Architecture's Impact

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Architecture's Impact

A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
of North Dakota State University

By

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Primary Thesis Advisor

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This thesis project, *Architecture's Impact*, will aim to find a solution to the question, "How can architecture be used as a tool to educate its inhabitants about environmental issues?" The typology involved in this investigation is an educational facility, located just South of Mankato, MN. The unifying idea, which provides direction for research is, "Architecture can provide itself as an example of good environmental decisions, as well as offer information about those decisions in order to help the inhabitants better understand environmental issues." The project justification is, "Harming of the environment and the depletion of natural resources is one of the greatest issues facing our world today. In fact, according to Winham (1972), polls in both Canada and the United States show that pollution has been one of the top domestic concerns for decades. Architecture that can both perform sustainably and teach its inhabitants about sustainability would be instrumental in working to combat this issue." The unifying idea, typology, historical context, and site will all be researched utilizing a mixed method approach, encompassing qualitative and quantitative research.

Key Words:
Environment, educate, example

How can architecture be used as a tool to educate its inhabitants about environmental issues?

Statement of Intent

Typology: Educational/Research Facility

Claim: Architecture can provide itself as an example of good environmental decisions, as well as offer information about those decisions in order to help the inhabitants better understand environmental issues.

Premises:

Actor: Architecture is a product of many different design decisions coming together to form one cohesive and functional structure.

Action: All architecture can convey some degree of information to its inhabitants through its style, purpose, layout, decoration, function, etc.

Object Acted Upon: Every person will come into contact with some form of architecture in his or her life, most inhabiting one or several pieces of architecture on a daily basis.

Manner of Action: Architecture can provide examples of what an ideal building or system should look like.

Final Unifying Idea: Because architecture has the opportunity to make a great impact on the people utilizing it, it must take that opportunity to advocate good design decisions regarding the environment.

Project Justification:

Harming of the environment and the depletion of natural resources is one of the greatest issues facing our world today. In fact, according to Winham (1972), polls in both Canada and the United States show that pollution has been one of the top domestic concerns for decades. Architecture that can both perform sustainably and teach its inhabitants about sustainability would be instrumental in working to combat this issue.

Proposal

Our environment is one of our most precious resources, giving us fresh air, materials for building, energy, food, aesthetic pleasure, and so much more. Therefore, the harming of our environment and depletion of natural resources is one of the greatest problems facing humanity today. Put simply, if our environment is in trouble, we are all in trouble. The impact humans have on this destruction can and should be prevented, so why is this still a problem? The public needs to become more educated on environmental issues, as well as sustainable practices. This will allow people to make smarter environmental choices on a day to day basis.

This thesis design will make a statement and serve as an example of what sustainability looks like. With all of today's technological advances and green energy techniques, there is no excuse for creating new buildings that still utilize outdated building practices which harm the planet. This project will take these efforts in sustainability a step further by partnering with the Blue Earth County Environmental Services Department. Integrating the services already provided with a new facility and public education programs will bring new light to these important issues.

The "Green" movement seems to be taking hold all across the world, becoming stronger and stronger. It is my hope that this continues until we can achieve truly sustainable practices in living as well as building. We know that the technology is possible, and that the practices are attainable. The important factor to consider is that everyone needs to do their part in contributing to sustainable practices. Every building with net zero emissions, every person who recycles, every family with a compost pile is vitally important to the welfare of the environment. Since a truly sustainable and healthy Earth requires people everywhere to work together and contribute to this cause, education on this topic is vitally important.

All people interact with some form of architecture every day. Thus, creating a building that can have a positive influence on society's effect on the environment is an opportunity that we can no longer afford to pass by.

Owner:
The site and buildings on it will be owned and operated by the Blue Earth County Environmental Services Department. Working in conjunction with the existing environmental departments and recycling/landfill services, the project will emphasize the departments' environmental efforts and expand upon their educational services to the public. Care and maintenance, as well as programs and activities, will be turned over to this department.

User Groups:
Environmental Services
Waste and Recycling Specialists
Sustainability Specialists
Facilities Coordinators
Secretaries

Educational Facilities:
Tour Guides
Visitors

Maintenance:
Grounds Workers
Janitorial Staff

Requirements:
Usage of the facility and grounds will be predominantly regular business hours Monday through Friday, as well as weekends. The facility will be open during select evenings for special events, as well. There will be a need for a staff parking lot as well as a visitors' parking lot.

Environmental Services Departments:
Offices
Conference Rooms
Employee Lounge
Rest rooms
Storage
Mechanical

Observation Deck/Grounds:
Landfill
Recycling
Gardens
Water Collection and Storage

Education Center:
Reception/Information
Exhibits and Displays
Rest rooms
Classroom Space
Storage
Mechanical

Region:

The site is located in southern Minnesota. The southern Minnesota landscape contains a diversity of features, including lakes, rivers, bluffs, and plains (Southern MN). Because southern Minnesota has a continental type climate, this region experiences cold winters and hot summers, sometimes with long heat waves or cold snaps. This region usually receives around 40 inches of snowfall in the winter, and about 30 inches of precipitation during the spring, summer, and fall. Draughts, thunderstorms, tornados, and blizzards are all possible (Climate of Minnesota).

City:

The site lies just southwest of the city of Mankato, MN. Mankato has a population of 39,628 people, with an additional 1.6 million living within 60 miles of the city. Like the rest of the region, the city boasts beautiful lakes and parks, as well as a great diversity in landscape features. (About Mankato, Minnesota).

Site:

The site's approximate address is 20028 Gooseberry Lane, Mankato, MN. The site is bordered by T-188, or Gooseberry Lane, to the north and east, and sits at the top of a bluff overlooking the Ponderosa Landfill to the southwest. The landfill lies next to the Blue Earth River. The existing offices for the landfill are located less than a mile away.

This site will enrich the design in a number of ways. Primarily, its proximity to the Ponderosa Landfill will be an enormous benefit to environmental education and sustainability efforts. This landfill recently underwent a drastic expansion and upgrade, which included adding a system to line the area. This lining prevents rainwater from washing harmful chemicals from the solid waste into the ground by pumping it into water treatment ponds (Linehan, 2006). This site will allow visitors to learn by looking at the actual facility, rather than pictures.

Fig. 2.1. Region. From Google Earth, 2012.

Fig. 2.2. City. From Google Earth, 2012.

Fig. 2.3. Site. Underlying image from Google Earth, 2012.

The emphasis of this thesis is to educate the public about good environmental choices through demonstrations and examples. The mission is to create an environmentally sustainable design that will, in turn, inspire other environmentally sustainable practices.

Research Direction:

The unifying idea, project typology, historical context, site analysis, and programmatic requirements will all be topics of research for the thesis. Since these topics bring new information to light and provide further directions for research, the research process will be ongoing.

Design Methodology:

The design methodology utilized in this thesis will employ a mixed method of quantitative and qualitative analysis in order to explore all relevant information. This will include graphic and digital analysis as well as interviews of persons knowledgeable of the pertinent topics.

Qualitative data will be gathered through direct observation, through an archival search, and direct interviews. Quantitative data will be gathered through analyzing statistics and scientific data.

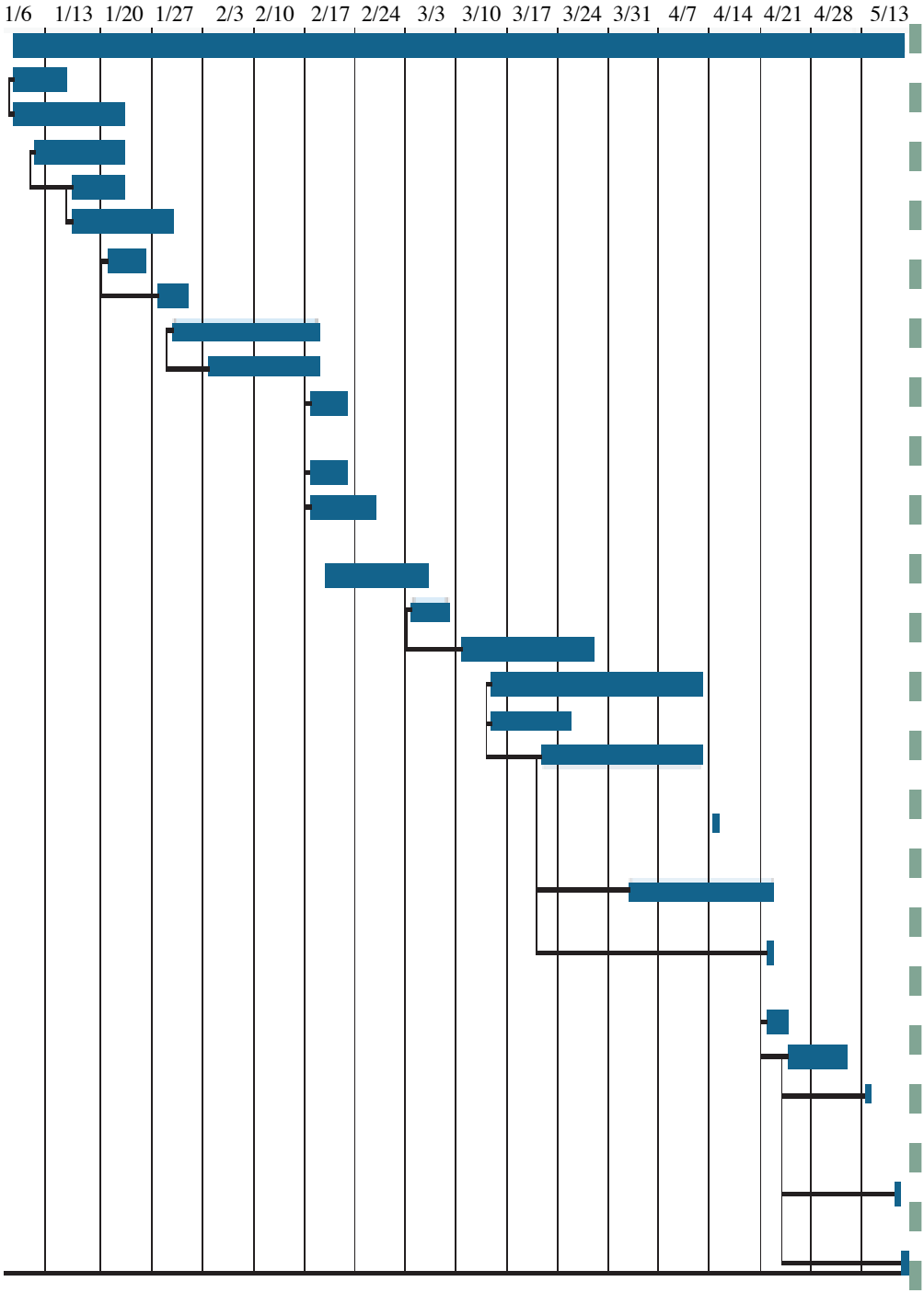
Qualitative and quantitative research will be gathered concurrently as new avenues for research are presented. Research will be guided primarily by the unifying idea, as well as typology research and site analysis.

Documenting the Design Process:

This thesis will be documented continuously throughout the research and design process. It will be preserved physically in printed form, as well as electronically. This information will be collected by the completion date of each category, and labeled as such. Upon completion, the thesis document will be placed in the institutional repository of the NDSU Architecture Library. At the conclusion of the thesis, the project will culminate in a visual and physical presentation.

Task	Duration	Start	Finish
Project Documentation	89 days	Tue 1/8/13	Fri 5/10/13
Context Analysis	5 days	Tue 1/8/13	Mon 1/14/13
Conceptual Analysis	11 days	Tue 1/8/13	Tue 1/22/13
Spatial Analysis	8 days	Fri 1/11/13	Tue 1/22/13
Floor Plan Development	5 days	Wed 1/16/13	Tue 1/22/13
Structural Development	10 days	Wed 1/16/13	Tue 1/29/13
ECS Passive Analysis	5 days	Mon 1/21/13	Fri 1/25/13
ECS Active Analysis	4 days	Mon 1/28/13	Thu 1/31/13
Envelope Development	14 days	Wed 1/30/13	Mon 2/18/13
Materials Development	11 days	Mon 2/4/13	Mon 2/18/13
Floor Plan Redevelopment	5 days	Mon 2/18/13	Fri 2/22/13
Context Redevelopment	5 days	Mon 2/18/13	Fri 2/22/13
Structural Redevelopment	7 days	Mon 2/18/13	Tue 2/26/13
Section Development	10 days	Wed 2/20/13	Tue 3/5/13
Midterm Reviews	5 days	Mon 3/4/13	Fri 3/8/13
Project Revisions	14 days	Mon 3/11/13	Thu 3/28/13
Rendering/Graphics	21 days	Fri 3/15/13	Fri 4/12/13
Presentation Layout	7 days	Fri 3/15/13	Mon 3/25/13
Preparation for Presentations	16 days	Fri 3/22/13	Fri 4/12/13
CD of Boards to Thesis Advisor	0 days	Mon 4/15/13	Mon 4/15/13
Plotting and Model building	14 days	Wed 4/3/13	Mon 4/22/13
Exhibits Installed on 5th Floor	1 day	Mon 4/22/13	Mon 4/22/13
Thesis Exhibit Opens	3 days	Mon 4/22/13	Wed 4/24/13
Final Thesis Reviews	6 days	Thu 4/25/13	Thu 5/2/13
CD of Final Thesis Documentation due to Thesis Instructor	0 days	Mon 5/6/13	Mon 5/6/13
Final Thesis Document Due	0 days	Fri 5/10/13	Fri 5/10/13
Commencement	0 days	Sat 5/11/13	Sat 5/11/13

Spring Semester Schedule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Fall 2009: Joan Vorderbruggen
Tea House
Minneapolis Boat House

Spring 2010: Darryl Booker
Montessori School
Birdhouse
Unconventional Dwelling

Fall 2010: Milt Yergens
Visitors' Center
Masons' Lodge

Spring 2011: Regin Schwaen
Steel Competition

Fall 2011: Bakr Aly Ahmed
KKE Competition
High Rise

Spring 2012: Don Faulkner and Frank Kratky
Marvin Windows Competition
Urban Design: Kindred, ND

Fall 2012: Mark Barnhouse
Water Resource Experimentation Station

Program

Architecture is something that is present in all societies in some shape or form, and, therefore, everyone interacts with some kind of architecture on a day to day basis. Because of this, architecture can make certain statements and influence public thought about various issues. One issue that has come to the forefront of discussion in recent years is that of environmental sustainability. Architecture has the opportunity to advocate good design decisions and sustainable practices through leading as an example, and can influence the public's actions as well.

How exactly do architects influence the public, and how much influence do they really have? With increasing certainty, it is becoming more and more widely accepted that architecture can regulate in certain ways the people using the building. These regulations include dictating how people feel about the building itself, how they interact with the building, and even how people in the building interact with each other (Shah & Kesan, 2007).

Depending on the decoration of the building and its features, an architect or designer can influence how people interpret the building, and what the building causes them to feel. This can be done, for example, through materials. Using hard, solid materials can create a sense of stability, while soft and comfortable materials can make people feel at ease. Or, by using specific cultural symbols, the building can subtly endorse a way of living or thinking. (Shah & Kesan, 2007). There is a lot more thought put into the decoration of a building than most people realize. This can be plainly seen once you start looking. For example, hospitals aim to reassure their visitors by projecting a clean, sterile feeling. Therefore, they are generally decorated with clean white walls, accompanied with comforting pictures and furniture.

Architecture also has a great influence over the way people interact with the building itself. A prime example of this is creating buildings that are accessible to everyone, even those with physical disabilities. Without making these adjustments, people with disabilities wouldn't be able to experience a building in the way that was meant, or maybe they wouldn't even be able to enter the building at all (Shah & Kesan, 2007). Another example of this is how architects can choose to affect the way people move through the building. Architects and designers can create a wide open entry lobby, or they can choose a series of enclosed hallways. These two choices create radically

different ways of experiencing a space.

In regards to social interaction, architecture perhaps has the greatest influence of all. Depending on the layout of the space, or placement of its features, people may feel more inclined to mingling. For example, a larger, open space may lend itself to congregation and socializing more so than a small corridor. Simply by building walls, or organizing open spaces, architects have the power to dictate how the users of a building will behave when in that building (Shah & Kesan, 2007). One example of this is the different possible approaches to offices and work spaces. One option would be enclosed offices, which would promote more private work. The opposite would be an open plan, which would promote dialogue between the workers. By simply making these different decisions, an architect can change the whole dynamic of an office.

Architects hold great influence over the people that utilize their buildings, which is a great responsibility. Architects cannot simply design buildings that function, but they must think about the way that these buildings function, and what their functions imply. Architects have a greater responsibility to create spaces that encourage positive behavior, and positive ways of living. Now, more than ever, this includes presenting good examples of sustainable living and sustainable techniques.

In recent years especially, the environment has been at the forefront of discussion all over the world. Mankind is finally realizing that we cannot continue to abuse our resources the way we have been, or we will face dire consequences. This realization is becoming more and more of a concern to experts, as well as the public. However, frighteningly, these consequences seem to be even more extreme, and happening even faster than scientists had first predicted.

Global warming is, perhaps, the most telling consequence of a planet in danger. Global warming is a result of natural events, but human activity is drastically speeding it up. Greenhouse gases form a natural barrier around the planet, locking in some of the heat from the sun. However, increased production of greenhouse gases, especially Carbon Dioxide and Methane, are thickening this layer and keeping in more and more of the sun's heat, leading to a warming planet (Shah, 2012).

According to the National Oceanic and Atmospheric Administration, there are ten signals of a warming planet. First, humidity, tropospheric temperature, temperature over both oceans

and land, sea surface temperatures, sea levels, and ocean heat content would all rise. They are. Second, glaciers, snow cover, and sea ice would all recede. They are. Furthermore, weather tracking has shown that temperatures are steadily increasing as time goes on. In other words, every decade is hotter than previous decades (Shah, 2012). Although the earth's climate does change over time, and may fluctuate even this much, there is no doubt that this series of events is something to be very, very concerned about. There is also no doubt that human activity is responsible for speeding up these changes and causing them to spiral out of control.

One reason to be concerned is the rapidity with which the climate is warming, and the chain reaction that is kick started by this. For example, the heating up of the climate produces more peculiar and forceful storms such as hurricanes, droughts, and tornadoes that would not otherwise have occurred (Shah, 2012). It is quite clear that we are already experiencing these types of storms and weather conditions that are unlike others that we have experienced before. Not only are these weather conditions happening more often, but they are stronger and more destructive, and much less predictable, hitting areas not usually affected. The World Meteorological Organization has stated that, "New record extreme events occur every year somewhere in the globe, but in recent years, the number of such extremes has been increasing" (Shah, 2012).

The chain reaction continues as the climate is changing so rapidly and becoming so volatile, this creates a problem for the species who are forced to try to adapt to the new habitats and weather systems created. This interference with the Earth's ecosystem opens the door for food shortages and allows infectious diseases to cultivate and spread. Finally, and most troublesome, the issues caused by global warming, such as rising sea levels, will only speed up other problems such as melting of the polar ice caps, creating a cycle of damage that is too late for us to escape from (Shah, 2012). This damage caused by the chain reaction cannot be remedied, nor can it be reversed, only slowed down.

Like the severe weather instances, there are other ways that demonstrate how we can already see climate change in effect, as well. Droughts have been responsible for shortages of food in one in six countries, and there are no signs that these droughts will not be permanent. This is because rising temperatures affect crops that are relied upon by half the world (Shah, 2012). It's not hard to imagine the

devastation that would occur if these crop shortages continued.

Obviously, if there is anything we can do to stop rapid climate change, the depletion of our natural resources, and pollution of our environment, we need to do it. Unfortunately, scientists are certain we will not be able to contain climate change at the current level. It was hoped that we could contain climate change at 2 degrees C higher than pre-industrial levels, but scientists are unsure if even that is possible. If we reach 4 degrees C higher, the damage would be irreparable, possibly with dire consequences (Shah, 2012).

This information has huge implications upon the built environment, as the built environment is the biggest contributor to the greenhouse gases that are so problematic. Industrialized countries are responsible for around 80 percent of all the carbon in the atmosphere so far. The United States is, by far, the worst offender, having created around 50.7 billion tons of carbon. This is more than both China and India combined, even though both of those countries have a larger population than the U.S. Thus, people of the United States create more greenhouse gases per person than any other country in the world (Shah, 2012).

When so few people are making such a huge impact on the environment, anything that can be done to reduce this impact is incredibly important. This means that reforming our building and design practices could be an imperative place to start. Buildings use around 30 to 40 percent of all energy, and are the biggest consumers of natural resources (Sinha, 2009). Buildings are also responsible for roughly one half of all greenhouse gas emissions as well as one sixth of the world's use of freshwater and one fifth of the world's wood (Glyphis, 2001). Obviously, the built environment takes a huge toll on our environment.

The way buildings are currently being constructed and run aren't nearly as conscious of resources and health impacts as they should be. There is too much focus on the bottom line of moneymaking and not enough on sustainable practices. Shoddy building design causes a plethora of other environmental problems, from inefficient use of land and other resources, excessive use of energy, water pollution, and harm to habitats and agricultural lands (Sinha, 2009). Unsurprisingly, buildings and their surrounding landscapes are responsible for more than a third of all carbon dioxide emissions in the United States, as well as nearly half of all sulfur dioxide emissions (Vasenda, 2004).

The built environment is estimated to double over the next few

decades (Glyphis, 2001). In fact, Building Design and Construction magazine reports that "an estimated $15 billion worth of green buildings are currently in design or under construction in the United States" (Vasenda, 2004). This $15 billion accounts for 12-15 percent of public construction, and around 2 percent of private construction. This provides an excellent opportunity to create buildings that are better suited to our environment (Vasenda, 2004).

Sustainable design began to take off in the 1970s, though characteristics of it have been found all over the world for many decades (Nalewaik & Venters, 2008). However, there has been a recent heightening in the realization of the role of design in environmental issues, which has led to many initiatives designed to encourage sustainable building practices. One of these initiatives is known as Architecture 2030. The goal of this initiative is to change the ways that buildings are designed, constructed, and operated so that greenhouse gas emissions are decreased. The initiative works by setting a series of challenges, gradually becoming more and more strict, eventually leading up to 2030, when all new buildings should be completely carbon neutral. The challenge also calls for existing buildings to be renovated to meet green standards for things such as fossil fuels, greenhouse gas emissions, energy consumption, and performance (Architecture 2030, 2011).

Another initiative is the Leadership in Energy and Environmental Design, or LEED, green building ratings, which assign outstanding green buildings with silver, gold, or platinum ratings. These ratings are determined by a points system, with points awarded for different green practices ranging from site location to material choices to use of passive systems. These kinds of programs are a great start in trying to make sustainable design an important part of any new building and encouraging architects to think about the environment while designing. A building with a LEED rating is also a great marketing tool, as it provokes interest in the building and whatever company or organization uses it. A LEED rating can also promote a positive public opinion of the building and company as well.

These initiatives are all designed to promote green buildings, a term that has become incredibly well known in recent years. Green building encompasses "practices and techniques to reduce and eliminate the impact of buildings on the environment and human health" (Sinha, 2009). Green buildings utilize strategies that reduce the impact that the building makes on its surrounding environment,

both micro and macro. Some of these strategies involve using products that conserve resources through reuse, recycling, or more efficient processes, products that are not toxic and do not produce harmful emissions, products that conserve resources such as energy and water, and so on, along with strategies that would create the least amount of harm to the site on which the building is placed. (Sinha, 2009).

Along with promoting these changes in building practices, sustainable initiatives also promote a change in the architect's role into one of leadership. These issues were discussed in a 2001 conference in which professionals and educators examined the architect's role in sustainability. In this conference, Vitruvius's original concepts of architecture, commodity, firmness, and delight, have been evolved to adopt aspects of sustainability. For example, firmness would refer not to just structural soundness, but also to environmental sustainability in the long run. The architect needs to become an advocate of change in social thinking regarding the needs of the environment (Glyphis, 2001). Any change in how people live requires leaders and role models to advocate for this change. Who better to serve this role than people who are in a profession that gives them control over an industry that is tied so closely to the issue?

The conference went on to discuss that architecture needs to transform from simply creating buildings in which to live, into creating buildings that will promote a connection between its inhabitants and nature. Architecture should improve mental and physical health and well-being, and should work as part of the environment instead of being a drain upon it. The concept of "cradle-to-cradle" has become more of a defining guideline than ever. The building's materials should be recycled into another purpose at the end of its initial usefulness (Glyphis, 2001).

All of these new definitions of the profession of architecture culminate in goals for a sustainable community. These include making sure that necessary goods are nearby, that there is a balance between different types of transportation, that the people are able to take pride in where they live, that culture plays an important role in society, that buildings are sustainable, that the individual culture of the area has a visible impact upon the buildings and development, that income is guaranteed for the inhabitants, that universities play an important role, and that architecture is capable and effective in convincing its users of the value of sustainable design (Glyphis, 2001).

Clearly, architects have a lot on their plates in the many steps toward a more sustainable and environmentally friendly built environment. However, there is no one better suited to create positive examples and make positive design choices. Since architects have the opportunity to influence so many different projects, and all of the people that utilize those projects, there is no excuse not to take as many steps as possible to a truly sustainable society.

Not only do architects have a responsibility to the environment by making their design choices green and sustainable, these efforts also have a positive effect on the people who use the buildings every day. A few decades ago, people concerned with the environment were primarily thought of as hippies, and were generally in the minority. However, sustainable design and environmentally friendly practices today are a common area of concern among the general public. It is also not uncommon for those concerned with environmental issues to be very passionate and outspoken about the topics (Hoffman, 2009).

Green design has also become incredibly desirable for the workplace. This is because sustainable buildings also contribute to healthier work environments and higher morale among workers. Studies have found that sustainable facilities have a positive effect on attendance as green buildings have better air quality and lighting, with more natural lighting and ventilation. These features also increase productivity. Additionally, the United States Environmental Protection Agency has found that an average employee spends around 90% of their time indoors, and therefore, illnesses related to the building cost their employers billions of dollars every year. Furthermore, the 1999 Heschong Mahone Daylighting study reported that there is a great correlation between a daylit learning environment and performance (Hoffman, 2009).

Furthermore, studies have also shown that people under 35 are more responsive to facilities that appear to respect the environment. In fact, the study shows that 83% of this age group find facilities that are socially and environmentally green more trustworthy and desirable; this links to the morale of the staff. As previously stated, green design contributes to a more positive morale in the workplace. The Mortgage Lenders Network USA conducted a poll, which showed that 94% of Americans would rather work in a place that made efficient and sustainable building and design choices than one that did not. The degree of sustainability in these choices also affected how employees evaluated their employment options. Facilities with a more green

design had more applications and employees stayed with the organization for a lengthier period of time (Hoffman, 2009).

As with almost everything else in today's society, money also plays a large role in green design. Sustainable design choices may often present higher initial costs, and this can deter architects and designers from considering them. However, they often fail to take into account the life cycle costs of these choices. These life cycle cost savings include not only the materials and their extended uses, but also lowered utilities costs from more efficient systems, as well as maintenance savings because of the more durable materials (Nalewaik & Venters, 2008).

A more surprising aspect of the cost saving promises of green design lies in the lowered premiums from insurance companies. Because sustainable design features are better for human health and happiness, people who spend their time in green buildings are generally healthier. Green buildings also reduce what has been referred to as "sick building syndrome," where the indoor environment is less than conducive to good health. This is because of the lowered liability, which stems from reduced toxins, or other harmful substances (Nalewaik & Venters, 2008).

Although life cycle costs may not always offset the initial building costs, especially if the wrong decisions are made, this still shouldn't deter from making green choices. This is because the initial building costs and operations and maintenance costs only amount to eight percent of the total lifetime costs for the building. The other 92 percent lies in personnel costs. Undoubtedly, this is a very convincing reason for making sustainable design choices that would positively affect the personnel and others using the building (Nalewaik & Venters, 2008).

In conclusion, architecture has a profound impact upon its users, and the environment, as well. Therefore, any step that can be taken to lesson the built environment's burden on the natural environment is a very important opportunity. This effort has many other positive effects, including promoting the wellbeing of the people living and working in the buildings. When architects take on this leadership role and make green choices for their buildings, they are also making the public more aware of issues concerning the environment, and inspiring them to become more sustainable in their personal lives, as well.

