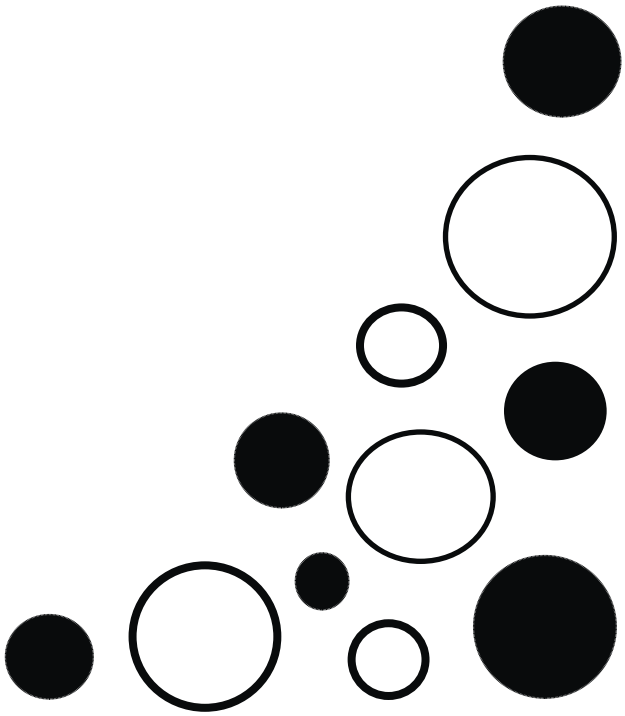
Rehabilitation Through Environmental Attributes



Stephanie Louis

Rehabilitation Through Environmental Attributes

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

by

Stephanie Louis

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

4/7/2010
Primary Thesis Advisor

4/7/2010
Thesis Committee Chair

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Table of Contents

This thesis explores some possible answers to the question, "What is the correlation between physical, social, and emotional attributes?" The typology examined for this thesis is a physical rehabilitation facility. People's physical, social, and emotional attributes and behaviors affect both them and the environment in which they inhabit on a daily basis. The Theoretical Premise/Unifying Idea which guides the research is, "The physical environment is changed because of the changes in the day to day behavior of people." The Project Justification is, "People change others and the environment in ways they may not see and by ways they do not understand. Functional, sustainable designs should be developed to ground people in their relationship to the world."

The environment has its own powers of healing the sick and should be incorporated into the design concept. Those using the facility will be patients, staff, and family members from the Duluth area and those traveling to Duluth for treatment. The facility will be divided into four sections, spaces for staff, doctors, patients, and general usage areas. The Center will be located in the Kenwood district of Duluth, Minnesota. Research will be done through investigating case studies and environmental studies, and be placed in a binder to be reviewed periodically.

The Physical Rehabilitation Center is an out-patient treatment center around 28,000 square feet. The emphasis of this thesis is to incorporate the environment as a form of treatment, into the property of the Center. The environment is another aspect of treatment beyond that found within the built environment. In order for an individual to heal fully, the mind, the soul, and the body need to be healed in unity with one another. Aqua therapy is a new trend in the field of physical therapy and will be incorporated into the design as a treatment.

Key Words: Attributes, physical environment, functional, sustainable designs, facility, environmental studies, out-patient, emphasis, aqua therapy, unity

What is the correlation between physical, social, and emotional attributes?

Statement Of Intent

The Project Typology:

Physical Rehabilitation Facility

The Claim:

People's physical, social, and emotional attributes and behaviors affect both mankind and the environment in which they inhabit on a daily basis.

Premises:

People are influenced by others and the circumstances of life.

Situations occur daily, causing people to be affected by their own and others behaviors, which in turn influence decisions.

People and their environments are changed based on the circumstances which affect them and lead them to react in a way which may not be in their best interest.

The Theoretical Premise/Unifying Idea:

The physical environment is changed because of the changes in the day to day behavior of people.

The Project Justification:

People change others and the environment in ways they may not see and by ways they do not understand. Functional, sustainable designs should be developed to ground people in their relationship to the world.

Proposal

Lives change drastically after a severe illness or accident. An entire family or community can be negatively affected when a disability occurs suddenly. Learning to deal with and overcome this new disability is crucial to recovering a sense of the whole self. Once people have learned to live and work with their physical impairment, they are able to move on and function in society.

When something unexpected happens to an individual and a family, it can affect an entire community. The creation of a reliable treatment facility can bring peace to the individual, a family, and a community. Healing of the entire self also heals the family and community.

The environment and its inhabitants are changed by the actions of other people. Nature has its own powers of healing, but it can be destroyed if not preserved and used to create a positive experience.

A Physical Rehabilitation Center is a place where people with physical impairments come for reliable, trusted treatment. Healing needs to happen on multiple levels: the soul, the mind, and the body. These three aspects of an individual need to be healed as a whole, in order for the individual to completely recover.

The objective of the project is to provide healthy, reliable physical rehabilitation services to the residents of Duluth, Minnesota, the surrounding area, and those traveling to Duluth to seek physical rehabilitation. The Physical Rehabilitation Center is a place where people with a physical impairment are able to learn, grow, and overcome their disability.

A local hospital corporation will be the owner of the center which will be staffed by their own therapists and intern students at the local colleges. The number of patients will vary throughout the year and from year to year. There is easy access to and from the site with a stoplight for traffic control and plenty of parking available on site.

Once people have learned how to live with their physical impairment after completing rehabilitation, a ripple effect will occur affecting all those who come in contact with them.

The project typology is a Physical Rehabilitation Center. The Physical Rehabilitation Center needs to be divided into four sections: faculty spaces, physician spaces, patient spaces, and general spaces.

1. Types of Therapy Provided

a. Aqua Therapy
b. Sports Medicine
c. Lymphedema Therapy
d. Spine Rehab
e. Worker's Comp
f. Anodyne Therapy

2. Faculty Spaces

The faculty, consisting of doctors, nurses, and support staff, need areas within the center where they are able to do their work. The division of faculty and patients is crucial in providing positive rehabilitation.

a. Reception/Check-in/Registration
b. Staff Bathrooms
c. Records
d. Lounge
e. Kitchen

3. Physician Spaces

Doctors need private spaces to conduct research on patients, illnesses, and methods of treatment. Storage of equipment is important, so that doctors can decide which equipment is going to work best for the patient.

a. Director's Office
b. Doctor Offices
c. Breakout Spaces
d. Library
e. Lounge
f. Supply Rooms
g. Equipment Storage
h. Laboratory

4. Patient Spaces

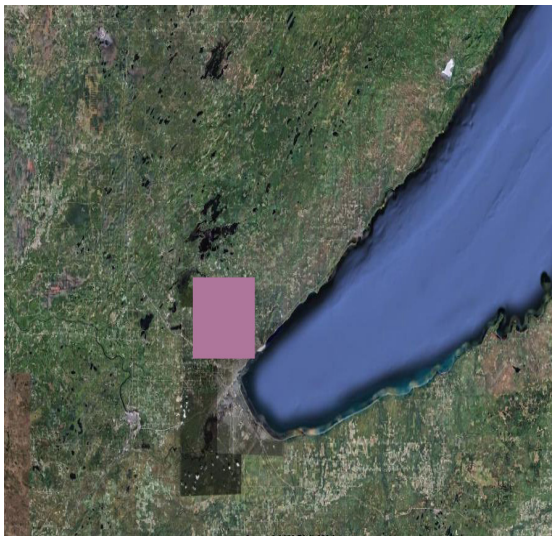
Patients need to feel a sense of security while they let go of the past and move on in a new direction. Patients are able to learn how to work with their disability in life settings, within a house and outside of the built environment.

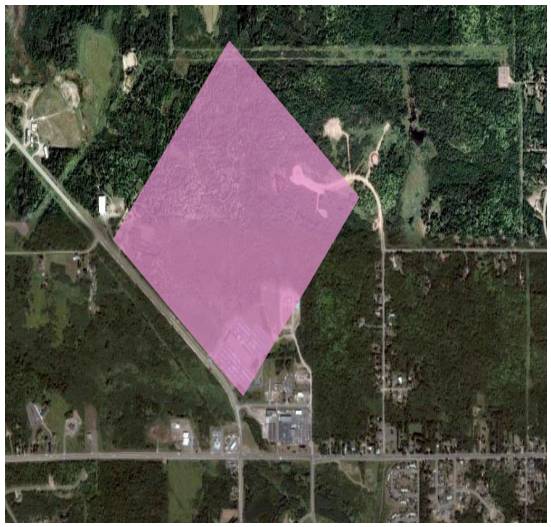
a. Examination Rooms
b. Changing Rooms
c. Bathrooms
d. Exercise Stations
    -Amputation Rehabilitation
    -Joint Replacement Rehabilitation
    -Balance
    -Spinal Cord Rehabilitation
    -Muscle Build Rehabilitation
e. House/room Setup
f. Specialty Services
g. Aqua Therapy Stations
h. Environmental Conditioning

5. General Spaces

Besides parking outside, patients and patient families need waithing areas, as families are not always encouraged or allowed in patient treatment areas.

a. Waiting Rooms
b. Bathrooms
c. Vending
d. Nursery for children
e. Lounge





Images from Google Earth. (2009)

Macro-Location

Located on the Southwestern banks of Lake Superior, where Minnesota and Wisconsin meet is the city of Duluth, Minnesota. This port city in the middle of the continent is filled with historic attractions. The varying elevation of two hundred feet makes the city of a Duluth a city of wonderful views.

Macro-City

Discovered by early explorers and fur traders in the 1670s, the city of Duluth, Minnesota was named after the lead explorer Sieur Duluth. Duluth is a commercial, industrial, and cultural center of Minnesota, and a convention headquarters of the Great Lakes, (Pearson Education, 2009).

Landmarks representing Duluth include: the Aerial Lift Bridge, Park Point, Skyline Boulevard, Chester Bowl, and Leif Erickson Park.

Micro-Site

The Physical Rehabilitation Center is located in the Kenwood District on the northern edge of Duluth, Minnesota. The specific site is around a half mile square located just north of the intersection where North Arlington Avenue becomes Rice Lake Road and West Arrowhead crosses. Access to the site is a stoplight at the intersection of these major roads.

This site is on the outskirts of the city in an undeveloped area, which is perfect for including the environment in the recovery process of the patients. The site's varying terrain makes it easy for a people's recovery from their impairment, to stroll the site on trails without further jeopardizing their recovery process, but learning how to deal with situations outside of the built environment.

The emphasis of this project is to provide rehabilitation services for those suffering from a physical impairment. Those affected by physical impairments are able to come and receive reliable and trusted services to aid in their recovery and learn to deal with and live with their disability.

