

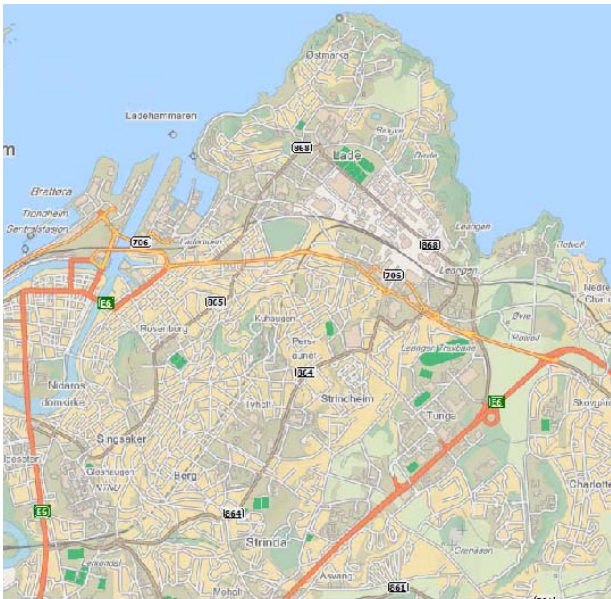
BRØSET KLIMA CENTER

Arjun Basnet, Mila Shrestha, Nigar Zeynalova, Sarah Flaussse

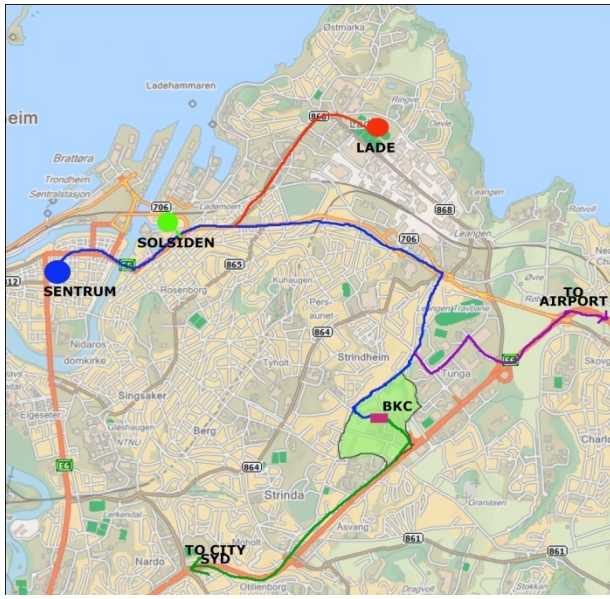
SITE AND CONCEPT



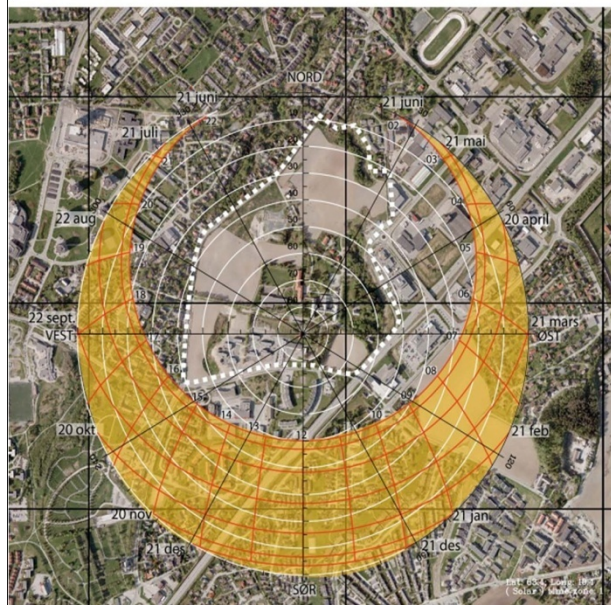
→ Summer wind
 → Winter wind
 Surrounding situation



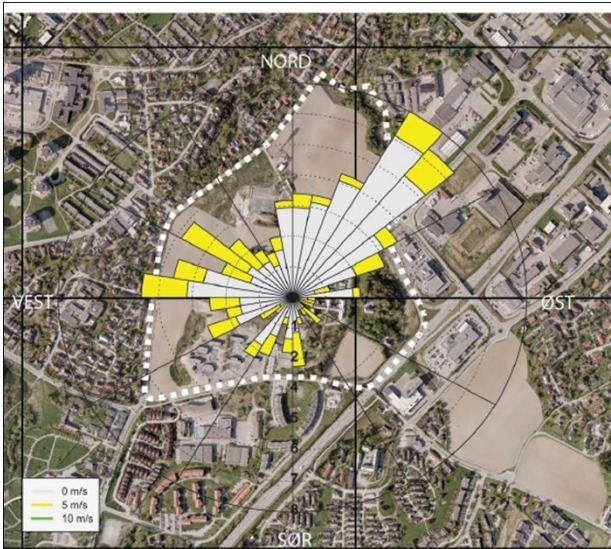
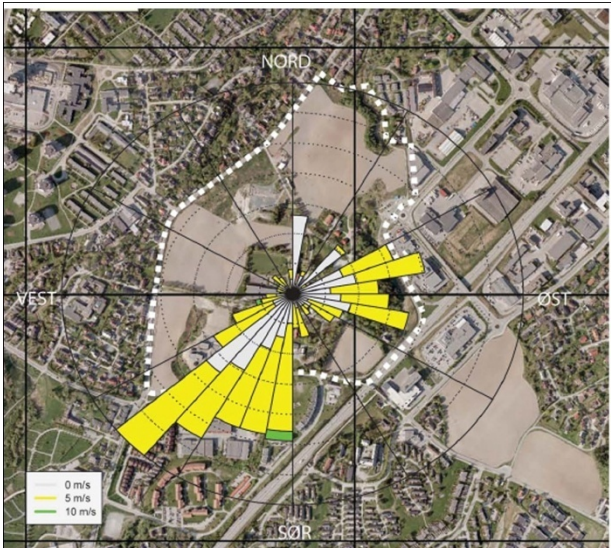
Location



Access

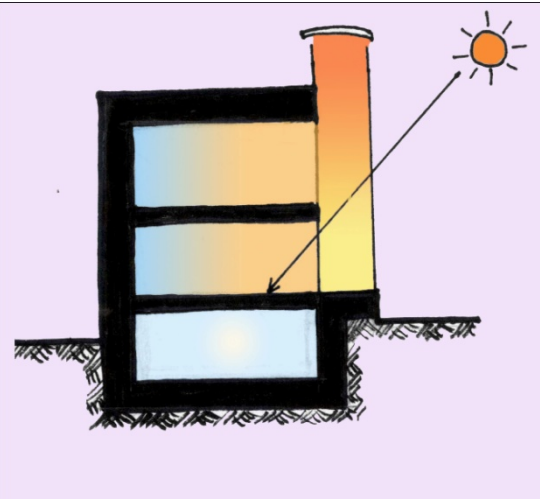
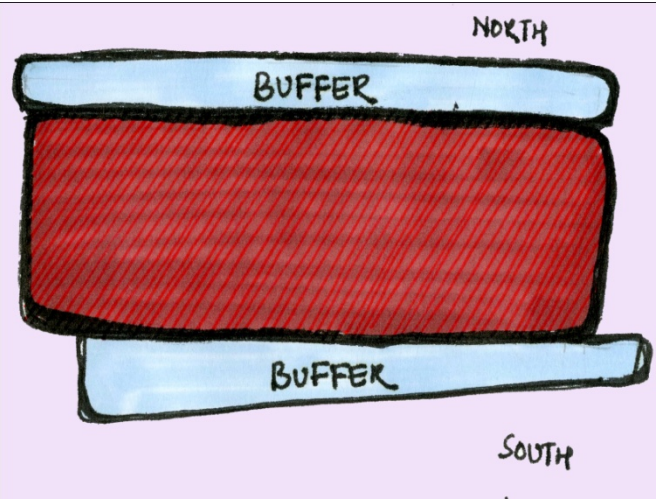


Sun path



Prevailing wind

"The new suburb, Brøset, will be carbon neutral. Built from healthy materials and using little energy, Brøset will make an integrated and future-oriented suburb. The work in Brøset will be given full priority in Cities of the Future and should become a model for future urban development." -Brøset. Trondheim Kommune'



Main concept of design is to sandwich the main building space within buffer zones on north and south (protection from extreme environment) and make these buffer as useful space in design implementation.

BRØSET KLIMA CENTER

Arjun Basnet, Mila Shrestha, Nigar Zeynalova, Sarah Flausse

SITE AND CONCEPT

- Selective Design approach adopted for the design development. We don't intend for closed insulated box, rather we want the building to communicate with the surrounding environment and breath.
- Basically we tried to be as simple as possible both in plan and form; plans being more open and flexible.
- Architectural vocabulary is used to adapt the building to local climate and condition.
- Zoning is implemented to minimize heating
- renewable energy sources, to fulfill energy demand in building.
- Material chosen are certified recyclable natural materials.

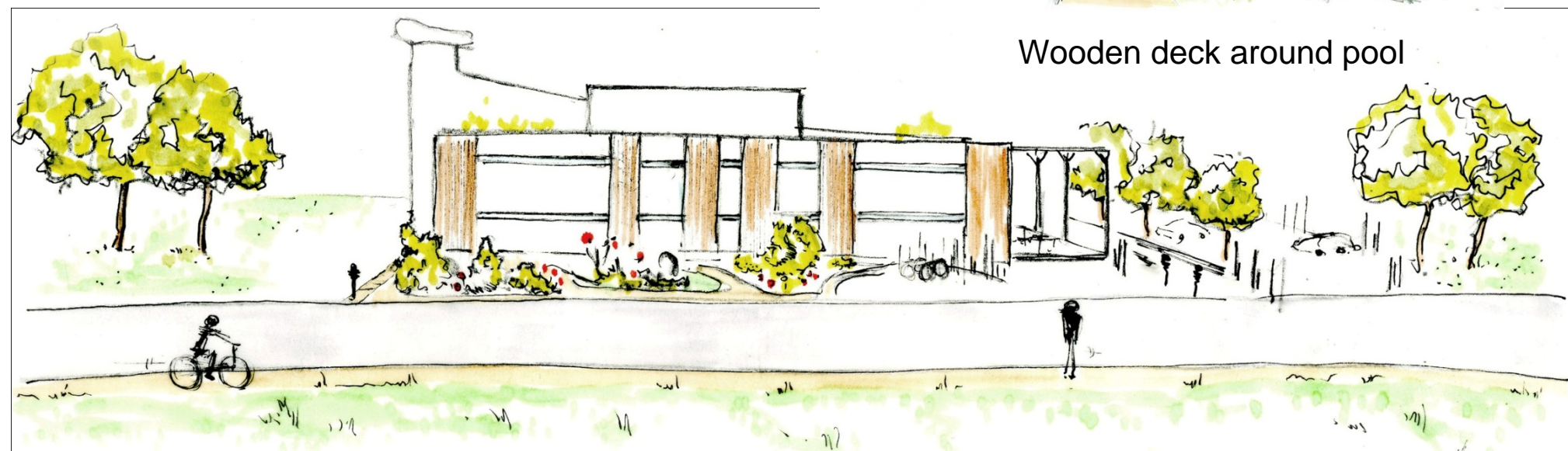
Selective design is a system of interrelated and interacting elements in a building where the form, fabric, materials, mechanical systems of a building and the controls that operate upon them are located within a naturally occurring climate with all of its seasonal and diurnal variations of solar radiation, temperature, humidity, wind speed and direction, variations of ambient light and so forth. This is then inhabited by human activity that creates a complex set of demands for space and environment that the building has to satisfy. The occupants of the building and their behaviour play a vital role in the operation of the environmental system to adjust the fabric; by opening windows, drawing blinds and the like by their operation of plant, setting heating controls, switching lights, and so forth. -Hawkes, D., McDonald, J. & Steemers, K. 2002. The Selective Environment'



