



THE RECONNECTION OF NATURE AND HEALTH

THE RECONNECTION OF NATURE AND HEALTH

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

By

Kirsten Spaude

In Partial Fulfillment of the Requirements of the Degree of
Master of Architecture

Cindy Urness

(Primary Thesis Advisor)

Stephan Wischer

(Thesis Committee Chair)

May 2023
Fargo, North Dakota

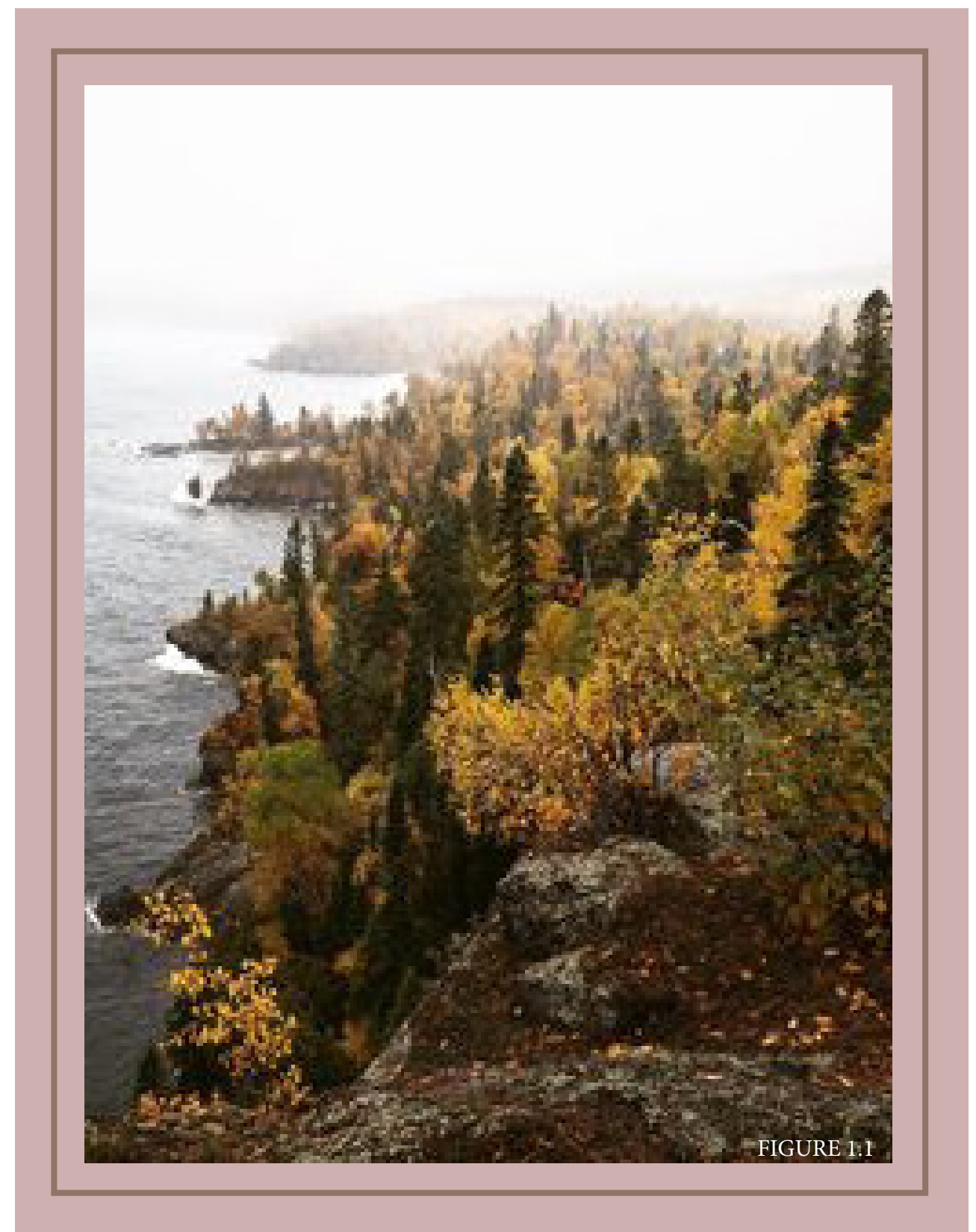


FIGURE 1.1

TABLE OF CONTENTS

01	TITLE
03	SIGNATURE PAGE
06	TABLE OF CONTENTS
08	FIGURES & TABLES
11	THESIS ABSTRACT
13	THESIS NARRATIVE
15	PROJECT TYPOLOGY
17	PRECEDENT STUDIES
18	WATERCREST NAPLES SENIOR LIVING CENTER
22	RENZO PIANO TRIO OF HOSPITALS FOR GREECE
25	LMU UNIVERSITY HOSPITAL CAMPUS GROSSHADERN
28	NYT HOSPITAL NORDSIAELLAND
31	ALZHEIMER'S VILLAGE
34	ZAAN MEDICAL CENTRE
37	JIAXANG KAIYI HOSPITAL
41	PROJECT JUSTIFICATION
42	PROJECT EMPHASIS
44	PROJECT ELEMENTS
46	USER/ CLIENT DESCRIPTION
48	SITE CONTEXT
51	SITE ANALYSIS
56	GOALS OF THESIS
59	PLAN OF PROCEEDING
60	DESIGN METHODOLOGY
61	PROCESS OF DESIGN DOCUMENTATION

62	PROJECT SCHEDULE
65	PERFORMANCE CRITERIA
66	PERFORMANCE CATEGORIES
68	SPACE MATRIX/ ALLOCATION TABLE
72	PROGRAM RELATIONSHIP DIAGRAM
74	EXPLORATION AND RESULTS
76	WHAT IS BIOPHILIA?
78	CRITICAL ACCESS HOSPITALS
86	LITERACY REVIEW
94	DESIGN IMPLEMENTATION
102	RENDERS
112	SMART CARE PODS
116	SUSTAINABLE SYSTEMS
118	FINAL BOARDS
120	REFERENCES
122	PREVIOUS STUDIO EXPERIENCE

LIST OF FIGURES & TABLES

FIGURE 1.1- LAKE SUPERIOR SHORE
FIGURE 2.1-EVERGREEN FOREST
FIGURE 3.1- HOSPITAL BED
FIGURE 4.1- WATERCREST NAPLES FLORIDA
FIGURE 4.2- MARKET STREET
FIGURE 4.3- PLAYROOM
FIGURE 4.4- EXTERIOR PATIOS
FIGURE 5.1- GENERAL HOSPITAL OF SPARTA
FIGURE 5.2- UNIVERSITY PEDIATRIC HOSPITAL
OF THESSALONIKI
FIGURE 5.3- SITE SECTION
FIGURE 5.4- GENERAL HOSPITAL OF KOMOTINI
FIGURE 6.1- LMU HOSPITAL CAMPUS
FIGURE 6.2- LMU SITE PLAN
FIGURE 6.3- EXTERIOR TERRACES
FIGURE 6.4- CAMPUS SITE SECTION
FIGURE 7.1- NYT HOSPITAL
FIGURE 7.2- NYT CENTRAL NODE
FIGURE 7.3- BUILDING FORM
FIGURE 7.4- SCHEMATIC DESIGN SECTION
FIGURE 8.1- ALZHEIMER'S VILLAGE
FIGURE 8.2- ENTRANCE VESTIBULE
FIGURE 8.3- VILLAGE SITE PLAN
FIGURE 8.4- SITE SECTION
FIGURE 9.1- ZAANS MEDICAL CENTRE
FIGURE 9.2- COFFEE SHOP
FIGURE 9.3- ATRIUM

FIGURE 10.1- JAIXANG KAIYI HOSPITAL
FIGURE 10.2- ATRIUM/ LOUNGE
FIGURE 10.3- HEALING GARDEN
FIGURE 11.1- NORTHERN CALIFORNIA FOREST
FIGURE 12.1- PATIENT
FIGURE 12.2- VISITOR
FIGURE 12.3- STAFF
FIGURE 12.4- PROFESSIONAL
FIGURE 13.1- U.S. MAP
FIGURE 13.2- MINNESOTA OUTLINE
FIGURE 13.3- TWO HARBORS MAP
FIGURE 13.4-5 SITE TOPOGRAPHY/ SITE ANALYSIS
FIGURE 13.6-13 POPULATION & HEALTHCARE
DEMOGRAPHICS
FIGURE 14.1- NAMAN SPA
FIGURE 15.1-2 HOSPITAL/ CLINIC SPACE MATRIX
FIGURE 15.3- HOSPITAL/ CLINIC SPACE ALLOCATION
TABLE
FIGURE 15.4- ASSISTED LIVING MATRIX & SPACE
ALLOCATION TABLE
FIGURE 16.1- NORTH SHORE
FIGURE 17.1- CRITICAL ACCESS HOSPITALS IN MINNESOTA
FIGURE 17.2- CRITICAL ACCESS HOSPITALS ON THE
NORTH SHORE
FIGURE 18.1- NATURAL CONTACT DIAGRAM
FIGURE 18.2- MISSING LINKS IN HEALTHCARE
FIGURE 18.3- HEALTHCARE ENVIRONMENTS DIAGRAM
FIGURE 18.4- DESIGN APPROACHES DIAGRAM
FIGURE 18.5- BIOPHILIA PRINCIPLES & APPLICATIONS

THESIS ABSTRACT

Healthcare is an ever-changing field and often a field of uncertainty of what will be around the next corner. As of recent we have faced new challenges such as the Covid-19 pandemic where the medical field had to shift of this virus that was completely unknown to the world. We, as a society, are increasingly aging and urbanizing. Even among staff there are shortages, efficiency problems among departments, and the need for better work environments. Thus, becoming the premise for this thesis project which dives into how circulation can improve movement and efficiency with patients and professionals. Which leads to the question of **“How does implementing biophilia in architecture improve the well-being and way-finding of those who are using the facilities?”** The focus of this thesis is to bring these natural forces back into built environments so we can live healthier as a society.



FIGURE 2.1

THESIS NARRATIVE

When one thinks of going to the doctor there are many negative connotations and dreads that come with the thought. The environment is cold and hard to navigate. It can sometimes leave people lost or going in the wrong direction. Spaces in retirement homes are often built for residents who need the care but not for the care staff who helps them. This thesis will explore the ideas of circulation and nature to bring into healthcare facilities to improve the efficiency and wellness of staff and patients.

Two Harbors, Minnesota has become one of the many ports for ships that are traveling through the Great Lakes to Duluth, Minnesota. The town is set on the shore of Lake Superior and is surrounded by miles of nature. There is a renowned appreciation for what has now become a sanctuary for those who explore the area. What attracts visitors to this area is to fully be immersed in nature, which leads in the concepts of this thesis 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-yoka which is a form of ecotherapy that has been adapted by the Japanese. Forest bathing (shinrin-yoka) 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.

For us as society we have always lived in a built environment or for that matter, we were physically born into it. A time where life in general has become a stressor because of the constant pressure that is given by the world. One stressor leads to another, and we are stuck in this domino effect that leads more health issues. Now for me, personally, I have had a passion for healthcare design for the last few years because of the work I have done in the field. I have seen the good and bad, interacting with residents and staff and experiencing that there are too many aspects that are not designed with occupants in mind. It has become a place where residents are not in a place that they want to be.

The goal of this research is to find ways to promote positive experiences and new ways to implement nature and better circulation ideas through the spaces. It will not solve all the world's problems but will be an impactful step into bettering healthcare programs and facilities. Patients are put in a position of vulnerability while staff are under the stress of taking care of them. It is crucial to create safe and positive spaces that will subside these stressors and turn a new corner in healthcare.

PROJECT TYPOLOGY

Healthcare is always going to be prevalent in our lives. It is a place that focuses on improving the quality of life for those who are in the community. It is something that us as a society cannot live without and something that we grow with as it grows with new changes. It is there to serve a community for a greater good and to allow people to live long and healthy lives.

This project will implement green-spaces in interior and exterior spaces and make sure they are accessible by patients and employees. The proposed healthcare campus will have a hospital that will provide treatments for cancer infusions, general surgery and recovery rooms, and therapy suits. Attached is a clinic that houses a pharmacy, check up rooms, and all administrative offices. The nursing home will have access to nature, spacious rooms that can be personalized and have built in stores and restaurants to give them freedom within the facility. Lastly an on site hotel will be available for loved ones who need to stay close to family members.



FIGURE 3.1

PRECEDENT STUDIES

WATER CREST NAPLES SENIOR LIVING CENTER

LOCATION:
NAPLES,
FLORIDA

ARCHITECT:
HKS
ARCHITECTS

TYOLOGY:
RETIREMENT
HOME



FIGURE 4.1

The Sleepover Project

In 2008, David Dillard was influenced by the idea of visiting nursing homes and assisted livings for a couple of hours meeting staff and residents to brainstorm ideas and find inspiration. The idea, Dillard would come up with, is that designers would spend 24 hours at the senior living community. Allowing for designers to be fully immersed in the lives of residents and staff to gain the understanding of everyday life. Finding solutions that will be thoughtful, user oriented and can in general better serve senior living communities.

There have been more than 30 sleepover projects that have been conducted across the U.S. and are used as references for other projects that are pushing new ideas in the development of senior living design. The sleepover project has been more about building empathy with the residents and staff . Building connections and improving them with designs that promote residents to be comfortable and open up to those who are supporting them



FIGURE 4.2

The Challenge

For HKS the challenge was taking the insight of two clients and creating a unique blend to produce the final results. The two companies Watercrest and United Properties wanted to mix the luxury of upscale assisted living and a unique memory support to residents residing in Naples. Creating a competitive market that exceeds what other assisted living centers can provide.

The Design Solutions

The design overall is to ease the anxiety of residents and visitors. Using the research from "The Sleepover Project" creates the central meeting that holds all the amenities and services. The clubhouse is surrounded by luxury amenities that include dining room with exhibition kitchen, casual dining, grandchildren's playroom, art studio and several other screened-in porches and spa.

Independent living strives to keep residents active and comfortable with the environment that is their now home. Having units that include balconies, washer/dryer appliances and walk-in closets. Allowing for residents to continue their daily activities and improving their health in the process.

The apartment was designed as a loop to improve way finding, staff efficiency and to encourage indoor exercise that weaves its way through the facility showing relaxing views of the nature surrounding. The innovation of Market Street creates a similar environment and stimulates exploration for residents who struggle with memory lost and other issues from being in an assisted living.



FIGURE 4.3

The Design Impact

While the design impacts those who live there it also impacts their loved ones and those who work and care for residents. All of the private spaces, meeting areas and activities allow for bonding with other people in the community or private time with themselves.



FIGURE 4.4

Takeaways: These luxury apartment like rooms make residents feel the independence they need. There are plenty of spaces within the facility that are social places for residents and their families. Designing similar places that are familiar to their lives outside of memory care. While it is for residents it also provides spaces for families especially children that get a playroom. Incorporating elements to make the facility more like a home to create the independence that seems to get lost in translation.

Renzo Piano's Trio of Hospitals for Greece

LOCATIONS:
SPARTA
THESSALONIKI
KOMOTINI,
GREECE

ARCHITECT:

RENZO
PIANO

TYOLOGY:

HOSPITAL



FIGURE 5.2

THE UNIVERSITY PEDIATRIC HOSPITAL OF THESSALONIKI

This \$750 million trio is bringing a new infrastructure and public healthcare to Greece. The hospital's will support the existing healthcare in the country and will provide patients and staff with a connection to the outside. Surrounding the facilities is a park with multiple play areas, and private healing gardens.

The building is linked by two main circulation spaces, one for public and one for staff. Within treatment rooms there is additional thought in the design for parents and caregivers who will be with patients. The envelop will include about 70,000 square meters of parkland. Gardens are an important part of the site and design intent. With a mix of green spaces and play areas that will be visible from the interior spaces with large windows to ensure the connection with nature.



FIGURE 5.1

THE GENERAL HOSPITAL OF SPARTA

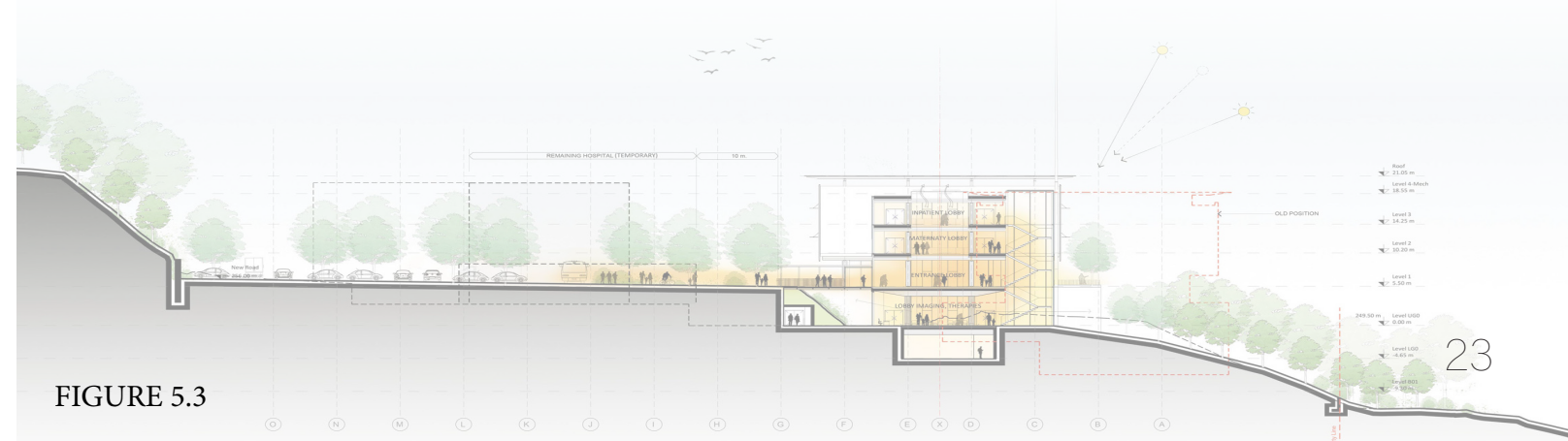


FIGURE 5.3



FIGURE 5.4

THE GENERAL HOSPITAL OF KOMOTINI

"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."

The key elements of the design for this hospital includes a mass timber superstructure, with materials that include cross-laminated and glulam. Featured is wood-clad facade and canopy supporting photovoltaic panels that will provide renewable energy and solar shading for the building.

Takeaways: Choosing a site that is immersed in nature makes it easier to provide that peaceful and calming environment. Along with site selection the design and materials should reflect the nature around it so there is a flow from inside out and vice versa. A place that is designed for patients, staff and other visitors to all have a cohesive place within a variety of spaces. Inspiring ideas to use a variety of natural materials like wood and calming colors with textures. With in the landscape to create group and private spaces for reflection and healing.

LMU UNIVERSITY HOSPITAL CAMPUS GROSSHADERN

LOCATION:

MUNICH,
GERMANY

ARCHITECT:

C.F MOLLER
ARCHITECTS

TYOLOGY:

HOSPITAL



FIGURE 6.1



FIGURE 6.2

The Grosshadern Campus is one of the leading national and international medical sites. Costing around one billion dollars, the park forms the central element of the design as a healing and meeting space for visitors, patients and staff. The intertwining of the park- this is what makes this master plan special and guarantees a high amenity quality.

