P5 | July 10, 2020

WATERING THE SEMIARID

DESIGNING A WETNESS RETENTION LANDSCAPE IN JAGUARIBARA, BRAZIL

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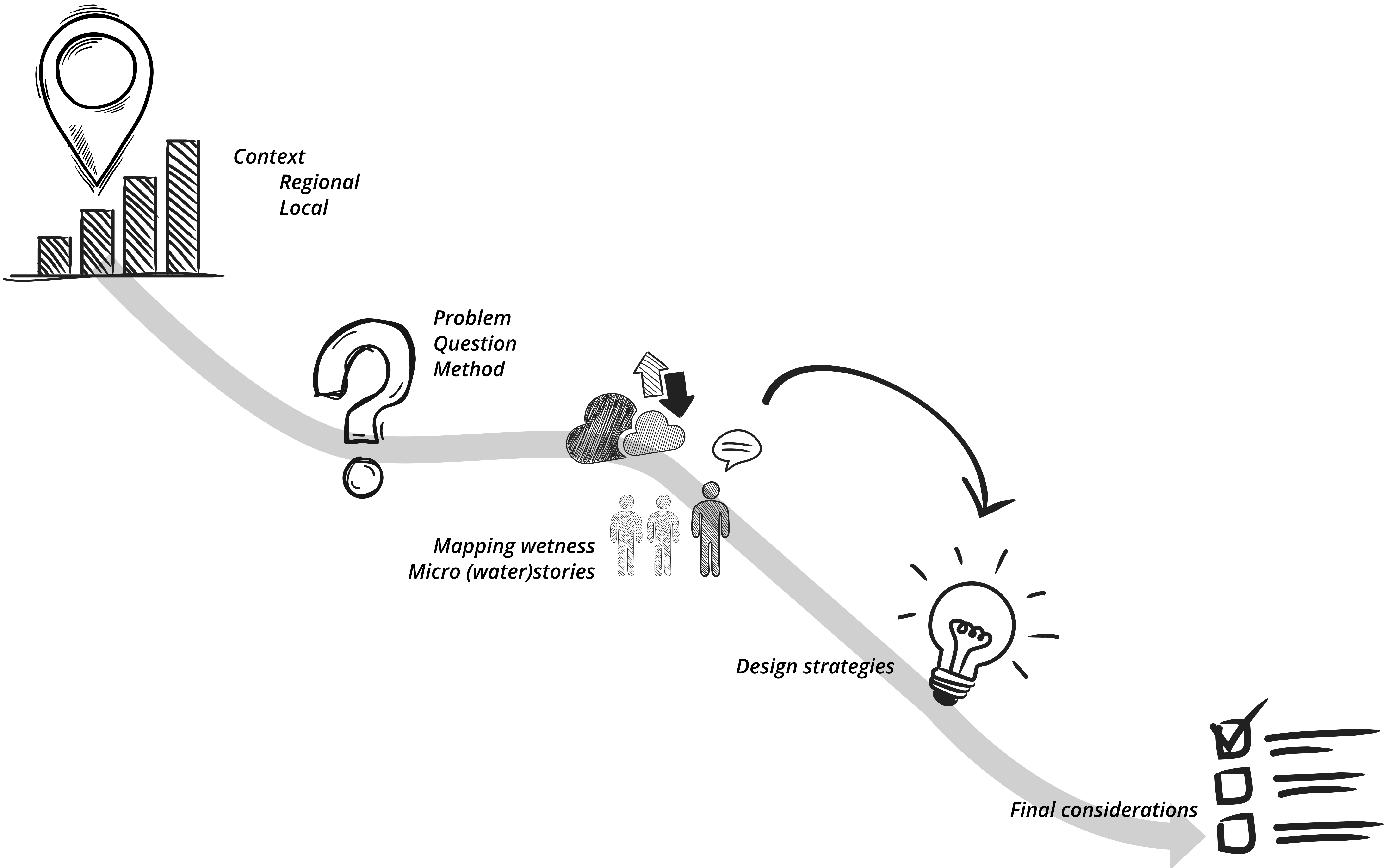
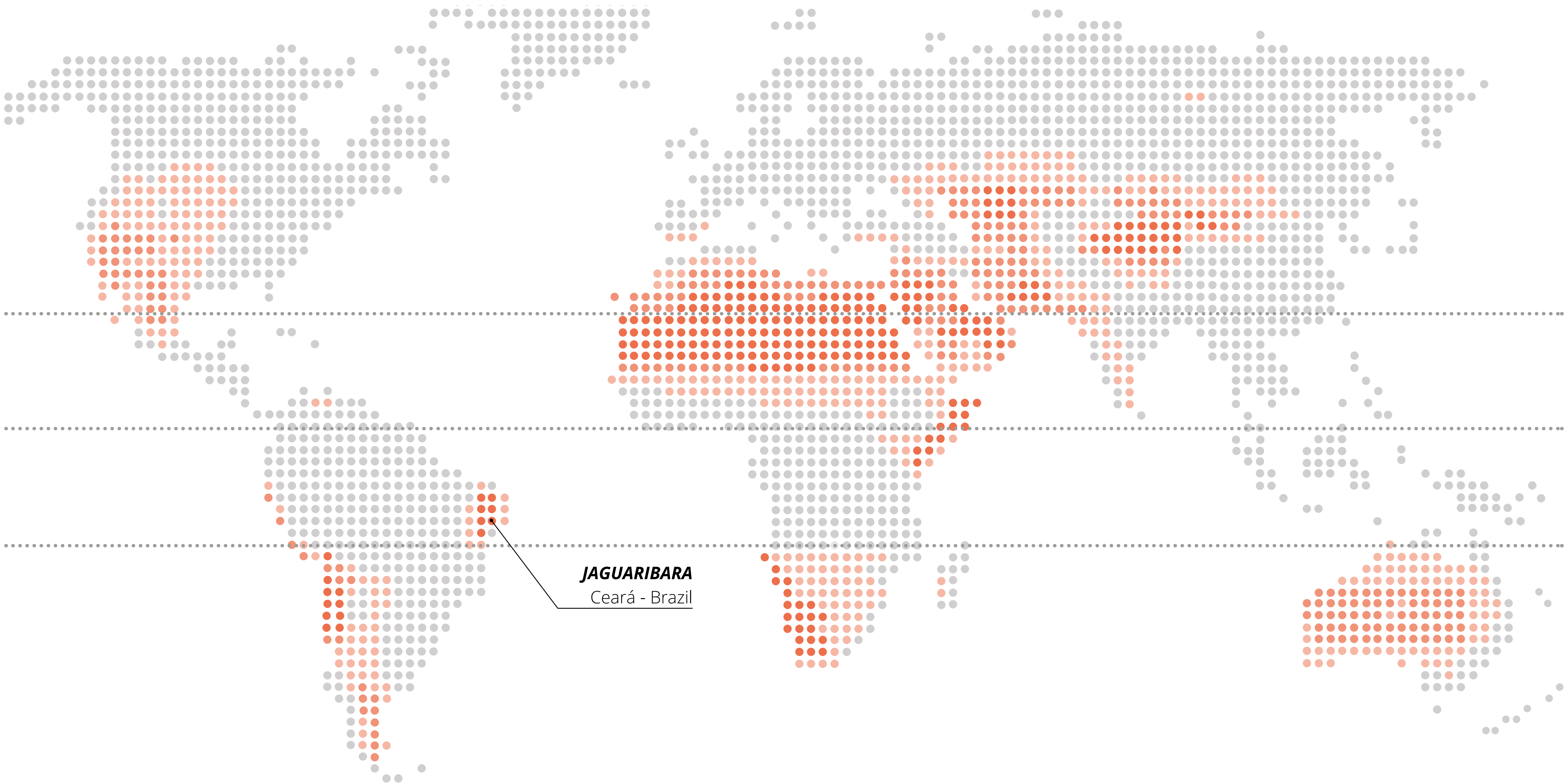
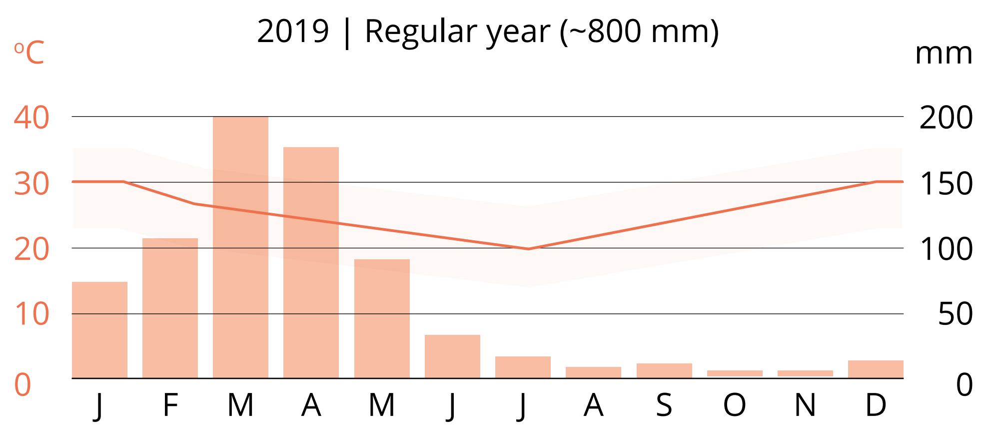
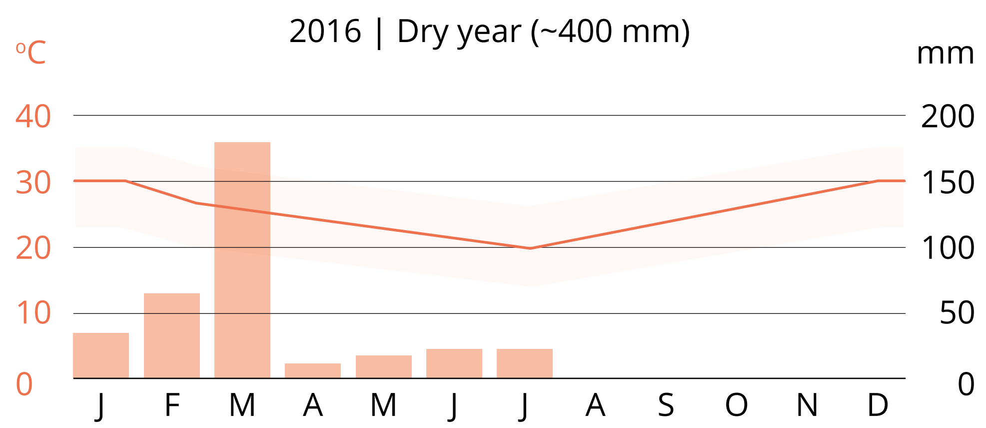


Context
Regional
Local
Problem
Question
Method
Mapping wetness
Micro (water)stories
Design strategies
Final considerations

CONTEXT: REGIONAL







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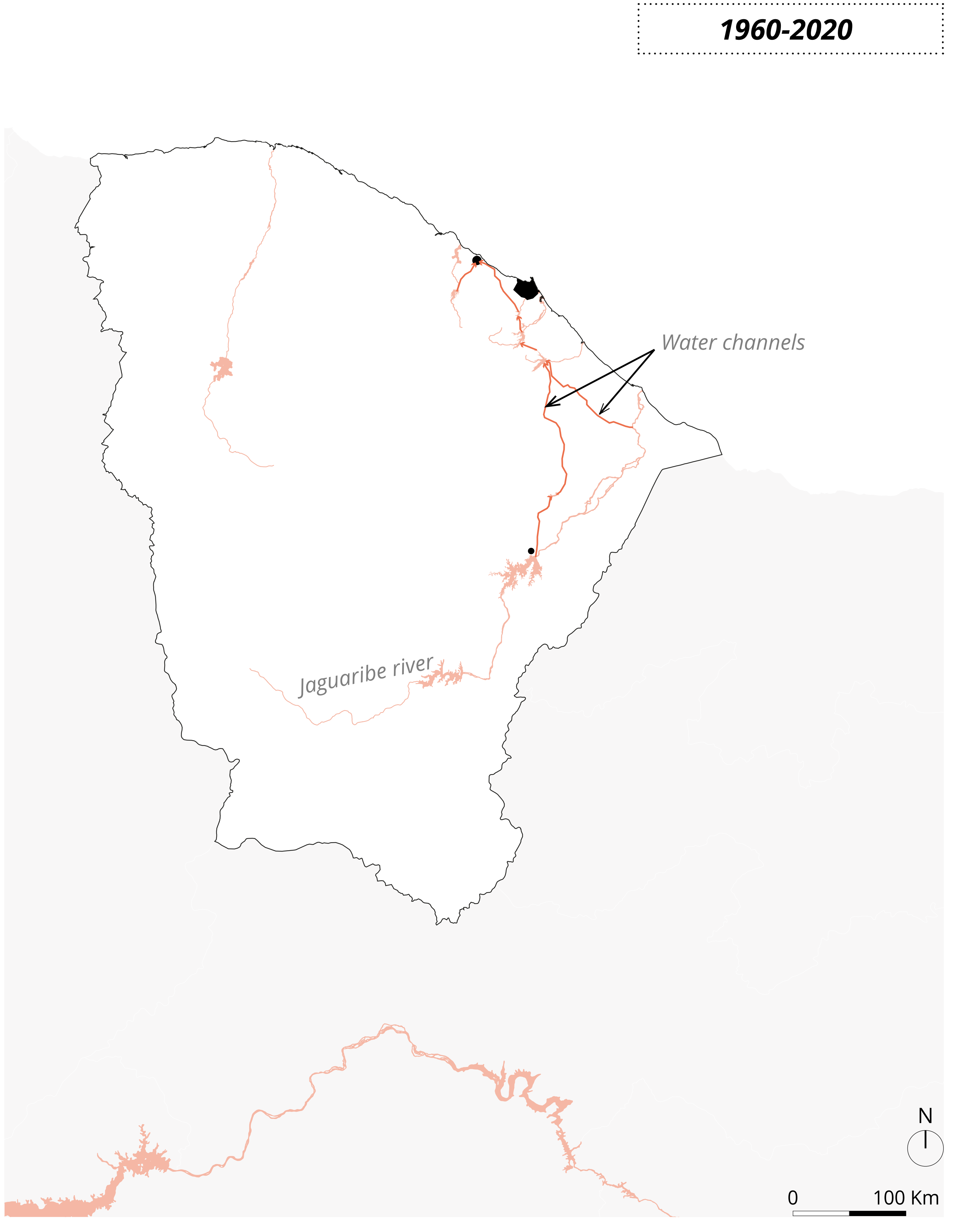

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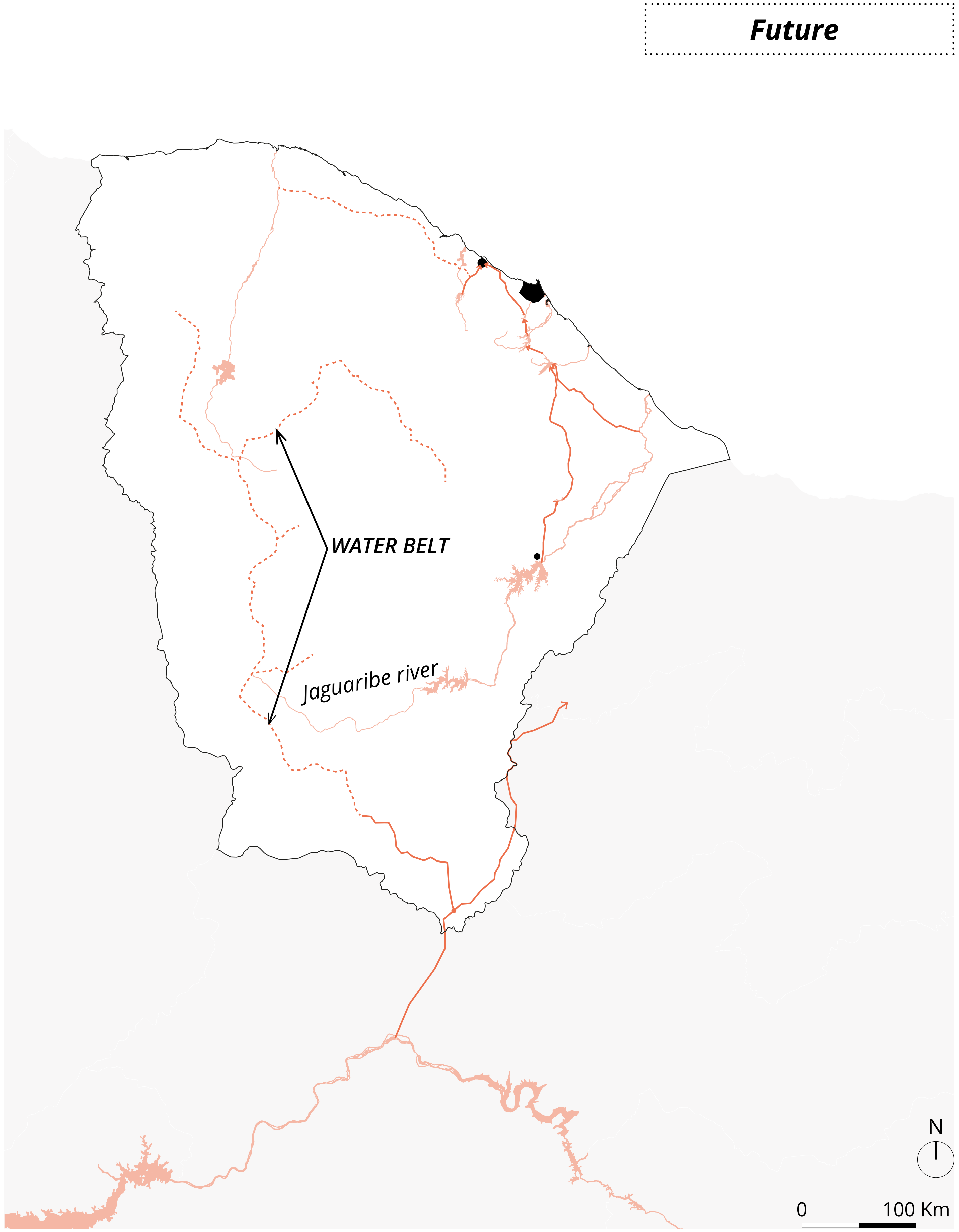
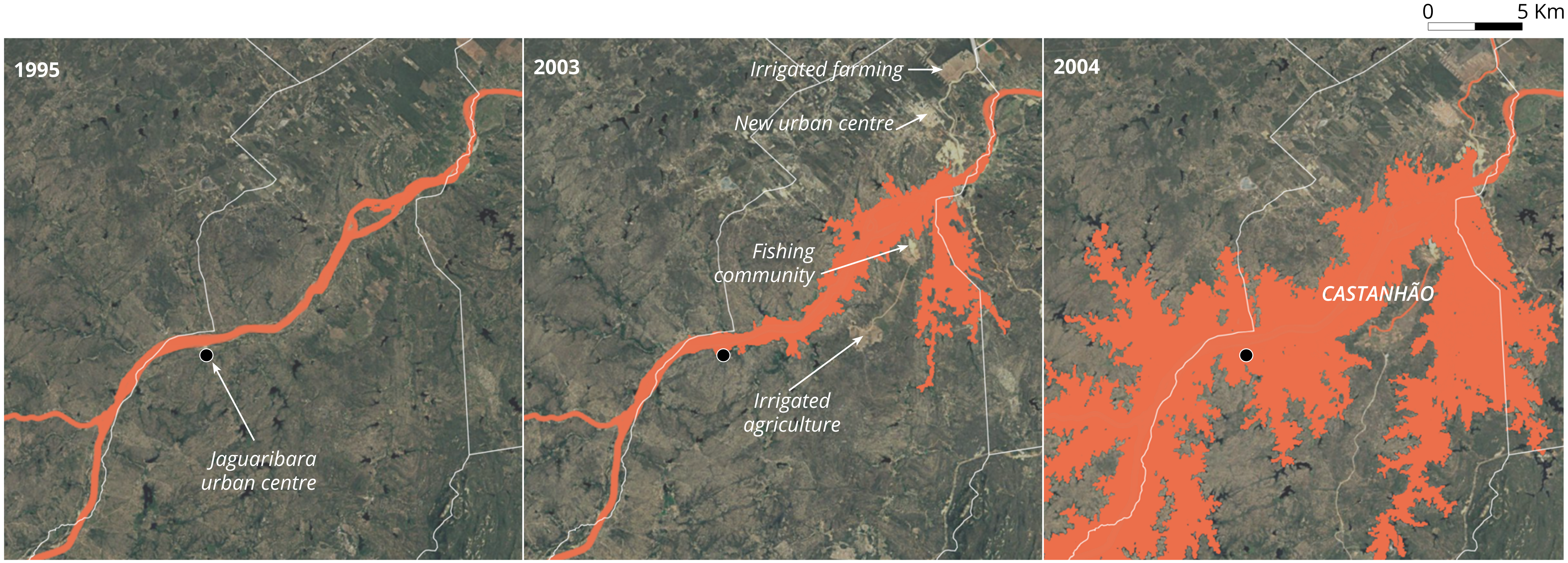


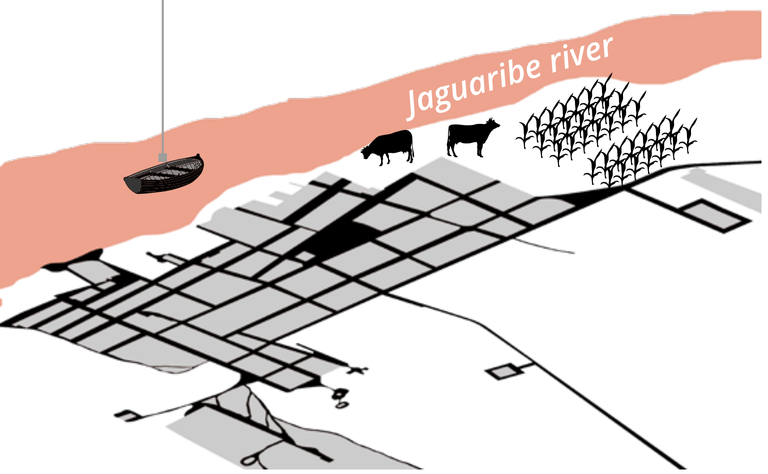
CONTEXT: REGIONAL

CONTEXT: LOCAL



CONTEXT: LOCAL

Until 2001

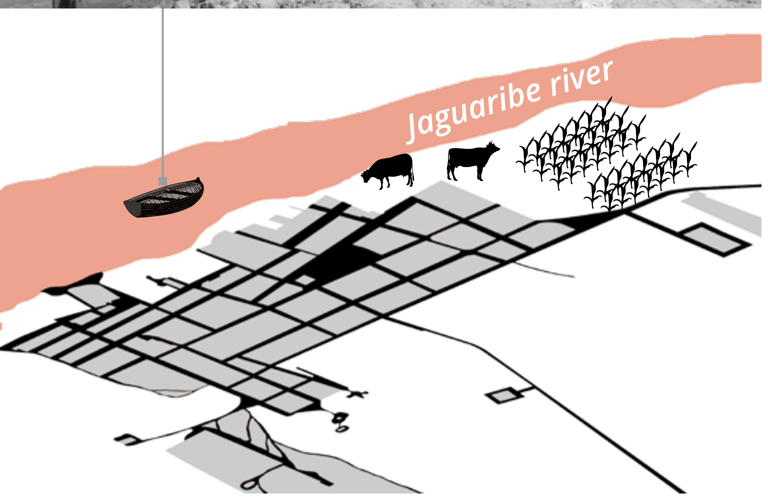


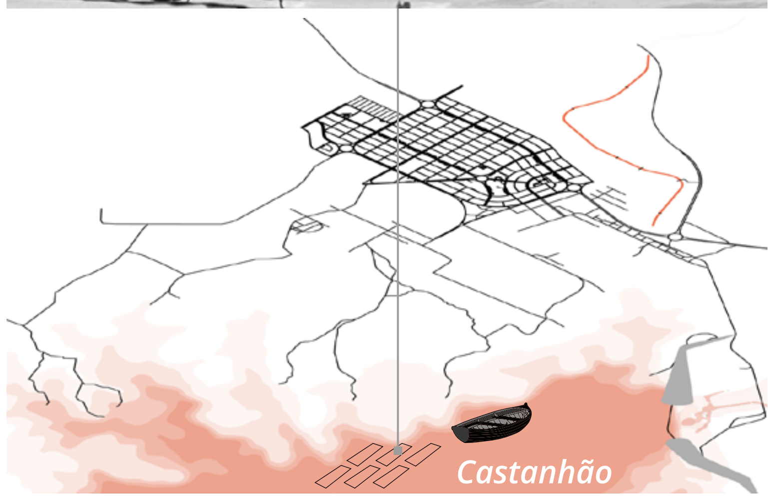
CONTEXT: LOCAL

Until 2001

2012-2019

MANDACARÚ PROJECT
(Irrigated farming)

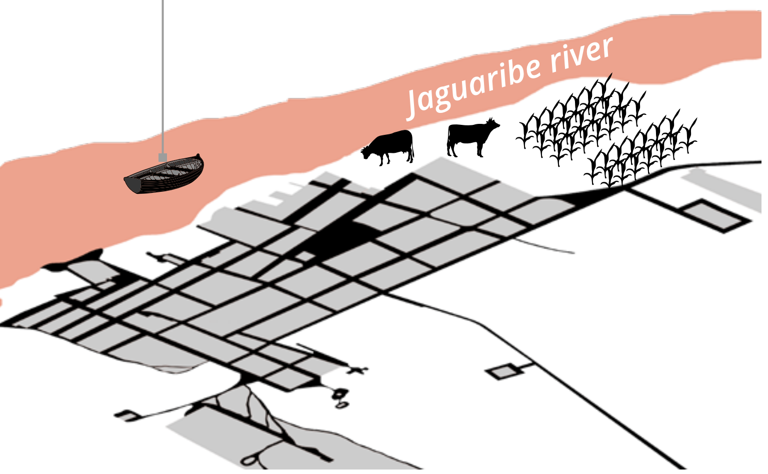




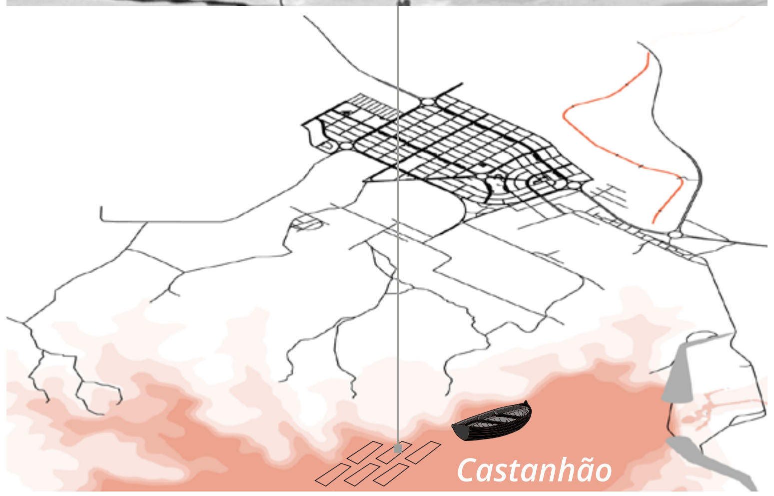
CURUPATI PROJECT
(Irrigated agriculture)

CONTEXT: LOCAL

Until 2001



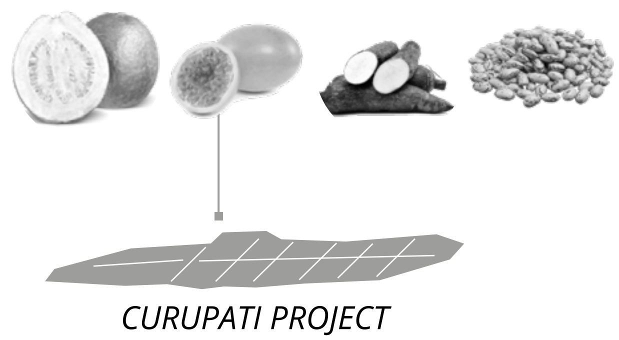
2012-2019

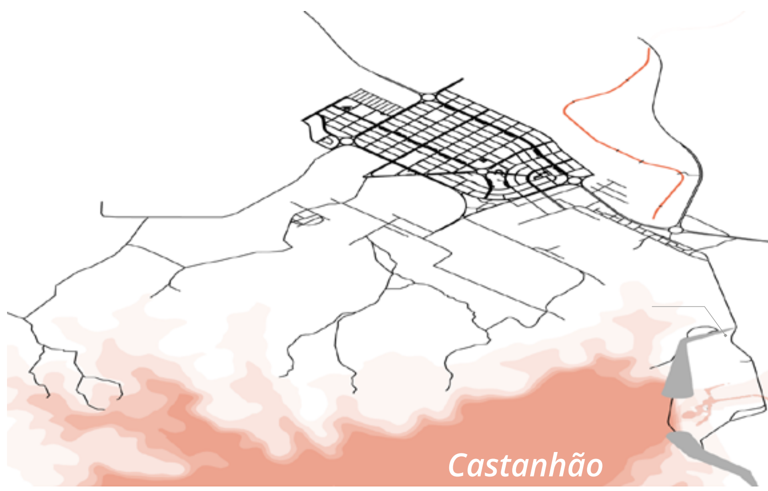


MANDACARÚ PROJECT
(Irrigated farming)

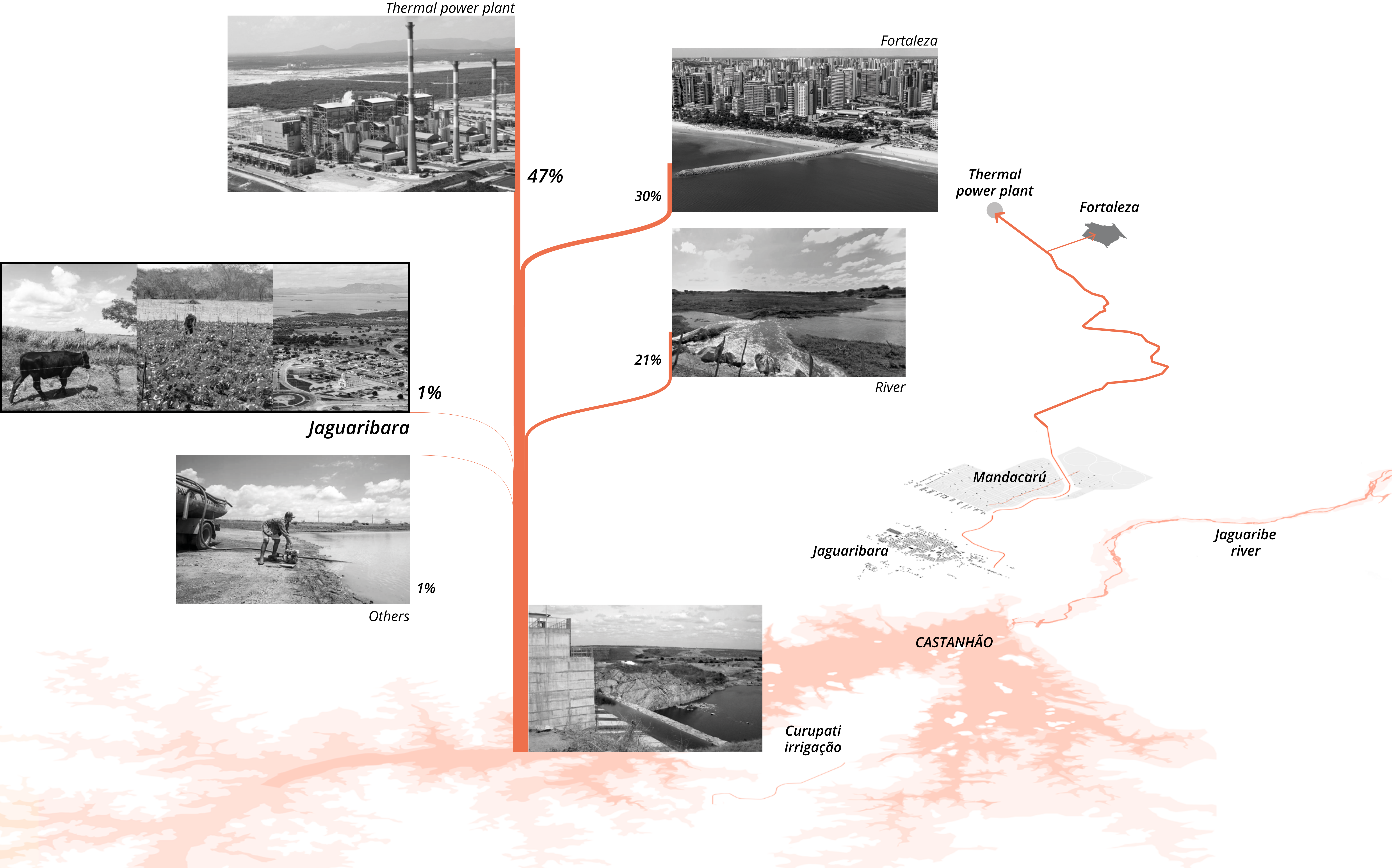
CURUPATI PROJECT
(Irrigated agriculture)

From 2019





CONTEXT: LOCAL



PROBLEM

The current water system is unsustainable

Privileges economic development
Undemocratic water supply
Loss of productive autonomy

Inefficient to droughts

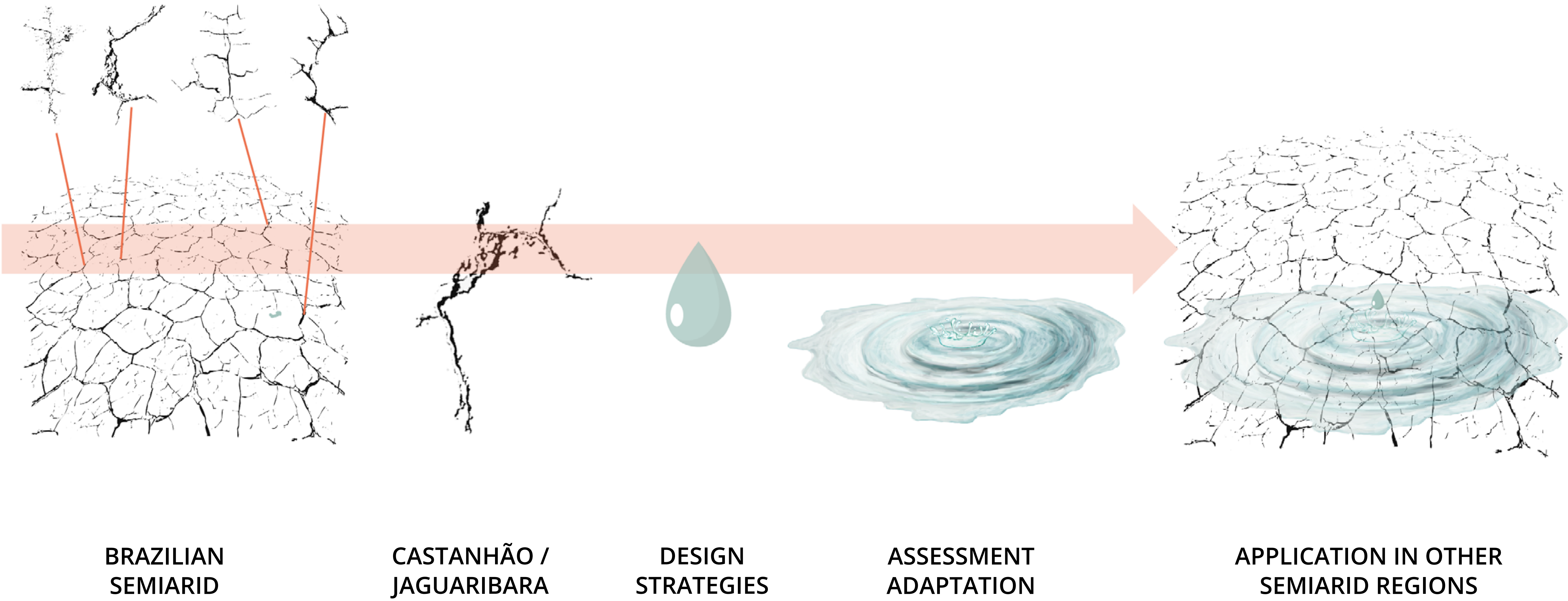
The water system can be improved by holding wetness in the landscape

Productive autonomy

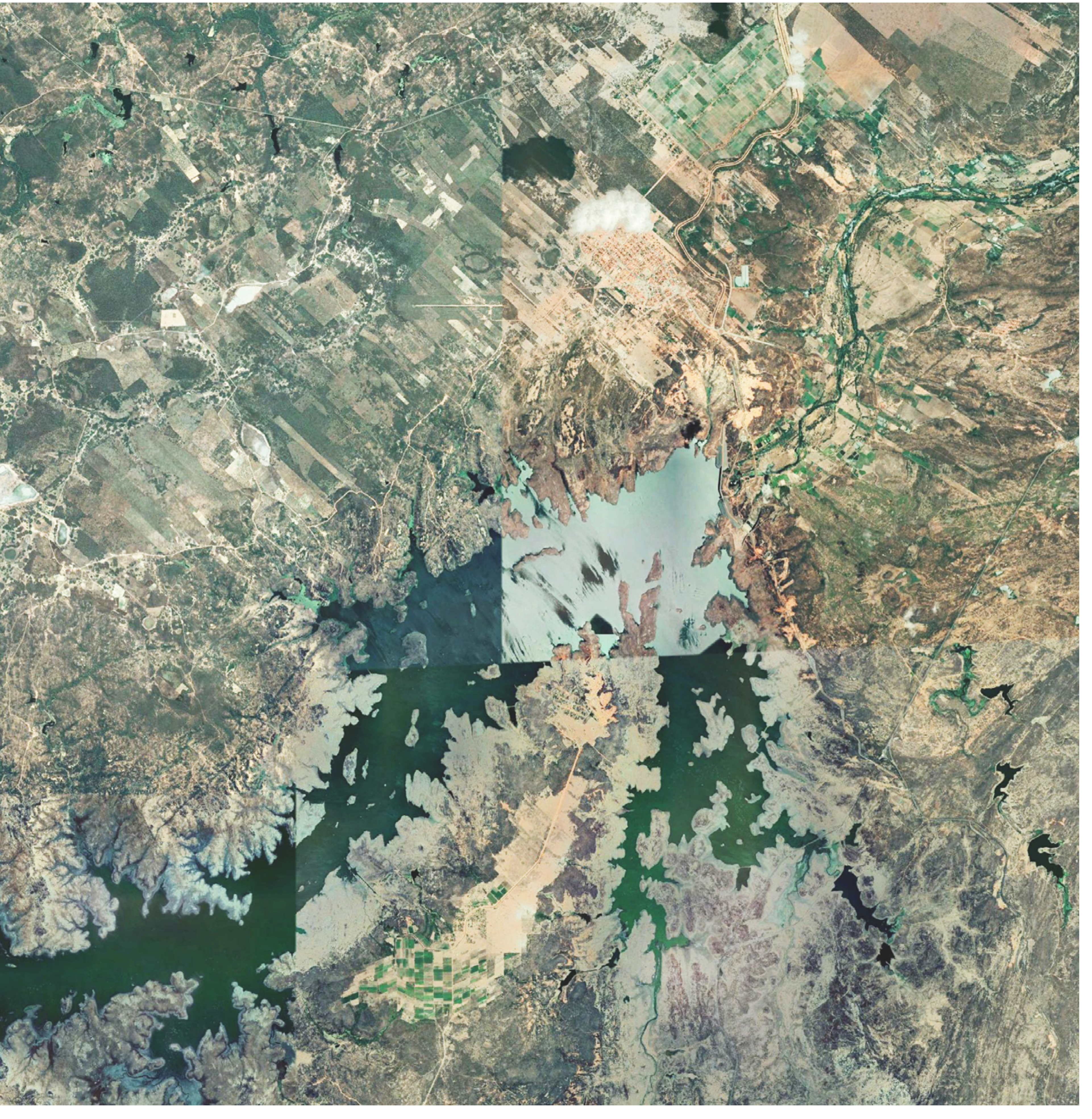
RESEARCH QUESTION

How to **improve the water management** in Jaguaribara, considering the relationship between **inhabitants and landscape**?

