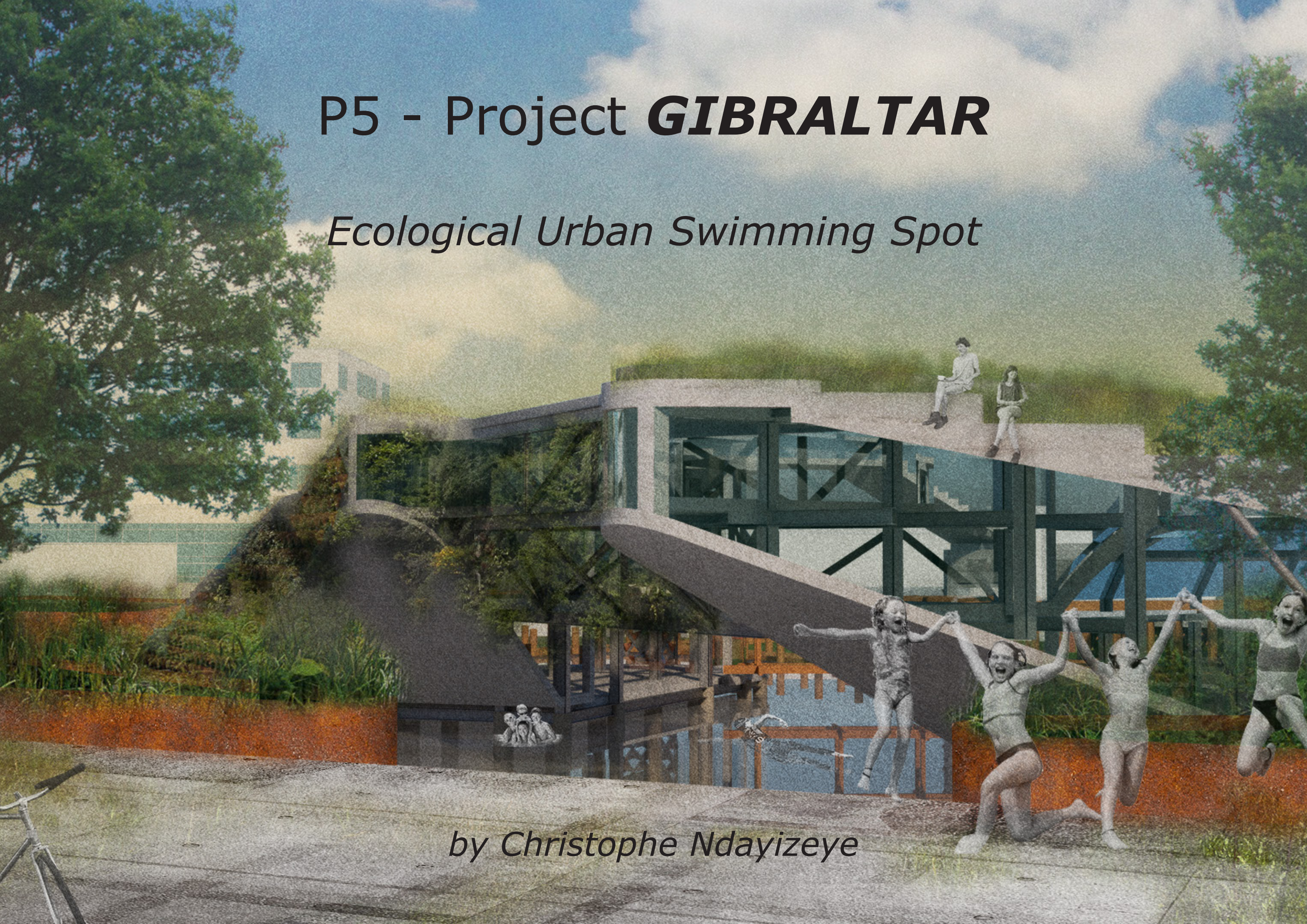
P5 - Project ***GIBRALTAR***

Ecological Urban Swimming Spot



by Christophe Ndayizeye

Aqua-Purifier Phyto-Façade System

‘Exploring the contribution of a green-facade in the purification of wastewater in an urban environment’

Contents

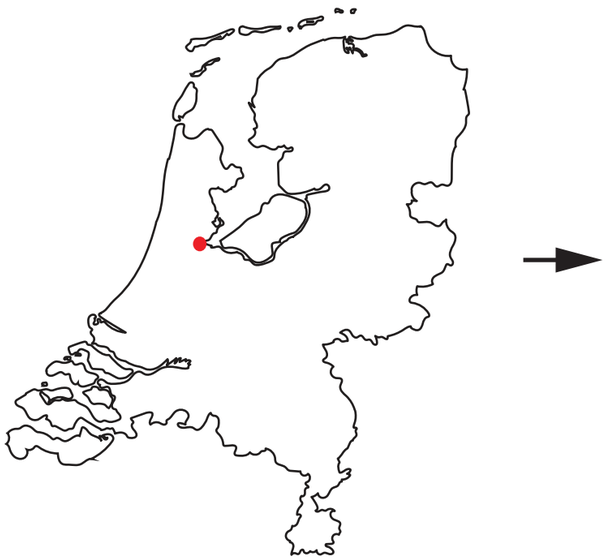
Problems statement

Amsterdam - Marineterrein

Amsterdam - Marineterrein

Foto Peter Elenbaas © UNKNOWN

Amsterdam - Marineterrein



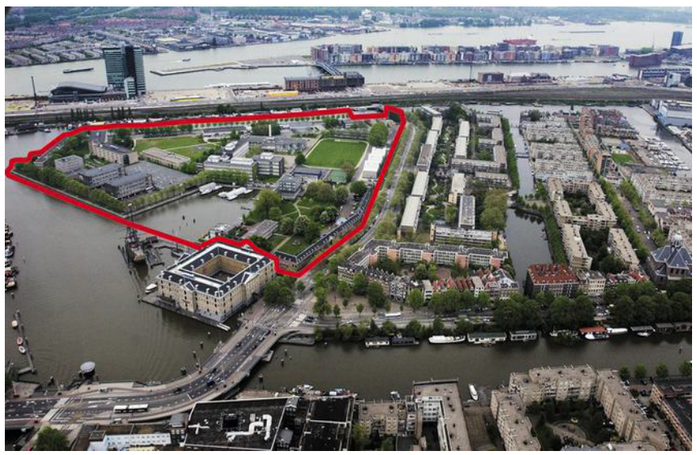
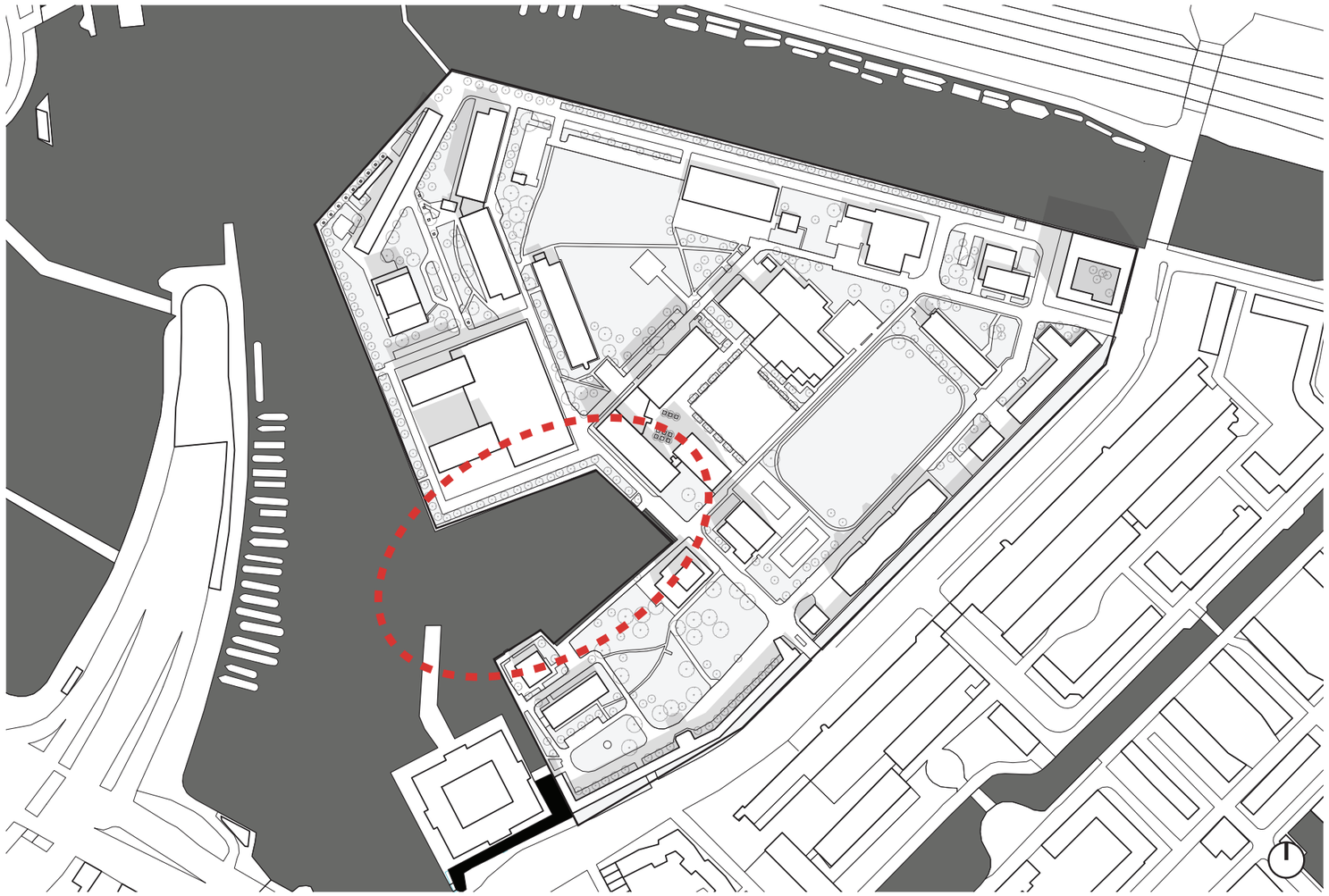
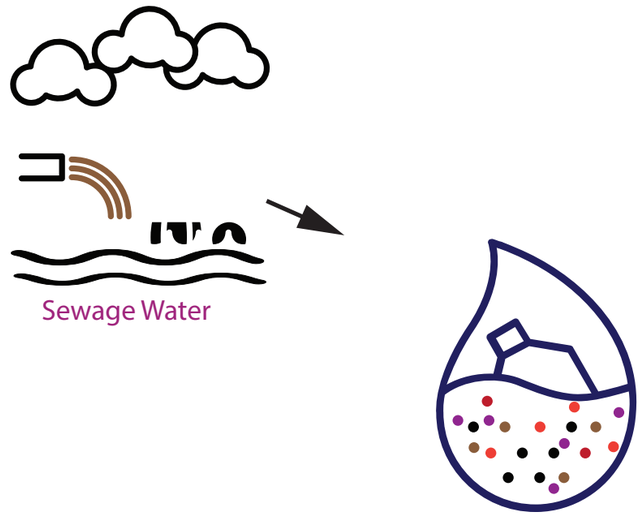


Foto Peter Elenbaas © UNKNOWN

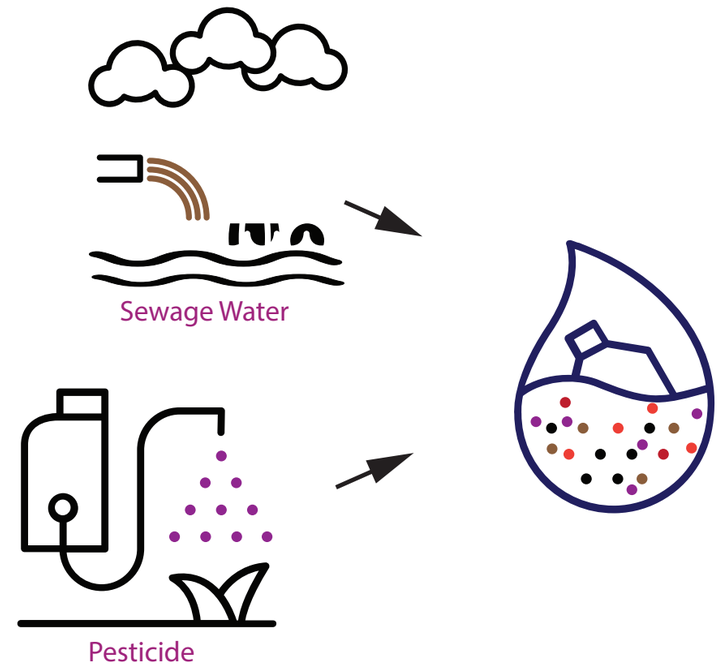


Most common type of water pollutants

Most common type of water pollutants



Most common type of water pollutants



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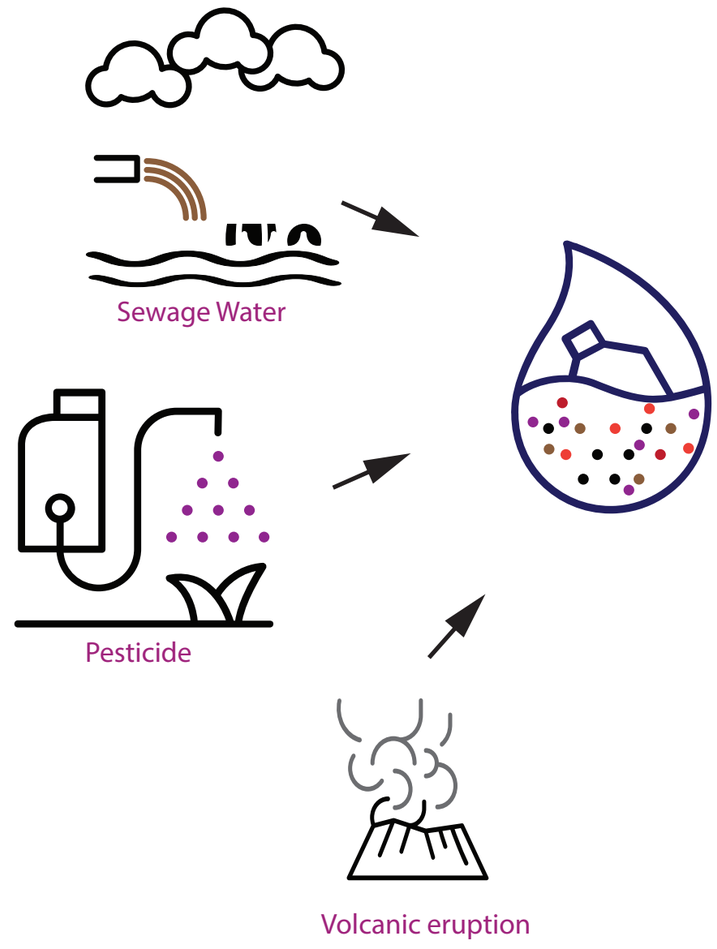
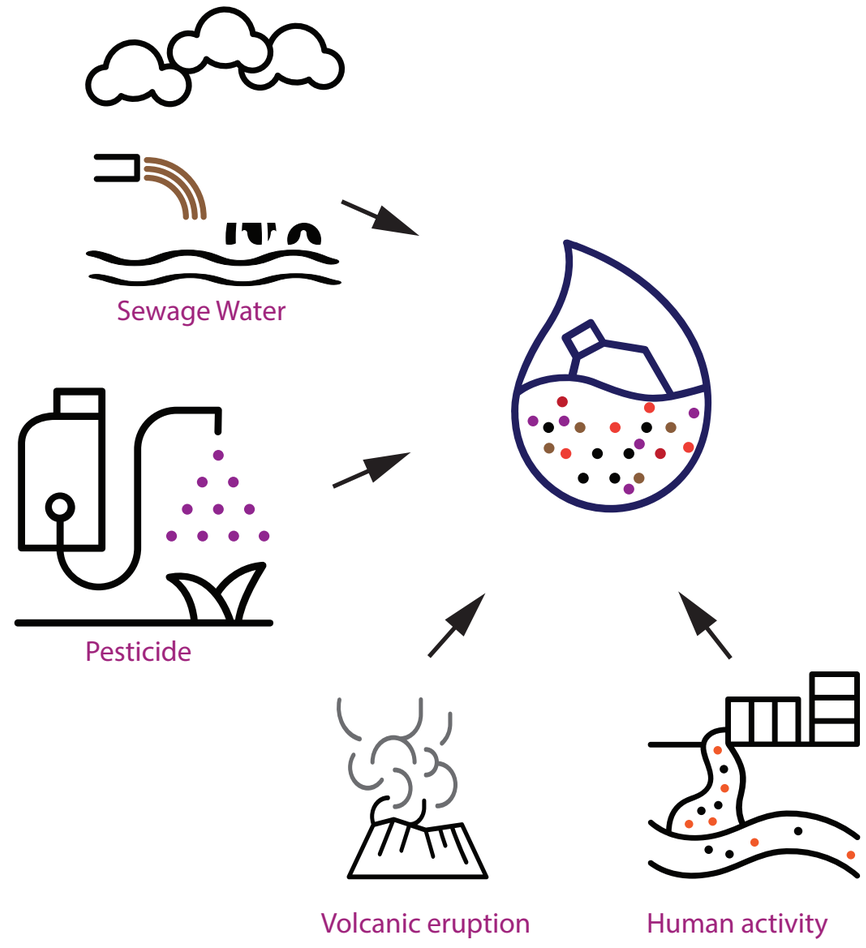


Most common type of water pollutants



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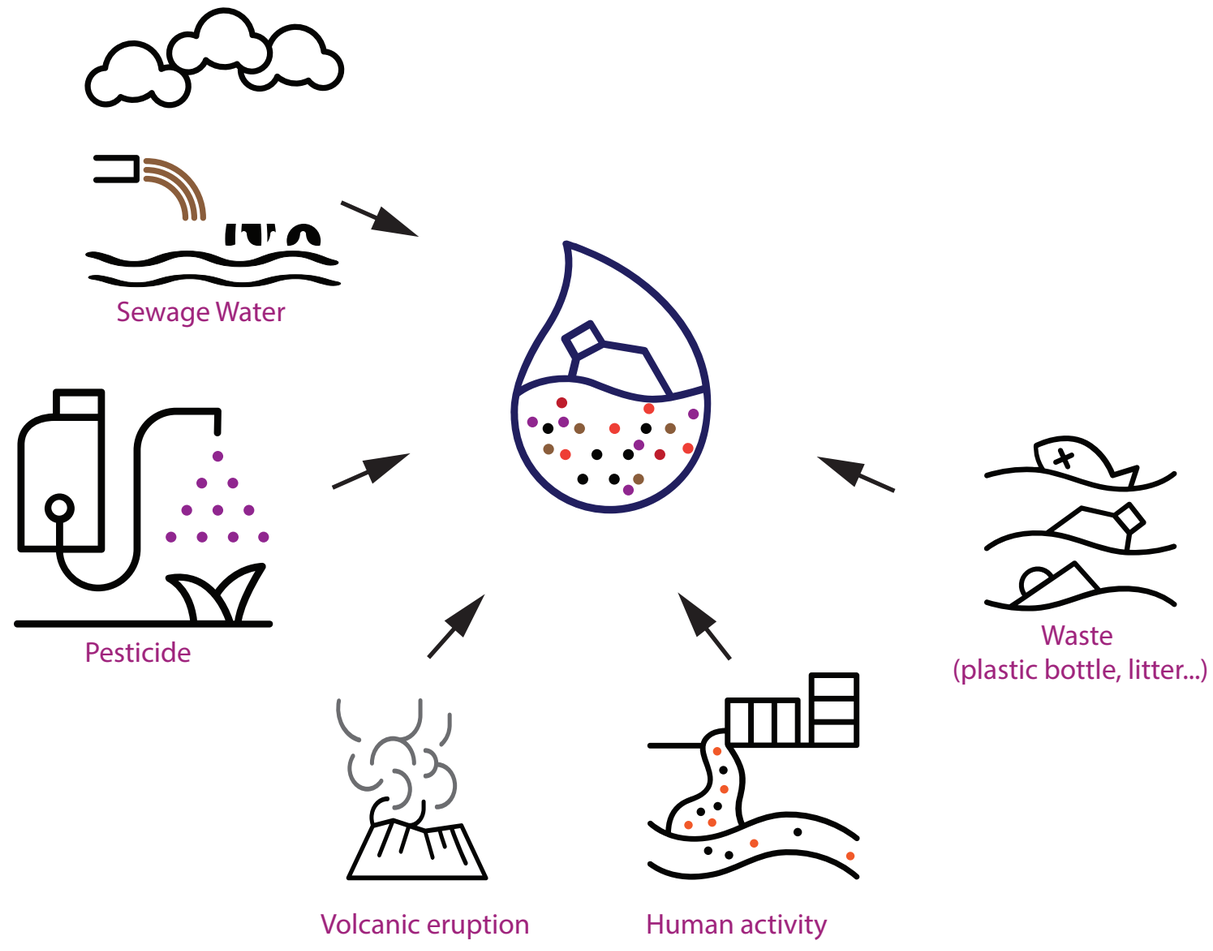
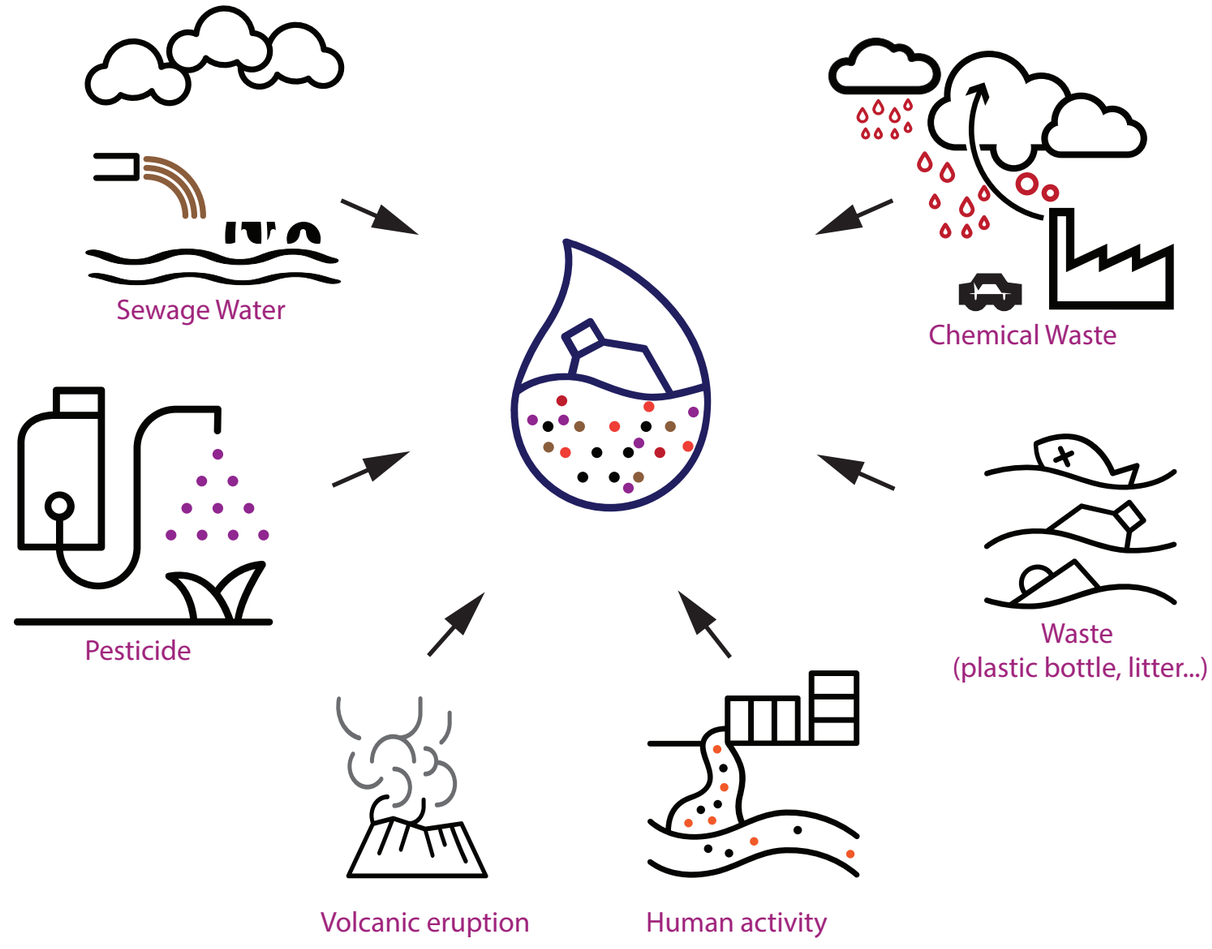
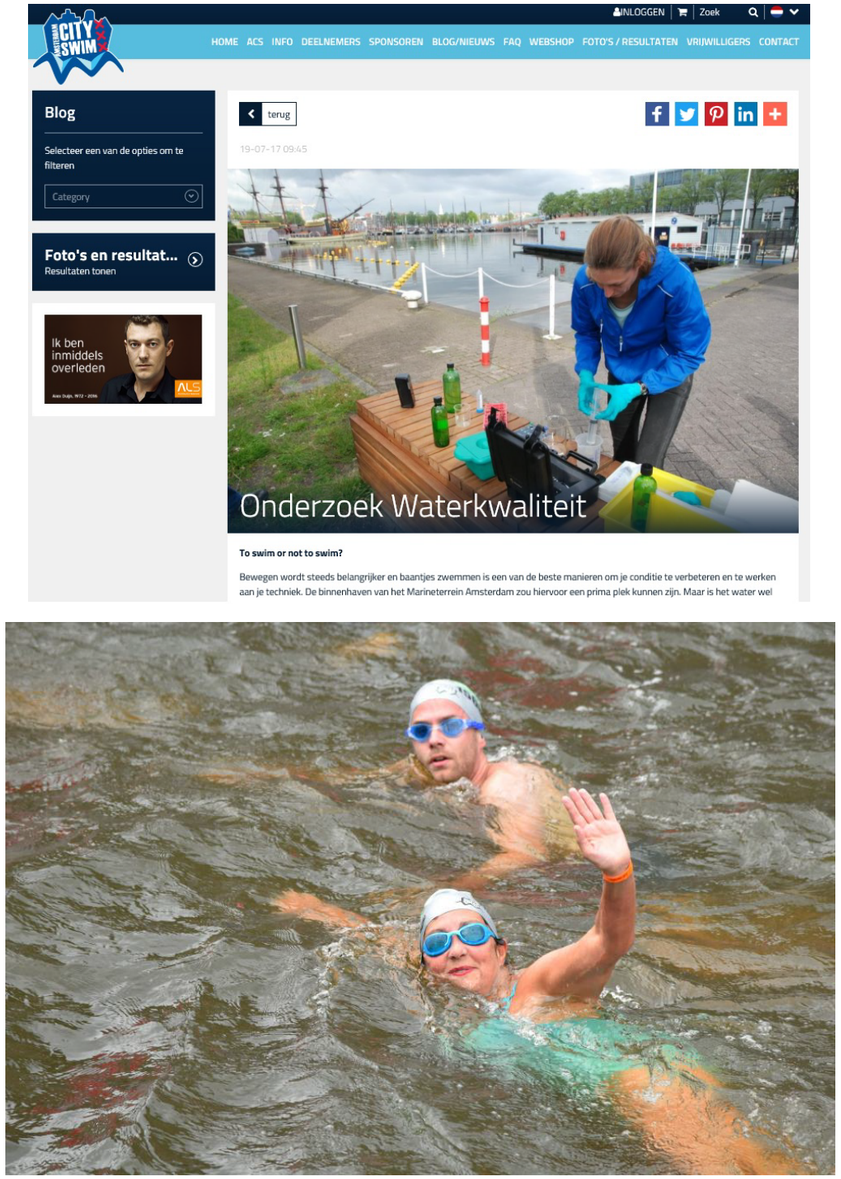
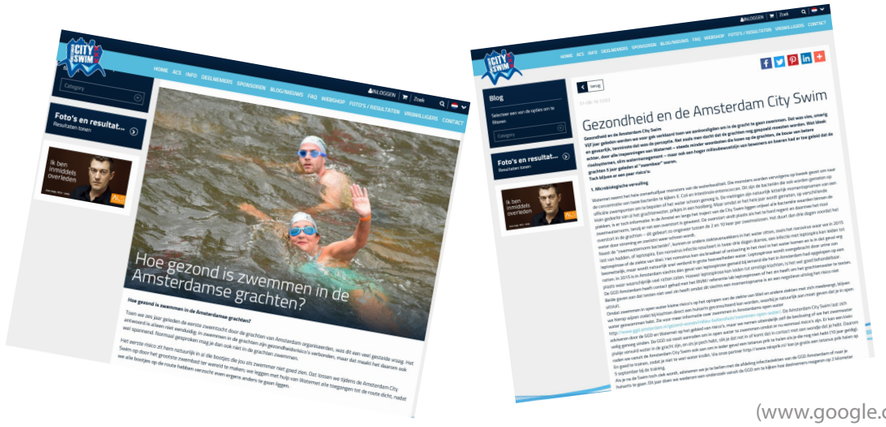


Most common type of water pollutants



Canals water quality





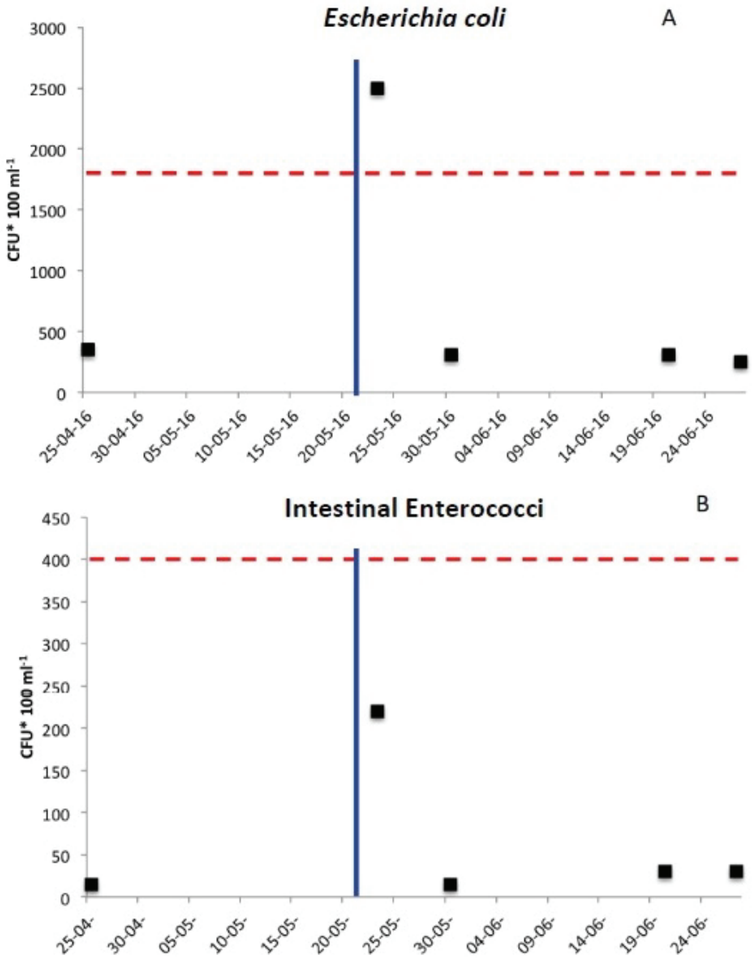
(www.google.com)

