

E
C
O
L
U
X



ECOLUX COMMUNITIES

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

By
Blaze Irwin

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

North Dakota State University Libraries Addendum

To protect the privacy of individuals associated with the document, signatures have been removed from the digital version of this document.

May 2021

Table of Contents

The Proposal

Project Title and Signature Page	2
Table of Contents	3
List of Tables and Figures	4
Abstract	6
Narrative of the Theoretical Aspect of the Thesis	8
Project Typology	12
Typological and Precedent Research	15
Naturhusvillan	
Findhorn	
Aerofarm	
Typological & Precedent Summary	
Major Project Elements	30
User/Client Description	32
Site Information	35
Project Emphasis	38
Goals of the Thesis Project	40
Plan for Proceeding	43

Table of Contents

The Program

Results from Theoretical Premise	50
Project Justification	60
Thesis Context	64
Site Analysis	70
Performance Criteria	81
Appendix	86

List of Tables & Figures

- Figure 01 | Smog Pollution | Page 10
- Figure 02 | Wilfire Devastation | Page 11
- Figure 03 | Hurricane Destruction | Page 12
- Figure 04 | Traditional Ecovillage | Page 14
- Figure 05 | Solvarm Naturhus | Page 16
- Figure 06 | Modern Naturhusvillan | Page 18
- Figure 07 | Naturhusvillan Section | Page 19
- Figure 08 | Naturhusvillan Program | Page 19
- Figure 09 | Findhorn Village | Page 20
- Figure 10 | Findhorn Wind Turbine | Page 21
- Figure 11 | Findhorn Site | Page 22
- Figure 12 | Cellulose Insulation | Page 23
- Figure 13 | Triple Glazing | Page 23
- Figure 14 | Solar Panels | Page 23
- Figure 15 | Straw Bale Detail | Page 23
- Figure 16 | Aerofarm System | Page 26
- Figure 17 | Aerofarm Stacked | Page 27
- Figure 18 | Site Analysis | Page 34
- Figure 19 | Site Analysis | Page 34

List of Tables & Figures

Figure 20 | Glide House | Page 53

Figure 21 | Venn Diagram | Page 63

Figure 22 | 1995 | Page 66

Figure 23 | 2005 | Page 66

Figure 24 | 2015 | Page 66

Figure 25 | 2020 | Page 66

Figure 26 | Green Buildings | Page 69

Figure 27 | Site Overview | Page 73

Figure 28 | Site Location | Page 74

Figure 29 | South | Page 75

Figure 30 | East | Page 75

Figure 31 | Winter solstice | Page 76

Figure 32 | Summer Solstice | Page 77

Figure 33 | Soil | Page 78

Figure 34 | Topography | Page 79

Figure 35 | Net | Page 84

Figure 36 | Matrix | Page 85

Table 1 | Building Benefits | Page 68

Table 2 | Usage | Page 82

Table 3 | Analytics | Page 83

The Proposal

Abstract



Statement regarding overall purpose, method and design intent regarding the thesis project.

Abstract

Seven years, 103 days, 40 minutes and 17 seconds...

On September 17, 2020, Artists Gan Golan and Andrew Boyd displayed a clock in Manhattan Square. This clock, however, displayed exactly how long we have until an irreversible climate disaster occurs, not regular time. Unless greenhouse gases are significantly reduced, the time we have before something like this occurs is limited. It is very easy to see the repercussions of our actions already happening. Many areas of the planet have already seen the 2.7 degrees fahrenheit average above pre-industrial levels. The consequences of this, are also showing. Storms are increasingly getting worse, droughts are getting longer and heatwaves are getting more extreme. The planet is getting sick and we are feeling the effects, but we can also help heal it.

The path to a healthier and more sustainable way of living can be paved by architects of today. Currently, buildings generate, on average, 40% of greenhouse gas emissions annually. The incorporation of new construction techniques, building materials and technologies could significantly help reduce that average. Sustainable design is a necessity in this endeavor and should immediately be incorporated into all types of design whether it be residential, commercial, or industrial.

This thesis project will focus mainly on how to incorporate sustainable design into smaller communities. A proposed self-sufficient neighborhood will convey how altering our lifestyles can not only help improve the life of the planet, but also the physical and emotional well-being of humans as well. The community will focus on finding the balance between modern technology and traditional living methods to create a healthy, comfortable and unique environment where individuals and families can thrive.

Narrative of the Theoretical Aspect of the Thesis



Provides an overview of what will be the main focus of the design and research. Additionally, explains why I chose this topic and the importance it has to me.

Narrative of the Theoretical Aspect of the Thesis

The integration of sustainable design into the modern community and its benefits.

Supporting Premise

- The immediate need for new building strategies to promote environmental wealth.
- The promotion of a different living style to promote health and well-being for individuals.
- The adoption of new farming practices to adapt to the reduction of arable land.
- The education of food growing and providing an alternative to help reduce homelessness and hunger.

These supporting premise, along with the main theoretical aspect of the thesis will help portray a new picture of life for a brighter future.

Why Sustainability?

I chose this topic as I have felt that there is a continuing importance for this type of design to be implemented into the field on a more consistent basis. I have always been one who has enjoyed what nature provides us and believe that it should be protected at all costs. Unfortunately, us, as humans, have consistently lacked general courteousness to our surroundings and what it provides. This has lead us into our current situation of irreversible climate effects and it seems that there is still not enough vocalization and agreement amongst peers about how necessary and immediate a change must be.

Narrative of the Theoretical Aspect of the Thesis

The Problem

It is no question at this point that the climate has changed and the environment has suffered as a result. The main issue facing us now is how do we change the path we are on? How do we convince people that sustainability needs to occur? The answer is not one easily attained. Change is always met with reprisal. This can easily silence the new proposition. However, if done correctly, change can be implemented in an efficient manner where ideologies and methods spread and gain popularity due to overall effectiveness compared to the original ideal. This is why the main takeoff for sustainable design should go through smaller communities and neighborhoods. These communities can provide a basepoint for similar areas which would then lead a more direct and planned approach to incorporation into larger cities. This, of course, is a method that takes time, and would not solve all the problems that the environment currently faces. However, it could serve as a tipping point, beginning a new, popular trend that spills into other sectors, thus, growing the expansion of eco-friendly, sustainable living.

fig. 01 | Smog Pollution



fig. 02 | Wildfire Devastation



The Destruction

Wildfires have continually gotten larger and more destructive with the main cause being long droughts and extreme heat due to a change in climate.

Storms, such as hurricanes, have now been proven to not only be stronger, but also occur more frequently as a result of climate change.

fig. 03 | Hurricane Destruction



Project Typology



Summarizes the architectural and landscape type as well as well as analogous similarites.

Project Typology

Self-sufficient communities, or ecovillages, have actually existed for numerous years. Located around the world, these villages attempt to maintain a healthy balance between nature, technology and common lifestyle practices. However, it seems that the balance has yet to be discovered and sustainable communities remain to be found very far and few in between. Many lack the technological advancements it would take to implore newcomers into this way of life. There is no doubt that we have reached a point in time where technology and ease of life are a necessity in many peoples lives. From phones and laptops to cars and buildings themselves, technology is found almost everywhere. But have we become so reliant on this technology that it has actually become a detriment to our society and well-being as a whole?

This new sustainable community aims at finding that balance between tech and environmental wealth. How can we provide advanced, sustainable, modern technology into communities built around traditional methods of sustaining life? While not commonplace in our current timeframe, many sustainable technologies have already been introduced into the world of architecture and design. The appropriate interaction between these technologies and traditional methods breeds a relationship to excel the overall health of not only our planet, but people as well

The 'ecovillage' also intends to bring social reformity, designed to be a new and engaging environment for those involved. Incorporated into the community are a mix of private and public spaces, creating an appropriate blend of areas for people to interact with as well as the necessary hygenic factors to properly clean and renew waste. The community creates a new brand of living, one, if popularily adopted, can spring the the world into a new era of sustainable living.

Project Typology

Issues facing this typology

Many alternate factors besides the technological disadvantage play a role into the skepticism of sustainable communities. Living in this way requires arable land, which the earth has already run out of to provide enough crop calories for every human on the planet, and the population is only increasing. Currently, 55% of crop calories are used for human consumption, and with the population expected to boom to 9 billion people by 2050, new methods, such as vertical farming and self-grown food, need to be incorporated to continually be able to provide enough food calories. To do this we must use space effectively and create our own arable land for crop use. These methods will all be incorporated into this thesis project as an effective solution to this problem.

The typical ecovillage does not include modern technology that many would find necessary for comfortable living in today's era, as shown in the image .

fig. 04 | Traditional Ecovillage



Typological and Precedent Research



Numerous studies providing insight and evidence into similar building typologies compared to the thesis project.

N

a

Project Type: Residential

t

Location: Vanersborg, Sweden

u

Size: 1560 sq ft log cabin enclosed by 3230 sq ft greenhouse

r

Almost everything about this residential establishment separates it from that of ordinary home living. The simple definition is a log cabin encased in a glass building, however, it is much more than that.

h

Naturhusvillan cooperates with nature, meaning it uses environmentally friendly technology to create a space suitable for living without “destroying, looting, and poisoning” the environment.

u

s

v

i

l

l

a

n

Program elements found in this project include a majority of what the building itself exists upon. Naturhusvillan is completely self-sustaining and greatly enhances the interaction between people and plants. Anders Solvarm, the owner and creator of this house, envisioned a space where his autistic son could live happily and comfortably & this building is the result. The Solvarm family are able to grow their own food for a longer season with the increased heat due to the greenhouse and also treat waste in a safe and effective way. The whole concept of this establishment is to bring people closer to nature, not further away.

fig. 05 | Solvarm Naturhus



Naturhusvillan

Naturhusvillan is not a completely new concept. The original Naturhus was designed by Bengt Warne in Saltsjobaden, Stockholm in 1970. Anders Solvarm actually designed his house around the original principles that Warne originally established. These include that housing should learn from nature, cooperate with nature, control flows and cycles and use sophisticated but environmentally friendly technology. Although this concept was introduced many years ago, it is still one that has yet to be fully adopted by the public eye, although it is slowly growing in popularity in some areas such as Sweden.

The Solvarm house does include some unique features unbeknownst without directly looking at it. Waste from the house, black and grey water, is collected in settling tanks for two days. This allows the time to form a nutrient-rich liquid that is then re-used and pumped into the 1.1m deep soil beds to provide nutrients for the plants.

Solvarm also incorporates plant pollinators such as bees to provide another growth stimulus amongst the greenhouse.

This type of house is obviously everything the environment could hope for, from the building materials itself to the greenhouse and renewable waste to nutrients, Naturhusvillan is the epitome of sustainable residential design at this point in time. Despite how sufficient this home is, it still does not come without controversy. Politics and social differences always seem to find their way into uncommon ideologies. Anders Solvarm was not immediately met with open arms by his city about the type of waste management system he was using. It is not common practice in Sweden for people to have things considered higher quality compared to others and the Solvarm waste system was considered better than what the city was providing, which caused for some push back. Eventually, they managed to

“Sometimes, when you build a house, you push nature away... Naturhus is all built around trying to enhance the interaction between people and plants” - Anders Solvarm

Naturhusvillan

successfully expedite this process and continue with their waste management system. This just goes to show, however, that no matter what the idea may be, even if it is considered better quality, it will almost never be accepted immediately by everybody.

The Business

Anders Solvarm, along with Niklas Dahlstrom have come together to form what is now known as Naturhusvillan, building residences similar to that of Anders' original Naturhus. They are currently involved in most of the Nature house projects being built in Norway and Sweden.

The Buildings

Naturhusvillan currently has three types of houses that they build:

Naturhusvillan Mini- 100m² building area, 55m² core living house. 1-2 people

Naturhusvillan Midi-210 m² building area, 110 m² core living house. 1-4 people

Naturhusvillan Maxi-300 m² building area, 135 m² core living house. 2-6 people

All offer expansive customizations and features.

