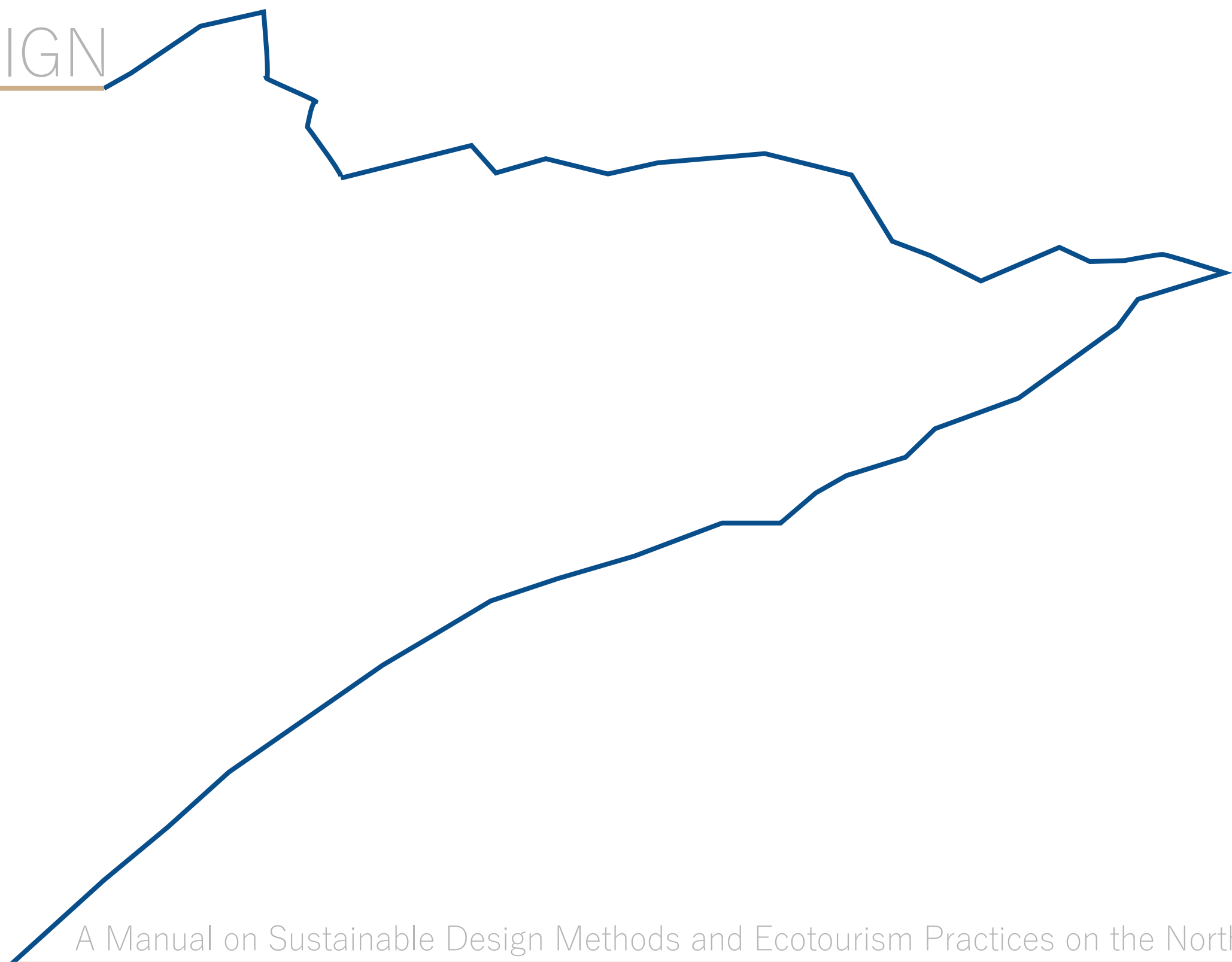


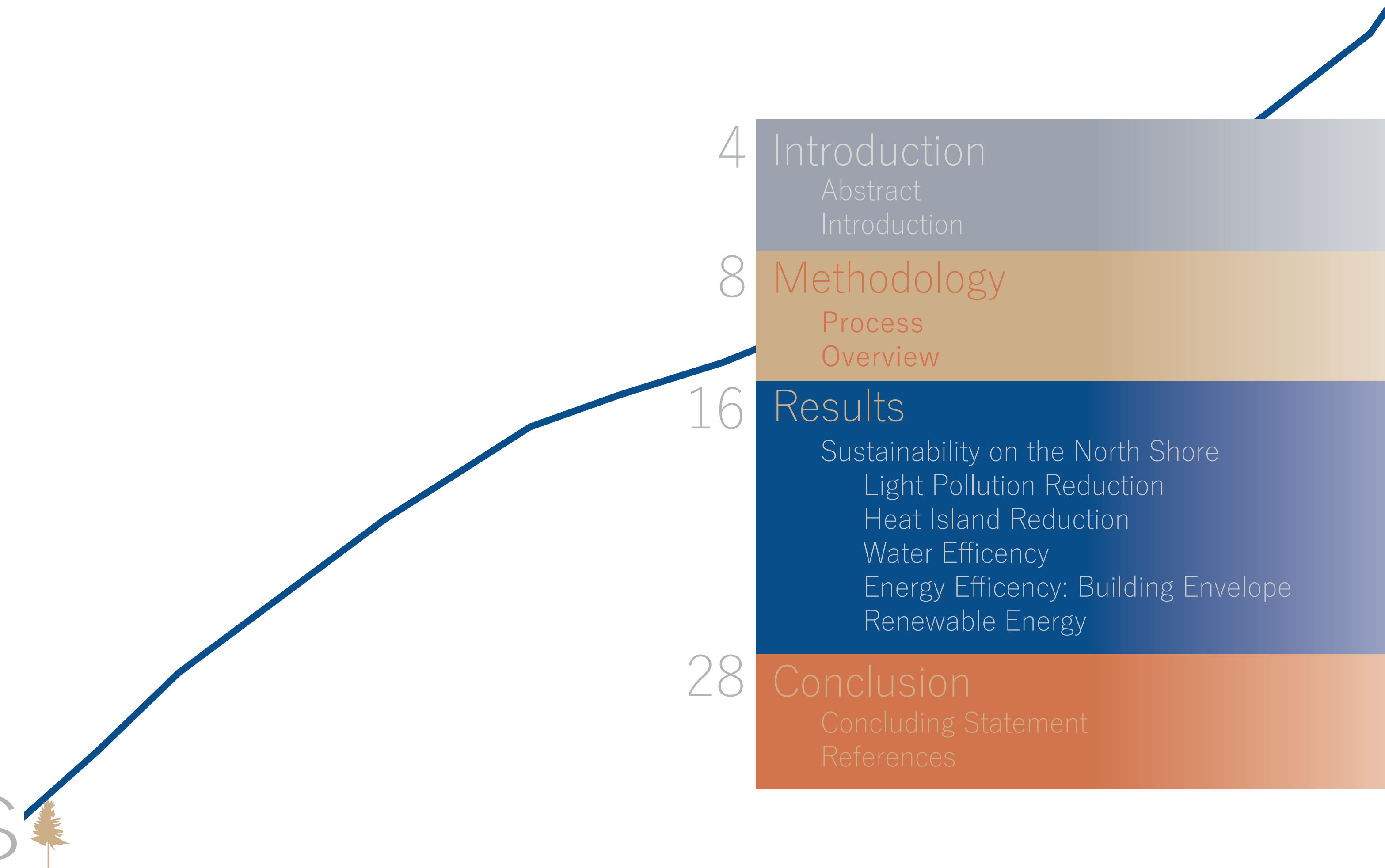
SUSTAINABLE DESIGN & ECOTOURISM



A Manual on Sustainable Design Methods and Ecotourism Practices on the North Shore



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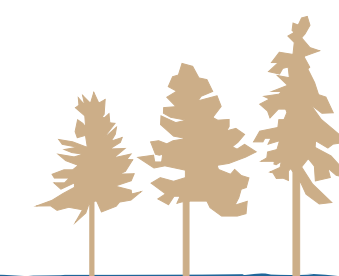


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INTRODUCTION



Abstract

The Minnesota North Shore boasts vast natural beauty, a plethora of recreational activities, and a thriving tourism industry. In order to protect the North Shore's natural scenery and tourism industry, sustainability and ecotourism must be heavily considered when designing here. This research report aims to provide sustainable design methods and ecotourism tactics that are specifically catered towards the North Shore. Through literature review and case study examination, this report is a compiled list of methods and tactics that provide design options to reduce impact on natural scenery, are environmentally conscious, and benefit tourism.

