

The background consists of a light-colored, repeating geometric pattern of interlocking hexagons. A wooden stick is positioned diagonally across the frame, from the top left towards the bottom right. The stick has a series of starburst or floral-like patterns carved into its surface, which are rendered in a slightly darker shade than the background. The overall aesthetic is clean, modern, and natural.

**DESIGN
THAT
HEALS**

Design that Heals

Maureen Elizabeth Smith

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Architecture
in
Architecture

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Design that Heals

Maureen Elizabeth Smith

ABSTRACT

It is the architect's responsibility to protect the public's health, safety, and welfare. Ironically, healthcare facilities, whose programs focus on those elements, often seem to fall short of those basic design standards. The evolution of healthcare practices has brought us to a stage of design that focuses on the machine rather than the patient. This shift has created stripped, unwelcoming, and unnatural healthcare environments that have proven to negatively impact the health and well-being of facilities' patients.

Dialysis treatment facilities, whose medical procedures rely so heavily on machines, are an even more extreme demonstration of this imbalance. In an effort to raise awareness of this problem and reinvigorate architectural design that actually promotes healthy environments, I chose to explore the idea of "design that heals". Through the conscientious integration of nature, light, and color, this project redefines the priorities of a healthcare facility and takes a holistic and sustainable approach to design that better cares for the patients and enlivens the community.

The proposed program pairs a dialysis clinic with a community nutrition center, creating a symbiotic ecosystem which helps address the causes of kidney disease at the source. Located in an underserved Anacostia neighborhood, the people-focused building provides healthcare services, food production, and nutrition education. Taking inspiration from the filtration process of dialysis, the building celebrates and exposes its own water circulation systems, mirroring the beautiful, yet chaotic, systems within the human body.

Design that Heals

Maureen Elizabeth Smith

GENERAL AUDIENCE ABSTRACT

This thesis explores how the architectural design of healthcare facilities impacts the health and well-being of the building's occupants. Healing requires a holistic support system that provides for the patients physically, psychologically, and socially. Therefore, the environments which are designed to support this healing must be in tune with those needs and cater to each those factors.

"Design that Heals" applies this holistic design strategy to a dialysis treatment facility, a branch of healthcare whose design is often overlooked and underserved. This research reveals specific environmental elements that can be improved upon through design in order to create spaces that better support healing, including the integration of natural light, nature, artwork, social support, increased patient control and decreased noise levels. This proposed treatment facility, which acts as an example for the design of future clinics, illustrates the application of these design strategies, creating a facility that actually supports the welfare and healing of the building's occupants.

DEDICATION

To my committee; Susan, Paul, and Paul...

Thank you for ALL of your advice, feedback, brainstorming, and last-minute desk crits. Your enthusiastic encouragement of my pursuit of this topic helped to carry me through the year. You all challenged me to dive deeper into my explorations, and helped me to retain the elements of theory and practice within my design.

To my mentor; Tom...

You taught me what it is actually like to be an architect; the fun, the funk, and the grit. Thank you for encouraging / insisting my pursuit of grad school and for introducing me to the WAAC.

To my husband; James...

What a wonderful, yet strange, first year of marriage this has been! Thank you for your endless support, encouragement, patience, and proof-reading. You kept me company through so many late nights, and hardly ever complained about my strange podcasts. I'm so grateful for having you by my side, cheering me along.

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THE PROBLEM

Window-less, color-less, nature-less, soul-less “health” care facilities.

Healthcare design has transformed in such a way that the human is ironically no longer the focus. As technological advances have continued to progress and improve healthcare practice, it in turn has become the primary determining factor of these environments' design. The shift in focus from the patient to the machine has led to an imbalance within the space, ignoring the application of human-centered design-conscious architecture. This has resulted in many healthcare facilities that are sterile, depressing environments which hinder, rather than promote, patients' healing.

How can we expect patients to heal when we put them in such toxic environments?

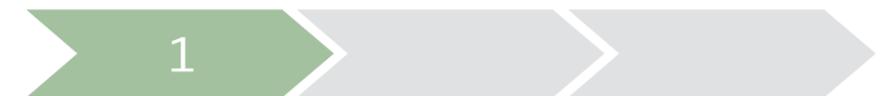
With the development of healthcare facilities on the rise, now is the time for a design intervention. In order to better understand how we got to where we are today, I explored the evolution of healthcare treatment and design.

“An awareness of how place affects mood and behavior, and in turn our health, is helping today's architects design places that work with our bodies to maintain health and promote healing, rather than work against us to worsen stress and disease”

- Esther Sternberg
(Sternberg, 2009, p. 291)



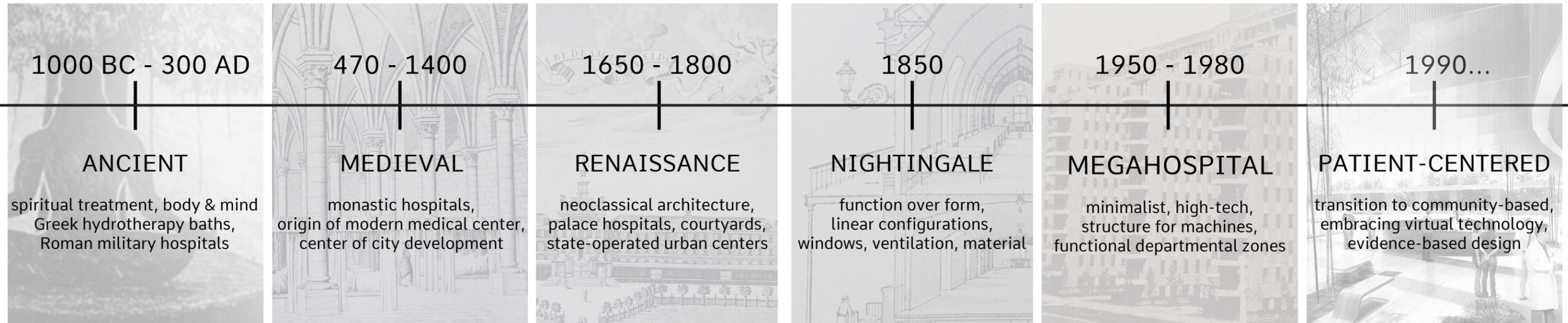
HEALTHCARE RESEARCH



EVOLUTION OF HEALTHCARE

Up until the twentieth century, the scientific understanding of the human body was so limited that the majority of patients who entered the hospital received infections during their stay and passed away. As methods of anti-septic strategies were discovered and techniques became widespread, the death-trap identity of the hospital transformed into one that was actually life-giving. Advocate Florence Nightingale, in collaboration with architect Henry Currey, further revolutionized the sterility of hospital facilities by promoting strategic ventilation of rooms and exposure to sunlight, proving to drastically improve mortality rates (Sternberg, 2009, p. 224).

While these advances helped to decrease the spread of disease, "they also led to the barrenness and stressfulness of today's hospitals...The increasing emphasis on diagnosis and diagnostic equipment meant that hospitals were devoting more and more space to machines rather than to people and healing" (Sternberg, 2009, p. 226). All-powerful machines and technologies became the principal means of acquiring health, but this shift in design left the occupants of these healthcare facilities in a state of neglect. While their bodies were being physically cared for, their psychological health was being ignored. Recent awareness of the impact of psychological health on the healing process and well-being of patients has led to a reanalysis of the healthcare system.



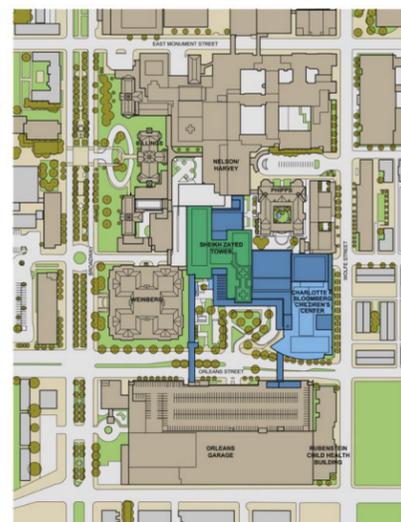
(Thompson, J. & Goldin, G, 1975)

CASE STUDY: JOHNS HOPKINS HOSPITAL

PERKINS + WILL, 2012 BALTIMORE, MD



Johns Hopkins Hospital's twelve-story addition of the Sheikh Zayed Tower and Bloomberg Children's Center offers high-tech operating rooms, private patient rooms, and emergency departments, all of which accommodate the most advanced medical technology, while retaining a psychological and environmental design for patient-centered care (Vinnitskaya, 2012). Several evidence-based design strategies can be seen throughout the facility.



(Perkins + Will, 2012) Site Plan



Photograph: children's lobby

NATURE



(Weller Keith, 2013) Zayed Tower Ground Entry landscaping by OLIN

The integration of nature benefits patients and staff, for exposure to nature helps to elicit positive emotions, reduce stress, and distract patients from focusing on their pain (Ulrich, 2008, p. 81).

JHH's Applications:

- landscaped healing gardens, visible from windows
- nature-themed artwork / sculptures

COLOR



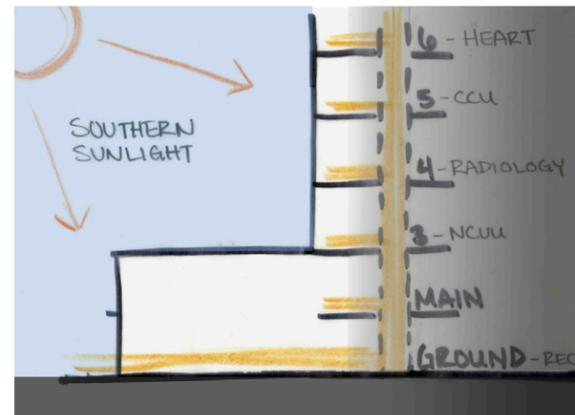
(Monet, 1899) Painting of The Japanese Footbridge

Color use has physiological and psychological implications. Natural earth tones help to provide a soothing, calming environment that promotes healing (Novak, 2012, p. 147).

JHH's Applications:

- natural color palette, inspired by Monet's paintings
- color paired with art/sculptures to assist wayfinding

LIGHT



Section diagram: sunlight with public circulation

Exposure to natural light offers psychological and physical benefits. "Sunlight exposure increases levels of serotonin, a neurotransmitter known to inhibit pain pathways" (Ulrich, 2008, p. 82).

JHH's Applications:

- time-responsive lighting supports circadian rhythm
- circulation and communal spaces kept to exterior, allows deeper sunlight penetration

HEALTH IN THE DISTRICT

Despite the compact location of DC, there are drastic health disparities between the eight wards. Anacostia, the neighborhoods east of the river, is an incredibly underserved area that repeatedly proves to be the "worst" of various categories.

Compared to the rest of DC, Ward 8 has...

- highest **poverty**
- highest **unemployment**
- less than 10% of DC's grocery stores,
- despite 50% of youth living in Wards 7 and 8
- highest **obesity** rate (42.8% of residents)
- least likely residents to exercise or consume recommended fruit and vegetable servings
- highest **decrease in population** (2000-2010)
- high **hospitalization rate**, 3 X higher than Ward 3
- increased deaths due to **diabetes**
- highest prevalence of **kidney disease**

Nearly every chronic condition is most common within Ward 8:

arthritis, asthma, high cholesterol, diabetes, hypertension, depression, heart disease, heart attacks, and kidney failure

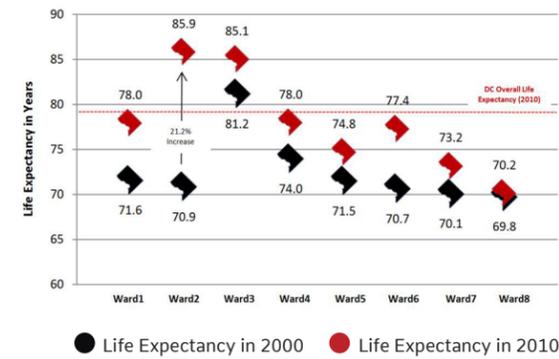
The environment, social/economic status, clinical care, and health behaviors are factors shown to be the root causes of health outcome disparities. This inspired my building's program, which strives to address and promote each of these elements.

An analysis of the dreadfully divisive health conditions between Ward 8 and the surrounding District confirmed the location as an appropriate site for an intervention. Statistics steered the program to be one that holistically addressed the area's nutritional needs and improved accessibility to kidney care.

(DC Health Communities Collaborative, 2016)
(DC Department of Health, 2017)

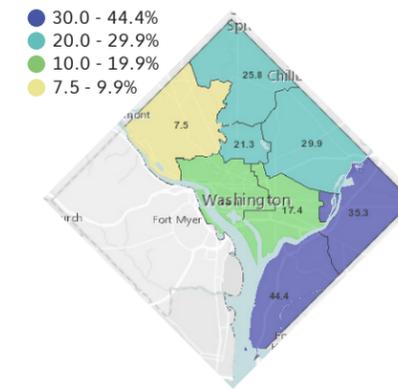
DC LIFE EXPECTANCY

(DC Community Health Needs Assessment, 2013, p. 17)



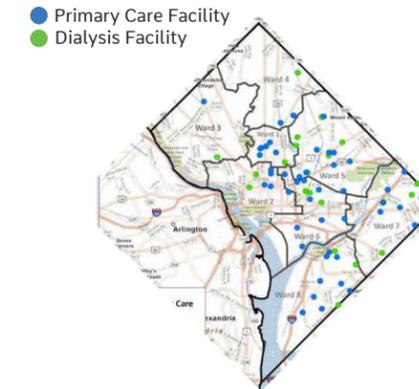
OBESITY RATE BY WARD

(Community Commons, 2010)



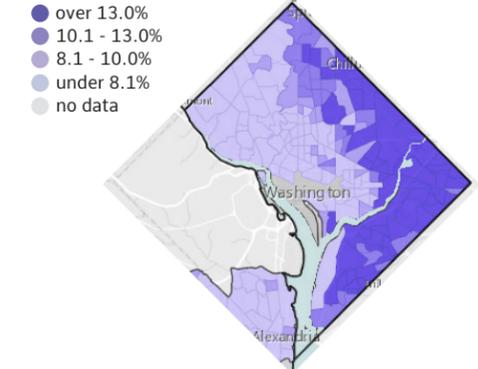
PRIMARY & SPECIALTY CARE

(DC Department of Health, 2017, p. 60)



PREVALENCE OF DIABETES

most common cause of kidney disease (Community Commons, 2015)



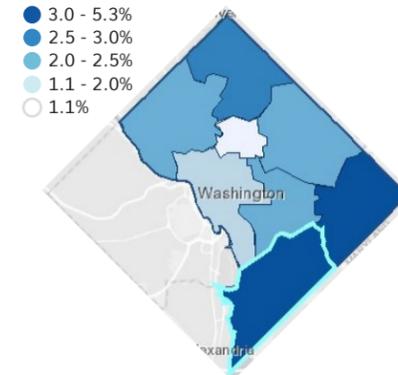
CHRONIC DISEASES

(DC Health Communities Collaborative, 2016, p. 54)

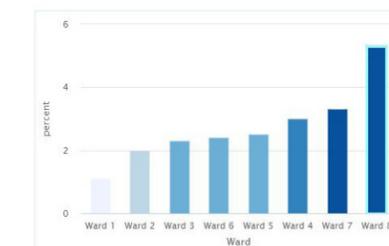
Selected Chronic Disease Indicators	Citywide (DC)	Ward							
		1	2	3	4	5	6	7	8
Adults who were diagnosed with arthritis, 2013 (%)	19.5	17.0	20.2	19.8	23.2	27.6	23.0	27.8	28.6
Adults who currently have asthma, 2013 (%)	11.9	9.9	12.5	7.2	9.5	10.7	12.3	14.2	20.6
Adults who were diagnosed with diabetes, 2013 (%)	7.8	6.6	4.8	3.1	8.4	10.9	6.5	14.5	16.0
Adults who were diagnosed with kidney disease, 2013 (%)	2.4	NA	NA	NA	NA	3.2	2.0	3.8	4.2
Adults who were diagnosed with depression, 2013 (%)	20.	22.4	18.7	23.7	15.4	16.4	23.2	18.4	28.0
Adults who were diagnosed with COPD, 2013 (%)	5.8	3.5	2.4	5.4	4.2	5.9	3.7	8.5	16.4
Adults who had a stroke, 2013 (%)	3.2	NA	NA	NA	4.5	3.7	NA	5.7	5.5
Adults who were diagnosed with heart disease, 2013 (%)	2.6	NA	NA	3.3	3.1	3.1	NA	3.2	4.5
Adults who had a heart attack, 2013 (%)	4.1	NA	NA	2.3	3.7	5.7	2.9	7.3	12.3
Youth ever told by doctor that they have Asthma, 2013 (%)	31.0	data not available							
Seniors with Diabetes, 2012 (%)	NA	13	20	13.8	11.7	14.7	12.9	14.9	16.5
Seniors with Arthritis, 2012 (%)	NA	26.1	24.4	27.7	25.6	23.1	26.1	25.3	22.9

PREVALENCE OF KIDNEY DISEASE

(DC Department of Health Behavioral Risk Factor Surveillance System, 2011)

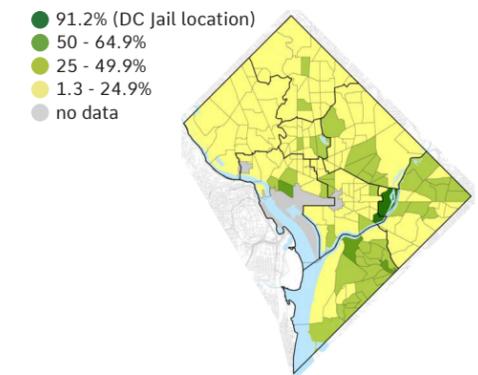


WARD 8: 5.3% prevalence



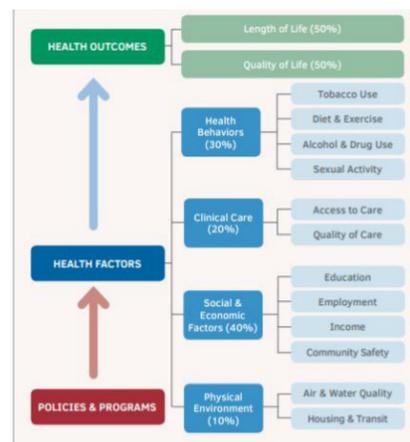
POVERTY PERCENTAGES

(DC Community Health Needs Assessment, 2013, p. 11)



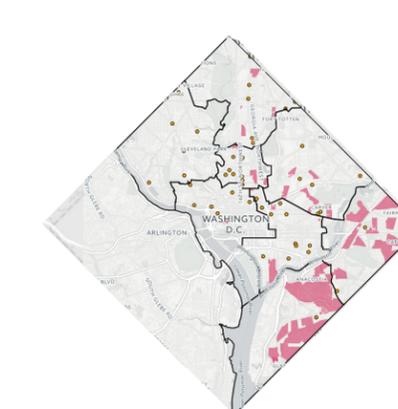
CONCEPTUAL FRAMEWORK FOR HEALTH DETERMINANTS

(DC Department of Health, 2017, p. 3)



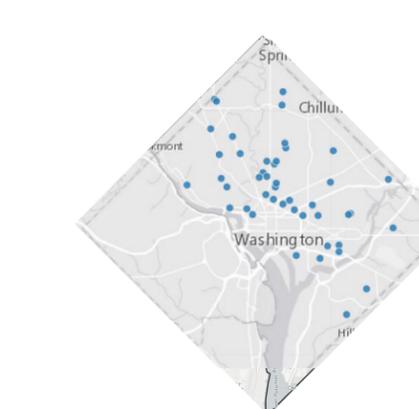
FOOD DESERT CENSUS

(DC Policy Center, 2017)



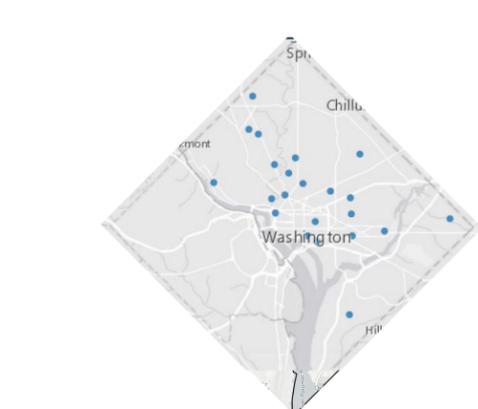
GROCERY STORES

(DC GIS Open Data, 2012)



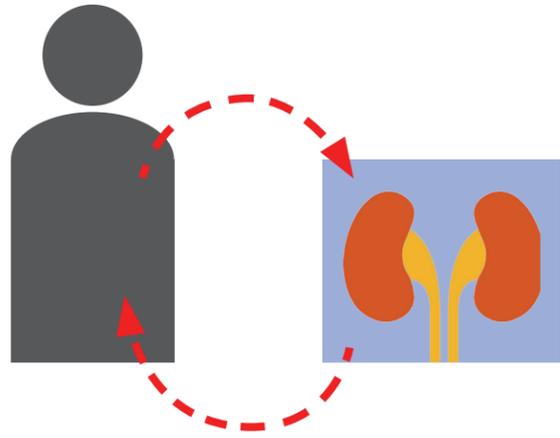
FARMERS MARKETS

(DC GIS Open Data, 2018)



DIALYSIS RESEARCH

WHAT IS DIALYSIS?



Dialysis is a treatment for patients with end stage renal disease (ESRD) which cleanses their blood in the ways that their kidneys are no longer able to.

