Rapid Revival

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Landscape Architecture
Thesis Program

Thesis Archival Note

The following thesis project, entitled Rapid Revival: "Re-imagining The Former Blandin Paper Mill Through Sustainable Design Practices And Public Amenity Planning In Grand Rapids, Minnesota.", Was composed over the course of the 2018-2019 academic school year. The Thesis Program, as contained here, was initiated and completed in the fall semester as apart of the LA 563/763: Programming and Thesis Preparation course. Supplemental material, including the Thesis Boards and the Thesis Presentation documents, were generated in the spring semester as a part of the LA 572/772: Design Thesis studio. Any inconsistencies between the different documents, in terms of research and design, should be excused per the evolution of the project across the two semesters.

Rapid Revival

"Re-imagining The Former Blandin Paper Mill Through Sustainable Design Practices And Public Amenity Planning In Grand Rapids, Minnesota."

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

By

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In Partial Fulfillment of the Requirements
for the Degree of
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Table of Contents

Project Title and Signature Page	Pg. 2
List of Tables and Figures	Pg.5,6
Thesis Abstract	Pg. 8
Narrative of the Theoretical Aspect of the Thesis	Pg. 10
Major Project Elements	Pg. 12
User Client Description	Pg.14
The Site	Pg.15
Project Emphasis	Pg.17
Goals of the Thesis Project	Pg.18
A Plan for Proceeding	Pg.19
Research Results	Pg.20
Literature Review	Pg.22-33
Additional Material	Pg.34,35

Table of Contents

Project Typology	Pg.37
Typological Research	Pg.38-45
Project Justification	Pg. 46,47
Historical, Cultural, and Social Context	Pg.49-54
Site Analysis	Pg.55-61
Performance Criteria	Pg.62,63
Appendix	Pg.65-68

List of Tables and Figures

Figure 01 : Blandin Yard 07
Figure 02 : Dam Bridge 08
Figure 03 : Reservoir and Mill 09
Figure 04 : Blandin East Entrance 10
Figure 05 : Naturalized Space at Blandin 13
Figure 06 : City View 15
Figure 07 : State View 15
Figure 08 : Log Storage at Blandin 16
Figure 09 : Main Building at Blandin 21
Figure 10 : Green Roof 24
Figure 11 : Rain Garden 24
Figure 12 : New York Paper Mill 27
Figure 13 : Phytoremediation 29
Figure 14 : SITES Prerequisites 31
Figure 15 : SITES Rubric 31
Figure 16 : Thermal Desorption 33
Figure 17 : Pollution Graph 34
Figure 18 : Phytoremediation Plants 35
Figure 19 : Burbank Eco Campus Common Area 36
Figure 20 : Pure Energy Stream 38
Figure 21 : Site Perspective 39
Figure 22 : Site Plan 40
Figure 23 : Meeting Space with Overhead Trellis 41
Figure 24 : Silva Cell Detail 42
Figure 25 : Permeable Paving Detail 42
Figure 26 : Plaza Space at Campus 43

List of Tables and Figures

Figure 27 : Canal Walkway 44
Figure 28 : Mill Ruins 45
Figure 29 : Preserved Staircase 45
Figure 30 : Lake Pokegama, Grand Rapids 48
Figure 31 : Blandin Railroad Tracks 49
Figure 32 : Log Storage at Blandin 50
Figure 33 : Log Storage at Blandin 51
Figure 34 : Birds Eye Blandin Site 52
Figure 35 : Log Cutting Competition 53
Figure 36 : Forest 54
Figure 37 : Mississippi River Reservoir 55
Figure 38 : Circulation 56
Figure 39 : State Context 56
Figure 40 : Site Context 56
Figure 41 : Impervious Surface 57
Figure 42 : Site Buildings 57
Figure 43 : Native Trees 58
Figure 44 : Native Plants 59
Figure 45 : Rainfall Graph 60
Figure 46 : Site Climate 60
Figure 47 : Site Images 61
Figure 48 : Site Interaction Matrix 62
Figure 49 : Site Railroad 64
Figure 50 : Mississippi River 65
Figure 51 : Mississippi River 66

Figure 01 | Blandin Yard
Photo Cred: Michael Tollefson

Thesis Abstract

As technology progresses, more companies are choosing paperless practices. As this trend continues, numerous paper mills are beginning to shut down leaving behind first rate spaces to be redeveloped. Problems we face with the turmoil of the closed down paper mills include polluted soil from the waste of making paper, water pollution from the same paper making process, and large structures left behind that need to be repurposed.

Through sustainable landscape design and research concerning the pollutants that result from the paper making industry, these spaces that commonly line the water's edge can be transformed into an environmentally friendly oasis for people, wildlife, and native vegetation. With these areas it is crucial to incorporate low impact designs near the water to protect the natural environment surrounding the site. While using SITES grading system as a basis for sustainable design, different sustainable practices will be considered for the best path to take in remediating and redeveloping paper mills. With the finding on what works best, an appropriate framework for redeveloping these sites can be made to propose the best options possible for future paper mill brownfields.

Figure 02 | Dam Bridge
Photo Cred: Michael Tollefson

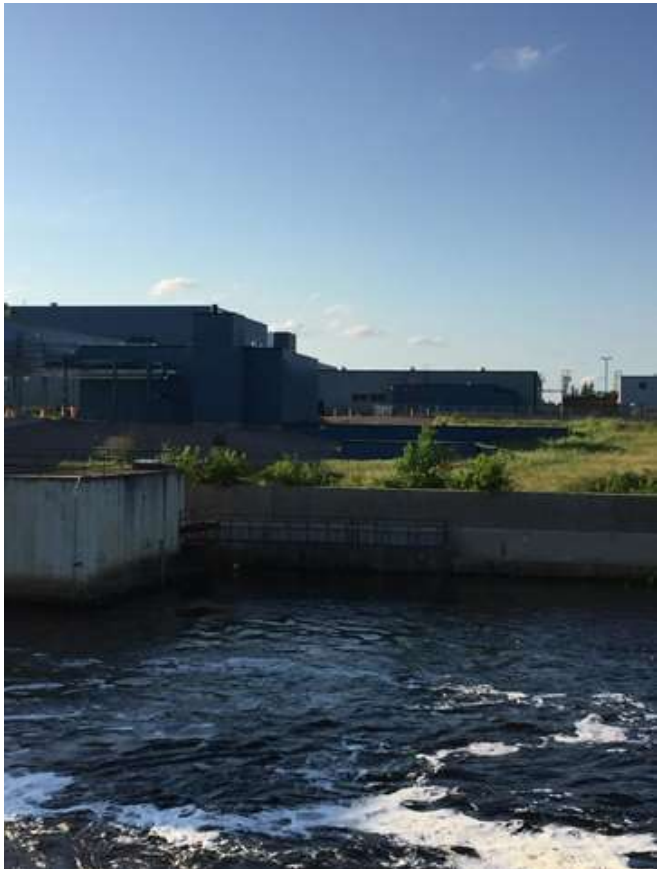

Figure 03 | Resivoir and Mill
Photo Cred: Michael Tollefson

Thesis Narrative

Abandoned paper mills need to be remediated and redeveloped as they are becoming more obsolete and are degrading the environment. With the growth of paperless practices, paper mills are slowly shutting down, leaving behind contaminated buildings and soil. These areas have the opportunity to be redeveloped and reused to benefit the communities around them. My research question focuses on how to redevelop and maximize the performance of a paper mill brownfield through sustainable design. Through these findings, a general framework for enhancing paper mill brownfields sustainability can be constructed and utilized for future designs.

The relevance of this question aids the landscape architecture field by shedding light on an upcoming area of research for sustainability and remediation. To achieve the best results many factors need to be researched, such as paper pollution effects on soil and vegetation, material and structure repurposing, integrating native vegetation to improve soil conditions, sustainable practices, and storm water management practices.

The initial assumption is that Paper mill waste is harmful to the environment around it and that with the right guidelines the space can be redeveloped to positively impact the city and environment around it. This can be done by implementing different soil remediation techniques as well as figuring out different methods to recycle materials on the site.

A majority of the data needed will be a qualitative study. Data about paper waste pollutants will be needed, as well as research on different sustainable practices and different success rates. Desired findings include material recycling techniques and how they can hybridize with different sustainable practices. These results will be used to influence the intervention on the chosen site.

The design will answer the analysis through a mixture of sustainable design methods in order to fit the needs of a run down paper mill. All design features will be rated with the ASLA SITES (V2) rubric. This improves Landscape architecture research because it sheds light on a new and upcoming amenity for remediation and we can all learn how to better plan and design for these spaces.

Figure 04 | Blandin East Entrance

Photo Cred: Michael Tollefson

Major Project Elements

Context

Located in Grand Rapids, MN

Along the Mississippi River

Near center of the city

Structures

Mixed use buildings

Brewery

Event Space

Overhead elements

Education Center

Environmental

Native Plantings

Storm water management

Wetland integration

Permeable ground materials

Materials

Permeable Pavement

Stone

Wood Mulch

Steel

Riverwalk Area

Direct water access

Kayak Launch

Boardwalk

Native Plantings

Solar Lighting

Plaza Space

Seating areas

Outdoor venue

Vegetation

Existing production structures

Figure 05 | Naturalized space at Blandin
Photo Cred: Michael Tollefson

User Client Description

Clients

City of Grand Rapids

Chamber of Commerce

EPA

Community Organizations

Itasca County

Blandin Paper Company

Excel Energy

State Office

Users

Tourists

Citizens of Grand Rapids

Environmentalists

Bird watchers

Fisherman

Schools

Kayakers

The Site

Figure 06 | City View Photo Cred: Google Maps

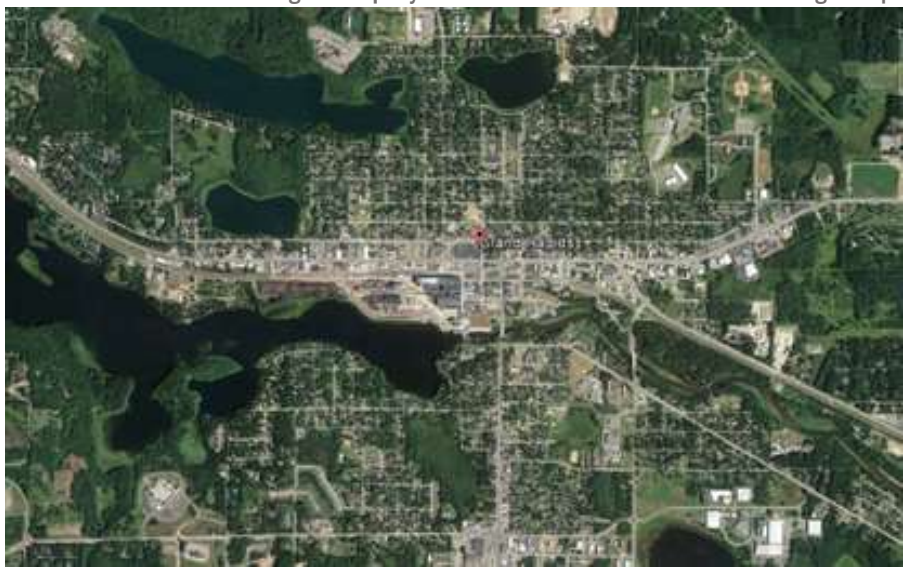

Figure 07 | State View Photo Cred: Google Maps

Location: Grand Rapids, MN

Context: Macro-Middle of Minnesota, iron range

Micro- South side of city adjoining Mississippi River.