There are two main research topics that lie at the center of this thesis project. These two topics received the highest priority in research, and bear the most weight upon the direction of the project. The first topic is the effect that architecture has on its users, including the ways different design decisions have different effects. The second is how these effects can be used in a positive way, specifically, to promote environmentally friendly practices in the building sector, but also in other aspects of society, as well.

The unifying idea research focused on these two topics, and sought to expand upon them. This opened up more questions that led to opportunities for research. The final research product offers plenty of insight into the topic of this thesis, and is a strong guiding force. This research strengthens the understanding of the unifying idea, and provides a more concrete direction for the project.

Research started from the premise that architecture of some kind is present in every society on earth. This wide presence allows for a lot of influence on the people who utilize the buildings and spaces created. Therefore, architects need to take great care when making design decisions, and really think about the statements they are making with each choice.

The public is influenced by architecture in many ways, usually without even realizing it. Material and decorative choices can influence how people feel about a place emotionally, and what they think of it. Additionally, the aspects of a building will influence how people interact with the building itself, and affects things such as accessibility, and how they move through the building. Furthermore, the layout of a space can create or deter social interactions between its users.

All of these ways in which architecture is influential creates many ways for architects to positively affect the lives and choices of those using the buildings they create. One important way they can use their influential power is displaying design choices that are good for the environment, such as utilizing environmentally friendly materials and systems, and encouraging users to be environmentally friendly through the inclusion of recycling bins, etc.

Being a good example of sustainability is especially important today as most of the public is growing more and more concerned about the environment. Issues such as global warming affect changes in the

ecosystem as well as weather patterns, and these changes have great implications on the practices of the built environment.

The built environment is responsible for much of the pollution and consumption of natural resources, therefore it offers the greatest opportunity for positive change. Realizing this opportunity, there are a few different programs put in place, such as the Architecture 2030 plan, and the LEED certification program, both of which encourage green design.

In addition to practicing sustainable design, architects also have the opportunity to be leaders in innovation and create buildings that will promote more of a connection to nature, as well as improve the physical and mental health of those who spend time in their facilities. Studies have shown that people prefer to work in buildings that show positive green design choices, and those that do are happier and healthier for it.

Although sustainable design choices may create a higher initial cost, when long term building life is considered, sustainable choices often save money through more efficient operating systems and use of materials. Money is also saved in employee health costs, lowered insurance rates, and increased productivity. Sustainable design can also be a valuable marketing tool, used to promote the particular organization or company and produce a positive public opinion of it, which can prove invaluable.

From this research, it is possible to conclude that architects have the great privilege of holding a position that gives them the opportunity to have a positive effect on the people who use their buildings. However, this is also a great responsibility. One of the best ways that architects can assume this responsibility is by promoting choices that have a less harmful effect on our environment. Architects need to show examples of good sustainable design, and encourage the public to become more sustainable in whatever ways they can, as well.

By reinforcing the importance of making sustainable choices and demonstrating different ways to be sustainable, architects can serve an important role in creating a more environmentally friendly way of living.

Fig. 3.1. Philip Merrill Environmental Center. From *Sustainable Facilities* by Keith Moskow, 2008.

The Chesapeake Bay Foundation's Philip Merrill Environmental Center, by SmithGroup Inc. Architects, is a 32,000 square foot facility located on a 31 acre site in Annapolis, Maryland. This facility houses various environmental departments, including office work stations, meeting rooms, and a common dining room and kitchen, as well as mechanical and storage spaces. This facility is located in Maryland's Smart Growth zone, right on the Chesapeake Bay (Moskow, 2008).

The facility responds to its surrounding environment by adapting to the beauty of its surroundings. The design aims to complement the site, not distract from it. This meant creating a facility that is subtle and simple enough to not stick out, yet beautiful and interesting enough to create interest in the building itself, as well. This also came into play on the interior of the building. On account of the open plan, everyone on the inside feels connected to nature through the views of the bay provided (Moskow, 2008).

Much like the other case studies, this facility put its green design strategies and materials on display for users of the building to see. This creates interest and dialogue about the sustainable strategies that are put in place. In particular, the water storage tanks used by the building are placed above the entryway to the building. Instead of hiding this aspect, this facility puts them on display (Moskow, 2008). In this way, the people working in and visiting the center are shown that the foundation practices what they preach.

The other case studies that were investigated took sustainable systems and materials into great consideration, but this facility goes far beyond the others in its green attempts. The Philip Merrill Center was the first building in the world to receive a LEED Platinum rating, and because of this, it has become a destination for business owners, government leaders, contractors, architects, engineers, as well as members of the public who are interested in sustainable design (Moskow, 2008).

These sustainable features included a "cradle to cradle" construction philosophy, which dictated that chosen materials should aim to be recycled, and that they should be recyclable at the end of their time in use. This idea was put into place when the existing facility was torn down to make room for the new one. Instead of demolishing it, it was deconstructed, so as to preserve the materials for future use in other projects. Additionally, all wood used in the project was Forest Stewardship Council certified, or taken from renewable sources. These strategies accompanied many more green efforts such as

passive solar and heating techniques, rainwater collection, occupancy sensors, and sustainable landscaping to achieve the LEED Platinum rating (Moskow, 2008).

The Chesapeake Bay Foundation also took sustainability a step further by putting into practice their goal to protect and restore Chesapeake Bay in addition to leaving the majority of the large site undeveloped as a conservation area. This included restoring woodlands, wetlands, and even an oyster reef (Moskow, 2008).

The concept of the design revolved around the LEED rating system. Every decision was made giving consideration to what sustainable aspects could be incorporated, and how the facility could push the boundaries of standard green buildings (Moskow, 2008). This concept is becoming more and more important in the profession of architecture and design, as society continues to call for more sustainable and environmentally friendly ways of living.

This case study contributes to the unifying idea that pursuing environmentally friendly building and construction systems is not only good for the environment, but these are also design decisions that will often have a positive effect on those working and spending time in the building. The Philip Merrill Center's employees took part in a survey conducted by UC Berkeley, which surveyed 2500 workers from 150 buildings. The survey was aimed at determining the user's overall satisfaction with their workplace's air quality, comfort, acoustics and lighting, etc. Largely because of the sustainable efforts and the resonating effects of these decisions and philosophies, the center received the second highest satisfaction score (Moskow, 2008).

This case upholds the unifying idea by reinforcing the idea that design and construction offer great opportunities for strides in environmental sustainability. By being the first building in the world to achieve the highest LEED rating, the Chesapeake Bay Foundation put front and center their commitment to sustainable design choices, and the importance of doing everything possible to preserve natural resources and energy.

As is stated in the unifying idea research, architects have a responsibility to be leaders in innovation and to always strive for better, more efficient, and more environmentally friendly ways of constructing and operating buildings. Again, the Philip Merrill Center's achievement of a Platinum LEED rating, and the positive effects this has had reinforces the need for architects to push their designs to the limits.

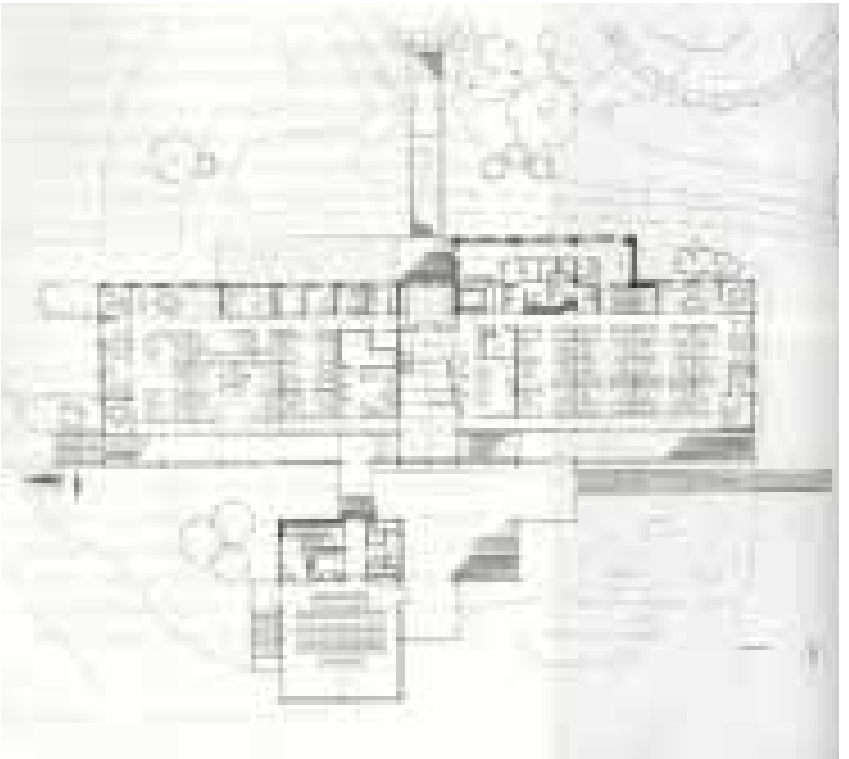


Fig. 3.2. PMEC Plan. From *Sustainable Facilities* by Keith Moskow, 2008.

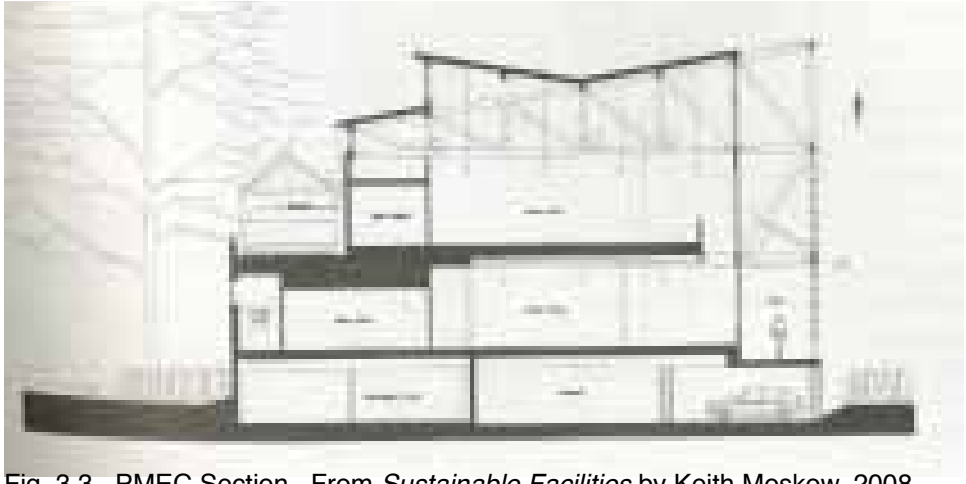


Fig. 3.3. PMEC Section. From *Sustainable Facilities* by Keith Moskow, 2008.

Hierarchy:

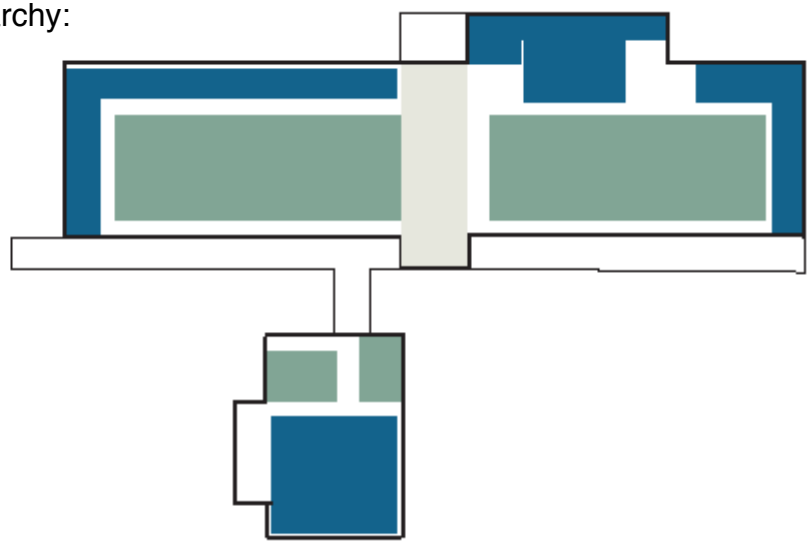


Fig. 3.4. PMEC Hierarchy.

Circulation to Use:

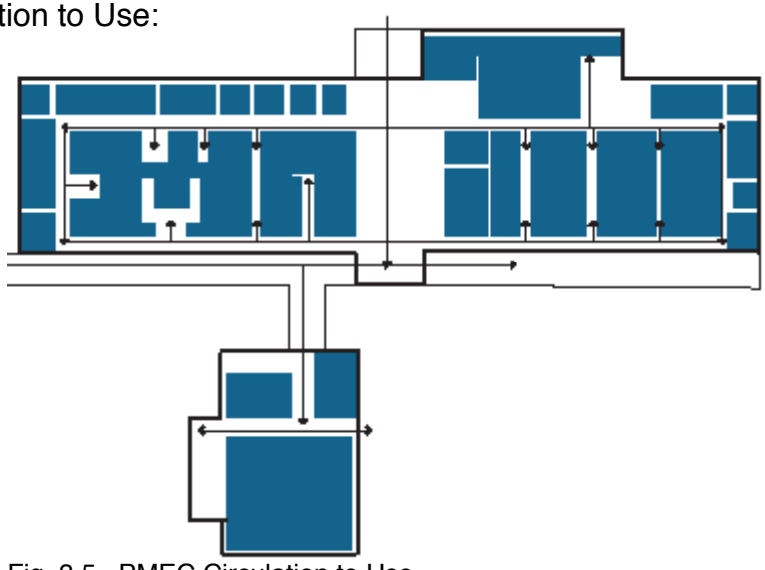


Fig. 3.5. PMEC Circulation to Use.

Geometry:

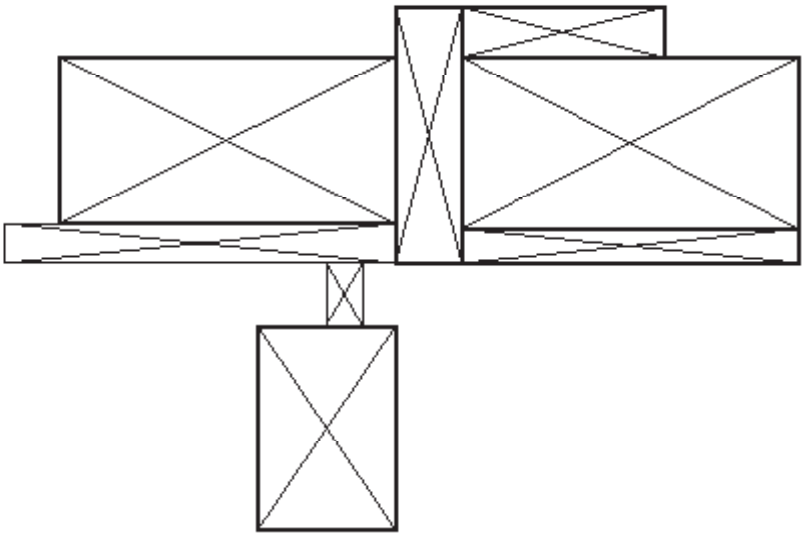


Fig. 3.6. PMEC Geometry.

Structure:

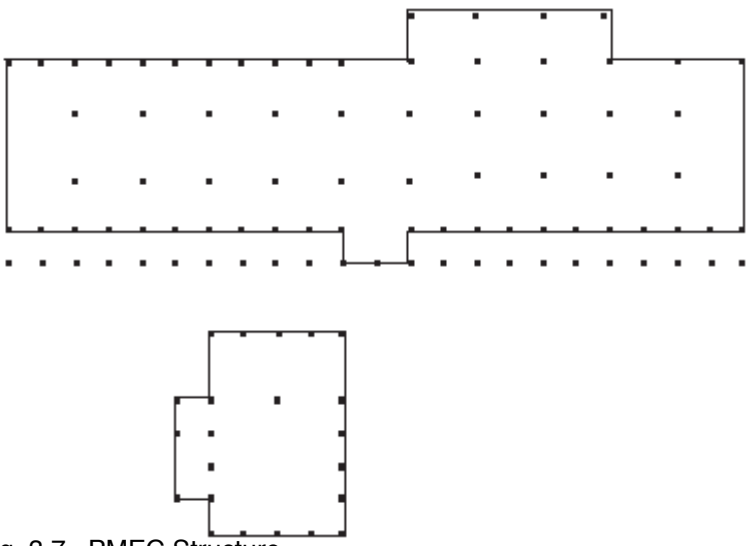


Fig. 3.7. PMEC Structure.

Massing:

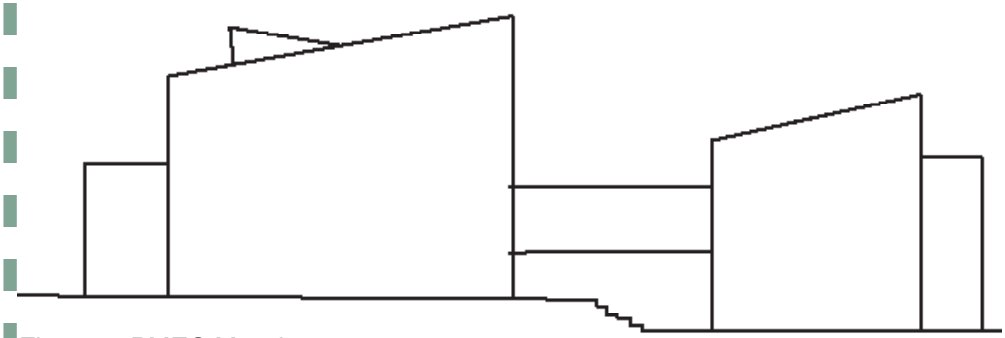


Fig. 3.8. PMEC Massing.

Natural Light:

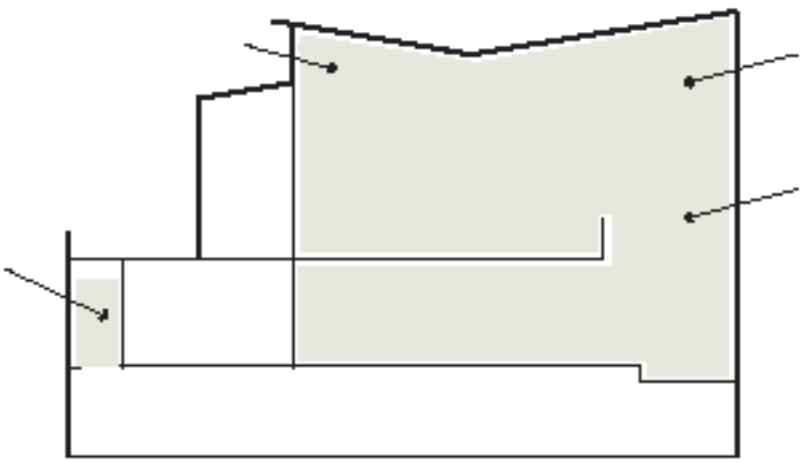


Fig. 3.9. PMEC Natural Light.

Plan to Section:

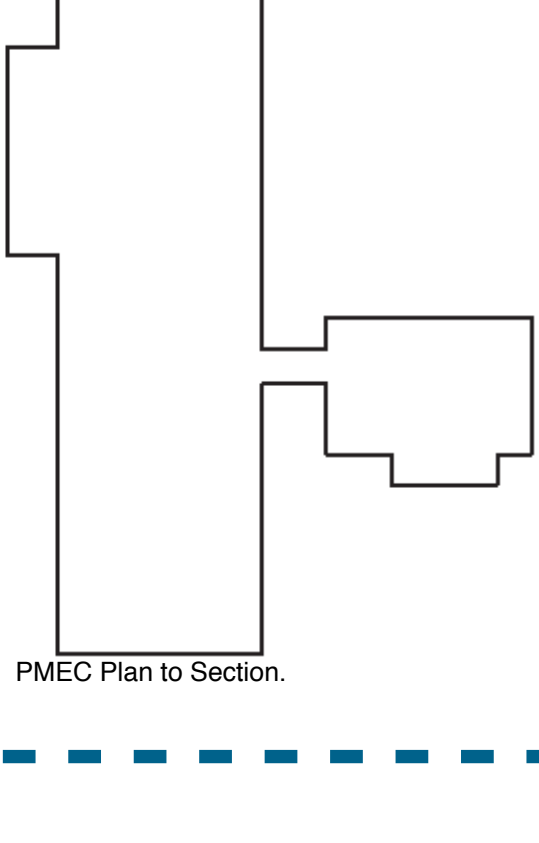


Fig. 3.10. PMEC Plan to Section.

Fig. 4.1. Arizona Science Center. From http://www.chanen.com/special2/AZScienceCtr.asp

The Arizona Science Center, by architect Antoine Predock, is located in Phoenix, Arizona. The facility was originally completed in 1997 with 120,000 square feet, and later received a 22,500 square foot addition. The facility includes a lobby, exhibits, multiple theatres, a planetarium, and educational facilities, as well as offices, mechanical spaces, and storage spaces. The facility is located in a pedestrian friendly area next to Heritage Park Square (Baker, 1997).

The Science Center responds to its environment by making a statement through its form. This statement resonates the surrounding landscape features and aims to create interest within the people travelling by on its busy street. Through this statement, the building creates a dialogue about what the facility is for, what the purpose is, and what goes on inside. People who see the exterior are drawn to it and want to know more.

Although the Arizona Science Center has a slightly different purpose than the other case studies investigated, like the rest of them, it makes great efforts to speak to the public. This building, like the others, is not created solely for the use of those who work there. The building is primarily for the public to visit, enjoy, and learn from. The focus is primarily on learning, in fact, as countless exhibits are displayed for the purpose of public education, including hands on exhibits and galleries, planetarium shows, and 3d films. Permanent teaching exhibits include information and experiments concerning the human body, the digital world, nanoscale science, finances, the human brain, and others. The science center also integrates revolving exhibits that change from time to time, highlighting different topics, most recently, lego adventure and dinosaur fossils (Arizona Science Center, 2012).

One difference between this facility and the other case studies investigated is in its location. While the other facilities are set in areas removed from urban life, this is placed right in the middle, and, thus, has to take a different approach to design. The architect did that by making more of a statement with the building. Instead of letting the environment take precedence like the other case studies, this facility commands its surroundings (Baker, 1997).

Another difference is in the main purpose of the facility. While the others are primarily some kind of environmental education, this facility is a science center. The purpose is to educate and entertain visitors by allowing them to investigate different scientific topics, and learn and discover at their own pace. While the other facilities are predominantly tour-guided or lecture based, this facility allows people

to move through it and experience the galleries and exhibits alone. This changes the way the facility needs to be structured, so that people can see how to navigate through the building on their own.

The concept of this facility revolves around Predock's fascination with the Sonoran Desert and its landscape. He chose to create the building as though it was located in the desert, even though it was to be placed in the middle of a busy city. The peaks, valleys and canyons of the desert inspired the form of his building. He used these shapes to give observers outside of the building a stunning silhouette (Richardson, 2001).

The interior of the facility was also designed with the concept of leaving the city behind as the user enters. This is done by creating vast windowless spaces to effectively cut off visitors from the outside world (Henderson, 1998). Visitors move through the facility by first descending into the sunken building through a covered walk (Richardson, 2001). Visitors are led through the completely enclosed galleries and exhibit spaces to eventually emerge at the roof, where they are treated to beautiful views of the sky (Henderson, 1998).

This case study contributes to the unifying idea by offering clear examples of how to create an interactive learning space for visitors. This includes how the building design can be used in a positive way to reinforce what the program of the building provides for activities. For example, as previously stated, Predock designed the galleries without windows or other distractions; when visitors are in the galleries, they are fully immersed in what they are reading, doing, and learning.

The Arizona Science Center is a prime example of what the unifying idea research shows about the effect of building and design decisions on the people who use the building. The research shows that an architect has great control over dictating how people experience a space, move through it, or even how they feel while they are inside it, simply by making different material or design choices. This is evident in the science center's windowless galleries, made to make people feel as though they are cut off from the world outside. They move through the space in a very specific way; the way that Predock wanted them to experience the building.

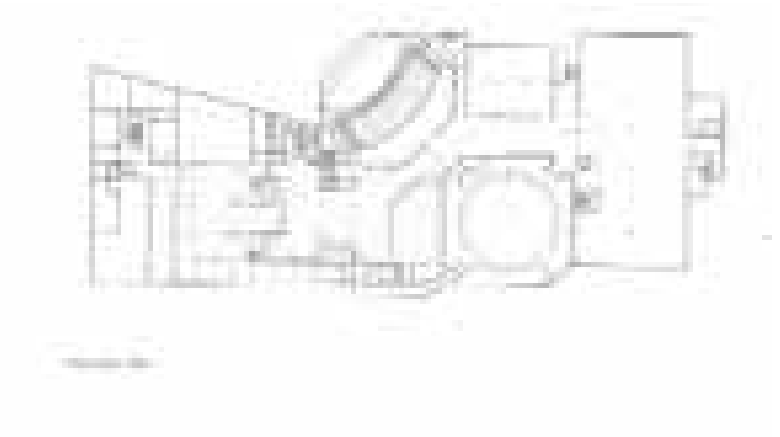


Fig. 4.2. ASC Plan. From *Museum Architecture* by Justin Henderson, 1998.

Fig. 4.3. ASC Site Plan. From *New Vernacular Architecture* by Vicky Richardson, 2001.

Fig. 4.4. ASC Section. From *New Vernacular Architecture* by Vicky Richardson, 2001.

Hierarchy:

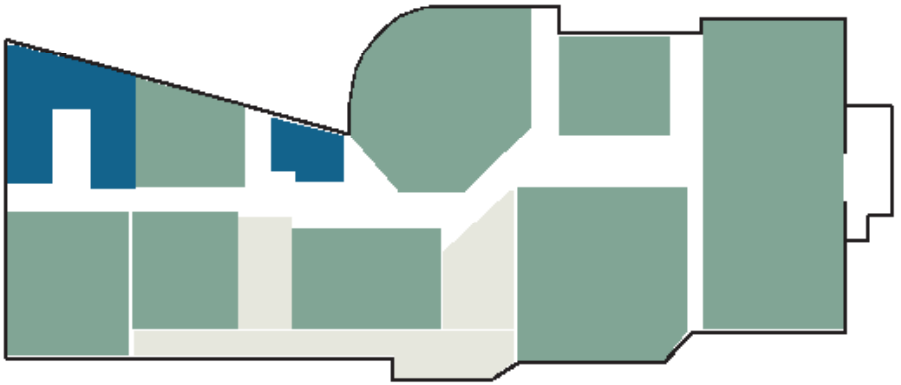


Fig. 4.5. ASC Hierarchy.

Circulation to Use:

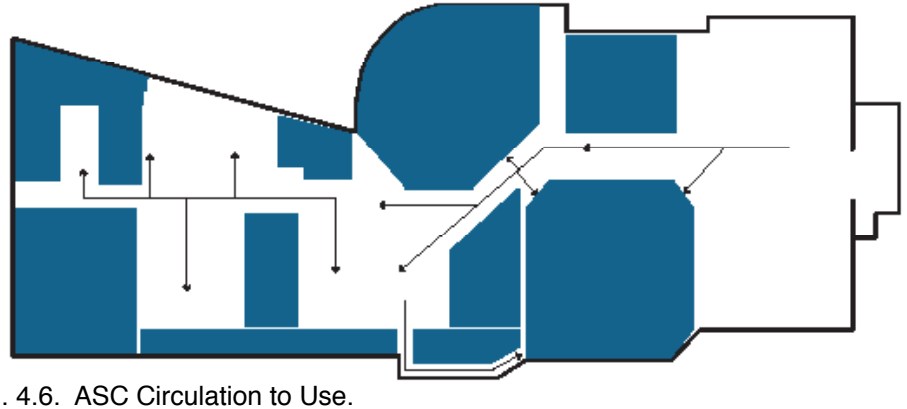


Fig. 4.6. ASC Circulation to Use.

Geometry:

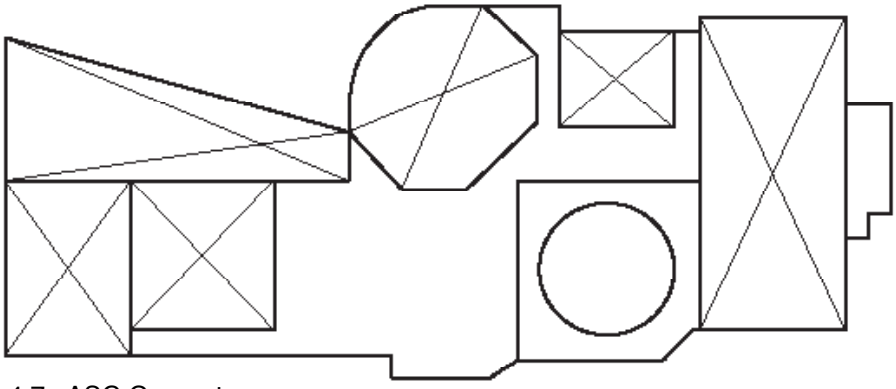


Fig. 4.7. ASC Geometry.