After heavyrains, the sewage system overflows excessive water into the canals, introducing high concentrations of faecal bacteria (E. coli and intestinal Enterococci) and potentially causing health risks for swimmers. (Evie Cox, 2016)

Source:
- www.amsterdamcityswim.nl
- www.ois.amsterdam.nl

Research - Marineterrein - Water pollution stand

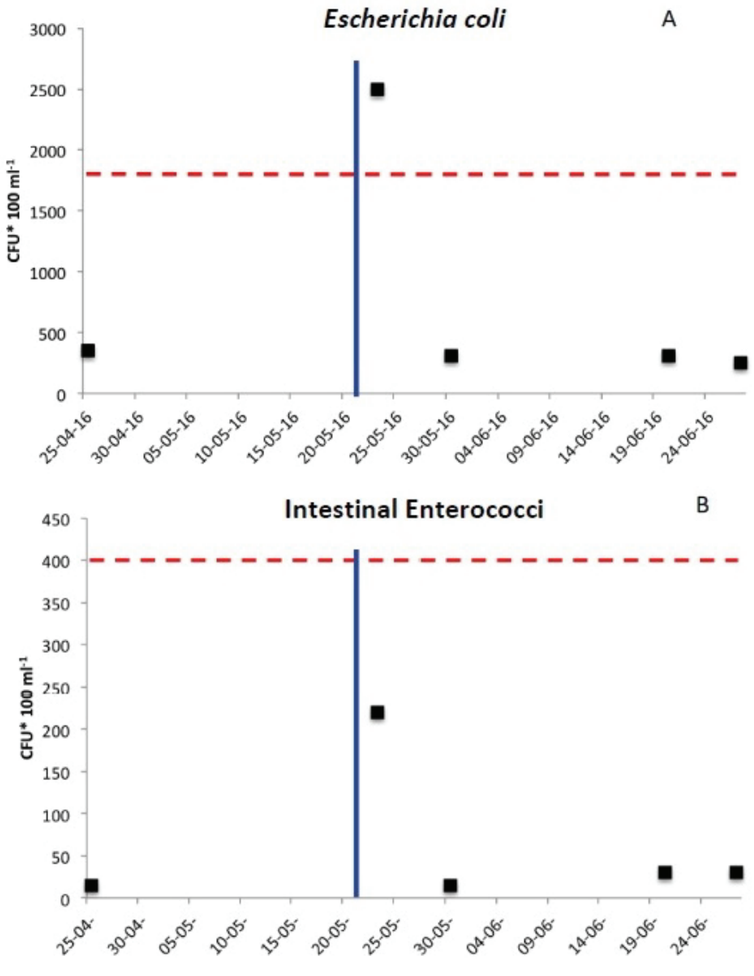
High concentrations of faecal bacteria (E. Coli and intestinal Enterococci) due sewage system overflows (Evie Cox, 2016)



(Evie Cox, 2016)

Research - Marineterrein - Water pollution stand

High concentrations of faecal bacteria (E. Coli and intestinal Enterococci) due sewage system overflows (Evie Cox, 2016)



(Evie Cox, 2016)

Table 4. Norms for different quality categories for natural surface water for intestinal Enterococci and *Escherichia coli* (adapted from *Zwemwaterrichtlijn*).[29]

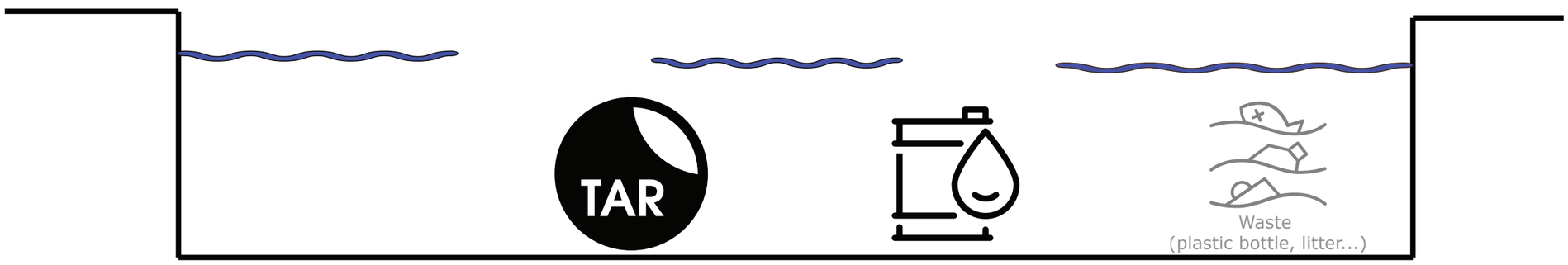
Parameter	Excellent quality	Good quality	Acceptable quality	Warning threshold (***)	Reference-methods for analyses
Intestinale enterococci (kve/100 ml)	200 (*)	400 (*)	330 (**)	400	ISO 7899-1 or ISO 7899-2
Escherichia coli (kve/100 ml)	500 (*)	1000 (*)	900 (**)	1800	ISO 9308-3 or ISO 9308-1

(*) Based on rating on the 95-percentile of the probability distribution. See *Zwemwaterrichtlijn* Appendix II[29].
(**) Based on rating on the 90-percentile of the probability distribution. See *Zwemwaterrichtlijn* Appendix II[29].
(***) When warning threshold is exceeded, a negative swim advise (at official swim spots) is given by Waternet.

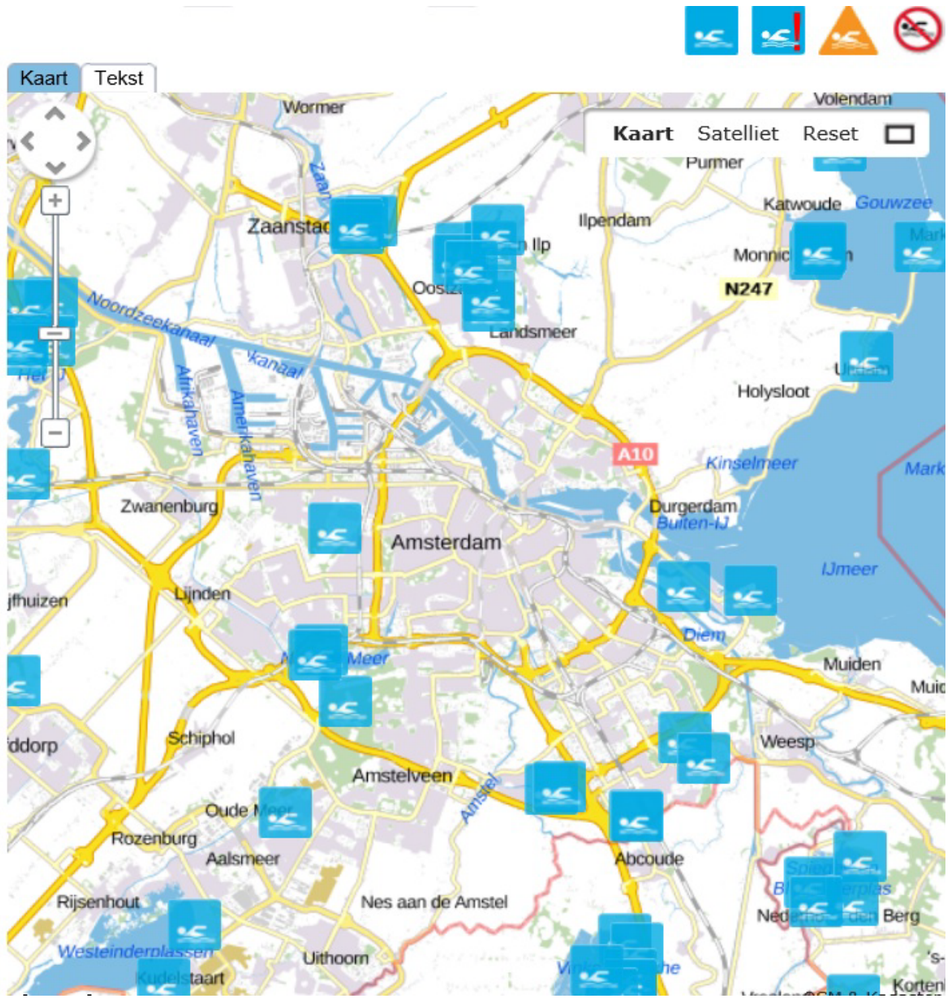
Research - Marineterrein - Soil pollution stand

The soil of water bottom seems to be heavily contaminated by:
- chemicals and heavy metals such lead (Pb) (due to the build of IJ-tunnel in 1962)
- tar and mineral oil (caused by shipyard activities through years).

The aquatic sediment of the basin used to be polluted by all kind of debris (floating, emerged) but they have been removed by Waternet responsible of water quality in Amsterdam.



Lack of natural swimming spots



The all 24 official swim spots (Sloterplas, Gaasperplas, Amsterdamse Bos (speelweide), Nieuwe Meer en de Oudekerkerplas, etc.) are situated outside of the city borders.

Source:
- www.zwemwater.nl
- www.amsterdam.nl
- www.metronieuws.nl

Objectives & Goals

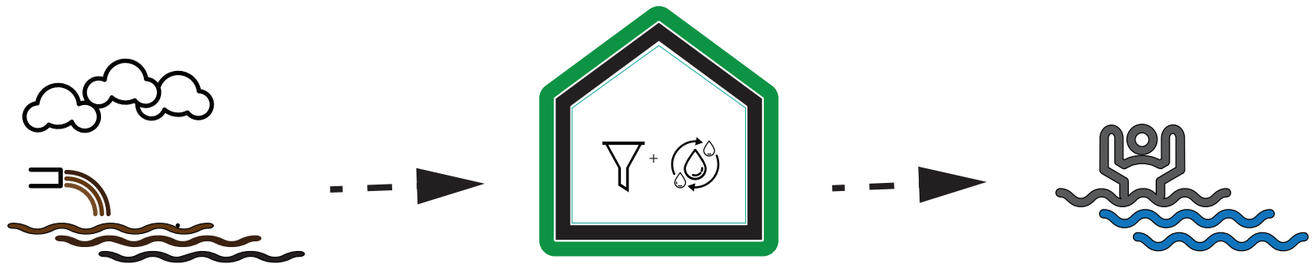
Objectives

‘Exploring the contribution of a green-facade in the PURIFICATION OF CANAL AND WASTEWATER in an urban Environment’

Objectives

‘Exploring the contribution of a green-facade in the PURIFICATION OF CANAL AND WASTEWATER in an urban Environment’

Project goal

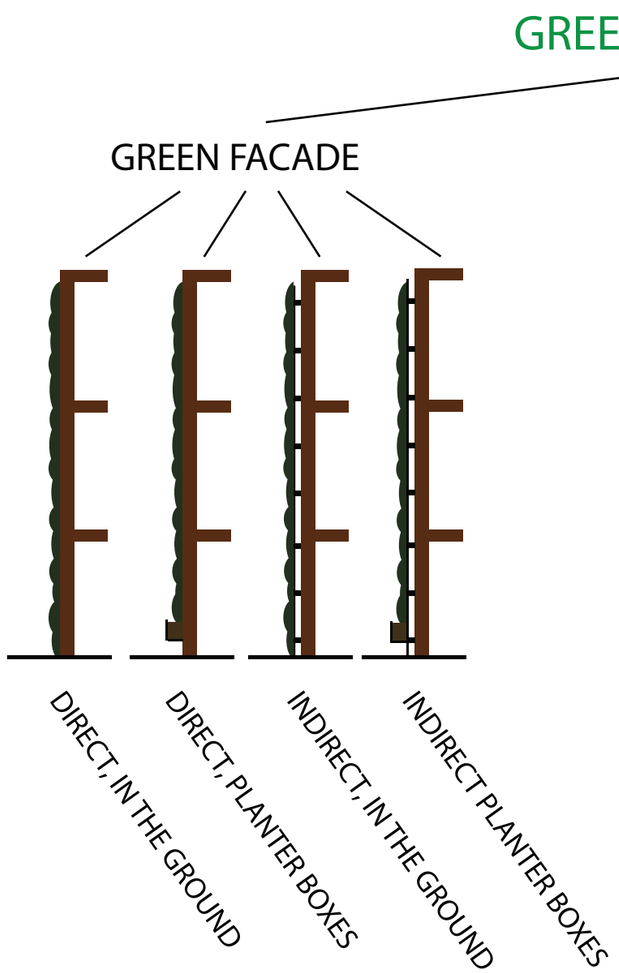


‘Using the a building facade to clean the canal water in order to create a natural swim spot’

PROJECT GOAL

GREEN FACADES

PROJECT GOAL



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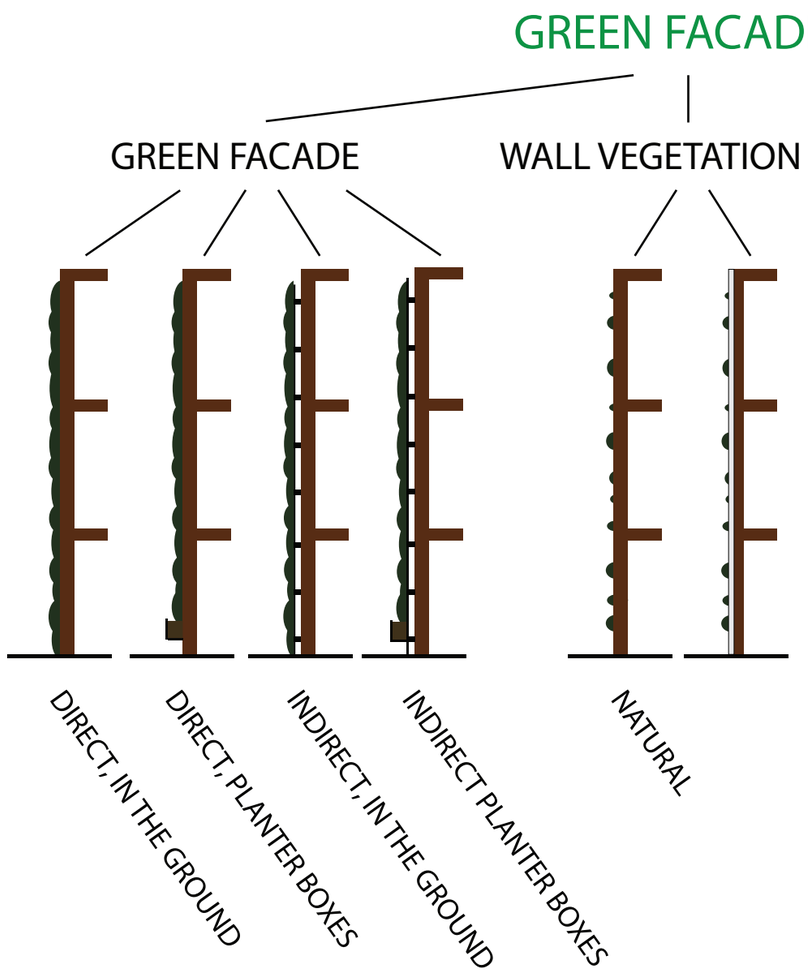
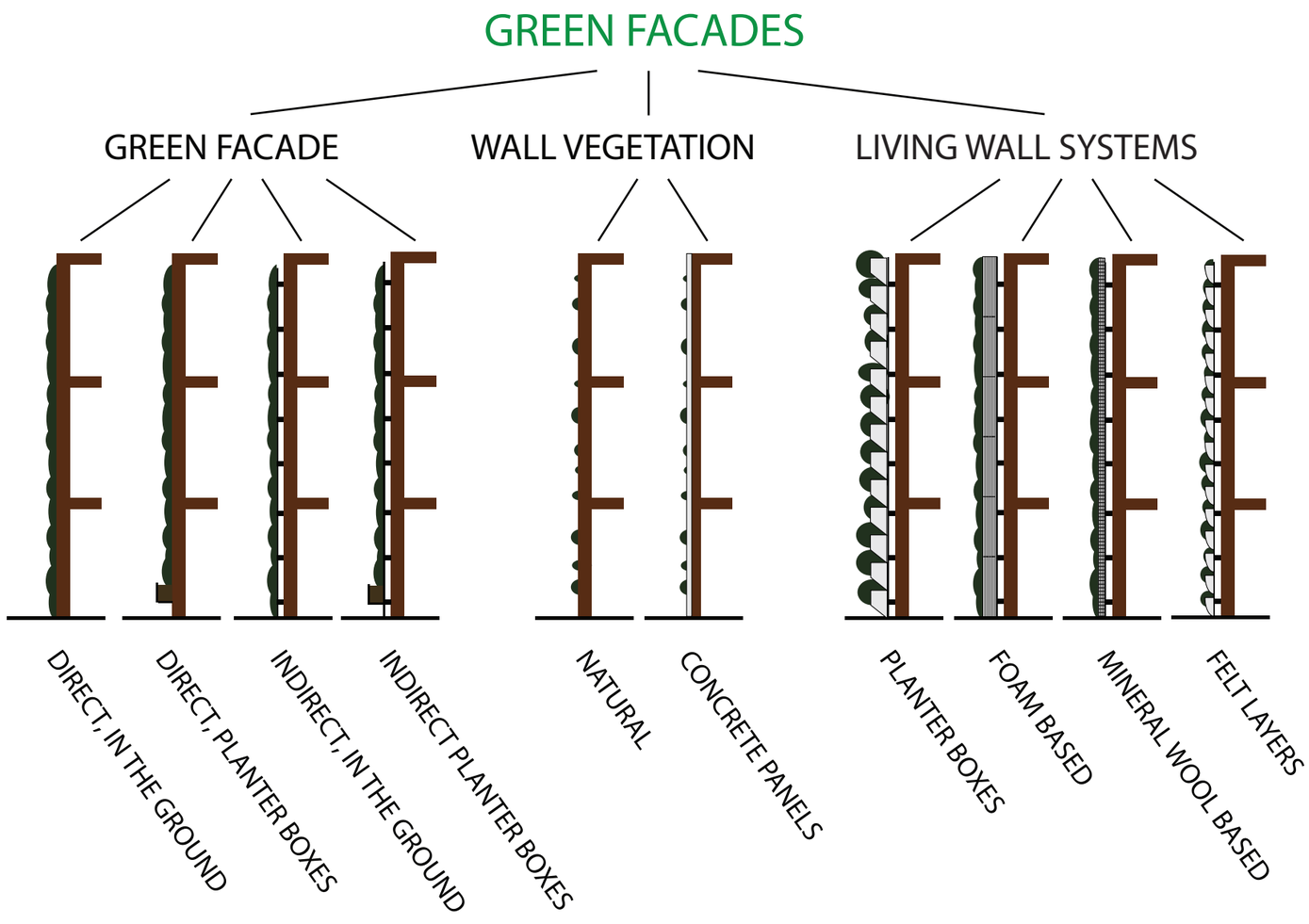
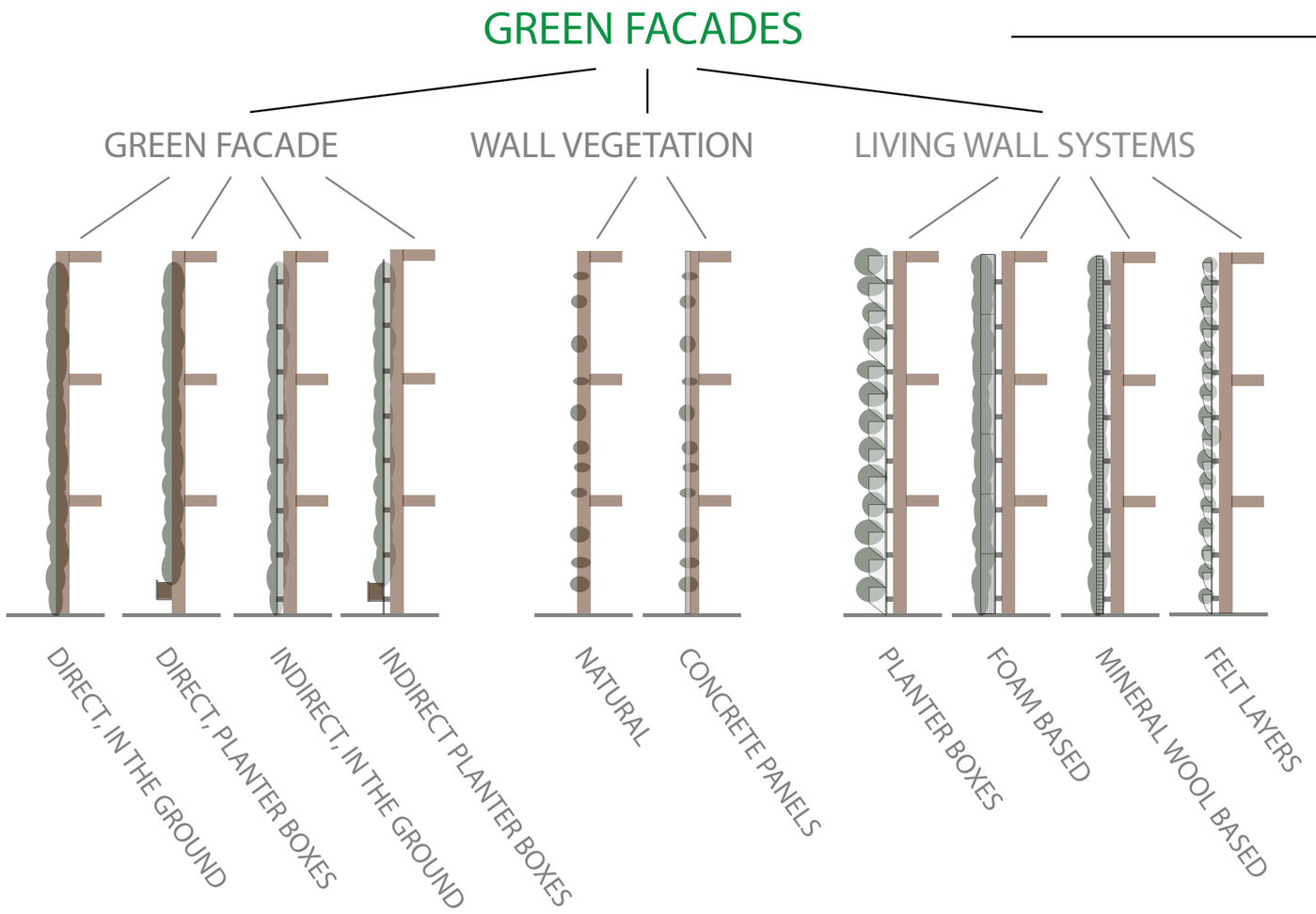


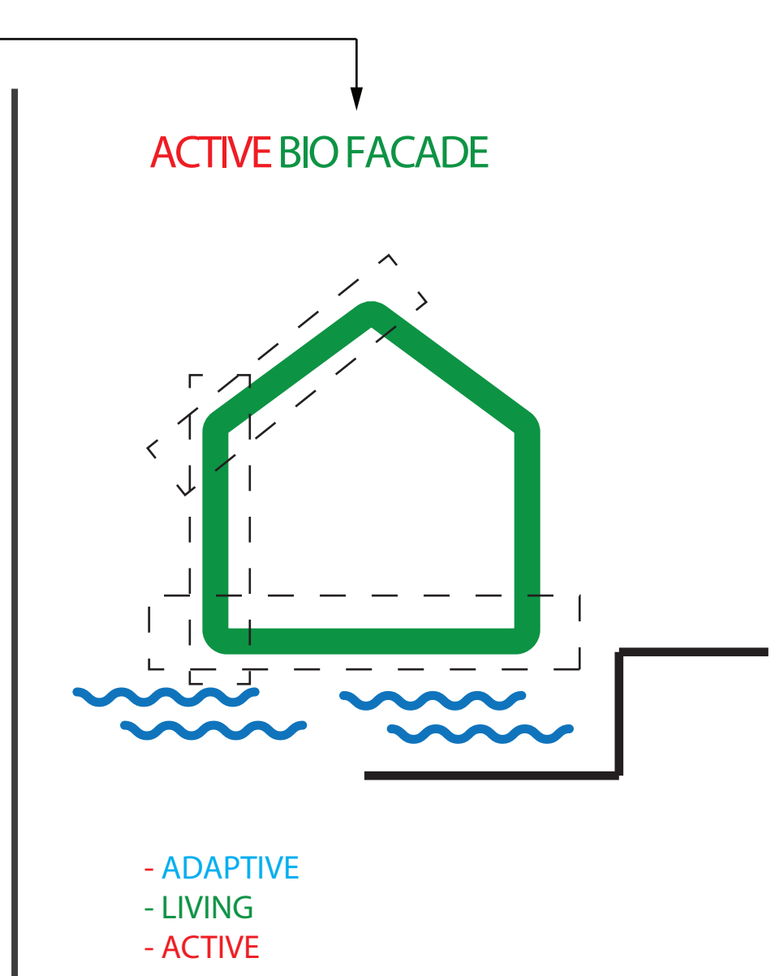
PROJECT GOAL



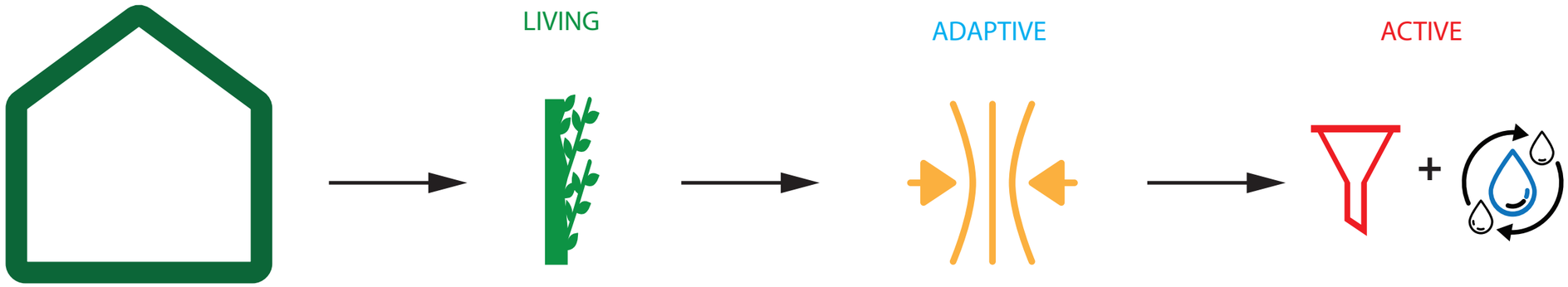
PROJECT GOAL



source: JeroenWinden



Active Bio-facade



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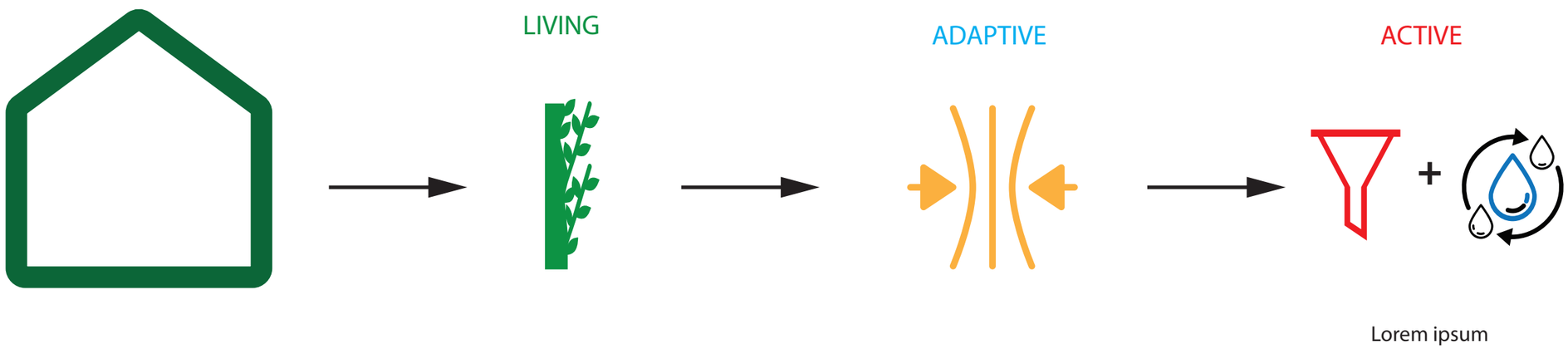
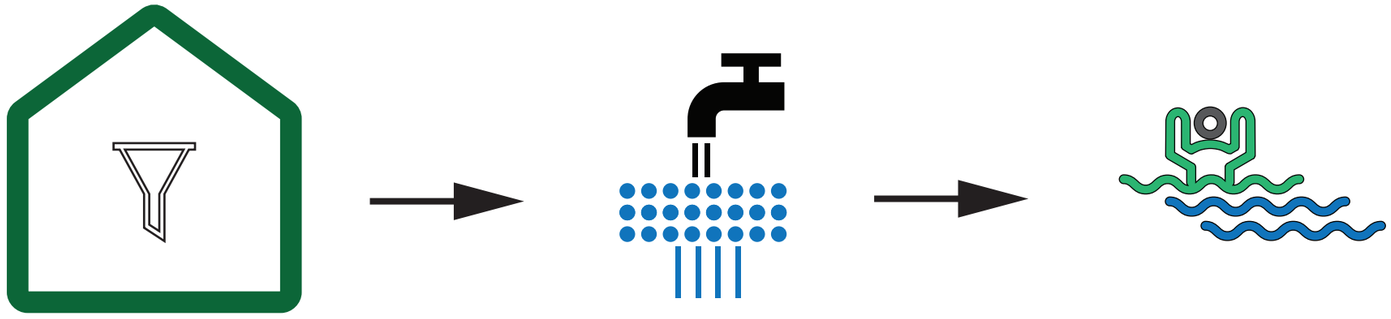


Example of a bio-façade

Algae-Fueled Building: World's First Bio-Adaptive Facade
source:weburbanist.com

DESIGN QUESTION

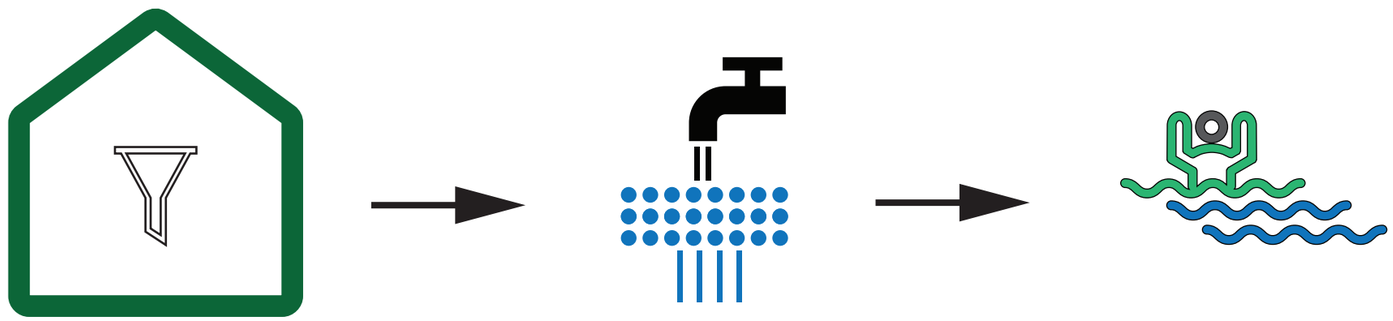
How can an active green-façade of a new building contribute to the purification of the Marineterrein water with the aim of making it suitable for swimming?