Human and Healing

Greening the roof of the main axis and including numerous terraces, natural elements are systematically brought into the structural core of the hospital. The landscape concept is intended to promote atmospheric diversity as well as patient well-being and recovery. This idea is in line with a basic principle of contemporary healthcare architecture: the focus is on the human being.

The designers wanted to keep this project on a smaller- scale to transform the existing building into an urban and human appearance. The master plan layout focusing on short distances, clear orientation and attractive design.



FIGURE 6.3

Takeaways: While this is a bigger campus, the focus was on making this a smaller-scale project that makes it less intimidating. Creating short distances and clear circulation paths outside but also shifting that focus to the interiors. The architects wanted the central elements to be derived from the natural parks to promote healing and well-being while also making it a space for all of the users. The layering of the terraces throughout the different floors brings in natural air flow and views that normally could not be seen from some of the interior spaces. Creating access for everyone will promote a safe, positive and healing environment. Thinking about circulation and distances that suite patients and residents in the nearby nursing home. Using nature to promote way finding both inside and out.



FIGURE 6.4

NYT HOSPITAL NORDSJAELLAND

LOCATION:

HILLEROD,
DENMARK

ARCHITECT:

HERZOG &
DE MEURON

TYOLOGY:

HOSPITAL

A Pavillion in the Forest

From users of the space it is described as a beautiful healing and functional building, there is a sense of calm and harmony, a homely feeling. The views of the surrounding landscape, large roof garden and the light that streams in from both sides of this building.

The small ponds and one of the largest forests in the country. Flat green roofs that blend in with the natural topography. There have been many studies done to show how daylighting and views of nature can have healing effects on patients who cannot leave.

The Patient's Hospital

The hospital is in the shape of a clover and will take the form of a pavilion in the middle of the forest. Like traditional functions the architectural design will be planned to every logical and clinical function. Unlike traditional hospitals the architecture is seen on a human scale and is adapted to the surrounding landscape. The hospital is built around a central node which allows access to all departments. The purpose to optimize the flow of circulation and to keep the ground floor free from functional hospital.



FIGURE 7.1

FIGURE 7.2





FIGURE 7.3

“ Preserve the site’s existing natural features while optimizing the efficient hospital machine.”

Takeaways: The central node is an open area that is exposed to the outdoor elements. The opening in the center has access to every department but doesn’t have the chaos of a typical hospital corridor. It allows for the separation of patients going in and out of surgery and those who are in recovery. Above the two floors of hospital functions and rooms is the roof top gardens that are in relation to recovery rooms. For design purposes the views will provide the natural healing of biophilia while creating the different circulation paths for patients in different stages at the hospital and other users that are supporting patients.

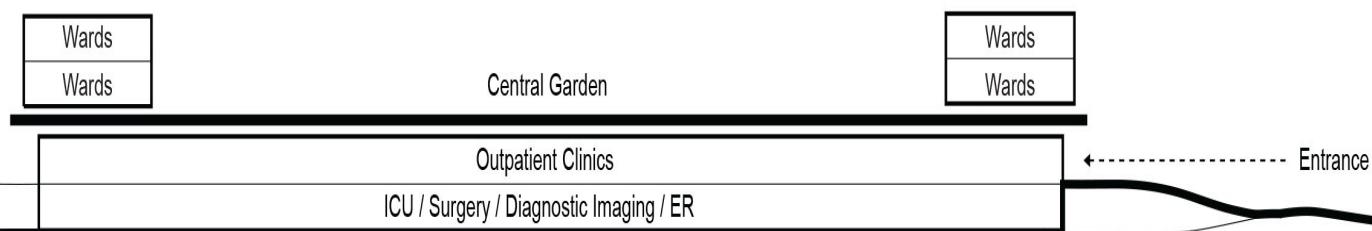


FIGURE 7.4

ALZHEIMERS VILLAGE

<p>LOCATION: HILLEROD, DENMARK</p>	<p>ARCHITECT: NORD ARCHITECTS</p>	<p>TYPOLOGY: RETIREMENT HOME</p>
--	---	--



FIGURE 8.1



FIGURE 8.2

We are facing a welfare challenge that is going to develop, as the global number of elderly people increases. So how do we rise to the challenge and create built environments to accommodate the significant trends we are currently witnessing, while providing space for efficient, soothing, healing treatment?

NORD Architects have designed several dementia villages, including the Alzheimer's Village in Dax, which is the first care home in France for people with dementia. NORD Architects have taken into account the individual residents, the health care staff, and the local culture and nature, so everyone, from relatives to researchers, will experience people – including those with dementia – living in an environment that prioritizes dignified aging.



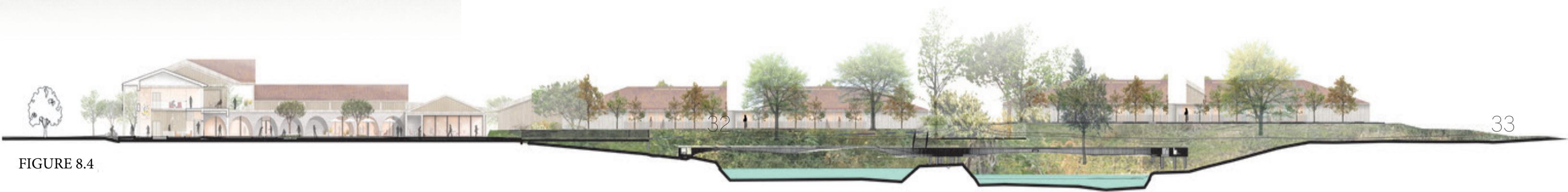
FIGURE 8.3

Recognizability creates continuity and a sense of belonging. Alzheimer's Village is designed to create a safe environment, in which residents, relatives and health care professionals all get a feeling of well-being.

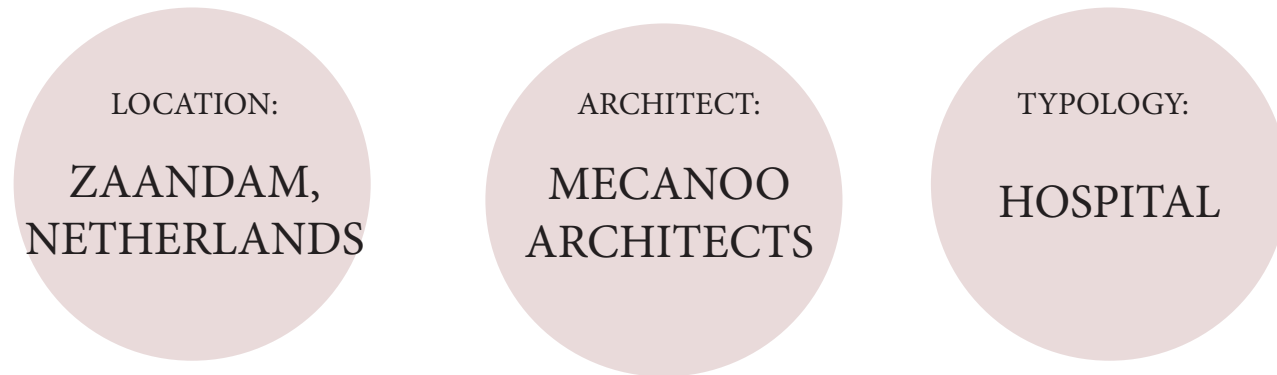
Social interactions and recreational nature. The everyday connections, across generations, institutions, and the town, are essential when it comes to integrating the Alzheimer's Village into the local environment and enhancing the sense of continuity and cohesion across different life patterns.

The architect's creative vision caters to the needs of both communities and individuals, providing each resident with options that are reassuring and diverse.

Takeaways: With creating a nursing home and assisted living there are the thoughts of memory care and how to combat side effect like sundowning. Creating recognizable spaces like a hairdresser, restaurant and market square bring back memories of their past to allow them to feel something familiar. Making spaces not seem challenging or disrupting cognitive functions.



ZAANS MEDICAL CENTRE



Text description provided by the architects. Zaans Medical Centre is the first lean hospital in the Netherlands. It is an efficient and compact building in which professional healthcare and a personal approach strengthen each other. Architecture, urbanism, landscape and interior are brought together in a coherent design. Clear routing, an abundance of daylight, and positive distractions contribute to an environment that does not feel like a hospital, but as a place that promotes wellbeing.



Lean and Future Proof

The smart lean design identifies five care processes: acute, elective, outpatient, clinic, and diagnostics. The clear stacking of outpatient clinics, clinical departments and a flexible facility layer between them, optimally serves these primary care processes. All departments are designed to prevent any form of waste. Whenever possible, the outpatient clinics and nursing departments are standardised, allowing for exchangeability and adaptability. The Zaans Medical Centre is therefore flexible and future-proof.

FIGURE 9.3



Positive Distractions

The patient experience played a crucial role in the design process. Positive distractions can reduce the stress of a hospital visit and advance recovery. The spacious multi-story lobby has the feel of a welcoming public building. Semi-circular voids and skylights, the use of wood, bright colors, good acoustics and unobstructed views of the surroundings provide a pleasant atmosphere. All hospital wards can be accessed from an internal street with many sheltered waiting areas.

Takeaways: The importance of patient experience was a key factor in the selection of this case study. The natural materials and allowance of natural daylighting with unobstructed views that will be implemented into the design to show the naive forest and Lake Superior. All things that are known to promote advanced healing in healthcare settings. Making a project that flows together among all the disciplines will create a cohesive space for the benefits that natural brings

JAIXANG KAIYI HOSPITAL

LOCATION:

JIAXING,
CHINA

ARCHITECT:

B+H
ARCHITECTS

TPOLOGY:

HOSPITAL



FIGURE 10.1



FIGURE 10.2

Shared public amenity spaces such as the Family Hub on the third floor, where the operating theaters rooms, ICU and delivery rooms are located, provides families a place to rest, pray, and support each other while waiting for their loved ones. Meanwhile, the 11th floor hospital inpatient tower functions as part of the larger community identity, encompassing a large lecture hall, a sunken garden that connects to restaurants and a public park with water features and seating areas. These public spaces are designed to promote social activity amongst patients, visitors and care staff, with the hopes of fostering connection during recovery.

The facility was designed to put the experience of the patient first and establish itself as a place of wellness as opposed to illness. Half of the patient rooms in the Integrated Procedures Unit (IPU), for example, face south to maximize access to natural light, while other features that amplify patient comfort include wider hallways, optimized exterior views, temperature and lighting controls and calming colors.

Located in the Jiaxing Economic and Technological Development Zone, the building's design has been developed to accommodate evolving technology and the changing needs of the community. Phase two of the project will be comprised of a senior care facility alongside other public facilities that provide integrated healthcare services to better meet the diverse needs of its growing population.

Biophillic design is woven throughout, including the sunken garden next to the restaurant, rooftop gardens, indoor horizontal and vertical greening, the public garden with walking paths and multiple water features. These connect the outdoors to the indoors and help bring a sense of wellness to users.

With an emphasis on resiliency, the design of the building features materials that are environmentally friendly and energy efficient, promoting energy savings and indoor air quality requirements that exceed China Green Building Two Star sustainable standards. Designed in a park-like setting, the hospital is set back from major traffic, with vegetation and mature trees used to buffer the hospital from surrounding noise. In addition, building orientation captures the prevailing winds and harvesting natural daylight, resulting in less reliance on artificial light and providing natural ventilation when needed.

Takeaways: Putting patients first is always the goal of healthcare facilities. One that creates community and private spaces that are designated for families a place to support each other. The outdoor spaces provide social activity among users and connect them to nature during recovery periods. What was taken into account was the staff to create a functional and optimized areas where workers can perform their job effectively. Always evolving with the economy and technology that seems to be one step ahead of design.

FIGURE 10.3

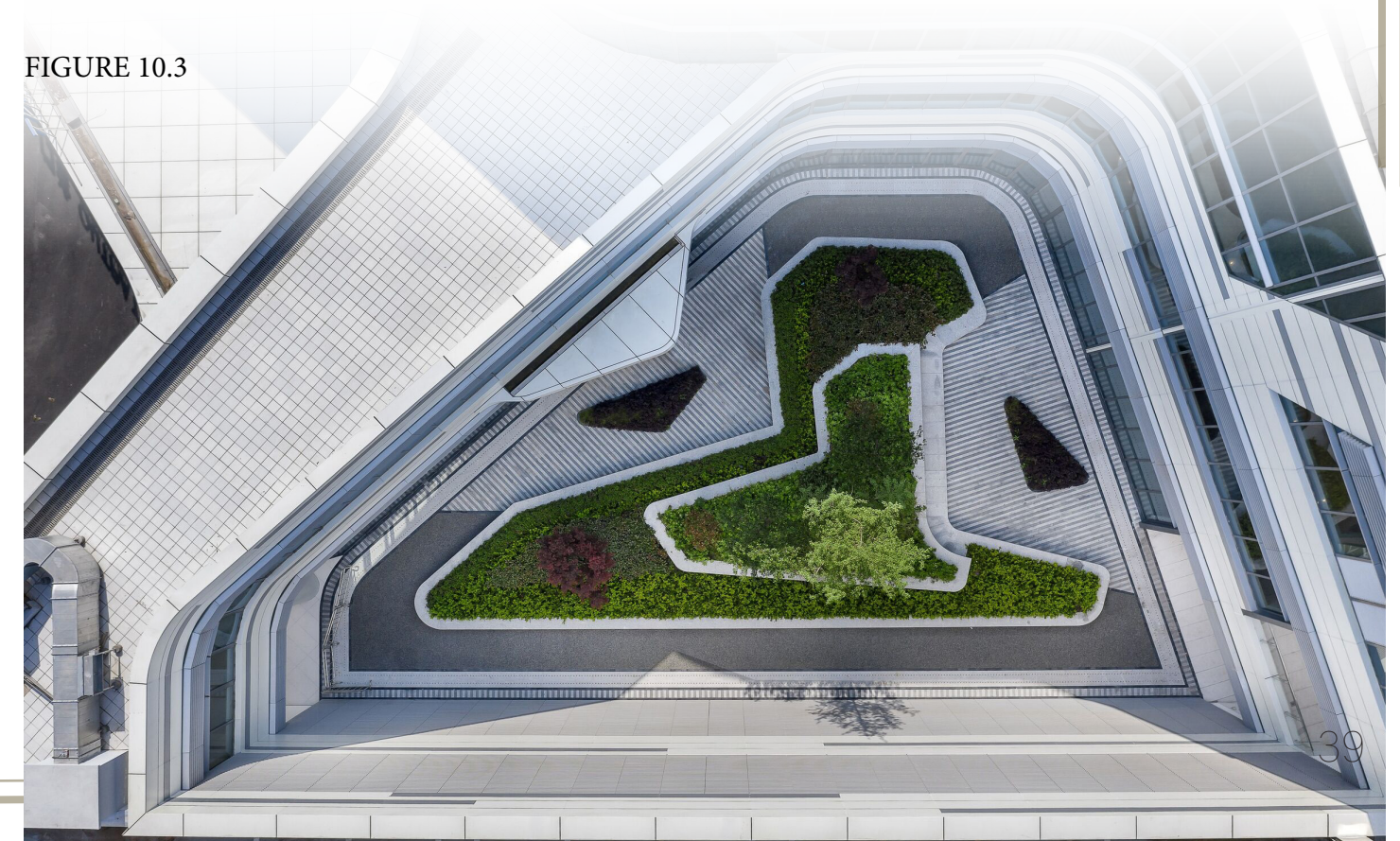




FIGURE 11.1

PROJECT JUSTIFICATION

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 it that are not big enough to maintain it. The direction of this research is based partially off of personal experiences as a CNA. 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 until 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 and psychological both physical health.

PROJECT EMPHASIS

There are four points of emphasis that will be prominent in this thesis project:

01

BIOPHILIA

How nature can affect healing processes within hospital and long-term care settings.

Concept of Shinrin-yoka and how it affects people mentally and physically in their situations

In a rural setting how can the natural surroundings of the site be implemented into the campus

02

CIRCULATION

The circulation between staff and patients, and the circulation between the different buildings and areas within each individual building.

Incoming and outgoing patients, separate entrance, and exit.

03

SPACE

How can spaces be improved in nursing home setting for residents to better transition into a new home setting?

Creating spaces that function to staff and equipment while creating ample space for residents.

04

SECURITY

Being in a rural setting creating well lit spaces at night.

Crime Prevention/ Help phone for pathways.

MAJOR PROJECT ELEMENTS

PROGRAMMING SPACES BY DEPARTMENT

Admissions:

At the Admitting Department, the patient will be required to provide personal information and sign consent forms before being taken to the hospital unit or ward. If the individual is critically ill, then, this information is usually obtained from a family member.

Anesthetics:

Doctors in this department give anesthetic for operations and procedures. An anesthetic is a drug or agent that produces a complete or partial loss of feeling. There are three kinds of anesthetic: general, regional and local.

Cardiology:

Provides medical care to patients who have problems with their heart or circulation.

Central Sterile Services Department (CSSD):

(Sterile Processing Department (SPD) - Sterile Processing - Central Supply Department (CSD) - Central Supply) - A place in hospitals and other health care facilities that performs sterilization and other actions on medical equipment, devices, and consumables.

Diagnostic Imaging:

Also known as X-Ray Department and/or Radiology Department

General Services:

Support Services include services provided by Departments such as Porterage, Catering, Housekeeping, Security, Health & Safety, Switch, Laundry and the management of facilities such as parking, baby tagging, access control, CCTV etc.

General Surgery:

Covers a wide range of types of surgery and procedures on patients.

Gynecology:

Investigates and treats problems relating to the female urinary tract and reproductive organs, such as Endometriosis, infertility and incontinence.

Haematology:

These hospital services work with the laboratory. In addition doctors treat blood diseases and malignancies related to the blood.

Intensive Care Unit (ICU):

(Intensive Therapy Unit, Intensive Treatment Unit (ITU), Critical Care Unit (CCU) - A special department of a hospital or health care facility that provides intensive treatment medicine and caters to patients with severe and life-threatening illnesses and injuries, which require constant, close monitoring and support from specialist equipment and medications.

Infection Control:

Primarily responsible for conducting surveillance of hospital-acquired infections and investigating and controlling outbreaks or infection clusters among patients and health care personnel. The department calculates rates of hospital-acquired infections, collates antibiotic susceptibility data, performs analysis of aggregated infection data and provides comparative data to national benchmarks over time.

Maternity:

Maternity wards provide antenatal care, delivery of babies and care during childbirth, and postnatal support.

Medical Records:

Includes a variety of types of “notes” entered over time by health care professionals, recording observations and administration of drugs and therapies, orders for the administration of drugs and therapies, test results, x-rays, reports, etc.

Neurology:

A medical specialty dealing with disorders of the nervous system. Specifically, it deals with the diagnosis and treatment of all categories of disease involving the central, peripheral, and autonomic nervous systems, including their coverings, blood vessels, and all effector tissue, such as muscle. Includes the brain, spinal cord, and spinal cord injuries (SCI).

Nutrition and Dietetics:

Dietitians and nutritionists provide specialist advice on diet for hospital wards and outpatient clinics.

Obstetrics/Gynecology:

Specialist nurses, midwives and imaging technicians provide maternity services such as: antenatal and postnatal care, maternal and foetal surveillance, and prenatal diagnosis.

