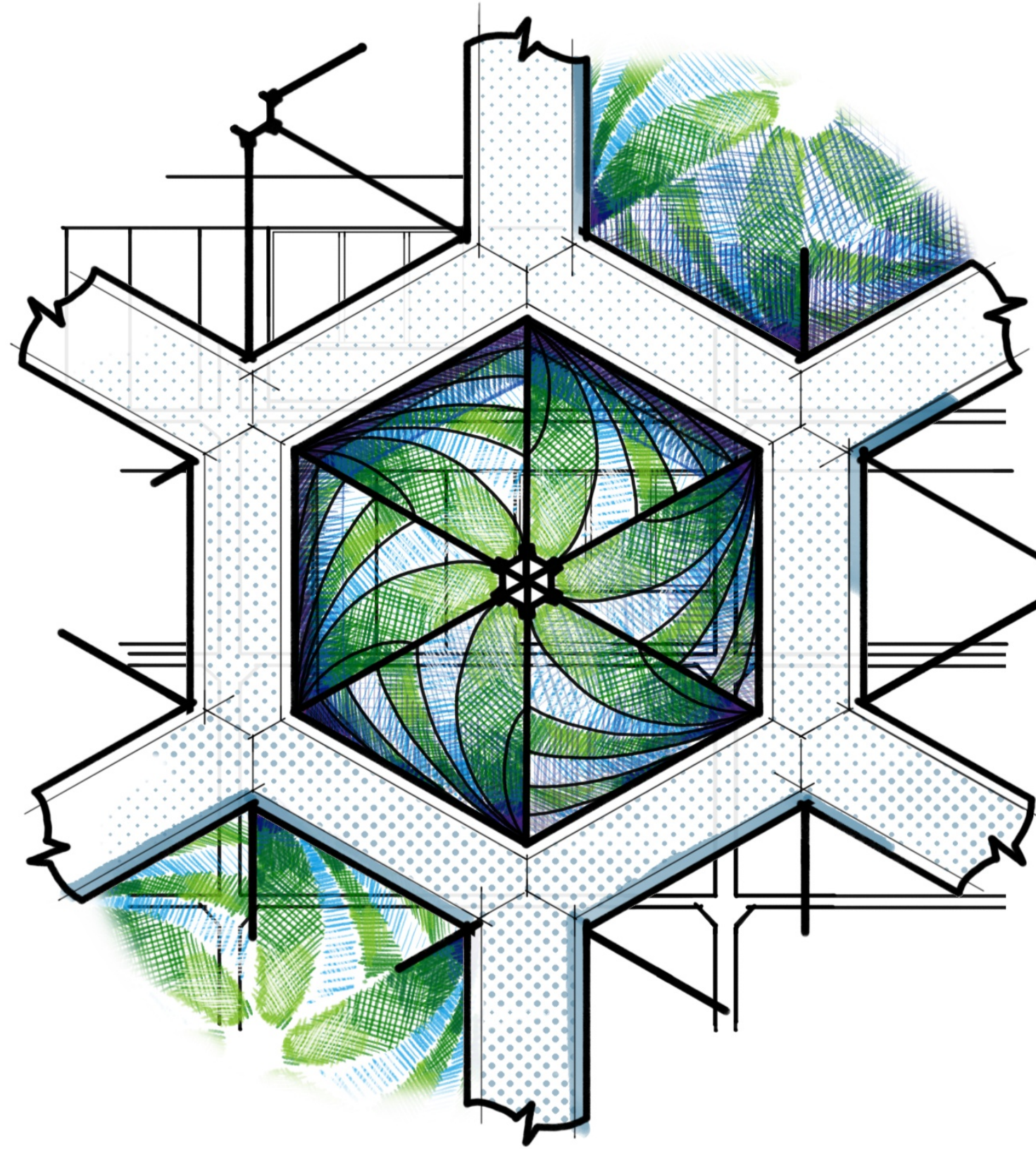


ARCHITECTURE  
& DESIGN PORTFOLIO



NATHANIEL KING

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**Design Team**

Jonathan Dessi-Olive | Nathan King | Kristen James

**Professor**

Jonathan Dessi-Olive

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**Design Team**

Nathan King | Riley Decker | Braxtyn Degler

**Professors**

Kyoung-Hee Kim, PhD | Parham Kheirkhah Sangdeh, PhD Student

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**Design Team**

Nathan King | Faith Tootle | Savannah Cherry

**Professors**

Kyoung Hee Kim, PhD | Hamideh Hosseiniirani, PhD student

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**Design Team**

Design Collaborative

Nathan King | Derek Stahl | Jesse Blevins

**Client**

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# ONGOING RESEARCH | MYCELIUM DESIGN

spring 2026

## Design Team

Jonathan Dessi-Olive | Nathan King | Kristen James

## Professor

Jonathan Dessi-Olive

Mycelium is a cutting-edge, but surprisingly popular, medium in contemporary design & small-scale architecture. It carries inherent pest-resistance, fire-resistance, is fast-growing, and is bio-degradable, with potential as a self-supporting structural material. As a research endeavor, my professor and I have been interested in Mycelium's potential as a form-able medium for acoustic panels. The material itself is not inherently acoustically absorptive, but when formed into channels of specific widths, it works to diffuse sounds of certain frequencies.

The objects pictured here have been fabricated and hung in installations around Charlotte's campus, some as permanent additions to the School of Architecture. They have since proven their applicability as sound dampeners in those settings and more, and with their compositional interchangeability, they have a bright future in acoustically-focused architecture & design.



*10-piece mycelium composite accoustical panels*



*12-piece mycelium composite accoustical panel*



*9-piece accoustical panels, performance and aesthetic variants*



# MICRO-ALGAE BIO-REACTOR

spring 2025

## Design Team

Nathan King | Riley Decker | Braxtyn Degler

## Professors

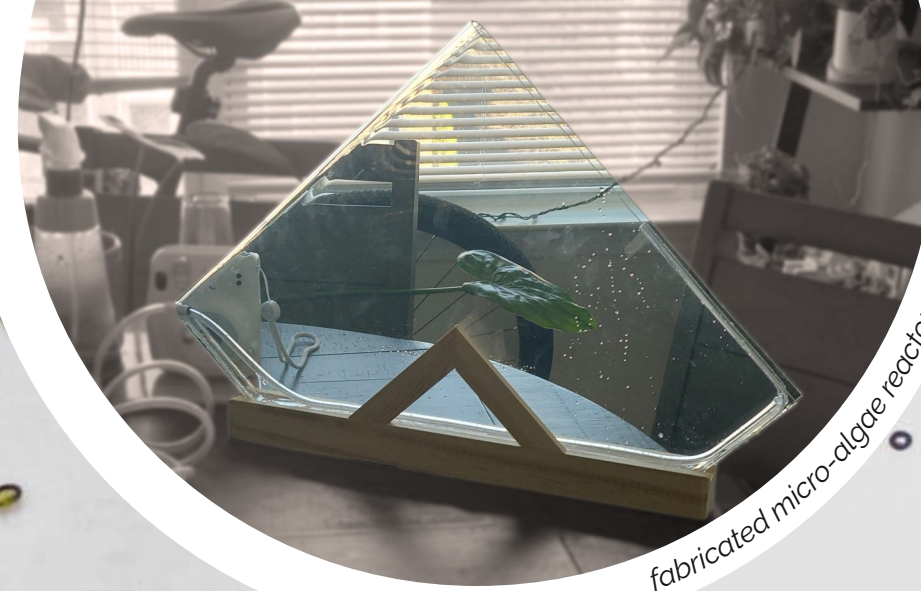
Kyoung-Hee Kim, PhD | Hamideh Hosseiniirani, PhD student

This small design project was an exploration of micro-algae, a phytoplankton found in fresh- and salt-water that has a promising future in sustainable design as an alternative to conventional greenwalls. Its ability to sequester carbon and provide enriched biomass mirrors that of other living vegetated systems, but its propensity for exponential growth and widespread climatic usability position it as a stronger performer, especially for architectural applications.

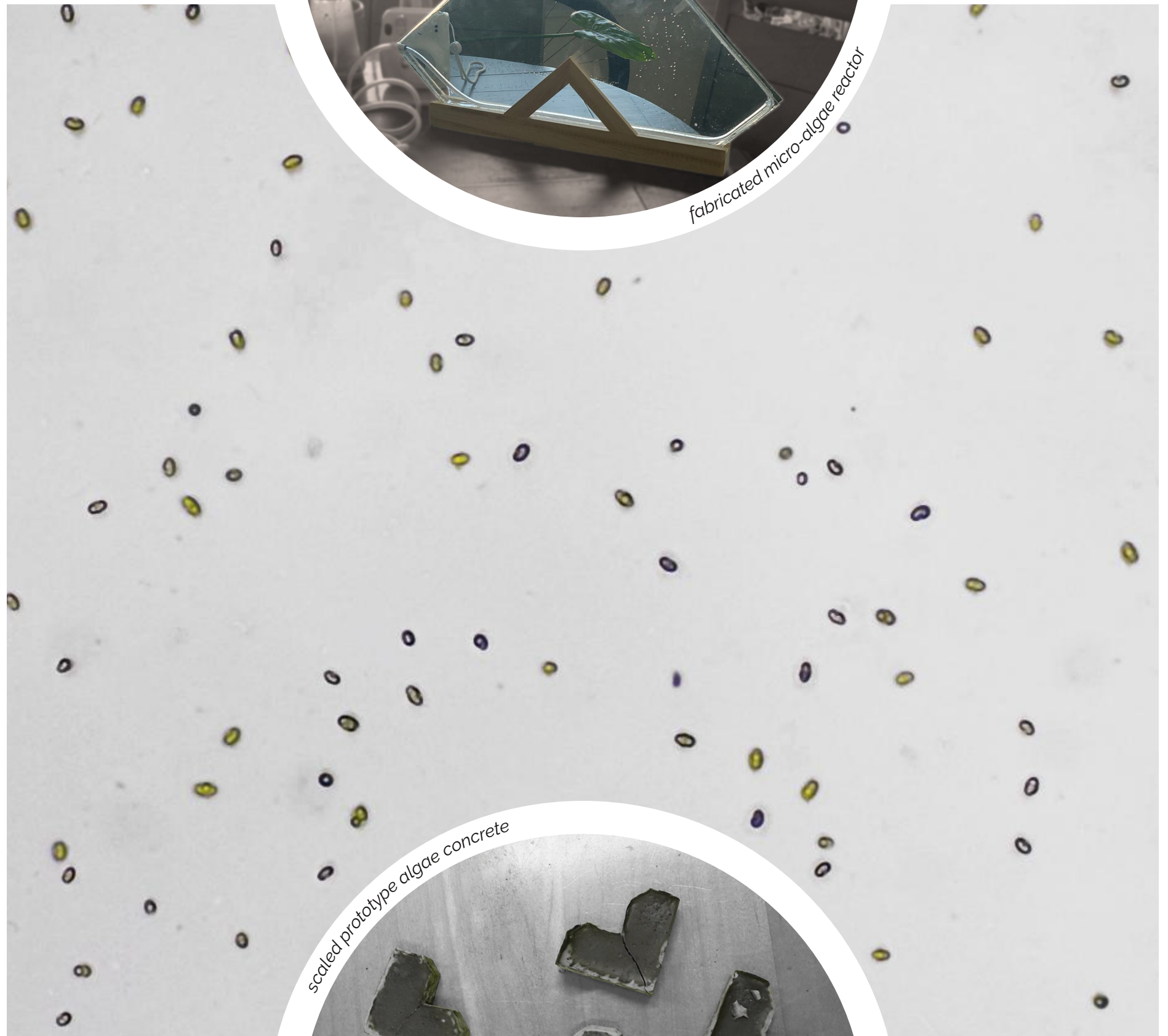
Our task was to research, design, and fabricate micro-algae 'reactors'--suitable environments for growth and regular study. Each of the members of the design team were assigned a different type of reactor, with the environment's respective strengths and weaknesses in algae growth and harvesting to be evaluated comparatively by the team over time. My reactor was 'foam-based', a type in which micro-algae attach to rising bubbles in the growth medium for easier surface-level harvesting and access to sunlight. Once created, my algae environment was given access to regular sunlight and monitored continually for several weeks.

After 33 days of study, the micro-algae was ready for harvest, having multiplied in density and surviving foreign contamination. The gathered algae was then repurposed, having completed its previous journey, as a sustainable additive for concrete. Once embedded, the overall embodied carbon of that mixture will have decreased, with some research teams even claiming that, post-cure, the algae is able to sequester even further emissions.

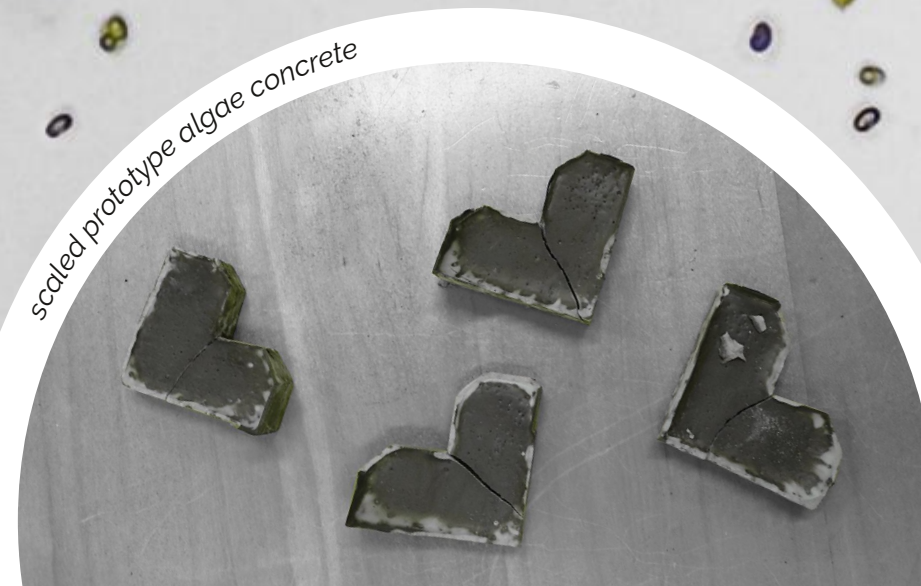
The research and information gathered in this design has great ramifications for the future of sustainable architectural design, and would go on to be explored in my spring topical design studio, Hexus.