Aqua-Purifier Phyto-Façade

DESIGN QUESTION

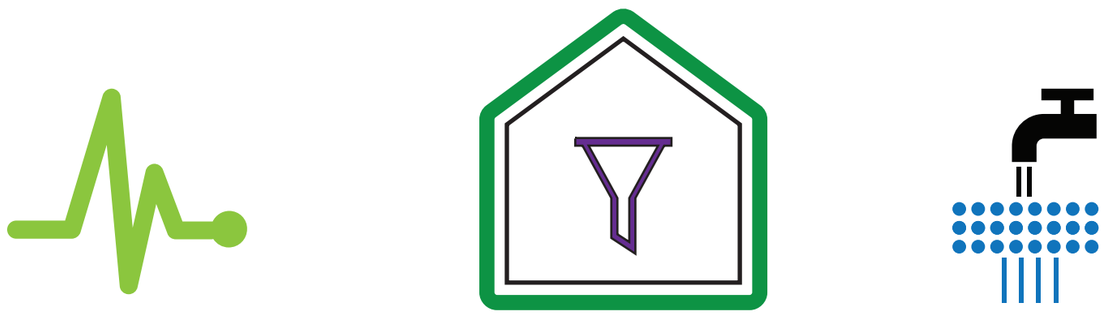
How can an active green-façade of a new building contribute to the purification of the Marineterrein water with the aim of making it suitable for swimming?



Aqua-Purifier Phyto-Façade

THEMATIC RESEARCH QUESTION

How to implement phytoremediation on and around a new building in order to make canal water suitable for swimming?



Research finding

Research - Constructed Wetlands

3 types of constructed wetlands:

- Free water surface (FWS) wetland

- Horizontal subsurface flow (HSSF) wetland

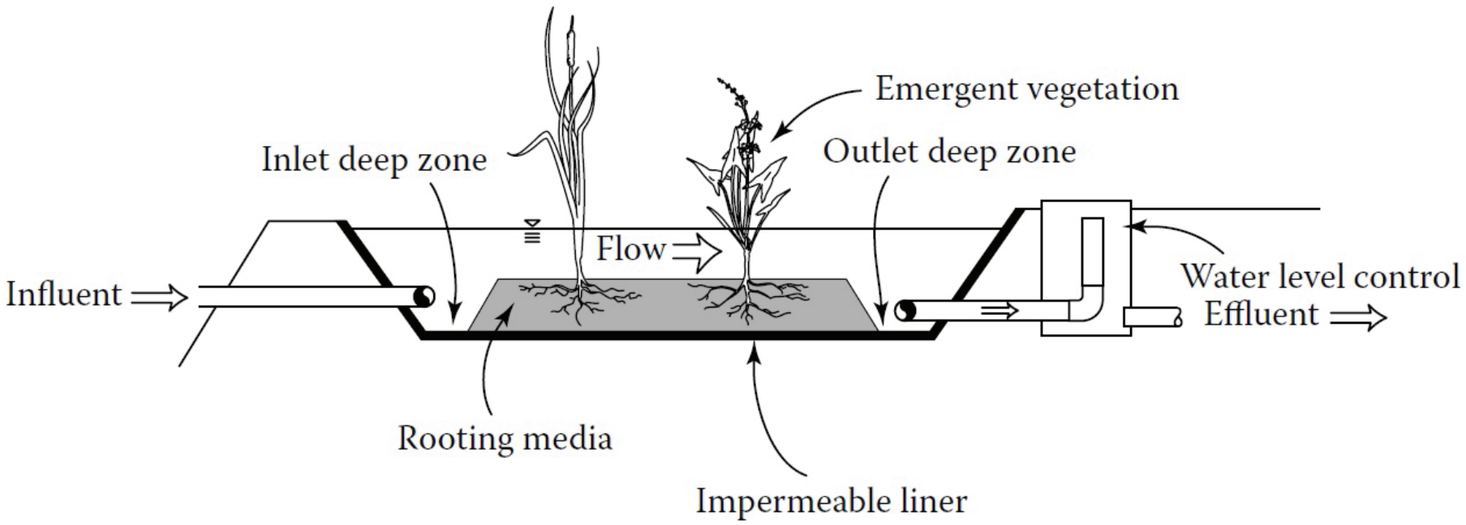
- Vertical flow (VF) wetland

& 4th type

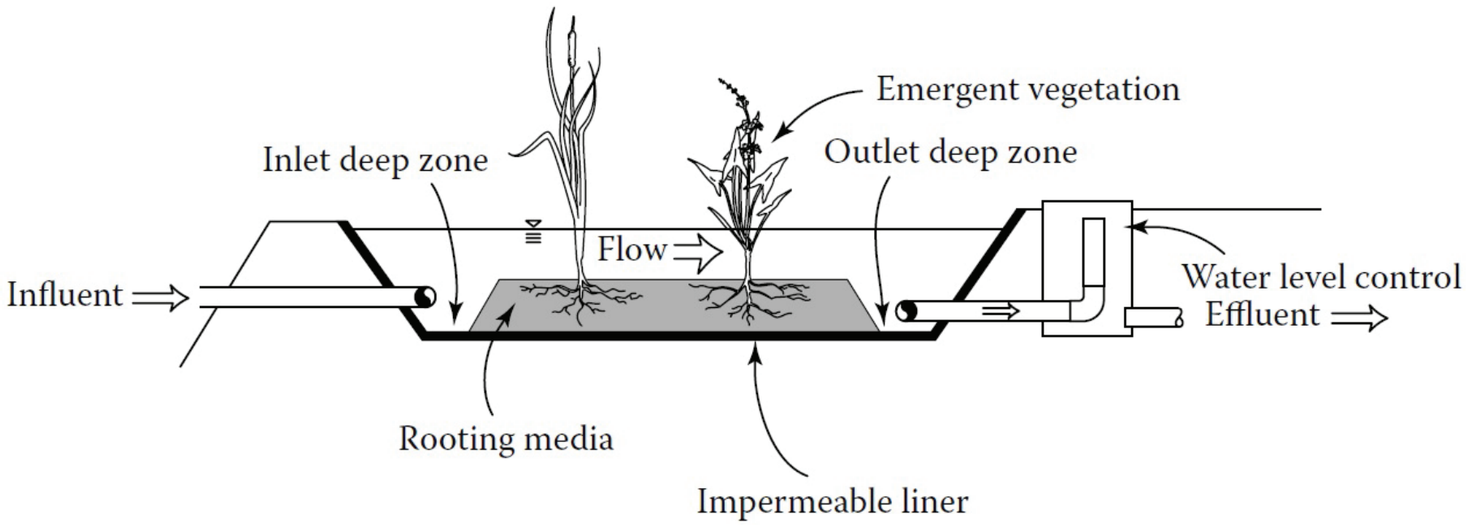
- Hybrid constructed Wetland

(www.vaswcd.org)

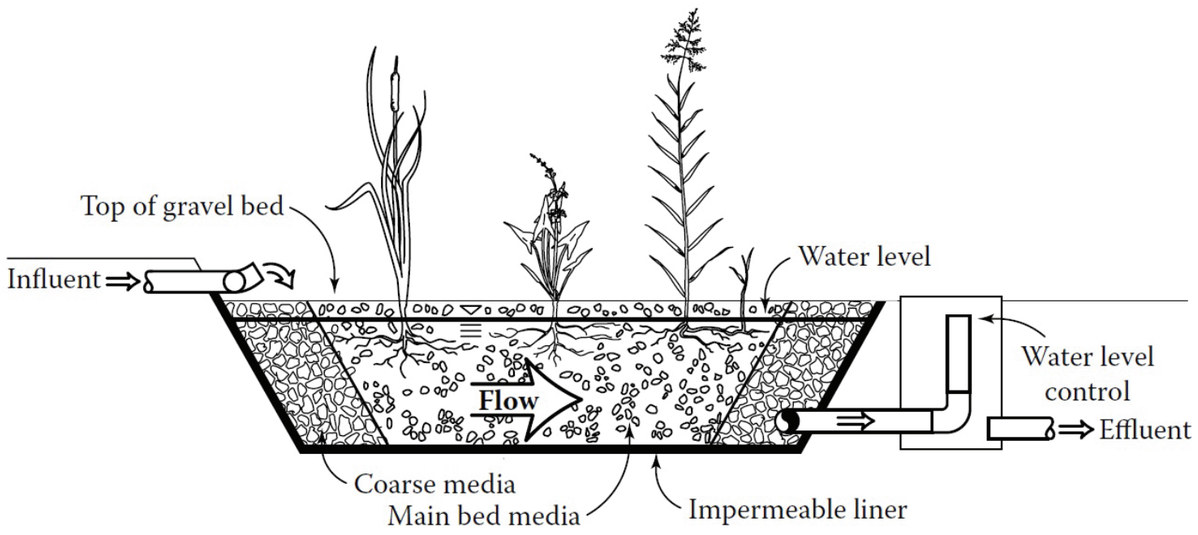
Free Water Surface (FWS) wetland



Free Water Surface (FWS) wetland



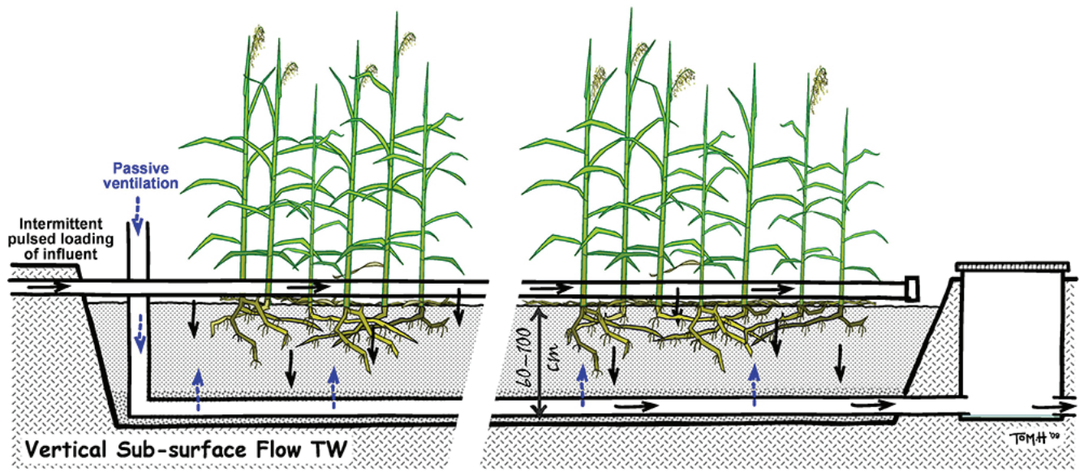
Horizontal subsurface flow (HSSF) wetland



(Kadlec and Wallace, 2009)

Vertical flow (VF) wetland

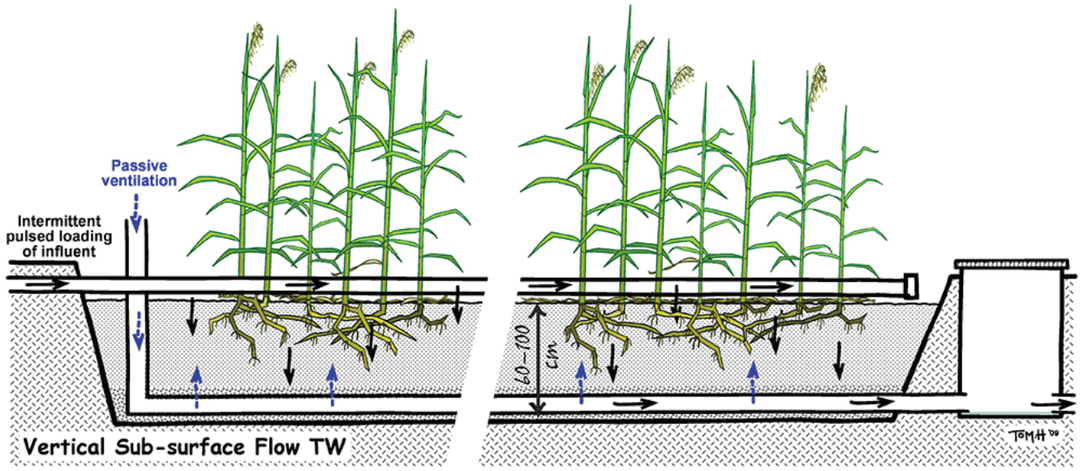
The pulse loading system



(www.waterandcarbon.com)

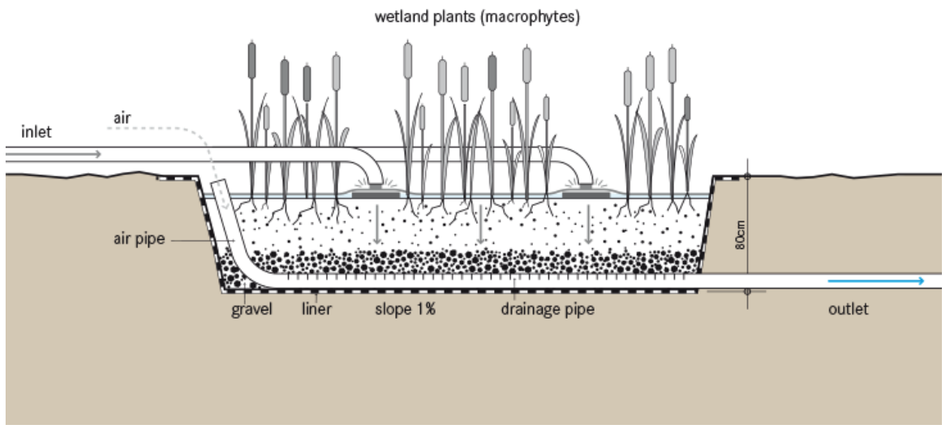
Vertical flow (VF) wetland

The pulse loading system



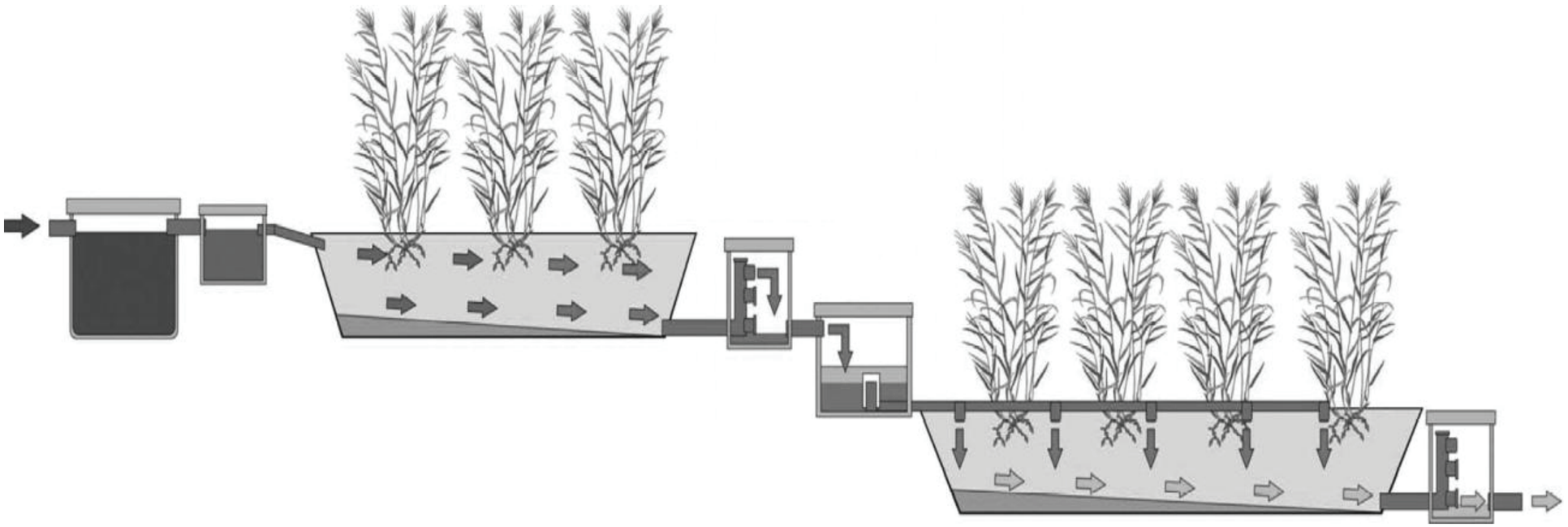
(www.waterandcarbon.com)

Tidal flow system



(www.sswm.info)

Hybrid constructed Wetland



(ww.wp.wpi.edu)

Research - Constructed Wetlands

ADVANTAGES

DISADVANTAGES

Research - Constructed Wetlands

ADVANTAGES

Cost effective

DISADVANTAGES

Research - Constructed Wetlands

ADVANTAGES

Cost effective

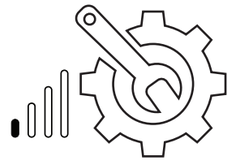
Low maintenance (if Outdoor applied)

DISADVANTAGES

Research - Constructed Wetlands

ADVANTAGES

Cost effective



Low maintenance (if Outdoor applied)

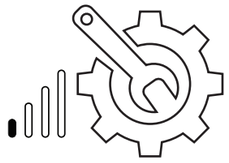
Environmental friendly

DISADVANTAGES

Research - Constructed Wetlands

ADVANTAGES

Cost effective



Low maintenance (if Outdoor applied)

Environmental friendly

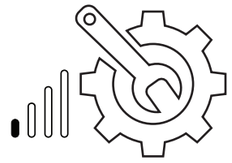
Aesthetic

DISADVANTAGES

Research - Constructed Wetlands

ADVANTAGES

Cost effective



Low maintenance (if Outdoor applied)

Environmental friendly

Aesthetic

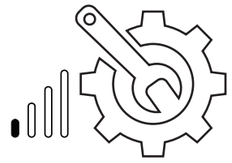
No noisy

DISADVANTAGES

Research - Constructed Wetlands

ADVANTAGES

Cost effective



Low maintenance (if Outdoor applied)

Environmental friendly

Aesthetic

No noisy

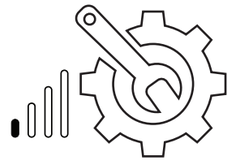
No equipement needed (almost)

DISADVANTAGES

Research - Constructed Wetlands

ADVANTAGES

Cost effective



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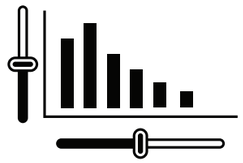
DISADVANTAGES

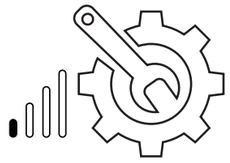


Low Effectivity

Research - Constructed Wetlands

ADVANTAGES

Cost effective



Low maintenance (if Outdoor applied)

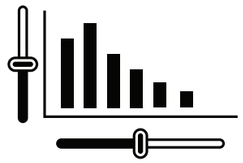
Environmental friendly

Aesthetic

No noisy

No equipement needed (almost)

DISADVANTAGES



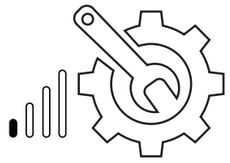
Low Effectivity

High maintenance (If IAQ applied)

Research - Constructed Wetlands

ADVANTAGES

Cost effective



Low maintenance (if Outdoor applied)

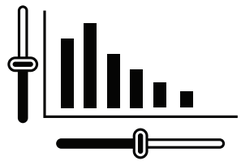
Environmental friendly

Aesthetic

No noisy

No equipement needed (almost)

DISADVANTAGES



Low Effectivity

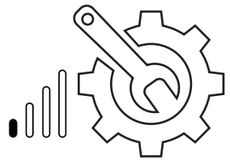
High maintenance (If IAQ applied)

Slower Process

Research - Constructed Wetlands

ADVANTAGES

Cost effective



Low maintenance (if Outdoor applied)

Environmental friendly

Aesthetic

No noisy

No equipement needed (almost)

DISADVANTAGES

Low Effectivity

High maintenance (If IAQ applied)

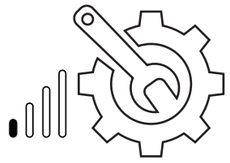
Slower Process

Lower contaminant concentration

Research - Constructed Wetlands

ADVANTAGES

Cost effective



Low maintenance (if Outdoor applied)

Environmental friendly

Aesthetic

No noisy

No equipement needed (almost)

DISADVANTAGES

Low Effectivity

High maintenance (If IAQ applied)

Slower Process

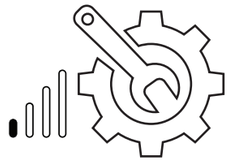
Lower contaminant concentration

Seasonally effective

Research - Constructed Wetlands

ADVANTAGES

Cost effective



Low maintenance (if Outdoor applied)

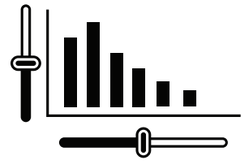
Environmental friendly

Aesthetic

No noisy

No equipement needed (almost)

DISADVANTAGES



Low Effectivity

High maintenance (If IAQ applied)

Slower Process

Lower contaminant concentration

Seasonally effective

Food chain affected by chemicals

Research - Implementation Strategie

Depending on type of contaminants, choose the right type of plants & animals and using the right process

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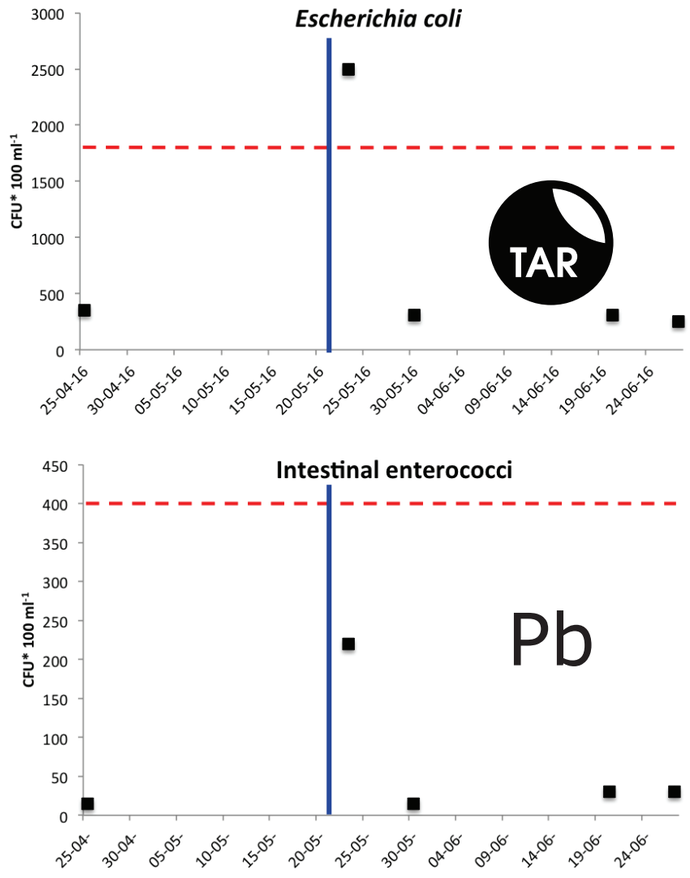
Contaminants

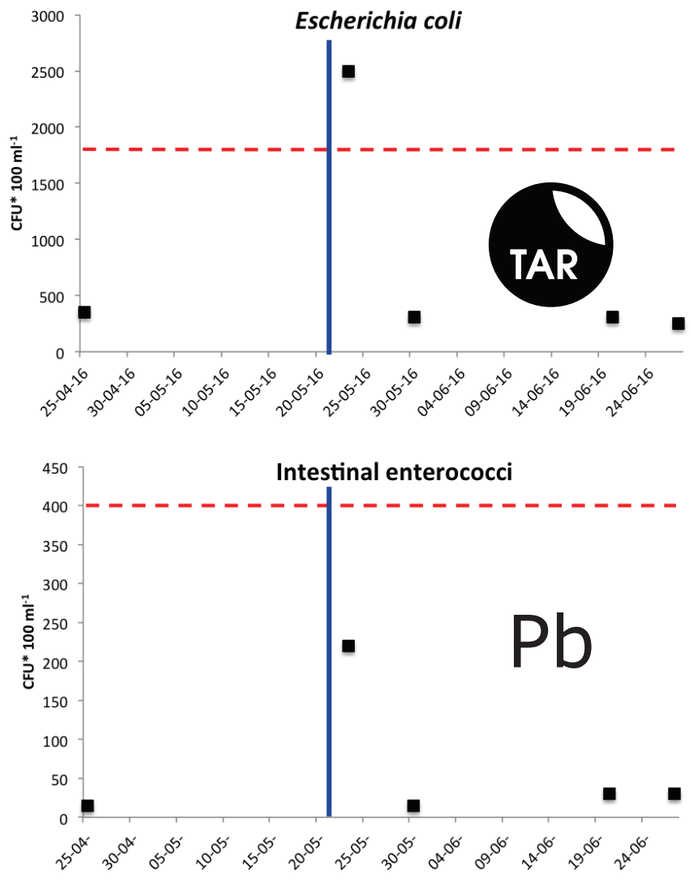


Evi Cox 2016

Research - Implementation Strategie

Depending on type of contaminants, choose the right type of plants & animals and using the right process

Contaminants



Evi Cox 2016

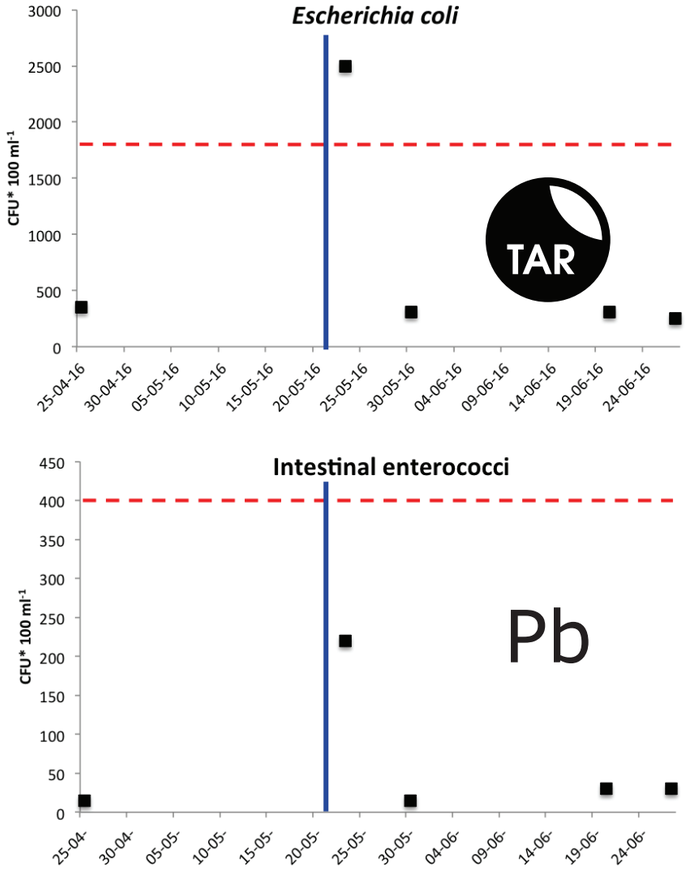
Plants

P. Sakkas 2012

Research - Implementation Strategie

Depending on type of contaminants, choose the right type of plants & animals and using the right process

