

Architecture + Rehabilitation: How Architecture can be Rehabilitative for its Patients, for its City

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Thesis submitted to the faculty of 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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Abstract

This building serves as a rehabilitative center for patients in recovery from mild traumatic brain injuries (mTBI). It is located on the Columbia Medical School and New York Presbyterian Hospital campus in the Washington Heights neighborhood of New York City. The building is designed with three goals in mind: to provide a safe and healing environment tailored specifically to the needs of the patients; to provide a positive working environment for the doctors, nurses, and staff who care for the patients; to provide a space for the public to find healing of their own.

Patient rooms are broken up into three stages - dark, intermediate, and light - that encourage a slow and gentle reintroduction into the world. Staff areas are designed to allow in natural light, easy access to the outside, and privacy away from patients that allow the caregivers a space to recover and find moments of revitalization. The roof, open to the public, lifts upward toward the Hudson River and allows an unobstructed view of the Hudson River Greenway, the Hudson River, and Fort Lee, New Jersey. In a neighborhood of overworked doctors and staff, family members visiting sick loved ones, and residents of an urban environment this roof overlook provides a rehabilitating view of a rare natural environment.

The following words, sketches, and drawings attempt to convey the process, structure, and poetry of the building.

DEDICATION

My sincerest gratitude to -

My committee members Paul Emmons and Susan Piedmont-Palladino,
and to Jaan Holt who taught me that architecture demands bravery.

My classmates in Blacksburg for making every night Latin Night.

My family, whose love I feel every day from over 2,000 miles away.

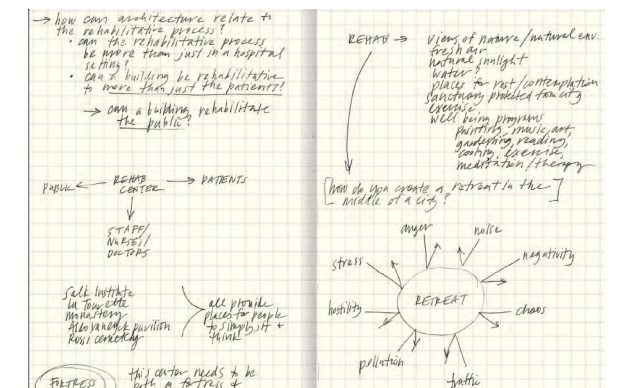
And to MCL, you make me better.

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01 WHY + WHAT

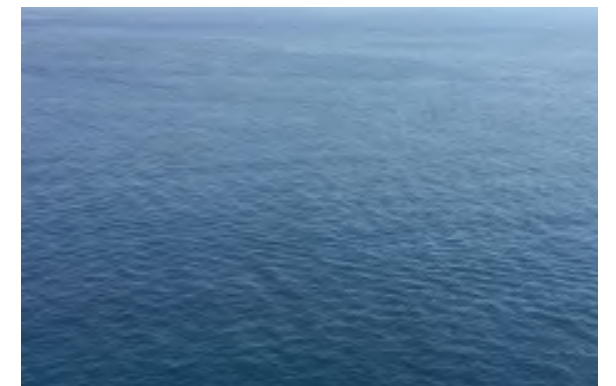
- + why this building?
- + what do I hope to accomplish?



This is a rehabilitation center but unlike a traditional rehabilitation center this one attempts to be rehabilitative for the patients, the staff, and the public. Architecture can play a significant role in the rehabilitative process but, even more broadly, architecture can contribute to our quality of life. Too often architecture perpetuates exclusivity - only those who can afford admittance are able to reap the benefits of the design. Architecture should be more than that. A building is not a private object, visible only to those who can pay the price of admission - it should not limit itself. A building, particularly a rehabilitative building, can and should be rehabilitative for more than just the patients. It can be rehabilitative to both members of the staff and members of the public. It has the chance to better everyone's lives.

02 mTBI + REHABILITATION

- + background info + treatment for mild traumatic brain injuries
- + symptoms and solutions for patients of mild traumatic brain injury
- + how architecture can be a part of the solution
- + building diagram
- + architecture and rehabilitation



There are a range of problems that people are forced to confront and manage while in recovery from a traumatic brain injury. These can include problems with: attention, concentration, speech and language, learning and memory, reasoning, and planning and problem-solving. Skills and coping mechanisms that we take for granted every day can suddenly become difficult and foreign to someone who has suffered a traumatic brain injury¹. The brain is an extremely fragile organ and, if not treated correctly, any trauma to it can have profound and longterm effects.

Immediately following a brain injury, patients should be placed into a dark room for 24-48 hours. The room should be devoid of any light and should block out any noises or negative environmental distractions. During this time, a patient should essentially “turn off” the brain. This period is extremely critical to the recovery process and should be taken very seriously².

After 48 hours, a patient can be moved to an intermediate room that provides minimal natural light and limited outside interference. This place should serve as a retreat for the patient. Patients recovering from a brain injury will experience great fatigue throughout the day and should take the time to rest often. Pushing oneself too far too soon will only result in a relapse of symptoms which could potentially take weeks or months to recover from³.

As patients make strides in their recovery, they may eventually be moved to a light room. This room should allow plenty of natural light and have outside exposure. At this stage, patients should be preparing themselves to reenter the world and their daily lives and will need to build up a tolerance to exterior environments and learn to find ways of coping with outside stress. These rooms should still serve as a retreat for the patients as fatigue may still be a serious issue at this point in his or her recovery.

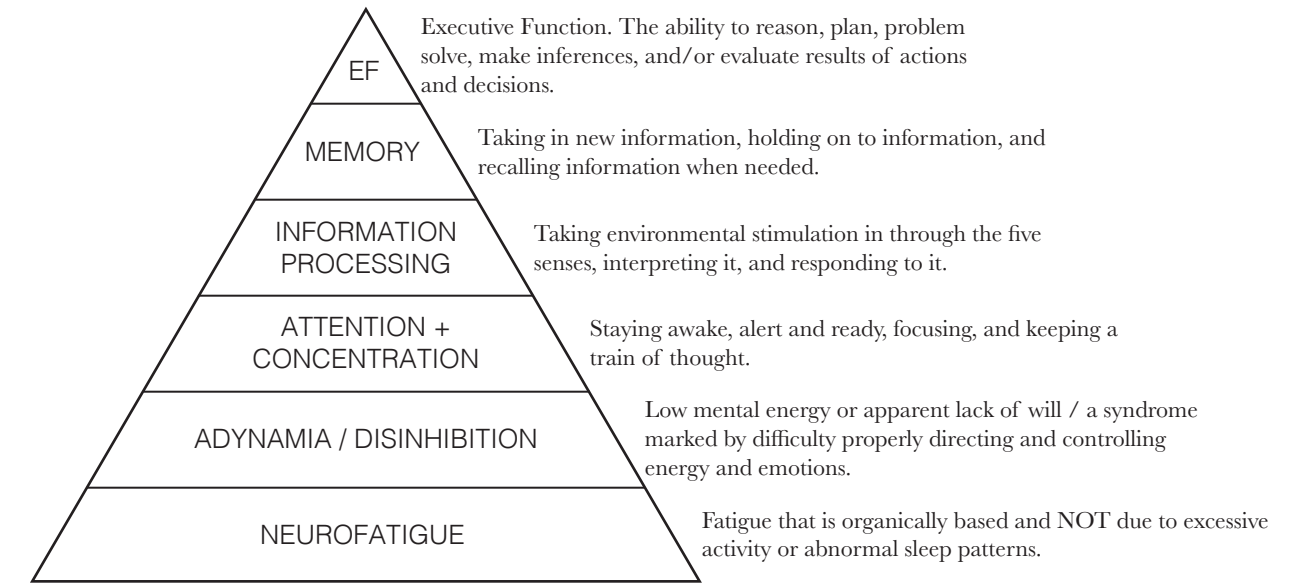
The opposite page lists typical symptoms patients suffer from after sustaining a brain injury as well as strategies for survivors as they relate to/can be addressed by architecture⁴.

¹ “Traumatic Brain Injury: A Guide for Patients.” MentalHealth.va.gov. U.S. Department of Veterans Affairs. Web. 12 Jan. 2015.

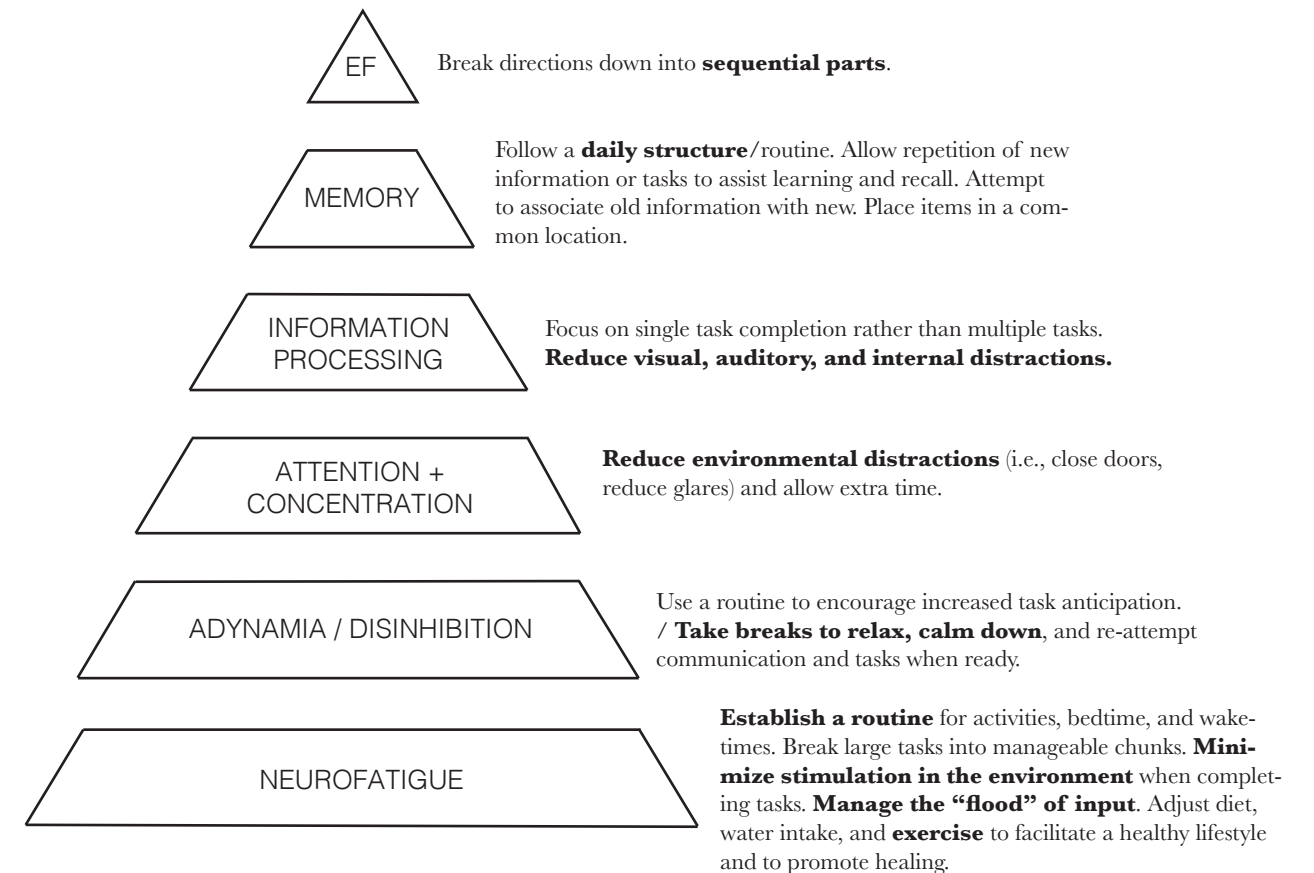
² Lee, Michael A., and Benjamin Fine. “Adolescent Concussions.” ConcussionMD.com. Connecticut Medicine, 1 Mar. 2010. Web. 12 Jan. 2015.

³ Rice, Stephen G. “Concussion: Making the Diagnosis, Managing the Aftermath.” RWJTrauma.org. Robert Wood Johnson University Hospital, 2012. Web. 12 Jan. 2015.

SYMPTOMS OF MILD TRAUMATIC BRAIN INJURY:



STRATEGIES FOR SURVIVORS IN RELATION TO ARCHITECTURE:



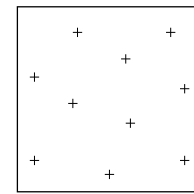
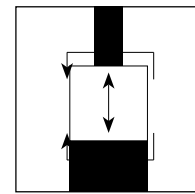
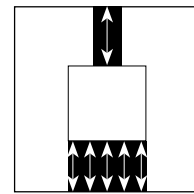
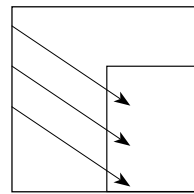
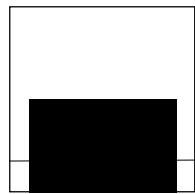
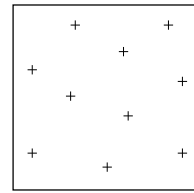
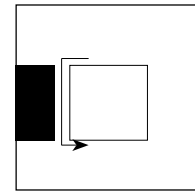
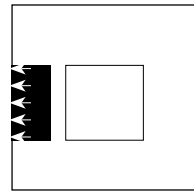
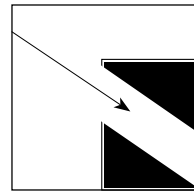
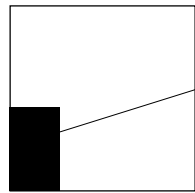
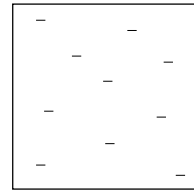
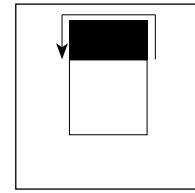
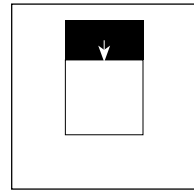
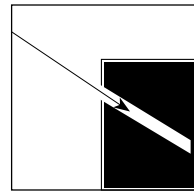
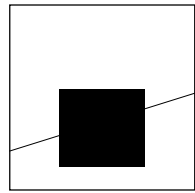
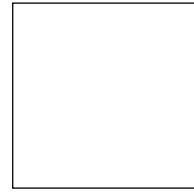
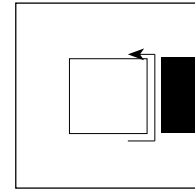
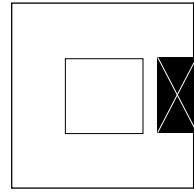
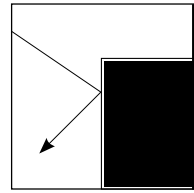
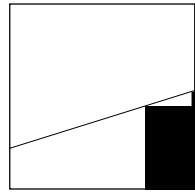
**ROOM
PLACEMENT**

LIGHT

EXPOSURE

CIRCULATION

TEXTURE



Dark rooms should be placed on the east side where the slope is highest. As rooms get lighter, they should move toward the west (lower slope). Staff areas can be placed in low slope areas.

Dark rooms should have zero light penetration. Light penetration should increase as patients progress in their treatment. Staff areas should be light.

Dark room patients should have no exposure to outside world. Intermediate room should have exposure to interior courtyard. Light room patients should have exterior exposure.

Circulation around a courtyard makes it easy for patients to understand. Circulation can act as a buffer between patient rooms and negative outside environments.

Limit textures to patients in the dark rooms. Textures, patterns, colors, light may all increase in rooms/environments as patients progress in their recovery.

Architecture is a unique profession that has the ability to not just create spaces that people occupy but to actually transform and effect the lives of the people who occupy those spaces. A school can encourage learning, an office can enhance productivity, and a hospital can increase the health of its patients.

There have been numerous studies done on the benefits of good design in relation to a patient's recovery. The most famous among them was conducted by Robert Ulrich in 1984 which found that patients recovering from surgery who had a view of a row of trees as compared to that of a brick wall had a shorter postoperative recovery time, required fewer pain medications, and received fewer negative comments on nurses' reports¹. These findings demonstrate that the patients benefited significantly from having a view of nature from their hospital room, that nature can aid in increasing the health and well being of those who witness it, that the human-nature relationship is a profound and important one.

Within the context of a city, this relationship becomes more difficult to define but is no less important. To find nature and peace within the chaos of an urban setting is a substantial achievement.

This line between nature and shelter becomes even more essential when designing for patients who are recovering from a traumatic brain injury. A balance between protecting the health of patients and exposing them to the benefits of nature must be struck precisely.

Of no less importance in this discussion is the health and wellbeing of the nurses, doctors, and staff who spend their careers caring for patients in need. The happiness of these providers correlates directly with the health and recovery process of the patients and, as with the patients, views of natural environments have a profound effect on job satisfaction and stress².

If architecture can be deployed in such a way that takes advantage of any natural surroundings (or creates a space in which to build one), it can create an environment which is conducive to healing and can create a space to increase the wellbeing of those who occupy its spaces.

¹ Ulrich, R. "View through a Window May Influence Recovery from Surgery." *Science* (1984): 420-21. Print.

² Shin, Won Sop. "The Influence of Forest View through a Window on Job Satisfaction and Job Stress." *Scandinavian Journal of Forest Research*: 248-53. Print.



03 SITE

Fort Washington Avenue + 165th Street
Washington Heights
New York, New York

- + site plan
- + description of site and neighborhood
- + site model

+ HUDSON RIVER

+ HUDSON RIVER GREENWAY

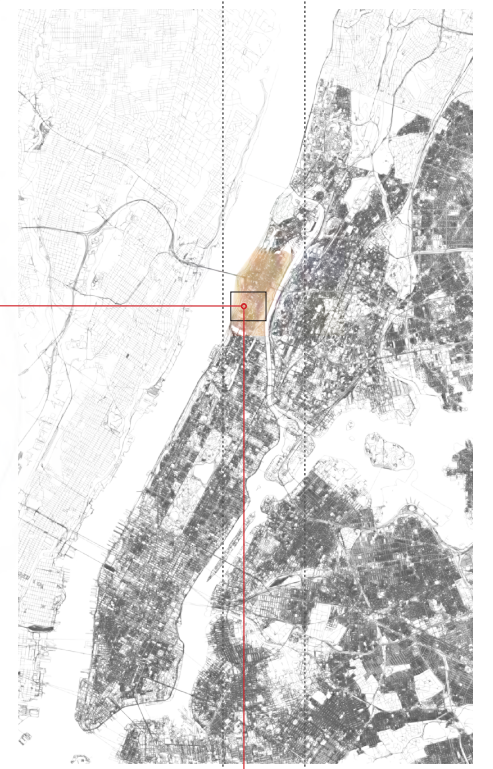
+ HENRY HUDSON PARKWAY

+ NEW YORK PRESBYTERIAN HOSPITAL

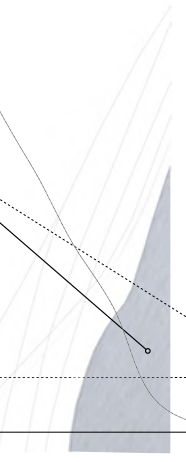
+ NEW YORK CITY HOUSING AUTHORITY

+ HARLEM RIVER

+ WASHINGTON HEIGHTS
+ NEW YORK, NY



ELEVATION PROFILE OF W 165TH STREET



INWOOD
NEW JERSEY
BRONX
HARLEM

0' HUDSON RIVER

0' HARLEM RIVER

The site is located in a parking lot in the Washington Heights neighborhood of New York City - north of Harlem and flanked on the east and west by the Harlem River and Hudson River, respectively. Washington Heights, once used as a fortification by the Continental Army during the Revolutionary War, boasts some of the highest elevations in Manhattan. Washington Heights has a population of 164,304 with 73% Dominican, 14% caucasian¹. It is serviced by both the 1 and the A/C subway lines.

The site is located on the New York Presbyterian Hospital and Columbia and Cornell University Hospital Medical School campus, which boasts the best neurology department in the United States. The hospital has 2,508 beds in total and is one of the largest and busiest hospitals in the country².

The building site slopes west from Fort Washington Avenue (elevation: 140') toward Riverside Drive with an elevation of 110'. Further to the west lies the Hudson River Greenway and the Hudson River. On the east, there are some small apartment buildings with small businesses on the ground floor. To the north, the site runs along West 165th Street while on the south it is bordered by a hospital parking garage.

¹ "Washington Heights Neighborhood in New York, New York (NY), 10032, 10033, 10040 Detailed Profile." City-Data.com. City-Data, 2013. Web. 2 Feb. 2015. <<http://www.city-data.com/neighborhood/Washington-Heights-New-York-NY.html>>.

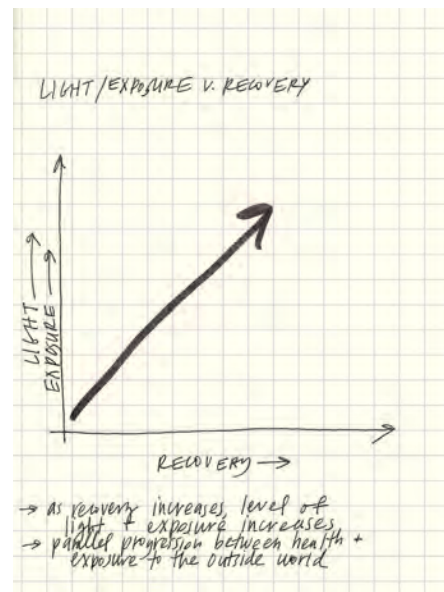
² "2013 Facts and Financials." Nyp.org. New York Presbyterian, 2013. Web. 25 Jan. 2015. <http://nyp.org/pdf/facts_and_financials.pdf>.



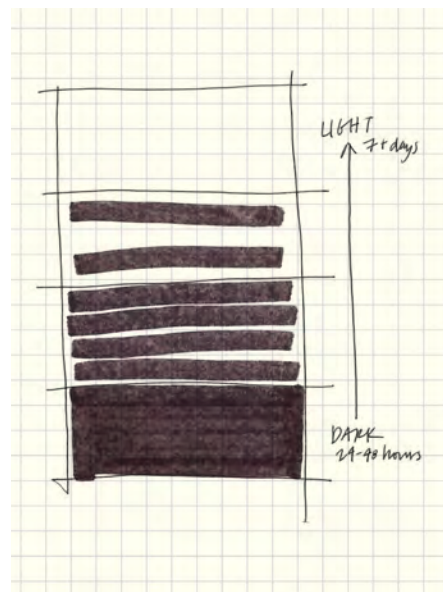
04 PROCESS

- + concept sketches
- + diagrammatic sketches
- + study models
- + vignette sketches and collages

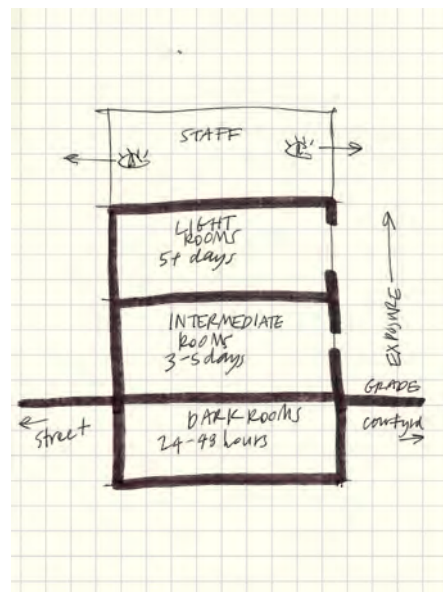




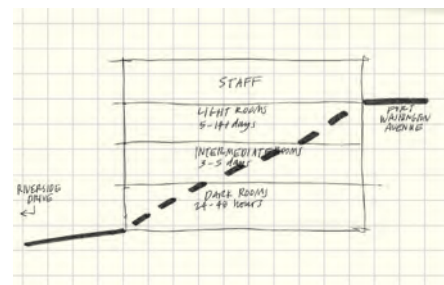
As patients progress in their recovery, their exposure to light and the outside world will increase. This can happen through their placement and openings both vertically and horizontally.



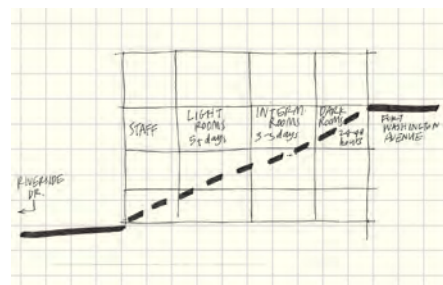
As you move vertically in the building, the amount of exposure to both light and the outside world will increase. The darkest rooms will be located below grade, the lightest rooms on the top level.



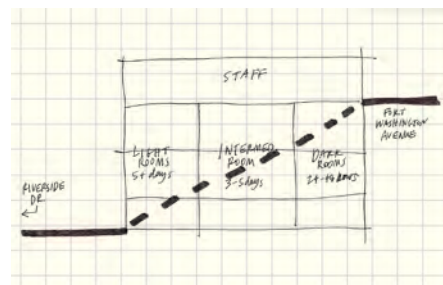
Patient rooms should be protected from the street exposure on W 165th Street. Openings that allow light and exposure to patient rooms should be located on the interior side of the building, to the courtyard.



