# PROJECT OUTLINE

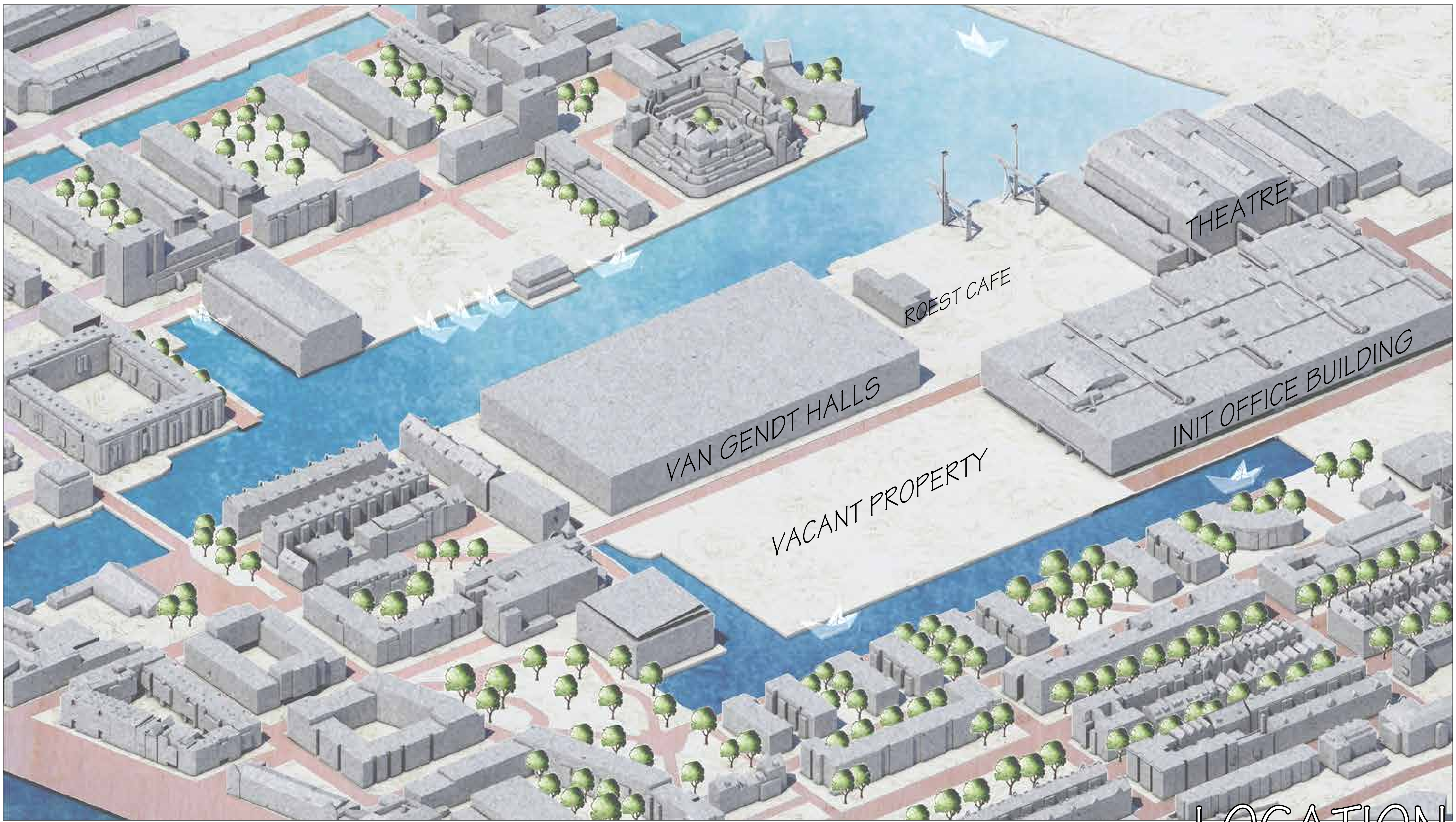



AMSTERDAM


CITY CENTRE


EASTERN ISLANDS

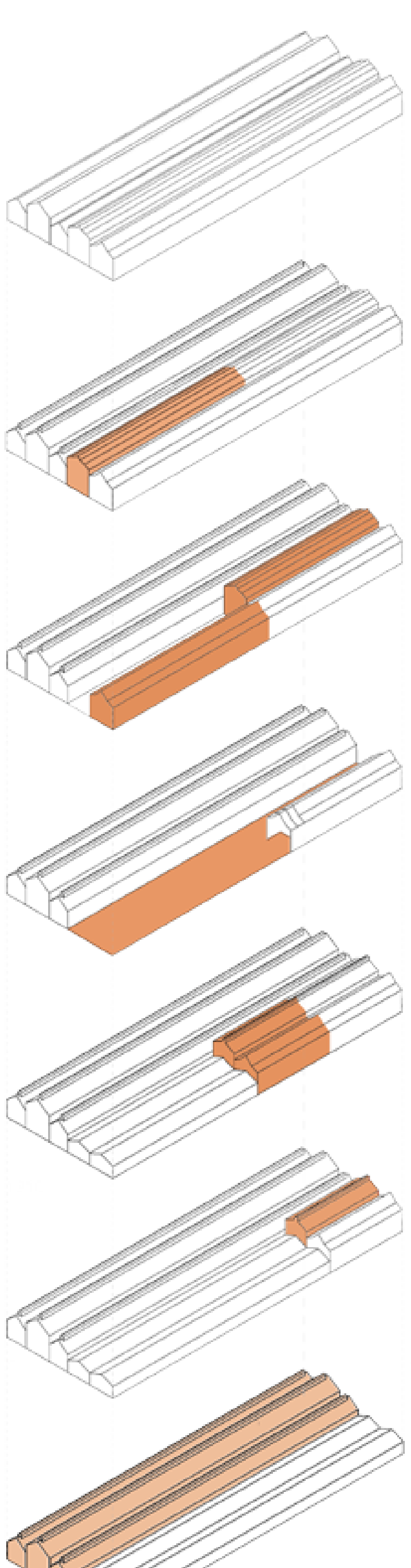

OOSTENBURG




OOSTENBURGER ISLAND; LOCATION OF THE VAN GENDT HALLS

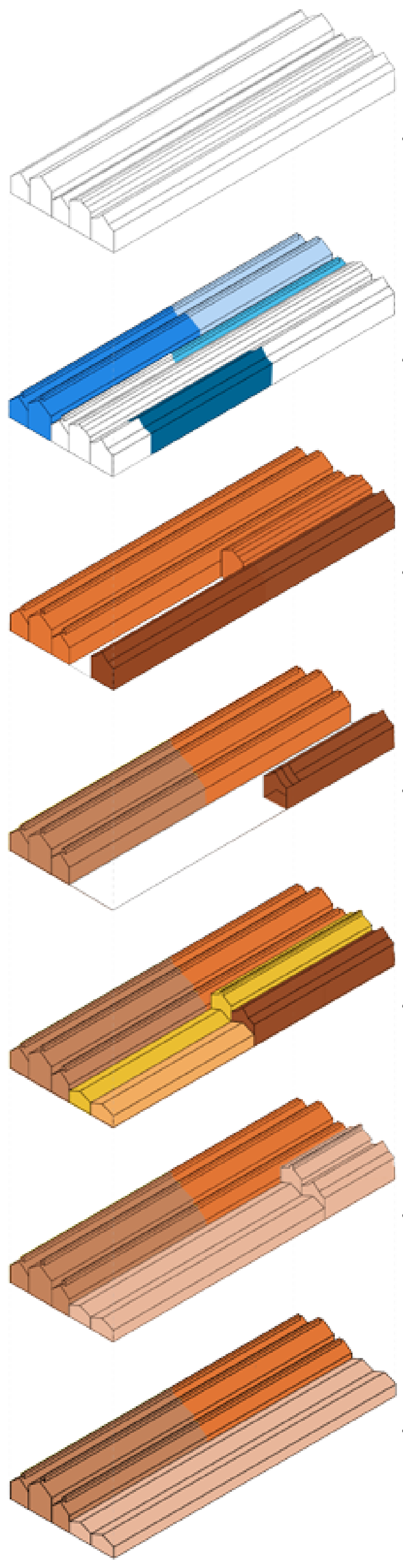
## LOCATION

## DEVELOPMENT THROUGH TIME



- NOW - THE VAN GENDT HALLS AS WE KNOW IT
- 1924 - HALL 4 IS FINISHED
- 1923 - HALL 5 IS FINISHED, HALL 4 IS HALFWAY REBUILT
- 1922 - FIRE BURNS DOWN THE OLD HALLS, ALL OF HALL 4 AND PART OF HALL 5
- 1910 - HALL 4 & 5 ARE FINISHED TO HALF THEIR FINAL LENGTH
- 1905 - FIRST HALF OF HALL 4 & 5 IS BUILT
- 1898 - THE FIRST THREE HALLS ARE BUILT

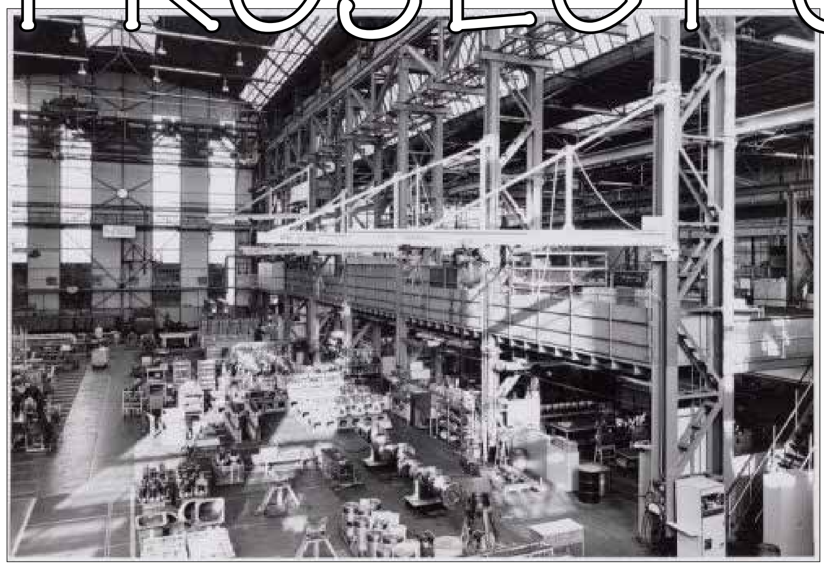
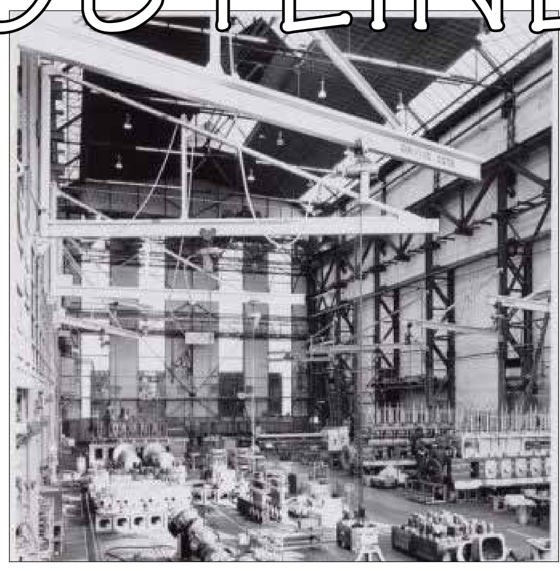
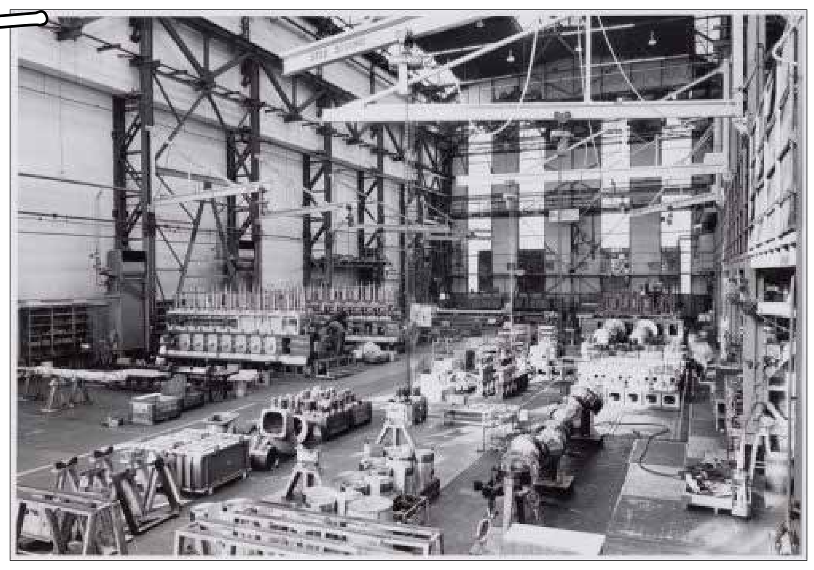
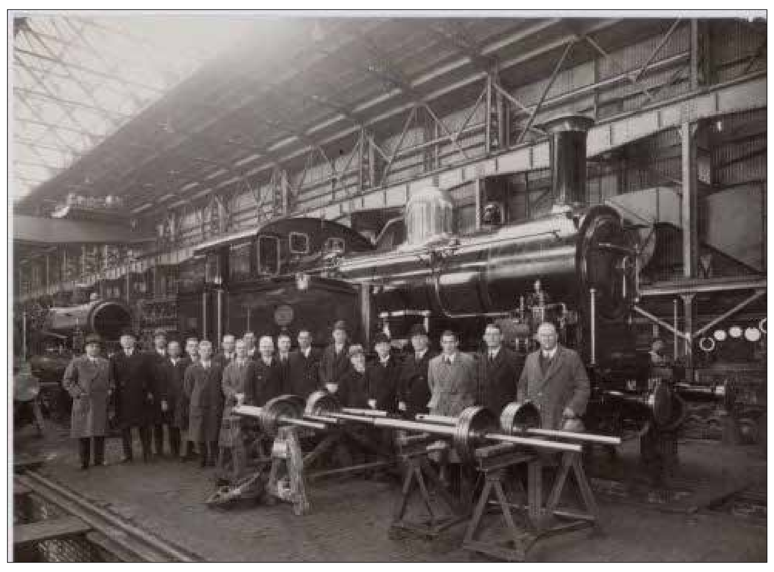
## USE THROUGH TIME



- NOW - AN EMPTY CANVAS
- 2014 - NO LONGER A FACTORY; HALF OF HALL 1 & 2 IS FOR A SHIPBUILDER, THE OTHER HALF BELONGS TO MEDIAMATIC. MOST OF HALL 3 BELONGS TO ROEST, AND PART OF HALL 5 BELONGS TO THE ARTIST HANS UBBINK
- 1950 - HALL 1,2,3 AND 4 BECOME A MACHINE WORKSHOP; HALL 5 REMAINS A LOCOMOTIVE DEPOT
- 1922 - THE FOUNDRY AND MACHINE WORKSHOP REMAIN, HALL 4 AND PART OF 5 IS BURNT DOWN, AND THE REBUILT HALL 1 IS A LOCOMOTIVE DEPOT
- 1916 - HALL 4 BECOMES A METAL WORKSHOP; WHEREAS HALL 5 IS CONVERTED INTO A MODEL WORKSHOP AND LOCOMOTIVE DEPOT
- 1905 - THE FUNCTIONS STILL REMAIN A FOUNDRY, MACHINE WORKSHOP AND WAGON WORKSHOP
- 1898 - THE FUNCTIONS CONSIST OF A FOUNDRY, MACHINE WORKSHOP AND WAGON WORKSHOP

# PROJECT OUTLINE



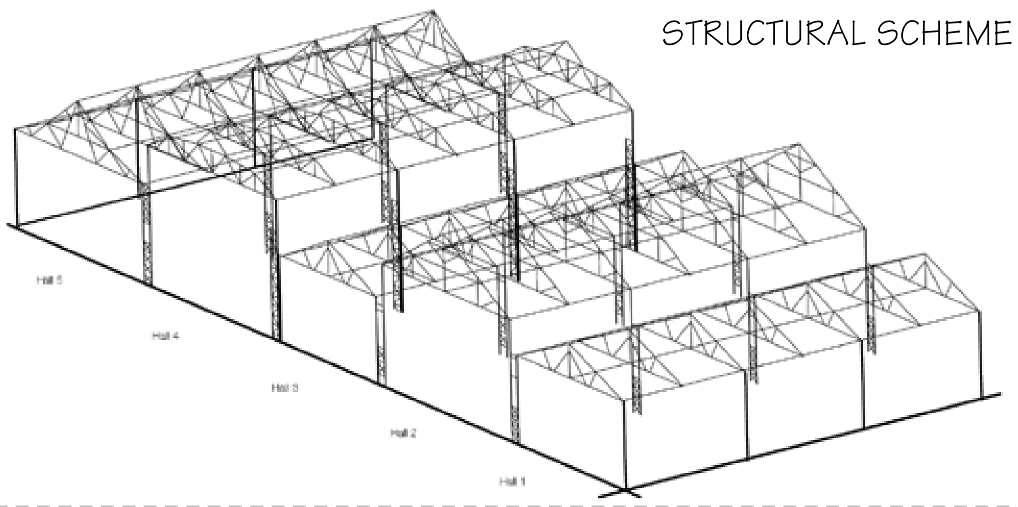
"THE BUILDING OF FIVE LINKED HALLS THAT HAS COME TO BE IN EXISTENCE IS IMPORTANT BECAUSE OF THE ARCHITECTURAL-HISTORICAL AND TYPOLOGICAL VALUE, AND AS ONE OF THE LAST REMAINDERS OF HEAVY INDUSTRY AND SHIP-BUILDING FROM THE TURN OF THE CENTURY IN AMSTERDAM. IT IS ALSO OF HISTORICAL VALUE AS A REMINDER OF THE DEVELOPMENT OF THE DUTCH IRON- AND ENGINEERING TECHNIQUE."