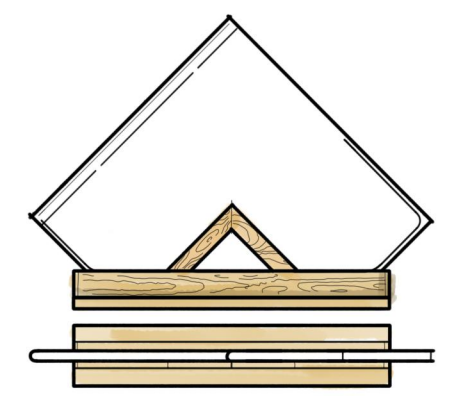
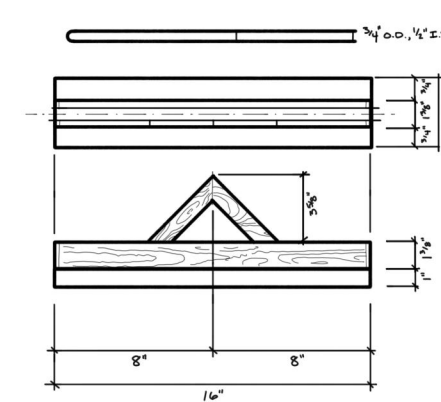
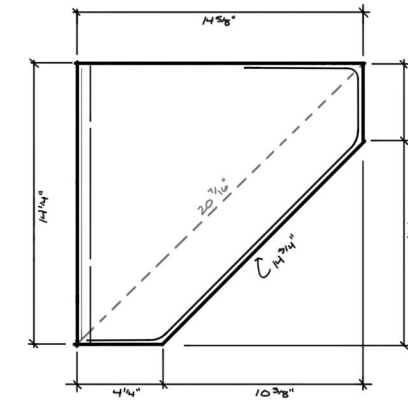
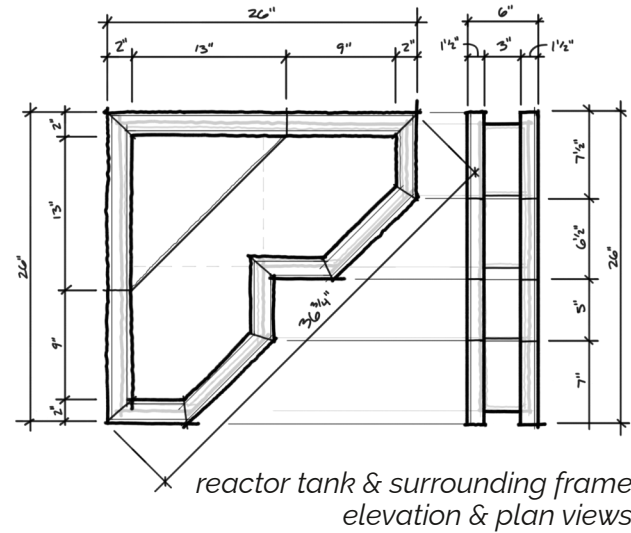
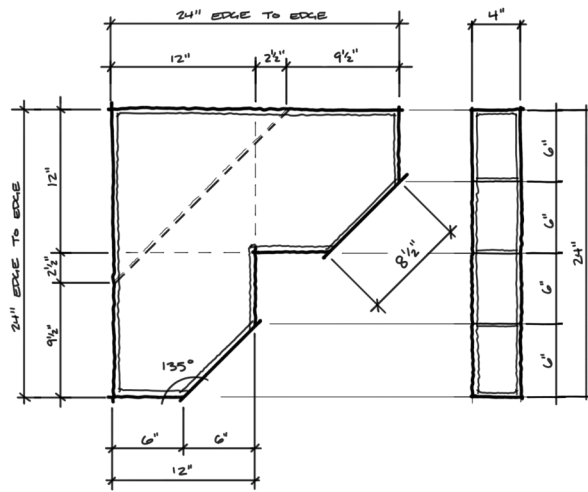
*fabricated micro-algae reactor*



*algae cells under microscope*



*scaled prototype algae concrete*



reactor tank & surrounding frame elevation & plan views

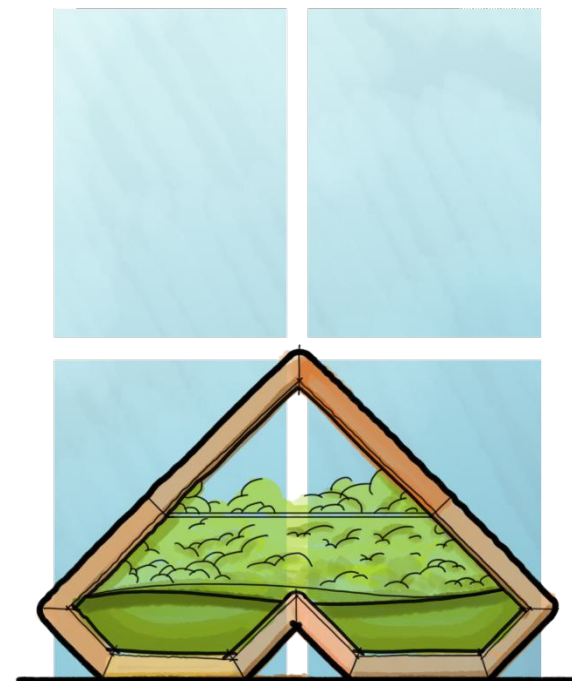
reactor tank, stand, and completed design elevation & plan views

### Original Design

scale 1/16" = 0'-1" | render not to scale

For my first iteration, I chose a triangular form with plenty of potential for exposure to sunlight, with a simple wooden frame to highlight the geometric articulation. My initial interior was rather large, sporting a 4 inch depth across a 26 inch face, which would have meant for a lot of volume for the growing medium. Given the weight of the water-based solution inside, this would have provided much in the way of stability, but would put stress on connective joints of an admittedly small surface area.

Overall, this version established a strong design motif, but needed further consideration in constructability and suitability as a foam-based algae reactor.



hand-rendered elevation

### Revised Design

scale 1/10" = 0'-1" | render not to scale

My second design took these concerns into account, with an immediate focus on overall volume. Through precedent study, I found that a foam-based reactor works best when it's depth is roughly 1/2", so as to provide a slim cavity for the rising, algae-coated bubbles to cling to as they rise through the medium. Proliferation of air as a mixer and agitator of the culture became the main priority from there, resulting in a simplified envelope, and an open-air top, to allow for maximum circulation.

This iteration would go on to be approved, ready to be fabricated and used for study.



hand-rendered elevation

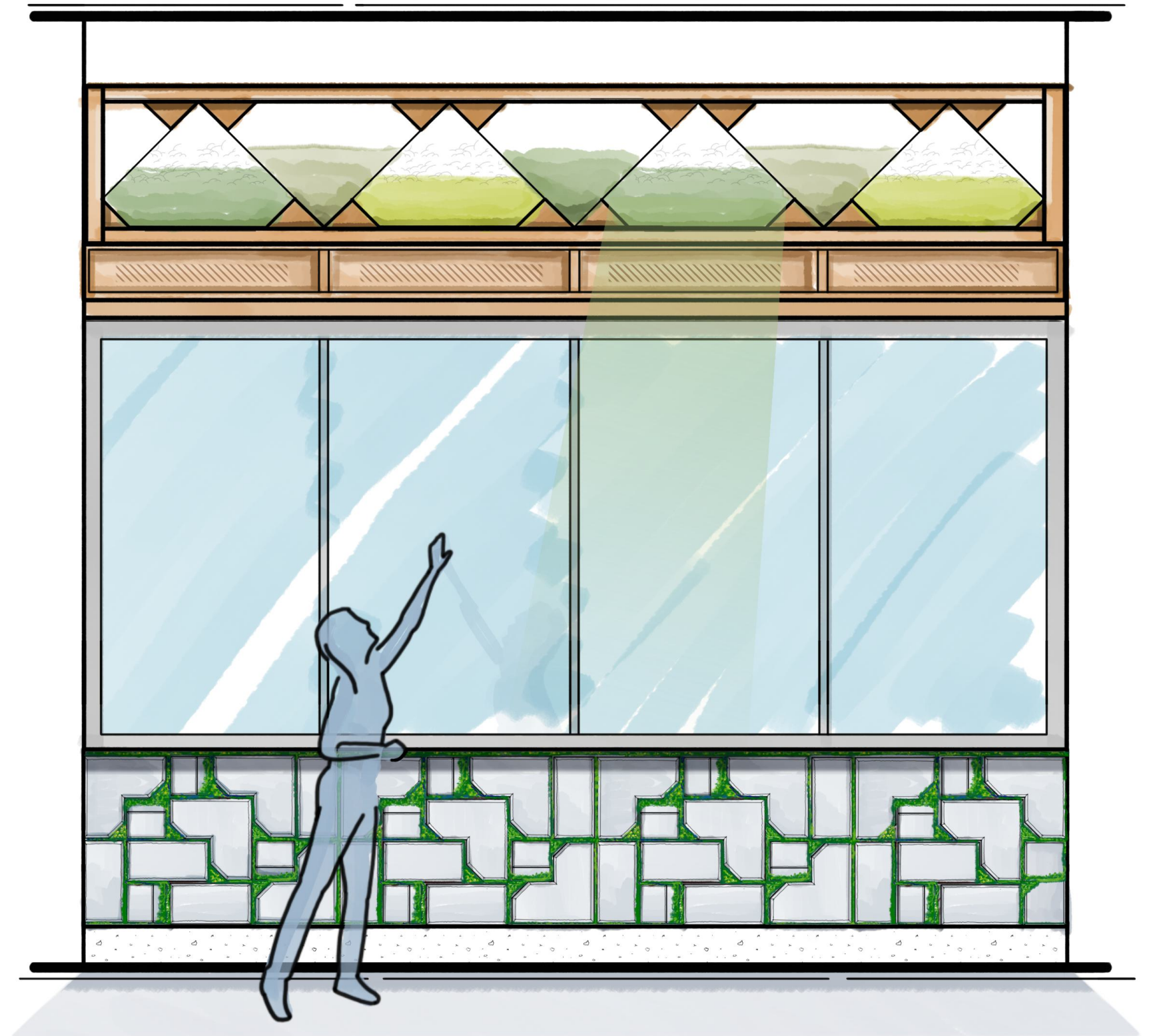
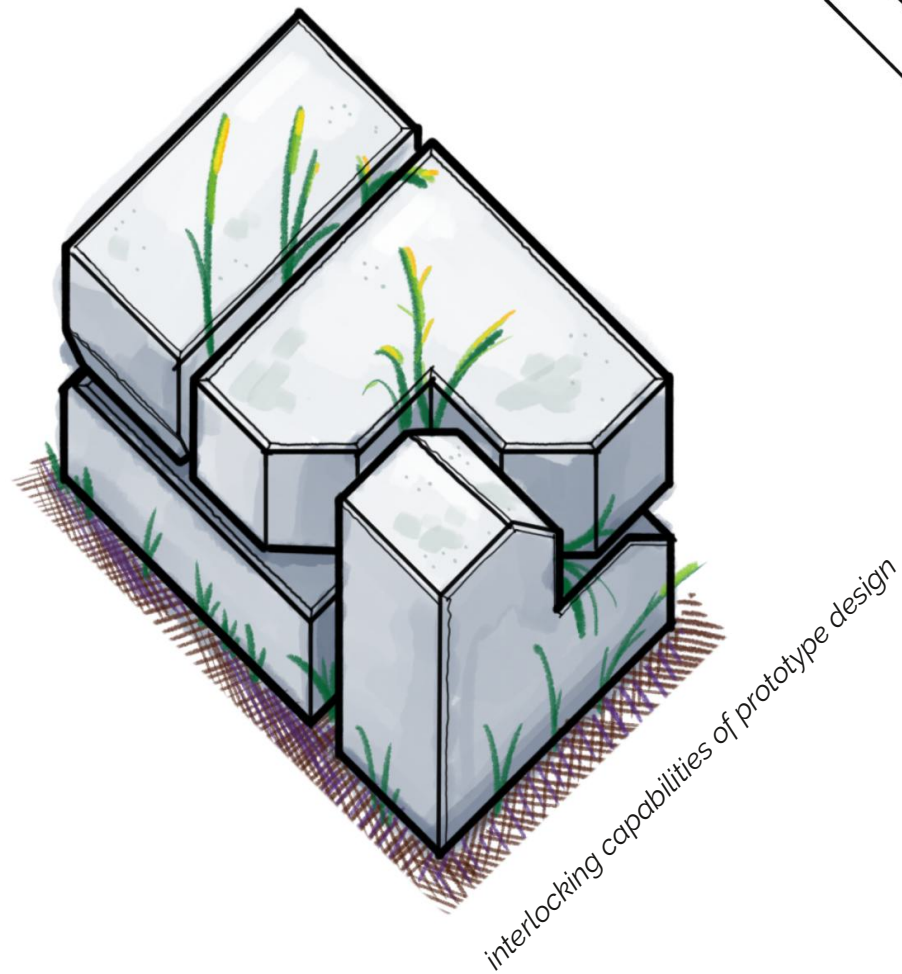
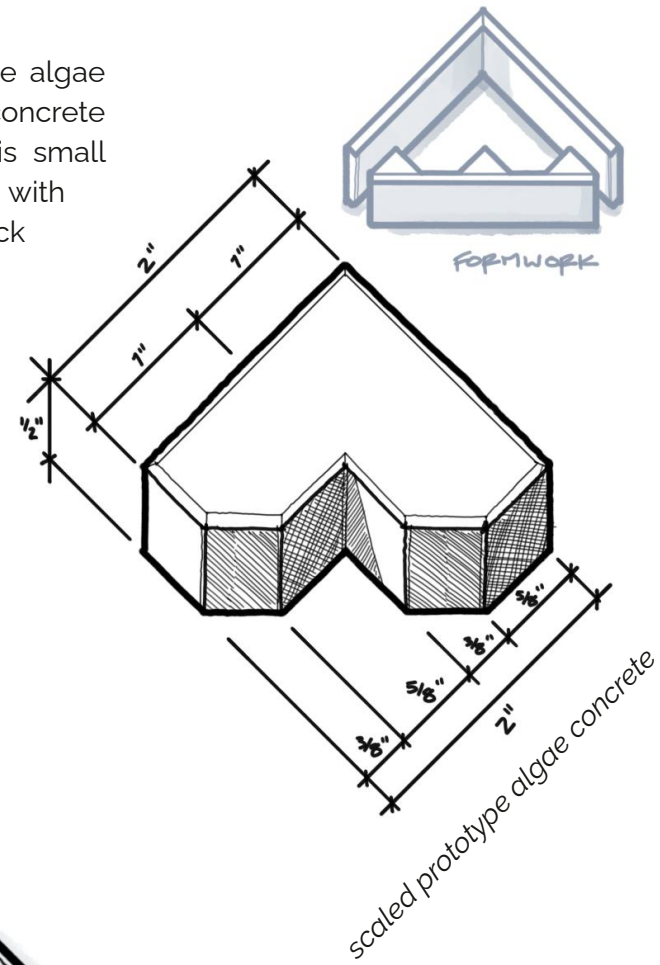


algae growth, as captured over the duration of the experimentation period

## Algae Concrete & Architectural Applications

scale varies

Once the study period had concluded and the algae was ready for harvest, it was time to make our concrete prototypes. As an homage to the reactor, this small artefact was designed in a similar formal style, with the re-added depth providing for a nice interlock between multiple modules. After the concrete was finished, the final focus was to bring the pieces together into a vision of an architectural composition. In this version, the algae-embedded concrete units provide the foundation to support the collected reactors in the space above.



architectural applications for prototype reactor & algae concrete designs



**FLOOR 23**  
 GROUP 2035, LLC suite 231

**HEXUS  
 UPTOWN RETROFIT**  
 spring 2025

**Design Team**

Nathan King | Faith Tootle | Savannah Cherry

**Professors**

Kyoung Hee Kim, PhD | Hamideh Hosseiniirani, PhD student

400 South Tryon St. in Uptown Charlotte is a building in need of architectural intervention. The exterior envelope provides little in the way of a pleasurable workspace for its occupants, and its regular vacancy is proof of their reluctance to embrace its current state. As a group, I and my design partners took this challenge head-on, working to create a new exterior, interior, site-level courtyard, and roof-top plaza for this once-iconic Charlotte high-rise.