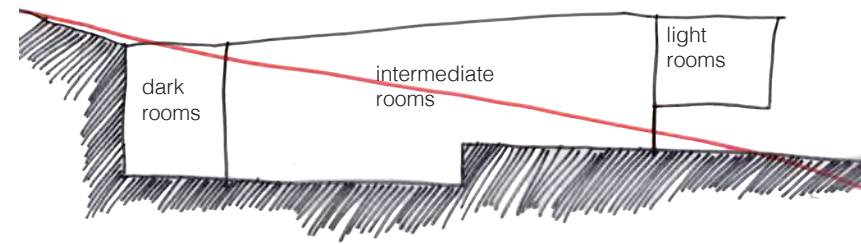
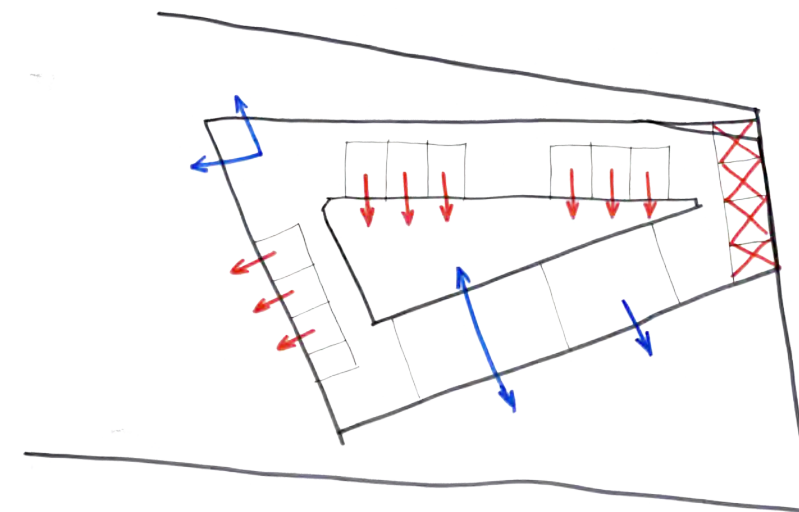
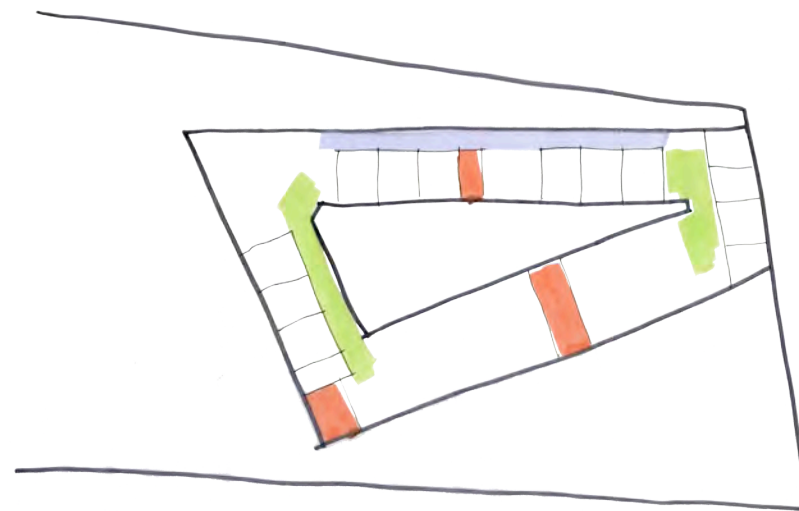
Patient rooms stacked vertically - darkest on bottom, lightest on top. Staff located on Level 4 above grade at Fort Washington Avenue. Darkest rooms located below grade (site level).



Patient rooms stacked horizontally - darkest rooms up against Fort Washington Avenue and lightest rooms out toward Hudson River. Use slope of the site to create dark, intermediate, light rooms. Staff located furthest west.



Patient rooms stacked horizontally - darkest rooms up against Fort Washington Avenue and lightest rooms out toward Hudson River. Use slope of the site to create dark, intermediate, light rooms. Staff located on Level 4.



The hallways serve as buffer zones between the patient rooms and the exterior. For the beginner patients, the hallway separate the courtyard from the patient rooms. For the intermediate patients, the hallway acts as a buffer between W 165th Street and the patient rooms. For the healthiest patients, the hallway acts as a buffer between the interior courtyard and the patient rooms, pushing the patient rooms toward the exterior where they will have more exposure to the outside. Nurse's stations and staff areas may have hallways on either side or through the center.

The dark, intermediate, and light patient rooms have different exposures to the outside world. The dark room is completely closed off from the exterior world, devoid of all light, noise, and outside interference. The intermediate room is exposed to the interior courtyard - a controlled exposure to the outside world. Here, the hallway serves as a buffer between the patient rooms and the city to the north at W 165th Street. The light patient rooms are located the furthest west in the building, facing out toward the Hudson River. These patients are ready to begin preparing to reenter the outside world. Nurse's stations and staff areas can be exposed to both the courtyard and the city.

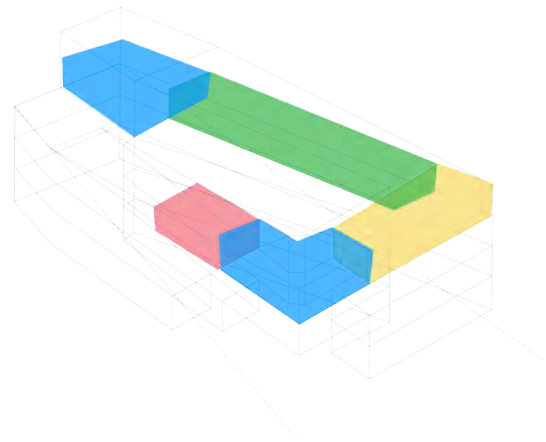
The placement of the dark, intermediate, and light rooms must take advantage of the slope of the site. The darkest rooms should be placed at the point of highest elevation so that they can be buried underground and protected from the light and noise of the city. Light rooms may be placed to the furthest west point of the building, facing out toward the Hudson River and the Hudson River Greenway. These rooms have the highest exposure to the outside. The intermediate rooms may be placed in between the dark rooms and the light rooms, allowing for a controlled exposure to the outside world.



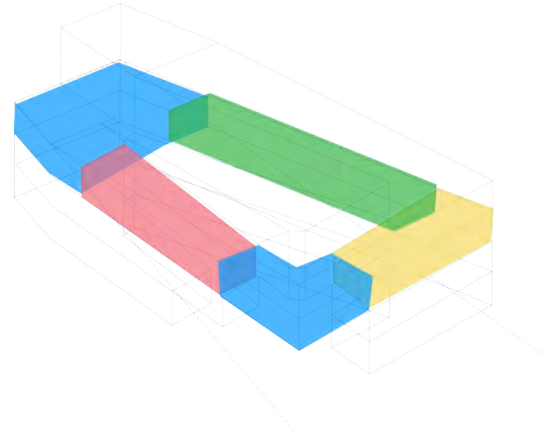
Section diagram showing the increasing levels of light as you ascend in the building, corresponding to the increased health of the patients.

LEVEL 4

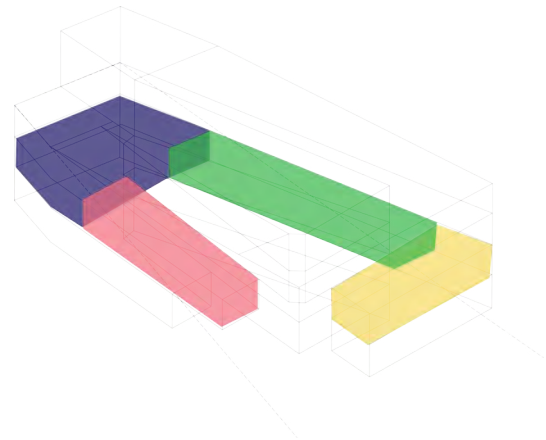
Level with Fort Wash Ave



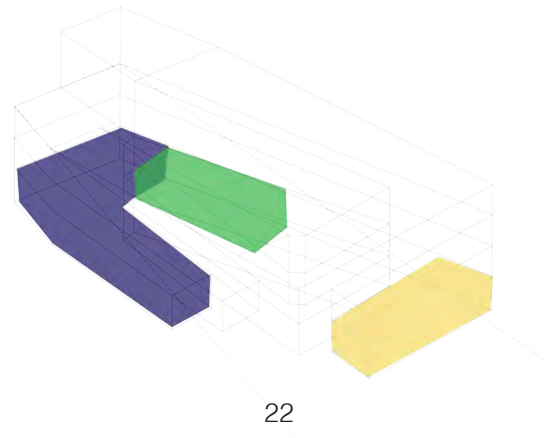
LEVEL 3



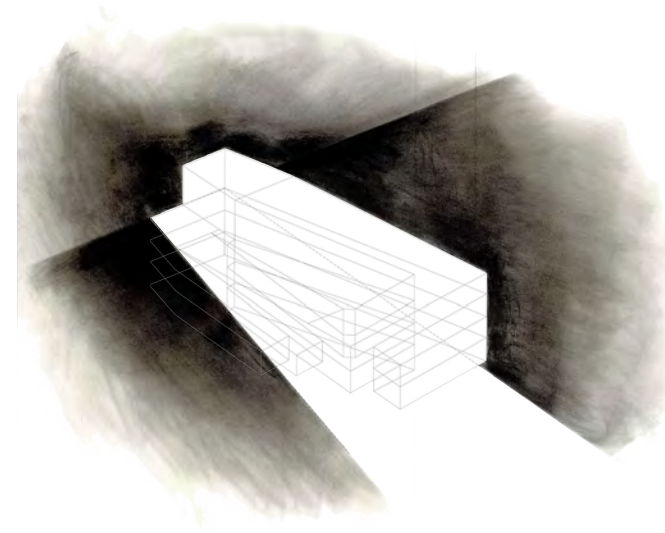
LEVEL 2



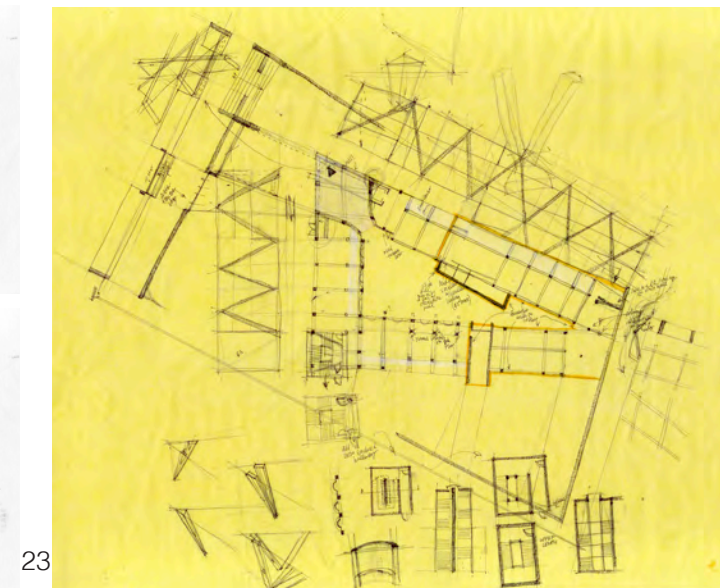
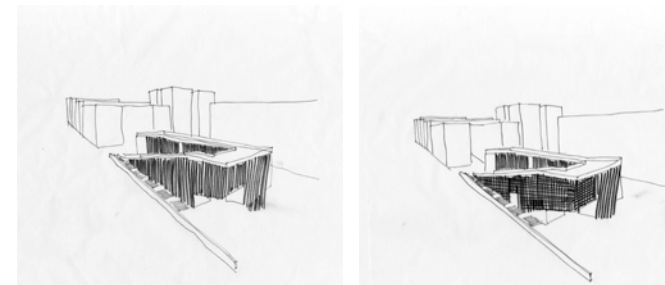
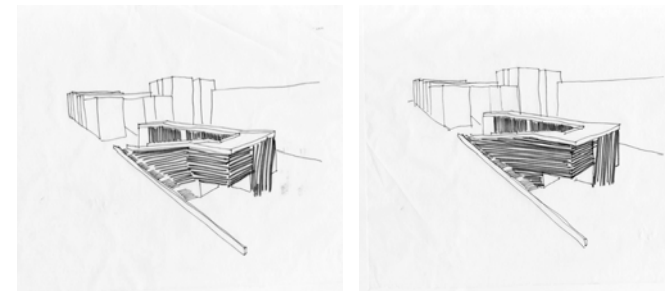
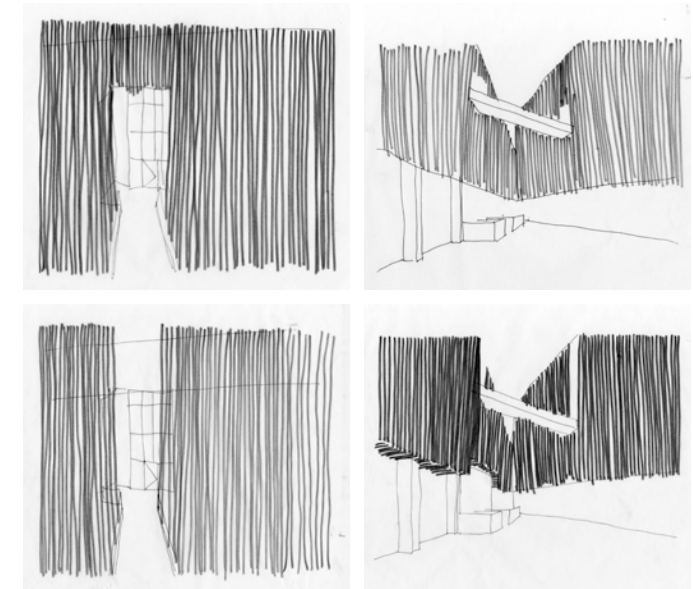
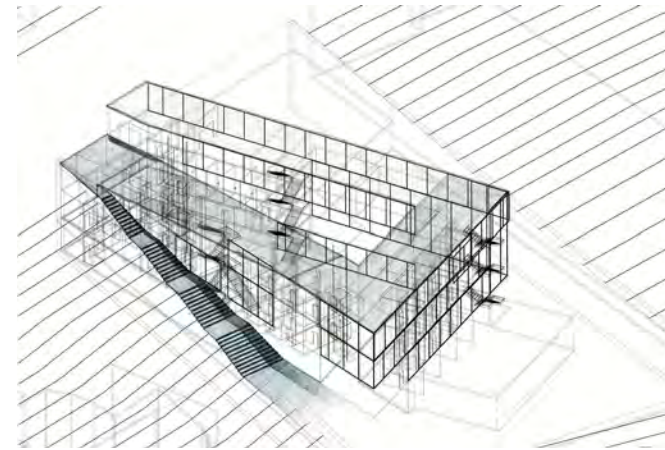
LEVEL 1

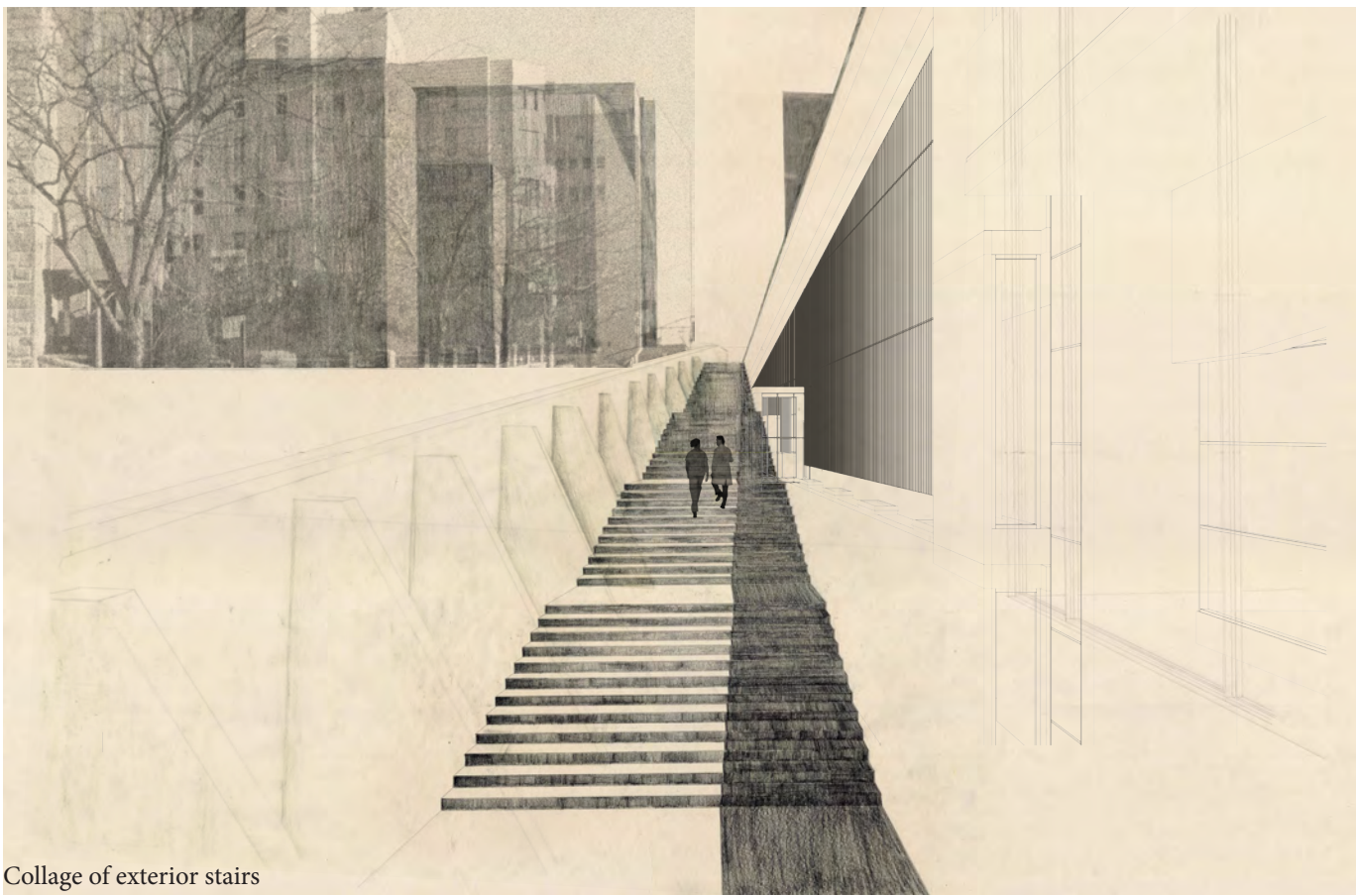


- Dark Rooms (24-48 hours)
- Intermediate Rooms (days 3-5)
- Light Rooms (days 5-14+)
- Communal Space
- Staff

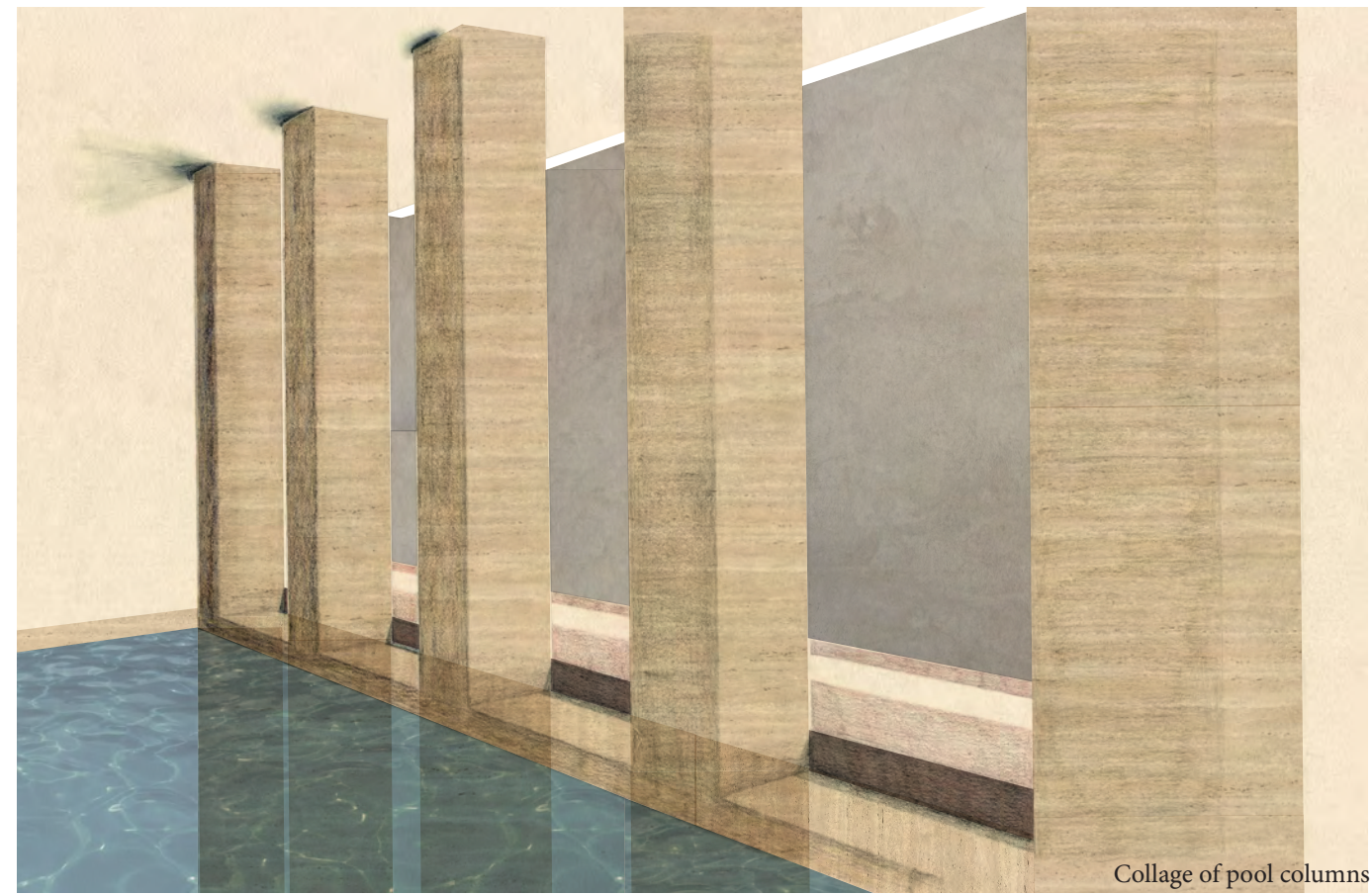


The following are a small example of sketches, diagrams, and vignettes that occurred throughout the design process.

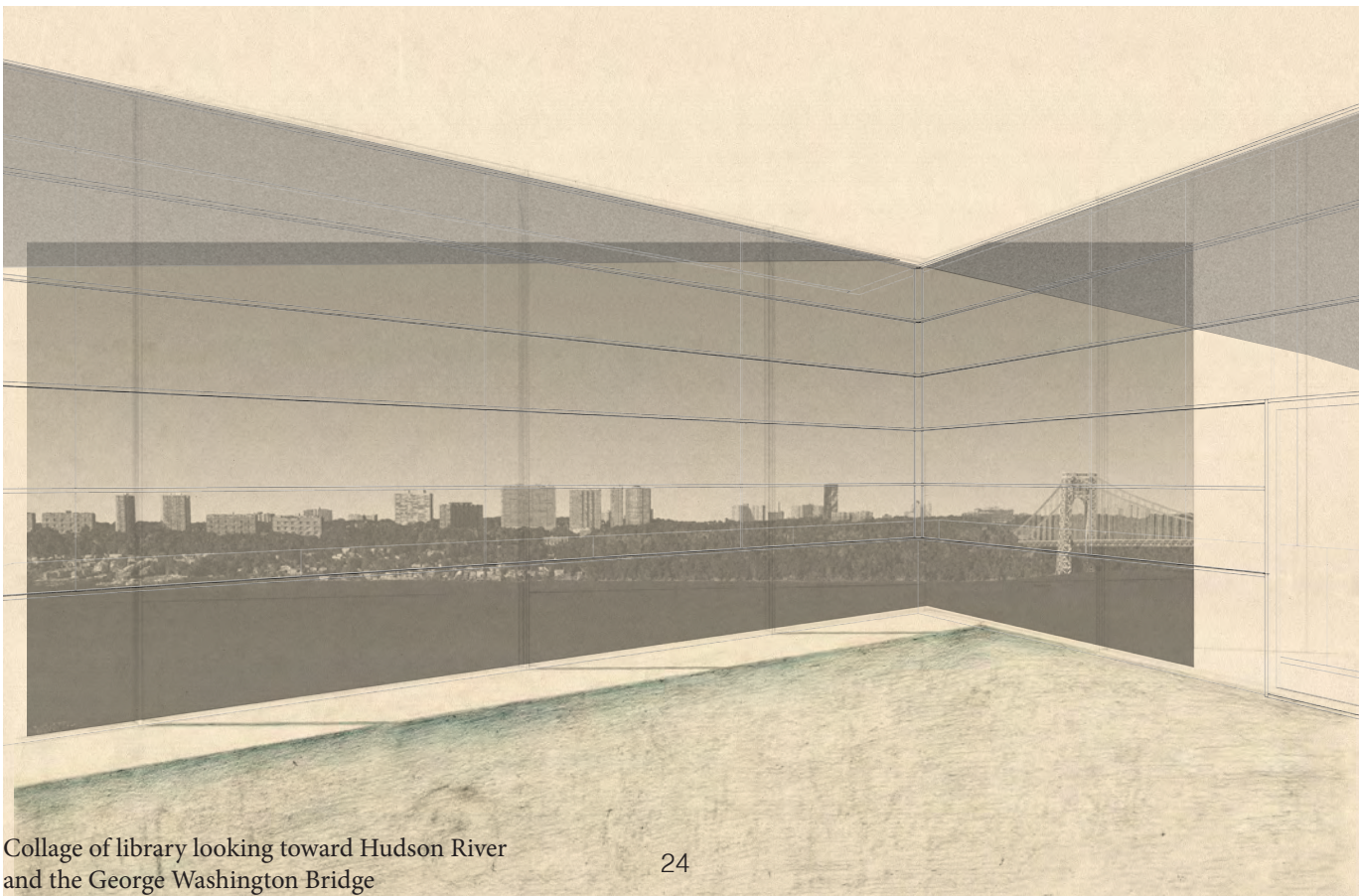




Collage of exterior stairs



Collage of pool columns



Collage of library looking toward Hudson River and the George Washington Bridge



Collage of courtyard, looking out under cantilever

05 PLANS

- + plans for levels 1-4 and the roof level
- + plans are oriented to the north





- 1 Nurse's Station
- 2 Patient Rooms - Dark (24-48 Hours)
- 3 Bath
- 4 Patient Rooms - Dark (24-48 Hours)
- 5 Bath
- 6 Nurse's Station
- 7 Fire Stairs
- 8 Fire Stairs
- 9 Stair to Courtyard
- 10 Pool Foundation (pool located on level 2)
- 11 Below Grade

- 1** Patient Rooms - Medium (3-5 Days)
- 2** Fire Stairs
- 3** Nurse's Station
- 4** Patient Rooms - Medium (3-5 Days)
- 5** Patient Rooms - Dark (24-48 Hours)
- 6** Bath
- 7** Nurse's Station + Staff Offices
- 8** Fire Stairs
- 9** Pool
- 10** Lockers
- 11** Fire Stairs
- 12** Patient Rooms - Light (5-14+ Days)
- 13** Courtyard
- 14** Stairs to Nurse's Station on Level 1
- 15** Patient Garden
- 16** Reflecting Pool
- 17** Public Access to Park