Nature is an excellent remedy when it comes to speeding up the recovery process of the mind, the soul, and the body after injuries. Creating ways in which nature can have a direct involvement in the recovery process is crucial.

An in-depth study involving both the physical built environment and natural environment will result in a symbiotic relationship between the built environment and the natural environment.

Definition of Research Direction

The research conducted throughout this thesis will cover a wide variety of topics. Areas of research will be comprised of the history of the area, a comprehensive site analysis, and case studies of the project typology. The unifying idea and programming requirements will be reviewed and recognized as the project progresses throughout the thesis phases.

Design Methodology

A variety of different design methodologies will be used to examine the research required for this thesis to be successful, but the main one will be the Concurrent Transformative Strategy. Examining a variety of case studies related to the project typology, and looking at different types of graphical analysis on the site is important. Contacting some of the people involved with case studies and professionals in the field of rehabilitation will give further insight into what is crucial to a successful design.

Several site visits will be conducted during the different seasons to see how the site is affected by the environment. Research on the site conditions and analyzing the geography, the climatology, and the location of possible building locations is crucial to designing the finest possible space. Analyzing the environment to determine the most efficient ways of incorporating nature into the design will be done during the site analysis and through case studies.

Documentation of the Design Process

The magnitude of saving, organizing, and filing all the information pertaining to the examination of this thesis is crucial for the documentation of the final project. I will organize a binder with ideas, research, and sketches which will be available throughout the design process phases. An electronic system of files will also be available.

A review will occur every two weeks, and the information will be examined and investigated to see if it will be incorporated into the design.

Second Year:

ARCH 271 - Architectural Design I - Joan Vorderbruggen (2006)
Japanese Tea House (Red River - Fargo, North Dakota)
Rowing Club Boat House (Mississippi River - Minneapolis, Minnesota)
Bear Lake Lodge (Bear Lake - Colorado)

ARCH 272 - Architectural Design II - Bakr Aly Ahmed (2007)
Montessori/Waldorf School (Fargo, North Dakota)
Prairie Dance Academy (Fargo, North Dakota)

Third Year:

ARCH 371 - Architectural Design III - Steve Martens (2007)
Inuit School Design (Nunavut, Canada)
Kawneer Out-Patient Clinic Competition (Duluth, Minnesota)

ARCH 372 - Architectural Design IV - David Crutchfield (2008)
Mixed Greens Competition (Fargo, North Dakota)

Fourth Year:

ARCH 471 - Architectural Design V - Don Faulkner (2008)
Folsom Tower Highrise - Renovation Competition (San Francisco, California)

ARCH 472 - Architectural Design VI - Frank Kratky (2009)
Santo Domingo Urban Planning (Santo Domingo, Dominican Republic)
Marvin Window School Design Competition (Tanzania, Africa)
Santo Domingo Housing Project (Santo Domingo, Dominican Republic)

Fifth Year:

ARCH 771 - Advance Architectural Design - Mark Barnhouse (2009)
Water Property Analysis (Water Withdrawals by States)
Water Resource Experiment Station (Missouri River - Linton, North Dakota)

ARCH 772 - Design Thesis - Mark Barnhouse (2010)
Solid Rock Physical Rehabilitation Center (Duluth, Minnesota)

Program Document

There are many design aspects to a Physical Rehabilitation Center, but each can be dramatically altered and influenced by people. Four main areas to be researched for this design thesis are geography, psychology, behaviorism, and determinism. All four areas of research are needed to design the most effective and successful solution to this problem. These four areas also have their own distinct way of looking at the world and people in it.

The location chosen for the Physical Rehabilitation Center is Duluth, Minnesota on rough terrain. One area to be researched for this specific site is geography. The knowledge of the composition of the features on site is important for laying the groundwork to support the entire finished project. The environment will be used as another aspect in the treatment process.

Psychology, behaviorism, and determinism are all important parts in the physical rehabilitation process. Understanding how a person thinks in the design process is important in knowing why a person may react to a space. Psychology studies the mind and the interaction between multiple aspects of life. Behaviorism studies how individuals are affected by emotions and behaviors. Determinism studies how a person comes to grips with their condition and situation. For the treatment to work, people do have to realize their condition and want to recover before they can go through the entire treatment process and recover to the fullest extent.

Geography is the study of the earth and its contents, which include both physical features and its inhabitants. The two divisions of geography are human geography and physical geography, which are both interconnected to create one discipline. Human and physical geography are divided into four main categories: natural and human spatial analysis, area studies, relationship studies, and research of the earth.

Physical geography itself is "the study of natural and human constructed phenomena relative to a spatial dimension" (Smithson & Briggs, 1993, p.1). Physical geography has been studied over the past several centuries. Even though geography was first studied 2000 years ago by the oldest civilization on earth, our knowledge of how the earth works and how things have evolved over time keeps progressing.

It was during the first half of the twentieth century that large strides were made in how geography is perceived and studied. Experts in the field of geography started to look at earth in smaller segments to understand geography to a fuller extent. Physical geography uses climatic forecasts to understand how the climate affects land formations, soils, vegetation, and water over time and possibly predict what may happen in the future.

Physical and human geography both need to be studied in order to fully understand the environment we inhabit. Knowing the basics behind what constitutes geography, like the type of soil and history of the land, helps in the development of future sites.

Unlike physical geography, human geography looks at patterns and human interaction with the environment. There are six main interactions of human geography: human, political, cultural, social, behavioral, and economic. Human geography studies have evolved over time as knowledge and information has changed to become more relevant to the present.

Human geography became a recognized field in the early nineteenth century by European geographers. The field of human geography is quite diverse, with research conducted in small villages and large urban cities, from commerce to trade.

To understand human geography to the fullest extent, one has to look at the world around us. The interaction of human beings to the earth itself is human geography; how people use what is around them in order to survive. Human geography is studied through case studies, surveys, statistics, and model building. These studies show how humans have used the environment in the past, the present, and may be used in predicting the future.

Population density is the biggest relationship between geography and humans (Agnew, Livingstone, Rogers, 1996). The environment is fragile, and humans do not always realize what they are doing to the earth until it is too late. Transportation has changed over time and has created areas of more concentrated populations, which does not allow the environment to naturally repair what we have damaged.

Psychology is the study of human and animal mental functions and behaviors. Psychology studies perception, cognition, attention, emotion, motivation, personality, behavior, and interpersonal relationships. The mind may also be studied to understand why an individual is reacting to and dealing with specific situations a certain way. Social sciences, natural sciences, and humanities are all studied in order to understand psychology and how individuals function.

The study of psychology itself dates back to ancient civilizations that were trying to understand the greater purpose behind the acts of people and groups. The actions of humans can lead to outcomes not always predictable. Psychology was an experimental field of study before it truly became recognized in 1879. Beginning in the second half of the twentieth century, psychology became more of a cognitive science, studying the mind and thoughts of individuals in order to understand the inner workings of the mind.

Schools of thought have changed over time, leaving no one single way of studying the minds of individuals. Recently psychology has changed perspectives to understand the conscience, individual behavior, and social connections. Cognitive views and abilities and emotions play a large role in how individuals react to situations. When individuals encounter a situation, emotions take over and sometimes lead to the worst outcome for specific events.

There are more than 20 main subfields of psychology that study the mental processes and behavior of people. Abnormal, biological, and clinical are the three most common subcategories of psychology. All three are individually studied at the university level. Each is interconnected to one another, yet are separate in their viewpoints.

Abnormal psychology studies the abnormal behavior in question to describe or predict functioning patterns in humans. It can sometimes be difficult to see the difference between normal and abnormal behavior, as the two are closely related to one another. Recently abnormal behavior has been associated with mental disorders and unanswered and puzzling psychological questions.

Biological psychology studies the biological aspects of the mind and how they control behavior and mental states. It studies how behavior and emotions are interconnected with one another and the basic human brain functions. Individuals may perceive a situation differently than others and possibly change the predicted outcome.

Clinical psychology studies the understanding, prevention and relief of distress caused by the events of life. It tends to be used in hospital settings to understand why an individual is in a certain situation. Helping individuals understand what is happening to them guides them through the decision to recover.

Behaviorism is a field of psychology founded in the early twentieth century that studies the actions, thoughts, and feelings behind behaviors. There are six identified categories of behaviorism: methodological, radical, teleological, theoretical, biological, and interbehaviorism. Methodological and radical behaviorism are the two most researched and understood categories of behavioral psychology.

Methodological behaviorism refers to mental behaviors and describes how animal beliefs and desire are common to human beings. "Mental states are private entities which, given the necessary publicity of science, do not form proper objects of empirical study" (Stanford Encyclopedia of Philosophy, 2000). The combination of animal and human leads to understanding human behavior in a broader spectrum.

Radical behaviorism accepts and encourages individual feelings and states of mind to be understood in order to be treated. The study is connected with biological and evolutionary approaches of psychology. Radical behaviorism believes that animal behaviors can be studied and compared to human behaviors. Studying animal behaviors gives insight into how humans may react to certain situations; the basics of how animals and humans react and deal with behaviors are similar, the difference is the awareness of individuality. The environment can have unseen impacts on the way individuals behave.

Determinism is the philosophy dealing with human performed actions and consequences. Events that humans perform can be altered by unforeseen actions, leaving the actor not knowing if the action itself will lead to consequences. A person's cognitive abilities, behaviors, and decisions can sometimes affect the outcome of a situation. One is not always able to predict the possible outcome of a situation based on what has occurred in the past.

Determinism is broken down into two main categories with three additional secondary categories. Causal and logical determinism are the two main categories. The three additional categories include: environmental determinism, biological determinism, and theological determinism. There are two main categories of determinism that influence design and they are causal and environmental determinism.

Causal determinism states that past and present actions will affect future outcomes. By studying the actions of the past and the present it is possible to predict the future of these actions. Determinism and time are viewed as being interconnected, since we are able to predict outcomes. "Determinism is a necessary condition for freedom" (Stanford Encyclopedia of Philosophy, 2003).

Environmental determinism, also known as geographical determinism, proposes that the physical environment determines a specific culture. Human beings are able to control the outcome of their environment by their behaviors and views of the world; the environment does not control the individual. The distance a community or society is from the equator shapes and develops what is needed for survival, which includes culture and architecture (Briney, 2009). Cultures are defined by the limitations of the environment, and societies make decisions based on these limitations.

That climate has a strong impact on the psychological outlook of people is the main argument made by geographical determinists. These views attempt to identify the overall behaviors of a society and culture. Environmental factors like culture and the skin color of a society can be identified and located to specific regions of the world (Briney, 2009).

The research and development in environmental determinism is incomplete compared to research developed for other fields of science. The study of environmental determinism is a new academic field, but some of its roots go back to the distant past. Some 20 years after environmental determinism developed in the early twentieth century, its value declined based on its findings (Briney, 2009).

