



TEARS OF THE TERRIL

ETHZ | HS 2023 | FINAL REVIEW MASTER THESIS

DYLAN TORRI | 18.12.2023

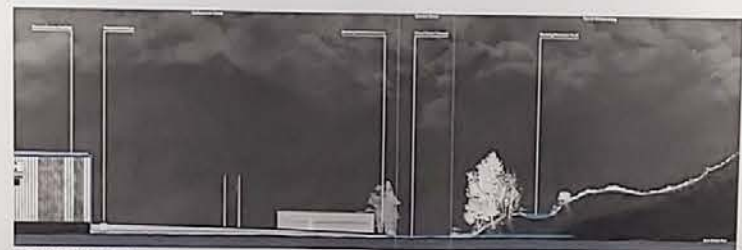
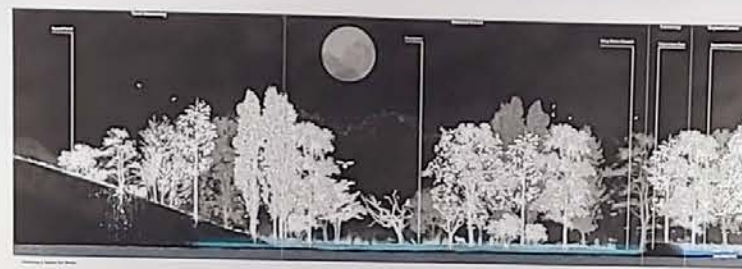
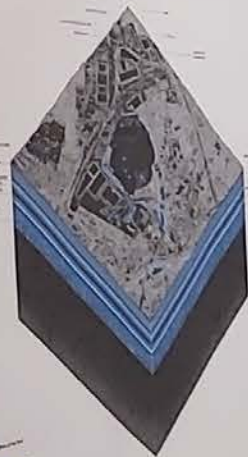
TEARS OF THE TERRIL

Restoring the Bonds of the Terril and its Surroundings through Water

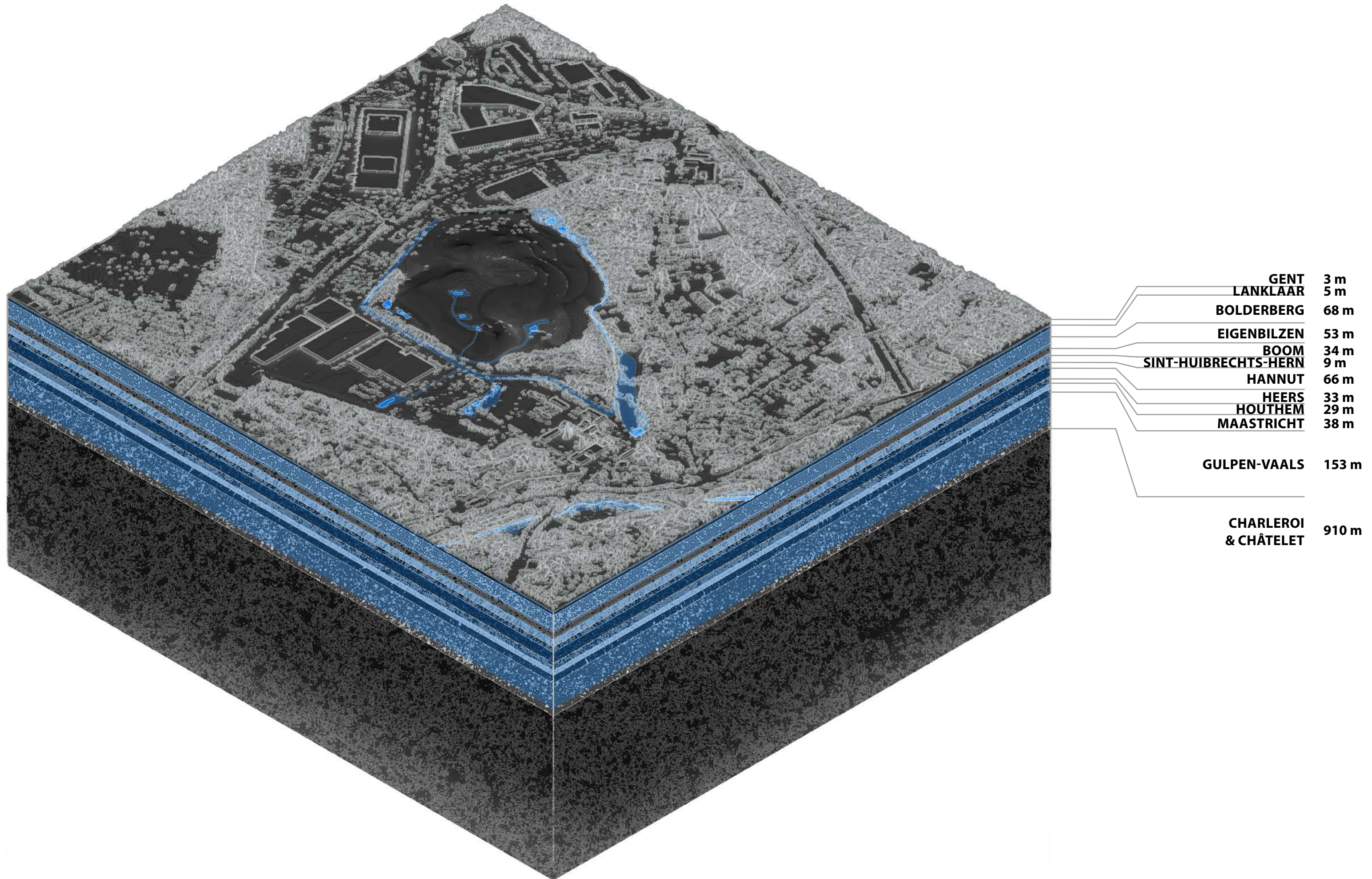
Spring 2006
ENC 104-5.20

Spring 2006
ENC 111-5.20

Spring 2006
ENC 111-5.20



THE DARK GIANT'S ORIGIN





















31.12.1974

de laatste
van de

Limburgse Koele
O.N.

