



OUT OF THE ASH:

Exploring New Material Agendas in Architecture and Landscape

MSc Architecture, Urbanism and Building Sciences
Cross Domain City of the Future Graduation Studio
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OUT OF THE ASH:

Exploring New Material Agendas in Architecture and Landscape

00 Opening

Project title

01 Introduction

The Illusion of Away

waste flow diagram / wastescape diagram / Dutch waste metabolism

02 Problem Statement

From Waste to Residue

incinerator map / bottom ash volume comparison / Delft scenario

03 Research Position

Ash as a Material Logic

research question / theoretical framework / project thesis diagram

04 Site Analysis

Het Groene Schip as Artificial Ground

location map / site photos / ash transport diagram / mound section

05 Design Strategy

Material Afterlife

sorting sequence / process diagram / user-function diagram / material catalogue

06 Landscape Strategy

Operational Landscape & Pavilions

masterplan / logistics route / visitor route / parcels

07 Architectural Strategy

The Approach

floor plans / program zoning / sections

08 Public Experience

Routes of Observation

elevator sequence / visitor route section / moving observation room / landscape connection

09 Technical Integration

System section

HVAC / water filtration / environmental approach

10 Conclusion

Ash to ash, dust to dust, fade to black

closing statement

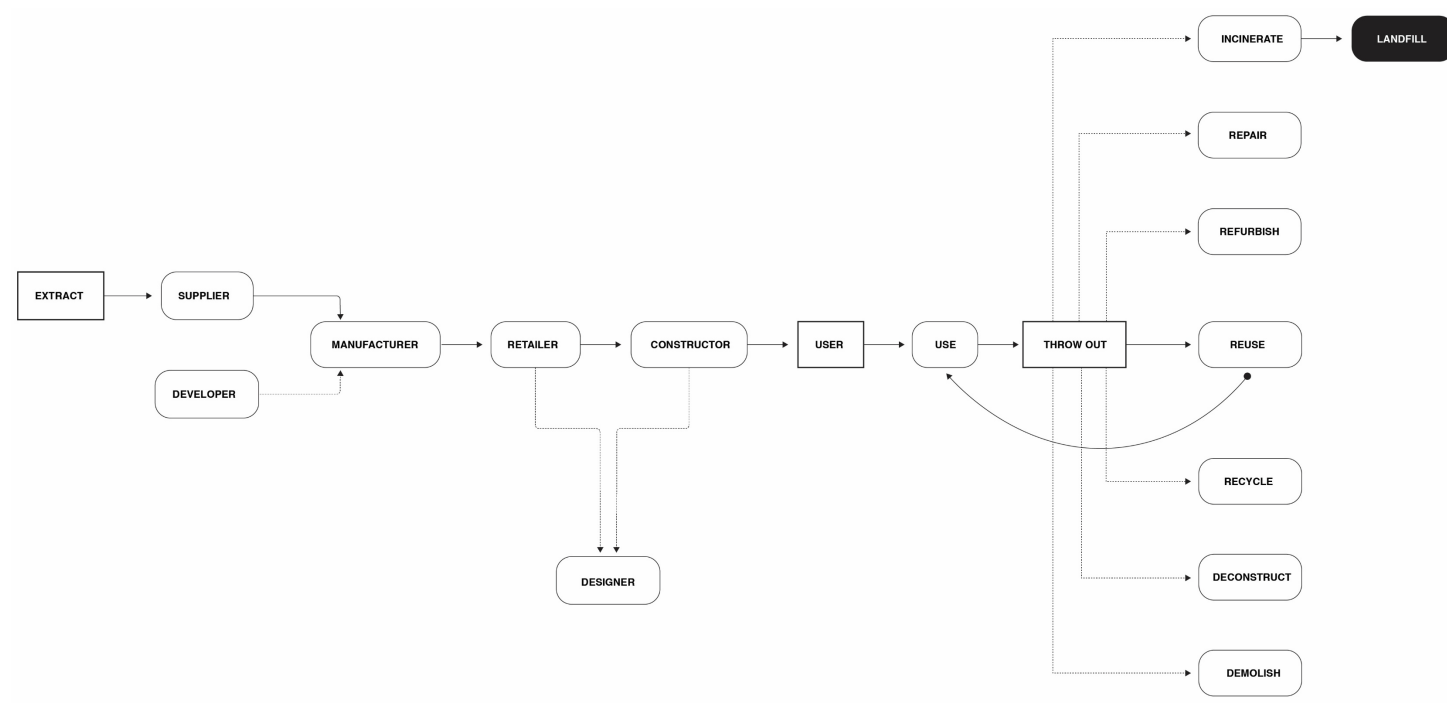
11 What is next?

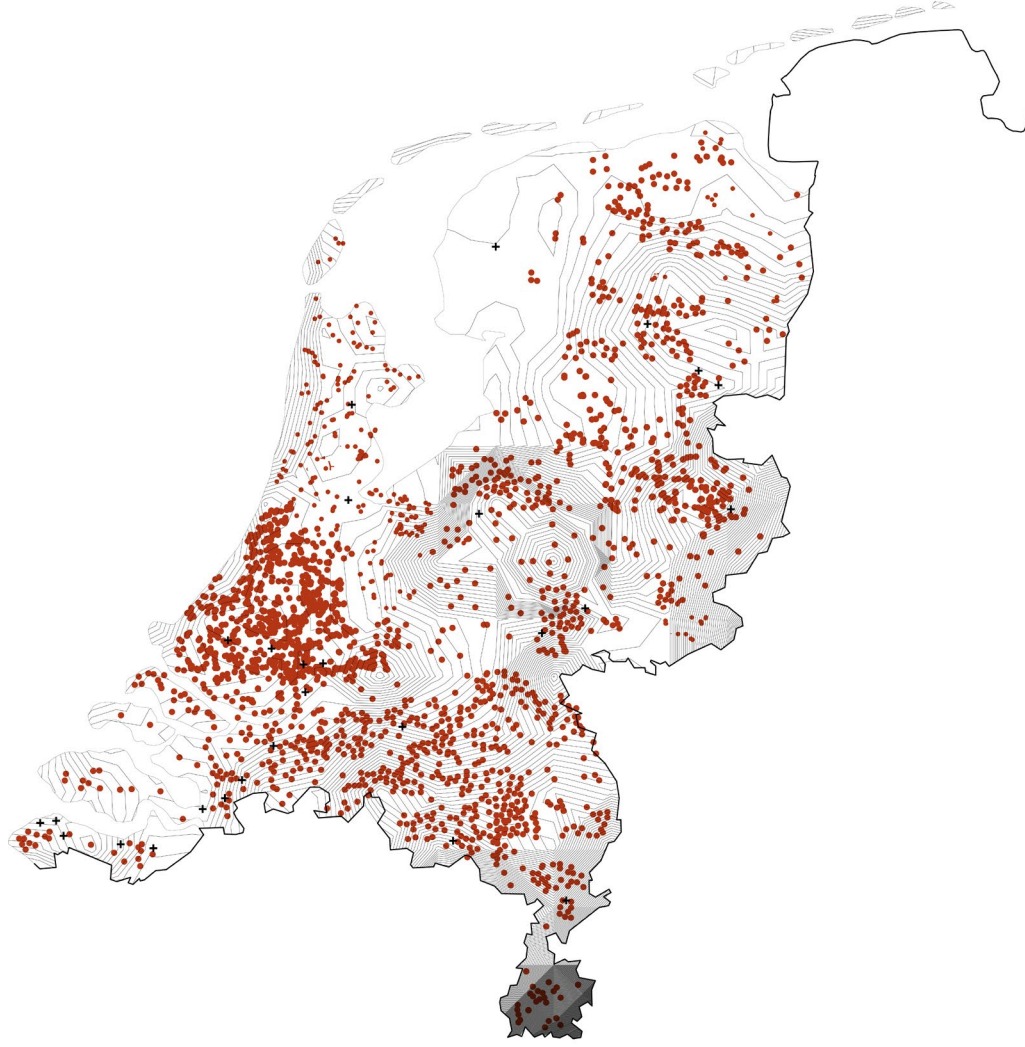
Keeping the circle small / neighborhood incinerators

Produce, consume and throw out.

We throw things away because they disappear for us.

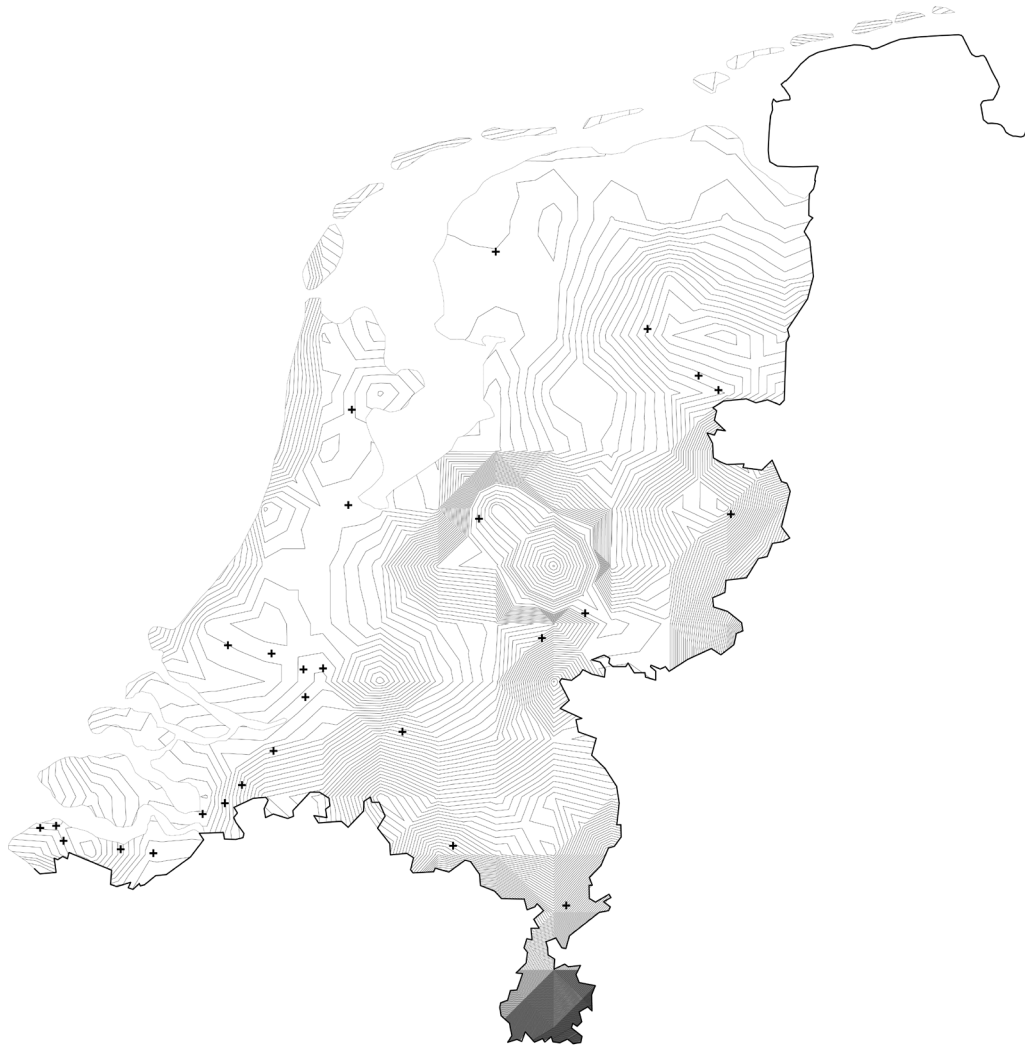
We throw things away because disappearance feels immediate.



