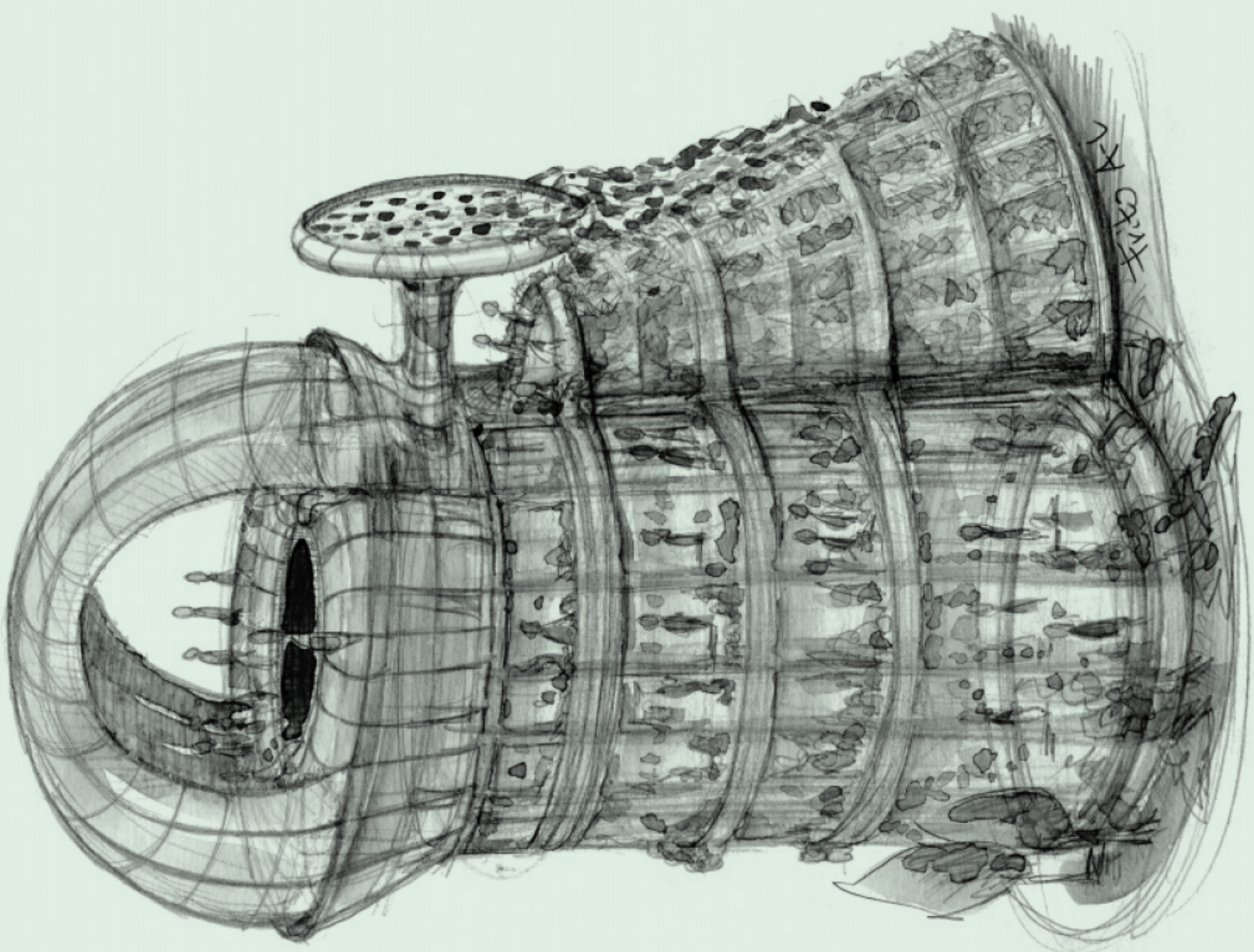
A NEW ROOT

architecture for food production



HOW CAN ARCHITECTURE BE DESIGNED FOR FOOD PRODUCTION TO HAVE AN IMPACT ON THE HEALTH OF PEOPLE AND THE ENVIRONMENT?

01 PRELIMINARY RESEARCH

PROJECT TYPOLOGY

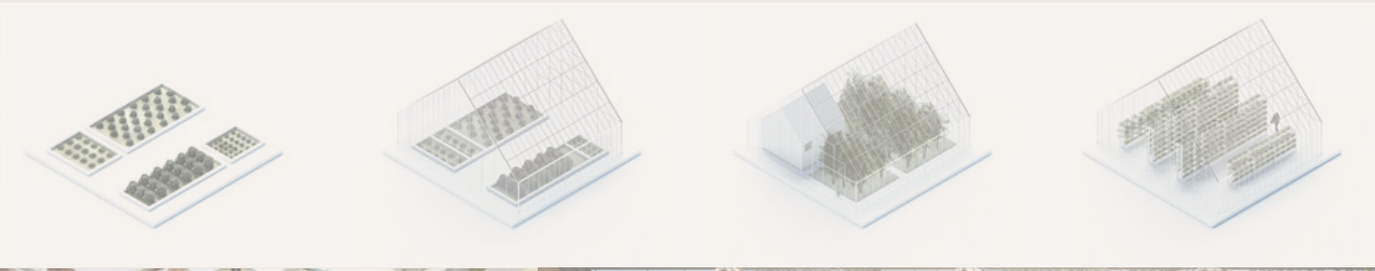
01 Stand-alone urban farm community center

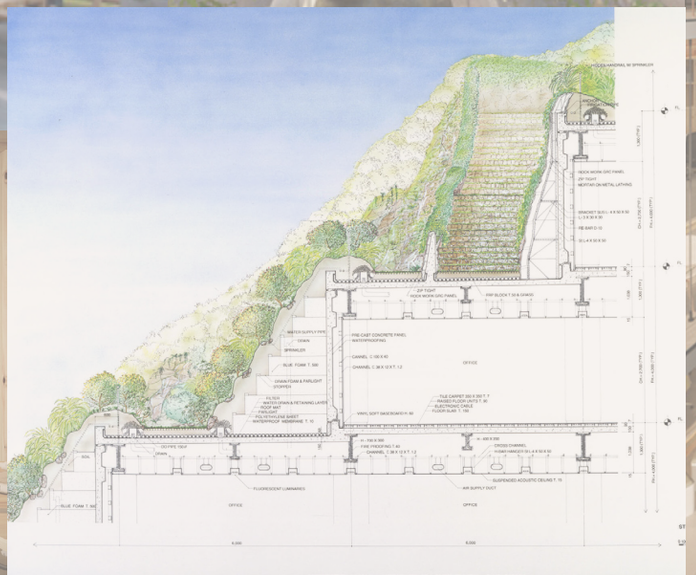
02 Mixed-use building typology with built in vertical farming

03 Farms integrated into a grocery store

04 Institutional farms for research/education, campus

TYPOLOGICAL RESEARCH





HEALTH

access to healthy food
food-health literacy
healthy eating
physical activity

SOCIAL

empowerment + mobilization
youth development + education
food security
safe spaces
socially integrated aging

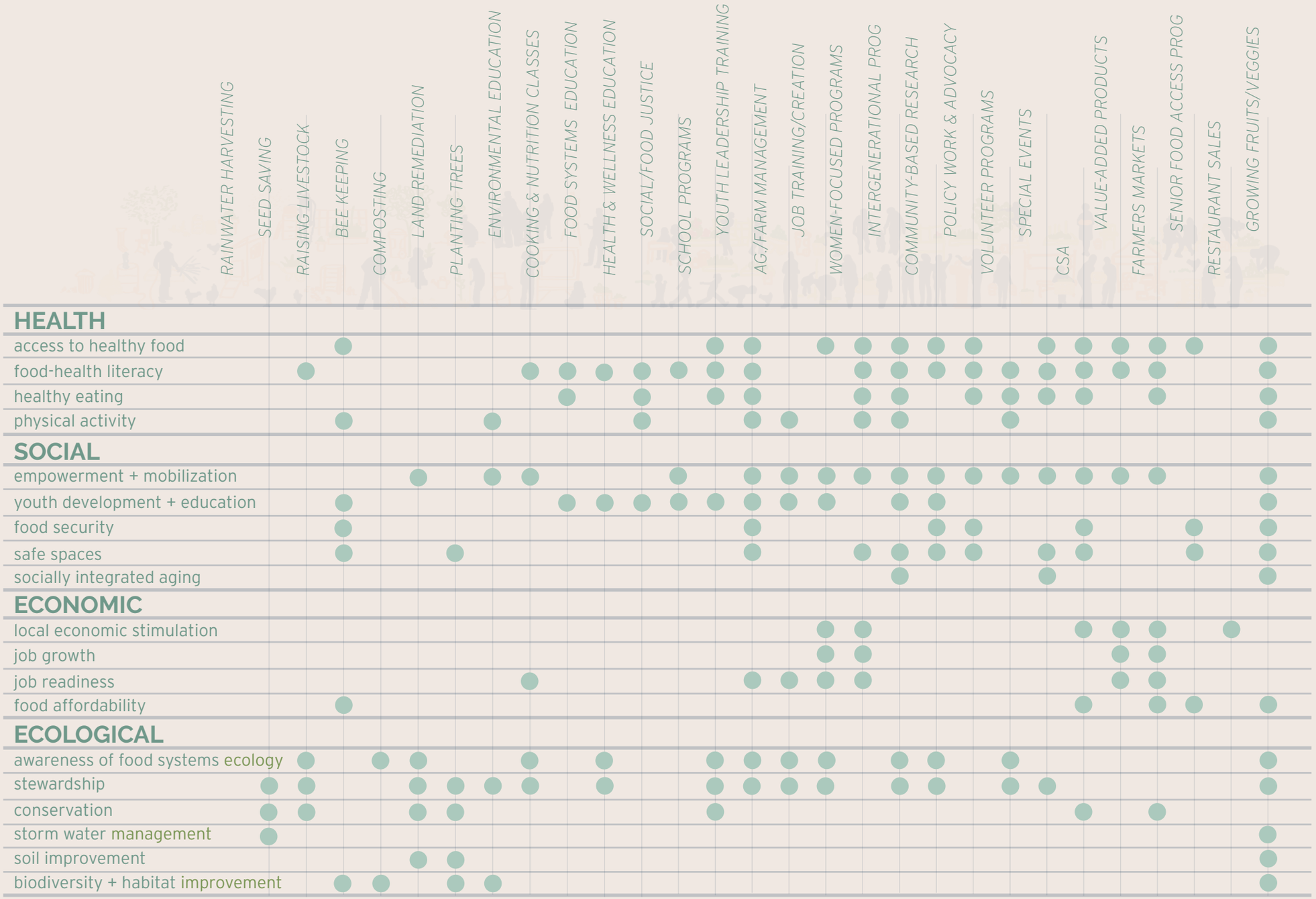
ECONOMICAL

local economic stimulation
job growth
job readiness
food affordability

ECOLOGICAL

awareness of food systems ecology
stewardship
conservation
storm water management
soil improvement
biodiversity+ habitat improvement

benefits


RAINWATER HARVESTING
SEED SAVING
RAISING LIVESTOCK
BEE KEEPING
COMPOSTING
LAND REMEDIATION
PLANTING TREES
ENVIRONMENTAL EDUCATION
COOKING & NUTRITION CLASSES
FOOD SYSTEMS EDUCATION
HEALTH & WELLNESS EDUCATION
SOCIAL/FOOD JUSTICE
SCHOOL PROGRAMS
YOUTH LEADERSHIP TRAINING
AG./FARM MANAGEMENT
JOB TRAINING/CREATION
WOMEN-FOCUSED PROGRAMS
INTERGENERATIONAL PROG
COMMUNITY-BASED RESEARCH
POLICY WORK & ADVOCACY
VOLUNTEER PROGRAMS
SPECIAL EVENTS
CSA
VALUE-ADDED PRODUCTS
FARMERS MARKETS
SENIOR FOOD ACCESS PROG
RESTAURANT SALES
GROWING FRUITS/VEGGIES
HEALTH
access to healthy food
food-health literacy
healthy eating
physical activity
SOCIAL
empowerment + mobilization
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job growth
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ECOLOGICAL
awareness of food systems ecology
stewardship
conservation
storm water management
soil improvement
biodiversity + habitat improvement

metrics

PROJECT EMPHASIS

01 Design Sustainably

02 Community Connections

03 Design for Year-Round Usage

04 Accessibility & Convenience

05 Implementation of Educational Opportunities

MAJOR PROJECT ELEMENTS

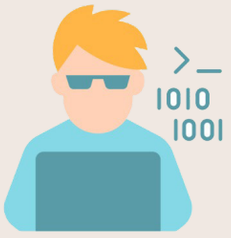
SPACES

- crop beds, growing structures, greenhouse
- waste, green waste, composting and recycling
- bulk materials storage
- tool and facilities storage
- produce washing and packing stations
- retail
- educational aspects

ATTRIBUTES

- greywater system
- water storage cisterns
- water harvesting system
- irrigation system
- solar energy collection system and converter