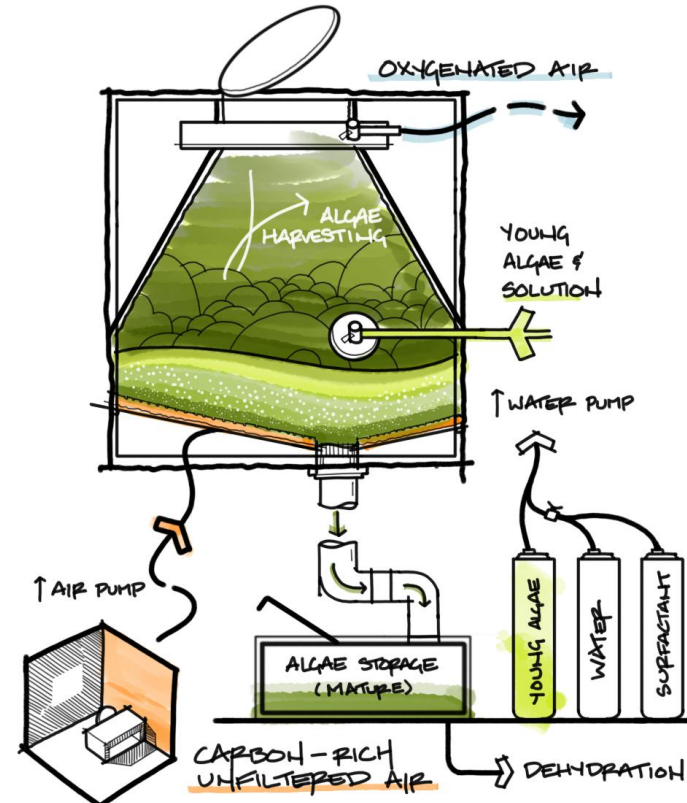
Building on the knowledge gathered from my experience with micro-algae, Hexus takes the small-form successes from my prototypes and attempts to actualize them at a truly architectural scale. This new design incorporates micro-algae into kinetic, hexagonal fins that recess and protrude from the building's exo-structure in rhythm with the sun's progression across the sky. This movement across hundreds of cells creates a facade that is truly dynamic, with a new combination created every single day. Each cell responds to its respective levels of solar exposure--too much heat and the cells retreat into the cool shadow of the surrounding structure--too little light and they push out beyond the rest of the envelope to gather as much sun as possible. Taken together, this maximizes the number of healthy cells in the algae culture, which in turn provides occupants with shade, nutrients, fuel, and even biophilic effects like decreased stress & anxiety.

With the algae cells as the prevailing design move, everything else falls in lock step behind them, from the green-ified public site to the hexagonal, geometric interiors.

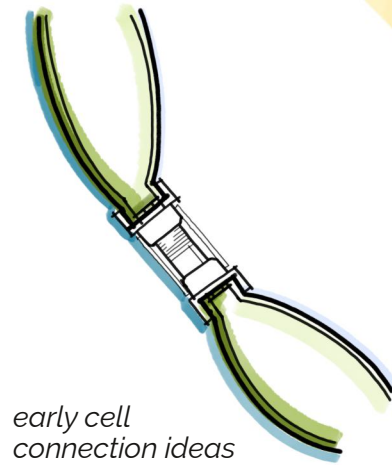
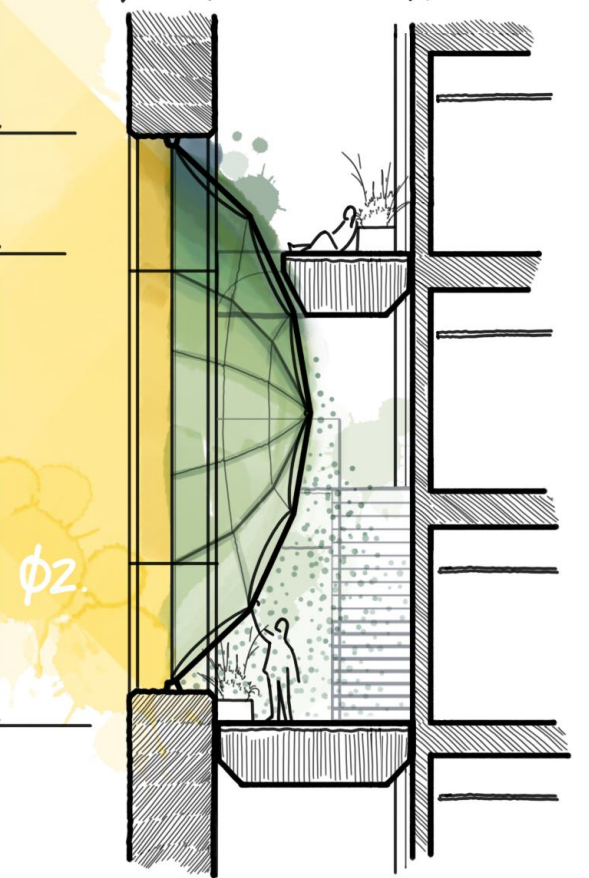
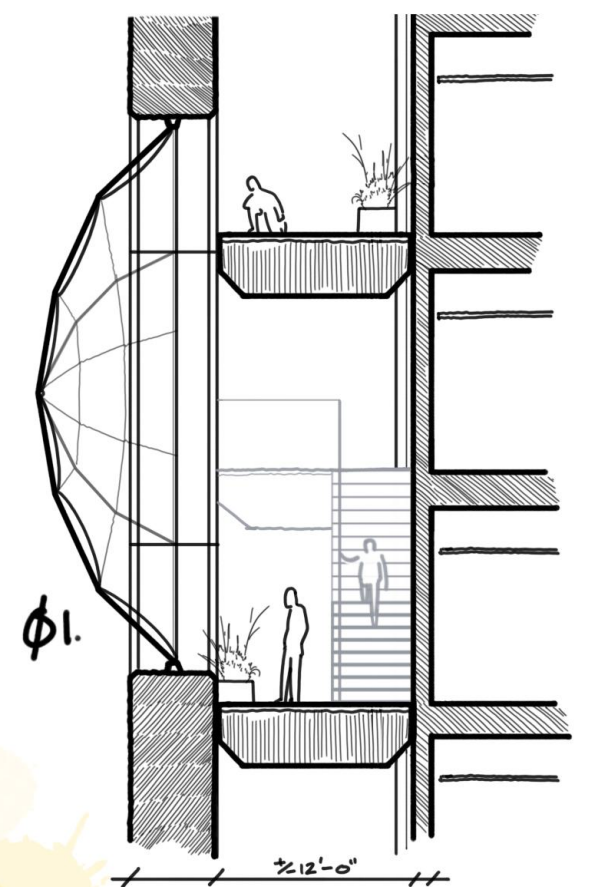
# Early Design Sketches

scale varies

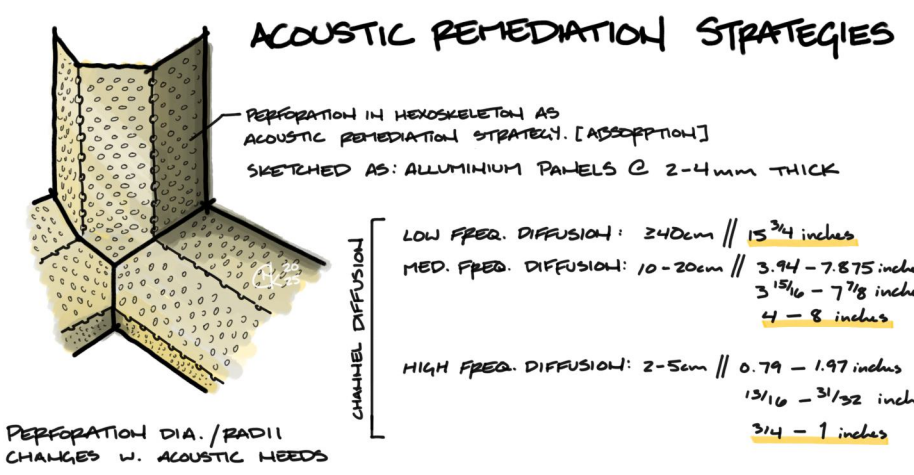
Prior to any real momentum in Hexus's development, sketches like these were essential in ideating around our bespoke design element, Micro-Algae, and the opportunities & challenges we foresaw in using it as a central part of our design. We examined various formal opportunities, material and fabrication strategies, and even structural implications that were conferred by using such an under-tested material, many of which stayed relevant throughout the rest of the design process.