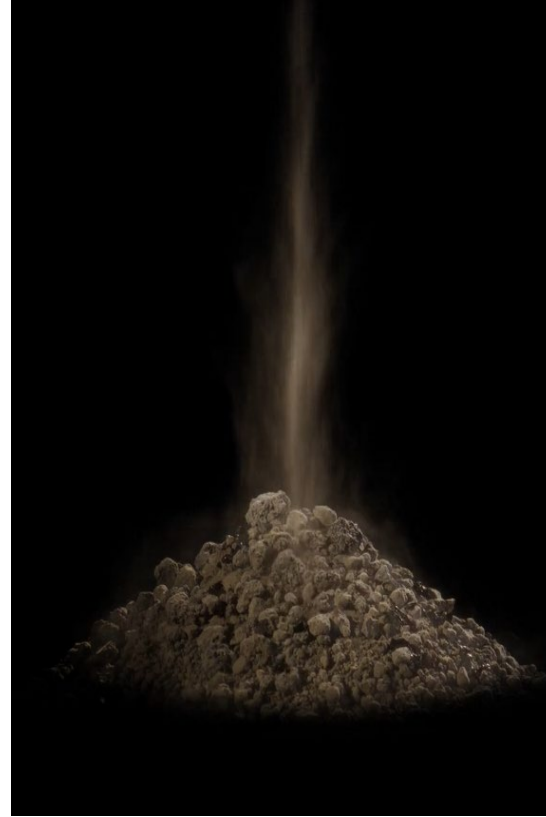


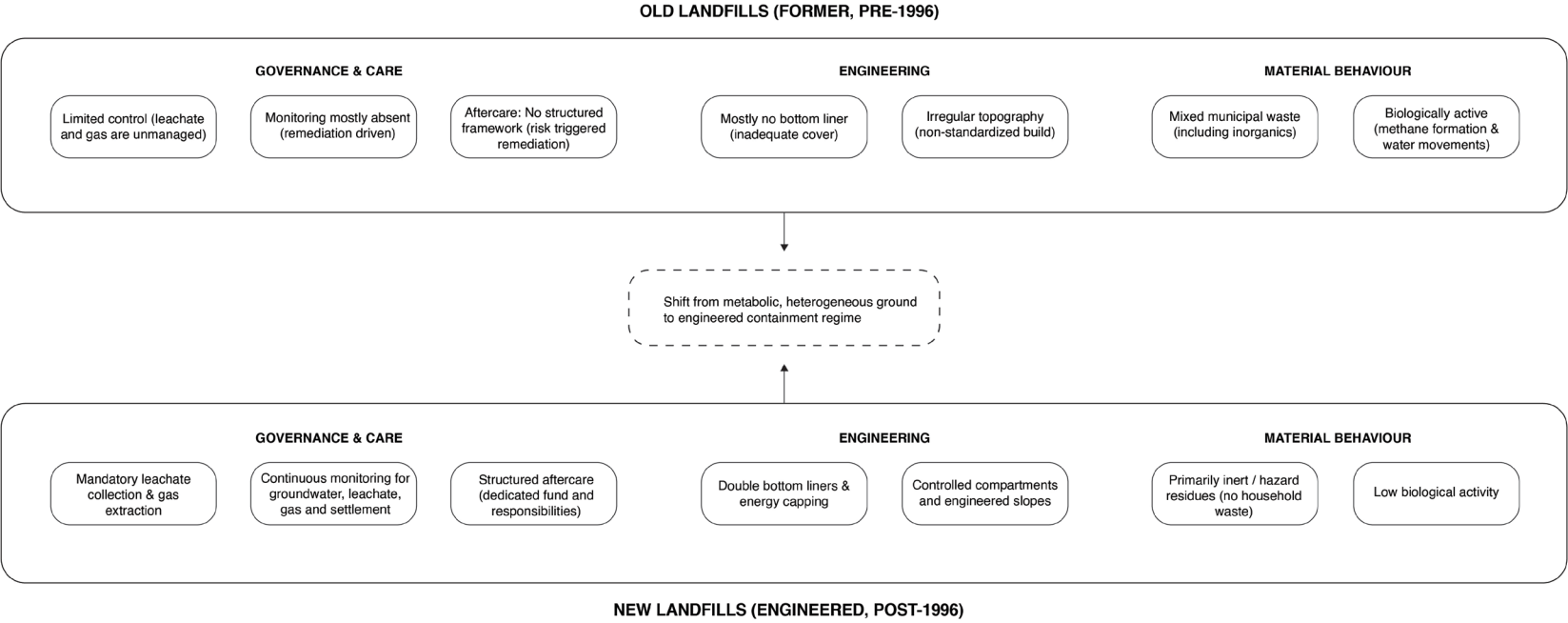
INTRODUCTION

Incinerator locations

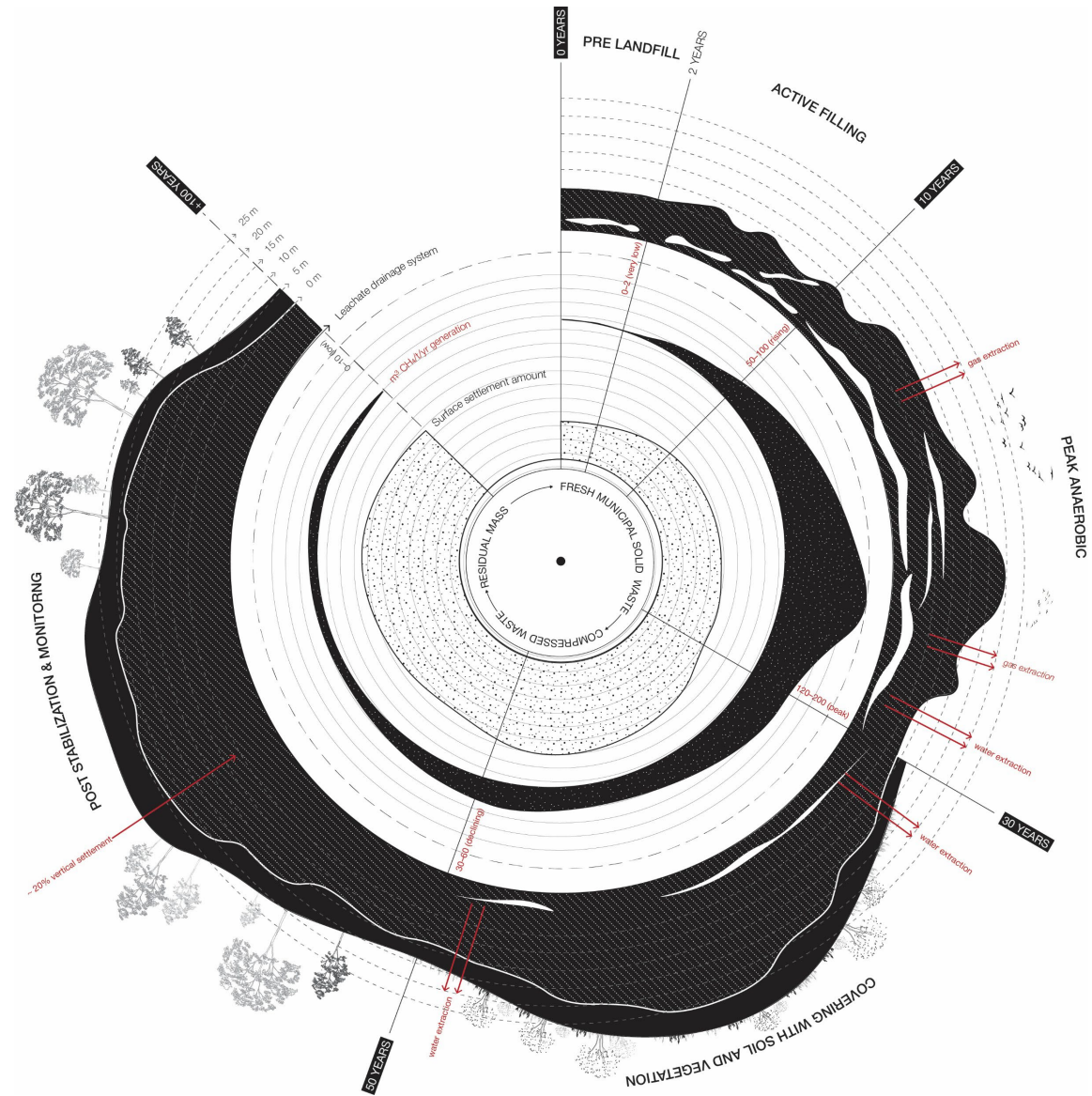


INTRODUCTION
Incineration process

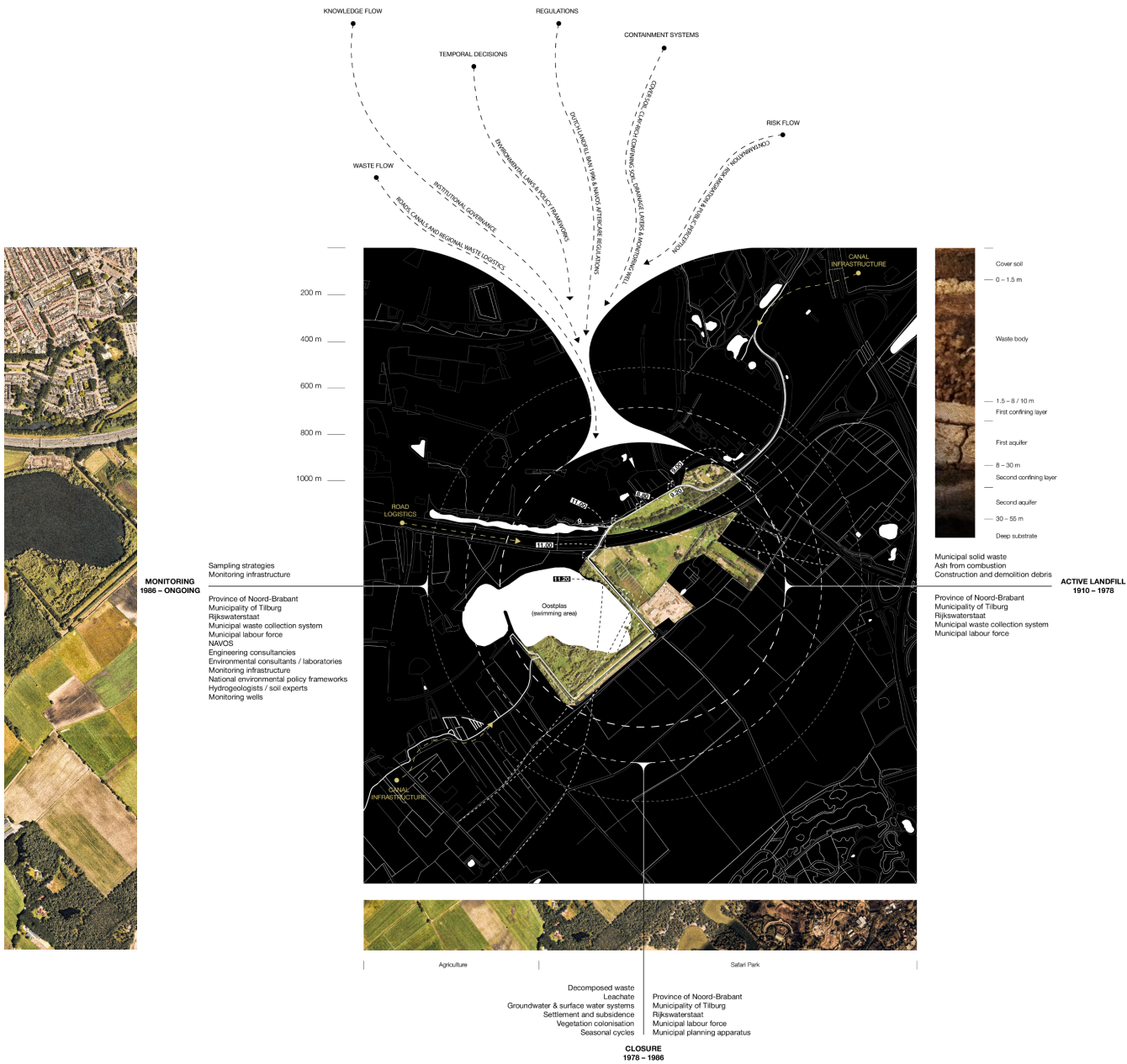




INTRODUCTION
Life journey of an old landfill



INTRODUCTION
Life journey of an old landfill



INTRODUCTION
Life journey of a new type landfill



PROBLEM STATEMENT

Annual bottom ash production in AVR Rotterdam Waste Incineration Plant

AVR Rotterdam

435.000 tons bottom ash production per year



Museum Boijmans van Beuningen / Depot

155.000 m3

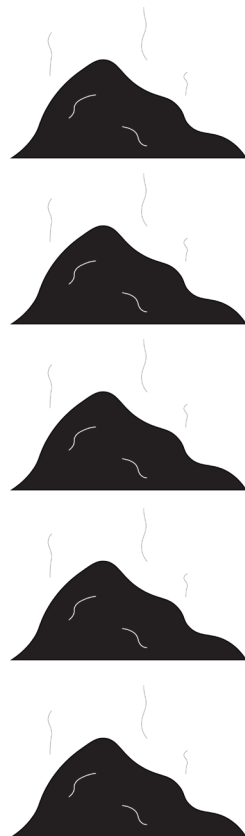


PROBLEM STATEMENT

Annual bottom ash production in Waste Incineration Plants in the Netherlands

13 Incineration Plants in Netherlands

2.300.000 ton bottom ash production per year



Museum Boijmans van Beuningen / Depot

1.533.000 m3



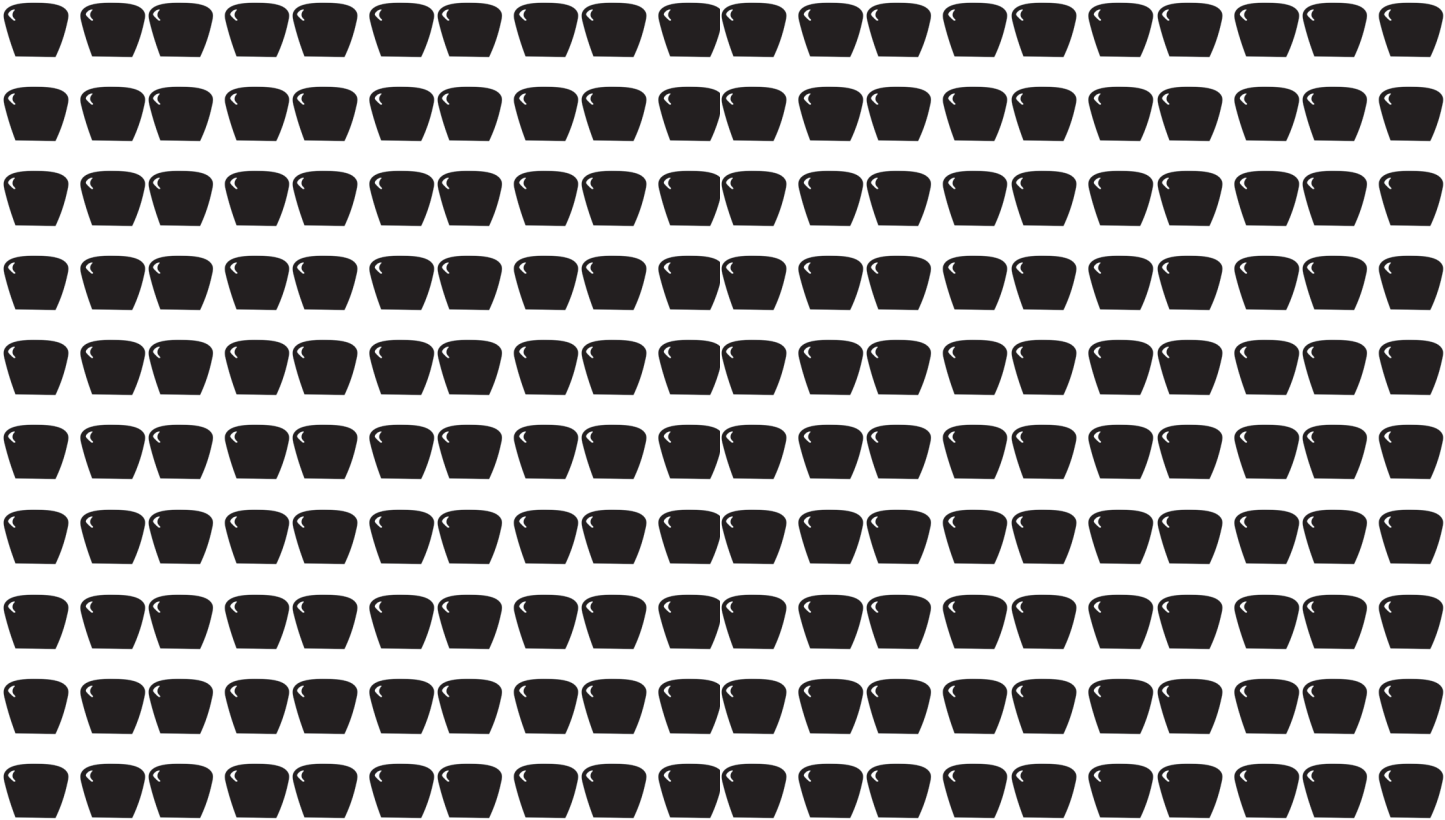
PROBLEM STATEMENT
waste production in Waste Incineration Plants in the Netherlands in 20 years

Waste Production from 13 Incineration Plants in Netherlands

46 Million tons in 20 years

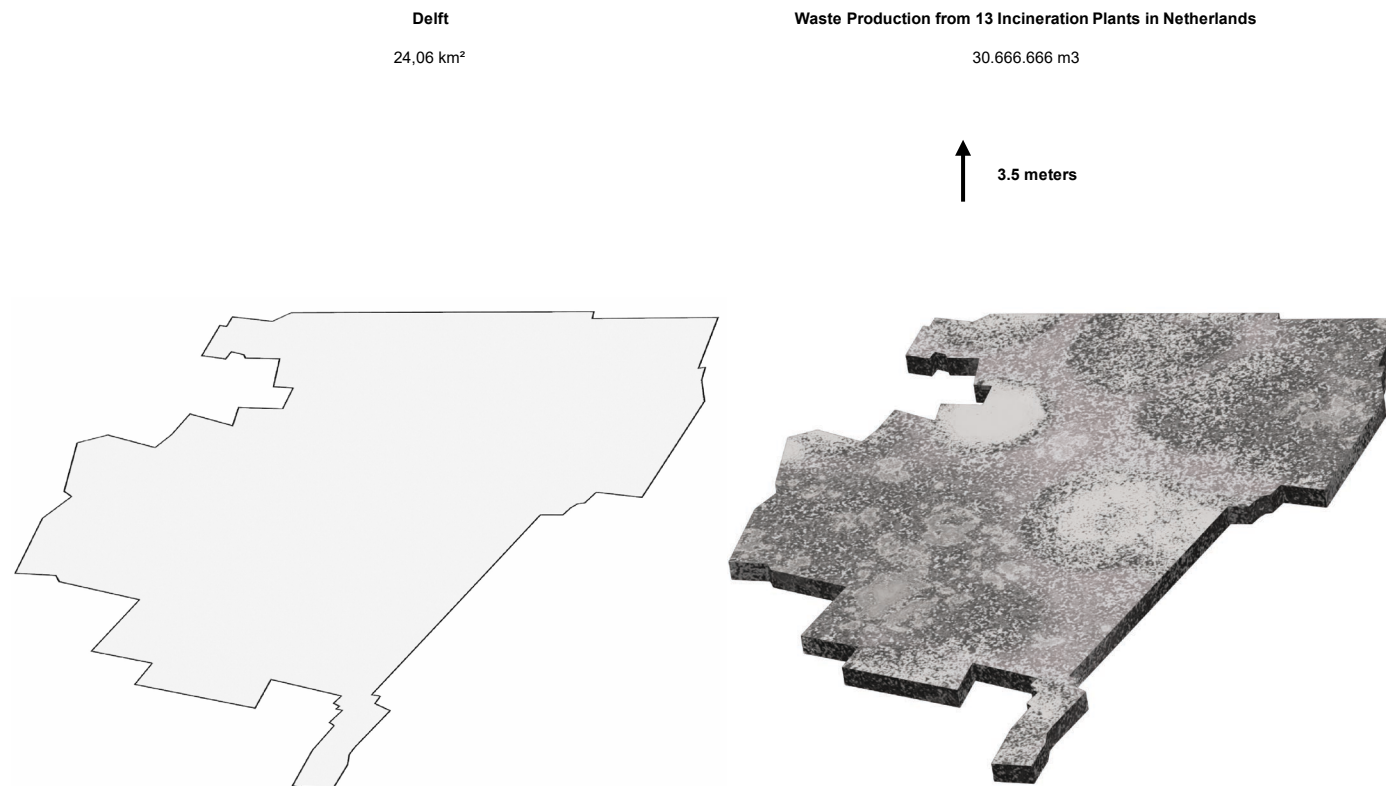
Museum Boijmans van Beuningen / Depot

30.666.666 m3



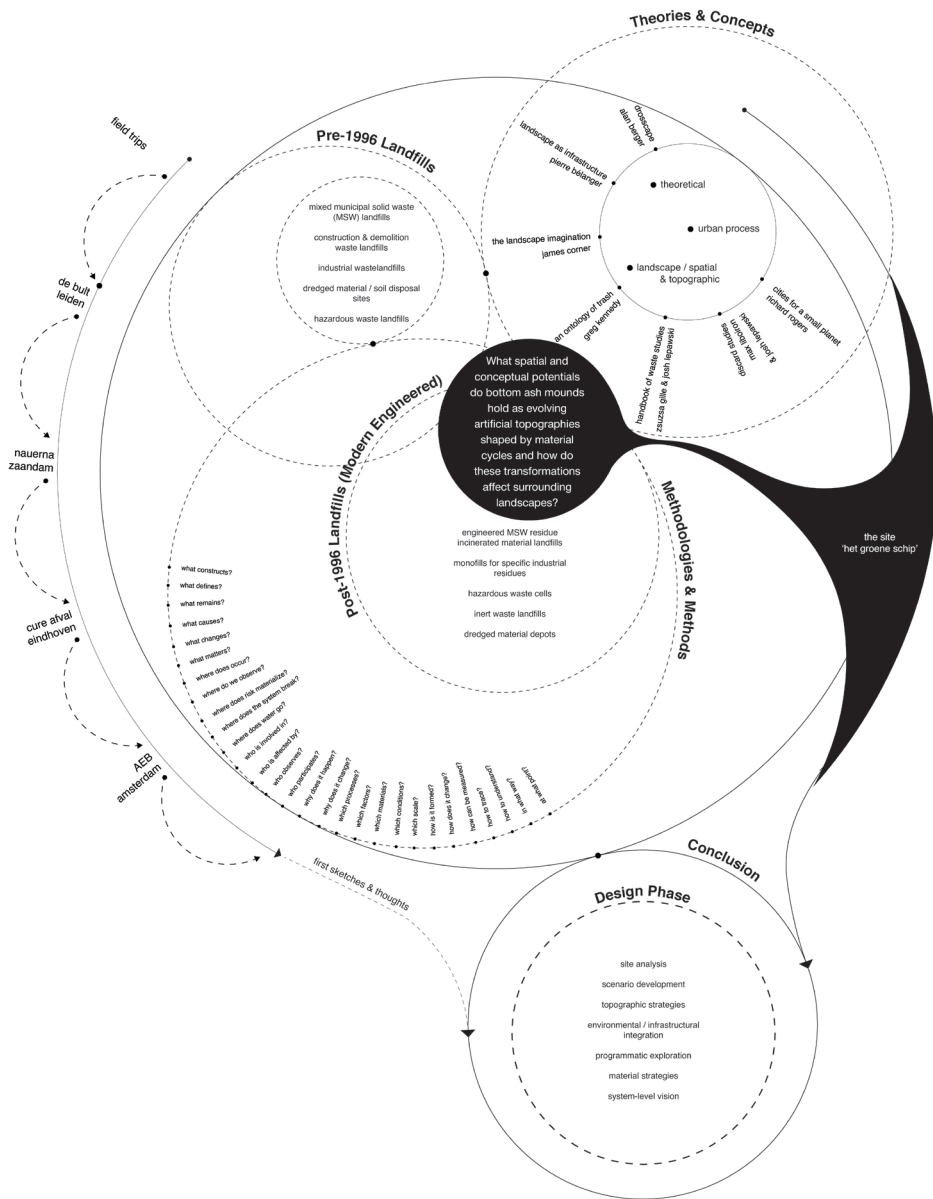
PROBLEM STATEMENT

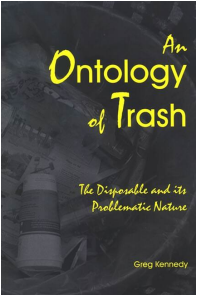
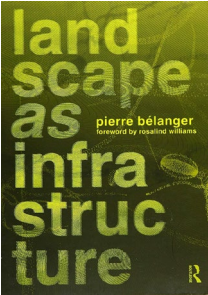
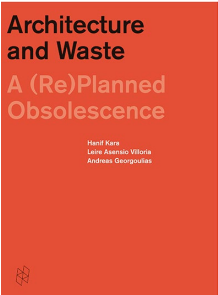
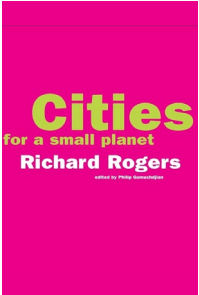
What if Delft's new ground is made of 20 years of nationwide ash?



What spatial and conceptual potentials do bottom ash mounds hold as evolving **artificial topographies shaped by material cycles** and how do these transformations affect surrounding landscapes?

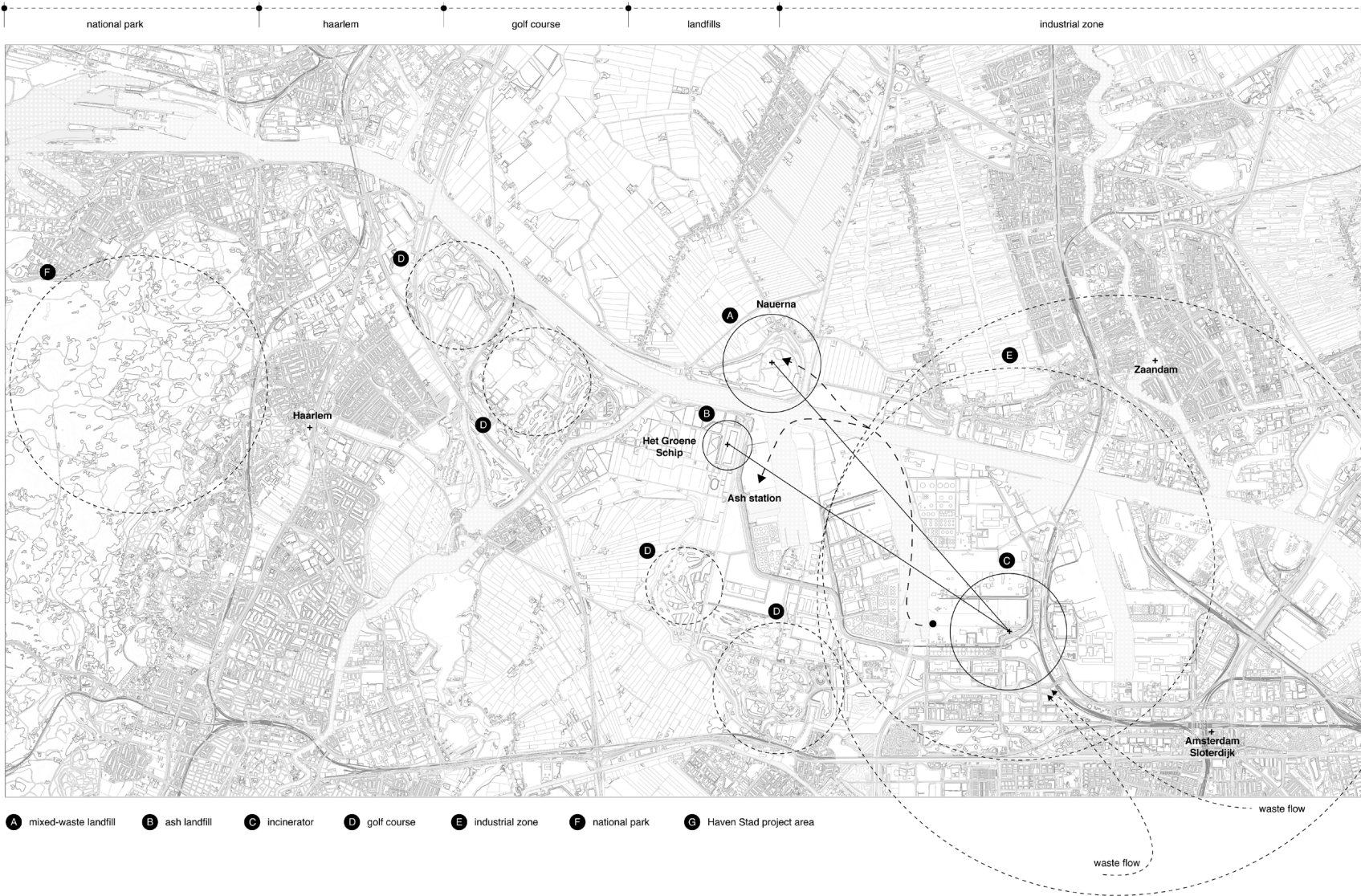
RESEARCH POSITION
Research diagram

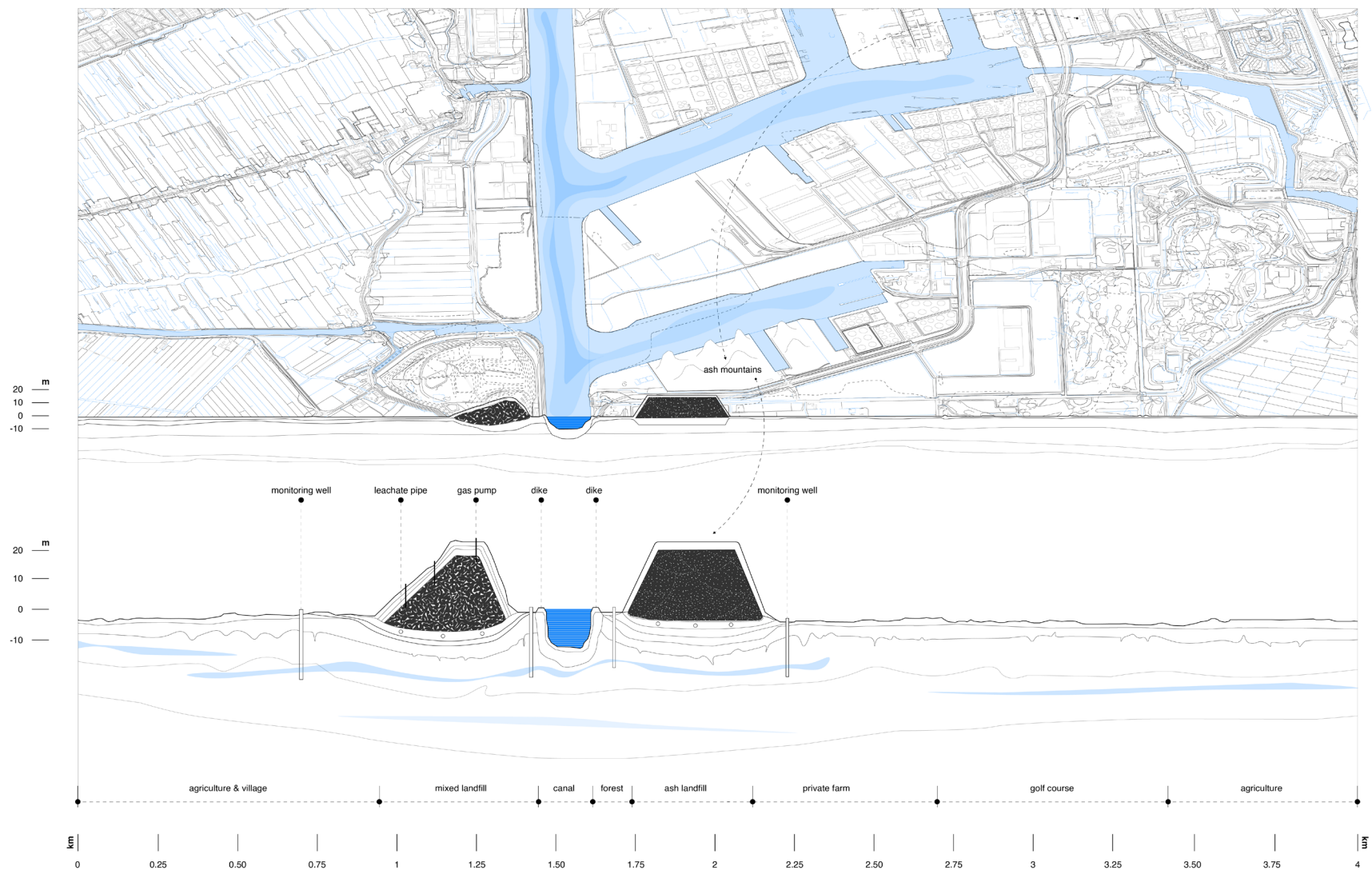




SITE ANALYSIS
Het Groene Schip

Het Groene Schip
Westpoort, Amsterdam



















COMPOSITION

Mineral / inert fraction: 80–85%
Metals total: 10–12% (steel + non-ferrous)
Non-ferrous metals: 2–5%, mostly aluminium

