2012

# Environmental Architecture: Environmental Discovery Center on the Woonasquatucket River

Nathan Bonaiuto
*Roger Williams University*, nbonaiuto393@g.rwu.edu

# ENVIRONMENTAL ARCHITECTURE

## ENVIRONMENTAL DISCOVERY CENTER ON THE WOONASQUATUCKET RIVER

Nathan Bonaiuto

Master of Architecture

School of Architecture, Art, and Historic Preservation
Roger Williams University
March 2012

# Environmental Architecture

Nathan Bonaiuto _____ Date _____

Andrew Cohen _____ Date _____

Stephen White _____ Date _____

# TABLE OF CONTENTS

“ENVIRONMENTAL ARCHITECTURE”

The woonasquatucket River Environmental Discovery Center (WREDC) is a place where students of the environment can enjoy a natural space within their own community. It provides a much needed connection to a site which, for far too long has been off limits to the community. As a potential learning environment for young students, the WREDC becomes a platform for a sustainable lifestyle. In this place we learn about the past, connect it to the present, and allow for change in the future.

The thesis titled, “Environmental Architecture,” is about making these connections of past and future through the current constructs of the Social, Historical, Cultural, and Environmental constructs of a specific place. This architecture is about linking place with building, and understanding that context is of the utmost importance when it comes to sustainability. If we as architects provide smart, culturally rich architecture, communities will take care of it, and allow it to live on.

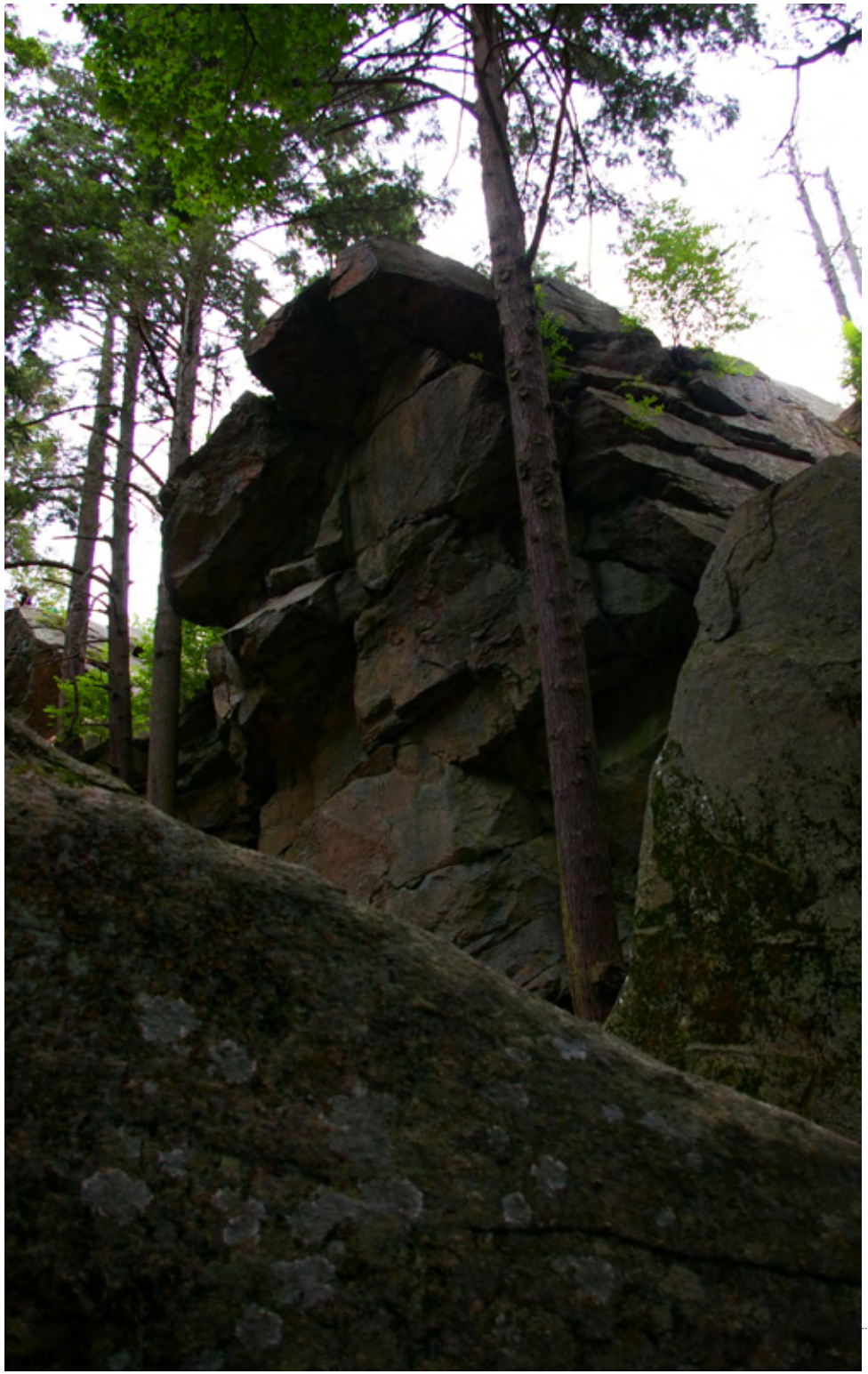
“Our goal is a delightfully diverse, safe, healthy and just world, with clean air, water, soil and power; economically, equitably, ecologically and elegantly enjoyed.”

[William McDonough]

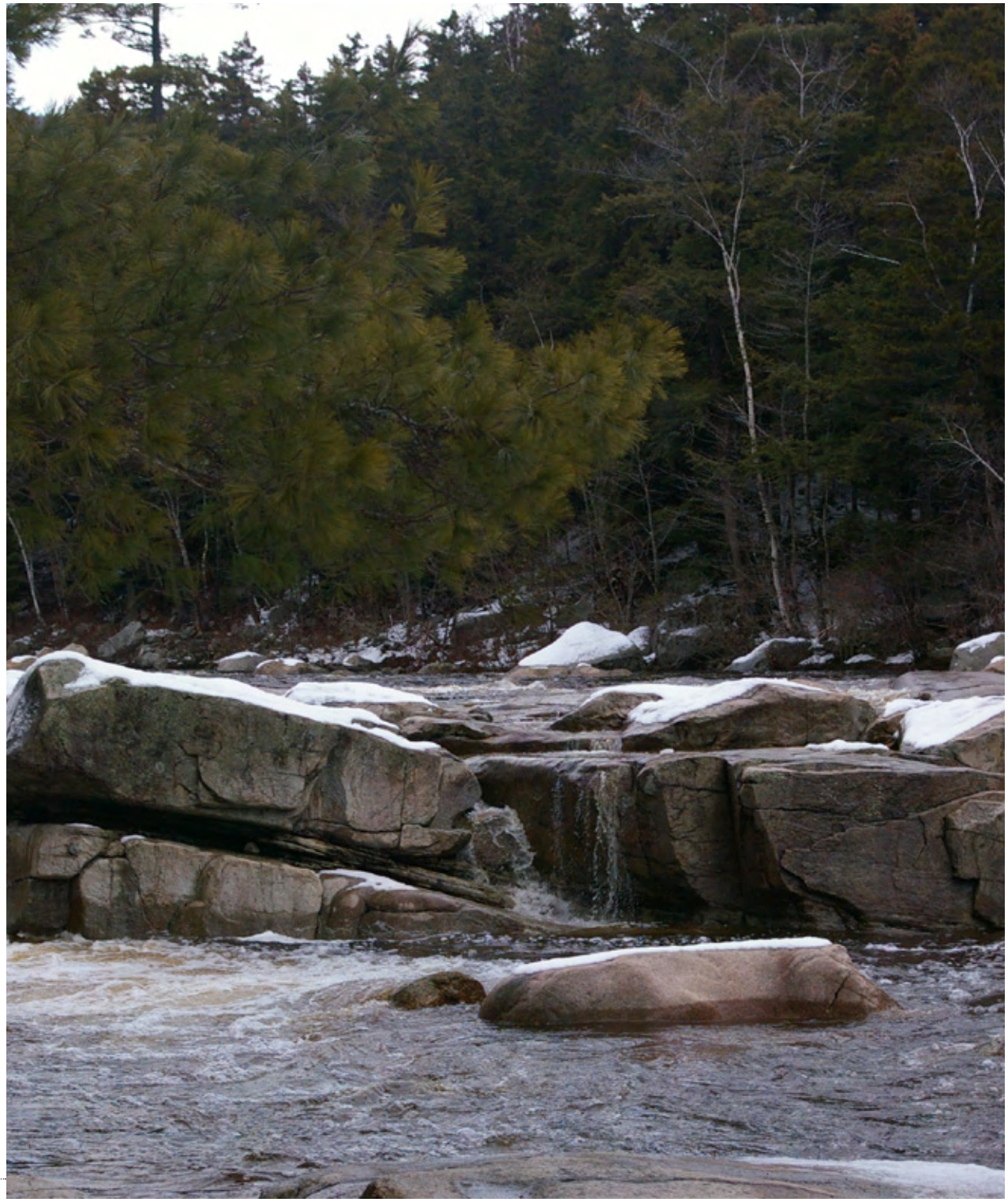
# 1 | THOUGHTS ON ARCHITECTURE

When I first started to think about a thesis proposal, I began with my love of nature. Nature is filled with inspiration at every turn; from the oldest tree, to the smallest trace of life, there are miracles everywhere. As architects it is our job to help preserve, and ultimately combine the natural environment into the built one. The idea of nature is a very powerful one, however, it has become apparent to me that environment does not only mean the purity of wilderness. Environment is the place you grow up in and includes the culture and traditions which were taught to you. Environment has incredible implications when combined with nature and architecture to create new and exciting places.

In the past it has been man's goal to conquer the wild places, and then look at it from a distance or from behind a glass wall. Man has distanced himself from nature so much that we no longer understand its value to us as humans. Nature is something to look at and study, but not to touch, or taste or smell. There used to be something romantic about nature.



Photograph by: Nathan Bonaiuto



"We shall not cease from exploration
and the end of all our exploring
will be to arrive where we started
and to know the place for the first time."

T.S. Eliot

I think there is an idea here about having discovered the world, and now simply re-discovering it. It is in those left over spaces in our cities and towns which have been resilliant to the development around them, that this natural beauty comes through.

# NATURE

Stepping from pavement to dirt, for me, has always been an uplifting experience. That one step is a threshold for release which takes away pressures of society and work. In nature you have to be completely aware. There is no daydreaming of doing something else. The senses come alive. The quieter you are the better because it allows the symphony of the place to engulf you. The trees wine, the birds sing, and the gravel under your feet crunches. At night, the senses are even more acute because eyesight is disadvantaged.

Nature is a perfectly balanced machine. It is a “society” of abundance, feeding and providing space for everyone in it. Each member has a job. There is no waste. The waste of one becomes the food of another. There is something beautiful about an environment which simply works. A cherry tree produces hundreds of blossums each year, all for the chance to reproduce. It simply takes one, but hundreds fall. There is however, no waste. The seeds that do not produce a cherry tree are eaten by other animals or broken down by decomposition and enrich the soil for the few seeds that do survive. When the tree eventually dies, it becomes a home for other animals, and when it falls, it becomes part of the soil, and another tree will be nourished by the one which came before.

# SUSTAINABILITY

As the lines become blurred between nature and architecture, it seems necessary to explain the reasons. An architect does not put a tree on a site so that he/she can earn points for LEED. The tree should be something inherent within the design from the beginning and has social, environmental, ecological, economical, and sustainable implications. A tree provides shade in the summer, and allows light to pass in the winter. This means that glass can be shaded by a tree thus allowing less heat gain, more views of greenery, more diffused light, less glare, etc. The tree shades the courtyard, so that the air becomes cooler, so now we can open a window, and allow the cool air to pass through the building. We now have fresh cool clean air that we did not pay for. The tree provides habitat for local wildlife including squirrels, and birds, which people inside the building can enjoy seeing while taking a lunch break. The shade makes for a nice place to sit outside and enjoy the fresh air. This is the result of a well placed tree.

A green roof is not a whimsical thing. When an architect decides to plant grasses on a roof, the potential is incredible. Grass on the roof provides a nice place to eat lunch, high above the bustling street, while providing views of the city. A grassy roof provides habitat for birds, collects rainwater, diffuses and uses sunlight, produces oxygen and takes in carbon dioxide. This is the result of providing a green roof.

The point I am attempting to make is that nature offers incredible opportunities. If we start to learn from the natural environment, we will have buildings and cities that are livable, workable, and enjoyable.

## LOCATION

Location is a literal idea about environment in that designing in Texas is completely different from designing in Maine. The climates, precipitation and needs of the people are completely different. Architects must remember and start their design by understanding the location in which they are designing.

## CULTURE

The next aspect of the environment is culture. Culture has to do with where in the world you are from, your religion, social practices and so on. We can design the most sustainable building in the world, however, for example, if it is in an Islamic country, and there is no place to worship, then the building is a failure, and is not sustaining of its occupants. In the end we do not design buildings for looks or points, but for people.

## TRADITION

Tradition in society is about repetition of something that is culturally or personally significant. For example my Italian family makes raviolis every Christmas. While the architect needs to pay attention to these types of things, there are other types of traditions to understand and use to your advantage. Every place has traditional building practices. These are based on available material and labor. In Spain, there is a very common floor building system called Bovedillas. It is a precast flooring system made of terracotta, which spans between small beams. Concrete is poured over this to even out the floor and tie it together. The result is a simple, lightweight flooring system. The reason that this is important because we use local materials, stimulate local labor, minimize travel distance, and allow traditional craftsmen to build the character of the building. This gives the building cultural and traditional significance.

http://info.comegoogle.com/phone/world-map.gif

APACHE NATIVE AMERICAN HOME
The apache native americans perfectly addapted to their environment by using local materials for everything. When the home was no longer needed, they simply disposed of the material back to nature.
http://www.flickr.com/photos/shirleytwofeathers/2565824849/

# 2 | PROBLEM STATEMENT

A Science Museum is a place where man can have dominion over nature. We can control it, and look at it through a glass window. We can see sharks and fish at eye level, and reproductions of environments like rainforests, and the arctic. In most science museums it is the challenge of the architect to re-create a habitat in a falsely lit and tempered environment. We build buildings like the ECHO Lake Aquarium and Science Center in Burlington Vermont. While the building is nice, it is a three story structure with a huge glass wall facing a wind blown lake, and simply could have been designed with more thought about its environment. Renzo Piano's Science Center in California falls victim to this as well. There is a long list of sustainable features on its website such as solar panels, roof vents, green roof, sunshades, and efficient HVAC systems. The building is in the middle of a beautiful park very close to the pacific shoreline, yet it focuses on the interior. In this case it might have been nice, although the main program focuses on a more worldly idea about nature, to have some local aspect to the project by leading people outside into the beautiful park to experience some part of the local environment. Unfortunately, the building has nothing to do with its context. The same building could just as easily be placed in a dessert in Nevada as in Massachusetts, and would have the same cultural impact. It is a universal building with no social or historical identity. When we build buildings that do not identify with their surroundings, they have no meaning for the people there, and will not be preserved. This is not sustainable.

The connection between environment and architecture is community, learning, and conservation. The Woonasquatucket Watershed Council and the River Greenway have been dealing with this issue for over twenty years. The community's involvement in park, and river clean-up as a tool for leaning and conservation is a great way of revitalizing a beautiful place.

Over a hundred years ago the Woonasquatucket river was a driving source of the industrial revolution in this area. The river provided much needed power to grind the corn and grain being produced in this place. Fresh clean power to make much needed items. The people used a small part of the river for only what they needed.

At a certain point in the early 1900s textile mills started using the river. Several mills went into business at this time. They adapted the natural flow of the river and formed dams and waterfalls so that during the dry season, water would still flow. The left over chemicals for the dyes were subsequently dumped into the river as a convenient disposal method. For the next 50 years the river absorbed these chemicals.

Today we are left with the after affects of this brutal business. The river is so toxic that it is unsafe to swim. The soils at the bottom hold toxic heavy metals and other chemicals. The fish, when found, are unsafe to eat as they filter these chemicals.

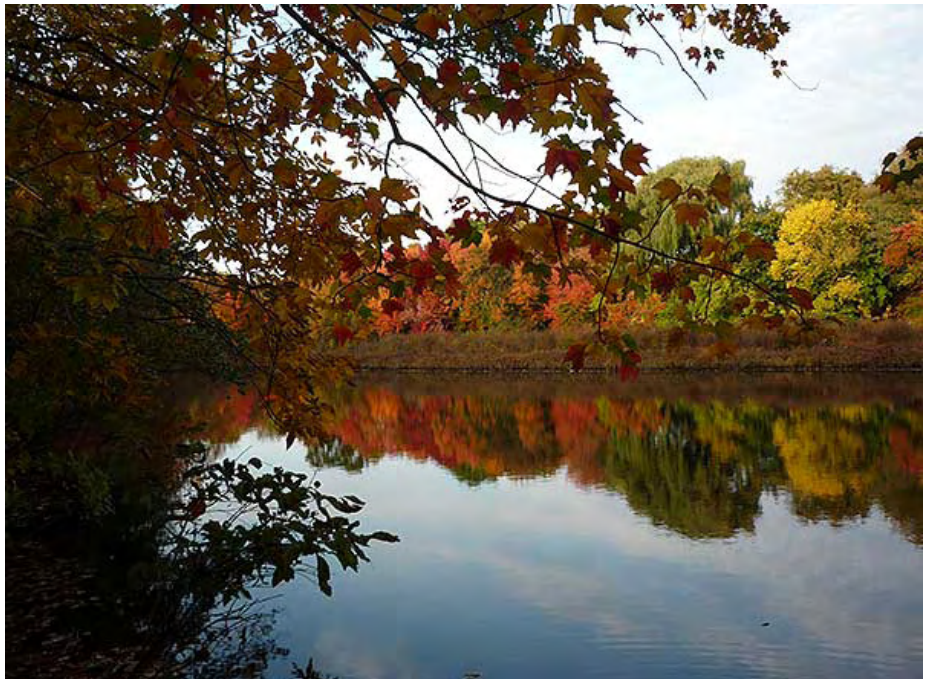
http://www.woonasquatucket.org/galleryPhoto.php?galleryID=3&photoID=28

Photograph by: Carol Drowne

The river, green spaces, and mills along the river were abandoned, and in more recent times, gangs, drug dealers, and all manner of criminal activity happened in these places. The housing projects around the river and its parks could not use them, and in fact felt unsafe in their own communities.
About 20 years ago a few dedicated people decided that the river and its parks could be a major asset to the surrounding communities. They formed the Woonasquatucket River Watershed Council and the Woonasquatucket River Greenway. Over these last 20 years, the council has worked with the surrounding communities to revitalize the river and its greenway. They have installed a four mile long bike path, cleaned up 5 or 6 parks, and formed a system which hosts kids in the summer. In 2009, as part of the government's recovery and reinvestment act, "River Rangers" were hired to lead younger kids in clean-up and conservation of the River Greenway.

The parks no longer have gang related activity, graffiti, or crime of any kind because this is a nice place to be. There is constant vigilance and surveillance by the community as well.

Left over from this clean-up is a seemingly unusable, hilly site slated simply for a bypass for the bike path. It will be a spur and possible access point for the main path, yet nothing else will be developed here. As a left over space it has been largely unused except for the occasional dog walker. The site is actually fenced off so that it is inaccessible to the community that borders it. The site is rich in plant life, and animals such as deer, squirrels, raccoons, skunks and all kinds of birds. The interesting part is that it is right in the middle of a highly urban environment. By developing a small portion of this landscape, it can potentially open up this place for local enjoyment of nature.



WOONASQUATUCKET RIVER
Photograph by: Carol Drowne
http://www.woonasquatucket.org/galleryPhoto.php?galleryID=3&photoID=29

A TEXTILE MILL ALONG THE WOONASQUATUCKET RIVER
http://upload.wikimedia.org/wikipedia/commons/6/67/Woonasquatucket_River.jpg

# 3 | PROJECT STATEMENT

“ENVIRONMENTAL ARCHITECTURE”

(MY GOAL IS TO MAKE) **ARCHITECTURE** WHICH IS **AUTHENTIC TO THIS PLACE** (HARTFORD COMMUNITY, PROVIDENCE, RI) **CULTURALLY, SOCIALLY, HISTORICALLY,** AND **NATURALLY**

The project is about opening up an urban community to a local environment which can be seen as an asset. It is about a deeper understanding of architectural practice which is not just skin deep. The project is about becoming part of two communities, the built one and the natural one, and finding its place within each.
Environmental Architecture is a holistic way of looking at a project. It starts with a regional understanding of temperature and climate, then refocuses on its immediate surroundings. It must come from a rooted cultural construct which expresses the character of its surroundings.
Environmental architecture is as much about nature as it is about the society and community in which it is built. It is not about a global problem, but rather, a local idea about a local site framed within a local community.

Photo by: Nathan Bonaiuto

# 4 | PROGRAM

The Environmental Discovery Center is about the seamless integration of nature and community. The community uses the natural environment as an asset, and nature also benefits from the attention. The programming responds to a need to learn and educate the local community about this place. It becomes a hub for this organization which has, over the years made a huge and positive impact in this area. The programming responds to the needs of the Woonasquatucket River Watershed Council, as well as the needs of the people of the surrounding community, and schools. The Discovery Center provides spaces for exhibition of habitat, flora, fauna, and tracking.

The watershed council has started an informal summer camp for the communities surrounding the River Watershed. Kids from Olneyville and Harford use these programs as a kind of daycare during the summer. The watershed employs "River Rangers" to help watch over them during the day. When it rains they need some place to go, and so as part of the Discovery Center, there will be a pavilion style outdoor classroom used for arts and crafts, dancing, and all manner of fun activities.

Most science museums like the California Academy of Sciences, and the Boston Science Museum have interactive exhibits in which the visitor gets to touch a starfish, or see a simulation of a habitat. The Environmental Discovery Center is a place where the exhibit starts inside the building with these wonderful hands on things, and then spills onto the landscape, and we get to see and interact with Mother Nature herself. As a society, we no longer look to nature as a home, but rather as a battle field, and the Discovery Center is aimed at bringing people back into their home. Starting with the tracking and awareness room as part of the museum, there will also be program supporting kayak and bike rentals. It is important to both learn about the river, and then see how beautiful it is by navigating it. This will also start to generate some funds to help support the summer programs and other activities that the watershed council is always involved in.

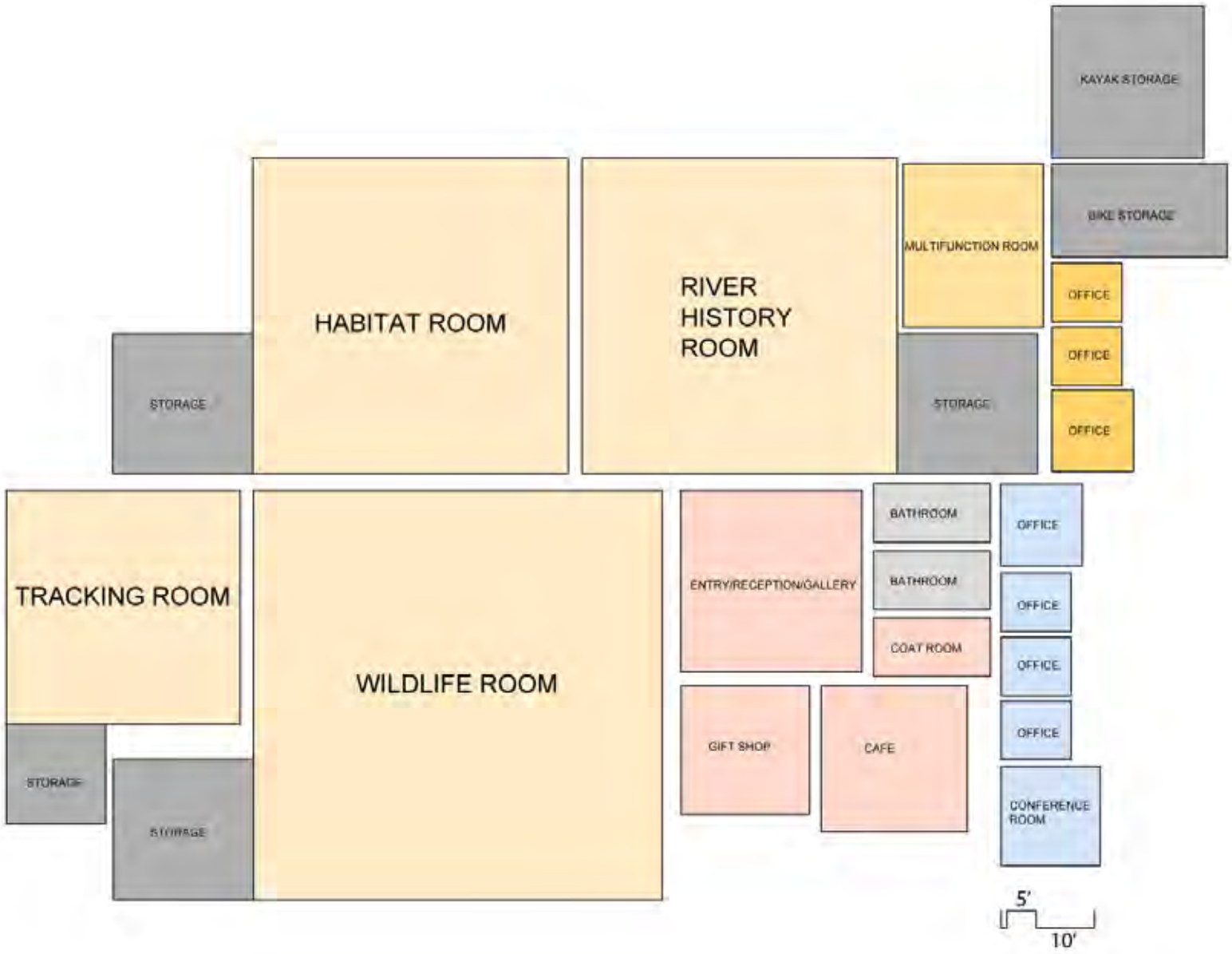
Photograph by: Nathan Bonaiuto
Current site for the Woonasquatucket River Watershed Council summer program.

## ORIGINAL PROGRAM

| PROGRAM | | AREA sqft |
|---|---|---|
| MUSEUM | | |
| **ENTRY:** | | |
| Reception and gallery | | 1000 |
| Café | | 600 |
| Coat room | | 200 |
| Museum Shop | | 500 |
| Bathrooms | | 400 |
| | Total: | 2700 |
| **EXHIBITION ROOMS:** | | |
| Habitat | | 3000 |
| Wildlife | | 5000 |
| River History | | 3000 |
| Tracking | | 1500 |
| storage | | 2400 |
| | Total: | 14900 |
| **ADMINISTRATION:** | | |
| Curator office | | 200 |
| Finance office | | 120 |
| Offices | | 240 |
| Conference Room | | 300 |
| | Total: | 860 |
| **WOONASQUATUCKET WATERSHED COUNCIL** | | |
| Executive Director office | | 200 |
| Program Director office | | 120 |
| Program Assistant office | | 120 |
| Break room | | 200 |
| Multifunction Room | | 800 |
| Kayak Storage | | 700 |
| Bike Storage | | 500 |
| | Total: | 2640 |
| MECHANICAL | | 1000 |
| | Total: | 1000 |
| | Net Total: | 22100 sqft |
| | Gross Total: | 28730 sqft |

## REVISED PROGRAM

| PROGRAM | | AREA sqft |
|---|---|---|
| **ENTRY:** | | |
| Reception and gallery | | 1634 |
| Coat room | | 88 |
| Auditorium | | 937 |
| Community Space | | 1369 |
| | Total: | 4028 |
| **EXHIBITION ROOMS:** | | |
| Habitat | | 3261 |
| Wildlife | | 2371 |
| River History | | 1436 |
| Tracking | | 1351 |
| | Total: | 8419 |
| **PUBLIC SPACES:** | | |
| Café | | 1555 |
| Atrium | | 1557 |
| Bathrooms | | 500 |
| Gift Shop | | 1455 |
| | Total: | 5067 |
| **ADMINISTRATION:** | | |
| Curator office | | 130 |
| Finance office | | 130 |
| Offices | | 130 |
| Offices | | 130 |
| Offices | | 130 |
| Conference Room | | 300 |
| | Total: | 950 |
| **SYSTEMS:** | | |
| Water Filtration | | 750 |
| Storage | | 500 |
| Mechanical / Storage | | 1556 |
| | Total: | 1556 |
| | Net Total: | 20020 sqft |
| | Gross Total: | 29339 sqft |

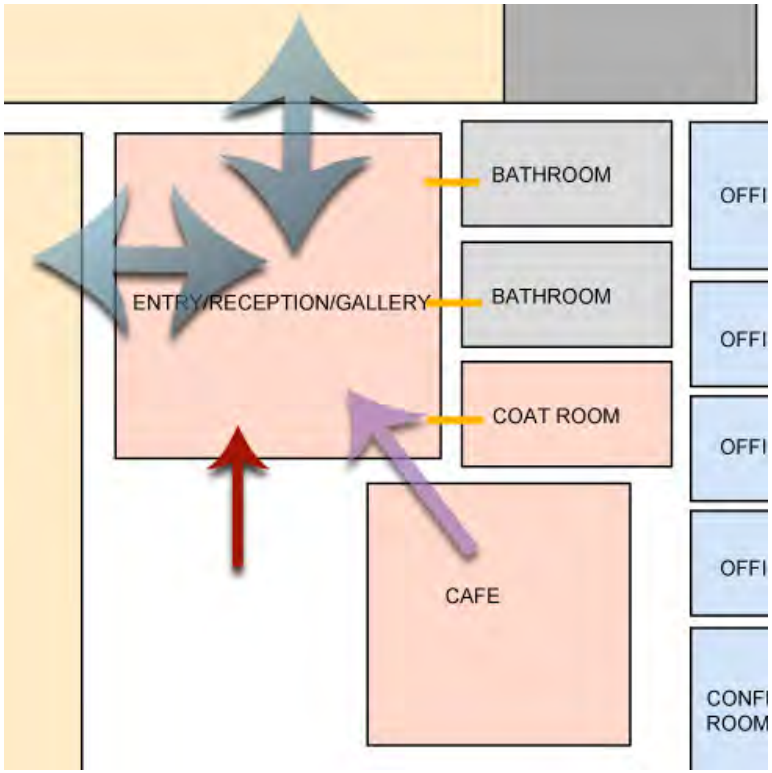



POSSIBLE PROGAM LAYOUT

# PROGRAM DESCRIPTION: ENTRY

| PROGRAM | | AREA sqft |
|---|---|---|
| ENTRY: | | |
| | | |
| Auditorium | | 500 |
| Traveling exhibit space | | 300 |
| Reception area | | 200 |
| Reception and gallery | Total: | 1000 |
| | | |
| kitchen | | 350 |
| Serving area | | 250 |
| Café | Total: | 600 |
| | | |
| Coat room | | 200 |
| Museum Shop | | 500 |
| Bathrooms | | 400 |
| | Total: | 1100 |

| Total Entry: | 2700 sqft |
|---|---|




## ENTRY:

The entry is a special condition for the Environmental Discovery Center. There are both logistical and philosophical ideas about it. The entry is a gallery spanning the height of the building. This allows light to come in from the roof, but it also becomes an orientation device as to where you are within the building. There is space for a small auditorium area for when students first come into the Center. It will give an overview of what the museum is about. Also within the main gallery space is a small exhibition area for traveling exhibits. It is important that this space seem light and airy, a transition between outside and inside, and then in turn opens itself up to the rest of the museum. It is not only a space for reception, but also for benefits, and other fundraising opportunities. In this way, the café is directly adjacent, and spilling into the main entry gallery. This is a place where food and drinks can be served at an event. In the end, it must be a self-sustaining part of the museum, in other words, it must function independently as it performs multiple functions. This means that it must be surrounded by support functions such as a café, bathrooms, and storage.

# NARRATIVES

The following are imagined accounts which describe the nature of the place through the eyes of a young boy on a field trip with his class, and that of the teacher bringing them on the field trip. Both will offer insight into how the spaces work, and something of an experience while walking through them.

## Boy speaking to his parents after visiting The Environmental Discovery Center.

We went to the EDC today for a field trip. We left right after we got to school, and we took a bus to get there. When we got there, a nice lady brought us around. From outside the building looked very old and I thought at first that it would be really boring, but I was wrong, cause when we went inside, it was all new looking.

First we went to a room that told all about the river in Providence. They told us that the river used to be used by textile mills, they are the people that made clothes a long time ago. They said that because of these factories, the river got really polluted and we can't swim in it or eat the fish if we catch any.

After that, we went to the... I forget what it's called, but it was a room about where the animals live. We learned that turtles like to sunbathe because they are not warm blooded animals. The sun warms them up, just like it warms me up in the winter when it's cold out! They had a room in there that had a lot of glass, and the lady that was bringing us around said that when the sun shines on the glass, it warms up the building in the winter just like the turtle. I thought that was pretty cool. The rest of the room was cool, they had a display about swamps, and rivers, and oceans, and the types of animals and plants that grow and live there. Then we went outside and saw a real swamp that they said was made to help clean the water in the dirty river. She said that each plant had a job to do, and that job was very important to the ecosystem. Some plants eat some of the bad things in the river, and other plants add nutrients to the water. The Animals also help by keeping the system balanced and stuff.

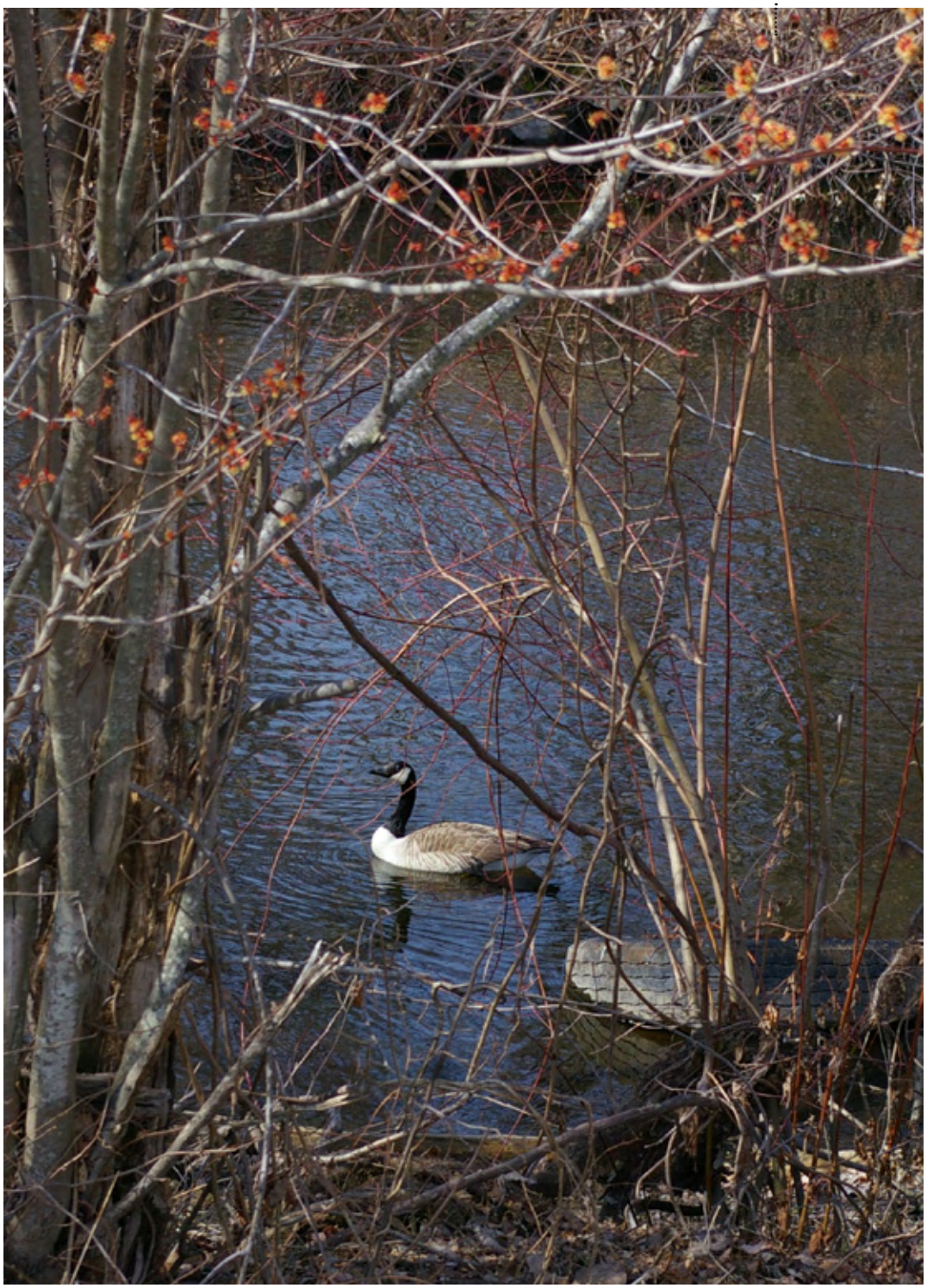
The last part was the coolest part I thought. We met a guy that had a big beard, and he said he was going to take us to the tracking room. The tracking room was all about the things that animals leave behind, like their footprints, scat, nibbled food, nests, and other things. We started in a big room with other displays, but all the displays were of footprints, and pictures of them. The guy started to tell us that tracks are a way of understanding and studying animals. If we follow an animal's tracks, we learn where they go, what they eat, where they sleep, and what they do all day. Next we went outside and saw a big sand pit with sticks in it. When we got closer, the guy told us too look closely at the ground. There were footprints everywhere! He asked us if we could tell him any of the animals that had walked through. I recognized one of them as a raccoon. I had just seen what it looked like inside!

# HABITAT ROOM

The habitat room is an exhibit about the different conditions along the Woonasquatucket River. There are marshes, grasslands, wetlands, lakes, and the river itself. Each one creates its own ecosystem. The Habitat room is about the plants and animals that live in these areas and the restoration efforts going on right now to help repair them. This room will have a direct connection to the river habitat on the site, and will therefore spill out beyond the museum and into the landscape.

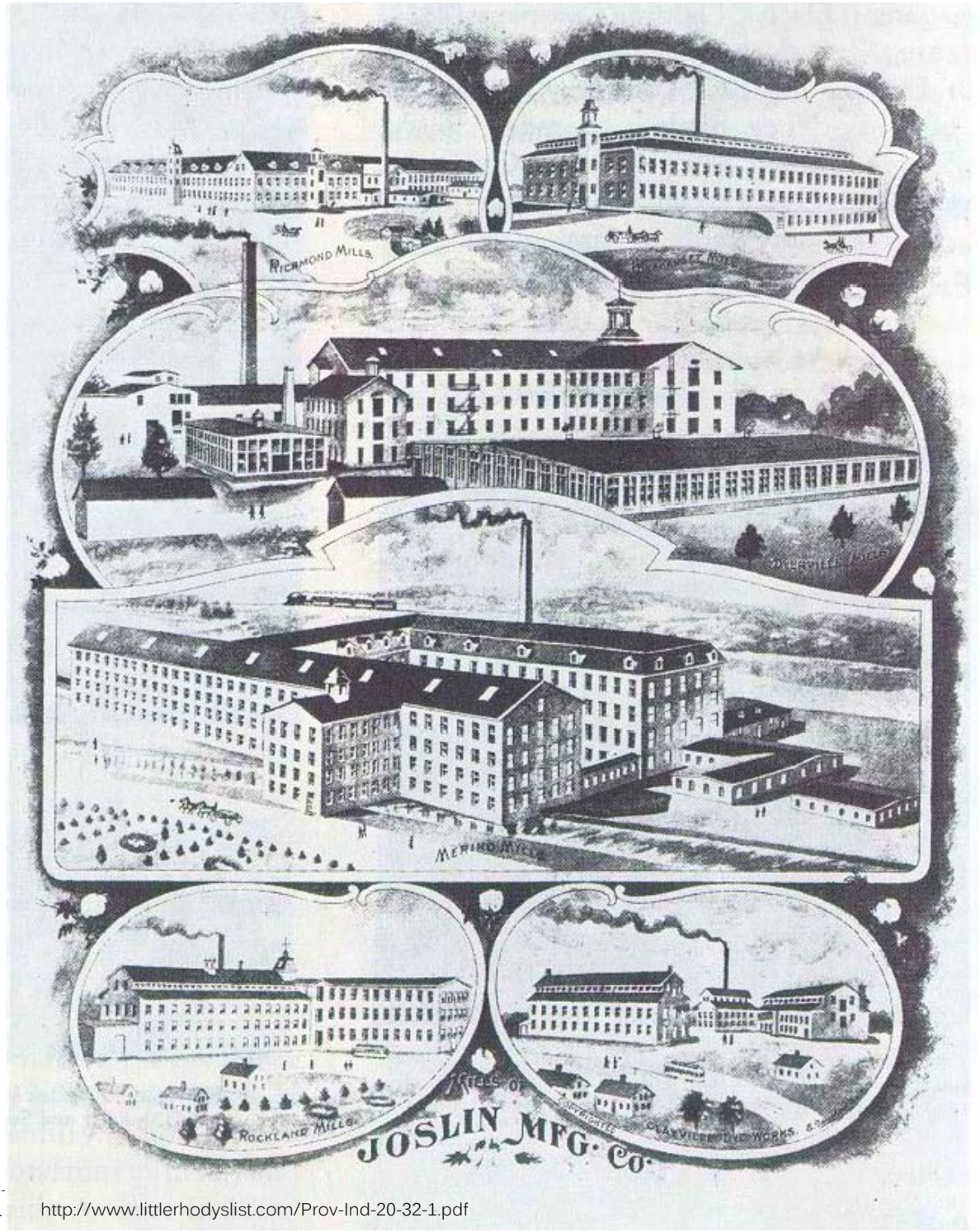
Riparian Buffer. One of the many habitats found along the woonasquatucket river.

# WILDLIFE ROOM



The wildlife room is the largest of the exhibits. Here, the different types of animals found along the woonasquatucket river will be the main display of the exhibit. It is important that this is hands on especially for the younger kids because this is what keeps them here and interested. While there will be live animals in here, it will be limited to fish, and other water bound animals. This room will extend beyond its four walls in that kayaks can be taken out onto the river to further explore the river wildlife.

An example of the local wildlife, Canadian Geese




http://www.littlerhodyslist.com/Prov-Ind-20-32-1.pdf

The river history room has a direct connection with the Woonasquatucket River Watershed Council. The reason for this is that they are continuously looking at the past in order to fix it for the future. They are also changing the place every day through their many programs. It is also important that this room has views of the river and site because of the direct connection with the history of this place. It is possible that a foundation or site landscaping could be exposed in order to remember the mill that ultimately built this Hartford community.

# TRACKING ROOM

http://farm1.static.flickr.com/164/355988564_354053c6eb.jpg

Lastly, the tracking room is what sets this museum apart from others. Nature is a beautiful thing, and tracking and awareness can help us to see nature in its fullest state. There is no question that this room is connected to the landscape, and in fact the outdoors will be a continuation of the exhibit inside. On the inside there will be exhibits about different types of animal footprints and their habits. As the visitor moves outside, there will no longer be pictures of tracks, but the real thing. As they move into the landscape they will learn to slow down and appreciate the natural environment. It is here that the thesis is realized. It is necessary to continue with our efforts of sustainability so that they can preserve the beauty of what they are looking at. It doesn't matter if they are in the middle of a city, or in the White Mountains, both are beautiful, and both are necessary for our future survival.

