Archive Fever
Introducing Data Storage in the city of Hamburg

Transitional Territories
North Sea: Landscapes of Coexistence.
A Topography of Chance

Zuzanna Rosinska

P5 Presentation | 23rd June 2020

I
Location



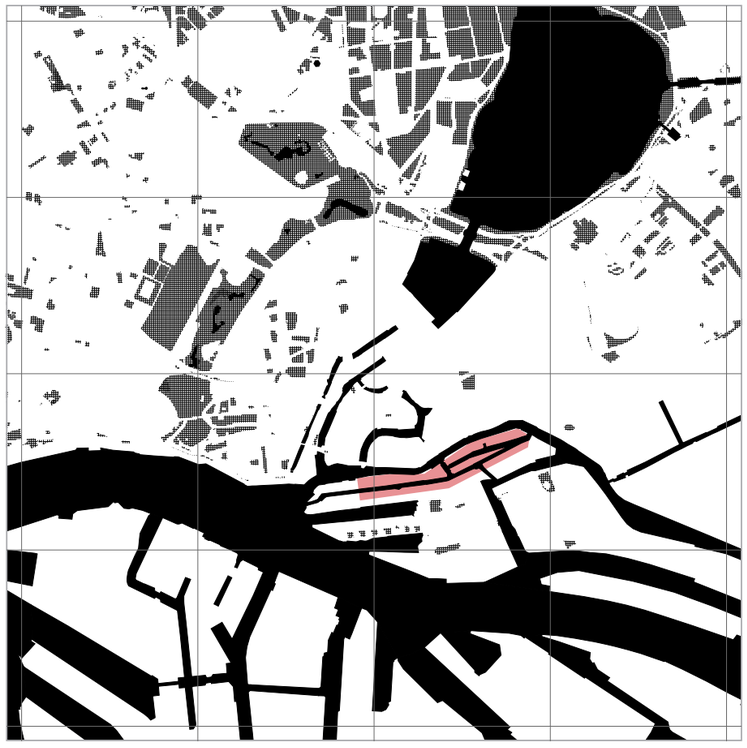
Hamburg canal

photograph by author, 2020

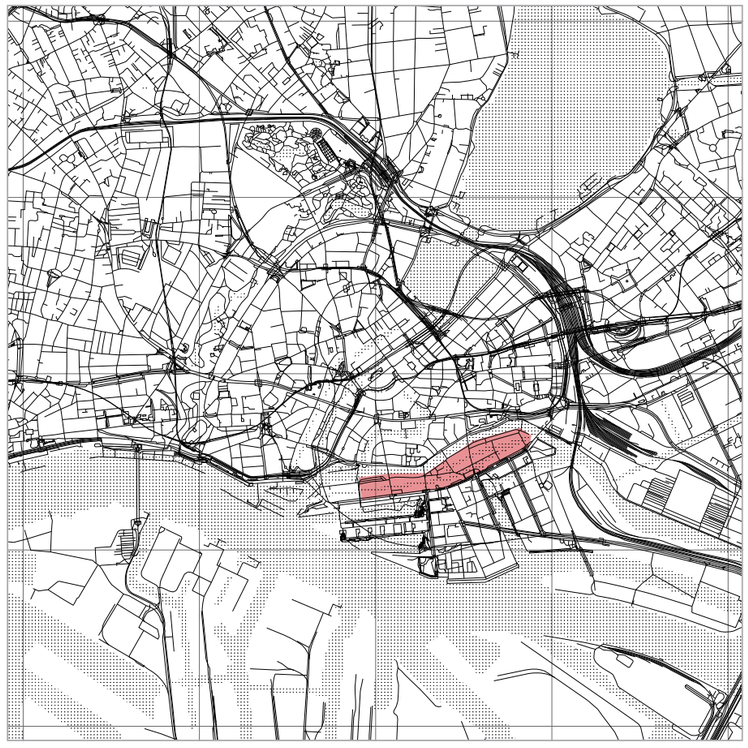


Site in the context of the North Sea

Hamburg, the Elbe River







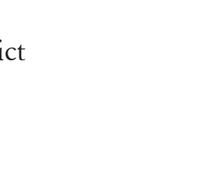
Infrastructure

Urban Analysis

01 Waterscape and Green Spaces
02 Schwartzplan
03 Road and Rail Networks

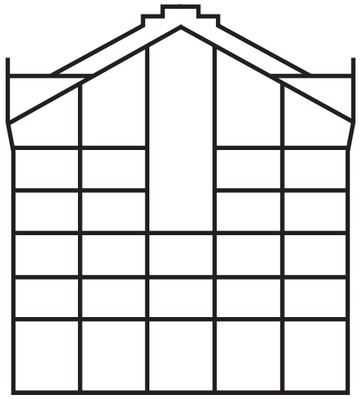
unit

sack of the coffee beans



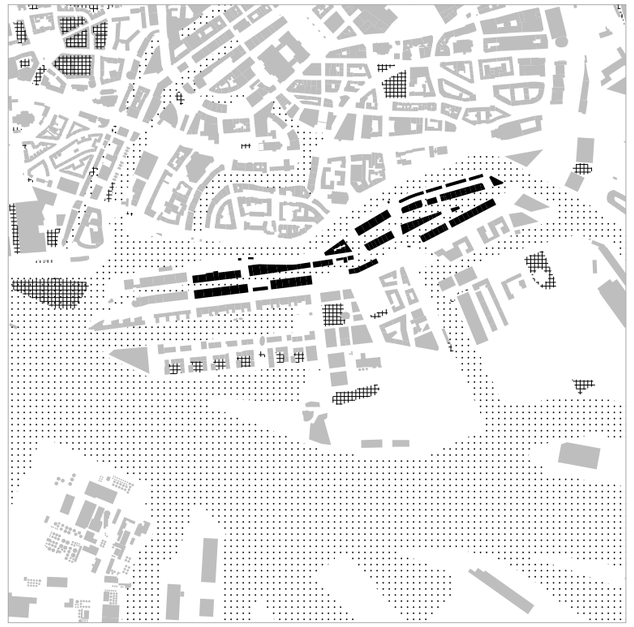
rack

sack of the coffee beans sacks,
storage unit



building

floors filled with racks
warehouse



district - part of the city

warehouses Speicherstadt,
the port of Hamburg



Intra-European
Fibre-optic network

N

0 50 100 M

Site plan | 1 : 5 000 @A3

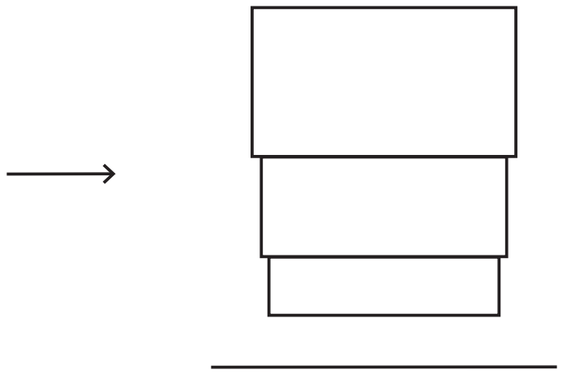
Speicherstadt, Hamburg

II
The beginning

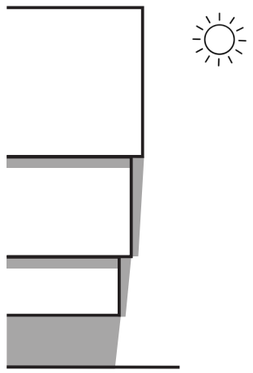




Storage buildings in
Hanseatic City of Hamburg

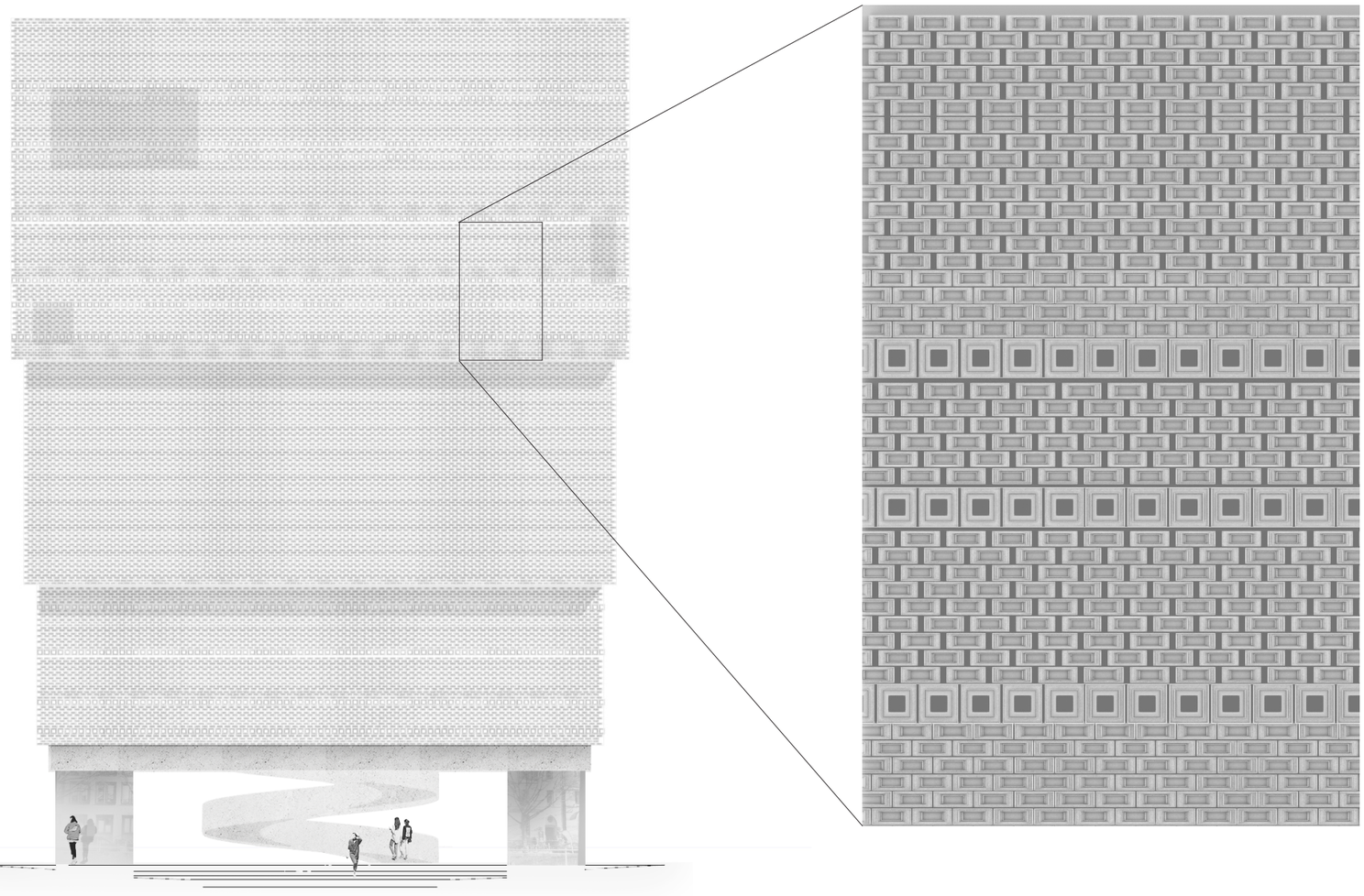


Stepping massing

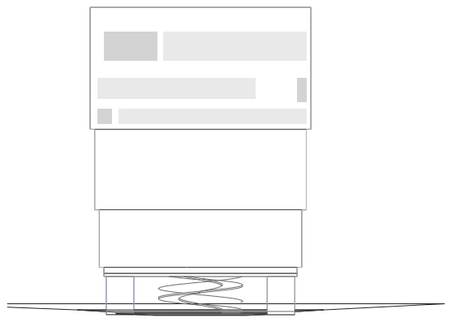


shading Data Centre

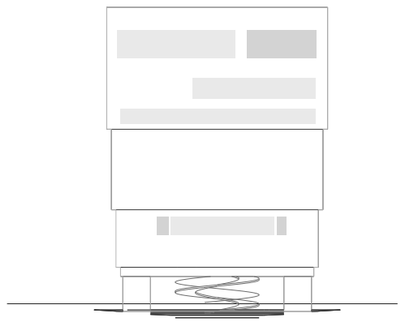




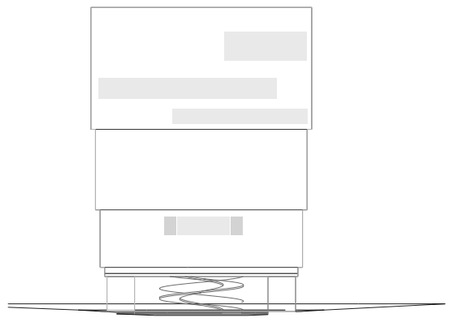
Speicherstadt brick facades



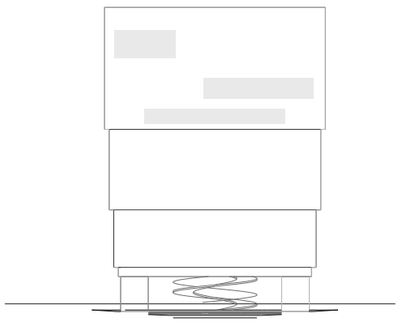
North facade



East facade



West facade



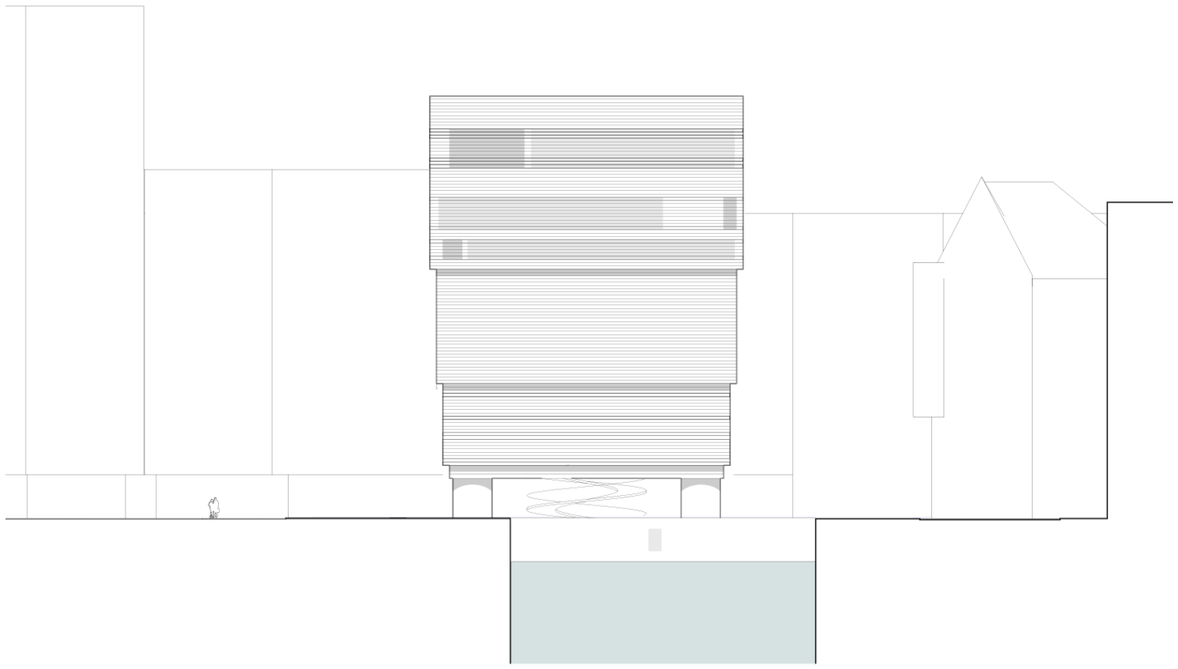
South facade

opening - city view

perforation



North facade

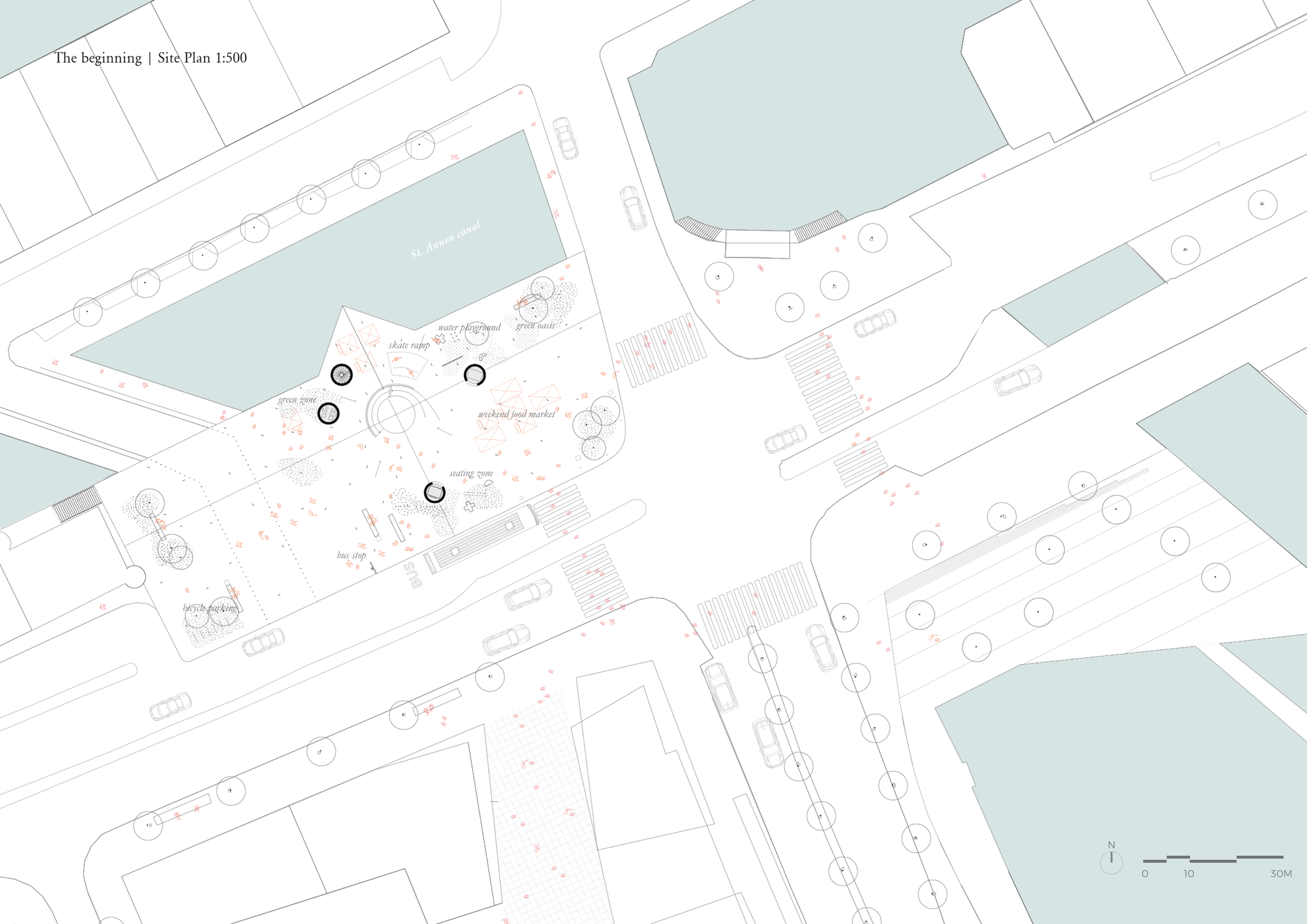


East facade

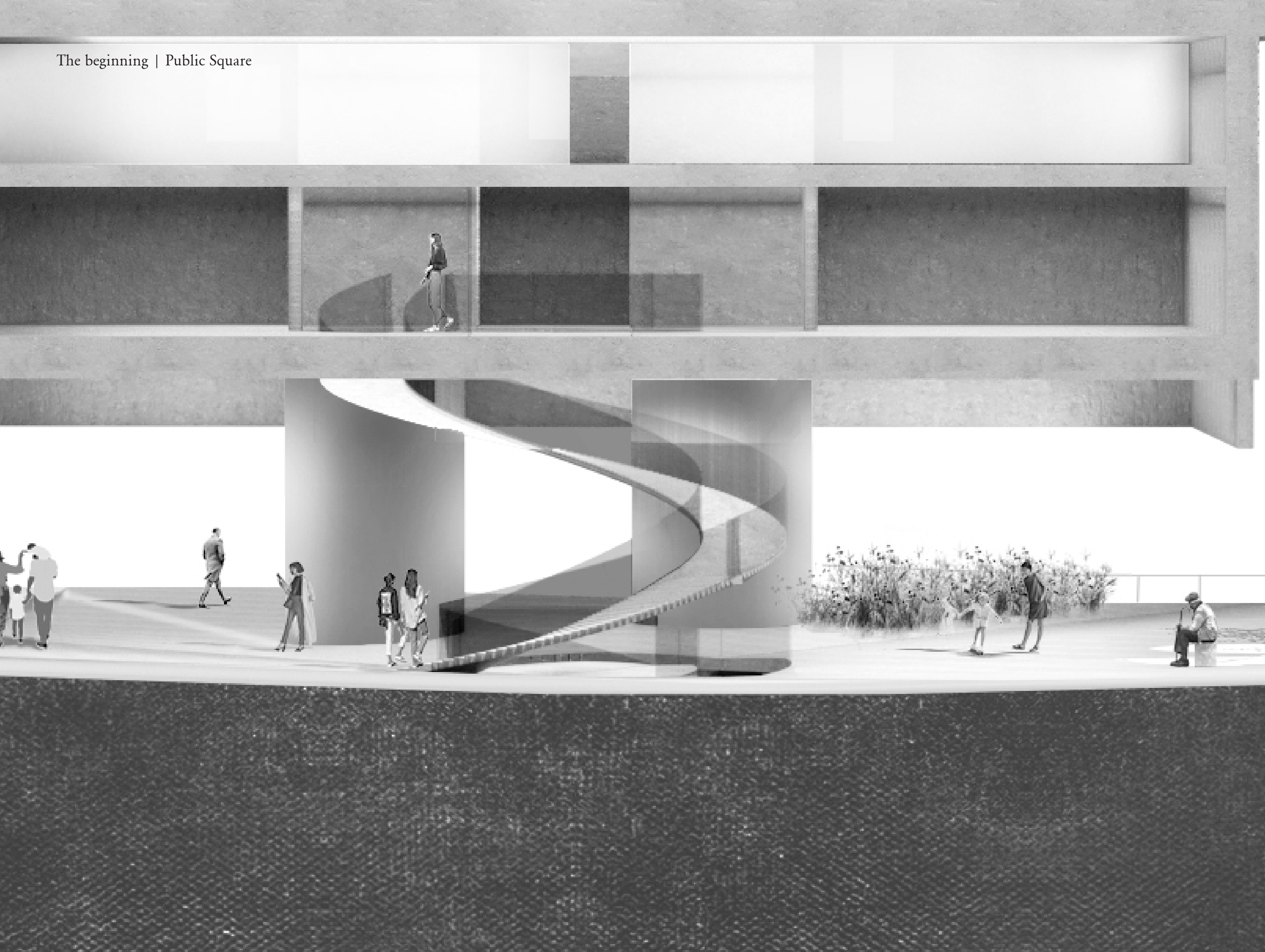
Façades in the context | 1 : 200 @A3

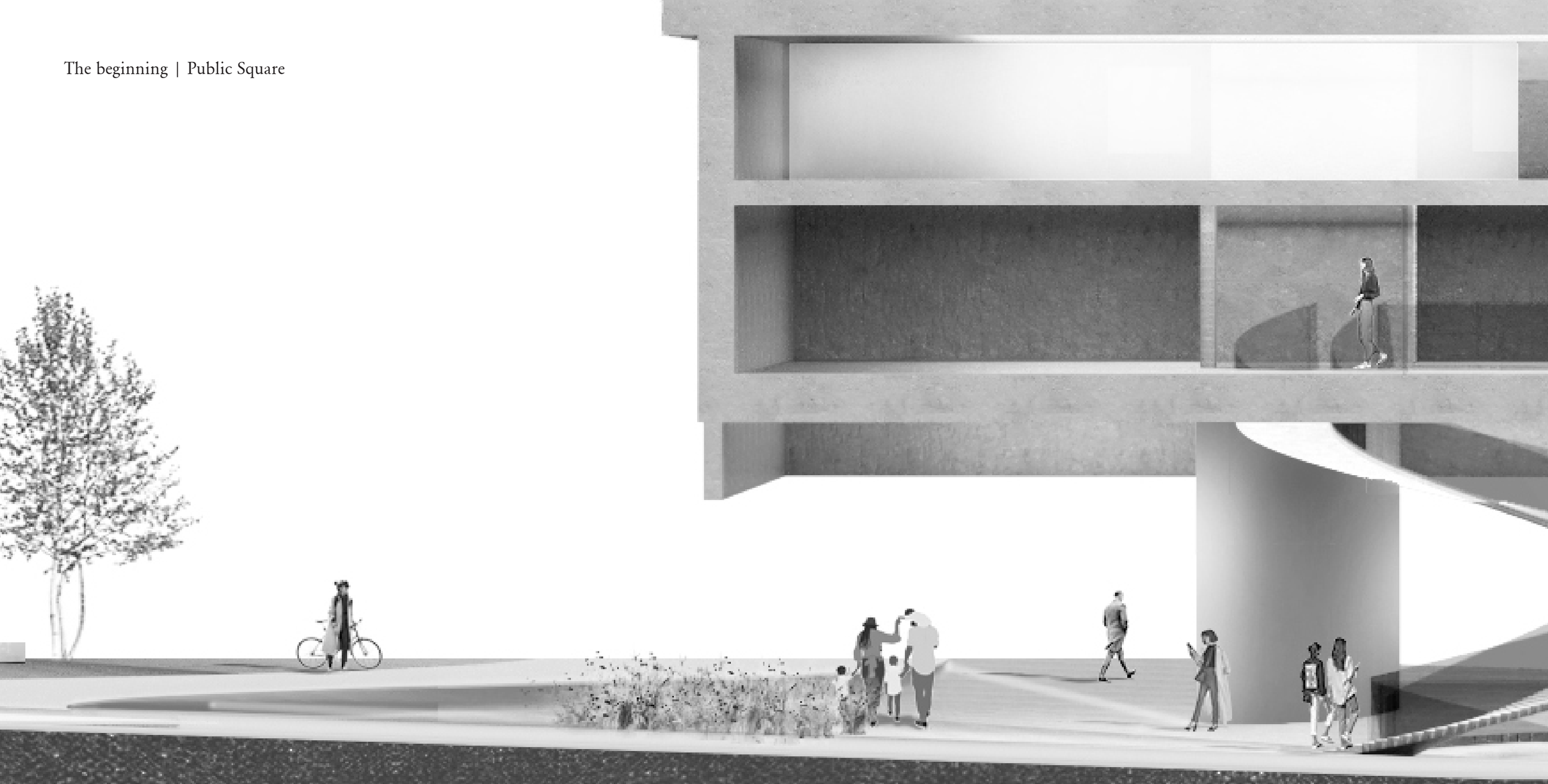