USER & CLIENT DESCRIPTION



hobbyists

workers

specialists

researchers

tenants

shoppers

children

adults

elderly

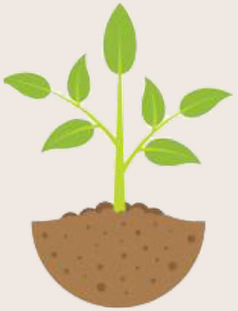
students

families

couples

singles

GOALS OF THE PROJECT



Theoretical Goals

Generate a project that stresses the importance of a research-based design that utilizes my previous educational knowledge. 01

Create a primary example, future designers and architects can reference when moving forward with more sustainable vertical farming practices 02

Provide various solutions of how these urban farms can take shape – stand-alone, attached to other buildings, inside markets, etc. 03

Physical Goals

Design indoor urban farms that are sustainable and can be maintained year-round in less suitable agricultural climates 01

Create solutions that do not harm current architecture but instead contribute to the future 02

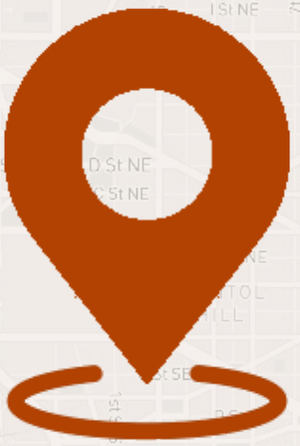
Social Goals

Create a contribution to the community through the proposed urban farms 01

Educate people on the importance of the future of our environment, the future of food, and how architecture can play a role in that 02

02 SITE RESEARCH

THE SITE



WASHINGTON, D.C.,
UNITED STATES

QUICK FACTS

population

701,974

density

10,984 people per square mile

parks

643+

parkland

7,800 acres

THE NUMBERS

#1 city for public transit

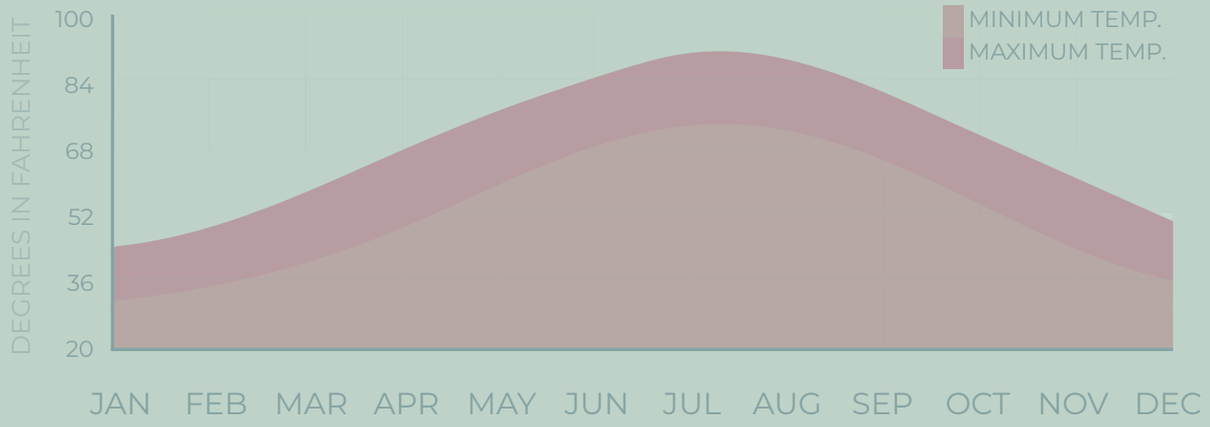
#3 greenest city in america

#1 city with access to farmers' markets

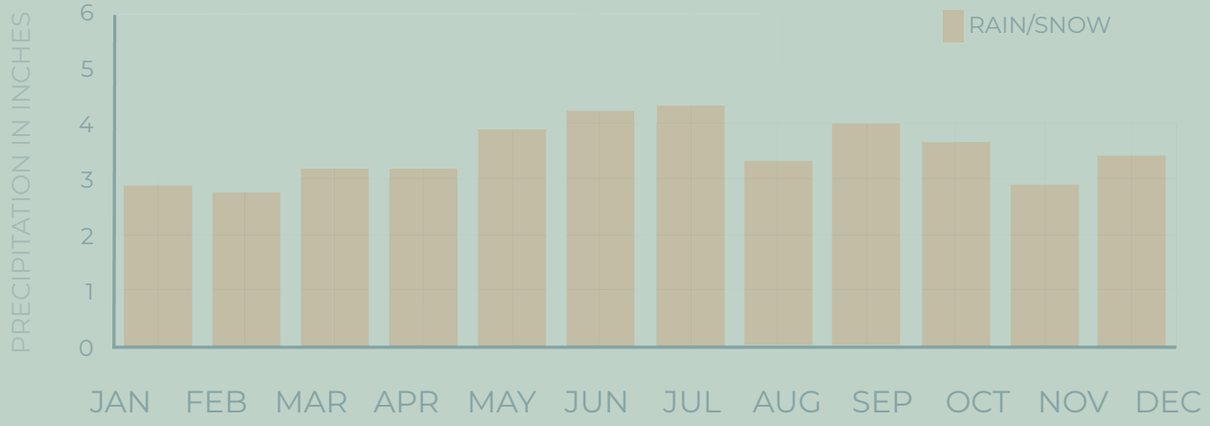
35+ organizations that focus on sustainability

climate data

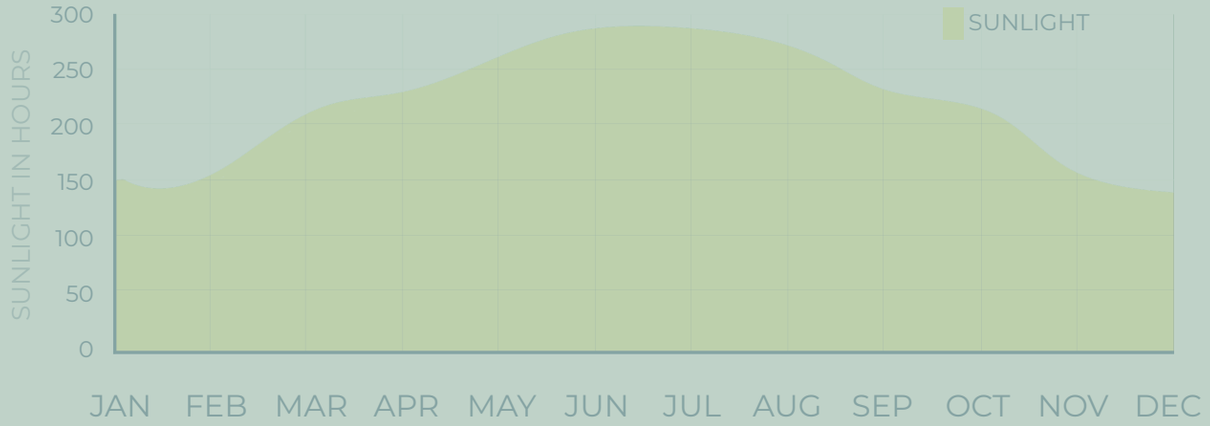
AVERAGE TEMPERATURES

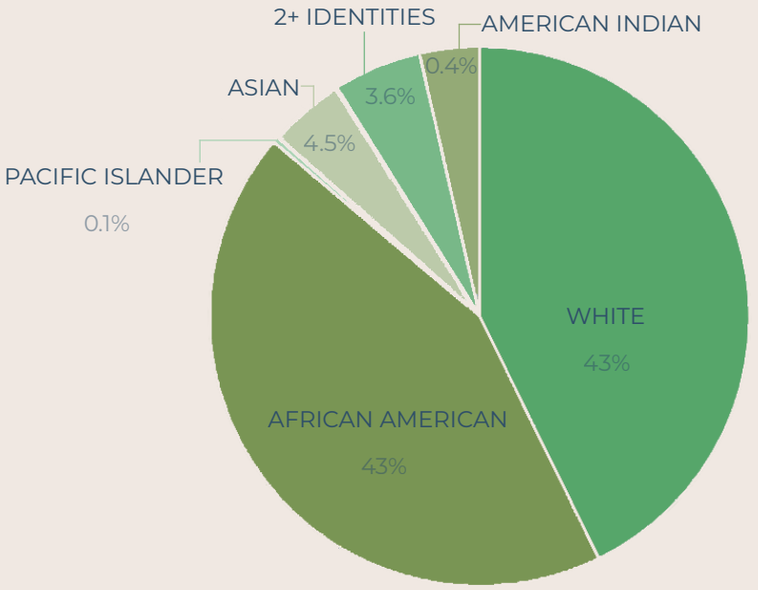


AVERAGE PRECIPITATION

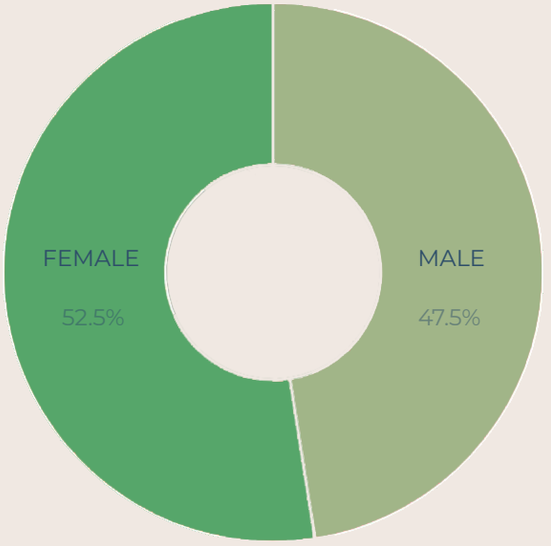


AVERAGE SUNLIGHT



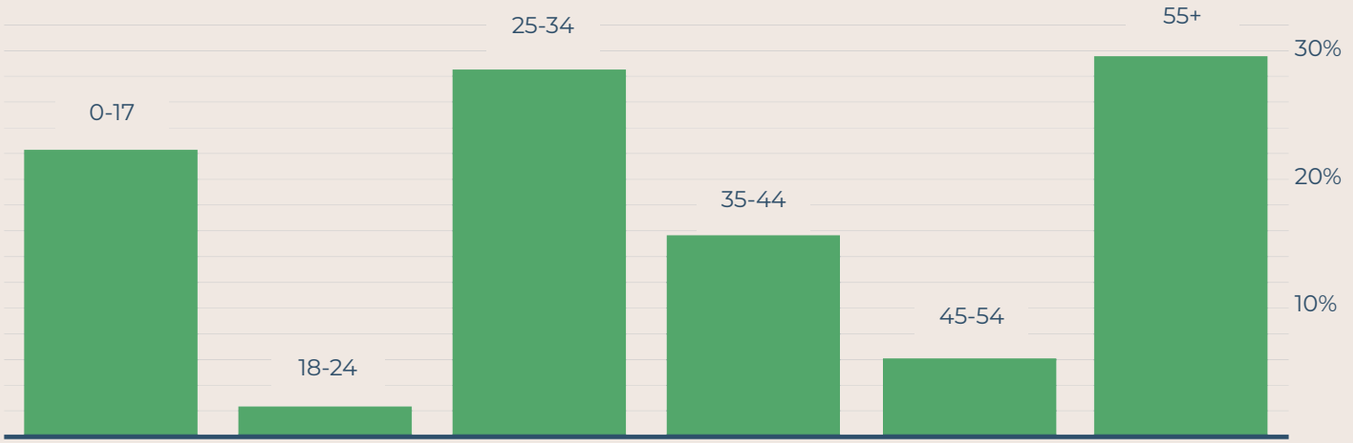


POPULATION BY RACE (%)