Structure:

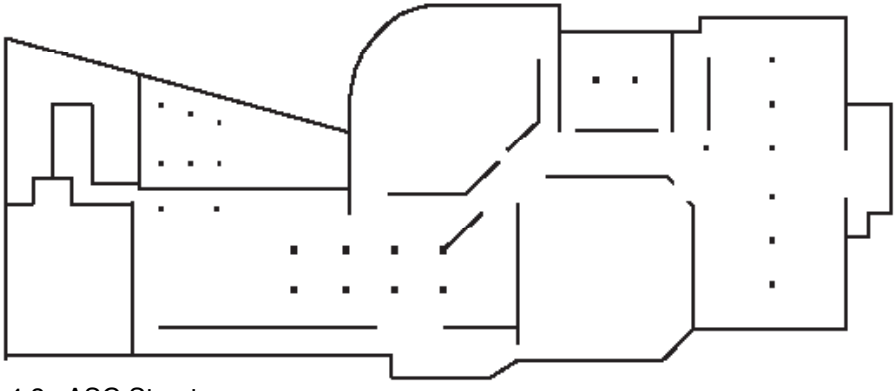


Fig. 4.8. ASC Structure.

Massing:

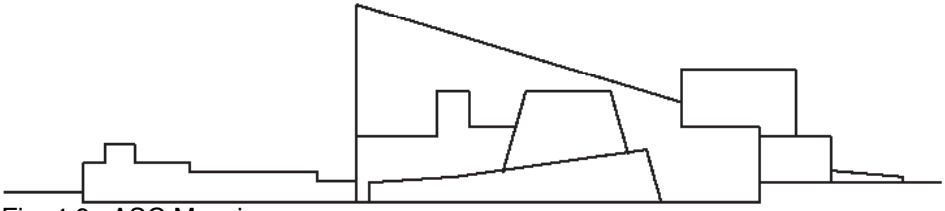


Fig. 4.9. ASC Massing.

Natural Light:

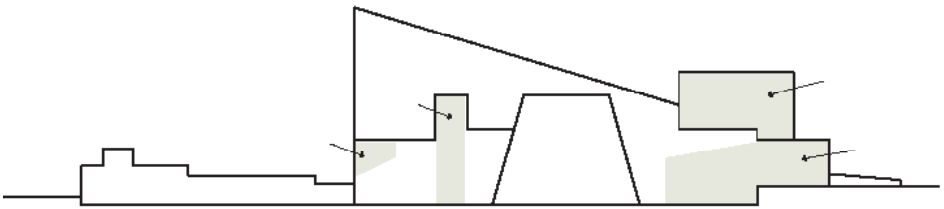


Fig. 4.10. ASC Natural Light.

Plan to Section:

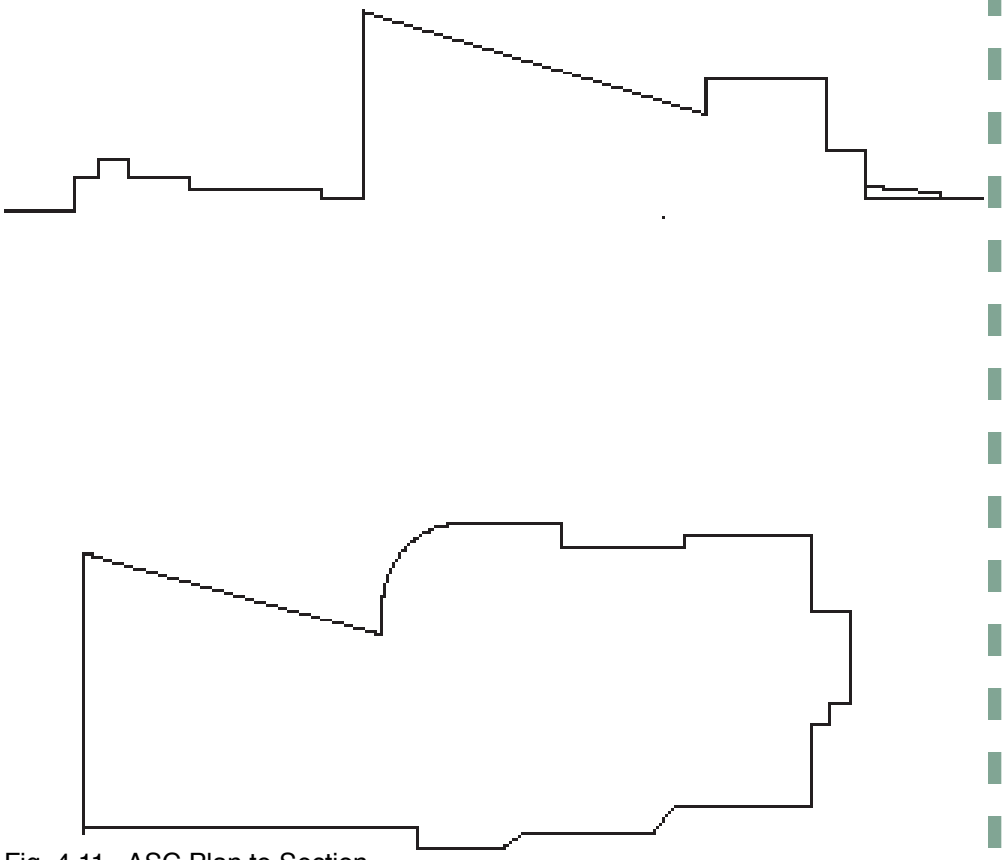


Fig. 4.11. ASC Plan to Section.

Fig. 5.1. Pocono Environmental Education Center. From *Sustainable Facilities* by Keith Moskow, 2008.

The Pocono Environmental Education/Visitor Activity Center, by architect Bohlin Cywinski Jackson, is a 7,750 square foot facility located in Dingman's Ferry, Pennsylvania. The facility encompasses a large gathering space for dining, meetings, lectures, and other environmental learning activities, as well as support spaces such as an office, kitchen, porch, locker room, mechanical, and storage spaces, surrounded by a beautiful forest and wetland in the Delaware Water Gap National Recreation Area (Moskow, 2008).

The Environmental Education Center provides visitors with an entrance that begins as they travel through the forest, over the wetland, and approach the entrance to the facility. Once inside the building, visitors move through the building's clerical functions and support spaces, and emerge in the beautiful sun filled, south facing great room. This great room lends itself to meetings, conferences, and public forums for the community and local environmental groups. The room has large windows offering great views of the surrounding forest, and a large, accessible deck (Moskow, 2008).

This center took the facility's surrounding environment into extreme consideration during design and construction. Before even beginning construction, various studies were conducted to investigate wildlife habits so as to not disturb or harm any of them. In fact, this research led to careful consideration of the Indiana Fruit Bat's migration patterns, and the tree bark they nest in. In response to this, removal of trees was restricted to certain times in order to not disturb them. (Moskow, 2008).

Much like the other case studies investigated, this facility was sure to incorporate green design strategies in both its design and its construction. Providing a good example of sustainable design and sustainable systems is incredibly important in a facility that aims to teach the public about environmentally friendly practices. The strategies in the Pocono Center include natural daylighting, natural ventilation, and passive solar heat. During its prime operational season, mechanical lighting and other systems generally aren't necessary (Moskow, 2008).

One unique aspect of this facility is the high level of involvement from the community. From the initial planning stages, the staff, as well as the public, were encouraged to give their input. A particularly great addition to this effort was having schoolchildren create drawings showing the process of building the facility and its green practices. Some of these drawings were then carved into the walls of the existing facility. During the construction process, the public was also invited

to view the repurposing of old tires into shingles for the roof (Moskow, 2008). This outreach was a really great way to get the community involved and knowledgeable of what the education center was trying to accomplish, and generate interest and excitement for the project. The particularly ingenious part is the inclusion of children into the process. Informing and educating children will create a generation that takes environmental sustainability seriously.

From the very beginning, the Pocono Environmental Education/ Visitor Activity Center set out to create a facility that responded to, respected, and protected the environment, as well as educating the public about these issues. This was the driving force behind the design, construction, and marketing of the project. Thus, environmental sustainability affected many of the decisions that were made regarding the facility. With society becoming more and more concerned about environmental issues, this is quickly becoming a necessity. Every decision needs to be viewed from the position of how that decision might affect the environment, such as whether it involves harmful chemicals, pollution, or waste.

The Pocono Environmental Education Center contributes to the unifying idea the concept that architecture isn't the only aspect of design that can have a positive effect on the public and its users. Through the careful consideration of its surrounding environment, the facility shows that not only buildings can serve as an example of good sustainable design choices, but what is *not* built can serve this purpose, as well. Architects need to remember that building may not always be the solution. Working with the surrounding wildlife and their habitats is an incredibly important aspect of sustainable design.

The environmental education center also upholds the unifying idea, especially in its attention to sustainable design. In addition to ensuring that the facility was made with reused and reusable materials, and runs as efficiently as possible, the dedication to preserving the surrounding habitat shows that good design decisions don't have to end at the building's walls. Architects have an even greater responsibility to protect the areas around their designs, as well. This is another example of how architecture can go above and beyond their standard expectations to create buildings that are not only functional, but improve the lives and environment they reside in, as well.

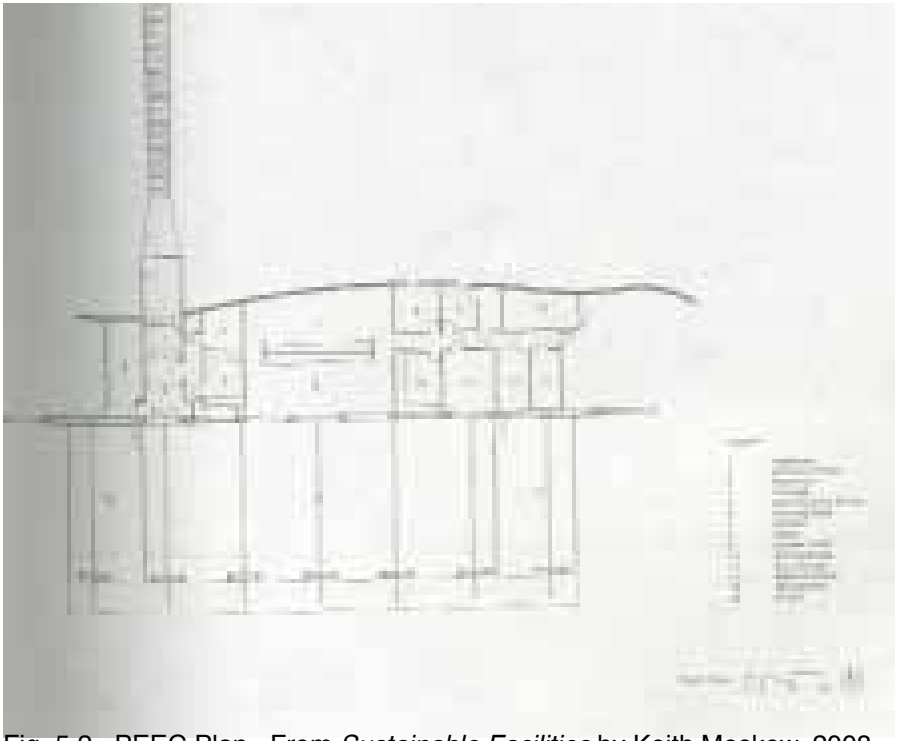


Fig. 5.2. PEEC Plan. From *Sustainable Facilities* by Keith Moskow, 2008.

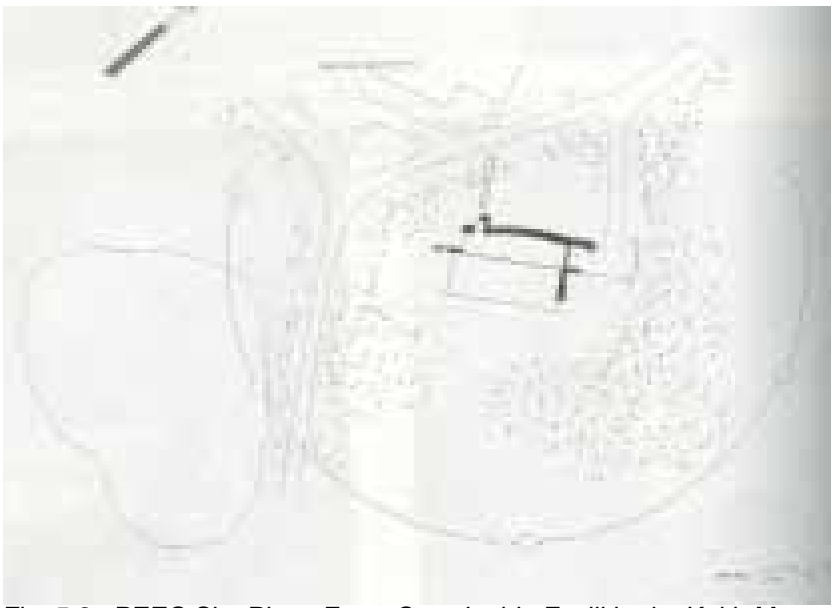


Fig. 5.3. PEEC Site Plan. From *Sustainable Facilities* by Keith Moskow, 2008.

Fig. 5.4. PEEC Sections. From *Sustainable Facilities* by Keith Moskow, 2008.

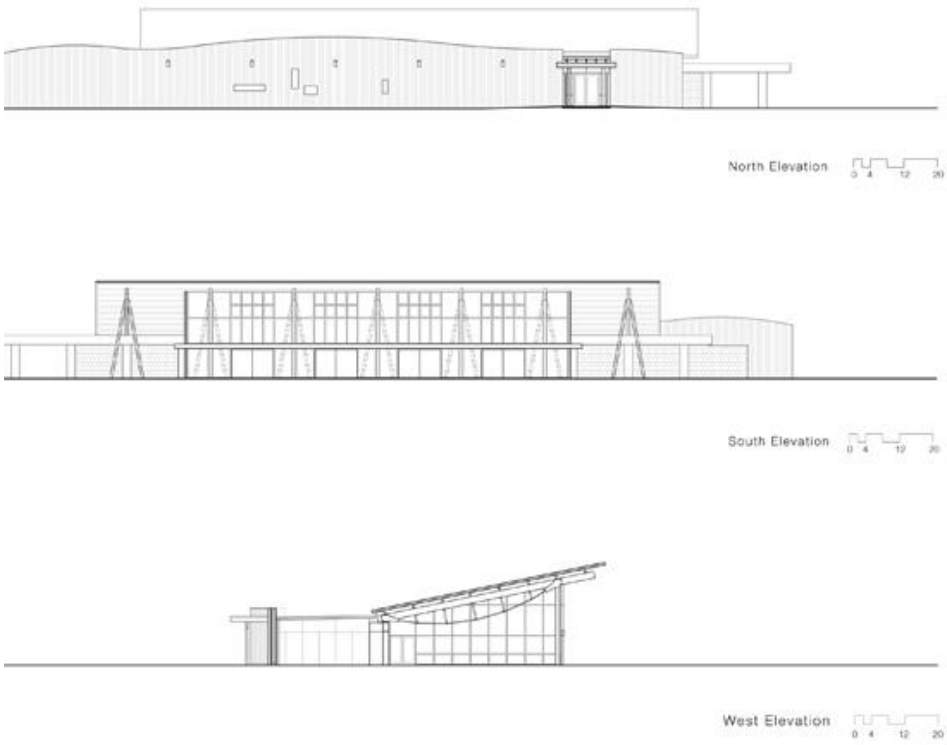


Fig. 5.5. PEEC Elevations. From http://www.aiatopten.org/node/128

Hierarchy:

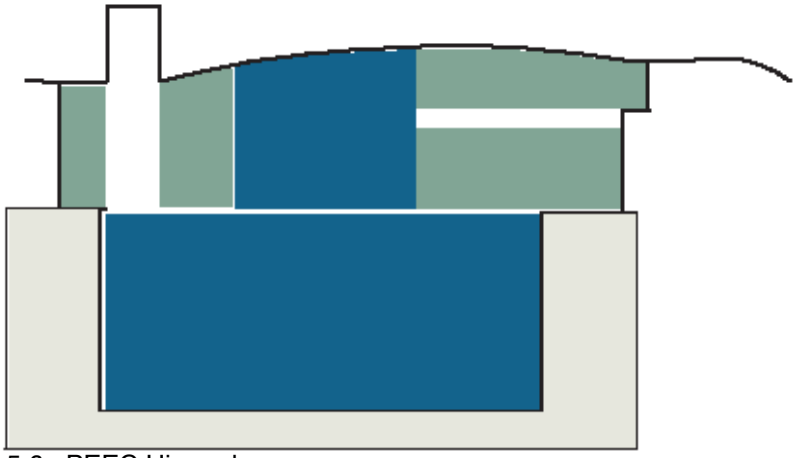


Fig. 5.6. PEEC Hierarchy.

Circulation to Use:

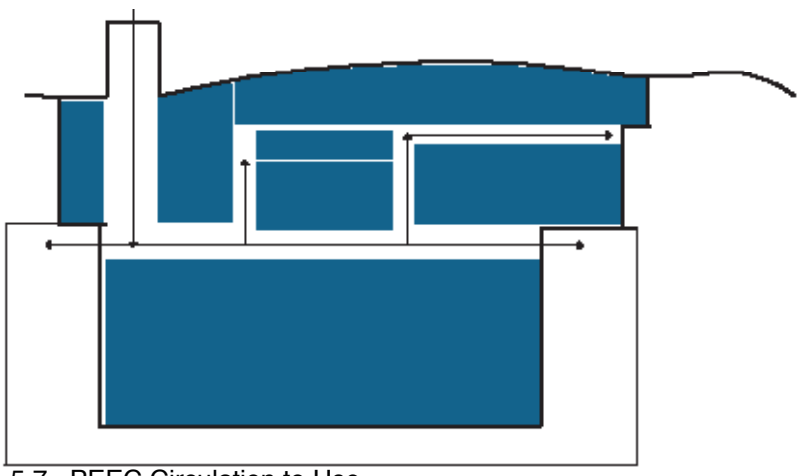


Fig. 5.7. PEEC Circulation to Use.

Geometry:

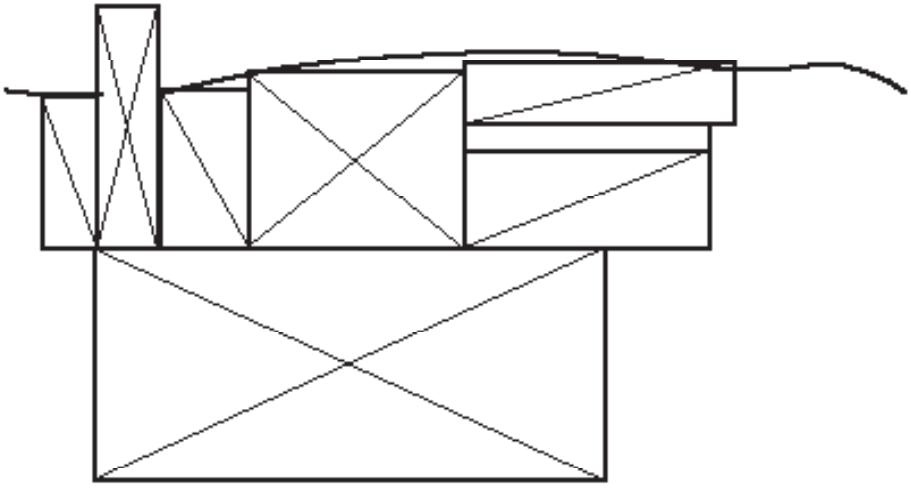


Fig. 5.8. PEEC Geometry.

Structure:

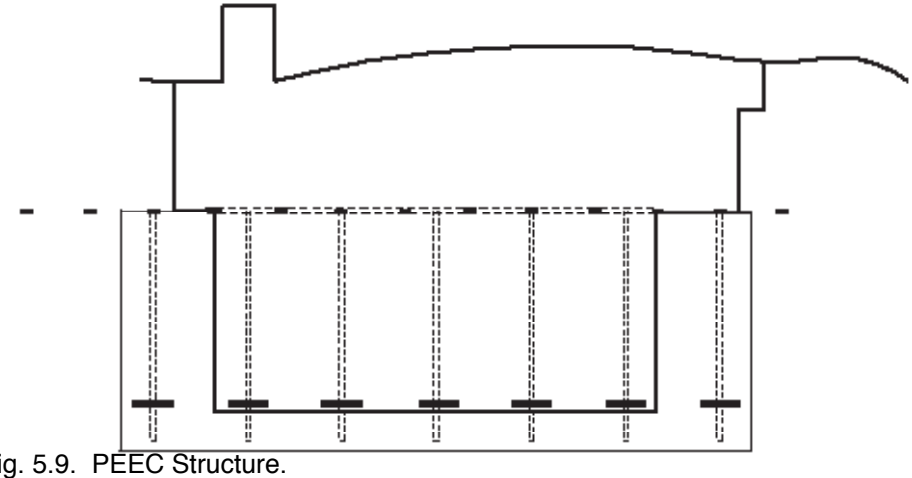
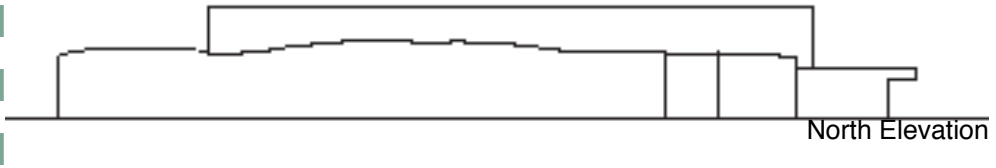
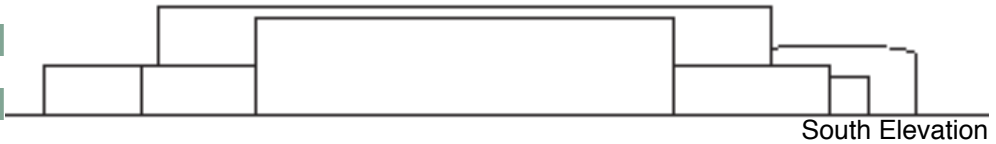


Fig. 5.9. PEEC Structure.

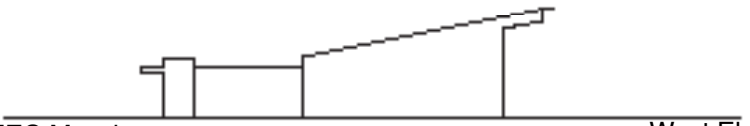
Massing:



North Elevation



South Elevation



West Elevation

Fig. 5.10. PEEC Massing.

Natural Light:

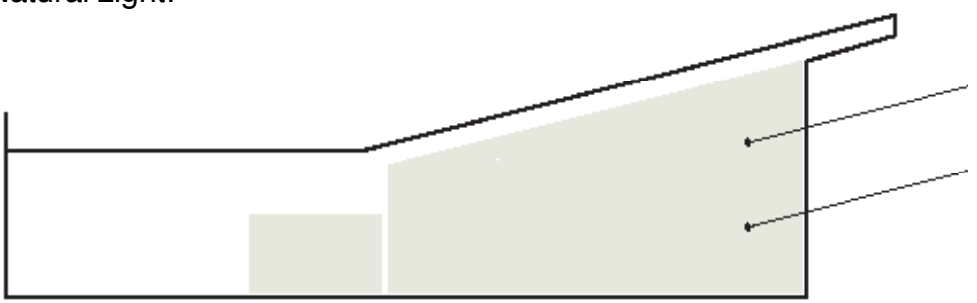
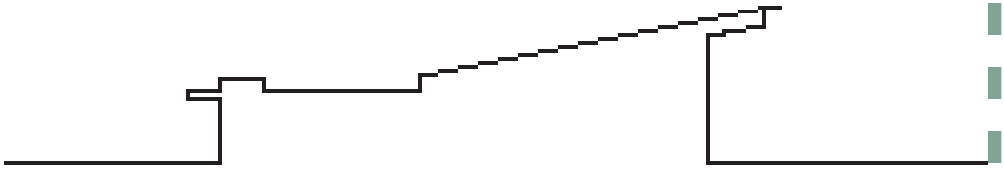


Fig. 5.11. PEEC Natural Light.

Plan to Section:



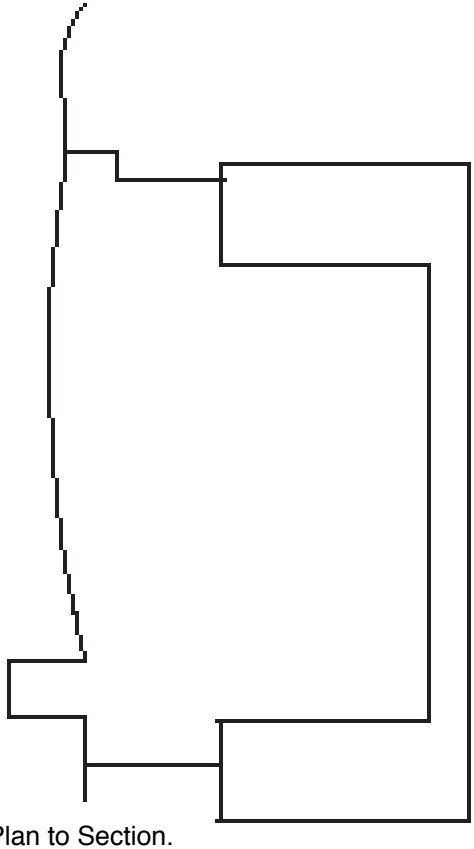


Fig. 5.12. PEEC Plan to Section.

Fig. 6.1. Landfill of North Iowa Education Center. From http://www.landfillnorthiowa.org/pages/education.php.

The Landfill of North Iowa Education Center, by Waggoner & Wineinger Architects, is located in Clear Lake, Iowa. This small facility encompasses a classroom accommodating 60 people, where information about the adjacent landfill is distributed, and local meetings are held. The facility also gives tours of the landfill to any interested groups, and runs them from this facility (Landfill).

This facility was created in response to the needs of the landfill and the public. The public wanted a space for meetings and other gatherings, which aligned well with the landfill staff's desire to provide more informational and educational programs to inform visitors about the landfill itself, as well as environmental practices.

This case study is similar to the other case studies investigated in that one prime function is to educate. The classroom in this facility, and learning aspects of the other case studies, aim to make sure that visitors to the facility leave with a greater understanding of green practices and the importance of sustainability issues, or, in the case of the Arizona Science Center, a greater understanding of scientific issues. No matter what the facility's main focus topic is, it is put on display so that visitors can cultivate an interest about the subjects that will hopefully go with them after they leave.

One difference between this facility and the other case studies that were investigated is in the way the project was brought about. Rather than being created for a larger environmental group or city, this facility was proposed at a landfill board meeting. It was brought to the board's attention that a classroom at the landfill site would be beneficial in teaching the public about issues concerning the landfill, as well as sustainability and proper recycling (Landfill).

The concept in the design of the education center was to create a building that was as environmentally friendly as possible, and to share these environmentally friendly strategies with those visiting the facility. Much of the design was based upon the definition of green architecture, in that it:

> Uses environmentally recycled and environmentally friendly materials, conserves energy, is healthy for people during construction and building occupation, encourages contractors to recycle during construction, makes the best use of the building site for solar purposes, is economical to operate, and reduces the use of our precious natural resources (Landfill).

Green systems include geothermal heating and cooling, passive lighting, septic tank and drainage field, and plenty of sustainable and

sustainably used materials. The landfill staff and designers wanted the facility to utilize a minimum of 30% recycled materials, and to display these recycled materials openly. The finished building surpassed the 30% goal (Landfill).

This case study contributes to the unifying idea that not only does architecture have a profound impact on the people that utilize the spaces, but the facility can also reach out to the public and invite them in when they might otherwise not have gotten involved. The Landfill of North Iowa has worked very hard to advertise their programs to the public, and make it as easy and inviting as possible for the public to experience their facility and their educational programs. This lends the idea that the facility does not need to be static; it can be proactive and take charge, like the way the landfill reaches out to local schools and community groups. This way, the facility and sustainable systems can affect and influence an even wider range of users than it otherwise would have.