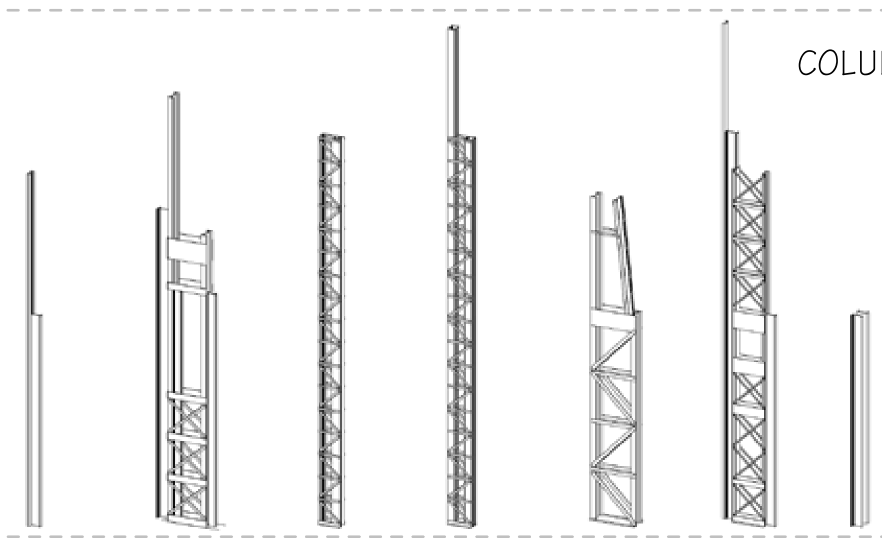

## APPEARANCE

THE INDUSTRIAL APPEARANCE IS THE MAIN MONUMENTAL FEATURE TO THIS BUILDING, AND THIS INDUSTRIAL APPEARANCE STEMS FROM THE LOAD-BEARING STRUCTURE. PRESERVING THIS STRUCTURE IS KEY TO PRESERVING THE MONUMENT.

STRUCTURAL SCHEME



COLUMNS



## ATTITUDE

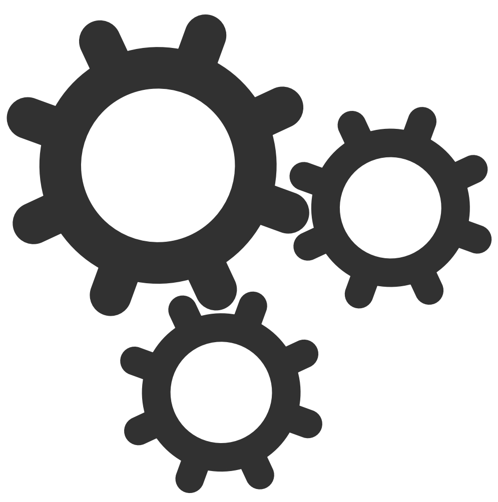
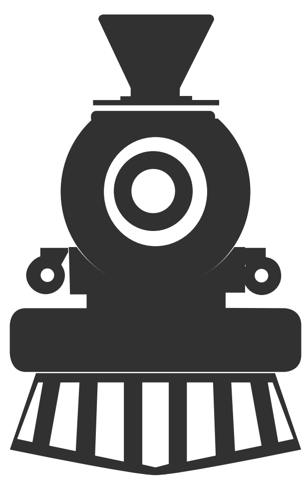
DESPITE OF THE MONUMENTAL STATUS, IT IS MY OPINION THAT CHANGES CAN BE MADE MODERATELY (AND WHEREVER NECESSARY; IT LIES WITHIN THE FUNCTION AND ITS IMPLEMENTATION TO RESTRICT CHANGES AS MUCH AS POSSIBLE) DUE TO THE PRAGMATIC ATTITUDE USED IN THE PAST TOWARDS THE VAN GENDT HALLS.

THE PRAGMATISM OF WHICH I SPEAK SHOWS ITSELF BEST IN THE FACADE. WHEREVER A CHANGE WAS NECESSARY, IT WAS EXECUTED VERY FUNCTIONALLY. NEED A NEW DOOR? MAKE A HOLE. DON'T NEED IT ANYMORE? CLOSE IT UP WITH SOMETHING. THIS PATCHWORK IS ALSO CHARACTERISTIC FOR THE MONUMENTAL STATUS OF THE BUILDING.



## THEME

OVER THE ENTIRE LIFE SPAN OF THE VAN GENDT HALLS, THE MAIN THEME HAS BEEN PRODUCTION. PRODUCTION OF SHIPS, STEAM ENGINES, TRAINS AND ART AMONG THEM.

THE GOAL IS TO CONTINUE THIS THEME OF PRODUCTION NOT WITH MATERIAL OBJECTS, BUT WITH EDIBLE PRODUCTS.



# URBAN FARMING

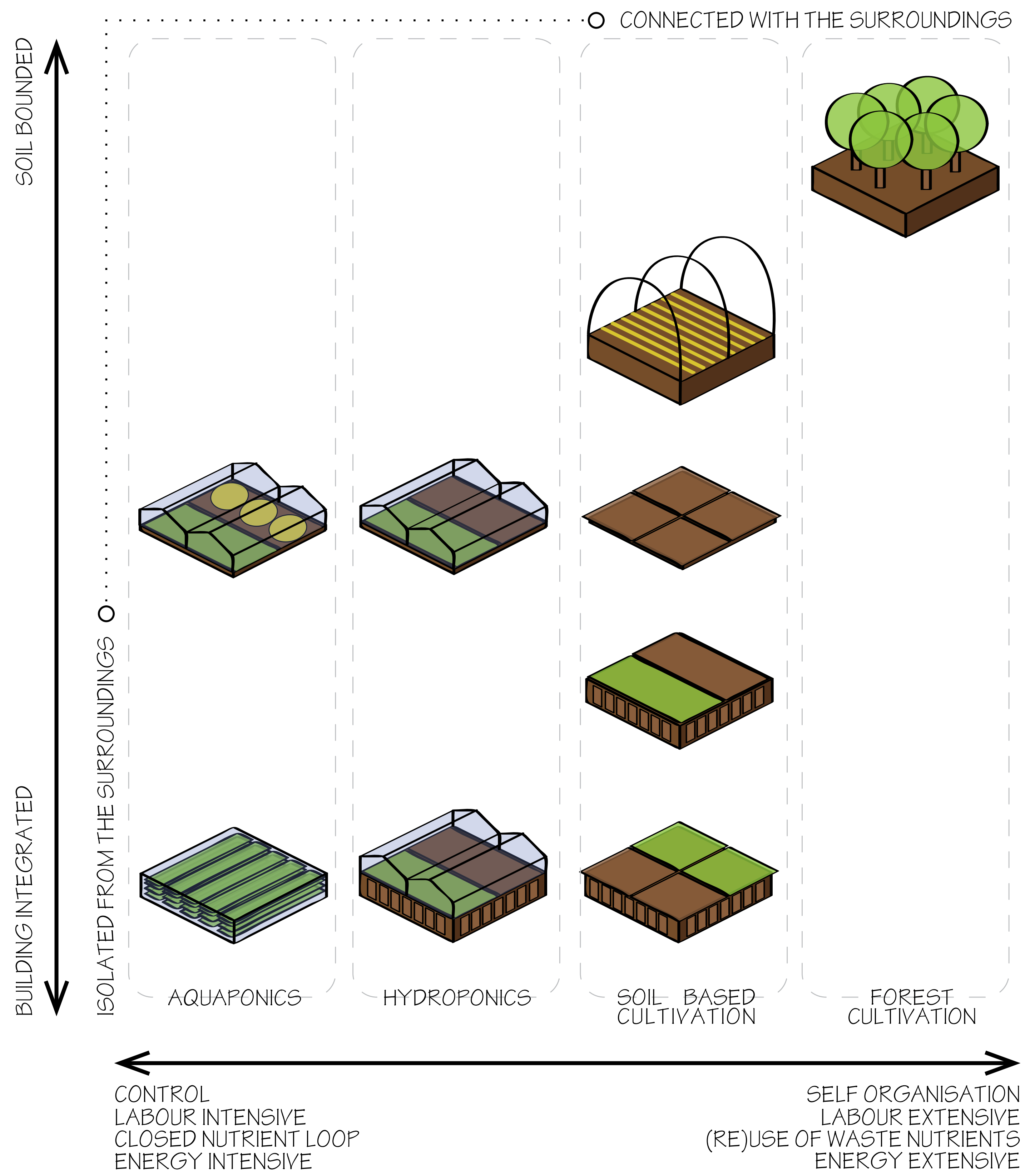



URBAN FARMING ON THE LOCATION; IN AND OUTSIDE

## CONCEPT

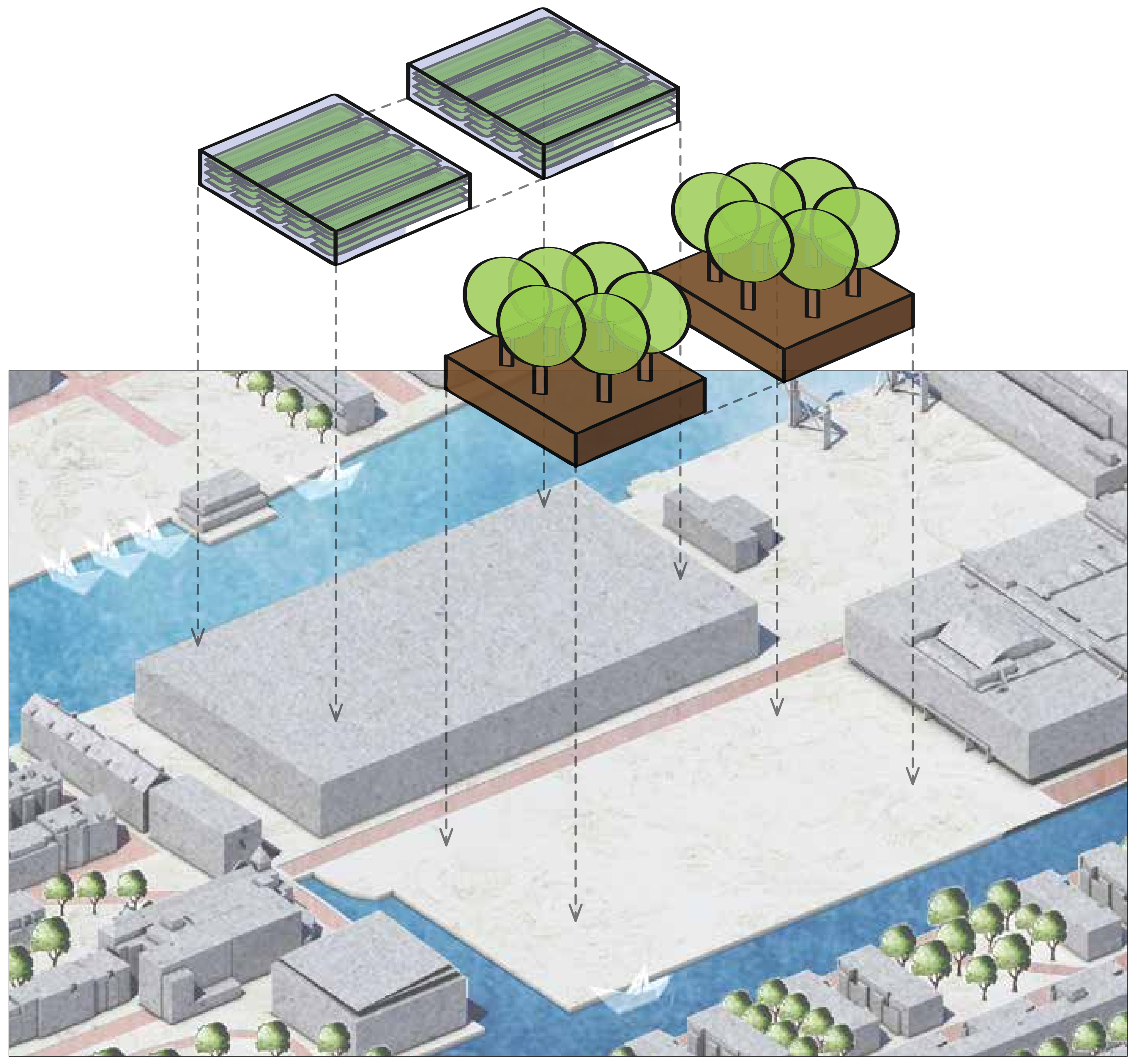
URBAN FARMING CAN BE DEFINED AS GROWING FRUITS, HERBS, AND VEGETABLES AND RAISING ANIMALS IN CITIES, A PROCESS THAT IS ACCOMPANIED BY MANY OTHER COMPLEMENTARY ACTIVITIES SUCH AS PROCESSING AND DISTRIBUTING FOOD, COLLECTING AND REUSING FOOD WASTE AND RAINWATER, AND EDUCATING, ORGANIZING, AND EMPLOYING LOCAL RESIDENTS

## TYPES OF URBAN FARMING




ON THE LEFT A DIAGRAM CONCERNING THE DIFFERENT TYPES OF URBAN FARMING IS DISPLAYED. IT TAKES INTO ACCOUNT DIFFERENT FACTORS, FOR EXAMPLE HOW CONNECTED THEY ARE WITH THEIR SURROUNDINGS, HOW MUCH CONTROL ONE HAS OVER IT, AND WHETHER THE NUTRIENT LOOP IS CLOSED OR NOT. ON THE BOTTOM LEFT THE MOST DISCONNECTED AND INTENSIVE FORM OF URBAN FARMING IS DISPLAYED (AQUAPONICS) WHEREAS THE TOP RIGHT SHOWS THE MOST CONNECTED AND EXTENSIVE FORM (FOREST CULTIVATION).

BELOW IS AN ILLUSTRATION SHOWING THE CHOSEN TYPES FOR THE PROJECT.



## WHY AQUAPONICS?

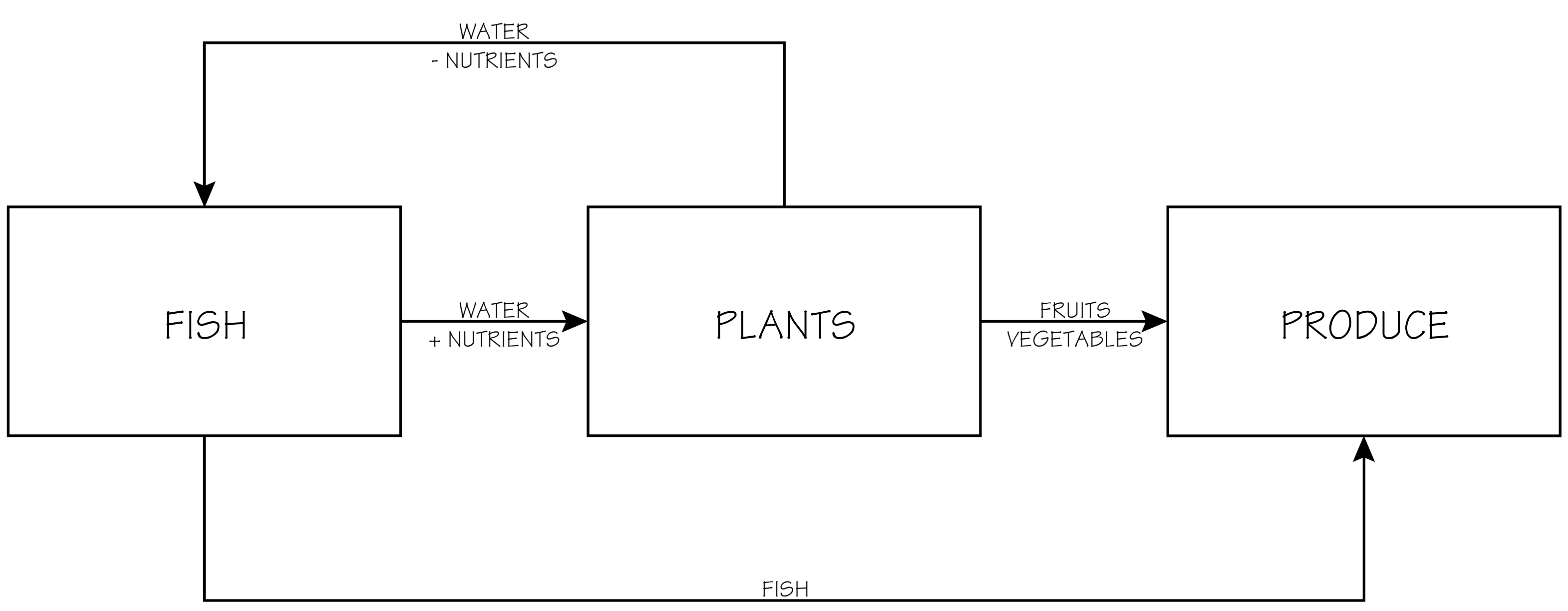
AQUAPONICS IS A COMBINATION OF AQUACULTURE AND HYDROPONICS.

