

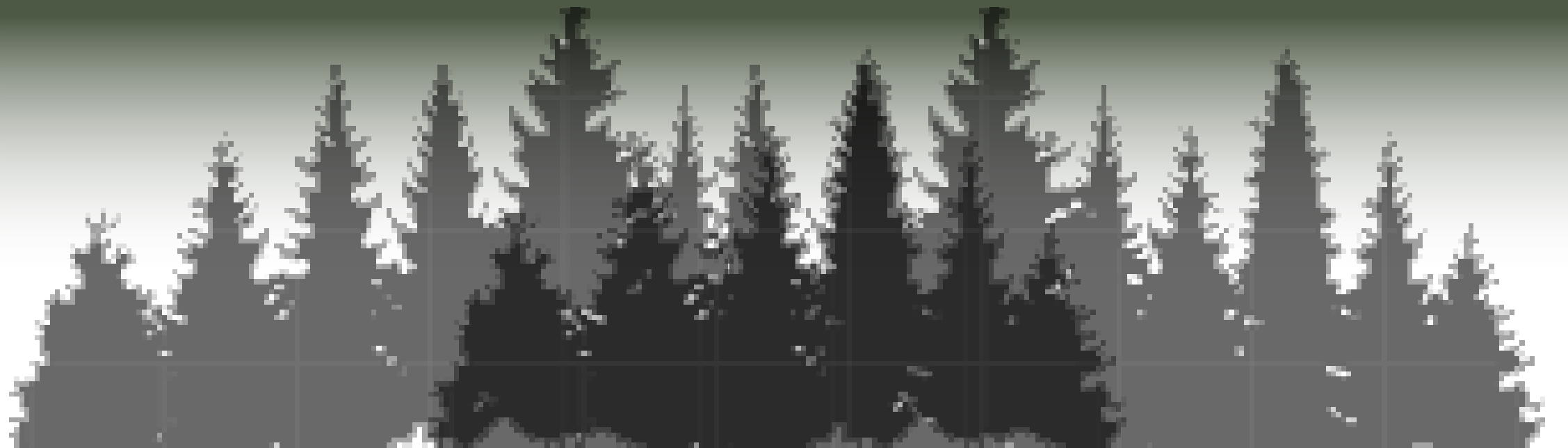


# THE RECONNECTION OF NATURE AND HEALTH



# Introduction

How does implementing biophilia in Architecture improve well-being and reconnection to nature?

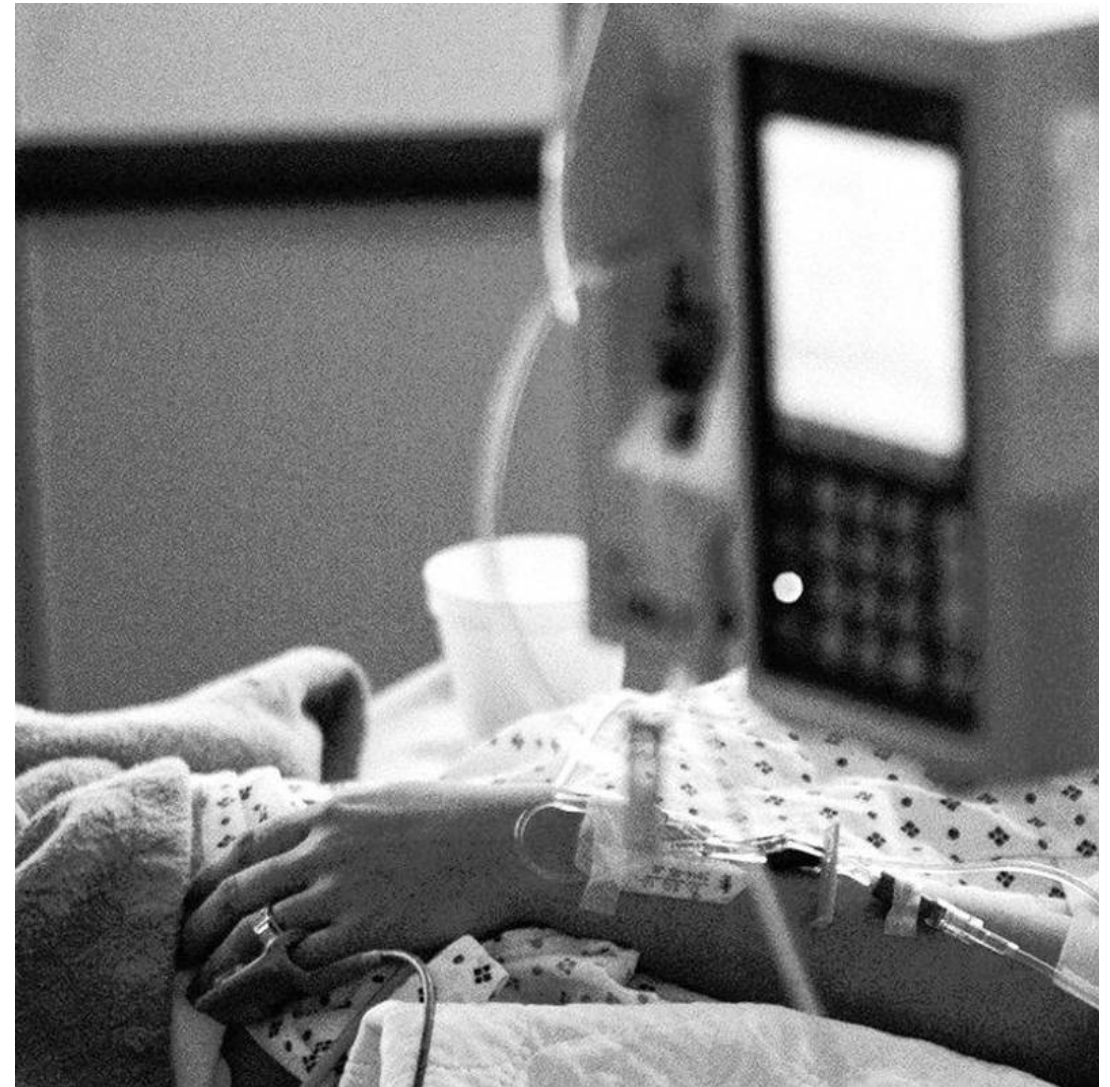


# Preliminary Research

# Typology

## ***Institutional: Medical Facilities***

Critical Access Hospital and Clinic  
Nursing Home  
Senior Assisted Living



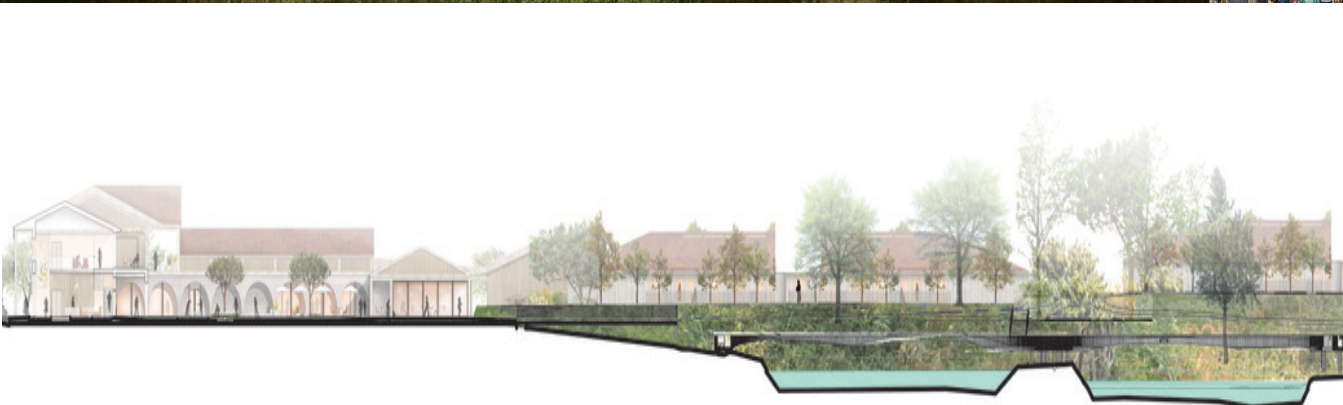


The General Hospital of Sparta



LMU University Hospital Campus Grosshadern

"The idea is to create a hospital immersed in nature, fostering a peaceful and calming environment—not only for patients and their relatives, but also for doctors, nurses, and the rest of the staff. Nature plays a therapeutic role in this project."



NYT Hospital Nordsiaelland



Alzheimers Village



# The 14 Patterns of Biophilic Design

## What is Biophilia?

### ***DEFINITION***

Biophilia is a term coined by the Harvard naturalist Dr. Edward O. Wilson to describe what he saw as humanity's "innate tendency to focus on life and life like processes."

