

Verticality

An experiment on a vertically organized house

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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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June 29th, 2012
Blacksburg, VA

Keywords: verticality, cliff house, vertically
organized house

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Abstract

Today, housing dominates the majority of land use due partially to its horizontally organized living spaces which results in relatively large building footprints. As an alternative to this default horizontality, a vertically-oriented single family house is studied. The house takes advantage of the verticality by offering unusual spatial overlaps with a set of choreographed views corresponding to level and visibility distance of the surrounding terrain.

Acknowledgement

I would like to thank my committee members, Heiner, Hilary, and Jim, who have given me invaluable advice throughout steps of my design development. I have had a great lesson in learning the importance of working with time frames that reflects how an architectural project gets done on time in real life.

I would like to express my appreciation to Heiner who helped shaping my design ideas with great patience on my slow progress. I am grateful to his understanding and support along my difficult time.

I would like to express my appreciation to Hilary who gave me inspiration and encouragement to analyse design problems and synthesize the solutions in order to achieve a good architecture.

I would like to express my appreciation to Jim who gave me valuable inputs and helped indicating all the good side of my work, as well as redirected me to the right design direction.

Table of Contents

| | |
|---|-----|
| Abstract | |
| Acknowledgement | iii |
| Table of Contents | iv |
| List of Figures | v |
| The house in the horizontal | |
| <i>Organic principle in architecture</i> | 1 |
| - Why a house should be organized horizontally | |
| Connection to the landscape | |
| <i>Ribbon window</i> | 1 |
| - Natural light and panoramic view | |
| Verticality | |
| <i>Sky occupancy and human benefits</i> | 2 |
| - The lack of vertically spatial design for living | |
| - Why a house should be organized vertically..... | 3 |
| The house in the vertical | |
| <i>Case studies of famous residential tower designs</i> | |
| - Tadao Ando's 4x4 tower house..... | 4 |
| - Mario Botta's Switzerland..... | 5 |
| <i>Thought process and design development</i> | 6 |
| - Program and ideal site..... | 13 |
| - The early design..... | 14 |
| Final iteration | |
| - The square grid system..... | 24 |
| - The structure of the house..... | 25 |
| - Air flow..... | 26 |
| - Architecture drawings..... | 28 |
| Design evaluation | |
| <i>Building as an object in nature</i> | 44 |
| - Entrance area..... | 47 |
| - Living/ sitting area..... | 48 |
| - Kitchen/ dining area..... | 50 |
| - Sleeping area..... | 52 |
| - Recreation area..... | 54 |
| - Library area..... | 56 |
| - Swimming pool area..... | 58 |
| Conclusion | 60 |
| Bibliography | 61 |

List of Figures

| | |
|---|----|
| Figure 1: Robie House (1909) by Frank L. Wright..... | 1 |
| Figure 2: Fallingwater (1935) by Frank L. Wright..... | 1 |
| Figure 3: Kentuck Knob (1986) by Frank L. Wright..... | 1 |
| Figure 4: Queen Land Number One (All-residential building)..... | 2 |
| Figure 5: Vertical layer in nature..... | 3 |
| Figure 6: 4x4 tower house, designed by Tadao Ando..... | 4 |
| Figure 7: Elevations (bottom) and plans (top) of the tower house..... | 4 |
| Figure 8: Villa Bianchi (Right), Villa Bianchi's floor plans (Left)..... | 5 |
| Figure 9: A section drawing of the bridge house concept..... | 6 |
| Figure 10: An elevation drawing of the bridge house concept..... | 6 |
| Figure 11: Perspective sketch of the bridge house concept..... | 6 |
| Figure 12: Planar and elevation drawings of the tower house concept..... | 7 |
| Figure 13: A preliminary model of the vertical house..... | 8 |
| Figure 14: Building volume profile comparison of the vertical relationship between a bridge house and a tower house..... | 8 |
| Figure 15: An exploration of visibility from various positions..... | 9 |
| Figure 16: Single supported tower..... | 10 |
| Figure 17: Sided suspended tower..... | 10 |
| Figure 18: Top suspended tower..... | 10 |
| Figure 19: Double pivot column as the main support to create a perception of floating..... | 11 |
| Figure 20: Modified pivot column as the main support to create a perception of floating..... | 11 |
| Figure 21: Single column as the main support to create a perception of floating..... | 11 |
| Figure 22: Elevations and section drawn using the golden ratio..... | 12 |
| Figure 23: The first attempt to arrange a vertical stair (wrapping around the main column support) within the square-shaped floor areas..... | 12 |
| Figure 24: Aerial view of the project's site location and surrounding context..... | 13 |
| Figure 25: SketchUp renderings of 3-d digital model showing the bridge as the entrance that connects the cliff to the house..... | 14 |
| Figure 26: Structural model showing the double core concrete columns with steel structure supporting each floor of the house..... | 15 |
| Figure 27: Physical model of the cliff house..... | 16 |
| Figure 28: Column and floor structural essence..... | 16 |
| Figure 29: Spatial interlocking..... | 16 |
| Figure 30: Interior envelope (north-west)..... | 17 |
| Figure 31: Exterior envelope (north-west)..... | 17 |
| Figure 32: Exterior envelope (south-east)..... | 17 |
| Figure 33: The earlier design of the house looking at the waterfall..... | 18 |
| Figure 34: The earlier design of the house showing a walkway path to the river below..... | 18 |
| Figure 35: Aerial view of the site property showing road access..... | 18 |
| Figure 36: Plan of the parent's bathroom on the upper level..... | 19 |
| Figure 37: Plan of the children's bathroom on the upper level..... | 19 |
| Figure 38: Plan of the parent's bathroom on the lower level..... | 19 |
| Figure 39: Plan of the children's bathroom on the lower level..... | 19 |
| Figure 40: Parent's bathroom in perspective showing the double height bathroom idea..... | 20 |
| Figure 41: Children's bathroom in perspective showing the cantilevering shower platform..... | 20 |
| Figure 42: Plan of the Children's bedroom (1)..... | 21 |
| Figure 43: Plan of the Parent's bedroom..... | 21 |
| Figure 44: Plan of the Children's bedroom (2)..... | 21 |
| Figure 45: Plan of the living room from the original design..... | 22 |
| Figure 46: Plan of the living room from the redesign..... | 22 |
| Figure 47: Plan of the kitchen and dining area showing furniture arrangement along the north-south orientation to maximize the flow of the space and outdoor vision..... | 23 |
| Figure 48: TOP: A diagram showing an alignment of the 16-square grid system onto a plan BOTTOM: A diagram showing an alignment of the 36- square grid system onto a section..... | 24 |
| Figure 49: An illustration of how reinforced concrete columns and steel beams are used to support the entire house..... | 25 |
| Figure 50: Diagram of the air flow in the triple height chamber at the north facade..... | 27 |
| Figure 51: Drawing of the site plan..... | 28 |
| Figure 52: Ground floor plan and section..... | 29 |
| Figure 53: Second floor plan and section..... | 30 |
| Figure 54: Third floor plan and section..... | 31 |
| Figure 55: Mezzanine floor plan and section..... | 32 |
| Figure 56: Fourth floor plan and section..... | 33 |
| Figure 57: Fifth floor plan and section..... | 34 |
| Figure 58: Sixth floor plan and section..... | 35 |
| Figure 59: Ground floor plan and section..... | 36 |
| Figure 60: Second floor plan and section..... | 36 |
| Figure 61: Third floor plan and section..... | 37 |
| Figure 62: Mezzanine floor plan and section..... | 37 |
| Figure 63: Fourth floor plan and section..... | 38 |
| Figure 64: Fifth floor plan and section..... | 38 |
| Figure 65: Sixth floor plan and section..... | 39 |
| Figure 66: Drawing of the east elevation..... | 40 |
| Figure 67: Drawing of the west elevation..... | 41 |
| Figure 68: Drawing of the north elevation..... | 42 |
| Figure 69: Drawing of the south elevation..... | 43 |
| Figure 70: An exterior view of the house from the north west on a sunny day..... | 45 |

List of Figures (continued)

| | |
|--|----|
| Figure 71: A view looking at the main entrance in the morning of a typical working day..... | 46 |
| Figure 72: The sliding door as a physical threshold where inside and outside meet..... | 48 |
| Figure 73: View from a person looking to the north west direction once stepping inside the living area..... | 48 |
| Figure 74: View from a person looking to the north east direction once stepping inside the living area..... | 48 |
| Figure 75: Color diagram showing the angle of view from the living area..... | 49 |
| Figure 76: View from a person looking to the north direction from the cooking area..... | 50 |
| Figure 77: View from a person looking to the south direction from a dining seat..... | 50 |
| Figure 78: Color diagram showing the angle of view from the kitchen/ dining area..... | 51 |
| Figure 79: View from a person standing inside the parent's sleeping area looking to the north..... | 52 |
| Figure 80: View from a person laying on the bed looking at the cliff wall below the bridge..... | 52 |
| Figure 81: View from a standing person in the bathtub area looking out..... | 52 |
| Figure 82: Color diagram showing the angle of view from the parent's bedroom..... | 53 |
| Figure 83: View from a person standing at the beverage bar area looking to the north..... | 54 |
| Figure 84: View from a person standing at the pool table area looking at the cliff wall beyond the beverage bar area..... | 54 |
| Figure 85: Color diagram showing the angle of view from the recreation area..... | 55 |
| Figure 86: Interior view of the library looking out through the north facade..... | 56 |
| Figure 87: Color diagram showing the angle of view from the recreation area..... | 57 |
| Figure 88: View of the cooking out and swimming pool area at noon..... | 58 |
| Figure 89: View from a standing swimmer looking toward the cliff edge..... | 58 |
| Figure 90: Color diagram showing the angle of view from the swimming area..... | 59 |

The house in the horizontal

Organic principle in architecture

- Why a house should be organized horizontally

In Frank Lloyd Wright's nine principles of Organic architecture, he conceived the new architecture, the so-called Organic architecture. Outlined in his essay "*The new architecture: Principles*", he claims under the heading "*Earth line*" a principle that the ideal profile for modern buildings is horizontally low to the ground in order to synchronize a building's layout with the natural scale and spatial demand of a human being. He further claims that this profile provides a sense of permanence with a clear commitment of belonging to the land and a sense of a structure deeply rooted in the ground¹ (Figure 1 to 3).



Figure 1: Robie house (1909) by Frank L. Wright⁵
,http://commons.wikimedia.org/wiki/File:Frank_Lloyd_Wright_-_Robie_House_2.JPG [Used under fair use, 2014]



Figure 2: Fallingwater (1935) by Frank L. Wright⁶
,http://commons.wikimedia.org/wiki/File:Falling_Water_01.jpg [Used under fair use, 2014]

Connection to the landscape

Ribbon window

- Natural light and panoramic view

In my opinion, a sense of belonging to the land can also be achieved with the constructing of beautiful views of the landscape in the interiors with carefully placed openings. A carefully constructed opening has the ability to provide natural light and to engage the outside landscape to become part of the house.

Three of Wright's principles assisted in the design of a vertical house: the strength of steel to suspend building masses, the architectural elements as spatial design organizers to transform architecture into a work of art, and balancing building load with optimal supports commensurate with the effectiveness of an organic form. The proposed house embraces a strong sense of verticality, lightness, and floating.



Figure 3: Kentuck Knob (1986) by Frank L. Wright⁷
,<http://philelleontheroadagain.blogspot.com/2010/10/falling-water-and-kentuck-knob.html> [Use under fair use, 2014]



Figure 4: Queen Land Number One (All-residential buiding)²
http://commons.wikimedia.org/wiki/File:Q1_Gold_Coast_March_2006.jpg [Used under fair use, 2014]

Verticality

Sky occupancy and human benefits
- *The lack of vertically spatial design for living*

Steel construction technology allows high-rise towers to be built in big cities anywhere in the world. However, most existing towers do not take advantage of verticality as a perceptual experience. Spaces are generally based on horizontal layouts stacked on top of one another. In such structures, the upper level units are generally the most expensive because they offer a better view of the surrounding environment. But most of the time these towers do not give the awareness of the vertical building nature unless you are next to a window and look down (Figure 4).

- Why a house should be organized vertically

Living spaces such as living rooms, bedrooms, bathrooms, and kitchens are typically organized horizontally, built close to the ground with a view that is limited by the surrounding environment including buildings, trees, and other natural elements of the terrain.

In this proposal all major living spaces are elevated above the ground to expand the view. The elevated position suggests a better sense of possession over the surrounding landscape and an increased sense of security. Second, a horizontal framed window on different floor levels of the same side of wall lets one enjoy different views of nature. In this proposal there are three different layers of view: ground natural elements (e.g. waters, shrubs, and tree base), mid-air natural elements (e.g. tree tops, small cascades), and high ground natural elements (e.g. mountains, waterfalls) (Figure 5).

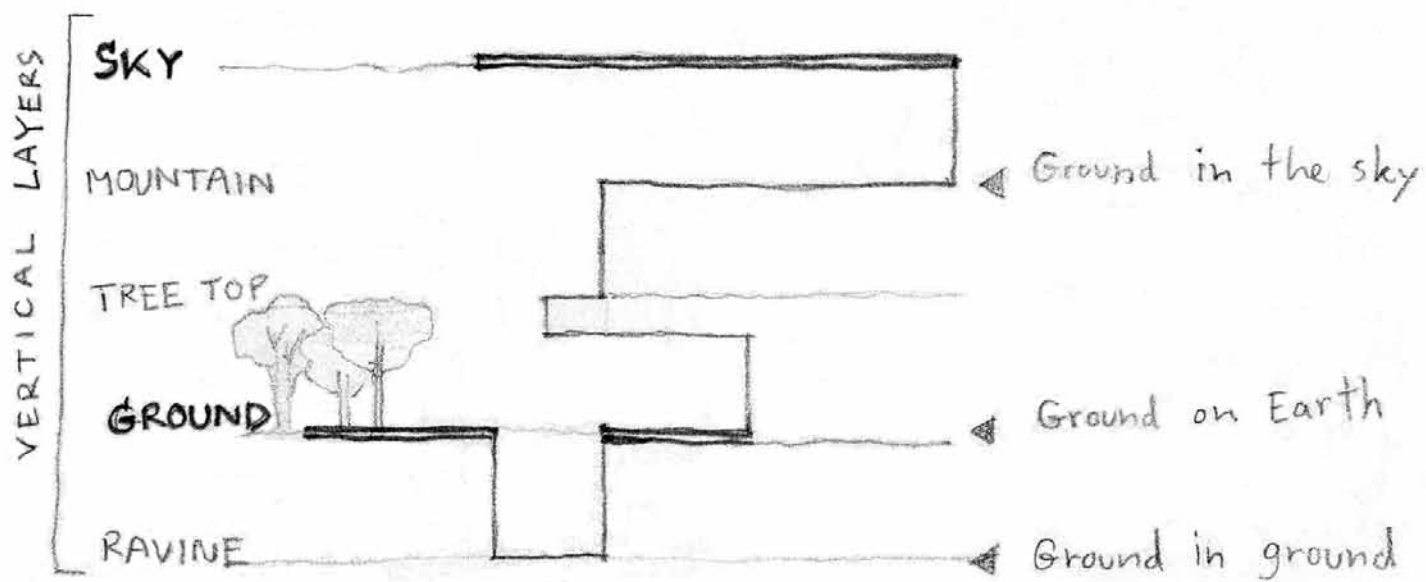


Figure 5: Vertical layers in nature

The house in the vertical

Case studies of famous residential tower designs

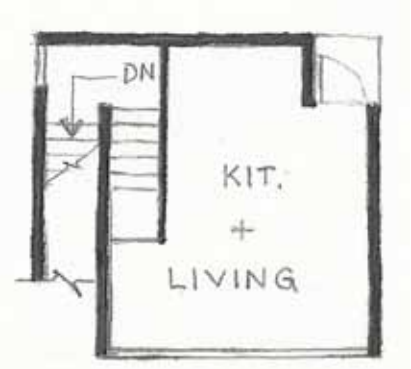
- Tadao Ando's 4x4 tower house

This house in Tarumi, Kobe City, Japan, is located on a scanty site of 5m by 5m of an eroded sandy coastal area. The square plan is, the largest possible size allowed for the footprint of the tower. To achieve a desired ocean view on the top level (the living/ dining room area), Ando strategically increased the ceiling height to be the same dimension as the floor plan and projected its volume to the front opening to the sea by a meter³ (Figure 6-7).

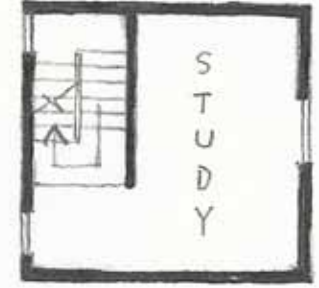
A nine square grid is used to organize the plans and the top floor volume is projected to create a floating effect.



Figure 6: 4x4 tower house, designed by Tadao Ando³
<http://architizer.com/projects/ando-4x4-house/> [Used under fair use, 2014]



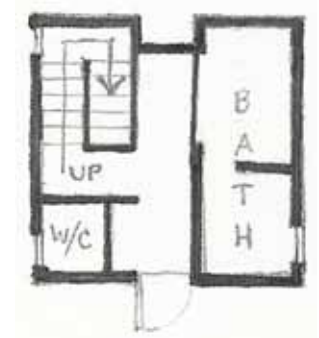
Fourth floor plan:



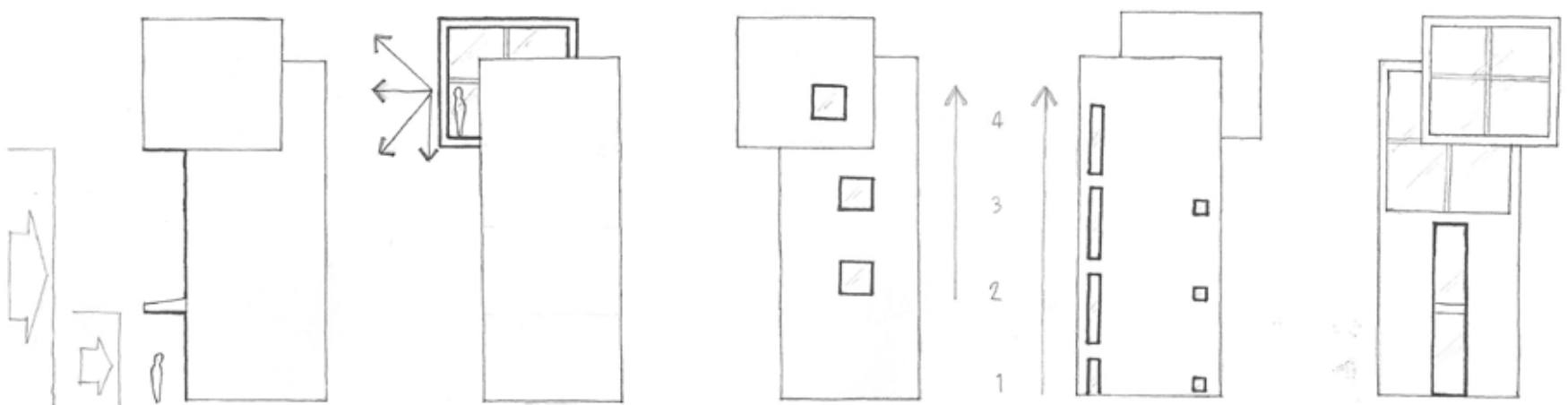
Third floor plan:



Second floor plan:



First floor plan:



Negative vertical volume as an architectural element helps attract visitors to the main entrance.

Projected floor with an increased ceiling height helps achieve the sense of lightness and floating.

Vertical rhythm of windows generates the visual perception of vertical living.

Tall rectangular window to emphasize the visual perception of vertical living.

Figure 7: Elevations (bottom) and plans (top-right) of the tower house



Fourth floor plan:
Studio



Third floor plan:
Living/dining/kitchen



Second floor plan:
Children's bedroom



Ground floor plan:
Master bedroom



Figure 8: Casa Bianchi (Right)⁴, floor plans (Left)
<http://besthomedesign.org/villa-bianca-in-switzerland-by-mario-botta.html>

[Used under fair use, 2014]

- Mario Botta's, Switzerland

Botta deliberately choose the form of a tower as to mark the limit of the urban fabric. The tower has a strong contact with the ground in order to achieve the sense of anchoring into the land.

Botta used most of the volume to not only create geometrical landscape that corresponds to the movement of the sun but also create facades to frame the view to their facing environment. This artificial landscape acts as a transition between the interior of the house and the surroundings.

Botta organized living spaces around a central staircase that is just big enough to accommodate human movements.

Concrete is used for the exterior to achieve the sense of a solid, heavy tower. Botta establishes a strong contrast between the unplastered concrete block and black painted steel window frames, the penetrating steel red bridge and the volume of concrete tower⁴. (Figure 8)

Thought process and design development

In this proposal, three qualities are at the forefront:

Verticality is perceived as position at right angles to the horizon.

Lightness is perceived through thickness of structure, texture, and opacity of materials.

Floating is perceived via how the object touches the ground.

In this proposal, a bridge between two cliffs connects two prismatic spaces whose bases attach to each other to make a diamond shape. The upper story is the structural floor that carries its own load and that of the lower story below. The entrance to the house is via the upper story where it contains a guestroom and service functions (e.g. kitchen and bathrooms). The lower story has an inverse sloped transparent envelope which contains a living room and bedrooms. The inverse sloping of the glass wall prevents direct sunlight from penetrating the glass and it also prevents observation from viewers at the top floor ground level due to reflection, thereby maintaining privacy.

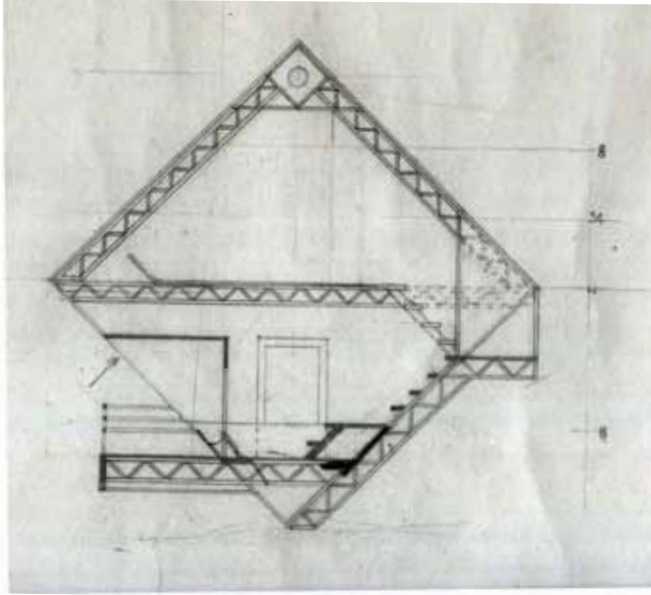


Figure 9: Section of the bridge house concept

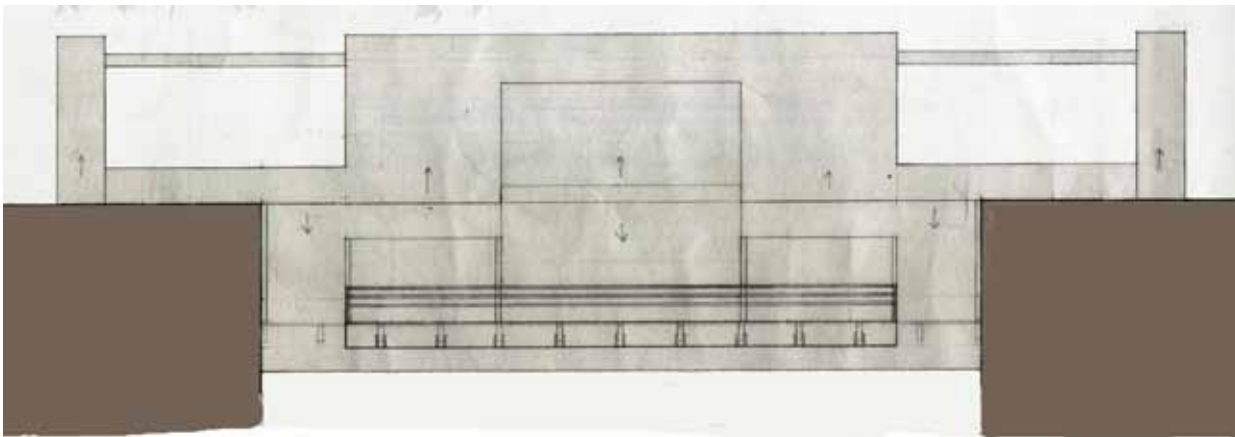


Figure 10: Elevation of the bridge house concept

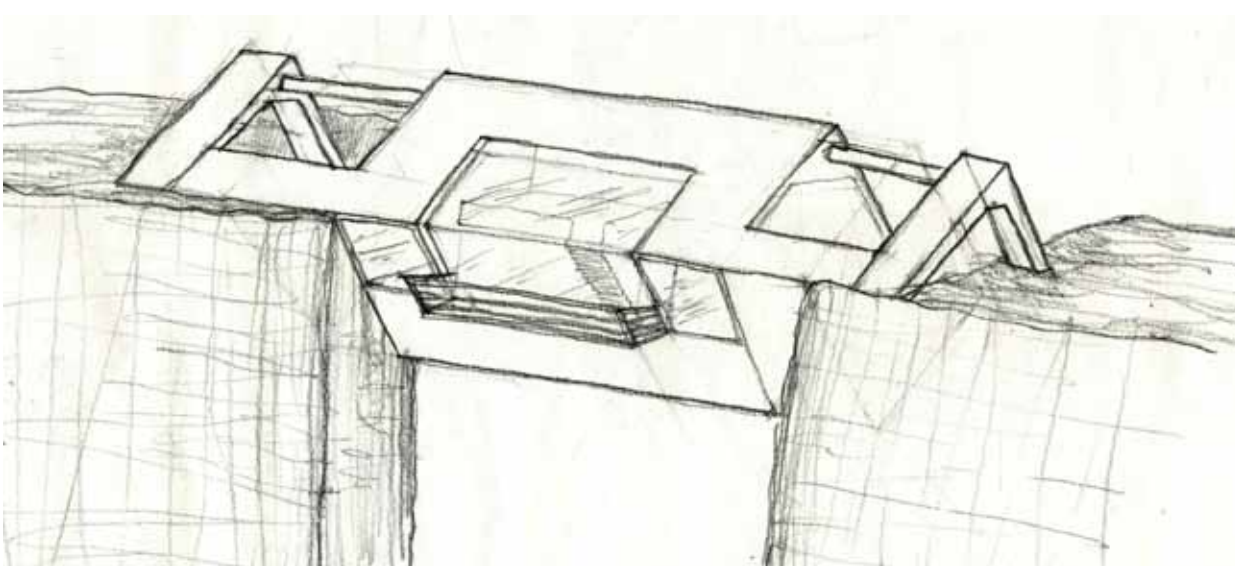


Figure 11: Perspective sketch of the bridge house concept

My second approach employs a tower configuration. The tower consists of a steel truss framing system which is composed of two parts: a top-level structural chamber with a three story volume suspended from it allowing its lower volume to be perceived as if it floated over the ground. The entire house stands on four slim tubular steel columns located at the four corners of the house. Opaque walls and transparent walls are alternately layered to achieve a floating appearance by separation.

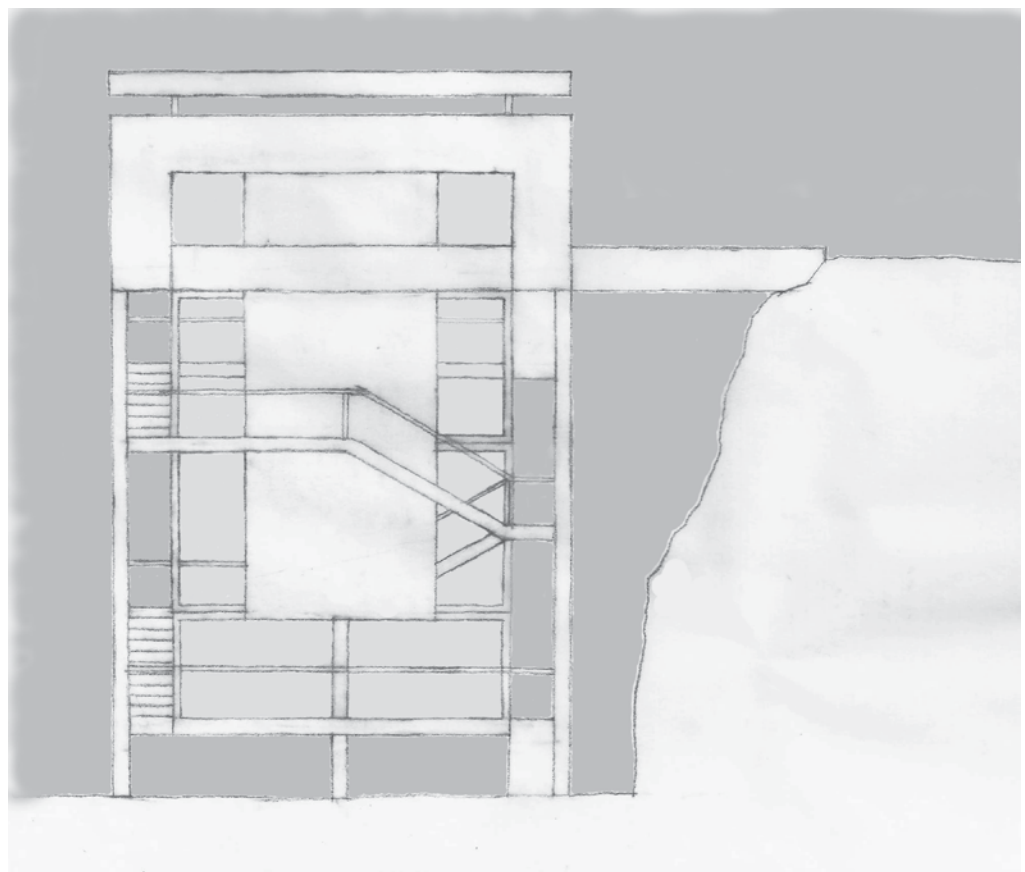
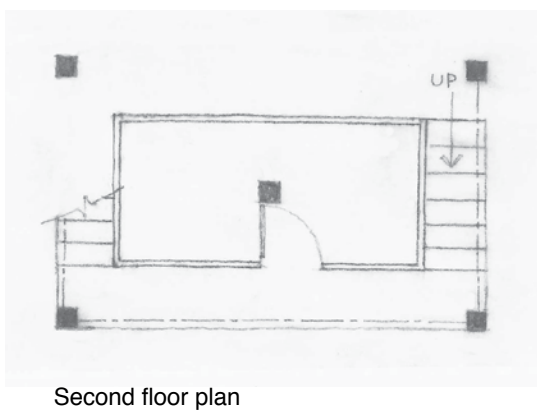
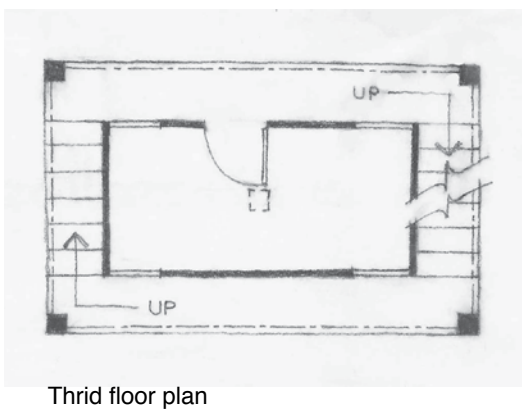
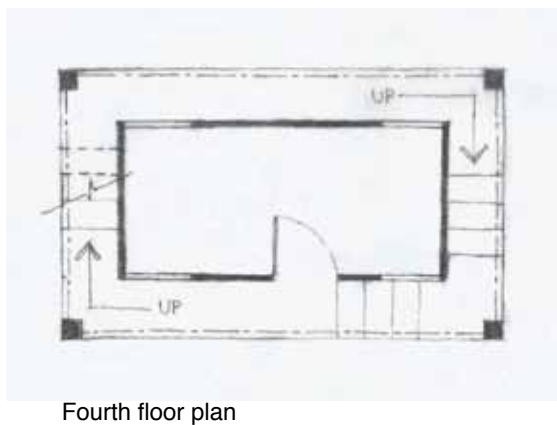
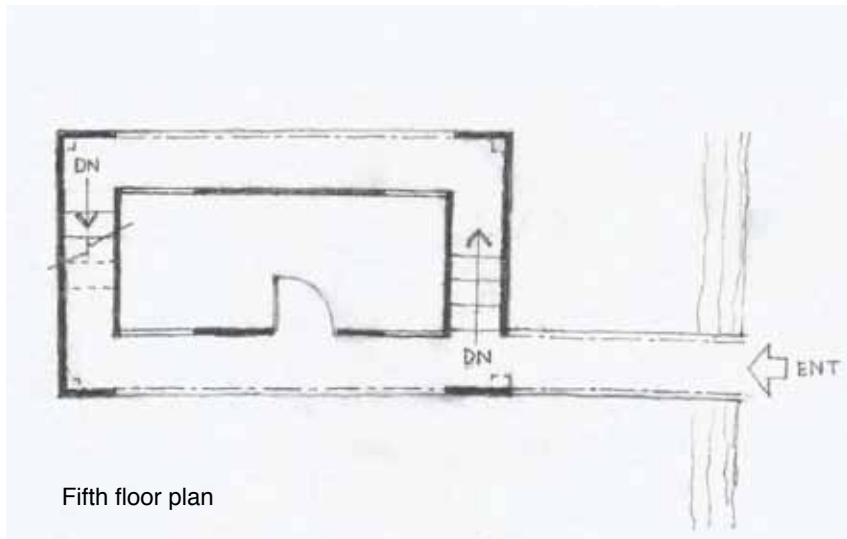