Geography, psychology, behaviorism, and determinism each in their own ways affect society, individuals, and design. All four are interconnected, especially when it comes to designing for people who inhabit spaces. Designing a Physical Rehabilitation Center in an undeveloped area includes challenges when it comes to the lives of its future occupants. People react and behave differently to every situation they encounter.

Geography is not just the study of earth and its features. There are two main fields of study when it comes to geography: physical and human. Physical and human geography have been studied for centuries and the understanding of them keep developing. To understand the importance of geography one must look at the world and recognize the importance of the earth.

Studying the field of psychology helps understand the human mind to the fullest extent. How and why people react to circumstances is important when it comes to developing design strategies for people. Psychology has developed several branches of study spanning the past two centuries. Those keep branching off creating new fields of study. There are three main subfields of psychology: abnormal, biological, and clinical psychology. All study in different ways how the brain functions with the circumstances of life.

Behaviorism is a psychology field studied to examine actions, thoughts, and feelings behind the way individuals react to situations. This field of study is roughly a century old and has been divided into six main categories. Understanding how individuals deal and function with emotions and feelings is important in understanding how the environment is impacted by human behavior.

Determinism deals with the actions and consequences of human behavior. The events in individual lives are influenced by an individual, the environment, or other human actions. One is not always able to predict the outcome of a situation; humans influence situations by the actions they perform. Determinism is broken down into two main categories of study: causal and logical, but there is also environmental determinism which is highly studied.

Geography, psychology, behaviorism, and determinism all have deep roots in the human psyche. All studies are connected to one another and to the understanding of humans. The human population is affected by the circumstances of man and the environment. We as humans will never be able to fully predict how situations will be influenced by the outcomes developing from individual actions.

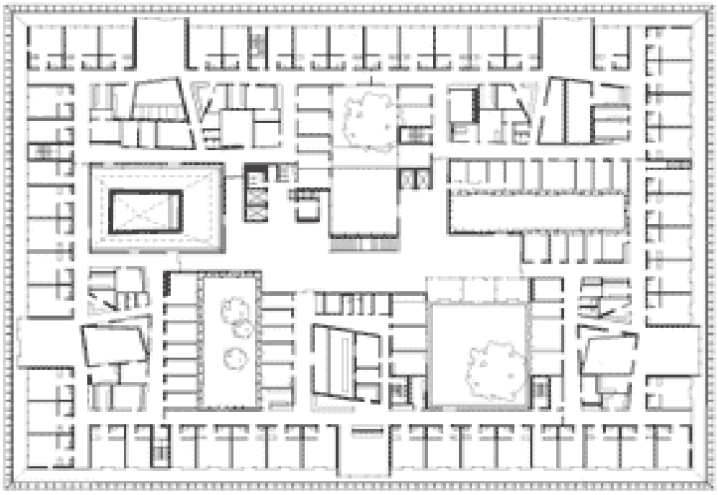
The typological research is based on three similar yet different building types. Different types studied are all in the healthcare field, but are a rehabilitation center, a medical research center, and a hospital. The places studied are: Center for Spinal Cord and Brain Injuries in Switzerland, Center for Advanced Medicine in California, and the Guardian Angel's Hospital in Italy.

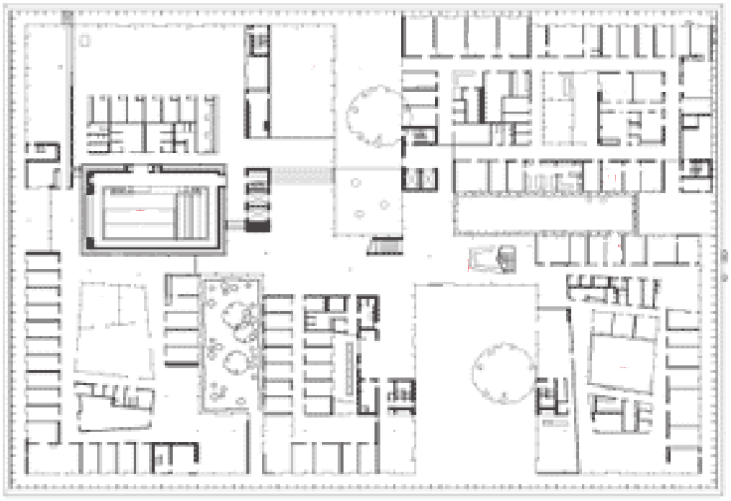
Each has a distinct relationship to the environment and is influenced by individuals in a specific way. One of the designs places the building on the site without really affecting the environment, another design completely destroys the environment and is nonexistent even in the initial plan, and the final design was designed to connect both the environment and the building.

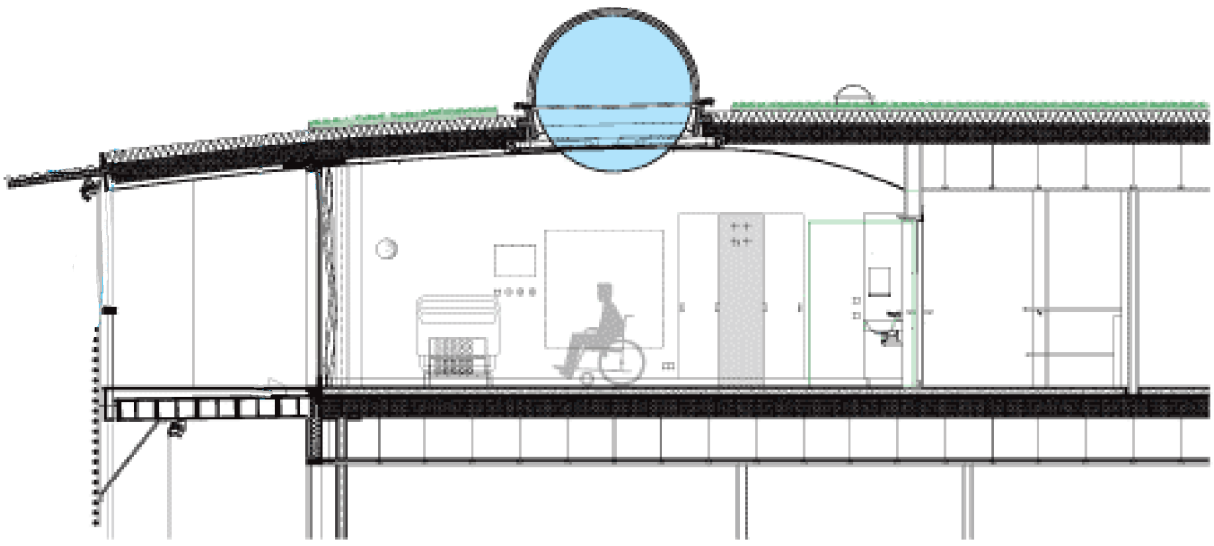
The REHAB, Center for Spinal Cord and Brain Injuries is a privately-run clinic in Basel, Switzerland. The Center is an inpatient treatment facility with 92 double and single rooms. Patients receiving treatment are allowed to stay through the entire rehabilitation process or up to 18 months. Spaces within the Center includes: a day clinic, physical and neurological therapy rooms, medical facilities, conference rooms, a gym, a swimming pool, and patient rooms.

There are several spaces within this treatment center that are similar to other rehabilitation centers. These spaces include areas for treatment, staff, and patient relaxation and reflection. It is uncommon for rehabilitation centers to allow patients to stay for an extended period of time, let alone during the entire treatment process.

Location: Basel, Switzerland
Owner: REHAB Basel
Architect: Herzog & de Meuron
Gross square footage: 246,386 sq. ft.
Total construction cost: $110 million







The Center for Spinal Cord and Brain Injuries appears very elongated to the site, but the ratio of length to width is rather close. The connection of the Center to the environment has an organic feeling. It is on the outskirts of the city of Basel, Switzerland in an undeveloped area. There are plenty of spaces within the design for social interaction and spiritual relaxation and reflection.

This two story design is light and airy. Wood, glass glazing, and green roofs are the main structural members of this facility. The rectangular shape looks more like a house then a place of business, but the plan allows for maximum amount of daylight to penetrate into the corridors of the facility. A central courtyard allows patients to retreat to the outdoors for moments of relaxation.

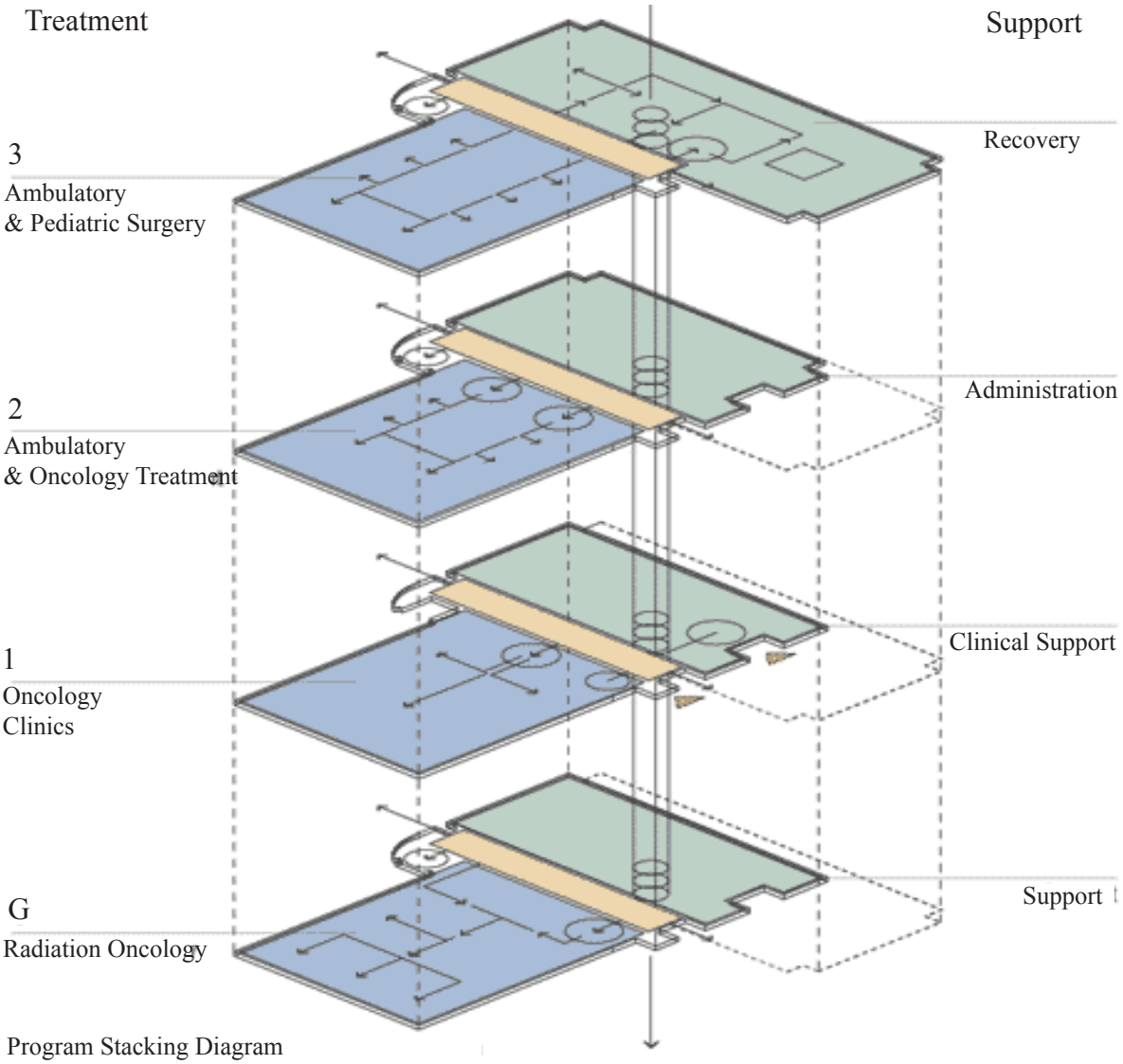
The environment is not impacted in a harsh fashion; nature still has its abilities to heal itself. Construction and humans impact the environment in a very minimalist fashion. The organic design of the Center is not destroyed by negative attitudes of humans.