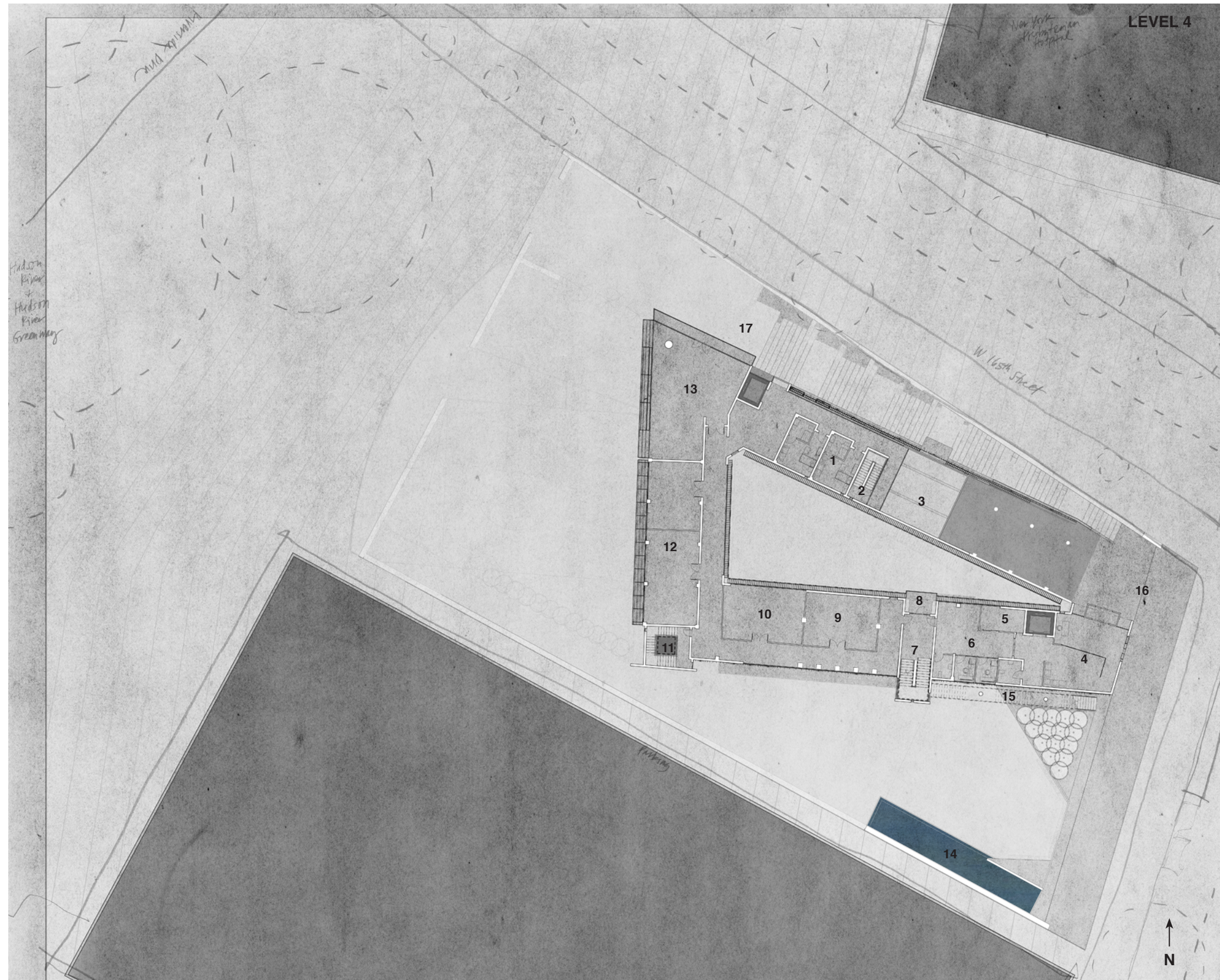
LEVEL 2



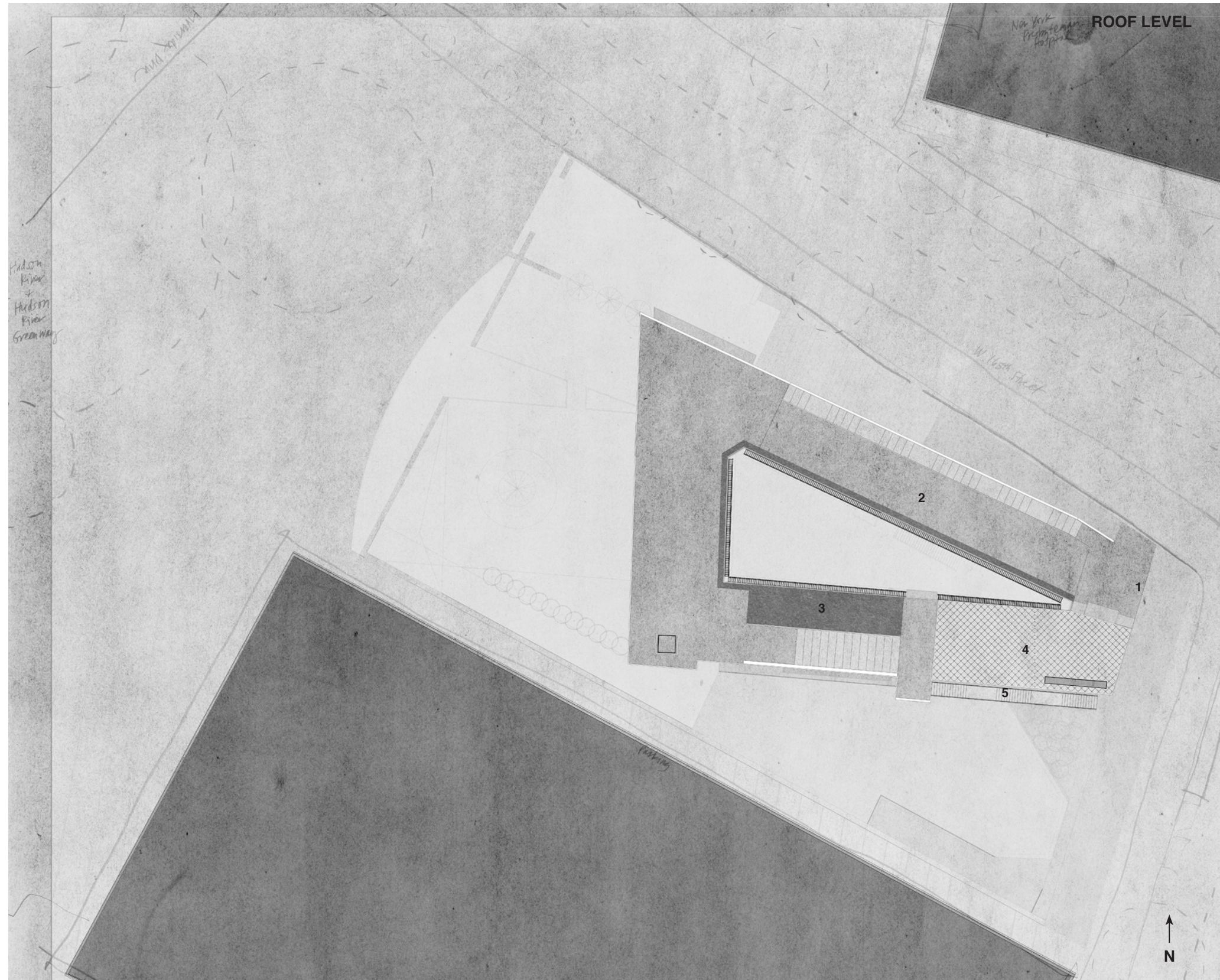
- 1 Patient Rooms - Medium (3-5 Days)
- 2 Fire Stairs
- 3 Nurse's Station
- 4 Patient Rooms - Medium (3-5 Days)
- 5 Therapy Rooms
- 6 Staff Break Room
- 7 Fire Stairs
- 8 Gym / Physical Rehabilitation Center
- 9 Fire Stairs
- 10 Patient Rooms - Light (5-14+ Days)
- 11 Nurse's Station
- 12 Cafeteria
- 13 Staff Patio
- 14 Public Access to Park



- 1 Patient Rooms - Medium (3-5 Days)
- 2 Fire Stairs
- 3 Open to Nurse's Station Below
- 4 Lobby
- 5 Director's Office
- 6 Staff Offices
- 7 Fire Stairs
- 8 Balcony
- 9 Art Therapy Room
- 10 Music Room
- 11 Fire Stairs
- 12 Classrooms / Group Therapy Rooms
- 13 Library
- 14 Reflecting Pool
- 15 Fire Stairs from Roof
- 16 Entrance off Fort Washington Avenue
- 17 Public Access to Park

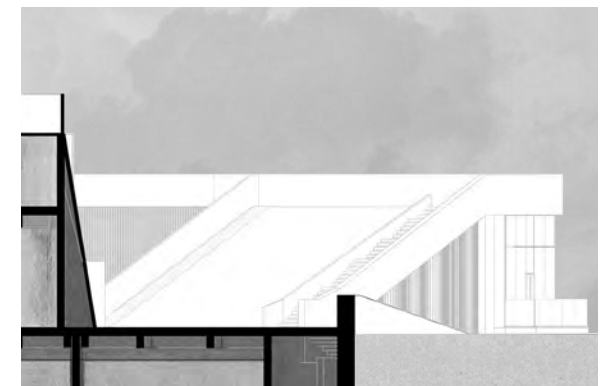


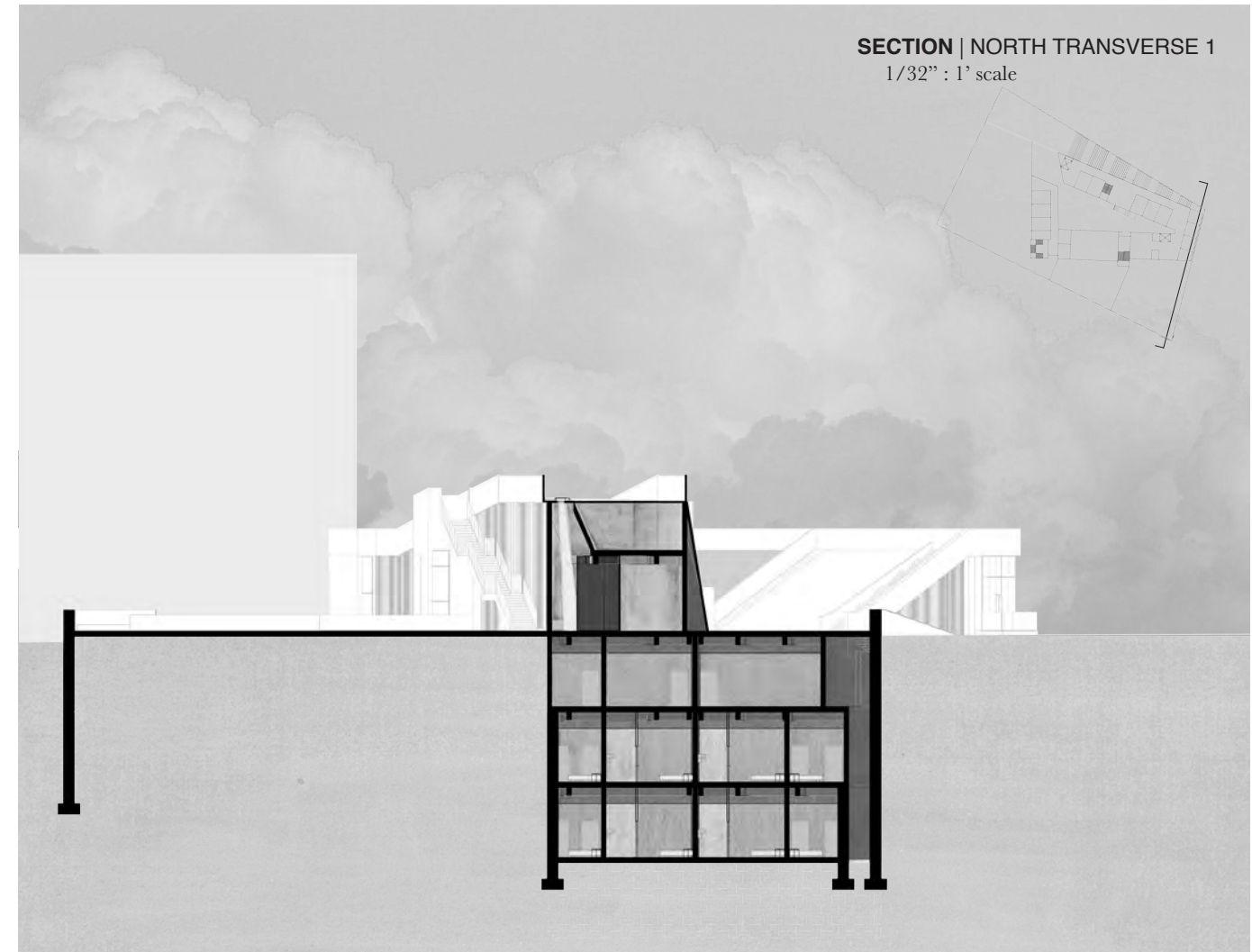
- 1 Entrance off Fort Washington Avenue
- 2 Ramp to Hudson River Overlook
- 3 Ramp
- 4 Mechanical, Electrical + HVAC Systems
- 5 Fire Stairs to Street Level



06 SECTIONS

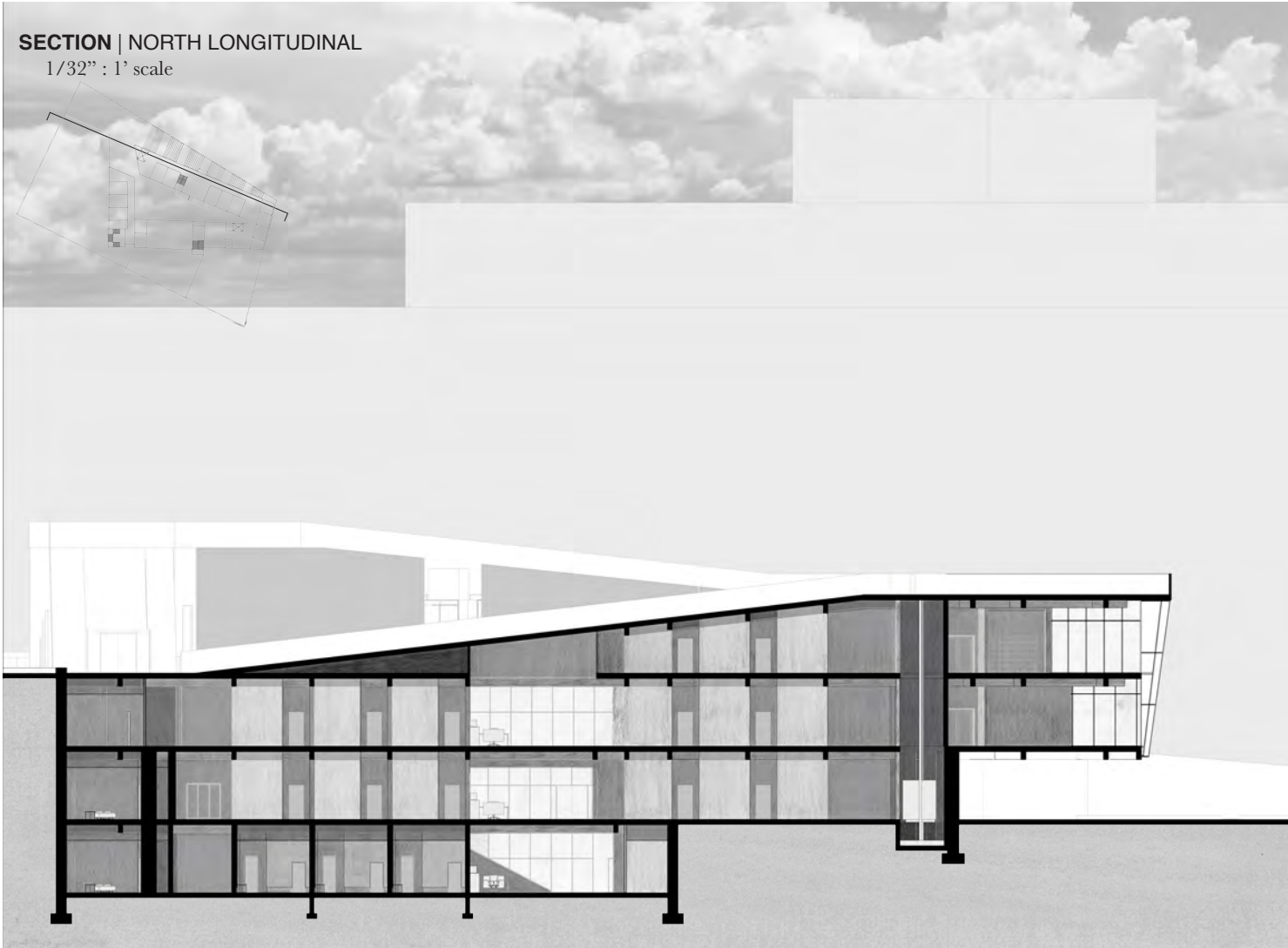
- + longitudinal and transverse sections
- + sections are at 1/32" : 1' scale





SECTION | NORTH LONGITUDINAL

1/32" : 1' scale



SECTION | NORTH TRANSVERSE 1

1/32" : 1' scale



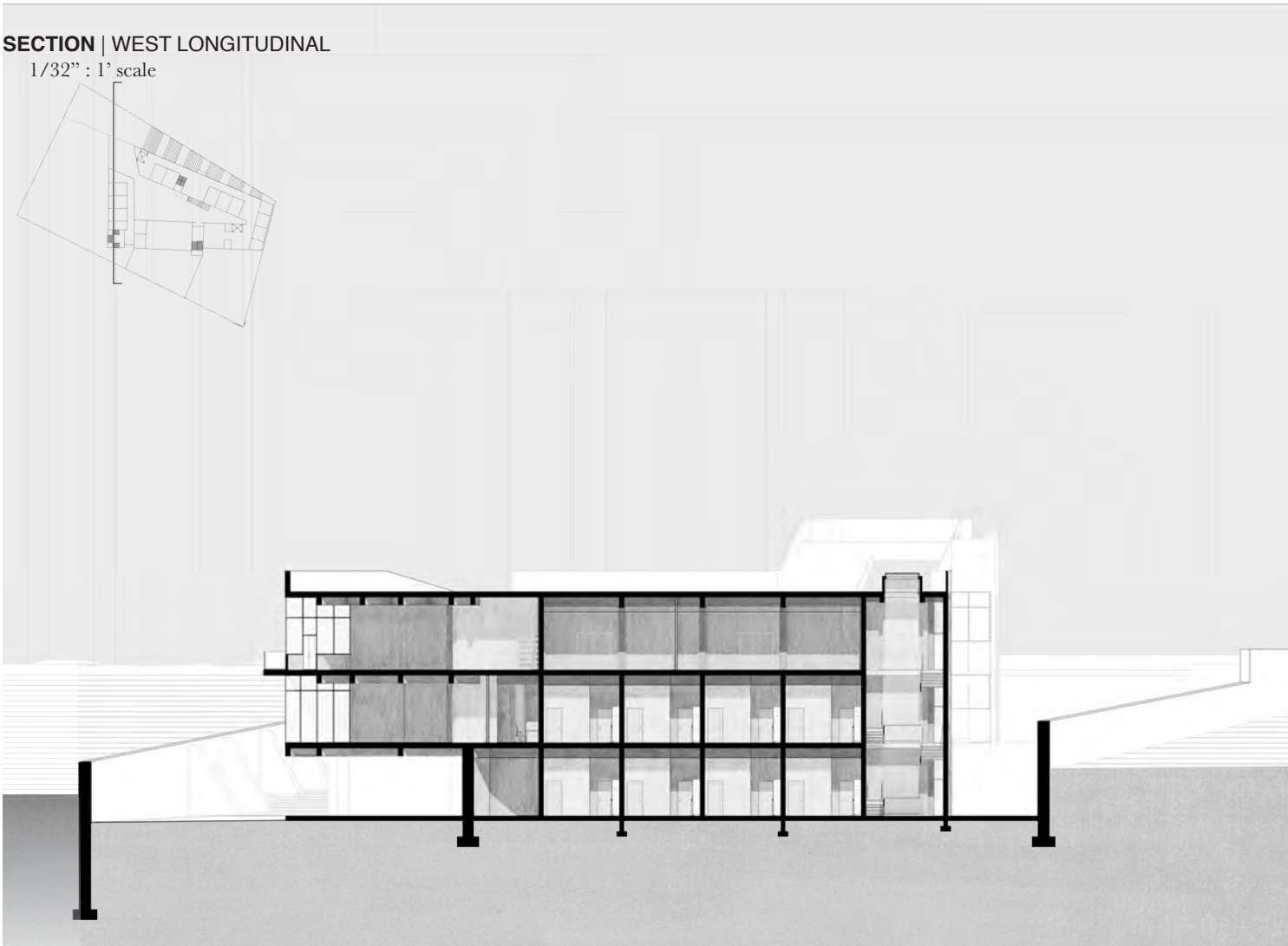
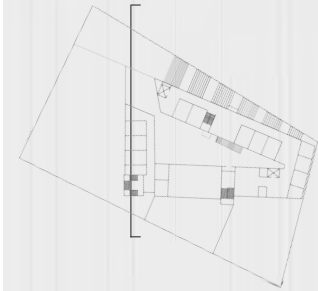
SECTION | NORTH TRANSVERSE 2

1/32" : 1' scale



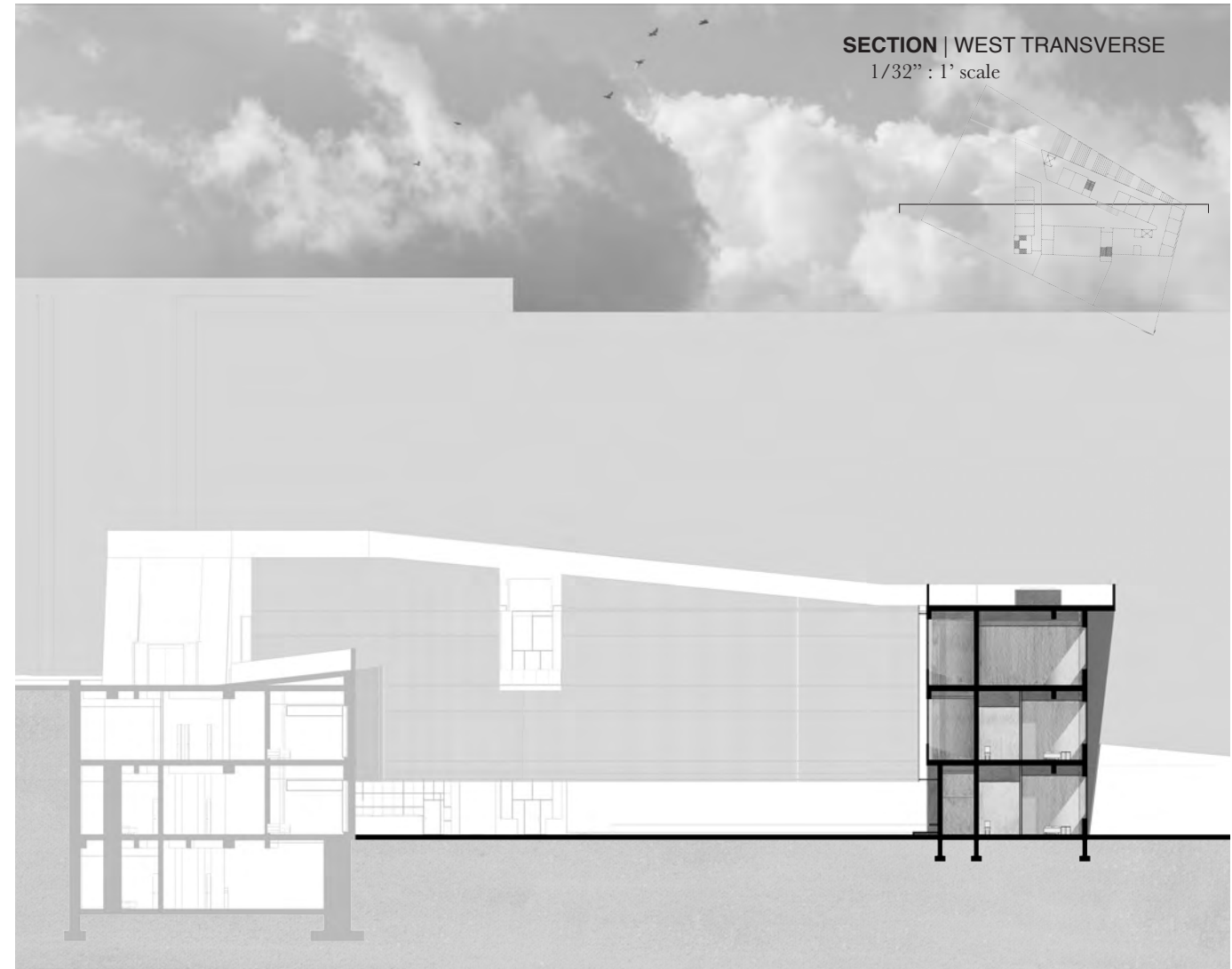
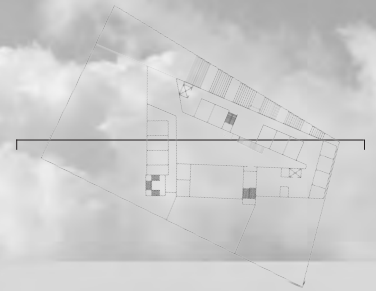
SECTION | WEST LONGITUDINAL

