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BENEFITING YOUTH AND THE NATURAL ENVIRONMENT:
INTEGRATION OF BIOPHILIC DESIGN IN A YOUTH CENTER

By

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BENEFITING YOUTH AND THE NATURAL ENVIRONMENT: INTEGRATION OF BIOPHILIC DESIGN IN A YOUTH CENTER

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ABSTRACT

This thesis will entertain the idea of integrating biophilic design principles into a youth center. First there is a discussion of biophilic design, community centers, and youth centers with the intent to understand what they are and the benefits of each. Seven case studies are examined next to provide examples of how biophilic design has been applied to community centers, youth centers, and preschools. The design of a youth center that uses biophilic design principles to foster a relationship with children and nature is presented as a solution. The created youth center is titled Elk River Community Center. There is a detailed description of the youth center along with plans and renderings that show Elk River Community Center. Lastly, steps that could make the youth center even more integrated with nature are stated.

TABLE OF CONTENTS

ABSTRACT iii

LIST OF TABLES vii

LIST OF FIGURES viii

LIST OF ABBREVIATIONS xiv

1. INTRODUCTION 1

1.1. Problem Statement / Introduction 1

1.1.1. Research Question 1

1.1.2. Proposed Outcomes 3

1.2. Objective 3

1.2.1. Aim of Research 3

1.2.2. Significance 3

2. LITERATURE REVIEW - BACKGROUND 5

2.1. Background 5

2.2. Literature Review 5

2.2.1. Benefits of Biophilic Design for Improved Human and Environmental Health 5

2.2.2. Benefits of Community and Youth Centers for Improved Human Well-being 9

2.2.3. Implementation of Biophilic Design 12

2.2.4. Implementation of Community and Youth Centers 19

2.2.5. Issues and Considerations for Biophilic Design 21

2.2.6. Gap Identification 22

2.3. Project Type 22

2.4. Project Issues 23

3. RESEARCH DESIGN & METHODS 25

3.1. Approach 25

3.1.1. Data Collection 25
3.1.2. Analysis 26
3.1.3. Conclusion 26
3.2. Project Location – The City of Elk River, Minnesota 26
3.3. Project Location – Surrounding Site Context 29
3.4. The Specific Site 31
3.5. Precedents / Case Studies 38
3.5.1. Kakapo Creek Childrens Garden 40
3.5.2. Wonderforest Nature Preschool 46
3.5.3. REACH Ashland Youth Center 51
3.5.4. Gary Comer Youth Center 56
3.5.5. Lubber Run Community Center 65
3.5.6. Carla Madison Recreation Center 72
3.5.7. Big Sky Community Center - BASE 81
3.5.8. Case Study Conclusion 89
3.6. Detailed Space Program 89
4. Results and Conclusions 92
4.1. Final Project Description 92
4.2. Project Objectives 93
4.3. Project Design and Documentation 94
4.3.1. Plans 94
4.3.2. Renderings 96
4.3.3. Section Cuts 103
4.3.4. Elevations 104
4.4. Conclusions 104

REFERENCES 106

APPENDIX 116

LIST OF TABLES

Table		Page
1.	Criteria for site selection	27
2.	Soil types	36
3.	Case study criteria	39
4.	Biophilic Design Features	39
5.	Building program table	90

LIST OF FIGURES

Figure Page

1. Image of the different layers of a green roof 8

2. Green wall in New Jersey Institute for Food Nutrition & Health. (Urbanstrong, n.d.). 14

3. Earth tone color palette 16

4. Natural materials and colors 16

5. Building based of a plant found in nature. (Awadalla, 2022). 17

6. View showing a great distance outside. Photo by Jane Messinger. (Erin, 2015). 19

7. City's Location within Minnesota 28

8. Graph of average climate 28

9. Average temperatures and precipitation 29

10. Main Roads 30

11. Site context map 31

12. Picture of site in 1991 32

13. Picture of site in 2004 32

14. Picture of the site in 2023 32

15. Zoning map 33

16. Land use map 33

17. Race percentages 34

18. Crime statistics 35

19. Contour map of site 35

20. Soil types 36

21. Existing vegetation 36

22. Sun and wind patterns 37

23. Circulation patterns 37

24. Safety map 38
25. Context map 3.6.1. 40
26. Site map 3.6.1. 41
27. Overhead view of building and site 41
28. Main level floor plan of Kakapo Creek Children's Gardens 42
29. View of interior courtyard and playground 43
30. Interior view of classroom 43
31. View looking outwards from school 44
32. View of playground made from the recycled materials 44
33. Overhead view of green roof and interior courtyard 45
34. Close up of the different levels that make up the green roof 45
35. Context map 3.6.2. 46
36. Site map 3.6.2. 47
37. Floor plan of Wonderforest Nature Preschool 47
38. Floor plan of preschool 48
39. Mud kitchen and water table in the 'wetland' area 48
40. Classroom with a view of 'nature' through the windows 49
41. Exterior view of the Wonderforest Nature Preschool 49
42. View of the interior play area in Wonderforest Nature Preschool 50
43. View of interior play area in Wonderforest Nature Preschool 50
44. Context map 3.6.3. 51
45. Site map 3.6.3. 52
46. Site plan of REACH Ashland Youth Center 52
47. Exterior view of the building 53
48. view of the surrounding context of the site 53

49. View of front of the building and the skate park 54
50. Interior view of a commons space 54
51. Context map 3.6.4. 56
52. Site map 3.6.4. 56
53. Exterior view of Gary Comer Youth Center 57
54. Level floor plan of Gary Comer Youth Center 57
55. Flex space functioning as the performance hall 58
56. Flex space functioning as the gym 58
57. The cafeteria in the Gary Comer Youth Center 59
58. An interior view of a space that has pool tables and colorful furniture 59
59. A mixed-use space that is being used as a dance studio 60
60. Close up of the colorful concrete panels 60
61. Floor plan of upper level and roof 61
62. A diagram showing the location of the different flowers, fruits, and vegetables 61
63. Northwest – Southeast section cut of the building showing 62
64. View of the green roof, skylights, and the walls of glass 62
65. View of youth learning about the food that they are growing 63
66. View of skylights on the green roof 63
67. View from a hallway inside of the building looking out on the roof 64
68. Context map 3.6.5. 65
69. Site map 3.6.5. 66
70. Diagram showing the different layers of the Lubber Run Community Center 66
71. The lower level floor plan of the Lubber Run Community Center 67
72. The upper level floor plan of the Lubber Run Community Center 67
73. View of the exterior Northwest corner of the building 68

74. Exterior view of the building showing the ground and green roof connection 68
75. Street View of the East side of the Lubber Run Community Center..... 69
76. Exterior view of the East side entry and the green roof..... 69
77. Exterior view of the Lubber Run Community Center 69
78. Interior view of the gymnasium looking outside to 'nature'..... 70
79. The sports courts at Lubber Run Community Center..... 70
80. Interior view showing natural material choices..... 70
81. Interior View of stairwell and seating area outside of the gymnasium..... 71
82. Interior view of the front desk and the natural materials..... 71
83. Interior view showing the wall of floor to ceiling windows..... 71
84. Context map 3.6.6. 73
85. Site map 3.6.6. 73
86. First level floor plan of Carla Madison Recreation Center..... 74
87. Second level floor plan of Carla Madison Recreation Center 74
88. Third level floor plan of Carla Madison Recreation Center 75
89. Exploded diagram showing the different spaces 75
90. Exterior view of the Carla Madison Recreation Center..... 76
91. View of the rooftop event space. Carla Madison Recreation Center..... 76
92. View from inside looking out of the rooftop event space..... 77
93. Childcare room in the Carla Madison Recreation Center..... 77
94. Lap pool in the Carla Madison Recreation Center..... 77
95. Leisure pool in the Carla Madison Recreation Center..... 78
96. Gymnasium view. Carla Madison Recreation Center..... 78
97. Main fitness area within the Carla Madison Recreation Center 78
98. View of the small fitness room in the Carla Madison Recreation Center 79

99. View from in the small fitness room with the operable garage door open 79
100. View showing both outdoor climbing walls 79
101. People and their dogs in the shade of the dog park 80
102. Context map 3.6.7. 81
103. Exterior view of the main entrance of BASE 82
104. Site map 3.6.7. 82
105. First level floor plan 83
106. Second level floor plan 83
107. View of fitness area in BASE 84
108. View looking outside to 'nature' from the fitness area 84
109. View of the gym 85
110. Ceramics studio in BASE 85
111. View of the front desk at BASE 85
112. View of the 'community living room' at BASE 86
113. Main staircase and children's area with trees painted on the wall 87
114. View of lobby and front desk 87
115. View of lobby from second level of BASE 88
116. Bubble diagram showing the different spaces. 91
117. Site Plan of Elk River Community Corner 94
118. Level 1 floor plan of Elk River Community Corner 95
119. Level 2 floor plan of Elk River Community Corner 95
120. Entry way of Elk River Community Corner 96
121. Juice bar in Elk River Community Corner 96
122. Community kitchen in Elk River Community Corner 97
123. Study area in Elk River Community Corner 97

124. Indoor playground in Elk River Community Corner 98
125. Hide out in the indoor playground in Elk River Community Corner 98
126. Outdoor playground at Elk River Community Corner 99
127. Vertical leaves (L) and Water table (R) 99
128. Reading area in the outdoor playground at Elk River Community Corner 100
129. Rooftop patio at the Elk River Community Corner 100
130. Seating area on the rooftop patio at the Elk River Community Corner 101
131. Teen hangout area in the Elk River Community Corner 101
132. Gym and walking track in the Elk River Community Corner 102
133. View from treadmill (L) and outdoor exercise area (R) 102
134. Butterfly Garden on the Elk River Community Corner 102
135. Front view of the Elk River Community Corner 103
136. Section cut 1 of Elk River Community Corner. Looking East 103
137. Section cut 2 of Elk River Community Corner. Looking South 103
138. North elevation of Elk River Community Corner 104
139. East elevation of Elk River Community Corner 104
140. South elevation of Elk River Community Corner 104
141. West elevation of Elk River Community Corner 104

LIST OF ABBREVIATIONS

Biodiversity	"Diversity of plants and animal life" (Oxford English Dictionary, n.d.).
Biophilia	"The innate tendency to focus on life and lifelike processes" (Wilson, 1984).
Biophilic Design	"Biophilia is applied to the design and further development of the human built environment, derived from a basic understanding of human evolutionary biology and how our inherent inclination to affiliate with 'nature' contributes to human health, fitness, and well-being" (Brown & Fink, 2022).
Built Environment	"The man-made or modified structures that provide people with living, working, and recreational spaces" (US EPA, 2017).
Children	Also used interchangeability in this thesis as Kids/Youths/School-age Kids/Teenagers. Meaning people from the ages of 1 to 18 years of age.
Eco-gentrification	When 'nature' is added or improved to an area or site which causes housing/property prices to increase to the point that causes the current people who live there to move away because they are no longer able to afford living there due to the increase of prices. (Wolch et al., 2014).
Greenspace	"An umbrella term used to describe either maintained or unmaintained environmental areas" (Barton & Rogerson, 2017).
Low-E Glazing	Low Emissivity Glass/glazing, it is a thin non-toxic coating that is applied to windows to make them more energy efficient. It allows light into a building while reducing the heat loss of a building (Inc, 2020).
Mental Well-being/Mental Health	"Mental health is a state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community" (World Health Organization, n.d.).

Natural Environment/Nature	"Consists of land-based ecosystems such as grasslands and forests, aquatic ecosystems such as rivers and wetlands, and coastal and marine ecosystems such as mangroves and sea-grass meadows" (Environment, 2022).
Nature Based Learning	"The study of nature-based learning brings together research on access to nature, human health and well-being, and settings that support learning. Nature-based learning occurs in natural settings and where elements of nature have been brought into built environments" (Pennsylvania State, n.d.).
Passive Design	To use design strategies that minimize or eliminate the need for additional heating and cooling sources (YourHome, n.d.).
Physical Well-being	"The ability to maintain a healthy quality of life that allows us to get the most out of our daily activities without undue fatigue or physical stress" (Australian National University, 2020).
Sustainable Transportation	"low- and zero-emission, energy efficient, and affordable modes of transportation" (Department of Energy, n.d.).
Urban Heat Island Effect	"Urban areas, where these structures, buildings, roads, other infrastructure, are highly concentrated and greenery is limited, become "islands" of higher temperatures relative to outlying areas" (US EPA, 2014a).
Users	People who visit and experience a space or building.

1. INTRODUCTION

1.1. Problem Statement / Introduction

1.1.1. Research Question

The world is becoming urbanized at a fast rate, with 55% of the world's population living in urban areas, of which there are approximately 4.3 billion people (Ritchie & Roser, 2018). Urbanization leads to a person's loss of connection to 'nature' as people are choosing instead to spend their leisure time on technology indoors (Weinstein et al., 2015). Establishing a connection with 'nature' is especially important when it comes to children's health and development. Lack of that connection can hinder the ability for children to relax, deal with stress, concentrate, and affect the way they socialize with others (Horwitz-Bennett, 2020). As people spend more and more time indoors on technology this causes the amount of human social interaction to decline which can lead to mental health issues. Author Bruce Boul stated that "one-fifth of the population feels lonely all the time or often" (Boul, 2022, pg. 7). One way to combat that loneliness is by way of biophilic design.

Biophilic design is a solution that not only works to combat the existing contemporary issues with living in the urbanized setting, but it works to prevent and mitigate future issues like biodiversity loss, air quality and water quality. There are many benefits that come with using biophilic design both in new and existing buildings as it "promotes physical, emotional, and intellectual well-being" (Whitehead, n.d., para. 2). Community and youth centers are examples of this in the built environment and are additional ways to offset the effects from urbanization by addressing physical and mental health problems. Community and youth centers encourage community involvement that increases individual health and well-being.

Biophilic design is when “biophilia is applied to the design and further development of the human built environment, derived from a basic understanding of human evolutionary biology and how our inherent inclination to affiliate with ‘nature’ contributes to human health, fitness, and well-being” (Brown & Fink, 2022). Architecture is one way that biophilic design can be used in the world. The goal of using biophilic design in architecture is to find ways to increase people’s daily interaction with ‘nature’ to improve their health and wellbeing (Panlasigui et al., 2021). While there are many human benefits of using biophilic design principles in a project, it also benefits the natural environment; for example, cleaner air, more variety of vegetation, and a reduction in the energy that the building is consuming.

The amenities of a community and youth activity center both vary depending on the community and their needs. The overall goal of a community center is to provide a public place where people can go to connect with each other through socializing, recreational activities, and educational programs to receive social support from others (*Community Centers*, 2020). Community centers are important because they can foster and encourage higher community involvement and give people a “sense of citizenship” (*Community Centers*, 2020). Youth centers are similar but have a focus on the younger generation and provide a space where they can learn new skills and share their ideas in a positive and productive environment (Green & Acenas, 2020).

This thesis proposal investigates how the combining of biophilic design, youth centers, and community centers will benefit the mental and physical health of the younger generation. Also, it will explore how implementing biophilic design can benefit the natural environment, by increasing biodiversity and improving air and water quality in an urban setting. Knowledge gathered on the topics of community centers and youth centers through the research done for this

paper will be applied to the design of a community center in combination with a youth center. This paper will use case studies and precedents to analyze community centers, youth centers, and the application of buildings that use biophilic design principles. Information from authors that is talked about in the literature review section will be applied to a community youth center that uses biophilic design principles to benefit the physical and mental health of the people who use it and the natural environment on and around the site.

1.1.2. Proposed Outcomes

Through research and design implementation, a building that benefits school-age kids both mentally and physically while simultaneously improving the natural environment is hoped to be achieved. The site for the community youth center should be a place that is close to a school, as it is focused on a place for kids and teenagers to spend time after school that benefits them both mentally and physically.

1.2. Objective

1.2.1. Aim of Research

This research aims to understand how to use biophilic design principles for the design of youth centers and community centers. This will be demonstrated through ways that include using daylight and natural materials, so that it benefits the mental and physical health of school-age kids as well as benefiting the natural environment.

1.2.2. Significance

This research is necessary because as the world becomes more and more urbanized, the natural environment is being replaced with the built environment. This causes people to lose their connection and interaction with ‘nature’ which can lead to a variety of health problems that include but are not limited to obesity and circulatory diseases. It is an Architects job to protect

the health, safety, and welfare of the public. A way that can be accomplished is by designing buildings and spaces that prioritize the health of the occupants. Biophilic design is a solution that can work to improve the health of all people and it can help restore and protect the natural environment. It can work to foster social interaction between people, which is important in the physical, emotional, and cognitive development of kids and teenagers.

2. LITERATURE REVIEW - BACKGROUND

2.1. Background

The topic of this literature review is biophilic design in relation to community centers and youth centers. It will go over the benefits and applications that go along with each. It will also touch on issues and concerns, such as eco-gentrification, that are associated with biophilic design. All of this will come together to provide an in-depth look at how biophilic design can be used to design both a community and youth center in order to improve the physical and mental health of the people living in the area and the environmental health of the area. Also, it will discuss the benefits that exposure to 'nature' can have on children's physical and mental health, identify stressors, and it can aid with reducing anxiety and depression. 'Nature' can be brought into these environments through biophilic design, so it will cover how biophilic design can improve the natural environment in terms of biodiversity, air and water quality, and energy consumption. Eco-gentrification can lead to things like an increase in property costs as a result of biophilic designed neighborhoods (Wolch et al., 2014). The understanding of the benefits gained from utilizing biophilic design principles for community centers, along with the know-how to apply them through design, can create a successful build. That is the outcome that is hoped to be achieved.

2.2. Literature Review

2.2.1. Benefits of Biophilic Design for Improved Human and Environmental Health

The use of biophilic design principles provides mental and physical benefits to all people as well as the natural environment. These benefits include healthy lifestyle choices, decreased levels of stress, anxiety, depression, a cleaner natural environment, and a more diverse ecosystem. There is consensus that using biophilic design allows for benefits to both people and

the environment. If designers can add permanent biophilic features into their projects they are allowing everyone who visit to receive those benefits (Gillis & Gatersleben, 2015). This can result in rewarding places that encourage therapeutic conditioning and work to improve human well-being through the promotion of mental and physical health (Brown & Fink, 2022). When a city invests in implementing green solutions they are providing economic, social, and ecological benefits for the whole city (Brown & Fink, 2022). Biophilic design, when included within the built environment can increase people's physical, emotional, and intellectual well-being, along with enhancing their overall creativity (Whitehead, n.d.). Greenspace and 'nature' can be associated with a decrease in health-related inequalities, as well as both income-related and not (Mitchell & Popham, 2008; Weinstein et al., 2015; Barton & Rogerson, 2017). Having green space that is close to children's home is important for their health, as shown by a study, morbidity is related to a green living environment, done by Mass et al. in 2009 (Maas et al., 2009).

The connection between children and 'nature' is crucial for their physical, social, and cognitive development. The benefits they gain from their connection to 'nature' can be strengthened through the application of biophilic design principles in the spaces that they spend most of their time, like schools, and places they frequent daily. When students experience 'nature' there is improvement in their learning performance, both in academics and social settings (Wolf et al., 2014; Brown & Fink, 2022). There is evidence that suggests that emotional and behavioral difficulties in children can be improved when exposed to greenspace and 'nature' (Vanaken & Danckaerts, 2018). Promoting children's cognitive, moral, and social development can be done by providing places that are in 'nature' and allow for play and experimental learning to happen (Wolf et al., 2014). School gardens are an instance which 'nature' can be used to

provide students with hands on learning and real world experiences (Brown & Fink, 2022). The improved ability to pay attention and concentrate along with improved motor skill functions were found when looking at what happens when children play in the natural environment and for a significant amount of time (Wolf et al., 2014). A study done by Vanaken and Danckaerts in 2018 found that there is a significant link between the mental health of children and adolescents and the exposure they have to greenspace.