+

METAL SORTING

Magnetic separation to extract metals
Screening into size fractions
Separation for non-ferrous metals (e.g., aluminium), using a conveyor system

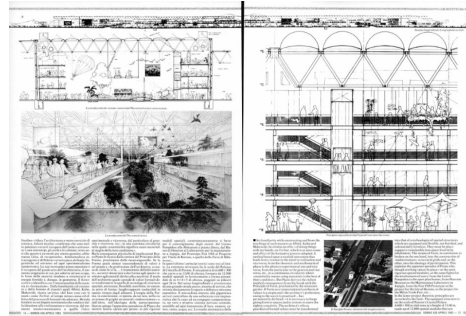
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TYPICAL PROCESS

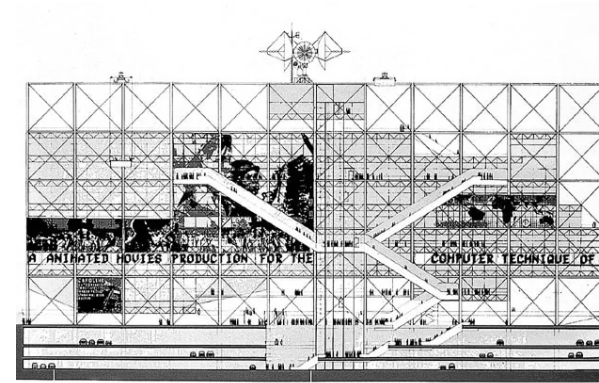
Remaining sediments are aged for 6–20 weeks to become stable
After ageing it can be used as secondary construction material: road
construction and as aggregate for concrete, substituting virgin gravel and sand

A Material Afterlife Center for Production, Testing and Public Observation

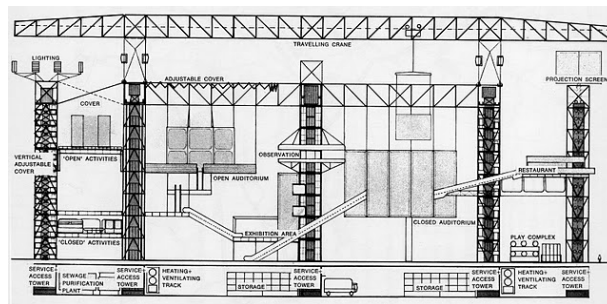
*From Waste to Resource
Material Afterlife
Constructing with Ash
Ground as Product
Testing the Landscape
Material as Infrastructure*



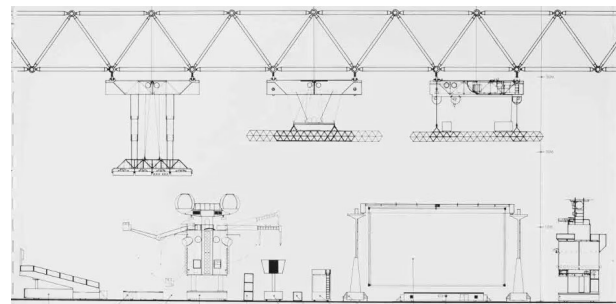
Project for the Milan Trade Fair, Renzo Piano. Domus 638, April 1983.



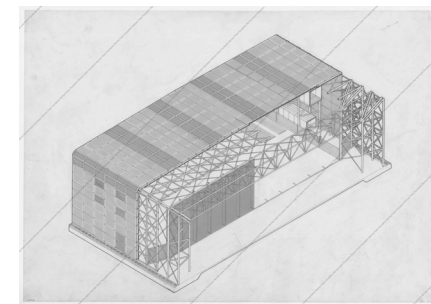
Centre Georges Pompidou, France, 1977. Renzo Piano, Richard Rogers and Gianfranco Franchini.



Fun Palace, Cedric Price. 1963.



Festival Plaza Expo '70, Osaka, 1970. Kenzo Tange, Arata Isozaki, Atsushi Ueda Tange was Chief Architect of the Expo, while Isozaki and Ueda were responsible for the Festival Plaza.

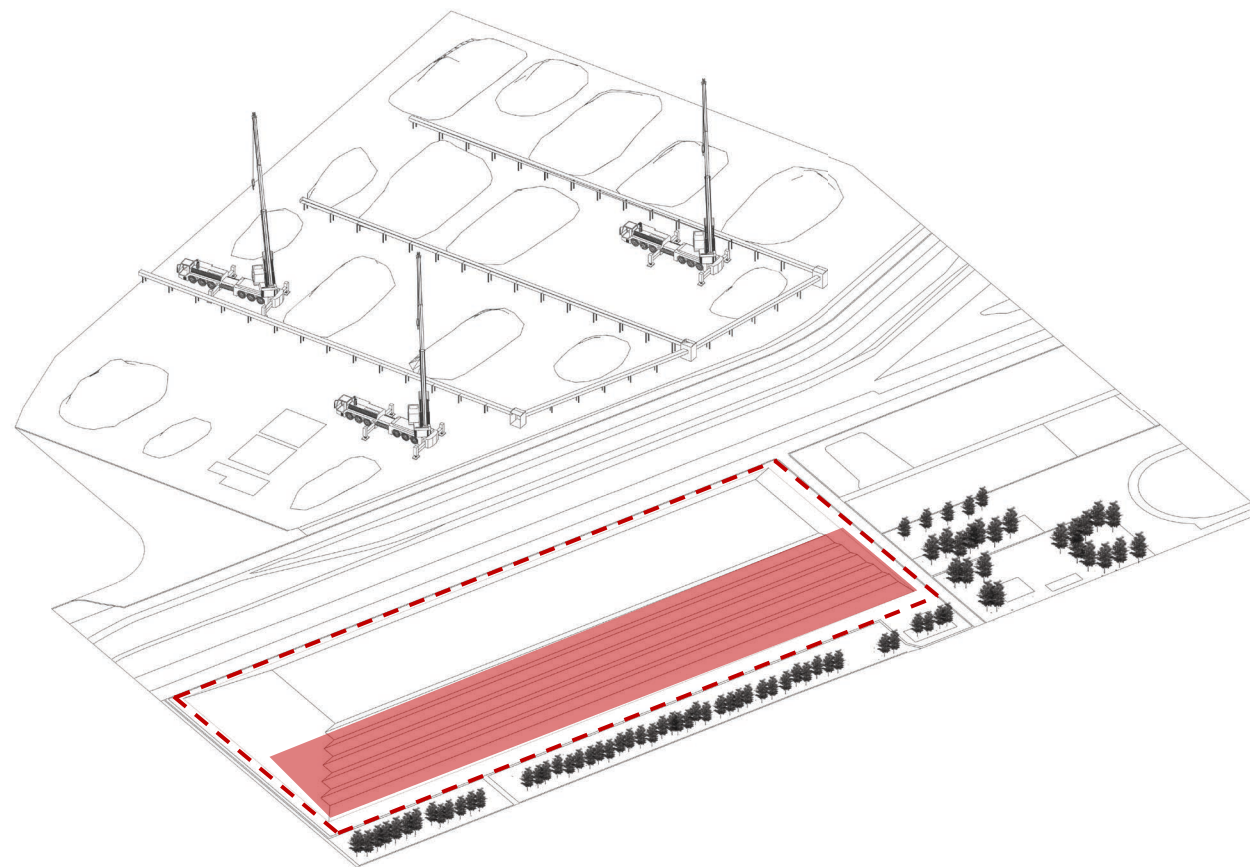


Sainsbury Centre for Visual Arts, UK, 1978. Foster + Partners.

MOUND + GROUND WORKS CENTER				
Space / Zone	Function	Users	Note	Relevance
Preserved Half Mound	Mineral monument	IW	No production; awareness + interpretation. Visible to everyone	testing - water
Exposed Section Face	Stratification reading	IW	Stabilized cut; monitored. Visible to everyone	ecology - vegetation
Catwalk Corridor	Sectional promenade	All users	Ramped, layered spatial experience	ecology - vegetation
Research Studios	Material research	All users	Sunlit, clean air access	ecology - vegetation
Observation Galleries	Public interface	All users	Overlooking cut	testing - air
Material Archive (indoor)	Sample documentation	All users	Archive of removed half (display)	production
Fabrication Hall	Rammed ash / precast	All users	Semi-industrial	testing - soil
Gabion Assembly Zone	Modular assembly	All users	Direct link to landscape parcels - easy access	education
Prototype Testing	Structural mock-ups	RS, IW	1:1 experiments	production
Worker Facilities	Operational support	IW	Service areas	empty
Seminar Room	Education + talks	All users	Linked to School2Work	production
Drainage gap under building	Drainage + technical	IW, EM	Continuous infrastructure corridor	production
Water Monitoring Nodes	Hydrology tracking	EM, RS, IW	Data + measurement	testing - water
Canal Interface Point	Controlled discharge	EM, IW	Infrastructure visible	testing - water
Café / canteen	Daily needs	All users	Public interface	public
Viewing platforms / overlooks	Process monitoring	All users	Safe distance, guided views	public

OPERATIONAL MATERIAL LANDSCAPE				
Parcel Type	Function	Users	Note	Location Logic
Education Parcel	Training workshops	RS, TR, LV	Vocational integration	Near School2Work
Wet Adaptation Parcel	Water-integrated mixes	RS, EM	Drainage experiments	Canal proximity
Poplar Parcel	Long-term growth cycle	EM, RS	30–50 years cycle	Existing tree grid
Forest Parcel	Humidity + shade testing	RS, PU	Surface performance in shade	Wooded zone
Farm Proximity Parcel	Soil transition study	RS, LV	Ash-to-soil experiments	Near farmhouse
Wind Exposure Parcel	Coarse fraction test	RS, PU	Aeolian (wind) erosion	Open flat zone
Topographic Formation Parcel	Artificial hills	All users	Performance + spatial modulation	Open buildable zone
Settlement Monitoring Parcel	Long-term deformation	EM, RS	Instrumented ground	Stable subsoil
Cycling Performance Loop	Surface comparison	All users	Material performance circuit	Linking parcels
Monitoring Nodes	Sensor network - Additional public func.	All users	Embedded infrastructure	Distributed
Future deposit	Future experiments / time related	RS, TR	Time-based occupation	In-between parcels
Maintenance Parcel	Repair + tools	IW	Operational support	Near production route
Material Archive + material production zone	Sample documentation	All users	Making operation visible	Close to visitor center and sorting station

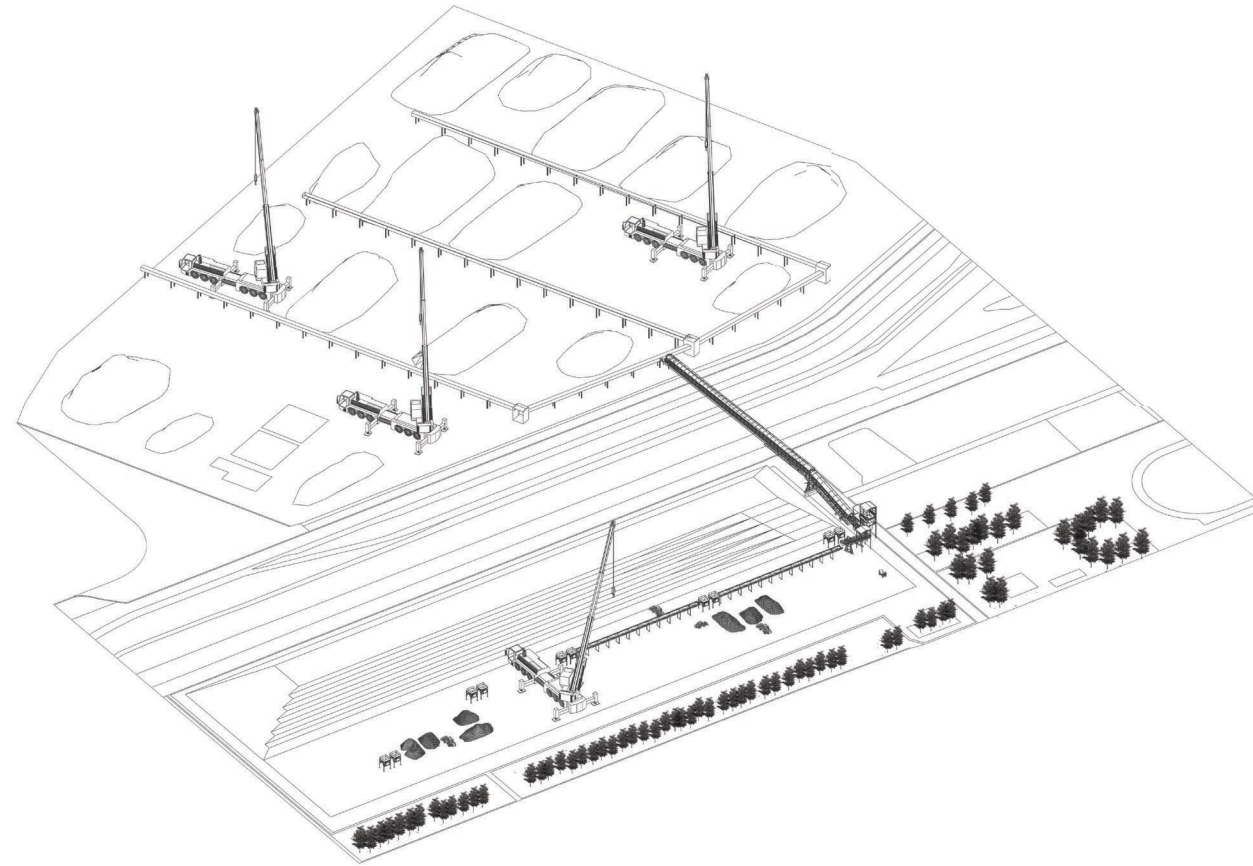
DESIGN STRATEGY
From Mound to Operative Ground



Phase 1: Controlled Excavation

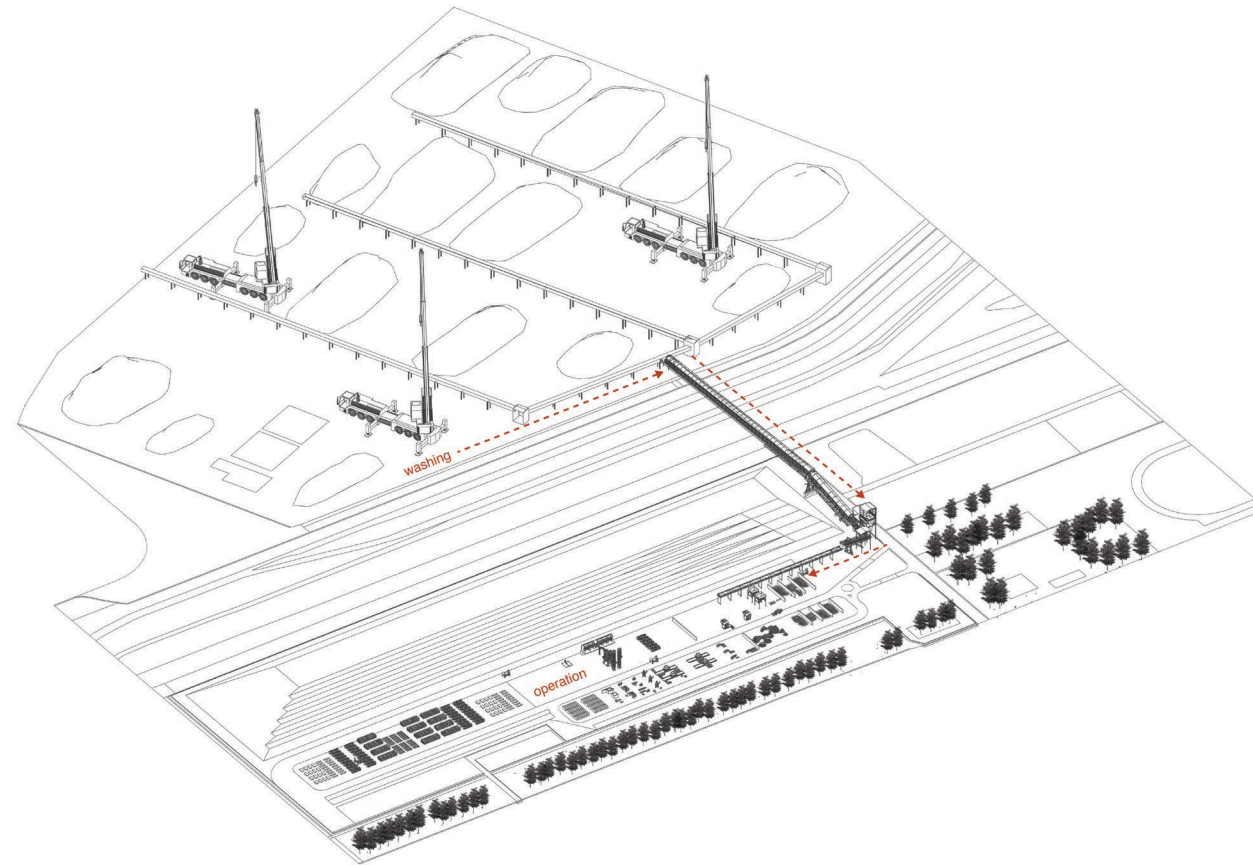
The selected part of the mound is carefully excavated. Dust, runoff and water movement are controlled during the process.

DESIGN STRATEGY
From Mound to Operative Ground

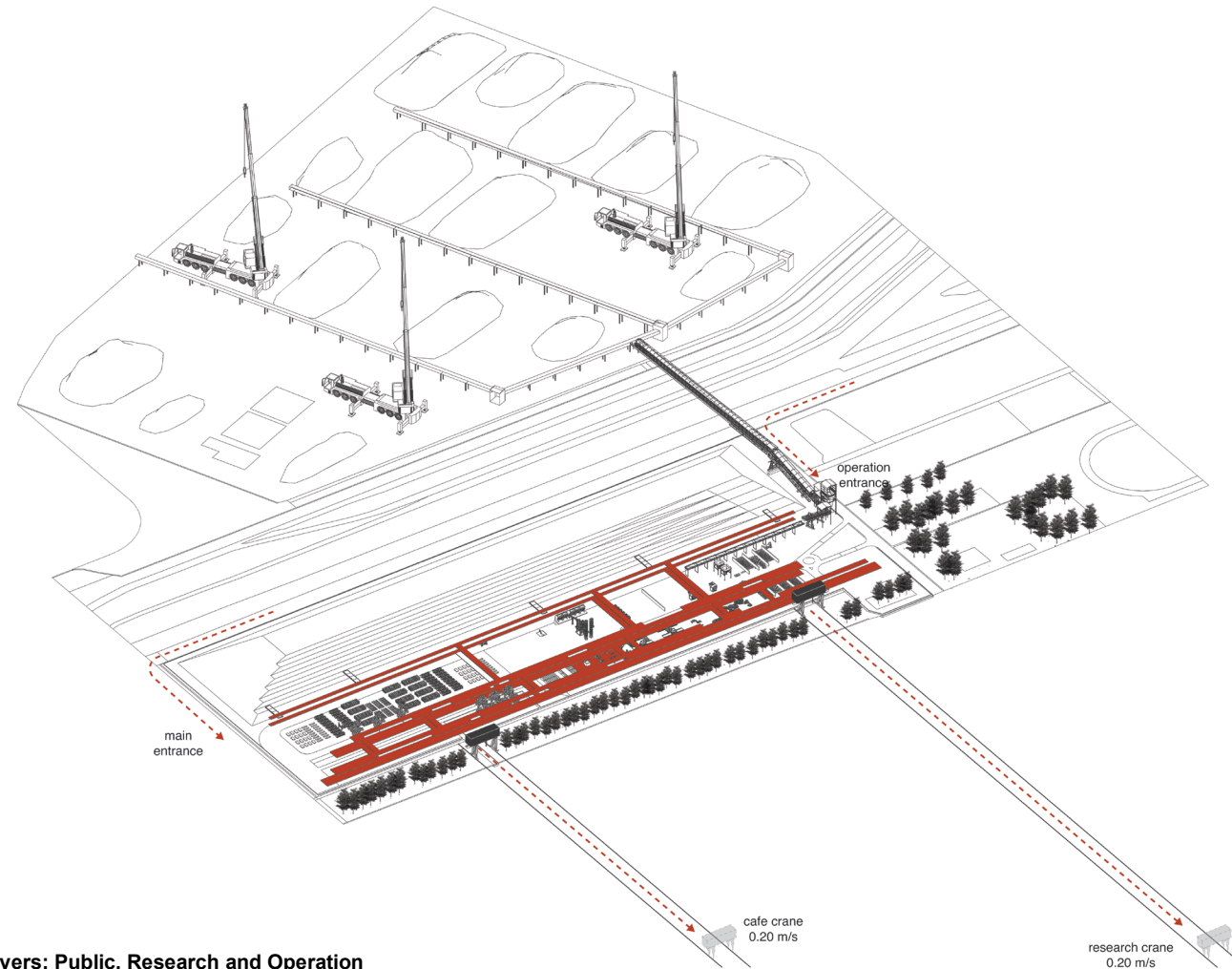


Phase 2: Closed Conveyor to the Sorting Station

The excavated ash is not spread across the site. It is transported through a closed conveyor system to the existing sorting station across the road for washing and sorting.