POPULATION BY GENDER (%)

demographics

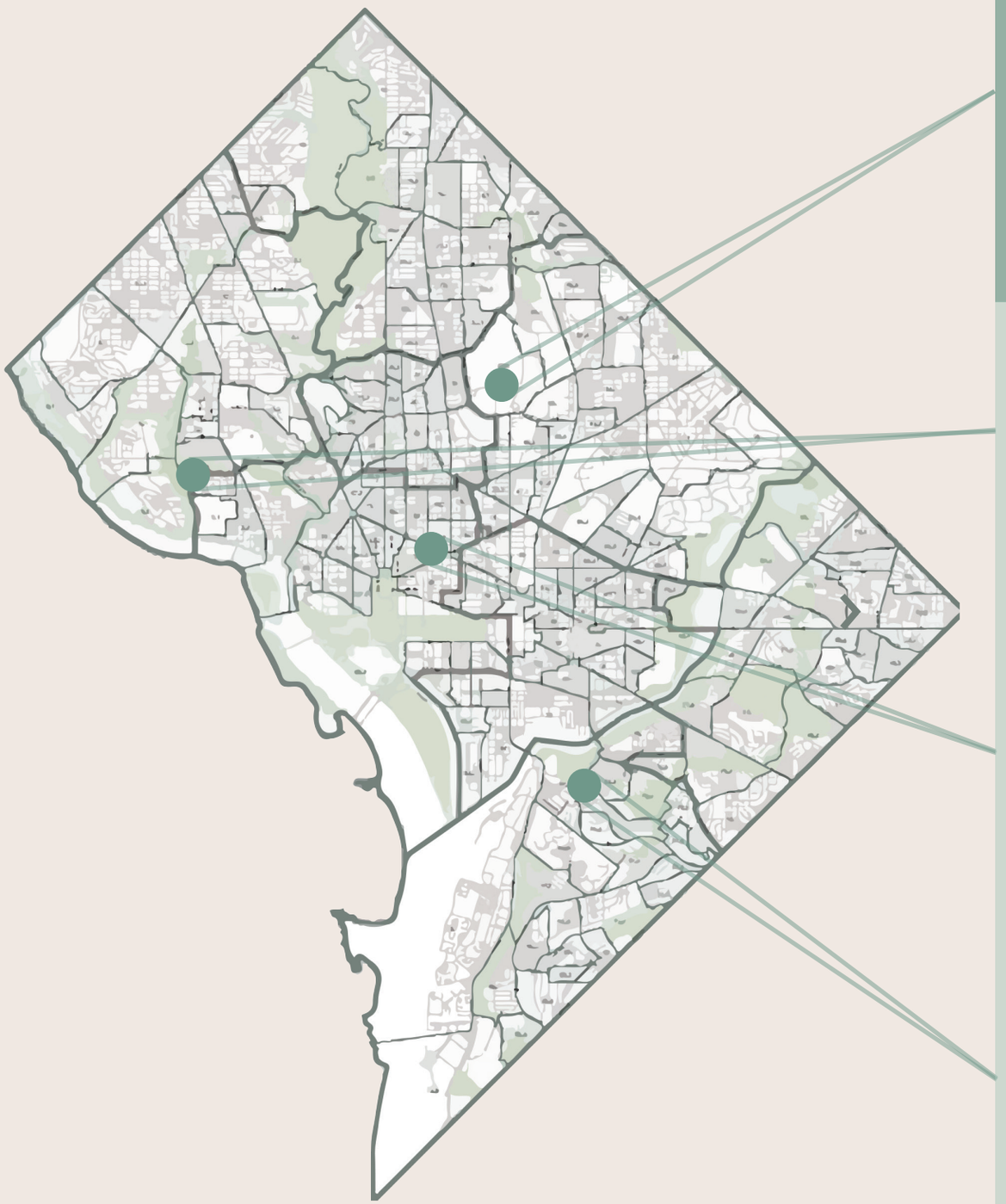


POPULATION BY AGE (%)

HOUSEHOLDS	FAMILIES
316,586 HOUSEHOLDS	131,238 FAMILIES
AVERAGE HOUSEHOLD SIZE	**HOUSEHOLDS WITH CHILDREN**
2.060 PERSONS	63,900 HOUSEHOLDS (20%)

HOUSEHOLD DATA

demographics



COMMUNITY COMPLEX

overview

50.00 ACRES

WARD 5

UNZONED PARCEL(S)