Introduction

The North Shore of Minnesota has been a bastion of natural beauty for decades. Naturally, people started traveling to this area, and in 1885 the first resort was built. Quickly becoming a popular tourist destination, over the years many resorts and lodges were built to accommodate these visitors. Currently, there are plenty of resorts dotting Lake Superior's coastline, giving refuge to thousands of visitors every year. However, many of these resorts are critically void of a few important concepts: sustainable design and ecotourism. Nature and outdoor recreation is the major driving force for attracting tourism in this area, meaning the preservation of the natural environment is essential to keeping the North Shore's tourism industry alive and well. Conversely, in many areas around the globe, tourism proves to be a detriment to the natural landscape, leading to the mutual destruction of both the industry and the environment. With nature being the life force of the North Shore, design strategies must be implemented that reduce impact on the natural scenery and environment while promoting ecotourism practices.

Project Goals

Produce

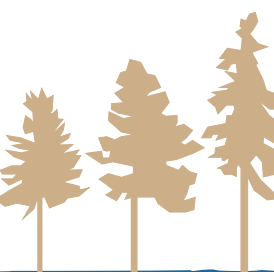
Devise a 'manual' that details design strategies specifically catered to the North Shore.

Implement

Relate these strategies to the North Shore.

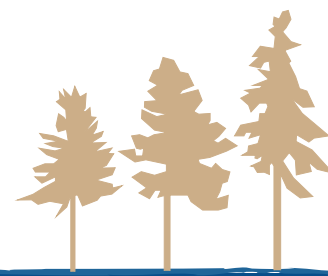
Research

Research the crossover criteria, determine why these criteria matter, and what strategies can be used.





METHODOLOGY



GTSC Criteria
LEED Criteria

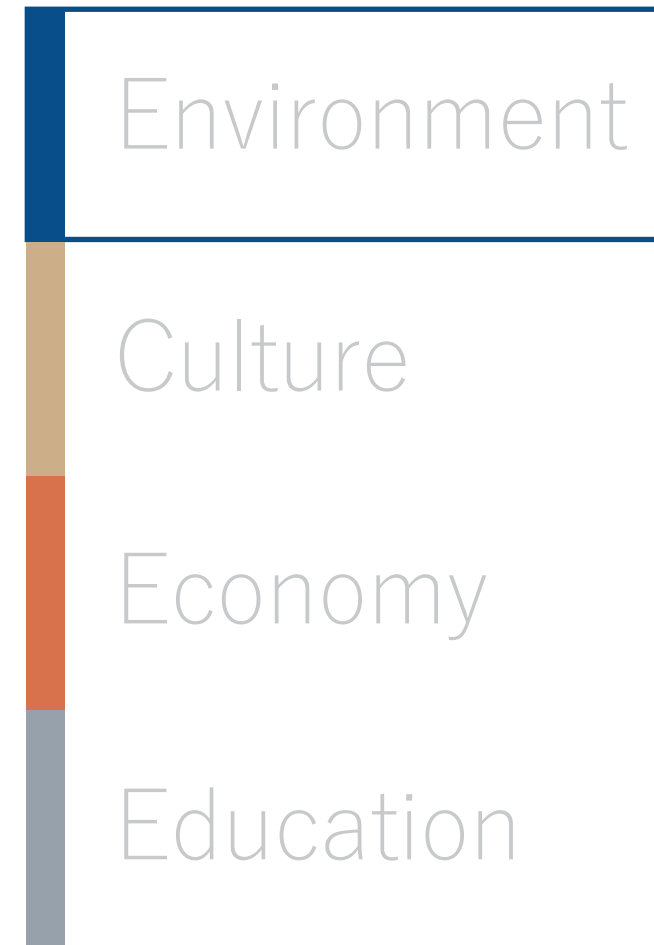
Sustainable Design
Ecotourism-Centered Design

North Shore
Site-Sensitive Design

What is Ecotourism?

Since the idea of it was conceived, the definition of ecotourism has been heavily discussed, revisited, and revised. As time has passed, our idea and understanding of ecotourism has grown. At its' conception, the widely accepted definition was given by Ceballos-Lascurain as: "Travelling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas" (Ceballos-Lascurain, 1987, p. 14). Recently, the definition has expanded. According to the International Ecotourism Society website, ecotourism is defined as "responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education" (TIES, 2015). Over time ecotourism has shifted towards not just the act of interacting with nature and culture but actively participating in conservation, education, and economic benefit of the local area. At current, the essence of ecotourism is a form of travel/tourism that promotes limiting negative impacts on the environment and local communities, while also focusing on environmental and cultural education of tourists. Throughout every understanding of ecotourism, many of the themes remain constant. The theme that will be focused on in this research report will be environmental conservation. The other themes (culture, economy, and education) will be fleshed out during the design phase.

Tourism plays a tremendously important role in both the environment and economy of the North Shore. Providing a rich cultural heritage, vast natural beauty, and numerous recreational activities, the North Shore draws hundreds of thousands of tourists every year. Providing thousands of jobs and generating millions of dollars, tourism to the North Shore is essential to the well-being of its community. With this in mind, ecotourism is a great concept to implement when designing on the North Shore.



Water Efficiency

<p>D6 Water stewardship</p> <p>The destination encourages enterprises to measure, monitor, publicly report and manage water usage. Water risk in the destination is assessed and documented. In cases of high water risk, water stewardship goals are identified and actively pursued with enterprises, to ensure that tourism use does not conflict with the needs of local communities and ecosystems.</p>	<ul style="list-style-type: none"> a. Provision of guidance and support for monitoring and reduction of water usage by enterprises. b. Program to regularly assess water risk. c. Setting, publication and enforcement of water stewardship goals, where water risk has been assessed as high. d. Monitoring and control of sources and volume of water used for tourism purposes and its effect on local communities and ecosystems. Promotion and checking of adherence to goals by tourism enterprises. e. Visitor information on water risk and minimising water use.
<p>D8 Wastewater</p> <p>The destination has clear and enforced guidelines in place for the siting, maintenance and testing of discharge from septic tanks and wastewater treatment systems. The destination ensures that wastes are properly treated and reused or released safely without adverse impacts on the local population and the environment.</p>	<ul style="list-style-type: none"> a. Written guidelines and regulations on wastewater treatment. b. System of enforcing guidelines amongst enterprises. c. Monitoring/testing of released wastewater. d. Provision of sustainable municipal water treatment systems, for use by the tourism sector, where practical and appropriate.

Light Pollution

<p>D12 Light and noise pollution</p> <p>The destination has guidelines and regulations to minimize light and noise pollution. The destination encourages enterprises to follow these guidelines and regulations.</p>	<ul style="list-style-type: none"> a. Guidelines on light and noise pollution – produced and promoted to tourism enterprises. b. Identification and monitoring of potential sources of noise and light pollution related to tourism. c. Mechanisms to enable residents to report noise and light pollution, with follow-up action.
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Energy Efficiency

<p>D10 GHG emissions and climate change mitigation</p> <p>The destination has targets to reduce greenhouse gas emissions, and implements and reports on mitigation policies and actions. Enterprises are encouraged to measure, monitor, reduce or minimise, publicly report and mitigate greenhouse gas emissions from all aspects of their operation (including from suppliers and service providers). Offsetting of any remaining emissions is encouraged.</p>	<ul style="list-style-type: none"> a. Published target for percentage of emissions reduction by specified date. b. Annual climate report, including monitoring and mitigation actions. c. Supported campaign or other engagement with tourism enterprises on reduction and mitigation of emissions. d. Action to reduce emissions from public sector operations. e. Information for enterprises and visitors on offsetting schemes that meet recognised standards.
<p>D5 Energy conservation</p> <p>The destination has targets to reduce energy consumption, improve efficiency in its use, as well as increase the use of renewable energy. The destination has a system to encourage enterprises to measure, monitor, reduce, and publicly report their contribution to these targets.</p>	<ul style="list-style-type: none"> a. Energy consumption targets are publicised and promoted. b. Programme to increase energy efficiency – e.g. promoting and supporting insulation. c. Investment in renewable energy and percent of total provision/consumption. d. Support and incentives for energy monitoring and reduction by enterprises.