Entrance to Building

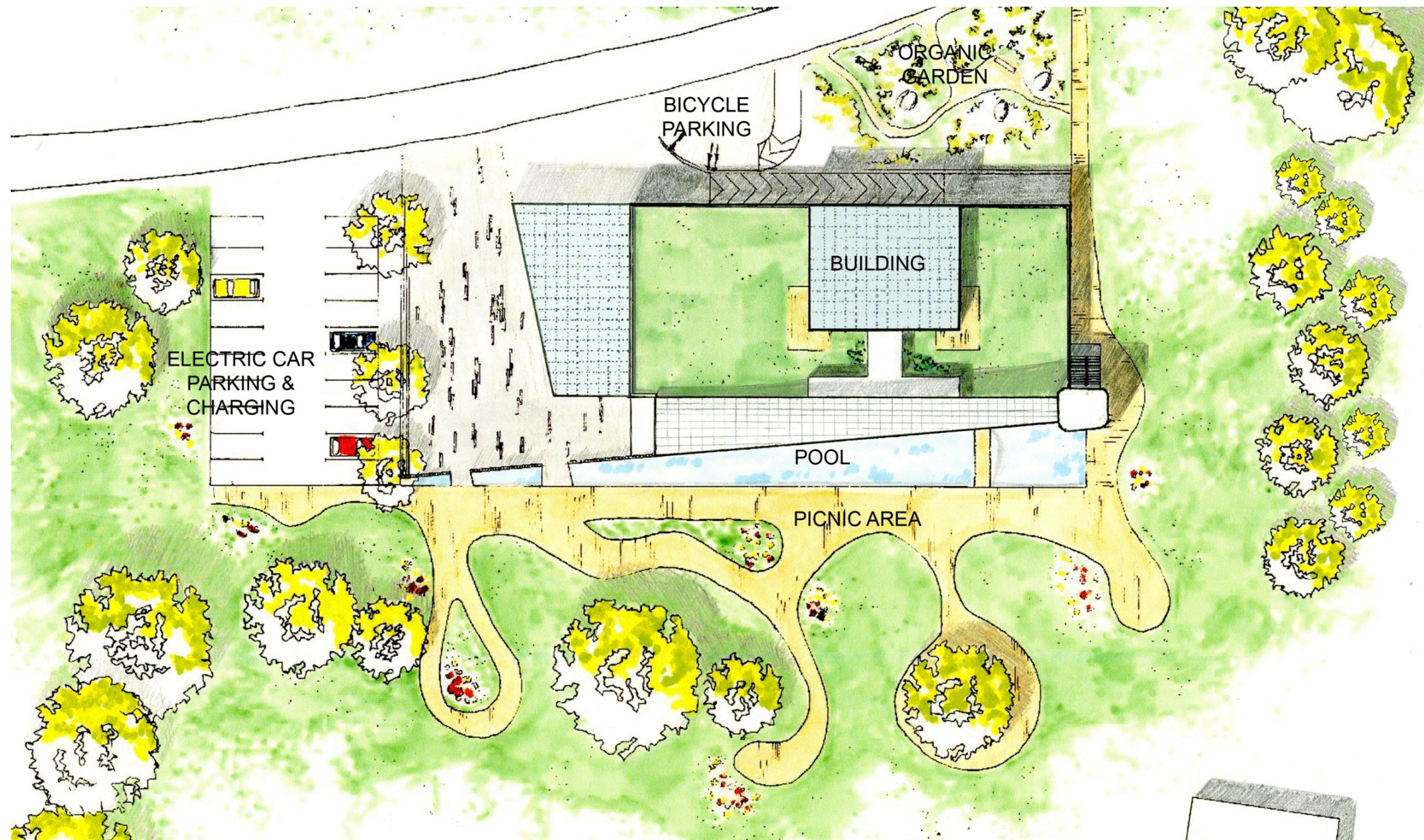


Wooden deck around pool



View of building from road

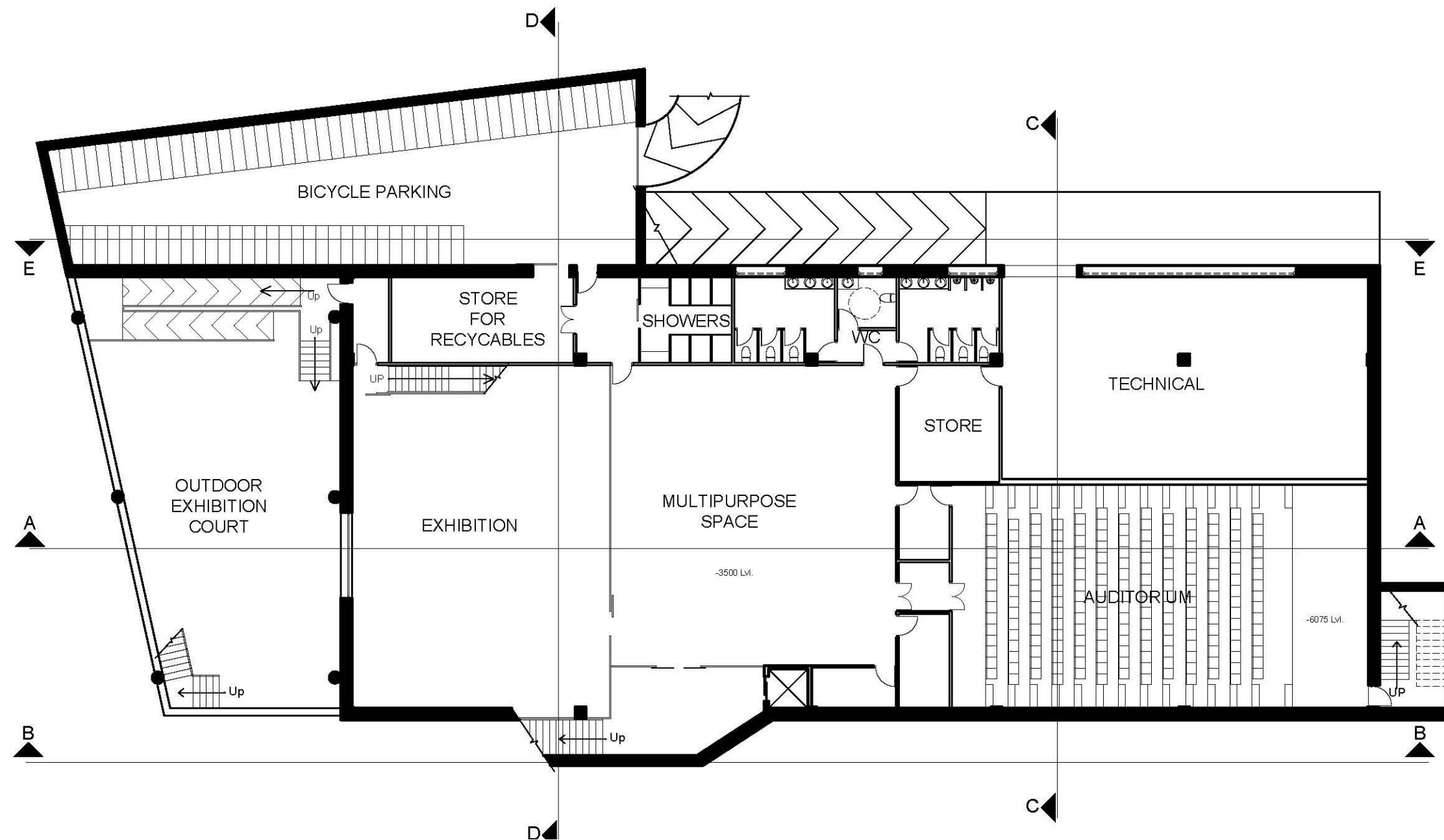
SITE



SITE PLAN
Scale-1:500

FLOOR PLAN

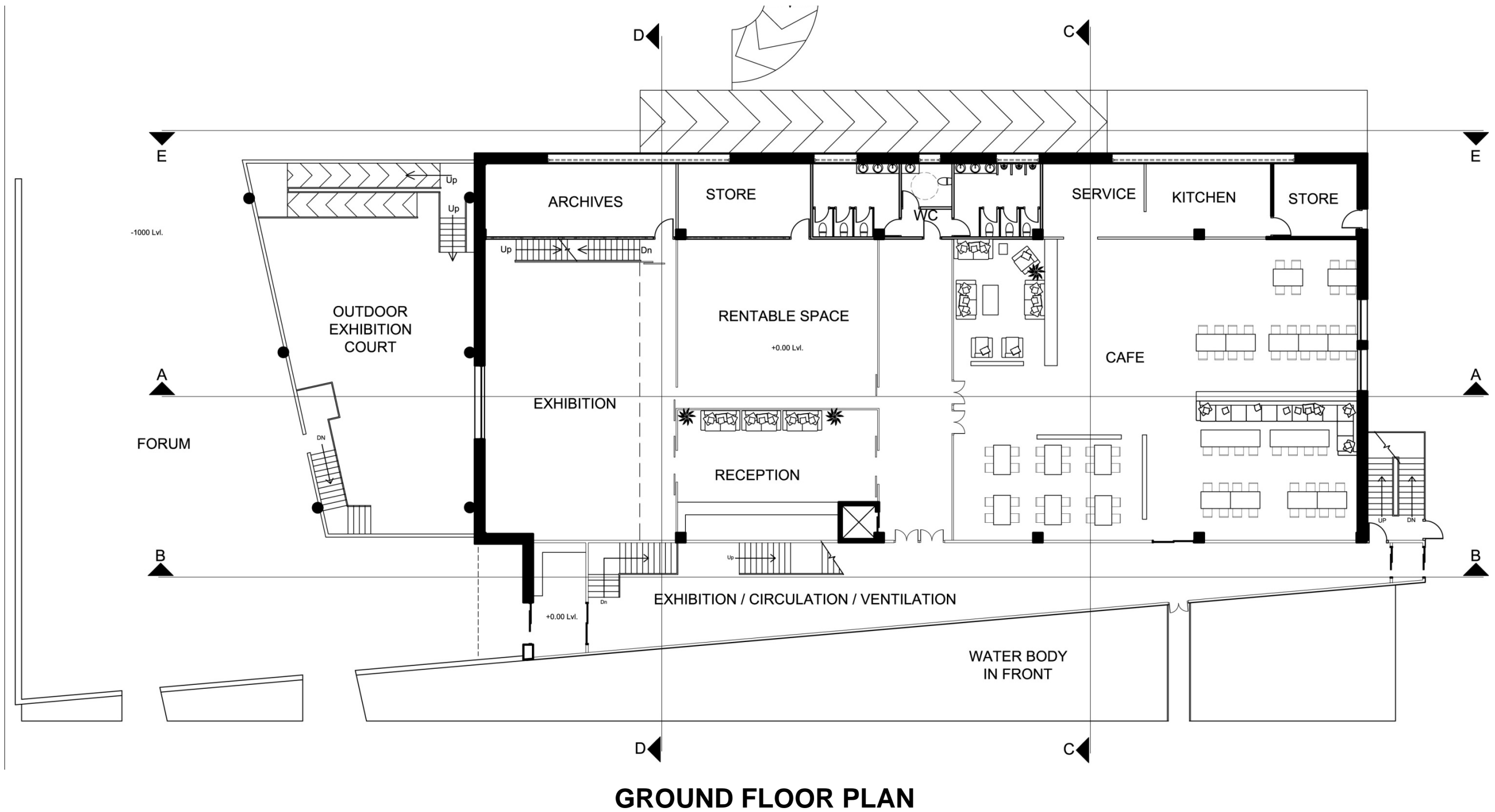
SCALE-1:200



BASEMENT FLOOR PLAN

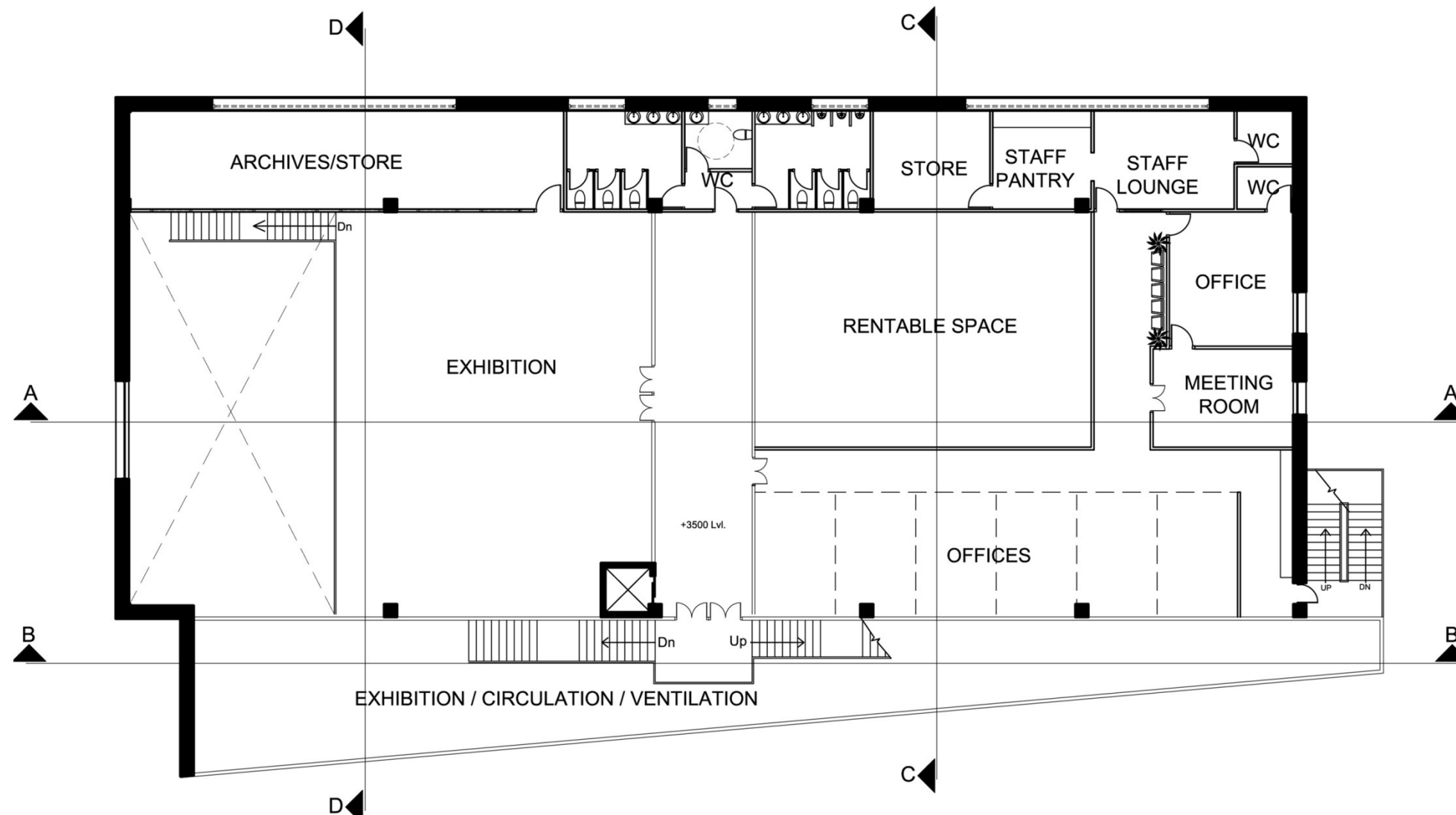
FLOOR PLAN

SCALE-1:200



FLOOR PLAN