INSTITUTIONAL GARDENS

satellite location 1

overview

1.25 ACRES

WARD 2

R-3 ZONING

MIXED-USE FACILITY

satellite location 2

overview

0.50 ACRES

WARD 6

D-6 ZONING

MARKETPLACE FARMS

satellite location 3

overview

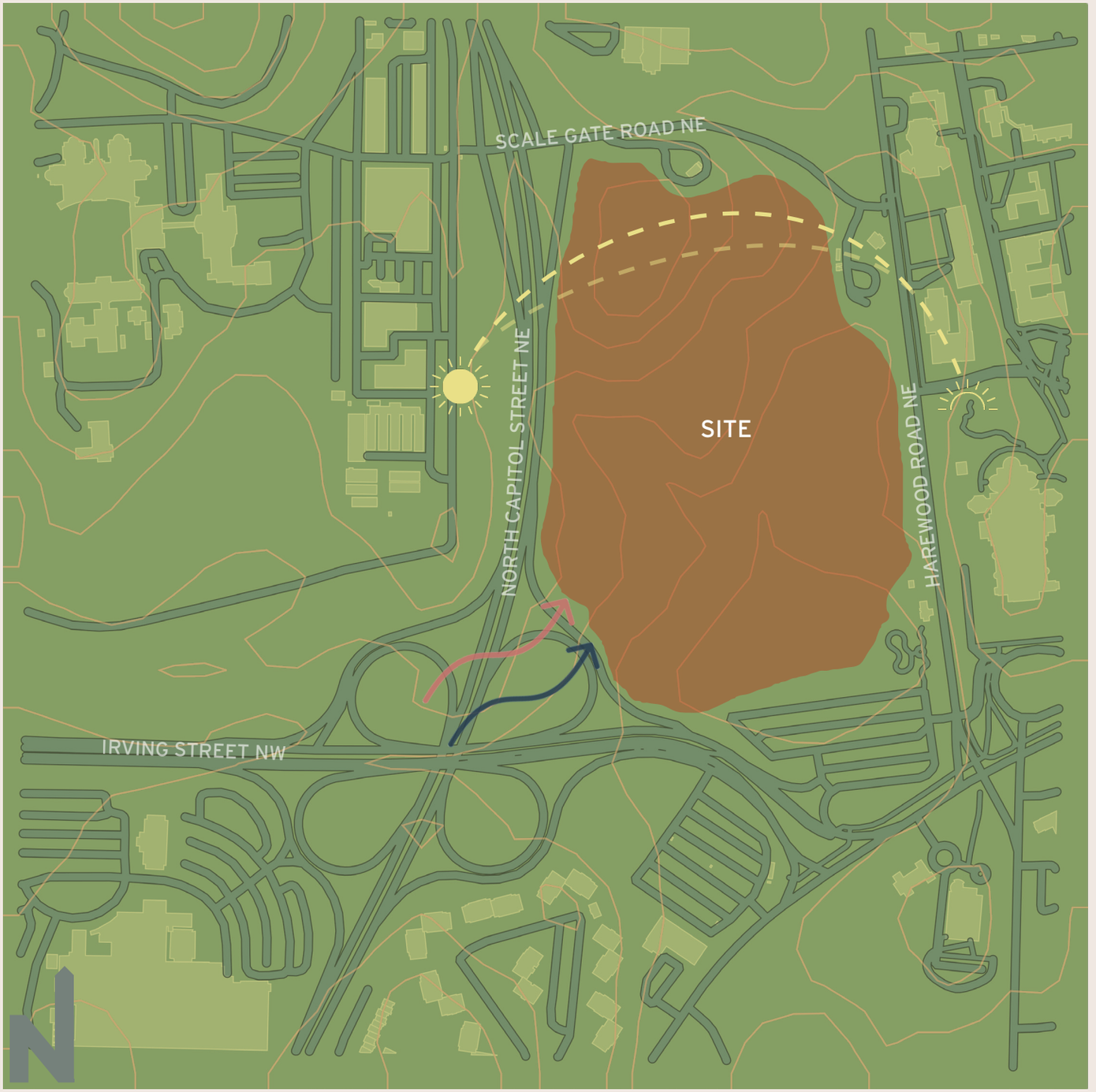
1.00 ACRES

WARD 8

MU-14 ZONING

COMMUNITY COMPLEX

3850 HAREWOOD ROAD NE

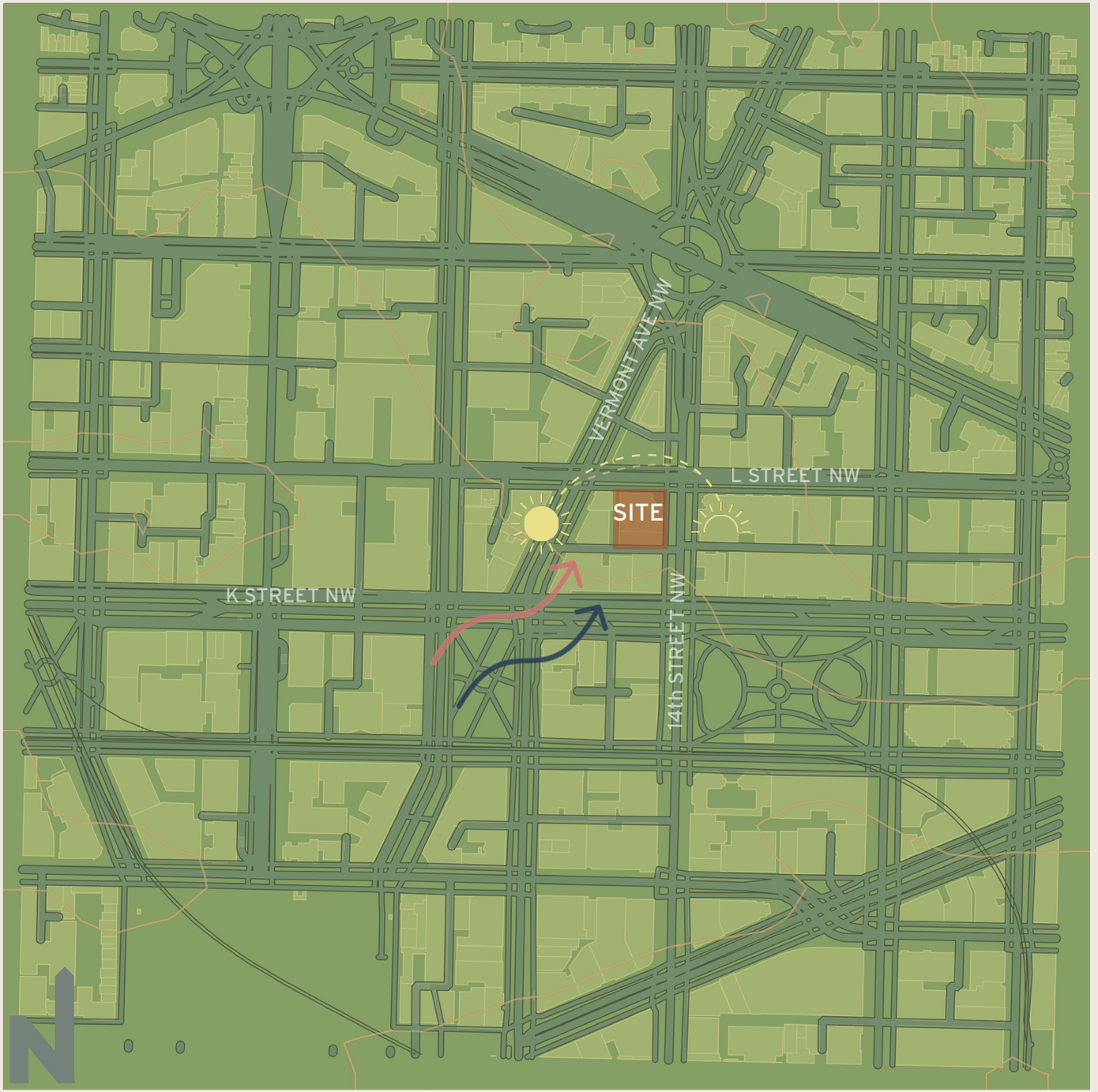


INSTITUTIONAL GARDENS

4010 RESEVOIR ROAD NW

MIXED-USE FACILITY

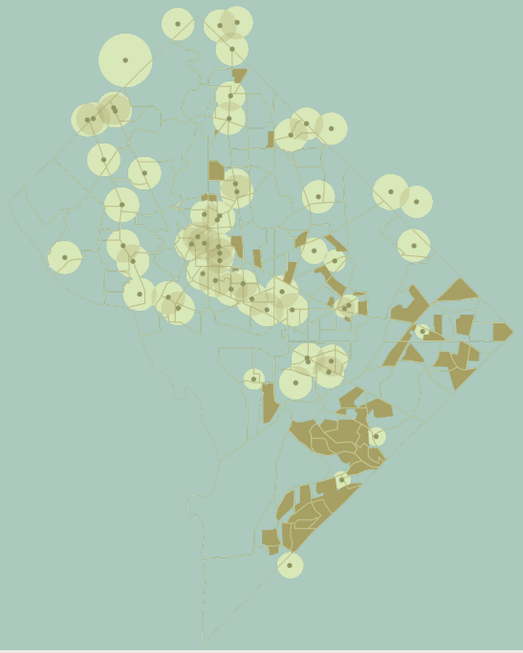
1400 L STREET NW



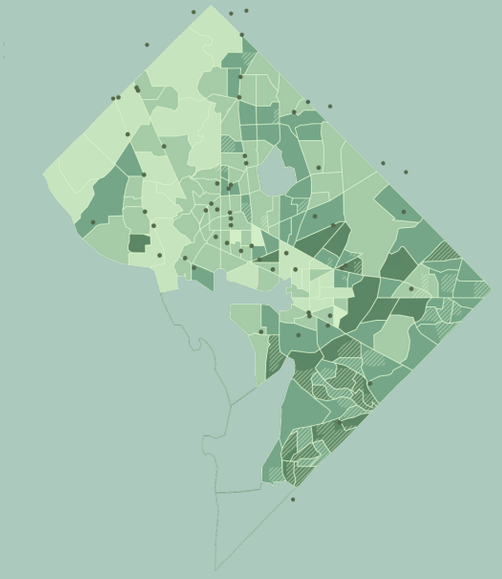
MARKETPLACE FARMS

1101 HOWARD ROAD SE

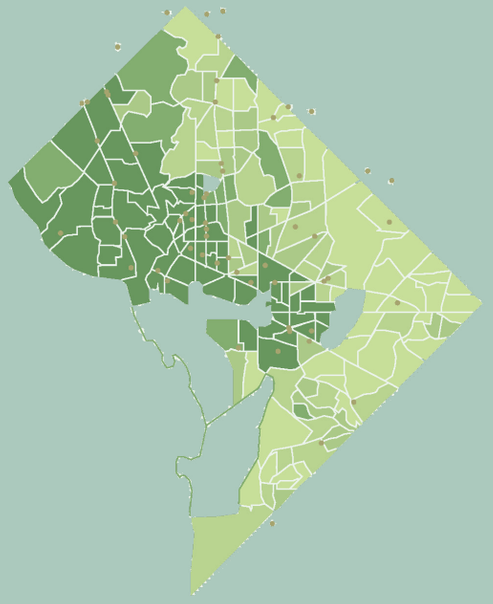
Food Deserts & Walkability



Food Access & Median Income



Food Access & Diabetes Populations



metrics

03 DESIGN RESEARCH

TRADITIONAL FARMING

VS

VERTICAL FARMING

80%
LAND IN USE

50%
OF CROPS ARE UNHARVESTED

70%
GLOBAL FRESH WATER USED IN SOIL-BASED FARMING

FOOD MILES
1500 TO 2000 MILES FROM FARM TO PLATE

0%
LAND IN USE

90%
OF CROPS ARE HARVESTED

70%-95%
LESS FRESH WATER USED FOR VERTICAL FARMING

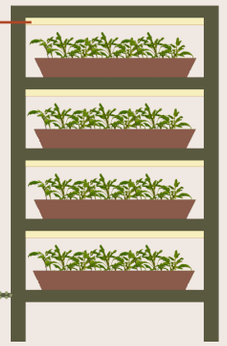
LOCAL
DECREASES NEED OF FOSSIL FUELS AND ENSURES QUALITY

methods

VERTICAL GROWING SYSTEM

1,016 PLANTS

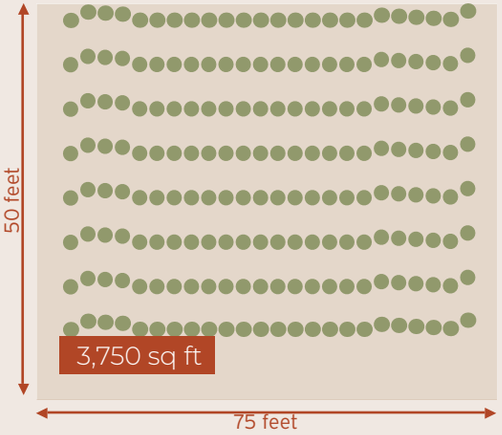
LED lights lead to 70% of energy savings and can be manipulated to alter the flavor of the plant



water and nutrient mix; nitrogen, phosphorous and potassium

TRADITIONAL CROP

1,016 PLANTS



relies on sun for growth

relies on rain for water

methods

PERFORMANCE CRITERIA

one

energy consumption

two

environmental performance

three

environmental impact

four

behavioral performance

five

code compliance

SPACE EFFICIENT

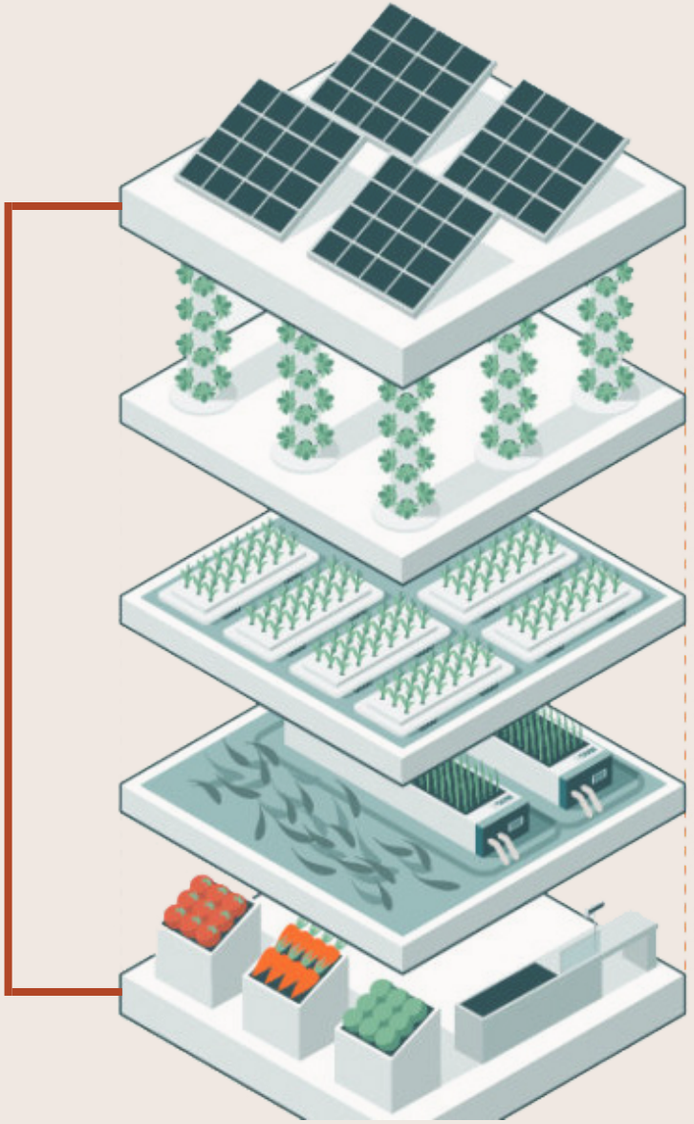
A vertical farm can grow 1 ton of lettuce with just 17% of the space needed by a traditional farm

LESS CHEMICALS

Indoor farming requires no pesticides, which in 71% of cases have been found to contaminate soil and reduce biodiversity

WATER CONSERVATION

By recirculating water, vertical farms can grow food with up to 90% less water



RENEWABLE ENERGY SOURCES

Artificial lighting and climate control systems require lots of energy

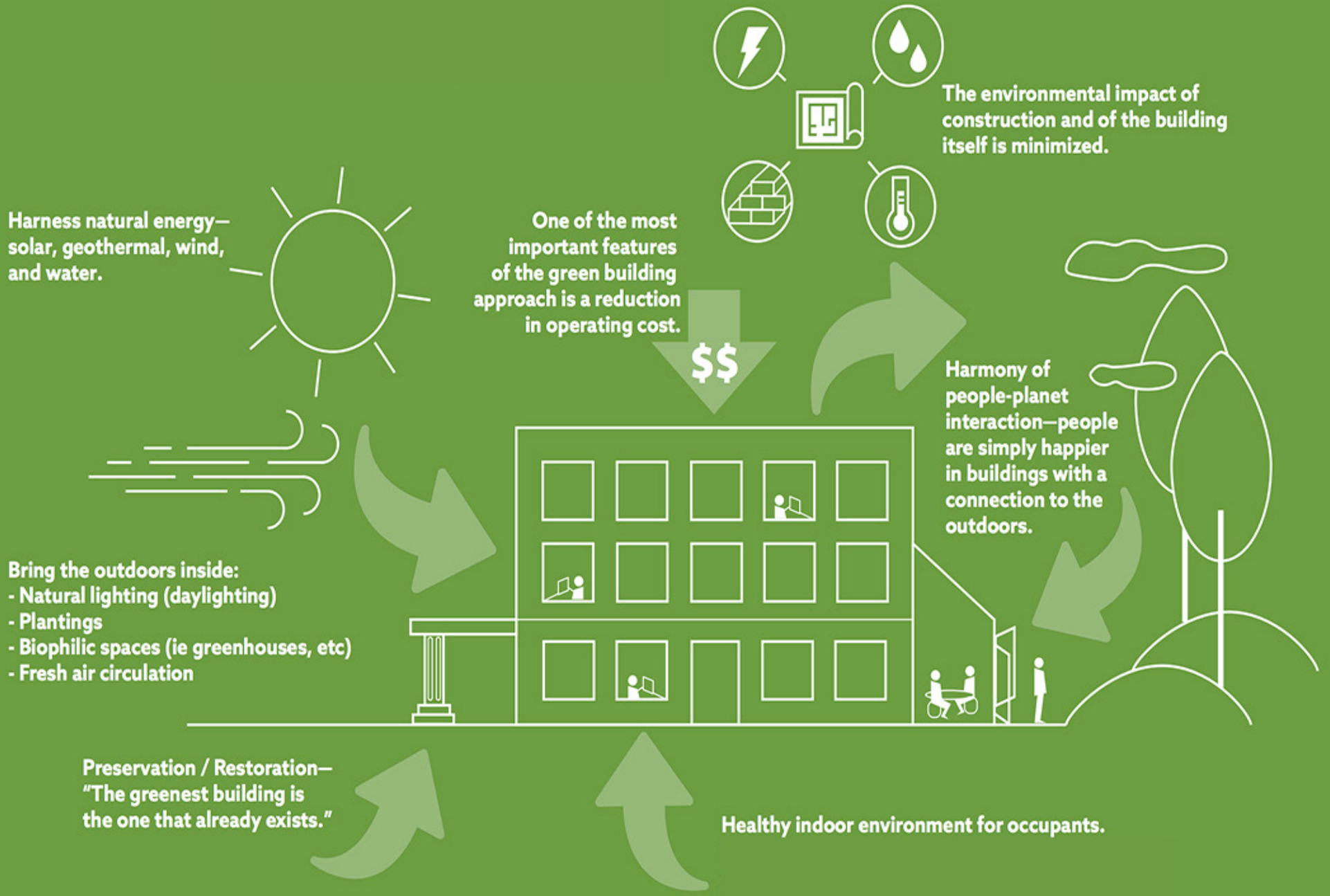
CONTROLLED ENVIRONMENT AGRICULTURE (CEA)

CEA refers to technologically advanced indoor farming

WASTE REDUCTION

Closer proximity to urban areas can shorten the supply chain and reduce food waste