Research through design



MAPPING WETNESS



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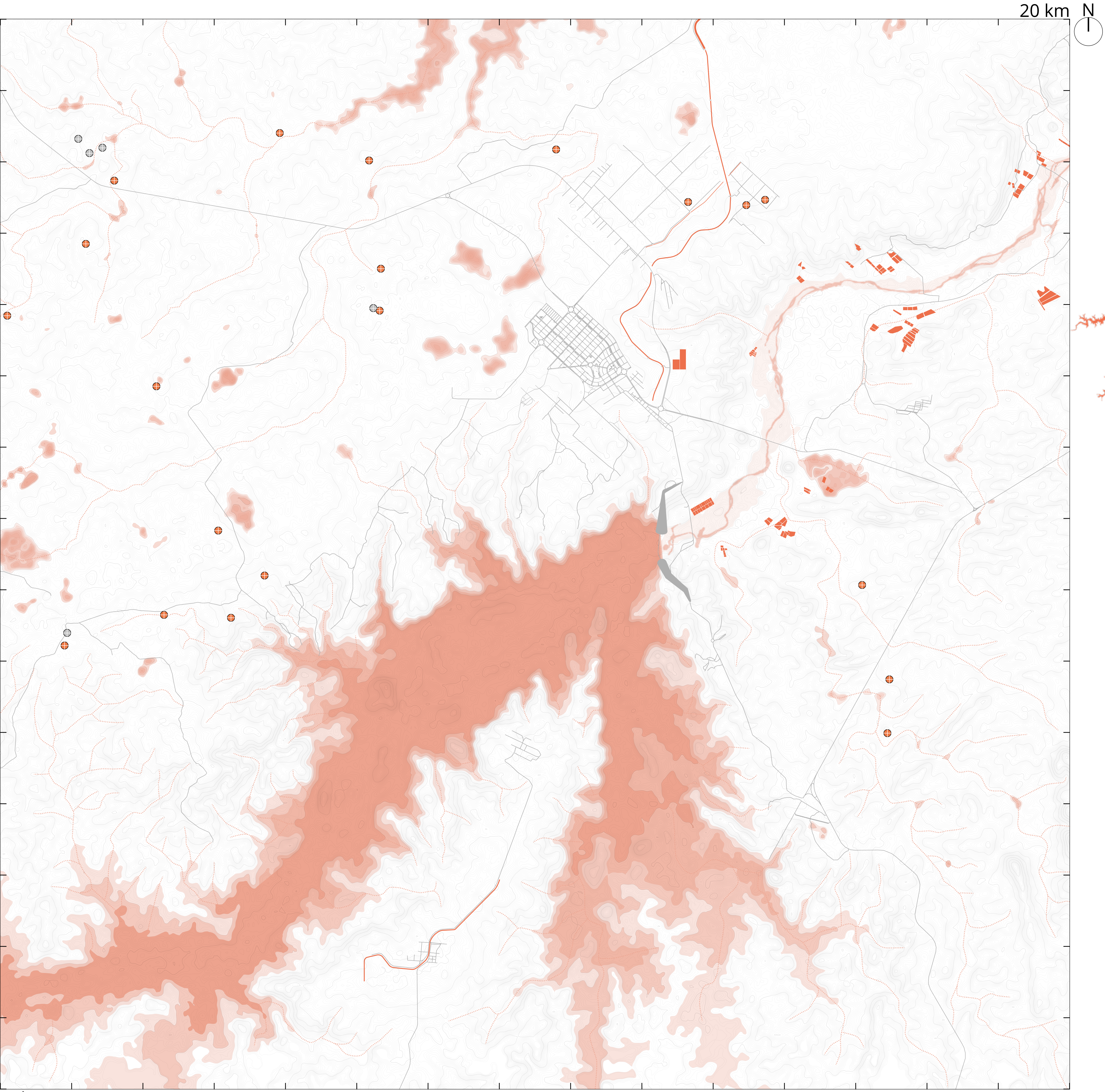

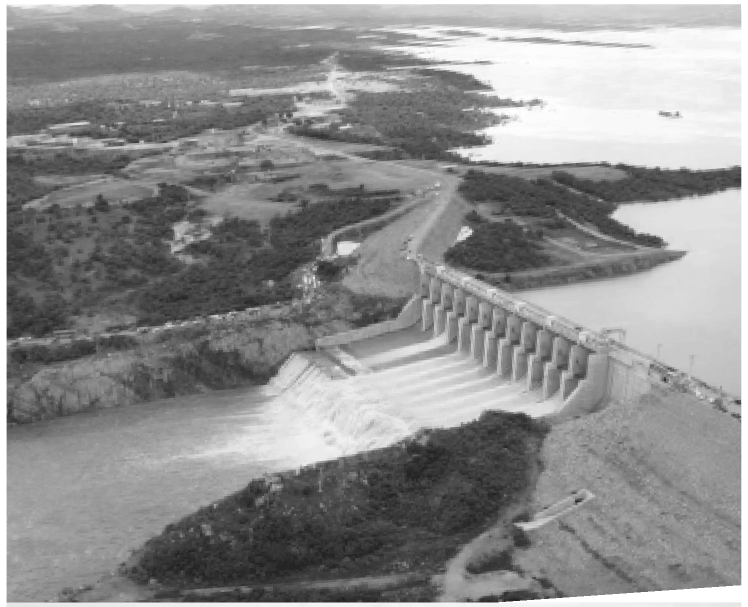

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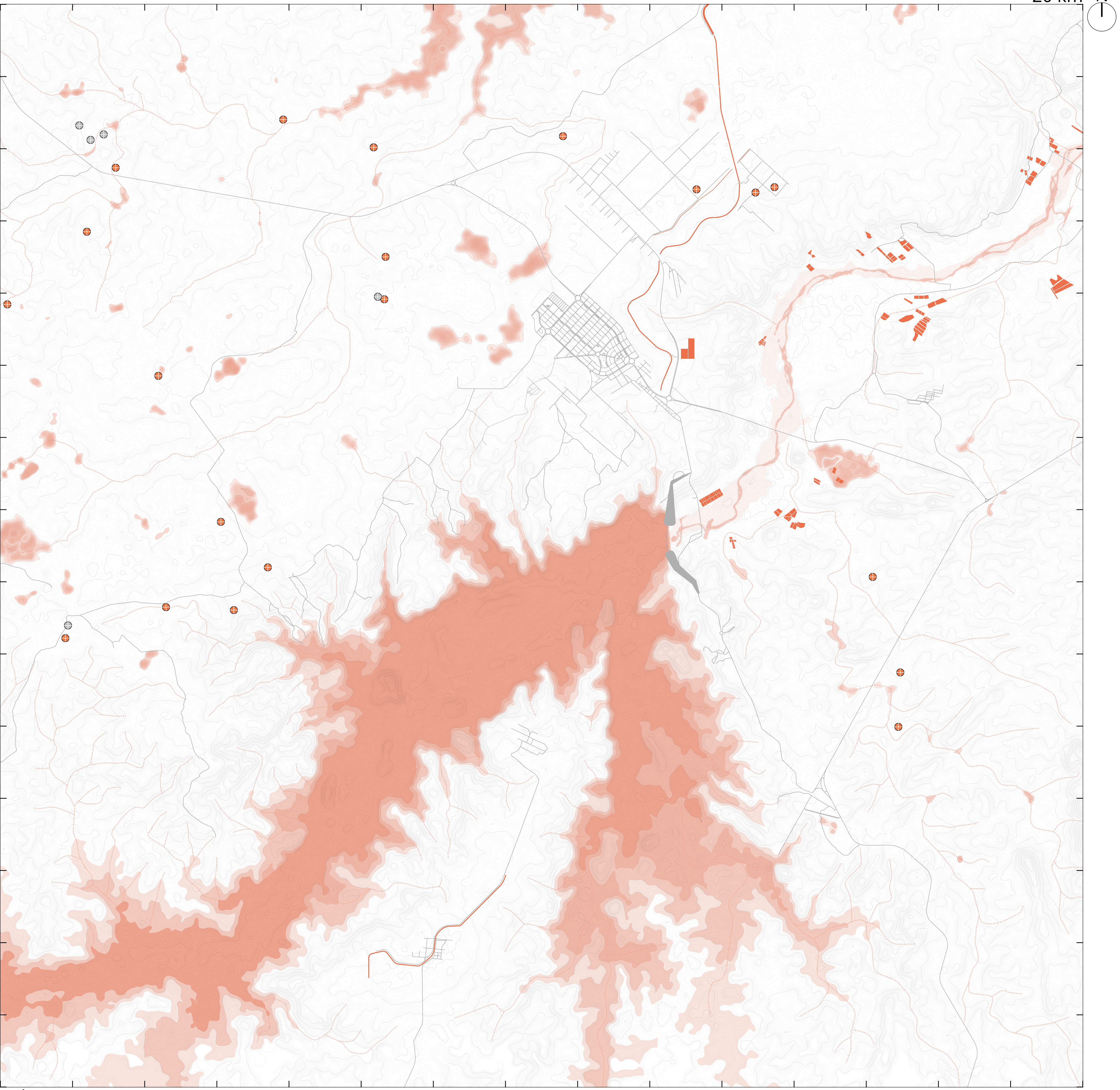
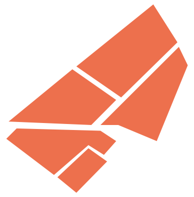
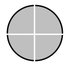
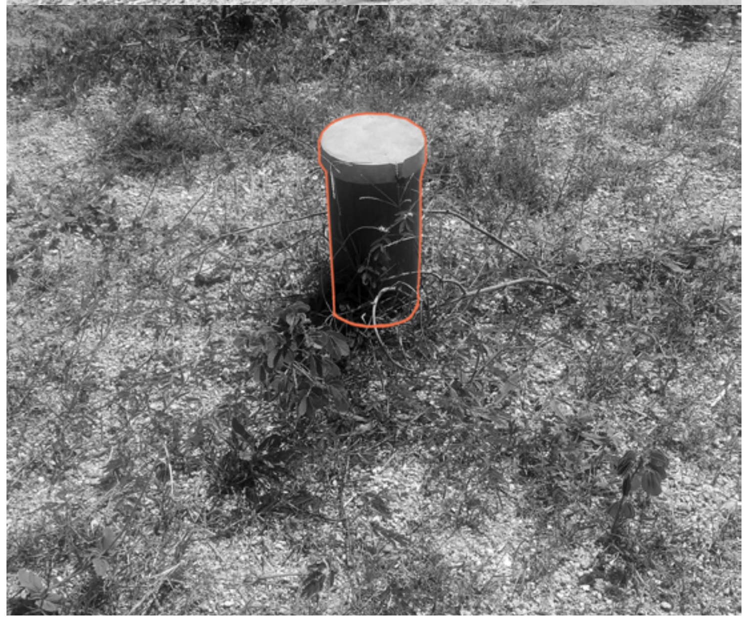
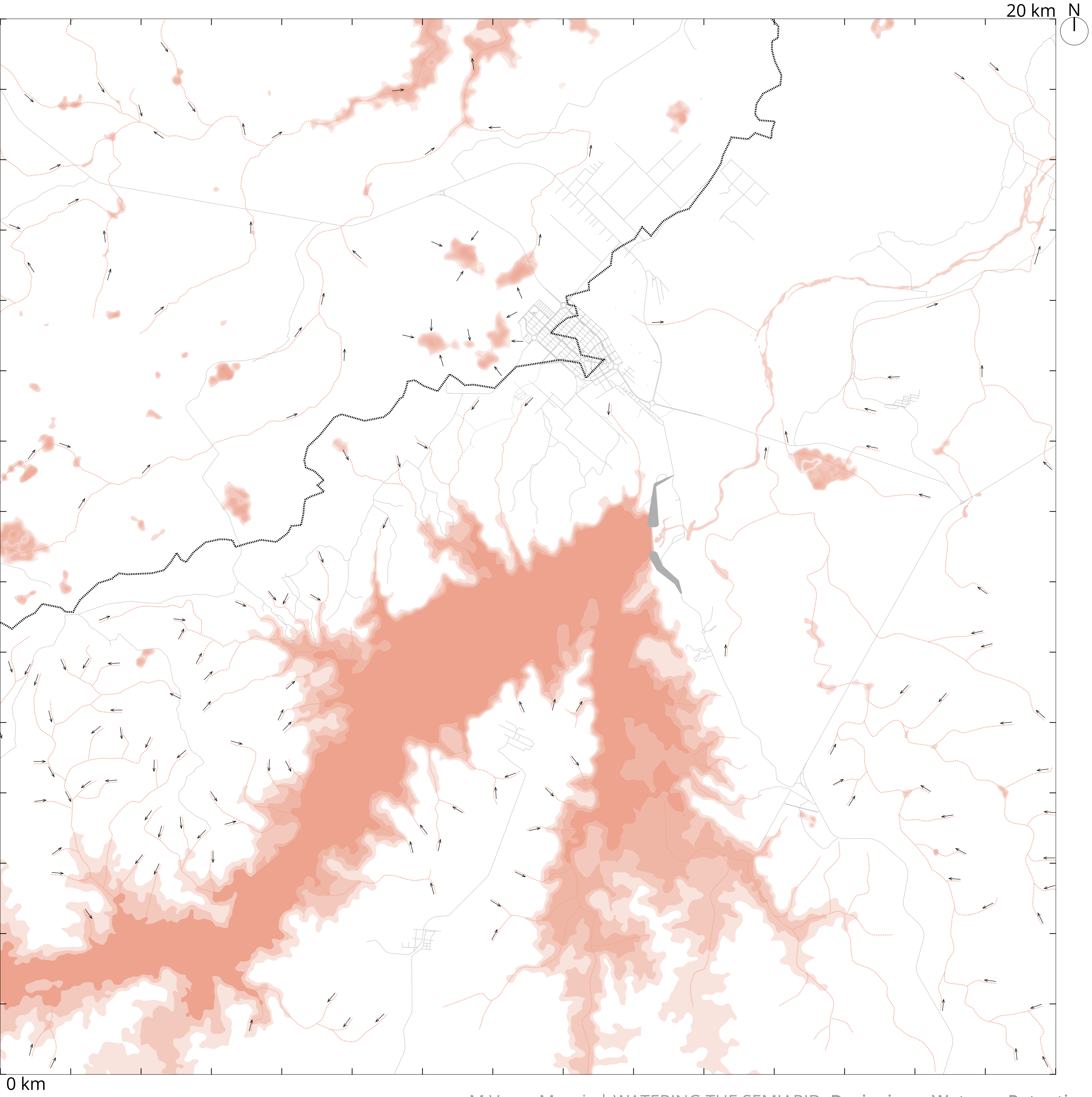






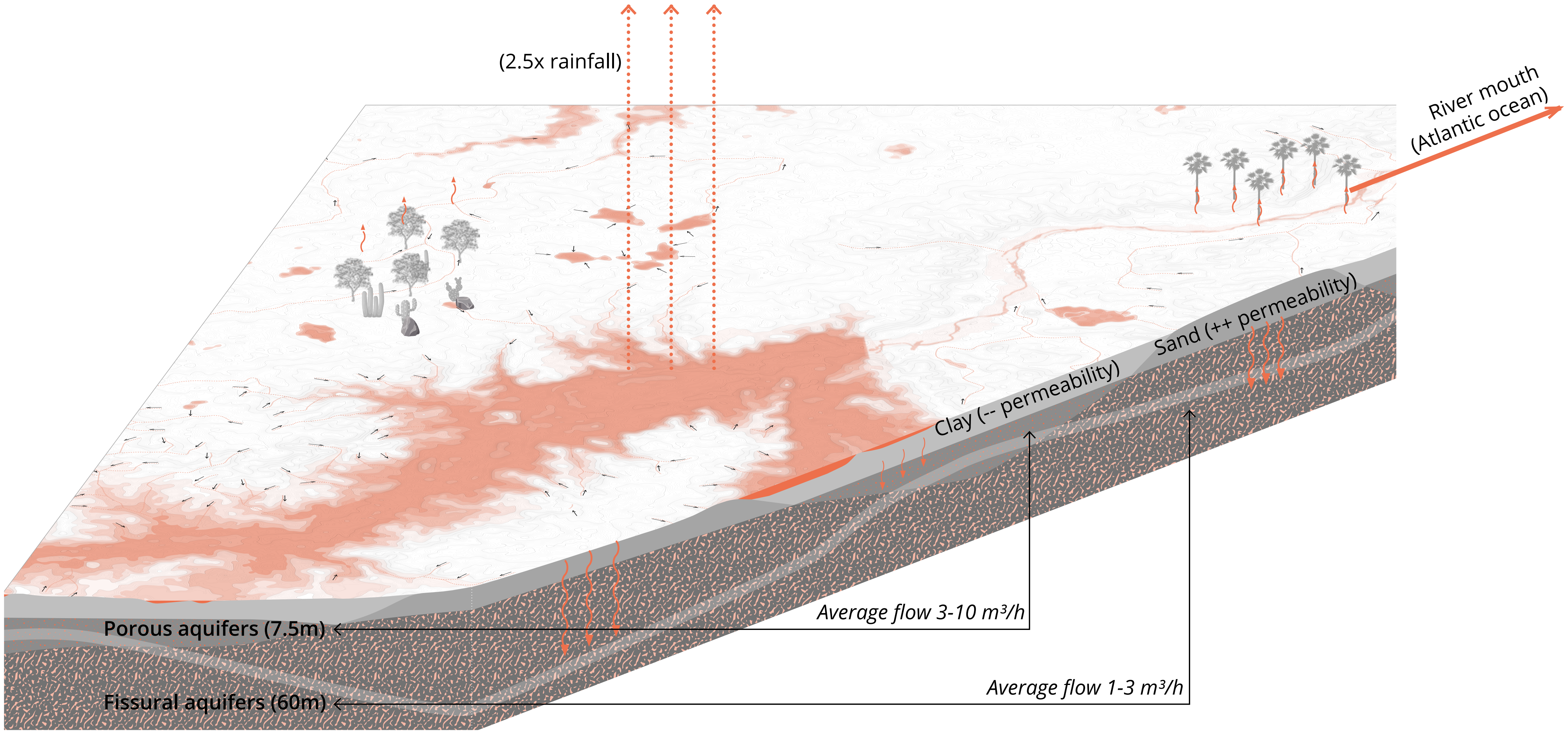


MAPPING WETNESS



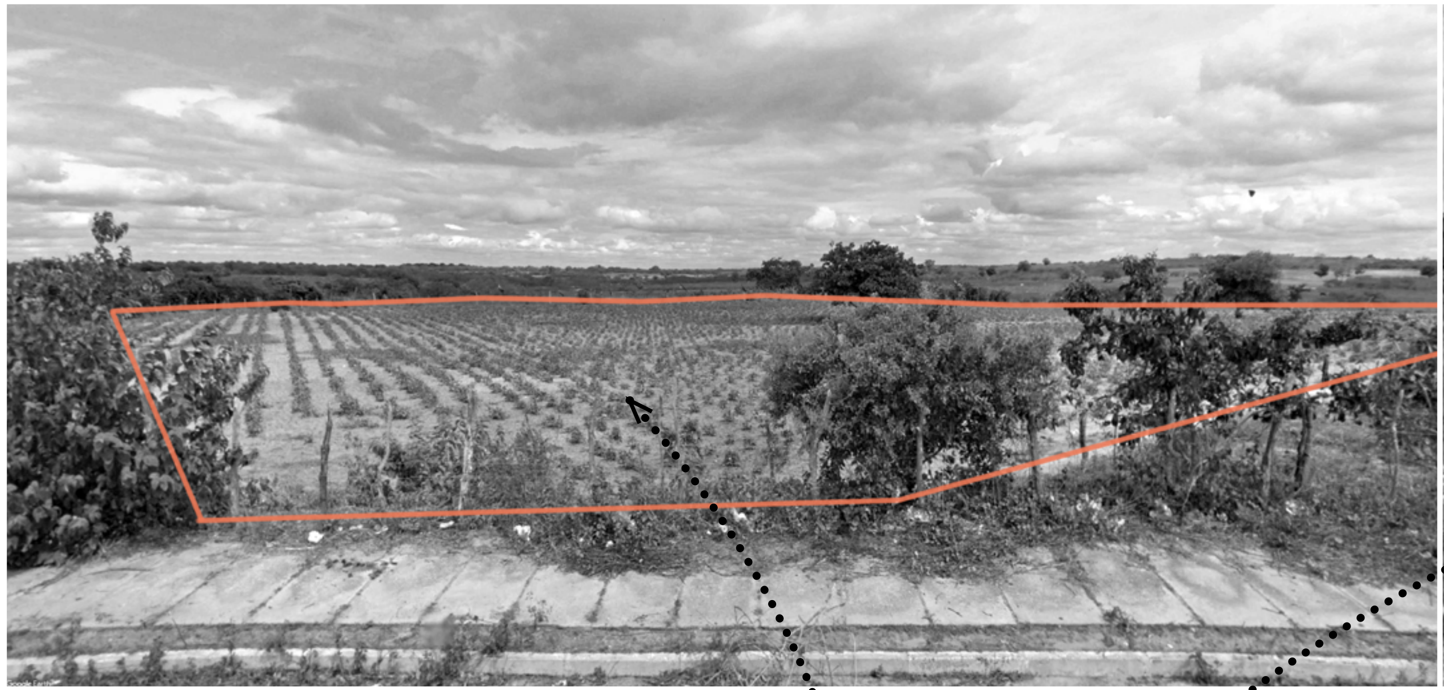
MAPPING WETNESS

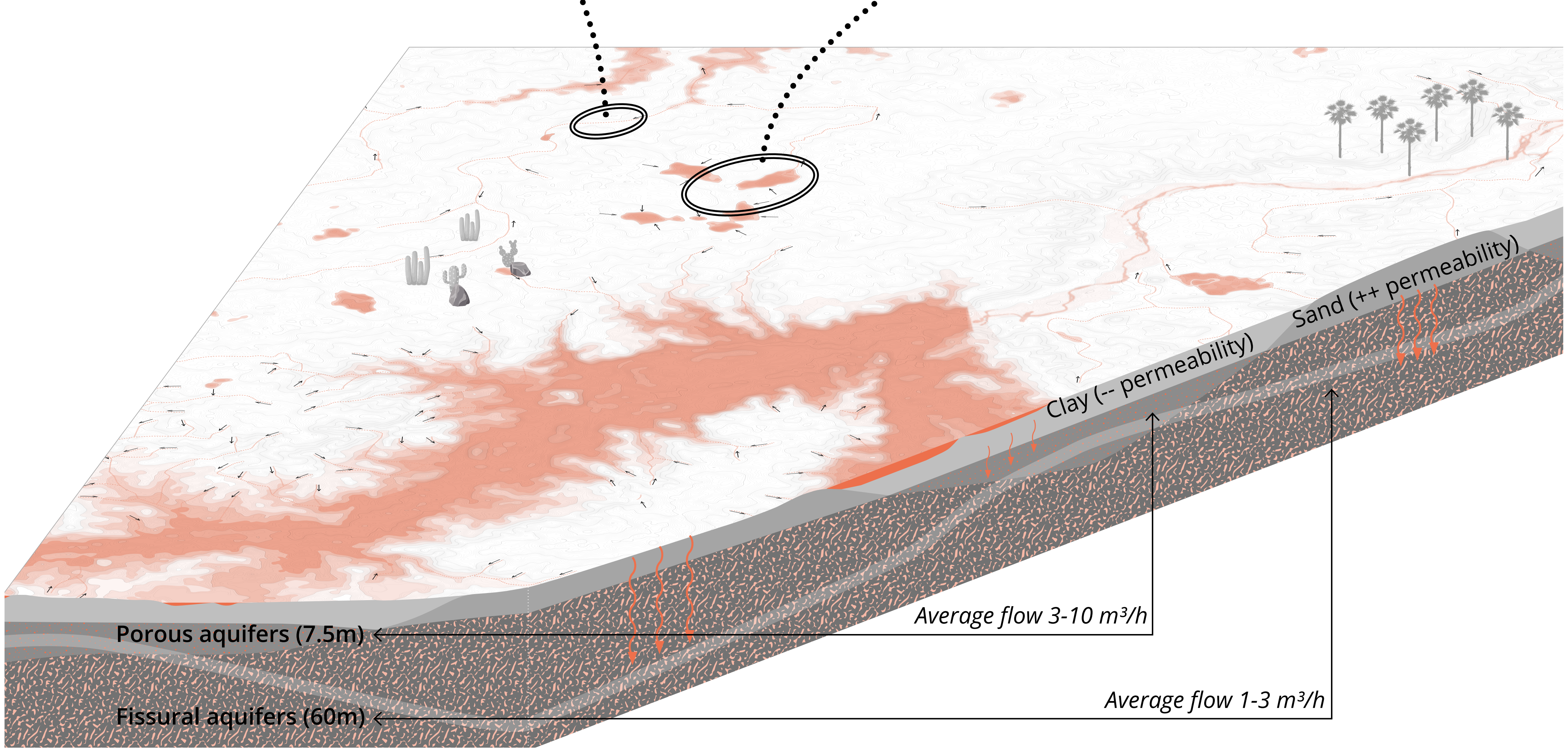
Water cycle



MAPPING WETNESS

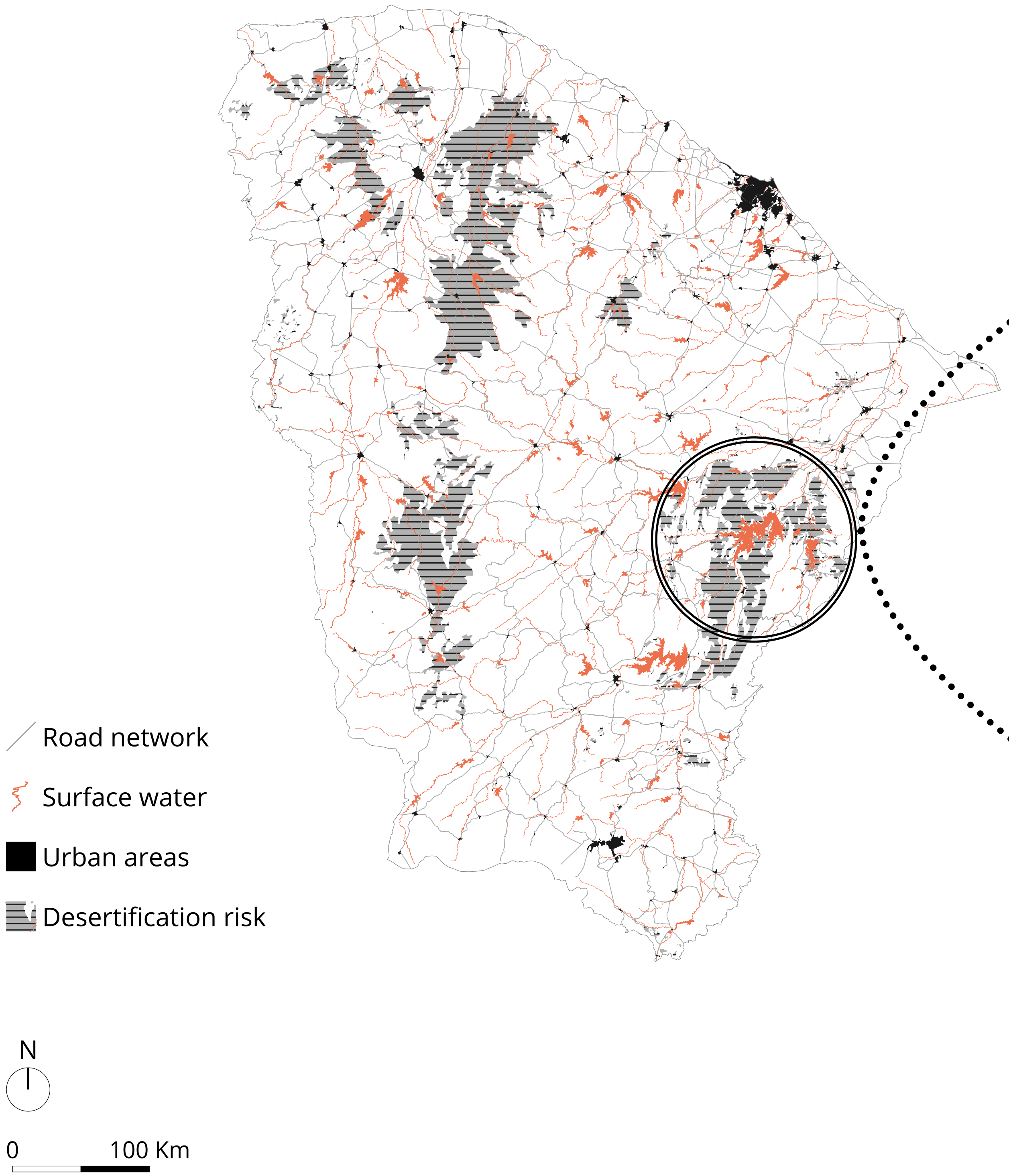
Seizing the wetness

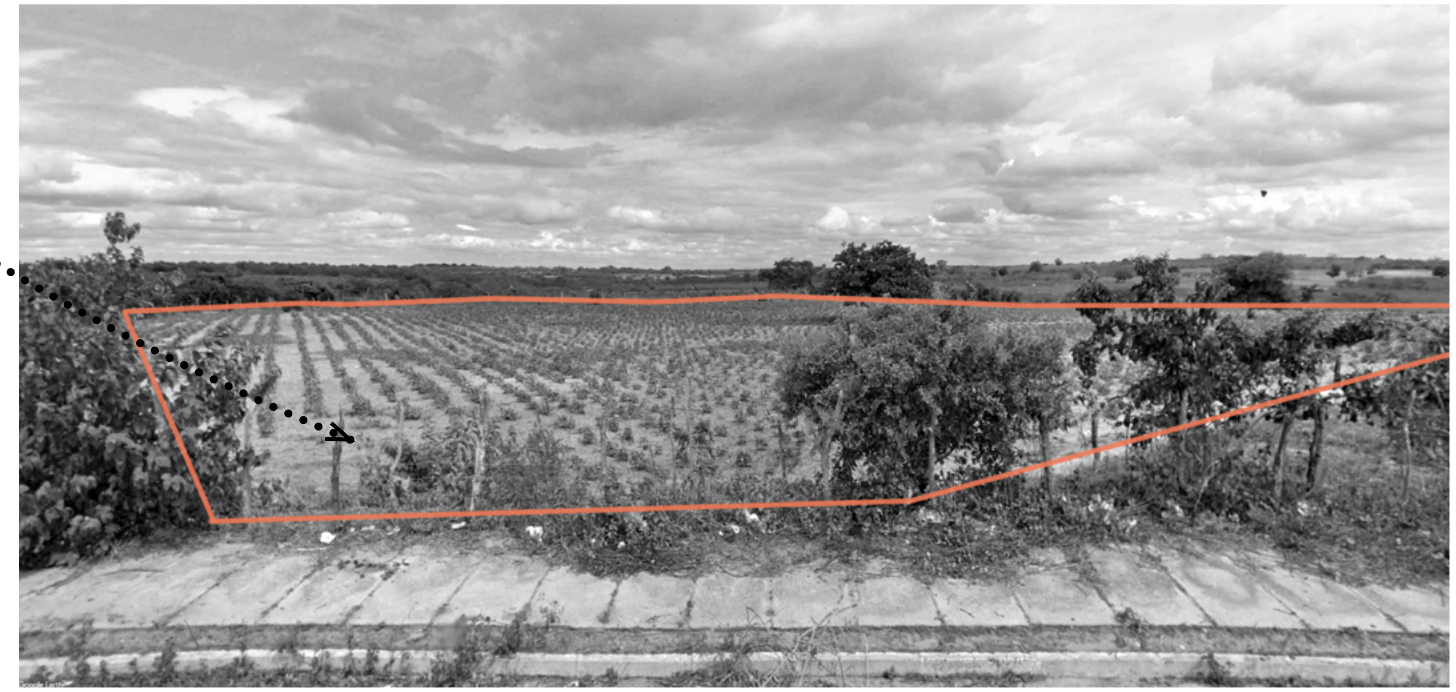




MAPPING WETNESS

Seizing the wetness

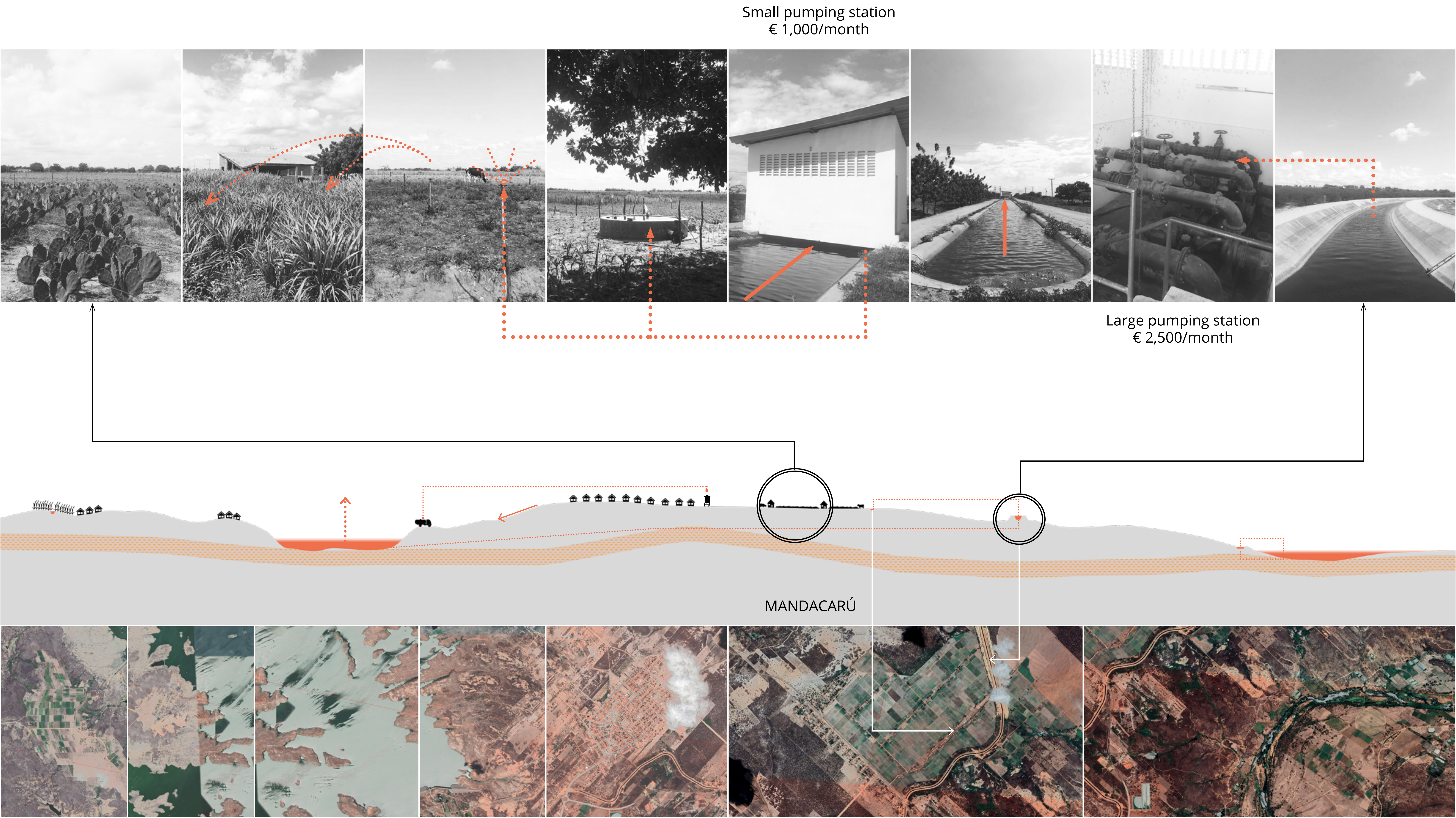




MICRO (WATER)STORIES

Irrigated farming community (Mandacarú)

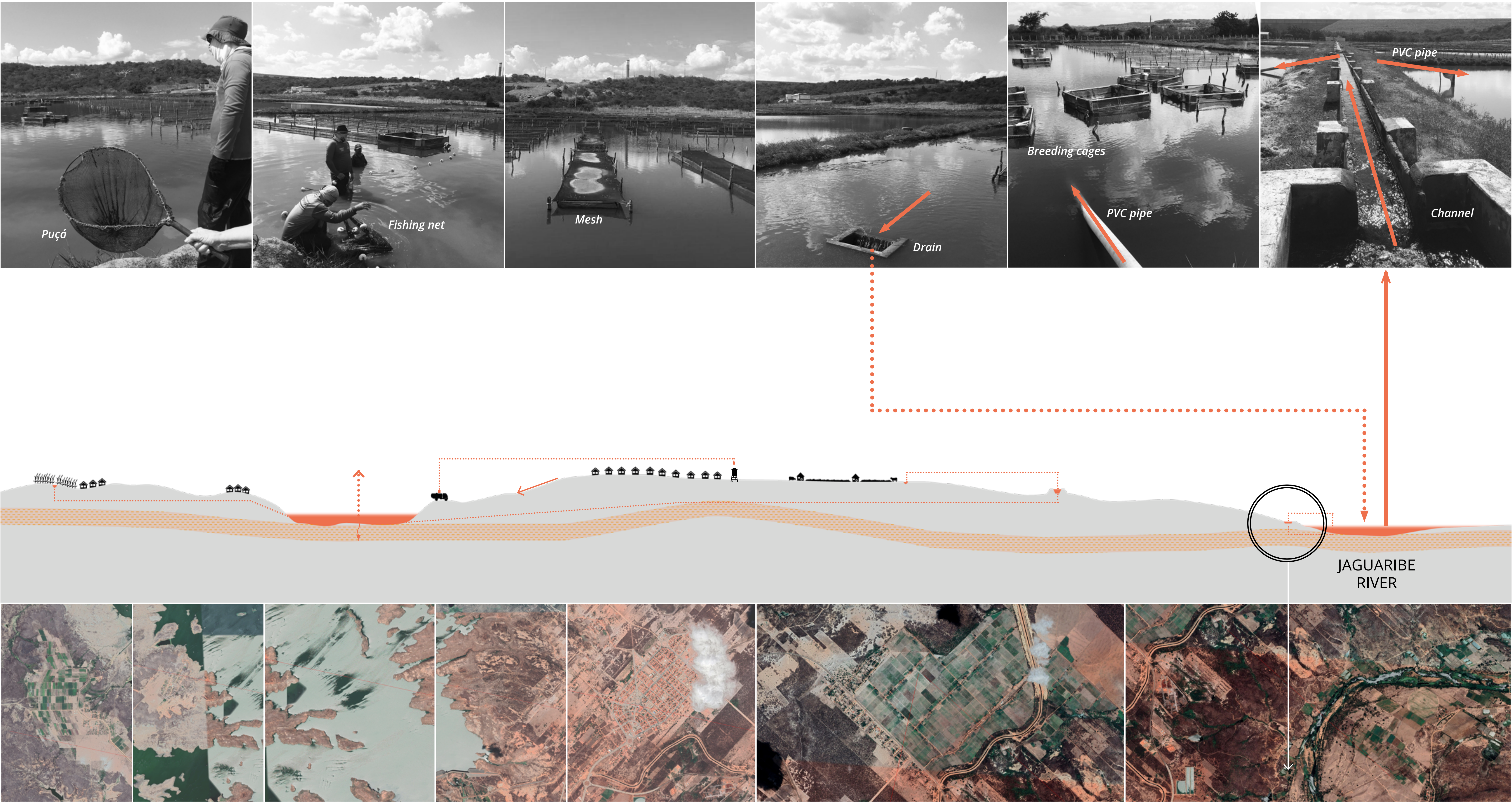
Sprinkled in the air
Surface flow
Underground flow