The Landfill of North Iowa Education Center ties in well with the aspect of the unifying idea that proposes architecture take on a leadership role, and display good design choices that will inspire the public to become more environmentally friendly in their own lives, as well. This center uses its own sustainable aspects as a way to show the public simple measures that can be taken in order to live more sustainably, and the information offered lets visitors know exactly how to recycle and reuse common materials around their house or workplace.

The case study of the Landfill of North Iowa Education Center is especially relevant to this thesis project, as the project proposed is also a public environmental education center that is tied to a landfill. The public outreach programs and classroom information sessions offered by the Landfill of North Iowa are especially inspiring, as well are the educational aspects of the facility and usage of green materials and systems.

The landfill's department also takes an active role in teaching the public, encouraging tours, and even offering to pay for transportation costs in order to make it even easier for classes to take their kids to learn about the landfill. Making the information readily available and being proactive about getting it out to the public is an important part of getting people on board with sustainable practices.

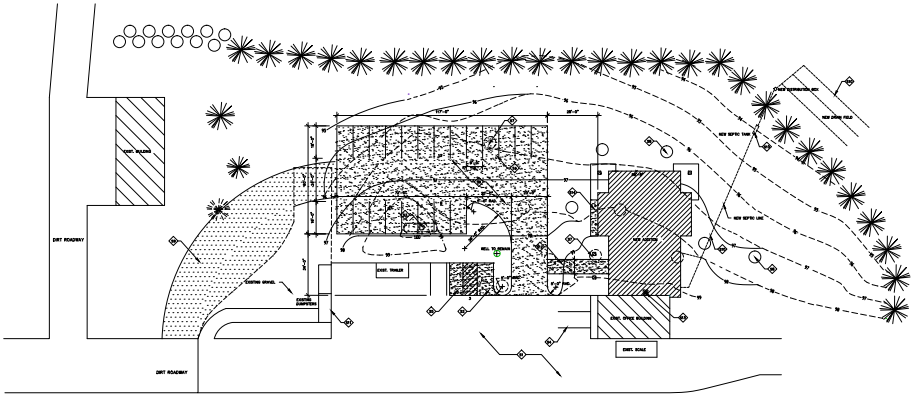


Fig. 6.2. LONI Site Plan. From Waggoner and Wineinger Architects.

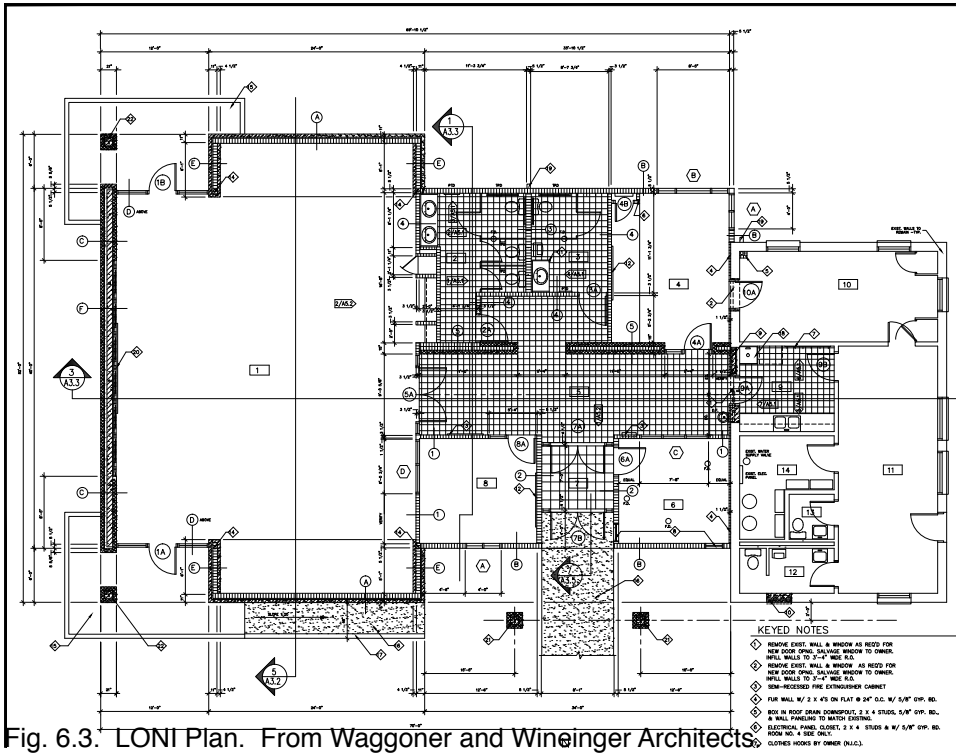


Fig. 6.3. LONI Plan. From Waggoner and Wineinger Architects.

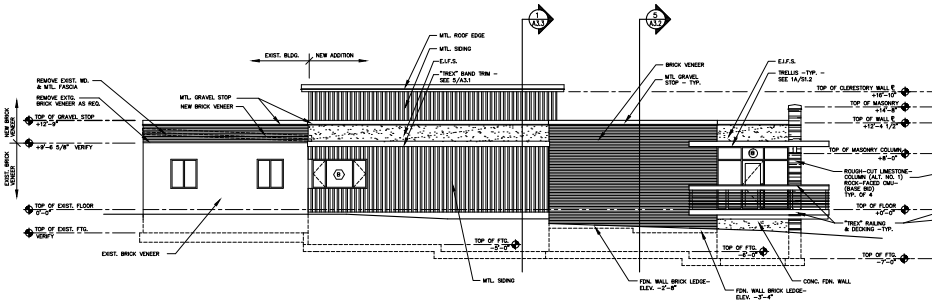


Fig. 6.4. LONI North Elevation. From Waggoner and Wineinger Architects.

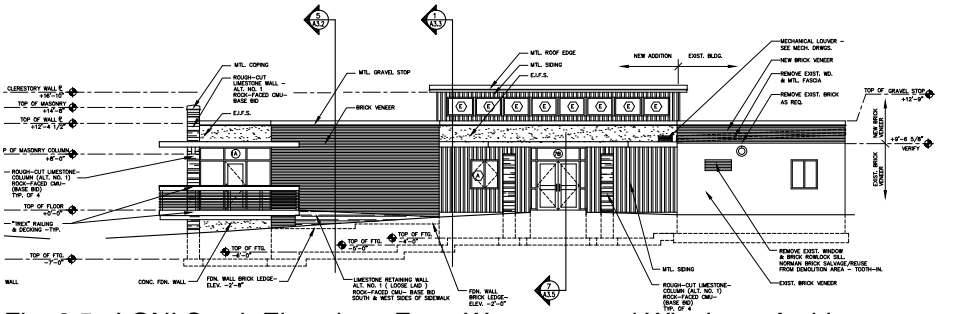


Fig. 6.5. LONI South Elevation. From Waggoner and Wineinger Architects.

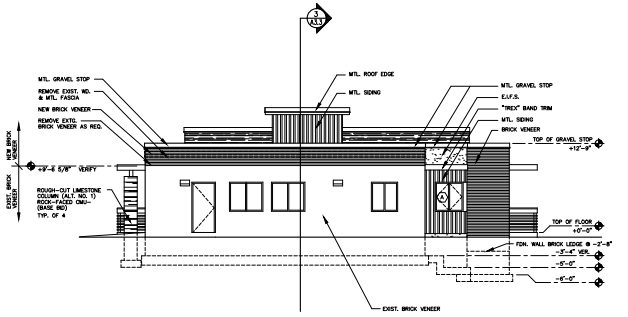


Fig. 6.6. LONI East Elevation. From Waggoner and Wineinger Architects.

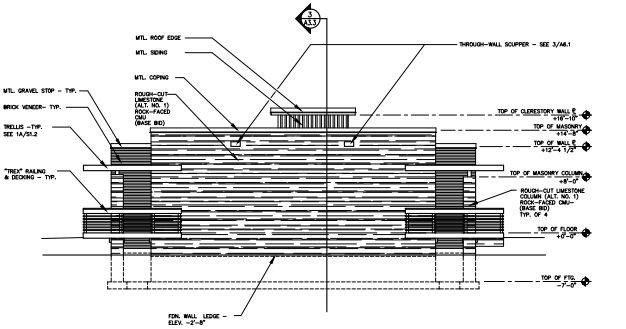


Fig. 6.7. LONI West Elevation. From Waggoner and Wineinger Architects.

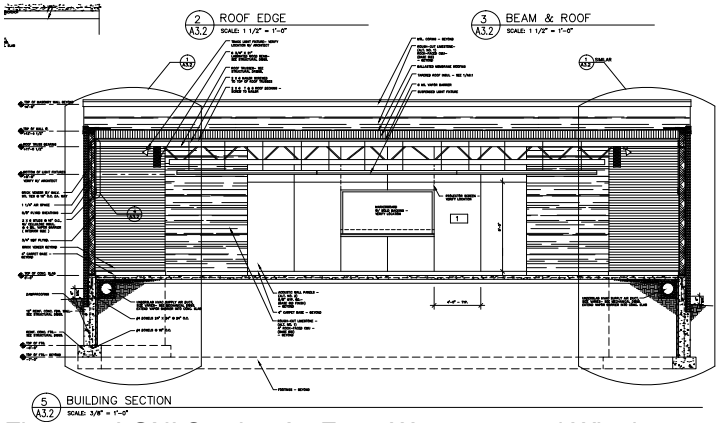


Fig. 6.8. LONI Section A. From Waggoner and Wineinger Architects.

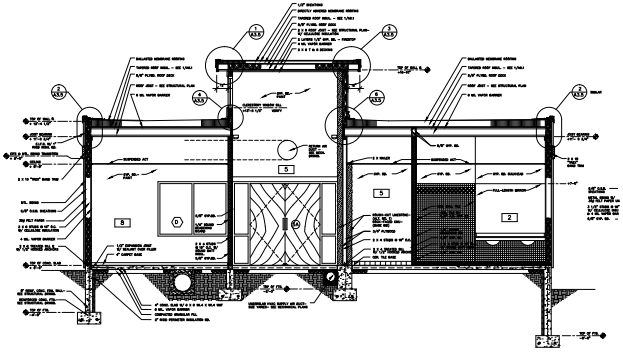


Fig. 6.9. LONI Section B. From Waggoner and Wineinger Architects.

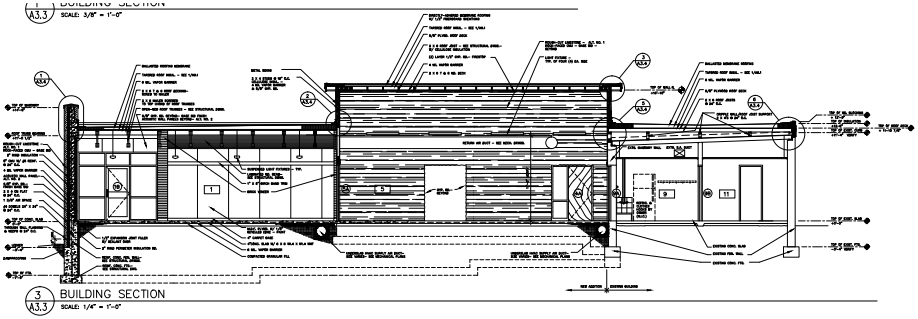


Fig. 6.10. LONI Section C. From Waggoner and Wineinger Architects.

Hierarchy:

Fig. 6.11. LONI Hierarchy.

Circulation to Use:

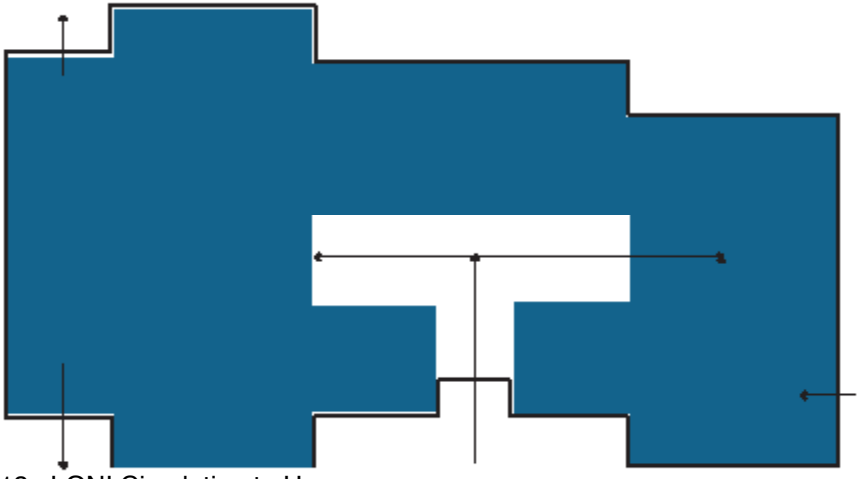


Fig. 6.12. LONI Circulation to Use.

Geometry:

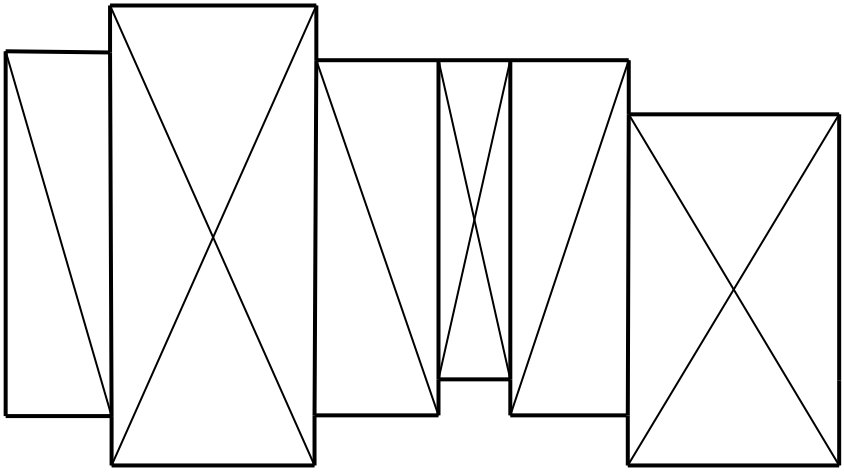


Fig. 6.13. LONI Geometry.

Structure:

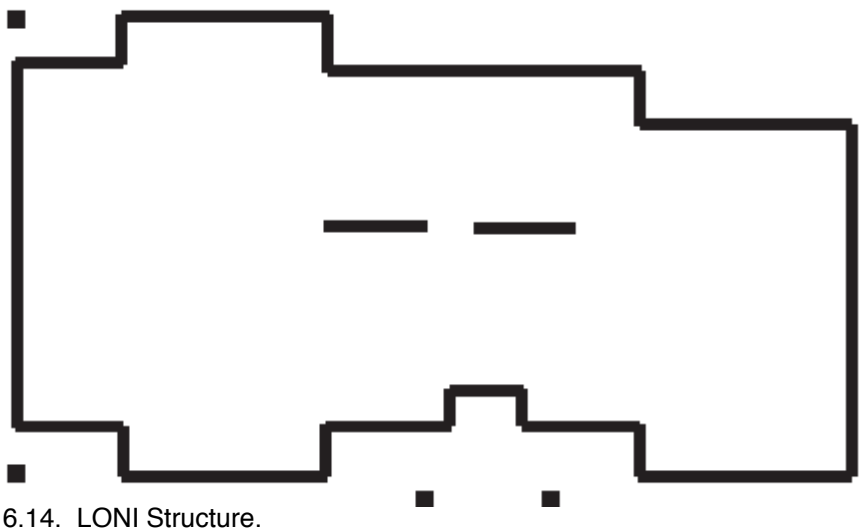


Fig. 6.14. LONI Structure.

Plan to Section:

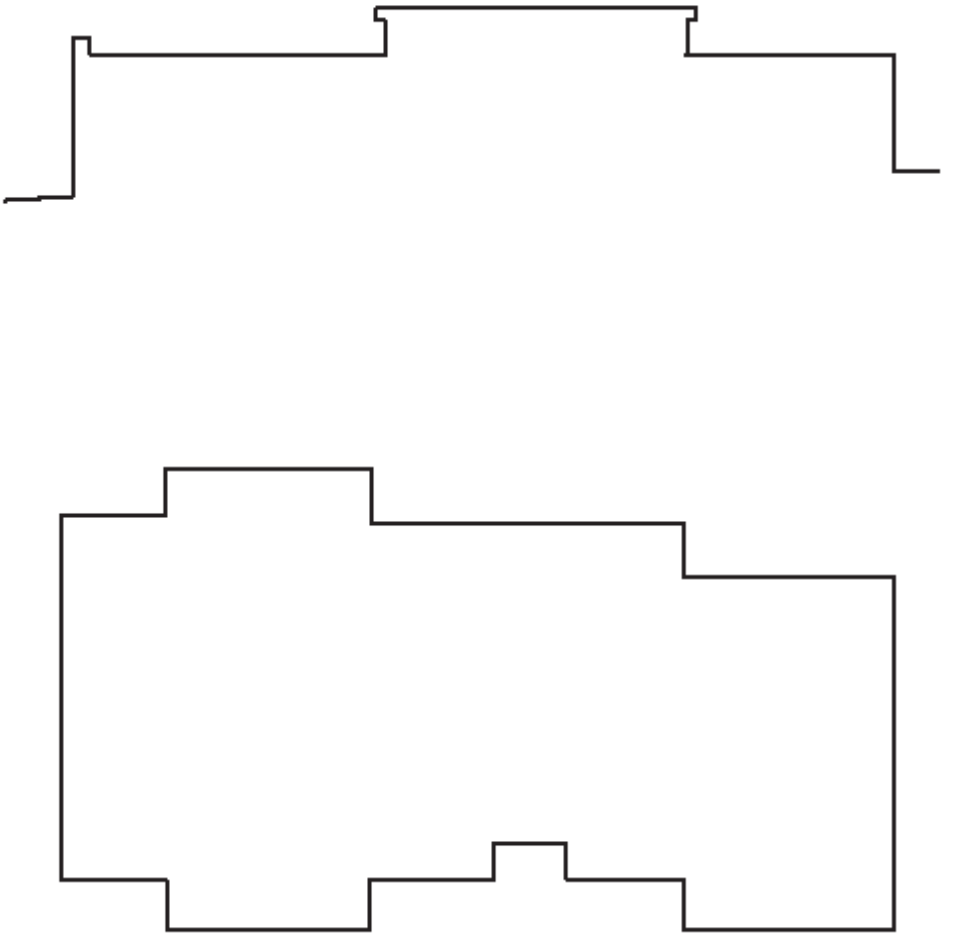


Fig. 6.15. LONI Plan to Section.

Natural Light:

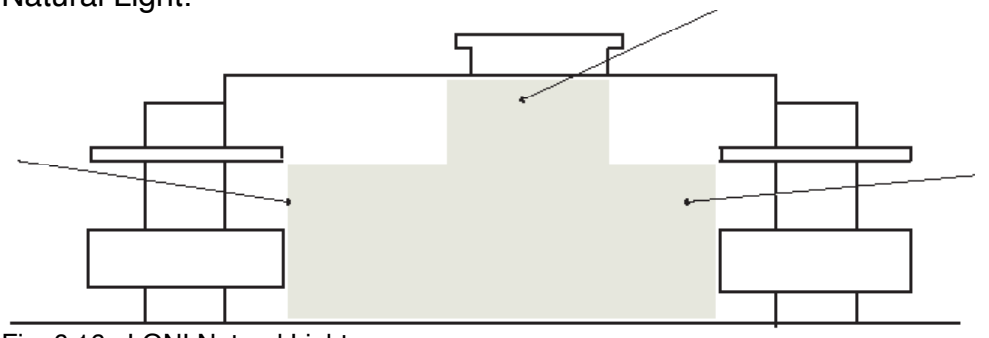
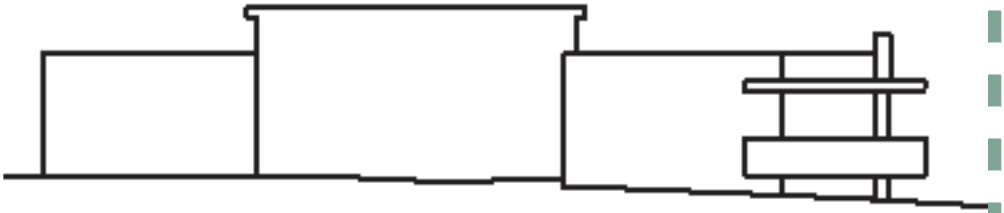
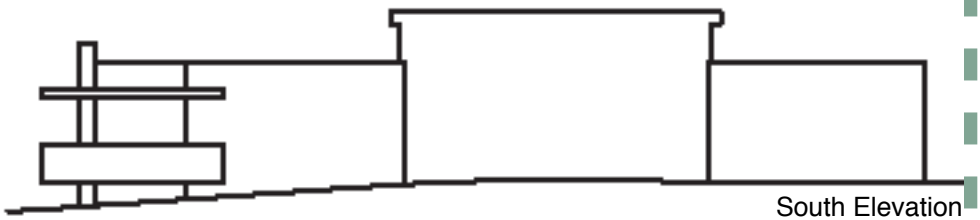


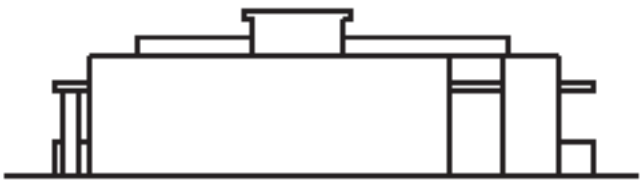
Fig. 6.16. LONI Natural Light.



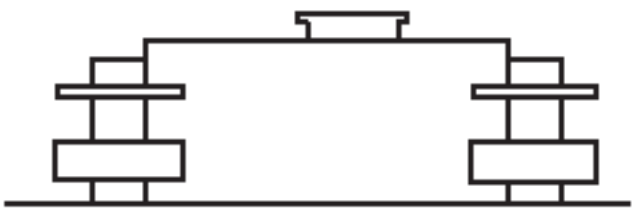
North Elevation



South Elevation



East Elevation



West Elevation

Fig. 6.17. LONI Massing.

These four case studies offer extreme insight into, and direction for, this thesis project. Together, they present similarities and differences in location, type, purpose, setting, layout, function, and much more. These similarities and differences are important in helping to guide which pieces are right for this thesis project; for example, which are most important and which are most useful. Because of this, each case study has a different impact on the unifying idea, and the conceptual direction of the project. While guiding the project and offering insight, however, these case studies largely upheld the original idea of the unifying idea: "Because architecture has the opportunity to make a great impact on the people utilizing it, it must take that opportunity to advocate good design decisions regarding the environment."

The four case studies all demonstrate a commitment to practicing what they preach. In example, each of them incorporate sustainable systems and materials that are recycled, reusable, or used in a more efficient way. In particular, the Chesapeake Bay Foundation's Philip Merrill Environmental Center went above and beyond in their devotion to sustainability, becoming the first certified LEED Platinum building in the world. Likewise, the Pocono Environmental Education/Visitor Activity Center went above and beyond as well, working to protect the surrounding habitat and ecosystem of the area. These examples show that an environmentally friendly facility is completely attainable, and that it is incredibly important to the unifying idea to use these sustainable initiatives to promote sustainability to the public.

Uncommon characteristics among the four case studies included the differences in the functions of the buildings. For example, the Arizona Science Center. Although it, like the others, focuses on learning, it does so through hands on exhibits in a museum like style. The Philip Merrill Center functions primarily as an office space, and the Landfill of North Iowa Education Center and Pocono Environmental Education Center operate as teaching and meeting spaces. These differences between the four case studies show what different forms the unifying idea could potentially take. The differences and their impacts to the individual projects outline the effects of these differences. This helps determine what aspects might be best suited for this thesis project.

The underlying conceptual ideas of all four case studies seem to be a commitment to educating the public. Whether they are educating

them on environmental issues, or on scientific thinking skills as in the case of the Arizona Science Center, they all have the mission of spreading knowledge about important issues. This has an important influence on the unifying idea because, as the historical context research shows, education is a key part of getting the public concerned about climate change and other environmental issues willing to take action. Therefore, any effort to advocate good environmental decisions relies heavily upon the role of education.

The sites of these case studies affected the external design of the facility, but not really the purpose. Each of the four buildings respond to their surrounding environment and landscape through their forms and construction. For example, the Arizona Science Center makes a bold statement evoking the shapes of the desert landscape, while the Pocono Environmental Education Center takes on a more rustic cabin feel in its setting in the Pennsylvania woods. However, as stated, these site influences don't distract or change the initial purpose of the facility, education and sustainability, they only affect the visual manifestation of the projects.

These projects all lie within the social context of ensuring that education readily available to the public. With the spread of information happening faster and easier than ever before, it is incredibly important to ensure that the public is getting the correct and true information from knowledgeable and trustworthy sources. Engaging the public and getting them excited, informed, and passionate about issues at hand, including environmental issues, is becoming a bigger and bigger part of how today's world issues are approached and solved.

These four case studies demonstrate different approaches to spatial arrangements and what those spatial relationships mean for the functional relationships of the building. Although the case studies all have different program components, and they are laid out in different ways, they are all functional. This is probably because the attention paid by the architect to the circulation plans, allowing for a clean and purposeful flow through each of the facilities, with designated dead ends in important spaces that are easily accessible from almost anywhere in the building.

Technical issues play a very important role in the case studies, particularly the Pocono Environmental Education Center, the Philip Merrill Environmental Center, and the Landfill of North Iowa Education Center. This is because all three of these facilities relied heavily upon environmentally friendly construction methods, wall and roof details,

and operating systems. Special attention had to be paid to ensure that these facilities are open to natural sunlight and ventilation and that the entire building - facade, systems, floor, walls, and roof, etc, operate as efficiently as possible.

In conclusion, from a comprehensive look at the typographical research as a whole, it can be concluded that the unifying idea has been largely upheld and supported. However, these four facilities studied for the typological research all helped to enrich the understanding of the unifying idea in some way. Whether it was offering insight into spatial programming needs, the effect of the site upon the project, or common or uncommon characteristics for typology, each case study had something to offer. From here, the direction of the project can begin to be narrowed, focusing upon the aspects of the facilities found especially useful or relevant to this thesis: how to incorporate an emphasis on education and sustainability into a successful public facility.

"Public sentiment is everything. With public sentiment, nothing can fail; without it, nothing can succeed." This famous quote by Abraham Lincoln is becoming especially meaningful to the sustainability movement currently taking hold all over the world. Public endorsement can make or break products or ideologies as their opinions will effect our politicians, who are becoming increasingly wary of anything that could put them in a bad light in the eyes of the public. Society's influence can be seen clearly in the progress that has been made toward environmental sustainability over the last few decades (Vasi, 2012).

One example of the effect of public opinion can be seen in the story of Chlorofluorocarbons. CFCs were hailed as a miraculous invention when they were first revealed. They were remarkably different from other chemicals doing the same thing, as CFCs are non-toxic, less flammable, and don't react with other chemicals. These safety issues spawned an incredibly high public opinion of CFCs, and, therefore, there was an insurgence of CFC use. Until the connection between Chlorofluorocarbons and the depletion of the ozone layer was discovered in the late 1970s, that is. Once the public knew the extent of the harmful effects of CFCs, their dissent of the chemical became an invaluable asset in the successful phasing out of the chemicals in both the United States and Europe (Vasi, 2012).

The phasing out of CFCs marks the beginning of a new environmental era. The 1970s and 1980s was when concern about climate change, depleting resources, and biodiversity really came to the forefront of concern and discussion. One of the first big conferences addressing this issue was the United Nation's 1972 Stockholm Conference on the Human Environment, which brought together leaders from all over the world to talk about issues concerning the environment (A brief history, 2000). This conference gave us the phrase "sustainable development" which was coined to describe the need for growth and development that no longer clashed with the needs of the environment (History of sustainability, 2012).

Next, the United National Environmental Program, UNEP, was formed with the purpose of taking a closer look at issues of global development and the environment. From this program stemmed the International Environmental Educational Program, or IEEP, which debuted in 1975, and the World Conservation Strategy in 1980 (History

of Sustainability, 2012). The World Conservation Strategy promoted the idea that protecting our environment and natural resources was in the best interests of humans, as well (A brief history, 2000).

The next major congregation for sustainability that occurred was the World Commission on Environment and Development, also known as the Bruntland Commission, established by the United Nations in 1987. This commission served as the United Nations' source of research, as it conducted surveys and public meetings in order to gain a greater understanding of sustainable issues (History of sustainability, 2012).