Depending on the patient's situation, treatment can be self-administered at home through peritoneal dialysis, or is administered in-center through hemodialysis. Hemodialysis procedures require the filtration of patients' blood through a cleansing machine. On average, each treatment takes 3-4 hours and must be completed 3 days per week.

2 million people in the world currently suffer from ESRD and the number of annual diagnoses continues to increase at a rate of 5-7% per year. (UCSF Schools of Pharm. & Med. - Dept. Bioengineering, 2017)

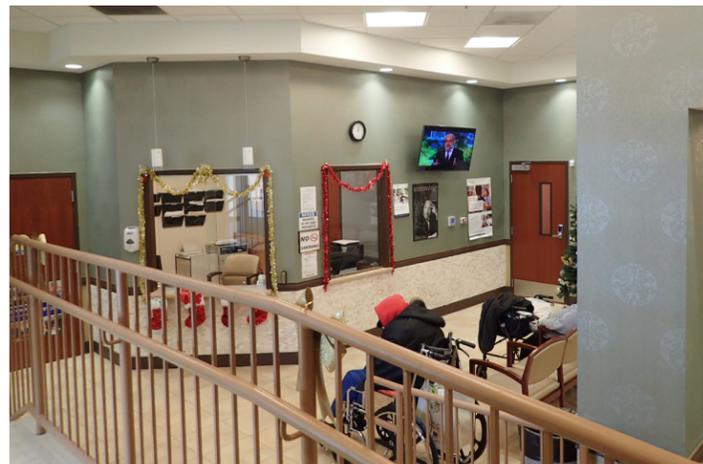
DIALYSIS TREATMENT CENTERS

The technical requirements of hemodialysis procedures paired with the need for constant staff surveillance has led to depressing, inward-looking environments. The linear layouts make the filtration machines divisive elements that can hinder socialization. Often a facility's desire to protect patients' privacy from outsiders results in windowless or blind-covered spaces.

Unfortunately these dismal, mentally unhealthy environments have become accepted as the "norm".



isolation room



treatment center's waiting room



treatment floor

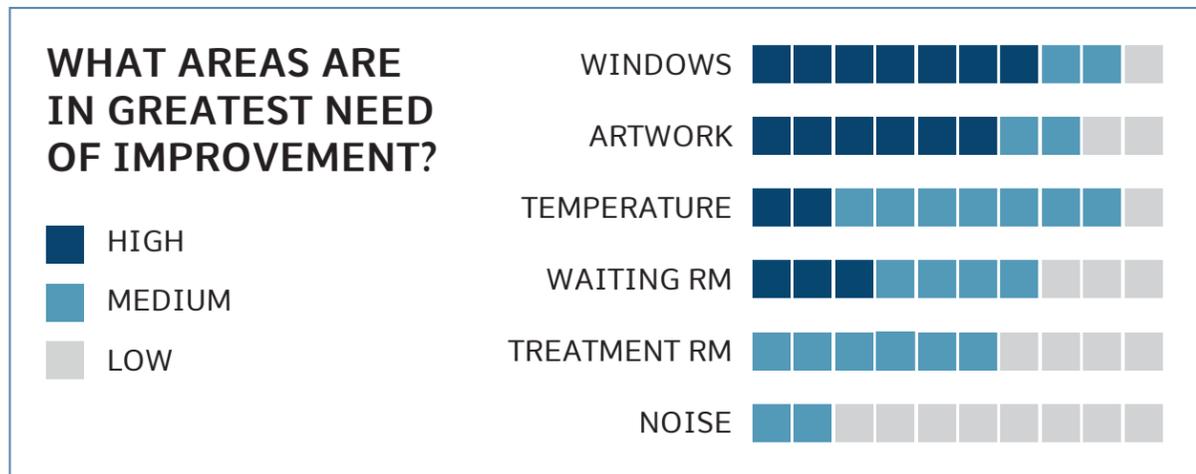


Collage representing the draining adjustment to dialysis, transitioning from unsettling terror to withdrawn submission. Rather than creating a treatment center that ominously plugs these patients into the system, my design aims to set the patients free from their stifling facilities.

HEMODIALYSIS PATIENT INTERVIEWS

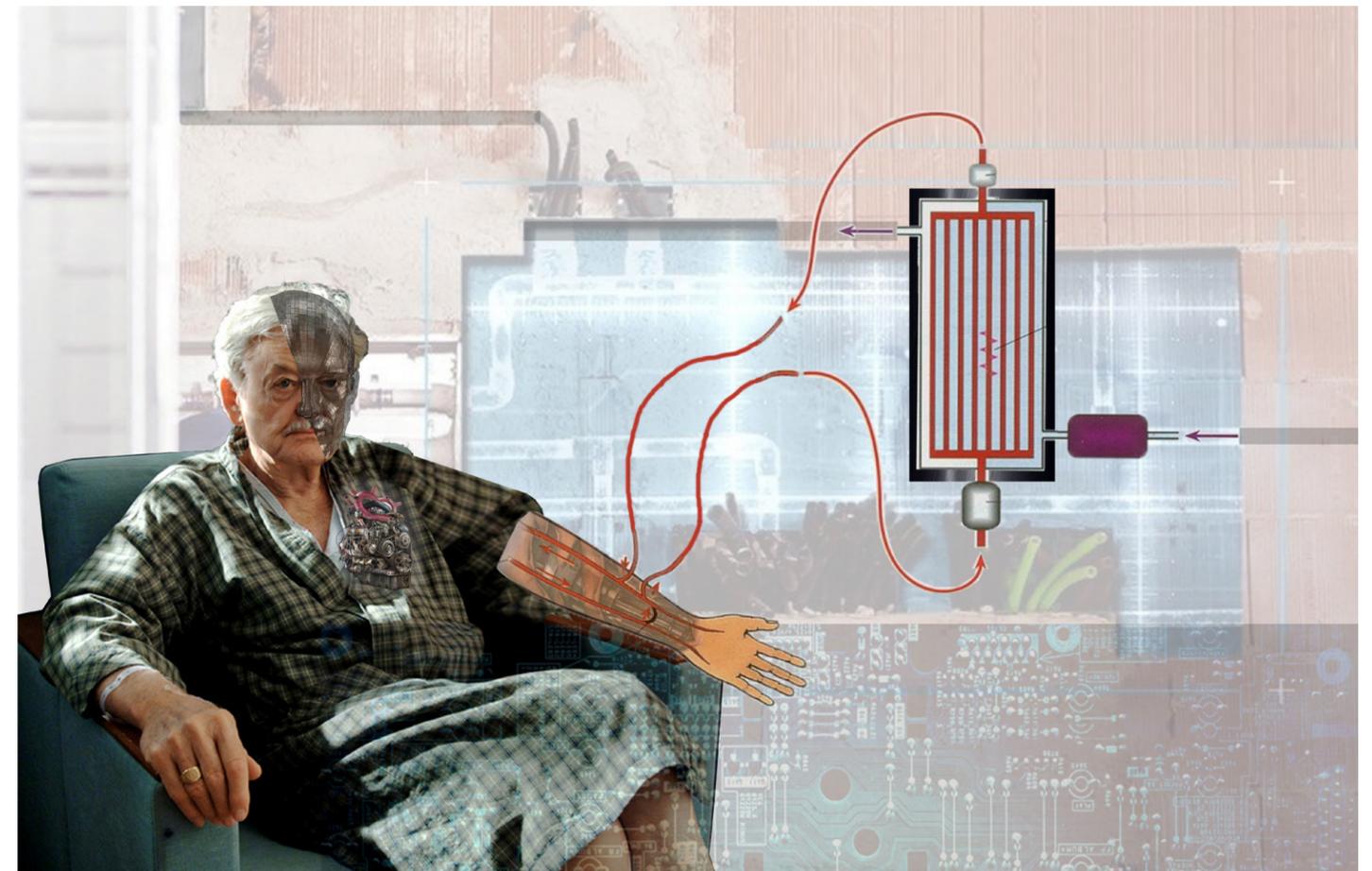
In order to obtain an insider's perspective, I conducted volunteer phone interviews with hemodialysis patients. Questions prompted patients to describe the experience of their treatment facility's environment and provide suggestions for improvement. A final ranking questionnaire inquired about six specific design categories, which were inspired by the topics explored by evidence based design research.

PATIENT	STATE	SEX	AGE	TRMNT (yrs)	FRIENDS	COMFORT OF...			PREVALENCE OF...		
						WAITING RM	TREATMENT RM	TEMPERATURE	NOISE	ARTWORK	WINDOWS
1	DC	M	56	4	N	7	6	6	6	5	0
2	MD	M	60	9	Y	8	8	5	8	8	2
3	DC	F	52	0.3	Y	3	5	5	5	0	1
4	VA	F	41	2.5	Y	6	8	3	10	2	5
5	MD	F	55	24	Y	2	8	5	8	1	4
6	MD	M	42	12	Y	8	9	7	10	8	8
7	PA	M	72	17	Y	7	6	9	10	5	1
8	VA	M	51	0.8	N	6	7	4	8	0	2
9	VA	F	55	1.5	Y	8	6	6	8	0	1
10	OH	F	72	7	Y	3	6	2	8	0	0



Interview results identified windows and artwork as being the areas in greatest need of improvement. Many patients also commented on how their first visits to the treatment centers were unsettling and uncomfortable, but that over time they became "used to" the environments.

Right: Collage representing the patient's unique relationship with technology and the building through the filtration machines.



CLINIC ANALYSIS

In an effort to better understand the clinic's technical space requirements and the staff's perspective on the environment, I met with a facilities manager and dialysis technician. They provided very few negative comments, but were able to provide insight on areas that could be reassessed to maximize circulation efficiency, especially in regards to the interconnecting doctor and manager's office locations.

The statistics below list the spread of services and demands of the average dialysis clinic:

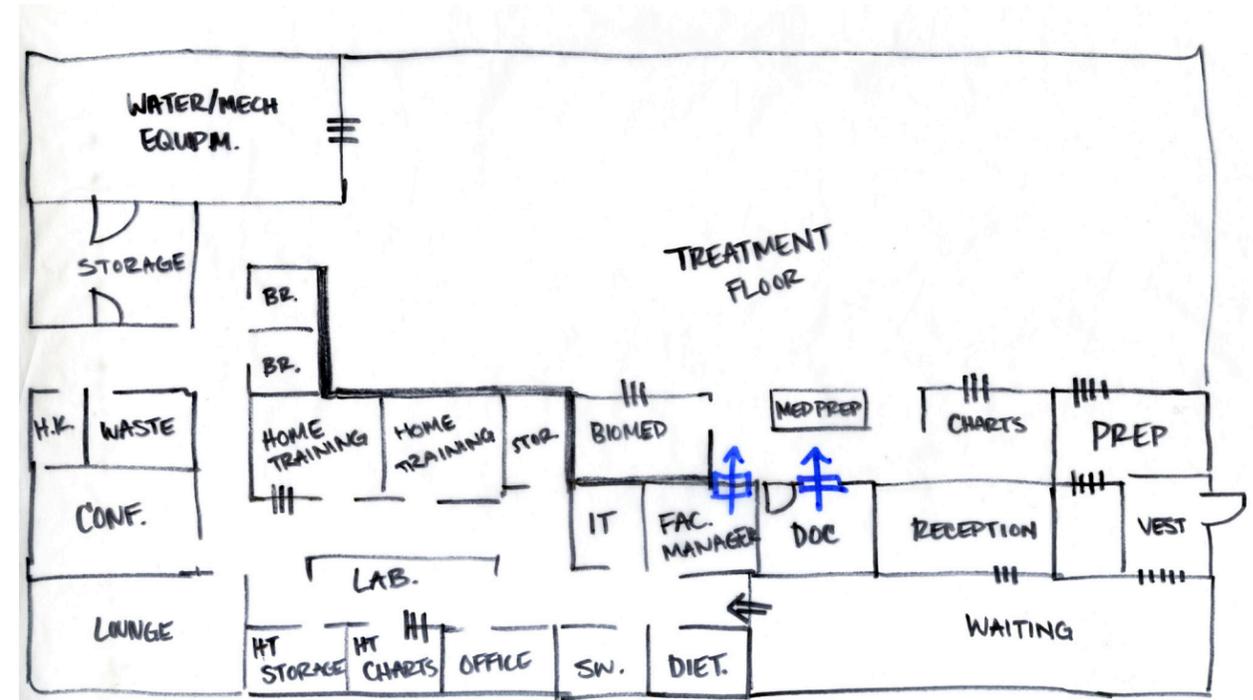
-  80 patients treated per week
- 18 stations (2 private)
- 17 employees
 - 1 medical director
 - 1 facilities manager
 - 1 social worker
 - 1 dietician
 - 1 receptionist
 - 6 nurses
 - 6 technicians

-  120 liters of purified water per treatment
- 75% of water is recycled
- Water Treatment : Purification Cascade
 - sediment filter
 - water softener
 - carbon filter
 - Reverse Osmosis (RO)

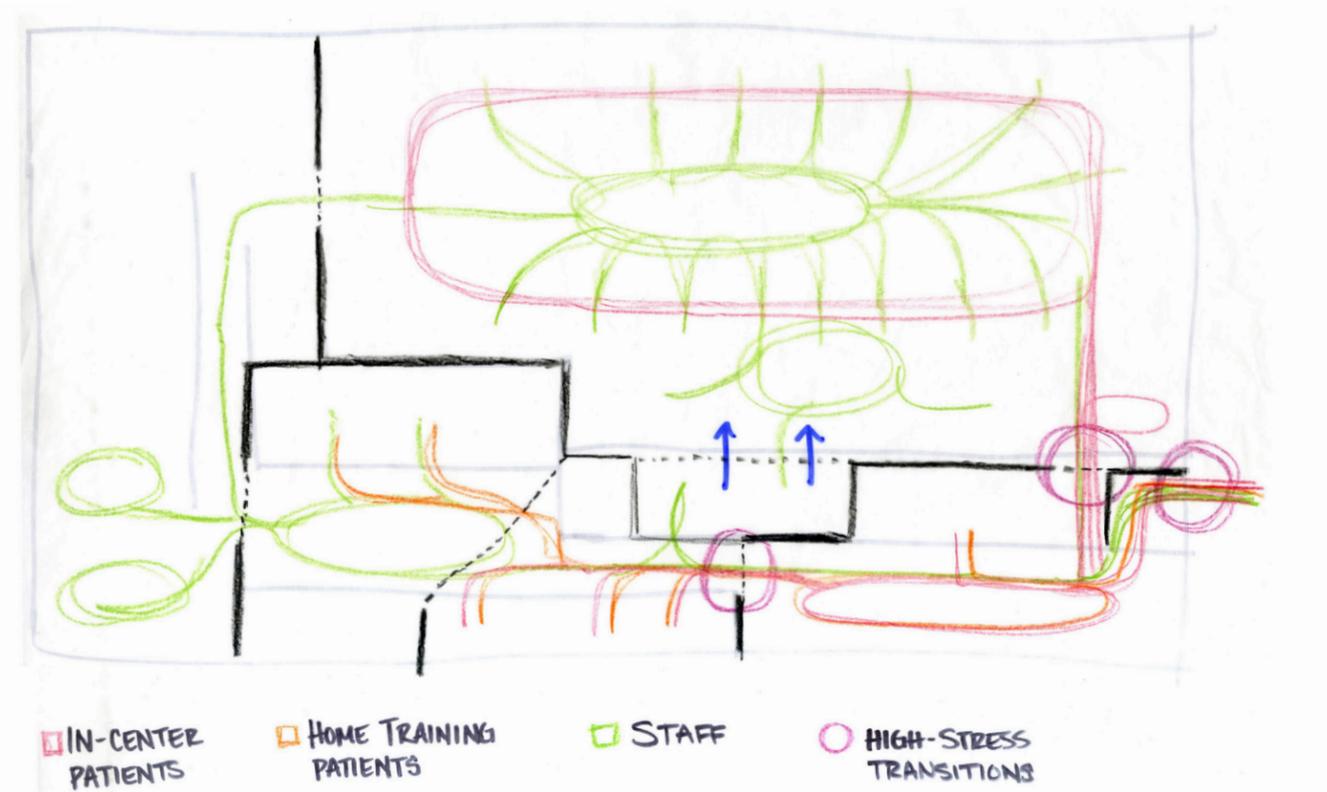
(Layman-Amato, Curtis, Payne, 2013)
(Tarrass, Benjelloun, Bensaha, 2010)

(Shinkman, 2016)

Right: The diagrams analyze elements of one of the toured facility's floor plan. The program organization shows which programs must border one another and where lines of sight must be retained. The circulation paths helps to reveal areas of unnecessary back-tracking and the points of "high-stress transitions", as noted by dialysis patients through the phone interviews.

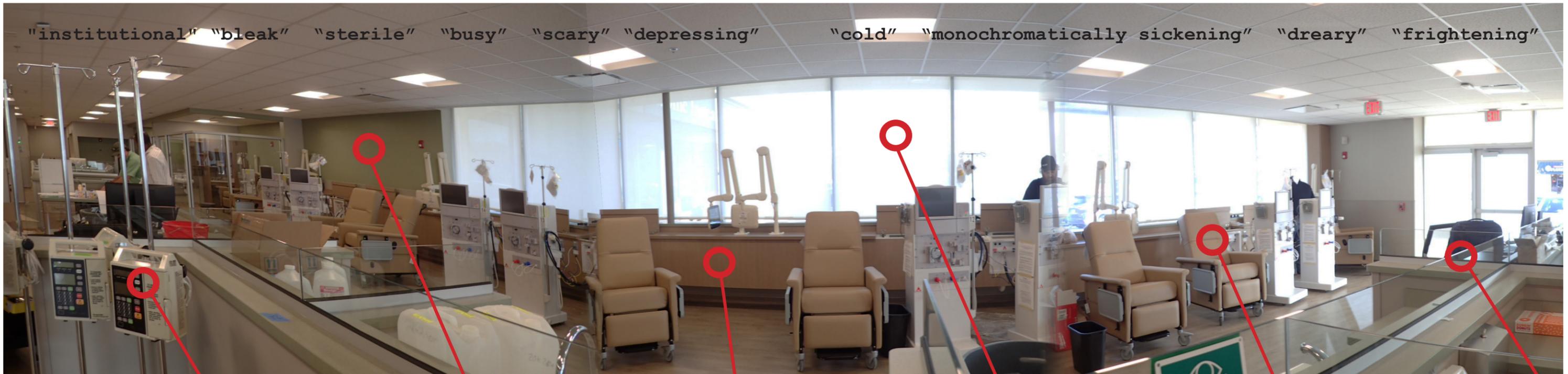


PROGRAM ORGANIZATION



CIRCULATION PATHS

Six environmental elements, supported by research, were identified as important design factors in need of improvement. I reevaluated these elements through my proposed design. These callouts are identified within the panorama picture of a "standard" dialysis facility. The string of adjectives along the top are additional environmental descriptors quoted by the interviewed patients.



PATIENT CONTROL

Biomedical literature has linked the feeling of having minimal control over stressors to the activation of stress responses which increases the risk of stress-sensitive diseases (Sapolsky, 2005, p. 96).

A dialysis patient's increased participation and involvement in their personal treatment helps to reduce errors and infections (Kliger, 2015).

ARTWORK

Images of nature, especially water, are also more psychologically beneficial to onlookers than images of urban environments, for they have a positive influence on heart rate and emotional state (Ulwin, 1981, p. 523).

Images with people may act as emotional triggers or projections of loss for patients struggling with depression (Silvis, 2012).

COLOR

Colors that promote pleasure and reduce arousal, such as blues and greens, are most likely to elicit calmness (Lankston, 2010, p. 498), which goes hand-in-hand with Ulwin's recommendations for nature scenes.

WINDOWS

Window views of nature improve recovery rates and result in patients requesting fewer painkillers, having fewer complications, and receiving less negative evaluations from the staff (Ulwin, 1984, p. 421).

SOCIAL SUPPORT

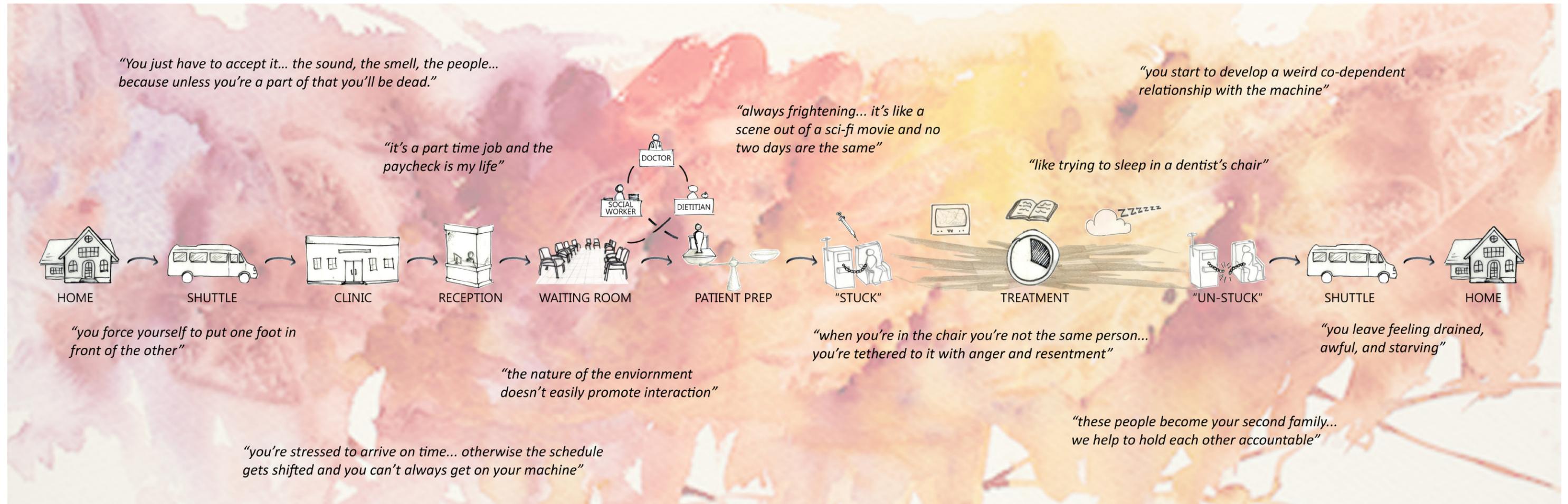
Dialysis patients receive positive health benefits from an increased social and emotional support network (Thong, 2007).