Biophilic design has been demonstrated to improve mental health by the reduction of stress, anxiety, and depression. Experiencing and viewing 'nature' has led to lower levels of stress, as shown by both individual self-assessments and medical review, and by looking at the levels of people's cortisol, the stress hormone (Brown & Fink, 2022; Browning et al., 2014; Gillis & Gatersleben, 2015; Kellert & Calabrese, 2015; Whitehead, n.d.). When people have a connection to 'nature' they have less anxiety (Barton & Rogerson, 2017; Browning et al., 2014; Kellert & Calabrese, 2015). Exposure to 'nature' can help people, especially adolescents and young adults, recover from depressive symptoms (Vanaken & Danckaerts, 2018). Also, there is a lower chance of depression when there is greenspace near where people reside in urban areas (Barton & Rogerson, 2017). Lastly, a person's mental health can be boosted by experiencing 'nature' in similar ways to their physical health.

Among the many benefits that people gain through the experience of 'nature' physical benefits are important primarily when it comes to health issues like obesity and lack of physical activity in general. A study showed that circulatory diseases that lead to mortality had the greatest reduction where there was the most amount of access to greenspace (Mitchell & Popham, 2008). It is important for people to increase their physical activity as in doing so it can better their well-being and lower the chance of disease, risk of injuries, and premature death

(Boul, 2022). There is a link between ‘nature’ and the amount of physical activity that people do. As a result of this link an increase in access to ‘nature’ would suggest an increase in physical activity (Brown & Fink, 2022; Kellert & Calabrese, 2015; Wolch et al., 2014). Having a connection with ‘nature’ can reduce obesity both in adults and children (Brown & Fink, 2022; White et al., 2019). Mitchell & Popham (2008) state that green space can be independently related to promoting physical activity, too. In a similar way, biophilic design works to bring ‘nature’ into people’s everyday lives and it can work to benefit the health of the ‘natural’ environment as well.

Biophilic design is a way that works to improve health and at the same time the quality of the natural environment. It does this through the increase of biodiversity, improved air and water quality and the reduction of energy consumption. All these play a significant role in the health of urban areas. Biodiversity is important for having a healthy natural environment as it is used to help mitigate urban heat island effect and collect and manage stormwater which leads to a healthy and correctly functioning ecosystem (Brown & Fink, 2022). When storm water goes through vegetation, like green roofs, it filters and cleans the water. This then leads to less polluted and contaminated water going into streams and rivers, which are often a source of drinking water for people and animals.

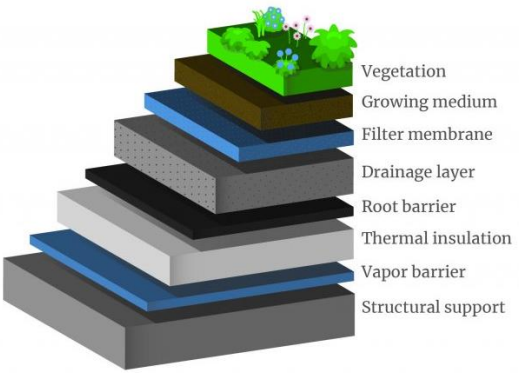

Figure 1. Image of the different layers of a green roof (US EPA, 2014b).

'Nature' can work to replenish groundwater, this is important when looking at what kind of vegetation and 'nature' should be grown on site (Wolch et al., 2014). Vegetation can improve the quality of the air as plants take in carbon and release oxygen, which reduces the amount of carbon found in the air (Browning et al., 2014; Wolch et al., 2014). The use of natural materials in buildings is beneficial as there are very few to no harmful chemicals that are applied to these materials. This in turn allows for less harmful toxins being released into the air (Horwitz-Bennett, 2020). Natural ventilation is another way that can improve the air quality of a space, as air exchange rates can be higher (Loftness, 2015). Natural ventilation can also be used to reduce the amount of energy a building consumes by relying on natural systems rather than mechanical systems (Loftness, 2015). The use of natural daylight is beneficial as it can make a huge difference in the amount of energy a building consumes. The more daylight that is let in, the less artificial light is needed which means less energy is used (Loftness, 2015). Also, daylight allows for the use of passive solar heating, harnessing and using the suns natural energy, which when used right can lead to carbon emission neutrality (Loftness, 2015). As previously noted, the use and implementation of 'nature' into the built environment is not only important for the health of the natural environment but for the health and well-being of people who live, work, and play there as well.

2.2.2. Benefits of Community and Youth Centers for Improved Human Well-being

Community centers and youth centers are important for a community, as they provide a common space for all members, even though youth centers are geared towards youths and young adults, they provide a connection to the whole community. They provide a place that people can gather and exchange resources, information, emotional support, foster higher community engagement, and give people a "sense of citizenship" (*Community Centers*, 2020). Socialization,

volunteerism, and civic pride are possible benefits when people visit community centers (Boul, 2022; Indigo, n.d.). Community centers promote relationships and civic pride all of which can give people a sense of belonging (Boul, 2022). Cultural diversity, inclusion, and active lifestyles are various benefits that can be received when spending time at community centers, because of this they can lead people to fulfill their social responsibility (Indigo, n.d.). Youth centers provide these benefits and they focus on opportunities that allow for the development of social, cognitive, emotional, and physical abilities of youths (Mion, 2017). Adolescences can experience things like achievement, enjoyment, friendship, and leadership when they spend time at youth centers (Mion, 2017). Youth centers can be thought of as public spaces where young minds can spend time out of school that is constructive. They can learn new skills and share ideas, which all can lead to the healing, empowerment, and resilience of today's young people (Green & Acenas, 2020). There are benefits from community and youth centers that not only improve the community but also provide benefits for individuals.

There are many personal benefits that come from spending time at a community or youth center. Social connections are improved when time is spent at a community center (*Community Centers*, 2020). Reducing time spent alone and on social media in the home allows in-person social connections to be fulfilled at a community gathering places. This can improve social well-being so that they may choose to spend more time with other people (Weinstein et al., 2015). Individuals can work on team building skills, learning new skills, and increasing their confidence and self-esteem (Boul, 2022; Green & Acenas, 2020). A person's individual well-being will likely be enhanced as the community's cohesion becomes greater (Weinstein et al., 2015). People can also make new friends through the connections created within the community that aid in the ability to create and establish a sense of social responsibility and self-reliance (Boul,

2022). Additionally, community centers can provide physical and psychological safety as well as enhance a person's soft-skills (Green & Acenas, 2020). The benefits for individuals spending time at community centers will increase their personal and community well-being, grow their sense of belongingness, and share in their diverse and cultural backgrounds with others.

Community centers are made to benefit the community and are a place where community activities can be held and allow people to make those connections. Higher community participation among the members of the community is an outcome of having a community center (*Community Centers*, 2020). Community centers can encourage people to help solve problems that the community is facing and enhance the quality of the community's life (Boul, 2022). The rates of isolation are lower among people who spend time at a community center and by doing so it improves people's mental health (*Community Centers*, 2020). Improved physical and mental well-being can come from being physically active (Indigo, n.d.). Another beneficial aspect of community centers, like gyms and fitness areas, is increased physical activity, as they provide opportunities for people to perform together while staying active, (Boul, 2022). The decrease of disease, injury, and premature death are all results from being physically active, making it important to provide spaces that allow for people of the community to be physical active (Indigo, n.d.). All in all community centers are a place for people from different backgrounds and areas of life to come together, which is one of the main aspects within a community (Boul, 2022). People are more likely to participate in environmentally friendly actions if they are part of a cohesive community (Weinstein et al., 2015). The benefits that come from having and spending time at a community center are often determined by the resources and opportunities that are offered.

The uniqueness of each community allows for the chance of several different resources and opportunities that can be provided for the community. Community centers provide a place

for active lifestyle opportunities, inclusive environments, and being a place for safe recreation (Boul, 2022). Community centers can help lower-income residents that may not have access to resources and opportunities to live a healthy lifestyle (*Community Centers*, 2020). While community centers can provide different opportunities and programs, youth centers are designed to have programs that benefit children and youths. These programs can be focused on students to increase their academic achievements, impact and improve their behavior in and out of the classroom, and be successful with increasing test scores (Boul, 2022). Not only do community and youth centers benefit the kids that spend time there, but summer programs that are offered can help the mental and physical growth of those kids which in turn provides benefits to the families of those kids that participate (Boul, 2022). Another valuable resource and opportunity are the mentoring, guidance, and leadership provided from supportive adults and elderly volunteers while the kids are at the community centers. Kids benefited the most when they interacted with adults and/or elderly people of the community (Green & Acenas, 2020). The resources and opportunities that community centers and youth centers provide can benefit the community as a whole, biophilic design can benefit the community, too.

2.2.3. Implementation of Biophilic Design

The principles of biophilic design can be broken down into three categories that relate to how people interact with ‘nature’. The first of which is people interact with ‘nature’ through ‘Direct Experience of Nature’. This means being able to have physical and/or direct contact with ‘nature’ or natural elements, like vegetation, light, and water (Browning et al., 2014; Gillis & Gatersleben, 2015; Gohil, 2021; Kellert & Calabrese, 2015; T. Wolf, 2020). Furthermore ‘Direct Experience of Nature’ can be broken down into seven elements, visual connection, Non-visual connection, Non-rhythmic sensory stimuli, thermal and air flow variability, presence of water,

dynamic and diffused light, and connection with natural systems (Gohil, 2021). When diversity of people, movement, and multi-sensory interactions in combination with natural elements are offered, people have a higher chance of receiving the benefits associated with experiencing 'nature' (Browning et al., 2014). According to authors Kellert and Calabrese, "Visual sense is by far the dominant way people perceive and respond to the natural world" and this causes physical, emotional, and cognitive responses in people (Kellert & Calabrese, 2015, pg. 11).

Vegetation is what most people think of when adding 'nature' to design (Horwitz-Bennett, 2020). Adding vegetation to the built environment is an easy way for people to have a connection to 'nature' and bring it inside of buildings (Gillis & Gatersleben, 2015; Kellert & Calabrese, 2015). Green walls, green streets, community gardens, and pocket parks are ways of using vegetation in an urban environment (Panlasigui et al., 2021). Other examples of vegetation integrated into buildings are through climbing gardens, wall tiles with plants, and potted plants according to McCain (2020). Brown and Fink (2022) offer more ways 'nature' can be brought into the built environment, like green streetscape, rain gardens, bioswales, and green roofs. Having these design features allows for improved air quality and reduced exposure to volatile organic compounds (VOCs) (*EPA*, n.d.; Heerwagen, n.d.; Whitehead, n.d.). The vegetation that is used should be abundant, biodiverse, native to the area, and work to help recycle nutrients in soil and encourage pollination (Kellert & Calabrese, 2015).

Figure 2. Green wall in New Jersey Institute for Food Nutrition & Health. (Urbanstrong, n.d.).

Light is another element of ‘Direct Experience of Nature’ that is important to utilize in design, incorporating natural light is important for human well-being and can be done through bringing daylight into interiors (Panlasigui et al., 2021). Windows are the most common and a lot of the time the easiest way to get daylight into a building. Where there are windows there is a view to the exterior setting and that means there is a view to ‘nature’ (Loftness, 2015). Skylights are also a way to incorporate daylight into a building; whereas artificial light can be used to simulate daylight or provide light where daylight cannot reach (Browning et al., 2014; Kellert & Calabrese, 2015).

Water is a third element of ‘Direct Experience of Nature’ that can be incorporated into design projects. Ways that integrate water are rainwater harvesting systems and rain gardens (Brown & Fink, 2022). Natural streams, ponds, rivers, and other bodies of water can be used if they are a part of the site already. Other water elements can also be simulated like water walls, aquariums, fountains, and man-made ponds and streams (Browning et al., 2014).

Vegetation, light, and water are all biophilic design elements that are a part of ‘Direct Experience of Nature’ and are important and beneficial in their own way. Using ‘Indirect

Experience of Nature' when designing is another way to allow people to gain benefits from having a connection to 'nature'.

The next category of biophilic design principles is 'Indirect Experience of Nature', which are elements that imply, represent, or imitate 'nature'. These can be things like colors, materials, shapes, and patterns (Browning et al., 2014; T. Wolf, 2020). Images of 'nature', whether it is looking out the windows or looking at pictures of 'nature' they are able to provide benefits to people (Heerwagen, n.d.; Gillis & Gatersleben, 2015; Panlasigui et al., 2021). These can include artwork like pictures, paintings, sculptures, videos, and murals, they should be abundant throughout the building (Kellert & Calabrese, 2015). The images can contain water and vegetation, seeing these elements can help to reduce stress and improve people's mood (Gillis & Gatersleben, 2015; Heerwagen, n.d.; Nevzati et al., 2021).

Colors are an 'Indirect Experience of Nature' that can be used to create a connection to 'nature'. Color can affect the way people perceive the space around them, using colors that 'enhance the beauty of nature' can lead to less anxiety, stress, and lower heart rate and blood pressure (Whitehead, n.d.). The colors that should be considered are "earth tones" or colors that mimic 'nature', for example blues, greens, and neutrals, all which can be found in things like rocks, soil, and plants (Kellert & Calabrese, 2015; Whitehead, n.d.).

Figure 3. Earth tone color palette. (Creative Fabrica, n.d.).

Figure 4. Natural materials and colors. Wood is used for the walls, stone is used in stairs and floor. Greens and browns are used. Photo by Dimitar Gamizov. (Ott, 2021).

Materials are a great way to represent ‘nature’ in a building and they provide benefits like reduced exposure to harmful chemicals that are often picked up in the construction phase (McCain, 2020). Using light colored materials will help natural daylight to reach further into interior spaces (Whitehead, n.d.). Examples of natural materials that can be used are wood, stone, clays, woolen fabrics, and leather (Gillis & Gatersleben, 2015; Kellert & Calabrese, 2015). Natural materials can be used for structural systems along with building materials, these are mainly wood or stone (Horwitz-Bennett, 2020). When a direct connection to ‘nature’ is not

possible, simulations can be used to gain that connection to ‘nature’. These can be when light and air are simulated or the sound of water, all can have benefits, like reduced stress and increased relaxation, when applied in the right manner (Gillis & Gatersleben, 2015; Heerwagen, n.d.; Nevzati et al., 2021).

Forms, shapes, and patterns can be repeated in design to provide a connection to ‘nature’. These should reflect natural geometries, systems, and patterns and can be found in things like ornamentation (Brown & Fink, 2022; Gillis & Gatersleben, 2015; Kellert & Calabrese, 2015). This is important when looking at places that may not provide opportunity for a physical connection to ‘nature’ like hospitals or government buildings. There are many ways that design can provide a connection to ‘nature’ through the ‘Indirect Experience of Nature’.

Figure 5. Building based of a plant found in nature. (Awadalla, 2022).

The last biophilic design principal category is ‘Experience of Space and Place’ this relates to how people experience places and movement through space. Space in this instance refers to the areas that people move through; such as rooms, corridors, and open areas that show relation to how these different areas flow together (T. Wolf, 2020). The spaces should work to represent settings and configurations that can be found in the natural environment and then bring them into the built environment (Gillis & Gatersleben, 2015; Gohil, 2021).

Place is when a space becomes comfortable and important to a person and can be created through deliberate and engaging settings (Browning et al., 2014). When people have a strong connection to a specific area it provides restorative benefits (Gillis & Gatersleben, 2015). An example is when a community can claim a space as their own because they feel like they belong there (Brown & Fink, 2022). Comfort is the key to turning a space into a place, and when accomplished it allows for benefits such as improved well-being (Brown & Fink, 2022; Kellert & Calabrese, 2015).

Prospect is an aspect of space and place, it refers to the 'long-distance views' and comes from a person that wants to see opportunities and/or danger from a distance (Heerwagen, n.d.; Kellert & Calabrese, 2015). This allows for people to have a sense of safety and control and can be accomplished by providing views where people can see farther than 20 feet, using transparent materials and balconies where you can see things from a distance are ways this can be accomplished (Browning et al., 2014). Refuge is another element of space and place that is important, it means places that offer safety, security, and protection (Heerwagen, n.d.; Kellert & Calabrese, 2015). It can be applied to though things like chairs with high backs, reading nooks, the use of tree canopies, gazebos, covered walk ways, and spaces that have a minimum of three covered sides (Browning et al., 2014). Prospect and refuge play an important role in the success of the 'experience of space and place'. All are important for a building that successfully uses biophilic design, similar is the implementation of certain elements that make successful community and youth centers.

Figure 6. View showing a great distance outside. Photo by Jane Messinger. (Erin, 2015).

2.2.4. Implementation of Community and Youth Centers

There are multiple factors that go into successful community and youth centers. One of these is making sure that everyone is able to have access to it, whether it be people of all ages, backgrounds, or groups, like immigrants and/or religious groups (*Community Centers*, 2020; Green & Acenas, 2020). Location is important to think about, it should be in area that is close to a residential area and allows for safe and easy travel to and from (Boul, 2022; Green & Acenas, 2020). The material and overall aesthetic of the building should be home-like, this will help to make people feel more comfortable when they are visiting the building (Mion, 2017). Mentioned above are just general considerations that should be thought of when looking at what makes a successful community youth center. The different programs that are offered to the people using the center plays an important role in the outcome of community and youth centers. The more programs offered then the higher chance there is something for everyone to engage in.

A variety of programs can be offered at and through community centers. Boul (2022) states that safety programs, cardiopulmonary resuscitation (CPR) training, and first aid classes

are all important classes for a community center to offer people. Other programs that should be considered include education classes about health, nutrition, and well-being (Indigo, n.d.). Workforce training, violence prevention, community engagement activities, and sexual and reproductive health classes are other options that can be offered at community centers to benefit the people of the community (Green & Acenas, 2020). More importantly programs that community centers can offer are different kinds of physical fitness classes, art, educational programs, and unstructured activities that focus on socializing and playing, which are important for children (Mion, 2017). Most of these programs do not need to have a dedicated room or space within a community center to be successful, but it is still important to think about what these spaces should look like.

Whether it is spaces designated for specific activities or a general area for people to gather it is important to consider how the layout and functionality of those spaces are designed. According to Green and Acenas (n.d.) the spaces should be flexible and there should be a variety of areas where it is possible for multiple different activities to be able to use the open design and even possibly at the same time. The same article also states that the arrangement of spaces and where people go is more important than the structure of the building (Green & Acenas, 2020). Some spaces that need to be thought about in the layout of the building are educational spaces and physical fitness areas, spaces should also foster creativity and provide a sense of independence for people (Mion, 2017). Spaces that encourage artistic exploration are important to include along with having spaces that are made for health focused activities (Boul, 2022). Also, Author, Boul states that providing a public meeting space for the community and a cost-effective event space that people are able to rent out is meaningful to include in the final product as well (Boul, 2022). With the information above about the beneficial spaces and programs that

can be included in a community youth center, it is possible to understand the issues and considerations that must be included in the design of successful community and youth centers.

2.2.5. Issues and Considerations for Biophilic Design

When adding ‘nature’ to the built environment or improving what is already there, it is important to realize two things, in the case of this project, eco-gentrification and accessibility. Eco-gentrification is when ‘nature’ is added or improved in an area or site which in turn causes housing prices to increase to the point that cause the current people who live there to move away. This is because they are no longer able to afford living there due to the increase in housing prices (Wolch et al., 2014). Boul (2022) states that “homes within a quarter mile of a park are 10% more valuable on average” (pg. 9). The High Line in New York is an example of this as property values had increased significantly after it opened to the public (Wolch et al., 2014). The idea of making areas ‘just green enough’ is meant to help prevent eco-gentrification, the idea aims to add ‘nature’ to the built environment through small-scale integrated methods or projects (Wolch et al., 2014). It focuses on what the needs are of the current residents, rather than a general implementation plan of adding ‘nature’ to urban areas (Brown & Fink, 2022; Wolch et al., 2014). This does not mean that the bare minimum ‘nature’ should be added or improved, but rather that the understanding of community needs, and accessibility should shape the outcome of ‘nature’ being used in those communities.