Contaminants

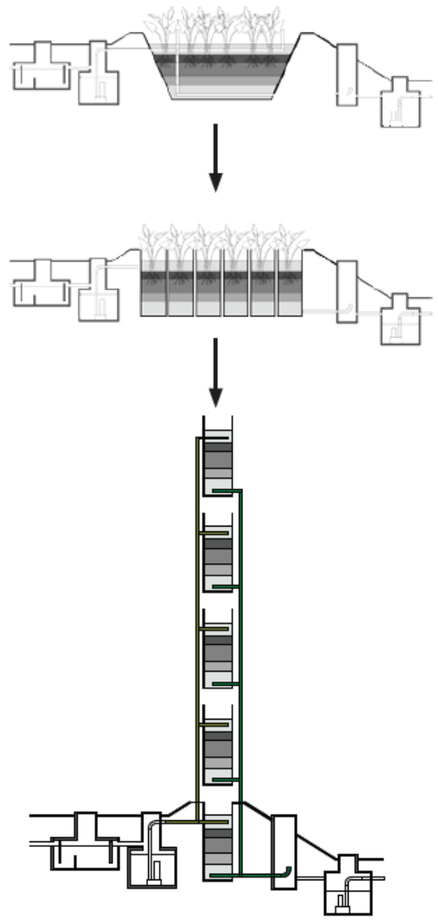


Evi Cox 2016

Plants

P. Sakkas 2012

Constructed Wetlands system

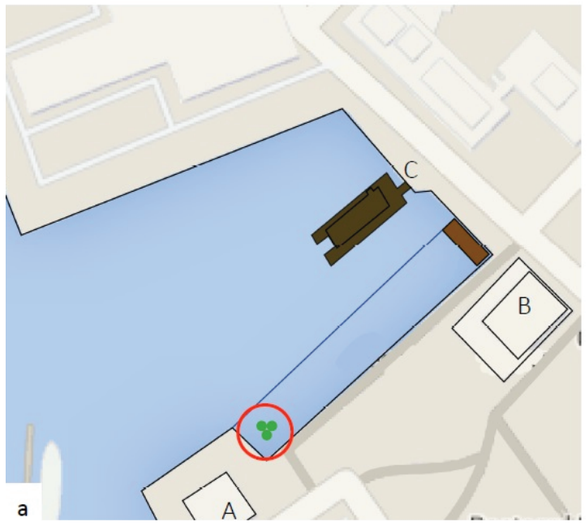


P. Sakkas 2012

Research - Implementation Strategie

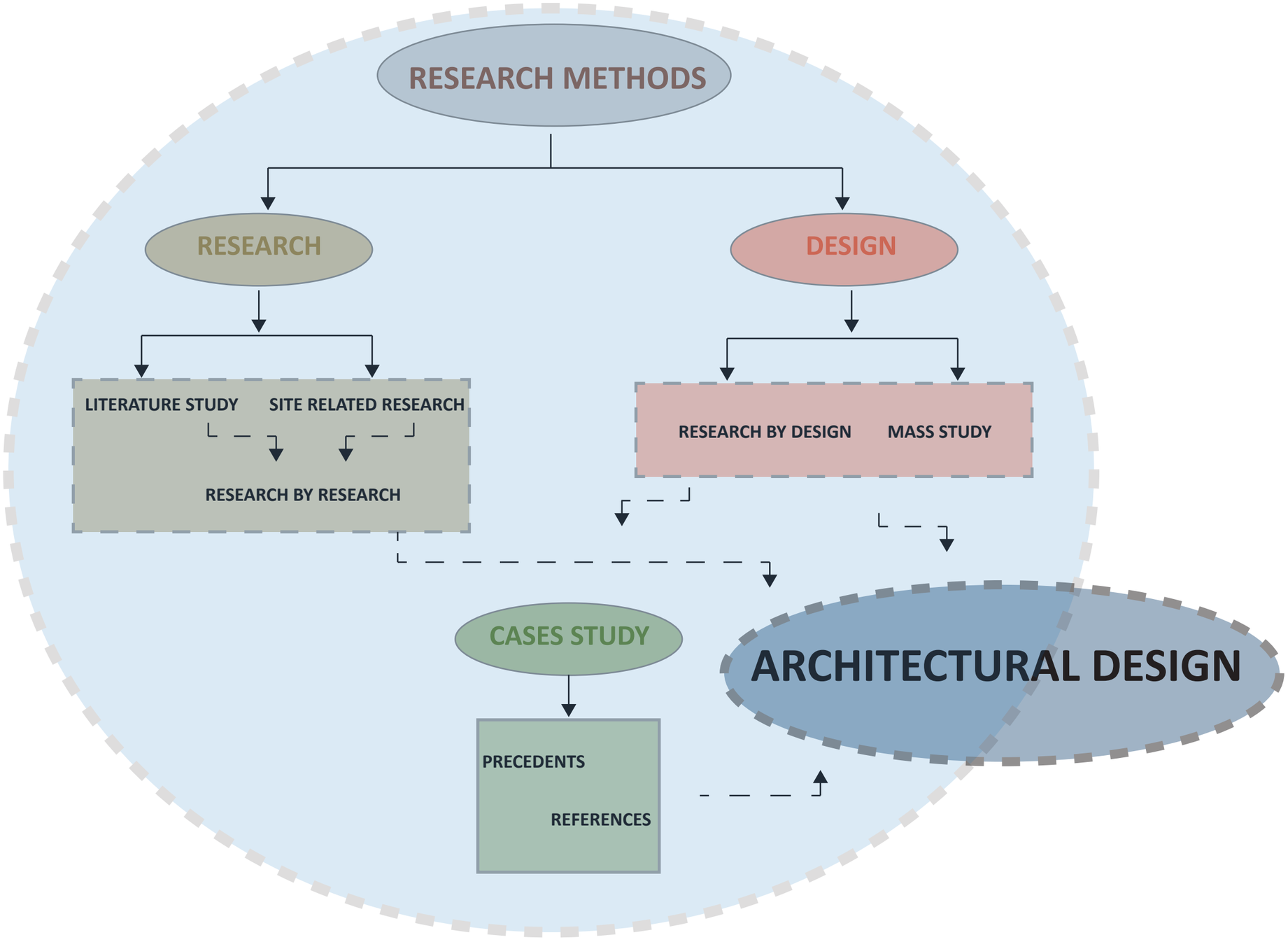
TAR

Pb

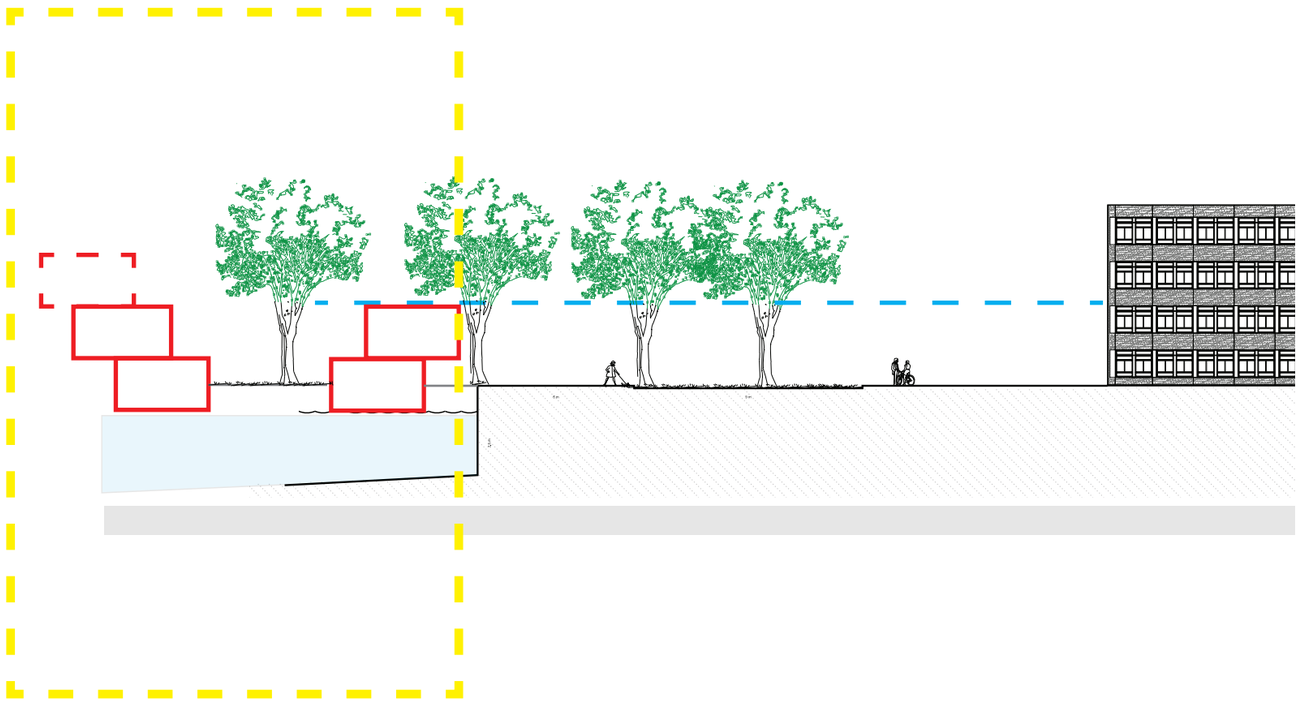


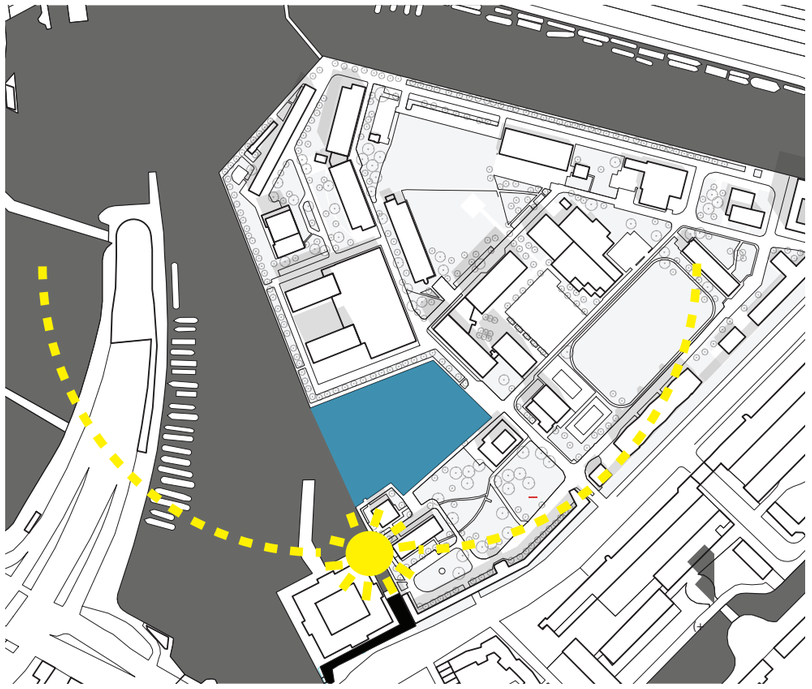
Conceptual approach

Design - Translation into design



Design - Guidelines





DESIGN CONCEPT

Biomimetic architecture is a contemporary philosophy of architecture that seeks solutions for sustainability in nature, not by replicating the natural forms, but by understanding the rules governing those forms.

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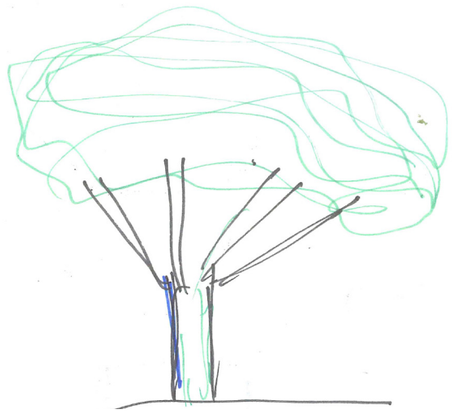
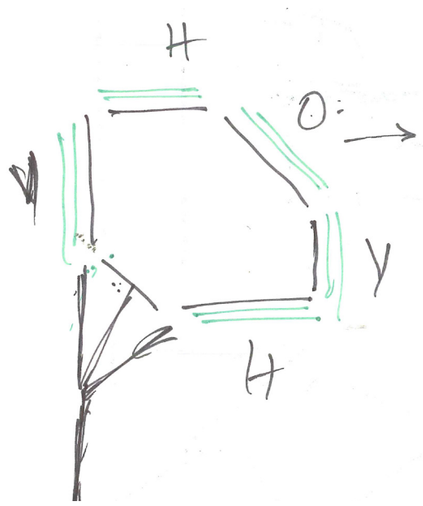
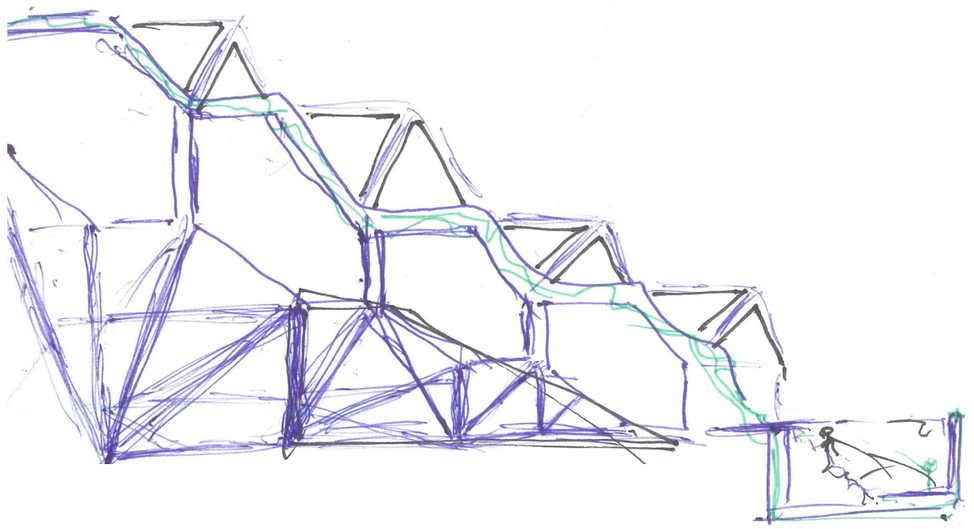
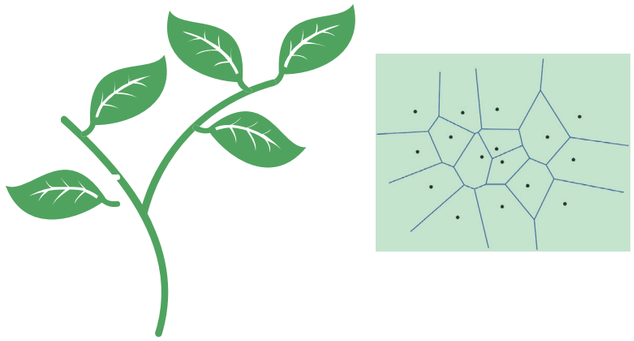






DESIGN CONCEPT

Plant leaf



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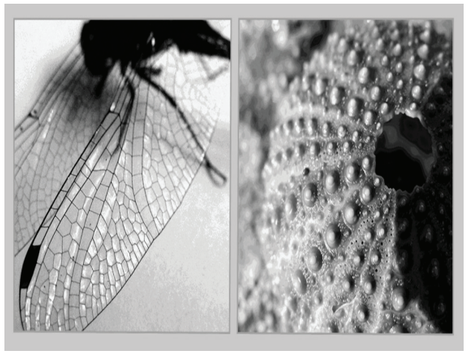
Dragonfly wing & sea



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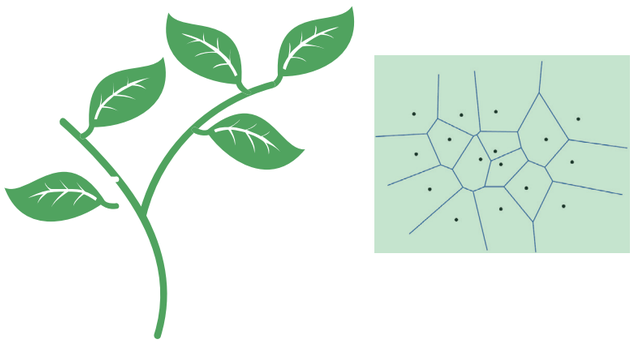
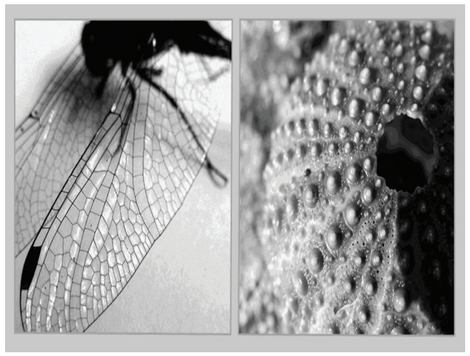
Voronoï diagram

DESIGN CONCEPT

Plant leaf

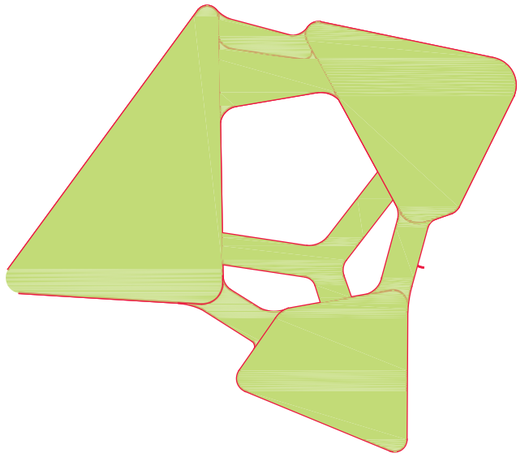


Dragonfly wing & sea

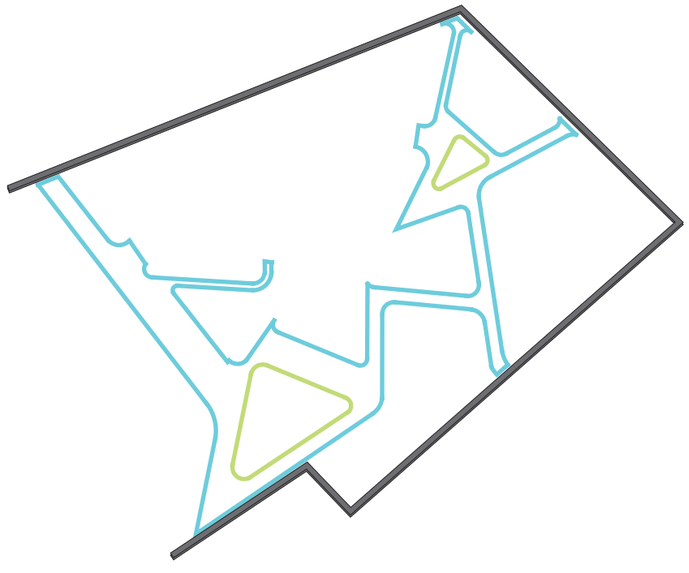


Voronoï diagram

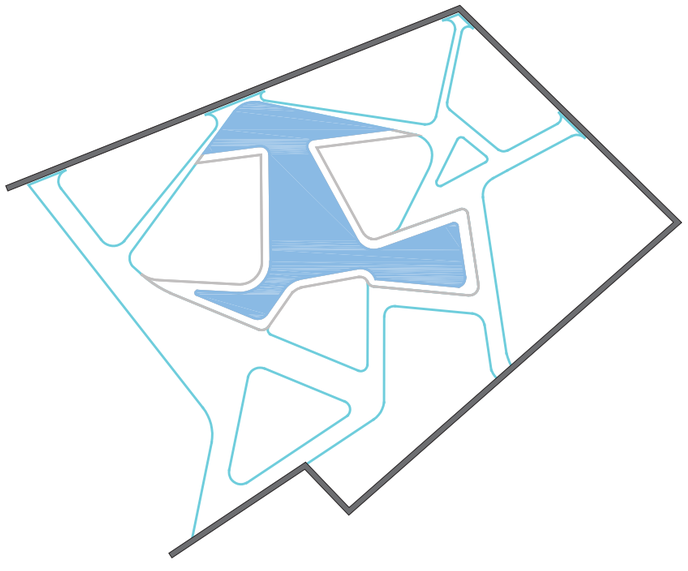
Organic shape



Ponton

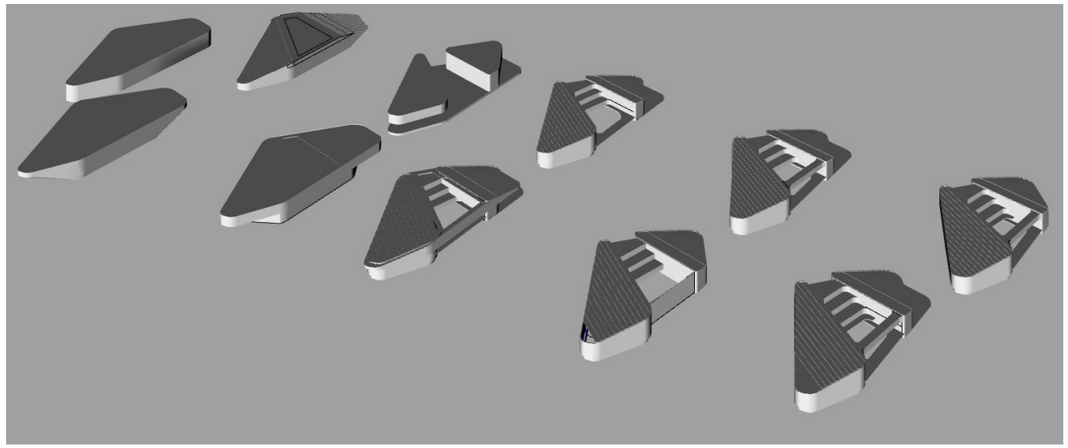


Open-air swimming spot

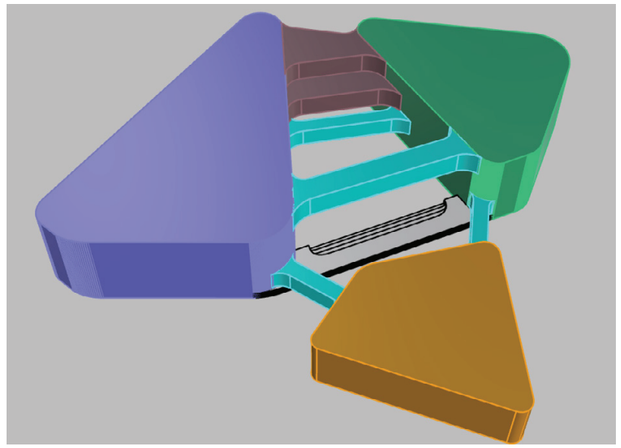


CONCEPT - Building mass research

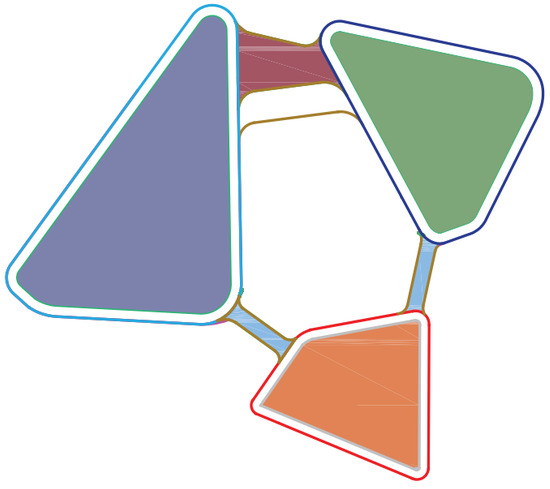
Mass research



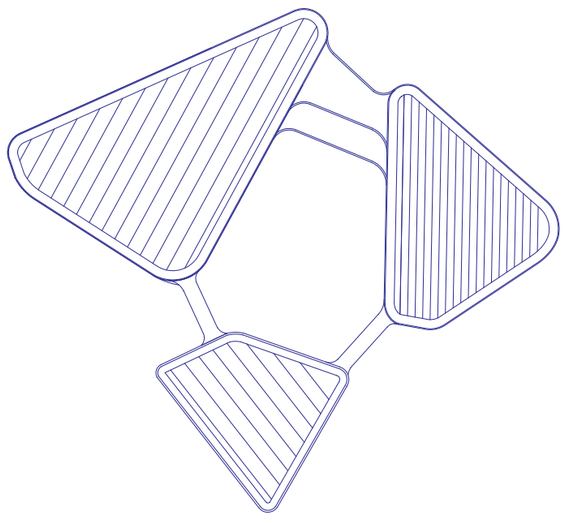
Functions research



4 volumes - 4 functions



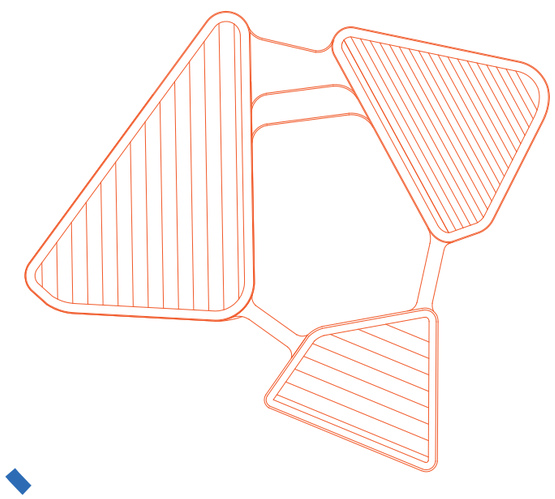
refined shape



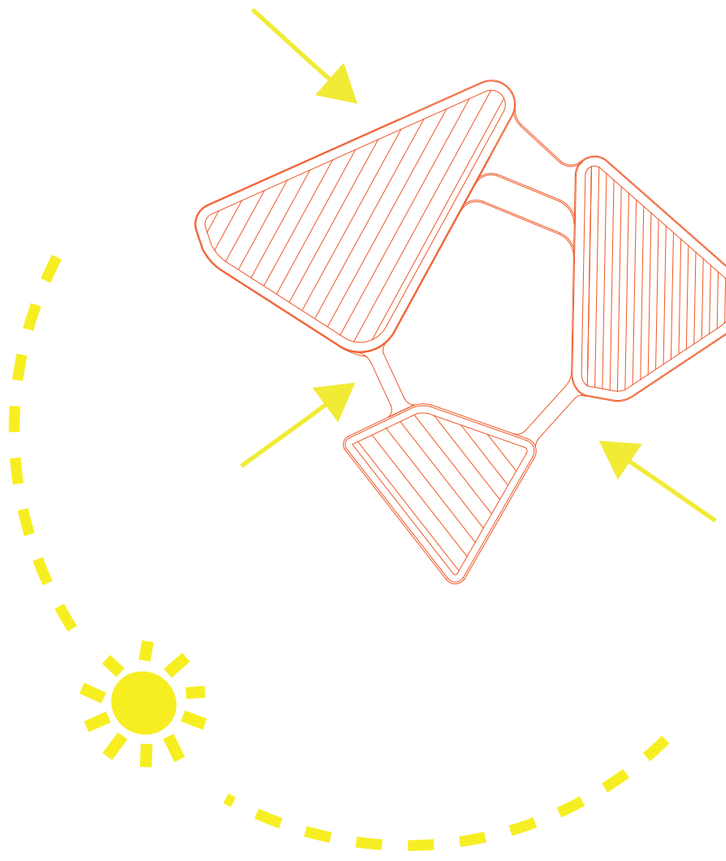
CONCEPT - Settlement

different views

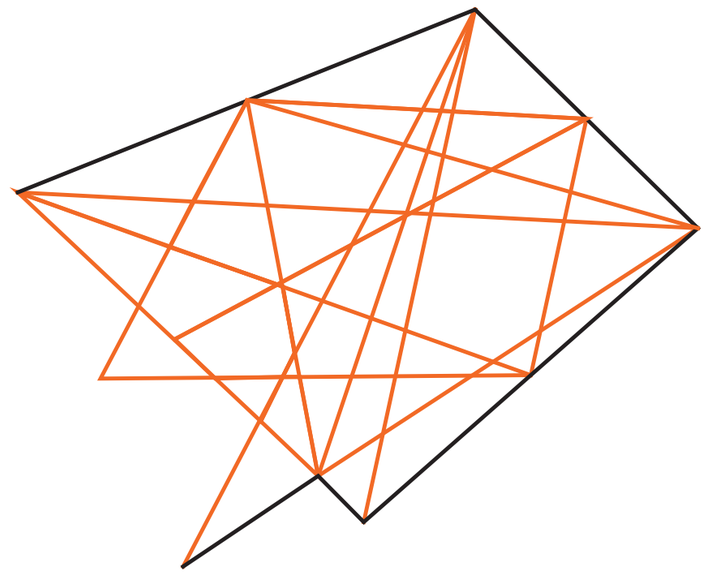
N



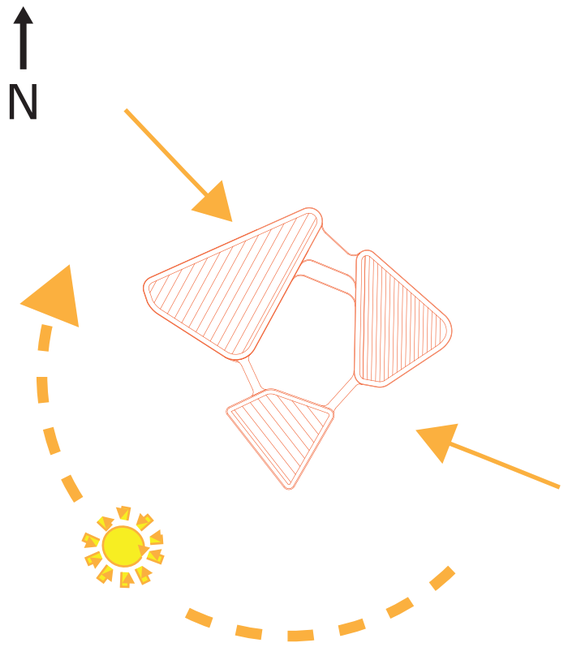
Sunlight



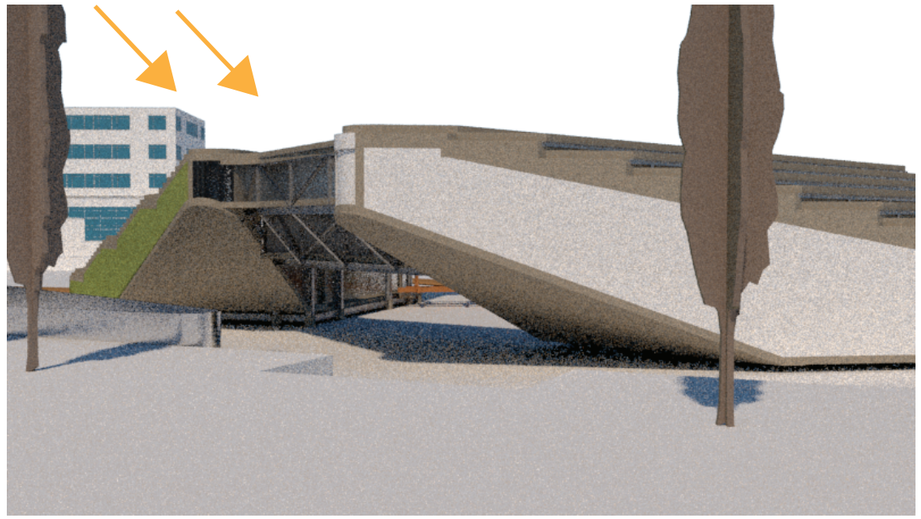
different views



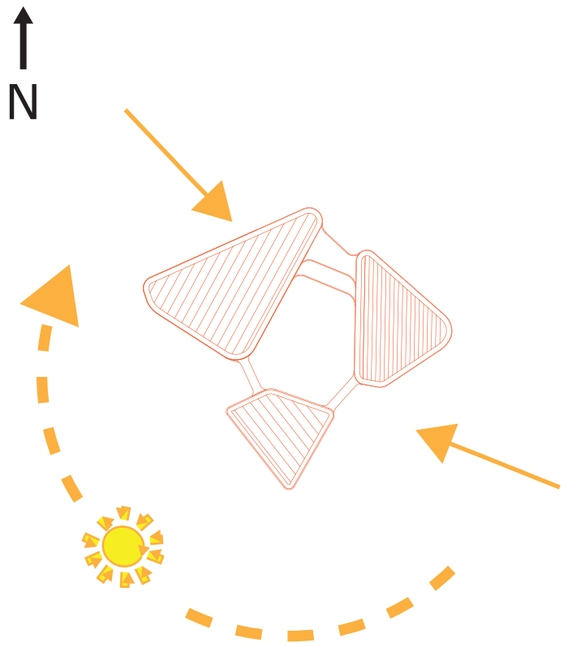
CONCEPT - Sunlight & Views >>building reshaping



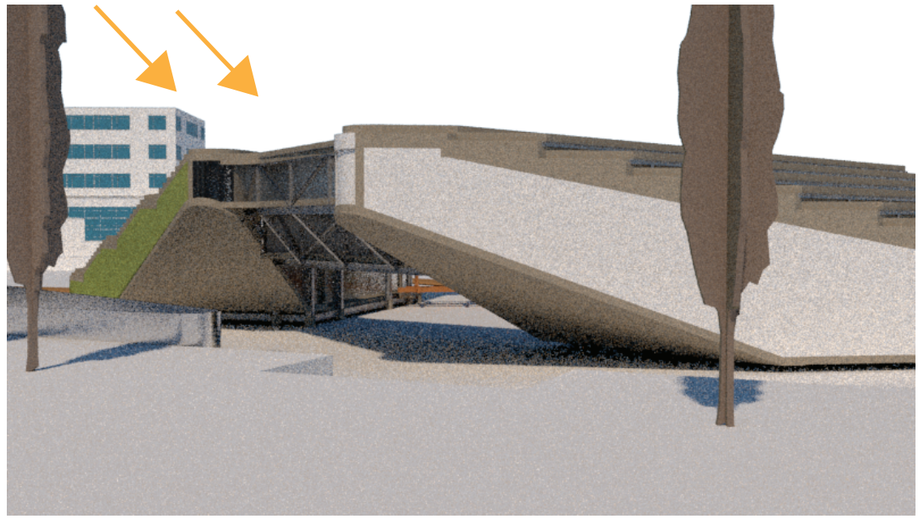
Sunlight



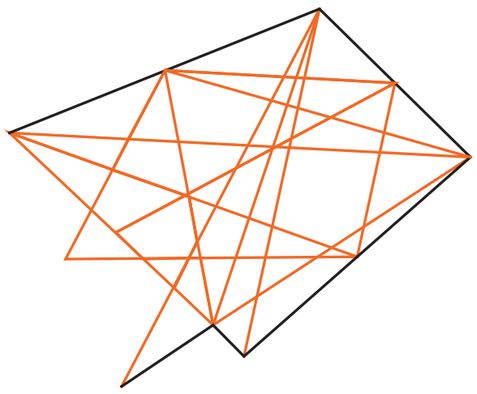
CONCEPT - Sunlight & Views >>building reshaping