Additionally, low quality relationships and social isolation is a major risk factor of mortality (Reblin & Uchino, 2009, pg. 201).

NOISE

Noise pollution within hemodialysis clinics have been documented as getting as loud as 110 dB (Ronco, 2008, p. 289).

Exposure to 55dB or higher increases the body's release of stress hormones, which can contribute to the prevalence of hypertension, diabetes, and obesity (Fink, 2017, p. 44). All of those conditions increase the risk of kidney failure.



This "experience map" depicts the step-by-step process of a dialysis patient's treatment. The water-colored background is representative of the patient's emotional experience, and the overlaid quotes were pulled from the patient interviews.

SITE RESEARCH



SITE SELECTION

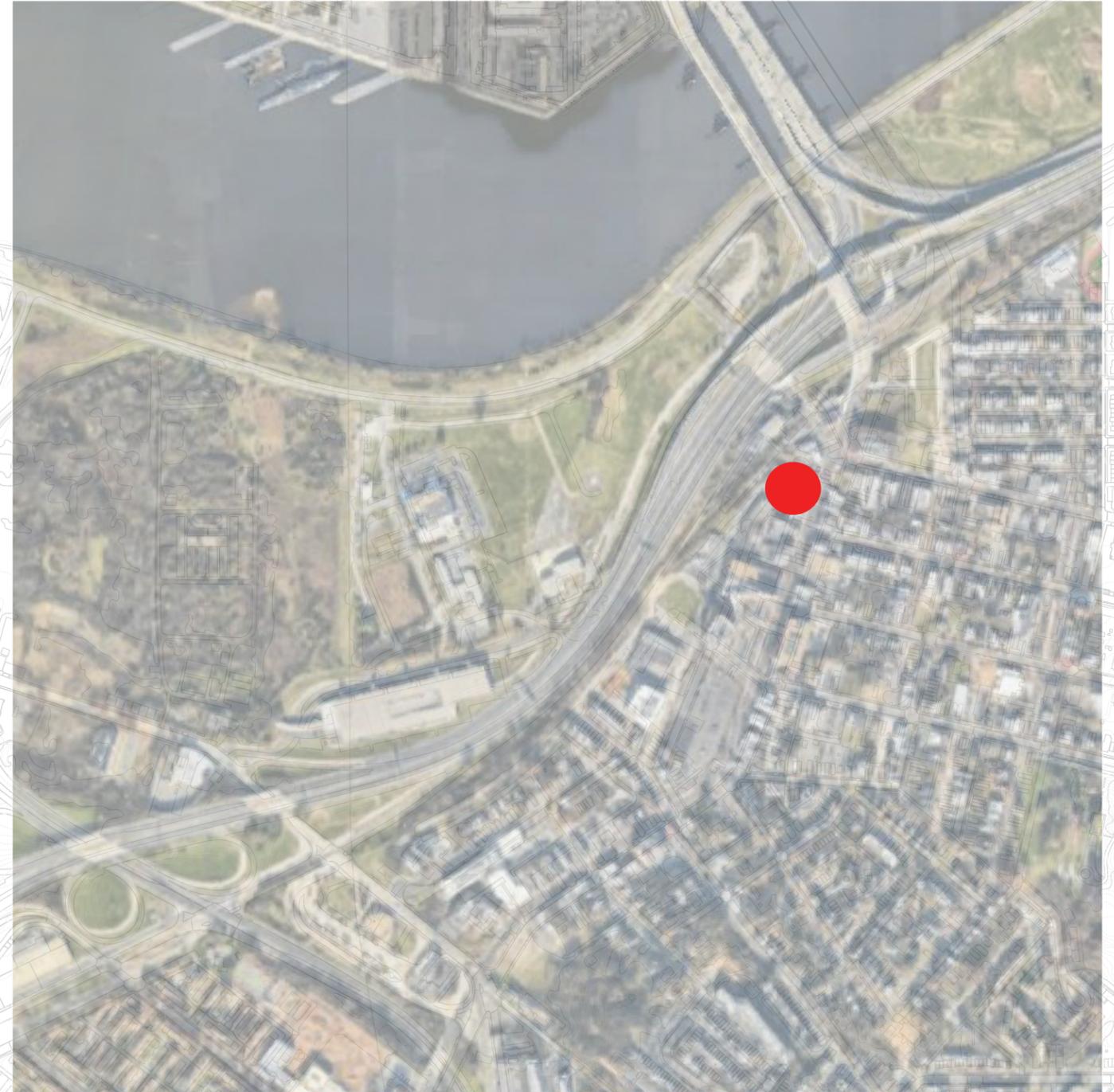


When exploring Ward 8 to find an appropriate site for the construction of a dialysis clinic / nutrition center, I searched for an open lot that supported the following conditions:

- proximity to "city center"
- easily accessible by various forms of transportation (car, metro, bike, foot)
- significant exposure to sunlight
- natural surroundings for calming views

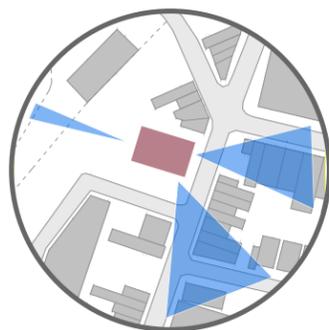
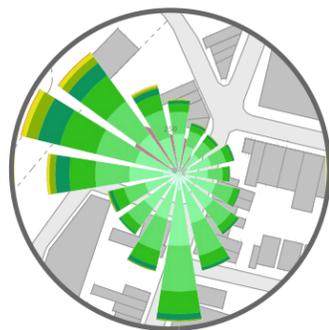
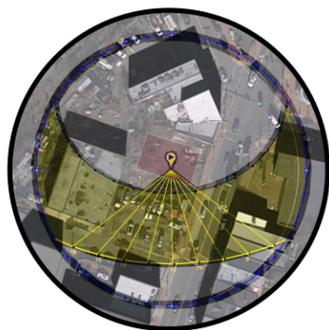
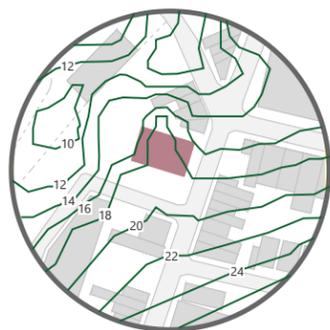
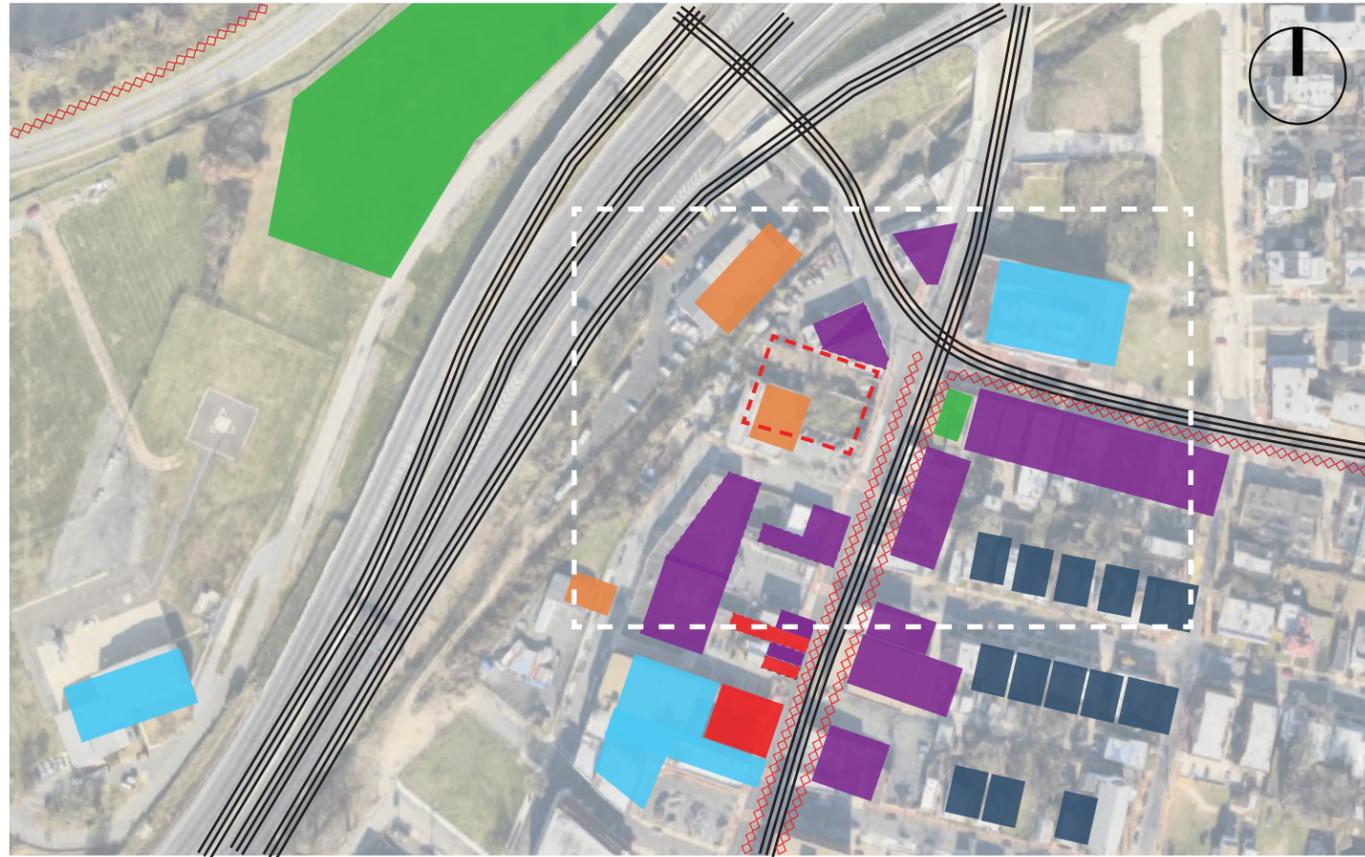
These conditions, paired with considerations of Anacostia's plans for future development, led to the selection of 1909 Martin Luther King Jr Ave SE.

- LOT SIZE: 28,650 SQ FT
- STATUS: urban
- ZONING: PDR (production, distribution, repair) / mixed use / Anacostia Historic District
- PUBLIC ACCESS: strong
- SUNLIGHT: direct, no shadows
- VIEWS: city-life, distant nature
- FUTURE: stable, continued development

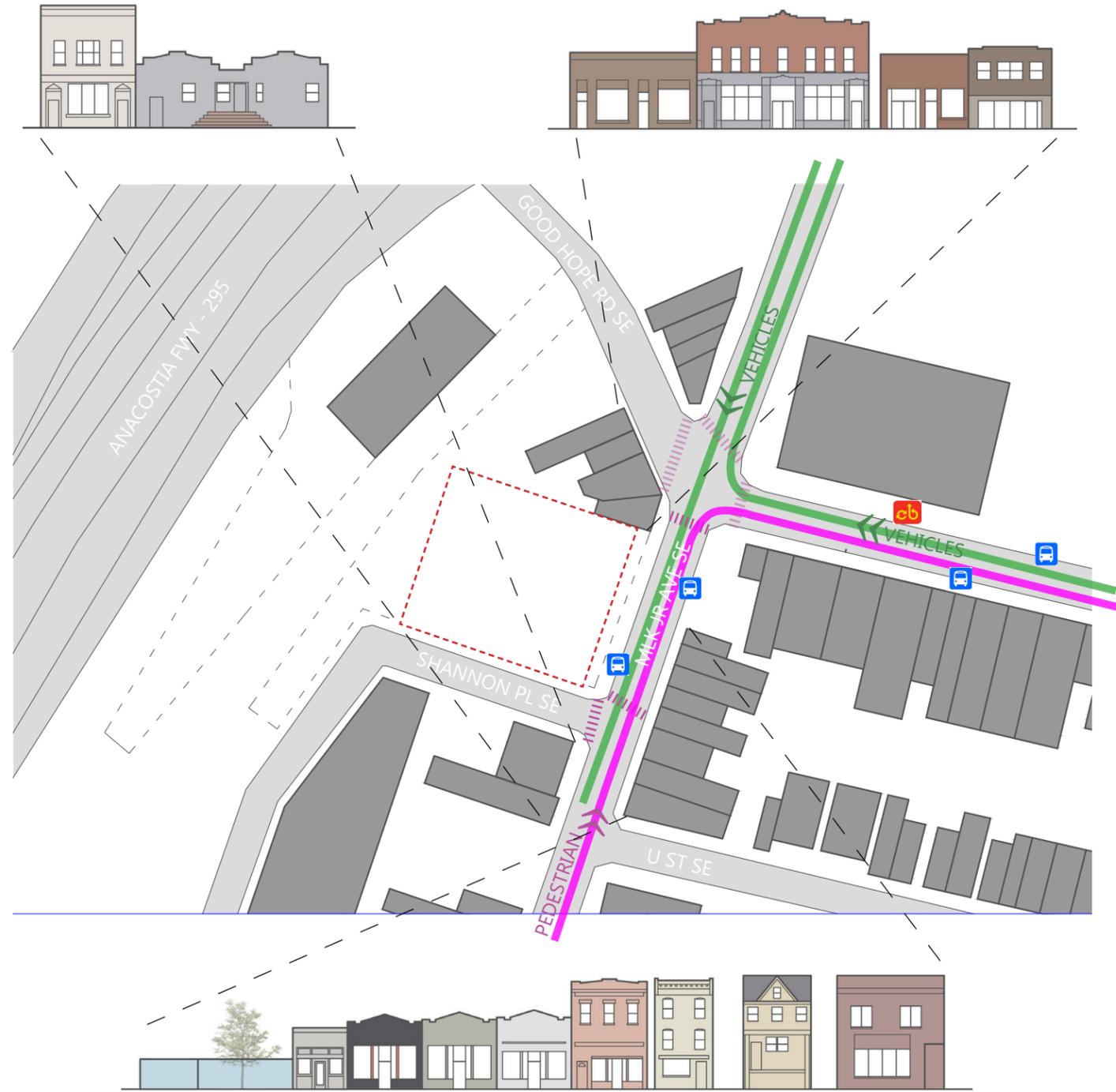


SITE ANALYSIS

1909 Martin Luther King Jr Ave SE is surrounded by a wide range of programs. Within a mile radius of this site lies an elementary school, charter school, and two high schools. This lot is within the first corner block of Anacostia; the face of the historic neighborhood. DC traffic pours down from 11th Street Bridge onto MLK while freeway-bound traffic flows from Good Hope Rd, making this a busy intersection for cars and pedestrians.



25 TOPOGRAPHY SUN WIND VIEWS



An awareness of the historic district's existing language regarding scale, color and materiality influenced the site's development

PRECEDENTS

EMENHISER INFUSION CENTER AT SAMARITAN LEBANON COMMUNITY HOSPITAL
Clark/Kjos Architects and Hoichi Kurisu Landscape Designer - Lebanon, OR, 2006



(Clark Kjos Architects, 2006)

Elements of Inspiration

- EBD strategies supporting restful, healing spaces
- natural views, space cantilevers over Japanese healing garden
- patient privacy control
- waterfall element acoustically and visually exposed throughout the facility
- treatment areas radiate out from central nurse station
- natural materials: bamboo, wood, etc.

SAN ANTONIO MILITARY MEDICAL CENTER
RTKL - San Antonio, TX, 2011



(AIA, 2011)

Elements of Inspiration

- materiality respects surrounding context and remains welcoming and light (both natural and warm: terra cotta, stone, wood, terrazzo)
- exterior composition inspired by interior health operations
- response to solar orientation
- visible collection of rainwater

URBAN FARM AT PASONA TOKYO HEADQUARTERS
Kono Designs - Tokyo, Japan, 2010



(Kono Design, 2010)

Elements of Inspiration

- integration of hydroponic urban farming within occupiable building
- environment promotes mental health, social interaction and community engagement
- harvest, preparation, and cafe for "farm-to-table" production
- Plants mix with work space: tomatoes suspended over conference rooms
- climate control: humidity, temperature, ventilation

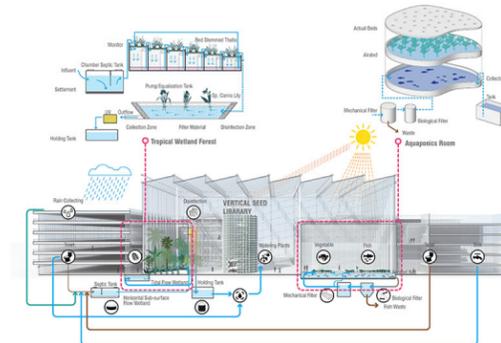
SUNQIAO URBAN AGRICULTURAL DISTRICT
Sasaki - Shanghai, China, 2016



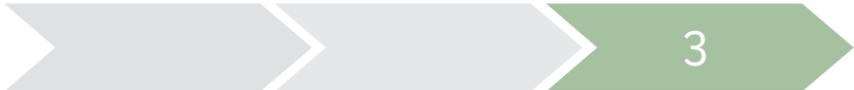
(Sasaki Associates, 2016)

Elements of Inspiration

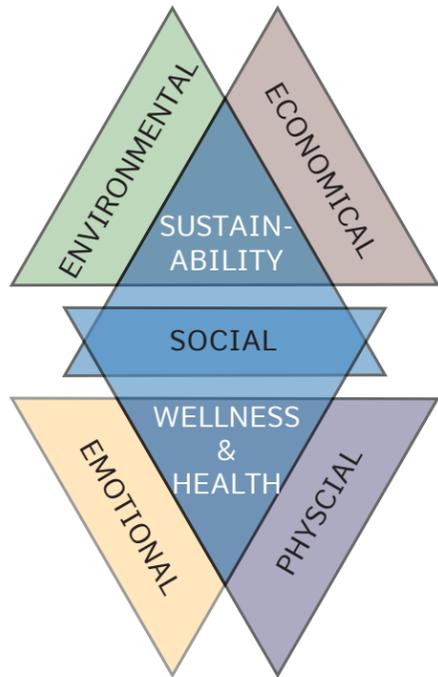
- new approach to urban, vertical agriculture
- focus on public outreach
- interactive, educational, socially engaging experiences
- aquaponic growing systems
- indoor and outdoor agriculture



DESIGN PROPOSAL



PROGRAM PROPOSAL



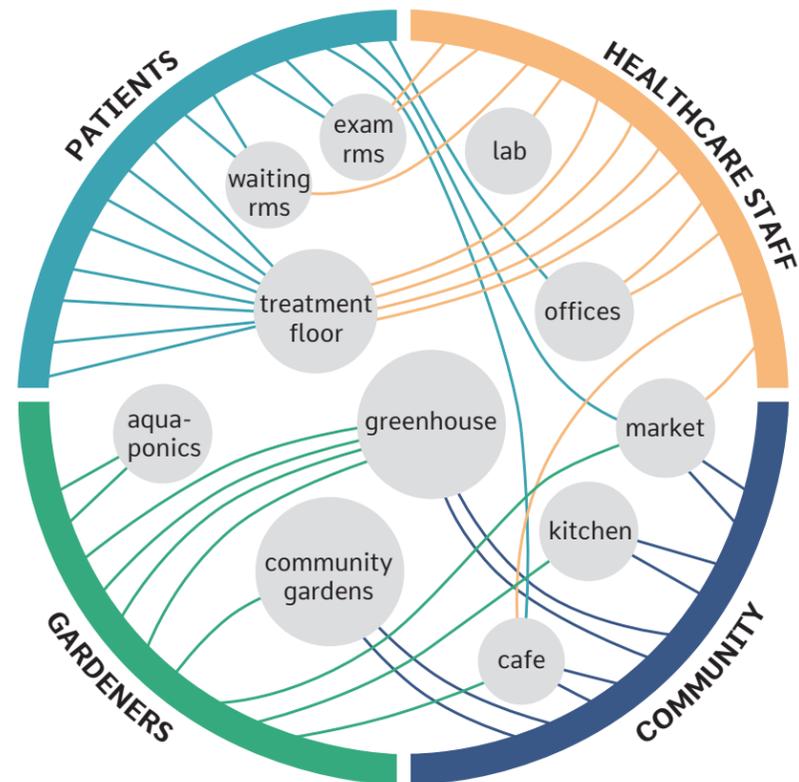
HOLISTIC SUSTAINABILITY
 Design that heals: the program of this healthcare facility will take a holistic approach to design that interweaves the elements of sustainability with the factors of health and wellness, creating a facility that supports the individual and the community.