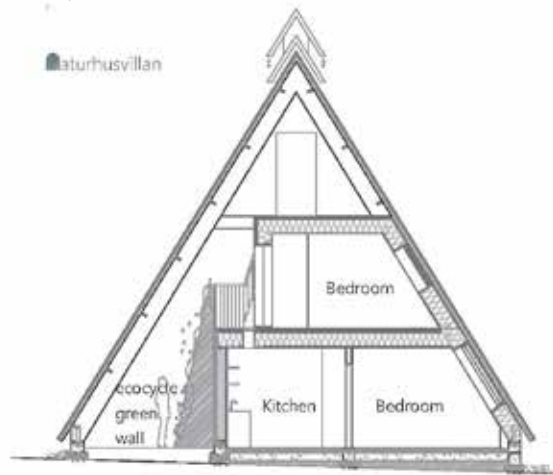
fig. 06 | Modern Naturhusvillan



Naturhusvillan

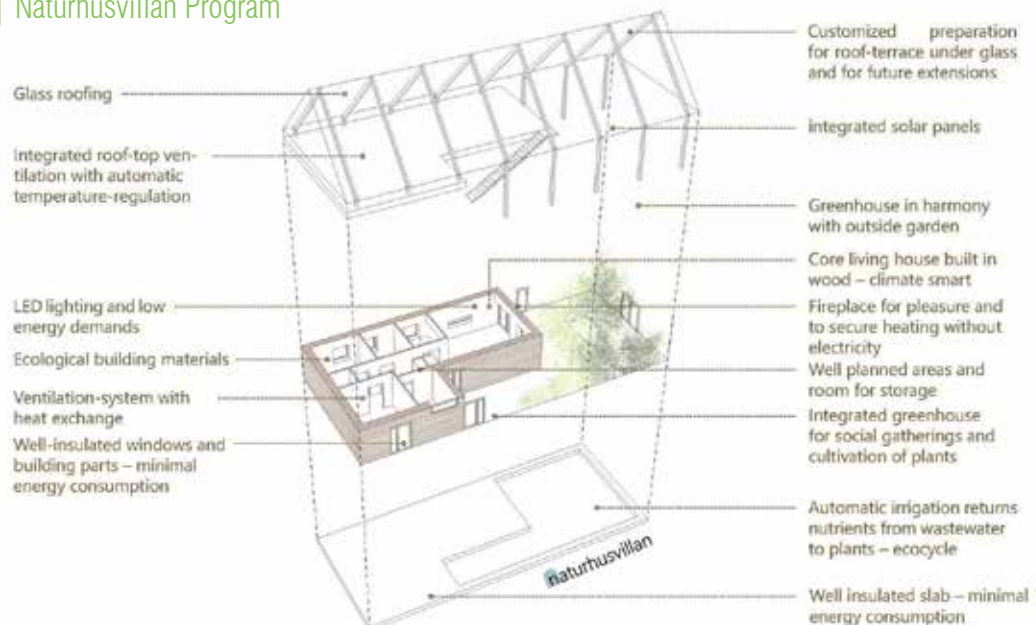
The Details

fig. 07 | Naturhusvillan Section



The new Naturhus exhibits an 'A' frame style compared to the traditional frame. There are many similar features with a more modernized style, as well as personalized options for homeowners.

fig. 08 | Naturhusvillan Program



Project Type: Ecovillage

Location: Moray, Scotland

Size: 123 acres

The Findhorn Ecovillage is considered the largest sustainable human settlement in the UK. This community engages in practices such as ecological buildings, organic food, renewable energies and water systems. Findhorn was established over 50 years ago by a few friends and now houses more than 400 residents.

Findhorn has now created its own foundation, titled the Findhorn Foundation, and aims to educate people on “low-carbon, place-based values & practices for human settlements to thrive.” The ecovillage provides a viable solution to the deterioration of the environment.

Program elements associated with Findhorn include many techniques analogous to other ecovillages. These include the previously stated eco-buildings, growing organic food and renewable energy sources. These common practices are generally obligatory when it comes to sustainable communities. The renewable energy systems used in Findhorn include solar panels found on the rooves of the buildings, wood heating and also wind power. The wind turbines, which set this sustainable community apart from many of the rest, supplies more than 100% of the communities electrical needs. The community also, uniquely, owns its own private electricity grid. Findhorn is continuing to attempt to advance the design methods incorporated throughout the village which is allowing for its persistent success.



Findhorn

Findhorn relies heavily on the social aspect of the community. For a niche like this to continually thrive, the people involved in the community must have a common goal and initiative to drive the success of the establishment forward. This states a common issue as to why the sustainable lifestyle has not gained popularity. Most people are not interested in the sustainable lifestyle. New sustainable communities must find ways to accommodate people and their needs as well as offer advantages compared to people's current way of living.

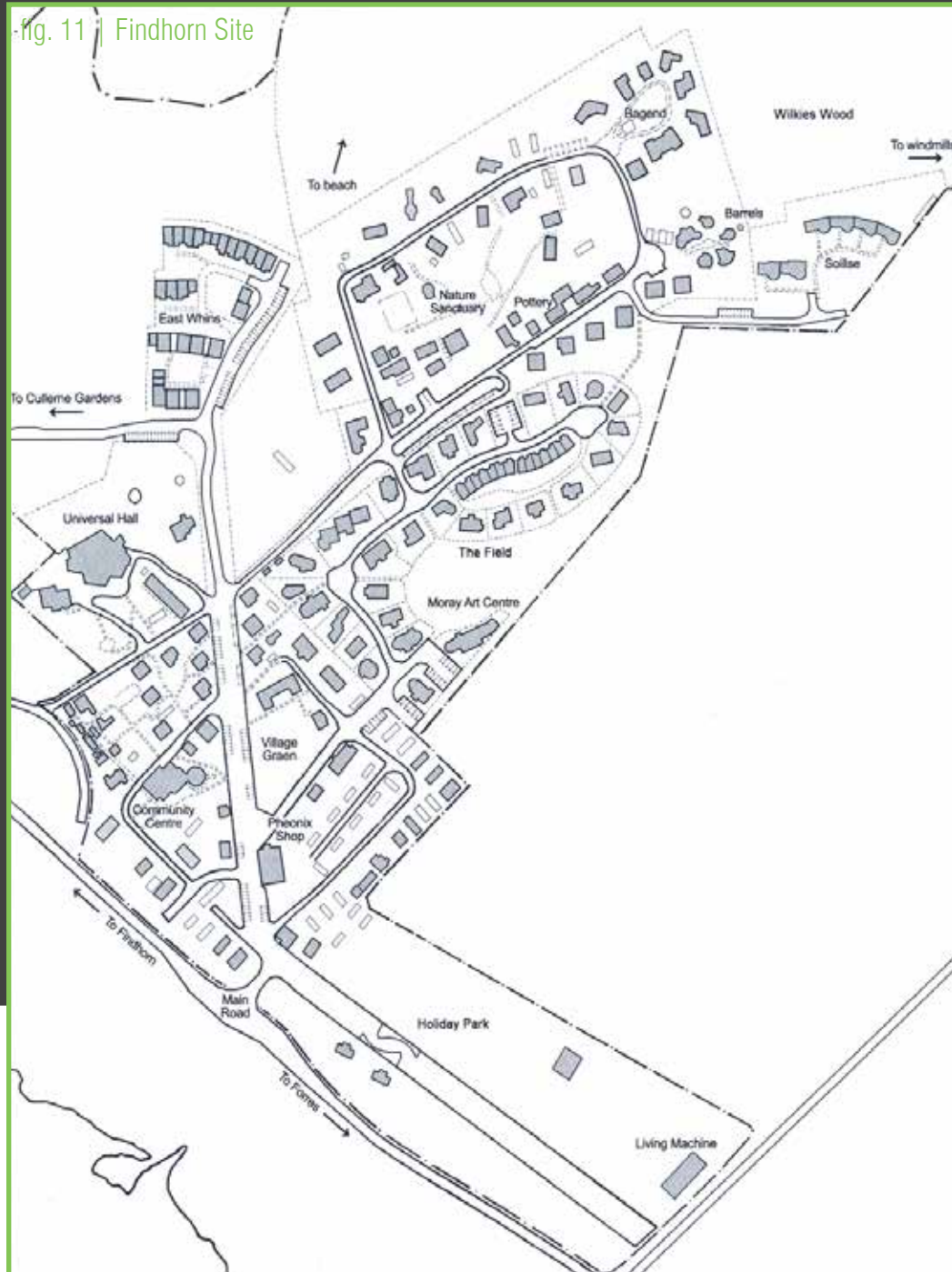
Another important aspect of Findhorn is its water system. It uses Europe's first Living Machine and Biomatrix Remediation system to treat wastewater. The water is transported to a greenhouse which contains tanks housing diverse species of bacteria, micro-organisms, plants, snails, algae and fish to filter water, which is then pure enough to be discharged out to sea or recycled. This is a relatively inexpensive cost for wastewater treatment and uses no chemicals, thus increasing its overall benefit.



fig. 10 | Findhorn Wind Turbine

Findhorn

The Site



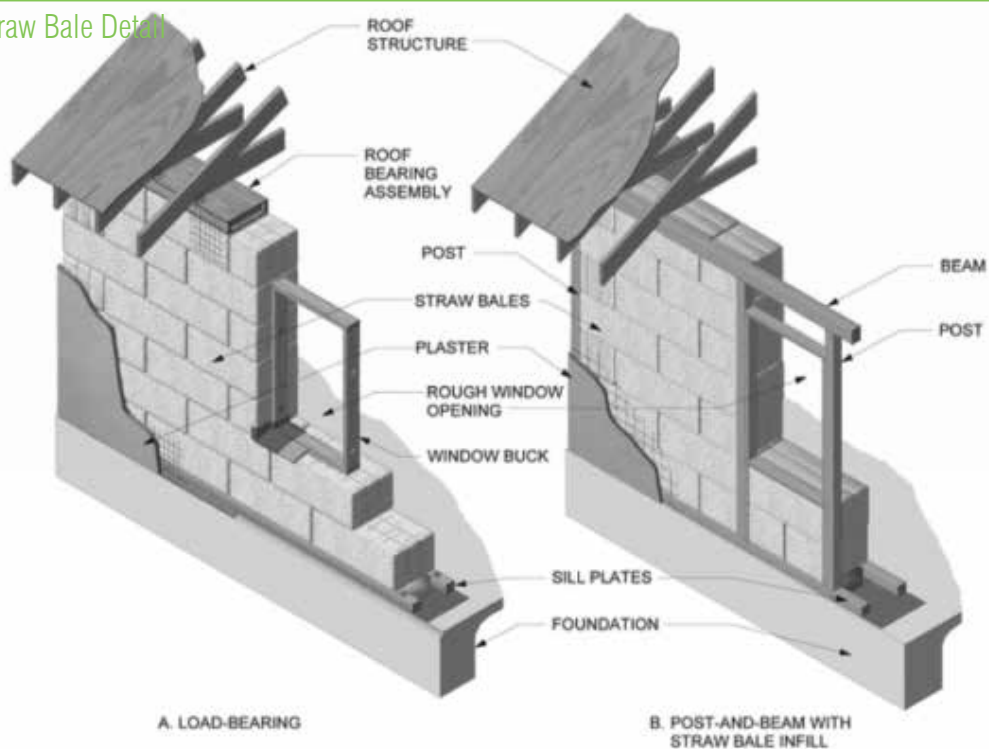


The Details

Findhorn ecovillage has been utilizing and exploring new and effective sustainable building techniques for years. Some of the methods they use are straw bale construction as well as incorporating what they call a 'breathing wall,' which dismisses the need for a vapor barrier. This allows for a controlled exchange of air and vapor. Other Ecological details include simple timber frame construction, cellulose insulation, low-energy light bulbs, district heating system using gas condensing boilers, natural clay tiles, triple glazing, and many more .

Example of straw bale construction shown below. Images shown above, from left to right include, cellulose insulation, triple glazing and solar panels. These are all sustainable design solutions found throughout Findhorn ecovillage.

fig. 15 | Straw Bale Detail



Project Type: Vertical Farm

Location: Newark, New Jersey

Size: 70,000 sq. ft.

A
e
r
o
f
a
r
m

By the year 2050, there will be 9 billion people on this planet, resulting in a drastic reduction of arable land. Aerofarms aims to help solve this issue by coming up with new farming solutions. They are currently one of the largest and most successful vertical farms in the world, growing more 390 times more crops per square foot while also using 95% less water. Their goal was simple: cultivate more food with less space. Their results are transforming agriculture. Aerofarm is revolutionizing farming with their award-winning aeroponic technology, which provides nearly perfect, controlled conditions for plants to thrive. Their first seeding was in 2016 and they now have grown to harvest up to 2 million pounds per year at their global headquarters.

Program elements found in this case study involve the use of vertical farming to cultivate more crops in a denser area. The sustainable community in this project will utilize vertical farming technology and explore other ways to maintain as much arable land as possible. What sets Aerofarm apart and makes them a reliable case study is how successful they are. Many vertical farms struggle to turn a profit and maintain operation. Aerofarm's business strategy, method of operation, growing technology, and environmental control all must be explored to understand what makes this type of agriculture be successful and maintain that success for years to come.

Aerofarm

Technology

Aerofarm's aeroponics system plays a large part in the company's success to grow plants in an effective way. This system mists the roots of their plants with nutrients, water, and oxygen. This water is then returned to a closed loop system which allows for 95% less water than farming and 40% less than hydroponics.

The light for the plants is provided by specific LEDs, customized to give the plants the correct amount to be able to perform photosynthesis.

Aerofarm's seed can actually be grown twice as fast as compared to typical field farming. This is the major factor that leads to the 390 times more productivity per square foot.

Everything is recorded and controlled at AeroFarms. This allows for super accurate, efficient data recovery, helping them make adjustments and improvements whenever needed

Benefits

Cultivating more crops is not the only benefit to vertical farming. 70% of water contamination actually comes from agriculture itself. With Aerofarm's aeroponics system, they are actually to put 70% of their water supply towards it.