Figure 12: Planar and elevation drawings of the tower house concept

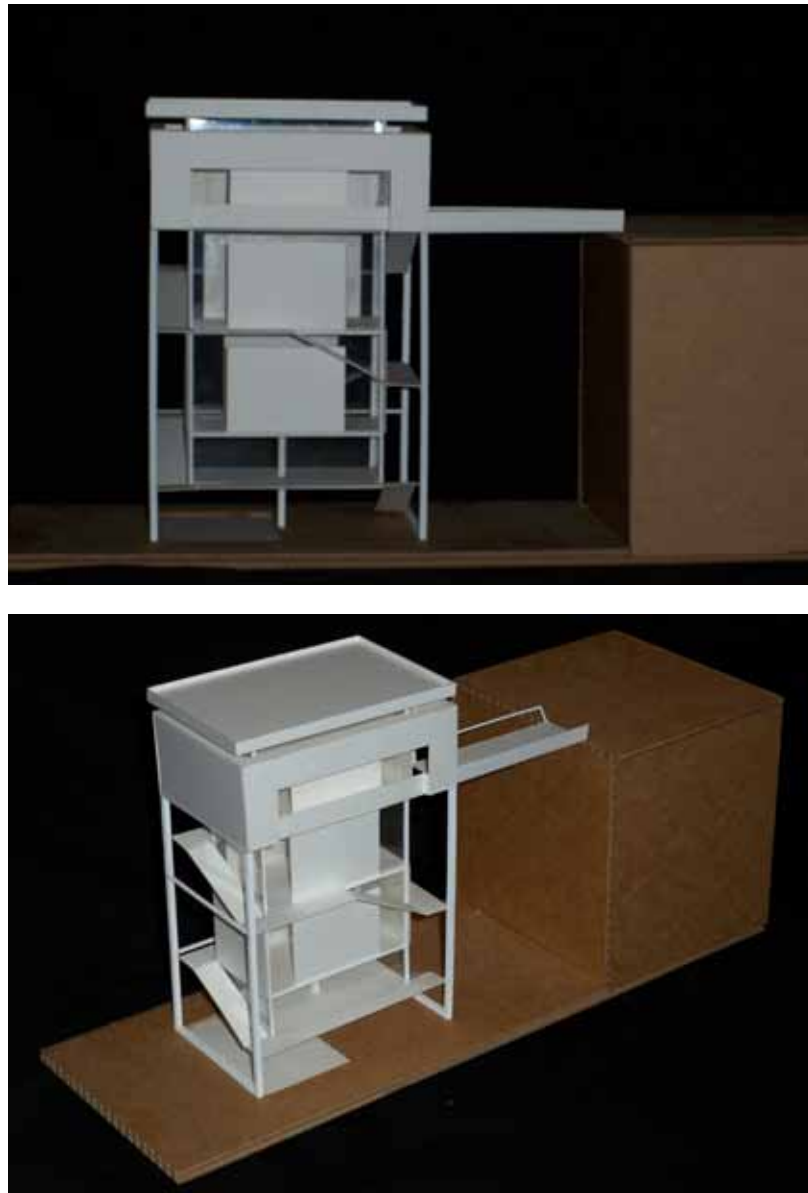
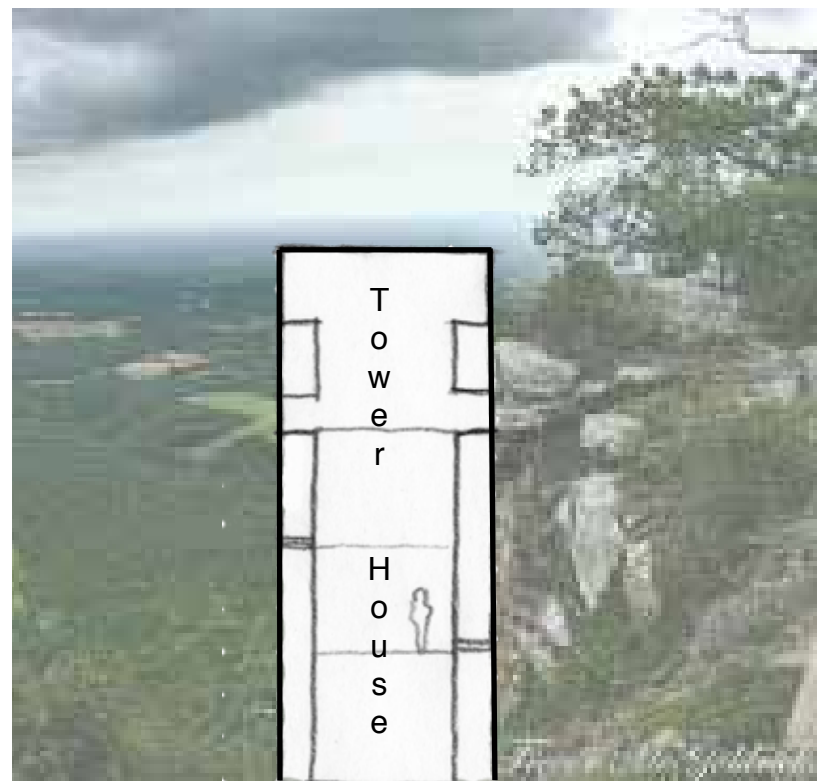


Figure 13: A preliminary model of the vertical house



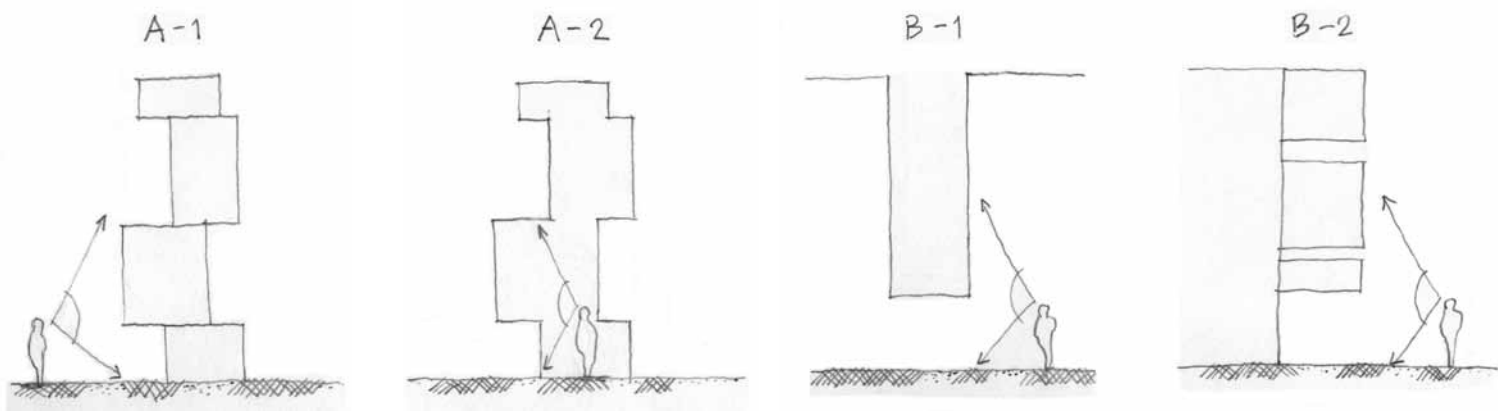
A bridge as a house provides a dominating horizontal profile⁹
http://commons.wikimedia.org/wiki/File:Cliff_New_River_Gorge_WV_USA.JPG [Used under fair use, 2014]



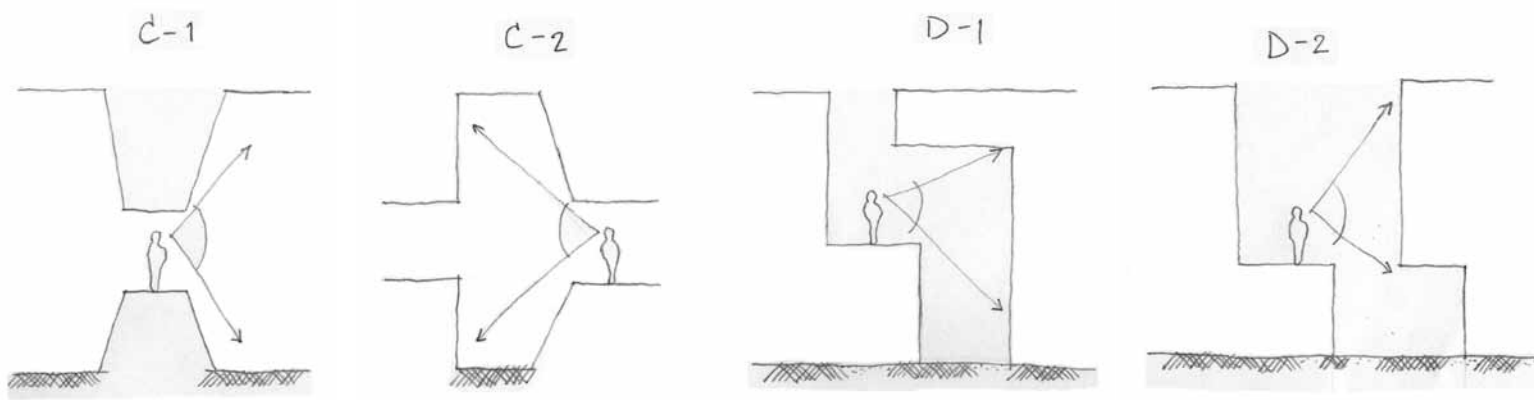
High possibilities of vertical connection within the livable vertical volume due to the vertical profile of the house⁸
<http://www.flickr.com/photos/39414003@N04/3868989645/> [Used under fair use, 2014]

Figure 14: Building volume profile comparison of the vertical relationship between a bridge house and a tower house

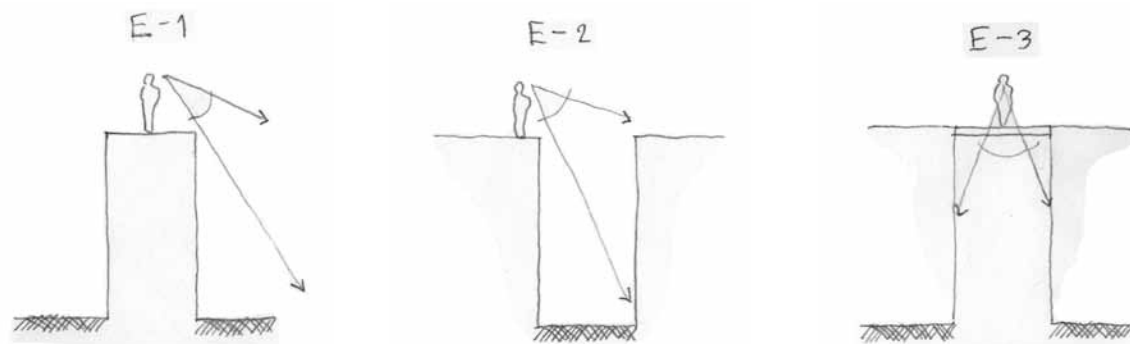
A Study of verticality



On-ground Observing



Mid-air Observing



On-top Observing

Figure 15: An exploration of visibility from various positions

Three approaches for the tower:

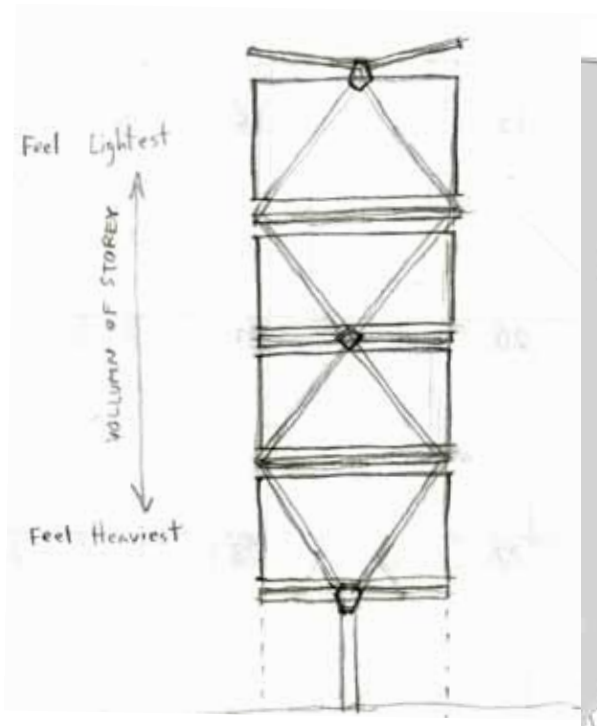


Figure 16: Single supported tower

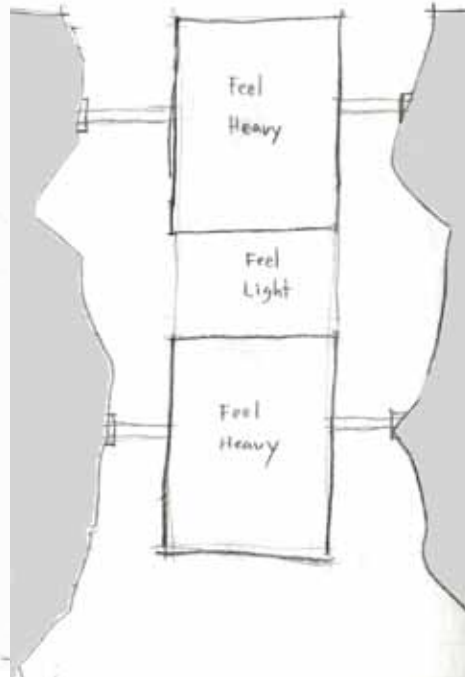


Figure 17: Side suspended tower

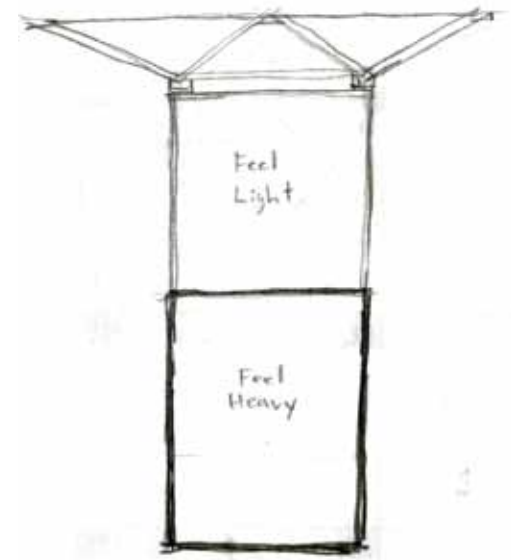


Figure 18: Top suspended tower

Single support

A single center column supports an elevated volume with spaces stacked over one another to make a vertical profile. This support also connects to a wall truss structure in the middle of the floor. This pattern continues over to the top. To create the sense of lightness, the wall surfaces on each floor create a pattern of decreasing opaqueness as it goes to the top (Figure 16).

The single supported tower was chosen for further development because the structure is simpler than the other two options. The complex structure in the other two options may result obstructing views. The structural support is a key element to generate the floating effect of the house by having the house touch the ground lightly.

Side suspended

Two suspended volumes on top of each other connect with a room. To create the sense of floating, the two units have an opaque wall surface while the connecting room has a transparent wall surface (Figure 17).

Top suspended

A truss bridge on the top allows a volume to be suspended. Two, two storey volumes are proposed, one light and the other heavy. The upper storey has clear walls and the lower storey has opaque walls (Figure 18).

The double pivot column

This column support takes a Y-shape. The top half is a v-shape reinforced concrete form and the bottom half is a reinforced solid concrete form (leg of the Y that is tapered at the base). The idea is to make the column appear as light as possible by minimizing the mass of the structure and leaving only the area where the path of the load is. To further amplify the sense of floating, the bottom half is hidden under the water surface at the ground level. To deal with the shear force in the other direction, the back wall of the first floor touches the raised ground. This design; however, diminishes the sense of verticality due to the diagonal profile of the column (Figure 19).

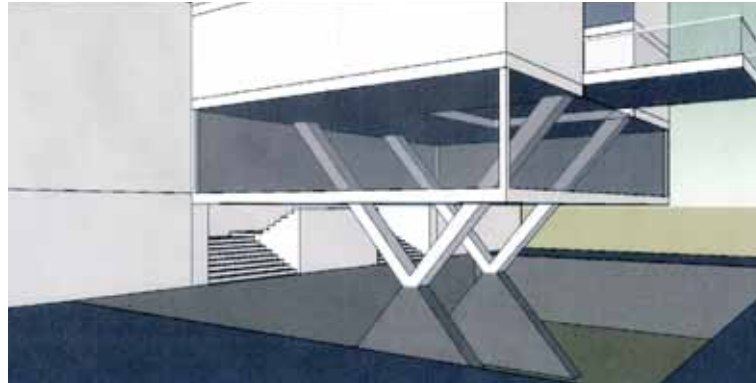
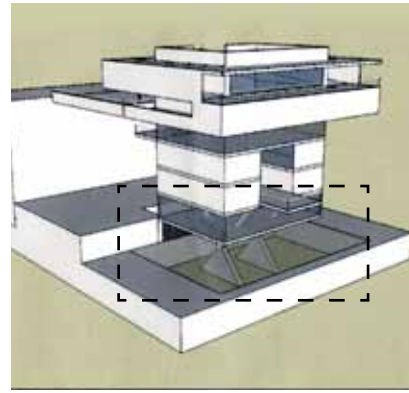
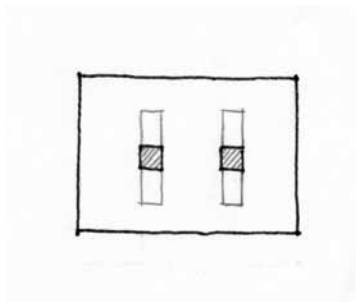


Figure 19: Double pivot column as the main support to create a perception of floating

The modified pivot column

The difference between this column and the first column is the shift from the back wall support to front column supports under the deck of the house (Figure 20).

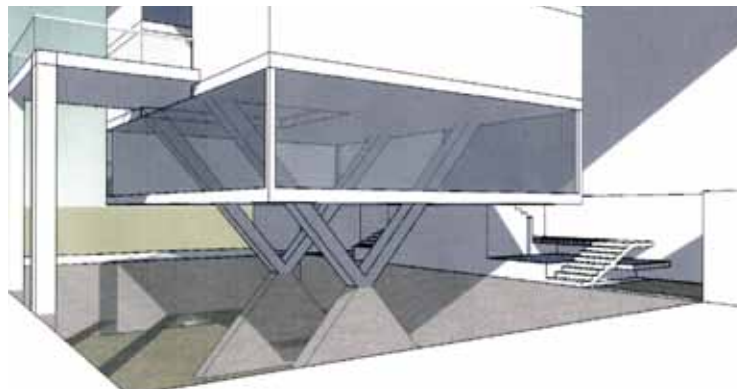
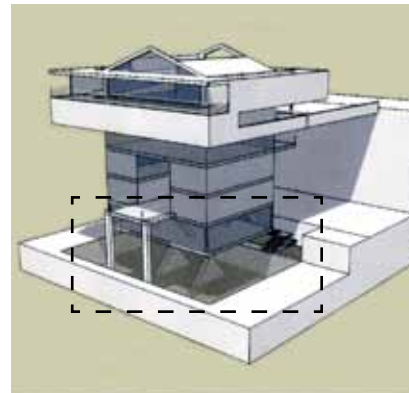
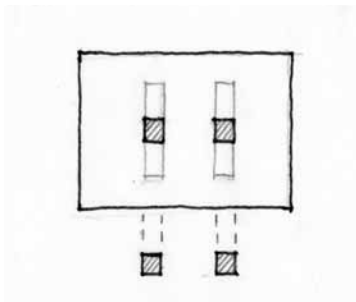


Figure 20: Modified pivot column as the main support to create a perception of floating

The single column

This is a stand-alone wall column support. This wall-like column has to be thick enough that it resists the shear force on both axes. The simplicity of this design makes it easy to manipulate space inside the house and, due to its vertical profile, it gives a sense of verticality (Figure 21).

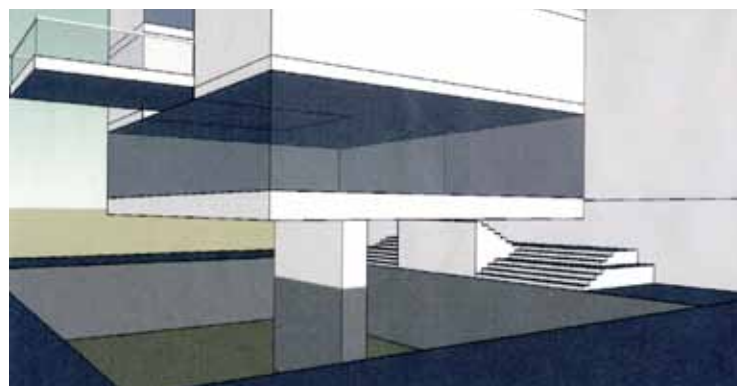
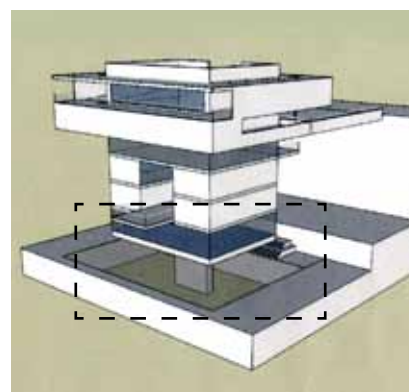
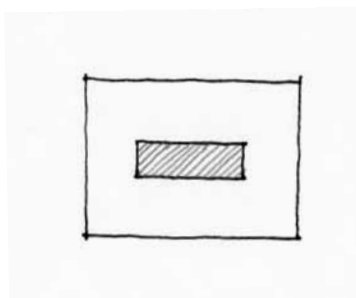


Figure 21: Single column as the main support to create a perception of floating

In the further development of the single column support, the golden section ratio was used for the proportion of the house (Figure 22-23).

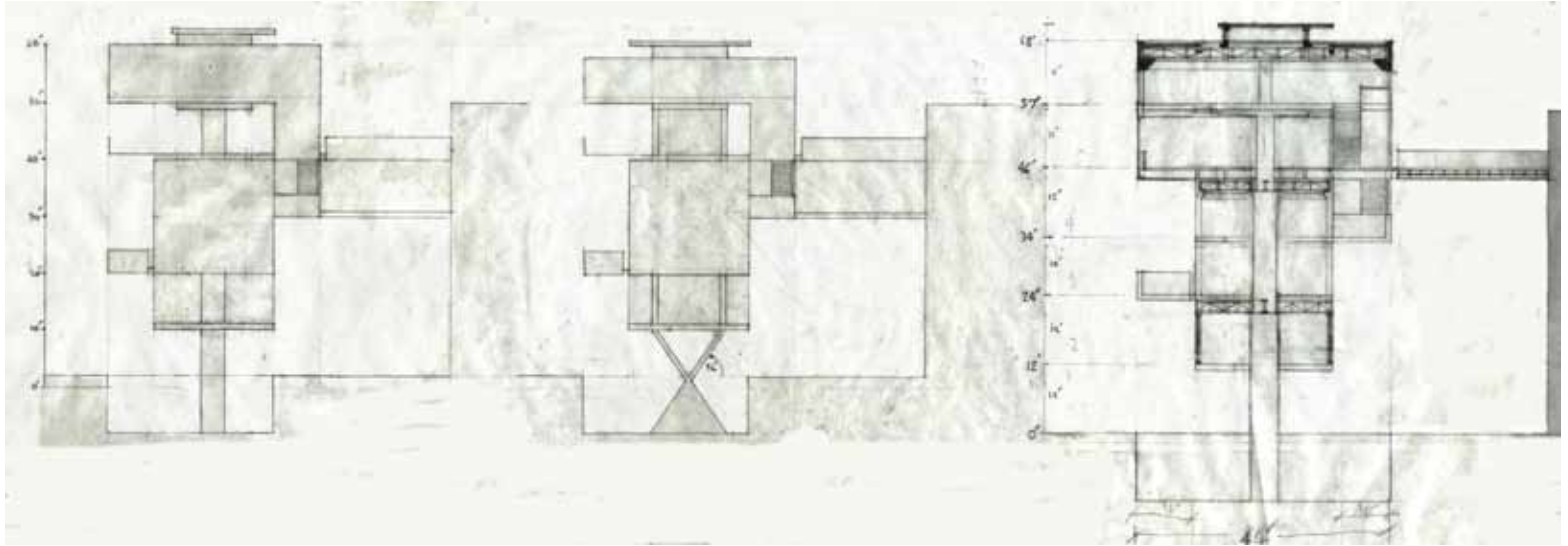


Figure 22: Elevations and section drawn using the golden ratio

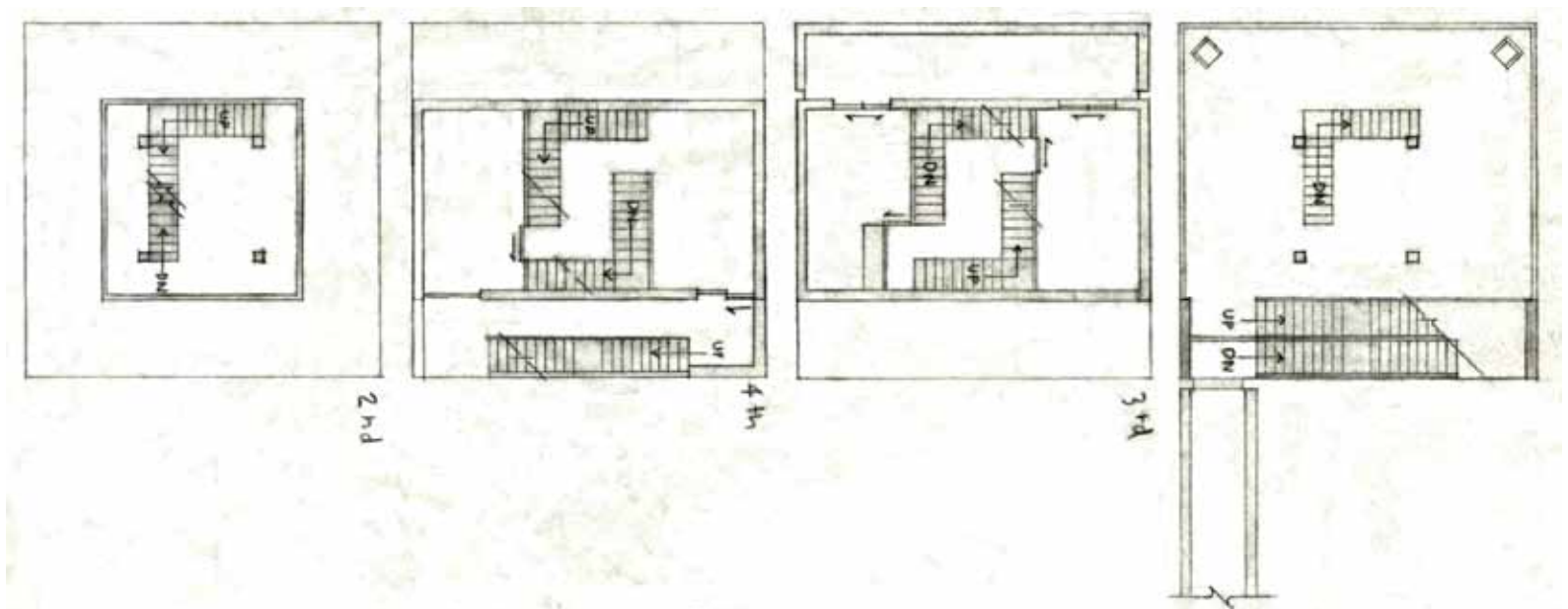


Figure 23: The first attempt to arrange a vertical stair (wrapping around the main column support) within the square-shaped floor areas

- Program and ideal site

This house is conceived as a vacation house for a wealthy couple with two teenage children. The ideal site of the house was set to be in a suburb area of the Southern California mountains that lie alongside a river with magnificent views of mountain ridges and a waterfall to the north (Figure 24).



Figure 24: Aerial view of the project's site location and surrounding context

- Preliminary assumptions based on the single column approach design

A nine square grid system is used to organize the plan, the small horizontal space forces the program to be organized vertically generating a vertical dwelling. Each floor consists of the main stair at the center grid surrounded by rooms. The vertical core staircases alternately connect to the adjacent floors. In this way, horizontal/vertical relationship between space and stair is different between floors. Floating and lightness is assisted by the walls of each floor alternating between opaque and transparent (Figure 25).