“Effects on human performance matter as much as building performance, when it comes to green design”

- Eve Edelstein
 (Sternberg, 2009, p. 293)

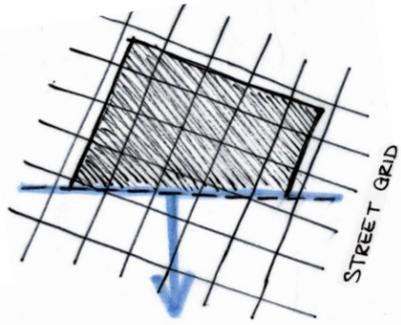
CROSSED INTERACTIONS
 Spaces are designed to allow the building's occupants to frequently interact with one another...

The patient meets the gardener in the market. The gardener meets the community member in the greenhouse. The community member meets the healthcare staff in the cafe. The healthcare staff meets the patient in the treatment floor.

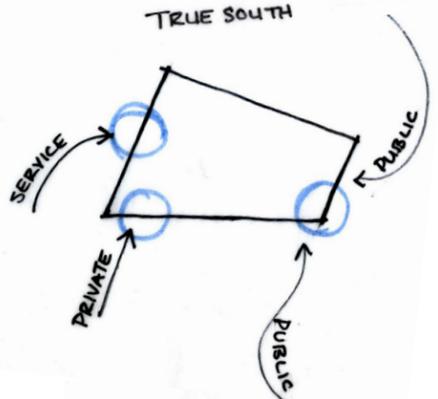


MASS DEVELOPMENT

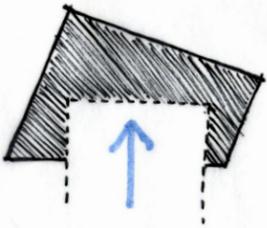
Strategic design moves shape the building to be directly responsive to the site conditions and program requirements.



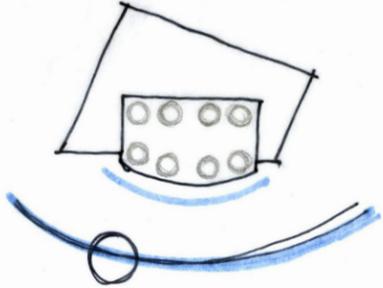
GRID SHIFT



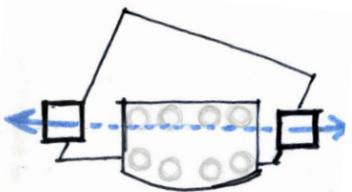
ENTRY POINTS



PULLING IN NATURE



SUNLIGHT OPTIMIZATION

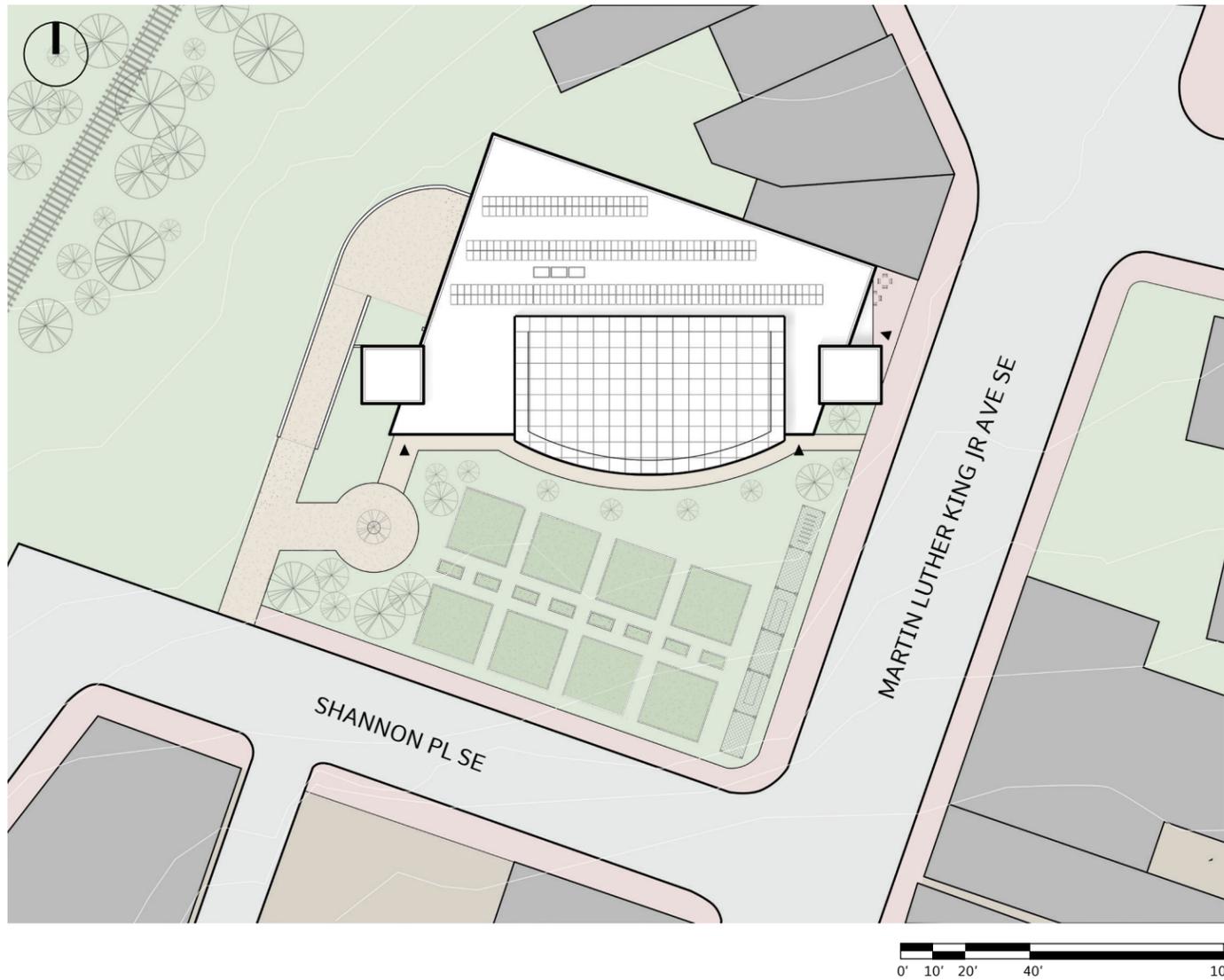


CIRCULATION NODES

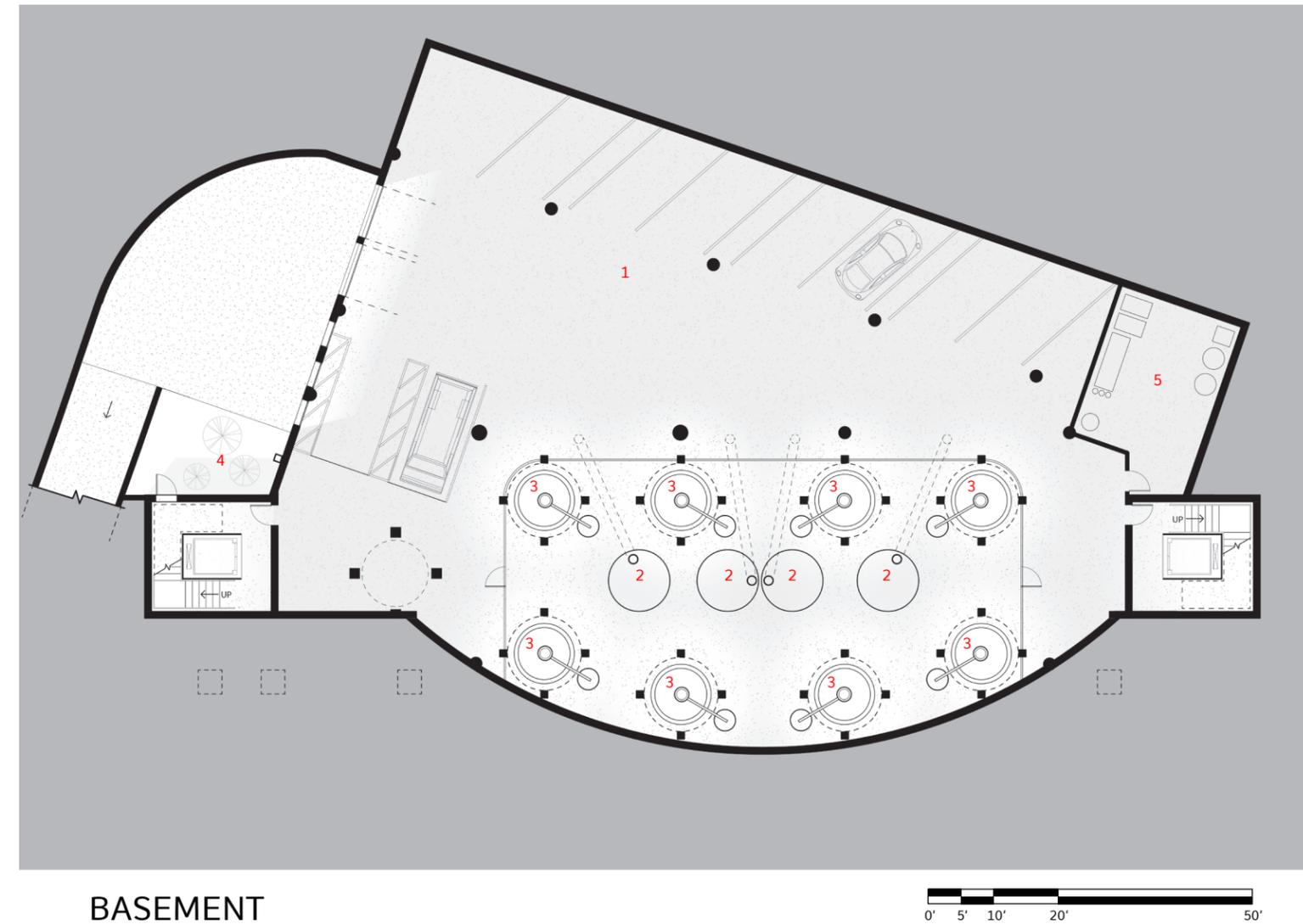


SITE PLAN

The eastern, street-side entryway is pulled back slightly to allow space for an outdoor cafe. The dialysis patients' more private entrance is pulled to the south-west corner with a direct drop-off location. The facility pushes right against the northern lot line and preserves the southern side as open lawn for a community garden. Eight 20'x20' garden plots and eight raised planter beds are provided, helping to vitalize the neighborhood's food production and increase nutritional education.

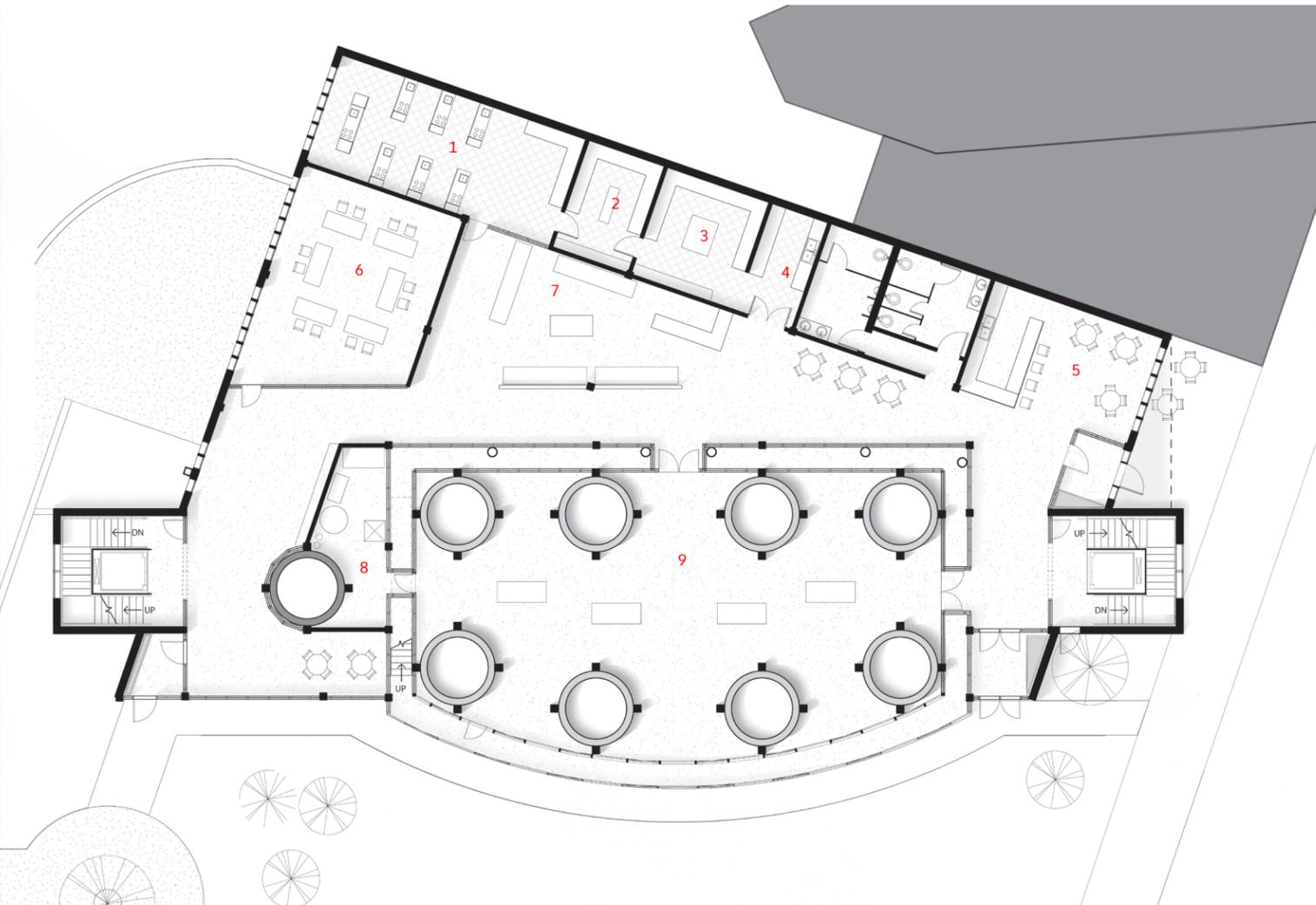


FLOOR PLANS



BASEMENT

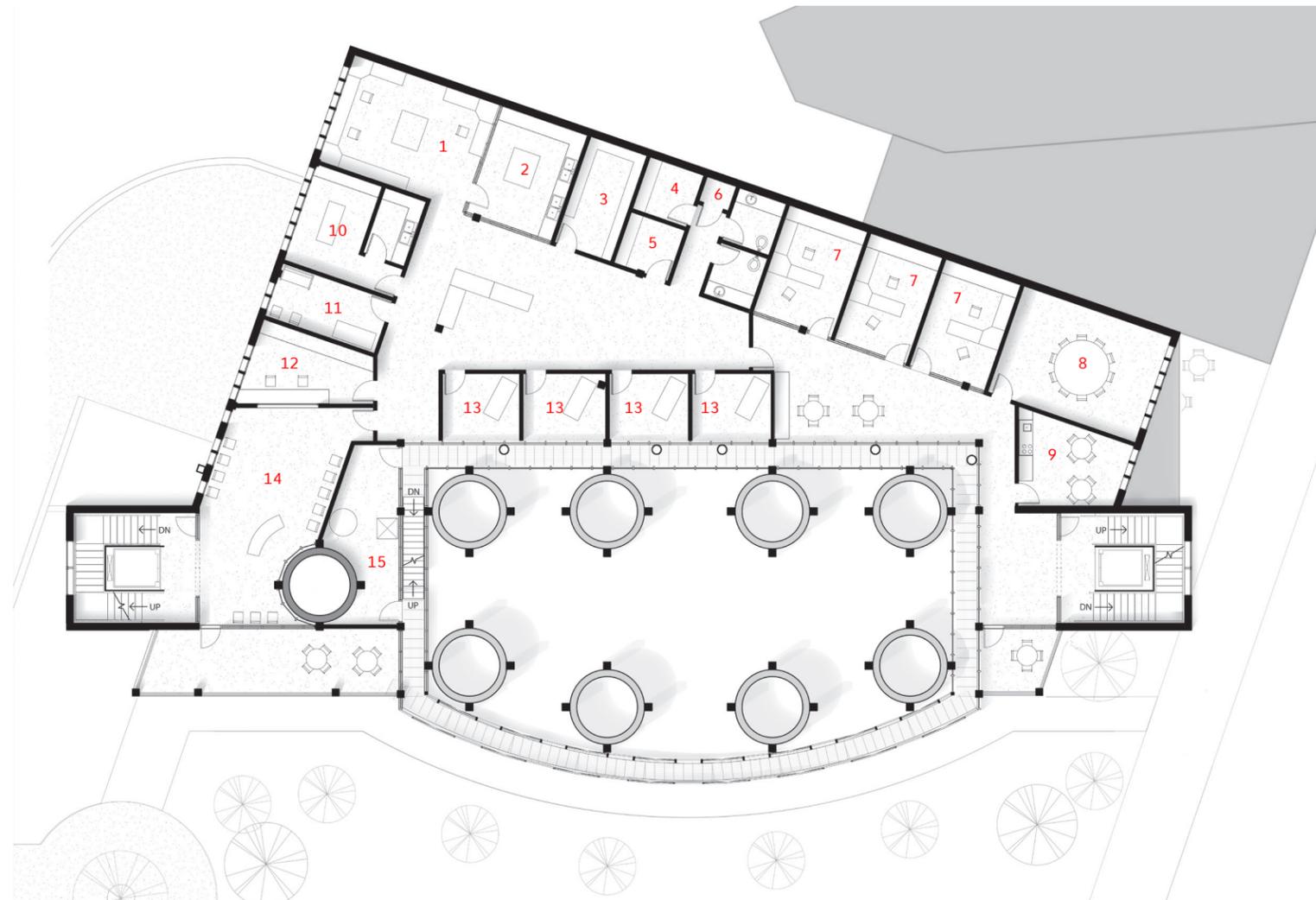
- 1 PARKING GARAGE
- 2 RAINWATER TANKS
- 3 TELESCOPING HYDRAULIC ELEVATORS
- 4 RAIN GARDEN
- 5 GEOTHERMAL / MECHANICAL ROOM



GROUND FLOOR



- | | | |
|-----------------------|---------------------------|-------------------------------|
| 1 EDUCATIONAL KITCHEN | 4 FOOD PROCESSING STATION | 7 MARKET |
| 2 FREEZER | 5 CAFE | 8 FISH TANKS |
| 3 REFRIGERATOR | 6 CONFERENCE ROOM | 9 VERTICAL HYDROPONIC FARMING |



SECOND FLOOR



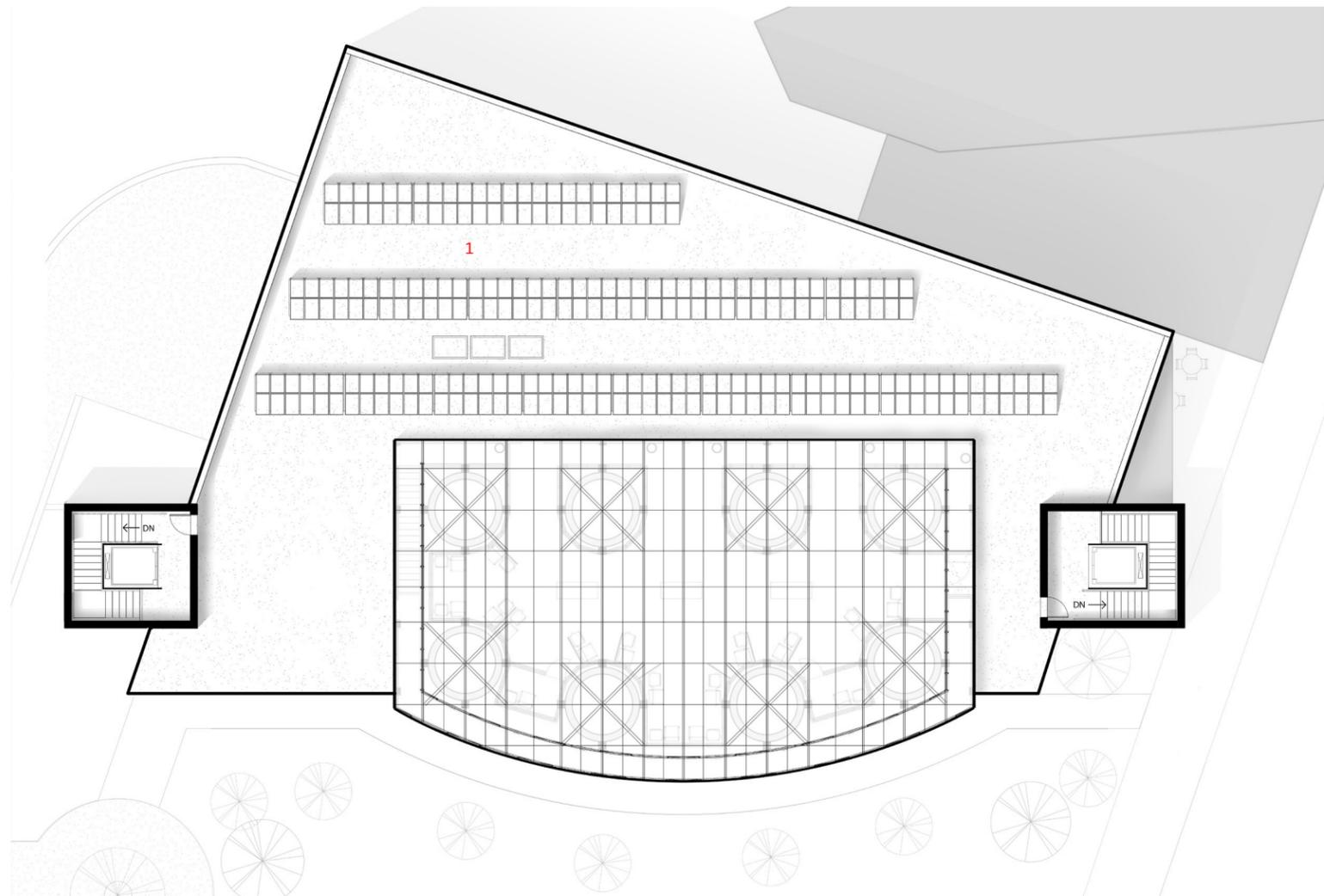
- | | | |
|------------------|---------------------|----------------|
| 1 WORKSPACE | 4 SOILED UTILITY | 7 OFFICE |
| 2 LABORATORY | 5 STORAGE | 8 MEETING ROOM |
| 3 RECORDS | 6 JANITORIAL CLOSET | 9 BREAK ROOM |
| 10 SURGERY ROOM | 13 EXAM ROOM | |
| 11 RECOVERY ROOM | 14 WAITING ROOM | |
| 12 RECEPTION | 15 FISH TANKS | |