Occupational Therapy:

Helps physically or mentally impaired people, including temporary disability, practices in the fields of both healthcare as well as social care. Often abbreviated as “OT”, Occupational Therapy promotes health by enabling people to perform meaningful and purposeful occupations. These include (but are not limited to) work, leisure, self care, domestic and community activities. Occupational therapists work with individuals, families, groups and communities to facilitate health and well-being through engagement or re-engagement in occupation.

Oncology:

A branch of medicine that deals with cancer and tumors. A medical professional who practices oncology is an oncologist. The Oncology department provides treatments, including radiotherapy and chemotherapy, for cancerous tumors and blood disorders.

Pharmacy:

Responsible for drugs in a hospital, including purchasing, supply and distribution.

Radiology:

The branch or specialty of medicine that deals with the study and application of imaging technology like x-ray and radiation to diagnosing and treating disease. The Department of Radiology is a highly specialized, full-service department which strives to meet all patient and clinician needs in diagnostic imaging and image-guided therapies.

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.

THE PATIENT



FIGURE 12.1

THE VISITOR



FIGURE 12.2

THE STAFF



FIGURE 12.3

THE PROFESSIONALS



FIGURE 12.4

CLIENT DESCRIPTION

The Patient

Healthcare is based around a patient's needs for the care of what they are coming in for. This should be an environment that is calming and will promote healing and positive experiences with the design of different elements. Patients come expecting the best care and above standard facilities that are going to make a stressful situation more manageable.

The Visitor

Within hospital and long-term care settings there is the opportunity for family members and other outside sources to come in and visit loved ones or patients for other companies. Designing areas in each building that can accommodate them such as a hotel, so they have easy access to the other buildings and things like coffee shops, food services, and play areas to keep children entertained.

The Staff

The typical staff that we think of is nurses and doctors but what about those who work behind the scenes. Staff who are indirectly and directly involved with patients and visitors in places like janitorial, administration, or food services.

The Professionals

Different from staff, professionals, are the doctors, specialists and nursing aids who are in direct contact with patients and have the priority of providing the best care possible. Designing circulation and areas that benefit and make their jobs more efficient is a prominent factor in facility designs.

SITE CONTEXT

Region: Mid- West United States



FIGURE 13.1

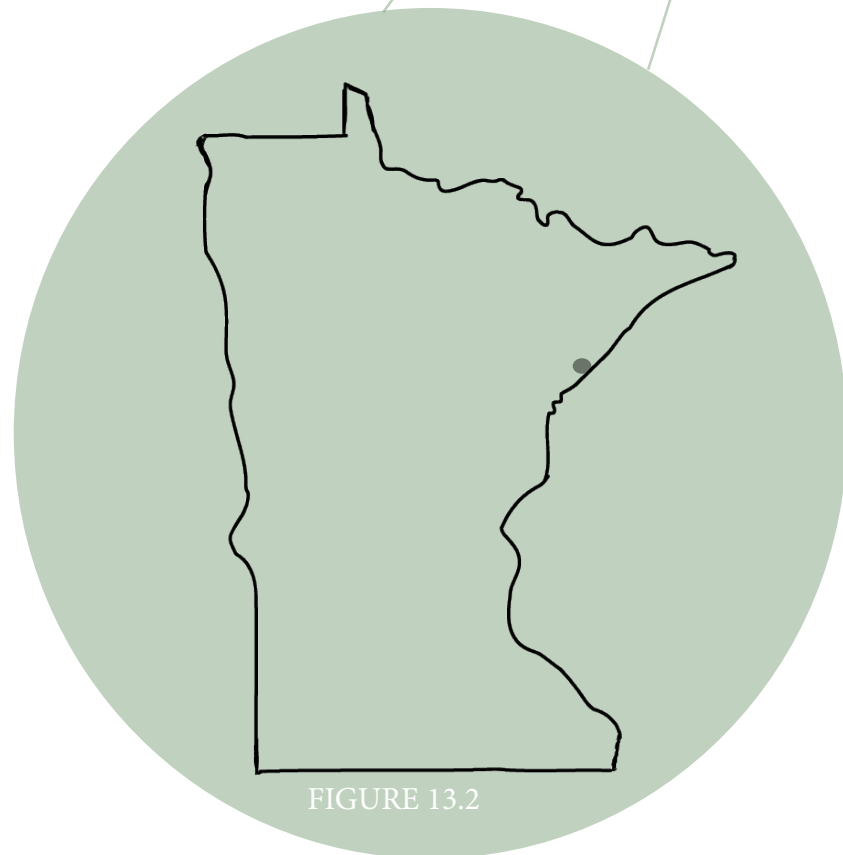
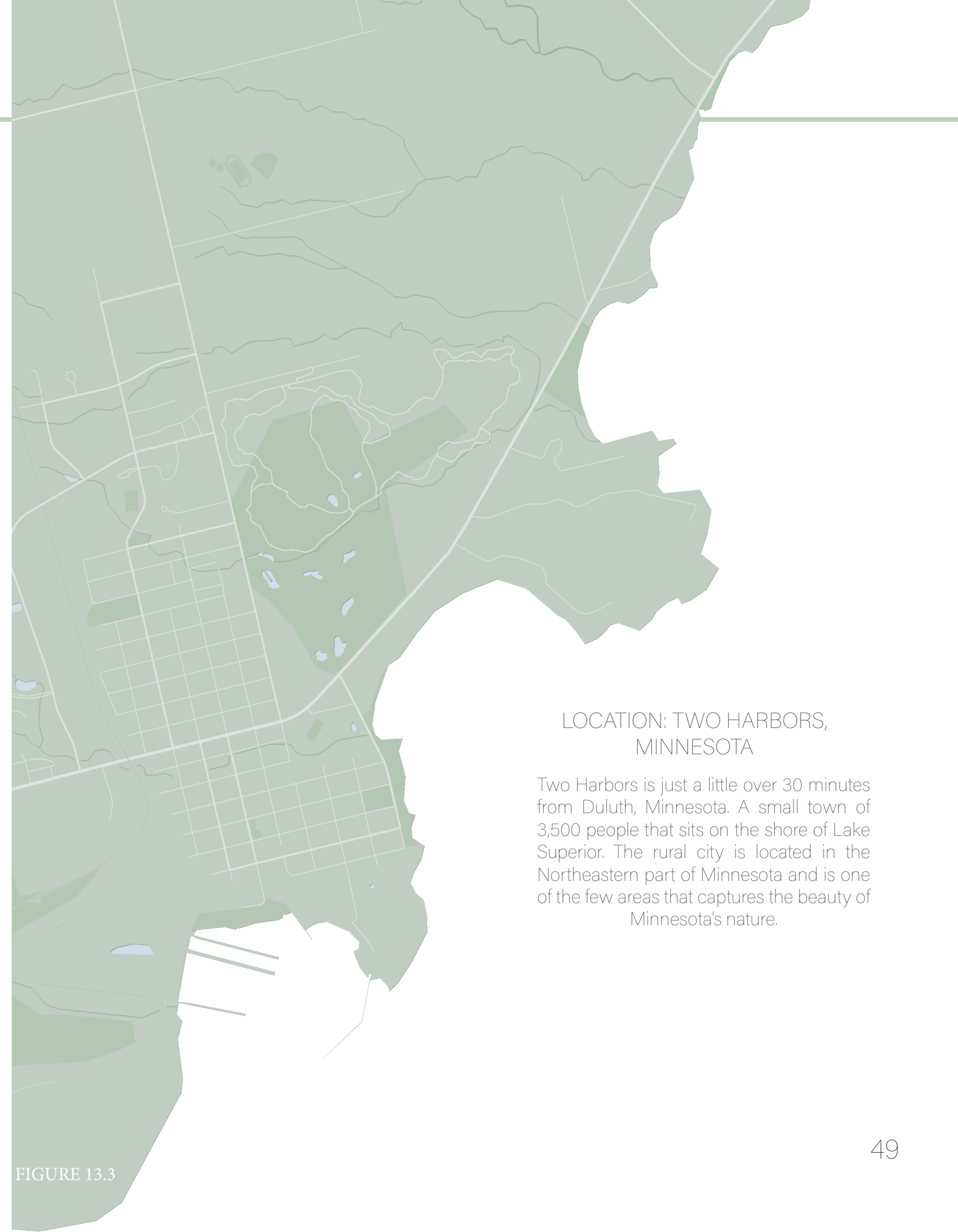


FIGURE 13.2

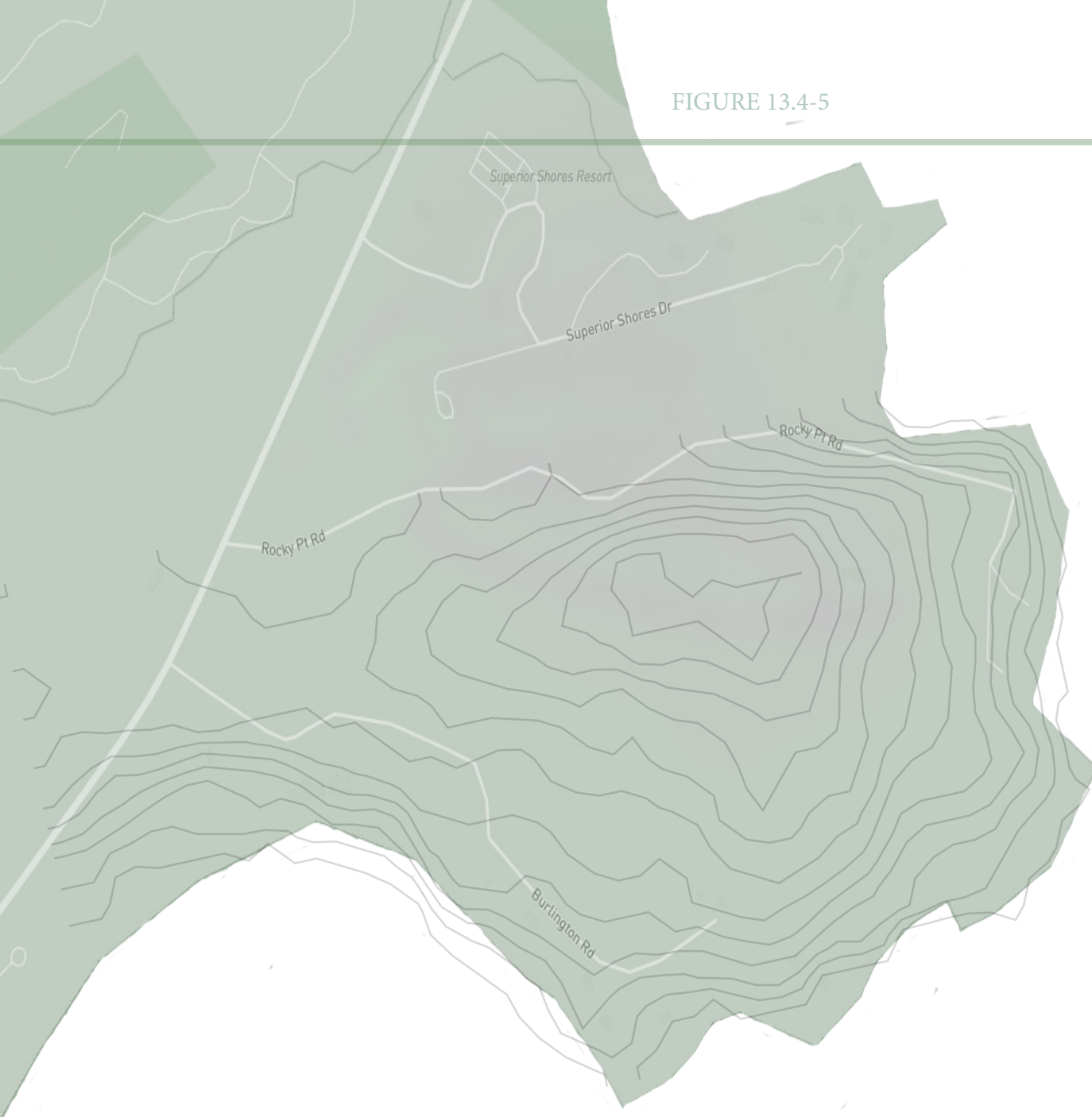


LOCATION: TWO HARBORS, MINNESOTA

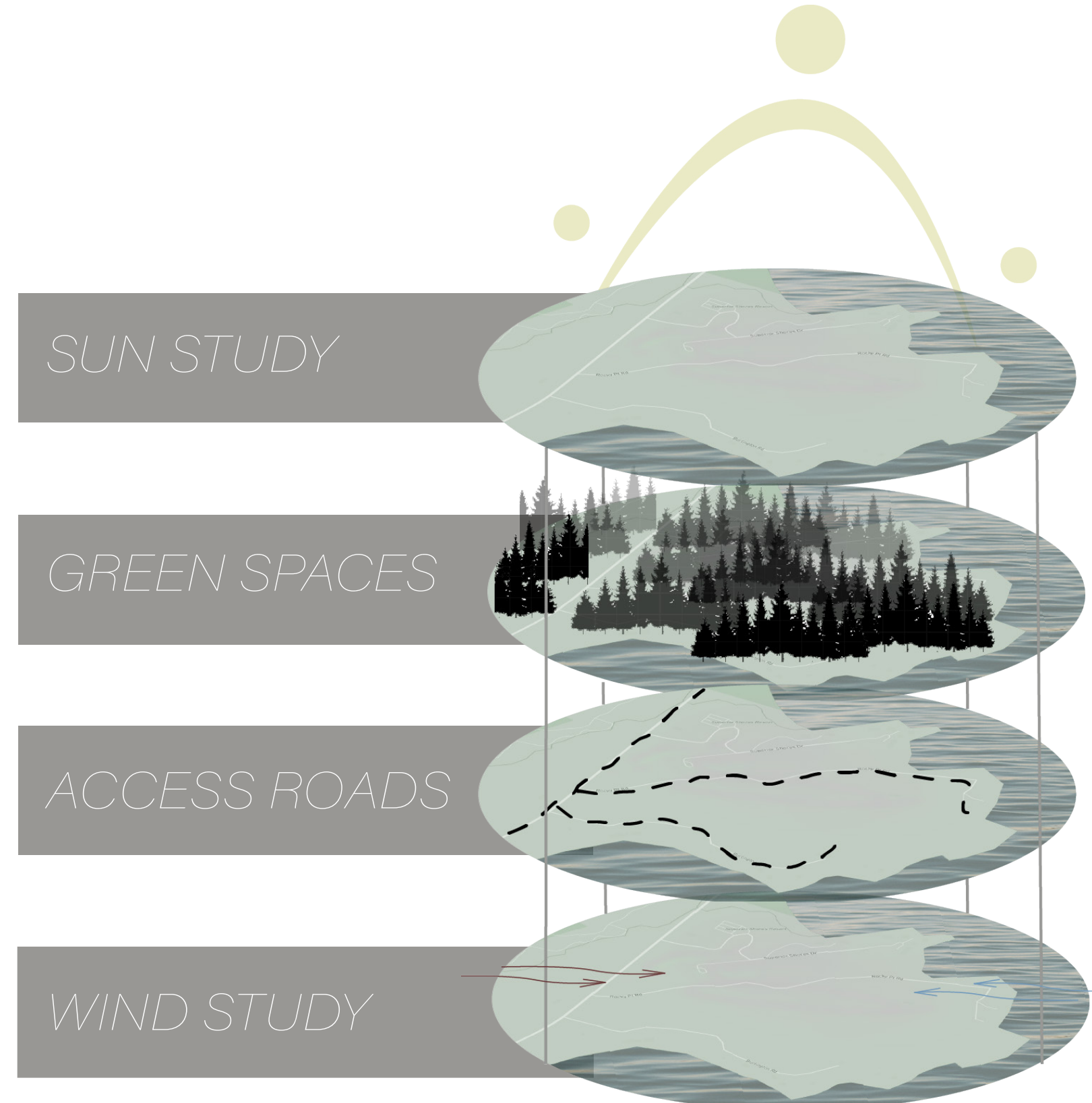
Two Harbors is just a little over 30 minutes from Duluth, Minnesota. A small town of 3,500 people that sits on the shore of Lake Superior. The rural city is located in the Northeastern part of Minnesota and is one of the few areas that captures the beauty of Minnesota's nature.

FIGURE 13.3

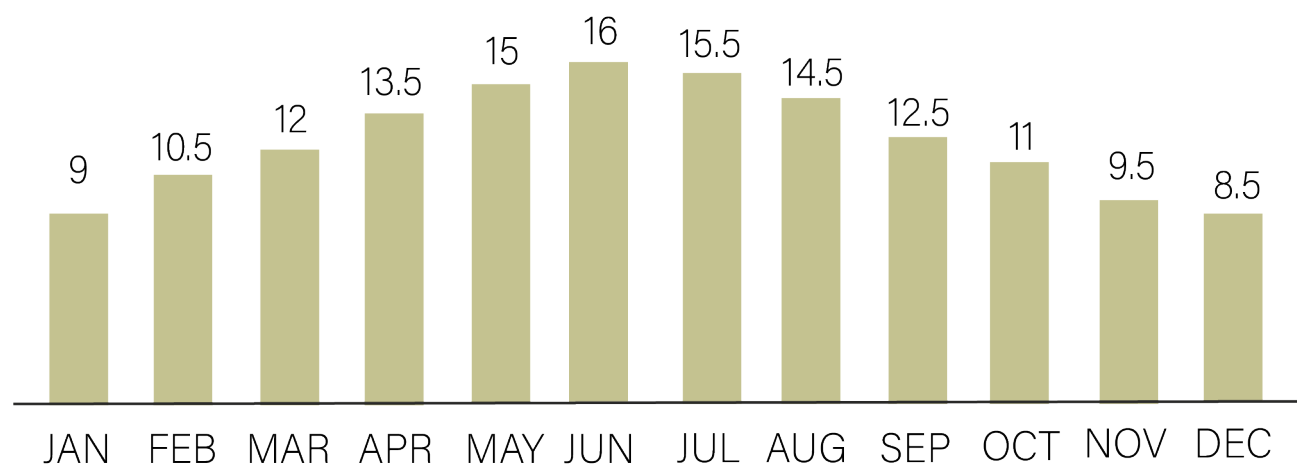
FIGURE 13.4-5



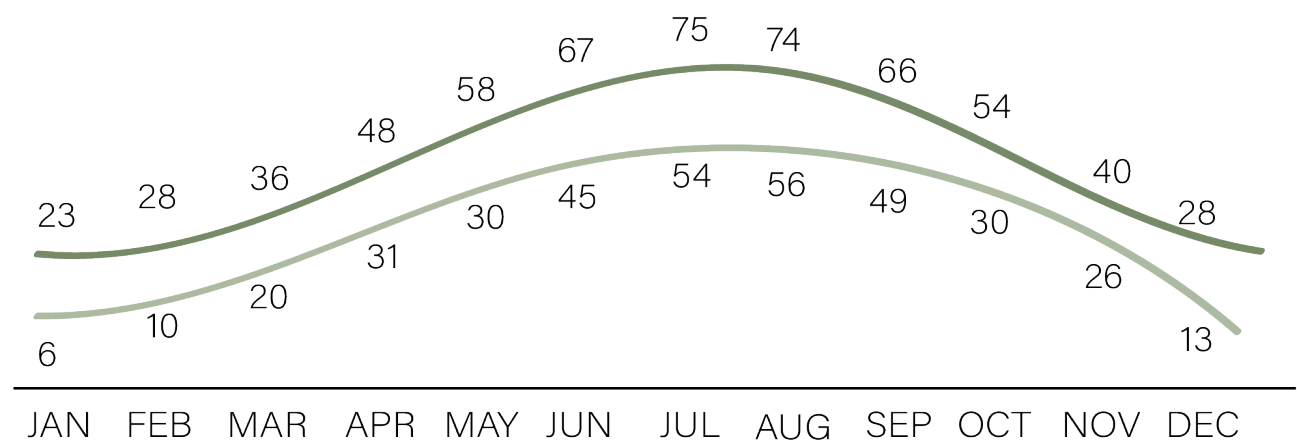
The site selection was based on the main ideas of biophilia and shinrin-yoka. Both concepts bring in the natural aspects of the site into the built forms that are being proposed. This is a larger site outside of the city limits surrounded by a denser forest and views onto Lake Superior. With the city 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.