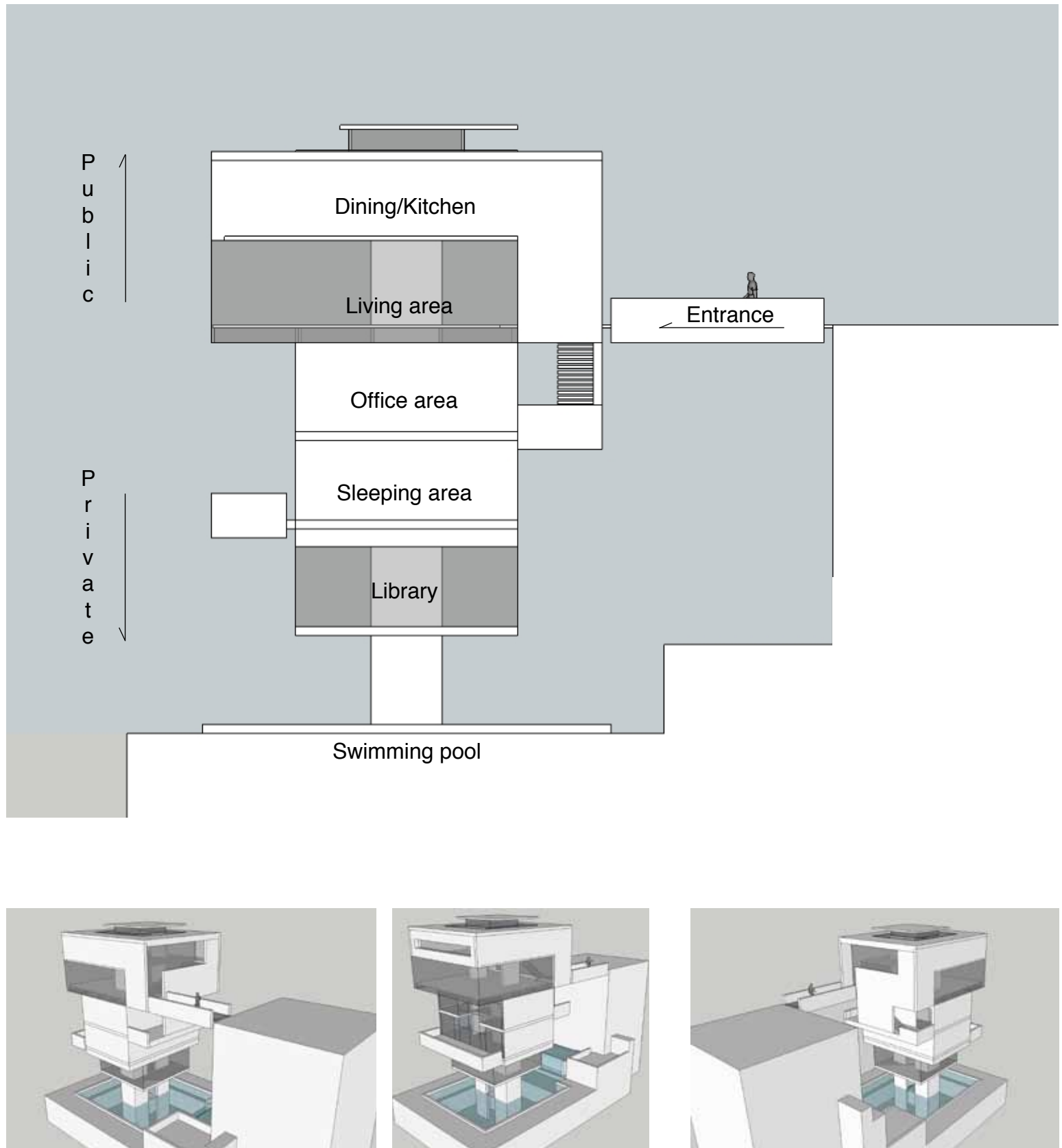


Figure 25: Digital model showing the bridge as the entrance that connects the cliff to the house

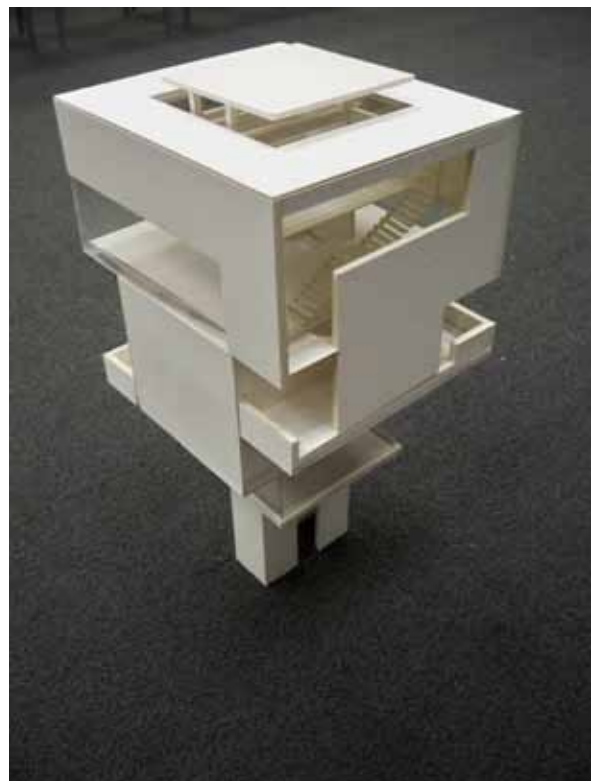
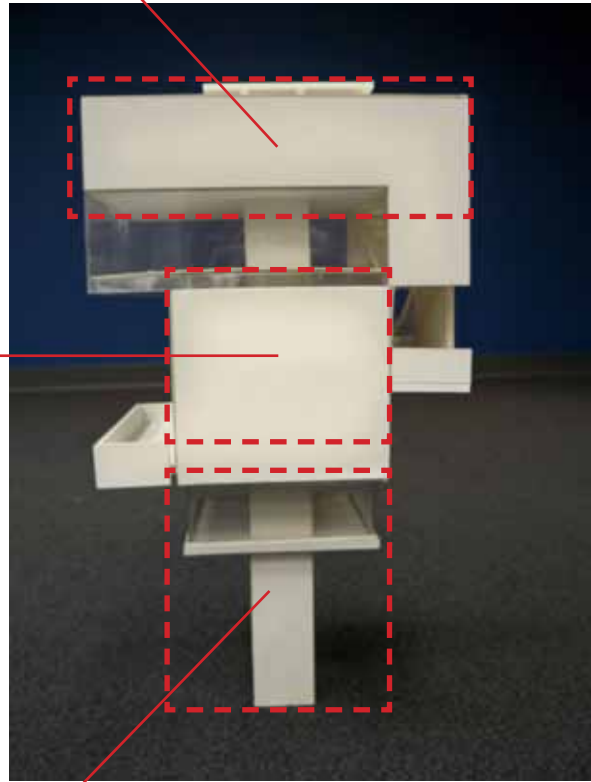
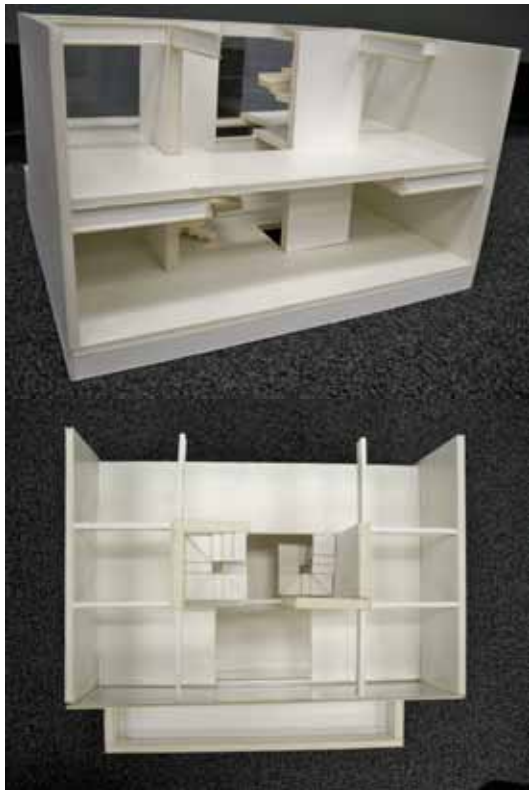


Figure 26: Structural model showing the double core concrete columns with steel structure supporting each floor of the house

Final iteration

With a restricted series of horizontal planes stacked on top of each other, the vertical perception of the space is impaired. A sixteen square grid system is used to replace the nine square grid system. A staircase runs along the shape of the square between inside and outside space. Each floor is further divided into multiple areas with the intention to blend floor levels together.

Building envelopes are divided into interlocking pieces over three axes to avoid shoebox spaces in a tower. The length of the wall columns is reduced as the columns step up to the top; and the depth of steel beams is reduced to its minimum. A supplementary suspension system on the sixth floor helps carry the triple height glass curtain facade (Figure 27).

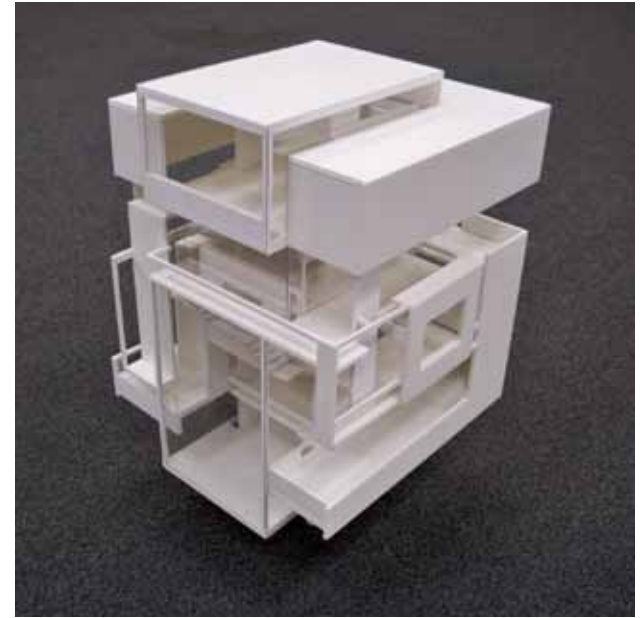
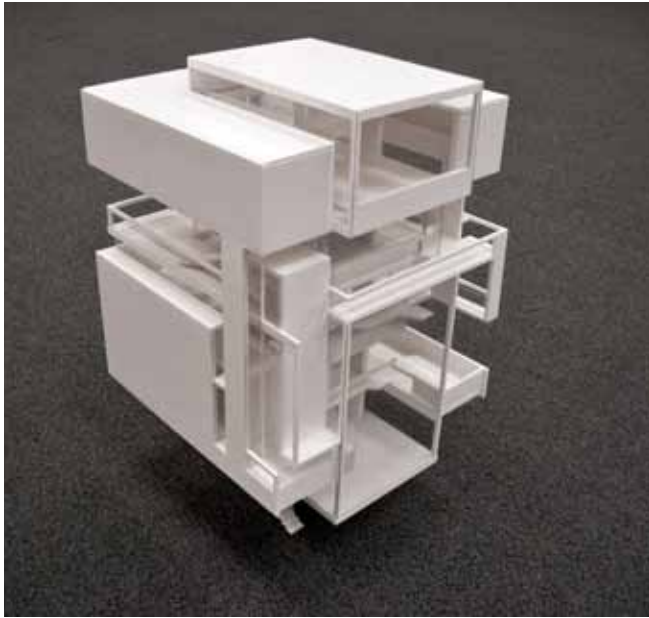


Figure 27: Physical model of the cliff house

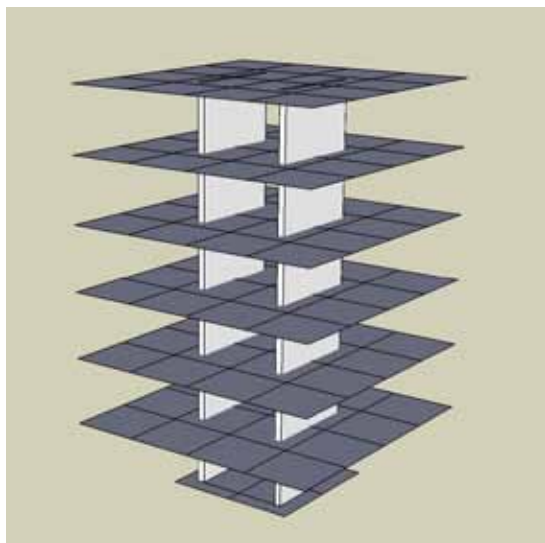


Figure 28: Column and floor structural essence

Two parallel wall columns are placed in the middle of the six stacking square-shape floor planes. The parallel walls set up a spiral alignment of steps climbing along the outer rectangular wall surface that reach all floor planes. These parallel wall columns divide the room into the inner space and the outer space. Each floor plane consists of sixteen square grids each of which has the dimension of 10'x10'x10' (Figure 28).

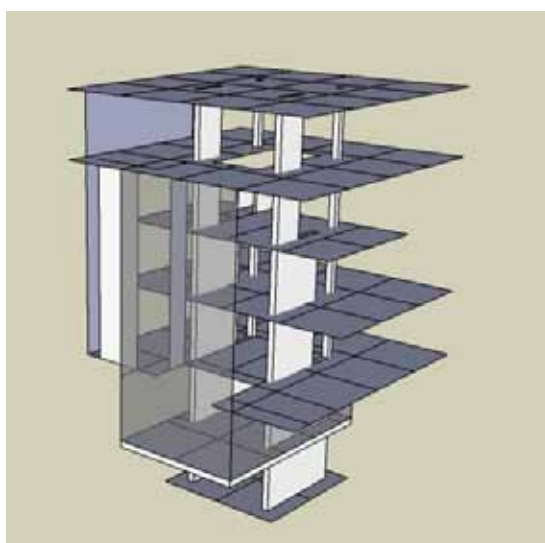


Figure 29: Spatial interlocking

The volume of both wall columns is progressively removed leaving only enough volume in order for the building loads to transfer safely to the ground. This is an attempt to achieve the lightness and floating visual effect on the house; whereas to maximize the usable space on the top floor. The front areas of the third, fourth, and fifth floor are deducted to allow a quadruple height vertical space to emerge. The obscurity of two axial volumes reduces the perception of dominating horizontal stacking floors in typical residential towers.

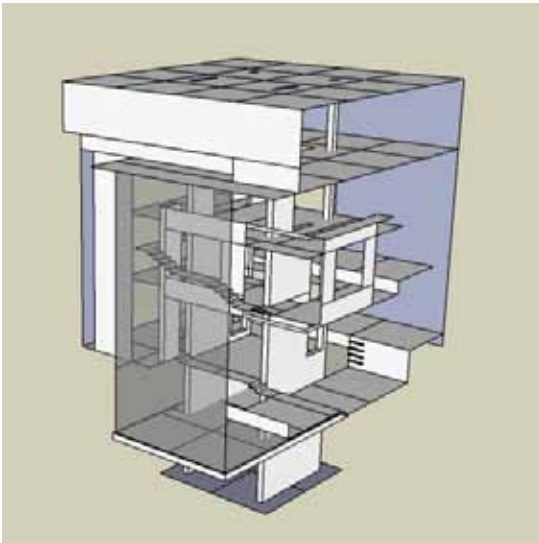


Figure 30: Interior envelope (north-west)

The central volume is further enclosed with two rectangular walls, facing north and west, with respect to the proportional square grid. This creates an effect of a floating room in the middle of the house. A square shape opening is cut on both walls to allow view. Diagonal steps are attached to the outer side of the north wall. This gives a walking path that offers motional experience in verticality on the northern chamber (Figure 30).

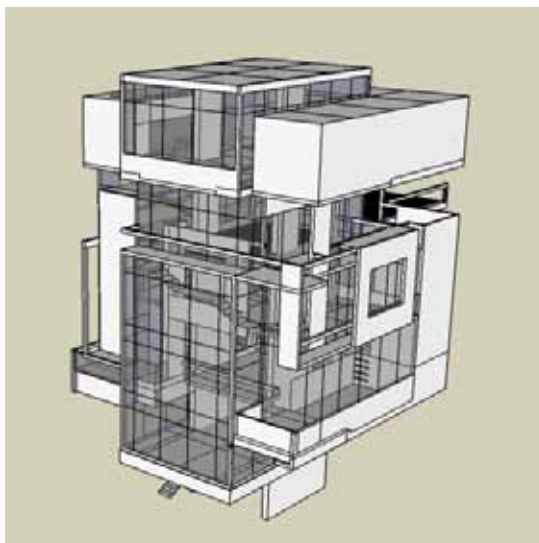


Figure 31: Exterior envelope (north-west)

The inner volume of the house is glazed with clear glass panes. The solid exterior envelope is offset in and out to create illusional perception of multi layers of incomplete envelopes generating a dynamic volume effect to the house. The identity of railing and framing profile of glazing panels helps blend building components and form the spatial relationship between exterior and interior volumes. The connection of horizontal railings to isolated walls generates an illusion of structural relationship around the entire volume of the house (Figure 31).

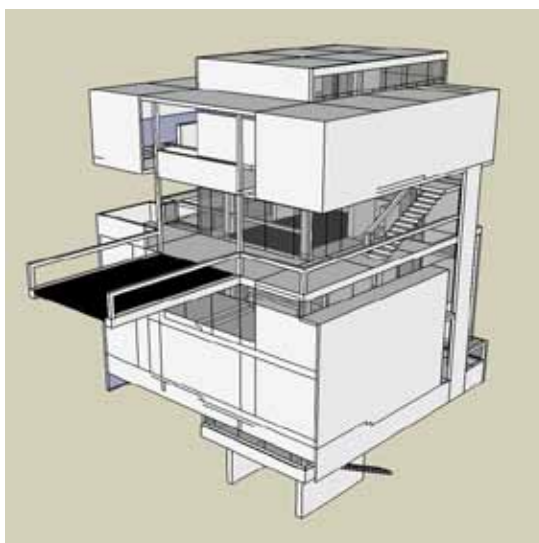


Figure 32: Exterior envelope (south-east)

On the south, there is a bridge connecting the house to the cliff which makes the main entrance. As one enters from the bridge to the covered terrace on the fourth floor, the set back clear glazing walls generates a perception of the floating effect to the volume above (Figure 32).



Figure 33: The earlier design of the house looking at the waterfall



Figure 34: The earlier design of the house showing a walkway path to the river below



Figure 35: Aerial view of the site property showing road access

The next goal was to further define the vertical house in a profound level. Each main room function, therefore, needs to demonstrate the nature of vertical living. Unique spatial arrangements were tested for the bathrooms, the bedrooms, the living room, and the kitchen.

The bathroom's concept

A double height bathroom with a cantilevering shower platform receives natural light from a tall window located next to the shower with a skylight above (Figure 36). The space below the shower platform provides for a bathtub (Figure 38). The tall vertical wall operates as a cascade where water runs along the textured surface (Figure 39).

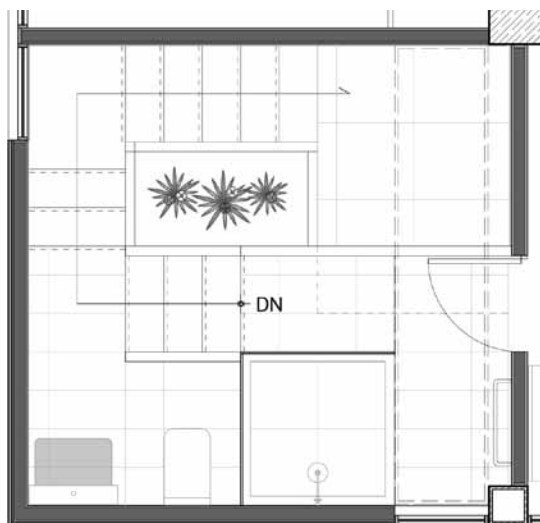


Figure 36: Plan of the parent's bathroom on the upper level

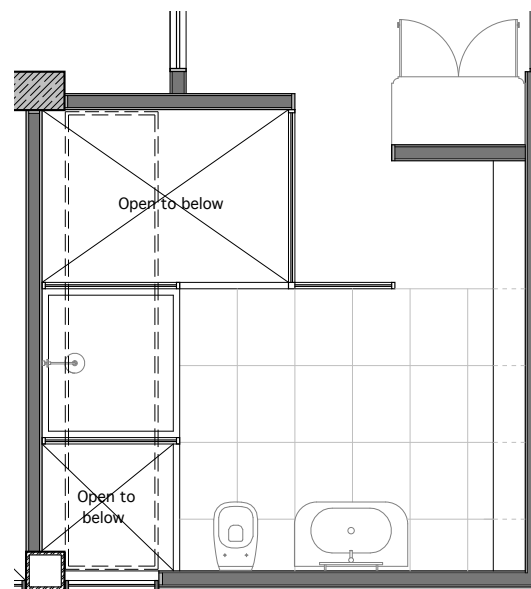


Figure 37: Plan of the children's bathroom on the upper level

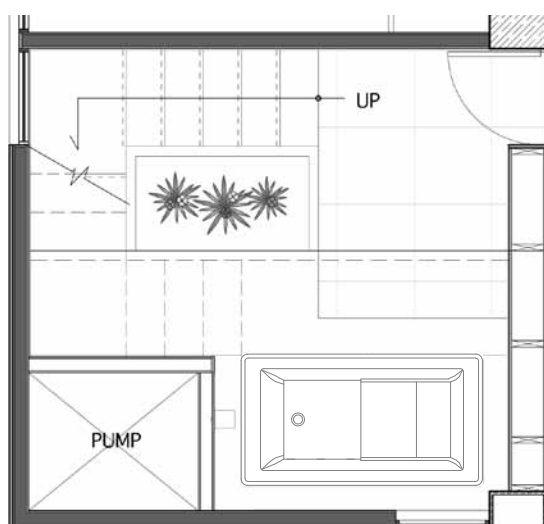
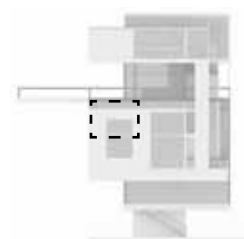
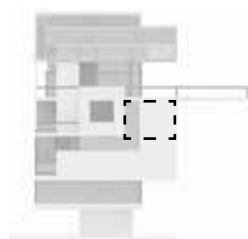


Figure 38: Plan of the parent's bathroom on the lower level

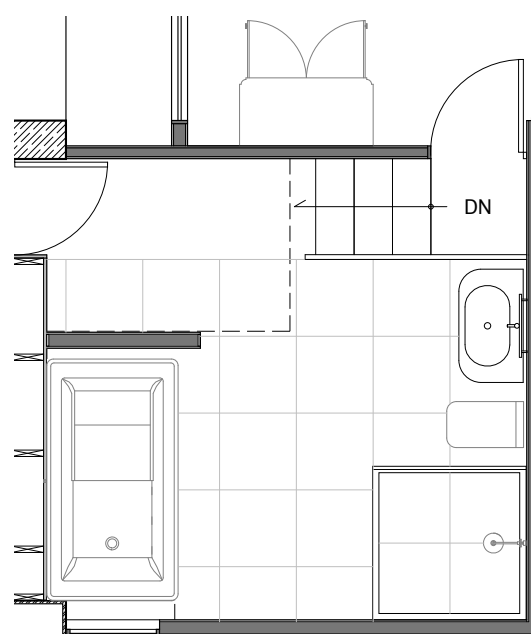
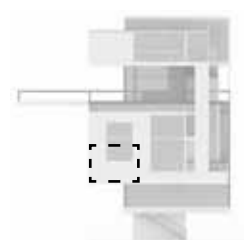
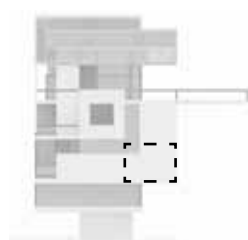


Figure 39: Plan of the children's bathroom on the lower level



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The proposal overall demands perhaps too much circulation space and also takes away some privacy inside the house.

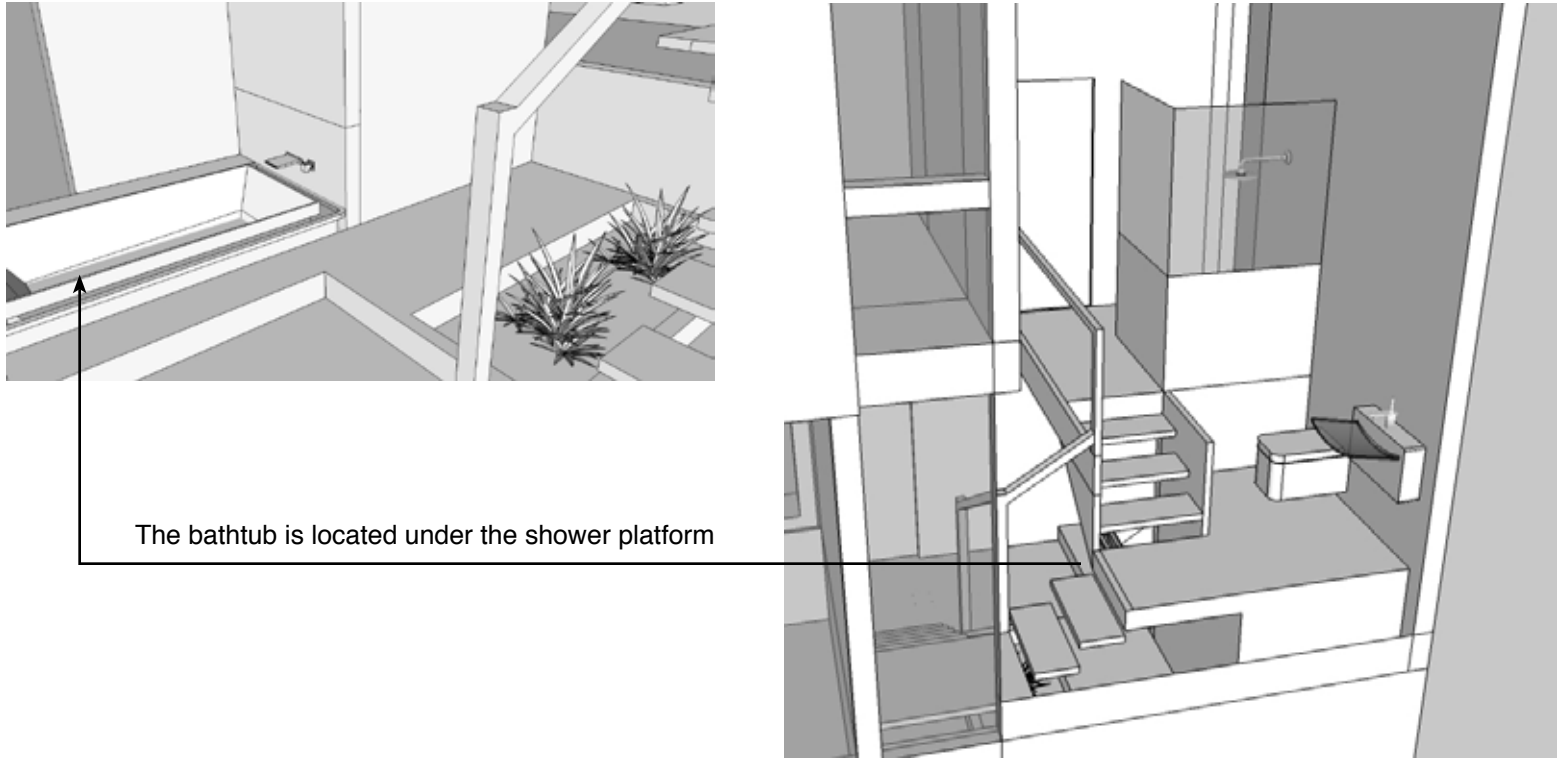


Figure 40: Parent's bathroom in perspective showing the double height bathroom idea

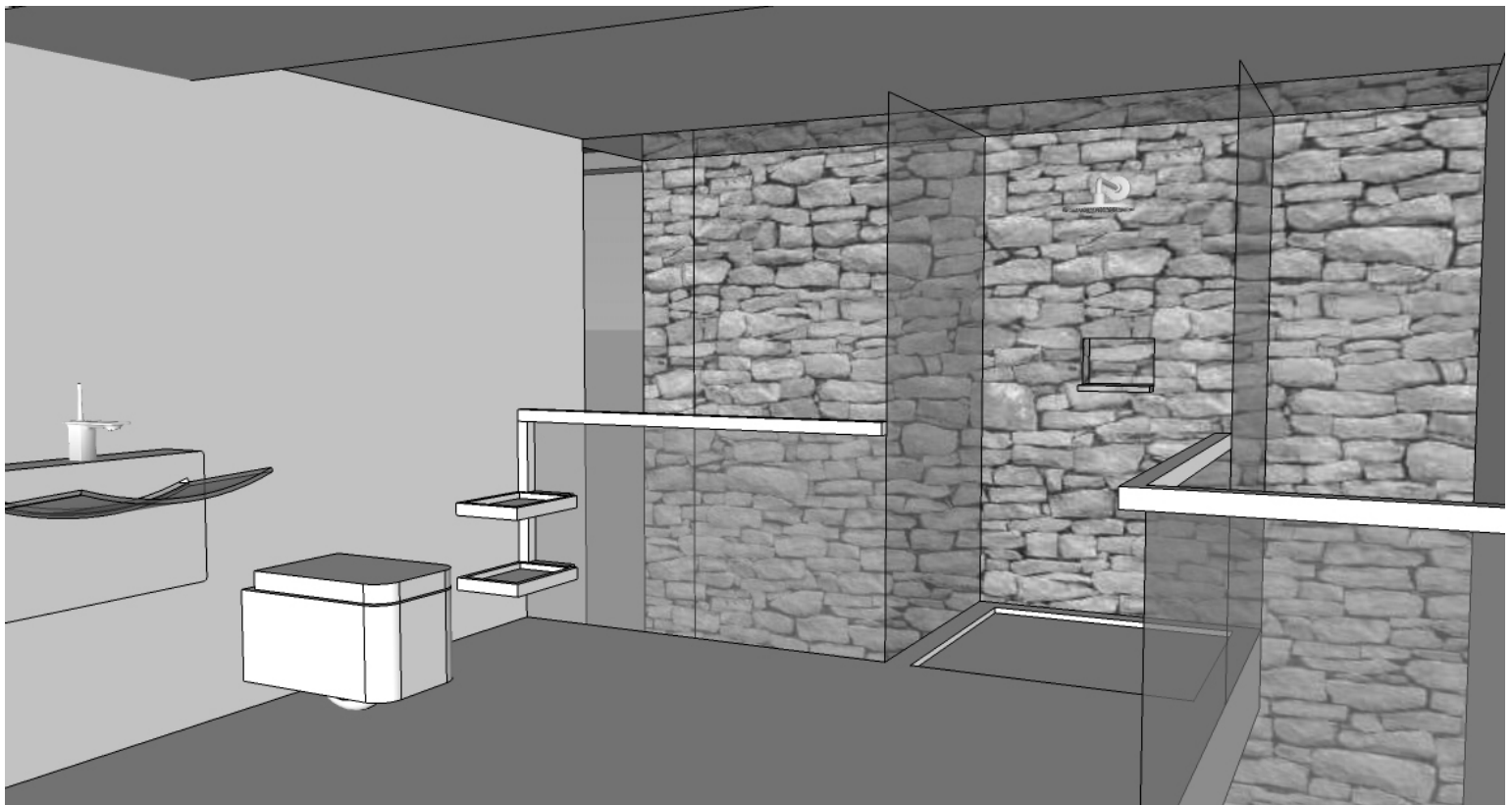


Figure 41: Children's bathroom showing the cantilevering shower platform

The bedroom concept

The main bedroom is located on a mezzanine level between the third and the fourth floor and has a view, at the south side, onto the cliff under the bridge entrance. The location allows the view through the ground level on the north side without being seen from any other room. In this proposal, both parent and children's bedrooms are too small as much of volume is claimed by the vertical bathroom arrangements, the size of the bathroom is increased in the proposal below (Figure 42-44).

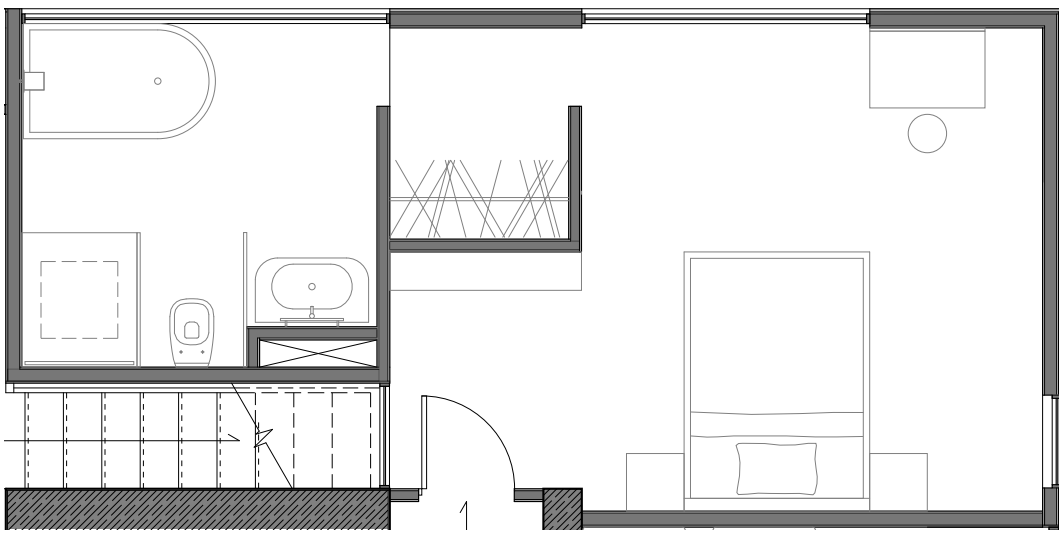


Figure 42:
Plan of the Children's bedroom (1)

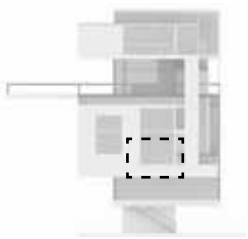


Figure 43:
Plan of the Parent's bedroom

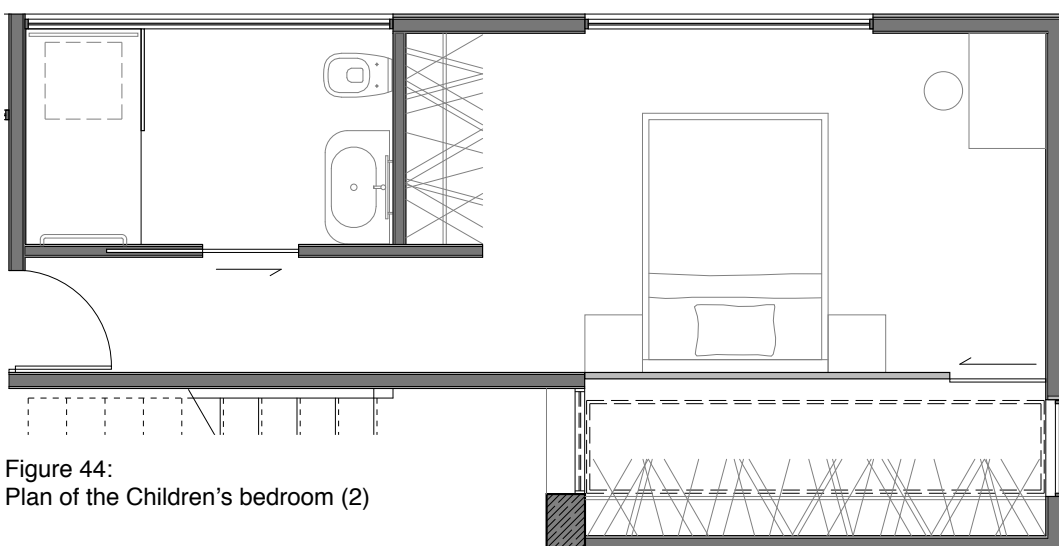
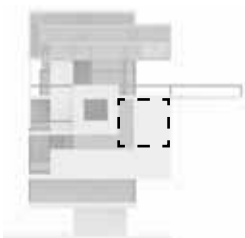
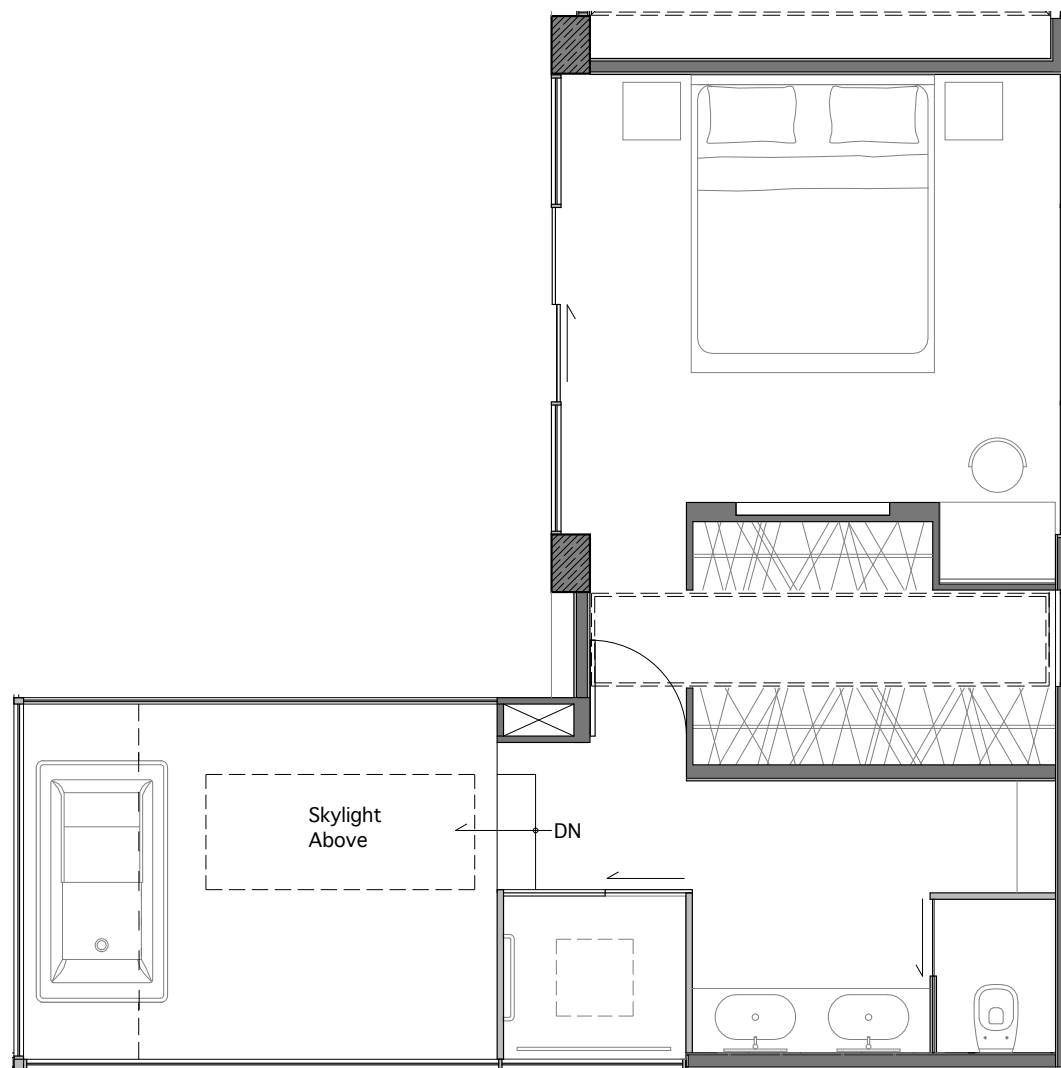
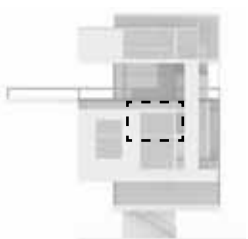


Figure 44:
Plan of the Children's bedroom (2)



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The living room

The floor of this room was initially conceived as an array of wooden beams spaced two inches apart almost as a permeable surface in the volume of the house (Figure 45).