Tracks in winter left by a common rabbit. Notice the larger hind feet come down infront of the front feet.

The Woonasquatucket River Watershed Council is currently residing on Sims Avenue in Providence. They have become stewards of the river for over the last 10 years. During the summer they run a “river rangers” program in which older kids watch the younger kids and all help to clean the parks and river. Other than Riverside Park there is currently nowhere for these kids to go for this organized program, and given the inherit connection with the river it seems necessary to include program for the Watershed council. The office needs are for three people working mostly full time. A multifunction room for the summer, and a place to hold meetings and debates in the winter would also be welcomed. This multifunction room is a place for the kids doing the summer program to do arts and crafts, as well as some of their larger scale projects that can then be placed in the entry gallery for exhibition. This classroom is not a place for kids to hang out in all day, but rather a place for rainy days and when a semi-enclosed space is needed. The multifunctional space will open completely to the landscape and act more like a pavilion than an indoor room. There will be storage space for art supplies and the like in this space as well.

Attached to this space, and rented out by both the Watershed Council and the Museum, as they are one in the same, is a kayak and bike storage area. In the end, the kids can use the bikes and kayaks, yet the museum will also use them for guided tours along the river.

http://www.woonasquatucket.org/greenway.php

## NARRATIVES

### ELEMENTARY SCHOOL TEACHER:

Mrs. Shmidt speaking to the principal about her class trip.

The class trip went well today. The students were well behaved, and seemed to really enjoy the trip. What these people are doing is quite amazing. When we got there, the students were all asked to gather around in this large entry area. The building was well suited for the large class size, which is nice because from the outside it looks like a very old building.

The tour guide told us who she was and what we would be doing today, as well as what this building is for and why it is here. She explained that the Woonasquatucket River has a rich and long past and that part of the job of the museum is to remember that past. In fact the first exhibit was about the history of the river. It started way back when the native Americans lived along it and then right up through the industrial revolution until the present day. The exhibit was interesting because it started in a larger space filled with plants and photographs of the people who lived here before us. It had the feeling of an art gallery. Next we entered into a darker more cramped space. The air was thicker and the space was gloomy. This was the space about the industrial revolution. It showed how textile mills just used the river for energy, and dumping. Finally, we got to the end of the timeline which is in the present and there was large glass openings where we could actually see the river. There were people working down there cleaning it and learning from the wildlife and plants. The exhibit turned into a hopeful mood and showed what is being done today. This was the most amazing part because these people have gotten together and decided that this river is a good thing for the community and they wanted to clean it up so that it could be used. The tour guide told me that they run programs where students go up and down the river in kayaks in order to explore the river more closely.

Next we went to the other exhibits which were about habitat and animals which was interesting. There are an enormous amount of variation in the plant and animal life around the river. There are several different ecosystems which are very fragile and the museum is doing its best to help these ecosystems, and in fact reverse some of the negative impact that the industrial revolution had on the river. They actually had a living machine there which processes the waste from the building as well as the river. The water actually goes out cleaner than it goes in. The machine was a separate building that we had to go out to see, but it was a perfect Segway to the tracking room.

The tracking room was all about what the kids could do when they are in their backyards, or at the beach. There was an inside room which identified all of the different animals in the area, and then a big sandbox on the outside leading to the Living machine. The box had all kinds of tracks in them, and the kids enjoyed making their own tracks and seeing how it works.

The day was incredibly interesting and a lot of fun for the kids. You might bring your family there this weekend. It's a perfect thing to do on a Sunday afternoon.

Woonasquatucket River between Merino Park and the EDC site
Photo by: Nathan Bonaiuto

# 5 | SITE

## SITE CHOICE

The Woonasquatucket River Greenway is approximately four miles long. Along this greenway there are various parks, a bike path, and viewing areas. Merino and Riverside parks are well used by their respective communities, and are well kept by the watershed council. Immediately to the west, adjacent to Marino Park are three empty plots of land. until the very recent past, this site held one of many textile mills along the river. This mill, called Lincoln Lace Braid factory, was a cotton mill until 1994, when a fire burned most of it down. The mill, during its existence treated the river, and the site as a waste basket, throwing toxic chemicals into the river, and on the site. The ground itself was unsafe to be on, and the river as has been explained, is still in a toxic state.

The city of Providence in harmony with the Woonasquatucket Watershed Council, and the Woonasquatucket River Greenway cleaned this site, starting in 1996 and ending in 2003, of its toxicity up to 12 inches below the surface. Currently, there is a plan to leave the site as a green space, and run a spur of the bike path through it.

The site itself offers numerous advantages in terms of placing an Environmental Discovery Center here. Designing the Discovery Center in this place adds a unique dimension to the idea of science museum. Traditionally, science museums are buildings within cities which show through interactive exhibits about wildlife and nature. Typically, the museum has exhibits that are about many different countries and habitats which exist all over the world. The Environmental Discovery Center captures within its exhibits, the specifics of its own place in Providence, RI. It shows the beauty and diversity of nature in an incredibly specialized environment, in direct connection with the history of this place. This allows for two things, first, there is an inherent commitment to and by the community for this center, as well as a direct connection with what the exhibits are teaching about. If the program is about allowing for interaction with nature, then the site is about facilitating that within the urban environment.

Providence, RI, and more specifically Narragansett Bay, was home to several tribes of Native Americans, the biggest of which was the Narragansett tribe. They were the protectors of several other smaller tribes including Nipmuck bands, the Niantics, Wampanoag, and Manisseans. The Narragansett people were typically warriors, farmers and hunters, who migrated between the summer and winter. The tribe stayed along the Narragansett bay coastal areas during the summer in temporary shelters called Wigwams or Wetus. In the winter long houses in which 20 or more families would live, were constructed further inland.

The first documented contact with another culture was in 1524 when Giovanni de Verrazano visited Narragansett Bay. The first European settlement came over one hundred years later in 1635. Roger Williams received land rights from the Narragansett Sachems and quickly started what would later be known as Providence, RI.

In the late 1700s European settlement was expanding so much, that it caused conflicts with the Native Americans, and so reservations of 15,000 acres were set up in order to handle the problem. The “kings” of the tribes were no longer in charge, although most people still followed the old ways of governing themselves.

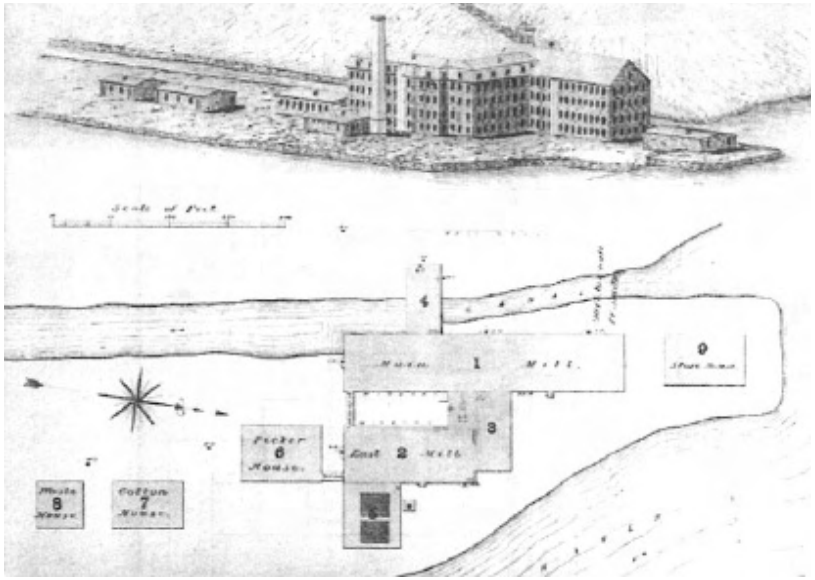
Between 1880 and 1884 illegal detribalization occurred by breaking up the bands of Native Americans. The people were forced to live in the surrounding towns and villages. Still, the leaders of the clans would host meetings for the tribes, and people would come. This still goes on to this day when they meet on the second Saturday of August.

http://www.runningpast.com/vintage_photos/tarzanpic.jpg

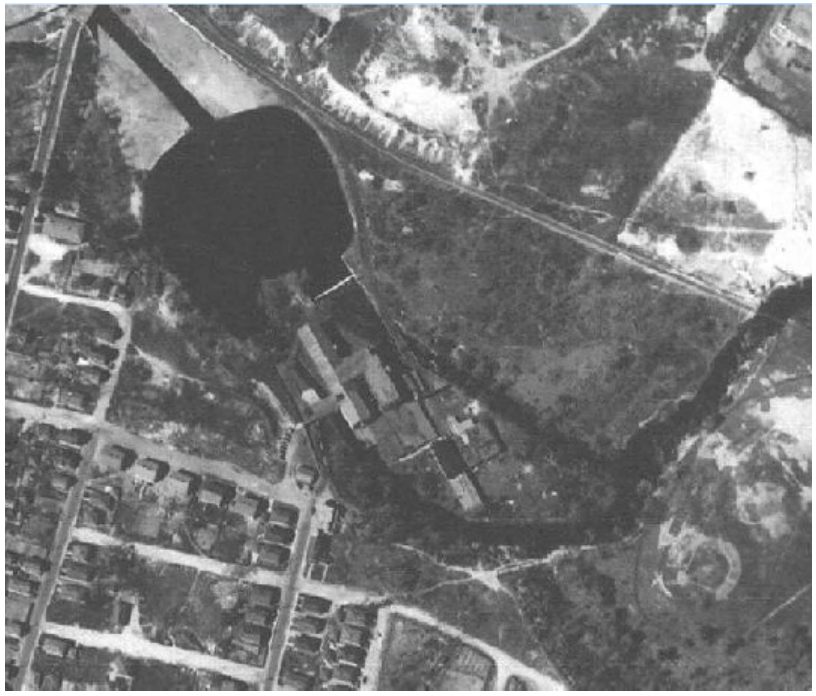
http://homepages.rootsweb.ancestry.com/~sam/roger.gif

The Industrial Revolution had incredible implications for the development of the areas surrounding the Woonasquatucket including the Hartford, Olneyville, and Manton neighborhoods. This means that several crossings had to be built, as well as access roads to and from the new mills that were being built. Essentially, infrastructure had to be built up in order for the mill to function properly. Like many areas at the time, the Hartford community was built on the back of this mill as there were a multitude of jobs and resources available. The community truly relied on the mill, even using the shift change whistle in order to sound the curfew for the children. The town called “Merino Village,” consisted of stone houses, a general store and water supply. All of this was built by the mill workers in order to support the families of the mill workers.The mill itself produced wool based textiles for its first two years before switching to the cheaper cotton. They produced a soft material that they called Merino Cloth. Unfortunately at the time the developers had very little respect for the river, and by damming it they prevented fish from migrating and spawning as they had been for hundreds of years before human intervention. The workers also spilled toxic chemicals and heavy metals from the production process into the river, so that over 100 years later, we can no longer use the river for anything.

Today, the river is in the process of being restored to its original state. The man-made lake no longer exists, and a fish ladder has been installed to allow the fish to migrate up the river for the first time in a hundred years. The river is also being used to facilitate social change through summer programs and awareness put on by the Watershed Council.



EA ENGINEERING, SCIENCE, AND TECHNOLOGY INC.



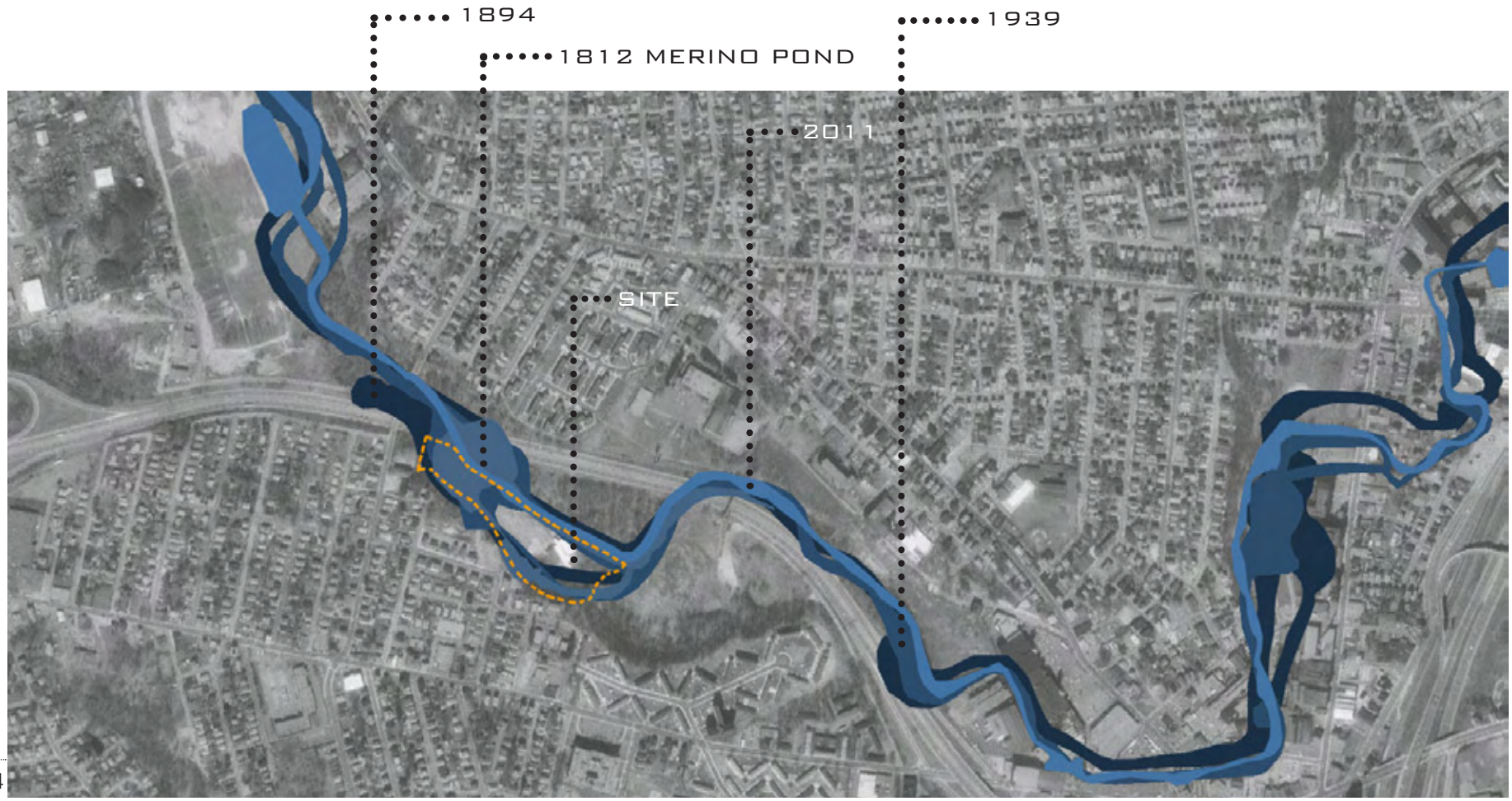
EA ENGINEERING, SCIENCE, AND TECHNOLOGY INC.

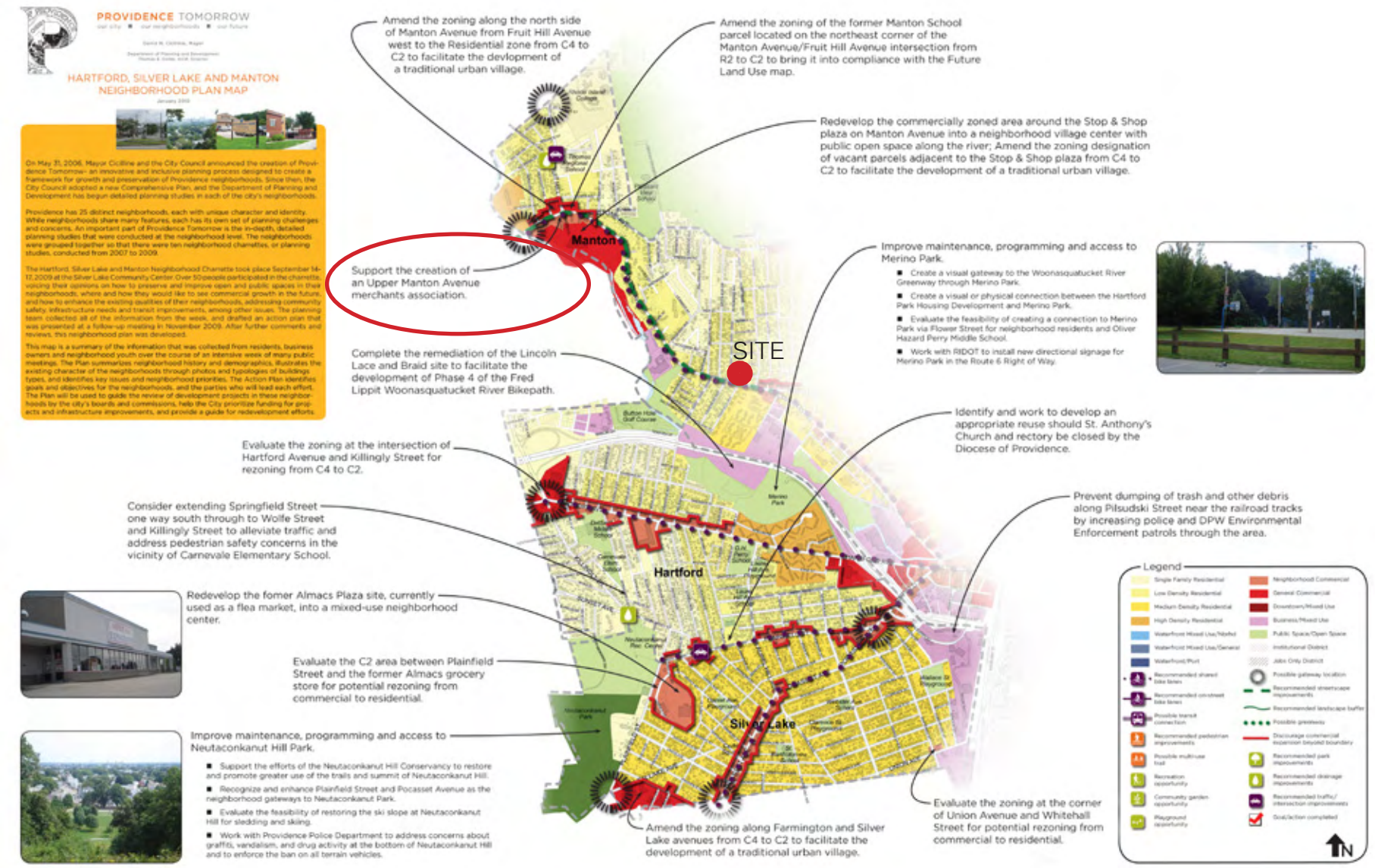
## RIVER

Up until 1812, the area around the Woonasquatucket River was home to the Narragansett Indians, and then later, settlers that primarily farmed the land.

Since the Narragansett Indians left the Bay area, the Woonasquatucket River has gone through several man-made changes. The most significant event in the Hartford area at this time was the building of the Merino Textile Mill in 1812. The mill was located directly adjacent and to the west of the present day Merino Park, and it served as a great development tool for the community surrounding it.

At the time of the building of the mills, a man made lake was also built in order to facilitate year round power for the mills. Now, even in the dry season the mills could easily power their machines using the river flow.






Department of Planning and Development January 2010


PROVIDENCE, RI


HARTFORD


SITE


MAJOR BUS ROUTES
BIKE PATH
RIVER
GREENWAY
SCHOOLS
Providence
Providence, RI

## WALKING DISTANCES

Within a quarter mile of the site there is a bike path, Merino Park, the Woonasquatucket River, and Buttonhole Golf course. Except for the golf course, each of these features are directly connected to the site. This is vital in terms of access (bike path) and connections (river).

Within a half mile radius there are already elementary and middle schools, as well as multiple housing developments, which is important for the catchment of the Environmental Discovery Center, and the primary reason for the community focused programing. Also within a half mile is River side park which is the current start to the bike path, as well as the main site for the Watershed Council summer program.

WALKING DISTANCES

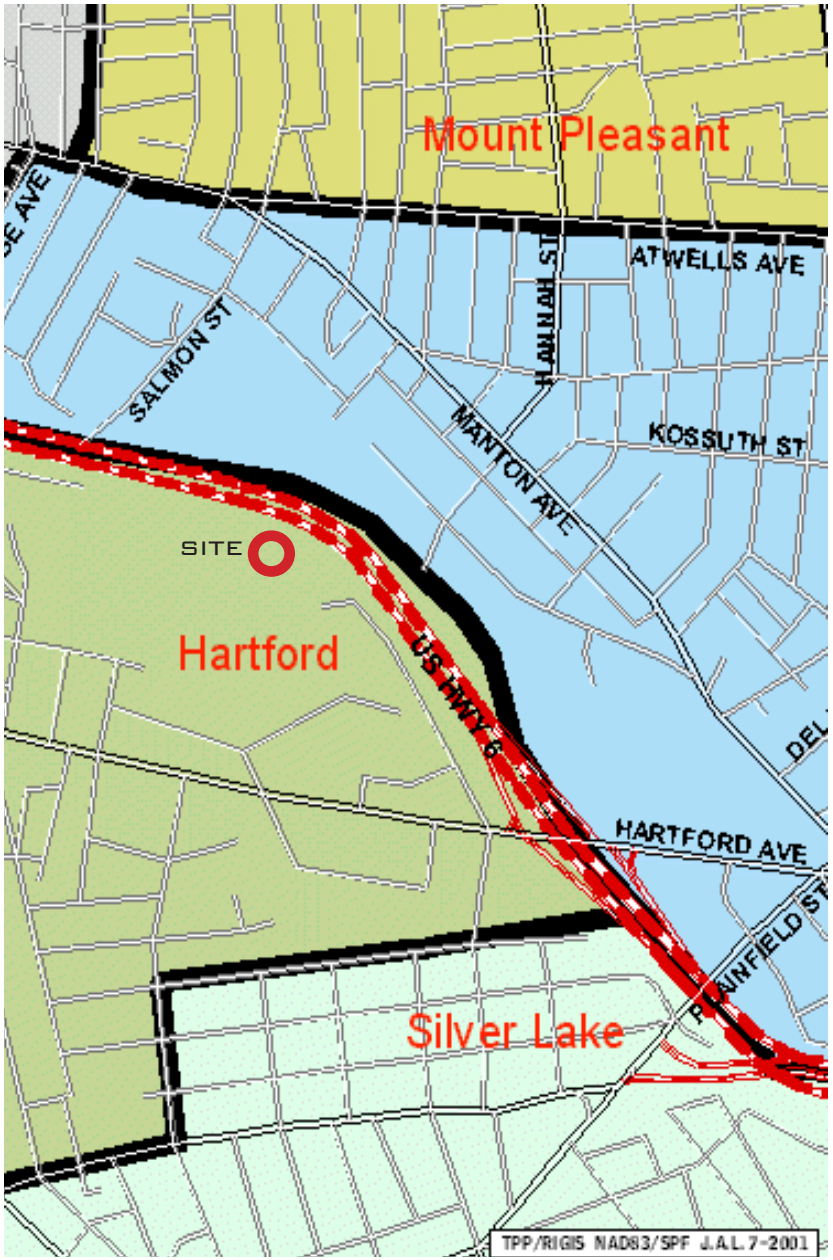
## NEIGHBORHOODS

The neighborhoods around this site seem to be distinct, in that you know where you are from. In terms of design, however, the neighborhoods are pretty similar with the exception of some low-income housing at the north border of Hartford (directly south of the proposed site). Otherwise, the houses consist of 2 and 3 family developments. Both Hartford and Olneyville have major routes that cut through them and are activated by shops and restaurants. They are not however, pedestrian friendly.

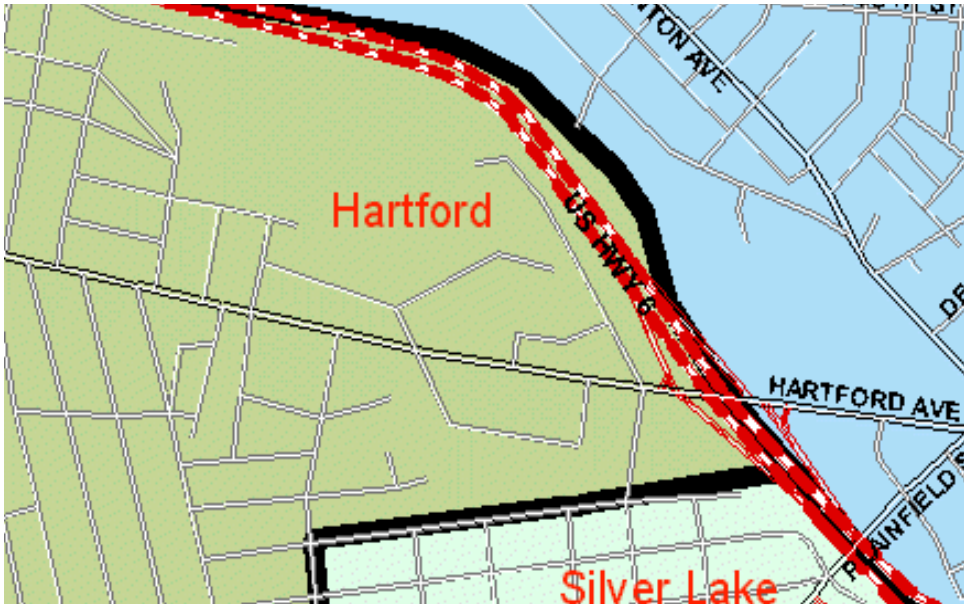
NEIGHBORHOOD SEPERATION

Olneyville consists mostly of two and three family houses in a “suburban” type of condition.

The bike path cuts along the southern edge of Olneyville. It moves with the river, but allows for connections across it.




http://local.provplan.org/profiles/maprnks/oln_base.gif


Hartford
US HWY 6
HARTFORD AVE
Silver Lake

# ACCESS


ROAD ACCESS TO SITE

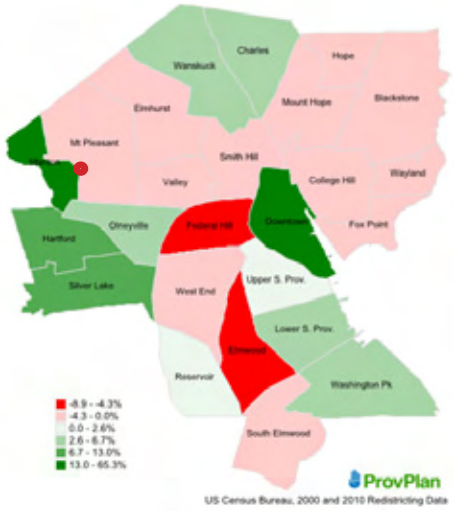
## VEHICULAR

Access is relatively simple in that there are really two major roads from Providence to the site. Route 6, and Manton Ave are both major routes through the Hartford and Olneyville neighborboods. To cross over the highway simply take Glenbridge ave.

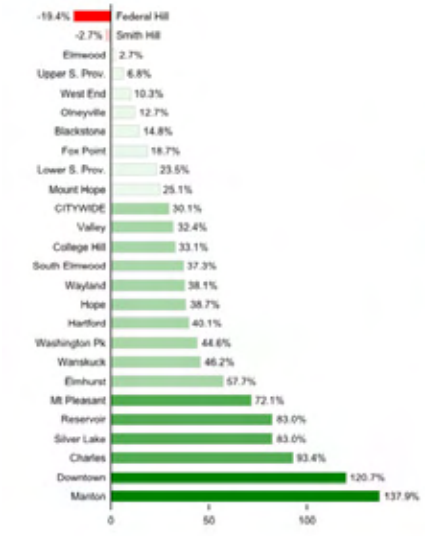
## PEDESTRIAN

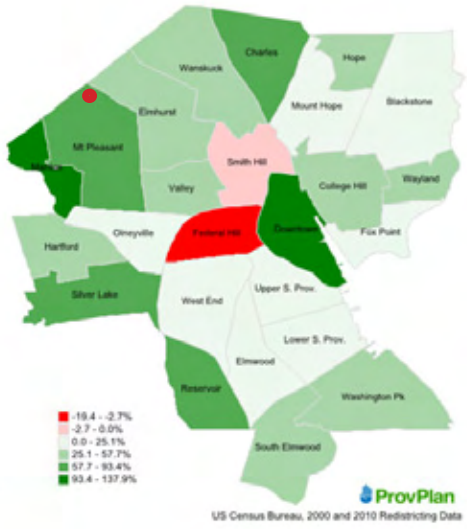
Access to the site is even simpler. Within the quarter and half mile radius, there is quite a lot of housing, and therefore the community portion of the project will use this as its catchment area. In bright red are the major access bridges and areas for the site

## POPULATION CHANGE 2000-2010

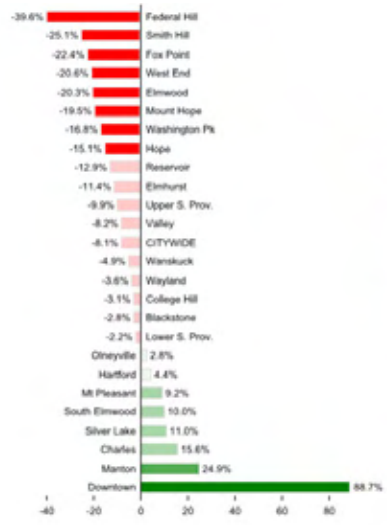



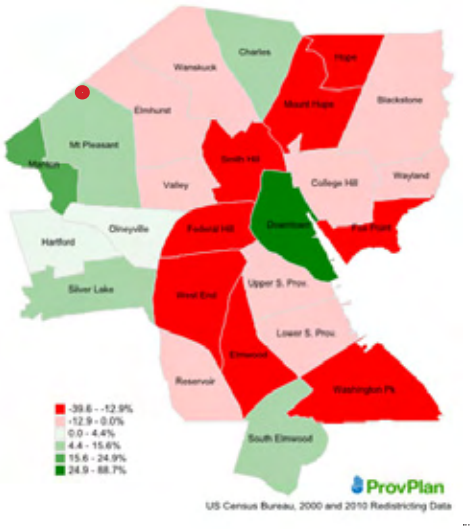

## HISPANIC POPULATION INCREASE 2000-2010



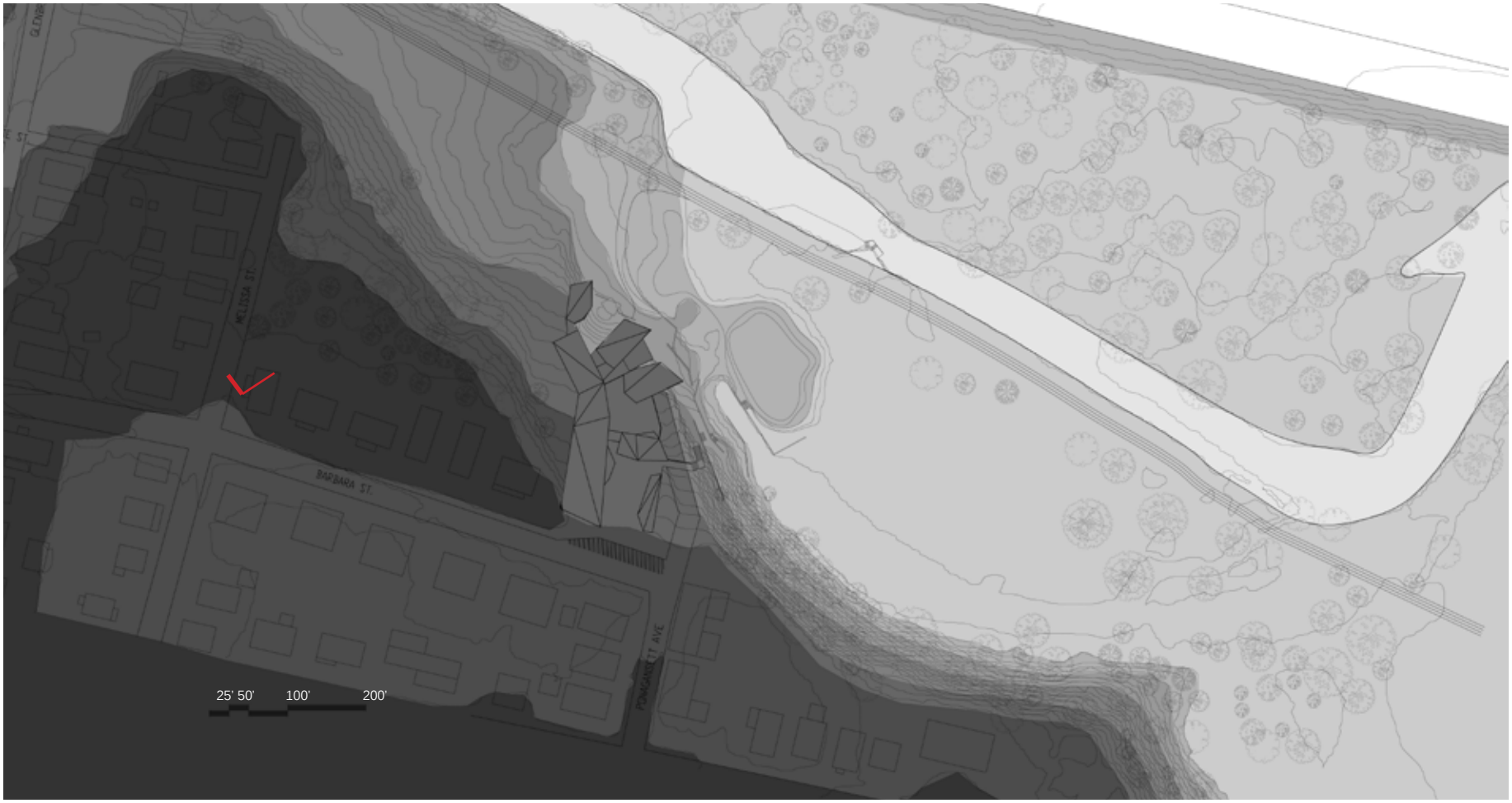

## POPULATION INCREASE UNDER 18 2000-2010



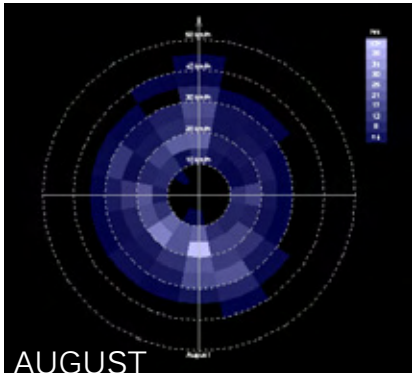
# INFRASTRUCTURAL SITE CONSIDERATIONS

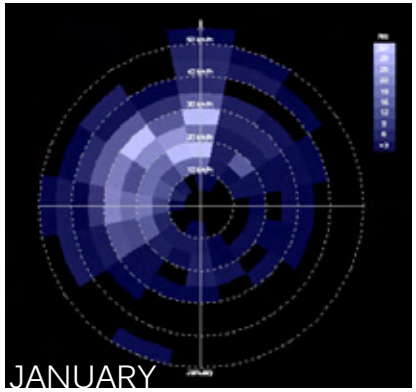
# TOPOGRAPHY

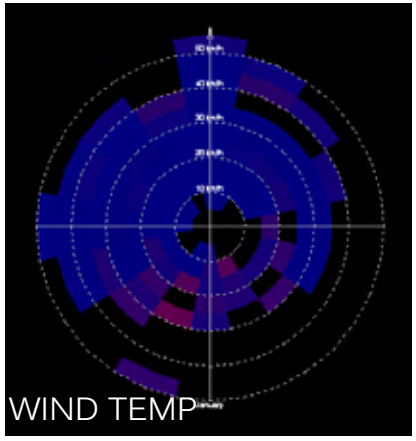




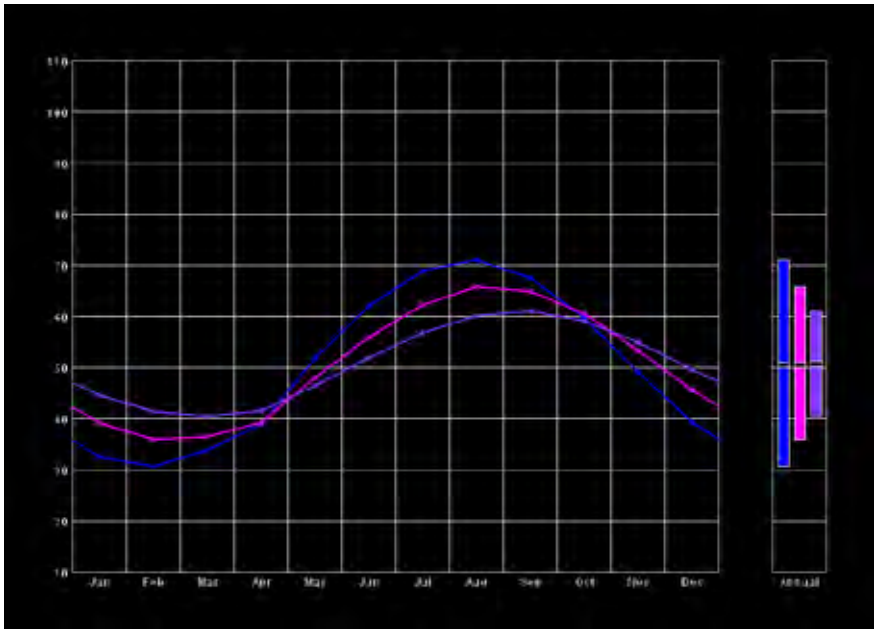
N.W. WINTER WINDS
KEEP EXISTING TREE BUFFER TO THE HIGHWAY
KEEP NATURAL DRAINAGE SWALE
5:00PM
DEC. 0
AUG. 25
9:00AM
DEC. 15
AUG. 45
N
S.W. SUMMER WINDS CAN BE CAPTURED TO COOL BUILDING
12:00 NOON
DEC. 25
AUG. 65

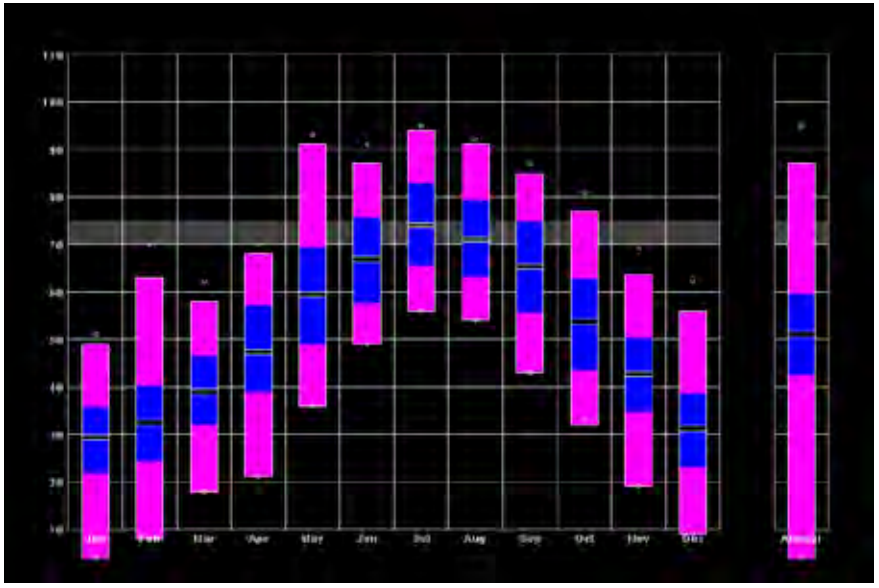


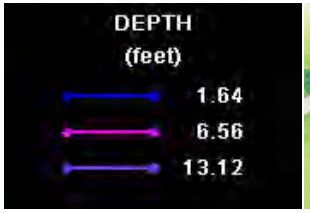



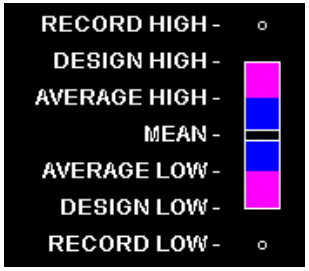

The wind patterns seem to be going n-ne in the summer and sw in the winter



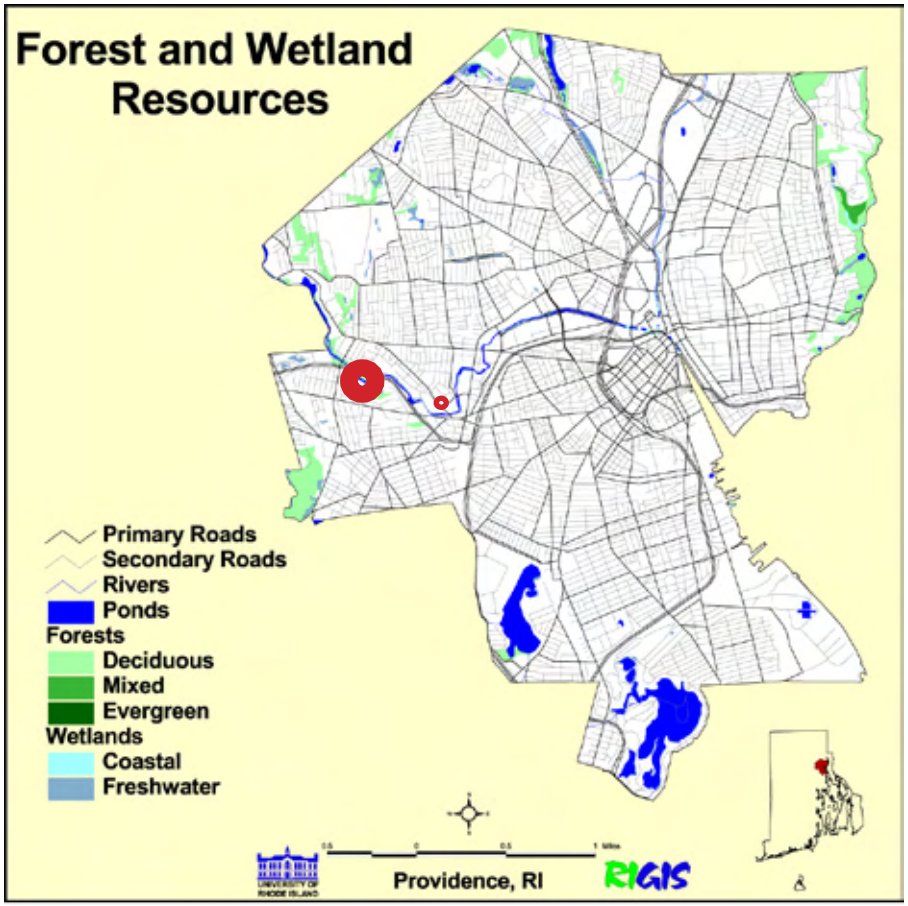




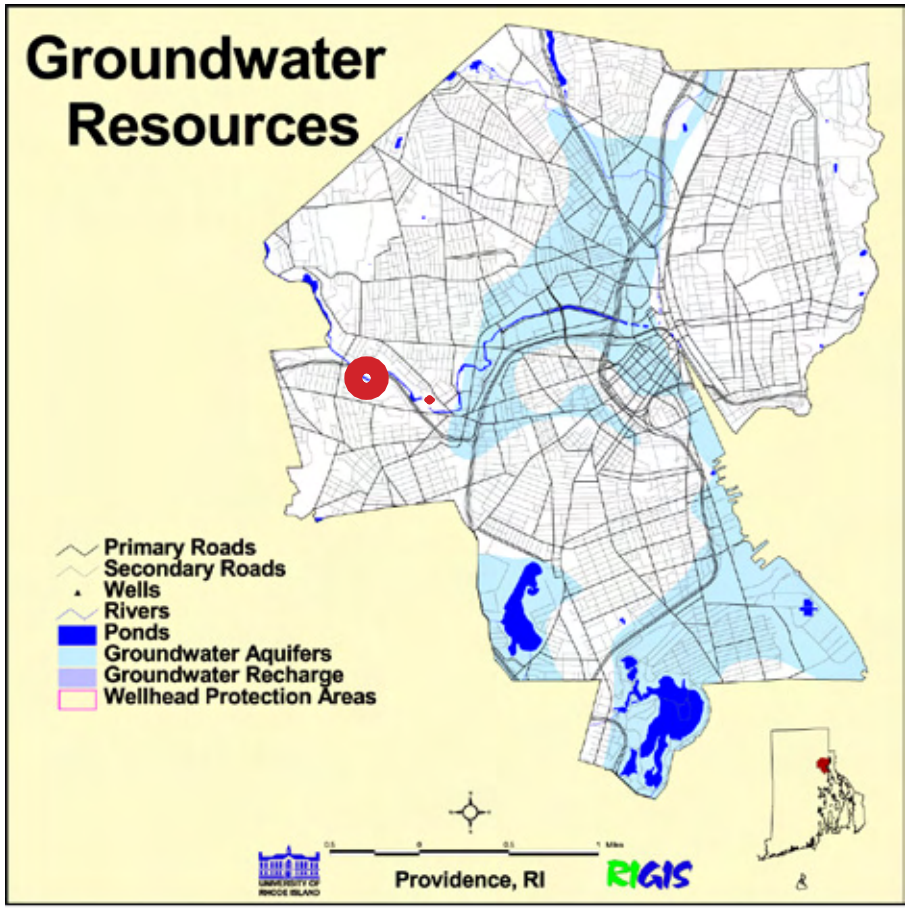

The ground temperatures vary throughout the year, however, the ground water stays relatively stable. In the case of this site, the water table is so close, that an open loop geothermal system would be plausable for this building.