MICRO (WATER)STORIES

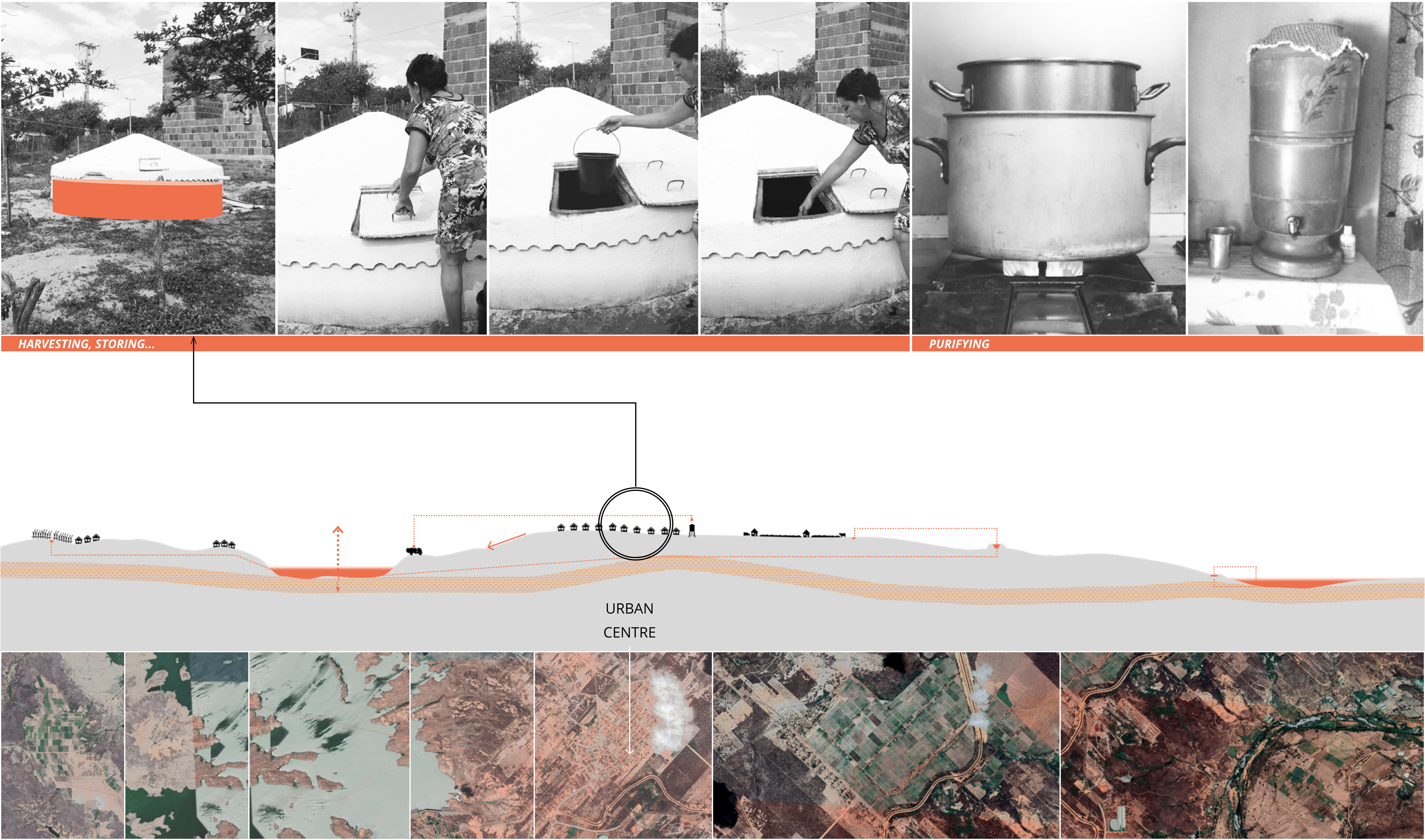
Fish farming (Castanhão)

Sprinkled in the air
Surface flow
Underground flow



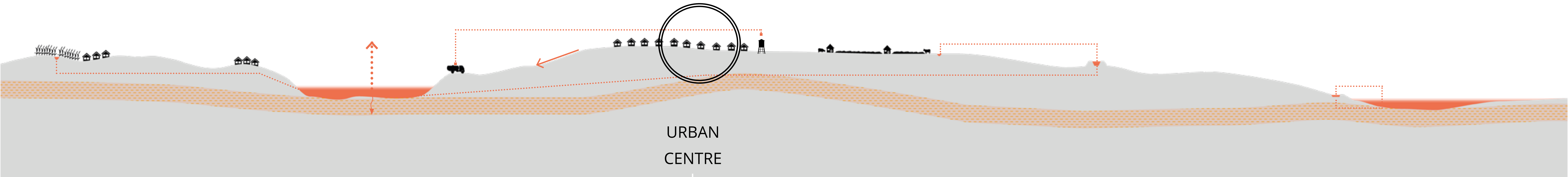
MICRO (WATER)STORIES

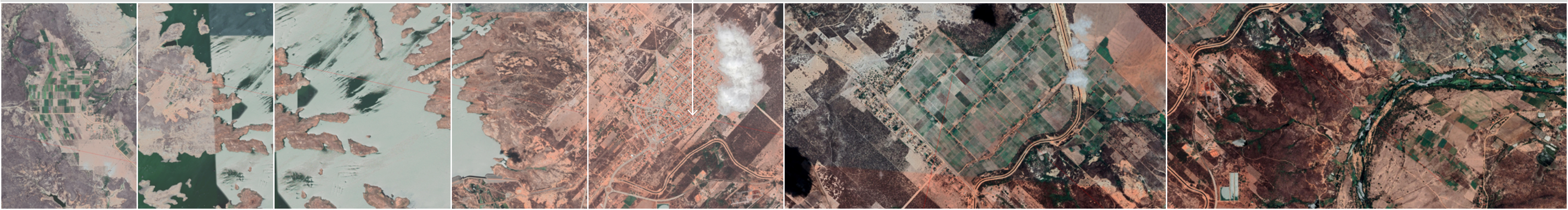
House water (urban centre)



MICRO (WATER)STORIES

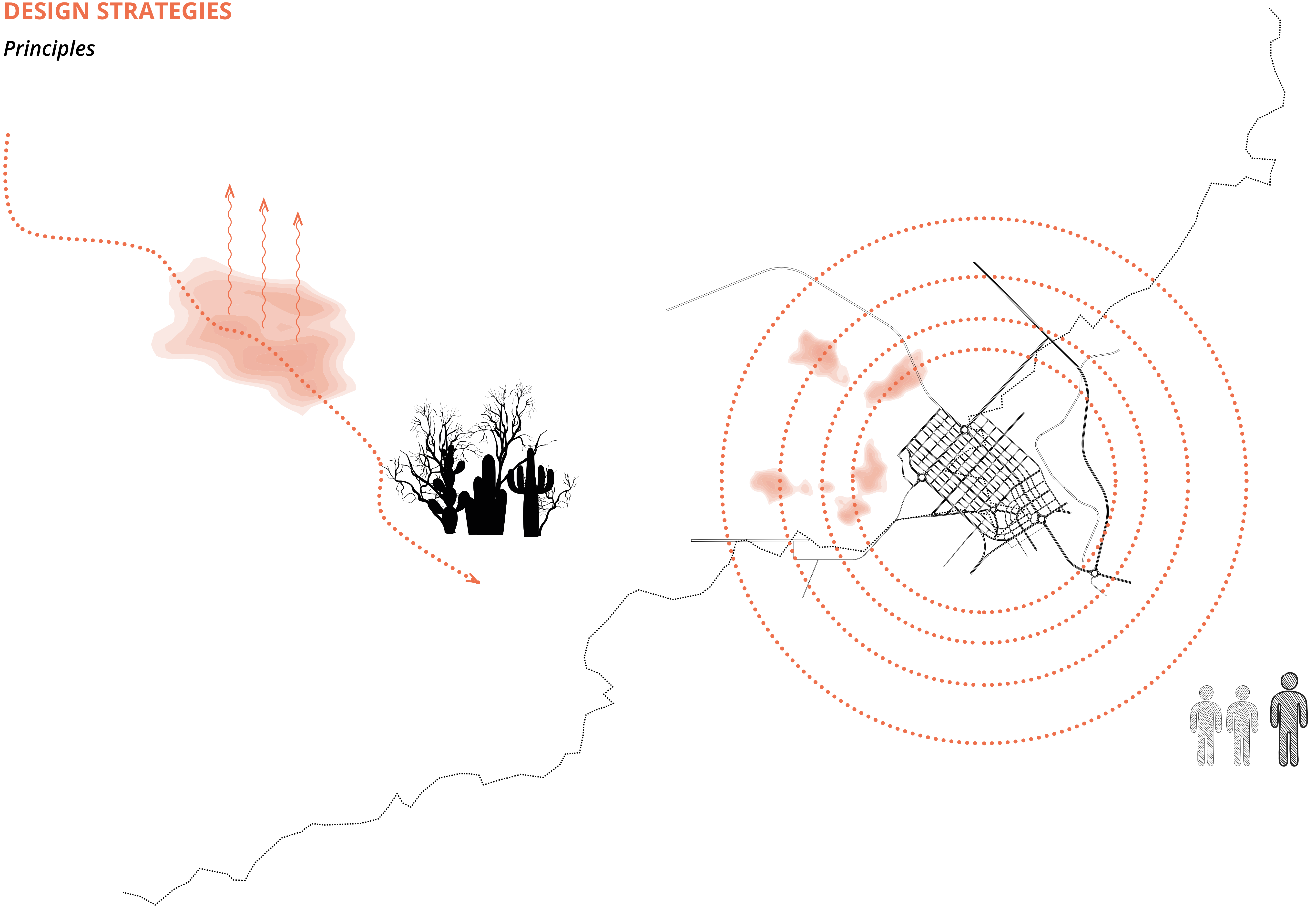
Wetness everywhere (urban centre)





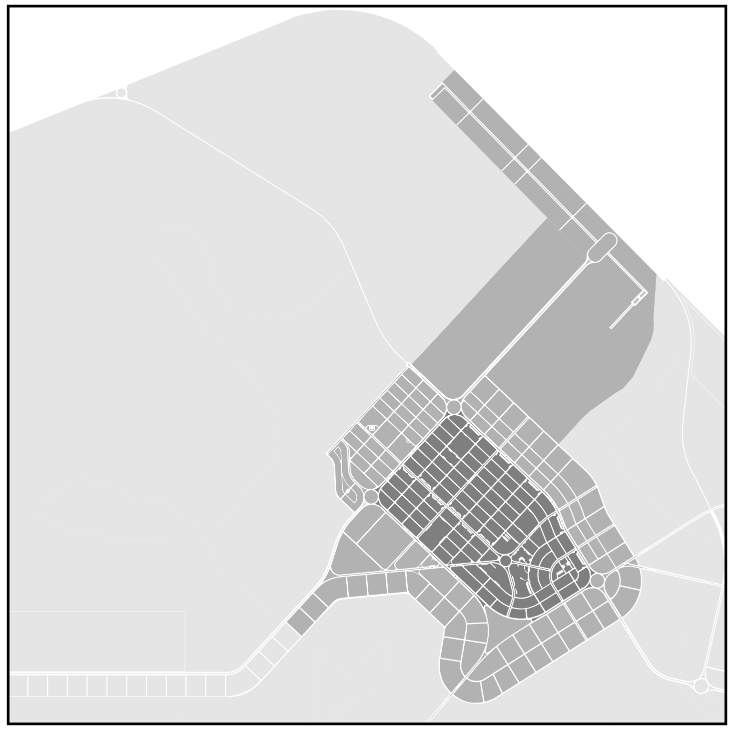
DESIGN STRATEGIES

Principles



DESIGN STRATEGIES

Principles



Consolidated urban area

Expansion area 1

Expansion area 2

Existing buildings

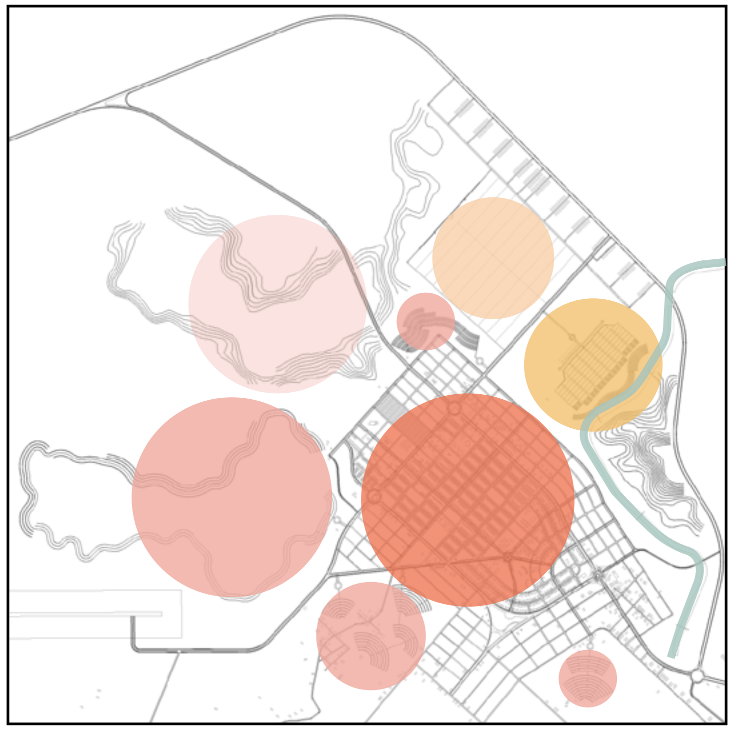
Existing streets

Occasional wetness

Thalwegs

Topographic ridge

Direction of run off



Urban wadi system

Keyline cultivation

Swales system

Underground dam rangeland

Underground water aquaponics

Green water channel

DESIGN STRATEGIES: LOCAL SCALE

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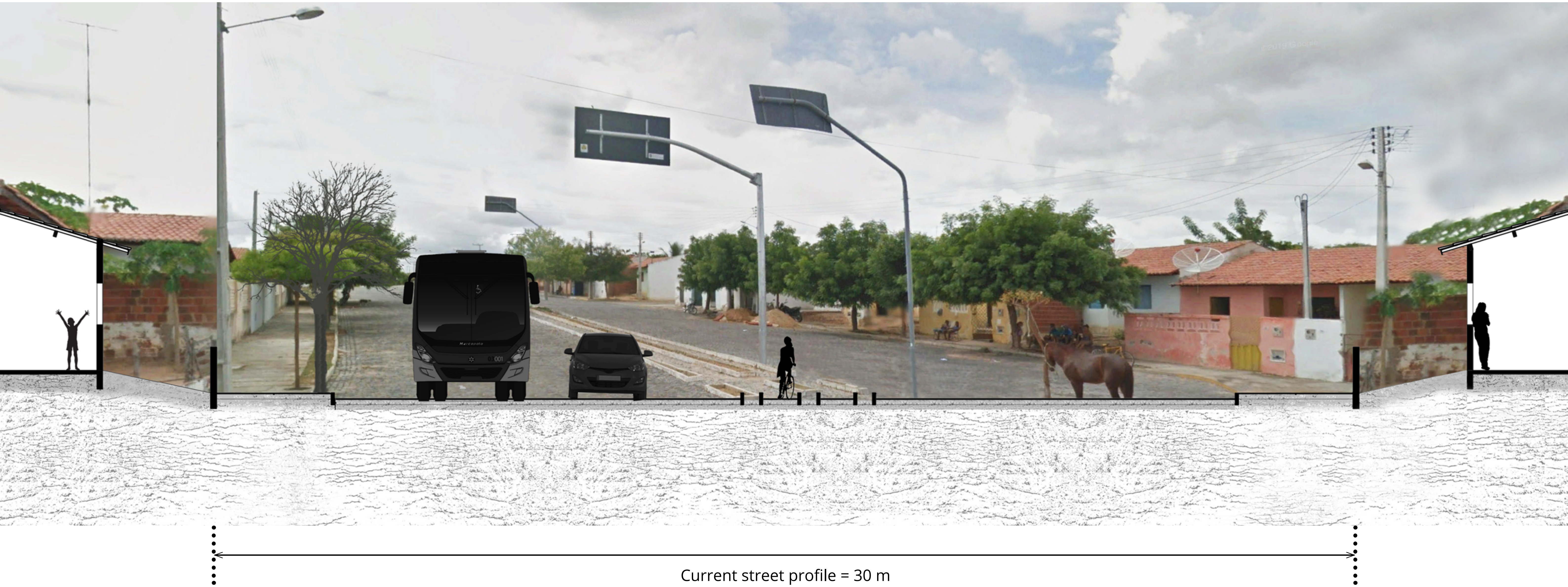
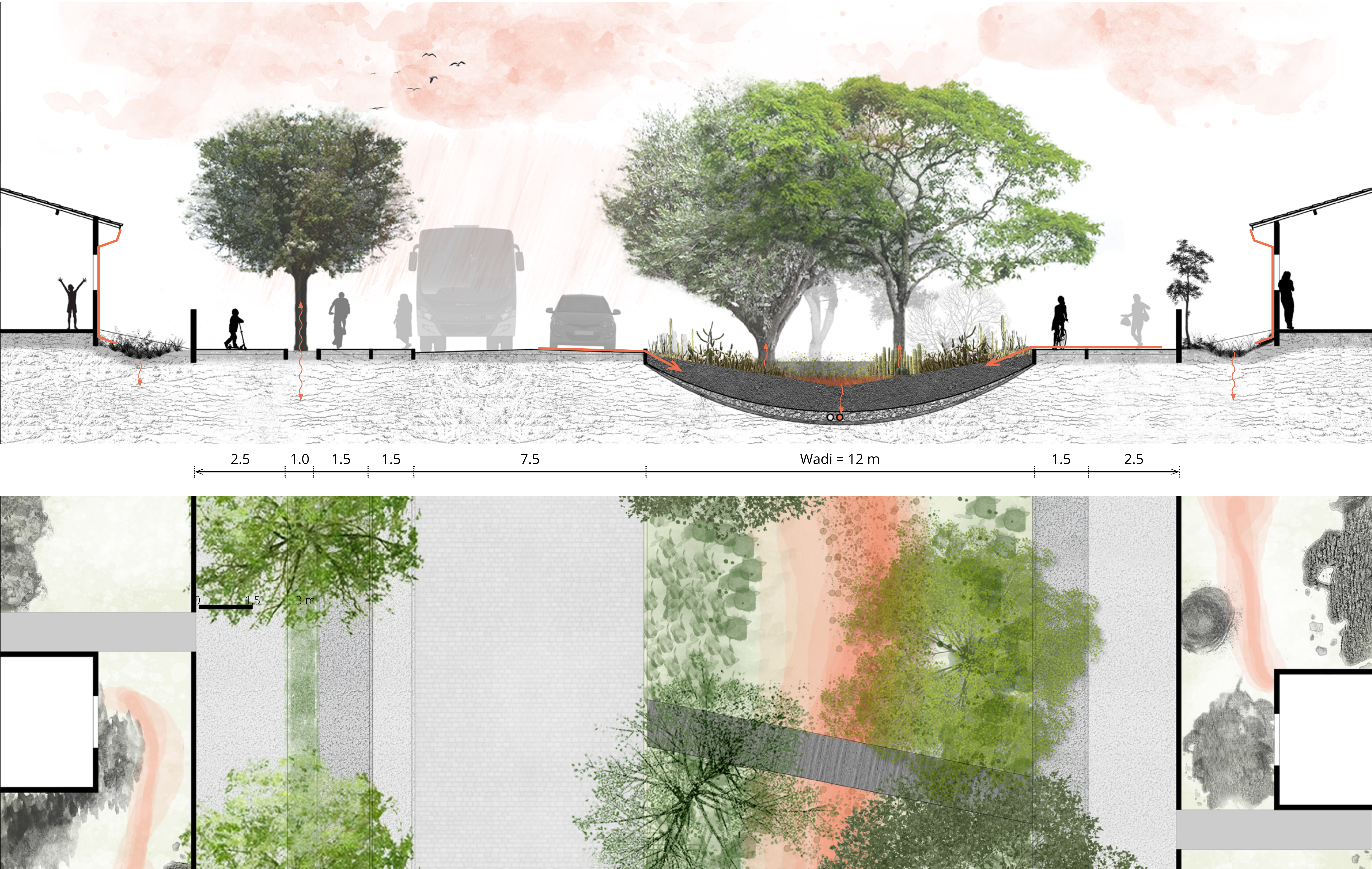
DESIGN STRATEGIES: LOCAL SCALE

URBAN WADI SYSTEM



Current street profile = 30 m

URBAN WADI SYSTEM



URBAN WADI SYSTEM

URBAN WADI SYSTEM

Rainy season

Drainage direction

Collector wadi

Infiltration wadi

Well

Cisterns

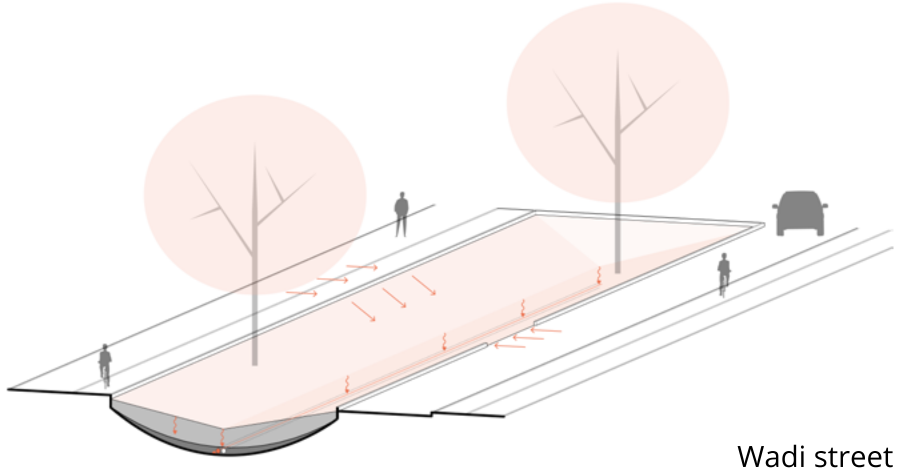
URBAN WADI SYSTEM

Rainy season

Surface runoff

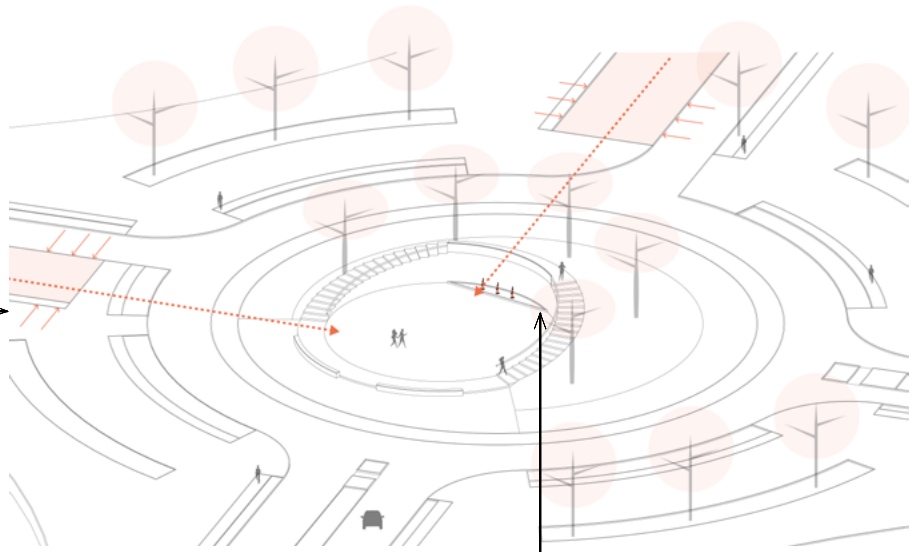
Wetness that infiltrates the soil

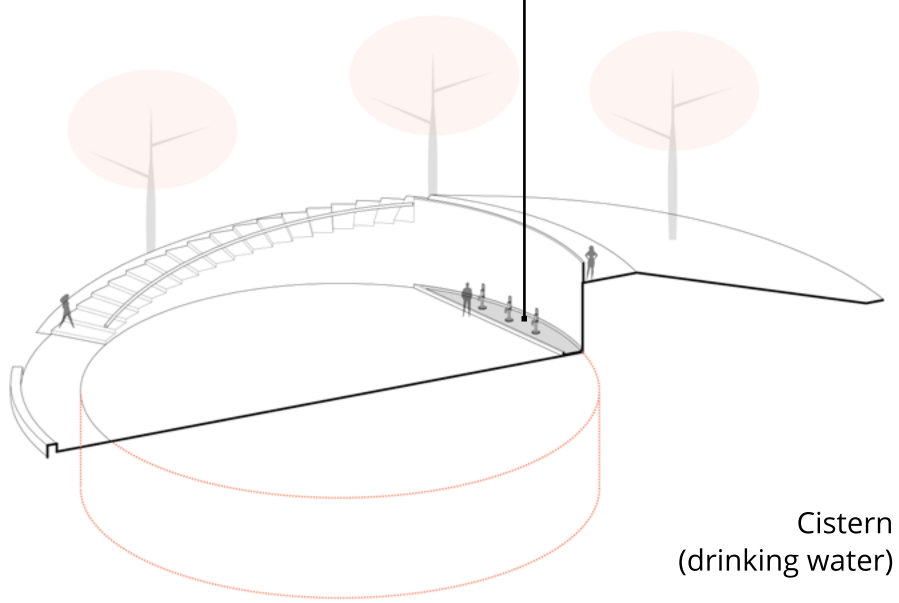
Underground route



Wadi street

Rainwater harvesting square

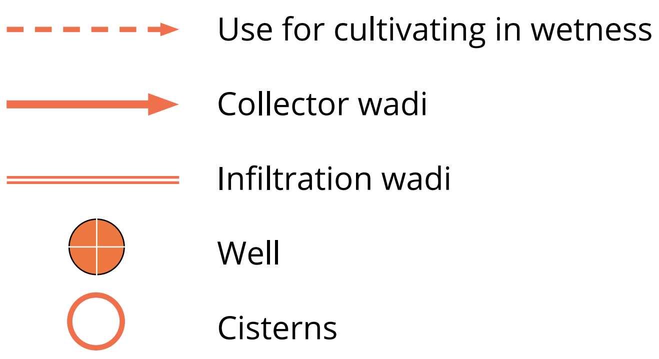




Cistern
(drinking water)