DE LAATSTE

ON.31.12.'74













Siderite Concretions; <1%



Pyrite Concretions; <1%



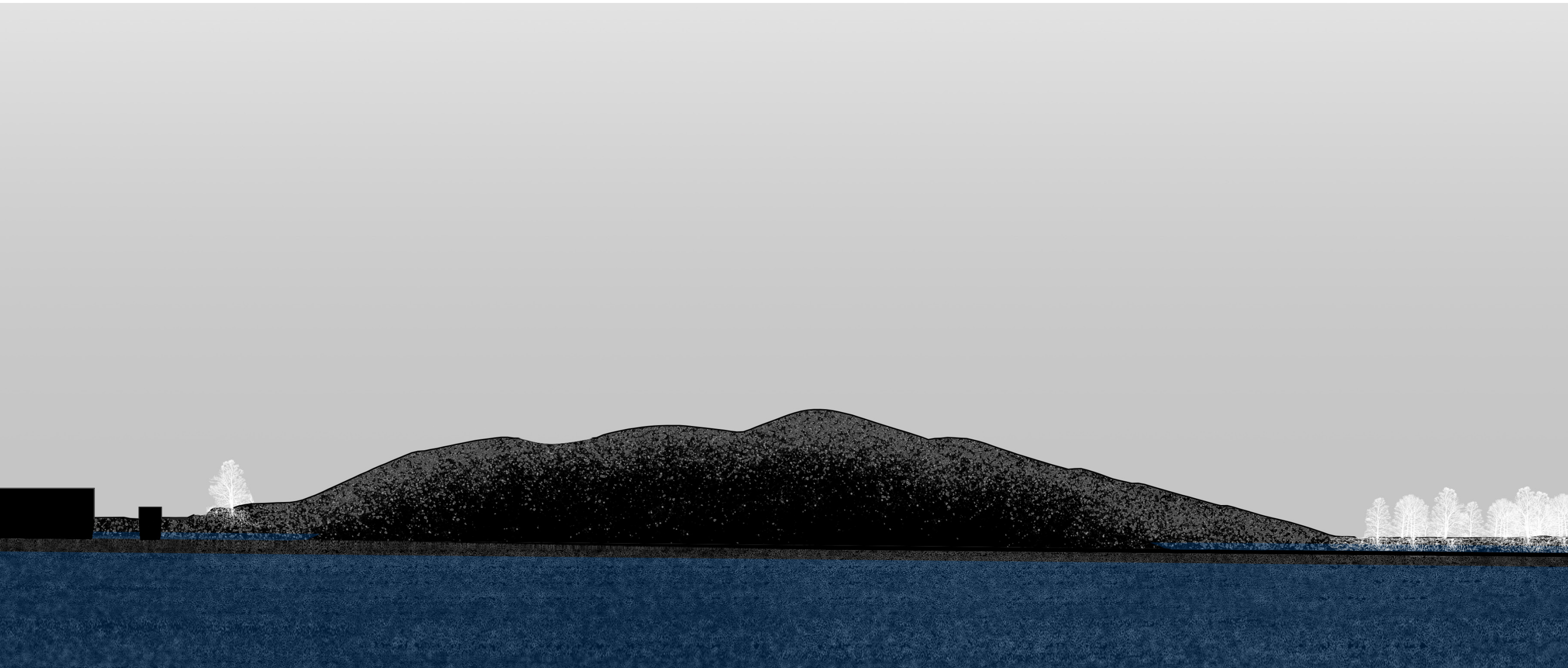
Coal & Carbshale; 1-10%



Sand- & Siltstone; 20%

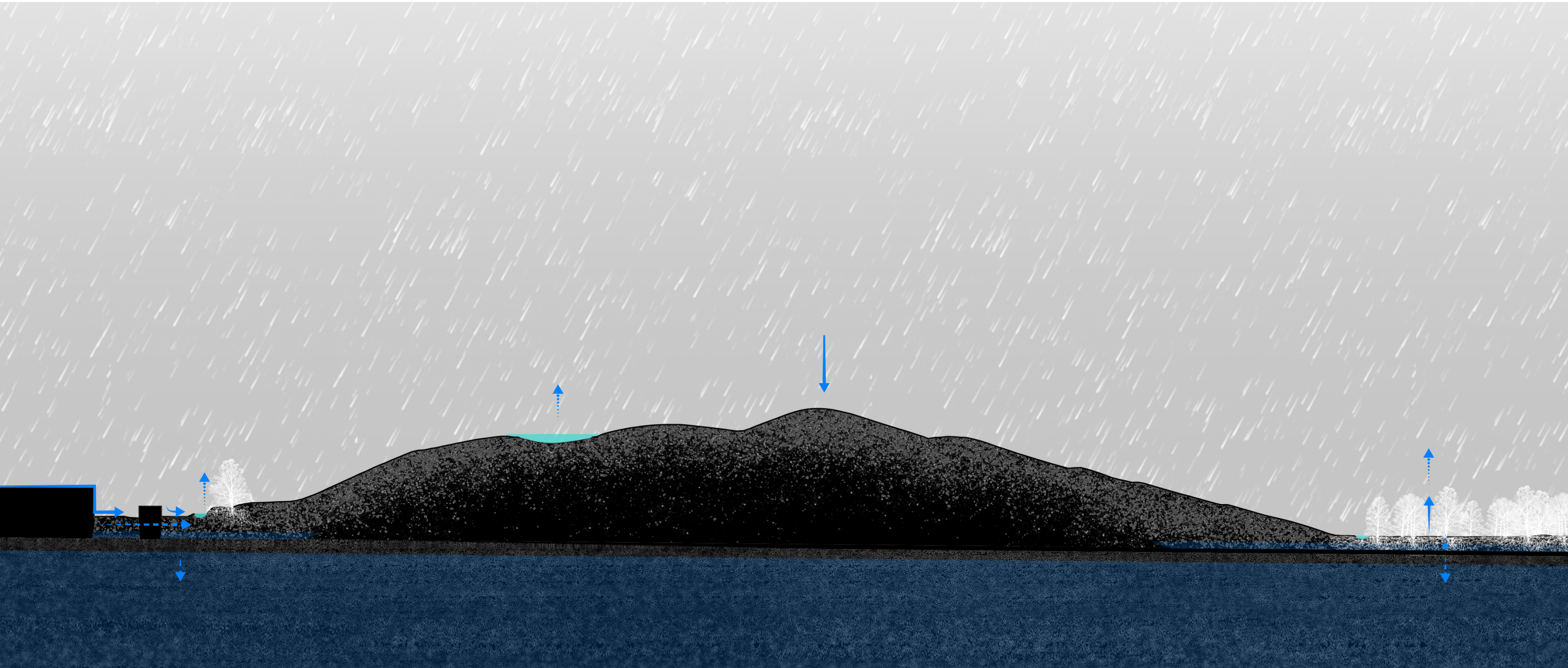


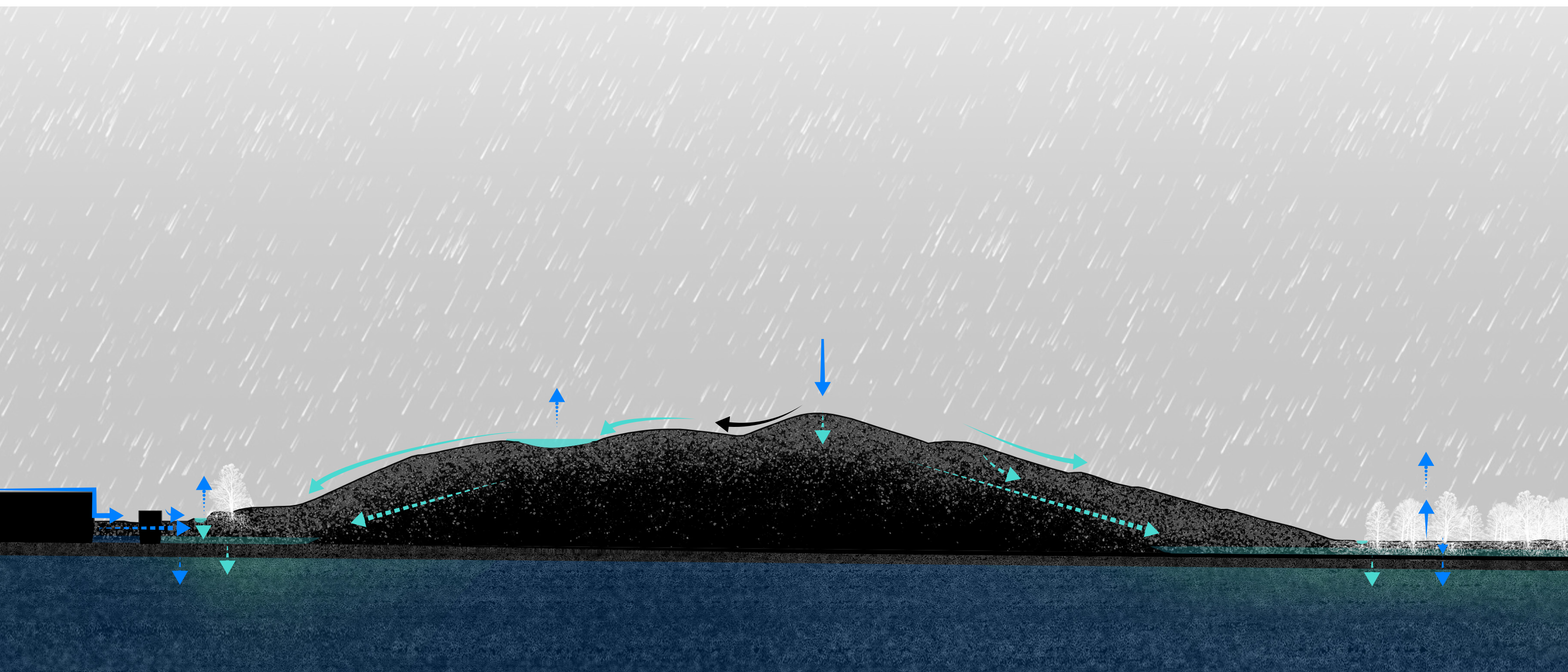
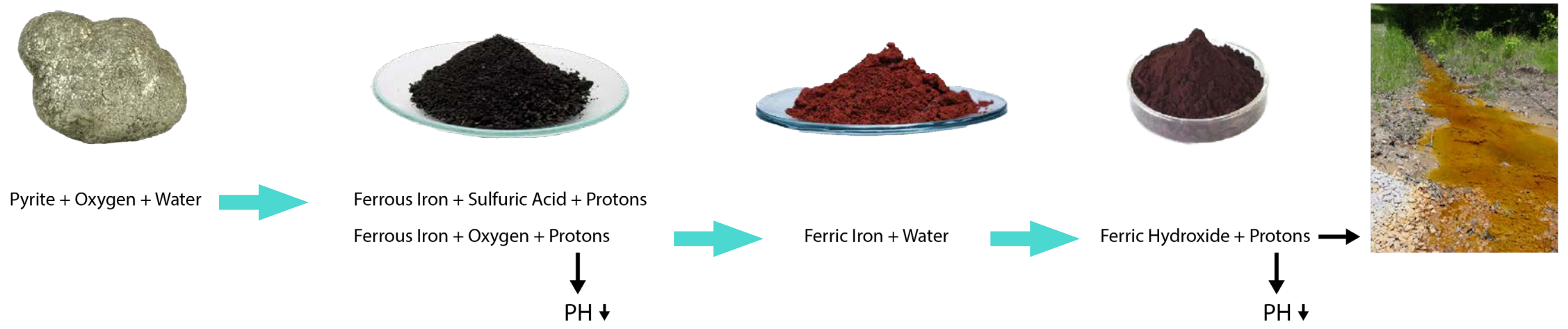
Mudstone; 70%