Speicherstadt, Hamburg

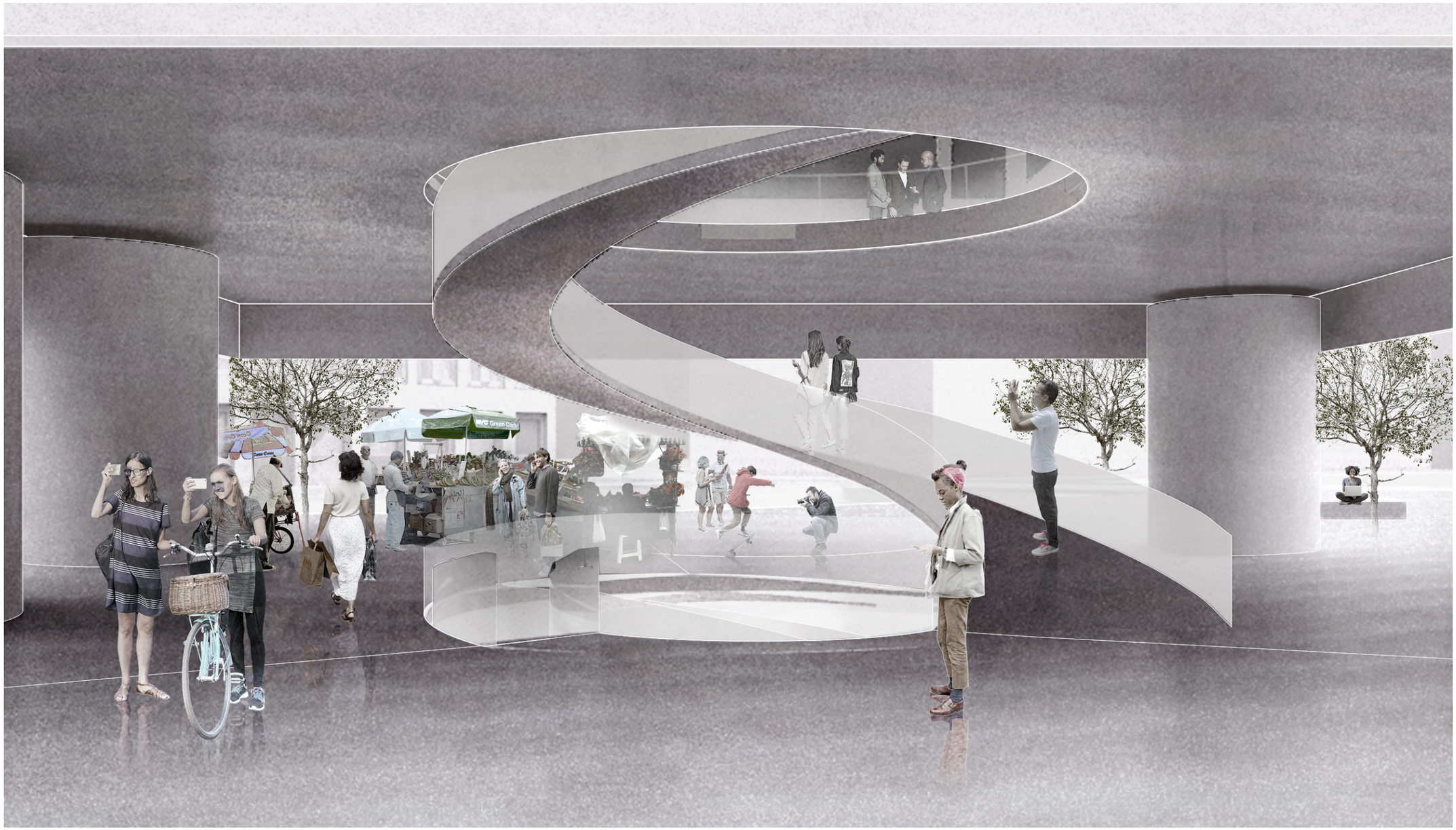
The beginning | Site Plan 1:500

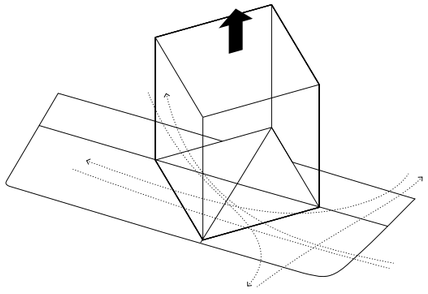


The beginning | Public Square

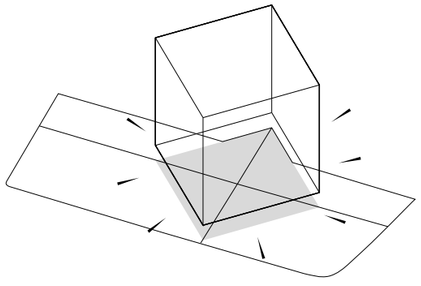




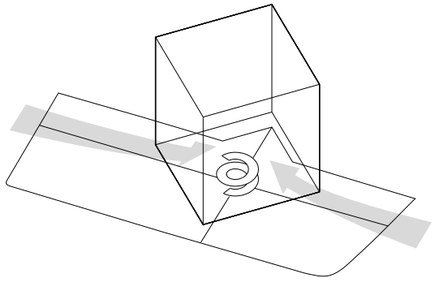

NYC Green Cart



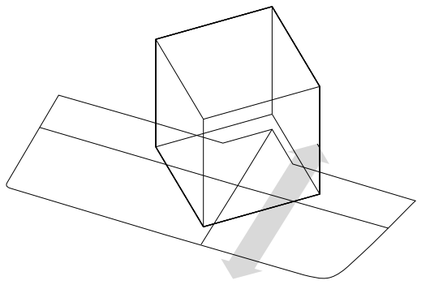
uninterrupted flow of people



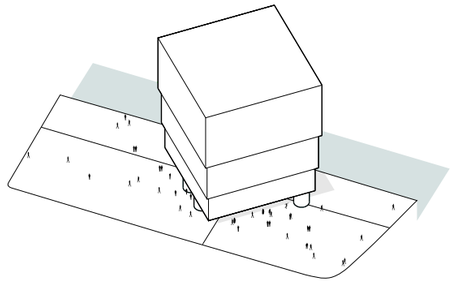
covered plaza



vertical street

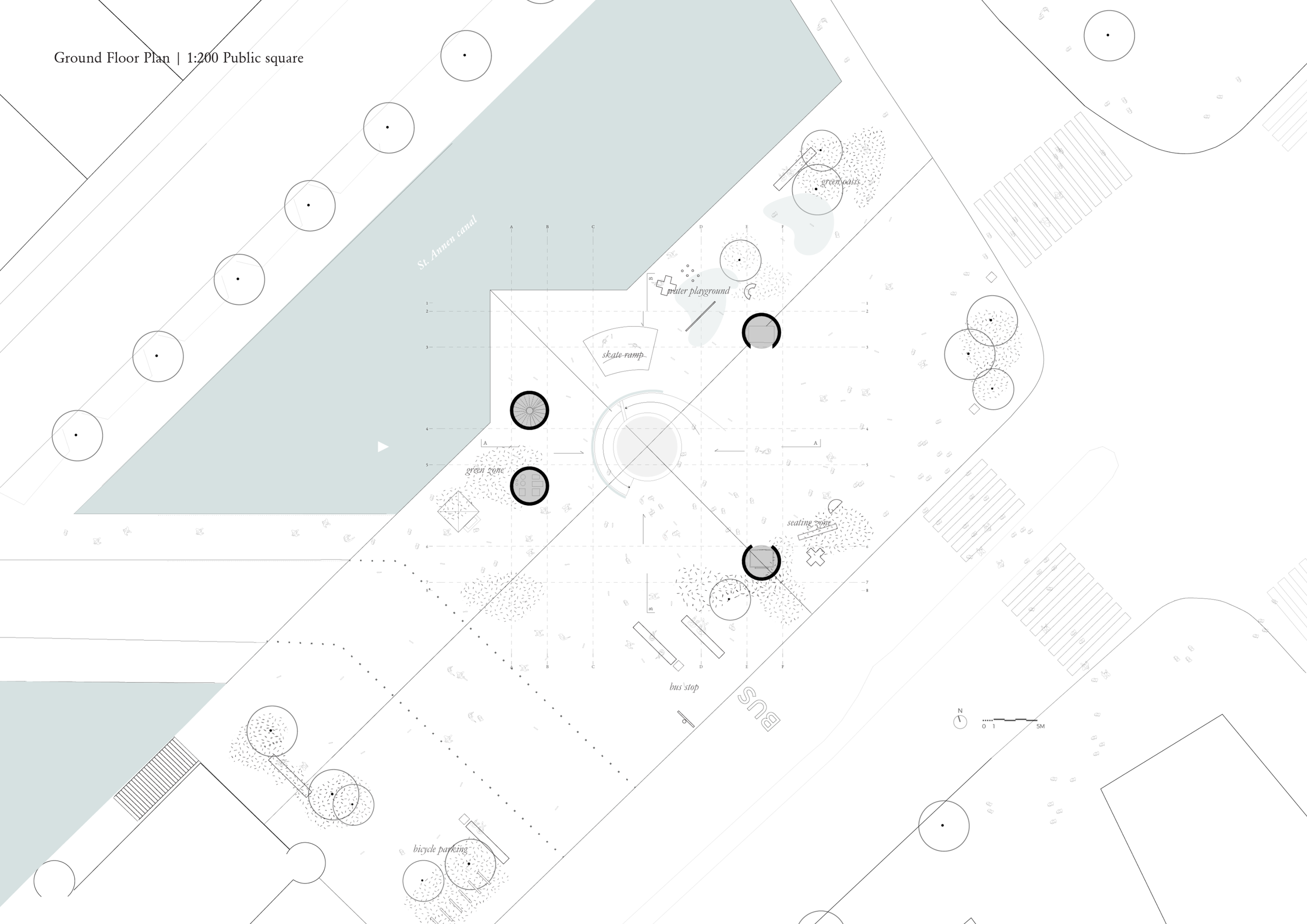


maintaining visual connection

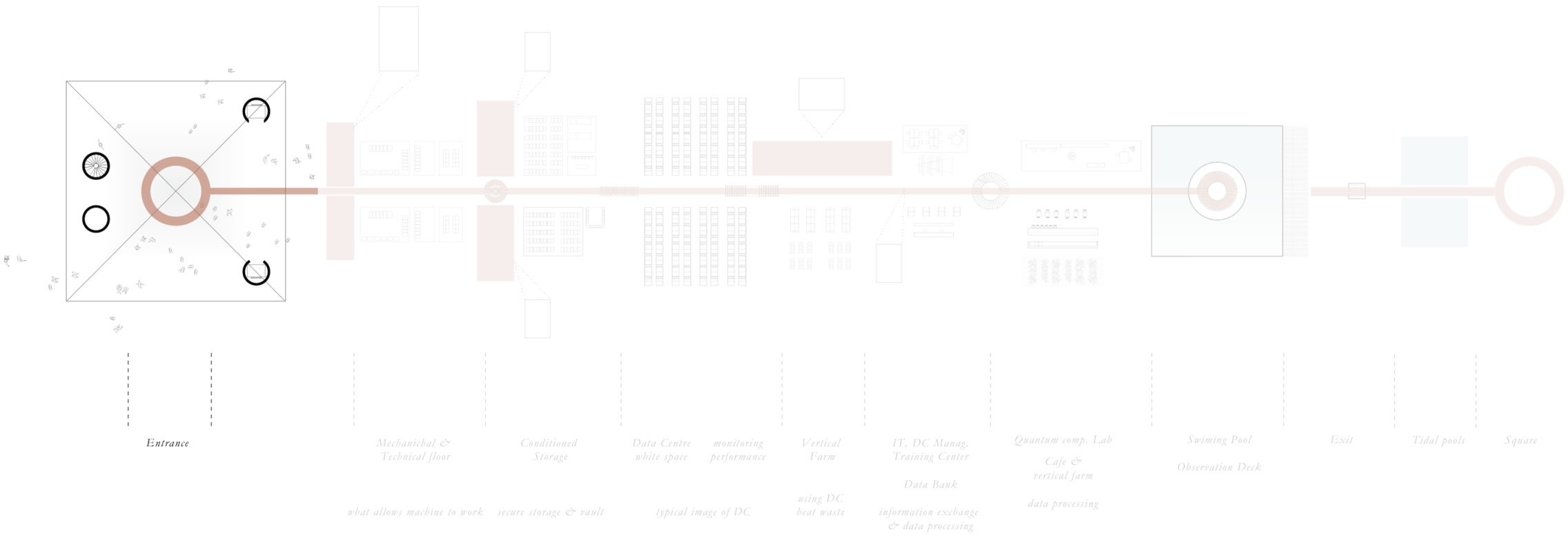


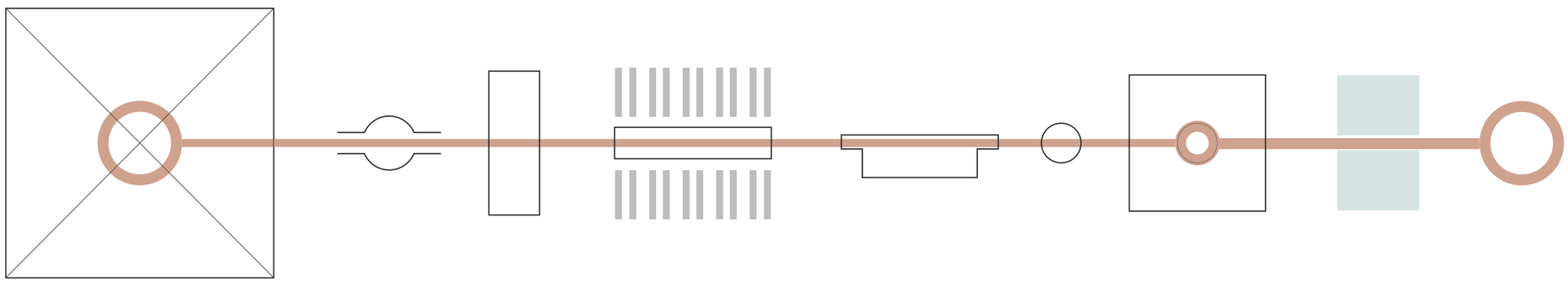
local centre of gravity

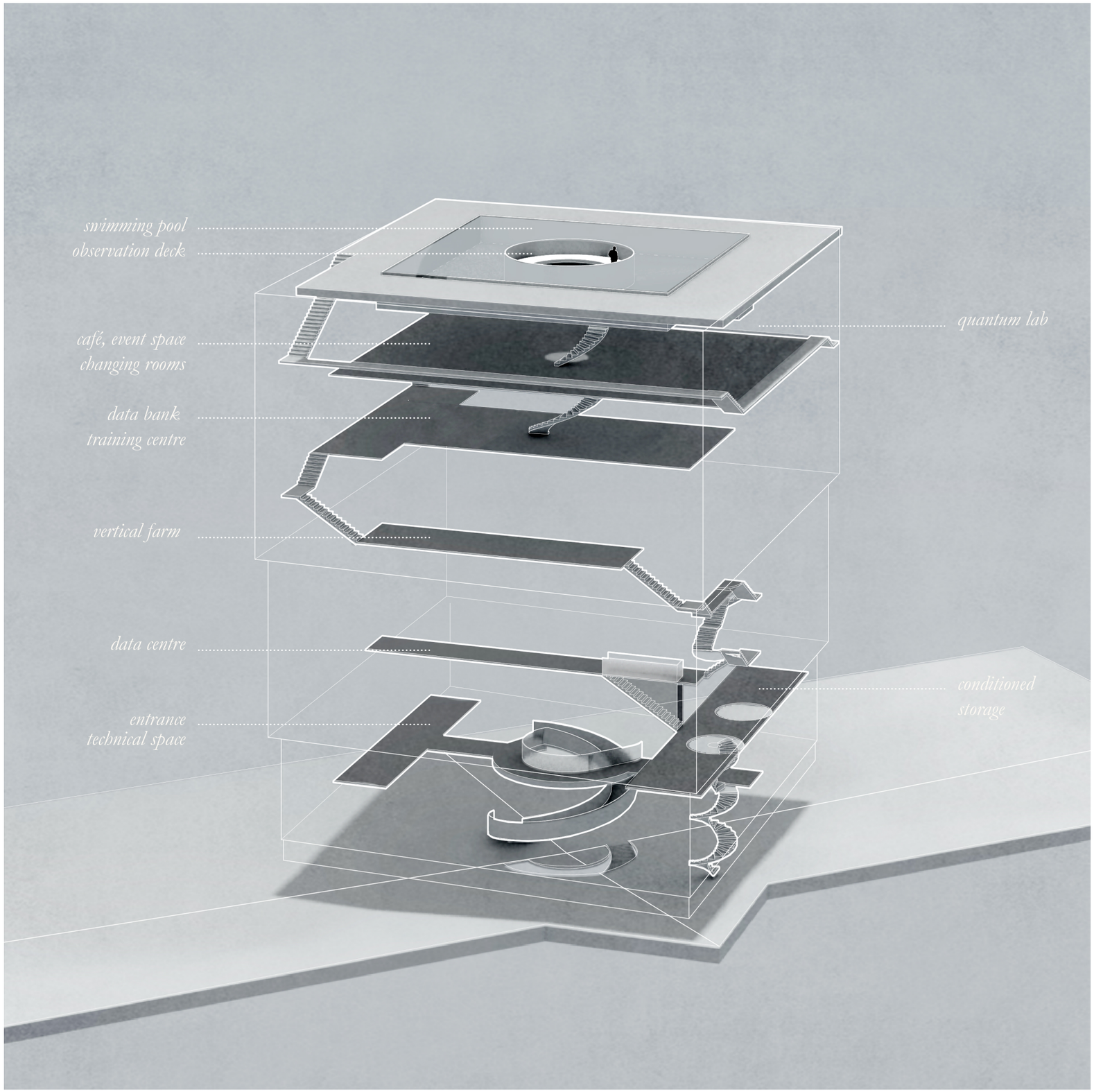
Ground Floor Plan | 1:200 Public square

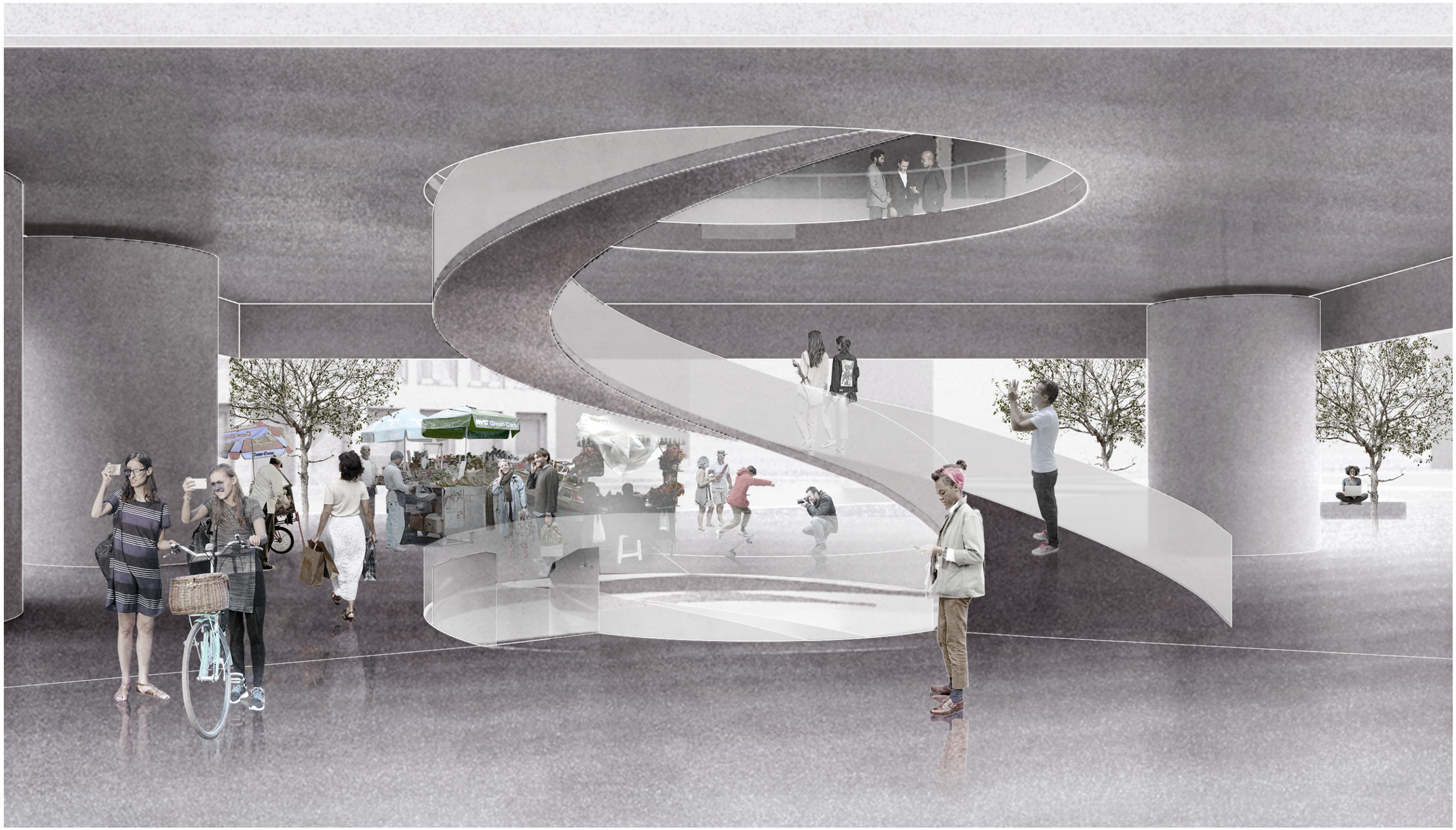


III
The Path


Entrance
Mechanichal &
Technical floor
what allows machine to work
Conditioned
Storage
secure storage & vault
Data Centre
white space
monitoring
performance
typical image of DC
Vertical
Farm
using DC
heat waste
IT, DC Manag.
Training Center
Data Bank
information exchange
& data processing
Quantum comp. Lab
Cafe &
vertical farm
data processing
Swiming Pool
Observation Deck
Exit
Tidal pools
Square

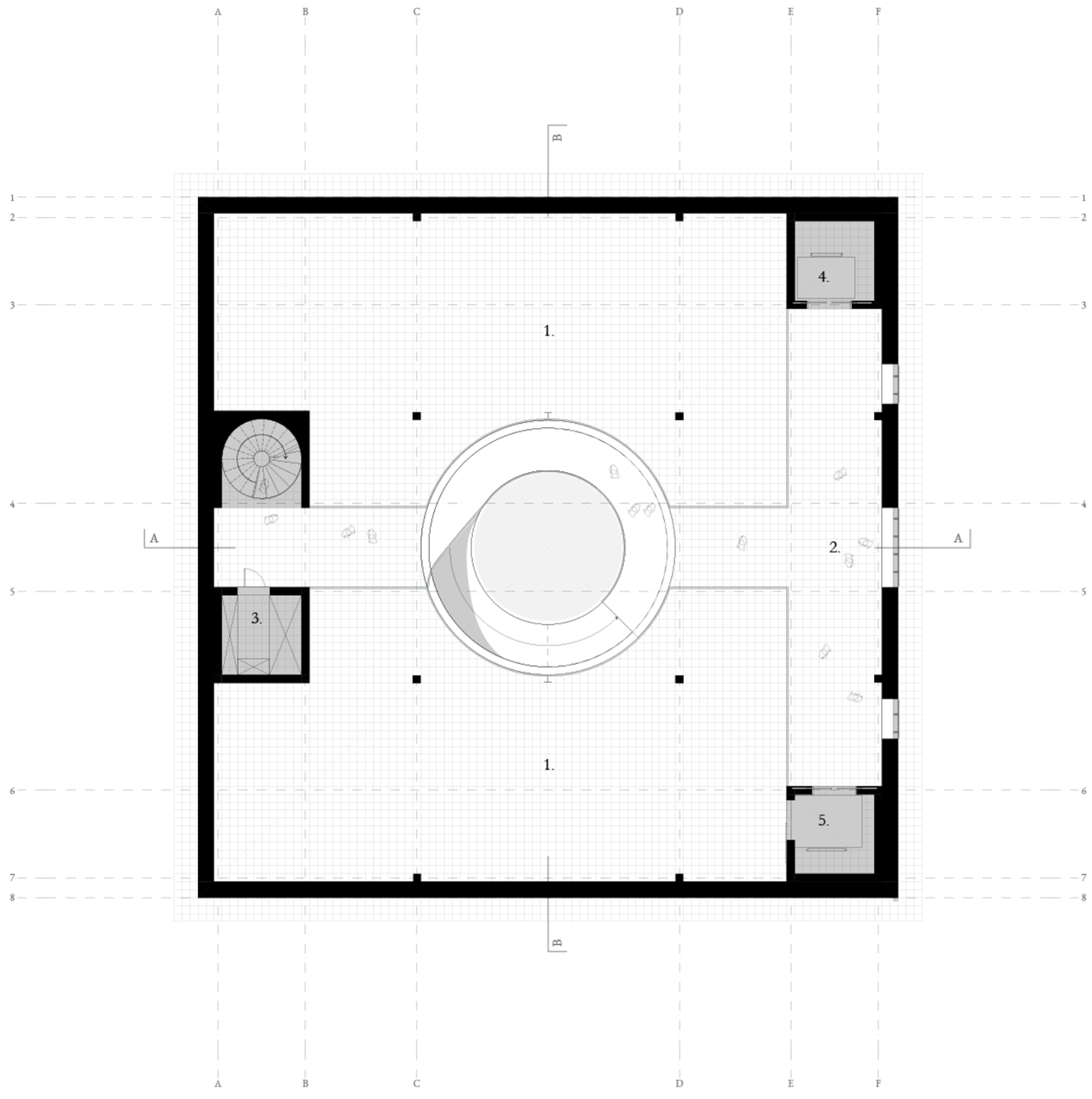



swimming pool
observation deck
café, event space
changing rooms
data bank
training centre
vertical farm
data centre
entrance
technical space
quantum lab
conditioned
storage


NYC Green Cart



IV
Genius loci
Memory of the place



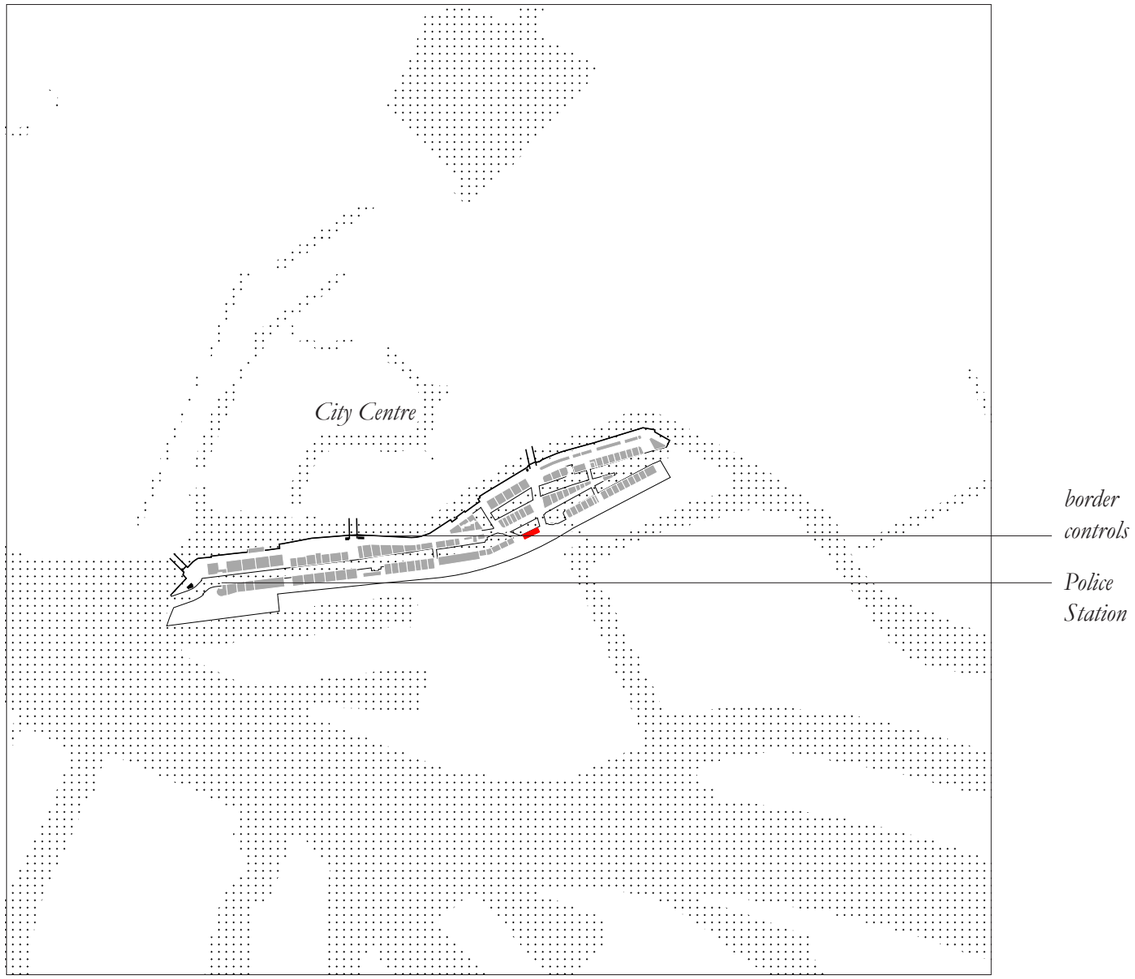
1. Technical floor | HEP & Electrical room
2. Viewpoint - vies towards:
   Port Canteen
   International maritime museum
   Überseeboulevard
3. Technical core - installation shafts access
4. Lift (employees and visitors)
5. Technical lift