## ***Nature in the Space***

1. Visual Connection with Nature
  - A view to elements of nature, living systems and natural processes
2. Non-visual Connection with Nature
  - Auditory, haptic, olfactory or gustatory stimuli that engender a deliberate and positive reference to nature
3. Non-Rhythmic Sensory Stimuli
  - Stochastic and ephemeral connections with nature that may be analyzed statistically
4. Thermal & Airflow Variability
  - Subtle changes in air temperature, humidity, air flow that mimic natural environments
5. Presence of Water
  - Enhance the experience of a place through seeing, hearing or touching water
6. Dynamic & Diffuse Light
  - Intensities of light and shadows that change over time to create conditions that occur in nature
7. Connection with Natural Systems
  - Awareness of natural processes, especially seasonal and temporal changes characteristics of healthy ecosystem

## ***Natural Analogies***

8. Biomorphic Forms and Patterns
  - Symbolic references that persist in nature
9. Material Connection with Nature
  - Materials and elements from nature that reflect the local ecology or geology and create a distinct sense of place
10. Complexity and Order
  - Spacial hierarchy similar to those encountered in nature

## ***Nature of the Space***

11. Prospect
  - Unimpeded view over a distance for surveillance and planning
12. Refuge
  - A place to withdraw from environmental conditions or the main flow of activity
13. Mystery
  - Promise of more information, achieved through partially obscured views and other sensory devices that entice the individual to travel deeper into the environment
14. Risk/Peril
  - Identifiable threat coupled with a reliable safeguard



01

*BIOPHILIA*

02

*CIRCULATION*

Project Emphasis

03

*SPACE*

04

*SECURITY*

## 5 Major Project Spaces

Emergency  
Department

Clinic

Cancer Center

Imaging  
Department

Nursing Home  
and Assisted  
Living Pods

-Sustainable  
Systems

-Regenerative  
Materials

-Outdoor  
Walkability and  
Parks

-Sustainable  
Systems

-Indoor  
Planters

-Regenerative  
Materials

-Outdoor  
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Materials

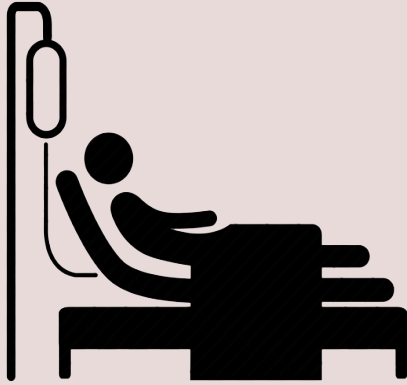
-Sustainable  
Systems

-Regenerative  
Materials

-New  
Technology  
for pods

-Outdoor  
Walkability and  
Parks

## THE PATIENT



## THE STAFF



## THE VISITOR

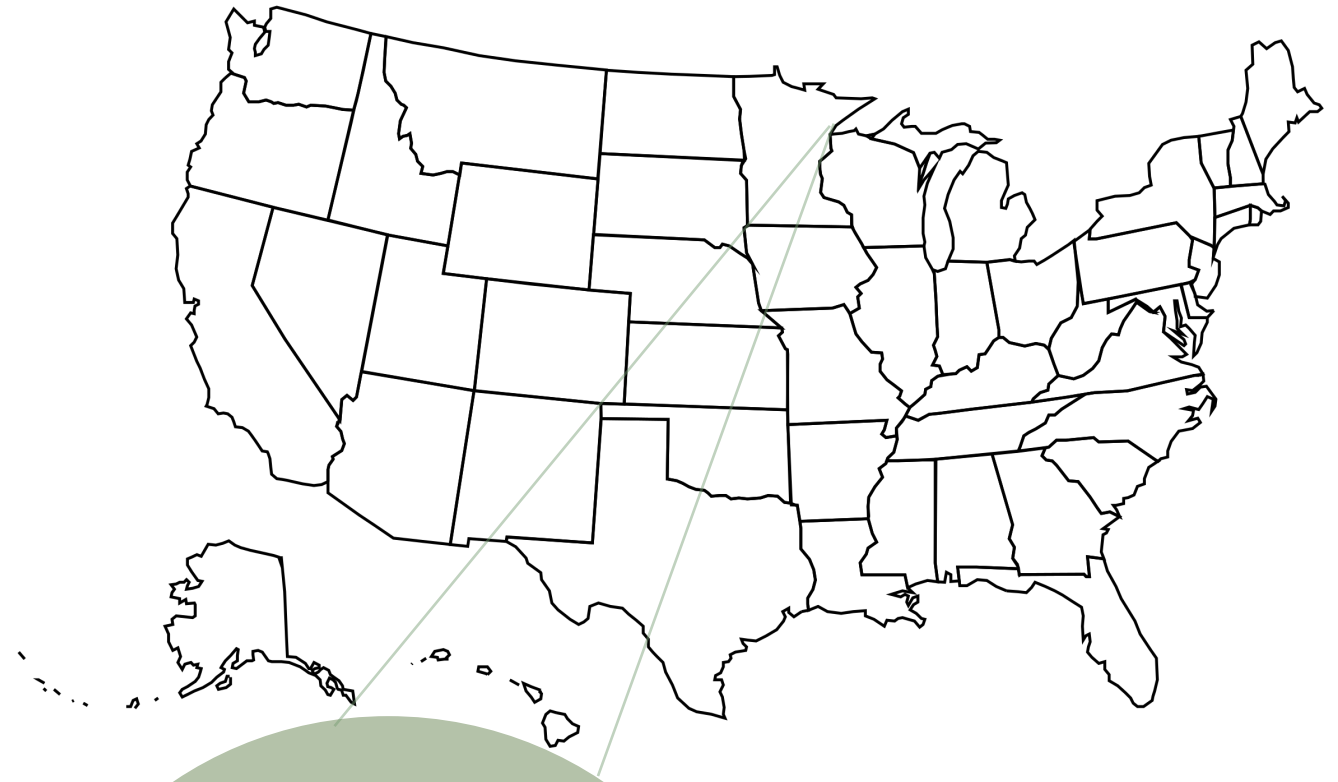


## THE PROFESSIONALS

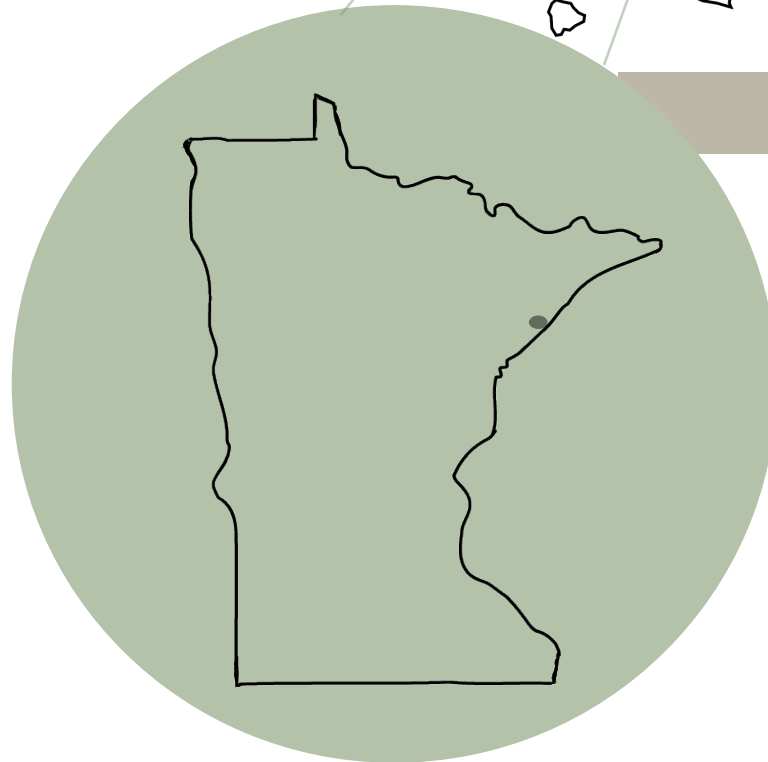


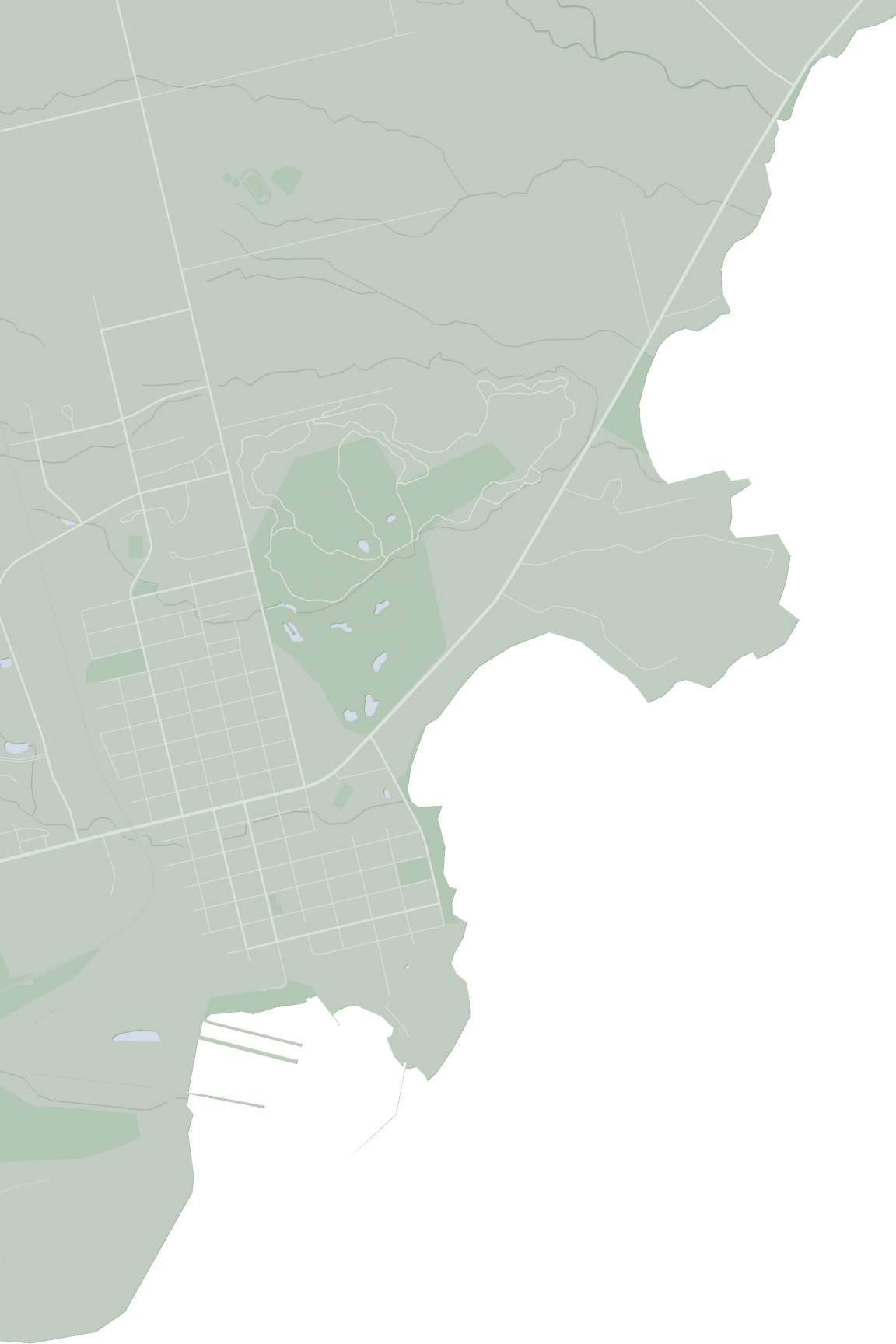
# The User

There is a wide variety of users that can and will use a healthcare facility. In general, there are four main groups that will be using the buildings and who are in mind as we design for them.