Pyrite + Oxygen + Water





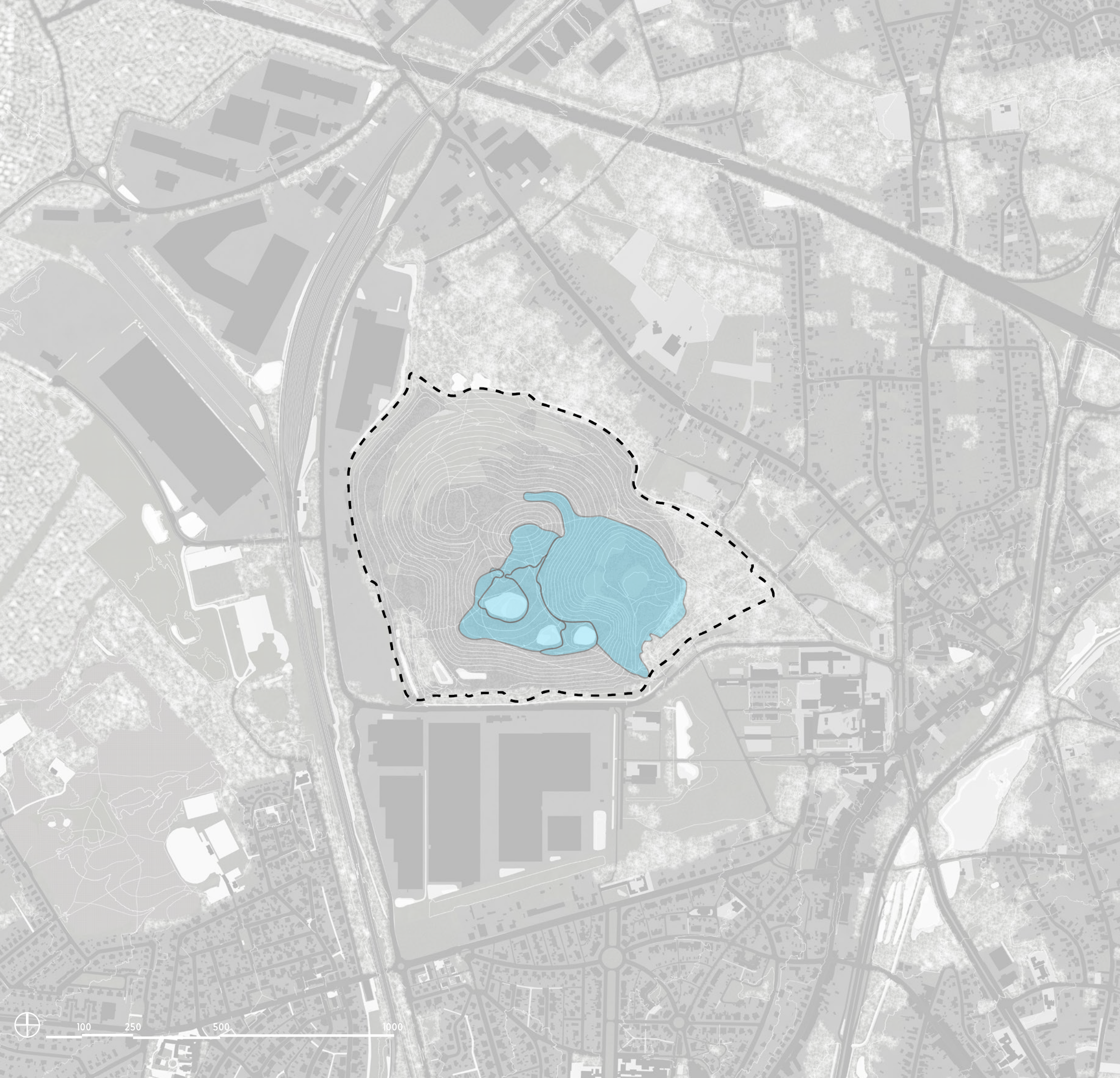


THE WATER'S NARRATIVE

Material boundary

— — — 3'600m





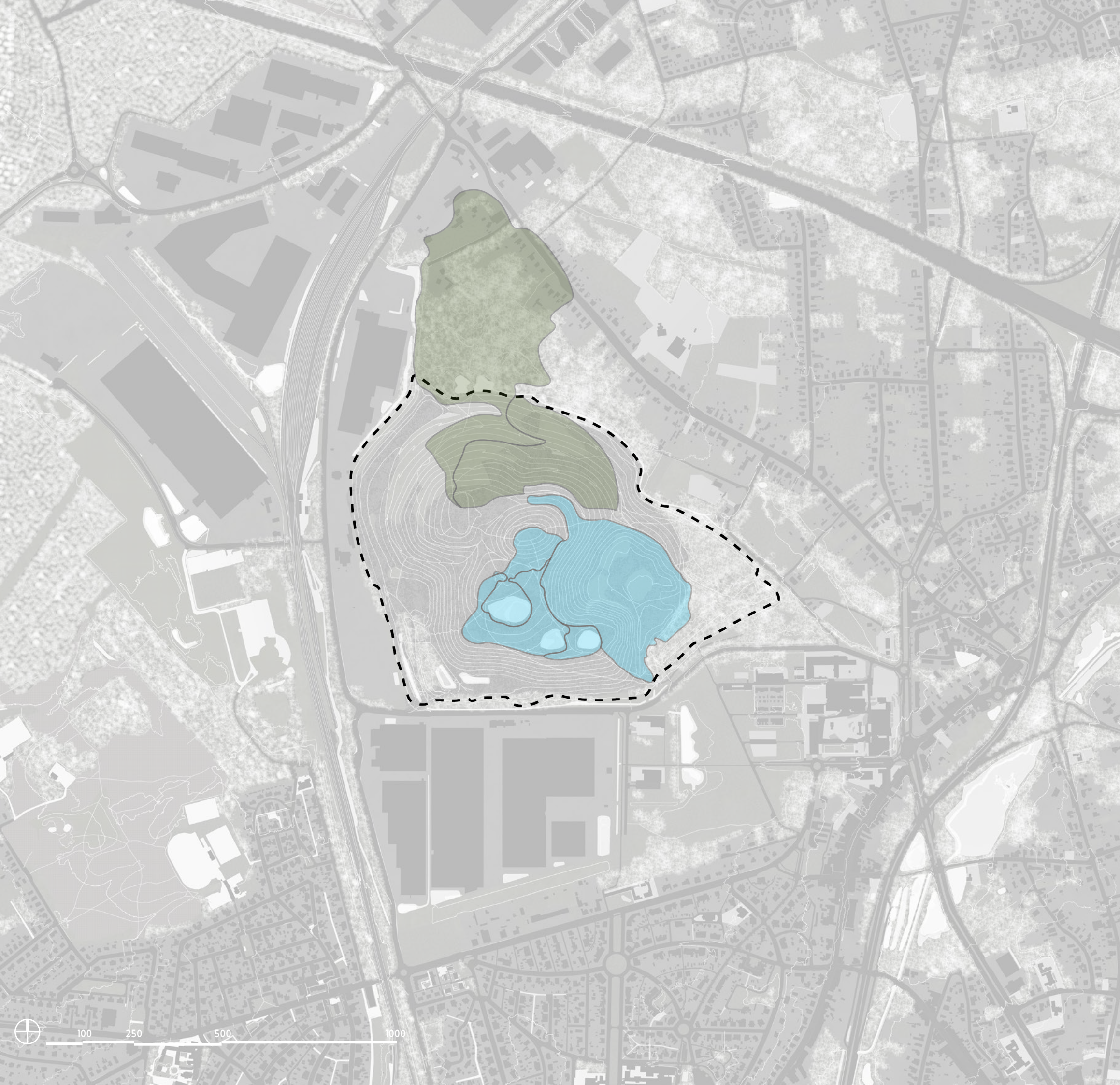
THE WATER'S NARRATIVE

Material boundary

--- 3'600m

Terril Inner Retention

203'000m²



THE WATER'S NARRATIVE

Material boundary

--- 3'600m

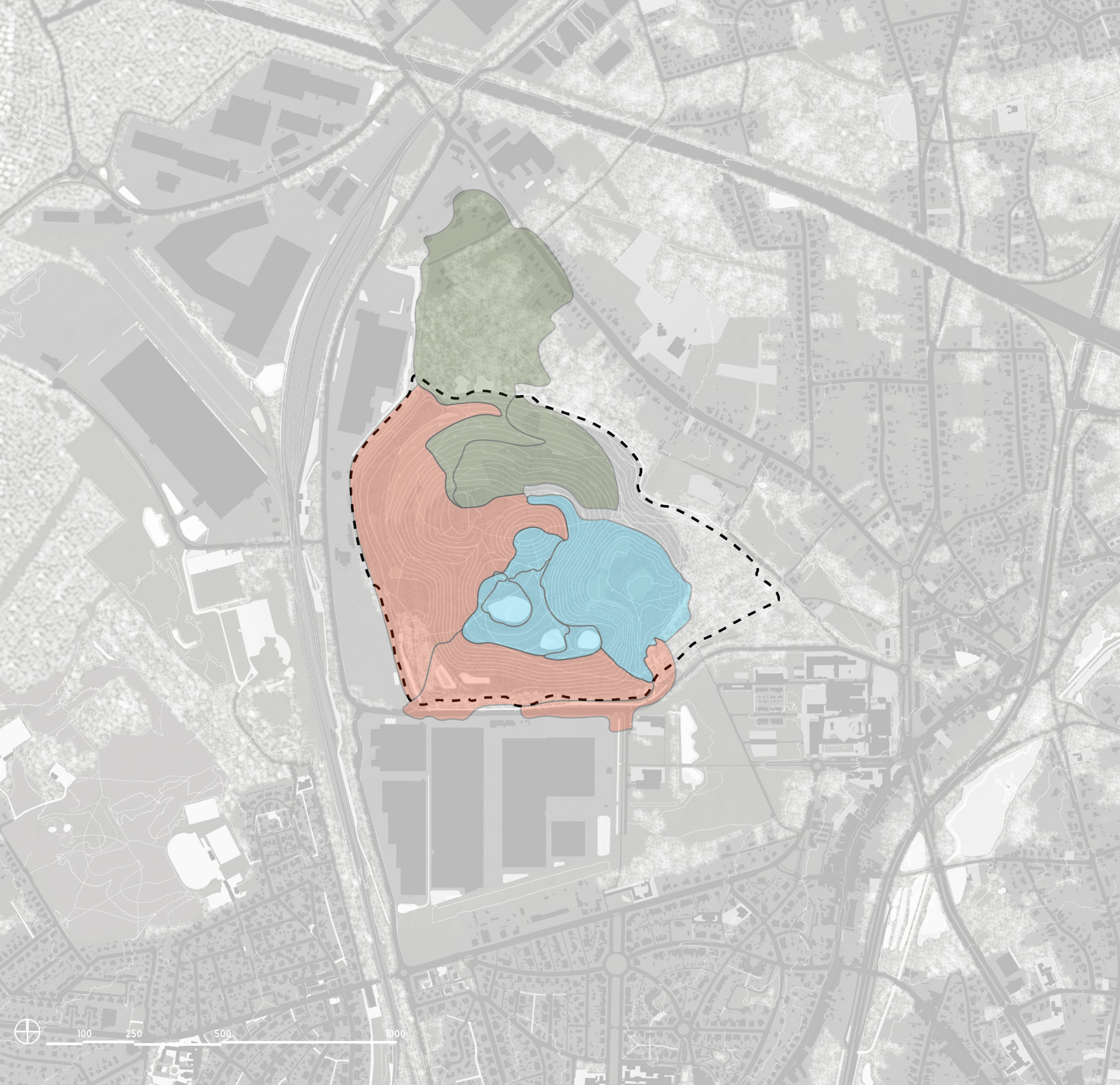
Terril Inner Retention

203'000m²

Basin North

496'000m²





THE WATER'S NARRATIVE

Material boundary

--- 3'600m

Terril Inner Retention

203'000m²

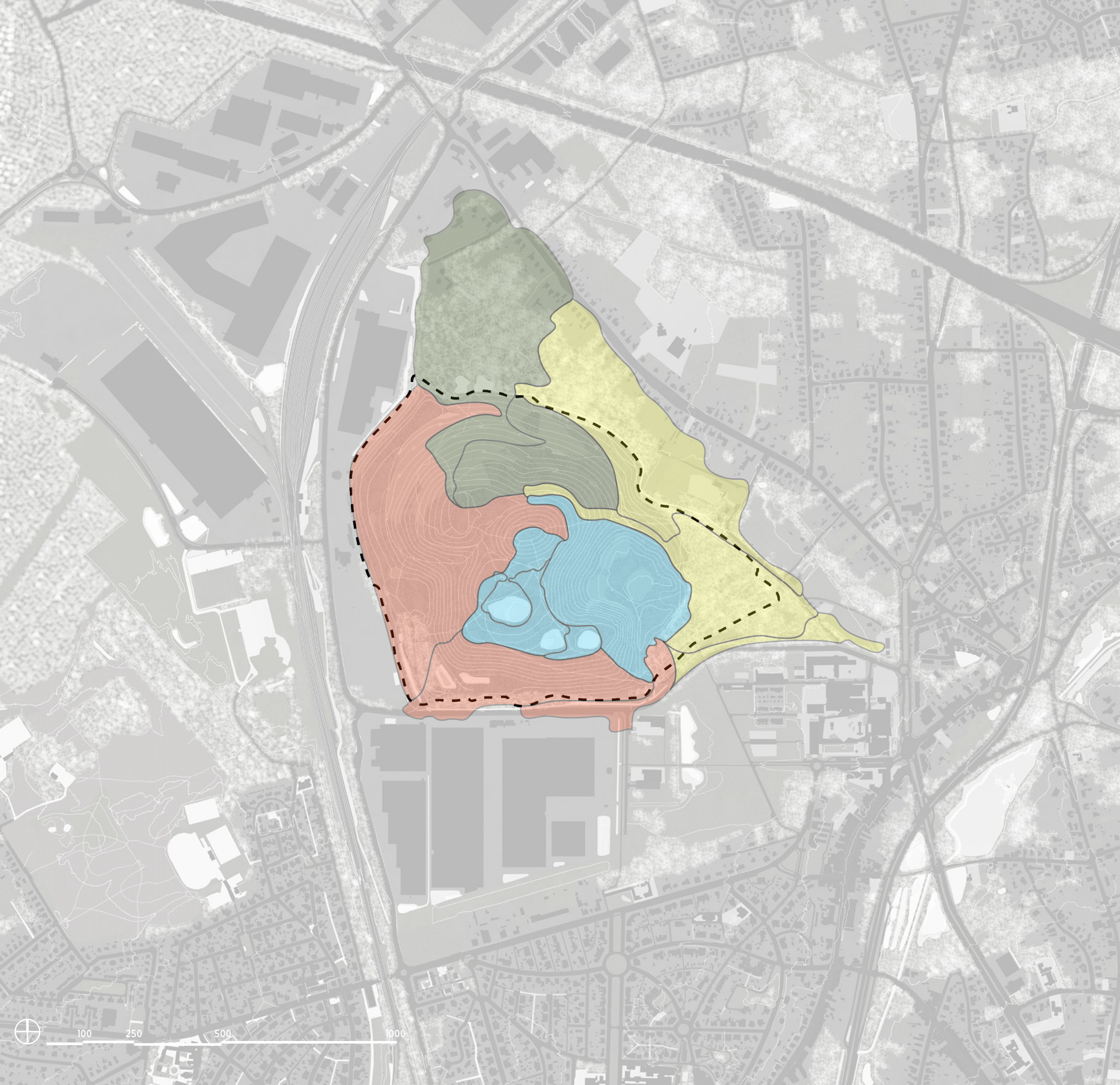
Basin North

496'000m²

Basin West

340'000m²





THE WATER'S NARRATIVE

Material boundary

--- 3'600m

Terril Inner Retention

203'000m²

Basin North

496'000m²

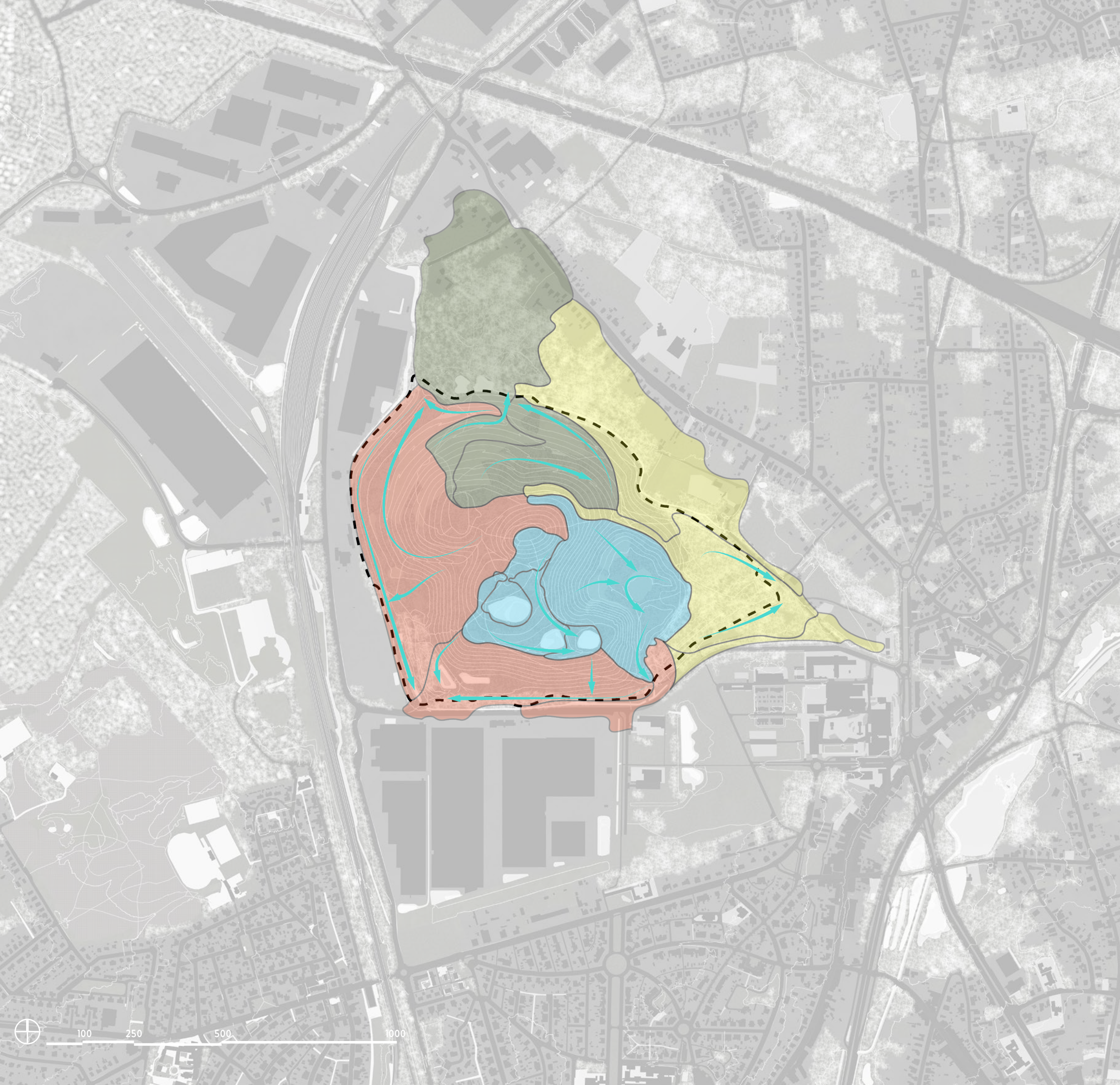
Basin West

340'000m²

Basin East

156'000m²





THE WATER'S NARRATIVE

Material boundary

--- 3'600m

Terril Inner Retention

203'000m²

Basin North

496'000m²

Basin West

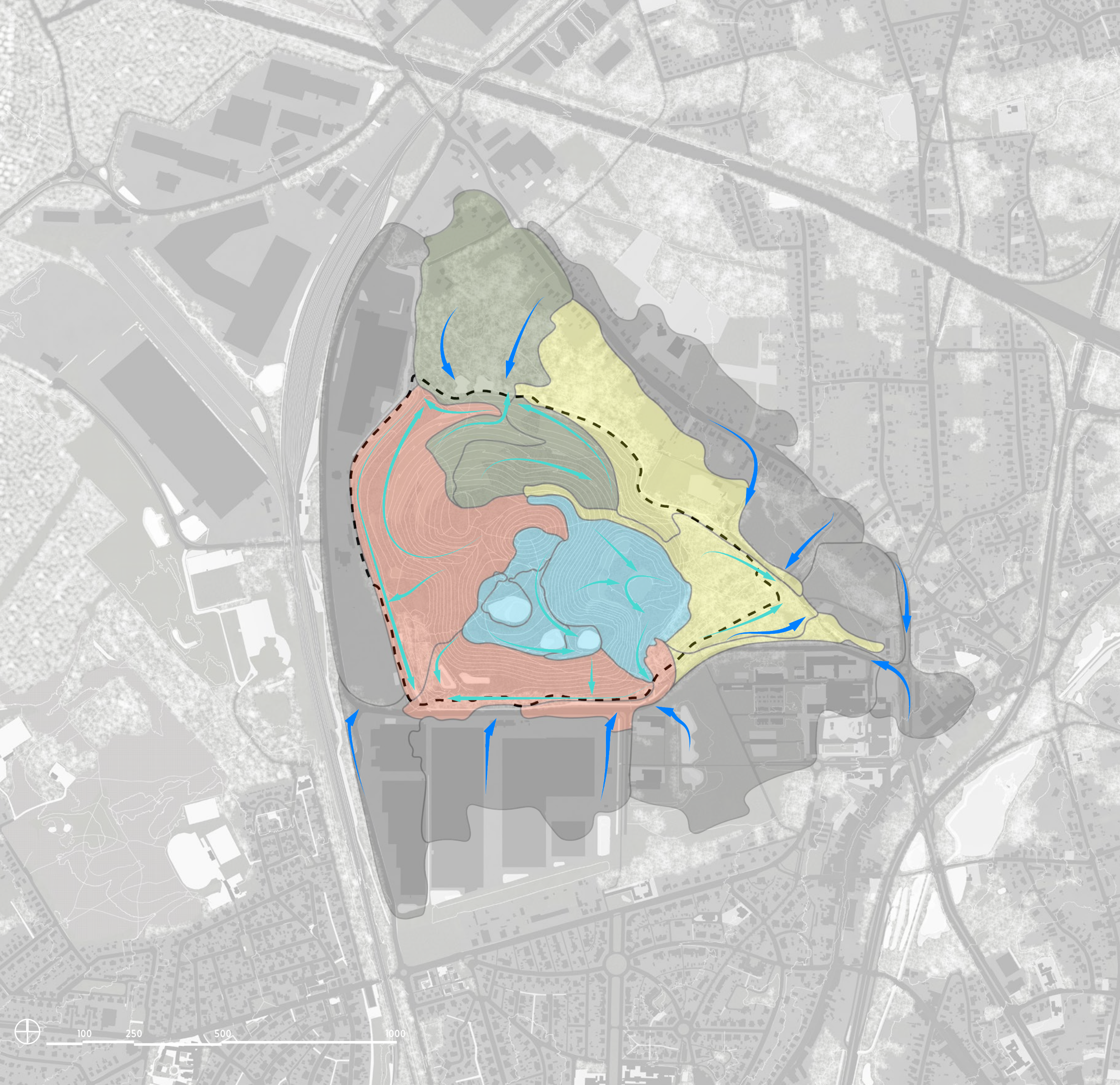
340'000m²

Basin East

156'000m²

Drainage
Terril





THE WATER'S NARRATIVE

Material boundary

--- 3'600m

Terril Inner Retention

203'000m²

Basin North

496'000m²

Basin West

340'000m²

Basin East

156'000m²

Basin Surrounding

856'000m²

Drainage
Terril



Streets





THE WATER'S NARRATIVE

Material boundary

--- 3'600m

Terril Inner Retention

203'000m²

Basin North

496'000m²

Basin West

340'000m²

Basin East

156'000m²

Basin Surrounding