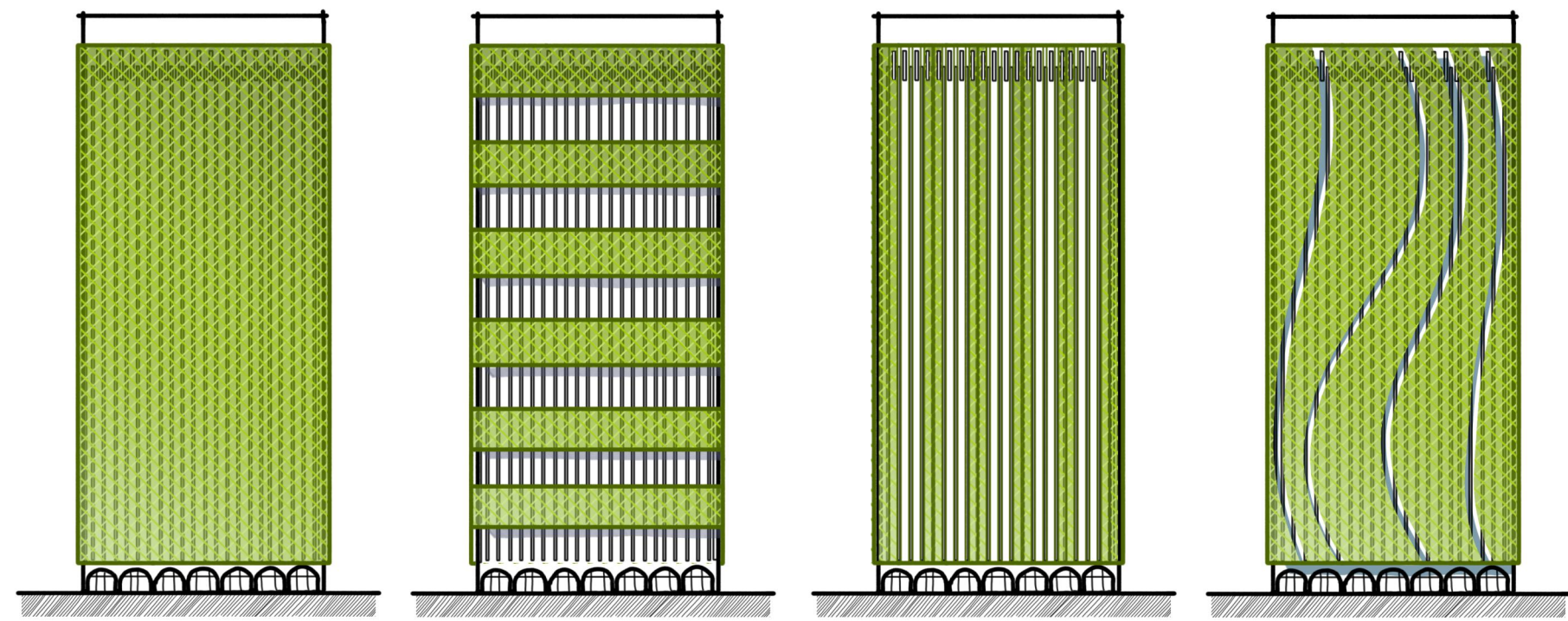
initial etfe design



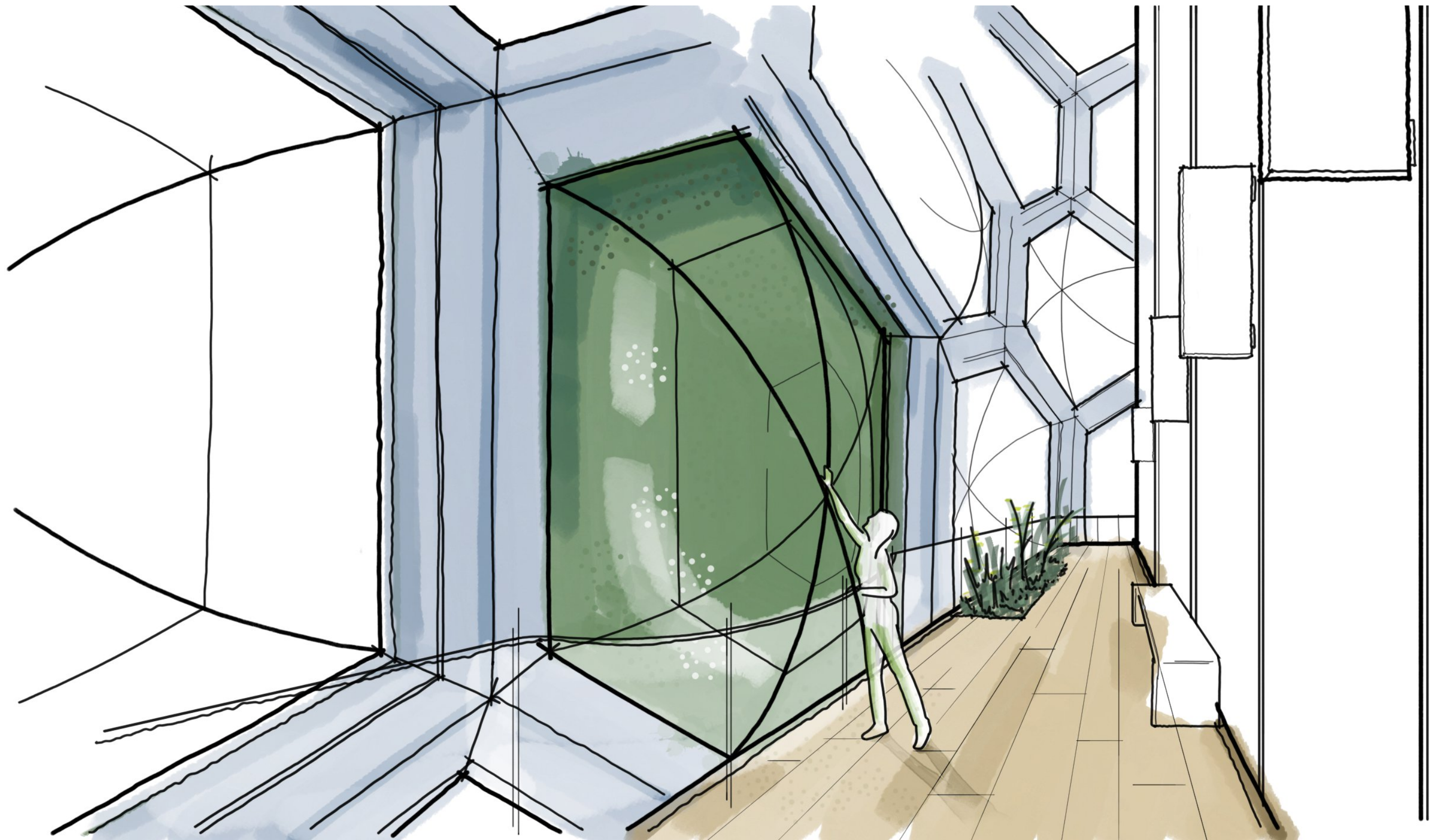
early cell connection ideas

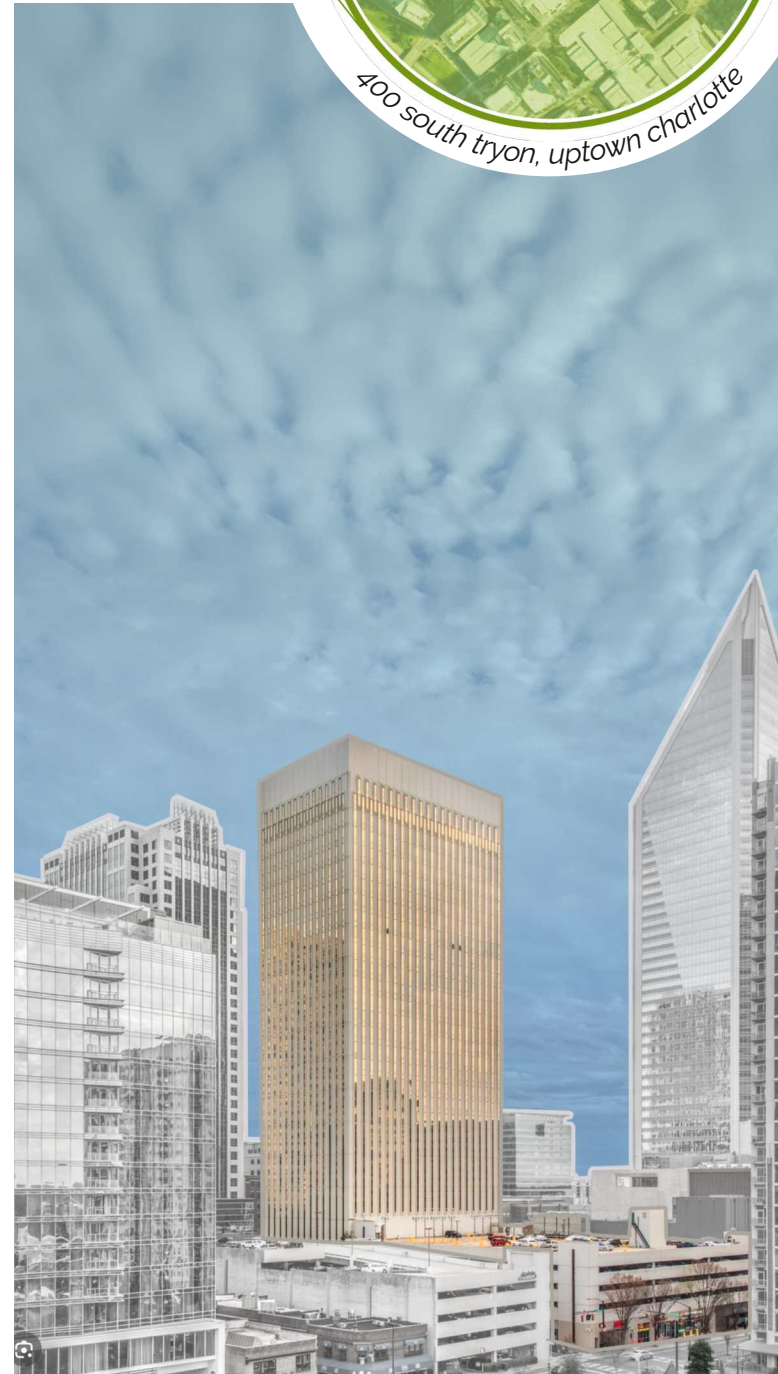
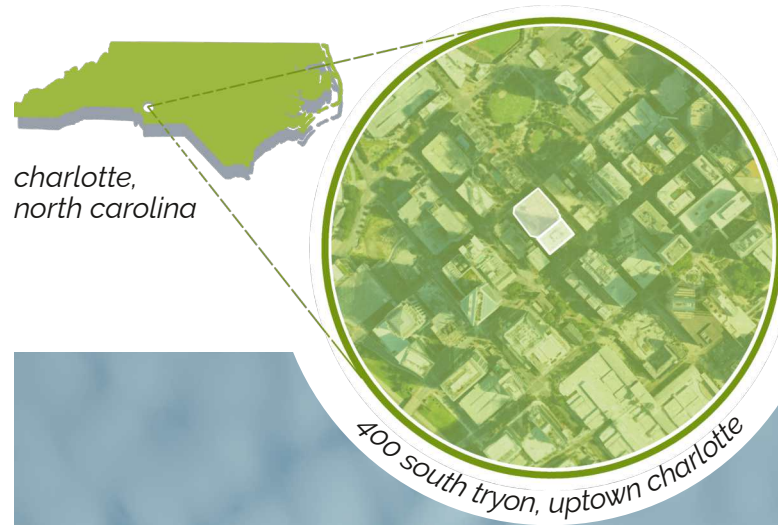


### FOAM-BASED ALGAE CULTIVATION SYSTEM SCHEMATIC | NOT TO SCALE

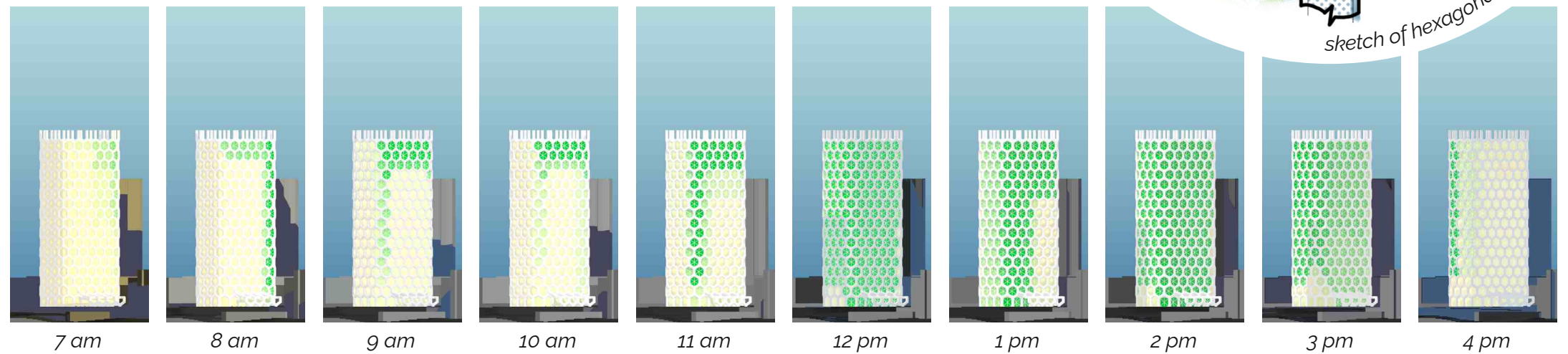
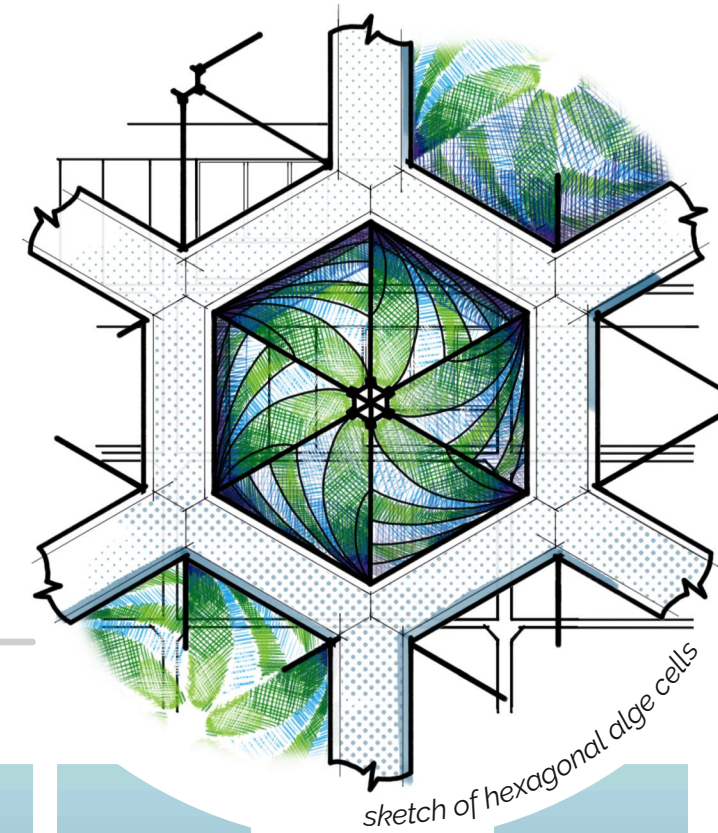
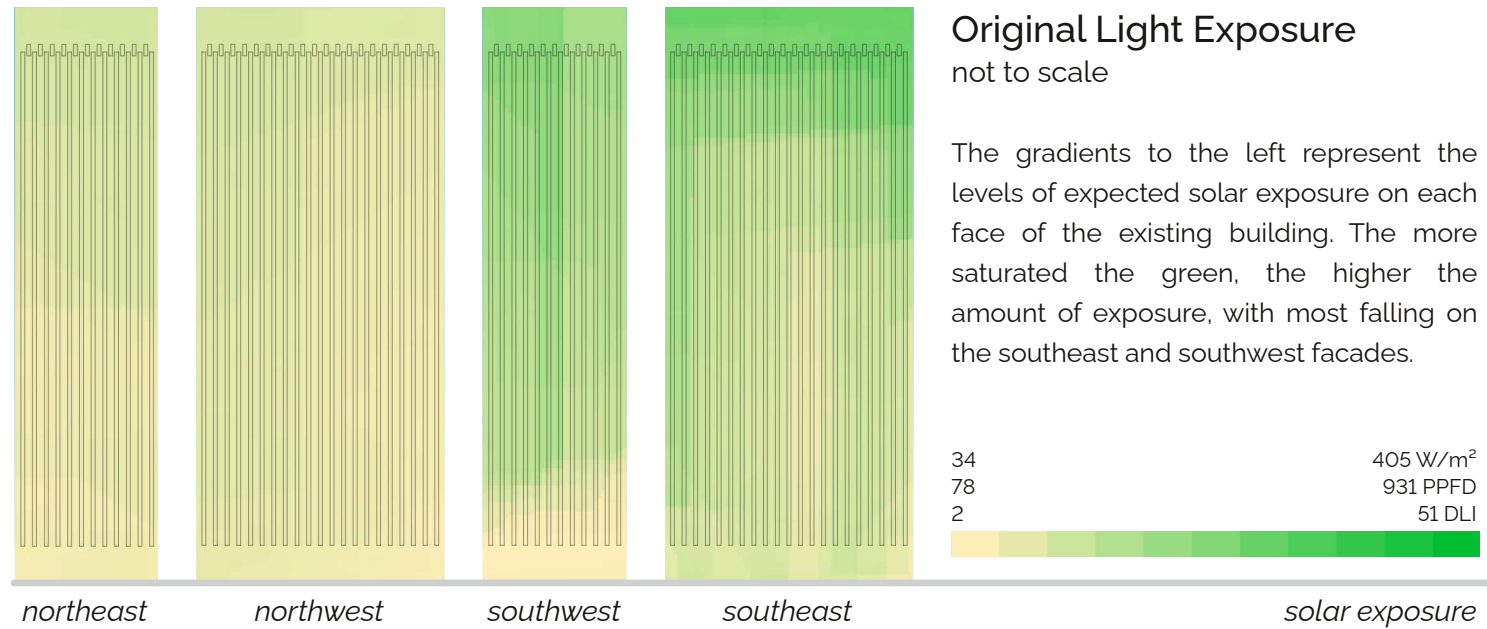


initial primary elevation studies





exterior view & surrounding context



### A New Facade Every Day

not to scale

Each of the images above represents the position of Hexus's algae cells throughout a given day, with the dark green meaning recession into the surrounding structure and pale yellow signaling protrusion away from it. At any moment, the amount of exposure on an individual cell's face is calculated and checked against the appropriate levels required for the growth of its respective algae culture which, when necessary, results in that cell's movement.