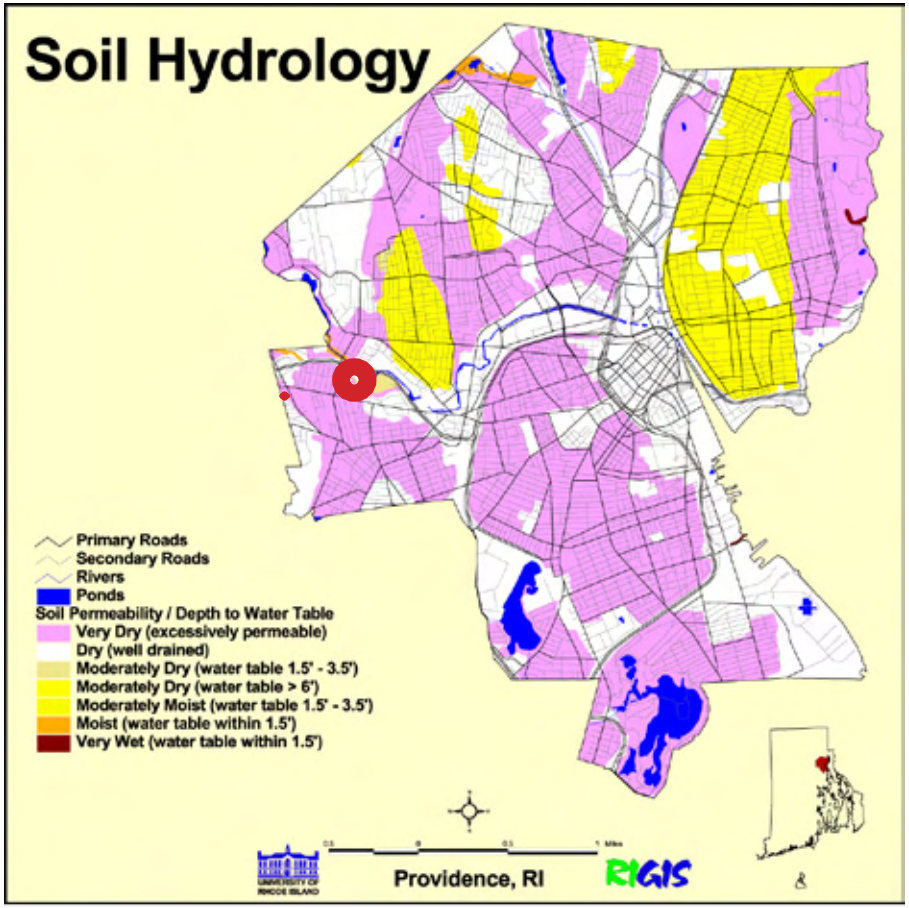

The wind and temperature are also varying, and this should be reflected in the facade and building orientation design.
It does snow here so snow loads are a concern. Operable windows can allow for greater control of resources as well as giving the patron greater individual control of their comfort.



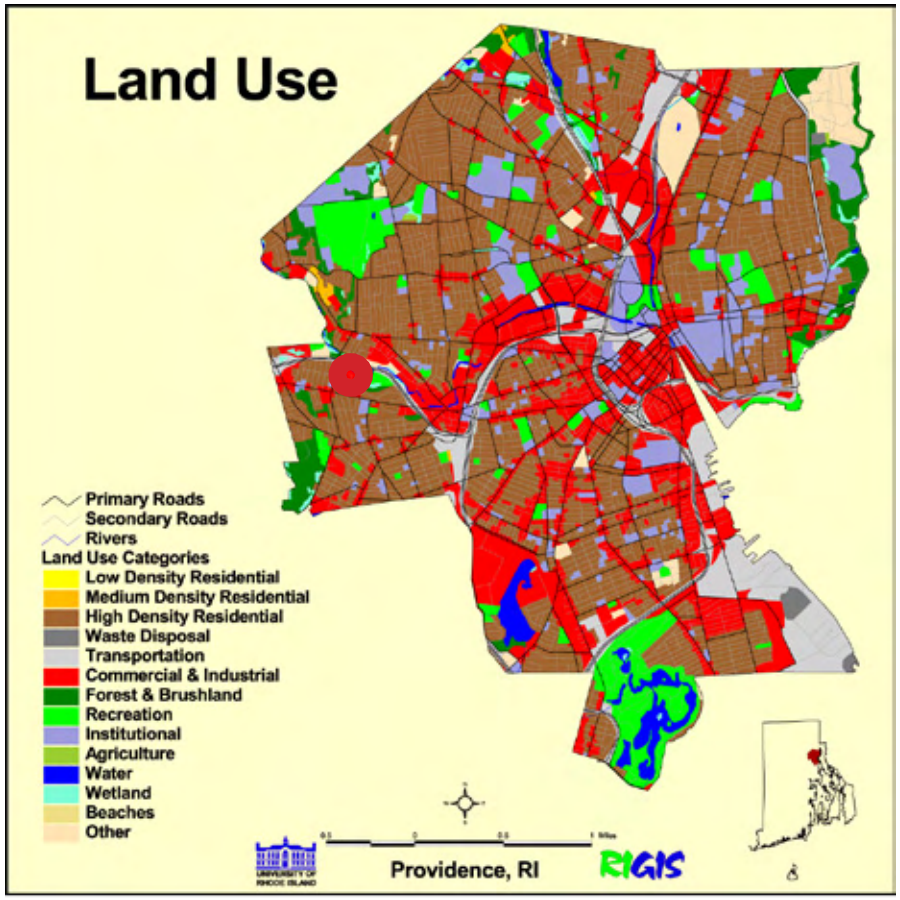

http://www.edc.uri.edu/riatlas/watershed/Woonasquatucket.html




http://www.edc.uri.edu/riatlas/watershed/Woonasquatucket.html




http://www.edc.uri.edu/riatlas/watershed/Woonasquatucket.html




http://www.edc.uri.edu/riatlas/watershed/Woonasquatucket.html

BIRDS:
Blue Herons
Kingfishers
Yellow-throated warblers
Orioles
Flycatchers
Blackbird, Red-winged
Bluebird, Eastern (NS,S)
Bufflehead (J, NP, P)
Cardinal, Northern (P, S)
Chickadee, Black-capped (P,S)
Cormorant, Double-crested
Creeper, Brown (NS, S)
Cuckoo, Black-billed (NS, S)
Dove, Mourning (P, S)
Dove, Rock (P)
Duck, Black (P, S)
Duck, Wood (J, NP, P, S)
Egret, Great (J, NP, P)
Falcon, Peregrine (P)
Finch, House (P)
Flicker, Common (NS, P, S)
Goldfinch, American (NP, P, S)
Goose, Canada (J, NP, P, S)
Gull, Ring-billed (P)
Hawk, Cooper's (P, S)
Hawk, Red-tailed (P, S)
Heron, Black-crowned Night (J, NP, P)
Heron, Great Blue (J, NP, P, S)
Heron, Green (J, NP, NS, P, S)
Jay, Blue (P, S)
Junco, Northern (P, S)
Killdeer (P)
Kingbird, Eastern (J, NP, NS, P, S)
Kingfisher, Belted (J, NP, P, S)
Kinglet, Golden-Crowned (S)
Loon, Common (P, S)
Mallard (J, NP, P, S)
Merganser, Common (J, NP, P, S)
Merganser, Hooded (J, NP, P, S)
Mockingbird, Northern (S)
Nighthawk, Common (NS, P, S)
Nuthatch, White-breasted (P, S)
Oriole, Baltimore (or Northern) (J, NS, P, S)
Osprey (P)
Owl, Great Horned (NS, S)
Pintail, Northern (S)
Robin, American (P, S)
Sandpiper, Spotted (NS, P, S)
Sparrow, Chipping (P, S)
Sparrow, Fox (NS, S)
Sparrow, House (P, S)
Sparrow, Swamp (NS, S)
Starling, European (P)
Swan, Mute (J, NP, P, S)
Swift, Chimney (J, NP, P)
Tanager, Scarlet (NS, S)
Thrasher, Brown (NS, S)
Towhee, Rufous-Sided (NS, S)
Turkey, Wild (NS, P, S)
Verio, Red-Eyed (NS, S)
Warbler, Orange-Crowned (P)
Waterthrush, Northern (P)
Waxwing, Cedar (NS, P, S)
Whip-Poor-Will (NS, S)
Woodpecker, Downy (P)
Woodpecker, Hairy (P)
Woodpecker, Piliated (NS, S)
Woodpecker, Red-Bellied


BLUE HERON
http://fineartamerica.com
robert pearson


COMMON LOON
http://www.junglewalk.com/animal-pictures/400/Common-Loon-1640.jpg


DOWNY WOODPECKER
http://fishandgame.idaho.gov

MAMMALS:
Bat, Brown (J)
Chipmunk, Gray Eastern (S)
Deer, White-tailed (J, NS, P, S)
Fisher (NS, P, S)
Fox, Red (N S, P, S)
Harbor Seal (P)
Mink (NS, S)
Muskrat (J, NP, P, S)
Otter, River (NS, S)
Raccoon (NP, NS, S)
Skunk, Stripped (P, S)
Snake, Hog-Nosed (NS, S)
Squirrel, Eastern Gray (NP, P, S)
Squirrel, Northern Flying (NS, S)
Squirrel, Red (NS, S)

AMPHIBIANS:
Bullfrog (J, NP, P)
Frog, Eastern Grey Tree (NS, S)
Frog, Green (J, NP, P)
Frog, Leopard (J, NP, P, S)


CHIPMUNK
http://www.raywilsonbirdphotography.co.uk/Galleries/Mammals/images/Eastern-Chipmunk-2.jpg

FISH:
American Eel (J, NP, P, S)
Bass, Largemouth (J, NP, P)
Bass, Smallmouth (J, NP)
Black Bullhead (Catfish) (J, NP, P)
Bluegill (J, NP, P)
Carp (J, NP, P)
Chain Pickerel (J, NP, P)
Crappie (J, NP, P)
Herring (P)
Johnny Darter Fish (J, P, S)
Menhaden, Atlantic (P)
Perch, Yellow (J, NP, P, S)
Pumpkinseed (Sunfish) (J, NP, P)

NATIVE FISH:
Anadromous [spend adult lives in salt water_ migrate upstream to spawn in fresh water]
Catadromous [live in fresh water and spawn in salt water]


BASS
http://www.flheritage.com/images/facts/symbols/bass.jpg

TREES:
Apple (P)
Ash, Green (P)
Basswood (American Linden) (P)
Birch, Gray (P)
Boxelder (P)
Buttonbush (P)
Catalpa, Northern (P)
Cedar, Atlantic White (NS, S)
Chestnut, American (NS, S)
Cottonwood, Eastern (P)
Crabapple (P)
Elm, American (P)
Elm, Slippery (P)
Hackberry (P)
Honeylocust (P)
Locust, Black (P)
Maple, Norway (P)
Maple, Red (P)
Maple, Silver (NS, P, S)
Mulberry, White (P)
Oak, Pin (P)
Oak, Red (P)
Planetree, London (P)
Sassafras (NS, P, S)
Sycamore (P)
Walnut, Black (NS, S)
Willow (P)
Willow, Weeping (NP)

PLANTS:
Jack-In-the Pulpit (P)
Pickerelweed (NP, P)

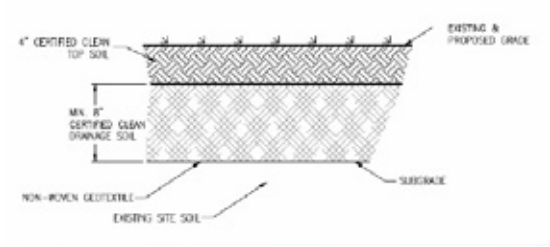
**LOCATIONS:**
NP, North Providence
NS, North Smithfield
S, Smithfeild
P, Providence
J, Johnston

## SITE REMEDIATION

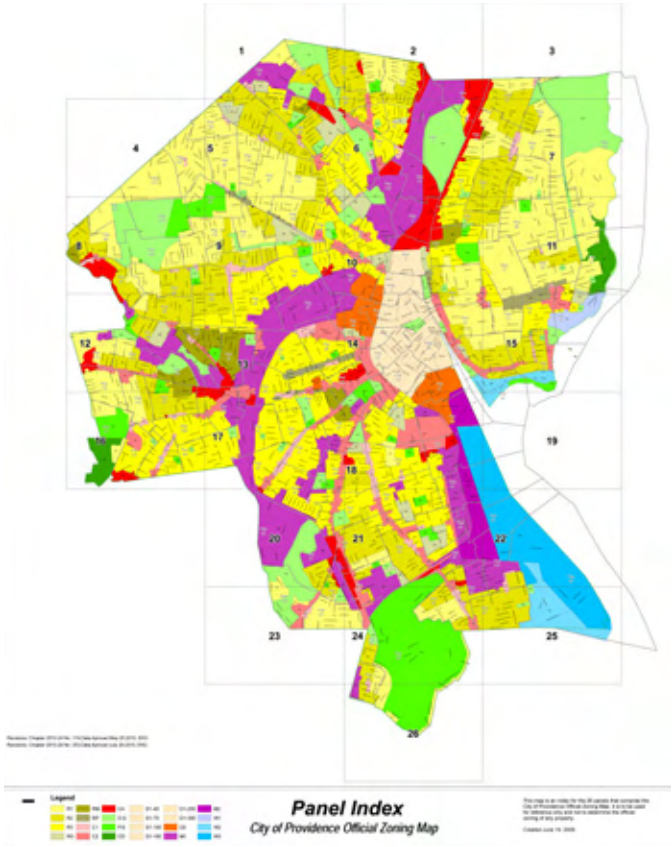
The site of the Lincoln Lace and Braid, formerly Merino Mill, has been used and abused for almost 200 years. Starting in 1812, Merino mill used the Woonasquatucket river as a power source. The textile mill used dyes that are incredibly harmful to the environment. This type of thing is very common along this river, and is the main reason for the watershed council and the river greenway. This site, however has been remediated, and is now a safe place for humans and wildlife alike.
The remediation took place as follows.
On September 12, 1996, Fuss and O'neil Inc. conducted on behalf of the RI department of Environmental Management division of site remediation, surveyed the site to give a scope of the problems.
There were numerous areas on the site that were a problem. Fuss and O'neil inspected the buried rail car fuel oil UST and underground piping, the boiler room of the mill itself, the loading dock where chemicals may have been spilled, and an on site landfill or dump area. Common in these kinds of site clean ups are chemicals like petroleum hydrocarbons, solvents, septage, metals, semivolatile organic compounds (semi-VOCs), and polychiorinated byphenols (PCBs).
21 test pits were made up to 12' below grade to test the soils for these chemicals.
Within these test pits, car batteries, tires, metal pipes, concrete and brick, and cloth were found.

# PRESENT CONDITIONS

The site (right) has been cleaned up to 12 inches below grade. Still left is a natural process, called iron staining. Naturally occurring iron oxidizes in the open air and stains the soil and water. it is a harmless process.




The geotextile fabric is a way of showing anyone digging there that below that surface is impacted soil. The fabric is 12 inches below grade. above the fabric is 8 inches of clean drainage soil, and above that is 4 inches of clean topsoil.




# 6 | ZONING AND CODES

# GENERAL CONDITIONS

101.4 - Industrial Zoning Districts

M-1 Industrial District - This zone is intended for general industrial uses that accommodate a variety of manufacturing, assembly, storage of durable goods and related activities provided that they do not pose toxic, explosive or environmental hazard in the City; and to support live-work spaces only in those existing underutilized industrial and/or commercial structures that are included in Article V, Section 501, “Industrial and Commercial Individual Structure District.”

101.6 – Open Space, Public Space and Conservation Zoning Districts:

OS - Open Space District - This zone is to insure that open space areas, conservation areas and outdoor recreation areas are preserved in the city. This district includes parks, wetlands, flood plains, conservation areas and areas that cannot be developed.

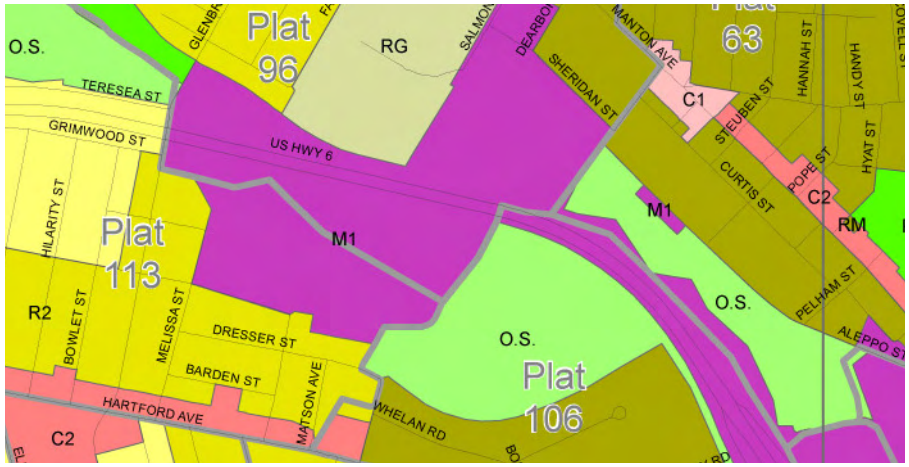
Section 203 - Land Nonconforming by Use:

203.2 - Change of Use: The nonconforming use of land shall not be changed to a different use, unless such use conforms to the use regulations of the Zone in which it is located.

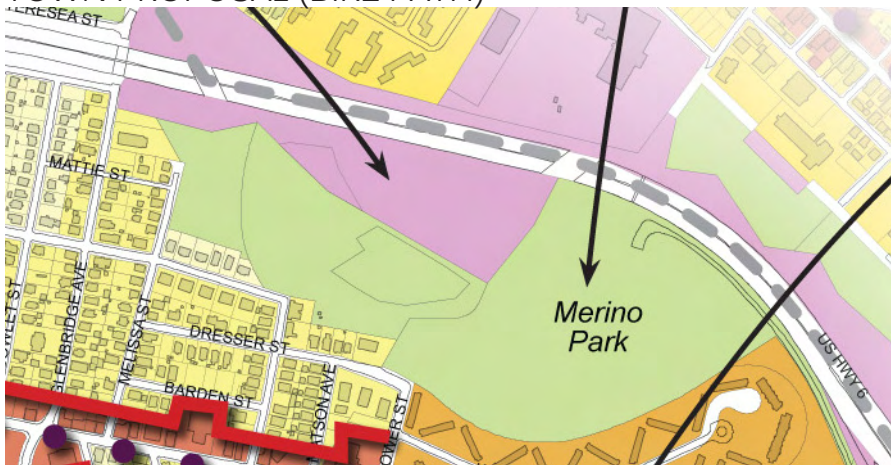
3.0 Cultural, Entertainment and Recreation Services

zone m-1 allowed to use land for non profit library Museum and art gallery

PROVIDENCE ZONING MAP




TOWN PROPOSAL (BIKE PATH)



# HEIGHTS AND SETBACKS

Section 305 – Dimensional Regulations – Commercial, Industrial and Institutional I-1 and I-2 Districts: [Ord. 2009-39]
Maximum height in M-1 ZONE: 6 stories -- 75'

Maximum height cannot exceed maximum height of any R-Zone which is not overlaid by an Institution Floating Zone within 150 feet of the structure.
(this applies because the buildings around the site are all residential)

Maximum height shall be limited to 40 feet whenever any part of the institutional building or structure is located within 30 feet from the property line of a lot in an R-zone and shall increase by one foot for every additional one foot setback from said property line up to a maximum of 75 feet/six stories.
412.1- Roof Structures Permitted Above Maximum Height:
The following roof structures are permitted above the maximum height as specified in this ordinance, provided that the total area of all such appurtenances is not more than one-third of the total roof area of the building: structures for the housing of elevators and elevator shafts; stairways; fire or parapet walls; skylights; towers; steeples; chimneys; and fully enclosed mechanical equipment rooms.

No such roof structure shall exceed the maximum height for the zone in which it is located, except by the amount allowed herein: 1-6 stories --- 10'

423.4 – Review of Flood Hazard Development Applications: for further study see ri zoning pg 50
No watercourse may be altered in a manner that will, in the opinion of the Director or designee, result in any decrease in the capacity of the watercourse, and no land shall be graded or altered in such a manner as to increase the BFE within the City of Providence.
On-site waste disposal systems shall be designed to avoid impairment or contamination of the floodway.

The bottom of the lowest floor, including basement, shall be elevated above the BFE (refer to the Rhode Island State Building Code for more specific elevation requirements)

In lieu of being elevated, non-residential structures may be dry floodproofed to one (1) foot above the BFE, provided that, together with all attendant utilities and sanitary facilities, the areas of the structure below the required elevation are watertight, with walls substantially impermeable to the passage of water, and provided that such structures are composed of structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effects of buoyancy.

Section 404 - Accessory Solar Uses:
An active or passive solar energy system which collects solar energy and provides heating, cooling, light or electricity to a building or end use, is permitted in all zones as an accessory structure. Such system may be located in any required side or rear yard, but shall not be located in any front yard nor exceed 8 feet in height. Solar systems erected on a roof shall comply with the requirements of Section 412.

425.1 – Quantity of Trees Required:
Sufficient trees shall be retained or planted on a lot so that the square footage of vegetative canopy of such trees, when mature, equals a certain percentage of the square footage of the lot.
All Other Zones: 15% of the square footage of the lot(s) or development.

425.3 - Land Adjacent to Water Bodies:
There shall be a vegetated buffer, at least 25 feet wide, measured from the water's edge, or the inland edge of a coastal shoreline feature for tidal waterbodies (as defined by the Rhode Island Coastal Resources Management Program), adjacent to the entire length of any water body. This buffer shall include trees and plant material that will filter stormwater runoff and help to improve the quality of the water body. No parking or buildings are permitted within this buffer. However, paving for a walking path, bicycle path, or access to docks, piers, or beaches may be included within this buffer.

## PARKING REQUIREMENTS

Section 701 - Accessory Parking:
Accessory parking required by this ordinance shall be located on the same lot as the principal structure or use the parking is intended to serve.

3.0 Cultural, Entertainment and Recreation Services:
1[space] per 500 sq. ft. GFA, excluding storage and stack areas (22,000sf gfa --- 44 spaces)

705.1 - Minimum Size of Parking Spaces:
Minimum width..... 8.5 ft. 7.5 ft.
Minimum length.....18 ft. 15 ft.
Minimum Aisle Width:
90 degree angle.....22 feet
60 degree angle.....16 feet
45 degree angle.....12 feet
30 degree angle.....11 feet

## PLUMBING REQUIREMENTS

2902.1 Minimum number of fixtures.
Plumbing fixtures shall be provided for the type of occupancy and in the minimum number shown in Table 2902.1. Types of occupancies not shown in Table 2902.1 shall be considered individually by the building official. The number of occupants shall be determined by this code.

Table 2902.1 specifies --- male: 1 toilet per 125 occupants
female: 1 toilet per 65 occupants
1 lavatory per 200 occupants
1 service sink
1 water fountain per 500 occupants

## SECTION 1005 EGRESS WIDTH

1005.1 Minimum required egress width. The means of egress width shall not be less than required by this section. The total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by 0.3 inch (7.62 mm) per occupant for stairways and by 0.2 inch (5.08 mm) per occupant for other egress components. The width shall not be less than specified elsewhere in this code. Multiple means of egress shall be sized such that the loss of any one means of egress shall not reduce the available capacity to less than 50 percent of the required capacity. The maximum capacity required from any story of a building shall be maintained to the termination of the means of egress.

# ACCESSIBILITY

## GENERAL

1103.1 Where required.
Sites, buildings, structures, facilities, elements and spaces, temporary or permanent, shall be accessible to persons with physical disabilities.

1104.1 Site arrival points.
Accessible routes within the site shall be provided from public transportation stops; accessible parking; accessible passenger loading zones; and public streets or sidewalks to the accessible building entrance served.
(this is important because of the heavily landscaped portions of the design. the site needs to be accessible to everyone.)

1109.2 Toilet and bathing facilities.
Each toilet room and bathing room shall be accessible. Where a floor level is not required to be connected by an accessible route, the only toilet rooms or bathing rooms provided within the facility shall not be located on the inaccessible floor. At least one of each type of fixture, element, control or dispenser in each accessible toilet room and bathing room shall be accessible.

## RAMPS

1010.2 Slope.
Ramps used as part of a means of egress shall have a running slope not steeper than one unit vertical in 12 units horizontal (8-percent slope). The slope of other pedestrian ramps shall not be steeper than one unit vertical in eight units horizontal (12.5-percent slope)

1010.5.1 Width.
The minimum width of a means of egress ramp shall not be less than that required for corridors by Section 1018.2. The clear width of a ramp between handrails, if provided, or other permissible projections shall be 36 inches (914 mm) minimum.

1010.5.3 Restrictions.
Means of egress ramps shall not reduce in width in the direction of egress travel. Projections into the required ramp and landing width are prohibited. Doors opening onto a landing shall not reduce the clear width to less than 42 inches.

1014.2 Egress through intervening spaces.
Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas and the area served are accessory to one or the other, are not a Group H occupancy and provide a discernible path of egress travel to an exit.

404.9 Travel distance.
In other than the lowest level of the atrium, where the required means of egress is through the atrium space, the portion of exit access travel distance within the atrium space shall not exceed 200 feet

1016.1 Travel distance limitations. Exits shall be so located on each story such that the maximum length of exit access travel, measured from the most remote point within a story along the natural and unobstructed path of egress travel to an exterior exit door at the level of exit discharge, an entrance to a vertical exit enclosure, an exit passageway, a horizontal exit, an exterior exit stairway or an exterior exit ramp, shall not exceed the distances given in Table 1016.1.

Table 1016.1 specifies max travel distance --- occupancy group A 200 ft unsprinklered
occupancy group A 250 ft sprinklered

1021.1 Exits from stories.
All spaces within each story shall have access to the minimum number of approved independent exits as specified in Table 1021.1 based on the occupant load of the story. For the purposes of this chapter, occupied roofs shall be provided with exits as required for stories.

Table 1021.1 specifies --- 1-500 occupants per story need 2 means of egress from each story.

# 5 | PRECEDENTS

# CA Academy of Sciences San Fancisco, California

PROBLEM STATEMENT

"The issues that science is trying to address today are interdisciplinary, and its crucial for us to make the science we do more accessible to the public."
This is the nation's only combined natural history museum, aquarium, planetarium, and research institution.[1]" - Renzo Piano

PROJECT STATEMENT

"It was given that the building would be at the forefront of "green" building design.
reflecting the Academy's ethic of environmental efficiency, conservation, and sustainability.
The new design would showcase world-class architecture that fully integrates green building features and would set a new standard for sustainable design.[2]"

http://mergy.org/wp-content/uploads/2008/10/aos100608_3.jpg

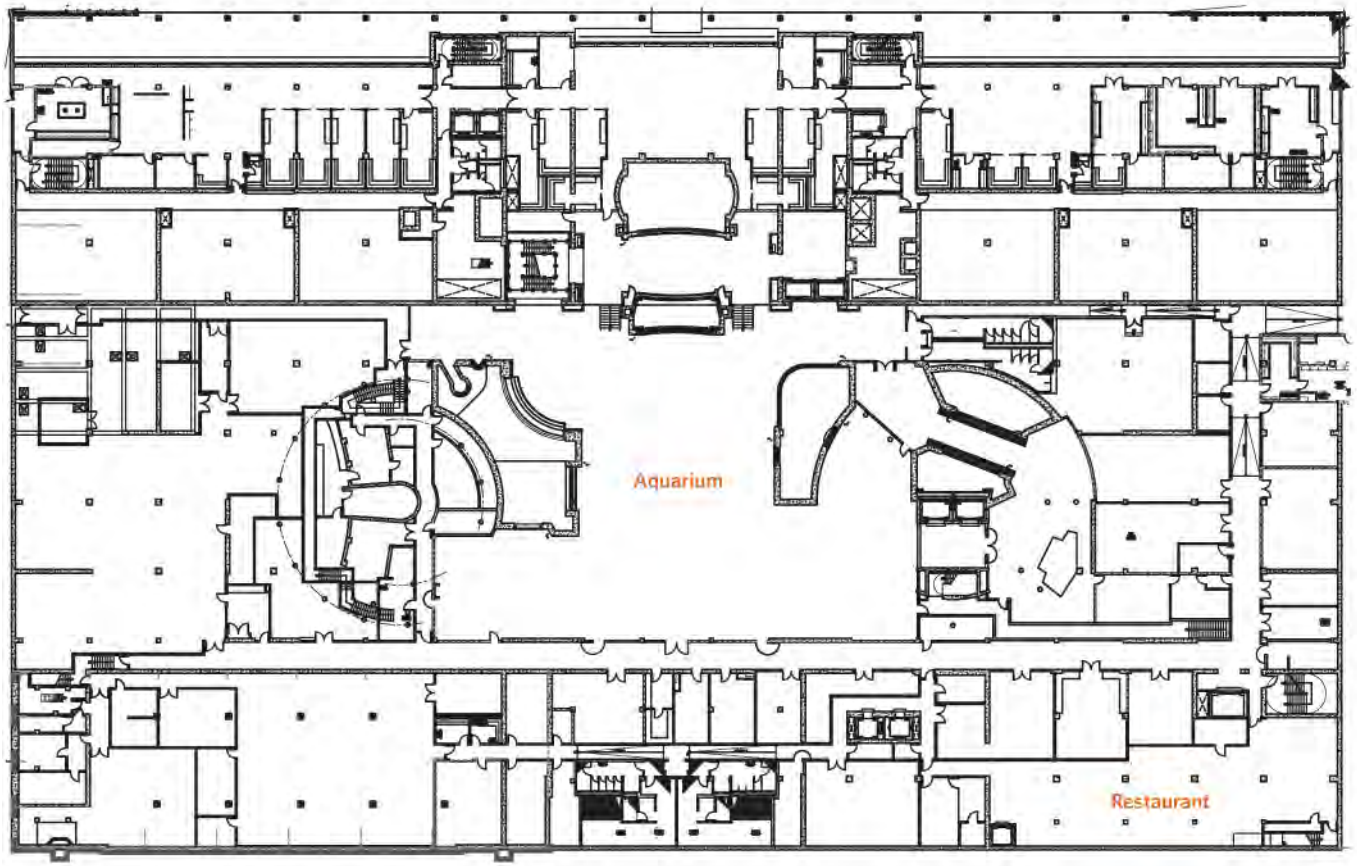
PROGRAM: Museum, Planetarium, Aquarium, Laboratories, Collections Storage, Offices

LOCATION: San Francisco, CA

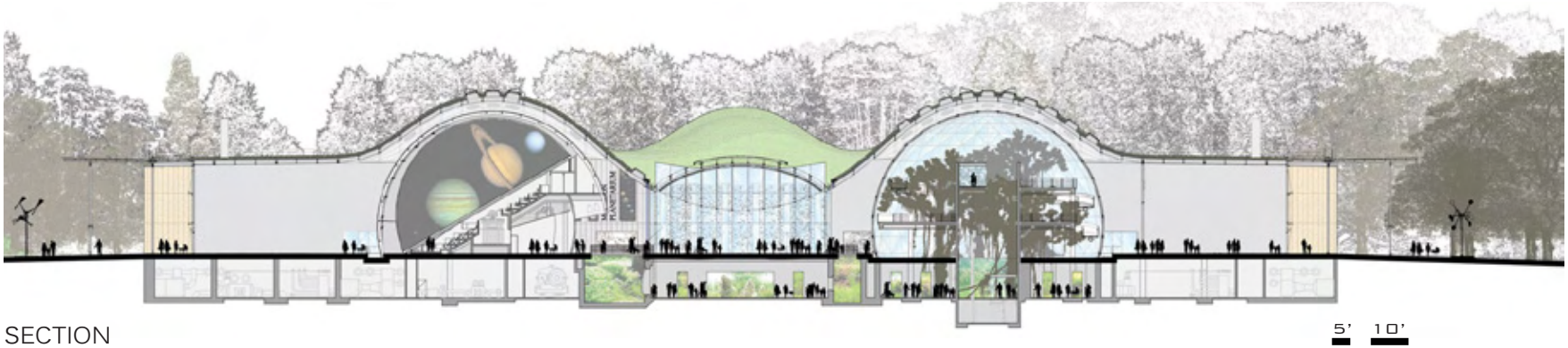
AREA: 400,000 sq ft

http://mergy.org/wp-content/uploads/2008/10/aos100608_52.jpg

1,2: Wels, Susan. California Academy of Sciences: Architecture in Harmony with Nature. San Francisco, CA: Chronicle Books, 2008.

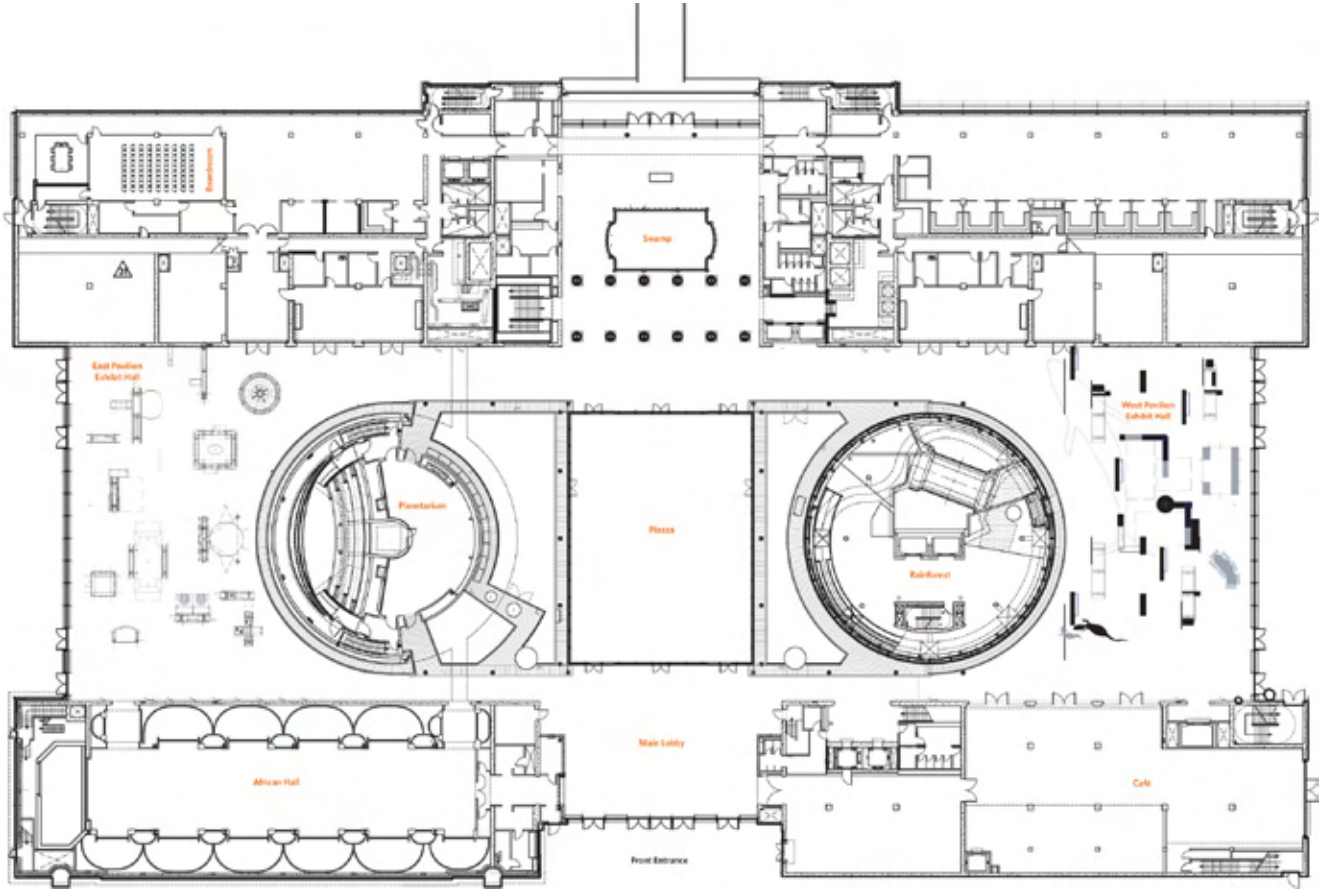



BASEMENT LEVEL




SECTION

http://www.archdaily.com/6810/california-academy-of-sciences-renzo-piano/



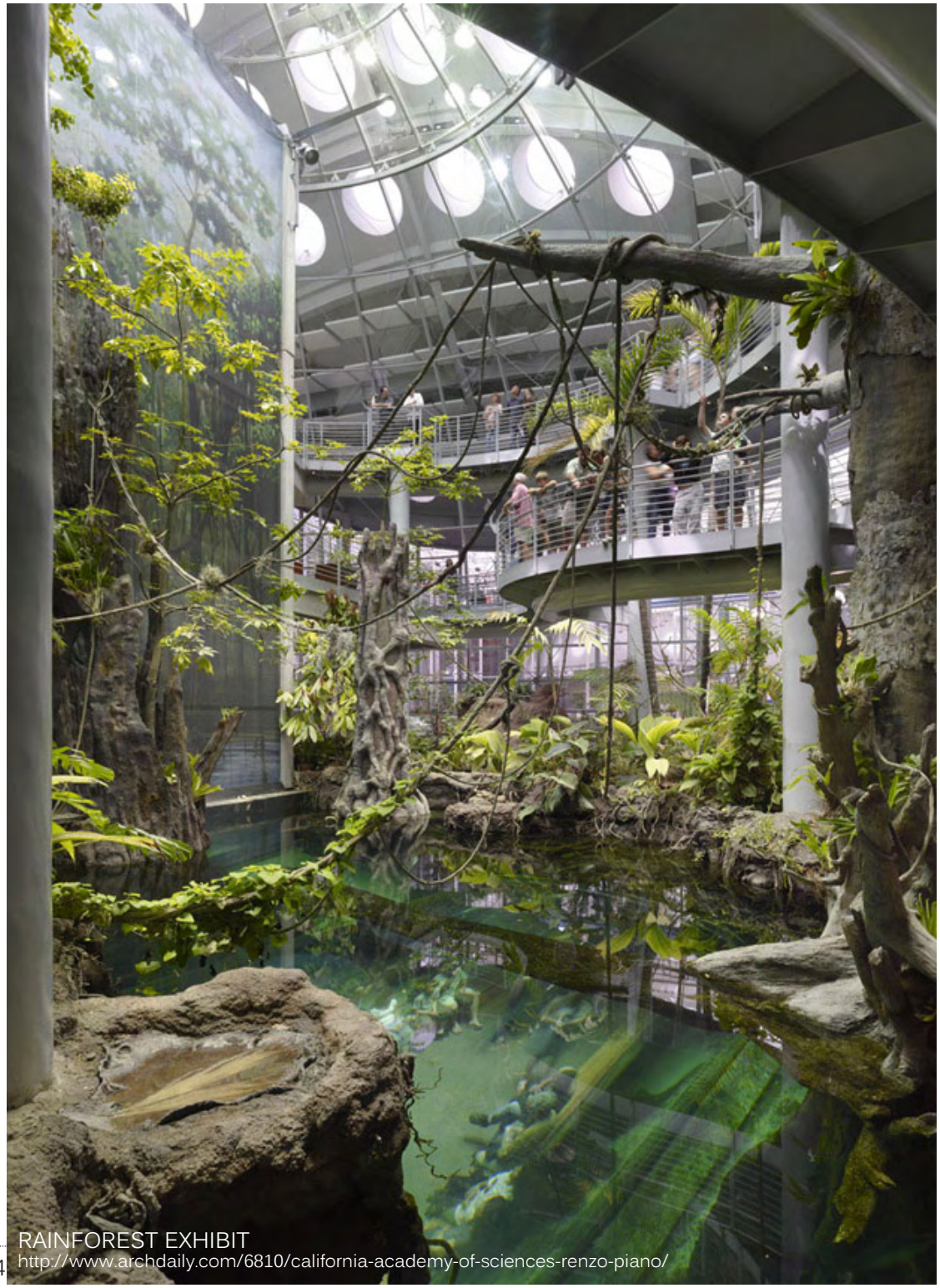

ENTRY LEVEL

5' 10'

FRONT ELEVATION

5' 10'

http://www.archdaily.com/6810/california-academy-of-sciences-renzo-piano/



RAINFOREST EXHIBIT
http://www.archdaily.com/6810/california-academy-of-sciences-renzo-piano/


Example of open exhibit

WIND:

"The undulating roofline will draw cool air into the open piazza at the center of the building, naturally ventilating the surrounding exhibit spaces. Skylights in the roof will automatically open and close to vent hot air out through the tops of the domes.