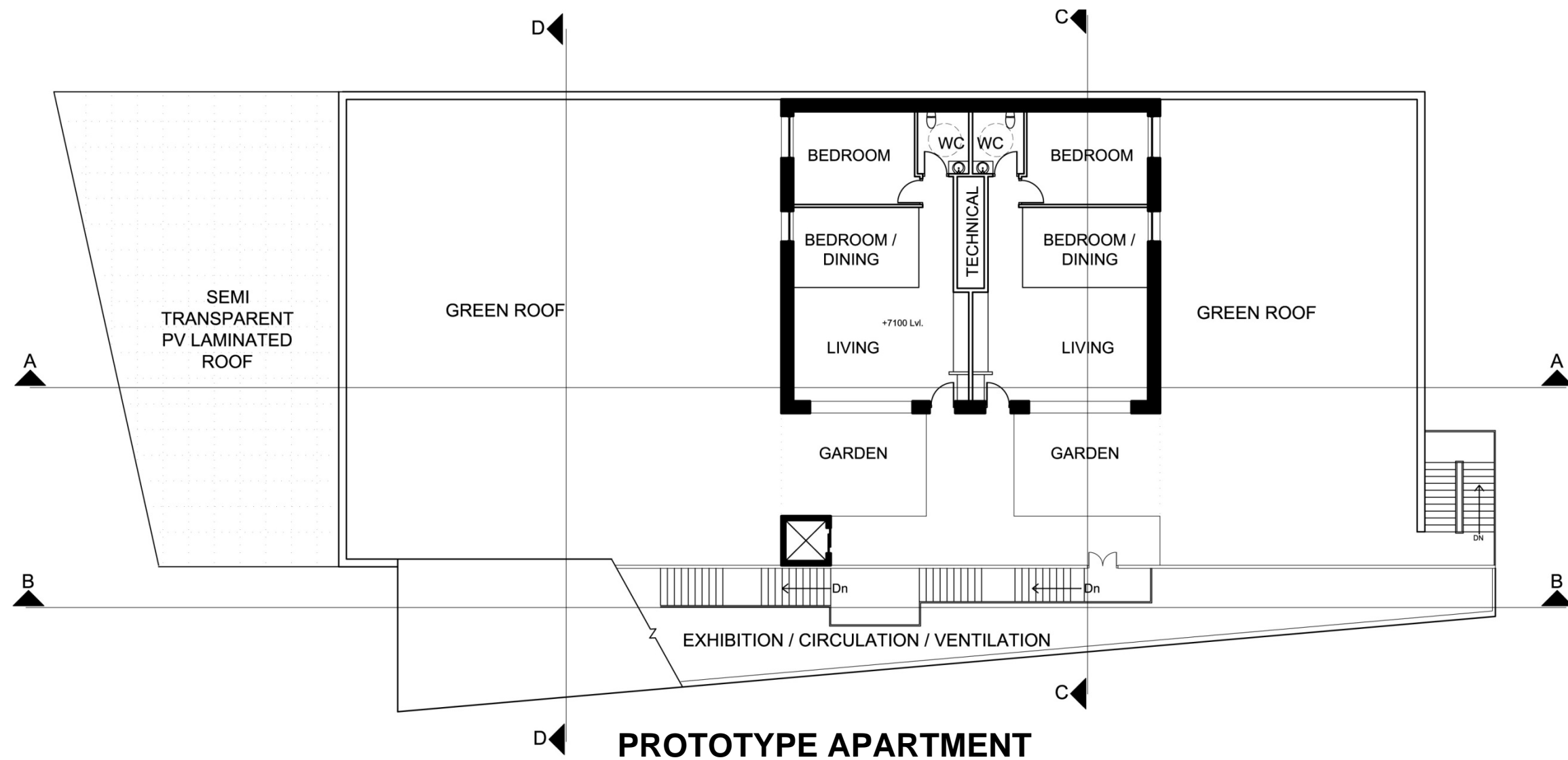
SCALE-1:200



FIRST FLOOR PLAN

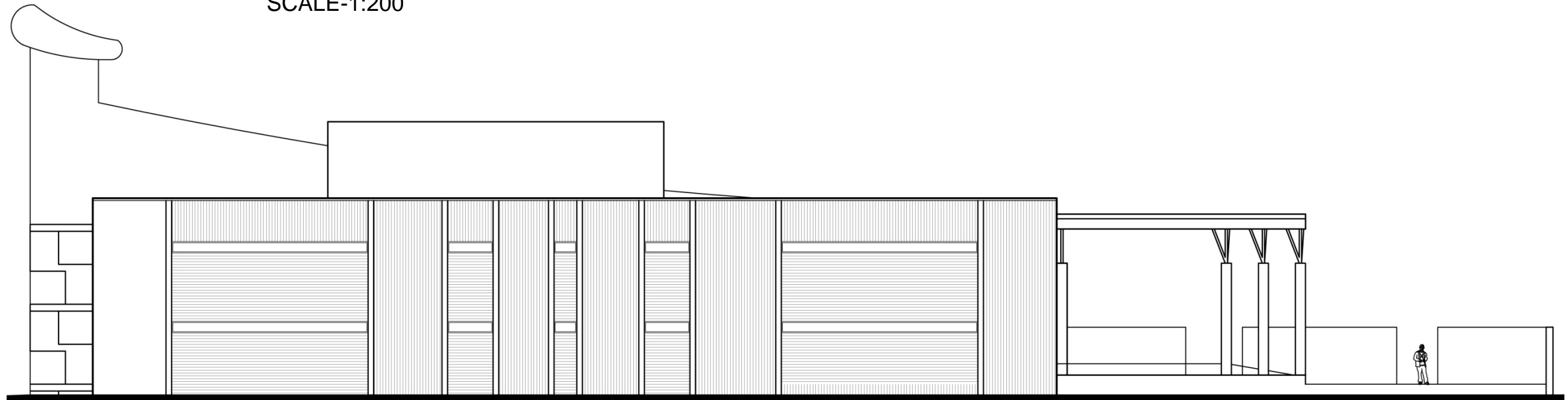
FLOOR PLAN

SCALE-1:200

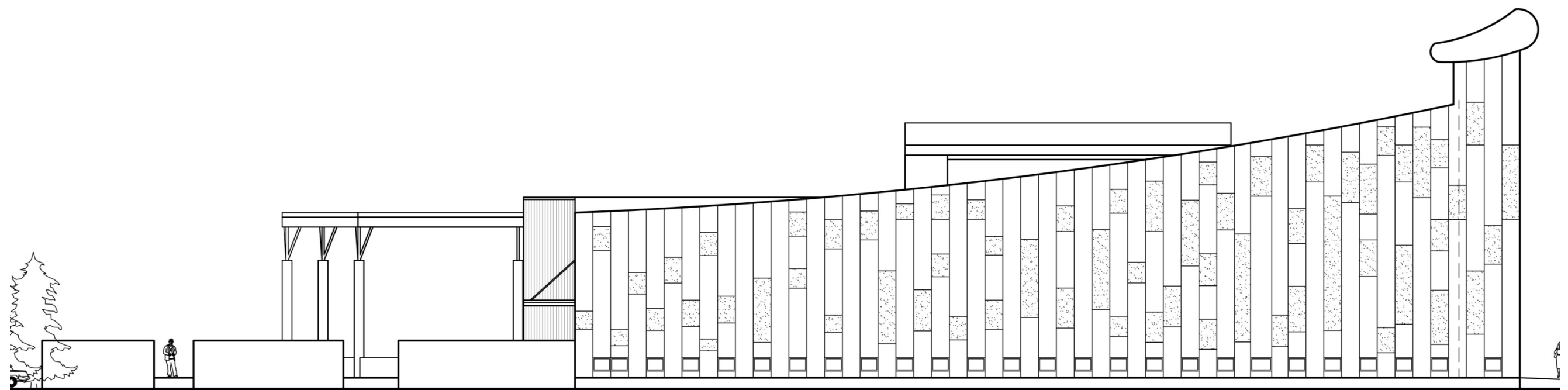


ELEVATIONS AND SECTIONS

SCALE-1:200



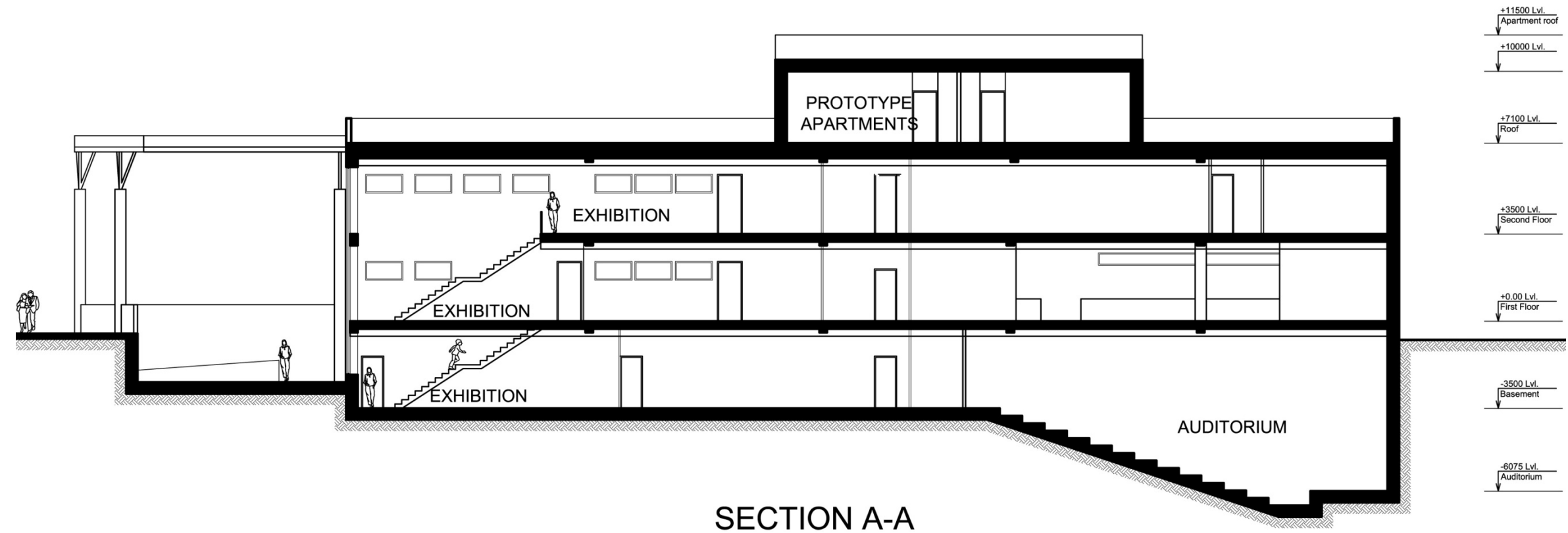
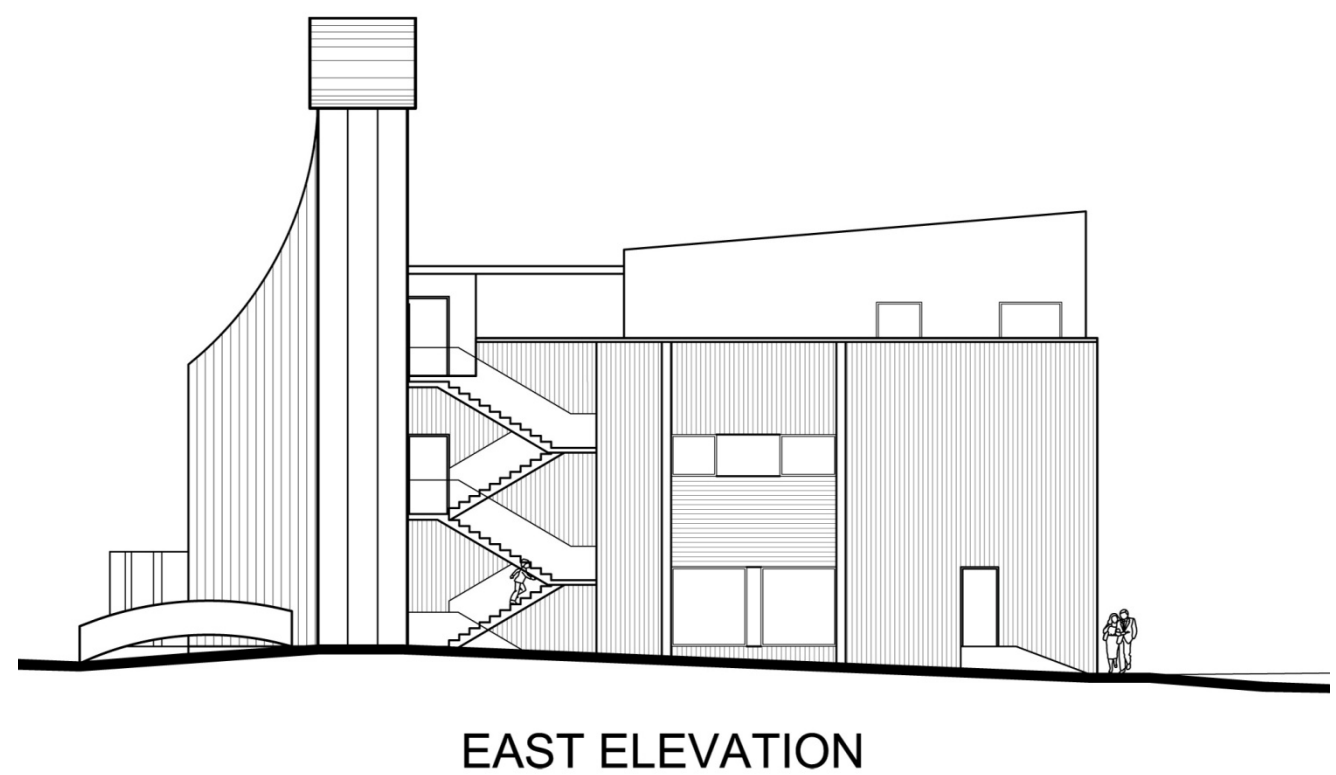
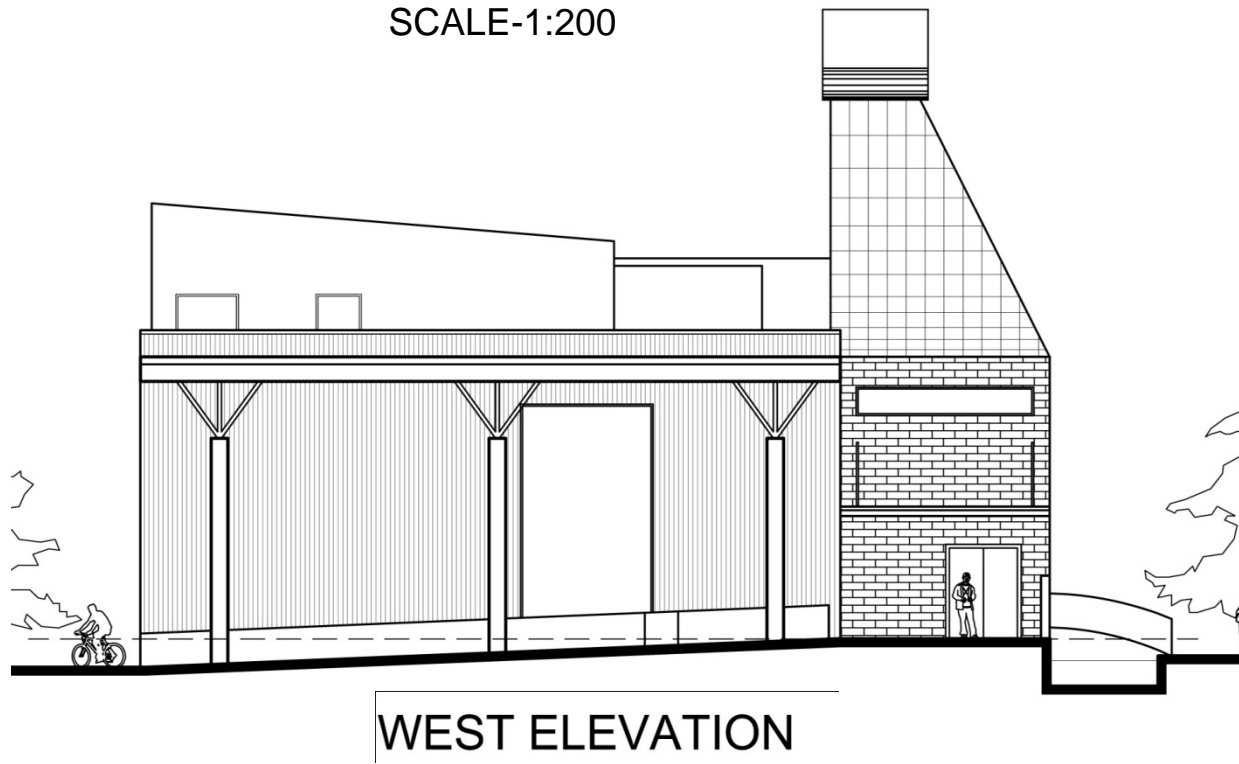
NORTH ELEVATION