# SITE CONTEXT





## LOCATION: TWO HARBORS, MINNESOTA

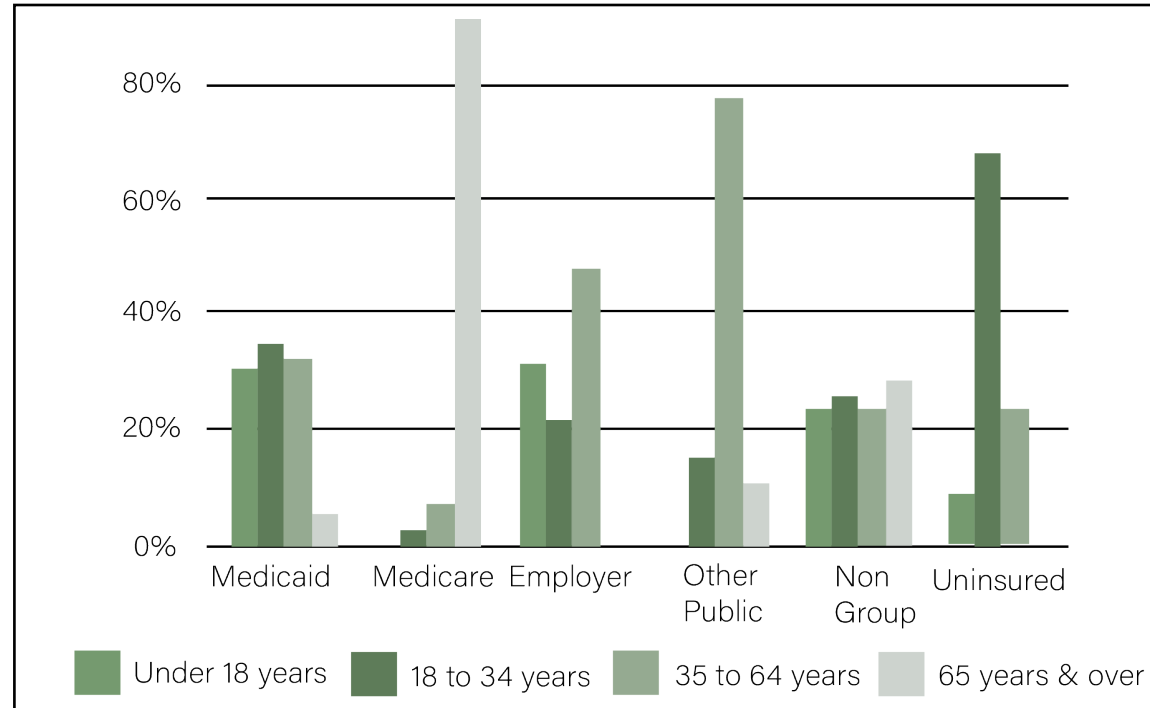
Two Harbors is just a little over 30 minutes from Duluth, Minnesota. A small town of 3,500 people that sits on the shore of Lake Superior. The rural city is located in the Northeastern part of Minnesota and is one of the few areas that captures the beauty of Minnesota's nature.



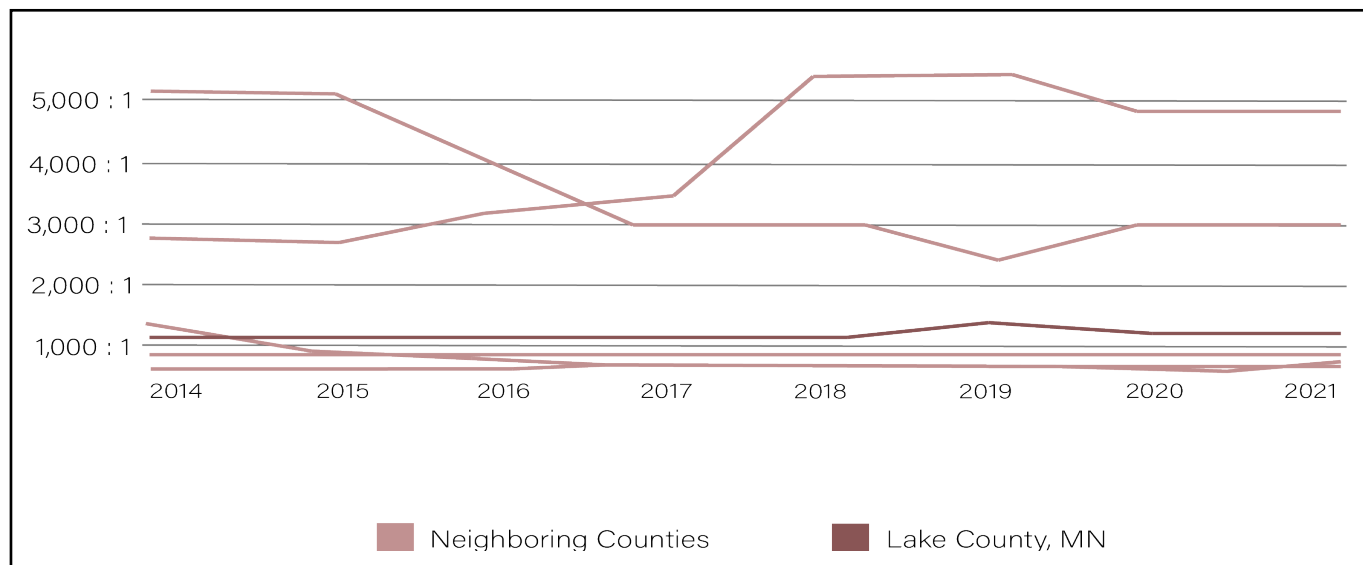
Concept that brings in the natural aspects of the site into the built forms that are being proposed. This is a larger site outside of the city limits surrounded by a denser forest and views onto Lake Superior. With the city of Duluth being a short commute away, the Two Harbors location will serve as a hub for the communities that do not have access to a healthcare facility. This site is accessible but also in a spot where biophillic design can be a prominent element.

# HEALTHCARE DEMOGRAPHICS

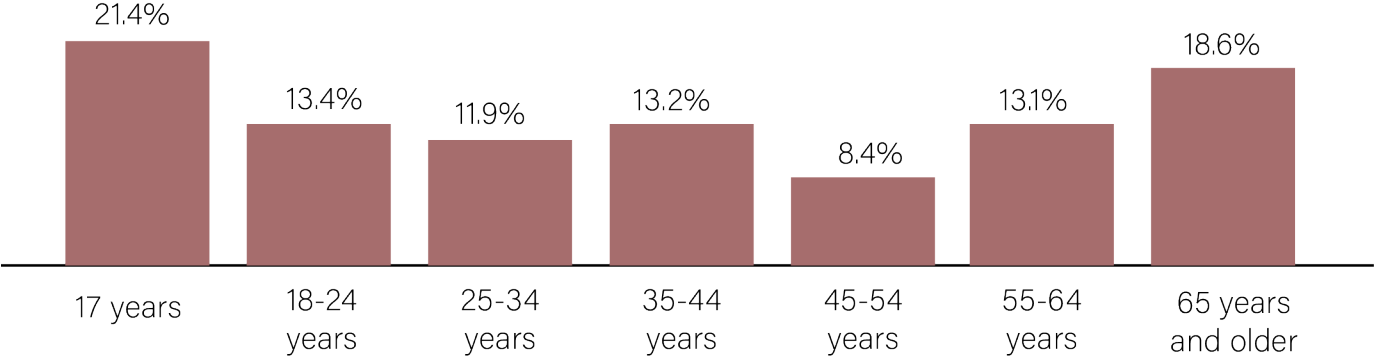
HEALTHCARE COVERAGE



PATIENT TO CLINICIAN RATIO



## POPULATION BY AGE GROUP



Two Harbors MN is a slowly decreasing city, with a small but steady growth rate.