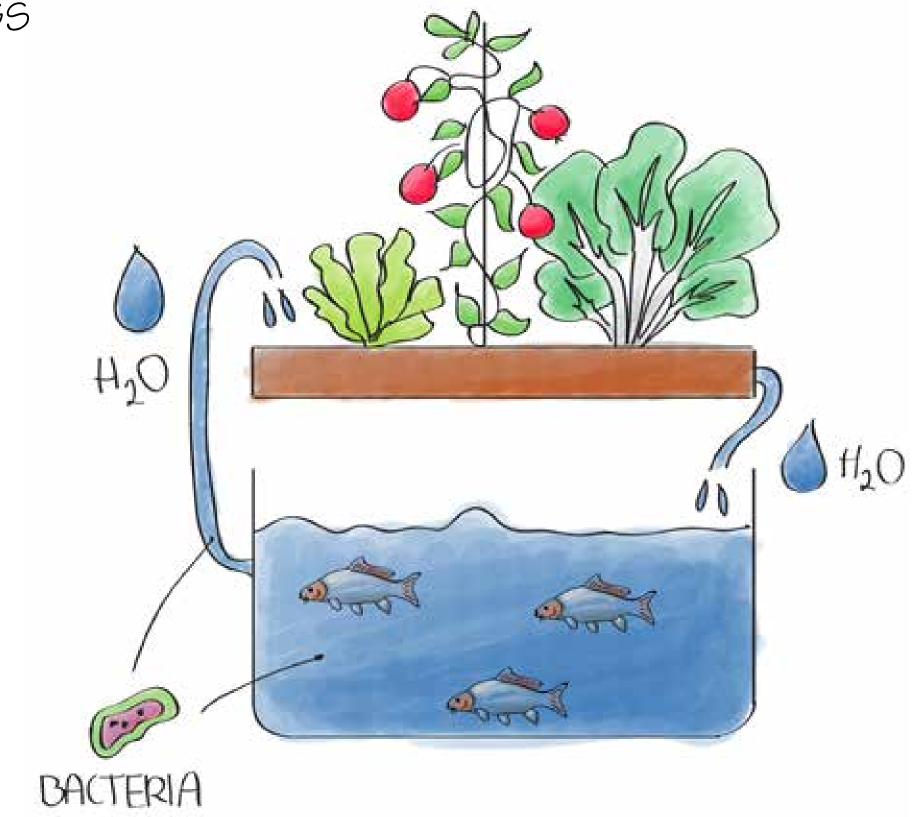
AQUACULTURE IS AN ENCOMPASSING NAME FOR THE BREEDING OF FISH, SHELL-FISH AND AQUATIC PLANTS.

HYDROPONICS IS A TYPE OF SOIL-LESS FARMING, WHERE THE NUTRIENTS THAT THE PLANTS NEED ARE ADDED TO THE WATER.

THE BENEFITS OF AQUAPONICS ARE:

- ALMOST NO WATER LOSS (1% - 3%)
- A HIGH CROP AND FISH YIELD
- LABOUR INTENSIVE, CREATES JOBS
- PERFECTLY SUITABLE FOR AREAS WITHOUT SOIL OR INSIDE BUILDINGS



# MASTERPLAN

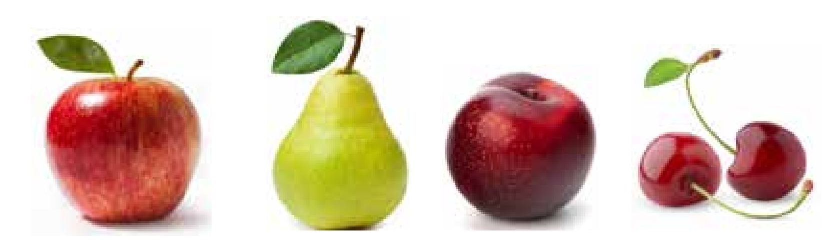
1:1000

MASTERPLAN

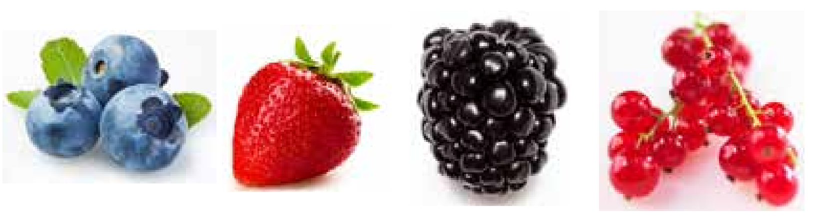
## GARDENS

THE GARDENS ARE SITUATED ON THE EMPTY PLOT NEXT TO THE VAN GENDT HALLS. IT IS A COMBINATION BETWEEN A PARK LANDSCAPE AND A FARMING LANDSCAPE. SHEDS ARE SCATTERED THROUGHOUT TO ACCOMMODATE STORAGE, TOOLS AND PUBLIC SHELTER.

TYPES OF TREES: APPLE, PEAR, PLUM, AND CHERRY

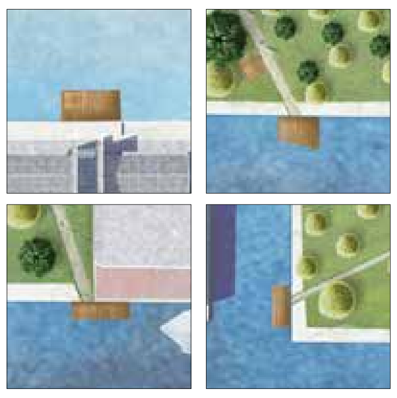


SHRUBS: MOSTLY BERRIES SUCH AS BLUEBERRIES, STRAWBERRIES, BLACKBERRIES AND RED CURRANTS.



HERBS: SAGE, MINT, THYME, CORIANDER, LAVENDER, CHIVES, PARSLEY, OREGANO AND BAY LEAF.


## DOCKS

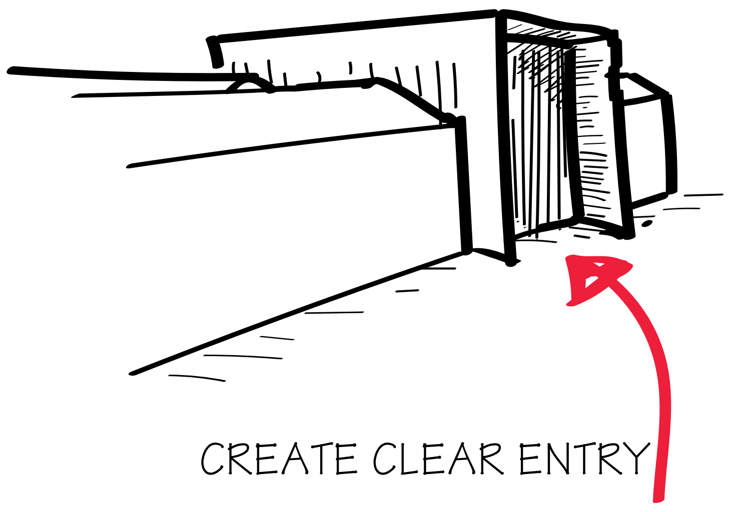


WOODEN FLOATING DOCKS ARE ADDED AROUND THE GARDEN AS WELL AS THE NORTH SIDE OF THE PROJECT. AROUND THE GARDEN THESE DOCKS ARE MEANT AS LEISURE SPOTS, WHEREAS THE NORTH DOCK IS MEANT FOR THE WATERTAXI AND ANY TRANSPORT BY BOAT.

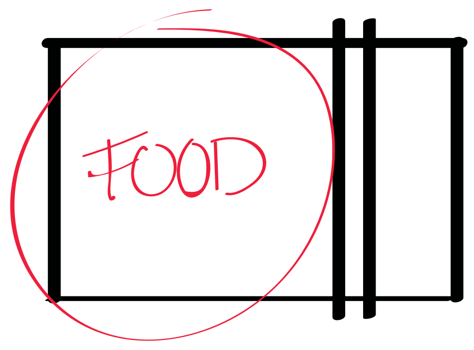
## SQUARE

AN ENTRY SQUARE IS CREATED TO MARK THE ENTRANCE AREA TOWARDS THE BUILDING AS WELL AS CONNECT THE GARDEN WITH THE GREEN AREA RESERVED FOR CAFE ROEST.