SOUTH ELEVATION

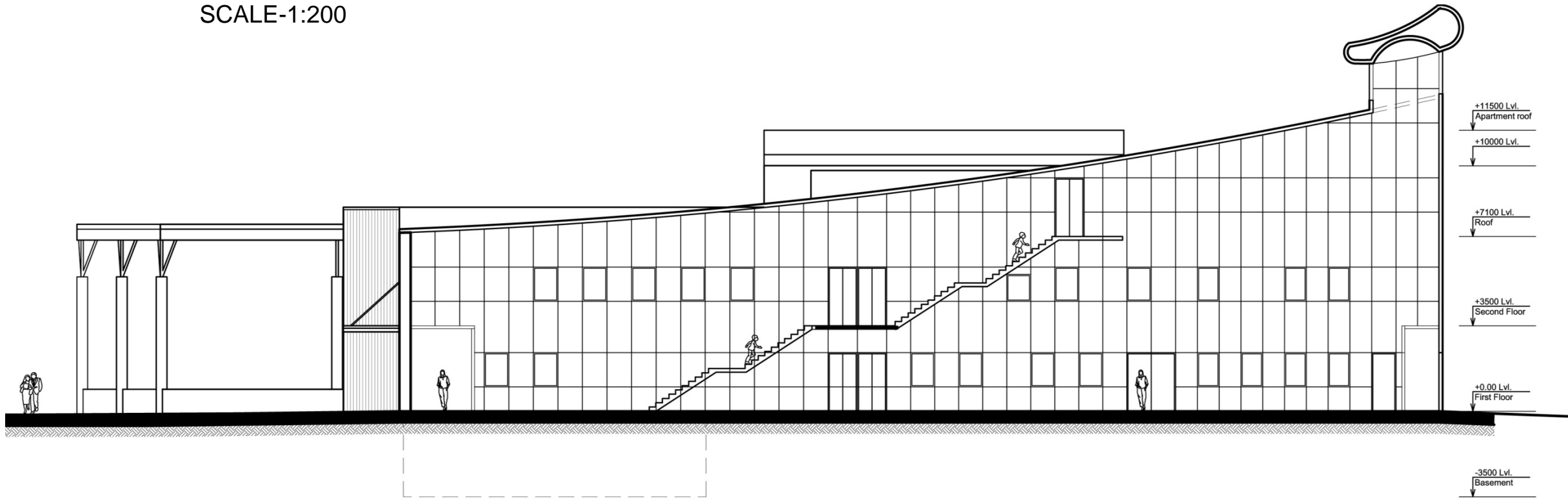
ELEVATIONS AND SECTIONS

SCALE-1:200

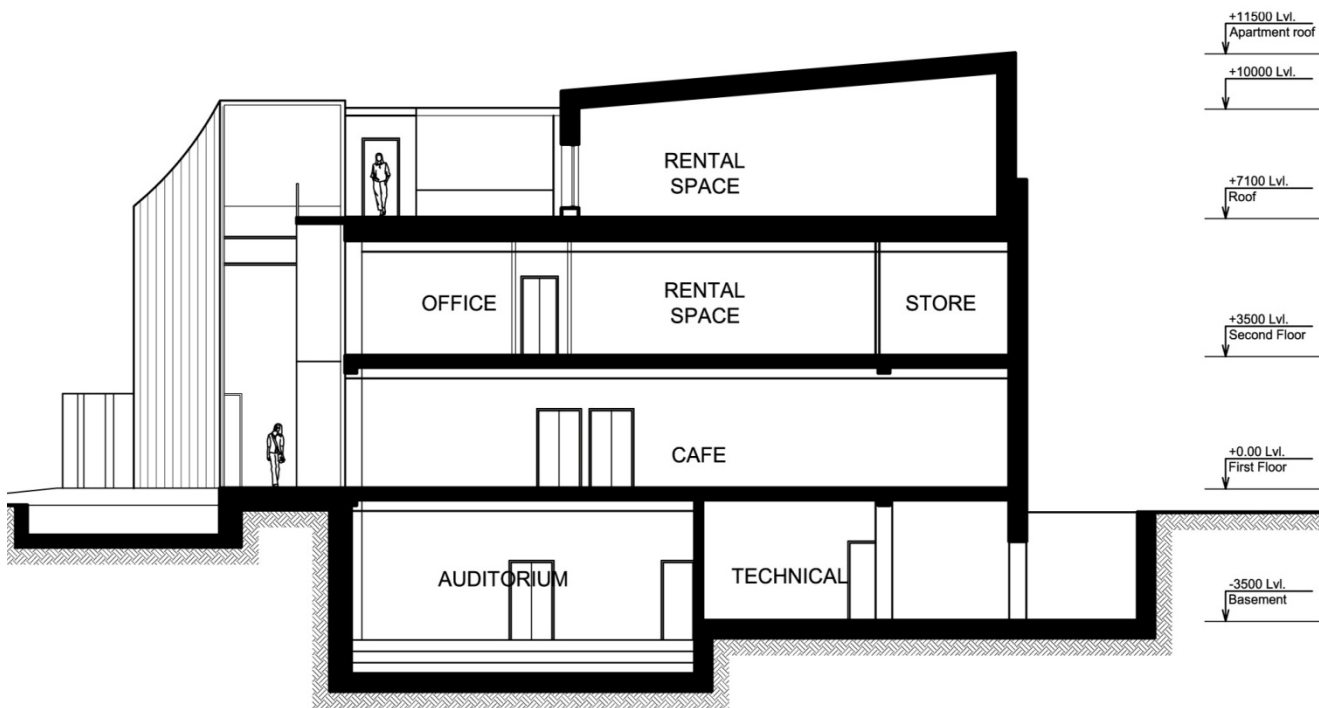


ELEVATIONS AND SECTIONS

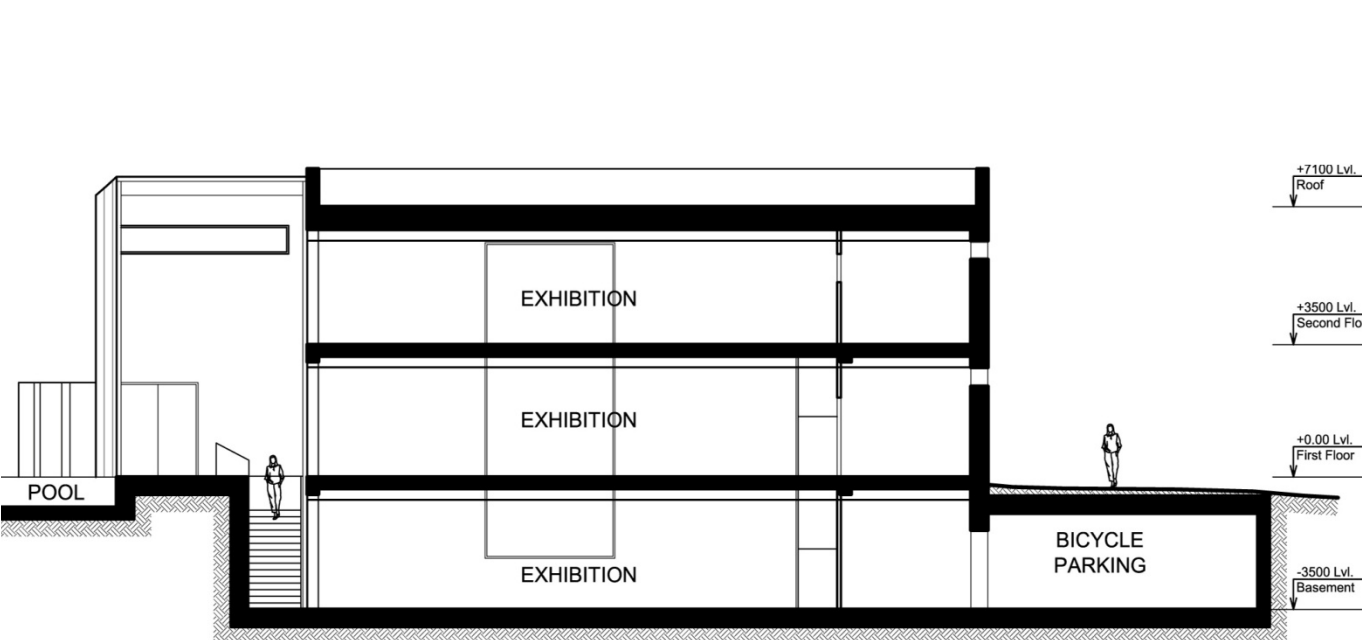
SCALE-1:200



SECTION B-B



SECTION C-C

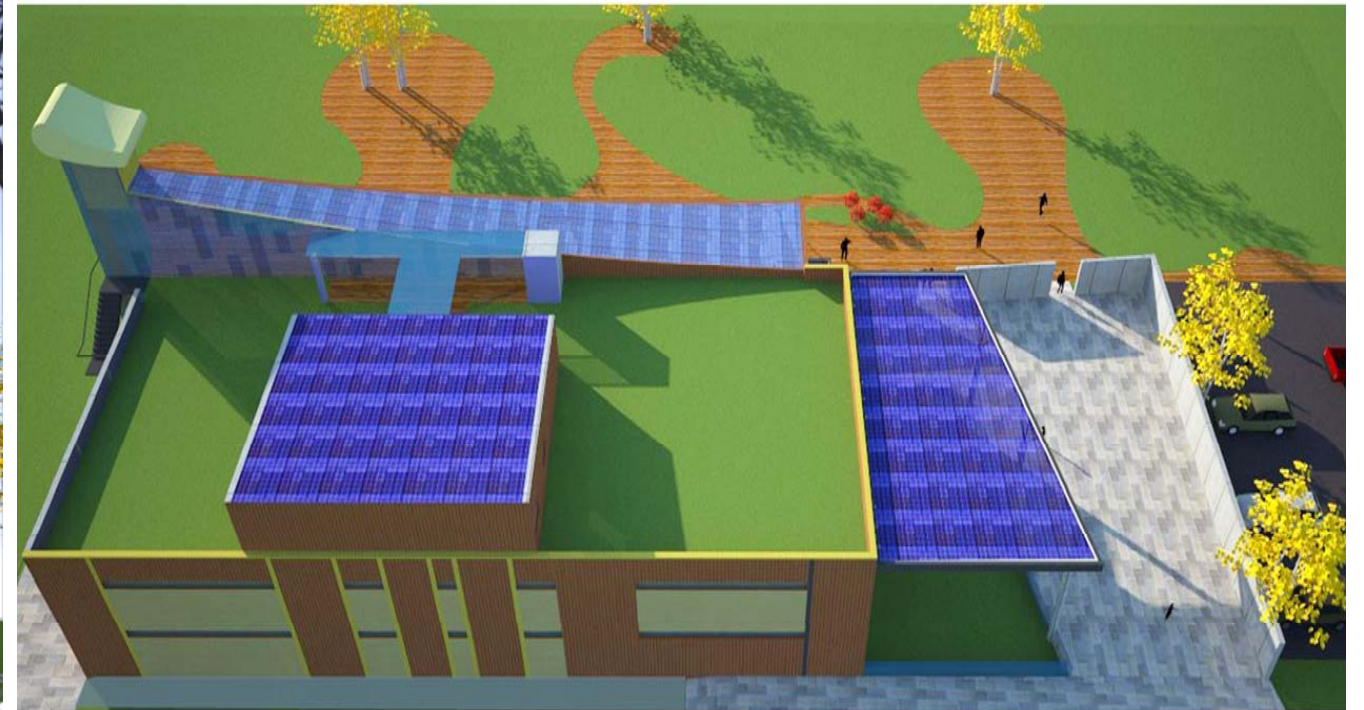


SECTION D-D

BRØSET KLIMA CENTER

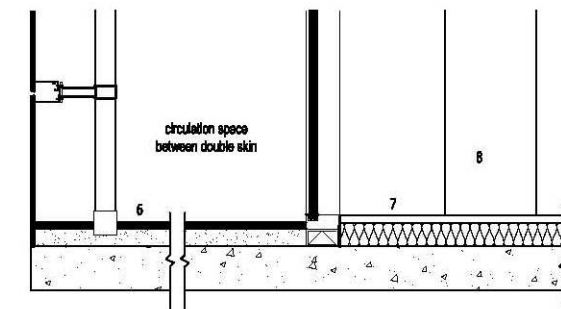
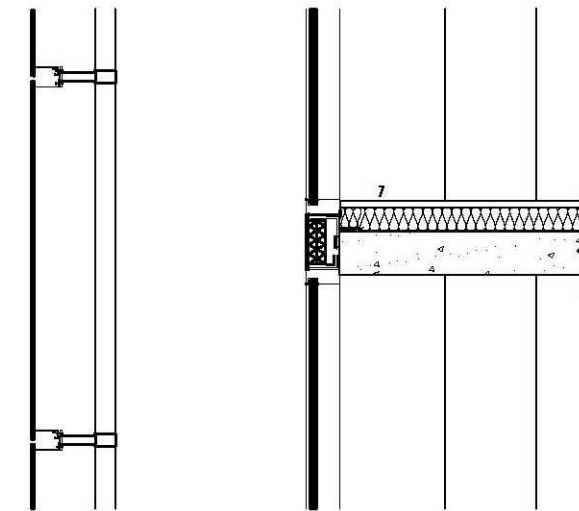
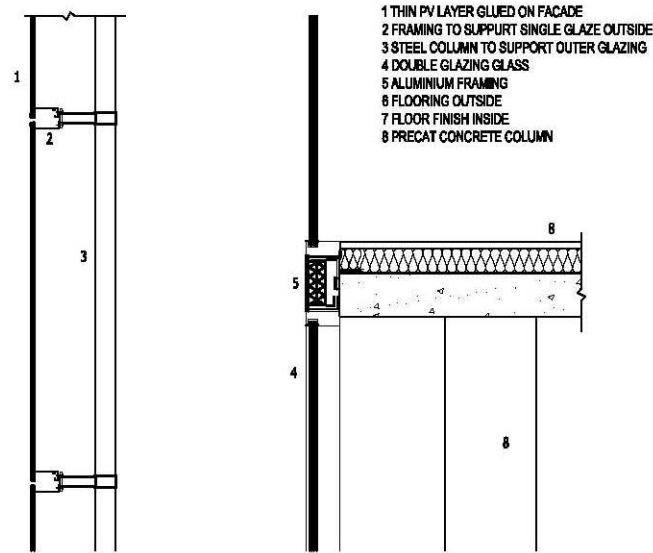
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PERSPECTIVE VIEWS



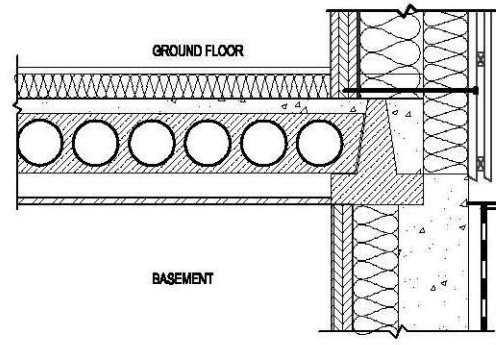