### HEALTHCARE & SOCIAL ASSISTANCE

PEOPLE IN THE WORKFORCE:



WORKFORCE GROWTH:



MEDIAN EARNINGS:



MEDIAN EARNINGS GROWTH:

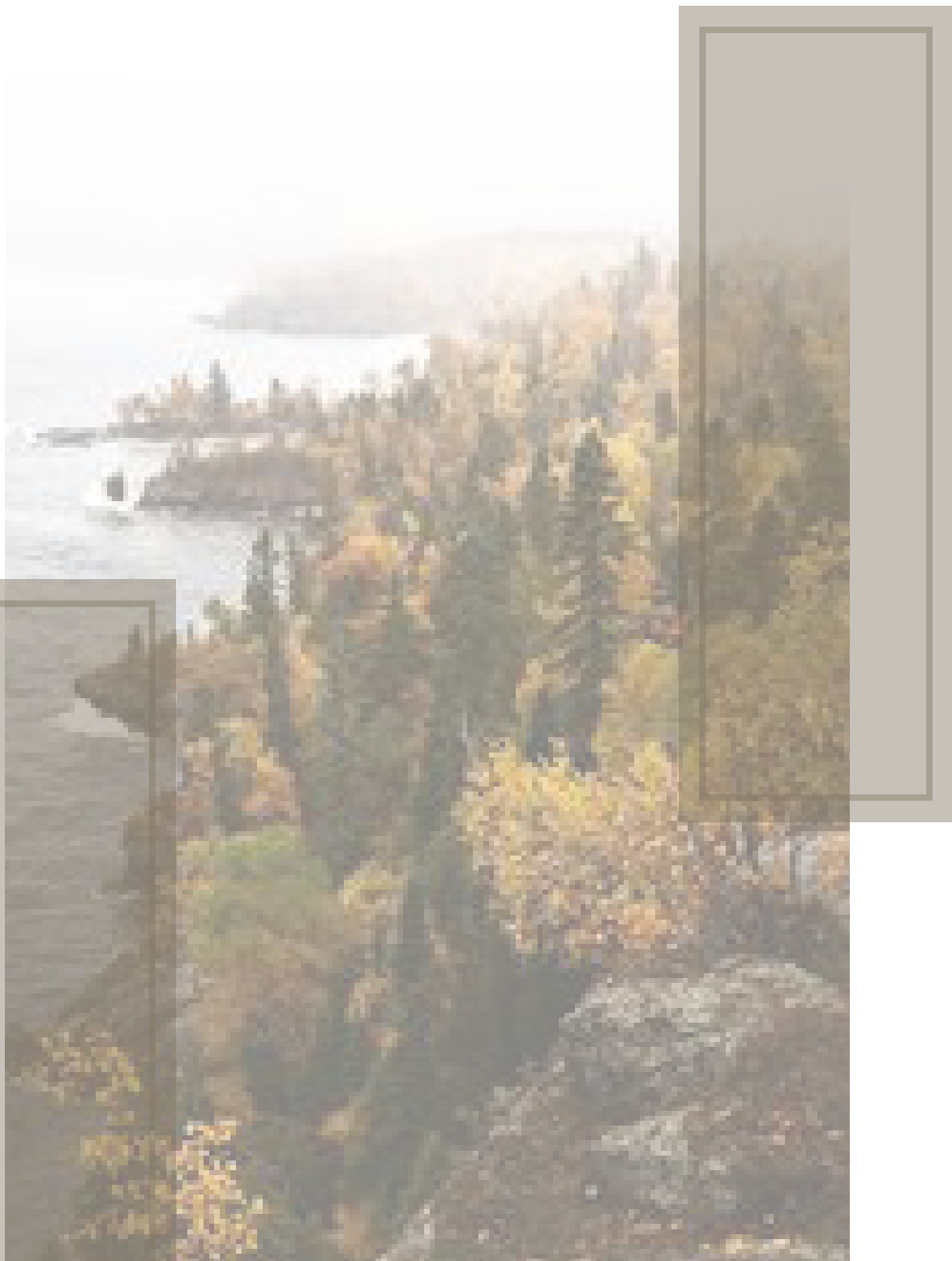


## OCCUPATIONS

HEALTHCARE SUPPORT OCCUPATIONS	HEALTH DIAGNOSING & TREATING PRACTITIONERS & OTHER TECHNICAL OCCUPATIONS	HEALTH TECHNOLOGISTS & TECHNICIANS
PEOPLE IN THE WORKFORCE: 114	PEOPLE IN THE WORKFORCE: 62	PEOPLE IN THE WORKFORCE: 43
WORKFORCE GROWTH: 46.2%	WORKFORCE GROWTH: 0%	WORKFORCE GROWTH: -6.52%
MEDIAN EARNINGS: \$25,313	MEDIAN EARNINGS: \$61,719	MEDIAN EARNINGS: \$51,875
MEDIAN EARNINGS GROWTH: 9.72%	MEDIAN EARNINGS GROWTH: 0.144%	MEDIAN EARNINGS GROWTH: -2.29%



# Design Exploration

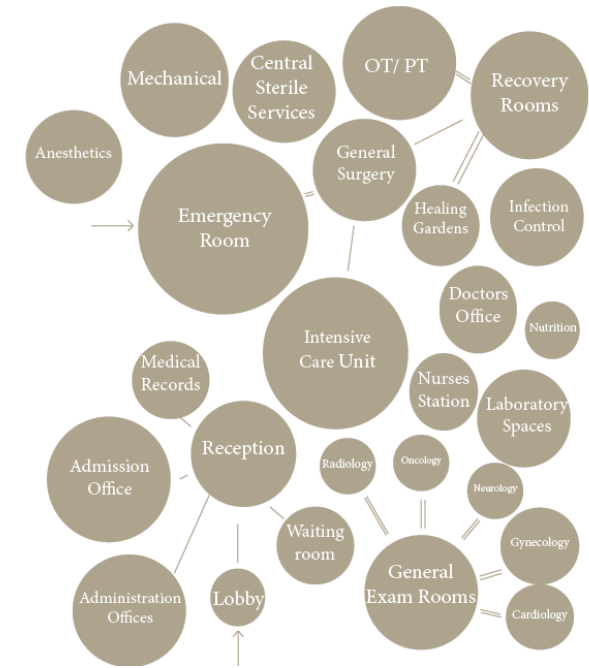


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Performance Criteria

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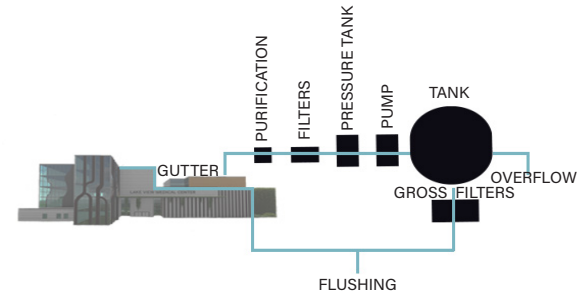
# 1 SPACE ALLOCATION



