TOURISM AND SUSTAINABILITY

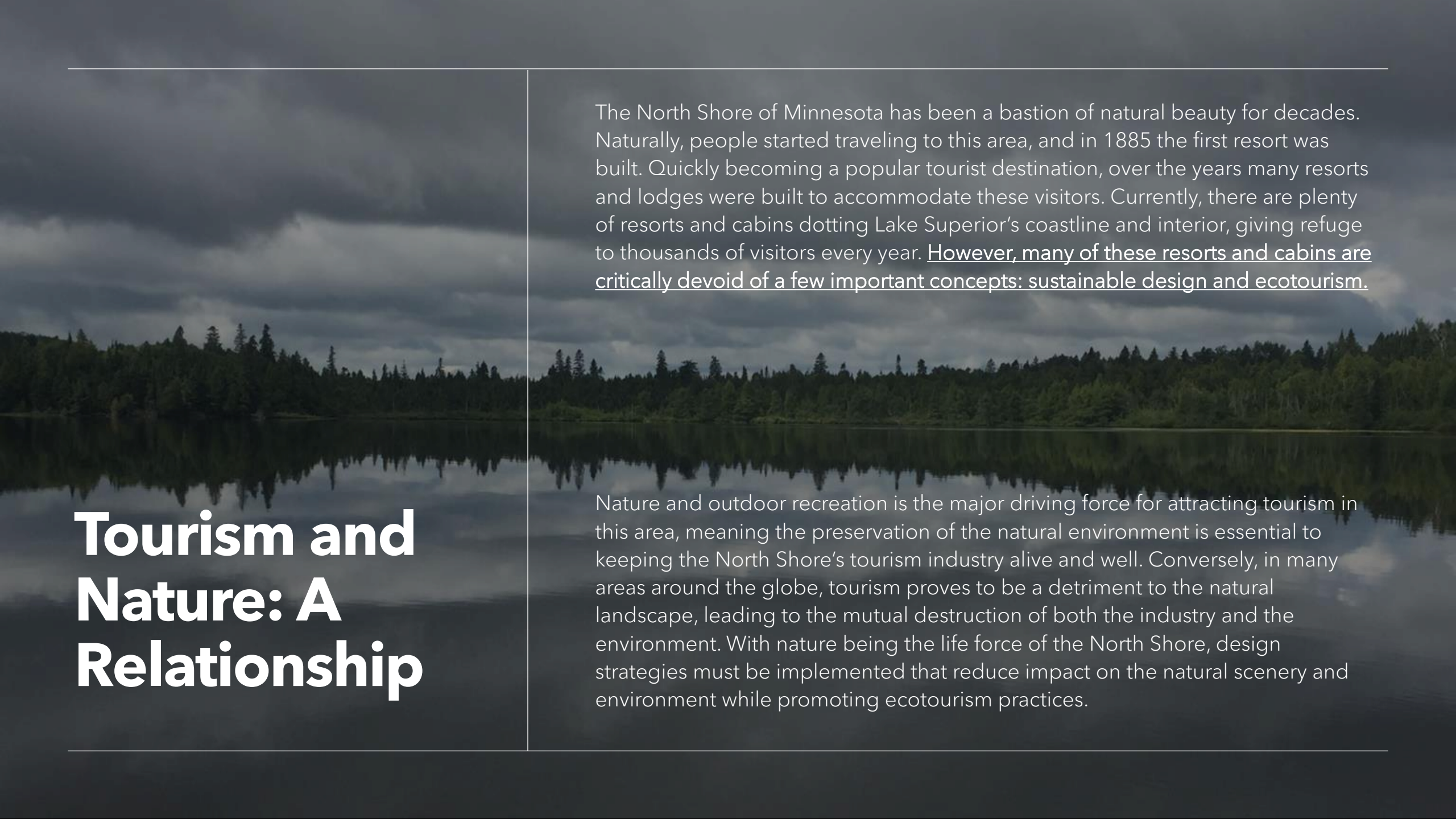
STRATEGIES FOR DESIGNING ON THE NORTH SHORE OF MINNESOTA

LUKE MADSON

Where is the North Shore?

- The North Shore is commonly defined as the Lake Superior coastline of Minnesota, and the forests North of it.
- Categorized into 3 distinct sections (Headwaters, Highlands, and Nearshore), each has its own set of ecological conditions.
- With most of the Headwaters situated in the Superior National Forest and BWCAW, this project will focus on one site located in the Highlands, and one located in the Nearshore.

(Anderson and Fischer, *North Shore: A Natural History of Minnesota's Superior Coast*, University of Minnesota Press, pg. 4)



Tourism and Nature: A Relationship

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 and cabins dotting Lake Superior's coastline and interior, giving refuge to thousands of visitors every year. However, many of these resorts and cabins are critically devoid 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

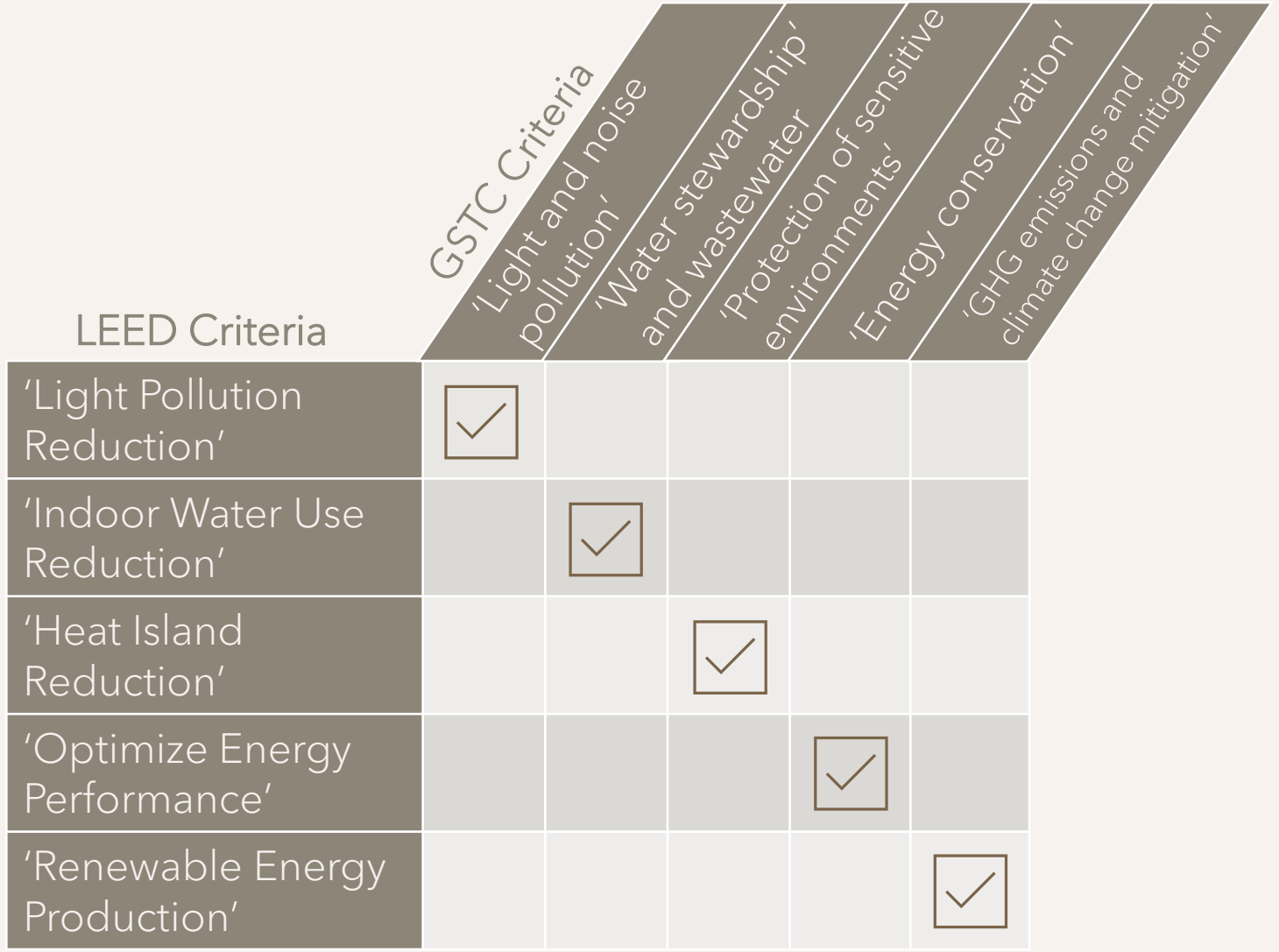
- Research sustainable design strategies and ecotourism principles, and cross reference them to see if there are any common criteria.
- Relate these strategies to the North Shore, determining if these strategies can reduce both visual and ecological impact to the local environment.
- Create a ‘manual’ that highlights sustainable design strategies that are specifically catered to the North Shore and implement these strategies in the design of a series of rentable cabins.

Methodology

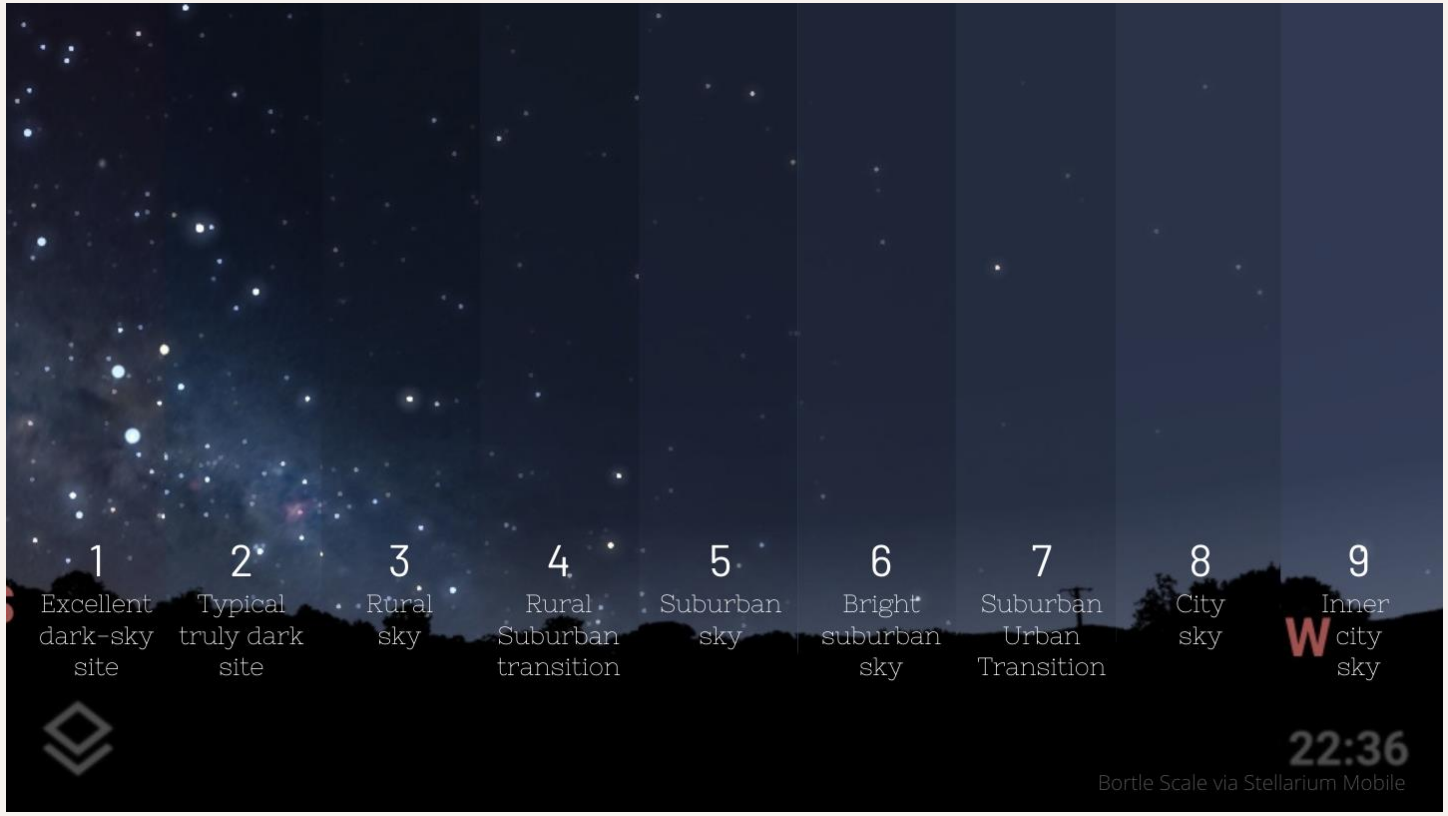
- Examine LEED (Leadership in Energy and Environmental Design) Criteria along with GSTC (Global Sustainable Tourism Council) Destination Criteria and cross-reference them.
- Determine which criteria overlap and review these criteria to see which can directly affect the visual impact of the design on the landscape.
- Extensively research the chosen criteria and see which strategies can be implemented in the reduction of visual and ecological impacts of the North Shore Environment.
- Implement these strategies into carefully designed cabins.