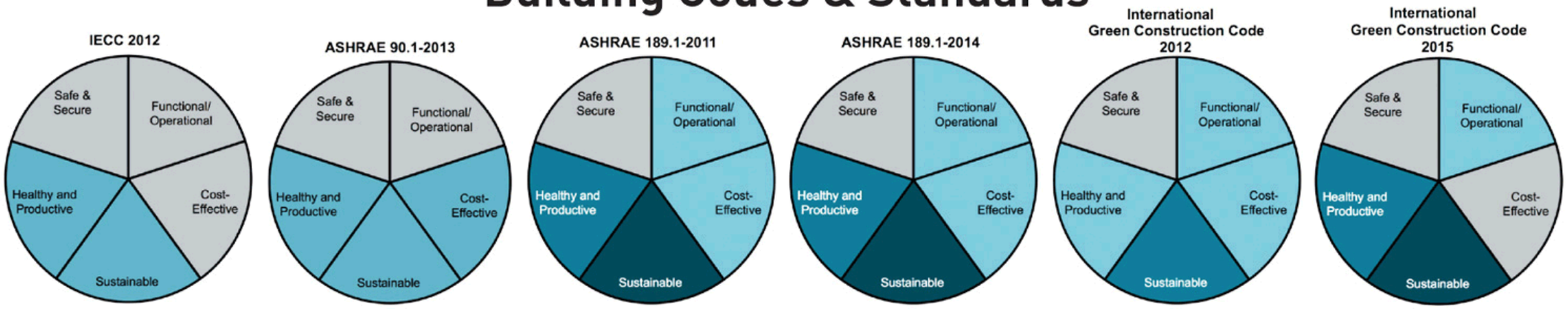
energy consumption



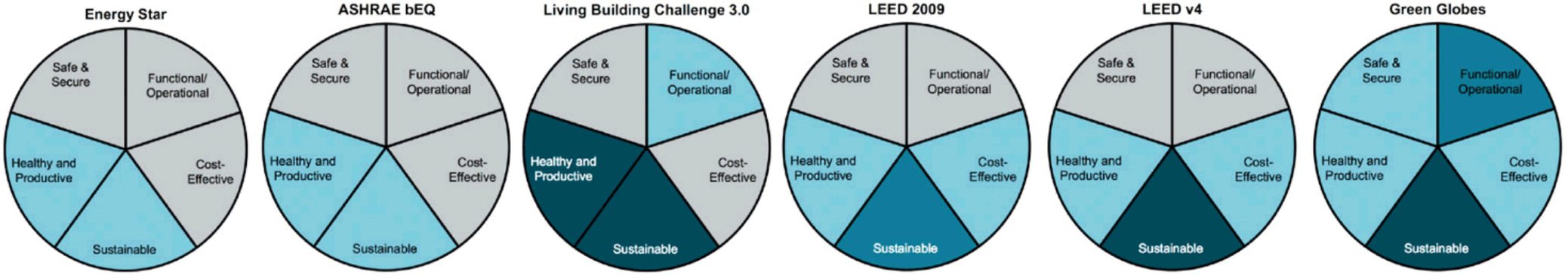
environmental performance

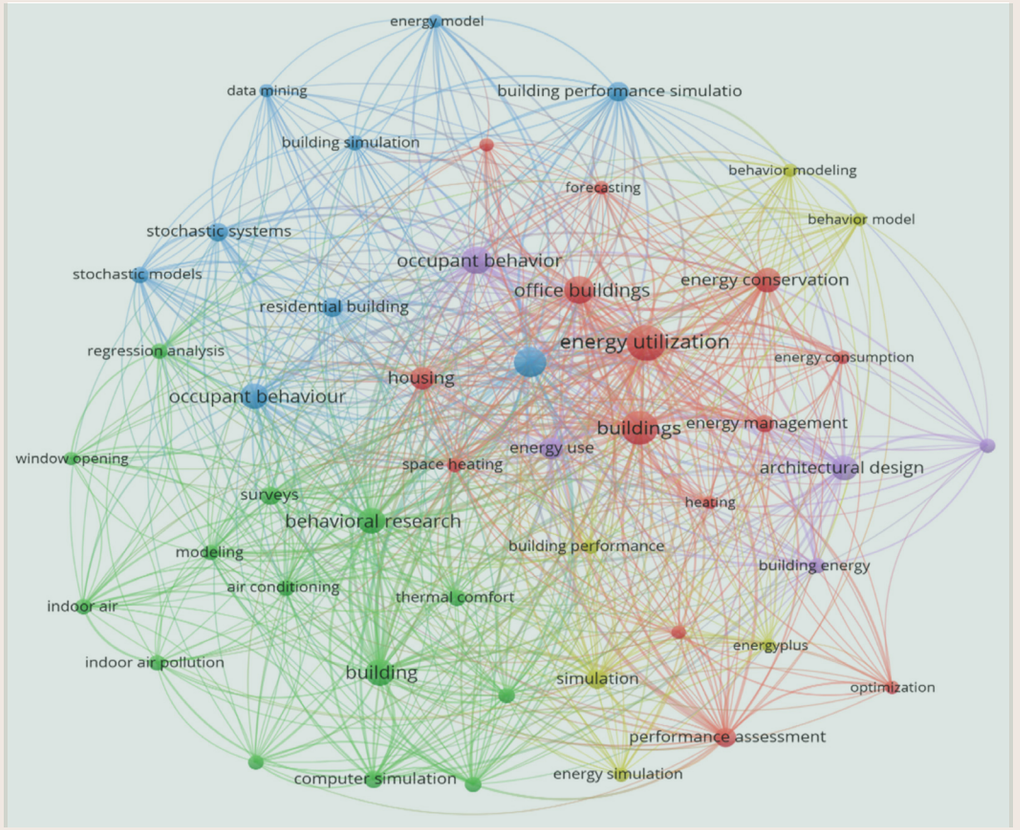
Complete Perspective | Partial Perspective | Minimal Perspective | Not Addressed

Building Codes & Standards



Rating Systems & Certifications





*all of the building's beahvioral performance criteria is tracked through automoated technological systems

24-HOUR FUNCTIONS

GROWING

requires LED lighting, water usage, temperature/humidity control

16-HOUR FUNCTIONS

FACILITIES

requires energy, water and other resources for building to function during standard usages

EMPLOYEE ACCESS

resources required for necessary tasks for personnel to complete during business hours

PUBLIC ACCESS

requires electricity and water resources for public usage

behavioral performance

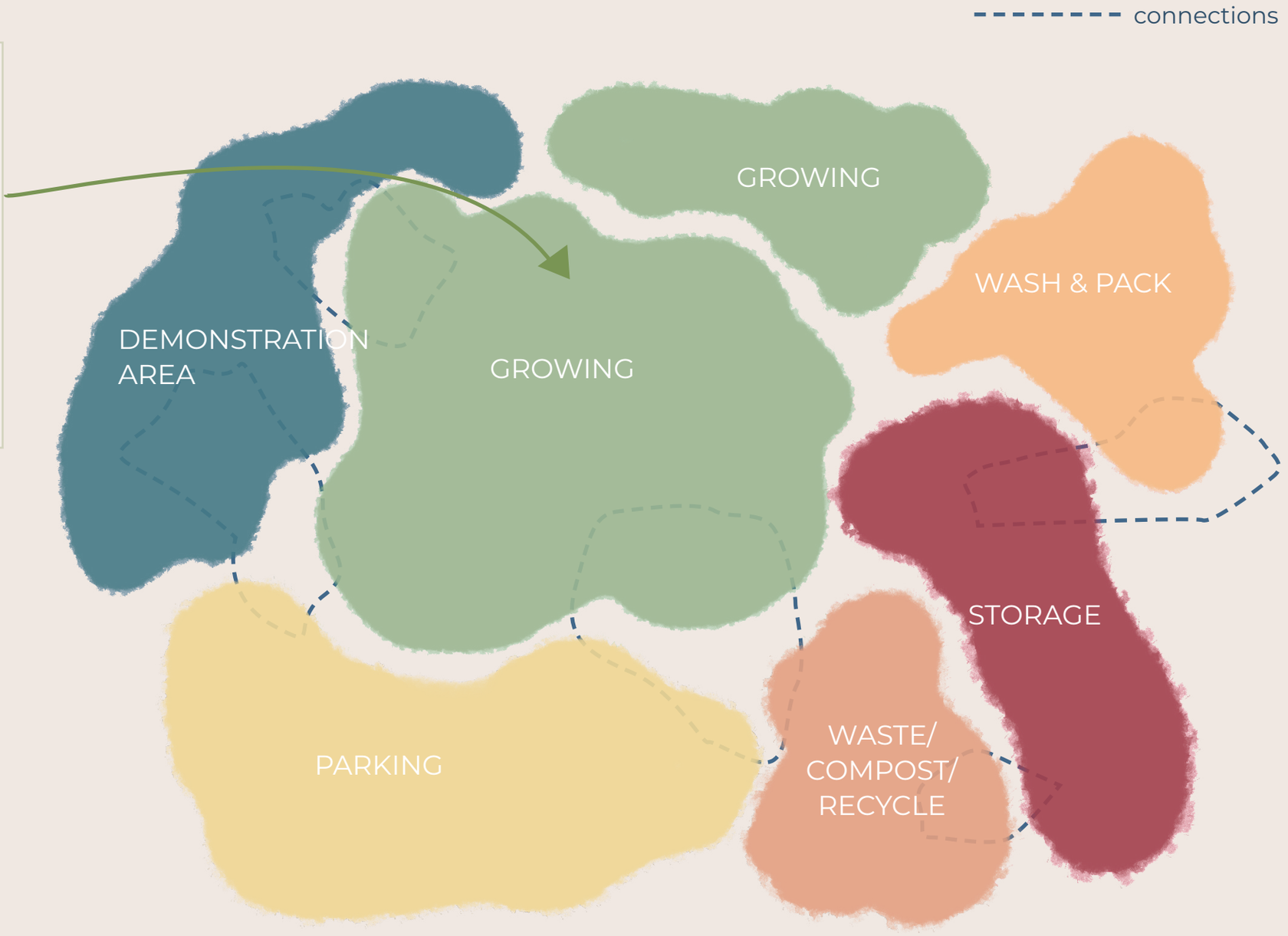
code compliance

SPATIAL ALLOCATION

INCORPORATED WITHIN:

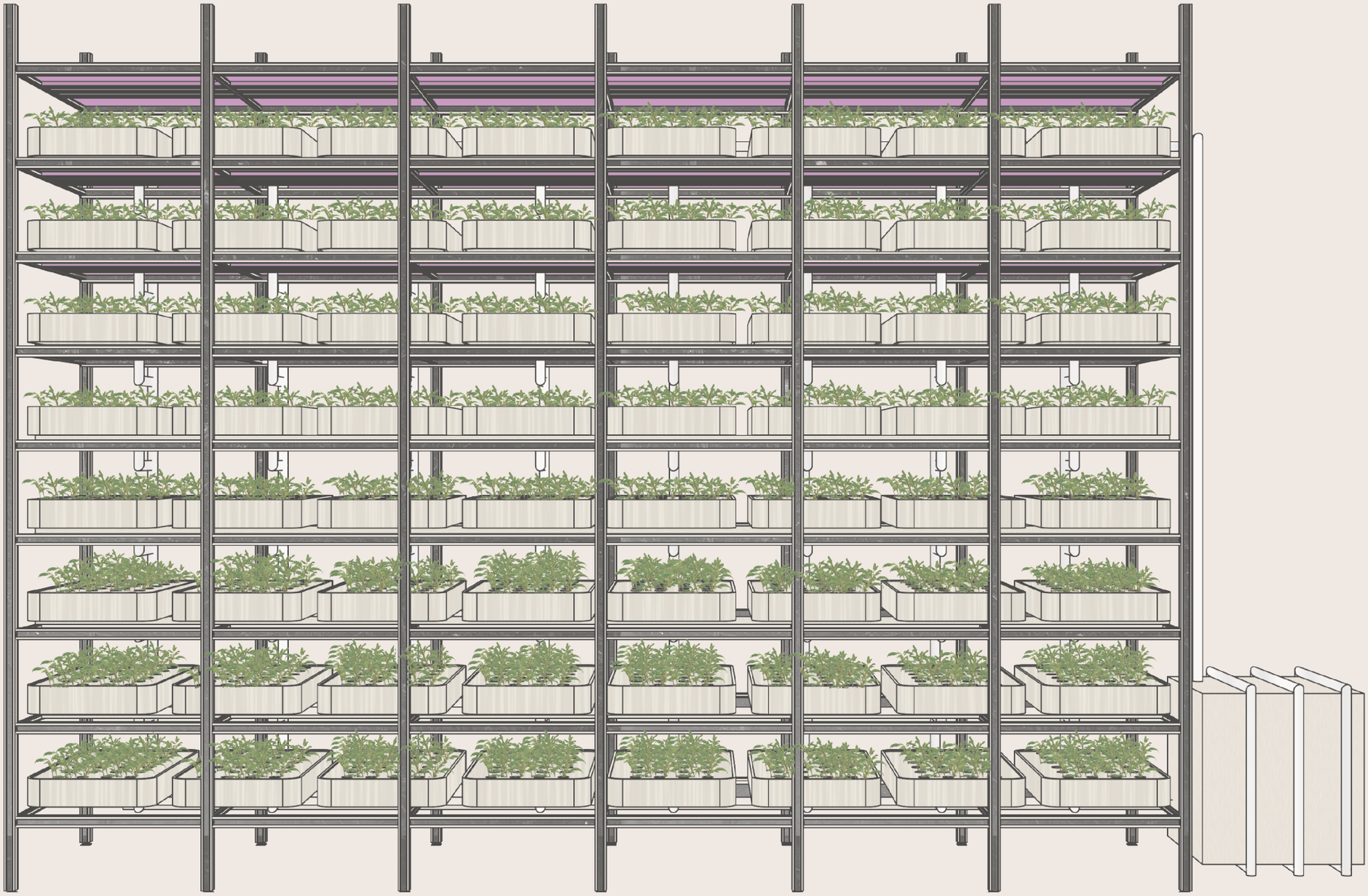
CIRCULATION + REFUGE

POLLINATION PATHCES + KOY PONDS + WATER FEATURES



04 DESIGN IMPLEMENTATION

distribution

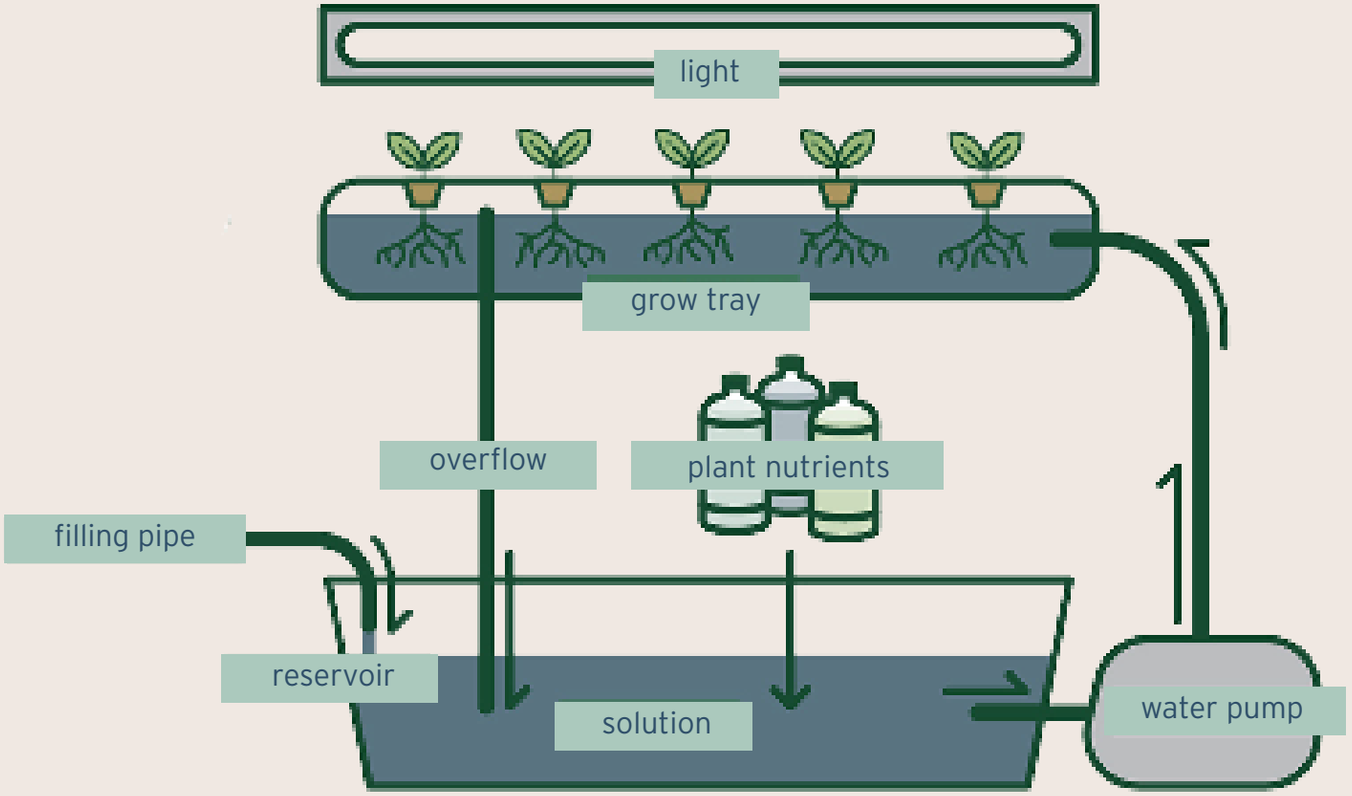


hydroponic systems

GROWING STAGE REQUIREMENTS

propagation	vegetative stage	flowering stage
- 78 DEGREES F CRITICAL COOLING	18/6 LIGHT CYCLE 78 DEGREES F 55% HUMIDITY	12/12 LIGHT CYCLE 82 DEGREES F 30%-50% HUMIDITY