The Bruntland Commission produced a report, which detailed their findings. These findings were that the world's development needed to drastically change in order to be less harmful to the environment. The term "sustainable development" was also perpetuated by this report. However, one of the most important statements in the report responded to effects of allowing climate change to continue (A brief history, 2000). The report stated:

> Major, unintended changes are occurring in the atmosphere, in soils, in waters, among plants and animals. Nature is bountiful but it is also fragile and finely balanced. There are thresholds that cannot be crossed without endangering the basic integrity of the system. Today we are close to many of those thresholds. (A brief history, 2000).

From the World Commission on Environment and Development came the creation of the United Nations Conference on Environment and Development, or UNCED. This was a program that spent two years preparing for another worldwide gathering similar to the previous Stockholm Conference (History of sustainability, 2012).

This conference, aptly called Agenda 21, was a summit that allowed leaders from many different countries to sign international conventions concerning climate change and related issues. At this conference, a "Declaration of Environment and Development" was created, outlining sustainable goals and procedures for the 21st century. This called upon nations all over the world to become more proactive in sustainability issues (History of sustainability, 2012).

In June of 1993, President Clinton signed an executive order with the purpose of creating the President's Council on Sustainable Development (PCSD). The purpose of this council was to encourage economic growth, job creation, and environmental protection (History of sustainability, 2012).

One of the most important occurrences in the history of the sustainability movement was the Kyoto Climate Agreement, which was adopted by over 150 countries in December of 1997. This agreement marked the first time world leaders agreed to put legal arrangements in place to restrict emissions of greenhouse gases. Additionally, 38 industrialized countries pledged to reduce their emissions of six different types of greenhouse gases to 5% below the 1990 levels. These 38 nations agreed to do this by 2012 for the purpose of protecting the earth (History of sustainability, 2012).

From August 26 to September 4, 2002, the World Summit on Sustainable Development, WSSD, took place in Johannesburg, South Africa (History of sustainability, 2012). This summit was a continuation of negotiations between world leaders on a number of topics, including Agenda 21 and globalization (History of sustainability, 2012).

Throughout all of these conferences, meetings, summits, and treaties, public opinion always remained an important aspect of environmental sustainability issues. As previously stated, public approval or disapproval has an enormous impact on every major issue worldwide. This includes whether or not the public acknowledges the problem of global climate change, and how seriously they take the issue.

There has been much research on the topic of sustainable issues and green development in the eyes of the public for many years. This research shows that the majority of the public is concerned about environmental issues. For example, the International Social Survey Program in 2002 found that over 50% of people surveyed either agree or strongly agree that “almost everything we do in modern life harms the environment.” Additionally, a little less than 50% of survey takers disagreed or strongly disagreed with the statement, “many of the claims about environmental threats are exaggerated. Furthermore, Environics International conducted a survey in 2000 with international respondents found that over 80% of the people surveyed were concerned about the environment either “a fair amount” or “a great deal” (Vasi, 2012).

The level of public concern for environmental issues is possibly best outlined in their willingness to pay more in taxes if that money would be used to help protect the environment. A 2005 study contacted people from 51 different countries and found that 51% of those people would be willing to pay these heightened taxes. In certain countries, such as Canada, Norway, and Sweden, the percentage of people that

were willing to pay higher taxes was over 65% (Vasi, 2012).

Unfortunately, however, just because the public shows great concern for climate change and wants to see something done to prevent it and protect the earth from other pollutions, this doesn't mean that they completely understand the issues at stake, nor do they understand what can and should be done. Research shows that the public believes that they are misinformed or badly informed about environmental issues, and that the majority of people do not truly understand the issues at stake (Vasi, 2012).

At the center of this confusion are problems such as the belief that economic growth and protecting the environment are two things that can't happen simultaneously; that they are at odds with each other. This leads people to the false belief that nothing can be done to combat climate change, or that existing solutions are too expensive, dangerous, or difficult (Vasi, 2012).

All of these studies lead to some unnerving conclusions. Although the majority of the public is concerned about climate change and recognizes it to be a problem, the majority of the public also isn't extremely resigned to changing their ways of living in order to make better green choices, most likely because they actually don't know much about the issues.

Education is the best way to combat this issue. One great example of this is the perception of wind farms. Much of the public is disapproving of wind farms because they think they are ugly to look at, that they are dangerous to birds or people, that they make annoying sounds, etc. However, studies have shown that once people experience wind farms first hand and are exposed to what they are really like, there are much less objections to wind farms. Knowledge of the truth allows people to bypass their preconceived notions and become more accepting of green systems (Vasi, 2012).

Preconceived notions and misinformation is the biggest obstacle to a more sustainable society. These are especially influential in the United States, which has a higher percentage of skeptics than most other developed and developing countries. In the United States, over 20% of the people don't see climate change as a major problem. Even more worrisome, there are still those who believe that climate change is a hoax, or some kind of lie by the scientific community. A Republican Senator, James Inhofe, even went as far as to say that climate change is "the greatest hoax ever perpetuated on the American people" (Vasi, 2012).

At a recent panel hosted at NYU Law, a discussion of natural disasters such as Superstorm Sandy took place. At this conference, a man asked why scientists, equipped with overwhelming evidence of climate change, have been unable to completely convince political leaders not only of the dangers associated with climate change, but, as Senator Inhofe so carelessly demonstrates, that climate change even exists to begin with (Walsh, 2012).

The reluctance of even our country's leaders to take action against climate change is related to the lack of public pressure being placed upon them, especially in America (Walsh, 2012). So, when so many people cite climate change as a concern, why aren't they urging our leaders to take action? For one, because there is still a large percentage of the population that doubts climate change. In conjunction with misinformation campaigns by fossil fuel proponents, inadequate or slanted media coverage leads to a nation that is not nearly as concerned about climate change as they should be (Vasi, 2012). As previously stated, public support and education is essential in solving the world's climate change issues.

However, some people simply are not receptive to this education. For example, studies have shown that people who experience the effects of climate change first hand, such as the freak weather events we have been seeing lately, are more likely to believe in and be concerned about climate change. Interestingly, though, people need to have an open mind, even after experiencing these storms, because if they hadn't believed in climate change previously, they will tend to filter the new information in order to rectify it with what they had previously believed (Walsh, 2012).

Unfortunately, trends show that education simply may not be enough. Even people who are well informed about the current environmental problems facing our world still may not know what they can do about it, or believe that they can make a difference. Individuals have a difficult time acting against their own immediate self interest, which many of the necessary environmentally sustainable practices require. Furthermore, there are lots of people who are unwilling to change their habits in favor of more sustainable ones because they think that others will shoulder the burden for them (Vasi, 2012).

It is difficult for many individuals to make the necessary sacrifices and lifestyle changes in order to live a more sustainable life. This is especially difficult because the benefits of making these sustainable changes aren't immediately recognizable or tangible (Vasi, 2012).

Additionally, the threat of climate change isn't as immediately worrying as, for example, being held at gunpoint. This threat is difficult to see on a personal, day to day basis, leading many to not take it seriously (Walsh, 2012). Moreover, the benefits of sustainability, such as cleaner water or air, are not only restricted to those who have put in the hard work to clean the water or air. Those who haven't contributed can still receive the benefits owed to those who have, giving everyone less incentive to participate (Vasi, 2012).

Another international survey was conducted, in which over 37% of those surveyed said that they didn't think there was any point in trying to help the environment unless other people were also actively participating. Also, over 35% stated that they believed that helping the environment was just too difficult for themselves and people like them (Vasi, 2012). Obviously, this type of thinking is very difficult to get around. People think it's not worth it to make an effort to help the environment because they think others will not do the same. However, those very "others" are thinking the exact same thing, and nothing gets accomplished.

In order to get everyone involved in sustainable practices, education is one extremely important ingredient, however, there are other initiatives that will help the situation, as well. For example, forming educational initiatives to target certain audiences, and speak to what is important to them, and how climate change and other environmental issues directly affect them. Targeting specific groups of people establishes responsibility, and stops people from assuming that they need not take action because someone else will take care of it (Vasi, 2012).

Going hand in hand with targeting specific audiences, tailoring messages to fit that audience's specific beliefs or value systems is also helpful. In this way, the public will see how sustainability issues are directly in line with many of the values they already hold. This serves as more reason to get involved and change their behaviors (Vasi, 2012). This is also connected with the strategy of making these messages easy for the public to understand by speaking to them in their own language. This means delivering the message through someone relatable, such as their local weatherman, instead of scientists who might be off putting or use too many technical terms (Walsh, 2012).

Another great way to get the public more involved in sustainable practices is to make it easier for them to participate. For example, many people don't take the time to recycle. However, if the number of

recycling centers were increased so that they are in closer proximity to people's homes, or if people had recycling service at their homes, they would be much more likely to participate in recycling.

Concern for the environment has been part of society for many years. The degree of this concern has been a constant fluctuation, however. This fluctuation is directly linked to public opinion and their level of concern about certain issues, and public opinion is influenced by their level of knowledge and understanding of these issues. Worrisome scientific evidence has brought together world leaders for decades in a number of conferences and summits, such as the previously mentioned Stockholm Conference, and the more recent World Summit on Sustainable Development. Public pressure has kept these issues at the forefront of discussion, and needs to increase if we are to truly find solutions.

With the continued and increasing warming of the climate, more and more people will become affected by its influence, whether by storms, shortages of goods, or other disasters. This means that it will be harder and harder for the public and our elected officials to continue to deny climate change, and we will all be forced to start making real changes and taking serious action. The question is, though, will it be too late? (Walsh, 2012).

When beginning any design thesis, a series of questions, ideas, and goals come to mind. How can this thesis project push boundaries and excel beyond any previous studio project? How can this thesis effectively investigate the questions at play, and make itself relevant to the societal and cultural trends of today? How can the product of the thesis stay relevant in the future?

This thesis project is committed to investigating and finding a solution to the unifying idea, "Because architecture has the opportunity to make a great impact on the people utilizing it, it must take that opportunity to advocate good design decisions regarding the environment." The conclusions drawn from the research relating to this will be presented in the design of an environmental learning center associated with the Ponderosa Landfill, near Mankato, MN.

This unifying idea gives a clear indication of where to start research: by investigating the effect architecture has on society, and how that effect can promote other environmentally friendly choices. This research focused, in particular, on the role that the built environment plays in global warming and other environmental issues, and how architects could serve two functions by making more sustainable choices: lessening the effect of their buildings on the environment, and promoting more sustainable lifestyles among the public.

A second research focus was on the history of the evolution of the sustainable movement that we have experienced in the United States as well as the rest of the world. This research quickly focused in on society's ties to the topic of environmental sustainability. In particular, how society's views of global climate change and other environmental issues affects our overall ability to combat the issue and search for solutions. This research is especially relevant as it showed that educating the public is the key to creating movement in the direction of a more sustainable way of living.

The over arching goal of this thesis is an educational one: to teach others about sustainable issues in the design field, and inspire them to become more sustainable in their own lives, much like the proposed environmental education facility would aim to do. Other educational goals relate to the placement of this project in North Dakota State University's Institutional Repository. This will allow the project to guide other students who might be interested in this topic, passing on

relevant information and ideas.

Academically, I wish to push myself to create a comprehensive thesis project that shows improvement in all aspects of design. I want to challenge myself to produce a design and corresponding presentation materials that surpass anything I have done so far in quality, completeness, thoughtfulness, etc. The thesis is my last chance to create a project within the freedom of education, which means that is entirely my own, and I am free to explore it and take it in any direction that I so choose.

One professional goal for this project is to further my education and prepare myself for entering the workforce. This includes strengthening my abilities in software, modeling, and overall design. This thesis project also brings architect's responsibilities as professionals to the forefront of discussion. The research shows that architects are responsible for not only creating functional facilities, but also creating facilities that users enjoy, and that will improve the health and well being of not only the users, but our environment, as well. This is a very important aspect of the profession of architecture.

Personally, I feel that the pollution of our environment and depletion of our natural resources is one of the greatest issues facing our country, and the entire planet, today. I'm worried by the dramatic increase in violent and unexpected storms all across the world. I'm worried by the extinction of our animals. I'm worried by the depletion of forests and other habitats important to our ecosystem. None of these problems are going to go away on their own, and education is our best tool in combating them. The more people are aware of environmental issues and just how important they are becoming, the more people will make green choices by recycling, driving less, and so on.

I want to be a part of the solution to our environmental crisis, so that, hopefully, future generations will grow up in a much more sustainable society, and will not take our resources for granted. Hopefully those resources will still be available to future generations. If we all come together and embrace environmental education and what this education is telling us, we may be able to change the way we live. If we can do this, perhaps our children and grandchildren will be able to experience and enjoy the environment as we have.

No one ever really thinks much about where their trash goes. I, for example, take the bag out of the trash can, walk it a little ways down the hallway, and drop it down the garbage chute. I don't have to leave the building, or even my own floor. Once that garbage bag leaves my hand and falls down the chute, it effectively leaves my mind, as well. Where that garbage goes, and what happens to it, are seemingly no longer my concern.

That couldn't be further from the truth, however. What happens to our trash is everyone's concern because if it's not being recycled, it is essentially pollution to our planet. If everyone could see what happens to our garbage, perhaps we wouldn't be so keen to throw so many things away. Perhaps we would try a little harder to reduce, reuse, and recycle our goods.

Visiting the Ponderosa Landfill was surprising in more ways than one. First of all, seeing actual piles of garbage mixed with dirt was a little shocking. I was unable to pretend that the garbage I drop down my garbage chute just disappears. Here I was, face to face with the product of not just my garbage, but everyone's garbage: piles of cups, plastics, papers and dirt, on what might have previously been a beautiful field.

However, until we come up with a more safe and efficient way of disposing of our garbage once and for all, it seems landfills are the best strategy we have. They have, at the very least, moved to sanitary landfills, which means that garbage is no longer dumped in rivers or swamps, but contained to specific areas of land and created in very specific ways. In fact, there are many rules and regulations that apply to landfills, which was the second surprise I received on my tour.

The tour started by travelling down the side of the bluff and up to the top of one of the small hills in the landfill. Looking at the landfill, I noticed the mounds of dirt and garbage rise from the landscape, and I learned that these were actually much more precise than they appeared. The hills of garbage could only be built to a certain slope before they had to be capped off with dirt and allowed to grow over. Then, a different hill would have to be the recipient of the trash. This created a particularly interesting vision of small rolling hills and valleys. To my surprise, the very mound of grass I was standing on while surveying the landfill was actually an overgrown cell of trash.

A thin dirt road led around the hills, highlighting which hills were

being added to at the moment and which had yet to be started. Trees surrounded the landfill and gave the place a secluded feeling, as though I was standing in the middle of a clearing that still remained a secret to many. Despite the garbage, or maybe because of it, the setting was actually quite captivating.

The setting became even more captivating when viewed from the project site, which is located on the bluff overlooking the landfill. After surveying the site from the top of the garbage mound, we took the car back up the side of the steep hill, where a few sparse trees jutted out from their tightly knit line, and followed a paved road all the way around the farm field that currently sits atop the bluff.

Standing at the top of the open bluff, I was fully exposed to the wind and sunlight, and had complete views of the landfill, all the way to the far end, where a small field meets more captivating trees. From this spot, the colors of the individual pieces of trash seemed to meld together and became less off putting as they created more of a palette amidst the dirt. The sunlight on these colors was especially intriguing, making viewers almost forget exactly what it is they are looking at.

I stood on the top of the bluff for quite a while, observing the landfill and its surroundings. This view was something I knew not many would experience, unless the opportunity presented itself. I realized that this would be the perfect spot for an educational facility where people could experience the unique beauty of a landfill, while learning about the important role it plays in our society and the many scientific factors that come to play.

The side of the bluff, especially, offers great building potential for a facility cantilevered out of the hillside, projecting visitors toward the landfill. I quickly envisioned an observation deck where people could look at the landfill and compare it to diagrams telling them what different zones were for, what the machinery does, and what the landfill's overall strategies and goals are.

I stood, picturing my proposed educational facility, and thinking about how this would give others the opportunity to learn about something that they, like me, probably never give a second thought to. Like myself, they probably have their garbage taken away and aren't very concerned about where it goes. Standing at the top of the bluff, looking at the landfill and thinking about everything I had learned about it that day, I thought about what I would do differently to reduce my amount of trash upon returning home.

Views or Vistas:

The site for this thesis project is located in a particularly interesting area. A farm field lies at the top of a bluff, which steeply slopes downward to the site of the Ponderosa Landfill. Because of the nature of the farm field and landfill, the site is incredibly open, allowing for wide, unobstructed views. The field is surrounded by trees on the east and west sides, and the landfill is surrounded by thick, tall trees, as well. This lends the site an isolated feeling, and cuts it off from the busy city and freeways nearby.

The farm field, in the shape of a triangle with rounded corners, lies on a flat plane, currently covered in tilled dirt, but filled with corn plants during farm season. Surrounding the field is a grassy road circling it. Surrounding that are the thick trees. Sloping down from the field in a South West direction is a grassy hill, flanked by more trees. The hill leads to the landfill, shaped like another rounded triangle, but a reflection of the farm field's triangle. Some portions have been covered by dirt which has grown over to create a grassy hill. Other portions of the landfill are filled with a mix of dirt, plastic bags, and other brightly colored garbage. Beyond that lies more grassy field and trees.

The site's boundaries are mainly the trees, as the road surrounding it is overgrown and rarely used. To the east lies the current scale house and the road down to the landfill, which offers a more concrete boundary. The hill to the southwest also bounds the site, as it is steep enough to indicate the difference between the spaces of the field and the landfill.

One would think that the view of the landfill would be unpleasant, as the term "landfill" usually contains very negative and undesirable connotations. However, especially from up on the top of the bluff, looking down on the landfill is actually quite pleasant. The rolling hills and machinery at work on them make for an interesting view. For me, this was because I had never given much thought to landfills, or how

they operate. Most people think of them as simply a pile of garbage, but there is actually much more science and strategy that goes into it. Viewing the landfill brings these aspects to light.

The sectional dynamic of the site offers more interest and character. The sloping hill serves as a separator, giving the feeling that those on top of the bluff aren't too close to the landfill, yet standing at the top of the hill offers splendid views of the entire space, and an overall view of the entire landfill. This view allows visitors to see the different sections of the landfill, or zones. The water treatment ponds and methane burners are also clearly visible.

Built Features:

The site is somewhat separated from the built environment as it is located a few miles outside of the busy city of Mankato. The trees surrounding it block even the furthest views of city life. There are only a few buildings on the site: the scale house lies to the east, where users can weigh and then drop off their garbage. The scale house also serves as an on site office for the landfill. Down the hill also lies a small shed, which houses machinery and supplies for the landfill. The only other buildings in the vicinity are a few older farm houses, hidden from view by trees.

A few other built features present itself around the site in the form of water testing wells. These wells encircle the farm field, and keep tabs on the effect of the adjacent landfill upon the water quality of the underground supply. Another small built feature is the methane burners located around the landfill itself. These burners take the methane created deep in the landfill and bring it to the surface to burn off in a safe manner. Though the wells and methane burners are little more than pipes sticking up from the ground, these built features are also important to consider when evaluating the site. A few power lines also have a presence on the site near the roads.

Light Quality:

Since the site is so open with few trees, there is plenty of natural light throughout the entire site, especially at the top of the bluff. This direct sunlight provided warmth to the site. The light had a bright white quality, especially in the fall when filtered through an overcast sky. The intensity of the light at the top of the bluff and on the hill was quite strong, because there wasn't much plant variation on the grassy hill, or tilled corn field. More filtered light was found down at the hills of the landfill, and near the edges of the site by the trees.

Vegetation:

The site is quite lacking in variation in vegetation because of the effect of humans on the site. The majority of the site is a farm field, and the majority of the adjacent lot is landfill, so there aren't many different types of grasses, weeds, or flora. The field is filled with corn plants during the farming season, and is tilled dirt, with some prairie grasses appearing here and there after harvest. The hill is covered in bland colored prairie grasses with not much else. The vegetation on the landfill is interesting, as some zones get piled as high as they will go, and then sealed off with dirt, where prairie grasses grow on top. The zones that are not sealed off lend itself to grasses that manage to grow through the piles of dirt and garbage. The texture of the grasses create a smooth looking hill, while the individual grasses, up close, are more prickly and dry than they are soft.

The trees surrounding the site offers some more interest and variation in the plant life of the site. The trees give some more lively and interesting textures and colors, especially in the summer and fall when they're most colorful.

Water:

The Minnesota River lies near the site, but is blocked from view by the plentiful trees. The river is the only surface water in the area. However, the water underground is extremely important to consider. Because the landfill is composed of less compacted materials, water drains extremely easily. This water is then collected at the bottom of the landfill in its lining, and brought to the water treatment ponds to prevent it from spreading into surrounding ground water. After the water runs through the treatment ponds, it is transported to irrigate the small field of crops on the other side of the landfill.

Additionally, the ground water needs to be monitored for pollution from the landfill. Wells are set up around the farm field to test the underground water to see how much of the water filtering through the adjacent landfill is seeping sideways into the bluff and affecting the existing ground water. At this time, small amounts of pollution is detected, but not enough to be a problem.

Wind:

At the top of the bluff, the site is considerably more vulnerable to wind. Because of its open nature, there isn't much protection, and the wind flows freely through the site, predominantly from the North West or the South, depending upon the time of year. The hill offers an interesting effect upon the wind, as the wind flows to follow its slope. The trees surrounding the site offer some protection when standing near the site's edges, or where the treeline bulges slightly into the site.

The wind at the landfill located at the bottom of the hill is no less harsh. Though the land is lower than that at the site atop the bluff, the open nature still lends itself to winds from any direction. The winds are stronger at the top of the hills than they are in the small valleys between landfill zones.

Human Characteristics:

Almost the entire site has been affected by human intervention. The farm field at the top of the bluff has clearly been created by humans, evidenced by its tilled up earth and flattened, tree-less topography. The Environmental Services Department owns the land, and rents it out to farmers who work the field. Thus, over the course of the year, the land is tilled, planted with corn, irrigated, and harvested. The road surrounding the field and going down to the landfill is another result of human's effects upon the site. The roads are simple gravel paths, and a switchback carved into the hillside allows vehicular travel down to the landfill.

The landfill itself is also a prime example of human tampering with the existing land. The landfill contains piles of trash that have been deposited by humans, piled to certain heights and areas, before being capped off by a layer of dirt and allowed to grow over. The locations for the piles are planned out, as the entire area is divided into different cells, to be filled in a certain order. Besides the landfill's topographical changes to the existing site, human activities are also present on the site. Machinery is necessary to compact the trash and mix it in with the dirt, and vehicles are also required to bring deposits to and from the landfill.

Finally, human influence upon the site is also found in the previously mentioned power lines, methane burners, and water testing wells.

Distress:

The entire site appears to be in distress. As previously stated, the majority of the site has been extremely affected and changed by human intervention, most likely for the worse of the site and environment. The farming is hardly a positive thing for the native environment, and actively work against what the site's natural conditions want to be.

By depriving the site of the natural grasses and vegetation that would otherwise be present, considerable distress is placed on the site.

However, the farm field pales in comparison to the distress placed upon the site by the landfill. Creating a landfill requires digging into the land, installing harsh, man made materials such as plastics for use in drainage and keeping the chemicals from the landfill from seeping into the ground. However, some amount of chemicals still affect the surrounding land, travelling in water that manages to move away from the site. Additionally, the piling of various types of garbage undoubtedly does irreparable and irreversible damage to the land, which we still may not know the full extent of for years to come.

Soils:

Blue Earth County soils belong predominantly to the order of Mollisols. Mollisol soil generally has a thick, nutrient rich top layer, and is found in the areas of Minnesota that were at one time, or are still, prairies. The suborders of soil found at the region are both Udolls and Aquolls soils (Soils, 2001). According to the Natural Resources Conservation Service's Web Soil Survey, the farm field at the top of the bluff is composed of terril loam, lester loam, shorewood silty clay loam, kilkenny clay loam, and grays silt loam. The hill leading from the top of the bluff to the landfill is composed of storden comples, and the landfill itself has lasa fine sand, wadena loam, le sueur clay loam, and terril loam (Web soil survey).

Soils in landfills are heavily artificial, as a specific kind is necessary to use, and therefore is often not the native soil of the site. Landfills are built on top of the existing soils, but soil is also brought in to be mixed in with the garbage. This helps hold down the garbage and ensures that it stays put. This soil needs to be rich in clay, which makes the soil less permeable. This helps control the leachate, or water, that flows through the landfill, and keeps it from leaving the landfill (Montezuma).

Water Table:

The water table in much of Minnesota lies relatively close to the surface, usually within about 50 feet or less (Water table, 2012). because of the farmland at the top of the bluff, water drainage isn't much of a problem as it sinks into the ground. Water falling on the hill runs downward into the landfill, and water in the landfill flows through the garbage piles and gets caught up in the landfill's filtering system. The water is then brought to the water treatment ponds to remove the toxins acquired from the landfill.

Utilities:

Located around the site are various water monitoring wells, which are tasked with testing the underground water supply to monitor the effect of the toxins from the landfill. Gas probes and wells are also located around the site. There are also power lines along both the roads around the site, and water and sewer service to the scalehouse nearby.

Vehicular Traffic:

The site is bordered on the northern and eastern edges by T-188 (Gooseberry Lane). T-188 dead ends shortly after the site. Also near the site is T-189, which leads down the steep hill and through the landfill. There is very little vehicular traffic on these roads, as there are only a few houses nearby. Therefore, the majority of the limited traffic is going to and from the scalehouse and landfill.

Pedestrian Traffic:

There are no sidewalks on the site, no designated walking paths, and, thus, no pedestrian traffic. This is because the only activity at the site are farmers plowing the farm land, workers compacting the landfill, and the public dropping off unwanted goods.

Topographic Survey:

The site is slightly higher in the middle of the farm field and very gradually slopes outward in all directions. The bluff slopes downward to the southwest at about a 25% slope. At the bottom of this slope, the landfill contains a variation of different artificial hills made by the piles of garbage.

Visual Form:

Standing at the top of the bluff, the farmland to the north and east appears almost flat. Looking down the hill of the bluff, which slopes from northeast to southwest, a clear feeling of separation from the landfill below occurs. The surrounding tree line encloses most of the site and landfill, except to the north where there is another flat farm field. The landfill below dips up and down in a series of mounds, before sloping back upward slightly at the three other sides of the landfill to meet the treeline.

Plant Cover:

There is very little variation in plant cover, which means that the plants don't have much of an effect in changing the feeling of different areas of the site. Whether it's bordering the farm field, covering the hill sloping from the top of the bluff to the farm field, or creeping into different areas of the landfill, the native prairie grasses are the predominant source of plant life. This grass doesn't offer much diversity, and, therefore, the majority of the site feels dry due to its direct exposure to the sun and wind. The trees surrounding the site offer a little more shade and humidity, although this is not quite as predominant in the dry fall.

Site Character:

The grasses at the site look fairly unhealthy near the landfill, but this is to be expected. The characteristics of the farm field and hill leading down to the landfill seem fairly stationary as there isn't much affecting it. New grass tries to grow in the field, and is then tilled up and brought back to dirt to be planted, which grows corn, and then is cultivated. Then, native grass tries to grow again, and the cycle continues.

The adjacent landfill, however, changes very quickly. New garbage is piled on almost daily, then crushed down and worked into the dirt. Over time, the garbage piles up until a small hill has been formed. This hill is then covered with dirt and allowed to grow over with native grass. Then, another cell is started, piling garbage and creating a new small hill. However, over time, the small hills continue to settle and shrink as time weighs down upon it. Thus, the character of the landfill and the views it provides from the site are ever changing.