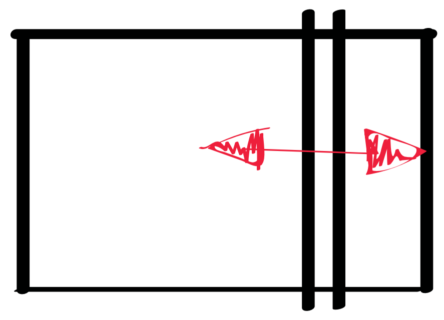
# THE DESIGN



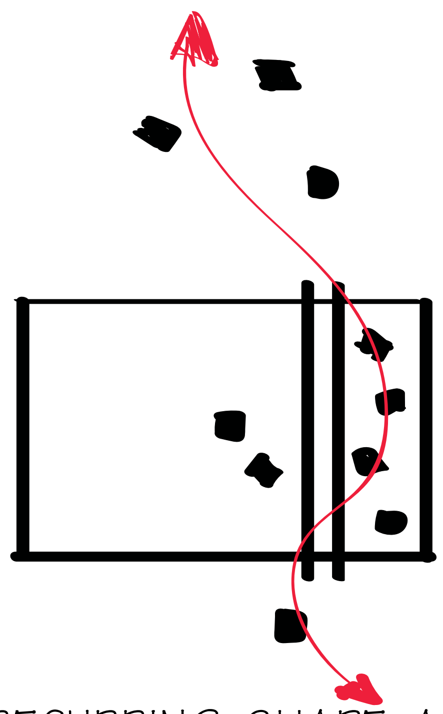
CREATE CLEAR ENTRY



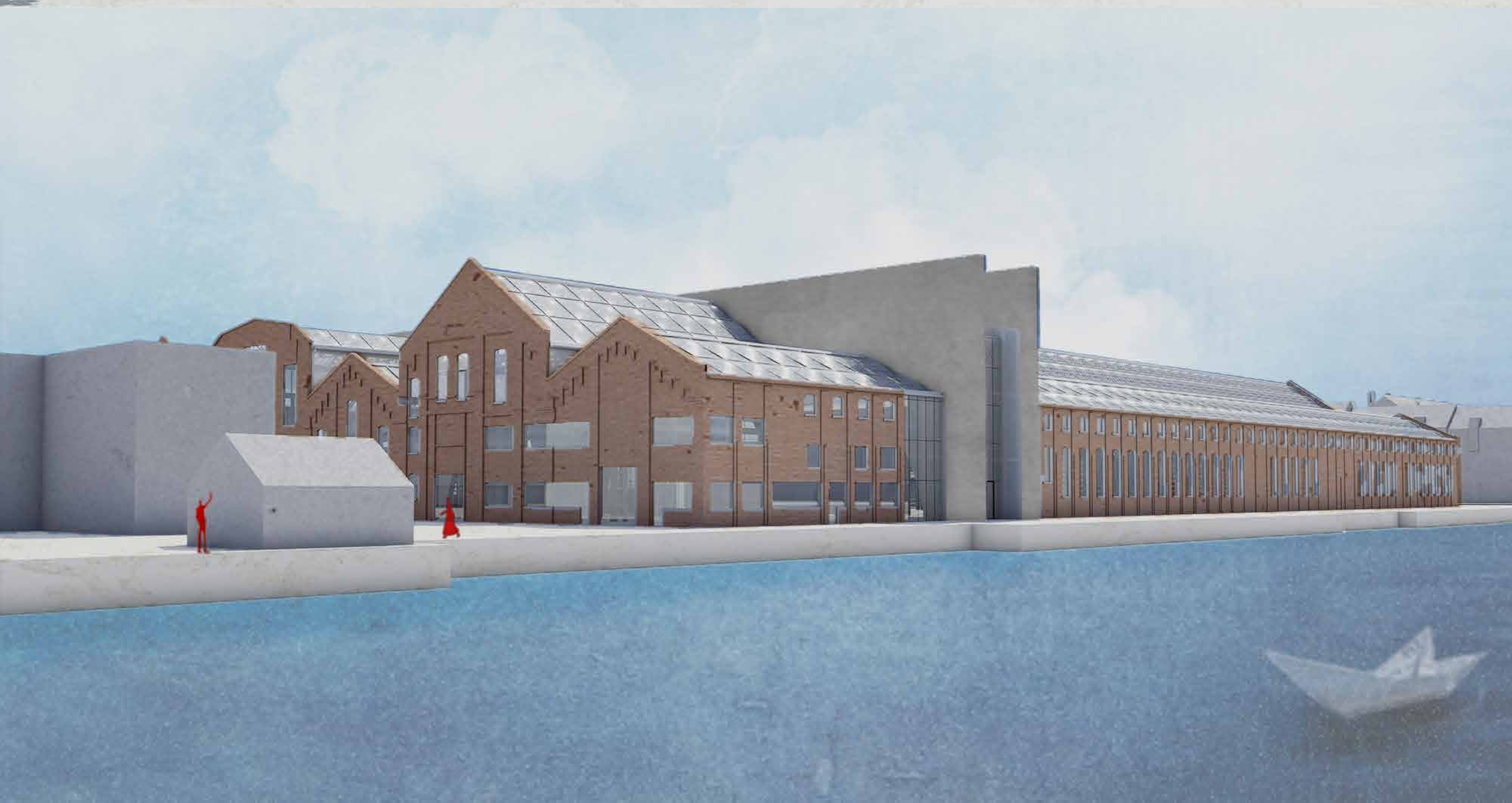

FOCUS ON PRODUCTION



CONNECT PRIVATE AND PUBLIC



RECURRING SHAPE AND MATERIAL LANGUAGE TO CONNECT IN AND OUT



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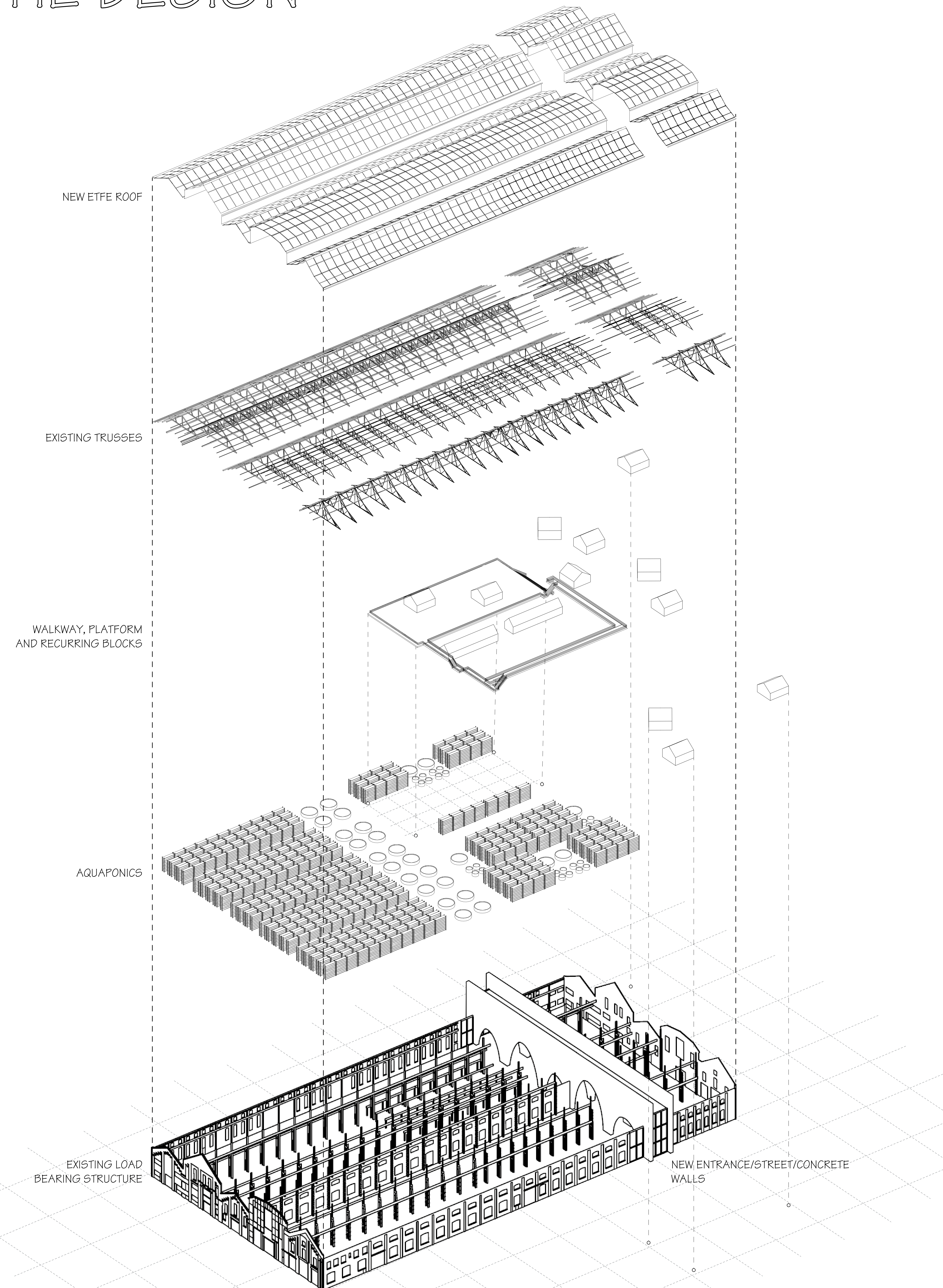
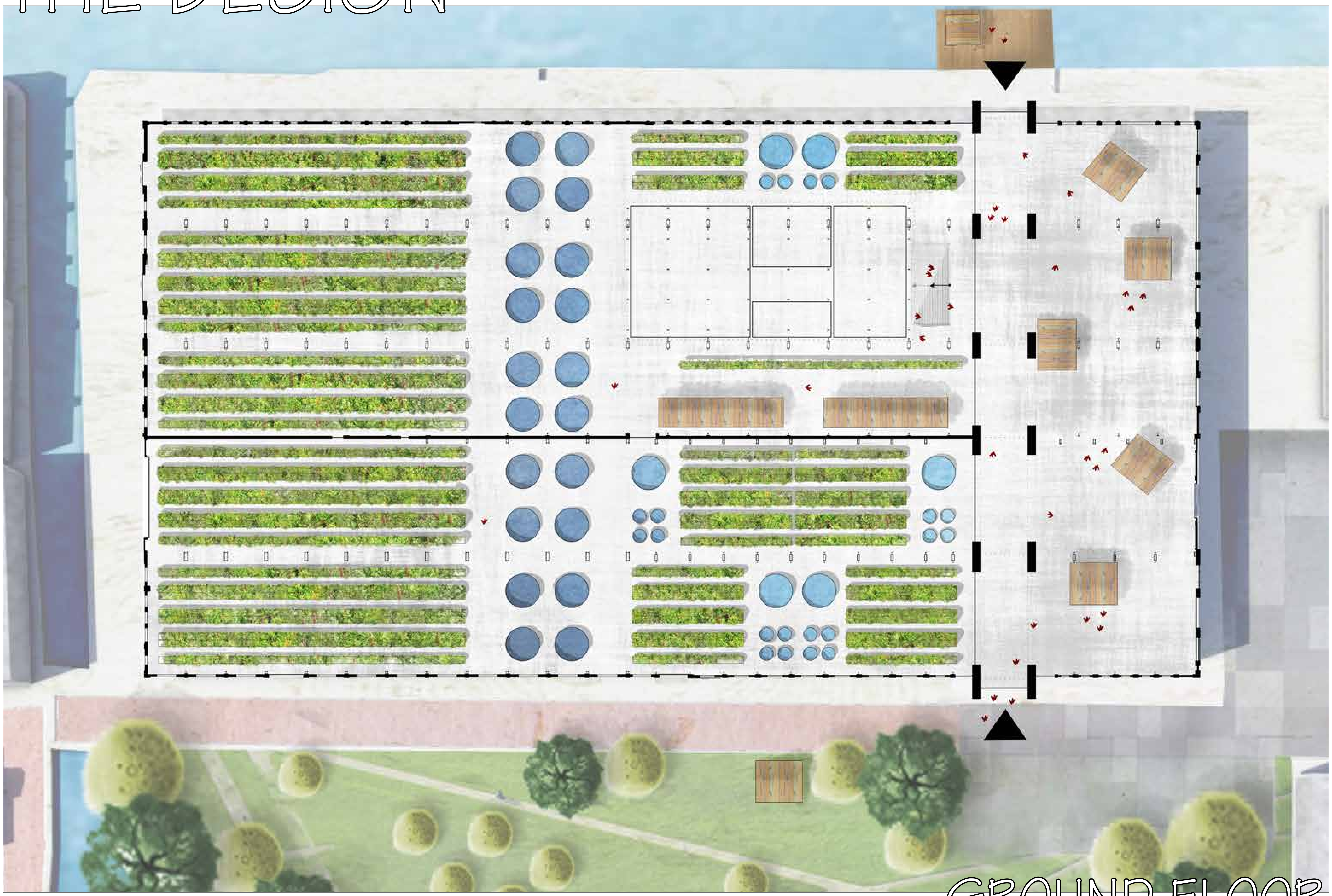



EXPLODED VIEW

# MAIN ELEMENTS

# THE DESIGN

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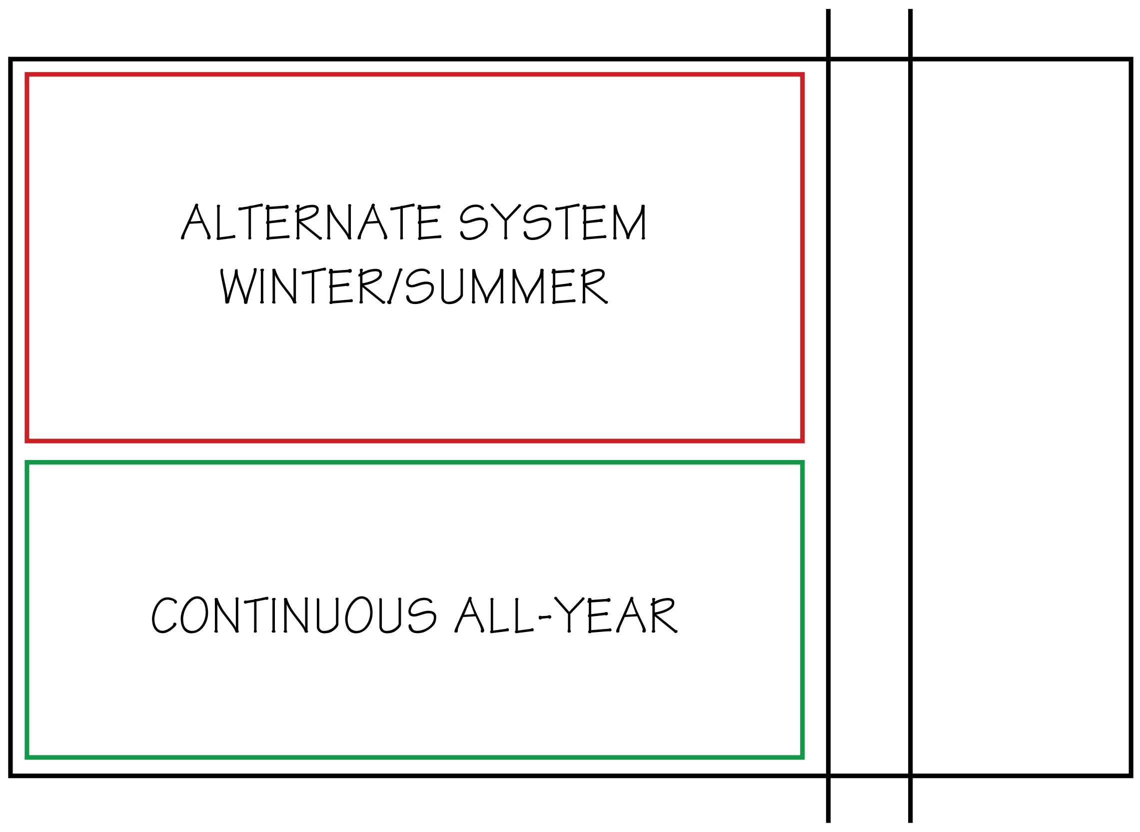
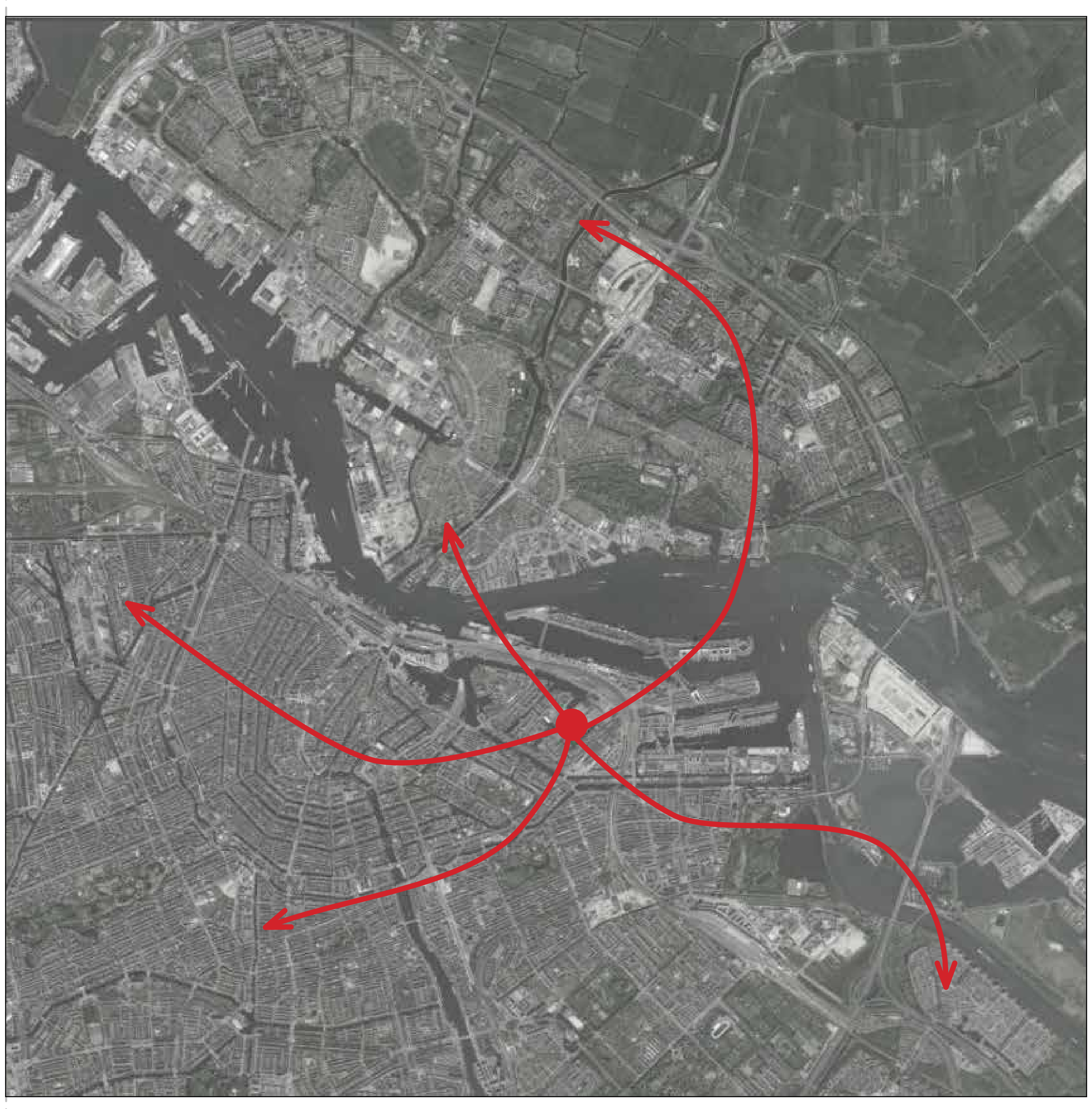
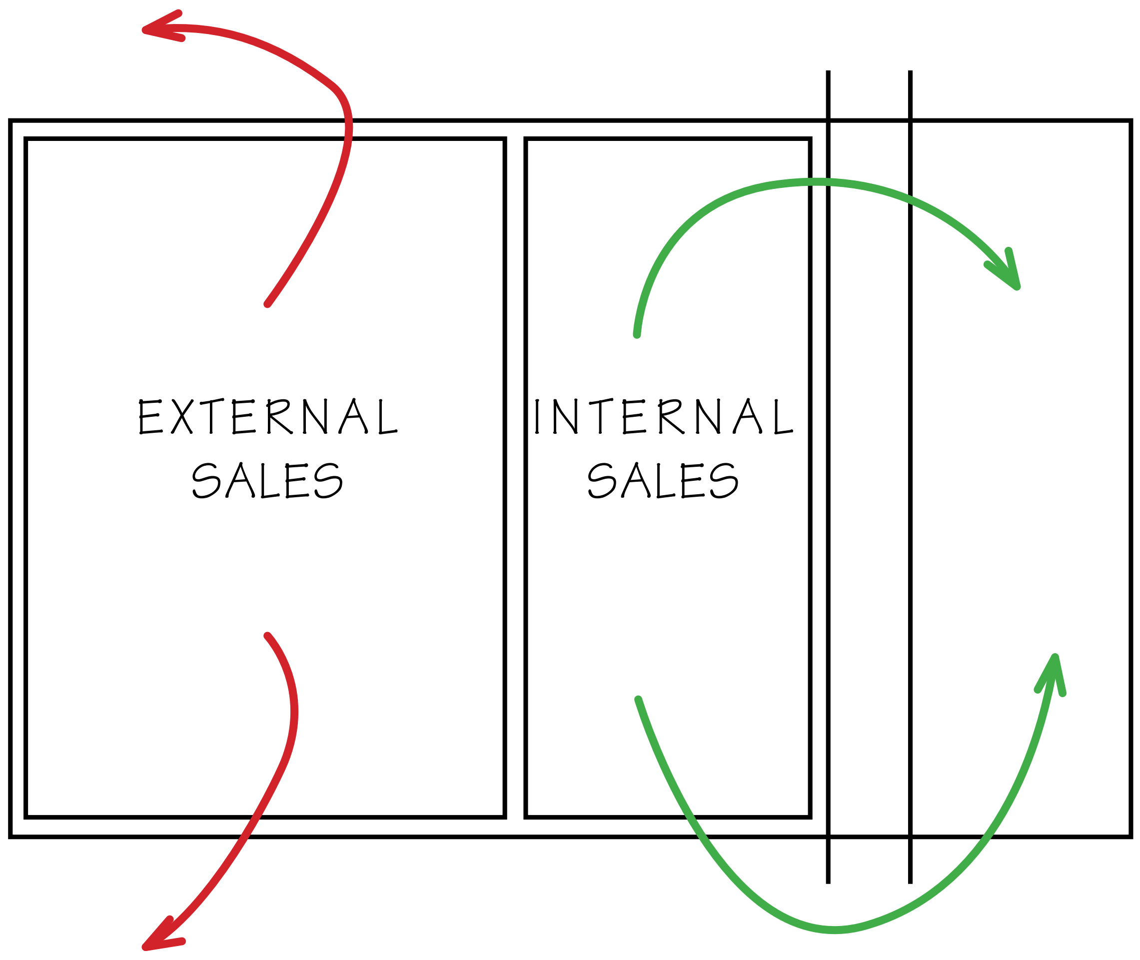



OPTIMAL PLANTS FOR THE WINTER: KALE, CABBAGE AND CAULIFLOWER - OPTIMAL TEMPERATURE: 15 TO 20 DEGREES CELSIUS
OPTIMAL PLANTS FOR THE SUMMER: EGGPLANT, SQUASH, PEPPERS, CHILIS, CUCUMBERS AND BEANS - OPTIMAL TEMPERATURE: 22 TO 25 DEGREES CELSIUS

OPTIMAL PLANTS FOR THE ALL YEAR AREA: MICRO GREENS AND HERBS, SWISS CHARD, BOK CHOI, SPINACH AND LETTUCE VARIETIES - OPTIMAL TEMPERATURE: 15 TO 20 DEGREES CELSIUS