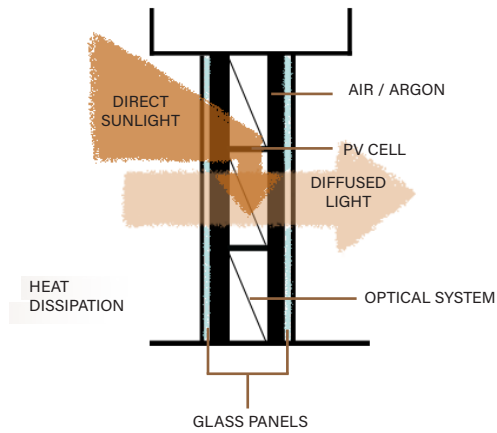
# 2 PSYCHOLOGICAL IMPACT

### 3 ENVIRONMENTAL IMPACT

RAINWATER HARVESTING SYSTEM

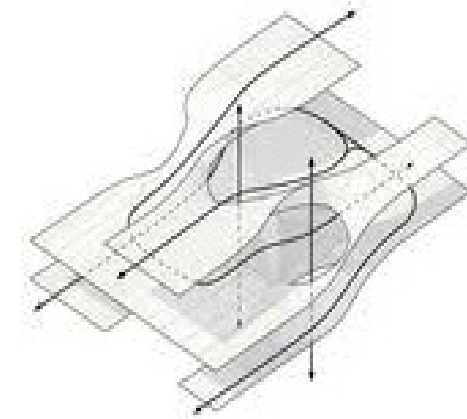


PHOTOVOLTAIC WINDOW SYSTEM



### 4 ENERGY CONSUMPTION

### 5 BEHAVIORAL PERFORMANCE



# What is a Critical Access Hospital?

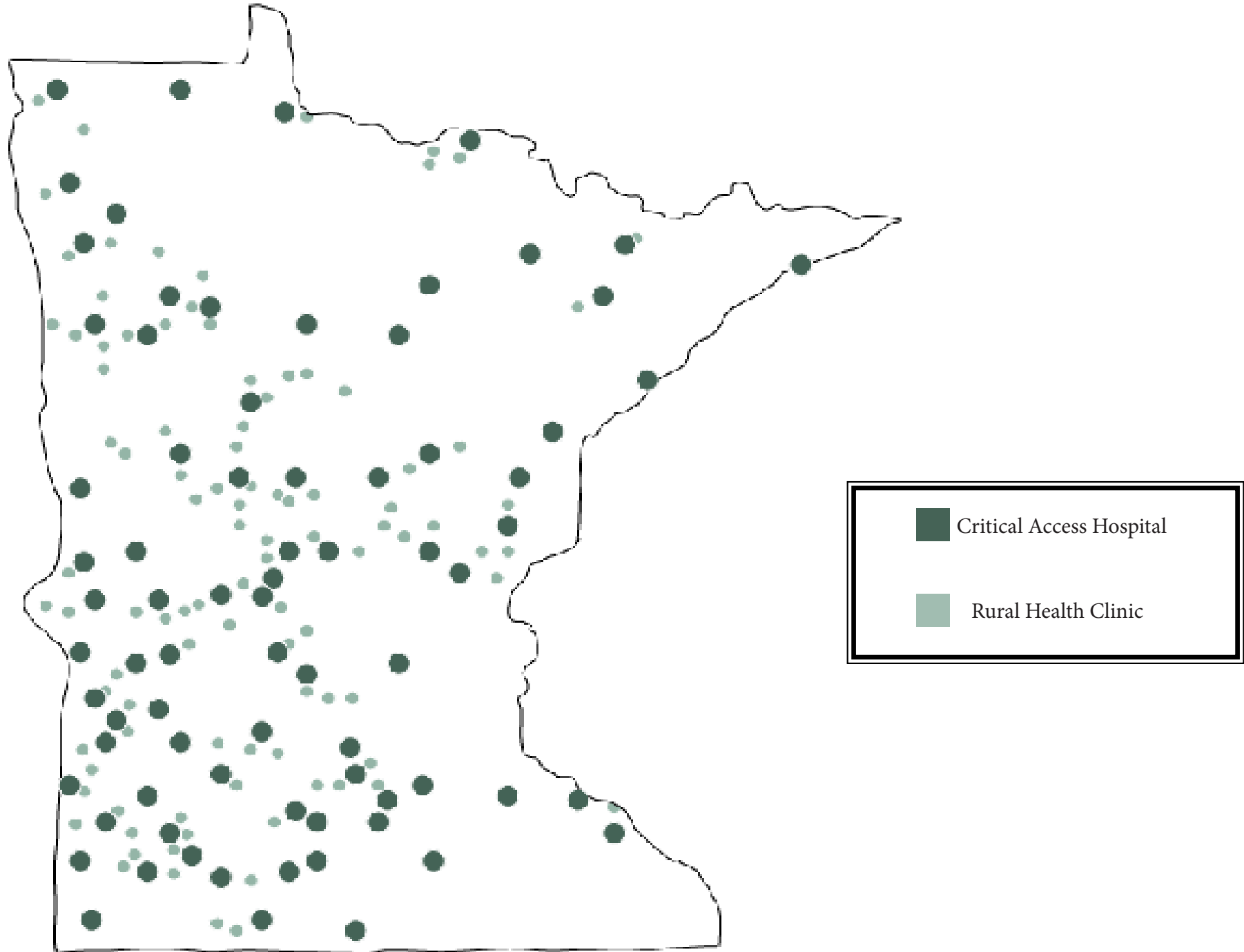
## **DEFINITION**

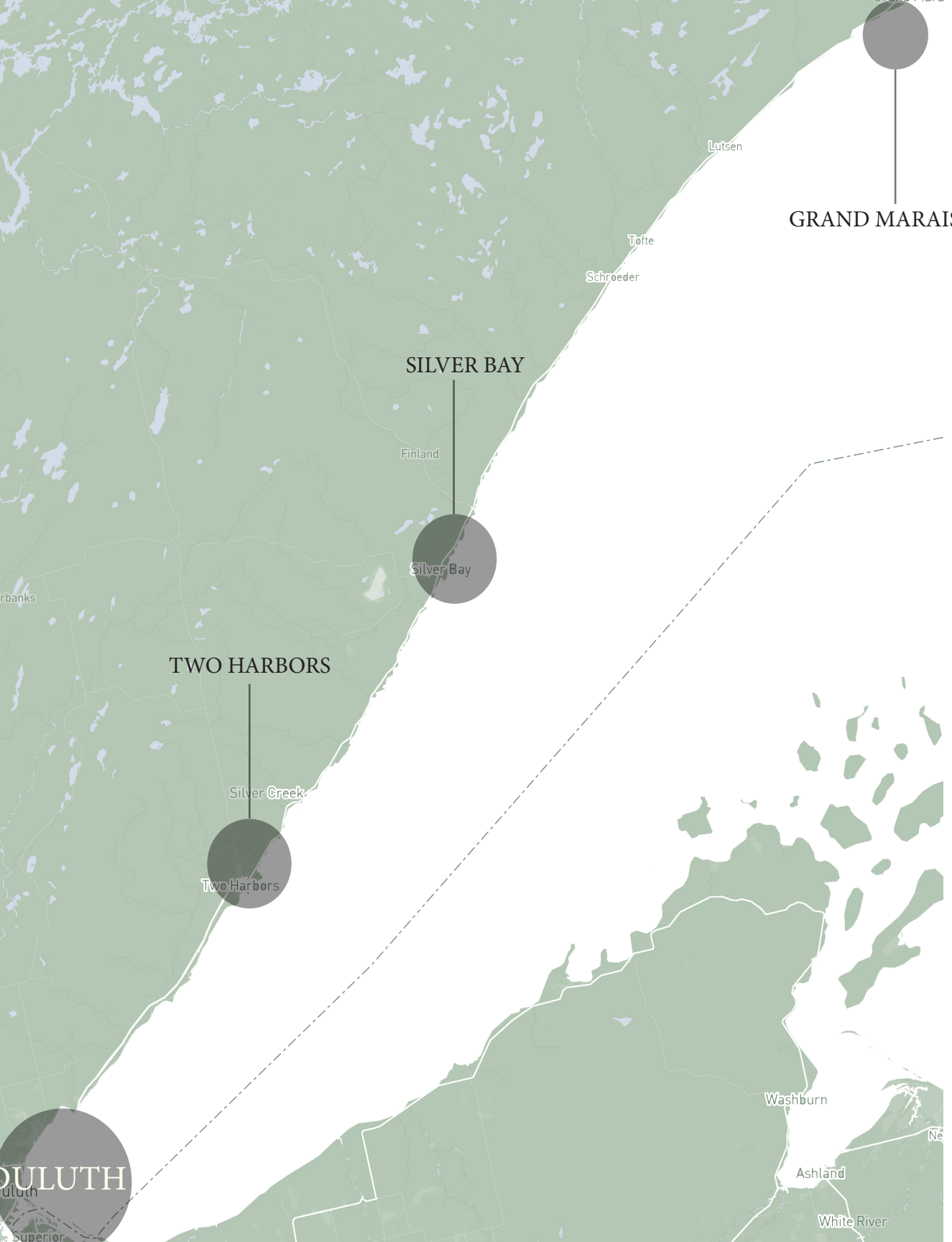
Designation given to eligible rural hospitals designed to reduce the financial vulnerability of rural hospitals & improve access to healthcare by keeping essential services in rural communities

***Total of 77 critical access hospitals across Minnesota***



# Rural Healthcare Facilities in Minnesota

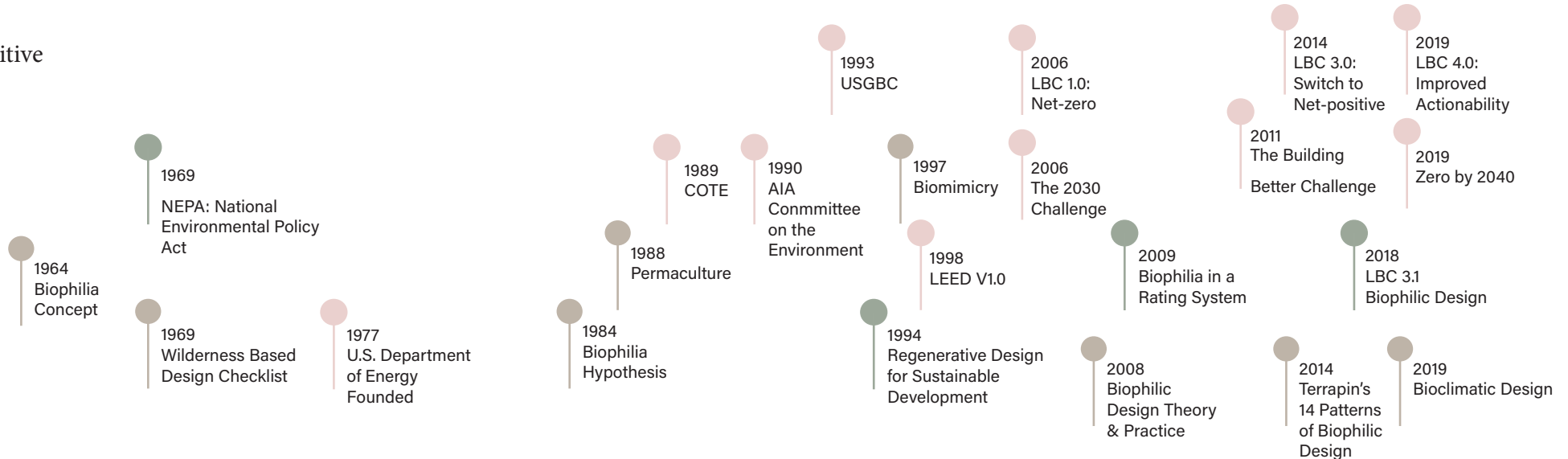




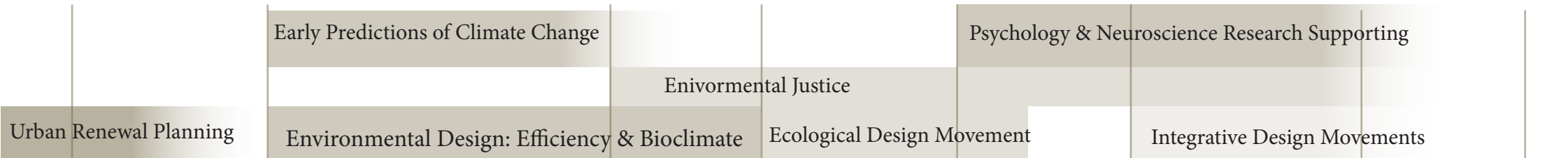
As seen on this map of the North Shore there are a select few critical access hospitals that serve the more rural parts of Northern Minnesota. Two Harbors being the last link to the major trauma centers like the one in Duluth, MN. Each playing an important part of bringing accessible healthcare to areas that are more remote. This map shows how spaced out the different locations are and how they are serving a wider range of communities.