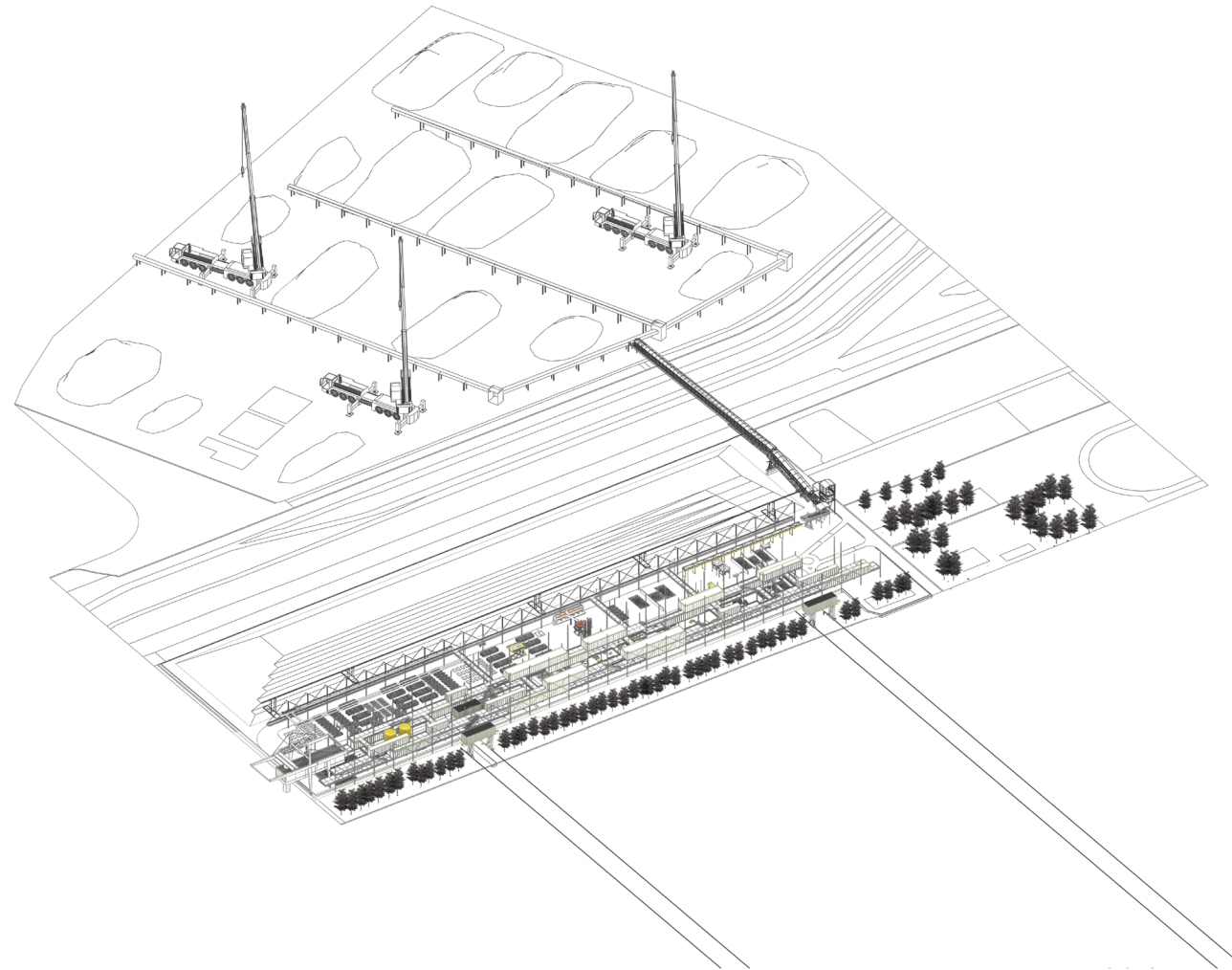
Phase 3: Return as Classified Fractions
Only the suitable and tested ash fractions return to the main building.



Phase 4: Construction of the Main Building Program Layers: Public, Research and Operation

A large industrial frame is built as the main interface between the mound, the sorting station, production and public observation.

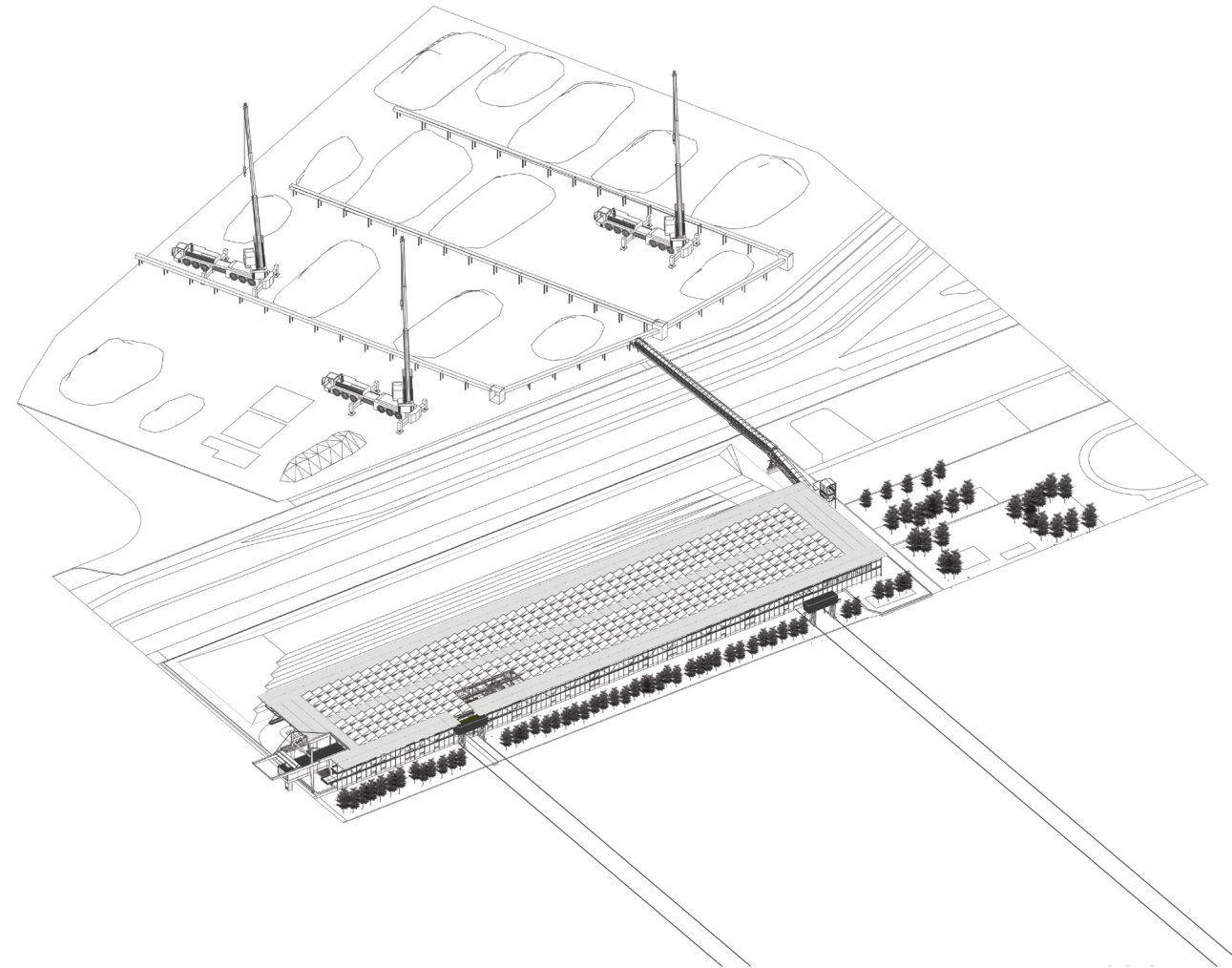
DESIGN STRATEGY
From Mound to Operative Ground



Phase 5: Material Production

After research and production, processed ash products return to the site as controlled material streams. These elements are placed by cranes and used for architectural and landscape applications, including paths, platforms, test fields and pavilion structures.

DESIGN STRATEGY
From Mound to Operative Ground

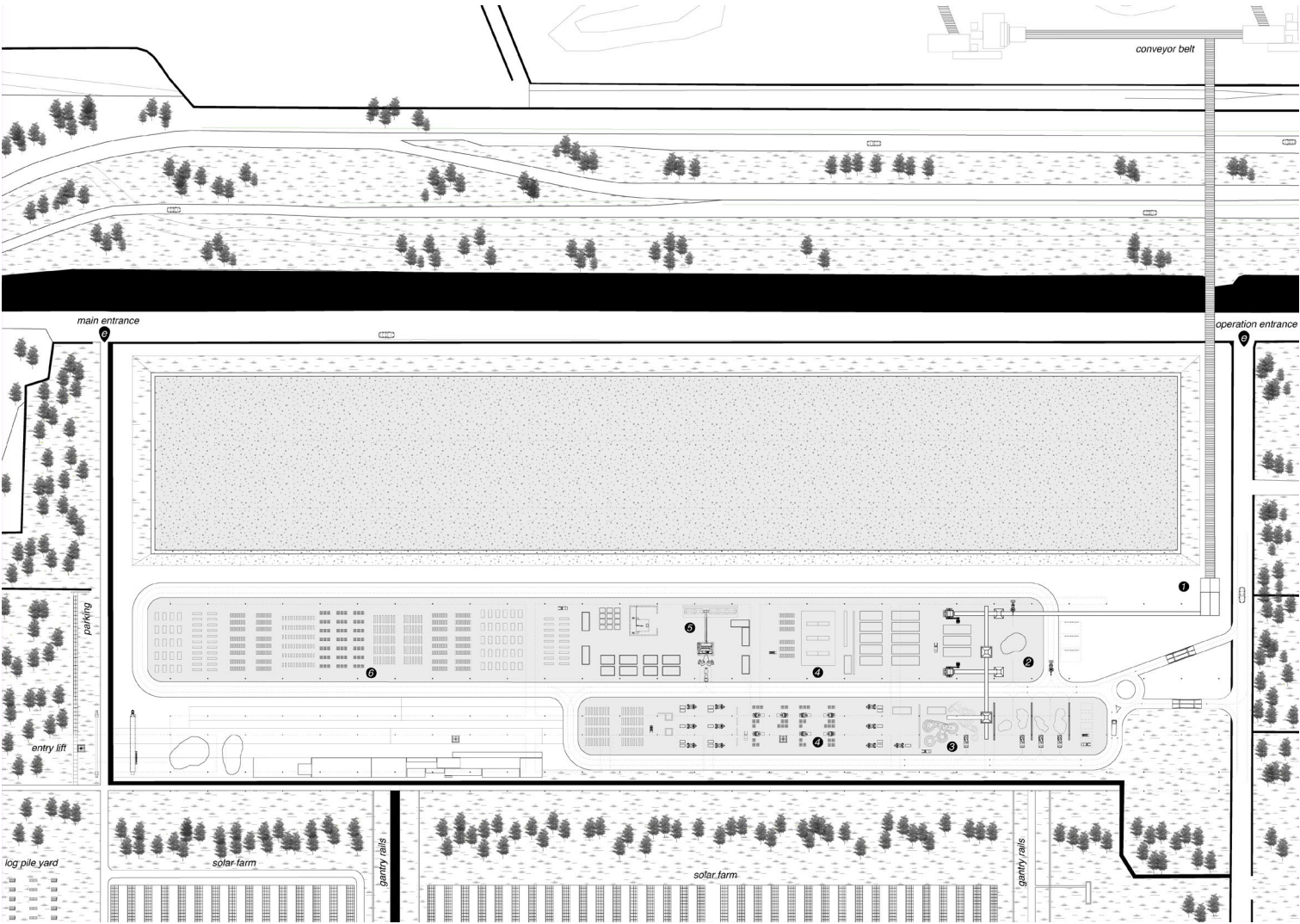


Phase 6: Activated Material Landscape

The site becomes an active material landscape where the main building, crane systems, pavilions, paths and testing parcels operate together. Processed ash becomes part of a visible cycle of production, observation, learning and reuse.

LANDSCAPE STRATEGY
Operational Landscape

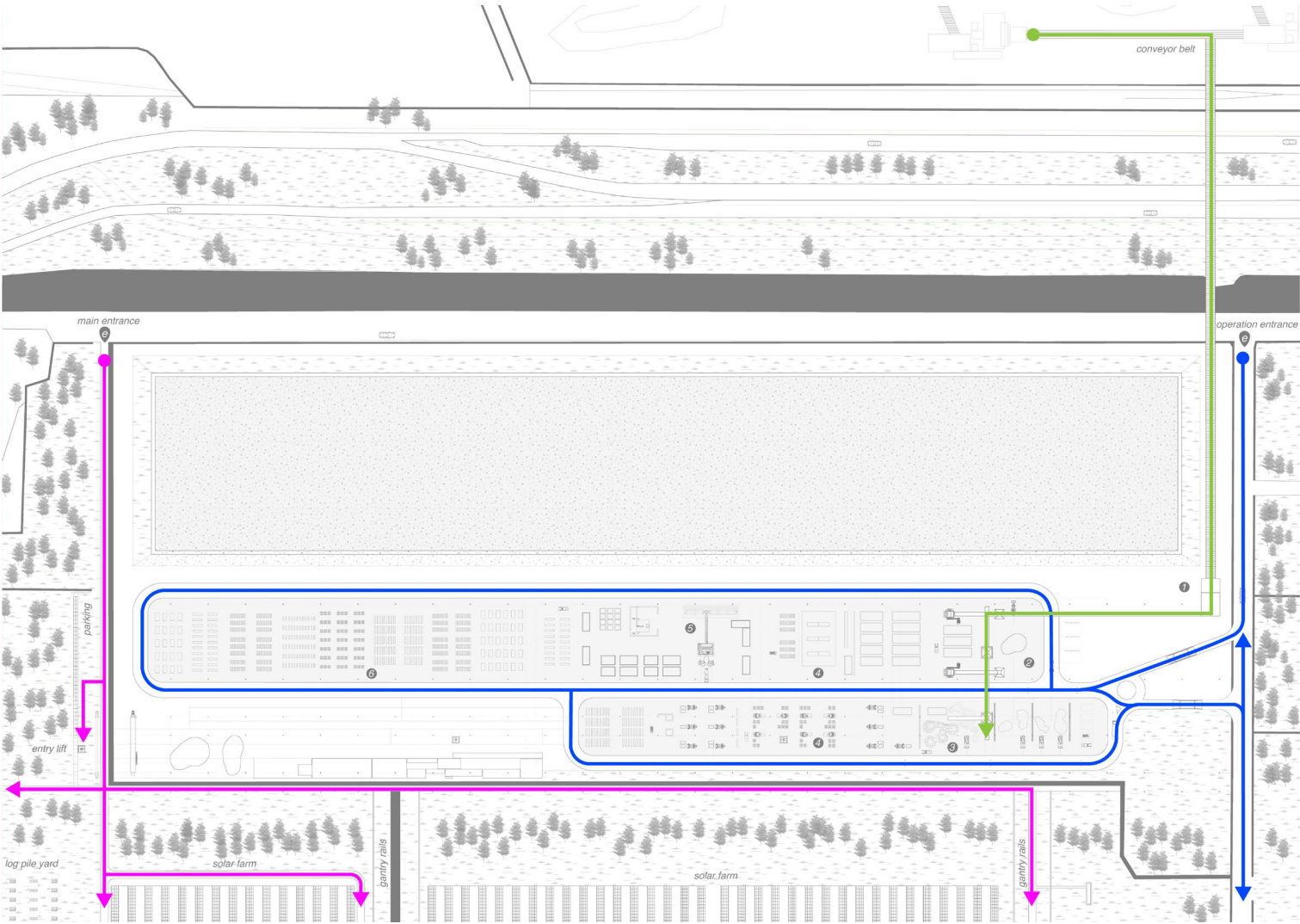
- 1 Bottom ash receiving
- 2 Unprocessed ash storage
- 3 Pre-processing
- 4 Mixing, casting & forming
- 5 Concrete lab
- 6 Drying yard



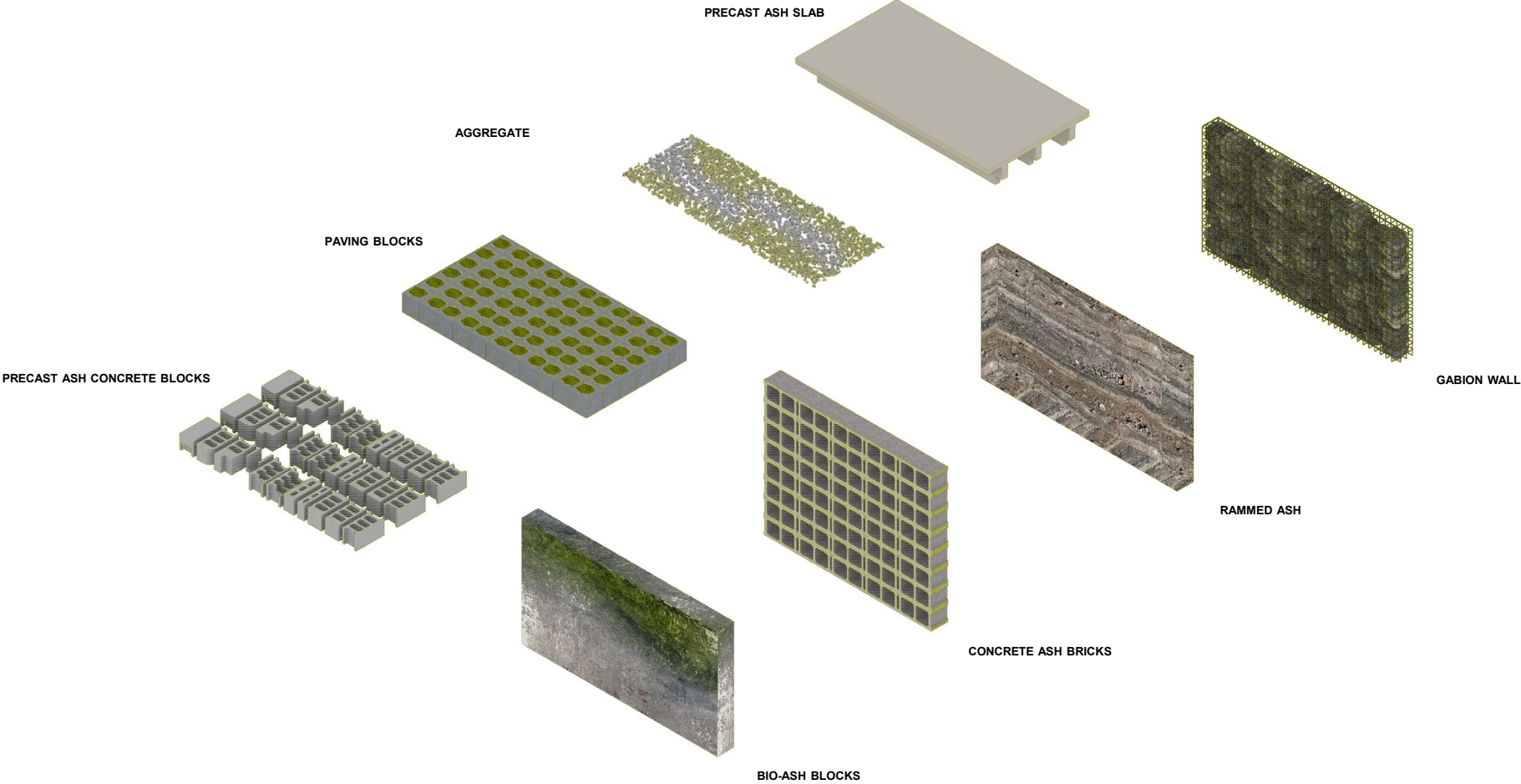
LANDSCAPE STRATEGY
Operational Landscape

- 1 Bottom ash receiving
- 2 Unprocessed ash storage
- 3 Pre-processing
- 4 Mixing, casting & forming
- 5 Concrete lab
- 6 Drying yard

- Visitor route
- Ash route through conveyors
- Operation trucks route







LANDSCAPE STRATEGY
Material Flow + operational landscape



USER PROFILES

RS researcher - scientist
LV local visitor

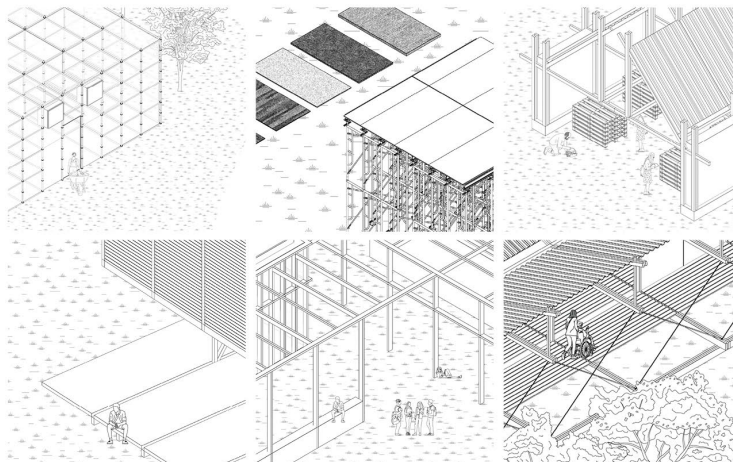
EM ecologist - monitor
IW infrastructure worker

TR trainee - vocational
PU public

tested results inform next deployment cycle - material returns as new landscape - ground is the product

