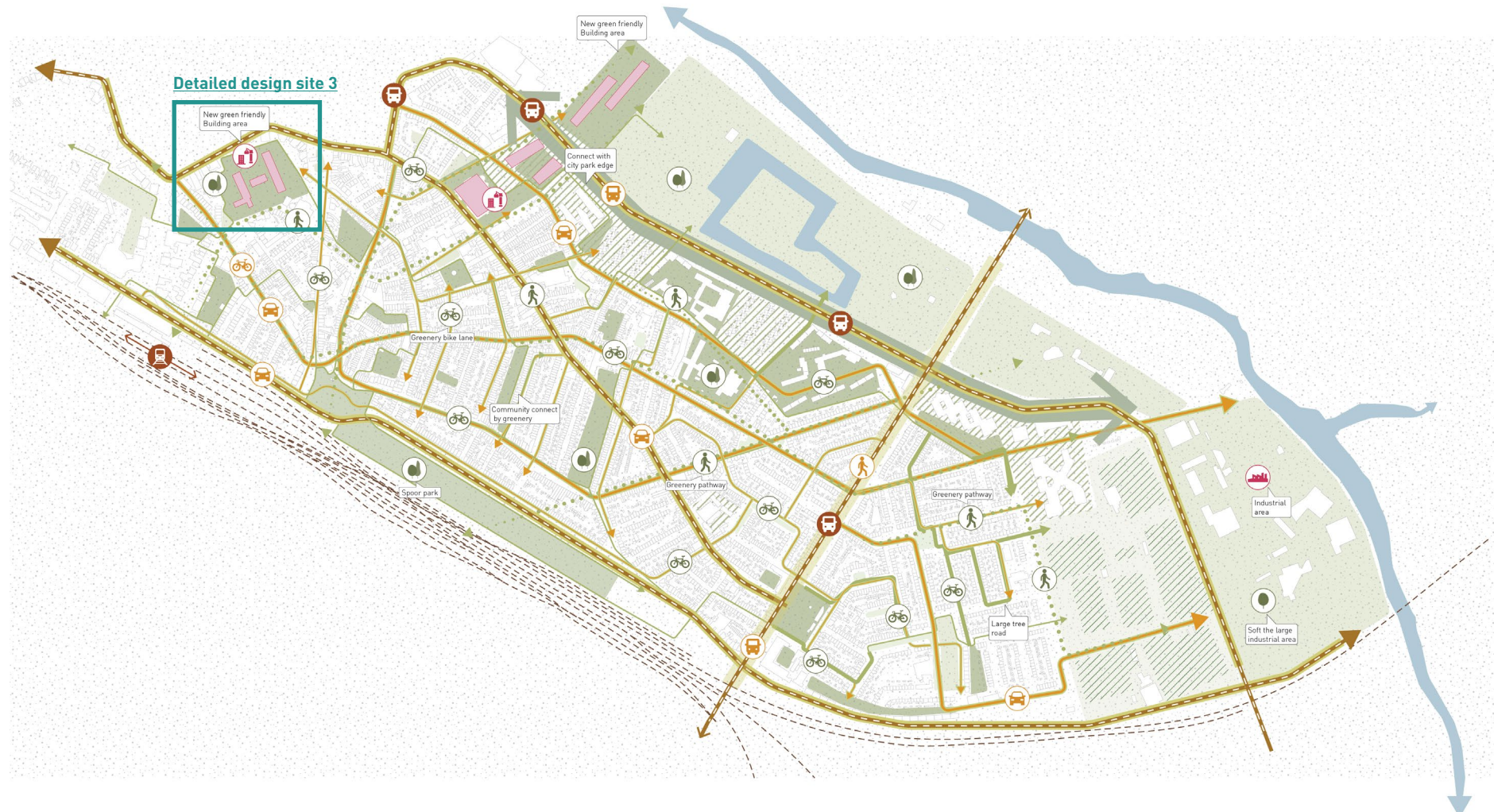
Perspective



The Relationship Between Tree & Street