DAYLIGHTING HOURS

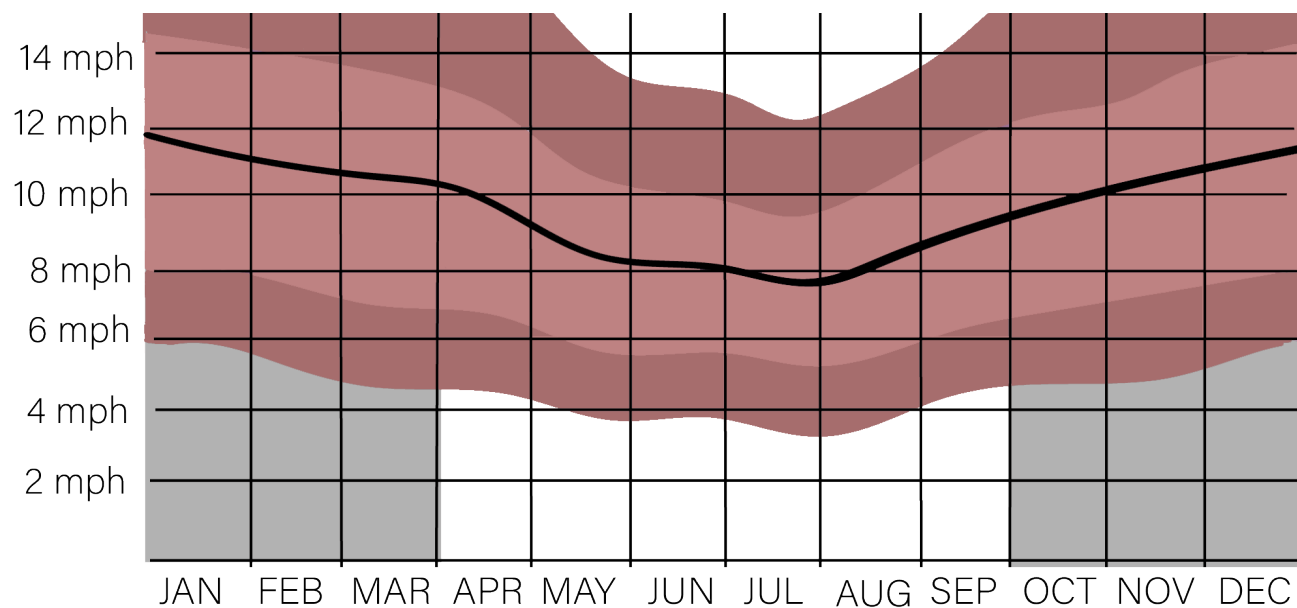


AVERAGE TEMPERATURES



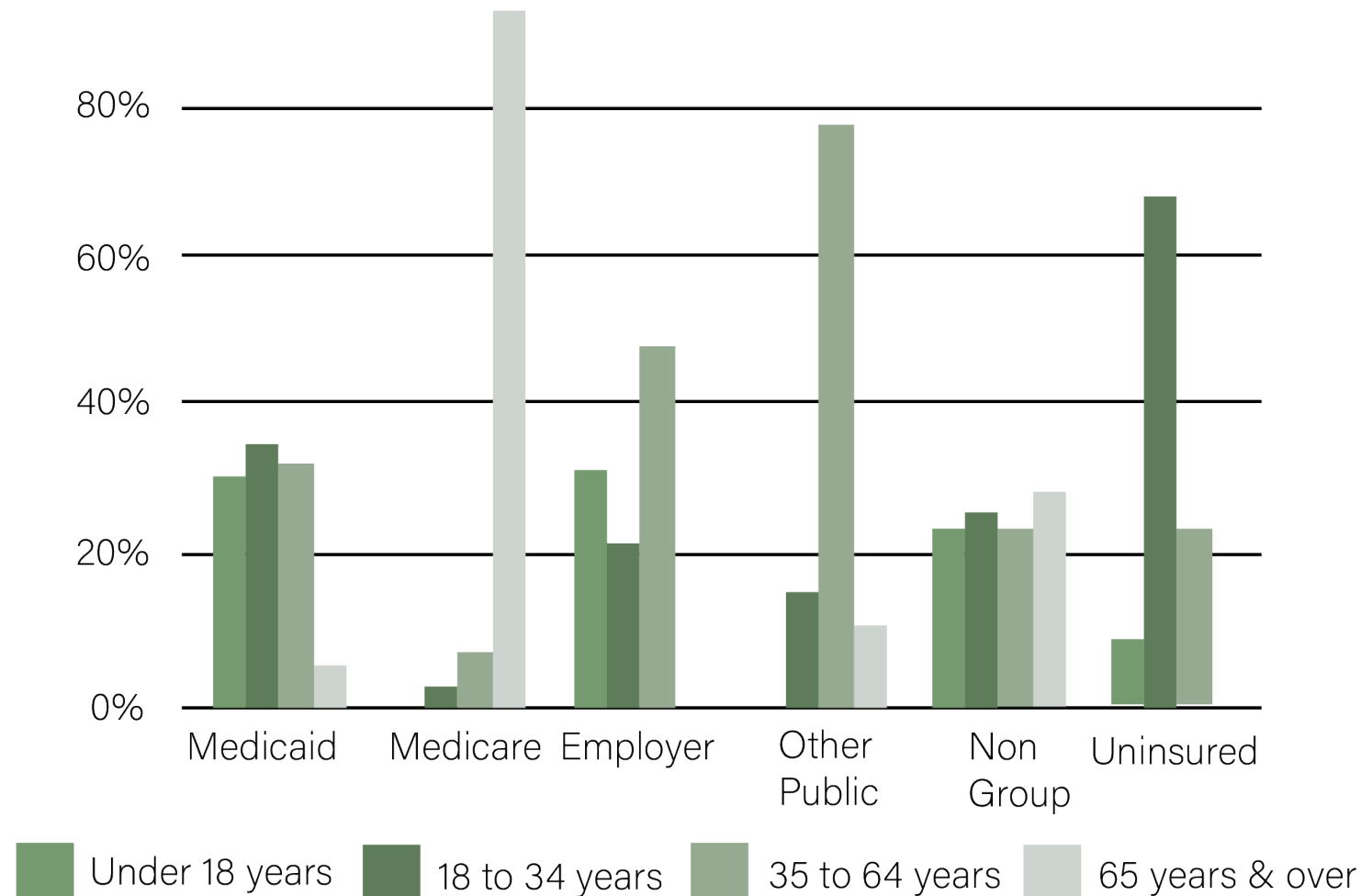
Highs Lows

AVERAGE WIND SPEEDS

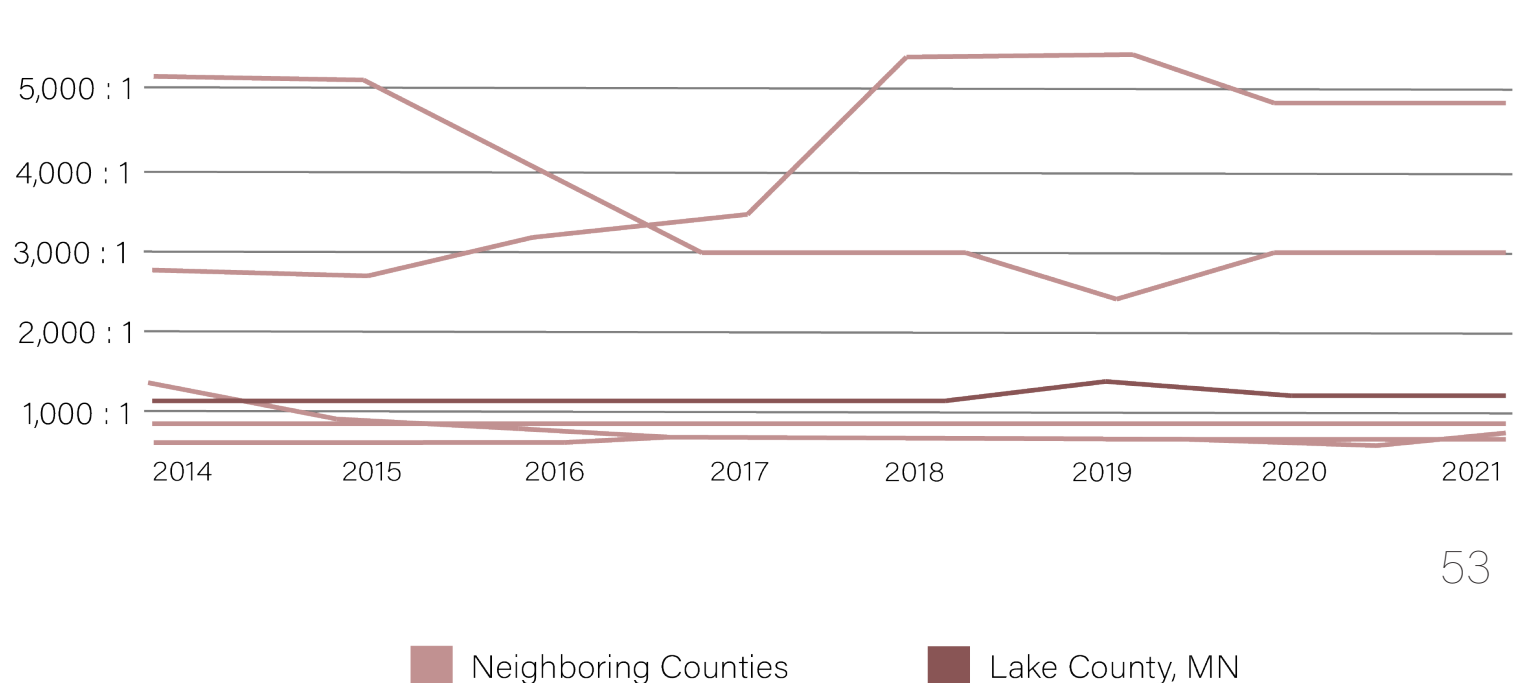


POPULATION AND HEALTHCARE DEMOGRAPHICS

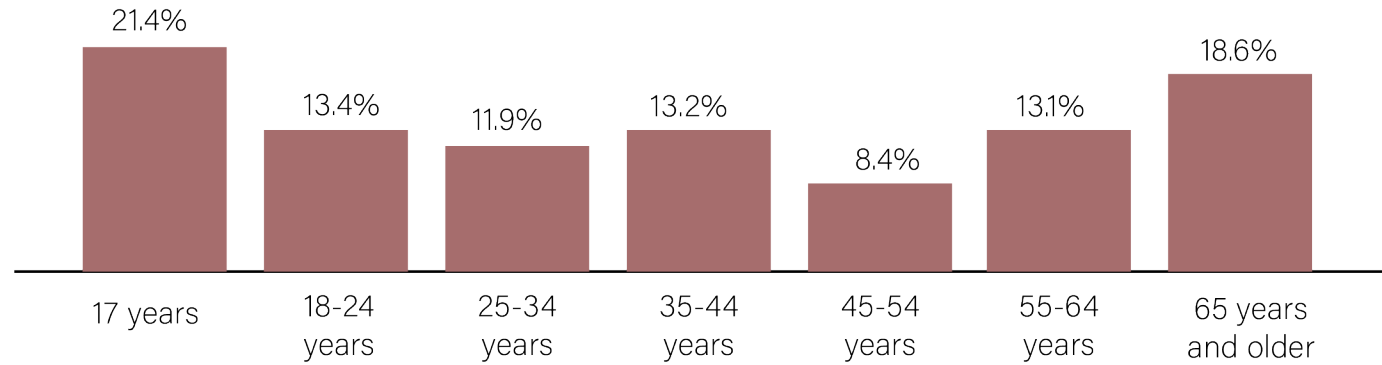
HEALTHCARE COVERAGE



PATIENT TO CLINICIAN RATIO



POPULATION BY AGE GROUP



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

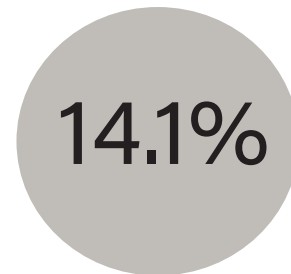
INDUSTRIES

HEALTHCARE & SOCIAL ASSISTANCE

PEOPLE IN THE WORKFORCE:



WORKFORCE GROWTH:



MEDIAN EARNINGS:



MEDIAN EARNINGS GROWTH:



OCCUPATIONS

HEALTHCARE SUPPORT OCCUPATIONS

PEOPLE IN THE WORKFORCE: 114
 WORKFORCE GROWTH: 46.2%
 MEDIAN EARNINGS: \$25,313
 MEDIAN EARNINGS GROWTH: 9.72%

HEALTH DIAGNOSING & TREATING PRACTITIONERS & OTHER TECHNICAL OCCUPATIONS

PEOPLE IN THE WORKFORCE: 62
 WORKFORCE GROWTH: 0%
 MEDIAN EARNINGS: \$61,719
 MEDIAN EARNINGS GROWTH: 0.144%

HEALTH TECHNOLOGISTS & TECHNICIANS

PEOPLE IN THE WORKFORCE: 43
 WORKFORCE GROWTH: -6.52%
 MEDIAN EARNINGS: \$51,875
 MEDIAN EARNINGS GROWTH: -2.29%

FIGURE 13.6-13

GOALS OF THESIS

Professional

I wanted this project to reflect what I would like to specialize in, in healthcare design and architecture. I have at least 5 years of experience working in different nursing homes, 2 of those as a Certified Nursing Assistant. I have seen the good and the bad of the facilities I have worked in and inspired me to make some sort of impact in this field. Within firms there does get to be that creativity limit because of clients and different factors that come with real world designing. As an outcome of any project, I am allowing my skills to bring ideas to life and create a project better than anyone could imagine.

Academic

From everything that has been taught in classes and seminars is knowledge furthering my ideas and concepts for different projects. This is continued into my professional career. Implementing technical aspects, renderings and design ideas and processes that I have developed through school. This has been a good base to what I have yet to learn in the field.

Community

There is always a community that is being served through healthcare. Communities generate the biggest support systems which is especially important when those around you in this environment are going through similar things. Even within the ecosystem of nature, it is a community that grows with each other. The architecture community has strong ties and allows for networking all over the world especially through North Dakota State University.

Personal

A personal goal of mine is to take every opportunity that comes to me. I want to travel as much as possible with this career because there is always something to learn from existing and new constructed buildings. My personal experiences will take me far with what I know and what I have learned. I want the buildings I design to be reflection of my style and passions that I want to bring into architecture.



FIGURE 14.1

PLAN OF PROCEEDING

DEFINITION OF RESEARCH DIRECTION

The focus of the research will be finding and analyzing precedent studies that relate to the typology and concepts that are being implemented. This will be done through a mix of case studies, historical research and quantitative research. The goal is to reconnect humans with the natural environment within a built one. The research cases will provide information on how these concepts have grown and where they are going in the future of this typology specifically. Influencing positive recovery, both physically and mentally.

Unifying Idea

Having the understanding of how each facility functions on an everyday basis is the foundation of how to implement changes of biophilia and way-finding. The healing effects of biophilia can provide and be a navigation tool for those who are making their way through spaces. While creating positive feelings and thoughts in a space that has negative connotations associated with it.

DESIGN METHODOLOGY

01 Case Study and Combined Strategies

Precedent studies will be important for the investigation into the different typologies that are being explored. With addressing ideas of circulation, programmatic spacing and biophillic design intent. Determining the different functions and activities that will be taking place.

02 Historical Research

In relation to site context and history of how biophillic design has developed with modern technology and medicine. This can be achieved through the use of medical and academic journals that go into extensive research that is being portrayed throughout this thesis.

03 Qualitative Research

The research that data comes from the processes or phenomena that is happening within its natural settings. Data will be self generated by interviewing personnel and observing circulation of users within facilities that represent the typology being researched.