# Timeline: Biophilic & Net-Positive Design History

- Biophilia
- Intersections
- Net-positive



1960                      1970                      1980                      1990                      2000                      2010                      2020                      2030



1963 U.S. Clean Air Act      1973 CFC's speculated linked to Global Warming      1979 World Climate Conference      1988 Intergovernmental Panel on Climate Change Founded      2013 President Obama's Climate Action Plan      2015 Paris Climate Conference



# Research Overview

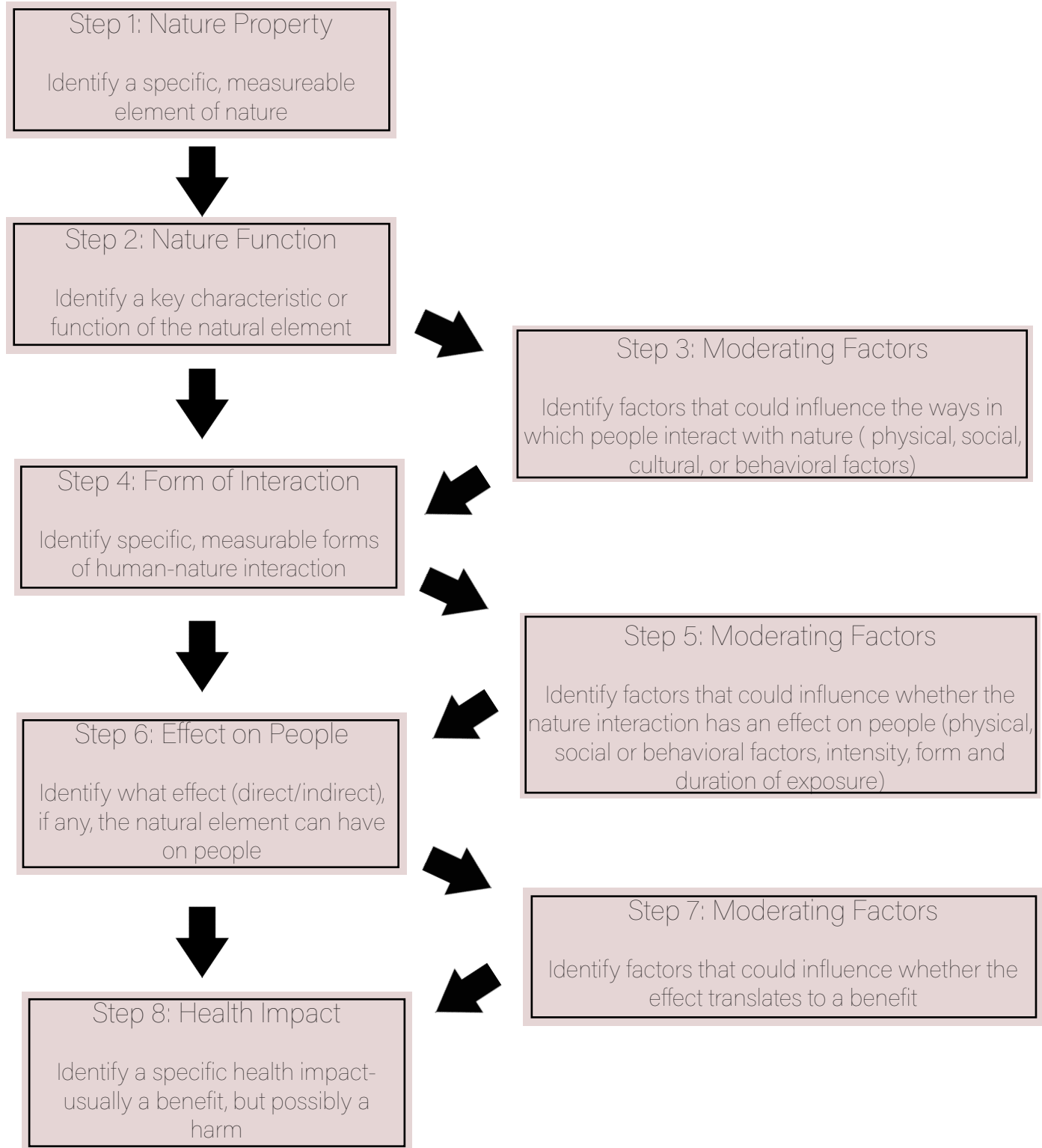
As humans we are and have been increasingly disconnected from nature. With the coming of new generations there is an increase of time spent indoors with screen times specifically steadily increasing. In many ways we, as human beings, have evolved from nature. There are many forms of nature varying by spatial, scale, proximity, the sensory pathway in which nature is experienced.

01 Psychological Pathways

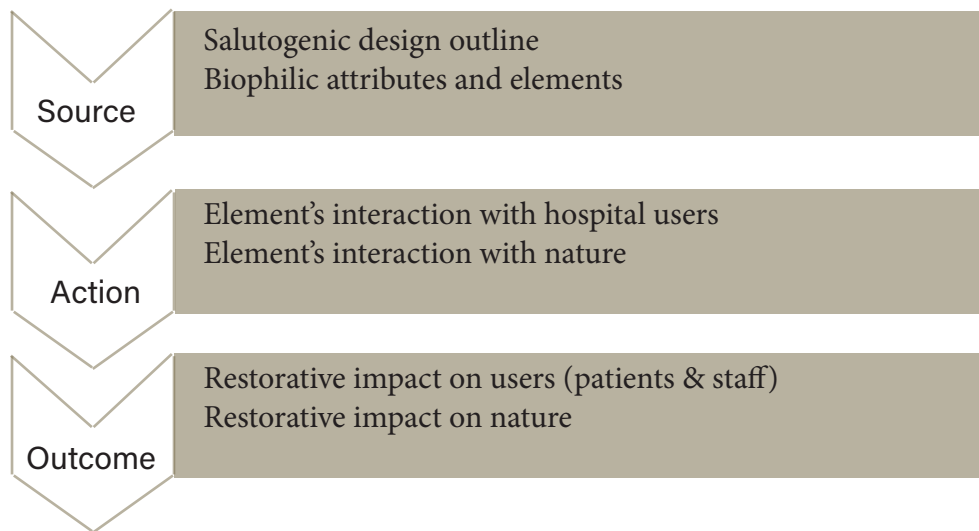
02 Enhanced Immune Function

03 Increased Physical Activity

04 Improved Air Quality



There is a constant need for developing designs that are going to improve hospital design to restore patients. These restorative environments will reconnect humans with nature. There is plenty of speculation to why today's industrialized hospitals are failing. This is the turning point to go back to restorative environmental design. Healthcare is moving in the direction of being a positive influence on patient's physical, mental, emotional and social health.



Primary health care is vital for linking knowledge and practice within healthcare as a whole. Nature is known to affect human health in different ways and the studies done on this topic reflect the changes in concepts of health. The concept of health is redefined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

PSYCHO  
EVOLUTIONARY  
AND RESTORATIVE  
PREFERENCES

NATURE  
BASED AND  
ENVIRONMENTAL  
PREFERENCES

### PRINCIPLES



natural



healthy



sustainable



### APPLICATIONS



decor



plants



light



air quality



colour palette



materials



sound



scent

Biophillic elements have benefits that are real and can be measured based off of productivity, emotional-wellbeing, stress reduction, learning, and healing.



# Design Implementation

***Lake View Medical Center***



# SITE SELECTION



Hospital

Assisted Living  
and Nursing Home  
Community



LAKE VIEW MEDICAL CENTER

# *REGENERATIVE MATERIALS*

*Copper*

A horizontal band showing a close-up, textured surface of copper, with a warm, golden-brown color and a slightly grainy, metallic appearance.

*Bamboo*

A horizontal band showing a close-up, textured surface of bamboo, with a vertical grain pattern and a mix of light and dark brown tones.

*Living Wall*

A horizontal band showing a close-up, textured surface of a living wall, with a dense, vibrant green color and a slightly grainy, organic appearance.

*Precast Concrete*

A horizontal band showing a close-up, textured surface of precast concrete, with a light gray color and a slightly grainy, industrial appearance.