HYDROPONIC PROCESS

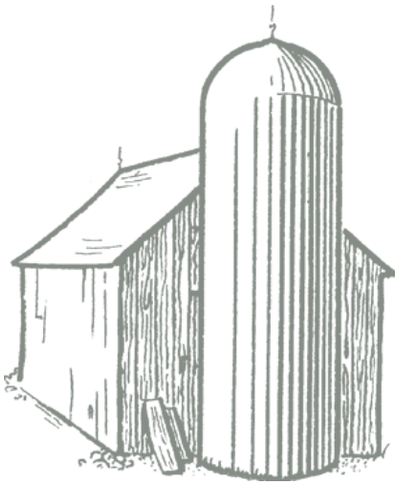


how it works...

GUIDING IDEA

complex interconnectivity of how a traditional farm operates

+

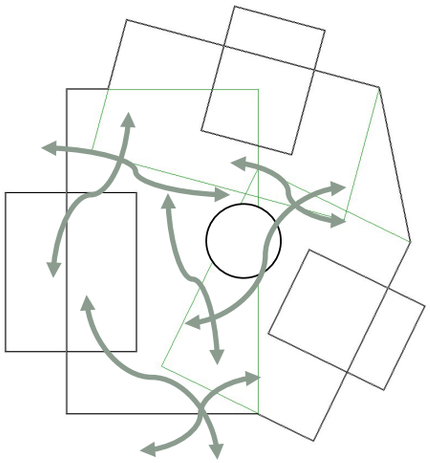


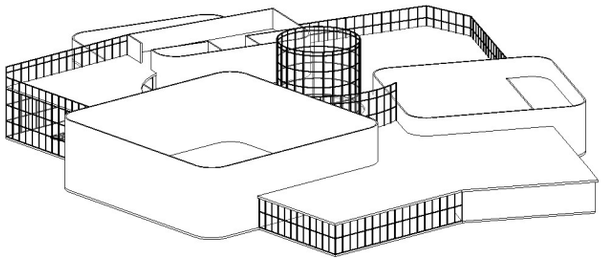
the silo as the center of food production and storage

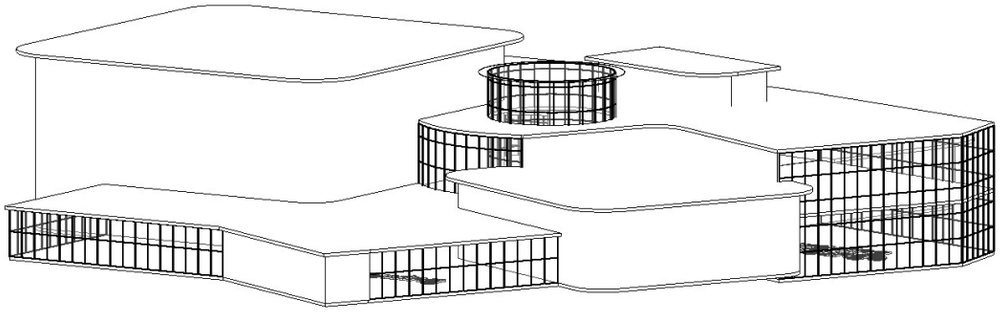
+

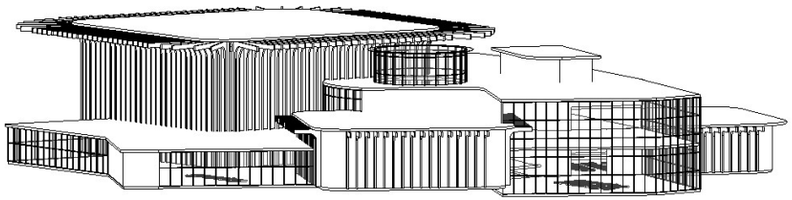
tree branching out to support and house life in the natural environment