DESIGN STRATEGY
From Mound to Operative Ground

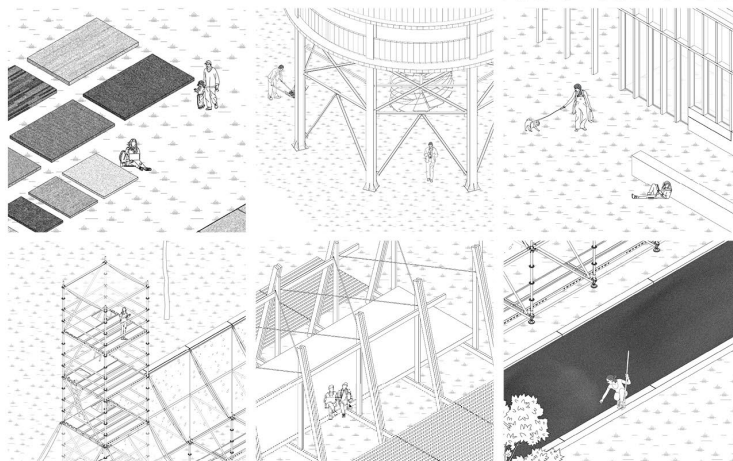


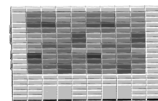
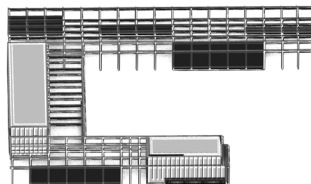
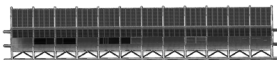
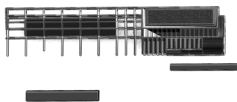
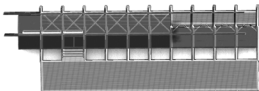
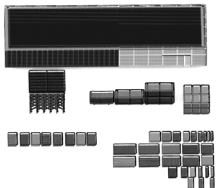


OUT OF THE ASH:

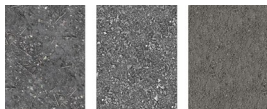
Exploring New Material Agendas in Architecture and Landscape

PAVILIONS

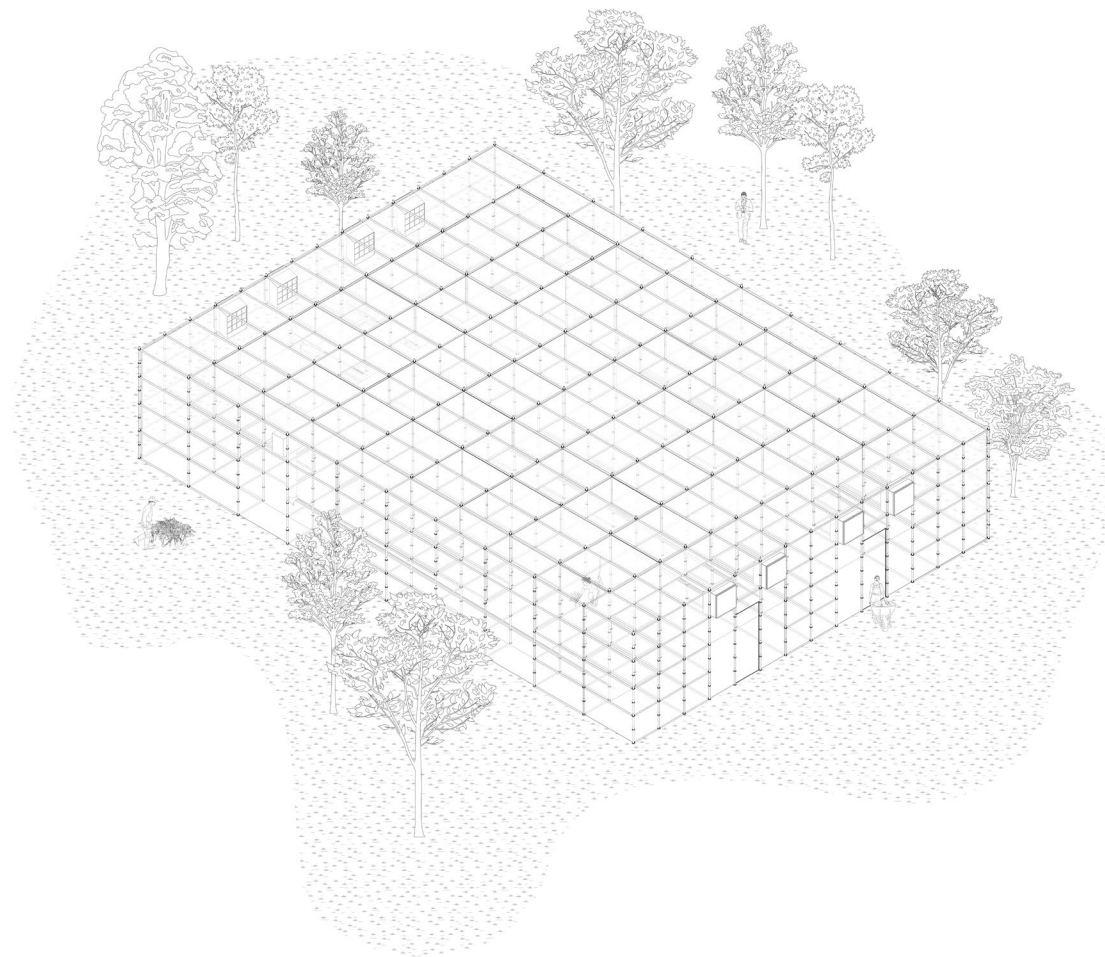




LANDSCAPE STRATEGY
Pavilions



Soil mixtures



P1 GREENHOUSE PAVILION
FARM PROXIMITY PARCEL

*in ash and soil, small roots begin to read the ground,
testing what can grow from what the city leaves behind*

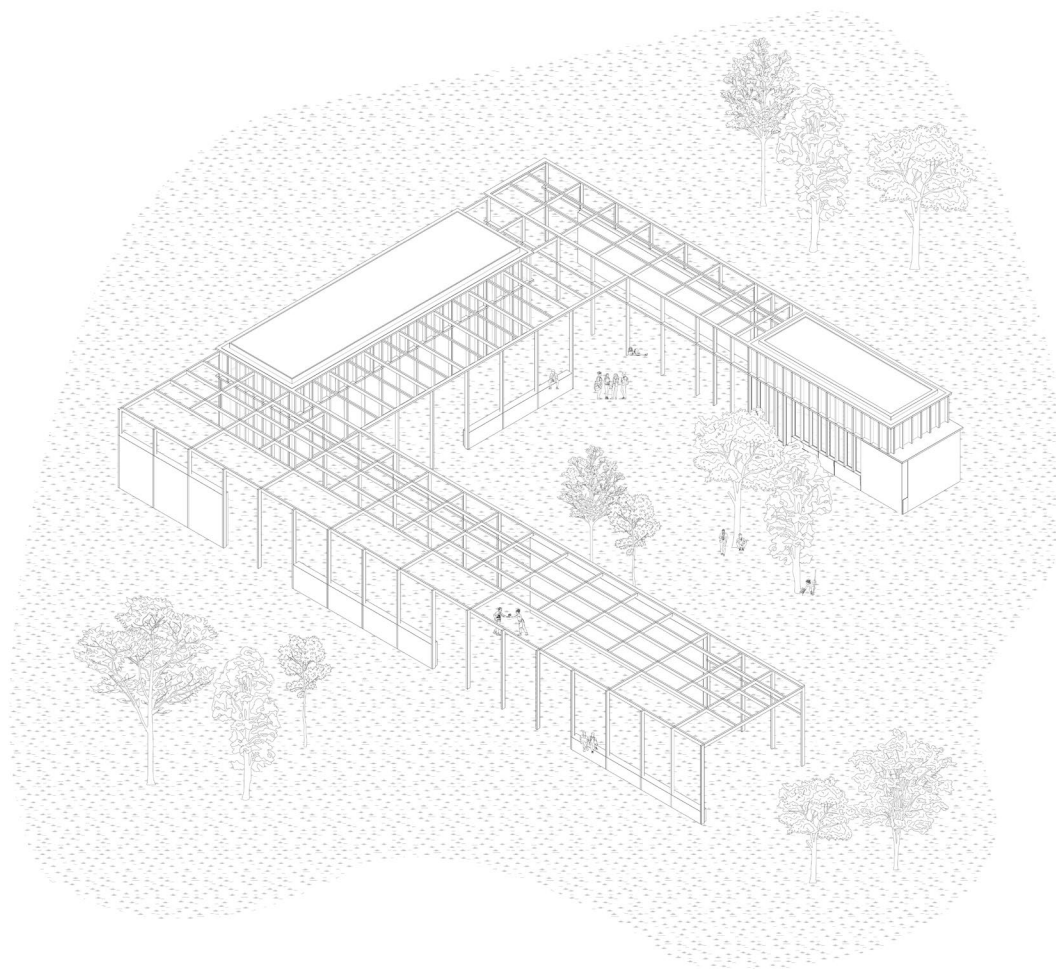




LANDSCAPE STRATEGY
Pavilions



Rammed ash



P2 FOOD AND BEVERAGE PAVILION
POPLAR PARCEL

*where heavy ash becomes a wall, people gather and rest,
 sharing warmth beside the work of a transformed ground*

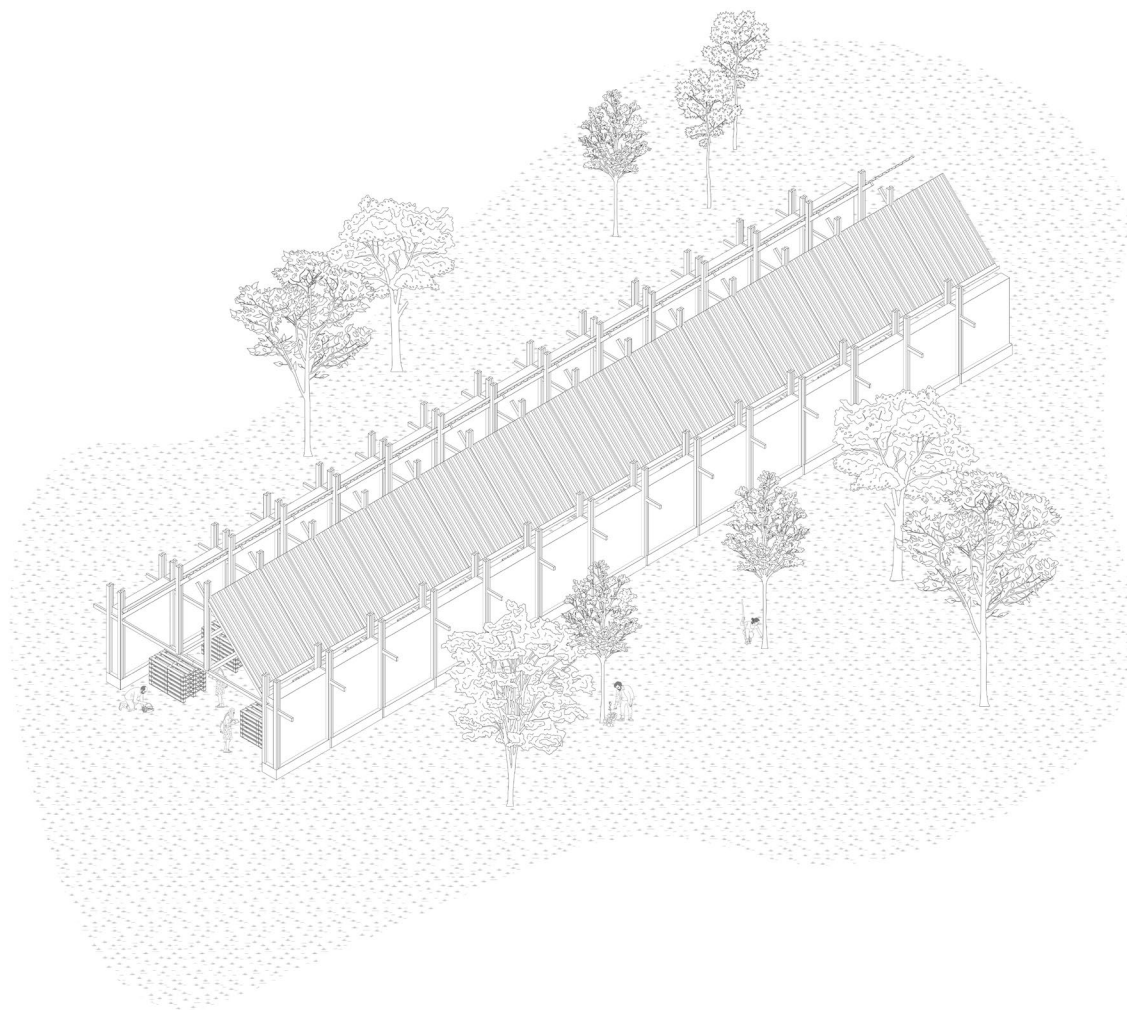


P2 FOOD AND BEVERAGE PAVILION
POPLAR PARCEL

LANDSCAPE STRATEGY
Pavilions



Rammed ash

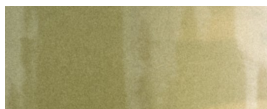


P3 THE HARVEST MARKET PAVILION
EDUCATION PARCEL

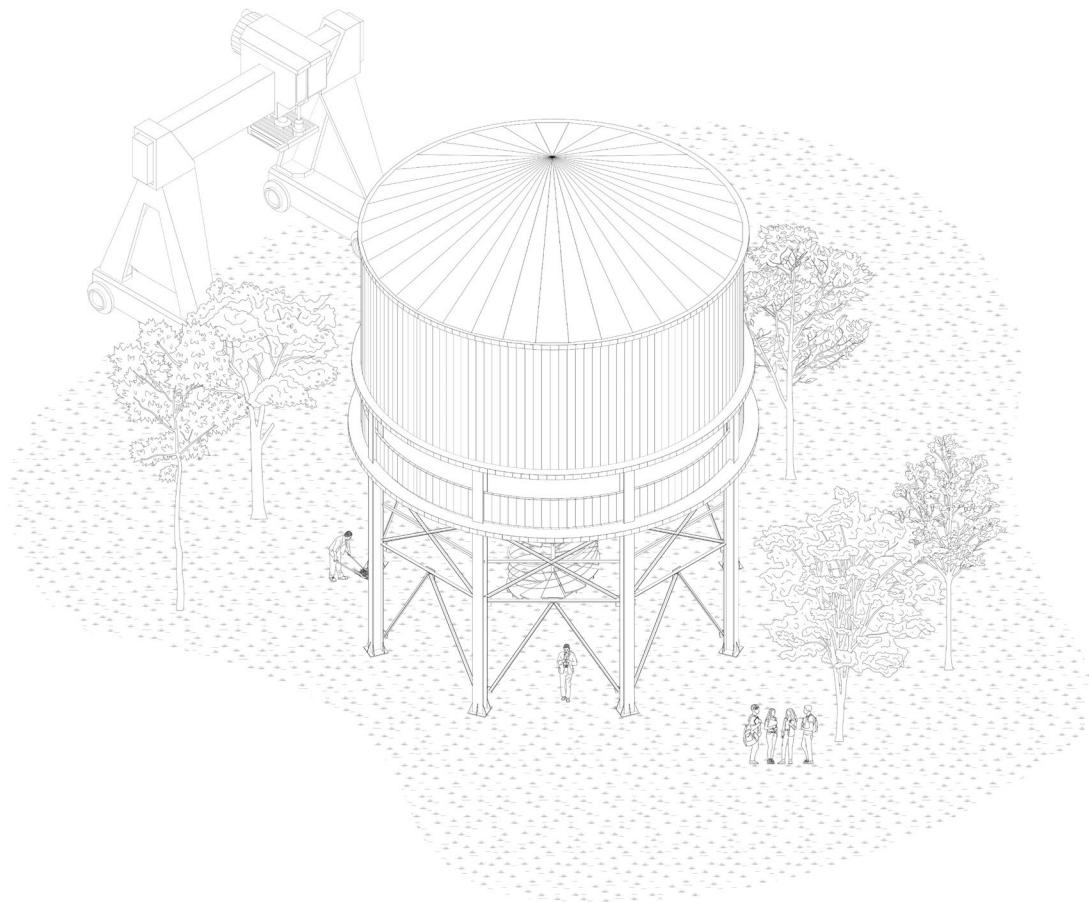
*what the port releases, the market gathers again,
turning leftover fragments into futures passed from hand to hand*



LANDSCAPE STRATEGY
Pavilions



Harvested material



P4 THE SILO PAVILION
SETTLEMENT MONITORING PARCEL

*a silent silo stands where the ash slowly shifts,
measuring time in movements too small for the eye*

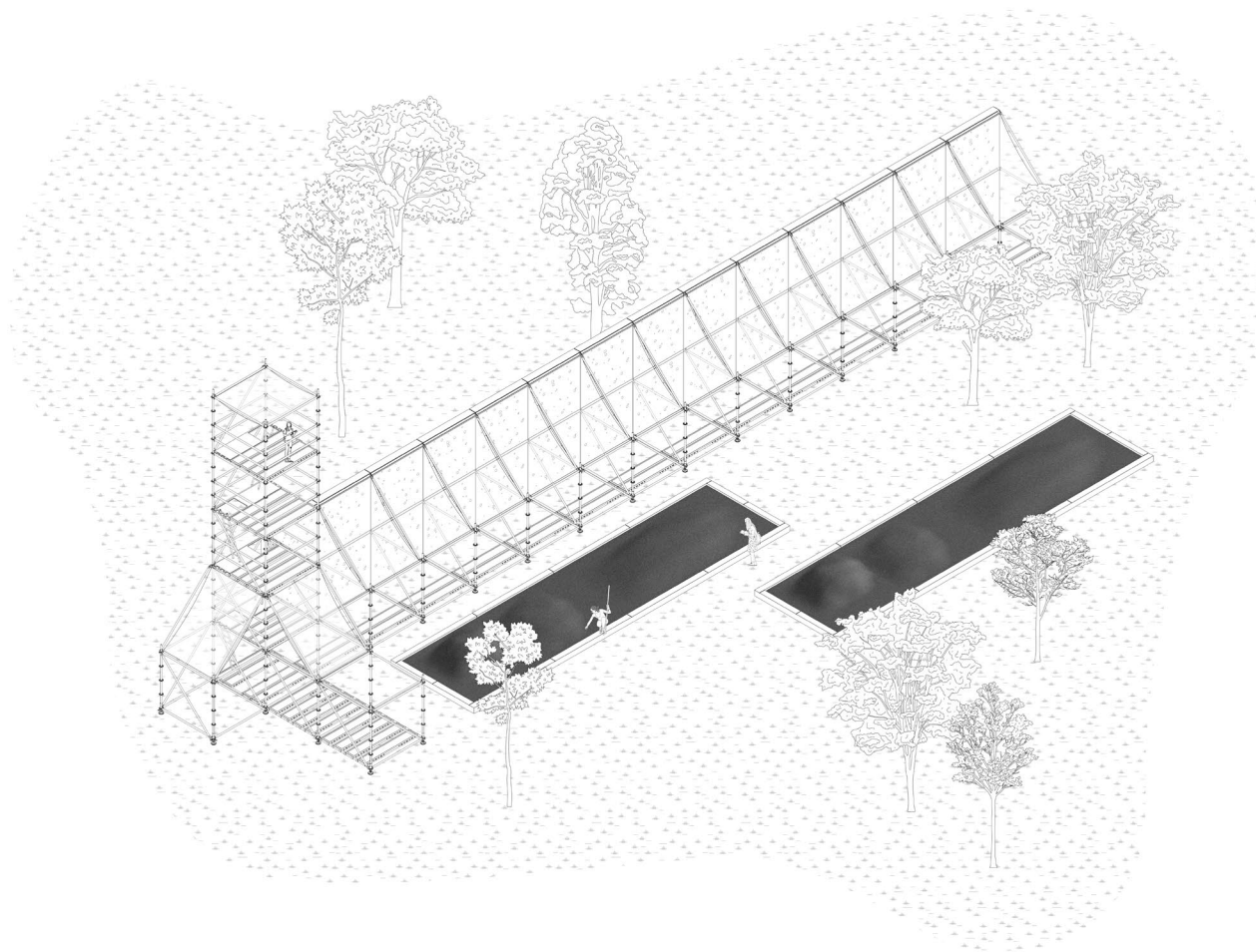


P4 THE SILO PAVILION
SETTLEMENT MONITORING PARCEL

LANDSCAPE STRATEGY
Pavilions



Ash-mixed concrete



P5 THE BEE PAVILION
EDUCATION PARCEL

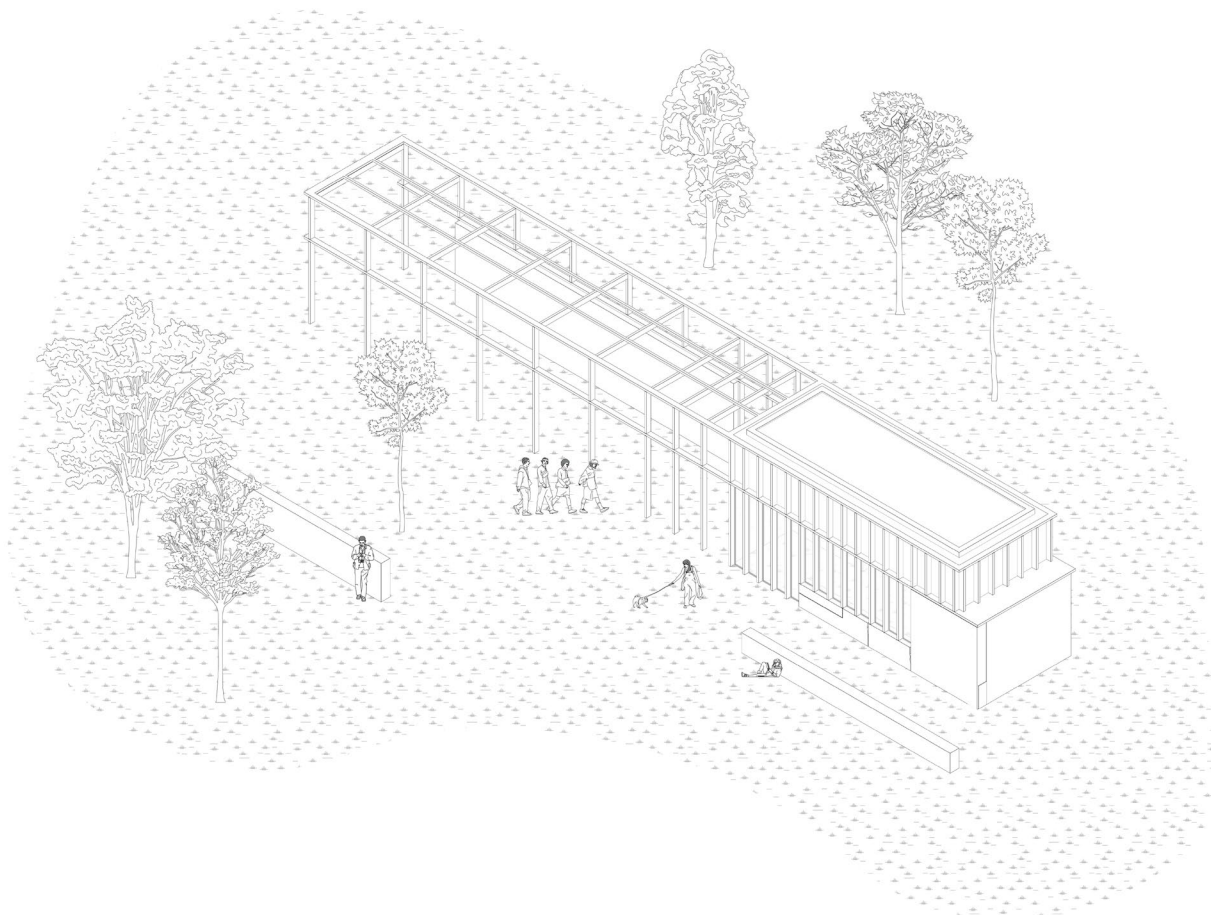
*in ash-block hollows, small wings make a home,
 teaching the landscape to bloom from its leftovers*