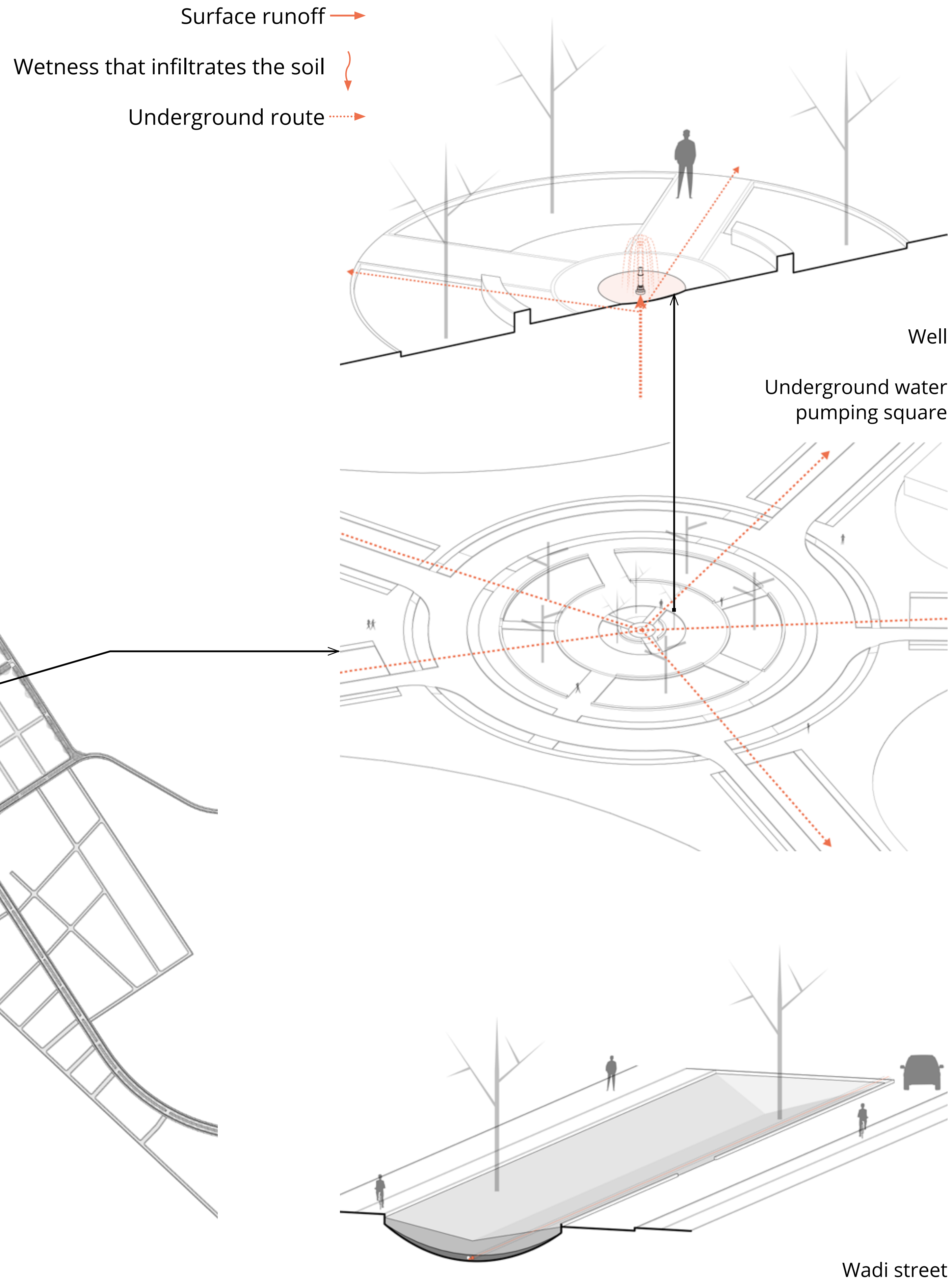
URBAN WADI SYSTEM

Dry season



URBAN WADI SYSTEM

Dry season

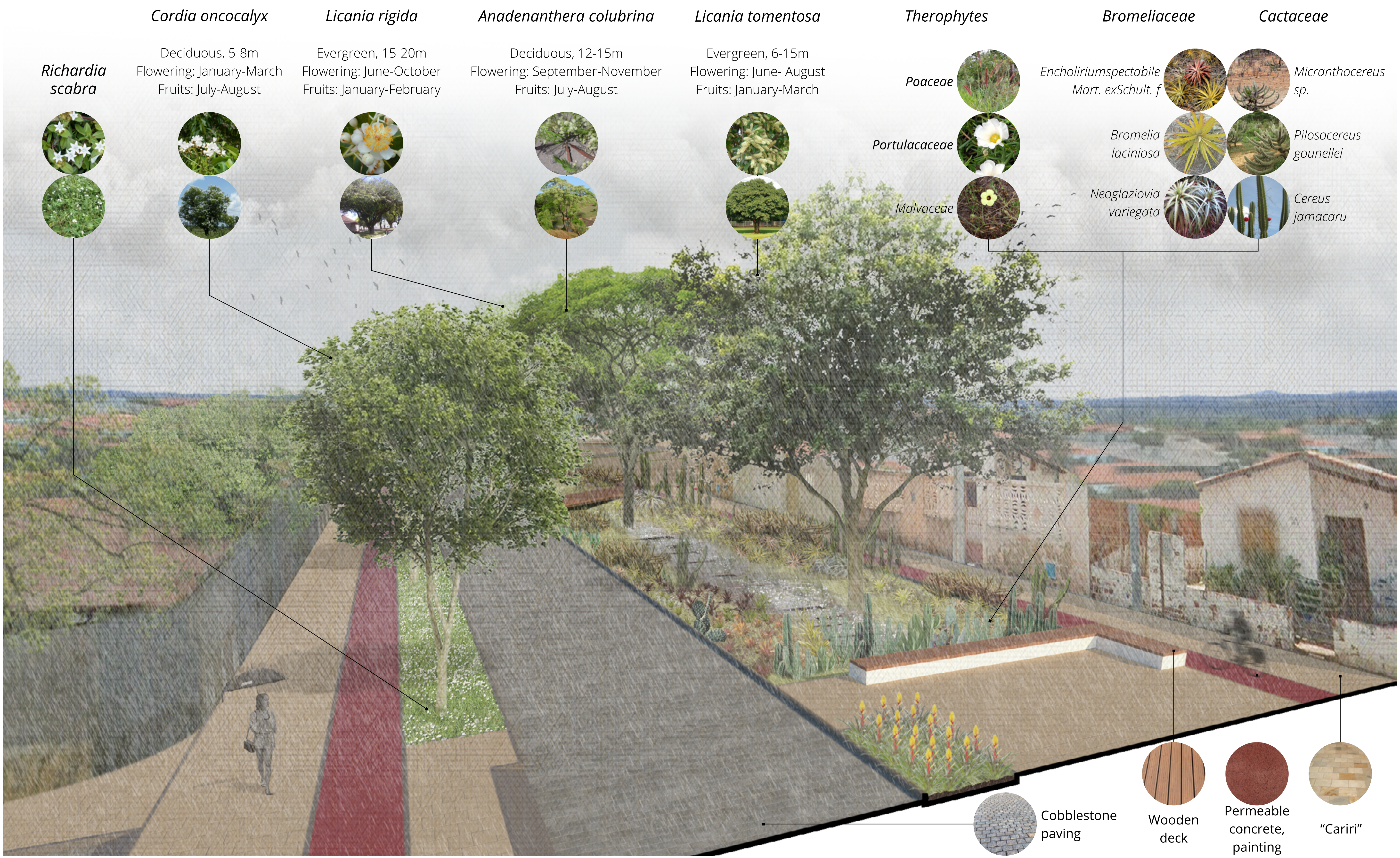


URBAN WADI SYSTEM

Street wadi

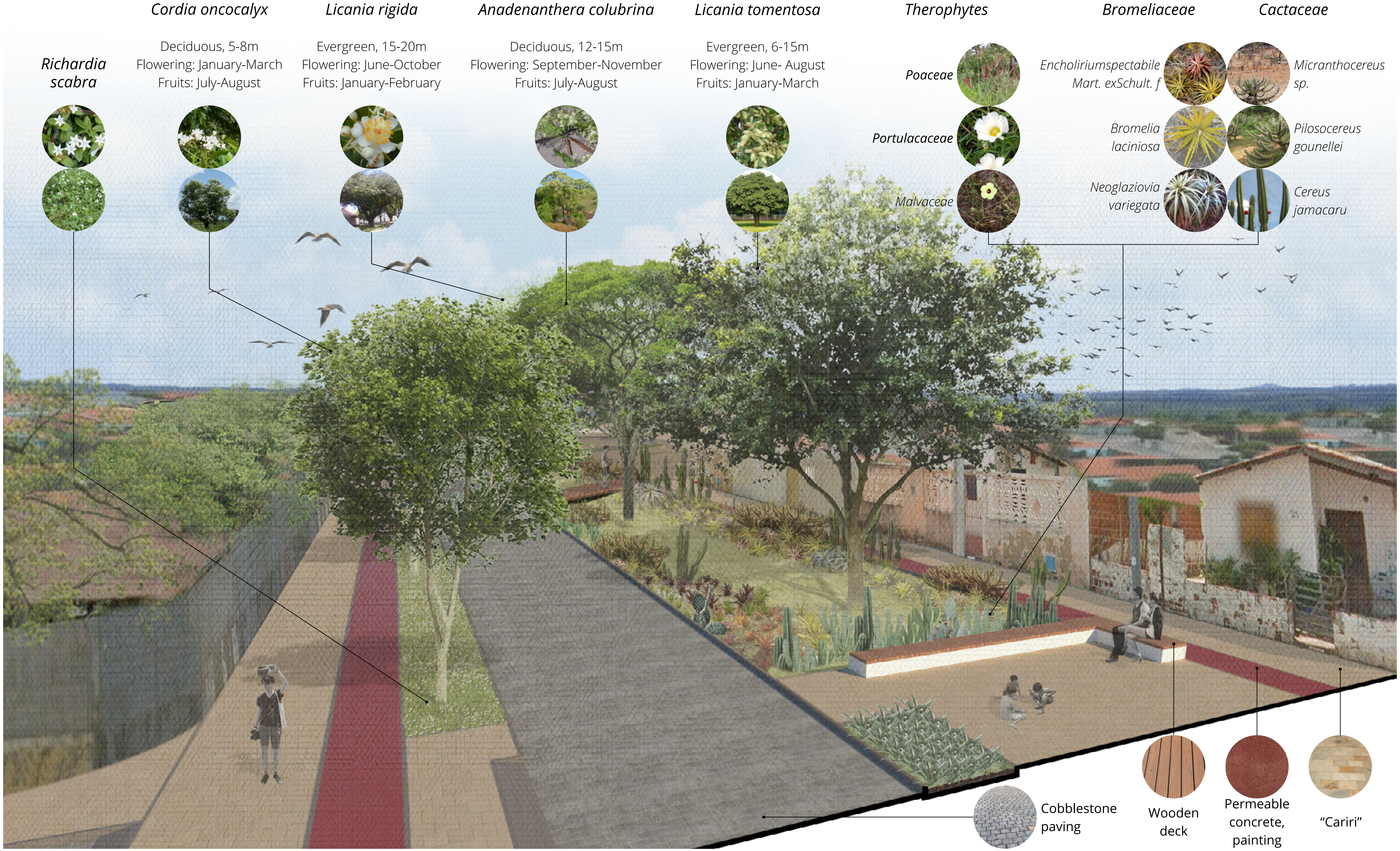
URBAN WADI SYSTEM

Street wadi - Rainy season



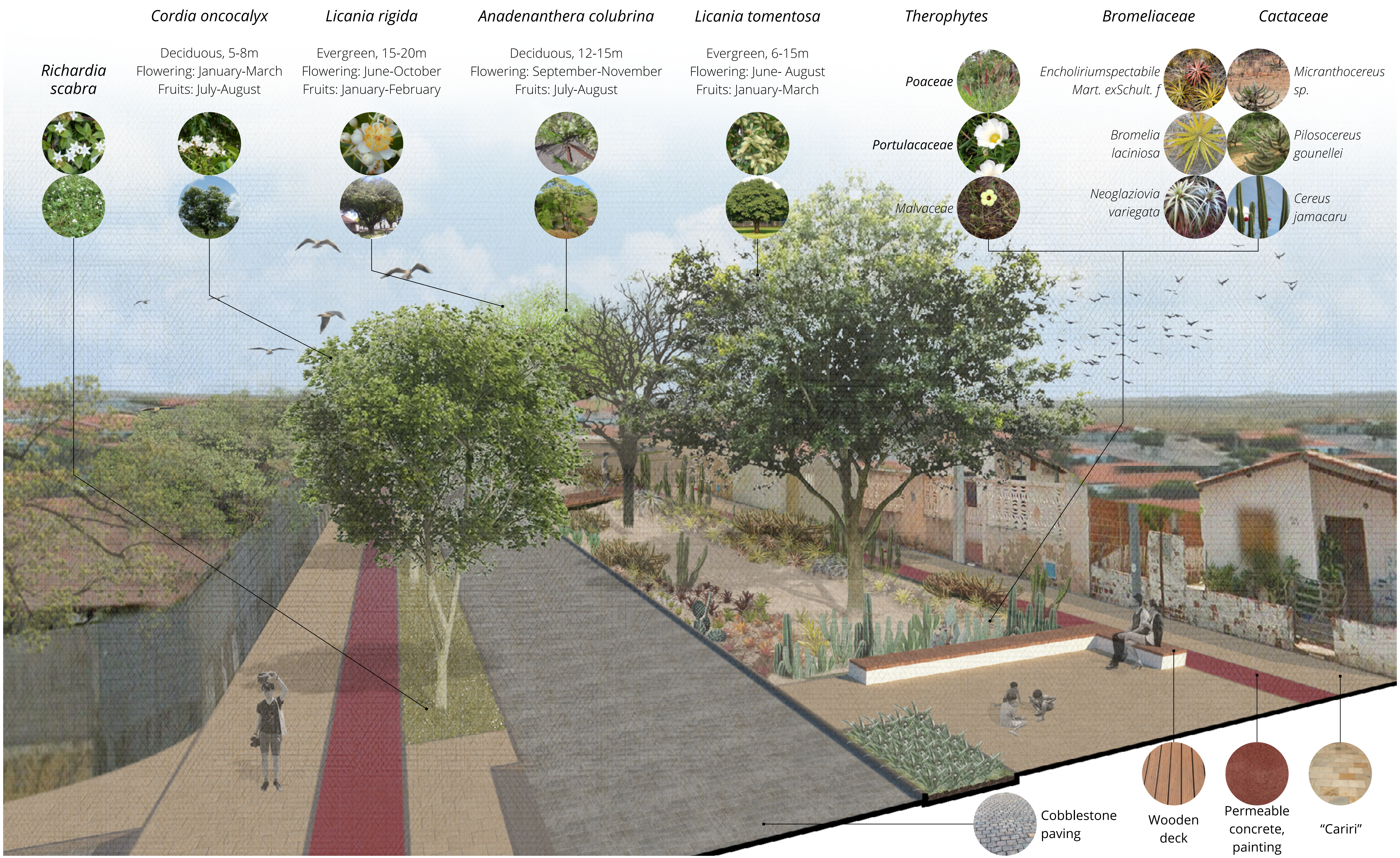
URBAN WADI SYSTEM

Street wadi



URBAN WADI SYSTEM

Street wadi - dry season

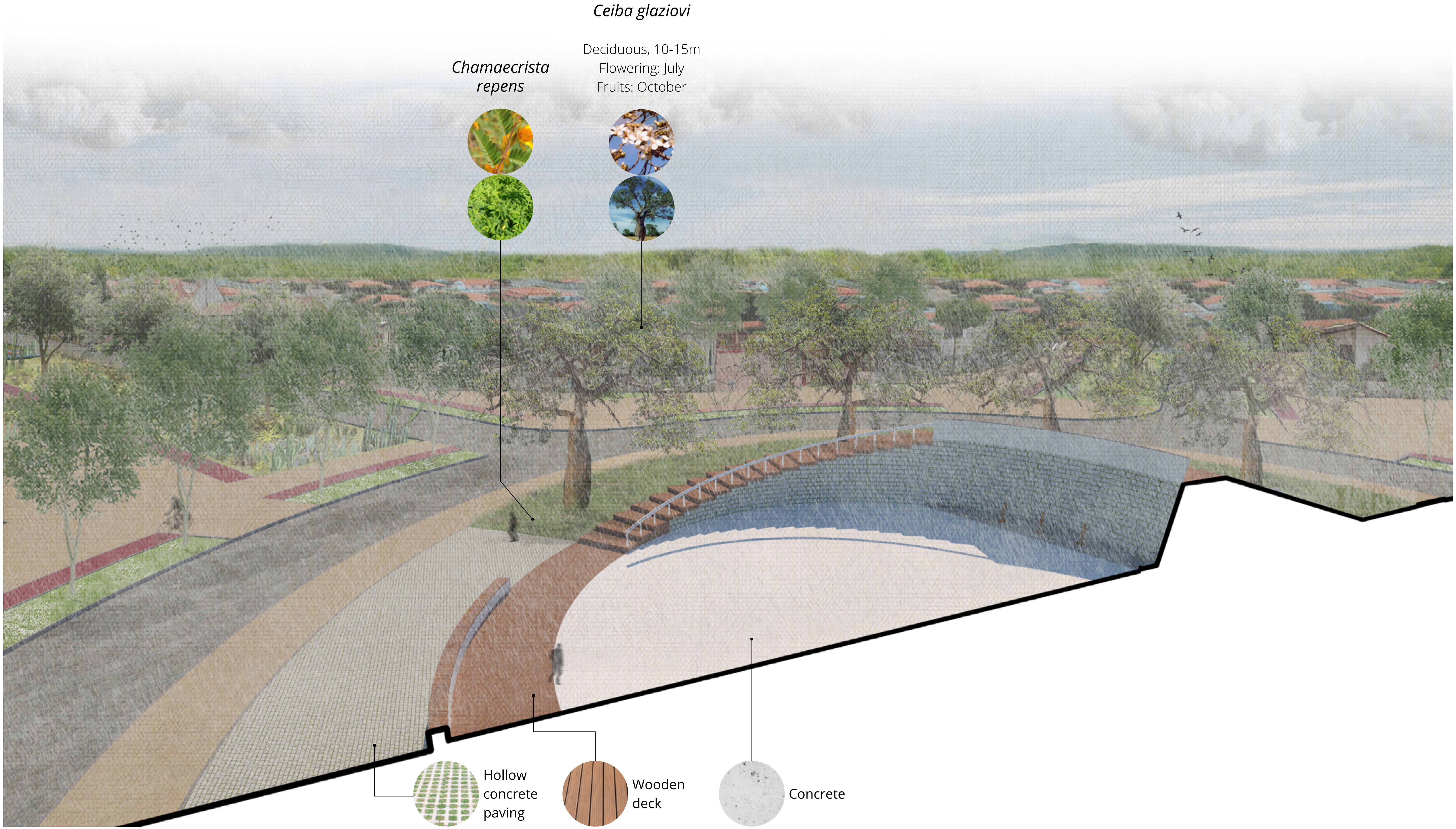


URBAN WADI SYSTEM

Rainwater harvesting square

URBAN WADI SYSTEM

Rainwater harvesting square - rainy season



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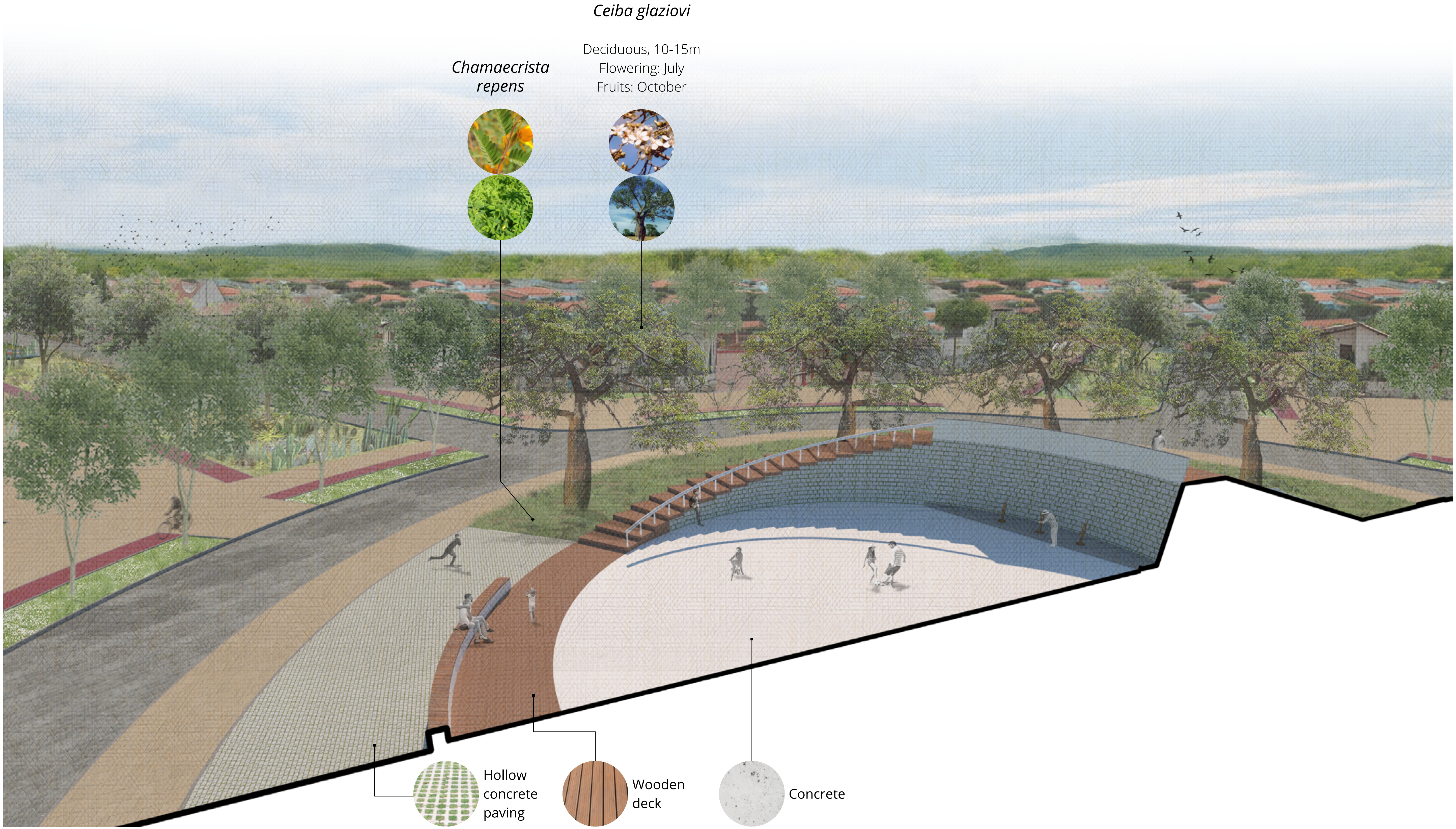
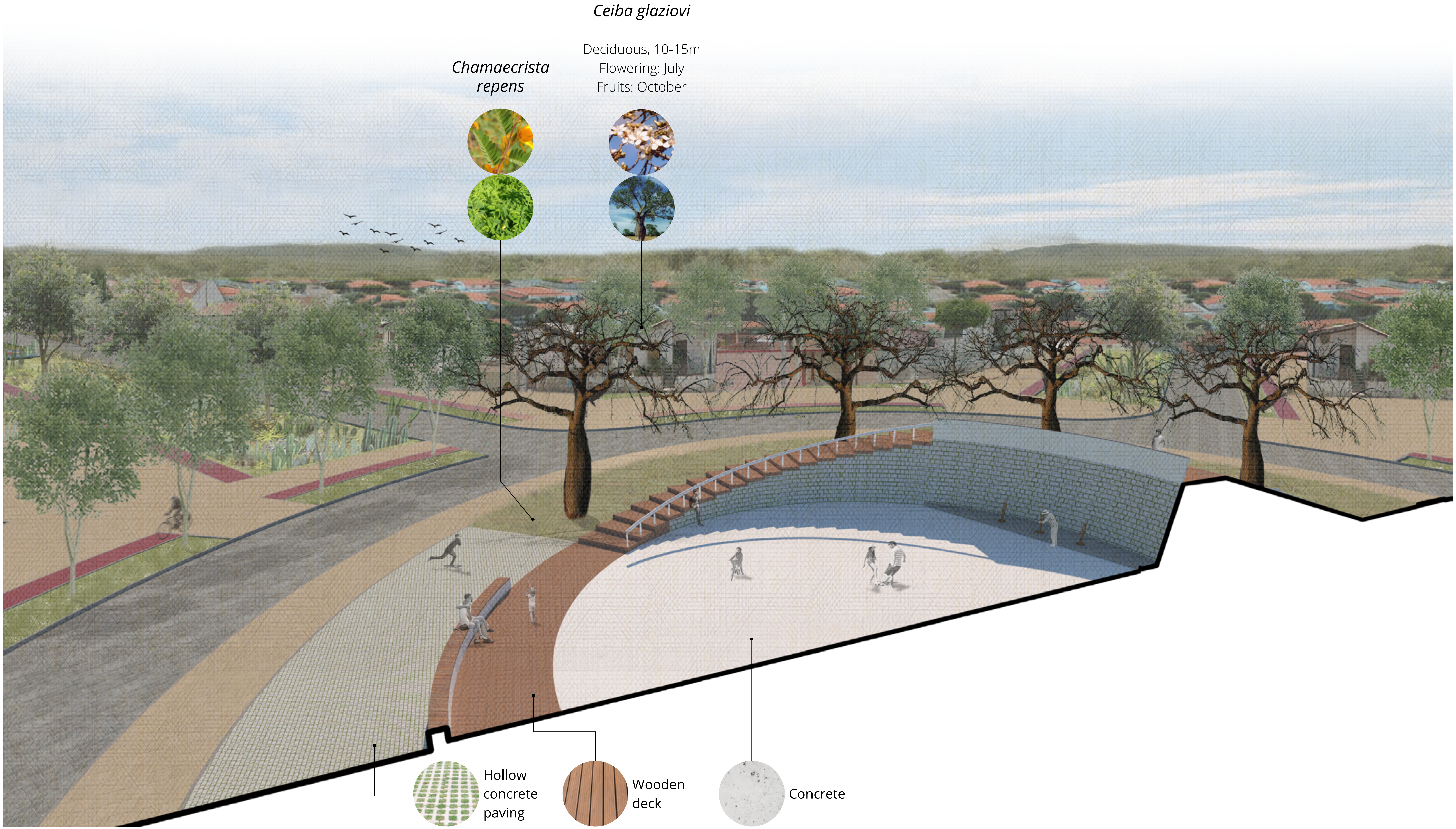
Rainwater harvesting square



URBAN WADI SYSTEM

Rainwater harvesting square - dry season



URBAN WADI SYSTEM

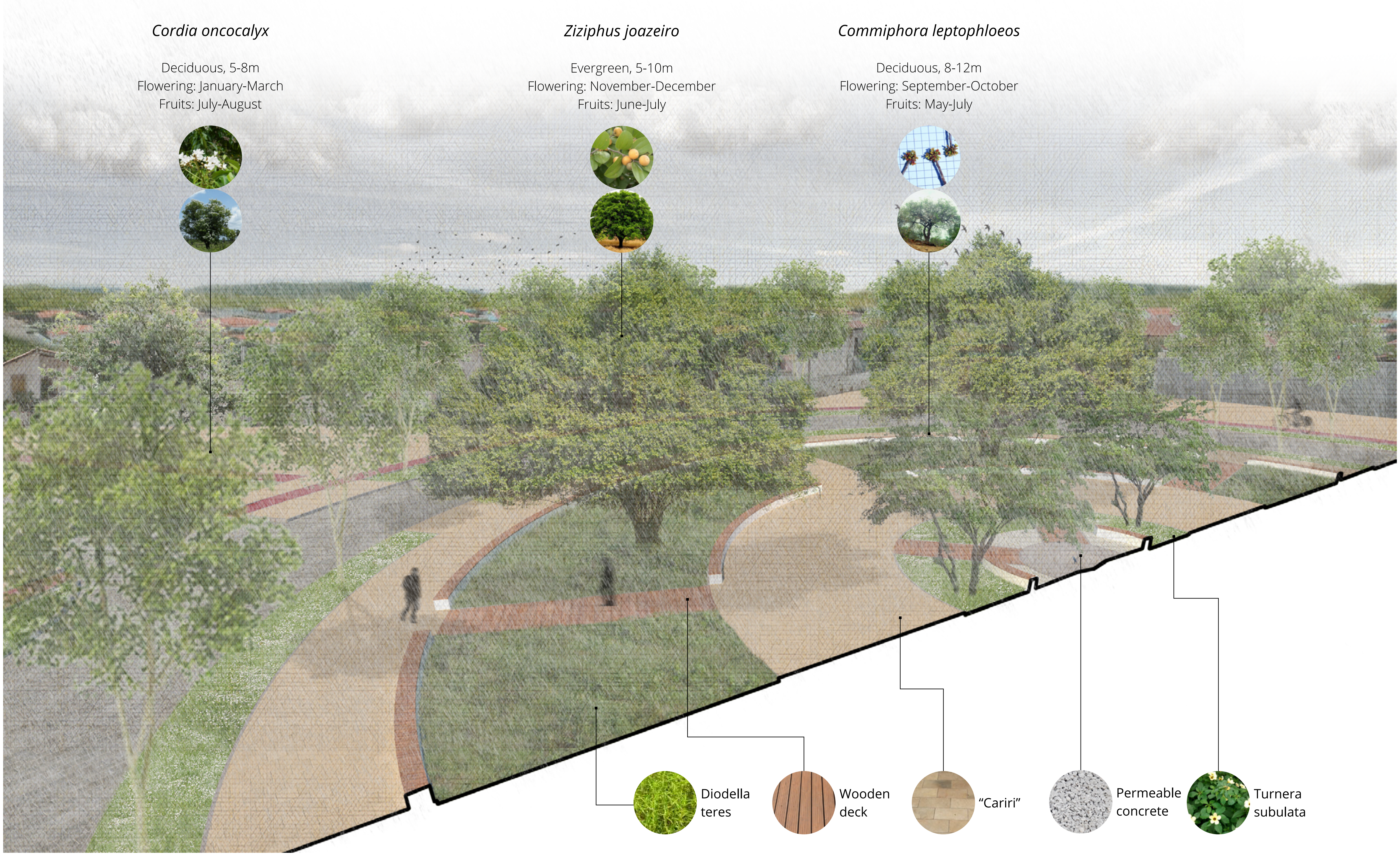
Rainwater harvesting square

URBAN WADI SYSTEM

Underground water pumping square

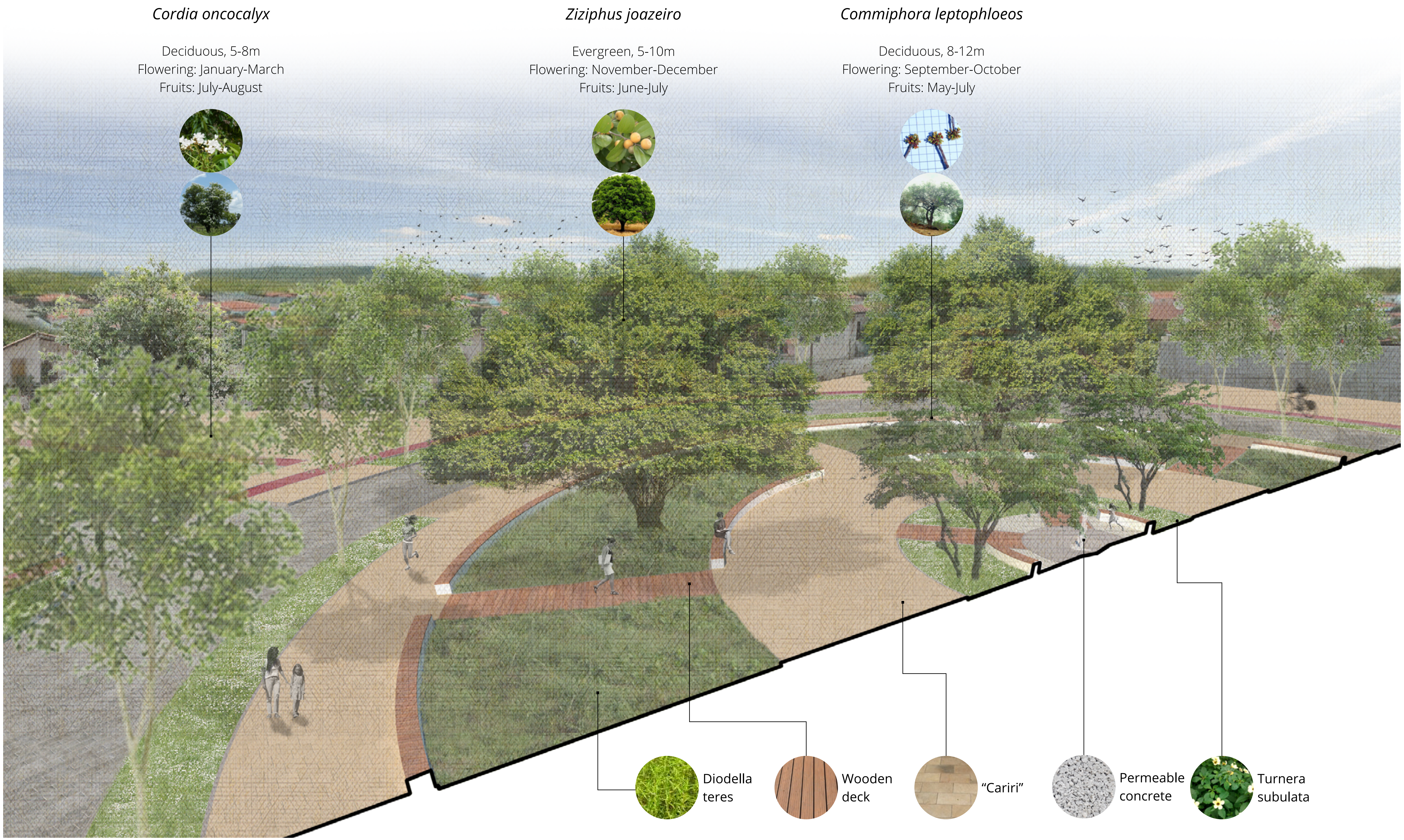
URBAN WADI SYSTEM

Underground water pumping square - rainy season



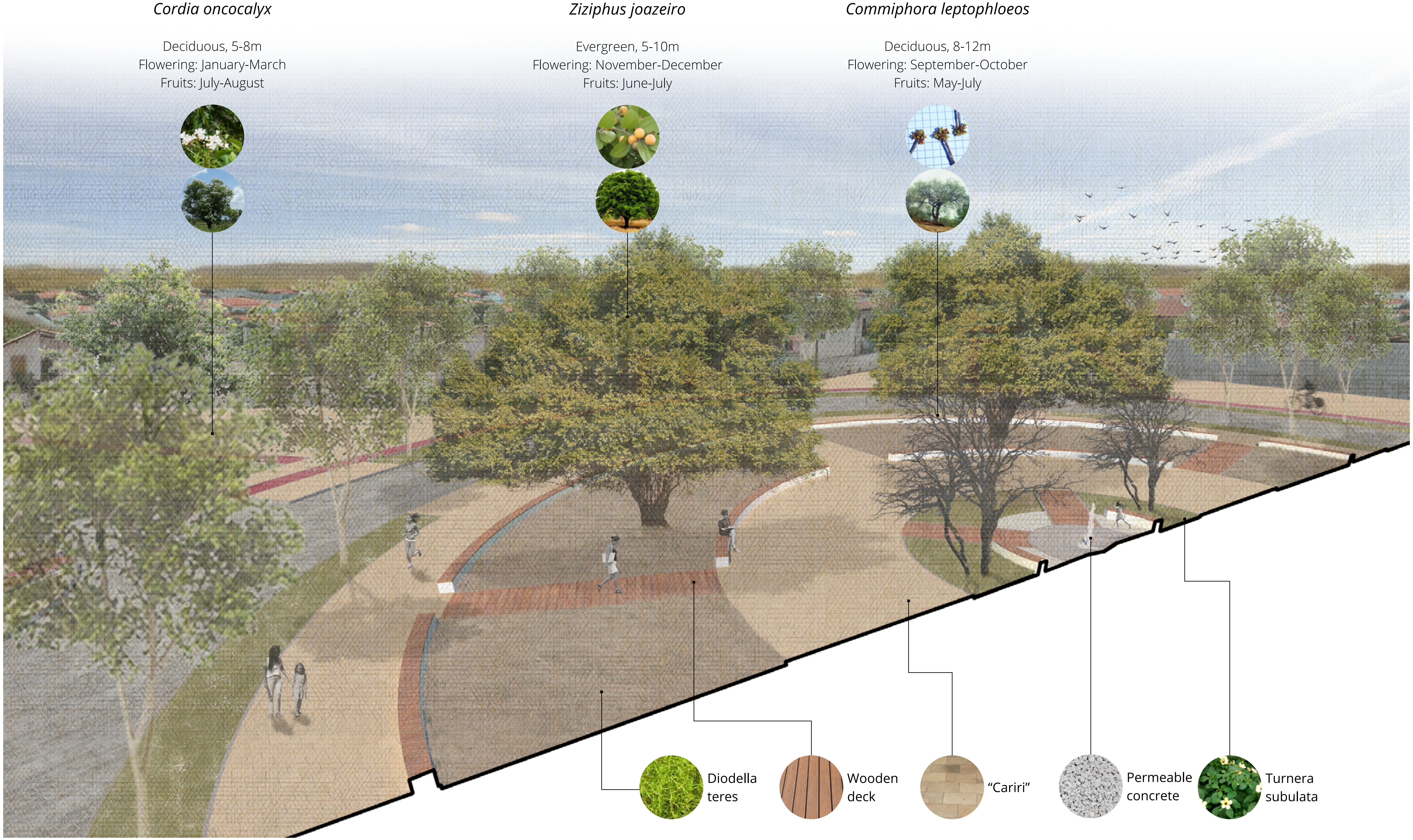
URBAN WADI SYSTEM

Underground water pumping square



URBAN WADI SYSTEM

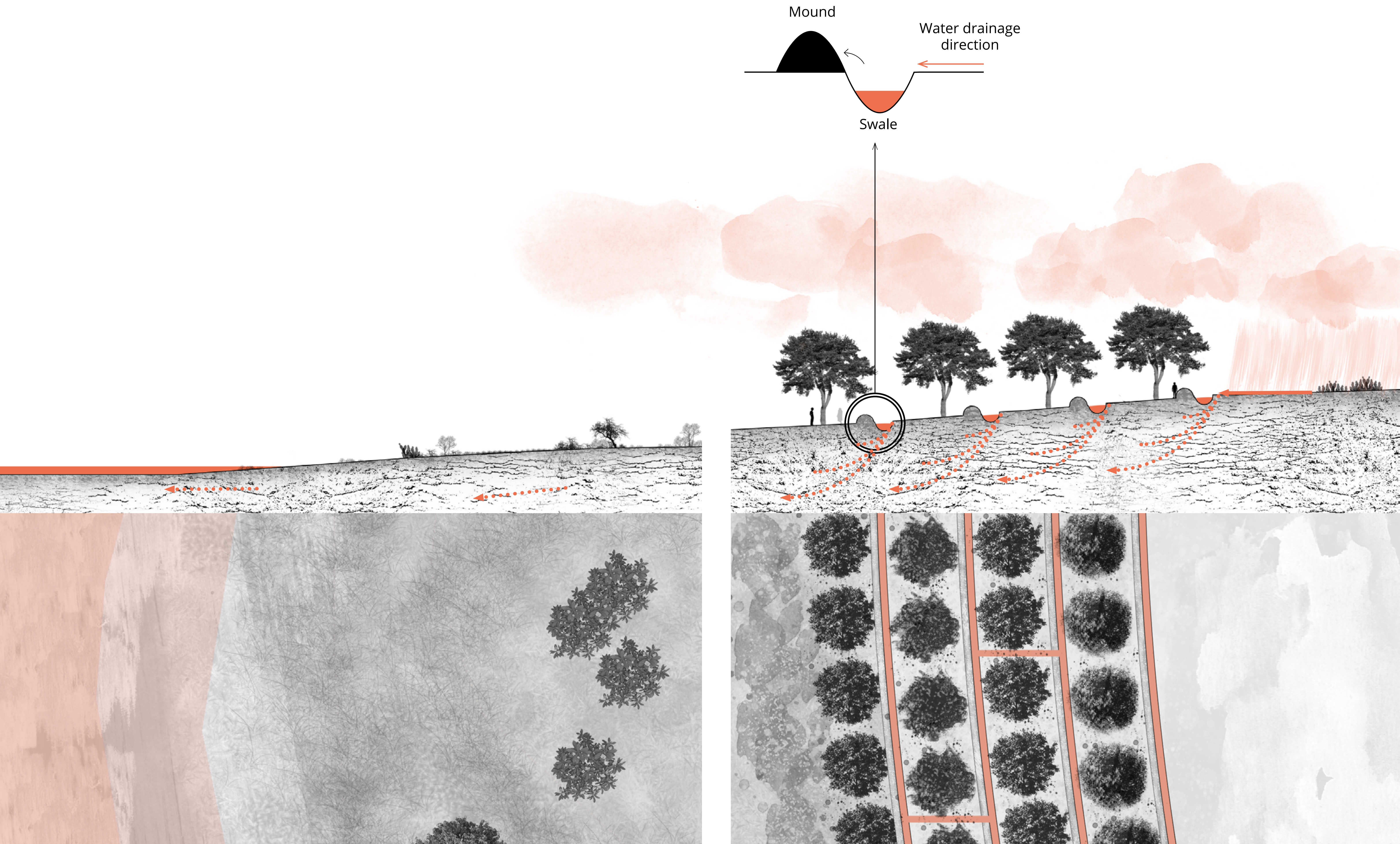
Underground water pumping square - dry season