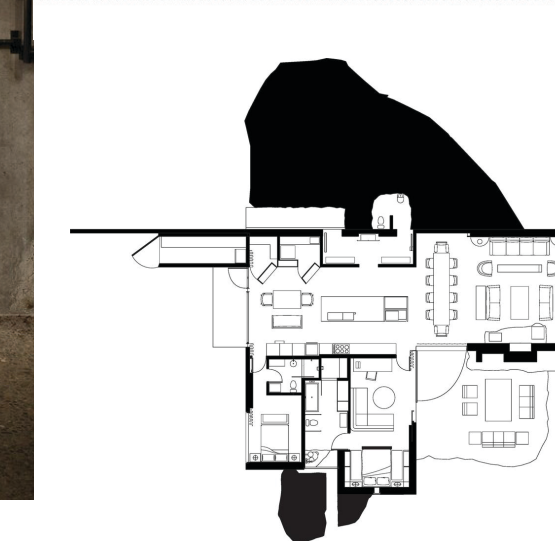
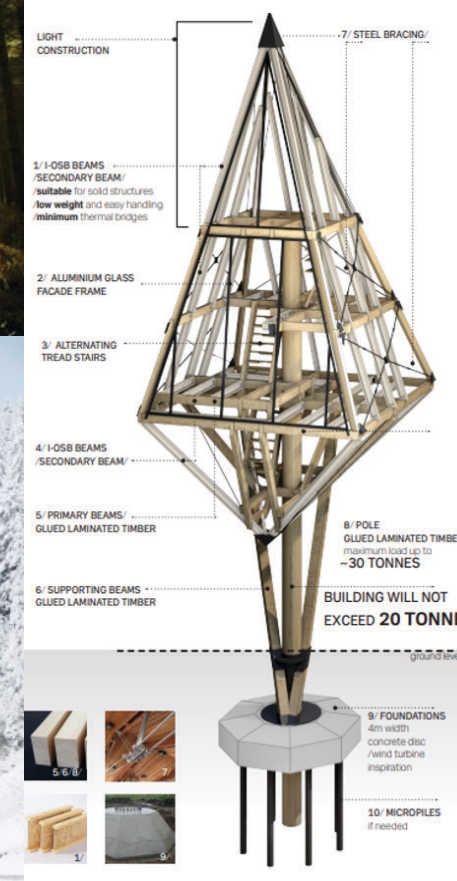
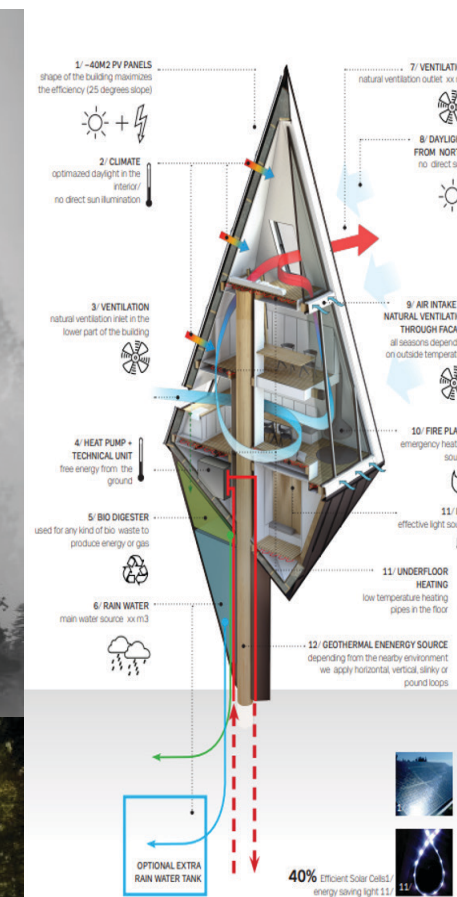
Primeval Symbiosis

Konrad Wojcik

Primeval Symbiosis combines an environmentally conscious design effort with a modern-style typography. With deforestation being a common practice utilized in the interest of residential expansion, Konrad Wojcik sought to provide a solution that allows this expansion to continue, without the need for environmental destruction. Designed with an emphasis on producing a home that leaves no footprint on the environment around it, Primeval Symbiosis takes inspiration from perhaps the most important thing in nature: trees. Konrad recognizes the importance of trees as shelter in nature. Being the best natural protection from predators and the elements, trees provide a place of refuge without taking up much ground space. This is precisely the reason why Konrad decided to emulate a pine tree in his design.

In an effort to reach his goal of 'leaving no footprint', Konrad designed the main structure to be raised into the air. A singular column, composed of glue-laminated wood, anchors the structure to the earth while providing a solid base for the rest of the home to emanate from. With the preservation of the environment at the forefront of Konrad's goal, sustainable methods are jam-packed into every design choice. From the bio digester to rainwater collection, or geothermal heating source, Konrad takes a dedicated approach to implementing sustainability into every decision he can. He has even made a point to only use materials that are 100% recyclable. Zinc, clay-tec, paper insulation, c2c furniture are among the variety of materials utilized.

The project of Primeval Symbiosis is both a commentary on rapid environmental destruction and a solution. With zero footprint, a 100% recyclable structure, and a form that blends effortlessly into the environment, this project is a statement. It is entirely possible to design attractive, functional, nature-friendly homes without the need for deforestation and destruction.



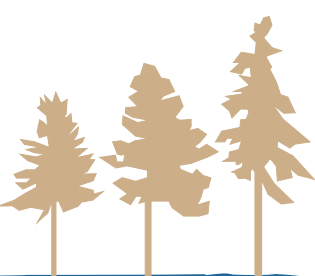
The Pierre

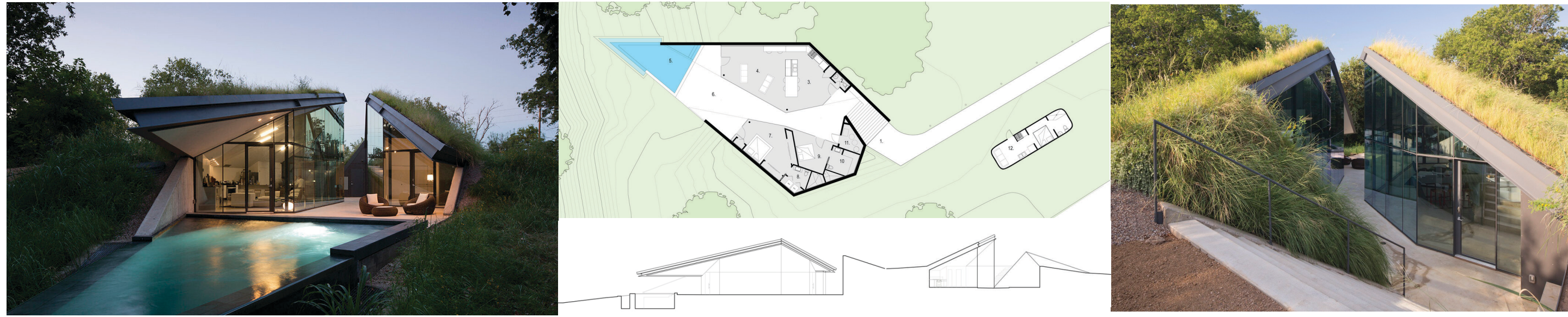
Olson Kundig

The Pierre, located on San Juan Island, Washington, is an incredible example of integrating architecture and the site. The name "Pierre," French for stone, is a commentary behind the core of this project: celebrating the site. Encased in a stone outcropping, The Pierre seeks to immerse itself into the natural contours of the land. From certain vantage points around the site, the house appears to fade into the landscape. Not only does the house conform to the contours of the landscape, but it actively integrates the essence of the site into its design. The profuse use and consideration of the site when designing this project lessens the divide between natural and man-made constructions.