Information and images from (Stephens, 2004).

The Center for Advanced Medicine is an addition to the medical campus at Stanford University for the use of cancer treatment and surgery. It was an effort by the architects to connect the medical campus by strengthening and clarifying the overall site plan. The placement of the Center on the medical campus was within a very constrained unbuilt section. It was a challenge to connect the new structure to the rest of the surrounding buildings.

Stanford Universities' Center for Advanced Medicine consists of four levels with areas for: oncology, clinics, ambulatory treatment, ambulatory surgery, recovery, administration, clinical support, and support. The treatment and technology zones of the Center are divided by a sunlit atrium penetrating to the lower levels. The design is flexible to allow changes depending on the needs of an area.

Location: Stanford, California
Owner: Center for Advanced Medicine, Stanford University Medical Center
Architect: Bobrow/Thomas and Associates
Gross square footage: 220,000 sq. ft.
Total construction cost: $82 million



Program Stacking Diagram

The Center for Advanced Medicine at Stanford University was an addition to the medical campus, but there is no environmental connection. The structure is connected to the other buildings by skywalks and pathways, yet the surrounding area is all urbanism by concrete courtyards.

The structure of the Center is a concrete skin with ribbons of glass. Natural daylight penetrates into the building through the exterior windows and a central atrium letting light into the core of the structure. The rectangular boxy design reflects the pattern of the surrounding buildings on campus. Circulation is at the core of the building with the atrium dividing the treatment and support areas.

The only environmental aspect of the site is a couple of patches of manicured grass and a couple of trees in the courtyard. Nature has no control in this built environment situation, and attitudes and ideals of man have control over the environment. The only way of getting the environment back in command of the site partially is to remove elements of the site plan like the concrete courtyard, and letting nature recover itself.

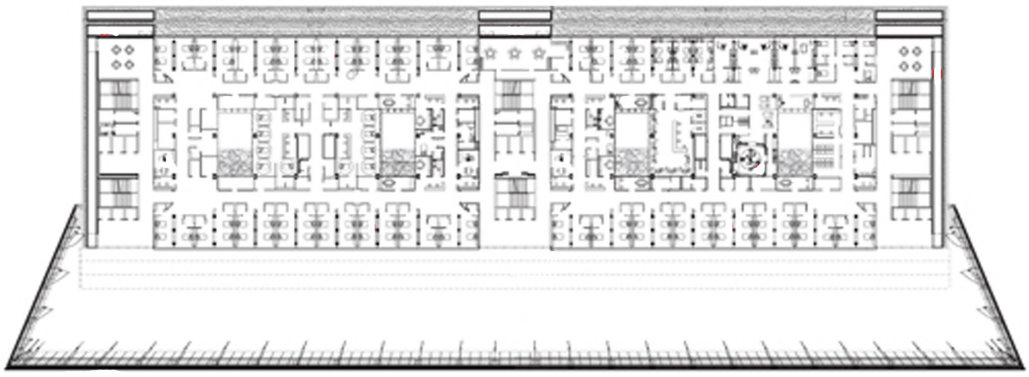
Information and Images from (Stanford University, 2004).

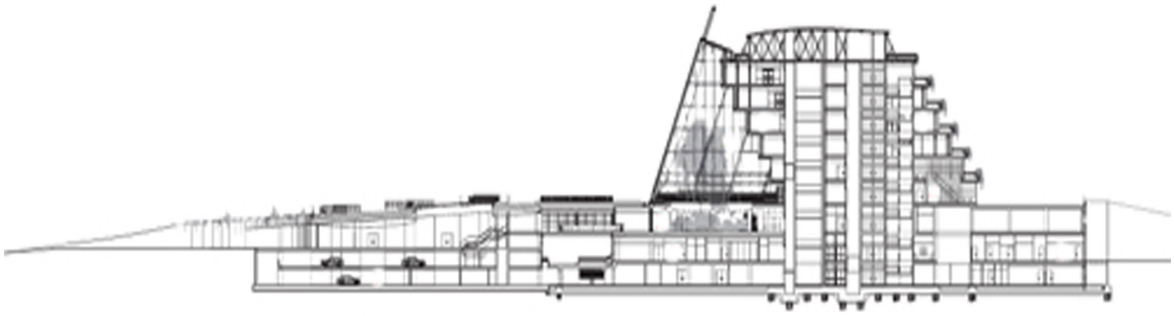
Ospedale dell'Angelo Regione Veneto, The Guardian Angel's Hospital, is a green hospital near Venice, Italy. The architect, Emilio Ambasz, is known for his designs fusing architecture and landscape into one complete entity. Once the project recouped some of its cost of construction, the hospital was to be turned over to regional government for ownership.

The hospital houses 335 double patient rooms and 10 single patient rooms, and the technology and research within the hospital are state-of-the-art. The spaces within the hospital complex are: an indoor and outdoor garden, gift shop, restaurant, chapel, patient rooms, operation rooms, examination rooms, administration spaces, and an ophthalmological laboratory. The ophthalmological laboratory specializes in eye transplants and stem-cell research.

The exposure to nature increases the chance of recovery for hospital patients in regard to the physical and psychological aspects of life. This exposure to the environment, both inside and outside the structure, is very unique when it comes to this scale of a hospital design.

Location: Venice, Italy
Owner: Regione Veneto
Architect: Emilio Ambas & Associates
Gross square footage: 1,265,000 sq. ft.
Total construction cost: $754 million





The design has an excellent connection with the environment in which it was designed for. Using nature as a method of healing, does not defeat the environment from its overall purpose of healing and restoring. Patients of the hospital are connected to the natural world, where doctor offices are on the interior darker sections of the structure. The vegetation of the interior garden is local palms, but there is no real organized pattern to their location.

The façade of this seven story hospital structure is steel, concrete, and slanted glass walls. Plenty of natural daylight penetrates in the inner core of the hospital. The slanted glass wall faces the south letting in the maximum amount of light to reach the large garden on the lower level of the hospital. The layout of the levels is easy to navigate from place to place. The entire hospital is naturally ventilated by more than 700 mechanical openings.

Individuals are able to relax and reflect at the hospital; the behaviors of humans do not destroy the environment's essence. There are multiple levels of the natural environment in the design of the hospital and surrounding site; there is a healing pond outside and healing gardens on the interior of the hospital. Nature does not have to do much in order to rejuvenate itself.

Information and Images from (Deitz, 2009)

The typological research was based on three similar types of buildings within the healthcare field. Three building types researched were a rehabilitation center, a medical research center, and a hospital. The places studied were the Center for Spinal Cord and Brain Injuries in Switzerland, Center for Advanced Medicine in California, and the Guardian Angel's Hospital in Italy. The three different building types were investigated for all the aspects of the project at hand, to look at the type of spaces needed for outpatient and inpatient rehabilitation facilities.

Studying an inpatient rehabilitation center gave insight into spaces that inpatient centers need in an addition to what outpatient centers have. Living quarters and social areas are needed, but should be directly separate from the treatment areas. Places of relaxation and reflection should connect the areas for treatment and the living quarters. Neurological therapy speed up the recovery process by healing the mind at the same time the body is being healed. A swimming pool for aqua therapy is another way to speed up the recovery process and strengthen the treatment.

Light is one of those things I did not think was going to aid or hinder the recovery process of physical impairments. The light was utilized in all three building types, creating interesting spaces for interaction. Light also added another dimension of healing, as one is able to view the outside environment.

The play of light and the types of spaces used were common among all three studies. When it comes to the Theoretical Premise, the physical environment was not completely changed by the day to day decisions of people; in one example the physical outdoors was replaced by concrete. The aqua therapy pool was an uncommon aspect of the studied cases, but it created a treatment method different enough to be successful where other treatments failed. Using the aqua therapy pools did not destroy the environment but added another aspect of the environment's healing abilities on the treatment and recovery from illnesses.

The biggest concern about the environment being destroyed is the site chosen. Picking a site where the design and construction will have the smallest impact on the environment is tricky in making sure the function of a Physical Rehabilitation Center stays intact. Sites which are too steep can be difficult to design for, since the purpose of a Physical Rehabilitation Center is to heal physical impairments.

The Center for Advance Medicine had the closest ties to the political context of projects, since it was built in a confined space and had to meet the standards put forth by the university and city. All designs were connected to the environment and their surrounding area. The designs on the outskirts of cities were more organic in order to follow the environment, while designs in highly populated area were more commercialized. The three studies either had an atrium or an open space at the core of the design, where all the divisions of treatment were connected off these core areas.

The healthcare field has specialized itself into different divisions of study, research, and treatment over the past couple centuries. A physical rehabilitation center specializes in the treatment and recovery of physical impairments, and learning to live life with these new disabilities. Physical therapy is like all the other studies in the healthcare field, the results for individuals vary and there is the chance of not recovering to a hundred percent functionality.

For individual to recovery fully, there are several things which need to take place. First, individuals have to accept that they have a condition and want to receive physical therapy. Second, they need to choose a facility that can handle their needs and has a good reputation. Third, recovery needs to take place in three areas: the body, the mind, and the soul. If all three areas are not treated, individuals can suffer and not accept their condition. The last thing that needs to occur is the environmental aspect of healing. Individuals need to take their treatment to the outdoors to the uneven terrain, to ensure they are able to function in both the built environment and the outdoor environment. The environment itself is also used as an element of healing during the entire treatment process as a place of relaxation and reflection.