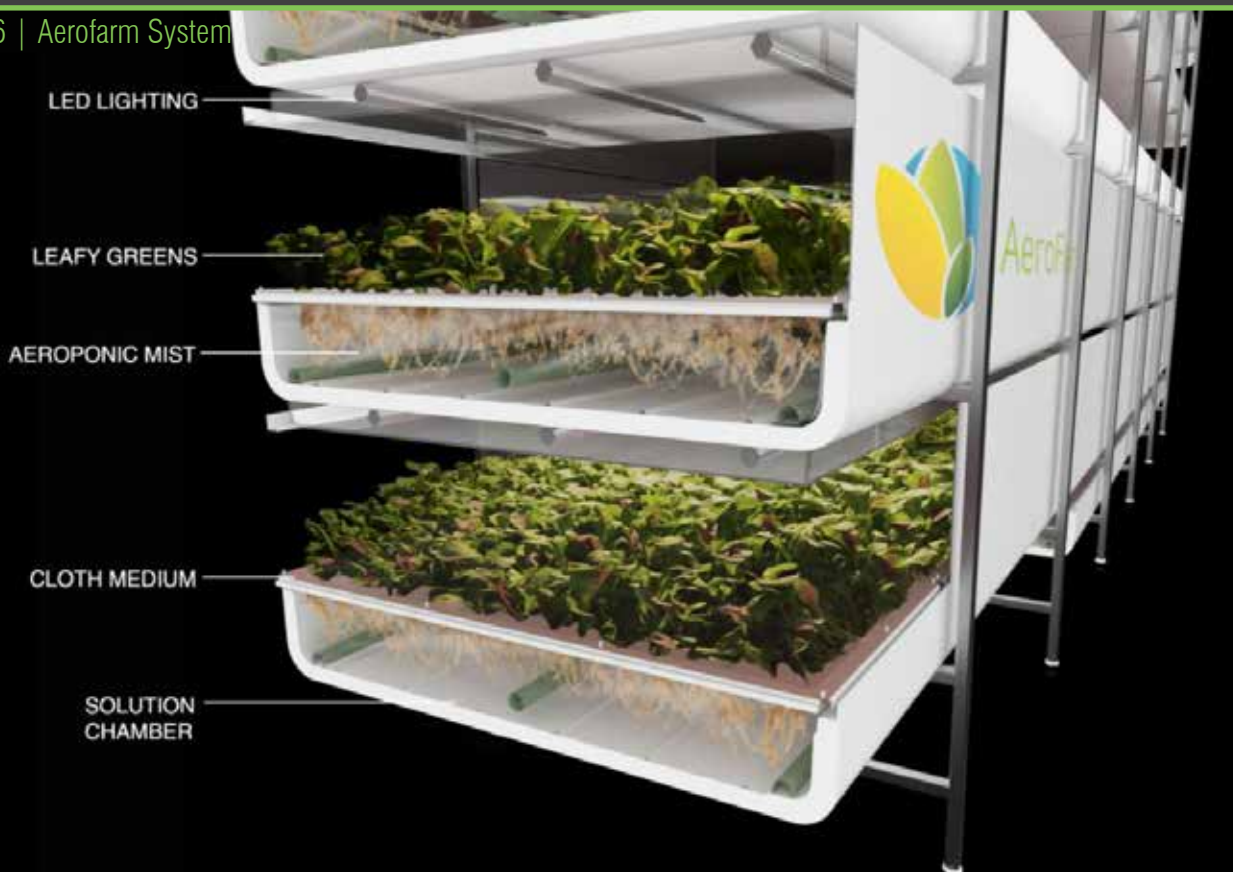
Vertical farms, including Aerofarm's, operate indoors. This offers a distinct advantage to traditional farming. Pesticides. These are typically the main cause of toxic runoff, which leads to harmful environmental interactions, such as algal blooms. By keeping the growing indoors, it is much easier to avoid these issues.

The Aerofarm's vertical farming method includes the opportunity for flexible customization such as size and alternative stacking methods, making installation possible in a variety of spaces.

Aerofarm

The System

fig. 16 | Aerofarm System



Aerofarm

The Modules



Typological & Precedent Summary

The goal for these typological & precedent studies was to find and analyze real world applications similar to what will be found in my thesis project. The strategy was to research individual buildings analogous to what will be found in the community as well as one larger example of an entire sustainable community itself. Doing so this way allows for more detailed exploration of individual structures and sustainable design systems, which then helps to incorporate them into the community in an effective manner. The study of these three different areas will also help me keep an open mind when it comes to the conceptual design phase. Each of these case studies allowed for personal customization. This helps give more freedom and less limitations when thinking about possible layouts and site organization.

Naturhusvillan provided a great starting point to learn from when it comes to sustainable, residential properties. The Solvarm residence offered many great methods of green design located throughout their property. These included the waste management system for black and grey water and recycling it back in as nutrients for the plants, the greenhouse system which prolongs the growing season, and also natural building materials used for the core portion of the house. Most of these methods will need to be incorporated into the type of residential properties located in the community for the thesis project. However, adjustments will need to be made to accommodate different conditions found at the project site. Some key factors will be climate and terrain, as well as a more urban environment and multiple people compared to just one family.

Typological & Precedent Summary

The Findhorn Village, located in Scotland also offered up many different methods for sustainable design in a community space. Although this 'ecovillage' looks like it maintains a traditional approach from an architectural standpoint, it is actually continually searching out new technology to help advance the community in a sustainable way. They have many basic uses such as triple glazing and solar panels, as well as wind power from turbines. Some of these methods may be incorporated into the thesis project but in a more modern and technologically advanced way. Findhorn also gives a good look into the amount of area taken up for this type of ecovillage. With traditional farming methods and wind turbines, this type of community takes up more space than what would generally be allowed in an urban setting. This is why I decided to find alternative methods, such as Aerofarm, and vertical farming.

Aerofarm is the world's largest indoor vertical farm, harvesting up to 2 million pounds per year. Compared to traditional farming, they are producing 390 times more crops and using 95% less water. All while being in a much more condensed environment. With such a high cultivation rate in a drastically smaller area, this is a method to strongly consider when it comes to providing and growing your own food in a community. This also prevents toxins getting into the water from runoff as well as the ability to have a much longer growing season, if not year round. Vertical Farming, however, has not yet been completely adopted yet by the public eye and many have actually struggled to make a profit. This type of farming will need more advanced research to find out if there was a way to make it a long lasting endeavor

Major Project Elements



Overview of substantial design solutions and primary research objectives that form the thesis project.

Major Project Elements

Architecture

The architecture found throughout this community will consist of private residential, mixed-use, and public spaces. The goal is to provide the adequate ratio of public to private, giving residents a comfortable mix of living options and activities. Major buildings will include:

- Resident Houses
- Mixed-Use Apartments
- Vertical Farms
- Greenhouses
- Water Treatment Facility

Landscape Architecture

The landscape architecture will consist of multiple sustainable design techniques including ponds, permeable sidewalks and roadways and locally derived plant life. Additional public and private spaces for people to use will be spread out amongst the community to freely use.

Well-Being

Mental and physical health are topics that have become widely popular and debated. Both are something that need to be prioritized. In traditional lifestyles, mental and physical health are continually deteriorating and more and more people are struggling with each. This new community will provide a unique lifestyle, aimed at adjusting the common daily schedule most people perform to a more suitable way of life humans were intended to live.

User/Client Description



States for whom the project will be designed along with the qualitative and quantitative data requirements.

User/Client Description

Overview

The sustainable community will be designed for multiple clients and users as it includes a variety of spaces. It will originally be designed to accommodate roughly 100 residents, therefore, proving the need for private housing. To reduce land use, some of the housing will occur in a mixed-use style building. Other clients include owners of the businesses located in the community and what their needs would be.

Public areas would need to be properly maintained, thus, providing additional staff members incorporated into the community.

Each individual house will have its own parking garage. Additional parking requirements will be fulfilled according the building type and location.

Overview Cont.

Other users of the community would be individuals from outer areas, visiting the site to use its amenities and support the businesses.

User/Client Description

Qualitative/Quantitative Data

Residential	8-10 Houses of Varying Size(1000 - 2500 SF)
Public Use	Community Center, Various Shops
Renewable Waste	Appropriate Number of Settling Tanks
Wind Energy	2 Wind Turbines for Energy Production
Aquaponics	1 Building for Food Production
Vertical Farm	1 Building for Food Production
Agriculture	2 Plots of Land for Food Production
Green Space	Large Green Areas Located Throughout Site
Parking	Guest Parking with Access Close to Public Spaces

Site Information



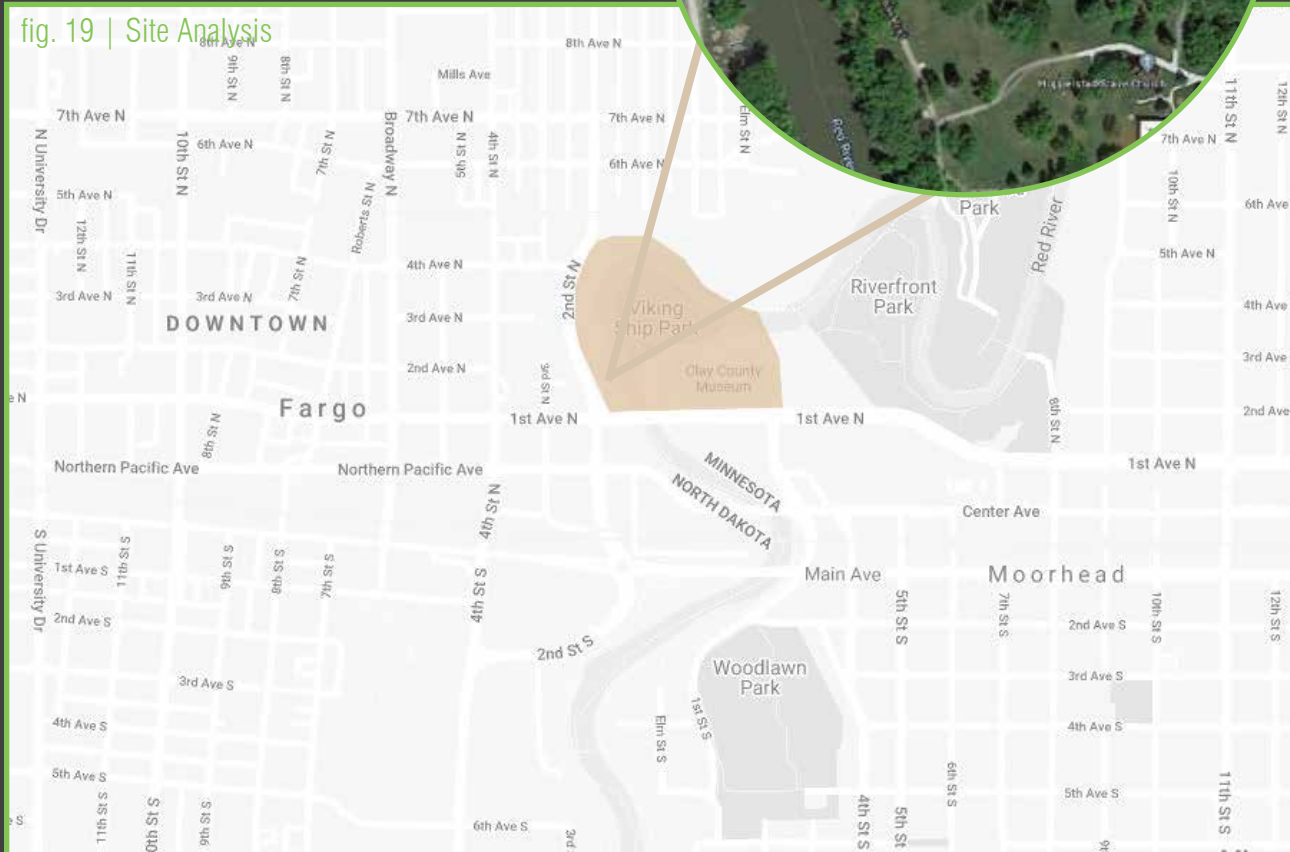
Brief description providing detail to the location of the project with corresponding images.

Site Information

fig. 18 | Site Analysis



fig. 19 | Site Analysis



Site Information

Location: Fargo, ND & Moorhead Minnesota

The site is located on the Red River directly between North Dakota and Minnesota. Numerous factors played a role in the decision to choose this site. The major one is that as buildings continue to be built outward, mainly on land that was once used for farming food production will slowly decline. Challenging ourselves to build on different sites not using arable land will help slow this decrease. The site does offer the distinct challenge of being completely within a flood zone, however, with modern building and design strategies, effective methods can be used to effectively incorporate a food producing community.

This location also could have the distinct advantage as serving as a great public hub for both Fargo and Moorhead by having a unique environment like nothing that has been built in the area before. This would be an ideal spot to provide a more permanent Red River Market to also help grow and stimulate the local economy.