LANDSCAPE STRATEGY
Pavilions



Rammed ash



P6 ENTRANCE PAVILION
POPLAR PARCEL

*at the edge of arrival, ash and timber begin the story,
 guiding each step into a ground waiting to be read*

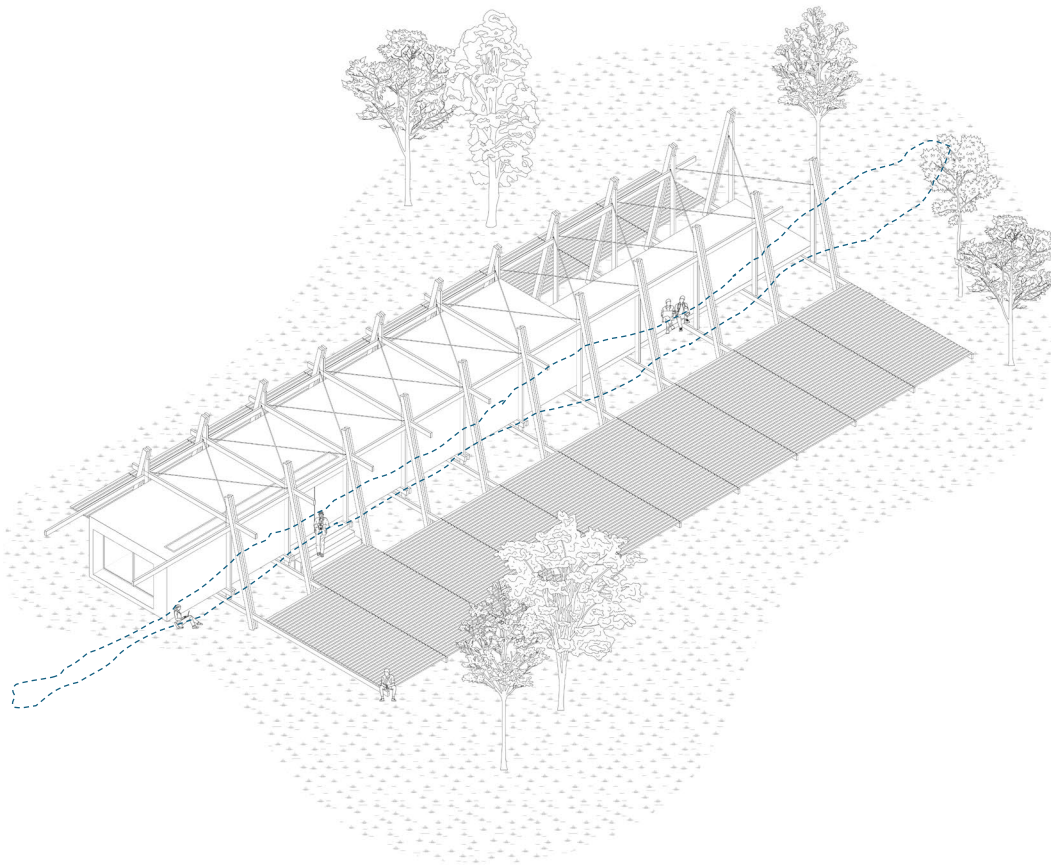


P6 ENTRANCE PAVILION
POPLAR PARCEL

LANDSCAPE STRATEGY
Pavilions



Ash-mixed concrete



P7 THE BRIDGE PAVILION
WET ADAPTATION PARCEL

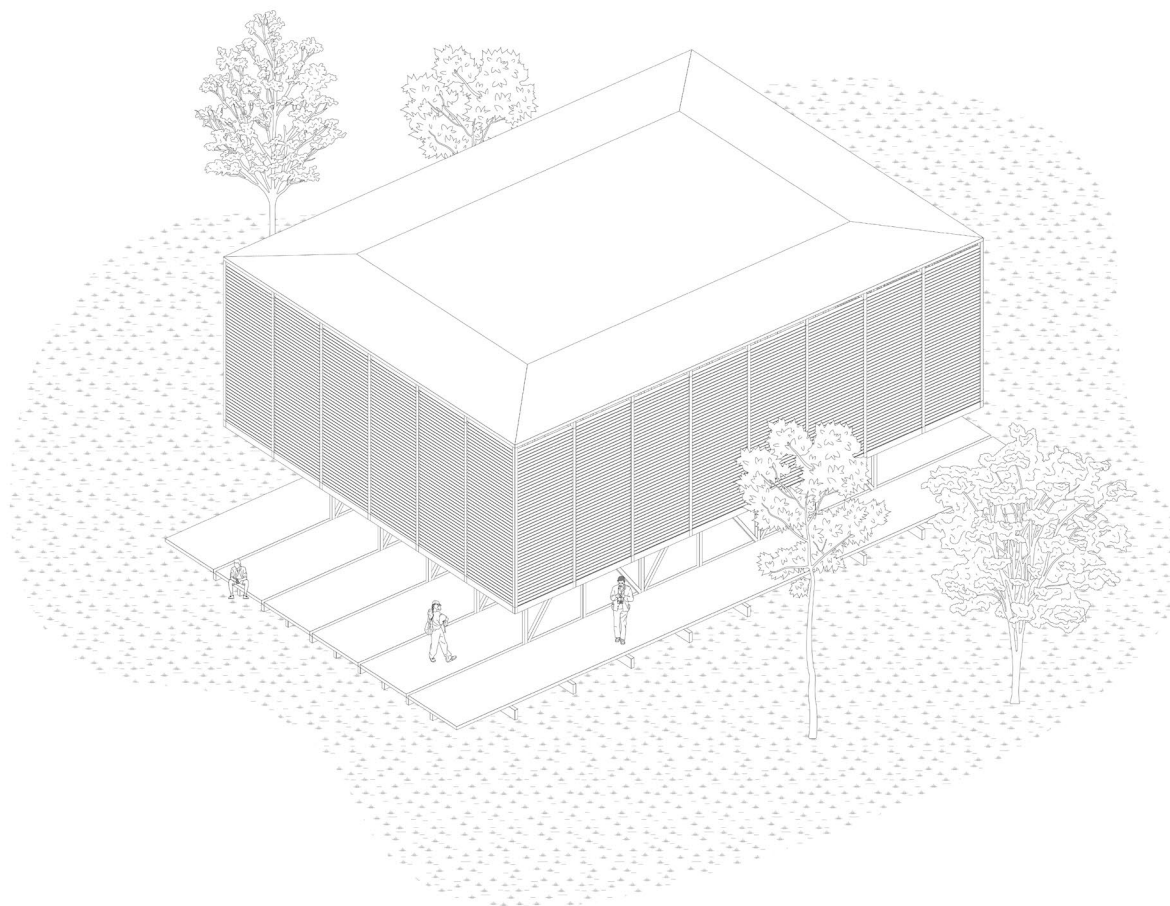
*between wet ground and moving water, the bridge pauses to breathe,
holding a small room where ash, timber and reflection meet*



LANDSCAPE STRATEGY
Pavilions



Timber



P8 THE ENTRANCE PAVILION
POPLAR PARCEL

*from trees once rooted here, a quiet frame begins the ride,
where learning hands turn timber into an entrance for the land*



P8 THE ENTRANCE PAVILION
POPLAR PARCEL



P8 THE ENTRANCE PAVILION
POPLAR PARCEL

LANDSCAPE STRATEGY
Pavilions



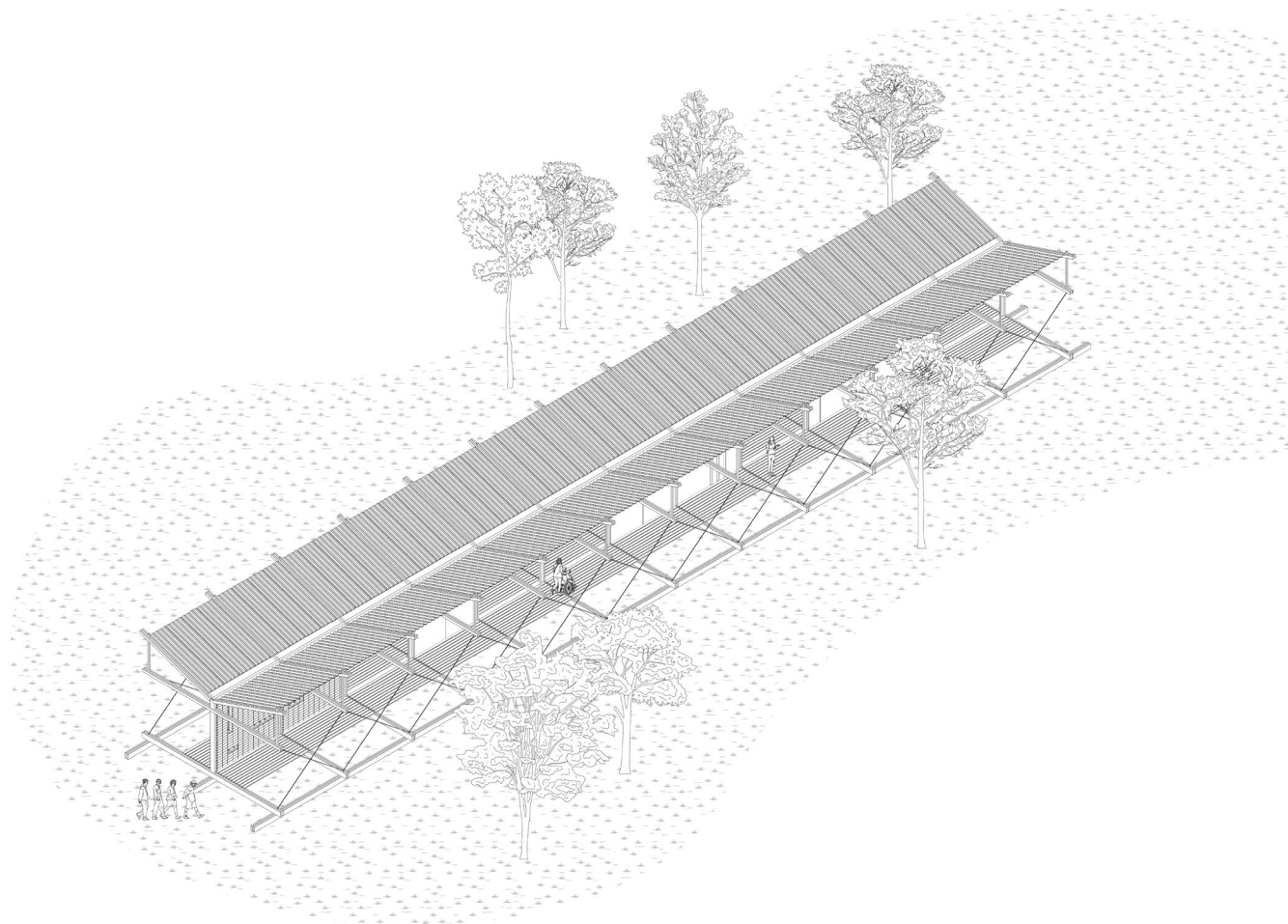
Ash-mixed concrete



Rammed ash



Gabion wall



P9 THE WALL PAVILION
WIND EXPOSURE PARCEL

*in the wind, each wall learns how long it can stand,
letting ash weather slowly into knowledge*



P9 THE WALL PAVILION
WIND EXPOSURE PARCEL

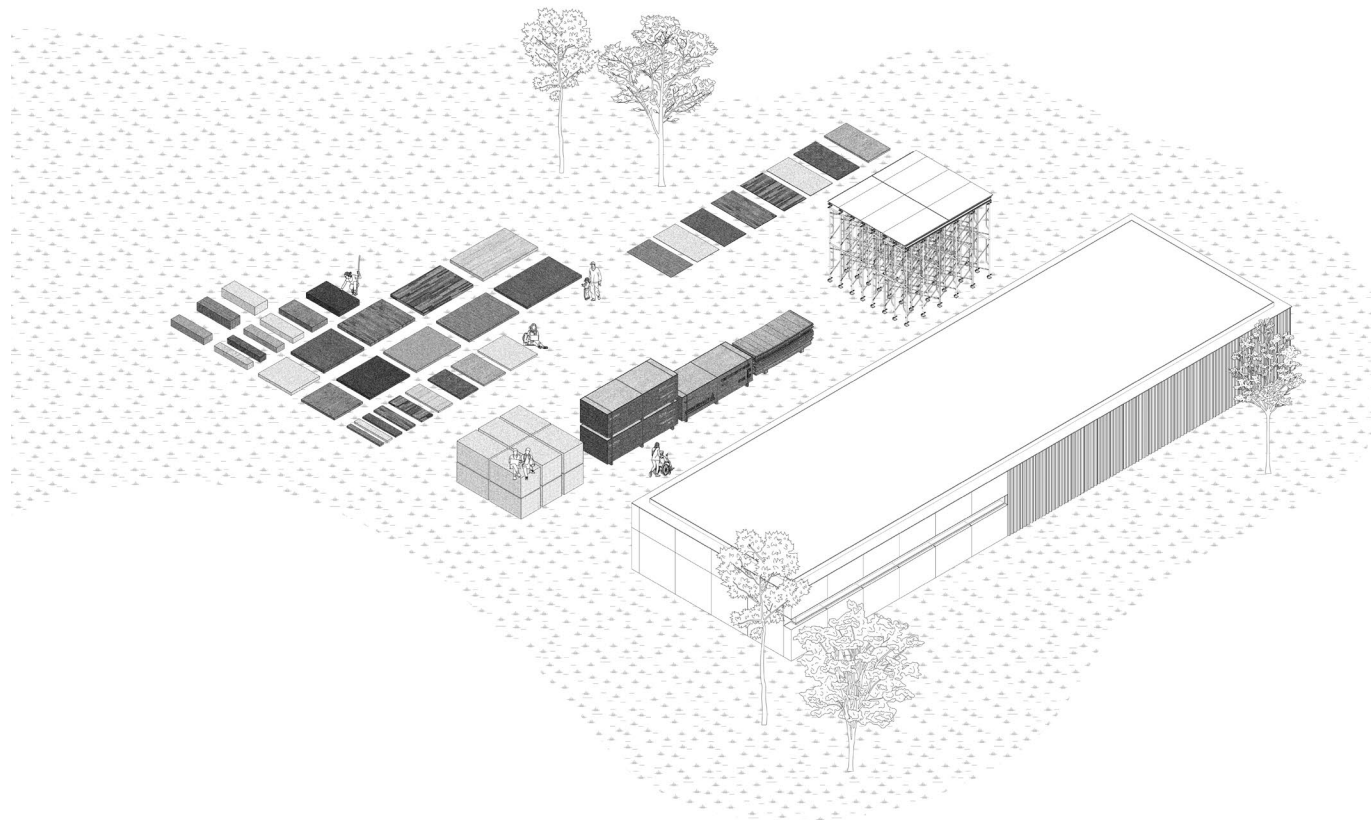
LANDSCAPE STRATEGY
Pavilions



Gabion wall

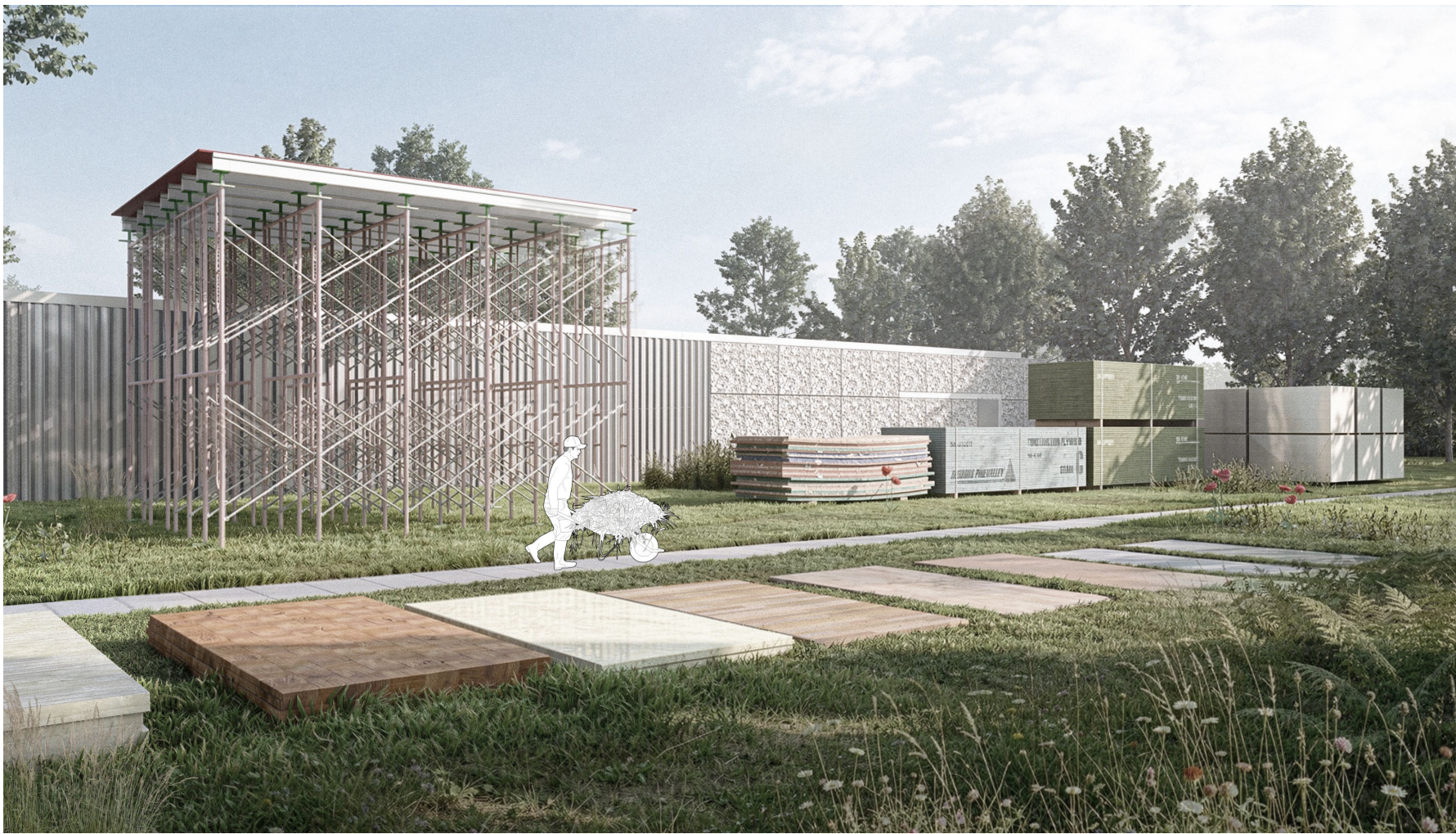


Harvested materials



P10 THE EDUCATIONPAVILION
EDUCATION PARCEL

*Here, hands learn from fragments, soil, timber and ash,
turning the field into a classroom for future grounds*