N

0 1 5M

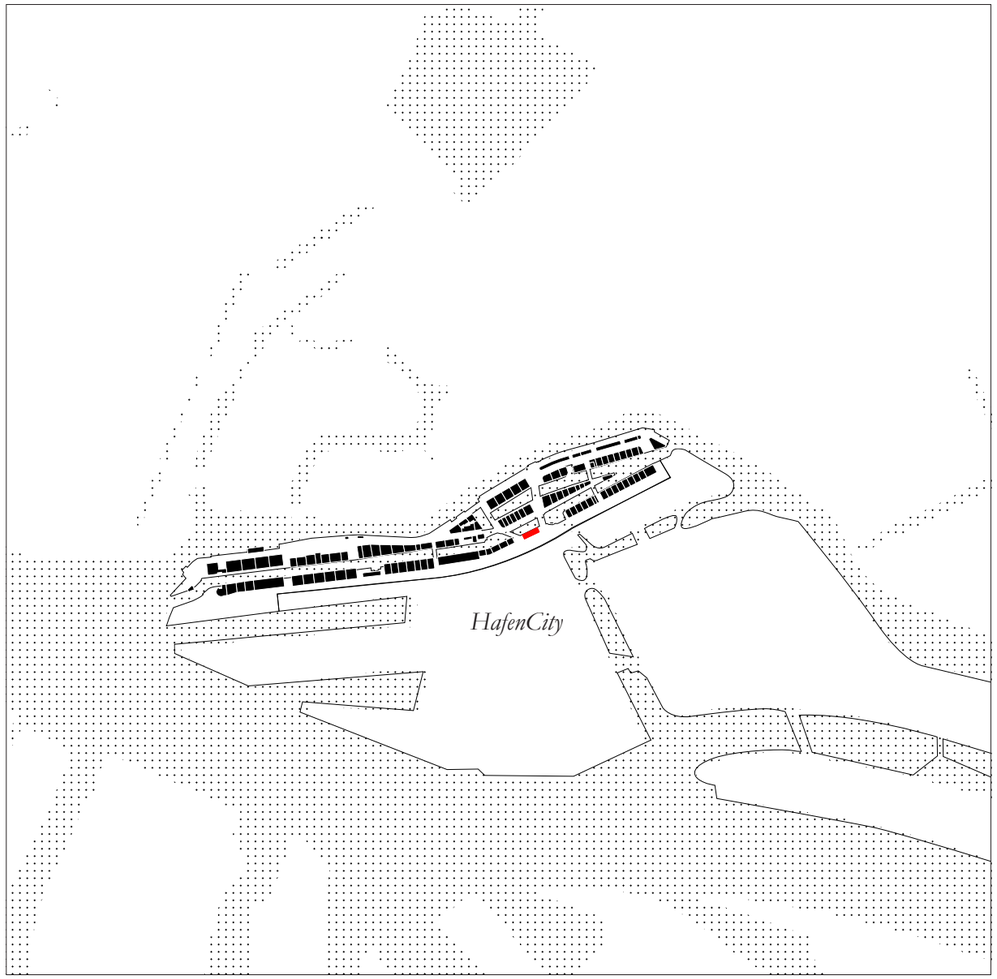


CHANGING CHARACTER OF SPEICHERSTADT



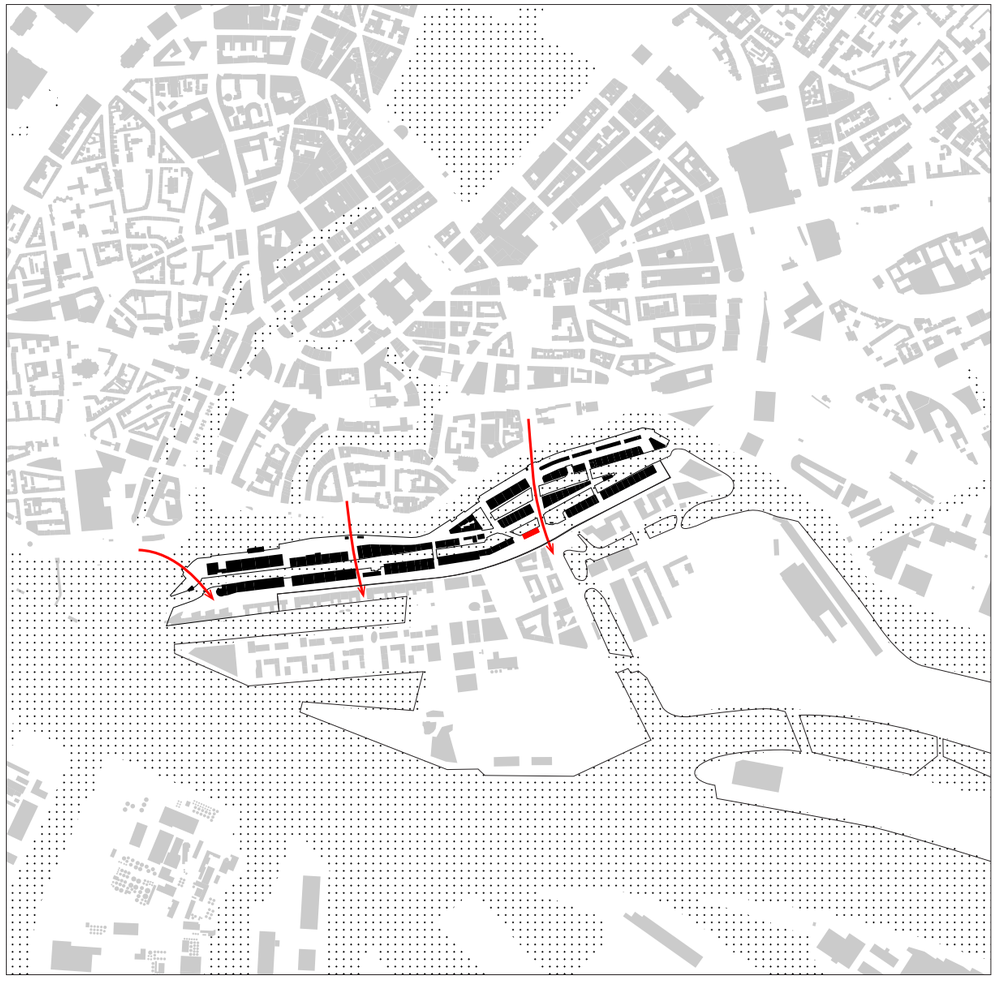
Fenced access to the port storage area, separated from the city

RECLAIMINED LAND



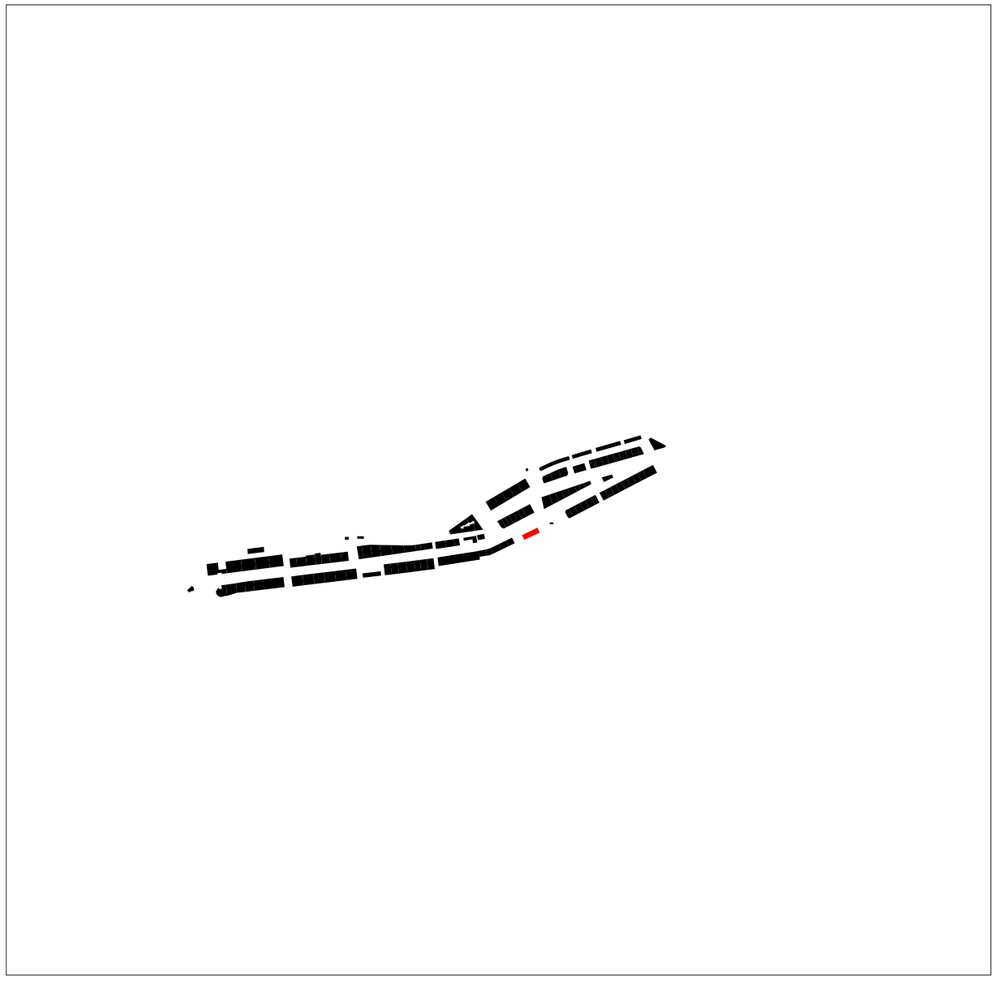
Port is moving away - new HafenCity district is emerging, extending Hamburg area by 40%

SPEICHERSTDT AS A BRIDGE

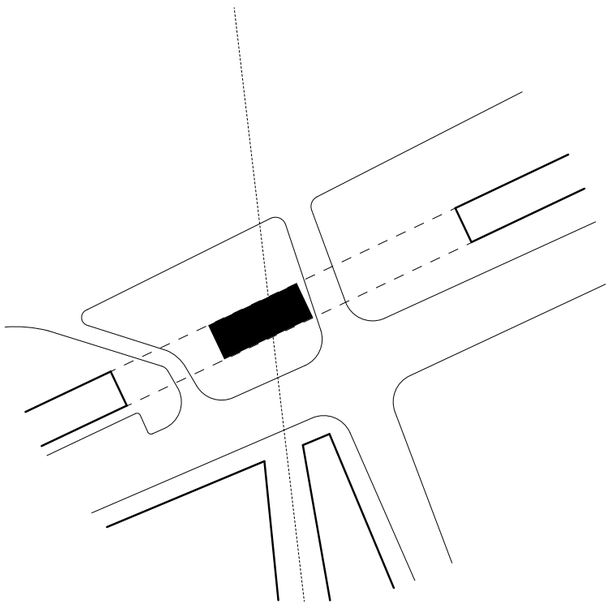


Speicherstadt becomes a connection, link between the city and the new district

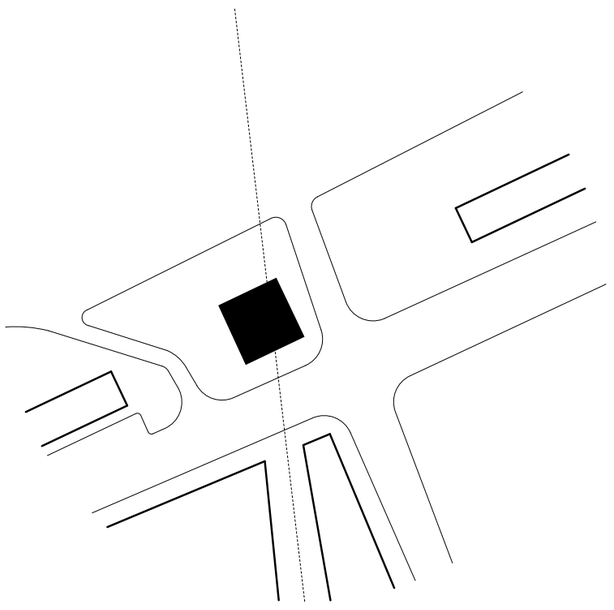
ENCLOSING STORAGE DISTRICT



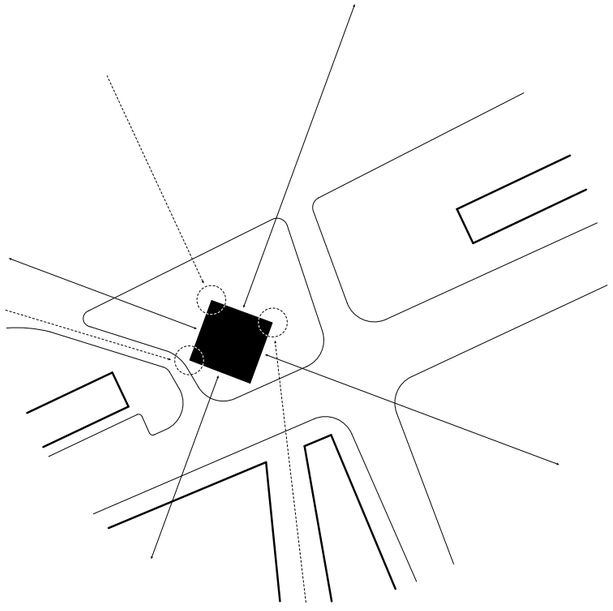
Speicherstadt in relation to the site



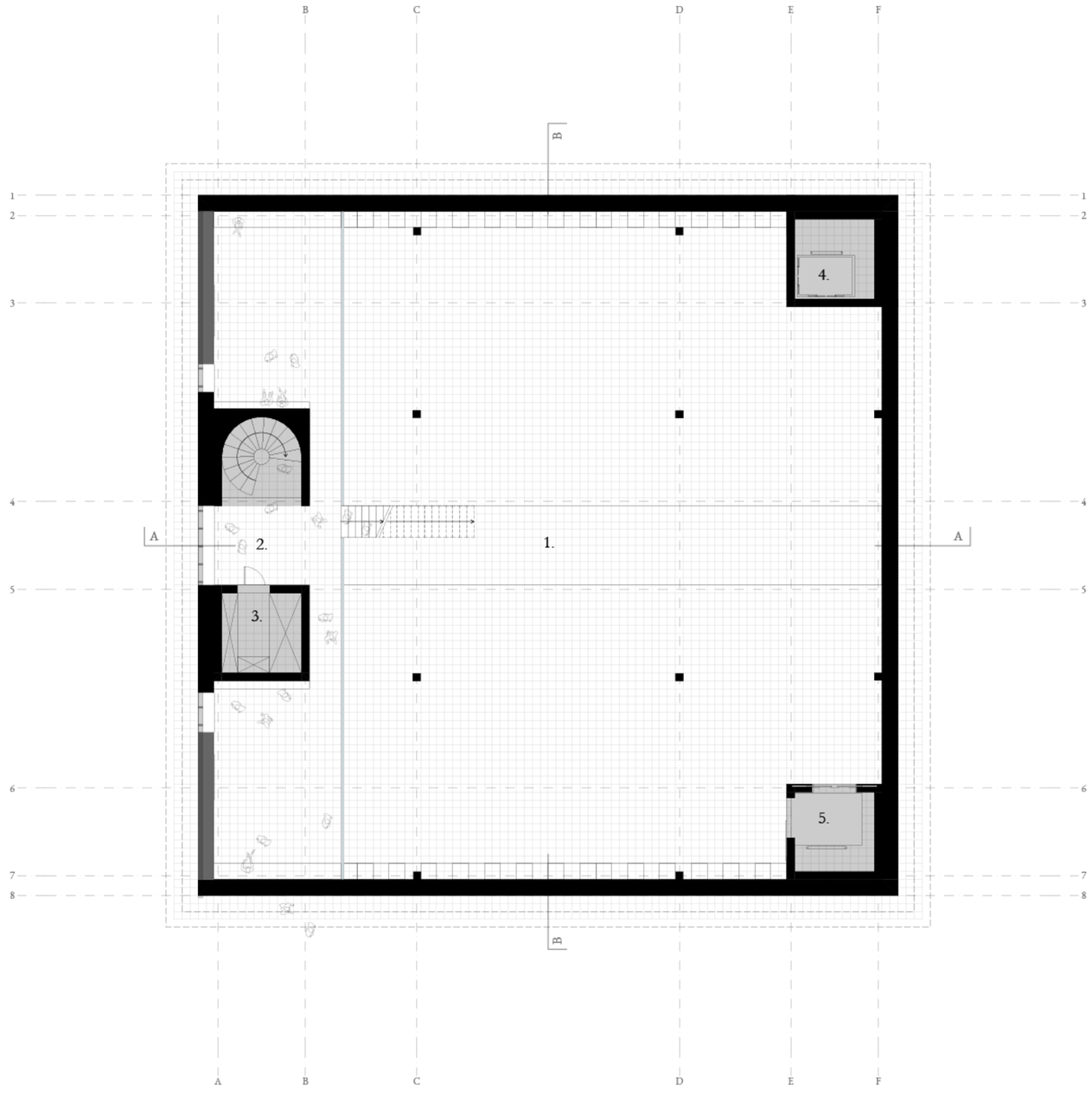
Building footprint proposed in the Speicherstadt Master plan



Data Centre footprint



Orientation towards the views



1. Conditioned storage
2. Viewpoint - vies towards:
   HTH Hamburger tea trade
   Coffee trade - stock exchange
   St. Annen canal
3. Technical core - installation shafts access
4. Lift (employees and visitors)
5. Technical lift

N

0 1 5M

Old Town towers

HHLA Port Authorities

HTH Hamburger tea trade

Port Cantine

Coffee trade/ stock exchange

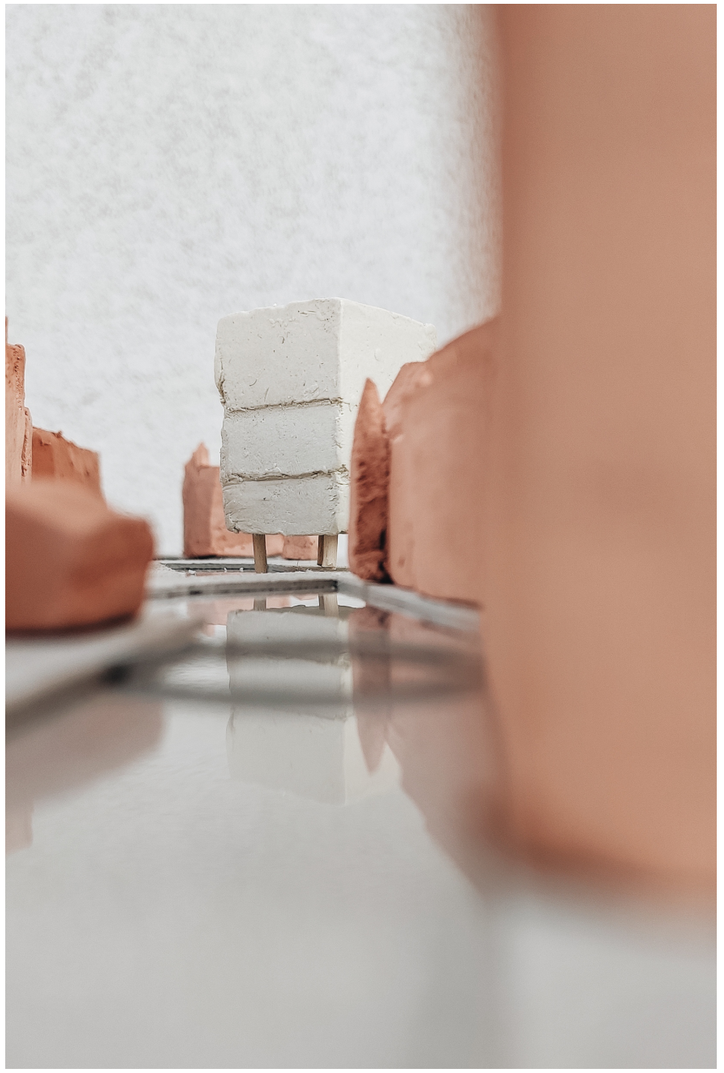
Dar-es-Salaam Platz

International Maritime Museum

HafenCity Überseeboulevard

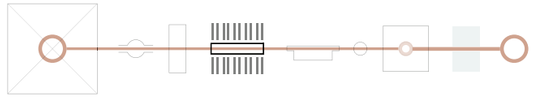


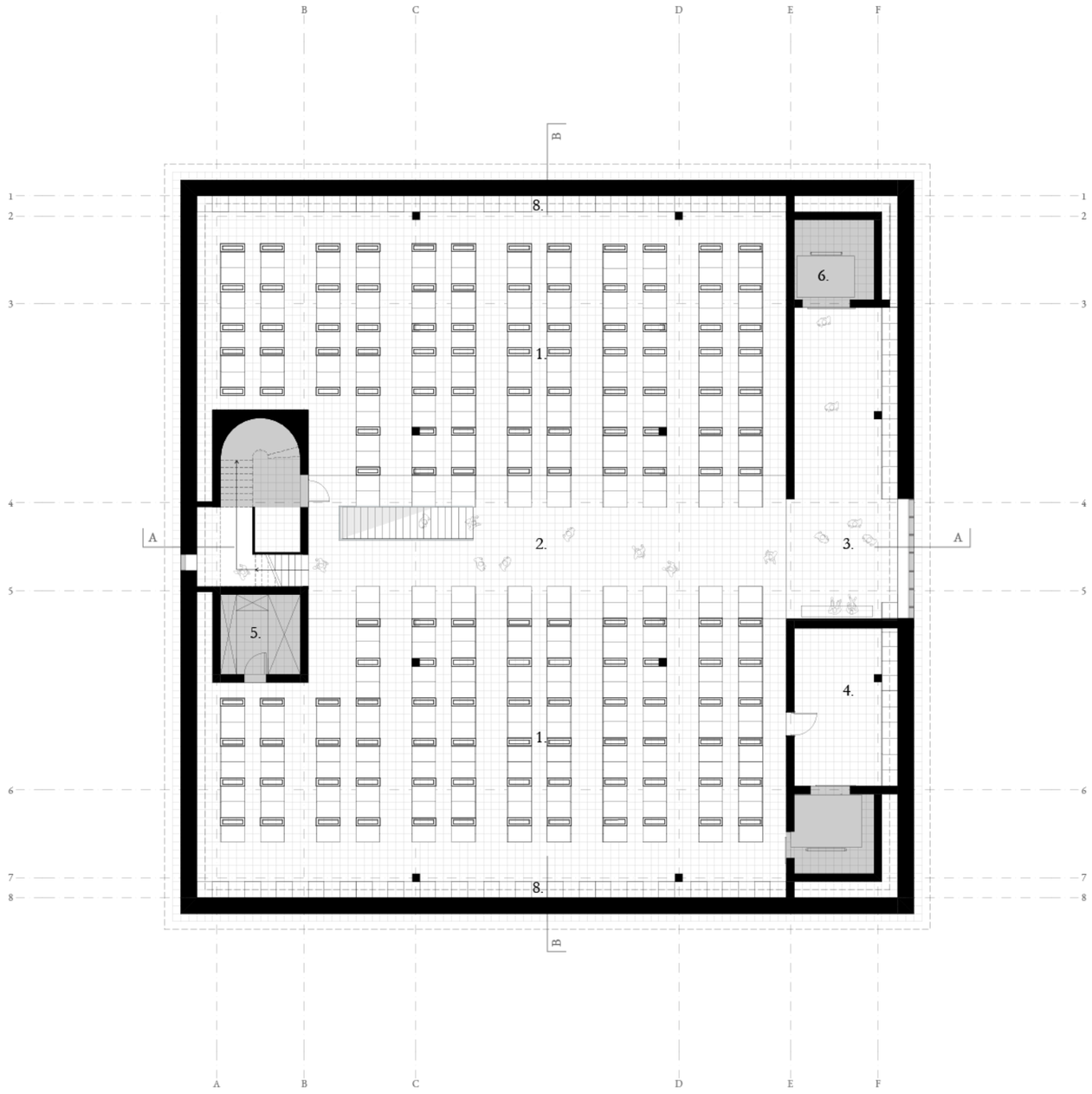


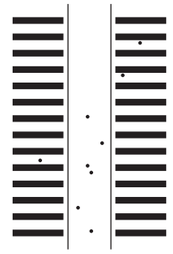


V
Data storage

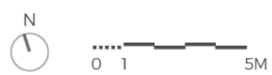








1. Data Centre white space
2. Visitor path - DC overview
3. Viewpoint - towards new HafenCity district
where data is produced and stored in the DC
4. Staging room
5. Technical core
Computer Room Air Handling CRAH
6. Lift (employees and visitors)
7. Technical lift
8. Main ditribution Frame MDF





At a moment when our collective history is digital,
the **data centre** is becoming one of our
most significant **cultural typologies**.