Motorized windows will automatically open and shut to allow cool air into the building. Operable windows will also be employed in staff offices."

WATER:

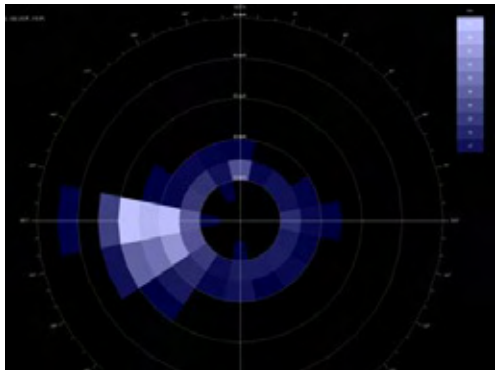
"Sensor faucets in the bathrooms will charge themselves with each use. Flowing water causes an internal turbine to generate power and charge the battery pack.

By absorbing rainwater, the new Academy's living roof will prevent up to 3.6 million gallons of runoff from carrying pollutants into the ecosystem each year (about 98% of all storm water).

Reclaimed water from the City of San Francisco will be used to flush the toilets, reducing the use of potable water for wastewater conveyance by 90%.

Due to both low-flow fixtures and the use of reclaimed water, overall potable water use will be 30% less than baseline.

Saltwater for the aquarium will be piped in from the Pacific Ocean, minimizing the use of potable water for aquarium systems. Nitrate wastes will be purified with natural systems, ensuring that aquarium water can be recycled.



Wind passes over the hills on the roof and is collected by opening the skylights. The form of the roof helps to channel the wind and be useful for the academy. The wind direction and constance is actually very useful for cooling the building.

http://www.archdaily.com/6810/california-academy-of-sciences-renzo-piano/

MATERIALS:
Local materials and products manufactured within 500 miles of the Academy will account for at least 20% of building materials. This reduces transportation impacts and supports the regional economy.
Over 90% of the demolition waste from the old Academy was recycled.
At least 50% of the wood in the new Academy was sustainably harvested and certified by the Forest Stewardship Council.
A new link in an ecological corridor for wildlife, the new Academy's living roof is planted with nine native California species that will not require artificial irrigation. The planted area measures 2.5 acres; it is now the largest swath of native vegetation in San Francisco.

http://www.archdaily.com/6810/california-academy-of-sciences-renzo-piano/

ENERGY:
"A solar canopy around the perimeter of the roof containing 60,000 photo voltaic cells will supply almost 213,000 kWh of clean energy per year (at least 5% of the new Academy's energy needs), and prevent the release of more than 405,000 pounds of greenhouse gas emissions annually.
The multi-crystalline cells are the most energy efficient cells on the market, achieving at least 20% efficiency."


http://www.archdaily.com/6810/california-academy-of-sciences-renzo-piano/

# James Clarkson Environmental Discovery Center

PROBLEM STATEMENT
"The James Clarkson Environmental Discovery Center is envisioned as a place of learning, play, and gathering that seeks to open a window on the beauty and diversity of the natural world that exists in Southeast Michigan."

PROJECT STATEMENT
"The James Clarkson Environmental Discovery Center is dedicated to the exploration and celebration of the natural environment, educating users on the importance of biodiversity, native habitats, and environmental protection. Restored ecosystems and their associated wildlife inhabitants are within an arm's length, optimizing interaction with the natural world, while preserving and protecting its sensitive ecological areas and endangered species."
"The master plan includes teacher-training sessions, research, activities and exhibits for the Environmental Education Center and activities for groups of elementary through college age students.
The plan also addresses methods to generate community involvement and interest, both in the general public and the educational community.
The goal is to use the site to teach about ecosystems and to give visitors an appreciation of the complexity of natural systems and the interrelationships between all aspects of nature, including the role of human beings."

HTTP://WWW.GARDENER.RU/PAGE_1547.HTML

PROGRAM: Environmental discovery center
LOCATION: Seattle, WA
AREA: 18,000 sqft
ARCHITECT: Smith group Inc. Architects,
MSI Landscape Architects

The James-Clarkson Environmental Discovery Center does many things that the Center in Providence, RI does. There is a direct connection between what is being taught, and the site that the museum exists on. The landscape and the building design seem to coexist, and in fact, become seamless in both material, and overall handling.

Learning about the environment while you are in it is the only way to truely understand it. In the end it is not only about the science of the marsh, but how it feels under your feet, and how it sounds when you walk on it, and how it smells when you breathe it in.

The landscape design functions on two levels. The first is that paths are created for easy human interaction with the natural surroundings. The second is that the design of all the paths and walls all have a function in terms of cleaning or routing water. Whenever we can build something which has multiple roles, it is good for the site, as well as the people paying for it.

Classes are taken out into the landscape in order to learn from experience rather than lecture. The dock, however is designed into the landscape, yet has a real connection to the design as a whole.

http://msidesign.com/index.php/james-clarkson/

# Adam Joseph Lewis Center for Environmental Studies, Oberlin College

"Described by The New York Times as 'the most remarkable of a new generation of college buildings" and by the U.S. Department of Energy as one of the 30 'milestone' buildings of the 20th century, William McDonough + Partner's design for The Lewis Center aspires to be as bountiful and effective as a tree.
By reconsidering design assumptions for the future, the building operates on three fundamental principles of nature—eliminate the concept of waste, rely on natural energy flows, and honor diversity. The Center's disposition of spaces derives from an integration of natural energy flows and the building's energy needs, its use as teaching and public space, and the desire to blur the distinction between indoors and out. The light-drenched two-story atrium serves as the primary organizing space while acting as the southern campus's town hall, or public square. Daylighting and natural ventilation enhance the atrium's feeling of an outdoor room, as well as its role as the building's physical and social center. In 2006, the site became a net energy exporter, producing 30 percent more energy than it needs to operate and sharing this excess energy with the community."

http://www.mcdonoughpartners.com/projects/view/adam_joseph_lewis_center_environmental_studies_oberlin_college


http://www.mcdonoughpartners.com/projects/view/adam_joseph_lewis_center_environmental_studies_oberlin_college

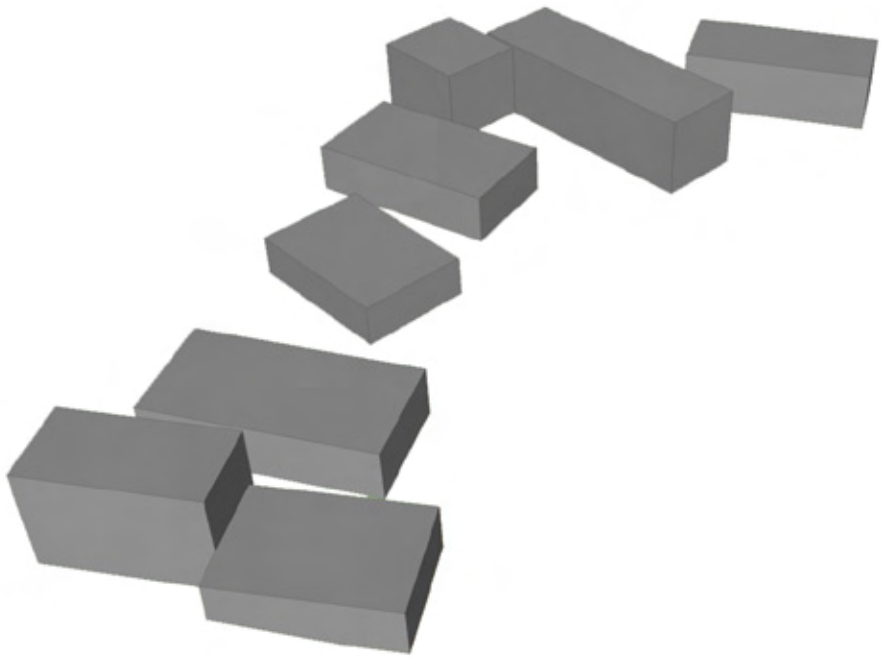
http://www.mcdonoughpartners.com/projects/view/adam_joseph_lewis_center_environmental_studies_oberlin_college

PROGRAM: Classrooms, offices, atrium, & auditorium
LOCATION: Oberlin, Ohio
AREA: 13,600 square feet
ARCHITECT: William McDonough and associates.

# PEABODY ESSEX MUSEUM

The Peabody Essex Museum is the embodiment of what the Environmental discovery center was trying to achieve formally. As part of an addition to the museum the architect, Moshie Safdie, seemlessly integrated the old and the new. The main atrium space is full of light and warmth, and is inviting even to the passerby. The museum is located in historic downtown Salem, MA, and is therefore immediately out of place given its more modern design. Safdie however, was able to integrate this new museum with the surrounding context as well. Shown in the picture (left) is a brick exhibit hall. The proportions are similar to the context both in the exhibit itself, and how it relates to the other exhibits. The sometimes gabled, sometimes arched roof lines also add to the resemlance of historic Salem.

While the details of the glass atrium are impressive, what is more impressive is something as simple as the vents for the hvac. Sometimes they are hidden where two planes meet, as is the case inside the exhibits, and sometimes they are expressed as in the staircase leading to the second level.

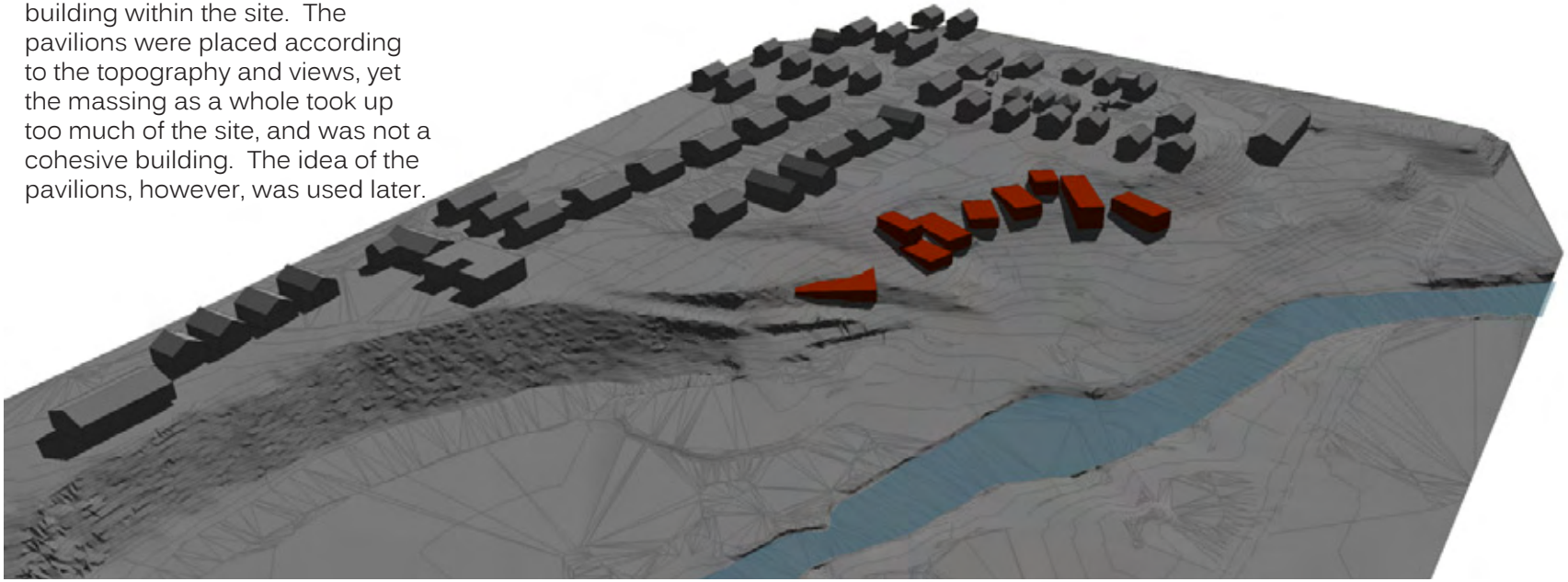


# 7 | DESIGN PROCESS

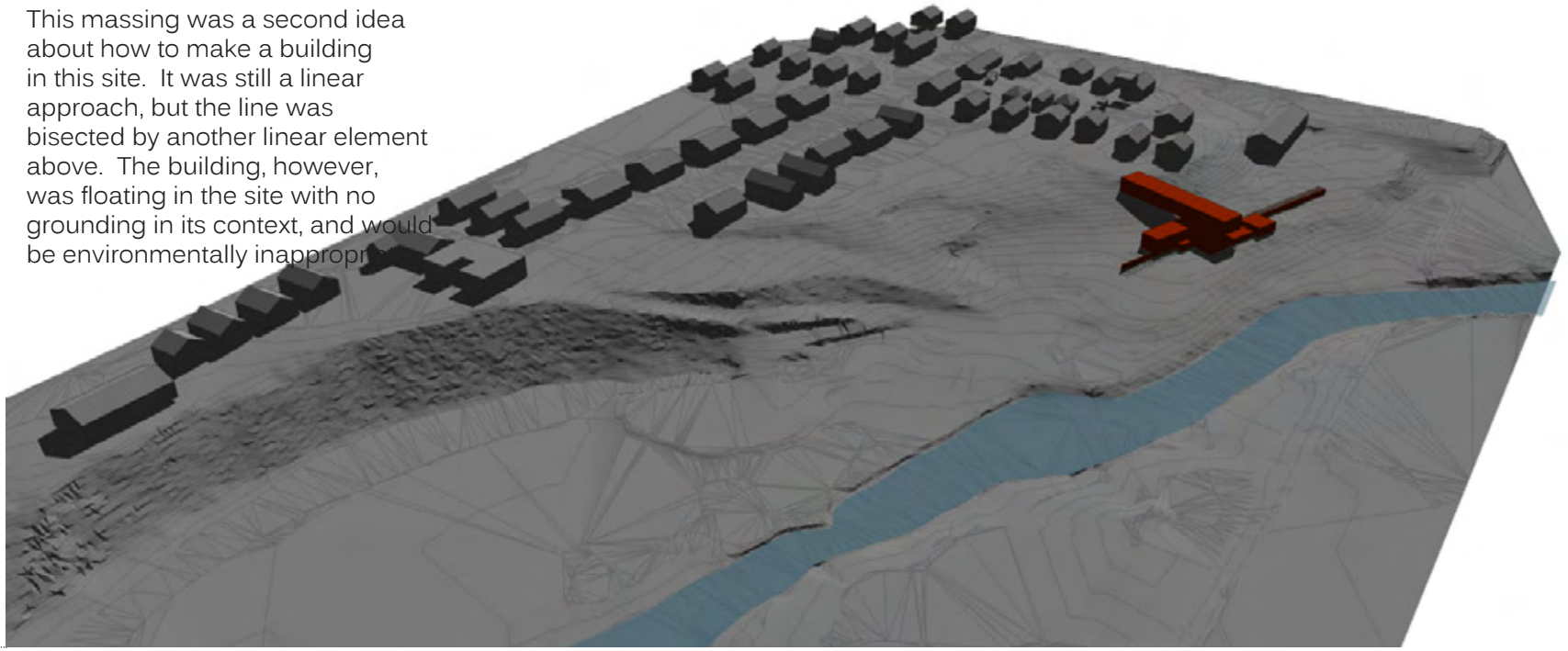
The massings development for this site was always about full engagement with the site. Allowing the site to flow up and become part of the building was something that was very important. In terms of placement, the solar orientation, wind patterns, topography, and views all had to line up. The massings too needed to reflect these environmental factors. At first, the idea was to engage the site fully by digging into it, and allowing visitors to go underground. This was in order to really “feel” the site. However, after several more site visits, it seemed an inappropriate move for this site. Instead, the massing should “grow” from the site. It must engage both the site and the neighborhood, however these are two different conditions and should be treated as such.

# MASSINGS

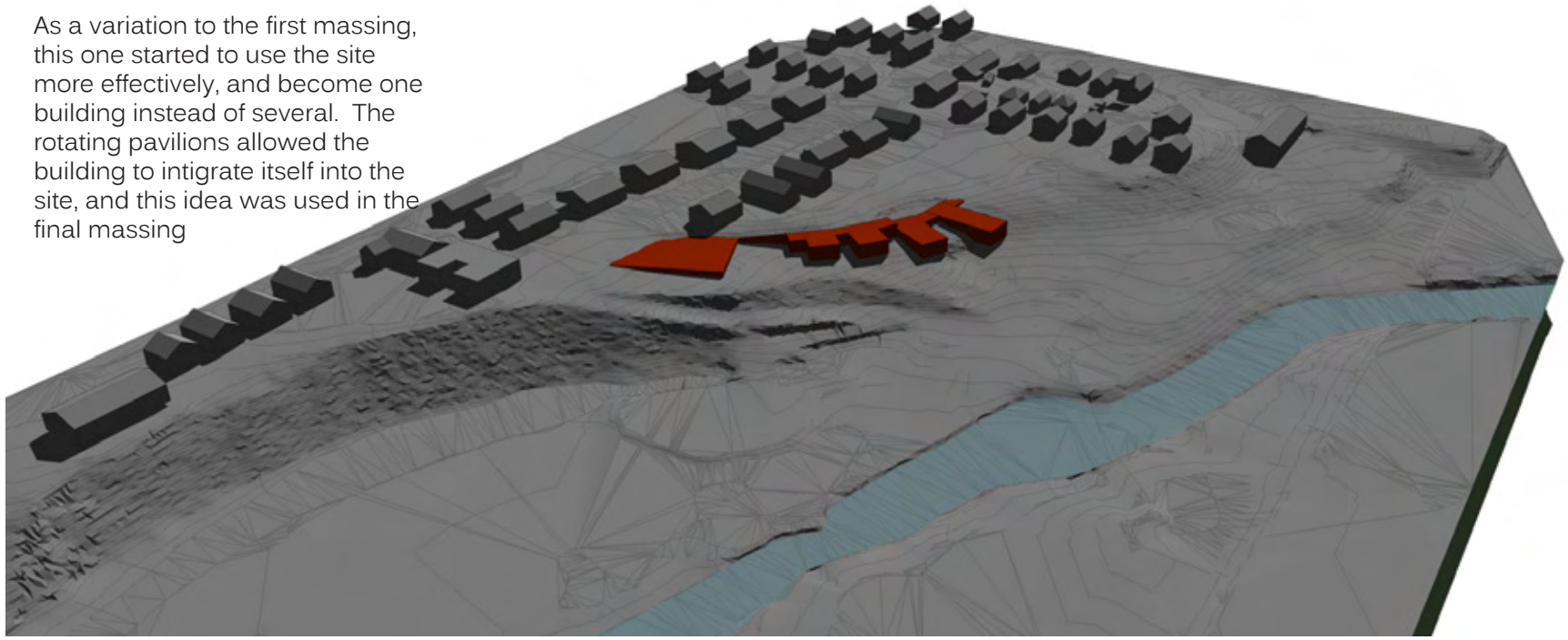
The first massing had everything to do with fully integrating the building within the site. The pavilions were placed according to the topography and views, yet the massing as a whole took up too much of the site, and was not a cohesive building. The idea of the pavilions, however, was used later.



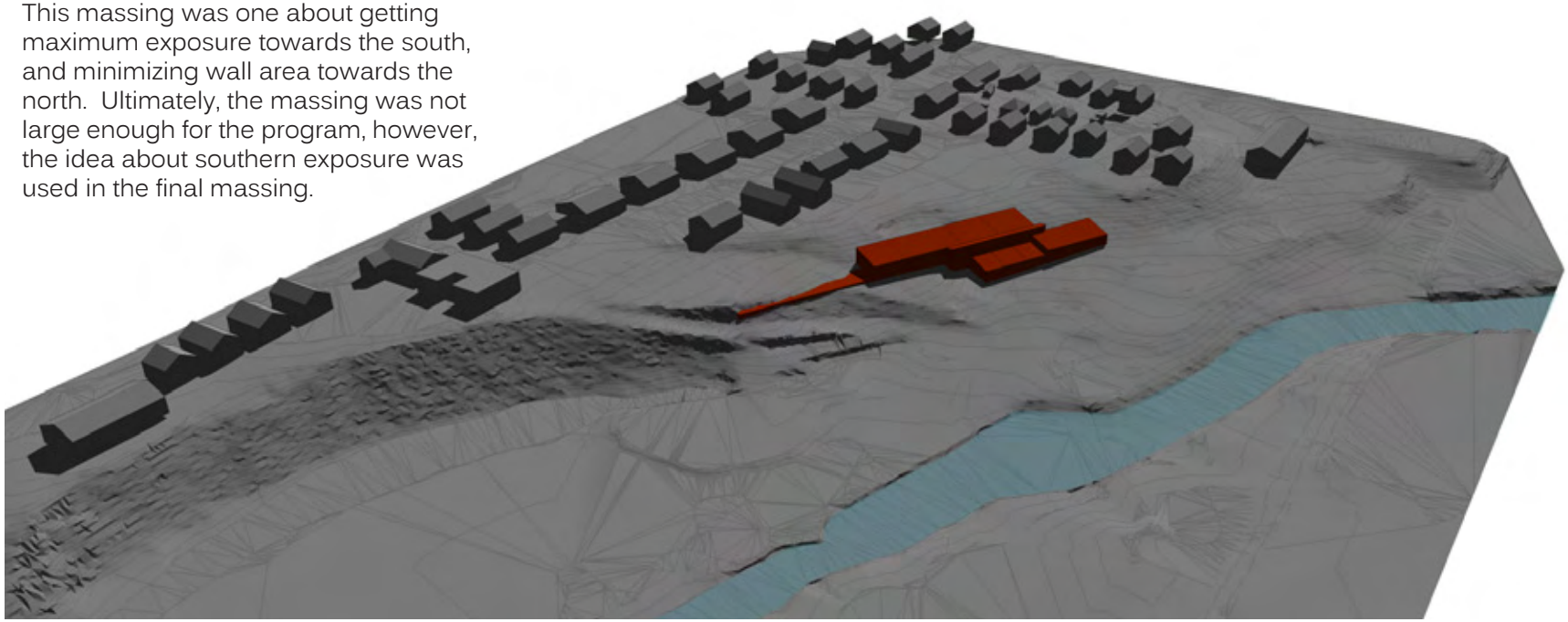
This massing was a second idea about how to make a building in this site. It was still a linear approach, but the line was bisected by another linear element above. The building, however, was floating in the site with no grounding in its context, and would be environmentally inappropri



As a variation to the first massing, this one started to use the site more effectively, and become one building instead of several. The rotating pavilions allowed the building to intigrate itself into the site, and this idea was used in the final massing

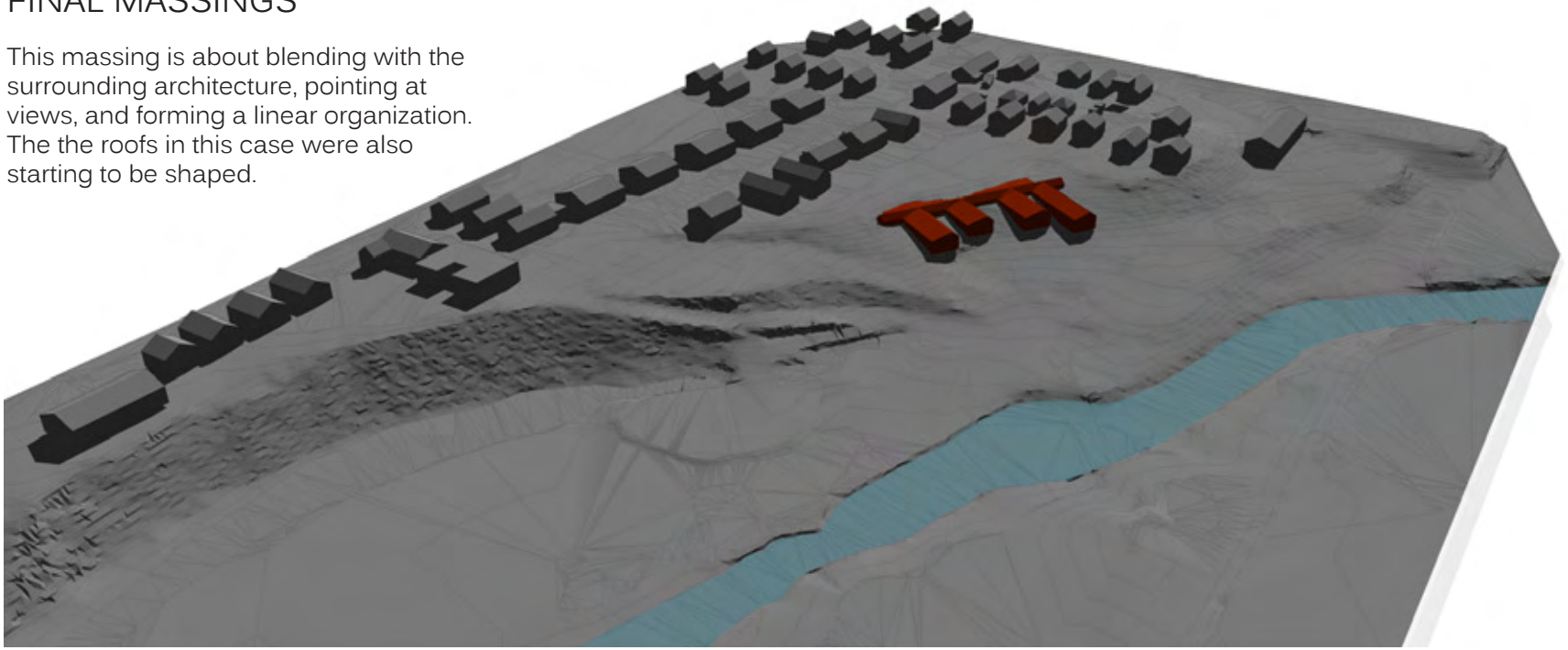


This massing was one about getting maximum exposure towards the south, and minimizing wall area towards the north. Ultimately, the massing was not large enough for the program, however, the idea about southern exposure was used in the final massing.

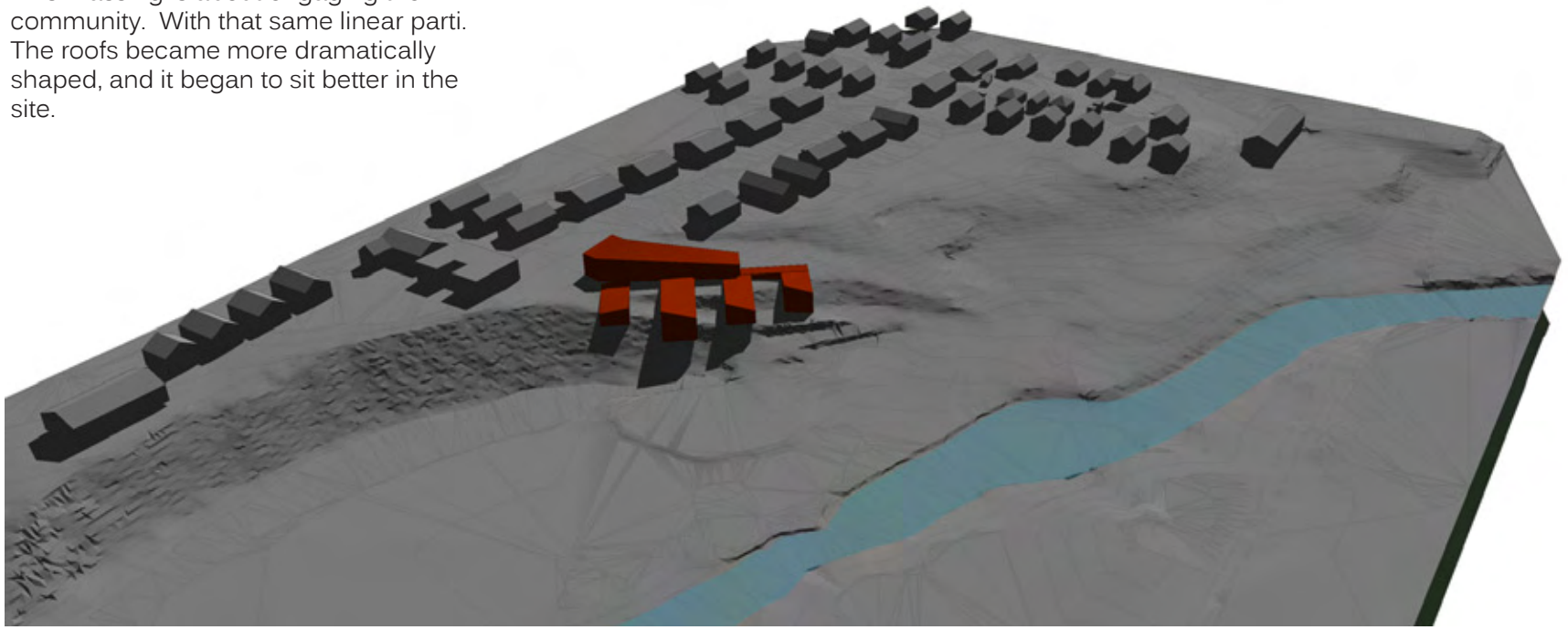


# FINAL MASSINGS

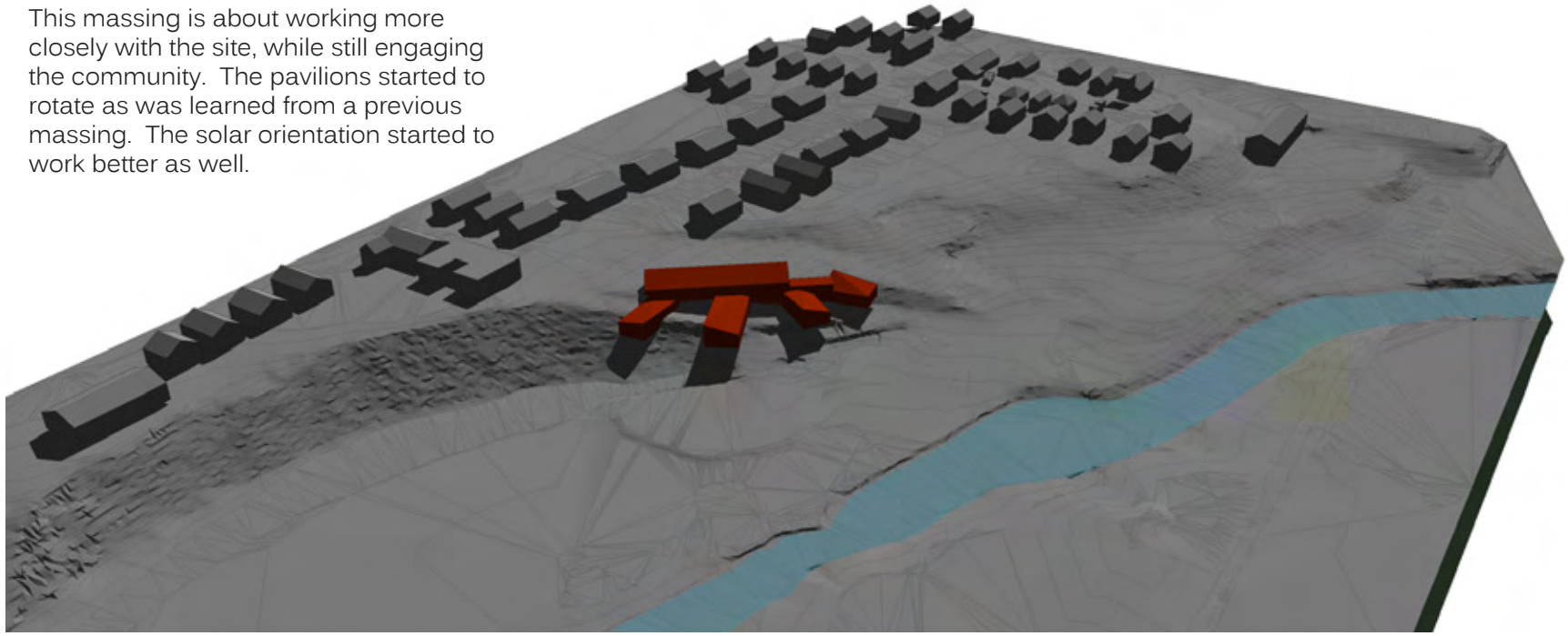
This massing is about blending with the surrounding architecture, pointing at views, and forming a linear organization. The the roofs in this case were also starting to be shaped.



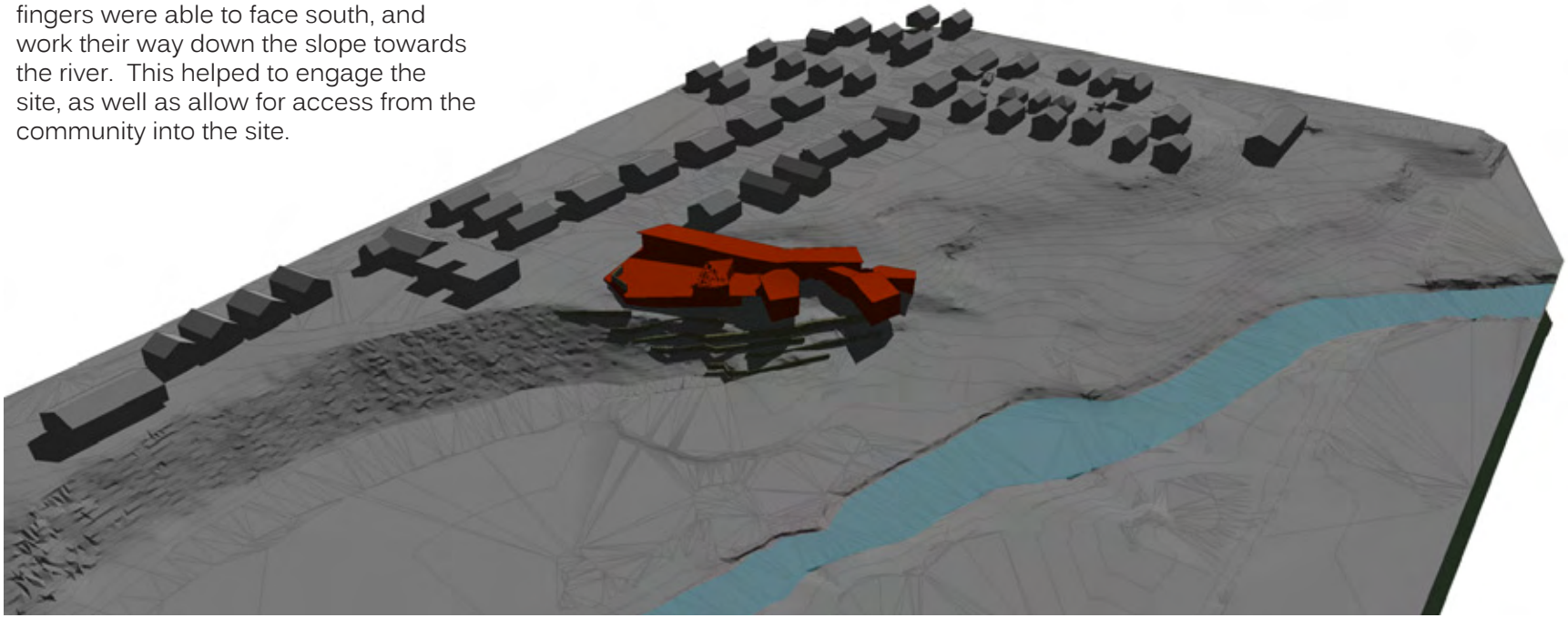
This massing is about engaging the community.  With that same linear parti. The roofs became more dramatically shaped, and it began to sit better in the site.

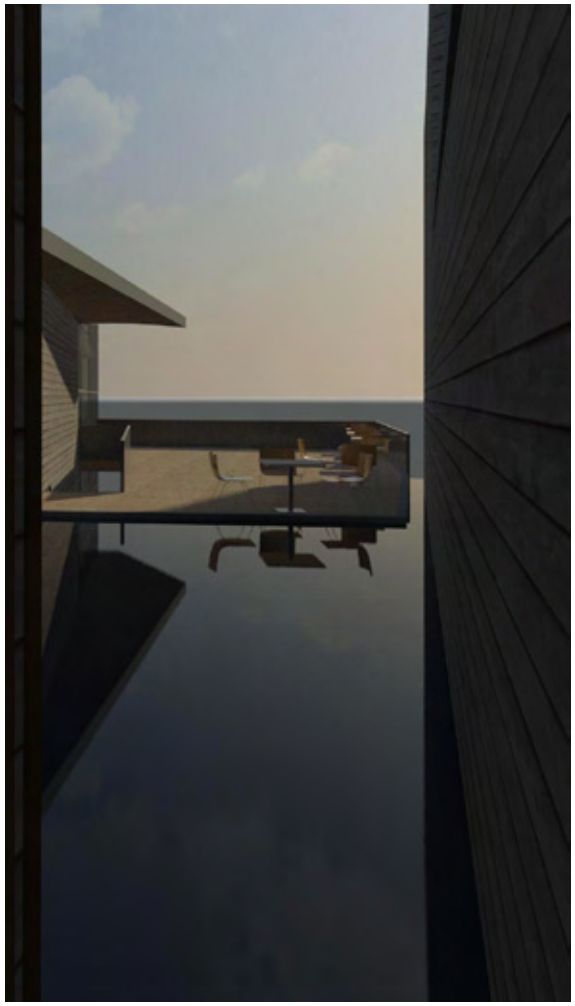


This massing is about working more closely with the site, while still engaging the community. The pavilions started to rotate as was learned from a previous massing. The solar orientation started to work better as well.



The final massing was pushed west on the site, fully engaging the street. The fingers were able to face south, and work their way down the slope towards the river. This helped to engage the site, as well as allow for access from the community into the site.



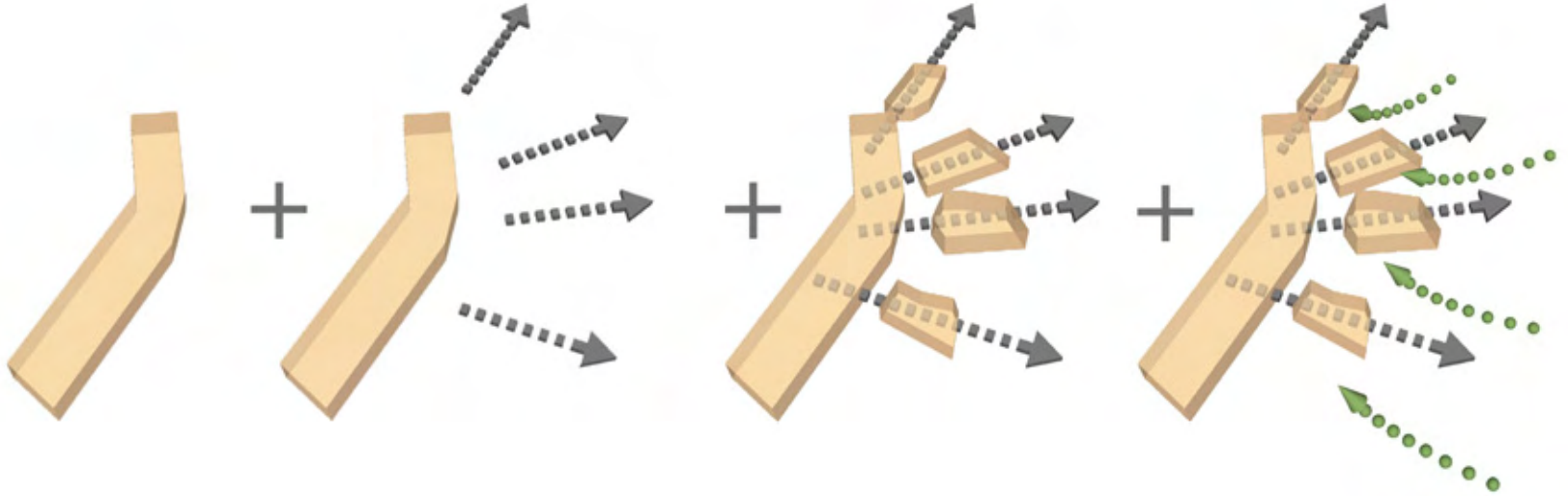


# 7 | FINAL DESIGN

"ENVIRONMENTAL ARCHITECTURE"

(MY GOAL IS TO MAKE) **ARCHITECTURE** WHICH IS **AUTHENTIC TO THIS PLACE** (HARTFORD COMMUNITY, PROVIDENCE, RI)
**CULTURALLY, SOCIALLY, HISTORICALLY,** AND **NATURALLY**

# PARTI



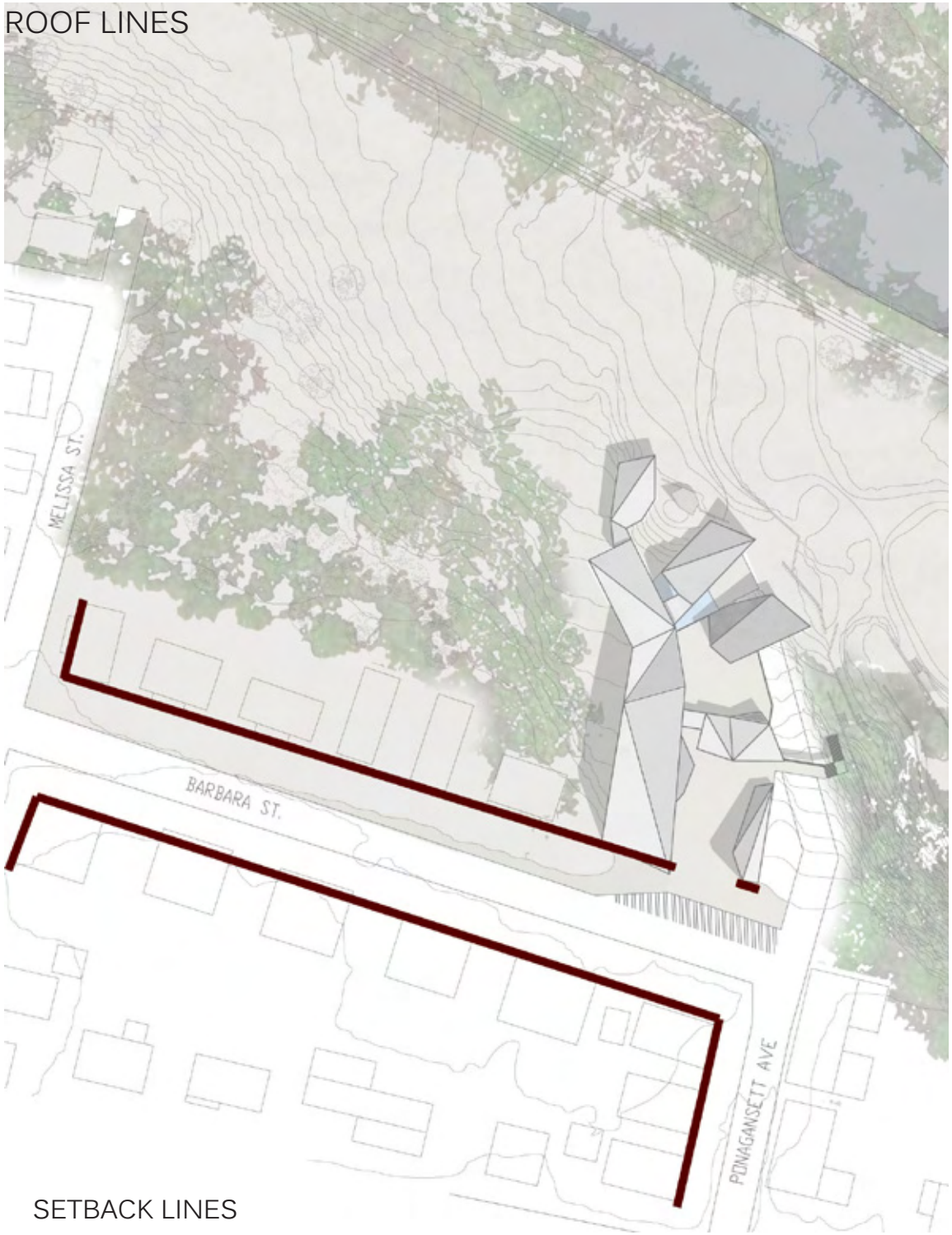
The building parti starts with the linear element which slopes downward toward the river. It then wants to reach itself out into the site, and so the pavilions act as fingers extending views, collecting sunlight, and channeling wind. Finally, the site itself comes back into the building making up its program, and final massing.
The parti basically shows a simple building fully integrated within its surroundings.
Each new element simply strengthens the building and the thesis.