A key part of understanding the community is making sure that everyone in the neighborhood has access to the site. This means addressing accessibility both in terms of complying with the Americans with Disability Act (ADA) and making an environment useable for as many people as possible. The goal for complying with ADA guidelines is that the site and building can be used and experienced by everyone, no matter their ability. Things to think about

when making sure locations are accessible is if people of different abilities can get around easily. This is addressed by things such as elevation changes, signage, wayfinding, and clear entries and exits from buildings (Brown & Fink, 2022; Kellert & Calabrese, 2015). When looking at the functionality of a project layout, it is important to think about what the specific spaces are meant for. Are they meant for independent time or group interaction (Brown & Fink, 2022). In relation to 'nature' people can only gain benefits from it if they are able to experience it (Weinstein et al., 2015). If greenspace is both ADA complaint and available for use, it can "be the social glue that helps bring communities together" (Brown & Fink, 2022, pg. 26).

2.2.6. Gap Identification

From the information gathered above, there is only separate research on biophilic design, community centers, and youth centers available. From the research and literature reviewed above, there was little to no literature and research done on what happens if biophilic design principles were to be applied to a community youth center.

2.3. Project Type

The goal of this thesis is to combine the programs of community and youth centers and use features of biophilic design to maximize the benefits that are provided for the users of the building. Other architects and designers of the built environment have successfully designed community centers, youth centers, and buildings that use biophilic design principles, some examples are provided in section 3.6, case studies, of this thesis. As the world focuses more and more on sustainability, community, and the resilience of both, biophilic design implemented into community centers and youth centers are a promising solution.

2.4. Project Issues

People spend 90% of their time in the indoor built environment, as this becomes the 'natural habitat' of people, the connection to 'nature' and the natural environmental is weakened if not lost (Kellert & Calabrese, 2015). This loss affects people of all ages and abilities, this can be very important when it comes to the development of children and their health and wellbeing. Richard Louv, an author and child advocacy expert, has called this issues and others like it "nature deficit disorder" which links the amount of time children spend in 'nature', which is less and less, to the increase in obesity, depression, and attention disorders in children (Brown & Fink, 2022). The inappropriate and excessive use of technology leads to multiple issues like, obesity, physical inactivity, insufficient quality of sleep, developmental and musculoskeletal problems, these lead to learning obstacles and behavioral issues some being, moral, social, and emotional development problems (Agha & ZaaZa, 2021). This same article states that the number of children with obesity has tripled in the past 20 years and using technology so much can be lead to a lifetime of obesity (Agha & ZaaZa, 2021). Technology is not the only issue that children face when it comes to their development, the amount of pollution in the air can affect their brain development and cause reduced attention function and autism (Vanaken & Danckaerts, 2018). This issue arises from the impacts that urbanization has caused on the natural environment.

The environmental consequences from urbanization can be seen in the loss of biodiversity, the deteriorating quality of air and water, and the amount of energy that is consumed for the built environment. "The World Economic Forum (WEF) ranks biodiversity loss and ecosystem collapse as one of the top five economic threats humanity will face in the next 10 years" (Brown & Fink, 2022, pg. 30). "The health of ecosystems on which we and all

other species depend is deteriorating more rapidly than ever" (Brown & Fink, 2022, pg. 28). When rainwater falls in an urban area it encounters many different surfaces, such as roofs, gutters, sidewalks, roads, and pipes, all before running into streams and rivers. Along the journey from the sky to rivers and streams it collects man-made impurities that diminish the quality of the water. This leads to the deterioration of the quality of water that humans use every day. Also, urbanized and industrial areas are in need of green ways that positively affect water runoff and that provide for energy savings to mitigate the energy consumed as well as by addressing the increased C02 levels affecting the planet. The issues that this thesis addresses are physical health; obesity, mental health; stress, anxiety, depression, and environmental health; biodiversity, air quality, water quality, and energy consumption.

3. RESEARCH DESIGN & METHODS

The following chapter goes over the approaches that were taken to gather information and data for this project. It also explains how the information and data is going to be applied to this thesis. An analysis of the site is done, starting with the site selection process, and then going into the information and characteristics of the city and ending with an in-depth analysis of the chosen site on a smaller scale. The next section provides information about the different programs and certifications that relate to sustainable and biophilic design. Following that information, seven case studies are presented, examined, and related to Elk River Community Corner. The last section in this chapter is a detailed program of the spaces that are included in Elk River Community Corner.

3.1. Approach

In order to try and answer the question of how can biophilic design be applied to community youth centers, for the purpose of benefiting people and the ‘natural’ environment, this thesis will use a number of approaches. The first one being using the pervious stated research about implementation of biophilic design principles and programing of community and youth centers. Case studies will be used to show what has been done successfully in the design world. Created based on the combination of all the knowledge gathered and presented in this thesis is a community youth center that uses biophilic design principles.

3.1.1. Data Collection

This project gathers both quantitative and qualitative data to understand how biophilic design can be applied to the community and youth centers. The quantitative data that is collected is site analysis information, climate, sun path, wind direction, soil types, etc., numbers and information about buildings, square footage, number of stories, etc. The qualitative data gathered

is the past and current knowledge about biophilic design, community centers, and youth centers, the programing of building, the layout of the building, and the design features. Sources, case studies, and energy models are used to collect the needed data for this thesis.

3.1.2. Analysis

Through many sources including books and journal articles information is provided about the benefits and implementation of both biophilic design and community and youth centers. Building programing ideas and examples are given through the sources and case studies. Case studies are also used to understand and show what design features and ideas work in the real world. Maps, tables, charts, and images are used to provide a site analysis of the chosen site for Elk River Community Corner. Tables are also used to compare possible sites for this project and to present the basic information about each case study and the biophilic design principles that are used in each project.

3.1.3. Conclusion

The intent of this thesis is to use the methods explained above to collect information and then apply that information to a design a community youth center that uses biophilic design principles to benefit the people of the community and the natural environment. The benefits that are hoped to be achieved are people's improved mental and physical health through having a connection to 'nature'. An increase in environmental health is aimed for through the use of biophilic and sustainable design features. Before this knowledge can be applied to a building, a site for the building needs to be chosen.

3.2. Project Location – The City of Elk River, Minnesota

After an initial search for a site was conducted, four potential sites were found. These four sites were then further examined to see if they would work for the site of Elk River

Community Corner. First, they were all chosen because they are all within cities. Next the city's school(s) were found and the area around was looked at to see if there was open space close by that would be large enough to accommodate a community youth center. The location from the potential site to the closest residential areas was noted after the open area was chosen. After the potential sites were picked, data was found relating to the current use of the site, the urban context, the distance from schools, neighborhoods, and community centers. The number of schools and students in each was also found and considered for each project location. From the data collected and summarized in table 1, site A was chosen to become the site for Elk River Community Corner. This site was chosen because there is the greatest opportunity to impact the most children and youth. Having the ability to visit the site, was another deciding factor. Summarized in table 1 is the information that was gathered into to determine the best site for Elk River Community Corner.

Possible Site	Location	Current site occupation	Urban Area (population per square mile)	Distance from Closest Neigborhood	Number of Schools within 1 mile	Distance from School(s)	Number of Kids in the school	Community center within 10 miles	Ability to visit the site
A	Elk River, MN	Parking lot	610.3	140 ft	5	120-1,704 ft	Middle: 521 students Middle: 725 students High: 1,631 students Elementary: 513 students Elementary: 500 students	YMCA 2 miles	yes
B	Brooklyn, MN	Open green space	3,316.40	500 ft	1	400 ft	626 students	BPAC - 1.5 Miles BCCC - 4.5 Miles	maybe
C	Brooklyn, MN	Empty	3,316.40	100 ft	1	150 ft	626 students	BPAC - .5 Miles BCCC - 4.1 Miles	maybe
D	Brooklyn, MN	Old Soccer fields	3,316.40	250 ft	1	3,400 ft/.64 miles	694 studentfs	BPAC - 1.4 Miles BCCC - 4.75 Miles	no

Table 1. Criteria for site selection. BPAC (Brooklyn Park Activity Center) and BCCC (Brooklyn Center Community Center). Modeled after Google Maps, U.S. Census Bureau, US News, and Niche.

The site for this thesis project is in Elk River, Minnesota. The city of Elk River is located about 50 miles Northwest of the Twin Cities. The 2020 Census reported the population is 25,835 people (U.S. Census Bureau, n.d.). There are roughly 610 people per square mile making it an suburban area, as the density falls between the range of 100 and 10,000 people per square mile (Pozzi, n.d.).

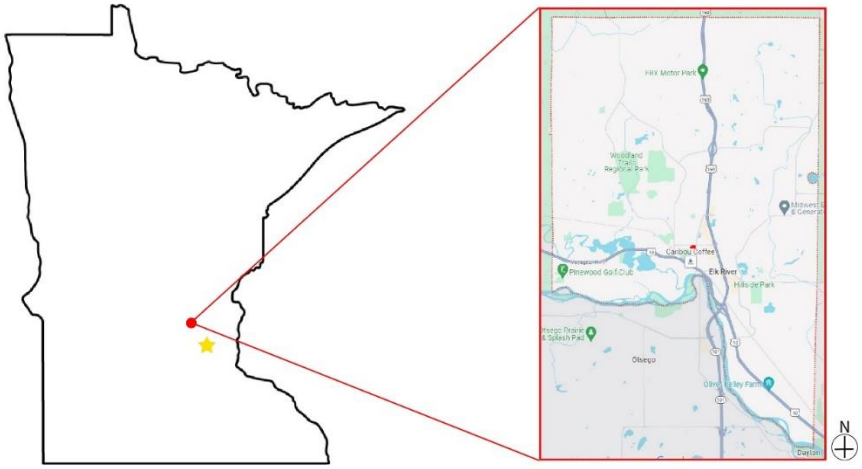

Figure 7. City's Location within Minnesota. Picture showing the city's location in Minnesota. The site is the red dot, and the Twin Cities are the gold star. Modeled after Google Maps.

The average high for temperature is 55˚F and the average low temperature is 34 ˚F for Elk River Minnesota (US Climate Data, n.d.). The average rainfall is 31.86 inches and the average snowfall is 40 inches per year (US Climate Data, n.d.). The site is in a temperature climate zone.

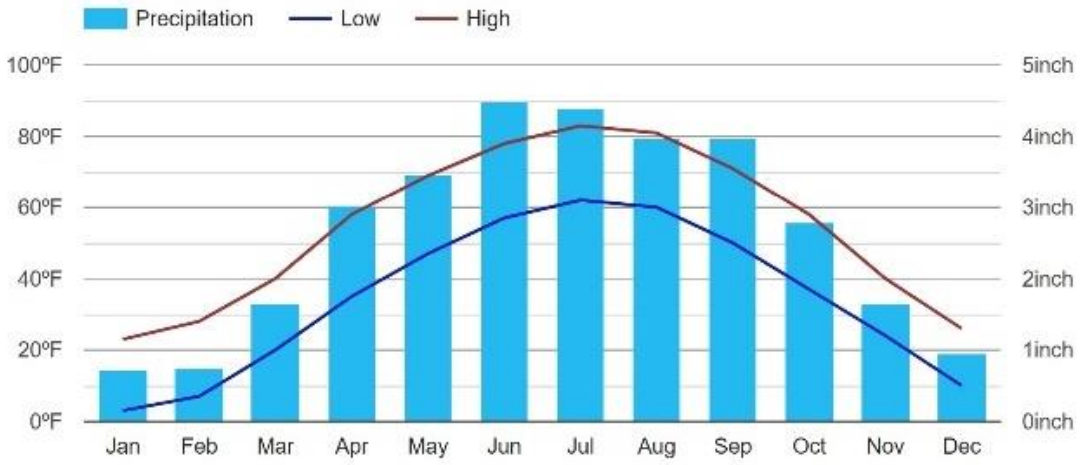

Figure 8. Graph of average climate. Graph showing the average precipitation, low and high temperatures for each month in Elk River, MN (US Climate Data, n.d.). https://www.usclimatedata.com/climate/elk-river/minnesota/united-states/usmn0989

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average high in °F	23	28	40	58	69	78	83	81	71	58	40	26
Average low in °F	3	7	20	35	47	57	62	60	50	37	24	10
Av. precipitation in inch	0.73	0.74	1.66	3.02	3.47	4.48	4.39	3.98	3.98	2.80	1.66	0.95
Av. snowfall in inch	8	7	7	4	0	0	0	0	0	0	7	7

Figure 9. Average temperatures and precipitation. A picture showing the average high and low temperatures along with the average amount of rain and snow for Elk River, MN. Numbers in the red boxes are the maximums (US Climate Data, n.d.). https://www.usclimatedata.com/climate/elk-river/minnesota/united-states/usmn0989

Elk River is part of Minnesota's GreenStep Cities, which means to help cities meet their goals that relate to sustainability and improved quality-of-life (Minnesota Pollution Control Agency, n.d.). They city at a 5 star level, the highest level, indicating that the city has shown improvement within the city's performance (Minnesota Pollution Control Agency, n.d.). The program outlines 29 Best Practices, the categories being buildings and lightings, land use, transportation, environmental management, and resilient economic and community development (Minnesota Pollution Control Agency, n.d.). Elk River Community Corner meets about 15 of the 29 Best Practices. Elk River Municipal Utilities offers a program called The Clean Energy Choice Program, it is a program that allows for residents and businesses to get 50%, 75%, or 100% of their electricity from renewable energy and environmental friendly sources, at a low cost (Clean Energy Choice, n.d.). Wind, solar, bioenergy, and hydropower are the renewable energy and environmental friendly sources that the city uses (City of Elk River, n.d.). Buildings that are owned by the city get 100% of their energy from the renewable energy and environmental friendly sources (City of Elk River, n.d.).

3.3. Project Location – Surrounding Site Context

When looking closer at the site's location, it can be seen that it is near the Mississippi River, only a little over a half a mile away. There are many major highways that are close,

Highway 10 is half a mile away, Highway 169 is .4 miles away, Highway 101 is 1.6 miles away and Interstate 94 being 8 miles away. There are also railroad tracks half a mile away.

Figure 10. Main Roads. Map showing the main highways in red and the railroad in black. The site is outlined in red. Modeled after Google Maps.

There is a high school, two middle schools, and two elementary schools right across from the site which provides the opportunity for Elk River Community Corner to be experienced by many students. The neighborhoods to the North and East make it possible for kids to travel to and from the site by foot, with the one to the North only being .25 miles away and the one to the East being across the street. The park to the South allows for the opportunity for more access to 'nature' without having to go far and is safe to get to because there are no roads to cross. In the city's 20-year comprehensive plan, one of their key community outreach themes is active transportation, this includes expanding current and adding new pedestrian and bike, with a focus

on safe school routes and getting across Highway 169, which Elk River Community Corner can help with (*Elk River Comprehensive Plan*, 2021).

Figure 11. Site context map. Context map for the area surrounding the site. Modeled after Google Map.

3.4. The Specific Site

The site is currently owned by Free Grace United Church and is currently being used as a part of their parking lot, an addition made in 2013. Before that it sat empty after the building that had been there since at least 1991 was torn down in 2004. The address of the site is 829 School St. Elk River, MN 55330. The size of the site is 5.14 acres and roughly 224,054 square feet. The current zoning of the site is C2, which is the Office Zone and labeled as Multifamily for land use.

Figure 12. Picture of site in 1991. From Google Maps.

Figure 13. Picture of site in 2004. From Google Maps.

Figure 14. Picture of the site in 2023. From Google Maps.

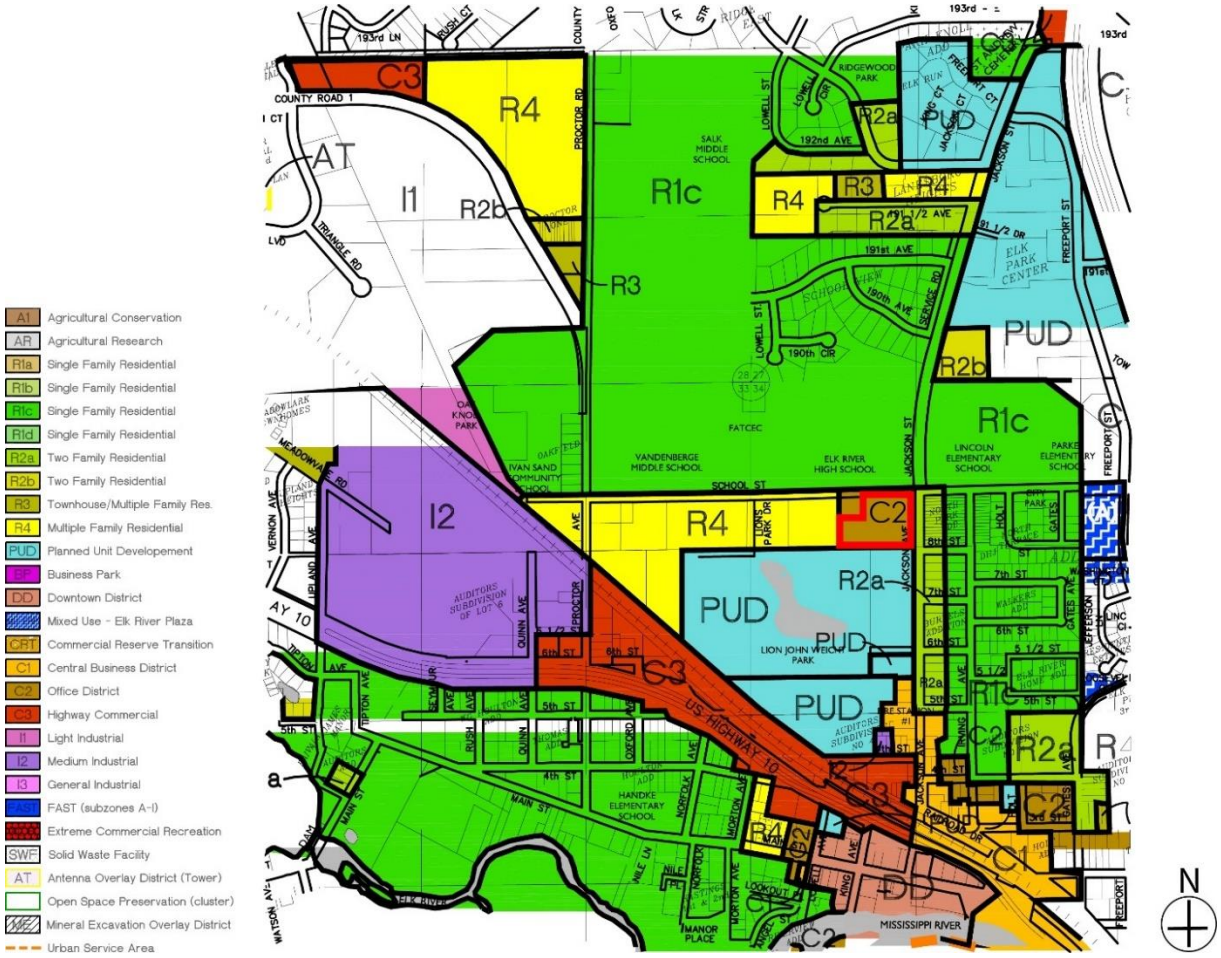

Figure 15. Zoning map. The site is in red and is in the C2, Office Zone (Elk River, Minnesota Gov., n.d.-b). *https://www.elkrivermn.gov/226/Maps*

Figure 16. Land use map. The site is in red and is labeled as multifamily (Elk River, Minnesota Gov., n.d.-b). https://www.elkrivermn.gov/226/Maps

According to the United States Census Bureau (2020) of the total population 7.5% are under the age of 5 and 25.6% are between the ages of 6 and 18, that makes a combined 33.1% of the population which is roughly 8,500 people that are in school or will be in the next few years (U.S. Census Bureau, n.d.). This is important to consider for this thesis, as the goal is to positively impact as many children as possible. The city's population is mostly white, see figure 11, and 50.3% are females and 49.7% are males (U.S. Census Bureau, n.d.). 93.8% of the population have a high school diploma or higher and 25.7% have a bachelor's degree or higher (U.S. Census Bureau, n.d.). For the employment of the people living in the city 70.7% are in the civilian labor force and the average time to travel to work is 28.3 minutes (U.S. Census Bureau, n.d.). The median household income for people living in Elk River, MN is $83,875 (U.S. Census Bureau, n.d.). The city does have 3.9% of people living in poverty and 5.9% of the city's population that are under the age of 65 and have a disability (U.S. Census Bureau, n.d.).