Results

This matrix provides a visual representation of the corresponding criteria between LEED and GSTC



Light Pollution

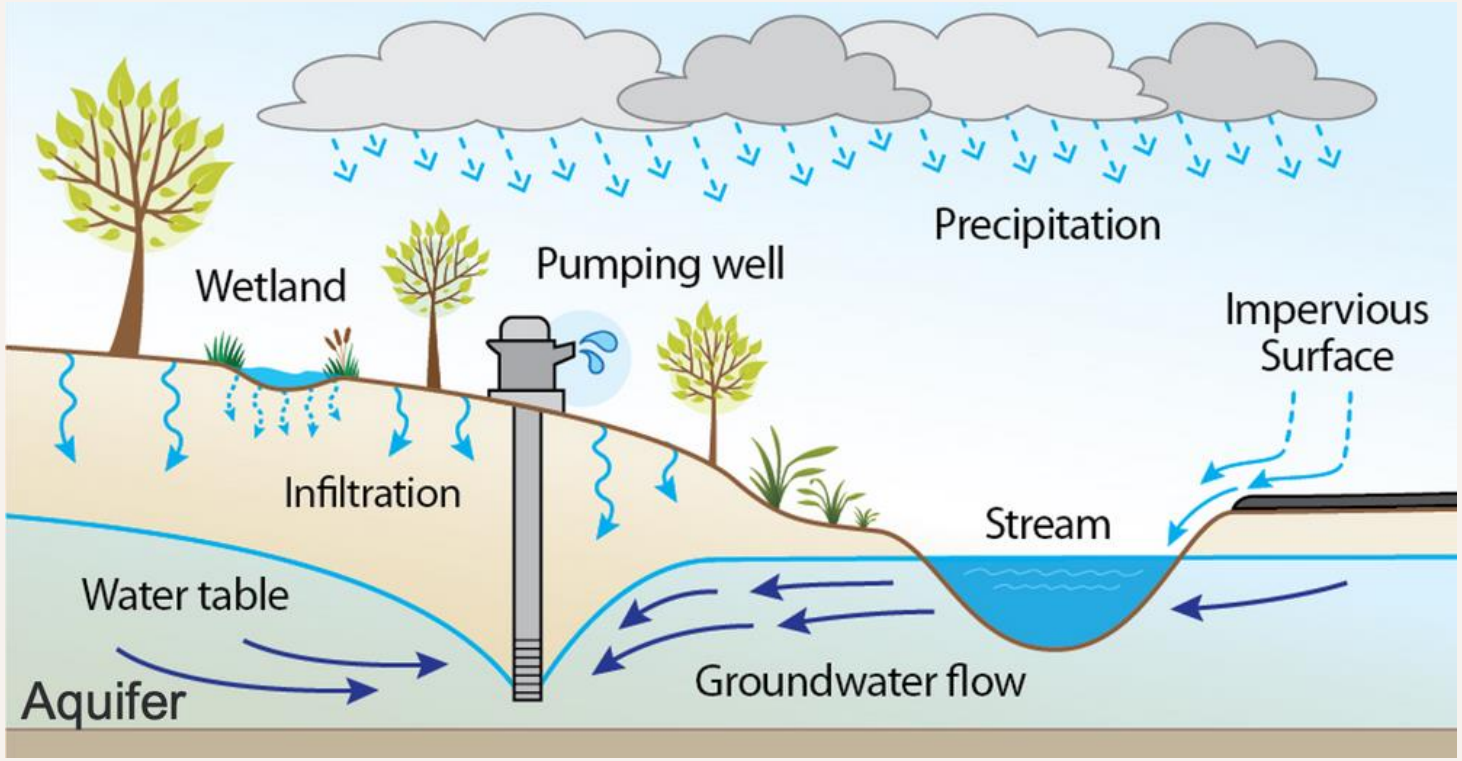


Stellarium Labs. Light Pollution with Stellarium Mobile | Stellarium Labs (stellarium-labs.com)

- Light pollution impacts the environment in a variety of different ways. 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, light pollution actively changes the natural views of the night sky, making them almost unseeable.
- The IDA (Internation Dark-Sky Association) designated the Superior National Forest as an international dark-sky sanctuary, meaning its starry nights are of the highest quality. Given the projects close proximity to the Superior National Forest, it is imperative to design with light pollution-conscious strategies.

Water Efficiency

- 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.
- As for the North Shore, a majority of residents receiving their water from wells, Lake Superior, and surrounding freshwater sources (MWI). Designing while keeping freshwater resources in mind is a must here.



Tortolita Alliance. Know Your H2O-Part V-Groundwater Recharge (tortolitaalliance.com)

Heat Island Effect

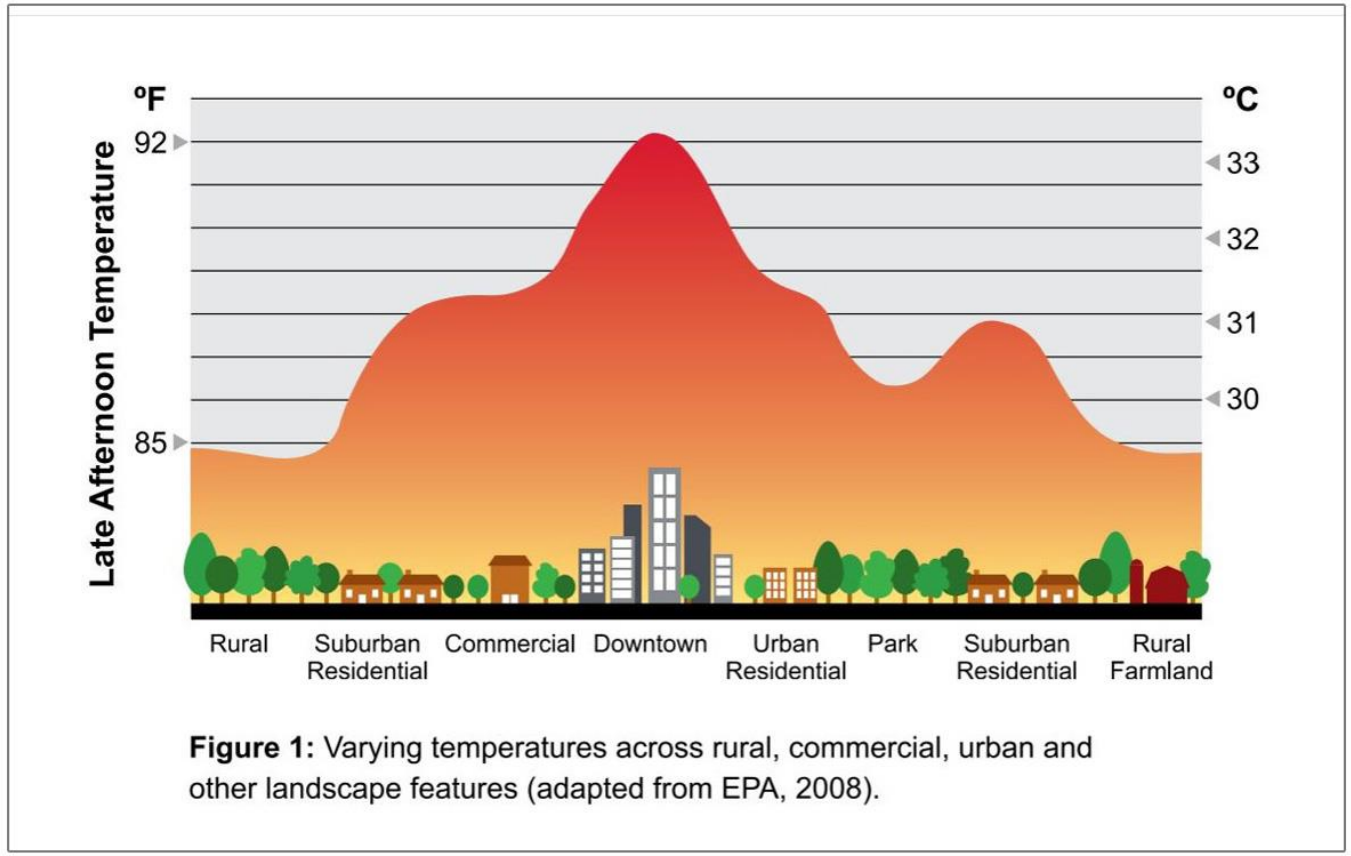


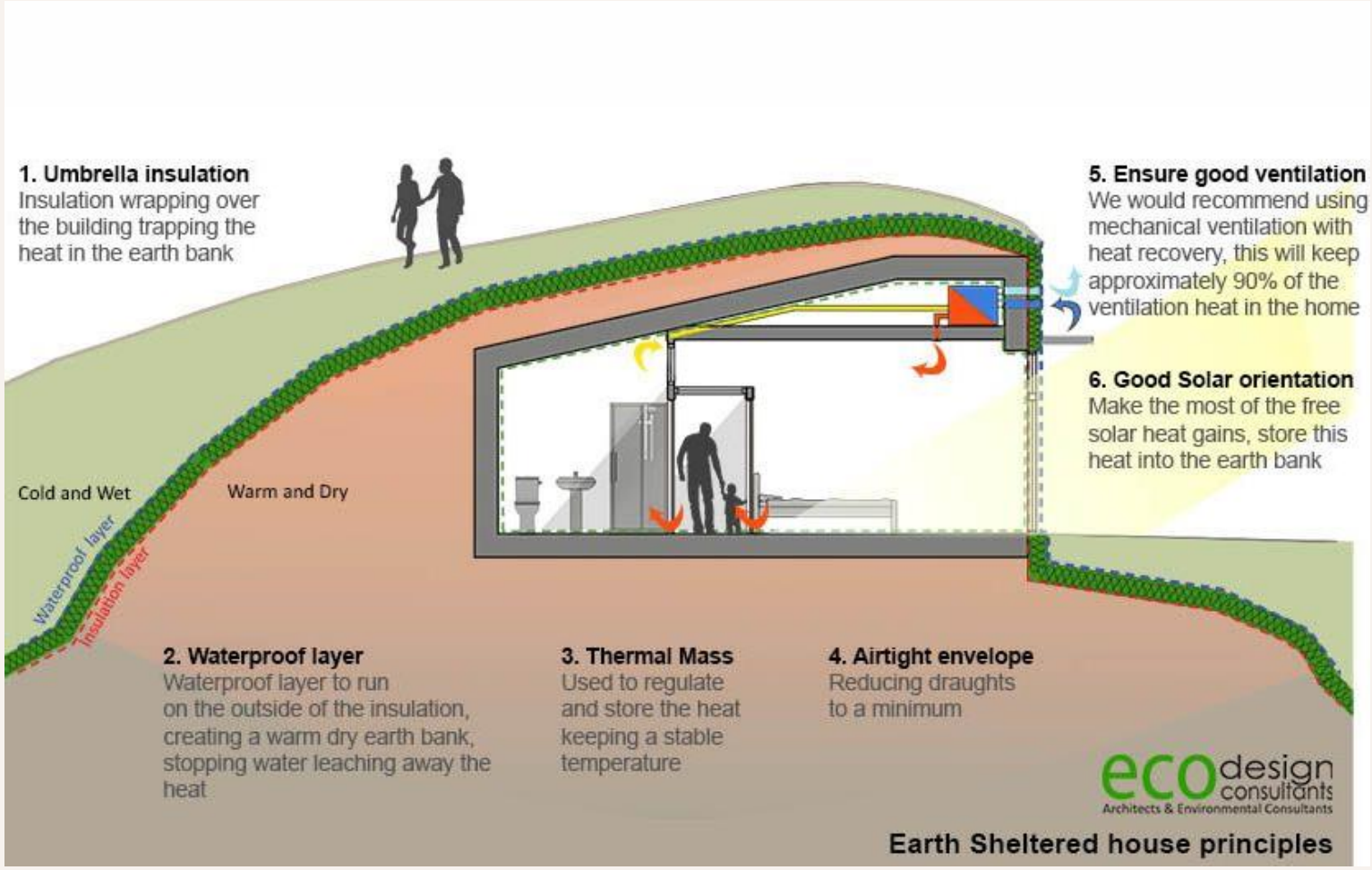
Figure 1: Varying temperatures across rural, commercial, urban and other landscape features (adapted from EPA, 2008).