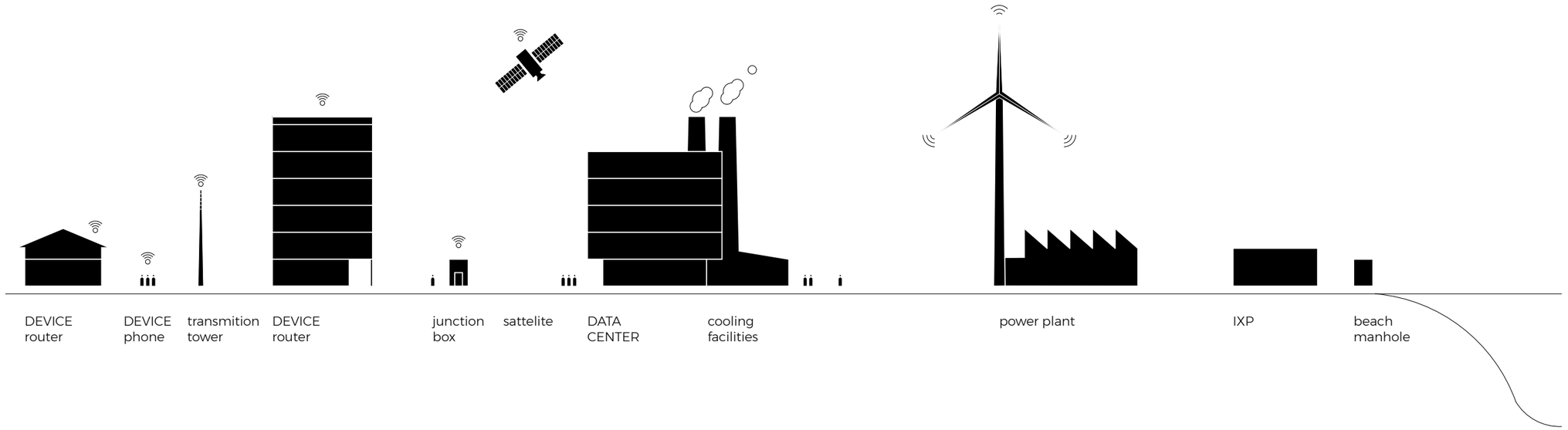
Rem Koolhaas, OMA

VI
Archive Fever



The Cloud
representing intangible aspect of digital data

Concept Model by author, 2019



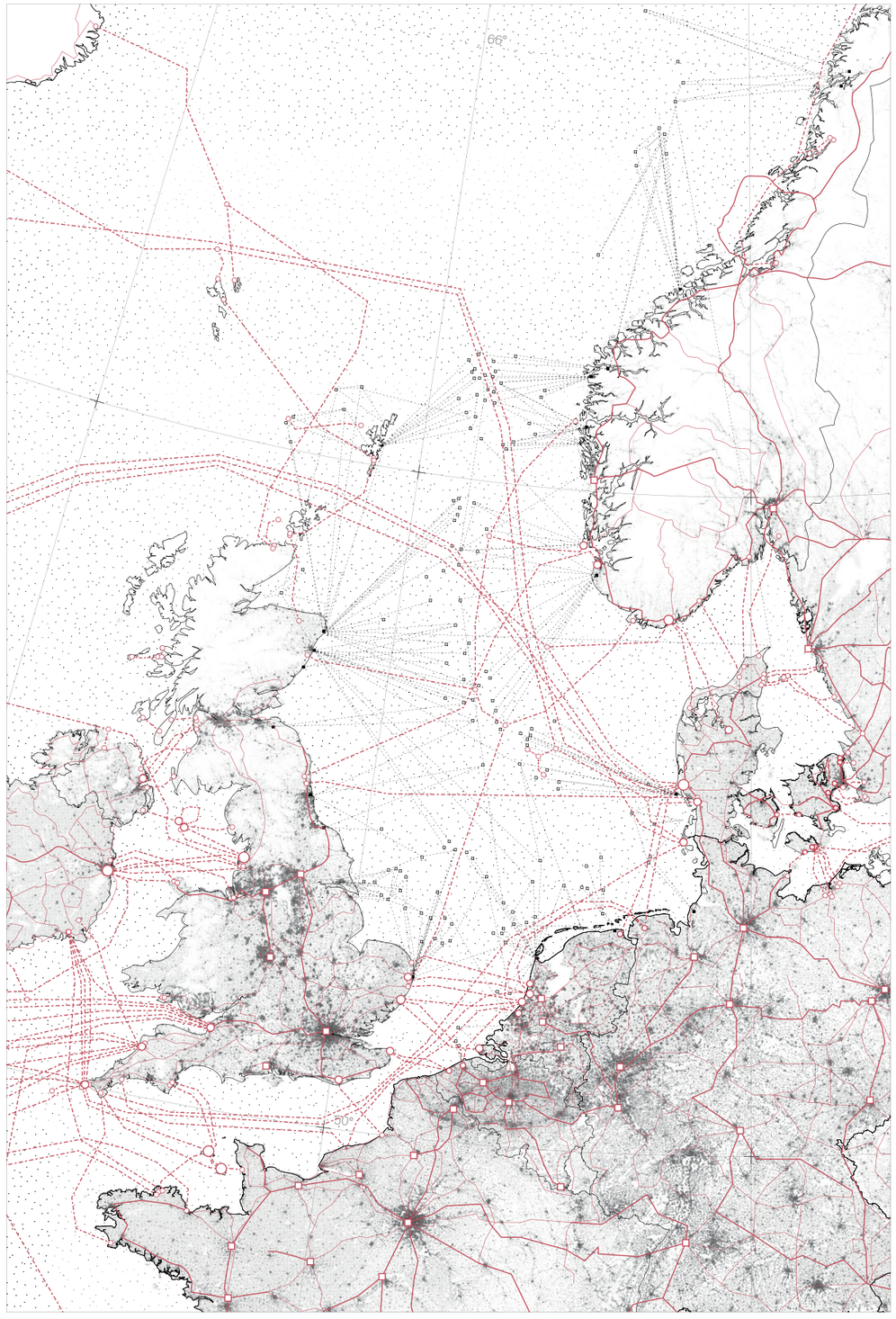
Physical Infrastructure of the Internet

diagram by author



Underground fibre optic cable marker, New Jersey

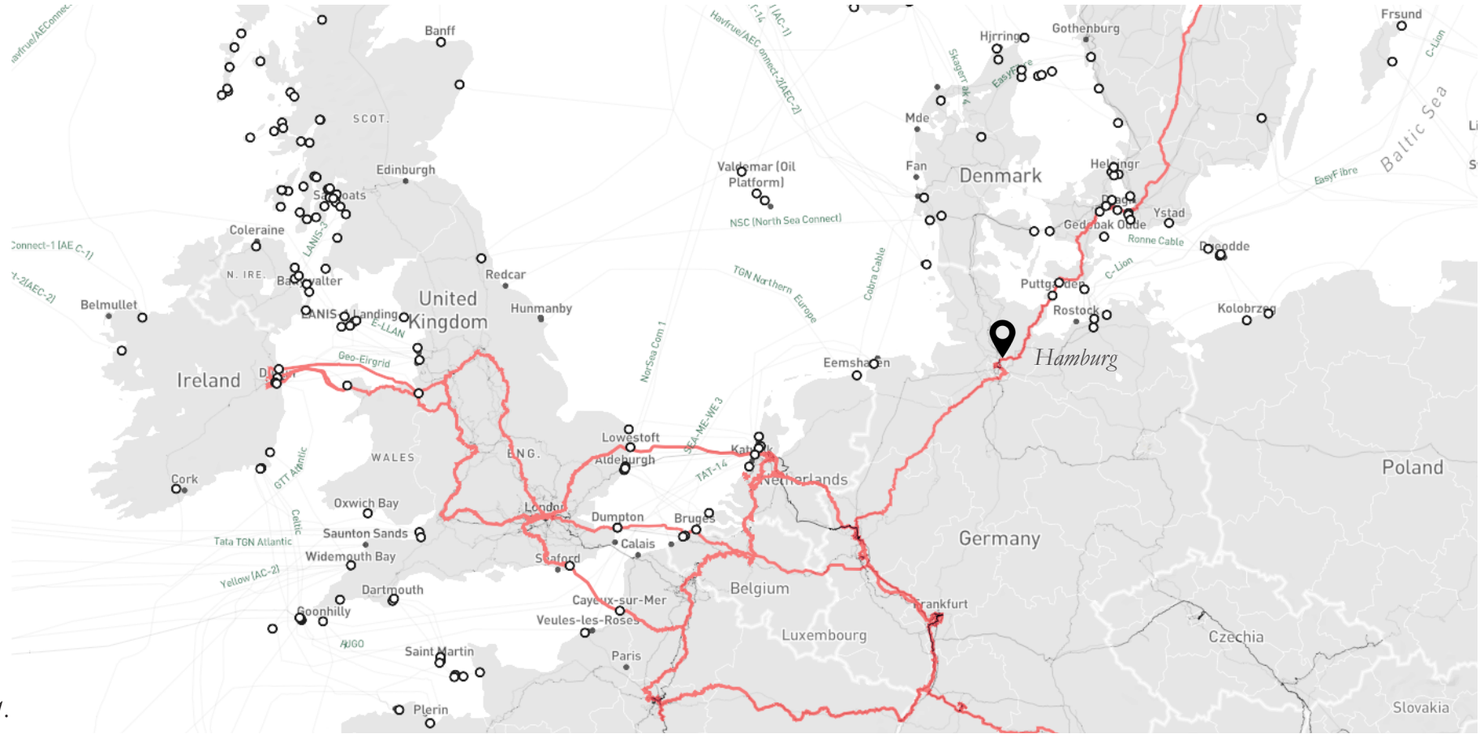
Dave Greer, *The Internet*



Fibre-optic network

Submarine Sea Cables and
Fibre Optic network on land

drawing by Sebastian Schulte, TT, 2019



1. Intra-European Connection
Eunetworks fibre optic connection
length: 13 000km



2. Hamburg in Intra-European network



3. Site St. Annenplatz in Hamburg in Intra-European network context

source: www.infrapedia.com/app

Research Question

Territorial scale

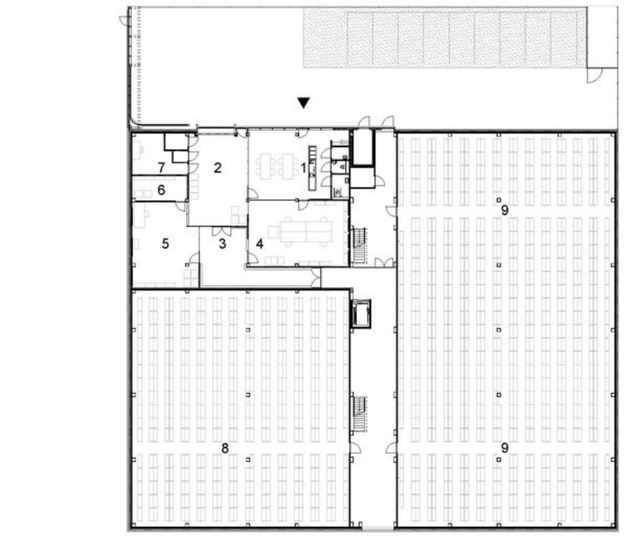
How a growing amount of data is affecting the North Sea territory?

What are the spatial consequences of the growing phenomena of the Archive Fever?

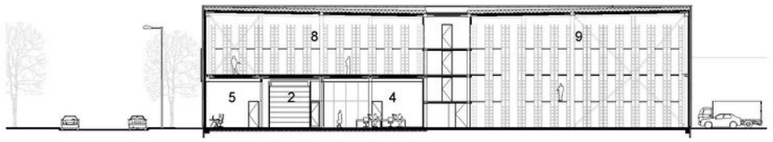


Anonymous Architecture
of Data Centres

collage by author

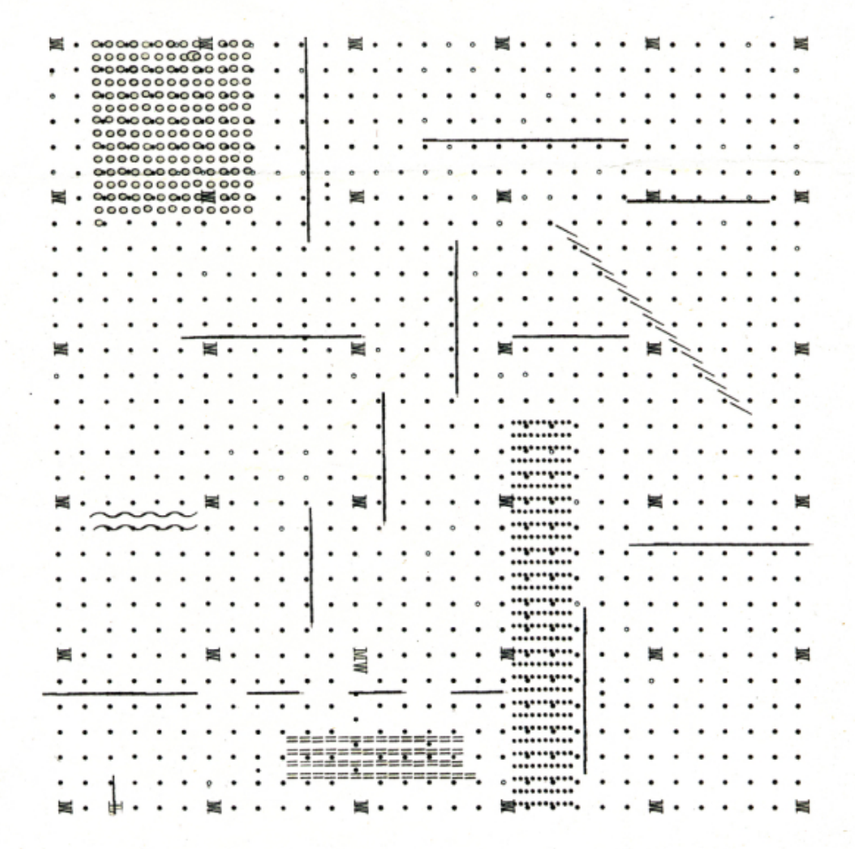


ground floor



Logistics takes over the
representative aspect of the

Archiefdepot Noord, 2019, plan
and section by BAM Bouw en

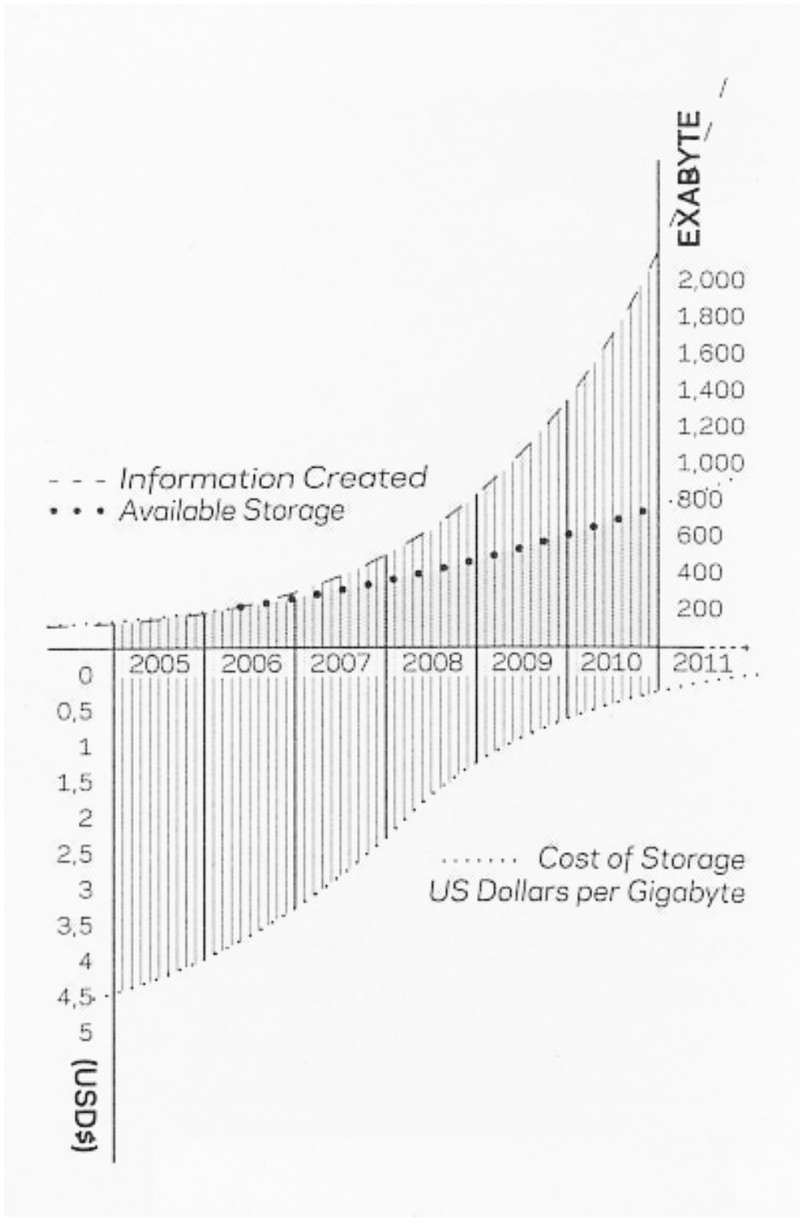


No-Stop City
by Archizoom



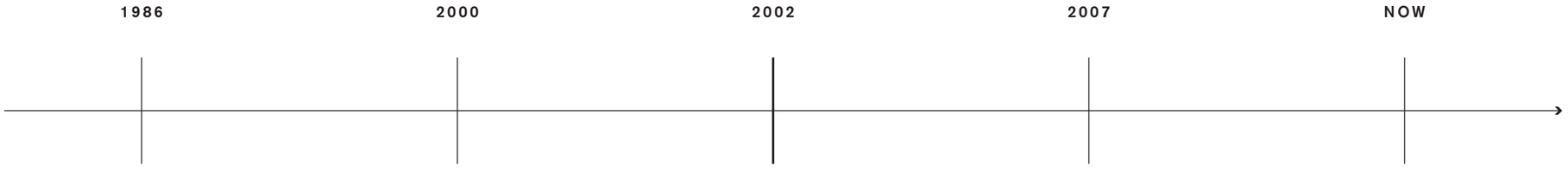
Julian Rosefeldt, *Archive of Archives*

(Storehouse of Asiatic antiques dealer) [nr.7], 1995



The amount of information created, captured or replicated exceeded storage for the first time in 2007. By 2011 almost half of the digital universe will not have a permanent home.

source: Garcia, D., 2010. MAP 003. Archive, David Garcia Studio; text sourced from The Diverse and Exploding Digital Universe - IDC Whitepaper, March 2008.



5% DIGITAL

begining of digital revolution

25% DIGITAL

75% of the world's
information was still in analog form

51% DIGITAL

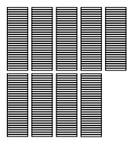
the world began storing more information in digital than in analog format

94% DIGITAL

94% of our global technological memory consisted of digital bits and bytes

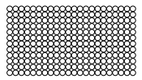
200% DIGITAL

we generate approximately
2,500,000,000,000,000 KB
(2.5 quintillion bytes)
of new data every day



BOOKS
x 290 000
(480 SHELFS)

AREA 520 M²



12"PHONOGRAPH RECORDS
x 24 286

AREA 32 M²



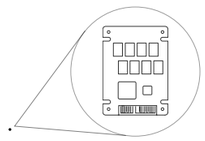
CD
x 13 080

AREA 4 M²



DVD
x 6 258

AREA 2 M²



SSD DRIVE 1TB
x 1

AREA 0.1 M²



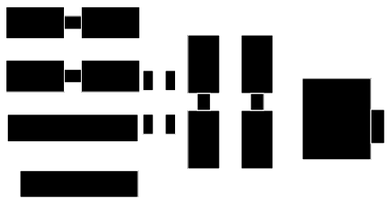
Amsterdam City Hall, NL
footprint 4 330 m²



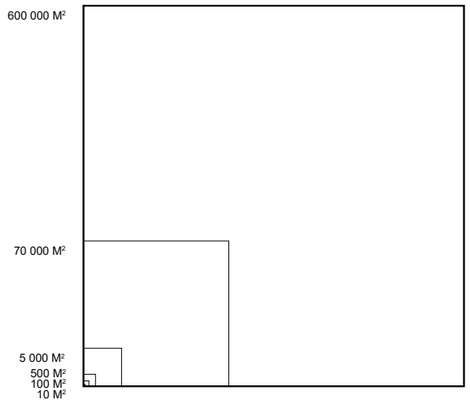
Amsterdam City Archive, NL
footprint 2 810 m²



Archiefdepot Noord, 1 790 m²
+ Amsterdam City Archive 2 810 m²
= 4 600 m²



Microsoft Government Data Center, Middenmeer, NL
footprint 100 850 m 2



Growth of Data Centers in Europe

Research Question

Architectural scale

1. What is the relation of a data storage as an architectural object to the city?

2. In the New Dark Ages, the media storage development only allowed us to store more is there a possibility to influence people to limit the amount they collect by explaining the unknown digital forces standing behind data flow?

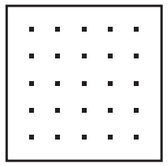


City of Hamburg

DATA



remote Data Center



new typology

TYPICAL DESIGN PROCESS

1. Total energy capacity



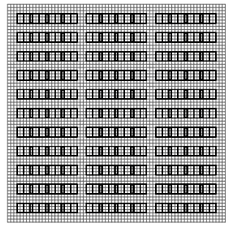
2. Divided into halls



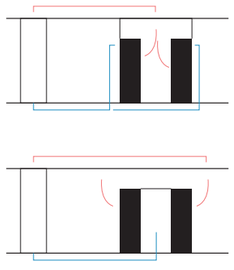
3. Divided into racks



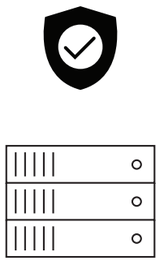
4. Racks aggregate into rows



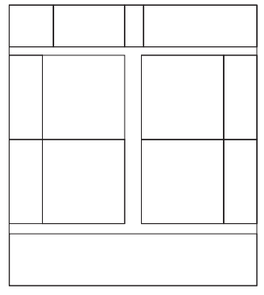
5. MEP determinates section



6. TIER determinates equipment



7. Creating floor plans



8. Design of the office space and facades

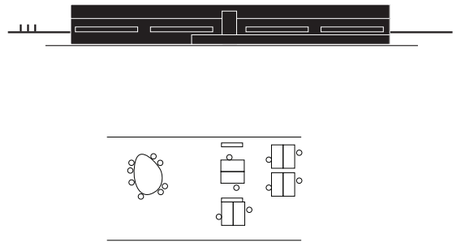


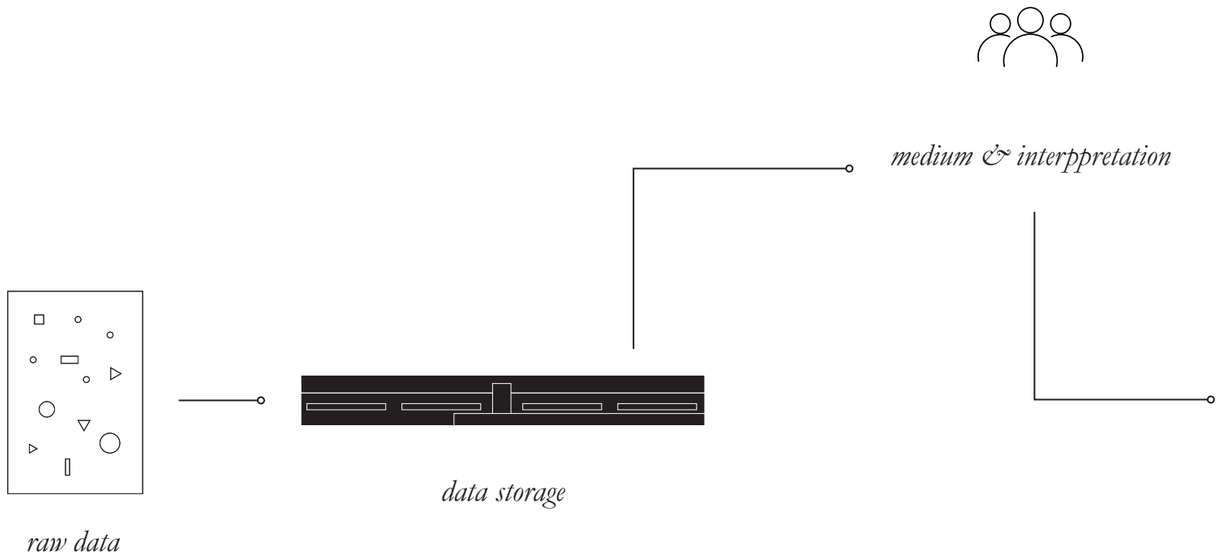
diagram based on the lecture by Ippolito Pestellini Laparelli & Aleksandar Joksimovic (OMA) at *Data Centre Seminar* (*Automated Landscapes*, hosted by Het Nieuwe Instituut)

DESIGN DOMAIN

Role of an Architect in the DC design process

VII
Fighting archive fever through redefinition of existing model

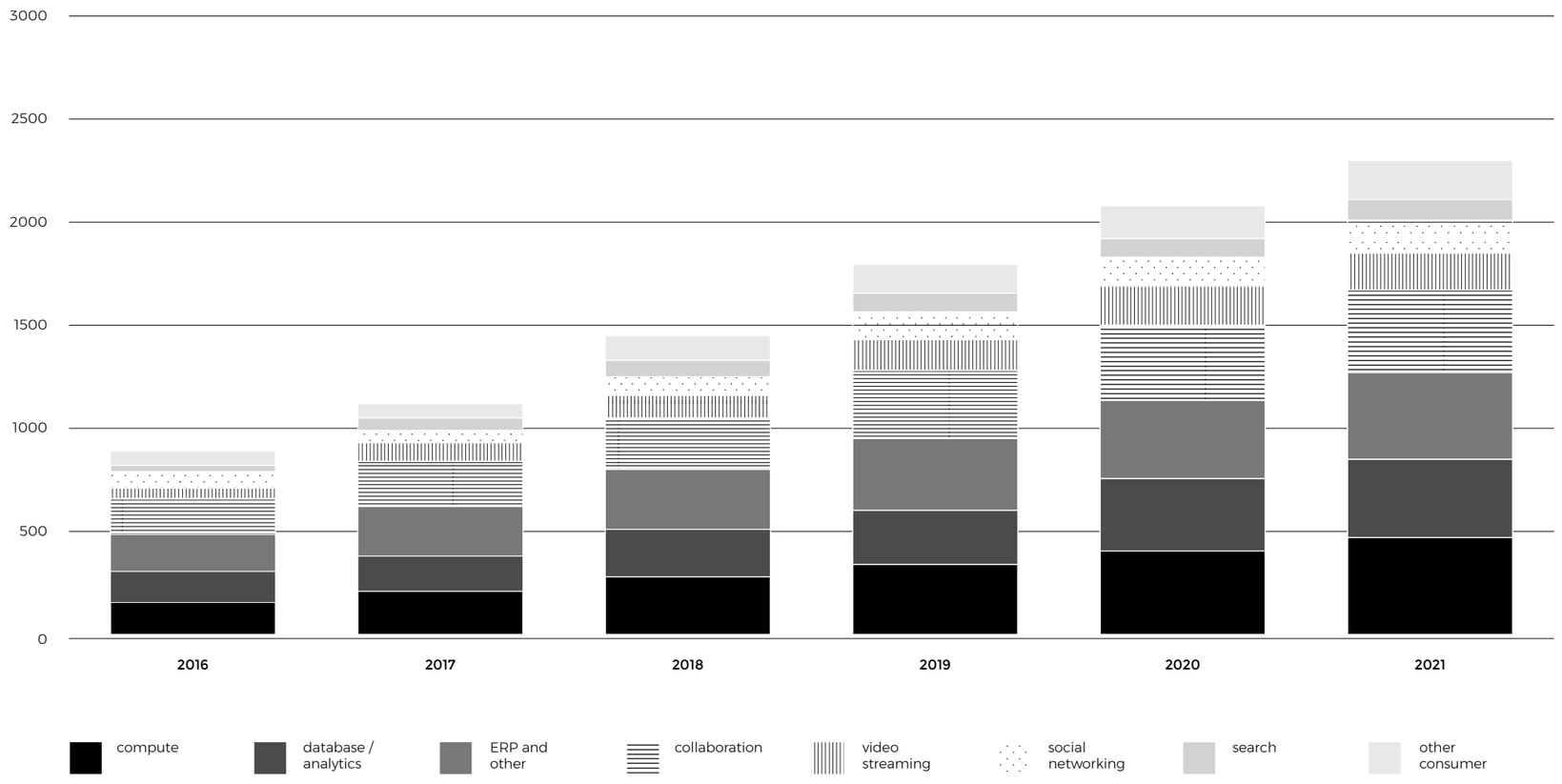
DATA IS NOT INFORMATION!