# INTEGRATION WITH THE COMMUNITY

CONTEXT

STREET ELEVATION

ROOF LINES

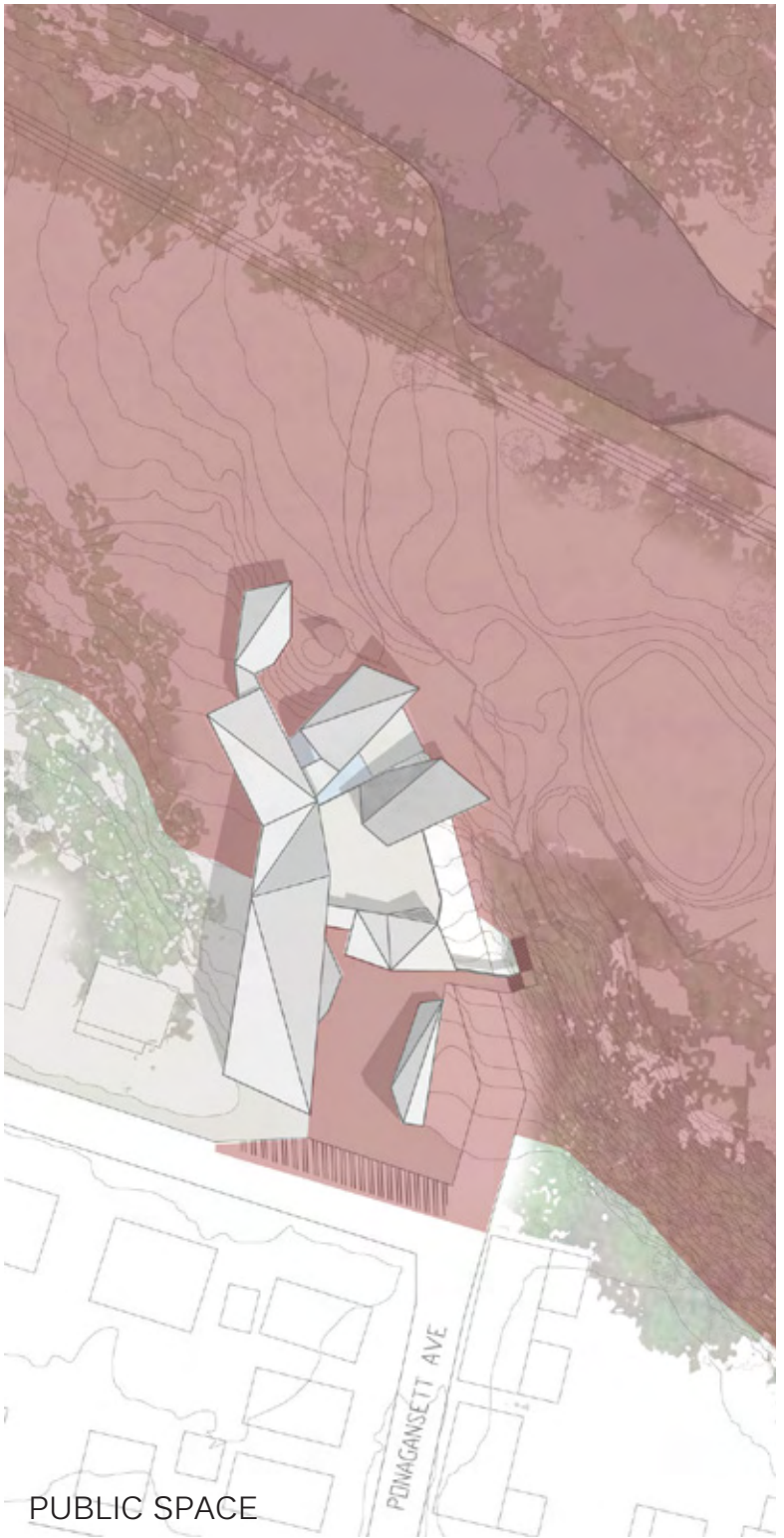



SETBACK LINES


PUBLIC ACCESS

Community involvement in this project is essential. So far this area has been cleaned up and kept up by members of the community, and this must also be true in the future. While the Environmental Discovery Center allows for and provides for the needs of the community in the form of a gathering space, and outdoor space, so too must the community provide care and surveillance of the place after hours.

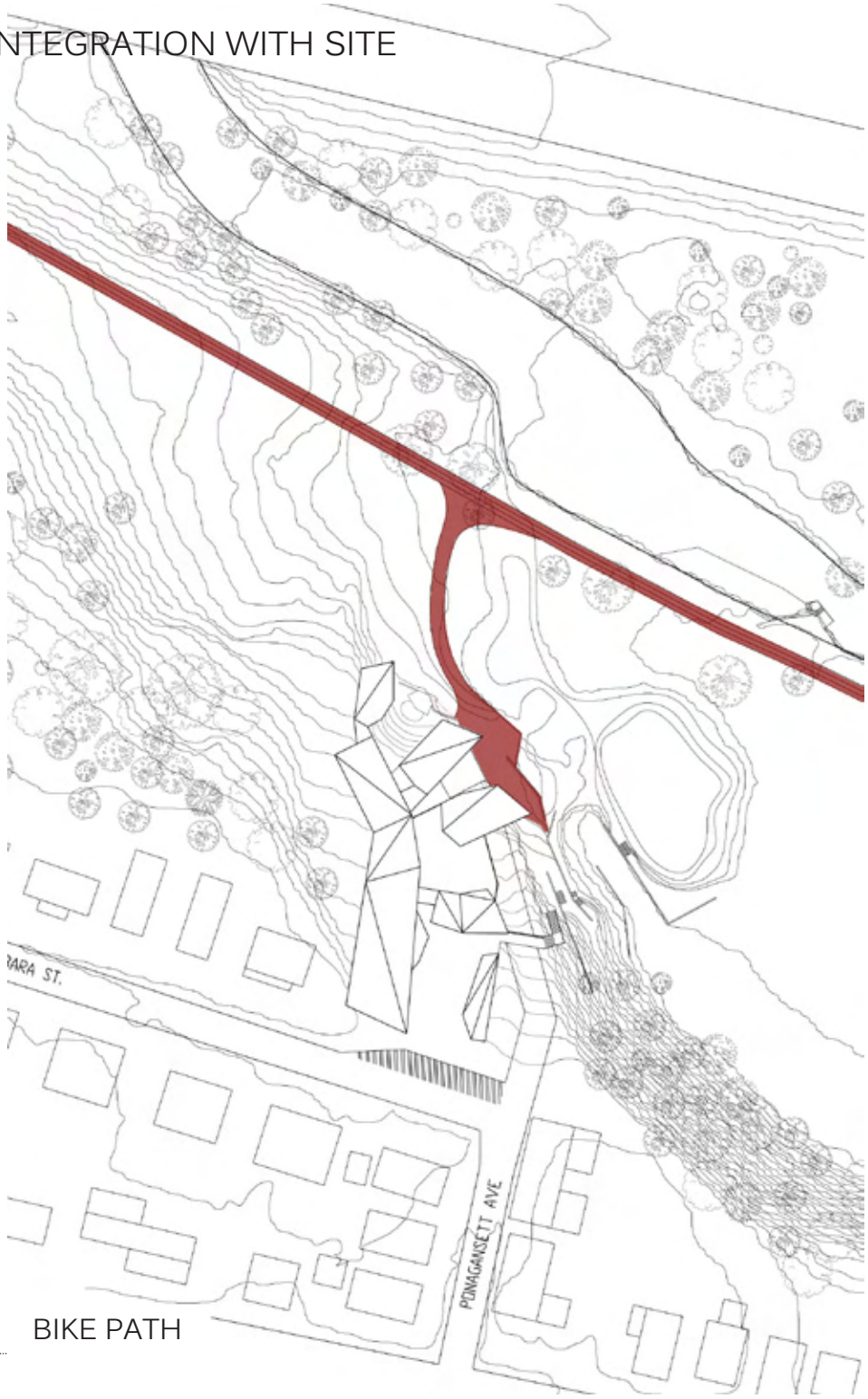

EDGES




PUBLIC SPACE

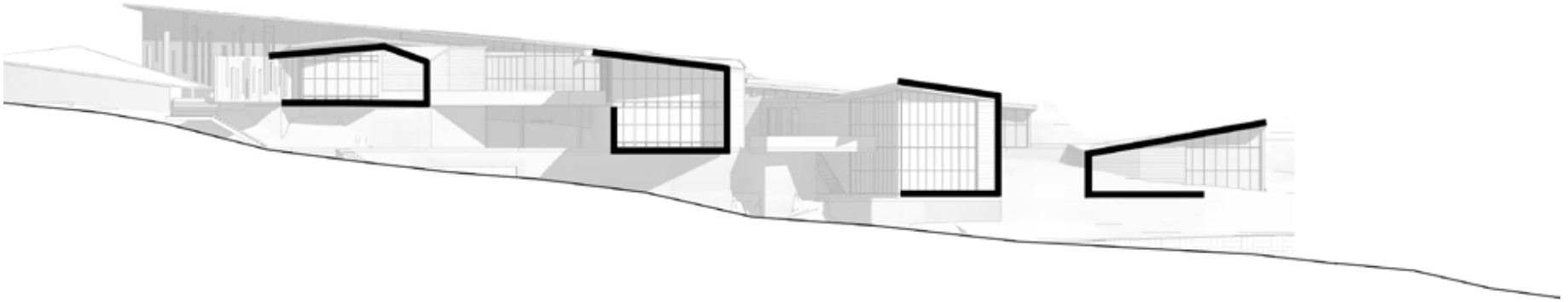
# ENTRY PLAZA

# INTEGRATION WITH SITE

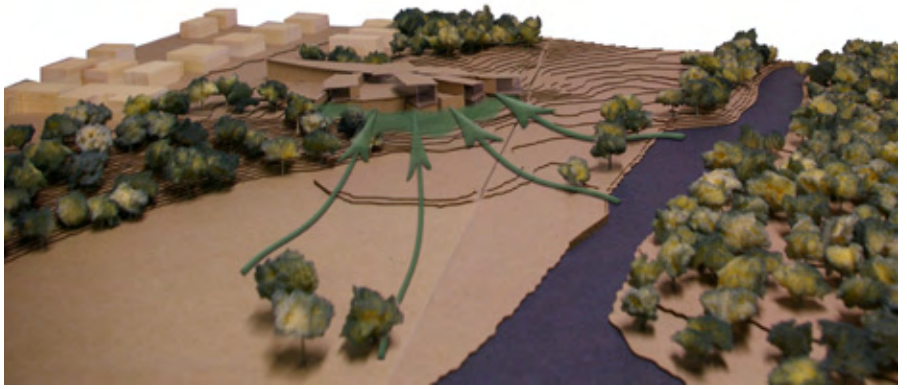


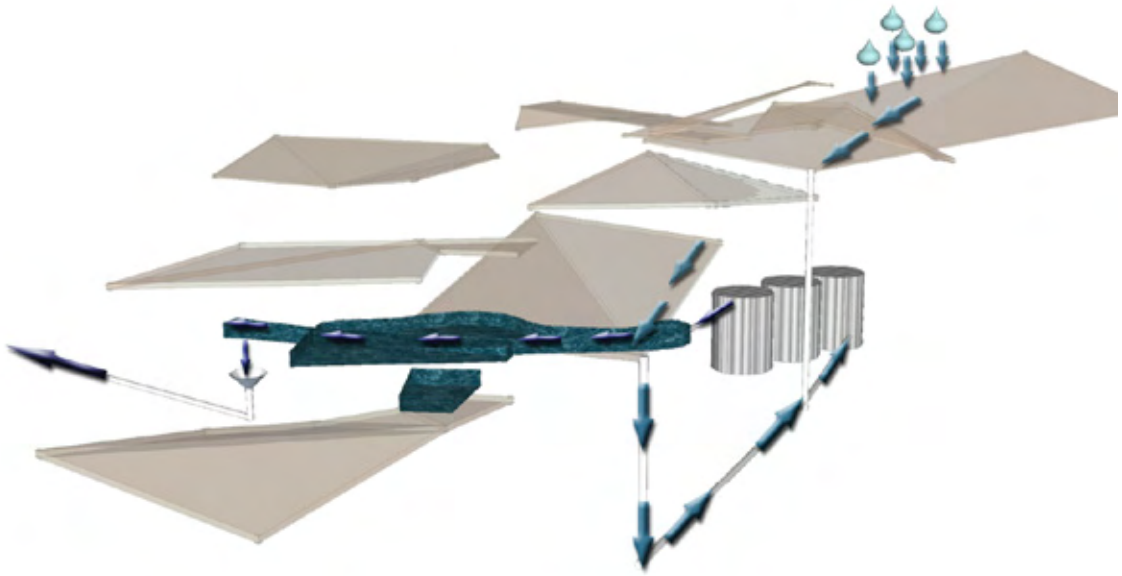

BIKE PATH


PUBLIC ACCESS

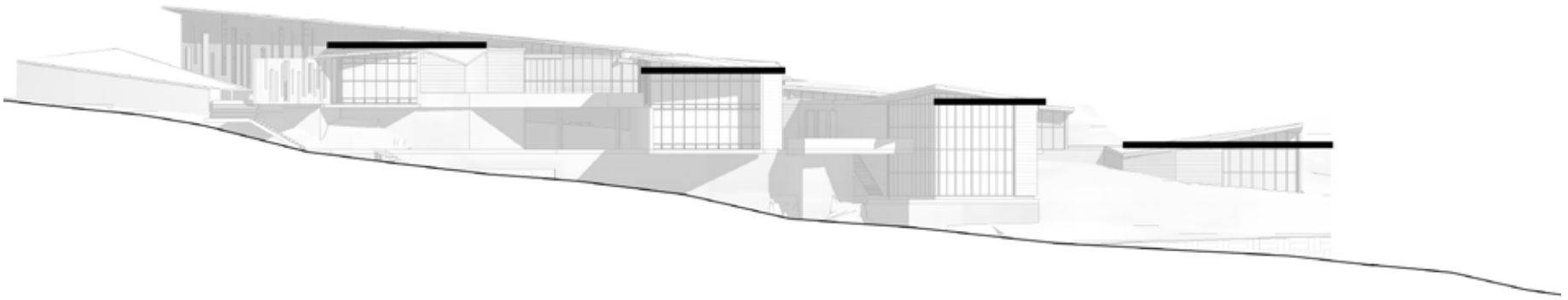


The idea for the building's integration started very literally, in that it was supposed to be "dug in" to the site. It would literally become part of it. Later however, it seemed that the building would be better served above ground because of the different environmental factors like wind, water, and sunlight. By allowing the building to be above ground, it is able to take advantage of these factors, yet it still must fit into the site, and be sensitive to it. The last part of the Parti takes care of this idea. By allowing the building to flow out into the site, and the site then flow back into the building, this sensitivity can be achieved. This is not enough however. The site has some incredibly complex topography sloping down and away from the road. The building has three levels to accommodate this change. Instead of looming over the site built up to the street level, the building gently works its way, like water, down towards the river. The roofs and pavilions slope down, seamlessly integrating themselves.

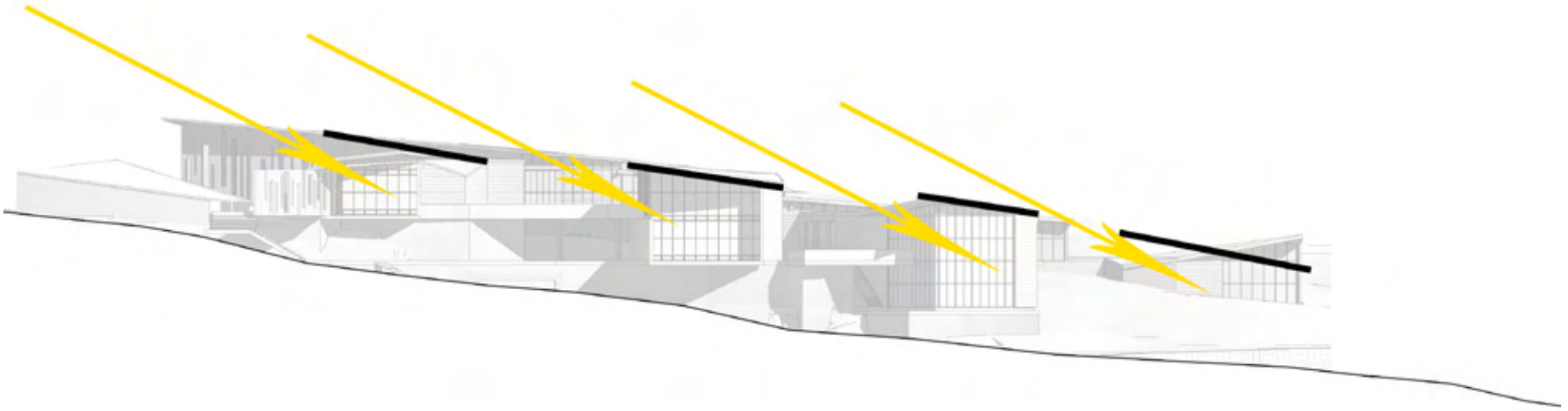




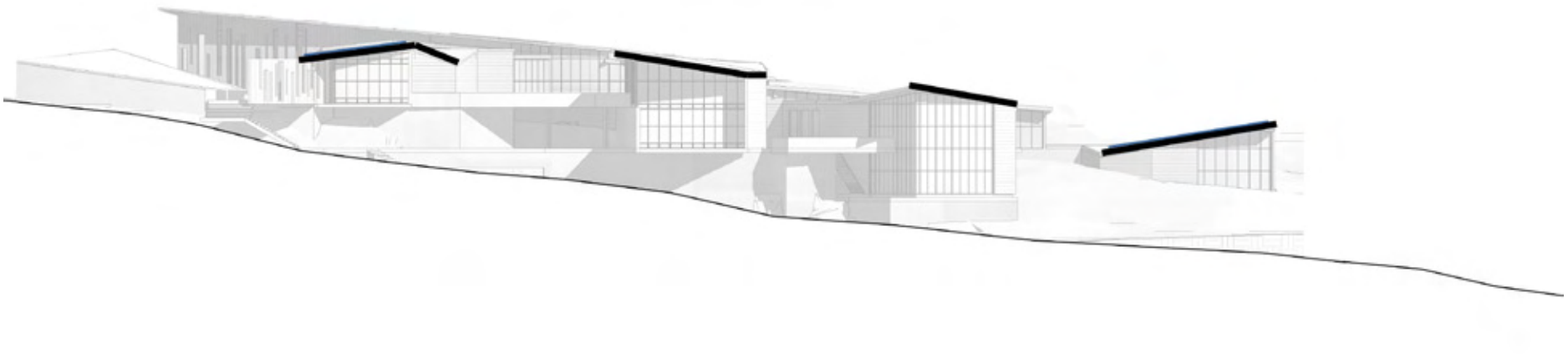
The shapes of the rooves while they do connect to the surrounding context, also allow for the capturing of rain water. In this case, the rain water is being collected for use in flushing toilets, as well as a water feature in the museum. Basically the building acts as a big water filter, taking the rain water in, storing and filtering it, then sending it to a constructed wetland where it can be fully cleaned and released into the environment safely. While the collection of rain water is performing a function for the building, because it is an environmental discovery center, it also acts as a teacher. Children can learn from this large scale idea and take it right to their homes by collecting rain water to water plants, and lawns.



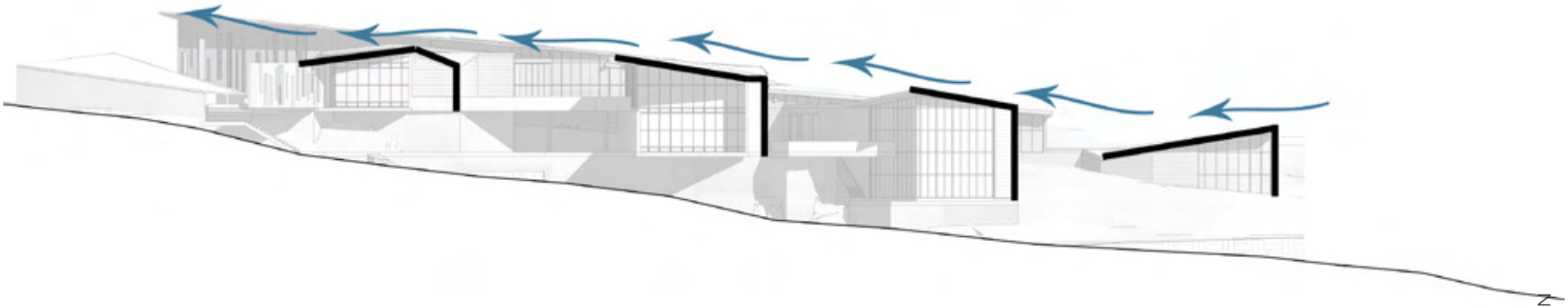
The roofs of the pavilions were very important for both environmental and aesthetic reasons.  evoking, yet not matching the roof lines to the context was very important to give the museum a sense of belonging and place.  Evolving from a flat roof to one with pitch allowed the pavilions to more closely match the existing context.



Environmentally, angling the roofs toward the south allowed for more window area to maximize solar gain in the winter.

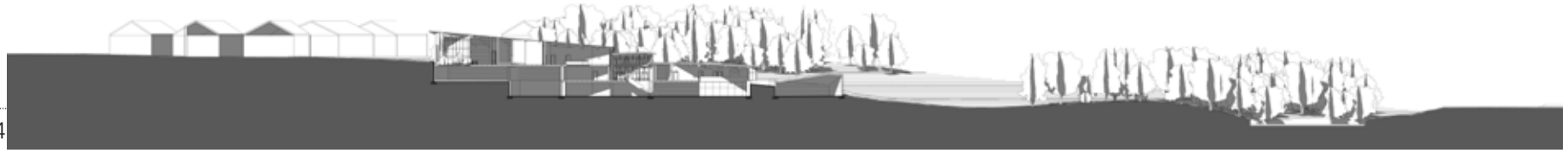


Solar panels as a teaching tool, as well as a potential energy saver were added.  It was important in this case to keep the same environmental advantages of the sloped roofs, yet slope them to maximize efficiency for the solar panels.

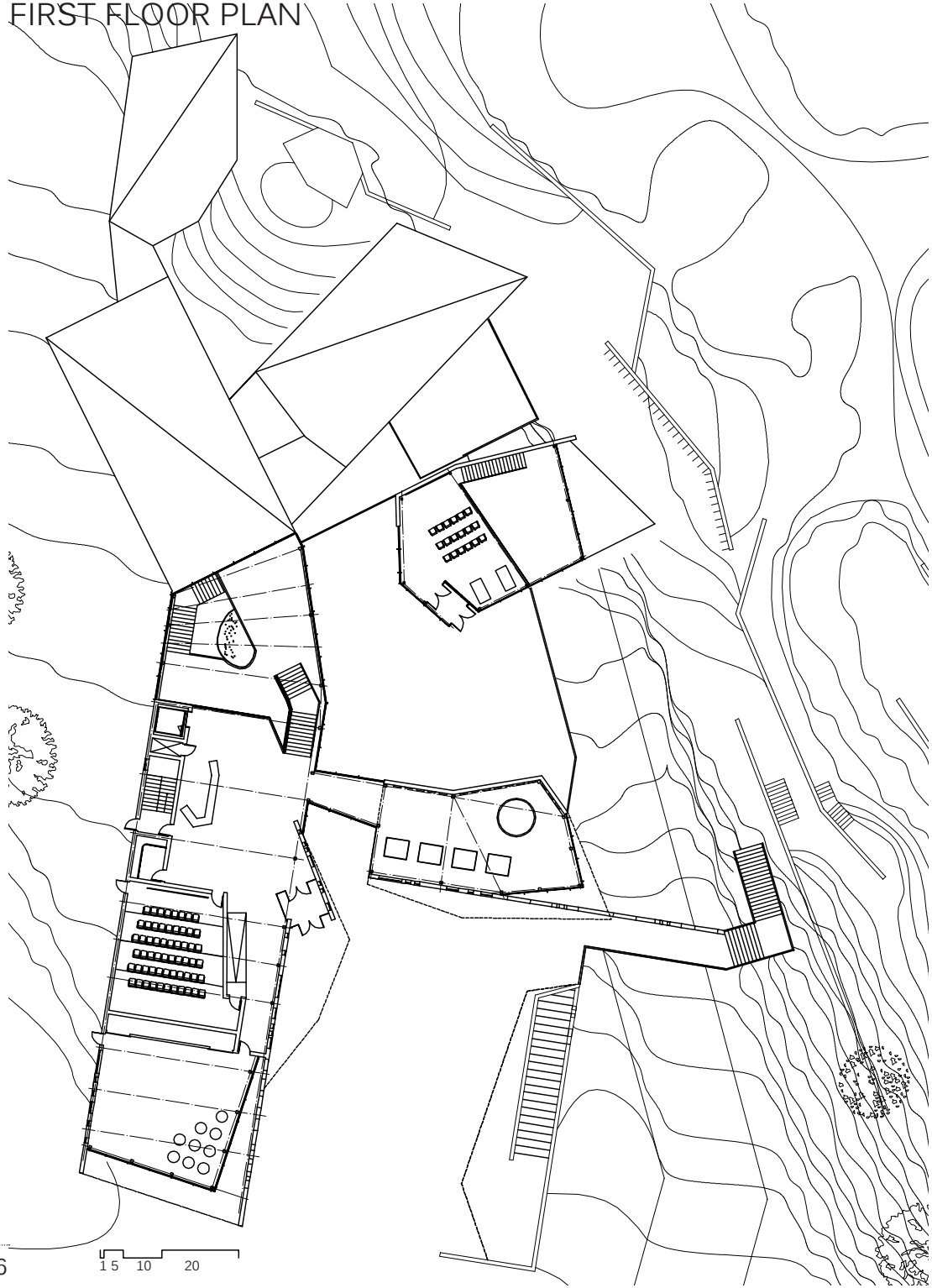


Finally, the roof angles allow for harsh winter winds to pass over the roof tops.

# SITE PLAN

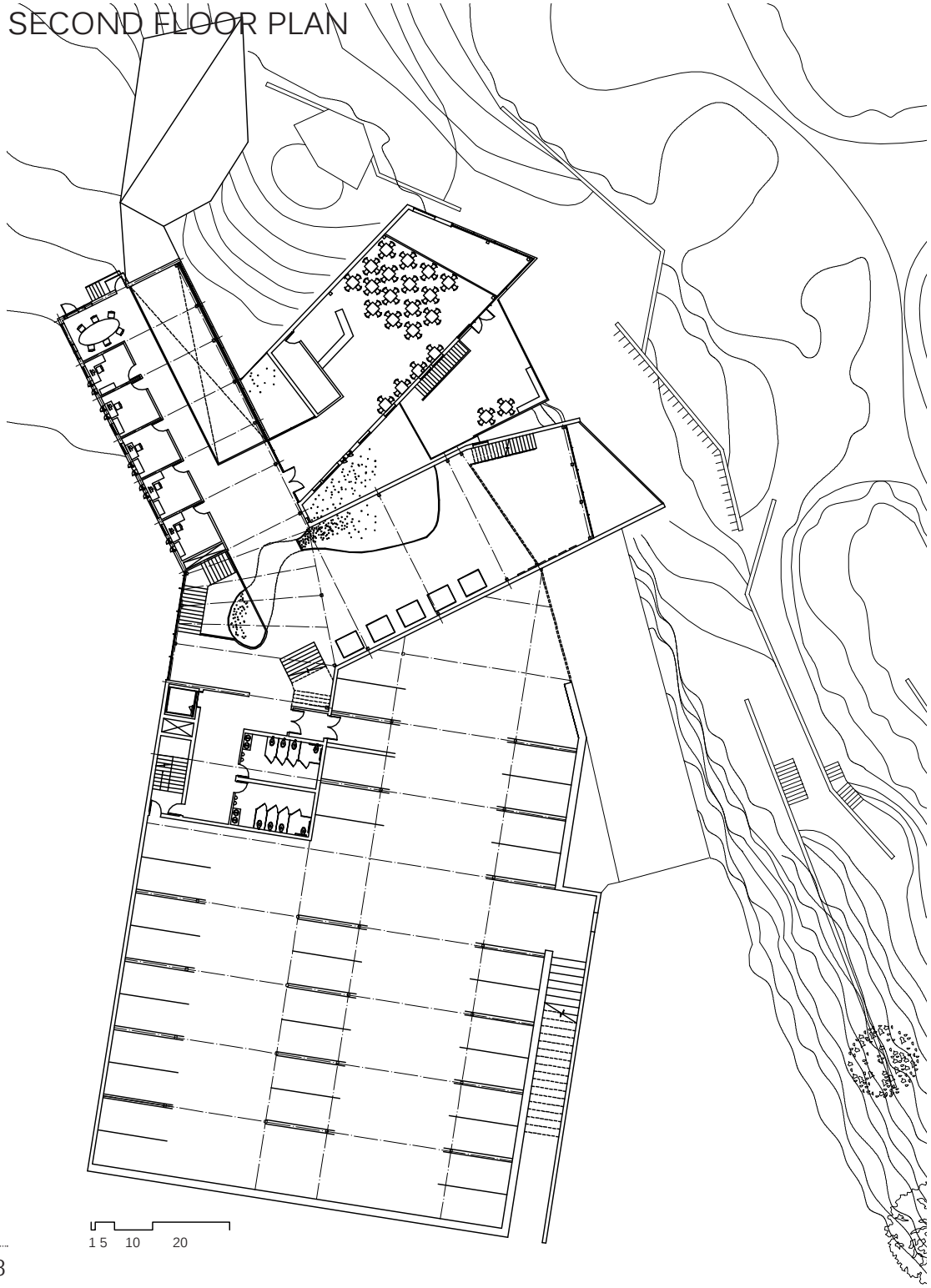
# FIRST FLOOR PLAN




| LEVEL 1 | sqft |
|---|---|
| Reception | 1,440 |
| Community Room | 1,406 |
| Auditorium/ Lecture Hall | 961 |
| Coat Room | 88 |
| History Exhibit | 1,290 |

This level is about the direct interaction with the community. It all starts with the entry plaza. It is not only an entry plaza, but a break in the urban context which can be used for anything from a farmers market to place to safely ride a bike. Looking back at the neighborhood is the history exhibit. The Harford community was really built because of the former mill that was on the site. The history room is about remembering that, as well as how the local community has progressed since then. The Community Room is about the advancement of this neighborhood in that locals can come and use the space for educational programs they want to put on, as well as night classes and other learning opportunities. The Auditorium / Lecture hall can also be used for this purpose of learning. The Environmental Discovery Center is really about the social environment in which it is placed, and therefore must provide programmatic space for these constructs.

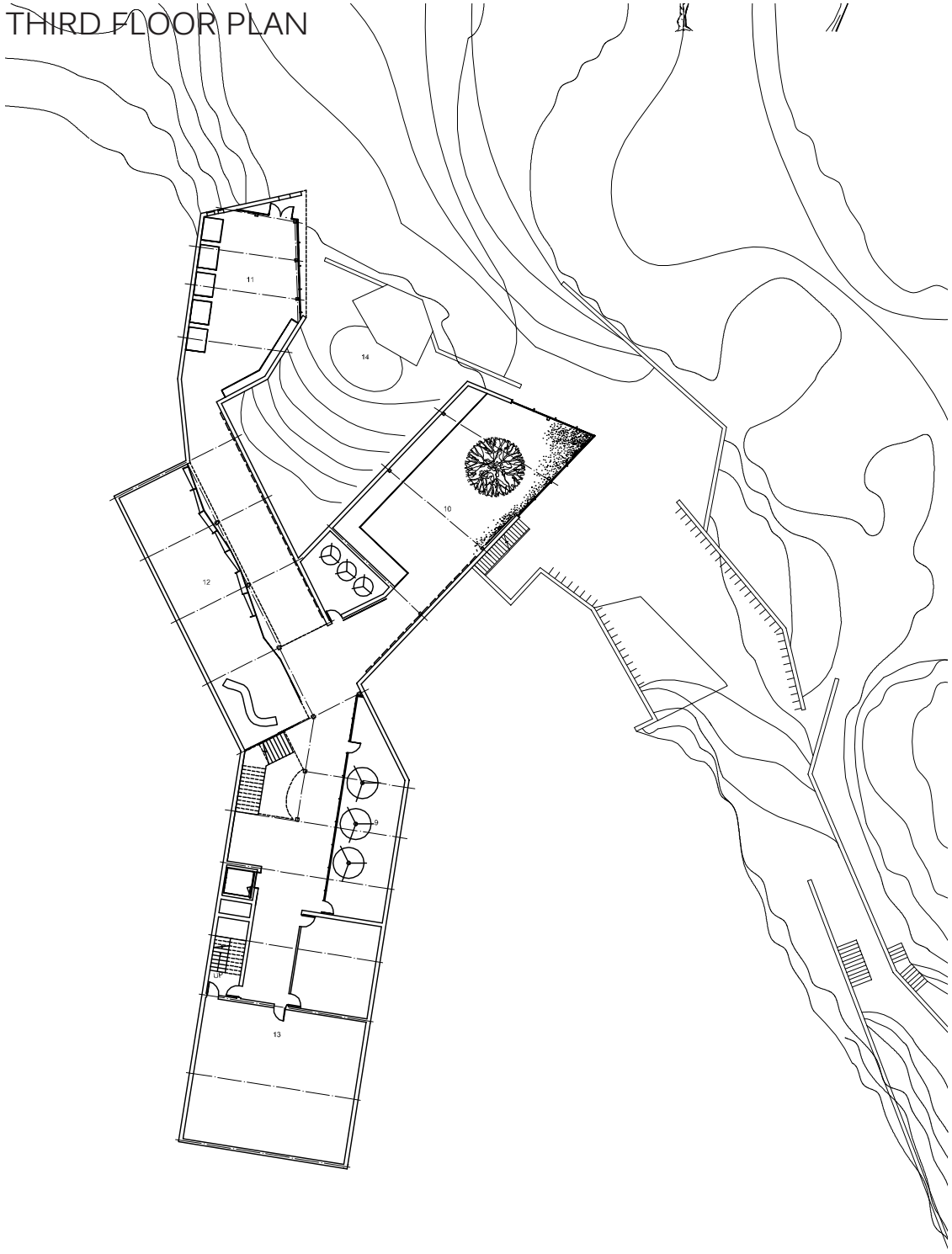
# SECOND FLOOR PLAN




| LEVEL 2 | sqft |
|---|---|
| Atrium | 1,525 |
| Habitat Exhibit (2 stories) | 4,056 |
| Café | 1,592 |
| Administration | 902 |
| Bathroom | 495 |
| Parking Garage | 13,879 |

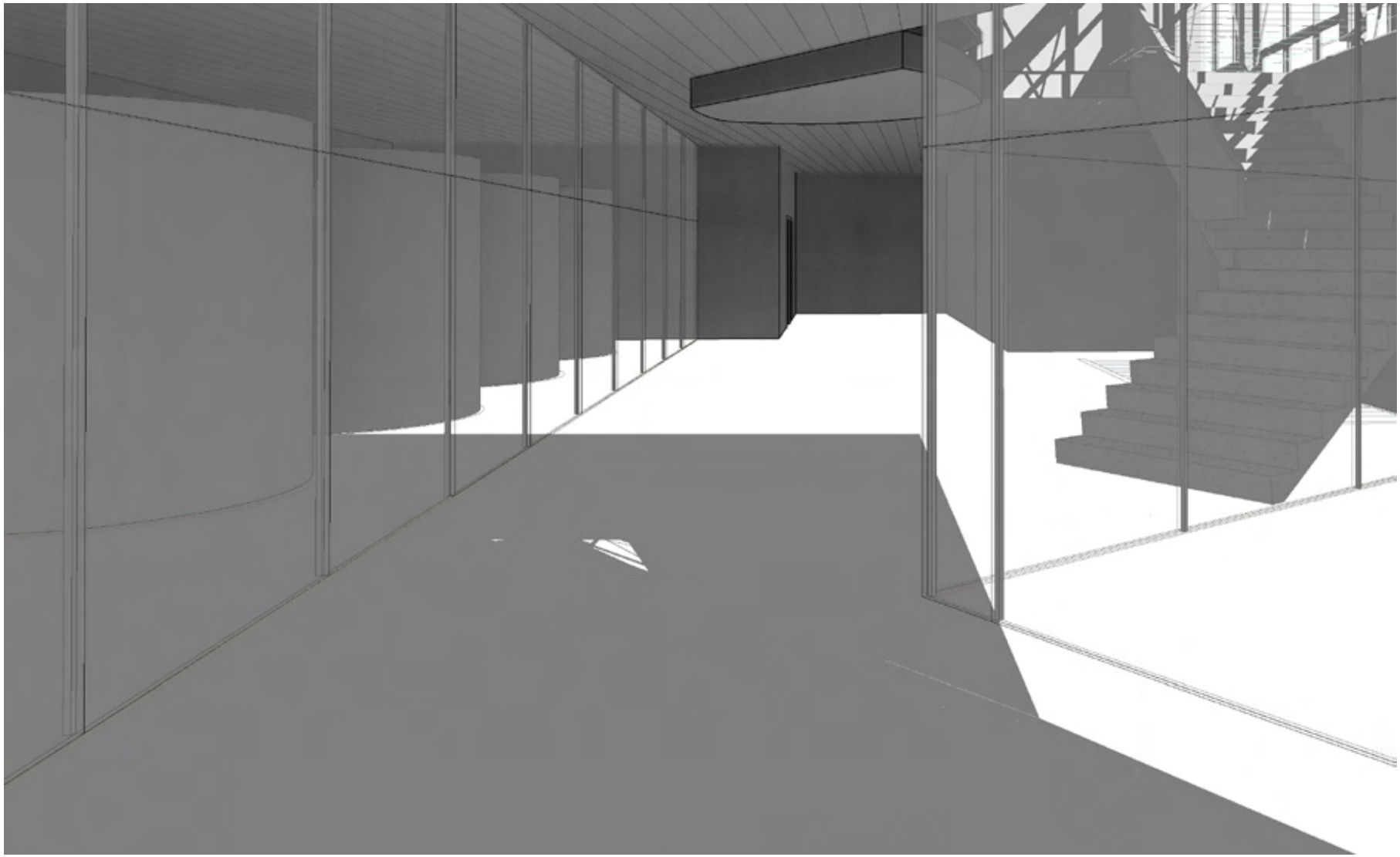
The second level is about experience. It is about feeling the wind come through the atrium in the summer, and the warmth of the sun in the winter. From this level the visitor can access the Habitat Room, and the Café. The Habitat's water feature flows right out into the main atrium space allowing the visitor to move along the edge and be drawn to the exhibit. Cattails rustle as the air moves because of open windows. This draws the attention to the fact that there is no air conditioning and instead, wind movements and thermal mass are used. The café is large enough to accommodate a good sized school class, as well as anyone else who finds themselves at this museum. Throughout the year, visitors can also use the outdoor space accessed through the café. In the summer, a water feature helps to keep the air cool. It is between two pavilions, and so it is shaded to make a nice cool micro climate to enjoy lunch, or a snack. The view at this point becomes uninterrupted, and sprawling of the entire landscape. This is part of the goal for the second level. As the visitor moves through the spaces, they experience different views of the landscape from different vantage points. Some of the views are expansive, and some are more focused.