Aerial View:

Fig. 7.1. Aerial View. From Google Earth, 2012

Boundaries:

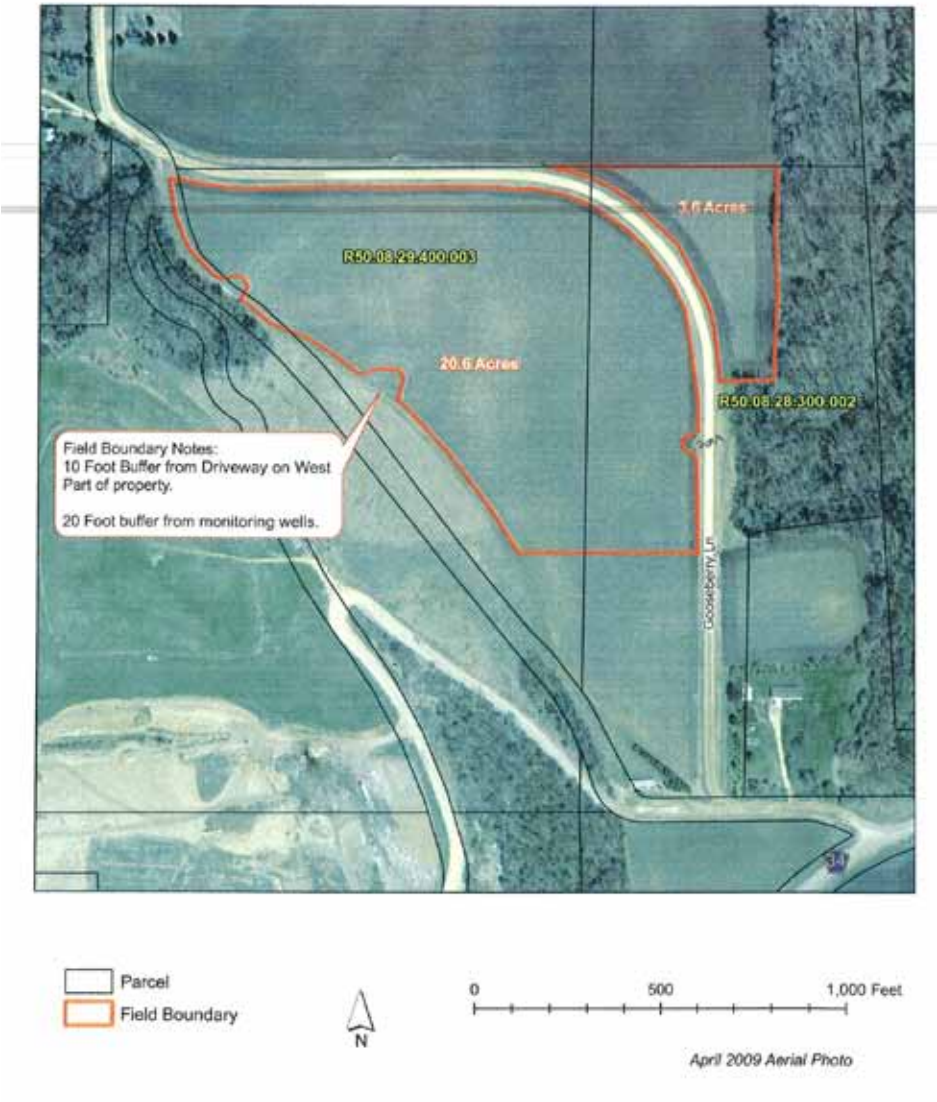


Fig. 7.2. Boundaries. From S. Fichtner, personal communication, October 2, 2012.

Land Survey and Topography:

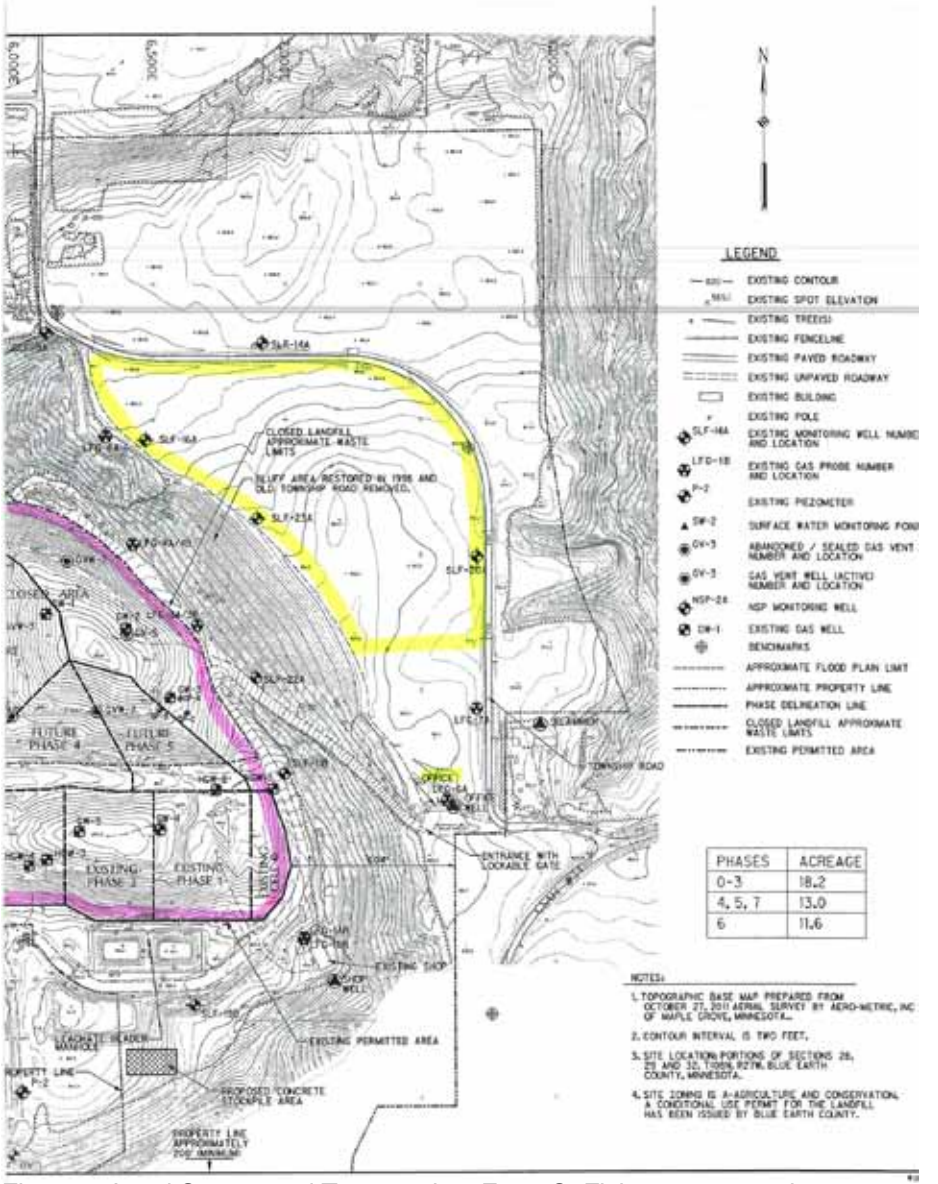


Fig. 7.3. Land Survey and Topography. From S. Fichtner, personal communication, October 2, 2012.

Base Map:

Fig. 7.4. Base Map. Underlying image from Google Earth, 2012.

- Paved Road
- Unpaved Road
- Blue Earth County Property Line
- River
- Monitoring Well
- Gas Probe or Well
- Existing Building
- Trees or Tree Line
- Farm Land
- Landfill Cells Boundary
- Prairie Grass
- Power Lines

Site Reconnaissance:

Fig. 7.5. Reconnaissance. Underlying image from Google Earth, 2012.

North:

East:

South:

West:

Temperature (in degrees Fahrenheit):

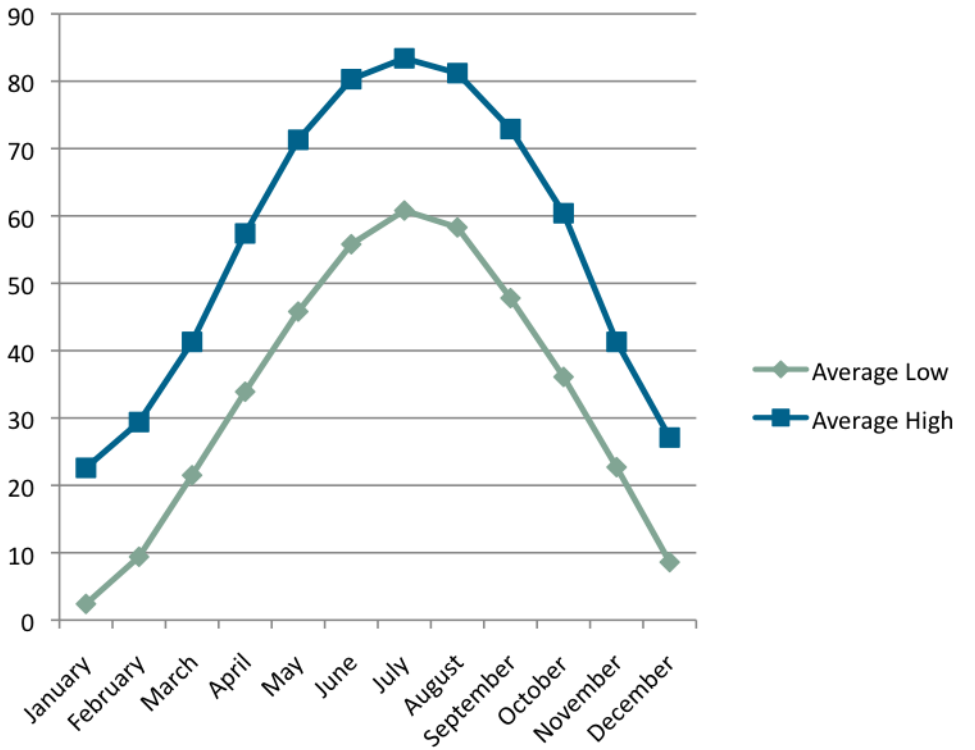


Fig. 8.1. Temperature. Data from Mankato, MN. Retrieved from http://www.city-data.com/city/Mankato-Minnesota.html

Humidity:

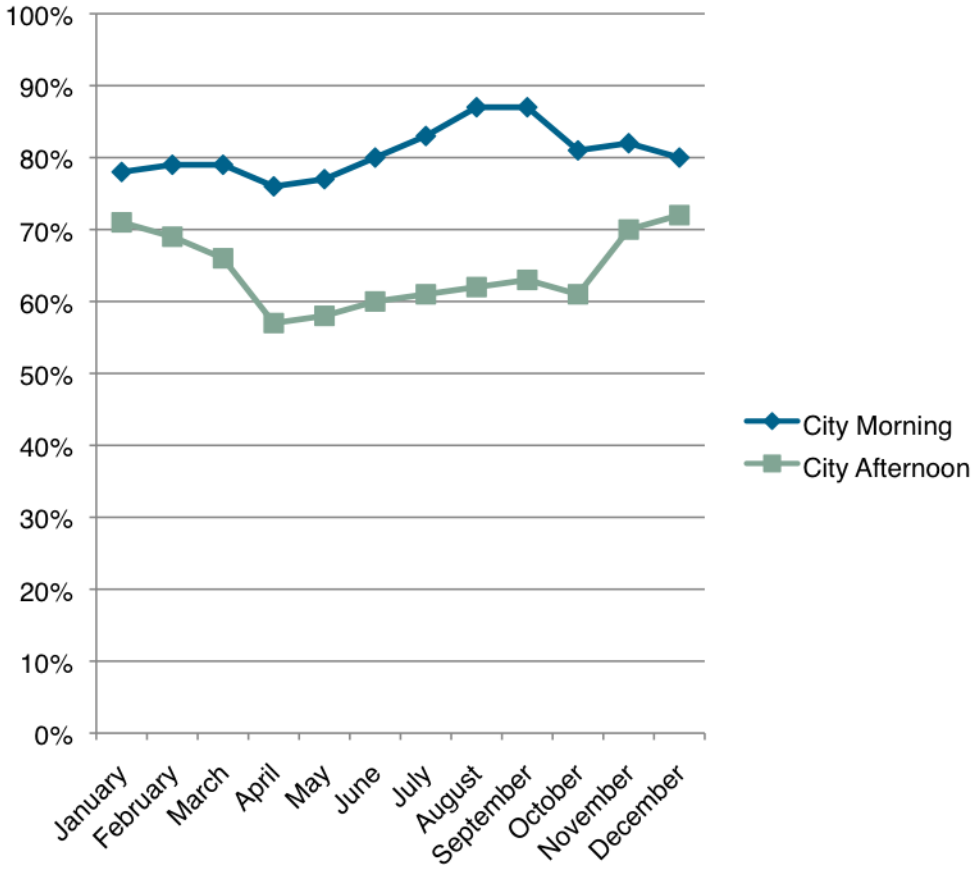


Fig. 8.2. Humidity. Data from Mankato, MN. Retrieved from http://www.city-data.com/city/Mankato-Minnesota.html

Precipitation (in Inches):

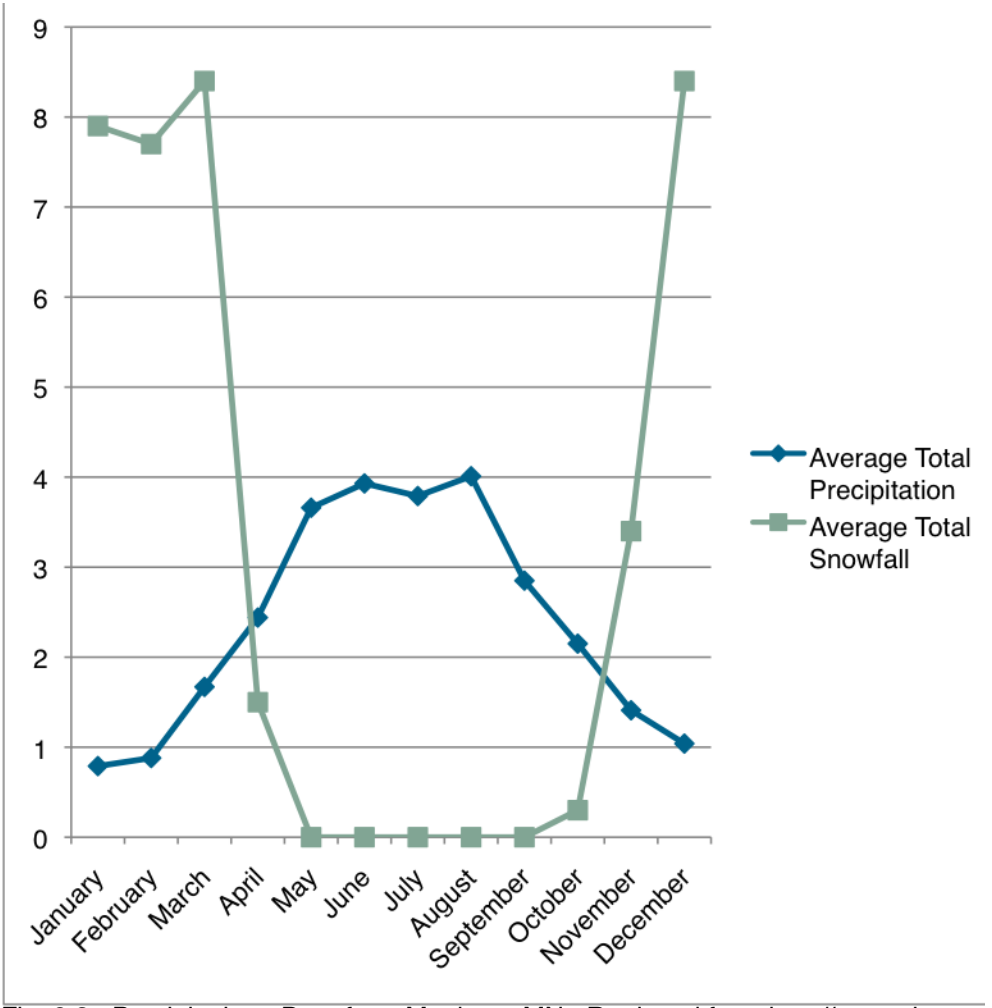


Fig. 8.3. Precipitation. Data from Mankato, MN. Retrieved from http://www.city-data.com/city/Mankato-Minnesota.html

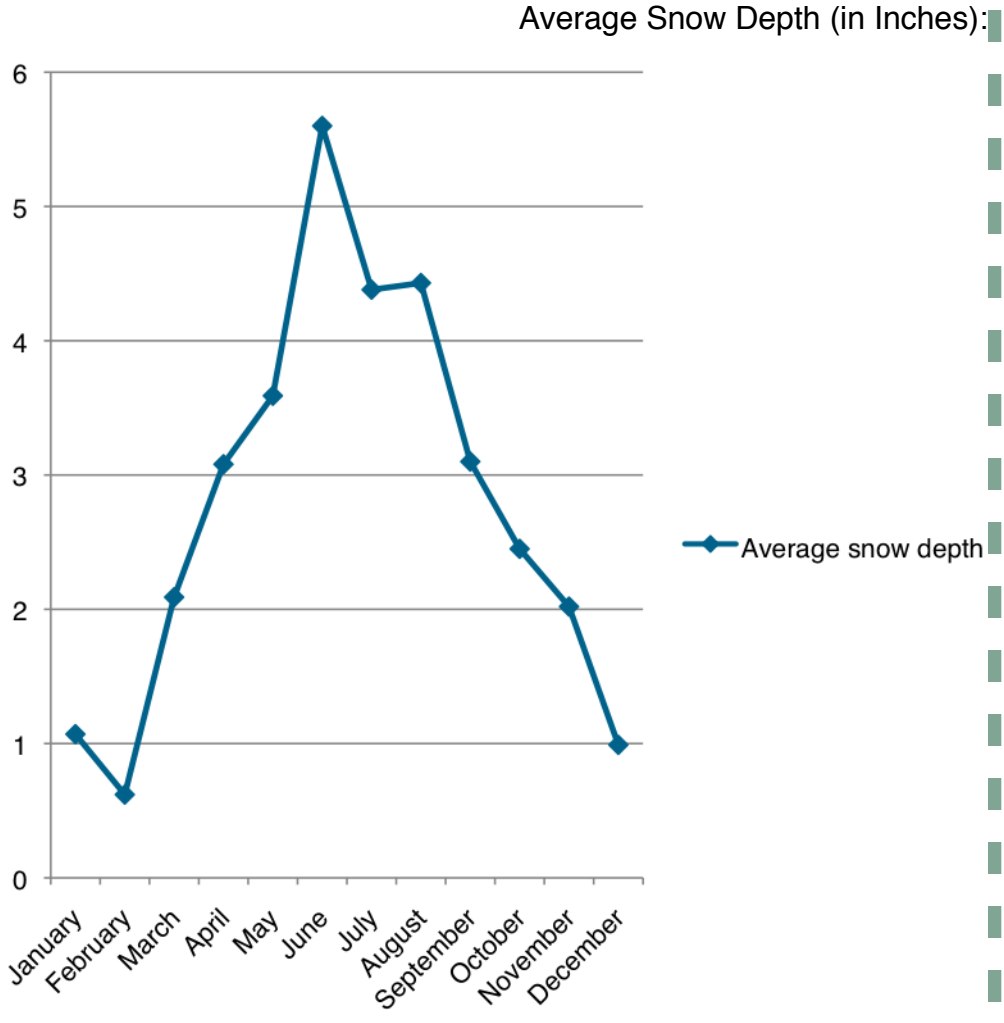


Fig. 8.4. Snow. Data from Mankato, MN. Retrieved from http://www.city-data.com/city/Mankato-Minnesota.html

Annual Cloudy Days:

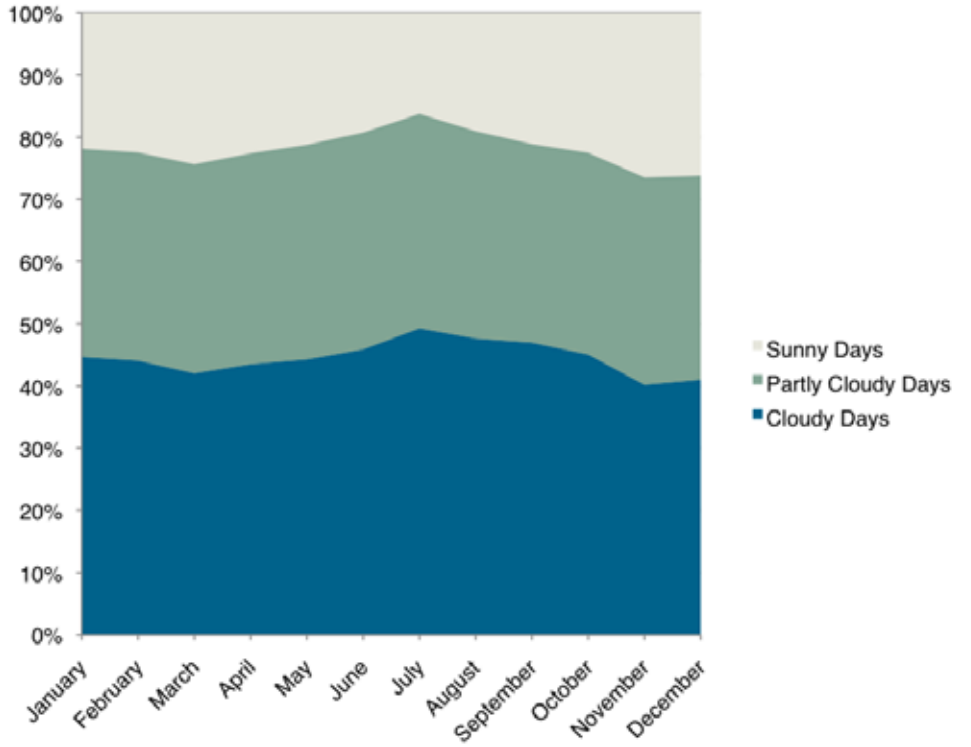


Fig. 8.5. Cloudy Days. Data from Mankato, MN. Retrieved from http://www.city-data.com/city/Mankato-Minnesota.html

Sunrise and Sunset:

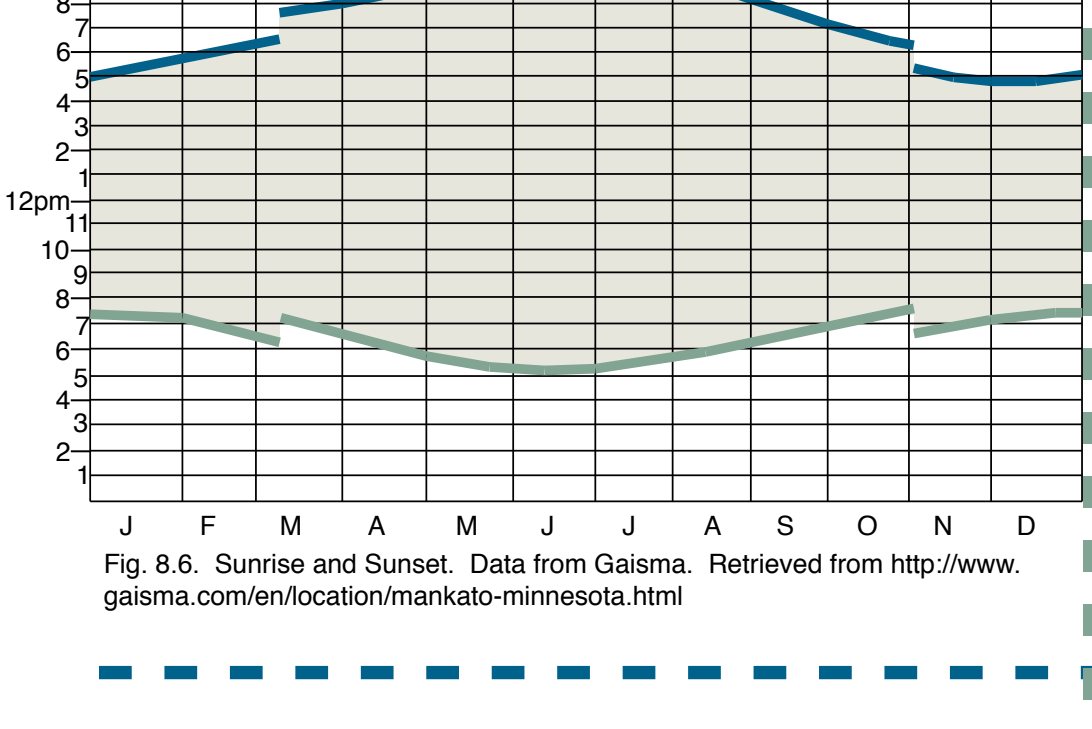


Fig. 8.6. Sunrise and Sunset. Data from Gaisma. Retrieved from http://www.gaisma.com/en/location/mankato-minnesota.html

Wind Speed (in MPH):

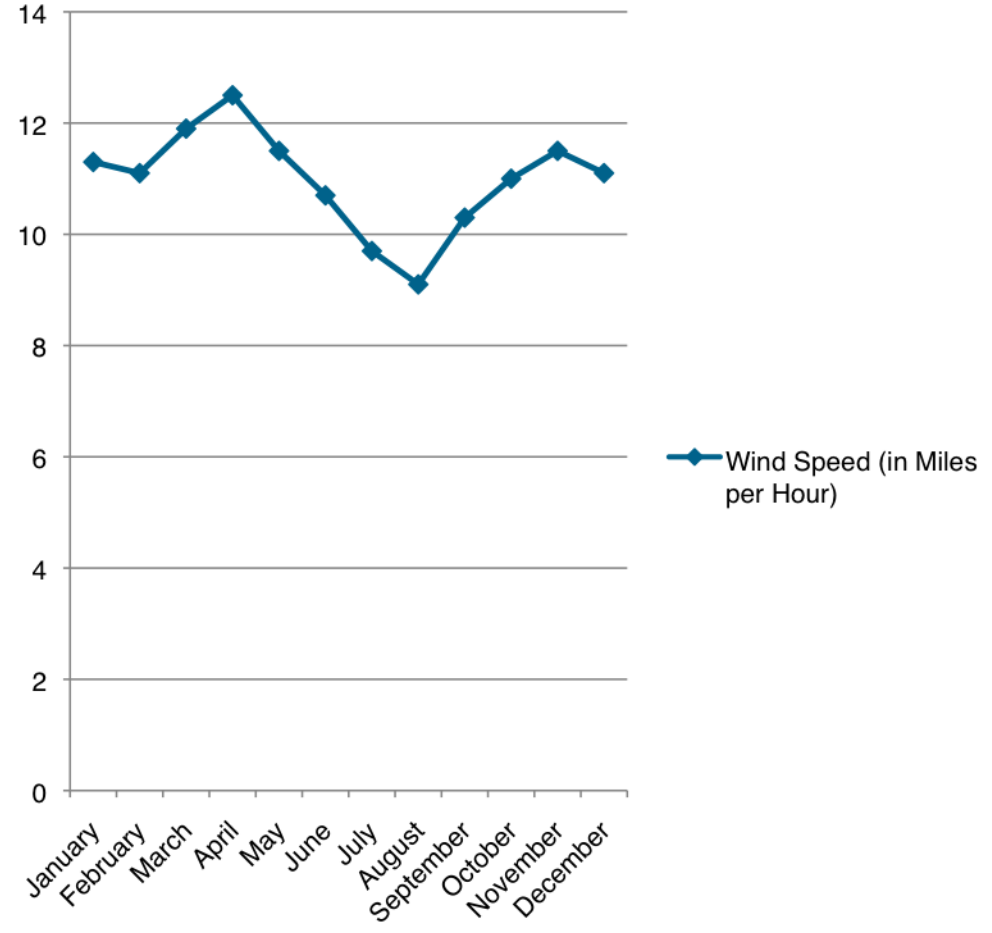


Fig. 8.7. Wind Speed. Data from Mankato, MN. Retrieved from http://www.city-data.com/city/Mankato-Minnesota.html

Wind Direction:

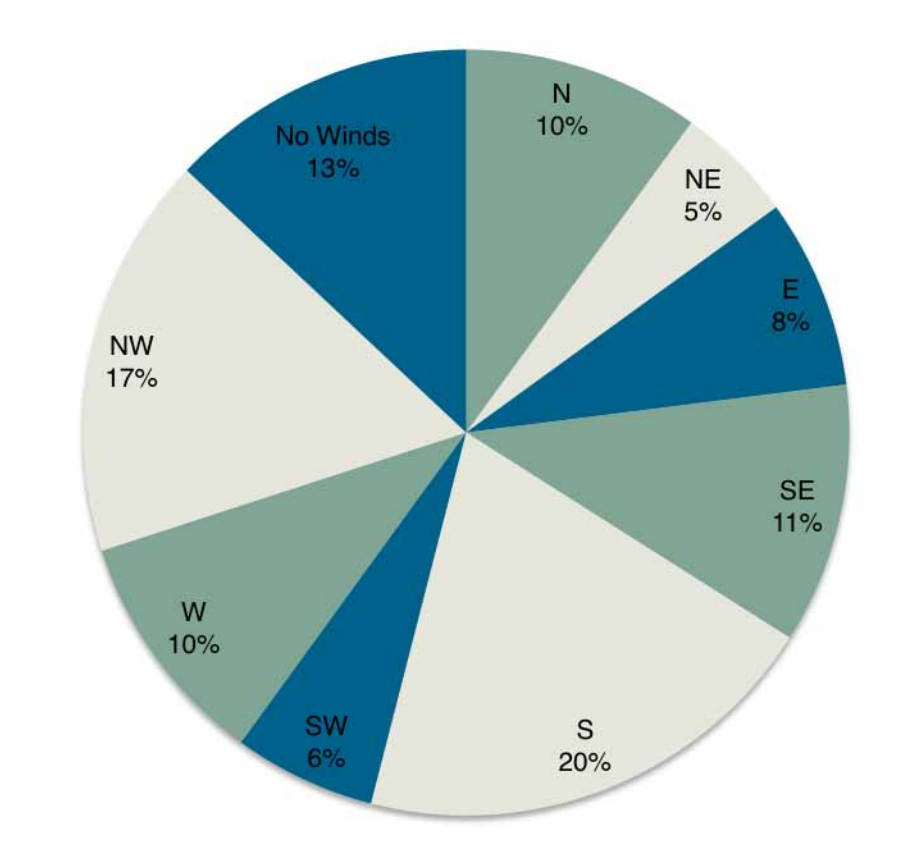


Fig. 8.8. Wind Direction. Data from Average Weather in October for Mankato, Minnesota, USA. Retrieved from https://weatherspark.com/averages/30901/10/Mankato-Minnesota-United-States

The city of Mankato has experienced 17 natural disasters over the years, 14 of which were declared major disasters by the president at the time (Mankato, Minnesota, 2012).

