Creating A Community A New Ecological, Economical, and Social Path to Uniting a Community

Andrew Stadnicki
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Creating A Community
A New Ecological, Economical, and Social Path to Uniting a Community

A Thesis Presented
By
ANDREW J. STADNICKI

Submitted to the Graduate School of the University of Massachusetts Amherst in partial fulfillment of the requirements for the degree of MASTER OF ARCHITECTURE
May 2017
Department of Architecture
Creating A Community
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ACKNOWLEDGMENTS

This research project has been a transformative experience. It has left me with a new foundational focus. I would like to thank Kathleen Lugosch and Ray Man my thesis advisors with their knowledge and support throughout the project. Their rigor and patient questioning throughout this long process, challenged me to confront my deepest assumptions. I would also like to express my appreciation for the insight of numerous project reviewers, for their constructive questions and probing insights. They truly pushed me to envision potential for my design. I would also like to thank Warren Hall my first Architectural professor, at Springfield Technical Community College, and the person who truly got me started on this long journey. Finally to my family, my deep appreciation is not enough; they’re continued support and personal encouragement assisted me through tough times, as well as the good times. Conventional words of thanks fall far short of my real sense of gratitude to them.
ABSTRACT

CREATING A COMMUNITY: A NEW ECOLOGICAL, ECONOMICAL, 
AND SOCIAL PATH TO UNITING A COMMUNITY

MAY 2017

ANDREW STADNICKI, B.F.A., UNIVERSITY OF MASSACHUSETTS AMHERST
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Humans are evolutionarily programmed to respond positively to nature, and maintaining a connection to it is necessary to the health and well being of every individual while we collectively stride for the goal of sustainability. This Thesis proposal will examine land and water restoration through the service of a sustainable community center. Environmentally low impact, organic, and vernacular design will be investigated as a means to heal, site and community with various techniques of resilient applications.

The area of research is the Blackstone River Valley, once the heart of America’s first industrial revolution. Canals, factories and mills bordered the shores of the Blackstone River and left the land and water with a legacy of pollution. The Blackstone River was once known as the most polluted waterway in the country, with extensive toxic sediment that continues to require remediation. The Thesis is located on the former Fisherville Mill site, a brownfield-designated area in the town of Grafton, Massachusetts. This design will be a possible prototype for other mill sites within the Blackstone River Valley by re-inserting an environmental and economic component into the site. The goal will be to return a degraded location into a site that will allow the community to reinvest in a spirit of reverence for their land and water.
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CHAPTER 1
INTRODUCTION

1.1 Intent

“Our Understanding must grow to encompass a union of nature and culture in which the sacredness of all life is honored”.¹ Humans are evolutionarily programmed to respond positively to nature, and maintaining a connection to it is necessary to the health and well being of every individual while we collectively stride for the goal of Sustainability. This thesis will examine land and water restoration through the service of a sustainable community center. Environmentally low impact, organic, and vernacular design will be investigated as a means to heal site and community with various techniques of biophilic, regenerative, and resilient applications and how they can address the disconnection between the built environment and nature. By providing a way to protect and or enhance the site environment and by creating a place for a community to live, work, and learn. I will address all three components of sustainability, environmental, social, and economic. The goal will be to return a degraded location, into a site that will allow the community to reinvest in a spirit of reverence for their land and water. Two important factors of sustainability are land and water, each resource of equally significance to the other. Water is necessary for most productive uses of land, and the same time the use of land has major impacts on both the quality and quantity of water resources. To ensure sustainability, the need for an integrated approach to the use

¹ Nancy Jack Todd and John Todd, From Eco-Cities to Living Machines: Principles of Ecological Design: (California, North Atlantic Books, 1993) pg.17
and management of these resources is increasingly recognized. Land, forms territory, which is a required for a region’s existence, while freshwater is a requirement for life.

1.2 Objectives and Goals

The primary goal for my research was to gain knowledge and insight into the field of Sustainable Design. This Thesis will include literature reviews from books and articles that directly focus on the topics of green aesthetics, regenerative, and resilient design. Also included will be historical books and articles, which lead to my decisions about location and site choice for this project. The scope of the Thesis project is to provide a use for a site that was once damaged by pollution, and now lays vacant in the town of Grafton, Massachusetts. The design of a sustainable community center will be a prototype for similar vacant sites while also returning a degraded location into a site that will allow the community to reinvest in a spirit of reverence for their land and water.

In so doing, the project will also provide a place for education, as well as providing a home for a community that has none.

The importance of the proposed research and project is to bring attention to the Nipmuck community, which has been a big part of the history of New England. In this document I will be going through the historical research of the Nipmuck tribe as well as colonial history up to the American Industrial Revolution, with respect to the Blackstone River Valley. I will also be examining three green strategies, which include, Regenerative, Biophilic, and Resilient Architecture. This also includes a list of purposed green building systems, within my purposed project. Next, I will review architectural precedents, a site, program analysis, and the final design of the purposed project. The
methodology behind this thesis is to prompt a more green approach to solving a difficult environmental condition.
CHAPTER 2
GREEN STRATEGIES

2.1 Green Concept Overview

In this chapter I will be discussing three green design strategies that I believe are game changers in the world of architecture and sustainable design. I will apply these strategies to a chosen site. Regenerative design is about system-based thinking, which allows the build output on a site to be equal to or be greater than its input. A next step is to focus on a natural-based approach to this project by using techniques of biophilic architecture. I will discuss resilient architecture, which is the practice of the building to respond to naturally manmade disasters, and/or disturbances. Finally, I will discuss building systems, how these systems work, and how I plan to apply them to my site and design. My belief and hope will be that these concepts will bring awareness of more natural processes within the built environment, especially when it comes to seasonal and temporal changes characteristic of a healthy ecosystem.

2.2 Regenerative Architecture

Regenerative Design is a process-focused way of thinking that is made up of three components; ecological, economical, and social. It is a strategy that seeks to tap into and find...
our place within a community, a watershed, and a bioregion in which we can participate. Engaged stakeholders within a community, identifies processes that support humans, natural systems, and the consciousness that connects them all. The process used to design to build the capability of people to engage in continuous and healthy relationship. There is continuous learning and feedback so that all aspects of the system are an integral part of the process of life and this is called co-evolution. Regenerative design is not just another cog within the wheel of sustainable design. “Regenerative design is a part of sustainable living; it is not the same as sustainable design. Sustainability implies something that endures over time without degrading, but it does not regenerate itself or create anything new”2. For example a plastic bottle, the plastic exists within an environment, it just sits there until it is recycled, which starts the process of being created again. This is the same for plants. They exist in one environment until they need to regenerate to meet the needs of a new environment. Whole Sustainable Design may meet the needs of a particular project or situation, Regenerative Design goes further in that it anticipates for the co-existence and future co-evolution of humans, other species, and systems.

“Improving the surrounding environment, restoring a site’s natural hydrology, providing for lost wildlife, and recreate plan habitat area the goals to this strategy”3. The strategy creates innovation by embracing below the line and above the line aspects of ecologic practice and design techniques. It fully integrates nature with human needs that are off


limits to humans in order to achieve sustainability. Humans should be a part of nature and have an obligation in nature’s role to maintain sustainability. Such as reciprocal relationships within large systems, mental model and processes can be used to deepen understandings in the building field of how sustainable choice can be used in a more wider ranging ways to help the environment.

The economical component within this strategy is the idea that the building is a vital component of an economic system, even acting as an economic driver in a community. One example is a building that conserves and produces all of its own energy, as well as sharing all the excess with other buildings and otherwise meeting energy demands within a community. Lowering energy cost for residents within a town or city economically benefits the collective whole. Capturing and treating water on a site is important, but the design can furthermore operate to achieve a net-positive impact on the surrounding ecosystems.

Finally, the social aspect of Regenerative Design seeks to give a site the ability to create community identity through engagement. As discussed in From Eco-Cities to Living Machines: Principles of Ecological Design: “Creating opportunities for urban agriculture such as growing food on a green roof; recharging groundwater systems or creating ecosystems for local species whose niches had been missing, damaged, or destroyed, are examples of how a buildings can help restore the environment.”

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4 Nancy Jack Todd and John Todd, From Eco-Cities to Living Machines: Principles of Ecological Design: (California, North Atlantic Books, 1993) pg 43
2.3 Biophilic Architecture

In an age where urbanization and industrialization isolates people from nature, where workers are more familiar with machinery in factories and their cubicles than with the characteristics of the natural world, Biophilia offers an approach to environmental architecture, based on the argument that a natural connection is important to your health and well being as a human. “Biophilia or biophilic is defined as the inherent human inclination to affiliate with nature.”

The first use of the term “Biophilia” was in 1964, by psychologist Erich Fromm, followed by Dr. Edward O. Wilson who went on to popularized the term Biophilia. “Biophilia is the idea that as humans we cannot flourish as individuals or as a species without a compassionate and considerate relationship to the natural world beyond ourselves.”

Typically, biophilic architecture involves the use of natural materials, natural light, vegetation, of nature and other experiences of the natural world integrated into the built environment. It is found that, “Biophilia can reduce stress, blood pressure, heart rate, fatigue, sadness, anger and aggression with a natural and simulated visual connection.” These might be vital therapies for individuals who work every week in nine to five jobs, stuck behind a computer within dull office buildings in a crowded city, not the greatest working environment. Current studies show that on average an employee spends more than 43 hours per week, working in an office building, behind a desk.

Employers hope their employees are productive every hour, but functioning at 100% efficiency is unlikely given the poor quality of the environment around workers.  

Employees from another dissatisfaction study within an office spaces, found that having the presence of water a condition that enhances the experience of a place through seeing, and hearing or touch along with subtle changes in air temperature, relative humidity, and airflow mimics natural environments in a pleasing way. Another method is introducing dynamic and diffuse lighting, such as leveraging varying intensities of light and shadow that mimic change over time to create conditions that also occur in nature. These connections bring awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem.

“The Economics of Biophilia: Why designing with nature in mind makes financial sense” by the Terrapin Bright Green LLC., highlights scientific studies of nature’s effect on productivity and human health in a variety of built environments, such as health care, retail, school, residential, and office buildings. This source provided great insight into how to maximize and manage practices in biophilic design, and how can it render profit through smart yet simple natural design strategies.

The author explains the opportunities by developing standardized language to systematically assess and test the economic value of biophilic elements in the context of environments. In order to understand the case for utilizing biophilic design, the author discussed how crucial productivity, health, and wellbeing can be to the guest, employees, or even the resident satisfaction and how this translated into dollar savings in such

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environments. The research that has been completed in this field shows various neurological and psychological effects of exposure to nature, which is why society can no longer ignore the value of nature on the human mind.