DATA PROCESSING

big data, machine learning, AI, super/ quantum computers

REDUCING AMOUNT OF STORED DATA

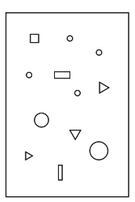


DATA PROCESSING
QUANTUM LAB

diagram by author
information source: www.statista.com/statistics/638593/worldwide-data-center-storage-capacity-cloud-vs-traditional

PROJECT PROPOSAL

DATA STORAGE
actual data centre



data

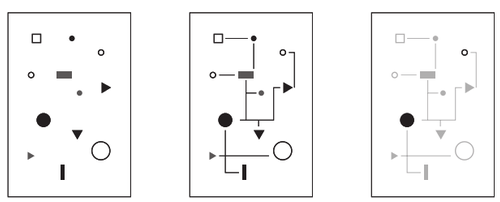
DATA BANK

safe and climate optimal storage for citizens
(uploaded and physical)
+ service:
upgrade of digital storage media to keep
them up to date (avoiding data loss),
backups, recovery

COLLOCATION DATA CENTRE

for local businesses

DATA PROCESSING
fighting archive fever

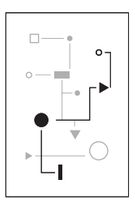


information *knowledge* *insight*

SUPERCOMPUTER/ QUANTUM COMPUTER LAB

processing dark data
(90% of stored business data),
looking for patterns and relations,
working with big data
- decluttering digital space

INFORMATION EXCHANGE



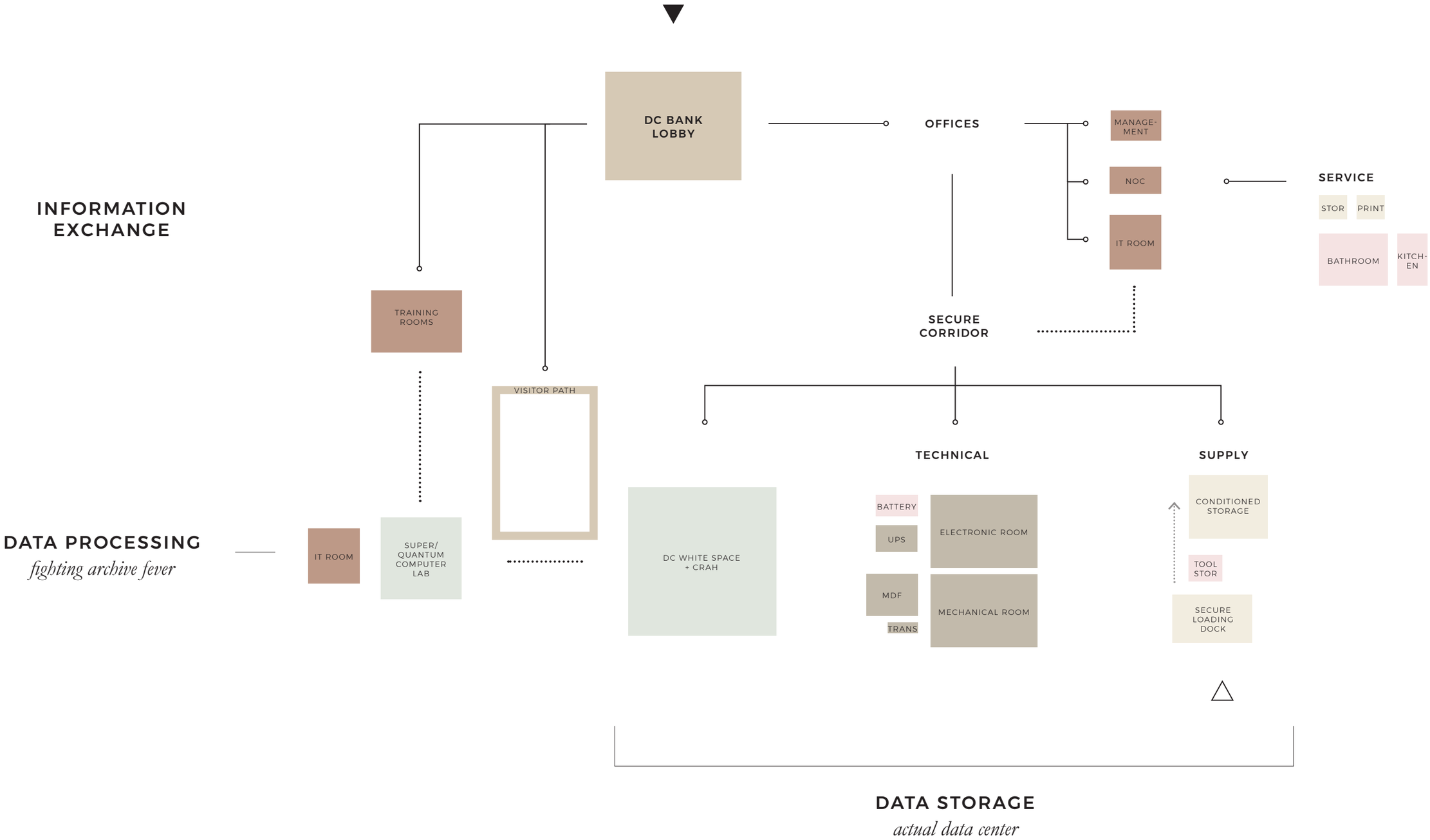
wisdom

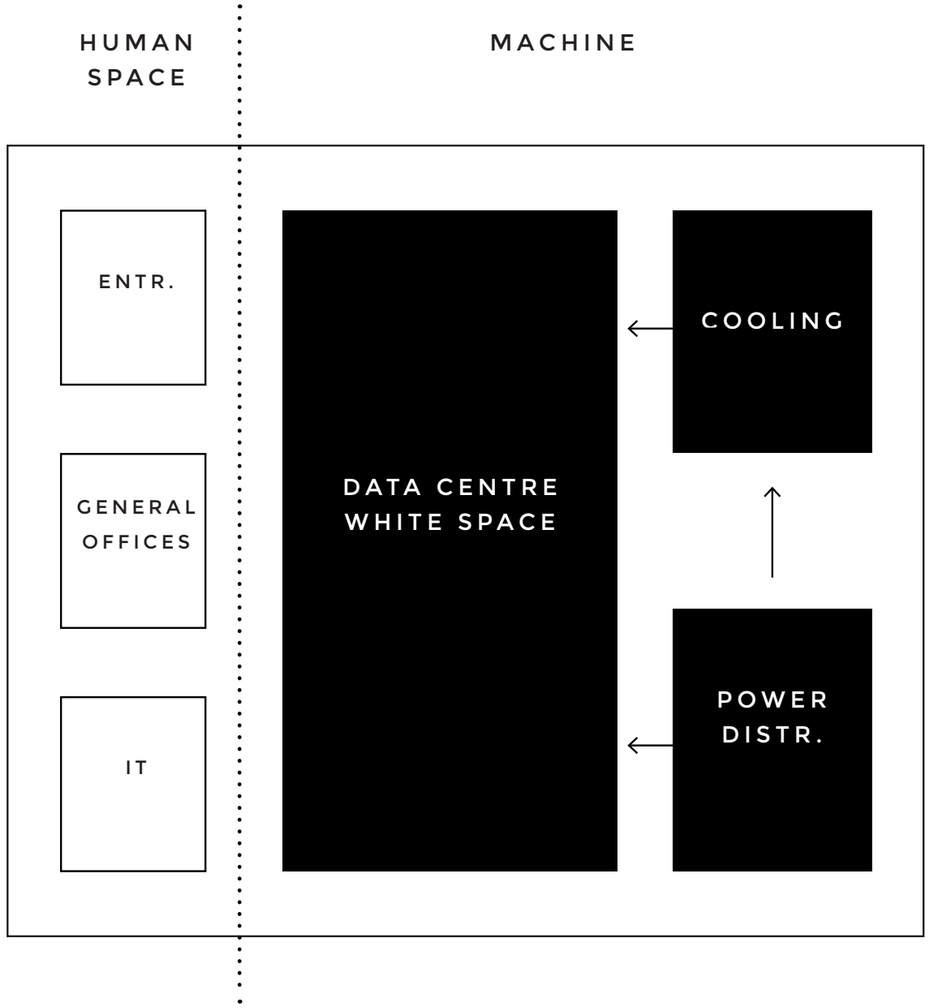
VISITOR PATH
insight, visual overview

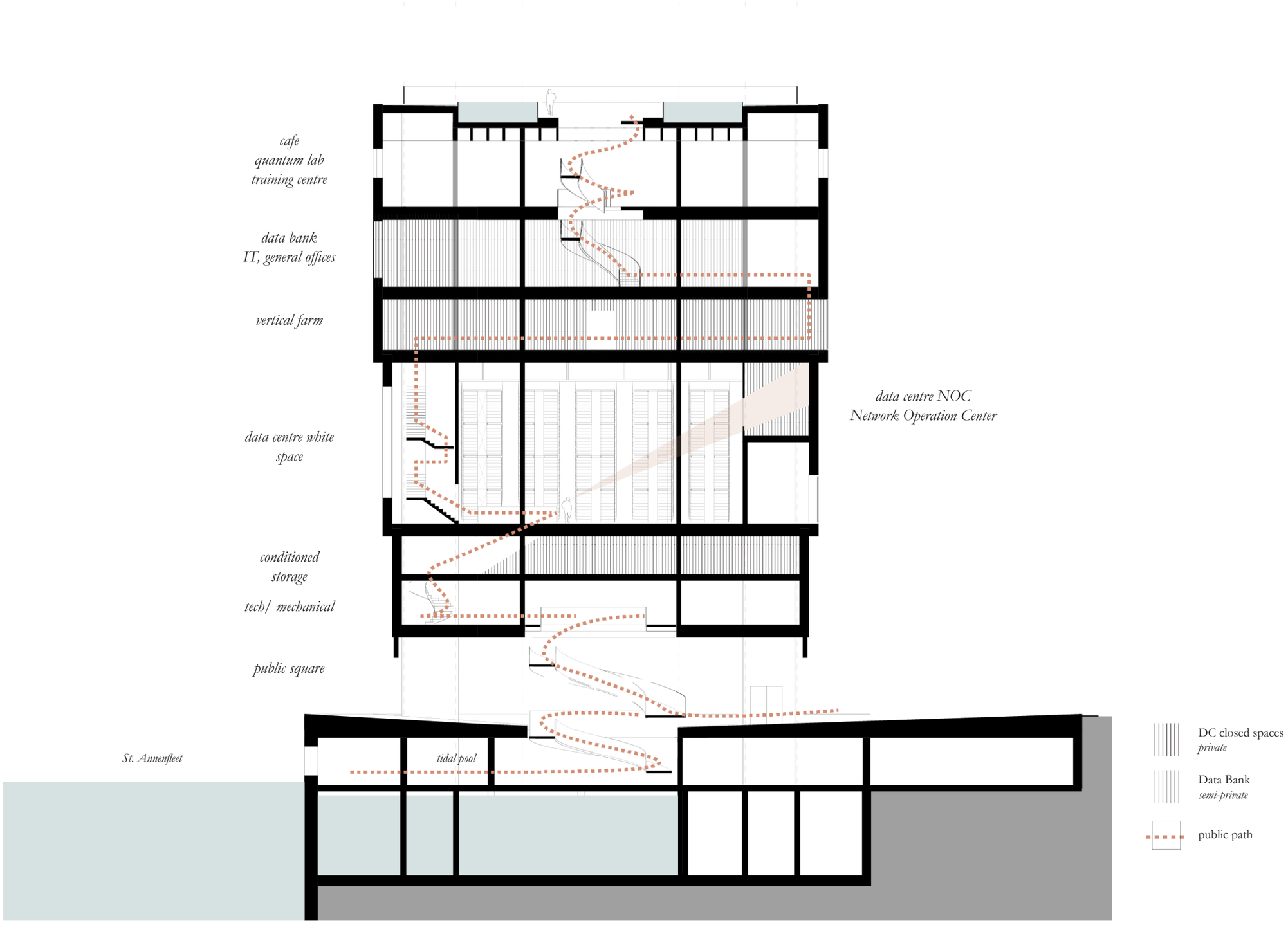
TRAINING /CENTRE/

programming super/ quantum computer,
work-flow, possibilities, big data processing

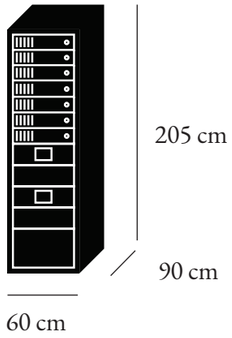
PROGRAM CONNECTIONS
1:500 @ A3



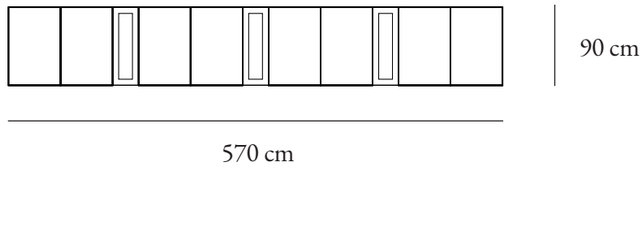

HUMAN SPACE
MACHINE
ENTR.
GENERAL OFFICES
IT
DATA CENTRE WHITE SPACE
COOLING
POWER DISTR.


cafe
quantum lab
training centre
data bank
IT, general offices
vertical farm
data centre white space
conditioned storage
tech/ mechanical
public square
St. Annenfleet
tidal pool
data centre NOC
Network Operation Center
DC closed spaces
private
Data Bank
semi-private
public path

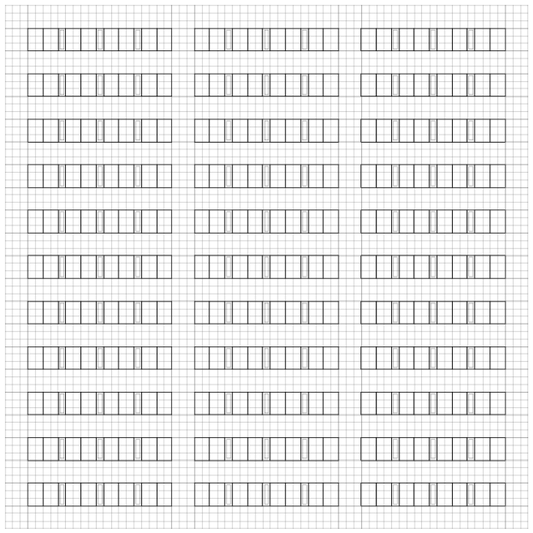
VIII
Flexibility



server rack 42 U
= 7.8 PB

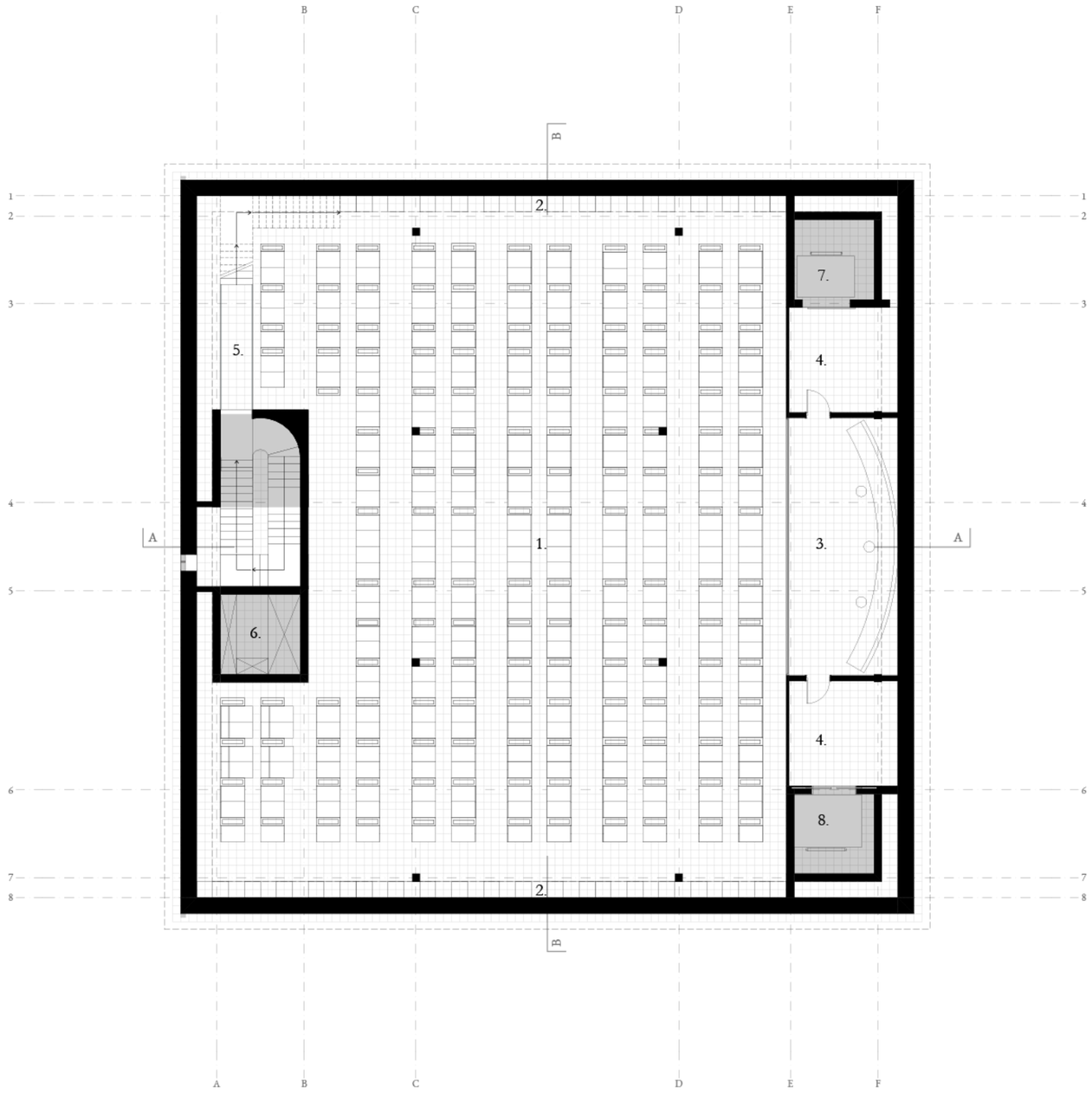


row (8 x 42U + ventilation)
= 62.4 PB



33 rows
= 2 060 PB

3.5rd Floor Plan | 1:200 Data Centre white space - bridge



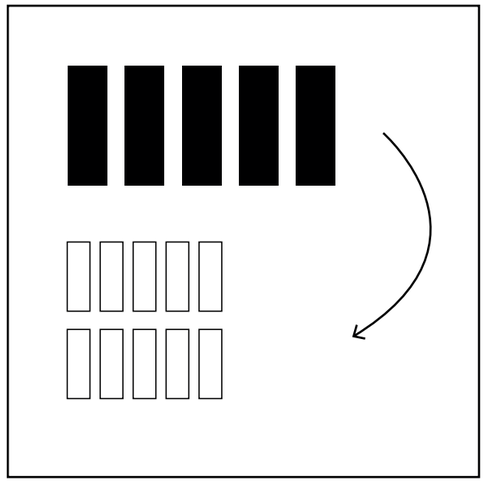
1. Data Centre white space
2. Main ditribution Frame MDF
3. Network Operation Centre NOC
monitoring performance of DC
4. Access control
5. Bridge - overview of DC and technical connections to racks *(cables, pipes etc.)*
6. Technical core
7. Lift (employees and visitors)
8. Technical lift

N

0 1 5M

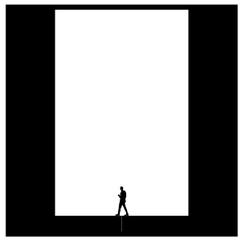
STORAGE SHRINKAGE

technological update every 5-6 years



GROWING & SHRINKING DATA VISIBLE INSIDE

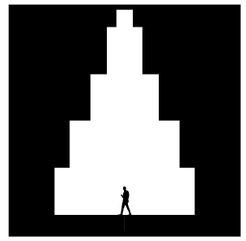
direct spatial impact of data amount



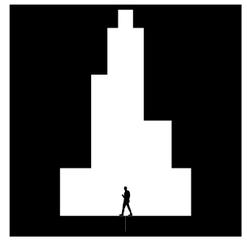
overview of the collected data



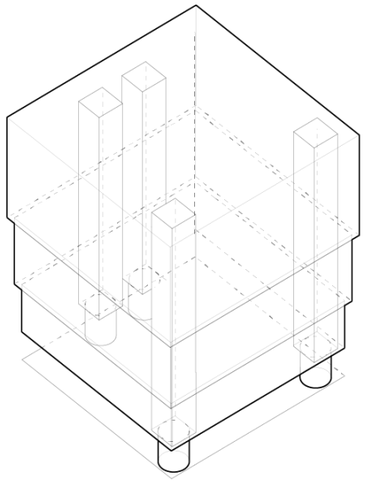
principal of growth

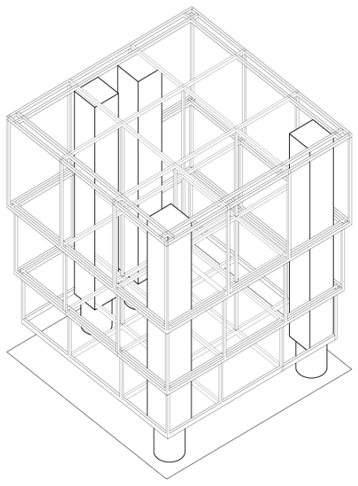


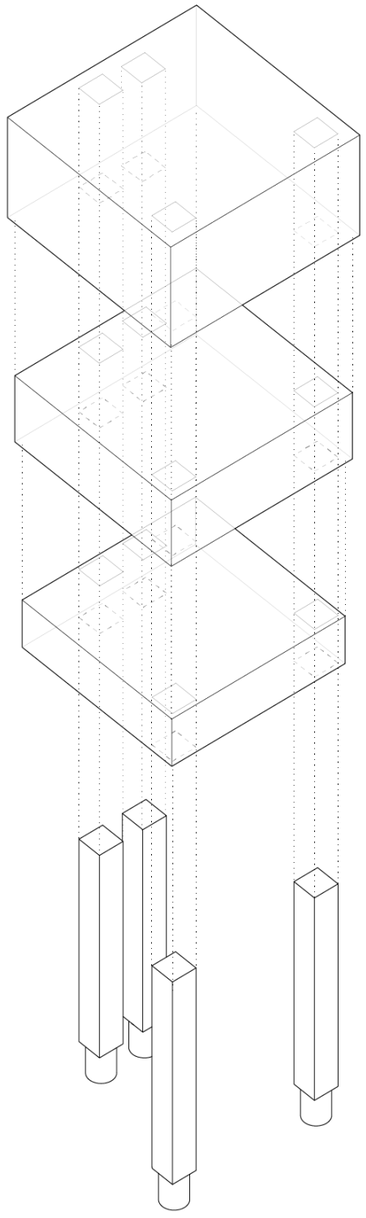
growing data

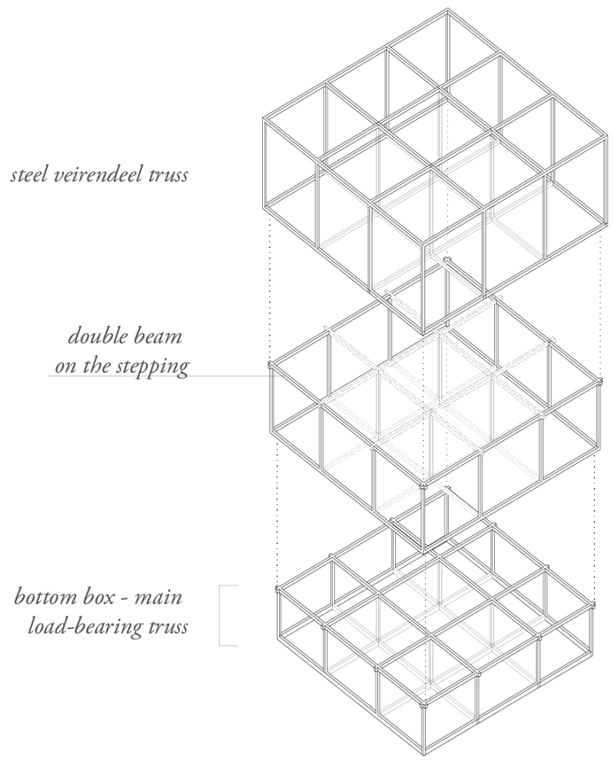


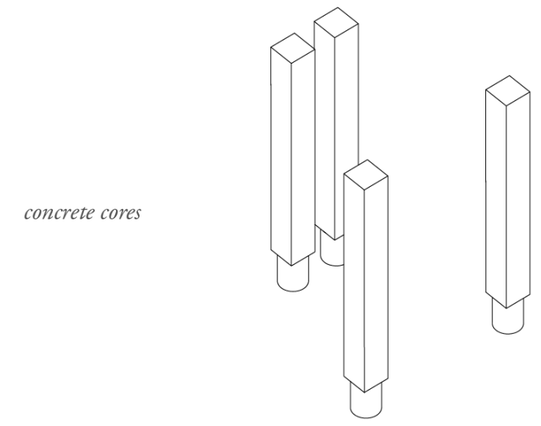
base state
(recurring due to server update ~every 3-5 years)