Green Infrastructure Ontario Coalition. urban-heat-island-effect-durham – Green Infrastructure Ontario

- 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.
- 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.

Energy Efficiency: Building Envelope

- 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.
- The building envelope can also directly affect the visual impact on the surrounding area, so designing with materials and strategies informed by the North Shore environment should be at the forefront of decision making.



Eco Design Consultants. The Bletchley Project – Eco Design Consultants (edc.eco)

Renewable Energy

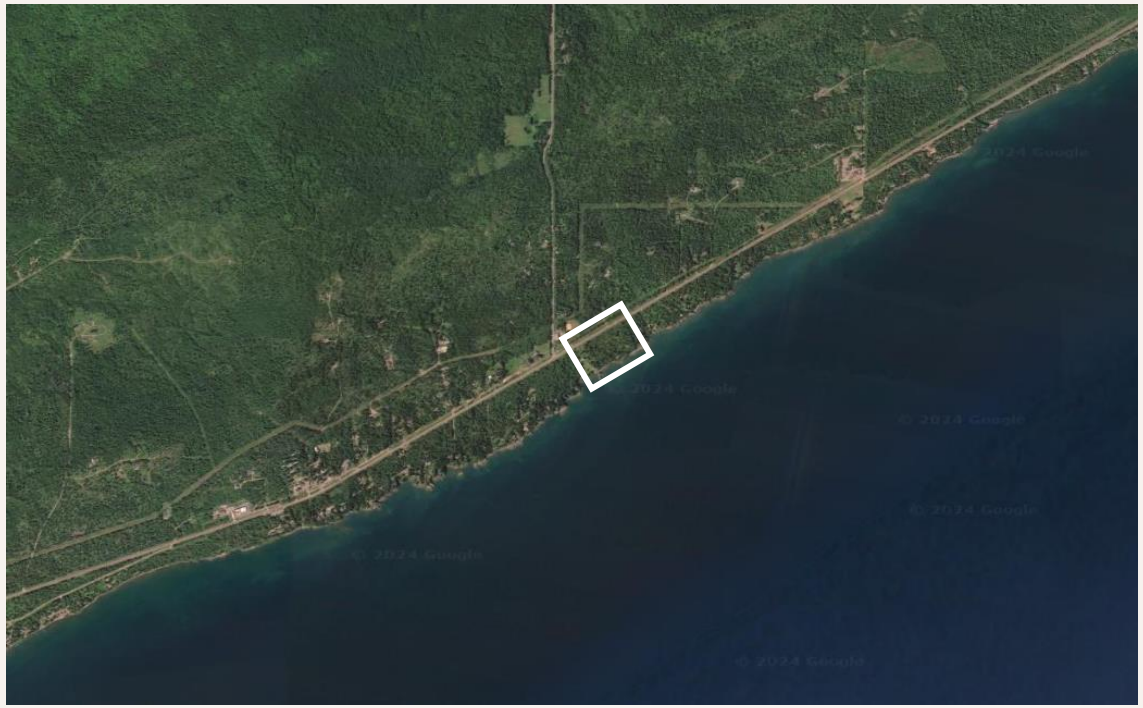
- Renewable or ‘green’ energy is defined as an energy source that replenishes over time, does not diminish in quantity, and provides environmental benefits (U.S. EPA). For example, the sun, wind, organic plant matter, moving water, and heat from the earth all classify as renewable sources of energy

- According to the United States Environmental Protection Agency, around 40 percent of the energy consumed in the U.S. is used for electricity.

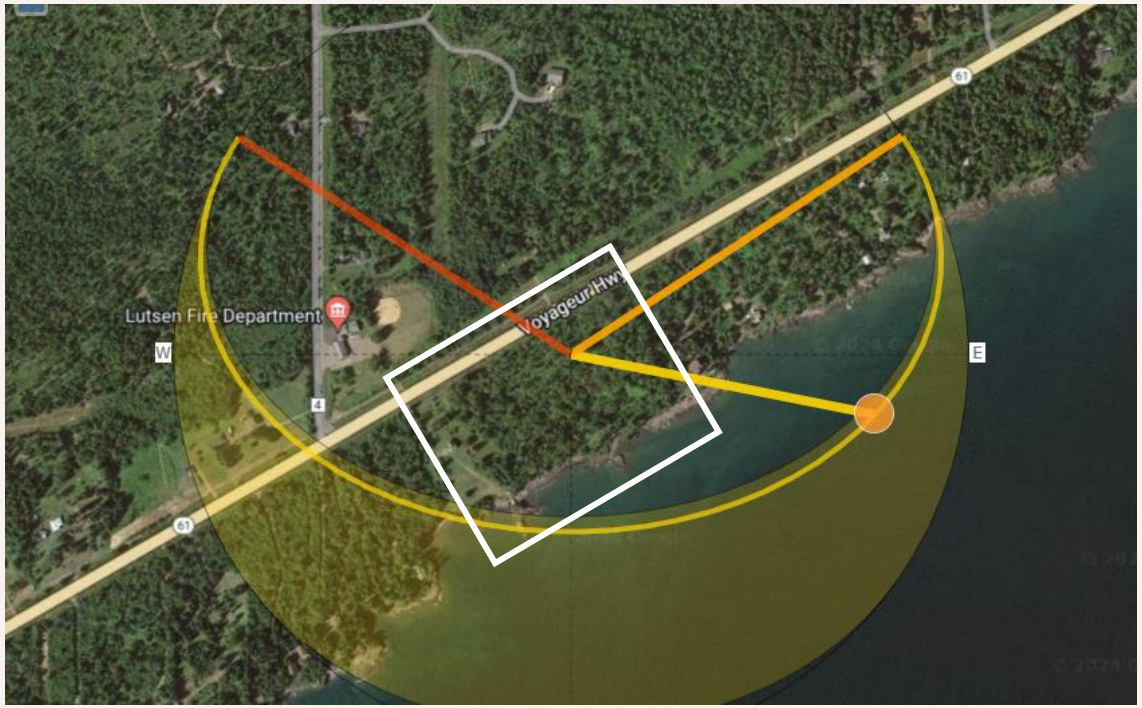
- In Cook County, where the site will be located, the majority of energy used for electricity is outsourced from elsewhere. Recently, Cook County has opted for a more sustainable form of electricity, with the Cook County Local Energy Project promoting the increased use of renewable energy (CCLEP).

Site Locations

- Both sites are located in Lutsen, MN
- One on the Nearshore, one in the Highlands