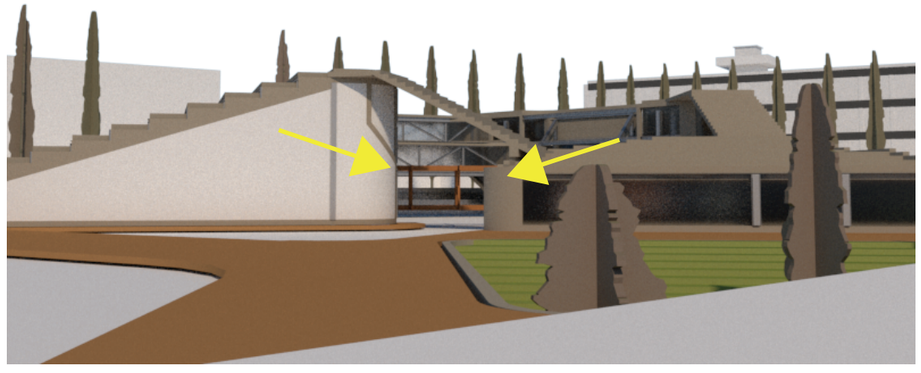


Sunlight

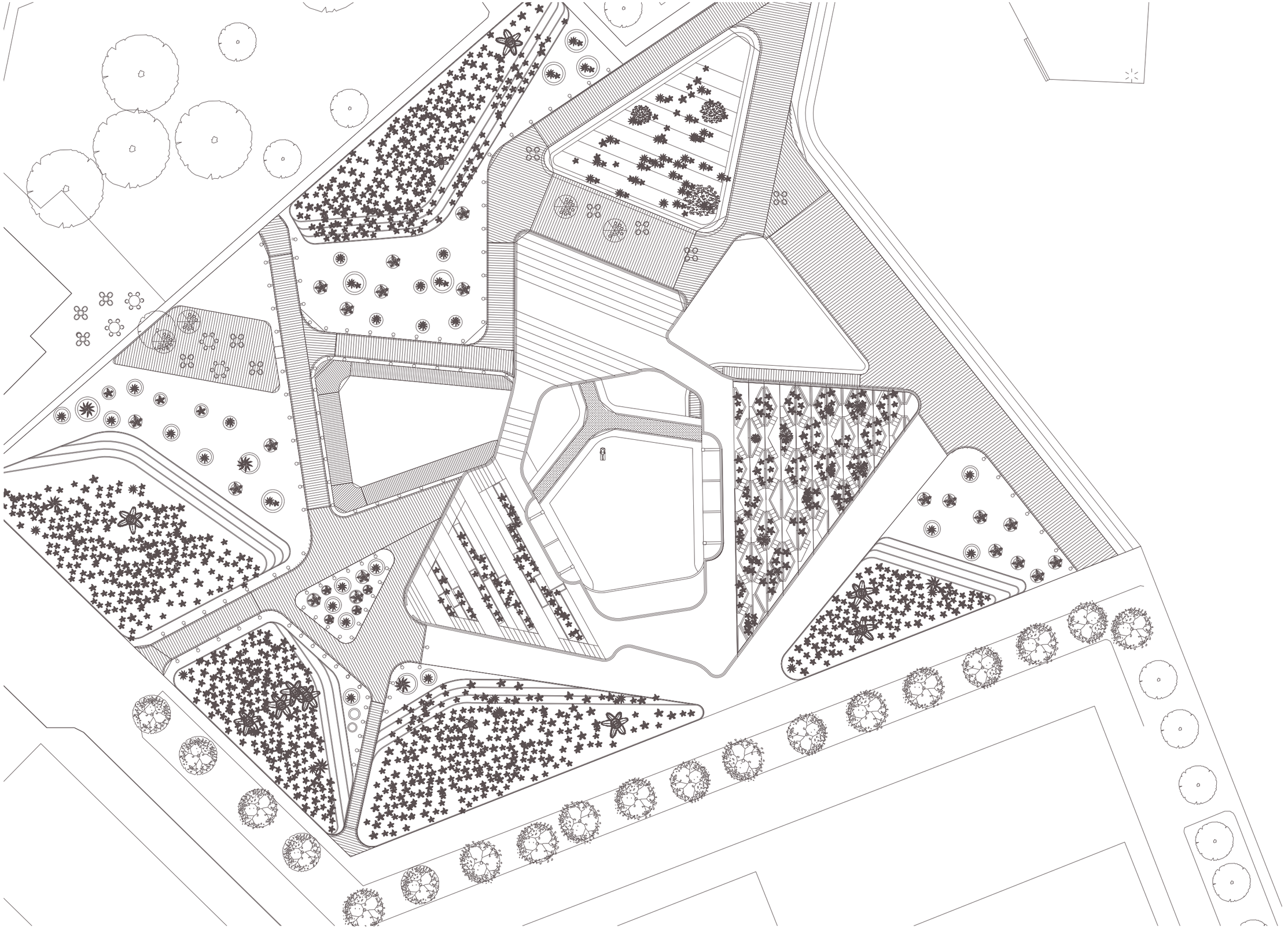


different views



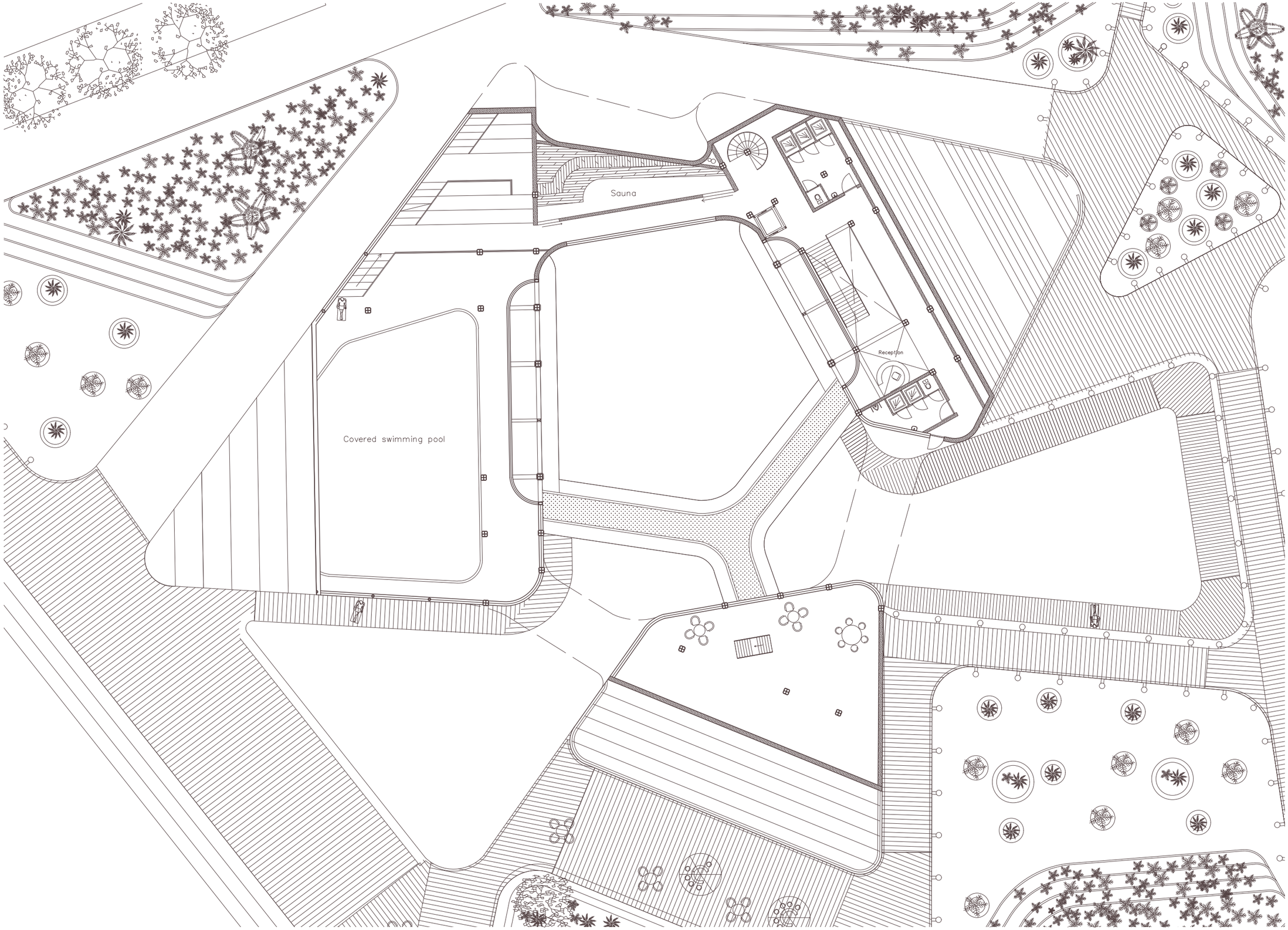


Architecture Design

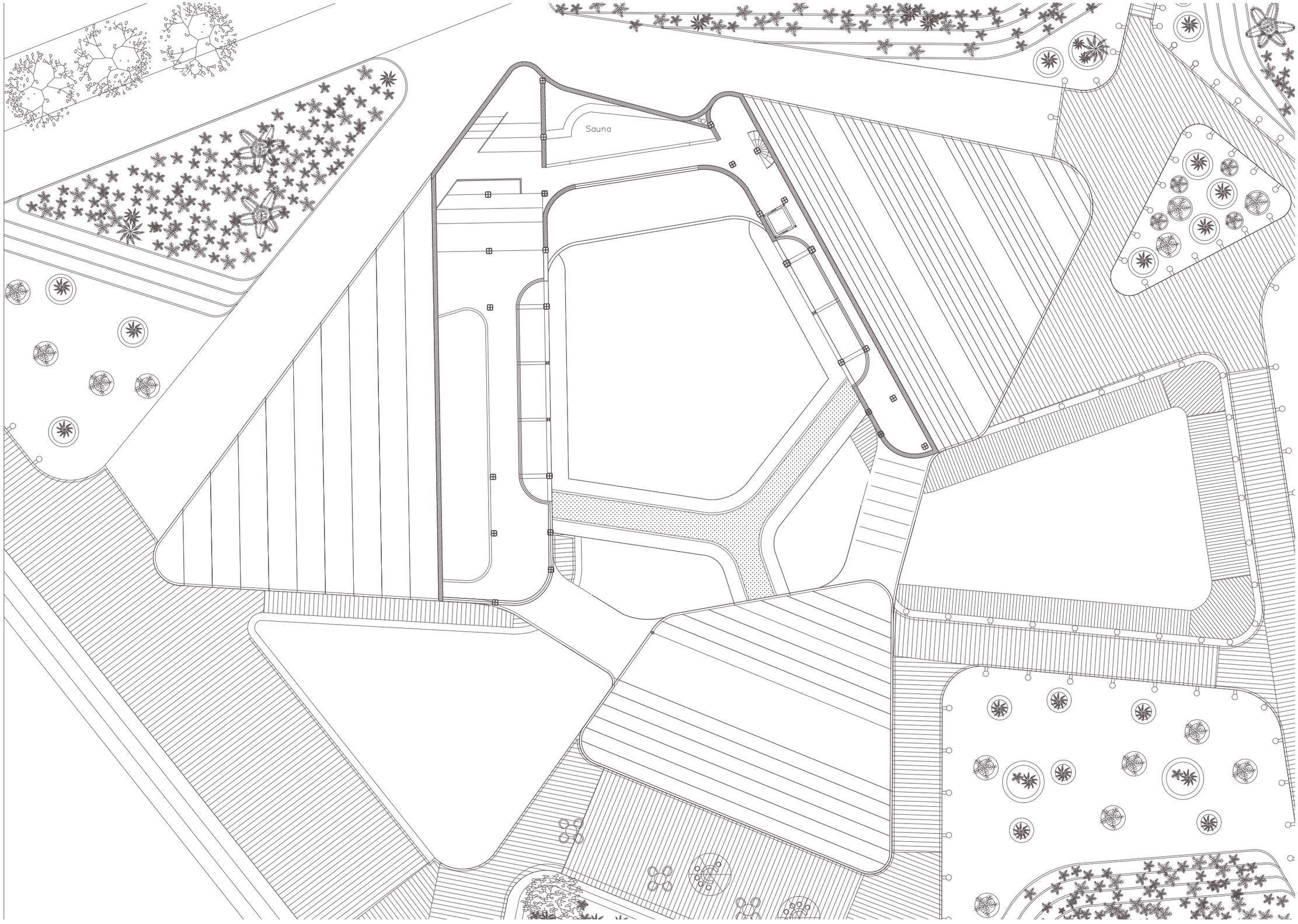


GROUND FLOOR 1:200

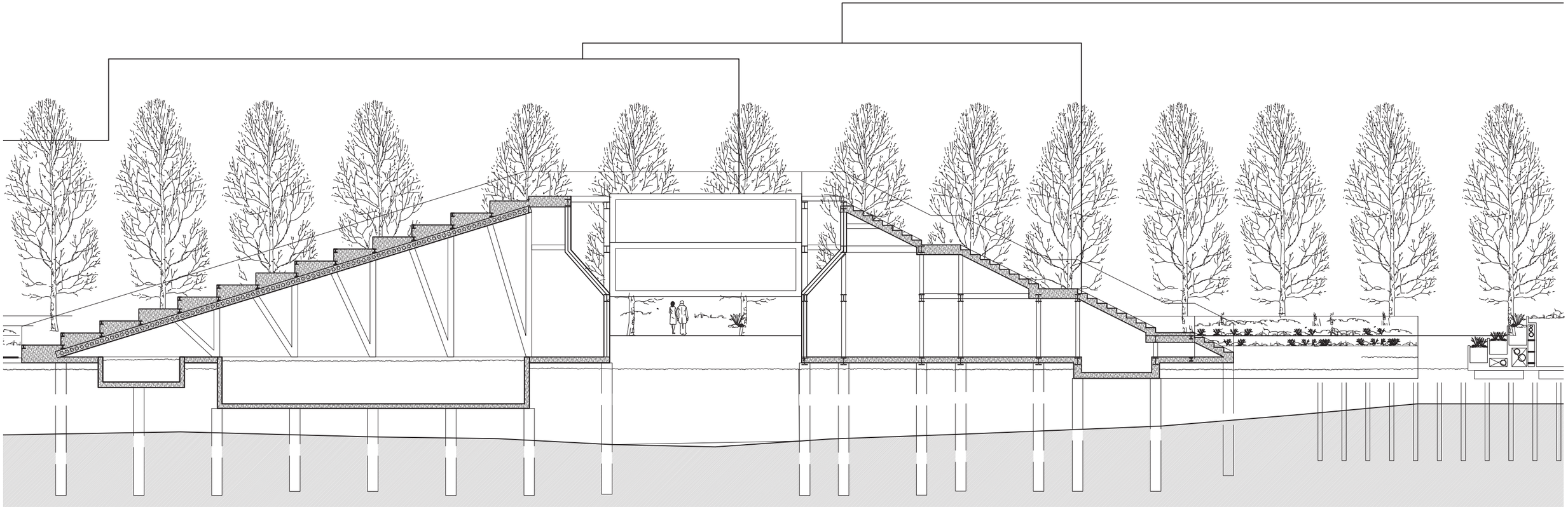
FIRST FLOOR 1:200



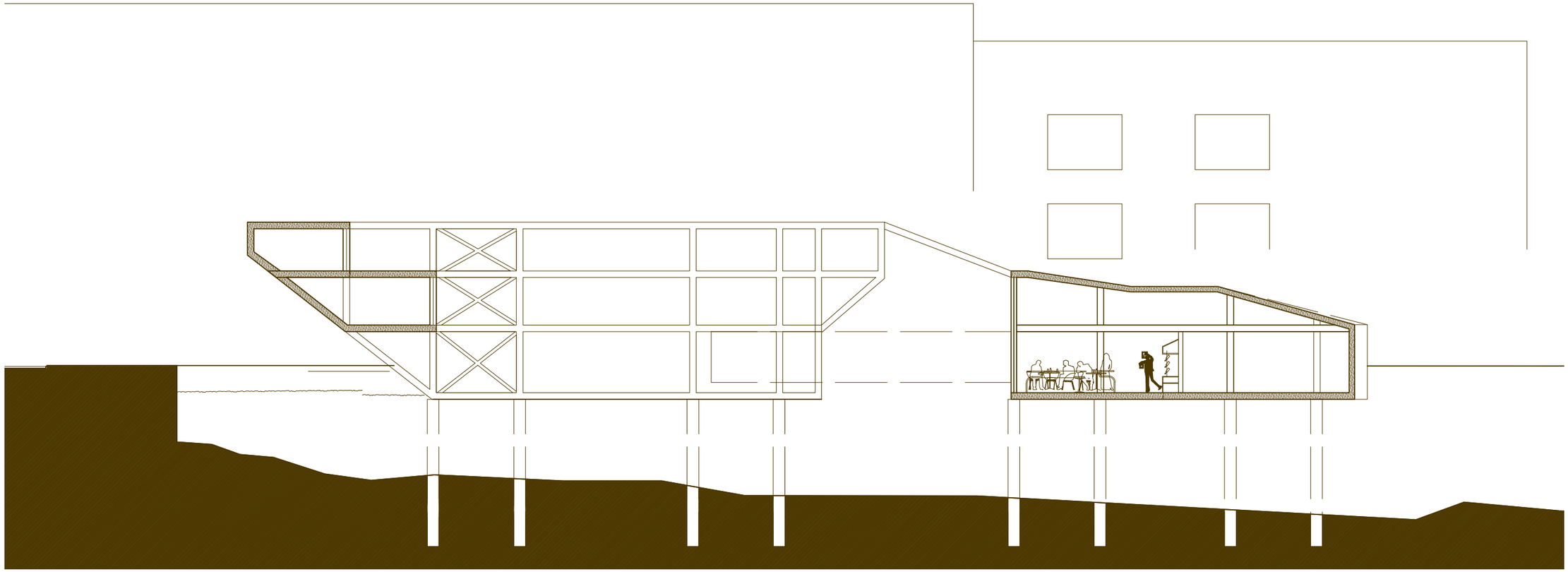
SECOND FLOOR 1:200



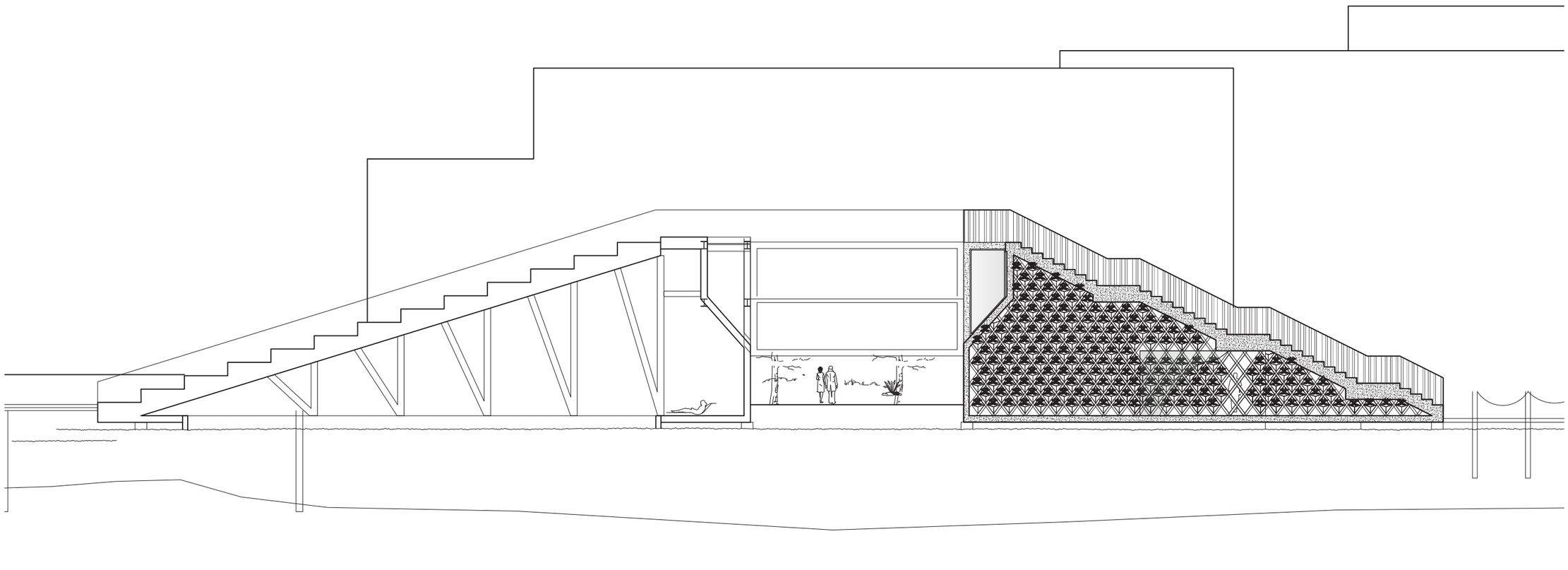
SECTION AA’ 1:200



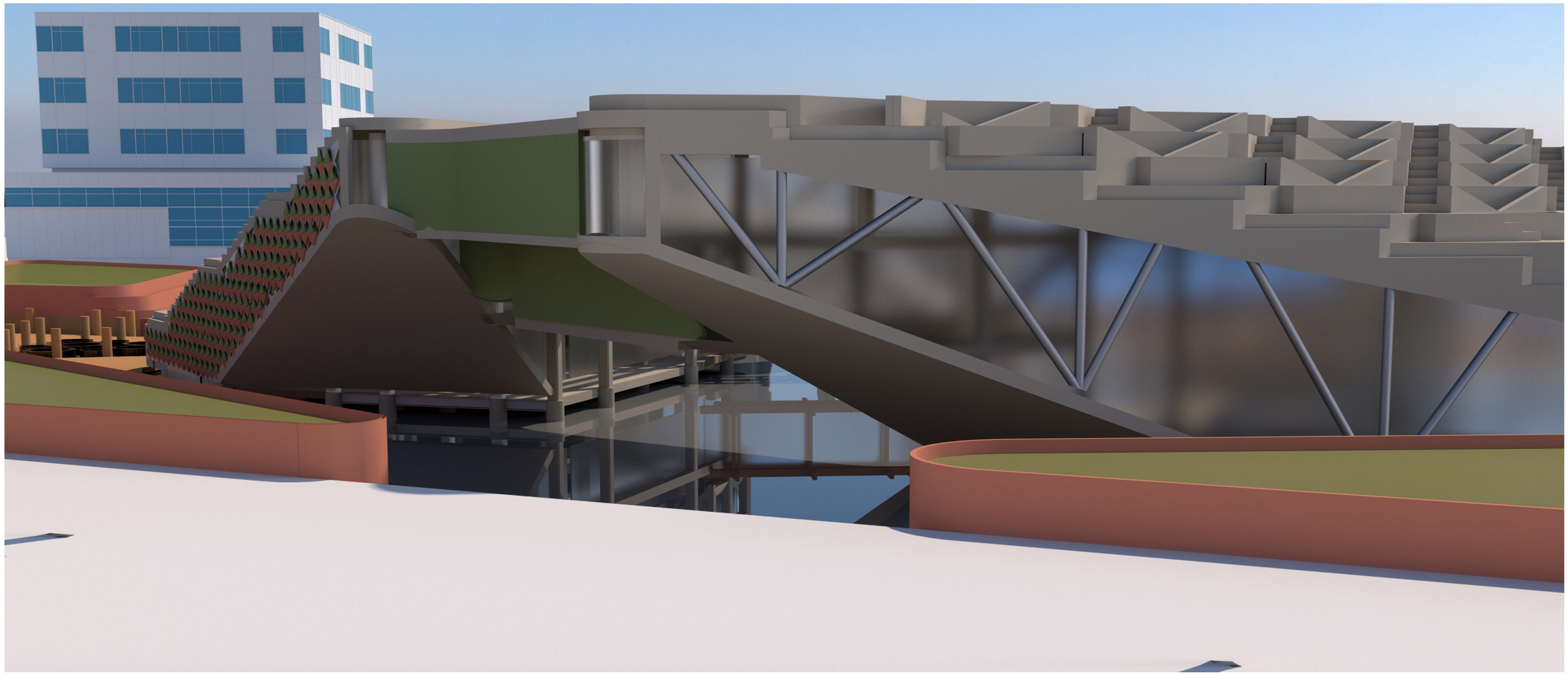
SECTION BB’ 1:200



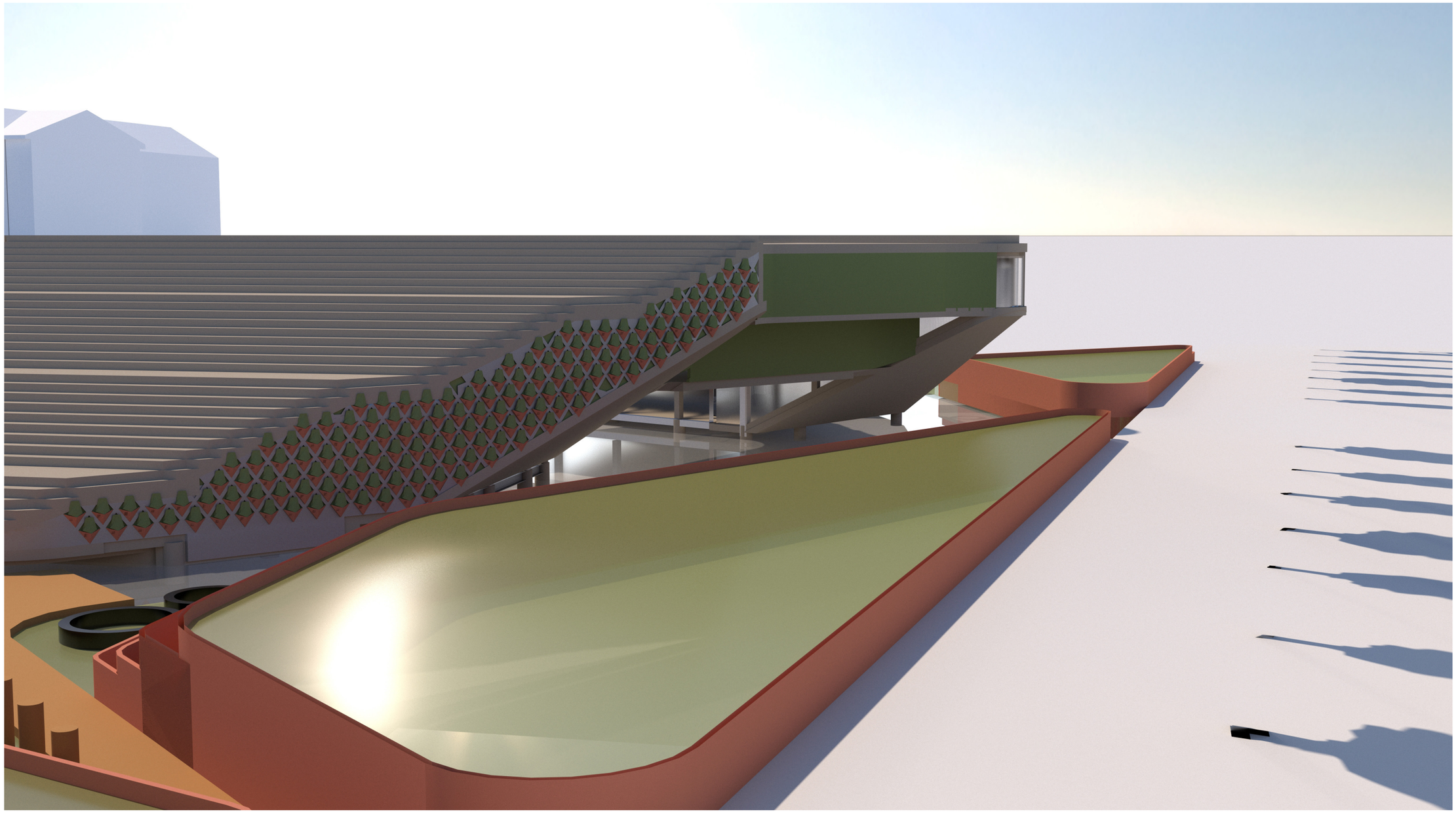
FACADE VIEW 1:200



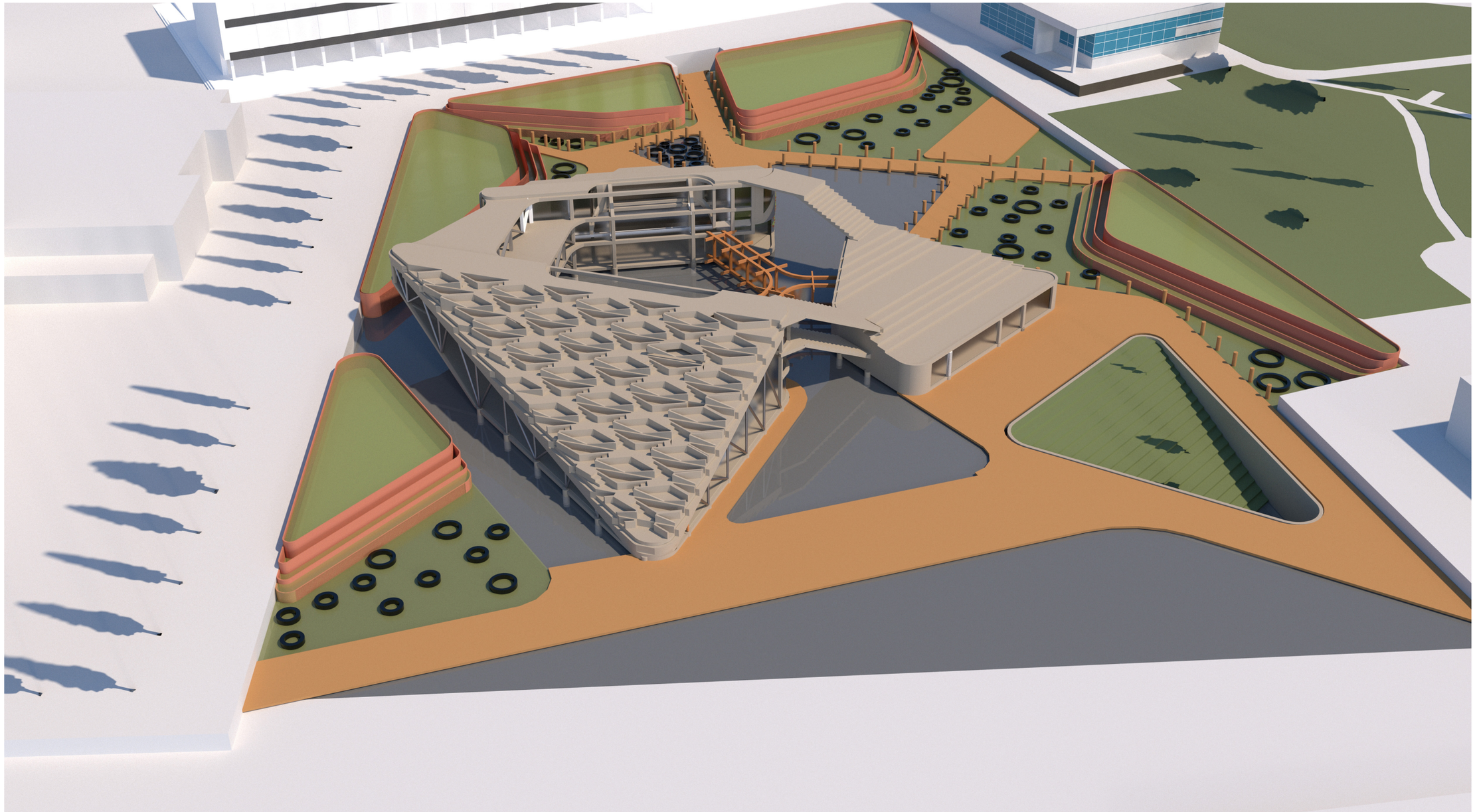
3D FACADE VIEW



3D FACADE VIEW

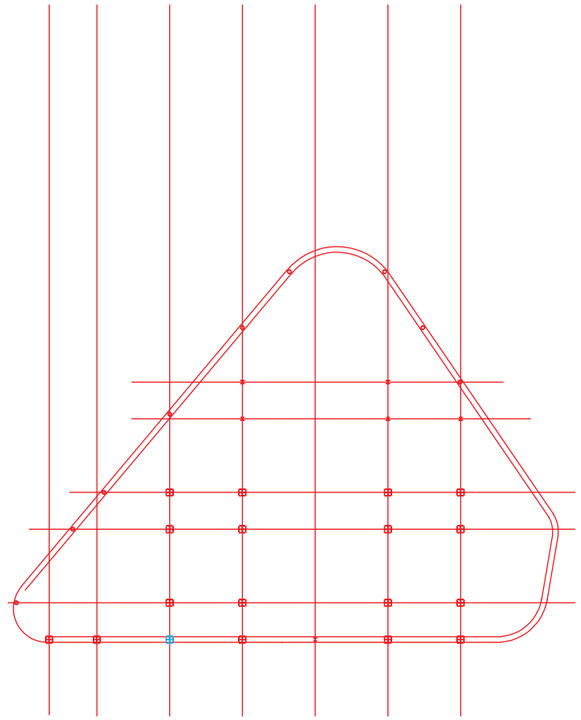


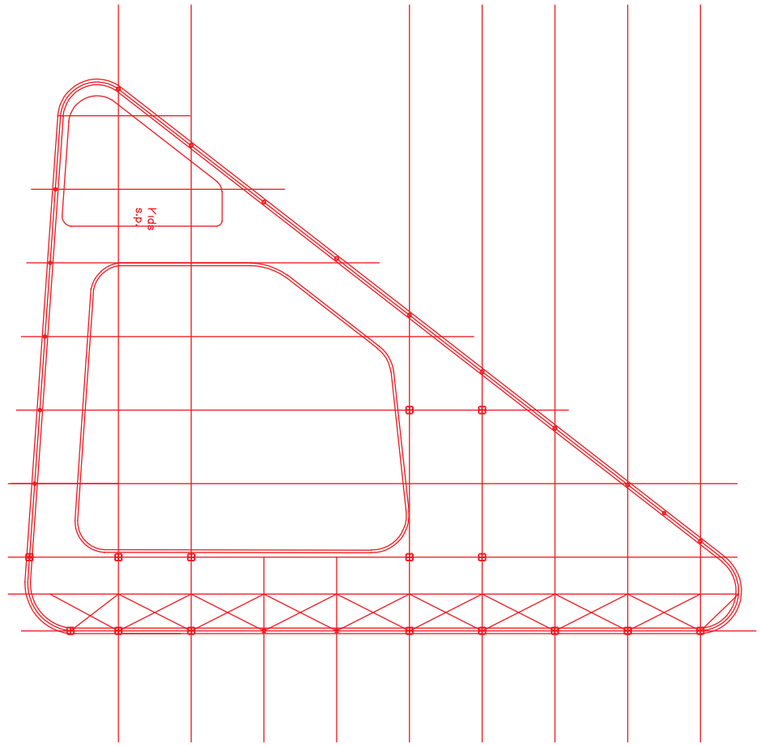
ROOF VIEW

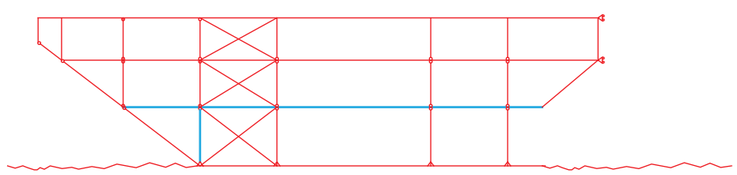


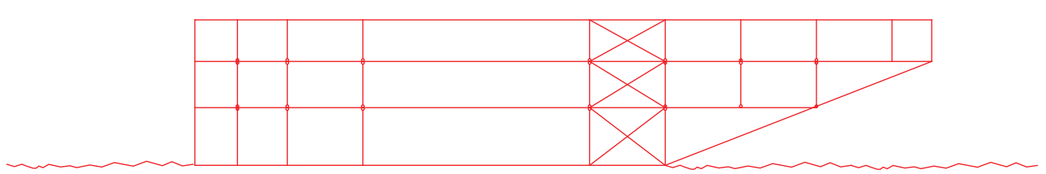
Building Technologies

STRUCTURE - Diagram



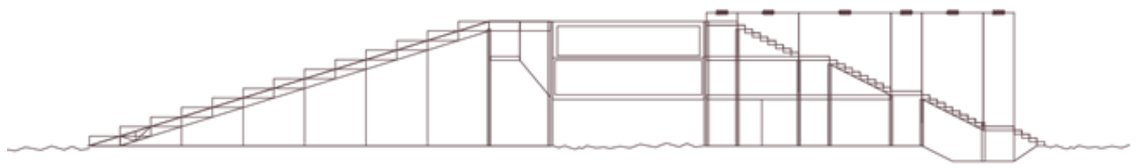




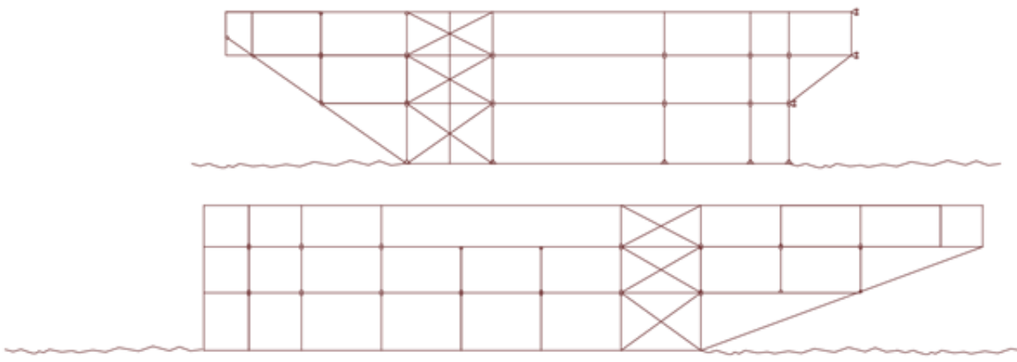


STRUCTURE - DIMENSION

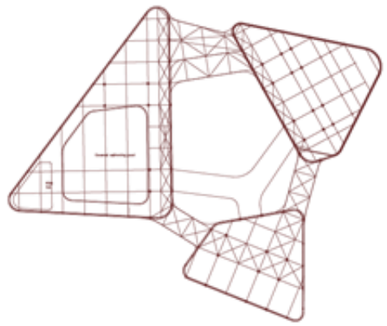
Doorsnede



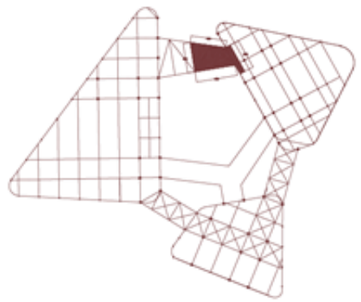
Statisch Schema



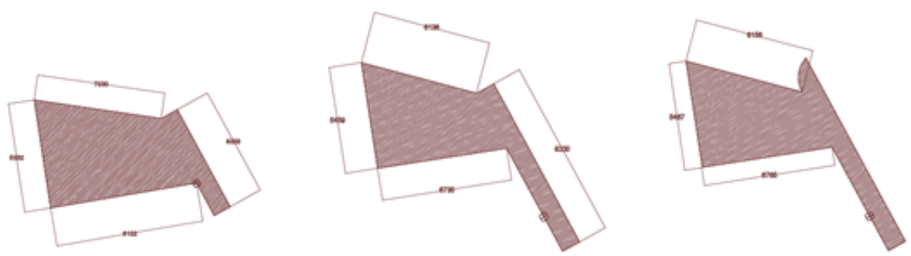
Schematische DC-plattegrond



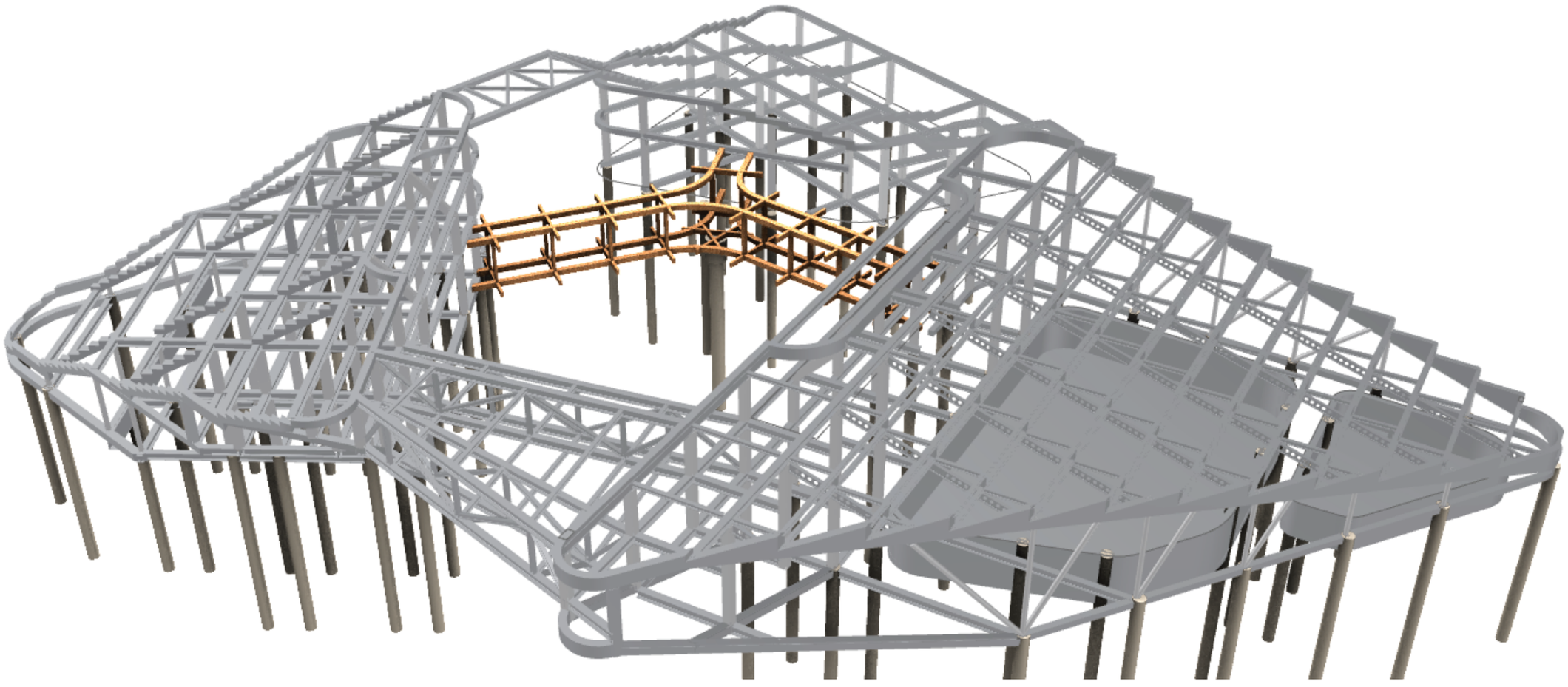
Eerste verdieping te dragen vloeroppervlakte