DESIGN STRATEGIES: LOCAL SCALE

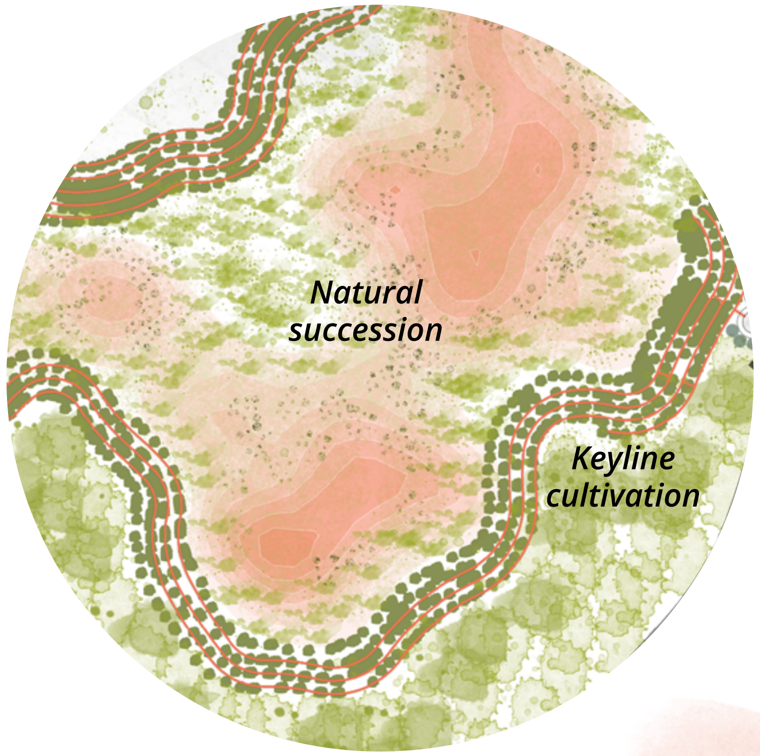
KEYLINE CULTIVATION

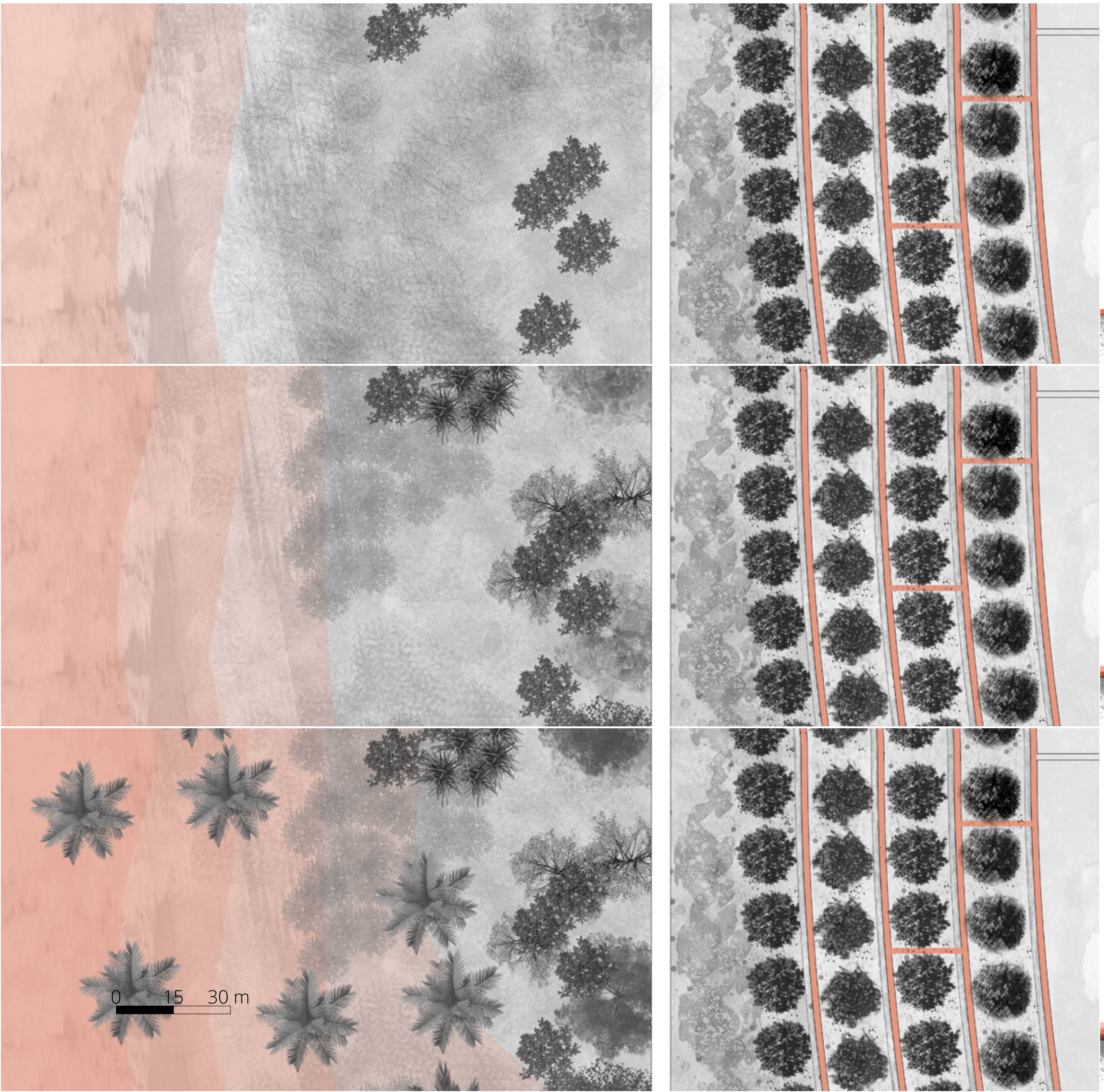
Basic principle

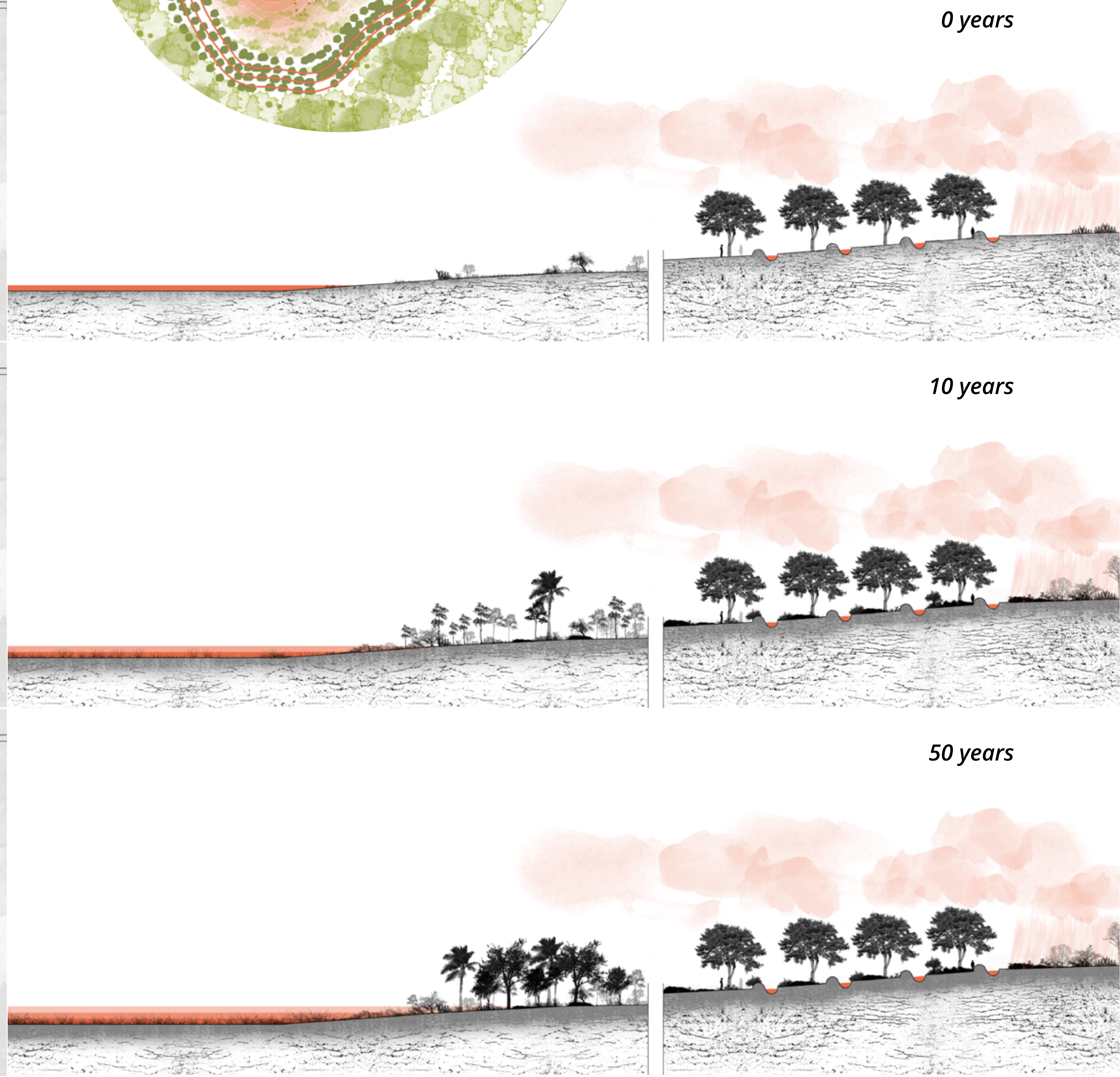


KEYLINE CULTIVATION

Association with natural succession

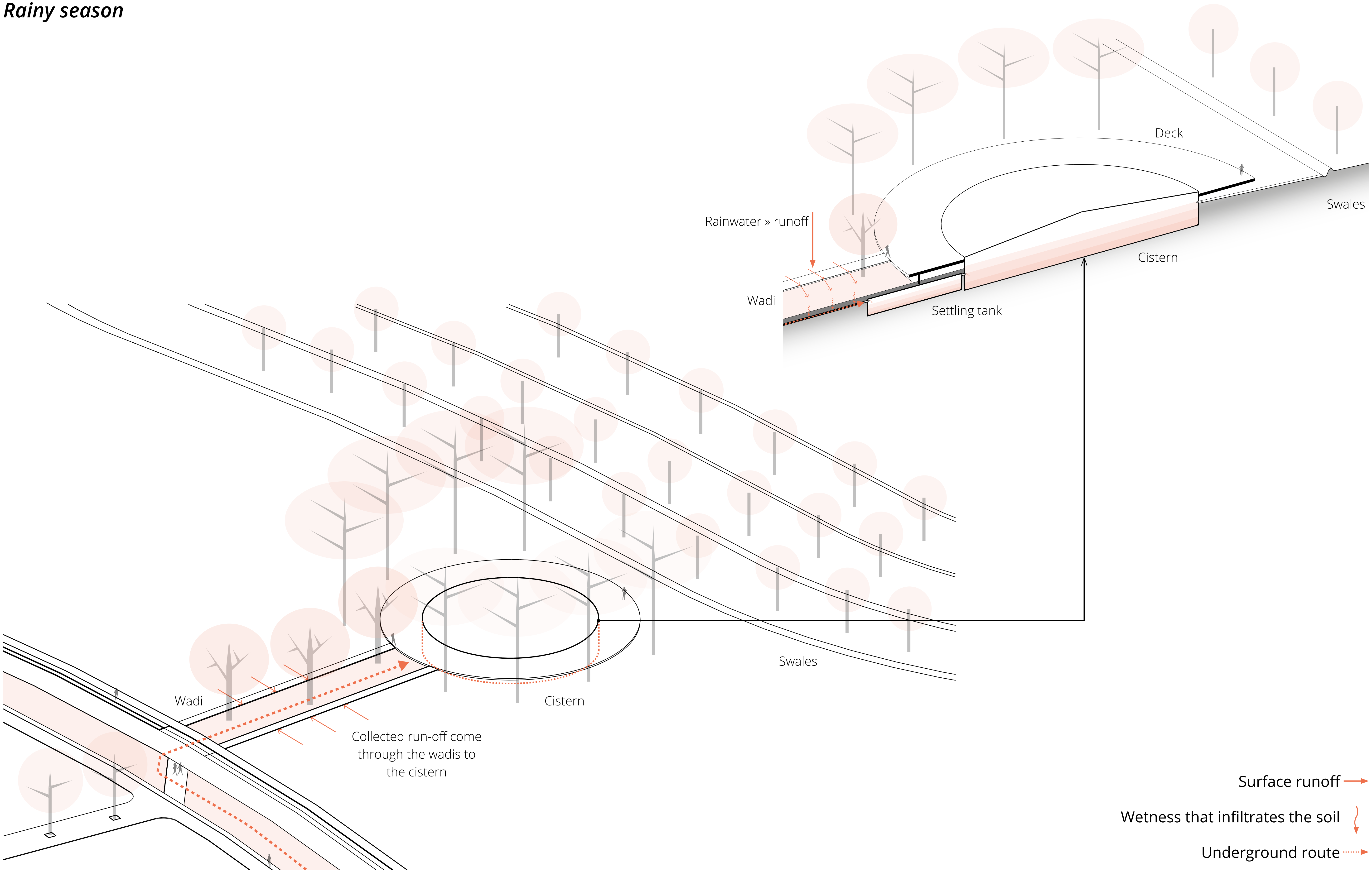






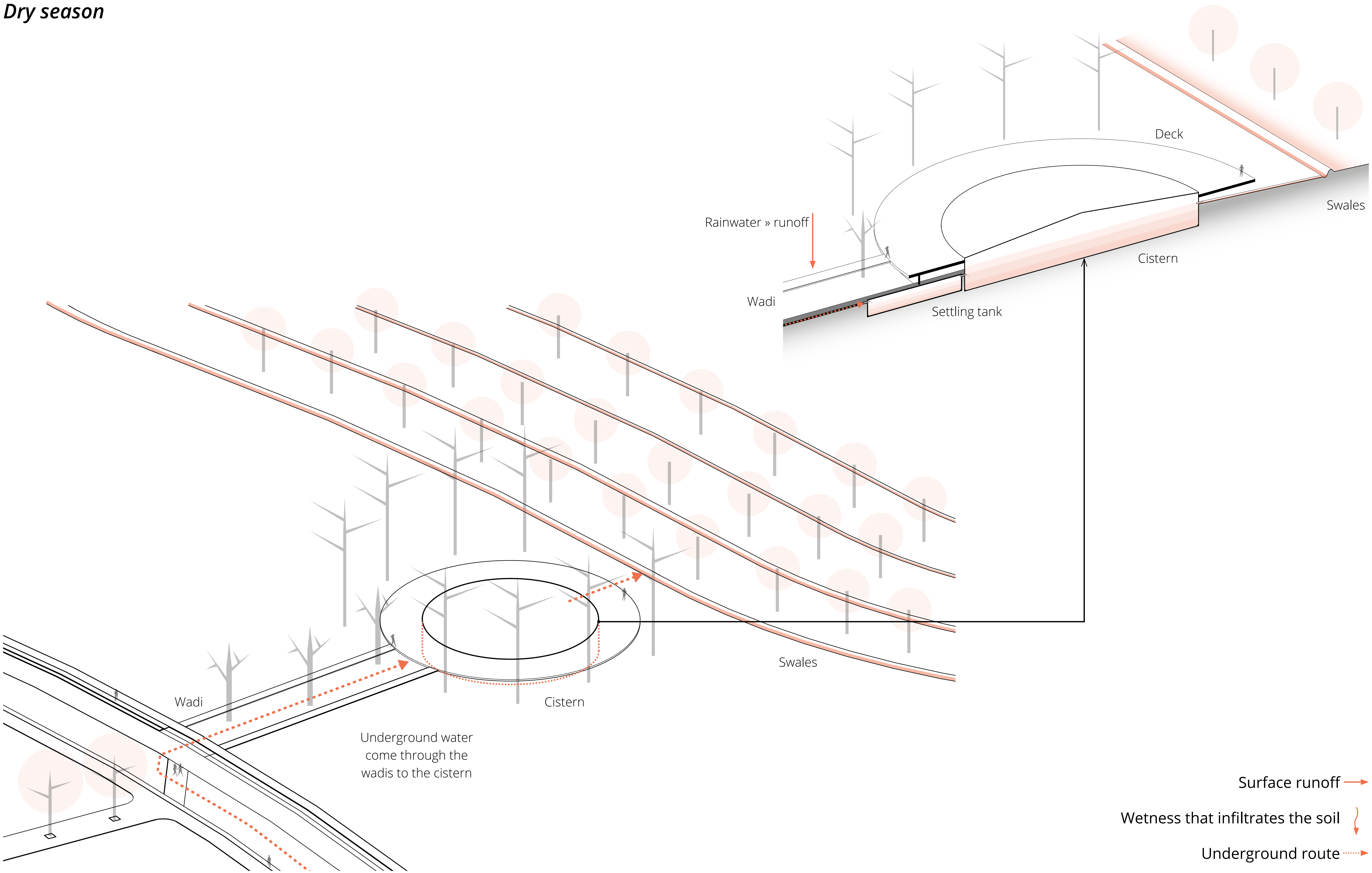
KEYLINE CULTIVATION

Rainy season



KEYLINE CULTIVATION

Dry season



KEYLINE CULTIVATION

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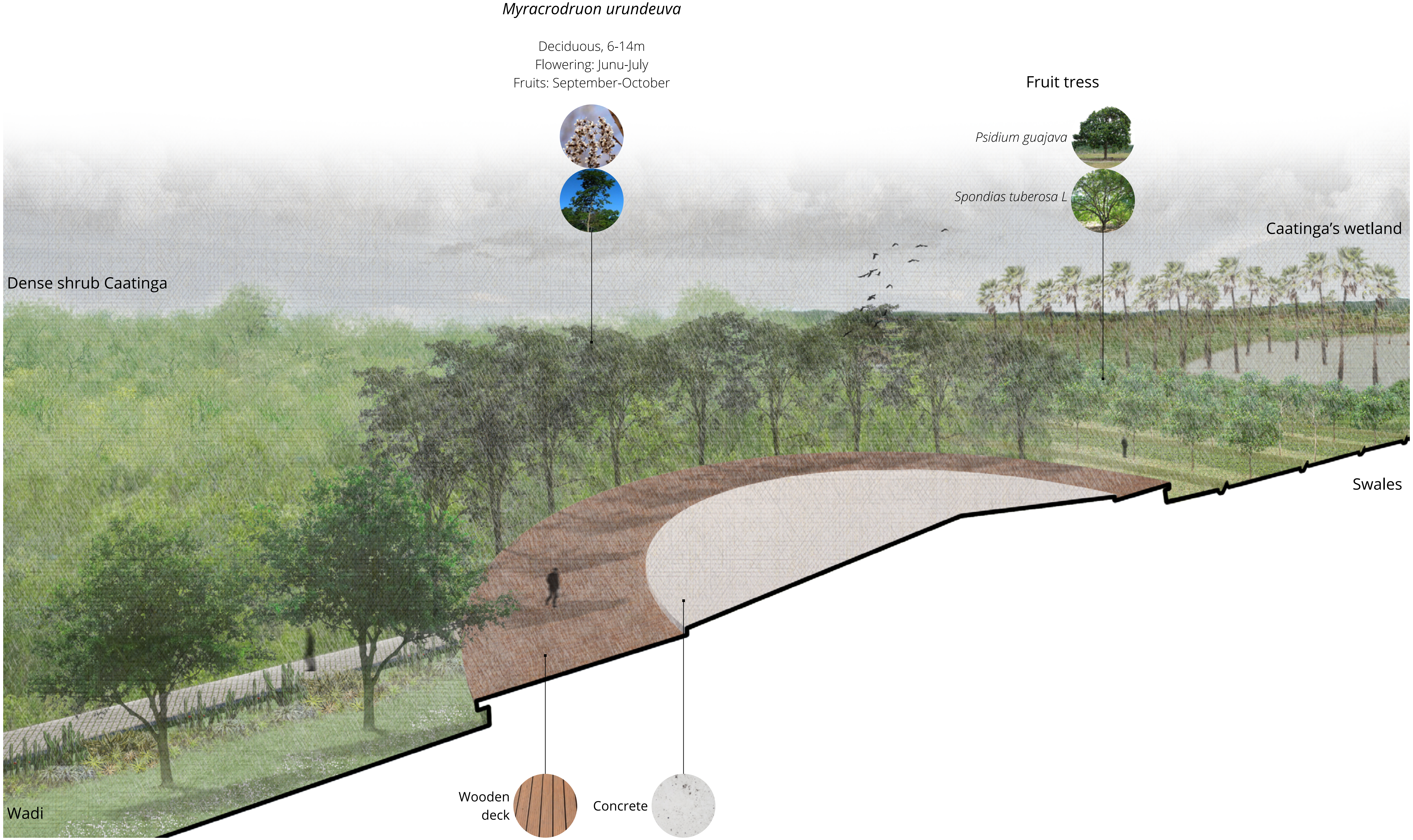
Rainy season



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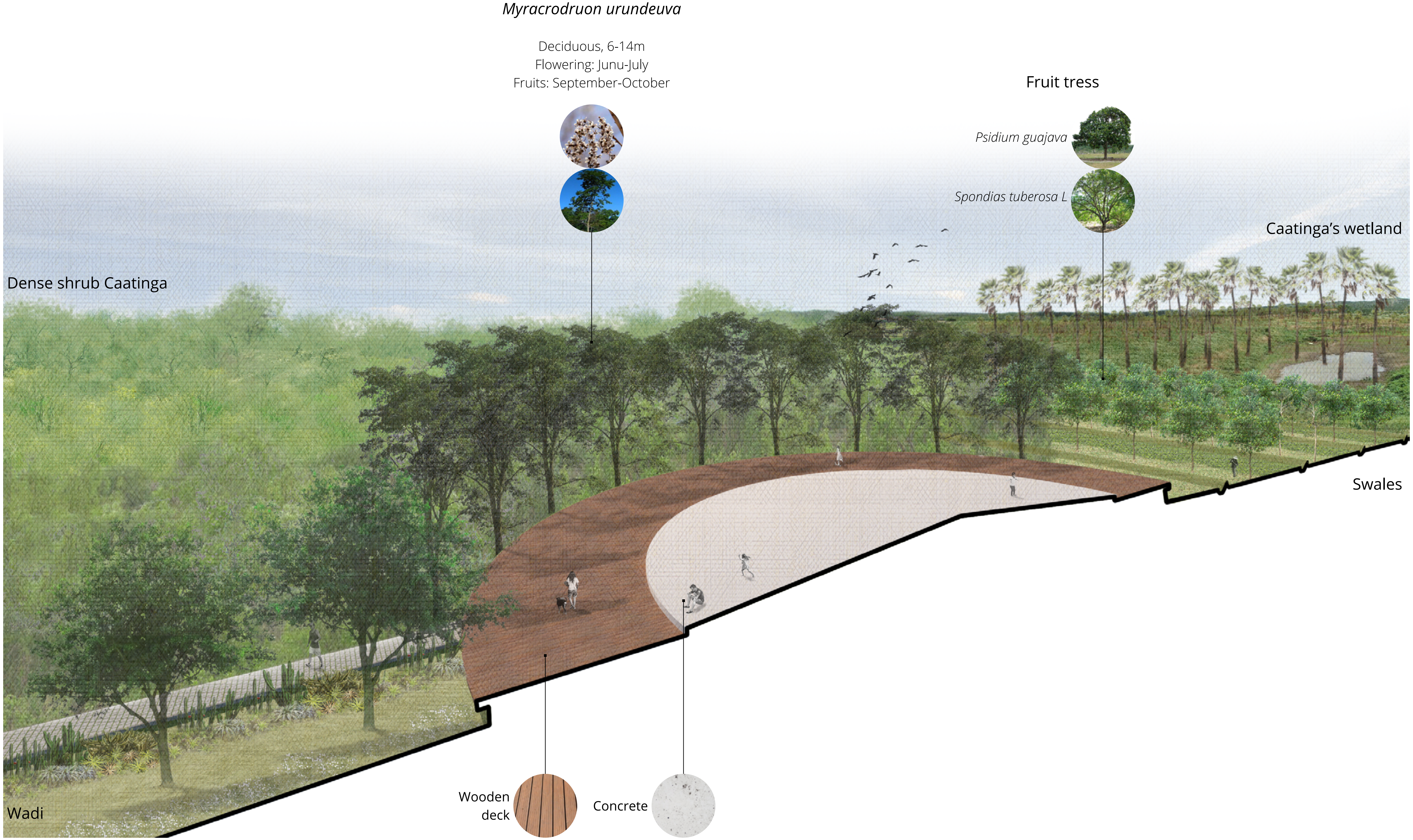

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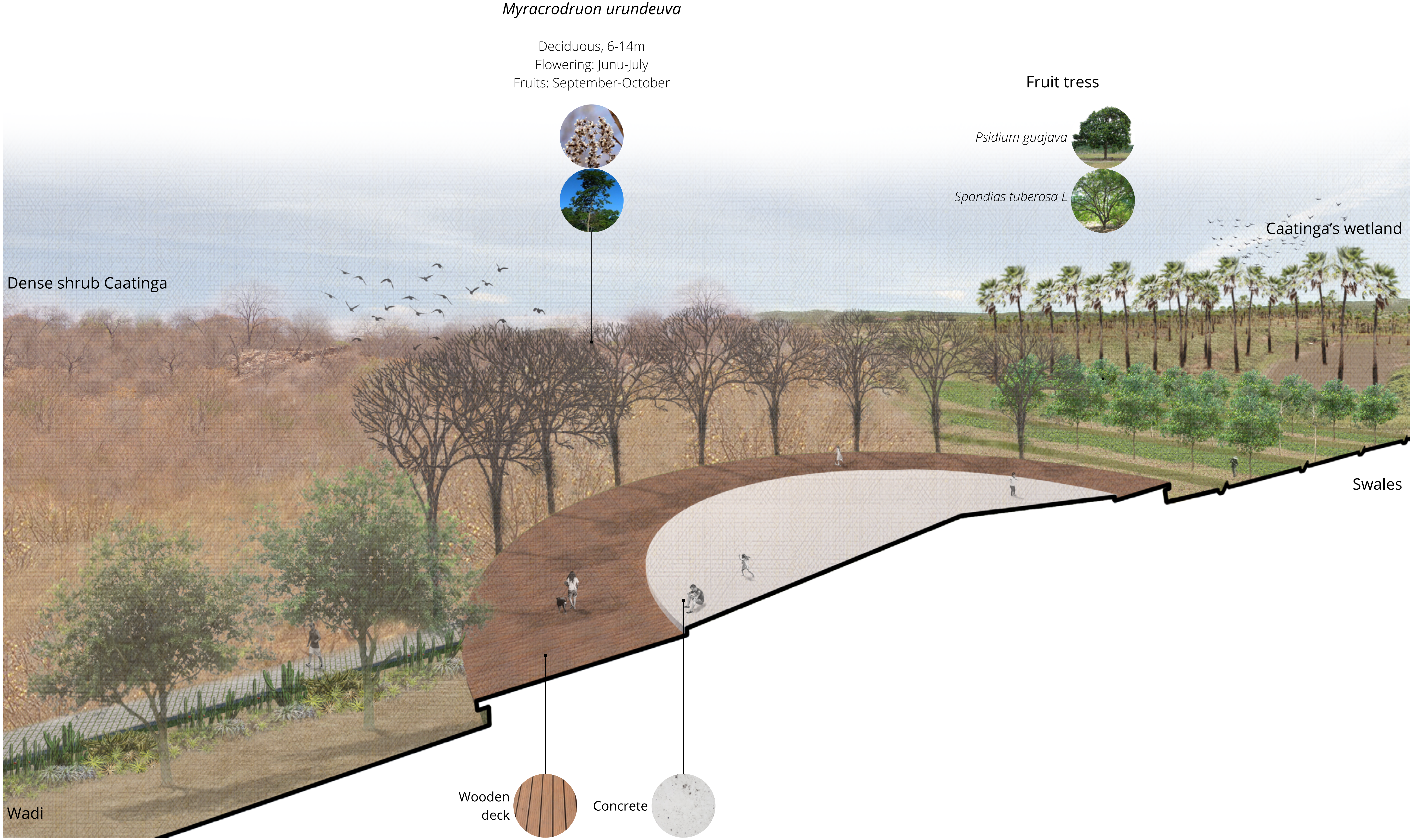
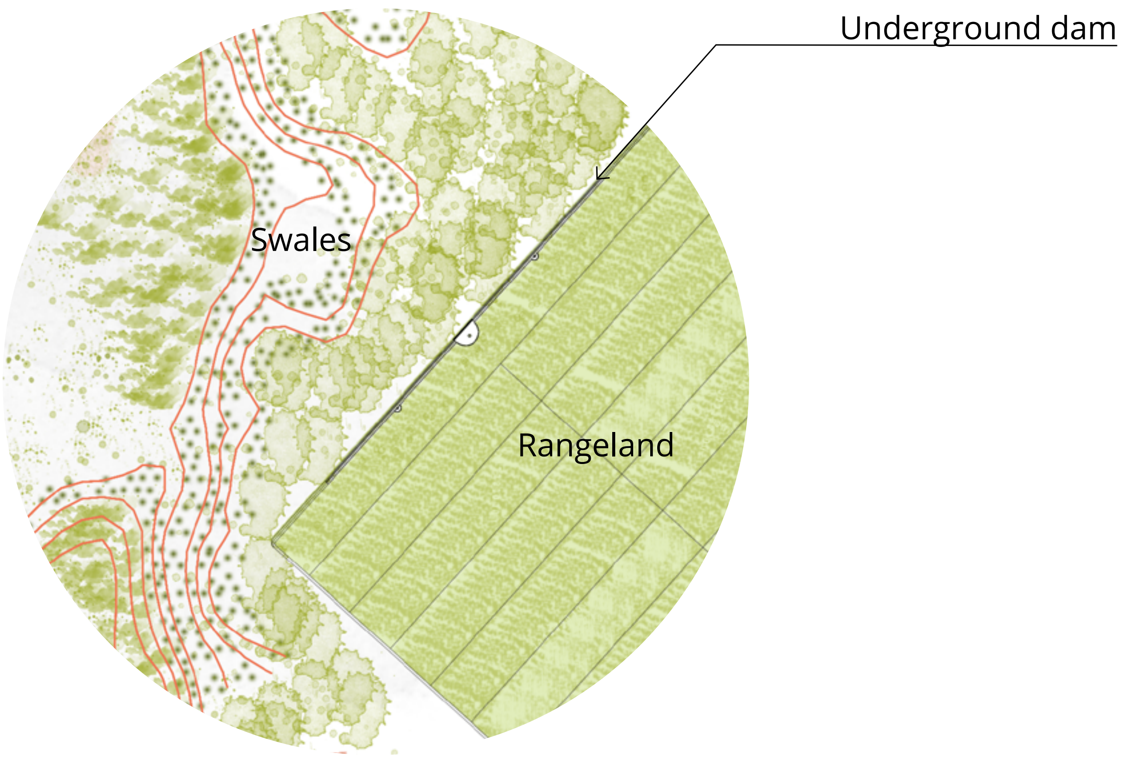
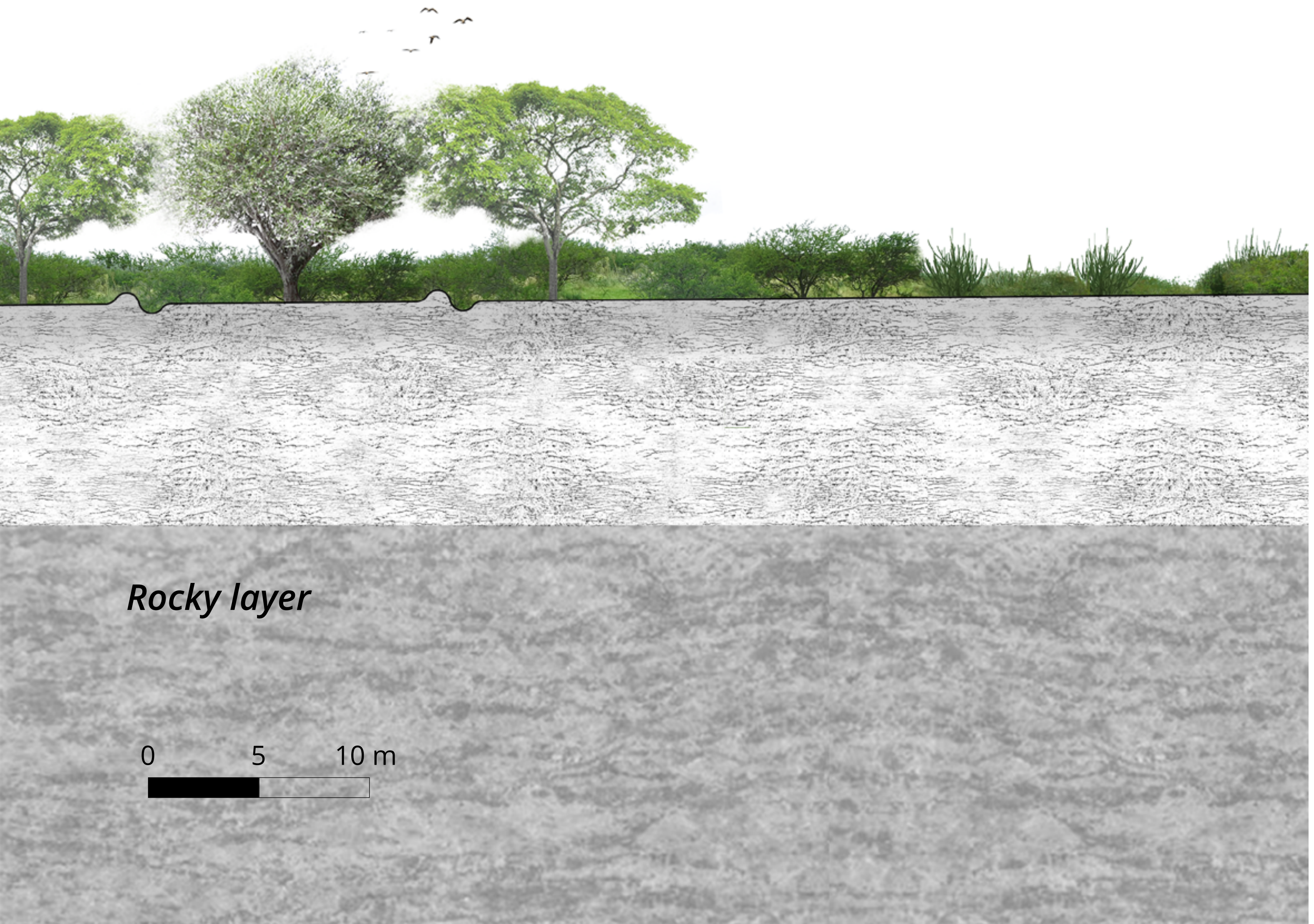
Dry season