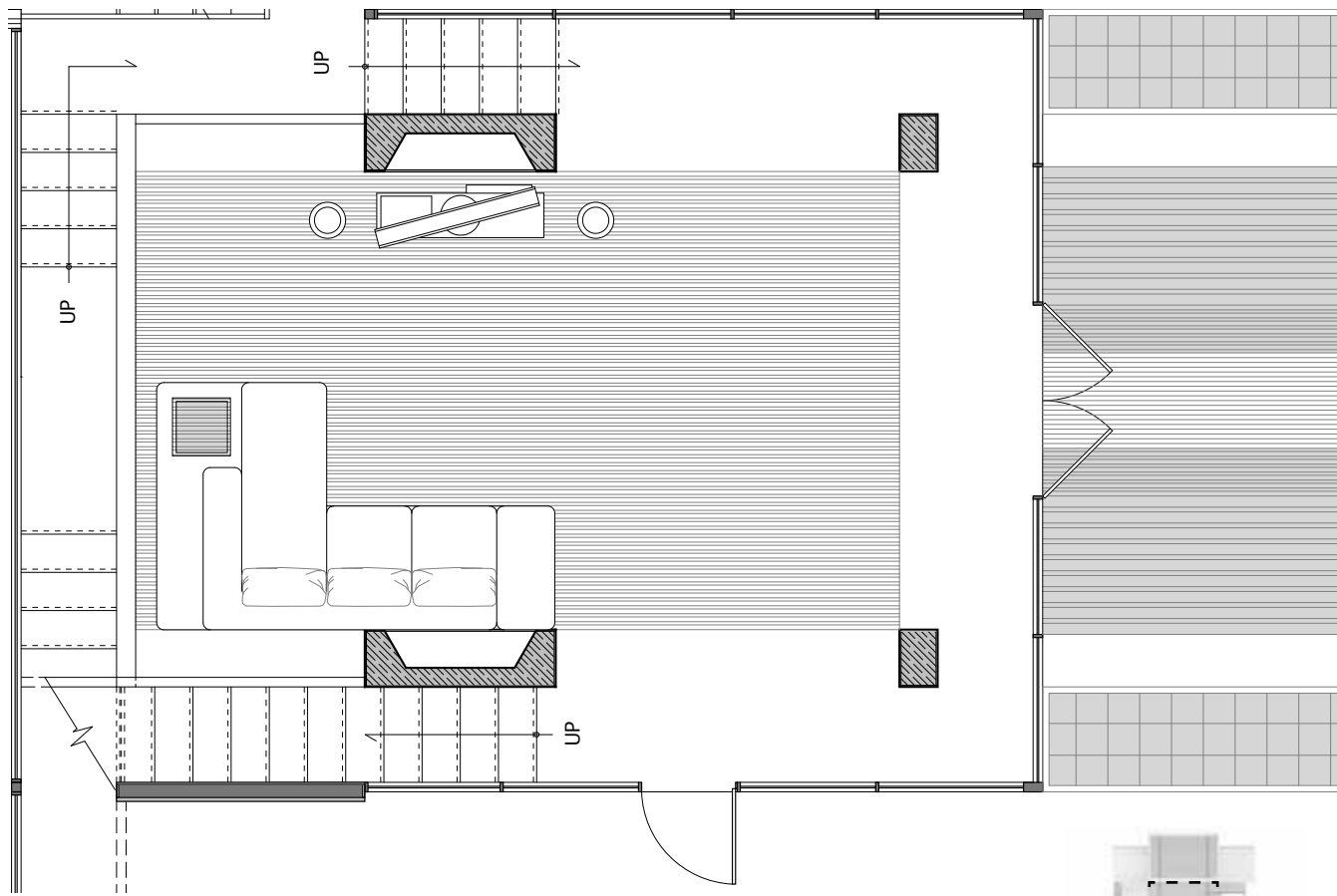


Figure 45: Plan of the initial living room

A series of clear plexiglass strips as infill is perhaps a possibility to preserve semi transparency. The continuation of the pattern to the bridge suggests a continuity from inside to outside (Figure 46).

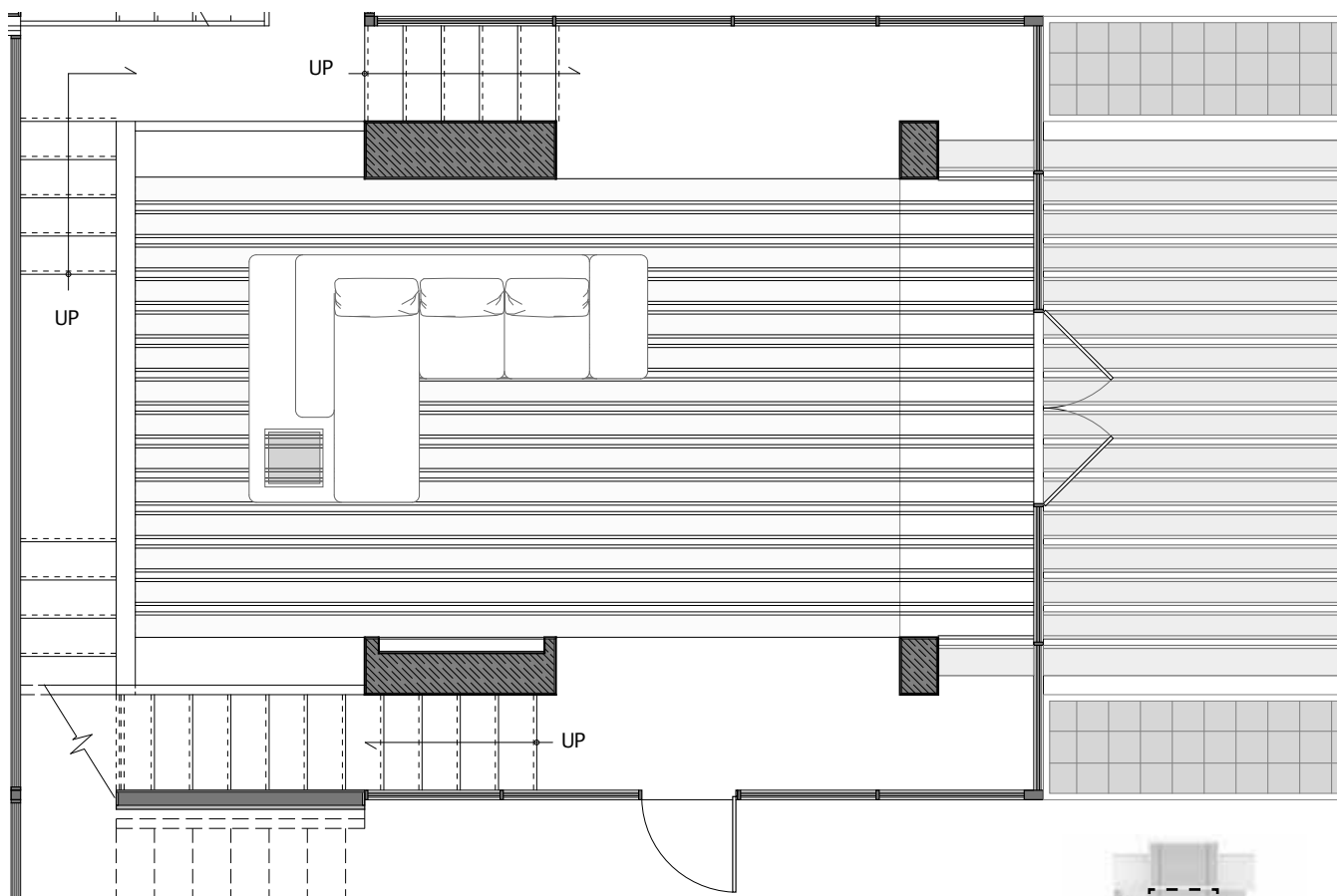


Figure 46: Plan of the living room



SCALE 0 2 5 10 FEET

The kitchen

The kitchen and dining room are located on the top level. It is the largest floor plate in the house as the columns have the smallest structural cross-section at the top. The low profile kitchen counters are a bar area along the west glass facade serves as a breakfast area with an unobstructed view (Figure 47).

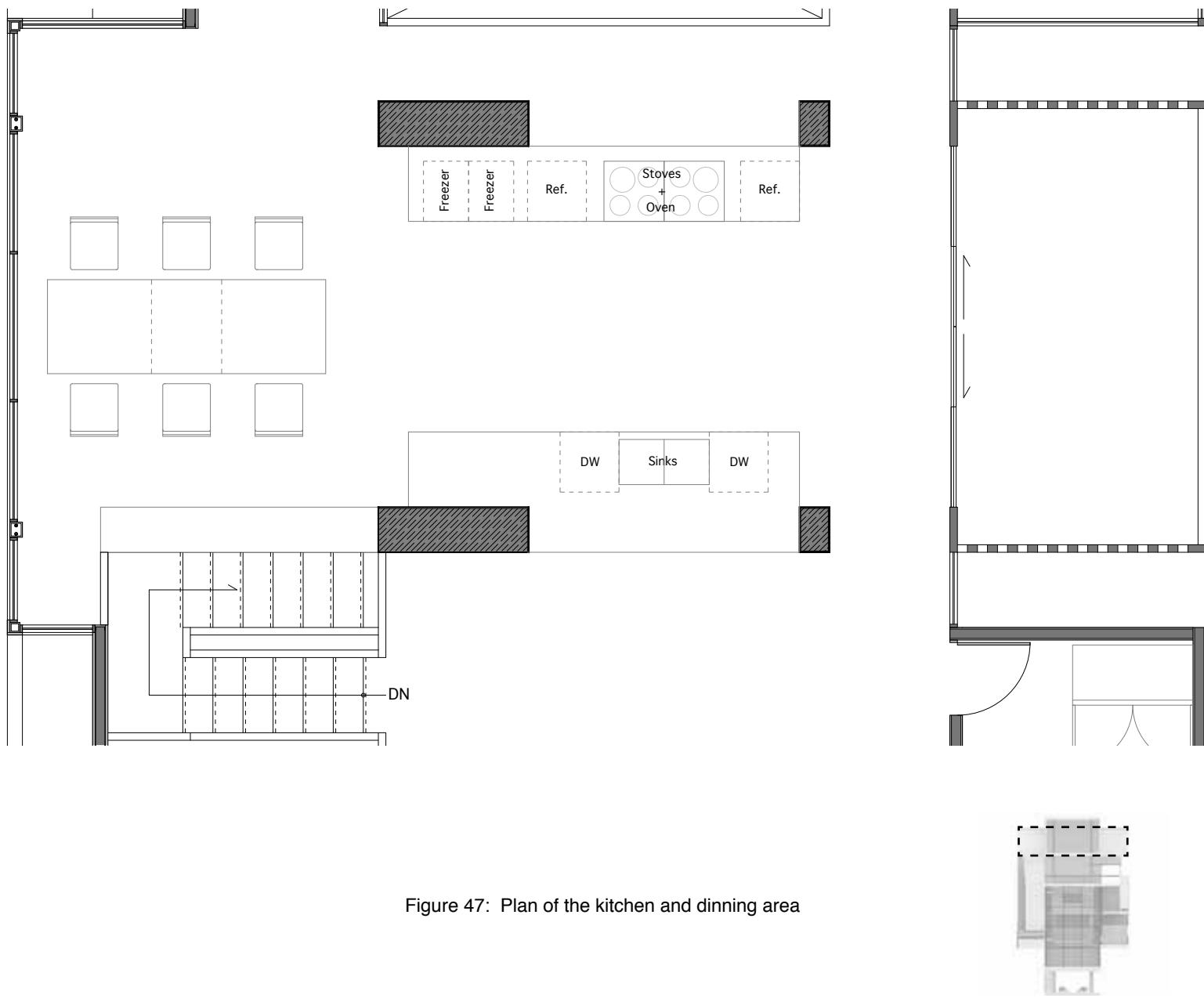


Figure 47: Plan of the kitchen and dining area



SCALE 0 2 5 10 FEET

- The square grid system

Both the area and proportion of the house are organized using the square grid system. A 16-square grid is used to arrange floor plans and a 36-square grid is used for the building to manage the house's vertical proportion.

A floor plan is divided into three parts; the inner space, the vertical circulation space, and the outer space (Figure 48).

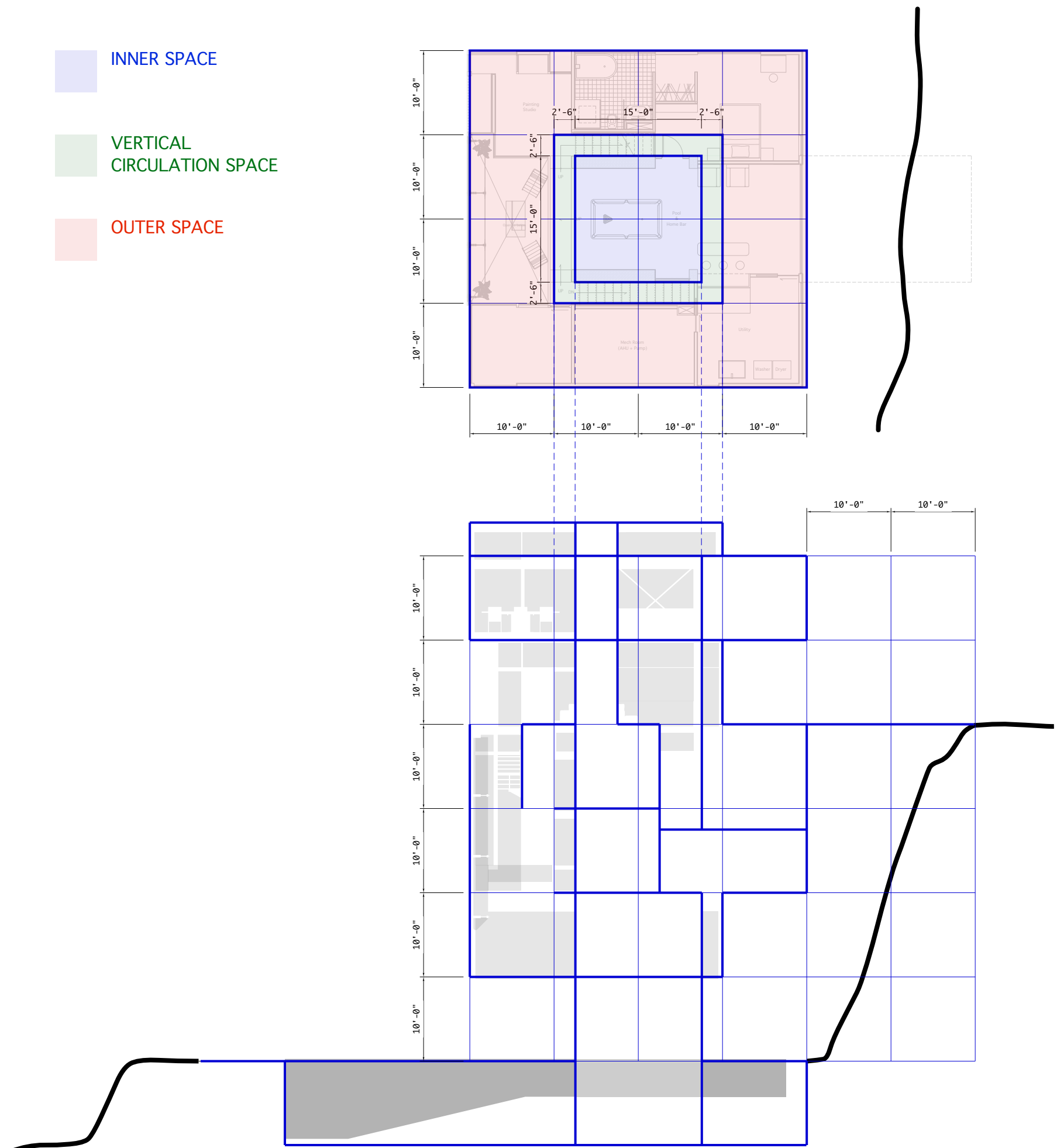


Figure 48: TOP: A diagram showing an alignment of the 16-square grid system onto a plan
 BOTTOM: A diagram showing an alignment of the 36-square grid system onto a section

- Structure

Cantilevered light gauge steel beams along coordinating grids support the load of walls and floors which in turn transfer to the two reinforced concrete wall columns and into the ground. The cross-section of the columns is reduced as the columns step up to the top and the depth of steel beams is reduced to its minimum. The triple height north glazing wall is suspended by two sets of double cable connecting the facade to the cantilevered steel beams on the top floor (Figure 49).

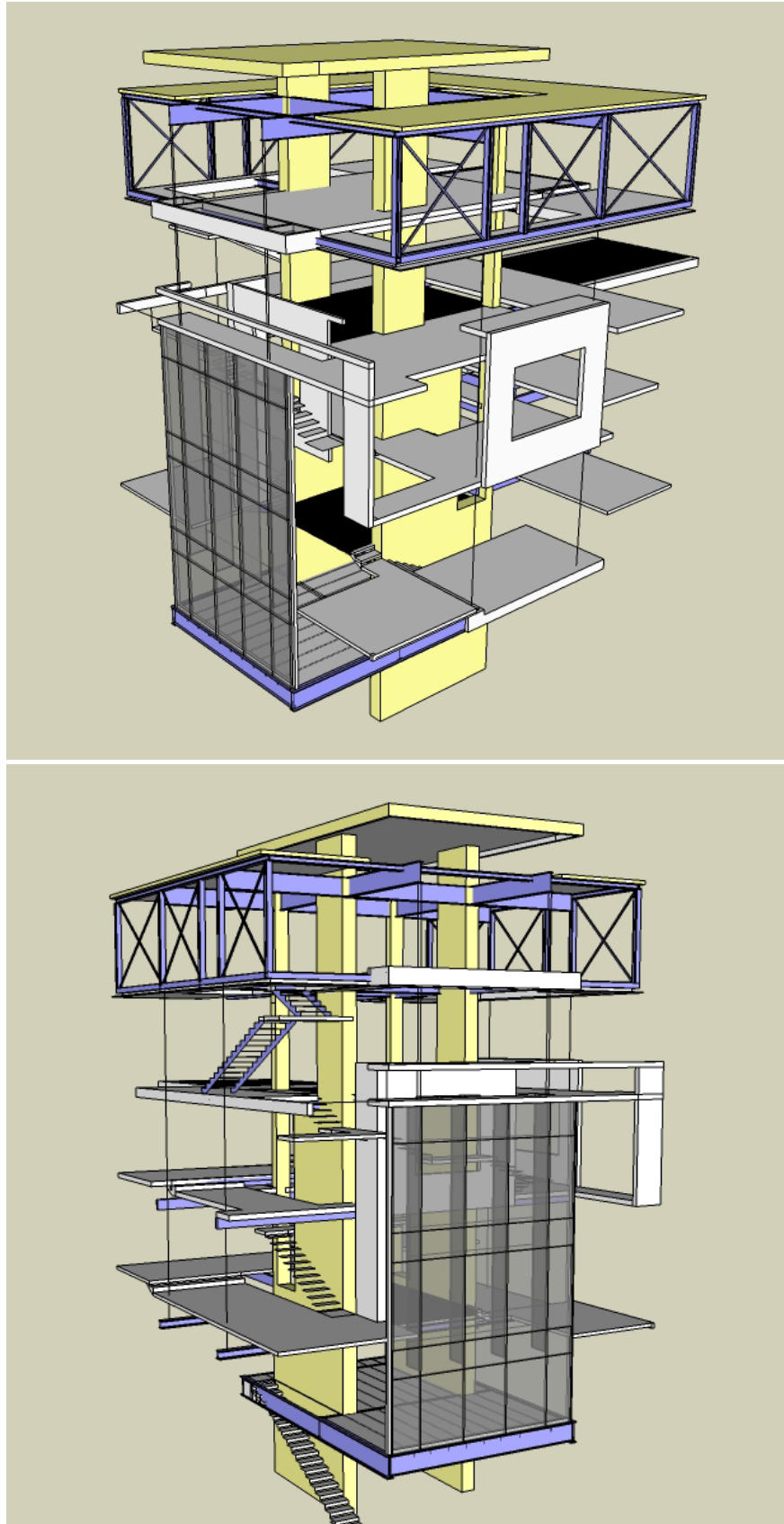


Figure 49: An illustration of reinforced concrete columns and steel beams

Yellow mass indicates main columns and roof slab
Blue mass indicates steel trusses and beams
Grey mass indicates floor planes
Transparent mass indicates suspended glazing wall

- Air flow

Operable windows are placed on the north and south glazing area to allow natural air to flow through each floor. The triple height north facade has a horizontal array of operable windows placed on the lowest and highest level of the glazing to create a counter clock-wise air loop where the air runs from the bottom floor upward passing the floating staircase in the chamber out through the top windows. This upward air flow allows the stair climber in this chamber to experience walking high in the sky, another way to promote verticality of experience inside the house. Such perception dissolves the threshold between the interior and the exterior of the house which supports the all-side visual connection between the outdoor nature and the house. The south windows on the library floor generate extra negative air pressure that helps pulling the air in for a stronger air loop (Figure 50).

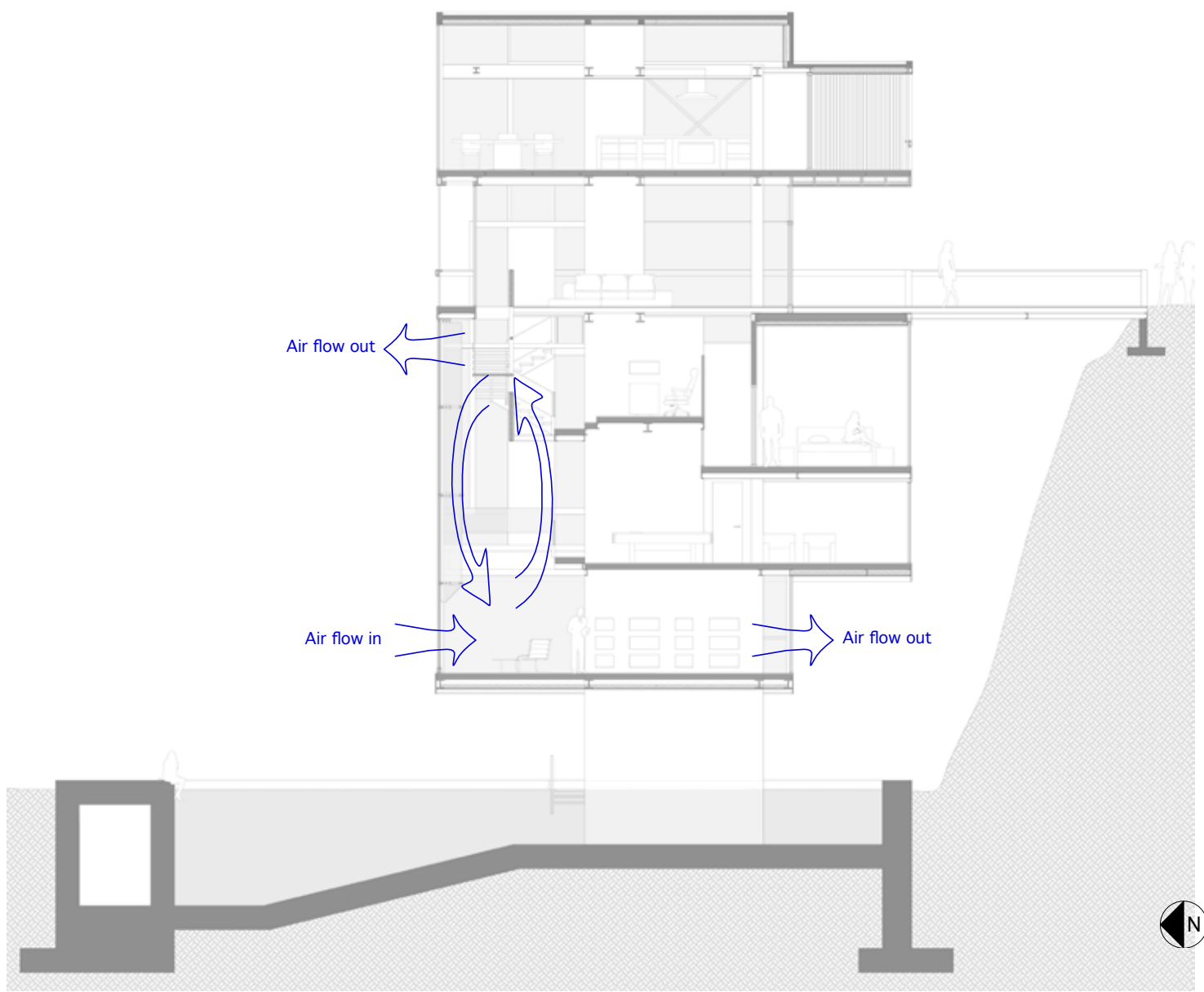


Figure 50: Diagram of the air flow in the triple height chamber at the north facade