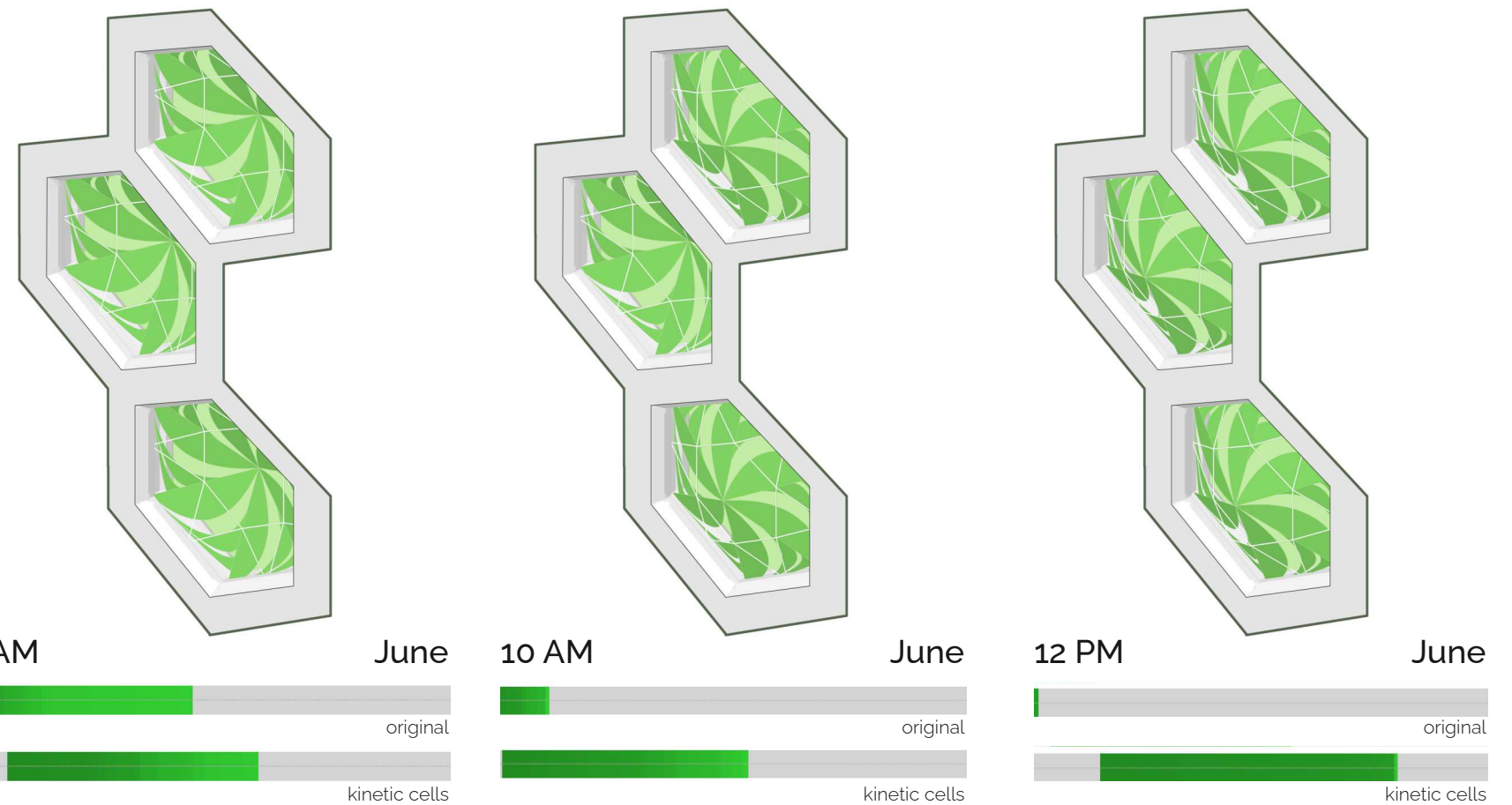
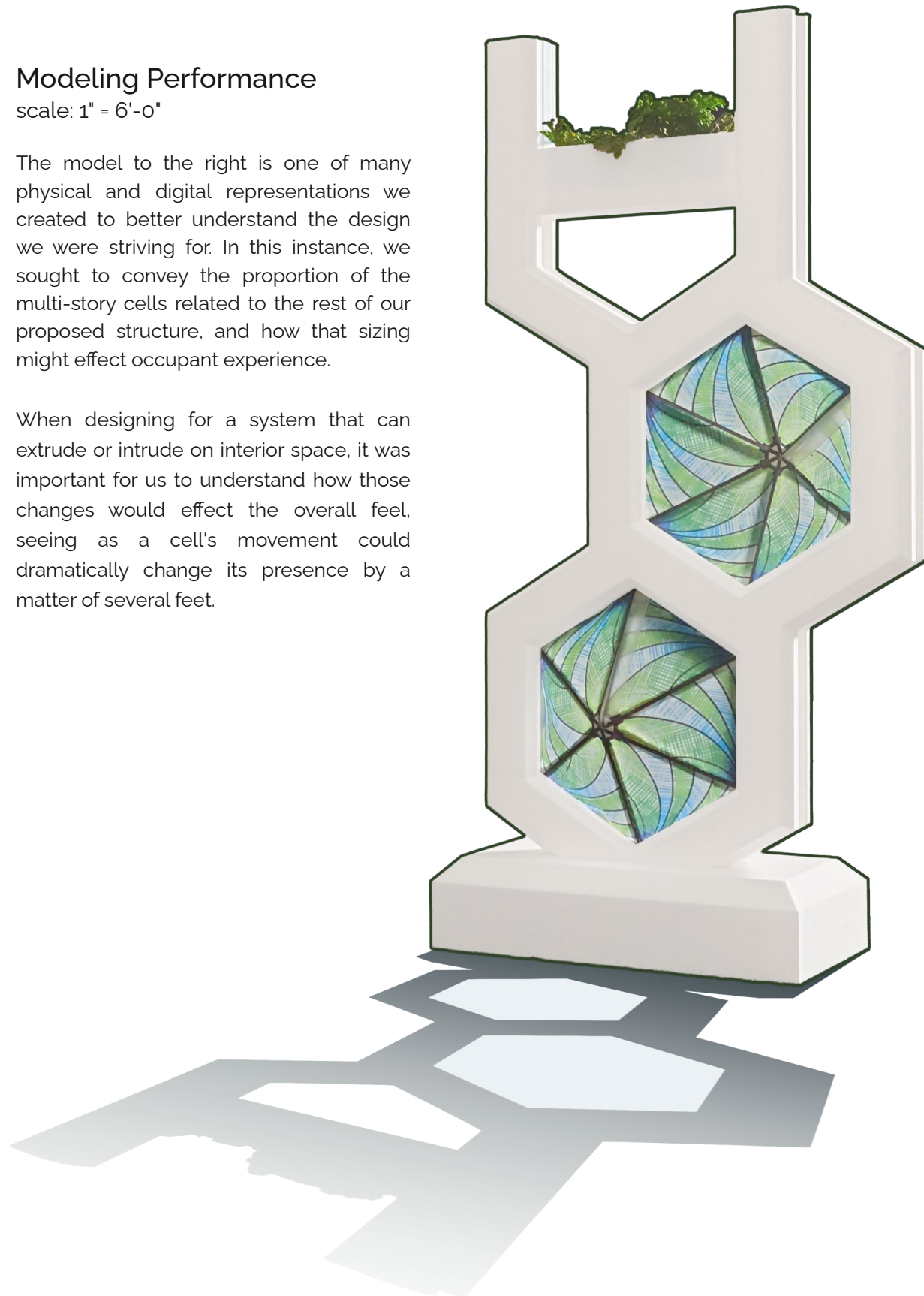
This movement could even be adjusted to the different exposure requirements for varying algae types or preferred culture density. If a part of the building is in need of more regular shade, the adjacent cells could be programmed to maximize algae growth, increasing its shade-making capability. If the opposite is true--if occupants want a very porous culture, that allows for unencumbered views to the outside, those cells could be designed to perform at sub-optimal levels to lessen growth, or be harvested more regularly.

## Modeling Performance

scale: 1" = 6'-0"

The model to the right is one of many physical and digital representations we created to better understand the design we were striving for. In this instance, we sought to convey the proportion of the multi-story cells related to the rest of our proposed structure, and how that sizing might effect occupant experience.

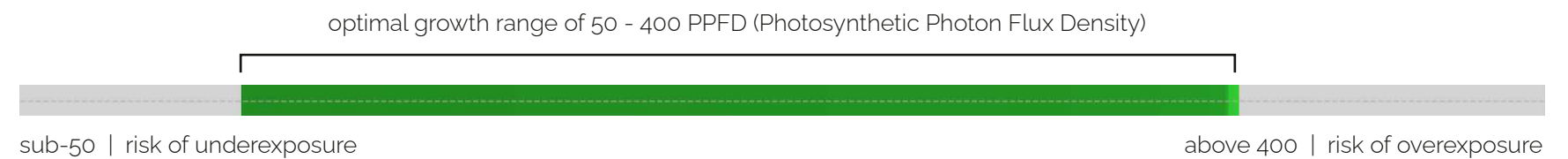
When designing for a system that can extrude or intrude on interior space, it was important for us to understand how those changes would effect the overall feel, seeing as a cell's movement could dramatically change its presence by a matter of several feet.