Causes of Natural Disasters (some incidents are attributed to more than one category):

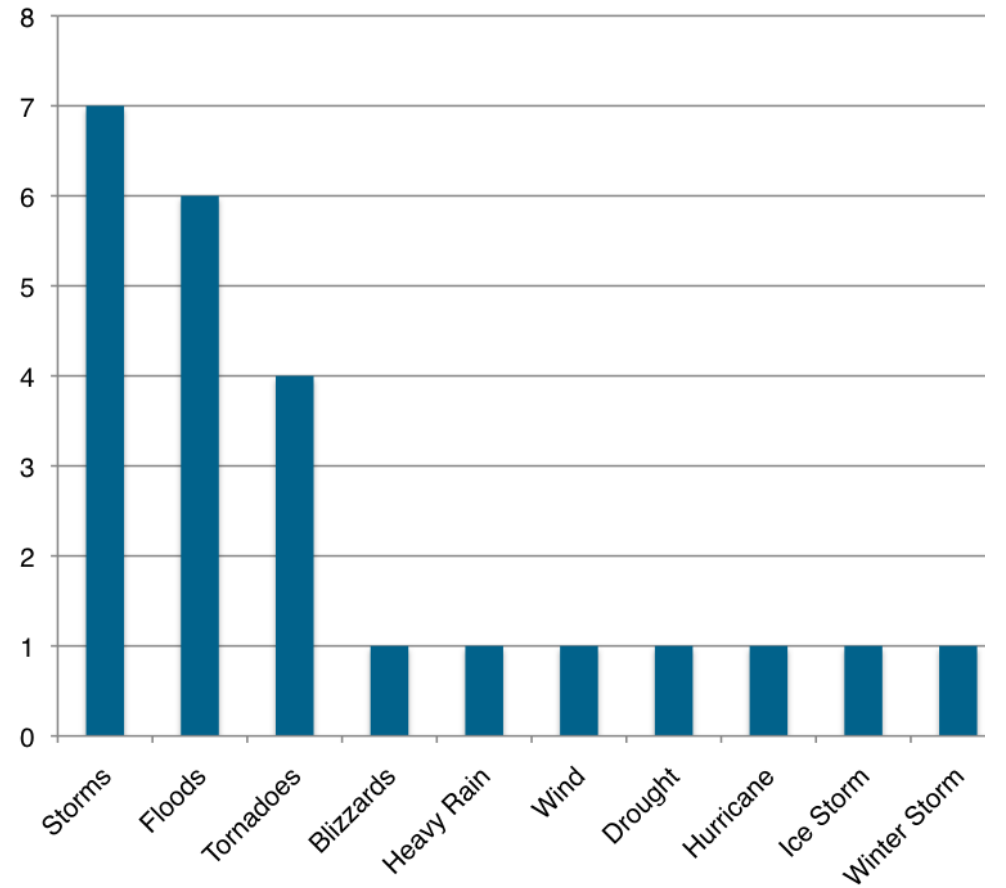


Fig. 8.9. Natural Disasters. Data from Mankato, MN. Retrieved from http://www.city-data.com/city/Mankato-Minnesota.html

Noise:

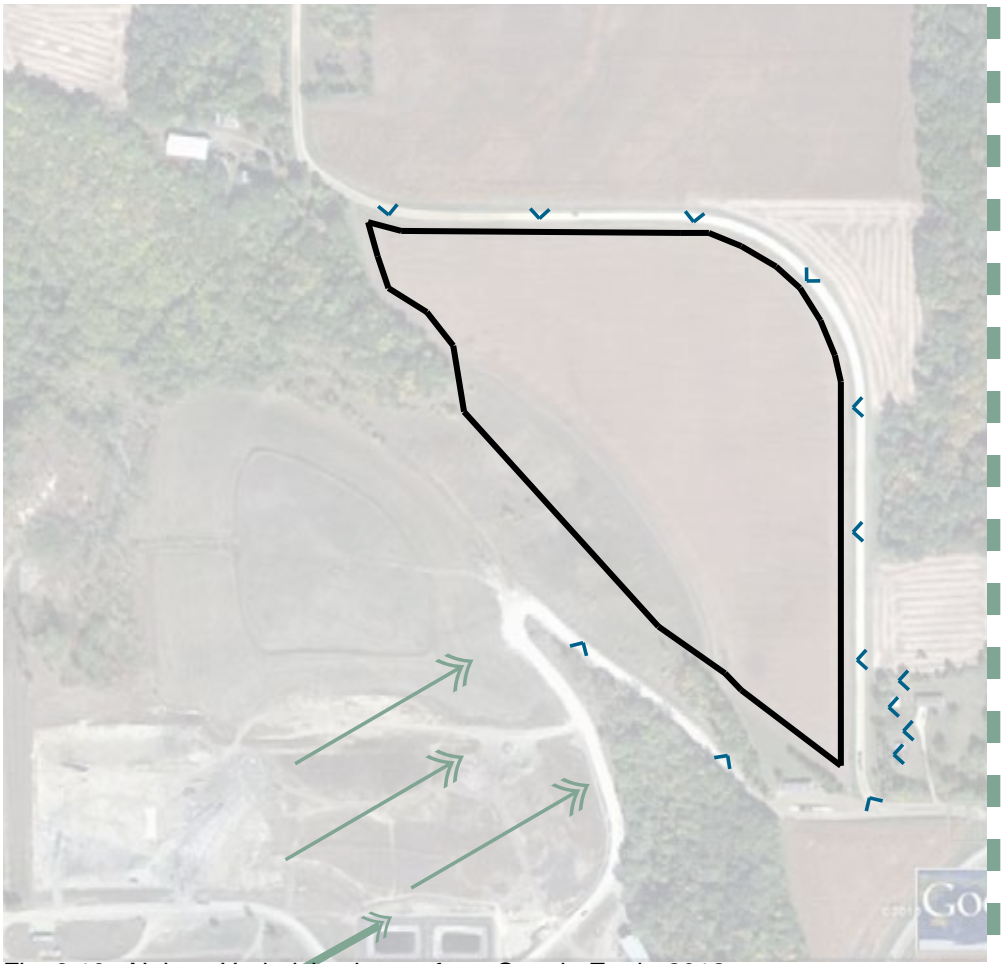


Fig. 8.10. Noise. Underlying image from Google Earth, 2012.

= Machines working in landfill

= Very light traffic, and noise from scale house

Shading:

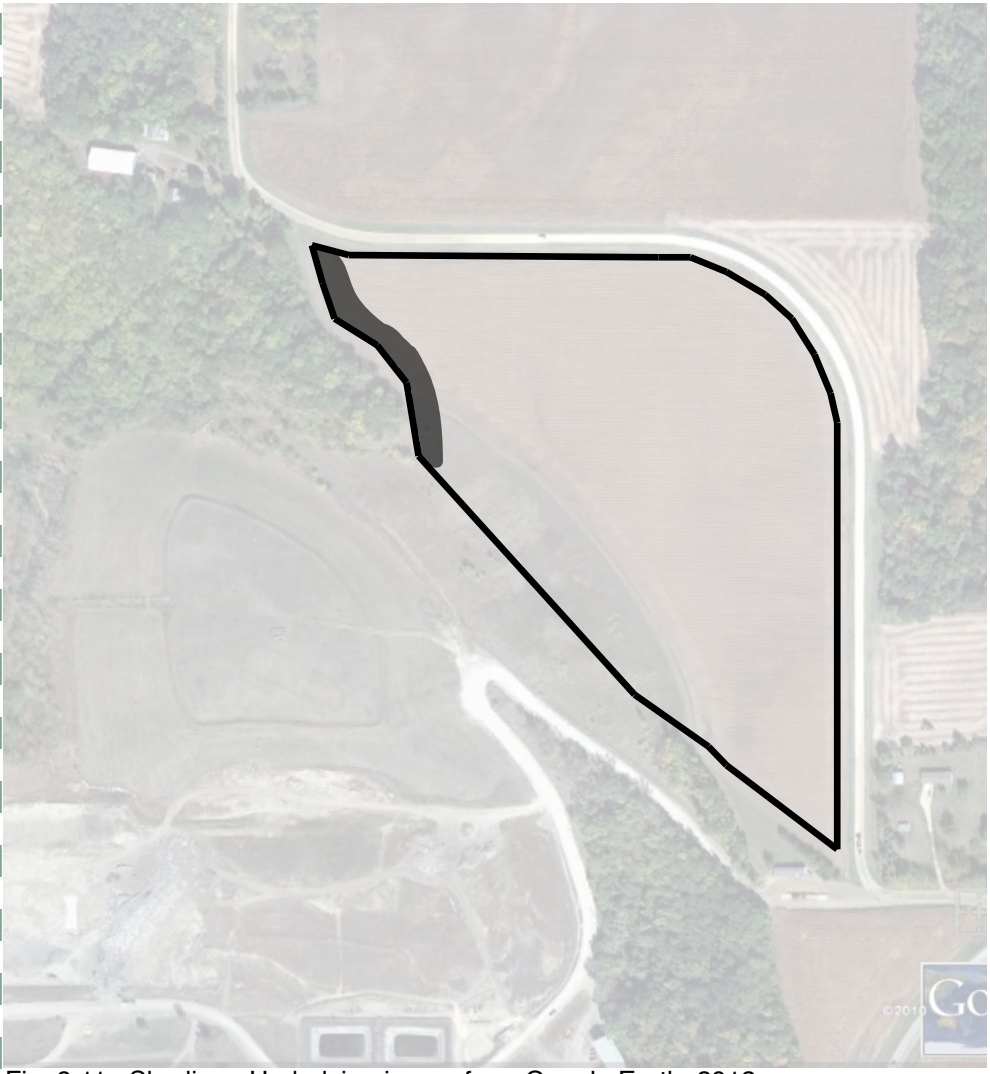


Fig. 8.11. Shading. Underlying image from Google Earth, 2012.

Sun Path:

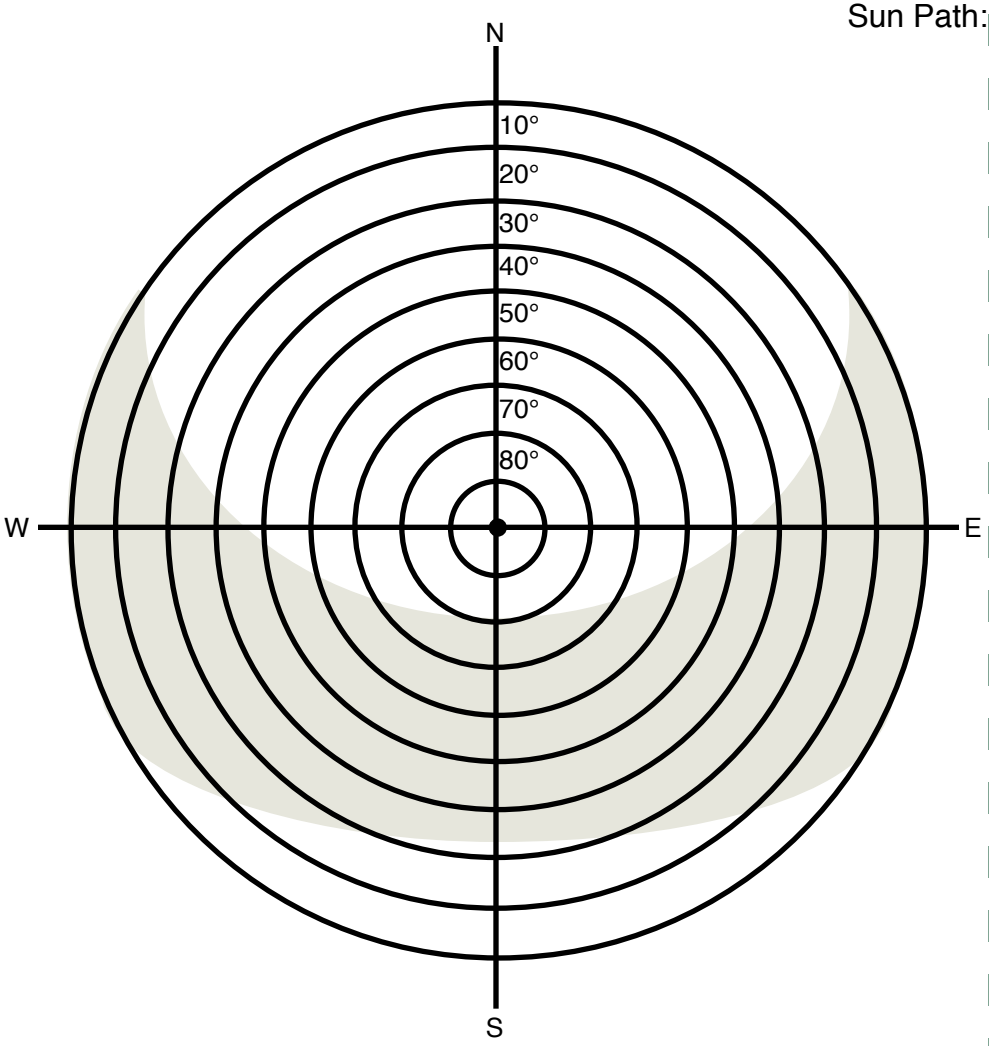


Fig. 8.12. Sun Path. Data from Gaisma. Retrieved from http://www.gaisma.com/en/location/mankato-minnesota.html

Topography and Air Movement:

Fig. 8.13. Topography and Air Movement. Underlying image from Google Earth, 2012.

The site has a relatively flat space sitting atop a bluff. The bluff slopes downward at around a 25% slope, in a south west direction. This slope affects winds travelling from the south, and exposes the hillside to more direct sunlight.

Slope and Climate:

Fig. 8.14. Slope and Climate.

Space Allocation:	
	Clerical:
Director's Office	250sf
Employee Offices (2)	2x150sf = 300sf
Conference Room	300sf
Employee Lounge	250sf
Kitchen	400sf
Employee Rest Rooms	200sf
	Education Center:
Entrance	250sf
Reception/Information	500sf
Exhibits and Displays	7500sf
Public Rest Rooms	400sf
Large Classroom/Presentation Space (2)	2x350=700sf
Small Classroom/Presentation Space	250sf
	Grounds:
Observation Deck	500sf
Recycling/Compost	750sf
Gardens	500sf
Water Collection and Storage	250sf
Parking	50 spaces + bus spaces
Circulation/Storage/Mechanical	20%
	11300sf +2260sf = 13560 total built square feet
	+ 2000+ square feet of grounds and exterior space

Interaction Matrix:

Fig. 9.1. Interaction Matrix.

Interaction Net:

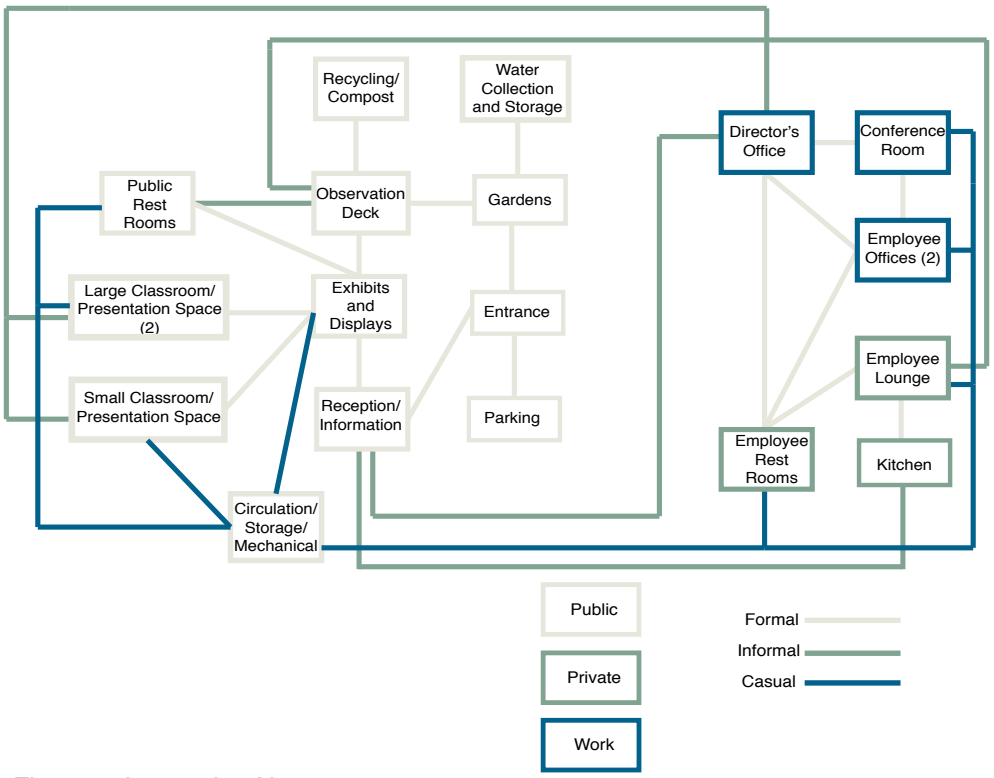
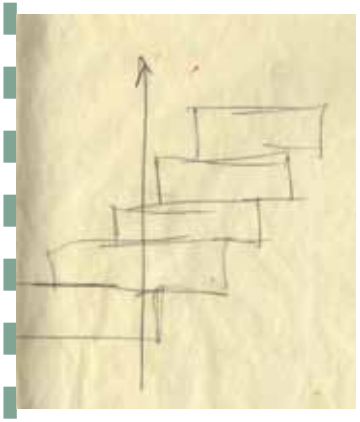


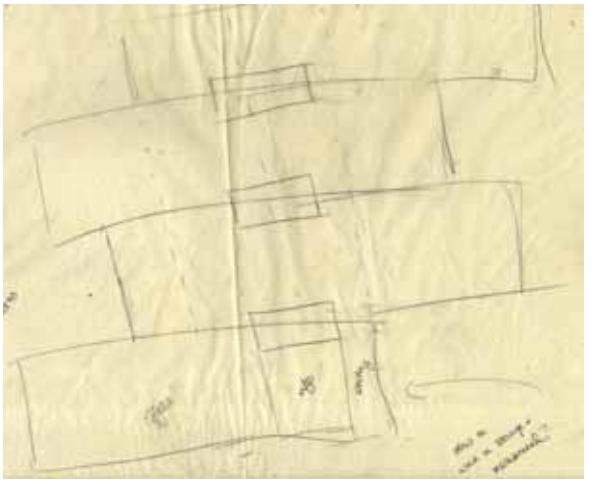
Fig. 9.2. Interaction Net.

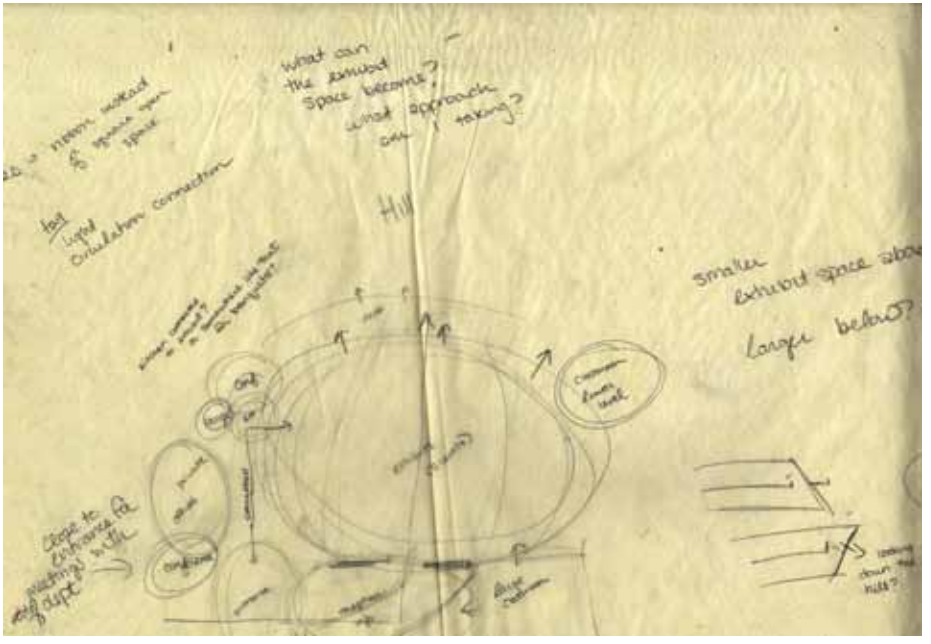
Changes to original program after design phase:

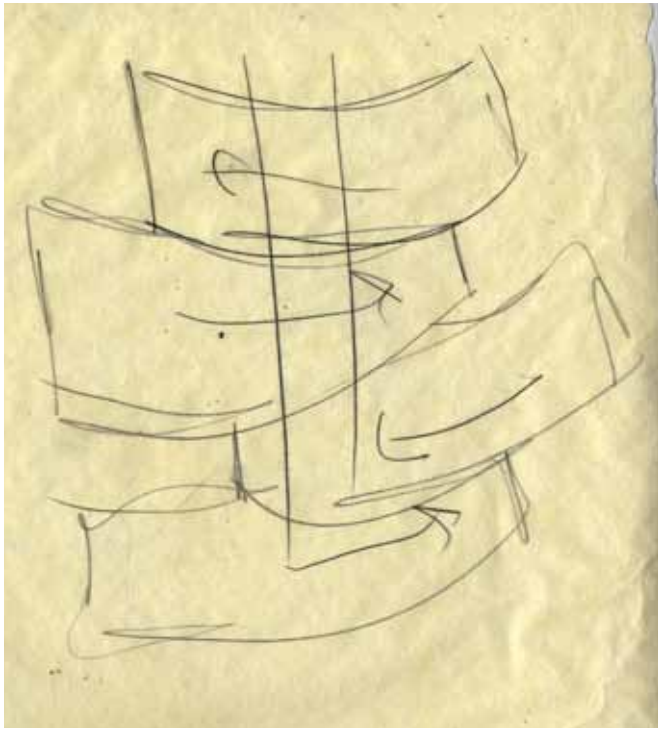
Lobby/Information
(850 sq. ft.)
Offices
(672 sq. ft.)
Conference Room
(350 sq. ft.)
Employee Break Room
(230 sq. ft.)
Mechanical
(385 sq. ft.)
Storage
(484 sq. ft.)
Classrooms
(1427 sq. ft.)
Flexible gallery/exhibit space
(Landfill info)
(1979 sq. ft.)
Flexible gallery/exhibit space
(What you can do at home to become more green)
(2229 sq. ft.)
Flexible gallery/exhibit space
(Green systems used in the building)
(1880 sq. ft.)
Flexible gallery/exhibit space
(Climate change)
(2792 sq. ft.)
[Total gallery/exhibit space: 8880 sq. ft.]
Observation deck
(2260 sq. ft.)
Garden

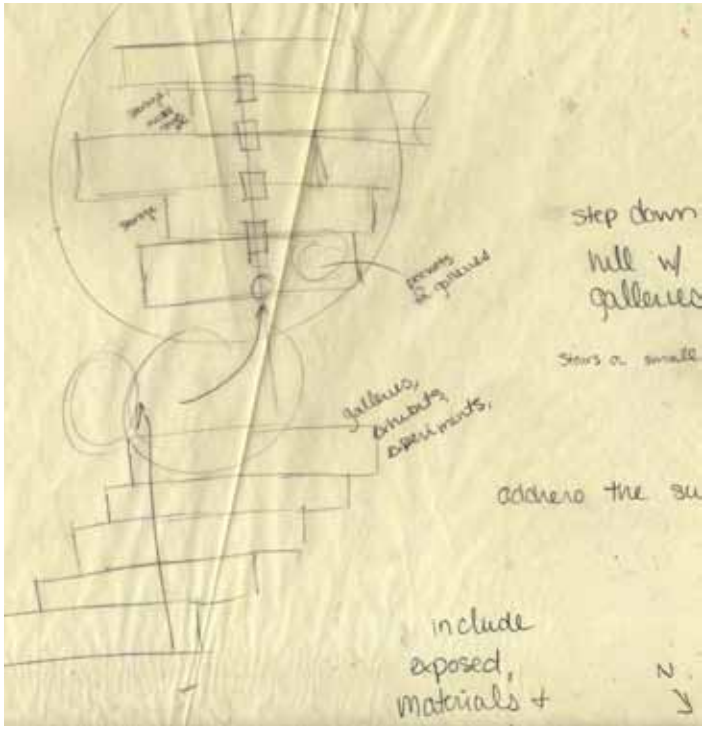
Design Documentation



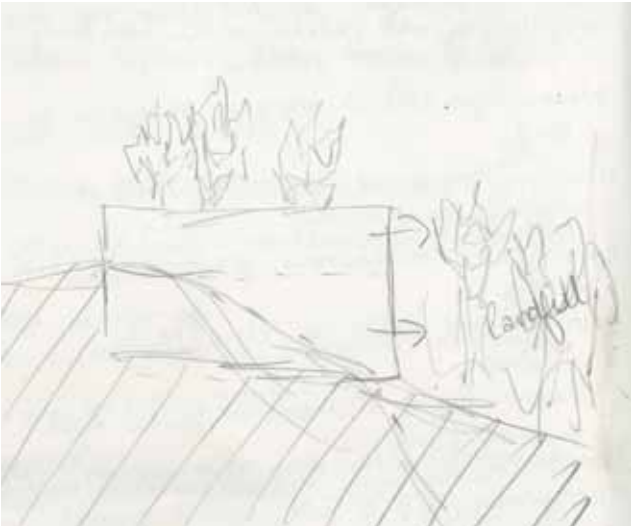



What can the exhibit space become?
What approach can I take?
smaller exhibit space above
Larger below?