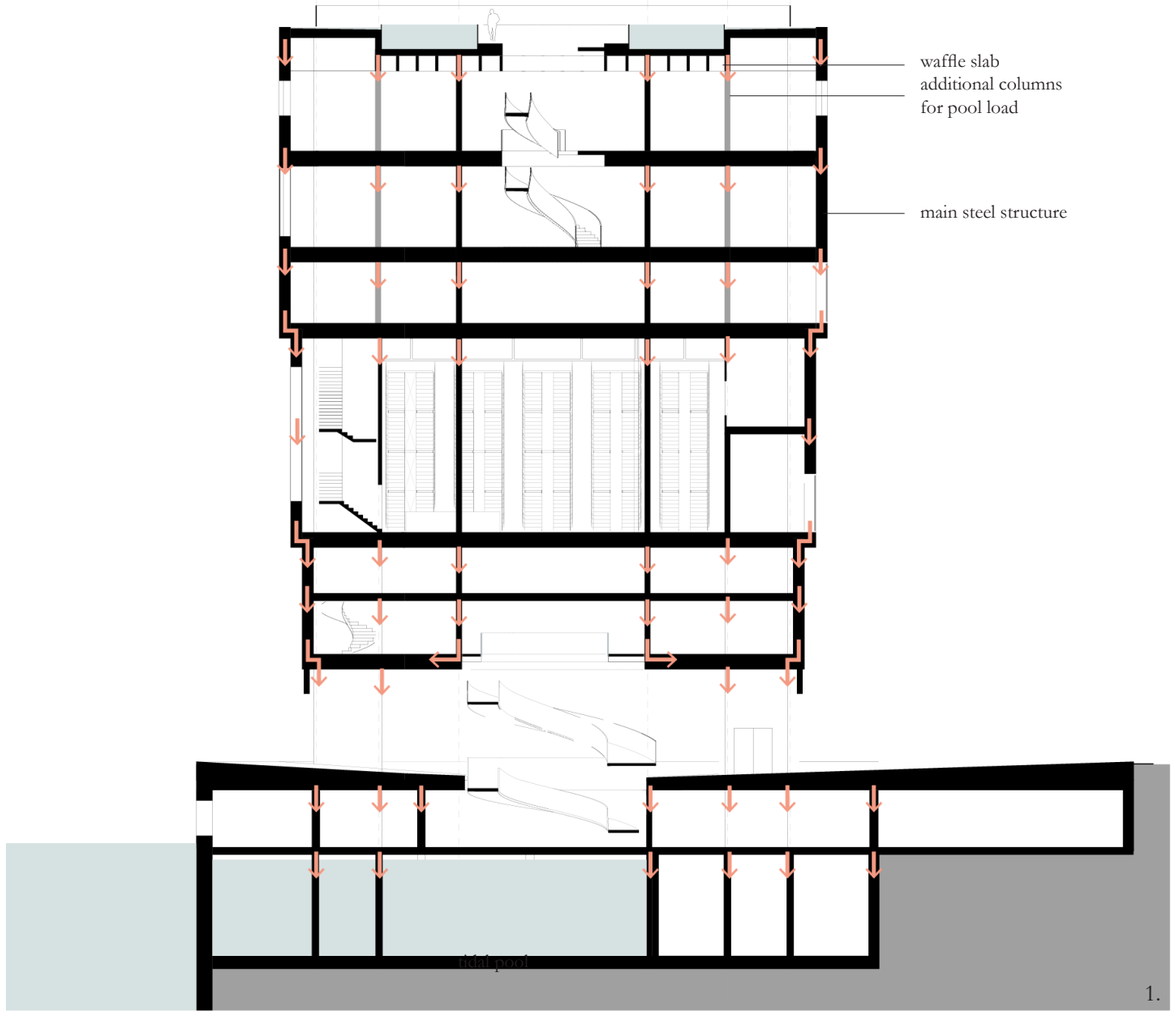


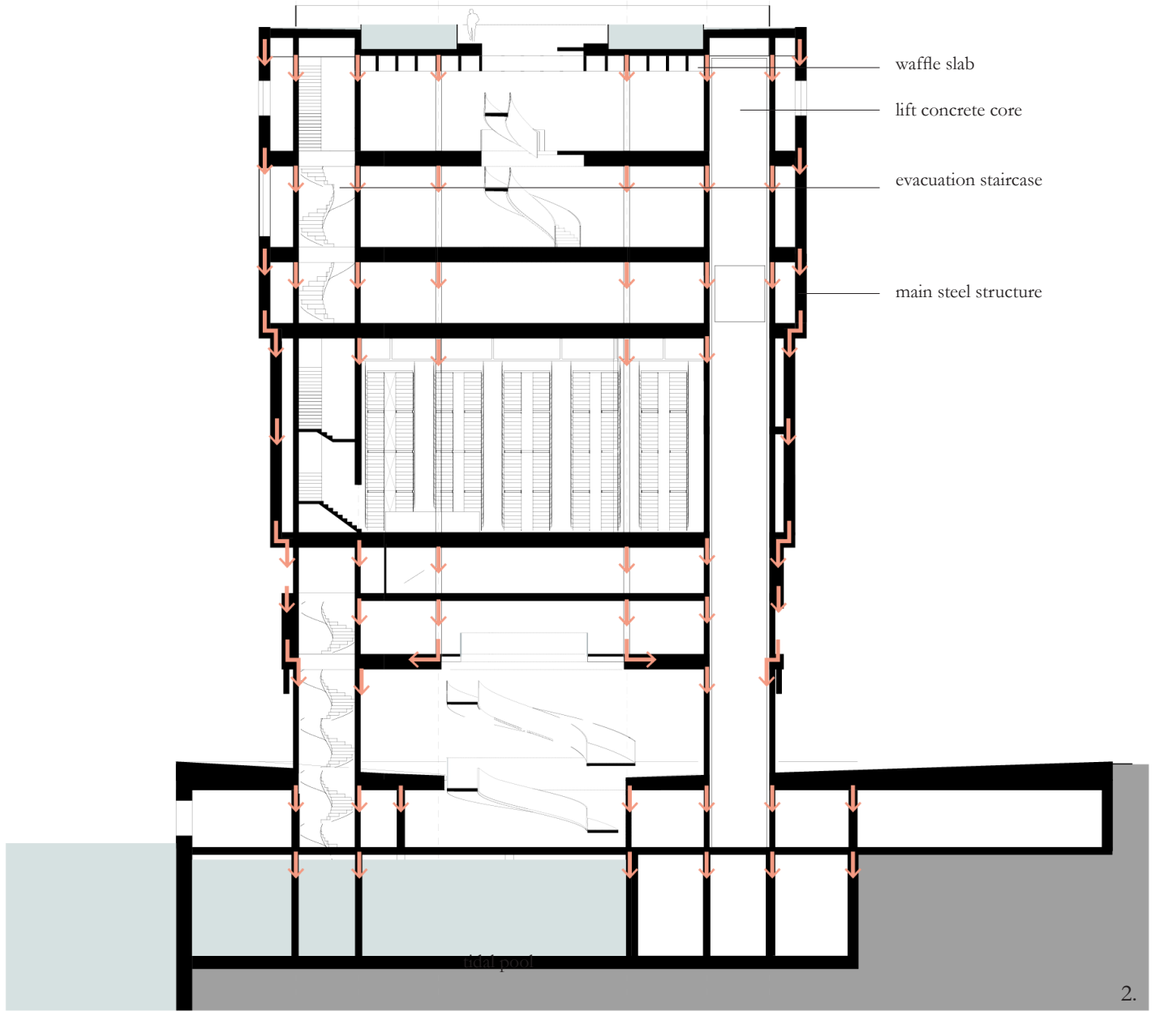






STRUCTURE AXONOMETRIC VIEW 1:500





1. Structural concept main structure and pool load bearing structure, *1-200 @A3*

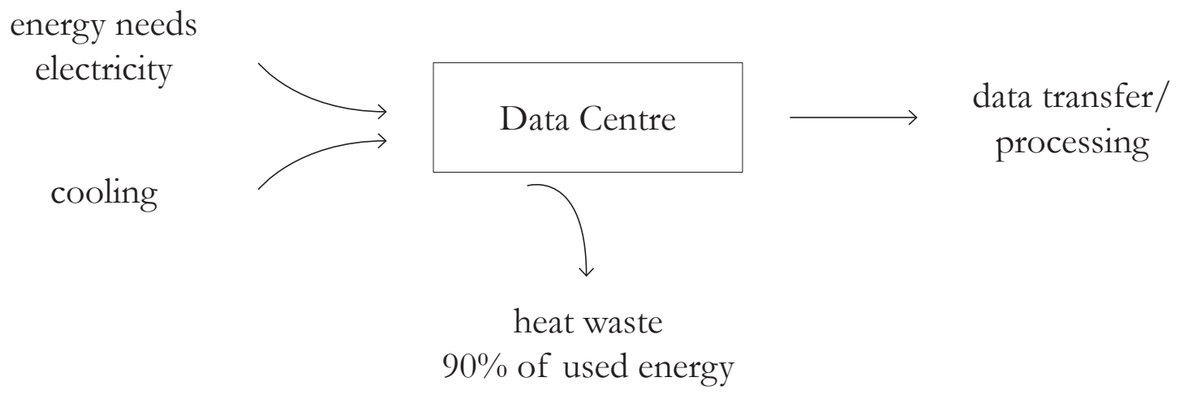
2. Structural concept main structure section through cores *1-200 @A3*

IX
Heat waste potential

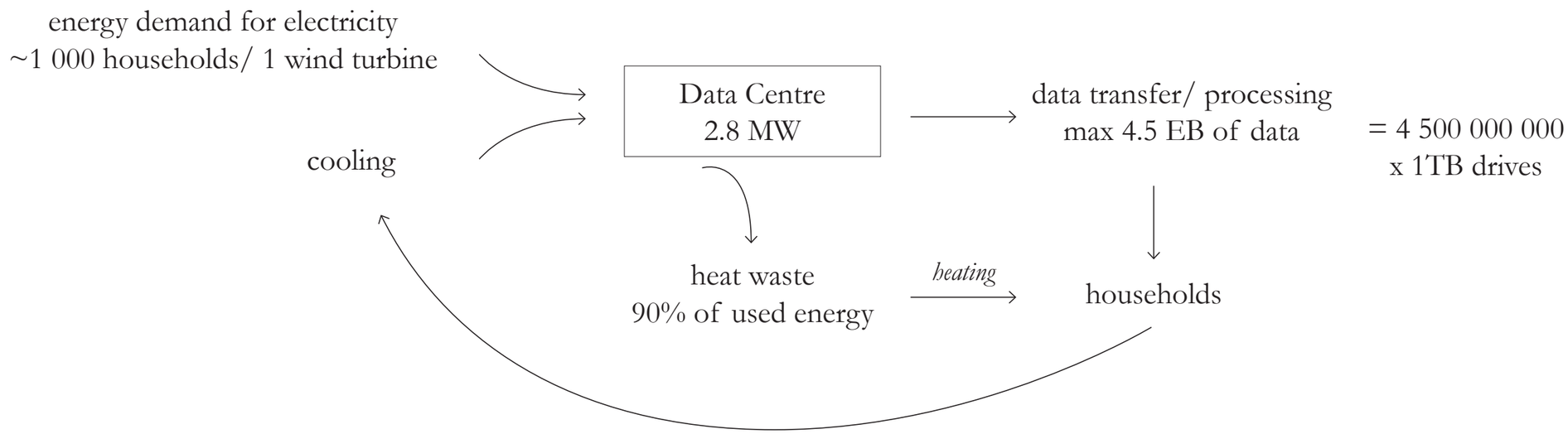
Heat Waste | View from DC towards the city

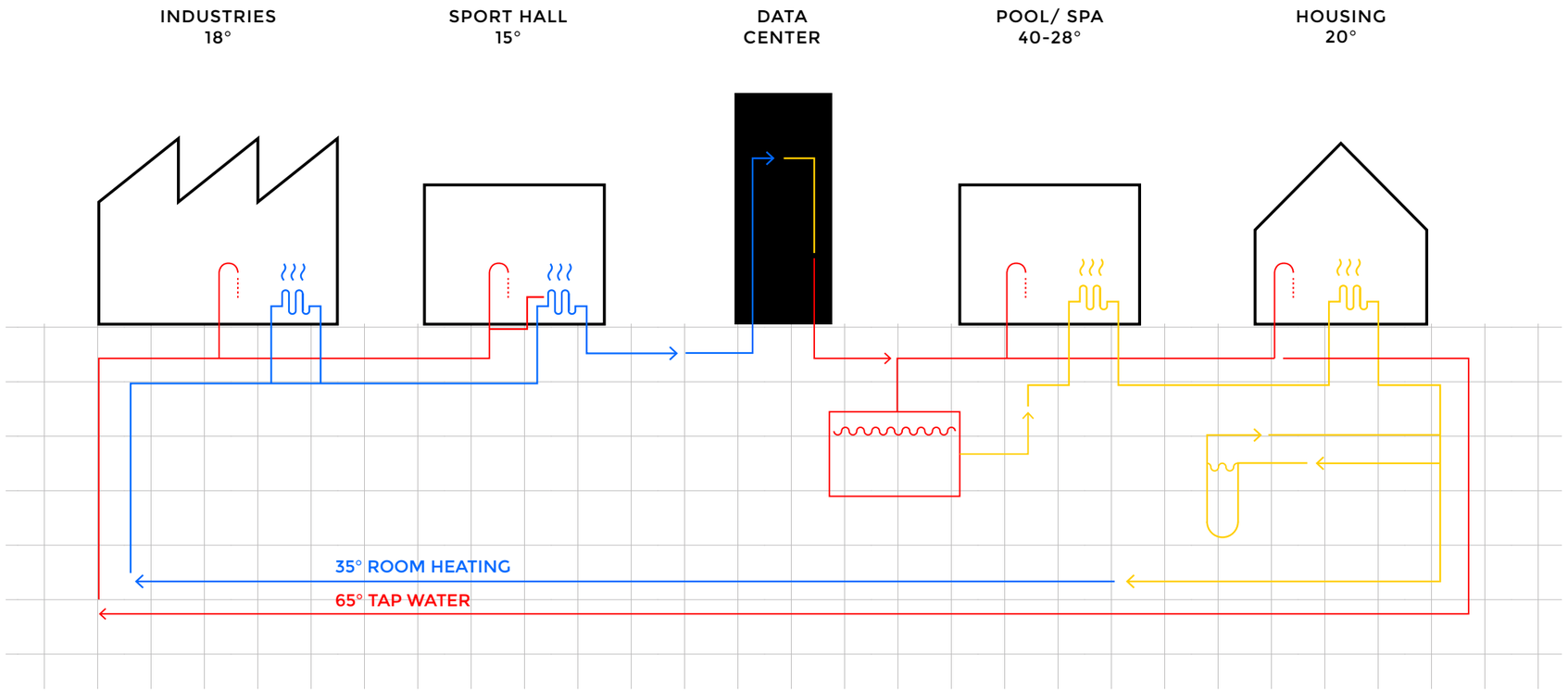


TYPICAL LINEAR SYSTEM



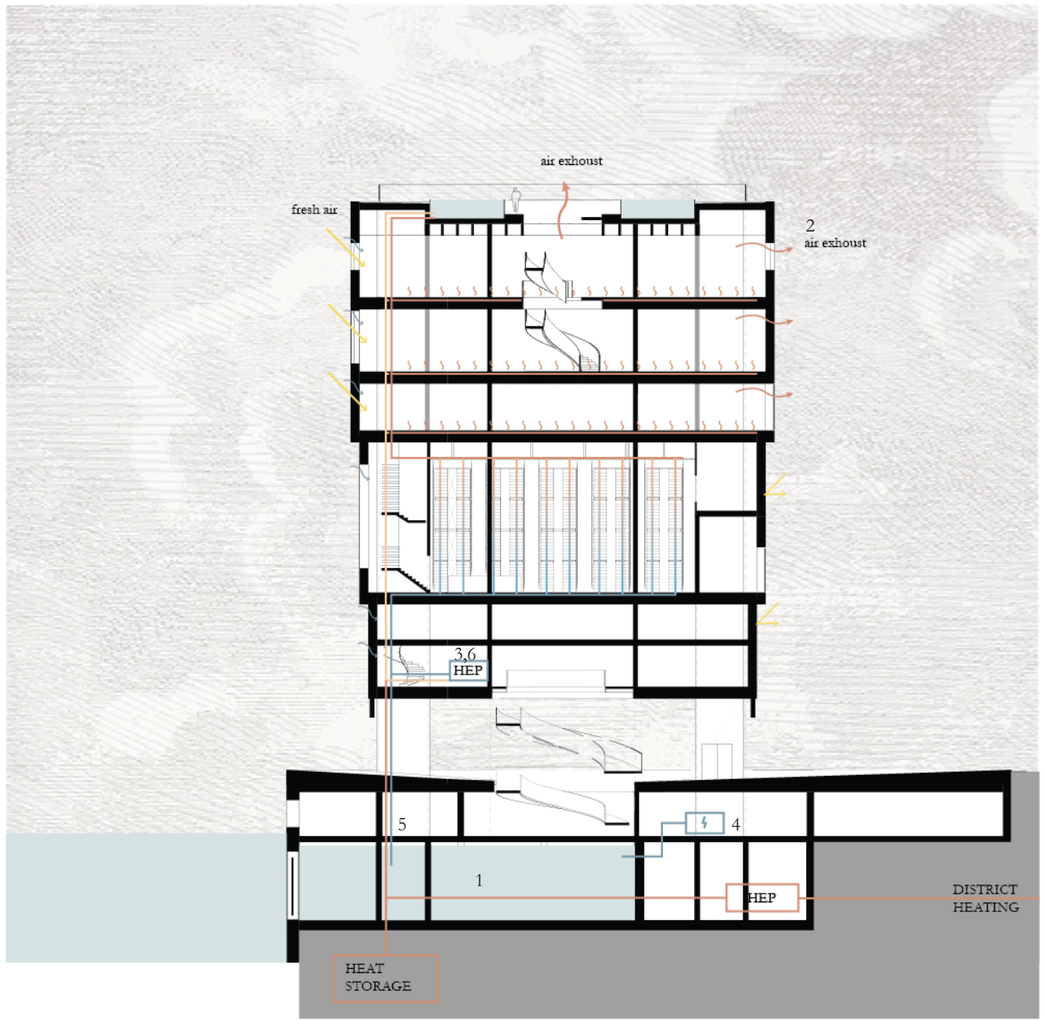
CIRCULAR SYSTEM



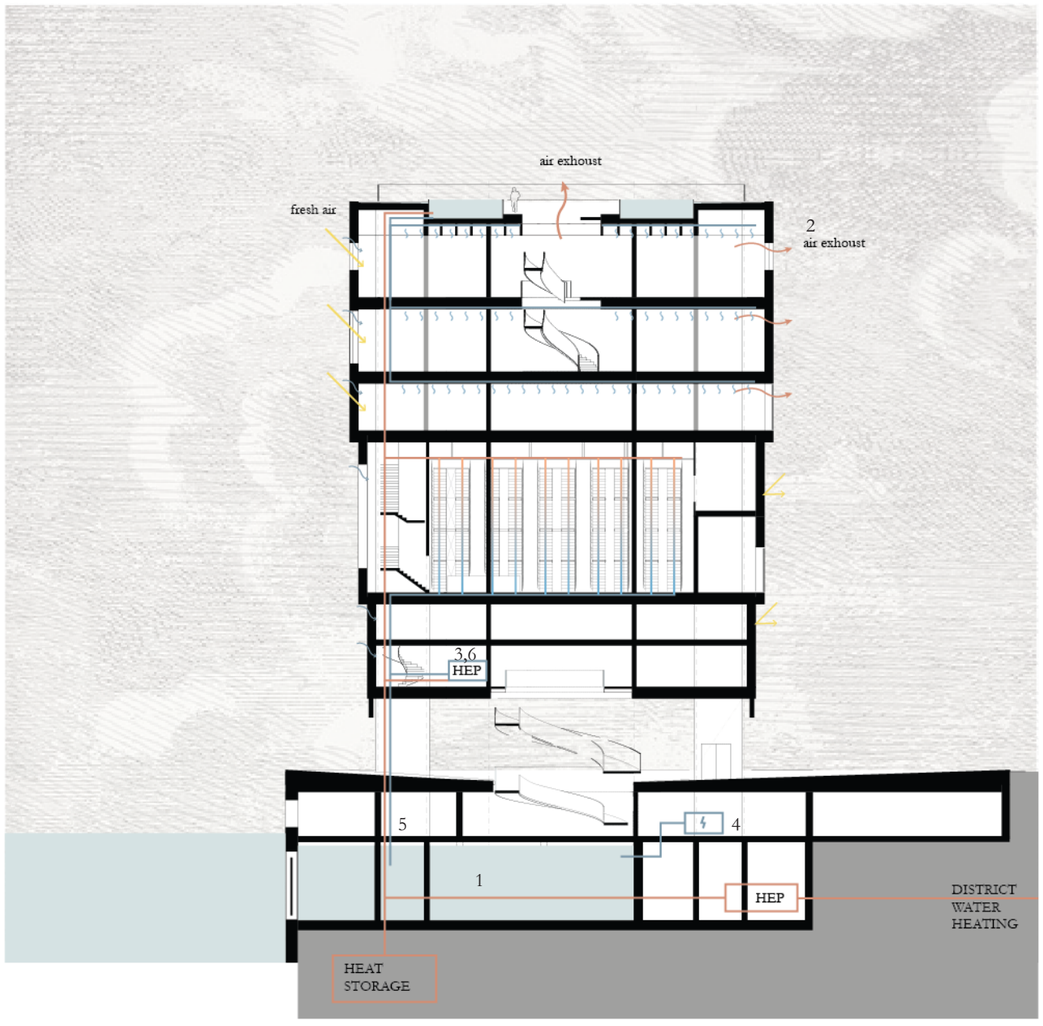


The Spark Model
by Snøhetta

Winter

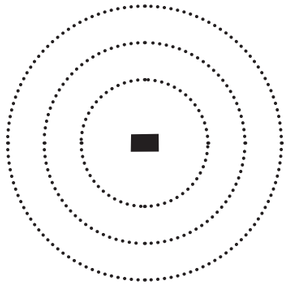


Summer

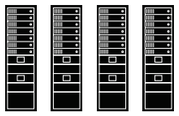


1 Tidal pools
2 Mechanical ventilation with heat recovery
3 Transformer / Inverter
4 Water-source heat exchanger (for server cooling)
5 Water pomp (from canal for cooling)
6 Heat exchanger for ventilation

HEAT WASTE AS
A DISTRICT HEATING





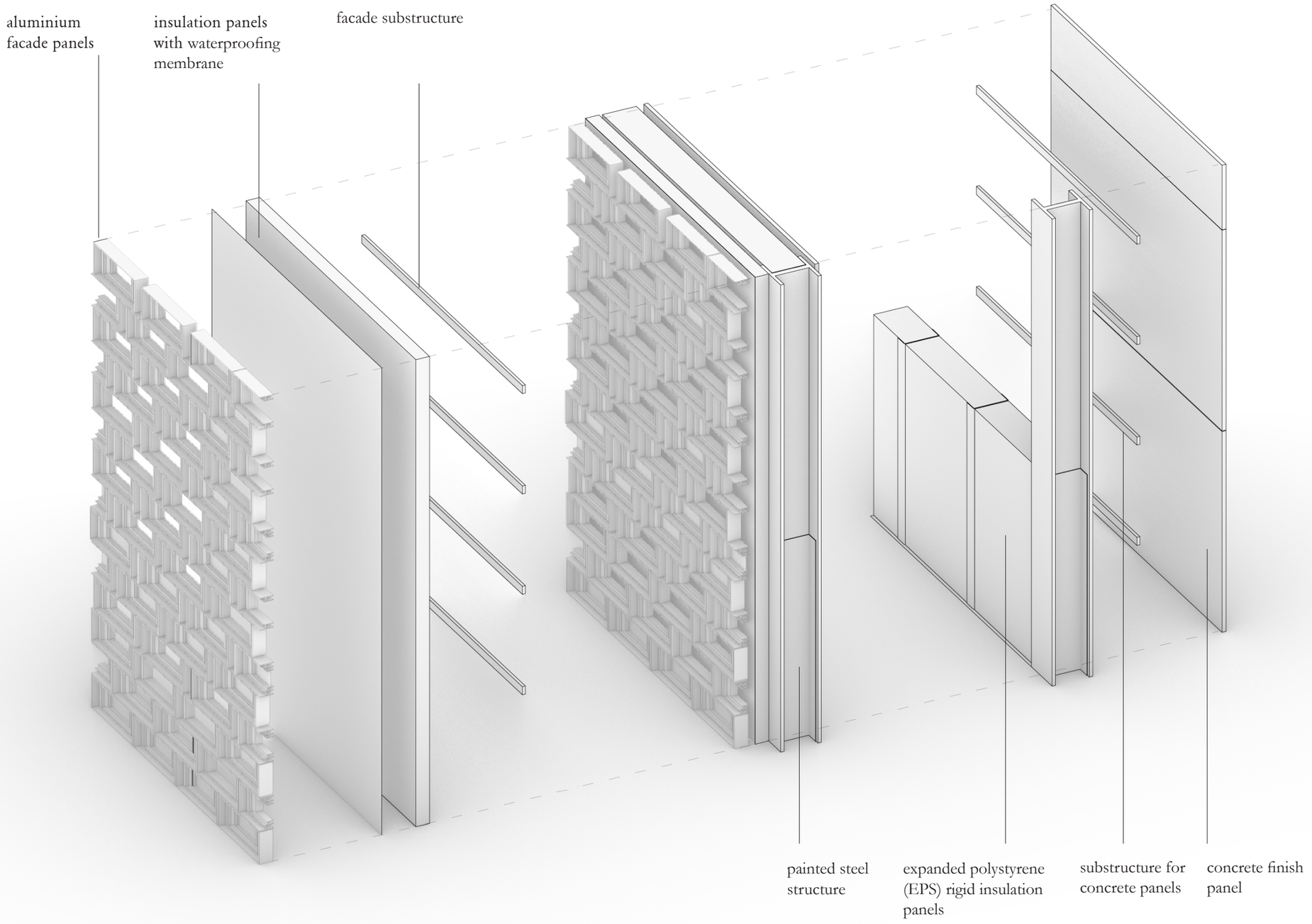


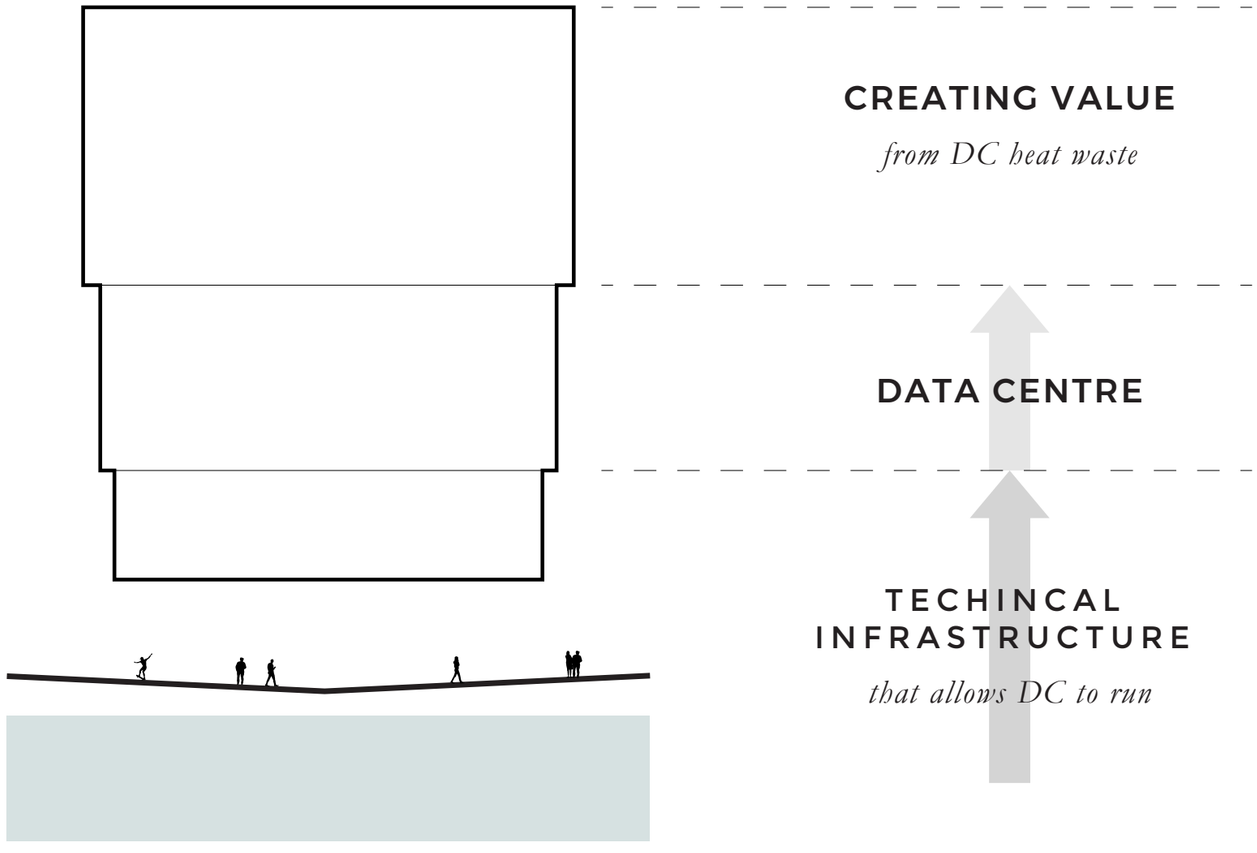






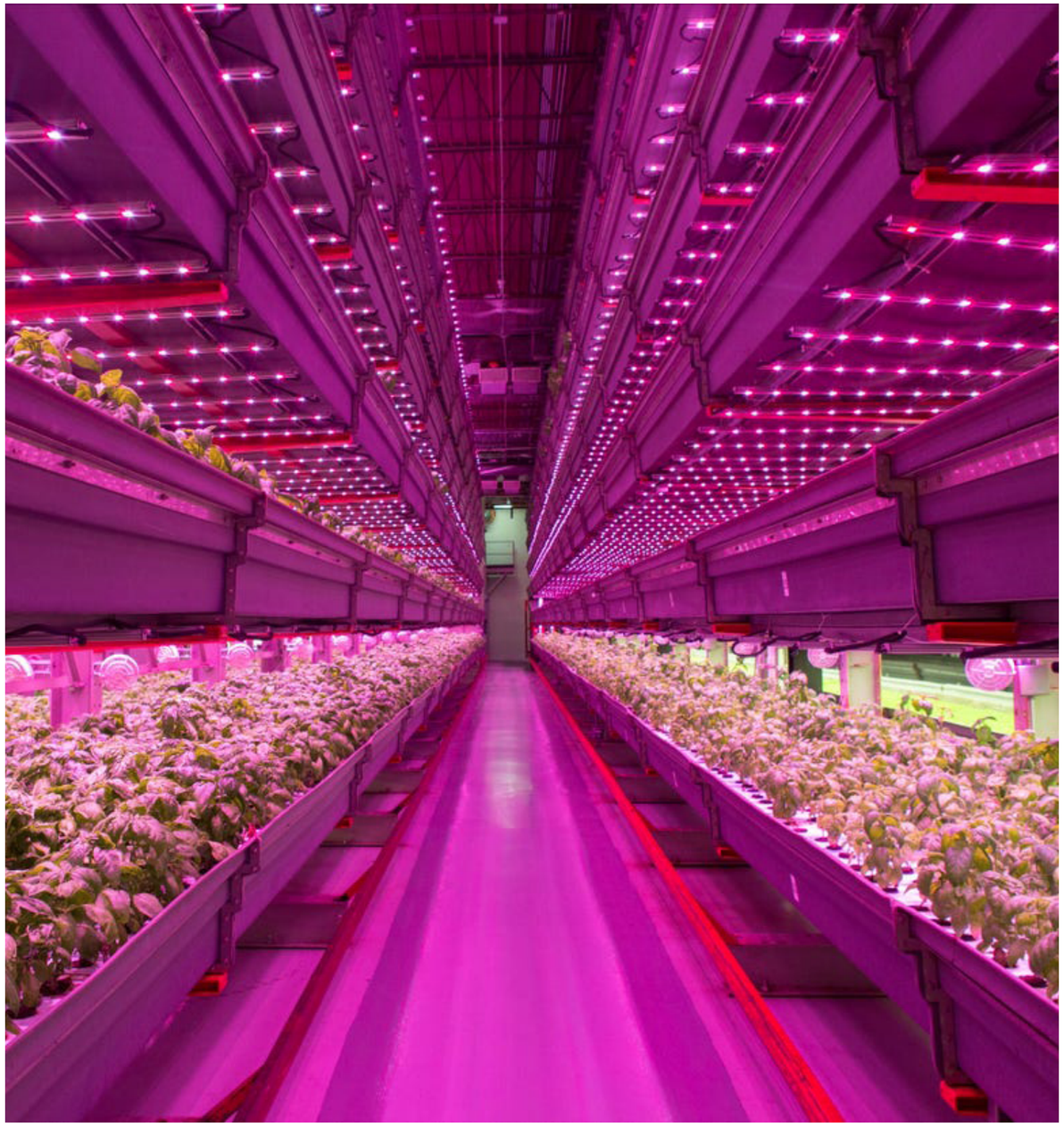
	DATA CENTER CAPACITY	RACKS	SQ M	HEATED FLATS	THERMAL ENERGY
Telia DC, Finland, 2015-18	24 MW	5 000	8 400 M²	20 000	200 000 MWh/ year
Yandex DC, Finland, 2018	10 MW	2 100	6 500 M²	8 400	84 000 MWh/ year
estimation for the Hamburg site	~2.8 MW	~580	~1 800 M²	~2 000	~23 300 MWh/ year


aluminium facade panels
insulation panels with waterproofing membrane
facade substructure
painted steel structure
expanded polystyrene (EPS) rigid insulation panels
substructure for concrete panels
concrete finish panel