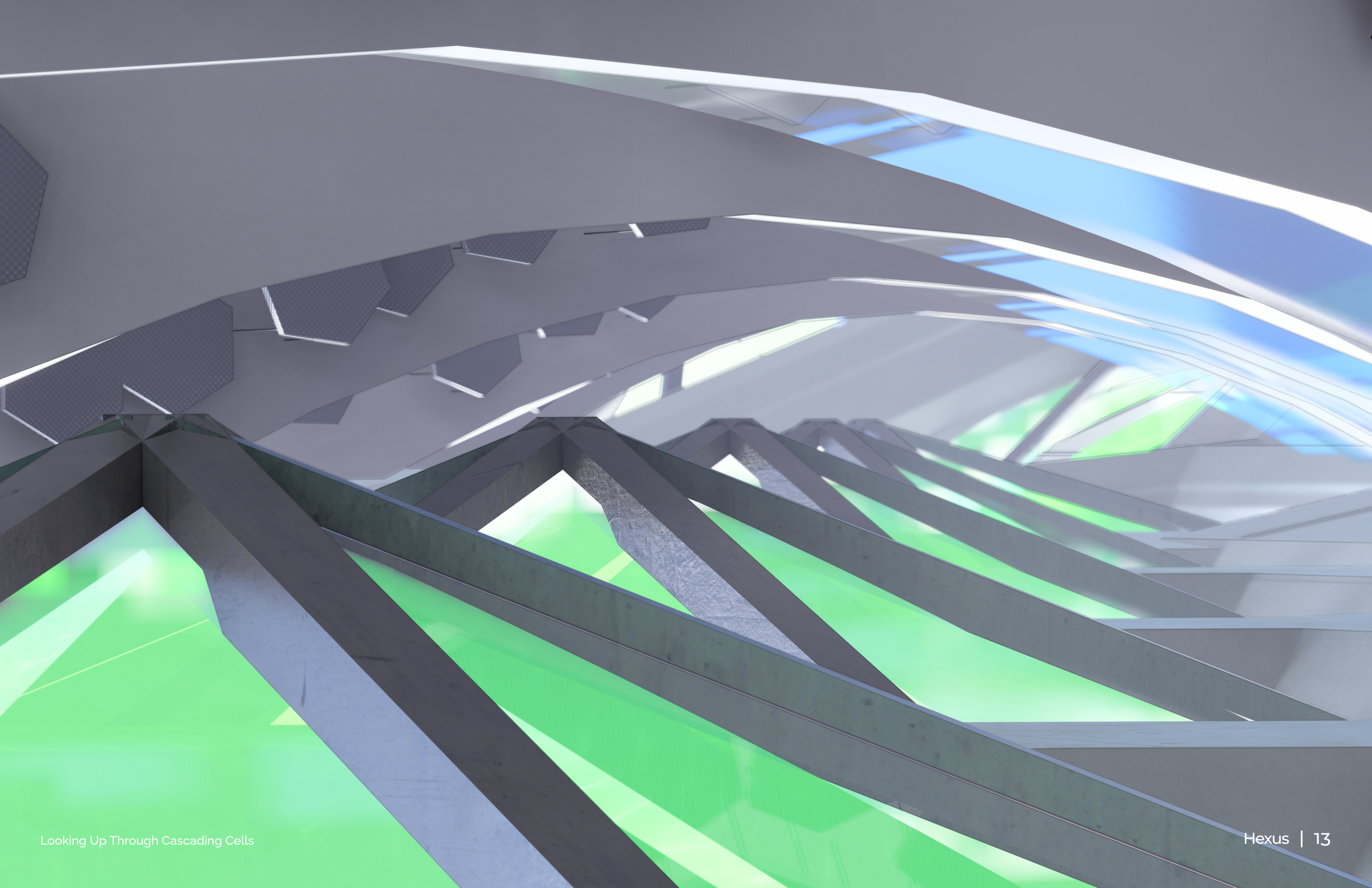
## Kinetically Responding to Sunlight

not to scale

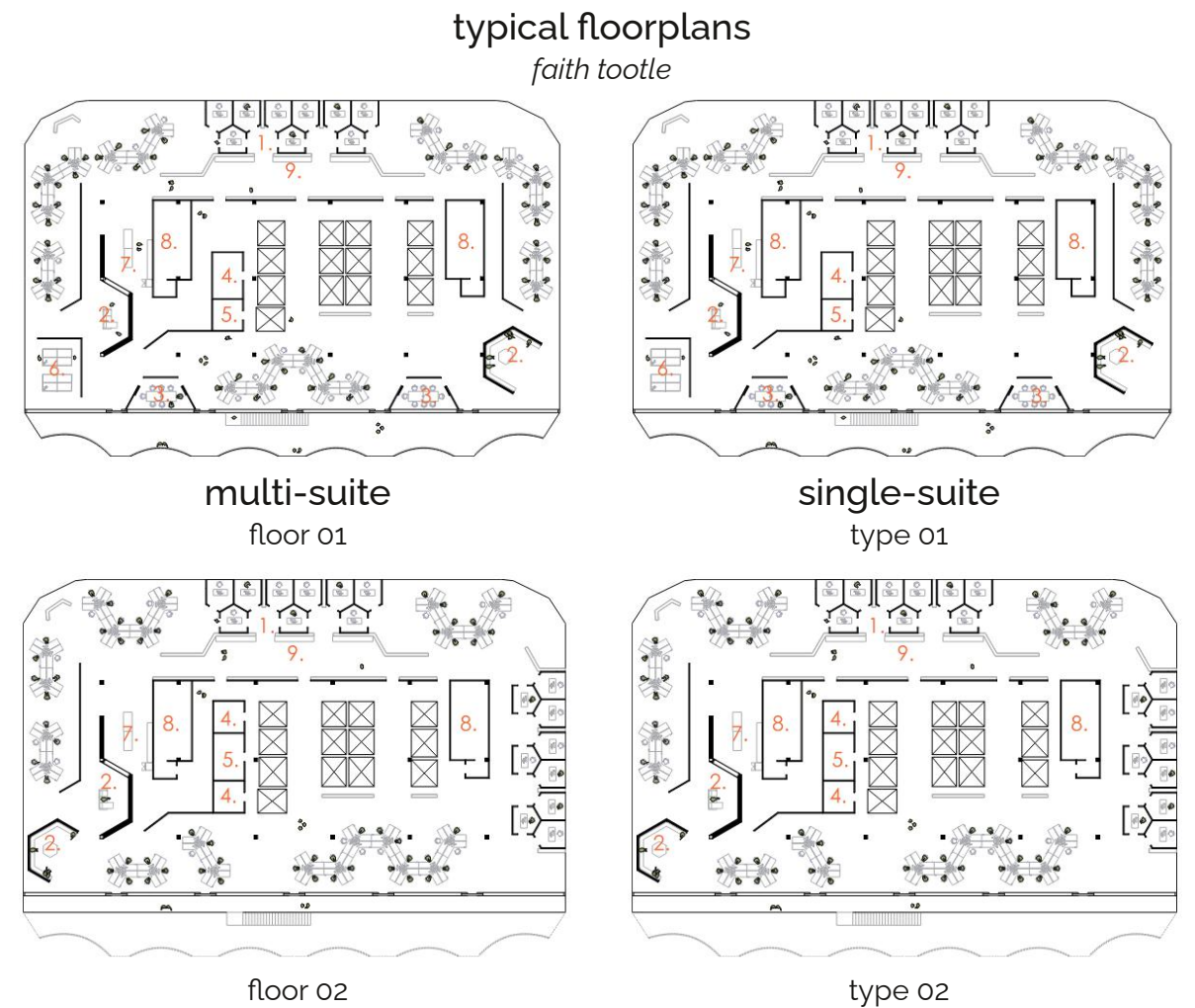
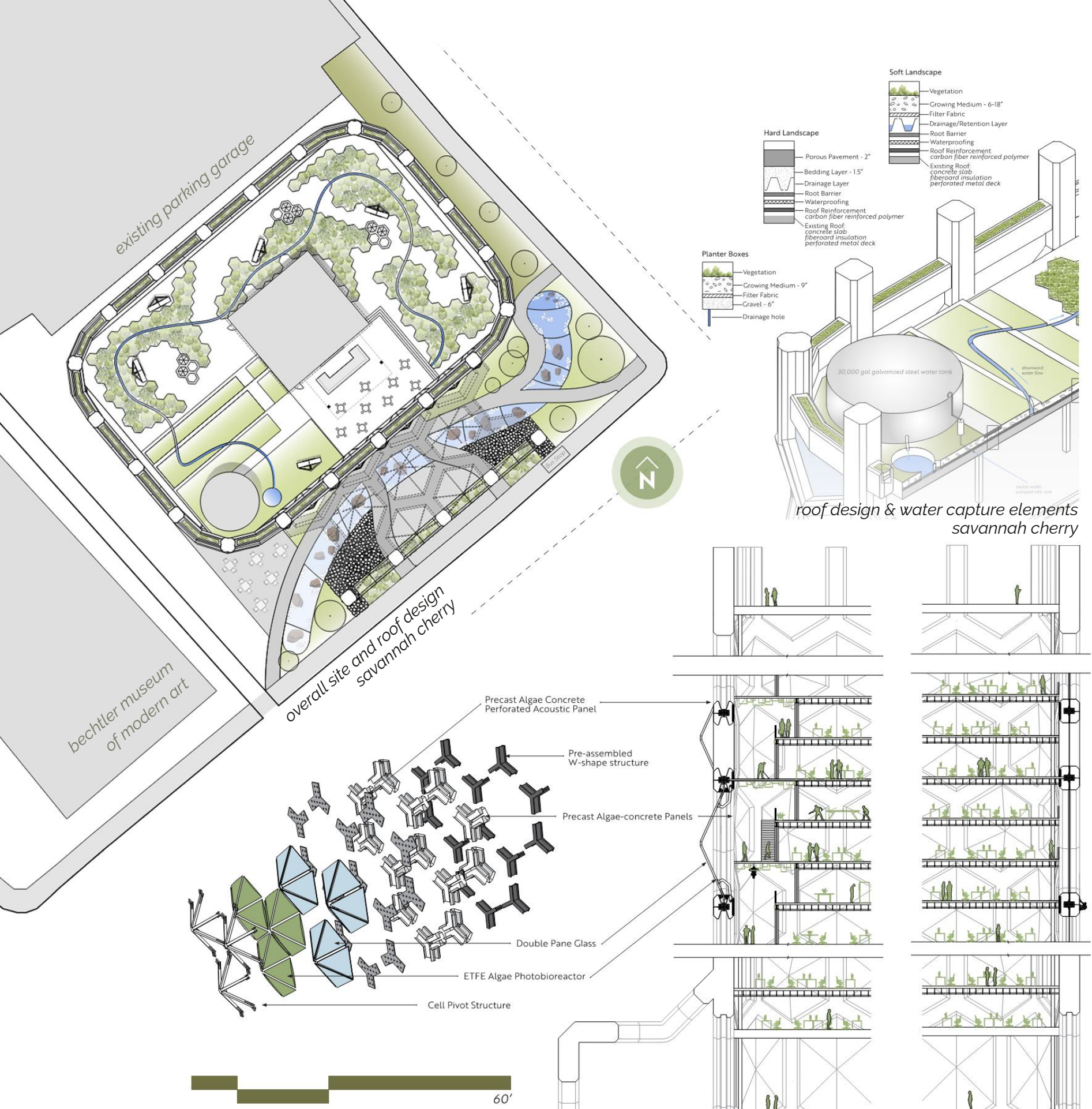
The diagrams above are representative of how cell groupings might change their position throughout the day, depending on the needs of their algae culture. As designed, the cell's center point can move a maximum of 5 feet, either towards or away from its default position within the surrounding structure, resulting in an overall adjustable range of 10 feet.



The graphs immediately underneath those diagrams are smaller versions of the type above. The green bounds represent how many of the hexagonal cells across the facade receive optimal amounts of exposure for algae growth. The gray sections to the left and right of those bounds indicate how much of the facade is under- and over-exposed, respectively, resulting in the shuttering of that algae's development. The more of the overall bar that is in the green, the better served the living cultures are, system-wide.







**A Group Effort in Actualizing Design**  
scale varies

I was paired with two other architecture students for the creation of Hexus, Savannah Cherry and Faith Tootle. While I generally took the lead in designing the form and parametric aspects of our new facade system, Faith and Savannah reliably contributed much of their own ideas for the landscape, occupiable roof, building interiors, and contributed heavily to the production of our final drawings. On this page, every drawing and diagram is of their creation, with minimal edits to ensure they worked cohesively with the rest of this portfolio. I chose to include and acknowledge them, rather than reproduce these drawings, because I felt it was important to give them credit for their meaningful contributions to this project, rather than pretend it was all my doing. So, while I can take credit for contributing to many of the design moves shown on this page, I certainly owe the drawings themselves to my design partners.

Their names have been attached to their respective drawings, to ensure they are credited for the great work they have done.

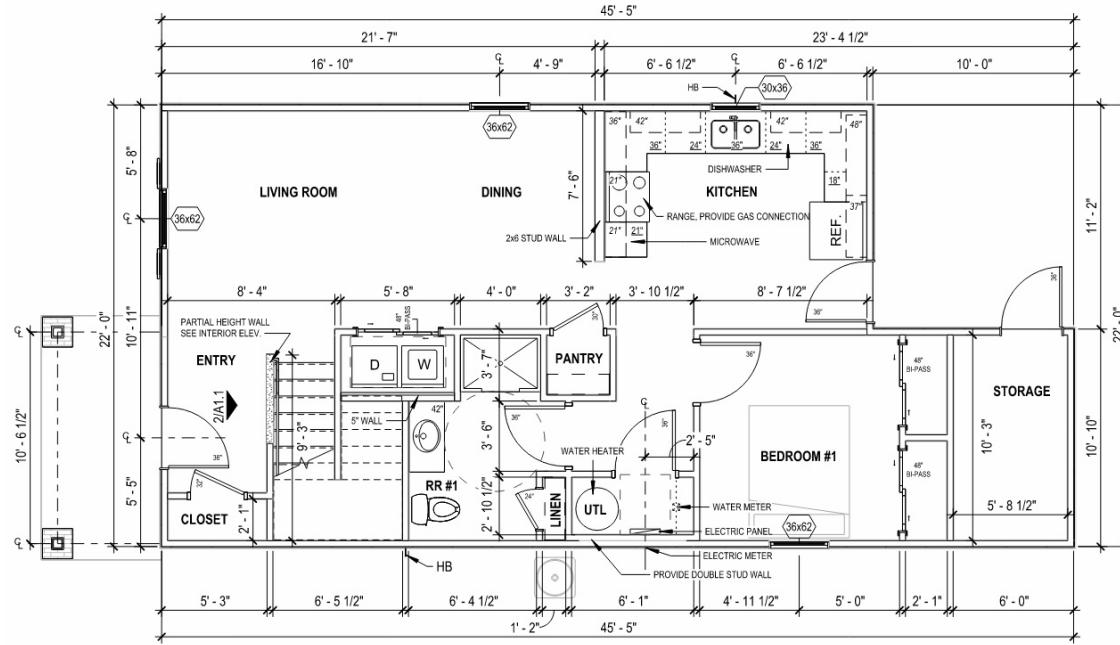
**building sections & hexagonal cell elements**  
*faith tootle*







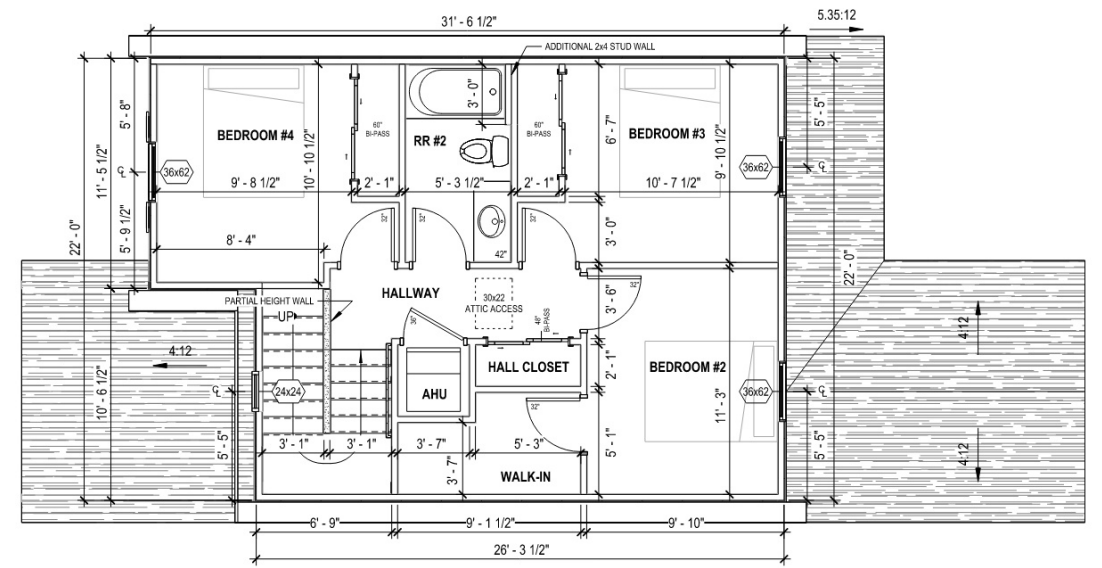
street-side render



first floor

### Maximizing the Floorplan scale: 1" = 10'-0"

With a tight square footage budget and a volunteer building force, plans have to be efficient, making the most of any given space, and logical, so as to be painlessly constructed, but should not sacrifice livability to achieve these ends. Both floors in this prototype went through multiple changes, still within a constrained footprint, before arriving at a solution that felt like the best use of space and resources, while staying true to the livability anyone would want from their own home.



second floor

## GFW HABITAT FOR HUMANITY

house prototype | 'charlotte'

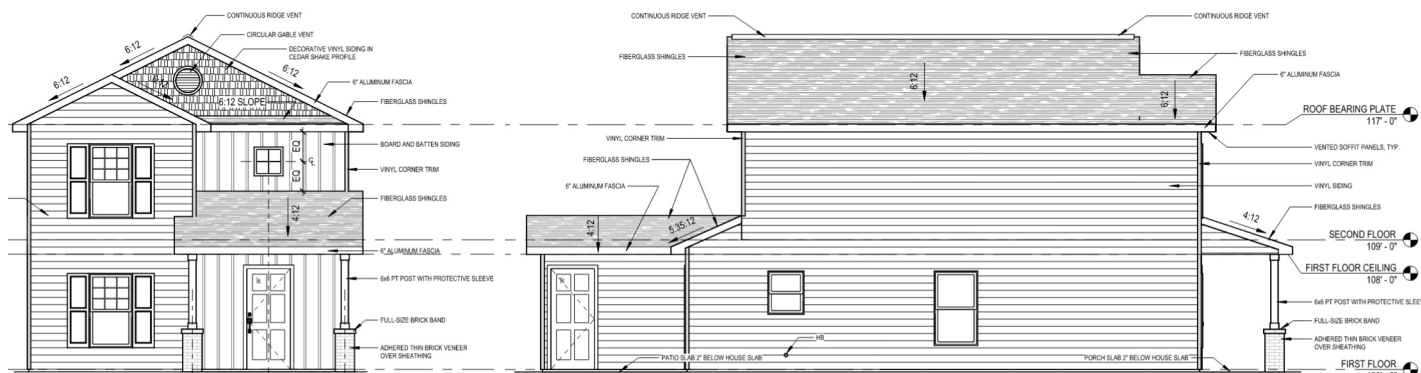
### Design Team

Design Collaborative  
Nathan King | Derek Stahl | Jesse Blevins

### Client

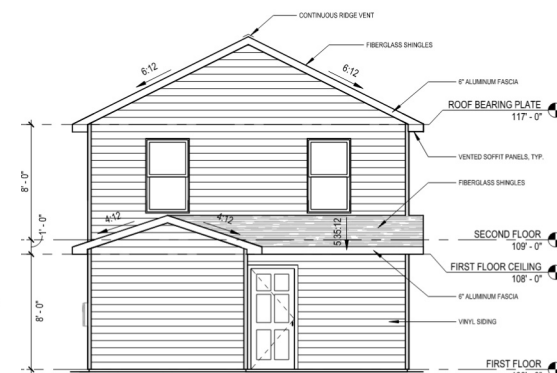
Habitat for Humanity of Greater Fort Wayne | Fort Wayne, IN

This project was one of several prototypes that Design Collaborative was asked to create for the Greater Fort Wayne chapter of Habitat for Humanity, dubbed, Charlotte. I was brought onto this project after an overall envelope had already been established, but was then instrumental in designing interior layout, doors, furniture, appliances, exterior fenestrations, and materials. I would then be tasked with creating the final construction set for this prototype, which was sampled for this selection of drawings.