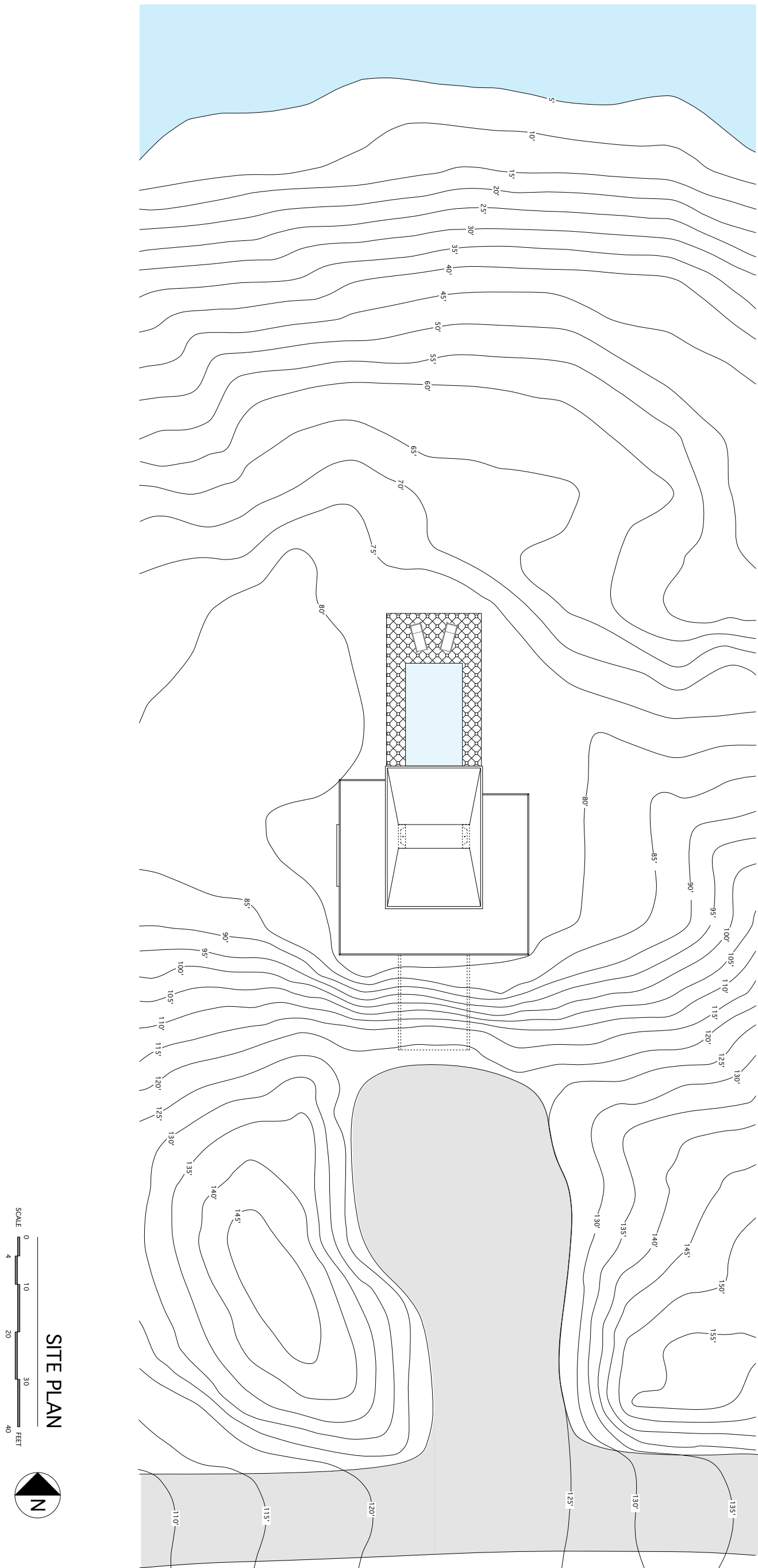
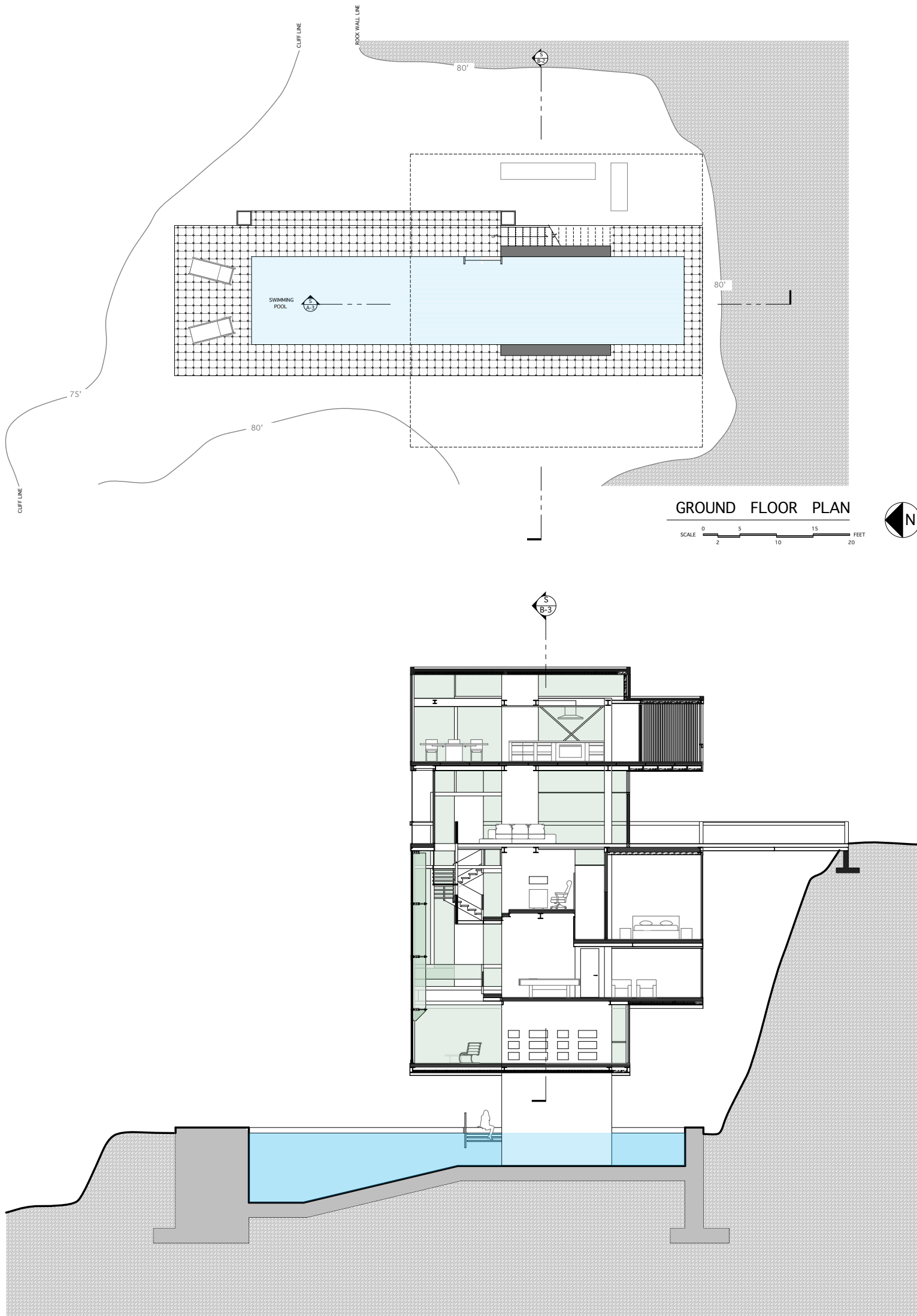
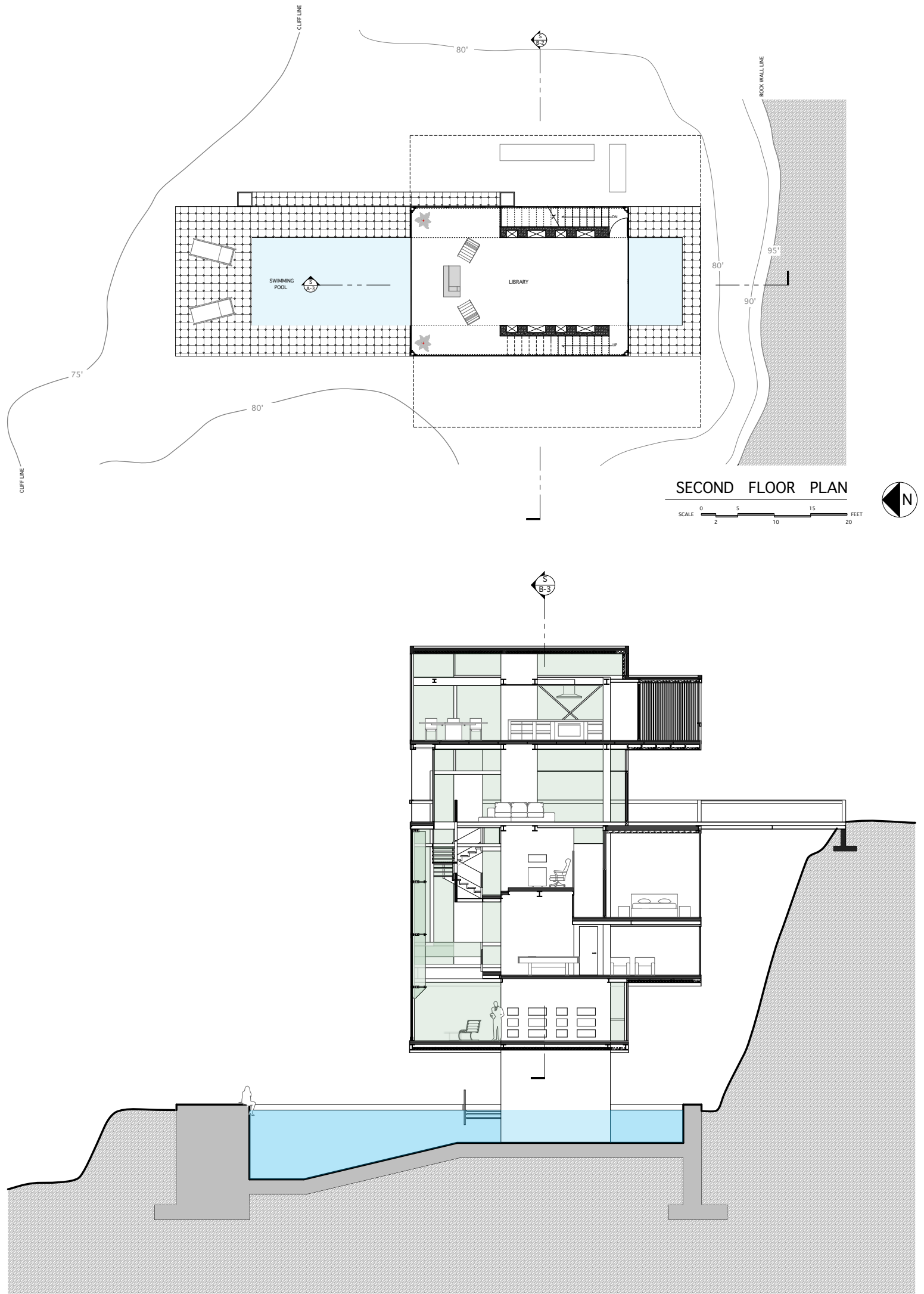


Figure 51: Drawing of the site plan



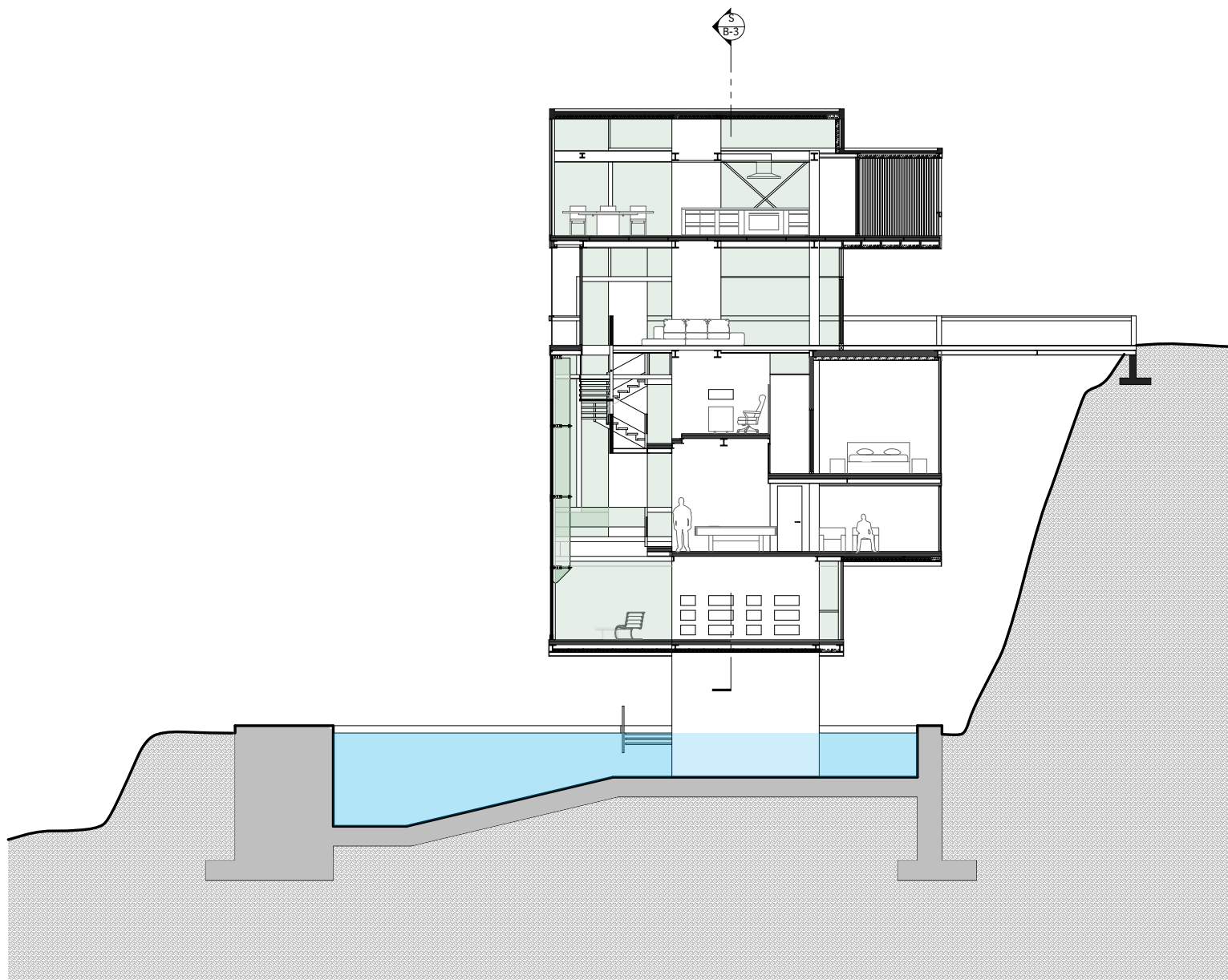
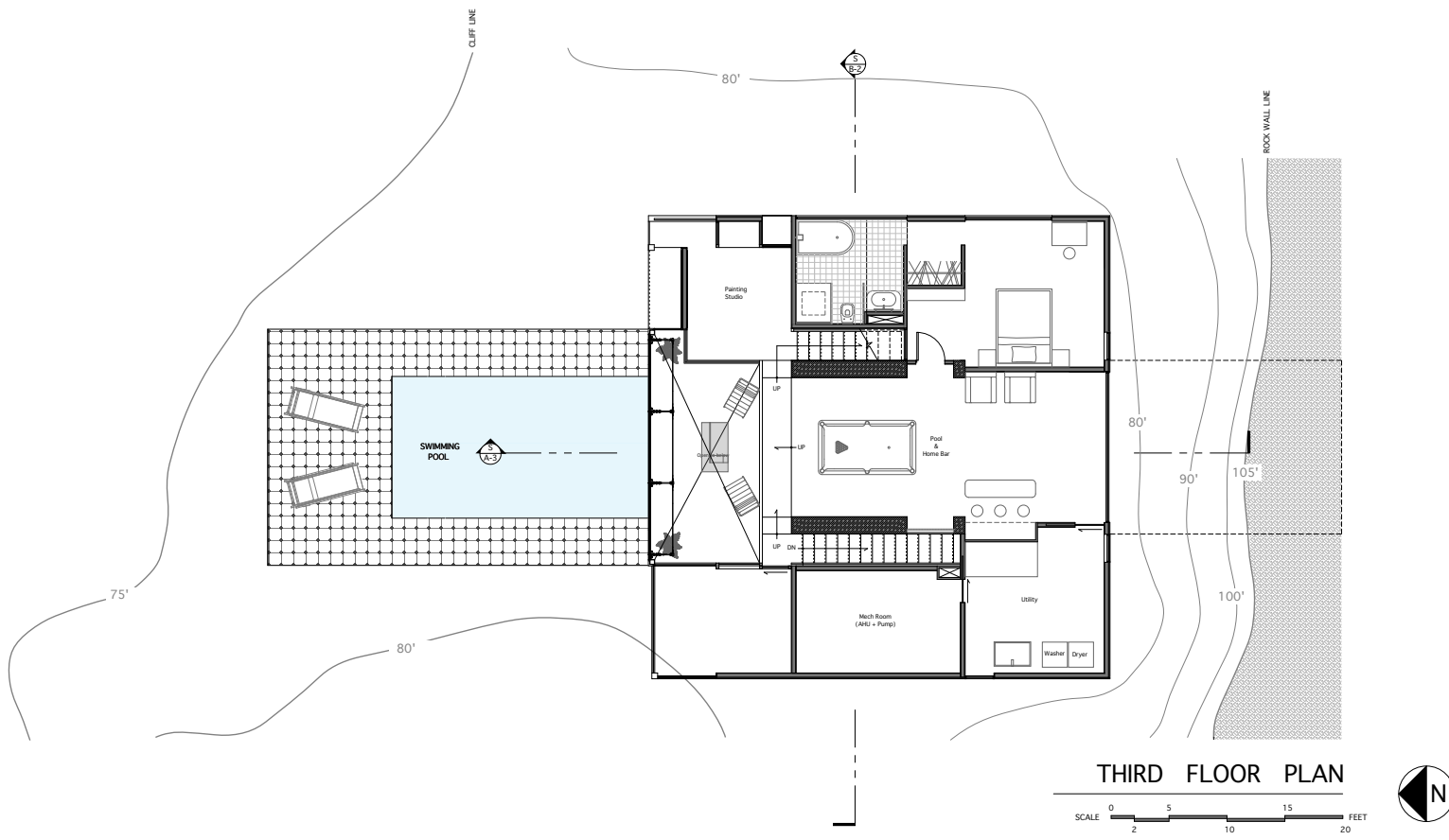
SECTION A-3

Figure 52: Ground floor plan and section



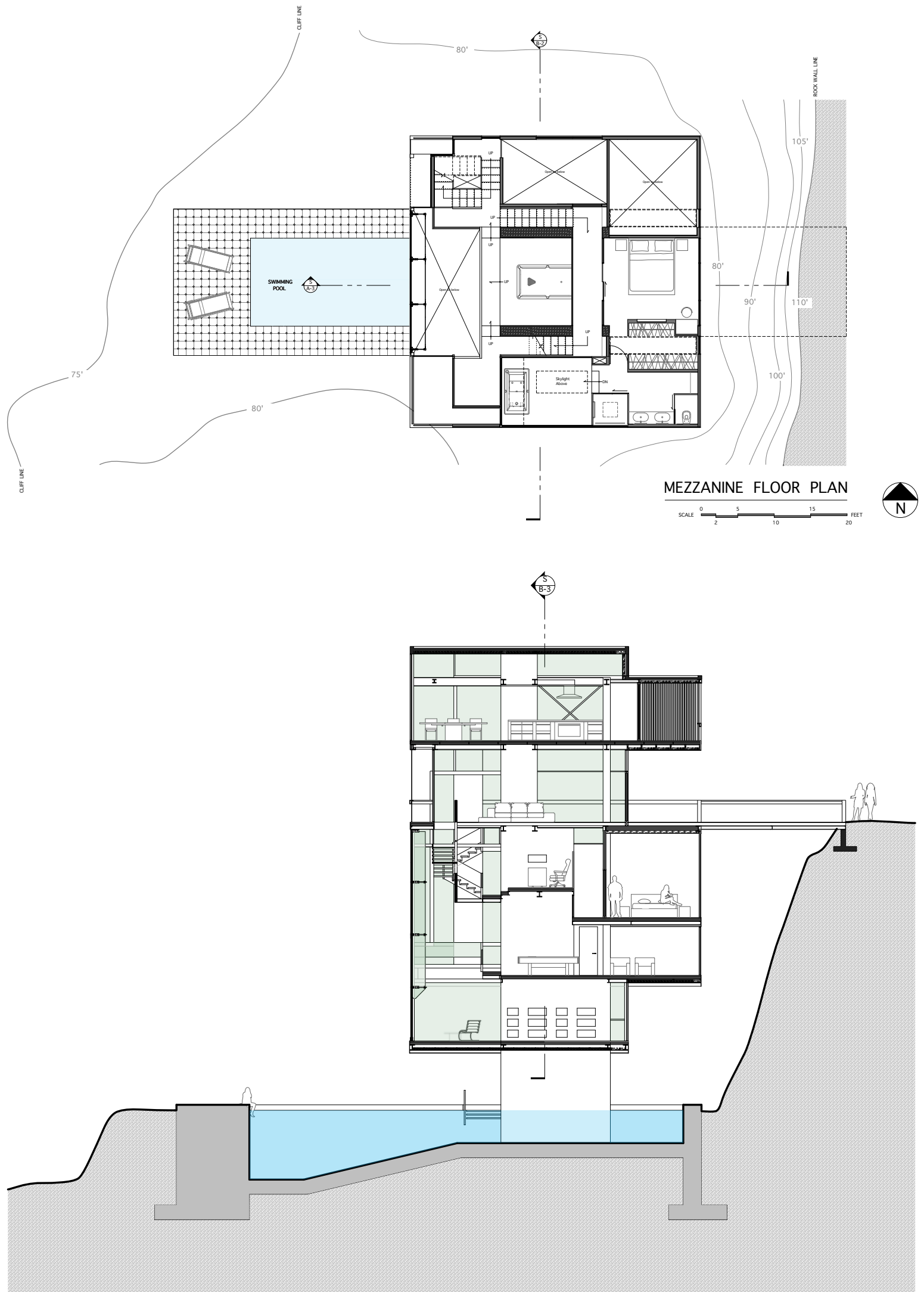
SECTION A-3

Figure 53: Second floor plan and section



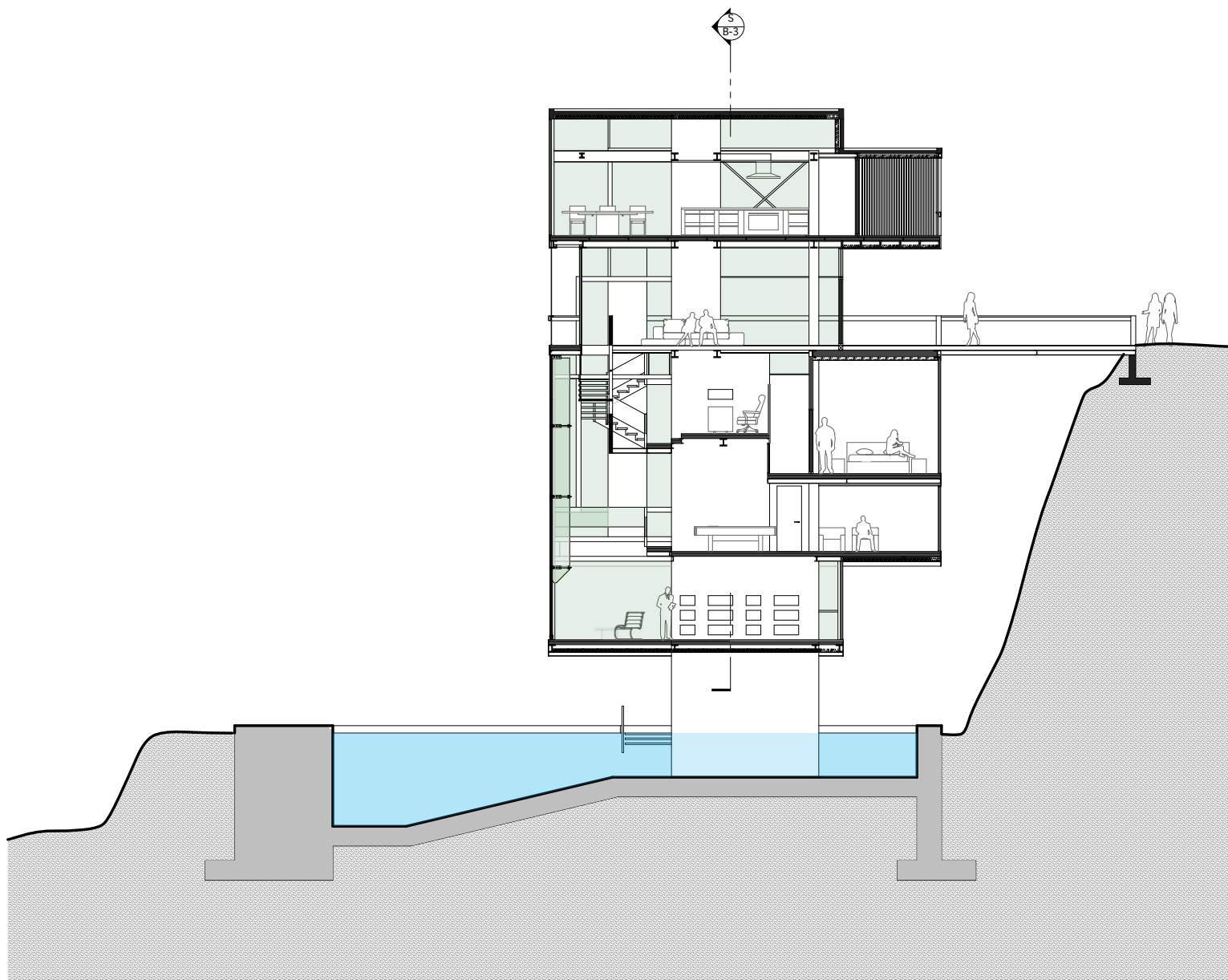
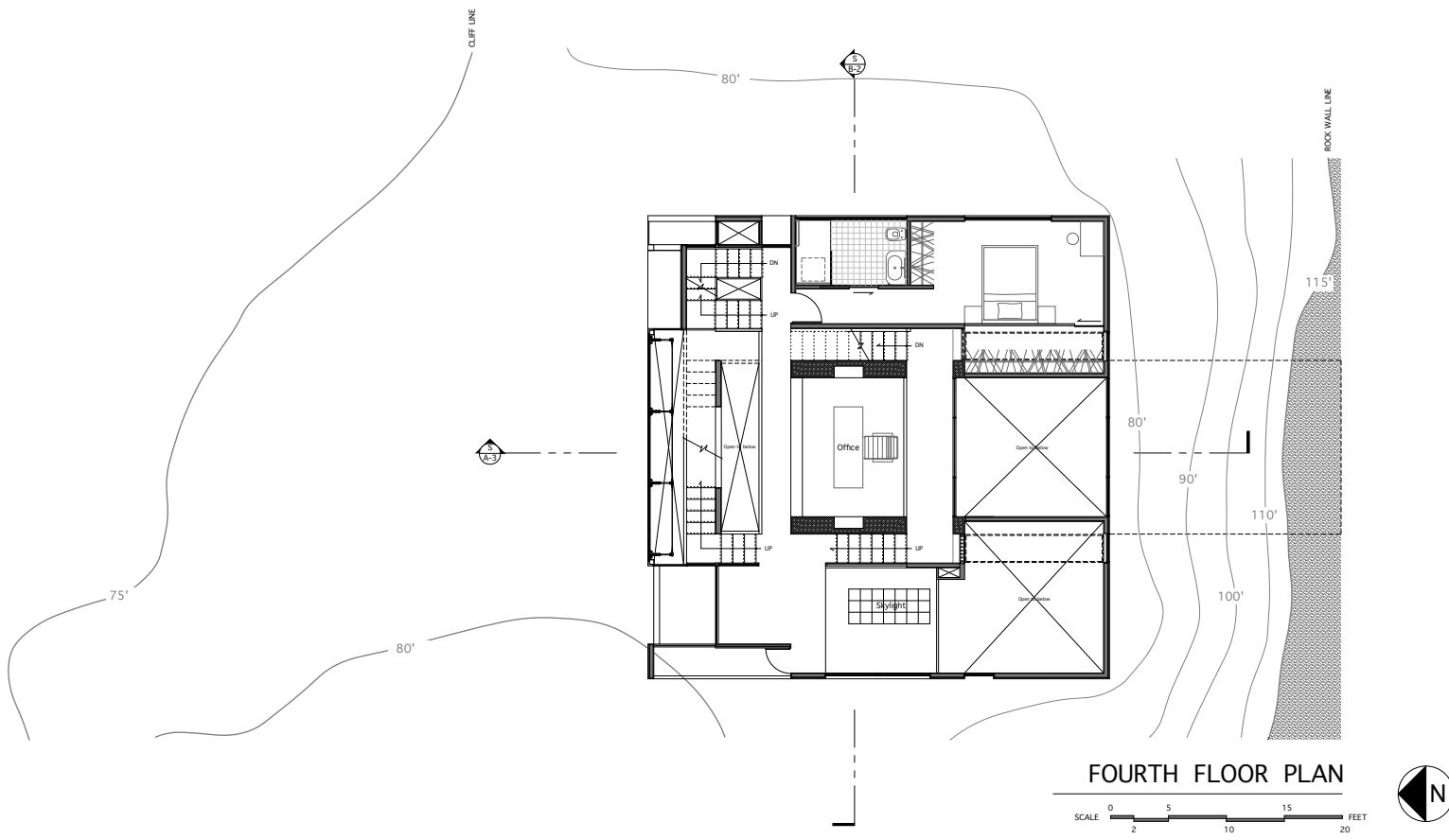
SECTION A-3