Overall, I believe this site provides a quiet location, maintaining the individual community feel, while also allowing efficient access to larger city amenities.

In the long run, this site could serve as a catalyst for future sustainable communities.

Project Emphasis



Elaborates on the overall Thesis premise and idea. Describes what the main point of focus on the project will be.

Project Emphasis

Focus

The main emphasis of the project is to design a functional, self-sustaining community that uses modern, advanced, sustainable design technologies. This community will show that this type of living is possible and actually beneficial to the overall health and well-being of individuals.

The intent is to establish a new narrative surrounding this lifestyle, showing that a community which interacts in this way can be effective towards environmental wealth as well as keep the feel of modern, technologically advanced living. The focus of the design will be a small community, however, this community intends to serve as a guideline for the transition of making sustainable design practices more common in larger urban environments.

Emphasis Support

Additional supporting points of emphasis will be included in the thesis project and research. These specific points are meant to provide alternative means of importance behind the thesis project, aside from the main premise. Together, the emphasis and supporting points will create a persuasive form of research, imploring people to change their outlook on and search for an interest in sustainable living and design.

Goals of the Thesis Project



Clearly laid out description of goals that the Thesis project is looking to attain.

Goals of the Thesis Project

Summary

The various thesis goals will be established into three separate categories. Each with its own precedent in various areas of the thesis research.

Theoretical:

- Answer how to change the narrative behind sustainable communities and make it a popular concept.
- Answer how changing to living in a sustainable community can have a positive effect on well-being.

Social

- Establish a variety of social capacities within the community where people can interact.
- Provide an adequate ratio of private to public spaces to create a comfortable living environment.

Physical

- Create visuals and analytical data proving effectiveness of thesis project and its intent.

The Academic

Academically, in this project I will strive to test my overall knowledge of architecture and use a combination of skills I have learned in my four previous years of undergraduate courses. These skills I have learned will help me generate models, diagrams, drawings, details and other necessary information to promote the thesis project in the most effective manner possible.

Goals of the Thesis Project

The Professional

The field of architecture is everything but monotonous, continually changing codes and building styles mean architects need to remain educated on the current climate of the profession. With this project, exploring new technology and upcoming design strategies is of utmost importance. Understanding the details and construction of how to properly incorporate sustainable design techniques will be necessary to properly execute an efficient building design. Learning these strategies will be new and something that will help me expand my knowledge in an unfamiliar area of architecture. Exploring building materials and systems and studying the properties each has will also be required to provide proper building structures. Finally, being aware of costs of specific design designs will be essential in creating a community for regular people.

The Personal

The overall personal goal for the project is to acquire a new sense of knowledge about sustainable living. The information I learn throughout this project is something I would like to establish in my own life and practice a healthier way of living. Nature is something I believe is something that, at this point, needs to be protected as much as possible and any knowledge I can gain from this process helps me understand ways this can be implemented into real life situations. With this information, it will help me encourage others to start healthier, more sustainable lives by providing them the necessary guidance they need to start that new journey.

Plan for Proceeding



Defines the overall method taken to complete the project. Provides a schedule and tasks to follow to help maintain organization.

Plan for Proceeding

Definition

The major areas of research that need to be accomplished in order to begin an effective design solution are:

Programmatic Requirements

- Number of residents
- Public to Private space ratio
- Parking requirements
- Adequate building space
- Circulation

Site analysis

- Drainage slopes
- Means of Access
- Size
- Soil
- Plant & Animal life

Project Typology

- Architecture and Landscape architecture
- Mixed-use buildings
- Residential buildings
- Public areas

Theoretical Premise

- How to effectively incorporate this design technique into communities

- Incorporating modern technology in an effective way
- Providing a community where people can experience growth in both mental and physical aspects of life

Design Methodology

The method I will be using as a means of exploration for the project will include several techniques. These are quantitative and qualitative analysis, meaning statistical and scientific data as well as information obtained directly from observation. Others include digital analysis and also interviews. I believe this will provide me with a quantifiable amount of information needed to justify the means for my thesis project

Documentation

Research and observations will be compiled with a combination of softwares to provide an exhaustive report of the findings. These findings will then be made available through pdfs and hardcopies as well as presented at the end of the year(2021)through powerpoint presentation and presentation boards.

The Program

Results From Theoretical Premise



Summary of research based articles and their application to the thesis project.

Literature Review

DASH

DASH stands for Designing Affordable Sustainable Housing. This article researches effective strategies in which sustainable housing can be successfully developed in an affordable and efficient manner. Some of their main goals include developing higher levels of sustainable design than what is currently out there and that can serve as models for future buildings. Another main component to this premise is making these new, higher level designs affordable as well. They aim to do this by longer term cost proposals where initial capital is traded for reduced life-cycle costs and shorter term cost proposals with more up front capital. Other factors that will effect affordability include the building itself. Throughout the complete construction and building process, the building itself only takes up about 45-50% of the actual cost.

There are a number of other factors that can be changed to help greatly reduce the cost of a building, including non-unionized construction, and housing associations. This development also stresses that it is not used to solve the particular issue of affordable, sustainable design but to serve as a point that future projects can look to as a reference and improve upon. In the end they want to come up with a design that contributes to “social, environmental, and aesthetic outcomes.”

Project Application

DASH provides great insight into many different categories that apply to my project. Although the project reviewed is a multi-family complex, it still incorporates many fundamentals and strategies into its design that I could work into the development of a sustainable community.

“social, environmental, and aesthetic outcomes.” - Diego Ramirez-Lovering

Literature Review

Project Application Cont.

Finding ways to develop sustainable housing while maintaining an affordable price range and a high level of design is going to be one of the main challenges of my thesis project. The DASH project comes up with alternate financial solutions and methods for funding and payment of the building and design. The incorporation of a new type of community to a current city or town that differs greatly from the current lifestyle trends is going to need to offer these different financial opportunities to attract the attention of ordinary people in the area.

Higher levels of design that stray away from the ordinary cookie-cutter method of house-building is also of utmost importance in this community. Creating a system where individuality can be expressed while still maintaining a community like atmosphere is a challenge that also needs a viable solution.

Options necessary to provide this solution could be offered through a substantial sustainable materials palette and multiple building footprints that can be altered to the clients needs and wants. Personal accent colors can also be offered to increase the individuality and expressionism of the consumers. Additionally, different tiers of luxury can be offered to allow for multiple price classes to become involved within the community.

Overall, the DASH method highlights many intriguing problems that arise when designing for sustainability. These problems need creative solutions that can then be used as a resource for future projects to help further the development of sustainable design not only in small communities, but to larger cities as well.

Literature Review

Glide House

The Glide House was designed by Michelle Kaufmann in 2004. It was built in only 19 days. How did this 1,344 sq. ft. home be built so quickly? Prefabrication. The home was built and put together in a factory near Vancouver, British Columbia. It was then hauled to its site on truck beds almost completely put together. Putting a building completely together and then hauling it does have its own unique complications, such as planning specific transportation routes to the site and dimensions of the building which allow it to fit on the truck bed. However, there are numerous advantages to the prefabrication process when it comes to construction. These include:

- Much shorter construction time
- Eco-Friendly
- Flexibility
- Cost Effectiveness
- Safety
- Less Site Destruction
- More Consistent Quality

Even though this home was built in a very short time in a factory, it is still very far from lacking design quality. On its initial opening, there was an hour long line just to walk through it. One person even stated “I liked the design so much, I wanted to go home, burn my house down, and start over.” Overall, this prefabrication process has proven to cut down on construction cost while also maintaining high quality design standards.



fig. 20 | Glide House

Literature Review

Project Application

The mention of designing a sustainable form of housing has been mentioned numerous times throughout this project. The Glide House project helps provide a viable solution by using the prefabrication process to a high form of success. Ultimately, this process can be used in certain parts of the design to help reduce certain construction costs and allow more room for alternate design variables. Unlike the Glide House, the houses used in my project would not be able to be completely built in a factory, but certain portions could be prefabricated and transported to the site and then put together on site.

Building a sustainable community is the main goal of the thesis project, however it is not the only goal. Constructing buildings and structures are also a large part of the greenhouse gasses and fossil fuels used in this

industry. The prefabrication process is also more environmentally friendly as opposed to traditional construction techniques. It eliminates the need for a lot of large equipment and machinery needed for on-site development. If buildings begin to use this process more frequently, it will only multiply the effect of these sustainable designs that much more.

The Glide House is a effective start for possible solutions to making sustainable design more affordable while also greatly decreasing the amount of time it takes to complete construction. With this reduction in time, this also makes the means of additional sustainable communities to grow at a much higher rate.

“I liked the design so much, I wanted to go home, burn my house down, and start over.” - Glide House Guest

Literature Review

Ecovillage Base for Well-Being Strategy

This article provides an in-depth review on the effect ecovillages have on a person's well-being. It states how ecovillages have always strived to maximize a person's well-being and overall happiness. The article then highlights 20 different areas in which ecovillages differ from typical industrial and urban cities. These areas may be found in urban environments but carry much less importance compared to individuals who live in sustainable communities. One may think that these specific factors are something that can only be easily maintained while living in an ecovillage but a majority of them are actually things that should be stressed as important in everybody's everyday lives. A few of the areas included in this research are healthy food, physical activity, proximity to nature, environmental activism, shared work, and celebration.

As you can see, these specific areas mentioned in the text are easily not only be limited to ecovillage life. These rudimentary actions can easily be forgotten in the current work-life balance trend, one in which is continually worsening in the United States. Things such as celebration, physical activity and healthy eating are far too often tossed aside for alternate actions which cause stress and anxiety, thus leading to the steep decline in well-being and happiness. The article also touches on how to get the masses to buy into the ecovillage lifestyle and the difficulties that come with doing so. A majority of people are very uninformed on sustainability, especially when it comes to living in this type of way. They may assume it is significantly harder and take more work than how they are currently living. To cope with this misinformation, the author suggests educating the public to fully understand sustainable living and the multiple ways this can be accomplished.

Literature Review

Project Application

This article fully encompasses one of the main goals of this thesis project and that is to improve the overall well-being of individuals. It has always been said that “nature is healing.” This does not only mean physically, in fact, I believe this statement applies more to the overall mental health of people and the positive impact nature can have on it. This does not mean that people must go to an extreme and live out in the elements, but just incorporating small doses of nature around neighborhoods and in households can go a long way, as well as provide an enjoyable aesthetically pleasing environment. I believe creating a blend of current technology and common everyday life with new and improved sustainable building and design techniques, people can live in spaces and areas that promote healthier, more interactive lifestyles.

Adopting these new strategies, however, cannot just happen over night. Governing policies and budget practices would have to be adjusted to allow and promote for such a substantial change to take place. This, also, is a difficult task as there is really no heavily based research on how to properly adjust these policies due to the lack of knowledge around sustainability heavy communities.

The next challenge is then attracting people to live in a sustainable community. The article emphasizes just how little public knowledge there is about ecovillages. To provide information, effective marketing strategies would be crucial in reaching the masses and showing the benefits of such a community.

In conclusion, positive well-being and ecovillages have shown a correlation in many instances. However, there has yet to be an effective design solution that has widely attracted the public. The goal of this thesis project aims to solve this lingering issue.

“20 different areas in which ecovillages differ from typical industrial and urban cities” - Robert Hall

Literature Review

Up on the Farm

This article, by Jim Thomas, pushes the idea of creating large, multi-story complexes used specifically for the production of food. This idea is now commonly referred to as vertical farming. Thomas, however, refers to this as 'farmscrapers' and imagines them on a very large scale. The article states that a 30-story farmscrapper the size of one city block could feed 50,000 individuals. Production at these rates could drastically alter the way of agricultural production. Bringing this form of farming into cities has numerous other benefits as well. These include:

- Reduction in Food Miles
- Maximize Land Efficiency
- New City Aesthetic

The evergrowing population continues to greatly increase. As cities continue to grow outward, arable land decreases. Our current crop production

rates already do not allow for enough food to feed the population we have now. New practices such as vertical farming provide ways to cope with this issue. Vertical farming would use much less space as compared to traditional row crop farming as well as bring the food closer to consumers, which lessens energy needed for transportation and lowers overall cost. Another advantage to this technique is bringing food to areas which greatly struggle with providing enough food. The conditions of vertical farms are controlled indoors, which makes it flexible enough to be used almost anywhere. A food source such as this in struggling economies could completely change how these communities live and prosper. This is still a very new and uncommon practice but it is clear that new methods of food production need to be considered as we continue to deteriorate crop land. Food production needs to be brought into alternate areas if we want to be able to feed the growing population.