Google Earth. https://earth.google.com

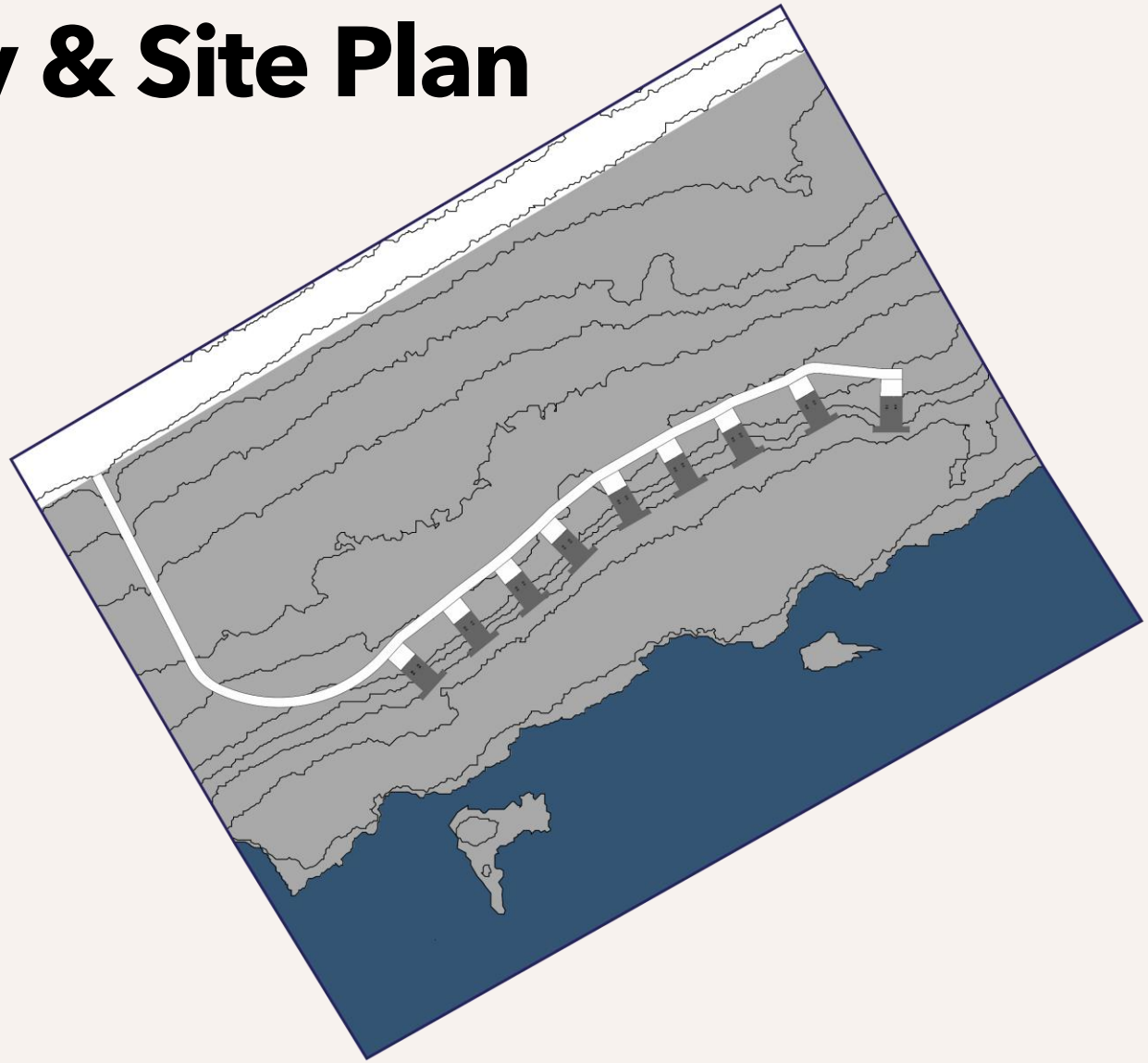


SunCalc. https://www.suncalc.org

Nearshore Location

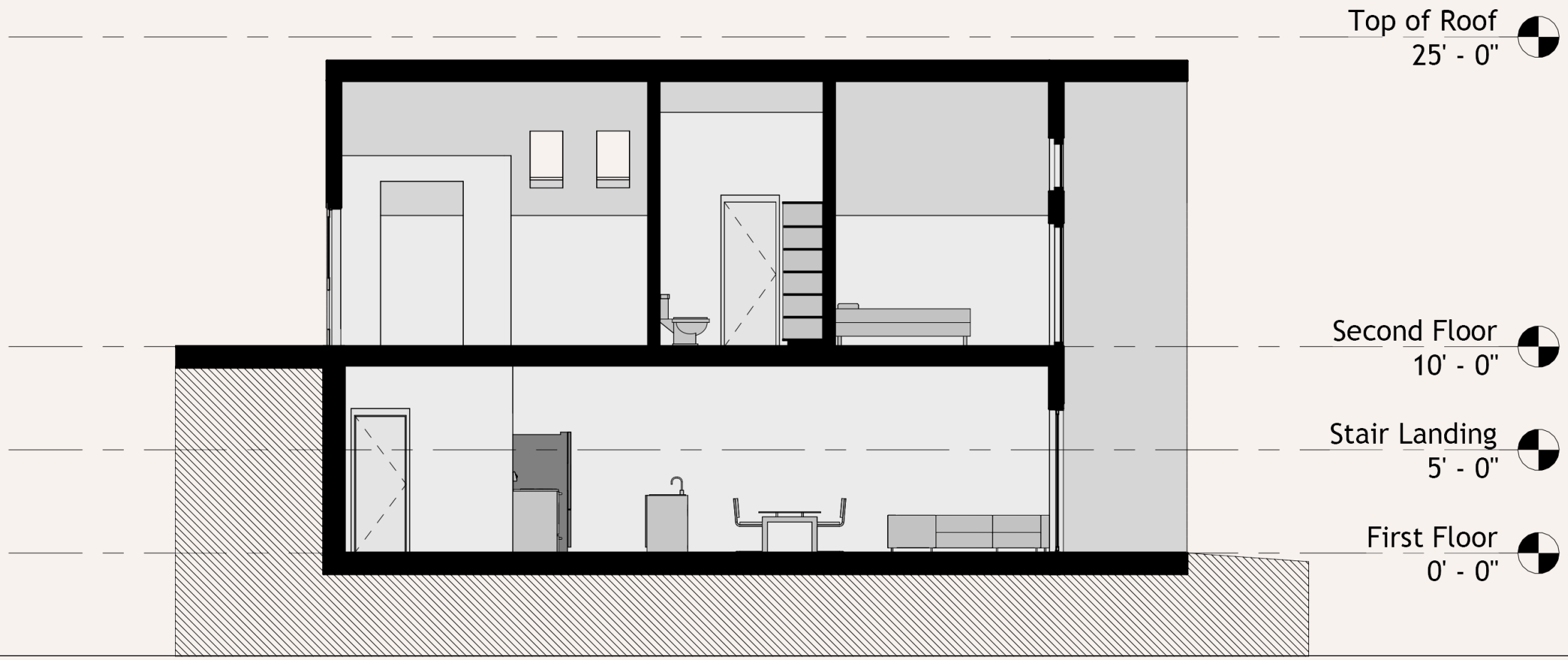
- Arial view and sun mapping

Nearshore Topography & Site Plan

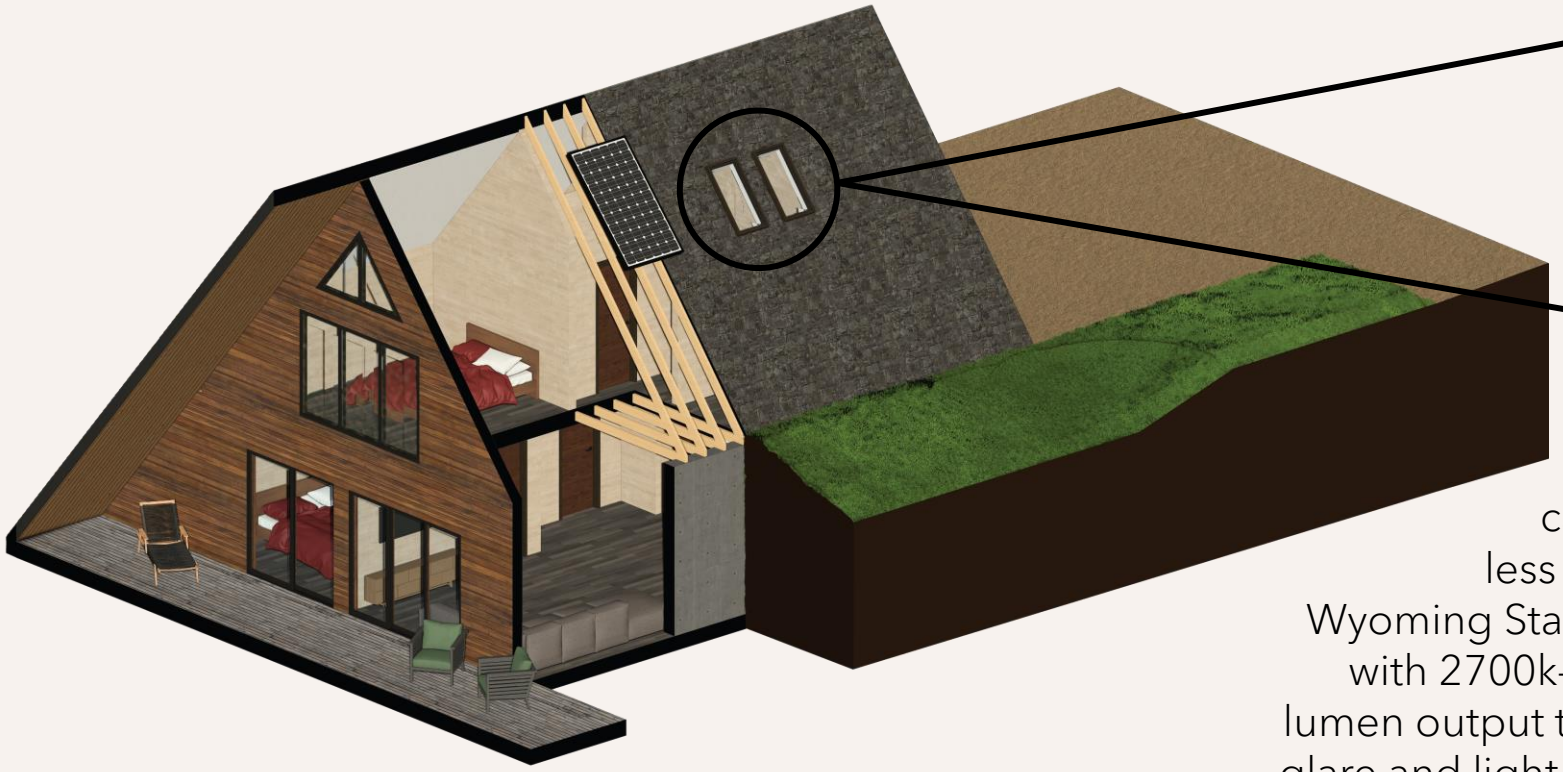


Nearshore Floorplans

Nearshore Section



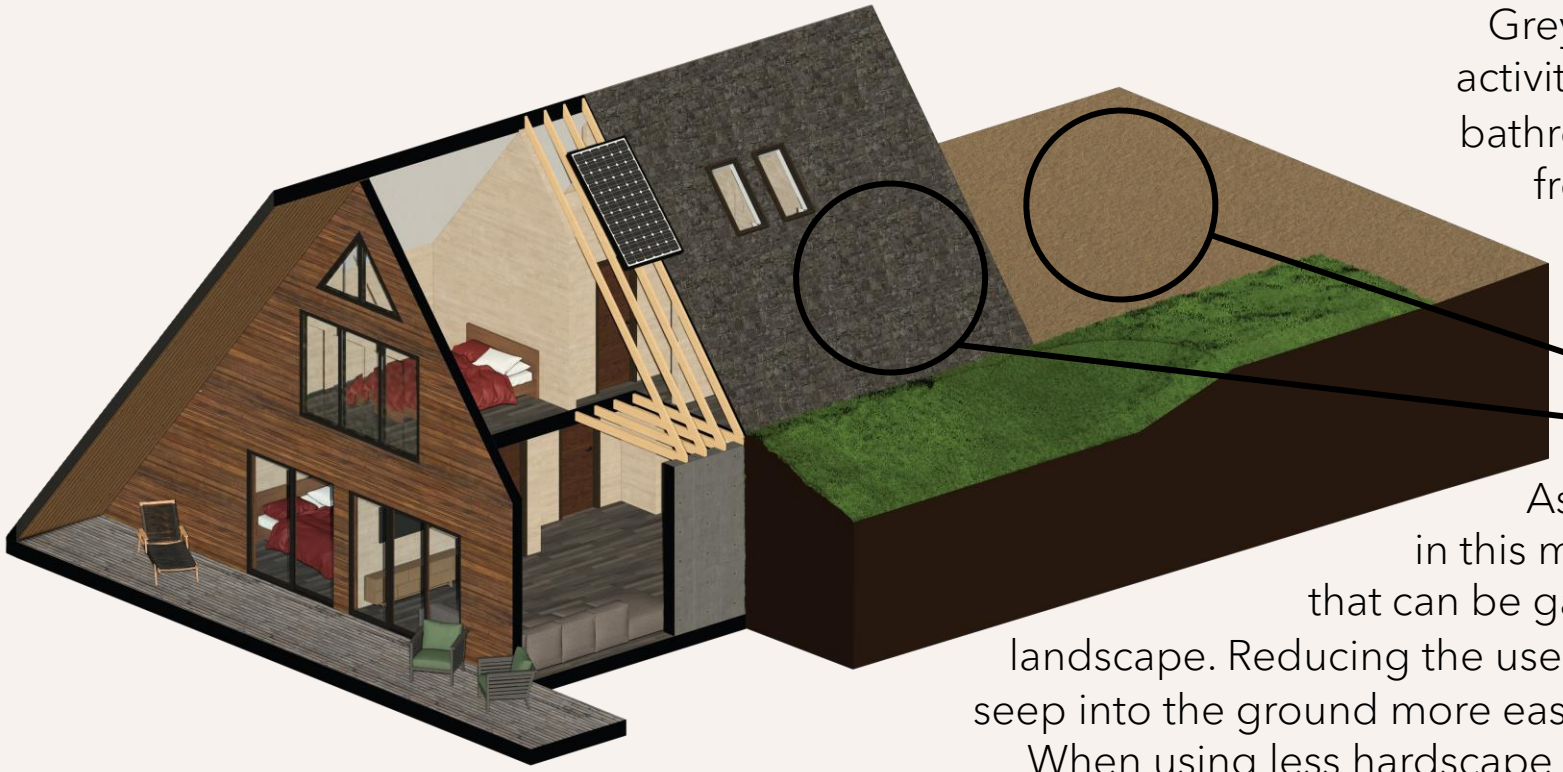
Sustainable Design Strategies: Light Pollution



Dark-Sky Compliant Lighting: Restrict the amount of upward-directed light, minimize bluish light, utilize lighting controls such as dimmers, and avoid glare and over-lighting

Light Bulb Selection: 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). 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.