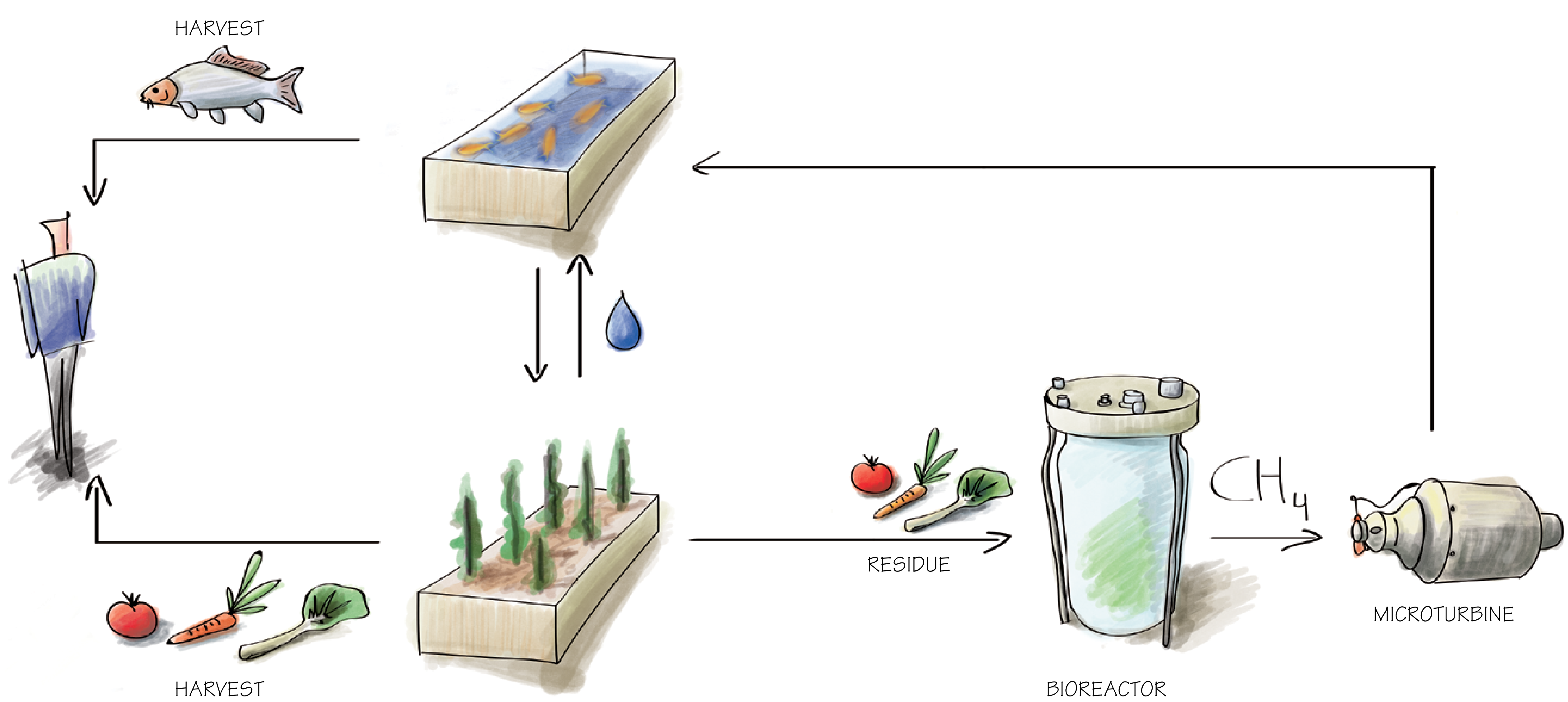
IN BOTH AREAS THE SAME FISH IS CULTIVATED: TROUT. THIS IS BECAUSE IT CAN HANDLE THE TEMPERATURE RANGE THE BEST. OTHER FISH ARE POSSIBLE BUT WILL BE HARDER TO CULTIVATE.






THE TOTAL OUTPUT OF THE AQUAPONIC SYSTEM SITUATED IN THE VAN GENDT HALLS WILL COME DOWN TO AN APPROXIMATE 195 TONNES PRODUCE PER YEAR. ONE PERSON CONSUMES ABOUT 73 KG PRODUCE PER YEAR (200 GRA PER DAY IDEALLY), WHICH MEANS THAT APPROXIMATELY 2600 PEOPLE CAN BE GIVEN PRODUCE.

HERE IS A SCHEME FOR THE AQUAPONIC SYSTEM IN THE VAN GENDT HALLS. THE FISH AND PLANT CYCLE IS PRETTY STRAIGHTFORWARD. HOWEVER, A BIOREACTOR AND MICROTURBINE ARE ADDED TO THE SYSTEM. THE BIOREACTOR TAKES ORGANIC WASTE AND CONVERTS IT INTO GAS WHICH THE MICROTURBINE BURNS FOR ENERGY. THE BYPRODUCT FOR THIS PROCESS IS CO2, WHICH WOULD NORMALLY BE A PROBLEM. IN THIS CASE HOWEVER, THE CO2 CAN BE PUMPED INTO THE PLANT AREA TO CREATE OPTIMAL GROWING CONDITIONS.



# PUBLIC SPACE & RECURRING BLOCKS

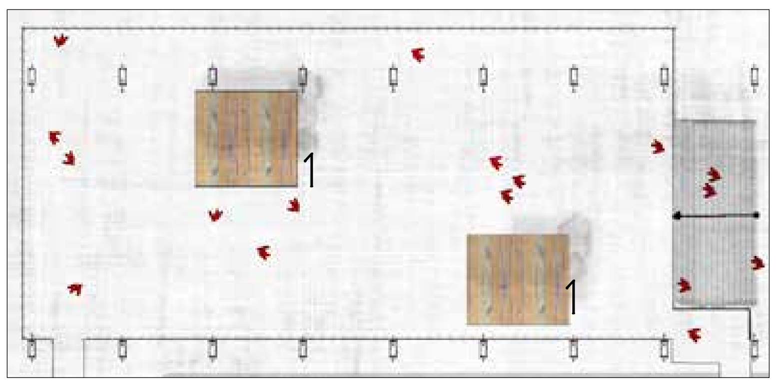
PVE:

INSIDE AQUAPONIC AREA:

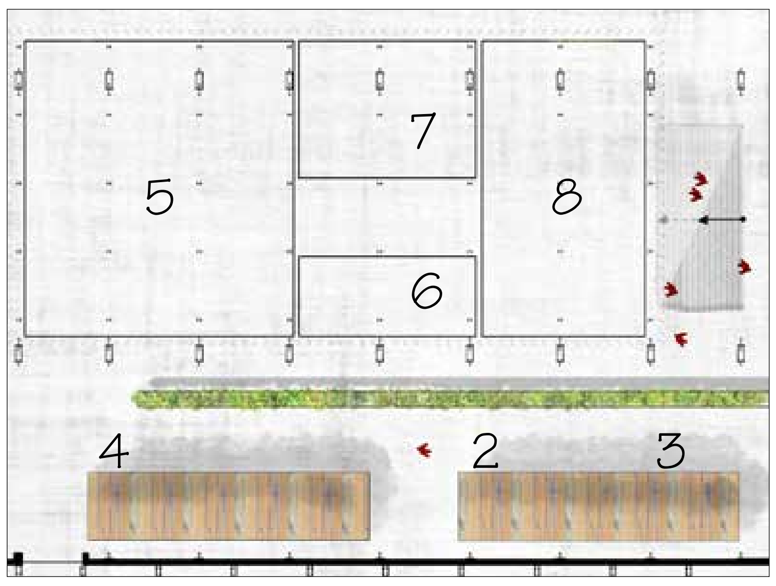
1. CAFE/SMOOTHIE BAR
2. OFFICE
3. GERMINATING LAB
4. STORAGE
5. MECHANICAL SPACE
6. COMPOSTING AREA
7. BIOREACTOR / MICROTURBINE
8. MUSHROOM FARM

PUBLIC AREA:

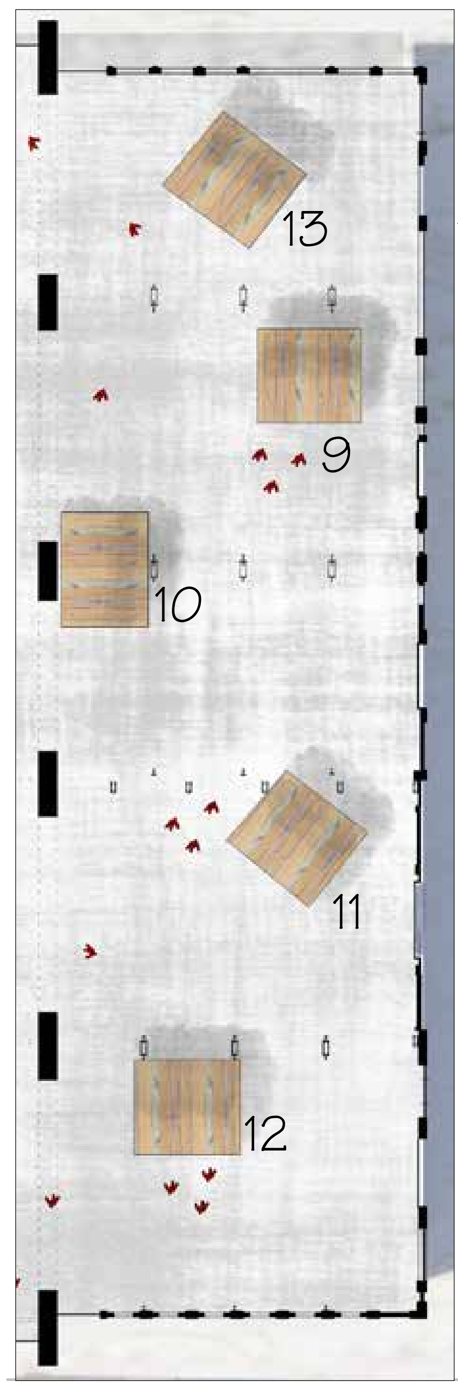
9. TOILETS
10. INFORMATION BOOTH
11. PRODUCE MARKET
12. FISH MARKET
13. PLANT SHOP



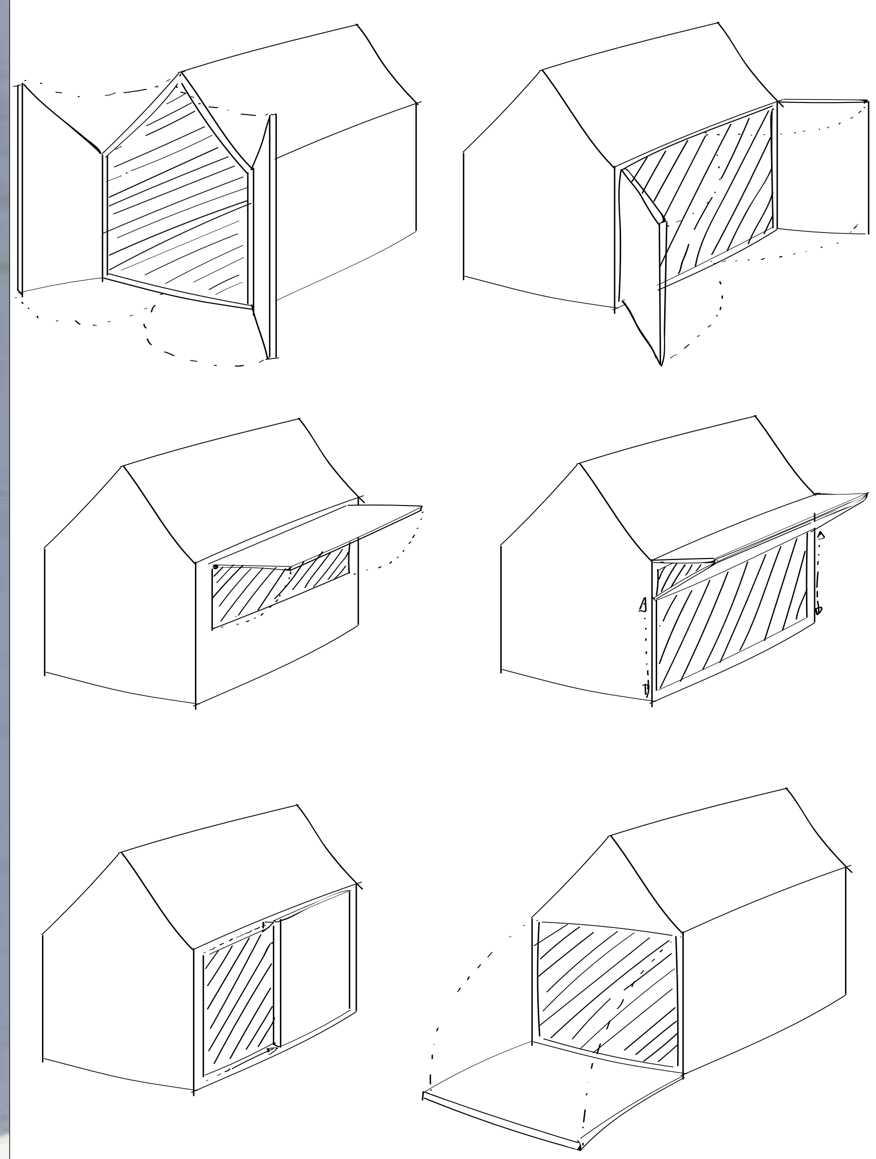

EXCERPT FIRST FLOOR (ABOVE)



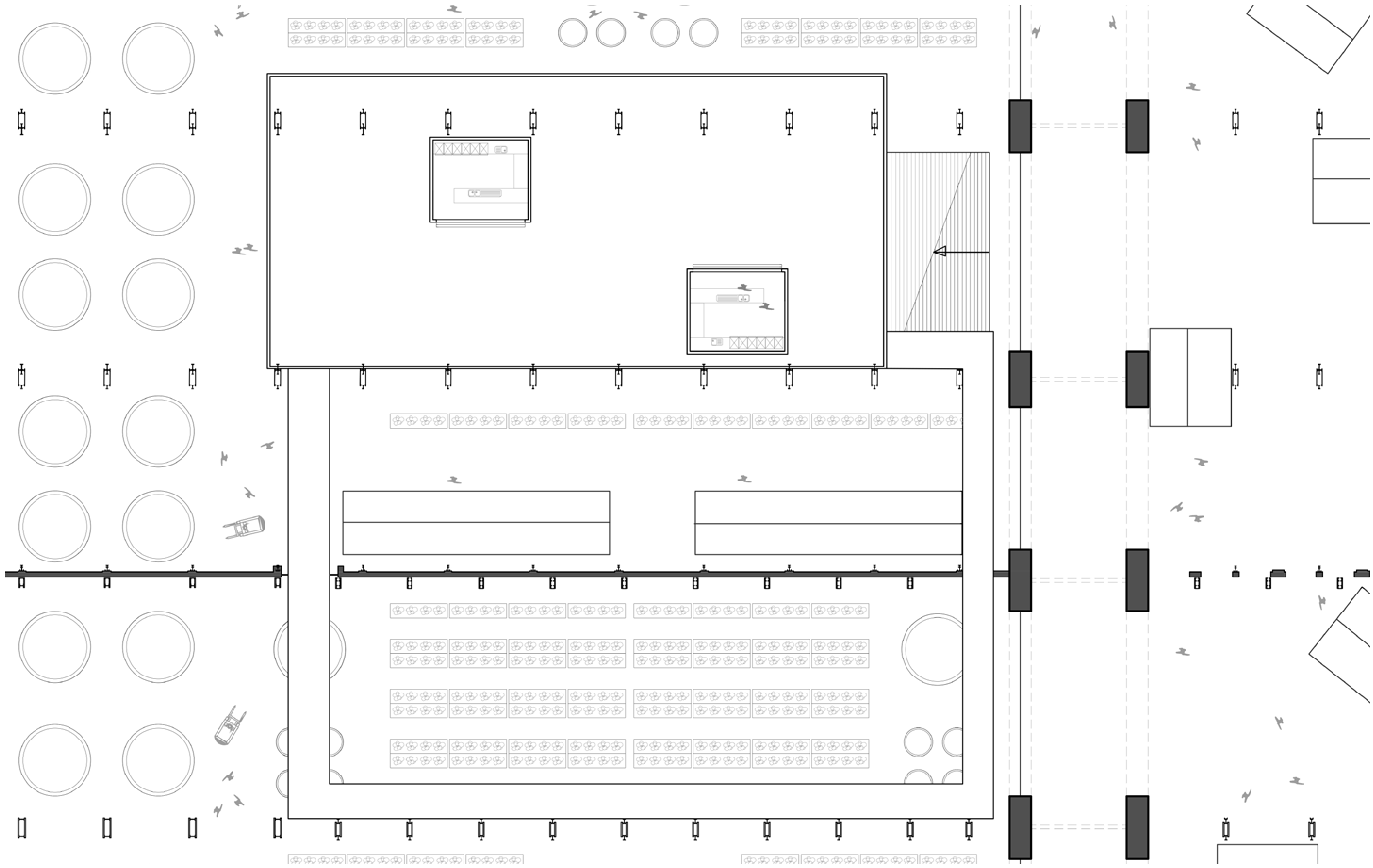

EXCERPTS GROUND FLOOR (ABOOVE AND RIGHT)