Literature Review

Project Application

The article mentions many positives in which vertical farming can have an effect on cities and communities. Using less land and growing in controlled environments can be a very consistent and reliable food source. These certainly are reasons to be enamored with this idea, however, this is not a perfect solution and there are some things to promote hesitation. This form of crop production is done completely indoors. This means that there needs to be ways to mimic some natural features that crops need to grow such as sunlight, soil, nutrients, and water. To accomplish this, more technologically advanced methods are used to sustain proper conditions for the plants to grow. The use of this technology requires energy, a lot of it to say the least. For each square meter of lettuce in a vertical farm, it requires 3,500 kWh annually to sustain. This number becomes frighteningly

high when accounting for an entire building. So the 30-story 'farmscape' mentioned by Thomas in the article is not necessarily the best approach to this when considering the numbers. I do believe that this is still a step in the right direction and a process that can be very successful if improved upon and used in appropriate situations. For my project specifically, I am going to try to incorporate vertical farming in an effective manner. To do this I will be alternating between traditional crop farming and then incorporating vertical farming in seasons where outdoor farming is not possible. This should help reduce the energy cost of vertical farming but also serve as another food source so large plots of land are not needed to provide so much crops in a short period of time.

“... a 30-story farmscraper the size of one city block could feed 50,000 individuals.” - Dickson Despommier

Review Summary

Review Summary

To summarize, these articles provide an insight into numerous different aspects of my thesis project. First, the DASH method coherently explained how alternate methods of construction can greatly reduce building price. It also expresses how high high levels of design in sustainable developments are possible and can be effectively executes in an affordable manner.

The Glide House article provided a great example as to how the prefabrication process can be used to create buildings at an extremely fast pace while still maintaining high design standards. It also expressed how the prefabrication process itself can be very sustainable as compared to traditional building methods by avoiding the need for heavy machinery and equipment.

Promoting an improved lifestyle and positive well-being is a large part as to why I wanted to do this project. The well-being article by Robert Hall is a very insightful approach to discovering how the differences in living sustainably can promote a more healthy approach to life as opposed to common industrial and urban city living. Some of the key factors mentioned such as celebration and physical activity are far too often pushed to the side in traditional lifestyles but widely promoted in sustainable communities. Just these slight and subtle changes can make all the difference in someone's outlook on life and something that should be more widely expressed.

Finally, the 'Up on the Farm' article helps show how alternate methods of crop production must start to be considered. Although vertical farming is not a completely perfect solution to the distress of arable land, it serves as a catalyst to similar initiatives to help solve the growing concern of food shortages.

Project Justification



Importance of the overall project personally
and to our society as a whole.

Project Justification

Personal Importance

The personal significance of this project and the development of a sustainable community stems from the blatant decline in overall well-being of people living in larger, wealthier areas of the planet. Mental and physical health continues to become a topic of discussion revolved around solutions to help mitigate issues and stresses involved with them. Studies have shown that incorporating nature into your lifestyle can help increase the overall happiness of an individual. However, most people have become comfortable with specific ways of life and would question the move to more sustainable living alternatives. The reason I am doing this thesis is to provide a solution where sustainable design and the application of nature can be implemented into current living situations in an effective way that encourages and excites the public.

To go along with improving the well-being of individuals, it has also become increasingly clear how negatively the environment has been impacted by current lifestyle trends. At this point this is something that cannot be argued. Climate change is continuing to have larger, more noticeable impacts around the globe. Hurricanes are becoming stronger, more destructive and occurring more frequently than usual. Wildfires are tearing through wilderness and people's homes on a consistent basis. These are only two examples on a larger scale. Many other factors that tend to go unnoticed include drought and water shortages, pest invasions, continued sea level rise and changes in rainfall patterns which can greatly effect crop growth. The list only continues to grow and worsen as changes are not being made quickly enough. Now is the time to start thinking and living sustainably.

Project Justification

Social Importance

Many of the reasons this thesis project has an importance socially are similar to why I felt there was a personal importance to it. Well-being and environmental distress are the main factors as to why changes need to be made in almost all sectors to become more sustainable. Socially, it seems as if there is occasionally a negative connotation when it comes to living in sustainable communities. Some may view them as 'hippy communities' with a lack of connection to the real world. Many years ago this may have been true but with today's design solutions, sustainable communities can be more efficient as well as technologically advanced and more comfortable to live in as opposed to the majority of current lifestyles. These 'green villages' can bring a sense of community and togetherness back into lifestyles through a common purpose.

Economics

Economically, I feel it has been very difficult to implement sustainable design strategies into most communities overall. Finding materials and affordable practices that include energy efficient design is not commonplace or ordinary. Funding for my sustainable design community I believe could come from several places:

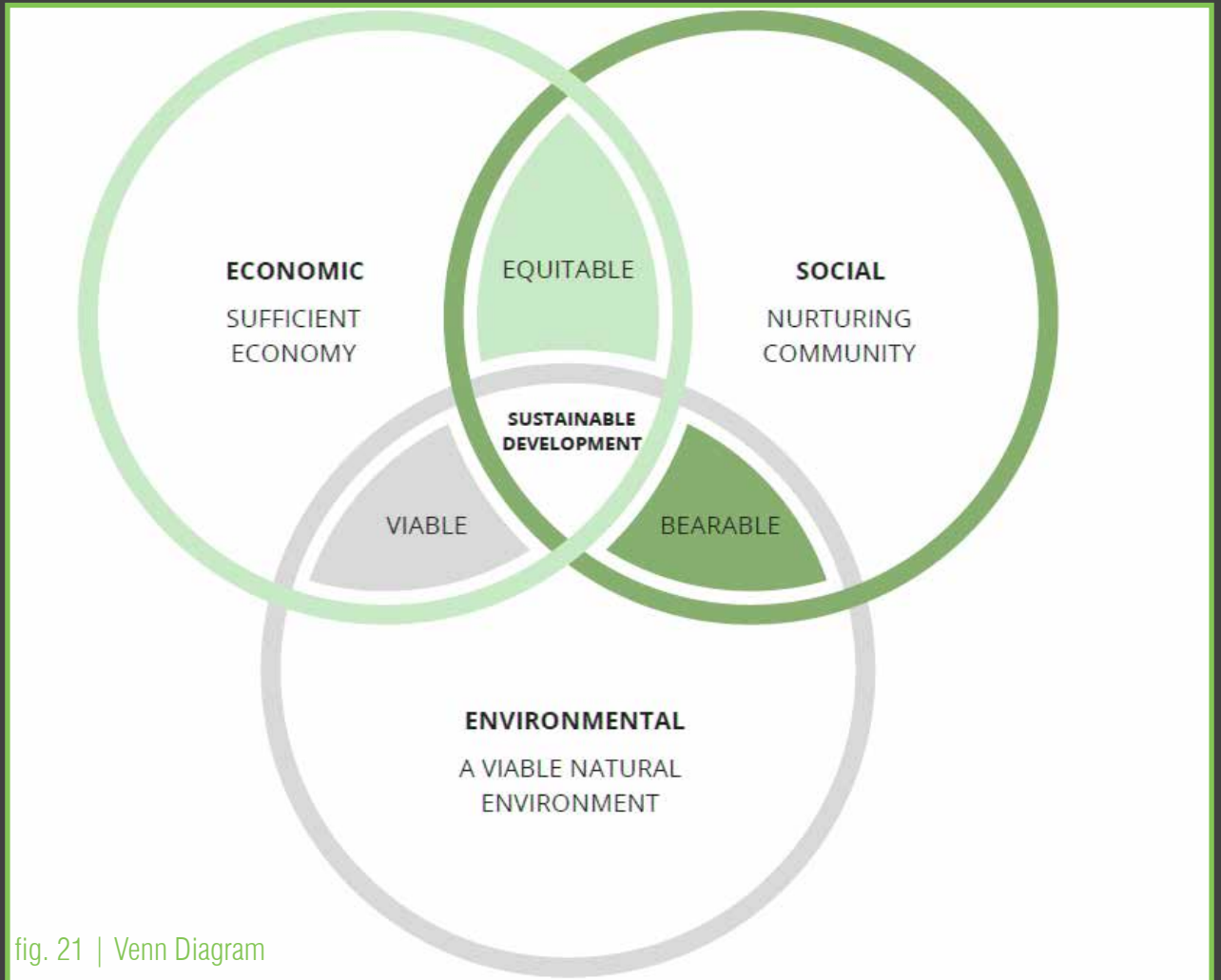
NDSU - (as it is located on the agricultural research plots and could be used as a place of research for alternative crop growth strategies),

Private Donors - with passions involving sustainability and the city of Fargo. I believe this funding strategy would allow the opportunity to create a well-established and thriving community.

Returns on living in a community such as this include producing its own energy which covers the cost of consumption.

Project Justification

Concept of Sustainable Design



Thesis Context



Project's relation to similar projects throughout history.

Thesis Context

Historical Context

Sustainable communities are not a new concept. They started appearing in the mid 1900s but have yet to take hold and become widely accepted a the lifestyle of choice. Several factors are involved in this. Most people believe they do not have the time to adjust to a sustainable lifestyle and the work that comes with it. Education on sustainability is also very inconsistent and often people need to search out information themselves. Proper education would allow people to be more confident in the move to sustainability and what comes with it. Other factors include changing public policies, measurements of sustainability, and convincing the wealthy and people in charge to make changes to become more sustainable. These barriers seem very fundamental and easy to break through, however, they have consistently withheld changes from happening at a rate that is necessary to make any real change.

Many think that substantial changes need to be made to help the environment but this is not completely true. This year(2020) we saw just how great of an impact a reduction in fossil fuels and greenhouse gasses can have on the world. As people were on lock-down due to the worldwide pandemic of the coronavirus, nature began to recover at a very fast pace. Waterways and canals saw water more clear than they have before, air pollution hit unprecedented lows and this was all done in the span of a few months. Obviously, the lockdown lifestyle is not healthy and should not be continued but it shows how quickly changes can be made and how if everyone can adjust their way of life just slightly enough, then major steps in the right direction can be made and progress will be seen.

Thesis Context

1995 Imagery



2005 Imagery



2015 Imagery



2020 Imagery



Thesis Context

Social & Physical Context

The project is set on the Red River between North Dakota and Minnesota. There are no other communities abutting this area due to zoning codes and is a relatively quiet area. This area provides an ideal spot to research specific traits linked to a sustainable community. This also provides an accessible and unique area for other people within the community to experience and learn about. Starting a community such as this and learning from it and having efficient design strategies visible to the public can help this ideal gain popularity. There are many different elements that can be found in sustainable communities to help well-being as opposed to common urban cities. These include proximity to nature, celebration, arts and culture, work-life balance, a pooled economy, inclusive decision making and self-development practices as well as numerous others.

These traits, as simple as they may sound, are easily lost in the repetitive nature of many peoples' daily tasks and routines. It becomes easy to get stuck in this lifestyle and lose track of other things that are really necessary to have that ultimate balance. The typical annual american work hours ranks amongst the highest in the world, yet, our work production ranks the third lowest. This is due to the common assumption of requiring 40 hours a week to be full-time. This can lead to unproductive work when it is not required as well as poor time management skills to accomplish certain tasks. Eliminating this system and allowing more flexible work schedules would also help accomodate living sustainably as it involves less travel to and from work, spare time to accomplish tasks necessary for sustainable communities as well as the free time to enjoy other hobbies and interests that people usually are not able to.

Thesis Context

Physical Benefits

Business Benefits Expected From Green Building Investments

(Medians Reported in 2012 and 2015)

Benefit	New Green Building		Green Retrofit Response	
	2012	2015	2012	2015
Decreased Operating Costs Over One Year	8%	9%	9%	9%
Decreased Operating Costs Over Five Years	15%	14%	13%	13%
Increased Building Value for Green versus Non-Green Projects (According to AEC Firms)	7%	8%	5%	7%
Increased Asset Value for Green versus Non-Green Projects (According to Owners)	5%	7%	4%	7%
Payback Time for Green Investments	8 Years	8 Years	7 Years	6 Years

table 1 | Building Benefits

Thesis Context

Economic Benefits



fig. 26

Site Analysis



In-depth information based on factors specific to the site and the impact they may have on the project.

Site Analysis

The project site, which is located on the Red River in North Dakota and Minnesota will include the components necessary to develop a sustainable community. This includes:

- Energy Farm
- Waste Renewal Building
- Vertical Farming
- Aquaponics
- Agriculture Plots
- Public Space
- Green Space

This will be done in an area that is already well suited to cope with conditions such as this. The current site is very natural, allowing for no removal of a built environment. Having the site already prepped for this eliminates the need for this within the community itself for crop growth.

Other benefits of this site are that there is no need to demolish any existing buildings or structures. This also completely eliminates the cost that would be used for this process and makes it a much more manageable project to undertake. Some major elements that would need to be added to the site are underground water and waste systems, connection to the electric grid, and drainage system.

Major qualitative characteristics of the site:

- River Flowing Through Site
- Drainage to ditches
- Crops grown in rotation every year
- Native grasses
- Medium to heavy traffic to the South and West
- Many Trees and Vegetation to act as natural buffers
- Currently accessible from the South and West
- Surrounded mainly by downtown Fargo and Viking Ship Park

Site Analysis

- Access to Electric Grid
- No unnatural sources of shade
- Need adjusted land parcel lines
- Within flood zone

Physical characteristics that would need to be added to the site:

- Connection to electrical grid
- Proper site access
- Proper drainage for runoff
- Water and Waste Systems

Making these adjustments to the site would provide for a more comfortable living environment for a community such as this to be built.