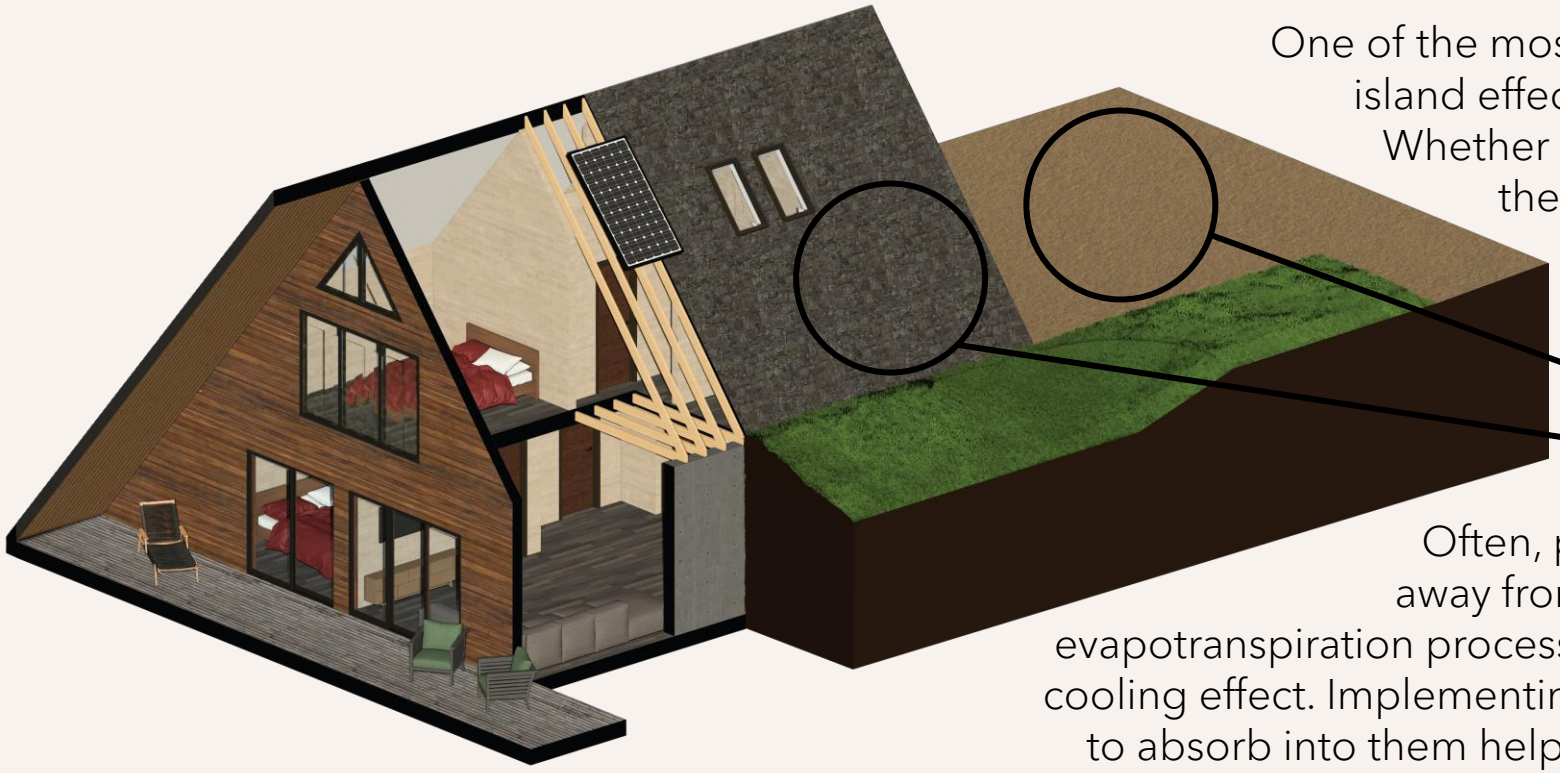
Sustainable Design Strategies: Water Efficiency



Greywater Catchment:
Greywater is the leftover water from everyday activities such as bathing, washing clothes, and bathroom faucets. Reducing the use of regular freshwater resources, greywater catchment allows for an additional water supply to be used instead of freshwater. An interior greywater catchment system will be installed.

Groundwater Recharge:
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. Reducing the use of hardscape surfaces allows for water to seep into the ground more easily, which leads to groundwater recharge. When using less hardscape materials, taking the route of minimal site disruption leads to positive effects when protecting the natural landscape.

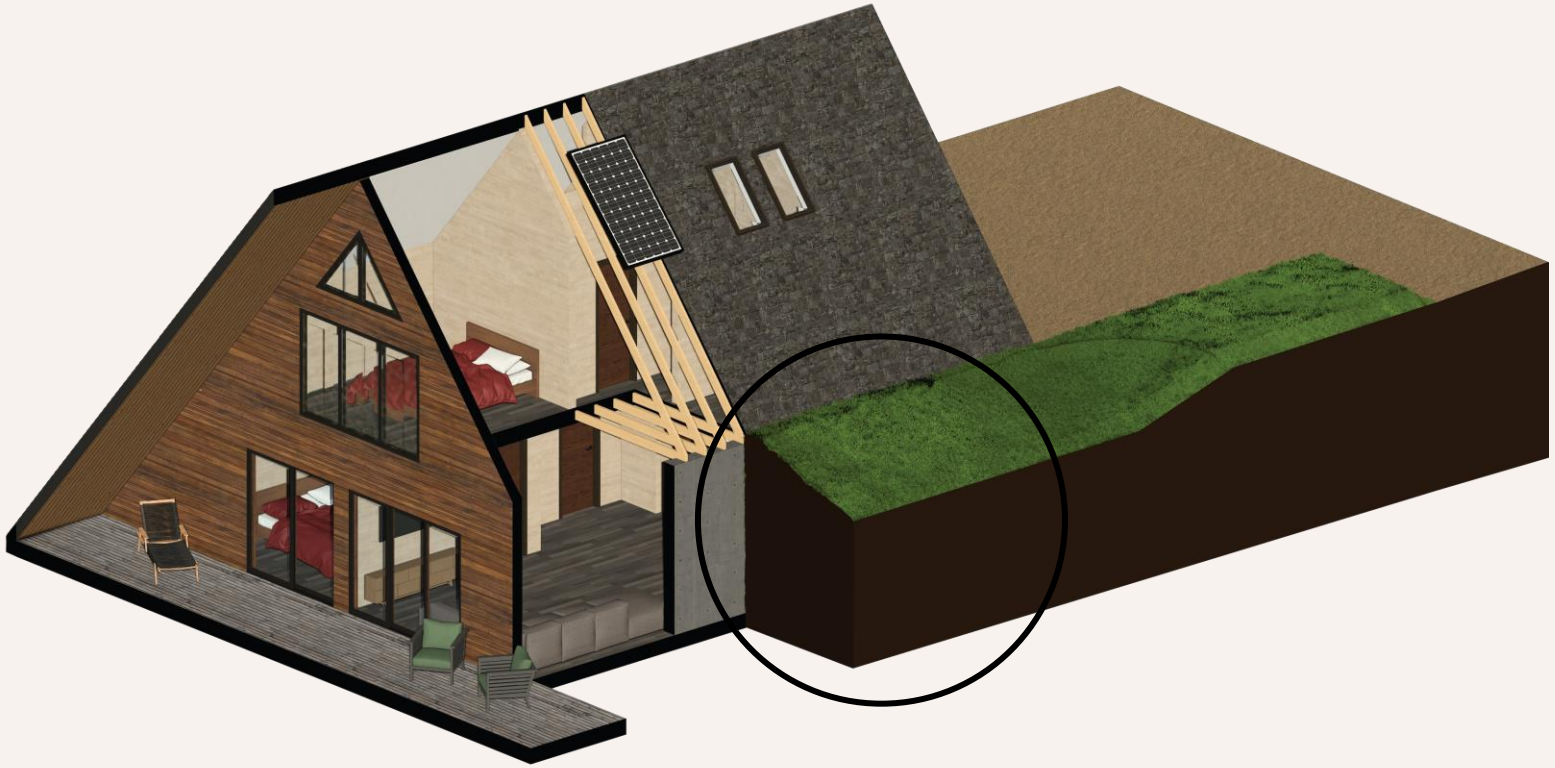
Sustainable Design Strategies: Heat Island Effect



Vegetation and 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.

Pervious Pavements:
Often, pavement is designed to funnel the water away from it , 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).

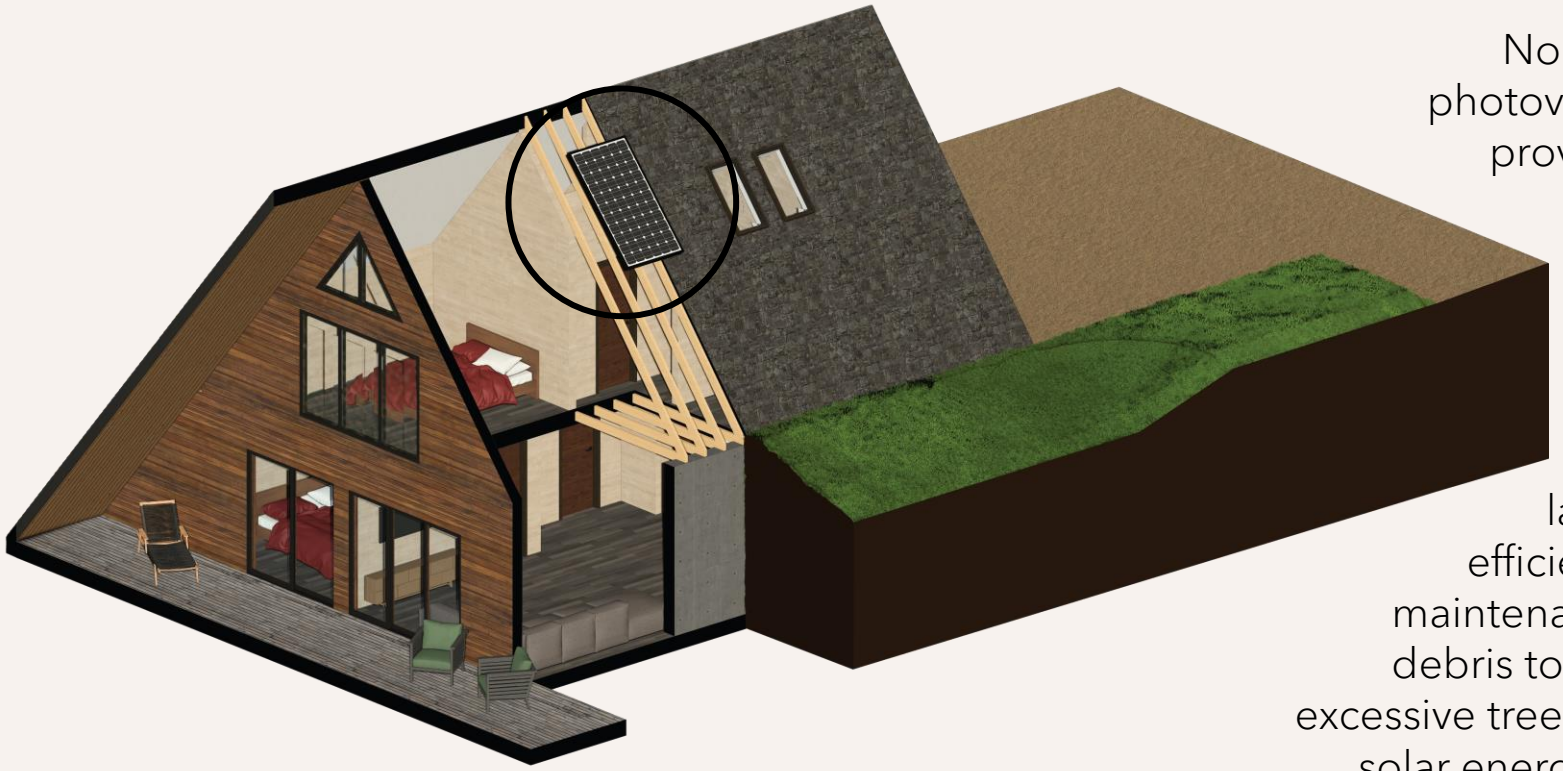
Sustainable Design Strategies: Building Envelope



Earth Sheltering:

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.

Sustainable Design Strategies: Renewable Energy



Solar Energy:

Normally harvested through the use of solar photovoltaic systems (solar panels), solar panels provide both advantages and disadvantages regarding the objective of this project. 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 specific trees will need to be removed, harming the natural views of the landscape.