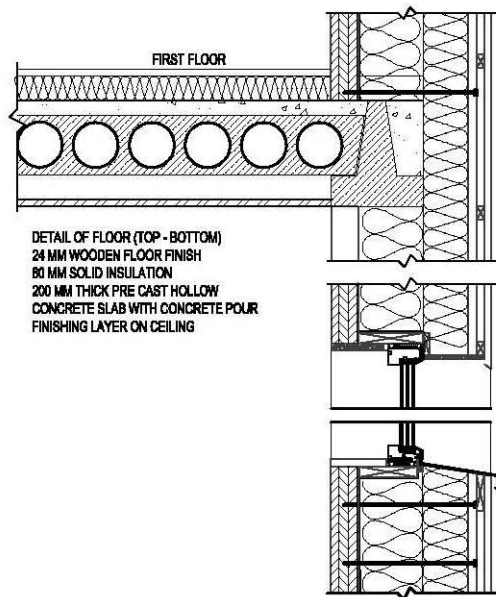
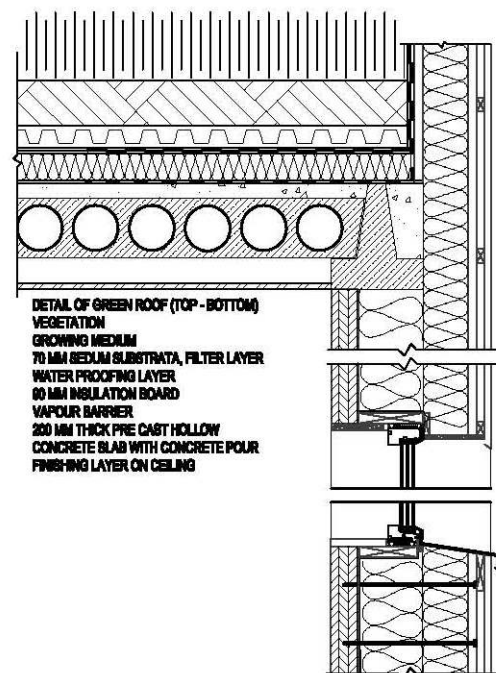
DETAILS

SCALE-1:25



DETAIL- DOUBLE SKIN FACADE

SCALE-1:25

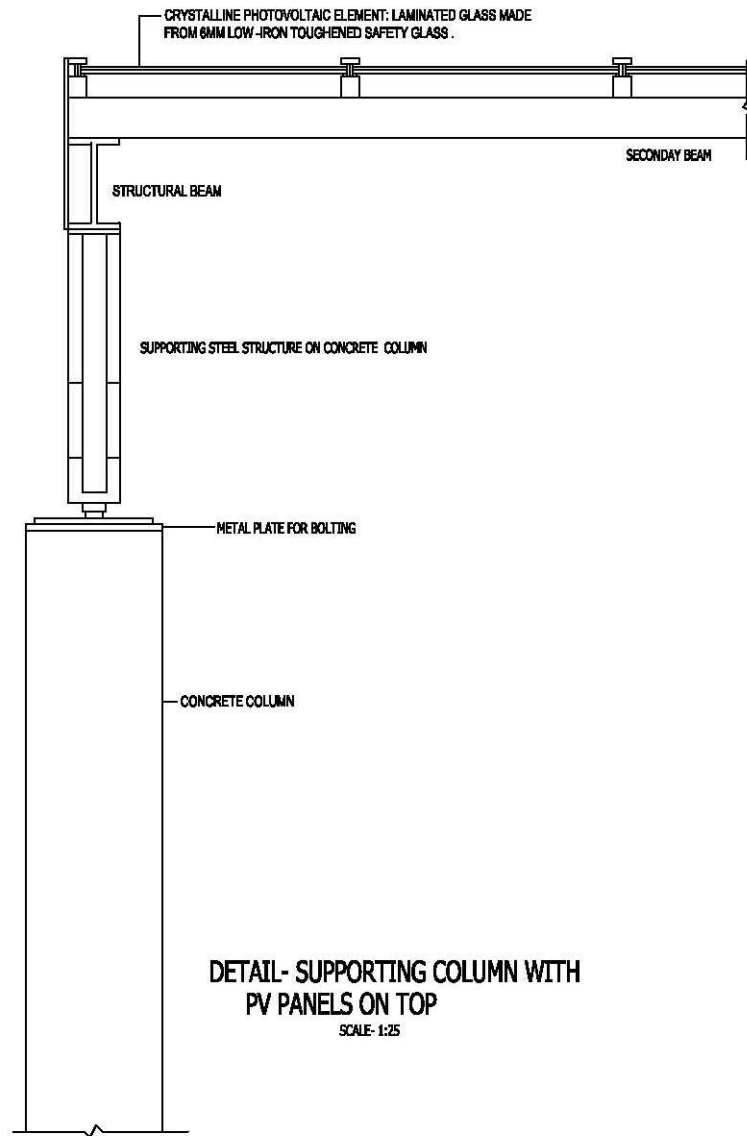


VERTICAL WALL SECTION

SCALE-1:25

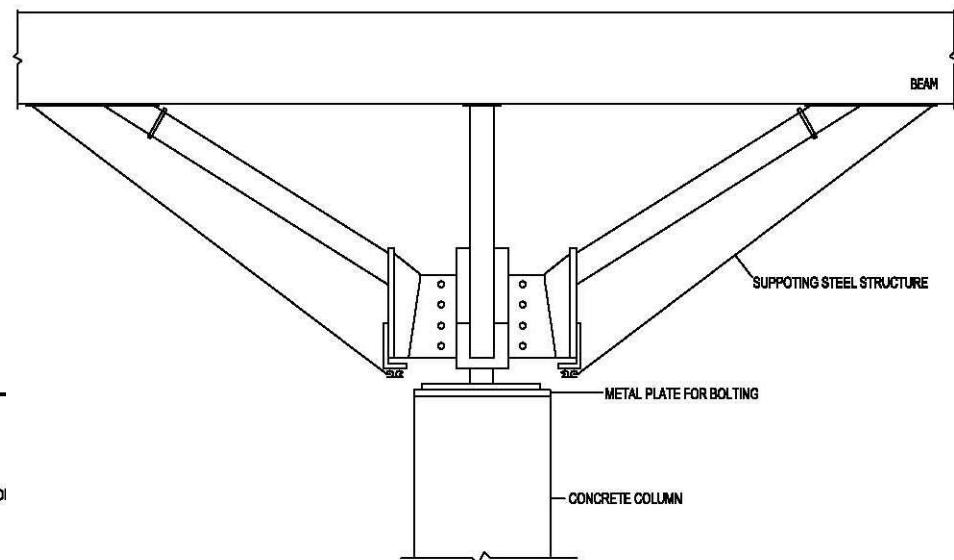
DETAIL OF EXTERNAL WALL (OUTSIDE - INSIDE)
14 MM WOODEN CLADDING PINE HEARTWOOD
25 MM HORIZONTAL FURRING
28 MM VERTICAL FURRING
WIND BARRIER
200+150 MM ROCKWOOL INSULATION
VAPOUR BARRIER
45 MM MASSIVE WOOD

DETAIL OF EXTERNAL WALL ON BASEMENT (OI)
80 MM INSULATION OUTSIDE
250 MM CONCRETE WALL
150 MM INSULATION LAYER
45 MM MASSIVE WOOD