Major quantitative statistics of the site:

- Soil types - Organic clay, non-plastic clay, plastic silt
- Average yearly soil moisture compared to other states
- Annual high temperature of 53 degrees fahrenheit
- Annual Low temperature of 32 degrees fahrenheit
- Average annual precipitation of 22 inches
- Average annual snowfall of 50 inches
- Prevailing winds from the west
- Annual wind speed average of 10.8 mph

Site Analysis

Site Overview



fig.27 | Site Overview

Site Analysis



fig. 28 | Site Context

Site Analysis

South Facing View



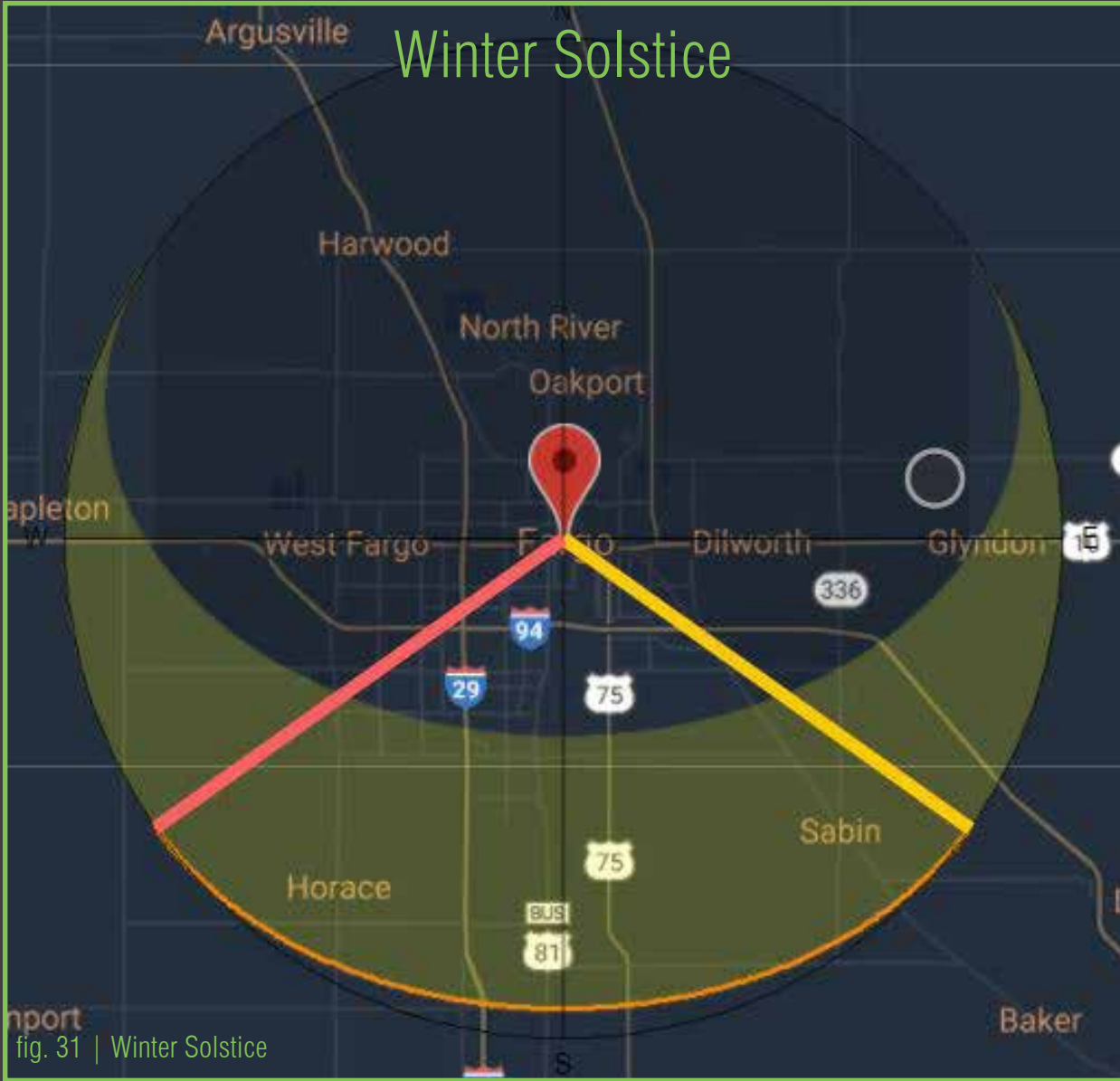
fig. 29 | South

East Facing View

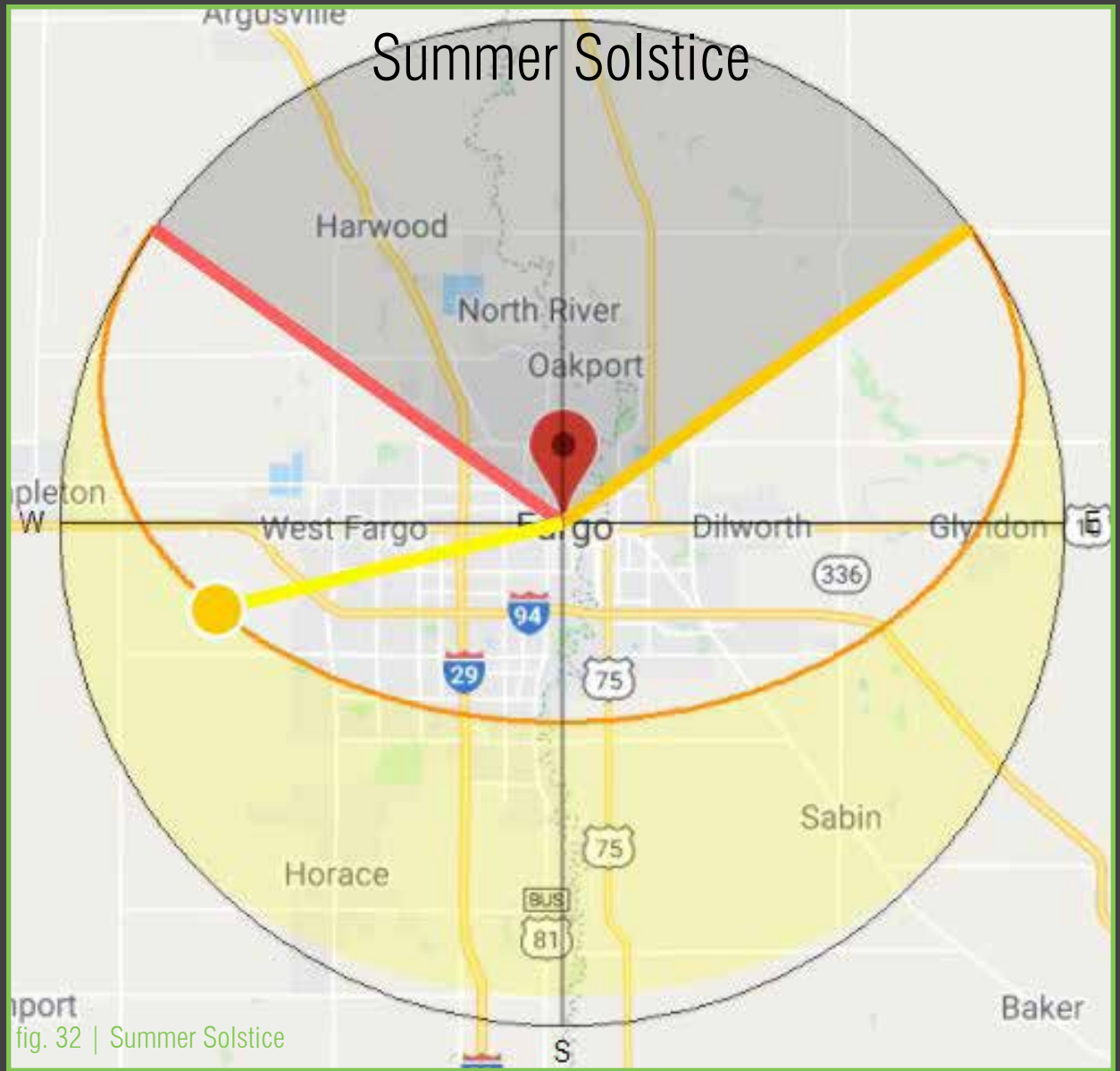


fig. 30 | East

Site Analysis



Site Analysis



Site Analysis

Soil Types

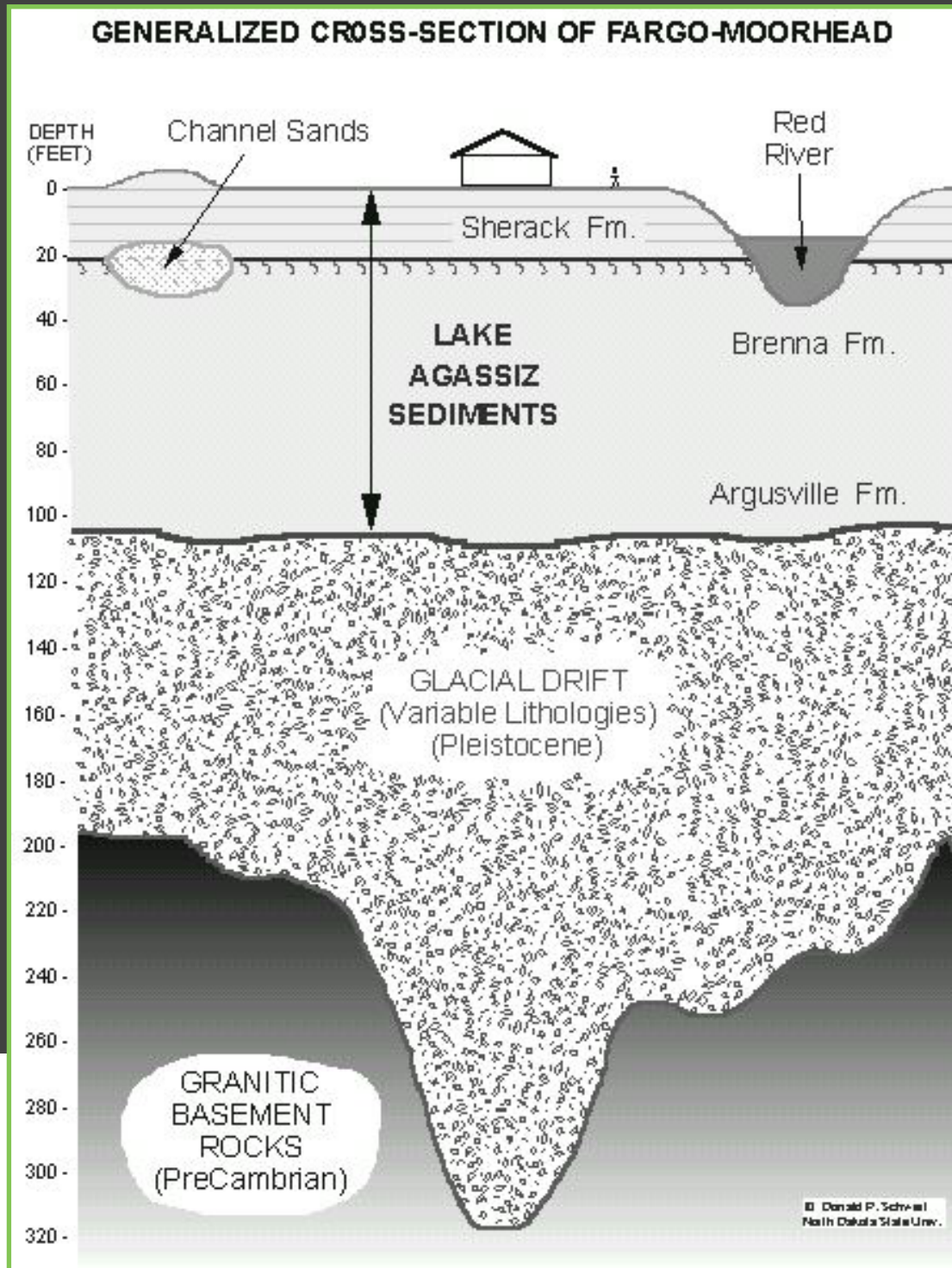


fig. 33 | Soil

Site Analysis

Site Contours



fig. 34 | Topography

Site Analysis

Site Intentions

The goals set forth for this site are to provide a comfortable living space that balances the divide between the built and natural environment. Some necessary additions to the site include:

- Natural tree line buffers on west side of site for wind protection and on the north side of the site to help alleviate noise pollution.
- An abundance of greenery will be added throughout the site to create a more enclosed community as well as aesthetically pleasing placement for design purposes.
- Lighting will be strategically located throughout the site.
- Accessible and adequate guest parking located on-site.
- Changes to slope and topography for different environmental aesthetic as well as drainage.
- Other features will be added as necessary to accommodate design intent and solutions.