Size: 84 Acres

Site Typology: Paper Mill

Status: In Process of shutting down

Climate: Warm summers and frigid winters

Ecosystems: Aquatic marine mammals and fish

Native Prairie

Urban Corridors

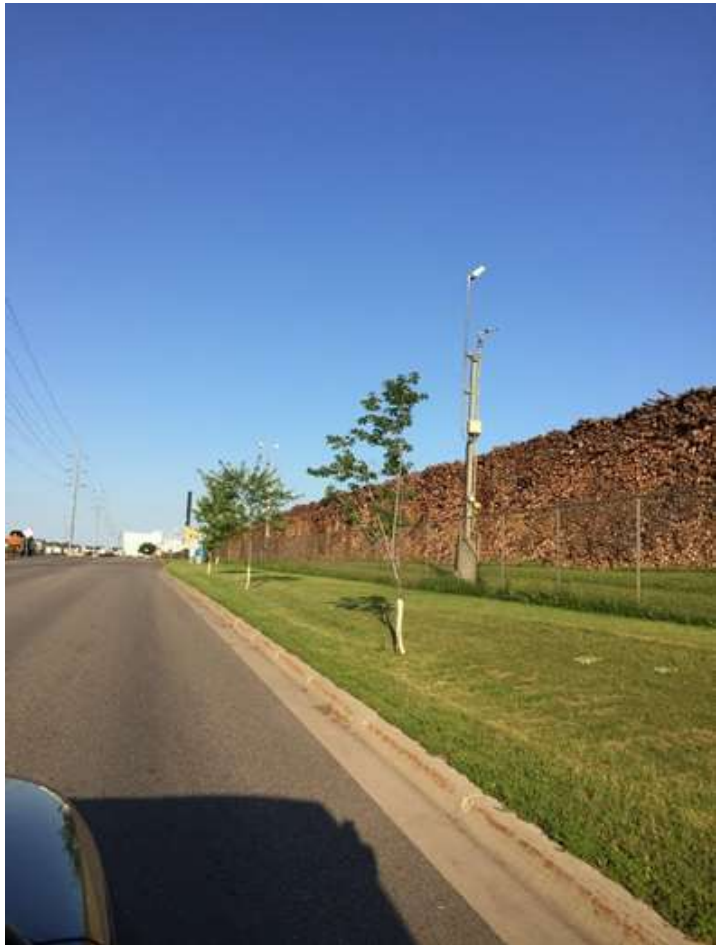

Figure 08 | Log Storage at Blandin
Photo Cred: Michael Tollefson

Project Emphasis

Sustainable Design

Will Be achieved through research of ASLA SITES guidelines and sustainable case studies.

Soil Remediation

Research on the pollutants paper mills produce and which practices best remediate them.

Material Recycling

Study how different materials on a paper mill site can be reused and repurposed into new structures and design details.

Structural Repurposing

Research paper mill structural elements and how they can be improved and transformed to fit different needs.

Project Goals

Remediate the Site

Use remediation techniques to properly cleanse the affected soil.

Introduce Native Habitat and Protected Species

By gaining knowledge of locally native and statewide native plant species, these species can be introduced to the project site.

Introduce species that are considered threatened or endangered to the area.

Increase Community Access to the River

Decrease barriers between the river and the city

Provide naturalized access to the river that integrates wildlife and pedestrians

Maintain a Gold/Platinum Level Sustainable design

Format design to fit the sustainable principles of ASLA SITES.

Detailed Construction Documents

Learn the construction methods of sustainable implementations such as storm water management systems, repurposing of materials and land reusability.

Plans for Proceeding

January | February | March | April | May

Site Analysis
- Pollutants
- Circulation
- Climate
- SWOT

Concept and Programming
- Programs
- Space Allocation
- Features

Design Development
- Sections
- Site Plan
- Perspectives
- Materials

Final Product
- Boards
- Renderings
- Model

Research Results

Literature Reviews

- Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices

- Technical Approaches to Characterizing and Cleaning up Brownfields Sites: Pulp and Paper Mills

- SITES v2 rating system: For Sustainable Land Design and Development

Typological Research

- Pure Energy Park
- Burbank Water and Power Eco Campus
- Little Falls, MN

Additional Material

- Remediation graphs

Figure 09 |Main Building at Blandin
Photo Cred: Michael Tollefson

Literature Review

Title:

Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices

Author:

Environmental Protection Agency

Topics Covered:

LID Practices

Abstract

In this literature review, I will be discussing low impact development strategies on managing stormwater. These strategies are a newer trend and they reduce and prevent the issues involved with development on nearby water bodies. The emphasis of the article discusses LID practices and how they can improve the health of the site and how they can lower the cost of stormwater management systems. This article is based on cased studies and factual data other than philosophical aspects.

Review

What will be discussed in this review are different kinds of stormwater management techniques that can be implemented into a site to improve its sustainability. I believe that with proper stormwater management strategies, low impact development will improve the sustainability of a site. The main takeaways from this article will be the main categories of Low Impact Development, and the different methods in which to demonstrate these different aspects of the development.

Low impact Development is described as a stormwater management strategy that has been adopted in many localities across the country in the past several years. Set of practices that can be used to reduce runoff and pollutant loadings by managing the runoff as close to its sources as possible. Other benefits of low impact development include promoting the use of natural systems, which can effectively remove nutrients, pathogens, and metals from stormwater and that it helps protect downstream resources from adverse pollutant and hydrological impacts that can degrade stream channels and harm aquatic life. What the article describes about the benefits of LID practices will be a big contributor to defining different practices that will improve the sustainability of a site. Along with the techniques used to manage stormwater, this article also reviews a series of case studies and compares the benefits of low impact developments to conventional developments. These will help me figure out how I can effectively reduce the cost of development on my given site and improve the economy of the space.

LID Groups

The Low Impact Development practices are categorized into six main groups. These groups consist of conversion designs, infiltration practices, runoff storage practices, filtration practices, and low impact landscaping. Conversion design is the first topic area and what it specializes in is minimizing the generation of runoff by preserving open space.

This focuses on disturbing the natural landscape as little as possible. Certain aspects of this practice include preserving natural habitats and by not completely grading an area of land in order to reduce the runoff rate during storm events. Examples of this kind of design include cluster development, open space preservation, shared driveways, reducing amount of pavement, reduced setbacks, and site fingerprinting. This group of LID practices will be beneficial to my study because it provides a series of measures that can be taken to preserve and enhance the ecosystems that reside within my site.

Infiltration Practices

Next is the second group of low impact development, which is infiltration practices. Which are landscape features or structures made to capture and infiltrate stormwater runoff. These practices are especially important in places where up keeping drinking water and maintaining a base flow for streams are of high importance. Four main examples of infiltration practices include: Infiltration basins and trenches, Porous Pavement, Disconnected downspouts, and Rain gardens and other vegetated treatment systems. The most beneficial takeaways from this group for my site will include the infiltration basins and trenches, the porous pavement, and the rain gardens.

Runoff Storage Practices

The third area of Low Impact development practices is runoff storage practices. This area of the article will prove to be one of the most important ones in relation to my site. Being able to store storm water and reuse it for watering and other purposes will help with the sustainability of my site. Runoff storage practices reduce the volume of runoff discharged to surface waters, lower the peak flow hydro graph to protect streams from the erosive forces of high flows, irrigate landscaping, and provide aesthetic benefits such as landscape islands, tree boxes, and rain gardens. With all designs, aesthetics may not be the driving factor for the emphasis of the design but incorporating elements into the site that enhance its beauty is something that is always sought after with design because it's things like vibrant flowers and gardens that most people will remember and bring them back to a site.

The main categories of this area of LID include: Parking lot, street, and sidewalk storage, Rain barrels and cisterns, Depressional storage in landscape islands and in tree, shrub, or turf depressions, and Green roofs. Of all things options, the practices intended for use at the project site will include just about all these factors. The reuse of the buildings will incorporate green roof structures to help improve the sustainability of the site. Rain barrels and cisterns can also be introduced around the renovated buildings and plaza spaces. As these practices require additional materials for storage, introducing them into the naturalized areas will be prohibited for the design of the site.

Runoff Conveyance Practices

The fourth area of Low Impact development is runoff conveyance practices. These are extremely important for managing the flow of water on the site. In large storm situations, these practices are used to allow water to flow throughout the site before it exits. Major benefits of runoff conveyance practices include slowing the flow velocities, lengthening runoff time of concentration, and delaying the peak flows of these storms that are discharged off-site. Key elements of this group include: Eliminating curbs and gutters, creating grassed swales, roughening surfaces, creating long flow paths over landscaped areas, installing smaller culverts, pipes, inlets, and Creating terraces and check dams. Introducing these elements to the site will not only improve the stormwater flow rates, but it will also contribute to the aesthetics of the design.

Filtration Practices

Filtration Practices are the fifth group of LID. The importance of filtration practices is that they help treat the polluted stormwater as it filters through the material that is implemented to catch the pollutants. With these practices, polluted media will begin to add up in these spaces, so in order to remove the pollution, removing the topsoil and replacing it will be an easy fix to the issue. The main landscape elements that this group is comprised of consists of Bioretention/rain gardens, Vegetated swales, and Vegetated filter strips/ buffers.

Literature Review

Low Impact Landscaping

The final group of Low Impact Development practices is low impact landscaping. With this area of development, the focus concerns aesthetics and maintenance. The goal for the maintenance is to reduce as much water, labor, and chemicals as possible. This group aids in the practices of finding appropriate plants for the site. Preferably native plants as they are the best equipped to perform in the area with the least amount of maintenance required. There is a series of practices in this group, Practices include: Planting native, drought tolerant plants, converting turf areas to shrubs and trees, Reforestation, encouraging longer grass length, Planting wildflower meadows rather than turf along medians and in open space, and amending soil to improve infiltration. This will be important for the site design as I will have to identify native plant species and which ones will thrive best in the environment the site has to offer them.

These six categories help provide useful techniques in improving stormwater on a site. Because of these there are many benefits of using them. Benefits in this report at categorized into two categories, Environmental and Land value and quality of life benefits. The main environmental benefits include: pollution abatement, protections of downstream water sources, ground water recharge, water quality improvement, reduces incidence of CSO's, and habitat improvement. The benefits that come with Land value and quality of life include: Reduced downstream flooding and property damage, real estate value, lot yield, aesthetic value, and more public participation for the public projects that incorporate these practices.