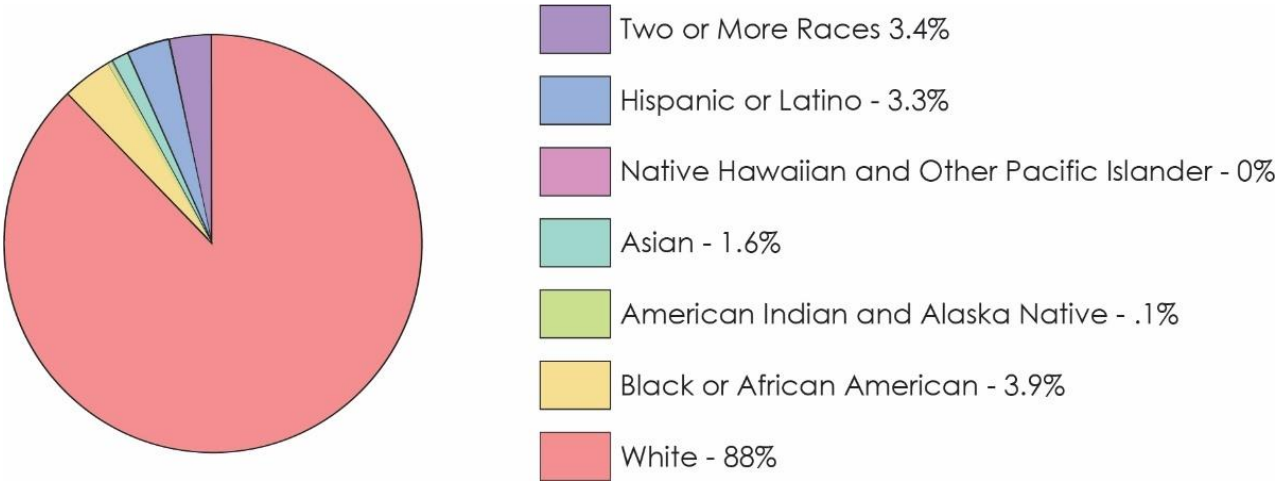

Figure 17. Race percentages. Pie chart showing the percentages of the different races that make up Elk River's population. (U.S. Census Bureau, n.d.).

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Part I												
Aggravated Assault	2	3	3	2	0	1	1					
Burglary	3	0	2	2	3	3	1					
Arson	0	0	0	2	2	0	0					
Criminal Sexual Misconduct	2	2	1	2	0	1	0					
Robbery	1	0	0	1	0	0	0					
Theft	17	16	15	14	15	14	12					
Vehicle Theft/Theft Related	7	10	7	5	10	10	9					
Total Part I	**32**	**31**	**28**	**28**	**30**	**29**	**23**					
Part II												
Other Assaults	12	22	4	8	9	10	6					
Forgery	0	0	1	4	1	3	2					
Fraud	11	7	5	20	15	18	15					
Vandalism	4	4	5	9	13	3	11					
Weapons	3	0	1	1	0	2	2					
Sex Offenses	2	5	3	2	6	1	2					
Narcotics	19	17	28	15	14	16	18					
DWI/Traffic	23	6	7	8	15	20	9					
Liquor Laws	2	1	1	2	3	3	0					
Disorderly	15	7	15	16	27	15	11					
Other	26	22	28	21	40	29	18					
Total Part II	**117**	**91**	**98**	**106**	**143**	**120**	**94**					

Figure 18. Crime statistics. Chart showing the number of different crimes that are committed each month in 2023 (Elk River, Minnesota Gov., n.d.-a).
https://www.elkrivermn.gov/1808/Crime-Statistics

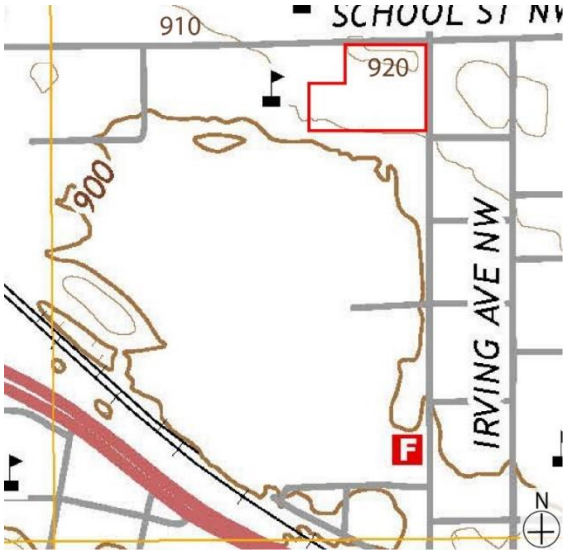

Figure 19. Contour map of site. The site is outlined in red (Anyplace America, n.d.).
https://www.anyplaceamerica.com/directory/mn/sherburne-county-27141/streams/elk-river-643267/

Figure 20. Soil types. Map of the site showing the different soil type areas (United States Department of Agriculture, n.d.). https://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx

Number on Map	Soil Type	Percent of surface on Site	Drainability	Susceptible to Ponding	Hydrological Soil Group	Ecological Site
260	Duelm Loamy Sand	17.60%	moderately well	no	A	loamy overflow
540	Seelyeville Muck	19.20%	very poor	yes - frequently	A/D	mucky swap
D67B	Hubbard Loamy Sand	63.20%	excessive drained	no	A	sandy prairie

Table 2. Soil types found on site and certain characteristics of each (United States Department of Agriculture, n.d.). https://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx

Figure 21. Existing vegetation. Map of the site showing the existing vegetation and lighting. Modeled after Google Maps

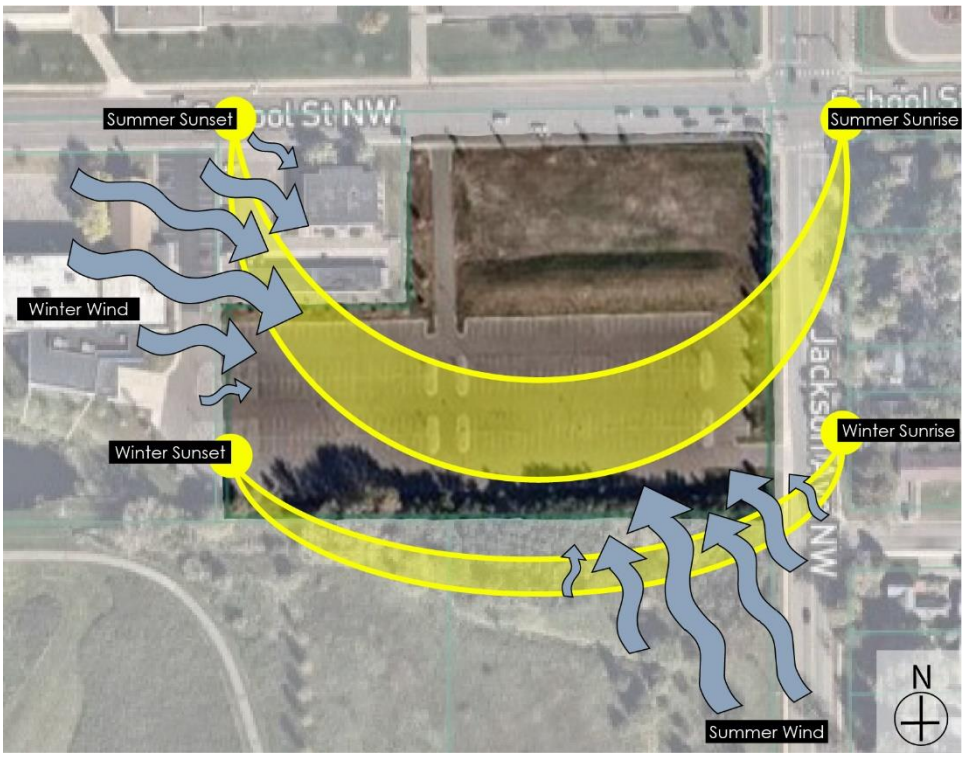

Figure 22. Sun and wind patterns. Map of the site showing the sun paths and wind directions depending on the time of year. Modeled after Google Maps

Figure 23. Circulation patterns. Map of site showing the existing entry points to the site and the roads that are next to the site. Modeled after Google Maps

Due to the site being across the street from four schools, School Street and Jackson Ave are typically the busiest Monday-Friday at 7-8:30 a.m., 1-4 p.m., and from 5-6 p.m. On Saturday traffic picks up around 11 a.m. and 1:30 p.m. and on Sunday there is traffic at 7 a.m. and 9:30 p.m. The fire and police department are 2.25 miles away from the site. The fire station is .25 miles away from the site. The HealthPartners Riverway Urgent Care and the HealthPartners Riverway Clinic are .64 miles away and the M Health Fairview Clinic is a mile away.

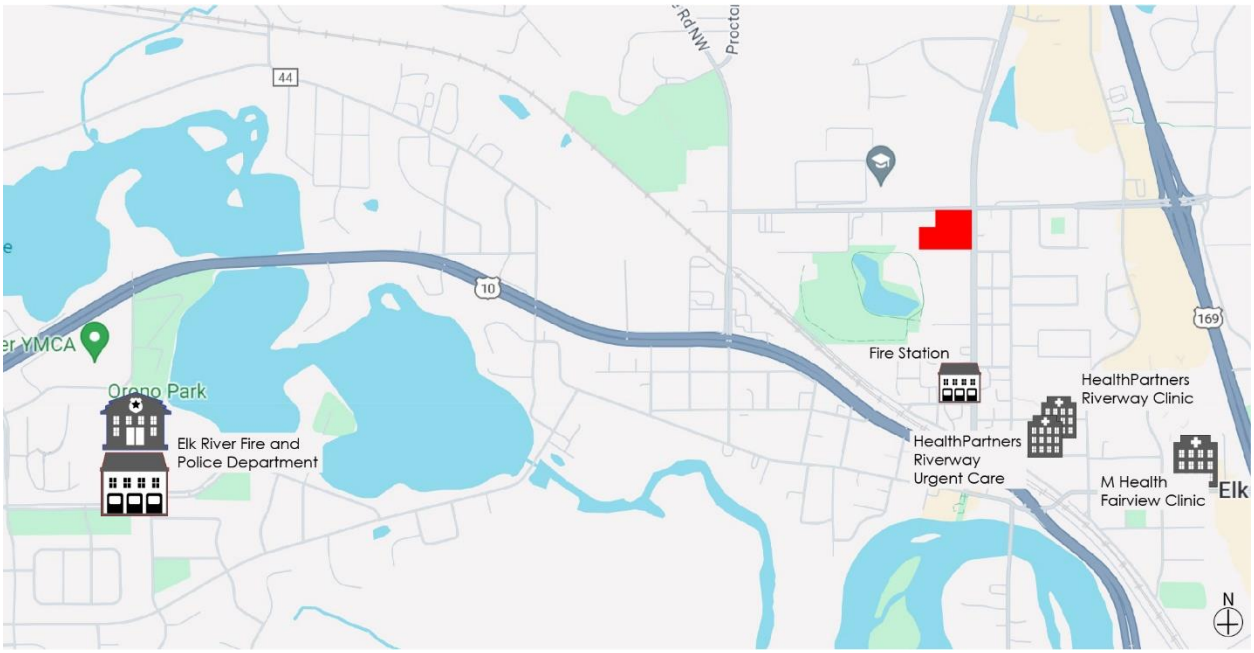

Figure 24. Safety map. Map showing the city's fire and police department and stations, along with the medical clinics in the city. The site is highlighted in red. Modeled after Google Maps

3.5. Precedents / Case Studies

The following sections examine seven case studies that relate to Elk River Community Corner. Chosen for the building's target audience and their use of biophilic design principles, basic criteria for each chosen case study can be found in the table below (Table 3). General information, like location, year built, architect, building area, target users, and included spaces are stated in the section about the project. The buildings sustainable aspects, for instance, energy

reduction and water mitigation, along with biophilic design elements, the use of water, vegetation, natural daylight, and/or natural materials that can be found in both the case studies and in Elk River Community Corner are going to be explained. Photographs and diagrams will also be shown to further illustrate and explain each project.

Project Name	Location	Year	Urban	Target Users	Same Climate	Square Footage	Number of Levels	LEED Certification	Other Cerification
Kakapo Creek Children's Garden	Auckland, New Zealand	2022	yes	Children	no	7,847 sq ft	1	no	no
Wonderforest Nature Preschool	Brooklyn, NY, USA	2022	yes	Children	*similar	3,600 sq ft	1	no	no
REACH Ashland Youth Center	San Leandro, CA, USA	2013	yes	Youth	*similar	31,500 sq ft	2	Platinum	no
Gary Comer Youth Center	Chicago, IL, USA	2006	yes	Youth	yes	75,000 sq ft	2	no	no
Lubber Run Community Center	Arlington, VA, USA	2020	no	All ages	*similar	50,000 sq ft	2	Platinum	Net Zero Energy
Carla Madison Recreation Center	Denver, CO, USA	2018	yes	All ages	*similar	65,400 sq ft	5	Gold	no
BASE Big Sky Community Center	Big Sky, MT, USA	2022	no	All ages	yes	28,00 sq ft	2	Gold	Net Zero, WELL Building Standard

Table 3. Case study criteria. The general criteria that were used when each case study was chosen. *Similar means that it snows there but the temperature does not get as low.

Project Name	Biophilic Design Principles Used														
			Vegetation		Water		Natural Materials								
	Natural Daylight	Natural Ventilation	Interior	Exterior	Interior	Exterior	Wood	Stone	Color	Views to Outside	Images	Green Roof	Solar Panels	Sustainable Transportation	Water Mitigation
Kakapo Creek Children's Garden	yes	yes	yes	yes	no	yes	yes	yes	no	yes	no	yes	no	no	yes
Wonderforest Nature Preschool	yes	no	yes	yes	yes	no	yes	no	no	yes	yes	no	no	yes	no
REACH Ashland Youth Center	yes	no	no	yes	no	no	yes	no	yes	yes	no	yes	yes	yes	yes
Gary Comer Youth Center	yes	no	no	yes	no	no	yes	no	yes	yes	no	yes	no	yes	yes
Lubber Run Community Center	yes	no	no	yes	no	yes	yes	yes	yes	yes	no	yes	no	no	yes
Carla Madison Recreation Center	yes	yes	no	yes	no	no	no	yes	no	yes	no	no	no	yes	yes
BASE Big Sky Community Center	yes	no	no	yes	no	no	yes	no	yes	yes	yes	yes	no	no	yes

Table 4. Biophilic Design Features. The biophilic design features that each case study has.

3.5.1. Kakapo Creek Childrens Garden

The Kakapo Creek Children's Garden is in the city of Auckland, New Zealand, it opened in 2022 and was designed by Smith Architects. The project is a 729 square meter early learning center that can be used to teach up to 100 children per day. The circular shape of the building comes from the goal to create a space based on Nga Hau E Wha, the four winds, and is representative of the coming together of all people from everywhere. This circular shape creates a central meeting space in the form of an interior courtyard. The curve of the building is a response to shape of the river that is on the North side of the site.

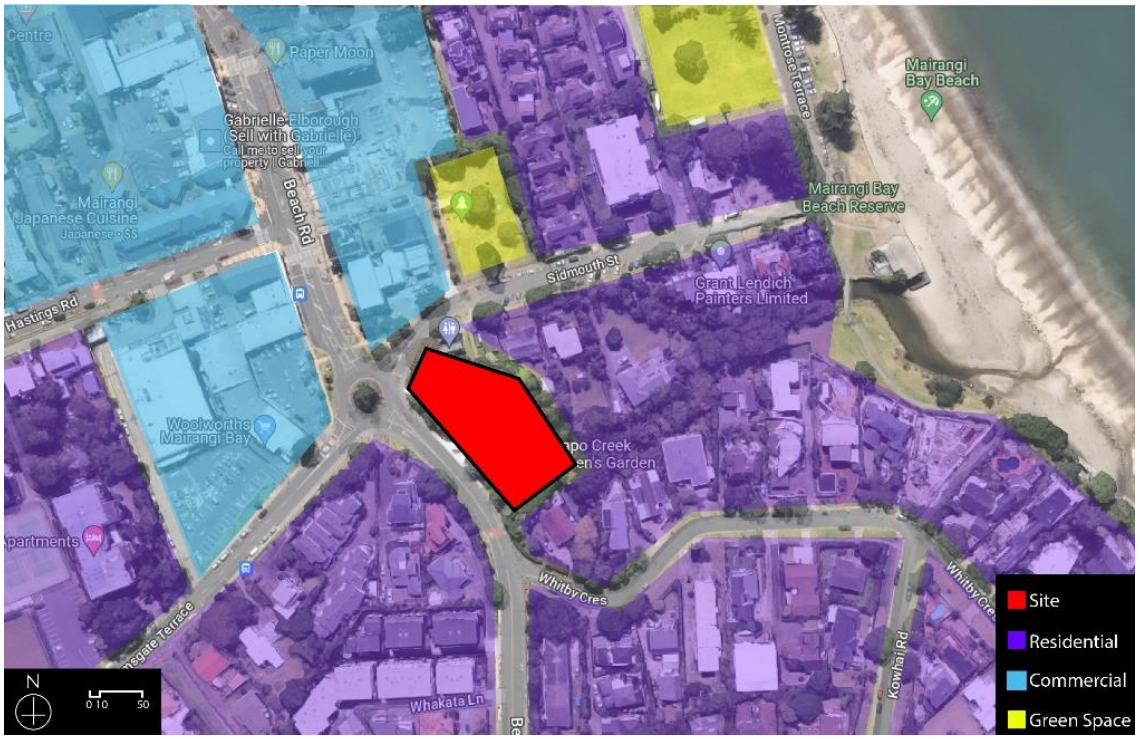

Figure 25. Context map 3.6.1. Context map of the area that surrounds Kakapo Creek Children's Garden designed by Smith Architects, 2022. Modeled after Google Maps

Figure 26. Site map 3.6.1. Site map of Kakapo Creek Children's Garden designed by Smith Architects, 2022. Modeled after Google Maps

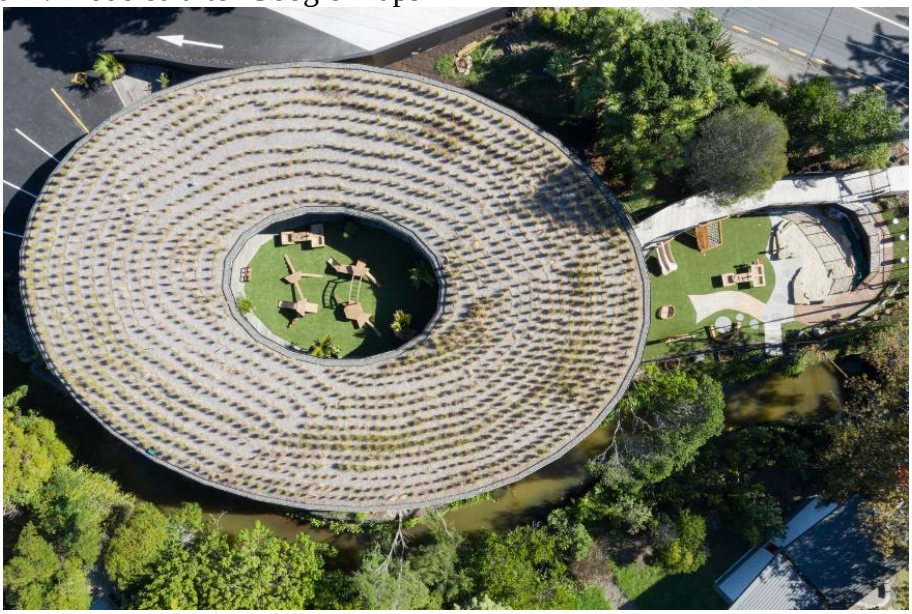

Figure 27. Overhead view of building and site. The river can be seen at bottom of photo. Project of Kakapo Creek Children's Garden designed by Smith Architects, 2022. (Scowen, 2022). https://www.markscowen.co.nz/kakapo-creek-childrens-garden