1/32" : 1' scale

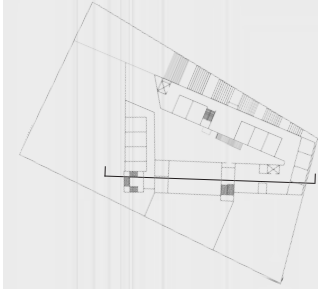


SECTION | WEST TRANSVERSE

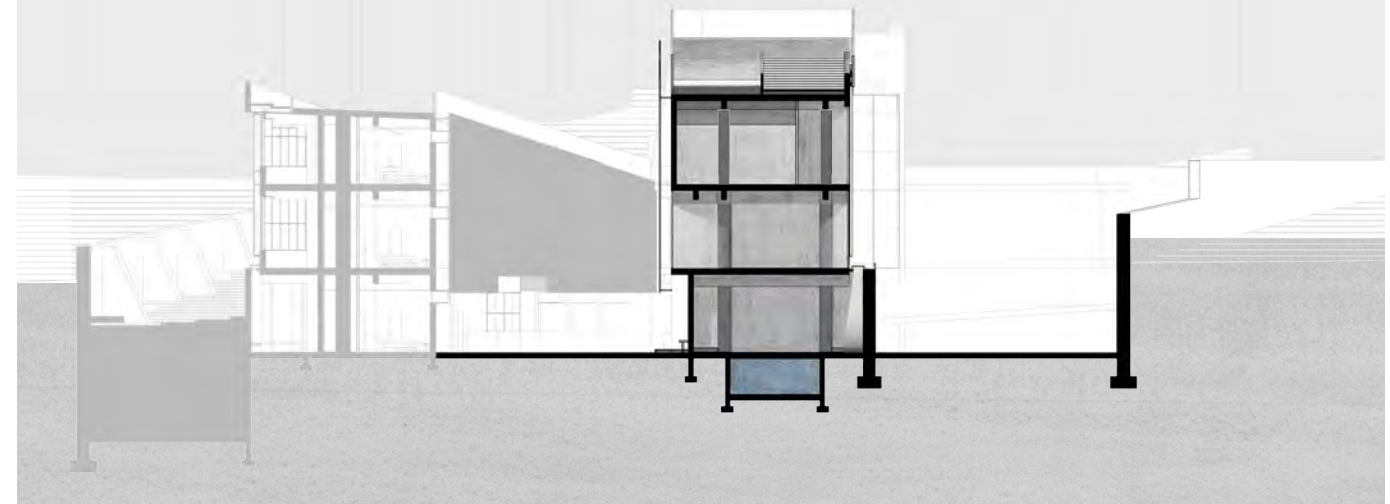
1/32" : 1' scale



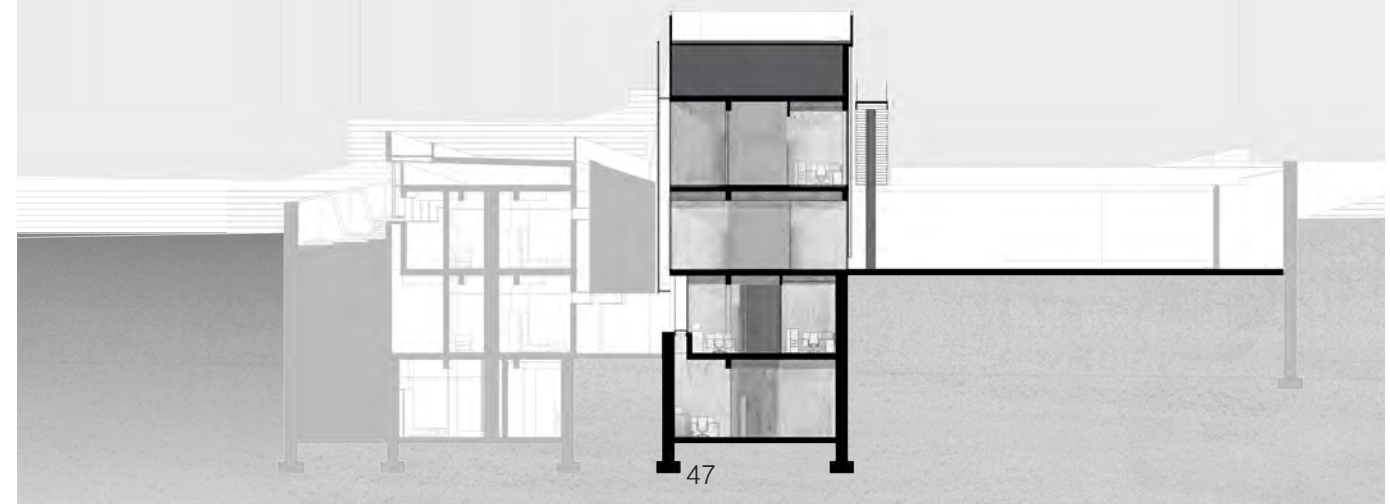
SECTION | SOUTH LONGITUDINAL
1/32" : 1' scale



SECTION | SOUTH TRANSVERSE 1
1/32" : 1' scale

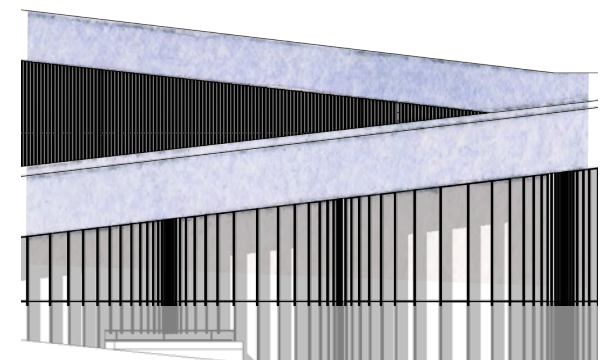


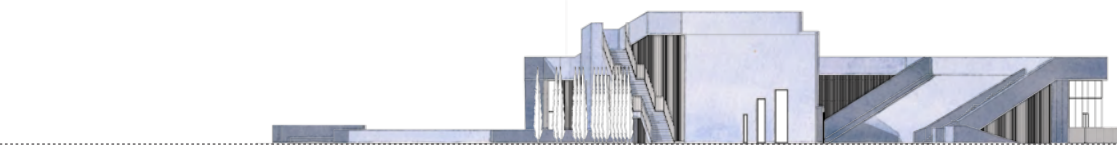
SECTION | SOUTH TRANSVERSE 2
1/32" : 1' scale



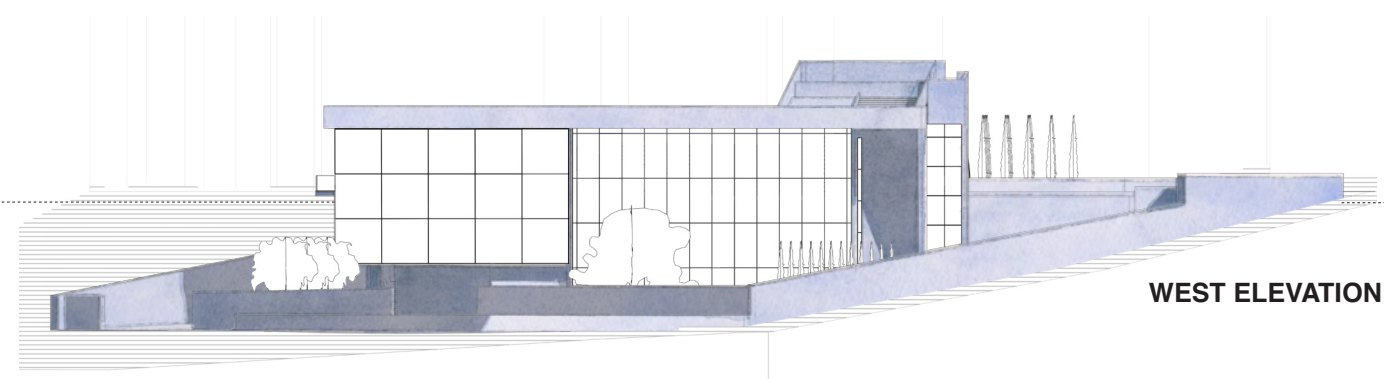
07 ELEVATIONS

+ east, north, west, south elevations
+ scale shown on following pages

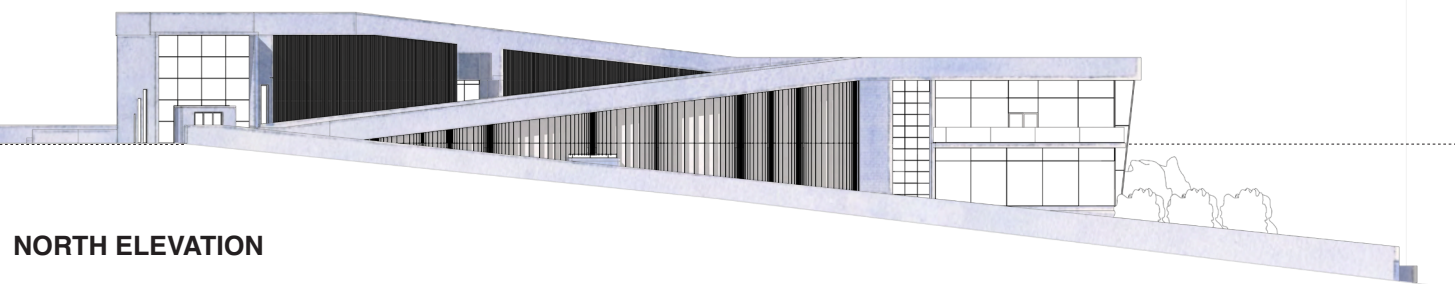




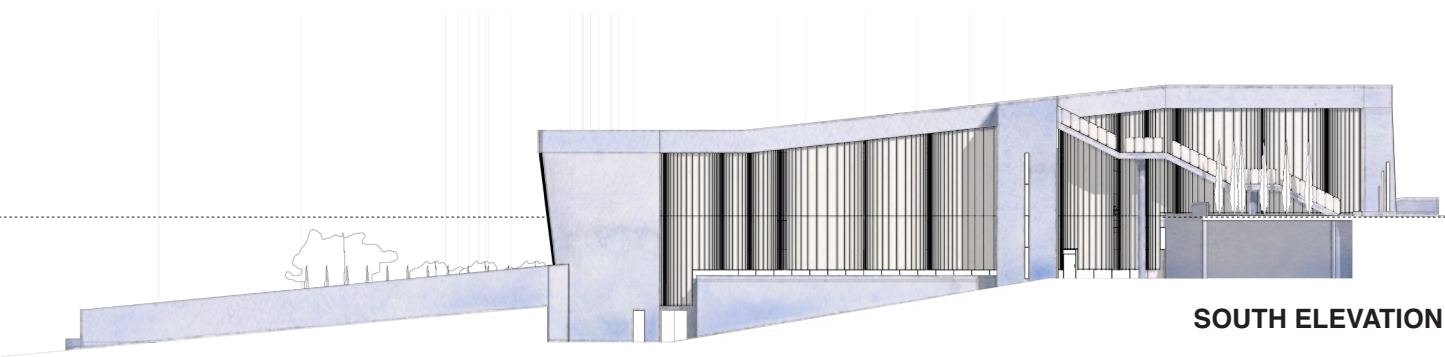
EAST ELEVATION



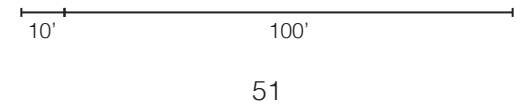
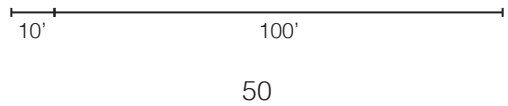
WEST ELEVATION



NORTH ELEVATION

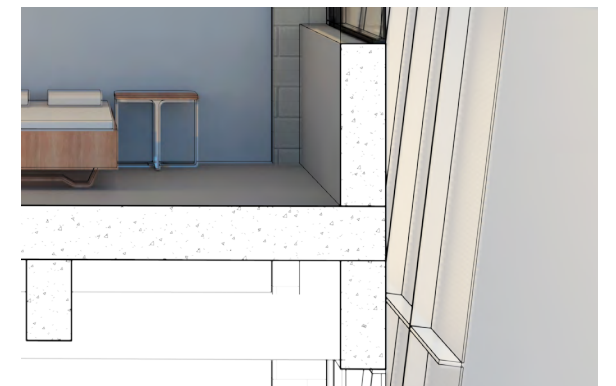


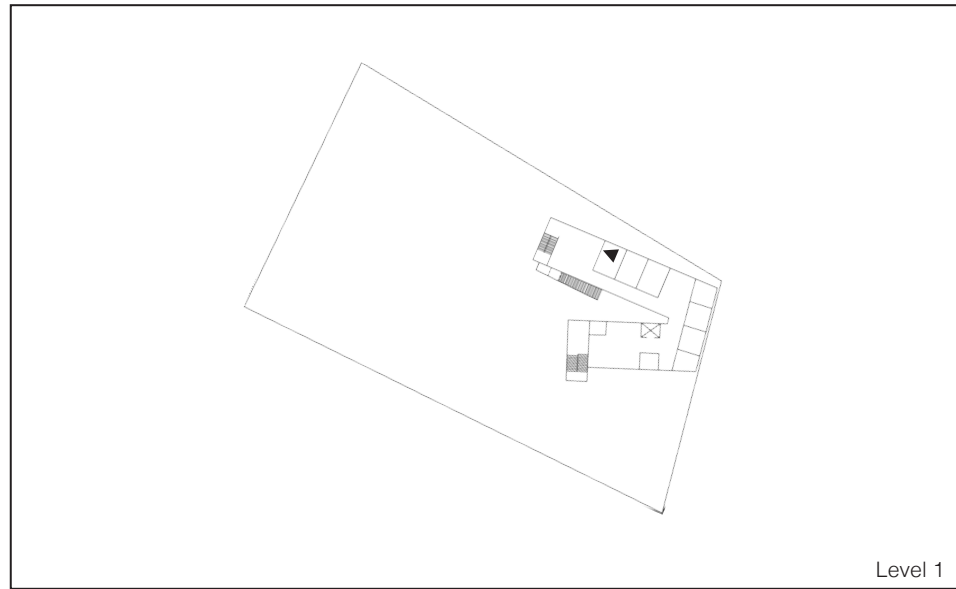
SOUTH ELEVATION



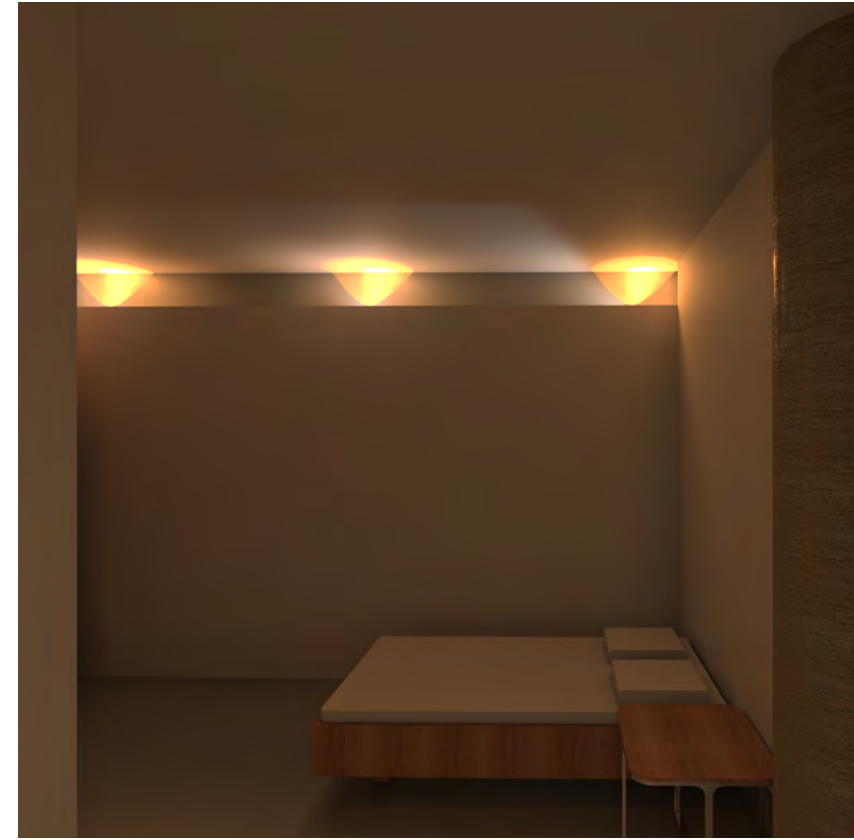
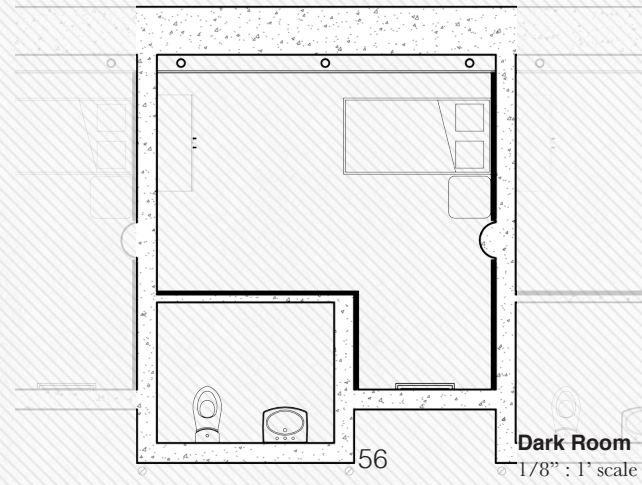
08 PATIENT ROOMS

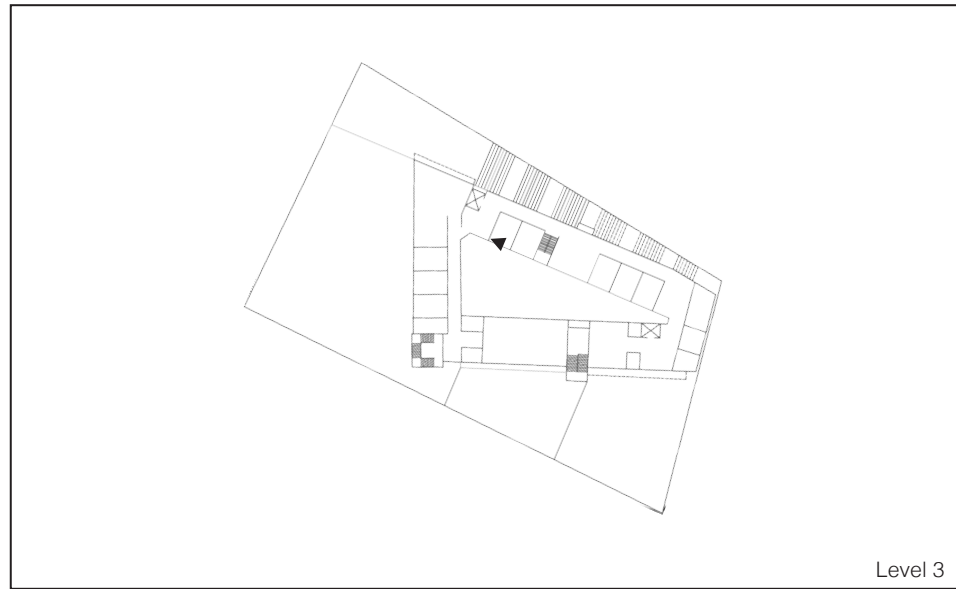
- + section perspectives
- + description of rooms
- + 1/8" : 1' scale plan of individual rooms
- + room renderings





The dark rooms are buried deep within the site, protecting the most fragile and vulnerable patients from negative outside interference - light, noise, and other stressors. These rooms are artificially lit with all lights pointing upwards or softened with filters so as to prevent the patient from being exposed to too much light during the crucial first 24-48 hour period after sustaining a brain injury. The hallways outside of the patient rooms are also devoid of any natural light, so that when doctors and nurses must enter the rooms none of the patient rooms will be polluted with too much light.

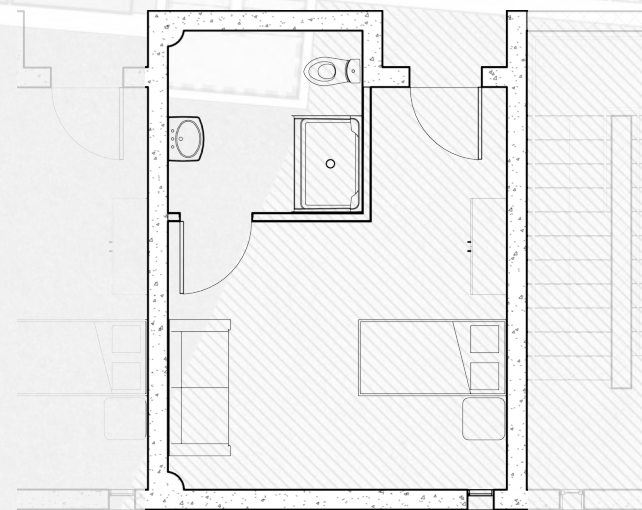




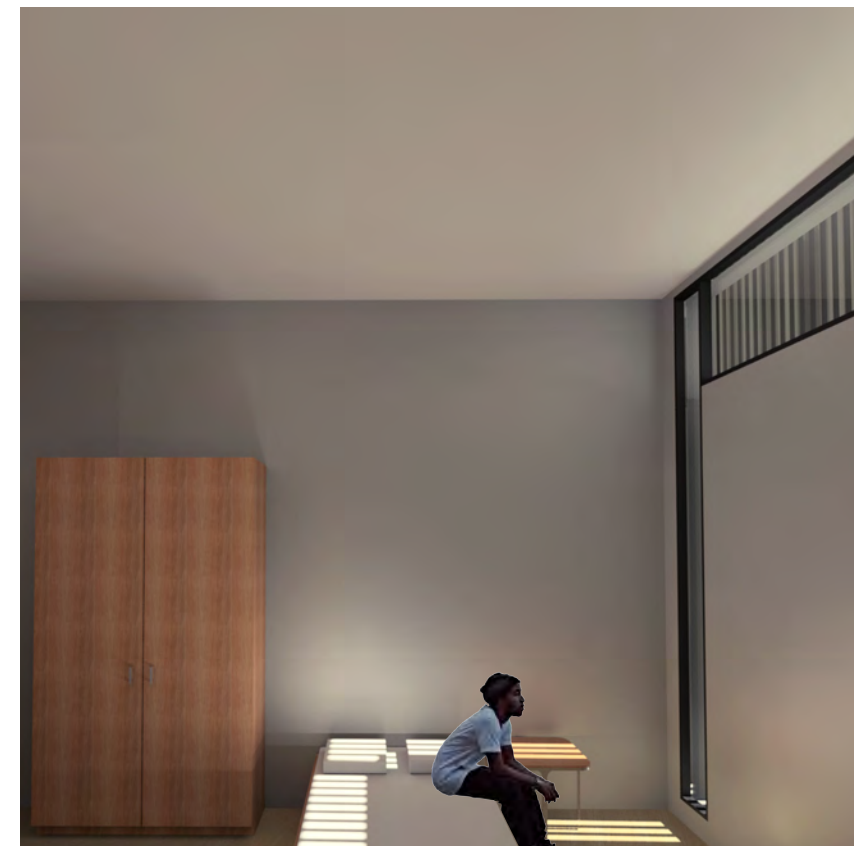
Section Perspective: Intermediate Room (3-5 days)

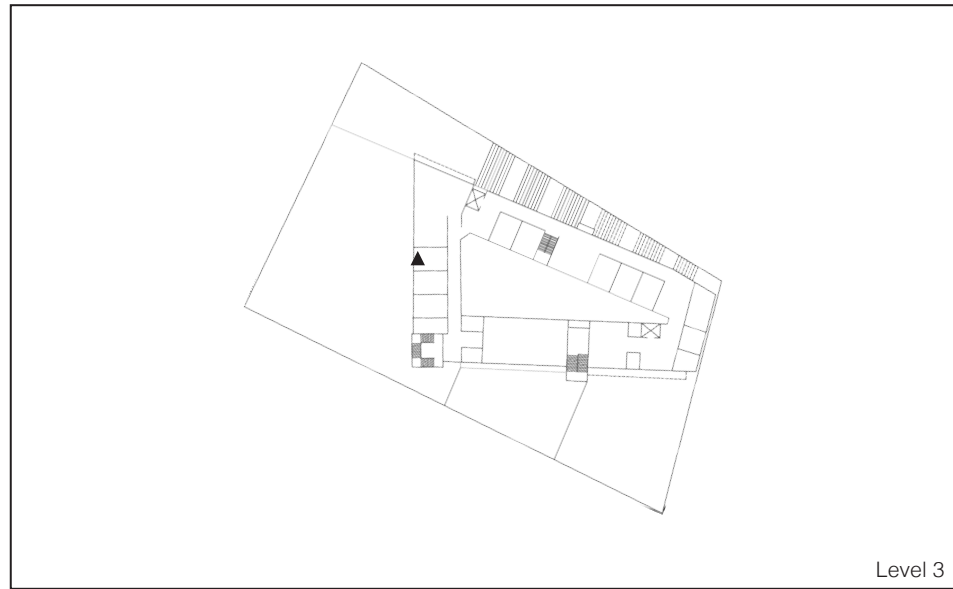
The intermediate rooms are located on the north side of the building, bordering the interior courtyard and flanked on the outside by the hallway. This hallway acts as a buffer between the patient rooms and W 165th Street, providing the patient rooms with a more tranquil setting. The patient rooms have a slit window that runs vertically on one side of the room and then horizontally above, allowing a small amount of natural light and a simple view into the interior courtyard. The narrow windows provide the patients with only a small view into the courtyard.

There is also a vertical metal screen that hangs on the interior of the building. This screen allows light to enter the rooms and allows the patients a view into the courtyard but, when viewed from within the courtyard it provides a sense of peaceful isolation as it gives the illusion of complete privacy, allowing the courtyard to become a place of relaxation and rehabilitation in its own right.