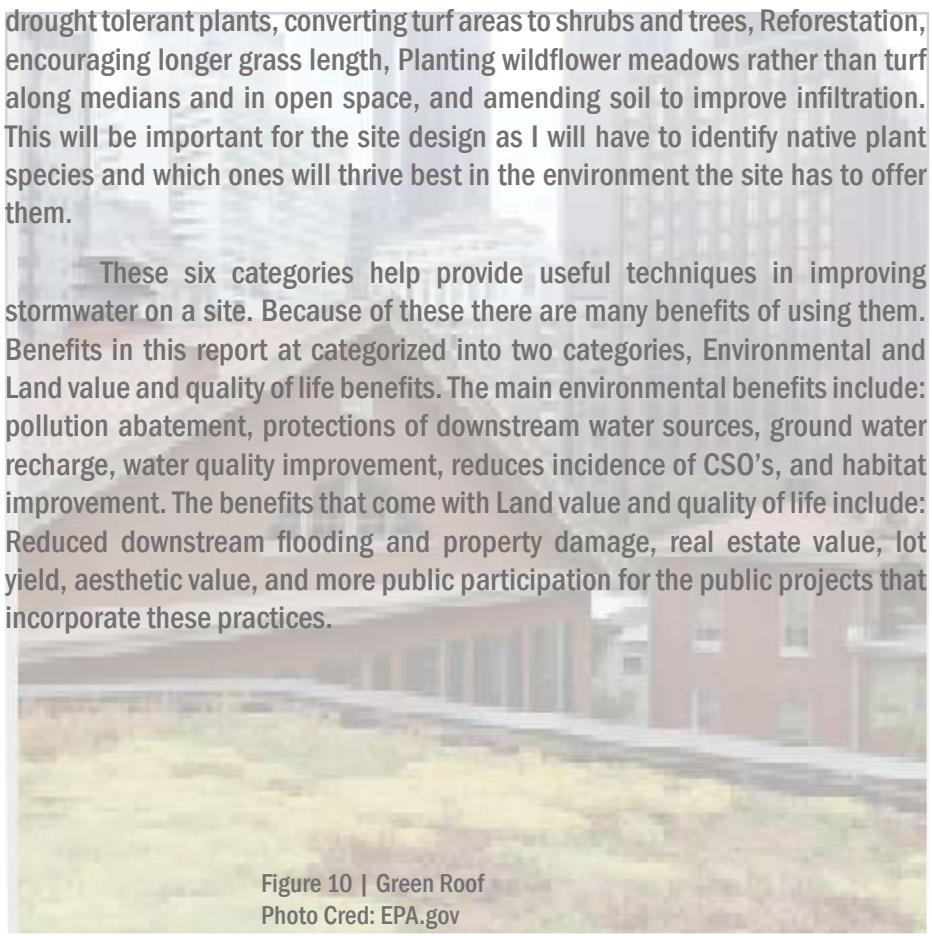

Figure 10 | Green Roof
Photo Cred: EPA.gov

Analysis

The article doesn't have a stance on whether these practices are useful or not, but through case studies the author is able to correlate the benefits of Low impact development practices to the reduction of cost and enhancement of stormwater systems on the site in which they are implemented. Though there isn't much opinion or argument, there is a segment where the author discusses how stormwater management is thought of more as an engineering project to the public, these LID practices have not had as much consideration as the infrastructure and piping that is used in engineering techniques. I agree that these practices should have a greater emphasis when deciding how to manage stormwater. With these considered before the implementation of pipes and costly infrastructure, the opportunity to save money and have less of a footprint on the environment would prove to be a better approach in terms of sustainability of a site. For the design of the project, elements of each of the LID groups will be selected to improve the stormwater management, and the sustainability of the site.

Figure 11 | Rain Garden
Photo Cred:EPA.gov

Literature Review

Title:

- Technical Approaches to Characterizing and Cleaning up Brownfields Sites: Pulp and Paper Mills

Author:

Environmental Protection Agency

Topics Covered:

- Paper Mill Background
- Paper Mill Pollutants
- Paper Mill Brownfield Remediation Techniques

Abstract

This article describes the history of paper mills, and their decrease in production. Additionally, the article covers the pollutants involved with the paper making productions, and how these pollutants can be removed from the effected site. This article, like the last relies on factual information other than philosophical views. Due to this, analysis will be made on the content written other than the views of the authors.

This article proves to be the most sufficient source of information for the thesis research. Throughout this review, the main areas of focus will be geared towards the sections that discuss the types paper mills, the pollutants they produce, and what remediation techniques can be used to clean the affected areas. Starting with the paper mill types, these are categorized into five categories, Market Pulp Mills, Non-integrated Mills, Integrated Mills, Converting facilities, and De-Inked Pulp Mills. Due to the variety of mills, this review will be based off the types that correlate with the mill at the thesis site, which are Integrated mills (EPA).

Pulping and Papermaking Pollutants

With integrated mills, you must worry about both the pulping and papermaking pollutants as they are the only kind of facility that deals with both processes. Pulping deals with taking the wood from its regular fibrous state and turning it into the pulp that is used to make the paper. This process requires the site to have a supply of logs stored on the site. These areas can take up a large area as the site chosen for research has a nine-acre plot of land designated for the storage of these logs, and the space is continuously filled with logs. Chemical pulping comes in two forms, Kraft/Soda process and the sulfite process. The Kraft process uses a sodium based alkaline solution (white liquor), consisting of sodium hydroxide and sodium sulfide, to digest the wood chips and produce pulp. Whereas the Sulfite process uses sulfurous acid to degrade the lignin in the wood. There are a series of contaminants that are involved with the pulping process, these products include: Sodium Hydroxide Residues, Sulfuric/Sulfurous Acid, Hydrochloric Acid, Hydrogen Sulfide, Ammonia, Lead, Cyanide, Zinc, Chromium, Resin, and Unnatural Fatty Acids and Chlorinated Analogs. These contaminants will play a key role in deciding which remediation techniques will be needed to remediate the site. Another factor that coincides with the pulp making process is the process of bleaching. This process is important to know because this process produces the most harmful contaminants in paper making. The contaminants released by this process are known as dioxins. These chemicals are known to have the highest toxicity to life.

They are persistent chemicals that are difficult to break down, in fact they cannot be broken down by bacteria. The article describes that it takes 28,000 gallons of water to produce a ton of paper. With this water the being released afterwards, only so much pollution can be treated, therefore some pollutants are released into the environment. Contaminants produced by bleaching include: Hydrogen Peroxide, Elemental Chlorine, Chlorinated Compounds, Sodium Hydrosulfite, Polychlorinated Biphenyls (PCBs), and Dioxins and Furans. All of which are to be considered in the remediation process.

Pulping and Papermaking Pollutants

In the process of making paper, there are two different options to use. These options are comprised of both Dry end and Wet end operations. Wet end operations work by spreading out the pulp on a screen that is in motion. The screen then is moved through a series of vacuums to remove as much water as possible (EPA). Once the sheets are rolled, they are then sent to the dry end operations. These operations take the product from the wet end operations and steam heat the sheets and then are sent through other machines that apply different coatings to the paper based on what the purpose of it is. It is when these coating machines are cleaned is when the pollutants are released into the environment (EPA). Contaminants produced by these two operations consist of Waste sludge, Bleaching and pulping contaminants, SVOCs (in coatings), VOCs (in coatings), Slimicides, Chlorinated phenols, some aminos, and quaternary ammonium compounds, Some organosulfur compounds, Some silver compounds, Titanium residues, Oil and grease discharges collected in sediments, and Polychlorinated biphenyls.

Now that the pollutants from the paper making process are known, a list of the possible remediation techniques will be reviewed. When it comes to the site remediation, there are two factors to consider, these are soil remediation and water remediation. Both need to be utilized in remediating these brownfield sites. If both aren't incorporated at the site, the risk of the pollutants continuing to spread greatly increase.

Figure 12 | New York Paper Mill
Photo Cred: wrvo.org

Literature Review

Soil Remediation

With soil remediation, the biggest struggle is the removal of dioxins. These pollutants require strict remediation techniques which include excavating the contaminated soil and remediating it off site. The other contaminants can be cleaned through less invasive procedures. There are five primary means of remediation for soil contamination, these include: Bioremediation (ex situ), Surfactant flushing, thermal desorption, phytoremediation, and in situ vitrification. Beginning with bioremediation, this process involves introducing white rot fungus to destroy chlorinated and organic compounds. Though this process is the surest way to remediate the site, it requires the most resources as badly contaminated soil must be shipped off site to be cleaned. The second process is known as surfactant flushing. This process is the most popular form of remediation for pulp and paper mill sites because it helps remediate a wide range of contaminants which is beneficial as paper mills have a lot of contaminants to account for. The process introduces a surfactant to wash the soil and the pollutants collected during the wash can be shipped off-site. The process of thermal desorption involves using low temperatures between 200 and 900 degrees Fahrenheit. Doing this helps remove organic compounds, sludges and dioxins. The gases emitted from the process can then be stored and treated on or off the site. This site is a good one to consider because it gets rid of the pollutants that are more harmful to the environment. The down side is that it cannot remove the heavy metals in the soil. Since it cant remove the metals, a good technique to accompany this technique is phytoremedition. This process used plants to use their remediation qualities to take harmful pollutants in the soil and remove them through absorbing the harmful media through the roots and releasing them into the air as cleansed elements. The final method is in situ vitrification. This remediation process involves using electricity to melt down contaminated soils and sludges produced by paper mills. Of all these processes, the two best options would be either the combination of thermal desorption and phytoremediation, or ex situ remediation. The key differences between these two deal with the time it takes to clean up the site, and the cost of the process.

Water Remediation

There are two main options for cleaning up contaminated water, these include treatment walls and groundwater extraction. The article states, “This treatment technique is a very affordable way to treat contaminated groundwater. After determining the direction of groundwater flow and ascertaining the source of the contamination, a trench is dug perpendicular to the direction of water flow, and a wall is constructed in the trench. The wall can be made from a variety of different materials, depending on the contaminants that are present. The walls are constructed such that water can flow through, while contaminants bond with chemicals in the wall. Activated carbon is typically used to remove contaminants.” As for groundwater extraction, a series of treatment wells are drilled on the site into the contaminated aquifer. There are two ways to go after the holes are drilled. Water can be added to dilute the contaminated aquifer, or water can be extracted and cleaned on the surface. With these two options in mind, the most sustainable option would be to implement the treatment walls as they would be less invasive on the existing habitat.

Analysis

Knowing that the Paper mill on my site is an integrated mill, I know that I need to plan for removing a majority of the contaminants mentioned in the article. Because of this, the remediation processes will have to be thorough but also as least invasive as possible to protect the habitat bordering the site. With the use of in situ remediation and treatment walls, most of the contaminants on the site will be both removed and trapped in order to make the soil and ecology of the site healthy again. In further research, a graph of the remediation processes and which chemicals they remove will be made for further understanding of the processes and how well they work.

Figure 13 | Phytoremediation
Photo Cred: rouxinc.org

Literature Review

Title:

- SITES v2 rating system: For Sustainable Land Design and Development

Author:

- Green Business Certification Inc.

Topics Covered:

- About SITES
- SITES process
- SITES Rubric

Source

Review

The overview of the rating systems starts by discussing why the Sustainable sites initiative was created. It discusses how urbanization and development of the past and present doesn't address the environment when developing. Instead the increase of urbanization is causing harmful effects on the environments, while in turn creating a bad environment for the community. This system is based on understanding the environment that lies on a piece of land, and how to positively effect it as much as possible. The SITES program provides guidance and incentives to developers that want to implement sustainable practices into their designs.

The SITES system has a set of guides that it follows when developing land. These guides are the following: Do no harm, Apply the precautionary principle, Design with nature and culture, use a decision-making hierarchy of preservation, conservation, and regeneration, Provide regenerative systems as intergenerational equity, Support a living process, Use a systems thinking approach, Use a collaborative and ethical approach, Maintain integrity in leadership and research, and Foster environmental stewardship (SITES). These guides were set in place to define measurable criteria needed for developing and they also act as a set of guidelines for developing land. SITES offer Ecosystem Services to benefit the environment with the introduction of plants, water, bedrock, and soil organisms. The overall goals of sites are to Create Regenerative Systems and Foster Resiliency, Ensure Future Resource Supply and Mitigate Climate Change, Transform the Market through Design, Development, and Maintenance Practices, and Enhance Human Well-Being and Strengthen Community (SITES). These goals are the basis for which the grading rubric is made in the SITES system. There are numerous factors that go into making a sustainable site. The important ones will be mentioned in this overview, and the ones that are more technical will be displayed through my design.

Scoring

The sites system certifies landscapes with a points system. There is a total of 200 points possible in the rubric. It is ranked by certified, with is 70 points, Silver, which is 85 points, Gold, which is 100 points, and lastly platinum, which is 135 points. The sections that contribute to these points are shown in the image below.