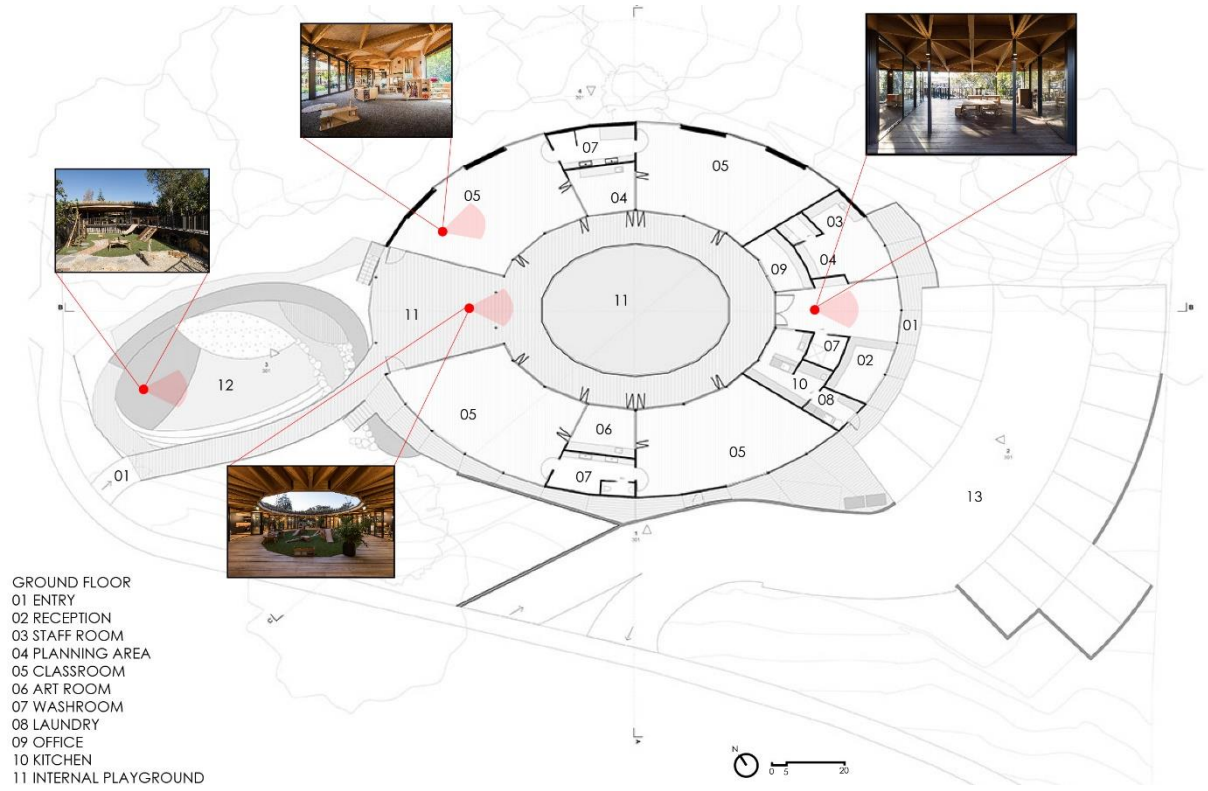

Figure 28. Main level floor plan of Kakapo Creek Children's Gardens, designed by Smith Architects in 2022. (Smith Architects, 2022). https://worldarchitecture.org/article-links/enhme/smith-architects-built-learning-centre-for-children-with-circular-shaped-green-roof-in-new-zealand.html

There are four main classrooms that all have floor-to-ceiling windows which allow for a connection to the interior courtyard and allow for natural ventilation to be used. These windows can let enough daylight into the building that artificial light is not needed during the day. Low-e glazing is used in the windows to help reduce the amount of heat loss that happens through windows. The insulation of the walls and roof also helps to minimize heat loss, the insulation thickness is way above the minimum requirement for LEED Certification. Light emitting diode (LED) low wattage and low carbon lights are used throughout the building. The heating and cooling systems use an electrical heat pump unit, which is cost-effective and uses a low amount of carbon to run. The main material used in this project is glulam timber for the roof canopy, materials from the existing house were recycled into the finishes that are used in the playground.

Figure 29. View of interior courtyard and playground in Smith Architect's 2022 Kakapo Creek Children's Garden. (Scowen, 2022). https://www.markscowen.co.nz/kakapo-creek-childrens-garden

Figure 30. Interior view of classroom in Smith Architect's 2022 Kakapo Creek Children's Garden. (Scowen, 2022). https://www.markscowen.co.nz/kakapo-creek-childrens-garden

Figure 31. View looking outwards from school. Smith Architect's 2022 Kakapo Creek Children's Garden. (Scowen, 2022). https://www.markscowen.co.nz/kakapo-creek-childrens-garden

Figure 32. View of playground made from the recycled materials. Smith Architect's 2022 Kakapo Creek Children's Garden. (Scowen, 2022). https://www.markscowen.co.nz/kakapo-creek-childrens-garden

This project has a green roof that reduces the amount of rainwater runoff by 50%. The green roof along with the landscaping around the building allows for enhanced biodiversity in native vegetation. The soil and gravel on the ground are used to filter the collected rainwater before it runs into the river.

Figure 33. Overhead view of green roof and interior courtyard. Smith Architect's 2022 Kakapo Creek Children's Garden. (Scowen, 2022). https://www.markscowen.co.nz/kakapo-creek-childrens-garden

Figure 34. Close up of the different levels that make up the green roof. Smith Architect's 2022 Kakapo Creek Children's Garden. (Scowen, 2022). https://www.markscowen.co.nz/kakapo-creek-childrens-garden

For the construction of this building only three small trees were removed, but many more were added back to the site after the project was built (Smith Architects, 2023).

This project was chosen as a case study because it brings sustainable practices into a building dedicated to children. It provides an example of how natural materials, natural ventilation, and daylight can be applied to a building that has a connection to nature that is located within an urban environment. Also, it offers a detailed example of a green roof that works to collect rainwater and to filter the water before it goes into the river. The natural materials and green roof elements were taken into consideration when designing Elk River Community Corner.

3.5.2. Wonderforest Nature Preschool

Wonderforest Nature preschool is housed in Brooklyn, New York and was opened in 2022. It was designed by Palette Architecture and is a 3,600 square foot school that promotes nature-based learning for the different age groups of two to four year olds. The children learn through interaction with water, plants, and dirt because these interactions represent playing in the park and being exposed to natural elements like water, vegetation, and earth. These elements of nature are displayed in the areas surrounding the layout of the preschool and are divided by levels of privacy. These public spaces and play areas allow circulation towards the front of the building and rear of the building encompasses the private spaces, classrooms, and restrooms.

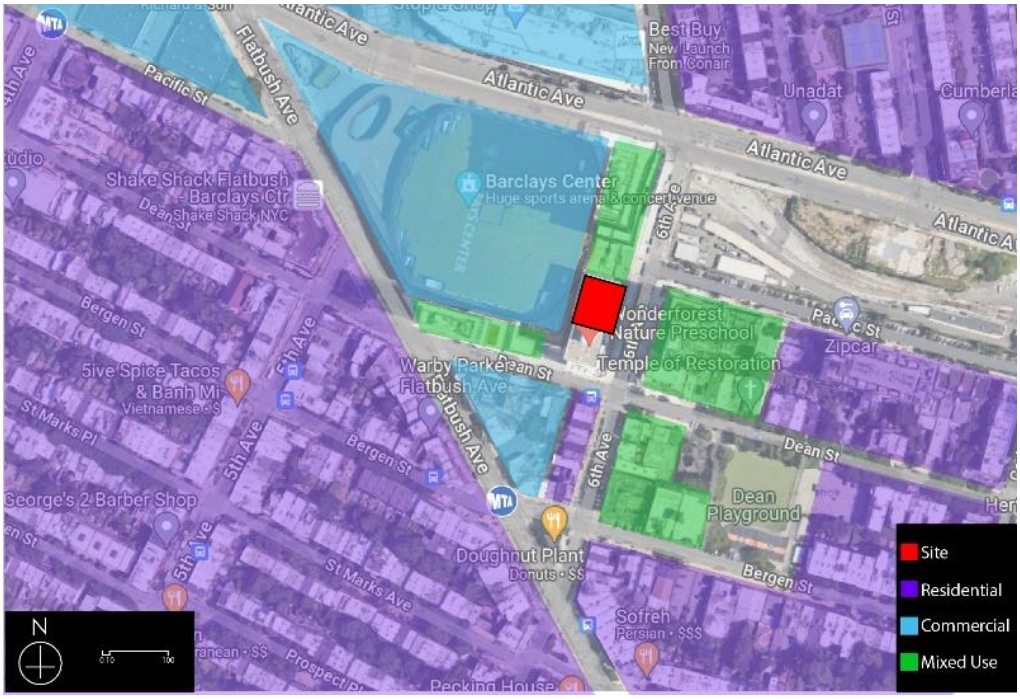

Figure 35. Context map 3.6.2. Context map of the area that surrounds Wonderforest Nature Preschool designed by Palette Architecture, 2022. Modeled after Google Maps

Figure 36. Site map 3.6.2. Site map of Wonderforest Nature Preschool designed by Palette Architecture, 2022. Modeled after Google Maps

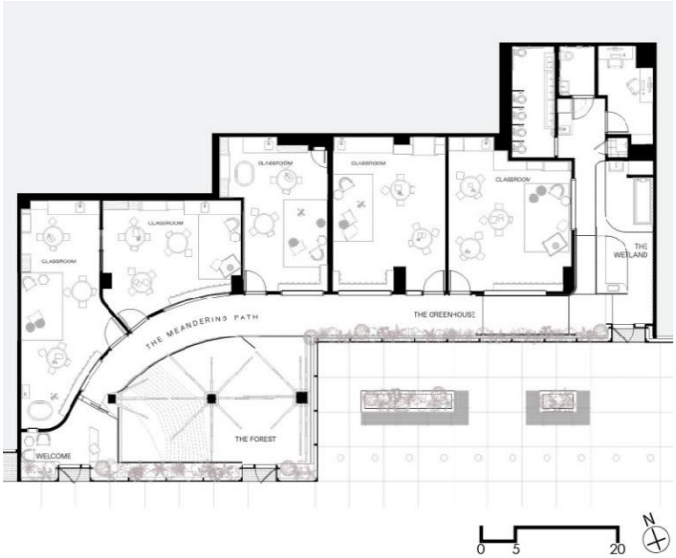

Figure 37. Floor plan of Wonderforest Nature Preschool. Palette Architecture, 2022. (Bendov, 2022). https://worldarchitecture.org/architecture-news/enmmv/palette-architecture-creates-abstracted-nature-for-preschool-in-brooklyn.html

Figure 38. Floor plan of preschool showing the location and angle each photo was taken from. Palette Architecture, 2022. (Bendov, 2022). https://worldarchitecture.org/architecture-news/enmmv/palette-architecture-creates-abstracted-nature-for-preschool-in-brooklyn.html

'Nature' influenced the names of the spaces in the preschool by identifying different places found in 'nature' and by having elements of those places in the related spaces. For example, 'the greenhouse' is populated with plants in order for the kids to form a relationship with and learn how to care for them. In the space called 'the wetland' kids learn through tactile play and sensory experimentation with a water table and mud kitchen.

Figure 39. Mud kitchen and water table in the 'wetland' area in Wonderforest Nature Preschool. Palette Architecture, 2022. (Bendov, 2022). https://www.pavelbendov.com/portfolio/commercial-interiors

Figure 40. Classroom with a view of 'nature' through the windows in Wonderforest Nature Preschool. Palette Architecture, 2022. (Bendov, 2022). https://www.pavelbendov.com/portfolio/commercial-interiors

Figure 41. Exterior view of the Wonderforest Nature Preschool. Palette Architecture, 2022. (Bendov, 2022). https://www.pavelbendov.com/portfolio/commercial-interiors

The street side of the building is a wall of windows and allows for daylight to enter the school. The acoustic interior windows let the daylight from the Southeast to reach into the classrooms. The interior windows are high enough to let the teachers see out but not the kids, it was designed this way to try and keep the kids from getting distracted. LED lights are used in the school to help save energy. This project used recycled material to create the artificial grass that is found in the play area, providing an example of how recycled materials can be incorporated into a project. The wood that is used throughout the building is from sustainable lumber. Biophilic

design features that are found in this project are reflected in color palettes and textures that can be found in ‘nature’. The color palettes of green and brown were used along with artificial grass to simulate real grass, and wood was used to represent trees (Palette Architecture, 2022; World Architecture Community, n.d.).

Figure 42. View of the interior play area in Wonderforest Nature Preschool. Palette Architecture, 2022. (Bendov, 2022). https://www.pavelbendov.com/portfolio/commercial-interiors

Figure 43. View of interior play area in Wonderforest Nature Preschool. Palette Architecture, 2022. (Bendov, 2022). https://www.pavelbendov.com/portfolio/commercial-interiors

This project is important because the design intent is to support children to connect and interact with ‘nature’. It incorporates biophilic design features as well as sustainable design practices to create a place that benefits both the natural environment and people. The *ways* in which they allow kids to explore natural elements, like the mud kitchen and water table, are inspiration for Elk River Community Corner.

3.5.3. REACH Ashland Youth Center

In 2013 the REACH Ashland Youth Center opened in San Leandro, California. Designed by RDC Architecture Inc. This 31,500 square foot building achieved LEED Platinum certification. The goal of the project was to empower the community's youth, between the ages 11 to 24. The program of the Ashland Youth Center focused on recreation, education, art, careers, and health (REACH) and by doing so creating a place where youths can thrive, build resilience, and become leaders. The building itself promotes transparency, openness, social connectivity, and flexibility. It provides opportunities for social connectivity by offering activities and spaces for youth to interact with each other.

Figure 44. Context map 3.6.3. Context map of the area that surrounds REACH Ashland Youth Center designed by RDC Architecture Inc. in 2013. Modeled after Google Maps

Figure 45. Site map 3.6.3. Site map of REACH Ashland Youth Center designed by RDC Architecture Inc. in 2013. Modeled after Google Maps

Figure 46. Site plan of REACH Ashland Youth Center designed by RDC Architecture Inc. (Architizer, 2013). https://architizer.com/projects/reach-ashland-youth-center/

Figure 47. Exterior view of the building. Roof showing the solar panels on REACH Ashland Youth Center designed by RDC Architecture Inc. (Architizer, 2013). https://architizer.com/projects/reach-ashland-youth-center/

Figure 48. view of the surrounding context of the site. A middle school is located in the upper left of the photo. REACH Ashland Youth Center designed by RDC Architecture Inc. (RDC, 2013). *https://www.rdcarchitecture.com/community*

Additional building programs are included such as a full medical and dental clinic, library, public café, media production, classrooms, computer lab, visual arts room, game room, career center, a courtyard, dance, and fitness rooms. More spaces that are incorporated in the building are no-cost recreation, like the skate park and playground, food distribution services, and no-cost childcare, along with behavioral health counseling.

Figure 49. View of front of the building and the skate park at REACH Ashland Youth Center designed by RDC Architecture Inc. (Architizer, 2013). https://architizer.com/projects/reach-ashland-youth-center/

Figure 50. Interior view of a commons space in the REACH Ashland Youth Center designed by RDC Architecture Inc. (RDC, 2013). https://www.rdcarchitecture.com/community

This building focuses a lot on sustainable practices. For example, the use of solar panels as a renewable energy source saves the youth center $22,000 per year which equates to 136,000 kWh per year. Saving water was another focus as the architects applied bay-friendly landscaping, high efficiency irrigation and low-flow plumbing. This allowed them to reduce the amount of water used outside of the building by 50% and water used inside the building by 30%. For this reason, the building's performance rating falls below California's strict energy standard by 42%. Another consideration was providing ways of transportation that help reduce the amount of carbon being released into the air, these include four bus lines for public transit and bike parking. Also, 75% of the construction waste was recycled. The project also used 20% of recycled materials and 10% of all materials were sourced locally. A high quality indoor environment is also achieved by using interior building materials and finishes that are low in volatile organic compounds (VOCs) and other interior pollutants. The material that is used for the roof is a white reflective color to help reduce the urban heat island effect and energy that is absorbed into the building through the roof. The roof works to manage and collect stormwater and planter boxes also work to collect and filter stormwater elsewhere on the site (Alameda County - Gov, n.d.; Architizer, 2022; REACH Ashland, n.d.).

The impact this youth center has on its' community and how it uses sustainable design features are the reason that this project was chosen to be an example. Elk River Community Corner used the programs and spaces that are provided in this project as an example of what spaces are important to include when designing a community youth center. The ways this project saves water and promotes environmentally friendly modes of transportation is an example for Elk River Community Corner.

3.5.4. Gary Comer Youth Center

The Gary Comer Youth Center is located on the south side of Chicago, Illinois. It opened in 2006, this 75,000 square foot building was designed by John Ronan Architects and Hoerr Schaudt Landscape Architects.

Figure 51. Context map 3.6.4. Context map of the area that surrounds the Gary Comer Youth Center designed by John Ronan Architects in 2006. Modeled after Google Maps

Figure 52. Site map 3.6.4. Site map of Gary Comer Youth Center designed by John Ronan Architects in 2006. Modeled after Google Maps

Figure 53. Exterior view of Gary Comer Youth Center designed by John Ronan Architects in 2006. (Hall and Blessin, 2006). https://www.archdaily.com/189411/the-gary-comer-youth-center-john-ronan-architects

The goal of this project is to provide a constructive environment for youths to go to after school is over for the day. To create a constructive environment for the students the architect included spaces such as classrooms, a cafeteria, library, a flex space that can be used as a gym, practice spaces, and a performance hall. The building is home to the South Sore Drill Team and Performing Arts Ensemble, it also houses a variety of different youth educational and recreational programs.