In more ways than one, The Pierre encompasses everything about the site. Deliberate design choices integrate the house deeply into the landscape. Rough materials, a green roof, and carefully curated foliage all complement the site, further blurring the distinction between the natural and built environment. In addition to enveloping the residence, the site provided elements that were also used in the construction and design of the house. When excavating the site to fit the house design, the leftover rock was crushed into aggregate and inserted into the concrete flooring. Portions of the rock even extrude into the interior of the house, combining both natural and artificial spaces. Fireplaces, hearths, and sinks are carved directly from existing stone, with even some rooms being completely comprised of it.

The Pierre pushes the boundaries of site integration in architectural design. Through various methods, both the natural and man-made features of the residence are united in harmony. This project showcases that a site should be treated as a source of inspiration, not just as a location to build upon.





Edgeland House

Bercy Chen Studio

Reclaiming what was once a brownfield the Edgeland House, located in Austin, Texas, seeks to return this site to the natural environment. A brownfield is a site that was once commercially or industrially utilized, with complete disregard for the surrounding environment. Bercy Chen Studio states “Edgeland House is about healing the land and ameliorating the scars of the site’s industrial past.” With inspiration taken from the Native American pit house, the home is nestled into the earth: almost being hidden by it. Simultaneously blending itself with the natural surroundings while incorporating various sustainable design elements, the Edgeland House is a remarkable testament to what can be achieved through innovative and eco-friendly architecture.

Through numerous sustainable design tactics, the Edgeland House was certified as LEED Platinum, one of the highest achievements in green building practices. Separated into two sectors, the residence requires exposure to the environment in order to fully utilize the house. These two halves are partially submerged in the ground, utilizing the natural heating and cooling attributes of the earth. As the house is 7 feet underground, naturally a green roof was incorporated into the design. In addition to managing stormwater runoff and adding an extra layer of insulation, the roof is adorned with a variety of native wildflowers and grasses to help preserve the local ecosystem. The roof also plays host to a system of gutters and pipes that harvest rainwater. Under the residence, a geothermal heat pump makes use of the natural heat produced by the earth to regulate temperature throughout the year.

The Edgeland House is evidence that environmental responsibility and modern architecture can be unionized in harmony with each other. Not only does this project succeed in reclaiming the site for nature, but it proves that the built environment does not need to be a detriment to the natural environment.

“...Sustainability beyond ‘doing less bad’—attempting to merely slow down environmental degradation—to create regenerative sites that restore ecosystem function and rebuild the earth’s natural capital.” -Heather Venhaus



Sustainability on the North Shore

Light Pollution

Overview

Ever since mankind created the first fire, light pollution has been a part of our world. Light pollution has been making a steady increase in tandem with the rapid technological advancement planet Earth has and is still going through. It is a byproduct of our thirst for advancement and expansion and has continually presented more issues as time passes. Affecting every populated area on the planet, what is seen when looking at the night sky, or rather what is not seen, makes the issue apparent. According to an article from National Geographic, 'Skyglow', the term used to describe brightening overpopulated areas, affects 80 percent of the global population. This phenomenon, caused by streetlights, car lights, commercial lights, and residential lights, is responsible for extinguishing the natural beauty of the night sky. Apart from especially bright solar bodies, it is nearly impossible to view the vast array of stars that would normally be seen in naturally dark conditions. Not only does it affect the visibility of the night sky, but light pollution also directly impacts human and environmental health. Artificial light conflicts with the natural brightness of the sun and hinders the production of melatonin through the circadian cycle which can lead to weight gain, job performance issues, and even cancer (Faid, Shariff, & Hamidi 2019). The effects on the environment, however, are much more widespread. Changes in behavior, reproduction, and predation have been observed in birds, insects, amphibians, and reptiles and are all direct consequences of light pollution (Longcore & Rich, 2004). In addition to the negative effects mentioned beforehand, artificial light is a blot upon the natural beauty of the environment. In an environment that is further away from larger cities, this is even more apparent. The site chosen will be located in the Superior National Forest and next to the Boundary Water Canoe Area Wilderness. The International Dark-Sky Association (IDA) has designated this portion of land as an 'International Dark-Sky Sanctuary'. This is defined by the IDA website as "...public or private land that has an exceptional or distinguished quality of starry nights and a nocturnal environment that is protected for its scientific, natural, or educational value, its cultural heritage, and/or public enjoyment." With this designation, the North Shore requires thorough attention to light pollution-conscious design. The average human can see candlelight from 1.6 miles away with no view obstructions, so imagine the disruption of natural beauty that can occur when there are multiple sources of artificial light dotting the landscape. The use of artificial lighting is a necessity in today's modern world, so how are we as architects able to simultaneously balance the conservation of the ecosystem, the preservation of the natural landscape, and the need for artificial lighting? There are a few methods and techniques that can be used to accomplish all of these.

Dark-Sky Compliant Lighting

Dark-sky compliant lighting is a term used to describe light fixtures that comply with the guidelines set by the International Dark Sky Association (IDA). According to the IDA website, several criteria must be met to be considered dark-sky compliant: restrict the amount of upward-directed light, minimize bluish light, utilize lighting controls such as dimmers, and avoid glare and over-lighting.

Timers & Motion Sensors

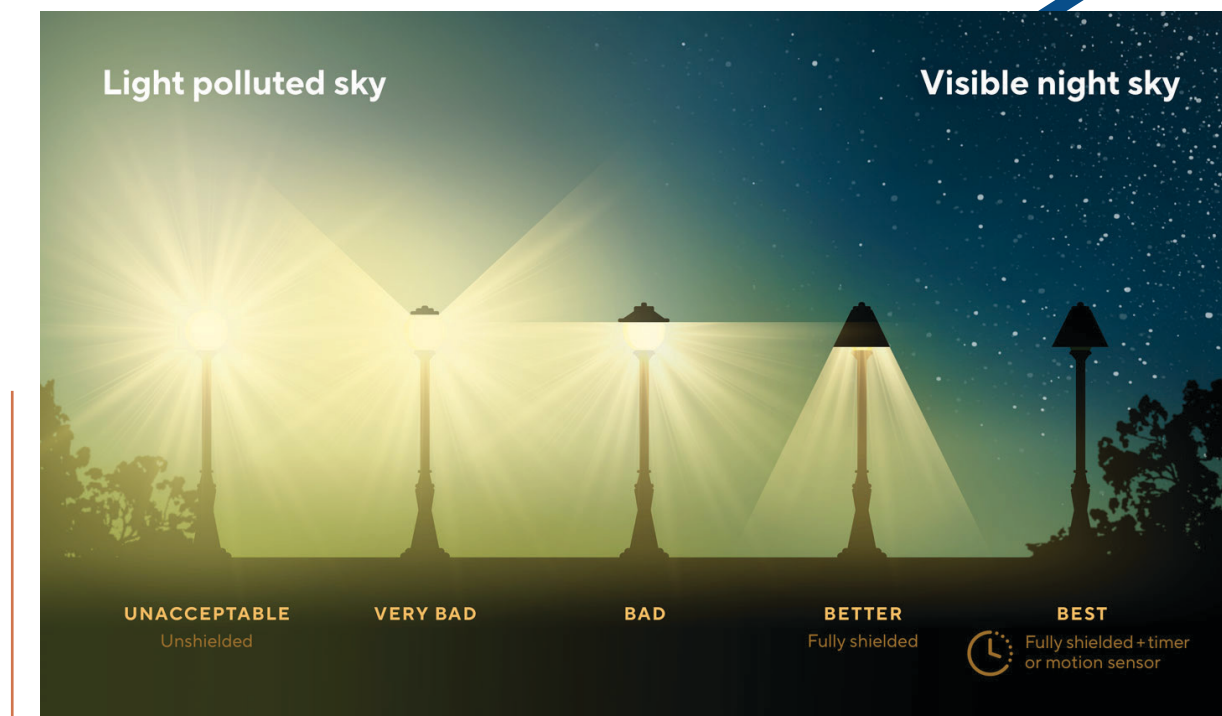
Timers and motion sensors are a valuable way to reduce light usage. These inhibit the use of light when not needed, and still enable the consumer to enjoy light when needed. This strategy can be employed at night, when light is more apparent on the landscape, and when light pollution is most noticeable.