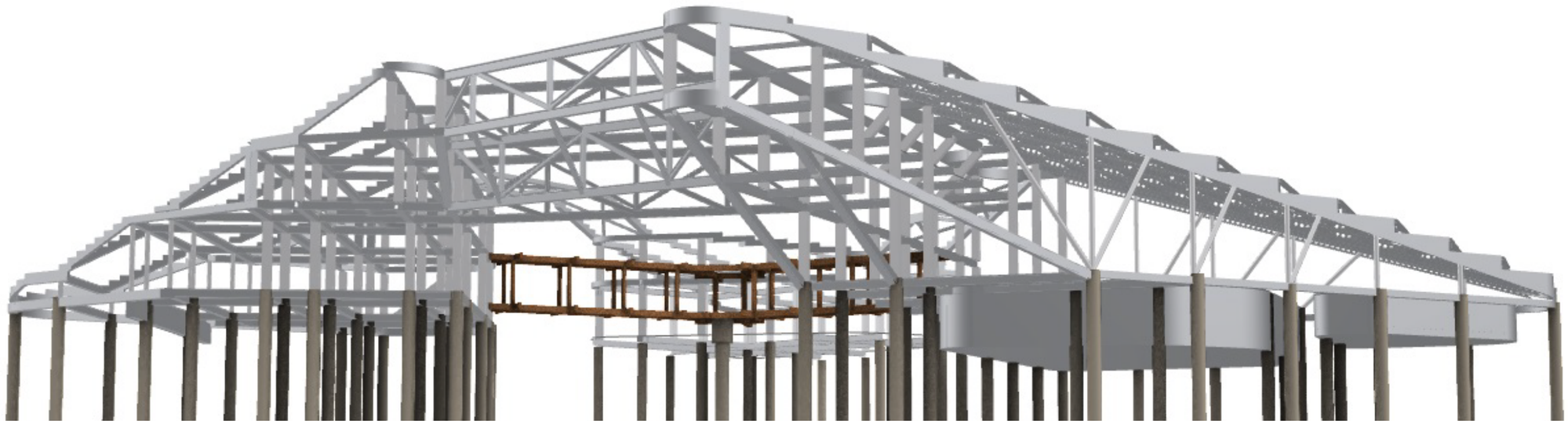
Te dragen vloeren voor kolom

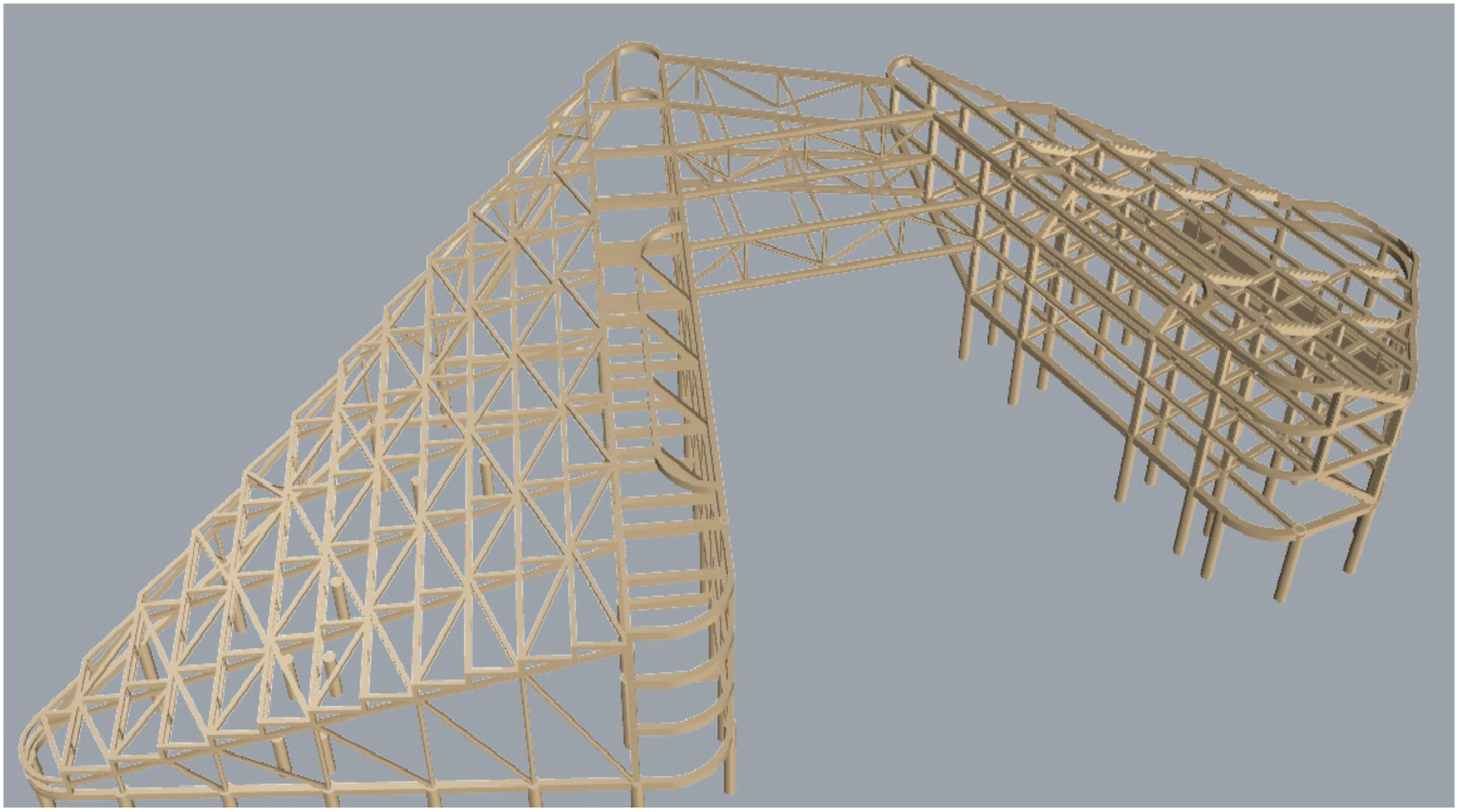


3D STRUCTURE

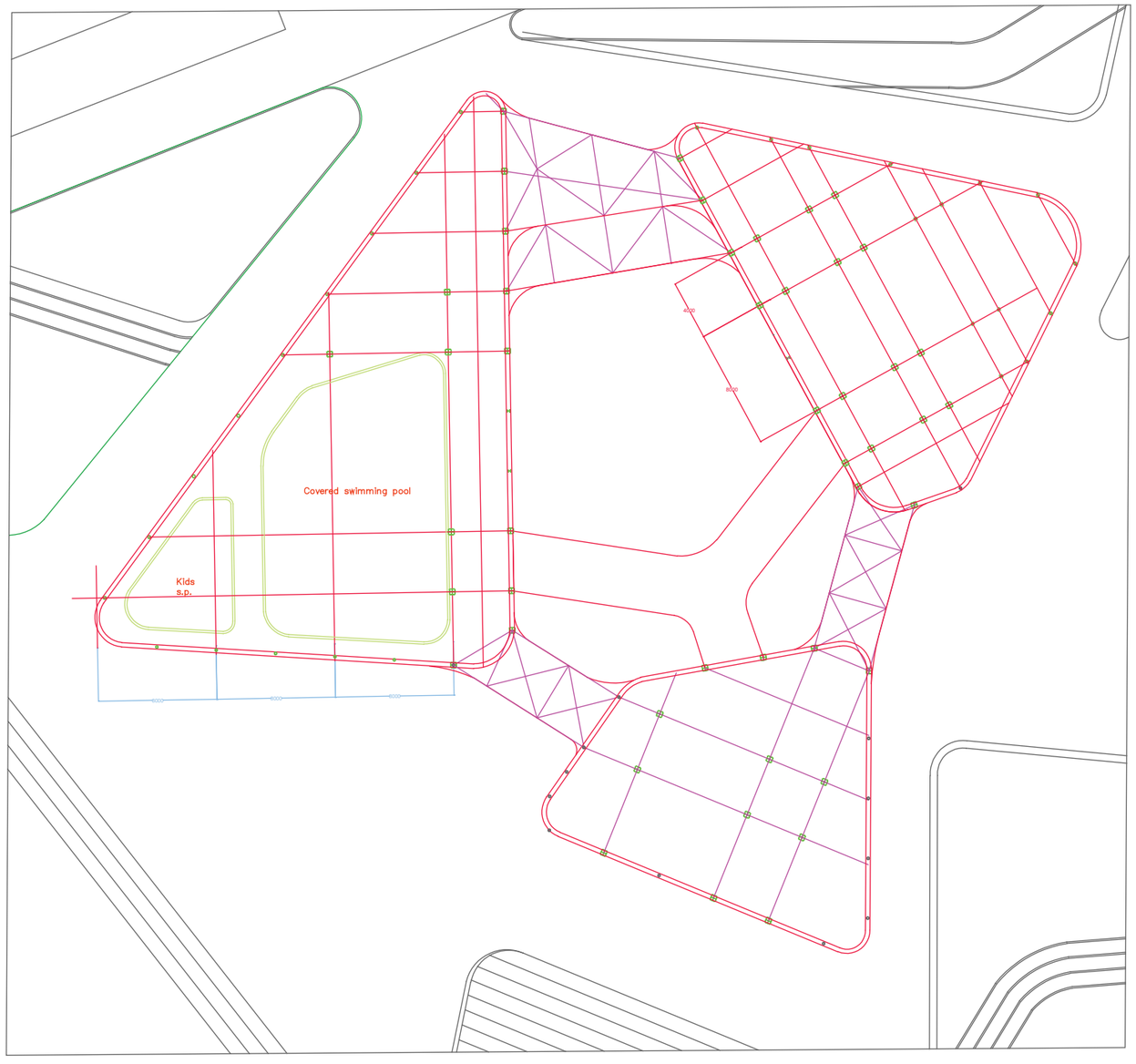


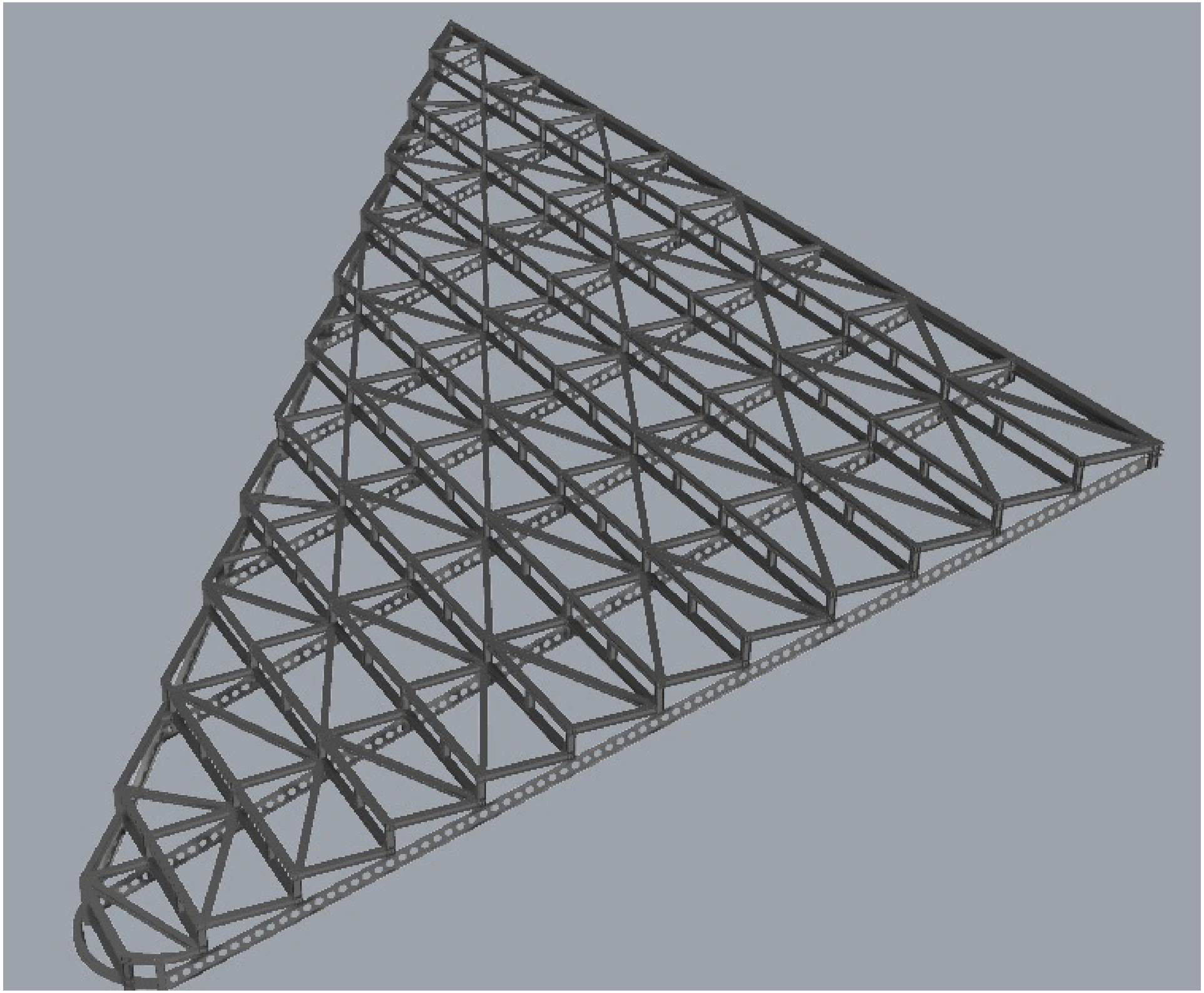
3D STRUCTURE

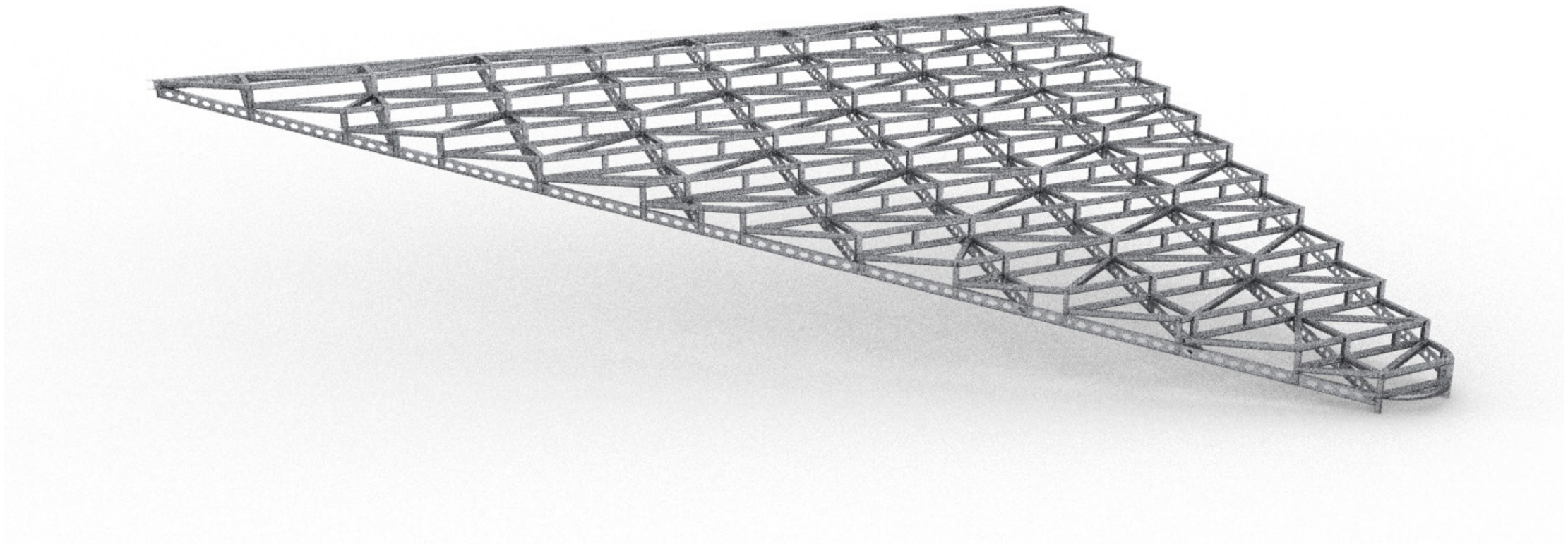


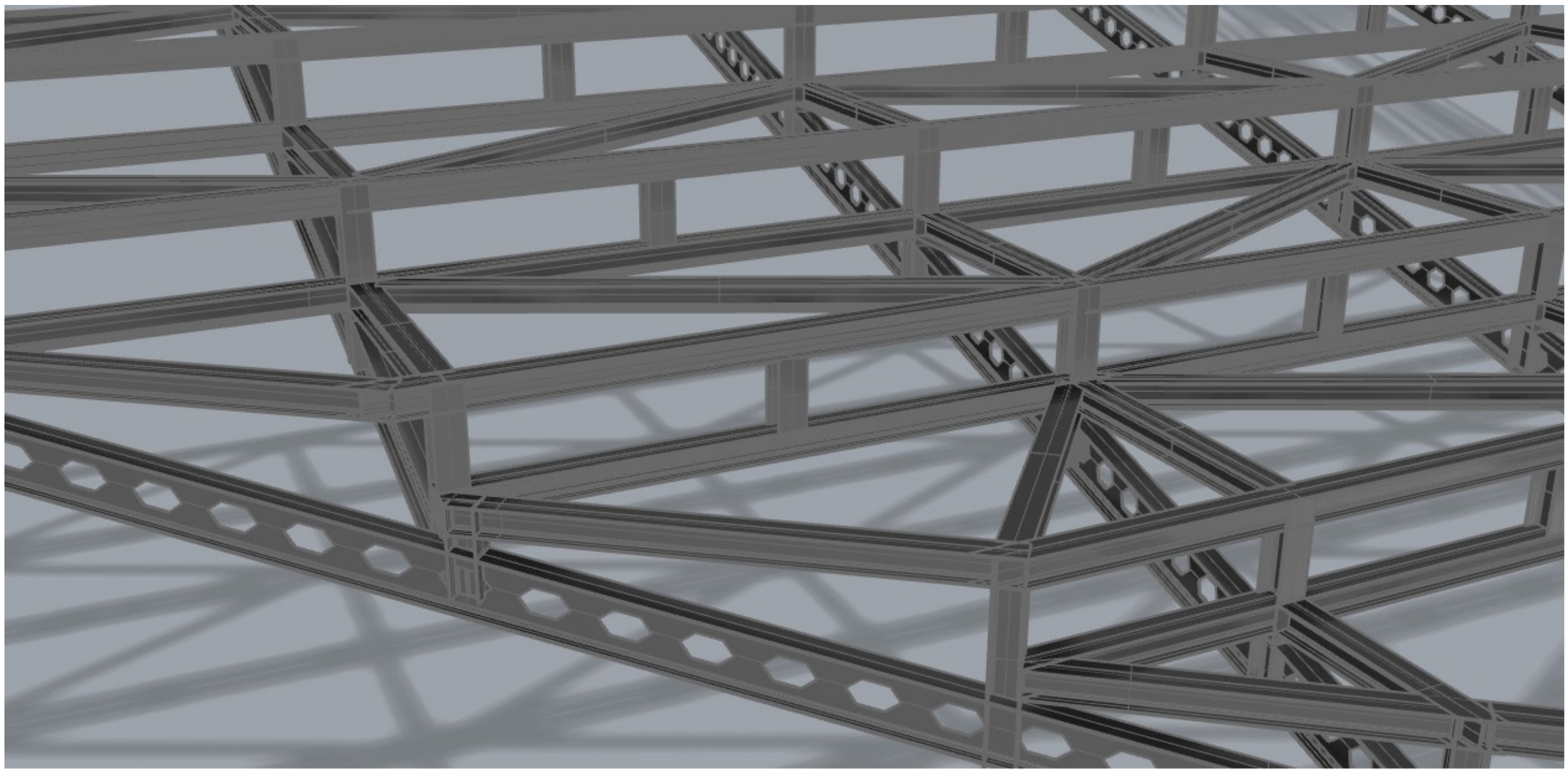


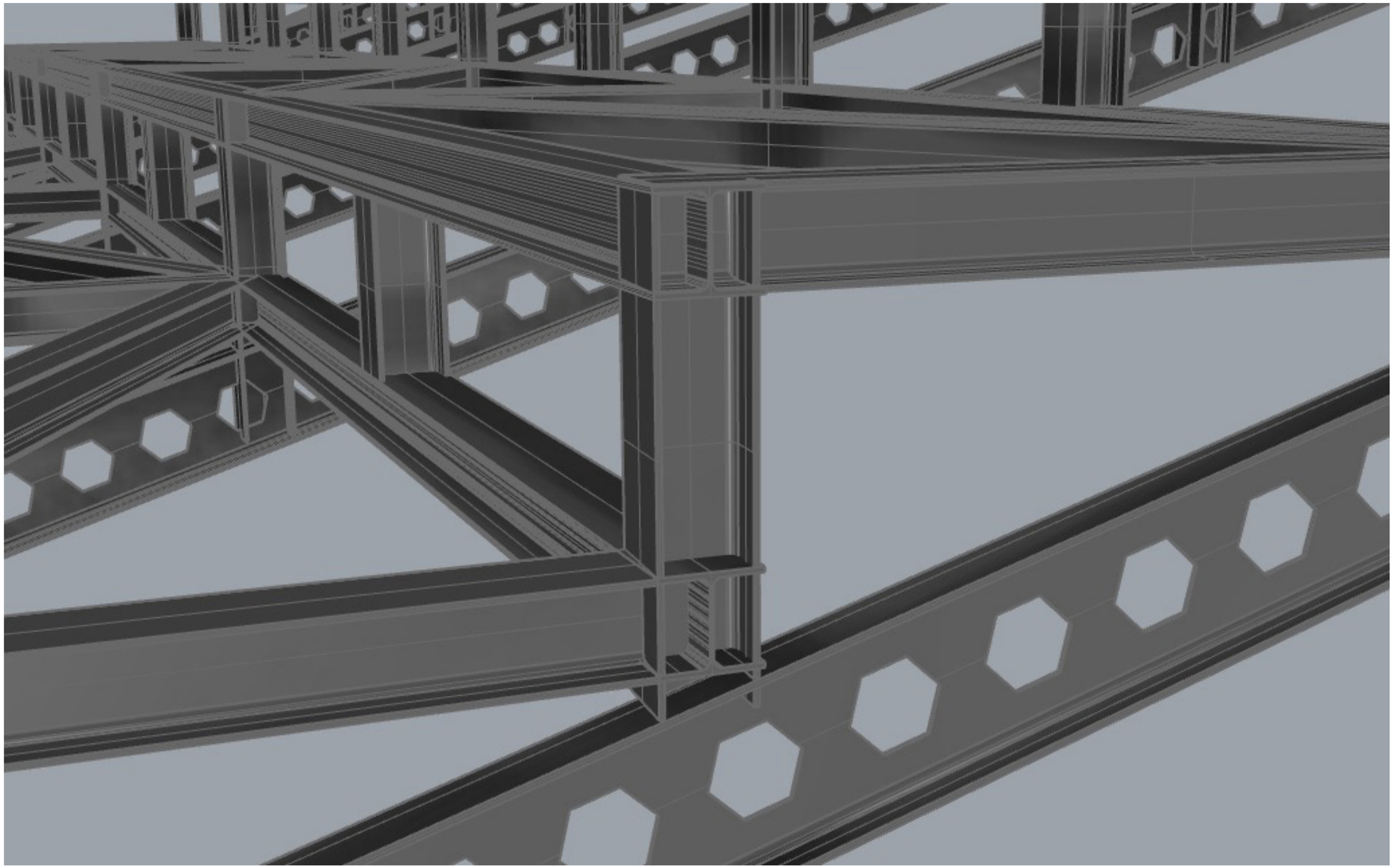
STRUCTURE - Grid

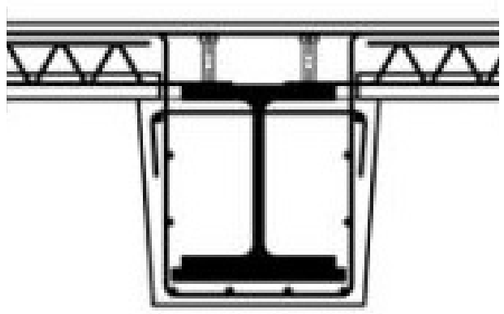




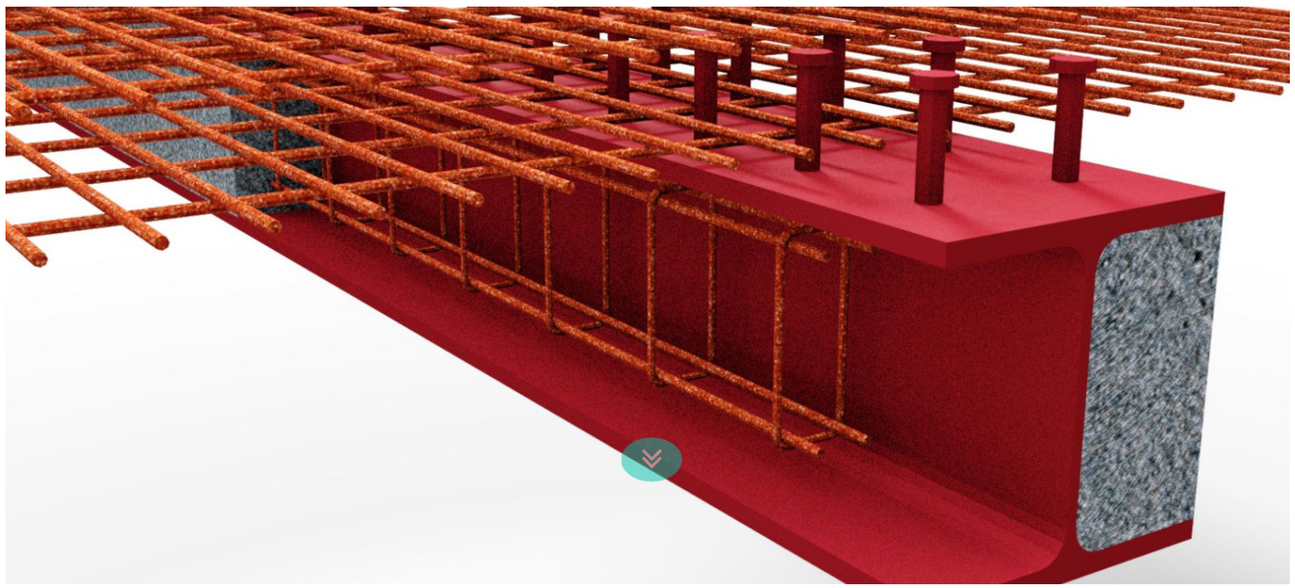


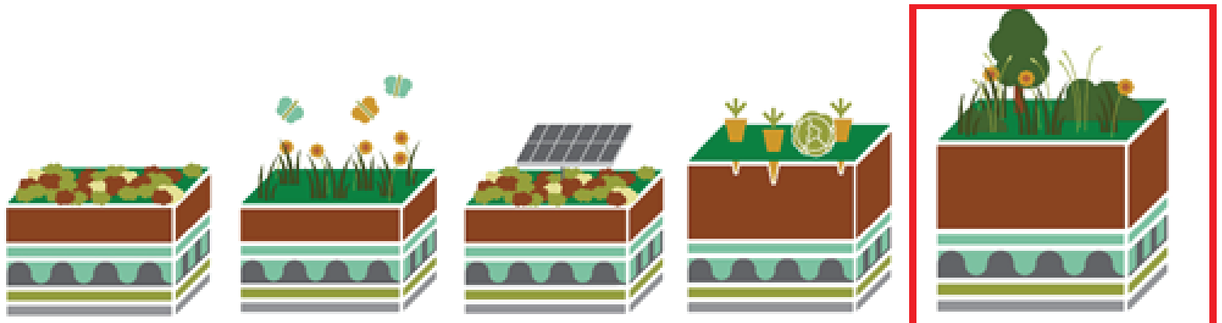




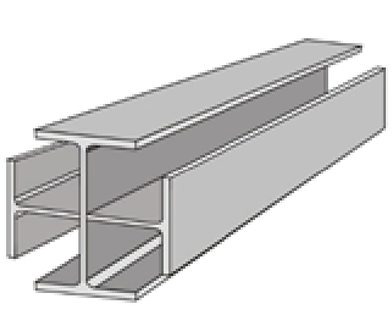


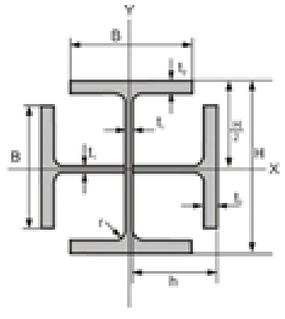
Precast incased steel beam filigree slab (No support needed duringe construction)





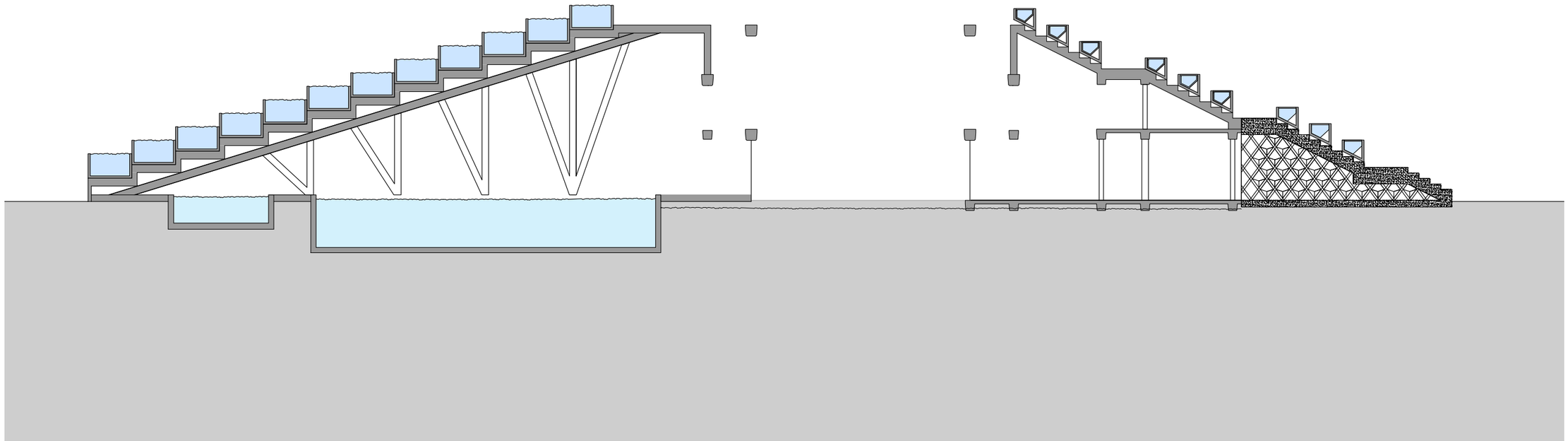
	EXTENSIEF GROENDAK	BIODIVERSITEITS DAK	SOLAR SEDUM	GROENTEDAK	INTENSIEF GROENDAK
Gewicht	70-110kg/m^2	100 - 140 kg/m^2	120 - 140 kg/m^2	150 - 600 kg/m^2	> 200 kg/m^2