Throughout history, physical rehabilitation centers have kept evolving due to new technology and methods of treatment available for these impairments and disabilities. The first physical rehabilitation centers focused on exercise, massage, and traction of muscles. Starting in the second half of the twentieth century physical therapy moved to research and outpatient treatment centers. In the beginning, physical therapy was only used within the hospital setting. Hospitals were able to diagnose problems and disorders, treat individuals, and release them back to the environment and society. The time it took for individuals to recover varied, but the treatment was not always specific to a condition and did not always have a lasting effect.

Designing a physical rehabilitation center is similar to how other projects have evolved throughout history. A physical rehabilitation center is similar in design to hospitals, but it does not include patient rooms and some of the specialized areas of treatment not related to physical therapy such as operation rooms. The only type of physical rehabilitation centers that includes patient rooms is an inpatient treatment center, which has to include rooms for patients to stay for a long period of time.

The initial ideas and thoughts are repeated until a successful design is accomplished for any specialized facility like a physical rehabilitation center. The processes of how banks, schools, and hospitals are designed are similar in their progress from one design to the next. Once a design has been constructed and work is being conducted within a facility, locations of spaces are deemed unpractical and missing spaces are realized. When the next building of that type is designed spaces are moved around and missing spaces are added.

The oldest physical rehabilitation facilities in the United States were constructed over one hundred years ago and since then technology has improved. Sheltering Arms Hospital in Richmond, Virginia was designed as a hospital, but a wing of the hospital was turned into a physical therapy department. It is one of the first inpatient facilities to treat physical impairments and serve both short-term and long-term disabilities.

Technology, materials, and methods of treatment are constantly changing, which makes it hard to design a place for treatment and still have it applicable and state-of-the-art in five to ten years. The scale of this specific project is going to be similar to other outpatient treatment centers, but including treatment areas for environmental adaption and aqua therapy for those unable to recover using other forms of treatment.

Aqua therapy is a newer method of treatment where therapy occurs in a pool of water. Since aqua therapy has only been used as a method of treatment for less than ten years, it has been highly observed at and new technology is being developed for this type of therapy. Aqua therapy is a method that is less harsh on an individual's body and is able to succeed where other forms of physical therapy have failed.

Society is changing and one of the main things that is changing is the level of technology. Technology is constantly evolving, as new materials are discovered and new ways of examination are researched. Scientists keep discovering new ways to speed up the progress and abilities of technology. Technology has its benefits and has to be controlled in order to not be destructive. Individuals and the environment are fragile and need to be carefully examined so they are not destroyed beyond their rejuvenation points.

This specific thesis project is going to examine the society of technology and how things may change over the next ten years when it comes to the field of physical therapy. Communication has changed over the years; information for records and physical therapy treatment is being transferred by emails, faxes, and other forms of electronic communication via the internet. Since patient files are now done on electronic forms, patient confidentiality is crucial.

Physical therapy recently has been adding chiropractic to its discipline. Adding chiropractic to the physical therapy discipline adds another element of treatment of physical impairments. Chiropracticors are able to do adjustments to the human body, which is useful during physical therapy.

Designing a structure with contents that will be relevant for more than one or two years is crucial. Designing for short term problems and not for long term situations is problematic. Accidents and illnesses will still continue to affect individuals and families in our society. When people are affected by uncontrolled circumstances of life, they take it out on others and the environment.

Developing methods of treatments and places for treatment to occur is important to help those injured to recover to a higher status. Finding ways that people are able to recover without injuring themselves more is important in providing them a way of joining society as a functioning member. Aqua therapy was developed as another less intensive method of treatment of physical impairments.

There are organizations within our society that provide individuals with methods of reconnecting with the rest of society. Once treatment is finished individuals need to be able to reconnect with society in a non-threatening manner. Those who have been treated need to feel like they have a connection to other people and not like they are being attacked because of their condition.

The Physical Rehabilitation Center will be constructed and operated in the Kenwood district of Duluth, Minnesota. The Physical Rehabilitation Center will be designed for and constructed on a half mile square rolling hill wooded area. It will be located on the outskirts of the city of Duluth, on the top of the hill. Currently there is a ski area to the north of this specific site and a United Health Insurance Group building to the south. The next closest populated areas are neighborhoods which are roughly a half-mile away.

The environment will be used as another method of treatment, by using the outdoors as the last phase of treatment before individuals are recovered enough to be on their own. Using the environment as another method of treatment helps the patients learn how to deal with situations not found within the built environment. Knowing an individual is able to walk over terrain not found within the built environment helps to keep some of the fear away that individuals will fall and reinjure themselves in another human action.

The Physical Rehabilitation Center will be integrated into the environment. Construction and design should have minimal impact on the environment; people should be the biggest contact. People should be allowed to use the environment for relaxation, reflection, and just enjoying the outdoor environment. The environment is not something just to look at, but it is not something to be destroyed or abused either, it must be respected.

The Academic

The academic goals for this thesis project consist of:

* Creating a design which is connected to the environment without being too destructive.

* Drawings that are clear and concise, easy to read and follow.

* Using the resources at hand and guidance from a professional level.

* Completing this thesis with the initial design requirements and intent.

* Finishing this thesis to the standards set forth by the university and architecture department.

The Professional

The professional goals of the thesis project consist of:

* Designing this project to a professional level.

* Using kowledge of case studies to create a successful design.

* Following the rules and building codes which have been set forth over the years.

* Using proven sustainable technology to the fullest.

* Using resources within the practical distance of the construction site.

The Personal

* Keep the environment the main element of the Physical Rehabilitation Center.

* Create ways that the environment can be used as another method of treatment.

* Create a design that is integrated into the environment.

* Use passive and environmental systems in relationship to mechanical systems.

* Develop a design which is organic to the environment.

* Develope organic floor plans for easy navigation and wayfinding.

* Use natural light to penetrate into the interior spaces.

* Develop spaces where the environment will be used for relaxation and reflection.

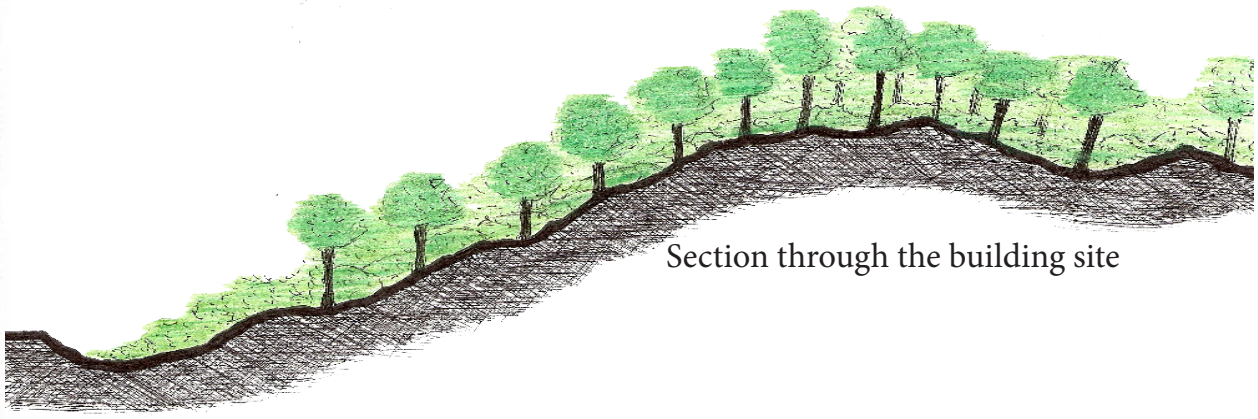
* Design with materials and resources native to the region.

* Create an expression in the interior that is also shown on the exterior.

* Create the treatment process to include healing of the body, the mind, and the soul.

* Create spaces for interaction between the environment and people, as well as person to person.

The site is located in the Kenwood district of Duluth, Minnesota, a tree-covered site about a half mile square. The scale of this site and the amount of terrain differences makes it the perfect site to build a Physical Rehabilitation Center and include the environment in the recovery process. The physical features of the site include areas to build and areas for recreation. Slope analysis of the rolling site is composed of 4 to 10% slope with some hills reaching up to 17%. The main slope faces to the south increasing the amount of sunlight available to light spaces; the natural daylight is only obstructed by the vegetation present on site near the ground.



Section through the building site

Traffic

Access to and from the site is directed by a stoplight located on Rice Lake Road, next to the main entrance to the United Health Insurance Group. The section of Rice Lake Road in front of both the United Health Insurance Group and the future location of the Physical Rehabilitation Center does not have much vehicular traffic. There are no sidewalks currently in the vicinity of the site; the closest sidewalks are about a half-mile away in residential neighborhoods. The major roads indicating the boundaries of the site carry the utilities which are needed for the project to be successful.

The main pedestrian traffic in the vicinity of the site is at the United Health Insurance Group in the south corner of the site and the cross country ski hills to the northwest of the site during the winter season. There are a couple of rough walking paths running through the trees currently on site.

Access to Physical Rehabilitation Center from the stoplight on Rice Lake Road.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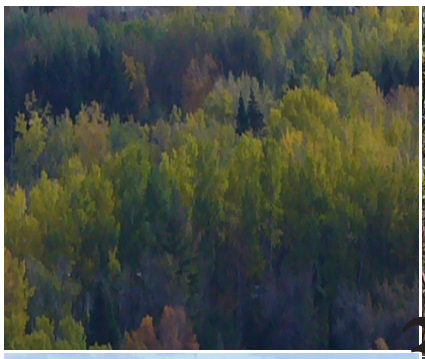