The author explains that the results of these studies have spanned from improved recovery rates of hospital patients, improved retail sales trends affected by day lighting, and increases in emotional value to those who benefit from reconnecting to nature. But the article also explains that these benefits are often overlooked because of the difficulty of connecting to positive outcomes. Several case studies highlight the benefits of biophilic architecture. For example, in 1984, Roger Ulrich experimented with the influence of natural views and urban views, on patients recovering from surgery. Ulrich’s research found that recovery rates accelerated and stress was reduced for the patients who had views of nature.

On average, patients whose windows overlooked scenes of nature were released after 7.96 days as compared with the 8.71 days it took for patients whose views were of the hospital’s exterior walls, a decrease of 8.5% (Ulrich, 1984). Ulrich’s experiment showed a corresponding cost decrease of over $161,000 for patients who were released just one day sooner. Evidence-based biophilic design for hospitals, point to the dual benefits of increased recovery speeds and cost savings.

In retail industry, the author cited a “Wal-Mart stores experiment with natural daylight they found that from 1999-2001. In a chain of 73 retail stores throughout

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California, 24 stores were categorized as having significant daylight illumination, whereas the remaining 49 relied on artificial light. A thorough analysis of sales reports showed with 99% statistical accuracy that in non-sky lighted stores experienced a 40% increase in gross sales after the installation of skylights”.11 After this occurred retail store business models across the country started to capitalize on day lighting to increase profits. By using natural day lighting techniques, the retail industry, developers, and storeowners have the opportunity to achieve optimal profit and a boost to the revenue.

Finally, the author provided a great example for schools and educational facilities. Initially they found that energy costs in schools and educational sectors were unlikely places to achieve major financial savings. The author examined many different reports and instead experimented with children who were able to play with nature and learn about nature via unique design elements. Student performance research demonstrated that classrooms could be strategically designed with biophilic elements to foster better test scores, optimal health, and increased learning rates. The author also found that these designs also improve mental restoration, better behavior, and enhanced focus with in the children who participated in the experiment. In an experiment by Wells and Evans, where the children were asked to draw their favorite place the majority of children drew illustrations of outdoor locations. This also validated the findings that nature acted as a buffer to psychological stress levels. “To validate the findings, two dependent variables served to measure their stress levels: (1) parent observations of their child’s distress and

(2) the child’s own self-worth report.”

This book offered great insight on how different perspectives on our environment can shape us. As an architecture student I appreciate the practical account of the how and when in programming, design reviews, and evaluations, to undertake environment behavior. How the brain processes and tests information as images, suggests how individuals can present ideas to influence conceptual ideas. For example, a TV shows “Call of the Wild”, that I recently viewed on the National Geographic’s Explorer channel, took David Gessner the show’s host and a nature writer had an opportunity to visit scientists who were doing groundbreaking research with the human brain and nature. The scientist used a device called (emotiv epoc) head set, which measures changes in a person’s brainwaves while in an urban environment versus looking at or being surrounded by nature. The result were remarkable, they found that even looking at nature in the daily life for a few minutes to a few hours can reduce stress, depression, blood pressure, and heart rate. He also interviewed people who left everything in the city behind and moved into a rural environment to explore healthier and freer lifestyle. In conclusion, Biophilic design should be an integral part of sustainable development by incorporating the positive experience of nature into the design of the built environment. Ultimately we may even realize through neuroscience that elements can enhances the performance of individual’s minds and leads us toward even greater environmental performance.

2.4 Resilient Architecture

Resilient Architecture is the third environmental theory that researched for this Thesis. Resilient design is an intentional design theory that affects everything from buildings, to landscapes, local communities, and regions. Its purpose is to create buildings that can respond to natural or manmade disasters and disturbances within a community setting. “Resilience is the capacity to adapt to changing conditions and to maintain or regain functionality and vitality in the face of stress or disturbance”\textsuperscript{13}. The goal is to create buildings that can change and adapt to the results of climate change, sea level rise, the increasingly frequency of heat waves, and regional drought. It tries to achieve this while also providing a legacy within a community, a place for community involvement and service, and facilities that can serve as gathering places during emergencies and interruptions, while relying on natural, biological water control solutions that grow stronger over time.

Resilient design operates on different scales. For example the building scale focuses on reducing dependence on complex building controls and systems. This includes “optimization of on-site renewable energy and designing, and constructing buildings to handle severe storms, flooding, and wildfire that are expected to result from a warming climate”\textsuperscript{14}. Another aspect is to provide redundant water supplies or water storage for

use during emergencies. Finally, design solutions are modeled on future climatic conditions as much as possible rather than relying on past data\textsuperscript{15}.

The community scale involves developing a building design that facilitates social structures that strengthen the fabric of community. Places that support community gathering are where residents get to know their neighbors. These communities maintain a sole focus to minimize dependency on transportation and fuels, providing key access for human-powered transportation options to the site, reliance on local or regional food security systems, and strategies for long-term, low-energy food storage.\textsuperscript{16} Vegetated roofs and a rainwater collection system bios-wales reduce the urban heat island effect and manage storm water, while physical infrastructures designed and built to handle storm water flows.\textsuperscript{17} Over time this reliance on natural solutions will grow stronger.

Finally, there are regional and ecosystem scales. These scales involve adopting policies that recognize and value ecosystems services that protect or restore the capacity to rely on those services. For example, water filtration systems, protective buffers at coastlines, natural erosion-control along streams and rivers, healthy forests that purify and replenish air. Other elements include developing a regional renewable power-generation systems to ensure a more stable, distributed electrical grid to pursue community ownership of utility-scale renewable power systems and garner regional support. (This was done successfully in Germany and Belgium with energy co-ops).

Finally, work to achieve a more diverse regional economy.\textsuperscript{18} Stewart Brand’s, “In How Buildings Learn, what happens to them after they’re built”, provides ideas about how to think about the site from a much longer historical perspective, and secondly, how to approach an architecture for a society that is in flux or maybe needs a graduated growth scenario that continually engages with and adjusts to the citizens’ needs as a project helps to spur recovery. Below are ten basic principles or methodologies behind resilient strategies. Principle 1: resilience transcends scales. Resilience is applied to or at large scale, such as buildings, communities, and regional ecosystem scales. But, they also can be applied to different immediate or long-term time scales that can be used for test purposes on newer projects. Principle 2: resilient systems provide for basic human needs. This strategy suggests that allowing equitable distribution of basic needs, such as potable water, sanitation, energy and food is great for a community that may need it or is struggling to maintain it. Principle 3: diverse and redundant systems are inherently more resilient. Communities that can respond to interruptions or changes are inherently more resilient. This includes communities that are more diverse regarding ecosystems, economies, and social systems. Communities can set systems that prioritize improvements on electricity, water, and transportation, in order to become more resilience. Principle 4: simple, passive, and flexible systems are more resilient. The idea that humans and buildings need to adapt to changing conditions, both short and long term. The solution is to override older, out-of-date solutions that require more maintenance with a passive system that is more flexible and resilient. Principle 5: durability strengthens resilience. Increasing the durability of any strategy enhances

resilience. Different building practices, building designs, infrastructure, and ecosystems can become more durable if more of these systems are used and improved over time.

Principle 6: locally available renewable, or reclaimed resources are more resilient. This strategy has been adopted for a while, not only in everyday life, but also in actual building practices such as the Living Building Challenge. One element of the challenge is resourcing all your materials at or close to the actual building site. The ideas of buying local and staying local, demonstrates abundant local resources in which the local foods provide a greater resilience in a community than receiving resources from far away.

Principle 7: resilience anticipates interruptions and a dynamic future. Climate Change is more prevalent than before. A resilient design responding to these changes is an opportunity for a wide range of system improvements. The goal of adaptation to these changes is by not just improving the building, but also the site and surrounding community.

Principle 8: find and promote resilience in nature. Nature is everything, everything that you surround your self with, and/or has come from or close to a living system. Resilience has been achieved from the evolution of all natural systems. We as humans have enhanced resilience by relying on and applying lessons from nature. Protecting these natural lessons will protect the strategies that enhance resilience.

Principle 9: social equity and community contribute to resilience. Communities that stay together and work together, having a community where people know you, respect you, and care for each within a community setting will fare better during times of stress or disturbance. This social unify can be as important as physical responses, which are greater when resilience is the goal of the community.

Principle 10: resilience is not absolute. Understanding that not every strategy will work. Recognize that steps must be
taken to achieve total resilience. In fact facing all the solutions to a problem at once is impossible. What will work in a short term should be applied first, while long-term strategies should be achieved in stages to allow for greater feasibility of community-wide resilience.

These principles are diverse, but each has a purpose, with various possibilities of reducing the environmental impact of buildings, site, and community impact. With these techniques, together materials and technologies will enable me to create a cohesive solution that will enhance building and its environmental performance. There will be issues and challenges to explore within my design, but what I will provide with each concept is collaboration or intertwining of all three strategies throughout. I will have visual connections with nature through openings that allow views outward as well as bringing in dynamic and diffuse lighting to the space. I will provide the presence of water through water collection, water filtration, and a connection with natural systems within that include plants and other organic matter. Finally, I will find and incorporate natural materials to use that are sourced within and from the region.

The community scale is the best fit for my design, but the other scales have elements that I can incorporate in my design. The goal of this Thesis and project is to create a community facility that provides gathering places during emergencies and interruptions in services. It can support other facilities such as schools and existing community facilities with access to key services, including water. Potential extreme weather events and climate changes will be considered in determining locations of critical facilities and systems. This building will be place along on a site that can maximize this potential.
2.5 Building Systems

This section will review systems that may be considered for this prototype project. These are only a few of a long list of environmental friendly building options.

2.5.1 Living Machine / Constructed Wetland Systems

An Eco-Machine or a Living Machine is a wastewater treatment system that is custom built to resemble a living ecosystem. Many water treatment facilities today use chemicals in their systems to treat water. Instead this system mimics the ecosystem. The system utilizes a series of tanks that processes the water through different stages by using interacting organisms. Contaminated water is cleaned by incorporating bacteria, fungi, plants, snails, clams, and fish that thrive together in these tanks to break down and digest all the pollutants within the water. The process of selecting and then cultivating these organisms is key to the success of the treatment and provides these everything they need to thrive they are able to grow and provide us with cleaning which can be used throughout a site. One option in such a system are constructed wetland systems, which are created to treat discharge from municipal or industrial wastewater, and storm water by harnessing the natural functions of vegetation, soils, and organisms to treat the water emulating a real natural wetland. The systems allows for nature to inhabit the space that plants and animals that had been displaced or depleted. Currently there are three types of constructed wetlands: First are subsurface flow constructed wetlands where water moves down the planted layer, through the soil and out of the system. Another type is the surface flow constructed wetland, where the flow of water moves parallel to the surface of the soil through the plants. Lastly, there are floating treatment wetlands, which are
constructed bogs built on a floating base which allow for the plants to root through the bog and into the water more naturally and less invasively. These bogs are then tied to the shore allowing the water to flow around them. This type of system can be seen in canals or streams. I will use combination of these systems. My initial concept would be to put the living machine with in the building allowing the system and nature to evolve the design, while placing the constructed wetlands nearby or raising the building up and placing them beneath, so that water is allowed to flow continuously. This will give the building the ability to be a pre-filter for the cleaning efforts that are currently happening on the southern portion of the site. The building would be a “natural sponge” to clean and restore the water and land.