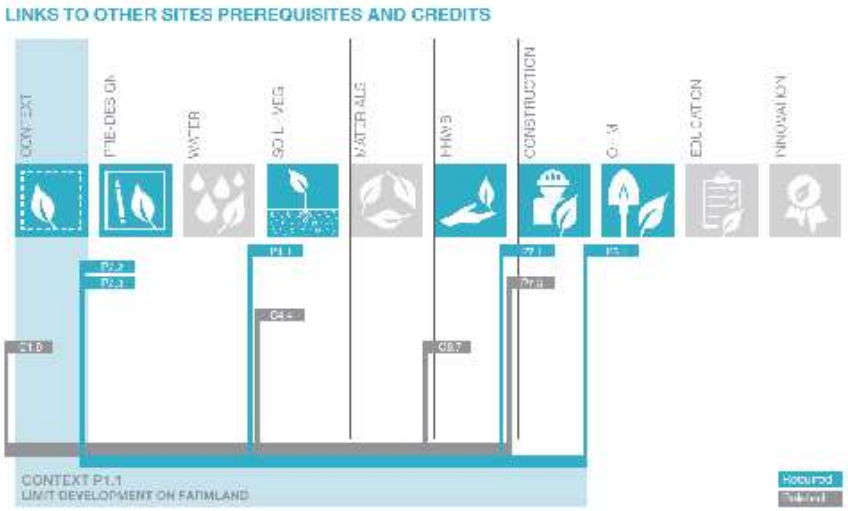

Figure 14 | Sites Prerequisites
Photo Cred: ASLA.org

Each of these sections have numerous requirements that need to be met to reach a certain level of sustainability. Since there is so many, they will be shown at the end of the review in the rubric that is provided for grading other than discussed individually. When it comes to the design process, the details of the sections will then be implemented into the design. Shown below is the grading sheet for a sustainable site. The ten categories are totaled up at the end of the design and added to discover the sites over score.

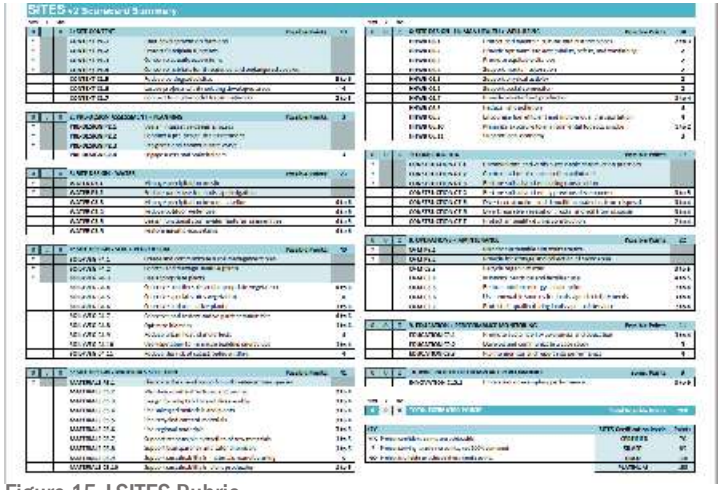

Figure 15 | SITES Rubric
Photo Cred: ASLA.org

Analysis

All the information provided in the SITES grading rubric is paramount to my research and how I will be able to score my overall design at the end of the spring semester. The most important takeaways from this article include the ten sections that need to be implemented into the design to deem it a certain level of sustainable. None of these factors are more important than the other because to successfully enhance a site and its sustainability, you need to make sure you are improving it in every way possible. This approach of design will practice both the techniques mentioned in the earlier literature reviews. With there being so many different requirements to meet, I will have to have an emphasis on certain areas to increase the score as much as possible while still taking the other requirements into account and providing a fluid design that will maximize the sustainability of the site I will be designing in Grand Rapids.

Literature Review

Summary

The topics covered in the literature review are the primary sources of information for the thesis research. Each one will be considered for design approach and methods when it is time for the final project design to be constructed. Of all the articles, some were more beneficial to the overall research than others, but all are necessary in terms future design decisions. In this summary the main takeaways from each literature review will be discussed as well as how they will be implemented into design decisions next spring during the design phase of thesis.

The first article about the Low Impact Development practices was a big contribution to the thesis because it helped explain different areas of stormwater management that need to be addresses and it also provided a series of practices that can be implemented into a design to achieve the greatest management of stormwater runoff. These things are important to know for my research because a large area of sustainability must deal with the management of stormwater on a site. With the article breaking the practices of Low Impact Development into six smaller section. It aided in helping the reader find information on each individual section much quicker. Each area of stormwater management will be implemented into the design of the thesis site and they will be constructed and displayed in the final design to further help the viewers understand the benefits and construction of these elements. This article goes hand in hand with my SITES rubric article. They just play a smaller part of the big picture of creating a sustainable landscape. This article also helped with showing the benefits of LID practices in terms of the cost of implementing them. The thesis research study is primarily based on what practices to use to improve the site but knowing how they can affect the cost of a site is beneficial when it comes to real life situations and describing to investors how these practices will be more beneficial environmentally and economically to their cause.

The second and most important literature review conducted was about paper mill brownfields and what pollution they produce. This was extremely important because to effectively remediate and redevelop my thesis site, I need to understand what pollutants will need to be dealt with. This article helped by categorizing paper mills into the main functions they are used for and through that I was able to figure out the functions and pollutants that come from it. There are a large number of chemicals involved with the paper making process, and while a fair amount of them aren't too harmful to the environment, there are a good number that have negative impacts. The perks of the newer modern paper mills are that they help filter out some pollutants that would be going into the environment. The issue is that the pollutants aren't completely filtered and because of that, issues with these chemicals leaking out into the environment begin to occur. With the paper mill being studied for the thesis design, all pollutants will have to be accounted for as the site is categorized as an integrated mill, which performs both producing the pulp that is needed to make paper, and the actual act of making the paper. With the mill taking part in both of these tasks, there will be much more pollutants and chemicals, and therefore, remediation methods will have to be extremely thorough. In the literature review, the most dangerous pollutant discussed was dioxins. These will be the most difficult to deal with when remediating because they cannot be destroyed easily. Because of this, remediation techniques discussed in the review will have to be implemented. The techniques with the highest success rate discussed in the review are the bioremediation, and in situ vitrification techniques. These will work well, but the bioremediation techniques will cause too much interference with the natural environment. The process that will be utilized for the site is surfactant flushing. This is choses because it is a process that can be done on site and doesn't require removing soil off the site to be cleaned.

Summary

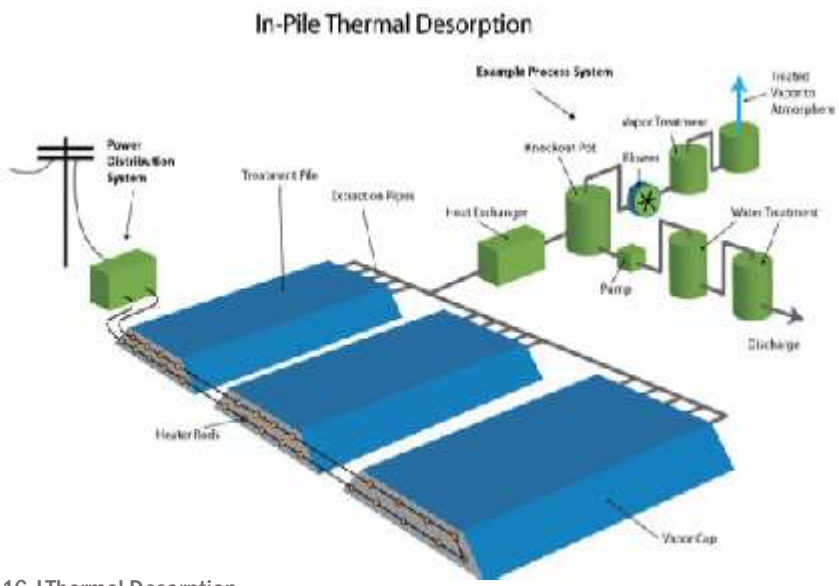

Figure 16 |Thermal Desorption
Photo Cred: Terratherm.com

This method is also being used because it treats the widest range of pollutants that are associated with paper mills. Any soil that is deemed untreatable will have to be sealed off from environmental conditions and monitored to make sure no pollutants are exposed or leaking into the environment. As for the groundwater remediation, there is not as many options with the remediation process. For the choses site, treatment walls will be the remediation source of choice as these will both provide options to educate the community and will have the least impact on the environment.

The final literature review was about the sustainable sites initiative and the rubric that is used to grade sustainable sites. The article covered a large amount of information that pertains to the research and will actually be the basis for judging the performance of the design once it is finished. The primary takeaways from this article include the design process that in adapted for making sites sustainable, and the ten primary sections for which a sustainable site is reviewed and scored. There was a graphic showing the order of which these sections are placed, and it goes; Context, pre-design, water, soil and vegetation, materials, human health and well-being, construction, operations and maintenance, education and performance monitoring, and innovation. Each one of these sections is paramount to the design of my project site. Within each of these sections are a series of requirement that are needed to be graded in the final site analysis. Since there are so many of these, they will be further researched and implemented in the design process in the spring semester. That way they can be graphically shown and explained. This review as mentioned before applies to the thesis research in all ways possible. With the emphasis being sustainability and brownfield remediation, the SITES initiative takes all aspects into account. With this I will be able to see which of the sections apply most to paper mill brownfields and create a method of design that is geared towards improving these sites and making the most out of them.