Blinds

Blinds are one of the easiest and most surefire ways to reduce light pollution. The most effective blinds are opaque blinds, which prohibit any interior light from trespassing outdoors. Some blinds can be set to an automated system, raising and lowering depending on the time. This method is a great way to reduce the impact on the surrounding landscape and environment.

Light Bulb Selection

The type of light bulb used when lighting an area is quite important. The factors to consider when selecting a bulb include warmth, lumen output, and bulb type. Warmth refers to the color the light emits. Cold light (bluish and white) is more likely to scatter in the atmosphere and cause skyglow, while warm light (amber) is less likely to scatter. According to the website Wyoming Stargazing, it is recommended to use a bulb with 2700k-3000k (warm), while avoiding anything over 5000k (cold). Lumen output refers to the brightness of the bulb. It is important to choose a lumen output that fits the task at hand, as this minimizes glare and light trespass. For example, a lumen output of 1000 or less is sufficient for any outdoor activity. The bulb type determines both of these variables, so considering the warmth and lumen output when selecting a bulb is crucial.

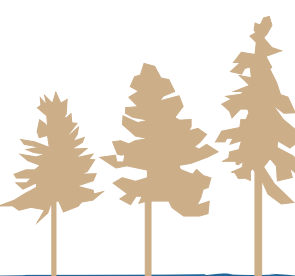


Sustainability on the North Shore

Water Efficiency

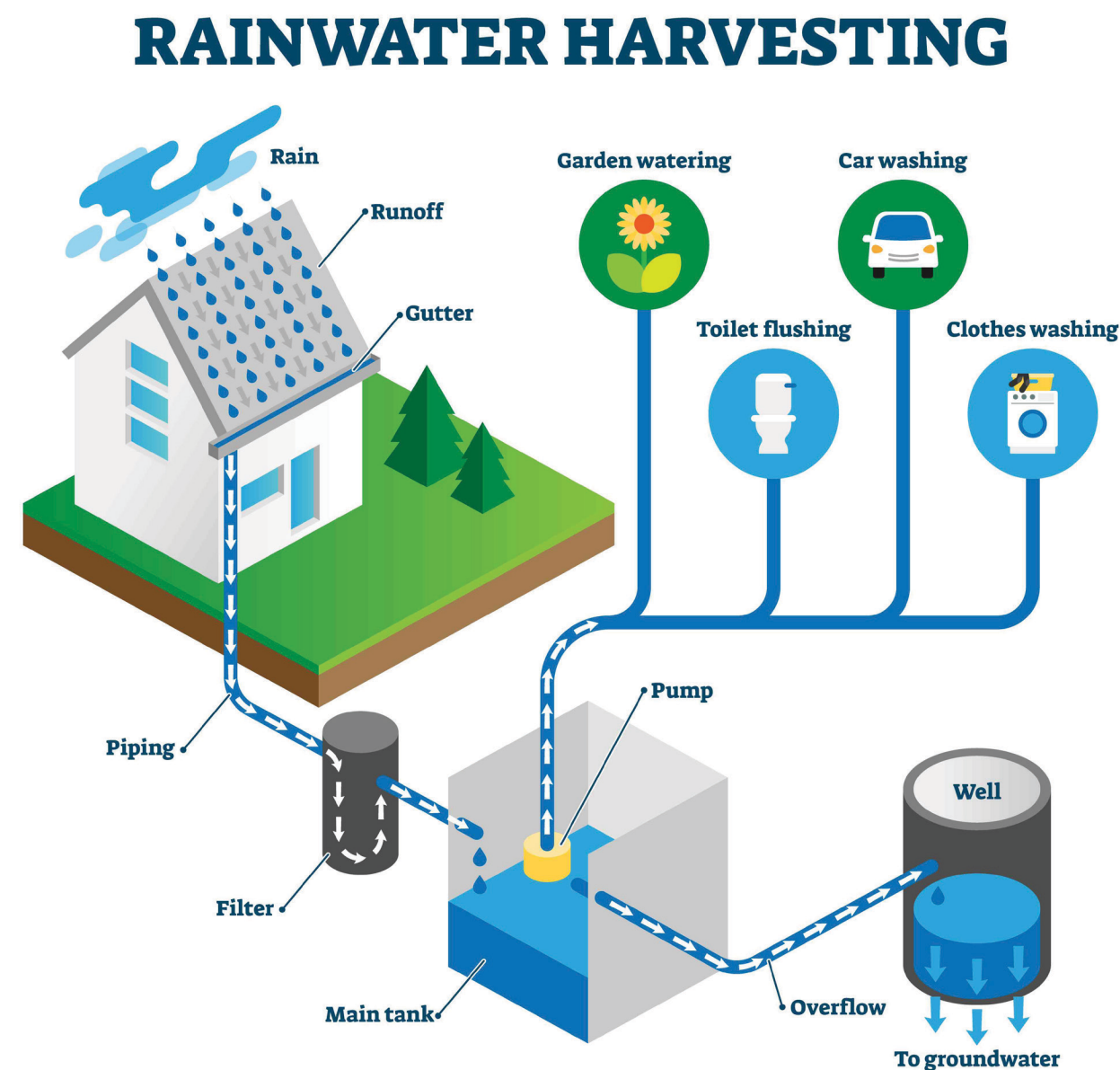
Overview

Access to freshwater has quickly become a major concern for humanity. With the rising population and steady decline of freshwater resources, the demand for freshwater has exponentially increased over time. Heather Venhaus mentions in *Designing the Sustainable Site* that as the scarcity and demand for freshwater continues to rise, water usage will need to be questioned and more methods of conservation will need to be implemented (161). In more developed, wealthier nations, people have easier access to water. Overuse of everyday amenities such as showers, toilets, and washing machines contributes to wasting a substantial amount of water. Irrigation systems also produce large amounts of wasted water, with over 30% of water usage in the U.S. coming from outdoor usage (Venhaus, 162). The transformation of the natural landscape into a hardscape is an additional contributor to lost water. Pavement and roofs prevent rainwater from soaking into the ground, in turn preventing groundwater recharging. Groundwater recharge is essential to the conservation of freshwater sources. According to an article published by the University of Minnesota, around 75 percent of Minnesota's population receives their water from groundwater sources, and the other 25 percent receives it from surface water sources. The North Shore is no different, with a majority of residents receiving their water from wells, Lake Superior, and surrounding freshwater sources (MWI). In an effort to prevent the loss of freshwater resources, there are many different techniques available that can be employed.