2.5.2 Vertical Living Wall

A Vertical Living Wall system allows for panels of plants, to grow vertically on walls. The system is attached to the structure of a building or can be free-standing. The nutrients and water flow down, feeding the roots to keep the plants alive. Bring this green, natural infrastructure inside would allow for a moment of effective biophilic architecture. For my application I will be connect the system with the living machine and/or the constructed wetland, instead of connecting to hydroponics. This would allow the living wall to feed off the nutrition created by both systems, saving the water supply on site to for other uses.
2.5.3 Rain Water Collection / Grey Water Recycling

This simple system has been around the world for hundreds of years. It is more prevalent in developing nations and has been proven it very cost affective for any site.  
The basic principle is that the water is collected from a gutter system on the roof. This water is then channeled into a collection system next to the building. It would then go through a mechanical and purification process so that is can be use as potable water for the building. Then the water can then be sent to the living machine for recycling and reuse as grey water for other non-potable uses, such as irrigation on the site.  
Finally, water would be sent to the living machine to be recycled again in the constructed wetlands where the water will be used and filter by the plants and other organisms before being sent back to the surrounding site.

2.5.4 Passive Solar Heating

Passive heating is a concept that takes advantage of natural heat from the sun in winter; and shade and wind in the summer. This concept has been around for centuries and has been recently upgraded with new structures. Passive solar works by having rays of the sun enter a building through windows. Those rays then heat the air or is absorbed by all the exposed elements of a building, namely floors, walls, furniture, etc. When the air-cools at night the absorbed heat releases into the building and maintains a comfortable temperature. Stone, brick and plaster, more effective materials that absorb heat. The basic application would be putting window on the side of the building that will receive the solar exposure to heat the building in winter.
2.5.5 Passive Cooling

Passive cooling works by using techniques to reduce internal and external heat gains, thereby reducing our reliance on mechanical cooling and ventilation systems and the energy needed to run them. Building components, such as insulation, overhangs, and energy-efficient windows, combined with natural forces contribute to passive cooling. The simple act of orienting a building to true south increases wintertime passive solar gain while greatly reducing summertime heat gain. The net effect of this simple measure is that the house stays warm in the winter and cool in the summer, naturally.

2.5.6 Composting Toilets

Composting toilets is the most natural way to process and recycle human waste. Properly composted human waste is a complete, nutrient-rich fertilizer. This can be used on plants and trees. It both reduces the need for commercial fertilizers while preserving local water quality through a natural cycling of nutrients. The correct balance of oxygen, moisture, heat and organic material is needed to ensure a rich environment for the aerobic process to work. The system uses the process of decomposition and evaporation. When waste enters the toilet, it is almost 90% water. Through the process of evaporation the water is vented out of the waste and what is left can be used as a natural fertilizer after composting. This is the similar to common garden-variety composter is that by setting up these toilets inside of low flow toilet will save water and enhance the plants that will help to establish the proposed building, then growing food and create another natural circle of life on the site.
2.5.7 Solar/Wind Power

Solar power is an alternative energy source. Photovoltaic panels absorbed energy that is converted into electricity, which can be converted to AC power. Many solar panels are needed to power school or communities. Wind is a result of the uneven heating of the atmosphere by the sun, which when combined with the rotation of the earth creates wind. When wind causes propellers to spin on a shaft, electricity can be created. I am proposing that the building create its own power not only to reduce the need to be on the grid. But to be able to give it backs to the local community. This can ether be done through solar or wind, but utilizing both would provide for a redundant system. If it’s not sunny the wind turbine will power the building, if its not windy the building will receive power from the sun.

2.5.8 Natural Day Lighting

Day lighting refers to the use of natural light from sun via direct or overcast light. This is becoming a standard practice in architecture to support the visual demands of occupants with light throughout the building. A day lit space uses natural light as the primary source of illumination. Creating a comfortable place uses visual and thermal connectors to maximize visual comfort and to reduce energy use, within a space. Connecting a space to the outdoors gives contrast and atmosphere, which is referred to the diffused daylight that is casted into the space. Each climate has a different composition. Day lighting can be affected by many different elements and strategies vary with locations and climates of every site. My chosen site is nearly aligned with the cardinal points and so it presents a perfect southern exposure that will cast light throughout my design space in the winter, Shading the summer sun will require a system
of louvers and shades for the exterior with a special roof system. Natural light will be incorporated into all of the natural systems. Including the living machine, the constructed wetlands, and living walls maximizing the natural affects.

2.6 Building System Precedent

Excellent precedents for green systems strategies are the Earth Ships in Taos, New Mexico. This past summer I had the opportunity to visit these structures first-hand and they were quite impressive. These structures are completely constructed of waste tires, glass bottles, and cans to create a structure that has minimal impact on the environment. They are completely off the grid, while creating their own water, heat, and cooling for the structure. Exterior walls are constructed of earth filled tires to provide thermal mass cooling and heating, while the interior walls are constructed of a honeycomb of empty cans and glass bottles. They are artistically beautiful and the houses appear to rise out of the earth. I believe that by utilizing these strategies this prototype design would have an effective chance at curing the issues of this degraded site.

Figure 4 - Earthship, Taos, New Mexico
3.1 Green Strategy Literature Review

In this section I will be reviewing literature and articles that represent case studies that the green strategies I discussed before will work for this site situation as well provide a template for other sites that match this situation.

3.2 From Eco-Cities to Living Machines: Principles of Ecological Design

Written by Nancy Jack Todd and John Todd this book was very specific and informative offering the interesting perspectives of a biologist and a green designer. The Todd’s holistic vision representing the ideal future for urban planning seemed well reasoned and made me envision for a solution on urban development. The illustrations were inspiring, as they brought together all the aspects of the book. This book inspired this Thesis because it showed how to clean a city, a canal, even a specific site with nothing but natural organisms, such that clean water that could be used to grow food could be productive. I learned how his modular systems could use the plant base in different solutions for green cleaning. The creation of the floating bogs, previously mentioned is one of many great examples in this book, and I believe in the near future the living machine will be a standard design element in every new building.
3.3 Building for Life: Designing and Understanding the Human-Nature Connection

This article written by Stephen R. Kellert, is a great example of how a love for natural elements can ignite a passion for natural architecture. I am truly cut from the same cloth, as I would rather be out in a natural world sleeping under a tree then sitting behind a desk. Kellert’s demonstrates that nature is the next solution toward building design and gathered the ideas from writings of all those who are interested in the field of Biophilic architecture. His thinking inspired me to take more cues from natural systems and utilize them in my own design. His logic requires us to considered how as a culture, we can respect nature through our built environment by establishing new standards for natural systems. He considers that if we don't “build places we love that are beautiful, light filled, well built and unique in character we will never put in the extra energy needed to preserve them long term”\textsuperscript{19}. He understands that we need to build beauty so that these design concepts will progress to purpose bigger and greater theories in the field of biophilic architecture. This book brought my passion for nature into perspective, to apply its logic and theories as a major component of the sustainability mission. Applying this logic and theories to my own thesis project will enable me to participate in the creation of a new environmental approach to the built environment.

3.4 Designing for Hope: Pathways to Regenerative Sustainability

This book written by Dominique Hes, and Chrisna Du Plessis, was an excellent resource. It brought a about newer more updated context to the world of regenerative understanding and green design. It exposed the new thinking that is being applied the

build environment. The author’s explain why we need a new way of doing things and demonstrates how it is possible, giving great examples of projects that are applying this new thinking all over the world. The natural system is something that shouldn’t be wasted, but it should instead be harnessed and applied towards new way of doing things. Communities and organizations could succeed beyond the limitations of the built environment. These incremental improvements draw a vivid image of how buildings, people and nature can shape a better future. I believe change is constant and a whole redesign of the built environment is needed. Fundamentally new approaches can impact the potential of our buildings and places, if we can work together to create building that change people’s minds.

3.5 New Architecture on Indigenous Lands by Joy Monice Malnar and Frank Vodvarka

Initially, I wondered how I could connect the two worlds of natural architecture and Native American tradition and culture. I found my answer when I came across a book titled “New Architecture on Indigenous Lands” by Joy Monice Malnar and Frank Vodvarka. “New Architecture on Indigenous Lands” takes the readers on a tour of recent Native building projects in Canada and the Western and Midwestern United States. The authors with great respect for the tribes, paid close attention to many details of design, addressing questions of tradition, and cultural required for in my own research. With respect to the Nipmuck’s, it would be necessary to determine what traditions are important to them and what are some elements or ideas that I can guide my own thoughts in the design. A Biophilic approach seemed like one good way to respond to their
cultural values. Even though it might not completely represent their values, it could still be a start. Could Biophilia connect the Nimpuck’s and bring them closer to nature by providing a building strategy that could enhance their site and provide a place for the youth to grow and learn traditional ways. Before reading any text, I reviewed some of the images, which lead me to wonder how each tribe created a unique building identity? Although all of them are different, each building reflects traditional aspects that make them unique and special.