PROCESS OF DESIGN DOCUMENTATION

The documentation of this process will be through a paper and digital footprint. Below is a list of how this design process will be captured and later on presented:

01 Modeling

Revit 2023
Sketchup 2022

02 Illustration

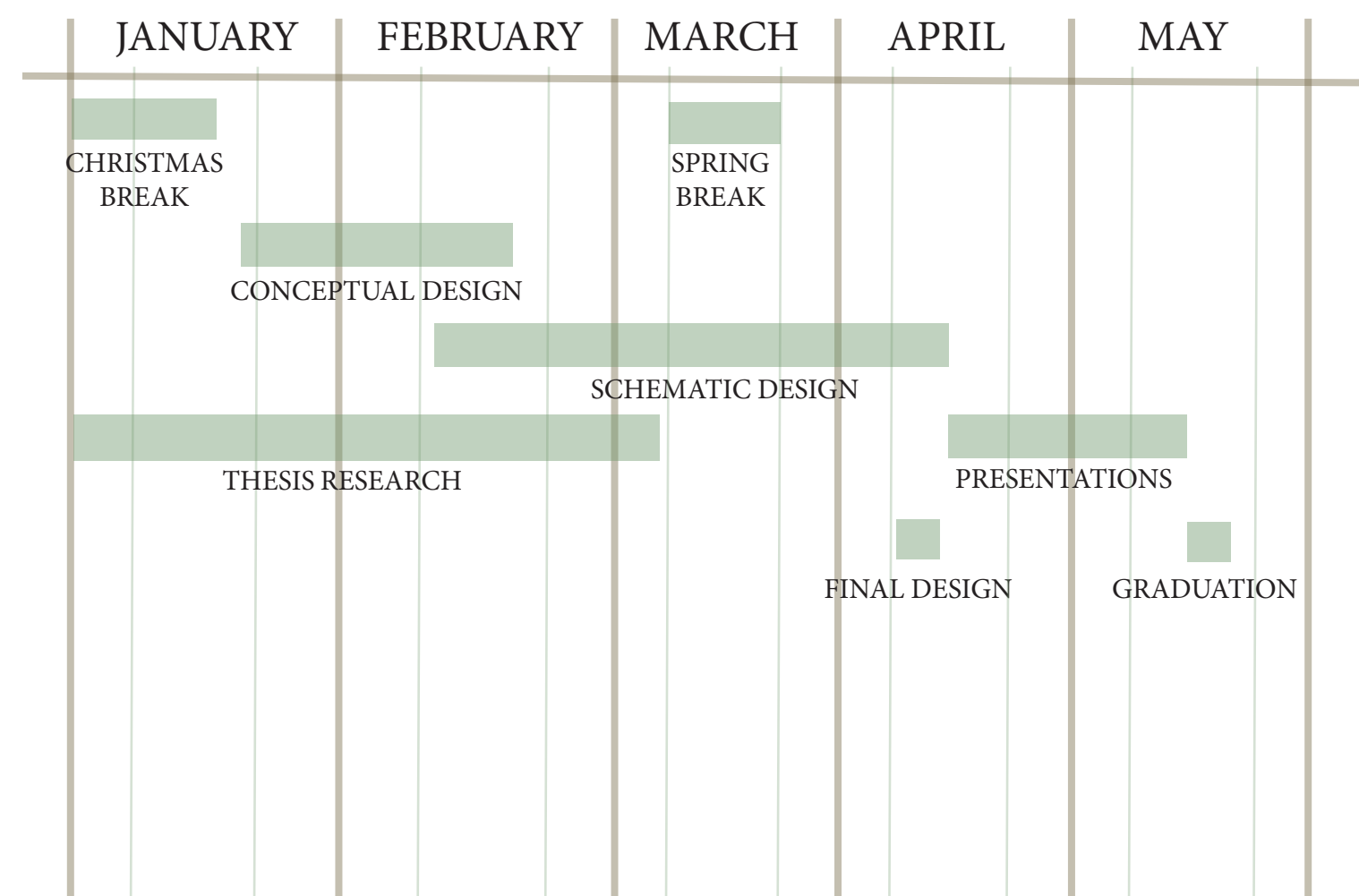
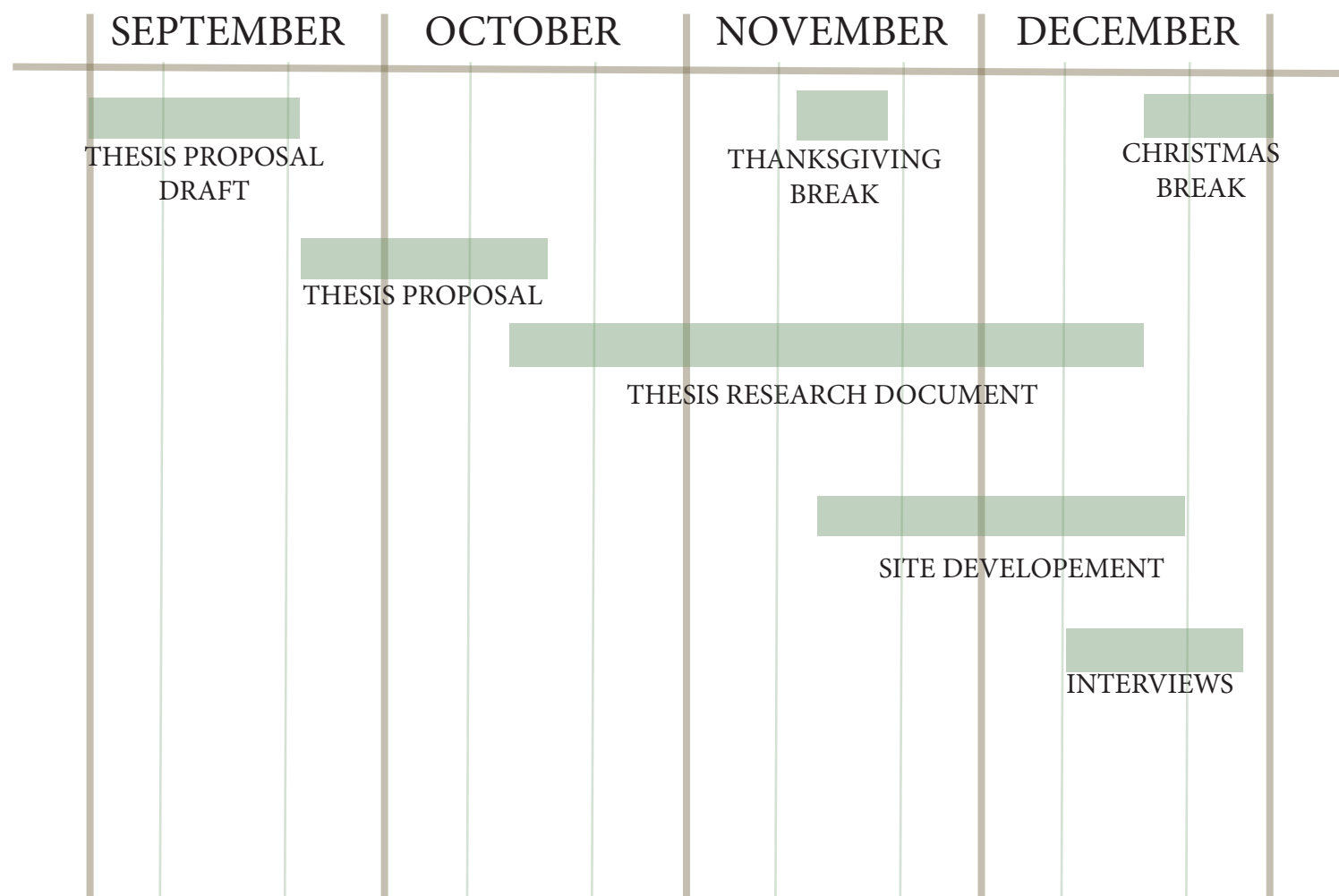
Photoshop 2022
Illustrator 2022
Handsketching

03 Documentation

Photographs
Lumion Renderings

FALL SEMESTER

SPRING SEMESTER



PERFORMANCE

CRITERIA

PERFORMANCE CATEGORIES

1 *SPACE ALLOCATION*

Through a space matrix to show the relation between the different spaces. Analyzing the different spaces and testing out circulation patterns to perform with clients and patients' routes.

2 *PSYCHOLOGICAL IMPACT*

Renderings done in Lumion and Photoshop make spaces appealing to users. Through user experiences and research into how biophilic design is impacting healthcare. The user will communicate their experience through emotions, recovery, and words to the aesthetic and sensory experiences.

3 *ENVIRONMENTAL IMPACT*

Measuring daylighting and energy consumption through simulations using Elumtool and Insight. Following LEED standards will measure and solidify the impact and regeneration that the building is producing and putting back into the environment.

4 *ENERGY CONSUMPTION*

Measured through simulations done in Revit through the program Insight. Insight is the main source of simulation that will be used to incorporate how much consumption healthcare facilities can produce and how to make it meet LEED standards.

5 *BEHAVIORAL PERFORMANCE*

The circulation patterns that are taken by patients, staff and other visitors will show users move through the spaces. Simulations can be done through Revit to measure on the common path of travel which can influence the changes in space allocations to provide the best circulation for each user.

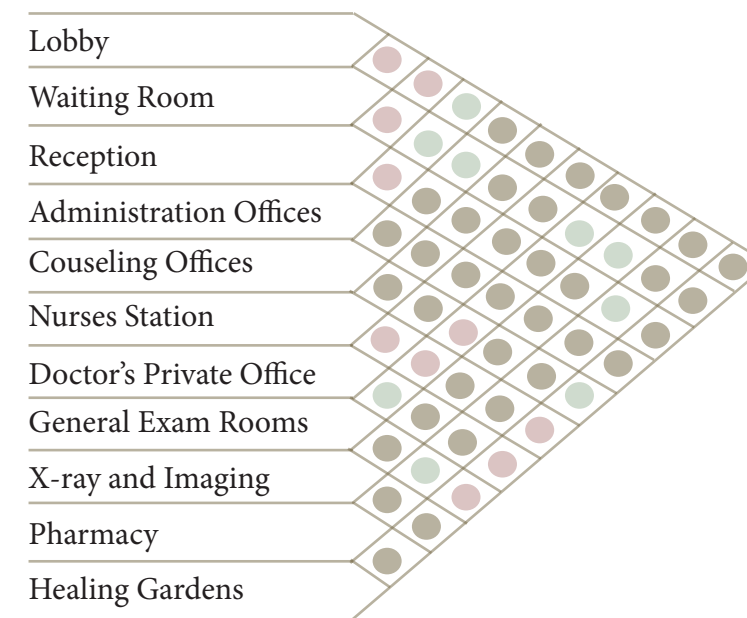
Executive Summary

From performance categories the five that are most applicable are based from user experience and environmental performance. Each is an important aspect that is defined in this research document in relation to healthcare with the implantation of biophilia. The user experience is derived from the concept of space allocation which can be considered the most important aspect in architectural healthcare design. The placing of related spaces to create efficiency between the different users. The behavioral patterns that are seen in the circulation patterns of users create a study to show the placement of spaces that relate to one another. Staff, patients, and visitors each on different routes but ultimately ending in the same place. Showing the most effective ways for staff to go through the hospital and for patients to easily find the right department. A way to emphasis and guide the behavioral patterns is connected to the psychological impact. An impact that will be seen and felt through sensory experiences of different biophilic components that will guide way-finding and other benefits.

The environmental performance is important in the twenty four hour function of healthcare facilities. Using the environment surrounding the facility to improve quality on the interior while giving back to the source it is taking from. The impact of the environmental aspects will be seen and recognized through LEED, standards measured through the recovery time of patients and effectiveness of staff. The performance of a buildings function is to provide pristine facilities for vulnerable patients.

SPACE MATRIX & ALLOCATION TABLES

CLINIC



HOSPITAL

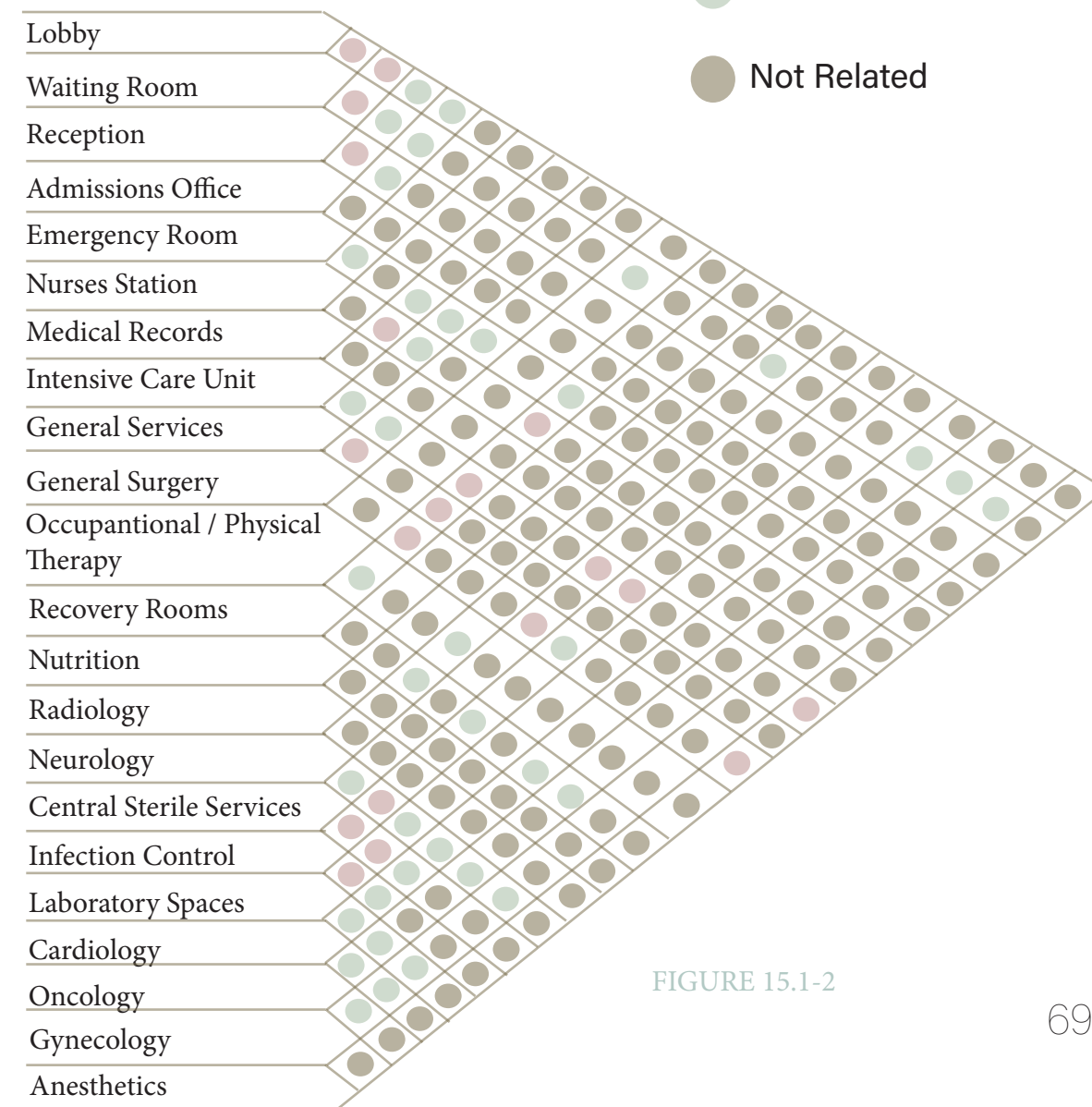


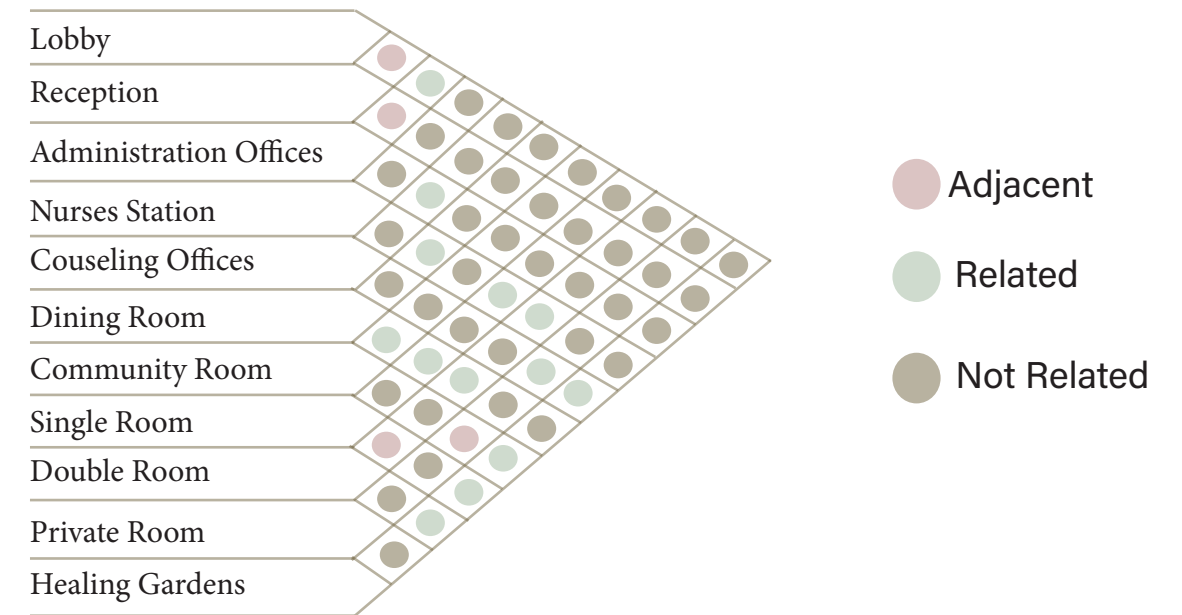
FIGURE 15.1-2

Hospital/ Clinic

	Average S.F.	Percentage (%)
Lobby	200	1.2
Reception	250	1.5
Administration Offices	200	1.2
Nurses Station	150	0.9
Counseling Offices	200	1.2
Doctor's Private Office	350	2.1
General Exam Rooms	250	1.5
X-ray and Imaging	550	3.3
Pharmacy	450	2.7
Emergency Room	2000	11.9
Medical Records	800	4.7
Intensive Care Unit	225	1.3
General Services	325	1.9
General Surgery	775	4.6
PT/OT	600	3.6
Recovery Rooms	275	1.6
Nutrition	450	2.7
Radiology	925	5.5
Neurology	600	3.6
Central Sterile Services	3200	19.0
Infection Control	775	4.6
Laboratory Spaces	500	3.0
Cardiology	550	3.3
Oncology	550	3.3
Gynecology	450	2.7
Anesthetics	625	3.7
Total	16,850	

FIGURE 15.3

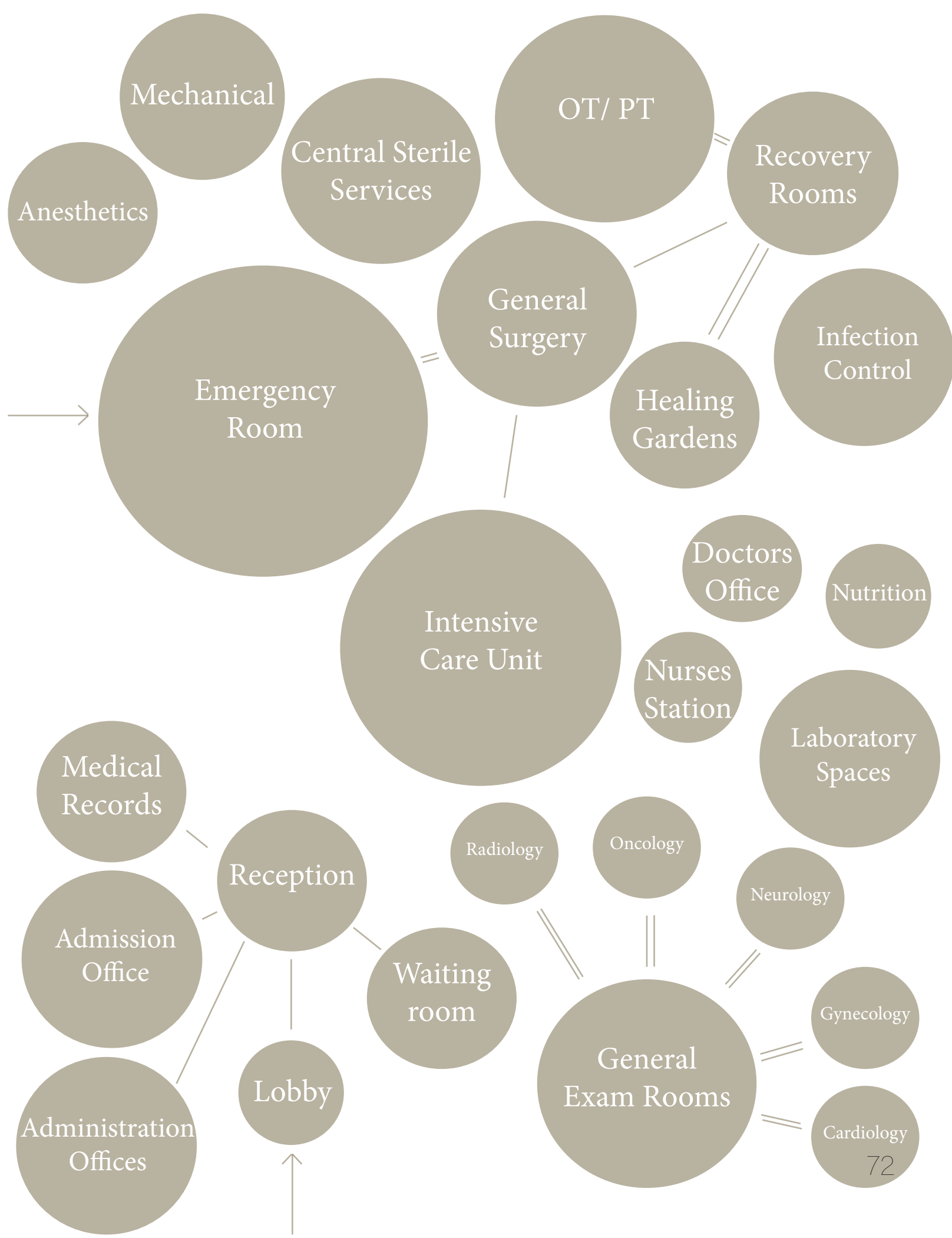
Assisted Living/ Nursing Home



Assisted Living/ Nursing Home

	Average S.F.	Percentage (%)
Lobby	200	6.9
Reception	250	8.6
Administration Offices	200	6.9
Nurses Station	150	5.2
Counseling Offices	200	6.9
Dining Room	400	13.8
Community Room	450	15.5
Single Room	250	8.6
Double Room	500	17.2
Private Room	300	10.3
Total	2,900	