THIRD FLOOR



- | | | |
|---------------------|-----------------------|-------------------|
| 1 MEETING ROOM | 5 WATER TREATMENT | 9 MULTIUSE OFFICE |
| 2 JANITORIAL CLOSET | 6 SUPPLIES | 10 SOCIAL WORKER |
| 3 STORAGE | 7 HT CHARTS / MEDS | 11 DIETITIAN |
| 4 IT | 8 HOME TREATMENT (HT) | 12 RECEPTION |
| 13 "HUDDLE" ROOM | 17 CHARTS / MEDS | |
| 14 PATIENT PREP | 18 WAITING ROOM | |
| 15 DOCTOR'S OFFICE | 19 FISH TANKS | |
| 16 FACILITY MANAGER | 20 TREATMENT FLOOR | |



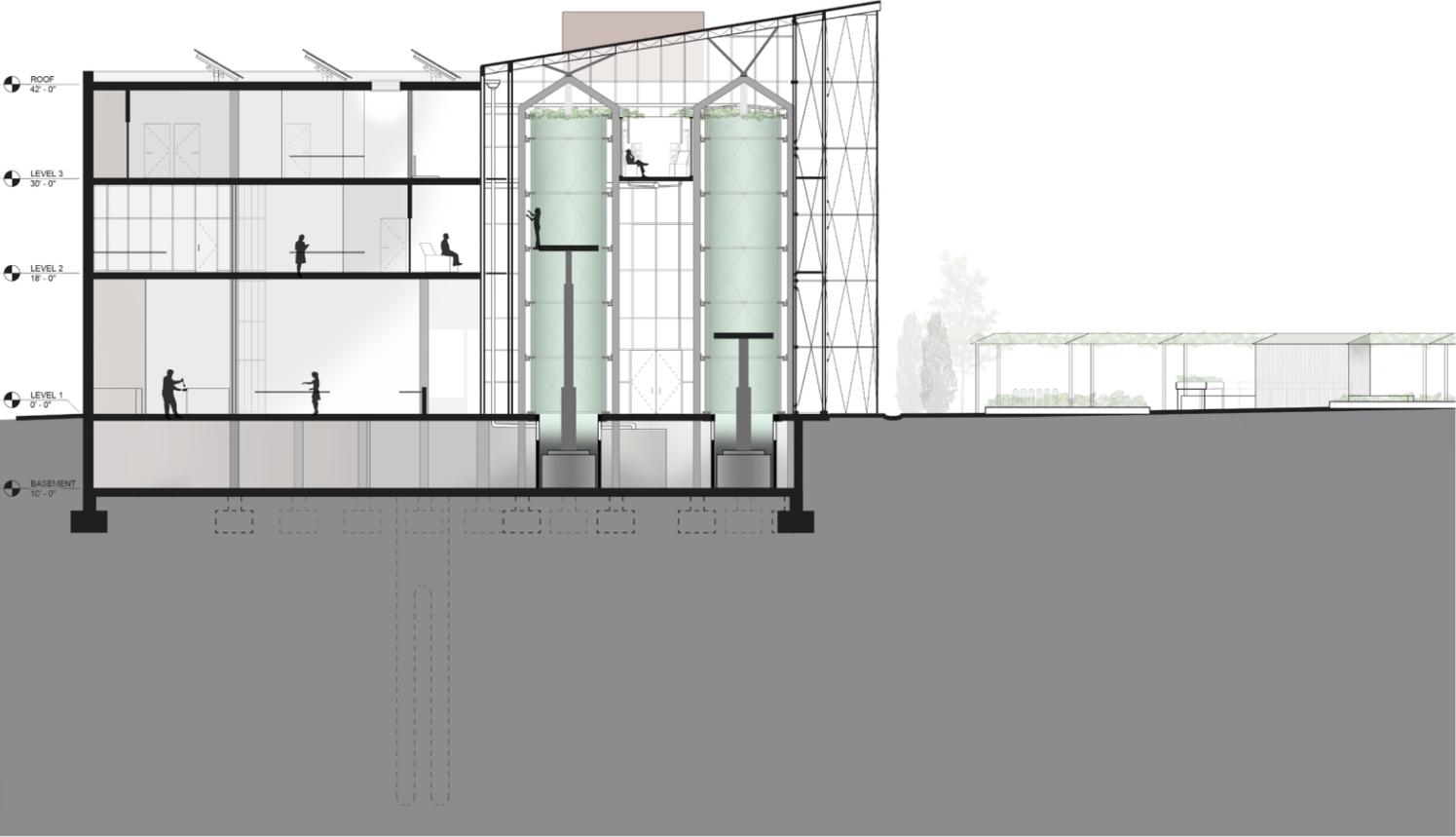
ROOF



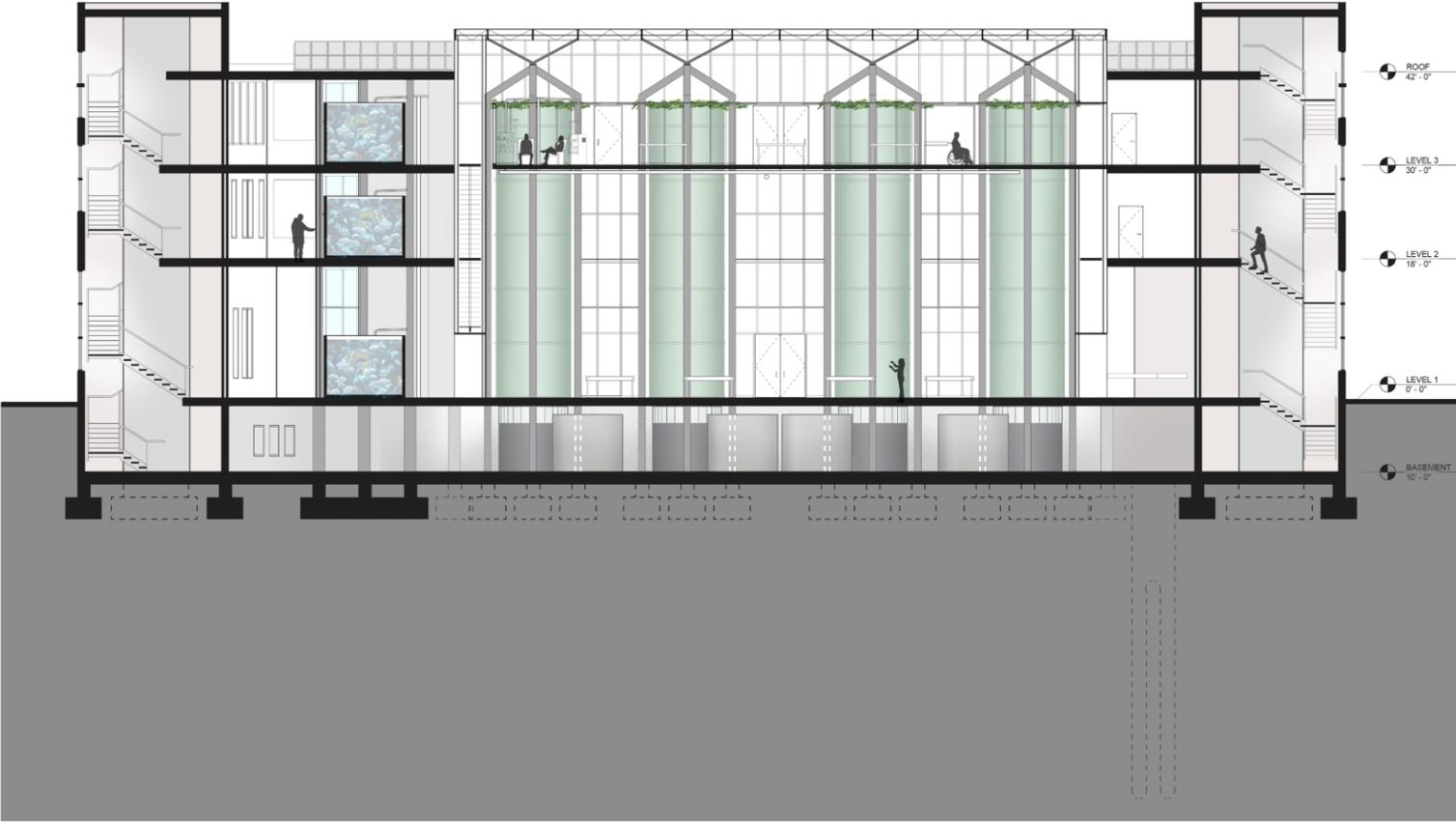
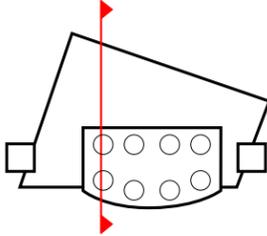
- 1 SOLAR PANELS

SECTIONS

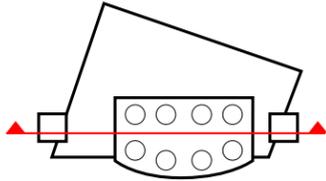
The northern side of the building is dedicated to healthcare services and community programming, which wraps around the southern, three-story, glass atrium space that is dedicated to vertical aquaponic farming. The third floor dialysis treatment center extends out into this garden space, creating an environment that is fully-immersed with nature, as the plant towers continue through this space and create an overhead canopy of vines.



NORTH- SOUTH



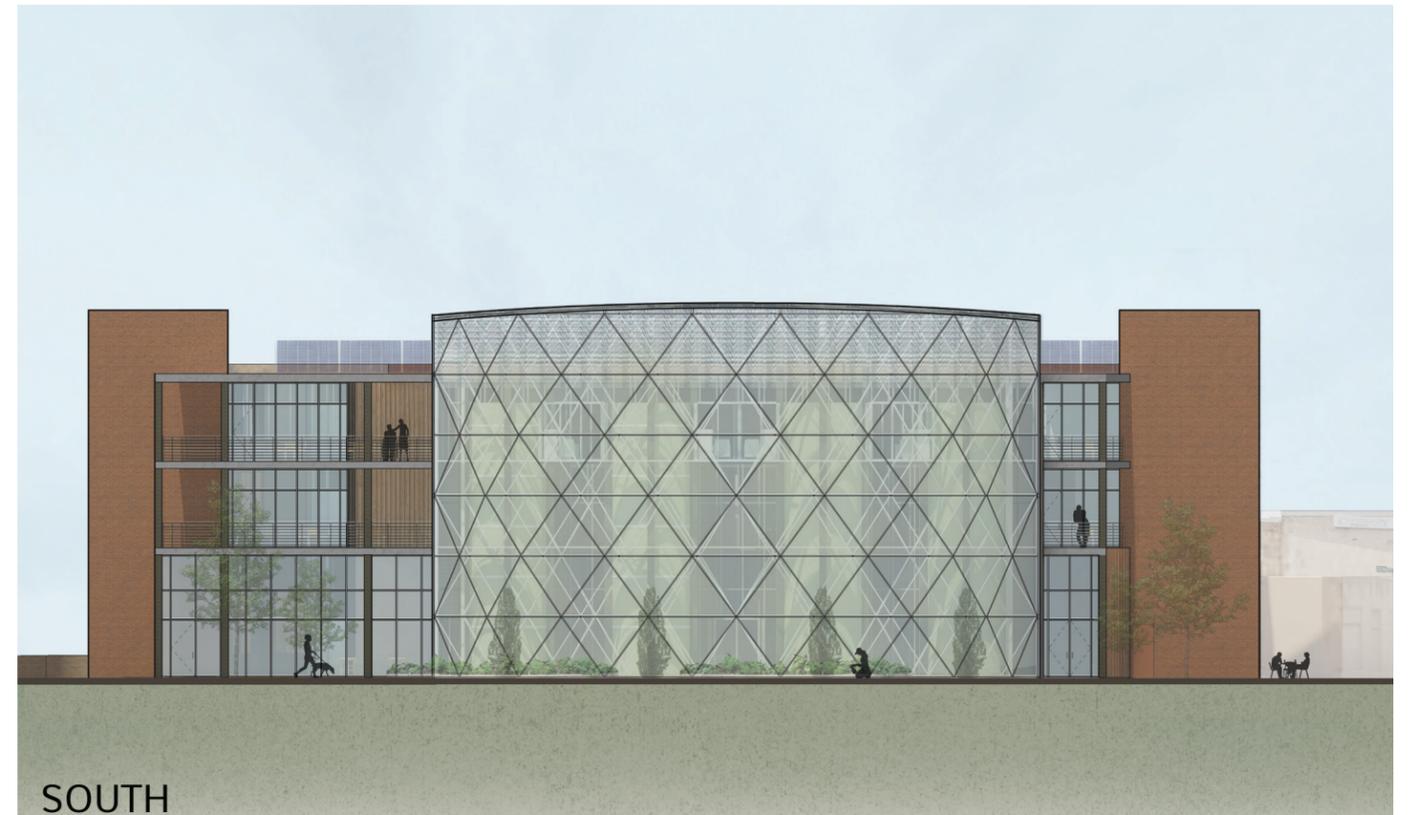
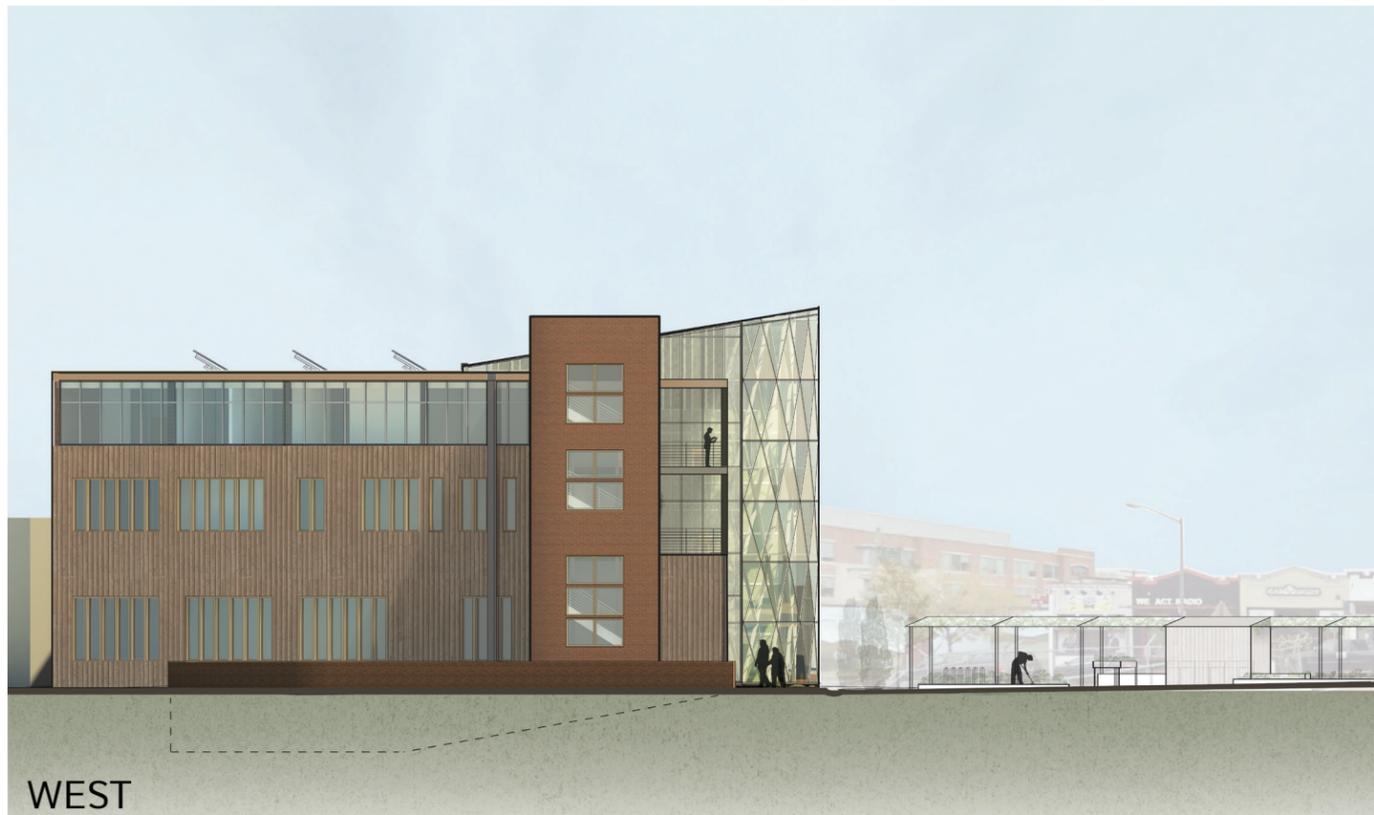
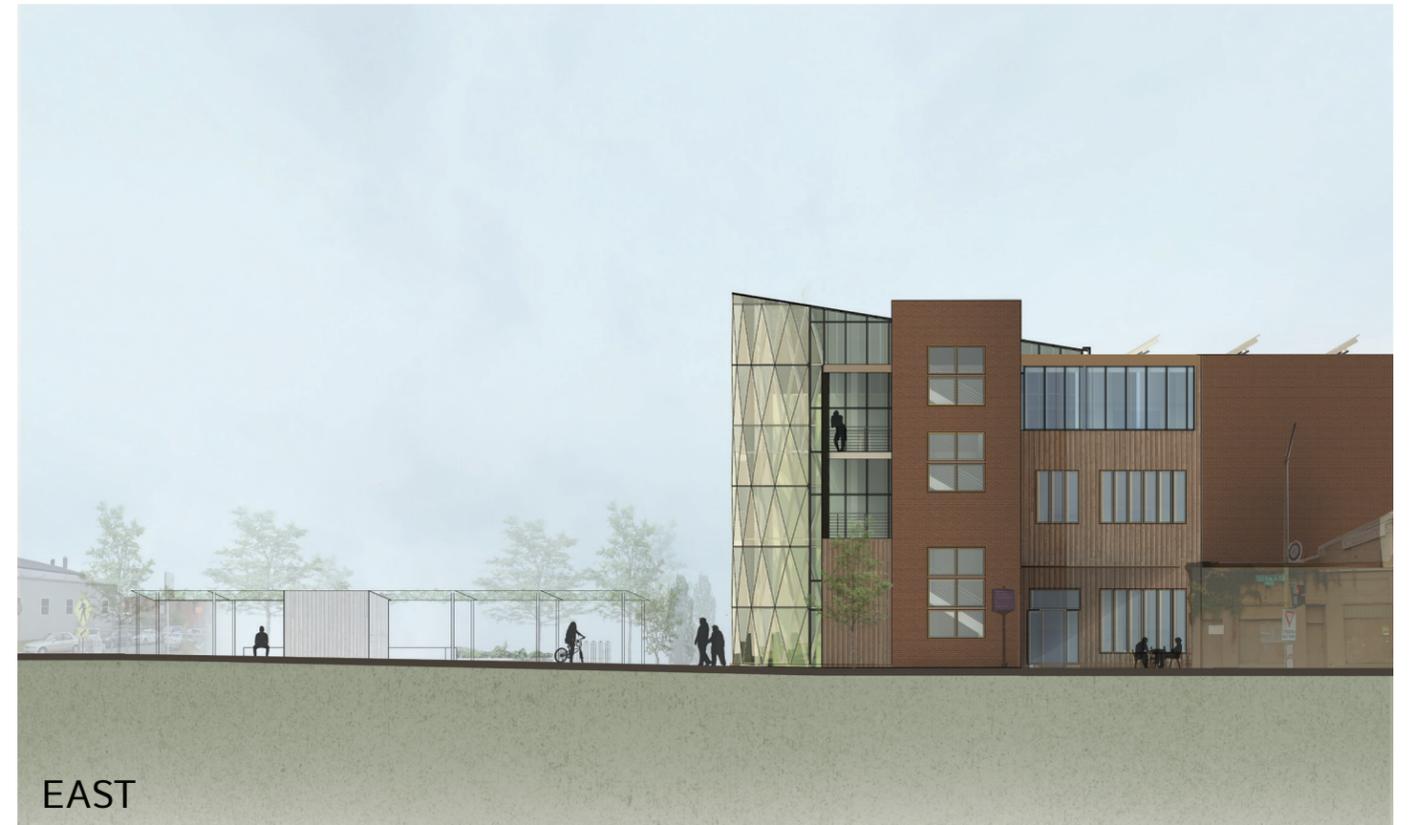
EAST - WEST



ELEVATIONS

The three-story building has a light and unobtrusive presence that blends with the neighborhood's current 1 to 2 story building heights. The northern facade (not pictured) is an entirely solid masonry wall built right against the property line with the assumption that future development will build-to and block any potential light and views.