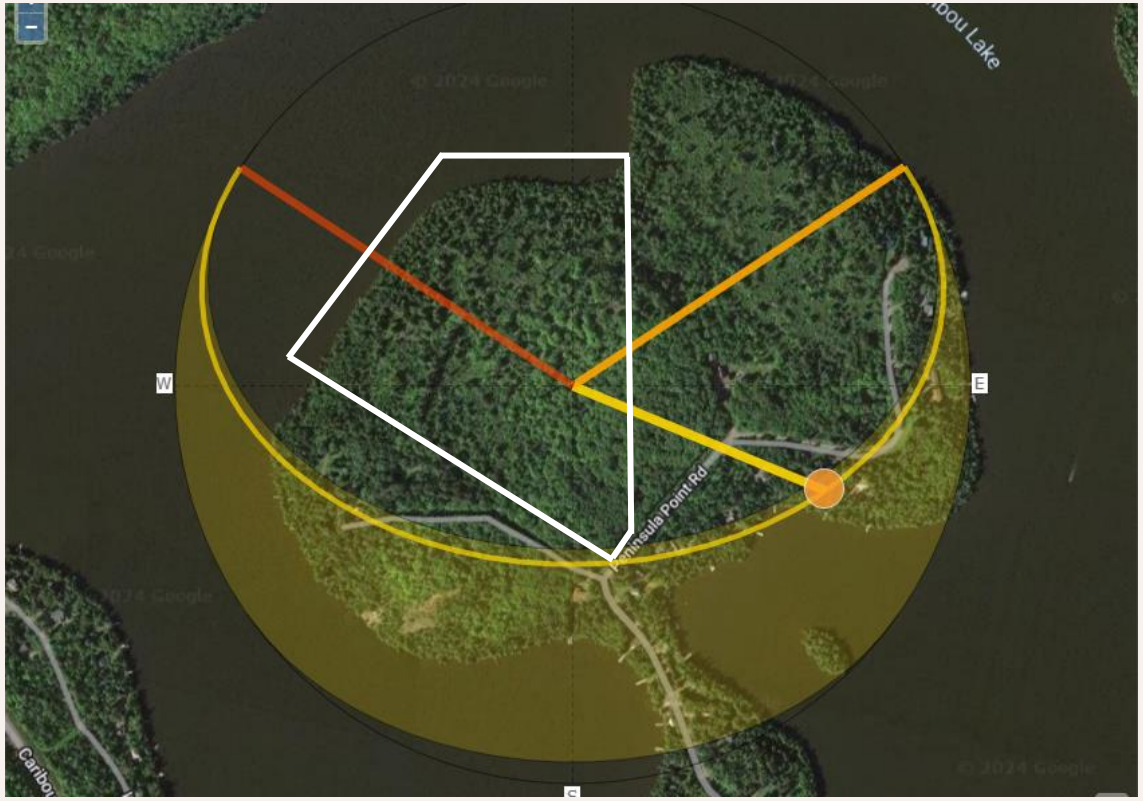
LaFever Roofing. Top Boise Slate Roofer Since 1978 👍 LaFever Roofing (lafever-roofing.com)

North Shore Explorer MN. Crystal Cliffs at Tettegouche State Park - North Shore Explorer MNNorth Shore Explorer MN (northshoreexplorer,com)

Environmental Influence

- Delivering on a more modern design, the nearshore design harbors unique design choices. Entering from the second floor, one will find the first floor to be almost completely encased in earth. With the roof clad in shale stone tiles, reminiscent of the rocky cliffs present on the lake shore. Combining both earth sheltering and a conscious material pallet, these cabins sink away from view into the hillside they are placed on.

Google Earth. https://earth.google.com



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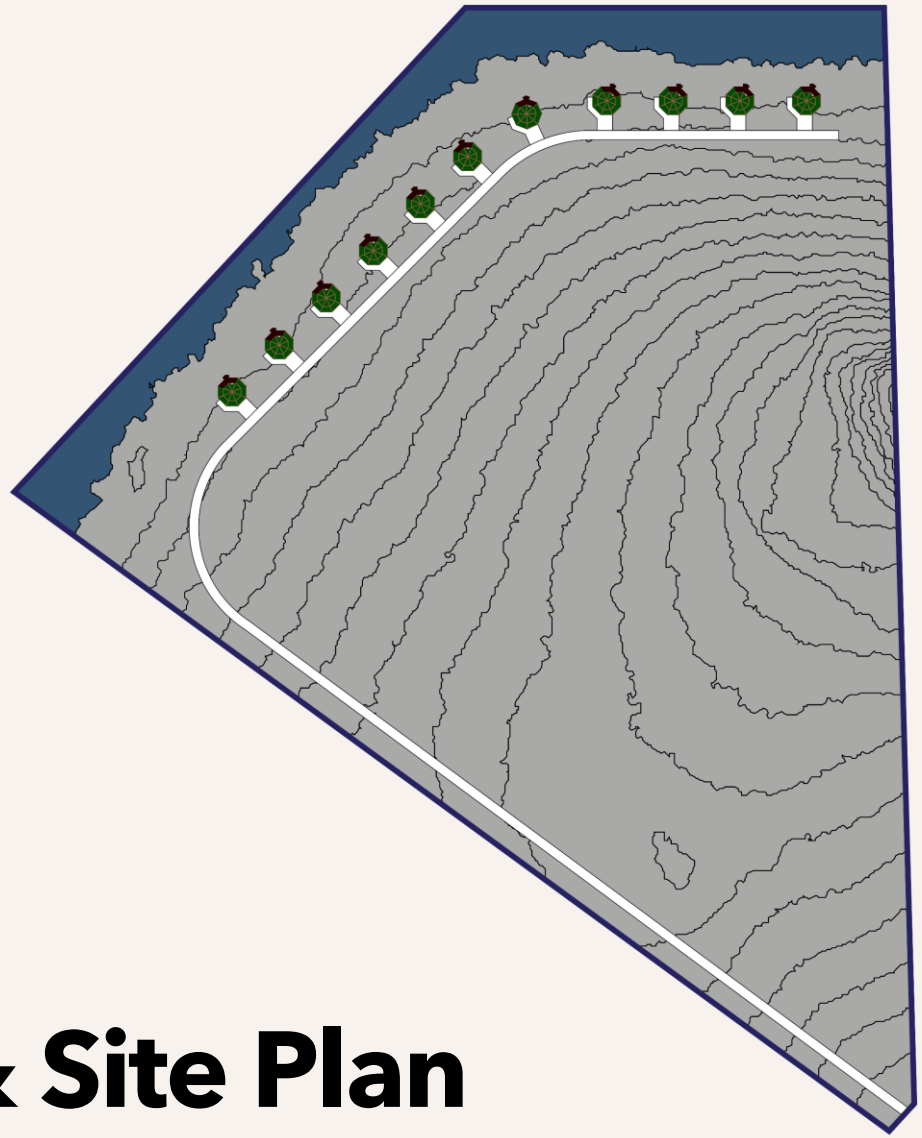
Highlands Location