FIGURE 15.4



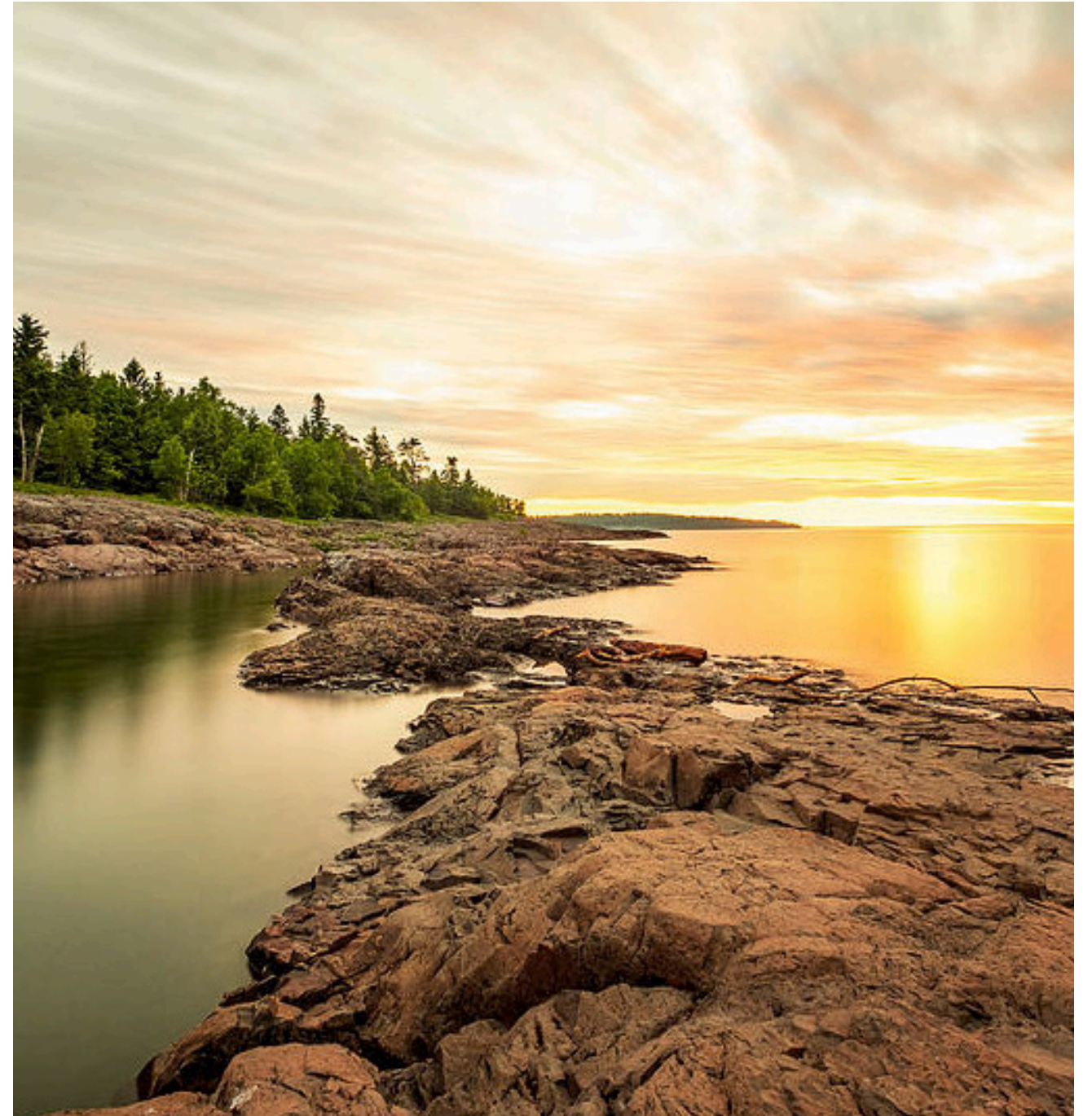
PROGRAM RELATIONSHIP DIAGRAM

 GENERAL CONNECTION
  MAJOR CONNECTION

NO CONNECTION LINE REFERENCES THE RELATED SPACES TO ONE ANOTHER WITH NO SPECIFIC CONNECTION

Exploration and Results

Research Results and Historical Context





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 health 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
Spatial 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

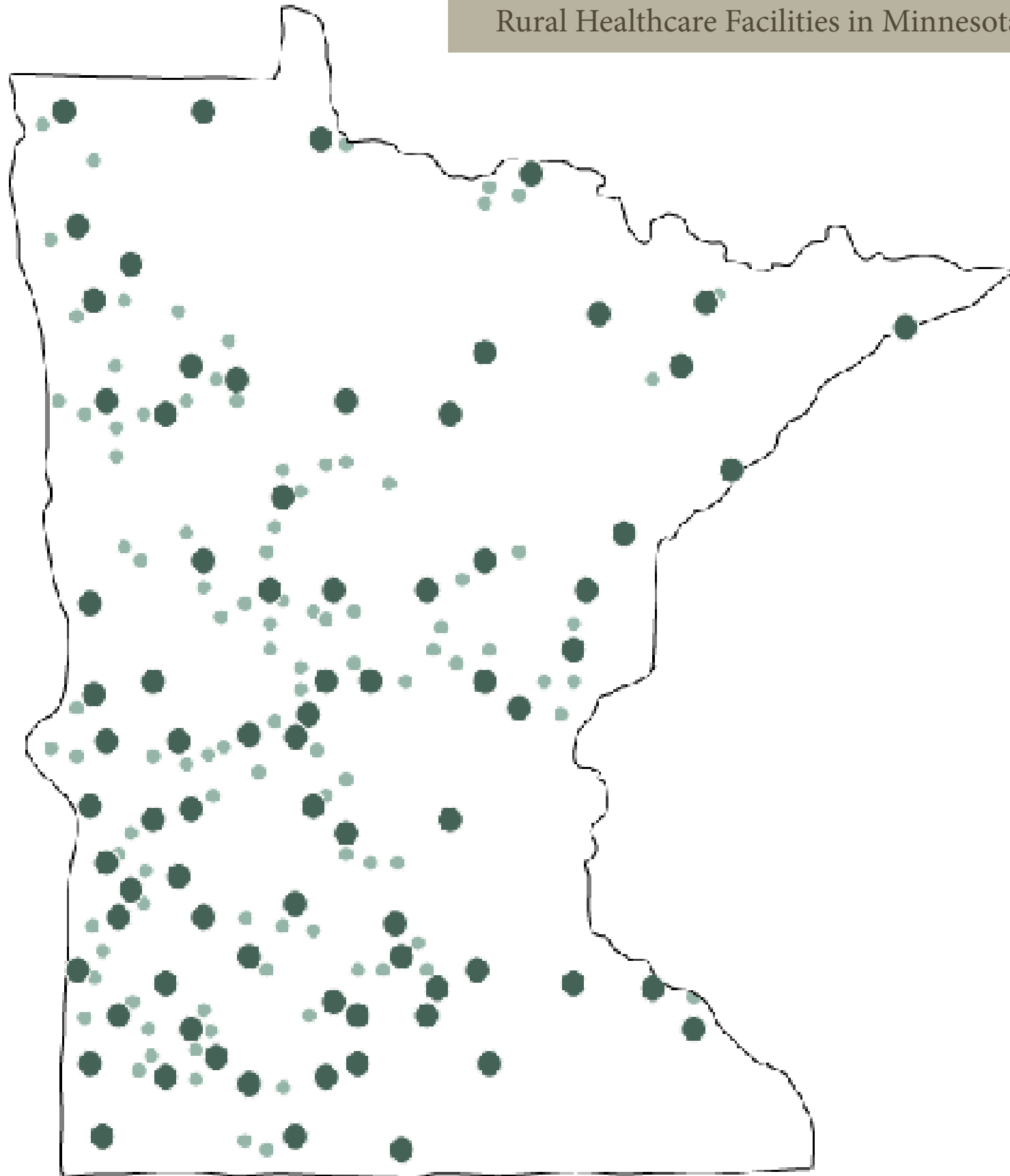


FIGURE 17.1

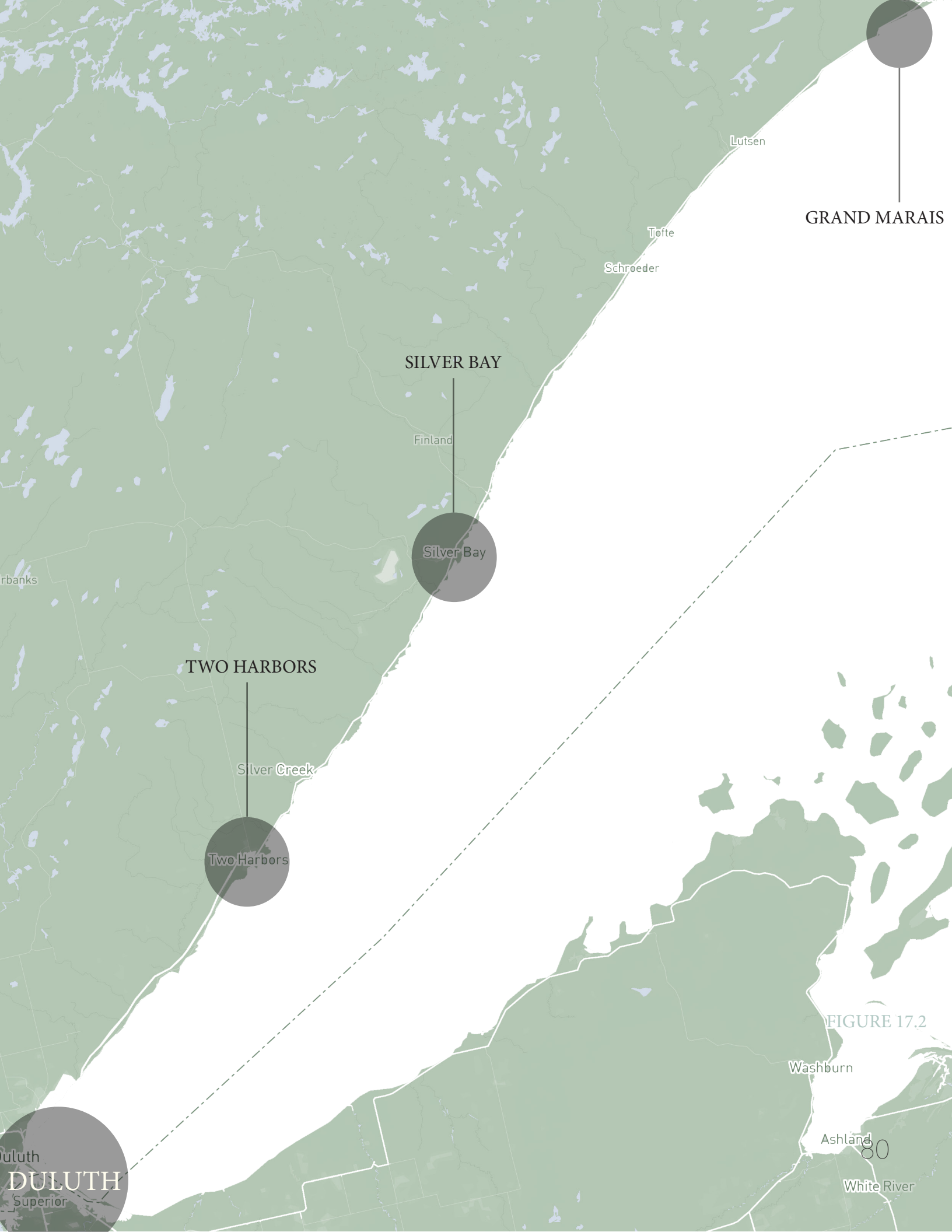
■ Critical Access Hospital ■ Rural Health Clinic

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

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.

Total of 77 critical access hospitals across Minnesota



GRAND MARAIS

SILVER BAY

TWO HARBORS

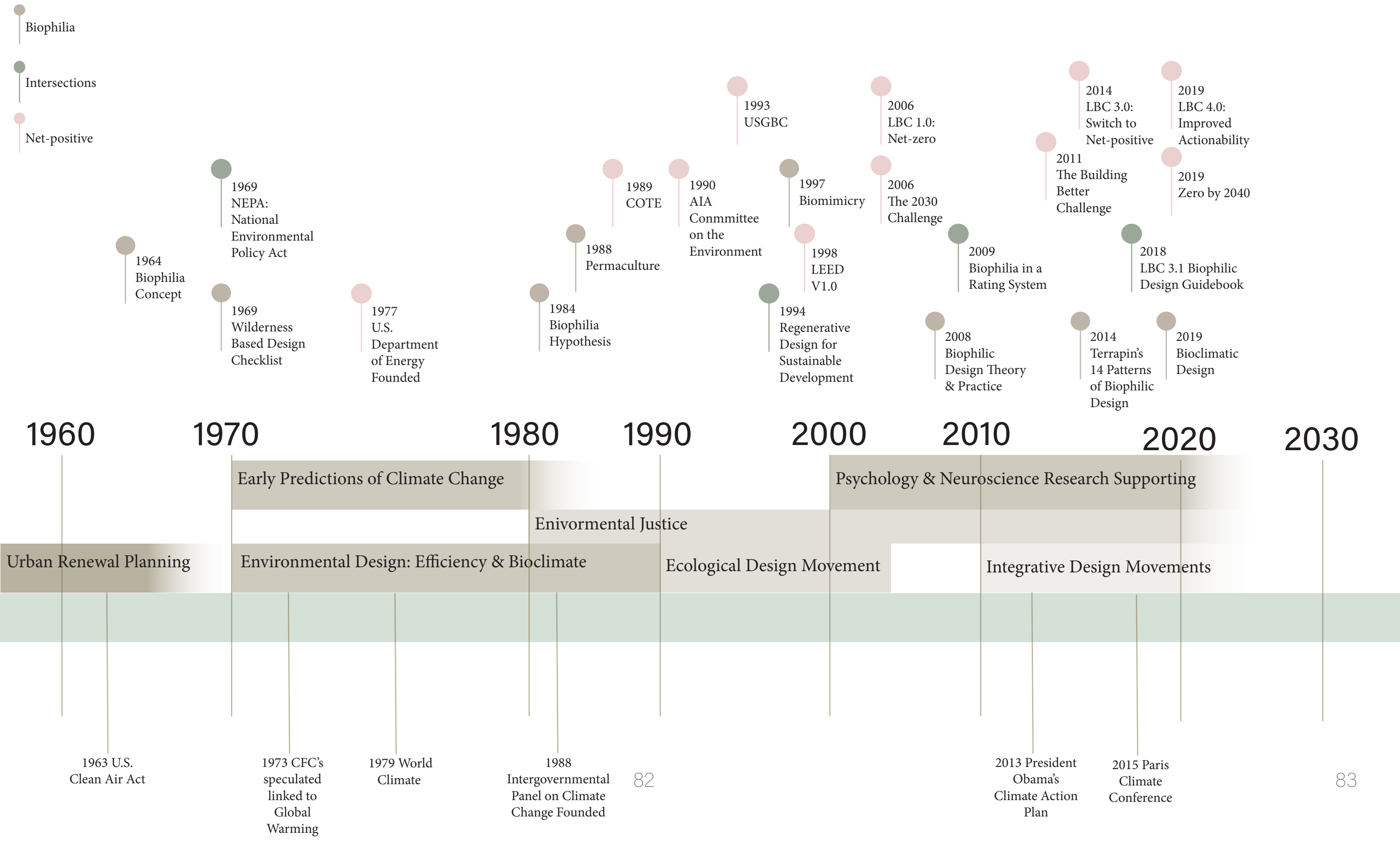
DULUTH

FIGURE 17.2

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.

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 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. An executive from Minnesota Hospital Association described the situation as unsustainable, stating that rural hospitals across the state had a median operating margin of 1.4 percent in 2019 and 30 hospitals reported negative operating margins.

Timeline: Biophilic & Net-Positive Design History



1900

1910

1920

1930

1940

1950

1960

1970

1980

1990

American Medical Association (AMA) becomes a powerful national force.

In 1901, AMA reorganizes as the national organization of state and local associations. This period is the beginning of "organized medicine."

Surgery is now common, especially for removing tumors, infected tonsils, appendectomies, and gynecological operations.

Doctors are no longer expected to provide free services to all hospital patients.

America lags behind European countries in finding value in insuring against the costs of sickness.

American hospitals are now modern scientific institutions, valuing antiseptics and cleanliness, and using medications for the relief of pain.

American Association for Labor Legislation (AALL) organizes first national conference on "social insurance."

Progressive reformers argue for health insurance, seems to be gaining support.

Opposition from physicians and other interest groups, and the entry of the US into the war in 1917 undermine reform effort.

Consistent with the general mood of political complacency, there is no strong effort to change health insurance.

Reformers now emphasize the cost of medical care instead of wages lost to sickness - the relatively higher cost of medical care is a new and dramatic development, especially for the middle class.

Growing cultural influence of the medical profession - physicians' incomes are higher and prestige is established.

Rural health facilities are clearly inadequate.

Penicillin is discovered, but it will be twenty years before it is used to combat infection and disease.

The Depression changes priorities, with greater emphasis on unemployment insurance and "old age" benefits.

Social Security Act is passed, omitting health insurance.

Push for health insurance within the Roosevelt Administration, but politics begins to be influenced by internal government conflicts over priorities.

Against the advice of insurance professionals, Blue Cross begins offering private coverage for hospital care in dozens of states.

Penicillin comes into use.

During the 2nd World War, wage and price controls are placed on American employers. To compete for workers, companies begin to offer health benefits, giving rise to the employer-based system in place today.

President Roosevelt asks Congress for "economic bill of rights," including right to adequate medical care.

President Truman offers national health program plan, proposing a single system that would include all of American society.

At the start of the decade, national health care expenditures are 4.5 percent of the Gross National Product.

Federal responsibility for the sick poor is firmly established.