Brick is also used for the two main stairwells, connecting with the historic district's material palette. Reclaimed cypress wood panels, local to the area, cover all remaining facades that are not glass. The low-e glass panels of the vertical farm's atrium dominate the southern facade allowing maximum sunlight to penetrate the farm and blend the connection between the indoor and outdoor gardens.



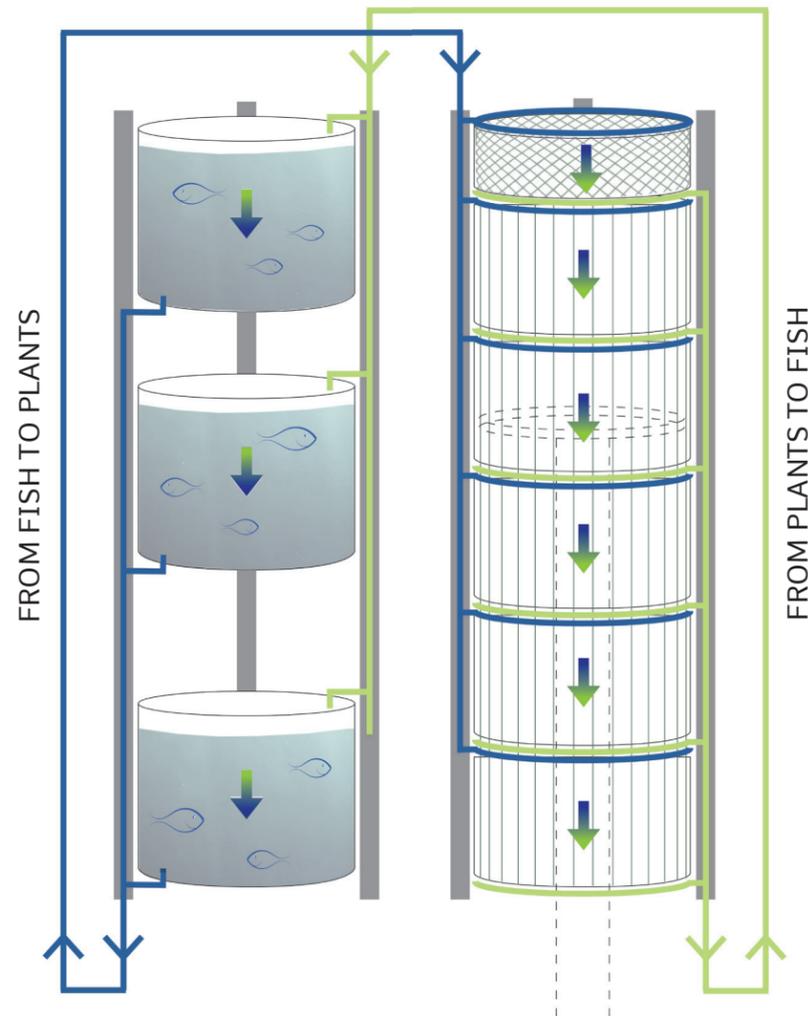
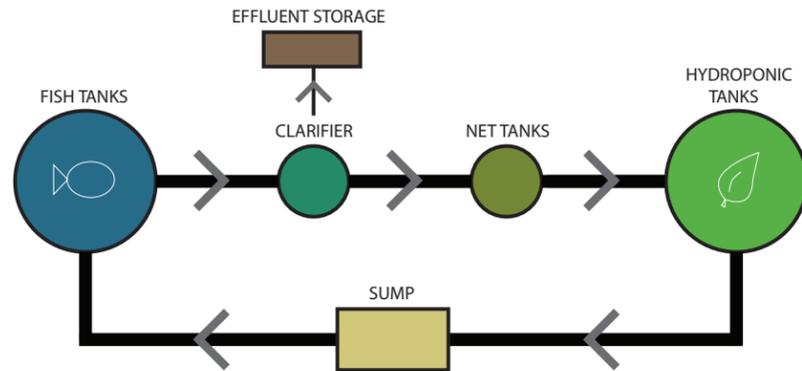


NUTRITION

Kidney failure is a disease that emphasizes the need for dietary restrictions and nutritional education. The integration of a nutrition program that focuses on both education and food production benefits the patients and their community. This will also help to counter Anacostia's food-desert status.

AQUAPONICS

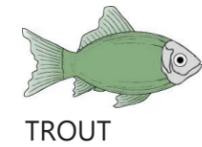
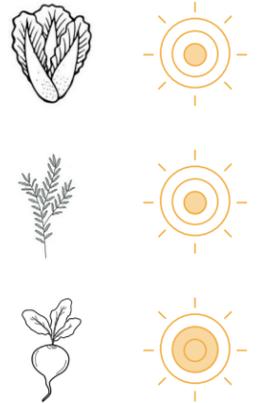
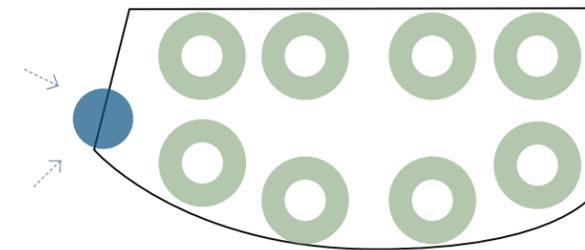
Aquaponics offers a closed loop food-production system in which fish waste provides fertilizer for hydroponic plants while the plants filter the water for the fish. This system uses 1/10 of the water consumed by soil-based gardening. (ISU, 2018) Both the fish tanks and the vertical hydroponic gardens are exposed to the building's occupants to reveal the filtration process and become an integral element of the healing environment.



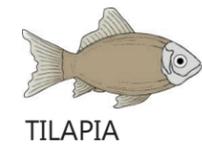
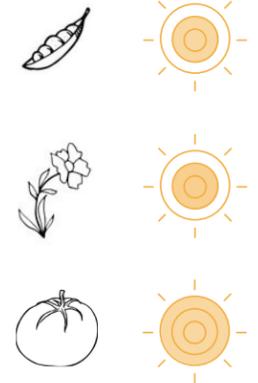
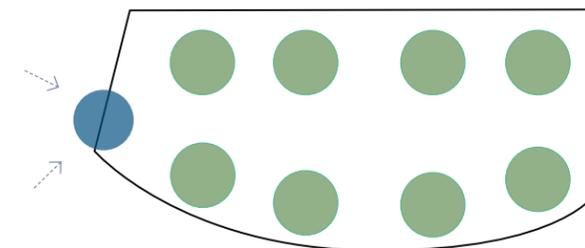
The three fish tanks are visible from the western lobby and the patient waiting rooms. The eight plant towers inhabit the southern atrium and extend through the dialysis treatment center.



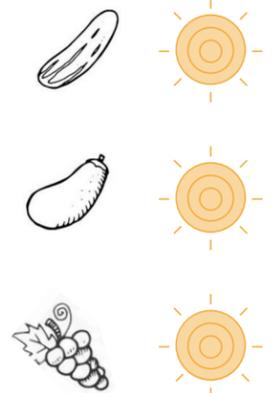
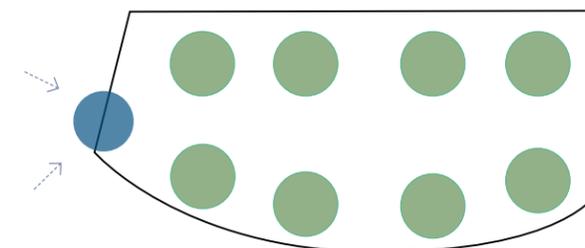
GARDEN - THIRD FLOOR:
overhanging vines - ornament / production



GARDEN - SECOND FLOOR:
vertical farm towers - production

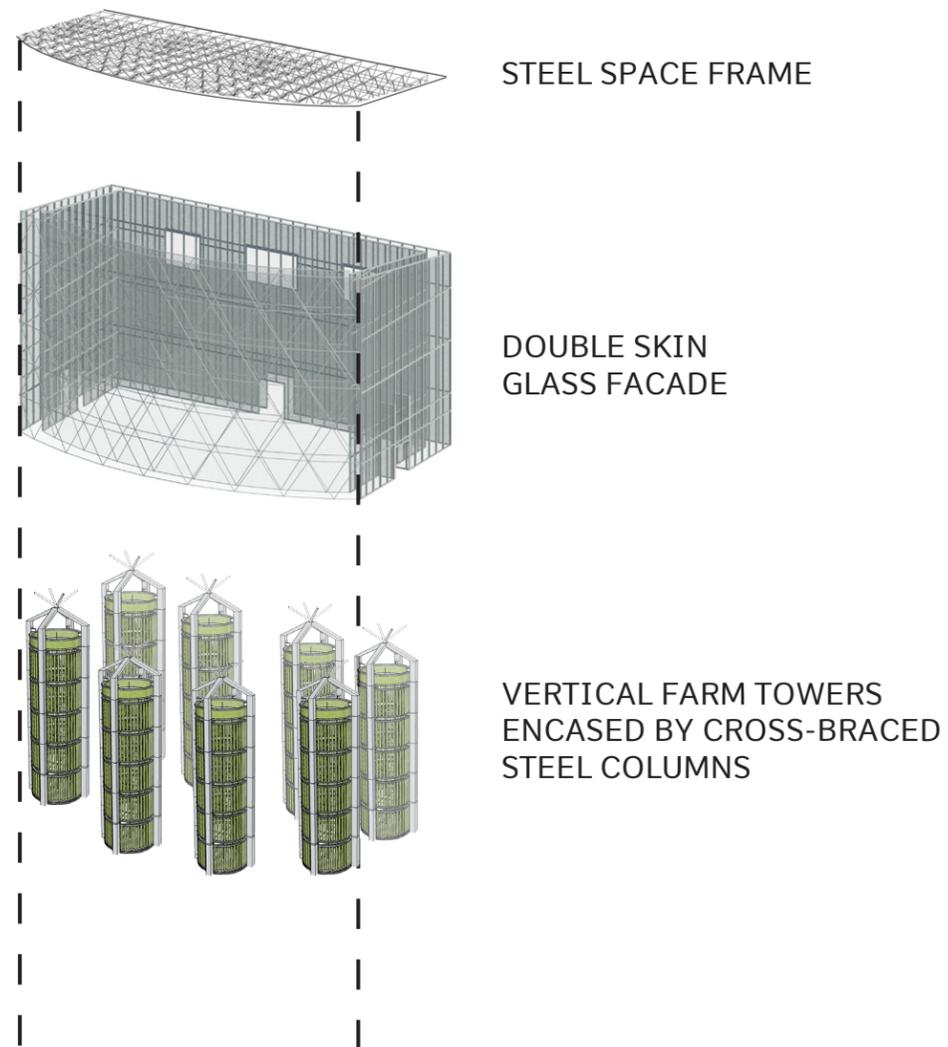


GARDEN - GROUND FLOOR:
vertical farm towers - education / production

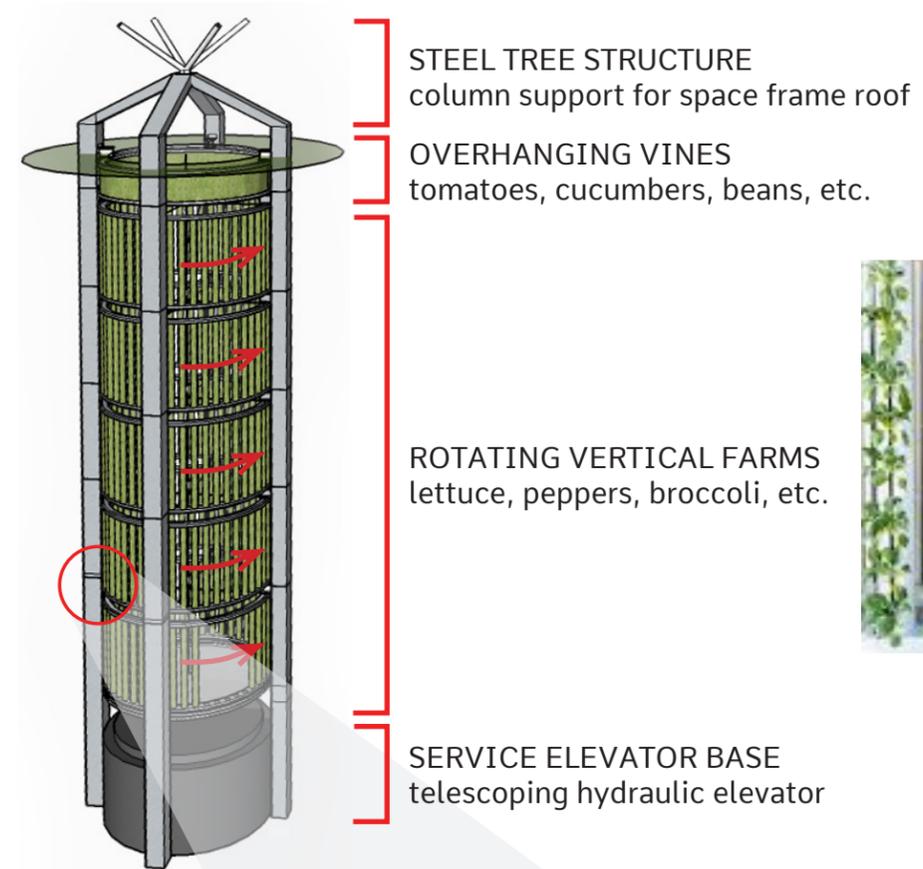


PRODUCTION: 4,500 GALLONS
APPROX 15,000 LBS OF FISH/YEAR

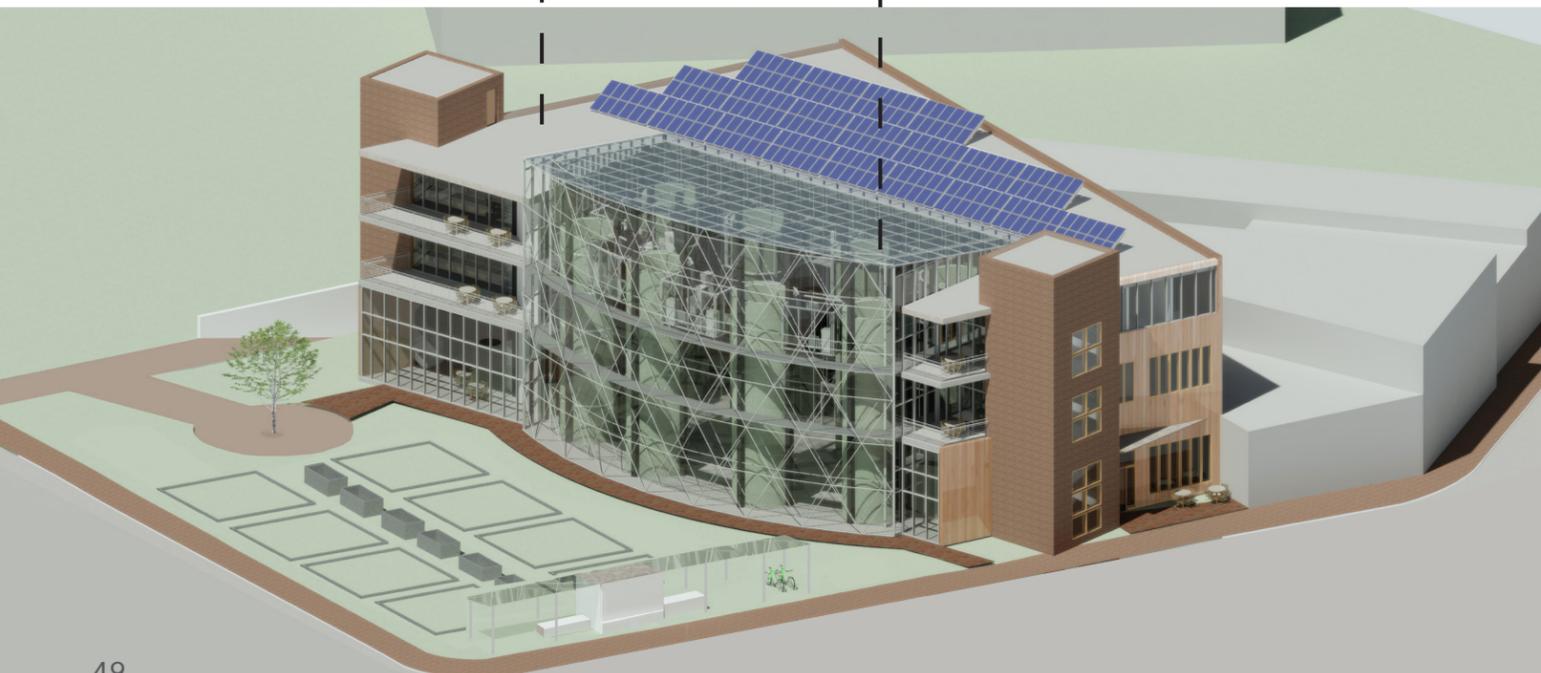
PRODUCTION: 401,860 SF
APPROX 3,100 LBS OF PRODUCE/YEAR



VERTICAL FARM TOWER



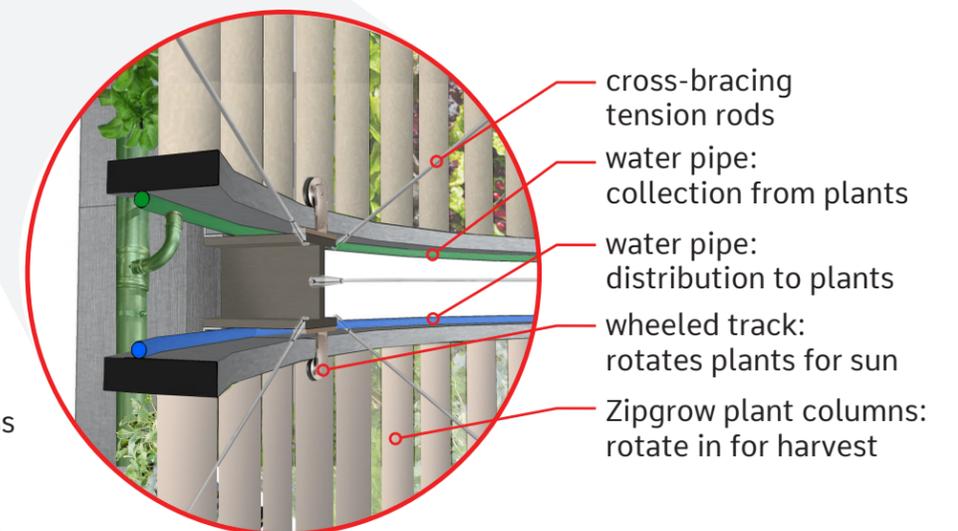
vertical farm composed of ZipGrow plant columns