From research on traditional aspects of tribal life, I learned that in 1996 government-housing policies on tribal lands became more flexible, inspiring the creation of a new kind of modern architecture. When they were no longer bound by federal rules of housing and design, the native communities were able to complete buildings and spaces that were more reflective of their own cultures. The author’s quoted tribal members and architects throughout the book that emphasized links between stakeholders, cultural values, and design decisions. The authors focused on the aesthetics and functionality of the architecture that is derived from a particular people or group of peoples. A tribal member named Black Elk “speaks of the “square boxes” his people were forced into, and another member Winona LaDuke of the “boxes of mints on Native Lands”. As the government was deciding what tribal buildings should look like, Native custom and culture were bound to be box in—or boxed out. Native Architecture has been largely unrecognized in North America, and I find it difficult to understand why it took so long to recognize its importance. I wanted to understand why and what kind of research has been done in this field prior to this emergence, and what other changes have occurred since then in the traditional culture? Architecture has finally begun to consider world
traditions and ideas of the people who inhabit it, and it made me want to research other varieties of sources of tradition and cultural information. The author’s offered wide-ranging insights into the sensory, symbolic, cultural, and environmental contexts of this new architecture. The book guides the reader through many different projects in great detail including interviews with designers and their Native clients. A variety of Native Architecture from cultural centers and schools, clinics and housing, and even a camp, are reviewed all which manifest tribal identity in various distinctive ways. Other projects include Tribal Council Chambers of the Pojoaque Pueblo; the Zuni Eagle Sanctuary in New Mexico; the Nk’Mip Desert Cultural Center in Osoyoos, British Columbia; and the T’lisalagi’law Elementary School. Many of these potential precedents have a lot of wide-ranging insights into the sensory, symbolic, cultural, and environmental contexts of this new architecture. This aspect will bring meaning to my Thesis and provide an enhanced conceptual understanding of the important of culture and tradition. In conclusion, this additional resource will improve my own understanding of theoretical concepts when applied to forming indigenous typologies, iconic design parameters, architectural expressions of culture, and sustainable housing. Incorporating symbolism, pattern, culture and traditions from native culture is critical to this design.
CHAPTER 4
HISTORICAL RESEARCH

4.1 Historical Research Overview

In this chapter I will be provide an overview of historical research between the pre-colonial time period and up to the American Industrial Revolution, including research into the Nipmuck tribe, who were initially the primary inhabitants of central Massachusetts. I will view the relationship between the settlers and the Nipmucks, as well as the different time periods between them. I will also include research into the Blackstone River Valley, its significance to the Nipmuck people, its roll in the American industrial revolution, and the history and production of the mills along it shores. I will include a brief summary of my current building site.

4.2 Early Massachusetts History

Contact with English colonists began almost immediately with heavy population losses due to epidemics and small pox from the first settlers in 1614, and then again from pilgrims landing at Plymouth in 1620. Settlements along the Massachusetts Bays increased dramatically by the Puritans in 1630. By 1633 traders from Boston reached the shores of the Connecticut River, where settlements increasingly brought more Puritans and missionaries to the area. As the English spread west creating small settlements, the Pequot war in 1637 broke the confederacies that dominated the Nipmucks. They were suddenly free of the Pequot rule to only face greater demands from a new and more powerful overlord, the new colonists.
4.3 Early Settlers and Nipmuck Indians

The Nipmucks are descendents of the Algonquin tribe. The Nipmuck’s lived along rivers and the shores of small lakes, were agricultural based, and occupied this area as far back as can be told. They generally stayed within their own territory, but moved locations with the seasons. Nipmuck tribes had partial allegiances to the Pequot, Narragansett, and Pennacook tribes, prior to the English settlers. Nipmuck’s were one of the first tribes to be involved with colonist as their homelands start only thirty miles west of Boston harbor.

4.4 Land Transfer and Purchases

The Lancaster Purchase of 1643, the Tantiusque Deed of 1644, and the Eliot and Brookfield Purchases of 1655 steadily eroded the Nipmuck’s land. Unfortunately, unregulated settlement took even more land away from the tribe. The farmlands in the river valleys where especially heavily settled by the colonist, leaving the Nipmuck’s, who depended on agriculture for survival, with a serious problem of feeding themselves. The 1640 exchange for land, the Nipmuck’s were forced to adopt Christianity from John Eliot and other Puritan missionaries. In the two years, two thousand Nipmucks were killed of the King Philip war in 1676.

4.5 Praying Towns / Colonial Settlements

In 1671, an English missionary named John Eliot, who preached in Hassanamisco, established an Indian church and school where the Bible was studied in the Indian language. By the beginning of 1674, seven praying villages of Christian
converts had been established throughout Nipmuck County. Nonetheless in 1675 many of them joined King Philip’s uprising against the colonists. In 1675 King Philip retreated west and attacked English settlements in the Connecticut River Valley utilizing Nipmuck Country for sanctuary. King Philip launched a series of raids throughout New England in 1676. The war didn’t end after King Philip’s death, as the English continued to hunt down and attack the Nipmucks and any former allies of king.

Surviving tribes of the King Philips war were then sent back and confined into these supervised praying towns by Puritan missionaries or confined to small reservations in remote areas. Many Nipmucks escaped to other tribes within the area including the Abenaki and Mahican. Within a few years it became impossible to assign tribal membership within the mixed populations of different praying villages. A few years after 1680, almost all tribal identities and traditions of the New England Algonquin were thought to have evaporated.

Currently only the Commonwealth of Massachusetts has recognized two identifiable groups of Nipmucks, estimated to have 1400 members. An additional 250 of members of said groups currently live in Connecticut, which has not yet recognized the Nipmucks.

4.6 Hassanamesit Woods Property

The Hassanamesit Reservation in 1728 contained 8,000 acres when the Commonwealth of Massachusetts purchased the land. In 1869, 250 years after the Pilgrims had landed in Plymouth, Massachusetts. The Enfranchisement Act passed and granting citizenship to the Nipmucks, but eliminating their rights to common
landownership. Today the Nipmuck tribe only has a small area of land about two and a half acres in size which is still part of ancestral land of which have never been in other hands. It is known of the Hassanamisco band of Nipmucs as the Hassanamesit Reservation located in Grafton, Mass. The second group of Nipmucks or the Chaubunagungamaug band, currently have a privately owned ten-acre reservation in northeast Connecticut, and are located within border town of Webster, Massachusetts. Both tribes gained federal recognition in the 90’s under the Clinton administration, only to have it reversed by Bush, a difficult and bitter experience. Nonetheless, the Nipmuck have decided to move forward to honor and preserve their culture
4.7 Blackstone River Valley

The Blackstone River Valley of Massachusetts and Rhode Island is the “Birthplace of the American Industrial Revolution,”\textsuperscript{20} The river travels 46 miles dropping 438 feet, from Worcester, Mass towards its mouth of Narragansett Bay in Rhode Island on average drops 10 feet every mile. The river’s power provided America’s drive to industrialization. Prior to renaming, the river was known as the Nipmuc River and it was an important resource for its people. The Blackstone River transformed farms to factories. The skilled labor and mechanical know-how available in the region of Pawtucket RI in 1790 and the power from the Blackstone River drove America to industrialize. Samuel Slatter and the Brown Family created the Slatter Mill, which was America’s first textile mill. It was built as a experiment to see if the river had the power for production. Because of the success of the Slatter Mill, other entrepreneurs built their own mills along the river, and then eventually all over New England. With this new industrialization there was an influx of homes, schools and churches as well as towns into the region. Industry brought in immigration, which created a whole new work force. Among the first immigrants where the Irish and then in the mid 1800’s mill owners recruited French Canadians from

Quebec. Later, Europeans came over to work in the mill, but at the same time surviving members of the Nipmucks were also among the workers. Then followed the transportation revolution. Mills struggled with moving these goods from mills along the river down to ports of Rhode Island until the construction of the Blackstone Canal in 1824-1828. They found that moving goods on large barges was much cheaper and faster than horse drawn carriages on the roads. Each barge could hold 30–50 tons of goods. Although this was an improved system, it was still cumbersome. It wasn’t until the advent of railroads that the industry in the Blackstone Valley and America exploded. Although the region is full of historical features, the industrial revolution also left the river scarred. Only a decade ago, that the river was still known as “The most polluted river in America” with respect to toxic sediment in the river. Currently the river has become much cleaner after cleaning efforts overseen by the EPA. The Blackstone Valley will always be an economic and an industrial powerhouse. Even today, people still coexist around the once used canal and mills, but now they serve as a greater part to history and a learning landscape as part of the Blackstone Valley National Heritage Corridor.
4.8 Grafton, Mass

Grafton is considered to be a semi-rural town that lies within Central Massachusetts just southeast of the City of Worcester, Massachusetts. The population is currently estimated to be just above 18,000 residents in 2015 according to the federal census. Grafton was originally occupied by Nipmuck Indians and was called Hassanamisco, which means “place of small stones”\(^{21}\). In 1724, members from the towns of, Marlborough, Sudbury, Concord, and Stow, Massachusetts met to petition the General Court of Massachusetts asking for the right to purchase 7,500 acres of land from Indian owners. In 1735 the town of Grafton was established in the honor of Charles Fitzroy, Duke of Grafton, and grandson of Charles II. The money used to purchase the land was held in an account for the Nipmucks in a bank in Boston, under the General Court of Massachusetts for the benefits of the tribe, but unfortunately the money was secretly embezzled for private use and to this day it was never repaid, or the embezzlers prosecuted. By the end of the 19\(^{th}\) century remnants of the old plantation were sold off. Currently only the only the Cisco homestead located on Brighton Hill in Grafton is in direct descendants of Nipmuck landholders. With industrialization of the Blackstone River and European immigration, the Grafton population increased dramatically by the mid-century. With the introduction of the railroad in 1874, manufacturing almost tripled. Because of all the growth,

residential, institutional, and commercial development continued in Grafton. Today, many residents are descendants of the immigrants who worked in mills.

### 4.9 Historical Research Final Thoughts

Throughout this research and project design, one goal was to identify potential land that could serve within Massachusetts as a strategic and meaningful location for the community. Discovering the strong ties between the Nipmuck, the Blackstone River Valley and town of Grafton, Massachusetts, helped to identify the Fisherville Mill site for this project. Continuing my research, I learned that the Fisherville Mill site is within the four square-mile Hassanamesit Plantation that existed until it was subsequently reduced to the current 2.5 acres.
5.1 Architectural Precedent Overview

The following architectural precedents include The Smart School Meadow, in Irkutsk, Russia, The Omega Center for Sustainable Living, Rhinebeck, NY, The Southern Ute Cultural Center and Museum in Ignacio CO, The Sidwell Friends School in Washington DC, and The Craig Thomas Discovery and Visitor Center in Grand Teton National Park. Each of these

5.2 The Smart School Meadow

While researching other topics for my thesis, I came across a diagram which lead me to a website of a Danish architecture firm named CEBRA, an international firm known for their innovative designs. The Smart School Meadow is a proposed conceptual design entry for an international competition for the smart school educational complex in Irkutsk, Russia, which is located near Mongolia and Siberia. According to the CEBRA website the smart school design was a new type of “School Park” that, “Would unite architecture and landscape into a unique learning environment and gathering point for the local community” (see figure one). A ring of individual structures that houses different

Figure 7- Smart School Meadow "CEBRA Architecture". CEBRA architecture. N.p., 2017. Web. 1 May 2017.
elements such as an elementary school, high school, government facility, community center, medical facility, and sport/ wellness center. The total size of the structure is between 300,000 - 500,000 square feet, which is a massive building for such a rural place. But I considered the potential for such a facility as an enhanced community center. The roof is the second interesting feature of this structure, as it is large, ridged rooftop. The pleated rooftop accommodates the necessary facilities in each segment. Breaks in the building serve to reduce the building’s visual massing to a more human scale at the ground level, while timber is proposed for external cladding and interior finishes to provide a warm aesthetic feel in what can be an exceedingly cold climate. With this roof, the spaces between the buildings are considered as multifunctional, semi-covered learning spaces as well as activity zones, it really draws nature inside the building and landscaped areas. I would like to emulate this concept into my own thinking for the Nipmuc community center. According to Arch-Daily, “CEBRA’s design offers a
vision of a new programmatic approach to schools and shared public amenities within non-urban areas”. The wider architectural community will undoubtedly monitor the building’s functionality closely upon its completion. Should the format prove successful, the Smart School Meadows has the potential to form a new precedent for education design in cities across the globe. This style landscape and architecture I could readily apply to different regions, as it could be adjusted for dry, wet, or even humid environments. Such a design could readily incorporate kinds of construction methods perhaps that are easily attainable or constructed so that the tribal community will be able to help in the process of design and construction. Straw bail construction, rammed earth, and even comb construction could work, as would timber framing. If the site were wetland environment it would be possible to elevate the structure.