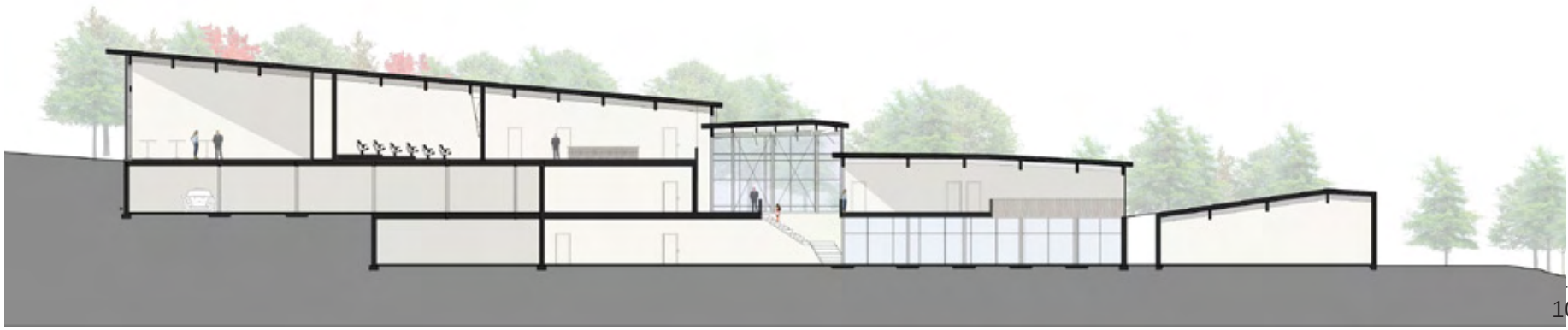
# THIRD FLOOR PLAN



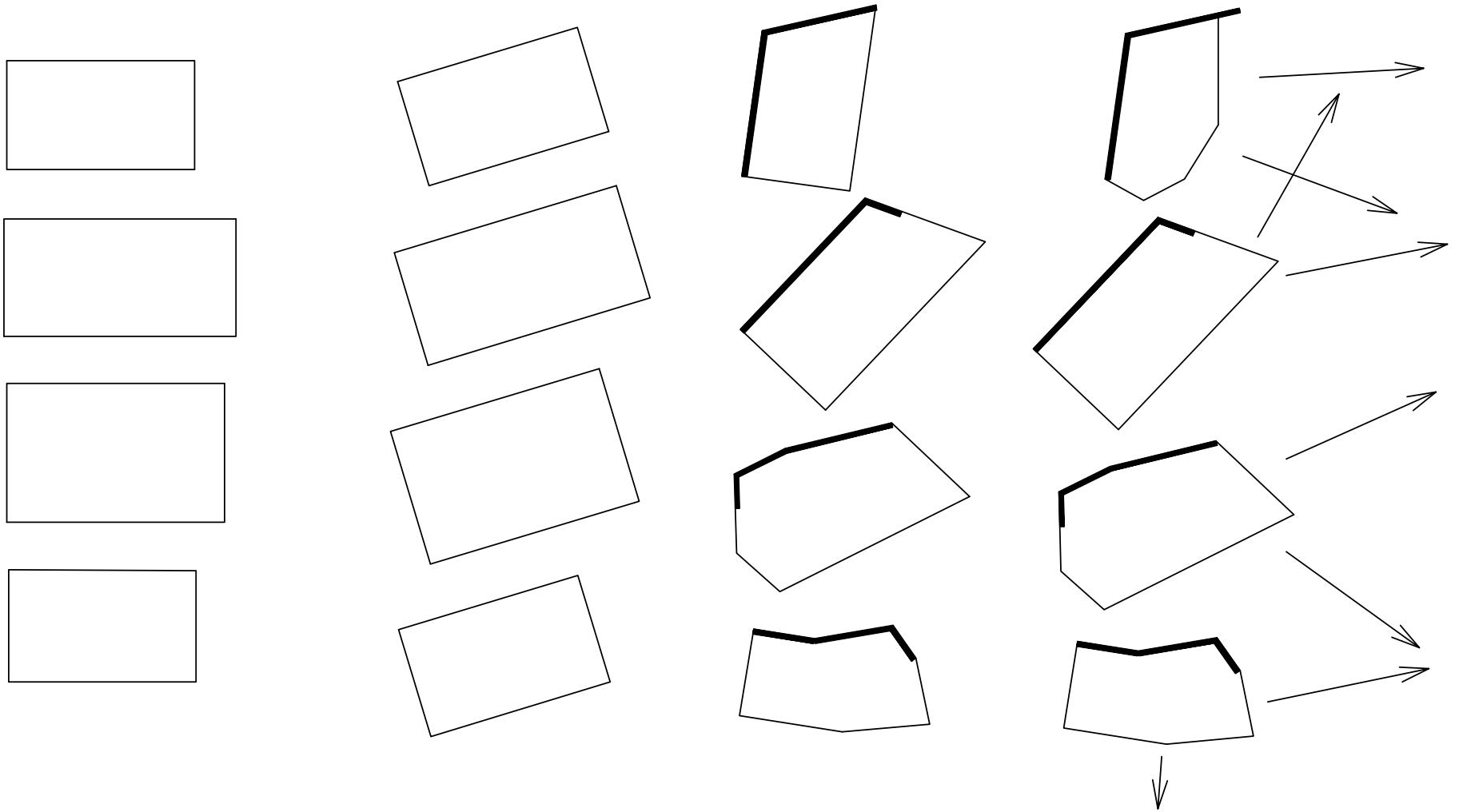

| LEVEL 3 | sqft |
|---|---|
| Wildlife Room | 2,422 |
| Tracking Room | 1,304 |
| Water Filtration | 750 |
| Mechanical Room | 1,557 |
| Gift Shop | 1,462 |

The third and final level is about the direct connection with nature. It is the threshold between the built environment and the natural one. These exhibits are the ones which get you ready to experience the outdoors fully. The Wildlife Room is one of adventure. The visitor sees the types of animals found in this landscape. They learn when the best time to see them would be, and how the animals feed and live. It is about comparing life styles, and therefore understanding how important places like these are. The Tracking and Awareness Room is all about the practical knowledge of being in the landscape. In order to see wildlife, and recognize different habitats, we must learn to see through a different lens than the one we are used to looking through. Opening the eyes to include peripheral vision and watch for movement. Walking slower so as to listen, and not disturb. Finally, tracking different animals can be the most fun. Animals leave all kinds of signs including footprints, and laydown areas. By remembering what we learned in the previous couple exhibits about habitat and wildlife, the visitor now knows where to look for signs of wildlife. The environmental Discovery Center is a teaching tool, and on the last level, it gathers all this information and prepares the visitor for their journey back out into a changed world.





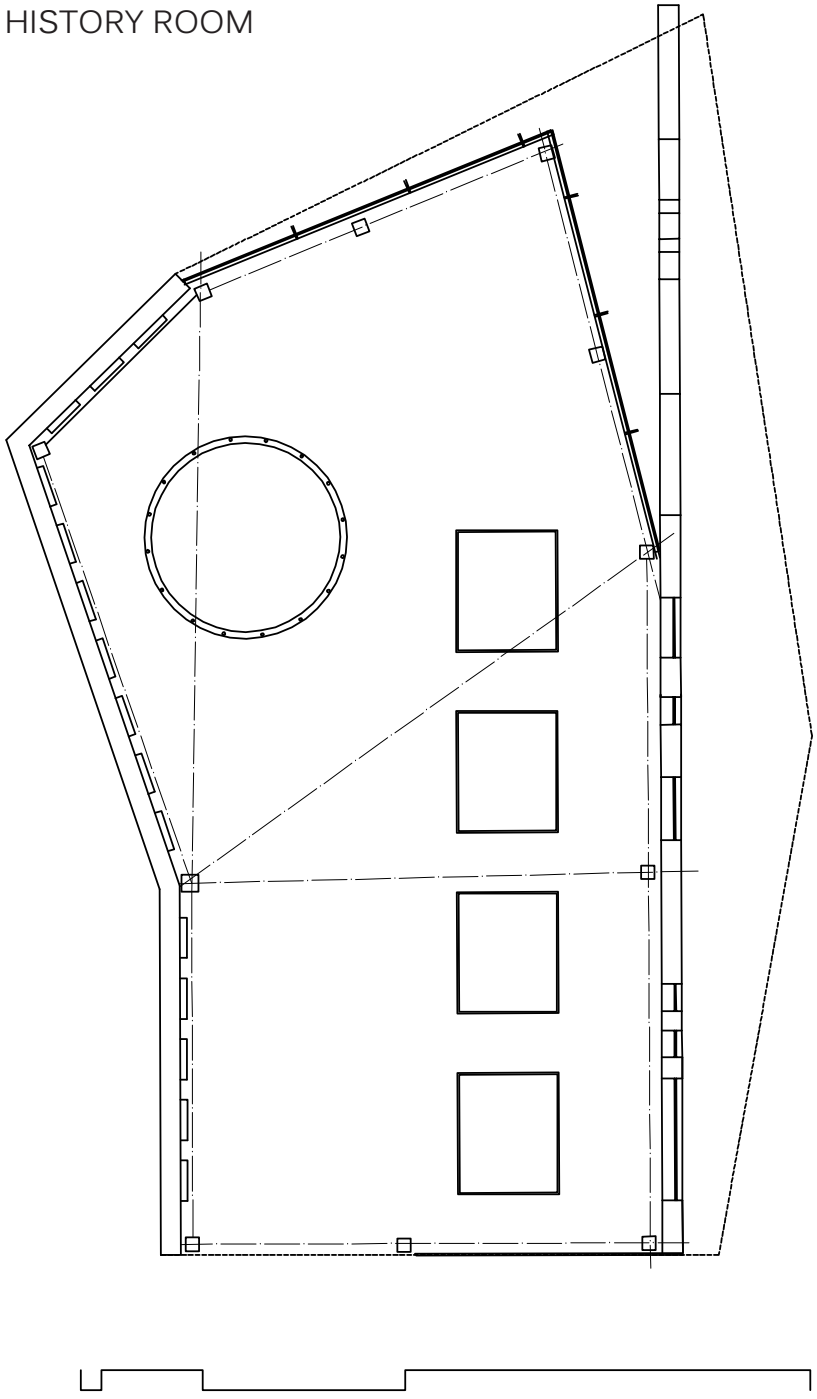
SHAPE SUN ORIENTATION WIND AND SHADOWS VIEWS



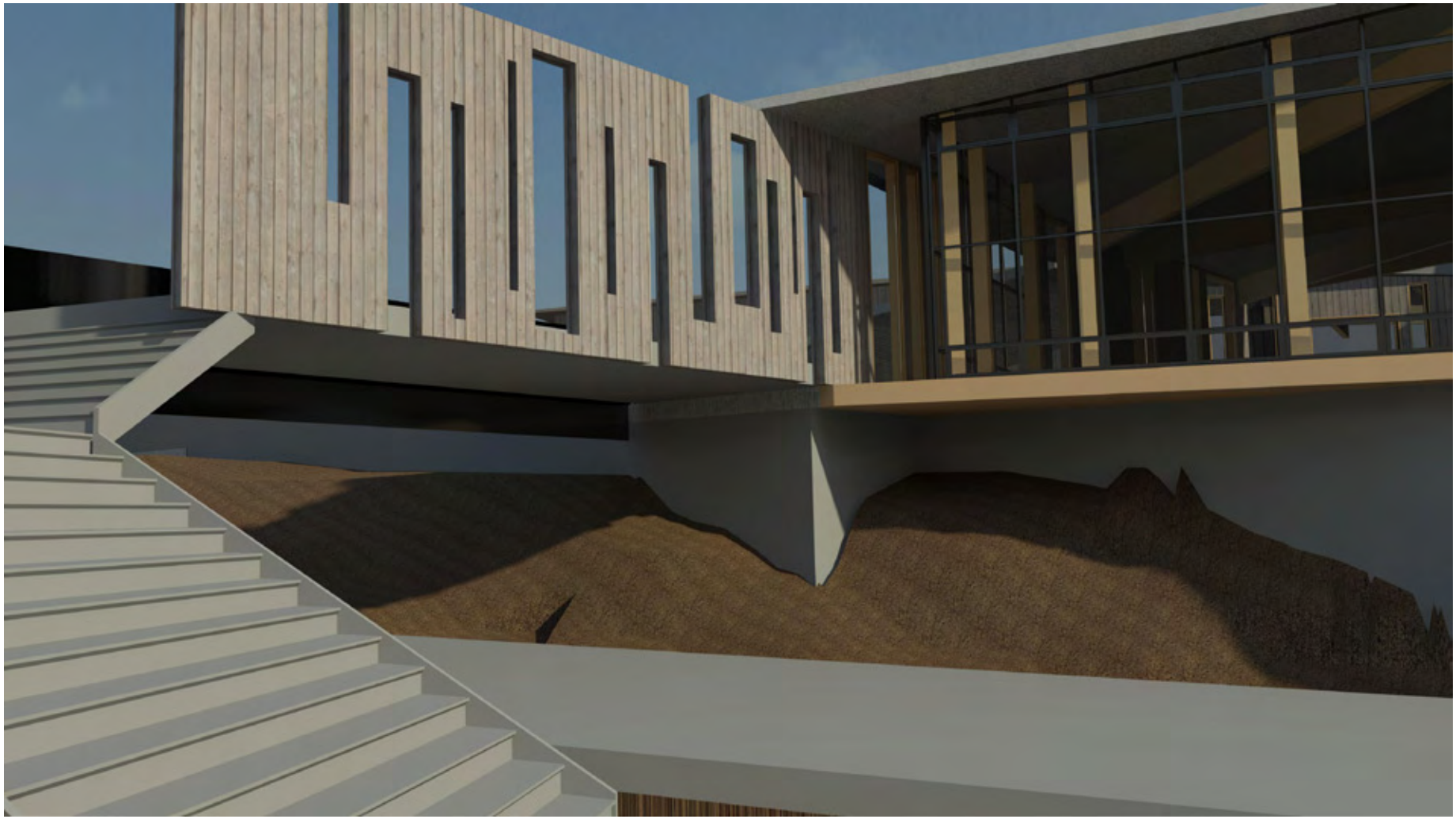
The evolution of the pavilions in terms of shape really came from understanding and responding to the environmental and formal conditions of this particular site. First, a simple rectangle shape representing the correct area needed for each pavilion is layed out. It is then adjusted for a southern solar orientation. Next, the shape is carved out to provide enough space in between for sun to get in, and wind to be directed. Lastly, the pavilions are re-directed towards different views, really binding this design to its surroundings.


FINAL DESIGN

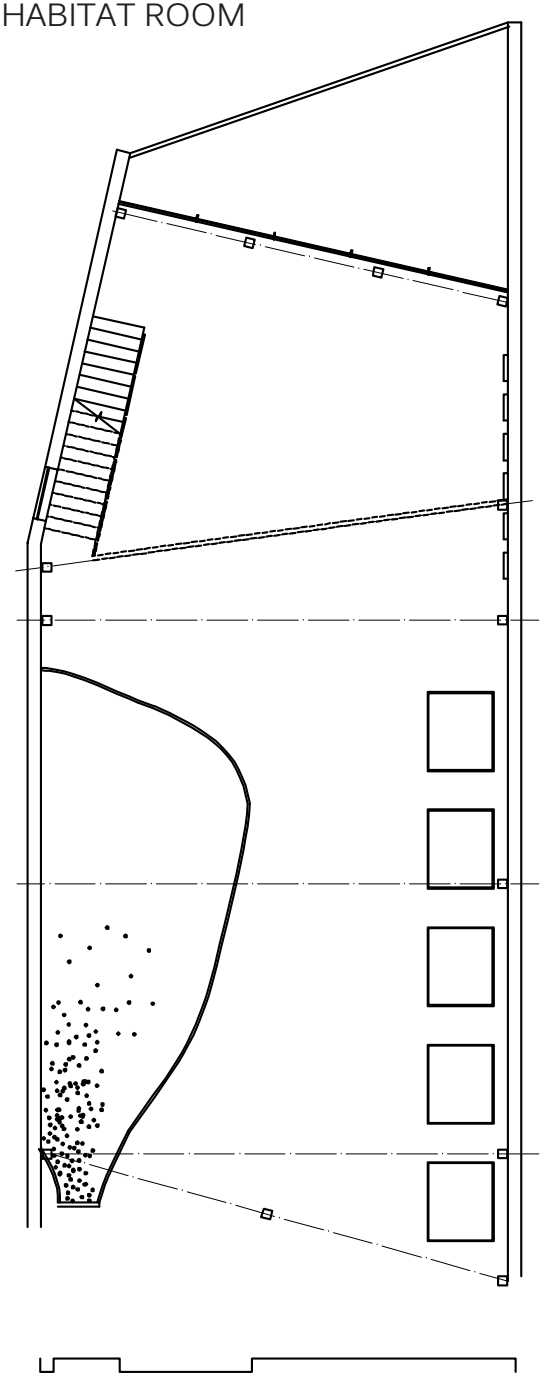
## HISTORY ROOM

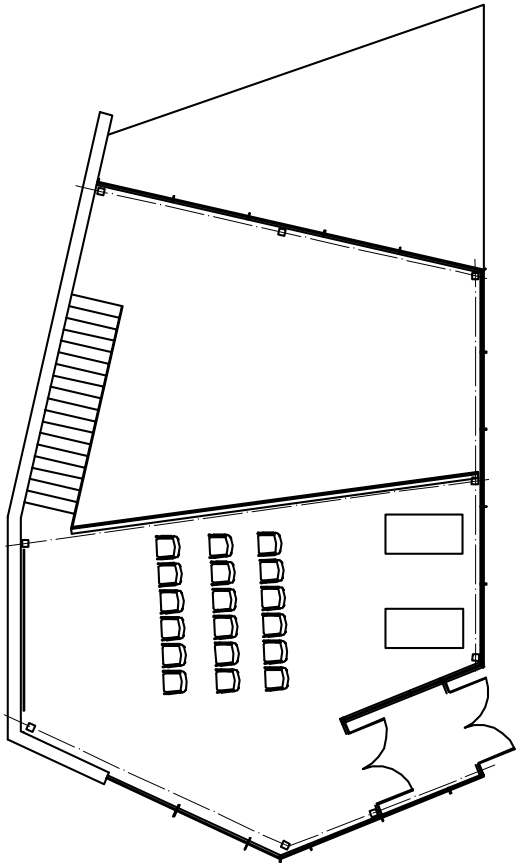


The history room is about the connection between the museum and the community. It is important that first, the visitor is rooted firmly with the spirit of this place. The history room starts with the Naraganset Native Americans, then moves to those who settle there. More importantly we fast forward to the 1800s when the Merino Mill was formed. It was through this mill that the Hartford Community was born. The workers needed a place to live, and therefore built houses in the local area. After the mill burned down in 1995 the land was remediated. It was then slated for bike path development, but otherwise inaccessible. The History Room also shows the natural history of how this place did and will develop. Finally, the WWC had much to do with the recent development of this place, so their history and message will also be included. The most important part of the History Room is its visual connection with what used to be the mill. The history extends out into the landscape where old walls and bridges used to be and only remnants remain.



## HABITAT ROOM

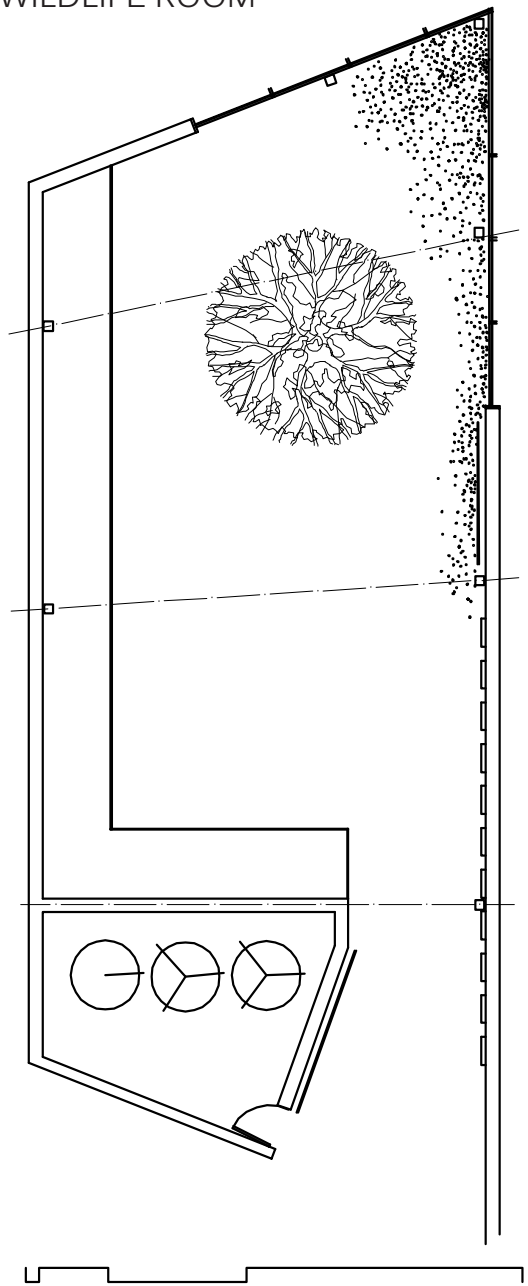


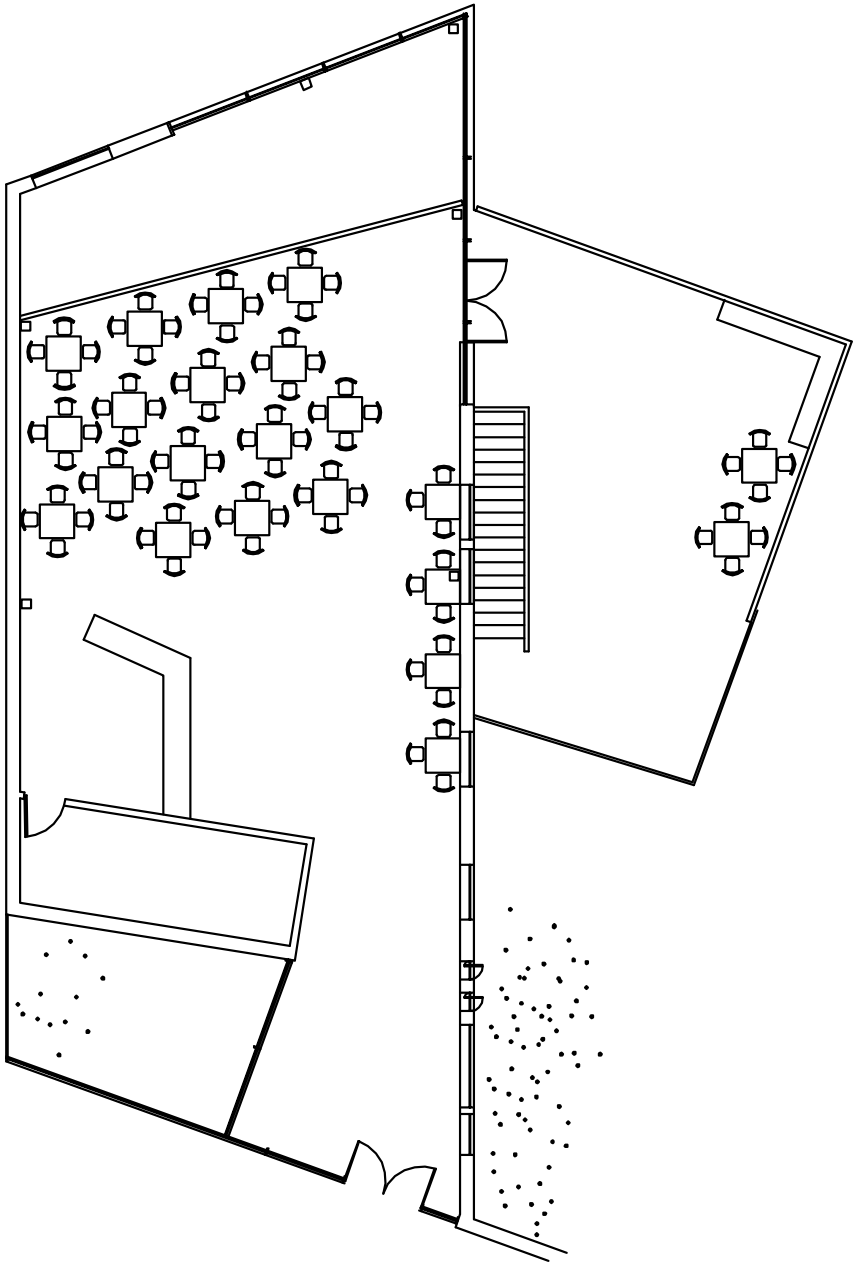


## Habitat Room

The habitat room is really the program that grounds the Environmental Discovery Center to this place. The habitats which are displayed are the same ones that you can look outside at and see. This really gives the museum a local feeling and idea about environment. In this space visitors learn about characteristics of habitats as well as how to conserve them. They also learn about how these habitats change throughout the seasons. The habitat room extends into the landscape so that the visitors can experience for themselves the majesty of these habitats.
The room itself is two stories and starts with a holistic view of the landscape it is in. Downstairs, the environment is broken down into heavy forest, riparian buffer, river, and grassland. It would also be interesting to show how nature has adapted to the urban environment, further proving the thesis.

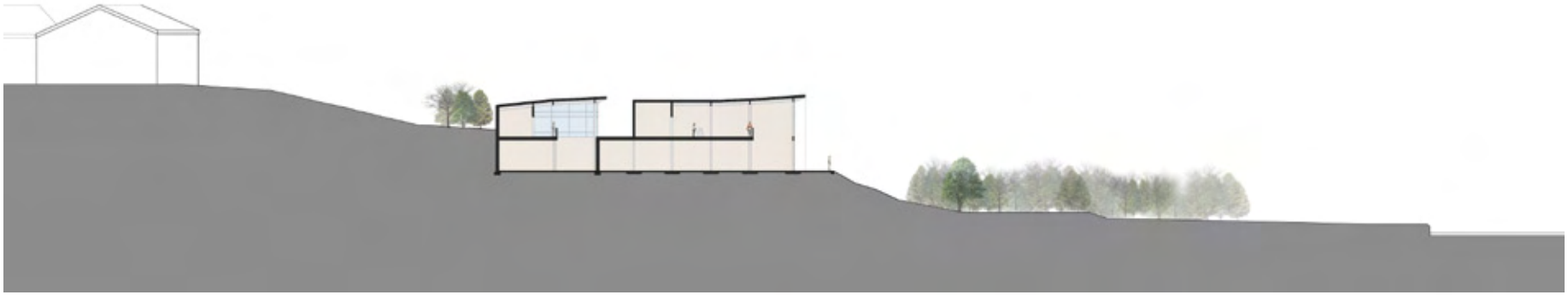
WILDLIFE ROOM



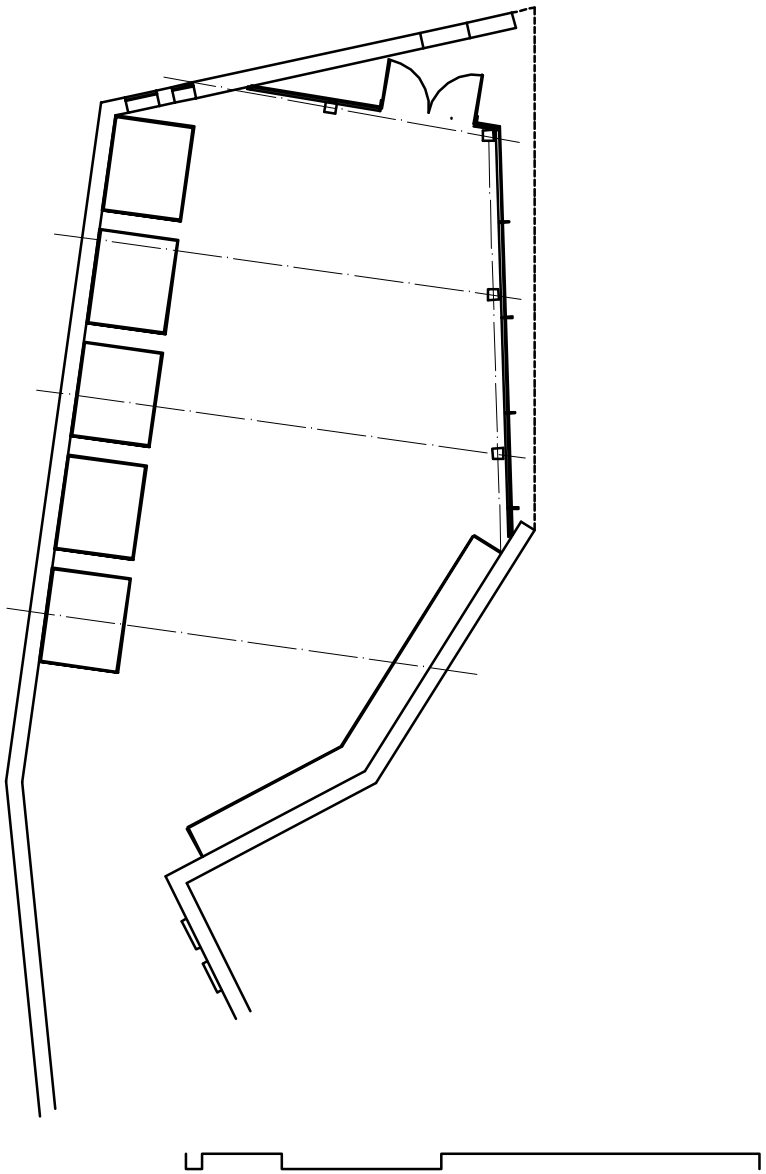


Wildlife Room

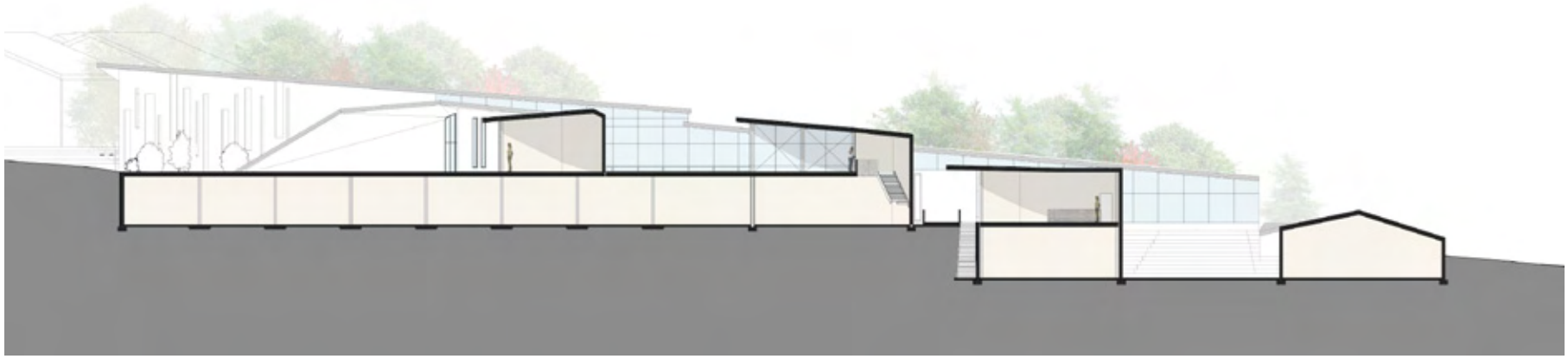
The Wildlife room is also dealing with the local environment. This exhibit focuses on the small mammals who have adapted to an environment surrounded by urban development. Squirrels, raccoon, deer, skunks, gofers, and chipmunks are just a few examples. Also integrated with this exhibit is the habitat each animal lives in. The river is a big part of that. Not only does the river provide habitat, but also the life blood which allows all animals to life in the ecosystem. This is why the WWC has worked so hard to restore it. The exhibit space itself is unique in its connection with nature. After visiting this exhibit, the visitor can walk right outside and potentially see the types of birds and mammals they have just learned about.



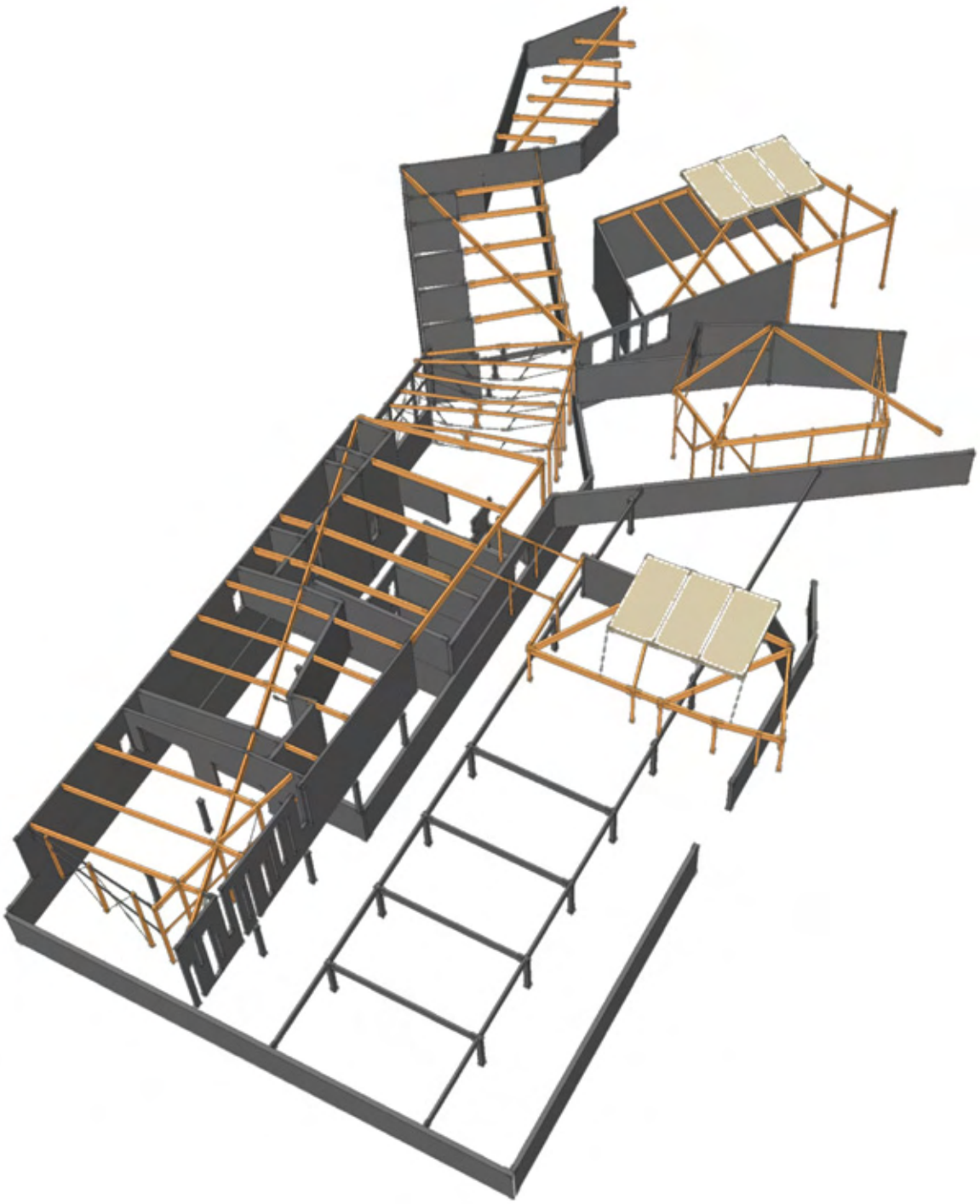
## TRACKING AND AWARENESS ROOM



The tracking and awareness room is a unique feature to this type of program. The goal is to allow the visitor to see through a new lens. This lens is one which requires slow movement. It allows you to see close to 180 degrees all at the same time, and it allows you to see subtleties in the landscape that typically you would never see. Awareness is about tapping into all 5 senses that we as humans possess. It is about becoming more in tune with your surroundings. Tracking similarly, is a subtle art. Animals of all kinds leave behind traces of where they have been, what they have been doing, etc. It is in this exhibit, that we learn to put together all the things that we learned about in the previous exhibits, and brings the entire experience of the museum into a new realm. In order to track a raccoon for example, you have to know its general behavior. A raccoon is primarily active at night. It generally enjoys being close to the water, as it prays on smaller mammals which are always close by. It burrows, and when it mates, has a whole litter of babies. All of this can be learned in the wildlife exhibit. The fact that the raccoon generally lives near water, and would find its home in a grassland or a forest can be learned in the habitat room. The fact that raccoons live here, and the habitat is right for him, was not always true, and this part of the story can be learned in the history room. All of this information is necessary when looking for the footprints of a raccoon in the wild. Programmatically, this becomes the ending of the building, yet it is also the gate for the outdoors. It is here that the knowledge comes together, and it is out there that we then use it. The pavilion itself points to the site and its many wonders. It opens up into the grassland so that the transition between inside to outside is simple and direct.



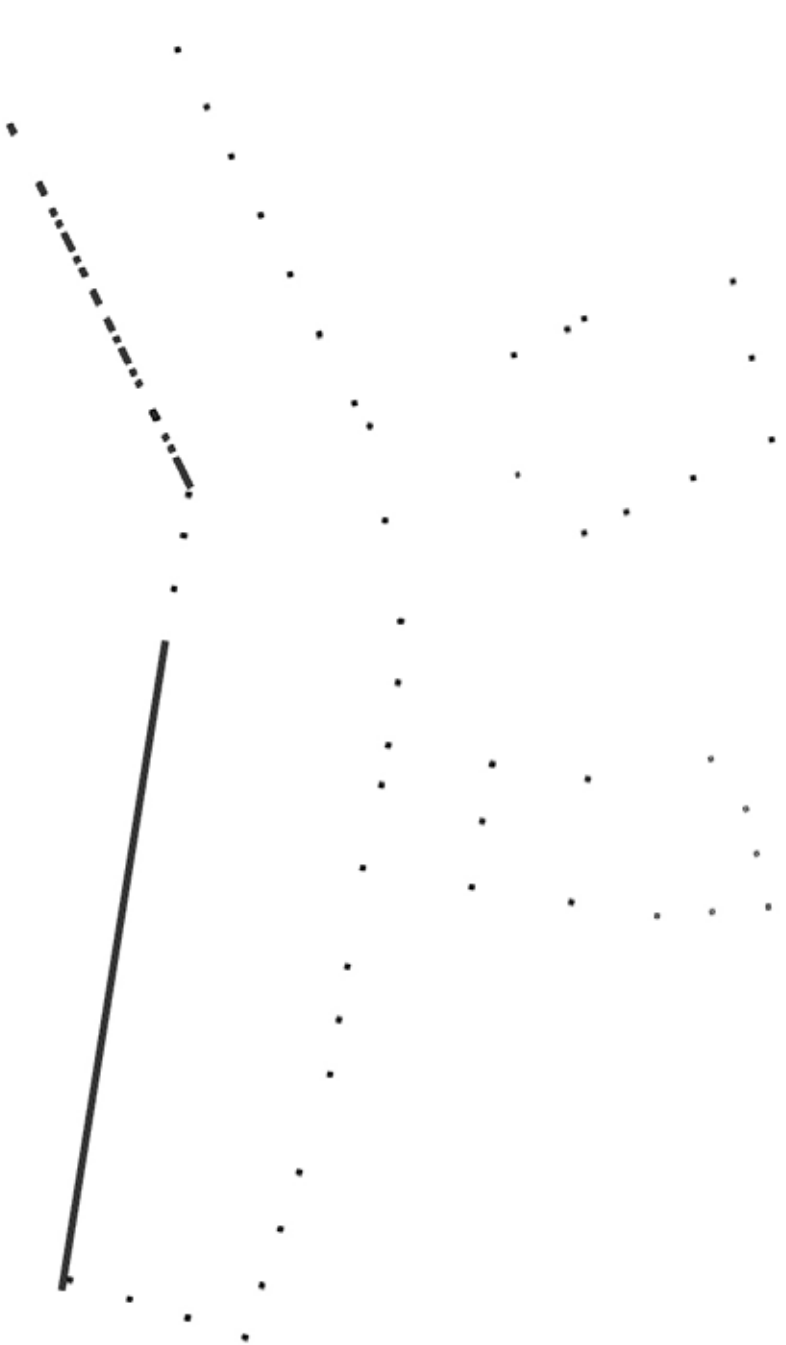
# STRUCTURE



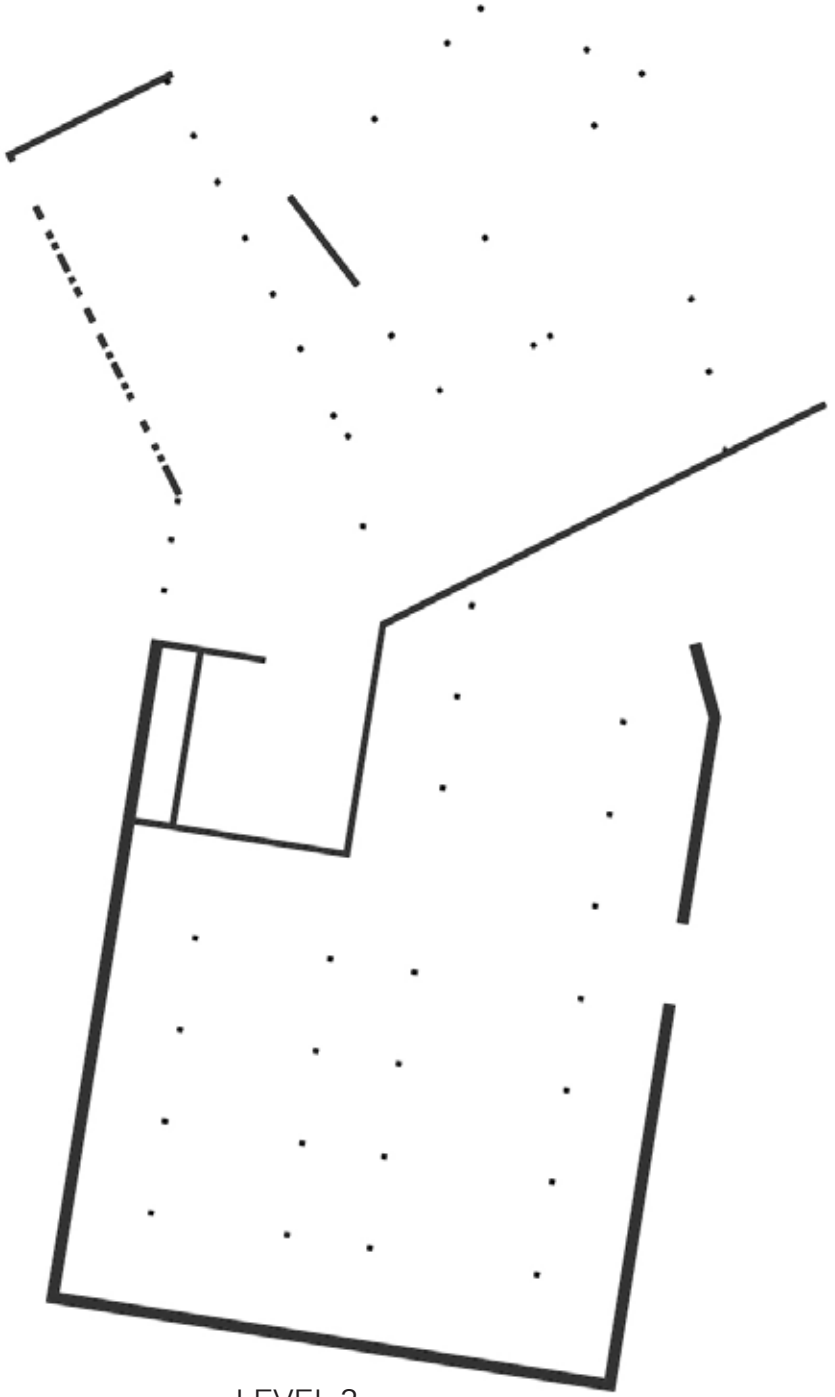
The structure of this building was inspired by the heavy timberframe houses from the northeastern part of the United States. The structure really gives the building a feeling of warmth and natural beauty that steel could never give. This was important because the structure has to be exposed.

The second part of this structural system actually had nothing to do with structure and everything to do with insulation. By migrating the structure from inside the wall to outside the wall, allows for a “free façade” as Le Corbusier called it. In this case, however, it was done because there can now be complete uninterrupted insulation along the entire north walls, protecting them from the harsh winter winds. The insulated walls are actually a system called Structurally Insulated Panels or SIPS. These SIPS are structural in that they can hold themselves, and any kind of siding for the exterior. They can also hold other SIPS as roof panels.