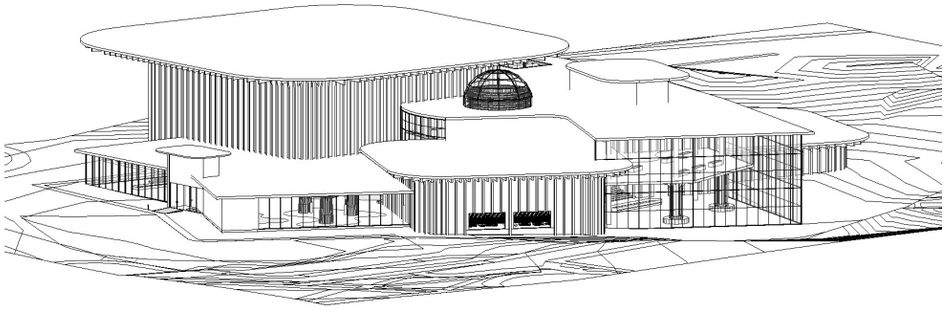
=



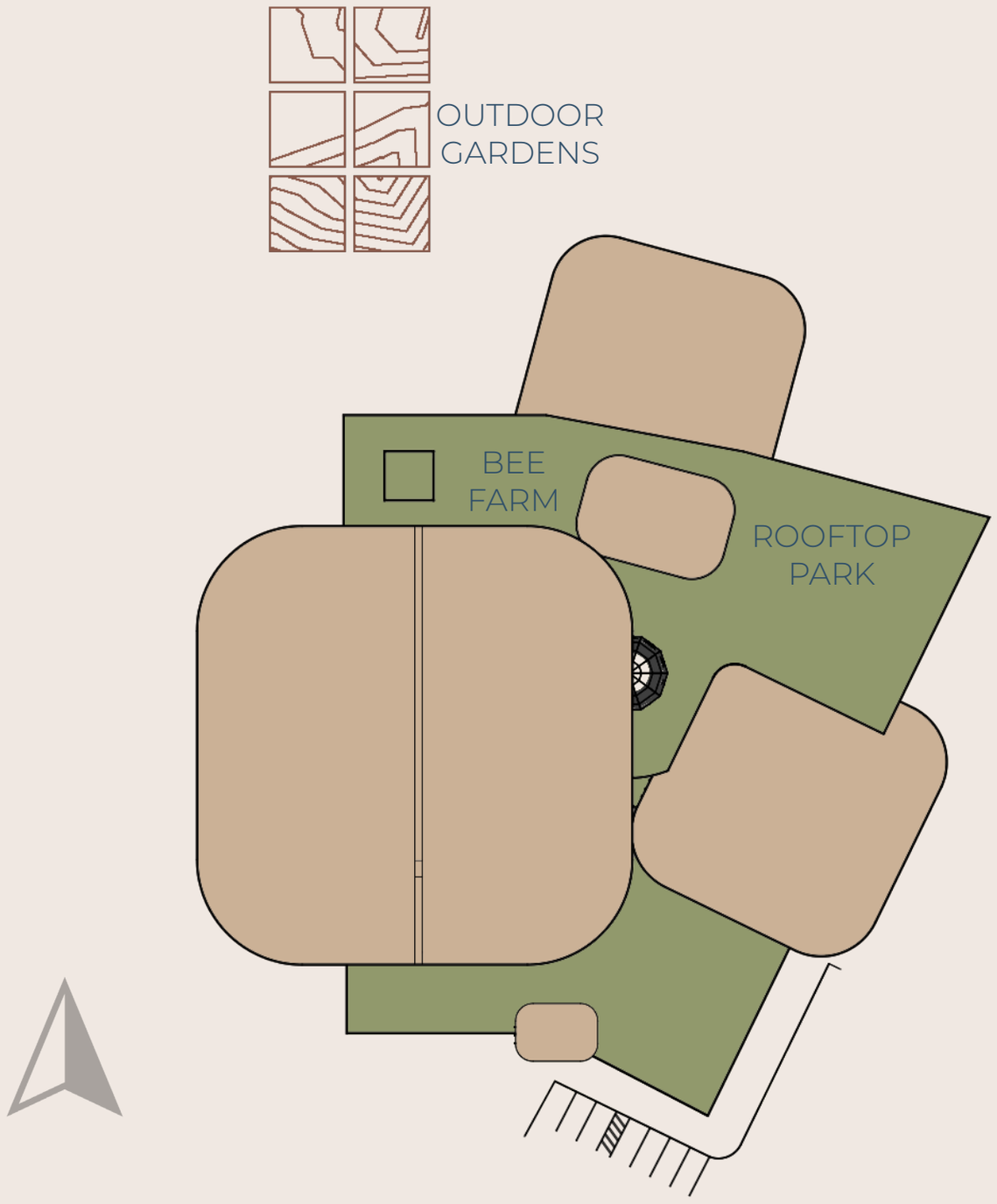




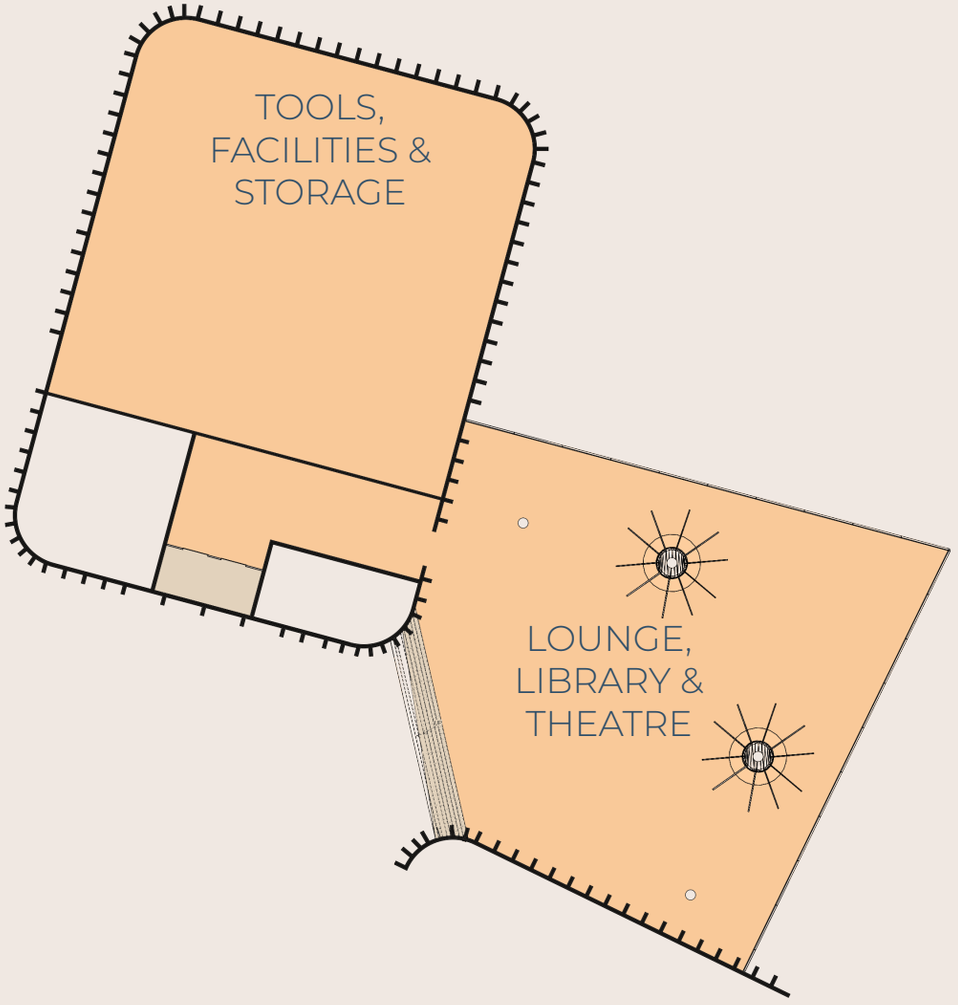




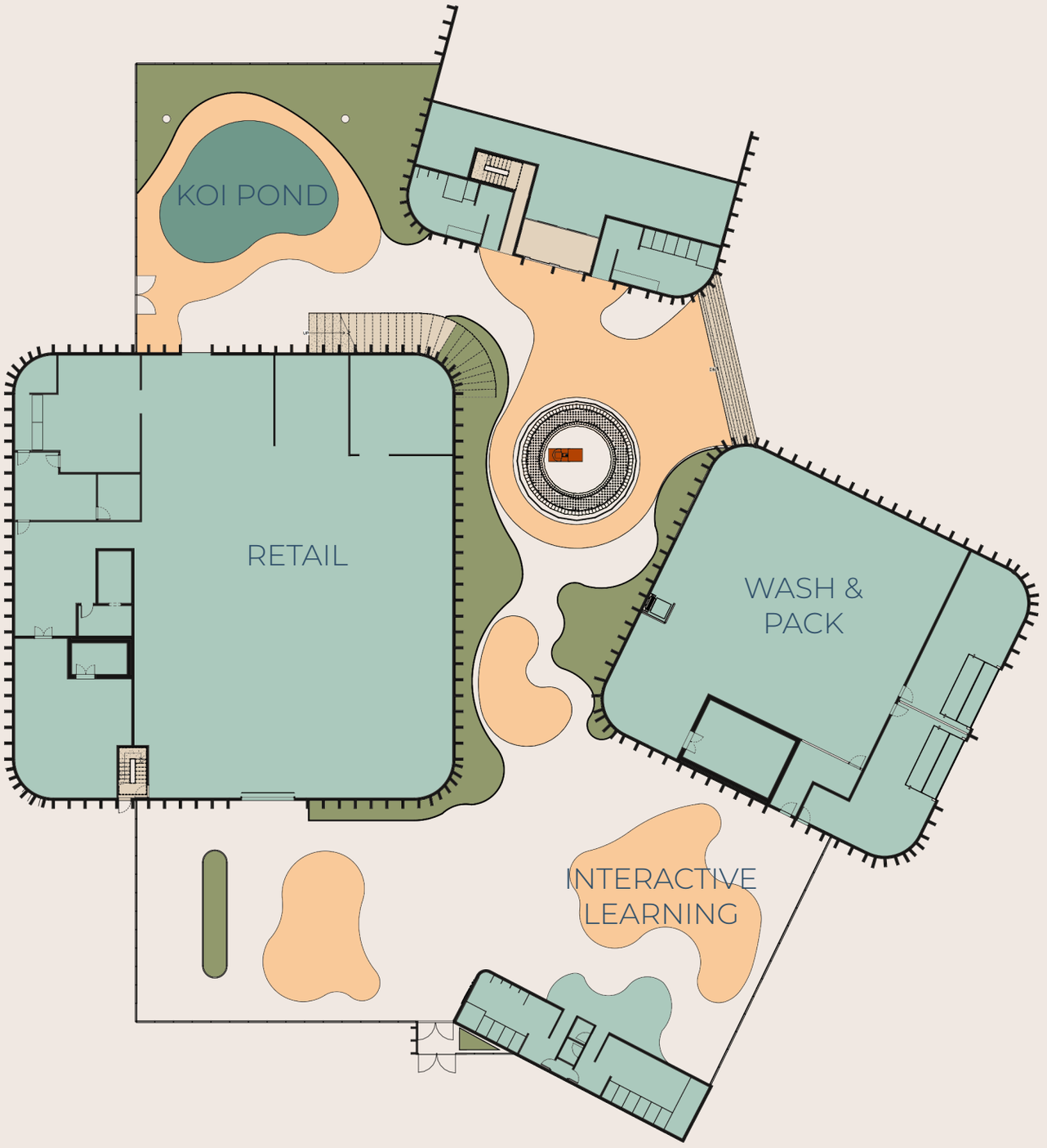
FINAL EXECUTION



SITE

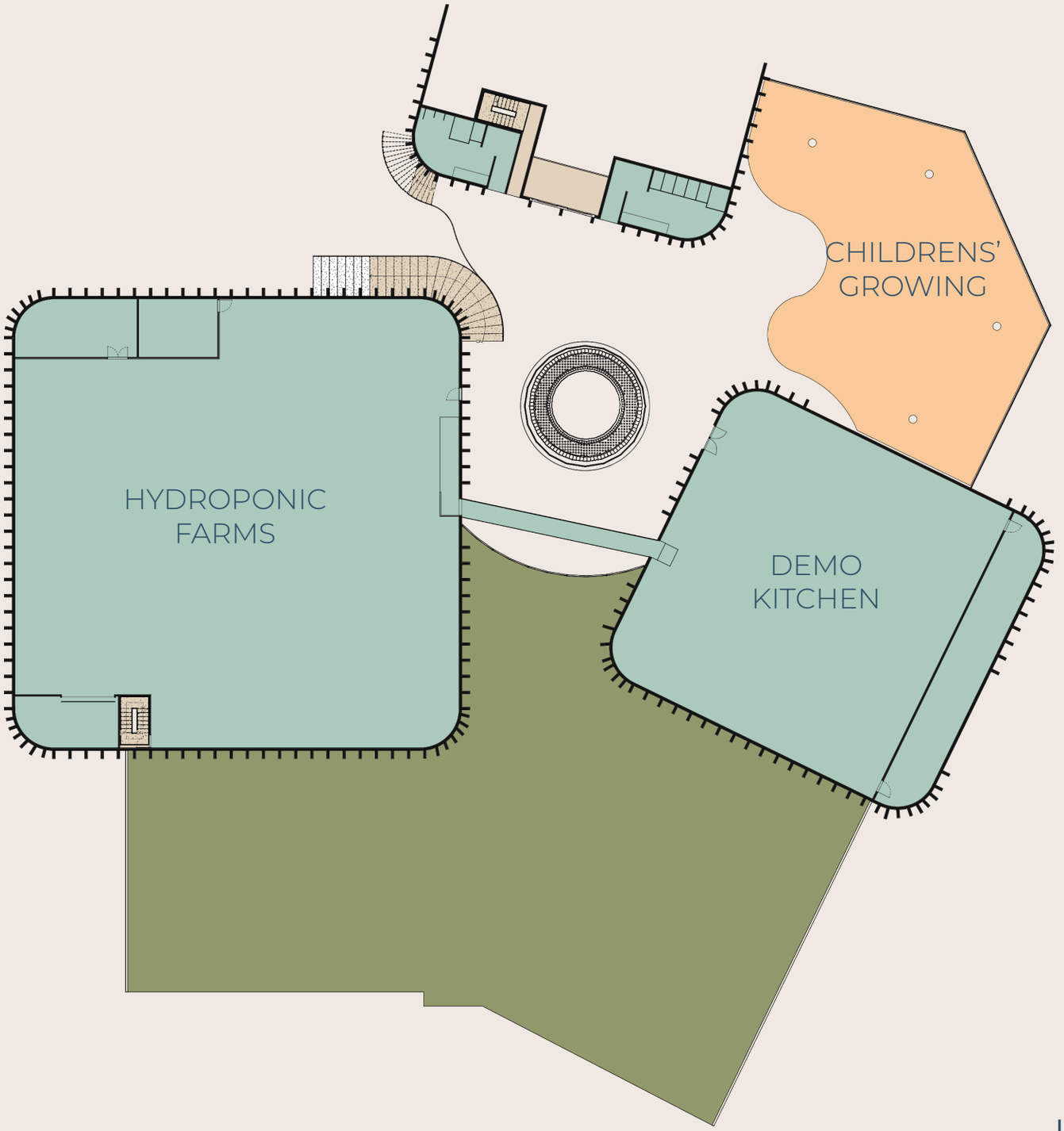


LEVEL ONE



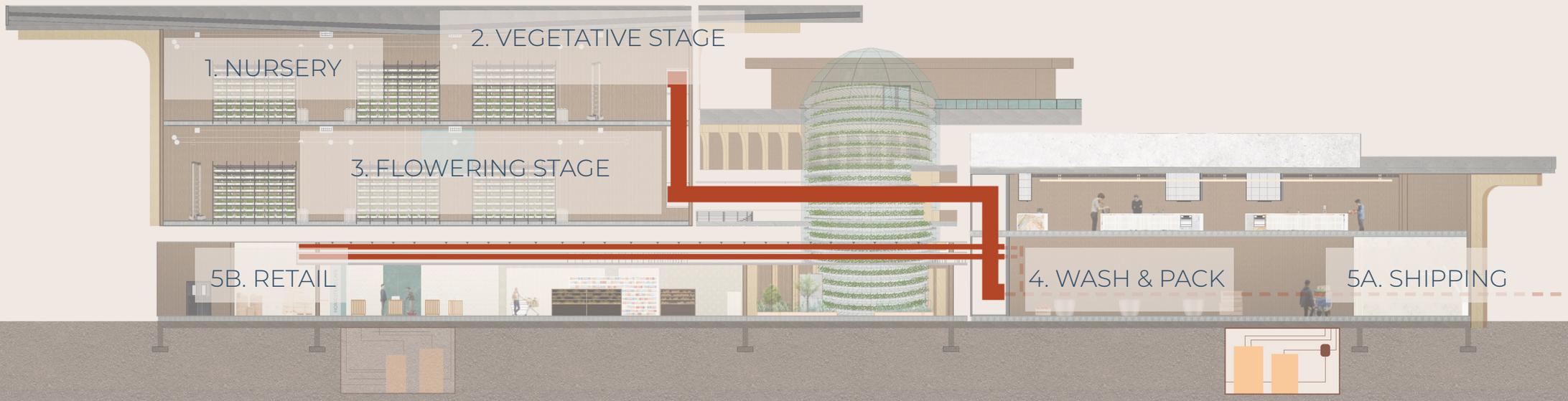
LEVEL TWO

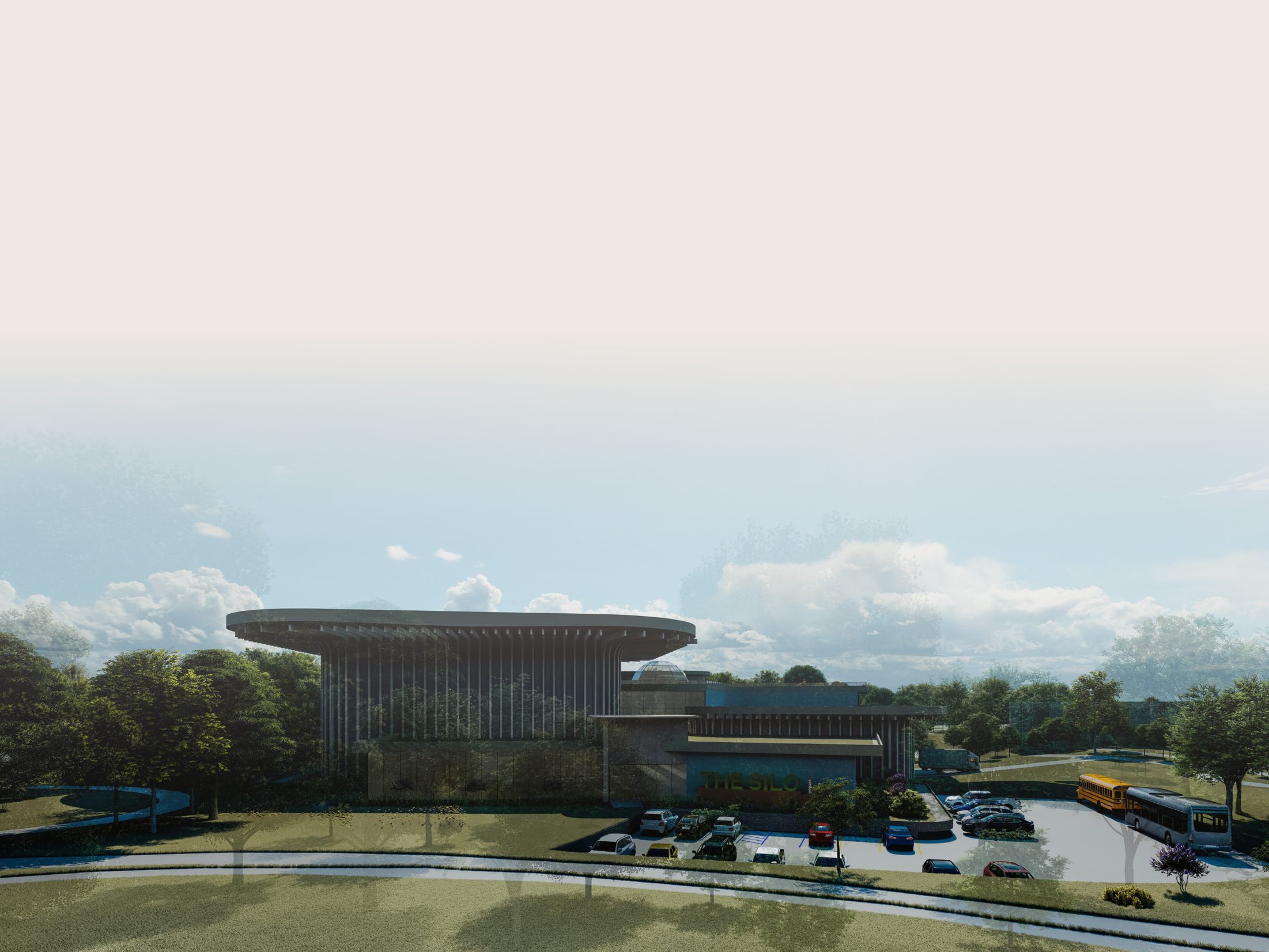

farm-to-fork

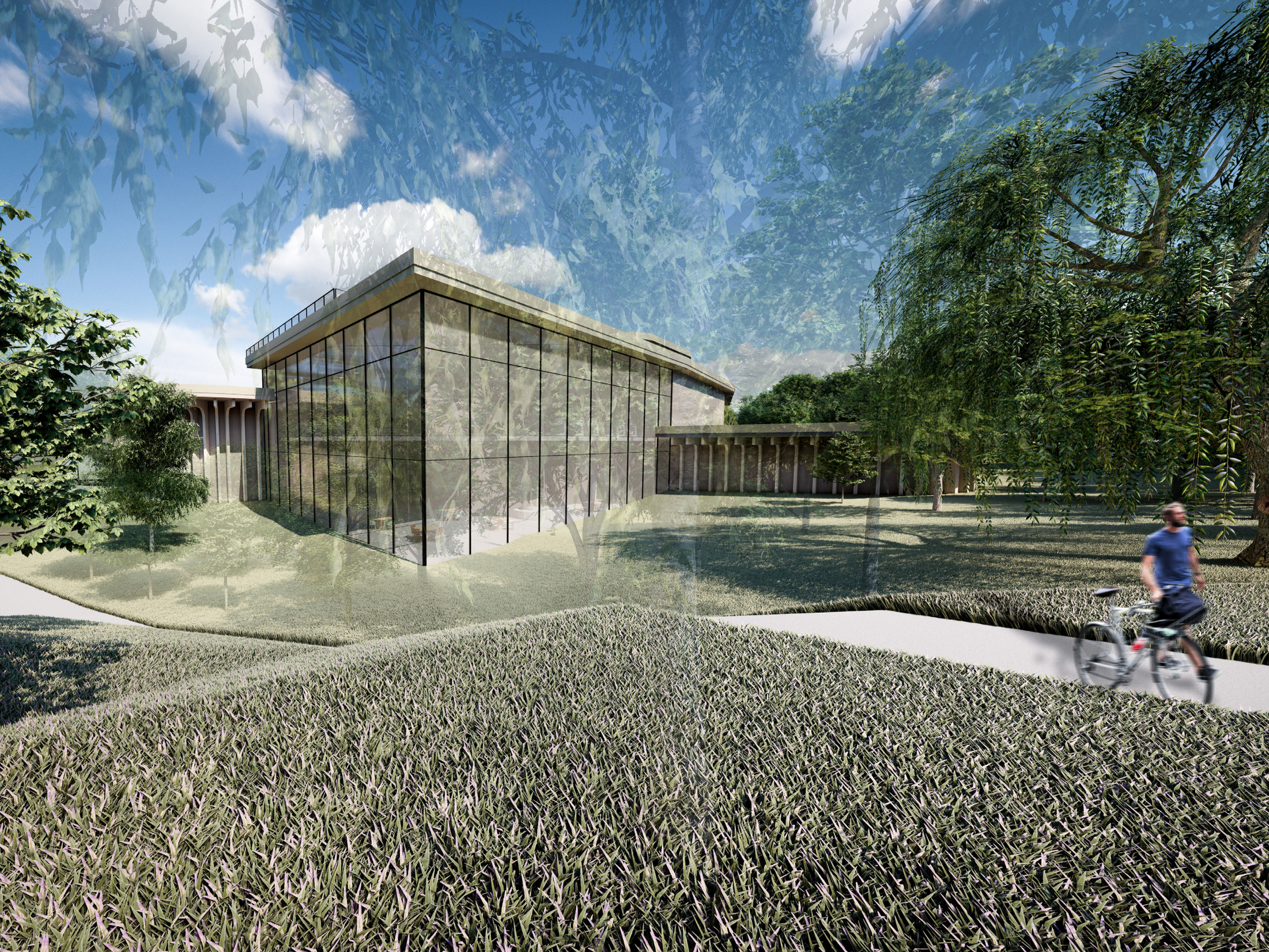


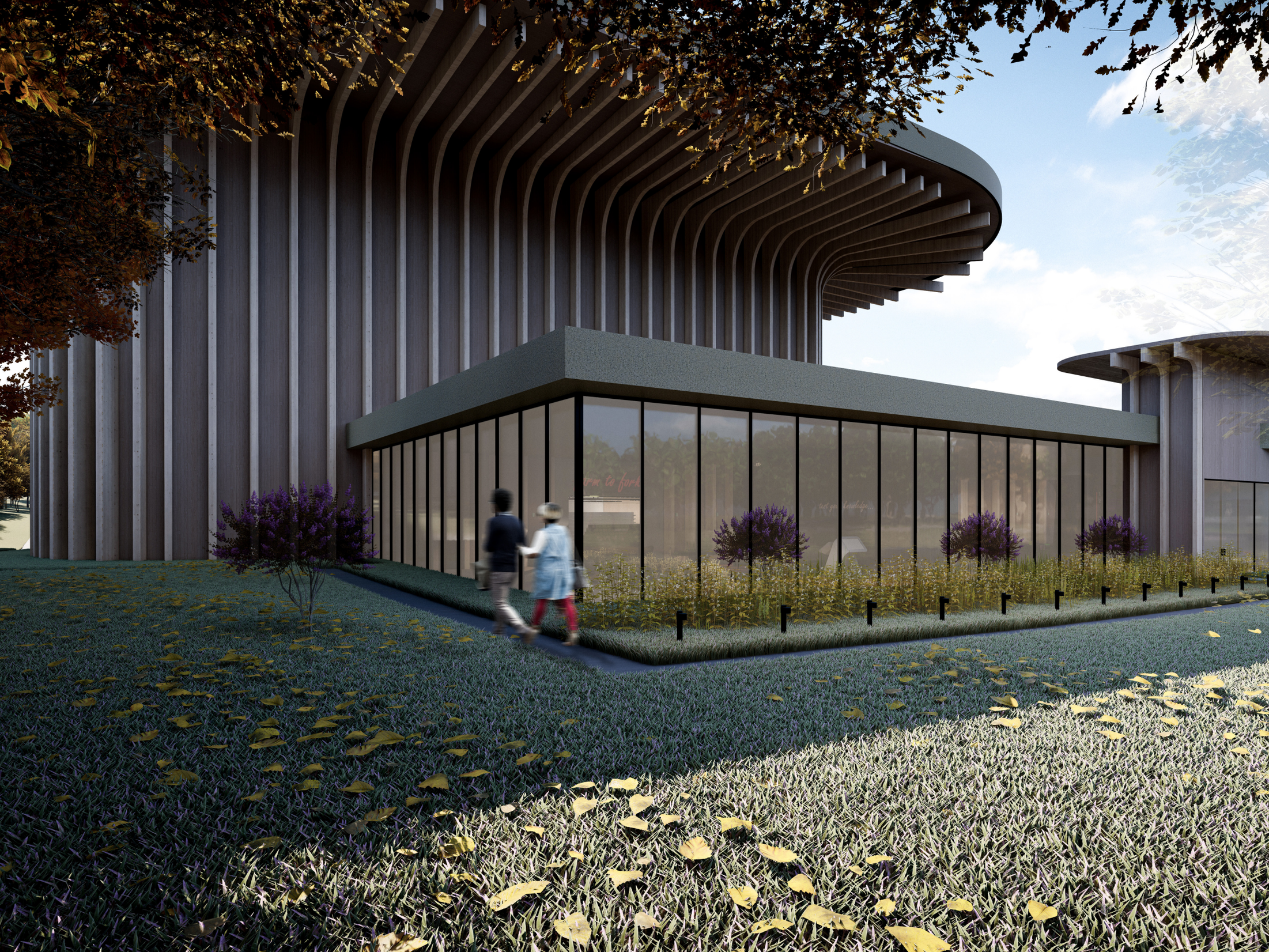
LEVEL FOUR

IN-FACILITY PLANT CIRCULATION




THE SILO





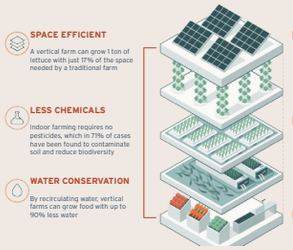
A NEW ROOT
architecture for food

Only 17% of America's land is considered ideal for agricultural purposes. However, traditional agriculture ruins our land in the long run by depleting the soil of essential nutrients. By conserving the land, we can reap its many benefits. To name a few, conserving the land can play a role in reducing air and water pollution, preserving biodiversity, preventing soil erosion, and can aid in sequestering greenhouse gasses. Because land is such a vital resource, we can further preserve it by bringing vertical farming into urban environments. This yields the question:

How can architecture be designed for food production to have an impact on the health of people and the environment?

This project investigates how the benefits of vertical farming greatly outweigh any drawbacks. It examines how traditional, crop and till, agriculture is harming the environment by contributing to climate change, utilizing more than what is necessary of important resources like land and water, and the challenges that growing faces with urbanization and other environmental-related factors. Even further, research explores how urban, vertical farms contribute to the community, and provide more nutritious food to the people at a more readily available time and location. All of these explorations ultimately examine an issue that can be mindfully thought about and implemented in terms of architecture and urban planning.