5.3 The Omega Center for Sustainable Living

The Omega Center for Sustainable Living is located in Rhinebeck, NY. Supplying all of its own energy needs, its operation is carbon neutral. The self-sustaining building is heated and cooled using geothermal systems, and it utilizes photovoltaic power. The building, which serves as the heart of Omega's ongoing environmental initiatives, includes a greenhouse, an Eco-Machine, constructed wetland, and a classroom, which is open year-round to the public. The result is a 6,200 square foot building that contains a classroom, laboratory, and a 4,500 square foot greenhouse for Omega's, the Eco Machine. In operation since
2009, the Eco Machine treats more than 5 million gallons of wastewater annually. The center will offer visitors a direct experience with the most recent, cutting-edge technologies in green building and sustainable living, and will show, in an experiential, accessible way, how we can move forward. John Todd, a pioneer in the field of natural wastewater treatment systems and author of “John Todd Ecological Design”, did the preliminary engineering work to envision Omega's living machine and how it would fit into the systems currently on campus. The up-to-date it is the most recent living machine technology designed by John Todd.

Omega's Eco Machine can process up to 52,000 gallons a day and includes anoxic tanks, constructed wetlands, the Eco Machine lagoons, sand filters, and large dispersal fields\(^\text{22}\). Much of the Eco Machine's natural wastewater treatment process is gravity fed, decreasing the amount of energy needed to operate the system. Omega plans to

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eventually use the purified and sterilized water from the OCSL for irrigation and in toilets throughout its campus.

In the first stage of the Eco Machine, all wastewater comes into two large septic anaerobic tanks and naturally occurring microbial organisms living in the water begin to digest the sludge that settles to the bottom of the tanks. This process occurs in the absence of oxygen and produces a modest amount of methane gas, though not enough to harvest and use as an energy source. Which I wonder if on a larger scale could this change and be collected as an energy source for a building?

The next step from the anaerobic tanks, water makes its way into a constructed wetland full of plants known for their ability to treat wastewater. These plants help clarify the water as particles in the water stick to the plants' roots. They also remove nitrates from the water, converting them into a harmless nitrogen gas that escapes into the atmosphere. There are four constructed wetlands in Omega's system, each the size of a basketball court. From the constructed wetlands, the water is collected in a 5,000-gallon tank where it is then pumped into the greenhouse and into the two lagoons of the Eco Machine. There are four cells in each lagoon, and as the water makes its way through each cell it is scrubbed and cleaned by plants, fungi, algae, bacteria, snails, and other organisms in the tanks. In turn, these organisms use the nutrients to grow and thrive and the tanks become full of lush plants and teeming with

Figure 12 – Rendered System View "Omega Center For Sustainable Living". BNIM. N.p., 2017. Web. 1 May 2017.
Before being reintroduced back into the environment, water is sent through a recirculating sand filter. Tiny microorganisms living in the sand are capable of removing any nitrogen, organic matter, or particulates that may still be present. At this point the water meets advanced wastewater standards and is ready for non-potable use.

Finally, the processed water is reintroduced to the environment via a subsurface network of chambers in two large dispersal fields under the parking lot. Eventually, the water is used to irrigate gardens, flush toilets, and maintain an outdoor water garden. This precedent offers a detailed study on a living machine and a constructed wetland. The way water is filtered and reused through a nature system, and the use of a contracted wetland that involves habitation will be incorporated into this design.

Figure 13 – Plan View "Omega Center For Sustainable Living". BNIM. N.p., 2017. Web. 1 May 2017.
5.4 Southern Ute Cultural Center and Museum

In Ignacio, Colorado. The Southern Ute Cultural Center and Museum, is a facility that houses the largest collection of rare artifacts, and recorded stories from the Ute Tribe. The 50,000 square foot building, design by Jones and Jones architects; is a modern interpretation of the circle of life. The goal was to promote, conserve, and share their culture with the world. The building houses galleries, storytelling room, classrooms, library, and a native plant demonstration garden. It provides an interesting modern interpretation of a teepee that allows for natural light to glow inward by day and let light out by night. The inspirational use of simulated eagle wings to brace the circle structure and garden provides a separation between public and private. The Center and museum builds community identity and allows for different cultures a have a place to preserve their story. This building has similar important aspect such program and culture and story that I am trying to currently involve into a similar design.

5.5 Sidwell Friends School

In Washington, DC the Sidwell Friends School is a facility that brings together green architecture and regenerative design. This creates a modern learning environment for its current middle school students. The school has been awarded LEED platinum status back in 2007, making it the first k-12 school to receive that rating. The renovation and addition to the middle school transformed a 55-year-old facility into a modern building that teaches environmental responsibility. It was interesting to see how Kieran Timberlake and Associates were able to provide modern spaces, while retaining and enhancing the value of the existing structure. The new 39,000 square foot addition houses spaces for music and art, science and computer labs, counseling, and a library. The most exciting element is the use of constructed wetlands on site as well as other green features that include green roof, passive solar design, solar-ventilation chimneys, photovoltaic array, and reclaim materials, features that have impacted this thesis.

5.6 The Craig Thomas Discovery and Visitor Center

In Grande Teton National Park,
The Craig Thomas Discovery and Visitor Center is a 23,000 square facility design by Bohlin Cywinski Jackson. It is a museum and welcome center for Grande Teton National Park; the building is designed to capture all the natural beauty of the surrounding site, and sits along the Snake River. The building features include exhibit spaces, reception and visitor information services, an art gallery, classrooms, an extensive bookstore, and administrative offices. The most impressive is the glass curtain wall located in a gathering space that reveals a stunning view of the Teton Range. Visitors can view three main themes in the dedicated space, people, place, and protection. These themes promote how each one has shaped the park, it really allows visitors to learn and discover how the park has involved over the time. The massive Douglas fir logs used in the timber structure show their majesty throughout the gathering space. Most of the structural system is bolt connected which allows for salvaged and reuse of the building materials. I have had the pleasure of visiting this structure and was inspired by the idea of allowing the building materials to be reused.
CHAPTER 6
SITE AND CONTEXT

6.1 Site and Site Context Overview

In this chapter I will be discuss the site and site context, and all the relative information about the region, including the Blackstone River Valley, the Town of Grafton, and the purposed building site.

6.2 Site Analysis

The town of Grafton is located 30 miles west of Boston, and 5 miles southeast of Worcester, and 14 miles northeast of the Connecticut and Rohde Island state lines. The Fisherville Mill site is located in the village of Fisherville in South Grafton, just downstream of the joining of the Blackstone River and the Quinsigamond River, which is at the north entrance of the Fisherville Pond. The site is central located in the southern portion of Grafton. The 32-acre site is split east-west Main Street or Route 122A. The northern parcel at 16.2 acres was the original location of the Fisherville Mill, and location of the majority of its contamination and pollution. It’s bordered by the Fisherville pond to the north and to the east by the Blackstone River, and residential neighborhoods. To the west is a housing complex and more residential neighborhoods. To the southwest of the northern parcel is the smallest of the three parcels at 1.1 acres and is separated by the dam to the Blackstone Canal. Currently this parcel is a dirt lot and is reserved for future development. The southern parcel at 17.8 acres is made up of the Mill Villages Park and

Figure 17 - Map of Massachusetts, Town of Grafton, Ma, Created by Author
the floodplain, with the Blackstone Canal and the Blackstone River on either side.

The site and town are all located within The Blackstone River National Heritage Corridor that stretches from Worcester, MA to Providence, RI along the Blackstone River and its tributaries, encompassing 25 cities and towns. The geology and hydrology of the Blackstone River’s it is 43 miles long and the river drops over 400 feet in that distance which is just about 10 feet per mile. The river at one time had about one mill per mile, and South Grafton alone had three mills. When the mills were running during the American Industrial Revolution period of manufacturing, the Blackstone river was consider one of the hardest working rivers in America. Within south Grafton, these mills lasted from 1800s to the mid 1900s. The Fisherville, Farnumsville, and Saundersville mills made up the Blackstone Canal district. These mills, where largely textile manufacturing from the time they where built to the time they where ether closed or abandon due to the Great Depression.

The Industrial Revolution brought great growth to the region turning small rural towns into large bustling cities. It had a large effect on the environment, as land was cleared and toxins were dumped directly onto the land and into the river. In addition, due to lack of fire safety standards and large amounts of cotton in the air, many mills burned down. This released additional toxins into the air, soil, groundwater, and eventually into the rivers. This was repeated many times throughout the region, including twice on the
Fisherville Mill property. After many years, the quality of the Blackstone River improved due to land use changes, and the formation of the Environmental Protection Agency and the Clean Water Act. The river is now the cleanest it has been in years and is a great recreational resource for the town and region, though clean up efforts continue to be needed.