CREATING VALUE
from DC heat waste
DATA CENTRE
TECHINCAL
INFRASTRUCTURE
that allows DC to run

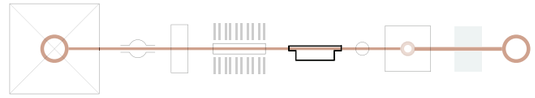
X
Creating value

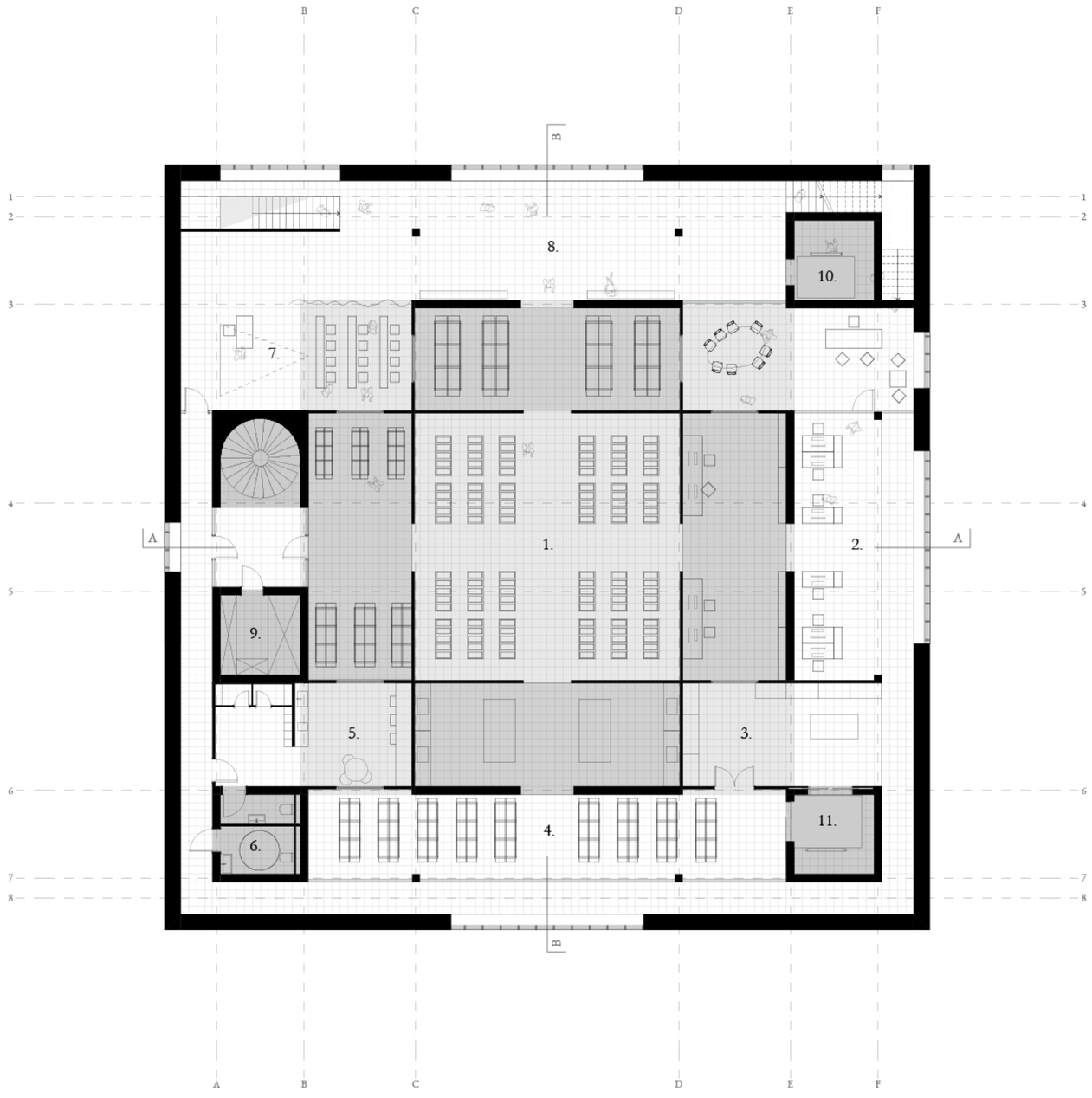

Swimming pool
Quantum Lab
Data Bank
IT offices
Vertical Farm



Vertical Farm interior

image source : www.wired.com/2015/10/leds-upended-marijuana-growing-can-upend-agriculture/

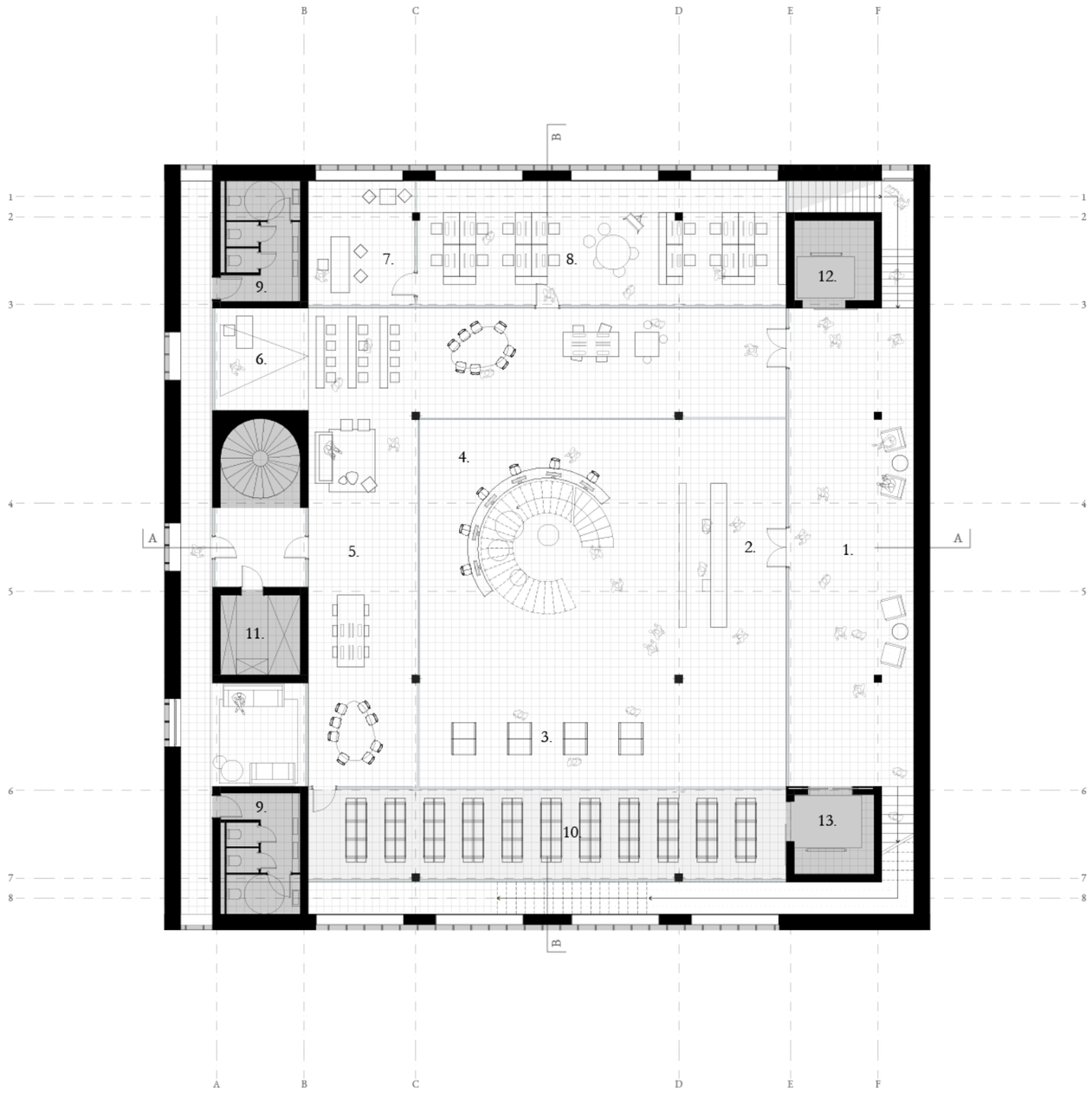




1. Vertical Farm Laboratory
2. Vert. Farm Offices
3. Food Storage
4. Vertical Farm - Plant growth (South Facade)
5. Employee changing room and kitchen
6. WC
7. Training space
8. Visitor Path
9. Technical core - Waste Heat distribution
10. Lift (employees and visitors)
11. Technical lift



5th Floor Plan | 1:200 General and IT offices

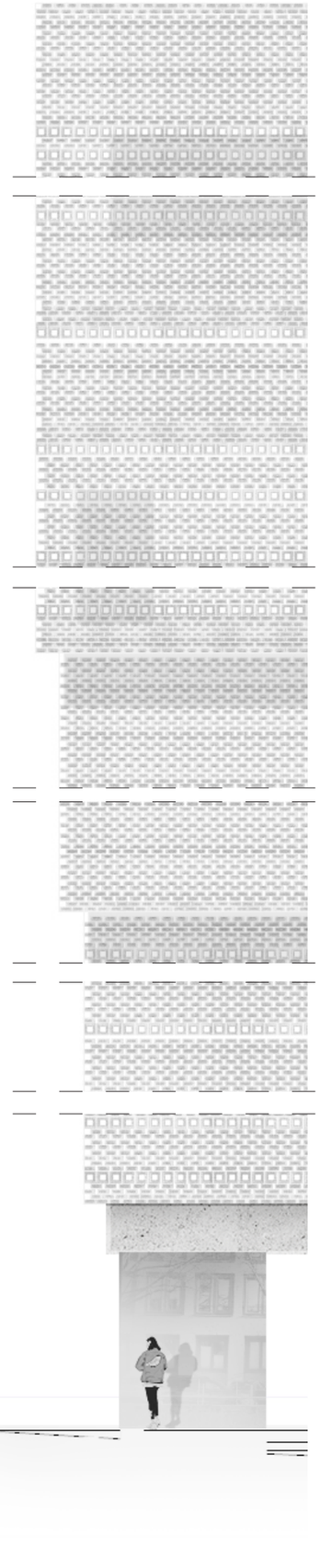


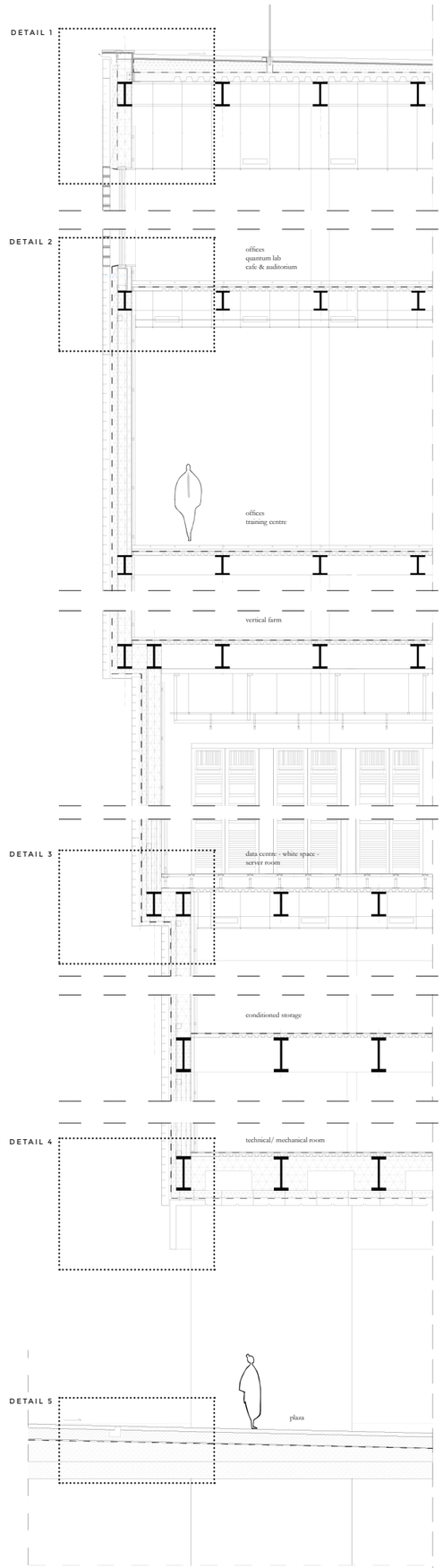
1. Visitor Path
2. DC & Data Bank Reception
3. Data Bank self-service
4. Coworking - latency critical workspace
5. Office Open Space
6. Quantum Lab Training space
7. Executive Office
8. IT office
   DC optimalisation
   Big Data processing
9. WC
10. Vertical Farm - Plant growth (South Facade)
11. Technical core
12. Lift (employees and visitors)
13. Technical lift

N

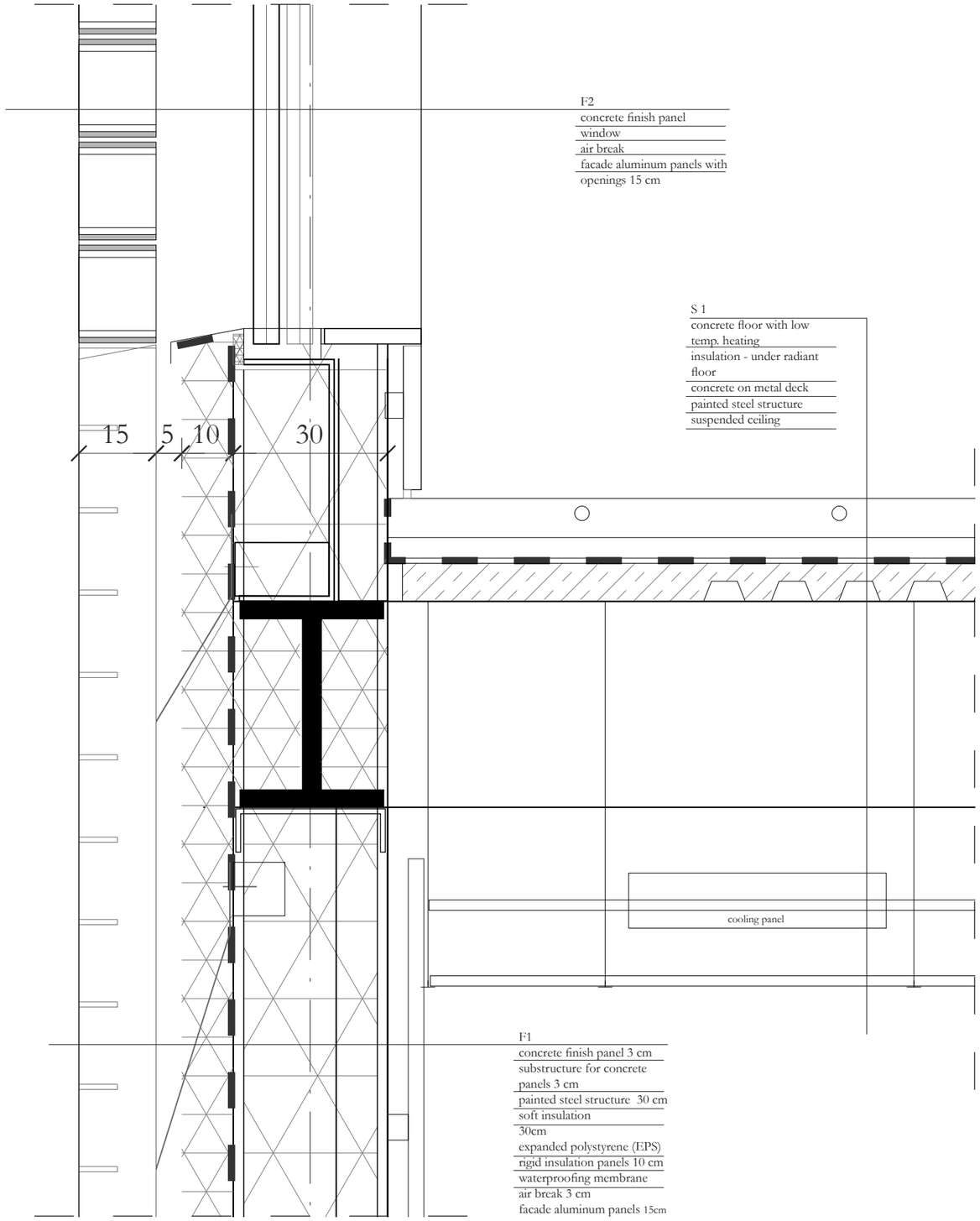
0 1 5M

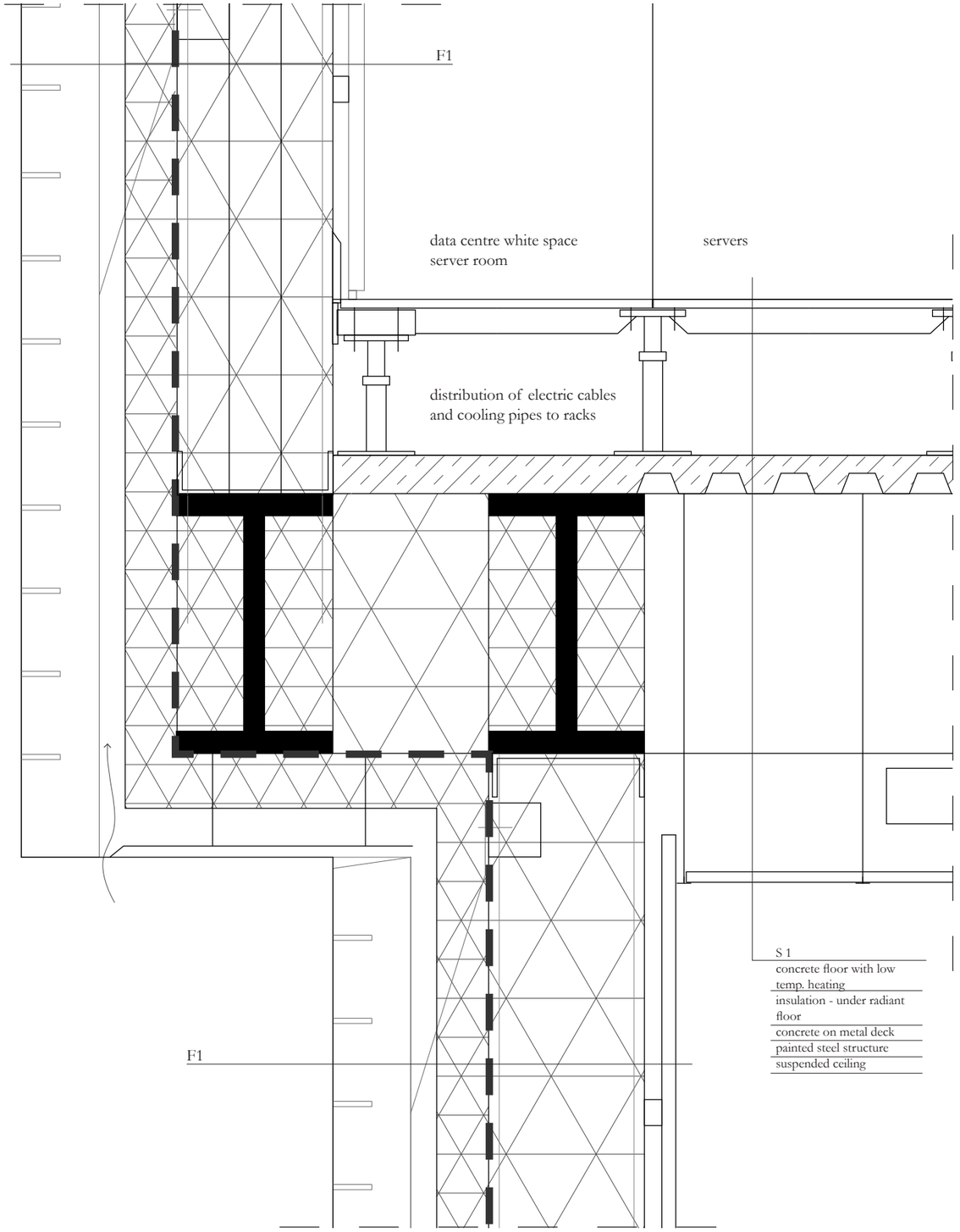
Facade fragment| 1:20





Facade fragment| details 1:5

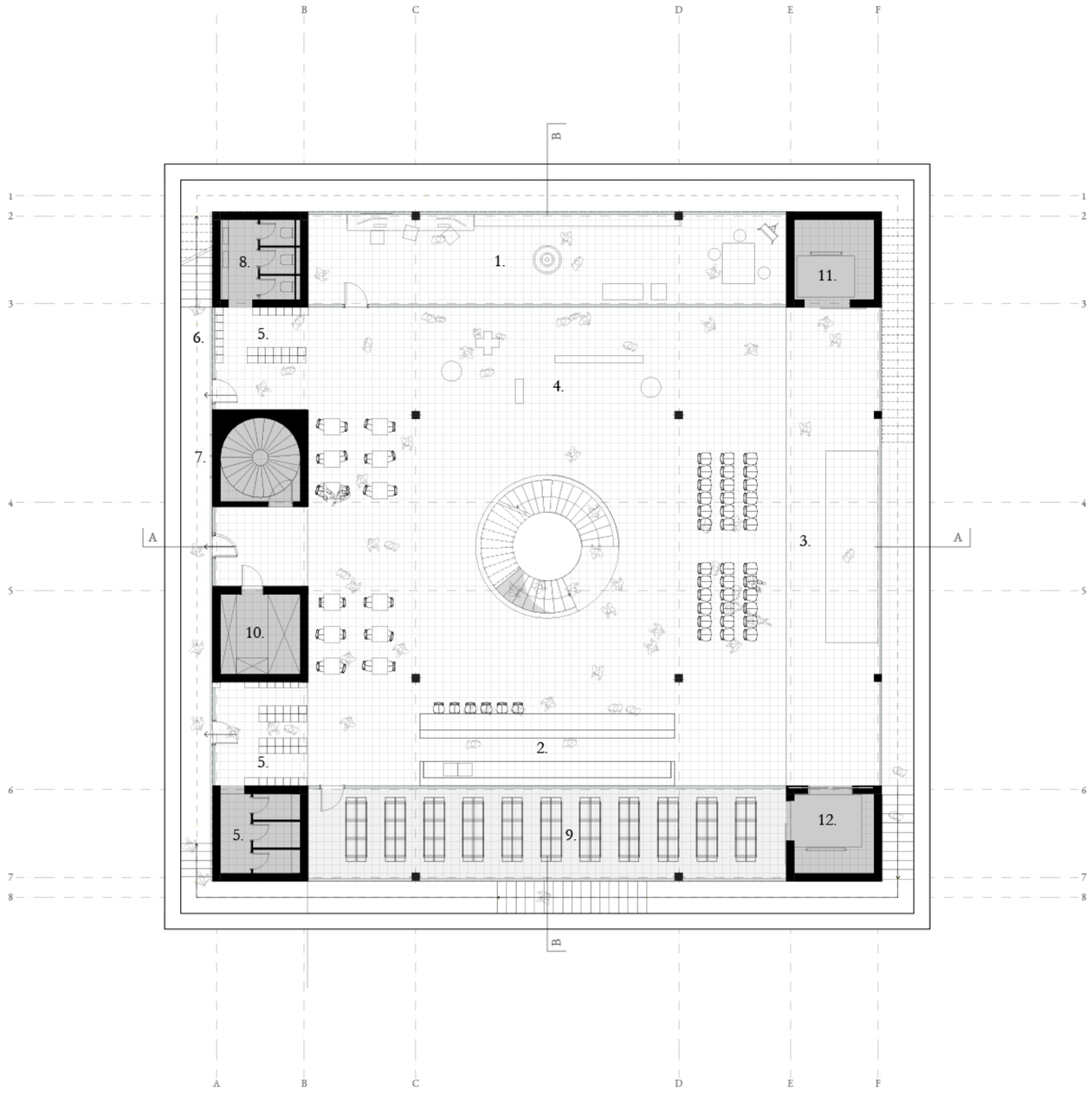






Quantum Computer

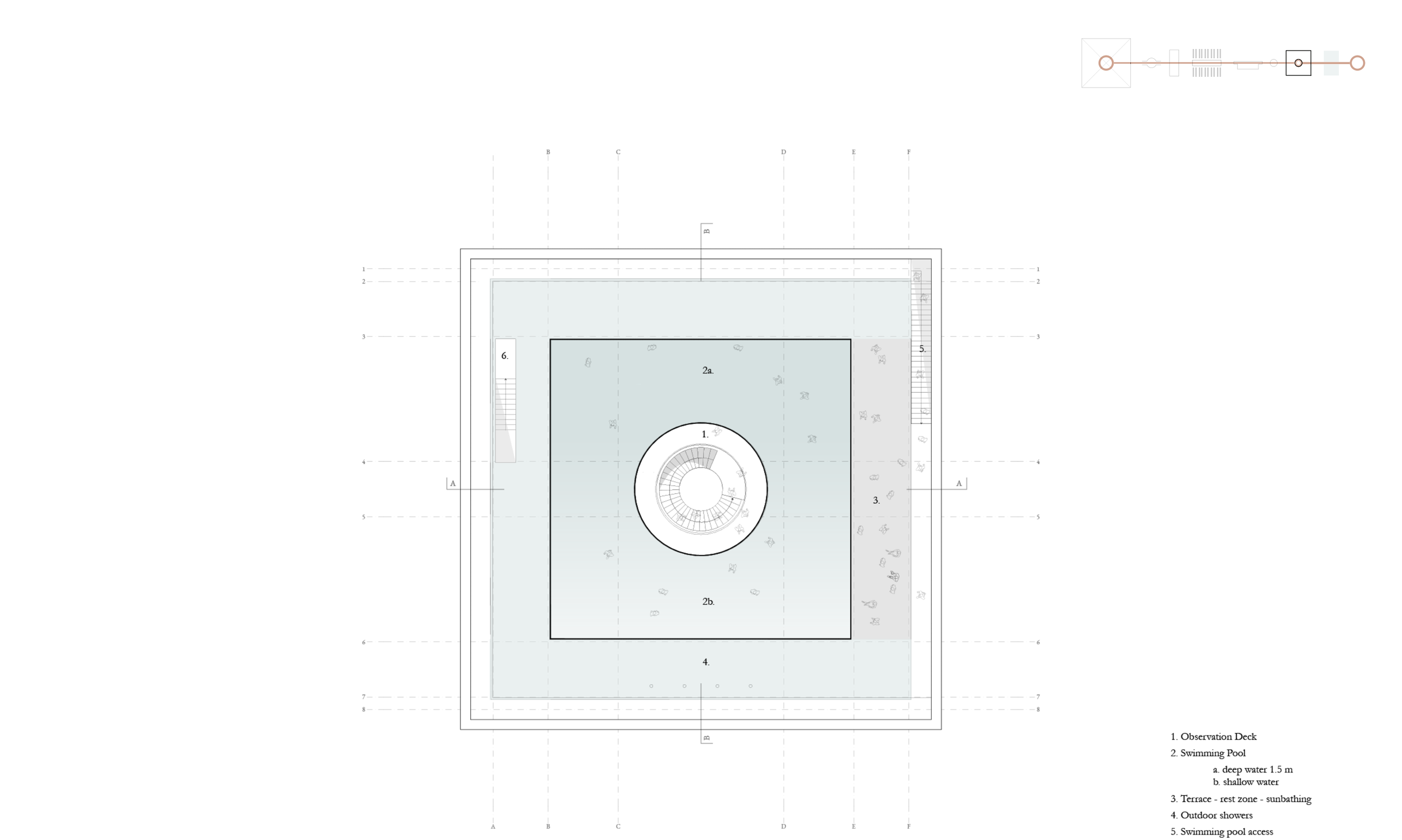
image source : www.crazynauka.pl/ibm-q-system-one-pierwszy-komputer-kwantowy-ktory-mozna-by-sprzedac/