SECTION DETAIL: INTERIOR OF VERTICAL FARM TOWER

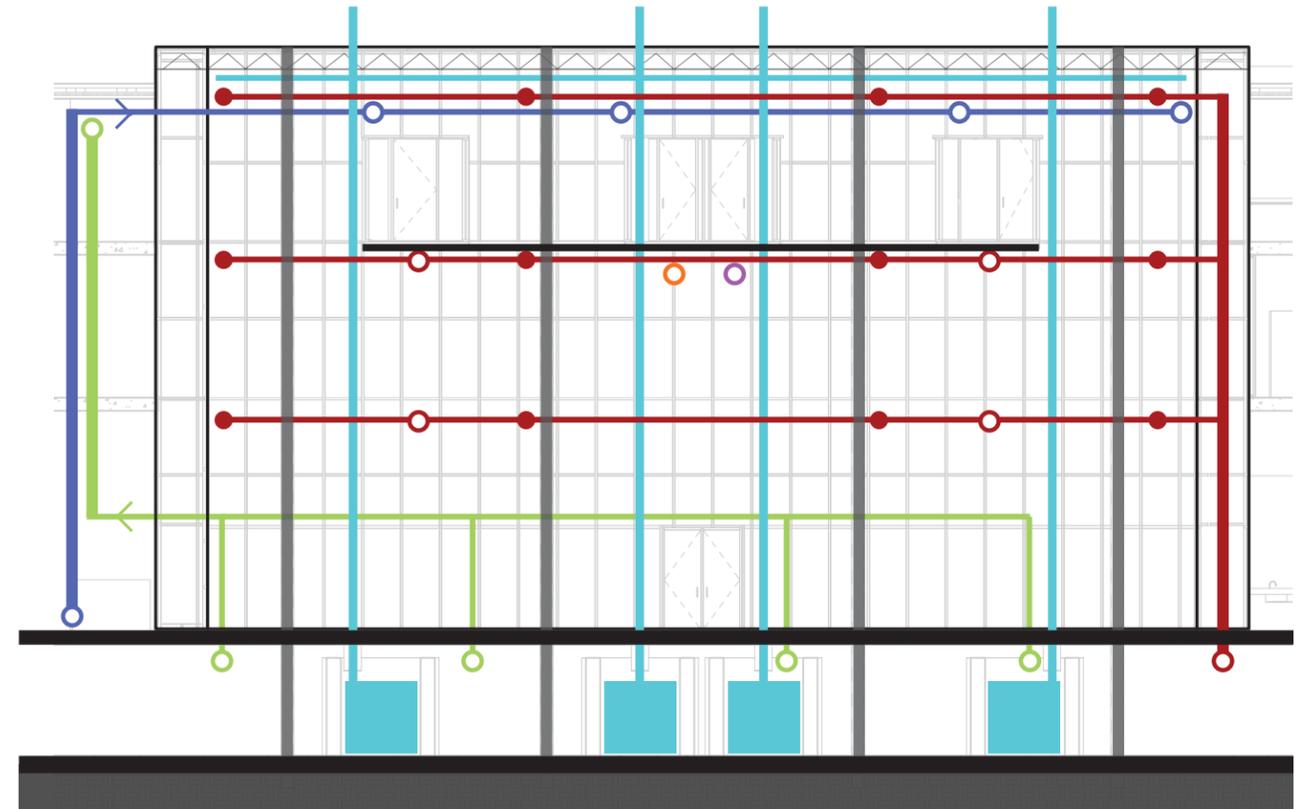
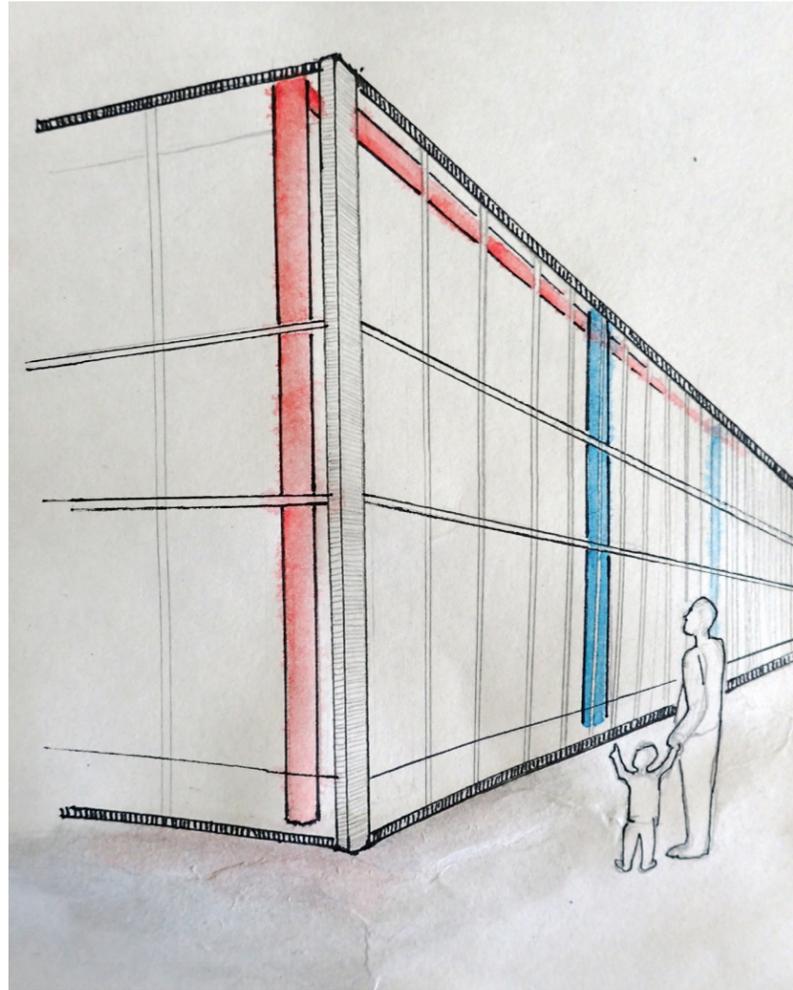
Each 7' tall vertical farm section rotates to provide the plants with evenly distributed sunlight. Within each section, ZipGrow columns individually rotate, allowing for the care and maintenance of the plants from the inside of the towers via the hydraulic elevator.

Aquaponic water pipes attach to each tower's columns with access lines splitting off at the top and bottom of each 7' section for water distribution and collection.



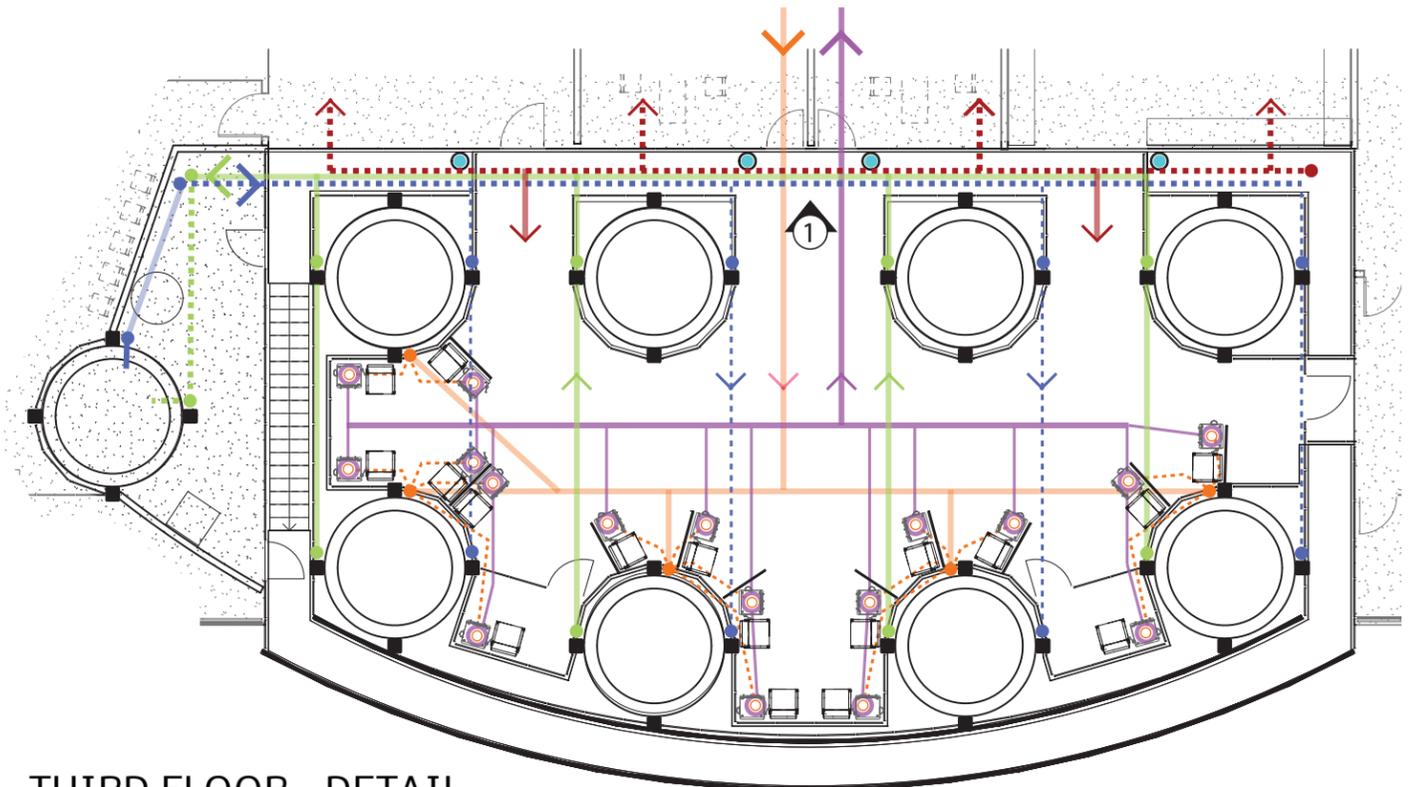
WATER CIRCULATION - FILTRATION

The interrelation of dialysis patients with the filtration machines, and thus the building, inspired a theme of celebrated circulations. The interior air cavity of the vertical farm's double-skin becomes a statement "filter wall" that displays the interweaving water pipes of the various filtration systems. This exposure helps to enlighten occupants of the different processes involved in the building's sustainable functions.

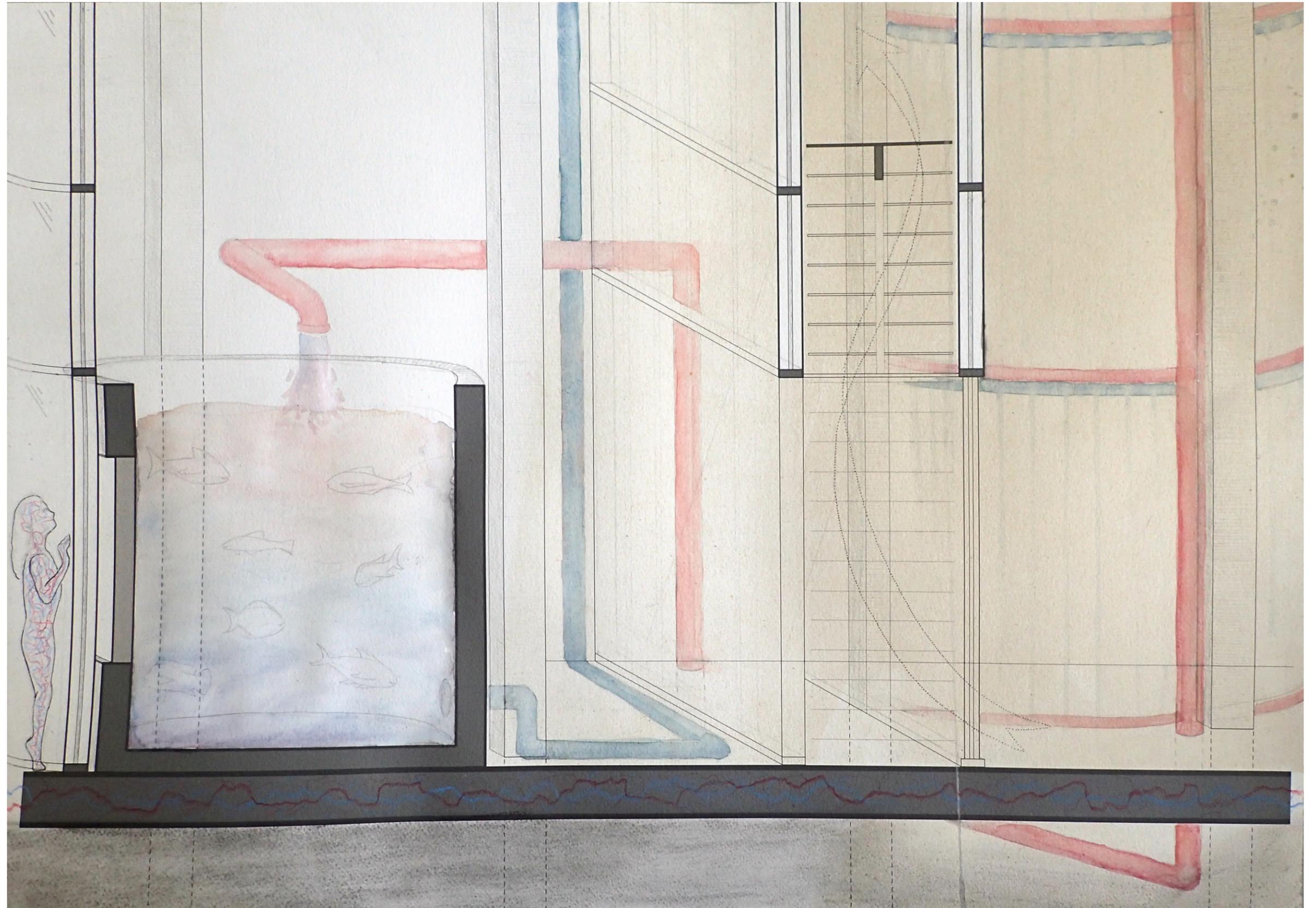


ELEVATION - FILTER WALL

- FILTERED WATER FOR DIALYSIS
- GREY WATER FROM DIALYSIS
- RAIN WATER
- WASTE WATER FROM FISH
- PURIFIED WATER FROM PLANTS
- GEOTHERMAL WATER SOURCE HEAT PUMP (WSHP)



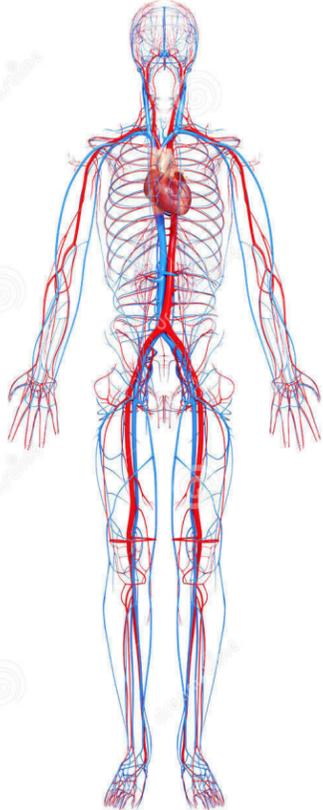
THIRD FLOOR - DETAIL



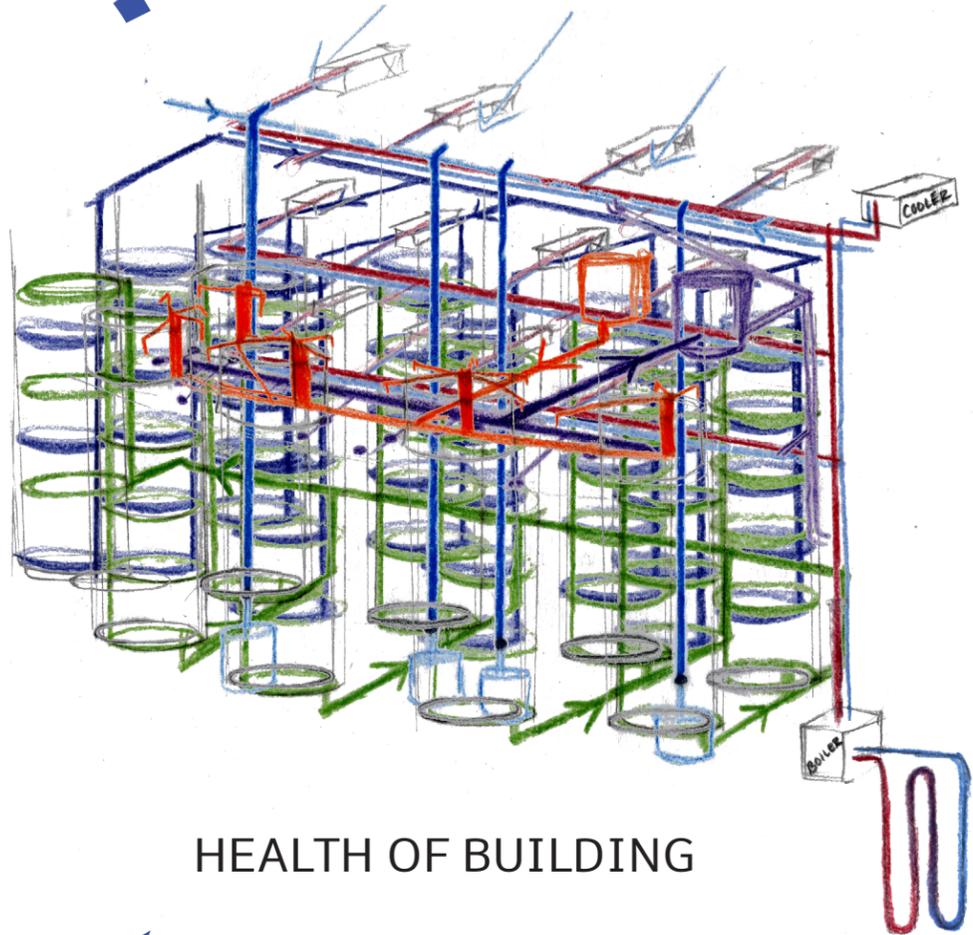
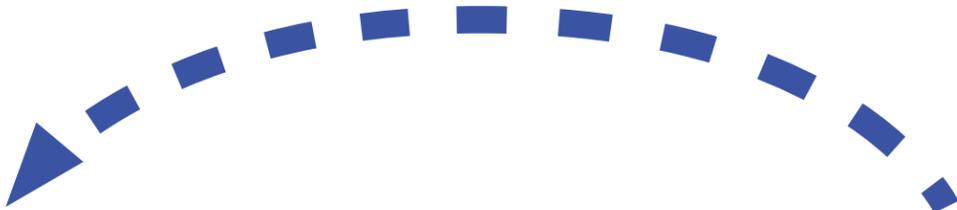
A woman peeks into the aquaponics fish tank from the lobby, getting a glimpse into the inner workings of the building's water circulation and filtration systems.

"The building is derived from the human form... the building is truly a living man"

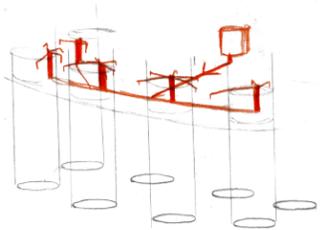
- Filarete
(Filarete, 1965, p. 12)



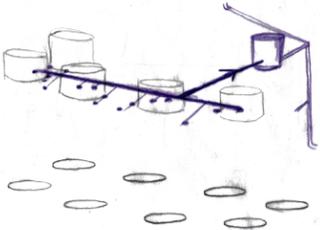
HEALTH OF MAN



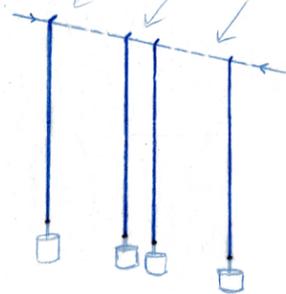
HEALTH OF BUILDING



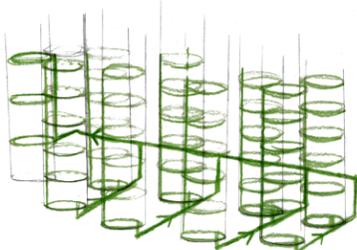
filtered water for dialysis



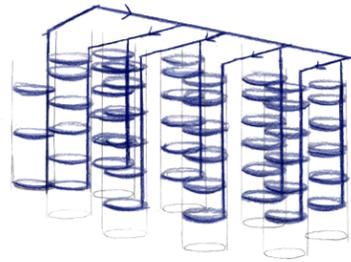
greywater from dialysis



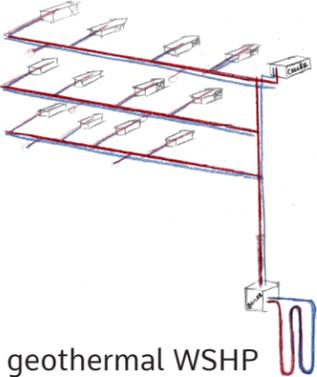
rainwater collection



purified water from plants



waste water from fish



geothermal WSHP

SUSTAINABILITY

Sustainable building methods matter as much as the sustainable programming. Multiple design features were made to make this building environmentally friendly:

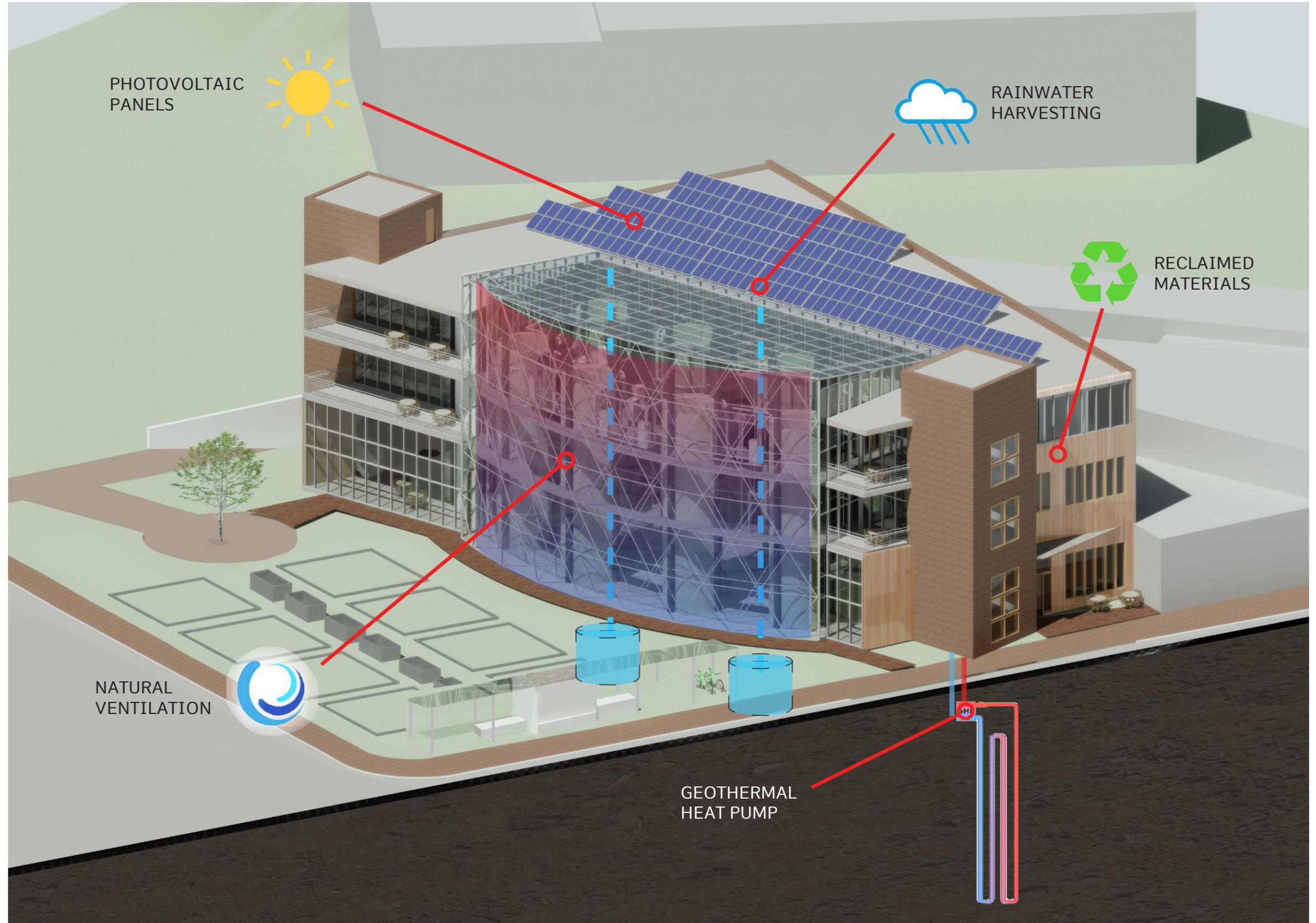
1800 square feet of photovoltaic panels on the roof produce approximately 24 kilowatts of electricity per hour. (Zientara, 2017)

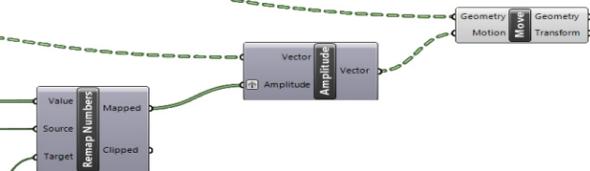
The low-e glazing of the farm's double skin facade allows for natural ventilation of the atrium space through the opening of vents.