DETAIL- SUPPORTING COLUMN WITH PV PANELS ON TOP

SCALE- 1:25

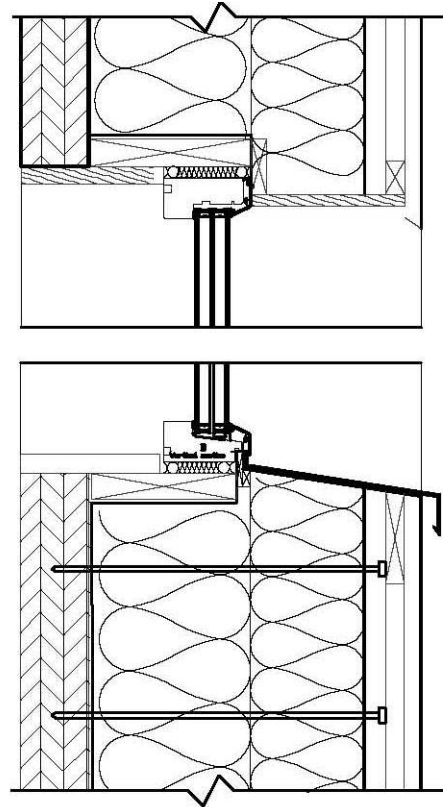


DETAIL- STEEL MEMBER ABOVE COLUMN

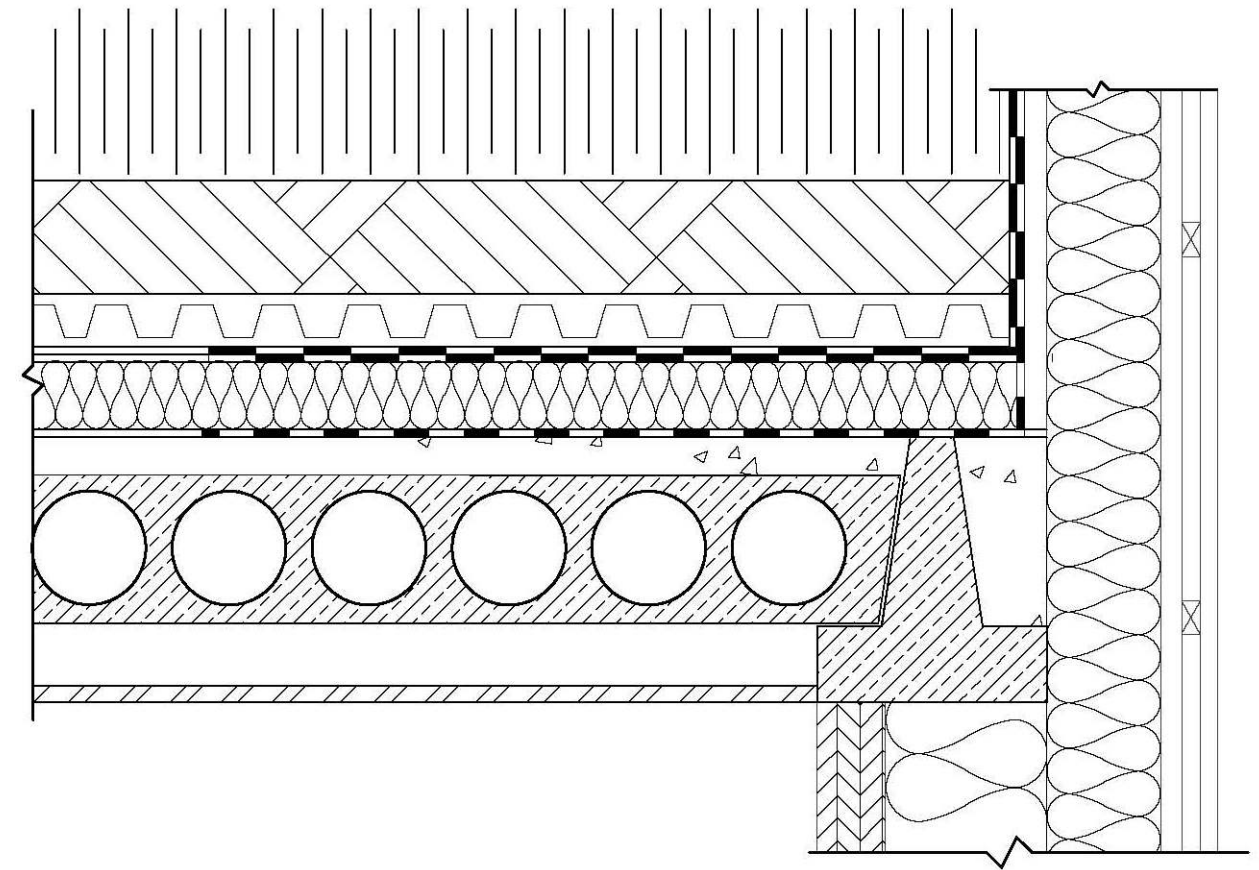
SCALE- 1:25

DETAILS

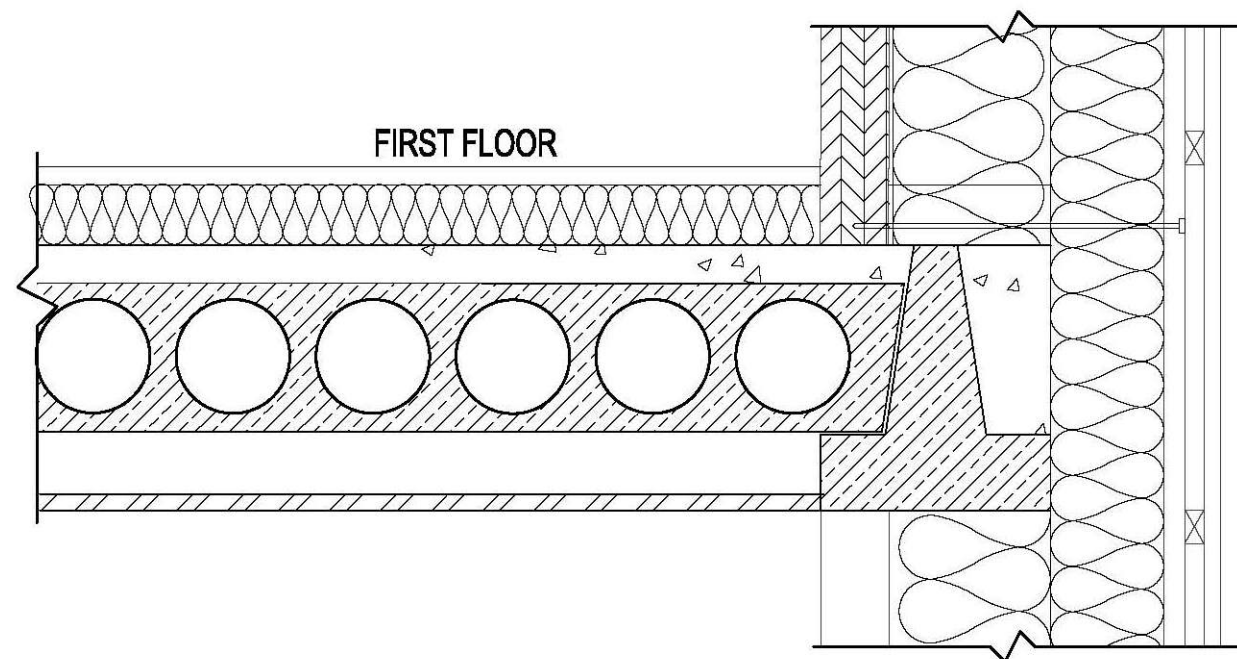
SCALE- 1:5



DETAIL- OPENING
SCALE- 1:5



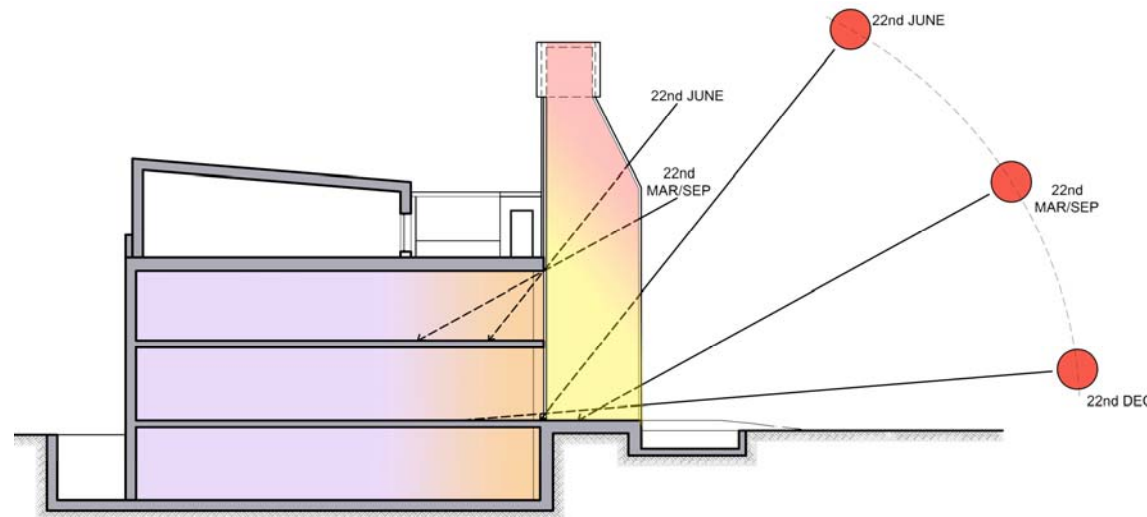
DETAIL- GREEN ROOF
SCALE- 1:5



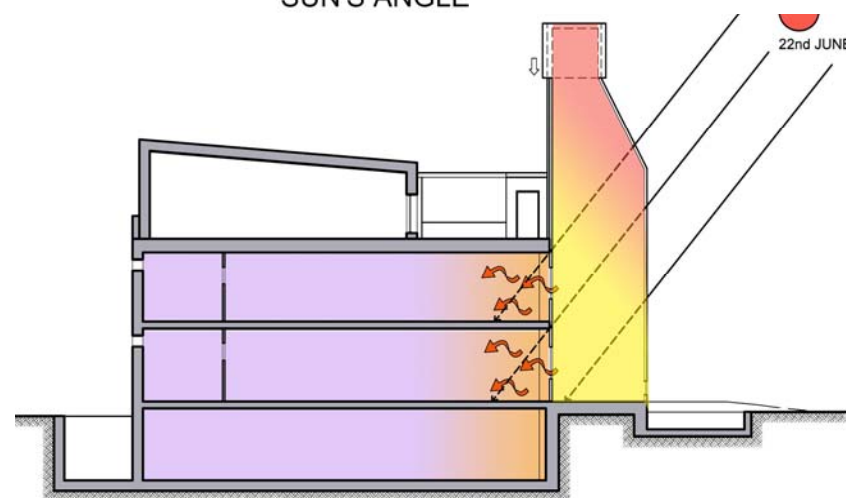
DETAIL- CONNECTION BETWEEN FLOOR AND WALL

DETAIL OF EXTERNAL WALL (OUTSIDE - INSIDE)
14 MM WOODEN CLADDING PINE HEARTWOOD
25 MM HORIZONTAL FURRING
28 MM VERTICAL FURRING
WIND BARRIER
200+150 MM ROCKWOOL INSULATION
VAPOUR BARRIER
45 MM MASSIVE WOOD