Many more medications are available now to treat a range of diseases, including infections, glaucoma, and arthritis, and new vaccines become available that prevent dreaded childhood diseases, including polio.

The first successful organ transplant is performed.

In the 1950s, the price of hospital care doubled. Now in the early 1960s, those outside the workplace, especially the elderly, have difficulty affording insurance.

Over 700 insurance companies selling health insurance.

Concern about a "doctor shortage" and the need for more "health manpower" leads to federal measures to expand education in the health professions.

Major medical insurance endorses high-cost medicine.

President Lyndon Johnson signs Medicare and Medicaid into law.

Corporations begin to integrate the hospital system (previously a decentralized structure), enter many other healthcare-related businesses, and consolidate control. Overall, there is a shift toward privatization and corporatization of healthcare.

Under President Reagan, Medicare shifts to payment by diagnosis (DRG) instead of by treatment. Private plans quickly follow suit.

Growing complaints by insurance companies that the traditional fee-for-service method of payment to doctors is being exploited.

"Capitation" payments to doctors become more common.

Healthcare costs are escalating rapidly, partially due to unexpectedly high Medicare expenditures, rapid inflation in the economy, expansion of hospital expenses and profits, and changes in medical care including greater use of technology, medications, and conservative approaches to treatment. American medicine is now seen as in crisis.

The number of women entering the medical profession rises dramatically. In 1970, 9% of medical students are women; by the end of the decade, the proportion exceeds 25%.

World Health Organization declares smallpox eradicated.

Health care costs rise at double the rate of inflation.

Expansion of managed care helps to moderate increases in health care costs.

Federal health care reform legislation fails again to pass in the U.S. Congress.

By the end of the decade there are 44 million Americans, 16 % of the nation, with no health insurance at all.

Human Genome Project to identify all of the more than 100,000 genes in human DNA gets underway.

By June 1990, 139,765 people in the United States have HIV/AIDS, with a 60 percent mortality rate.

Nature Contact and Human Health: A Research Agenda

Howard Frumkin, Gregory N. Bratman, Sara Jo Breslow, et al.

Research: 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.

Psychological Pathways: The Stress Recovery Theory emphasizes the roles that nature plays in the relieving of physiological stressors. The results of this one domain consistently show that natural contact reduces stress; the pathway is direct and is seen through social contact, physical activity, and other factors. All being measured in laboratories and field settings.

Enhanced Immune Function: Nature enhances immune function in two different time scales. One that is consistent with "hygiene hypothesis" coming into contact with microbial and other antigens in natural settings that develop over a span of time. Lastly the short term exposures to some natural substances have been associated with improved natural killer cell activity.

Increased Physical Activity: There are a wide and broad range of health benefits that help in the prevention or management of obesity, cardiovascular disease, some cancers, diabetes, some mental illness and other conditions. The mechanisms by which green surroundings might facilitates physical activities are not well understood.

Improved Air Quality: In rural settings the quality of air is generally considered to be superior than that of urban settings. Benefits must be weighed against the dis-benefits while tree canopies can reduce the levels of particulate matter and gaseous air pollutants but can also worsen asthma in some cases.

Nature extends beyond physical and physiological health mechanisms. It can affect environmental impacts like storm-water run-off, urban noise, island heat effect and reduce energy demand. Larger natural areas can contribute more to the environmental impact that was stated in the headings above. Nature contact offers promise both as a prevention and treatment. There are many questions that have went unanswered about the health benefits that surround this concept.

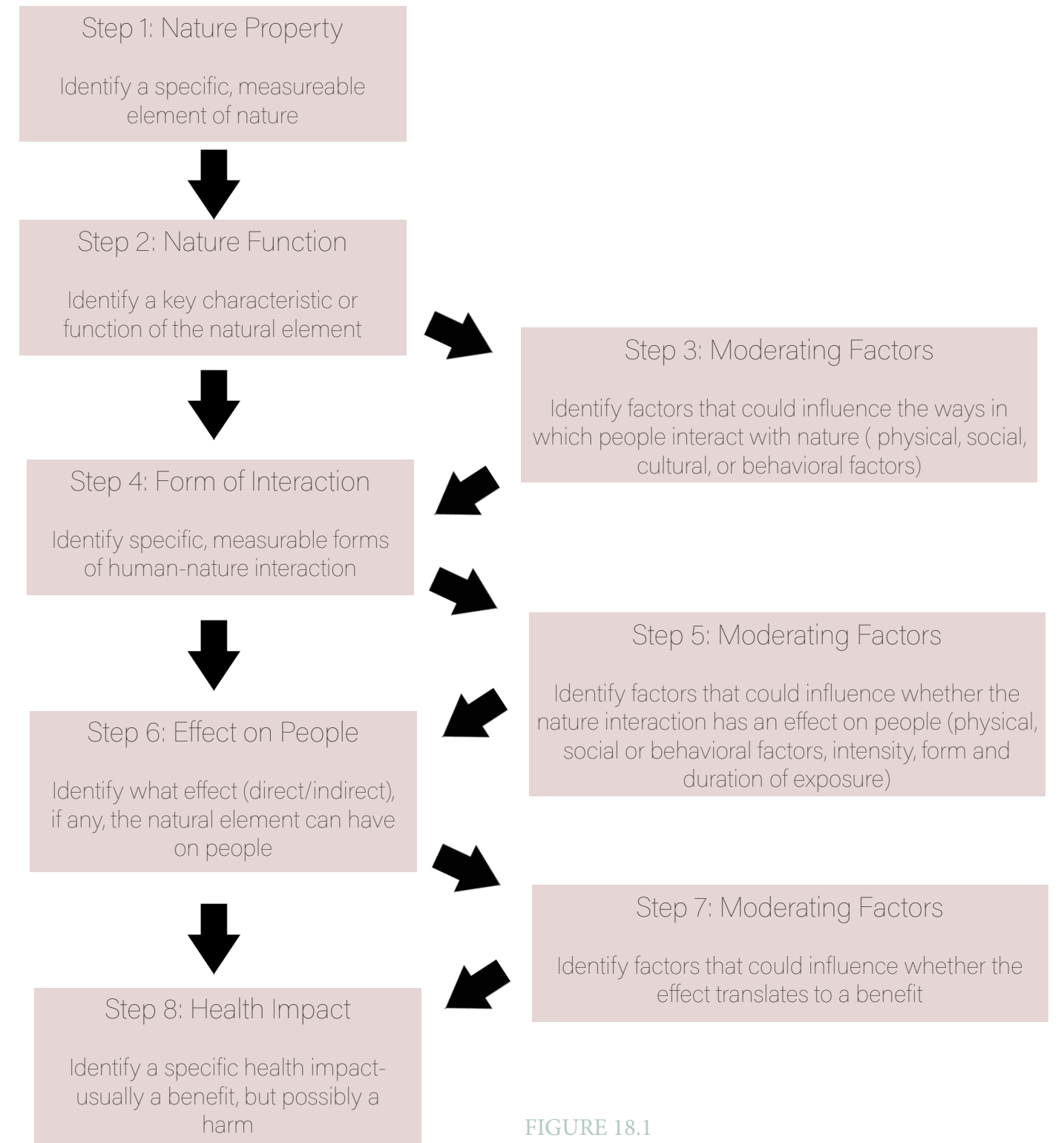


FIGURE 18.1

Nature's Contributions to Human Health: A Missing Link to Primary Health Care?

Laura Lauwers, Hilde Bastiaens, Roy Remmen and Hans Keune

Research: 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". A development in nature-based care it is considered to be an umbrella term for healthcare interventions related to nature. The diverse range of sub themes related allow for the connection to be fully understood. An argument that was focused on in this article was how environmental impacts like natural disasters have had great impacts on healthcare including costs and infrastructure.

A challenge that is faced is that populations in poverty are more dependent on natural resources in their communities due to access of healthcare. There have been many reports of budget cuts in the area of preventative care. The role of primary health care is clearly defined as nature based care in the terms of disease prevention and health promotion with the knowledge of traditional medicine and where green design is leaning toward in the future. This growing interest in the topic opens up a multitude of opportunities to research into the different benefits of natures effectiveness in healthcare settings.

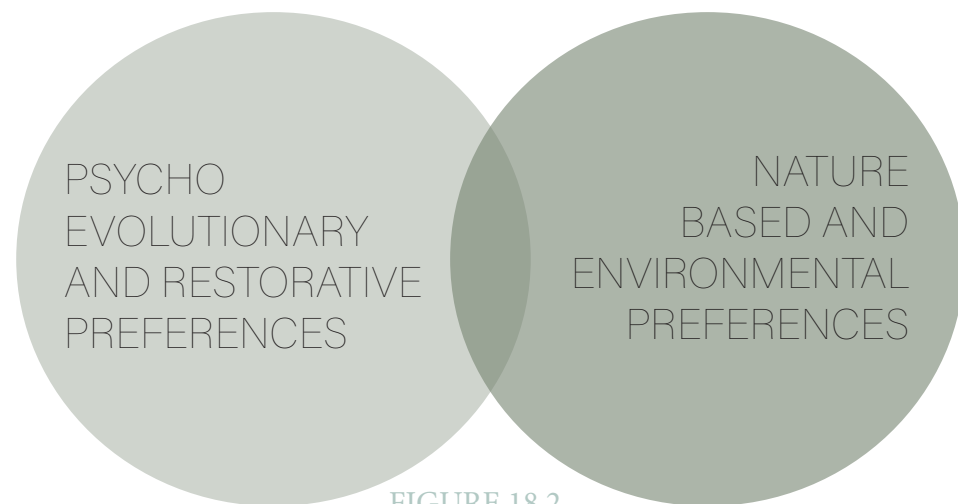
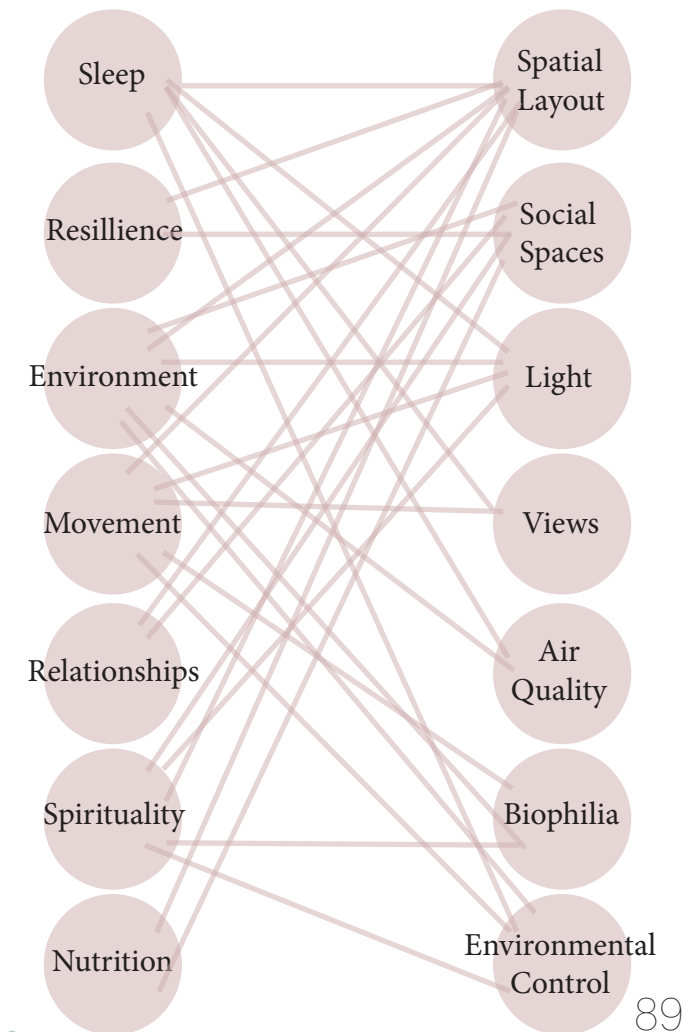


FIGURE 18.2

Building and Environment

Altaf Engineer, Ria Gualano, Robert Crocker, et al.

Research: Integrative health is defined as "healing- oriented medicine that takes the whole person into account. The framework guides design professionals in understanding how elements can support integrative health. Common themes are described including the access to natural and circadian lighting, views, connection to nature, air quality and spatial layout. All of these can be influenced by the surrounding environment and users of the space feel the effects of these integrative changes. It is not possible to have a healthy built environment without healthy air quality in which viruses, microorganisms, particulates, allergen, and other pollutants. Positive health facilitates patient-centered care through six dimensions: bodily functions, mental functions, perceptions, spirituality and existentially, quality of life, social participation and daily functioning. A nourishing environment contains daily doses of sunlight , reduced amount of stress, green spaces, peaceful views of nature, nourishing food sources, body movement and balances of relationships and sleep.



Many environmental features impact many aspects of health. These layers are all interconnected in complex networks and are shown as overlapping to convey the many interrelationships between them.

FIGURE 18.3

Biophilia and Salutogenesis as Restorative Design Approaches in Healthcare Architecture

Mohamed Abdelaal and Veronica Soebarto

Research: 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. The focus of this article is on the two nature-related approaches: salutogenic and biophilic design.

Salutogenic: the framework that sources stress and introduces the wellness factors that support the healing process.

Biophilia: practice of connecting people and nature within built environments.

Hospitals have the power to reshape the care setting and influence the built environment with its users and surrounding community. Investigating the different types of benefits of incorporating nature and seeing the interactions with users. There are many healthcare facilities that lack the understanding of the psychological needs of patients rather than focusing on the physical recovery and importance. Natural features help restore this balance and sense of coherence. Nature in no way has the power to heal physical illness but can promote the psychological benefits to reduce their duration and quality of recovery. Biophilic patterns that are to be considered: visual and non-visual connections with nature, airflow, presence of water, and diffused lighting sources along with natural daylighting. The topic of health-promoting built environment is rarely covered or studied. These principles will develop the future of healthcare design.

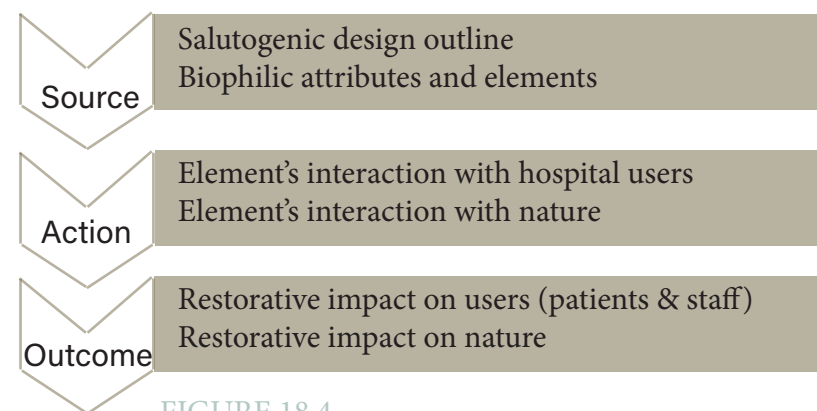


FIGURE 18.4

Biophilia in Practice: Buildings that Connect People with Nature

Alex Wilson

Research: Stephen Kellert, Ph.D. of Yale University refers biophilia as "the missing link in sustainable design." We as human beings have an innate and evolutionary connection to nature. It was evolved as an adaptive mechanism bringing them back to their roots and having access to resources for survival. It is in our nature to fight to keep biophilic features or place them, themselves if there are none. Biophilic elements have benefits that are real and can be measured based off of productivity, emotional-wellbeing, stress reduction, learning, and healing. The placement and preservation of these features foster a greater appreciation for nature and will lead to the protection of the areas. Keeping a clean environment for the community. Exposure of natural elements reduces pain and stress through different mechanisms. Cognitive mechanisms such as norepinephrine and serotonin that can block pain pathways to the central nervous system from views of nature and the exposure of natural sunlight,

Balancing Biophilia with other green design elements. Using large glazed windows, operable windows, and indoor-outdoor spaces. Some of these strategies conflict with the more high-density development. In relation to LEED Standards biophilic is related and rewarded through this accreditation. Reducing impacts of storm water run off, limiting heat-island effects, restoring ecosystems, and can reduce energy use of many of the mechanical systems. Nature comes in fractal patterns or shapes that are defined and measured mathematically. Design is constantly changing and using these standards to expand into the future of biophilic design. The knowledge about health benefits of both direct and simulated contact and mechanisms related to nature.

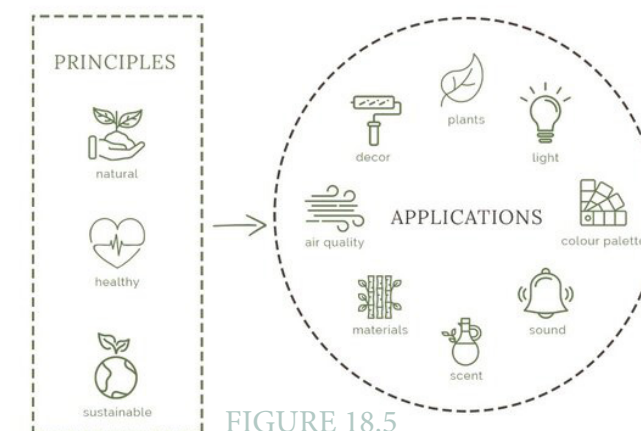


FIGURE 18.5

Interview with Carisa Buegler

Director of Operations at the New Ulm Medical Center

December 23, 2022

Job Description: Manages the daily operations of the company in overseeing several departments. An important part of the role is directing actions of the organization and managers to improve efficiency and reduce costs. All the functions of the healthcare facility are to benefit the patients and staff who are utilizing the spaces and the director makes sure that is happening.

GOALS TO THINK ABOUT:



HOSPITAL STATS:

- | | |
|-----------------------|--------------------------------|
| 120 Exam Rooms | Average 3 day stay |
| 3 Operating Rooms | Water harvesting from hillside |
| 5-10 Surgeries a day | 400-600 patients a day |
| 2 patients to 1 staff | |

The most important thing to think about in healthcare is what will the room be used for in the next five years. There are constant changes in this field, where it has gone from inpatient care to more outpatient care with the progression of technology. There is a consistent push and pull especially with a pandemic that the world has been experiencing for three years now. Giving the demand for inpatient care that has doubled compared to past year. Insurance is a huge deciding factor in why critical access hospitals have been more outpatient based.

In the last few years there has been an alarming rate of critical access hospitals that are closing in Minnesota but in the United States as well. The New Ulm area has three off site clinics to help with the on going demand for healthcare. The New Ulm Medical Center serves around 30,000 people in the region. The prices show in hospitals because of the twenty-four seven care, it cannot stop for anything. Finding cost reducing technologies that help with the high costs and environmental impact the facilities gives off. This building is built into the hillside and gives them the opportunity to harvest water for non-potable water.

Design Implementation

The Lake View Medical Center

SITE SELECTION



REGENERATIVE MATERIALS



Copper



Bamboo



Living Wall



Precast Concrete

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

Copper in a certain form is an essential element for the human body for bone and cartilage tissue engineering. Copper is a material that weathers and changes color over time. When hit and scratched the marks stay but the weathering only corrodes to how deep the scratches go.

Bamboo is a sustainable building material because it grows fifteen times faster than other traditional lumber like pine. Bamboo also self-regenerates using its own roots to replenish the surrounding vegetation. Nature in itself heals itself, and using bamboo will help preserve the biophilic elements that help those who are healing while creating better air quality within spaces.