POSSIBLE TYPES SHEDS



# WALKWAY

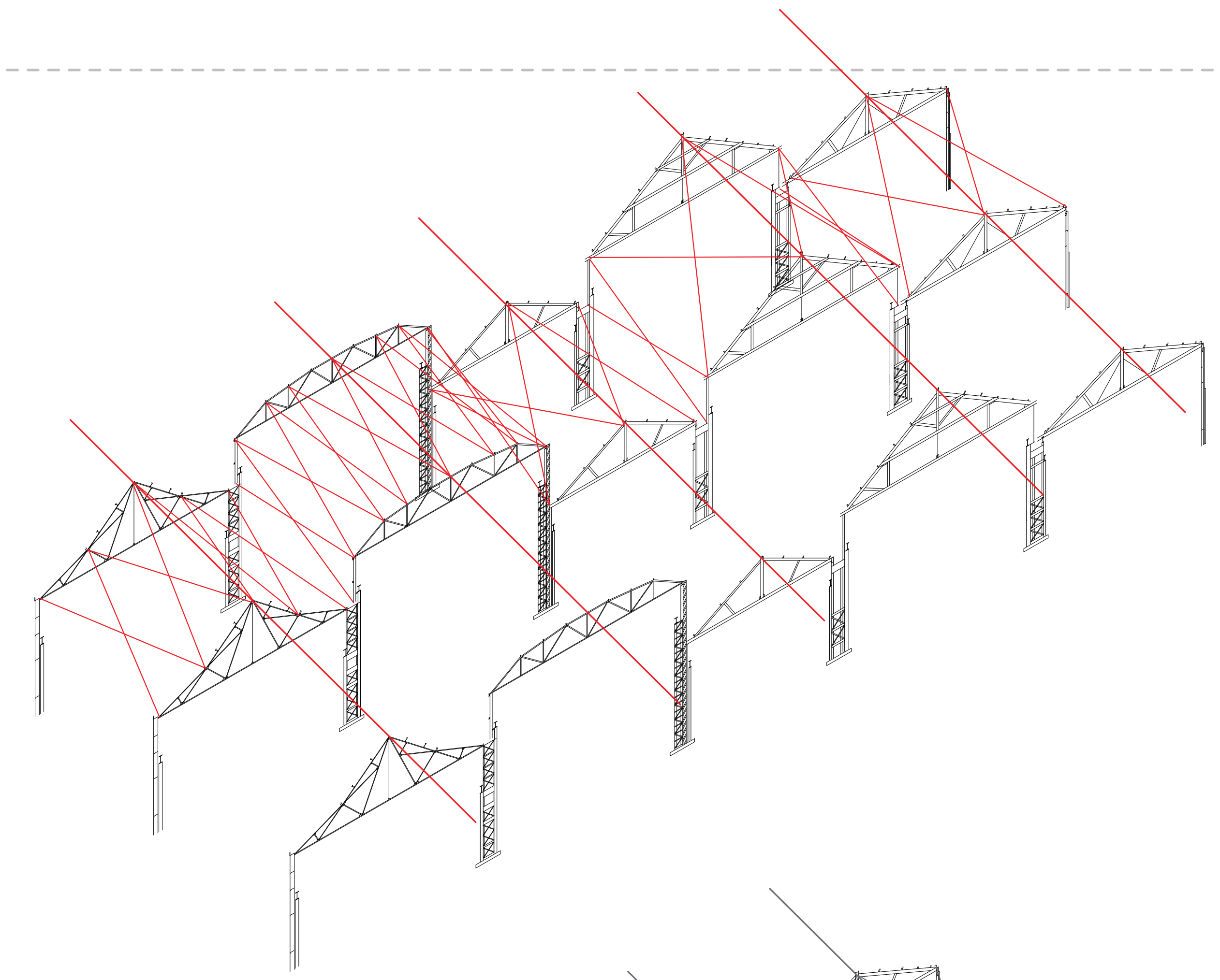


SITUATED IN HALL 4, 3 AND 2 - A NEW WALKWAY IS CONNECTED TO THE ALREADY EXISTING PLATFORM, WHICH CAN BE REACHED THROUGH THE ARCH LEADING TO THE INTERNAL STREET, THUS CONNECTING IT TO THE PUBLIC AREA OF THE PROJ-ECT.
FROM THE PLATFORM ONE CAN SEE THE ENTIRETY OF HALLS 1,2 AND 3, WHEREAS THE NEW WALKWAY GIVES ACCESS TO THE AQUAPONICS SITUATED IN HALL 4 AND 5.

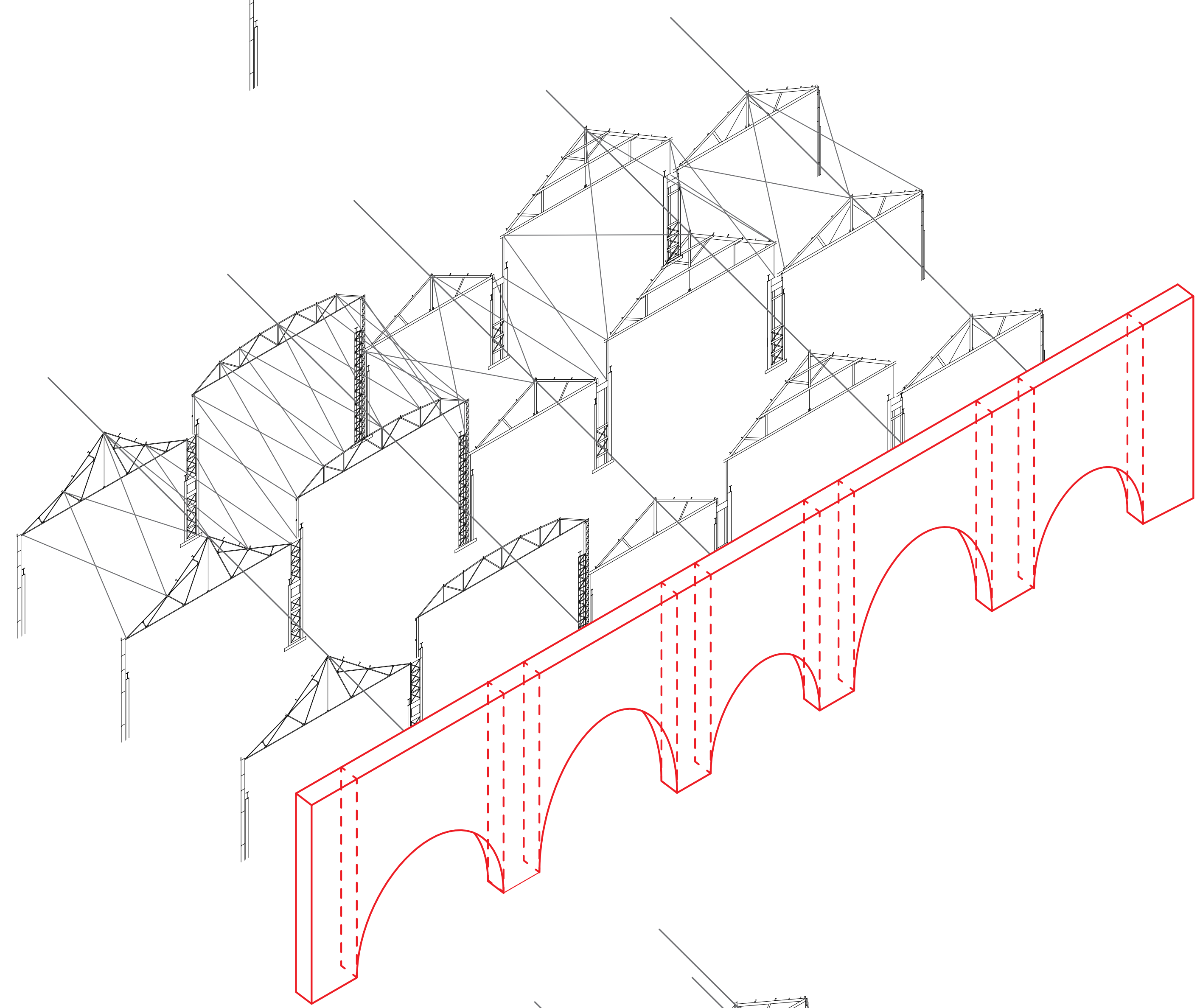
THE CHOICE WAS MADE NOT TO CONTINUE THIS WALKWAY AMONG THE PUBLIC PART OF THE BUILDING, THE WALKWAY IS AN EXTENSION OF THE PUBLIC SPACE INTO THE PRIVATE SPACE AND THEREFORE NOT NECESSARY WITHIN THE PUBLIC SPACE ITSELF.

ANOTHER FACTOR IS THE EMPHASIS OF THE SPACE. IN THE PRIVATE PART, THE LENGTH OF THE HALLS IS ON EMPHASIS DUE TO THE SHEER SIZE. THIS CAN BE EXPERIENCED ON THE WALKWAY WHERE ONE CAN SEE ALL THE WAY TO THE BACK OF THE BUILDING. IN THE PUBLIC PART HOWEVER, IT IS NOT THE LENGTH THAT IS EMPHASIZED BUT THE HEIGHT. NO WALKWAY MEANS THAT PEOPLE REMAIN ON THE LOWER LEVEL, THUS ALWAYS EXPERIENCING THE FULL HEIGHT OF THE BUILDING.

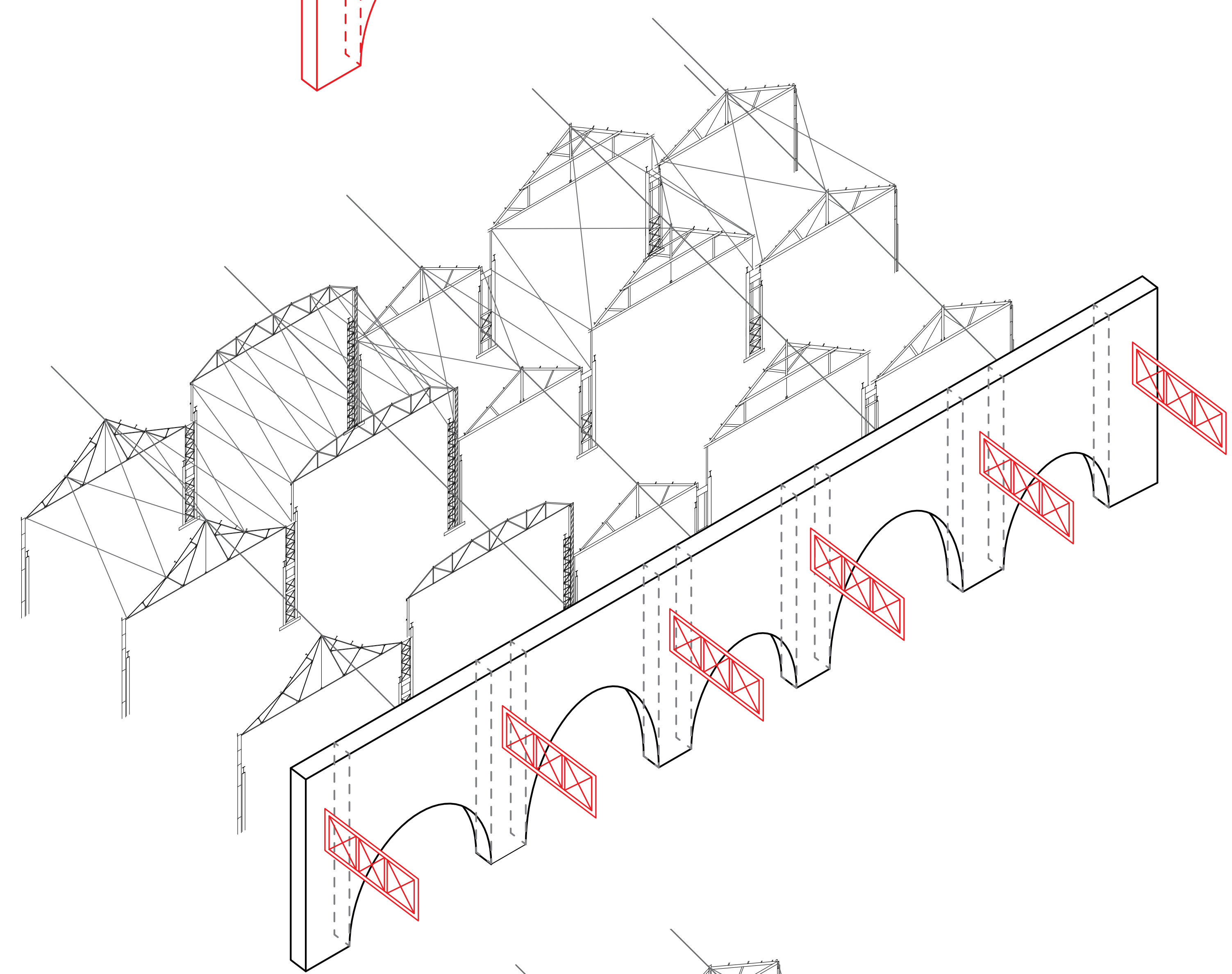
# CONSTRUCTION



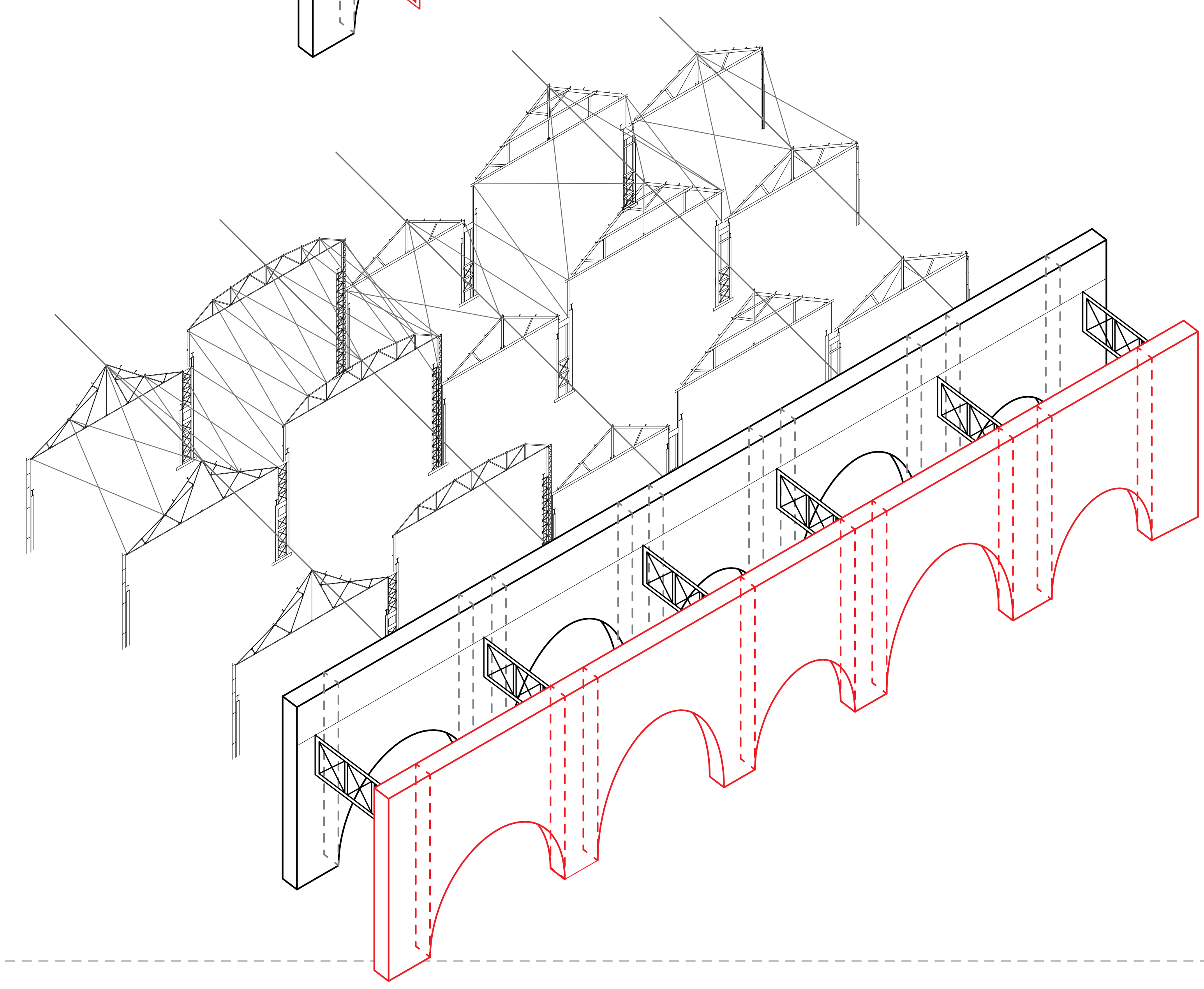
EXISTING  COLUMNS AND TRUSSES WITH
ADDED BRACING AND ROOF LATTICES TO
ACHIEVE STABILITY