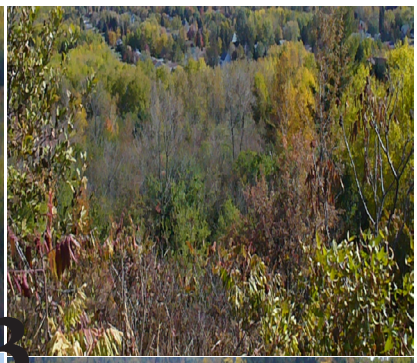

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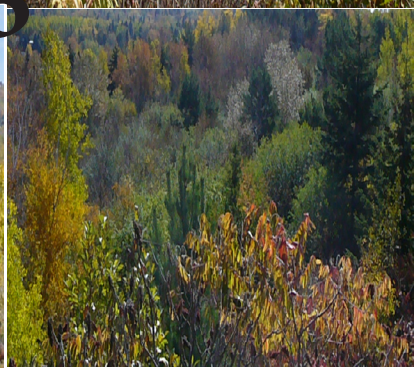
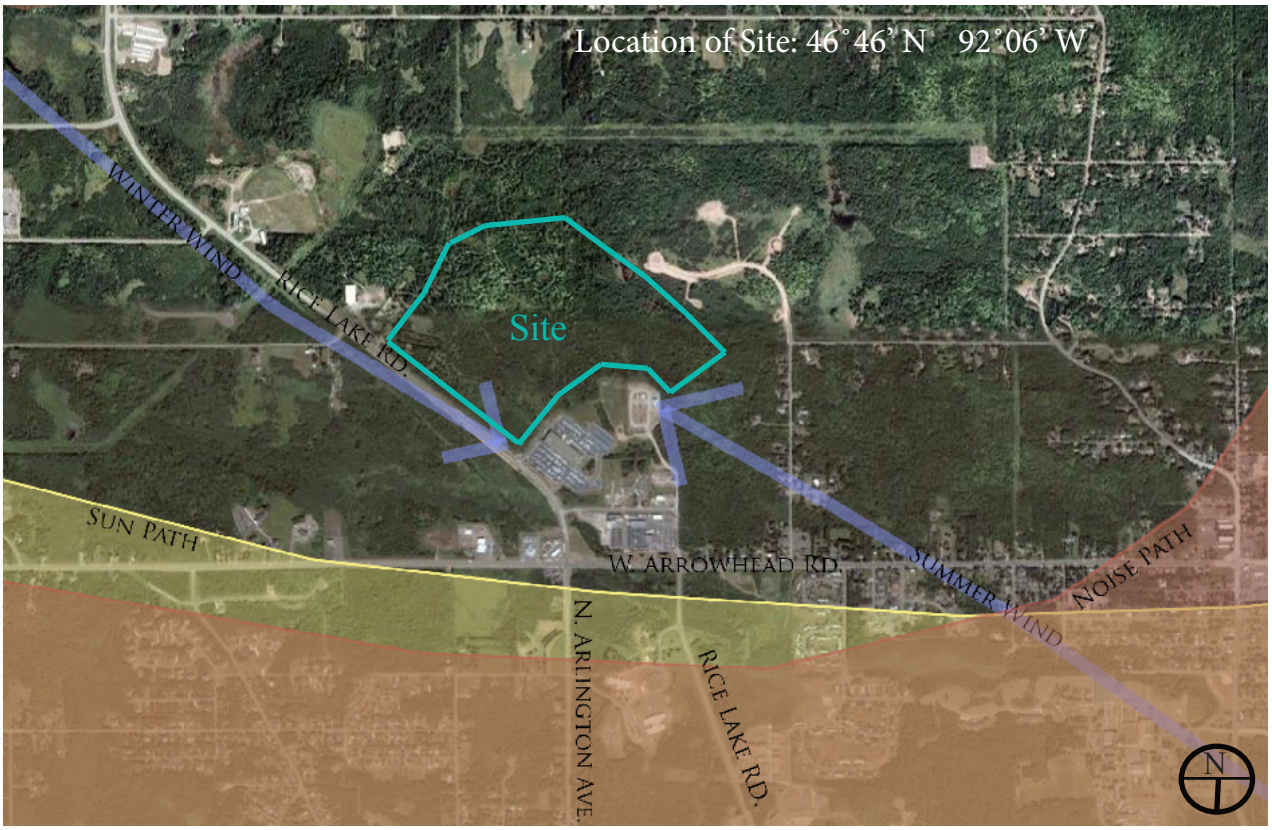


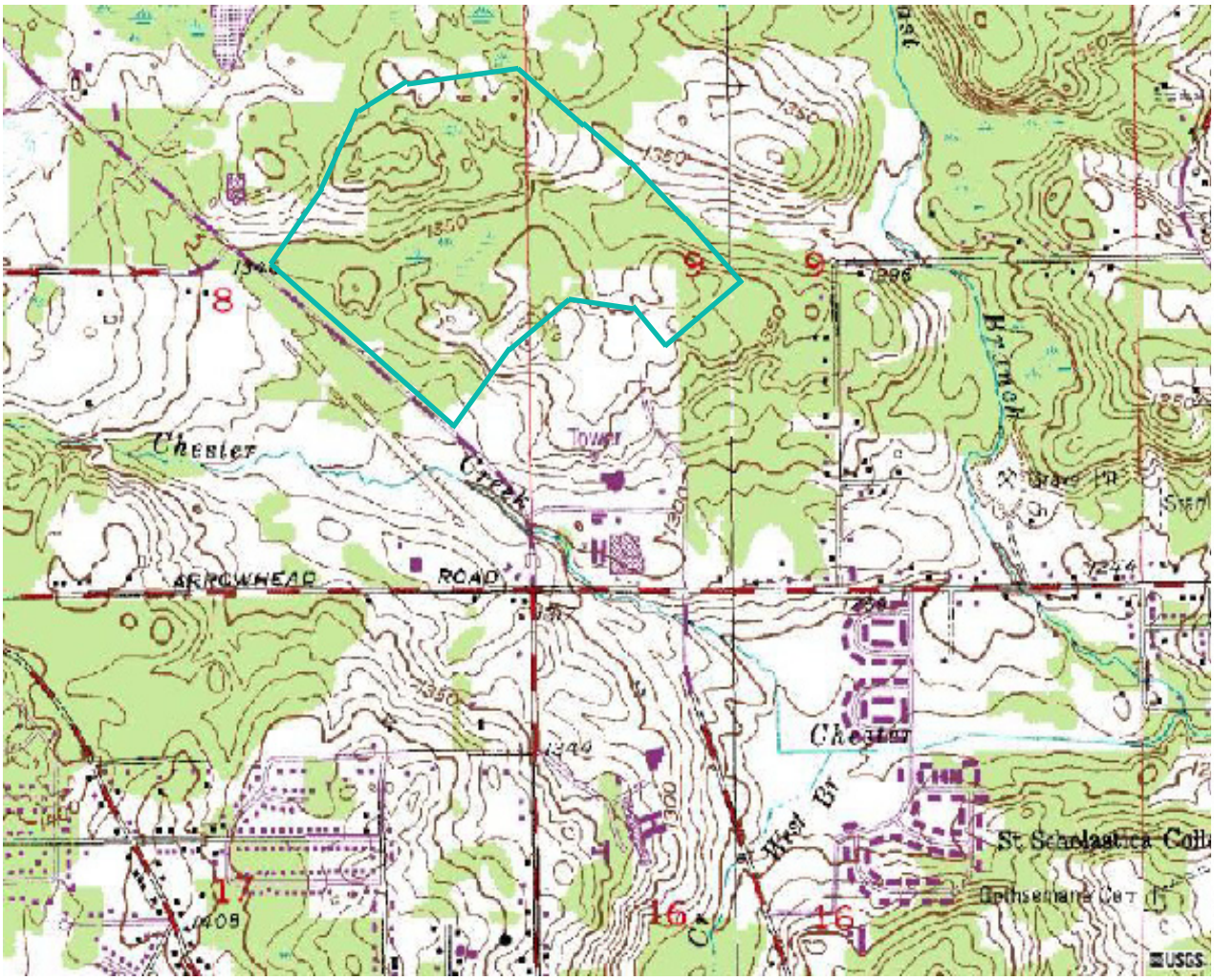
5

Human use is very minimal; only a couple of manmade and animal-produced trails go through the site. The only built feature on site is a United Health Insurance Group at the southern corner; otherwise the site is blanketed with trees and scrubs. The rolling vegetation on site is healthy, with only a few dying trees due to overcrowding.

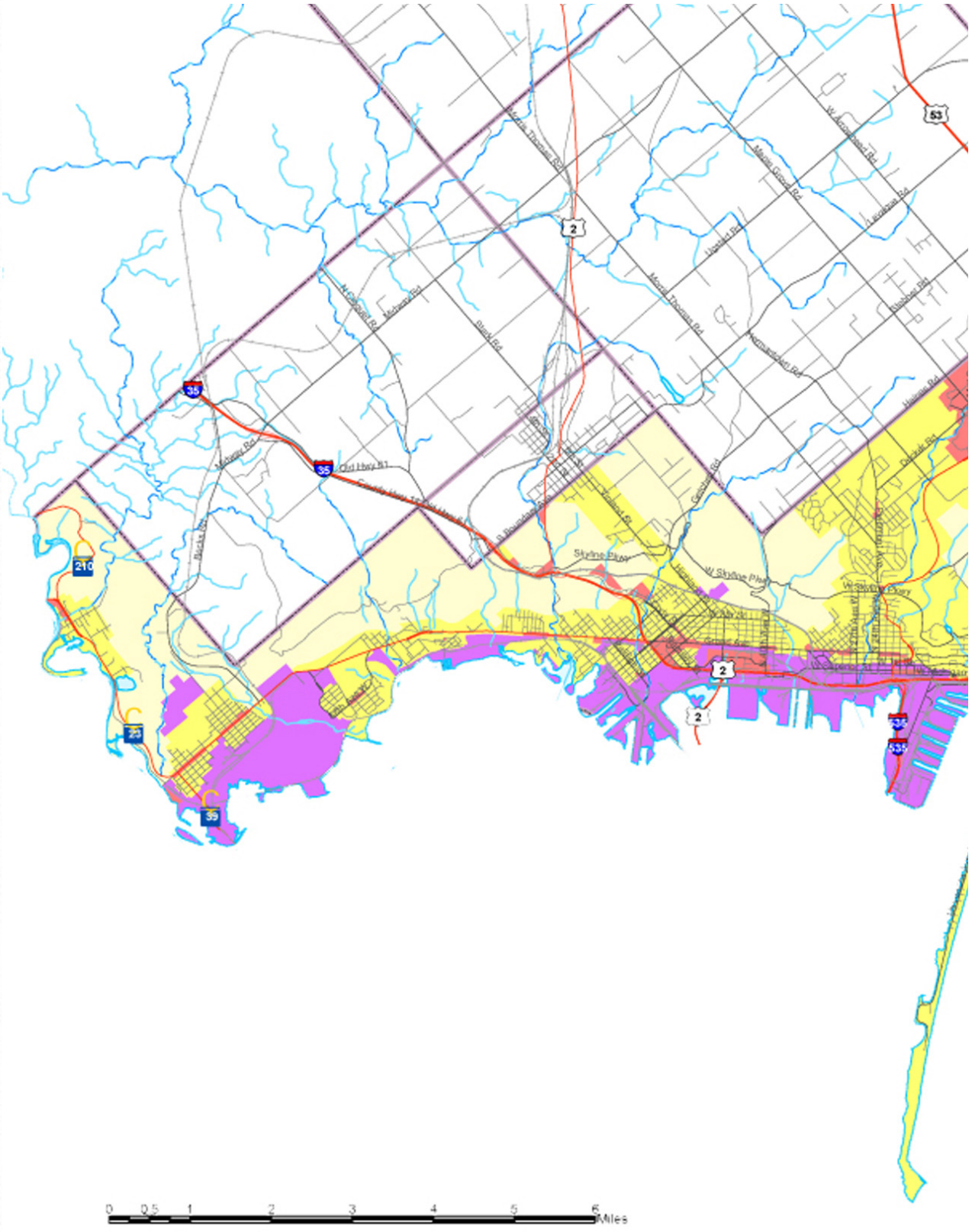
Standing water is present in the lower sections of the site after heavy rains, with no visible signs of erosion on site. The composition of the soils in the area is a combination of granite bedrock, gravel, and a little sand. The site itself is on top of the main hill in Duluth, meaning this specific site is stable and may only have minor shifting, if any. The bedrock foundation of the site is close to the surface which does not allow the water table to be too high. The site has not been contaminated by past activities occurring on site, such as construction or chemical processes.