OUTDOOR GARDENS | LOUNGE, LIBRARY & THEATRE | RETAIL | VERTICAL FARMS | CHILDRENS' GROWING



SPACE EFFICIENT
A vertical farm can grow 1 ton of lettuce with just 17% of the space needed by a traditional farm

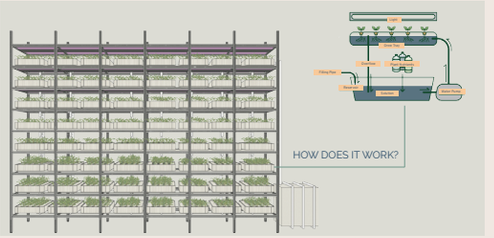
LESS CHEMICALS
Indoor farming requires no pesticides, which in 71% of cases have been found to contaminate soil and reduce biodiversity

WATER CONSERVATION
By recirculating water, vertical farms can grow food with up to 90% less water

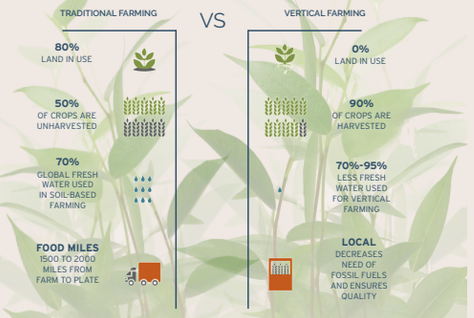
RENEWABLE ENERGY SOURCES
Artificial lighting and climate control systems require lots of energy

CONTROLLED ENVIRONMENT AGRICULTURE (CEA)
CEA refers to technologically advanced indoor farming

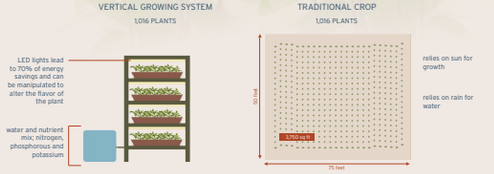
WASTE REDUCTION
Closer proximity to urban areas can shorten the supply chain and reduce food waste



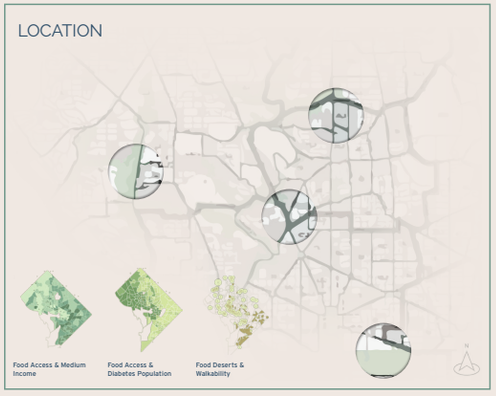
THE FUTURE IS VERTICAL



The future is vertical. With a growing population and less and less land being available, we are being forced to build up. What is to say the same cannot go for farming? Much of the United States is suffering from the loss of land resources – cities and surrounding suburbs are among those with the fastest rates of loss. One particular loss is that of viable land goes to agriculture. Continuing with our current trajectory, the future is becoming less and less green. Vertical farming has far more advantages than traditional agriculture. Some of these benefits include greater production yields, require less space and less water, are considered climate proof, seasonally agnostic, and outdoor contaminant proof, they lead to far less food waste, and are the most sustainable form of agriculture.



LOCATION



final board layout

QUESTIONS?