6.3 History of Fishersville Mill

The Fisherville Mill first produced cotton textiles, then moved production to tool and die cutting. Finally, in its later years it produced lawn furniture and foam rubber. Finally in 1986 it closed its door. In 1999 suspected arson fire burned the entire structure to the ground, leaving behind toxic rubble on top of an already degraded environment. The estimation at the time was the pollution would impact the site for 100 years. A five year clean up went in effect back in 2000, most of the materials and contamination has been clean up, including two large twenty thousand gallon crude oil tanks, which were discovered to have leached into the canal with rainstorms. Since then there have been both public and private efforts that have had success in remove contaminants from the site.
Figures 20 - photos from the Fisherville Mill fire in 1999 sourced http://www.oocities.org/graftonfd/Fisherville.htm

Figures 21 - Photos from the Fisherville Mill fire in 1999 sourced http://www.oocities.org/graftonfd/
6.4 Fisherville Remediation

Back in the 1970’s Fisherville mill’s oil tanks had been leaking into the ground and canal. In the 1990 the EPA was order to remove the tanks, which was too late as existing oil was still found in the canal water and sediments. At the time the main source of the contamination was limited to the north parcel, this mostly occurring east of the canal where the mill building once stood. In the adjacent map you can see the location of other contaminants included asbestos, Trichloroethylene or (TCE) a cleaning solvent, and other heavy metals. On the southern parcel, traces of TCEs were found in the groundwater. Many techniques used by the EPA, were used in the process in remediating the contaminants. The remaining oil was processed by capping the contamination site with flow-able concrete to prevent further surface water and sediment contamination. A structure was built and installed with an oil skimmer that removes and collects oil as needed in surfaced top tanks. These are later removed and trucked off site to other EPA approved storage and processing sites.

Figure 22 - Contamination Site Map: Sourced From Collins, Hillary, Jillian Ferguson, and Jeff Frisch, JR. Creating A Teaching Landscape: A Landscape Master Plan for Fisherville Mill. Rep. The Conway School, spring, 2015. Print.
After the fire, the primary concern was the asbestos. Asbestos is a naturally occurring fibrous material that was often used as insulation and a fire retardant in the built environment. It is dangerous to humans when airborne and inhaled, and has been linked to a number of lung and respiratory health conditions. Because of the health risk the EPA had to test the entire site and some near by properties and remove anything that was contaminated before it got into the canal and or river. Lead was also found with the asbestos on site. Lead is a naturally occurring element that causes health problems to humans, especially children, and is strictly regulated. The final chemical found was TCE or Trichloroethylene a cleaning solvent, an industrial solvent and degreaser that are known to cause cancer, as well as other health issues. Reports from the EPA indicated that low levels of these chemicals were found after testing the town’s drinking water, directly after the fire in 1999. The testing location found the chemical in the groundwater of the north parcel and under the new Mill Village Park on the southern parcel. Current remediation techniques were used on both sites, but no information is available to
confirm if this chemical was either removed or destroyed. A hydrologic study completed in 2002 demonstrated that the ground water flowed away from the town well, so it was decide to create a dam where the canal and river met. This was to increase the hydrologic flow towards the river and away from the town well.

According EPA records, nearly 7,000 tons of contaminated debris was removed in 2000 from the site. After the removal, because of all the exposed soil, additional action was required as Massachusetts considers all materials exposed to asbestos to be asbestos bearing. The area was then capped in 2004 with fourteen feet of fill to contain toxins, and to prevent any further exposure. It was difficult to find any information about the actual brownfield itself, how was it constructed and what is contained in it today. I believe the brownfield is still capped today and the toxins that are still sealed, though global warming effects and increased ground water run off may be causes for concern. What

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could happen to the site in 10 to 20 years from now? Today there is a living machine on
the lower canal on the south parcel, which filters the canal water using biological
methods. My proposed project is located on the north parcel and was design to act as a
filter for the currently living machine. This can be a solution for the future preserving the
pass and providing a place for habituation.

6.5 Living System Laboratory

Currently on the southern parcel of the site, John Todd from Ocean Ark
International has designed and built a Living Machine next to the canal that the water
flows from the upper canal that is located on the north parcel. The water source once
powered the Fisherville Mill. His device, which is housed within the greenhouse on the
southern parcel, cleans the effected run off and/or ground water, as well as the water that
normally flows from Fisherville Pond. The southern parcel canal is effectively dammed
on one end, so that the effected water can build up and be fully cleaned. The system
works in four parts: Stage one, is a sediment digester in which untreated water flows from
the river into a gravel filter, which begins to colonize with bacteria and other biological
organisms. The gravel filters sit beneath a blanket of sediment from which contaminated
water is drawn up into the greenhouse using a pump. The oil is heavily concentrated in
these filters and its biological breakdown begins.24 Next, in stage two the Myco-reactors
receive the water from the sediment-digester, and pass it through wood chips contained in
a series of black plastic bins. The wood chips house spongy mycelium, which is the web-
like tissue of fungi as it forms mushrooms. The Myco-reactor bins contain fungal species,

embedded in the wood chips, known to secrete enzymes capable of breaking down petroleum hydro-carbons and which are effective at removing other contaminants as well. Enzymes collect in the water passing through the system and are then pumped into the next stage of treatment. In stage three, the water flows through a series of vertical aquatic cells. These cells house a diverse colony of algae, bacteria, protozoa, zooplankton, snails and fishes. Shrubs and emergent plants grow from floating racks on top of these tanks. Water passing through this system comes into prolonged contact with these living communities and is purified, aerated, and seeded with living organism before it is discharged to the final stage. Finally in stage four, the water is discharged back into the canal through a floating restorer. This floating restorer is a thickly planted floating raft. Water from the greenhouse is discharged here through a series of sprinkler nozzles and flows through fruiting mushrooms and root zones before re-entering the canal. The floating restorer creates a pocket of clean oxygen and life-rich water and attracts a high

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concentration of life.  

As an ecological incubator, the Eco-machine has been placed to provide large numbers of beneficial organisms to the canal on the southern parcel. Within a year the system reduced petroleum hydrocarbons contaminating the river water by 95%.

### 6.6 Existing Conditions and Land Usage

Currently the mill site remains vacant after the mill burned down and the contamination cleaned up was completed. The current land topography, hydrology, and vegetative patterns were almost entirely man made. The original mill foundation doesn’t exist as it has been removed and covered with mounded earth. The original structures left are the water houses on the southern end of the north parcel that once held the turbines for the mill. Also existing is an original canal lock house to the north end of the north parcel sits next to the original water lock dam, which fed the turbines. The main element in the river is the granite step dam over which cascading water can be seen and heard from many areas of the property. Route 122A bisects the project site. The northern parcel has experienced heavy industrial uses and contamination, while the southern is less disturbed and is a wetland area. Though most of the former contaminants have been remediated, oil still seeps into the canal where the fuel tanks for the mill were. An oil skimmer helps remove some of this oil. 21 The land has been capped with a plateauing hill with steep slopes down to the river on the eastern side and a more moderate flat area

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to the canal on the western side. The canal is highly visible from its banks of the north parcel and the pond but there is no access to view it from the street side of the property. Later investigation of the site revealed two waterways that divide the northern parcel into three sections a 1.25-acre section west of the canal, a central 7.6-acre portion, and a 4.8-acre forested section east of the river. The soil itself is compact and stony. Along the Blackstone River and Fisherville Pond, trees are quite mature, and there is thick vegetation. One condition that I took, as inspiration to my design, was a high vantage point at the top of the brownfield, which has views of the canal, the pond, and the river in the distance. Turning around you have a wide view of the site and the southern parcel with the Mill Villages Park and the Living Systems Laboratory. The residents seem use this area as a recreation spot than before when it was a degraded parcel used for parking. The Blackstone River lies to the east of the parcel. The running water has eroded the steep slopes. The soil in this section was very sandy and somewhat marshy with younger trees of different species growing along it. A section of the original historic towpath lies between the canal and the tip of the southern parcel. The Blackstone Canal on the southern parcel is much deeper than in the northern property due to a temporary dam at the southern end where it meets back up with the main river. It contains a canal restorer along with vegetated and non-vegetated oil booms that passively remove oil from the water.

6.7 Future Developments in Grafton

Currently the town of Grafton has future plans in place that include the Hassanamesit Woods, Blackstone River Revision, North & South Village Master Plan, and an affordable housing production plan. As for the Fisherville property, there is a landscape and development master plan for the site created by the Conway School of Landscape Design. For these students the town is turning the property into a teaching landscape for people to recreate and gather. The property is for sale and is owned by the Fishersville Redevelopment Group and is currently in the stages a purpose redevelopment of the site. The purpose project will create a teaching landscape for the community.
Photos of Existing Conditions

Figure 28 – Fisherville Waterfall

Figure 31 – Atop the brownfield facing west

Figure 29 – Blackstone River & Fisherville Pond

Figure 32 – Atop the brownfield facing South

Figure 30 – Blackstone River

Figure 33 – Fisherville mill locks photo taken from kayak
7.1 Program & Concept Overview

In this chapter I will be discuss the steps I took in the design process of this community complex. First I will discuss the site visit and the relationships to each historical aspect that I wanted to make connection too. Next I took these elements and started to create massing models and linear planer models, within a scaled site model. This allowed me to develop my concept through analysis, furthering my design process. This then lead me to develop a program and analysis through the use of models. My models allowed me the ability to work with my hands, and really focused on my prototype design.

7.2 Site Observation

I visited my site twice, once in late august and once in late November. Seeing the site in different times of the year allow me to visualize the land and water concept place my design a top it. In August I focus on both the north and southern parcels and how they connected to the land and water. I also look for the many historical element that where

Figure 34 – Photo of Southern Parcel  Figure 35 Photo of John Todd Living Machine
left from the mill, which were hard to find because of the natural overgrowth throughout the site. Some element I could see from the existing parking and street, such as the old turbine house on the north parcel and the abandoned rail house and the living machine next to the southern canal on the southern parcel, even the capped brownfield on the northern parcel. At the time I didn’t have permission to walk around the northern parcel from the landowner so I mainly focused on the southern parcel, which is currently a public park. When walking around at the time of the site visit, the southern canal was very murky and overgrown. The southern most portions were too overgrown trees and planets.

Figure 36 – Photo of Blackstone Canal

Figure 37 - Photo of Existing Structure on South Parcel

The new mill village park was well manicured and taken care of by the town. It was interesting to see the first phase of the project that was created by the Conway school of landscape design. Currently the project title is; creating A Teaching Landscape: A Landscape Master Plan for Fisherville Mill. After further investigation of the mill village park, I mainly focused on the living machine on the site. I wasn’t able to get a tour but the information station that were set up around the site made it quite to view and learn more about each element of the canal restorer as well as the history of the site. I do view
the park as an asset to my purposed project. On my next site visit, which was later in the year, I want to see the site when most of the natural growth was gone. So I took on a trip down the river from a boat launch up river in my kayak. The experience was amazing and peaceful. Floating down I was able to see the river in its natural state for about a mile, because of the time of year the water was lower and the shore was very muddy, and a lot of the exiting wetland areas could be seen. Including seeing some local wildlife of swans, ducks, and geese. Once arriving to the site from the water I got to see the granite waterfall, the canal lock as well as Fisherville pond. Walking around the shore of the river and pond I was able to take photos and observer the site from another point of view. In the next phase I took this information and tied it altogether into a string model. This model represents all the relationship to different element that I want to bring in and focus on in my design. In the photo below I highlighted the element of water movement in light blue string, historical features with yellow string, water setbacks in purple and dark blue string, property boundaries in orange string. But the key point of this model was show all these elements coming together and be place in a area of the site so that can be observed, as a whole entity. Once complete with this model and my initial site observation I was able to focus more closely to

Figure 38 - Early Conceptual String Model
concept aspects of the design. This allowed me to start making judgment calls in my design. As seen in the string model At this point I started to look at the research and start applying it to the model, from this first realization I was able to create a core concept around this model.