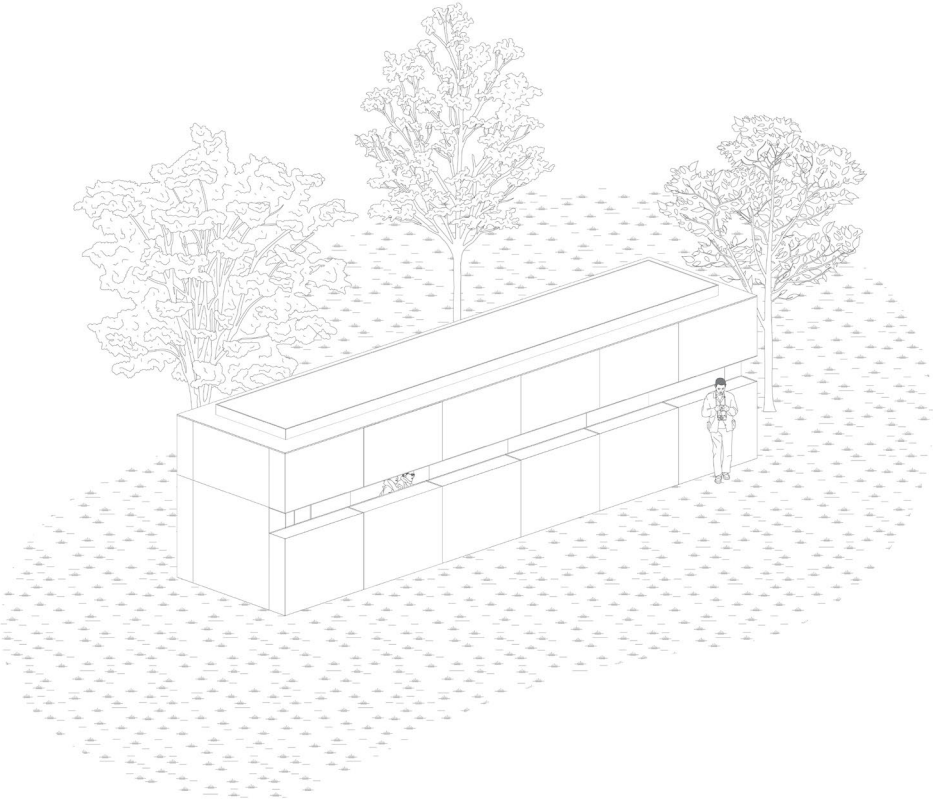


P10 THE EDUCATIONPAVILION
EDUCATION PARCEL

LANDSCAPE STRATEGY
Pavilions



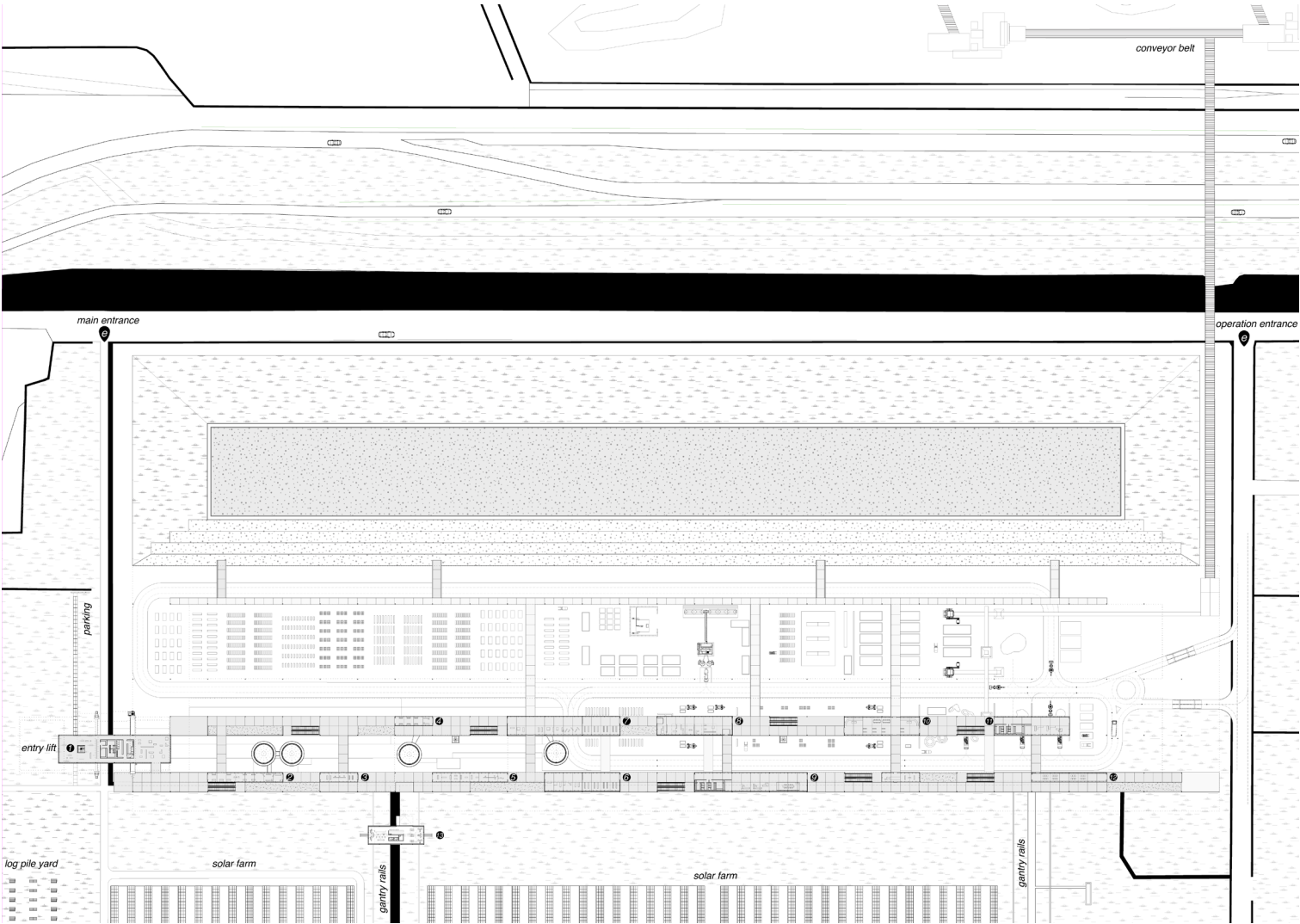
Gabion wall



THE MONITORING PAVILION
ALL PARCELS

ARCHITECTURAL STRATEGY
Second floor plan
+17.00

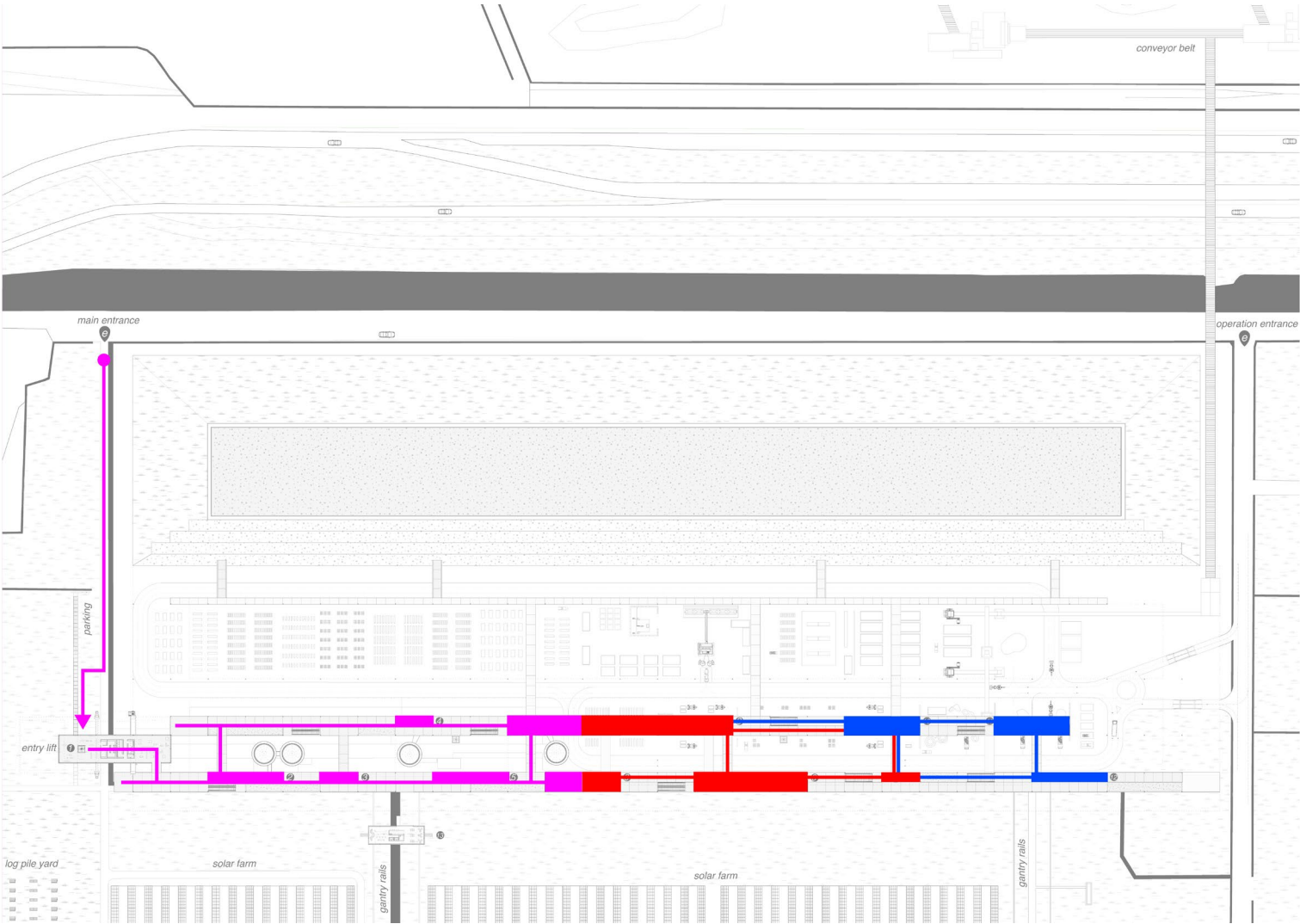
- 1 Visitor center
- 2 Orientation room
- 3 Ash process gallery
- 4 Material sample room
- 5 Environmental data gallery
- 6 Research collection & buffer zone
- 7 Research collection & buffer zone
- 8 Research labs
- 9 Researcher common room
- 10 Operation center
- 11 Operation common room
- 12 Technical room
- 13 Gantry cafe



ARCHITECTURAL STRATEGY
Second floor plan
+17.00

- 1 Visitor center
- 2 Orientation room
- 3 Ash process gallery
- 4 Material sample room
- 5 Environmental data gallery
- 6 Research collection & buffer zone
- 7 Research collection & buffer zone
- 8 Research labs
- 9 Researchers common room
- 10 Operation center
- 11 Operation common room
- 12 Technical room
- 13 Gantry cafe

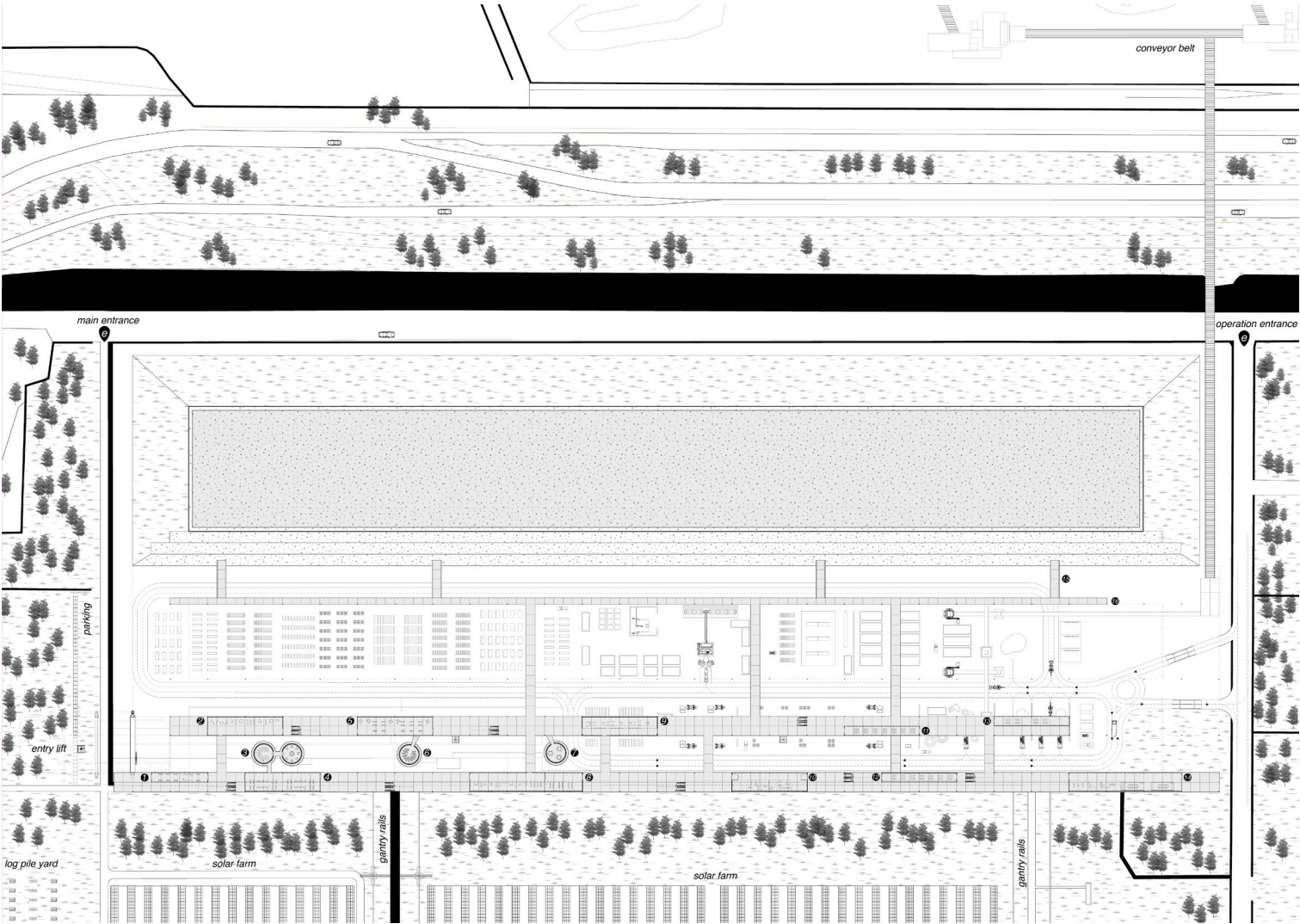
- Visitor route
- Researcher route
- Operational worker route





ARCHITECTURAL STRATEGY
First floor plan
+10.00

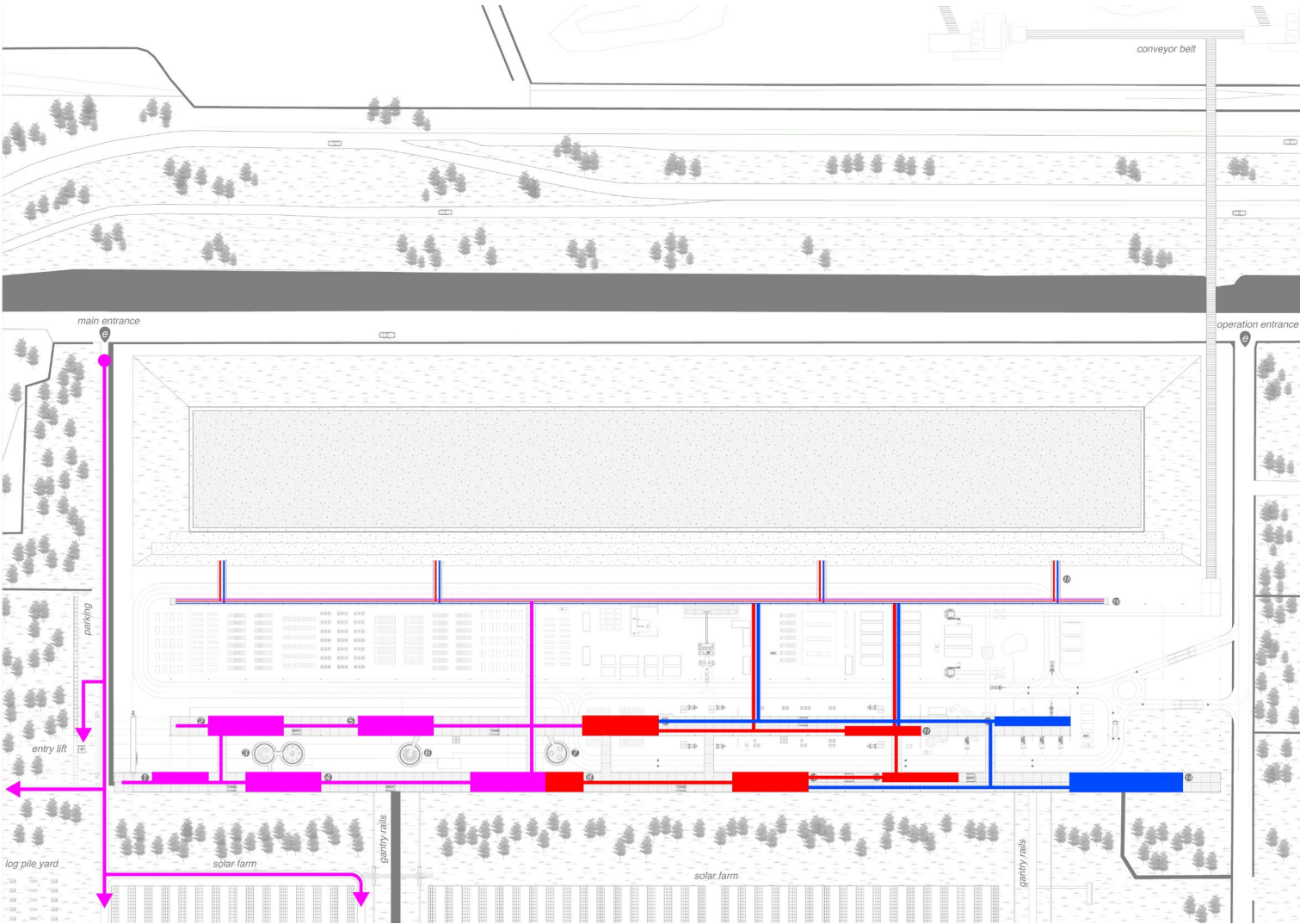
- 1 Exhibition space - soils
- 2 Exhibition space - fractions
- 3 Library
- 4 Material archives
- 5 Workshop area
- 6 Library
- 7 Small seminar room
- 8 Research data gallery
- 9 Sample preparation room
- 10 Research labs
- 11 Storage
- 12 Storage
- 13 Technical room
- 14 Operation rooms



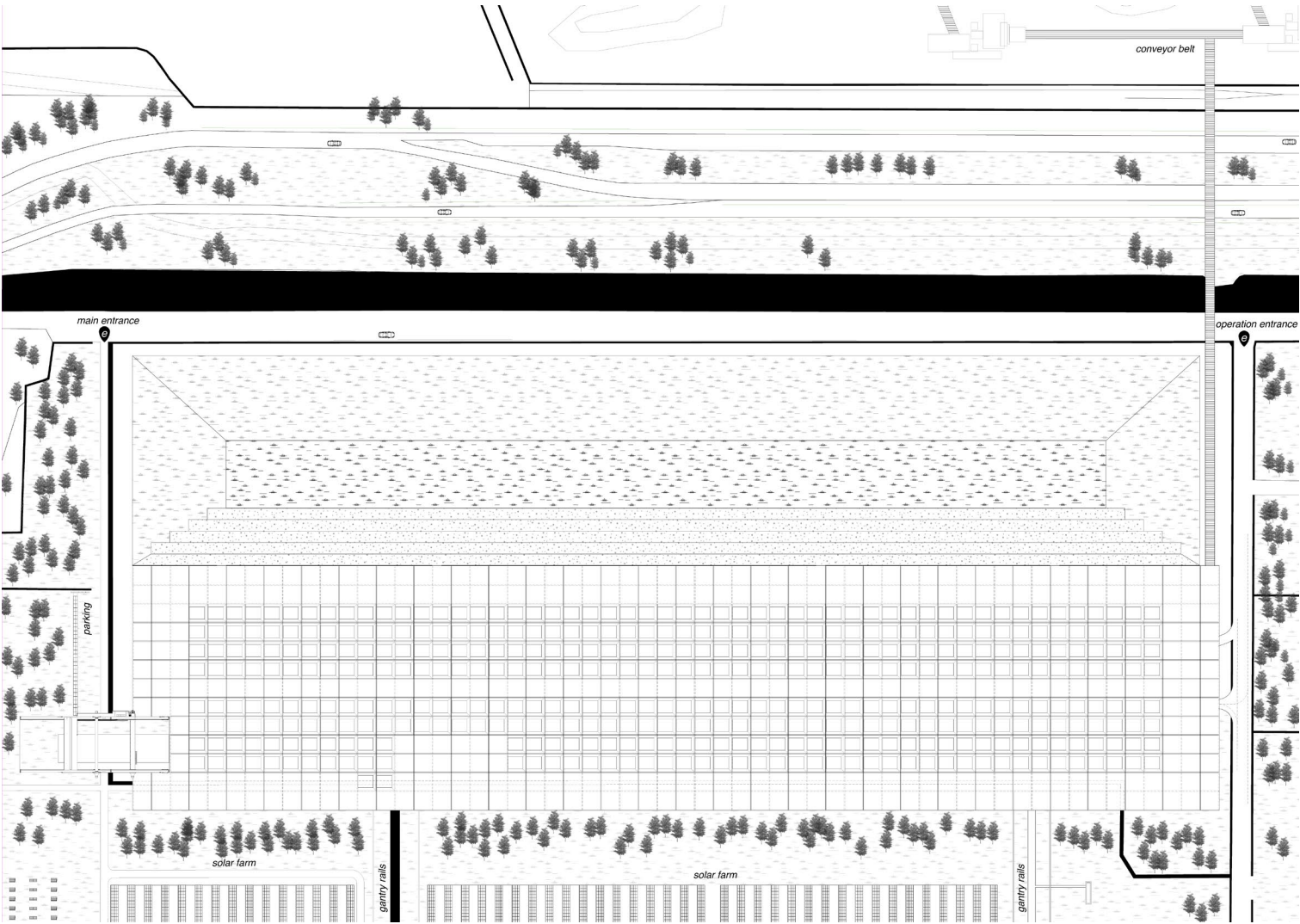
ARCHITECTURAL STRATEGY
First floor plan
+10.00