Figure 54: Third floor plan and section



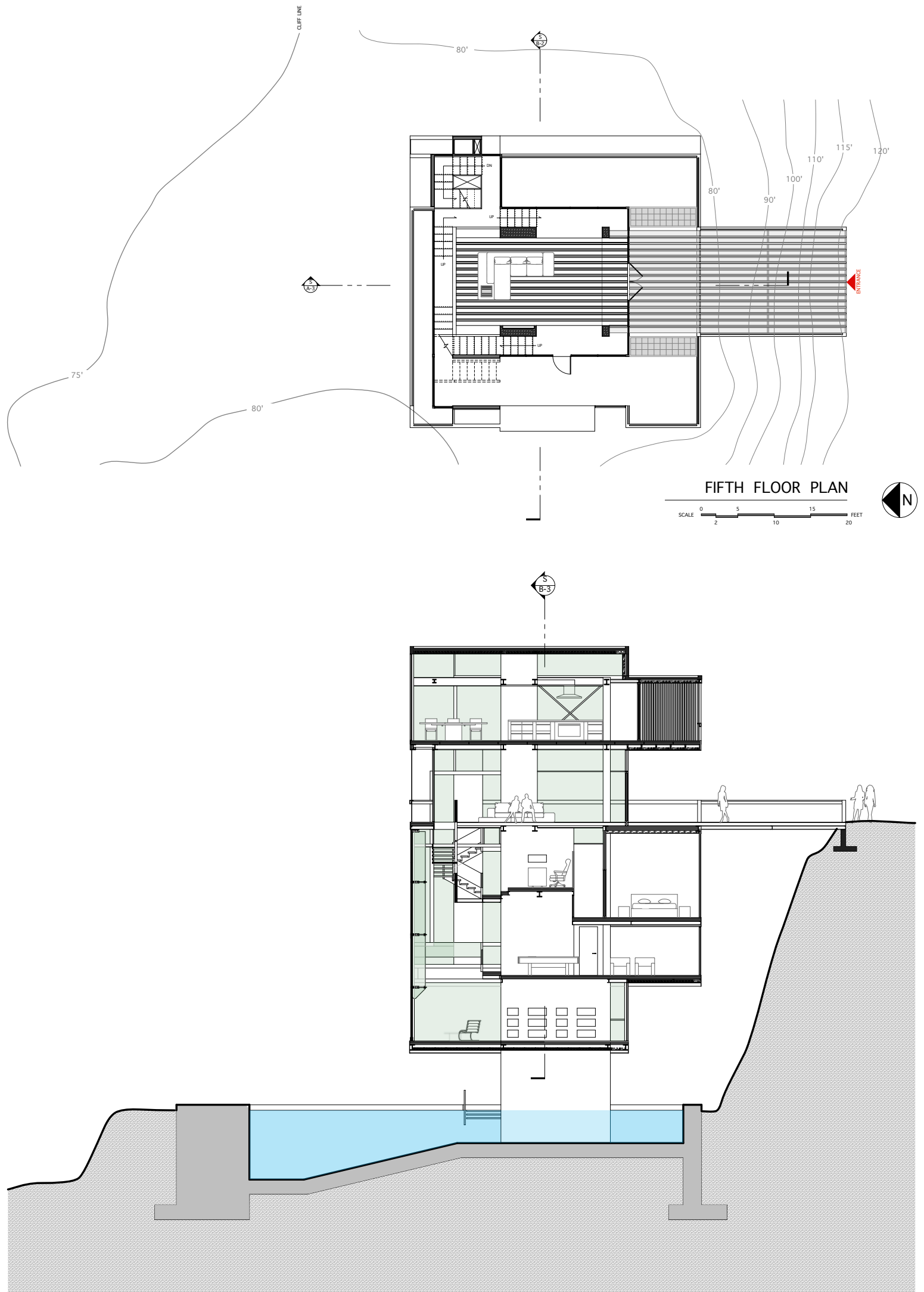
SECTION A-3

Figure 55: Mazzanine floor plan and section



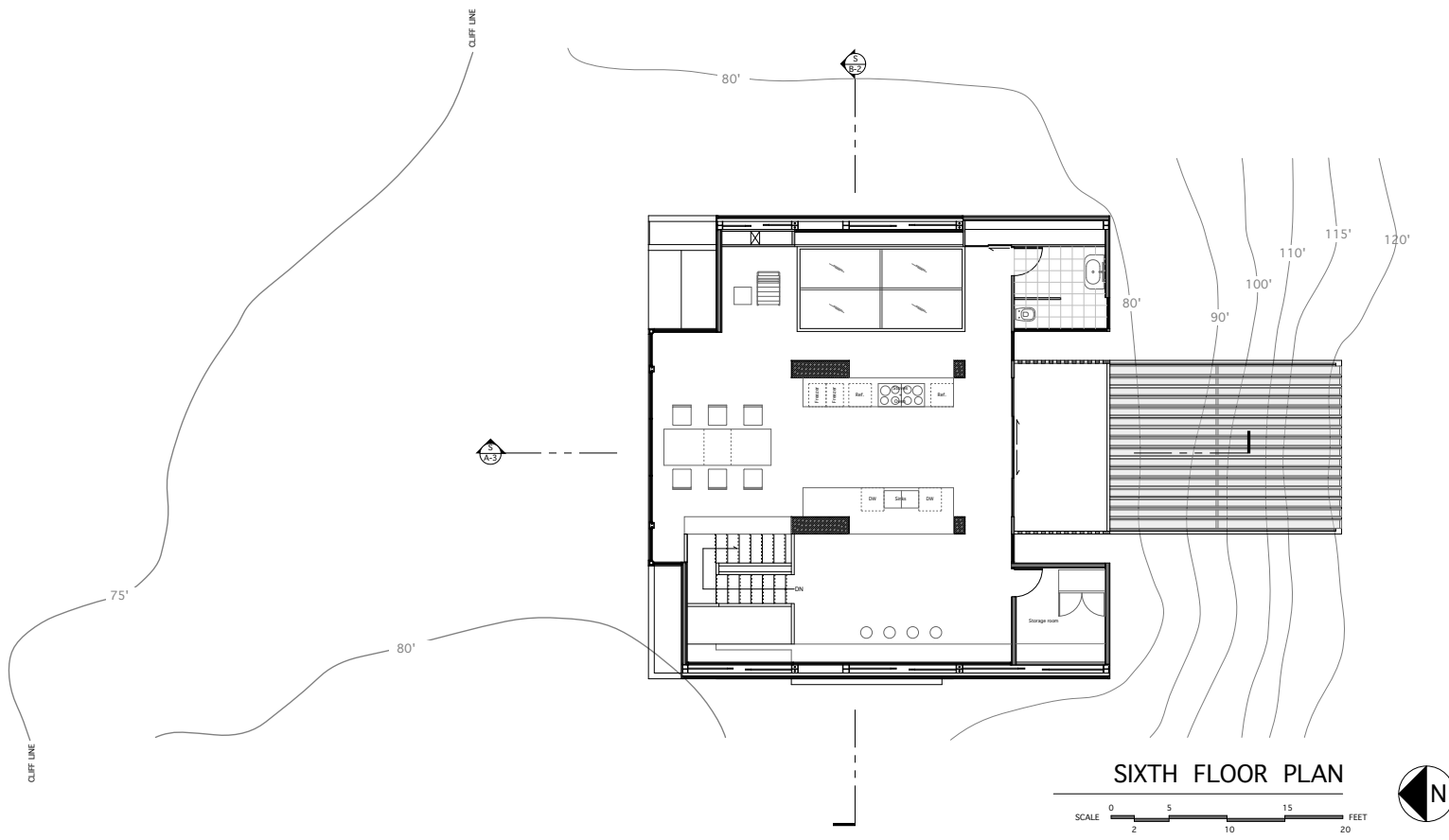
SECTION A-3

Figure 56: Fourth floor plan and section



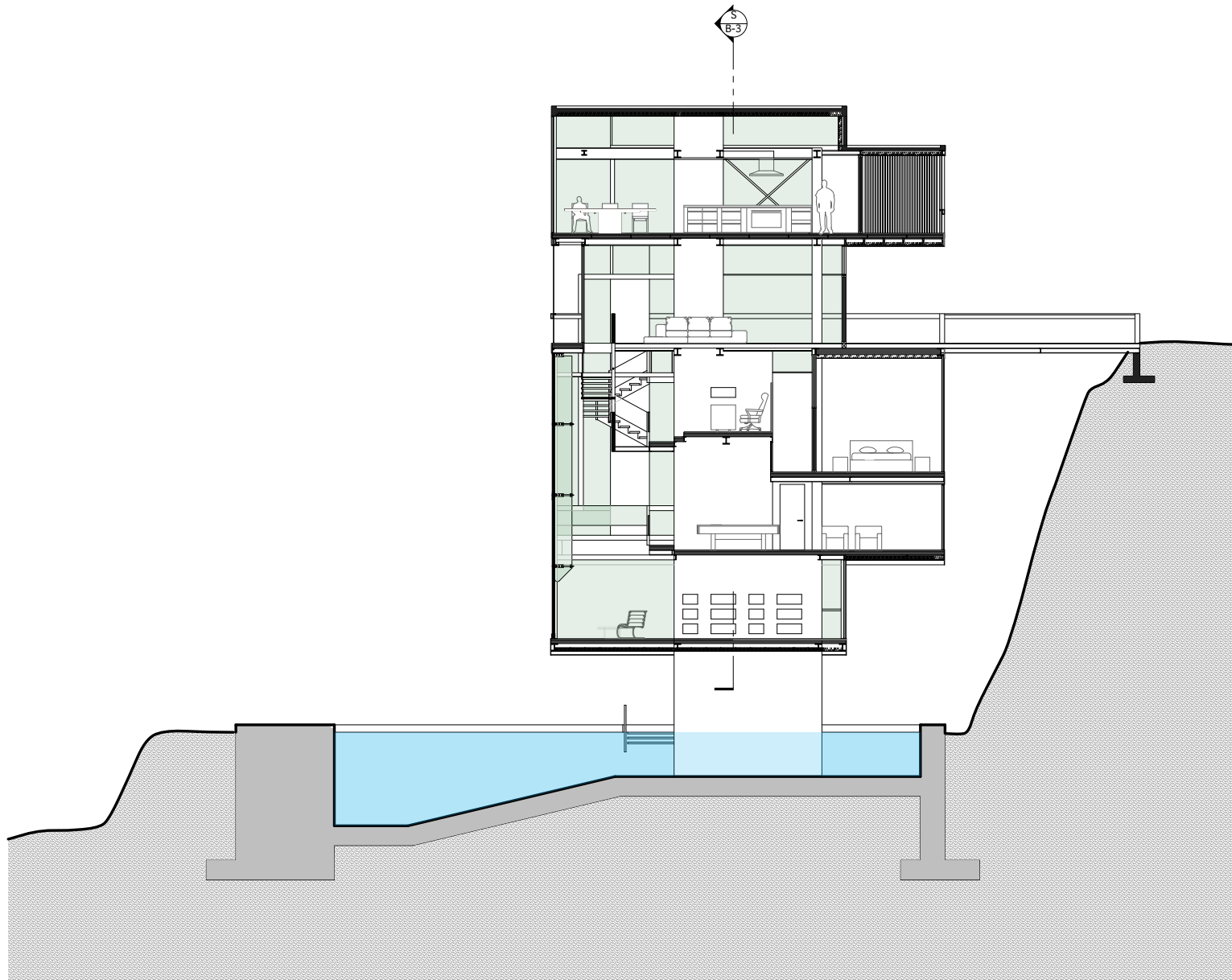
SECTION A-3

Figure 57: Fifth floor plan and section



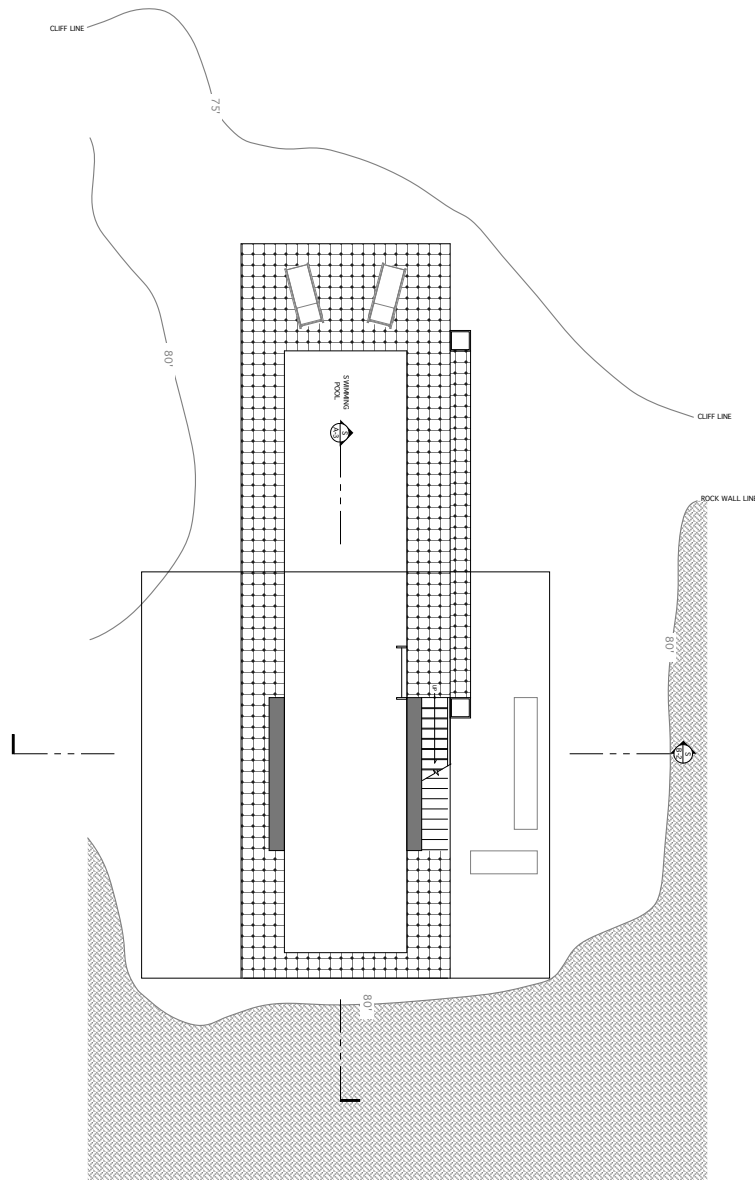
SIXTH FLOOR PLAN

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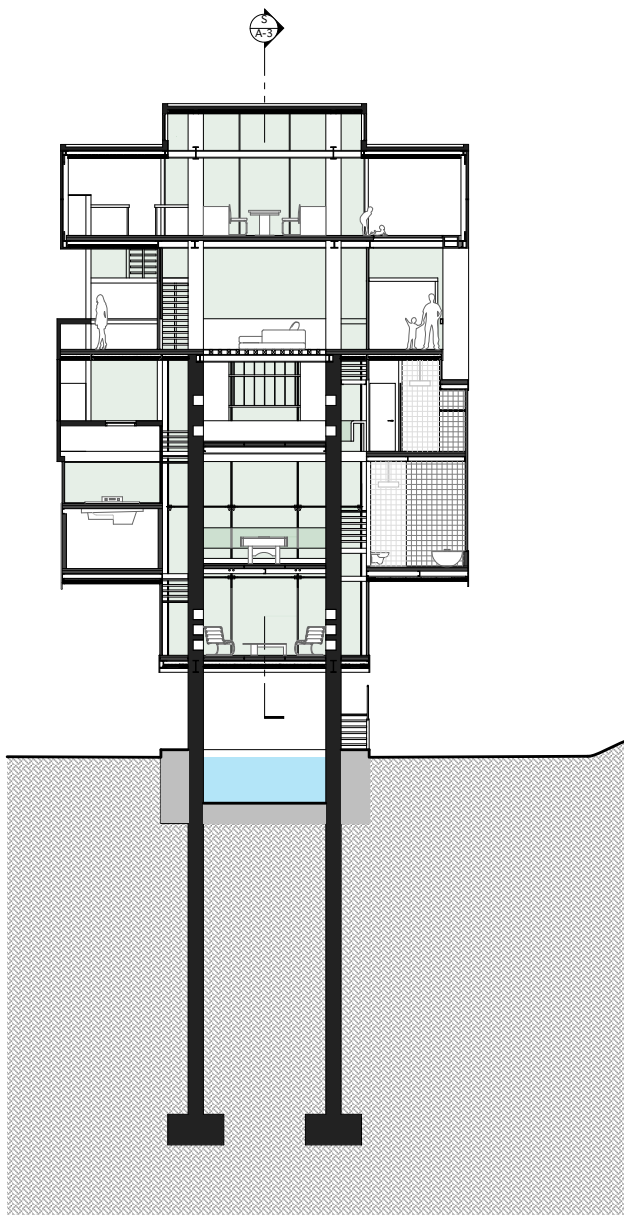