7.3 Concept & Concept Analysis

In concept development I started off by completing my research and focusing on certain details of the history the people and the region. For example the Nipmuck have certain elements that are important to them. The main one is the cardinal direction, which are north, east, south, and west. In their culture these point have specific symbolic meanings such as east means birth. South means youth. The youth of the tribe are focused on learning about their culture, language, history, etc. West means Adult this is where the knowledge is applied. Finally north means elder, where the knowledge is then pass down to the youth. The circle is another symbolic element it which, represents equality as well as life. It shows that no individual is more important than any other. For example when the tribe gathers, they organize in a circles. Dancing takes place in the center formed by the drums and then the audience. Fire is another important element. Fire had many uses; survival, providing food, a place to live, safety, and warfare are all great examples. But the mythology behind fire is most important. Earth is another important symbol in the native culture; the origin of this myth, explains that humans were created from the physical world and since they believe they are children of earth, native people believe they are part of earth. Many Native American tribes have hold reverence for the land, and every form of life. For example Native Americans would not kill anything they could not use. Fishing and hunting was a way to survive, living in harmony with nature is
still the ultimate goal. This also includes water, the Nipmuck tribes are known for being people of the water, and they view water as a scared element. In today world water is more important than ever, to many people take for granted. Water in some Native communities is so important that it is considered sacred medicine. The main reason for mentioning these elements, is because of the importance to the Nipmuck tribe, Even today the native people try more than every to help the natural eco-system by being part of conservation efforts. Creating a concept diagram of this information helps to represent my design goals.

Figure 39 – Conceptual Diagram
As you can see I focused on the four main elements mentioned above. I took and enlarged the cardinal points of my site, and started to sketch on it over and over. I focused on how water could really influence the design bring it within the space; to reuse and recycle it, but how could help the site was the big question. Looking at large natural filter like constructed wetlands, and living machine help and answer the ideas of how I could conserve and reuse this site land and water. I focused, on east main entrance represent birth which important. Using the south and west as area for exposure not only for gain knowledge for the youth and adult with in the tribe, but also bring in the perfect exposure for the living and regenerative aspects. Again I wanted the building to be a natural sponge for the site, I didn’t want the building to harm the already scared landscape. And to the north leaving this area for the elders and other tribe members with a special space too gathering. Another special area on the site and the diagram is this ceremonial space, which is located on the northeast corner of the brownfield. This spot has the perfect amount of seclusion, while providing majestic view of Fisherville pond, the Blackstone River. This area was my main focus, as I wanted the building to provide a private versus public aspect. Allowing one building to block the public while the other circulates and protects this special space. Using this diagram I was really able to focus on my evolving concept. Other aspects that I wanted to include were an understanding of the region, specifically the Blackstone River Valley and how could I bring attention to this part of historical research. Basically the base way was to provide a mixture of different space, which programmatic element could be house. As well as provide outward views of the land and water, with special attention different historical elements that surround the site.
In the next round of concept drawing, seen above I really focused on the site and design, a how my green strategies can help the land and water. As stated before, I want to focuses on a more natural approach using the building as a sponged to clean the site, giving this site a new life as a revitalized place, giving a community a place to inhabit were the goals. Applying this idea to a diagram, seen above was the best way to represent and allow this idea into an attitude. Which is letting eco system take control giving this separation between the natural environment and the built environment. Will allow the building to float above the damage while not effect the purposed cleaning system in any way. This collaboration should happen naturally but with some help of the building and its systems. I purposed that the building would be raised on a set of mixed shallow frosted projected walls and pylons giving minimal intrusion into the site. Allowing the building to elevate gives the natural element the ability to pass through and or under the building while being clean and process, this would also allow humans and nature to coexists in a new way, which was a big element in my design. Allowing the building to site on a structure, which is raised off the grown, would bring no harm to the already scared site.
### 7.4 Model Massing

After the site visits and concept realization, I was able to categorize and apply all this information into physical process models. For my own design process being able to build a physical models helps me visualize my own concepts. Each one allowed me to focus on a certain detail of the project. By doing this I was able to start a program application to each model and finalizing on a massing and planer models very quickly. Below are a few of the models from this process, in the beginning; I mainly focused applying different approaches with massing, then moving to more of a static extruded models.

![Figure 41 – Early Massing](image1)

![Figure 42 - Continuing Iteration of Massing](image2)

In this first round, letting the land and water forcing my design. Using the foam at first just to design a building shape then scaling that shape down and placing it within a scale cardboard land model. This help with placement and scaling issues I had at the time, this allowed me conceptual design a complex with two different structures. In the top right I used high-density foam to create a basic shape forming different spaces with in, this is where I started to apply a few programmatic elements to my form, such a,
museum space, market space, and a gathering space. The idea with the first foam model was made up of a community center and market; I will go further into this in the next section. To the top right photo on page 69, this model is where I started to work out the detail of structure and wetland filtration in a basic conceptual massing. I looked to apply the connection to nature, water, and building. By creating these long wall fingers that would stretch out from underneath building giving separation to each natural filter, while applying a structure for the building to sit atop. In the next round, top left photo I took a break from massing and focused on different structural styles that I could possibly apply to this building, this photo is a series of different models I made. These model allow me to play and test different structural system that focuses on timber construction and design, I really want to test the limits of different systems look at timber framed precedents, with this time, I was able to create these unique designs. This then lead me to more of a massing and sectional model that was then finalize, this can be seen in the top right photo. At this point I was able to strictly focus on the programmatic elements that I wanted to add to finalize this design.
7.5 Program Analysis

Finally in the last stages of my design process, I focused on programmatic elements. After continuous program iteration, I focused on eight categories. Starting with important aspect, rentable space such as office, stores, markets and gathering venues that will provide income revenue for the tribe, so that have to ability to provide for the building as well as for the legacy of the tribe. Next is museum space for the Nipmuck tribe, this area will be large enough to represents differ historical artifacts and provide a space for the general public to learn all about them and their history. I also proposed a small gallery space with intention of displaying historical information about the Blackstone River valley and Fisherville property. Another aspect this design was to provide many different places to gather inside the building and outside the building. I mainly focused on those areas where groups of people could gather and commune with each other. Next, most importantly was designing ability for the building to clean the site and the water runoff naturally to create a living system, turning a degraded site into something better than what it once was. Learning was another important element, Here I want to both focus on providing a space where the tribe could use to teach and educate that youth about their heritage, while also provide a town with a space that can teach the community about living systems and the history. I provided space within the building for

Figure 45 – Program Analysis Process Diagram
classrooms, galleries, library, and computer lab. As well as having view of the building systems, my intention was to reinforce this building as a community hub of learning with in the town. Feasting is one of the elements you might not think of, but idea of sustainability growing, harvesting, cooking, and eating food, is very import to the Nipmuck tribe, as well to the outside community. I have purposed areas to do all these events within these two structures, most important providing areas to grow and feast.

Final water, this element was more focused more on the symbolic and mythological properties of it when the two communities, while promoting the preservation for the future; being able to have areas to clean it shown how to recycle and reuse it, while provide natural views of water is my goal.

Above is a diagram showing my steps in my conceptual process, transforming these elements into a conceptual design layout. As you can see I took the eight categories, providing each with a color code. Then placing each color into a wedge within a circle. Giving the significance of a circle I thought this was an important step. From this I started to create a process of shaping and resizing each category within my basic conceptual floor plate. As the floor plate and design changed the program changed with it. In the beginning it was very monolithic and square but as the design evolved it
started to shrink and compact into this free-formed design.

At the same time, sketching diagrammatical with my program elements. I also created conceptual program model as well. The photo to the left shows a series, of intro model to more finalized model with in the same cardboard land model, at first took a complied list of space and cut them up into different shapes to show different room configurations and room sizes. This was more detailed than my diagram at this point I was getting into space allocation. By pinning these spaces down and up along the length of a toothpicks, help represent what space would be on the ground level and what would be on the first floor.

As the diagram changed I create a newer model to replace the old. Which helped to finalize floor plans and a building layout.

7.6 Program & Concept Final Thoughts

With the work done by John Todd, the Town of Grafton and my purposed project I know this site could become an asset for the Nipmuck tribe, and the community. Providing a place that promotes sustainability, while having the ability for a community to live, work, and learn, is only steps away from a green future.
CHAPTER 8
DESIGN

8.1 Overall Design

The overall design of the prototype was a success. I was able to give back to a community, while preserving and transforming a degraded site. The overall design was two structures, the main building is 30,000 square feet and houses a Community Center for the Nipmuck tribe and would be placed atop the brownfield. The second structure is a 20,000 square foot market with rentable spaces that will provide revenue to the tribe as well as give the community a place to gather. This market building will be placed along the Route 122 A, cutting and nestling the building in the southern portion of the brownfield, ever so slightly. The main access and most attractive for the market will be along the Route 122 A, while the Nipmuck community will have a main east entrance from a natural gravel path atop the brownfield. Main parking will be off site on one of the parcels, but there will be a drop off location to the lower ground level and a limited accessible parking near the east entrance for cars and buses. The Community Center space specifically designed the Nipmuck Tribe is 30,000 square feet, has a ground floor, that will house the service for the building and a lower lobby space access to a secondary

Figure 47 – Rendered View of Central Lobby in the lower Level of Community Center
entrances. This will lead you to the wood shop and craft area, where the tribe members will be able to teach the youth native crafts and building skills. These areas will have access to the outside with bi-folding doors so that material can be easily gathered. Also located adjacent to this space will be a management office for the main caretaker of the facility. Within the same lobby there is an administration space that will house a Main Office and Informational area and ticket booth for the museum. Over by the main services is the access to a grand staircase that leads to the main east entrance. Entering the museum for the lower lobby, this space is dedicated to the history of the region, people, and places. It will be a place for the Nipmuck’s to house and present their historical, artifacts, photos, and crafts from the past. Because nature is so relevant, I allowed to nature control the design, the basic shape of the museum came from the concept that nature is always in viewed. The large windows and living system control the place of the walls within the space and allow for a natural connection within a control environment. There are three large galleries in this space and each will have a different view out to the natural world. As we continue from the museum, there are two large spaces with one that is dedicated to a library, and the other is for storage. This storage
area is where artifacts will be staged and preserved for the museum. As we continued along the remaining ground floor, it will contain a facility services area and a large amphitheater. The amphitheater was designed to provide a large venue of space for the tribe to hold their indoor events. The large step provides sitting for patrons during events. With access from the first floor to the ground level allows for a natural feeling outdoor space within along with in large north face window that will direct light down into the surrounding space. One element that is not shown in the rendered view at is considered is applying natural plant feature to break up the large concrete step arena. To bring in more natural light within the space a glazed window to the east face exterior wall is added.