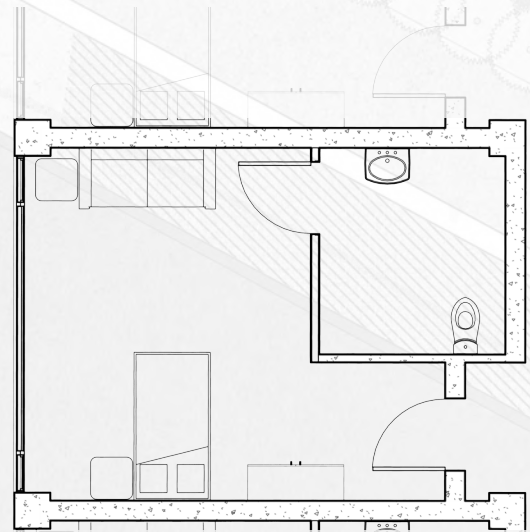
60 Intermediate Room
1/8" : 1' scale





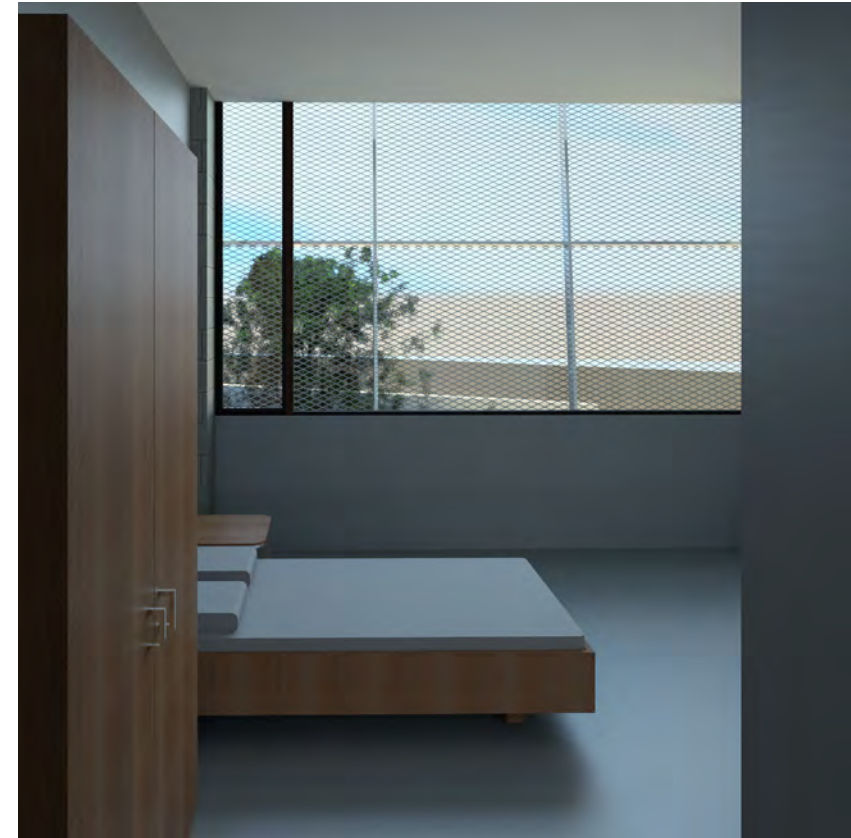
The light rooms are located on the west side of the building, facing out toward the Hudson River and the Hudson River Greenway. The hallway is located on the interior of the building, looking into the courtyard. The patients who occupy these rooms are now far enough along in their recovery that they must begin to adjust and prepare for reentry into their daily lives. For this reason, the rooms are placed with an outward facing view. The rooms are also, however, given a view of the river and tree-filled park - a view of nature that should provide great benefit to their physical and mental health as they continue their rehabilitation.

Outside the rooms a perforated aluminum screen hangs from the roof to the ground level and provides the patients with privacy from passerby on the street below while also allowing a clear view to the river and park. This screen also helps to prevent too much direct sunlight and glare from entering these mostly west-facing rooms.



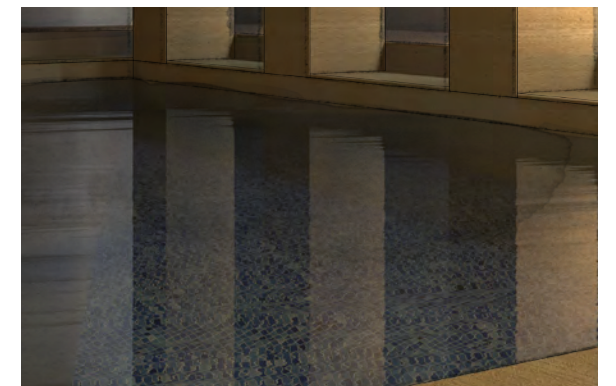
64

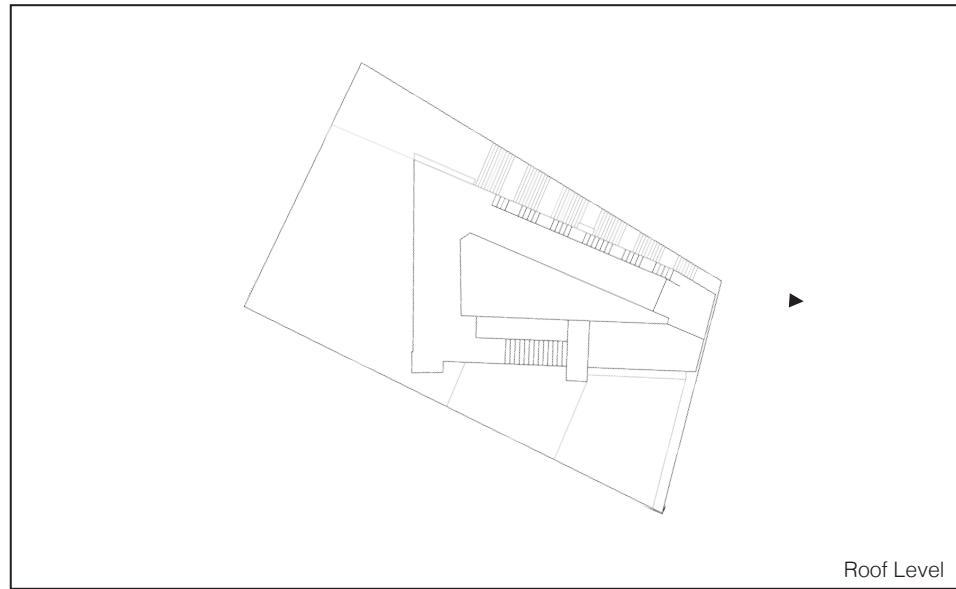
Light Room
1/8" = 1' scale



09 PERSPECTIVES

+ the following collages of digital renderings, line drawings, and watercolor attempt to capture the moments of poetry that occur within and throughout the building

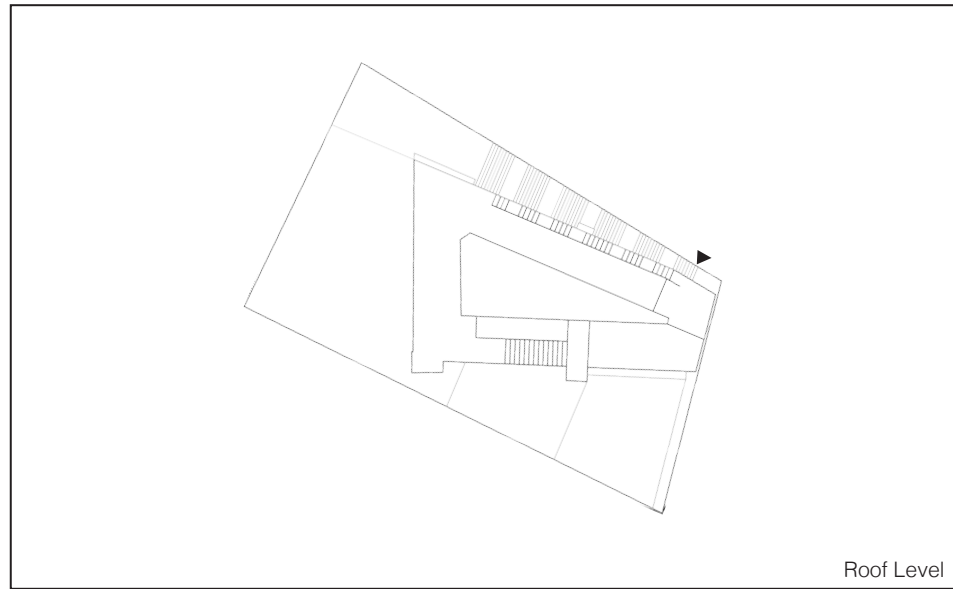




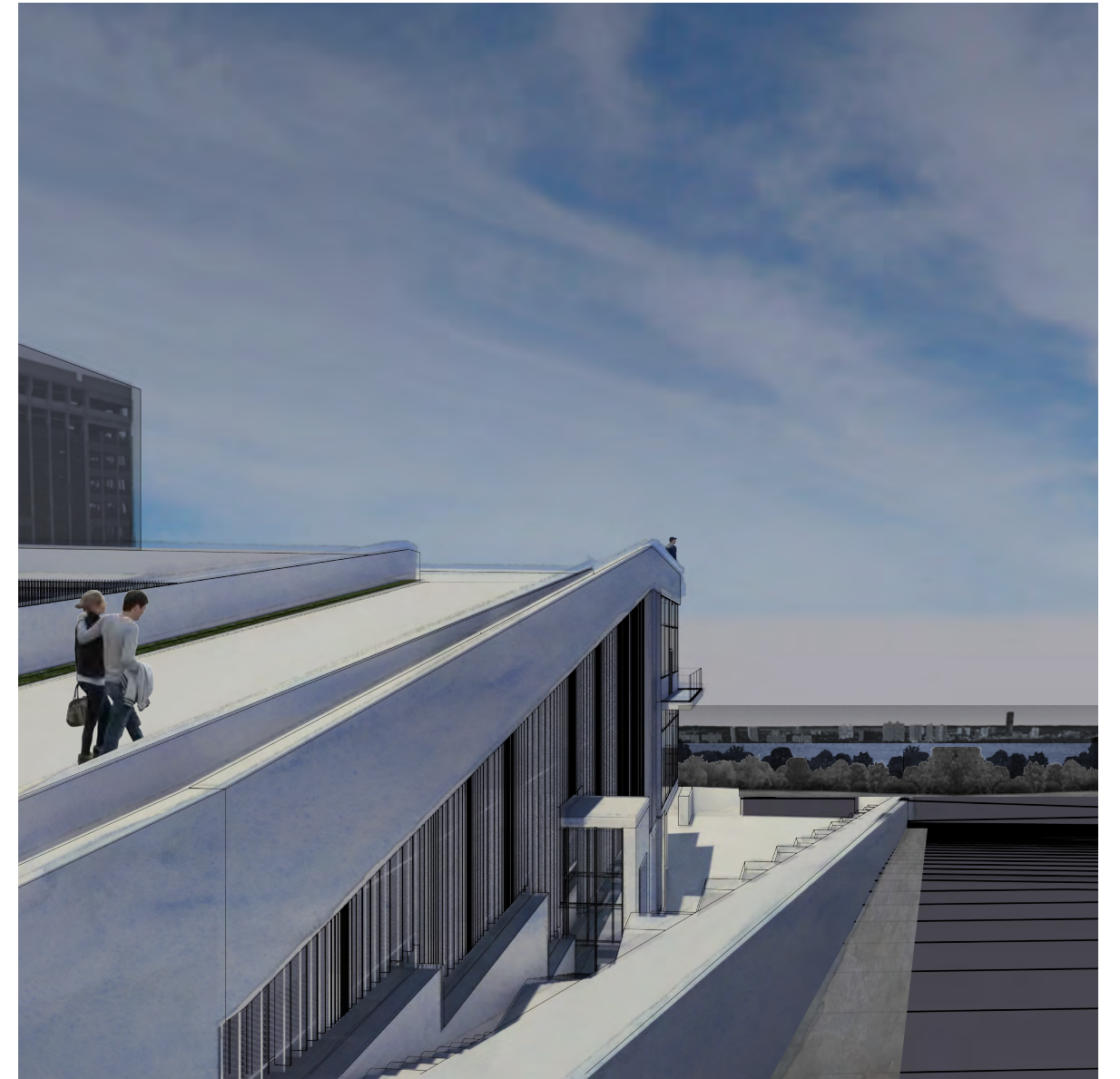
Roof Level



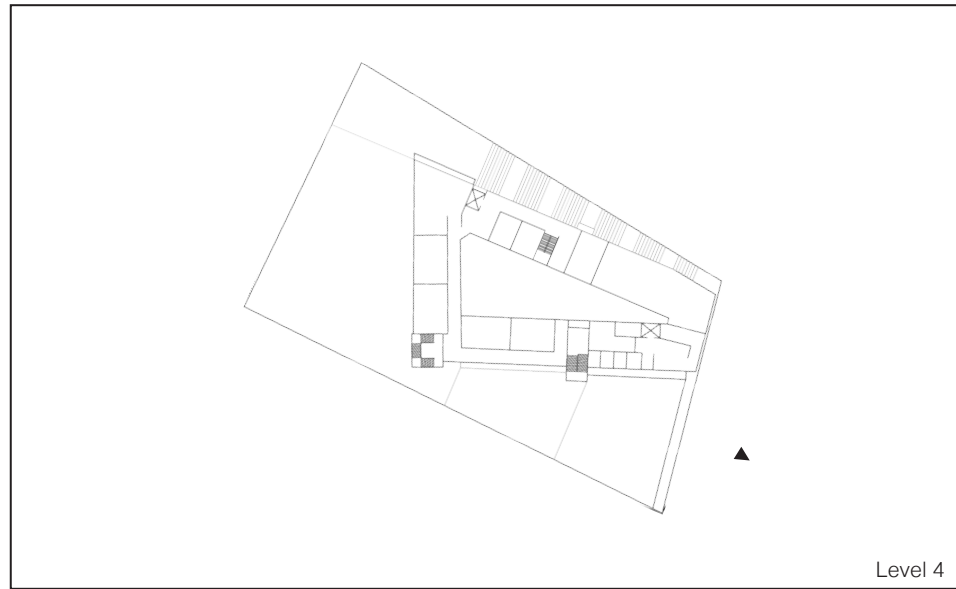
Entrance from Fort Washington Avenue



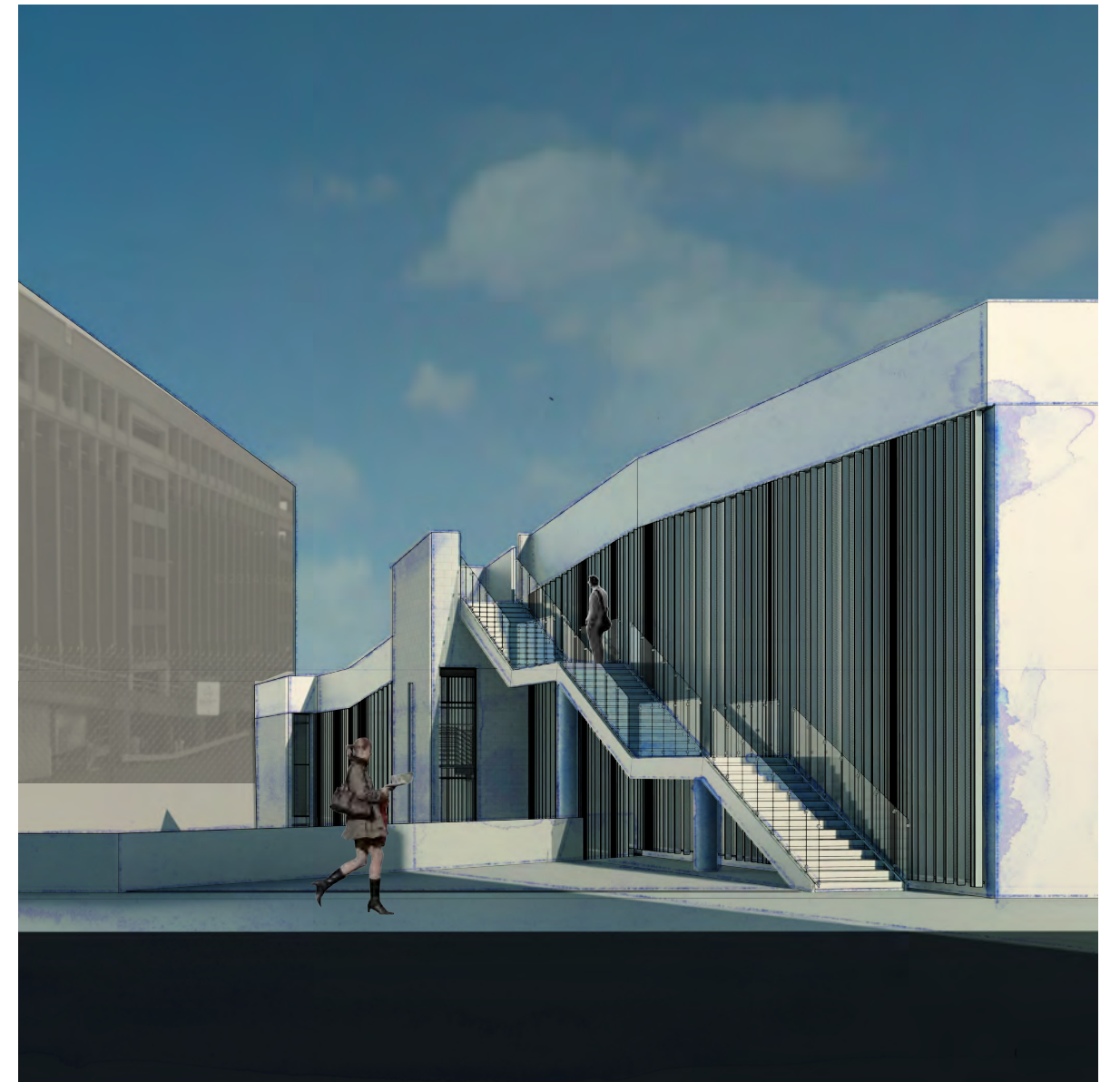
Roof Level



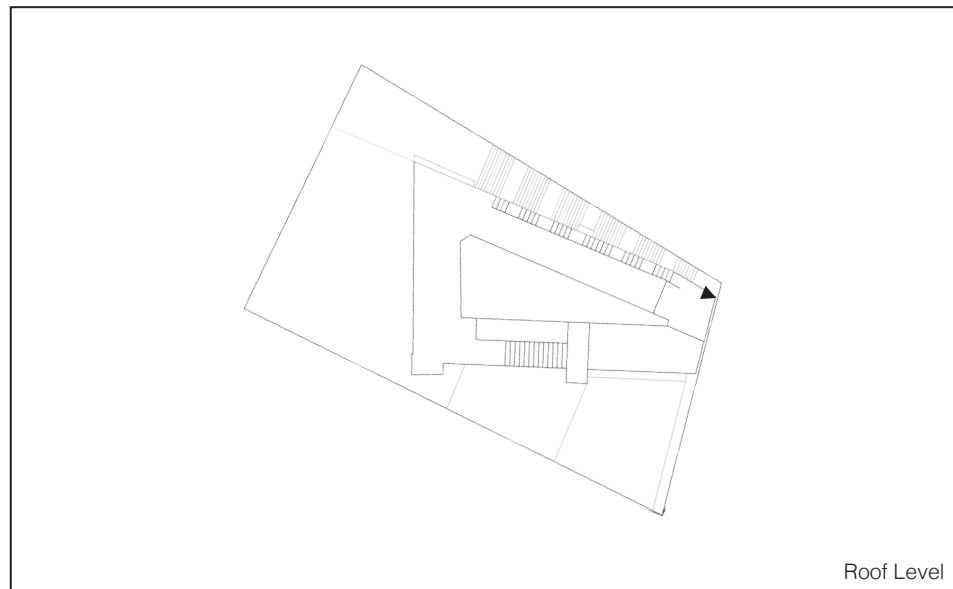
Looking west toward the Hudson River along the north facade



Level 4



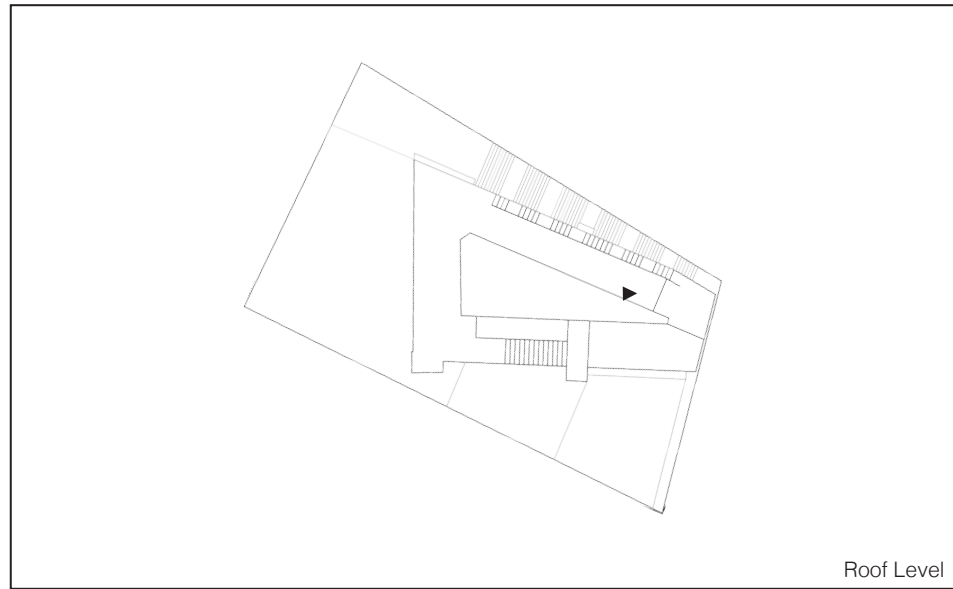
South facade from Fort Washington Avenue