SECTION A-3

Figure 58: Sixth floor plan and section

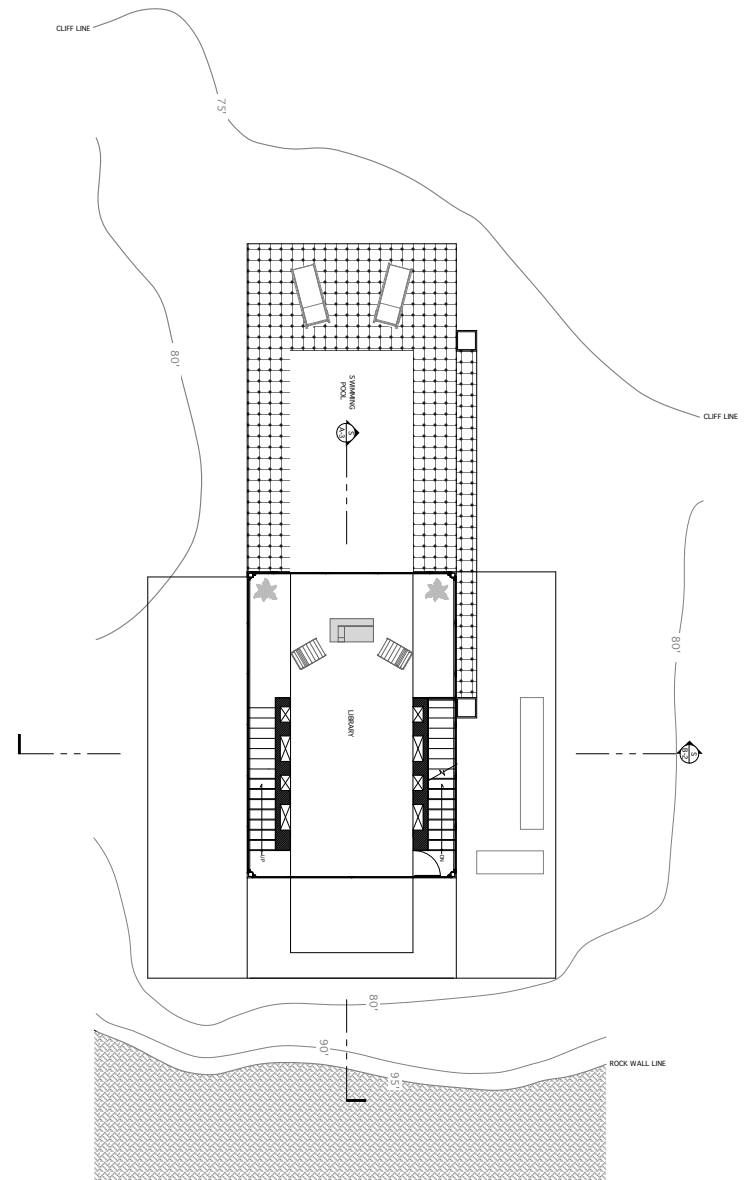


GROUND FLOOR PLAN

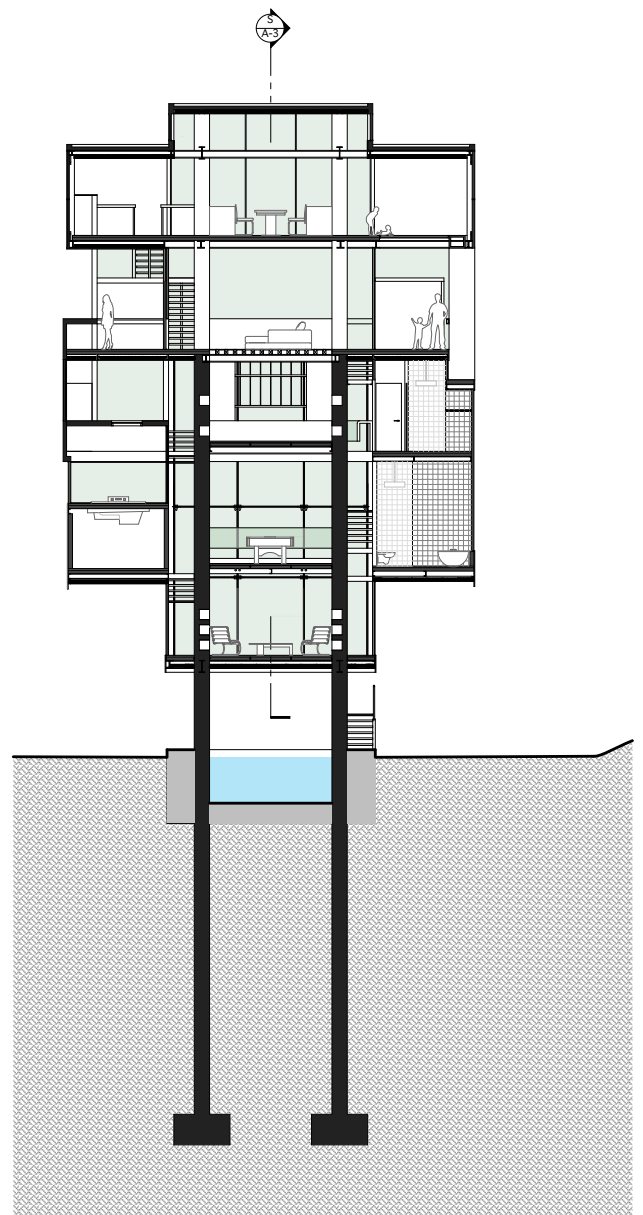


SECTION B-2

Figure 59: Ground floor plan and section

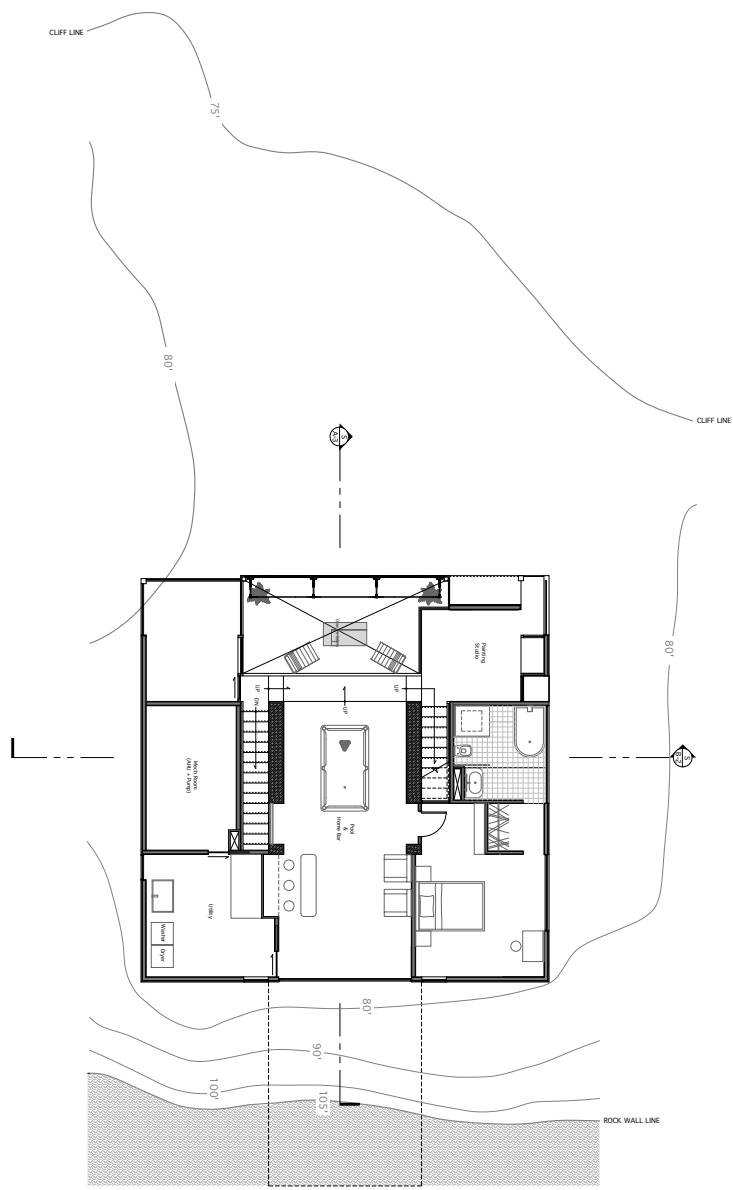


SECOND FLOOR PLAN



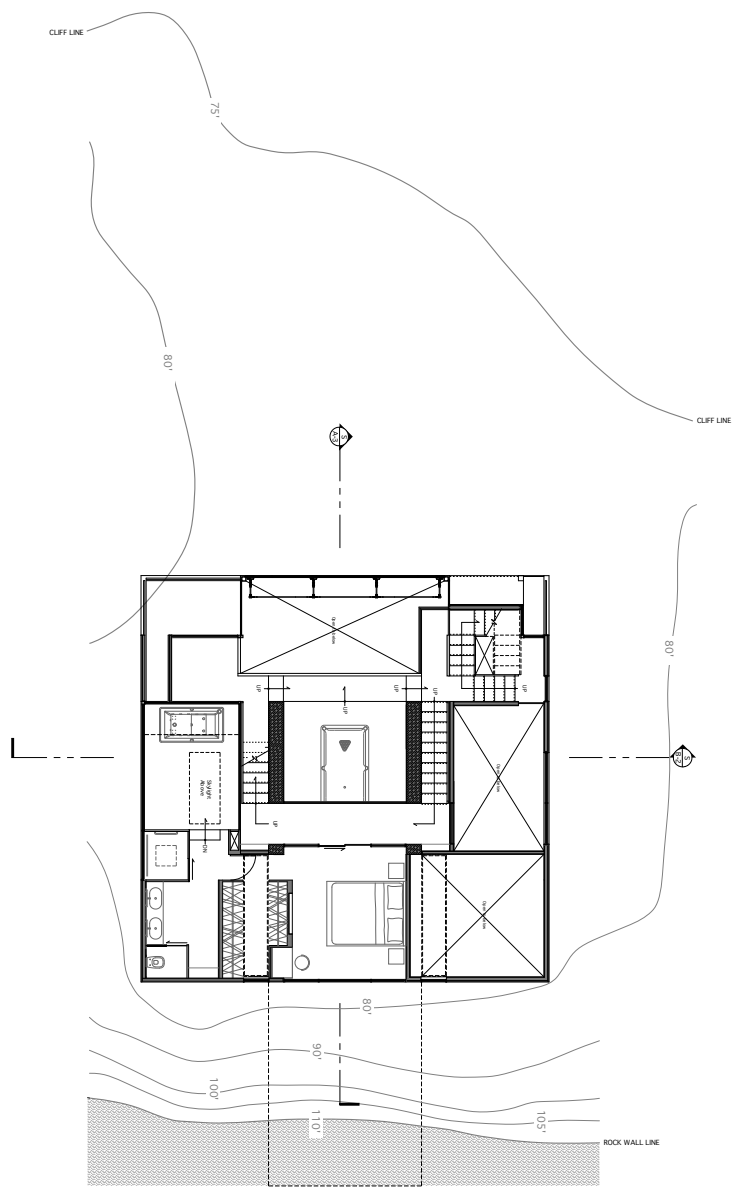
SECTION B-2

Figure 60: Second floor plan and section



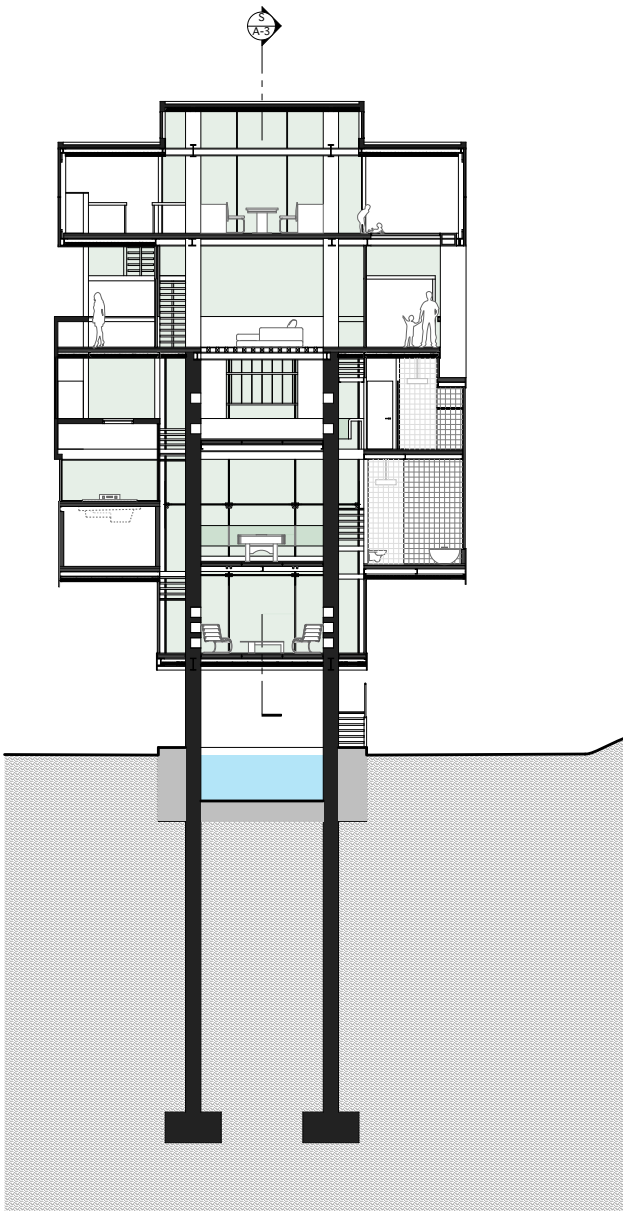
THIRD FLOOR PLAN

SCALE 0 5 10 15 20 FEET

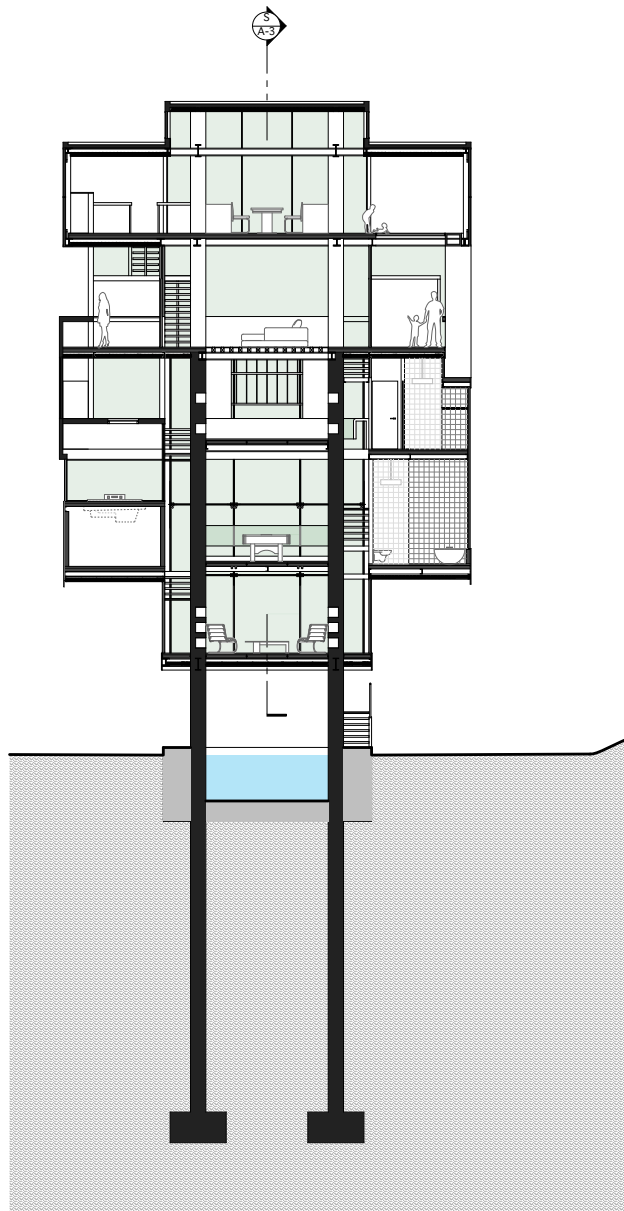


MEZZANINE FLOOR PLAN

SCALE 0 5 10 15 20 FEET



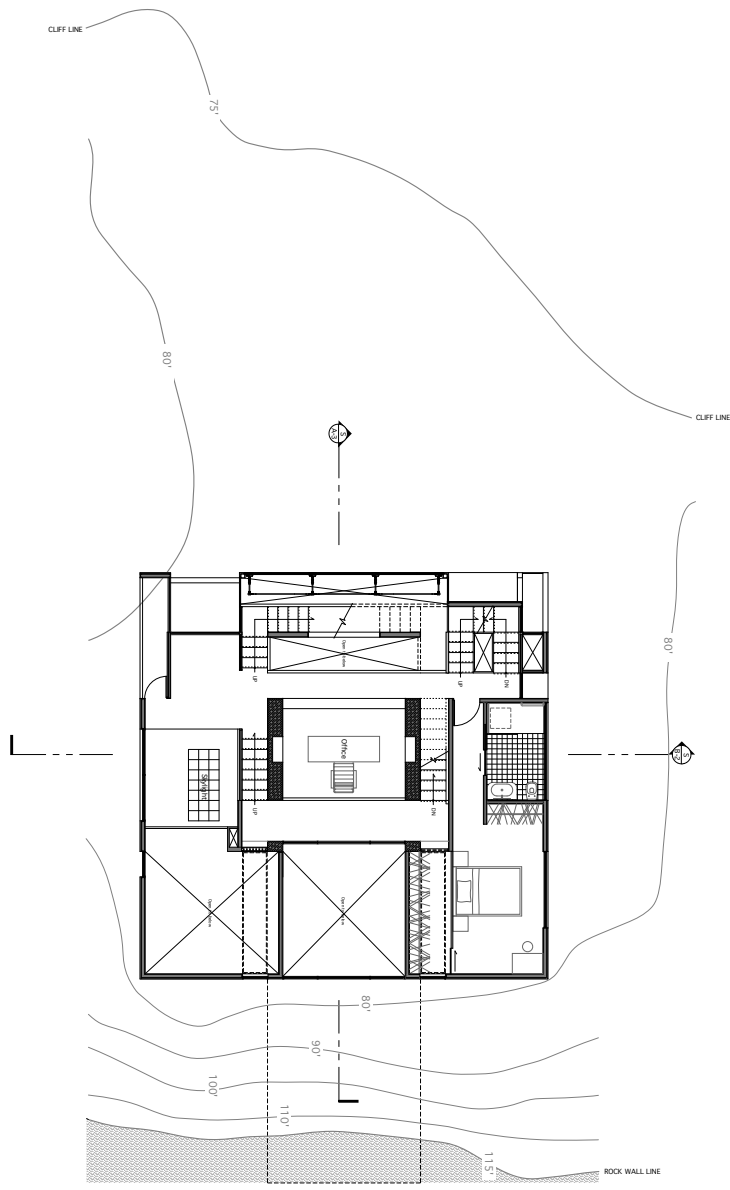
SECTION B-2



SECTION B-2

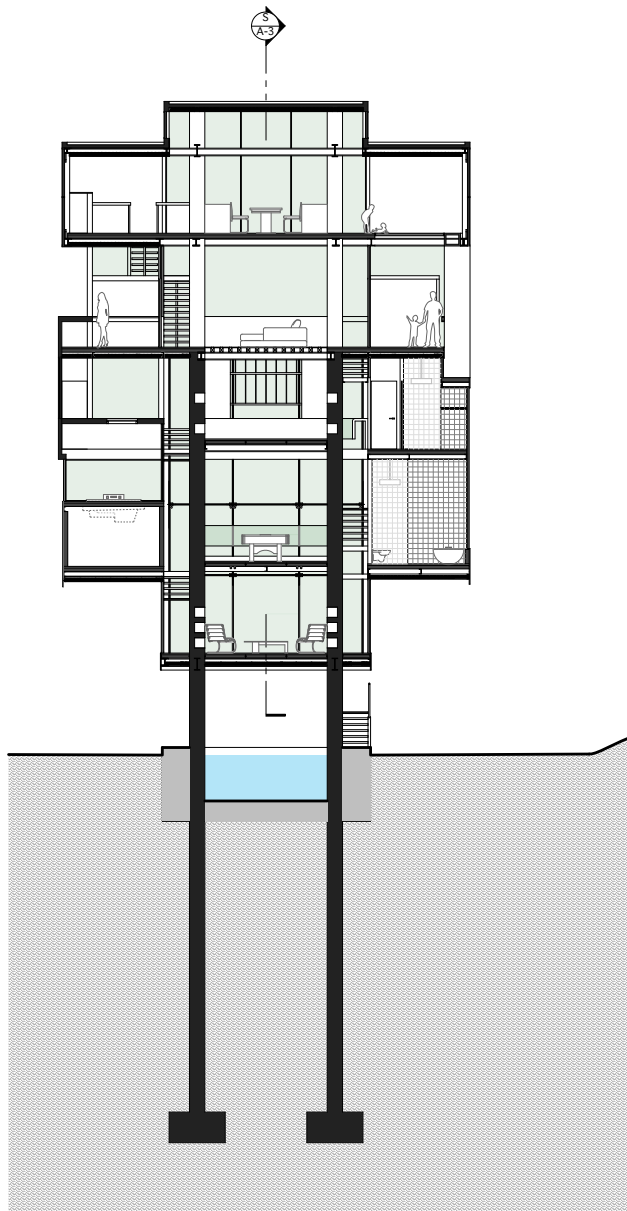
Figure 61: Third floor plan and section

Figure 62: Mezzanine floor plan and section



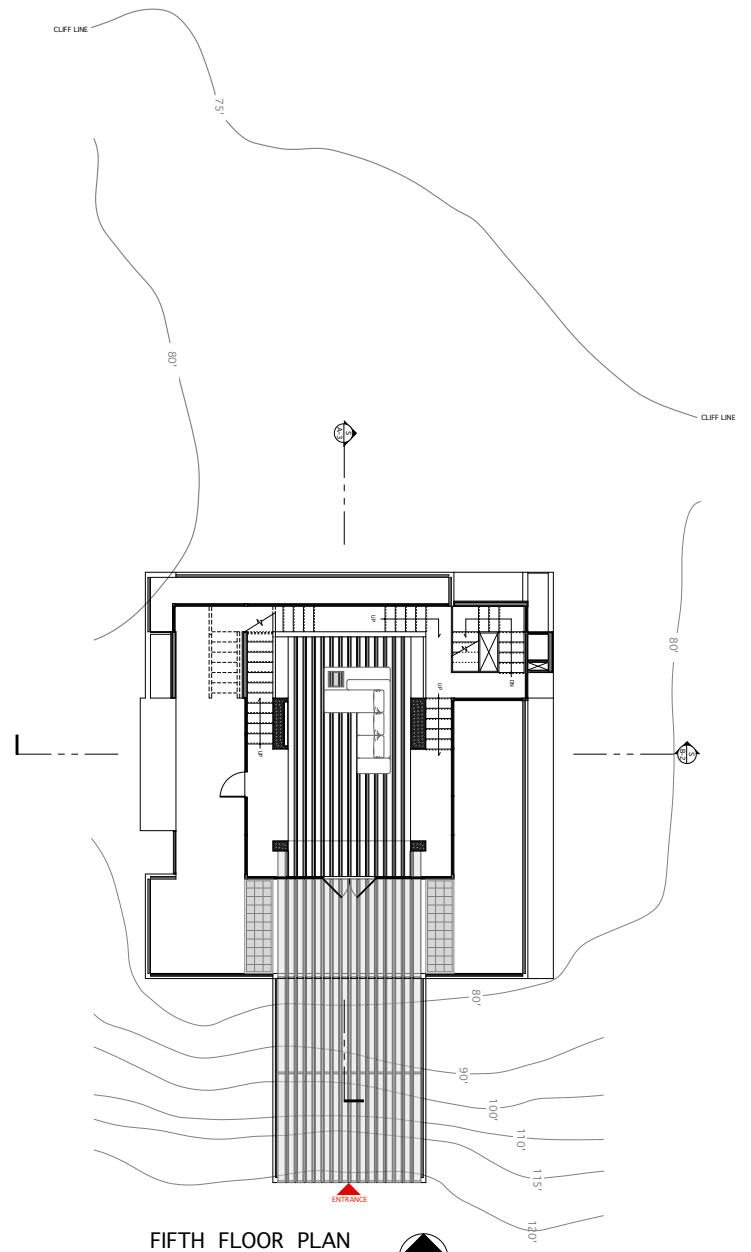
FOURTH FLOOR PLAN

SCALE 0 5 10 15 20 FEET



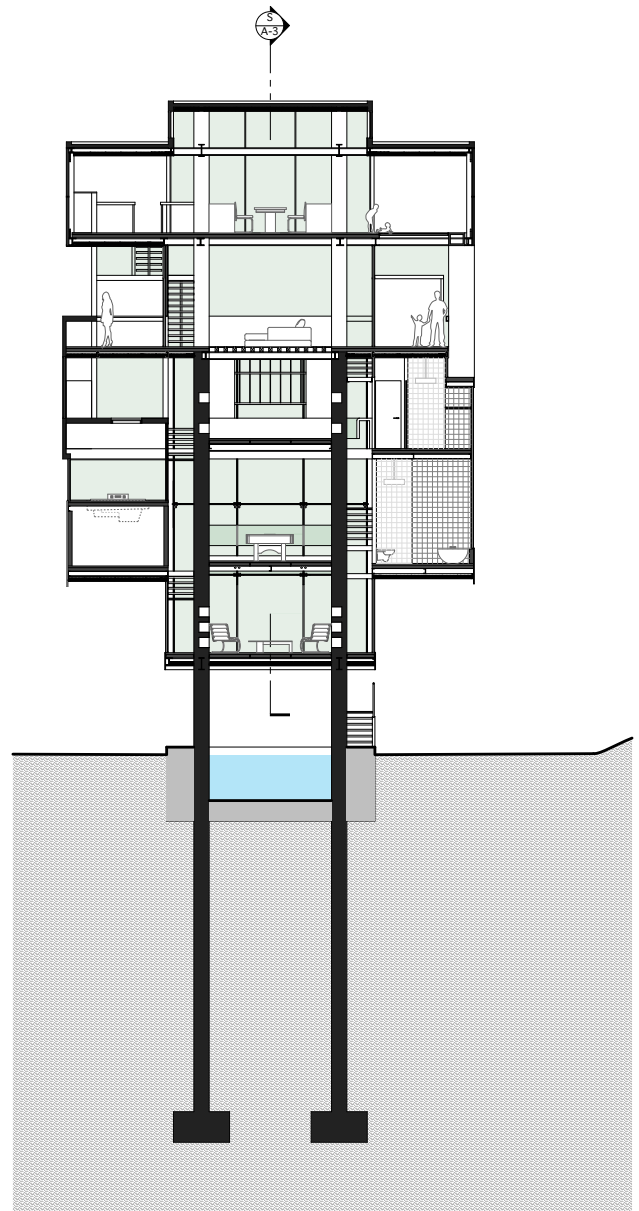
SECTION B-2

Figure 63: Fourth floor plan and section



FIFTH FLOOR PLAN

SCALE 0 5 10 15 20 FEET



SECTION B-2

Figure 64: Fifth floor plan and section

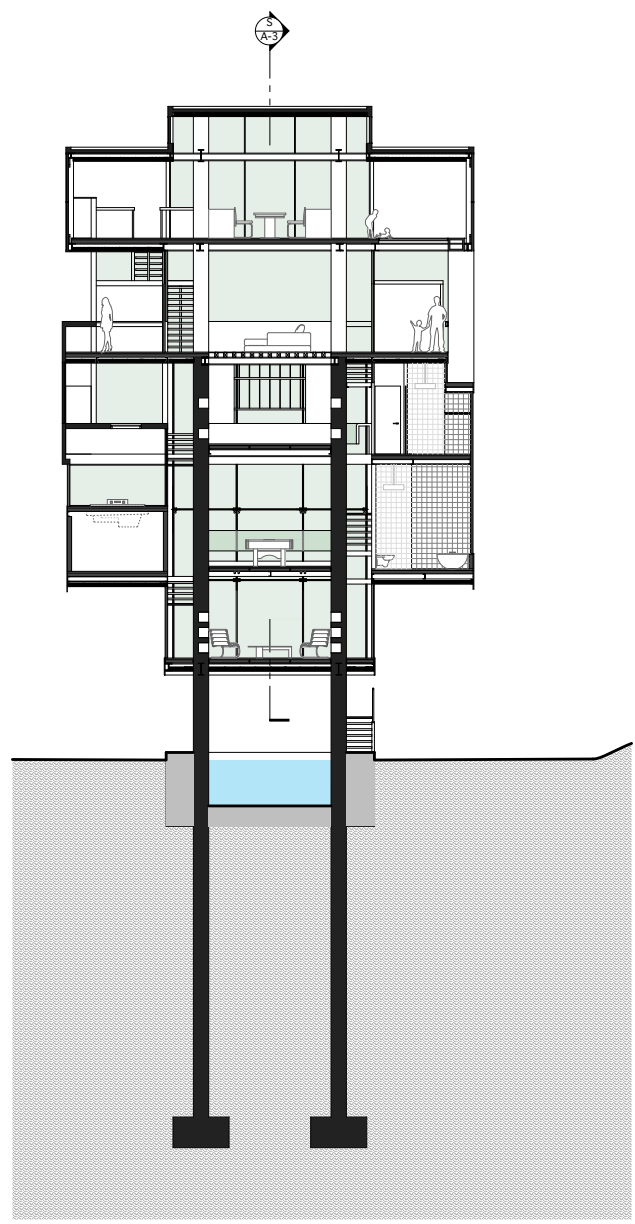
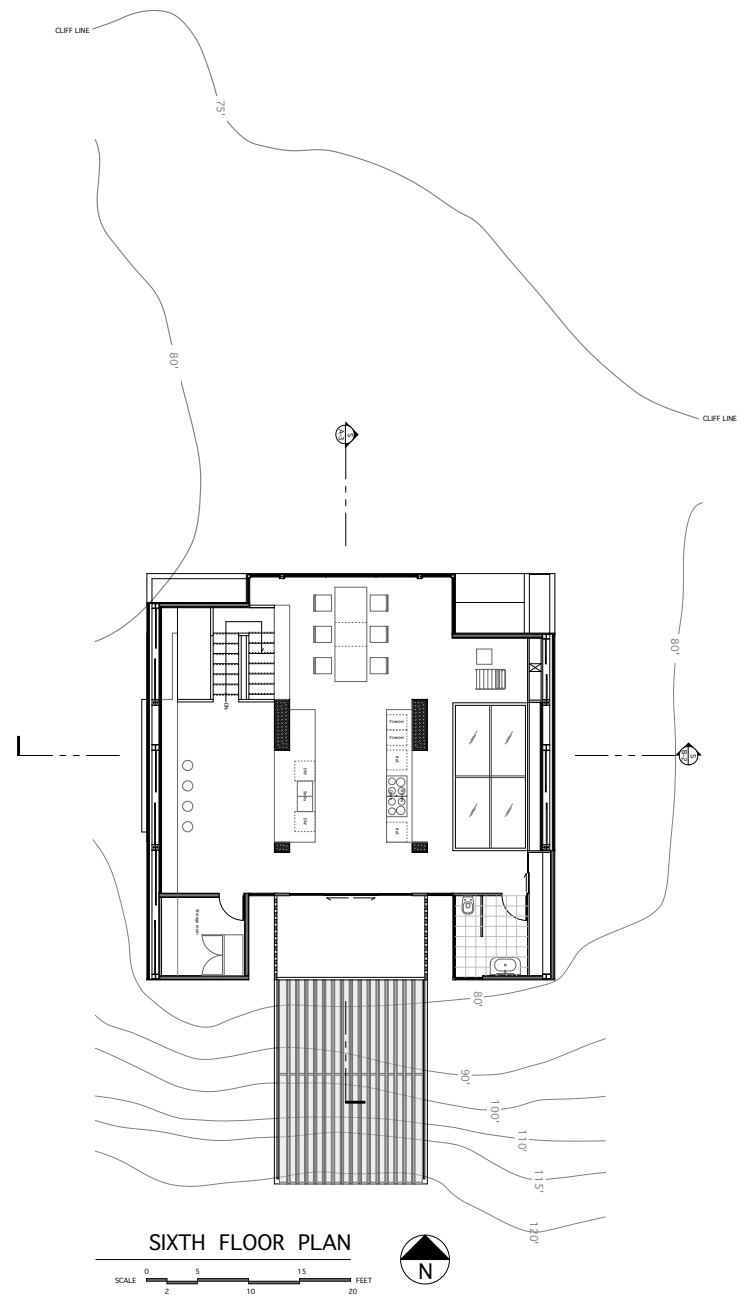
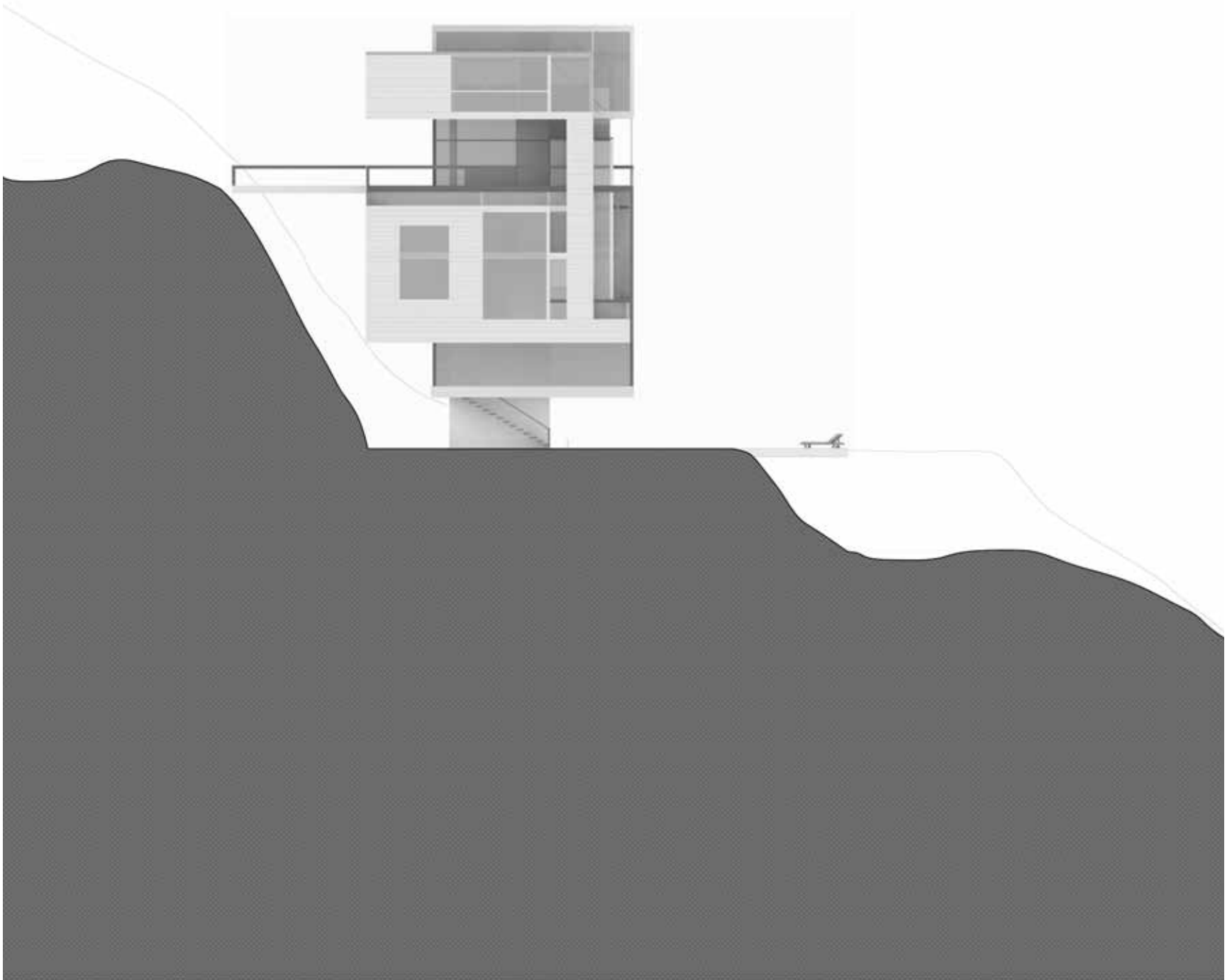
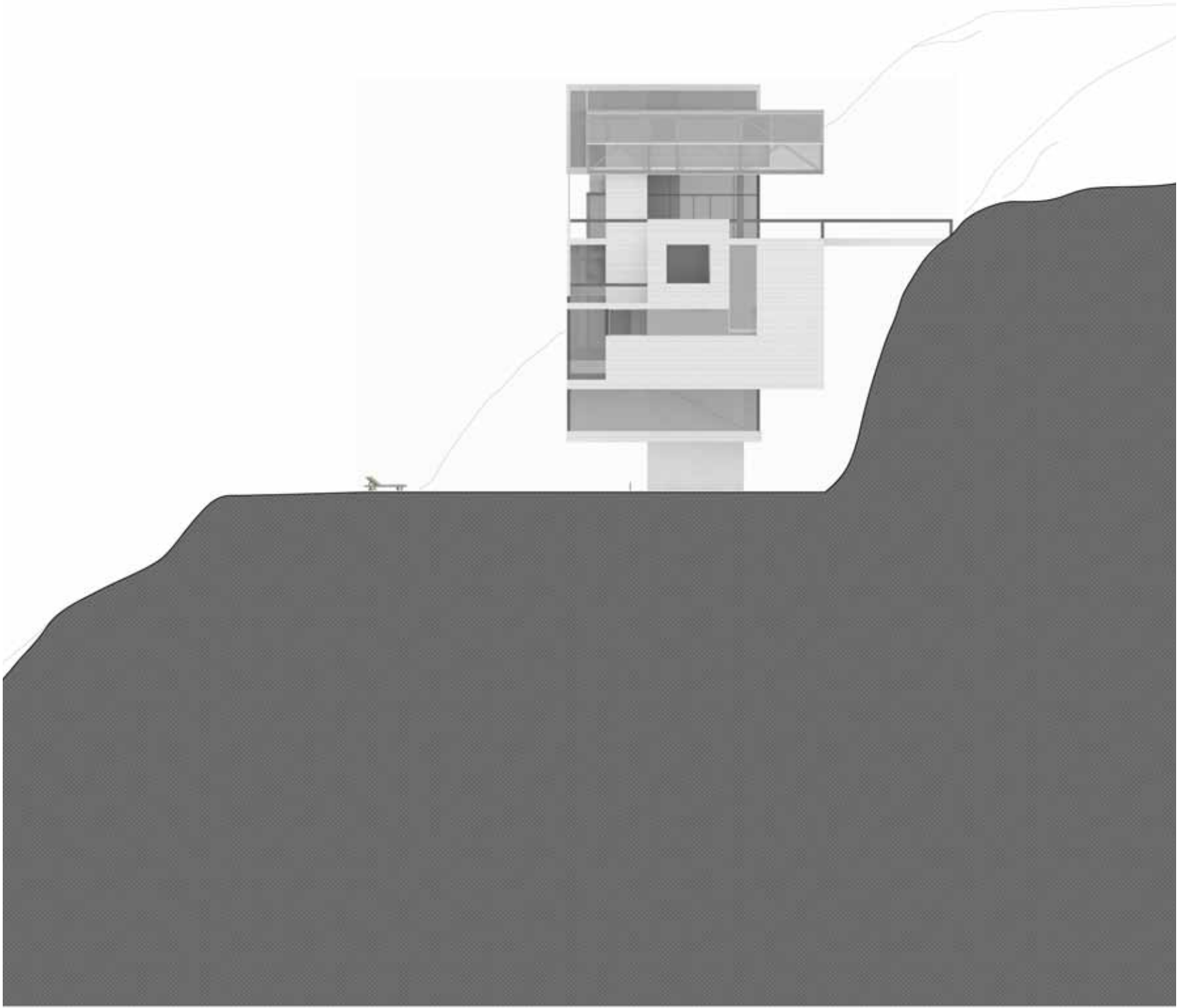


Figure 65: Sixth floor plan and section



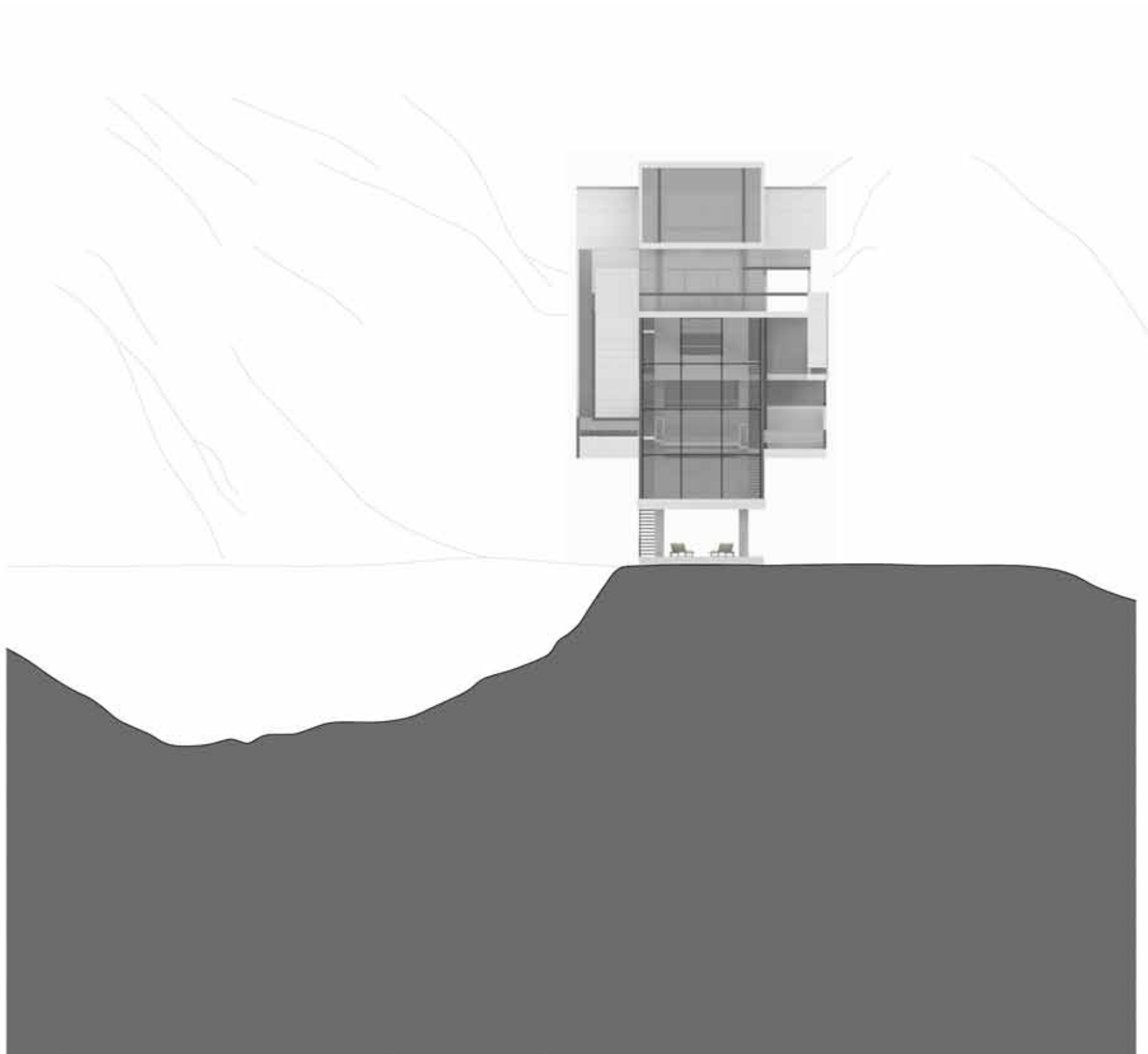
E a s t E l e v a t i o n

Figure 66: Drawing of east elevation



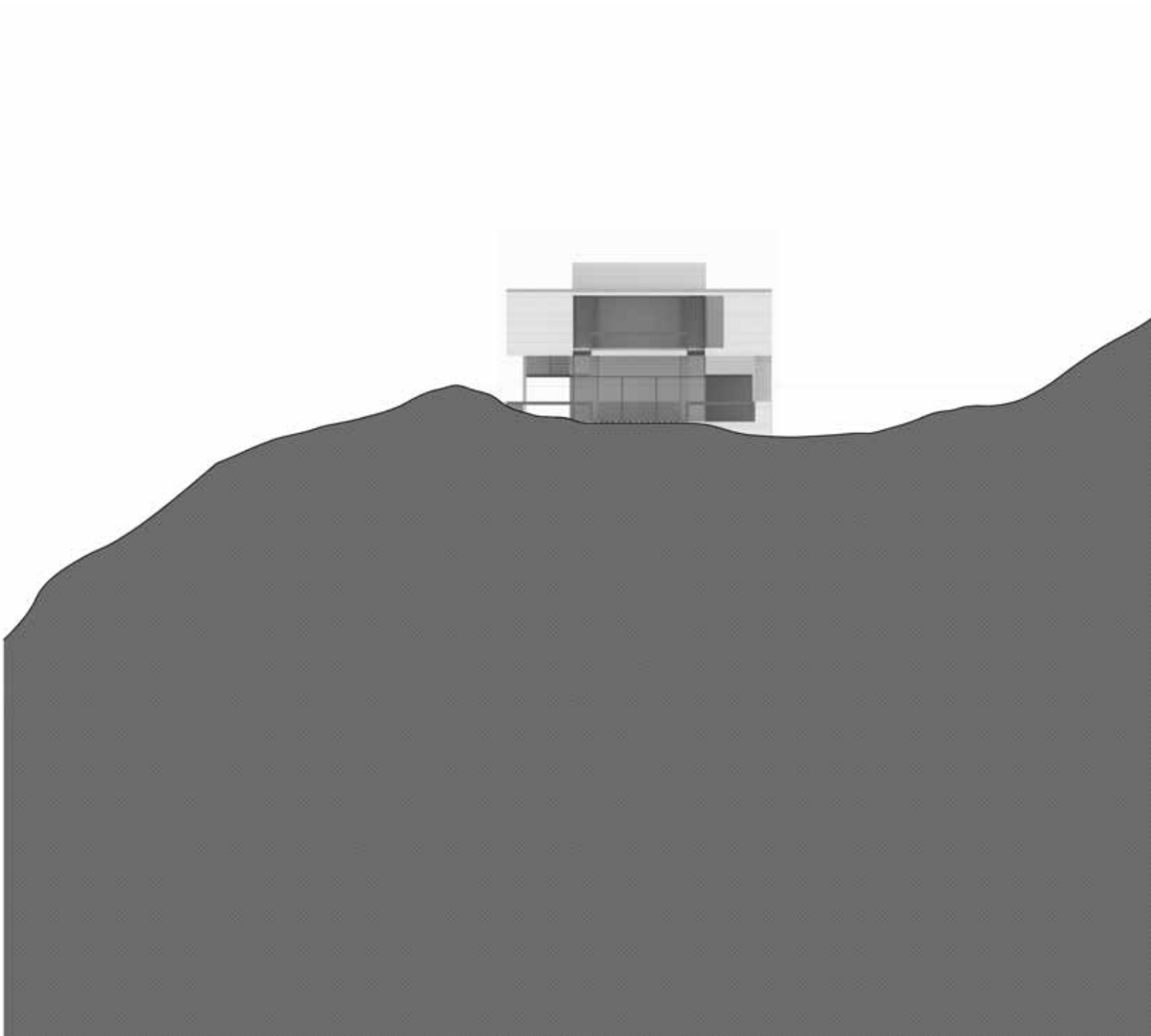
W e s t E l e v a t i o n

Figure 67: Drawing of west elevation



North Elevation

Figure 68: Drawing of north elevation



South Elevation

Figure 69: Drawing of south elevation

The building as an object in nature

The house provides a sense of verticality that is achieved by two concrete columns and cantilevered steel beams creating a tall, elongated structure with a floating appearance. The building touches the ground only with the footprints of the two columns, contrasting strongly with the surrounding environment to provide a sense of a solitary man-made object where it informs the inhabitant of the ever-changing circumstances outside its protection.



Figure 70: An exterior view of the house from the northwest on a sunny day



Figure 71: A view looking at the main entrance in the morning of a typical working day

Entrance area:

As one approaches to the entrance of this house at a cliff edge, it looks like a two story house floating in the air. One enters the house via an enclosed decking bridge connecting between the cliff edge and the house. A series of translucent plexiglass stripes are used to fill the gaps of the deck to allow sunlight to penetrate without visual encroachment. This bridge leads to the living/ sitting area of the house (Figure 71).

Living/ sitting area:

The decking bridge becomes the living room's floor that ends in the mid air, facing north, inside the house. The plexi-glass stripes are transparent in this area. The boundary of this area is obscured with the three sides glass walls surrounded by an outdoor terrace. The terrace has a black painted stainless steel hand rail that helps to emphasize the additional boundary beyond. In addition, the use of exterior siding panel for the north hand rail partition together with the decking floor obscure the sense of inside-outside perception; the sitting area could be perceived as if it was an outdoor area. Only the two columns exist as the opaque enclosure to maximize opening for view (Figure 72-74).



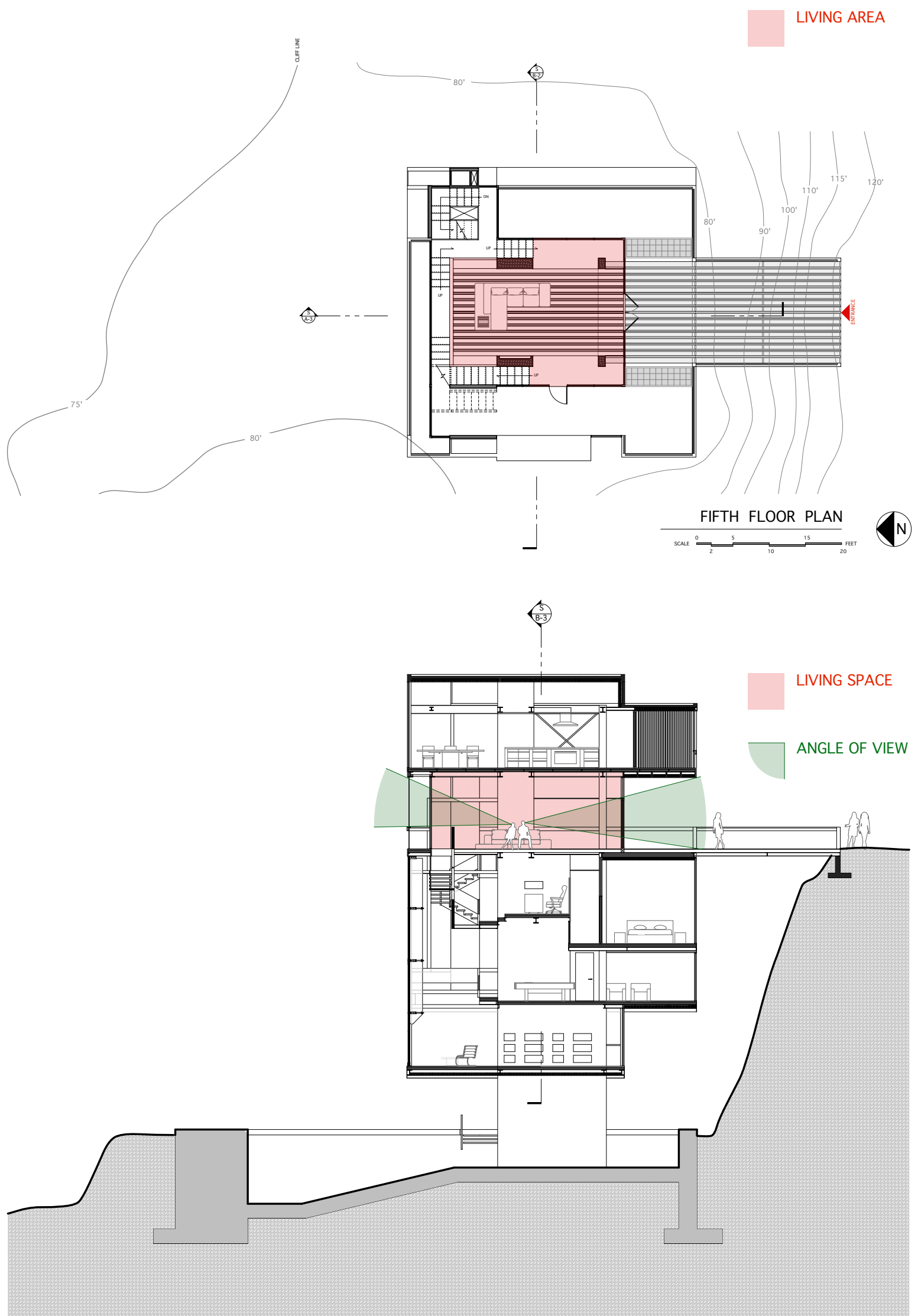
Figure 72: The sliding door as a physical threshold where inside and outside meet



Figure 73: View from a person looking to the north west direction once stepping inside the living area



Figure 74: View from a person looking to the north east direction once stepping inside the living area



SECTION A-3

Figure 75: Color diagram showing the angle of view from the living area

Kitchen/Dining area:

It is the top floor level that occupies the entire grid of sixteen by sixteen square feet area. Again, the only solid walls are the two columns. The first area to see on this level is the bar/ breakfast area facing west. The enclosure are mostly glass walls with room partitions separating toilet and storage space with a due-south rear balcony in between. The mid area is the kitchen space with low profile cabinets tucked along the two sides of wall columns leading to the dining area to the north. It is visually unobstructed along the north-south axis. There is one guest bathroom that provides a personal view to the natural cliff wall (Figure 76-77).