THE NEW CONCRETE WALL EXISTS OF 2
LARGE SLABS WITH PERPENDICULAR
SLABS BETWEEN THEM TO PROVIDE STA-
BILITY



LARGE WOODEN TRUSSES ARE ADDED
TO CONNECT THE TWO CONCRETE WALLS
AND CREATE A STABLE BOX

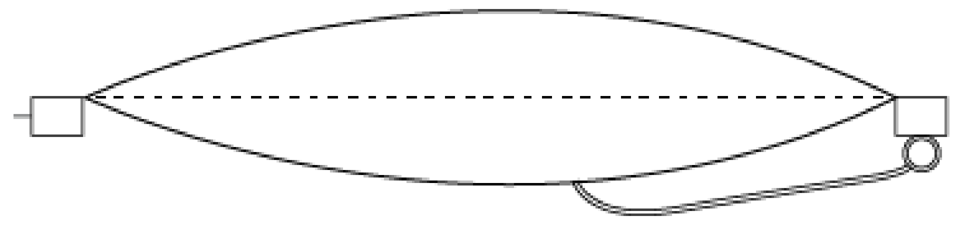


THE OTHER WALL IS BUILT UP EXACTLY
LIKE THE OTHER ONE; TWO SLABS WITH
PERPENDICULAR SLABS BETWEEN THEM
TO CREATE ON STABLE SLAB

# CONSTRUCTION

THE CURRENT ROOF IS IN A BAD STATE AND NOT FIT FOR A GREENHOUSE SETTING. THREE NEW OPTIONS WERE IDENTIFIED: POLYCARBONATE, STANDARD DOUBLE GLAZING, AND ETFE FOIL(S). THE DETERMINATIVE FACTOR FOR A CHOICE WAS THE WEIGHT OF THE SYSTEM AND WHETHER THE CURRENT ROOF STRUCTURE CAN SUPPORT IT. AFTER CALCULATION, BOTH POLYCARBONATE AND ETFE FOIL REMAINED A POSSIBILITY. THE CHOICE FELL ON ETFE BECAUSE OF THESE DECISIVE FACTORS:

- ETFE HAS AN INSULATION VALUE OF 2,6 W/m²K
- IT IS VERY LIGHTWEIGHT - 0,7 kg/m²
- UNAFFECTED BY UV LIGHT (CONTRARY TO POLY)
- HAS A GOOD UV TRANSMISSION
- EXCEPTIONALLY FITTING FOR GREENHOUSES (EG: THE EDEN PROJECT)
- NEEDS LESS CLEANING THAN STANDARD GLAZING



SCHEME OF A SINGLE CUSHION UNIT

$dakoppervlak = 3m \times 16m = 48m^2$

$G:$

$glas = 0,3kN/m^2 \times 48m^2 = 14,4kN$

$ETFE = 0,007kN/m^2 \times 48m^2 = 0,336kN$

$poly = 0,15kNm^2 \times 48m^2 = 7,2kN$

$$Gv = \frac{G}{\cos\alpha}$$

$belastingfactorG = 1,2$

$belastingfactorQ = 1,3$

$GLAS$

$$Gv = \frac{14,4kN}{\cos 28^\circ} = 16,309 \times 1,2 = 19,5708kN$$

$ETFE$

$$Gv = \frac{0,336kN}{\cos 28^\circ} = 0,38054 \times 1,2 = 0,456648kN$$

$POLY$

$$Gv = \frac{7,2kN}{\cos 28^\circ} = 8,1545 \times 1,2 = 9,7854kN$$

$Q = 1kN/m^2 = 48kN \times 1,3 = 62,4kN$

$glas = Q = 81,9788$

$etfe = Q = 62,85668$

$poly = Q = 72,1854$

$a = 3m$

$belasting$

$DubbelGlas = 0,3kN/m^2 \times 3m = 0,9kN/m^2$

$ETFE = 0,007kN/m^2 \times 3m = 0,021kN/m^2$

$Poly = 0,15kN/m^2 \times 3m = 0,045kN/m^2$

$$Gv = \frac{G}{\cos\alpha} = \frac{0,9kN/m^2}{\cos 28^\circ} = 1,0193kN/m$$

$$\square\ \square = \frac{5}{384} \times \frac{\square l^4}{\square \times \square}$$

$$\square it\square\square = \frac{1}{12} \times b \times \square^3 = \frac{1}{12} \times 140mm \times 250mm^3 = 182291666,666mm^4$$

$$\square\ \square = \frac{5}{384} \times \frac{\square l^4}{\square \times \square} = \frac{5}{384} \times \frac{1\frac{kN}{m} \times 8^4 m^4}{6000\frac{N}{mm^2} \times 182291666,66mm^4} = \frac{5}{384} \times \frac{4096m}{6 \times 182291666,66} = \frac{5}{384} \times \frac{4096m}{1093,749996} = \frac{5}{384} \times 3,744914m = 0,04876m$$

$doorbuiging \square\square\ 0,004 \times l$

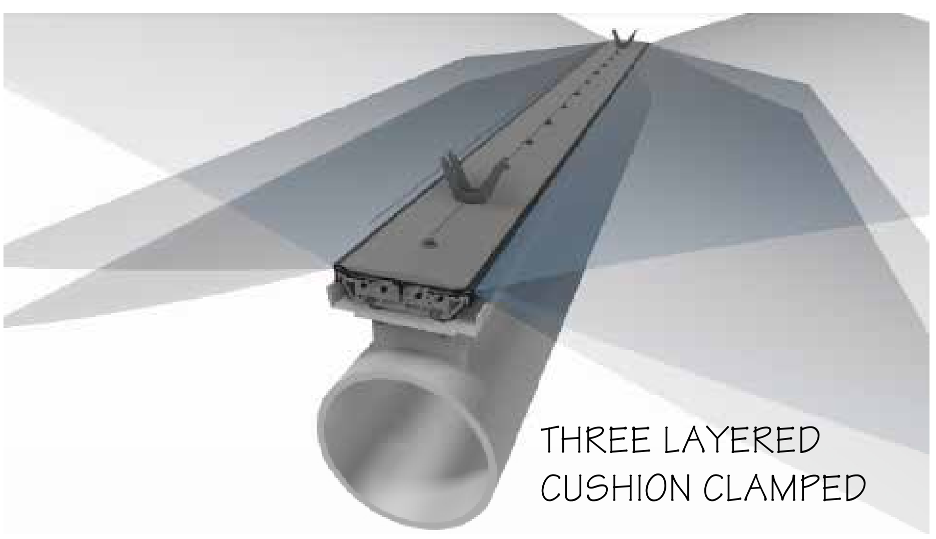
$doorbuiging \square\square\ 0,004 \times 8m$

$doorbuiging \square\square\ \square 0,032\square$

$\square oo\square\square\square\square\square\square s\square\square 0,04876\square$

$\square oo\square\square\square\square\square\square\square\square\square 0,0243809\square$

$\square oo\square\square\square\square\square\square\square\square\square 0,001024\square$



THREE LAYERED CUSHION CLAMPED

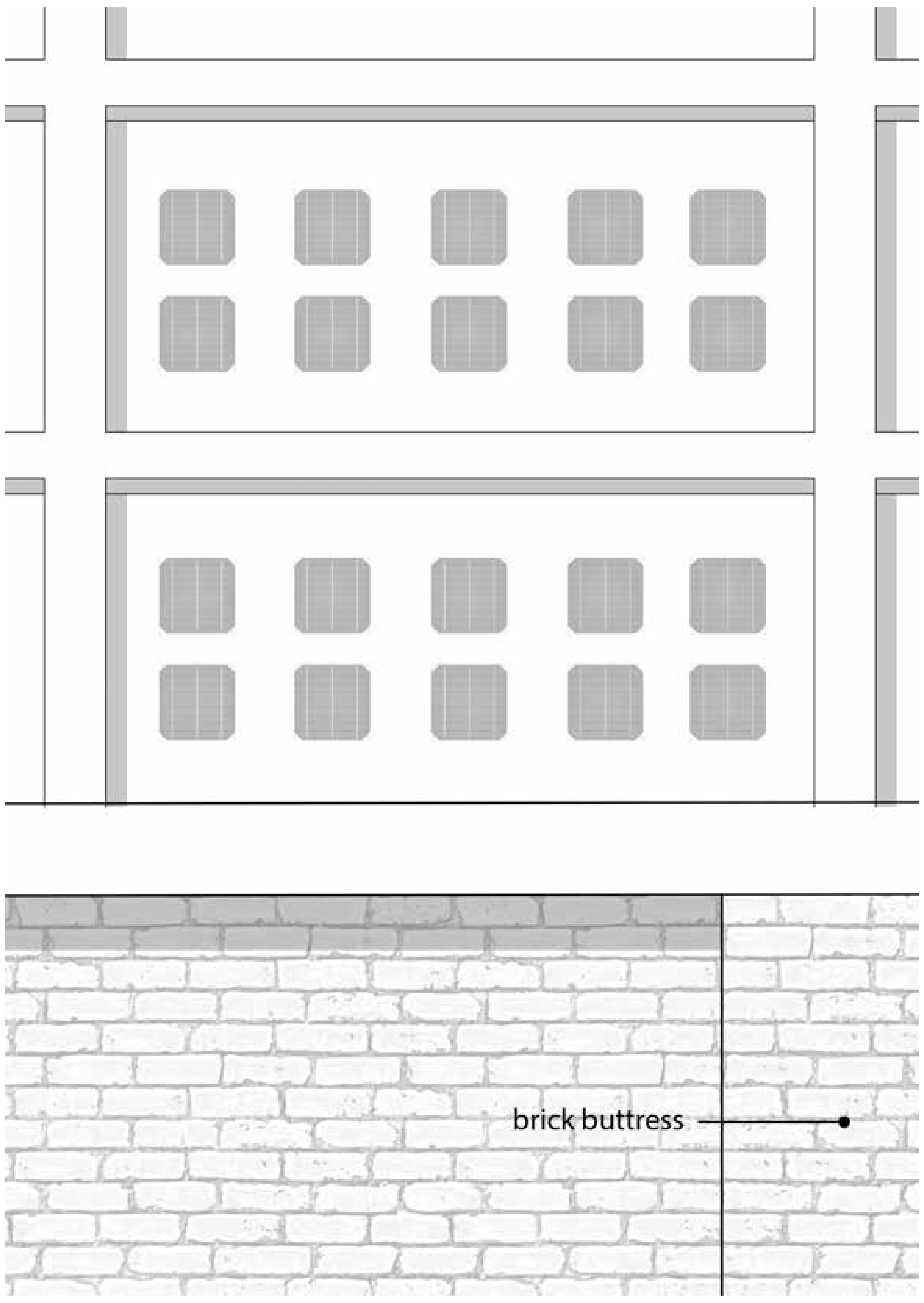
GUTTER EXTRUSION

NEW ROOF

# ENERGY

## SOLAR ENERGY

### ETFE CUSHION ROOF WITH INTEGRATED SOLAR PANELS




LET'S MAKE A FEW STATEMENTS :

- FROM THE RESEARCH PAPER WE CAN TAKE THAT A STANDARD OUTPUT OF 0,2 kWh PER 2 M² TAKES PLACE
- THE TOTAL SQUARE AREA OF THE SOLAR PANELS CAN BE ESTIMATED AT A MAXIMUM OF 1/3 OF THE ENTIRE ROOF, WHICH WOULD MEAN 4000 M²
- THE AMOUNT OF "SOLAR HOURS" (TOTAL HOURS OF SUN PER YEAR) FOR AMSTERDAM IS 2496 HOURS

WITH THIS INFORMATION, WE CAN CALCULATE THAT THE OUTPUT FOR THE ENTIRE AREA OF SOLAR CELLS WOULD BE APPROXIMATELY 400 kW. FOR AN ENTIRE YEAR THIS WOULD ROUND UP TO:

400 kW x 2496 HOURS OF SUN = 998400 kWh PER YEAR

IF WE USE THE HYPOTHESIS THAT A STANDARD LIGHTBULB USES 60W:

A BULB OF 60W = 525,6 kWh PER YEAR
998400 kWh PER YEAR / 525,6 kWh = APPR. 1890 BULBS, ALL YEAR ROUND

IF WE GATHER THE DATA FROM THE PHILIPS GROW LIGHT:

SPECIAL GROW LED USES 30W PER UNIT OR 0,03 KILOWATT
SO 0,03 kW * 24 HOURS * 365 DAYS = 0,03 kW * 8760 HOURS
= 262,8 kWh ENERGY TO LIGHT A BULB ALL YEAR ROUND

AND IF WE PLUG THE ENERGY WON FROM THE SOLAR CELLS INTO THE GROW LIGHTS:

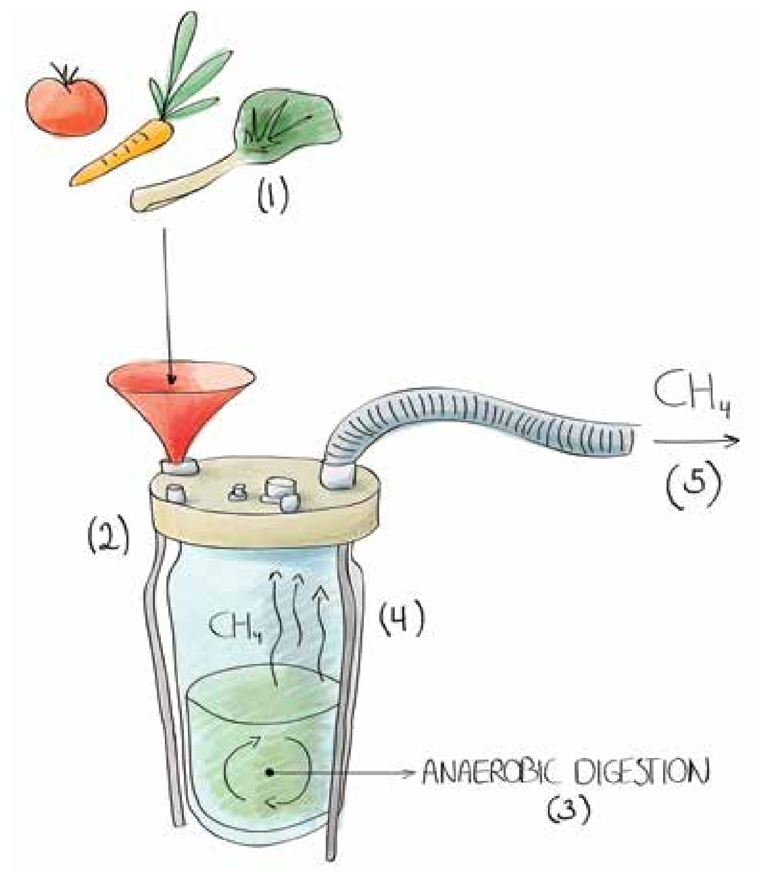
998400 kWh PER YEAR / 262,8 kWh = 3700 GROW LIGHTS YEAR ROUND

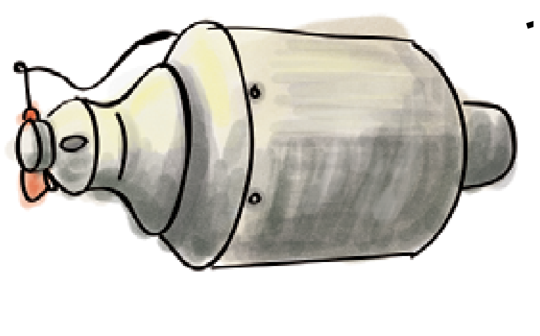
BUT ONLY 20 HOURS OF LIGHT ARE OPTIMAL FOR PLANT GROWTH

SO 0,03 kW * 20 HOURS * 365 DAYS = 0,03 kW * 7120 HOURS
= 213,6 kWh ENERGY TO LIGHT A BULB 20H ALL YEAR ROUND

998400 kWh PER YEAR/213.6 kWh = 4600 GROW LIGHTS 20h/DAY. YEAR ROUND

## BIOREACTOR AND MICROTURBINE



WHAT IS A BIOREACTOR?

A BIOREACTOR IS A CLOSED ENVIRONMENT WHERE A CHEMICAL PROCESS TAKES PLACE. THIS CAN BE WATER CLEANING, METHANE GAS PRODUCTION OR EVEN ALGAE GROWTH. IN THIS CASE I'M TALKING ABOUT THE PRODUCTION OF METHANE GAS.
THE CROP RESIDUE FROM THE AQUAPONIC SYSTEM (1) IS LOADED INTO THE BIOREACTOR (2). UNDER CONTROLLED CIRCUMSTANCES THE WASTE GOES THROUGH THE ANAEROBIC DIGESTION (3). THIS PROCESS INVOLVES A SERIES OF METABOLIC REACTIONS SUCH AS HYDROLYSIS, ACIDOGENESIS AND METHANOGENESIS (SEE "CHEMICAL CYCLE OF ANAEROBIC DIGESTION"). ONE OF THE PRODUCTS IS METHANE GAS (4). THIS IS WHAT WE WANT, SINCE IT CAN BE FUELED INTO A MICROTURBINE WHICH WILL USE IT TO GENERATE ELECTRICITY.