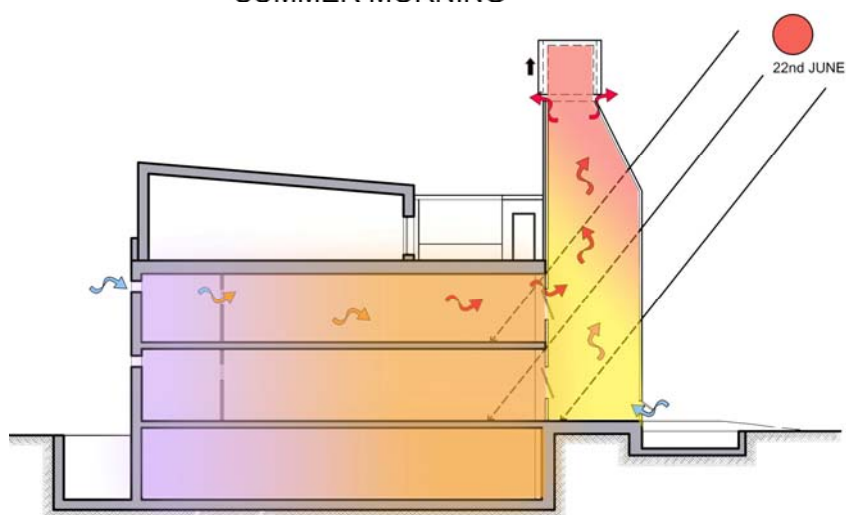
ACTIVE AND PASSIVE STRATEGIES



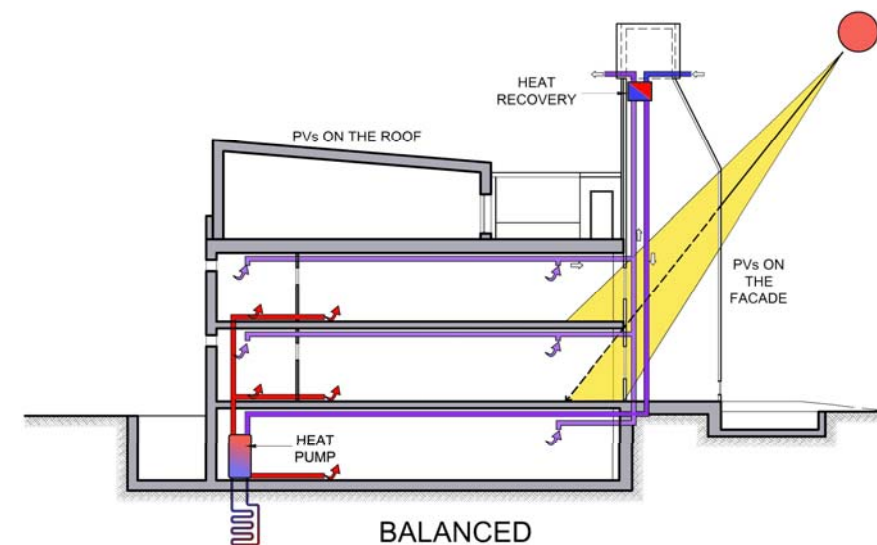
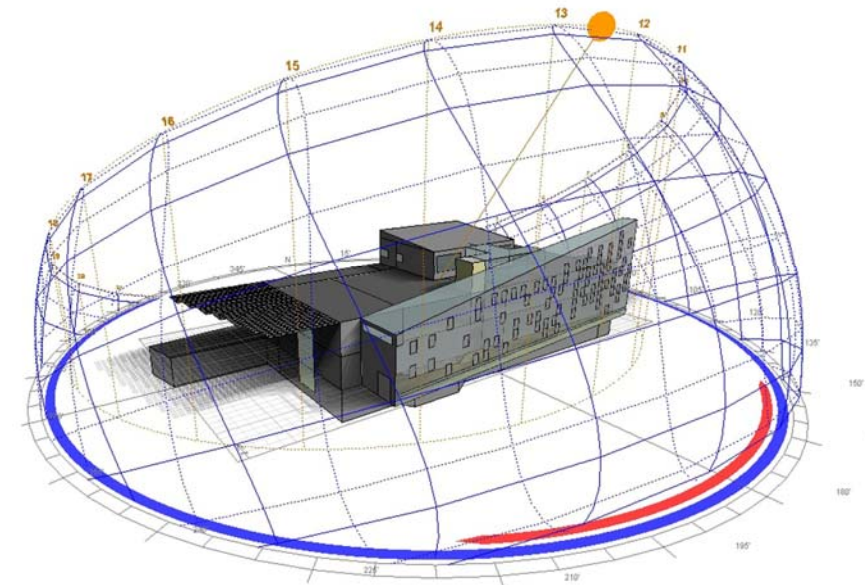
SUN'S ANGLE



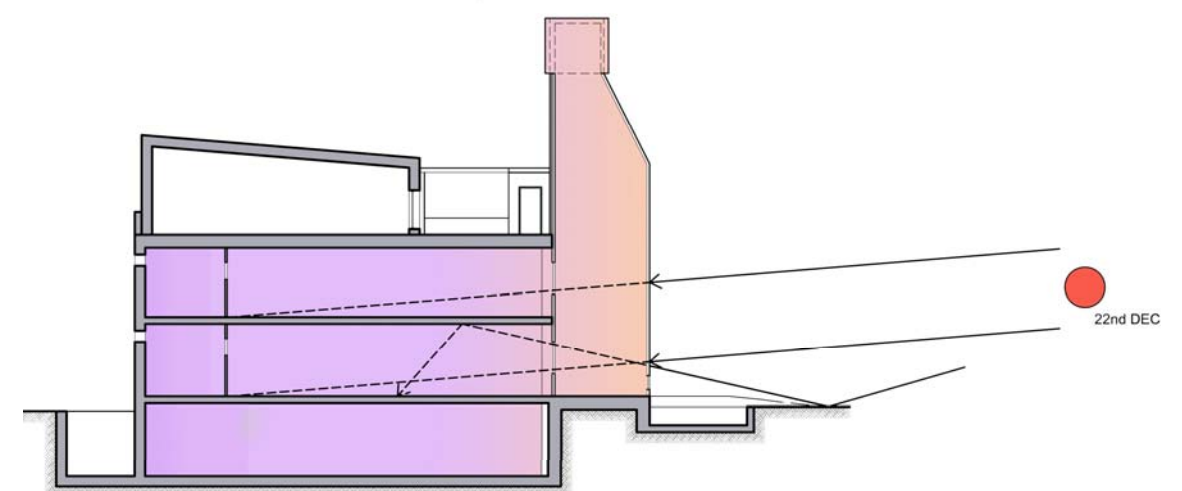
SUMMER MORNING



SUMMER AFTERNOON



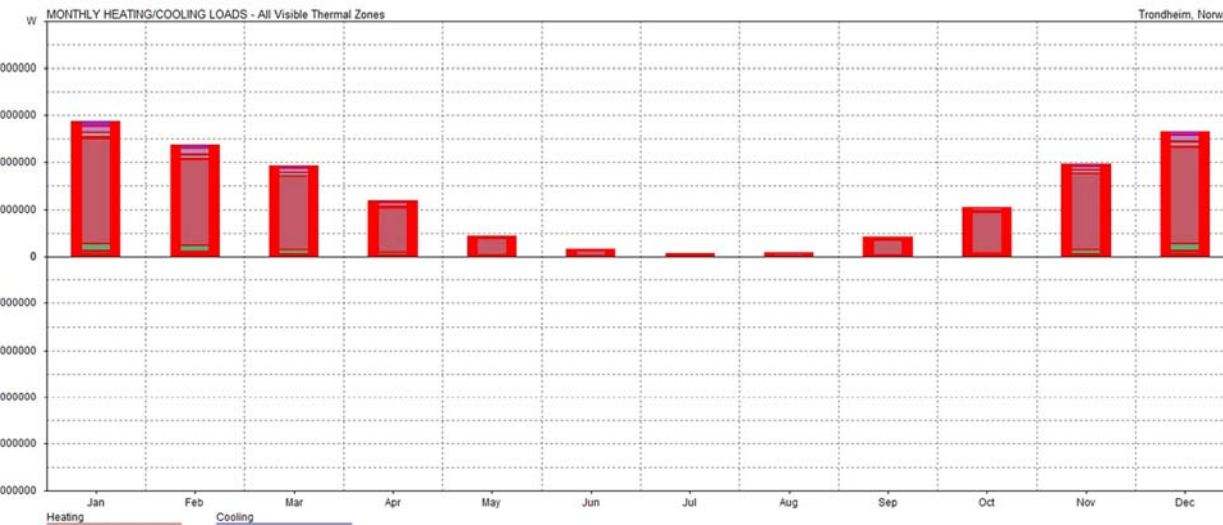
BALANCED VENTILATION



WINTER

ENERGY CALCULATIONS

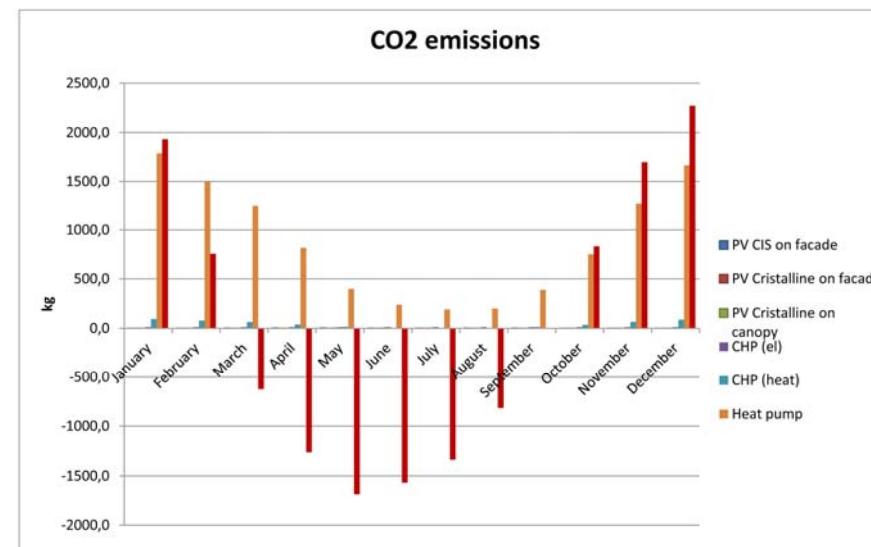
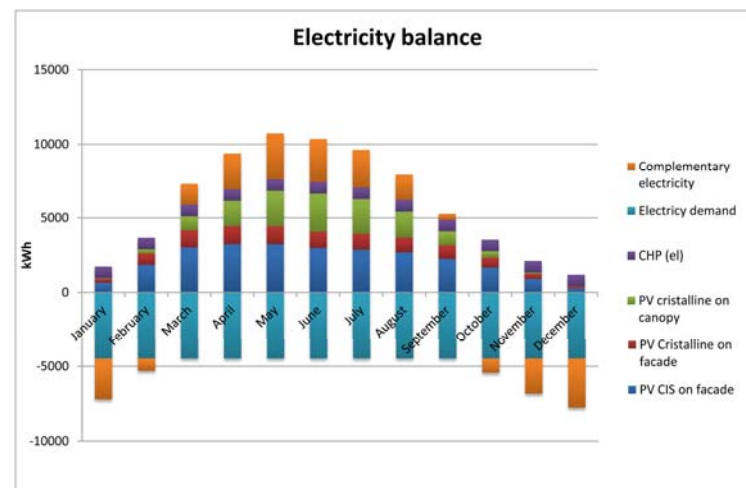
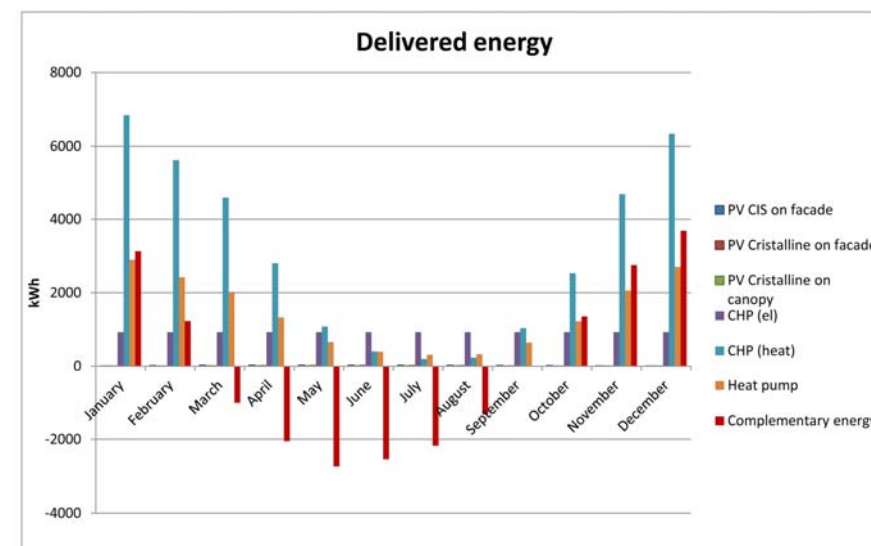
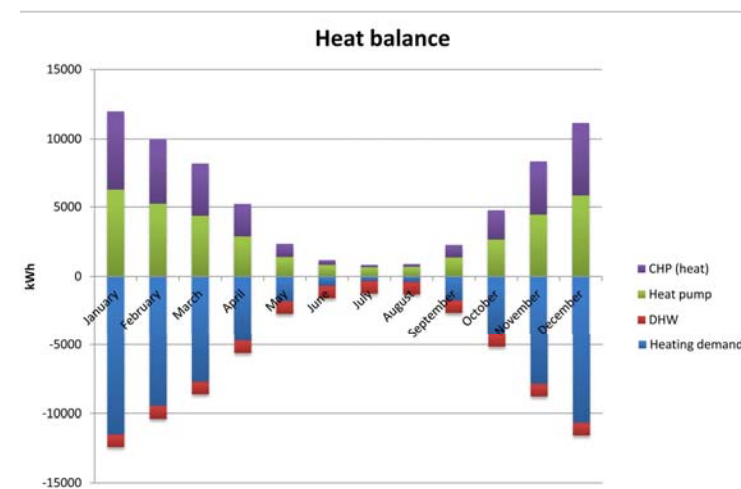
	HEATING	COOLING	TOTAL
MONTH	(Wh)	(Wh)	(Wh)
Jan	11493708	0	11499707
Feb	9455178	0	9460056
Mar	7706400	0	7710240
Apr	4709860	0	4711894
May	1806744	3824	1807168
Jun	673927	3841	673942
Jul	330210	5999	330211
Aug	393367	4878	393376
Sep	1734187	2034	1734454
Oct	4249592		4251068
Nov	7863191	0	7867014
Dec	10648384	0	10653563
TOTAL	61064748	20576	61092696
PER M2	25041	9,4	25052



Annual energy budget

	Heat (kWh/a)	Electricity (kWh/a)	Total net energy demand (kWh/a)
Space heating			
Ventilation heating	54600		
Domestic hot water	10920		
Fans and pumps		6115	
Lighting		34070	
Equipment		13540	
Cooling		0	
Sum	65520	53725	122521
kWh/m ² a (2184m ²)	30	24,5	54,5

	Delivered energy (kWh/a)	Specific delivered energy (kWh/m ² a)	CO2 emissions (kg)	CO2 emissions (kg/m ²)
Electricity	10155,4	4,7	-547,8	-0,23
Heating	53031,6	24,3	10323	4,6
Total	63187	29	9775,2	4,37



Energy generation on site

Onyx Solar BIPV on the South facade:

Transparent CIS PV glass:

Power: 130 W/m²

Area: 314 m²

Installed power: 40,8 kW

Semi transparent Crystalline PV glass with patterns:

Power: 180 W/m²

Area: 88 m²

Installed power: 15,8 kW

Onyx Solar Crystalline PV canopy:

Power: 180 W/m²

Area: 114 m²

Installed power: 15,8 kW

"Sunmachine Pellet" Bio fuel micro CHP (electricity 20%):