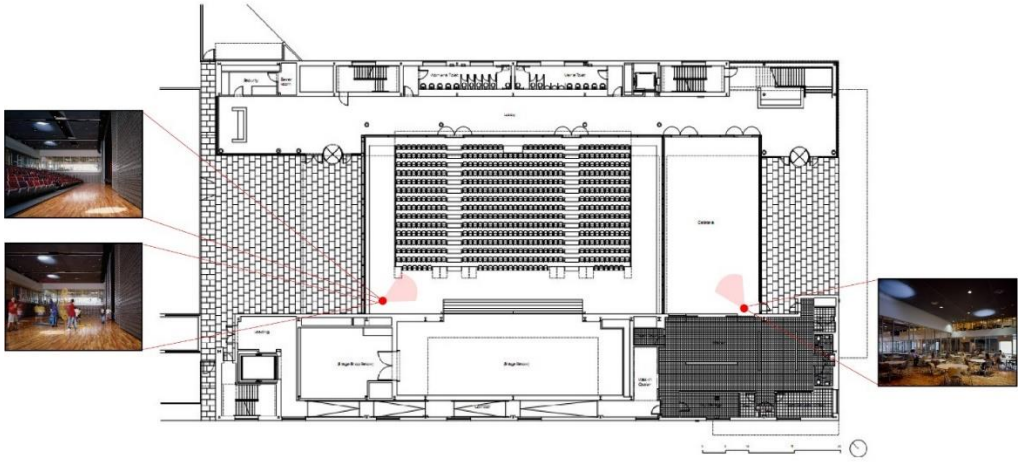

Figure 54. Level floor plan of Gary Comer Youth Center designed by John Ronan Architects in 2006. (Hall and Blessin, 2006). https://www.archdaily.com/189411/the-gary-comer-youth-center-john-ronan-architects

Figure 55. Flex space functioning as the performance hall. Gary Comer Youth Center designed by John Ronan Architects in 2006. (Hall and Blessin, 2006). https://www.archdaily.com/189411/the-gary-comer-youth-center-john-ronan-architects

Figure 56. Flex space functioning as the gym. Gary Comer Youth Center designed by John Ronan Architects in 2006. (Hall and Blessin, 2006). https://www.archdaily.com/189411/the-gary-comer-youth-center-john-ronan-architects

Figure 57. The cafeteria in the Gary Comer Youth Center designed by John Ronan Architects in 2006. (Hall and Blessin, 2006). https://www.archdaily.com/189411/the-gary-comer-youth-center-john-ronan-architects

Figure 58. An interior view of a space that has pool tables and colorful furniture. Gary Comer Youth Center designed by John Ronan Architects in 2006. (Hall and Blessin, 2006). https://www.archdaily.com/189411/the-gary-comer-youth-center-john-ronan-architects

Figure 59. A mixed-use space that is being used as a dance studio. Gary Comer Youth Center designed by John Ronan Architects in 2006. (Hall and Blessin, 2006). https://www.archdaily.com/189411/the-gary-comer-youth-center-john-ronan-architects

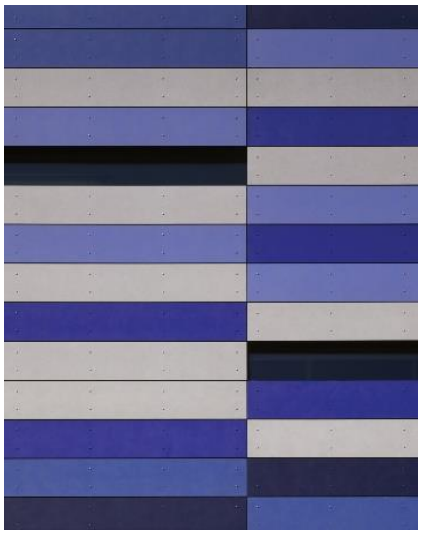

Figure 60. Close up of the colorful concrete panels that are used on the exterior of the building. Gary Comer Youth Center designed by John Ronan Architects in 2006. (Hall and Blessin, 2006). https://www.archdaily.com/189411/the-gary-comer-youth-center-john-ronan-architects

Color is an important part of the design and can be seen in the brightly colored concrete panels that wrap around the exterior of the building and are carried through into the interior spaces. The upper level of this building is a significant area of this project as the building creates

an interior courtyard that doubles as a green roof. The walls that face the green roof are glass and allow natural daylight into the building and provide views that connect people with nature.

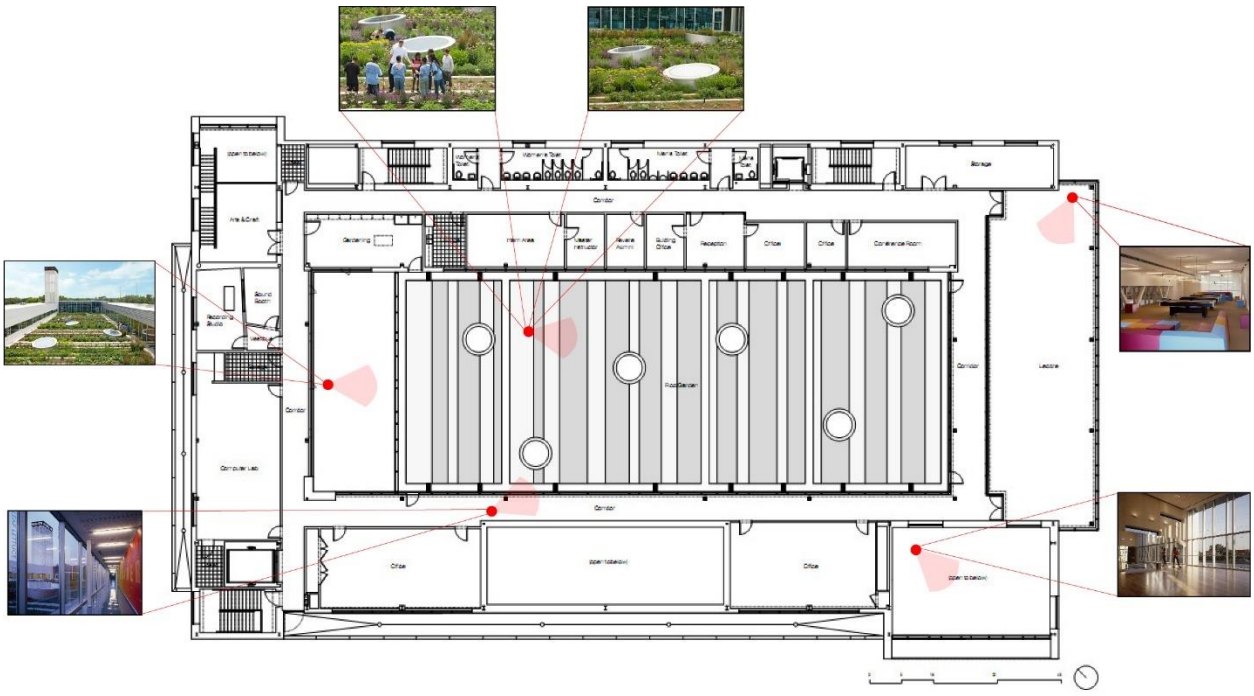

Figure 61. Floor plan of upper level and roof. Gary Comer Youth Center designed by John Ronan Architects in 2006. (Hall and Blessin, 2006). https://www.archdaily.com/189411/the-gary-comer-youth-center-john-ronan-architects

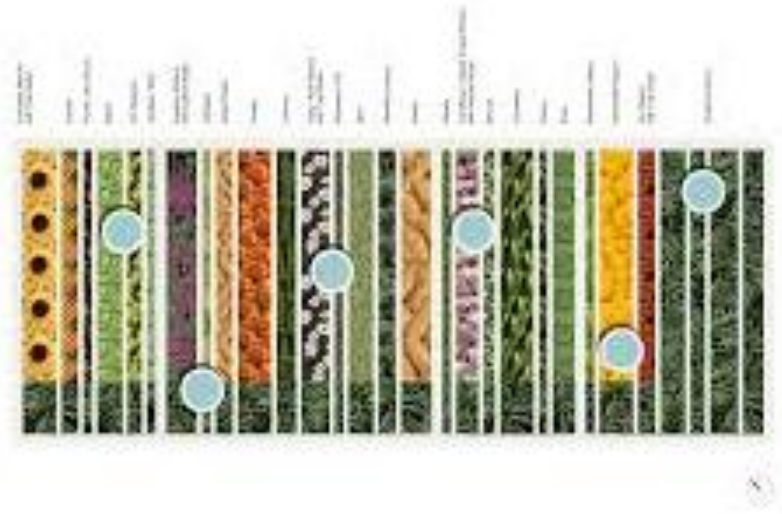

Figure 62. A diagram showing the location of the different flowers, fruits, and vegetables. As highlights the skylights location. Gary Comer Youth Center designed by John Ronan Architects in 2006. (HoerrSchaudt, 2006). https://hoerrschaudt.com/project/gary-comer-youth-center/

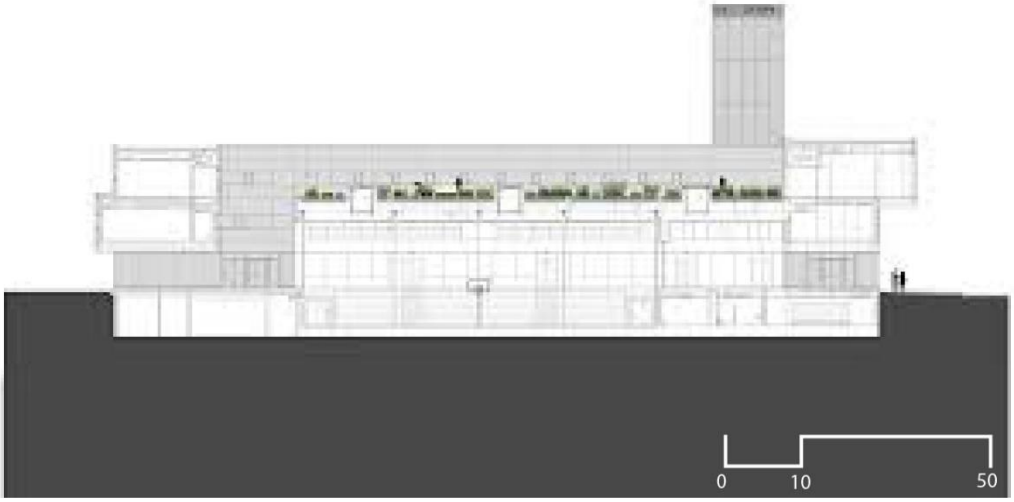

Figure 63. Northwest – Southeast section cut of the building showing spaces below and around the green roof. Gary Comer Youth Center designed by John Ronan Architects in 2006. (HoerrSchaudt, 2006). https://hoerrschaudt.com/project/gary-comer-youth-center/

Figure 64. View of the green roof, skylights, and the walls of glass that connect the roof with the rest of building. Gary Comer Youth Center designed by John Ronan Architects in 2006. (HoerrSchaudt, 2006). https://hoerrschaudt.com/project/gary-comer-youth-center/

Figure 65. View of youth learning about the food that they are growing. The skylights can also be seen in the background. Gary Comer Youth Center designed by John Ronan Architects in 2006. (HoerrSchaudt, 2006). https://hoerrschaudt.com/project/gary-comer-youth-center/

Figure 66. View of skylights on the green roof. Gary Comer Youth Center was designed by John Ronan Architects in 2006. (HoerrSchaudt, 2006). https://hoerrschaudt.com/project/gary-comer-youth-center/

Figure 67. View from a hallway inside of the building looking out on the roof. Gary Comer Youth Center was designed by John Ronan Architects in 2006. (Hall and Blessin, 2006). https://www.archdaily.com/189411/the-gary-comer-youth-center-john-ronan-architects

There are circular skylights that allow light to enter the levels below. The green roof is accessible to the users of the youth center and functions as an outdoor classroom for students to learn how to grow healthy fruits and vegetables. The 8,160 square foot and 18- to 24-inch-deep educational garden produces 1,000 pounds of fruit and vegetables a year. The fruit and vegetables that are produced go to the café in the youth center that serves 175 youth or they get sold to local restaurants. Other benefits of this green roof are the positive environmental impact it has by helping to mitigate stormwater, lowering the urban heat island effect, and reducing energy costs. Recycled milk cartons were used for the planter frames and recycled-tire pavers as paths (LA website). The shape of the building allows the roof area to be kept warmer in the winter and allows it to keep producing fruits and vegetables year-round.

The green roof is the main aspect of this project that is referenced in Elk River Community Corner, as it provides benefits for both people and the natural environment. This projects' target audience being youth is important for Elk River Community Corner because it focuses on the youth more so than the community in general, so the spaces that are in a youth center can vary from those in the community center (ArchDaily, 2011; ASLA, n.d.; JR Architects, n.d.).

3.5.5. Lubber Run Community Center

Located in Arlington, Virginia VMDO Architects designed Lubber Run Community Center. The 50,000 square foot, net zero energy, and LEED Platinum building opened to the public in the fall of 2020.

Figure 68. Context map 3.6.5. Context map of the area that surrounds the Lubber Run Community Center designed by VMDO Architects in 2020. https://www.vmdo.com/lubber-run-community-center.html Modeled after Google Maps

Figure 69. Site map 3.6.5. Site plan of Context map of the area that surrounds the Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

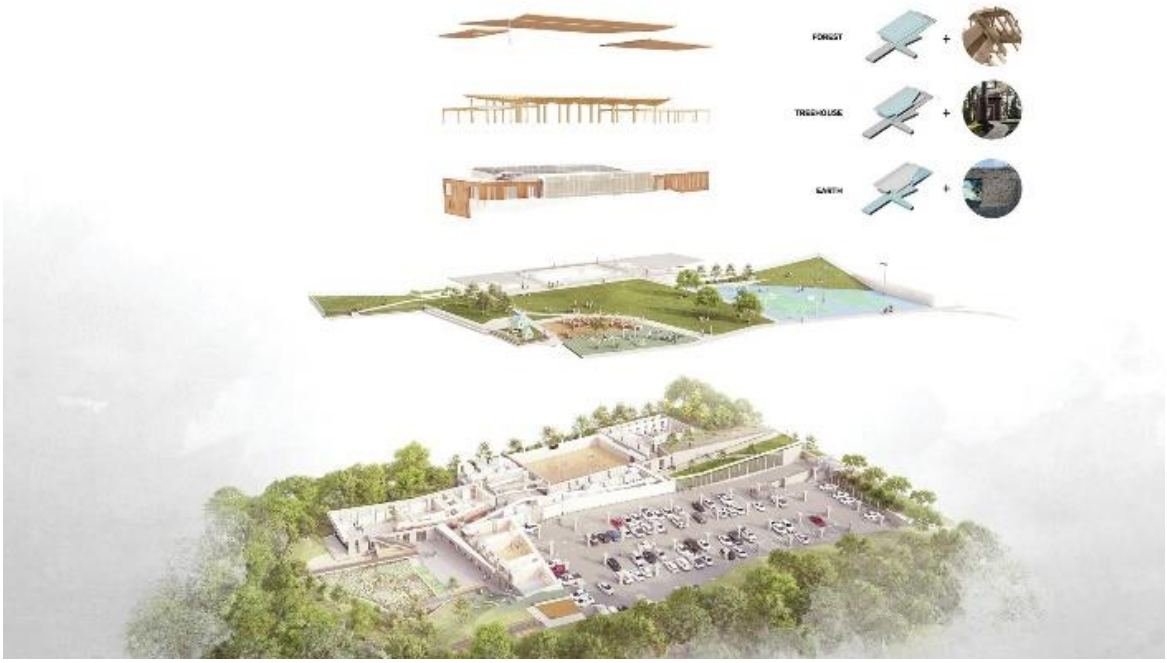

Figure 70. Diagram showing the different layers of the Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

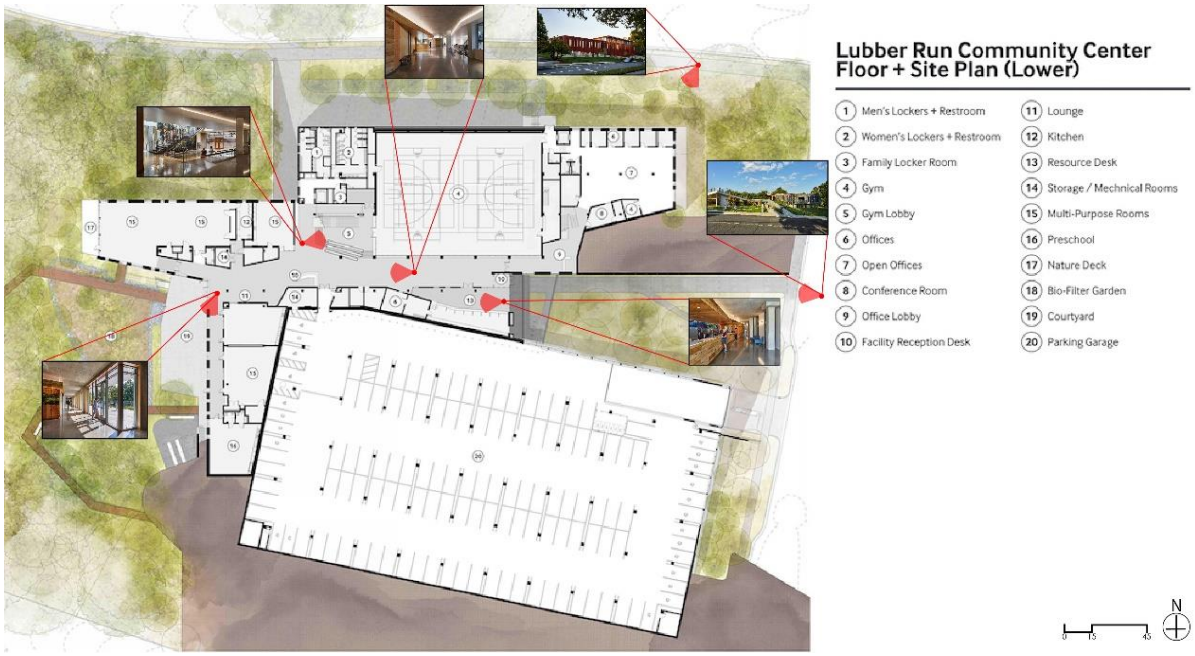

Figure 71. The lower level floor plan of the Lubber Run Community Center. (VMDO Architects, 2020). https://www.bdcnetwork.com/net-zero-energy-design-enhances-multidimensional-community-center

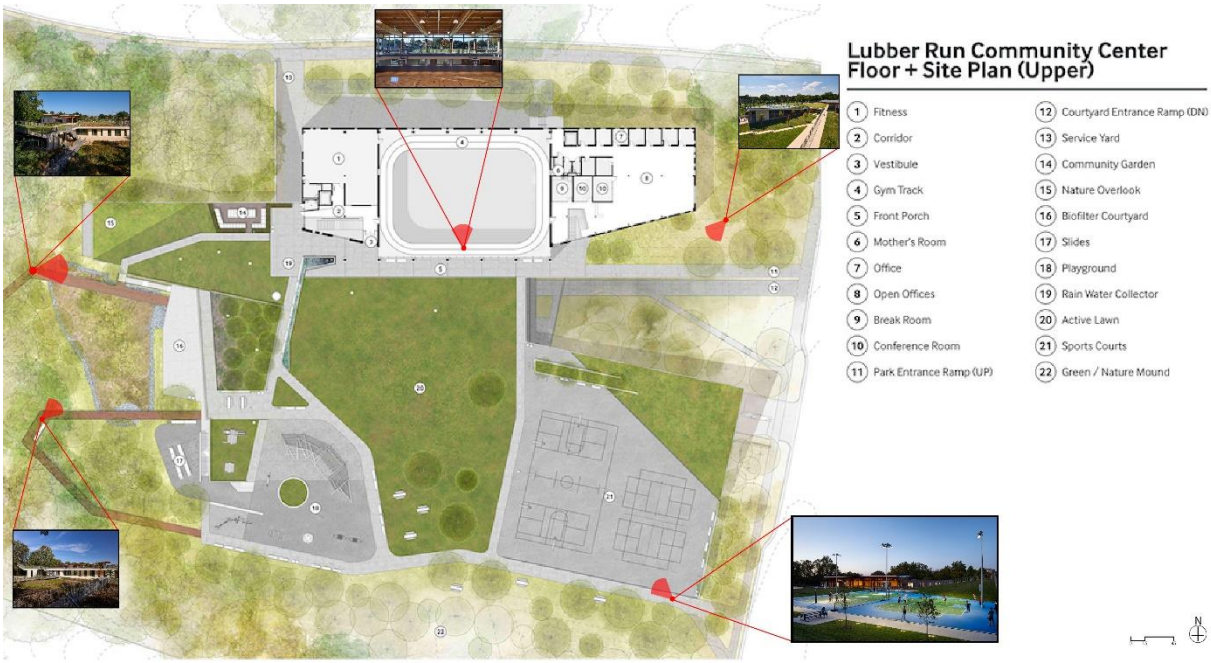

Figure 72. The upper level floor plan of the Lubber Run Community Center. (VMDO Architects, 2020). https://www.bdcnetwork.com/net-zero-energy-design-enhances-multidimensional-community-center

Forming a connection to ‘nature’ and keeping the space open are the main design of this project. The spaces that are included in the Lubber Run Community Center are basketball courts, multipurpose rooms, meeting rooms, a fitness center, gymnasium, kitchen, a playground, and offices for the parks and recreation department. Parking for this building is underground. The roof becomes part of the green space, which offers a dynamic connection to the outdoors. That dynamic connection is created by the ground and the parking area roof seamlessly blending into one another, which allows for people to use the green space that is above the parking area.