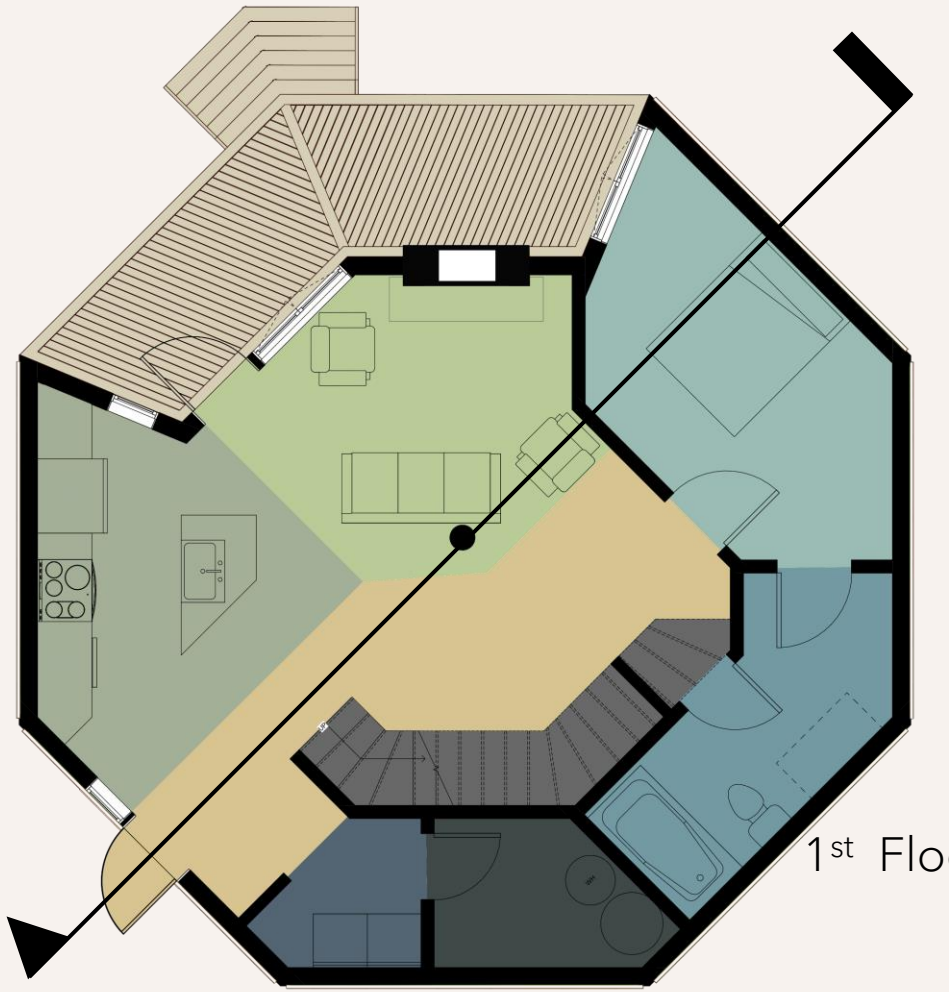
- Arial view and sun mapping



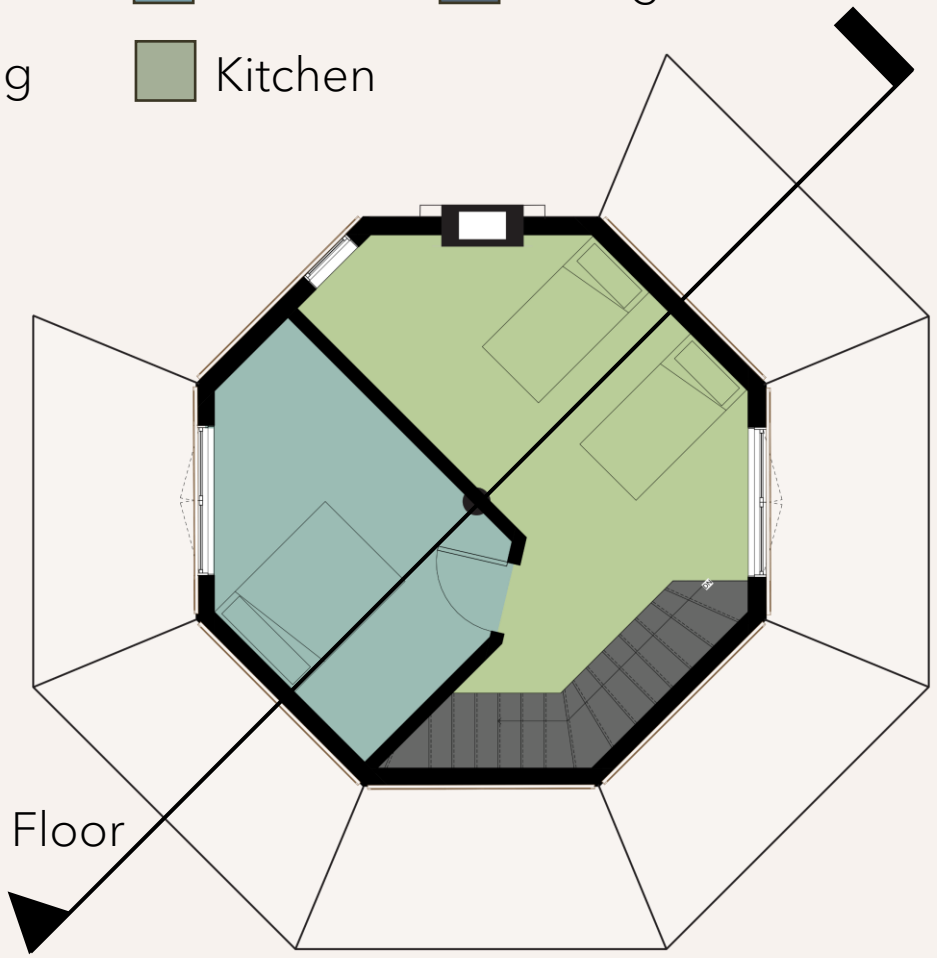
Highlands Topography & Site Plan

Highlands Floorplans

Hallway
Deck
Mechanical
Bedroom
Bathroom
Storage
Living
Kitchen

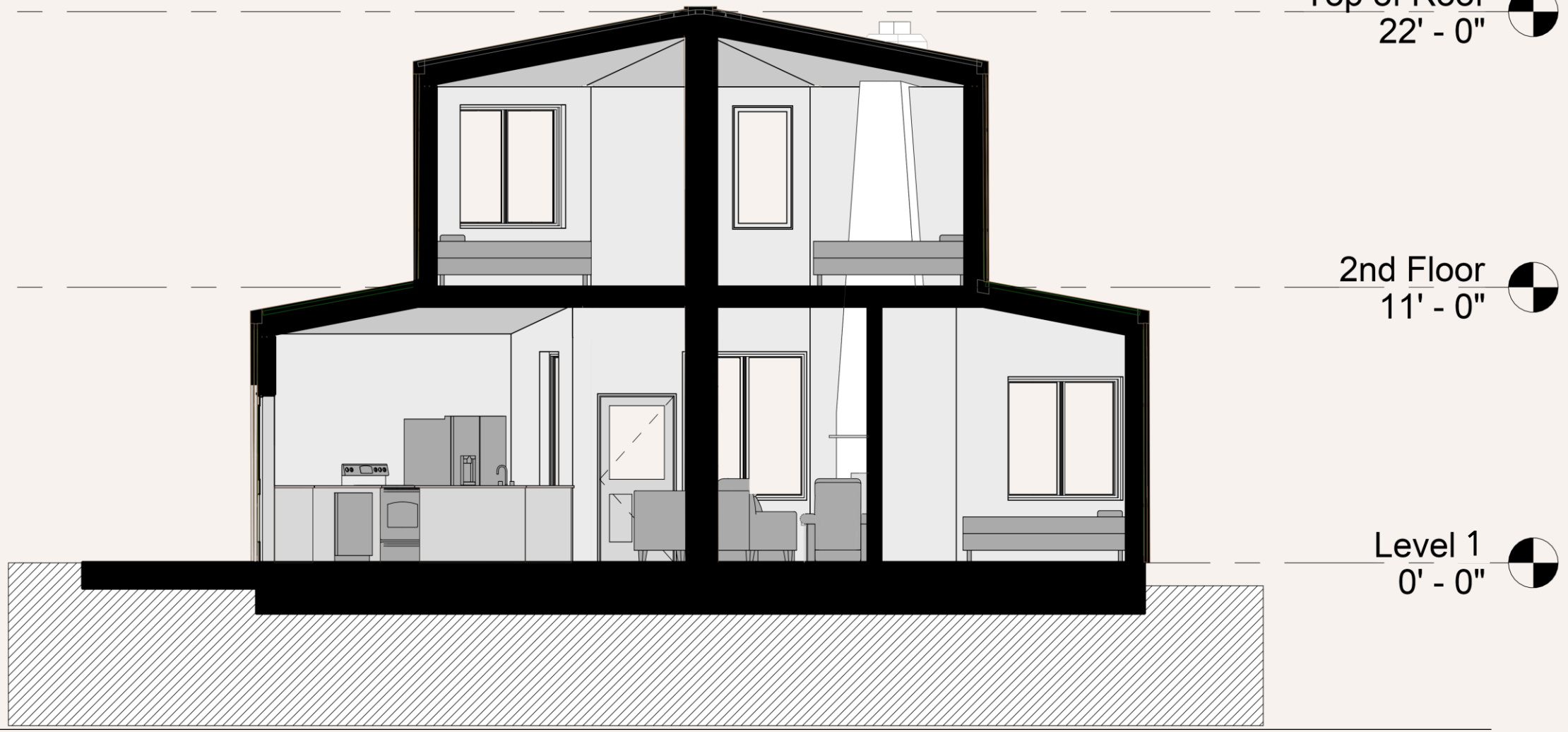


1st Floor



2nd Floor

Highlands Section



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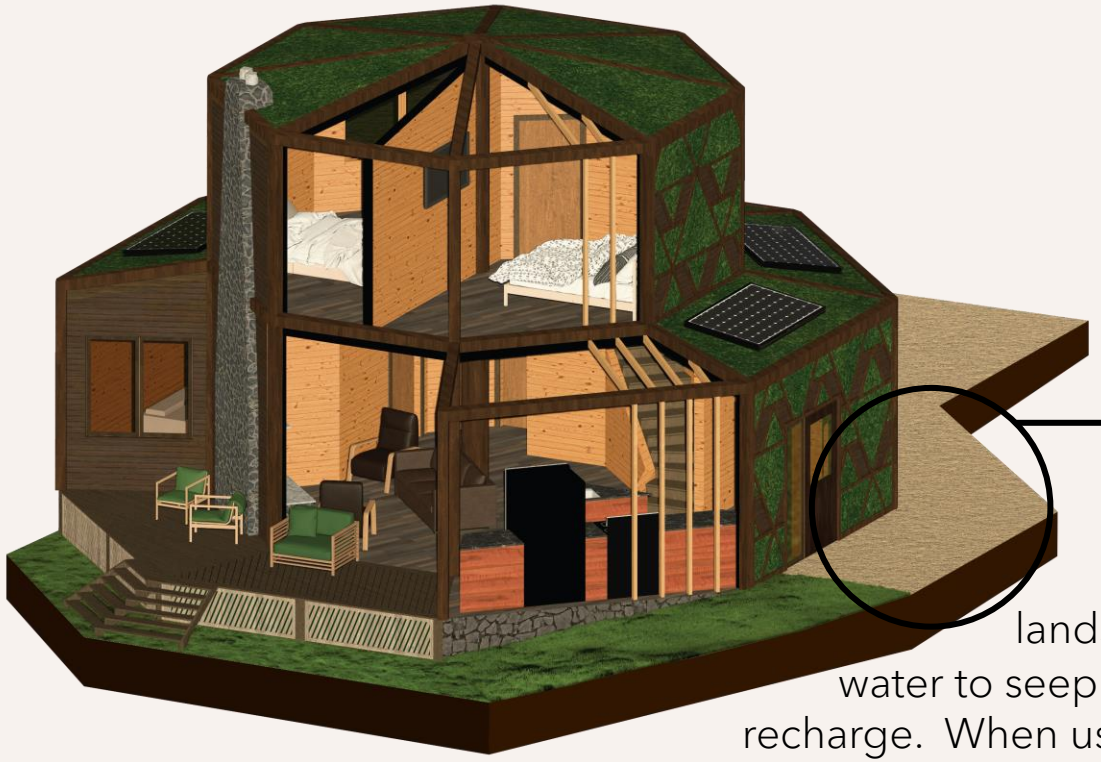

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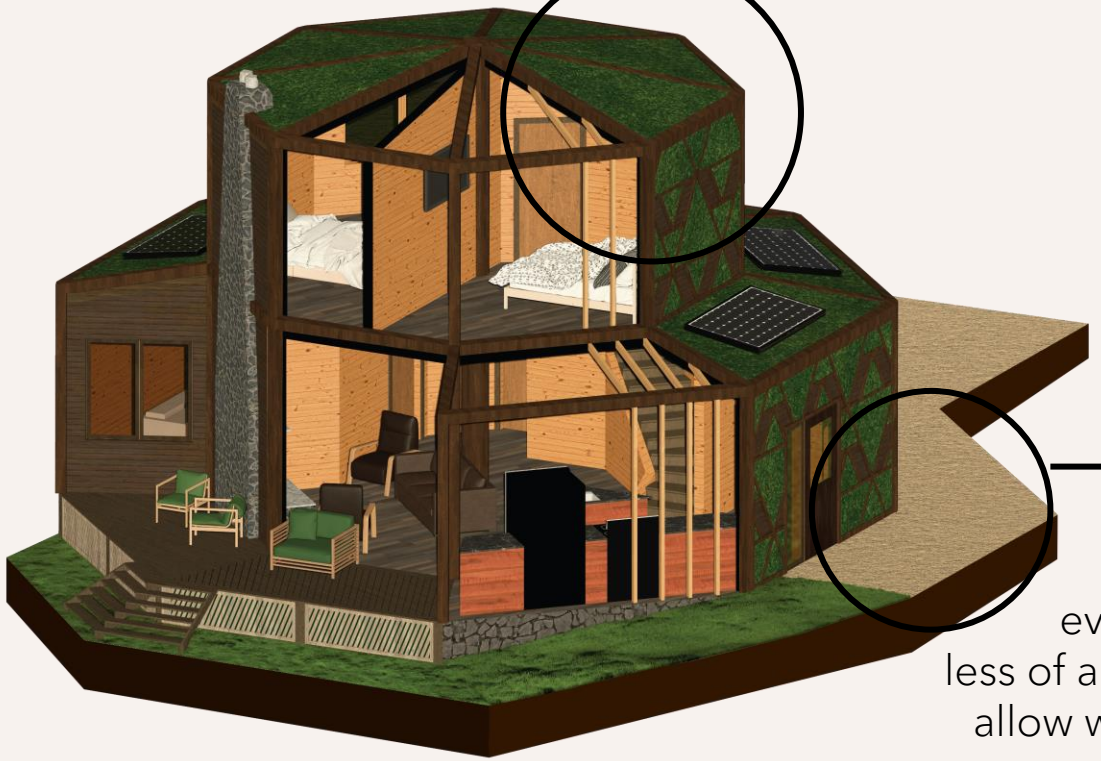
Sustainable Design Strategies: Heat Island Effect



Green Roofs:

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.

Pervious Pavements:

Often, pavement is designed to funnel the water away from it , 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).