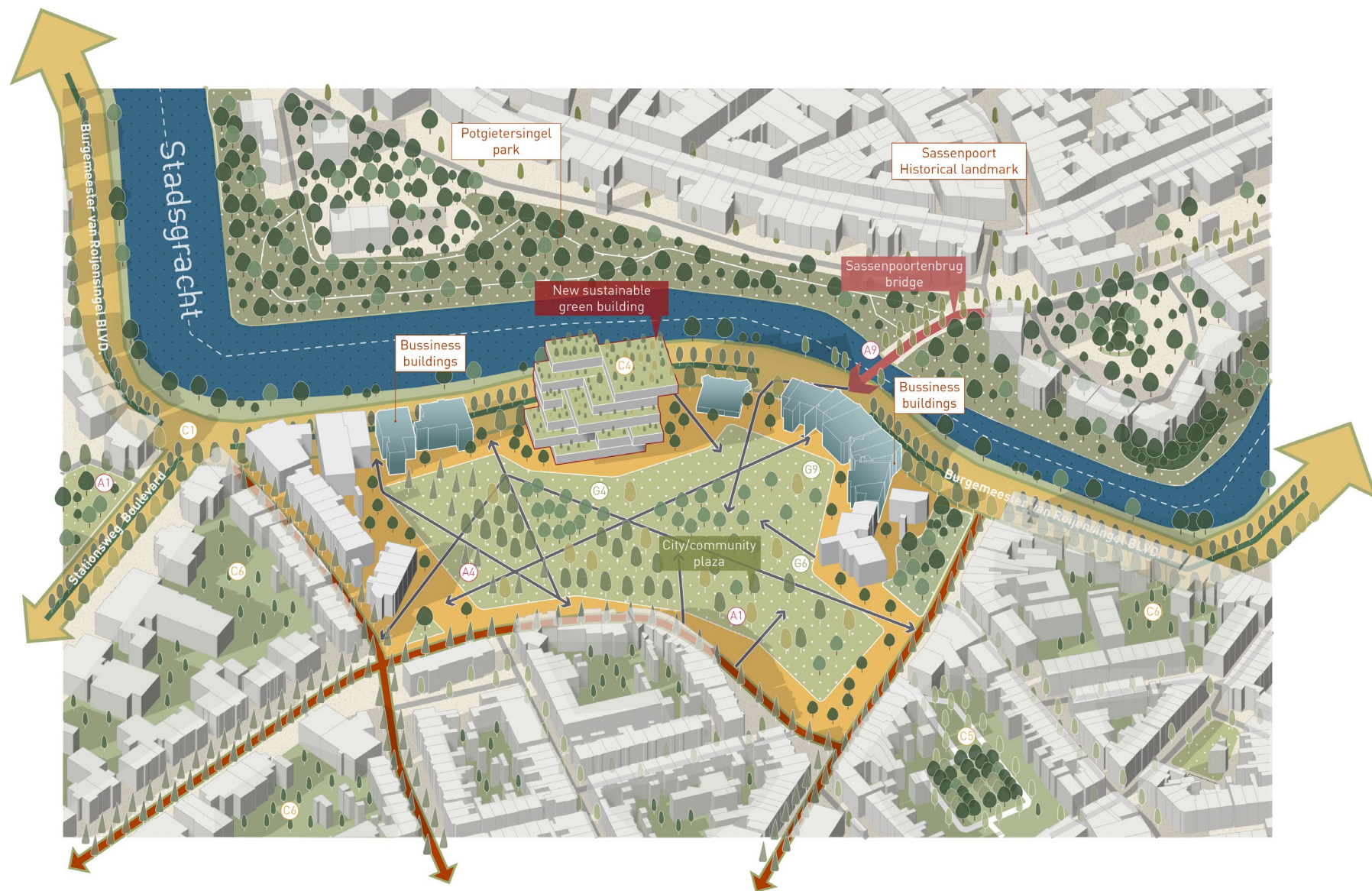
Design Layer 1+ 2 + 3: Line+ Group + Face