Additional Material

Pollution Graph

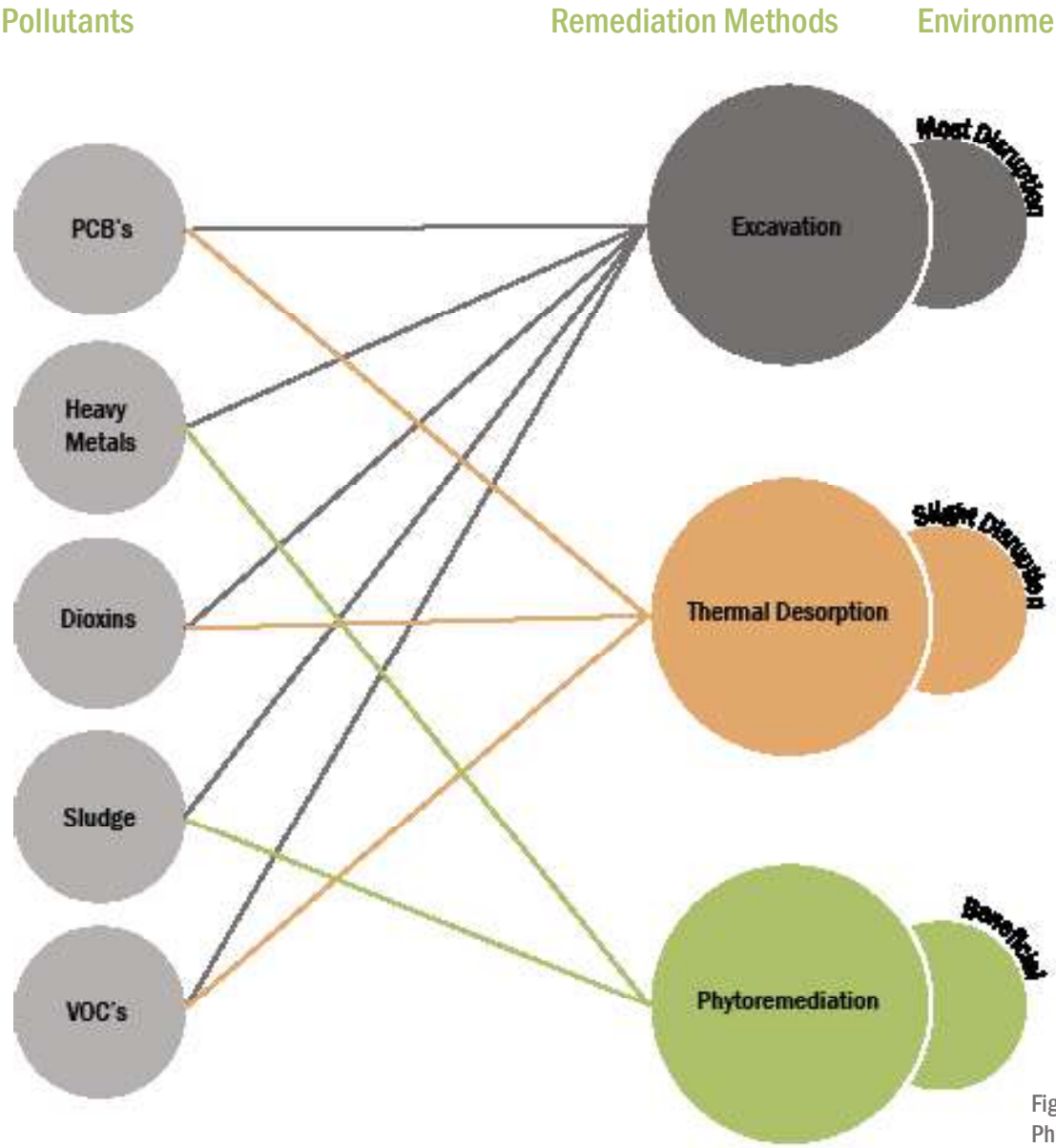

Figure 17 | Pollution Graph
Photo Cred: Michael Tollefson

Additional Material

Phytoremediation Primary Plants

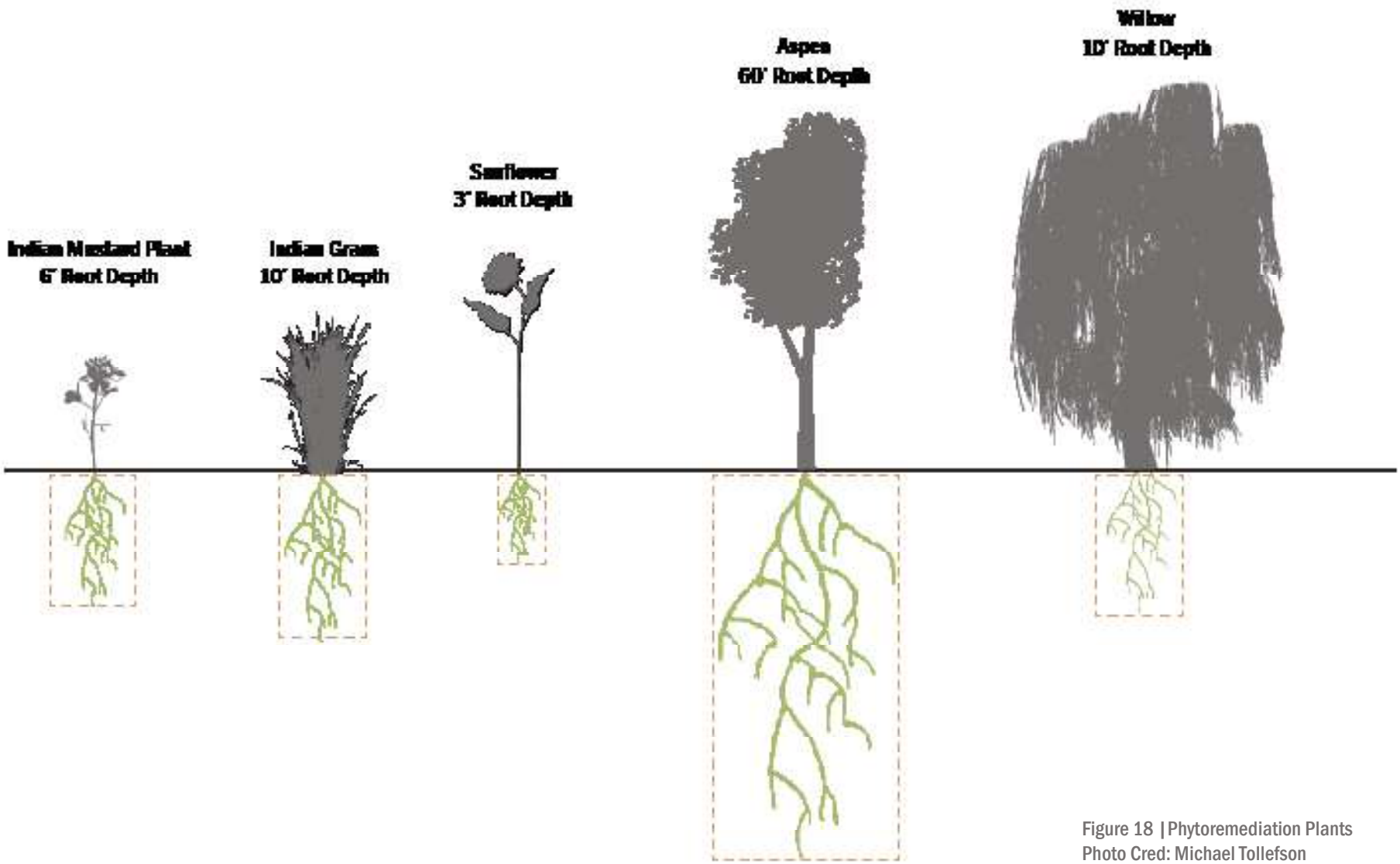

Figure 18 | Phytoremediation Plants
Photo Cred: Michael Tollefson

Figure 19 | Burbank Eco Campus Common Area
Photo Cred: Michael Tollefson

Project Typology

Brownfield Remediation
Sustainable Design
Storm water Management

Typological Research

Primary Research Categories

Typology

Paper Mill Brownfields, Waterfront Brownfields

Setting

Urban Areas, Northern and Western United States

Scale

Area of design intervention

Impact

Environmental improvements, city benefits

Influence

How the design influenced future projects of same discipline

Typological Research

Pure Energy Park

Muncie, IN

Context

Located in Munchie Indiana, this 50 acre site was formerly an Indiana steel site that eventually was run down had low productivity. Showing obvious sign it was in need of a revamp. Unique characteristics about this site are that it is located on a river allowing water access to the city, also that it is a sizable piece of the city, so redevelopment can have a major positive impact to the city.

History

The former site, the Indiana Steel and Wire Co, was first started by the Kitselman brothers in 1904. The site produced wire products used for telegraphs and more. (Muncie). It was peaked near the mid point of the 20th century and ceased production and closed down in 2002. Before cleanup, the site had two landfills as well as a sludge pond, so the site was highly contaminated before it was remediated. It wasn't until 15 years later that plans were made to remediate and redevelop the site into a park for the city.

Figure 20 | Pure Energy Stream

Photo Cred: http://www.cityofmuncie.com/Projects--Kitselman-TrailheadandPark.htm

Typology

Brownfield Sustainability Stormwater Management Park

Pure Energy Park

Muncie, IN

Contribution to Design

This case is important for the thesis because like the project site, this one is large scale and utilizes all its space through a unique design. It's important to be able to use all the space on the site to make the most out of it. Other than size similarity, it introduces innovative ways to manage stormwater as it proposes a man-made channel that will provide a buffer between the polluted area and the new clean development that will be constructed past the point of pollution.

Project Elements

Listed as a brownfield, the site underwent years of cleanup in order for it to be utilized and built on. The motto for the influence behind the design is "Live, Work, Play", the designer along with the owner want this area to breathe new life into the city of Muncie as well as add connections to existing green-ways with trail systems. (Muncie).

Elements going into the site include a five-megawatt solar power plant, a community center, headquarters and a hotel, green space, and stormwater management systems involving a man-made stream that will be utilized not only for water cleaning but for recreational activities such as kayaking. (Muncie).

What the developers of the Pure Energy park are doing is bringing in seven feet of clean soil to seed before any of the development begins. The main reasons behind this are to "one, raise the site above flood level, and secondly to make a barrier between the area of the site that is contaminated, and the site that is getting the new features." (Muncie). Because of this addition, it greatly enhances the environmental aspects of the site because without it, floods and a lack of barrier would continue to spread pollutants throughout the site and into the surrounding water body.

Figure 21 | Site Perspective Photo Cred: http://www.cityofmuncie.com/Projects--KitselmanTrailheadandPark.htm

Pure Energy Park

Muncie, IN

Project Elements

What is uncommon about the site is the use that the man made stream will be for stormwater management and the addition of recreational activities. In most cases, the stormwater system is primarily for the treatment but in this case the system will also harbor amenities that will allow citizens to kayak down it.

Environmentally, the design for this site will enhance it immensely, from integration of green spaces to the stormwater management systems. The Solar power plant will also enhance the energy on the site in an environmental way. Socially this site will bring together citizens of the city and allow them to have direct water access. Even more so, the addition of the educational classrooms and hotel will improve the social quality of the site. Politically this design introduces a community center for gatherings. In terms of what the site is trying to achieve, it responds to consumers with the addition of hotels and headquarters, while taking an environmental view with the sustainable practices taking place. Conceptually the site provides innovative approaches to keep pollution under control. While also incorporating social aspects to bring the city together.

Conclusion

This case is the best example that was found to base research and design off of for the thesis design. It incorporates innovative and interactive ways to manage stormwater and polluted soil. In addition to that, it connects green-ways and enhances circulation for the city of Muncie. Though it is in its beginning phases of construction, this design will bring a huge amenity to the city as well as demonstrate a unique way to redevelop a contaminated site.

Figure 22 | Site Plan

Photo Cred: http://www.cityofmuncie.com/Projects--Kitselman-TrailheadandPark.htm

Burbank Water and Eco Campus
Burbank, CA

Context

Located in Burbank, CA, the 3.2 acre site is home to a sustainable campus that the workers of Burbank Water and Power utilize. Its location is within a larger electric power station and is accompanied by other industrial buildings.

History

The Burbank Water and Power facility has been a large contributor of electricity and water to the city of Burbank. In fact it has providing these amenities for over 100 years.(ASLA). With the old infrastructure beginning to fail, it affected both the employees and the surrounding environment. The company recognized that the site was failing so it took it as an opportunity to redevelop the site and make it better for both the environment and its employees. One of the biggest challenges on the site was that most of the site was impervious, meaning making it a sustainable site was going to take some serious measures. In 2011 the Power and Eco Campus was constructed for the employees.

Figure 23 | Meeting Space with overhead trellis
Photo Cred: http://www.ahbe.com/portfolio/burbank-water-power

Contribution to Design

This case was chosen because it practices multiple different sustainable techniques which will provide ideas and different options for when the design implementation phase of the thesis takes place. Also, because the design features existing elements from the old site in order to preserve some of the historic quality of the site, which is desired in the design of the chosen site for the thesis.

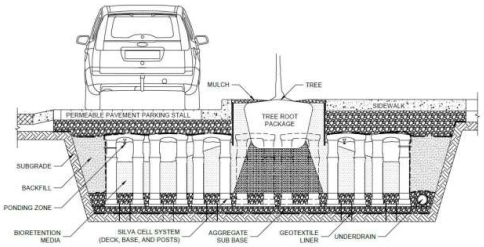

Figure 24 | Silva Cell Detail
Photo Cred: NCDEQ Stormwater Design Manual

Project Elements

One of the most interesting features on the site is the green street that was designed in order to show off the stormwater treatment methods for not only the employees, but also the public. Some features that the green street has include permeable paving, filtration planters, bio-filters, and silva cells. The silva cells are an important addition to the green street because they allow for larger trees to be introduced, other than smaller shrubs and perennials. In addition to the green street, the rest of the site encompasses multiple stormwater treatment options, and the plant is actually the first in the world to run completely off recycled water.

Along with the green street, the site is home to three different green roofs. These help with the filtration of stormwater as it makes its way to the ground level. Some of the materials on the roof consist of recycled glass pavers that are intended to portray a meandering stream that is surrounded by plants that are native to the area. To save money on energy costs, the company introduced led lighting on the roof surfaces resulting in the annual saving of $14,000 a year.