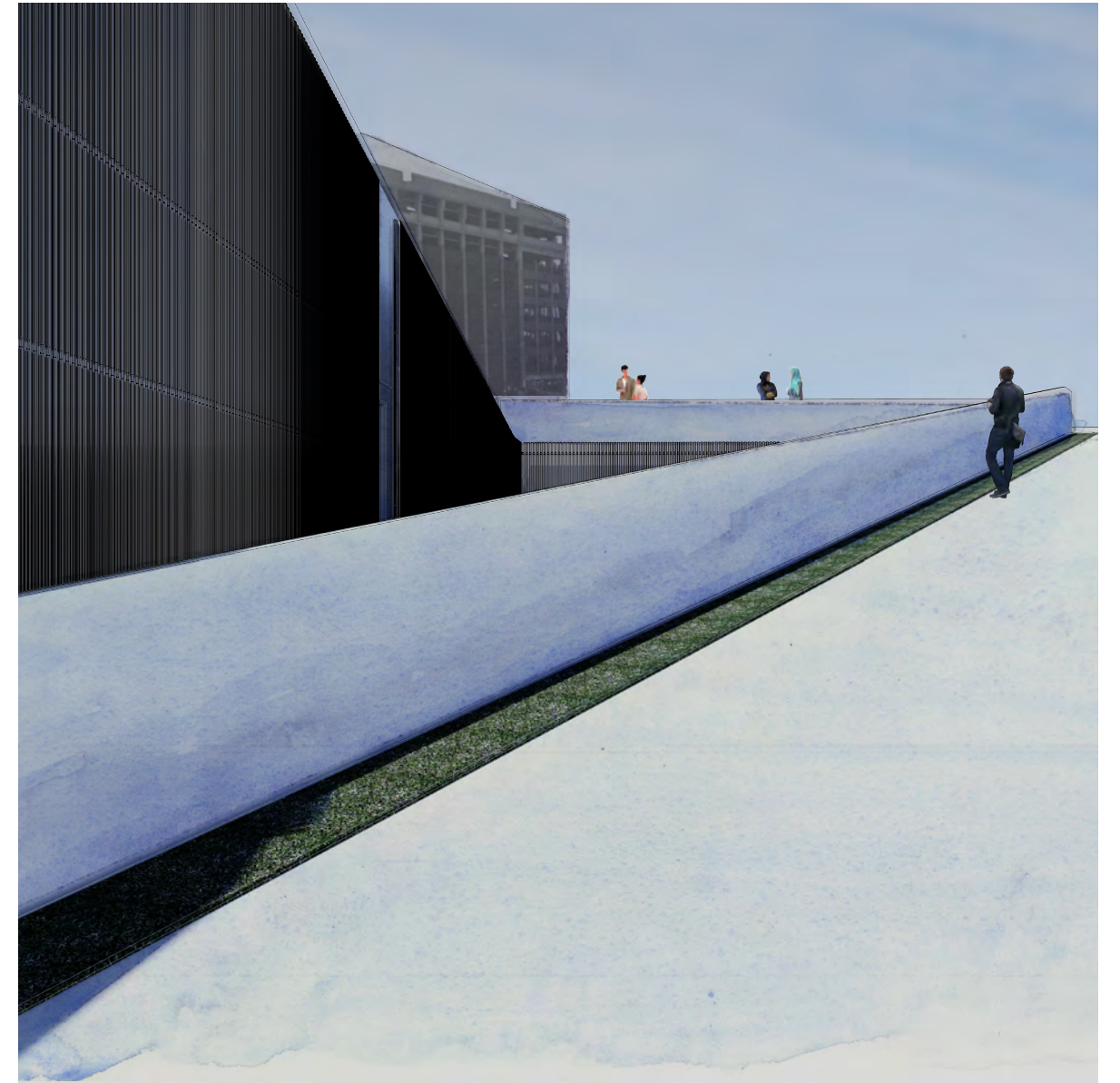
Roof Level



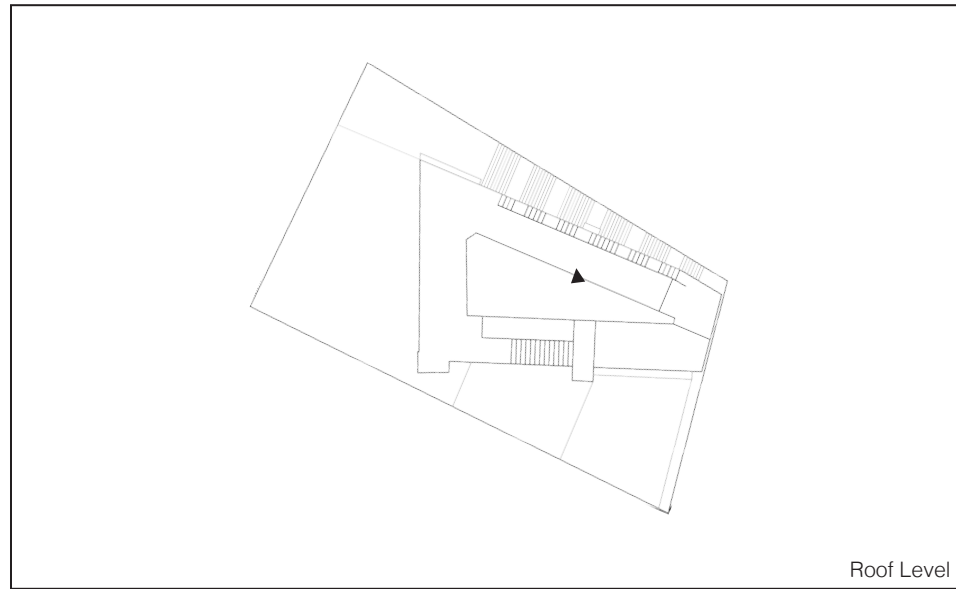
Roof ramp from Fort Washington Avenue



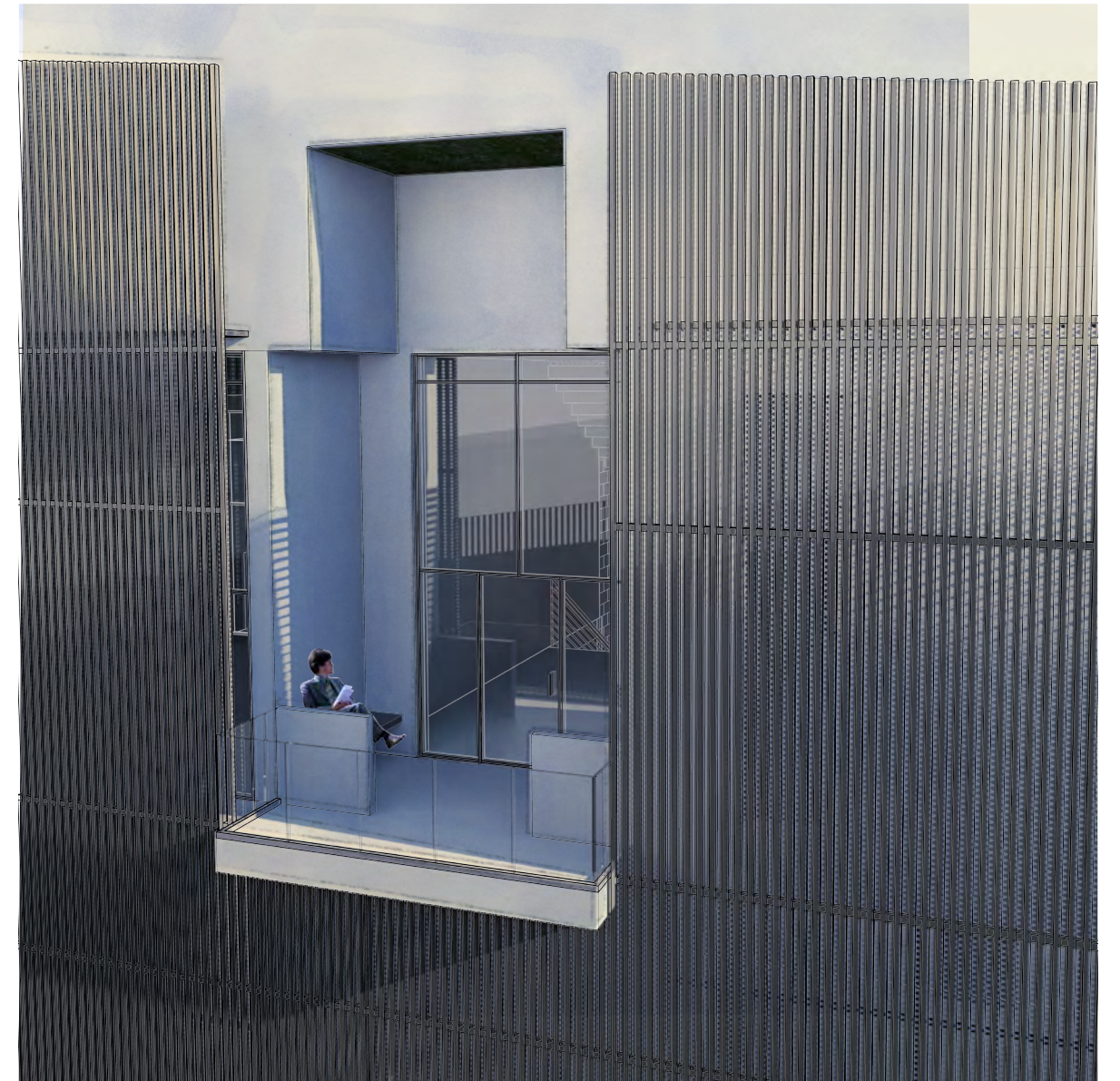
Roof Level



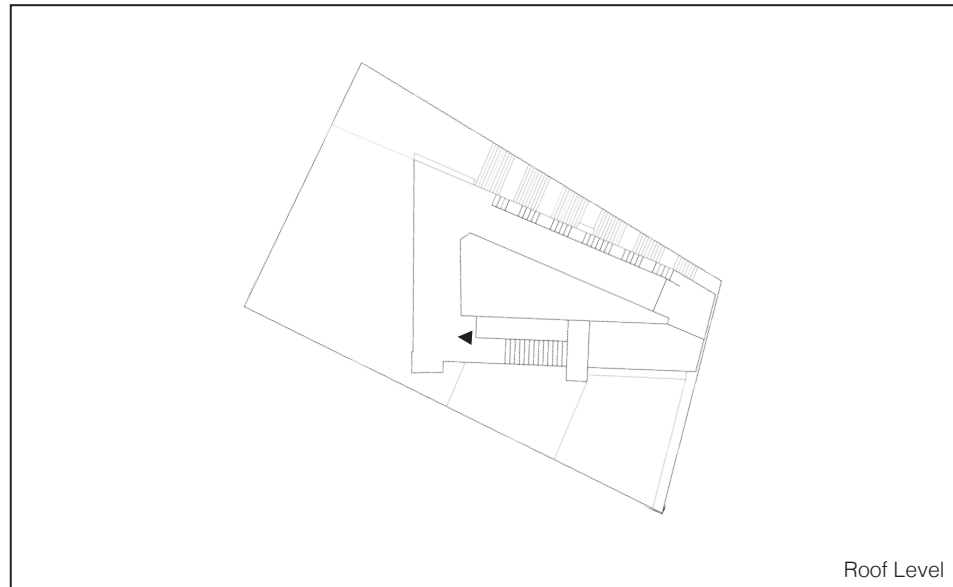
Roof looking east



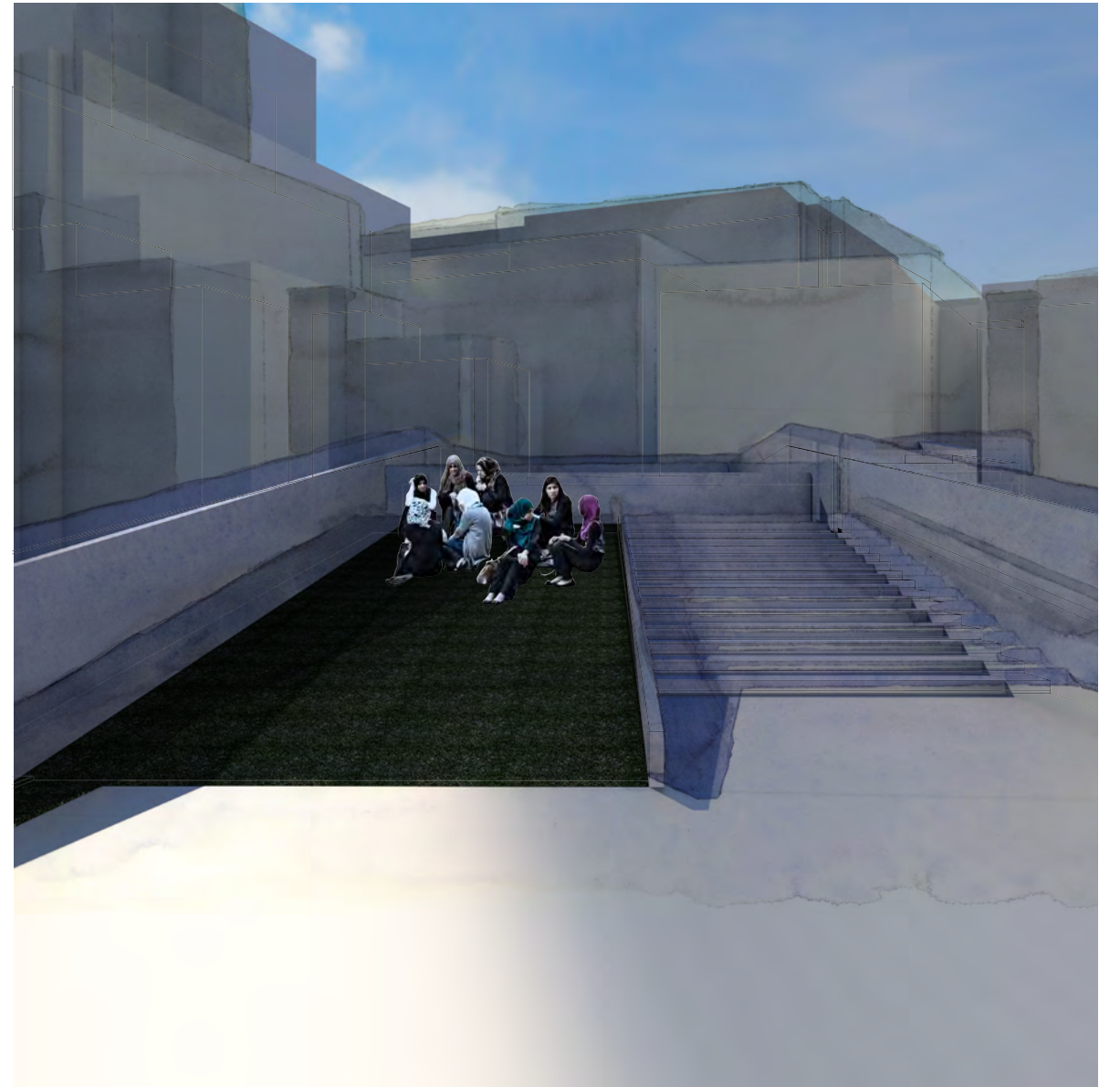
Roof Level



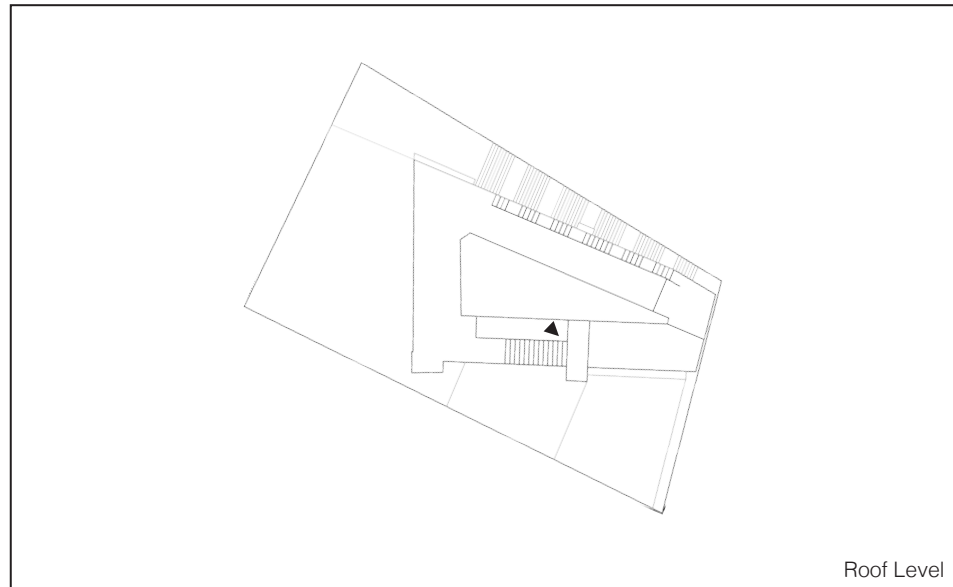
Stairwell balcony from roof ramp



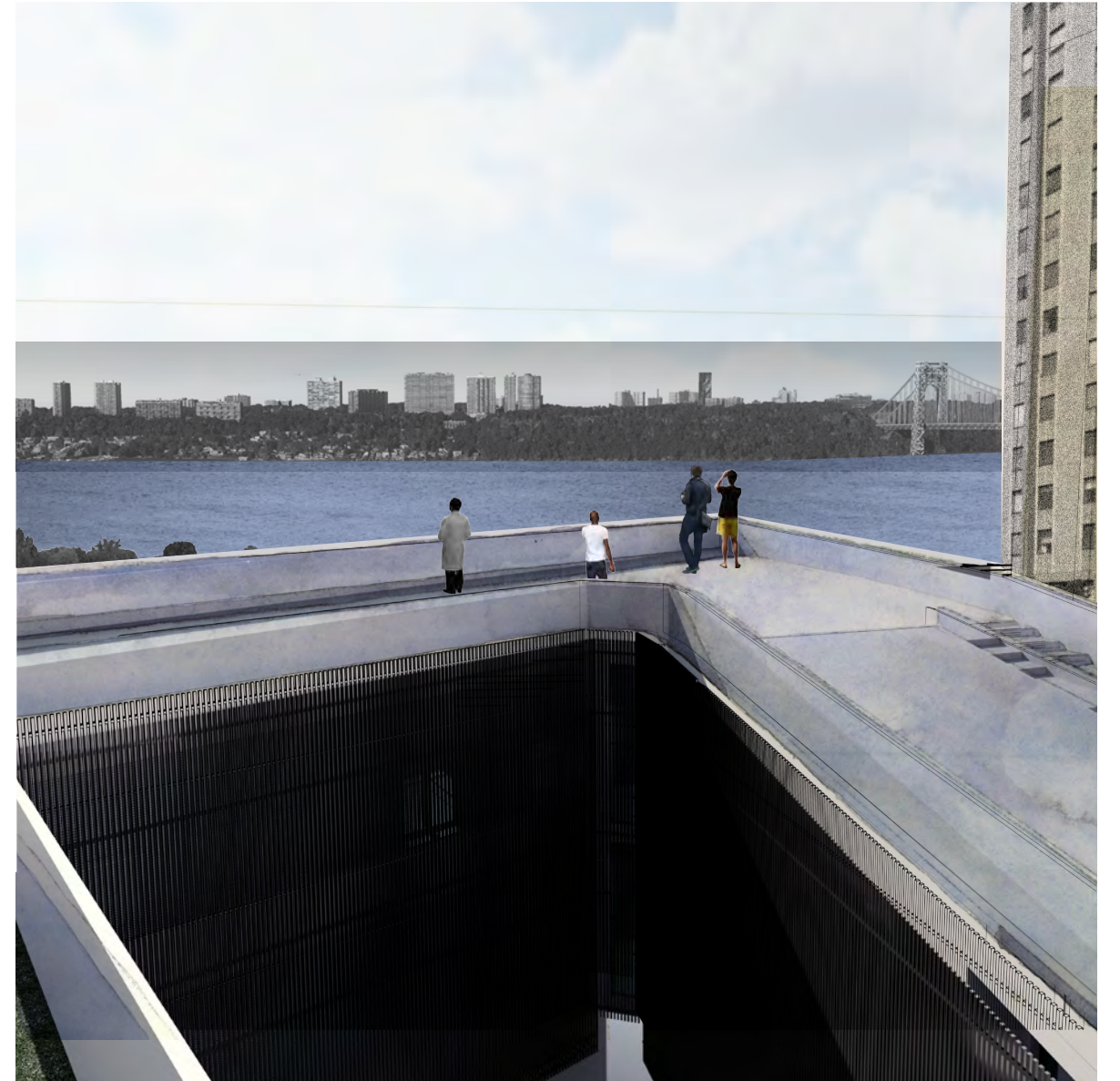
Roof Level



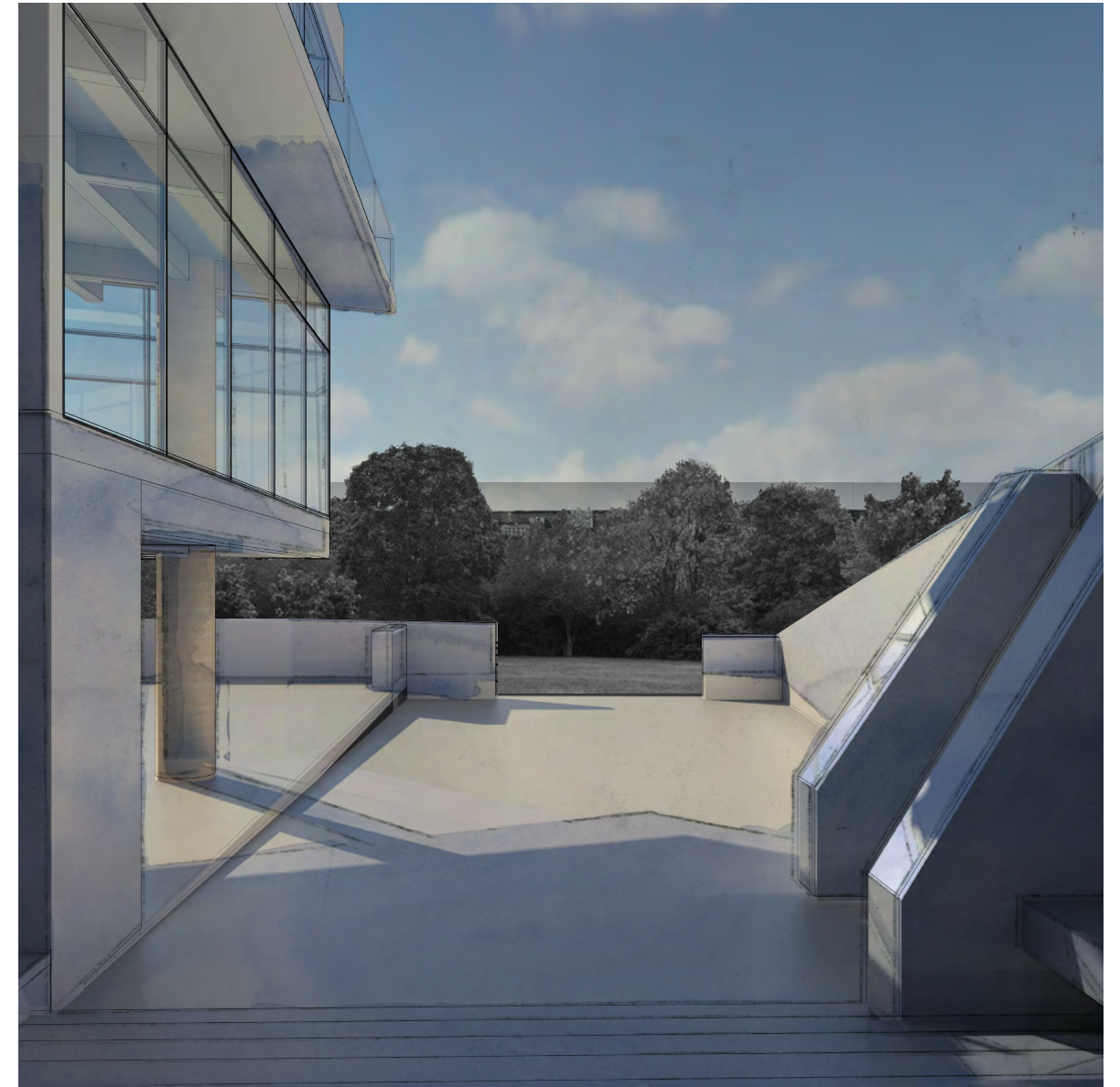
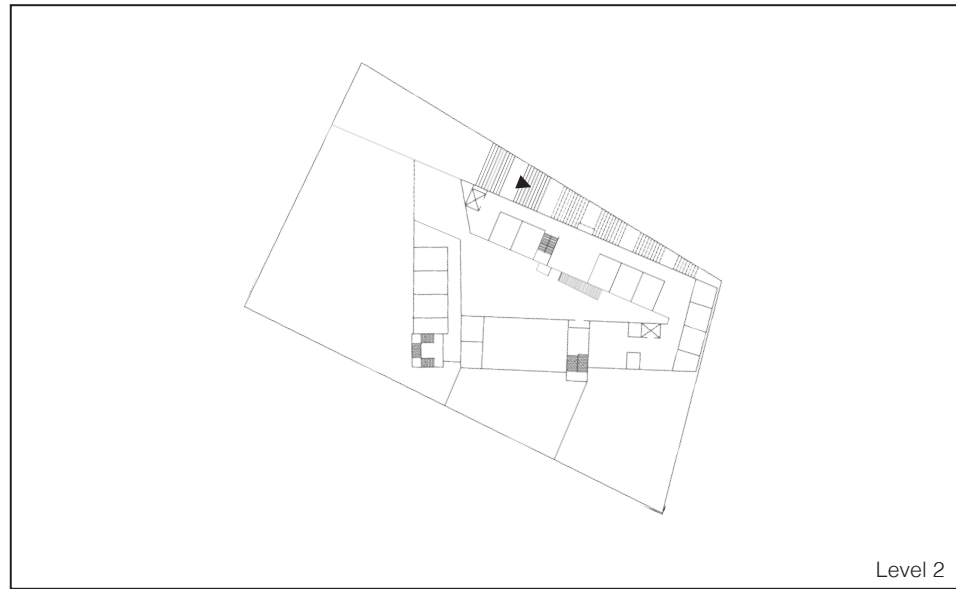
Roof looking east