Figure 73. View of the exterior Northwest corner of the building. Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

Figure 74. Exterior view of the building showing the ground and green roof connection. Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

Figure 75. Street View of the East side of the Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

Figure 76. Exterior view of the East side entry and the green roof. Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

Figure 77. Exterior view of the Lubber Run Community Center from the street to the North. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

Figure 78. Interior view of the gymnasium looking outside to 'nature'. Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

Figure 79. The sports courts at Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

Figure 80. Interior view showing natural material choices. Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

Figure 81. Interior View of stairwell and seating area outside of the gymnasium. Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

Figure 82. Interior view of the front desk and the natural materials that are used. Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

Figure 83. Interior view showing the wall of floor to ceiling windows and the connection to the 'nature' outside it provides. Lubber Run Community Center. (VMDO Architects, 2020). https://www.vmdo.com/lubber-run-community-center.html

The roof of this project is another important design feature, the butterfly shape allows for water to be moved across the site to a water collection system that is used for the irrigation of the green roof. There are also bio-filtration basins across the site that filter the water before it goes into the Lubber Run River and the basins act as water features, too. The sustainable design elements are what allowed the building to be net zero and achieve a LEED Platinum certification, for example the layout, massing, and systems were chosen to minimize the amount of energy that is needed to power the building. Because of the maximized energy efficient design, the number of solar panels that are on site are able to be minimized. For the building's heating and cooling needs it uses a geothermal energy system and has a dedicated outdoor air system with heat recovery. All these design choices supply 100% of the building's energy needs (AIA, n.d.; VMDO Architects, n.d.).

This project is a good example of a building that maximizes energy efficiency and creates a connection to nature, both aspects that can be found in Elk River Community Corner. It also provides different spaces that are included in a community center and are referenced when it came to deciding what spaces went into Elk River Community Corner. The connection between the building and ground is interesting and a design feature that would be cool to incorporate into Elk River Community Corner. This community center is referenced for how it uses natural materials and modern materials together to create a building that has a 'nature' feel to it.

3.5.6. Carla Madison Recreation Center

In 2018 the Carla Madison Recreation Center was opened in Denver, Colorado. The team for this project was made up of BRS Architecture, the landscape architecture firm Studio CPG, and the interior designers from Gallun Snow. The 65,400 square foot LEED Gold certified building is on a three-acre previous brownfield site, meaning that it was previously underutilized

or abandoned due to industrial use pollution. The location of the site allows for easy arrival for people on foot, by bike, and by public transportation and is across the street from a high school.

Figure 84. Context map 3.6.6. Context map of the area that surrounds the Carla Madison Recreation Center designed by BRS Architects in 2018. Modeled after Google Maps

Figure 85. Site map 3.6.6. Site plan of Carla Madison Recreation Center. BRS Architects, 2018. (Studio CPG, 2015). https://studiocpg.com/projects/facilities-and-infrastructure/carla-madison-recreation-center/

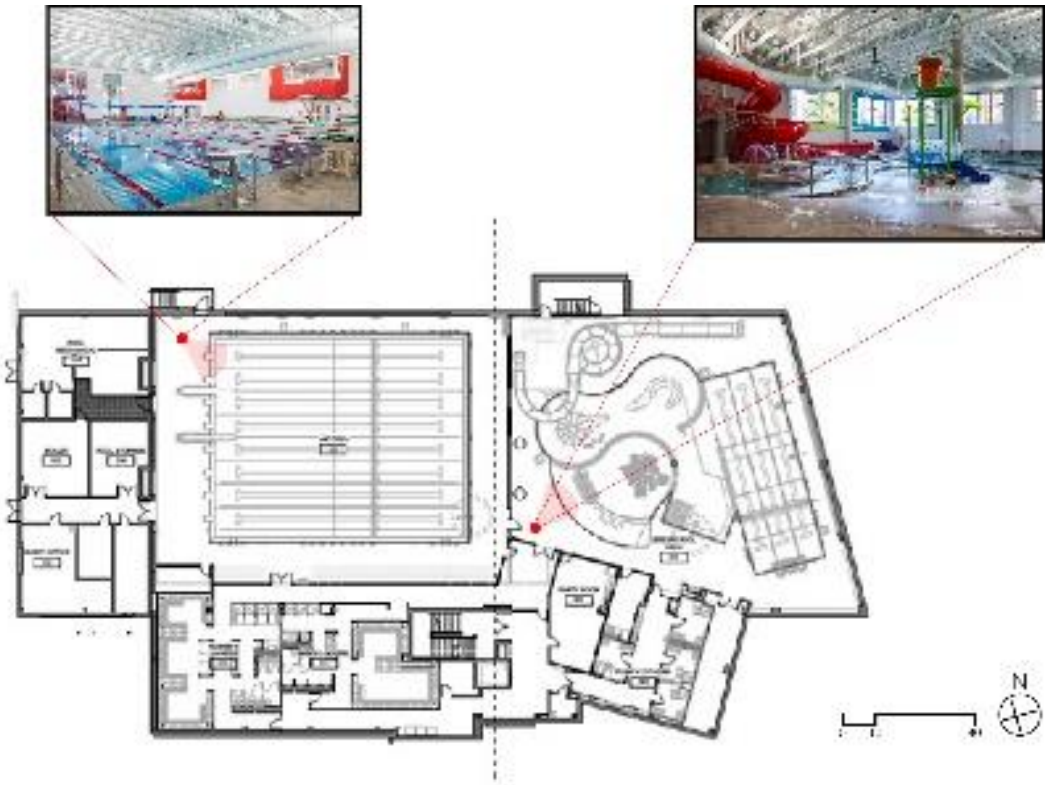

Figure 86. First level floor plan of Carla Madison Recreation Center designed by BRS Architects in 2018. (Denver Parks and Recreation, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

Figure 87. Second level floor plan of Carla Madison Recreation Center designed by BRS Architects in 2018. (Denver Parks and Recreation, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

Figure 88. Third level floor plan of Carla Madison Recreation Center designed by BRS Architects in 2018. (Denver Parks and Recreation, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

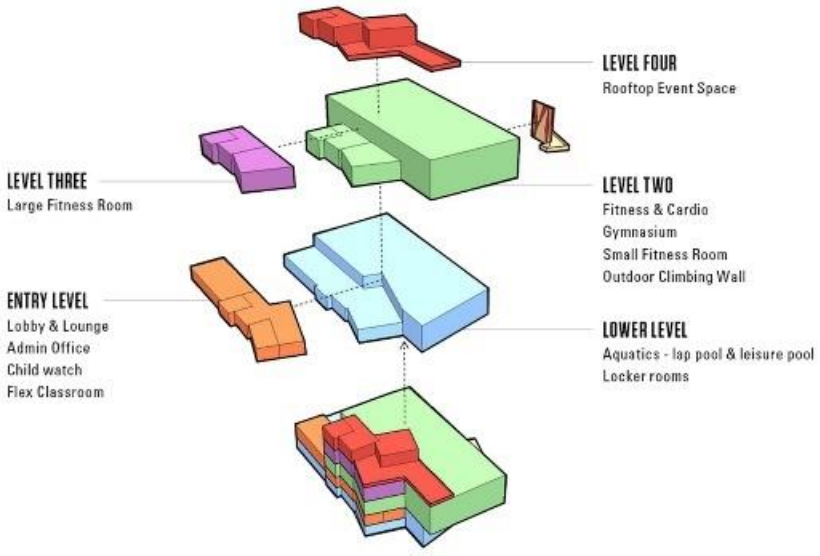

Figure 89. Exploded diagram showing the different spaces within the Carla Madison Recreation Center designed by BRS Architects in 2018. (BRS Architects, 2018). https://brsarch.com/carla-madison-recreation-center/

Figure 90. Exterior view of the Carla Madison Recreation Center designed by BRS Architects in 2018. (Spahn, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

The five-level recreation center is designed to respect and connect people to the historical landmarks in the area, like the Bosworth House and the Molly Brown House Museum. Called the 'health hub of activity' it allows for the much-needed recreation spaces for the people in the surrounding area, and being in Colorado it allows for activities all year round. It is a new venue for community gatherings and provides a rooftop event space. Also, it includes space for classrooms, childcare, a lifestyle pool, an eight-lane lap pool, a gymnasium, and both small and large fitness areas of which the small fitness area has garage doors that can open.

Figure 91. View of the rooftop event space. Carla Madison Recreation Center designed by BRS Architects in 2018. (Spahn, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

Figure 92. View from inside looking out of the rooftop event space. Carla Madison Recreation Center designed by BRS Architects in 2018. (Spahn, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

Figure 93. Childcare room in the Carla Madison Recreation Center designed by BRS Architects in 2018. (Spahn, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

Figure 94. Lap pool in the Carla Madison Recreation Center designed by BRS Architects in 2018. (Spahn, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

Figure 95. Leisure pool in the Carla Madison Recreation Center designed by BRS Architects in 2018. (Spahn, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

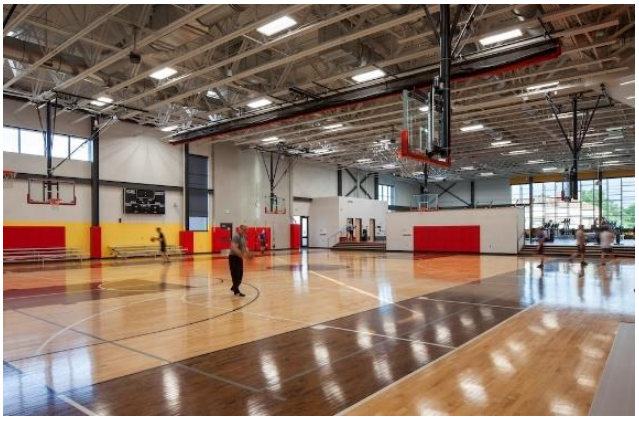

Figure 96. Gymnasium view. Carla Madison Recreation Center designed by BRS Architects in 2018. (Spahn, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

Figure 97. Main fitness area within the Carla Madison Recreation Center designed by BRS Architects in 2018. (Spahn, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

Figure 98. View of the small fitness room in the Carla Madison Recreation Center designed by BRS Architects in 2018. (Spahn, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

Figure 99. View from in the small fitness room with the operable garage door open. Carla Madison Recreation Center designed by BRS Architects in 2018. (BRS Architects, 2018). https://brsarch.com/carla-madison-recreation-center/

Figure 100. View showing both outdoor climbing walls. Carla Madison Recreation Center designed by BRS Architecture in 2018. (Spahn, 2018). https://pkelectrical.com/portfolio_post/carla-madison-central-denver-rec-center-denver-colorado/

Figure 101. People and their dogs in the shade of the dog park at the Carla Madison Recreation Center designed by BRS Architecture in 2018. (BRS Architecture, 2018). https://brsarch.com/carla-madison-recreation-center/

The recreation center also has many outdoor amenities like an outdoor climbing wall and a dog park. To achieve LEED Gold certification, they implemented multiple different sustainable features, for instance rain gardens that filter the water runoff from the building and site. They use natural daylight and energy efficient lighting in the project and use materials that are low in emitting VOCs. An advanced pool filtration system is used in the pools to help lower energy usage along with high-performing heating and cooling systems. The building was designed to use a quarter of the energy and half the water for an average building of that same size. The project saves about 32.2% in energy costs, has saved 40% above the LEED baseline amount of yearly indoor water use, and has reduced the yearly outdoor water use by 58% (BRS Architecture, n.d.-b; Group 14 Engineering, n.d.).

This project provides an example of a recreational center that is sustainable and is also in a climate that goes from hot to cold depending on the season, similar the climate of Elk River Community Corner. The Carla Madison Recreation Center is also referenced in Elk River Community Corner because of the wide variety of spaces they have. The fitness rooms that have an operable garage door is another feature that is brought into Elk River Community Corner.

3.5.7. Big Sky Community Center - BASE

BRS Architecture and A&E Design are the firms that designed the Big Sky Community Center. Located in Big Sky, Montana the community center also known as BASE, which stands for Big Adventure Safe Environment (BASE). The goal is to allow people to experience being in the mountains and provide multigenerational programs that encourage the well-being of all ages.

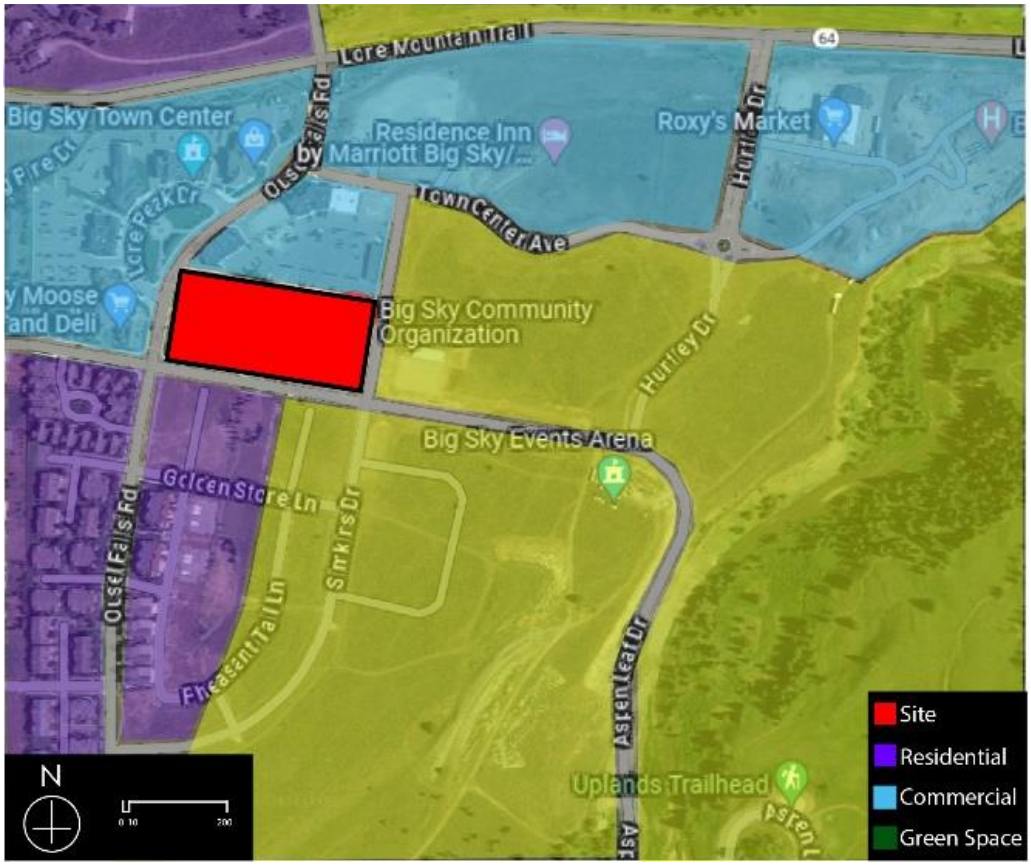

Figure 102. Context map 3.6.7. Context map of the area that surrounds the Big Sky Community Center designed by BRS Architects in 2022. Modeled after Google Maps

Figure 103. Exterior view of the main entrance of BASE designed by BRS Architects in 2022. (BRS Architects, 2022). https://brsarch.com/big-sky-recreation-center-base/

Figure 104. Site map 3.6.7. Site plan of BASE designed by BRS Architects in 2022. (BSCO, 2022). https://www.explorebigsky.com/transportation-district-bsco-align-to-leverage-community-center-funds/28742

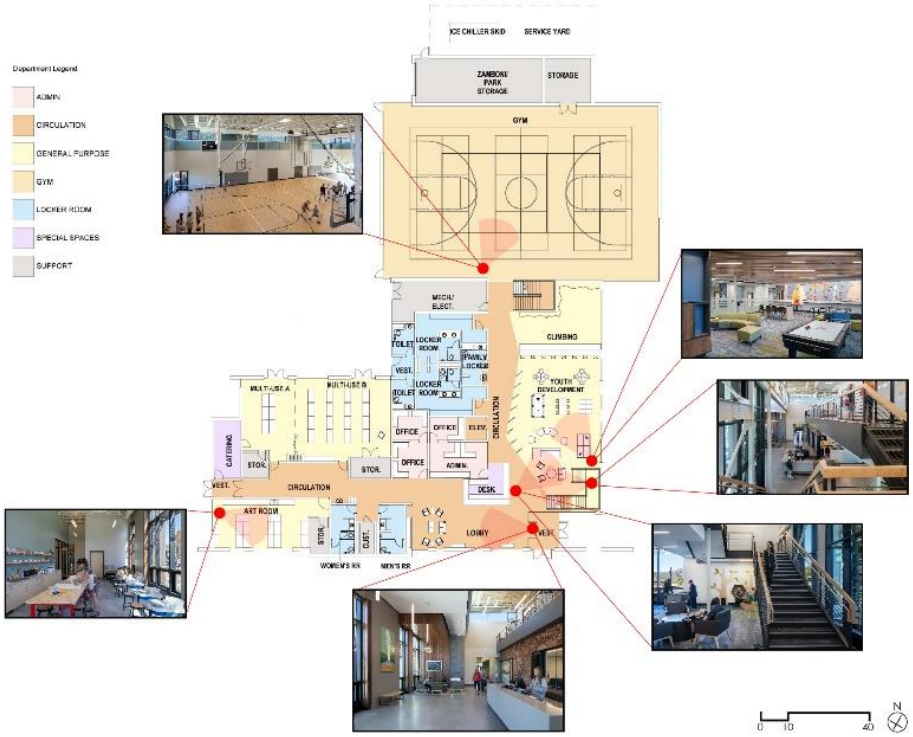

Figure 105. First level floor plan. BASE designed by BRS Architects in 2022. (BSCO, 2022). https://bsco.org/community-center-renderings/

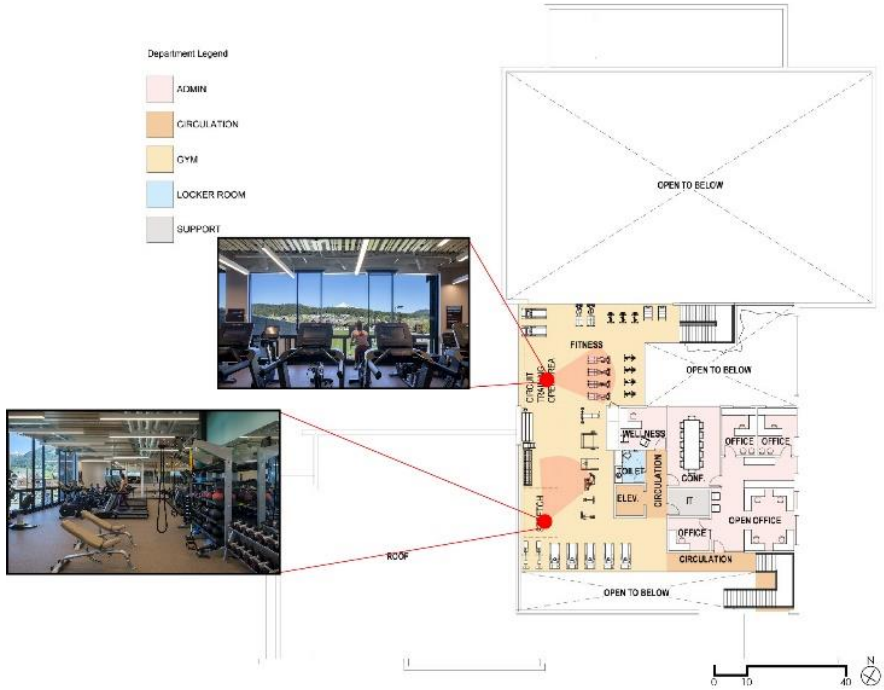

Figure 106. Second level floor plan. BASE designed by BRS Architects in 2022. (BSCO, 2022). https://bsco.org/community-center-renderings/

Opened in 2022 this 28,000 square foot building is net zero and has achieved both LEED Gold certification and the WELL Building Standard. This community center has a range of

different spaces for uses such as; a fitness center, gymnasium, climbing gym, multiuse studio, ceramic arts area, craft spaces, afterschool program setting, and a ‘community living room’.