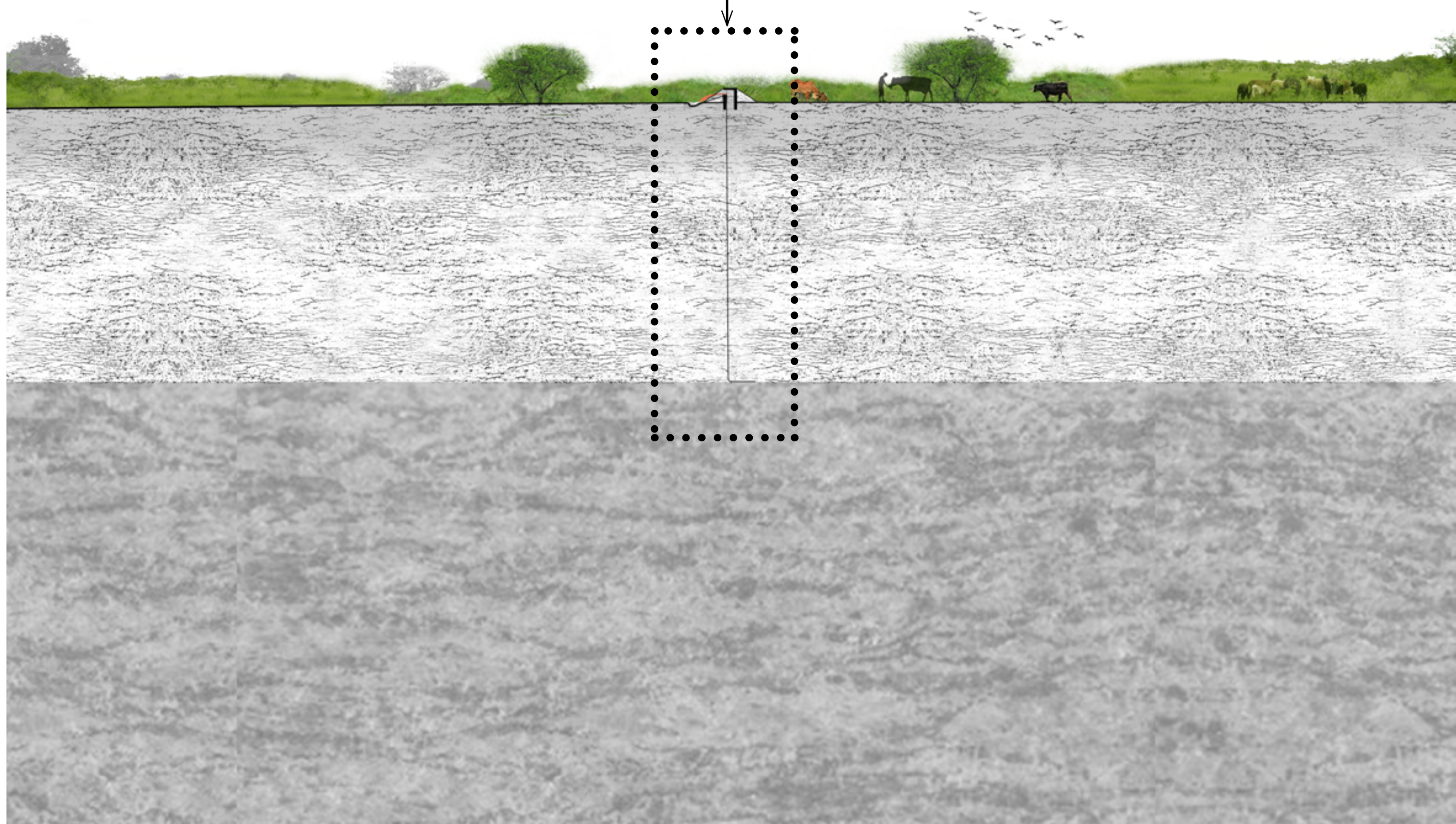


DESIGN STRATEGIES: LOCAL SCALE

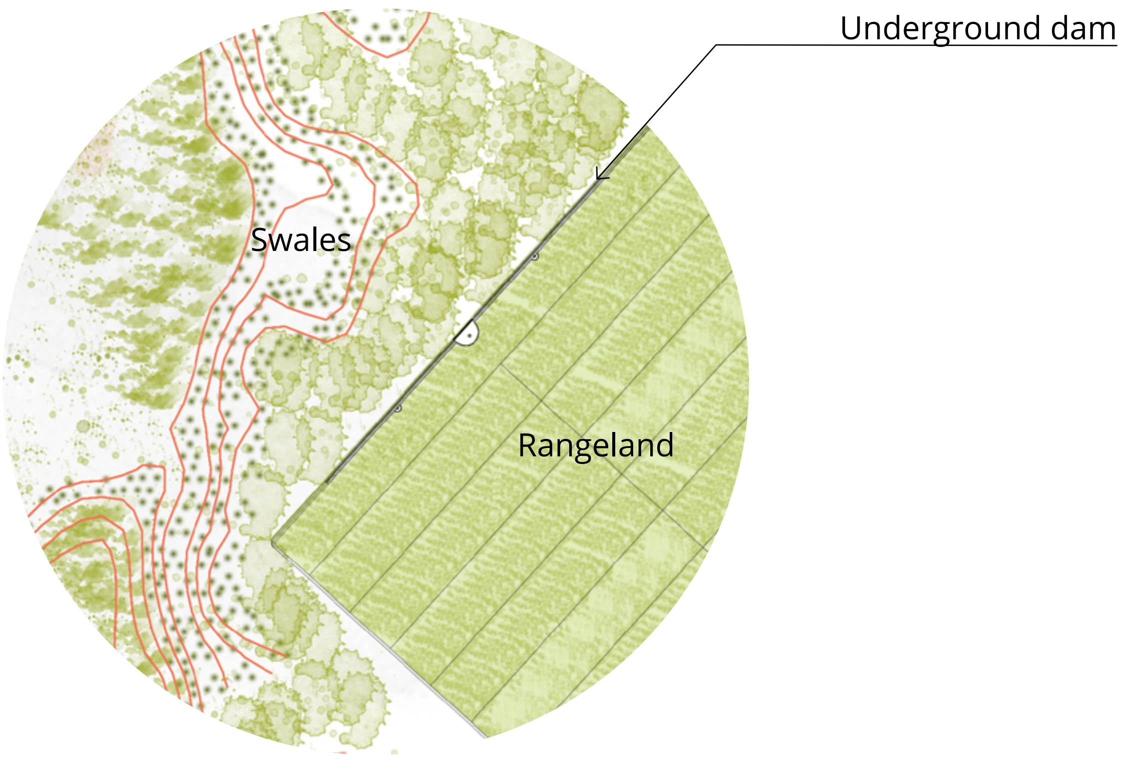
UNDERGROUND DAM RANGELAND



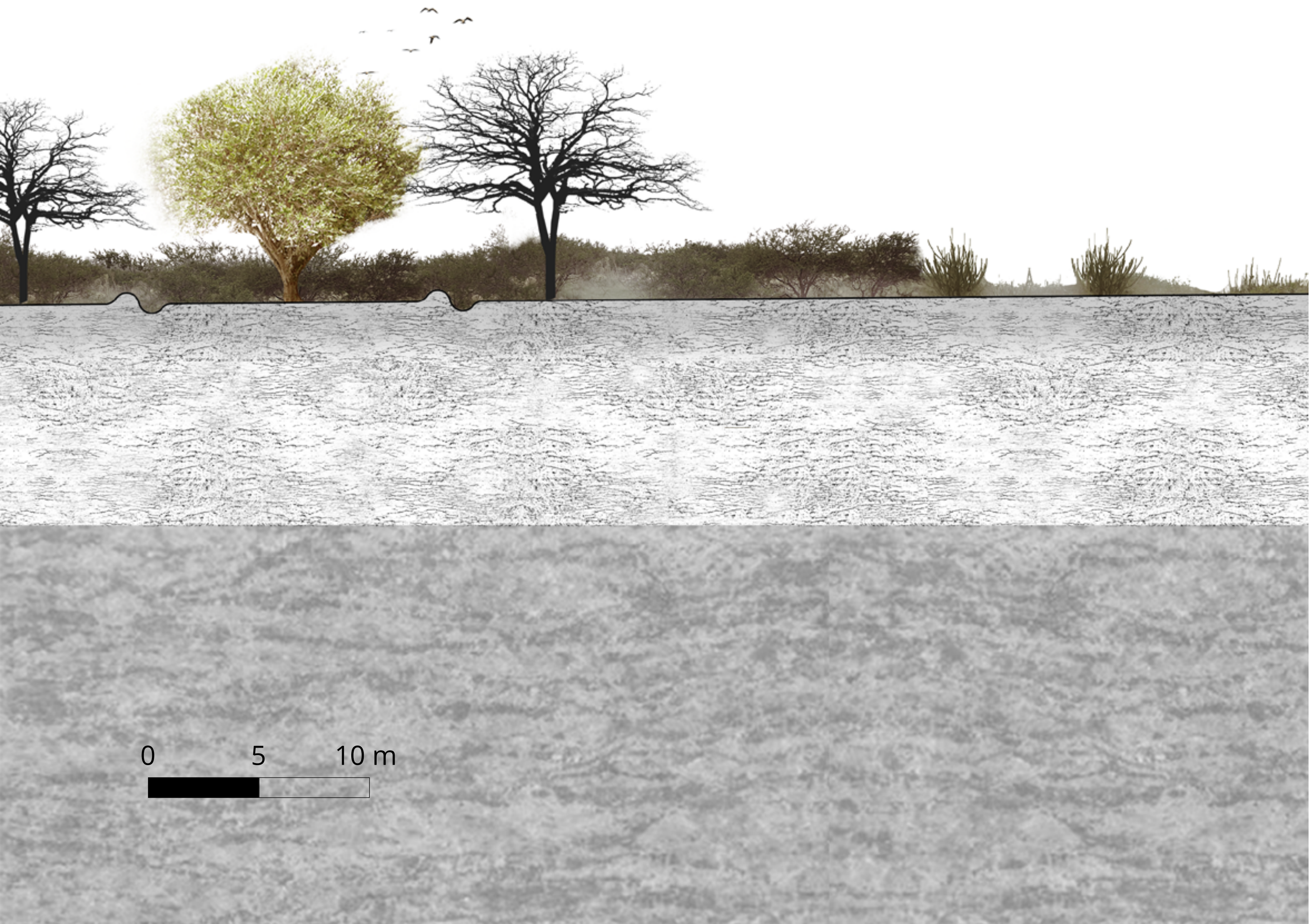


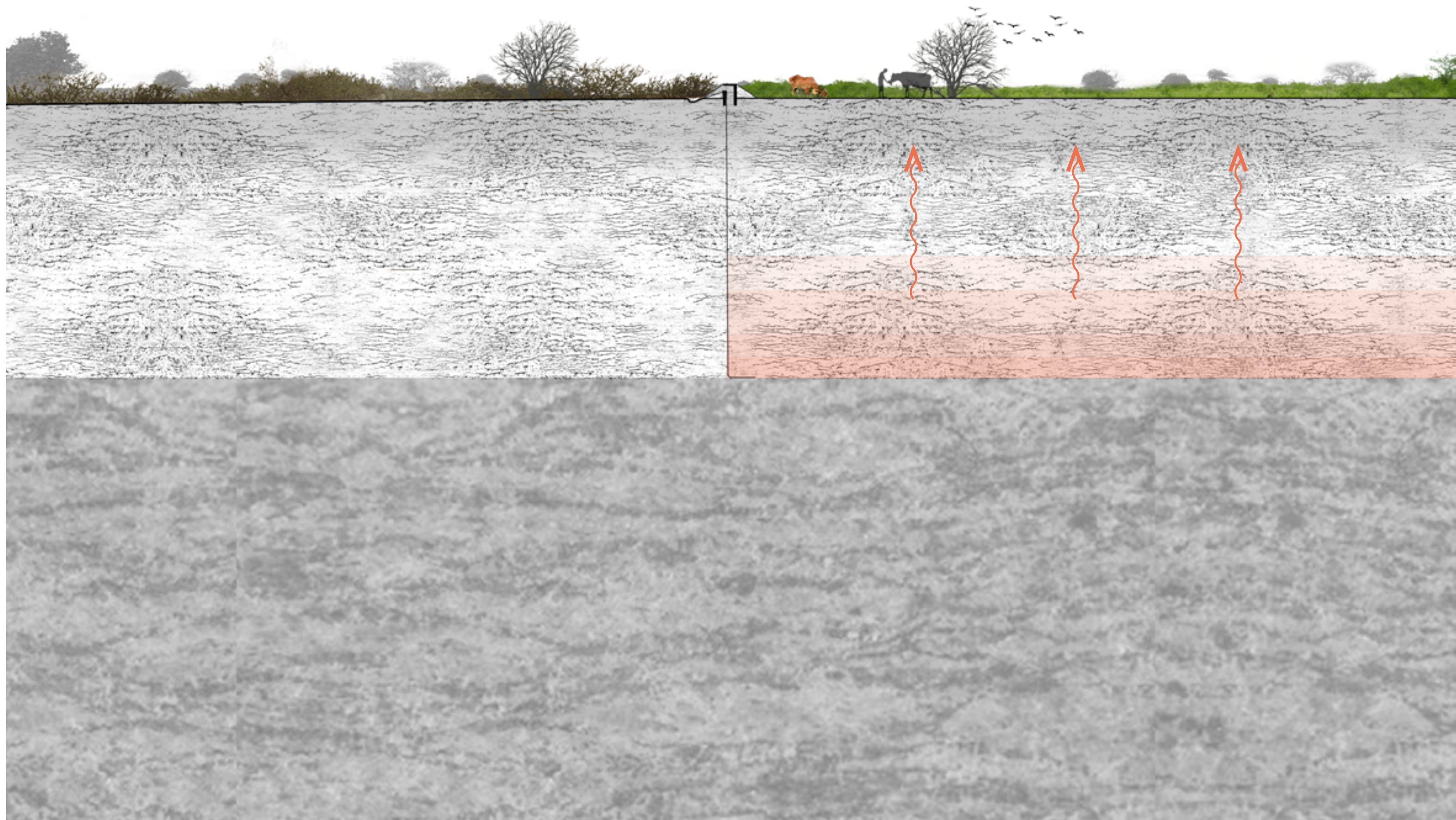


UNDERGROUND DAM RANGELAND

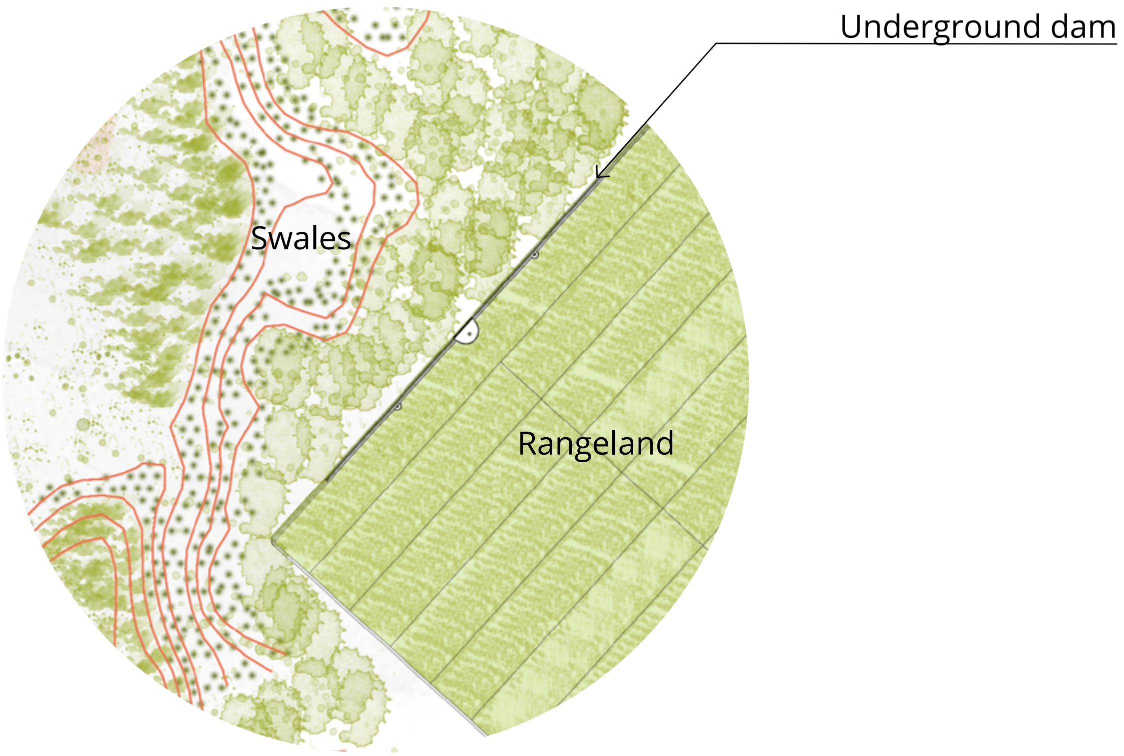


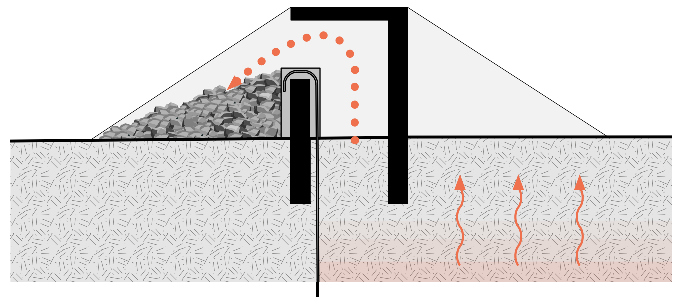
Dry periods



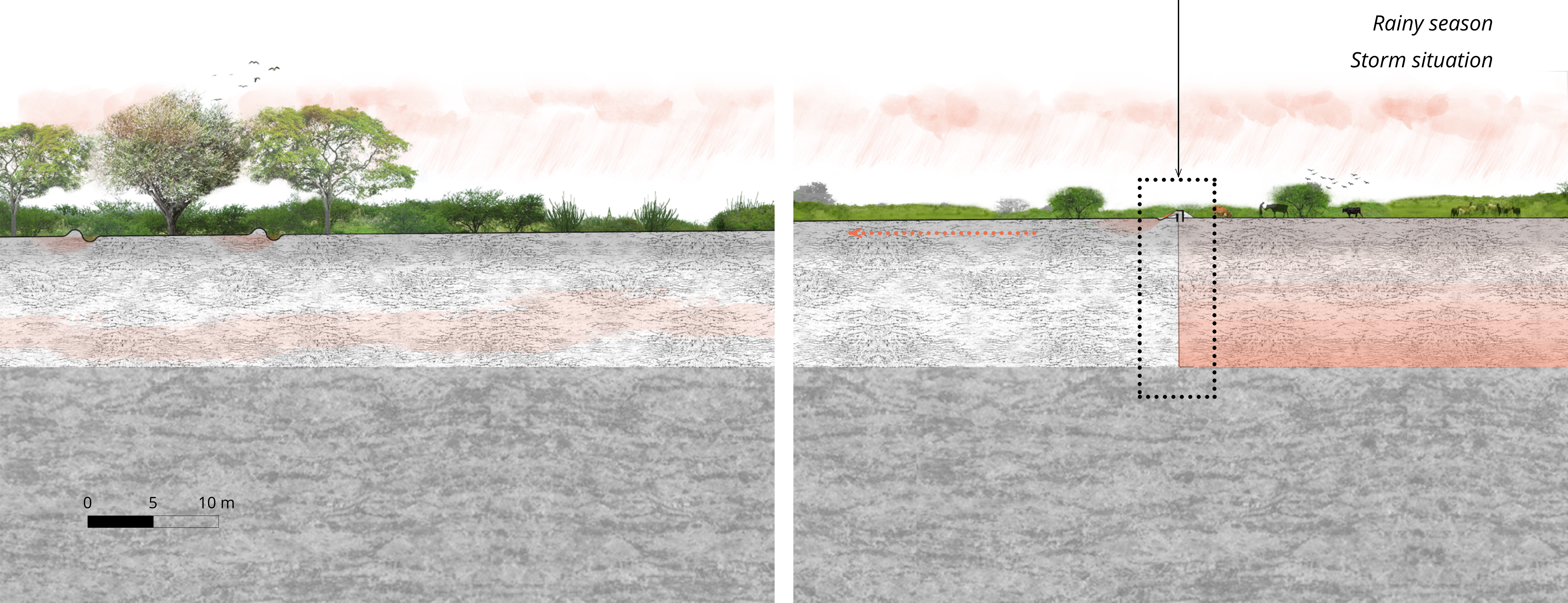


UNDERGROUND DAM RANGELAND





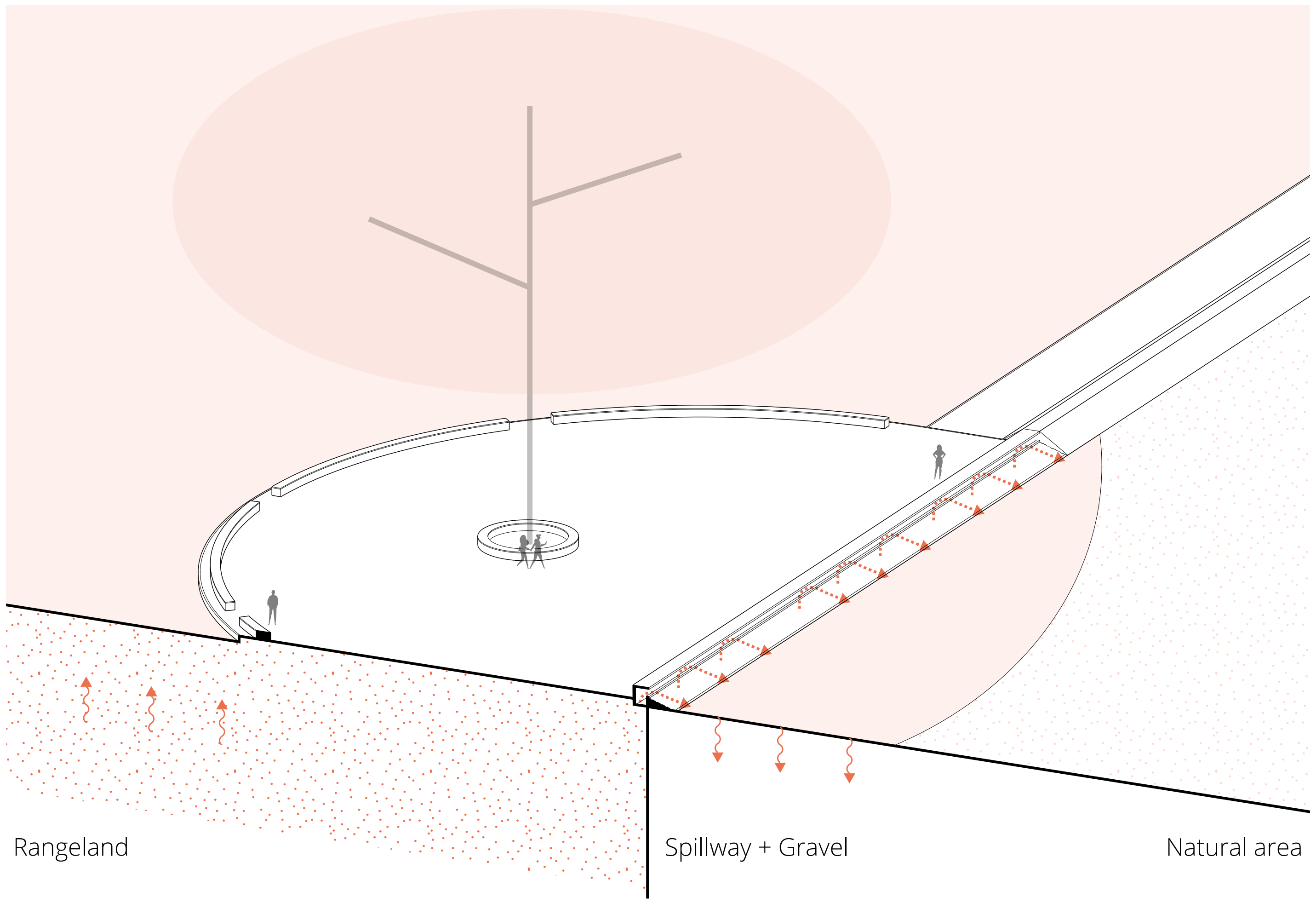
Spillway



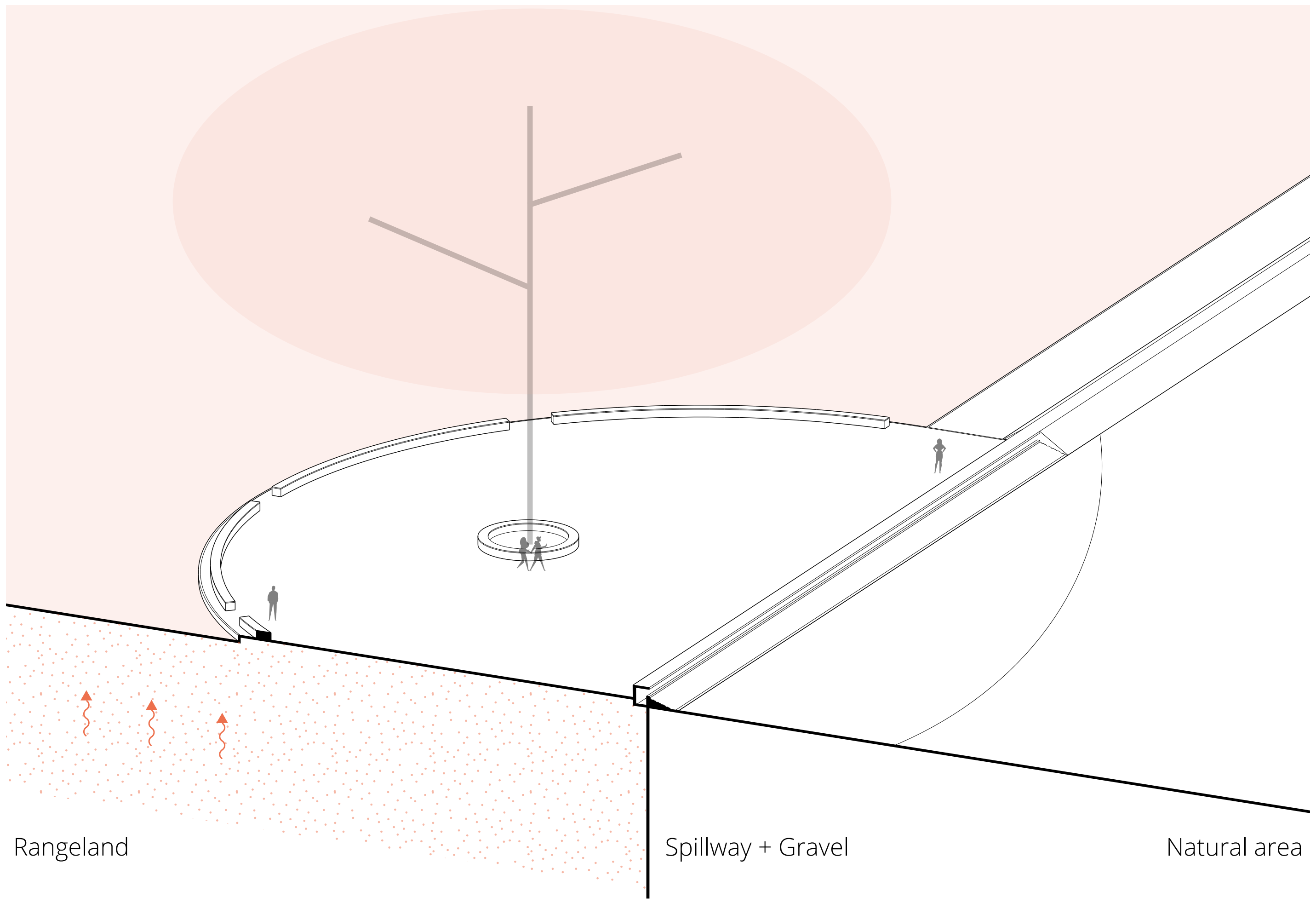
UNDERGROUND DAM RANGELAND

Spillway

Rain season | storm situation



Dry season



Surface runoff

Wetness that infiltrates the soil

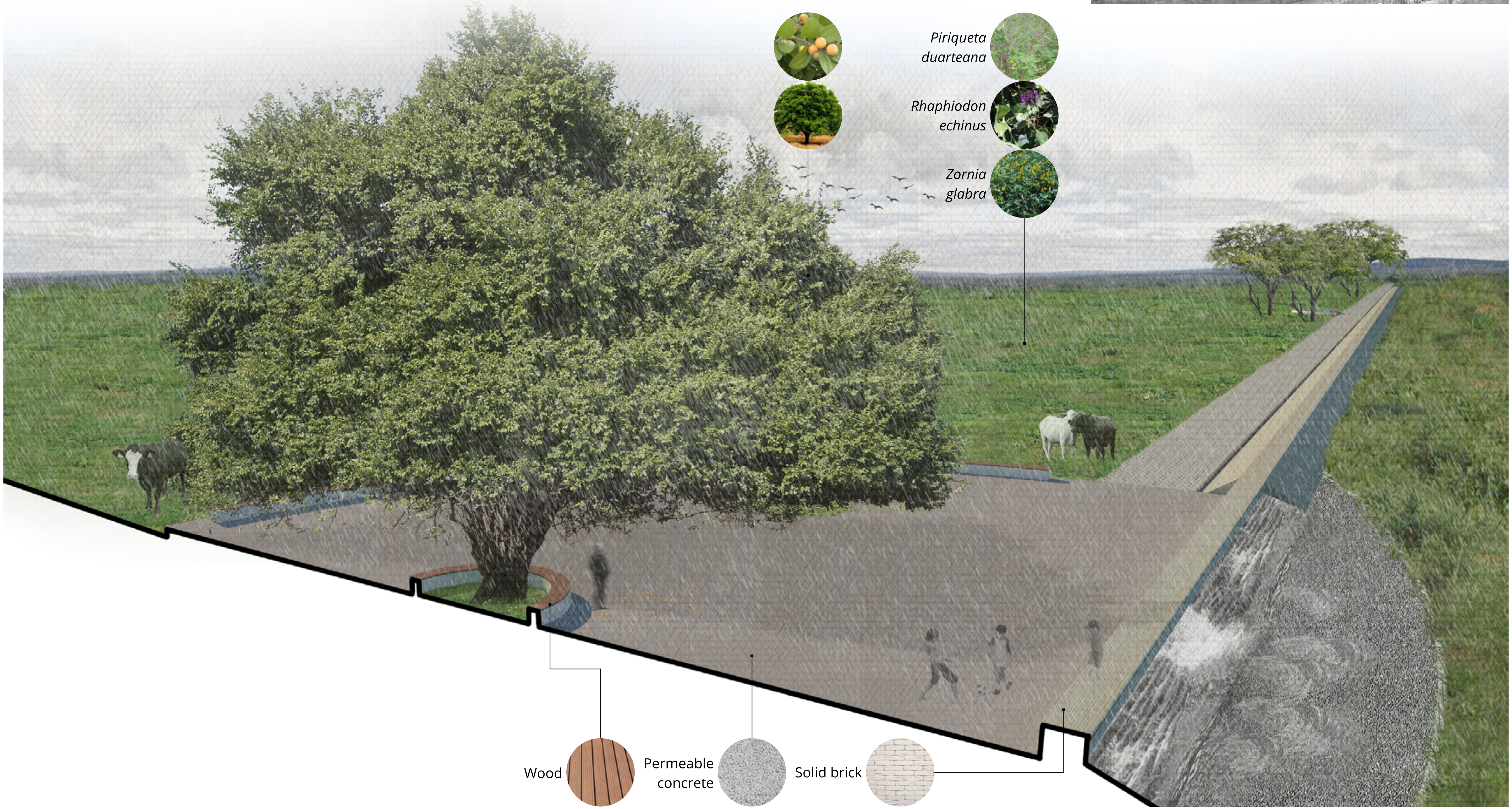
Underground route

UNDERGROUND DAM RANGELAND

Spillway - Rainy season

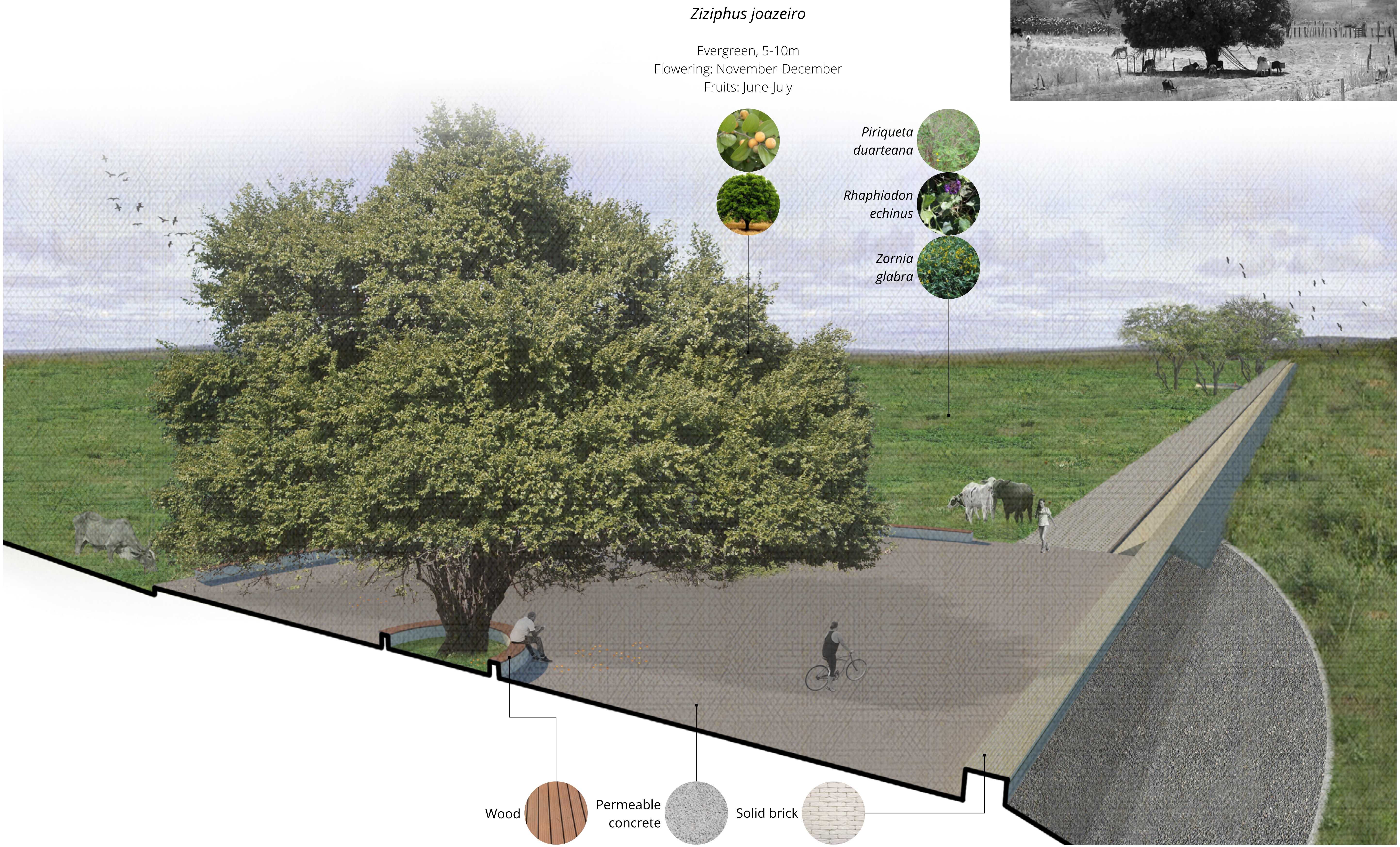
Ziziphus joazeiro

Evergreen, 5-10m
Flowering: November-December
Fruits: June-July



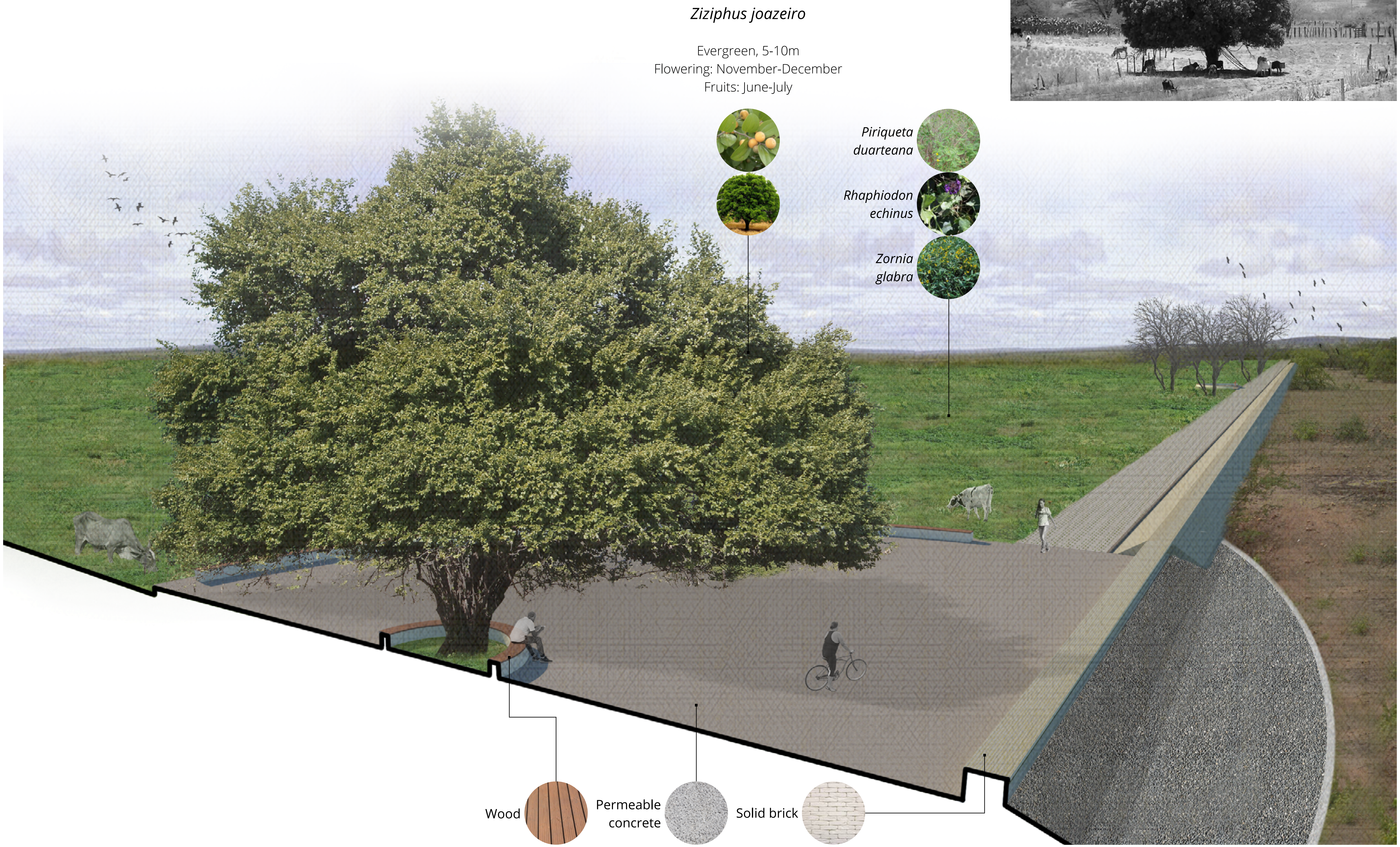
UNDERGROUND DAM RANGELAND