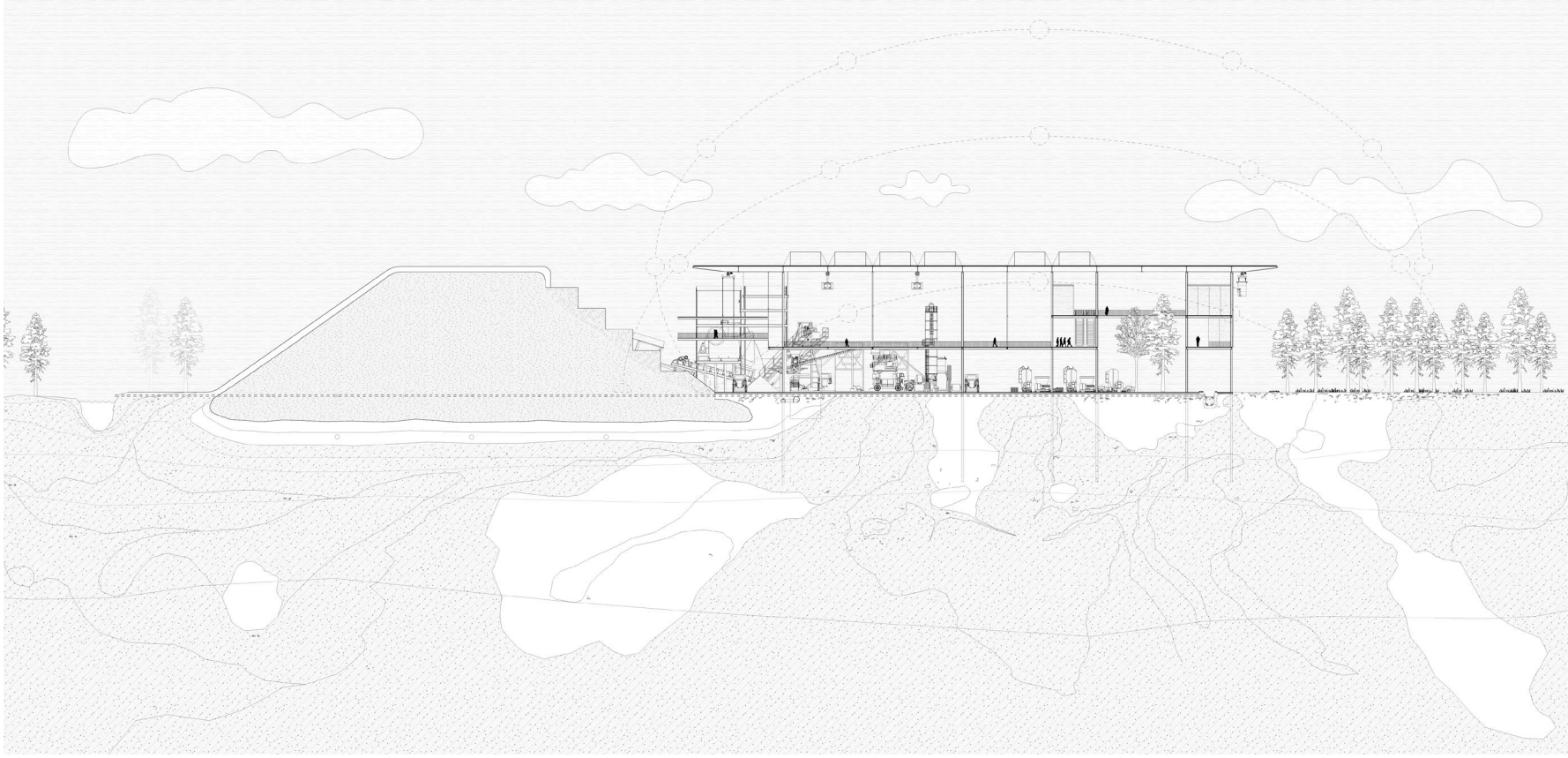
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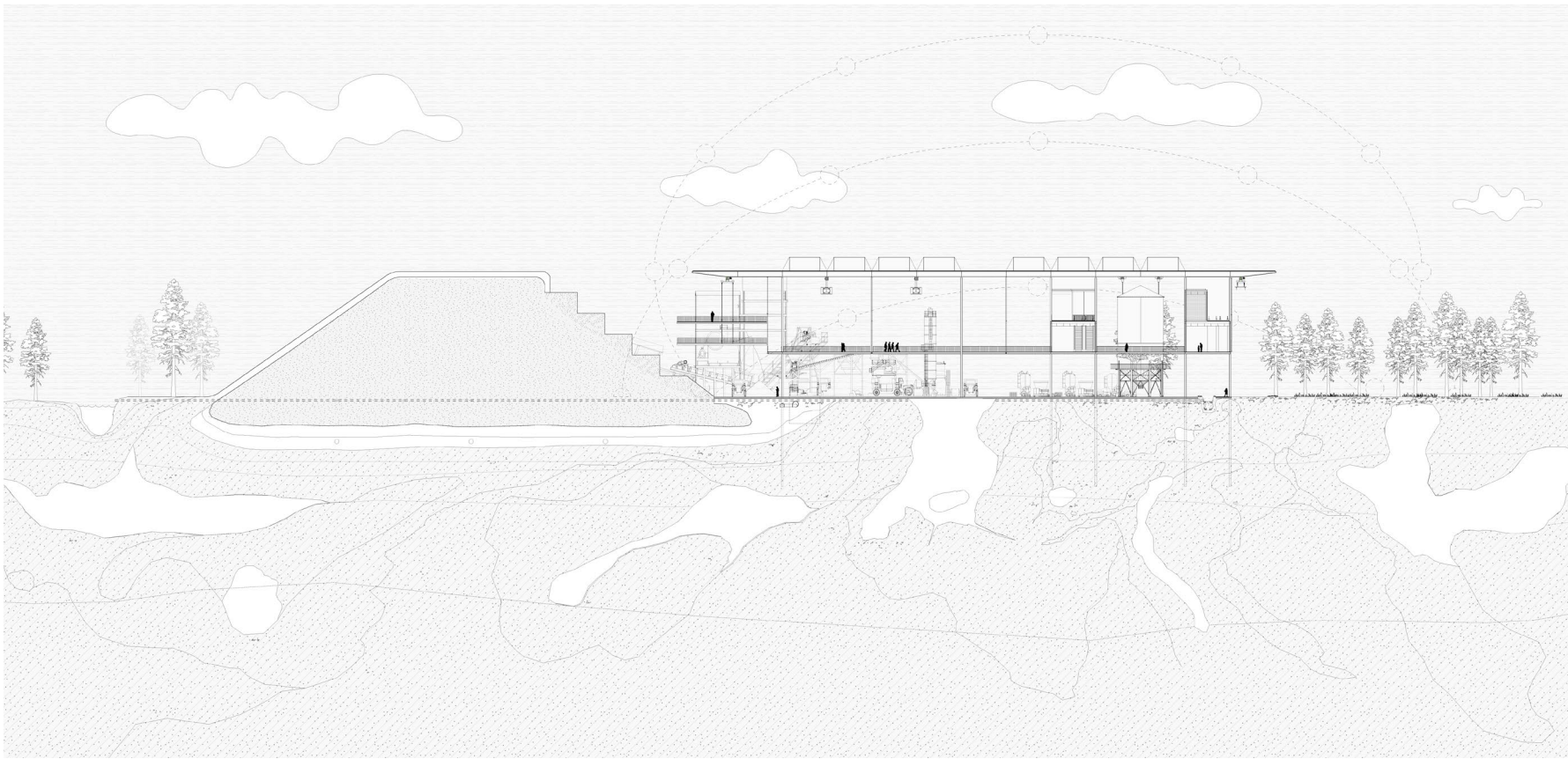
- Visitor route
- Researcher route
- Operational worker route



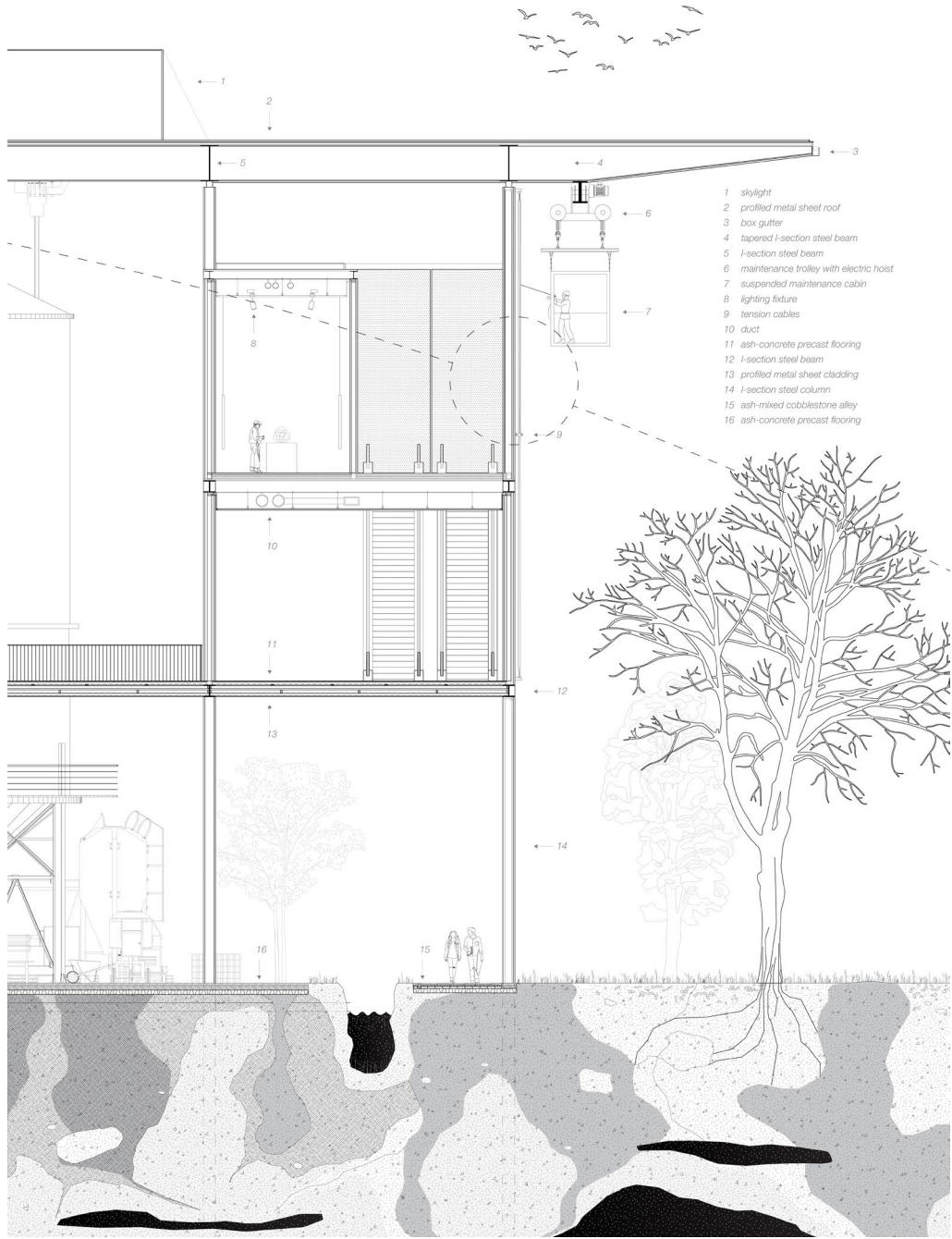








ARCHITECTURAL STRATEGY
System section



SUN PATH

- June solstice · high arc · avg 15 hrs daylight · 8.4 hrs sunshine
- Equinoxes · mid arc · avg 12 hrs daylight
- December solstice · low arc · avg 9.5 hrs daylight · 3.5 hrs sunshine
- Frequent detrimental sun · S / SW / SE facades · 1,690 overheating hrs/yr

PREVAILING WINDS

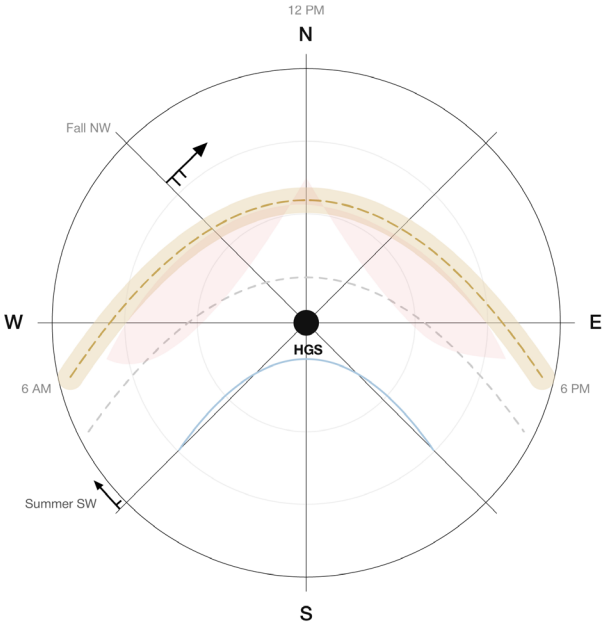
Winter	mainly breezy · occasionally strong · rarely calm (3%)
Spring	mainly breezy · occasionally strong · calm 8% hrs
Summer	SW prevailing · occasionally strong · calm 3% hrs
Fall	NW prevailing · occasionally strong · calm 7% hrs

KEY CLIMATE FACTS

WINTER Dec–Mar	SPRING Mar–Jun	SUMMER Jun–Sep	FALL Sep–Dec
3°C – 7°C avg 201 mm / 36 rain days min snowfall · 9.5 hrs light heating 70 days	8°C – 14°C avg 122 mm / 28 rain days no snow · 15 hrs light heating 13 / cooling 19 days	14°C – 20°C avg 212 mm / 42 rain days no snow · 15.1 hrs light cooling 82 days	7°C – 11°C avg 210 mm / 41 rain days 10 cm snow · 9.6 hrs light heating 26 days

FACADE SOLAR EXPOSURE · overheating hr / yr

S	1,690 hrs · shading required
SW	1,641 hrs · shading required
W	1,261 hrs · shading required
SE	1,267 hrs · consider shading
E	894 hrs · consider shading
NW	888 hrs · consider shading
NE	514 hrs · shading not needed
N	465 hrs · shading not needed



ARCHITECTURAL STRATEGY
Environmental Strategy

OPEN OPERATIONAL HALL
Natural ventilation + local dust extraction

ASH HANDLING AREAS
Enclosed conveyors

VISITOR CENTER
Sealed glass box + filtered air + local HVAC

CAFÉ / EXHIBITION
Comfort HVAC + filtered overhead supply

RESEARCH LABS
Independent HVAC + higher filtration + controlled exhaust

CONTROL ROOM
Sealed protected room + independent HVAC

OFFICES / MEETING ROOMS
Filtered fresh air + local heating/cooling

WORKSHOPS
Local extraction + filtered supply air

ENTRANCE / ELEVATOR LOBBY
Airlock + dust mat / grated threshold

VISITOR PLATFORMS
No HVAC, naturally ventilated sheltered route

SERVICE SPINE
Visible overhead ducts, pipes and cable trays

Roof / technical platform
HVAC unit + filters + fans



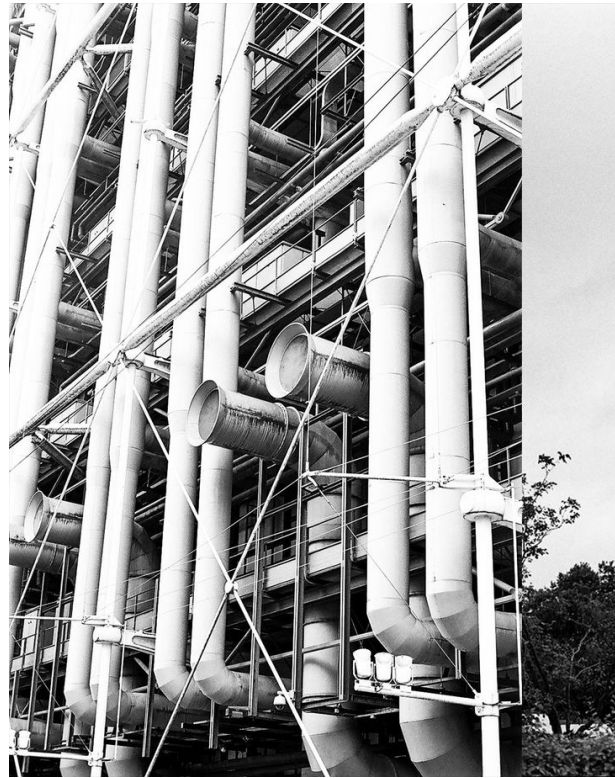
visible overhead ducts

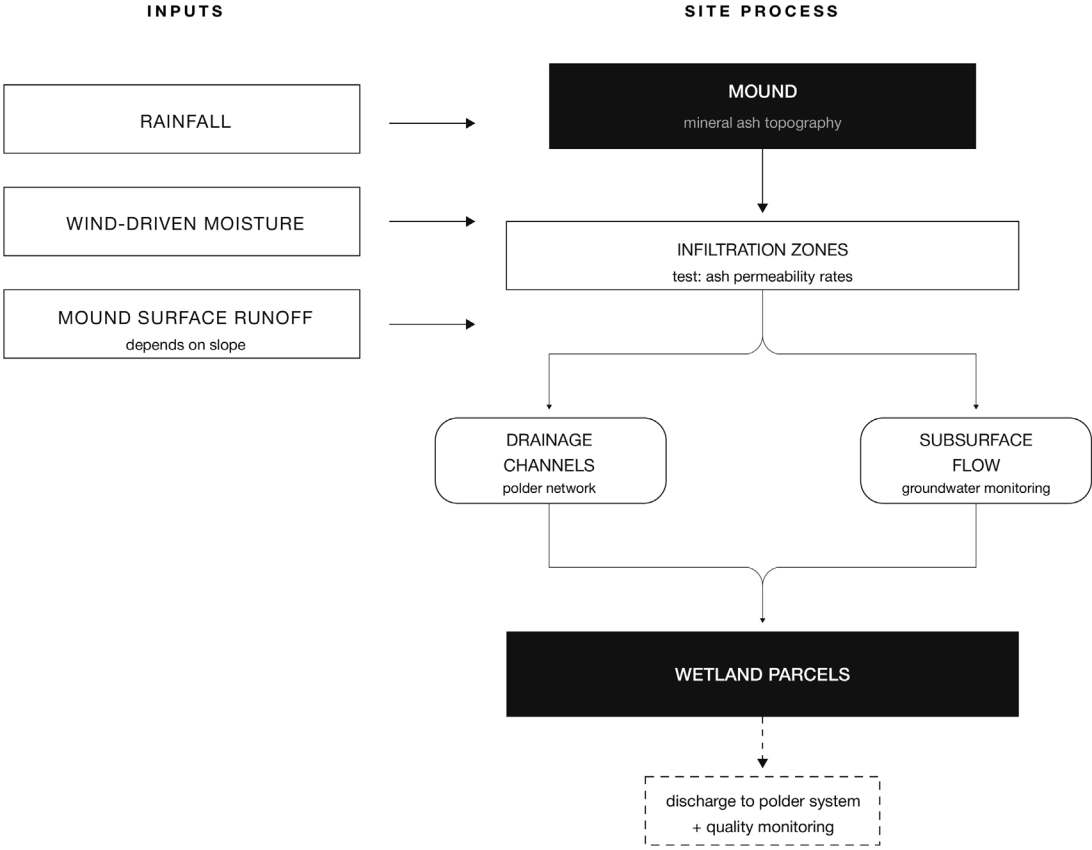


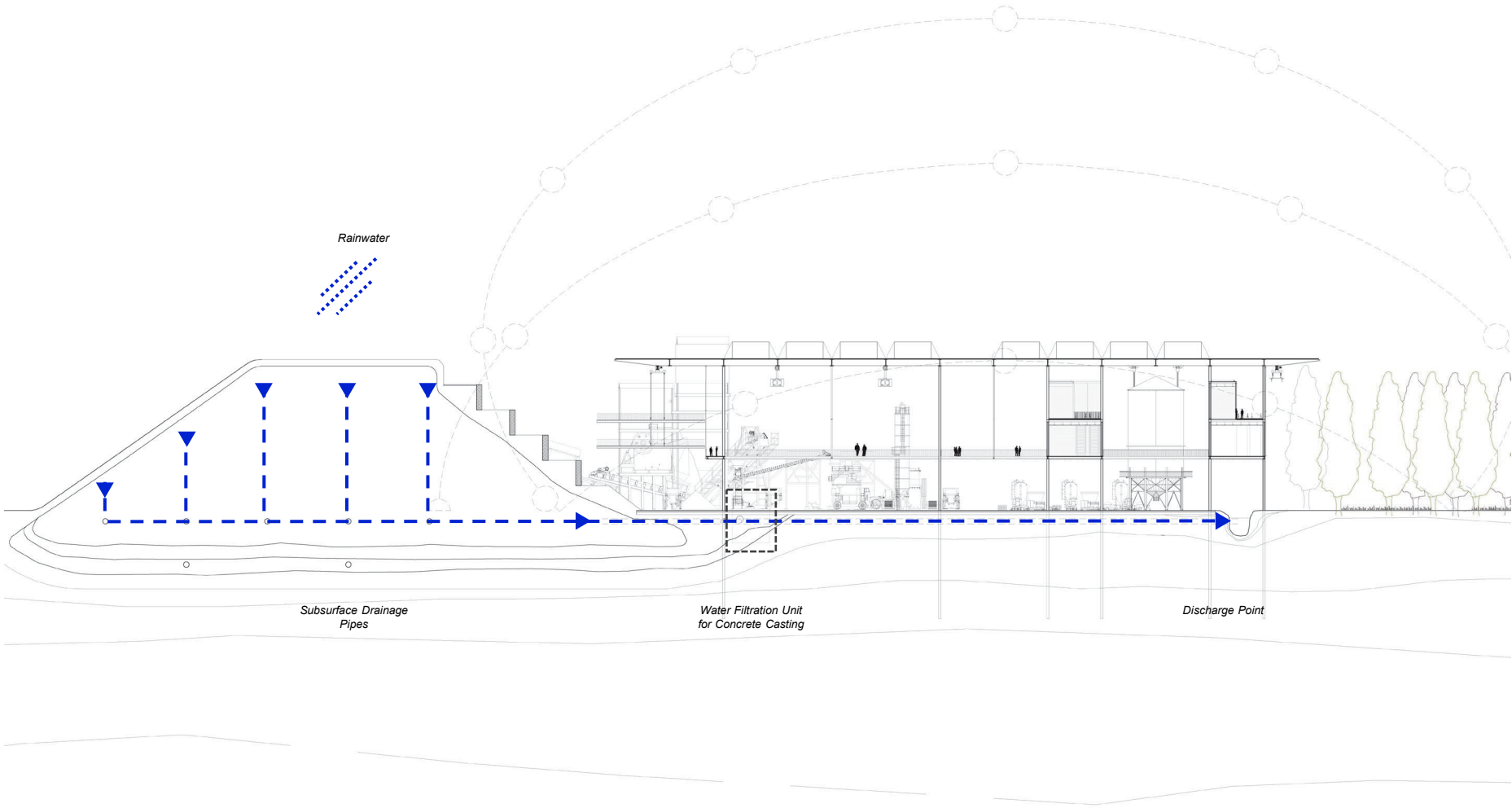
sealed glass rooms



clean air supply









Solar energy field

Harvested port materials

Ash mound as material stock

Natural sunlight

*Cantilevered Overhang
+ textile shading*

Reused Mineral Byproducts



WHAT IS NEXT?

To become truly circular, we need to **keep the circle small**.