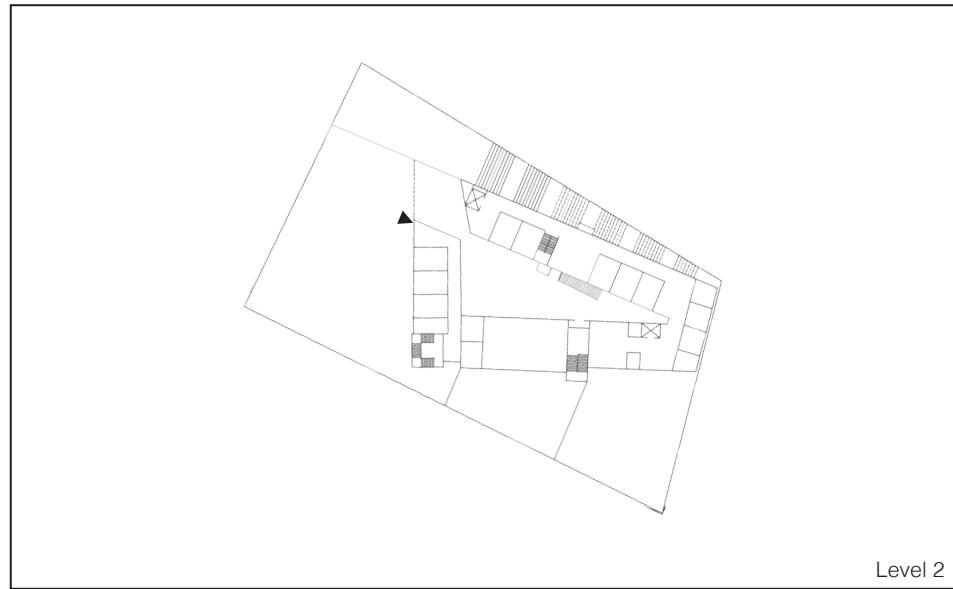


Roof Level

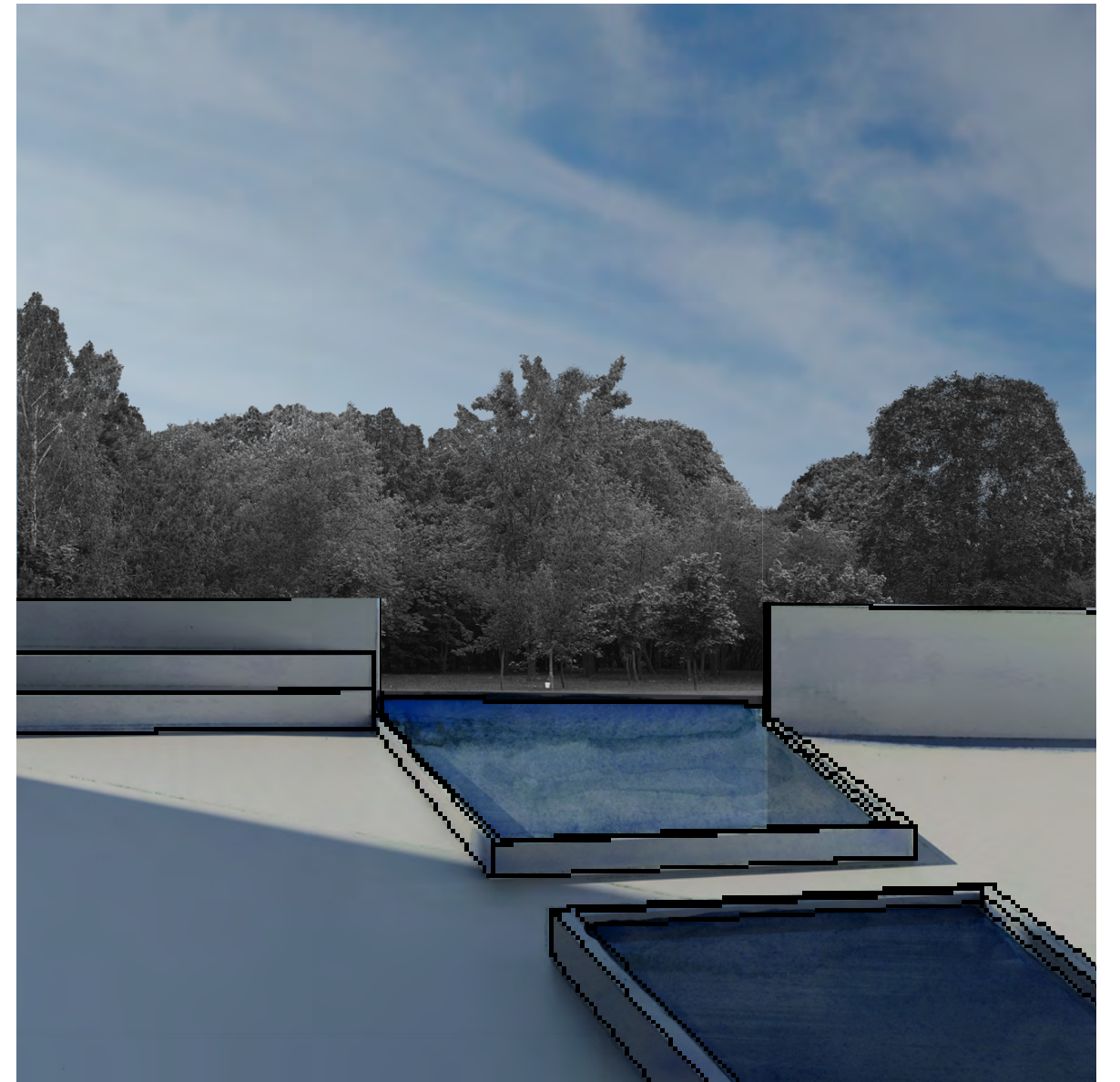


View from the roof looking west toward the Hudson River

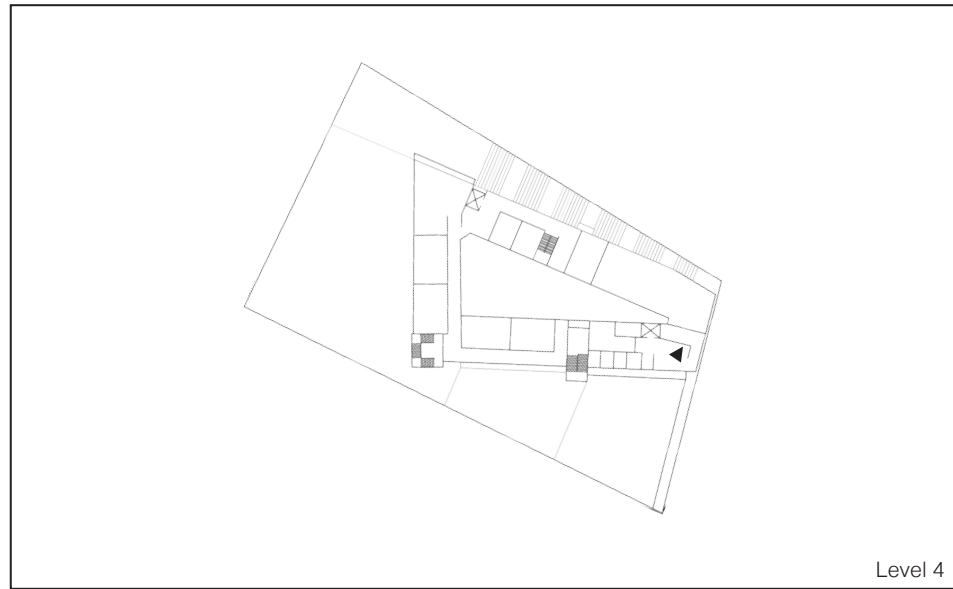




Level 2



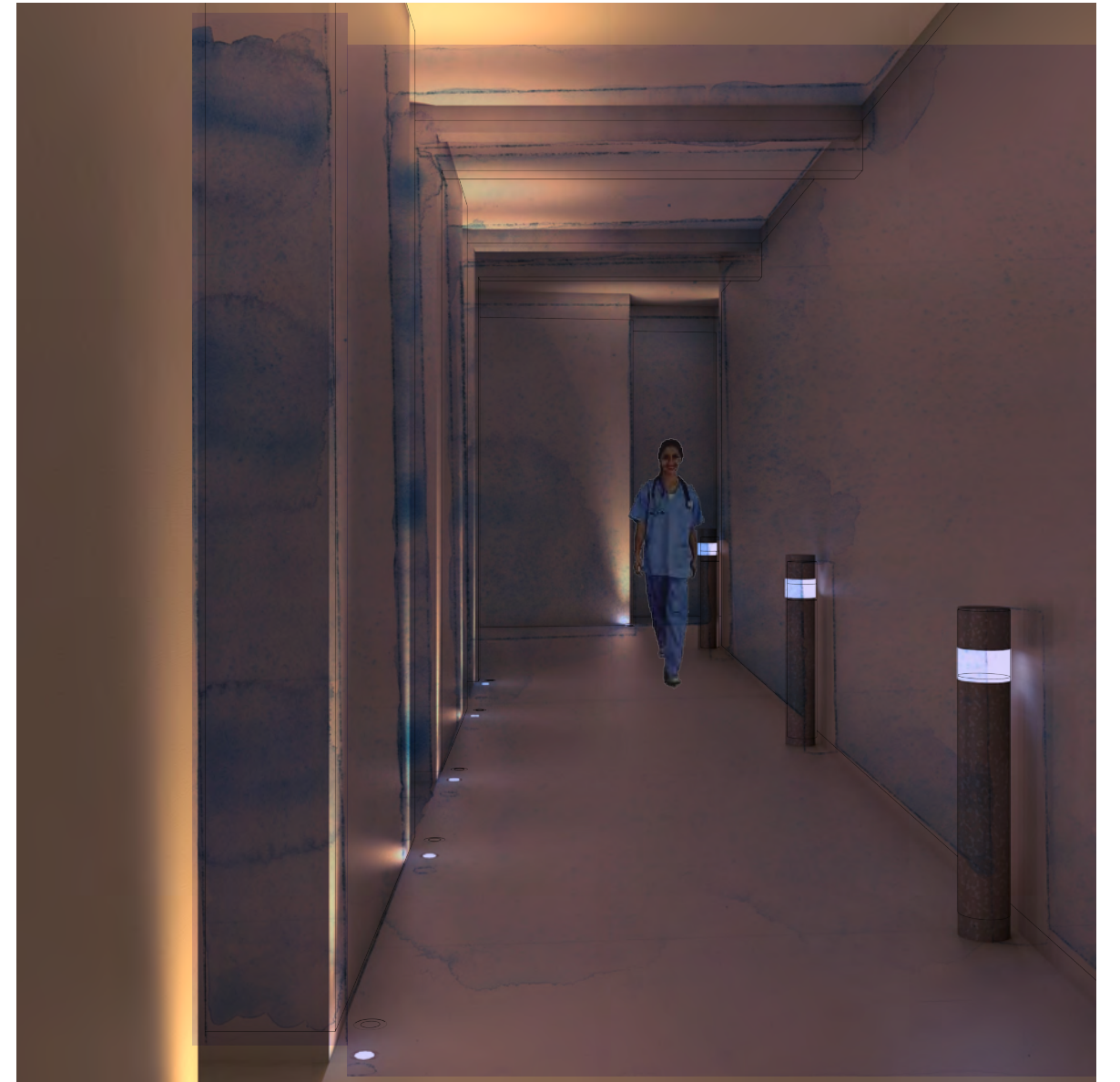
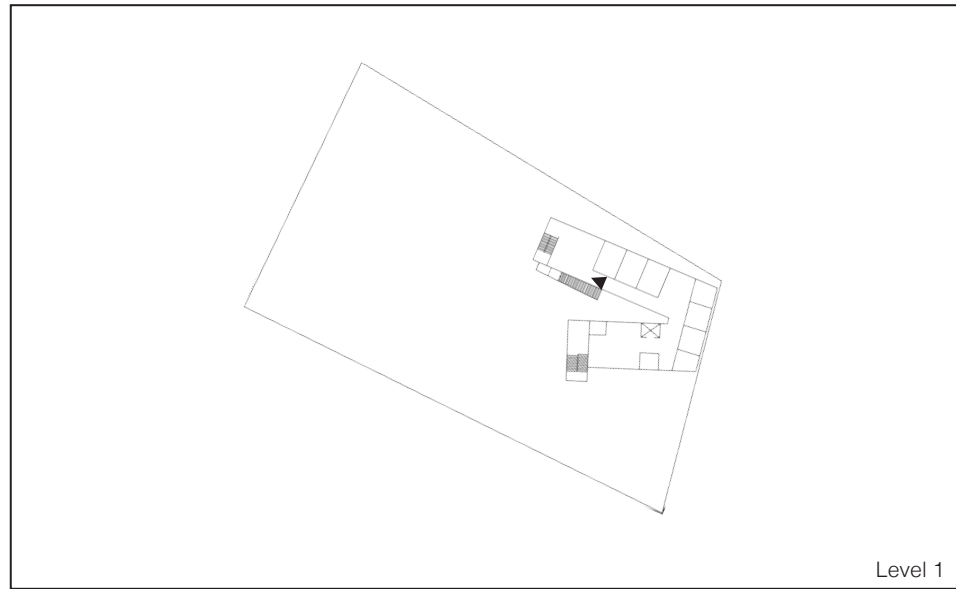
Reflecting pool, looking west toward park



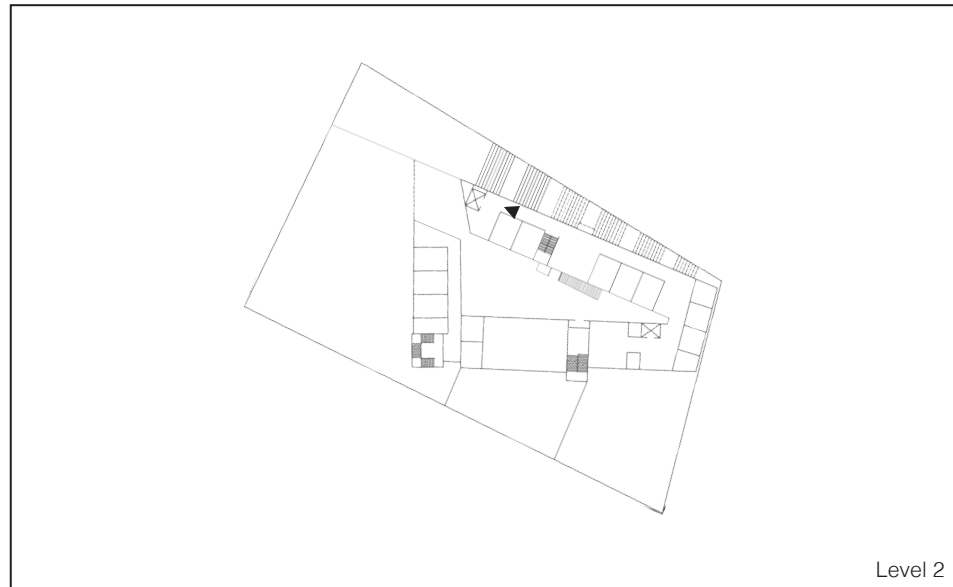
Level 4



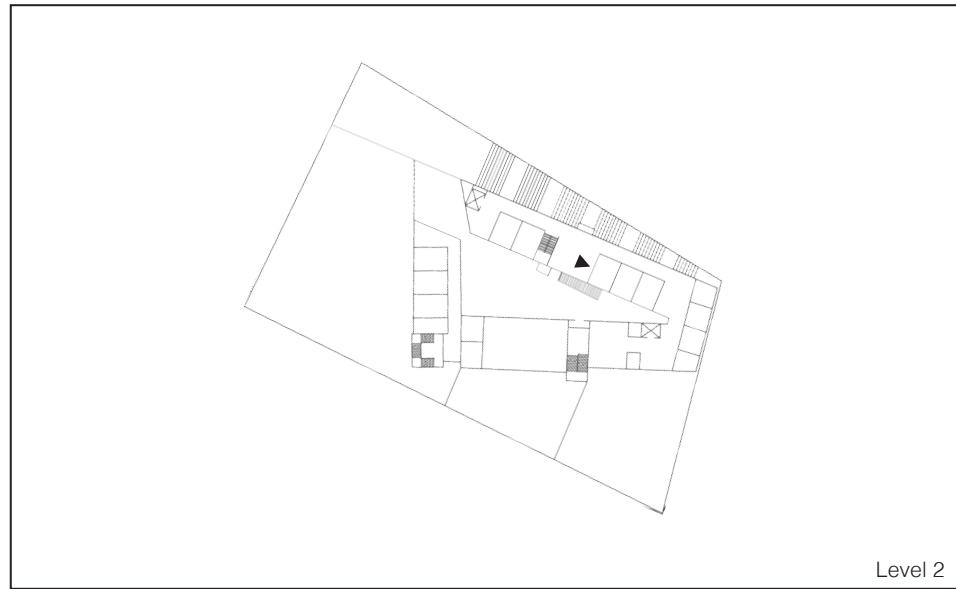
Lobby



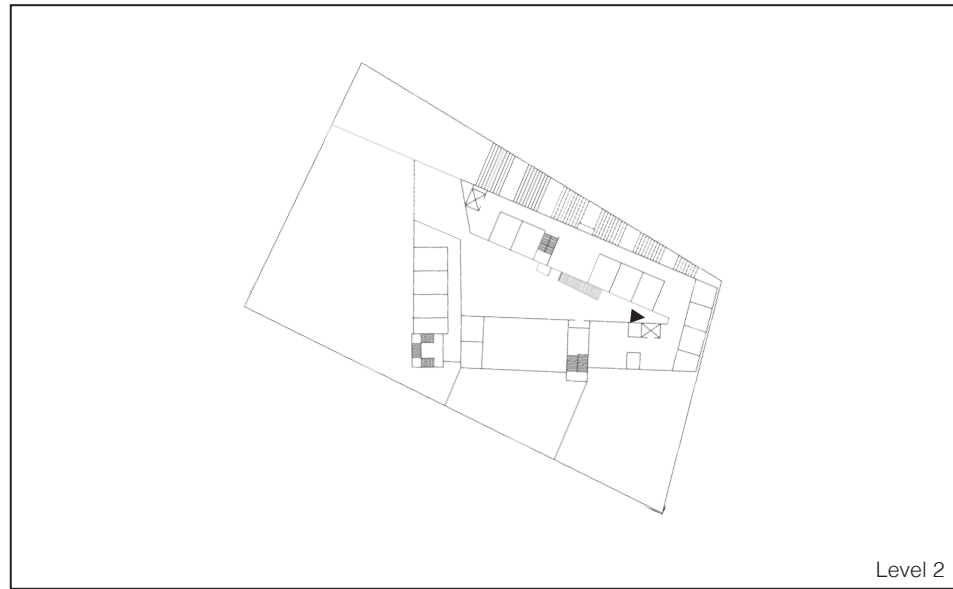
Hallway to dark patient rooms on Level 1



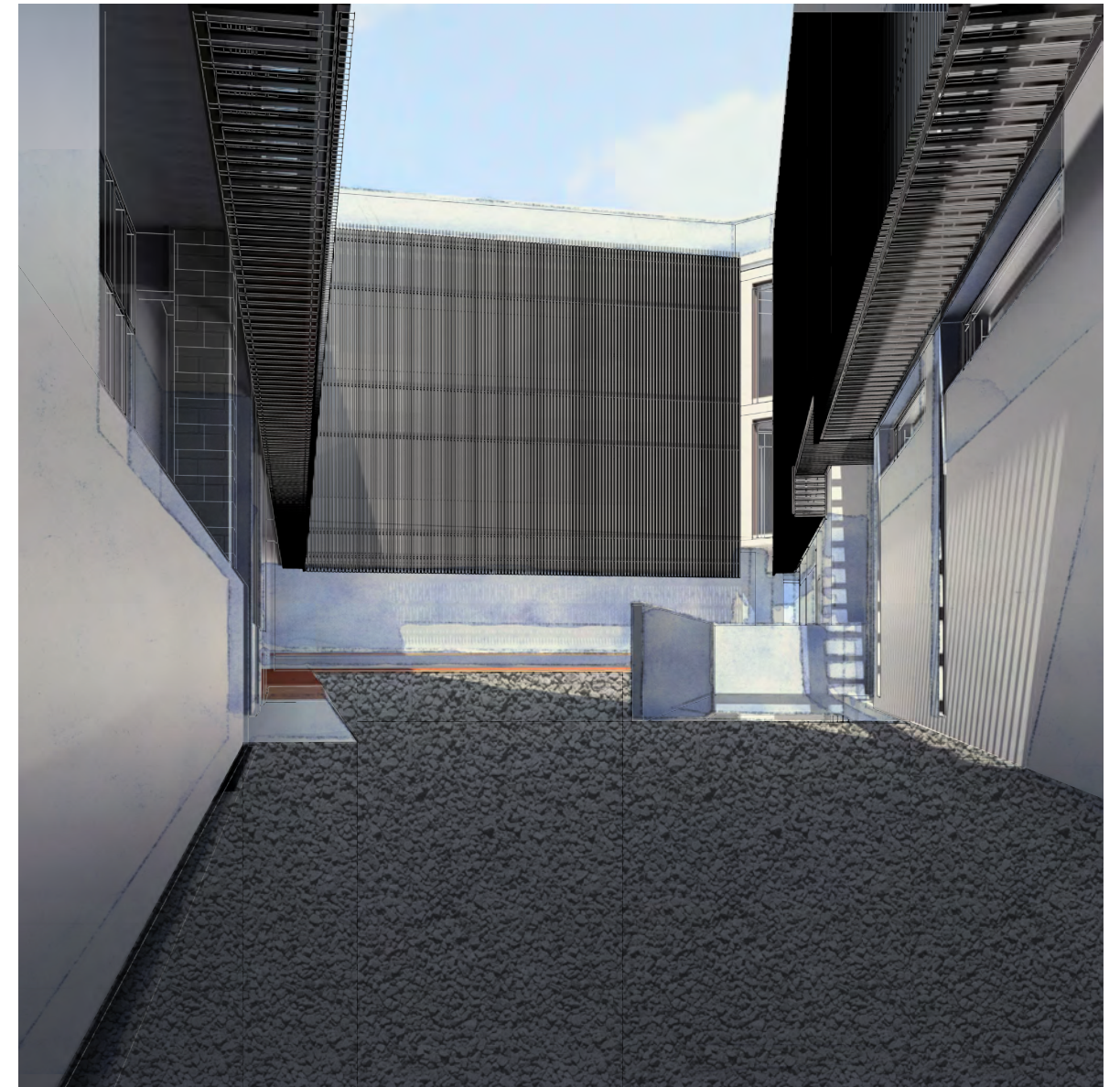
Hallway to intermediate patient rooms on Level 2



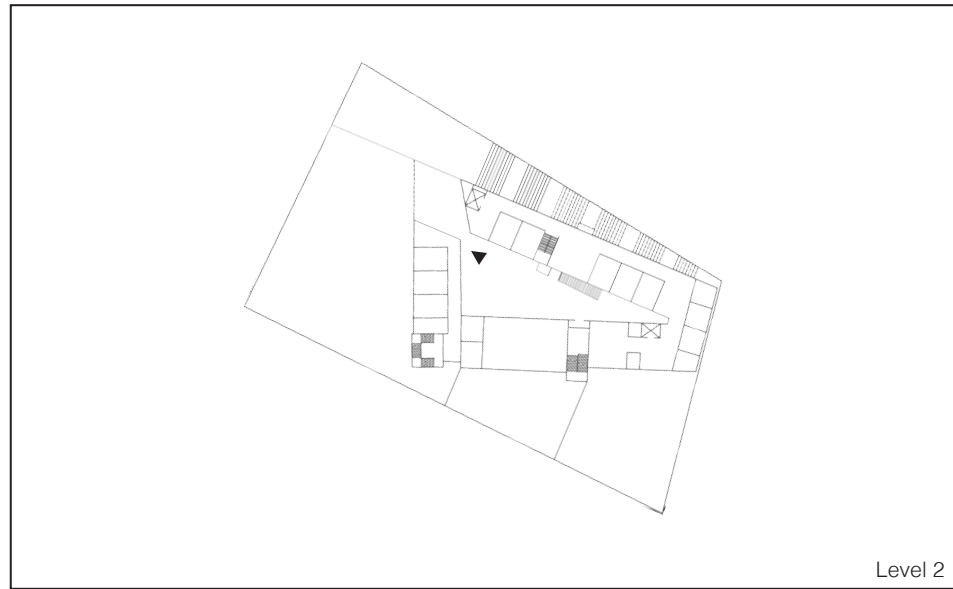
Nurse's station stairwell



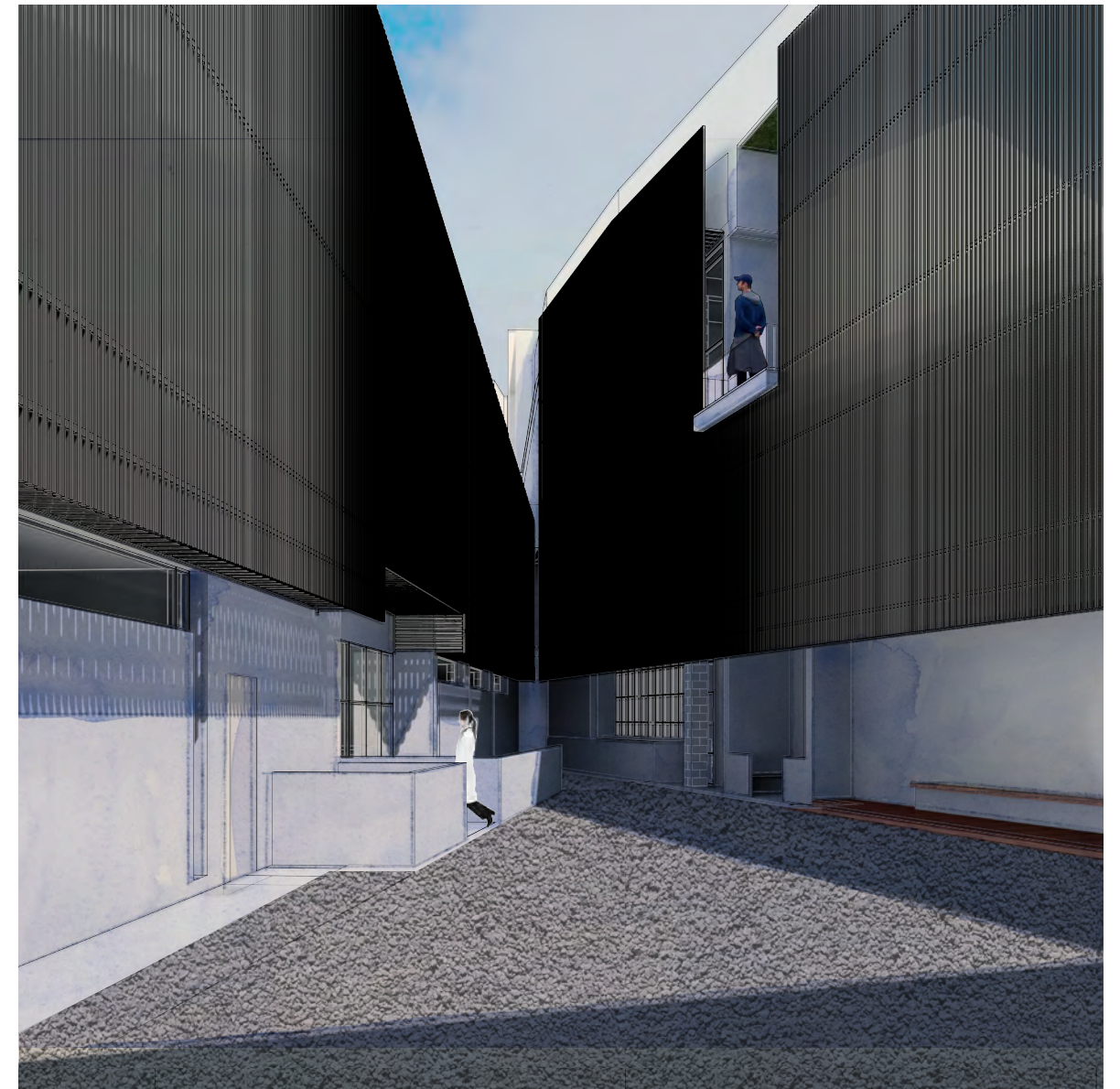
Level 2



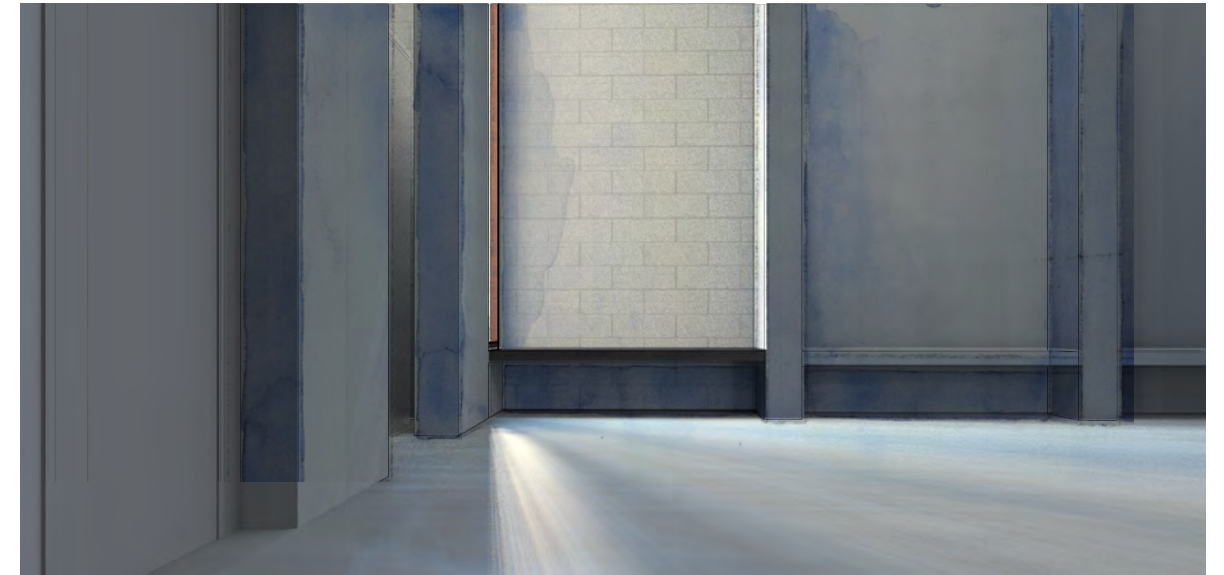
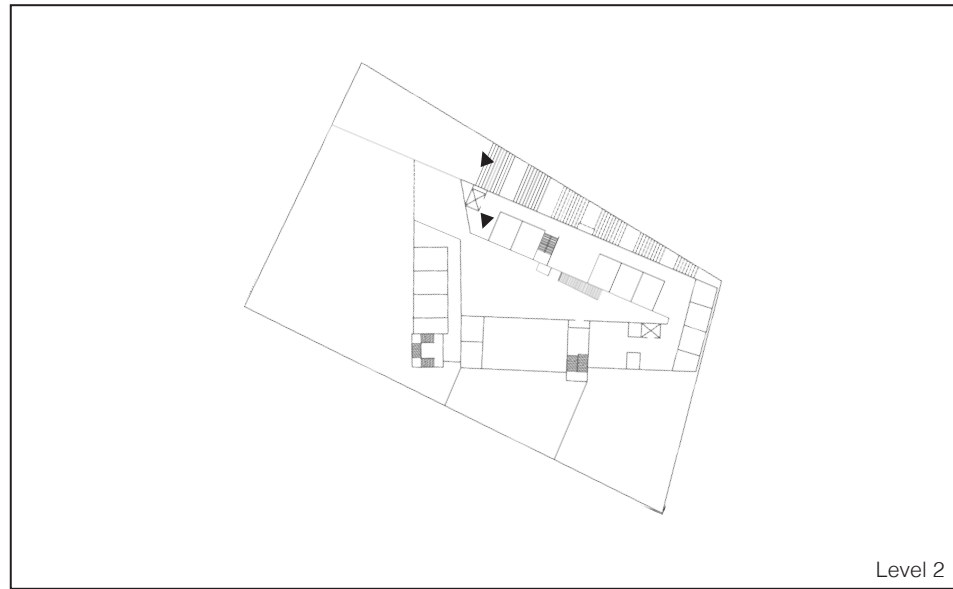
Courtyard looking west