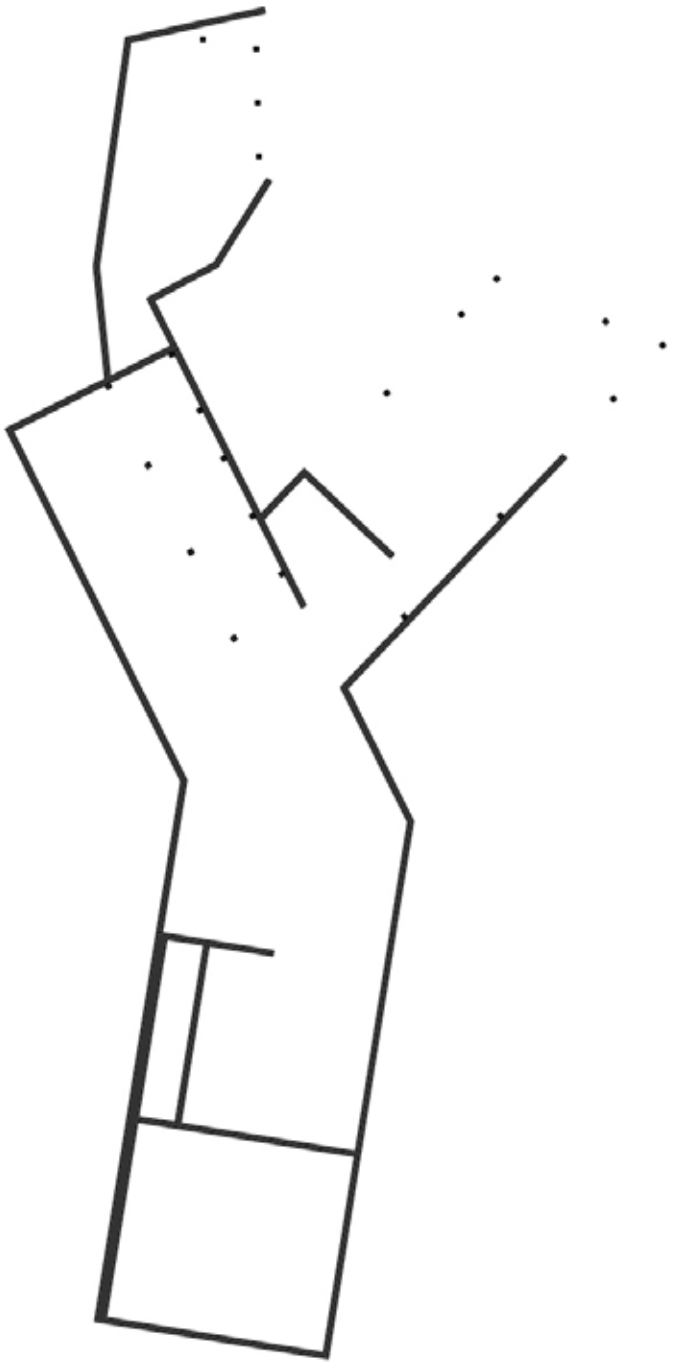
The post and beam system works throughout the building, except at the atrium. The uninterrupted span calls for a much larger system in the form of wooden trusses. Adapted from a bowstring truss, these trusses use steel rods and cables to span the 60’ space. They are however also part of the aesthetics of the place, and they show how beautiful structure can be when used for the right reasons. Trusses are also not solid, and so clearstory light, which otherwise would not be possible, can pass right through them into the large atrium space.



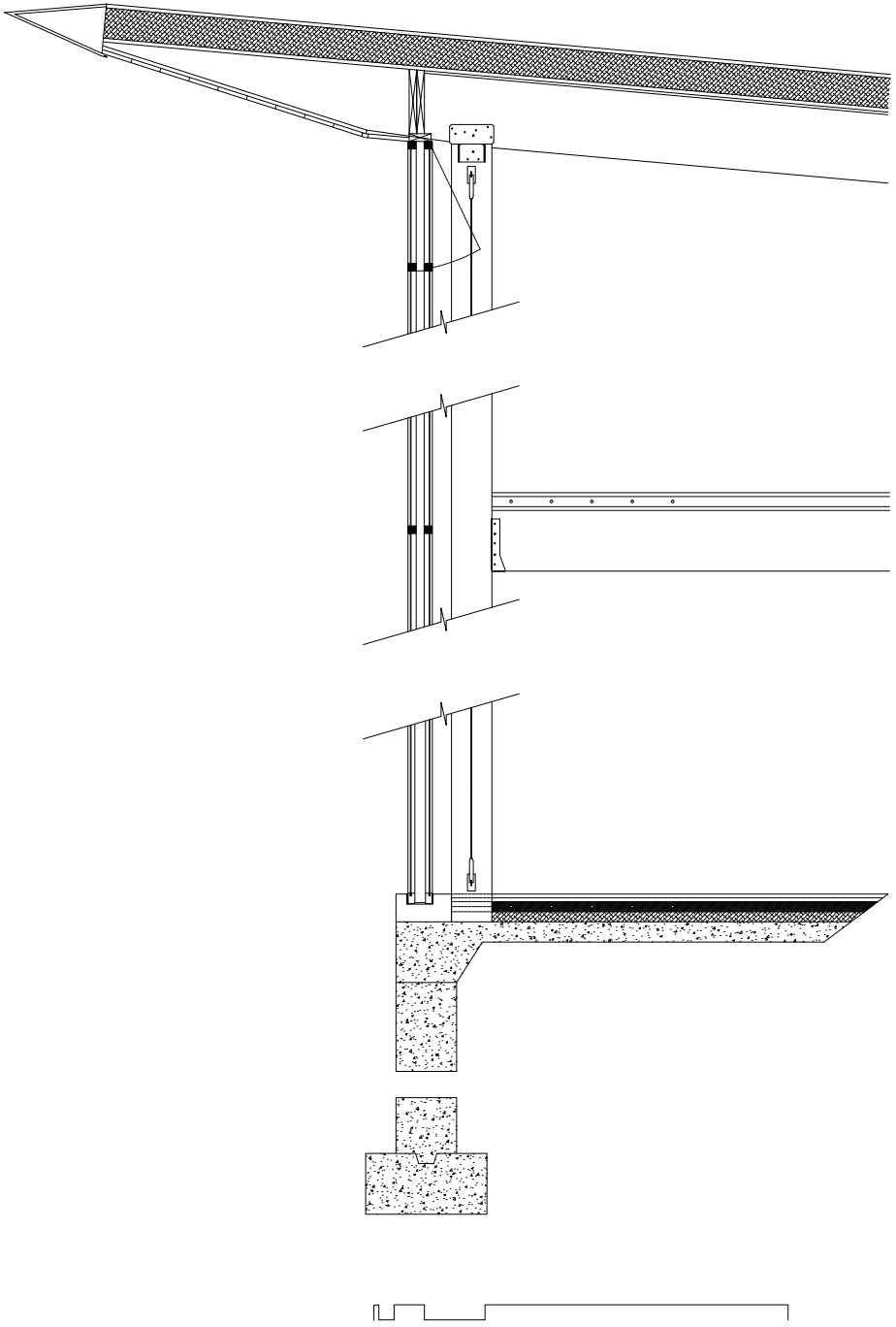
LEVEL 1

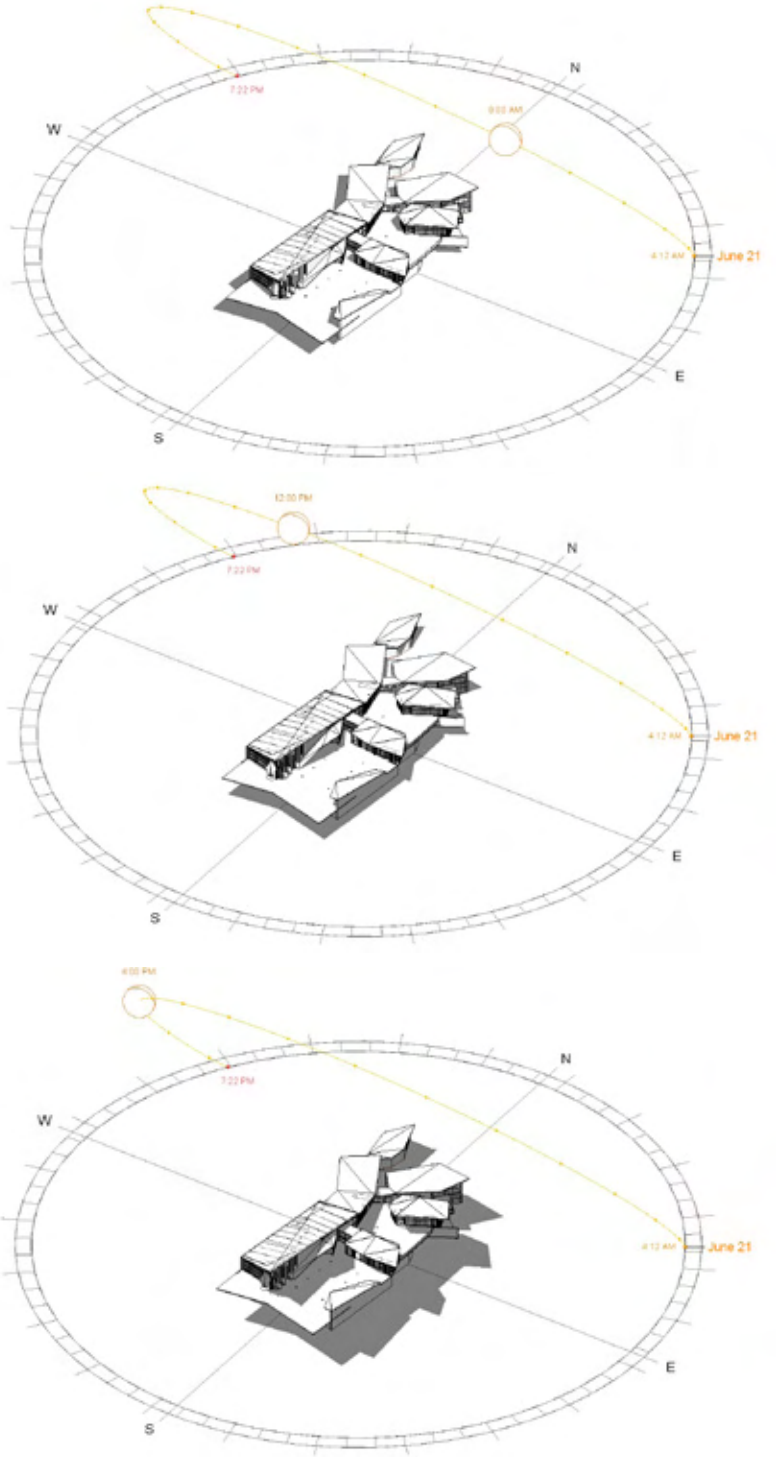


LEVEL 2



LEVEL 3



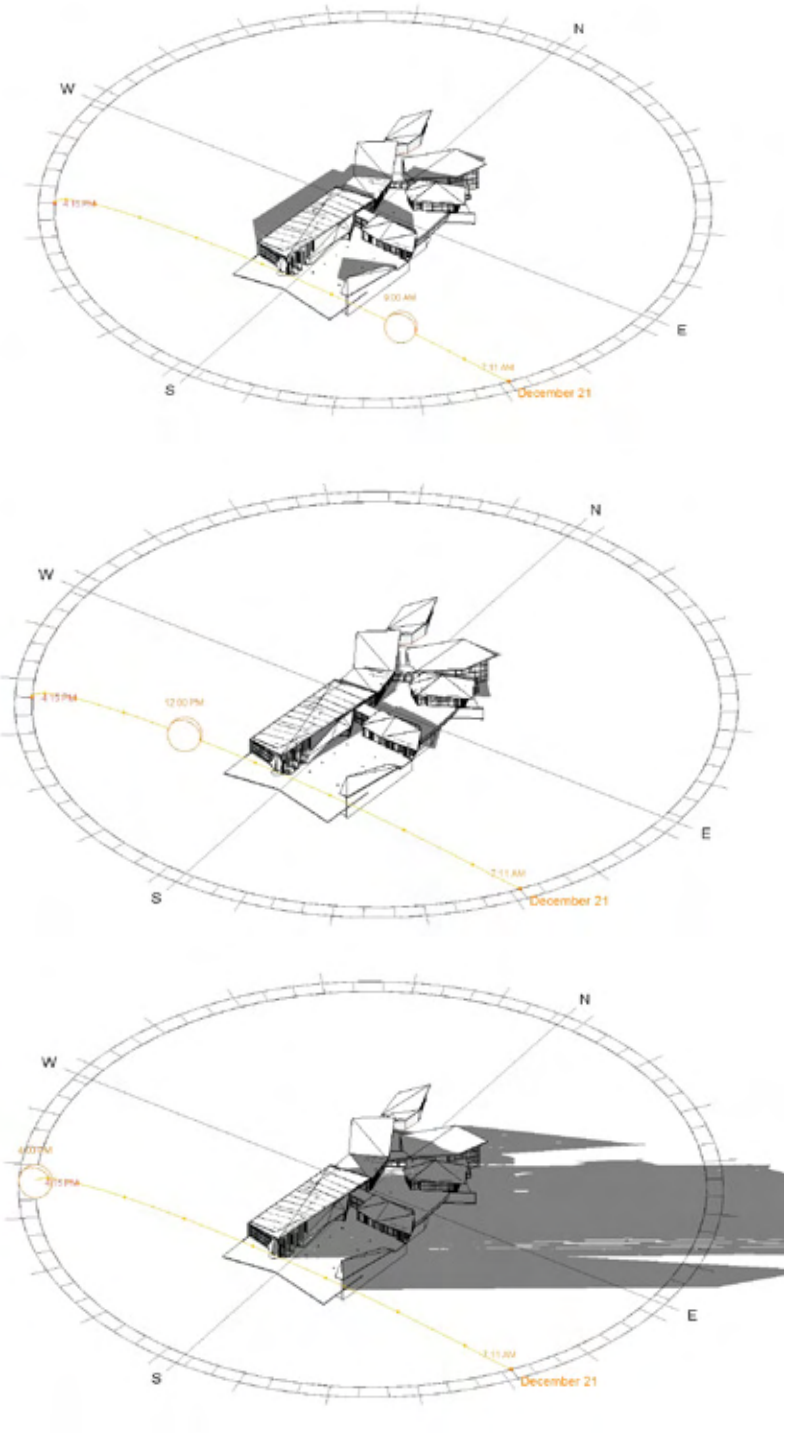



SUMMER SUN STUDY

Solar Orientation was incredibly important for this project. Providence is generally a cold place, although not frigid, so things like good insulation and solar gain were real possibilities for this project. At first the massings were more about integration and “digging in” to the site, but real integration comes from a complete understanding of the site. While earth does provide very good insulation, in this case, it meant the building had to face north and get no southern exposure.

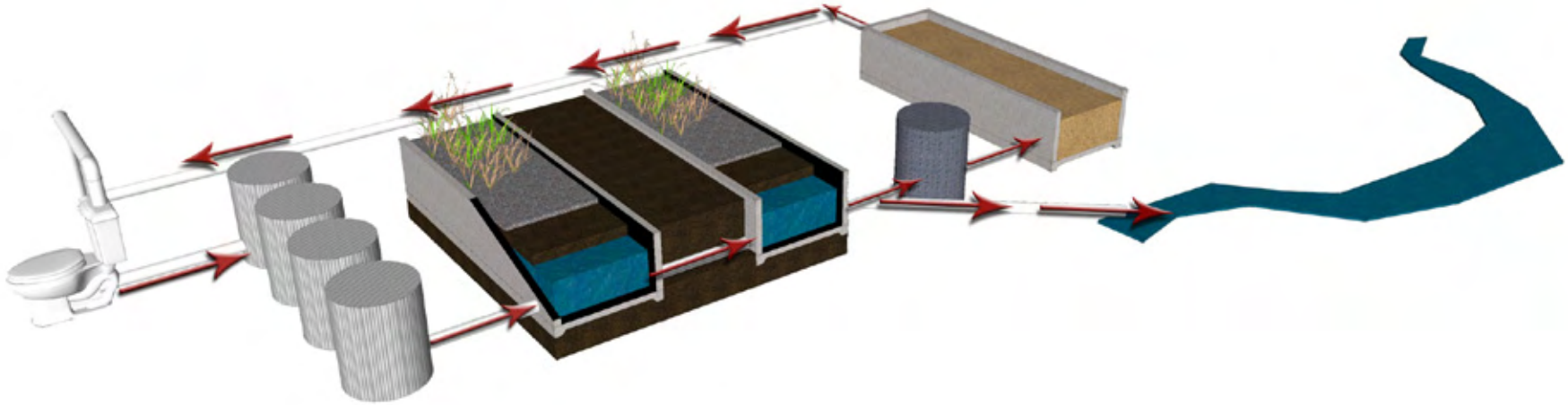
During the summer, large areas of glass are typically not a good idea, however, a short roof overhang, because of the high angle of the sun, will shade the glass and severely reduce the solar gain, while still providing a beautiful amount of light. In winter, large areas of glass are also typically not a good idea because they are not great insulators; however, when the glass is facing directly south, and the sun is allowed to beat on that glass for several hours a day, the solar gain outweighs the loss. Solar gain coupled with large areas of thermal mass help to heat the building passively.

The right Solar orientation also helps with lighting. The Environmental Discovery Center is open from about 9:00am until about 4:00pm all year. Between these hours, even though the angle of the sun changes, we are still within full light, and if the orientation is correct, the building can be day lit for most of that time. In using natural daylight from the sun, we can severely reduce the lighting needs during the day.




WINTER SUN STUDY

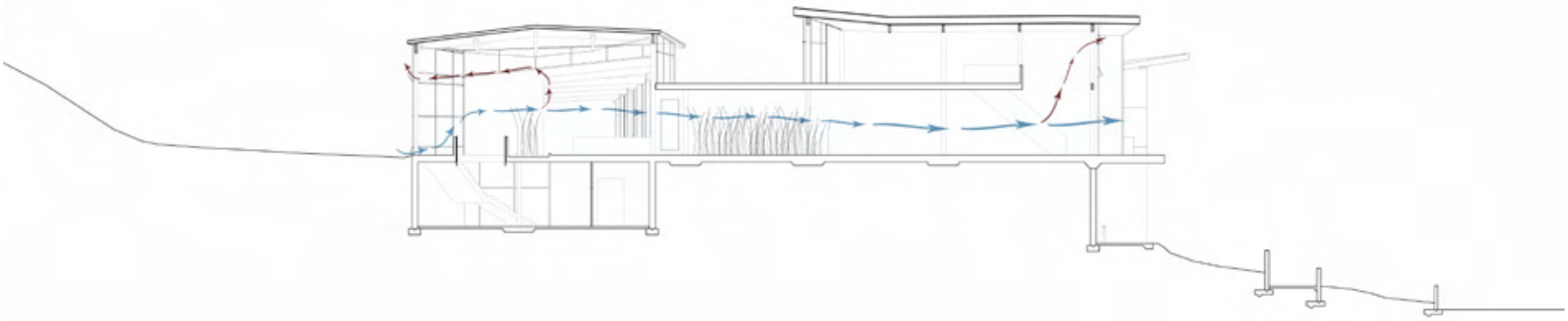
In this winter solar study, we see that the sun tracks very low in the sky, and therefore because of the large window areas, penetrate deep into the space, warming even the back wall of some of the exhibits, as well as the Community Space. While the roof overhangs prevent the hot summer sun from hitting the glass, in the winter, this heat is welcomed. The overhangs, are not long enough to prevent the lower angle of the winter sun to penetrate. This combined with the thermal mass, and high insulation on the north side, allows the buildings to heat up and regulate temperature throughout the colder months of the year.



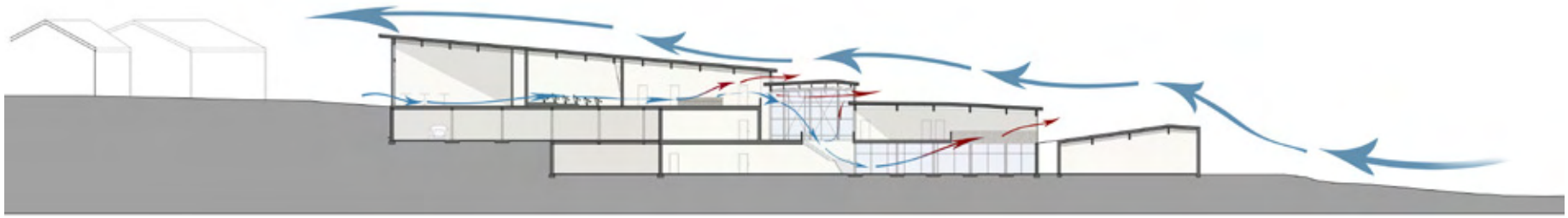
In the wild, all types of habitat are completely sustainable. The habitat, through its natural processes cleans water, uses all its waste, and cycles continuously. Humans on the other hand, make water dirty, then force it back to be “clean,” and we throw things away. We have however, learned how nature works, and have started to use these processes in our own lives. A constructed wetland is one of these simulated natural environments used to purify gray and black water. The system uses natural enzymes to break things down, and water is purified by plants and small aquatic organisms.

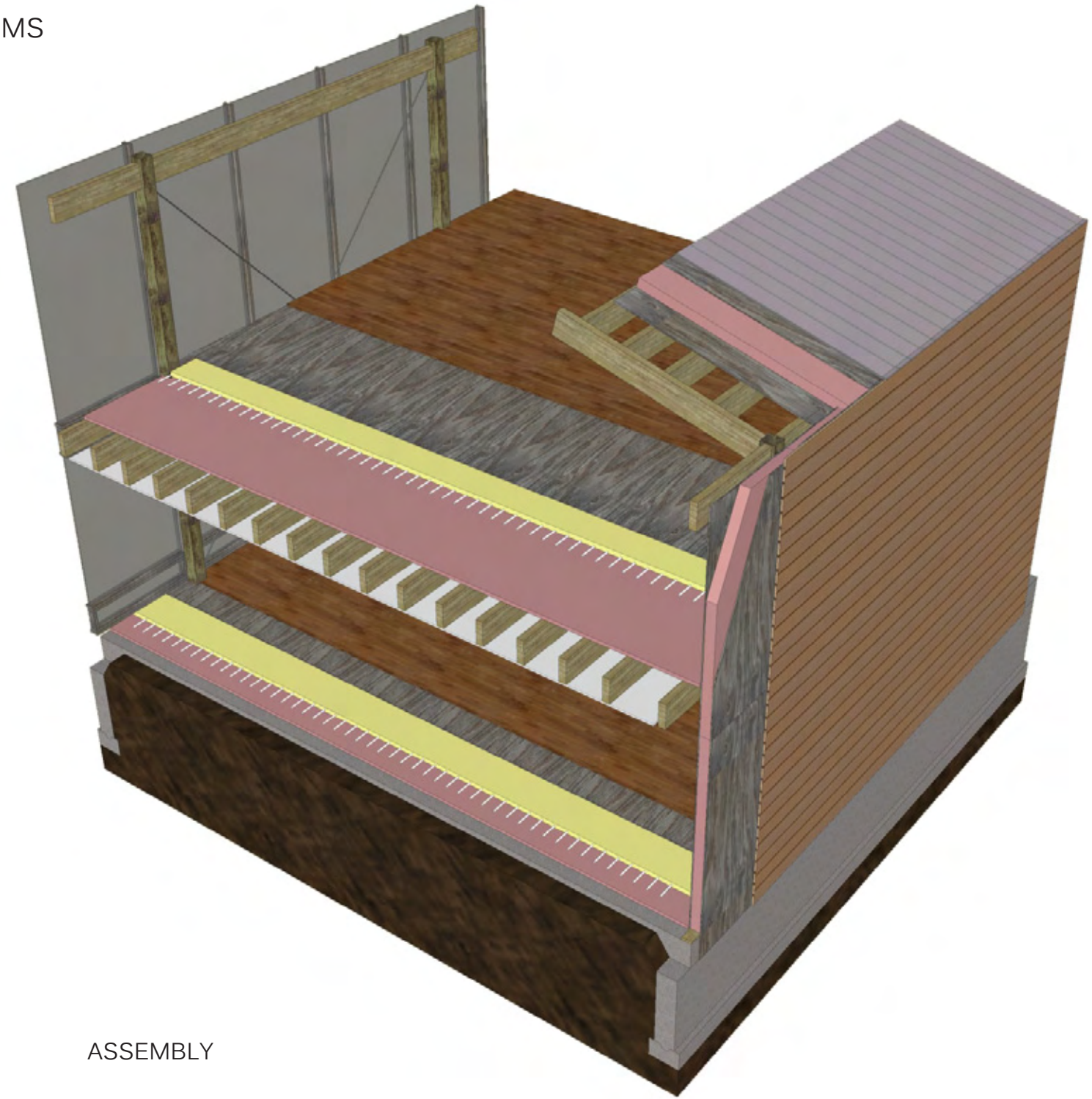
In the Environmental Discovery Center, this new idea about water purification has a real application in teaching kids and adults alike about the importance of water. The system takes all the gray and black water from the building, as well as rain water, and purifies it so that it can either be reused, or go back to nature safely and without chemicals like chlorine.

The actual process is simple. The water is collected in a large settling tank, where it is then gravity fed into large concrete tanks. The tanks are located underground, and seemingly out of site. They contain all the natural organisms necessary to purify the water. Grasses, and other native plants thrive above. The water is then fed into a filter, and from here can be released back into the environment. If the water is slated for reuse in toilets, it can go through an additional sand filter and then piped back into the building for reuse. The Constructed wetland is ideally suited for a place like this because there is a large open area where grasses, and native vegetation can easily grow.

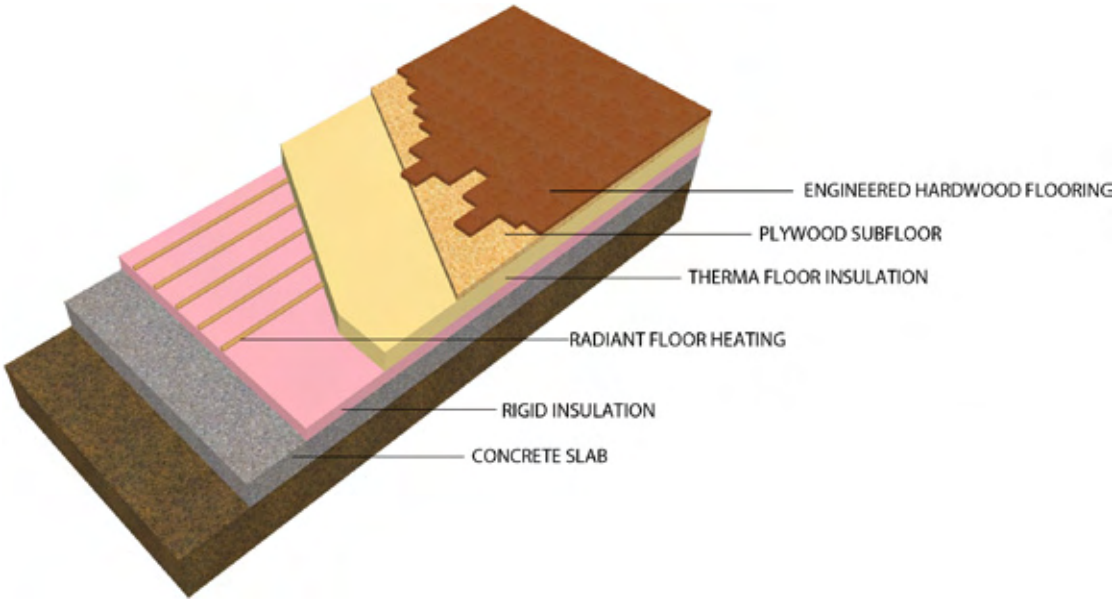


Wind and air movement are very important for this Environmental Discovery Center because there is no air conditioning. A combination of thermal mass, shading glass, and constant air movement is used instead. Operable windows both high and low allow cold and warm air to rise and fall and either be captured or released to the outside. For example, if we look at the bottom section, we see that cooler summer breezes move from the north west part of the building and sink into the lowest areas. As that air heats up, it rises and is expelled through clear story windows in the atrium. More air is drawn in by this current and thus, the process repeats.
The same is true for the top section through the habitat room. Cool air comes in low, and as it heats up, it rises and is expelled. The current is drawn through the building and can be realized by the visitors through the rustling cattails, signaling the air movement. The water in the building also allows moisture to cool the air as it passes over.





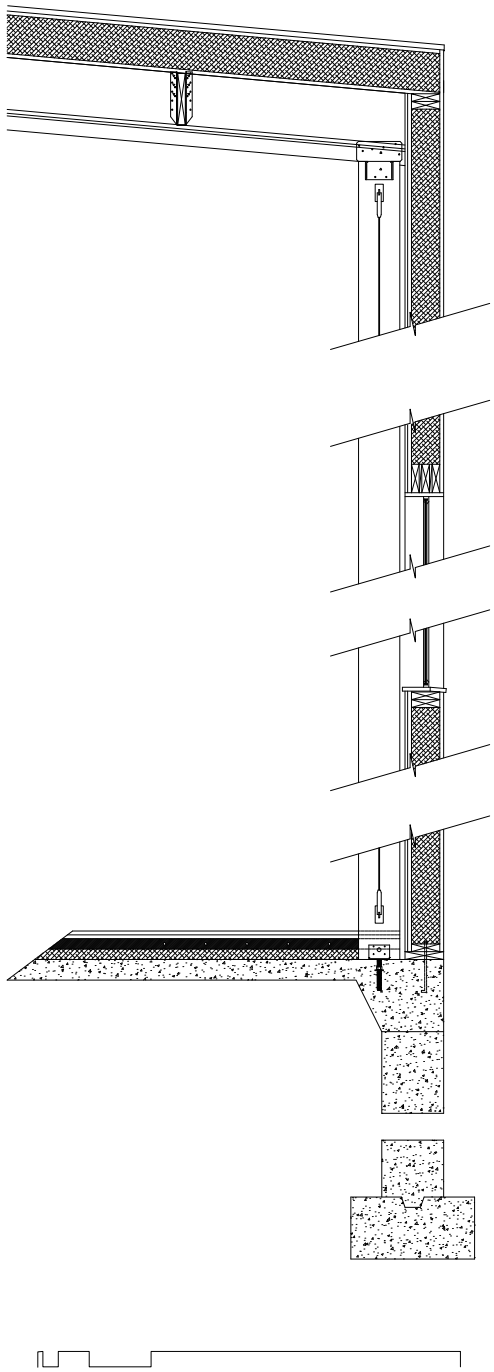
ASSEMBLY




TYPICAL FLOOR CONSTRUCTION

The assembly is based on environmental factors. Cold north winds make for a harsh winter environment, and therefore uninterrupted insulation would be ideal. Therefore, the structure is shifted forward outside the wall plane, and insulated panels cover the entire north face of the wall. The panels also move up and over to the roof plane allowing for constant insulation in the roof. This prevents any type of ice daming as well as heat escaping the building. This is important because the heating system depends on heat staying inside the building. When warm air simply circulates, it is easier to keep it warm. When cold air is constantly introduced through cracks in the walls, it becomes more difficult to heat the air.

The south face of the building almost always has large planes of glass that are shaded by the roof plane in the summer, but collect plenty of sunlight in the winter. The glass allows the warm winter rays of sun to penetrate the building and heat the floor comprised of engineered hardwood. The heat gets into the slab and stays there allowing the surface to warm up thus radiating its heat to the air around each surface.



NORTH FACING WALL SECTION

Aalto, Alvar, Peter Reed, and Kenneth Frampton. Alvar Aalto: between Humanism and Materialism. New York: Museum of Modern Art, 1998. Print.

Mark Treib looks at nature as a cultural construct, in that the definition of it changes depending on who is describing it. He also talks about the way that Aalto creates and deals with landscape. He does it elegatly understanding that the landscape is part of the design of the building. He considers both the the macro and the micro scale are considered, and one completely depends on the other

Brown, Tom. Grandfather. New York: Berkley Books, 1993.

Grandfather by Tom Brown Jr. is a the story of a displaced apache indian from the southern part of New Mexico. throughout his life he comes into contact with the white man and realizes that he is killing his grandchildren to feed his children. Basically this means that people are not living with the land. He understands that we need to change man's way of thinking in order for this planet to survive.

Burke, Edmund. A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful. London: Routledge and Paul, 1958. Print.

Edmund Burke speaks about the sublime and beautiful within the context of nature. The sublime is something which has an emotional affect on us as humans, and can consist of anything from the vastness of the grand cannon, to the shear face of a cliff. Nature can have a real affect on human emotion.

McDonough, William, and Michael Braungart. Cradle to Cradle: Remaking the Way We Make Things. New York: North Point Press, 2002.

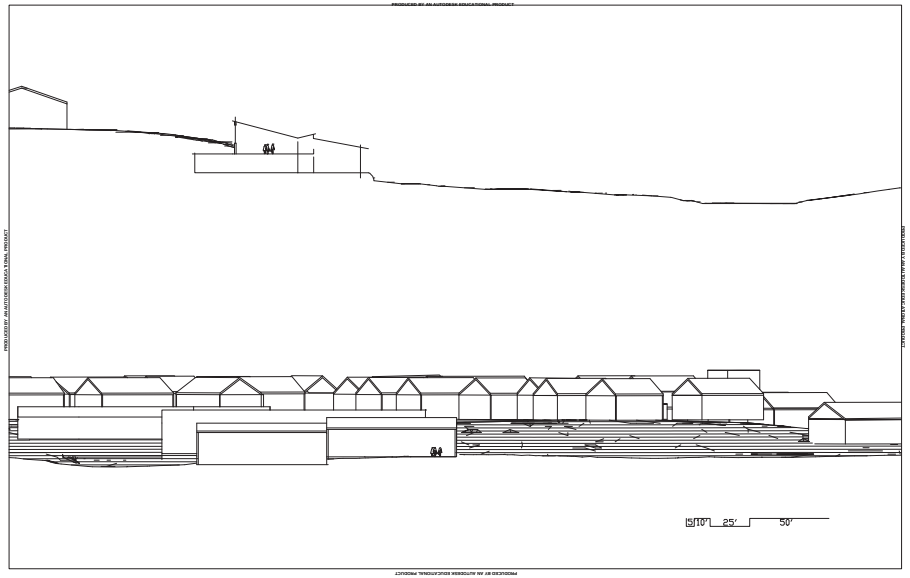
William McDonough is an architect who is looking far beyond the "green movement" of today. In his book called Cradle to Cradle, he explains that design is the first signal of human intention. We need to change our intentions towards architecture into something which will sustain us indefinetly. We speak of buildings having a certain life span, and he speaks of building with no end. Each peice either goes back to nature, or is infinetly recyclable within what he calles the technical nutrient cycle.

Olmsted, Frederick Law, Charles E. Beveridge, and Carolyn F. Hoffman. Writings on Public Parks, Parkways, and Park Systems. Baltimore: Johns Hopkins University Press, 1997.

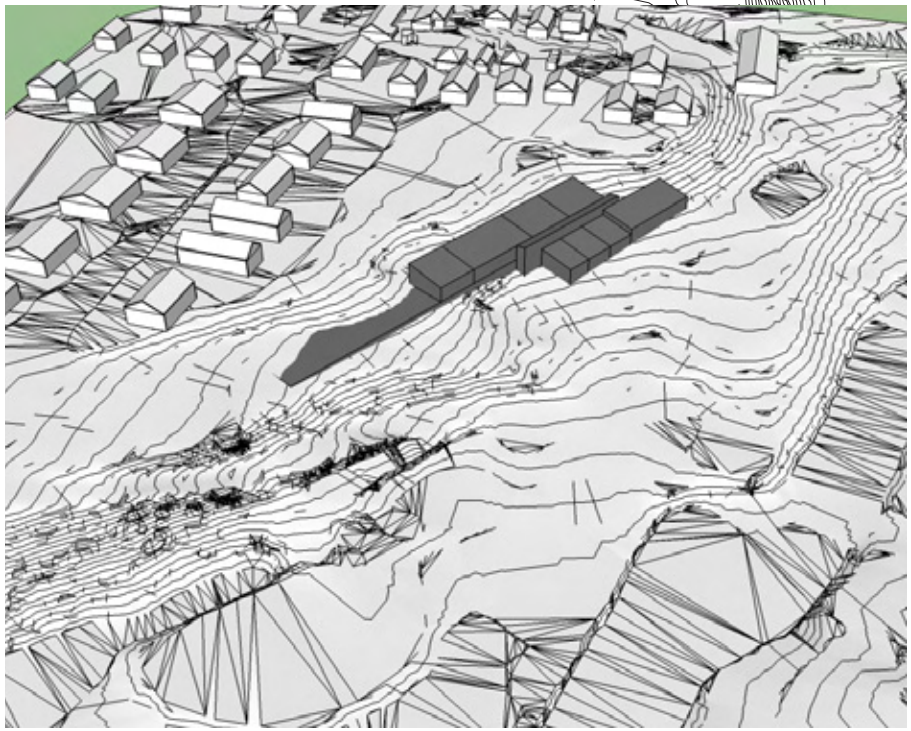
Frederick Law Olmstead was a landscape architect. He designed such things as the New York Central Park, and Boston's Emerald Necklace. At the Woonaskqatucket River, there is a large park system called the Greenway. Olmstead speaks about seperation of circulation paths, and desitinations for visitors as inherent in park design.

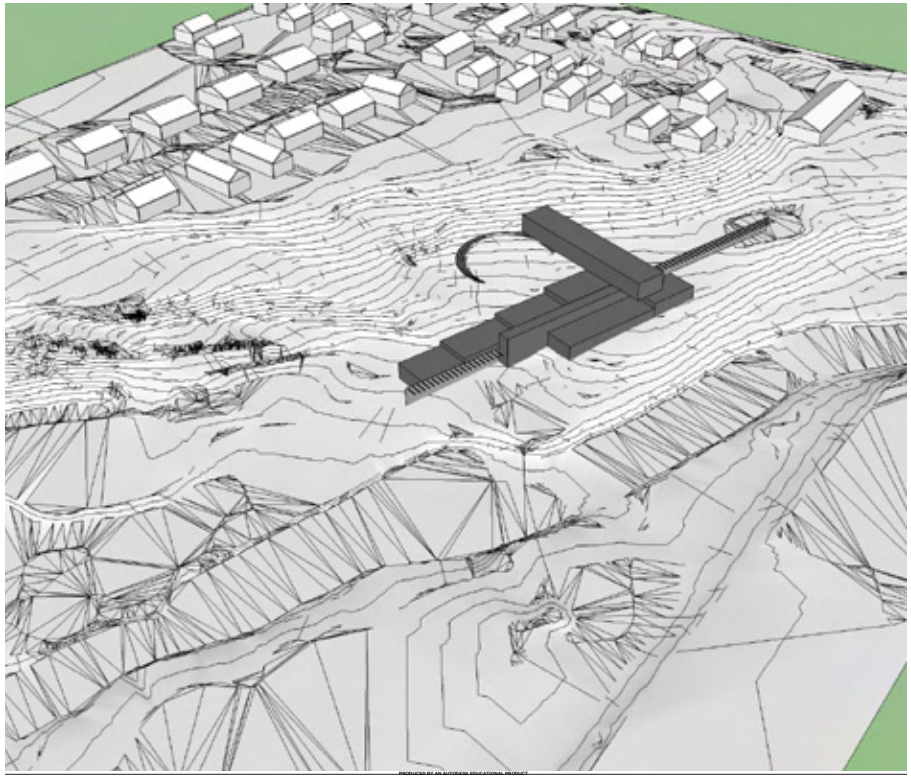
Accessed March 5, 2012.
http://www.calacademy.org/academy/building/sustainable_design/.