The most unique structure on the site lies in the sites "Centennial Courtyard", which is a meeting area near the electrical area of the site. The area saved a large structure that acts as a large trellis, both showcasing the historical elements of the site as well as showing innovative ways to introduce nature into the public space.

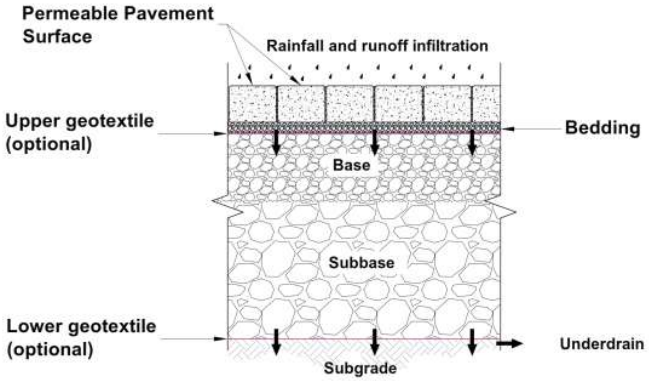

Figure 25 | Permeable Paving Detail
Photo Cred: NCDEQ Stormwater Design Manual

Project Elements

Environmentally the design takes a site that was struggling and completely revamps it to be a sustainable powerhouse in the Landscape Architecture field. From being almost completely impervious to being a place that manages stormwater better than most sites in the world the transition is quite remarkable.

Socially it creates a space that brings together the employees and enables them to interact in a more natural and inviting setting. For the public it invites them to visit the space from the green street that is open to them.

Culturally the site appreciates the past elements by implementing them into the design instead of completely removing them from the site. It also introduces a new direction of design for the community as it is showcasing how to manage stormwater and become more of a sustainable site.

Conclusion

Major elements of this case study that will give direction to improve the research will be how the site introduced different sustainable practices and I can then determine which are the most beneficial in terms of sustainability. Along with the sustainable practices, the integration of nature and industry gives unique ideas to implement when designing the final thesis project.

Figure 26 | Plaza space at campus
Photo Cred: http://www.ahbe.com/portfolio/burbank-water-power

Typological Research

Little Falls, Mn

Figure 27 | Canal Walkway
Photo Cred: John A. Weeks III

Context

Located in Little Falls, Minnesota in the middle of a rural area. The site is home to the ruins of a paper mill that was once up and running in the area.

History

The Hennepin Paper Company began back in 1890 and ran off mechanical power. Years later it expanded and became one of the largest mills in the country. Materials it produced were construction paper and the paper for Crayola Crayons. (Weeks). Nearly a century later in 1980 the production slowed and the company was sold. The last owner of the site was Minnesota power, who then closed in 1999, leaving the site abandoned. (Weeks). Due to the high pollution, the EPA had to tear down and remediate the site. A total of three million dollars. Once the land was safe, the decision to put a park on the site was made.

Project Elements

The main focus of design in the park was to keep existing artifacts of the mill ruins and to use them as an emphasis in the design. (Weeks.) This was to keep aspects of the history of the site intact as well as to create a green space for the people.

The materials on the design have rural small town features. These include seeded lawns, concrete walkways, and gravel paths for circulation. Some existing artifacts on the site include the company sign, brick arches from the building, the original canal that diverted water, and more tools and pieces from the original mill site. A unique feature on the site is the canal that once flowed water through it.

Since its use it has been dammed up and filled in, but there is word of opening it back up to allow water to flow through the site as it once had.(Weeks). This would add new life to the site that it hasn't had in years as well as add a landscape feature that would prove to be an amenity to the site.

All of the artifacts from the original site have had fencing and gates around them in order to preserve them and protect them from potential damage. Though the protection may not be the most pleasing to the eye, it is essential to protect whats left of the original paper mill.

Figure 28 | Mill Ruins Photo Cred: John A. Weeks III

Contribution to Design

This case is crucial to study because it gives costs of what it took to remediate the site, this will be beneficial to estimate future cost estimates.

Conclusion

What this case study reveals for the thesis is realistic costs of what it takes to remediate a polluted paper mill site in the state of Minnesota. It also provides methods to preserve and keep different artifacts from the original mill to preserve some of the history of the original site. Though it didn't offer many innovative ways to design or manage stormwater systems, it's a good reference in regards to paper mill remediation in the same area as the project site for the thesis.

Figure 29 | Preserved Staircase Photo Cred: John A. Weeks III

Project Justification

Personal and Professional Relevance

This project is important to me because I believe that when it comes to design, a healthy environment comes first. In terms of creating a healthy environment, the appeal of remediating polluted sites and making them as efficient and environmentally friendly as possible is what really connects with me. Being that my personal views are geared towards sustainable design, the direction i am going with the thesis research will be very beneficial in preparing myself to take on future tasks in this area of landscape architecture. This project is important at this stage of academic development because I know what I want to specialize in when I am done at this university and being able to study sustainable practices and get a handle on how they work now will better prepare me in real world situations. Professionally, understanding the framework for sustainable design and knowing the steps its takes to remediate a site will improves my chances of getting a job at a firm that shares the same view. The process of researching will also help in the professional setting because i will be able to find viable sources and case studies that will pertain to the projects i am given.

Skills and Knowledge

As briefly mentioned in the previous section, researching the main components of my thesis will help strengthen many aspects of my skill sets. From this research i will have a good understanding of stormwater management practices, and knowing these will be beneficial to any landscape design. In addition to the knowledge of stormwater practices, the study of sustainable practices and how they are graded will be extremely beneficial to know because the current trend in landscape architecture is to make the sites sustainable and beneficial to all aspects of the area they reside in. In terms of skills, from the design phase next semester i will be able to construct detailed construction documents regarding these sustainable and stormwater elements. With these skills i will be better prepared to describe and show developers proper ways to construct these site elements.

Funds and Investment

Economically, the project and design intervention I am proposing will increase the sites economy greatly. The site once supplied a large amount of jobs for the city, and once it is closed, there will be a lot of room for redevelopment of the buildings, making a space that doesn't serve one economy, but many different ones. This project should be funded because it will breathe a new life into a deteriorating city center. The city has been slowly declining in economy and population, and with the revival of such an important amenity the city once had, the opportunity of bringing in job options and amenities for both the citizens and tourists will be a major benefit. With these specific sites, the EPA will be a big option for funding as they fund brownfield redevelopment sites all around the country. Furthermore, groups and organizations such as the Minnesota DNR, the city of Grand Rapids, and other investors private or public will be the main sources of funding. With the implementation of mixed use buildings, and energy saving practices, the project is expected to have a high rate of return on the investment. Remediation and redevelopment will require a good amount of funding, but with the grants and loans environmental agencies give to these types of projects will be highly beneficial to the impact of the price.

Project Justification

Impact

Currently, the site is only accessible to the workers of the Blandin Mill. After the impacts of the project, the site will be open to the public. In addition to the site being public, businesses and residences will be introduced in the form of stores, apartments, and city infrastructure. There are a wide range of options listed because of the size and location of this site. It has to opportunity to transform the city center. Environmentally, the impacts of this project are going to be immense, currently, the site is degrading to the environment with its release of paper making pollutants. With the integration of sustainable design and remediation techniques, aspects of the site that will be enhanced include: ecosystems, habitat, stormwater management, and will be cleansed of pollutants. The site location plays a large role when it comes to the impact of this project. With its proximity to the city center and the natural environment. This is a perfect location to practice sustainable design and benefit both the environment and the economy of the city.

Figure 30 | Lake Pokegame, Grand Rapids
Photo Cred: Michael Tollefson

Figure 31 | Blandin Railroad Tracks
Photo Cred: Michael Tollefson

Historical
Cultural
Social
Context

Historical

Paper Mills are some of the oldest production industries in the United States. Over the years the paper industry has flourished. For hundreds of years it has been a primary source of communication, but now that technology is improving, the need for physical material is not as necessary due to digital media. This narrative will follow the history of paper mills in America as well as the history and growth of brownfield redevelopment. The narrative will end with the history of Grand Rapids, MN and the growth and success of the Blandin Paper Company, and ultimately how the growth of technology decreased demand for the paper production at this site.

The history of making paper goes way back, but the start of the industry in America dates back to 1690 in Philadelphia. An immigrant from Germany named William Rittenhouse had moved there and opened the first paper mill in the country. He was successful in creating the industry as he coordinated suppliers and finances will. He worked with partners and financial backers (). He was known as a big recycler as the materials he used for paper consisted of old rags and cotton. He continued to grow the business until he passed away in 1708, his sons then took over and the paper industry flourished throughout the country. It wasn't until 1719 that changing the material from used rags to wood, as there was a shortage of supplies. The inspiration of changing to wood came when the creator of it, Rene Antoine Ferchault de Reaumur, watched wasps building a nest. After this was proposed, the popularity of paper quickly grew and became the standard for the paper making world. This was not as environmentally friendly as the former method as it was now using unrecycled materials, but it made the process much easier and better. The change to a new material was a huge improvement to the industry, but there was still an issue with the efficiency of how paper was made, and this needed to be improved.

Figure 32 | Log Storage at Blandin
Photo Cred: grandrapids.com

Figure 33 | Log Storage at Blandin
Photo Cred: grandrapids.com

The solution to this issue came at the end of the century in 1798. A man by the name of Nicholas Robert created the paper making machine. This machine was run by a hand crank and it repeatedly made paper in a screen that revolved (). After the paper making machines improved, the need for better quality paper arose. Half a century later, a German immigrant by the name of Friedrich Gottlob Keller, proposed that paper should not only be made of wood, but specifically the pulp of the wood. This opened the idea of alternative options, but the original results produced low quality paper. Two years after this proposal. The method of pulping wood was perfected by Hugh Burgess, an England native that first introduced chemicals into the wood pulping business. Earlier methods didn't produce any chemicals in the process, so it is from this moment on that the introduction of foreign elements into the environment begins in the paper making industry. From the moment chemicals entered the industry, the efforts to improve the quality of paper meant continuing to experiment with the chemicals to see which ones produced the highest quality paper. The implementation of sulfites into the pulping process came in 1867 by CB Tighman, an American chemist. It is now a growing wave of different chemicals being added to these pulping solutions to get the best quality value of paper possible. As well as creating paper for different purposes. By the late 1880's, paper was being mass produced by the millions of tons.

Historical

In the 1870's, roads started to be implemented around that area that is now Grand Rapids, this helped the circulation and addition of more loggers in the area, and furthermore, more citizens to populate the site. By the 1890's, Grand Rapids had a seat in the county, and continued to grow in population and building amount. The area now had enough amenities for people to come and stay in the area, instead of temporarily stay then move on. The first paper mill opened in the city in 1902. After time, Blandin Paper Company bought the company and created a surge of jobs in the area as the paper mill in the area was very large and demanded a large number of jobs in order to run. The company quickly became one of the biggest employers in the area and helped the city of Grand Rapids boom in the paper industry.

Business went steady for years, then the 2000s came around and more media started appearing on the Internet rather than in physical form. Due to the reduced need of physical news, companies started buying less paper and production dropped for the company. As of last year, there is now one functioning machine left on the site and the rest have been shut down making the area less economical. The future of the site right now is currently unsure, but the opportunity for redevelopment could be a definite option.