Figure 76: View from a person looking to the north direction from the cooking area



Figure 77: View from a person looking to the south direction from a dining seat

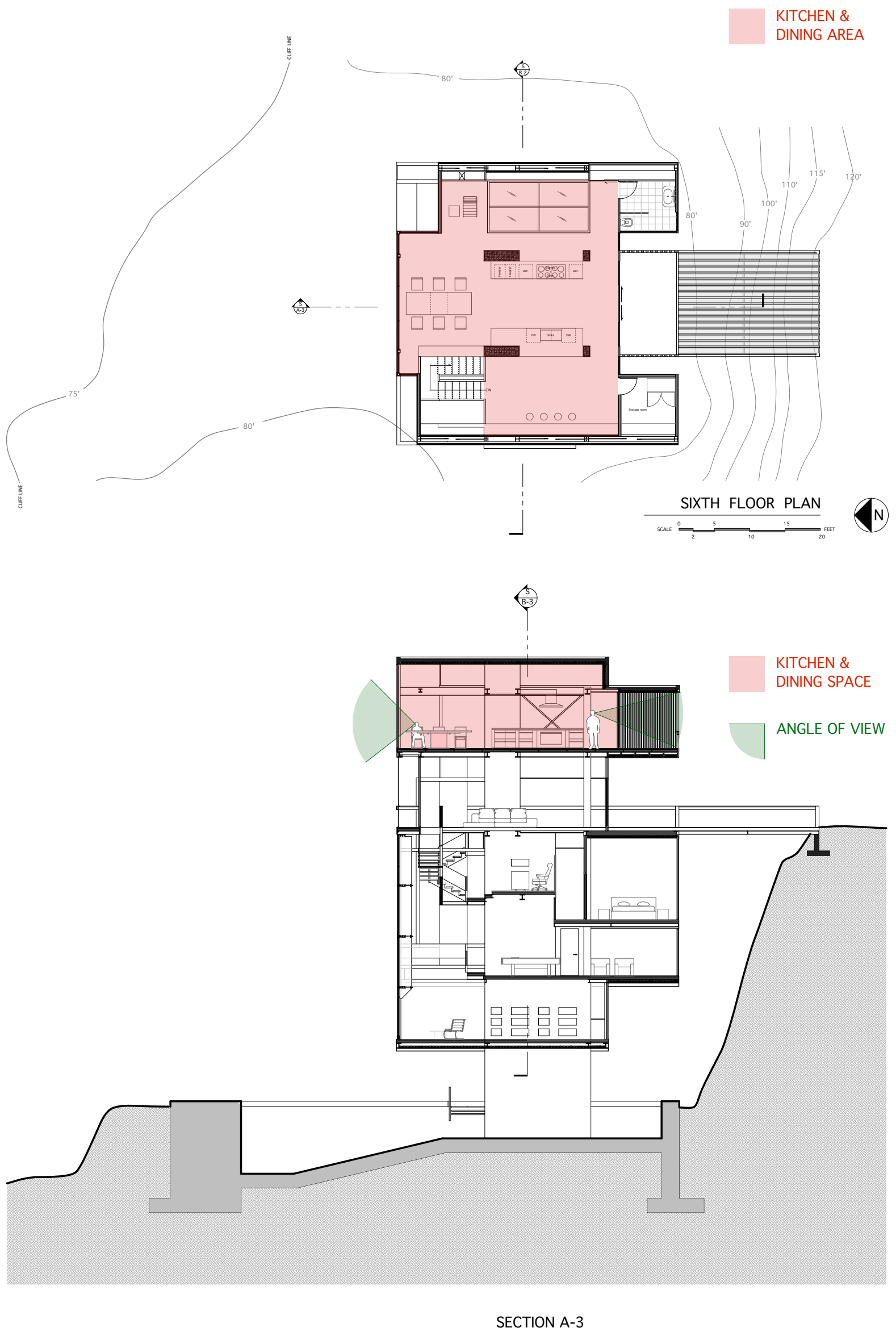


Figure 78: Color diagram showing the angle of view from the kitchen/ dining area

Sleeping area:

- Parent's bedroom

This bedroom has two viewing windows on opposite sides of the room; one with a view of the bridge entrance to enable observation of incoming visitors, the other with a view overlooking, in diagonal angle, the partial center area of the house to the swimming pool at the ground level. The bathroom is located in the west with a separate room to enjoy the mid-air layer of view while sitting and relaxing in the bathtub (Figure 79-81).

- Children's bedrooms

These bedrooms are located in the east so that the sun helps waking up the children. Since the east-west axis is parallel to the cliff line (without residential zone), the bathrooms are designed to have a glass wall open for mid-air layer of view toward the east.



Figure 79: View from a person standing inside the parent's sleeping area looking to the north



Figure 80: View from a person laying on the bed looking at the cliff wall below the bridge



Figure 81: View from a standing person in the bathtub area looking out

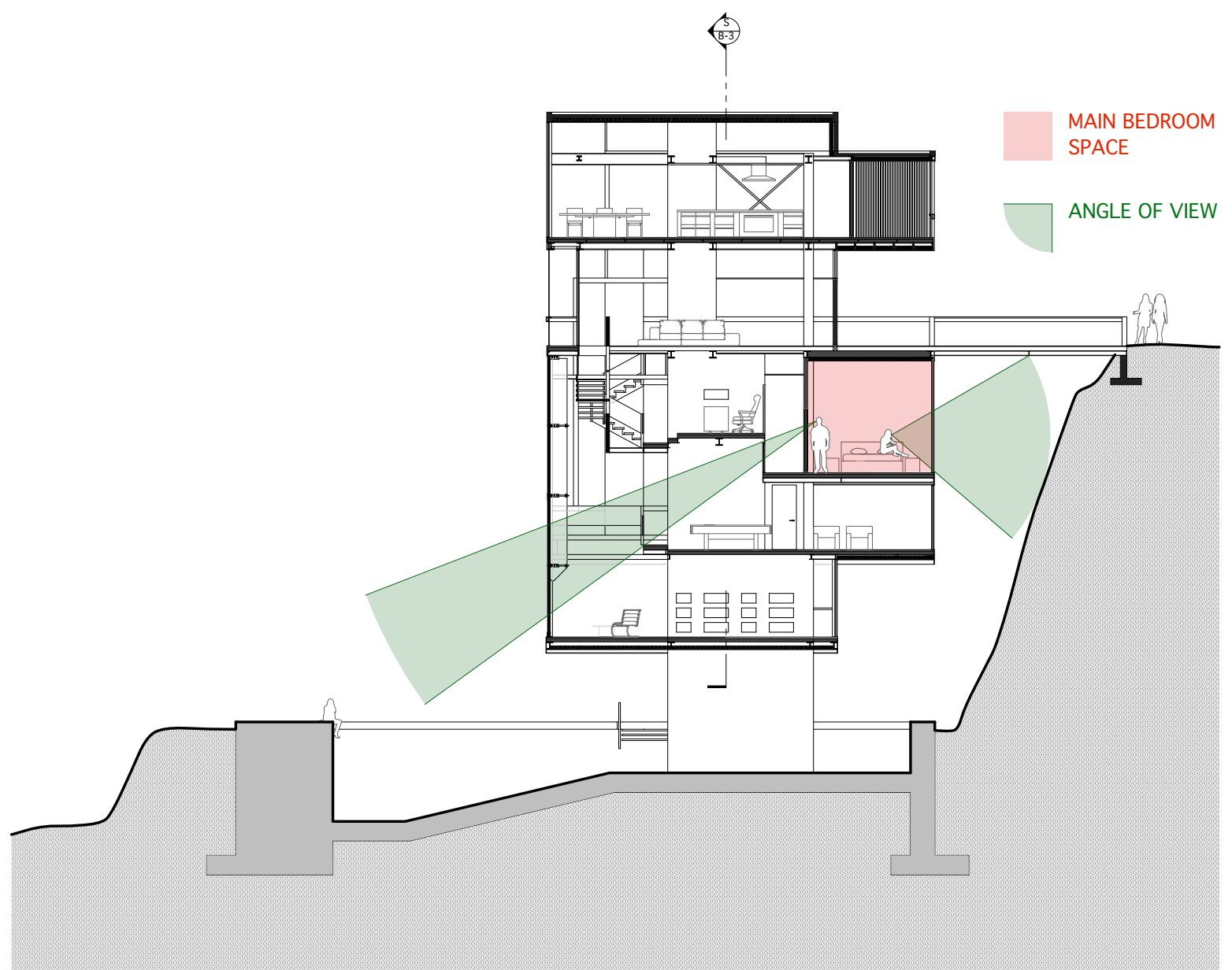
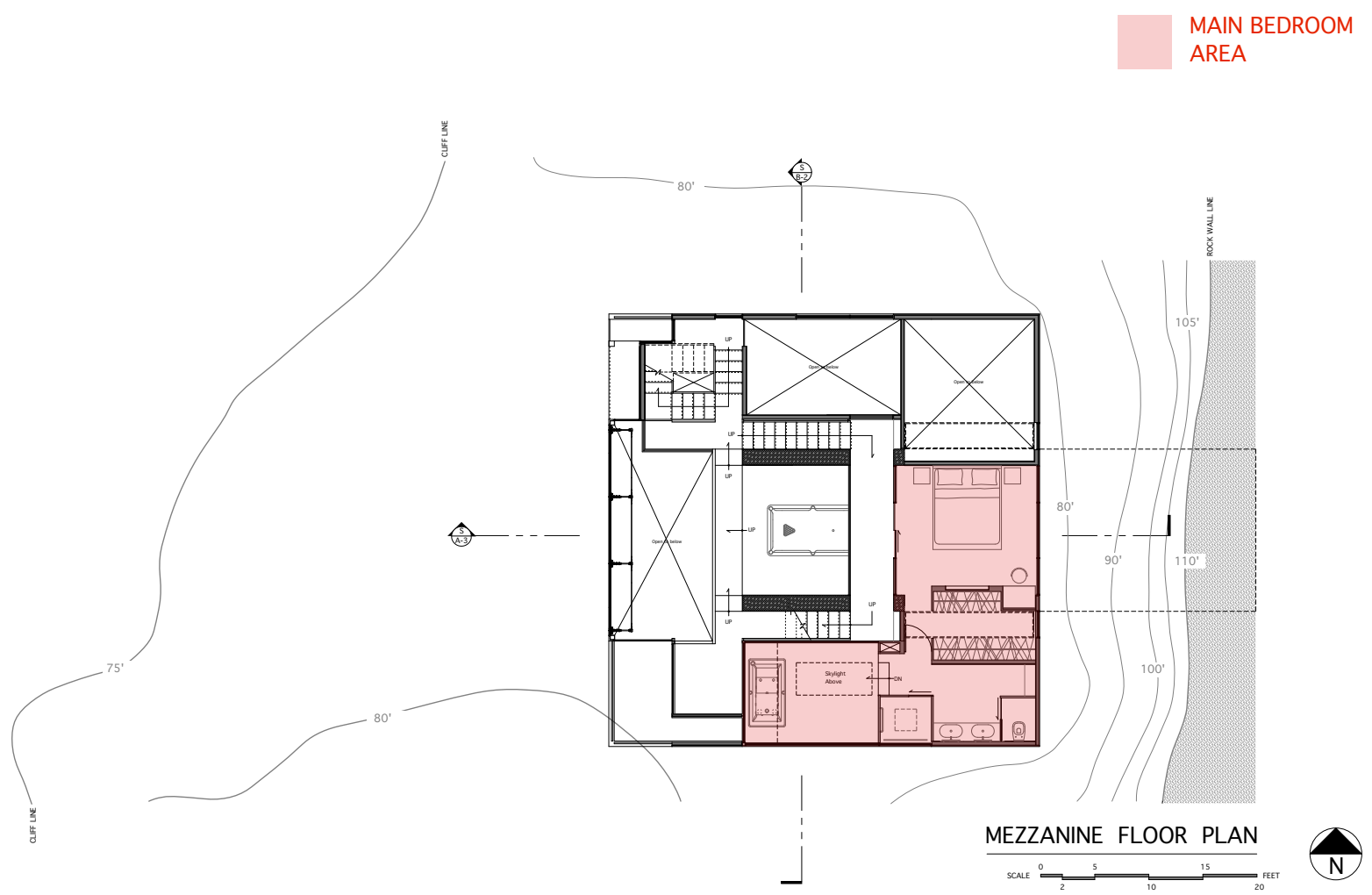


Figure 82: Color diagram showing the angle of view from the parent's bedroom

Recreation area:

This space occupies the center area of the grid which is unobstructed to north-south view. It was designed for pool table and a beverage bar counter with seats. There is a glass panel mounting on the back surface of the beverage shelves to give an illusion of a doubled depth and a reflection of view from the outside. One accesses to the laundry units behind the beverage bar from this area (Figure 83-84).



Figure 83: View from a person standing at the beverage bar area looking to the north



Figure 84: View from a person standing at the pool table area looking at the cliff wall beyond the beverage bar area

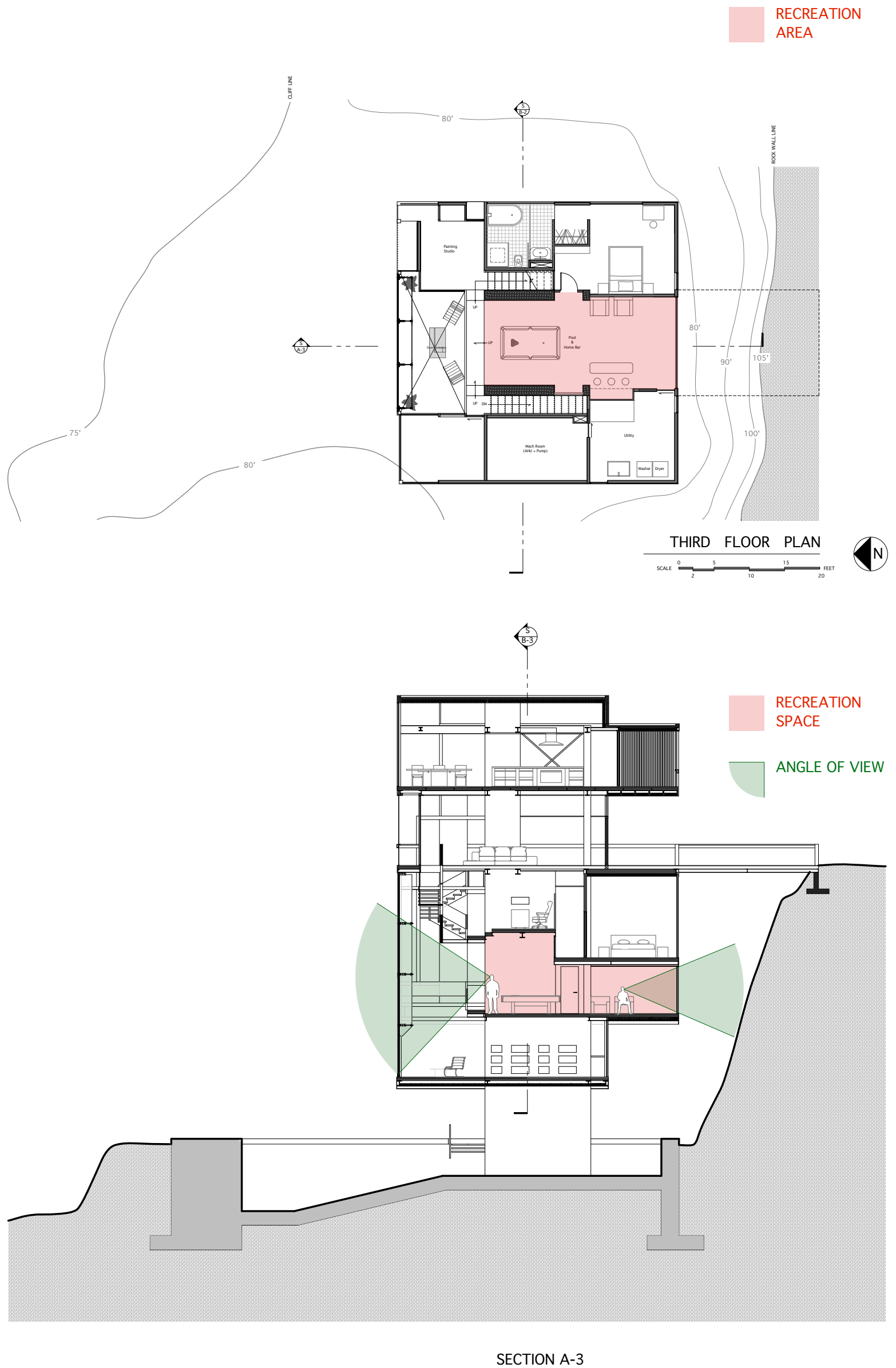


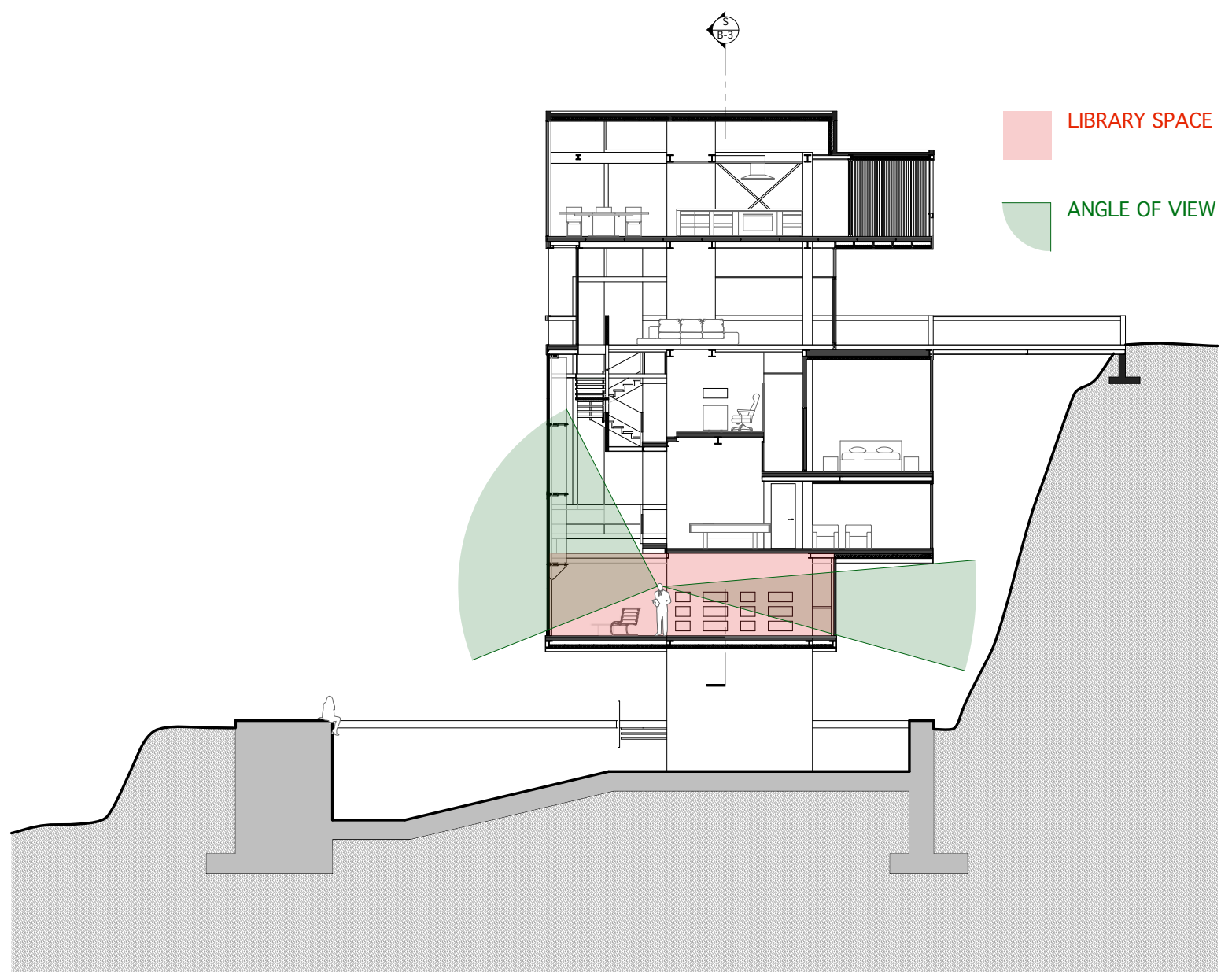
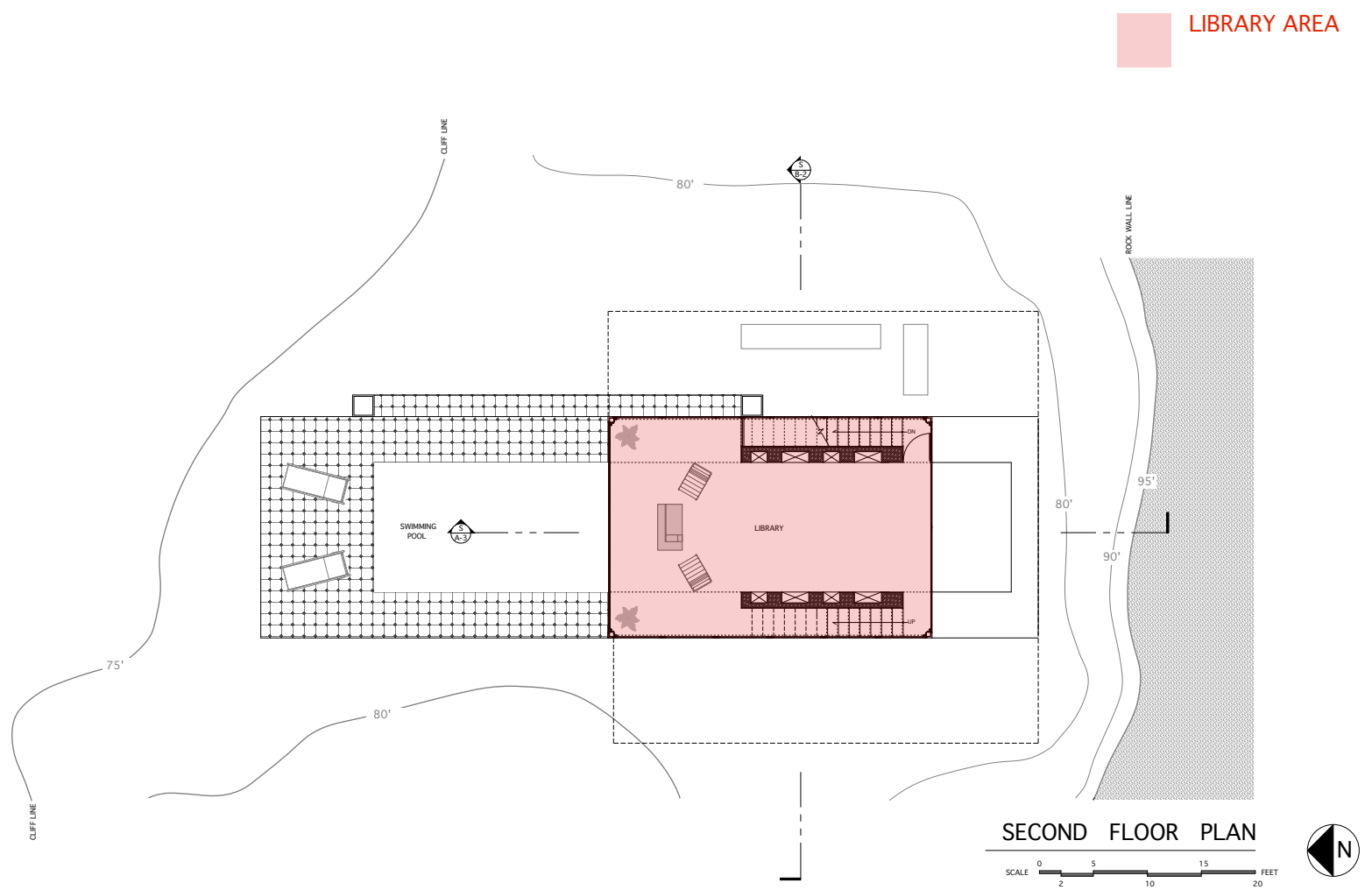
Figure 85: Color diagram showing the angle of view from the recreation area

Library area:

This area is placed right above the ground level swimming pool. It is enclosed with glass walls on all sides to receive maximum daylight; nevertheless, the area stays under shade all day long thanks to the offset glass walls that turns the above cantilevered floor to act as an eave. The book shelves were designed to embed in the two columns to maximize the north-south visibility for view. The direction of the wood floor establishes a horizontal datum in contrast to the vertical view (Figure 86).



Figure 86: Interior view of the library looking out through the north facade



SECTION A-3

Figure 87: Color diagram showing the angle of view from the recreation area

Ground level swimming pool area:

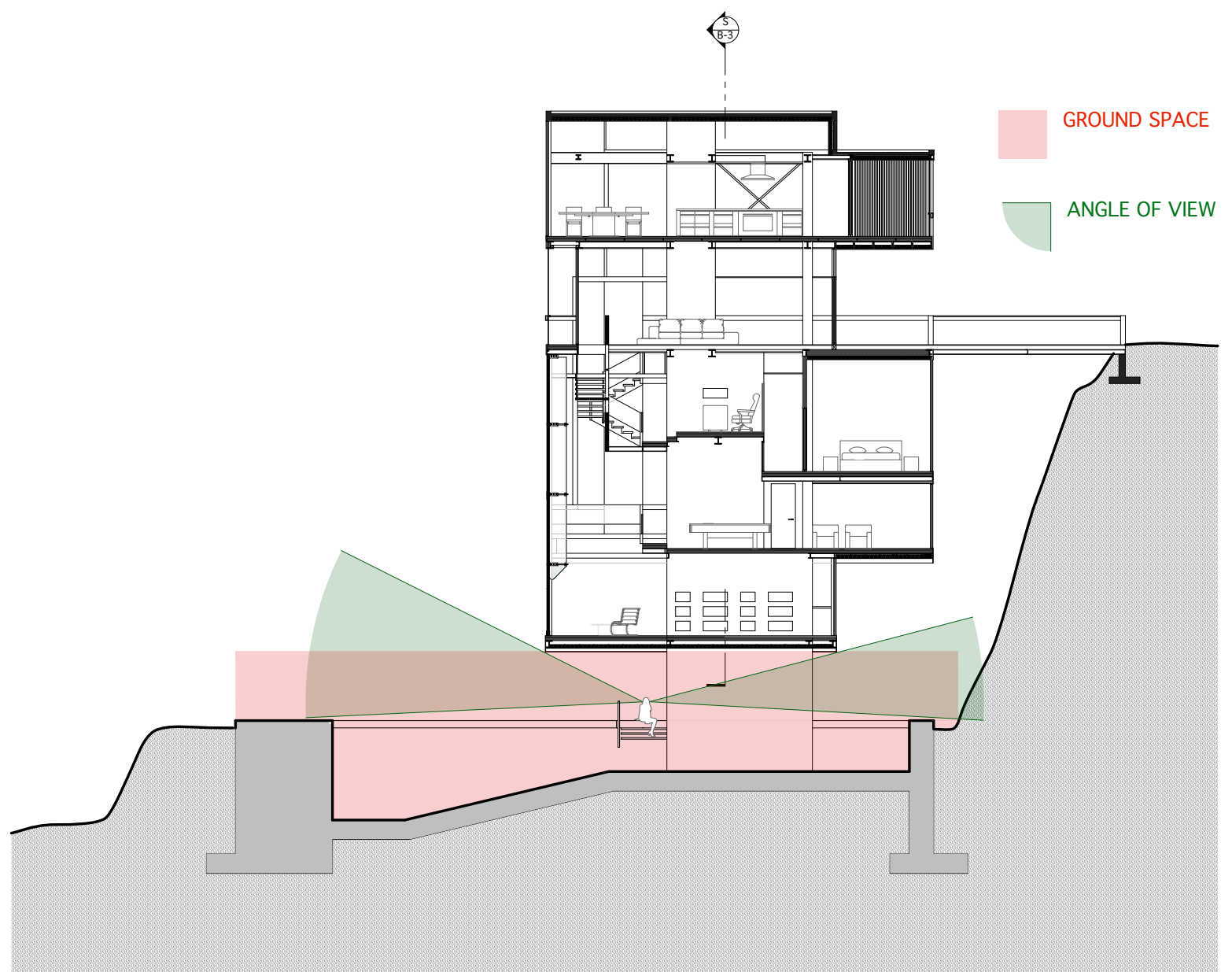
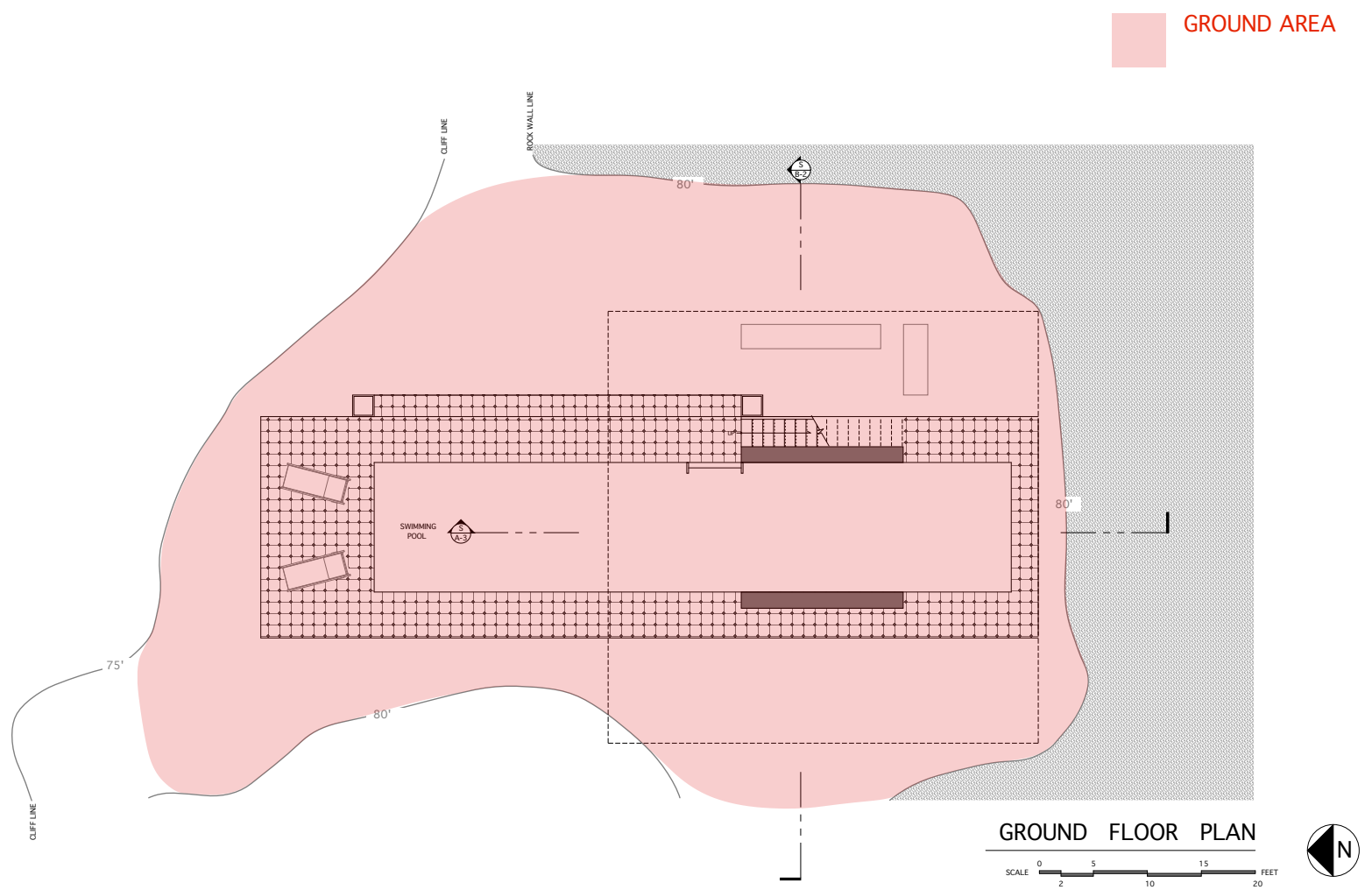
The shape of this swimming pool utilizes the same profile as the triple height glass facade so that the spatial arrangement of the two spaces (swimming pool and glass chamber library) creates an interrelationship which will be perceived as if such a glass volume was previously crafted-out from the ground. The negative space becomes the pool. The positive space (the crafted volume) was then pivoted perpendicular to become the library space. There is a cooking out area located on the east. This area will be undershaded from mid day throughout the evening. The underside of the second floor has a blue sky illuminated ceiling to create a blending effect to the natural sky. This creates a dematerialization effect, the ceiling becomes invisible to the background. This sense can be perceived by a person using the swimming pool. The materialization effect is further achieved using the inner sides of both wall columns as artificial cascades, reflecting surrounding landscape, to eliminate the sense that the house is being supported. The parallel wall cascades also emphasize the main axis (lengthwise direction) of the pool to direct a swimmer (Figure 88-89).



Figure 88: View of the cooking out and swimming pool area at noon



Figure 89: View from a standing swimmer looking toward the cliff edge



SECTION A-3

Figure 90: Color diagram showing the angle of view from the swimming area

Conclusion

The planar arrangement of the house is organized under the six layers of the 16 square grid planar system. Like a tree, the entire volume is organized similar to branch-like cells of habitable rectangular volumes, accessible via wrapping staircases.

Verticality can be mainly perceived while moving along the narrow walkways, terraces and stairs along the perimeter of the floor inside the house, and by activities next to the glass walls such as eating, showering and sleeping.

Lightness can be perceived both inside and outside the house. From the inside, the lightweight aluminum wall framing system supports the partitions without the typical corner column supports. From the outside, the building envelope suggests a floating volume organized around the two main columns.

This six-story house has the kitchen and dining area on the top floor. The walking path is architecturally choreographed to reward the effort of the lengthy climb or decent with a beautiful verticality of a man-made object positioned in a dramatic natural landscape.

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