Dikte	60 - 120 mm	80 - 150 mm	60 - 120 mm	120 - 500 mm	250 tot > 500 mm
Vegetatievorm	Sedumsoorten	Sedum, grassen & kruiden	Sedumsoorten	Groenten & tuinkruiden	Grassen, kruiden, struiken, bomen
Waterretentie	ca. 30%	30 à 50%	ca. 30%	60 - 95%	> 70%
Eco. waarde	+	+++	+	++	+++
Kostprijs	+	+	+++	+++	++++



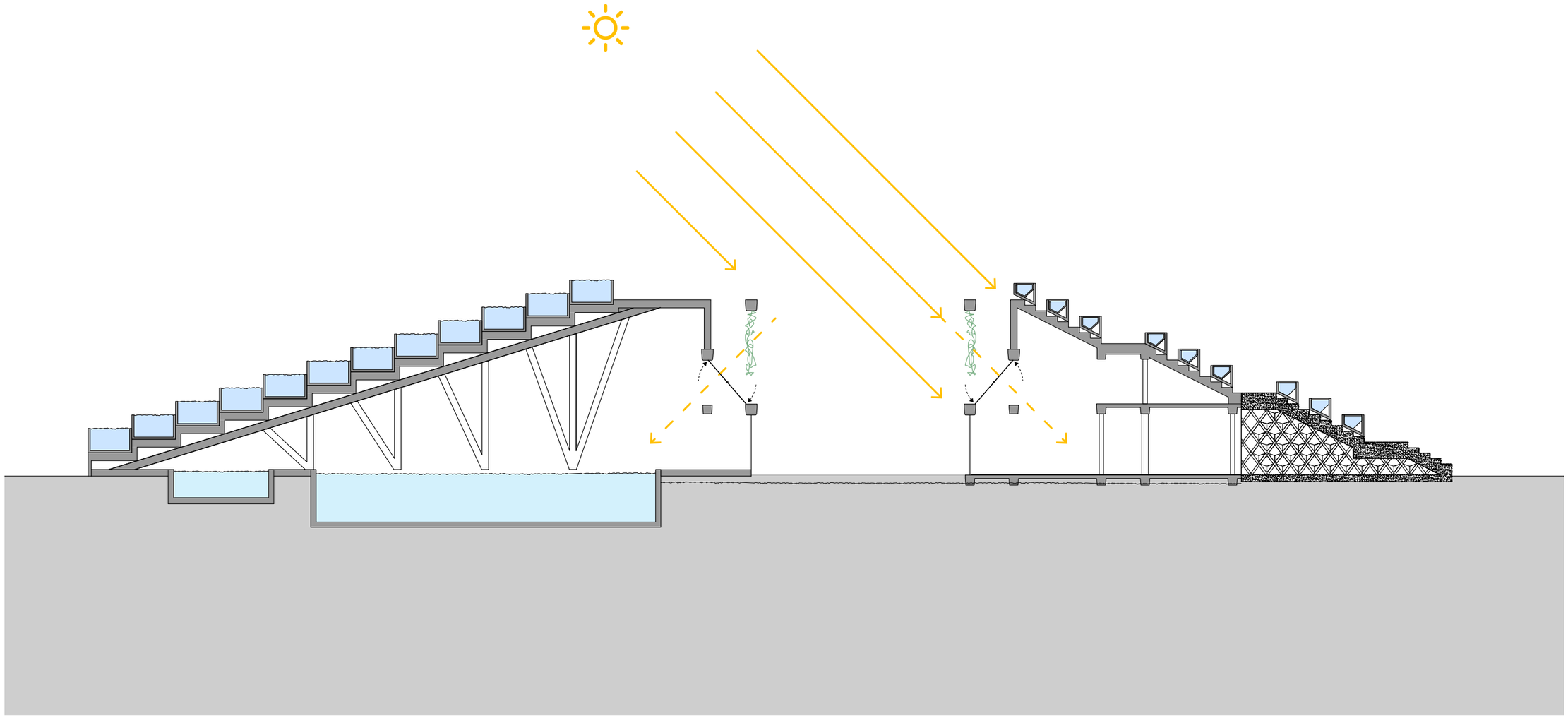


K 400 x 200	400	200	8	13	16	168.24	132.0	25,440	26,519	12.30	12.55	1,272.0	1,299.9

CLIMATE AND CW DESIGN

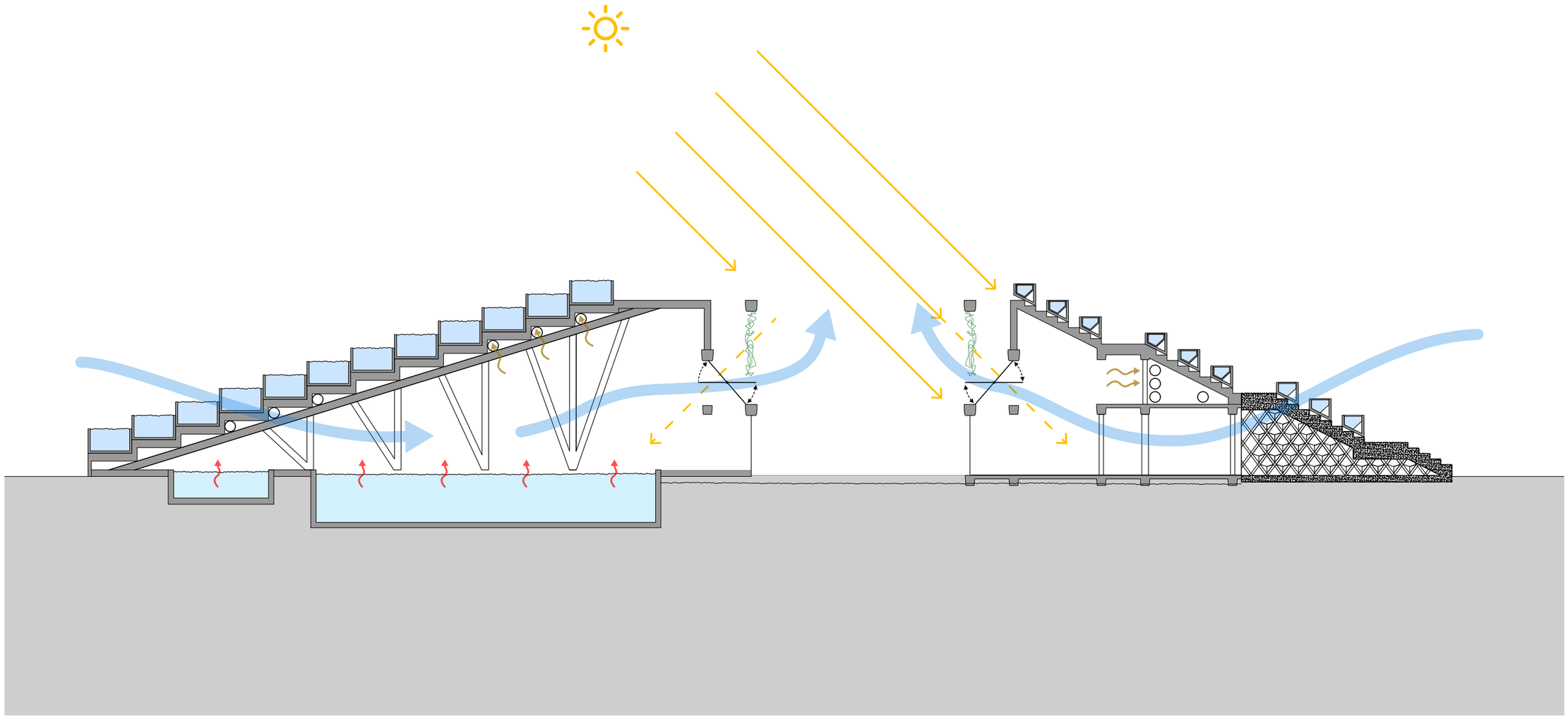


DAYLIGHT/ SUNSHADE



DAYLIGHT/ SUNSHADE

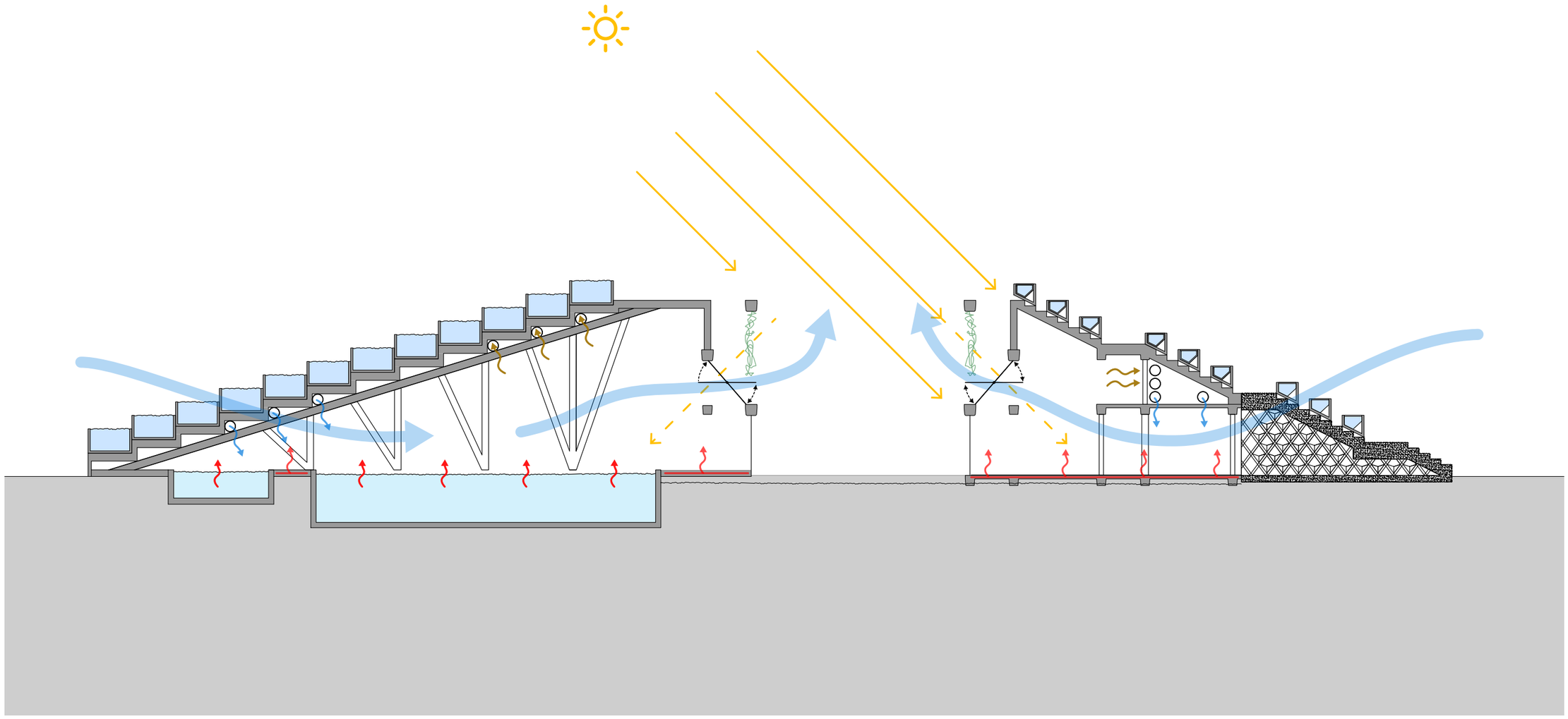
NATURAL VENTILATION (SUMMER) & MECHANICAL VENTILATION (WINTER)

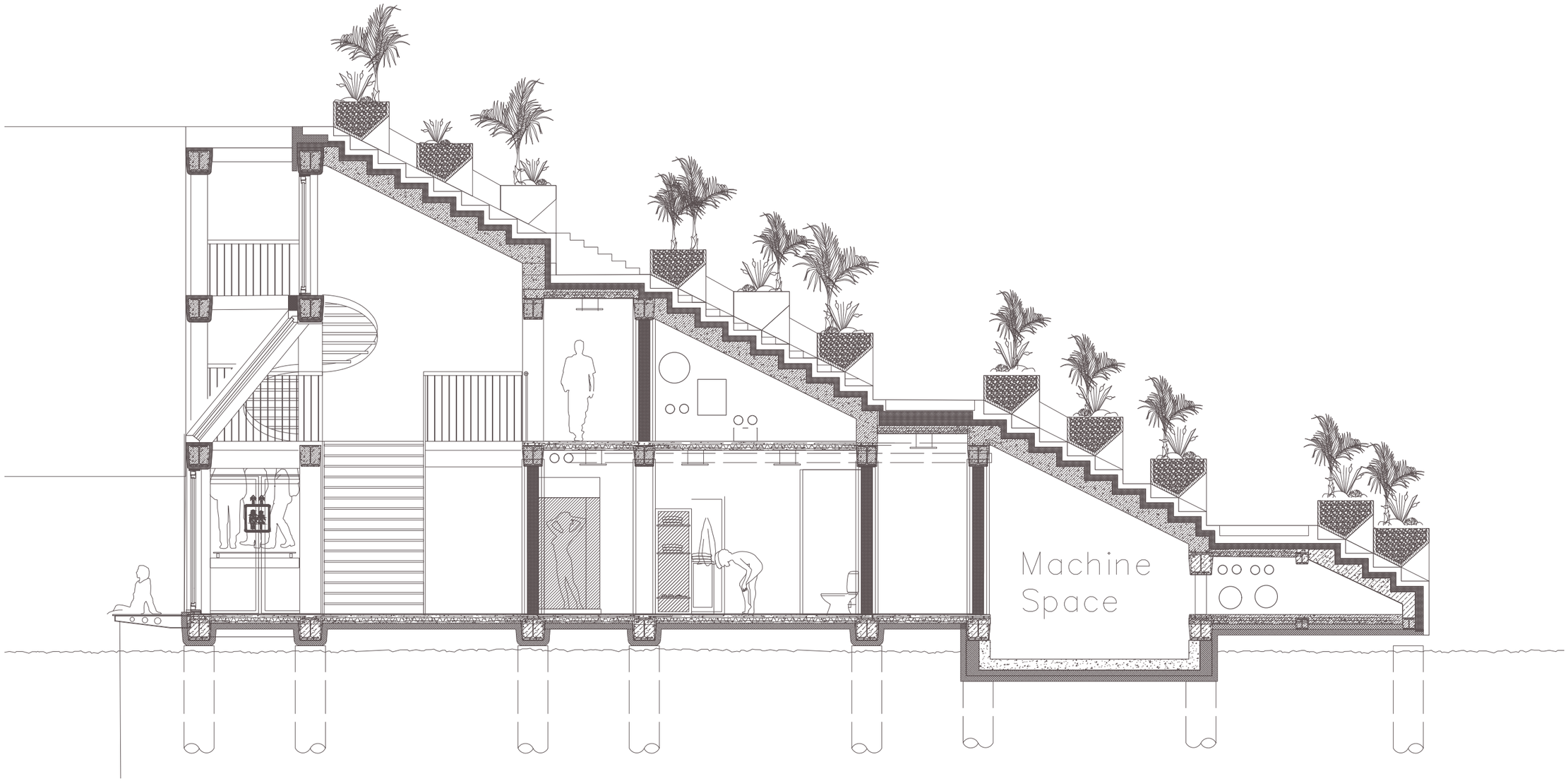


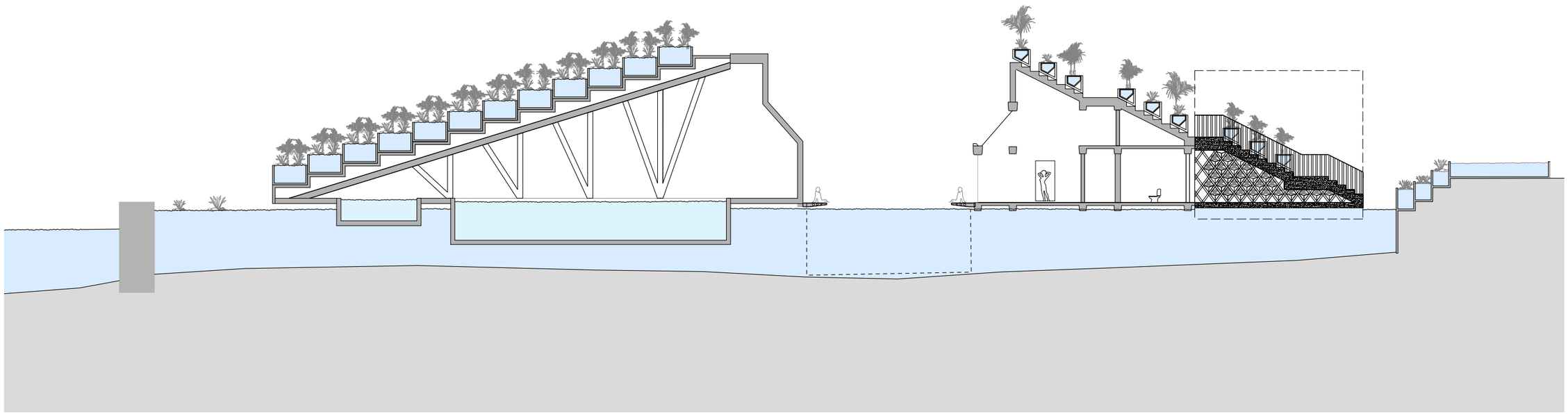
DAYLIGHT/ SUNSHADE

NATURAL VENTILATION (SUMMER) & MECHANICAL VENTILATION (WINTER)