856'000m²

Drainage
Terril



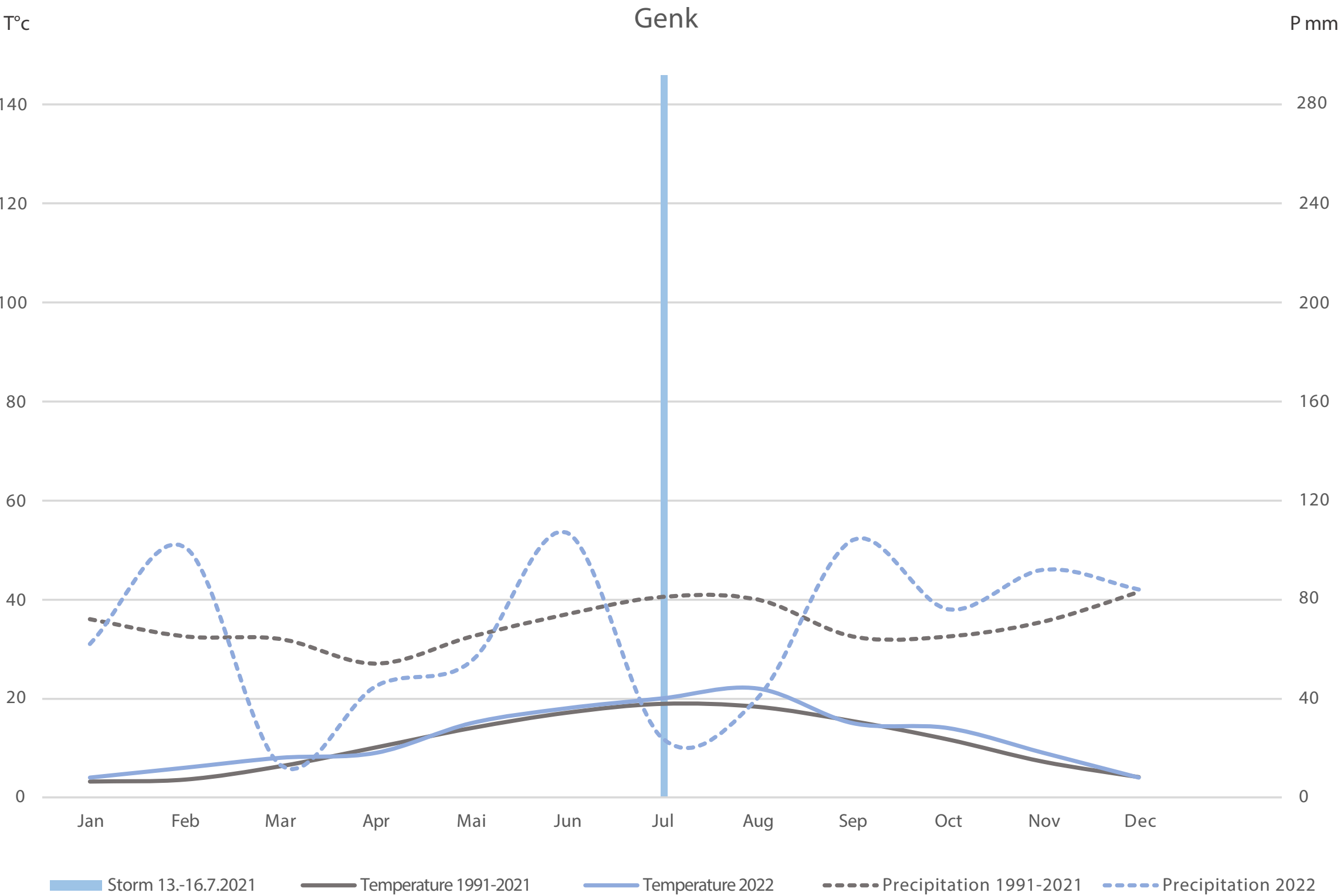
Streets



Mixed



THE WATER'S NARRATIVE



Retention Volume
576'400m³

Rain Volume Storm Event
598'892m³

Deficit
22'500m³

THE PLOT



THE PLOT



PHYTOSTABILISATION
Immobilisation of pollutants
in soil and water thanks to the
rootsystem

THE PLOT



PHYTOSTABILISATION
Immobilisation of pollutants
in soil and water thanks to the
rootsystem

RHIZOFILTRATION
Uptake of pollutants mainly along the
rootsystem of plants

THE PLOT

PHYTOREMEDIATION

Uptake of pollutants via roots and
storage in all plant parts



PHYTOSTABILISATION
Immobilisation of pollutants
in soil and water thanks to the
rootsystem

RHIZOFILTRATION
Uptake of pollutants mainly along the
rootsystem of plants

THE ACTORS

PHYTOREMEDIATORS



Populus alba (Cd, Ni)



Typha angustifolia
(Pb, Ni)



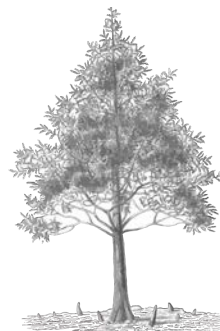
Brassica juncea (Pb)



Humulus lupulus
(Cu, Zn, Ni, Fe)



Carex pendula (Pb)



Taxodium distichum
(Cd, Pb, Zn)



Pteris vittata (As)



Equisetum telmateia
(Pb, Cu, Zn)

THE ACTORS

PHYTOREMEDIATORS



Populus alba (Cd, Ni)



Typha angustifolia
(Pb, Ni)



Brassica juncea (Pb)



Humulus lupulus
(Cu, Zn, Ni, Fe)



Carex pendula (Pb)



Taxodium distichum
(Cd, Pb, Zn)



Pteris vittata (As)



Equisetum telmateia
(Pb, Cu, Zn)

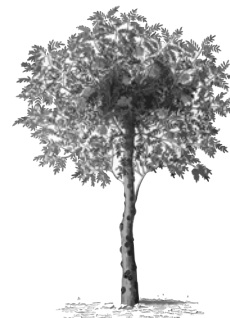
PHYTOSTABILIZERS



Eupatorium cannabinum
(As)