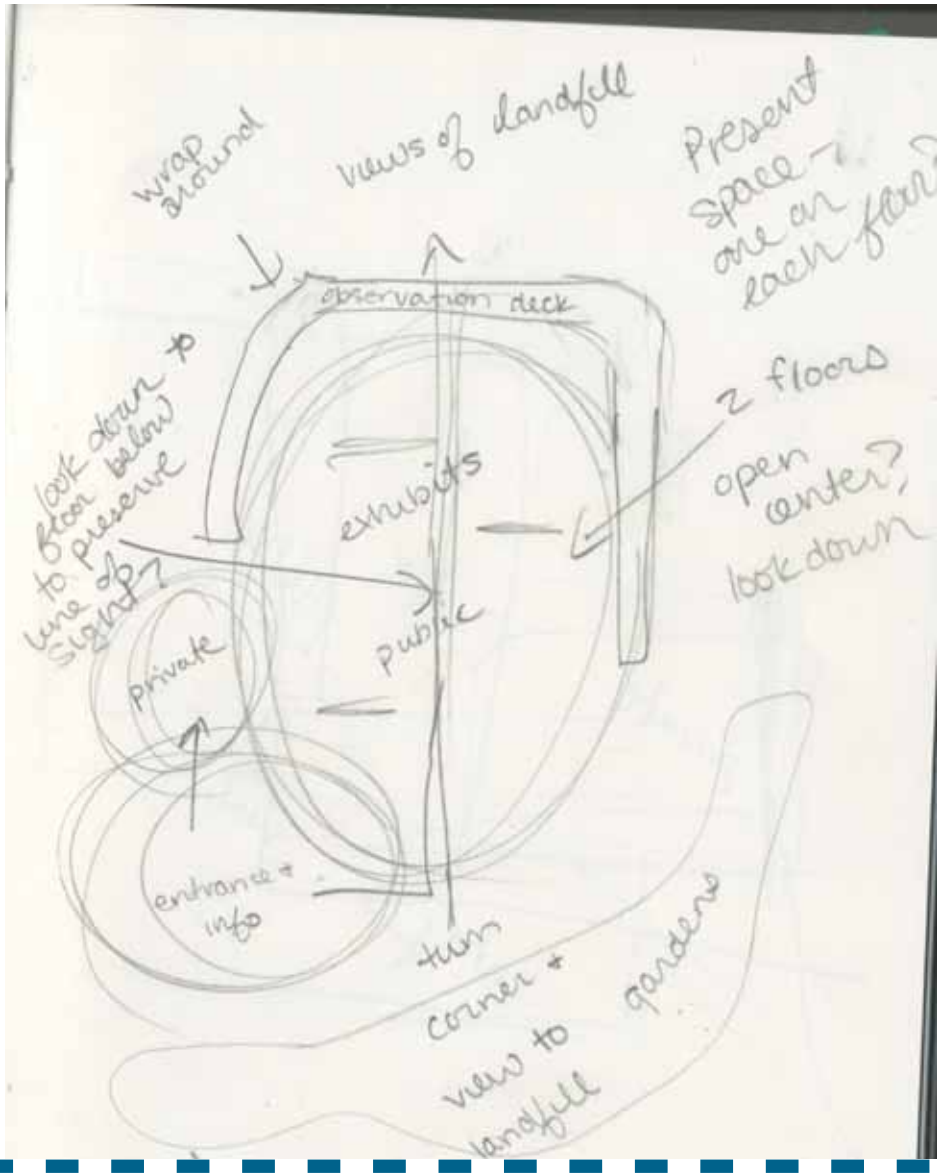

step down
hill w/
galleries
include
exposed,
materials +
N

This is a sketch I drew while visiting the site. I had originally planned on using the farmland at the top of the bluff, but once I visited, I was intrigued by the way the building could interact with the landscape of the bluff and look out over the landfill.

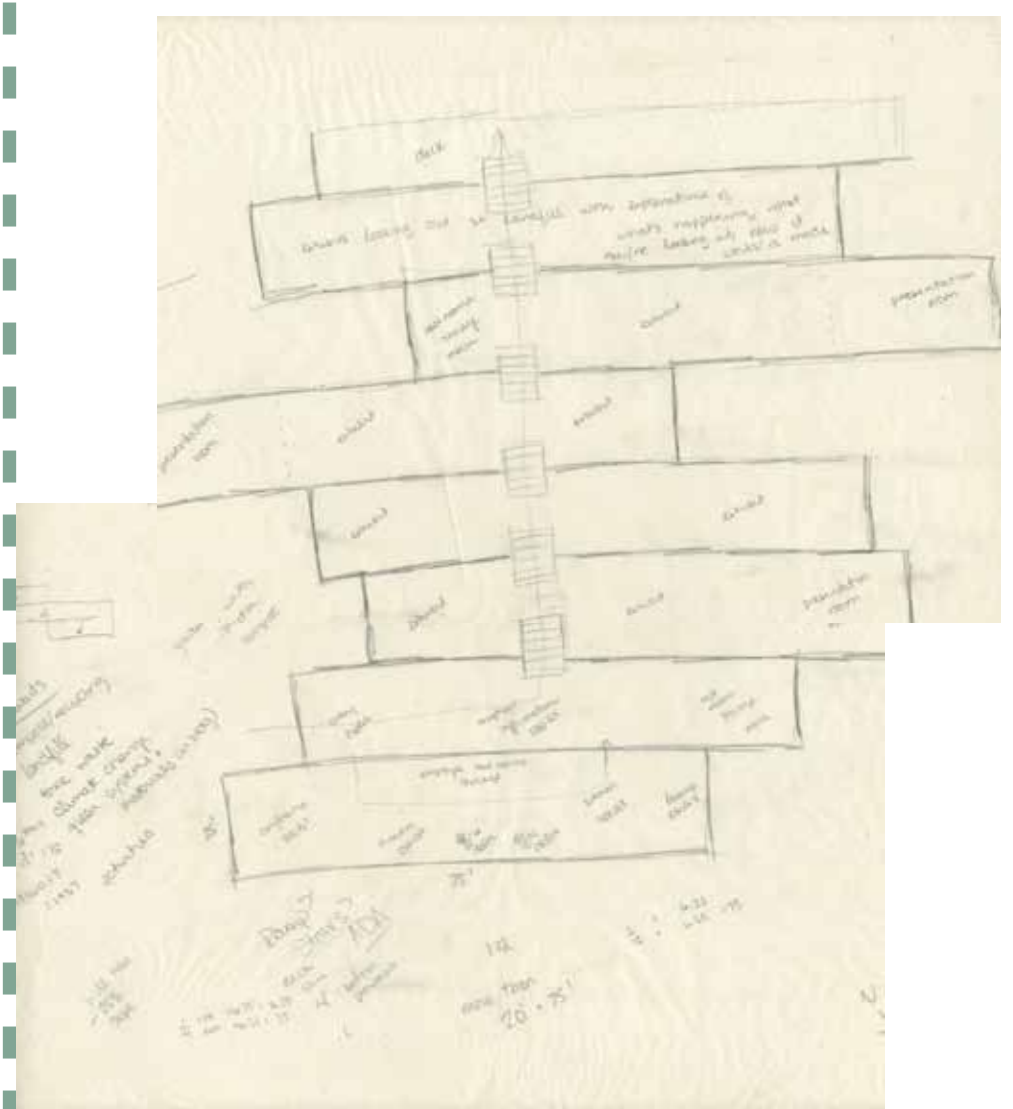


I also thought about placement on the site and how that would affect the facility's sun exposure, access and parking, and views.

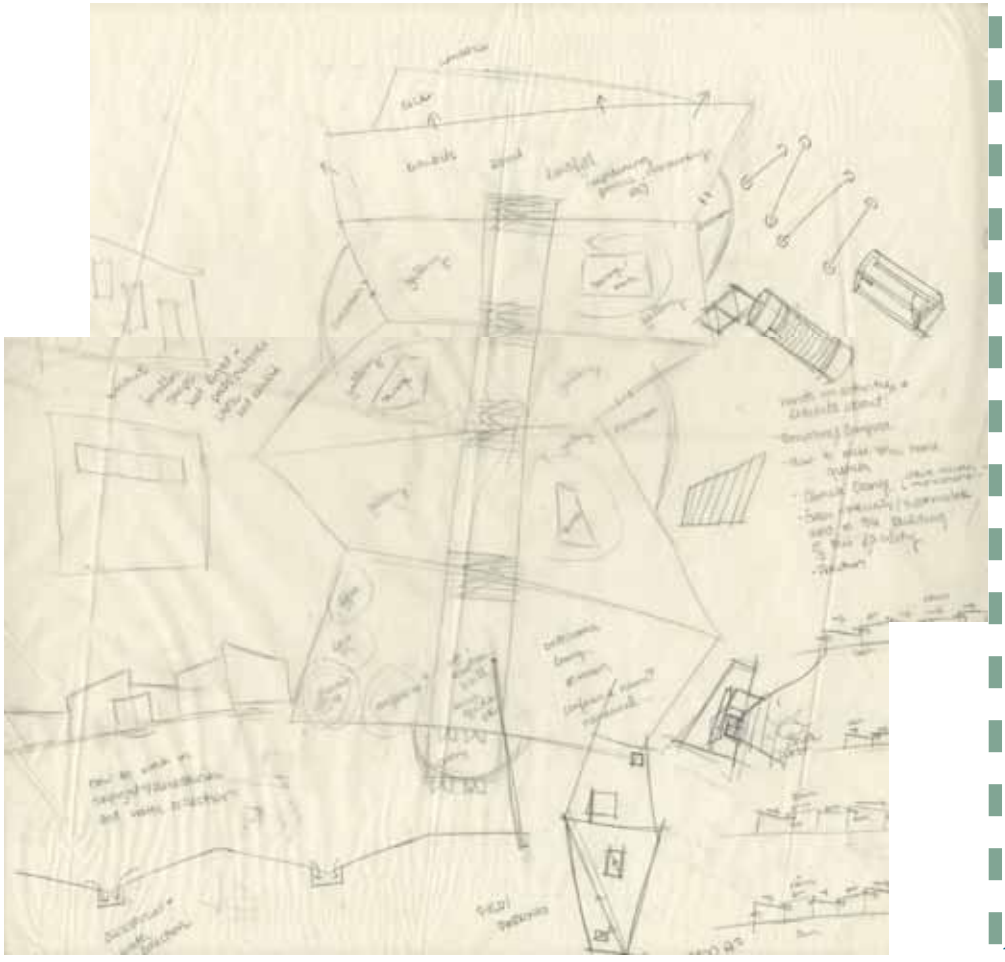
I began thinking about the relationships between spaces, such as the private office and conference spaces, and the public gallery spaces. I was also interested in the way visitors would move through the galleries and eventually be presented with the views of the landfill and surrounding property. During this time, I was also working on how many floors I wanted the facility to be, and how it would interact with the bluff.



This sketch begins to resemble my final solution. I was working on creating pockets of spaces which would make it easier to create exhibits focused on different topics. This is also where I started thinking about using multiple levels that would follow the slope of the hill.

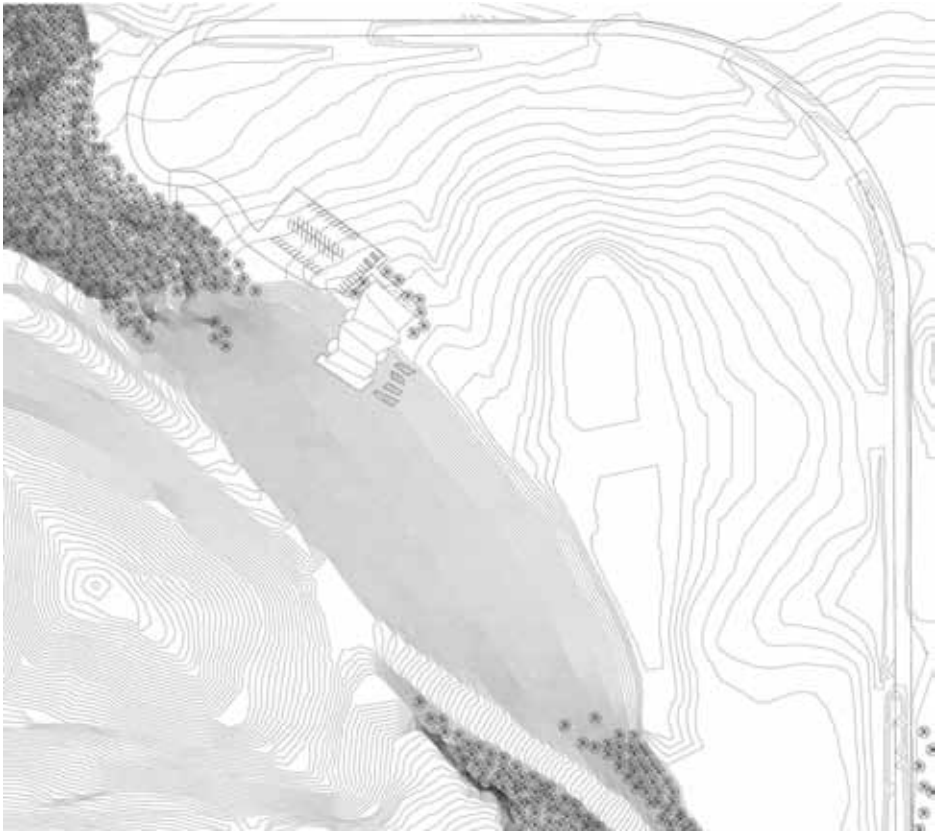


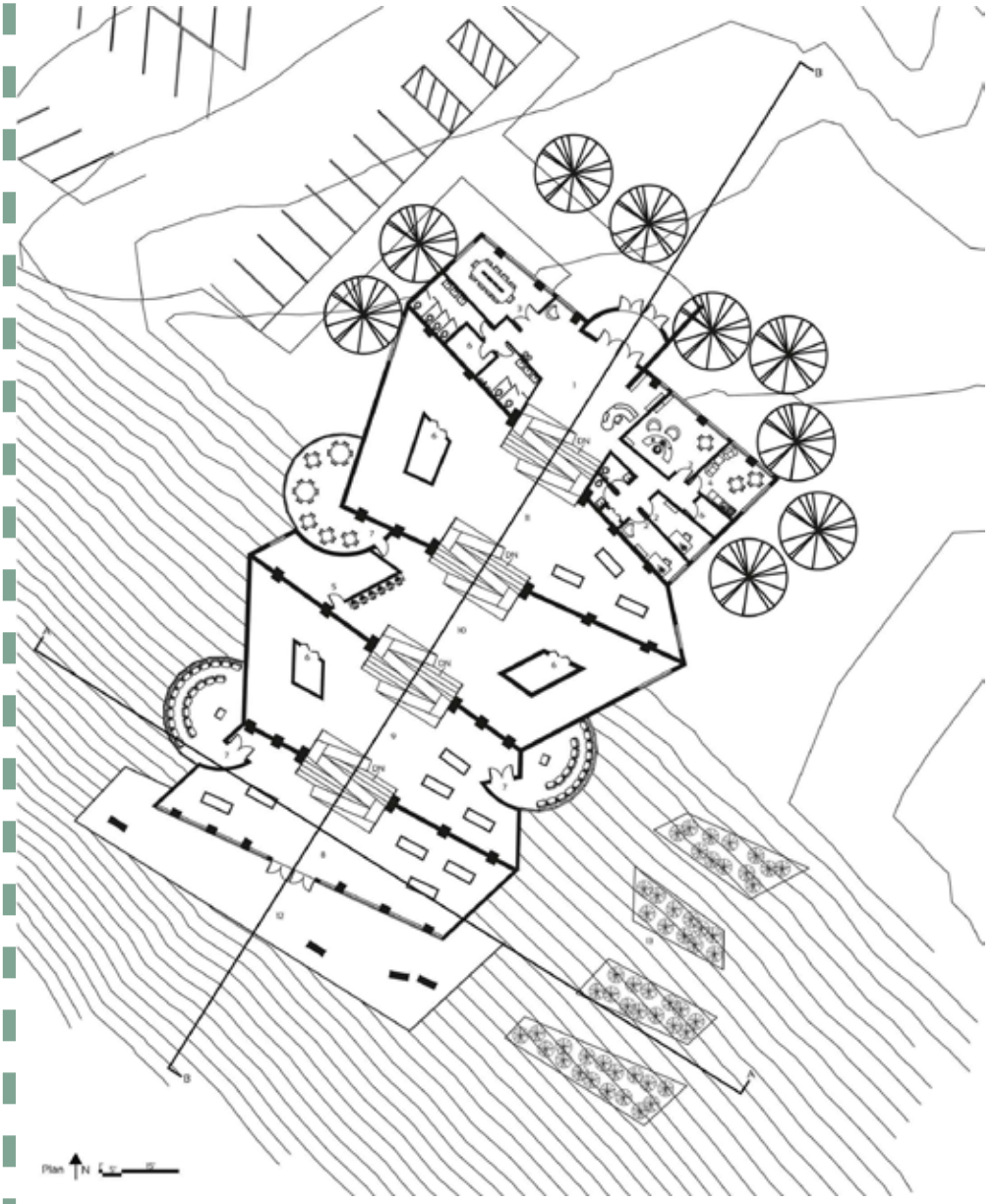
This sketch represents the very last brainstorming I did before moving to the computer. I wanted to create more interesting and dynamic spaces by skewing the walls creating more irregular shapes. This provided good pockets for classrooms given circular shapes to offset the sharper corners created by the resulting trapezoid shapes. This shape also inspired the roof planes, slanted in two directions at different angles to create a more interesting profile for people to see when they are dropping off garbage at the landfill. This way, people who didn't intend to visit the facility might get their interests piqued by the building and decide to investigate it. This is also the point where I resolved my issues of how people would move down the 4 feet from level to level. A ramp integrated into stairs would allow for accessibility without making people with disabilities miss out on the experience, or have to go out of their way to move through the building.



The Ponderosa Environmental Educational Facility

The final site plan shows parking, accessed through a small extension to the existing road to preserve as much farm field as possible. Gardens located on the South side provide opportunities for visitors to learn about growing their own vegetables and composting some of their trash. This site plan with contour lines shows the steepness of the bluff, flatness of the farm field, and the relation between the facility and the landfill.





Plan:

1. Lobby/Information (850 sq. ft.)
2. Offices (672 sq. ft.)
3. Conference Room (350 sq. ft.)
4. Employee Break Room (230 sq. ft.)
5. Mechanical (385 sq. ft.)
6. Storage (484 sq. ft.)
7. Classrooms (1427 sq. ft.)
8. Flexible Gallery/Exhibit Space:
   Landfill info (1979 sq. ft.)
9. Flexible Gallery/Exhibit Space:
   What you can do at home to be more green (2229 sq. ft.)
10. Flexible Gallery/Exhibit Space:
    Green systems used in the building (1880 sq. ft.)
11. Flexible Gallery/Exhibit Space:
    Climate Change (2792 sq. ft.)
12. Observation Deck (2260 sq. ft.)
13. Garden

Visitors enter the facility from the North into a large, versatile lobby space. This first section of the building also includes offices, a break room, and conference room, which are easily accessible for visitors coming to the facility specifically for meetings. This way, they don't have to wander through the whole building to get to their appointments. Guest and employee bathrooms are also located here. The next sections of the building are divided into spaces which allow for flexible gallery spaces, some rotating, some permanent. The plan also features storage spaces in three of the gallery spaces, making it easy to switch out or store materials. This also makes the galleries more dynamic and creates pathways for visitors to move through in a more structured way. This way, if an exhibit requires information to be presented in a certain order, there is a way to display it.

This space is meant for gatherings or any events the environmental services department might hold. There is also a receptionist waiting to answer guests' questions or suggest additional resources. Next to the receptionist is a nook holding books and other information.

This view shows what visitors see upon entering the facility: a straight axis running all the way through the building to the large windows at the other end. Another interesting feature is the bands of clerestories seen as the levels change.

This gallery features computers for visitors to use to interact with the building's management system and understand its energy performance. There are also windows into the mechanical room for visitors to observe the geothermal heating and cooling and other systems at work. This is also where the other sustainable materials are identified to visitors and explained.

Three classrooms provide space for lectures or other activities, such as craft projects with school groups. Two classrooms are set up like this one, with seats and a lecture stand, and a third has tables.

The last gallery space looks out over the landfill and gives visitors information about the landfill. This exhibit would feature models and diagrams of the landfill's structure, as well as explanations of what visitors are seeing when looking at the landfill.

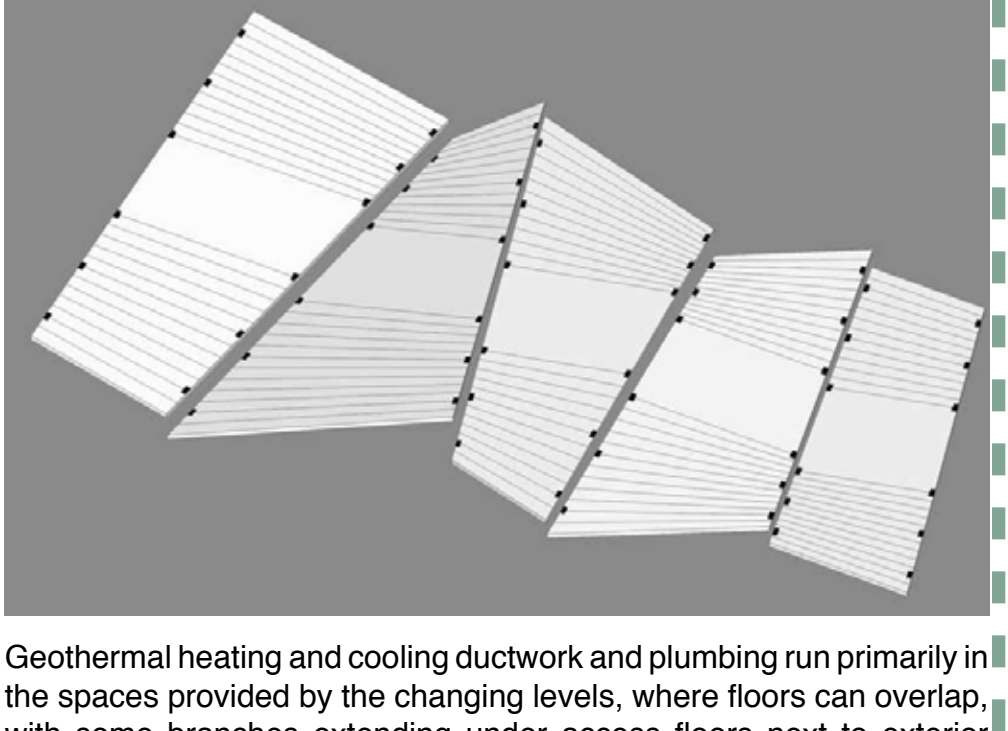
The landfill exhibit leads out to a large observation deck overlooking the landfill, which also allows access to the gardens next to the building. From the deck, visitors can get a closer look at what they have just learned about inside the exhibit. From here, visitors can see both the capped and active landfill cells, the water treatment ponds, and the machinery at work crunching the waste and mixing it with dirt.

The changing levels, as well as the sloping roof planes, are clearly shown in the longitudinal section. The windows in the galleries are sized using regulating lines correlating to the exterior facades, and are placed high enough to allow natural light without taking away display space. Major HVAC and plumbing runs under stairs and along walls where floors can overlap. Secondary lines run under access floors.

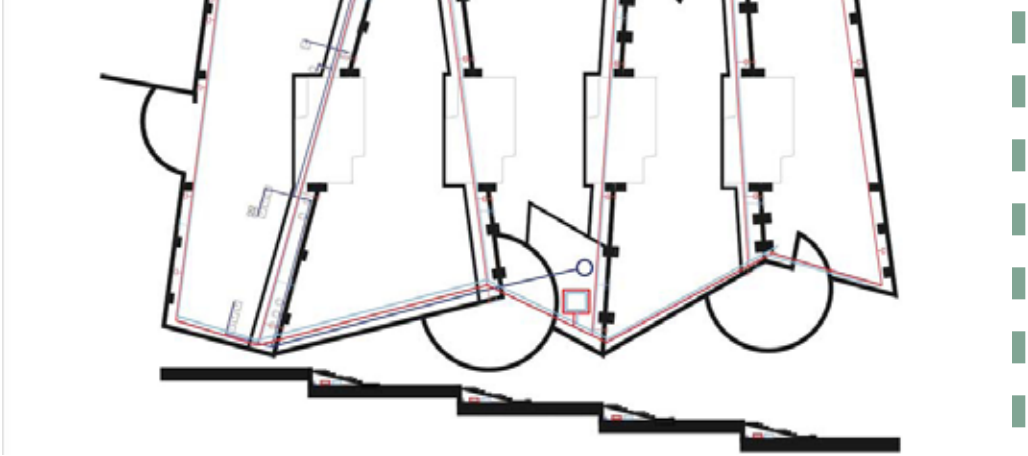
A second section through the last gallery space and classroom shows the changing levels from a different viewpoint. This section also provided an opportunity for a full wall detail depicting the Kasota Stone material, the footing and slab, insulation, roof, and other components. In this view, you can also see the large solar panels on South facing roof planes.

The structure of the facility consists of a site cast concrete column and beam system. This was chosen because of the beams' irregular arrangements and complex connection angles.

Columns are placed to preserve the axis running through the building with the other columns following the ruled surfaces of the sloped roof planes.

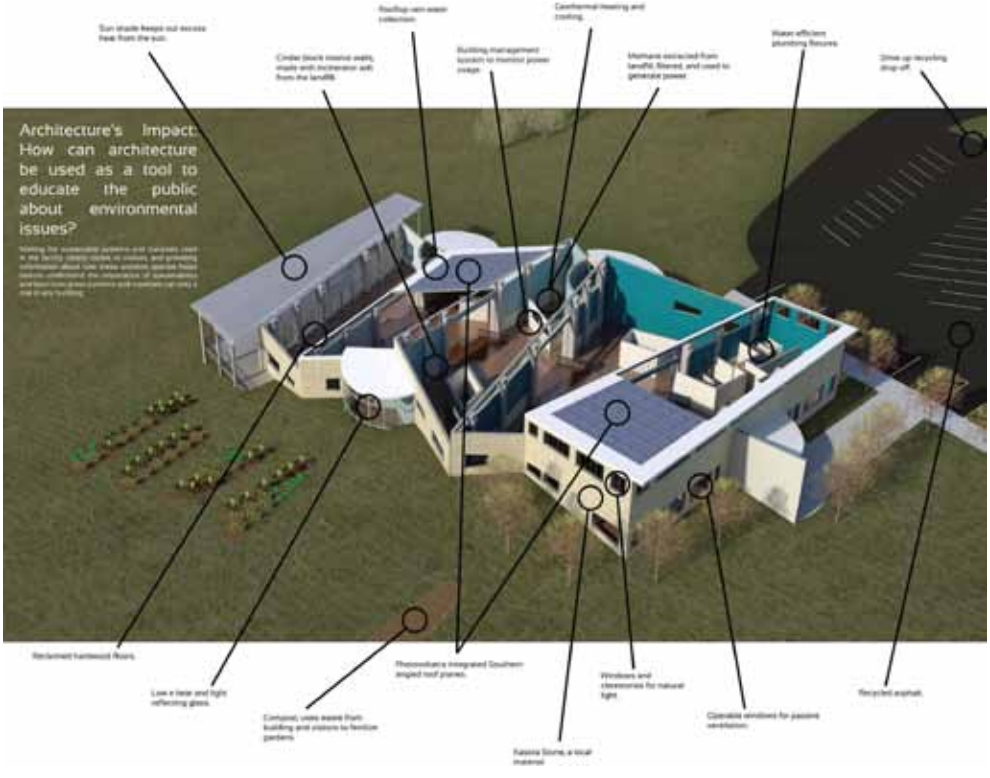


Geothermal heating and cooling ductwork and plumbing run primarily in the spaces provided by the changing levels, where floors can overlap, with some branches extending under access floors next to exterior walls. Floor and baseboard grates provide heating and cooling to each space.

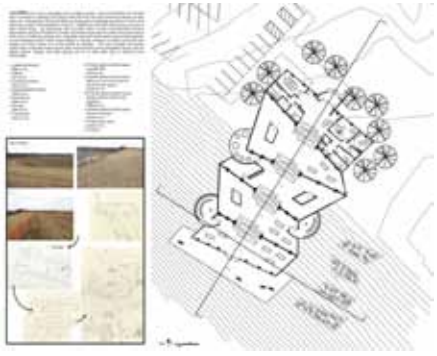


The three remaining elevations show different angles of the building, particularly, again, the way it fits into the site.

This diagram illustrates the sustainable systems and materials used in the project, and relates to my unifying idea that architecture can be used as a tool to educate people about environmental issues. Some of these systems relate to the landfill, such as the aforementioned incinerator ash cinder blocks used both for the entrance as well as infill walls between columns. Another system relating to the landfill is the collecting and filtering of methane produced by the landfill that is currently burned off into the atmosphere instead, used in a gas turbine to create energy for the facility. Other sustainable features include passive lighting and ventilation, Kasota Stone, which is a local material, a geothermal heating and cooling system, and recycled materials, among others. However, simply using sustainable systems would not address the unifying idea. This is why all of these systems are clearly visible for visitors to interact with along with information about how these systems work. This way, visitors are able to understand the role sustainable systems and materials are playing in the building and how those same techniques and attitudes could be applied to their own lives, as well.




The Ponderosa Environmental Education Center

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