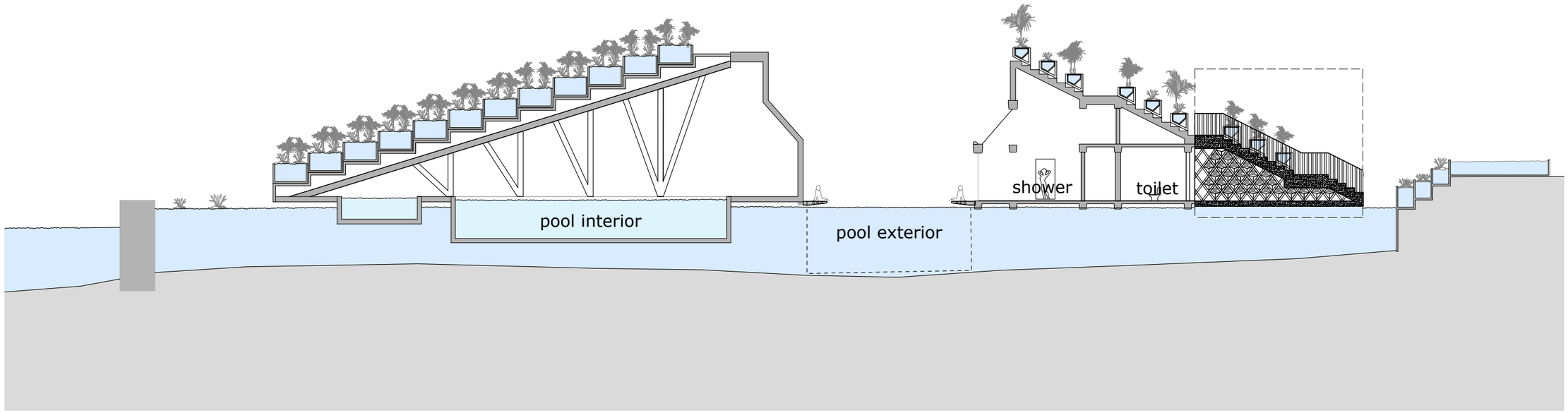
HEATING FLOW SYSTEM



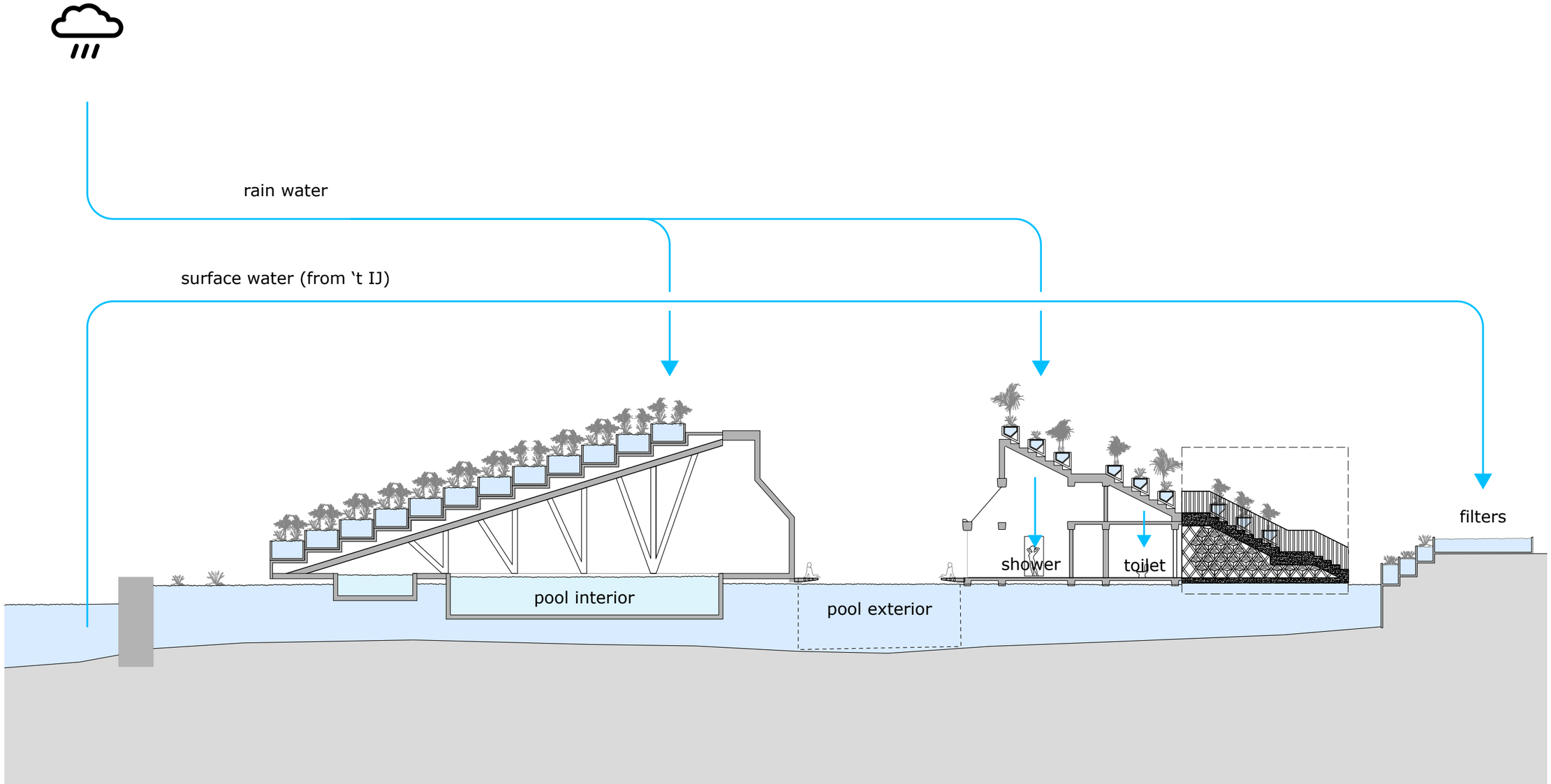

Machine
Space



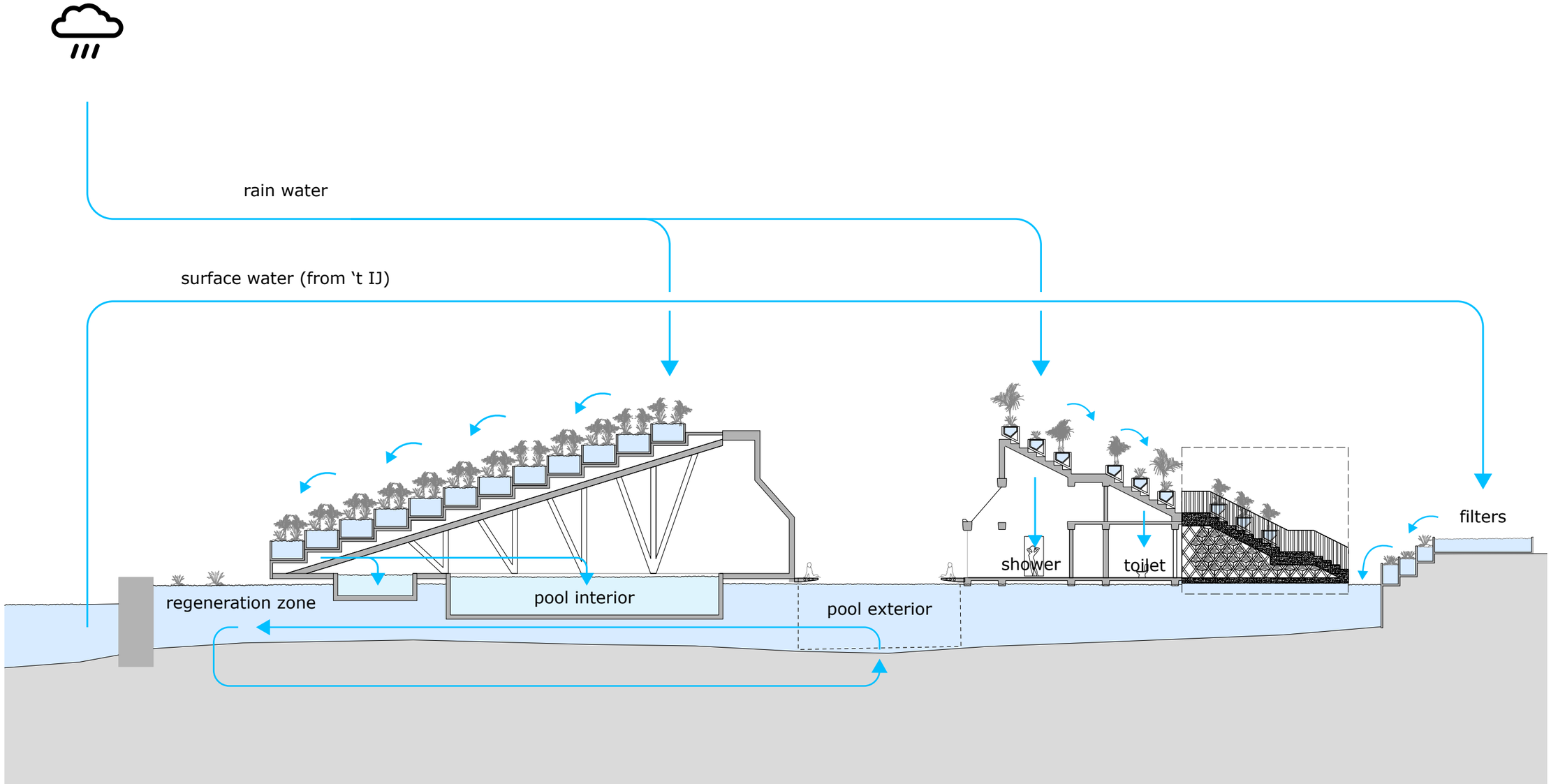
USE



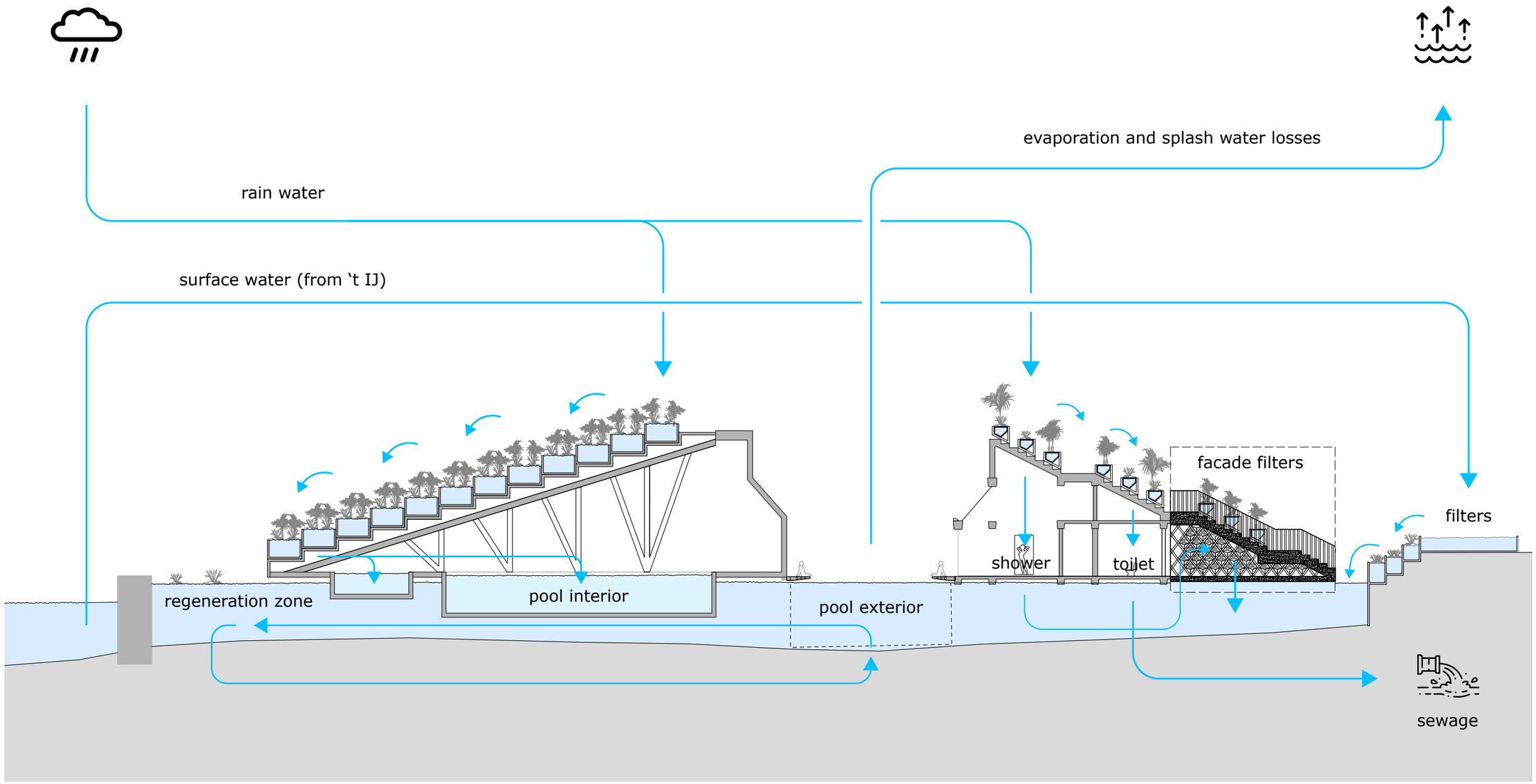
INFLOW → **USE**


rain water
surface water (from 't IJ)
pool interior
pool exterior
shower
toilet
filters

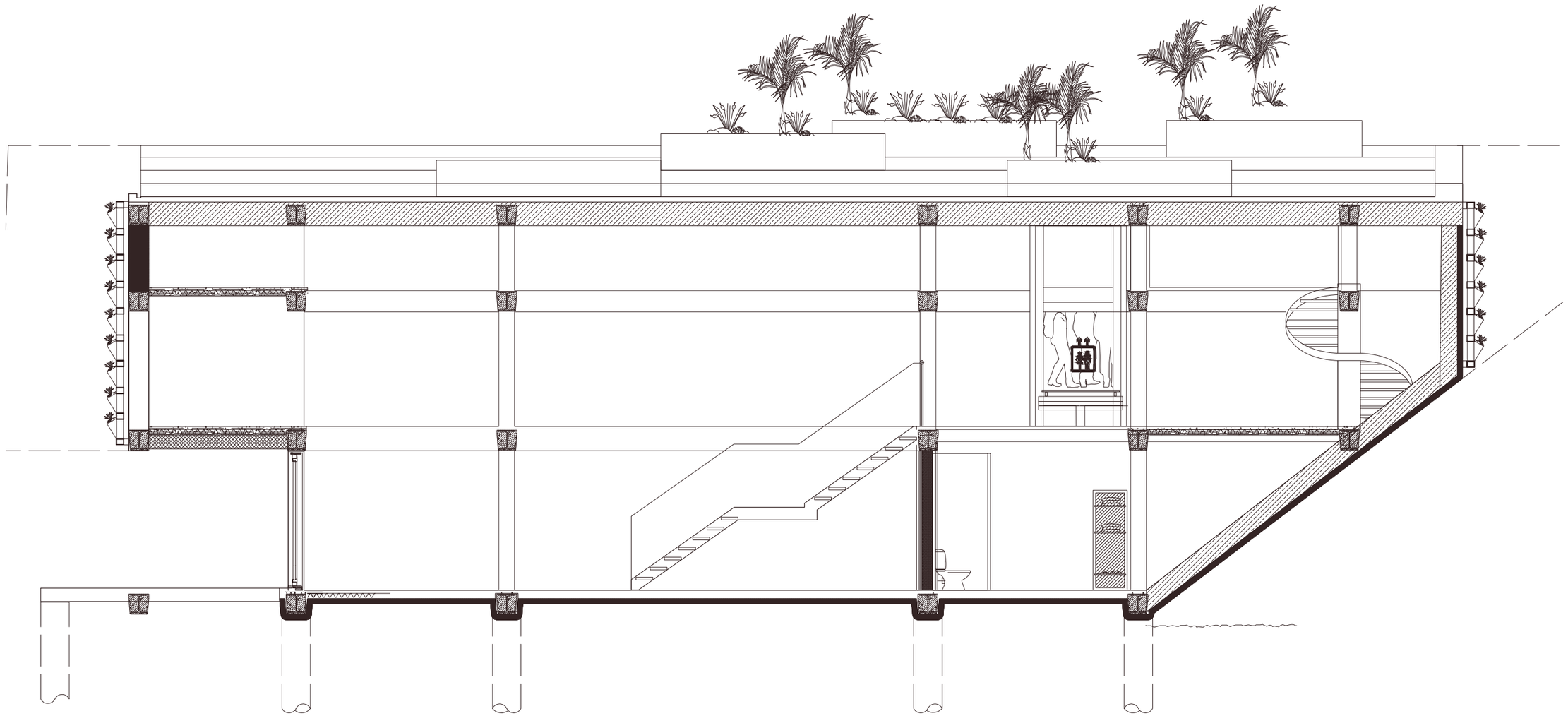
INFLOW AND FILTRATION → **USE**



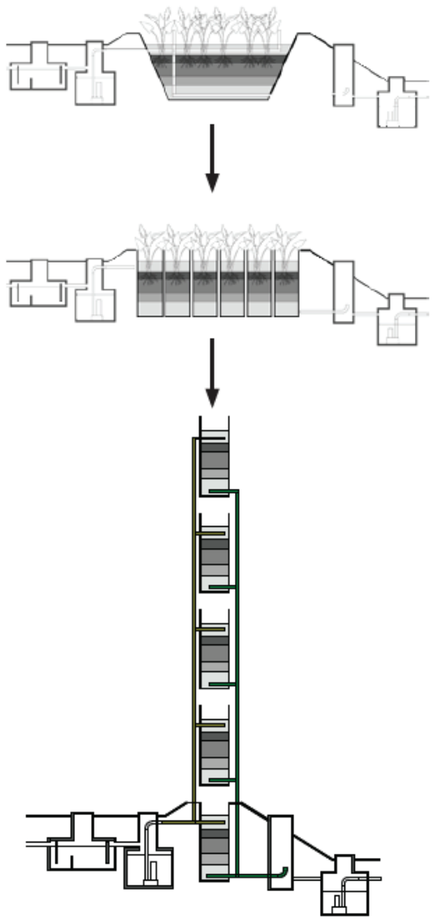
INFLOW AND FILTRATION → **USE** → **FILTRATION AND OUTFLOW**

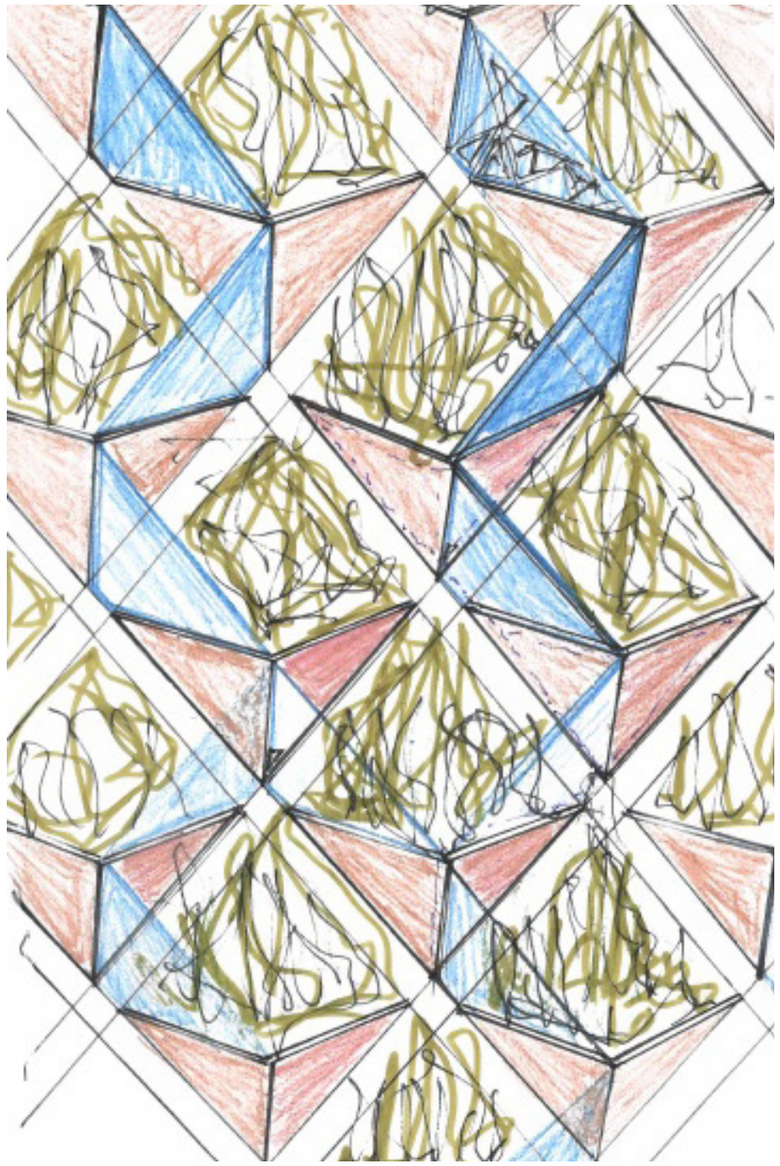


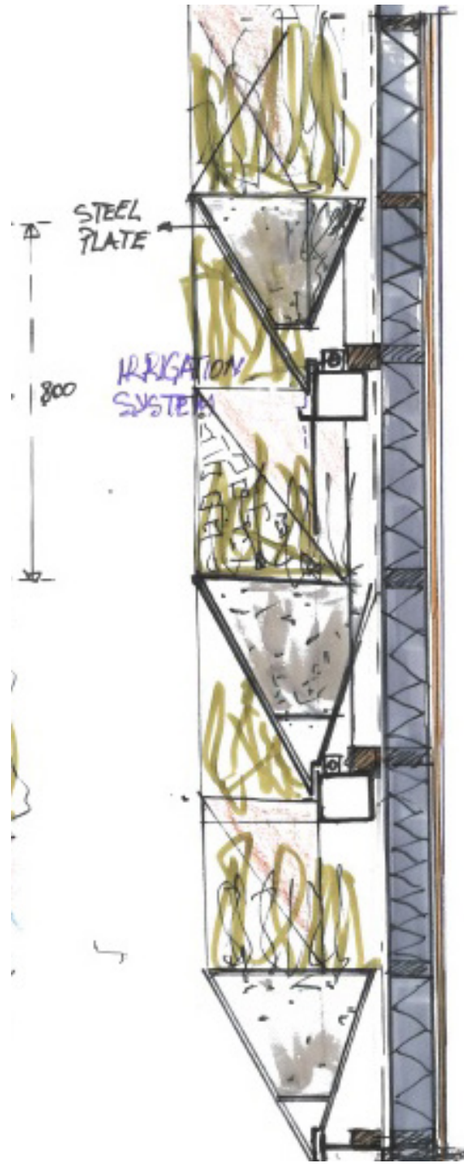
SECTION BB’



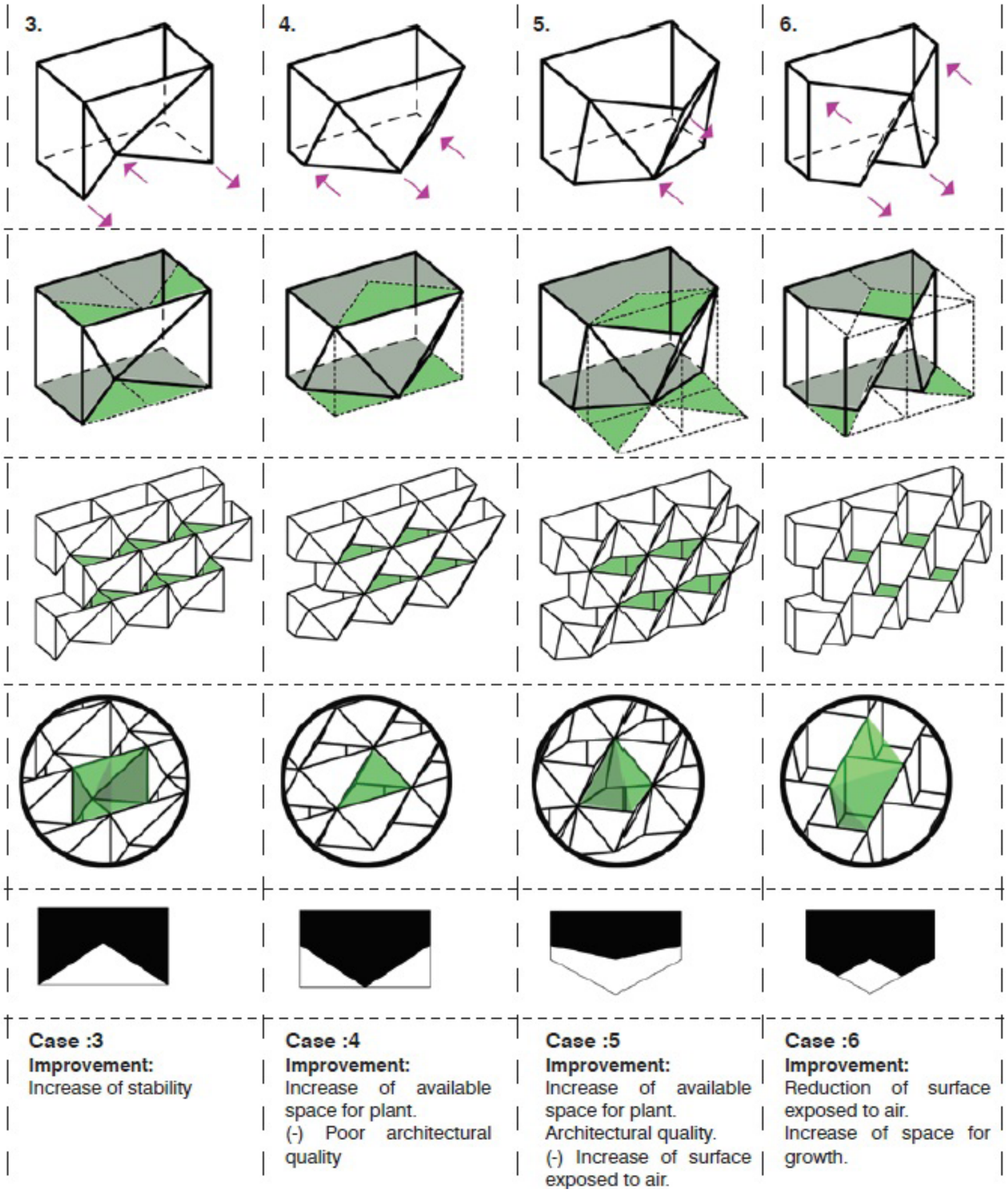
FACADE PRINCIPE







P. Sakkas 2012



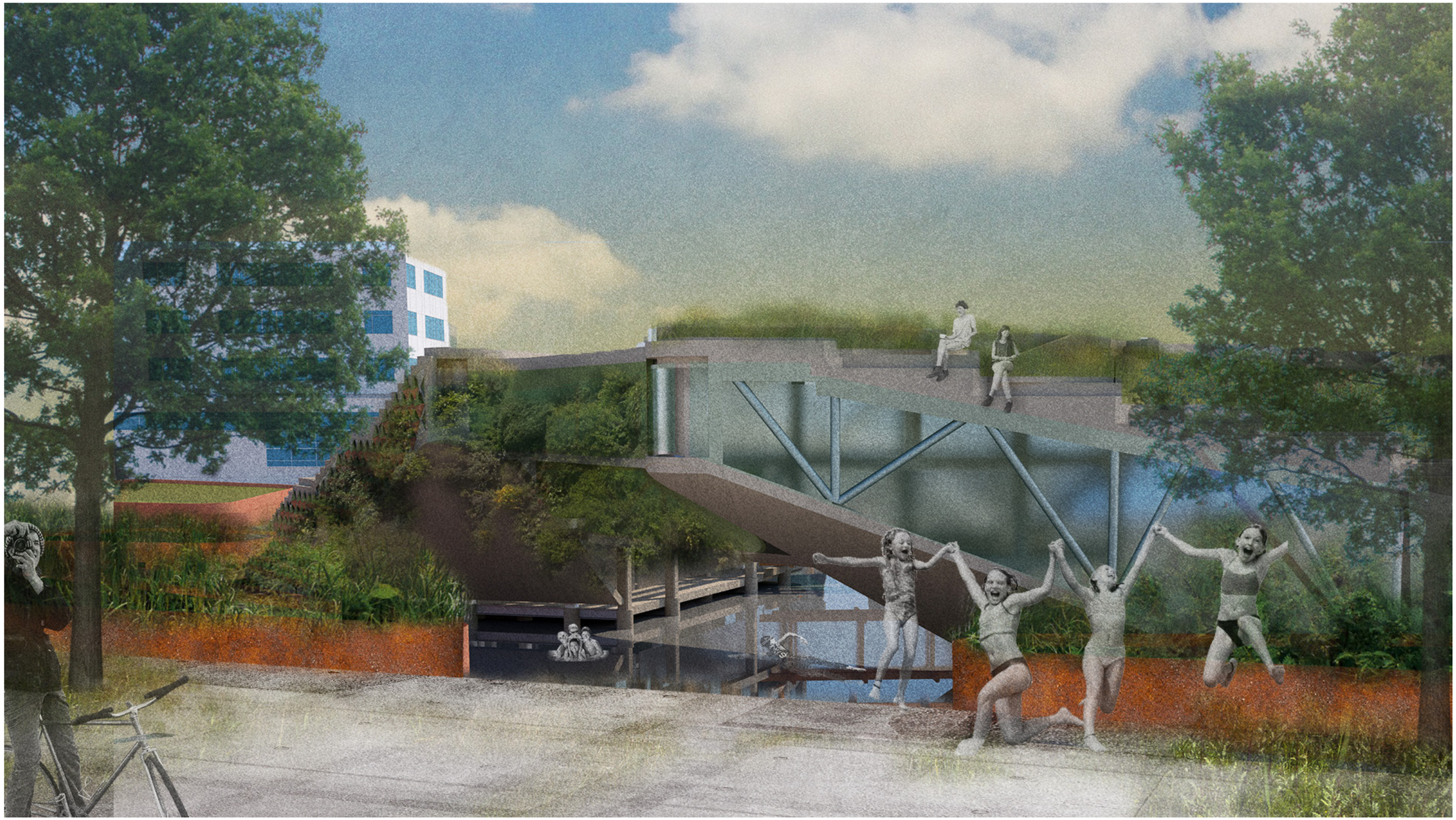
Case :3
Improvement:
Increase of stability

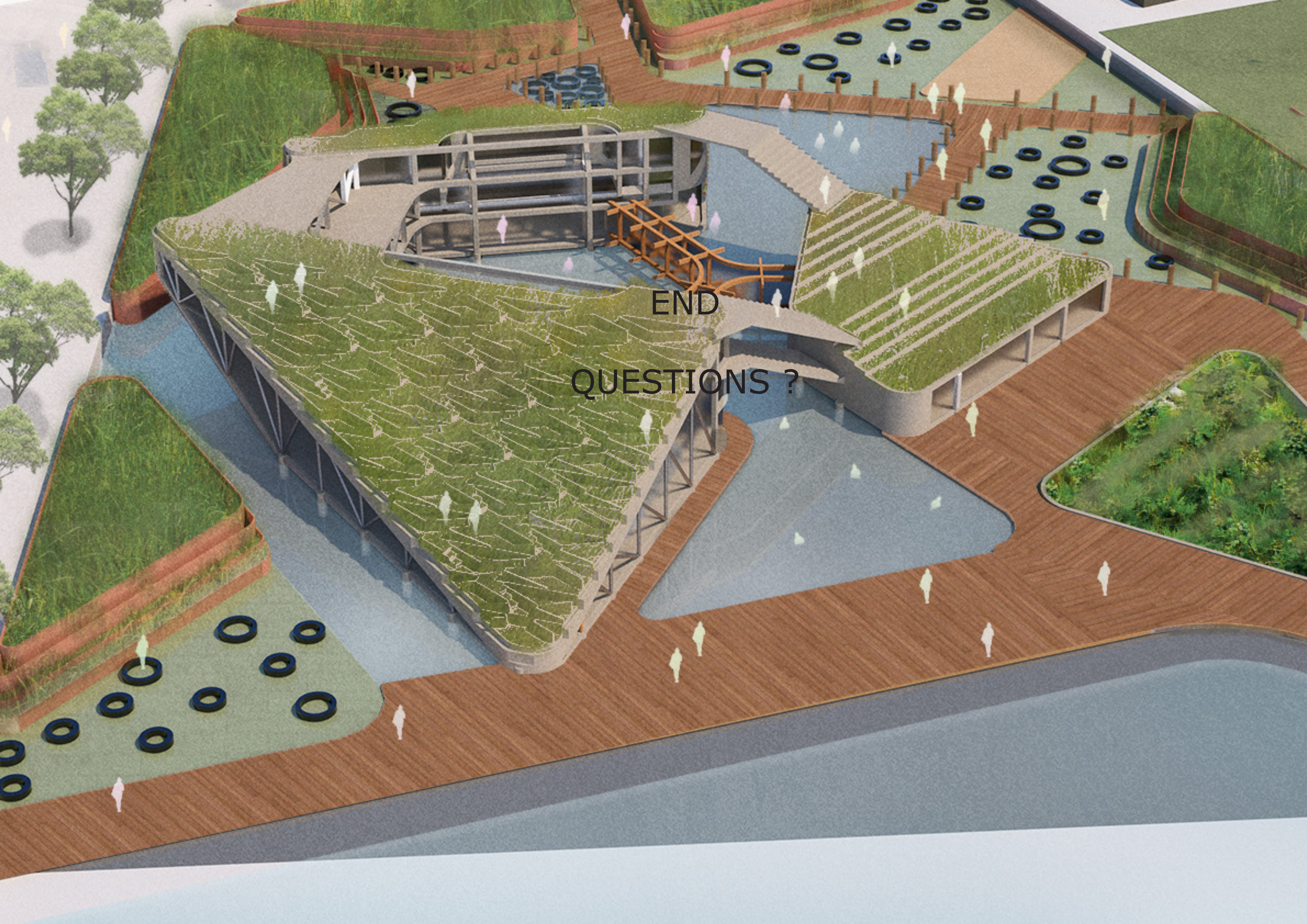
Case :4
Improvement:
Increase of available space for plant.
(-) Poor architectural quality

Case :5
Improvement:
Increase of available space for plant.
Architectural quality.
(-) Increase of surface exposed to air.

Case :6
Improvement:
Reduction of surface exposed to air.
Increase of space for growth.

Design / material




END
QUESTIONS ?

LITERATURE

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