Phragmites australis
(Cd, Pb, Ni)



Fraxinus excelsior (Pb, Zn)



Asplenium scolopendrium
(Ni, Pb)



Athyrium filix-femina
(Cd, Ag)



Osmunda regalis (Pb)

THE ACTORS

PHYTOREMEDIATORS

PHYTOSTABILIZERS

RHIZOFILTRATORS



Populus alba (Cd, Ni)



Typha angustifolia
(Pb, Ni)



Brassica juncea (Pb)



Eupatorium cannabinum
(As)



Phragmites australis
(Cd, Pb, Ni)



Spirodela polyrhiza
(Zn, As)



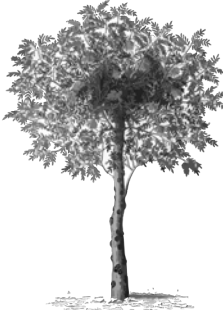
Eichhornia crassipes
(As, Ni)



Humulus lupulus
(Cu, Zn, Ni, Fe)



Carex pendula (Pb)



Fraxinus excelsior (Pb, Zn)



Asplenium scolopendrium
(Ni, Pb)



Taxodium distichum
(Cd, Pb, Zn)



Pteris vittata (As)



Equisetum telmateia
(Pb, Cu, Zn)



Athyrium filix-femina
(Cd, Ag)



Osmunda regalis (Pb)

THE ACTORS

PHYTOREMEDIATORS



Populus alba (Cd, Ni)



Typha angustifolia
(Pb, Ni)



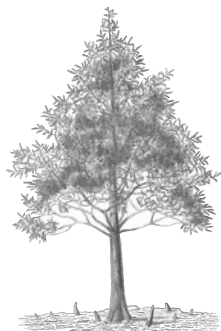
Brassica juncea (Pb)



Humulus lupulus
(Cu, Zn, Ni, Fe)



Carex pendula (Pb)



Taxodium distichum
(Cd, Pb, Zn)



Pteris vittata (As)



Equisetum telmateia
(Pb, Cu, Zn)

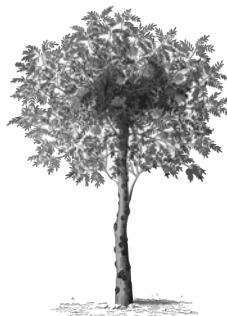
PHYTOSTABILIZERS



Eupatorium cannabinum
(As)



Phragmites australis
(Cd, Pb, Ni)



Fraxinus excelsior (Pb, Zn)



Asplenium scolopendrium
(Ni, Pb)



Athyrium filix-femina
(Cd, Ag)

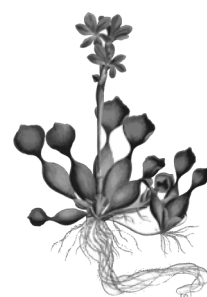


Osmunda regalis (Pb)

RHIZOFILTRATORS



Spirodela polyrhiza
(Zn, As)



Eichhornia crassipes
(As, Ni)