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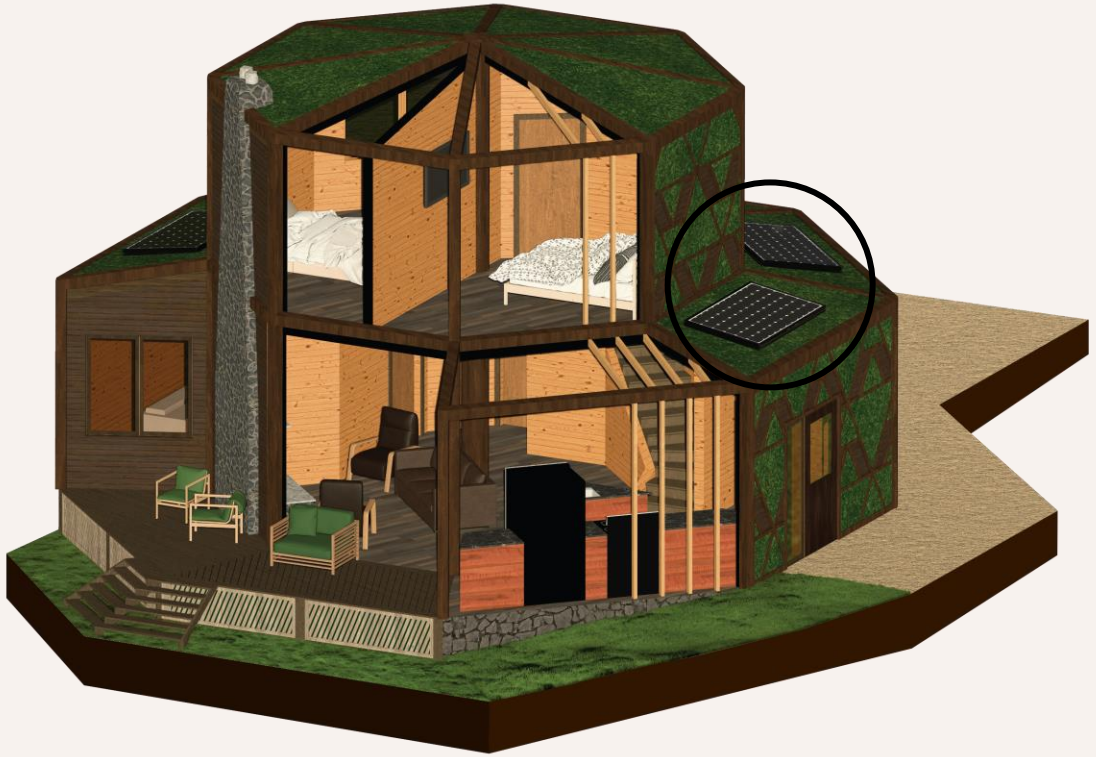

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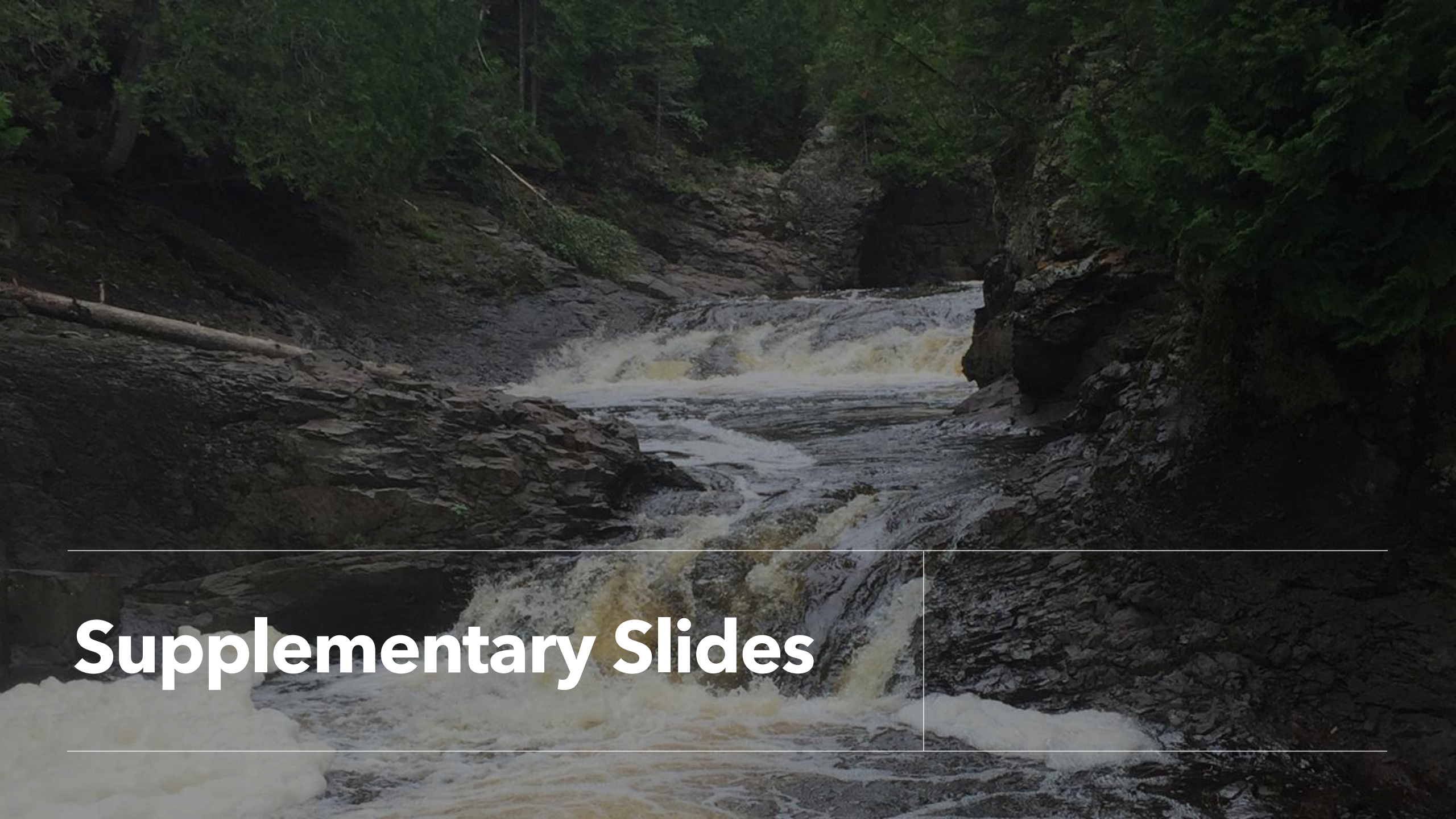
(Nabokov & Easton, *Native American Architecture*, Oxford University Press, pg. 71)

Anishinabe Lacrosse. Anishinabek Nation authorizes AB use of Thunderbird symbol (anishinabebaagaadowewin.org)

An Homage

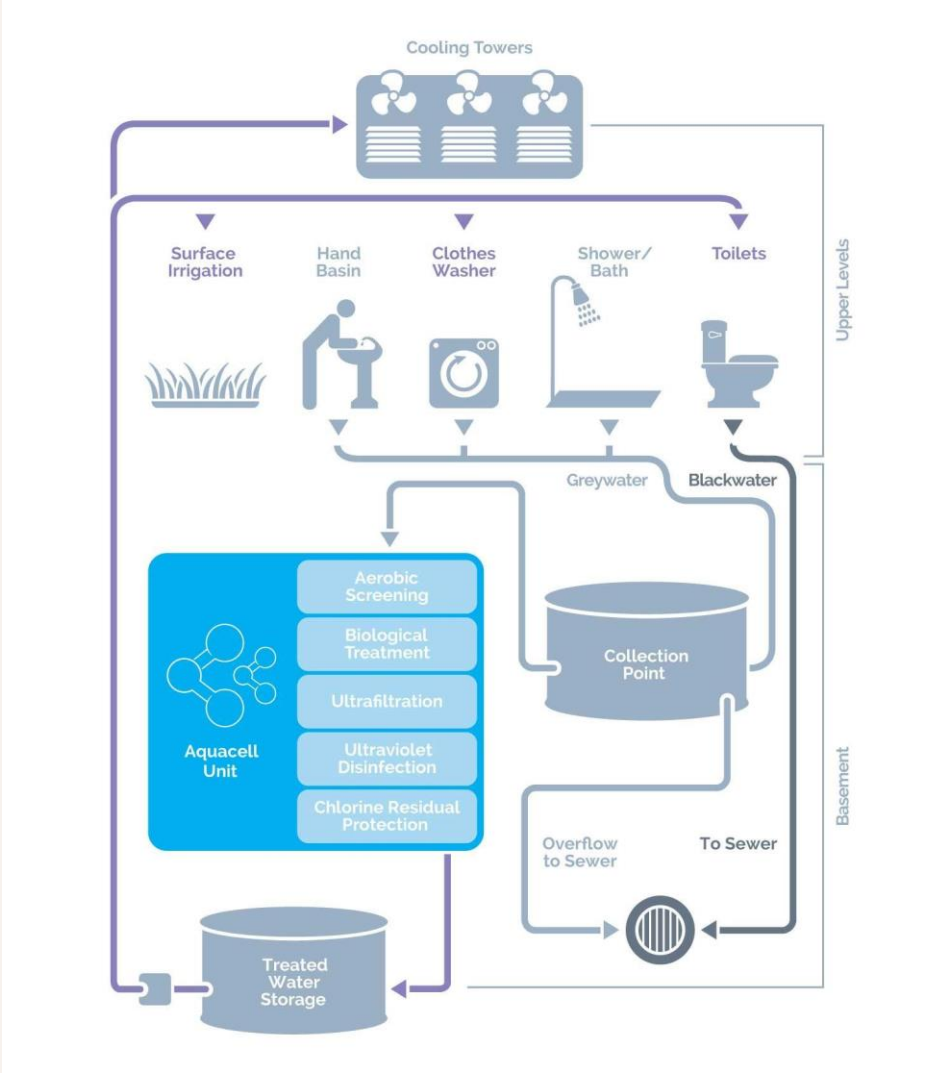
- The highland cabin design is inspired by Ojibwe architecture, who historically inhabited the land for hundreds of years. The geometrical cladding seen enveloping the building is inspired by the Ojibwe symbol for the thunderbird.

Thank You

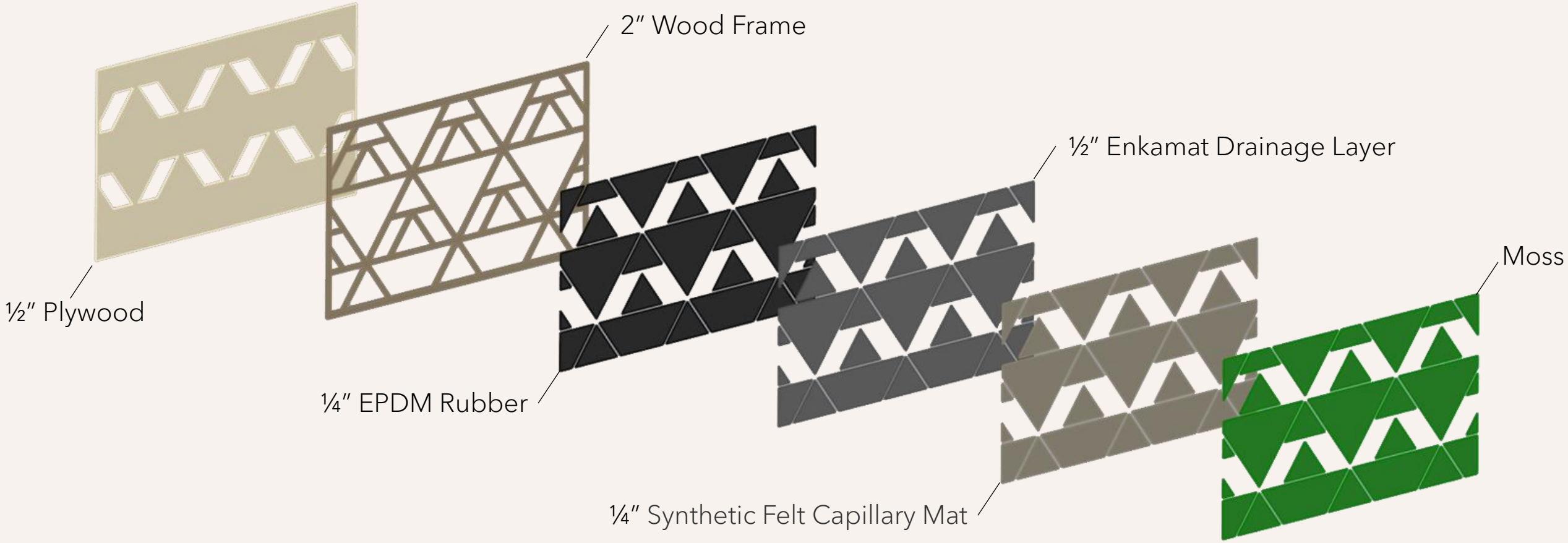


Supplementary Slides

Greywater Catchment Diagram



aquacell water recycling. Back to Basics – (aquacell.com)



Moss Structure Diagram

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