1. Quantum Lab
2. Café
3. Event Space with city view
4. Multifunctional space
5. Changing rooms
6. Swimming Pool Access
7. Outdoor showers
8. WC
9. Vertical Farm - Plant growth (South Facade)
10. Technical core
11. Lift (employees and visitors)
12. Technical lift

N

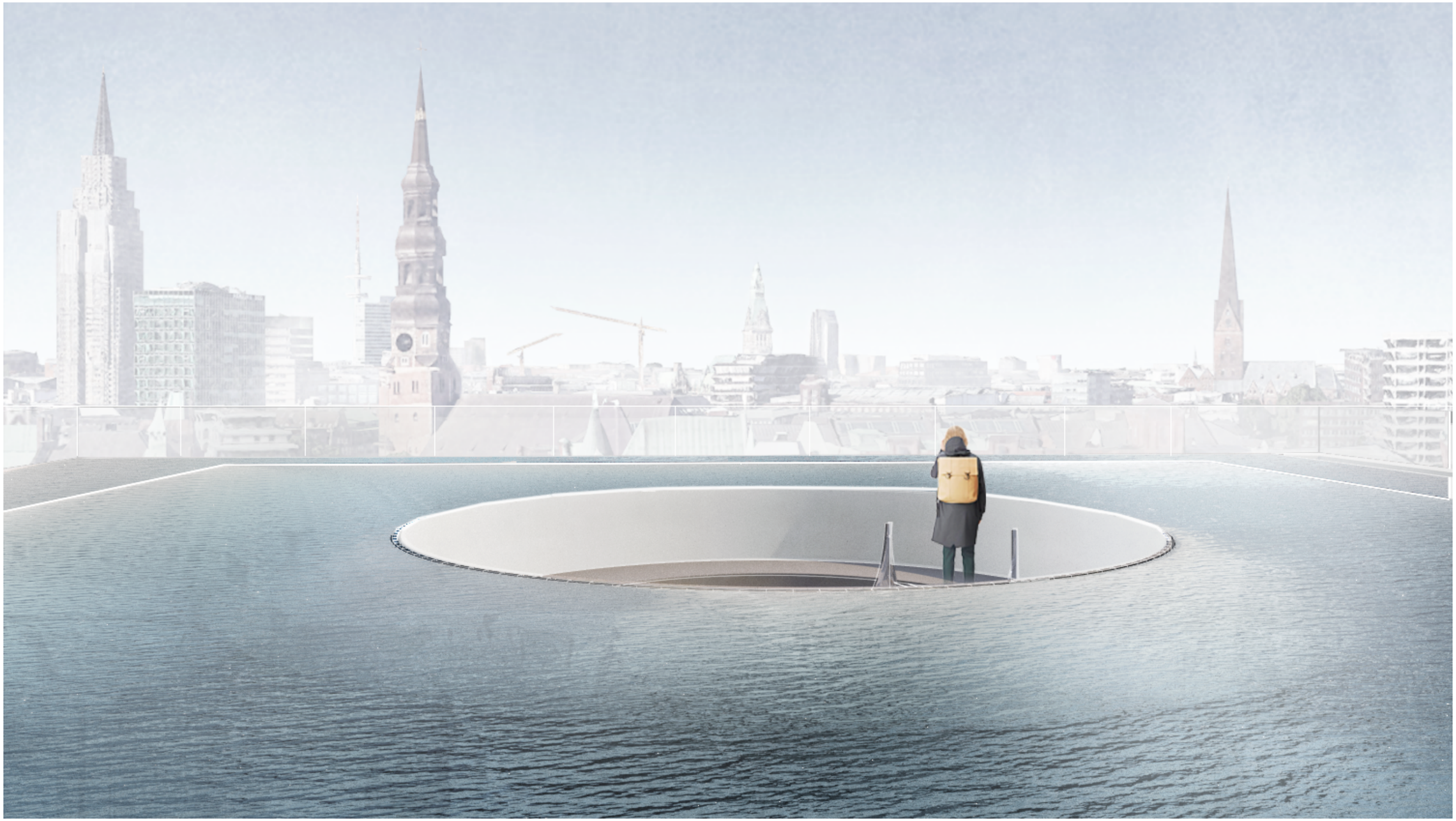
0 1 5M

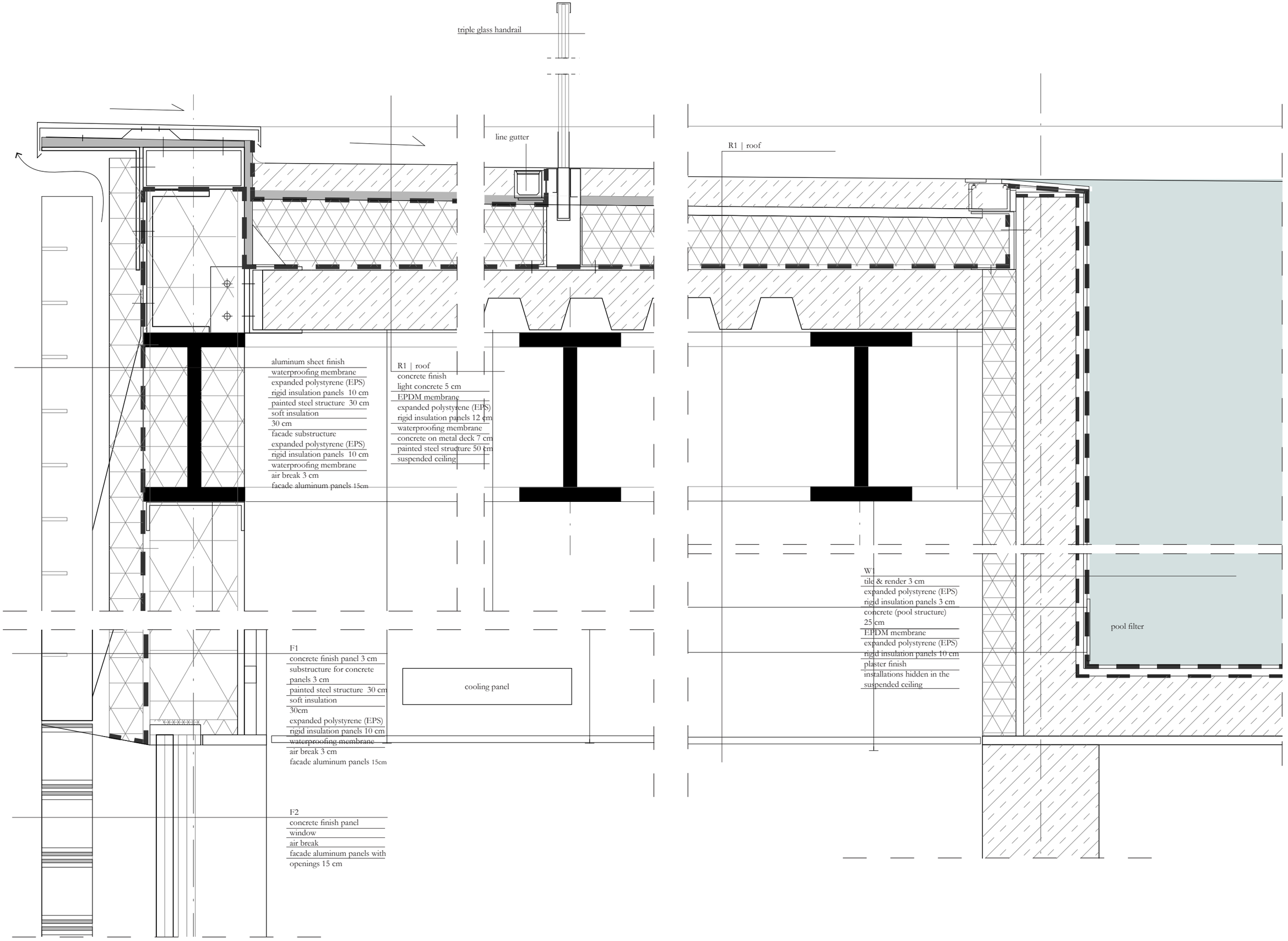


1. Observation Deck
2. Swimming Pool
    a. deep water 1.5 m
    b. shallow water
3. Terrace - rest zone - sunbathing
4. Outdoor showers
5. Swimming pool access
6. Evacuation Staircase

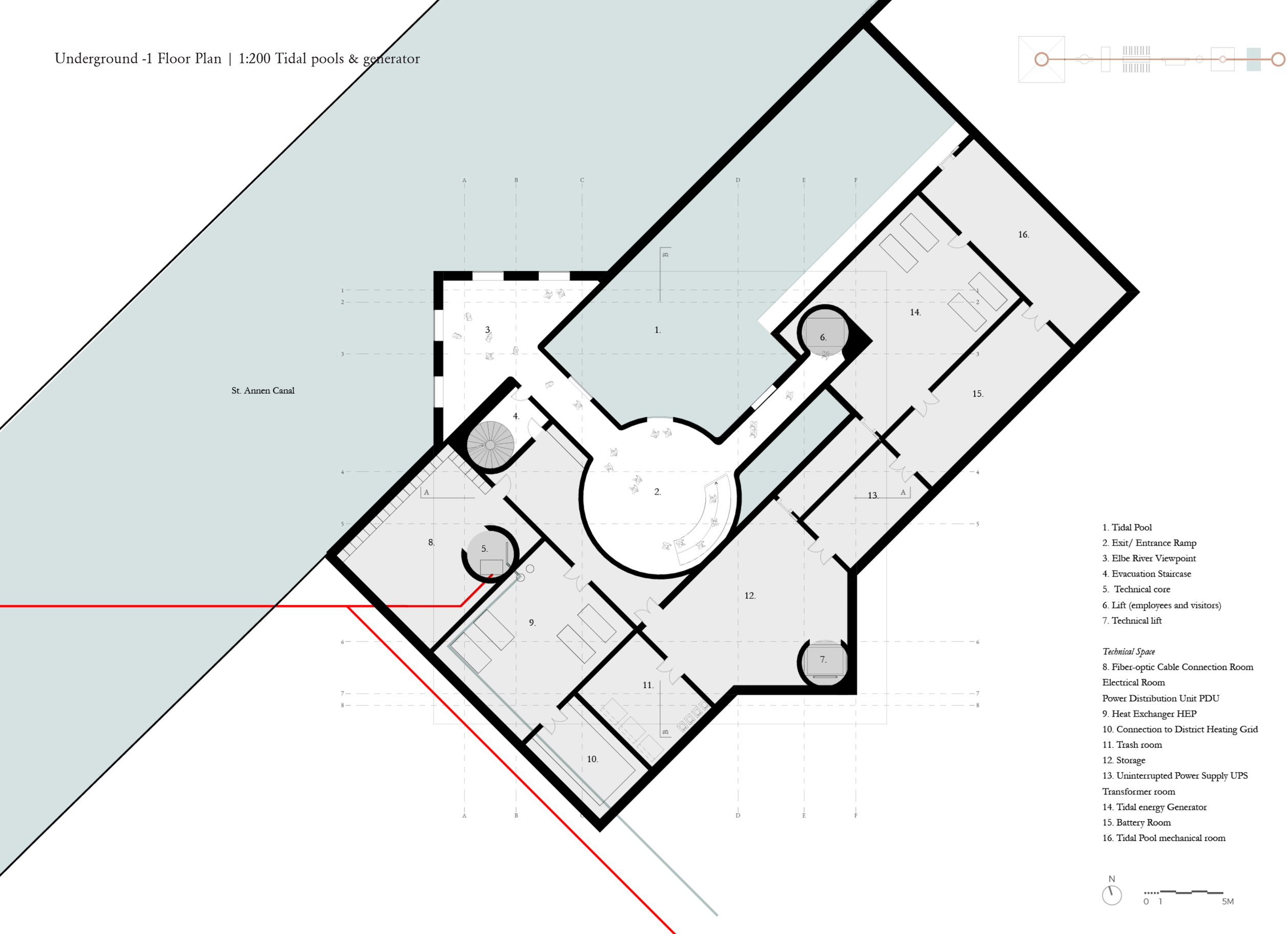
N

0 1 5M




triple glass handrail
line gutter
R1 | roof
aluminum sheet finish
waterproofing membrane
expanded polystyrene (EPS)
rigid insulation panels 10 cm
painted steel structure 30 cm
soft insulation
30 cm
facade substructure
expanded polystyrene (EPS)
rigid insulation panels 10 cm
waterproofing membrane
air break 3 cm
facade aluminum panels 15cm
R1 | roof
concrete finish
light concrete 5 cm
EPDM membrane
expanded polystyrene (EPS)
rigid insulation panels 12 cm
waterproofing membrane
concrete on metal deck 7 cm
painted steel structure 50 cm
suspended ceiling
F1
concrete finish panel 3 cm
substructure for concrete
panels 3 cm
painted steel structure 30 cm
soft insulation
30cm
expanded polystyrene (EPS)
rigid insulation panels 10 cm
waterproofing membrane
air break 3 cm
facade aluminum panels 15cm
cooling panel
F2
concrete finish panel
window
air break
facade aluminum panels with
openings 15 cm
R1 | roof
W1
tile & render 3 cm
expanded polystyrene (EPS)
rigid insulation panels 3 cm
concrete (pool structure)
25 cm
EPDM membrane
expanded polystyrene (EPS)
rigid insulation panels 10 cm
plaster finish
installations hidden in the
suspended ceiling
pool filter

Underground -1 Floor Plan | 1:200 Tidal pools & generator



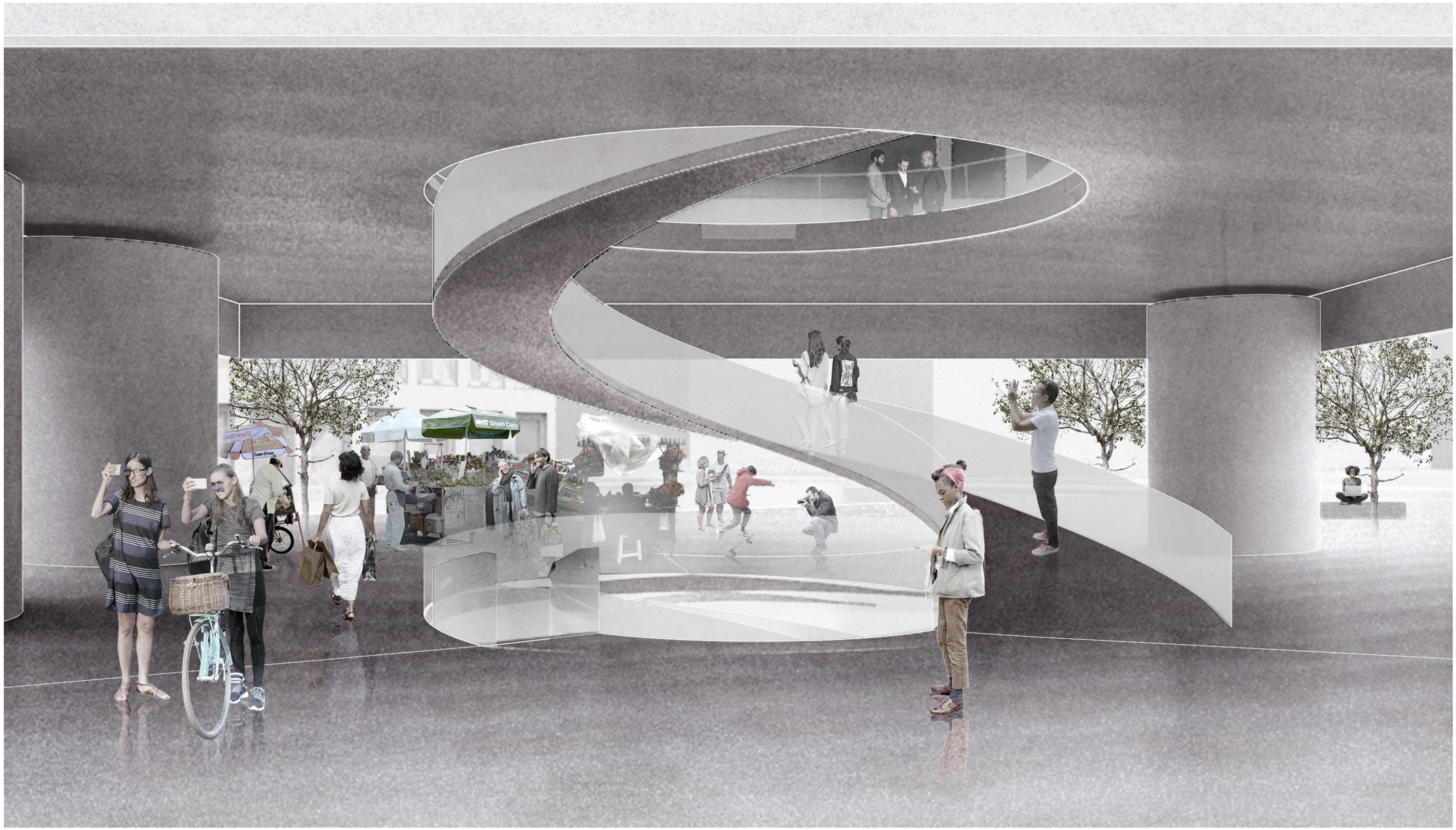
1. Tidal Pool
2. Exit/ Entrance Ramp
3. Elbe River Viewpoint
4. Evacuation Staircase
5. Technical core
6. Lift (employees and visitors)
7. Technical lift

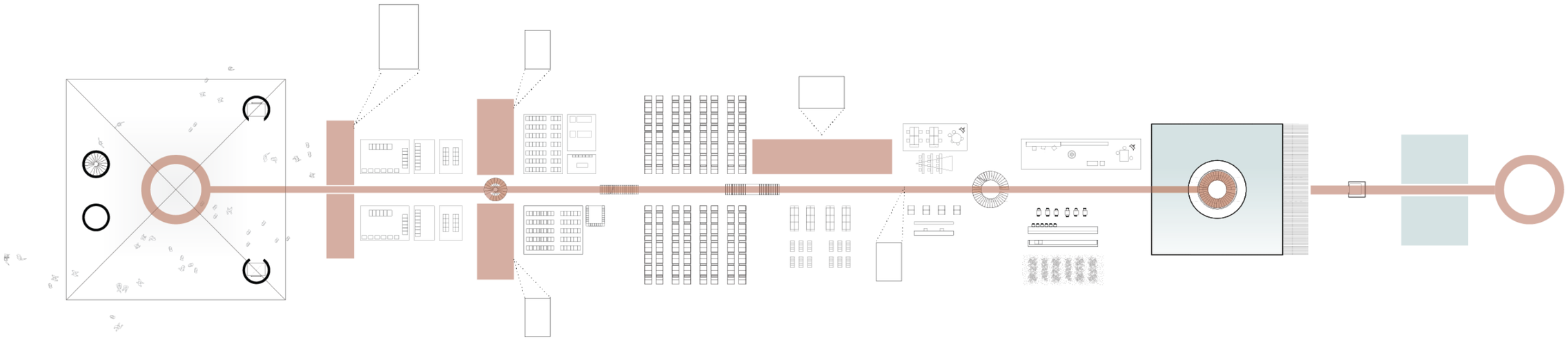
Technical Space

8. Fiber-optic Cable Connection Room
Electrical Room
Power Distribution Unit PDU
9. Heat Exchanger HEP
10. Connection to District Heating Grid
11. Trash room
12. Storage
13. Uninterrupted Power Supply UPS
Transformer room
14. Tidal energy Generator
15. Battery Room
16. Tidal Pool mechanical room

N

0 1 5M


NYC Green Cart



Entrance

Mechanichal & Technical floor

what allows machine to work

Conditioned Storage

secure storage & vault

Data Centre white space

monitoring performance

typical image of DC

Vertical Farm

using DC heat waste

IT, DC Manag. Training Center

Data Bank

information exchange & data processing

Quantum comp. Lab

Cafe & vertical farm

data processing

Swiming Pool

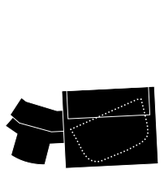
Observation Deck

Exit

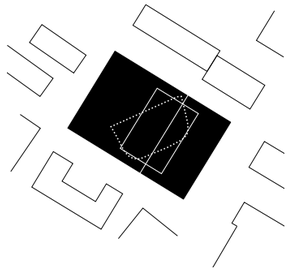
Tidal pools

Square

Conclusion



Amsterdam City Hall, NL
footprint 4 330 m 2



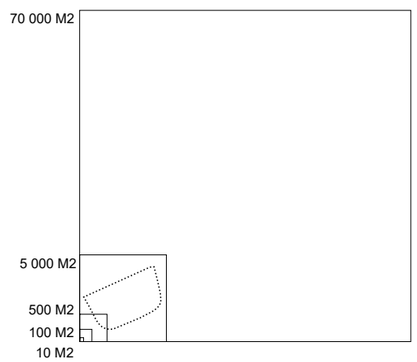
Oude Kerk, Amsterdam
footprint 3 700 m2

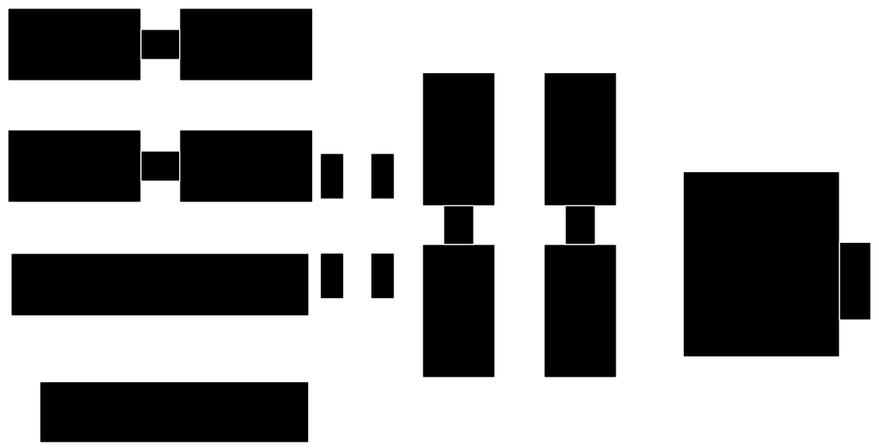


Amsterdam City Archive, NL
footprint 2 810 m 2



Archiefdepot Noord, Amsterdam, NL
footprint 1 790 m 2

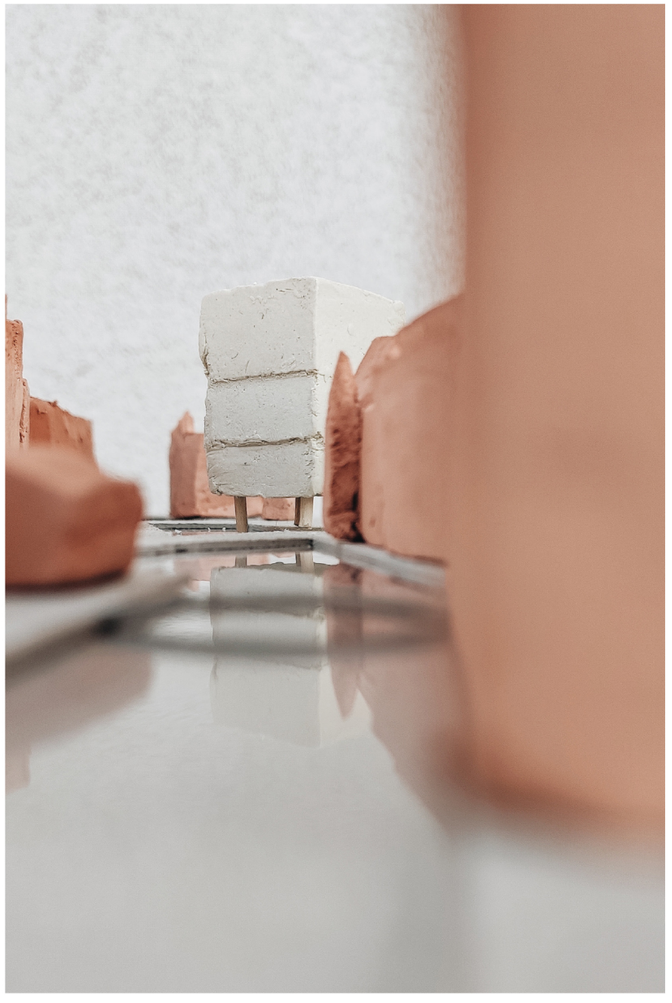




Microsoft Data Center, Middenmeer, NL
footprint 100 850 m 2





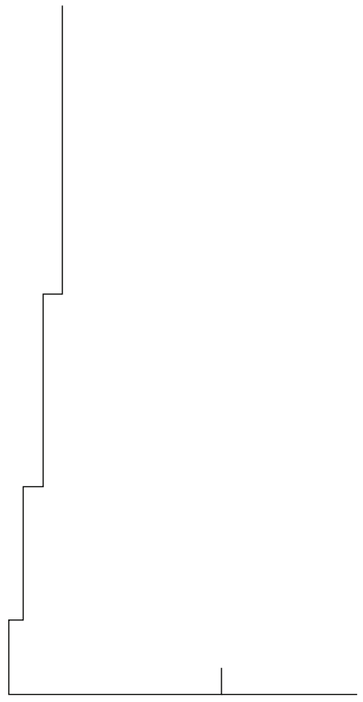












Thank You!