Spillway



UNDERGROUND DAM RANGELAND

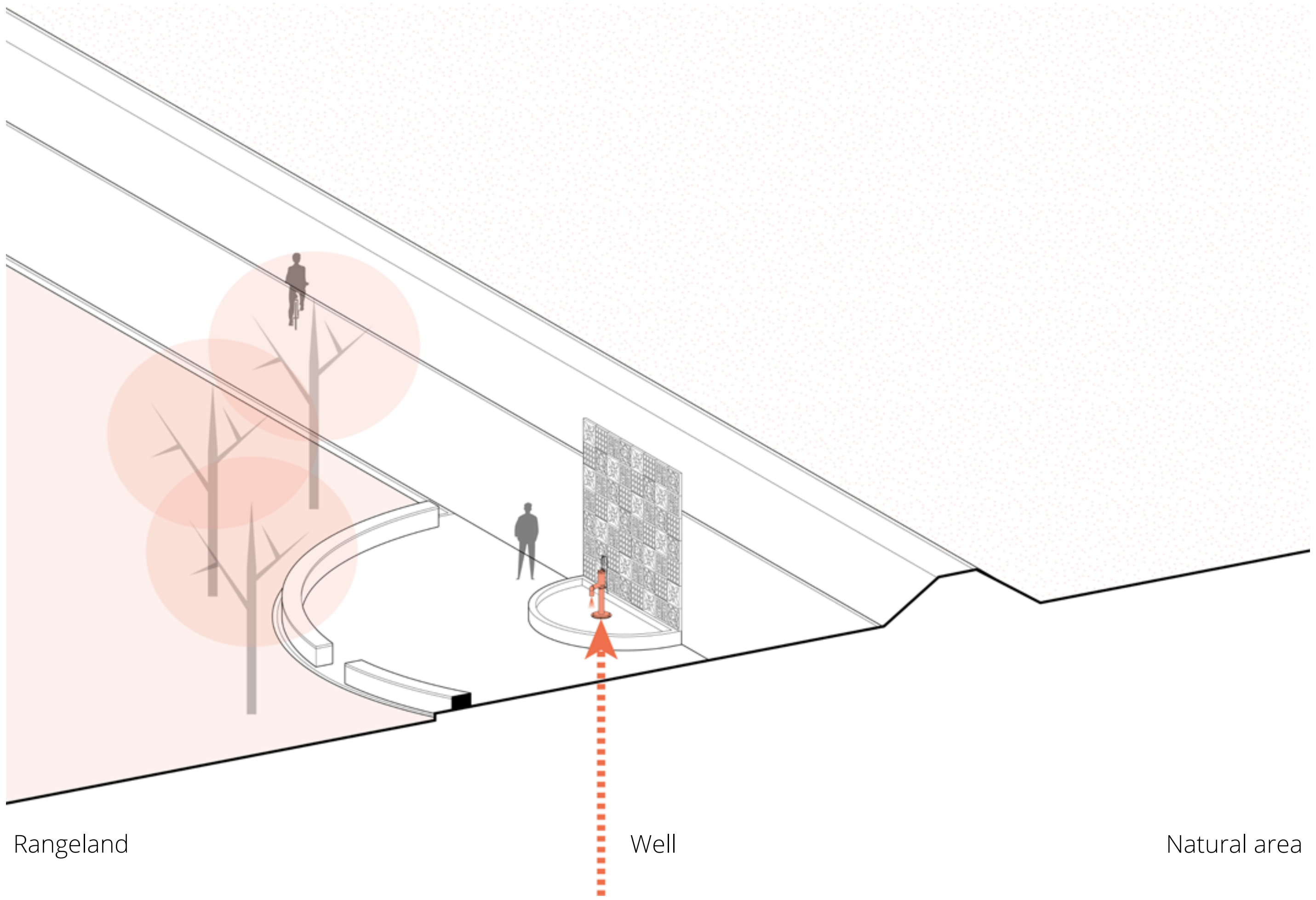
Spillway - Dry season



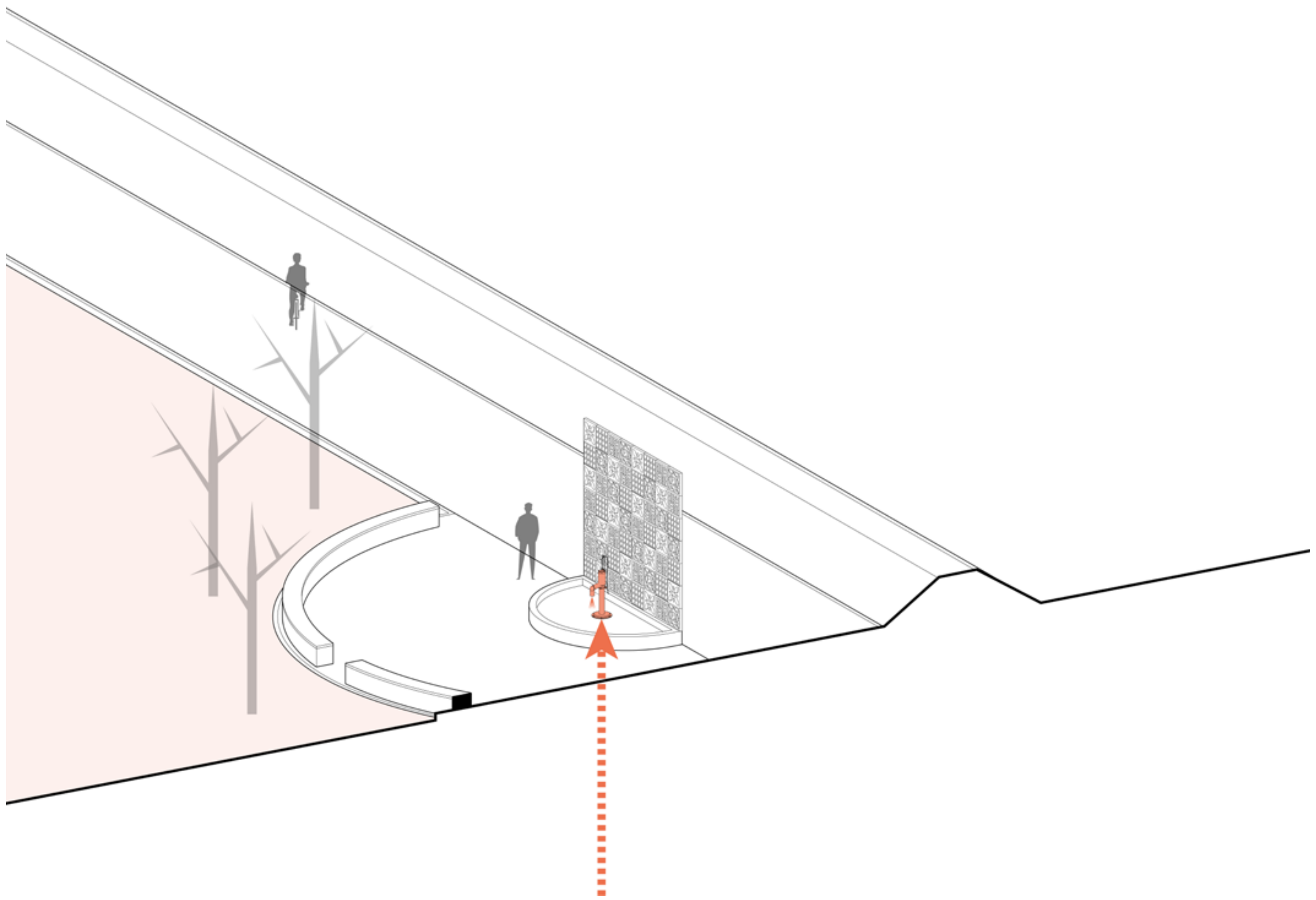
UNDERGROUND DAM RANGELAND

Well

Rainy season



Dry season



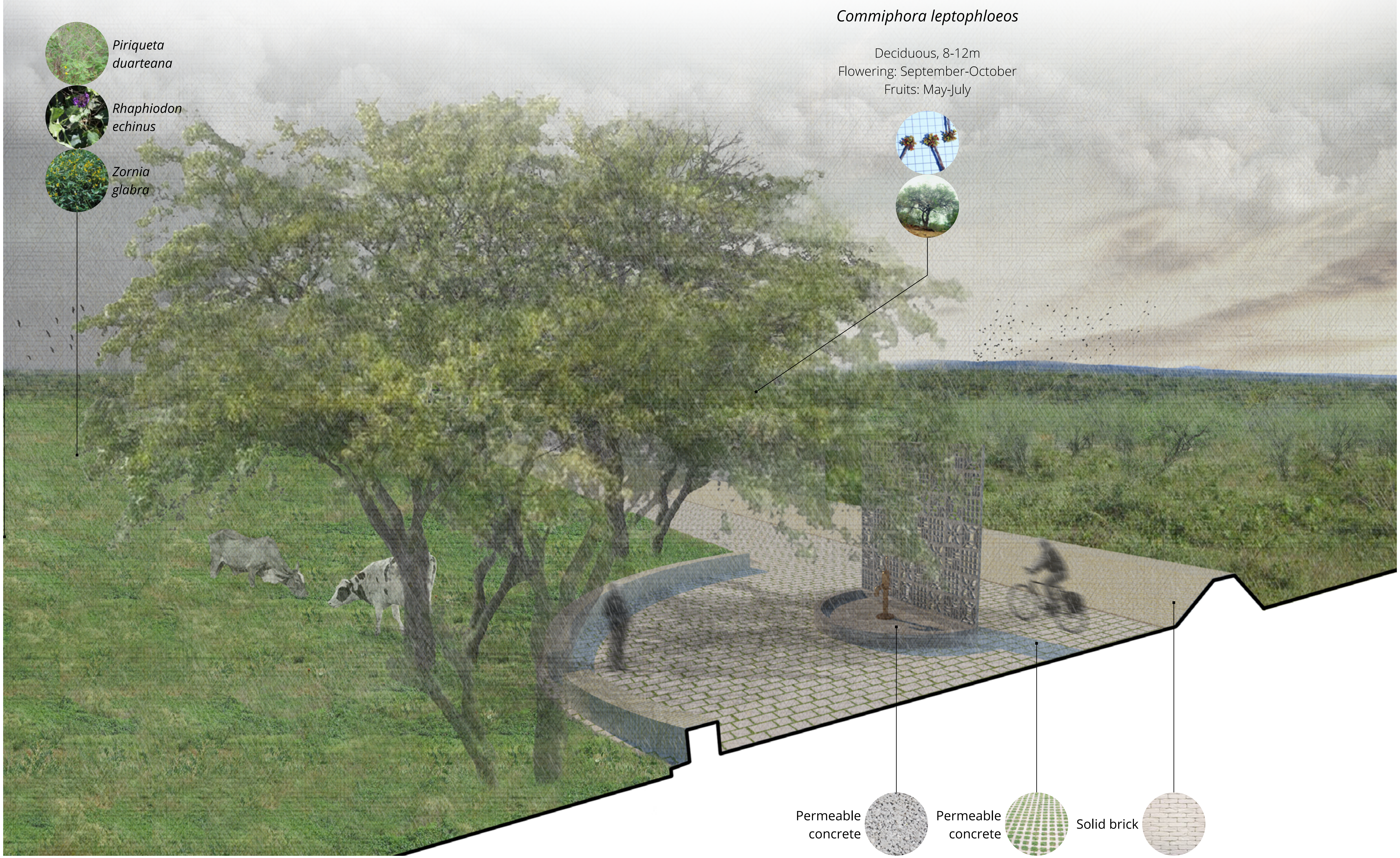
Surface runoff

Wetness that infiltrates the soil

Underground route

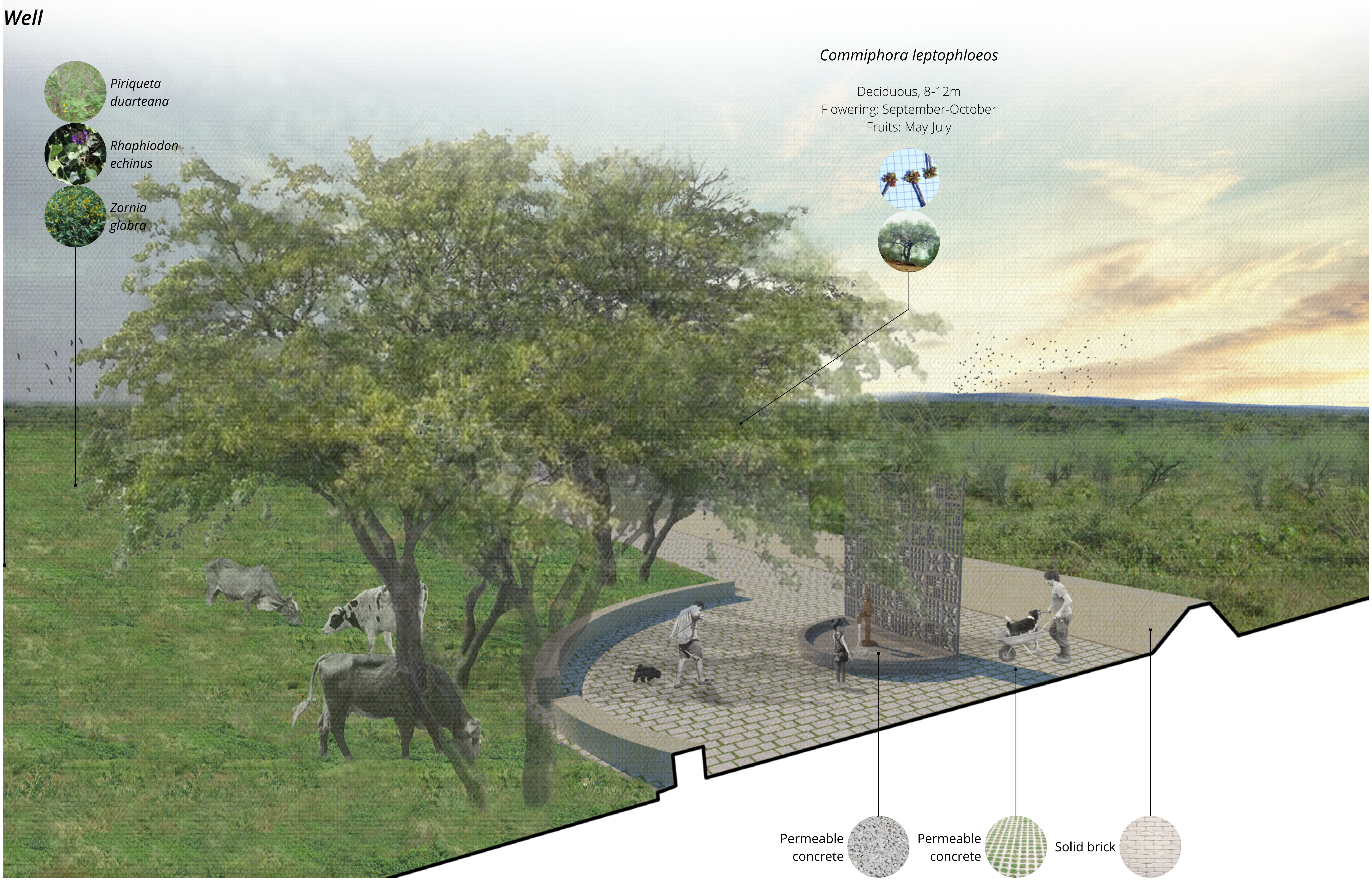
UNDERGROUND DAM RANGELAND

Well - Rainy season



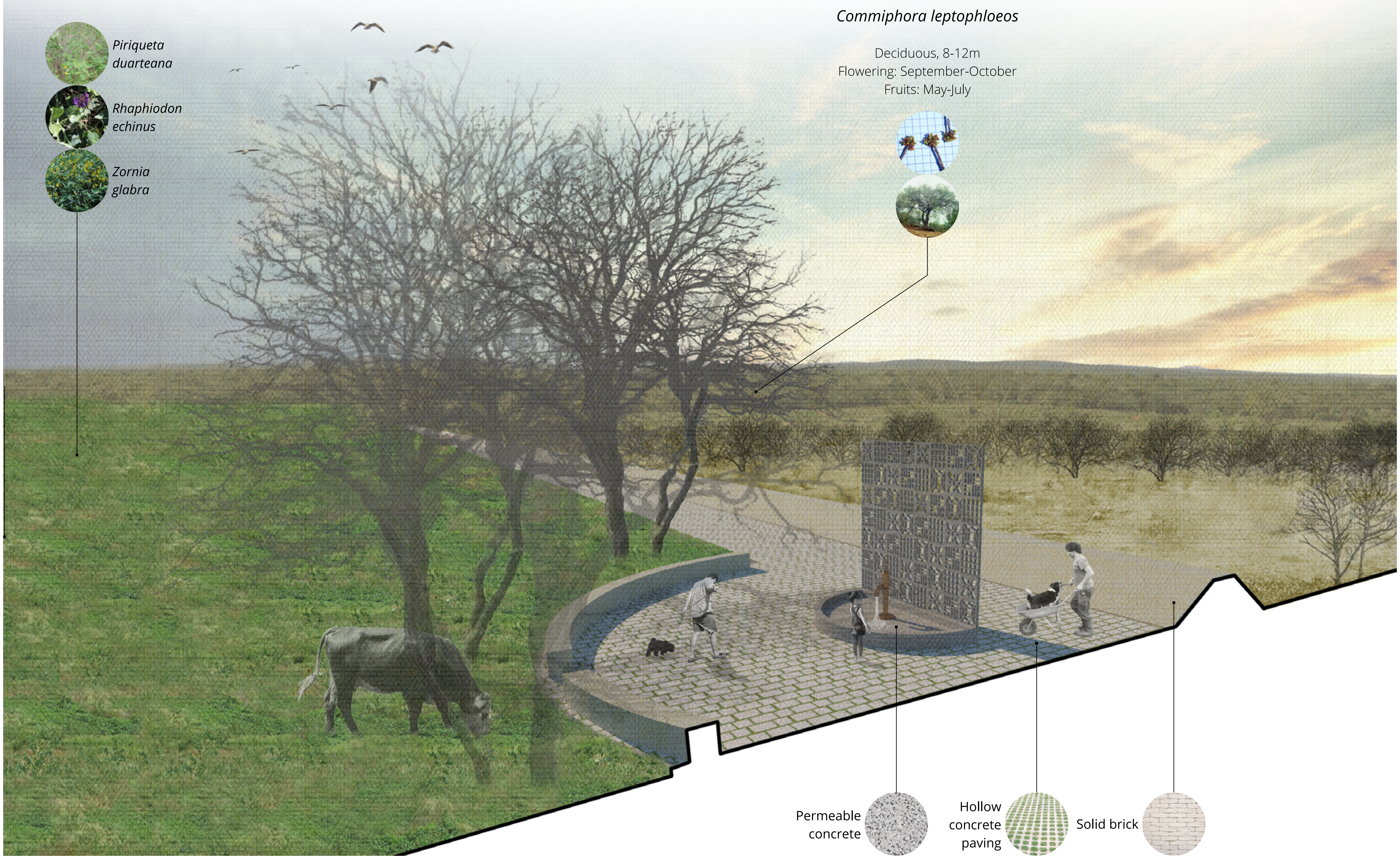
UNDERGROUND DAM RANGELAND

Well



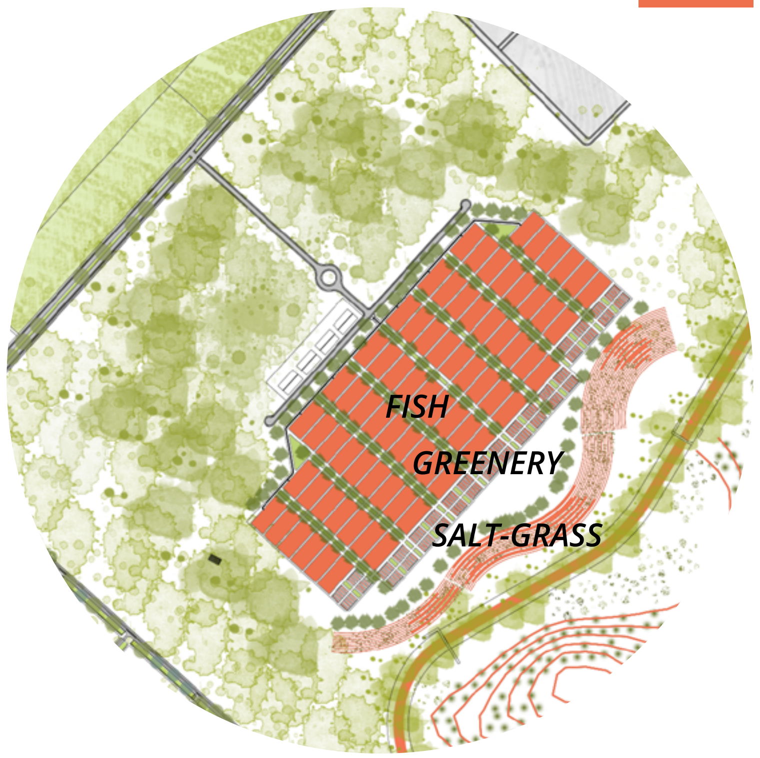
UNDERGROUND DAM RANGELAND

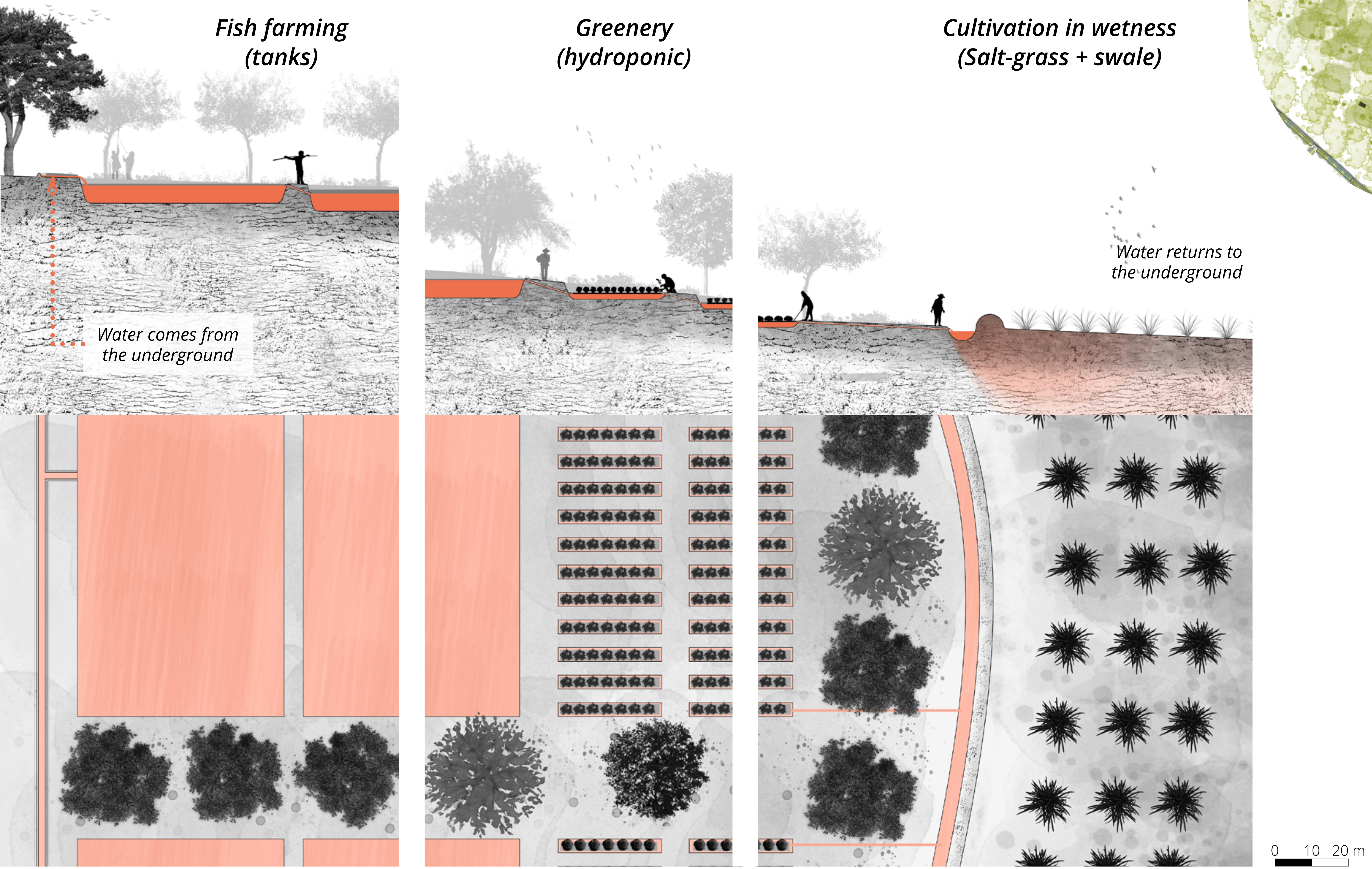
Well - Dry season



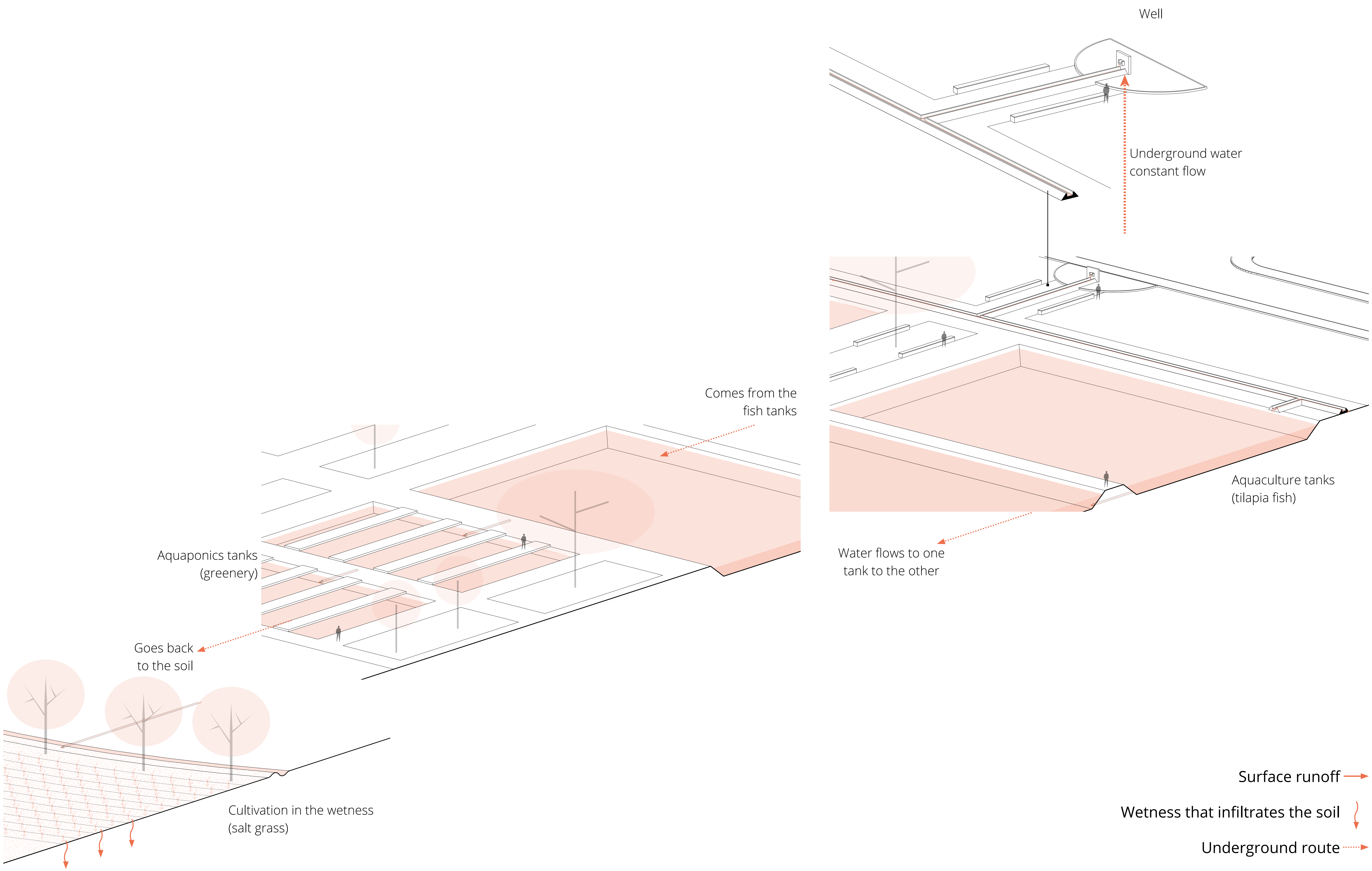
DESIGN STRATEGIES: LOCAL SCALE

UNDERGROUND WATER AQUAPONICS





UNDERGROUND WATER AQUAPONICS



UNDERGROUND WATER AQUAPONICS

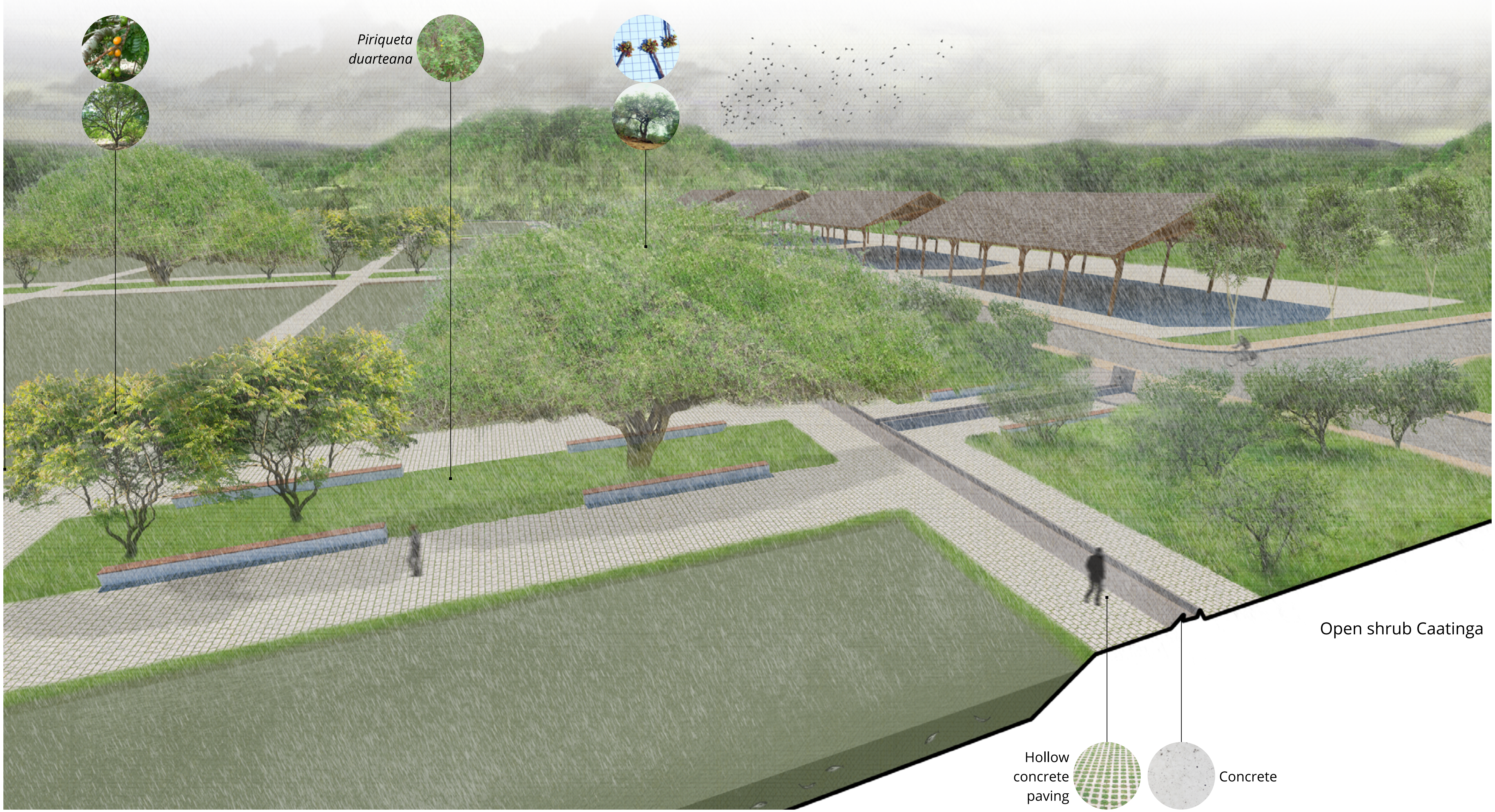
Rainy season

Spondias purpurea

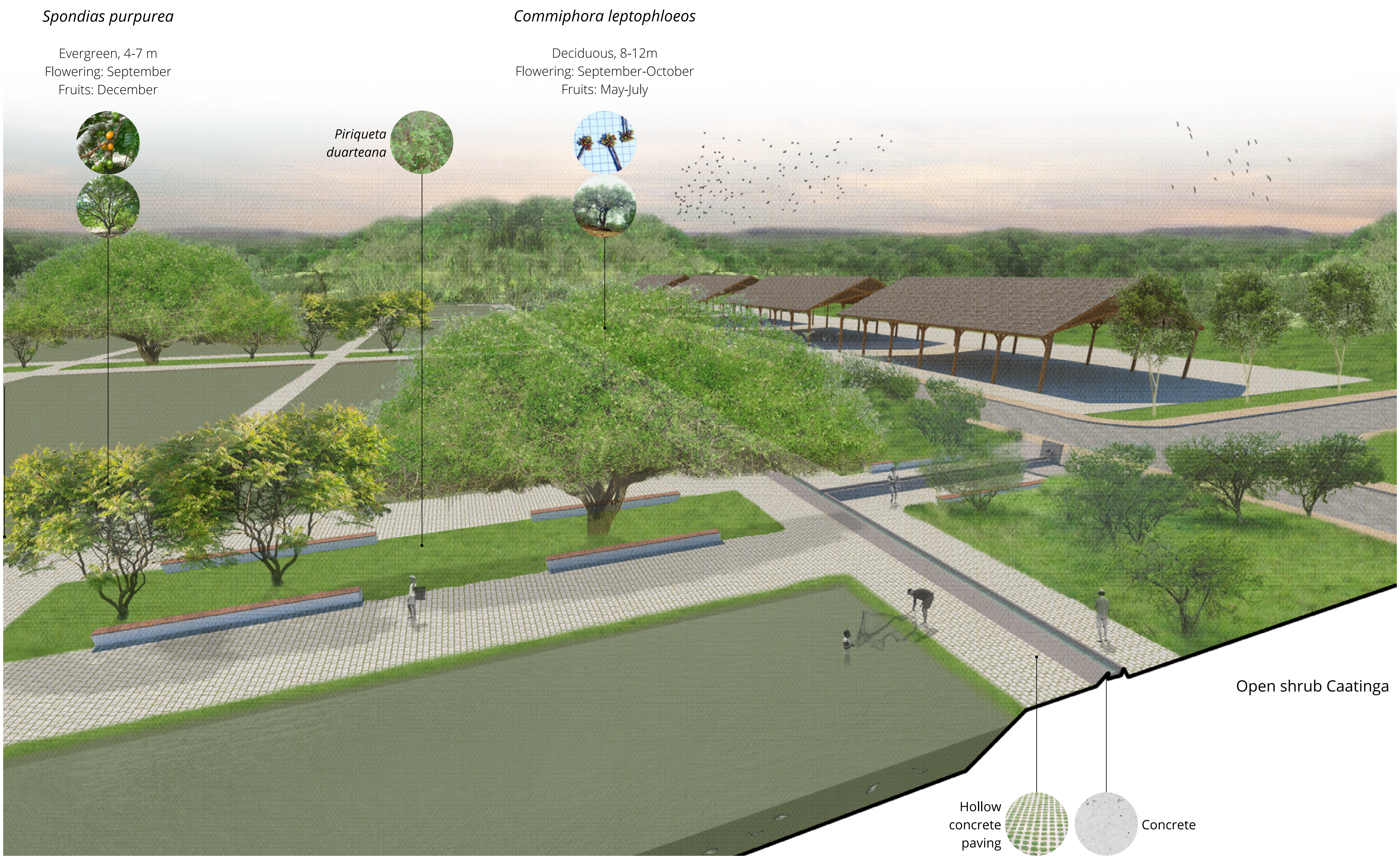
Evergreen, 4-7 m
Flowering: September
Fruits: December