The location of the site is very wide open and the intent is to transform the area into an environment that feels unique and welcoming while also maintaining privacy for people who will be occupying and living in the space.

Performance Criteria



Detailed Information regarding overall usage and efficiency of the project.

Performance Criteria

Space and Usages

	Area	Percentage
Residential	1,800 SF(per home) 21,780 SF(total)	5%(combined)
Green Space	217,805 SF	50%
Waste	8,712 SF	2%
Circulation	43,560 SF	10%
Public Space	65,340 SF	15%
Aquaponics	4,356 SF	1%
Vertical Farming	8,712 SF	2%
Renewable Energy (Wind)	21,780 SF	5%
Agriculture	43,560 SF	10%
TOTAL	435,605 SF	100%

table 2 | Usage

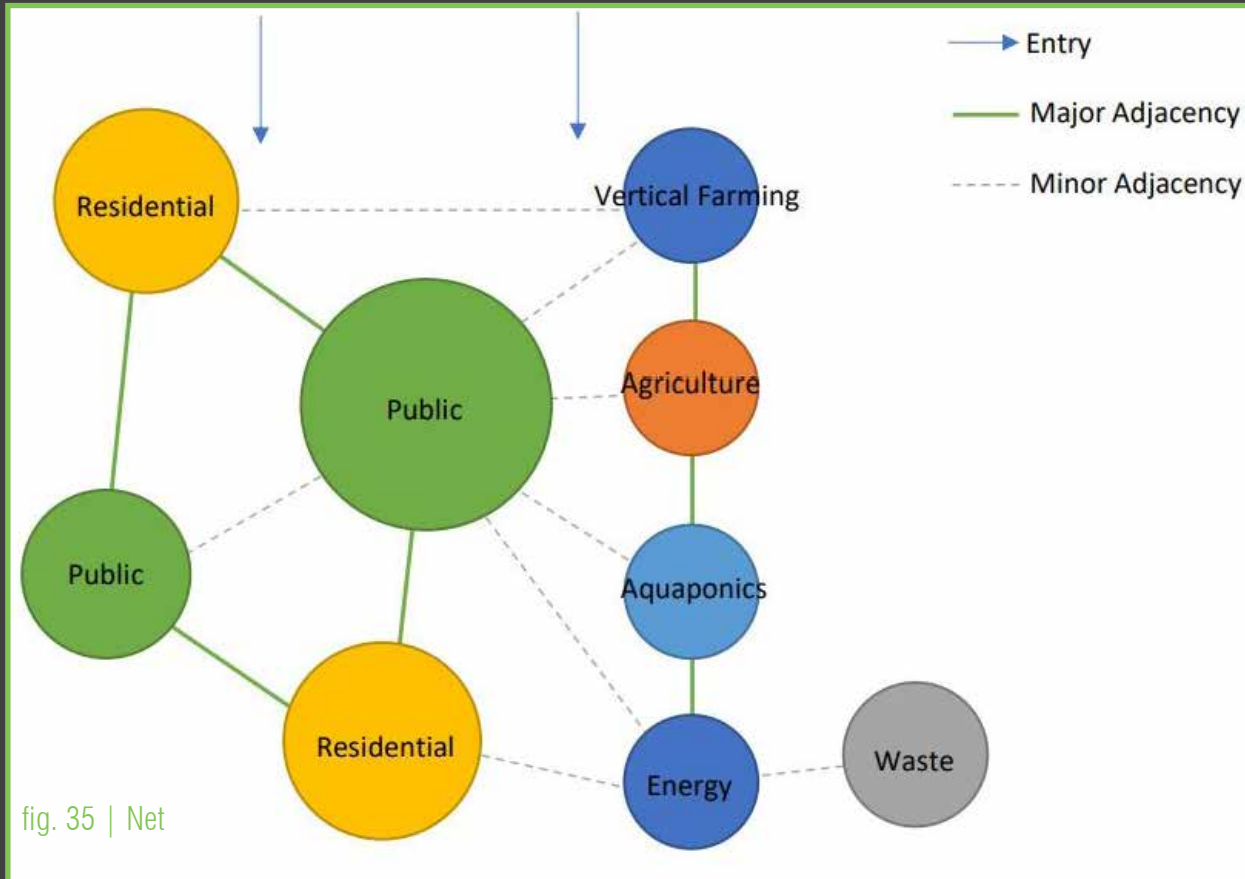
Performance Criteria

	Analytical Data		
	Consumption	Prosumption	Outlook
Residential	1000 kWh/monthly/ house	500 kWh/monthly/house	-500 kWh/monthly/ house
Green Space	None	Natural Environment	Shade/Cooling/Improved Air Quality
Waste	100 gal/person/day	Collection of Black & Grey Water	Stored in Settling Tanks and used as fertilizer
Circulation	None	Pervious Paths	Prevents Runoff
Public Space	2000 kWh/monthly	1000 kWh/monthly	Social Interaction
Aquaponics	1,625 kWh/monthly	Food Source	Low Energy Means of Food Production
Vertical Farming	2.5 million kwh/monthly	Yearly Food Production, Less Space	Large Energy Consump- tion, Alternatives?
Renewable Energy (Wind)	Construction	402,000 kWh/monthly	Main Source of Renew- able Energy
Agriculture	Minimal	Energy Efficient Food Production	On-Site Food Production

table 3 | Analytics

Site Analysis

Space Interaction Net



Site Analysis

Interaction Matrix

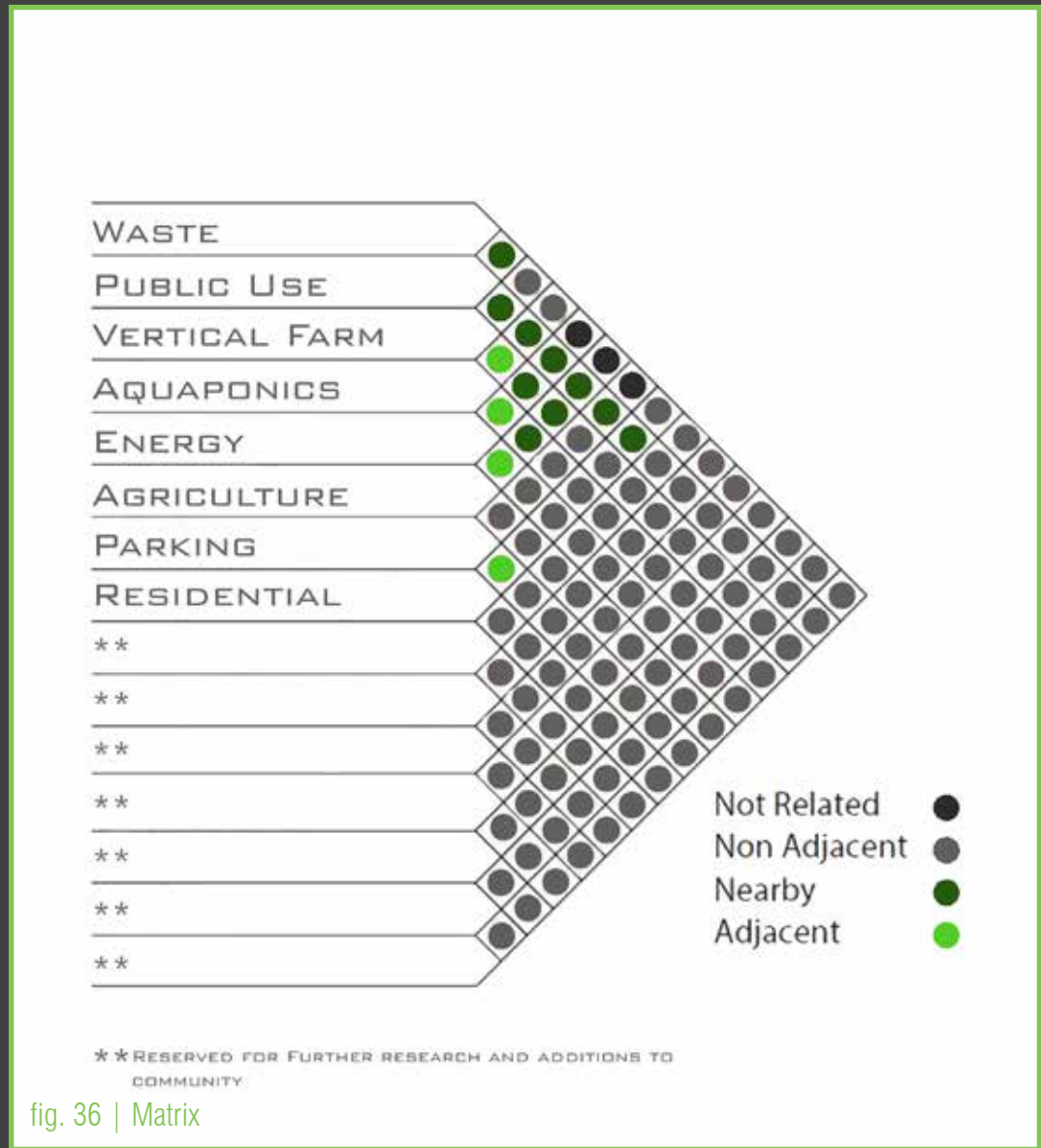


fig. 36 | Matrix

Design Solution

Design Solution

Sustain

Sustain arable land by incorporating food production areas within the building, as well as on the exterior. The public gardens would donate portions of the food produced while the residents with the private gardens would have the option to sell, donate or use the food for consumption.

Support

Support the local economy by reimagining the Red River Market and making it a more prominent part of Fargo culture. This would be done by creating a more permanent space for use and the opportunity for more operating hours throughout the week.

Embrace

Embrace the Red River and the building opportunities it presents, as well as the challenges such as designing a building for flood resilience. Exploring these new challenges allows for growth in areas that do not take up arable land.

Community

Create a high-dense community that maintains and promotes health and wellness through private gardens and green spaces for every unit, as well as amenities such as fitness centers and office space. This community also utilizes multiple property types such as apartment rental units, ownership condos and ownership homes.

Design Solution

Site



fig. 37 | Site Context



fig. 38 | Site Context



fig. 39 | Satellite Imagery



fig. 40 | Satellite Imagery

Design Solution

Site



fig. 41 | Site Solution

Design Solution

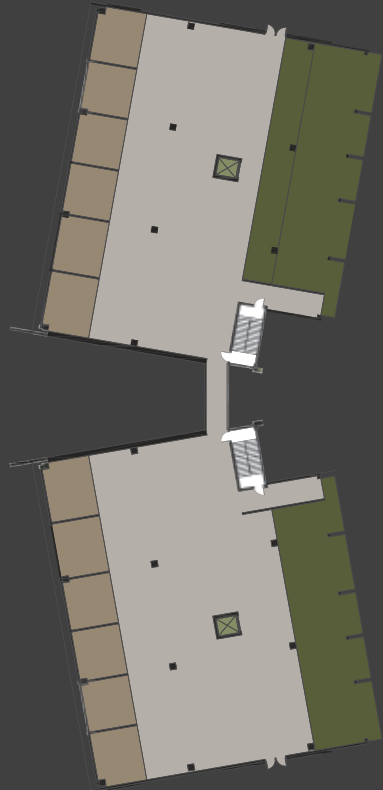
Building Program

4 BUILDINGS. 2 COMPLEXES. 1 COMMUNITY

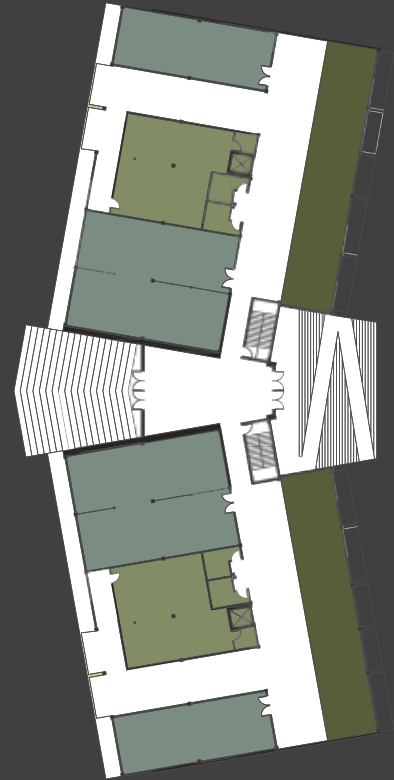
Tenant Spaces	16 Total Units -	12,300 Total SF
Green Space		18,000 Total SF
Rental Units	8 Total Units -	6,100 Total SF
Ownership Units	20 Total Units -	23,800 Total SF
Market/Flex Space		30,200 Total SF