Figure 34 | Birds Eye Blandin Site
Photo Cred: upmpaper.com

Cultural

Figure 35 | Log Cutting Competition
Photo Cred: talltimberdays.com

The Blandin Paper Company has been a staple for the city of Grand Rapids for many years. With the company declining, there needs to be a rejuvenation of the site to help boost city morale and public interaction. In regards to the social context of the site, this area is very important. The city of Grand Rapids has always been a town that revolves around the logging industry. Where the site is physically located, the city is surrounding the site. This enhances the site socially because this project will be a centerpiece for community interaction. With its context in the city it is a key part of the downtown area. The design for the future of the site will improve community interaction by means of recreation, educational purposes, and by adding a new area to socialize and explore with others. The major elements that will contribute to the social aspects of the site will be the mixed use buildings that will be proposed in the redevelopment of the existing buildings. These spaces have endless options as to what they can be used for. In future site analysis, existing amenities and public spaces in the downtown area will be analyzed. From this I will be able to see what the site could add to improve the core of the downtown. With its size, it could host city wide events and improve the social interaction between the residents. Other than events, public infrastructure can be introduced into the buildings, with the main production building being so large, there are much more possibilities as to what the site can bring to the city. In educational terms, with the implementation of native plants and sustainable techniques to the site, they can be emphasized and the community can learn the benefits of these practices and how they can contribute. Overall, the site has the opportunity to greatly enhance the social features of the city.

Cultural

With the history of the site and city being so saturated with the logging industry, it will be important to keep this in mind with the details in the final design for the site. The design will pay tribute to the history of the area and the Blandin company as it is such a big contributor to the city. Design details that will be thought over will include how to incorporate lumber and wooden elements into the design in efforts to bring attention to its history. The paper industry is so ingrained into the culture of the city that it holds events that reflect on the aspects of the city. One of the larger events that the city holds is the Tall Timber days celebration. This weekend of celebration pays tribute to the cities history of logging and paper making. Events that occur during this time include a parade, a street fair, and more. Different events that go on along with the street fair include musical concerts from local and traveling artists. In addition to the musical displays, there are competitions between active and former lumberjacks that tests their skills with axes, wood carving, and chainsaw work. With the size of the site being so large, it would be possible for it to host some of these events. With its location in the city, it would be a perfect place to bring everyone together.

Figure 36 | Forest
Photo Cred: Desenio.com

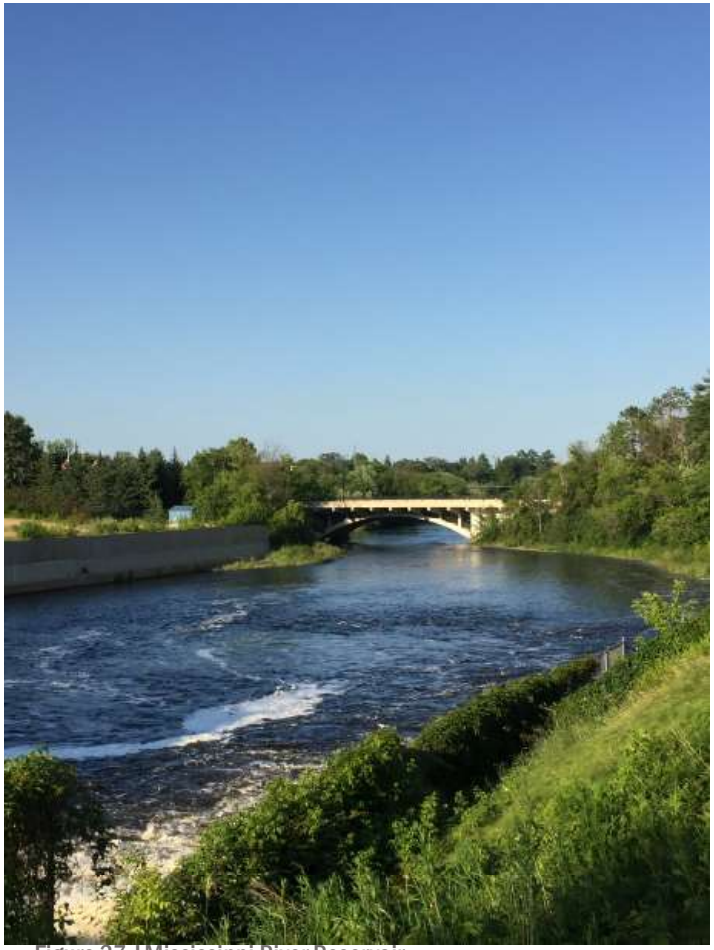

Figure 37 | Mississippi River Reservoir
Photo Cred: Michael Tollefson

Site Analysis

Context and Circulation

The site is located in the northern central area of Minnesota. At a city wide context the site falls on the southeast portion of town and takes up a fairly large chunk of it. It borders the downtown area as well as the Mississippi River. Creating a buffer between the urbanized cityscape and the natural environment.

One of the primary roads going through the city passes by this site. Other than the road, the downtown has walkable sidewalks and low usage neighborhood roads the further north you go. There is a railroad going through the northern edge of the site to drop off supplies, and it exits on the west side of the site. Circulation within the site is poor as it is one large working area, and is not made to meet the needs of the public.

Figure 38,39,40 | Circulation,State Context, City Context Photo Cred: Michael Tollefson

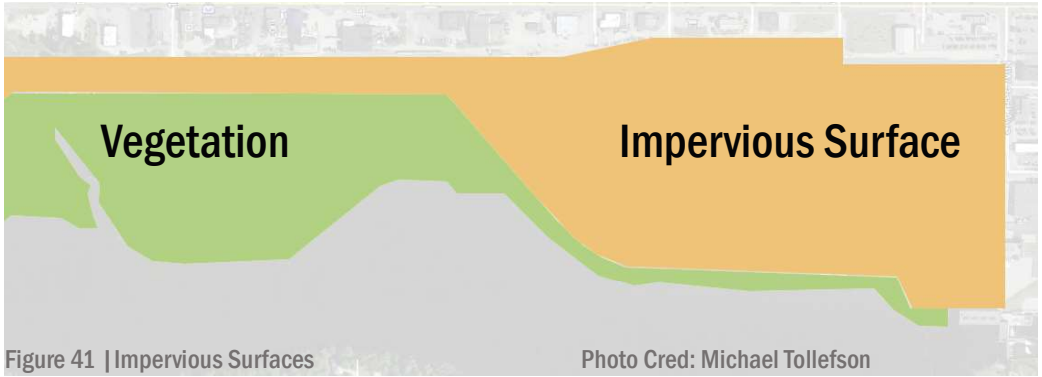

Figure 41 | Impervious Surfaces Photo Cred: Michael Tollefson

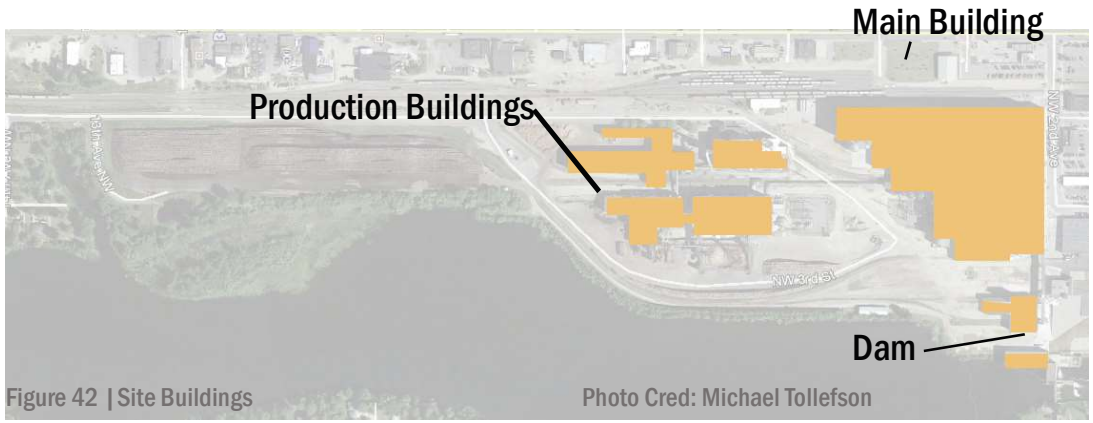

Figure 42 | Site Buildings Photo Cred: Michael Tollefson

Site Elements

Impervious Surface

Much of the front half is impervious as it is composed of buildings and concrete. The right side of the site is also mostly impervious as it is a large parking and production space. The southeast section of the site has vegetation and habitat.

Buildings

There are three areas of buildings on the site. In the northeast corner of the site, is the main paper making building. The buildings to the west are more associated with the power of the site. The smaller south area is for powering the dam they have on site. These buildings take up a large amount of space on the site. If they can be reused for mixed use purposes it will benefit the site and save costs in demolition. They offer unique features that can be focused upon and also have opportunity to be transformed into community space that will benefit all.

Site Analysis

Vegetation

Trees

Pine Forest

-Red pine, jack pine, and white pine

Spruce/Fir Forests

-Upland white spruce, black spruce, and balsam fir

Northern Hardwood Forest

-Sugar maple, red maple, basswood, yellow birch, white birch and oaks

Aspen and Birch Forest

-Trembling aspen, big-tooth aspen, and paper birch

Lowland Conifer Forest

-Black spruce, tamarack and white cedar Lowland

Hardwood Forest

-Black and green ash, balm-of-gilead, and some red maple and silver maple

Black Maple

Red Pine

Black Spruce

Silver Maple

Figure 43 | Native Trees

Photo Cred: woodfromthehood.com

Trembling Aspen

Figure 44 | Native Plants
Photo Cred: dnr.state.mn.us

Water Lily

Purple Pitcher Plant

Mountain Maple

Reed Canary Grass

Redosier Dogwood

Vegetation

Shrubs

Upland grass and brush type

-Hazel, mountain maple, willow, cherries, june-berries, and dogwoods

Lowland brush type

-Speckled alder, red-osier dogwood and willows

Lowland Grasses

-Reed canary grass, blue joint, brome grass, wild rye, fowl-fanna grass and many types of sedges

Muskeg

-Carpet of sphagnum moss and scattered stunted black spruce and tamarack. Other species found in the muskeg include Labrador tea, leather-leaf, bog birch, bog rosemary, cranberry and pitcher plants.

Marsh

-Smartweeds, cattails, bulrush, tufted loosestrife, white-water lily and marsh cinquefoil

Site Analysis

Climate

The climate for Grand rapids is a humid continental climate. Meaning the summers are warm and the winters are cold. In terms of hardiness, the area is a Zone 3 so winter temperatures can drop down to forty degrees below zero, which makes it a tough area for plants to thrive. In the summer time the temperatures reach up to 79 degrees. The average rainfall is 28 inches a year and the annual snowfall is 51 inches (Places). As for the wind, the average wind speed is around ten miles per hour. The wind comes from the north, west and south. North is primarily during the colder months and it comes from the south during the summer.

Solar energy produced in this area varies on the time of year. During the brighter time of the year, the average square meter of solar panel gets 5.8 kmh. On the darker days it drops down to 2.3 kwh. Knowing this will help in deciding whether or not solar energy components will be implemented into the design.