LAKE VIEW MEDICAL CENTER



**FIRST FLOOR PLAN**



atrium

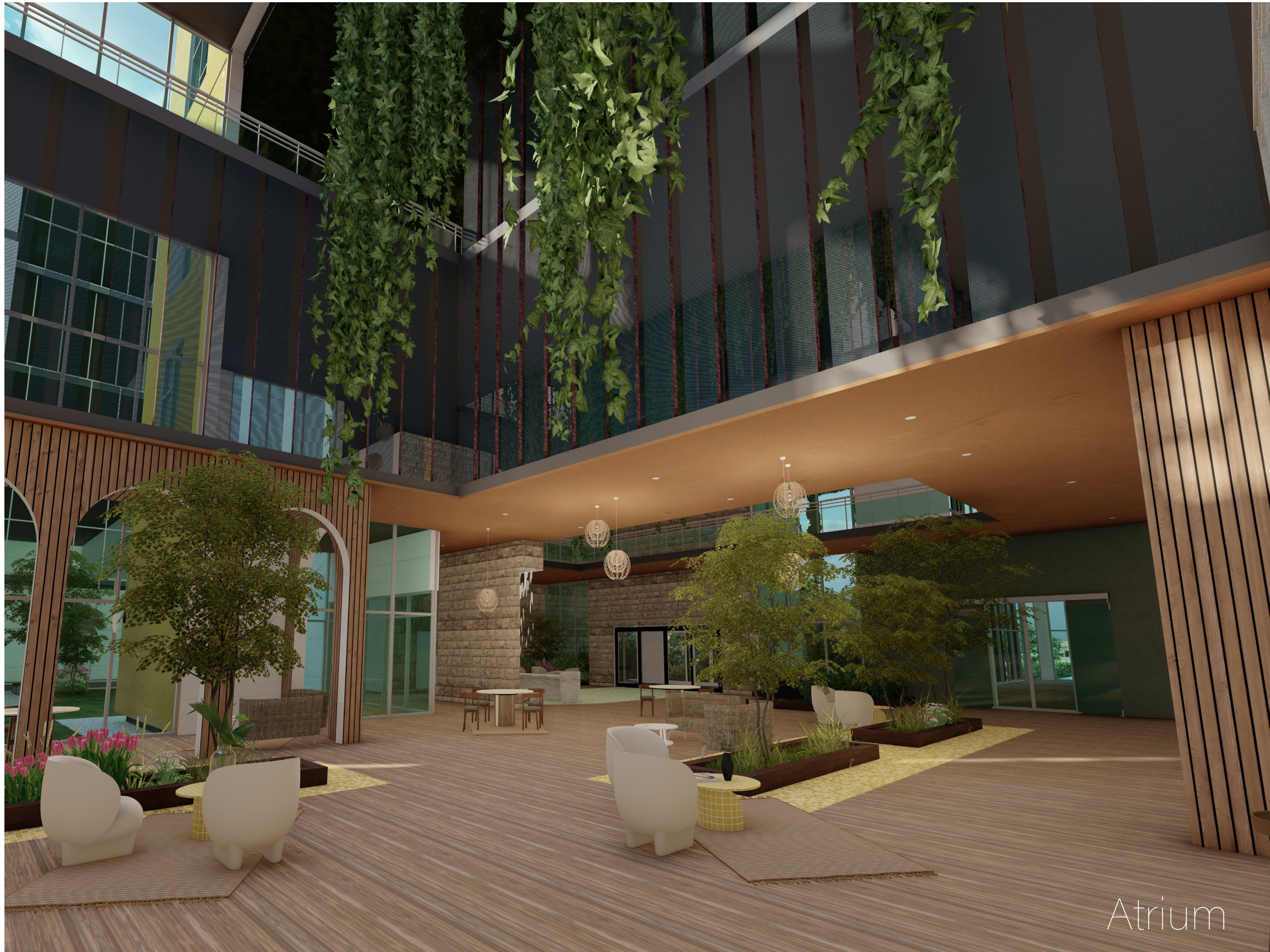
patient recovery room

cancer infusion center





Atrium



Atrium



Patient Recovery Room



Cancer Care Center

# Smart Care Pods

Care Pods offer a suite of 'smart' options to help care for elderly residents which include home automation of everyday tasks, vital monitoring, and the ability for the building to communicate status information and alerts both locally and to a remote destination.

Carer Inter Face allows for data retrieval and logging system allowing relatives or carers to access the occupants care history and share notes. Preparation for hoist systems, monitoring and specialised electrical and medical equipment.

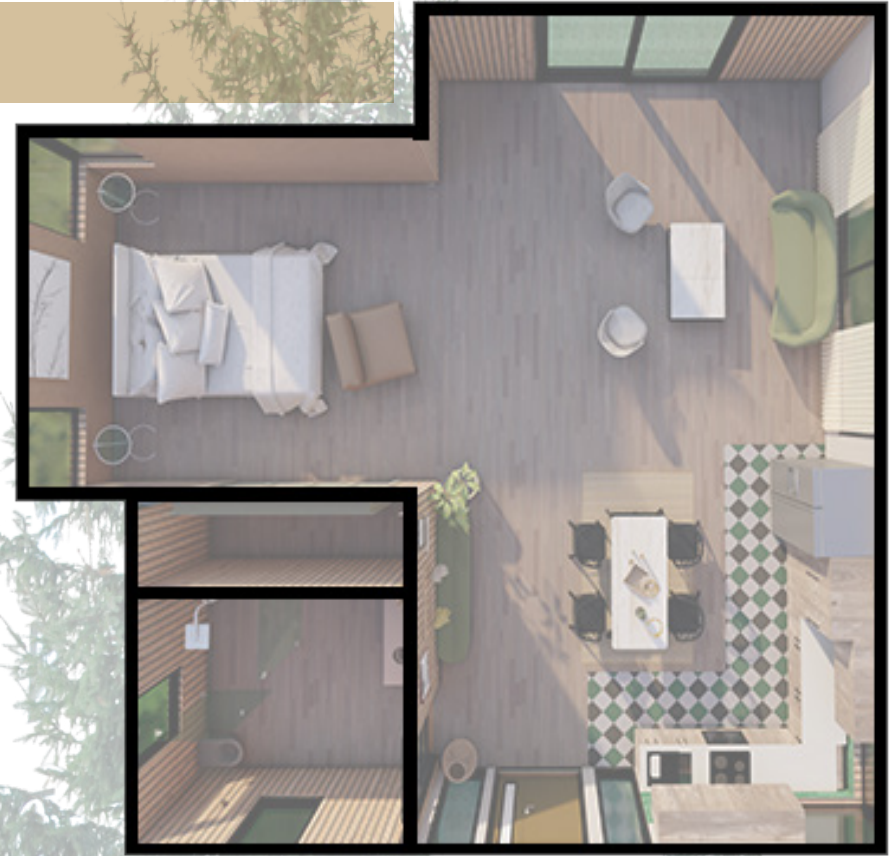




# Nursing Home

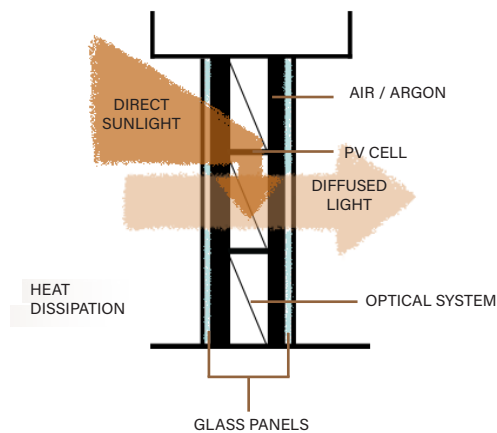


# Senior Assisted Living



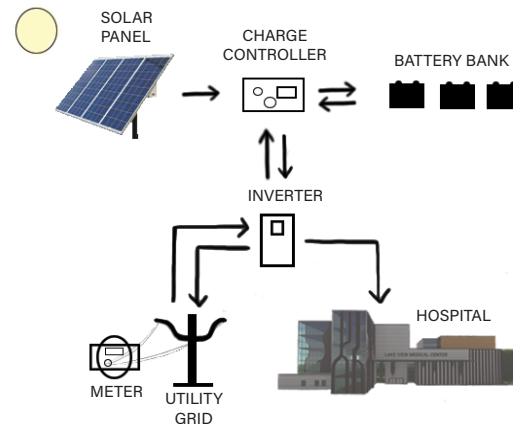
# Sustainable Systems

## PHOTOVOLTAIC WINDOW SYSTEM



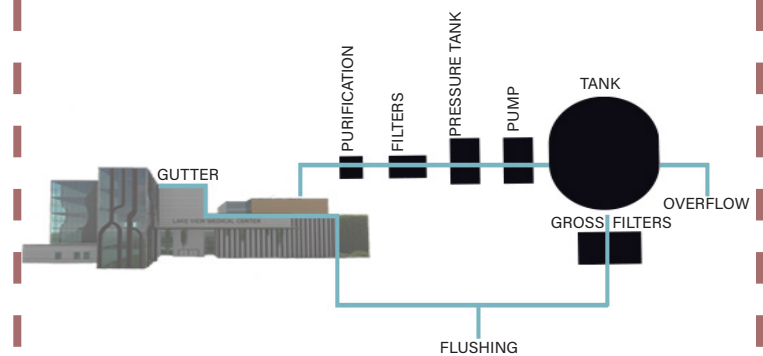
PV Glass generates free and clean electricity, turning buildings into vertical power generators. The glass allows natural light to pass through while providing thermal and sound insulation. The capacity to generate free clean electricity from the sun, it enables buildings to drastically improve their energy efficiency, decrease operation and maintenance costs, and reduce their carbon footprint.