![Figure 49 - Rendered View of Amphitheater in Community Center](image)

Starting from outside and atop the brownfield, we can enter the east entrance through the main lobby. In this lobby a staircase and an accessible ramp provide access to the lower level and the first floor. On the first floor within the main lobby space along where facility services is located and to left the ramp is where the first of two elevators are located. As we move further into the main lobby space and off to the left is placed two large classrooms for the tribe to provide education about their heritage. Next to the classrooms is a lounge for more relaxed gathering area. Moving to the right and going down the corridor, off to the right is the main indoor/outdoor gathering area. This area is
specifically design for pow-wows, meetings, and general tribal gatherings. In designing this space, accessibility was a major consideration for it to be enjoyed by everyone. I created a wrap around ramp that went down to the main performances space where the gathering with the tribal members would occur. Since fire is important to the tribe, I placed a large two-side stone fireplace in the middle to provide atmosphere for tribal performances. The upper level stage wraps around to provide seating for the rest of the tribe or invited patrons to the event. Surrounding this space is clearstory glass that will bring in the most natural setting as possible.

![Rendered View of Main Gathering Space](image)

From the main gathering space, as we turn right the next space is a large commercial kitchen, to provide the tribe ability to host large events. For the Nipmuck
tribe food is important and being able to provide, and cook a meal is special and symbolic. The kitchen is next to the main gathering space to effortlessly transition from dining to gathering. From dining area, we continue down the large corridor, in actuality, this transition space is oversized, so the guest will not feel restricted while transitioning from space to space. As we transition to the next two spaces they include a computer lab and a telecom room. Both areas are equally sized to provide a space to socialize as well as lean and communicate with other members of the tribe. The next space was design specifically for the elder members within the tribe to provide a place that not totally separated, but is quiet. It features a place for them to relax and gather. It contains a large lounge for gathering with two large offices for formal meeting spaces. Both of these areas are separated by a large glass wall that allows direct view and connection to the rest of the spaces, but also allow for seclusion. The lobby and transition spaces make up the large areas in the design. The idea here is to have all these other small spaces wrapping around the large event gather area to provide optimum collaborations between human and nature. Finally, the rest of the space within the first floor is dedicated to facility service in the north lobby, which also has direct access to the amphitheater bringing natural light into these indoor / outdoor experiences, with direct connections to the event and inhabitants. Moving across the property to the second structure is designed as a community-gathering hub for tribe as well as the town. This Market facility houses a large event space that runs length of the entire first floor. On the other side it provides space for services including administration offices as well as storage, bathrooms, and a space for shipping and receiving. The purpose was to leave the space as open as possible so that it could be also set up to support any events. Designed primarily for a town
market, the structure allows for vendors to setup booths to sell their wears, or it could be converter to be a rentable event space. Continuing up to the second floor of the market facility is space designed as rentable floor with offices for businesses. Included on this floor is large café with a commercial kitchen, and a large natural lite indoor-outdoor dinning space. This area provides views of the surrounding grounds. Beside rentable space for events this area is flexible for the Nipmucks to provide tradition meals to the visitors. Ability for the tribe to receive income from this second structure is important to provide continued revenue to support the entire complex.

Figure 51- Rendered View of Market Space  
Figure 52- Rendered View of Café dinning Room
8.2 Building Plans

Community Center First Floor Plan / Market First Floor Plan

Scale 1/16" = 1'
8.3 Elevations
8.4 Site Plan
CHAPTER 9

CONCLUSION

9.1 Final thought on Project

This Thesis was an exciting and a tough challenge for me. I have expanded my own knowledge on array of subjects from, green infrastructure, regenerative, biophilic and resilient designs to southern New England industrial and Nipmuck tribal history. I feel I have accomplished a thesis that will meet the needs of the community, providing a resilient design for the Town of Graton that will subdue the effects of the current brownfield and provide a natural functional design for the Nipmuck’s to experience and provide cultural education for their tribe for the future.

What I learned over the past year has intrigued me and was a great experience. I plan to spend more time on this project developing structural details, exterior finishes, and landscape finishes. I would like to have the opportunity to present this work the Nipmuck tribe and the Town of Grafton.

9.2 Final Review

I had a great final review of Thesis project. The panel enjoyed the in-depth research I did on the Nipmuck tribe, the Blackstone River Valley, and the Fisherville Mill site. They understood how I developed my theories and strategies around existing green infrastructure. They where excited to see how I developed these aspects of my research into a working concept that lead to my design. By allowing myself to explore my concepts and programs through modeling base designs demonstrated the strength of the project. The only criticism from the main discussions and comments concluded that on my exterior details and structural system, the panel agreed that my elevations could
require further development. Taking the time to focus on facade treatments, viewing
different material, and possibly tying in my cardinal point concepts into the exterior
treatment, was an offered solution by one-panel member. Another panel member enjoyed
the gesture I created and commented that my building was very dynamic. She wanted my
project to focus this same gesture outward to the exterior of the building as well. Another
panel member commented that it was a great choice that I created this building with low-
slung roofs that move with the landscape that was fitting with your building form but
suggested that on my next round to focus on senses, for example warmth, cold, ruff and
smooth when looking at these scaled geometric spaces, try to bring interior and exterior
space through the building. The final reviewer suggested that, the way I approached the
site and design was really in line with my style of architecture and that I focuses on ways
for the building to responded to the site. Now it is time to focuses on what is the resilient
or regenerative answer to these final steps with furthering my design. I welcome these
comments, as they were very genuine and thoughtful and gave me insight for future
projects.

9.3 In Conclusion

In conclusion this purposed project and thesis was a success. This thesis, push the
limits of my project and myself to demonstrates a new level of green design. Within this
project I was able provide a link to the past heritage of the Nipmuck tribe and create a
platform for them to pursue their culture, education, and experiences on a site that they
could continue a reverence for. For the Town of Grafton, my thesis will provide a
functional solution for a degraded brownfield site that would bring back pride in the
community by providing a resilient, biophilic and regenerative concept design that will
stand the test of time and will work to heal the area from the past. Utilizing applied green
technologies from proven precedents that incorporated solar, wind, water filtration,
passive heating and cooling, living machines, constructed wetlands, living walls and
natural day lighting as proposed, will provide for a regenerative platform that can provide
clean energy back to the community. By preserving the land and water through the built
environment is a great passion of mine that I hope to one day to be able to spread this
knowledge and implement as an architect.
APPENDIX

FINAL REVIEW BOARDS

CREATING A COMMUNITY
A New Ecological, Economical, and Social Path to Uniting a Community

Nipmuck Tribe

The Nipmuck people are descendants of the Algonquian peoples of Nipmucet, "the beautiful pond place," a region which is presently known as the vicinity of Central Massachusetts, from the southern side bordering the northeast portion of Rhode Island, and from there westward through the present-day towns of Sutton, Blackstone, Webster, Ashburnham, Clinton, Fitchburg, Mont Vernon, North Brookfield, and Sturbridge. They originated from the Algonquian languages, with a culture adapted to life in a wild and forested area. They were a horticultural people, living in small villages, and their economy was based on agriculture, hunting, and gathering.

Blackstone River Valley

The Blackstone River Valley is a region in central Massachusetts, United States, known for its industrial history. The valley was important in the development of the American Industrial Revolution, and today it is a popular destination for tourists and history enthusiasts. It is known for its history of textile mills, and the Blackstone Canal, which was constructed in 1828, played a significant role in the growth of the area. The valley is also known for its natural beauty, with many parks and scenic spots to explore.

Map Overview - Nipmuck land

Map Overview - Massacomet Reservation, Groton, MA
Regenerative Design

Ecological
- Improving the surrounding environment
- Restoring a site’s natural hydrology
- Providing for native wildlife and plant habitat

Economical
- Producing more energy than the building consumes
- Attracting the interest of other buildings to meet their energy demands
- Lowering energy cost for the residents with the town or city

Social
- Creating community identity with a nodal engagement
- Regrowth of soil or asphalted Community
- Respecting Diversity

Precedents
- Cobra Smart School, Khublai Russia
- Buckwill Friends School, Washington D.C.
- The Omega Center, Rhinebeck, NY
- Center for Sustainable Landscapes Pittsburgh, PA
- Southern Use Cultural Center, Ignatius, CO

Biophilic Design

Biophilia defined as the inherent human inclination to affiliate with nature
- Biophilia design, an extension of biophilia
- Visual connection with nature
- Presence of wild
- Dynamic & Ethereal light
- Connection with natural systems
- Natural materials
- Another dimension of the natural world placed within a modern built environment

Resilient Design

Resilience design: the intentional design of buildings, landscapes, communities, and regions in order to respond to natural and manmade disasters and disruptions.

Some examples include climate change, sea level rise, increased frequency of heat waves, and regional drought

General Application Community Scale
- Creates community facilities (resilience hubs) that can serve as gathering places during emergencies and interruptions in critical services
- Rely on natural biological erosion control solutions that will grow storage and wetlands
- Design vegetated roofs and rainwater harvesting to reduce the urban heat island effect and manage stormwater
- Non-potable irrigation
- Flood security

Site Strategy / Program Analysis

Concept Diagram
- Concept Site Section Analysis
- Concept Site Plan Analysis

Site Analysis Model
- Earlier Massing
- Earlier Structure Analysis
- Concept Site & Massing

Program Analysis
- Planning
- Gathering
- Cleaning
- Crafting
- Feasting
CREATING A COMMUNITY
A New Ecological, Economical, and Social Path to Uniting a Community

Site Plan

Building Analysis

Building System Axon

Building System Axon Legend
- Solar
- Water Collection
- Rain Harvest
- Natural View
- Vegetation-Green Space
- Circulation
- Site

North View

West View - Community Center

Complex View

Market View

Northwest View

East View

Material Analysis
- Stone Facade
- River Stones
- Wood Shingle Facade
- Tree Bark Facade
- Timber Structure
- Wood Shelter
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