Average Temperature: low 29.3˚ high 48.7˚
Average Wind Speed: 9 miles/hour
Average Relative Humidity: 77.5%
Average Precipitation/year: 2.58”



Terrain Map from terraserver.USA.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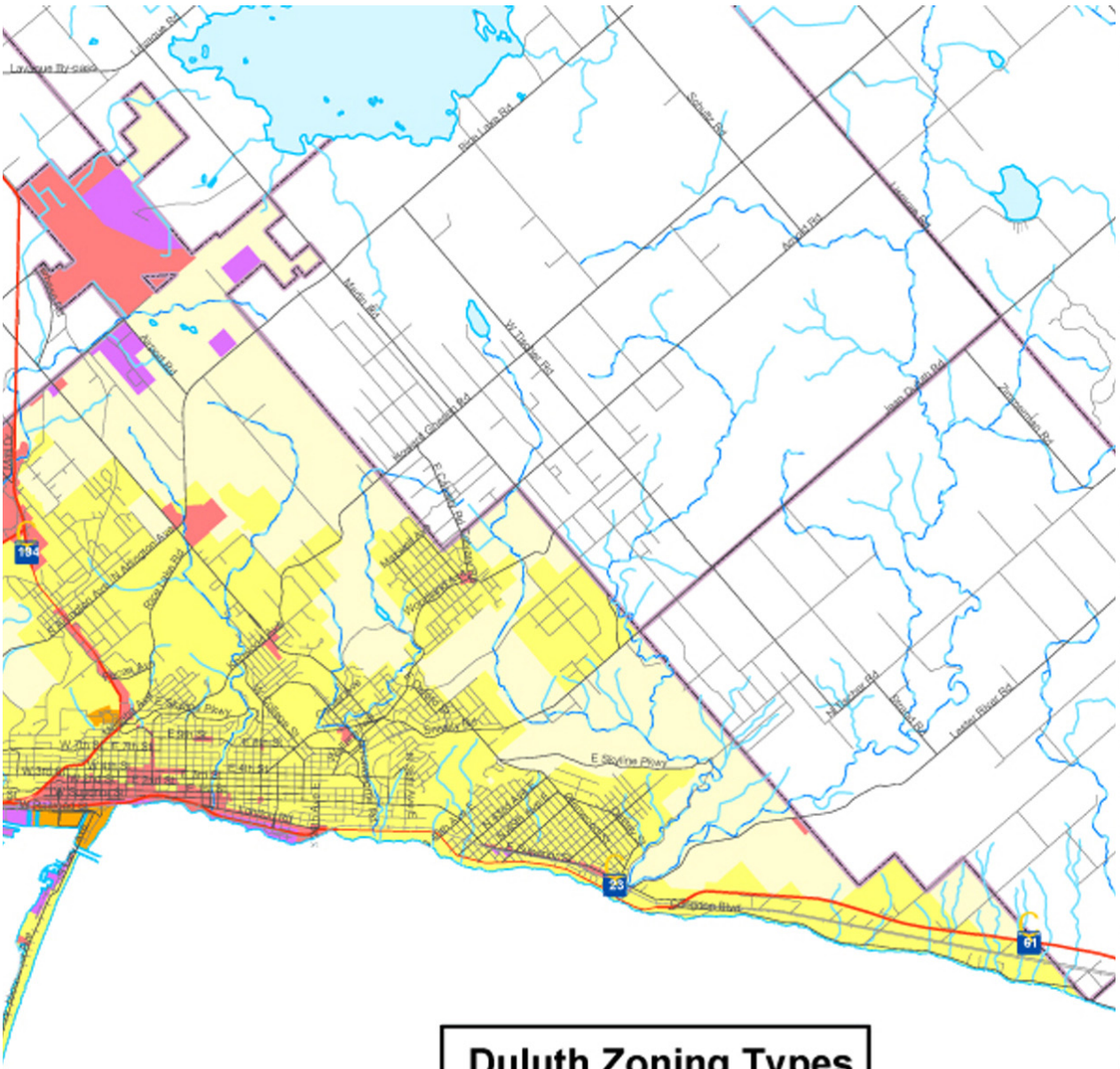
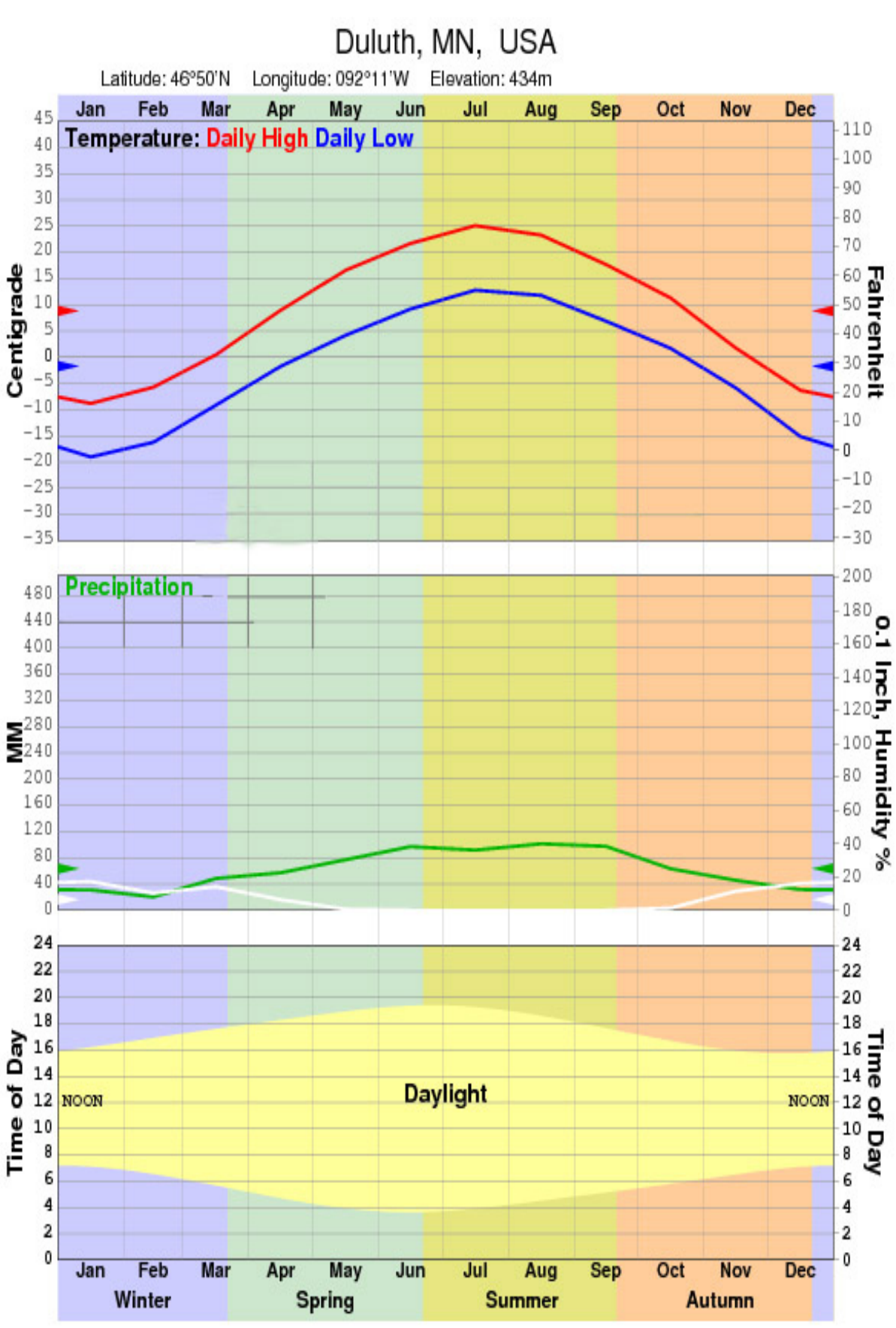

Duluth Zoning Types
Legend
Zoning Types
Rural Residential
Residential
Mixed Use
Commercial
Industrial
Other Features
Railroad
Principle Highway
On/Off Ramp
Major Street
Minor Street
Trout Stream (DNR)
Other Stream (DNR)
N
E
S
W


Duluth, MN, USA
Latitude: 46°50'N Longitude: 092°11'W Elevation: 434m
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Temperature: Daily High Daily Low
Centigrade
Fahrenheit
Precipitation
MM
0.1 Inch, Humidity %
Time of Day
NOON
Daylight
NOON
Winter
Spring
Summer
Autumn

The Physical Rehabilitation Center is an outpatient clinic open during the day from 7am to 6pm. It will be operated by a local hospital, its staff, and interns from the local universities. There are spaces for general purpose, faculty, physician, and patient. Departments within the Physical Rehabilitation center vary from support services to administration.

The Physical Rehabilitation Center will face the south for the maximum amount of natural daylight to penetrate into the structure. Sun shading techniques will need to be applied to the southern section on the structure to let light pass through, but not to exceed what can be handled by the facility itself. The artificial lights throughout the Center should be even to prevent injuries.

General Public Spaces

Waiting Room:	To be used by patients and family members of patients being treated.	761 sq. ft.
Multipurpose Space:	To be used for different functions going on at the facility, to be controlled by the Center's staff.	1595 sq. ft.
Cafeteria:	To serve those who are at the Center for treatment or who work there.	1173 sq. ft.

Total: 3529 sq. ft.