## SOLAR POWER ENERGY

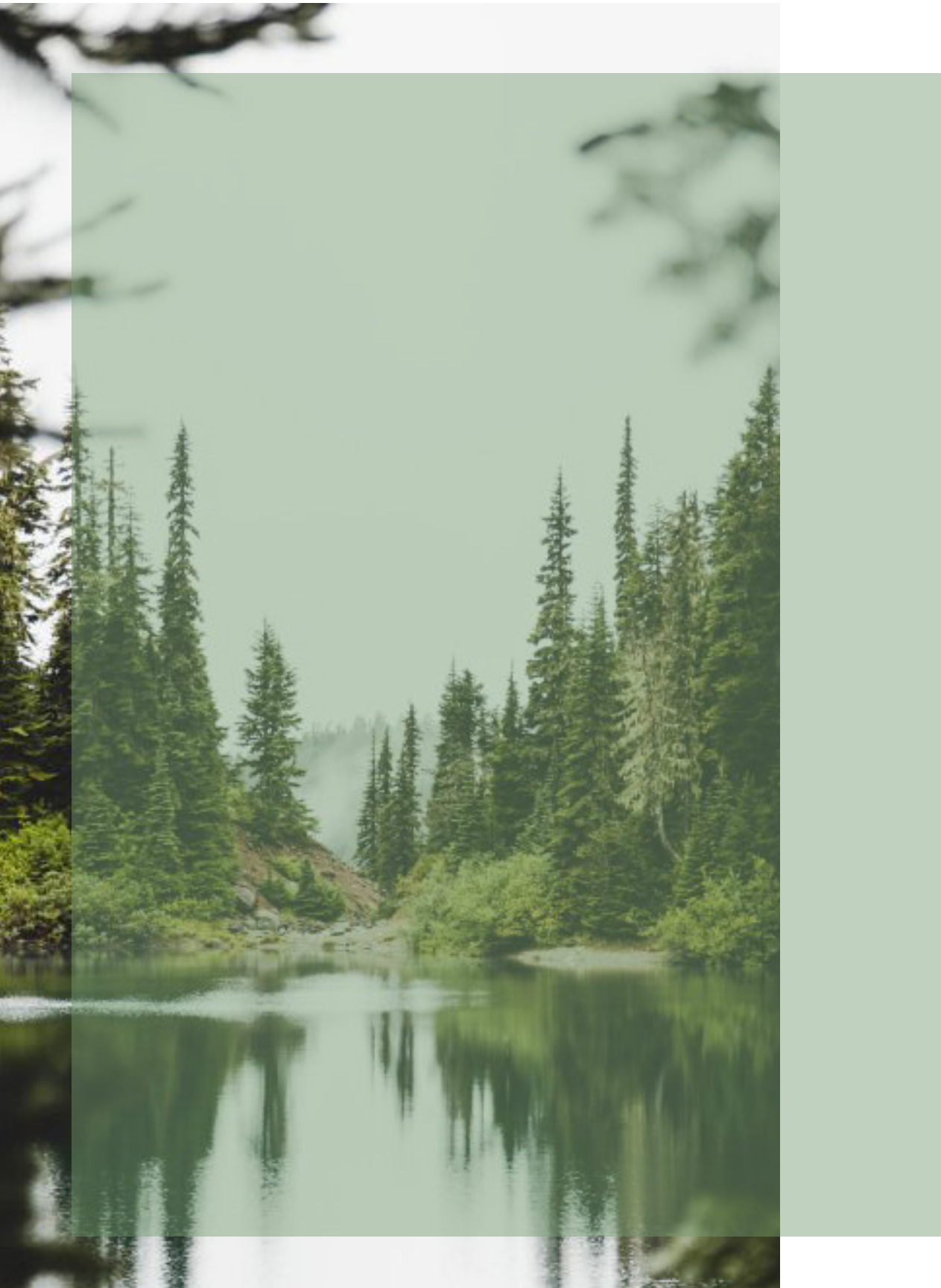


Hand in hand with photovoltaic window systems the solar panels work in the same way. This is more reliable on large scale projects and generate more back-up power or power outages that might happen. In relation to being on Lake Superior there is initiative to use hydro power to fuel electricity consistently from the movement of the lake.

## RAINWATER HARVESTING SYSTEM



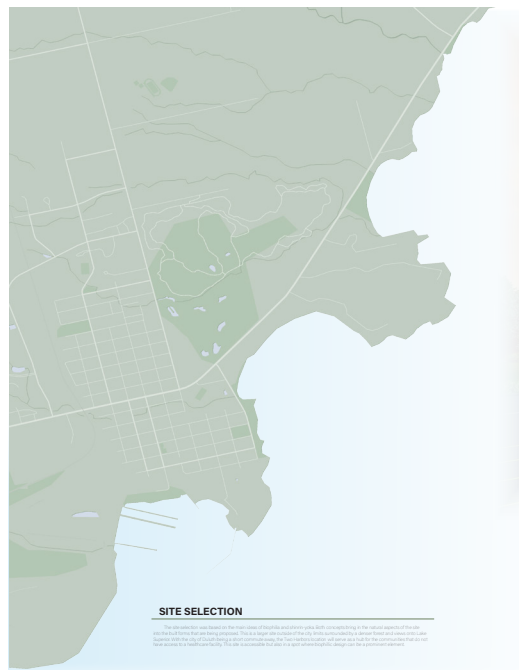
The function of rainwater harvesting cisterns provide an alternative water source to the facilities. It is not supplied as fresh water but as grey water for daily functions in the buildings. In the system shown above the rainwater is harvested from gutter systems, processed through filters and stored until it needs to be used.



Conclusion

# LAKE VIEW MEDICAL CENTER

The Reconnection of Nature and Health



### SITE SELECTION

The location of the site was chosen to be in a rural area, away from the urban centers of the state, to provide a critical access hospital to rural communities. The site is located in a rural area, away from the urban centers of the state, to provide a critical access hospital to rural communities.

### WHAT IS A CRITICAL ACCESS HOSPITAL?

Designation given to eligible rural hospitals designated to reduce the financial vulnerability of rural hospitals and improve access to healthcare by keeping essential services in rural communities.

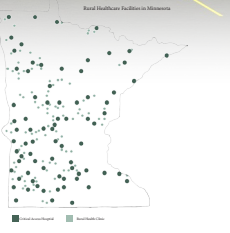
Almost half of the Minnesota's occupants live in rural areas. There is the possibility that there are going to be critical conditions and rural areas have difficulty accessing the types of care that are needed away from urban areas. There is a need for high-quality healthcare that is aligned with community needs. By providing training and the building foot print with all necessary components and promote sustainable improvement in the rural healthcare system. In the last 17 years of the 181 rural hospitals that have been shut down 64 were designated as critical access hospitals. This is because of a new federal budget from the state of Minnesota.

The critical access program was created in 1997 after many rural hospitals were closing alarmingly fast. This program was to make sure Americans in rural and isolated areas to still have access to healthcare. There is a loophole within the requirements that consider many hospitals critical access when they are not meeting the requirements. It means losing affordable healthcare that are check points on the way to big trauma centers, check points that are important to the well being of residents in Minnesota.

### WHAT IS BIOPHILIC DESIGN?

The idea of biophilia is a fairly new concept that was configured to describe how society seeks to connect to nature in a modern built environment. Our species has evolved based on the response to the natural world, not artificial forces that we have created in place of it. On a similar note, the idea of shinrin-yoku which is a form of ecotherapy that has been adapted by the Japanese. Forest bathing (shinrin-yoku) provides the science to support that time spent immersed in nature is good for us mentally, physically and has been now a form of preventative care. Embracing these green spaces can reduce unnecessary stress and immune functions.

The topic of healthcare is always going to be prominent in our society. With a forever aging society comes health problems and diseases that we cannot slow down. In a small rural town, there is a need for better healthcare facilities that also provide for the communities around that are not big enough to maintain it. Allowing spaces to be workable for staff and the equipment used to care for patients is necessary within the design. Making rooms of exceptional quality because for most this is the last place they will call home and nature takes its course. This is the chance to design a campus that usually has negative connotations and turn it into a positive and stress-free process. Incorporating the main focus of biophilic design is done to help connect people with nature to support with healing psychological and physical health and healing.



# Final Board Design

## REGENERATIVE MATERIALS

### Copper

One important aspect was the selection of materials. The topology of the project is based around healing and reconnecting people with their natural roots. As human beings we are broken and healed, in need of the support to be healed. We will not be in the condition we were in before but we are healed. The materials chosen resemble a similar process to healthcare and the healing process.

### Bamboo

Copper in a natural form is an essential element for the human body before and after. Copper in a natural form is an essential element for the human body before and after. Copper in a natural form is an essential element for the human body before and after. Copper in a natural form is an essential element for the human body before and after.

### Living Wall

Bamboo is a sustainable building material because it grows three times faster than other traditional lumber like pine. Bamboo also self-regenerates using its own roots to replant the grass after harvest. Nature in itself heals itself and using bamboo walls in the interior help preserve the biophilic elements that help those who are healing while creating better air quality in spaces.

### Precast Concrete

In the 21st century our cities face many challenges, including overheating, air pollution, surface flooding and lack of biodiversity. The effects of nature contribute to the goals of these smart construction. Filter out air pollutants that can cause respiratory issues and other discomfort, increased efficiency. Living walls bring in the elements of nature while giving off the beneficial effects.

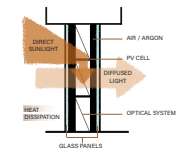
Most think any type of concrete would not be considered a regenerative material. With the use of carbonic anthracite, the same enzyme that transfers CO2 from cells into the blood stream. Whenever a tiny crack forms, the calcium carbonate fills it in. A millimeter scale crack can be filled within a day, preventing larger cracks from forming.



## SUSTAINABLE SYSTEMS

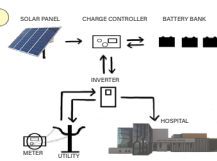
Healthcare systems are extremely expensive because of the twenty-four seven care that hospitals provide. The objectives of sustainability are to reduce the release of non-renewable resources, minimize waste and create healthy environments. Another element of using sustainable systems is lowering costs over the life time of the building.

### PHOTOVOLTAIC WINDOW SYSTEM



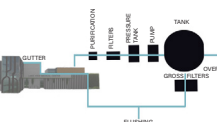
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### SOLAR POWER ENERGY



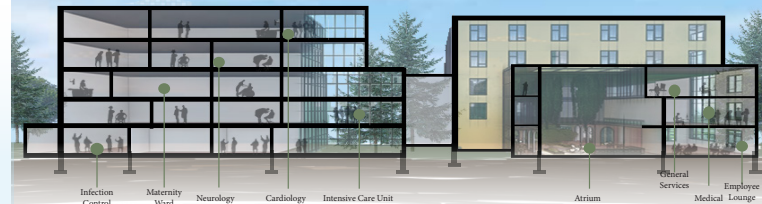
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# Questions?



### First Floor Key Plan

- Employee Lounge
- Imaging Department
- Physical Therapy Department
- Abum Common Area
- Cancer Infusion Care
- Clinic
- Emergency Department