INDICATORS

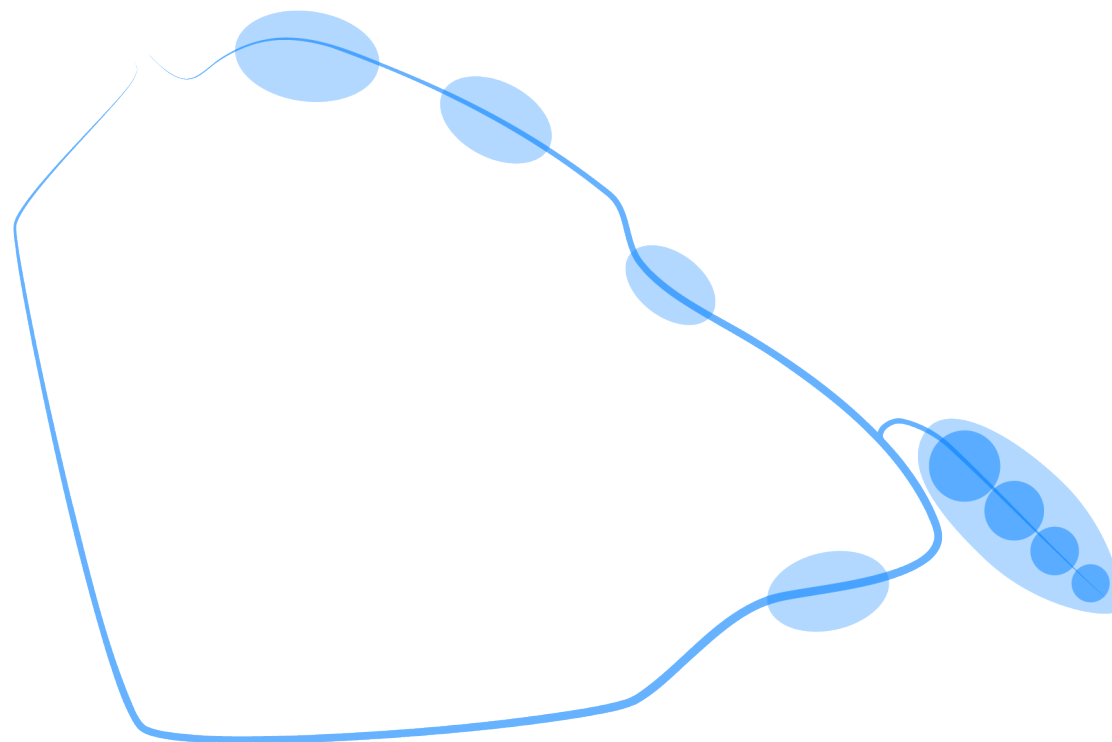


Callitriche pallustris



Hydrocharis morsus-ranae

THE STAGES



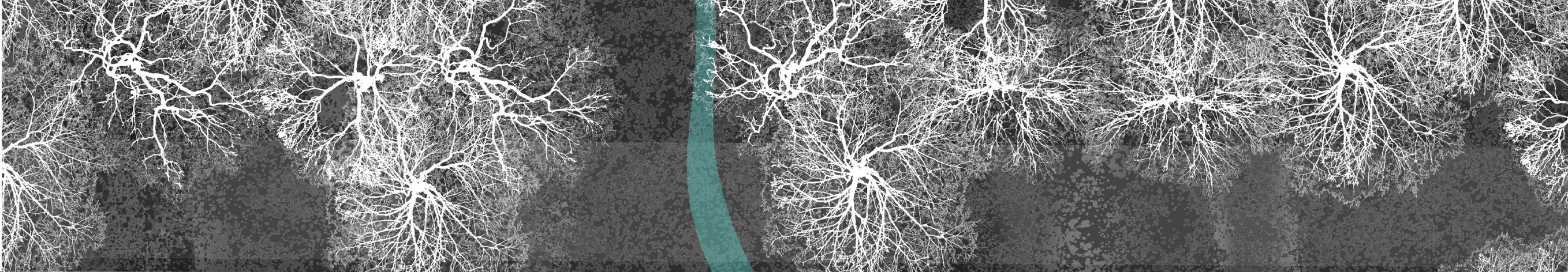
BLUE NECKLACE



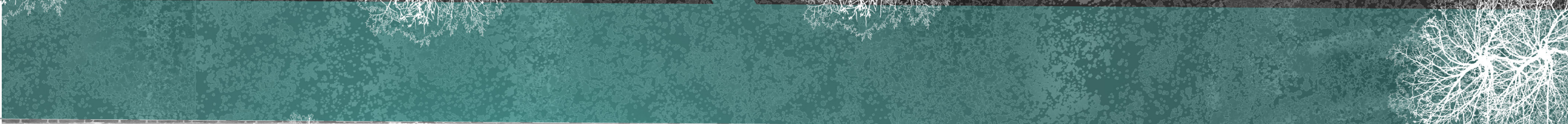
Cord



Forest Terril



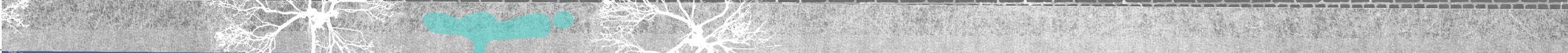
Retention Channel



Paved Path



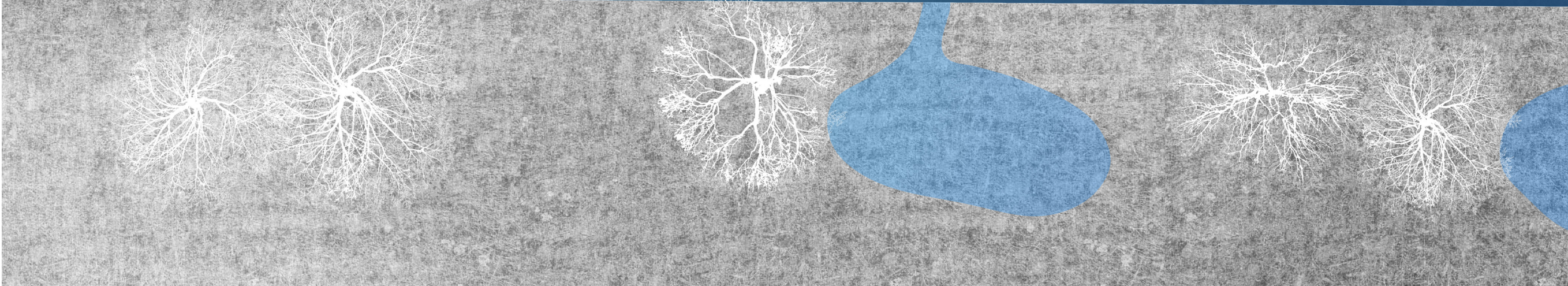
Vegetated Belt



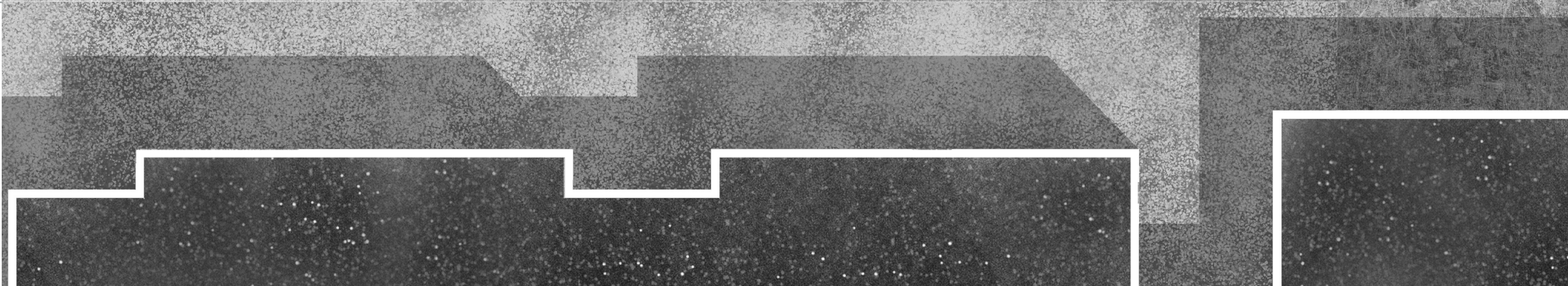
Flooded Street

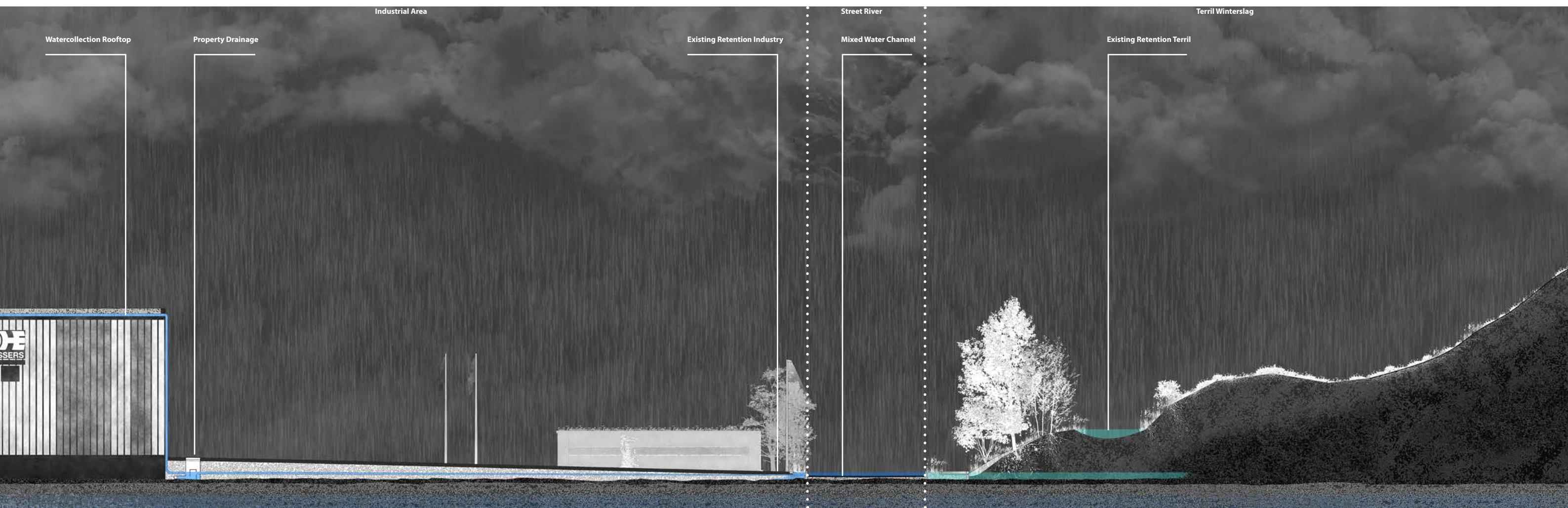


Retention Basins



Industrial Buildings





Flooded Street

Vegetated Belt

Paved Path

Retention Channel