Design Solution

Floor Plans



Ground Floor



First Floor

Market Stall

Green Space

Mechanical

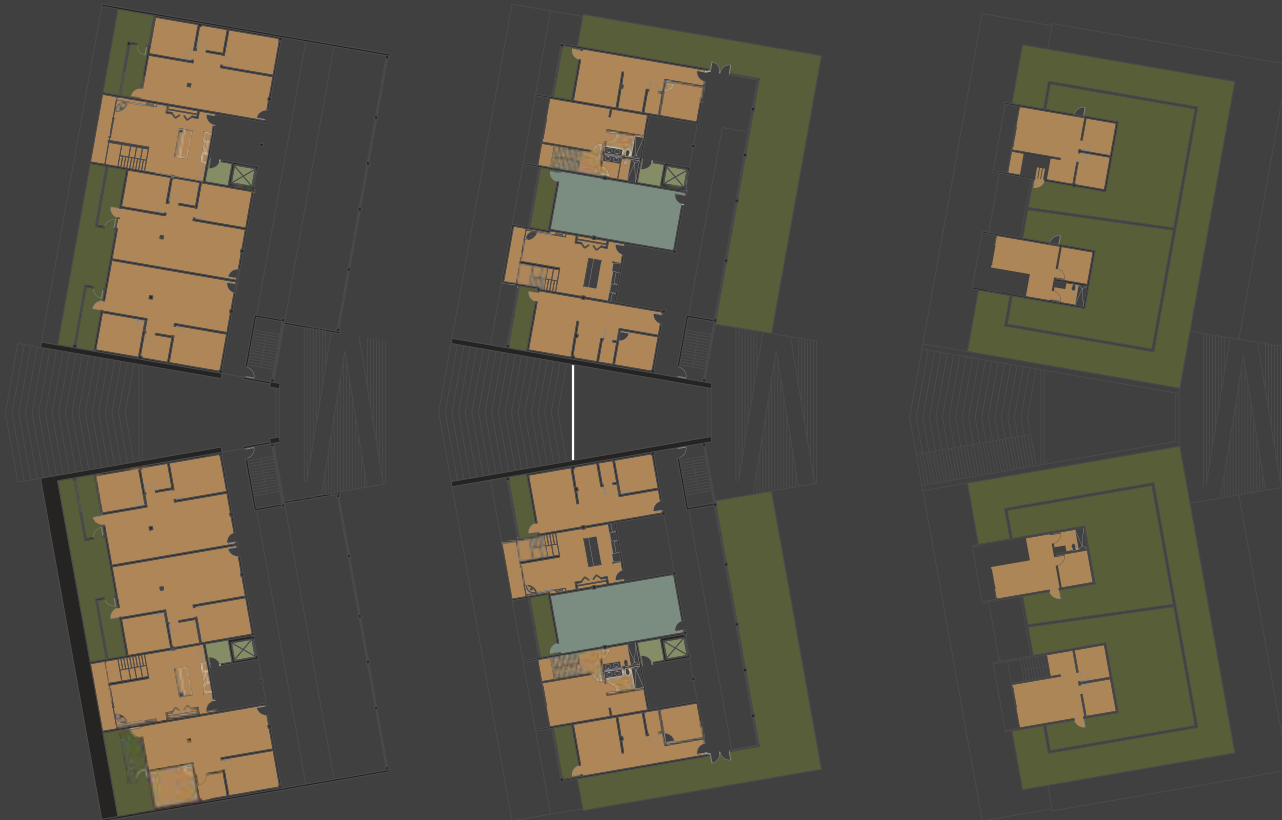
Market Flex Space

Tenant Space

Living

Design Solution

Floor Plans



Second Floor

Third Floor

Fourth Floor



Market Stall



Green Space



Mechanical



Market Flex Space



Tenant Space



Living

Design Solution

Building Integrated Agriculture

Operable Windows

Mini Garden

Mini Yard

Public Market



Full Yard

Inner Garden

Bifold Doors

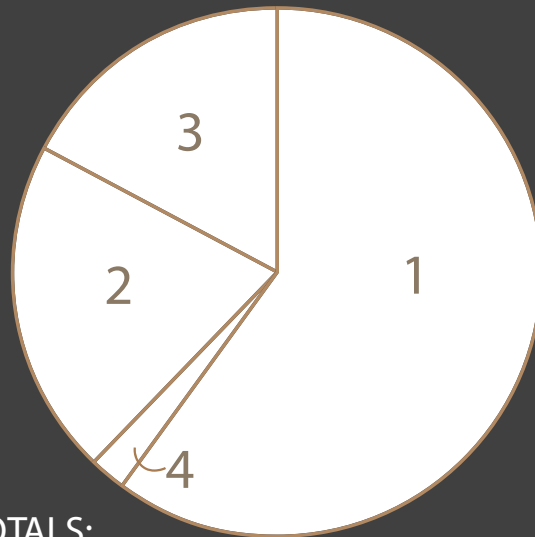
Design Solution

Analysis

Pounds of Food Grown per Space Annually

1. Public Space -
5,600 SF per Complex
16,800 LBs/yr per Complex
2. Condo Units -
1,900 SF per Complex
5,700 LBs/yr per Complex
3. Home Units
1,600 SF per Complex
4,800 LBs/yr per Complex
4. Apartment Units
200 SF per Complex
600 LB/Syr per Complex

Graphical Representation of Food Contribution



TOTALS:
27,900 LBs/yr per Complex
55,800 LBs/yr for Total Community

Design Solution

Elevations

Heavy Timber

Green Roof



East

Design Solution

Elevations

Concrete

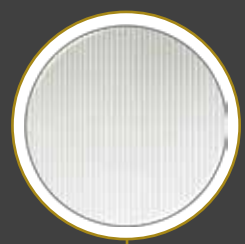


West

Design Solution

Elevations

Recycled Metal Siding



South

Design Solution

Site Section



Design Solution

Renders



fig. 42 | Riverwalk

Design Solution

Renders



fig. 43 | South Entrance

Design Solution

Renders



fig. 44 | East Perspective

Design Solution

Renders



fig. 45 | Flooded Space

Design Solution

Renders



fig. 46 | Living Space

Design Solution

Renders

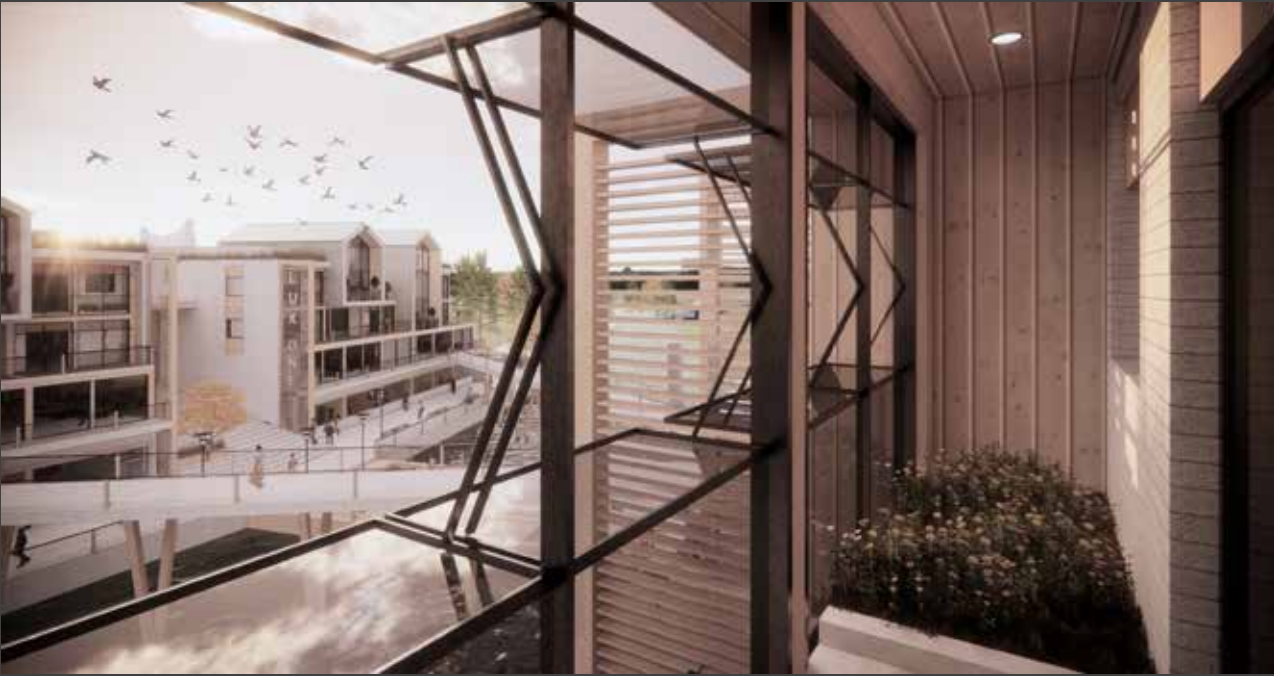


fig. 47 | Operable Windows

Design Solution

Renders



fig. 48 | Bird's Eye View

The Appendix

Previous Studio Experience

2nd Year Studio - Fall

Cindy Urness

Tea House

2nd Year Studio - Spring

Milton Yergens

Dwelling

Mixed-Use Building

5th Year Studio - Fall

Ganapathy Mahalingam

Amazon Alexa App

5th Year Studio - Spring

Bakr M. Aly Ahmed

Thesis Design

3rd Year Studio - Fall

Ron Ramsay

Chapel Addition

Shaker Barn

3rd year Studio - Spring

Regin Schwaen

Renaissance Hall Addition

Native American History Museum

4th Year Studio - Fall

Mark Barnhouse

Miami High Rise(Capstone)

4th Year Studio - Spring

Mark Barnhouse

Marvin Windows

Miami Urban Design

References

Proposal

AeroFarms is on a mission to transform agriculture. (2020, April 28). Retrieved October 14, 2020, from <https://aerofarms.com/>

Andrew Freedman, J. (2020, May 19). The strongest, most dangerous hurricanes are now far more likely because of climate change, study shows. Retrieved from <https://www.washingtonpost.com/weather/2020/05/18/hurricanes-stronger-climate-change/>

Corp., A. (2020, April 24). A Traditional Swedish Log Cabin Encased In A Green House Allows A Family To Live A Self-Sustaining Lifestyle. Retrieved from <https://metro.style/living/home-tours/naturhus-home-by-anders-solvarm/24708>

Miles, P. (2017, November 17). Nature House...complete with Grow Your Own Figs... anyone? Retrieved from <https://theecologist.org/2016/dec/07/nature-housecomplete-grow-your-own-figs-anyone>

New Frontiers for Sustainability. (n.d.). Retrieved from <https://www.ecovillagefindhorn.com/>

Solvarm, A. (1970, October 31). Retrieved from <https://www.naturhusvillan.com/>

References

Program

- Admin. (2020, March 4). The benefits of green buildings. ierek news. <https://www.ierek.com/news/index.php/2017/10/26/green-buildings/>.
- Company, S. C. F. (2014, July 18). How The Average American Work Week Compares To The Rest Of The World. HuffPost. https://www.huffpost.com/entry/american-work-week-stats_n_5599484.
- Cubick, R. (2018, August 20). 3 Reasons Why Environmentally Sustainable Design Makes Economic Sense. Uponsor Blog. <https://web.uponor.hk/radiant-cooling-blog/3-reasons-why-environmentally-sustainable-design-makes-economic-sense/>.
- Drinking-Water. (2019, August 23). What is the water flow rate to most fixtures in my house? Drinking Water and Human Health. <https://drinking-water.extension.org/what-is-the-water-flow-rate-to-most-fixtures-in-my-house/>.
- Geologic Cross-Section of Fargo, North Dakota. https://www.ndsu.edu/fargo_geology/xsection.htm.
- Grid-Connected Renewable Energy Systems. Energy.gov. <https://www.energy.gov/energysaver/grid-connected-renewable-energy-systems>.
- Hall, R. (2015, September 16). The ecovillage experience as an evidence base for national well being strategies. Intellectual Economics. <https://www.sciencedirect.com/science/article/pii/S1822801115000028>.
- How much Energy does a Solar Panel Produce? Solar.com. (2019, November 16). <https://www.solar.com/learn/how-much-energy-does-a-solar-panel-produce/>.
- Muneeb, A. (2018, September 27). 5 Ways to Create Positive Social Impact. Medium. <https://medium.com/1m11/5-ways-to-create-social-impact-today-104b18d9bc23>.
- Pervious Concrete Pavement. :: Pervious Pavement :: Pervious Concrete for Green, Sustainable Porous and Permeable Stormwater Drainage :: <https://www.perviouspavement.org/>.
- Ramirez-Lovering, D., & Murray, S. (2015, May 1). DASH-Designing Affordable Sustainable Housing. Fargo. <https://web-b-ebcohost-com.ezproxy.lib.ndsu.nodak.edu/ehost/pdfviewer/pdfviewer?vid=6&sid=ae52e0aa-4809-403d-bbf4-0c037a2d9b02%40pdc-v-sessmgr04>.
- Sunrise, sunset, solar noon, day length and sun map for Fargo, Usa. Find Current Time, Sun, Moon, Almanac, Retrogrades, Panchang and Eclipses for cities around the world. <https://geotimedate.org/sun/usa/nd/fargo>.