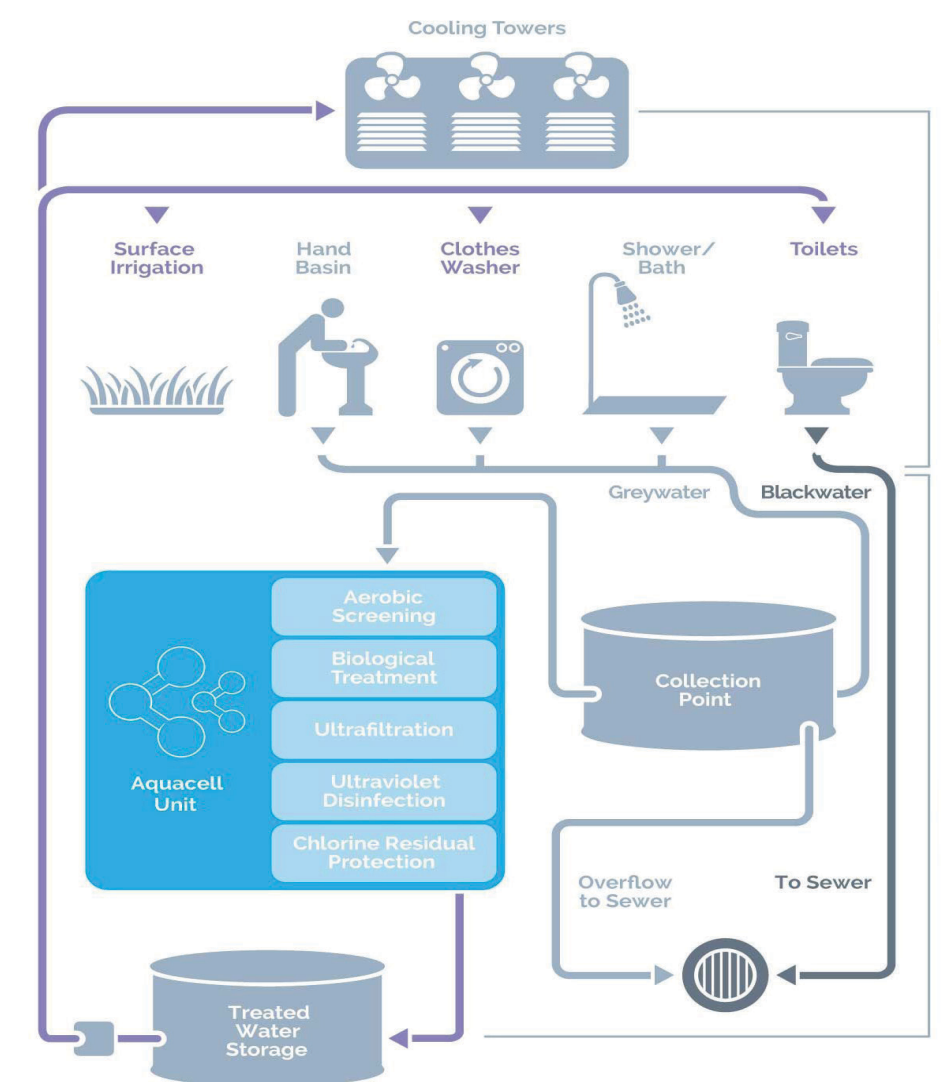
Rainwater Harvesting

Rainwater harvesting provides an active method of collection and reuse of water. With the benefit of increasing access to fresh water, rainwater collection should be a serious consideration when designing for sustainability. The collected water can be used in a variety of ways, depending on the treatment. If the harvested rainwater is filtered through the minimum means it can be reused for irrigation and other household amenities such as toilet flushing and washing clothes (Venhaus, 169). If filtered more thoroughly, it can then be used for other purposes such as bathing, food preparation, and consumption (Venhaus, 168). The rainwater is usually collected in cisterns, which are located either outside or underground the structure. With this in mind, it will be difficult to determine the best design choice when taking the preservation of the environment and natural landscape into account. If choosing to place the cistern underground, further excavation of the site will be needed, leading to more destruction to the environment. However, placing the cistern underground will allow protection from the freezing temperatures present during North Shore winters, provided it is placed below the frost line. Placing the cistern outside will not lead to any unnecessary environmental destruction, however, it will be harder to conceal. Exterior cisterns will also be vulnerable to the freezing temperatures of the North Shore and will require maintenance to prevent the system from freezing.



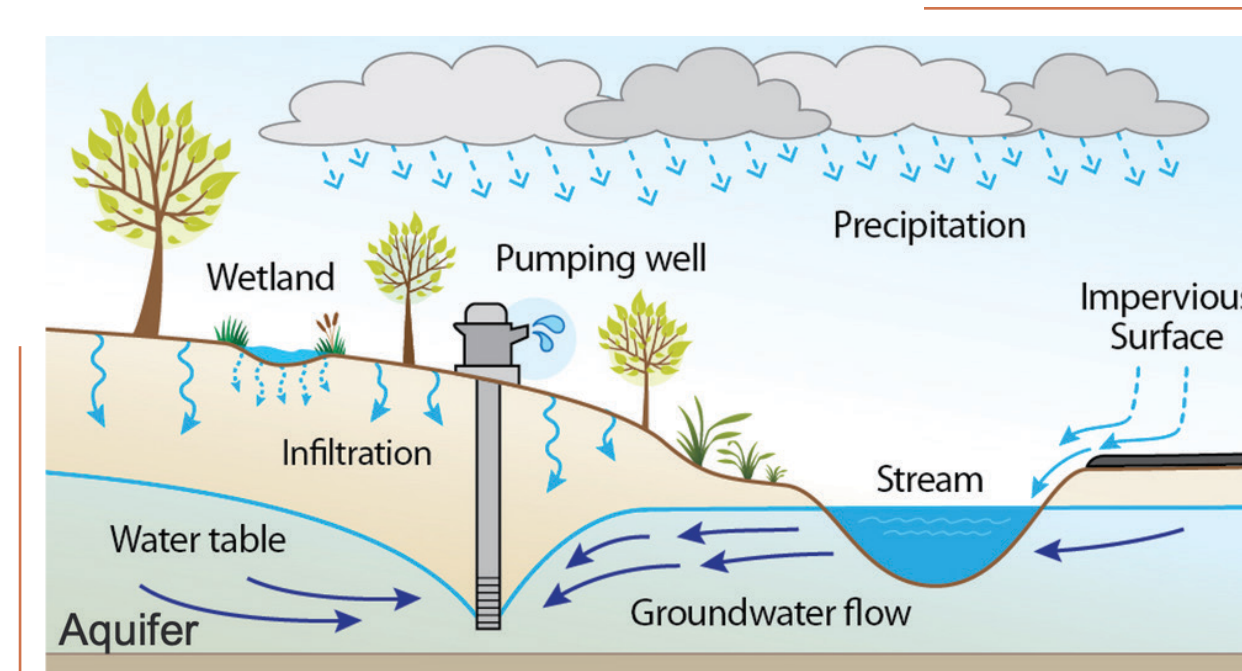
Greywater Catchment

Greywater is the leftover water from everyday activities such as bathing, washing clothes, and bathroom faucets. Not to be confused with blackwater, which is left-over water from toilets, dishwashers, and kitchen sink faucets as these sources can contain organic and toxic materials. According to Venhaus, there are a multitude of different benefits that can come from the reuse of greywater. Reducing the use of regular freshwater resources, greywater catchment allows for an additional water supply to be used instead of freshwater. This can be used in times of drought, or any time throughout the year. Furthermore, water bills are reduced, and awareness of water usage is increased (171).



Groundwater Recharge

Groundwater is a precious natural resource. According to data gathered by the U.S. Geological Survey, about 26% of the water used in 2015 was from groundwater. This is apparent even more so in the North Shore, with well water being the primary source of water for most residents. Proper site development is crucial to recharging groundwater. Venhaus notes that reducing the use of hardscape surfaces allows for water to seep into the ground more easily, which leads to groundwater recharge. Shading and restoring degraded soils also allows for easier penetration of water (182). As site development is of great importance in this method, one should also note the benefits that can be gained when designing around the natural landscape. When using less hardscape materials, taking the route of minimal site disruption leads to positive effects when protecting the natural landscape. When less of the site is disturbed (i.e., less vegetation and trees are removed) more natural elements are preserved.