Detailed Design 3
Site Analysis



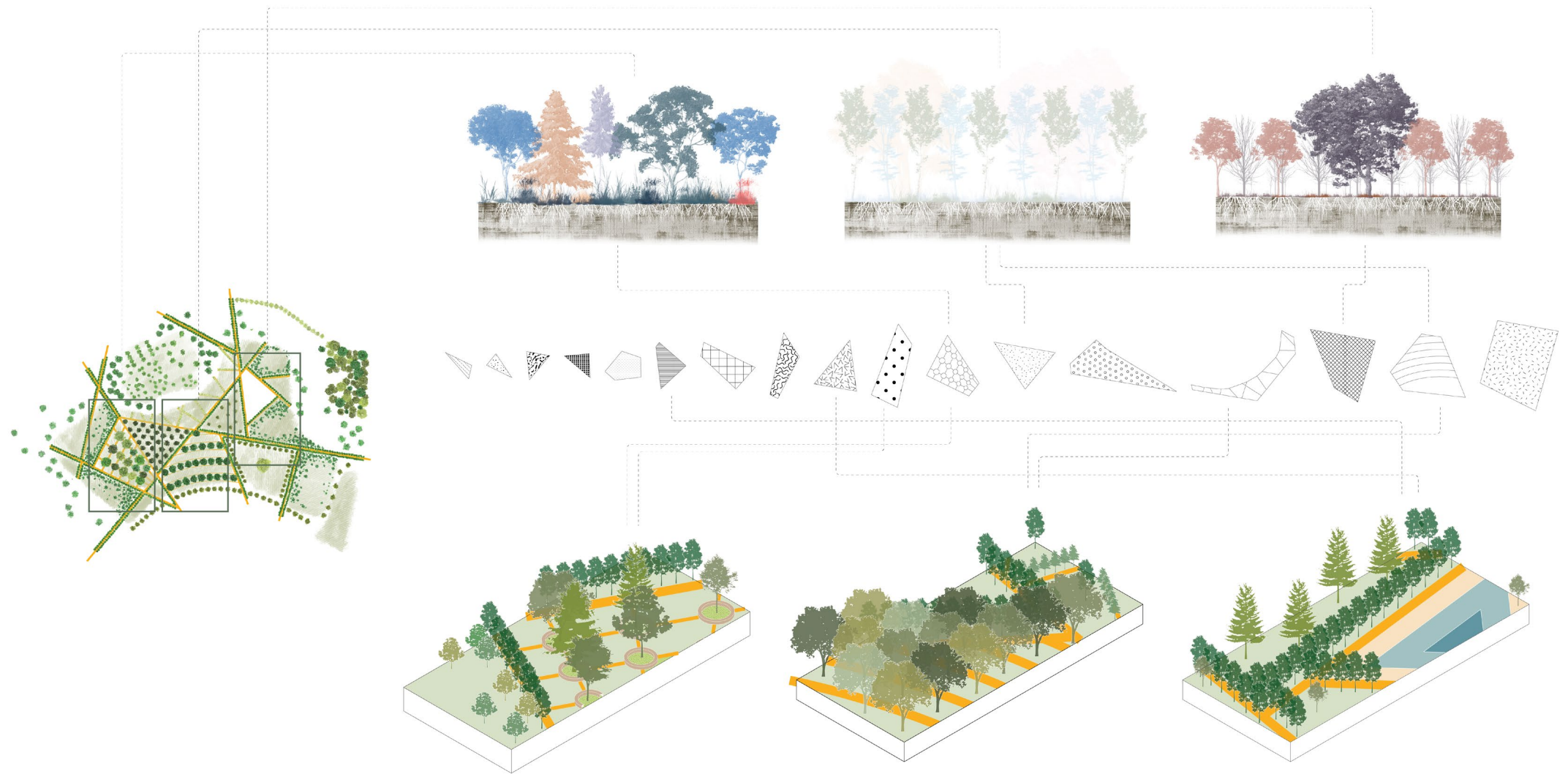
Design Concept & Process



Masterplan



Planting Plan/Design



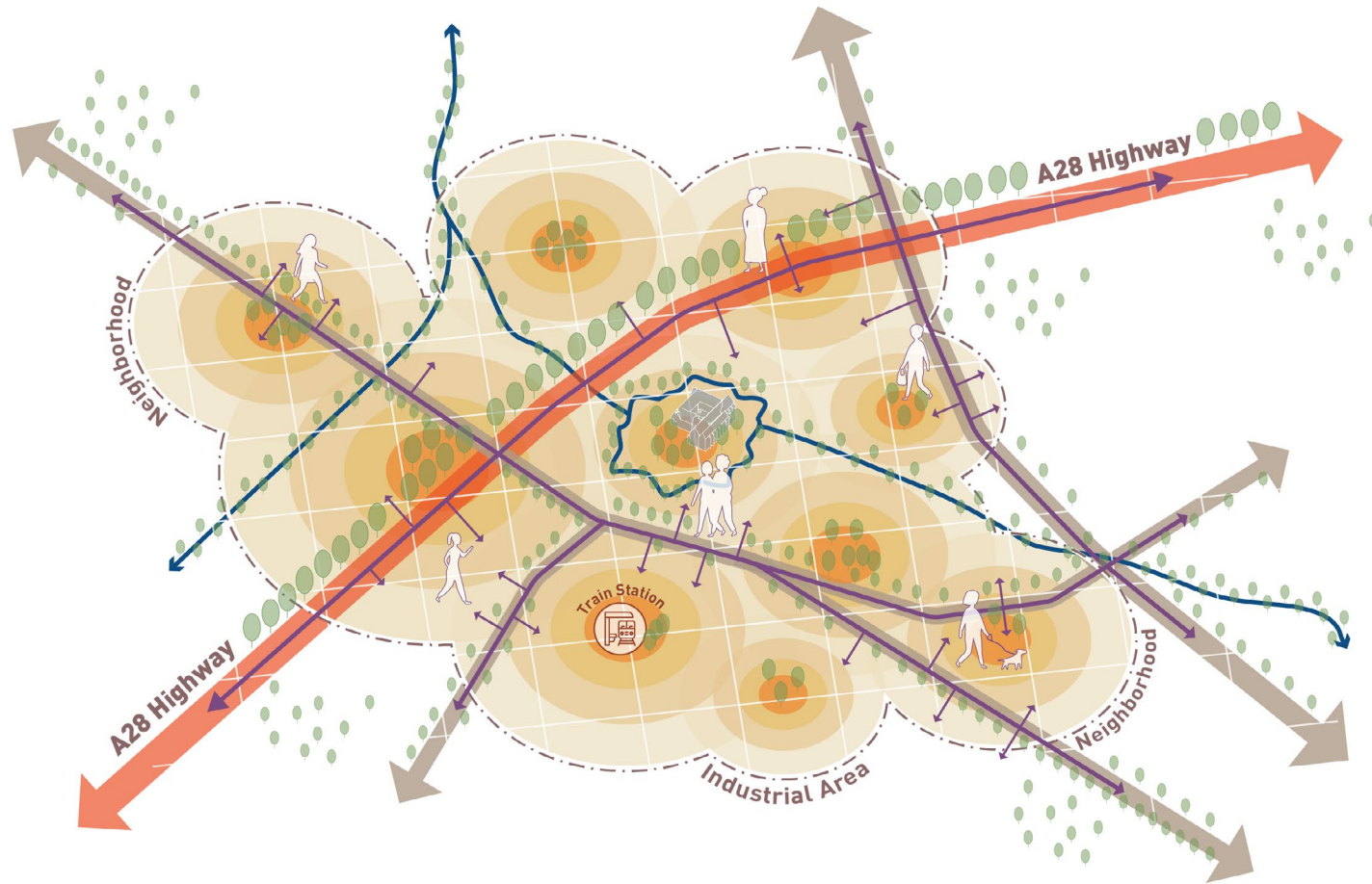
Perspective