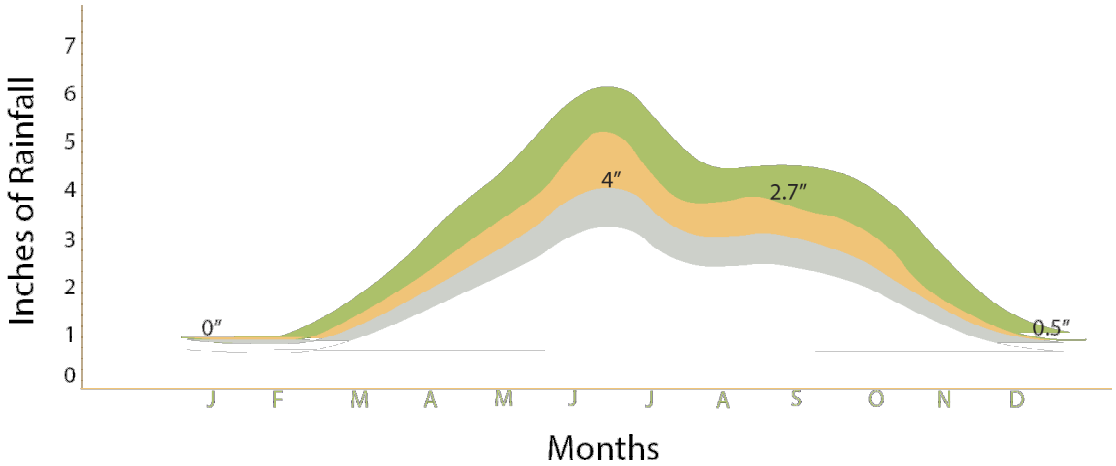

Figure 45 | Rainfall Graph

Photo Cred: Michael Tollefson

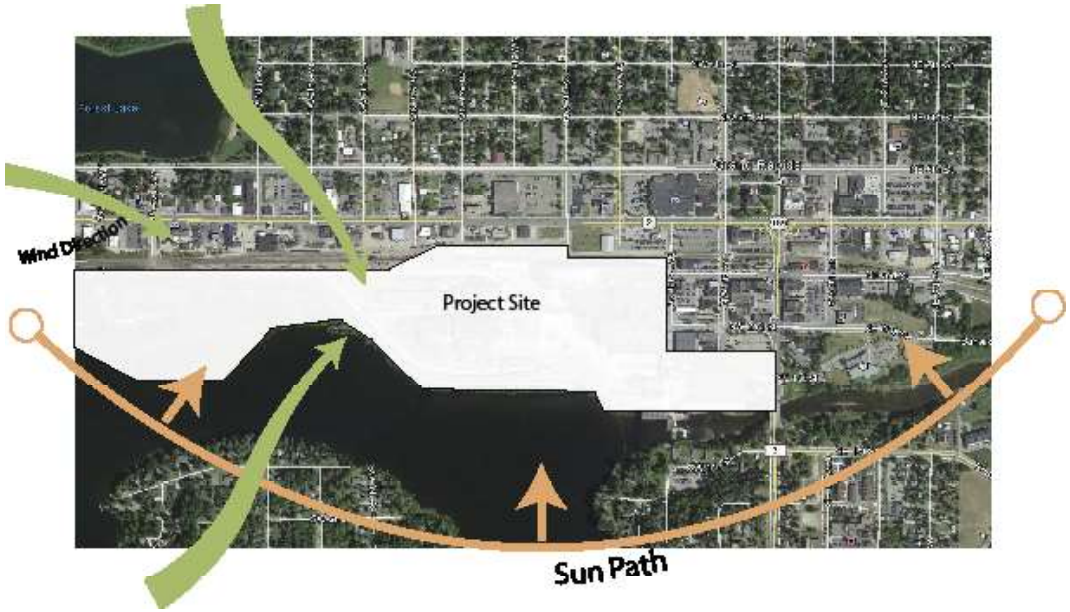

Figure 46 | Site Climate

Photo Cred: Michael Tollefson

Site Images

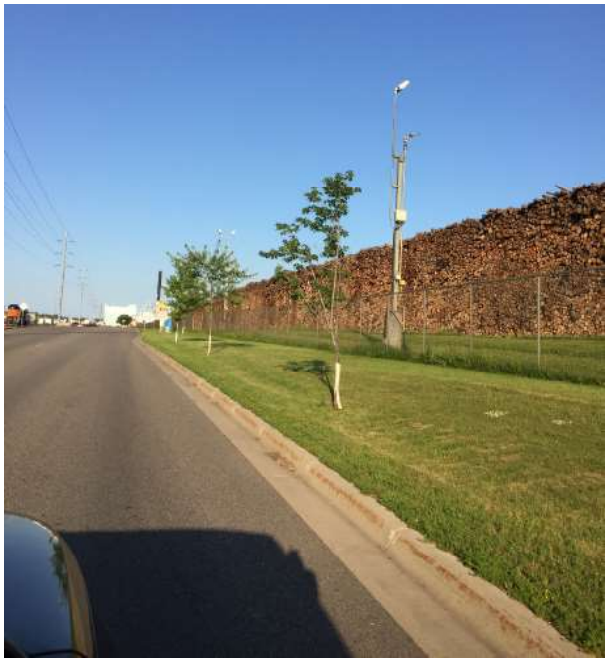

Figure 47 | Site Images

Photo Cred: Michael Tollefson

Performance Criteria

Space Allocation

This will be measured by categorizing the site into natural space, mixed use space, and circulation space. I will measure the amount of space used, and what type of space it is with mapping technologies to figure out exactly how much acres the certain spaces are taking up. I will analyze case studies that have done similar measures with these spaces and measure how much space, in percentages, certain areas take up. Such as buildings on the site, total green space, and more. With this info I will see which sites are more successful and which are not. For my given site, the emphasis for judgment will be on the environmental aspects such as natural space and habitat. For the judgment of my site, I will want a higher percentage to be placed in the category of natural space as I have described above, the ratio for the spaces is yet to be determined but it will favor natural space being the largest category.

Space Interaction Matrix

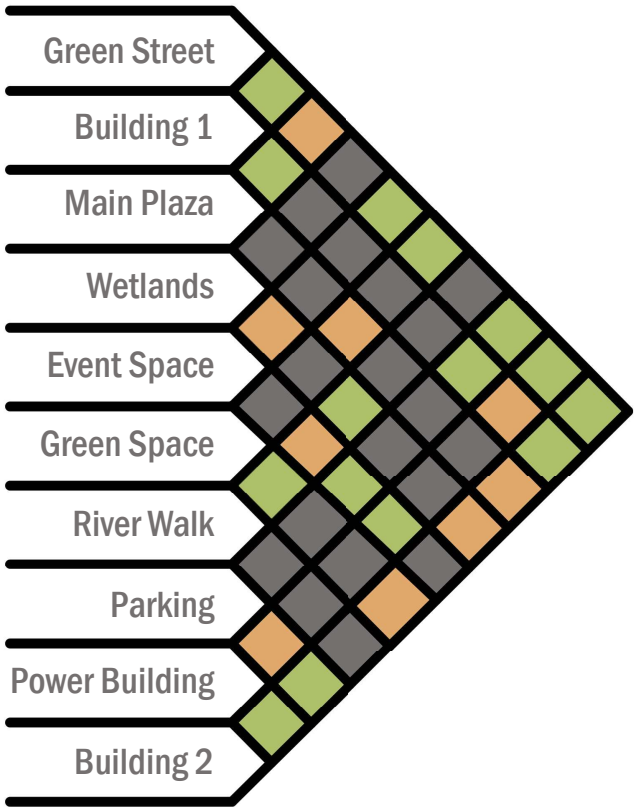

Figure 48 | Space Interaction Matrix

Photo Cred: Michael Tollefson

Performance Criteria

Environmental Performance/Impact

The units of measure for the project will be based on how sustainable the site is. Units will be categorized into points that can totaled and graded to determine the sites sustainability. Points consist of different criteria that needs to be met such as runoff, native habitat, and much more. The measure will be obtained from the ASLA SITES rubric that breaks down site performance and sustainability. This will be based on certain aspects the project must have in order to achieve a certain standard of sustainability. For the analysis the total acreage of the site will be needed as well as characteristics such as runoff, existing habitat, energy usage, and more. In addition to this information, there will need to be knowledge of the sites past use, soil, climate, and in depth site analysis. Case studies on existing projects that have practiced sustainability will be researched. Judgment will be based on which ranking the site gets for sustainability. Which is determined by the amount of points the site scores.

Behavioral Performance

What will be measured is the amount of visitors the site will get from tourists, citizens, and for educational purposes. The area will get tourists year round as the are is popular for its lakes and fishing. Because the climate creates such a variety of weather conditions, the site will have to account for warm and cold season elements. The main takeaways for this performance measure will be total tourists and total citizens. By knowing how many people come spend time in the city or even the area, as well as what is drawing them to the area. I can design the site to have amenities that will compliment the current draws to the area. By drawing in existing tourists, the site can then implement amenities that are newer to the region and can be used to bring newer visitors to the area. This will improve the economy and popularity of the area.

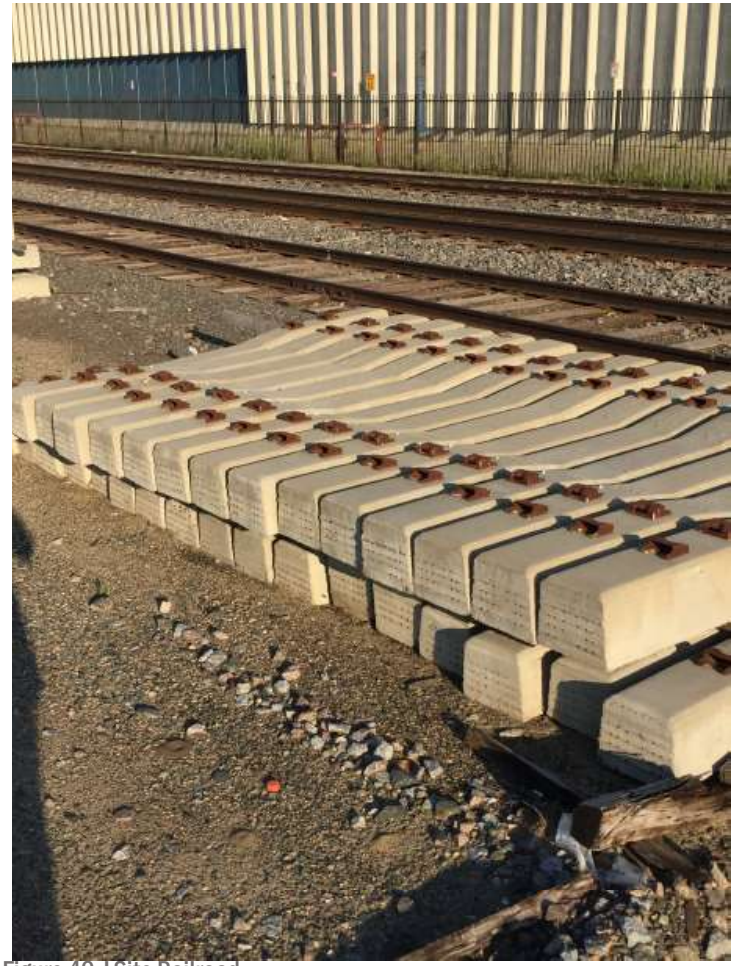

Figure 49 | Site Railroad
Photo Cred: Michael Tollefson

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Figure 50 | Mississippi River
Photo Cred: Michael Tollefson

Appendix

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Figure 51 | Mississippi River
Photo Cred: Michael Tollefson

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NDSU Experience

North Dakota State University has given me a fruitful experience with all the experiences I have had and all the things I learned over the five years attending here. I believe that the Landscape Architecture department has truly prepared me for professional practices when i graduate and pursue a career in the industry.

Appendix

Design Studio Experience

2nd Year

LA 271- Introduction to Landscape Architecture | Fall 2015 | Kathleen Pepple

- Tea House Project
- South Pleasant Church Memorial

LA 272- Parks and Open Spaces | Spring 2016 | Dominic Fischer

- Red Raven Courtyard
- William Marshal Park
- Riverfront Park

3rd Year

LA 371- Site Planning and Design | Fall 2016 | Matthew Kirkwood

- North Dakota Veterans Home Memorial
- Graffiti Park

LA 372- Community Planning and Design | Spring 2017 | Kathleen Pepple

- Bike Trail System
- Community Design Project

4th Year

LA 471- Urban Design | Fall 2017 | Jay Kost

- Mission Rock Project

LA 472- Environmental Remediation | Spring 2018 | Yang Song

- Ortonville Community Project
- Spirit Lake Trail System
- Fargo Diversiton Plan

5th Year

LA 571- Environmental Planning | Fall 2018 | Yang Song

- Red River Project