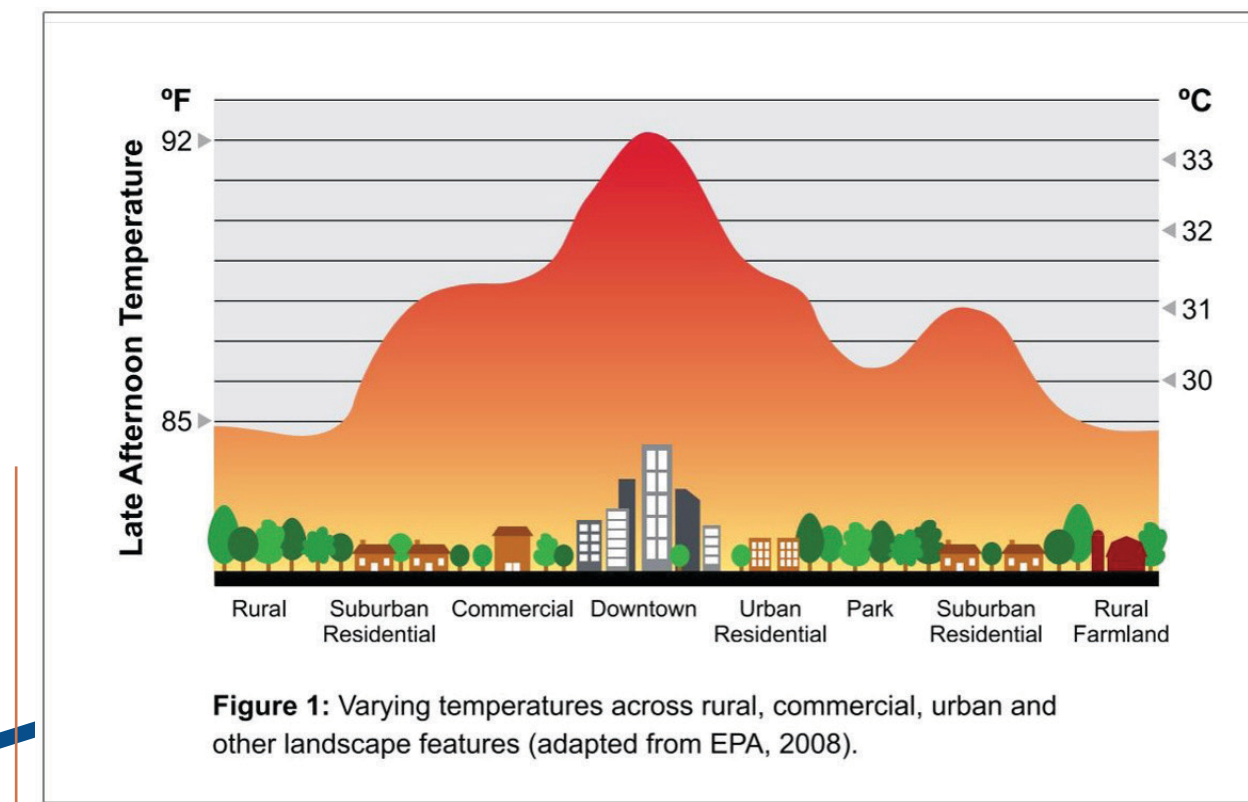


Sustainability on the North Shore

Heat Island Effect

Overview

As humanity expands, we continually replace our natural surroundings with artificial material. We erect buildings, roads, and other infrastructure to make our lives easier and more habitable. What has become an unintentional consequence of our desire to expand, is the heat island effect. The heat island effect is the process by which our built environment absorbs and re-emits the sun's heat far more than the natural environment does. This leads to an increased temperature in developed areas in comparison to the surrounding countryside. First studied in the 1800's, the understanding of the causes, effects, and reduction methods has increased over time (Mohajerani, 2017). There are a vast number of causes for this effect, most of which trace back to human activities. The natural environment is extremely efficient at reducing air temperature. Trees, vegetation, and water bodies all contribute to the reduction of temperature through shade and evaporation. Trees are especially adept at this, as they provide shade and absorb CO₂, making the environment cooler (Nuruzzaman 2015). During the process of development, we take away these natural systems, replacing them with hard and dry surfaces. These surfaces (pavement, buildings, homes, etc.) trap heat, reflect less solar energy, and block wind. Consequently, both humans and the environment are adversely affected. Due to the increase in temperature, humans become more susceptible to heat-related illnesses (Nuruzzaman 2015) In addition, the discomfort felt during this effect makes the use of air conditioning and other cooling methods much more common. This, in turn, requires more energy, which requires more fossil fuels to be used. This increases the expenditure of energy, while the climate declines. Northern Minnesota is not exempt from this effect, although it is less pronounced in comparison to larger cities such as Minneapolis. Cities like Duluth do experience the heat island effect, due to the increased infrastructure than the surrounding area. Although there are no cities as large as Duluth along the North Shore, the reduction of the heat island effect should still be taken into consideration as a preventative measure. Fortunately, there are a multitude of strategies that can be implemented. These strategies add to the rebuilding and preservation of the surrounding landscape, while also reducing/ preventing the heat island effect.



Green Roofs

Green Roofs are an amazing remedy for both reducing heat islands and camouflaging a building. Through the use of heat energy, plants keep the environment cool through the evaporation process (Nuruzzaman 2015). So, with the addition of a green roof covered in plants, the amount of heat absorbed by a structure is limited even further. With the added benefit of being able to absorb water, thus reducing the heat absorbed even more, green roofs provide an exemplary method of reducing the heat island effect. Green roofs also allow the structure to blend into its natural surroundings much more effectively. By introducing natural plants and colors back into the design, the rigidity of a regular roof is lessened. This allows for the building to create less contrast against the natural landscape.

Pervious Pavements

Evapotranspiration is the process through which water is absorbed into the atmosphere through evaporation from soil and other surfaces. Much of the hardscape surfaces we walk on are not pervious to water. Often, they are designed to funnel the water away from them, and into a drain. Because of this, the evapotranspiration process is unable to happen, leading to less of a cooling effect. Implementing pavements or surfaces that allow water to absorb into them helps keep these surfaces cool, which directly affects the temperature (Nuruzzaman 2015). The use of gravel or dirt roads can help in this process. With the added benefit of less damage to the environment through the construction process, these roads provide a more natural look.

Vegetation & Trees

One of the most effective strategies in reducing the heat island effect is the presence of vegetation and trees. Whether that be by replanting them or just leaving them alone in the first place, vegetation, and trees are incredibly important to this process. By providing shade and reducing CO₂, the surrounding environment becomes cooler. Although planting these might be necessary for an already developed area, when possible, reduce the amount of vegetation removed when starting a new development. This is because new plants need years to grow, in contrast to the already existing plants. In addition, reducing the amount of vegetation and trees removed preserves the natural look of the landscape, and is less harmful to the environment.