Commiphora leptophloeos

Deciduous, 8-12m
Flowering: September-October
Fruits: May-July

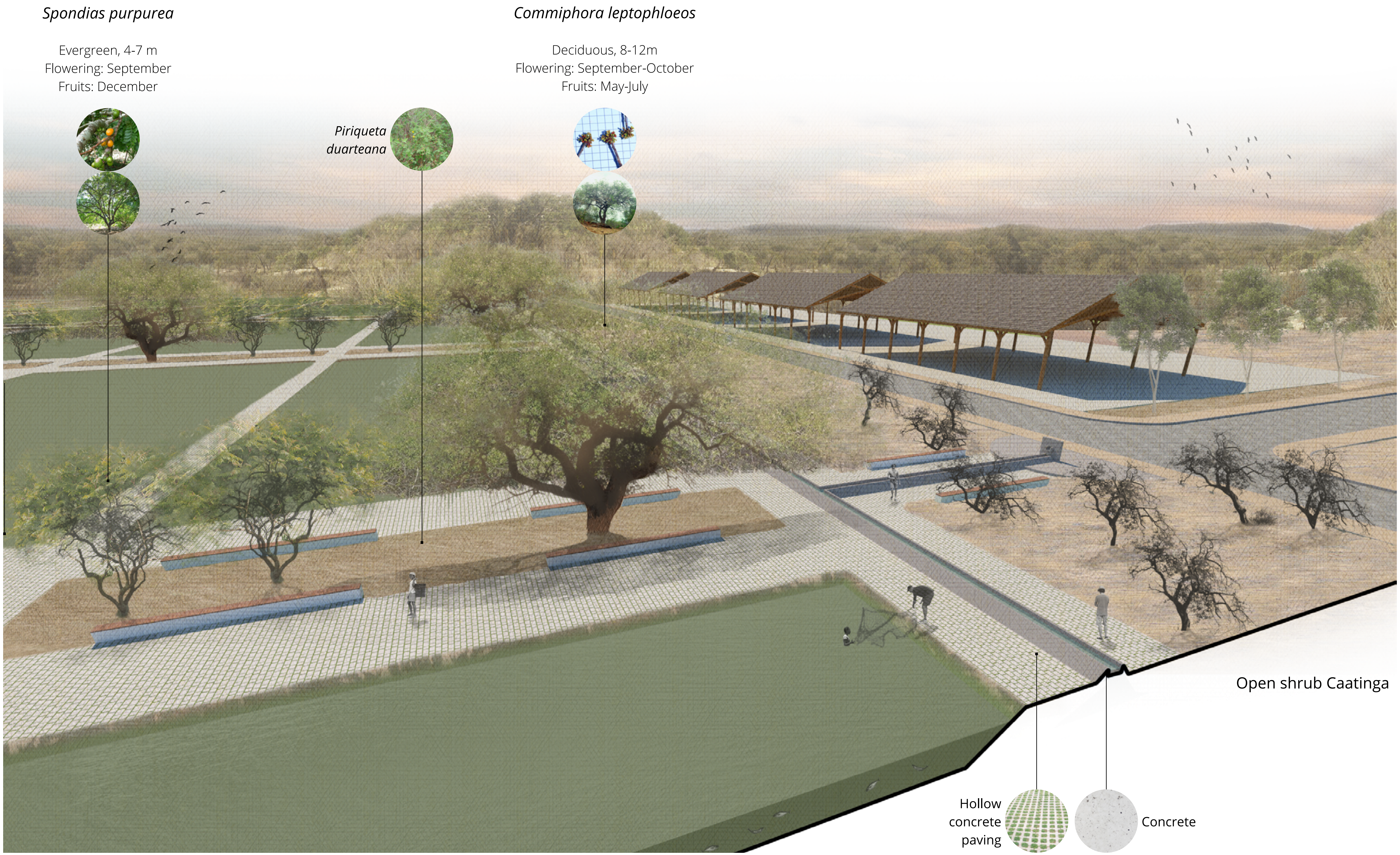


UNDERGROUND WATER AQUAPONICS



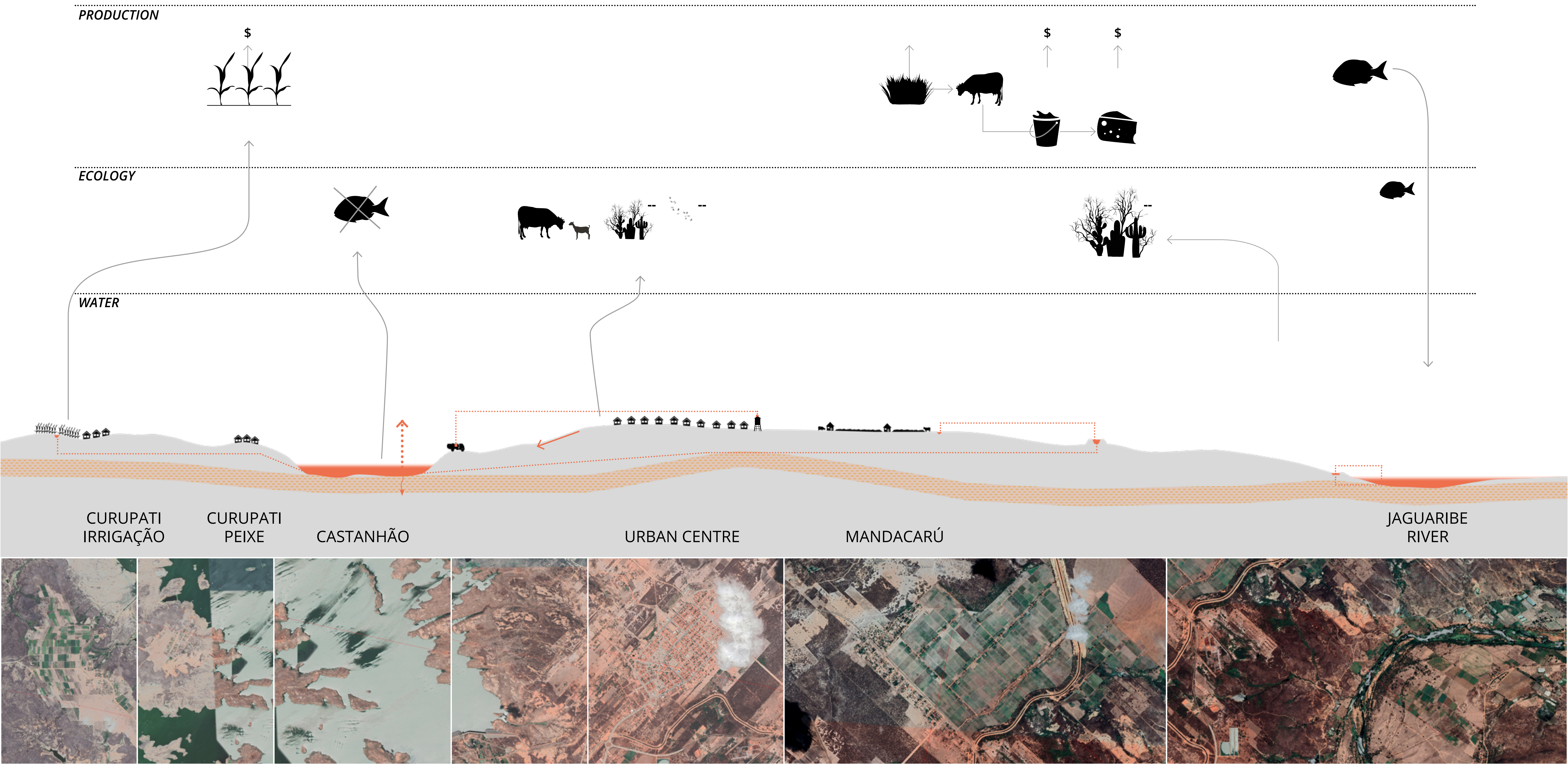
UNDERGROUND WATER AQUAPONICS

Dry season



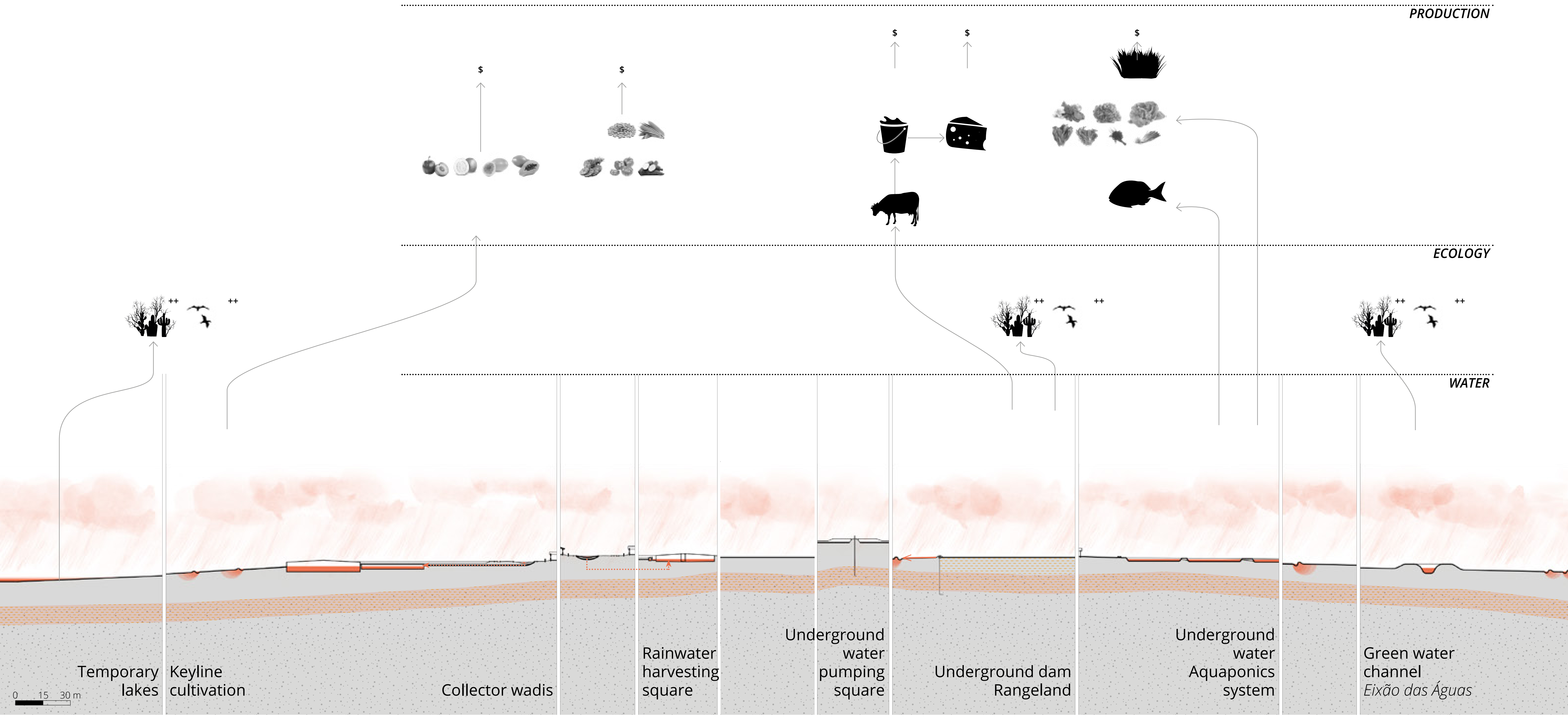
DESIGN STRATEGIES: LOCAL SCALE

Current flows



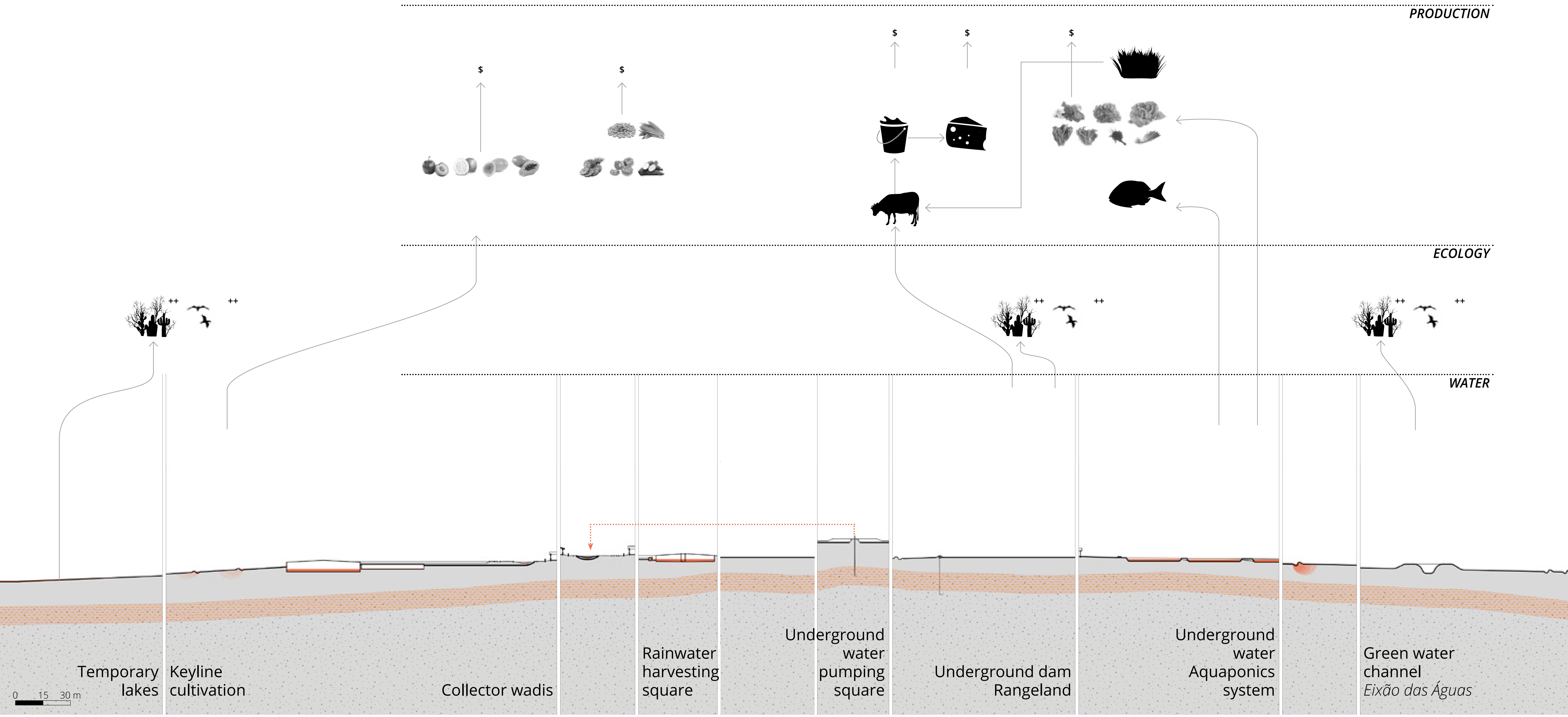
DESIGN STRATEGIES: LOCAL SCALE

Flows - Rainy season



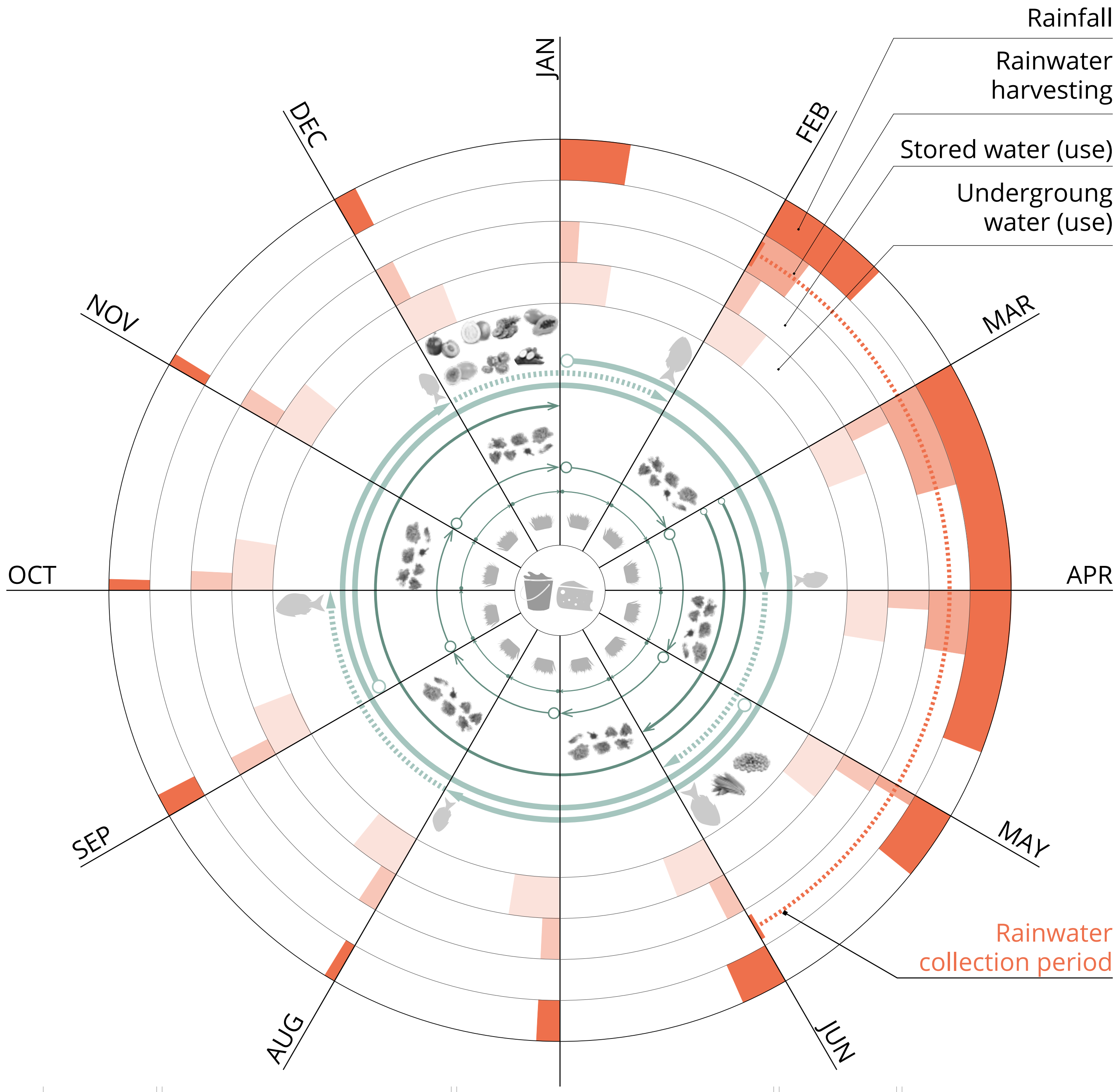
DESIGN STRATEGIES: LOCAL SCALE

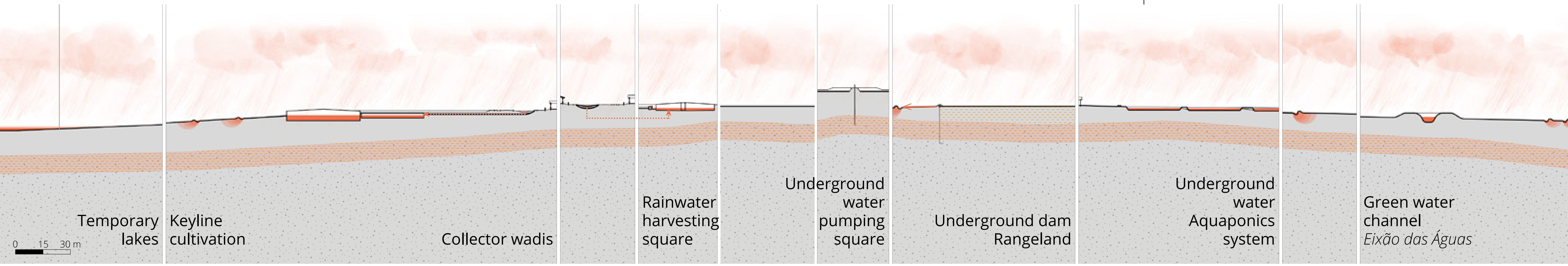
Flows - Dry season



DESIGN STRATEGIES: LOCAL SCALE

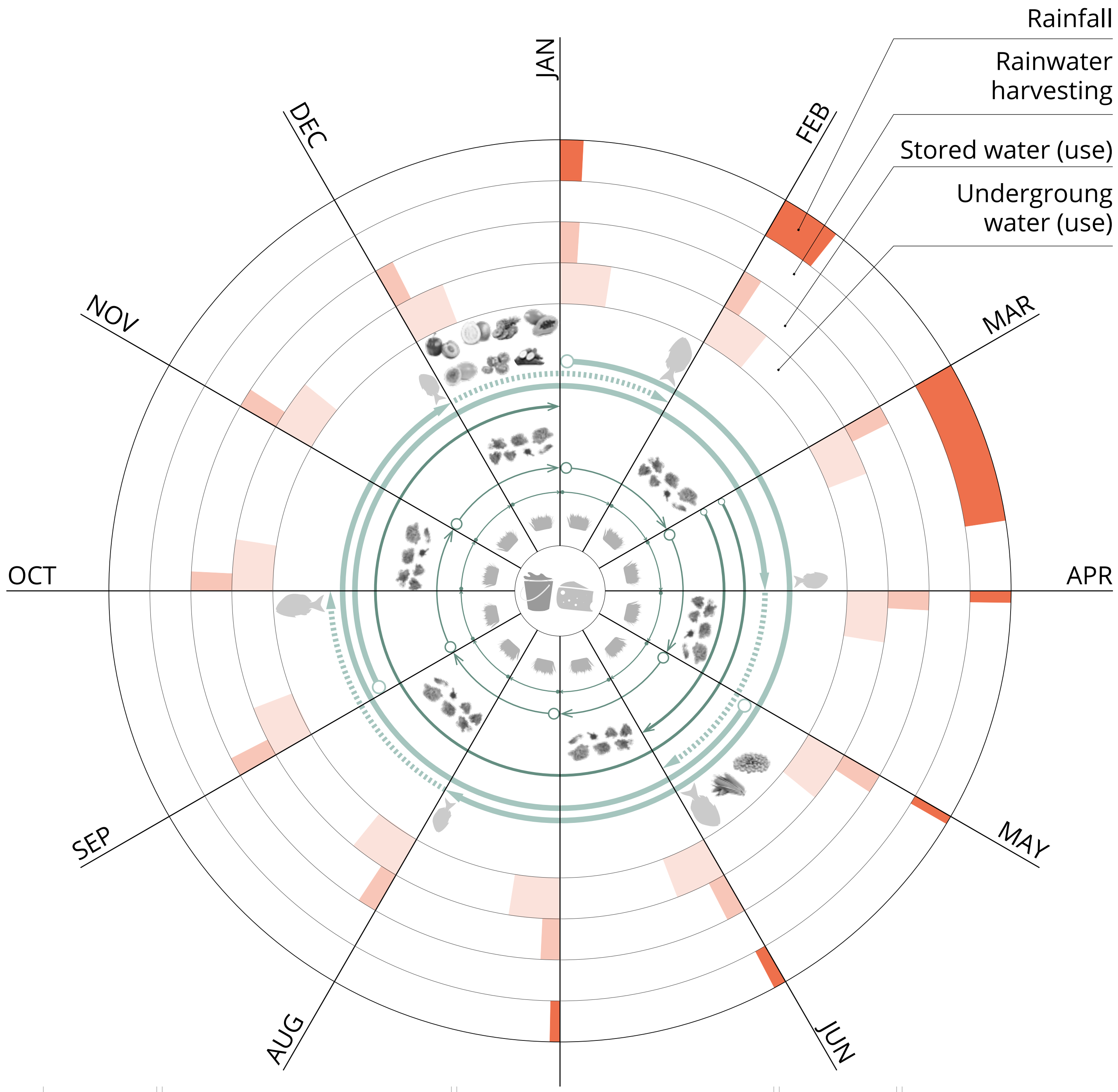
Calendar - Regular year

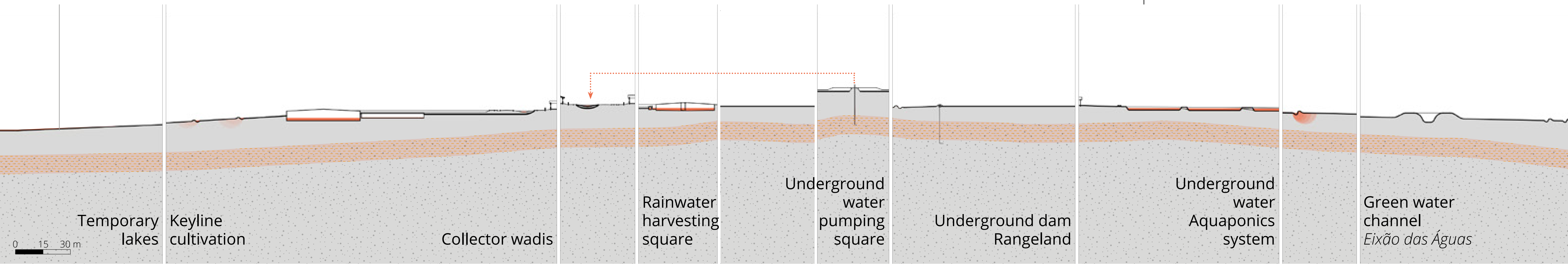




DESIGN STRATEGIES: LOCAL SCALE

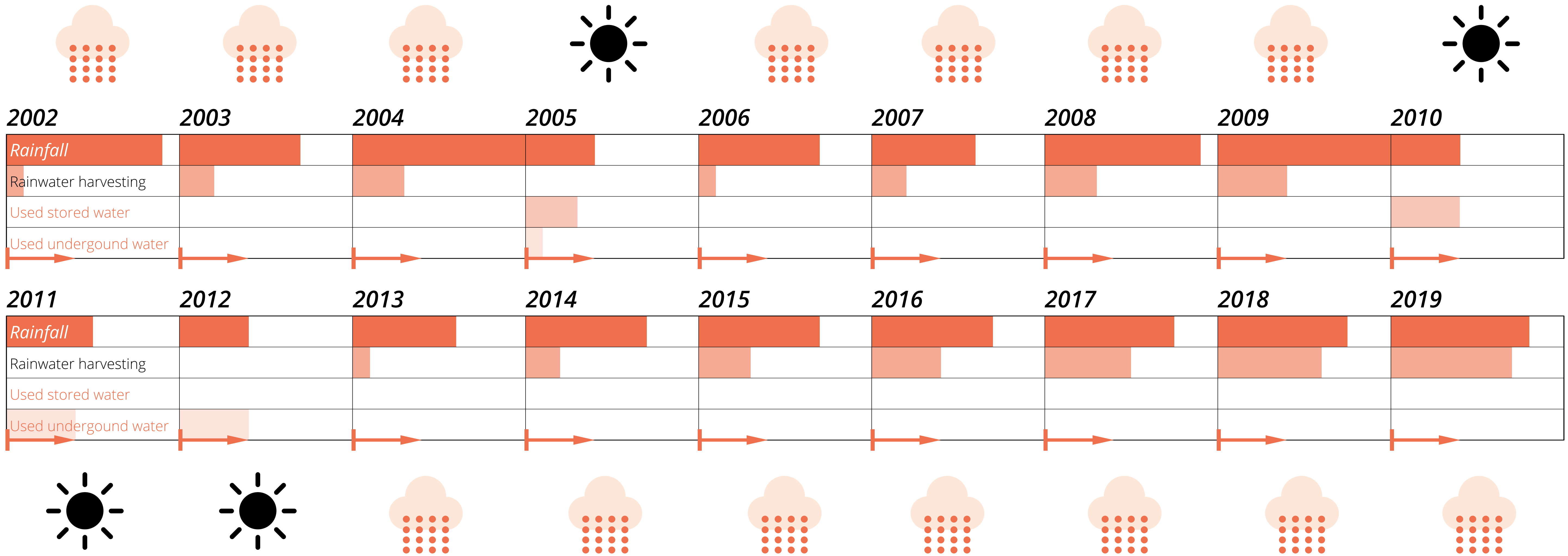
Calendar - Drought year



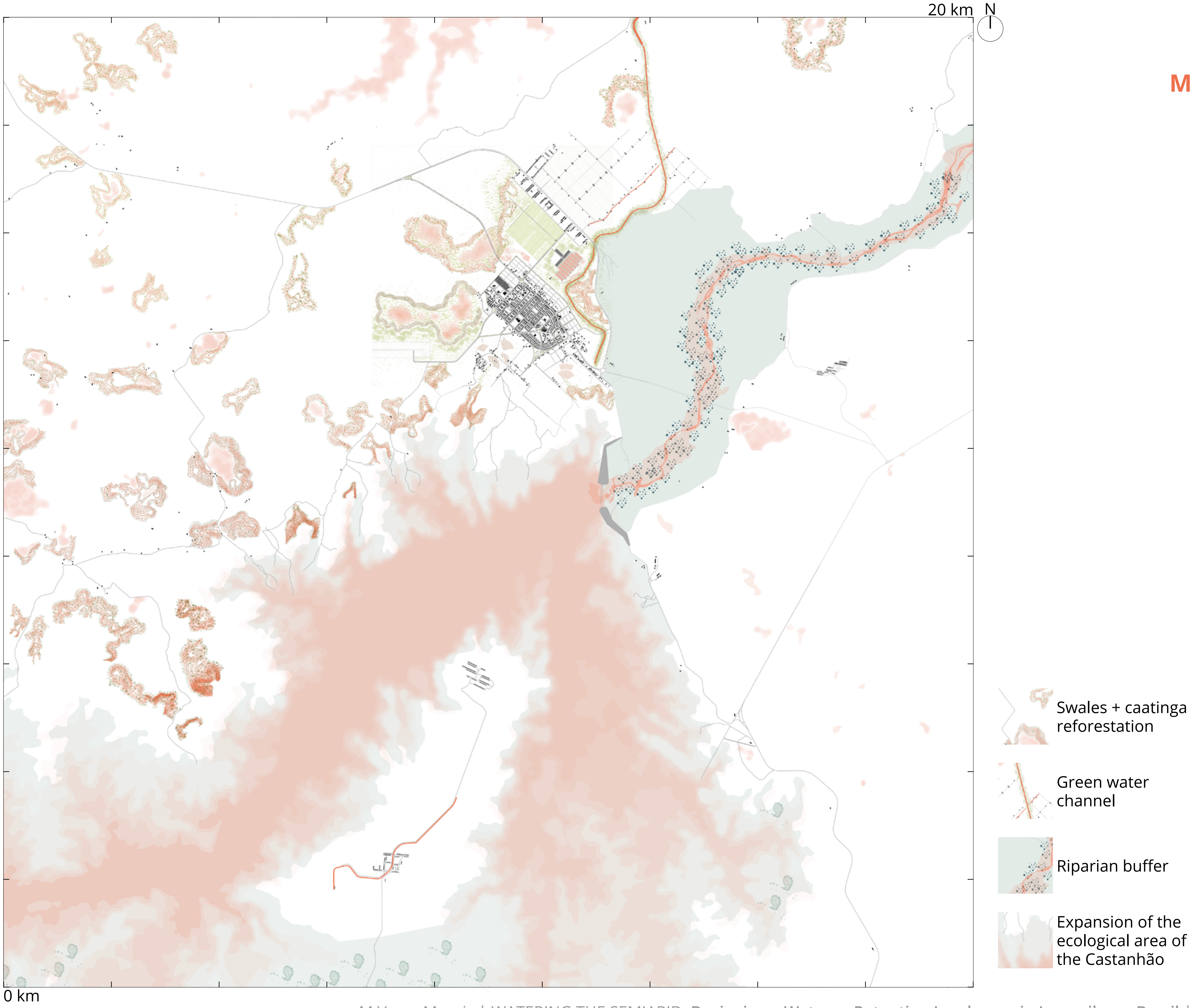


DESIGN STRATEGIES: LOCAL SCALE

Over the years

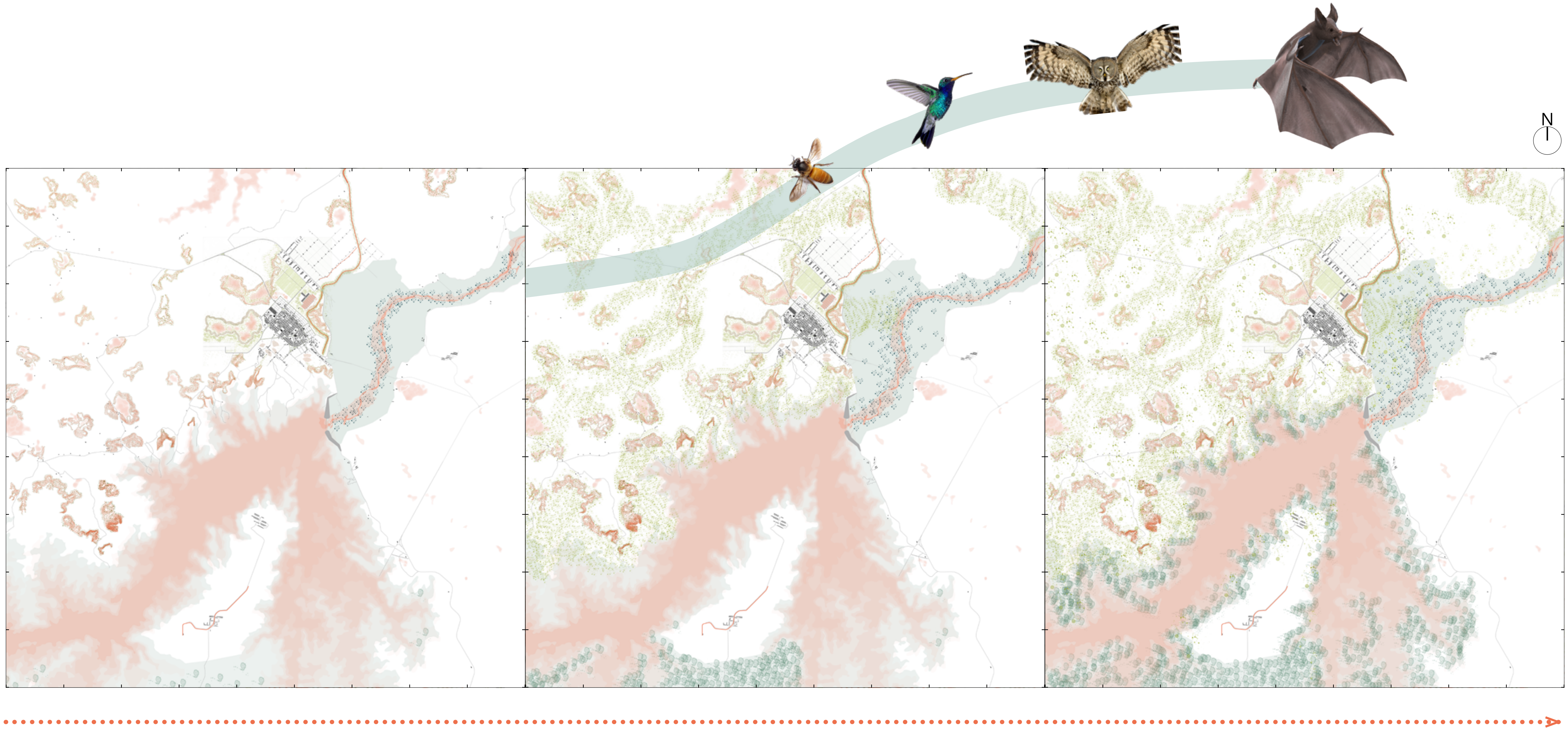


DESIGN STRATEGIES: METROPOLITAN SCALE

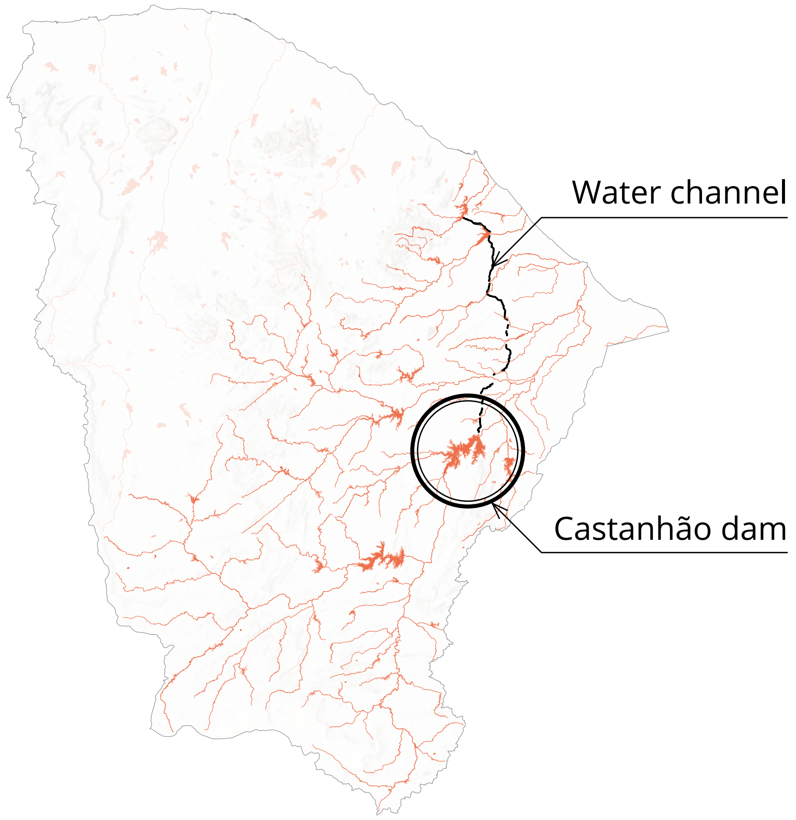


DESIGN STRATEGIES: METROPOLITAN SCALE

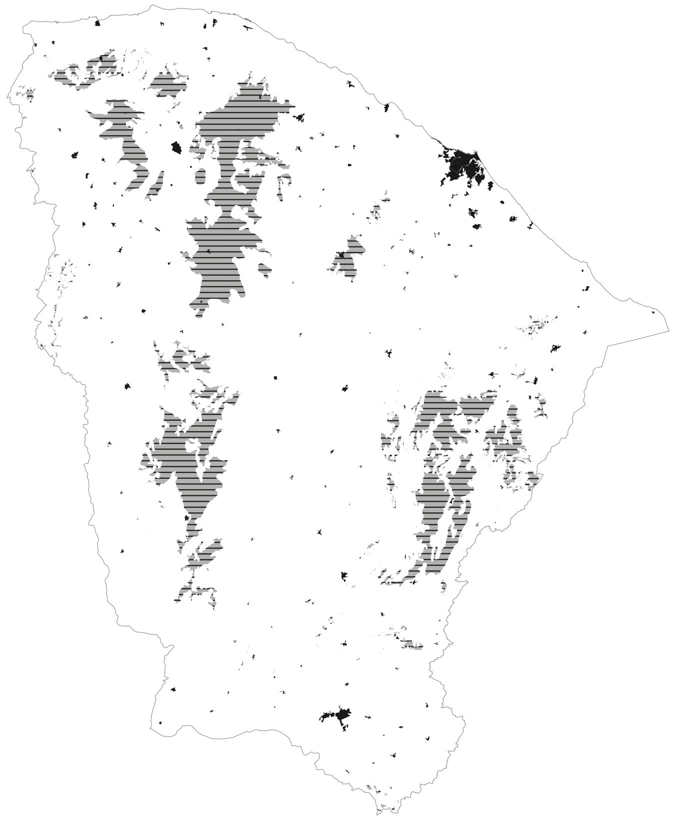
Over the years



DESIGN STRATEGIES: REGIONAL SCALE



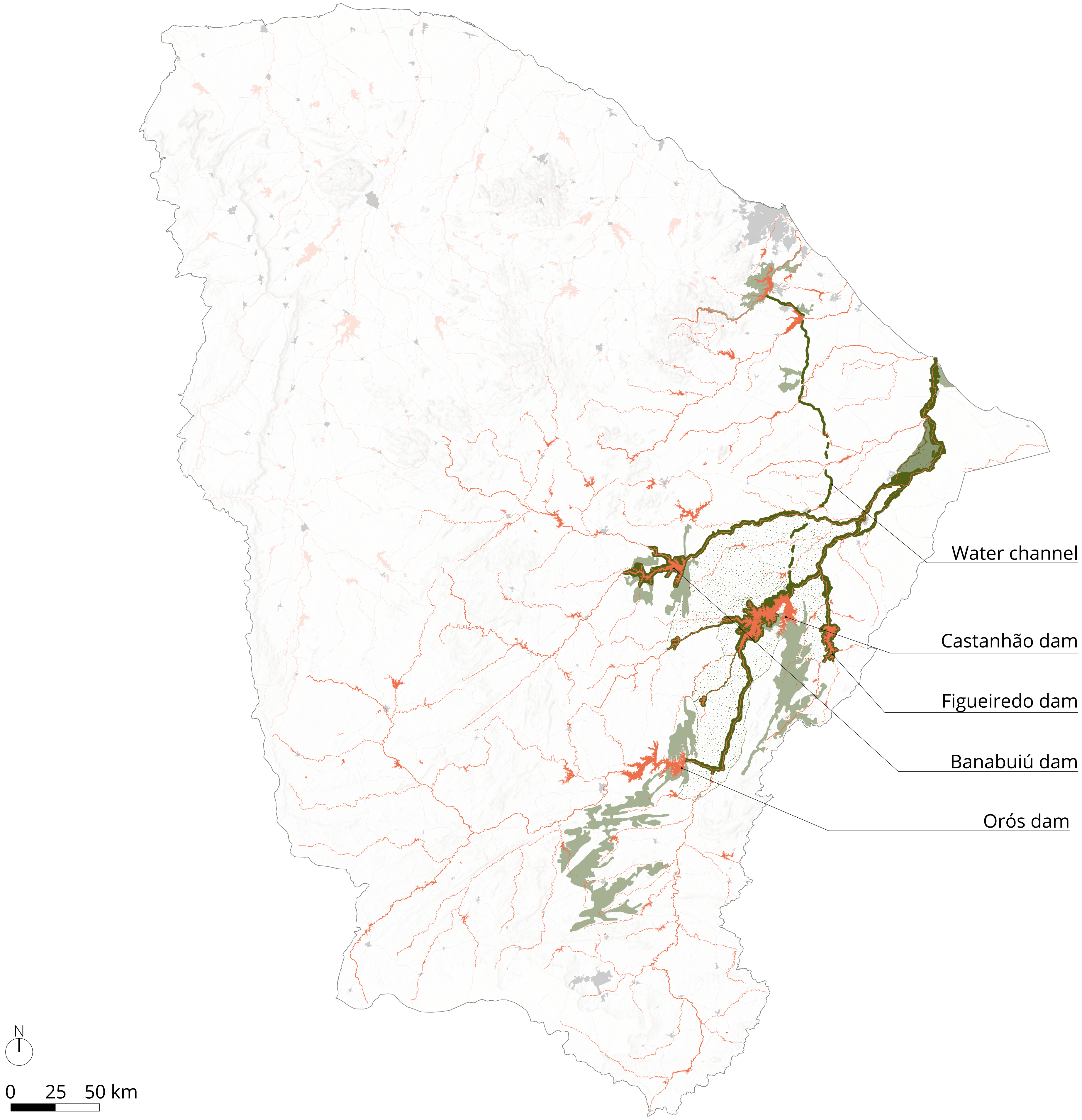
Jaguaribe river **(riparian buffer)**
+
water channel **(green channel)**

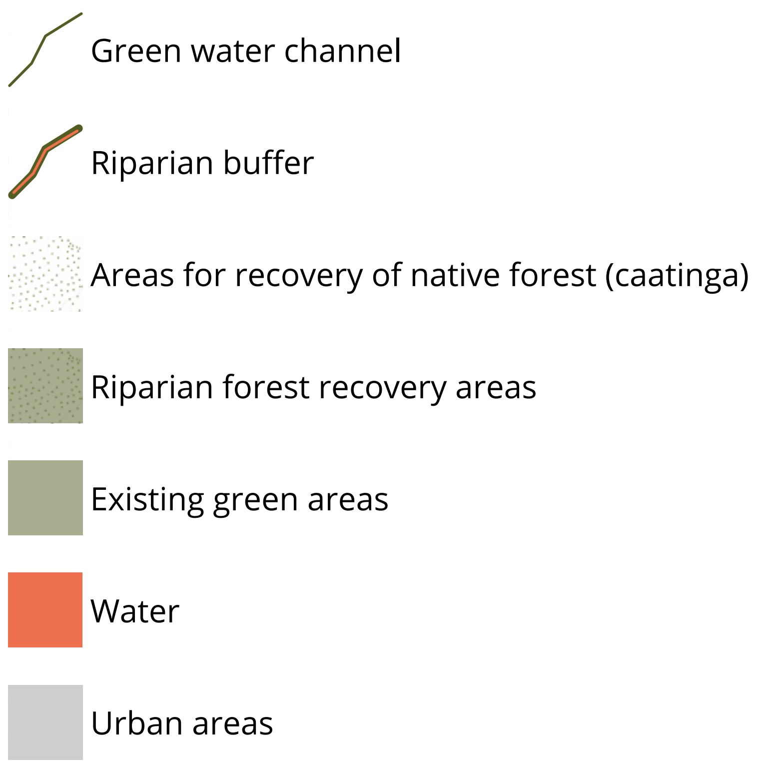


Tendency to desertification

Rangelands

DESIGN STRATEGIES: REGIONAL SCALE





PLANNING AND STAKEHOLDERS

FINANCING

Federal government
(from "Water belt funds)

Thermoelectric industry

Fish farming / agriculture *(river plains)*

COORDINATION PLANNING

Jaguaribe river watershed committee

Government agencies
Water regulation and use

IMPLEMENTATION

DNOCS
Construction

NGOs
Reforestation

Locals farmers
Landworks (cultivation)

OPERATIONALIZATION

Embrapa (gov)
Training
(new cultivation systems)

Castanhão fish farming
Supplies young tilapia fish to Aquaponics system

University
Research (fish skin)
Living lab

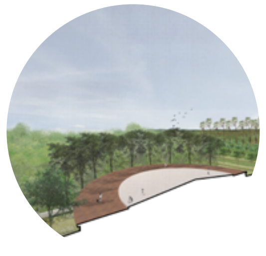
Locals farmers
Cultivations and production

FINAL CONSIDERATIONS

Design strategies assessment

URBAN WADI SYSTEM

Urban areas



KEYLINE CULTIVATION

Productive landscapes

UNDERGROUND DAM RANGELAND

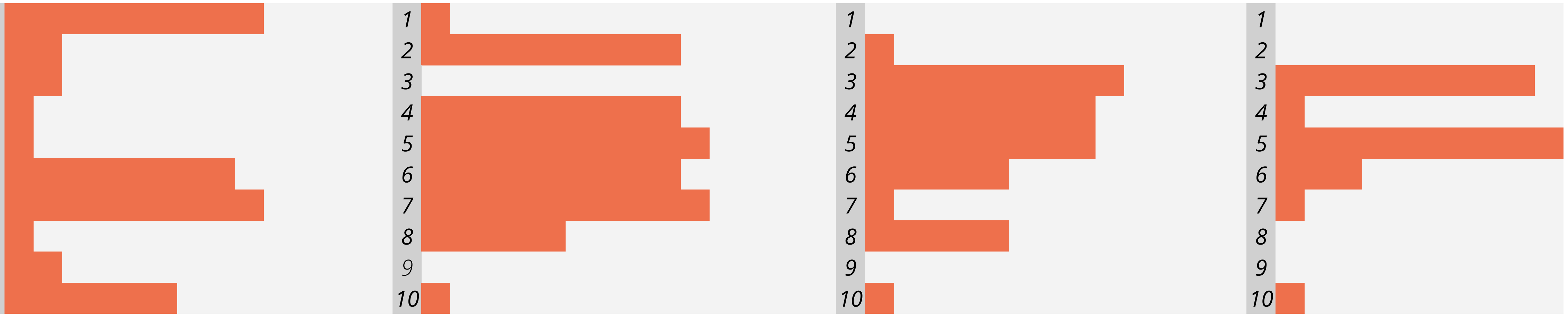
Rangelands, productive landscapes

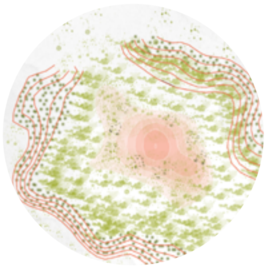
UNDERGROUND WATER AQUAPONICS

Productive landscapes

OBJECTIVES:

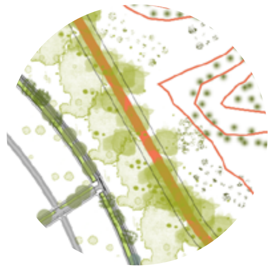
1. Rainwater harvesting
2. Water table recharging
3. Exploration of underground water
4. Expansion of vegetation covering
5. Prevent soil erosion
6. Promote productive activity
7. Protect water from evaporation
8. Reforestation of native vegetation
9. Water for human consumption
10. Water use/drought awereness





SWALES SYSTEM

Rangeland, natural areas



GREEN WATER CHANNEL

Artificial water bodies

RIPARIAN BUFFER

Natural water bodies

OBJECTIVES:

1. Rainwater harvesting
2. Water table recharging
3. Exploration of underground water
4. Expansion of vegetation covering
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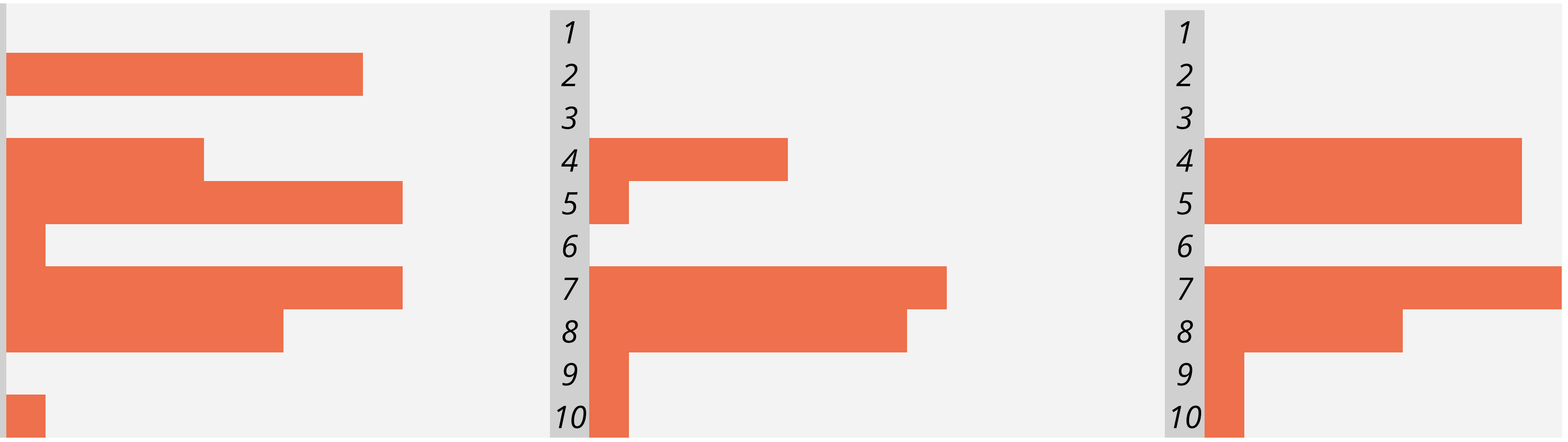
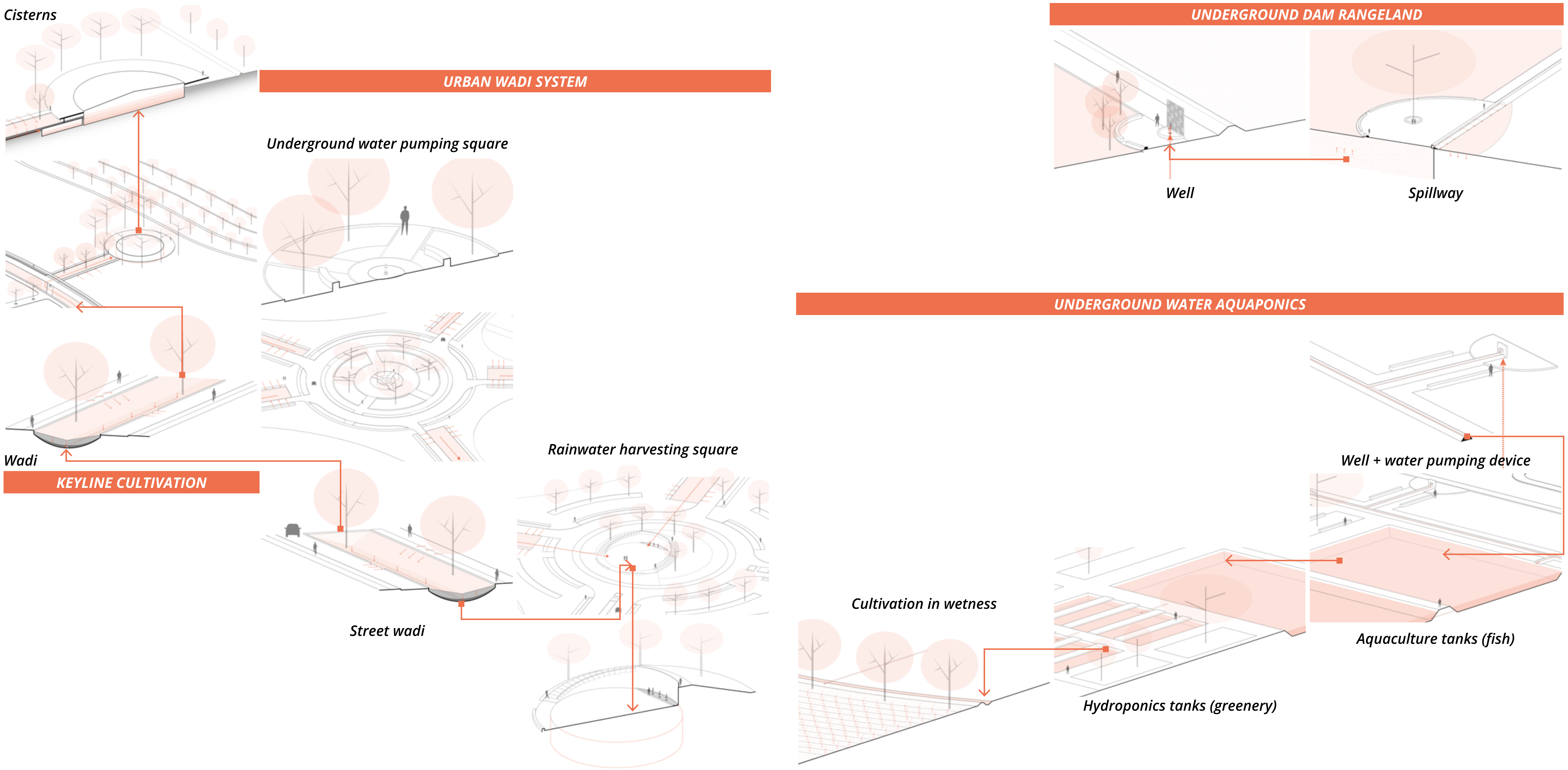


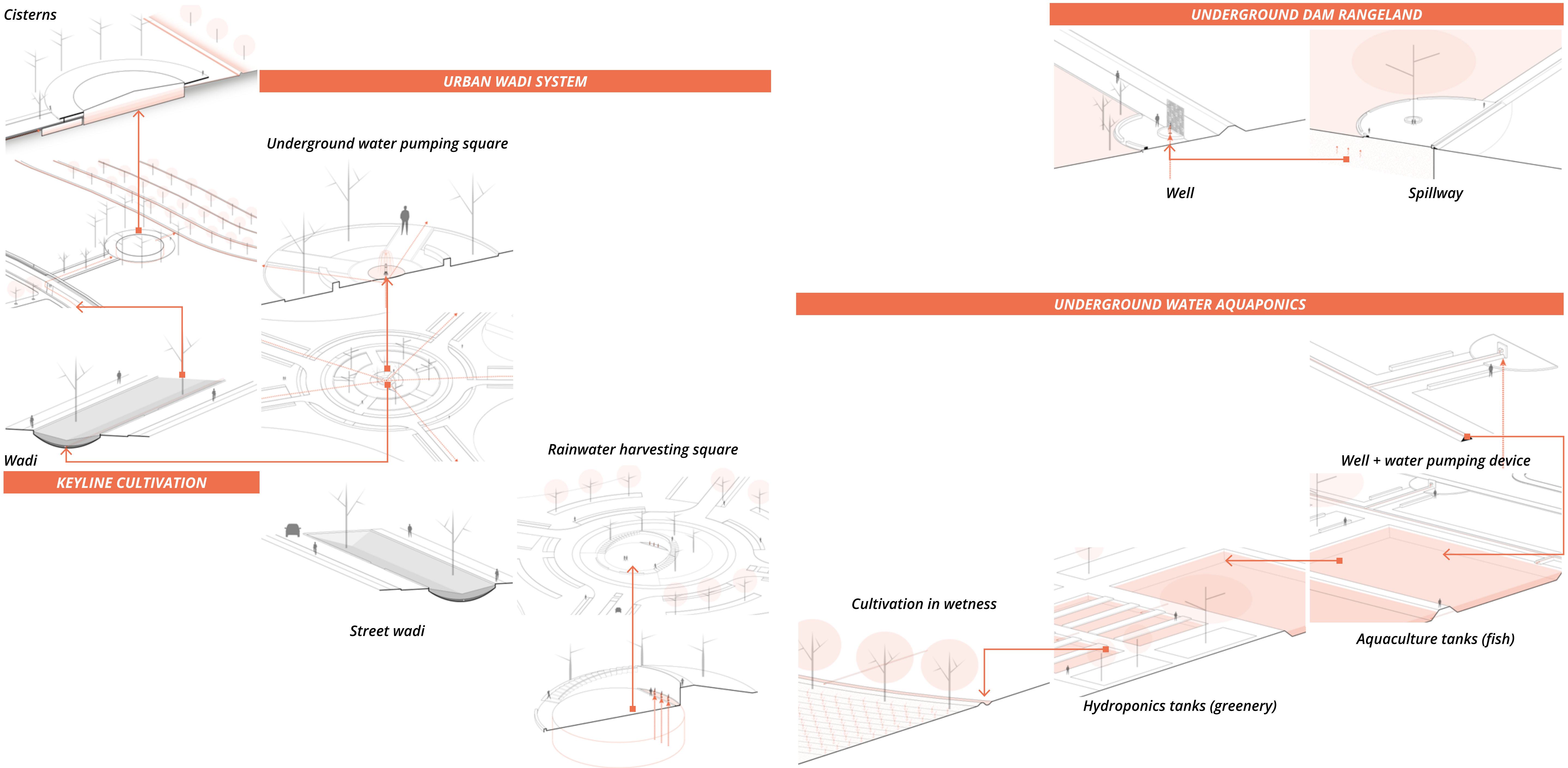
FINAL CONSIDERATIONS

System overview (rainy season)



FINAL CONSIDERATIONS

System overview (dry season)



FINAL CONSIDERATIONS

From the current situation...

URBAN AREA

30 m streets

Roundabouts

Housing water storage

PRODUCTIVE LANDSCAPE

Farming in empty lots

Rangelands

Irrigated farming

Aquaculture

Soil erosion + water loss + high energy consumption + dependent community

FINAL CONSIDERATIONS

... To a wetness retention landscape!

URBAN AREA

Wadi streets

Underground water pumping square

Rainwater harvesting square

PRODUCTIVE LANDSCAPE

Keyline cultivation

Underground dam - spillway

Underground dam rangeland

Aquaculture

Wetness retention + productive automony

Caatinga biome + economic development + local culture =

Sustainable development


Thank you.
Obrigada.