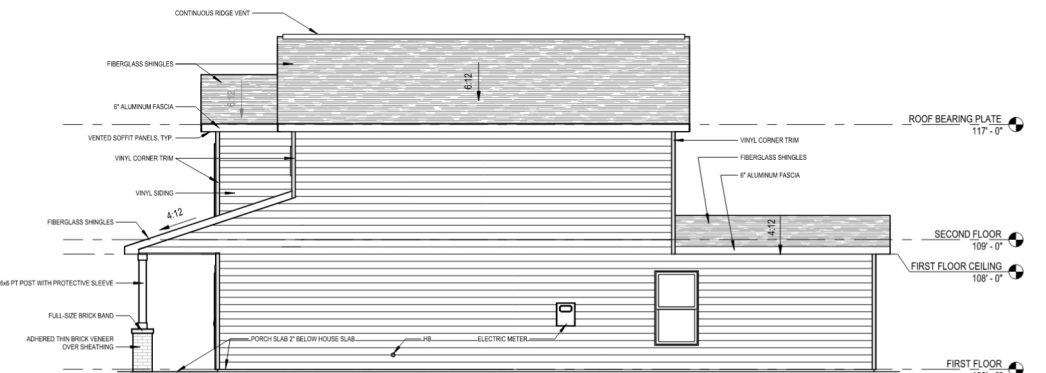


front elevation

side 01 elevation



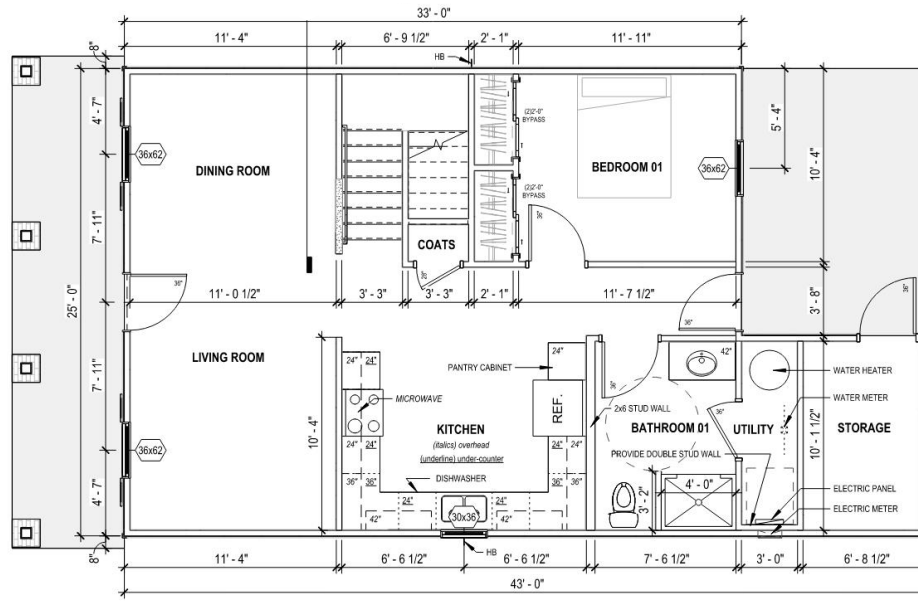
back elevation



side 02 elevation



street-side render

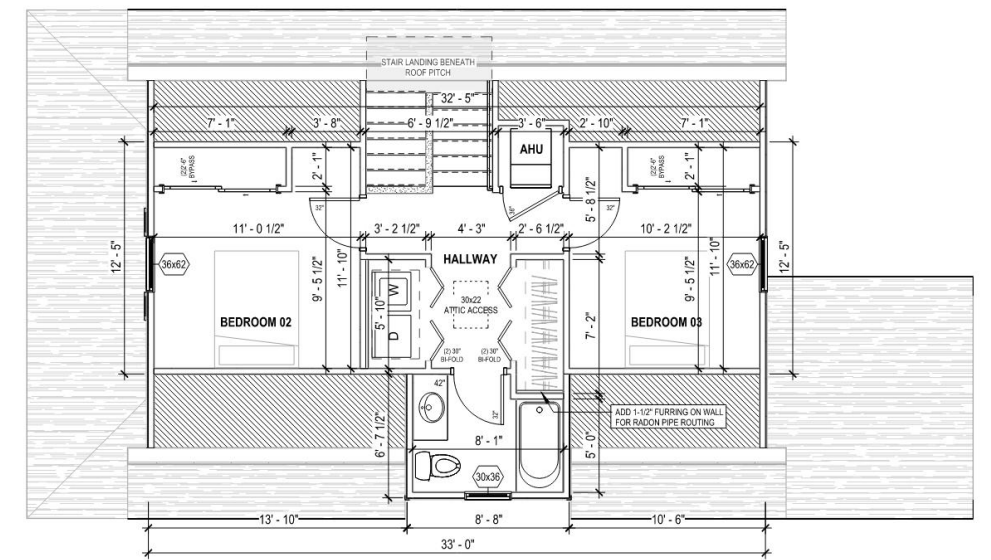


first floor

### A Challenging Interior Condition

scale: 1" = 10'-0"

With a smaller square footage budget than 'Charlotte', the 'Portland's' second floor was a unique design challenge, in that its layout was directly influenced by the steep, symmetrical roof slope directly overhead. The objective then became to find a solution that still fit the required programme onto the second floor, but didn't result in massive dormers or other noticeable additions to the silhouette of the front elevation. This was especially tricky and required many attempts at recomposing both the first and second floor, but I would say the quality of the final version was well worth it.



second floor

## GFW HABITAT FOR HUMANITY

house prototype | 'portland'

### Design Team

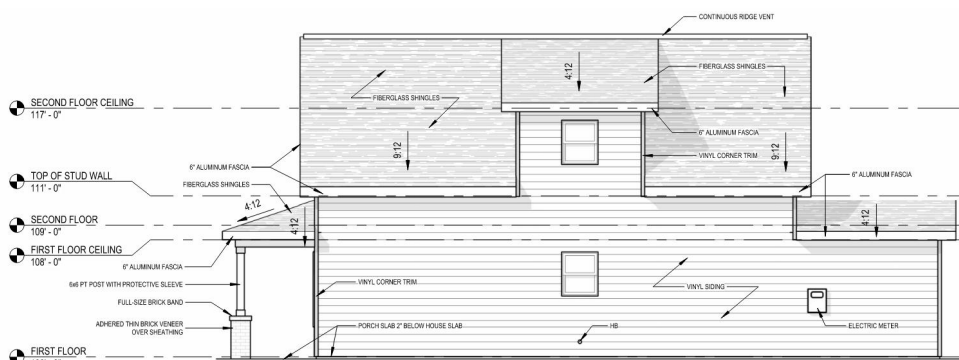
Design Collaborative

Nathan King | Derek Stahl | Jesse Blevins

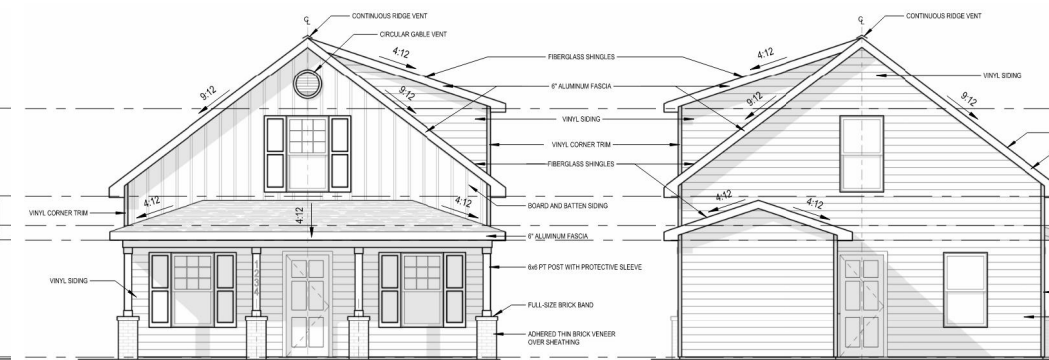
### Client

Habitat for Humanity of Greater Fort Wayne | Fort Wayne, IN

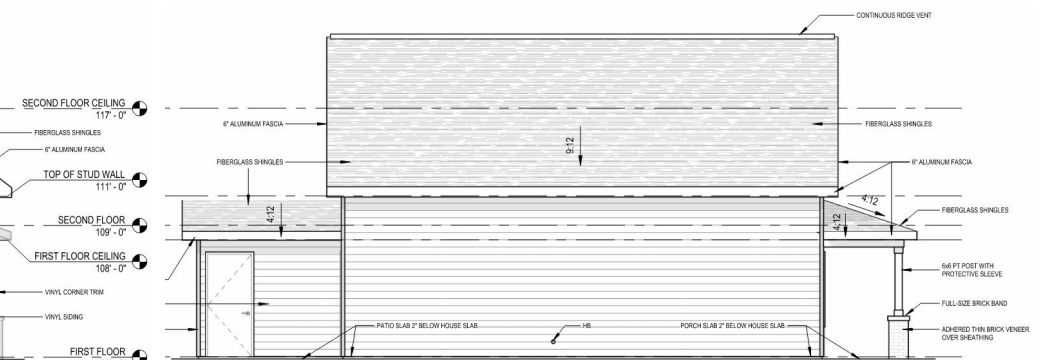
Similar to the previous project, this was another of the GFW Habitat for Humanity's new prototypes, called, Portland. The overall form was already determined by the time I was introduced, but subject to change after major rearchitecting of the interior. I worked with our client contacts and project manager regularly, ensuring that the design moves being made were practical and efficient, but would also respect the integrity of the future homeowners and the organization's mission. These drawings are a sampling of the final version.



side 01 elevation



front elevation



side 02 elevation

back elevation

# VITAL<sub>3</sub> | DETAILED DESIGN

autumn 2025

## Design Team

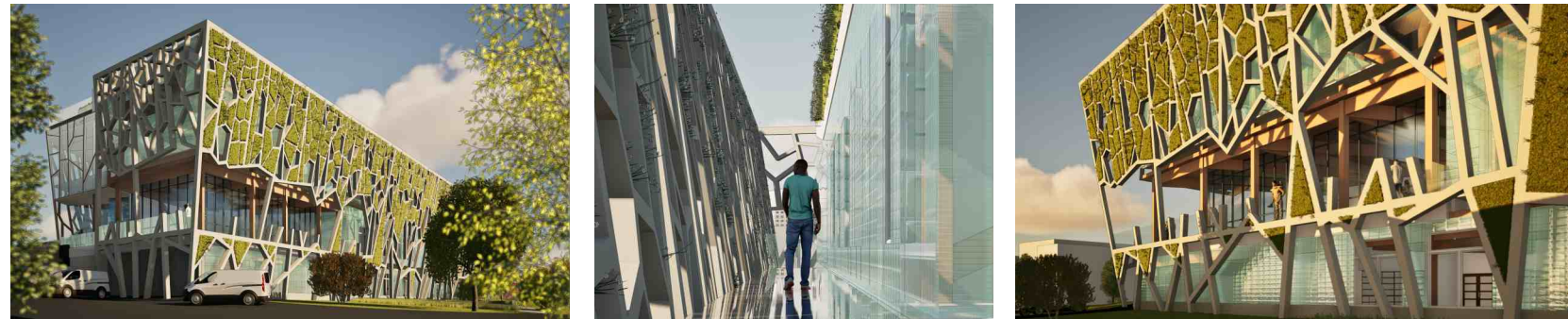
Nathan King

## Professor

David Harrison

Vital3 was the end-product of my fall 2025 integrated design studio--a 50,000 sq ft health center, with a focus on engineered lumber and the integration of sustainable technologies. The drawings on this page were developed in tandem with the progression of that studio, as part of a course focused exclusively on fleshing out the details of architectural projects. These drawings were to be seen as technical manifestations of our overall project's design intent, and were not meant to be simplified unnecessarily to more-quickly come to a feasible solution.

For V3, the intention was to create a gradient of transparency across the facade. From the bottom-most floor up to the vegetated roofscape, and from the interior spaces through the iridescent brick facade, ending in a filtering of light through the exterior greenwall. As a detailing exercise, this was exceptionally difficult, with the shifting gradient warranting numerous material transitions.