The Relationship Between Tree & Street

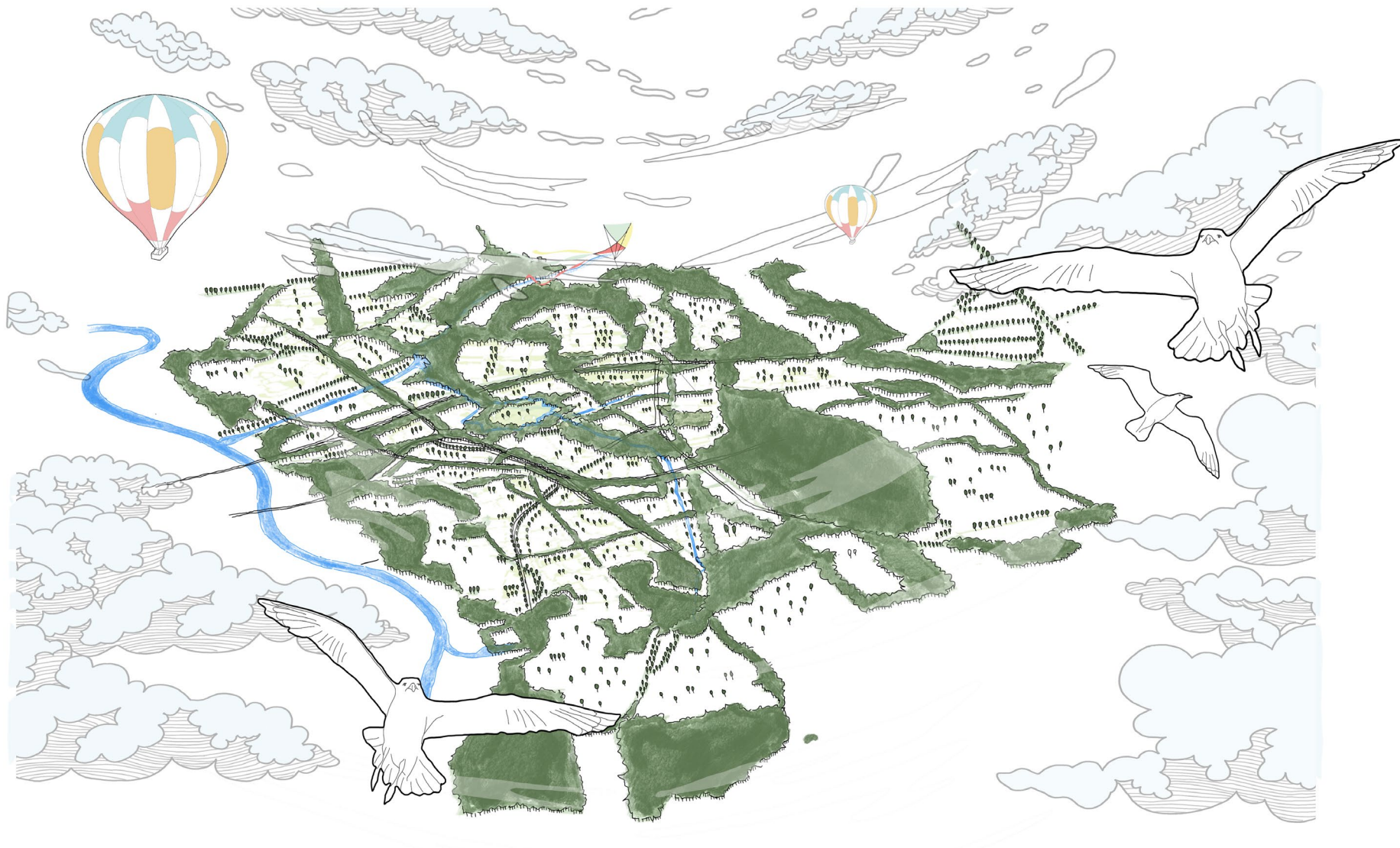


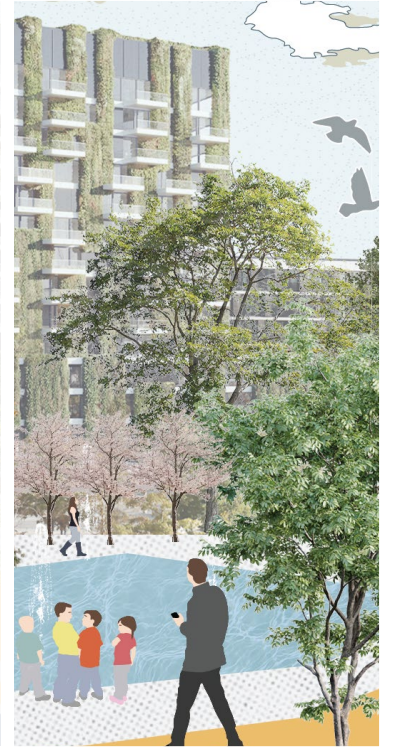
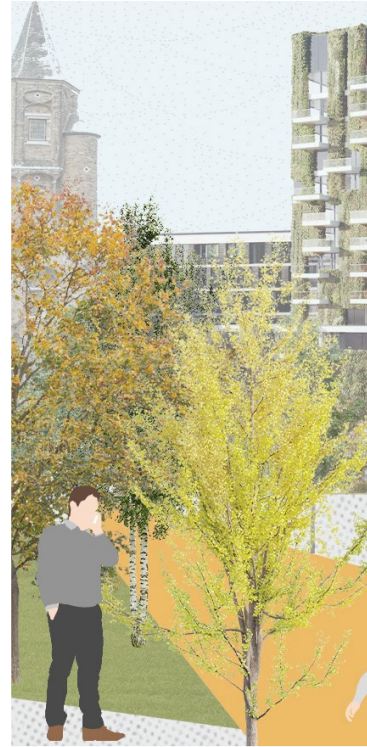
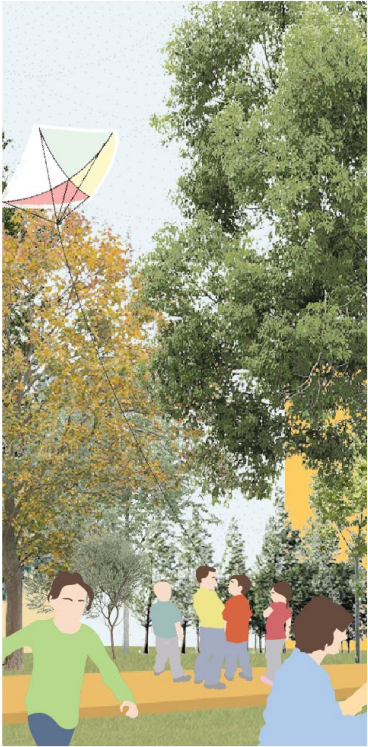
Future Regional Vision Design





Future Vision





Thank you for listening!

Special Thanks to:

First Mentor: Dr. Ir. René van der Velde

Second Mentor: Dr. Ir. Stefan van der Spek