Sustainability on the North Shore

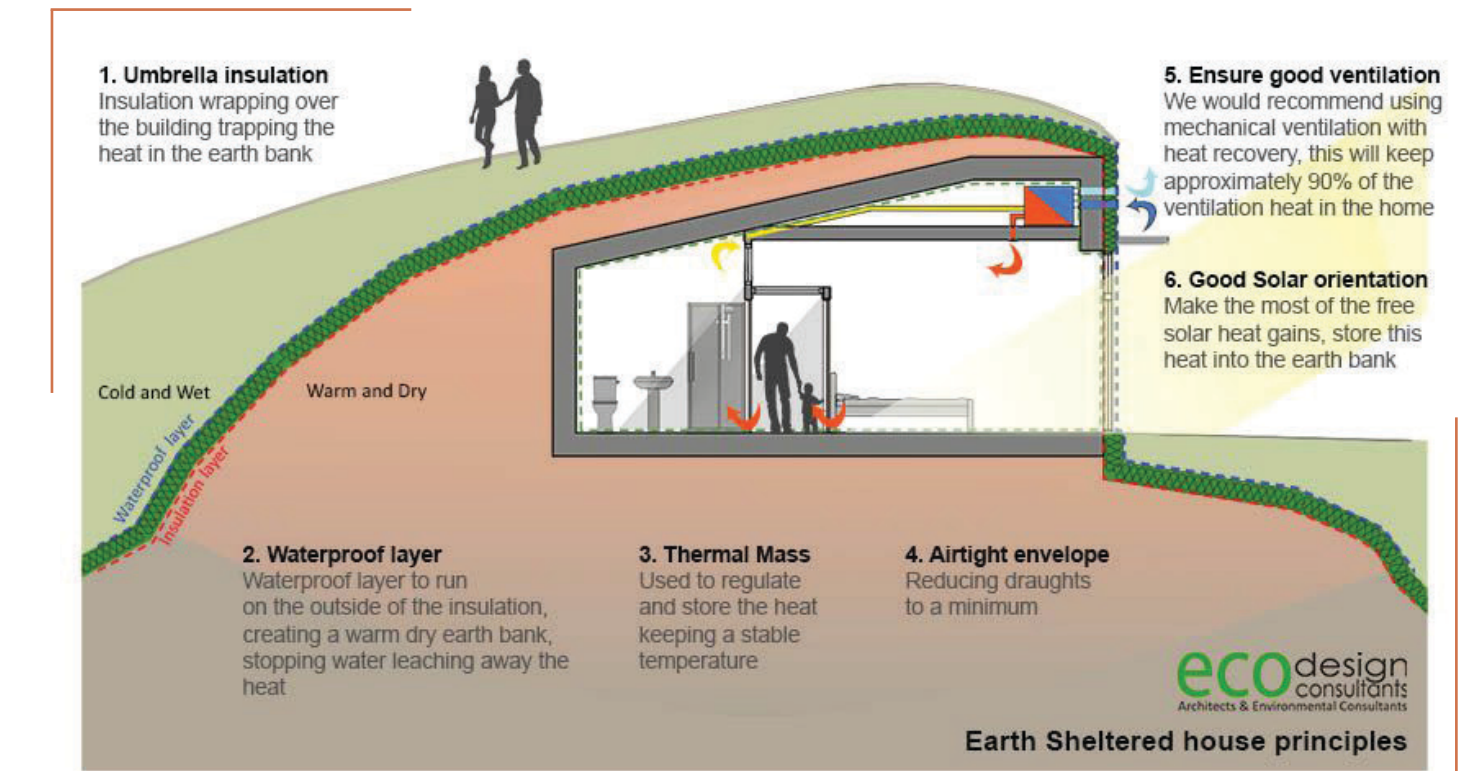
Energy Efficiency: Building Envelope

Overview

According to the U.S. Energy Information Administration, in 2022 16% of U.S. primary energy consumption came from the residential sector, with most of it being from fossil fuels. The burning of fossil fuels releases greenhouse gasses, which according to the United States Environmental Protection Agency, “is the most significant driver of observed climate change since the mid-20th century.” To reduce fossil fuel usage, energy efficiency is taken into great consideration when designing sustainable residences. A major focus point in this venture is the design of the building envelope. The building envelope is the barrier between the interior of the structure and the exterior. There are two types of strategies when improving the energy efficiency of a structure, which are active and passive (Sadineni, 2011). Improving energy efficiency in the building envelope is classified under passive strategies, and is a popular method (Sadineni, 2011). An efficient building envelope can impact the energy usage in heating and cooling systems, leading to a reduction in energy consumption. The building envelope should be heavily discussed and considered when designing a structure, as it can affect energy costs and help reduce environmental impact.

Earth Sheltering

An exciting method of building envelope design involves the use of the earth. Called earth-sheltering, it is a method that revolves around the full or partial coverage of a structure with earth. Earth-sheltered homes have been proven to be a sustainable construction option by regulating the thermal transmittance of heat much more efficiently than traditionally constructed homes (Asachi, 2014). An article titled Efficient earth-sheltered homes from the Department of Energy, adds a list of benefits that include decreased vulnerability to extreme weather conditions, low maintenance, and soundproofing. The appearance of an earth-sheltered home adds relevance to the goal of blending into the landscape. When covered in earth, a structure is able to effectively blend into the contours of the landscape, reducing the contrast between the built environment and natural surroundings. With the benefits of low environmental impact, quality of life improvements, and being less detrimental to the natural views, earth-sheltering provides an ideal strategy for this project.



Building Envelope Design Strategies

Sustainability on the North Shore

Renewable Energy

Overview

In 2022, Minnesota was determined to have received 27 percent of its electricity through coal power, and 18 percent through natural gas (U.S. EIA). Although this was the first year that renewable resource usage had surpassed coal usage, with 31 percent, fossil fuels are still heavily prevalent in the production of electricity (U.S. EIA). With fossil fuel usage still rampant, 'green' energy provides a clean, renewable source of energy. Renewable or 'green' energy is defined as an energy source that replenishes over time, does not diminish in quantity, and provides environmental benefits (U.S. EPA). For example, the sun, wind, organic plant matter, moving water, and heat from the earth all classify as renewable sources of energy. These resources provide no emissions and create low to no impact on the environment. With the current energy crisis, renewable energy sources will become much more commonplace in the future, or even required. According to the United States Environmental Protection Agency, around 40 percent of the energy consumed in the U.S. is used for electricity. Access to electricity is incredibly important in today's society, and most people cannot live without some form of it. In Cook County, where the site will be located, the majority of energy used for electricity is outsourced from elsewhere. Recently, Cook County has opted for a more sustainable form of electricity, with the Cook County Local Energy Project promoting the increased use of renewable energy (CCLEP). Renewable sources of energy provide a consistent source of electricity for everyday usage, without unwanted carbon emission and pollution. With the needs of the consumer, protection of the environment, and preservation of the natural landscape to balance when designing around energy sources, several options can be considered.

Solar Energy

By far the most abundant and readily available renewable energy source, solar energy is the most popular form of renewable energy (Panwar, 2011). Normally harvested through the use of solar photovoltaic systems (solar panels), solar panels provide both advantages and disadvantages regarding the objective of this research. For starters, a large surface area is required to produce a sufficient amount of energy (Panwar, 2011). This can hamper efforts to reduce the visual impact on the land, as the panels need large open spaces to harvest solar energy efficiently. There is also the factor of increased maintenance, as they must be cleared of dust and debris to function effectively. The North Shore has excessive tree coverage, meaning to effectively harvest solar energy a sizeable number of trees will need to be removed, harming the natural views of the landscape. The North Shore is also covered in snow during the winter season, which means constant removal of snow from the panels will be required. Although the most abundant renewable resource, site location should be taken into consideration when determining the use of solar panels. Cook County, the area the site is in, has also recently been pushing for more solar power usage.

Wind Energy

On the rise in popularity, the harvest of wind energy has expanded from large wind turbines into smaller, more residential-friendly units. With a variety of different designs, ranging from traditional to newer, vertical rotation designs, there are a multitude of benefits that come with using wind energy. Utilizing the vertical plane, these turbines generally do not consume much space when installed unless multiple different units are installed. According to the U.S. Department of Energy, the benefits include lowering the cost of your electrical bill and an uninterruptible electricity supply during power outages. With the added benefit of reducing carbon emissions, wind energy can provide great benefits to its users. However, wind turbines are quite noticeable. The height at which they are installed and the constant rotation prove to be distracting, especially against the backdrop of a natural landscape. Recently, there have been efforts to reduce the visual pollution that wind turbines produce through the use of biomorphic design. Noticeably, the French company New World Wind has developed 'Aeroleaf', a wind turbine that has been designed to mimic the look of a tree.



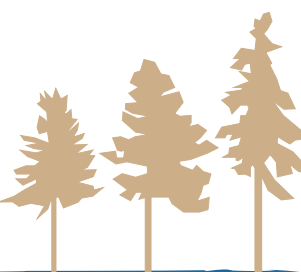
Conclusion

Ecotourism and sustainable design must work together in order to ensure a future for the North Shore. Man-made environments are proven to impact the natural environment in various different ways, so thoughtful design needs to be a necessity when designing in the North Shore. Luckily, the puzzle pieces are all set out, they just need to be put together. Through research detailing why the design strategies need to be considered and how to implement them, the results shown above give one conclusion. Ecotourism criteria and sustainable design criteria both crossover with one another, and should be combined. The design methods listed in the results portion of this report are a combination of LEED and WSTC criteria, making them essential design elements to consider when designing in the North Shore. In order to protect the natural beauty of the North Shore, these strategies need to be utilized. By designing with the intention of preserving the natural environment, the

Going forward, the other aspects of ecotourism will become prominent. During the design phase, opportunities for recognizing culture, improving the economy, and educating visitors will present themselves. Investigating the site and the local history, culture, economy, and local programs will aid in determining design choices that will benefit them. Investigating the site will also lend design options catered towards reducing the impact on the natural scenery. The natural beauty present at the North Shore is incredibly important for a variety of different reasons, so protecting it is key.



CONCLUSION



Light Pollution

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