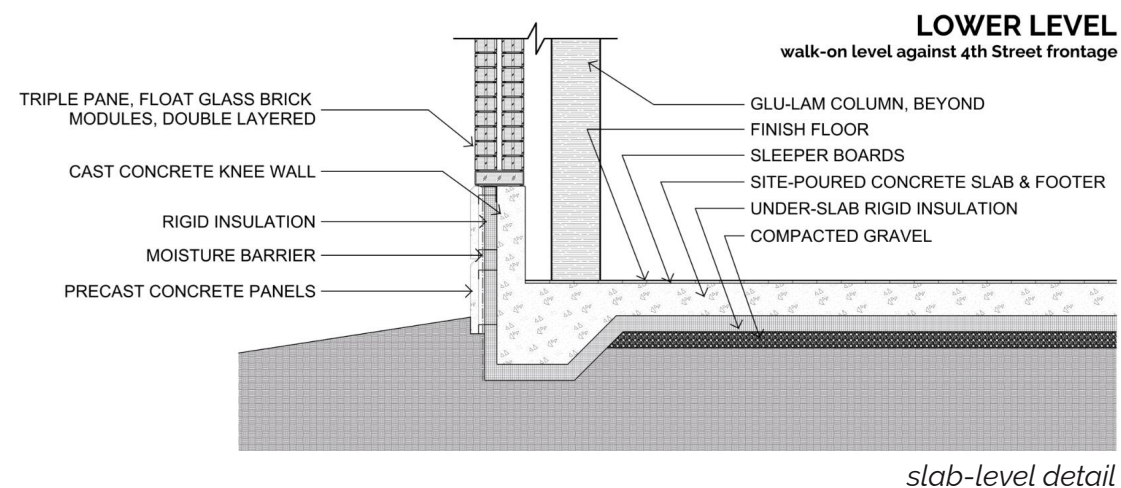


exterior renderings: the loading dock; the exterior walkway; and the terrace @ sunset

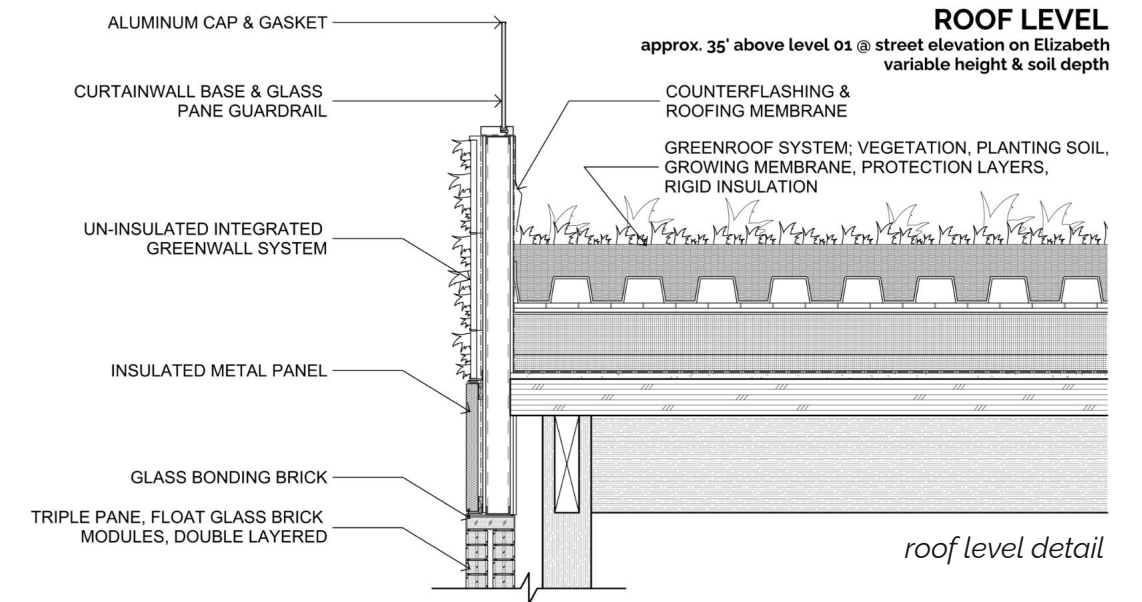
## A New Type of Brick

scale: 1" = 4'-0"

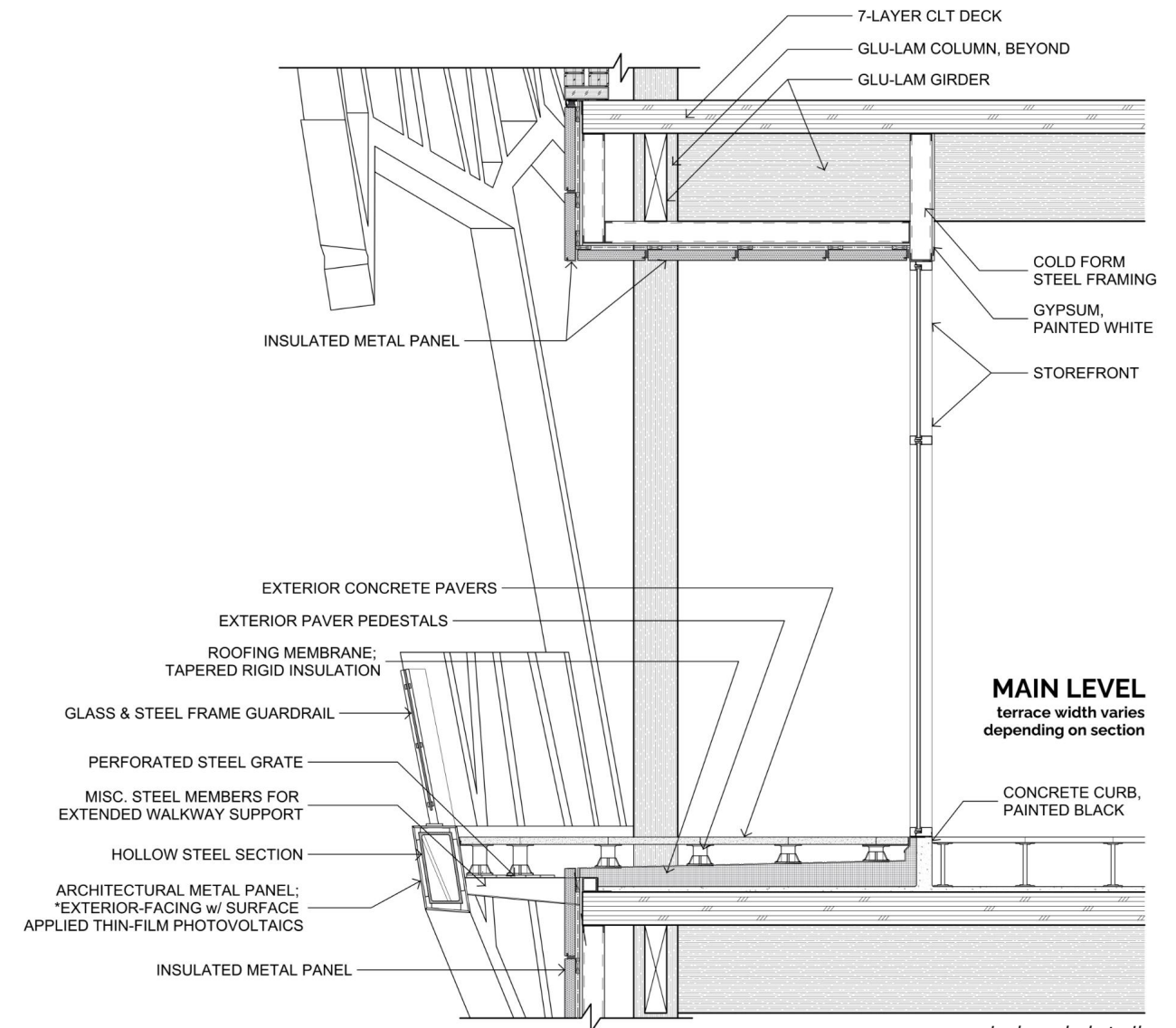
The brick modules shown in each of these details are a special type, with a hybridized function. Each brick is composed of 3 layers of recycled float glass, aerogel, and a specialized translucent frame & gaskets to tie them all together. Their composition allows them to function as a moisture and thermal barrier, while still allowing for great light infiltration.



slab-level detail



roof level detail



main level detail

# VARIOUS PROJECT SKETCHES

not to scale

## Design Team

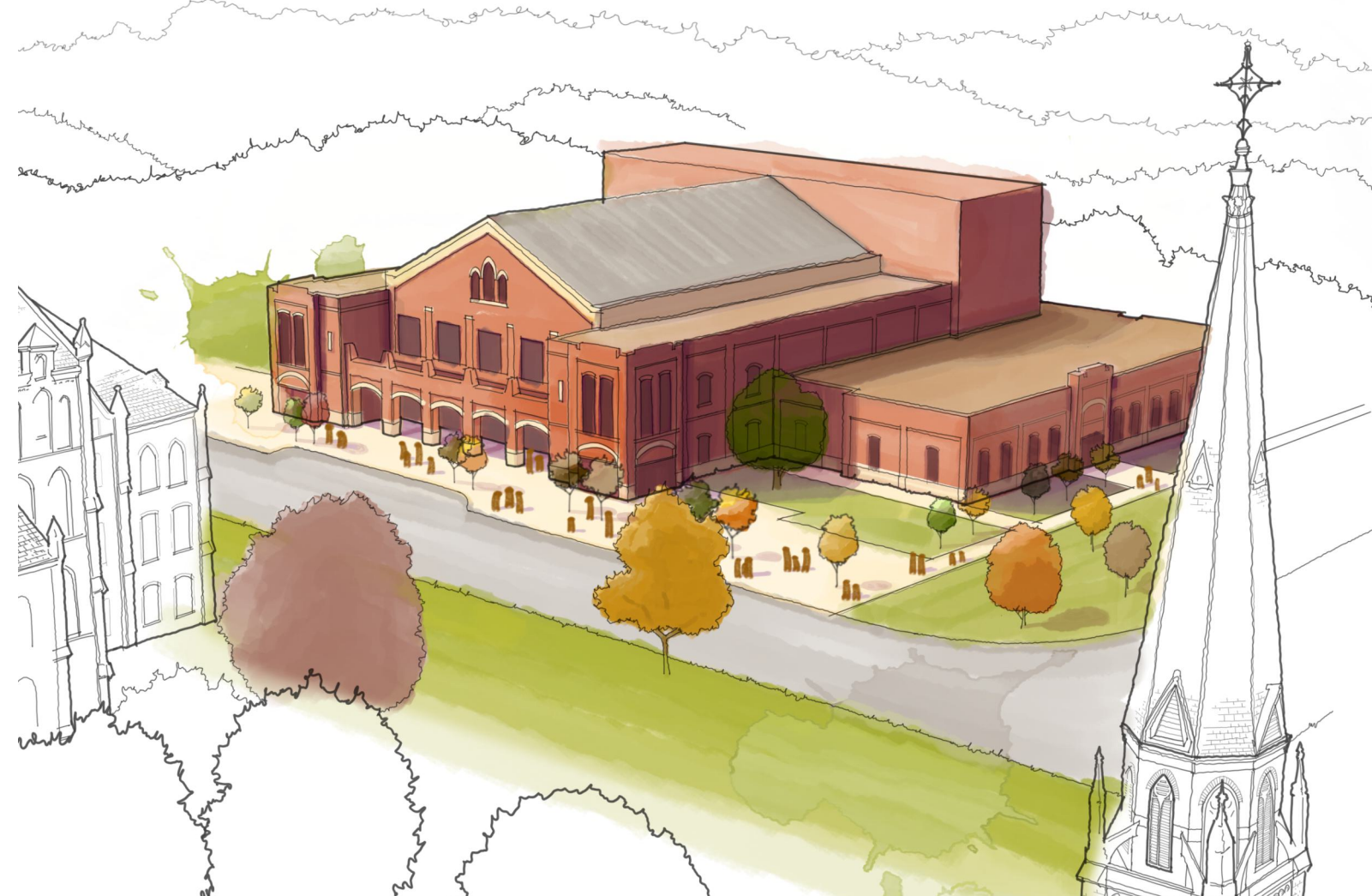
Design Collaborative

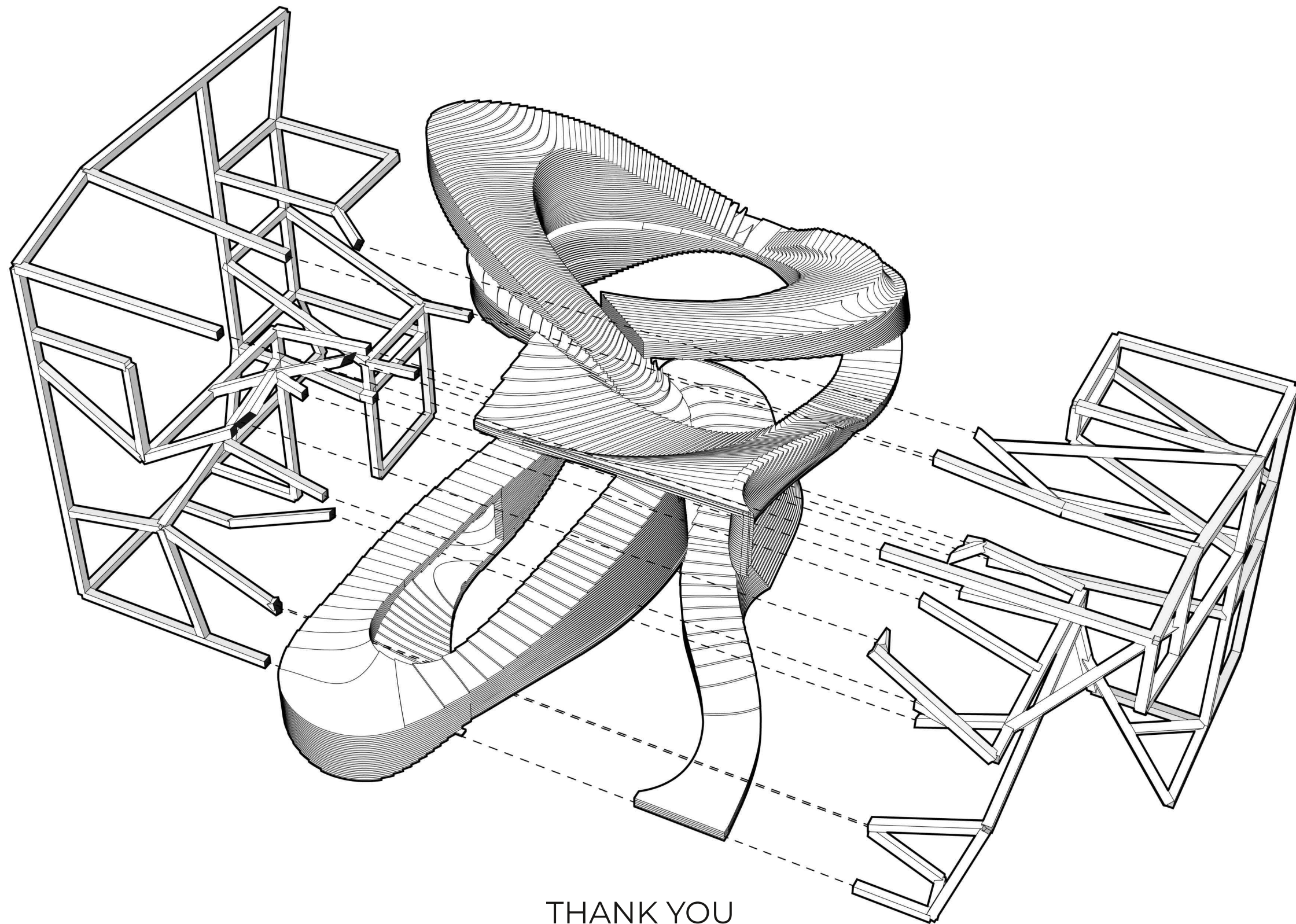
Nathan King

## Clients

Religious Institutions & Collegiate Athletics

Each of these sketches were instrumental in communicating essential early architectural intentions & ideas to clients, often needing to carry much of the then-established vision of the project in a single shot. A variety of artistic techniques were used to ensure that these images were clear and communicative, while still being evocative of potential for a project that has yet to be fully designed. In many cases, sketches like these would be regularly referenced by project teams and clients themselves, acting as reminders for the intended vision of the design when projects were in need of realignment as they progressed.





THANK YOU