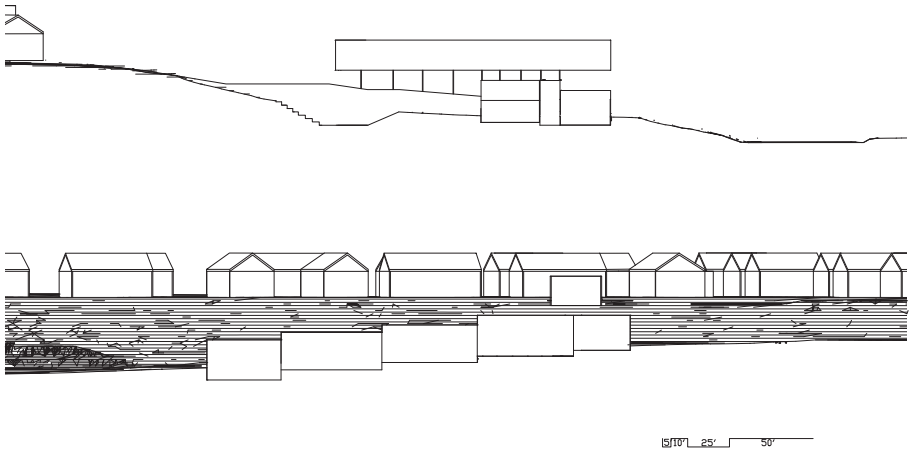
# APPENDIX A: REVIEW 1

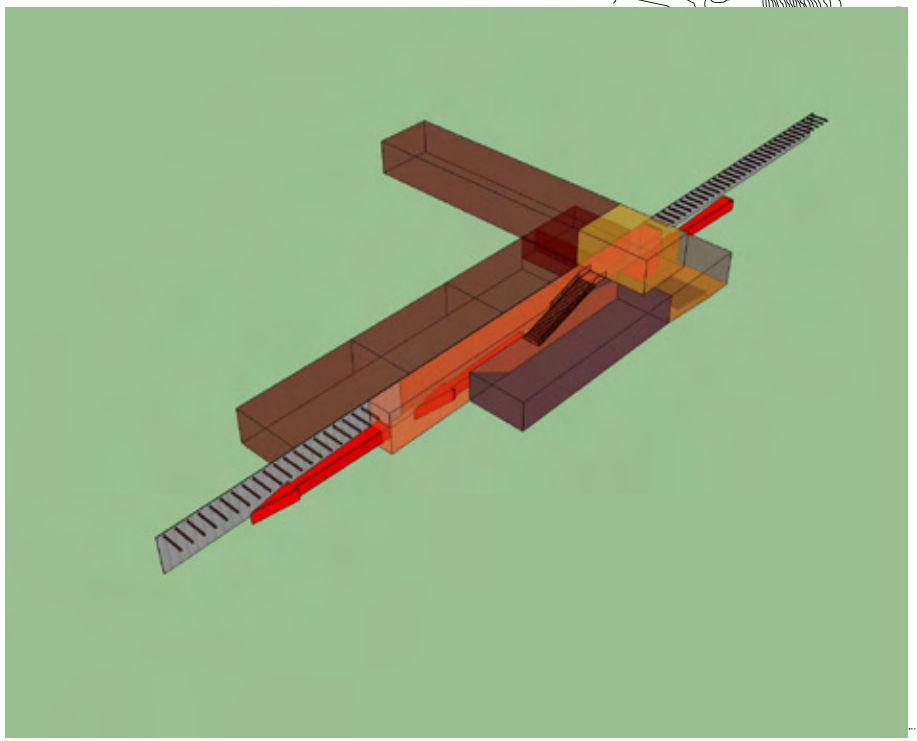





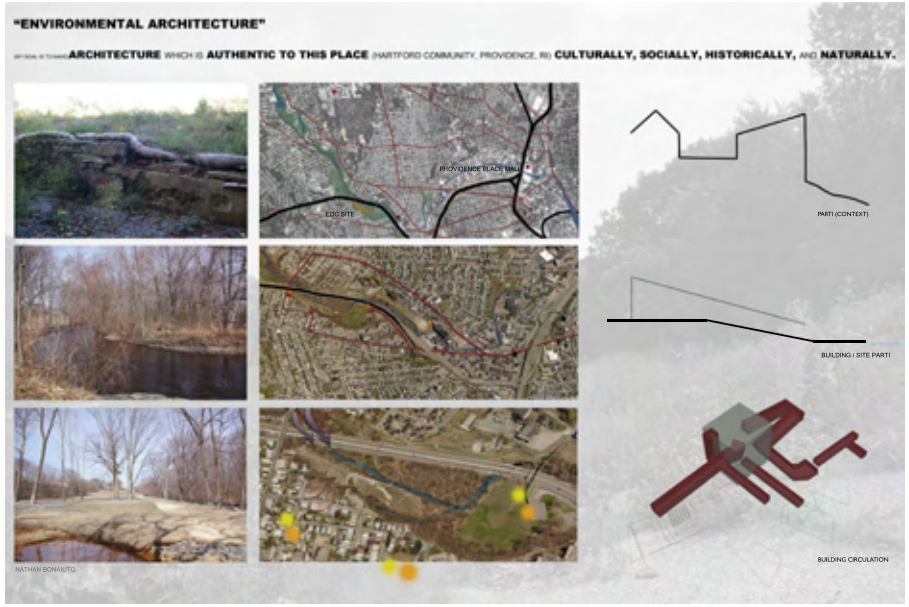



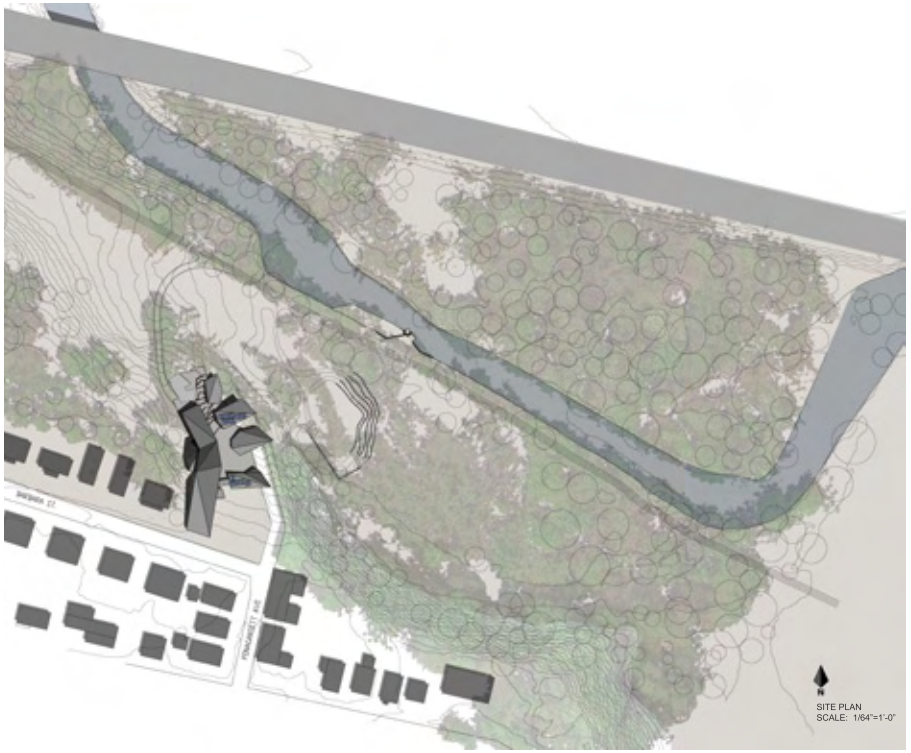


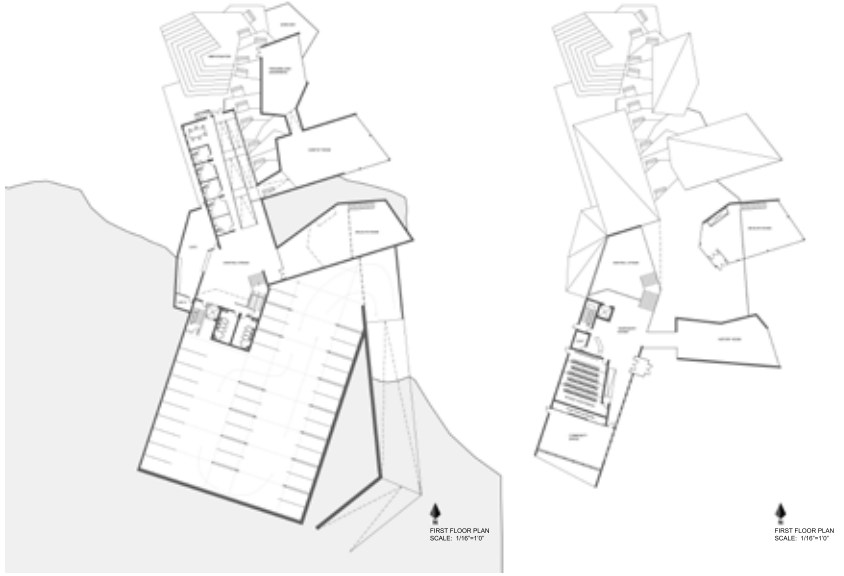




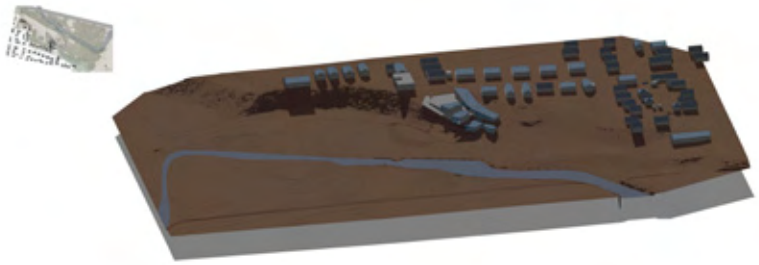
# APPENDIX B: REVIEW 2



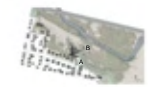


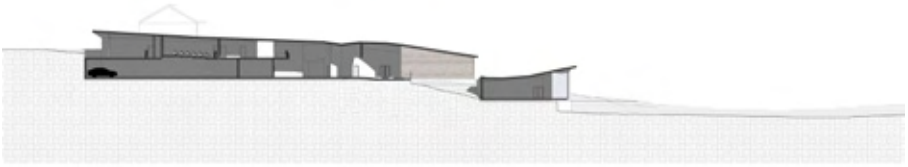


SITE AXON

SITE SECTION A
SCALE: 1/32"=1'-0"

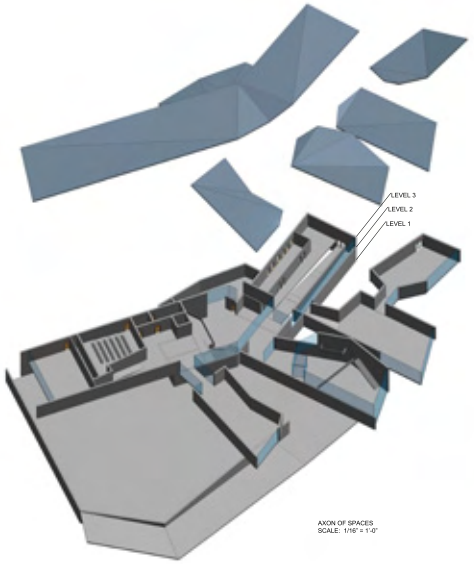
SITE SECTION B
SCALE: 1/32"=1'-0"



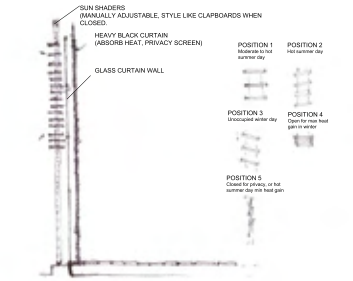



SECTION A (LOOKING SOUTH WEST)
SCALE: 1/16" = 1'-0"

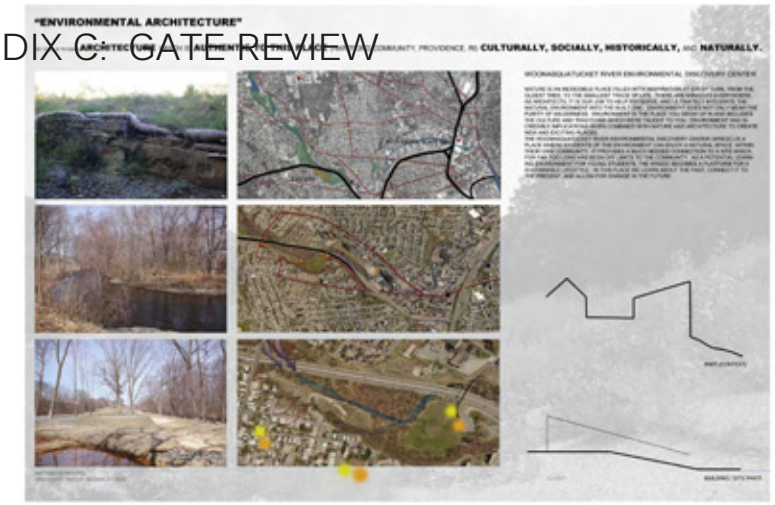
SECTION B (LOOKING NORTH WEST)
SCALE: 1/16" = 1'-0"

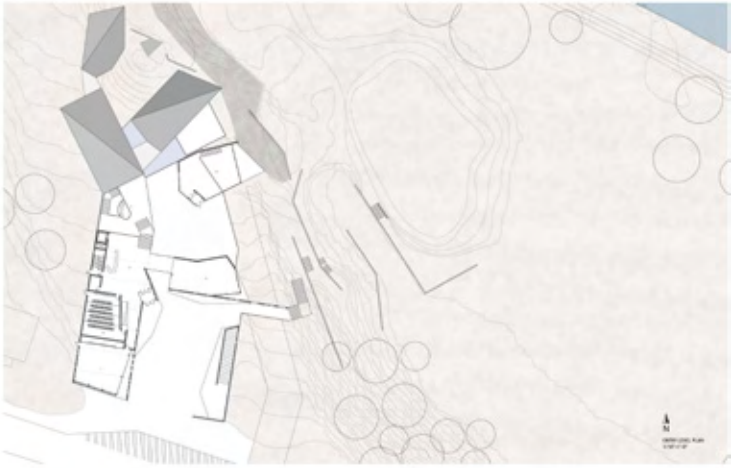



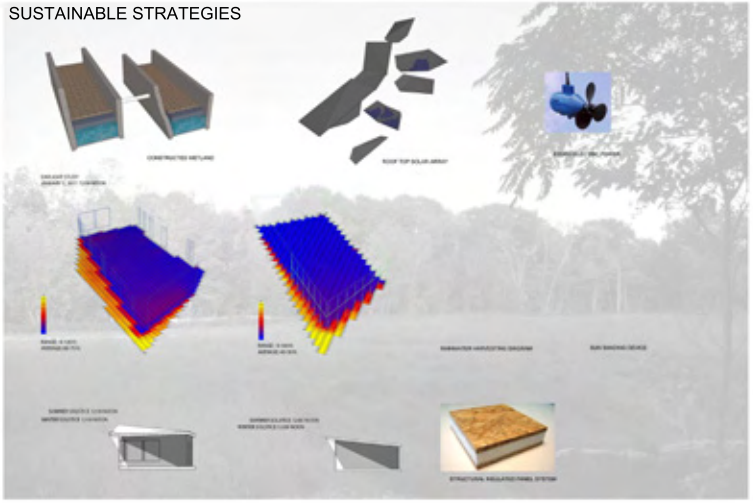

AXON OF SPACES
SCALE: 1/16" = 1'-0"

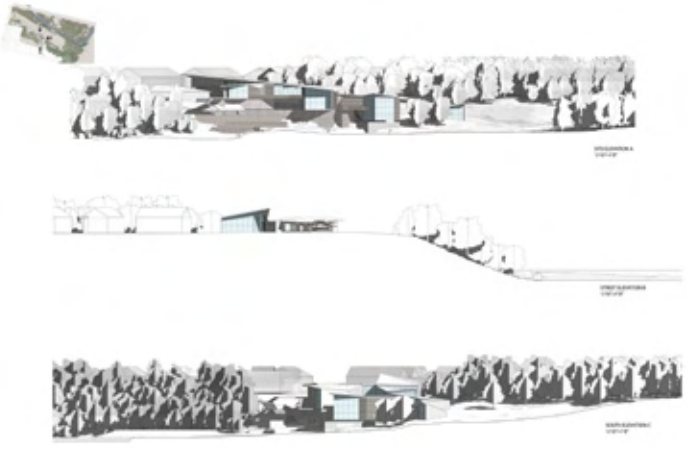



BIKE PATH DETAIL
SCALE: 1/16" = 1'-0"

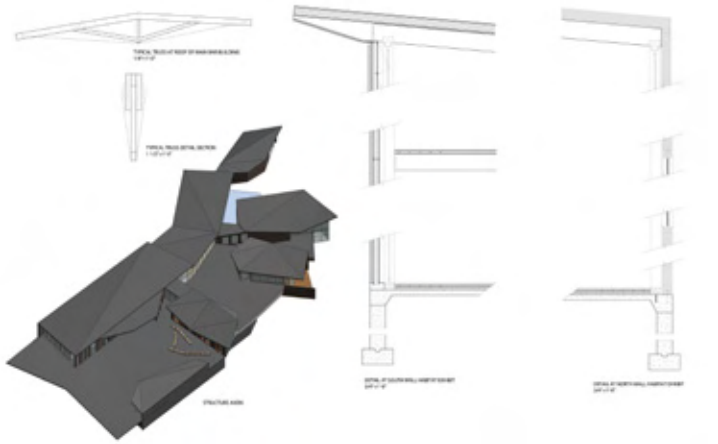

"ENVIRONMENTAL ARCHITECTURE"
CULTURALLY, SOCIALLY, HISTORICALLY, AND NATURALLY.

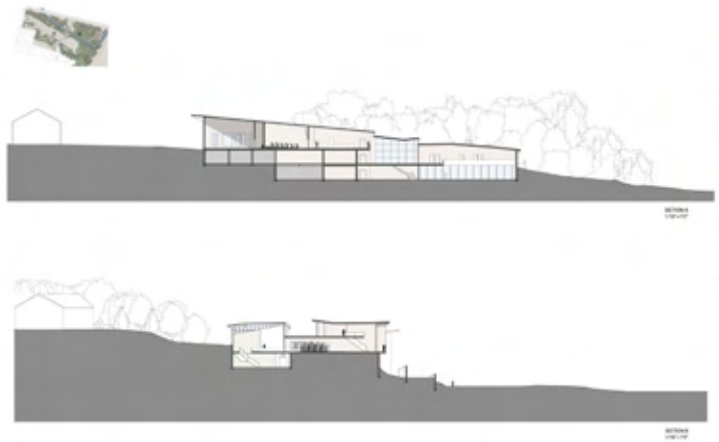



SUSTAINABLE STRATEGIES

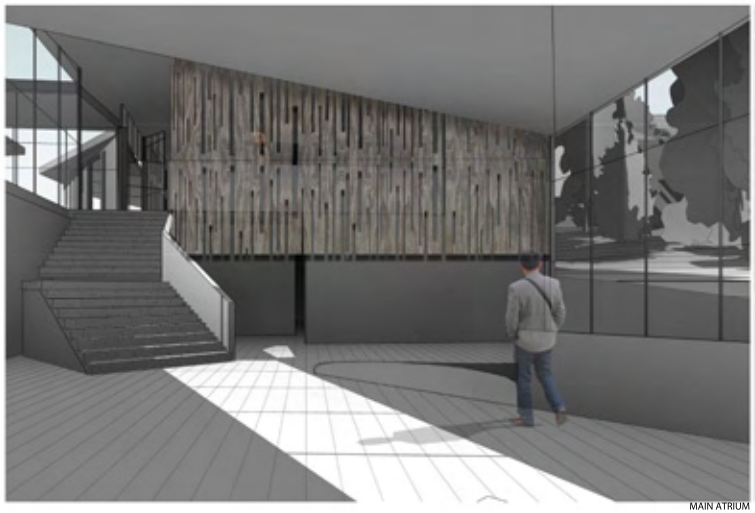


STRUCTURE

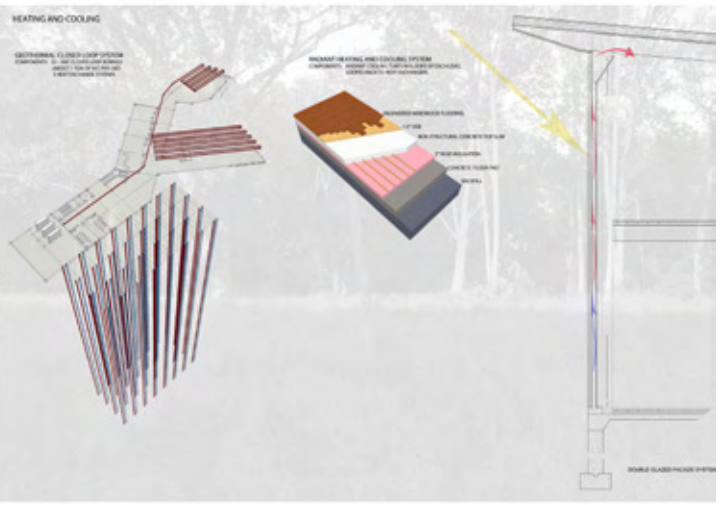




ENTRY PLAZA



MAIN ATRIUM



## "ENVIRONMENTAL ARCHITECTURE"

(MY GOAL IS TO MAKE) **ARCHITECTURE** WHICH IS **AUTHENTIC TO THIS PLACE** (HARTFORD COMMUNITY, PROVIDENCE, RI) **CULTURALLY, SOCIALLY, HISTORICALLY,** AND **NATURALLY.**

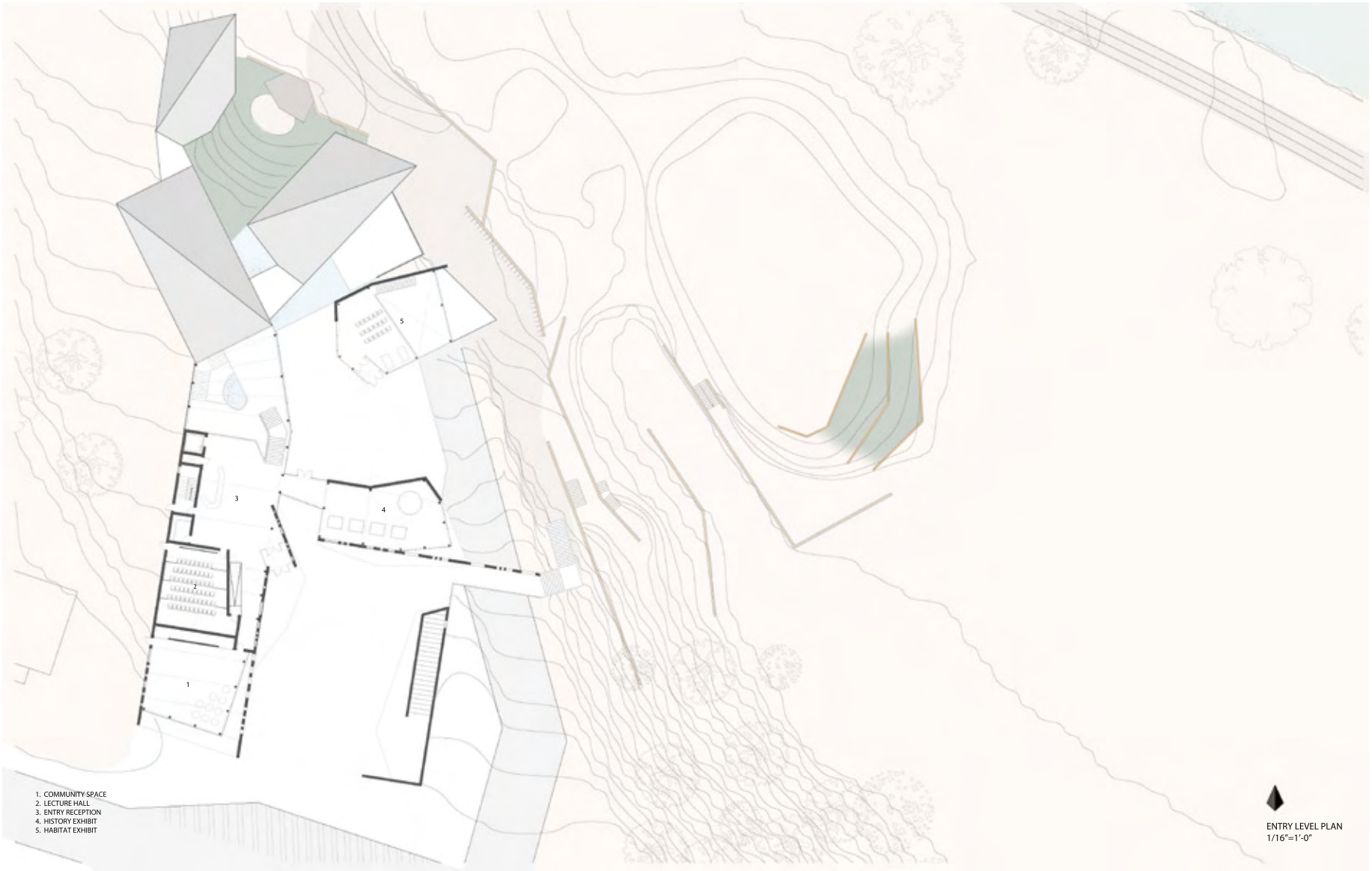

NATHAN BONAIUTO
GRADUATE THESIS DESIGN STUDIO

### WOONASQUATUCKET RIVER ENVIRONMENTAL DISCOVERY CENTER

NATURE IS AN INCREDIBLE PLACE FILLED WITH INSIPIRATION AT EVERY TURN, FROM THE OLDEST TREE, TO THE SMALLEST TRACE OF LIFE. THERE ARE MIRACLES EVERYWHERE. AS ARCHITECTS, IT IS OUR JOB TO HELP PRESERVE, AND ULTIMATELY INTEGRATE THE NATURAL ENVIRONMENT INTO THE BUILT ONE. ENVIRONMENT DOES NOT ONLY MEAN THE PURITY OF WILDERNESS. ENVIRONMENT IS THE PLACE YOU GROW UP IN AND INCLUDES THE CULTURE AND TRADITIONS WHICH WERE TAUGHT TO YOU. ENVIRONMENT HAS INCREDIBLE IMPLICATIONS WHEN COMBINED WITH NATURE AND ARCHITECTURE TO CREATE NEW AND EXCITING PLACES.
THE WOONASQUATUCKET RIVER ENVIRONMENTAL DISCOVERY CENTER (WREDC) IS A PLACE WHERE STUDENTS OF THE ENVIRONMENT CAN ENJOY A NATURAL SPACE WITHIN THEIR OWN COMMUNITY. IT PROVIDES A MUCH NEEDED CONNECTION TO A SITE WHICH, FOR FAR TOO LONG HAS BEEN OFF LIMITS TO THE COMMUNITY. AS A POTENTIAL LEARNING ENVIRONMENT FOR YOUNG STUDENTS, THE WREDC BECOMES A PLATFORM FOR A SUSTAINABLE LIFESTYLE. IN THIS PLACE WE LEARN ABOUT THE PAST, CONNECT IT TO THE PRESENT, AND ALLOW FOR CHANGE IN THE FUTURE.

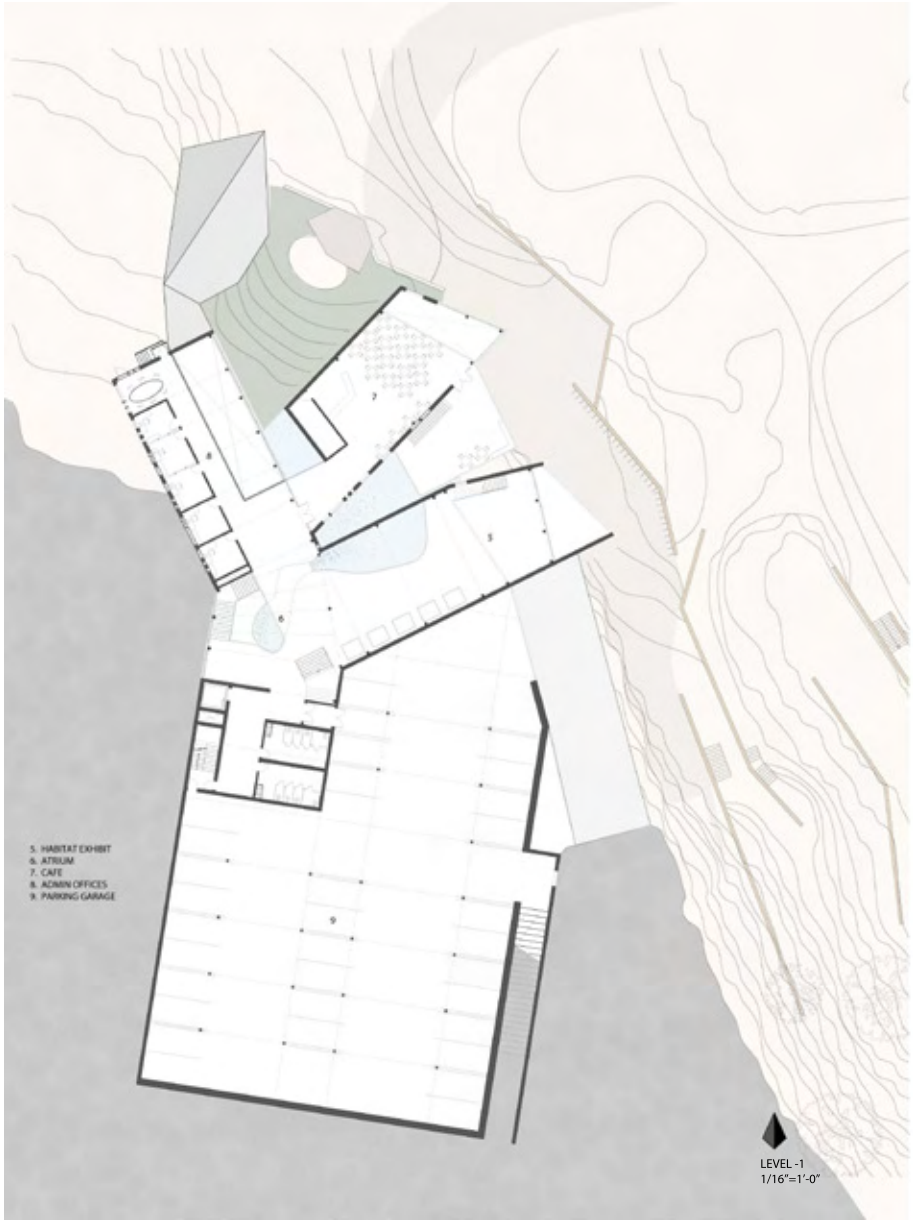
PARTI (CONTEXT)


GLENRIDGE AVE
MATTIE ST.
MELISSA ST.
BARBARA ST.
BARBARA ST.
PONGANSETT AVE
SITE PLAN
1/32"=1'-0"
SITE SECTION 1/32"=1'-0"




1. COMMUNITY SPACE
2. LECTURE HALL
3. ENTRY RECEPTION
4. HISTORY EXHIBIT
5. HABITAT EXHIBIT

ENTRY LEVEL PLAN
1/16"=1'-0"

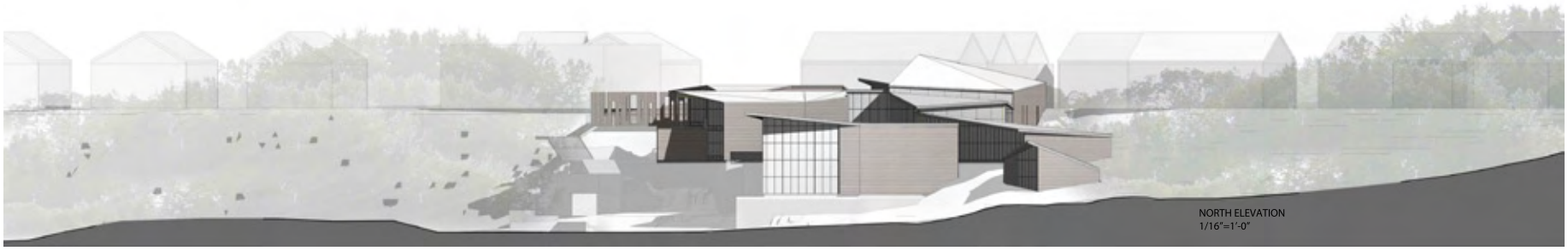

5. HABITAT EXHIBIT
6. ATRIUM
7. CAFE
8. ADMIN OFFICES
9. PARKING GARAGE
LEVEL -1
1/16"=1'-0"


10. WILDLIFE EXHIBIT
11. TRACKING AND AWARENESS
12. GIFT SHOP
13. WATER PURIFICATION STATION
14. MECHANICAL ROOM
15. AMPHITHEATER
16. CONSTRUCTED WETLAND
LEVEL -2
1/16"=1'-0"

SOUTH ELEVATION
1/16"=1'-0"

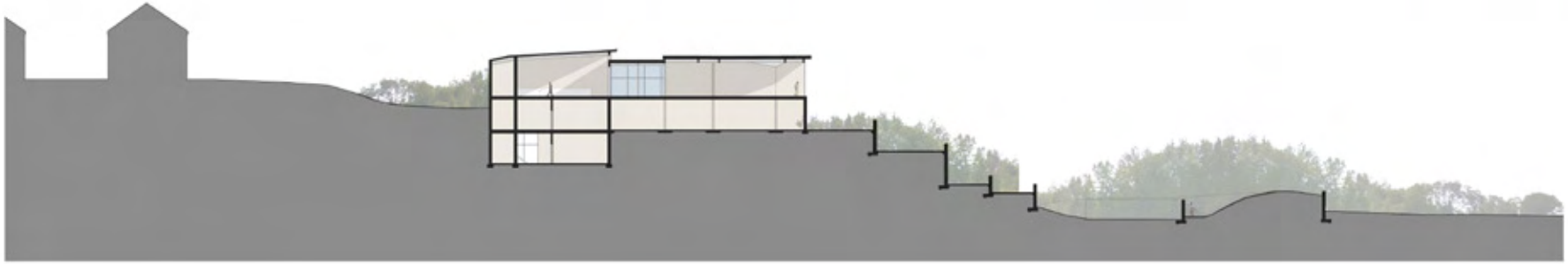
EAST ELEVATION
1/16"=1'-0"

WEST ELEVATION
1/16"=1'-0"



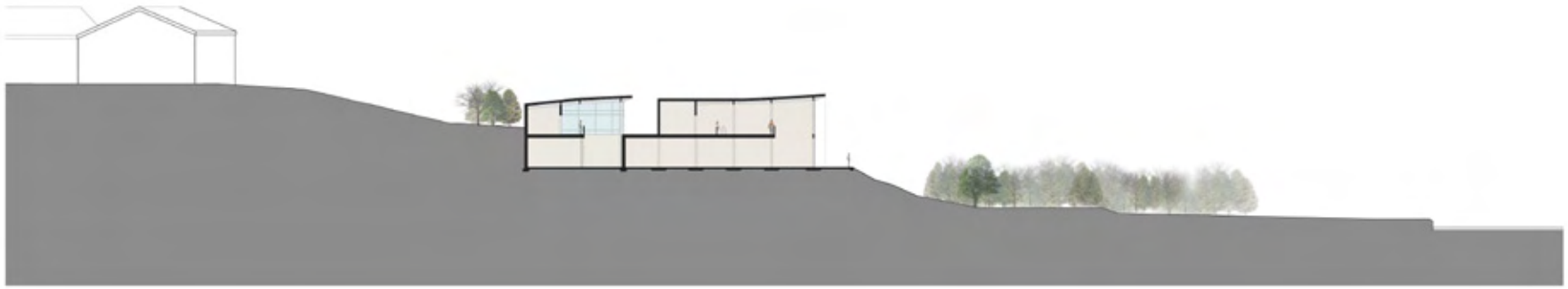
NORTH ELEVATION
1/16"=1'-0"


A. NORTH SOUTH SECTION
1/16"=1'-0"

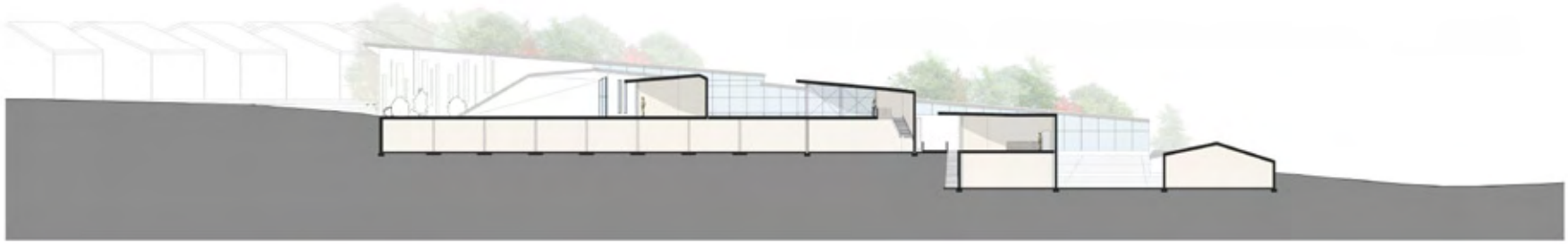


B. SECTION THROUGH HISTORY EXHIBIT
1/16"=1'-0"

C. SECTION THROUGH HABITAT EXHIBIT
1/16"=1'-0"

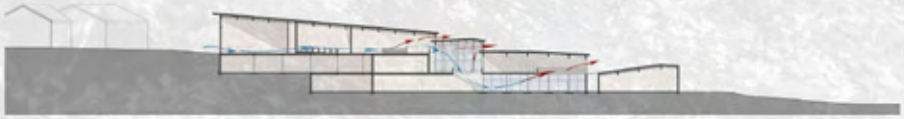


D. SECTION THROUGH WILDLIFE EXHIBIT
1/16"=1'-0"



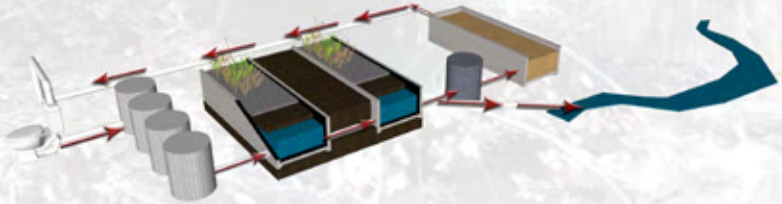
E. SECTION THROUGH EXHIBITS
1/16"=1'-0"

# SUSTAINABLE STRATEGIES

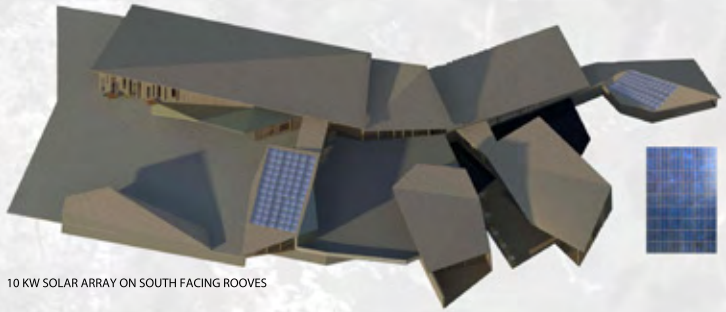


SUMMER AIR FLOW

WINTER WIND

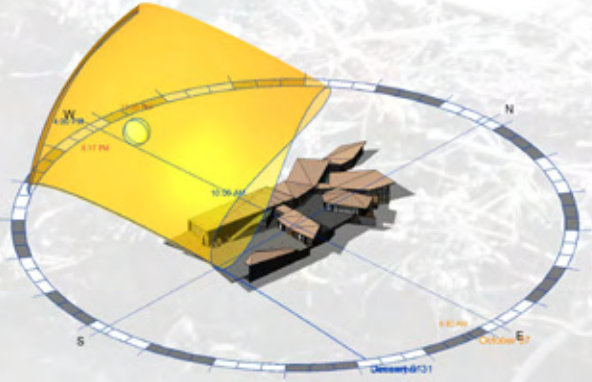


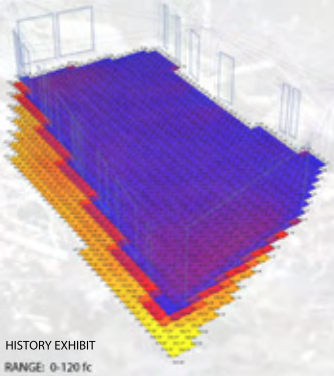
CONSTRUCTED WETLAND



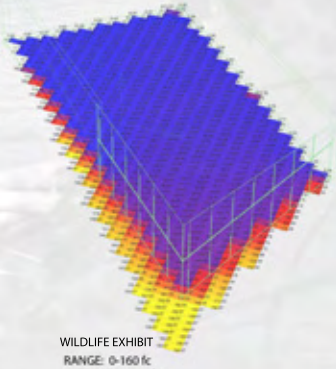
10 KW SOLAR ARRAY ON SOUTH FACING ROOVES

DAYLIGHT STUDY
JANUARY 1, 2011 12:00 NOON



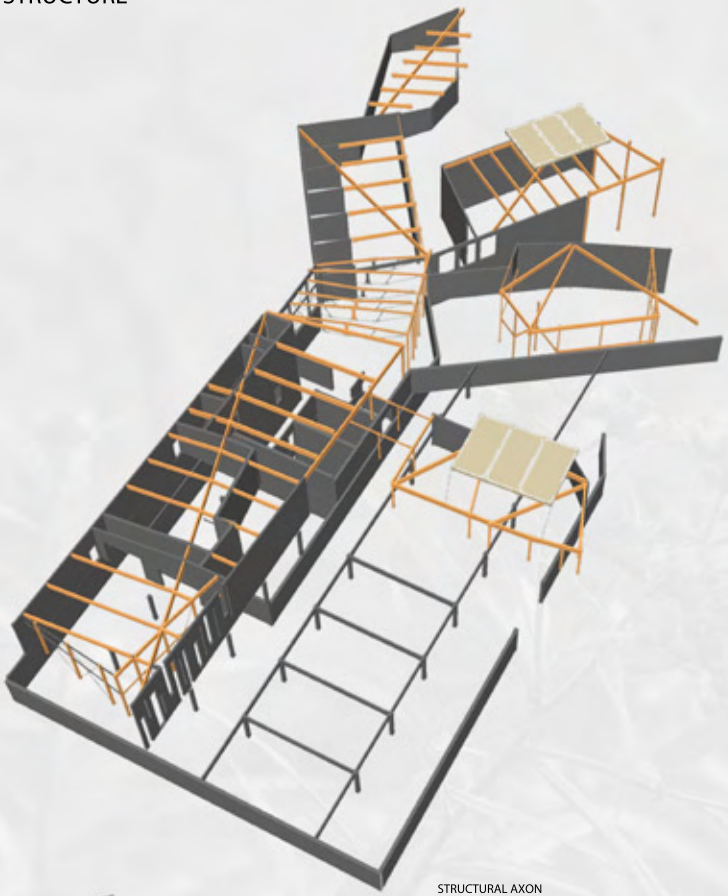



HISTORY EXHIBIT
RANGE: 0-120 fc
AVERAGE: 60-70 fc



WILDLIFE EXHIBIT
RANGE: 0-160 fc
AVERAGE: 40-50 fc

STRUCTURE



STRUCTURAL AXON

GLAZING DETAIL

SIPS PANEL DETAIL

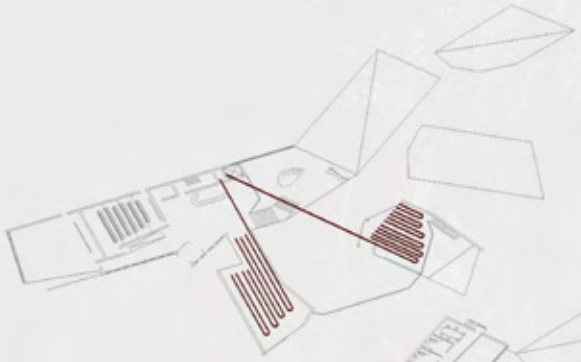
ENCLOSURE

STRUCTURE PLAN 1

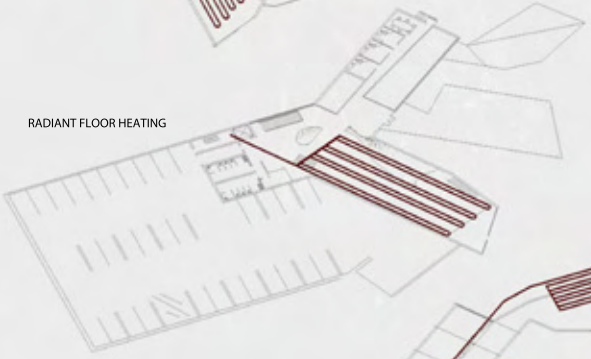
STRUCTURE PLAN 2

STRUCTURE PLAN 3

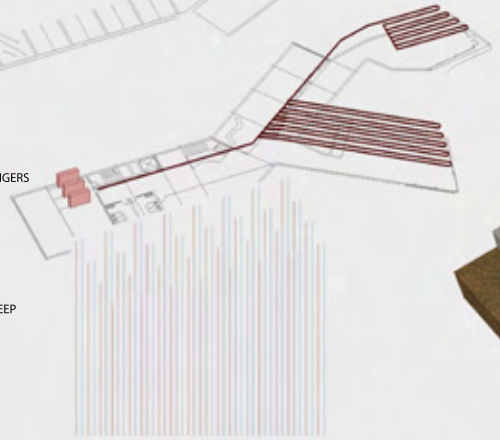
## BUILDING SYSTEMS DIAGRAMS



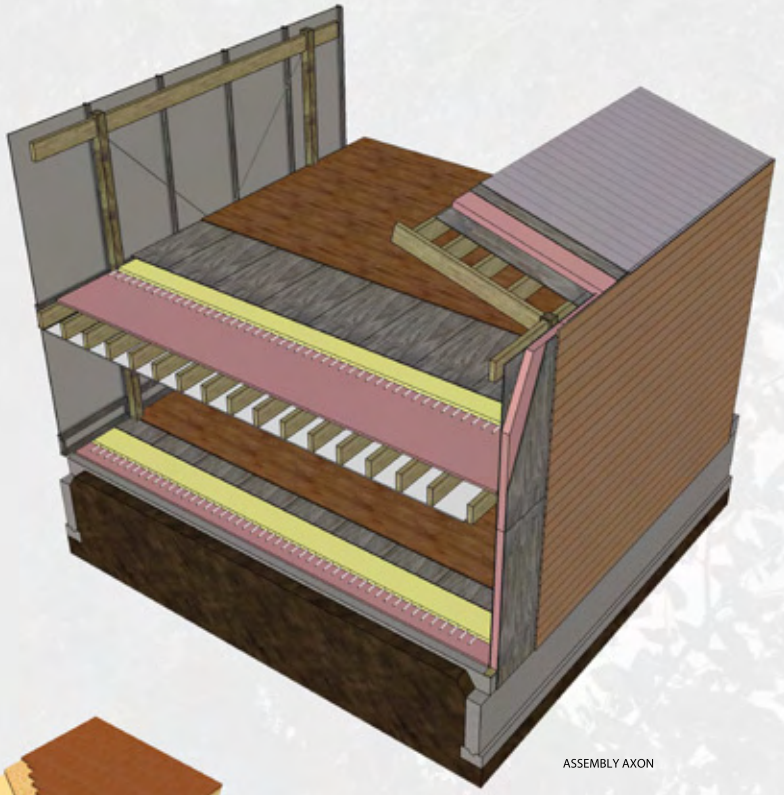
RADIANT FLOOR HEATING



GROUND SOURCE HEAT EXCHANGERS



GEOTHERMAL WELLS 200' DEEP



ASSEMBLY AXON