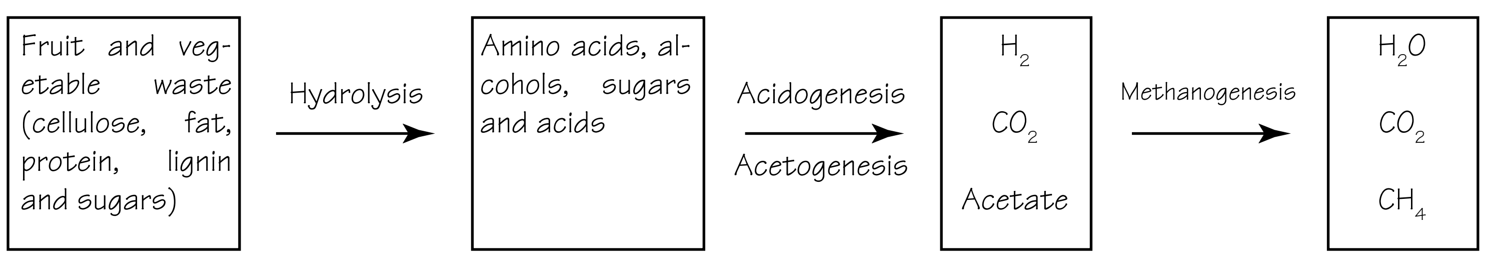
WHAT IS A MICROTURBINE?

MICROTURBINE OVERVIEW:

| | |
|---|---|
| COMMERCIALLY AVAILABLE | YES (LIMITED) |
| SIZE RANGE | 25-500 KW |
| FUEL | NATURAL GAS, HYDROGEN, PROPANE, DIESEL |
| EFFICIENCY | 20-30% (RECUPERATED) |
| ENVIRONMENTAL | LOW (<9-50 PPM) NOX |

MICROTURBINES ARE SMALL COMBUSTION TURBINES APPROXIMATELY THE SIZE OF A REFRIGERATOR WITH OUTPUTS OF 25 KW TO 500 KW. THEY EVOLVED FROM AUTOMOTIVE AND TRUCK TURBOCHARGERS, AUXILIARY POWER UNITS (APUS) FOR AIRPLANES, AND SMALL JET ENGINES. MOST MICROTURBINES ARE COMPRISED OF A COMPRESSOR, COMBUSTOR, TURBINE, ALTERNATOR, RECUPERATOR (A DEVICE THAT CAPTURES WASTE HEAT TO IMPROVE THE EFFICIENCY OF THE COMPRESSOR STAGE), AND GENERATOR.

*Chemical cycle of anaerobic digestion*




| | | | |
|---|---|---|---|
| TOTAL CROP RESIDUE | 283221,00 | KG | |
| METHANE YIELD | 400 | L/KG | |
| TOTAL METHANE YIELD | 113288400 | L | |
| TOTAL METHANE YIELD | 113288,4 | M³ | L -> M³ |
| 1 M³ METHANE IS 10 kWh | 1132884 | KWH | M³ -> kWh |

A STANDARD LIGHT IS 60 WATT OR 0,06 KILOWATT

SO 0,06 kW * 24 HOURS * 365 DAYS = 0,06 kW * 8760 HOURS
= 525,6 kWh ENERGY TO LIGHT A BULB ALL YEAR ROUND

AMOUNT OF BULBS: 2155 BULBS

SPECIAL GROW LED USES 30W PER UNIT OR 0,03 KILOWATT

SO 0,03 kW * 24 HOURS * 365 DAYS = 0,03 kW * 8760 HOURS
= 262,8 kWh ENERGY TO LIGHT A BULB ALL YEAR ROUND

AMOUNT OF LEDS: 4310 PHILIPS GROW LED'S

BUT ONLY 20 HOURS OF THE DAY
SO 0,03 kW * 20 HOURS * 365 DAYS = 0,03 kW * 7120 HOURS
= 213,6 kWh ENERGY TO LIGHT A BULB 20H ALL YEAR ROUND

AMOUNT OF LEDS: 5303 PHILIPS GROW LED'S

# CLIMATE

## COOLING

AFTER CALCULATION, THE BIGGEST IDENTIFIABLE PROBLEM IS OVERHEATING IN THE PLANT AREA OF THE BUILDING.

### LEAFY

| | |
|---|---|
| rough cooling load | 2562220 W = 2562 kW |
| % of toal cooling load | |
| internal load | 33% |
| heat load persons | 0,0% |
| heat load lighting | 27,6% |
| heat load machinery | 5,9% |
| external load | 67% |
| sun radiation through outside windows | 60,5% |
| transmission through outside windows | 3,9% |
| sun load through outside walls and roof | 0,1% |
| outside air supply | 2,0% |

### FRUITING

| | |
|---|---|
| rough cooling load | 3005552 W = 3006 kW |
| % of toal cooling load | |
| internal load | 33% |
| heat load persons | 0,0% |
| heat load lighting | 26,5% |
| heat load machinery | 6,6% |
| external load | 67% |
| sun radiation through outside windows | 64,9% |
| transmission through outside windows | 1,2% |
| sun load through outside walls and roof | 0,1% |
| outside air supply | 0,7% |

THIS CAN BE SOLVED BY TREATING THE ETFE CUSHIONS AND GIVING EACH LAYER A DIFFERENT MEASURE: THE TOP LAYER GETS A SPECIAL IR COATING THAT BLOCKS INFRARED, THE MIDDLE LAYER HOSTS SOLAR PANELS WHICH REDUCE SOLAR ENTRY AND THE BOTTOM LAYER IS MADE TRANSLUCENT WHICH ENSURES A REDUCTION OF 40% HEAT ENTRY.

### LEAFY

| | |
|---|---|
| rough cooling load | 1408192 W |
| % of toal cooling load | |
| internal load | 61% |
| heat load persons | 0,0% |
| heat load lighting | 50,2% |
| heat load machinery | 10,7% |
| external load | 39% |
| sun radiation through outside windows | 29,0% |
| transmission through outside windows | 6,3% |
| sun load through outside walls and roof | 0,2% |
| outside air supply | 3,7% |

### FRUITING

| | |
|---|---|
| rough cooling load | 1503186 W |
| % of toal cooling load | |
| internal load | 66% |
| heat load persons | 0,0% |
| heat load lighting | 52,9% |
| heat load machinery | 13,3% |
| external load | 34% |
| sun radiation through outside windows | 29,8% |
| transmission through outside windows | 2,4% |
| sun load through outside walls and roof | 0,3% |
| outside air supply | 1,4% |

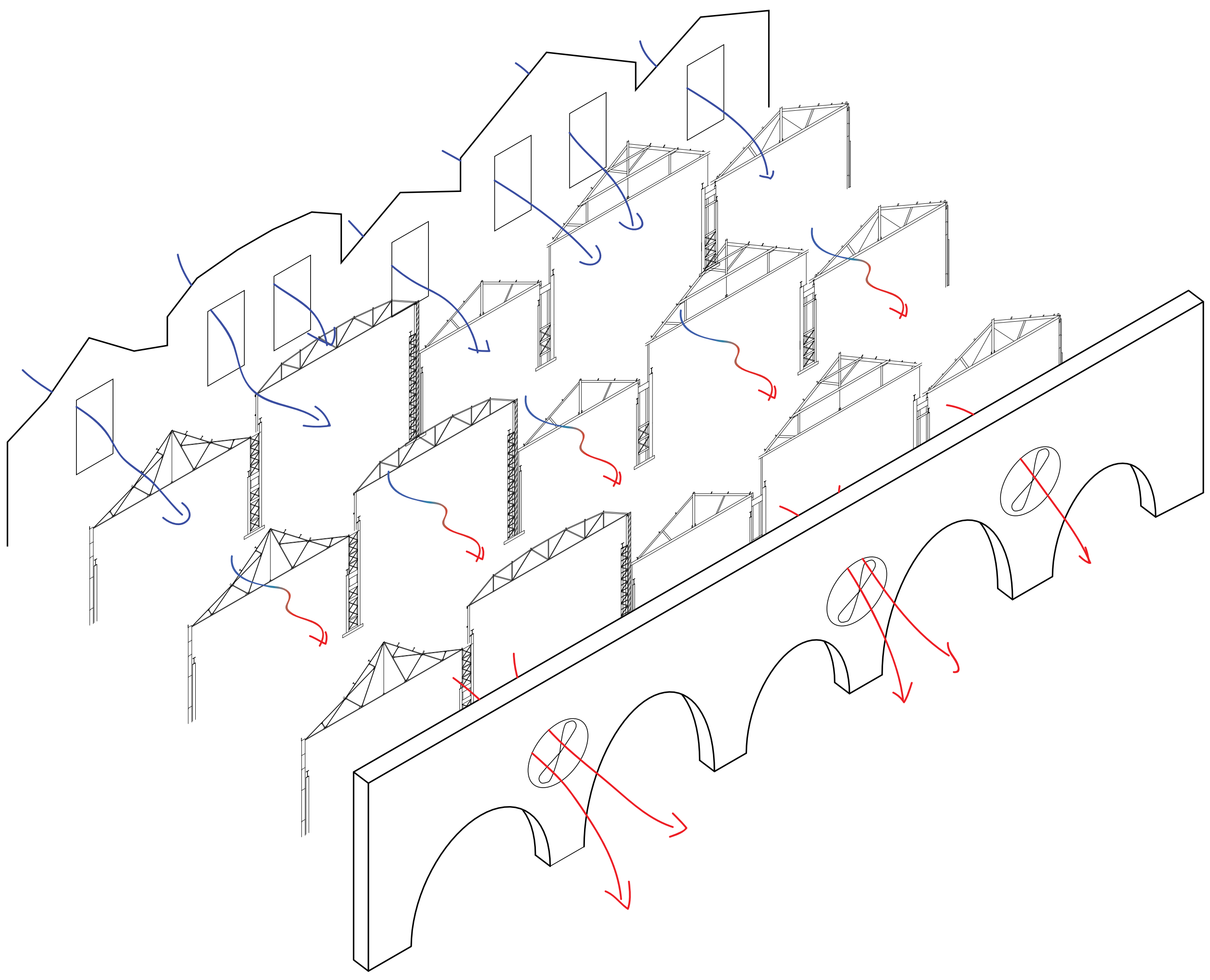
YOU CAN SEE THE HEAT LOAD PERCENTAGE CHANGE FROM EXTERNAL LOAD TO INTERNAL LOAD IN THE ABOVE NUMBERS. THE BIGGEST ISSUE NOW IS TO REDUCE THE HEATING LOAD CAUSED BY THE LIGHTING IN THE URBAN FARM SYSTEM. LUCKILY, THERE ARE SPECIAL GROW LIGHT SYSTEMS WITH LED'S THAT ARE DIRECTLY COOLED BY WATER!

**High Intensity Light Without the Heat**

**UNLEASH THE POWER OF WATER-COOLED LEDS**

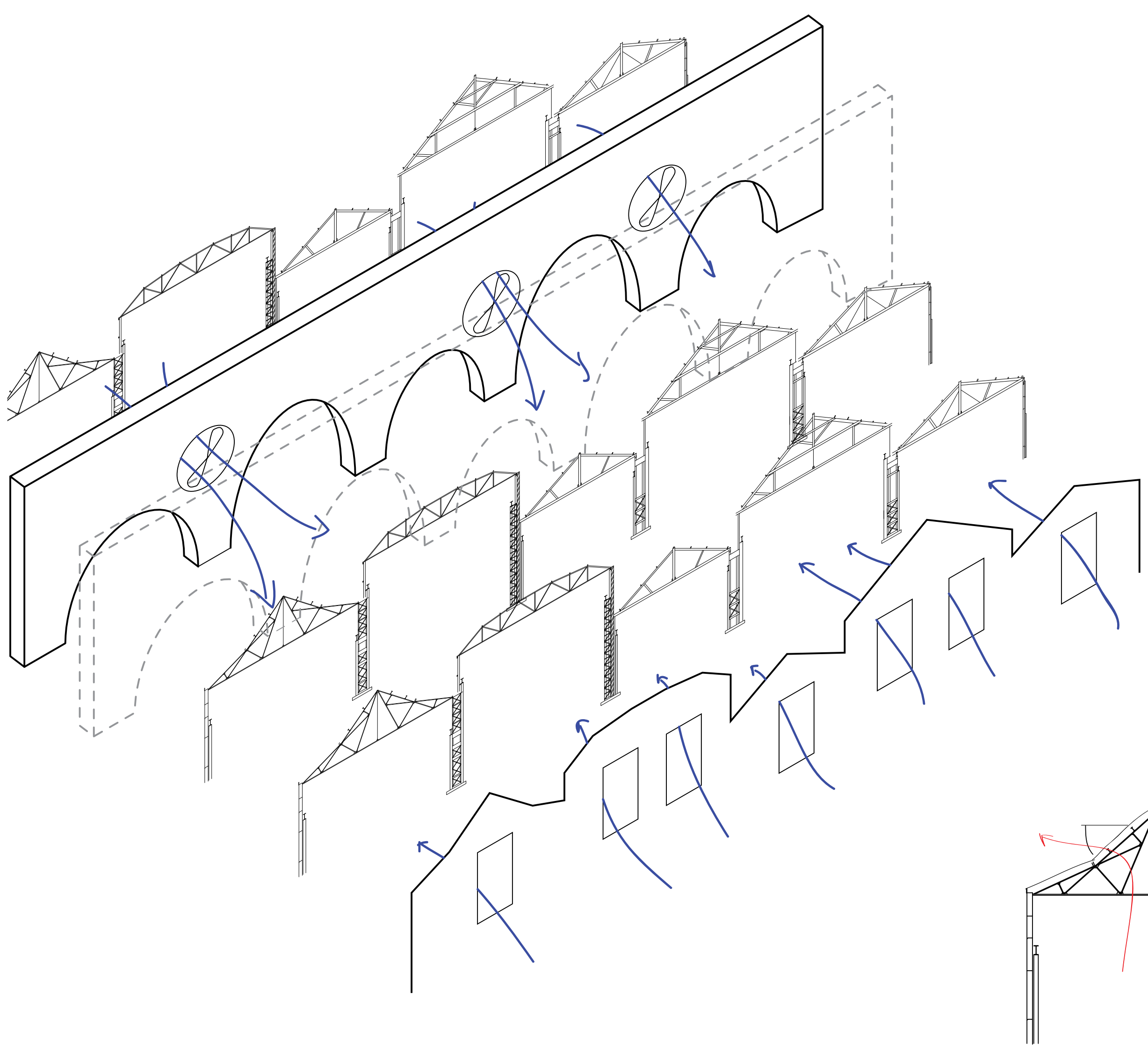
The CoolBar™ gives indoor growers more control over their growing environment with efficient, water-cooled technology. Using farmer-focused design, this high intensity light bar delivers the industry's top performance in a rugged aluminum body that holds up on a real farm. Unlike traditional LED fixtures, the CoolBar gives farmers the ability to perform in-farm maintenance as needed without sending it back to the manufacturer. Why is that important? Because farmers can't afford to lose production by taking their lights out of the system for days.

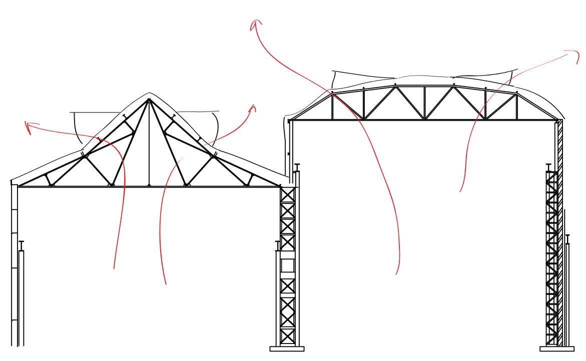
## VENTILATION



AIR INLET THROUGH THE FACADE, WITH VENTILATORS EXTRACTING THE HOT AIR TOWARDS THE PUBLIC AREA. THE INLET AIR CAN BE HEATED WITH FIWIHEX, WHICH IS BASICALLY A HEAT-EXCHANGE SYSTEM. THE SAME CAN BE DONE AT THE VENTILATORS TO COOL THE AIR GOING TO THE PUBLIC REA *AND WIN BACK THE HEAT).

THE PUBLIC AREA IS NATURALLY VENTILATED BY LETTING FRESH AIR IN THROUGH THE FACADE AND FROM THE PLANT AREA. THE USED AIR IS RELEASED THROUGH OPENINGS IN THE ETFE ROOF SYSTEM.






Seafood


market
fresh


RESTROOMS


cafe