Populus tremula

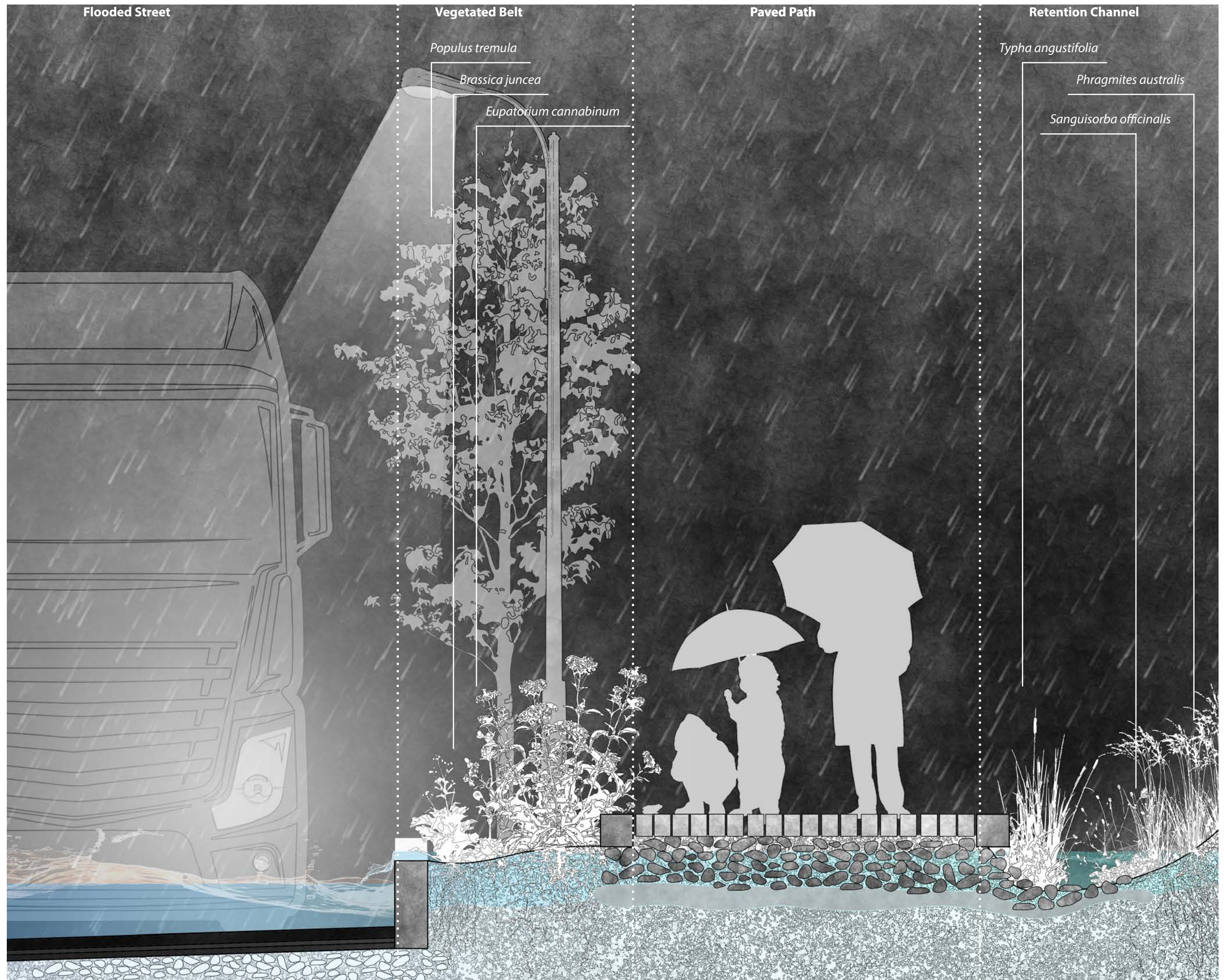
Brassica juncea

Eupatorium cannabinum

Typha angustifolia

Phragmites australis

Sanguisorba officinalis



BLUE NECKLACE



Cord



Beads

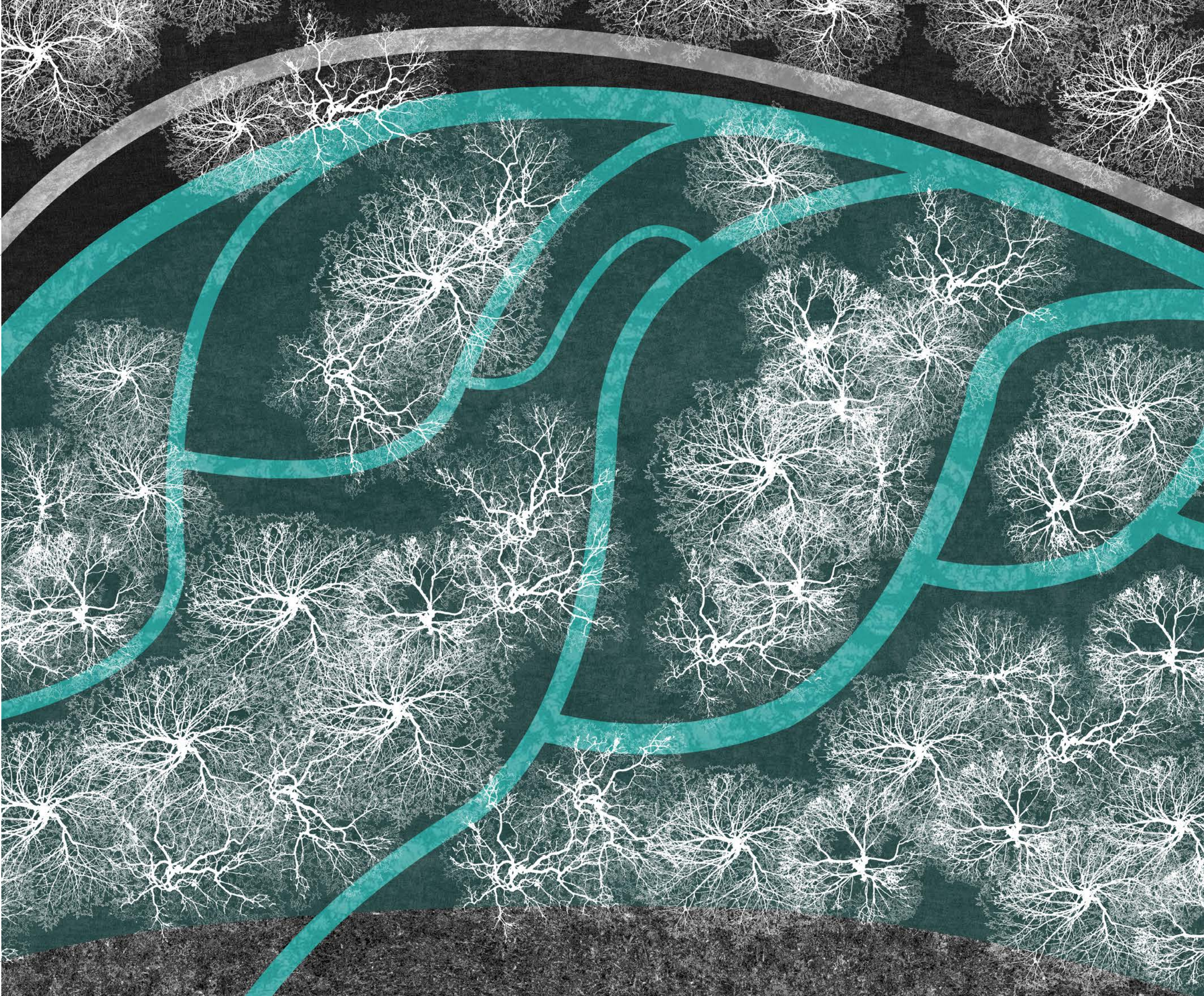


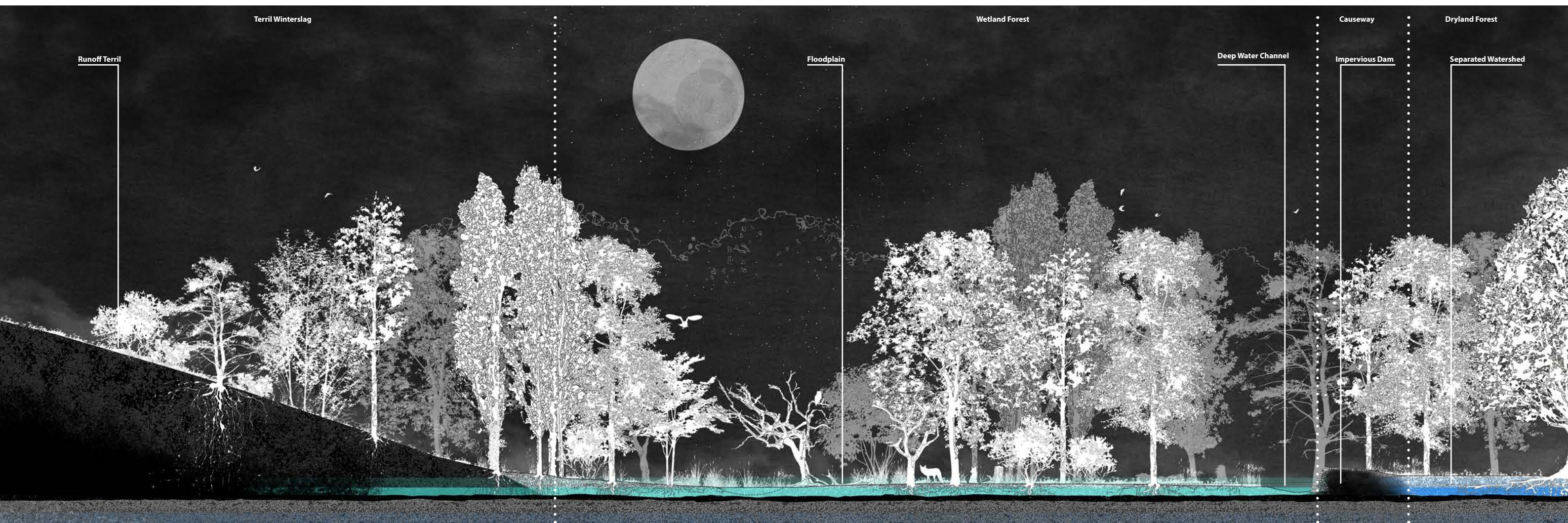
Dryland Forest

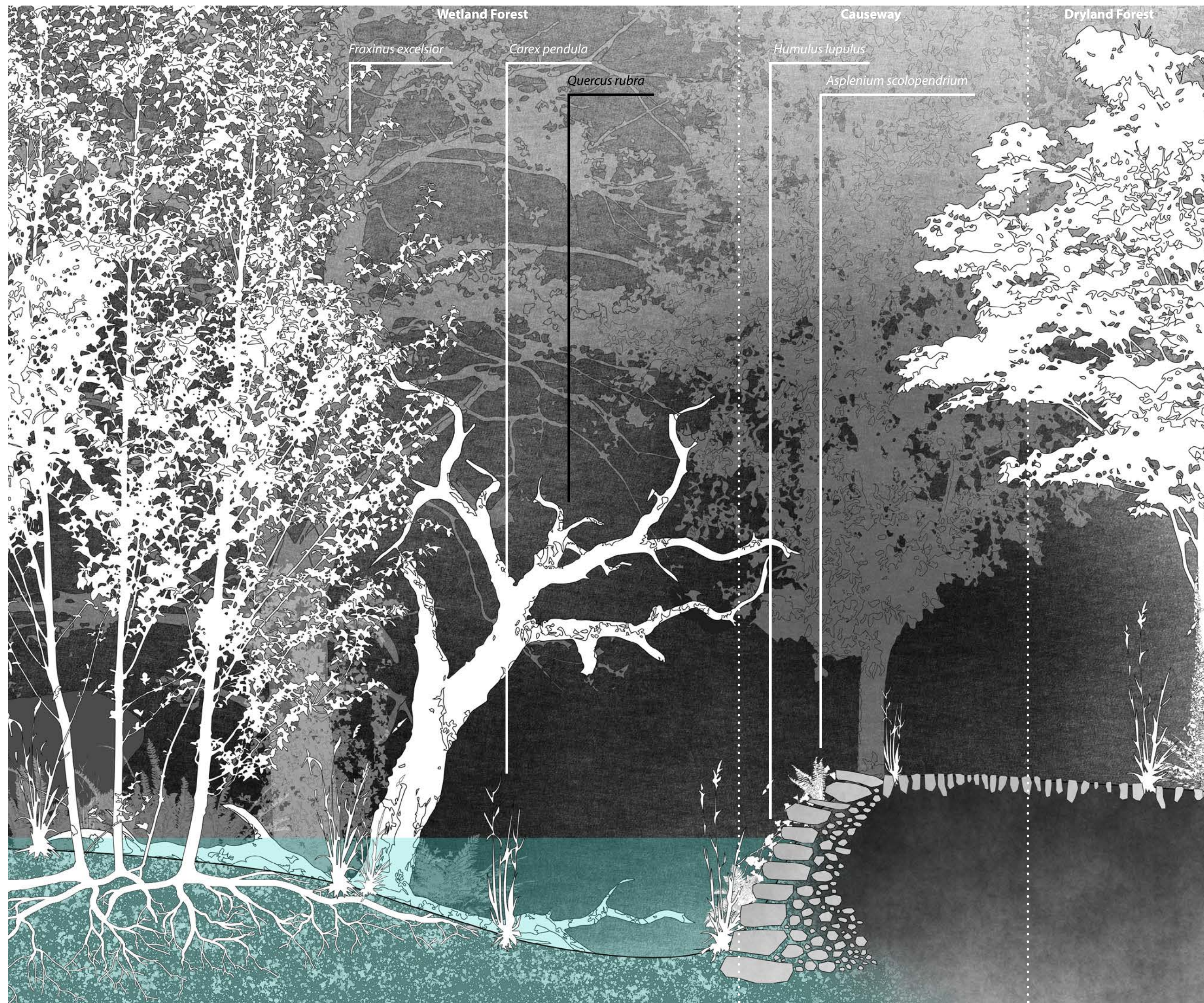
Causeway

Wetland Forest

Terril







BLUE NECKLACE



Cord

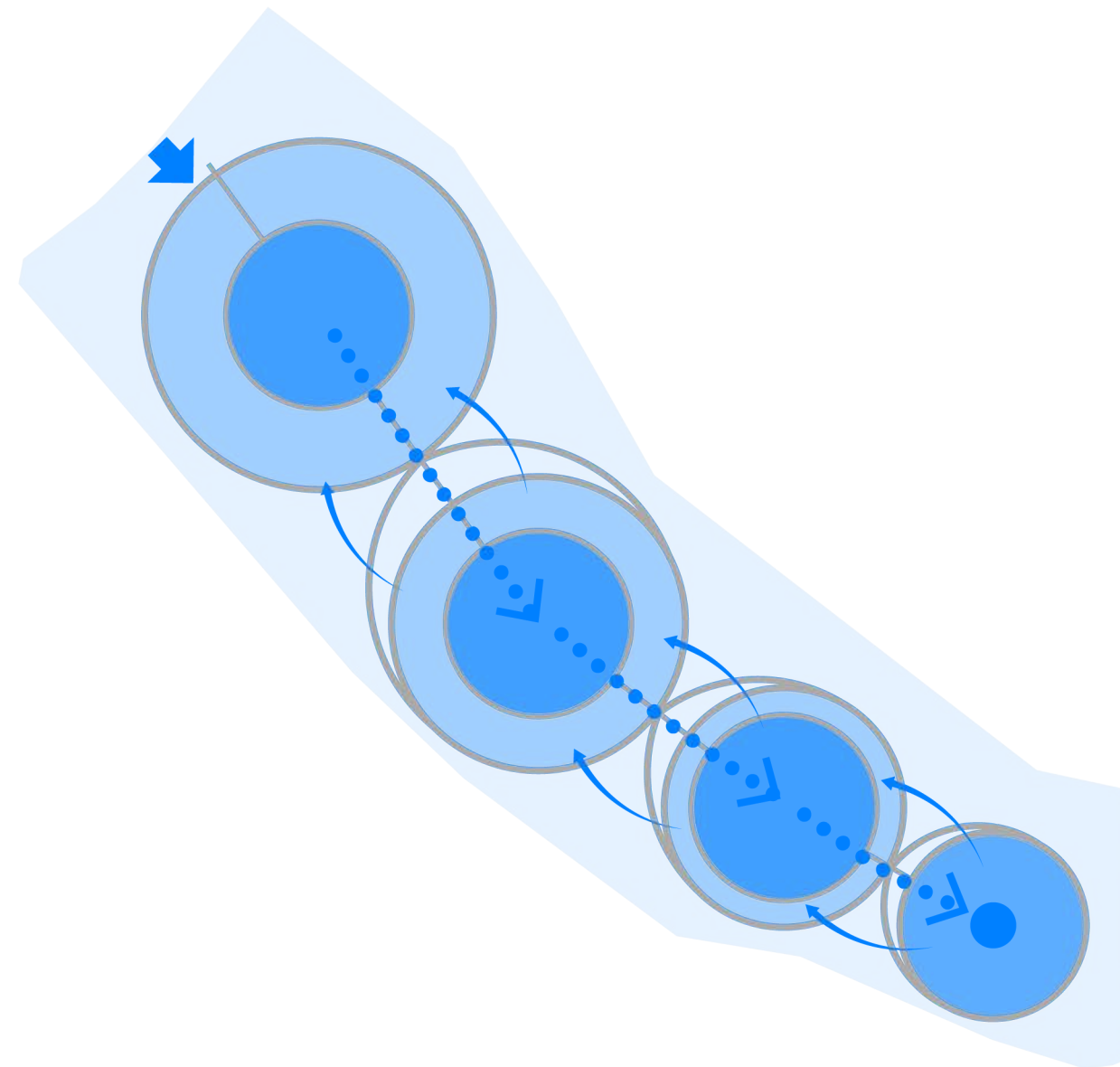


Beads



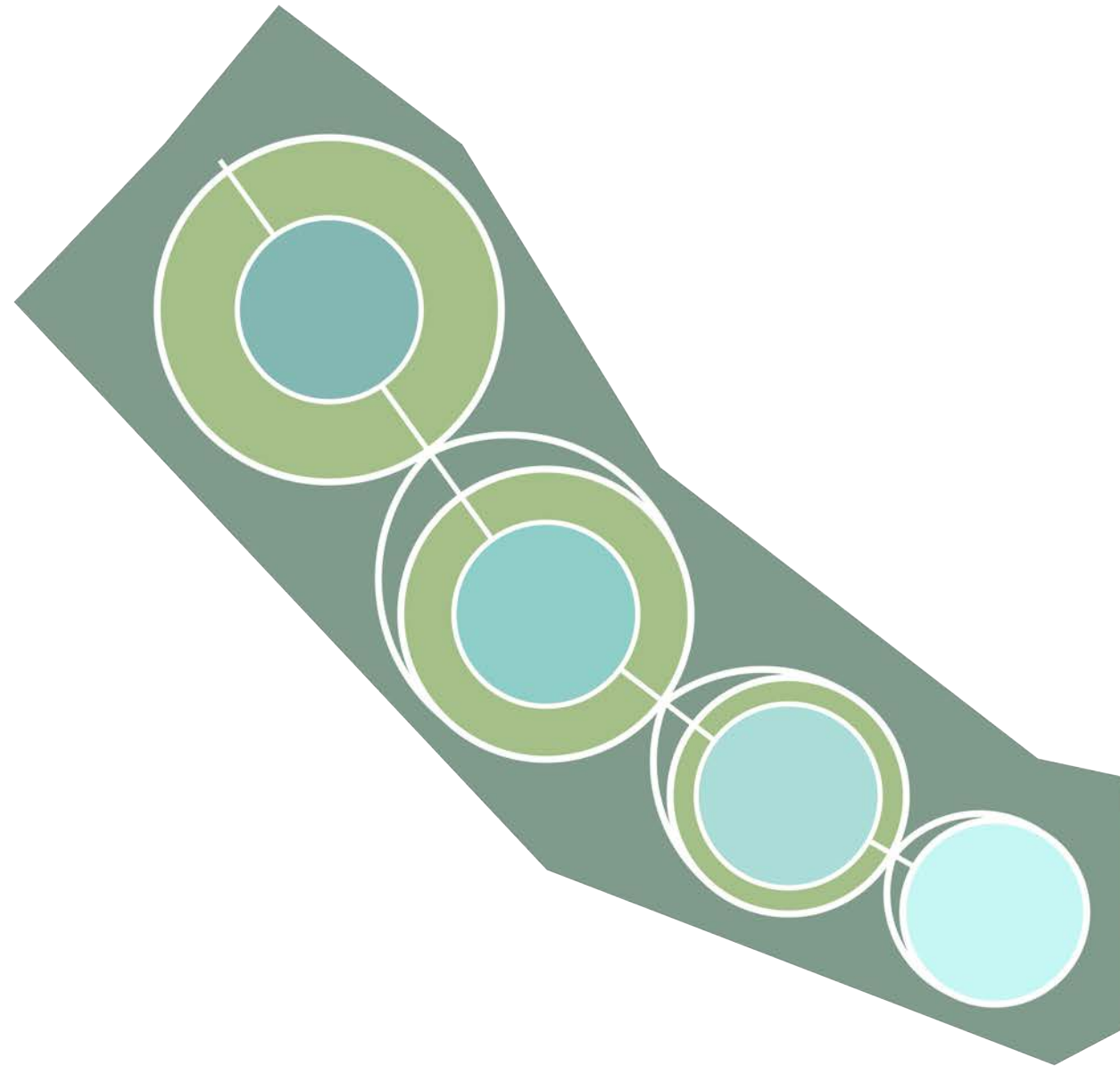
Pendant





WATER MOVEMENT

-  **CLEAN WATER BASIN**
-  **PUFFER BELT**
-  **OVERFLOW BASIN**
-  **ENTRY POINT DRAINED WATER**
-  **INFILTRATION POINT**
-  **UNDERGROUND FLOW
NORMAL WATERLEVEL**
-  **ABOVE GROUND FLOW
HEAVY RAIN EVENT**



VEGETATION

PRIMEVAL FOREST

- Taxodium distichum* & Sporophytes:
 - Pteris vittata*
 - Athyrium filix-femina*
 - Osmunda regalis*
 - Asplenium scolopendrium*
 - Equisetum telmateia*

BALD CYPRESS BELT

- Taxodium distichum* & Sporophytes orderly arranged and planted in distinct pits

FLOATING LEAF INDICATORS

- Eichhornia crassipes*
- Spirodela polyrhiza*
- Hydrocharis morsus-ranae*
- Callitriche palustris*