Electric power: 3 kW

Thermal power: 10 kW

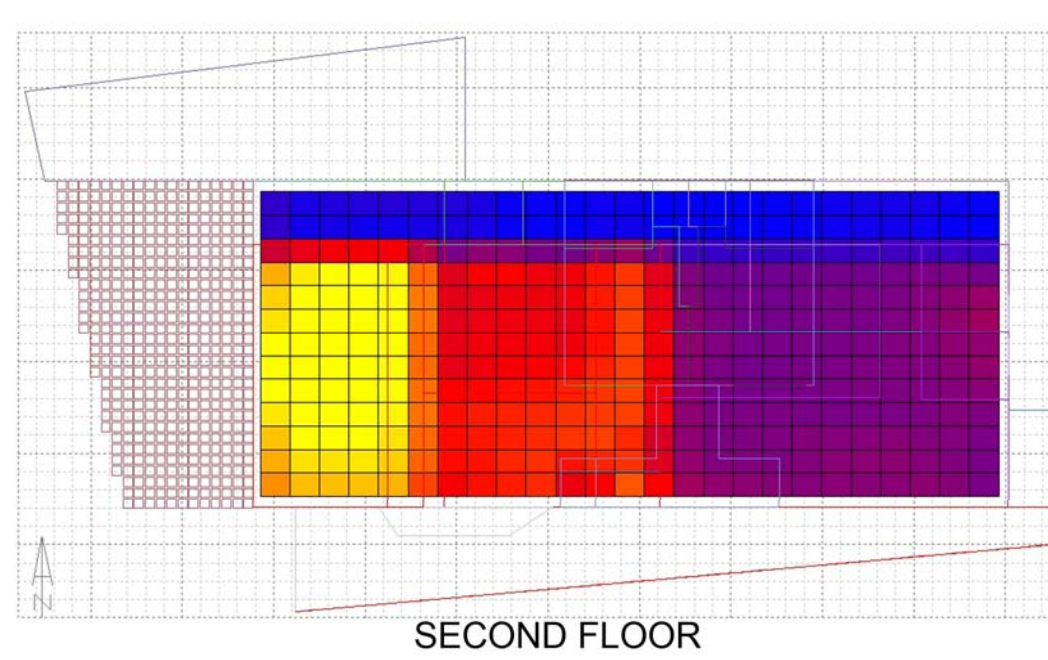
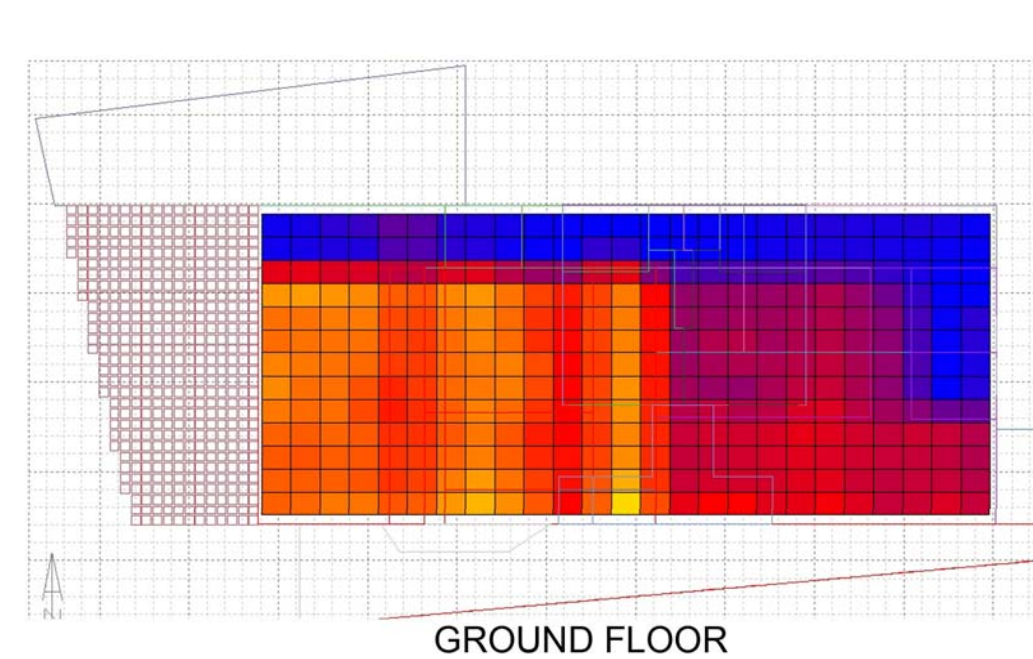
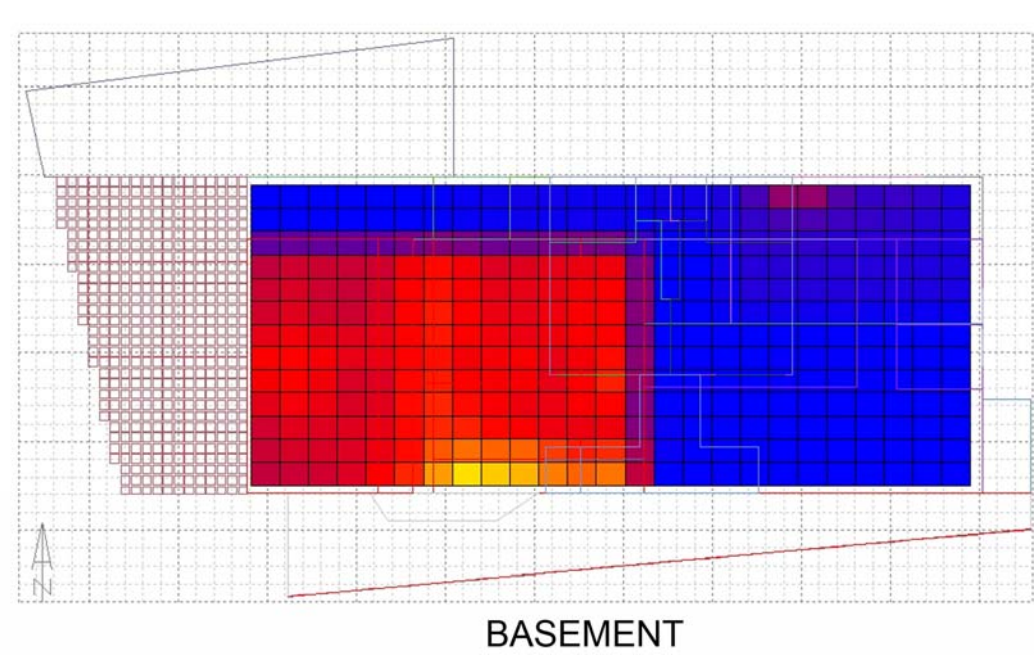
Efficiency: 0,84

Ground source heat pump:

Power: 11 kW

COP: 2,14

LIGHTING ANALYSIS



MATERIALS



Miljøindikatorer	Deklarert enhet: Fra råvareutvinning til fabrikkport	Funksjonell enhet: Fra råvareutvinning til avhending av bygget:
Global oppvarming:	141 kg CO ₂ /FE	144 kg CO ₂ /FE
Energiforbruk:	1 533 MJ/FE	1 542 MJ/FE
Andel fornybar energi:	19 %	17 %
Kjemikalier	Inneholder ikke stoffer fra OBS-listen	

PRECAST HOLLOW
CORE CONCRETE



ROCKWOOL
INSULATION



Global warming	5,6 kg CO ₂ -eq.
Energy consumption	166 MJ
Amount of renewable materials	87 %
Indoor classification (according to EN 15251:2007)	not relevant

NORWEGIAN EXTERIOR
CLADDING



Amount of renewable materials	98 %
Indoor classification (according to EN 15251:2007)	NA

NORWEGIAN EXTERIOR
CLADDING



Global warming	0,4 kg CO ₂ -eq.
Energy consumption	32 MJ
Amount of renewable materials	100 %
Indoor classification (according to EN 15251:2007)	not measured

NORWEGIAN INTERIOR
WOOD PANEL

Choice of materials

- use of local materials and products to minimize the CO2 emissions
- A and B rated elements from Green Guide to Specification as far as possible.
- NEPD (Norwegian Environmental Performance Declaration) certified materials.
- Materials fulfill BREEAM requirement and are environmentally approved materials.
- Materials also satisfy the Norwegian indoor air climate requirement on low emissions.
- timber for structure, cladding and floor finish are almost 100 % renewable materials.
- lightweight precast hollow core concrete consists 19 % of recycled material
- pervious concrete outdoors to assist the infiltration of rainwater.
- The Rockwool insulation contributes greatly to energy efficiency of the building through reduced heat loss.
- it has low embodied energy - 17.3MJ/kg and consists 23 % of recycled materials.
- The waterproof membranes consist to 50 % of recycled plastic.

U- VALUES

U- VALUES

External wall

1	Cladding	0,147							14
2	Vertical furring	0,147							28
3	Rockwool batt	0,037							350
4	Massive wood	0,147							45
5									
6									
7									
8									
		Percentage of Sec. 2		Percentage of Sec. 3				Total	43,7 cm

BREEAM sections	BREEAM issues	Credits	Minimum credits for Outstanding	Influence on Design	Easy credits	Credits achieved	Comments on strategies used in the project to achieve the points
ENERGY	Energy efficiency	15	10	+	-	12	Current energy requirement for label A building: 70 kWh/m ² per year and our annual delivered energy: 29 kWh/m ² Percentage improvement over the requirement: 59 % Renewable energy supplies: PV panels, and Biofuel micro CHP, heat pump Compactness of the building
	Low zero carbon technologies	3	1	+	-	1	
	Energy efficient lifts	2	-	-	+	2	
	Sub-metering of substantial energy uses	1	1	-	+	1	
	Sub-metering of high energy load areas and tenancy	1	-	-	+	1	
	External lighting	1	-	-	+	1	
	Innovation	3	-	+	-	0	
						14,87%	
HEALTH AND WELLBEING	Daylight: at least 80% of floor well daylight	1	-	+	-	1	Daylight simulation shows that the daylight factor is above the minimum requirement of 3,3 %; offices, exhibition rooms and café well-lit except for the auditorium installation of movable shading devices
	View out	1	-	+	-	1	
	Glare control: occupant controlled shading system	1	-	+	-	1	
	High frequency lighting	1	1	-	+	1	Use of a chimney to ventilate the building with stack effect
	Potential for natural ventilation	1	-	+	-	1	
	Internal and external lighting levels	1	-	-	+	1	
	Lighting zones and controls	1	-	-	+	1	Choice of materials: low emitting materials approved by Norwegian environmental declaration, which pass the indoor climate label Exploitation of As daylight is maximized, no need for artificial light during the daytime (less cooling loads from the use of artificial light)
	Indoor air quality	1	-	-	+	1	
	Volatile organic compounds	1	-	+	-	1	
	Thermal comfort	1	-	+	-	1	
	Thermal zoning: occupant control of temperature	1	-	-	+	1	
	Microbial contamination	1	1	-	+	1	
	Acoustic performance	1	-	-	+	1	
	Innovation	1	-	+	-	0	
						15%	
MATERIALS	Materials specification (green guide to specification ratings)	4	-	+	-	3	Each building element follows the green guide to specification: our elements are rated A and B Use of responsibly sourced materials for key building elements: materials approved by Norwegian Environmental Declaration Insulation: Rockwool Product rated A by Green Guide to Specification; embodied energy of 17,3 MJ/kg according to LCA
	Responsible sourcing of materials	3	-	-	+	3	
	Insulation : low embodied energy and responsibly sourced	2	-	+	-	2	
	Hard landscaping and boundary protection	1	-	-	-	1	
	Designing for robustness : durable materials	1	-	-	+	1	
	Innovation	2	-	+	-	0	
						9,62%	
MANAGEMENT	construction site impact	4	-	-	+	4	
	Commissioning	2	2	-	+	2	
	considerate constructors	2	2	-	+	2	
	Building user guide	1	1	-	+	1	
	security	1	-	-	+	1	
	Innovation	1	-	-	-	0	
						12%	
LANDUSE AND ECOLOGY	Enhancing site ecology	3	-	-	-	3	No change of the topography and greenery
	Mitigating ecological impact	2	1	-	+	2	
	long term impact on biodiversity	2	-	-	+	2	
						7%	
POLLUTION	Nox emission from heating source	3	-	-	+	3	
	Flood risk	3	-	-	+	3	
	Preventing refrigerant leaks	2	-	-	+	2	
	Refrigerant GWP- Building services	1	-	-	+	1	
	Reduction of night time light pollution	1	-	-	+	1	
	Noise attenuation	1	-	-	+	1	
						10%	
TRANSPORT	provision of public transport	3	-	-	+	3	Public transport available in close proximity Covered cyclist parking, changing rooms and showers A limited number: 20 parking places
	cyclist facility	2	-	+	-	2	
	Maximum car parking capacity	2	-	+	-	2	
	proximity to amenities	1	-	-	+	1	
	Pedestrian and cycle safety	1	-	-	+	1	
	Travel plan	1	-	-	+	1	
						8%	
WASTE	Construction site waste management	4	-	-	+	3	20 m ² storage close to the road
	Recyclable waste Storage	1	1	+	-	1	
	Recycled Aggregates	1	-	-	+	1	
	Floor finish	1	-	-	+	1	
						6,43%	
WATER	Water consumption	3	2	-	-	3	Rainwater collection thanks to the green roof and the pool
	Water meter	1	1	-	+	1	
	Measure leak detection	1	-	-	+	1	
	Sanitary supply shut off	1	-	-	+	1	
						6%	
						89,91%	