General Support Spaces

Mechanical:	Different sections to be spread throughout the facility, one large space with several smaller spaces for equipment and technology to be used in the treatment processes.	1549 sq. ft.
Circulation:	To connect the spaces within the facility in a functional and easy fashion, to be connected to the environment and let natural light to enter.	25697 sq. ft.
8 Bathrooms:	Bathrooms for staff and patients.	1443 sq.ft.
Computer Support:	To house all the computer and data services provided within the facility.	400 sq. ft.
Receiving :	The receiving point where packages and supplies enter into the facility, to be distributed by the staff.	816 sq. ft.
3 Janitorial Spaces:	Different spaces spread throughout the facility, to clean up messes when they occur and to clean spaces on daily basis. (each ~150 sq. ft.)	320 sq. ft.
Linen Storage:	To house scrubs, hospital gowns, and equipment covers for the facility.	440 sq. ft.
Staff Lounge:	To be used by staff and physicians of the facility for breaks and small meetings.	387 sq. ft.

Total: 31052 sq. ft.

Administration Department

Reception:	At the point of entry to the facility, first interior space patients and staff encounter.	150 sq. ft.
Accounting Office:	The financial center of the facility.	134 sq. ft.
Director's Office:	The head of the facility, public face of the ownership and inner workings of the Center.	178 sq. ft.
Assistant Director's Office:	Assistant to the director, second in command's office.	111 sq. ft.
Conference Room:	To be used by the staff, patients, and for meetings held at the Center.	252 sq. ft.
10 Offices:	For staff members helping with the basic operations of the facility. (each ~100 sq. ft.)	823 sq. ft.

Total: 1648 sq. ft.

Medical Department

3 Consultation Offices:	Physician offices for personal time and research. (each ~100 sq. ft.)	309 sq. ft.
6 Examination Rooms:	Patient and physician meeting spaces to talk about issues and treatments. (each ~100 sq. ft.)	464 sq. ft.
6 Diagnostics Offices:	To discover the cause and problems of physical impairments. (each ~100 sq. ft.)	568 sq. ft.
Labatory:	Laboratory space for basic experiments run at the facility.	239 sq. ft.

Total: 1580 sq. ft.

Physical Therapy Department

Head Therapist Office:	The director of the physical therapy department, a public face, a place for business to be conducted.	188 sq. ft.
3 Therapist Office:	Physician offices for private time and research. (each ~100 sq. ft.)	263 sq. ft.
11 Treatment Spaces:	Patient spaces where treatment occur. (each ~100 sq. ft.)	976 sq. ft.
Utility Area:	Storage of equipment and supplies needed for treatment.	55 sq. ft.
Exercise Area:	Location of treatment conducted on patients, substations for individual treatment.	992 sq. ft.

Total: 2474 sq. ft.

Aqua Therapy Department

Changing Room:	Changing room for patients to change before and after aqua therapy.	382 sq. ft.
Therapy Pool:	Specialized pool designed to provide aqua therapy to patients in need.	2257 sq. ft.

Total: 2639 sq. ft.

Sports Medicine Department

3 Offices:	Physician office for private time and research. (each ~100 sq. ft.)	305 sq. ft.
Exercise Area:	Location of treatment conducted on patients, substations for individual treatment.	562 sq. ft.
6 Examination Rooms:	Patient spaces where treatment is to occur and consultations are to occur. (each ~90 sq. ft.)	467 sq. ft.

Total: 1334 sq. ft.

Back Therapy Department

2 Offices:	Physician office for private time and research and for consultations to occur. (each ~100 sq. ft.)	228 sq. ft.
Exercise Room:	Location of treatment conducted on patients, substations for individual treatment.	834 sq. ft.

Total: 1062 sq. ft.

Occupational Therapy Department

2 Offices:	Physician office for private time, research and consultations. (each ~100 sq. ft.)	235 sq. ft.
Training Area:	Area where patients are able to learn how to work with their condition in a normal house setting.	1250 sq. ft.

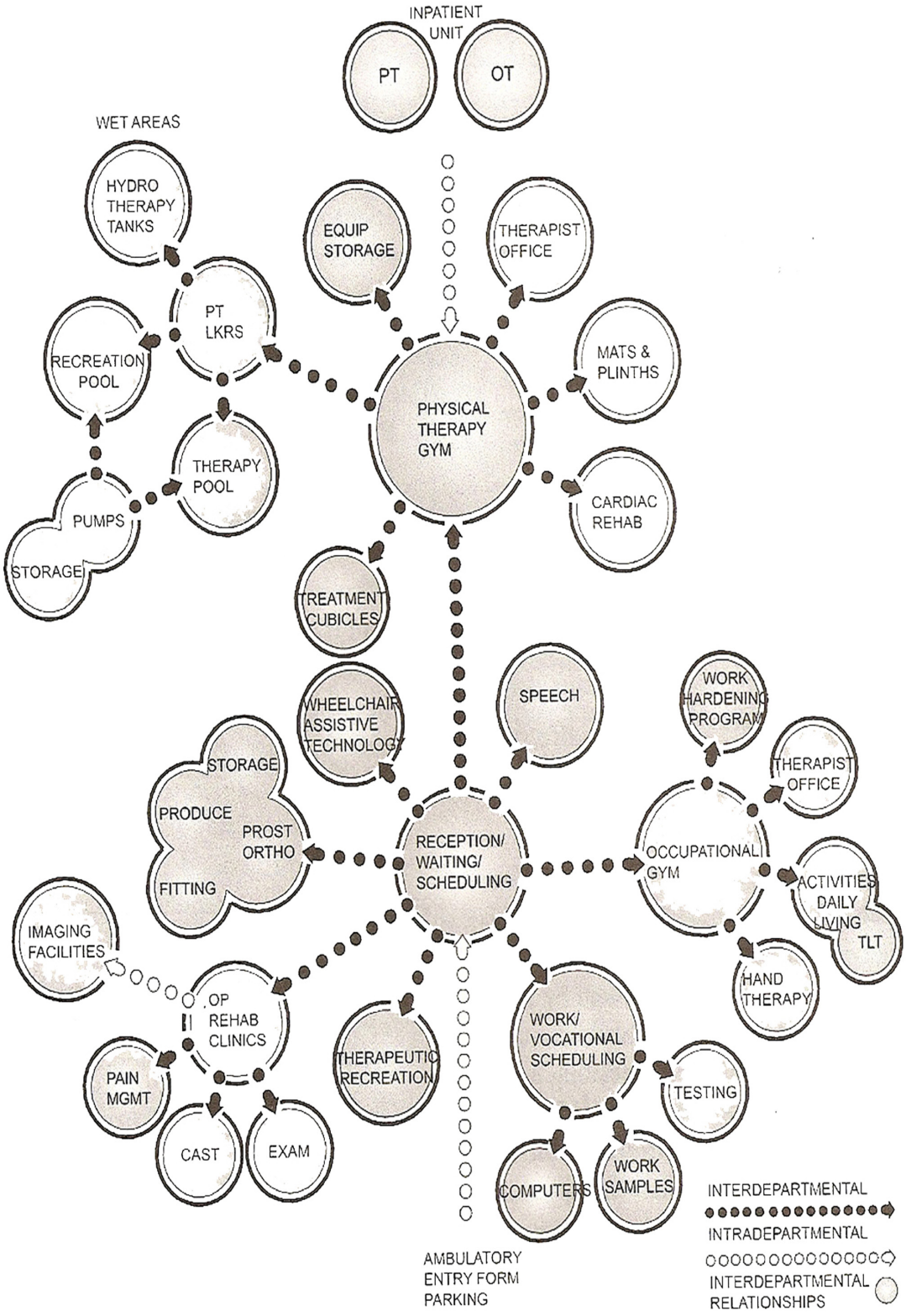
Total: 1485 sq. ft.

Neurological Therapy Department

3 Offices:	Physician office for private time, research and consultations. (each ~100 sq. ft.)	247 sq. ft.
Library:	Location where physicians and patients can research treatments and diagnoses.	712 sq. ft.
Meditation Room:	Location where patients and families are allowed to relax and reflect.	600 sq. ft.
7 Treatment Rooms:	Patient spaces where treatment and consultations will occur. (each ~100 sq. ft.)	613 sq. ft

Total: 2172 sq. ft.

General Public Spaces	3529 sq. ft.
General Support Spaces	31052 sq. ft.
Administration Dept.	1648 sq. ft.
Medical Dept.	1580 sq. ft.
Physical Therapy Dept.	2474 sq. ft.
Aqua Therapy Dept.	2639 sq. ft.
Sports Medicine Dept.	1334 sq. ft.
Back Therapy Dept.	1062 sq. ft.
Occupational Therapy Dept.	1485 sq. ft.
Neurological Therapy Dept.	2172 sq. ft.
Total:	48,975 sq. ft.



(Klimert, 2008. p.125)

Space	Final	Need for space to be quiet	Need for interaction with people	Connection to the environment	Need for open floor plan
ADMINISTRATION					
Reception	150		X	X	x
Accounting	134		x		x
Director's Office	178	X	X	X	x
Assistant Director's Office	111	X	X	X	x
Conference Room	252	x	X		X
10 Offices	823	x	x		x
	1648 sq ft				
GENERAL SPACES					
Waiting	761	x	X	x	X
Receiving	816				x
Staff Lounge	387	x	X	X	x
Social Area	500	x	X	X	X
Janitorial	320				x
Linen Storage	440				x
Multipurpose Space	1595	x	X	X	X
Cafeteria	1173	x	X	X	X
Circulation	25697		x	X	X
Mechanical	1549				x
Computer Head Room	400	x			
	33638 sq ft				
MEDICAL					
3 Consultation Offices	309	X	X	X	x
6 Examination Rooms	464	X	X		x
Lab/Utility Room	239	x	x		X
6 Diagnostics	568	X	X	X	x
	1580 sq ft				
PHYSICAL THERAPY					
11 Treatment Spaces	976	X	X		x
Head Therapist Office	188	X	X	X	x
3 Therapist Office	263	X	X	X	x
Utility Area	55				x
Exercise Area	992	x	X	X	X
	2474 sq ft				
AQUA THERAPY					
Changing Rooms	382				x
Therapy Pool	2257	X	x	X?	X
	2639 sq ft				

SPORTS MEDICINE					
3 Offices	305	X	x		x
Exercise Area	562	x	X	X	X
6 Examination Rooms	467	X	X		x
	1334 sq ft				
BACK THERAPY					
2 Offices	228	X	x		x
Exercise Room	834	x	X	X	X
	1062 sq ft				
OCCUPATIONAL THERAPY					
2 Offices	235	X	x		x
Training Area	1250	x	X	X	X
	1485 sq ft				
NEUROLOGICAL THERAPY					
3 Offices	247	X	X	x	x
Library	712	X	x	X	X
Meditation Area	600	X	x	X	X
7 Treatment Rooms	613	X	X	X	x
	2172 sq ft				

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Thoughts on NDSU:

North Dakota State University has given me an education which has been invaluable, in ways of thinking, usage of technology, and skills in design.