Living walls bring in the elements of nature while giving off beneficial effects. 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 this thesis, stress reduction, filter out air pollutants and increased efficiency.

Lastly one would not expect any type of concrete to be considered as a regenerative material. But with the use of carbonic anhydrase, the same enzyme that transfers CO₂ from cells into the blood stream, it has regenerative characteristics. 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.

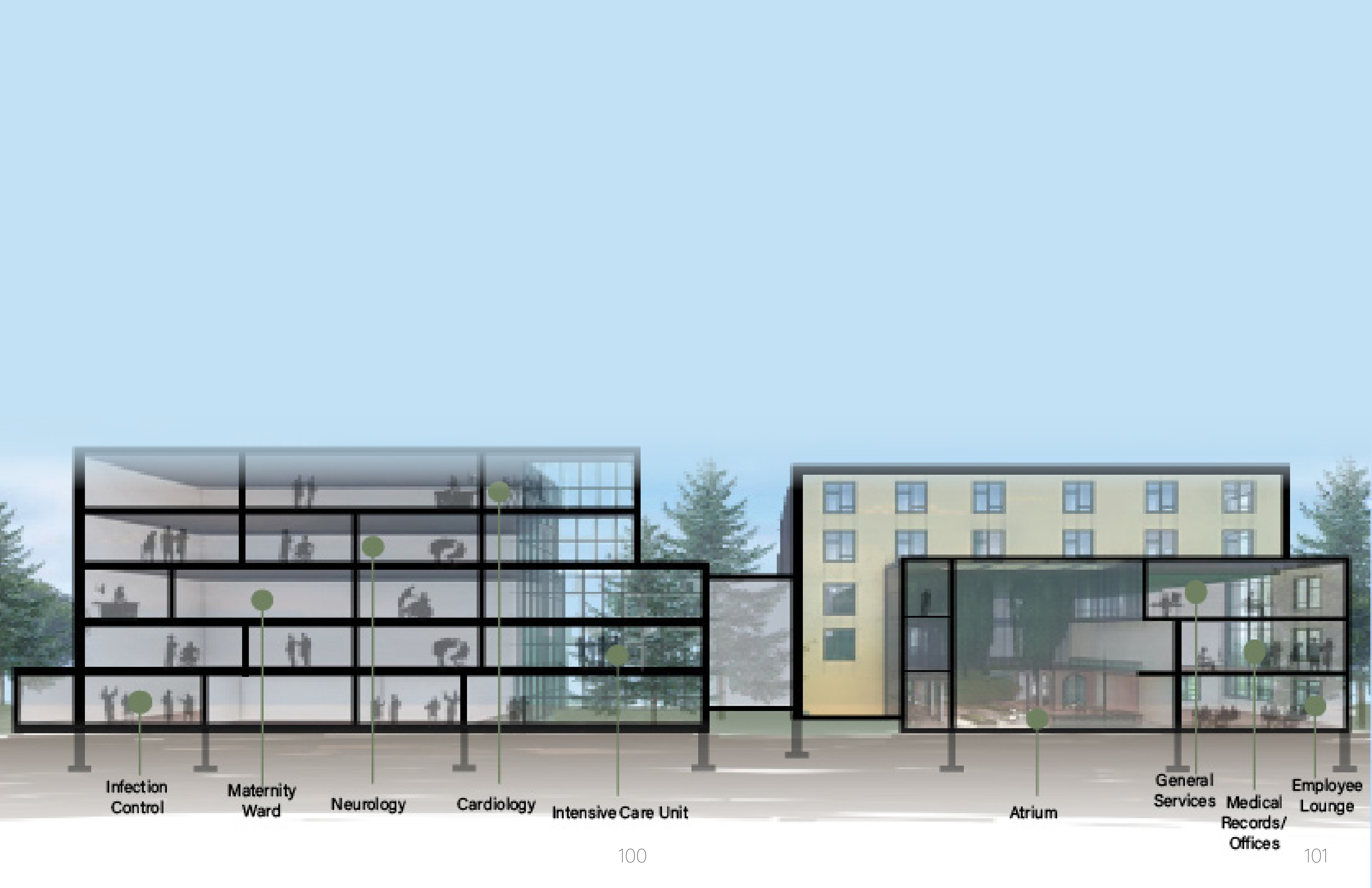


FIRST FLOOR PLAN



First Floor Key Plan

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



Infection Control

Maternity Ward

Neurology

Cardiology

Intensive Care Unit

Atrium

General Services

Medical Records/
Offices

Employee Lounge



LAKE VIEW MEDICAL CENTER



Atrium





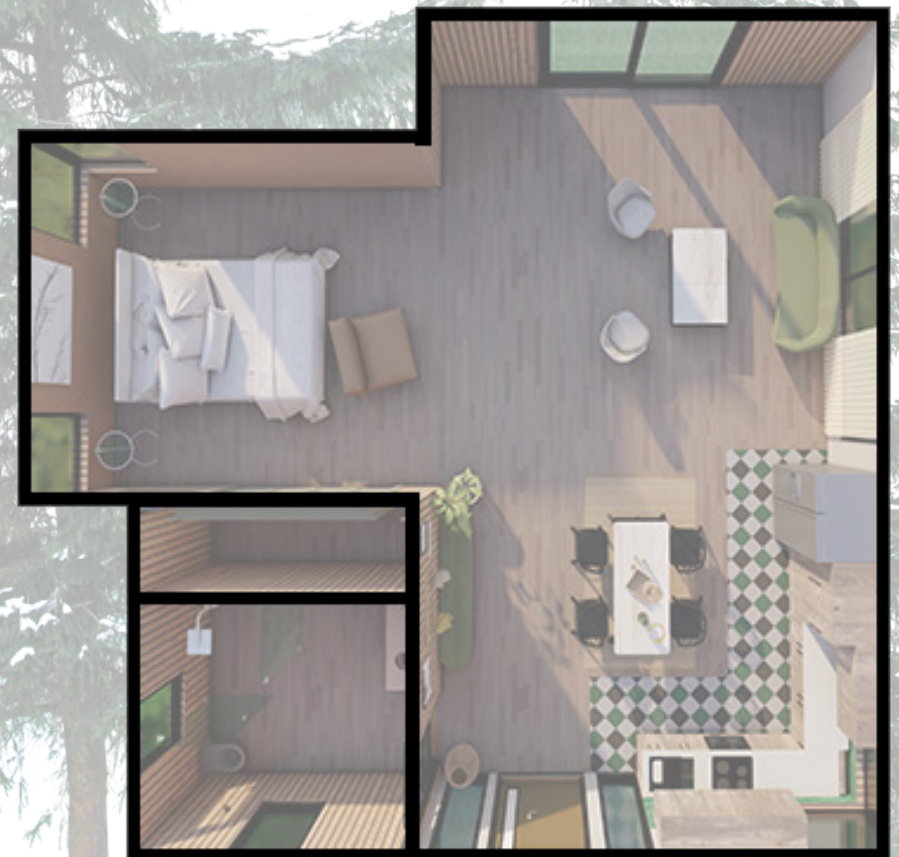
Patient Recovery Room



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.

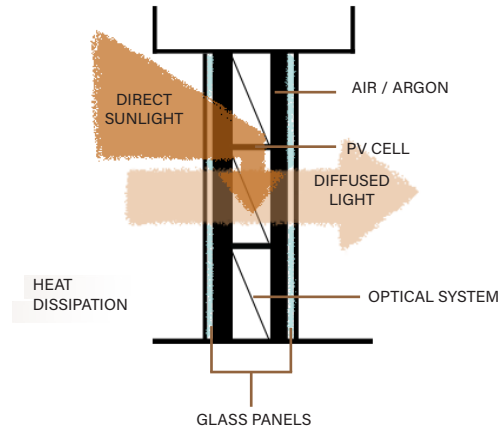




Sustainable Systems

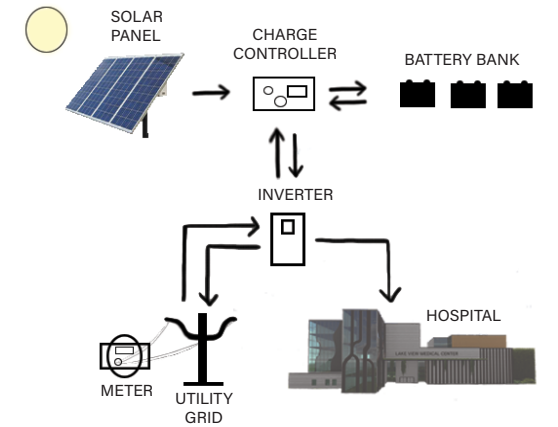
Our society is continually moving toward a more sustainable way of living. In the hospital setting they are operating 24 hours a day 7 days a week. Healthcare systems are extremely expensive, and the objectives of sustainability are to reduce the use of non-renewable resources, minimizing waste and creating healthy environments. Another element of using them is to lower the cost over the lifetime of the building.

PHOTOVOLTAIC WINDOW SYSTEM



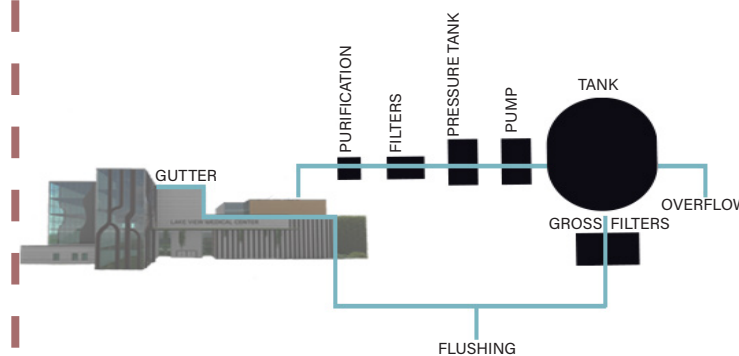
PV Glass generates free and clean electricity, turning buildings into vertical power generators. The glass allows natural light to pass through while providing thermal and sound insulation. The capacity to generate free clean electricity from the sun, it enables buildings to drastically improve their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

Final Board Design

LAKE VIEW MEDICAL CENTER

The Reconnection of Nature and Health



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 footprint 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.

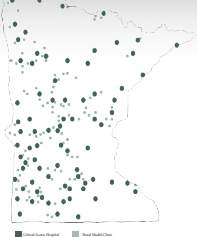
The critical access program was created in 1997 after many rural hospitals were closing alarmingly fast. This program was to make sure Americans in rural and isolated areas to still have access to healthcare. There is a loophole within the requirements that consider many hospitals critical access when they are not meeting the requirements. It means closing 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 ecopsychology 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 it 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 until 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.

Rural Healthcare Facilities in Minnesota



SITE SELECTION

The site selection was based on the main ideas of biophilia and shinrin-yoku. Both concepts bring the natural aspects of the site into the built forms that are being proposed. This is a larger site outside of the city's limits, surrounded by dense forest and has immense views of Lake Superior. With the city of Duluth being just 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 biophilic design can be a prominent element.

REGENERATIVE MATERIALS

Copper

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

Bamboo

Copper in a certain form is an essential element for the human body for bone and cartilage tissue engineering. Copper as a material over the year weathers and changes color. When hit and scratched the marks stay but the weathering is different in each spot.

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 regenerate the grass after harvest. Nature is best healed itself and using bamboo will, in the long run, help preserve the biophilic elements that help those who are healing while creating better air quality in spaces.

Precast Concrete

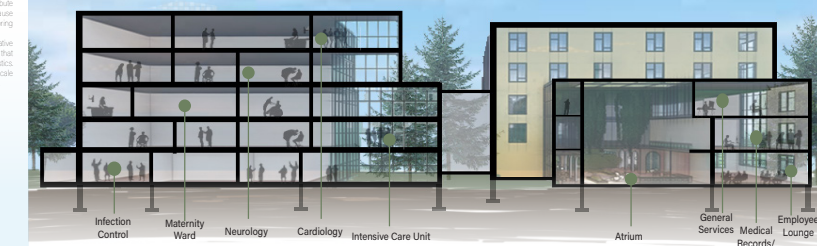
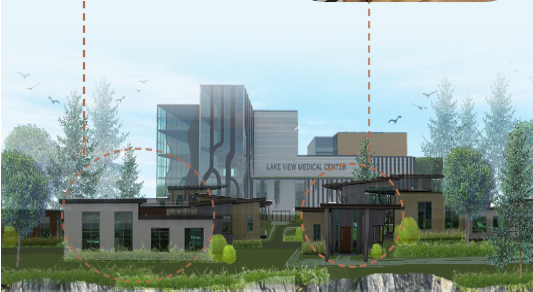
In the 21st century, our cities face many challenges, including overheating air pollution, surface flooding and lack of biodiversity. The effects of climate change contribute to the goals of this thesis, stress reduction, better air quality that can cause respiratory issues and other discomfort, increased efficiency. Living walls bring in the elements of nature while gaining all the beneficial effects.

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

Nursing Home



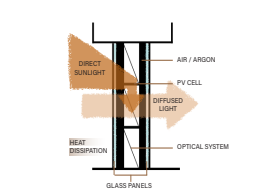
Senior Assisted Living



SUSTAINABLE SYSTEMS

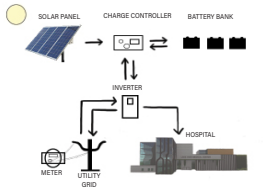
Healthcare systems are extremely expensive because of the twenty-four seven care that hospitals provide. The objectives of sustainability are to reduce the release of non-renewable resources, minimize waste and create healthy environments. Another element of using sustainable systems is lowering costs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

PHOTOVOLTAIC WINDOW SYSTEM



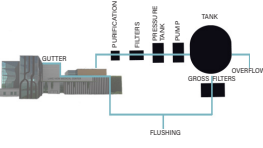
PV Glass generates free and clean electricity, turning buildings into vertical power generators. The glass allows natural light to pass through while providing thermal and sound insulation. The capacity to generate free clean electricity from the sun, it enables buildings to drastically improve their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

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 systems provide an alternative water source to the facilities. If 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.

REFERENCES

- + 14 patterns of biophilic design. Terrapin Home - Terrapin Bright Green. (2014, September 12). Retrieved October 12, 2022, from <https://www.terrapinbrightgreen.com/reports/14-patterns/>
- + Architecture projects. ArchDaily. (2008). Retrieved October 13, 2022, from https://www.archdaily.com/search/projects?ad_source=jv-header&ad_name=main-menu
- + Case study: Nature inspires healing from outside in - interior design. Healthcare Facilities Today. (n.d.). Retrieved October 12, 2022, from <https://www.healthcarefacilitiestoday.com/posts/Case-Study-Nature-Inspires-Healing-from-Outside-In--26204>
- + Engineer, A., Gualano, R. J., Crocker, R. L., Smith, J. L., Maizes, V., Weil, A., & Sternberg, E. M. (2021). An integrative health framework for wellbeing in the built environment. *Building and Environment*, 205, [108253]. <https://doi.org/10.1016/j.buildenv.2021.108253>
- + Frumkin, H., Bratman, G. N., Breslow, S. J., Cochran, B., Kahn, P. H., Jr, Lawler, J. J., Levin, P. S., Tandon, P. S., Varanasi, U., Wolf, K. L., & Wood, S. A. (2017). Nature Contact and Human Health: A Research Agenda. *Environmental health perspectives*, 125(7), 075001. <https://doi.org/10.1289/EHP1663>
- + Gonchar, J. (2012). Nature nurtures: two hospitals in very different settings rely on similar strategies to create environments for healing. *Architectural Record*, 200(8), 114.
- + How can biophilic hospital design aid mental health and patient recovery? Forest Homes. (2021, May 13). Retrieved October 12, 2022, from <https://www.foresthomesstore.com/blogs/decor-for-wellbeing/how-can-biophilic-hospital-design-aid-mental-health-and-patient-recovery>
- + Johnson, J. (2022, September 19). River & Land Preservation Illinois. The Conservation Foundation. Retrieved October 12, 2022, from <https://www.theconservationfoundation.org/>
- + Lauwers, L., Bastiaens, H., Remmen, R., & Keune, H. (2020). Nature's Contributions to Human Health: A Missing Link to Primary Health Care? A Scoping Review of International Overview Reports and Scientific Evidence. *Frontiers in public health*, 8, 52. <https://doi.org/10.3389/fpubh.2020.00052>
- + Mohamed S. Abdelaal & Veronica Soebarto (2019) Biophilia and Salutogenesis as restorative design approaches in healthcare architecture, *Architectural Science Review*, 62:3, 195-205.
- + Morley, M. (2021, March 28). Guide to biophilic design in Offices & Coworking Spaces. wellness Real Estate & Hotel consultants. Retrieved December 15, 2022, from <https://biofilico.com/news/guide-to-biophilic-design-in-offices-coworking-spaces>
- + Naples. Watercrest Senior Living Group. (n.d.). Retrieved October 12, 2022, from https://watercrestseniorliving.com/naples/?gclid=CjwKCAjw1ICZBhAzEiwAFfvFhCKqX02XkULQuHTsR6SH7l6-jFs57wI5A-CKcTeshfzw1GDUVFyphRoCsPcQAvD_BwE
- + Public Broadcasting Service. (n.d.). Healthcare crisis: Healthcare timeline. PBS. Retrieved December 15, 2022, from <https://www.pbs.org/healthcarecrisis/history.htm>
- + Rytzell, H. (2018, May 16). Mother nature takes a peek into medical facilities. Medium. Retrieved October 12, 2022, from <https://medium.com/the-healthy-city/mother-nature-takes-a-peek-into-medical-facilities-f62d4b76c6c9>
- + Stratis Health. (2022, September 30). Strengthening Minnesota's Rural Critical Access Hospitals. Stratis Health. Retrieved December 15, 2022, from <https://stratishealth.org/initiative/strengthening-minnesotas-rural-critical-access-hospitals/>
- + University of Minnesota. (2022). TIMELINE: Biophilic & Net-Positive Design History. Timeline & History of Biophilic; Net-Positive Design | Biophilic Net-Positive Design Project. Retrieved December 15, 2022, from <https://biophilicdesign.umn.edu/integration/timeline-history-biophilic-net-positive-design>
- + Wilson, A. (2006, July 9). Biophilia in Practice: Buildings that Connect People with Nature. Retrieved from <https://www.buildinggreen.com/feature/biophilia-practice-buildings-connect-people-nature>

PREVIOUS STUDIO EXPERIENCE

Second Year

FALL 2019

Ron Ramsey

*Single Family | Artist House
Facility | Minneapolis Rowing Club Boat House*

SPRING 2020

*Single Family | Cripple Creek Dwelling
Mixed-Use | Boutique Hotel*

Emily Guo

Third Year

FALL 2020

Regin Schwaen

*International Competition | City Puzzle + Puzzle City
Museum | Museum for Nekoma*

SPRING 2021

*Healthcare | Day Surgery Clinic
Lanz Competition | Red River Pavilions*

Cindy Urness

Fourth Year

FALL 2021

Mark Barnhouse

Capstone | Miami High Rise

SPRING 2022

*Single Family | Marvin Windows Lake House
Mixed-Use | Low Income Housing*

David Crutchfield

Graduate

FALL 2022 | SPRING 2023

Cindy Urness

*Facility | Wetlands Research Laboratory
Capstone | Thesis*