Rain water is collected from the roof, siphoned through the "filter wall", and stored in the basement until needed by the community gardens for watering.

Reclaimed cypress wood panels cover the east and west building facades serving as a green material that still fits the neighborhood's color palette.

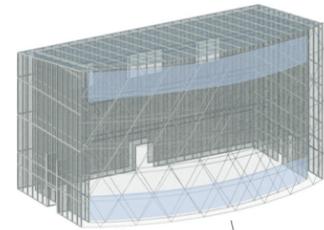
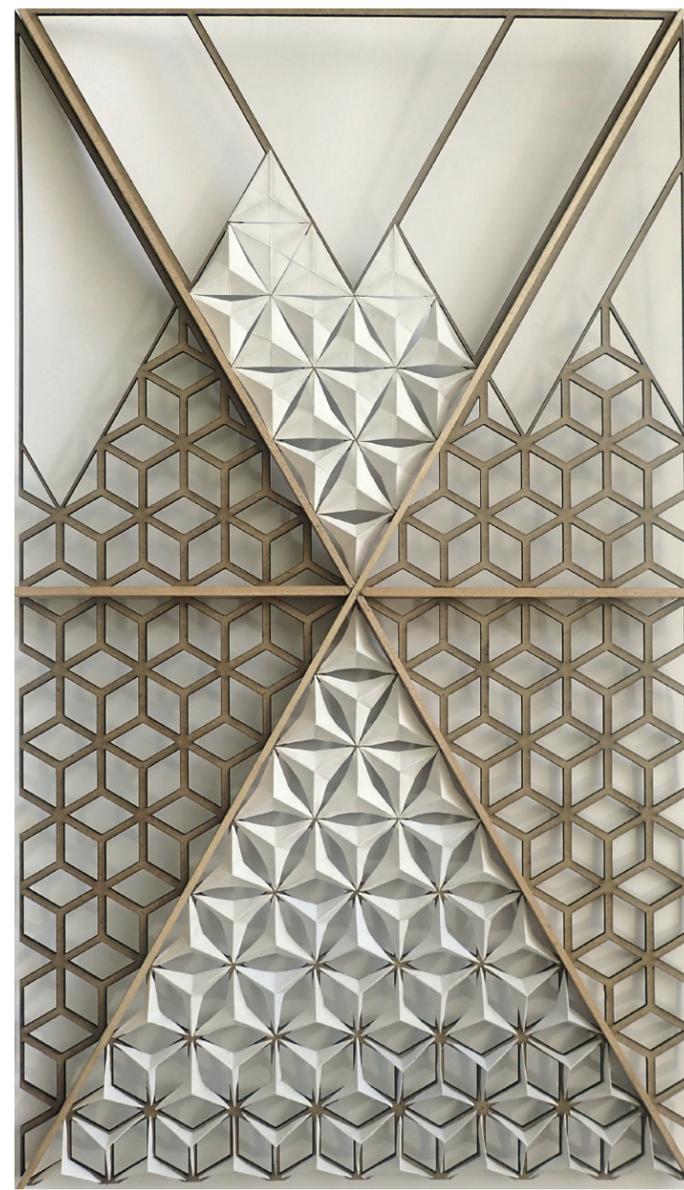
A geothermal heat pump acts as the central heating and cooling system for the building, taking advantage of the earth's natural temperature for its own regulation.



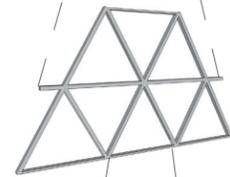


REACTIVE PANELS - NATURAL VENTILATION

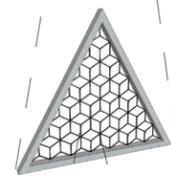
Grasshopper programming was used to design a facade system that supports natural ventilation. Bands of reactive triangular panels span across the bottom and top of the double-skin atrium, and are able to open and close prompting the natural ventilation of the interior through the stack effect. The panels open to let air flow cool the garden, or close to retain the double skin facade's air cavity to radiate heat into the garden. A thermostat tracks the temperature and triggers the mechanical opening of the panels once hotter than 78° Fahrenheit.



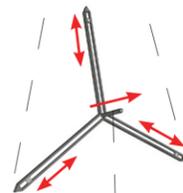
DOUBLE SKIN GLASS FACADE
reactive panels at bottom & top



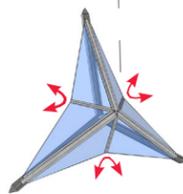
CURTAIN WALL FRAMING
steel 4" x 6" rectangular tubing



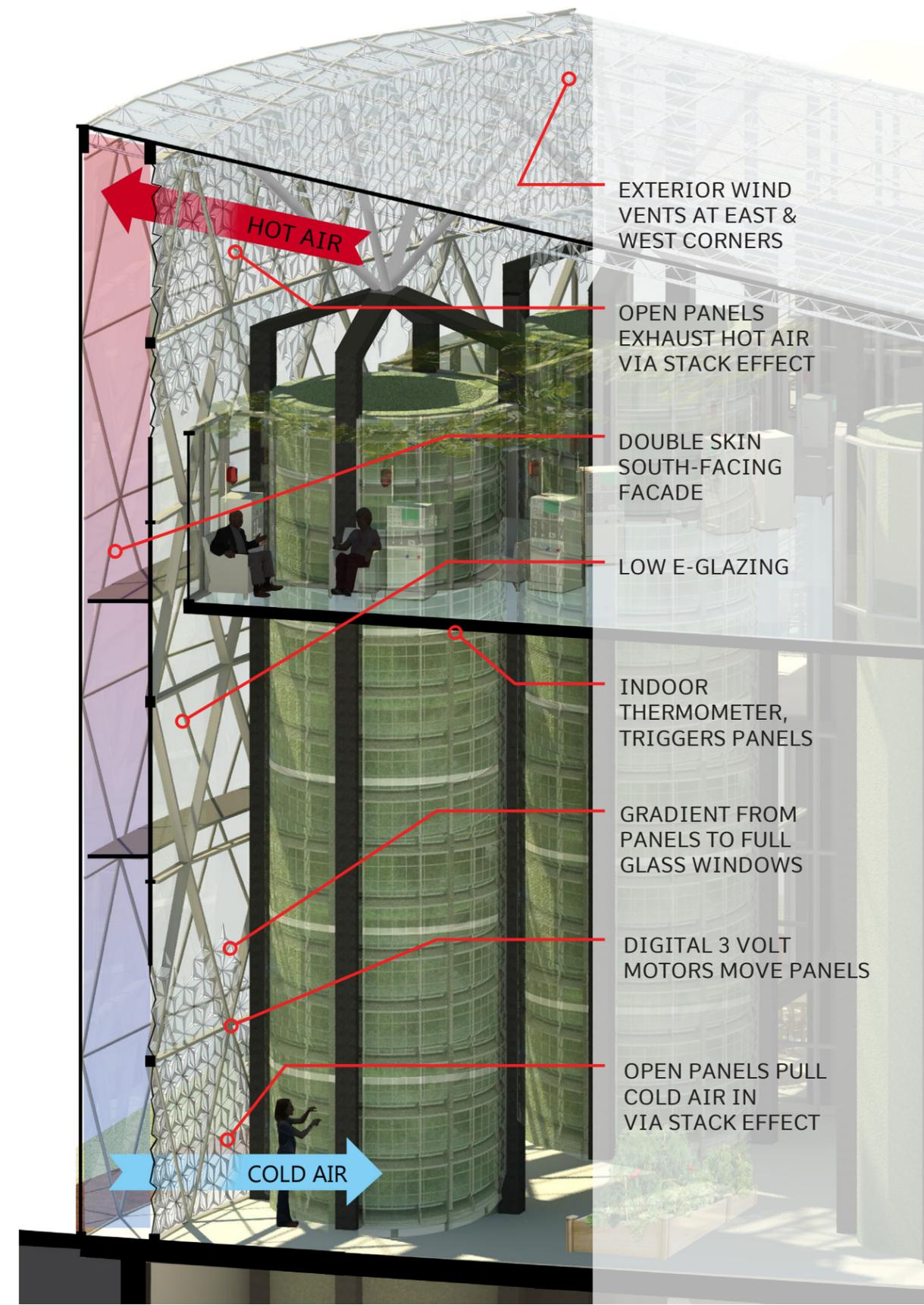
STRUCTURAL WEB
steel barstock, mounts track



ALUMINUM TRACK
pivoting members, sliding tracks



REACTIVE PANEL
glass panels in hinged aluminum frames



HOT AIR

COLD AIR

EXTERIOR WIND VENTS AT EAST & WEST CORNERS

OPEN PANELS EXHAUST HOT AIR VIA STACK EFFECT

DOUBLE SKIN SOUTH-FACING FACADE

LOW E-GLAZING

INDOOR THERMOMETER, TRIGGERS PANELS

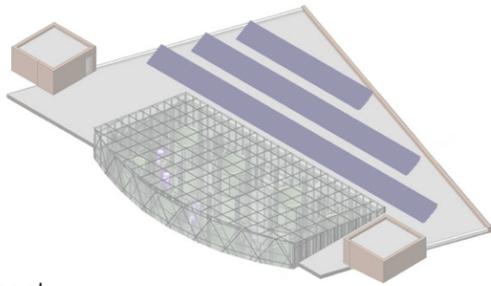
GRADIENT FROM PANELS TO FULL GLASS WINDOWS

DIGITAL 3 VOLT MOTORS MOVE PANELS

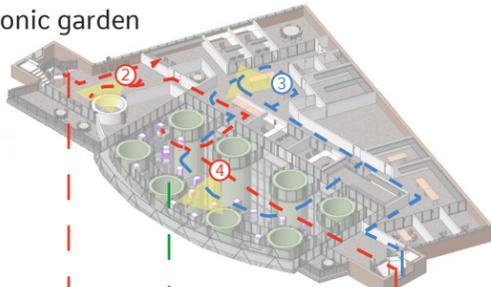
OPEN PANELS PULL COLD AIR IN VIA STACK EFFECT

EXPERIENCING THE BUILDING

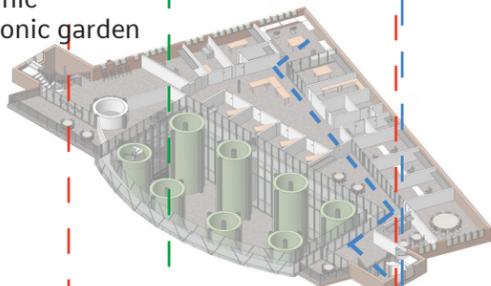
ROOF
solar panels



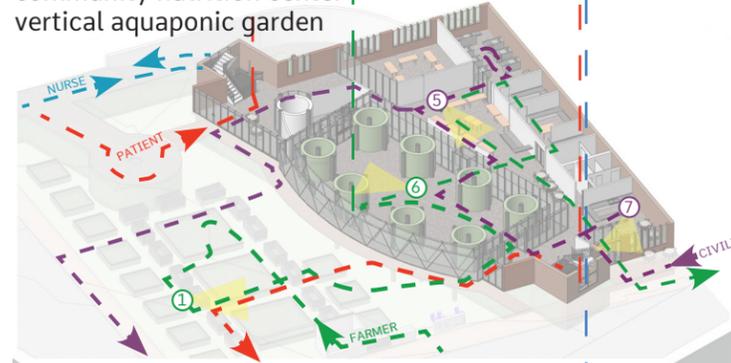
THIRD
dialysis treatment
vertical aquaponic garden



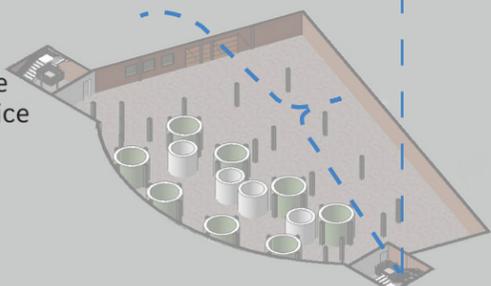
SECOND
nephrology clinic
vertical aquaponic garden



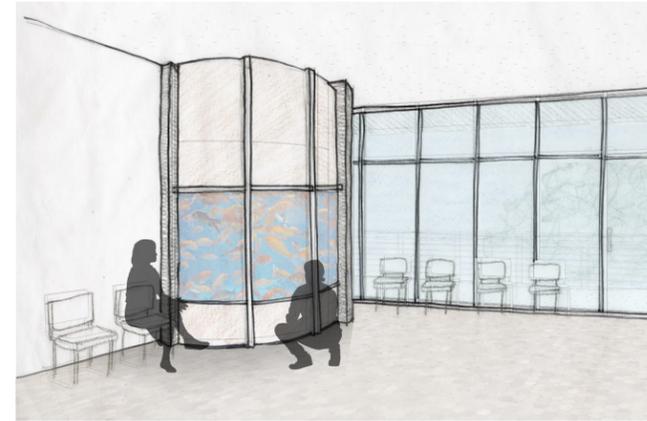
GROUND
community nutrition center
vertical aquaponic garden



BASEMENT
parking garage
storage / service



1 COMMUNITY GARDEN



2 WAITING ROOM



3 WORK SPACE

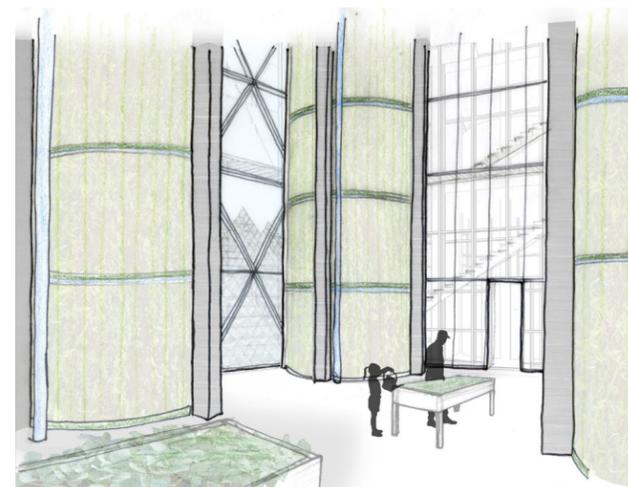
The interweaving paths of the building's occupants (patient, staff, gardener, and neighbor) promote cross-community interactions. These seven vignettes narrate an average experience of a dialysis patient's visit, illustrating the open, light-filled spaces.



4 TREATMENT FLOOR



5 MARKET



6 VERTICAL FARMING



7 CAFE

The original six environmental elements that were identified as factors in need of improvement are addressed and improved upon within my proposed facility design.



PATIENT CONTROL

Patient preferences for different seating locations offer suitably matched privacy levels: group or individual

ARTWORK

Sliding privacy panels are etched with varying patterns of nature. Furthermore, the rotating farms act as an ever-changing canvas

COLOR

The garden-immersed atmosphere of the dialysis treatment floor offers a calming, natural, color palette

WINDOWS

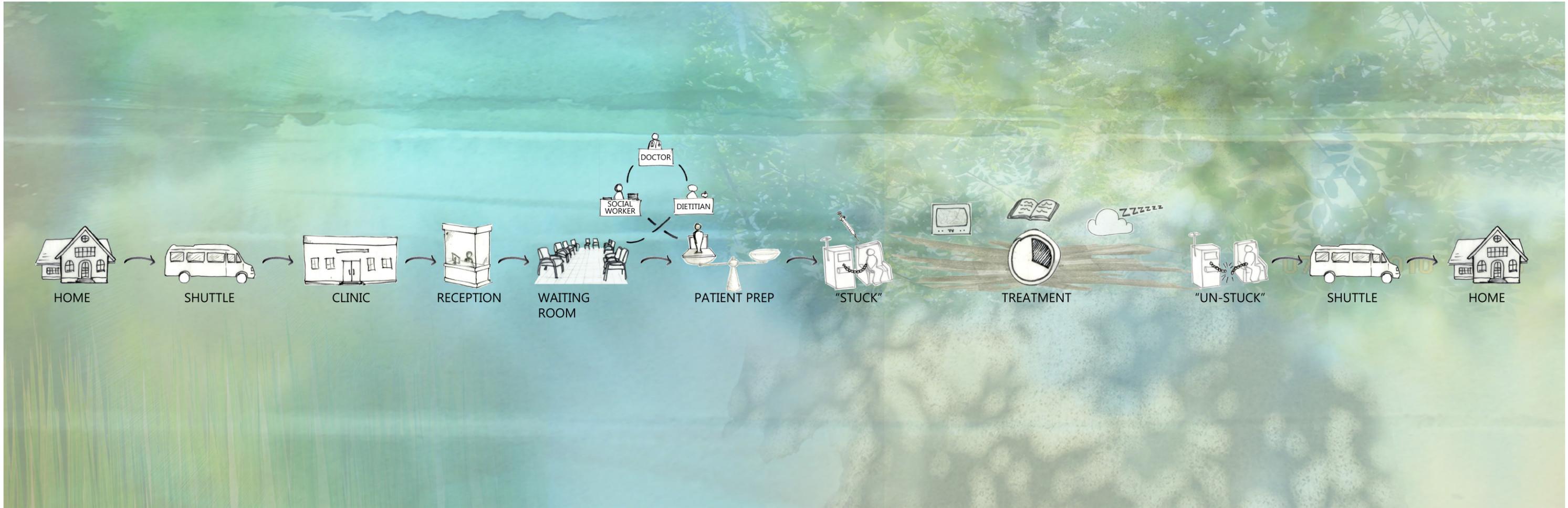
Windows look both into the vertical gardens and out at the community gardens, offering ample natural light and views

SOCIAL SUPPORT

Community pod seating arrangements provide spaces that encourage and support inter-patient relationships

NOISE

A stretched rather than condensed floor plan disperses sound and is further divided with dampening privacy panels



While the step-by-step medical process of a dialysis patient's treatment does not change, this conscientiously designed environment will improve the patient's experience, and thus, their health. The new water-colored background is representative of the patient's revised emotional experience, which has transformed to be less stressful, more pleasant, and more natural; a space that actually helps to support health and wellness.

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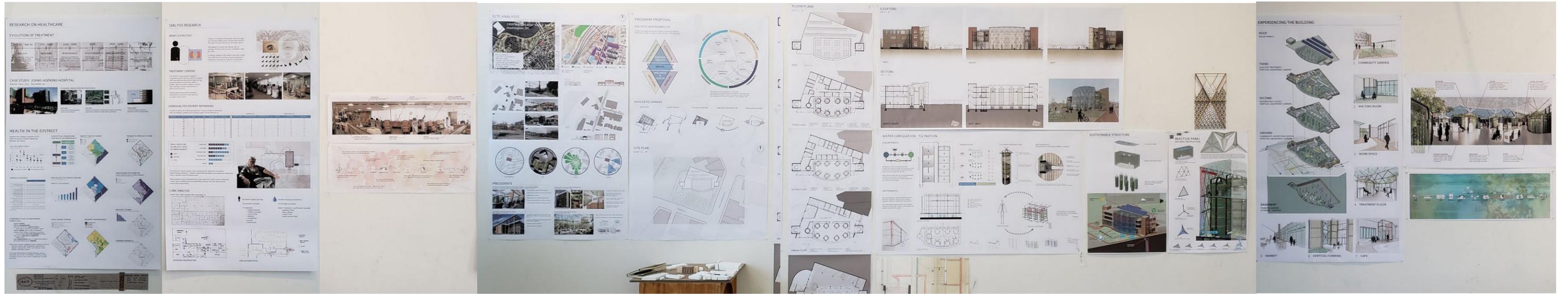
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All other images, collages, and drawings produced by the author.

DEFENSE





Greek deity Hygieia, goddess of cleanliness and good health (Greek-Gods, 2013), is overlaid on the building's floor plan, mirroring Palladio's comparisons of human proportions to building form. Her head and feet align with the circulation nodes while the arc of her arm matches that of the curved atrium. An unintentional, yet happy coincidence of proportions.