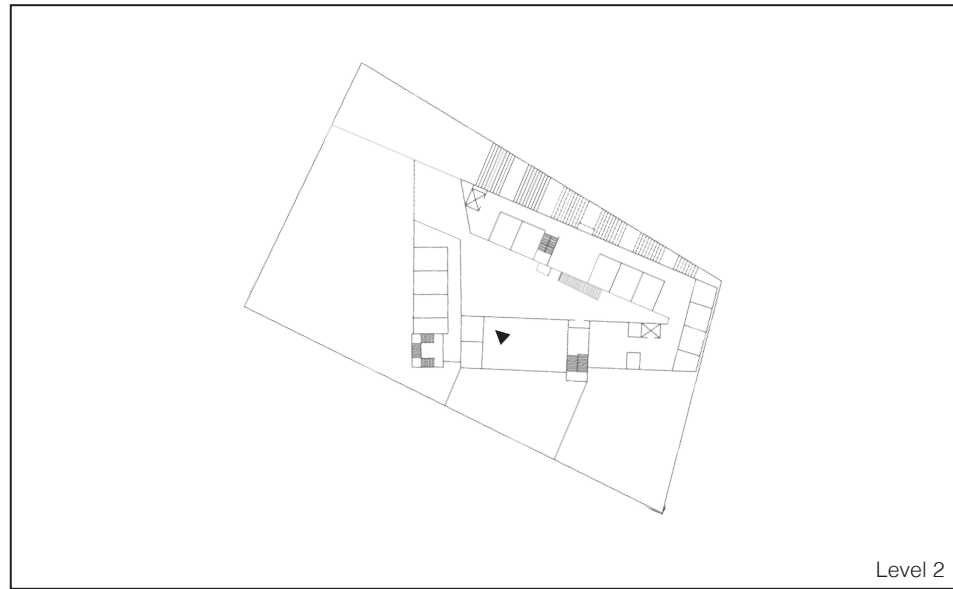
Level 2

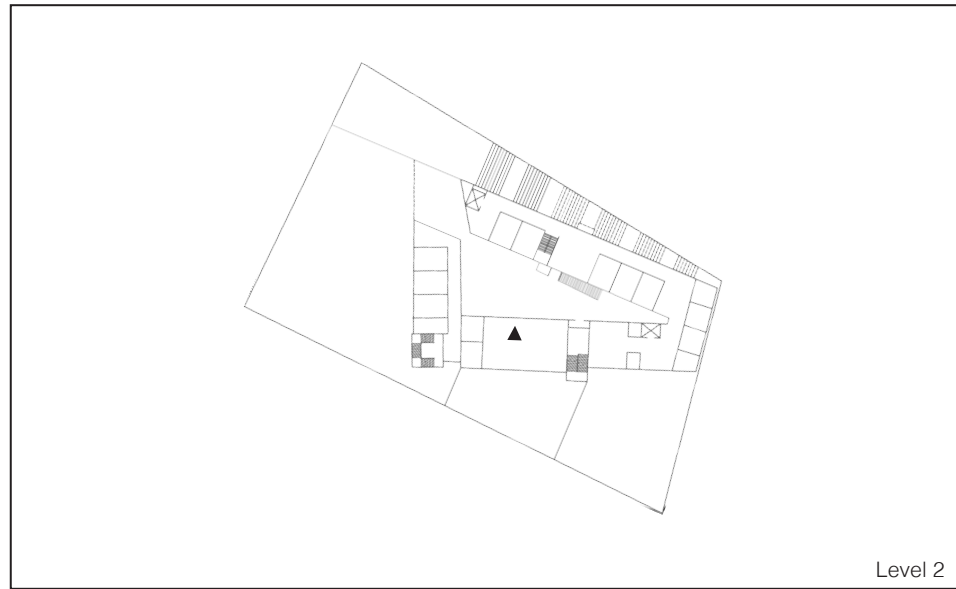


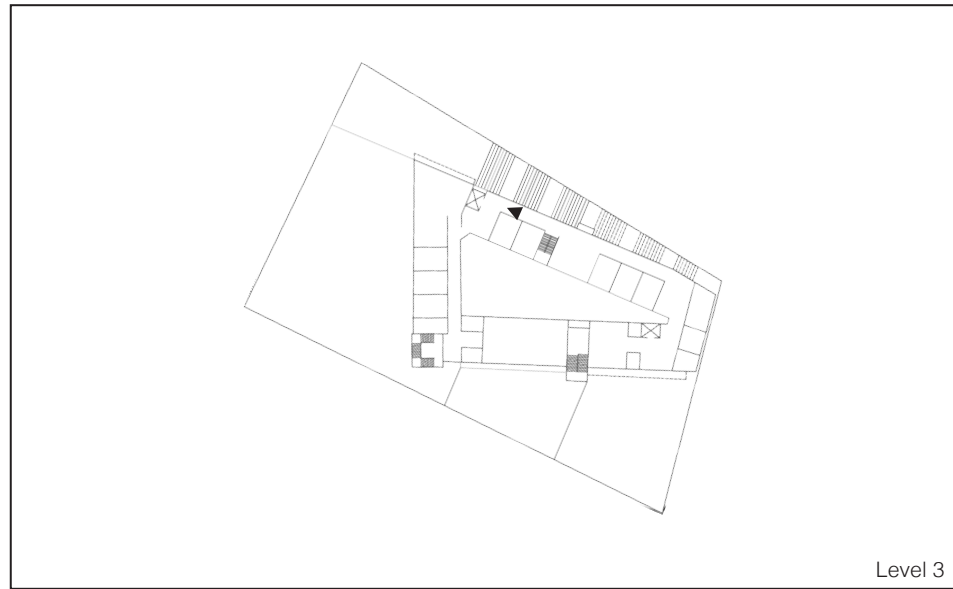
Courtyard looking east



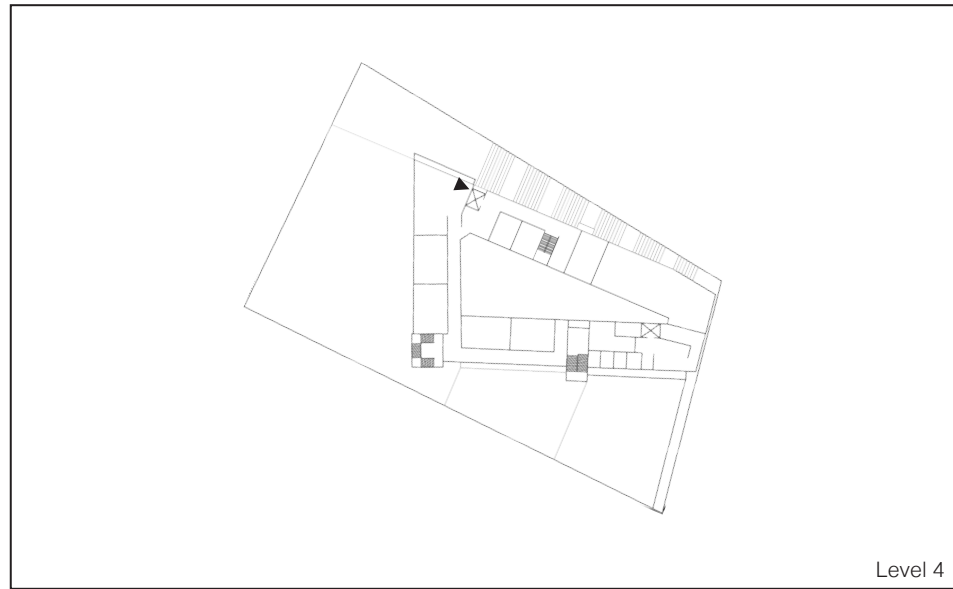
Elevator benches (Interior / Exterior)

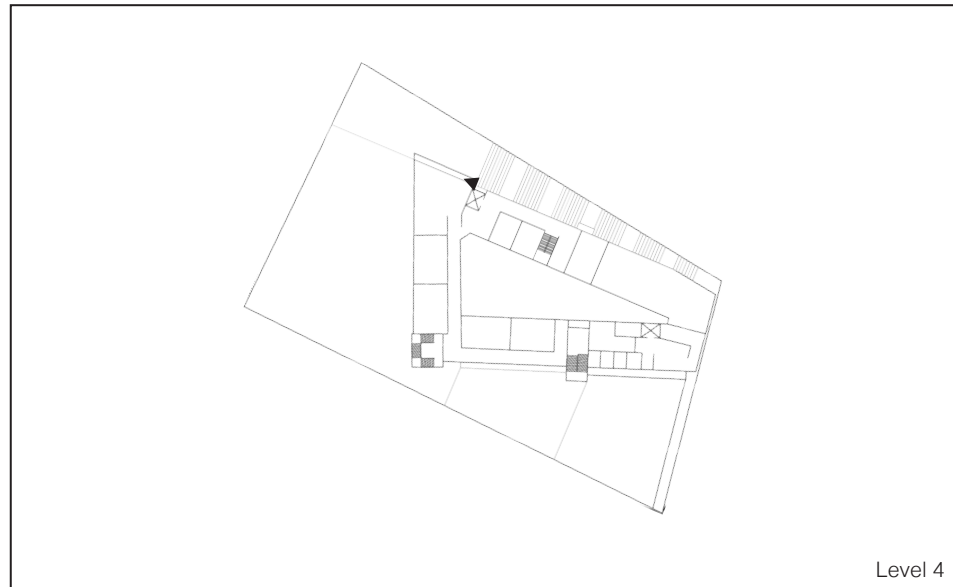




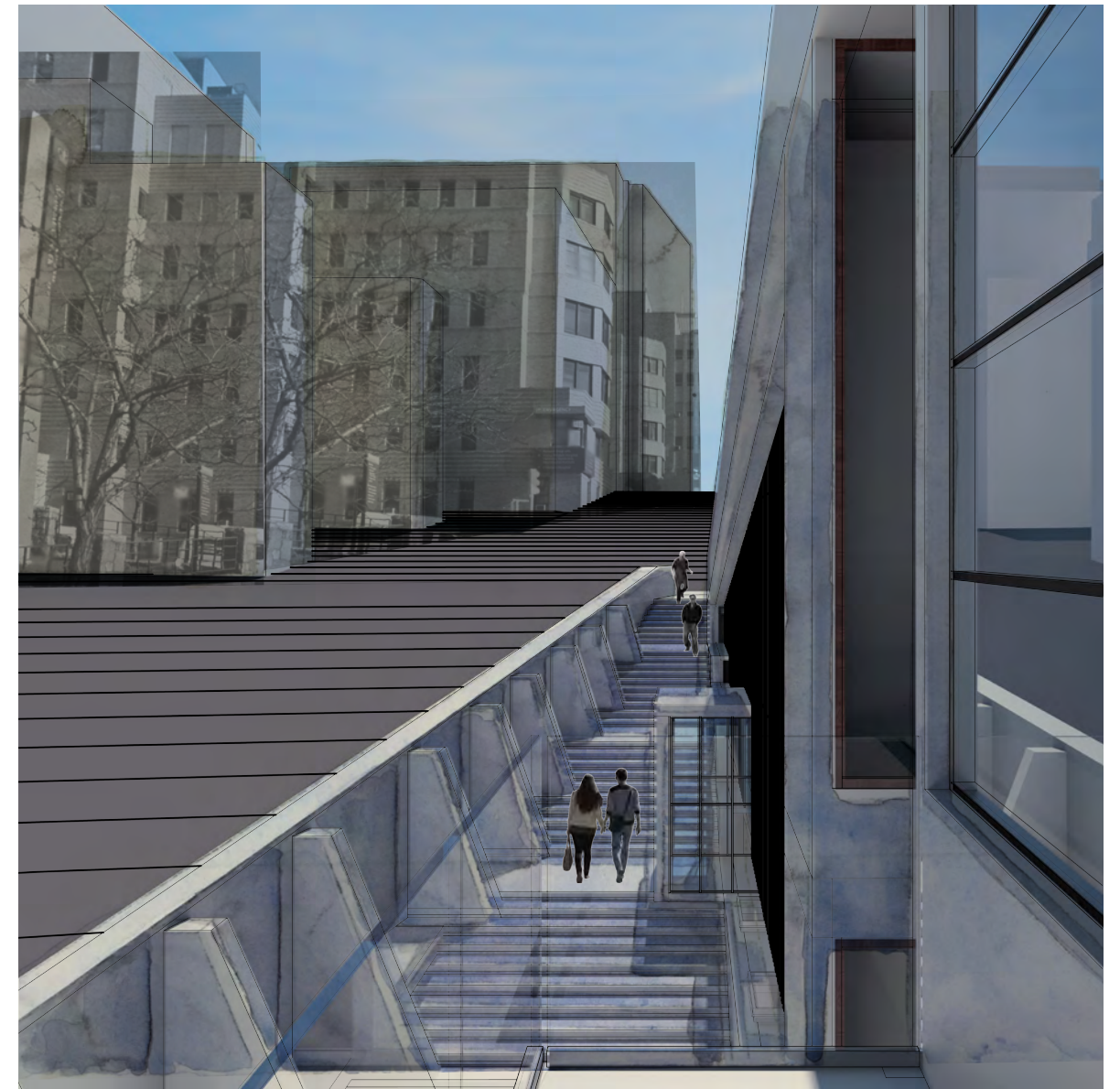


Hallway to medium patient rooms on Level 3

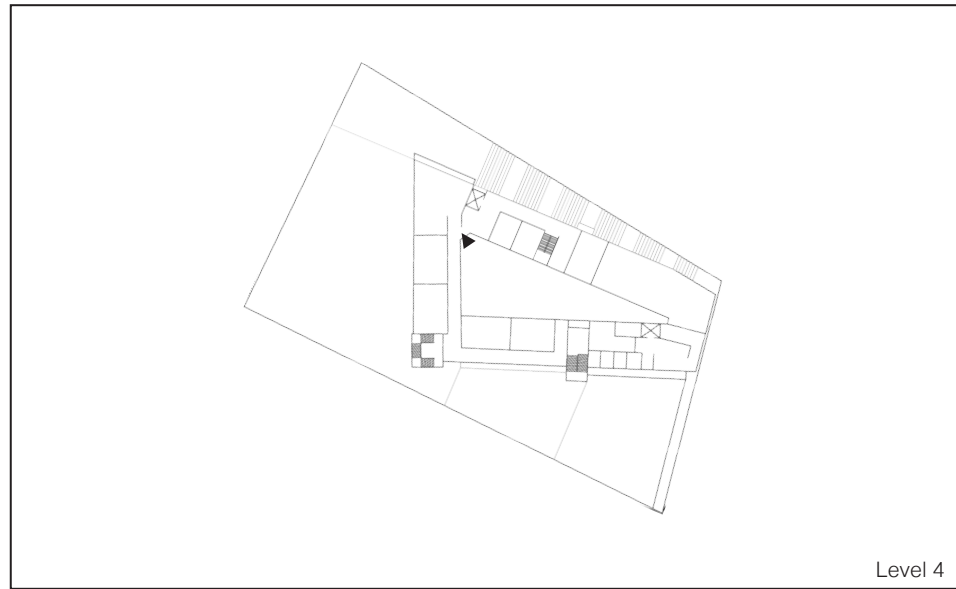




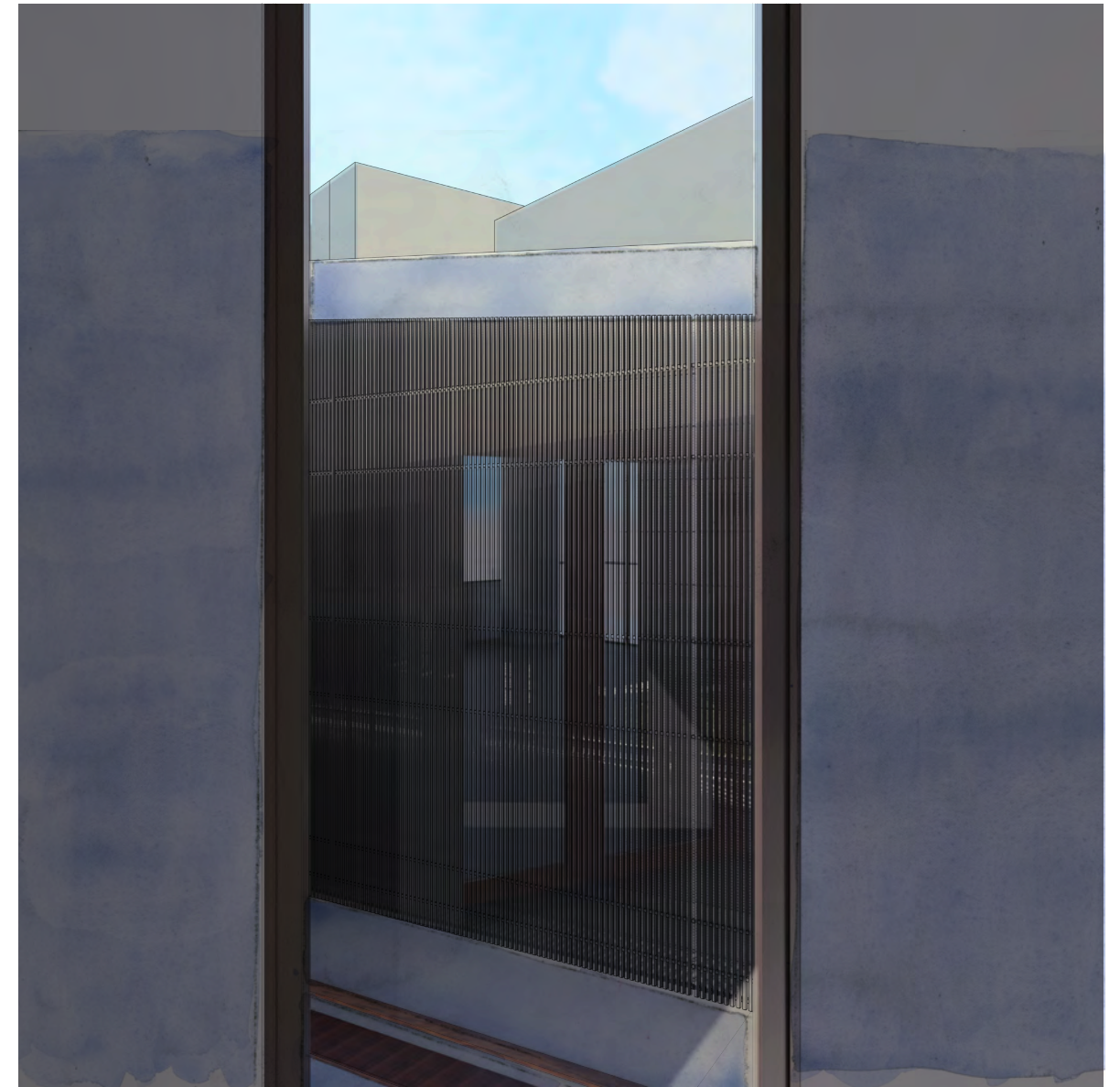
Level 4



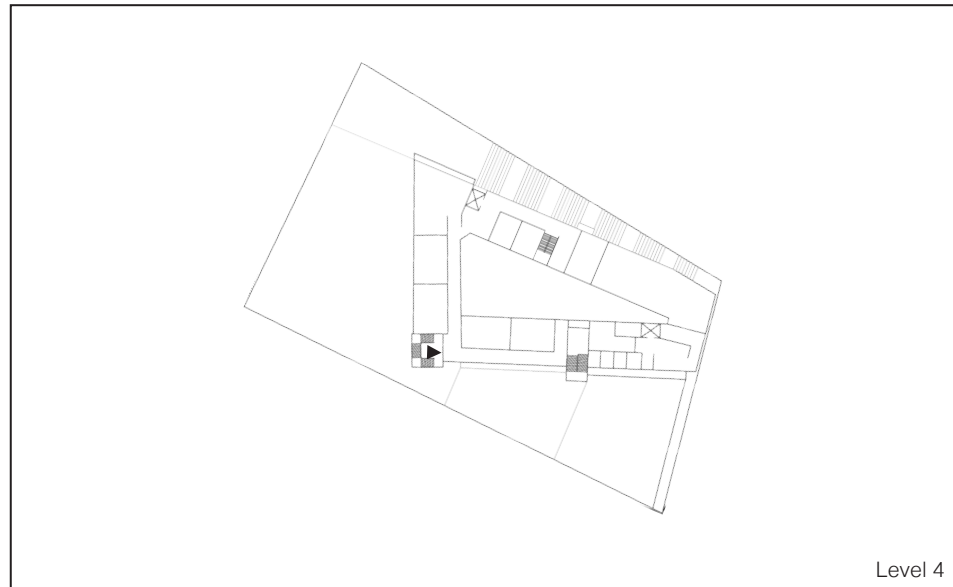
Library balcony looking east up public access stairway



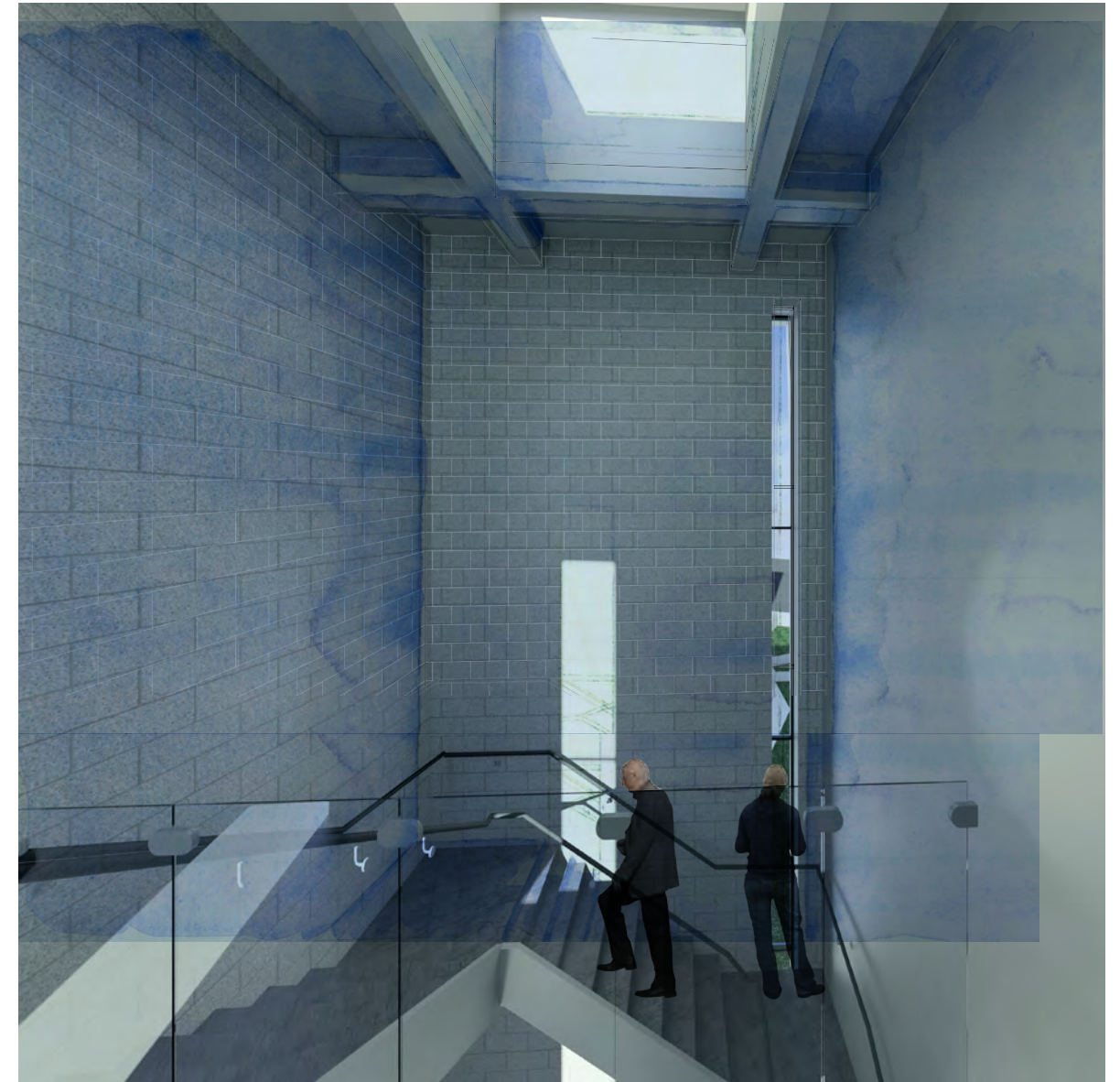
Level 4



Corner window looking out into courtyard



Level 4



Corner stair, facing west