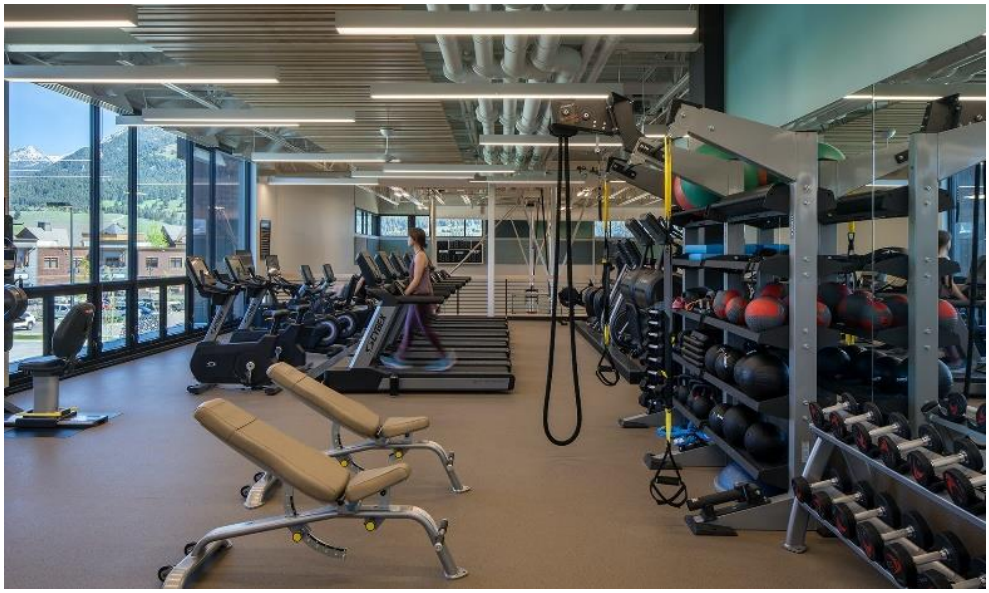

Figure 107. View of fitness area in BASE designed by BRS Architects in 2022. (BRS Architects, 2022). https://brsarch.co m/big-sky-recreation-center-base/

Figure 108. View looking outside to 'nature' from the fitness area. BASE designed by BRS Architects in 2022. (BRS Architects, 2022). https://brsarch.com/big-sky-recreation-center-base/

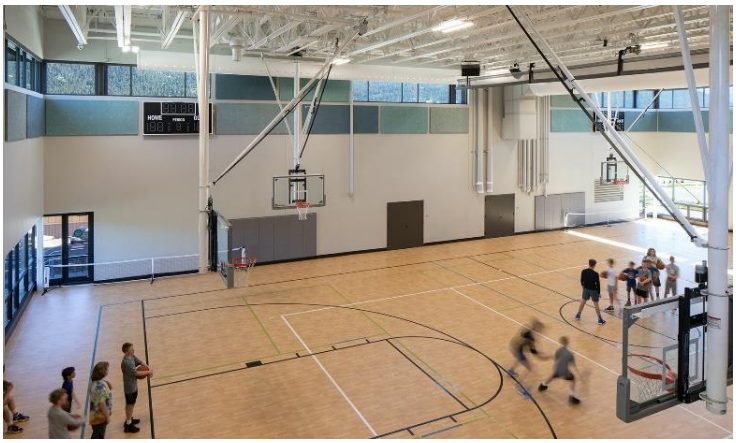

Figure 109. View of the gym. BASE designed by BRS Architects in 2022. (BRS Architects, 2022). https://brsarch.com/big-sky-recreation-center-base/

Figure 110. Ceramics studio in BASE designed by BRS Architects in 2022. (BRS Architects, 2022). https://brsarch.com/big-sky-recreation-center-base/

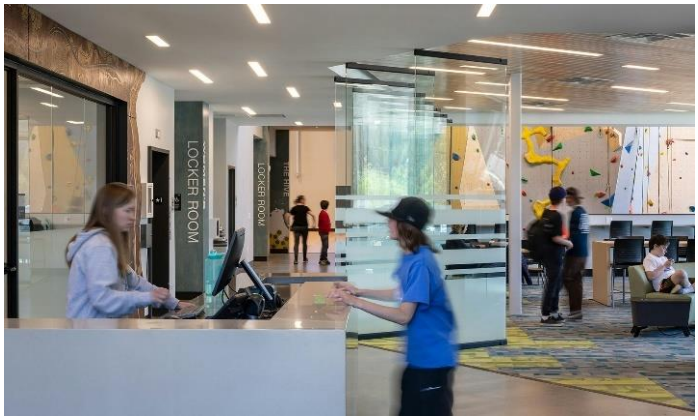

Figure 111. View of the front desk at BASE designed by BRS Architects in 2022. (BRS Architects, 2022). https://brsarch.com/big-sky-recreation-center-base/

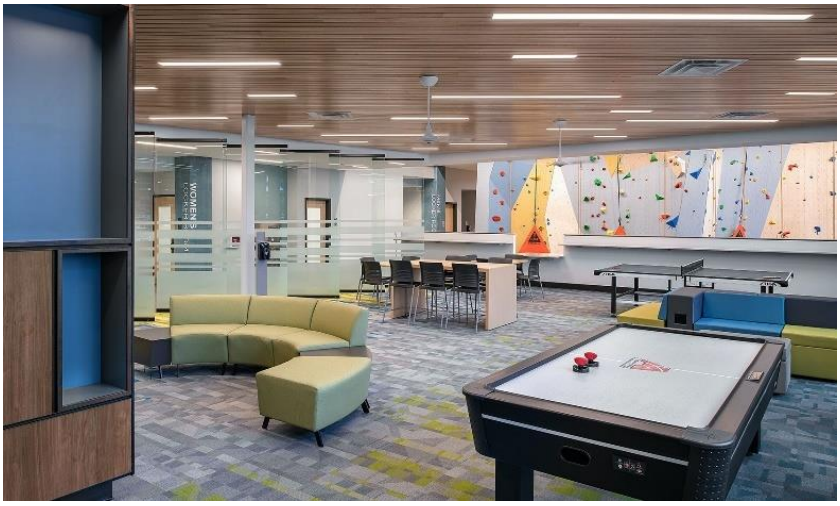

Figure 112. View of the 'community living room' at BASE designed by BRS Architects in 2022. (BRS Architects, 2022). https://brsarch.com/big-sky-recreation-center-base/

The materials, like the cedar siding and the large floor to ceiling windows, that are used are important for the sustainability of this project, the cedar siding is from a local source which means less of a distance it has to be driven in order to arrive at the site, cutting down the amount of CO2 emissions are being released from delivery trucks. The windows are not only used for optimizing daylight but also for providing views of the outdoors and allowing for natural ventilation in certain areas. Other sustainable features of this building include solar panels, native plants, and a green roof. The Big Sky Community Center uses biophilic design principles throughout the building, for instance ‘nature in space’ or ‘direct experience of nature’ as they have references to ‘nature’ in the building. ‘Natural analogues’ or ‘indirect experience of nature’ like biomorphic forms and patterns are used, they can be seen in the carpet as it is the color of tree bark and the stones around the fireplace look like the stone formations that can be found in the surrounding area. The materials and colors that were chosen were done with the intent of balancing into the surrounding environment, providing a connection to ‘nature’. The exterior façade is made from board formed concrete and cedar wood panels to allow for further blending into ‘nature’ of the surrounding scenery. Blues, greens, greys, and light browns are used not only

for their representation of colors found in ‘nature’ but also for the feeling of calmness and relaxation that they give to people. In the children’s area there are trees painted on the walls and they are sized so that the scale is proportional to the children’s heights.

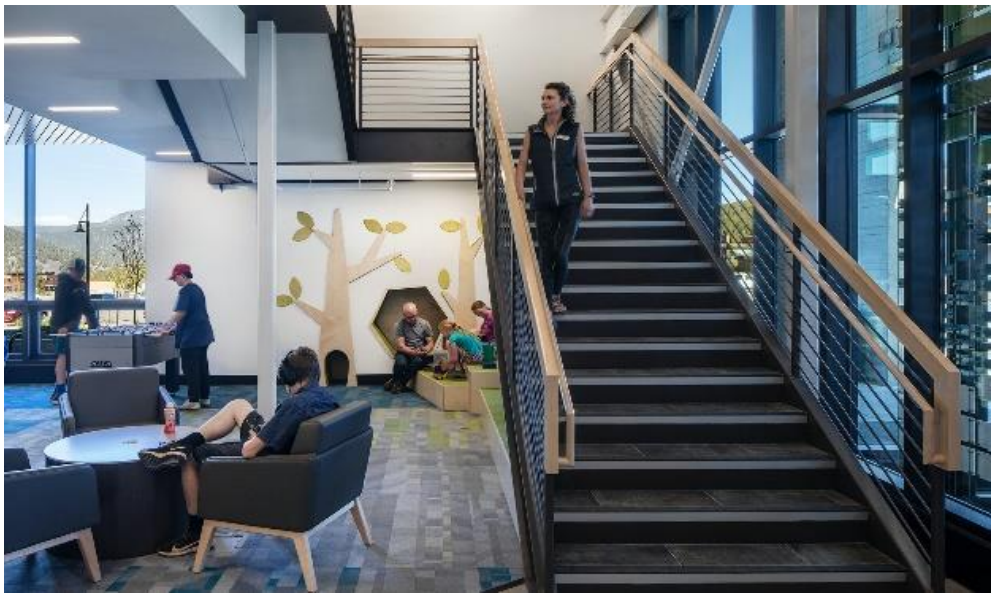

Figure 113. Main staircase and children's area with trees painted on the wall. BASE designed by BRS Architects in 2022. (BRS Architects, 2022). https://brsarch.com/big-sky-recreation-center-base/

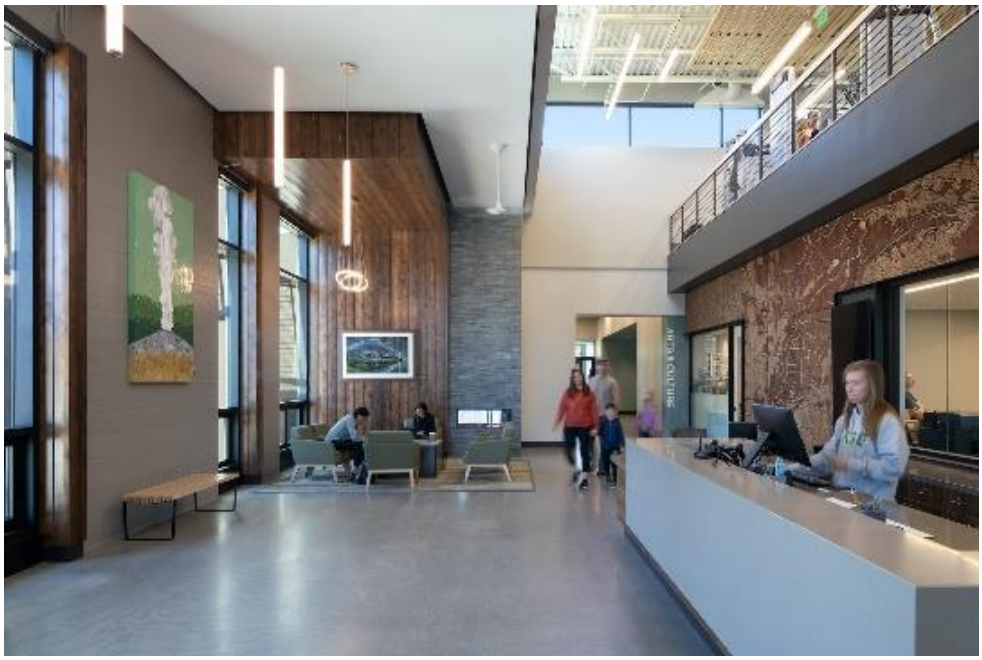

Figure 114. View of lobby and front desk. BASE designed by BRS Architects in 2022. (BRS Architects, 2022). https://brsarch.com/big-sky-recreation-center-base/

Figure 115. View of lobby from second level of BASE designed by BRS Architects in 2022. (BRS Architects, 2022). https://brsarch.com/big-sky-recreation-center-base/

For ‘nature of the space’ or ‘experience of space and place’ they focused on refuge and prospect. For refuge, there are spaces throughout the building that allow people to stop and pause while removing themselves from the daily hustle and bustle of life. The floor to ceilings windows provide both refuge and views of the outdoors while protecting people from the weather. They offer views of the mountains that are roughly only 1,500 feet away. Another way prospect is applied is that 75.62% of all spaces have direct views of people moving, seeing plants, and viewing animals. The upper levels are also open to the floors below, allowing people to see what is happening down below (BRS Architecture, n.d.-a).

The Big Sky Community Center is an important example for Elk River Community Corner as it uses biophilic design principles to give people a chance to gain a connection to the natural environment. The sustainability aspect of being energy efficient and the different spaces are other elements of consideration that went into the design of Elk River Community Corner. Being in Montana this project has a similar climate to Elk River Community Corner.

3.5.8. Case Study Conclusion

Bringing sustainability into buildings is something that most designers are working to achieve. Sometimes this includes bringing nature into a building, for instance to improve air quality, while they may not know that they are using the idea of biophilia and are providing people with a connection to nature. Community is a topic and goal that seems to be everywhere in today's world, with the hope to be a part of a community that is strong and resilient. These seven case studies, all though not every example, show how places like preschools, youth, recreation, and community centers can all focus on sustainability and giving people a chance to connection with nature, both which can be achieved through the use of biophilic design. The case studies provided in this thesis severed as examples and had an impact on the biophilic design principles, sustainable design features, and the spaces that are included in Elk River Community Corner.

3.6. Detailed Space Program

The spaces that make up Elk River Community Corner can be split into three areas, youth, child, and community. The community area contains spaces like, entry lobby, multipurpose room(s), café/coffee shop, the gym, weight area, and the fitness/studio rooms. The spaces in the child area and youth area focus more on learning, both academic and social, and while they share some spaces like the classrooms, the art space, and the resource room that has homework help and study spaces. The child area focuses on children 10 years old or younger and includes three childcare rooms and an indoor play area. The youth area has a hangout area and game room and is intended for youths 11 to 18 years old. Along with the interior building program, outdoor spaces like a green roof with a garden, an outdoor play area, and a youth hangout space. 'Nature' is brought inside by placing plants around the building and the

incorporation of natural materials and colors, and an abundant amount of natural light, both sunlight and daylight. The square footage for each space is listed in the table below along with the number of each room. A diagram showing the initial spatial relationships between each space is provided after the building program table.

Spaces	Number of spaces	Square feet per space	Total square footage
Entry/Lobby	1	3,158	3,158
Administaion Office	3	135	405
Childcare	3	714	2,142
Child-sized Restroom	3	69	207
Gym	1	7,871	7,871
Locker Rooms	2	651	1,302
Family Locker Room	1	505	505
Restrooms	4	428	1,712
Juice Bar	1	1,321	1,321
Kitchen	1	675	675
Homework Rooms	2	150	300
Homework Area	1	1,056	1,056
Multipurpose Room	1	1,659	1,659
Indoor play area	1	1,643	1,643
Hangout Space	1	3,373	3,373
Computer Lab	1	407	407
Single Person Restroom	1	69	69
Art Room	1	884	884
Music Room	1	950	950
Rooftop Patio	1	9,440	9,440
Fitness Area	1	613	613
Fitness Rooms	2	717	1,434
Walking Track	1	3,121	3,121
		Total square footage	44,247
		20% for cirulation	0.2
		Final total square footage	8,849.4

Table 5. Building program table. Shows the interior spaces, the number and square footage of each space. It also notes the total square footage of the building.

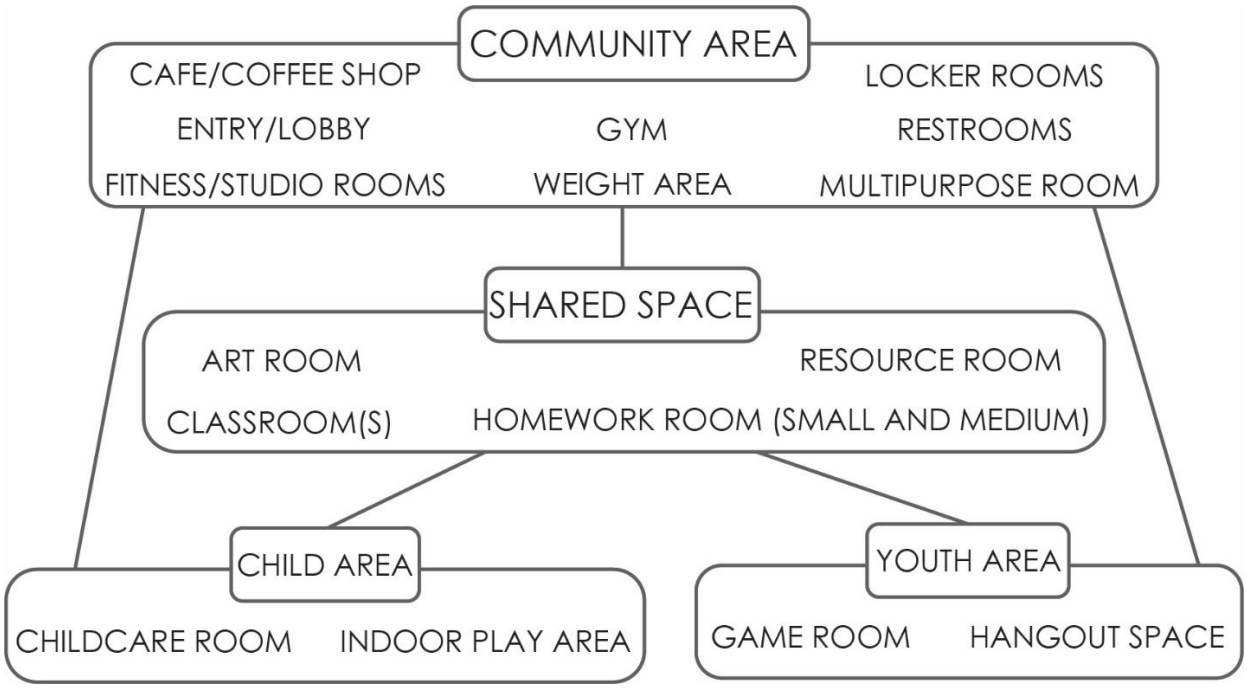

Figure 116. Bubble diagram showing the different spaces.

4. Results and Conclusions

4.1. Final Project Description

This project creates a two-story, 44,247 square foot youth center that is dedicated to the children and youth of Elk River, Minnesota. The building is open to anyone in the community, but the programming of the building is aimed for kids, kindergarten through 12th grade. With the site for this project being across the street from five schools, a high school, two middle schools, and two elementary schools, it is in a perfect location for maximum interaction with the students and to provide benefits to them, for example, improved mental and physical health. The Lions Park directly to the South of the site will provide further access to 'nature'. The building will have an outdoor play area for the younger kids and a hangout space for the older kids, along with a green roof, and a community garden. The youth center will have three areas, child, youth, and community. Each of these areas will interact with each other while still providing areas geared towards the intended group of people. The community area will have a juice bar, a multipurpose room(s), a gym, a fitness area, and fitness rooms. The child area consists of childcare rooms and an indoor play area and the youth area will have a game room, hangout space, and a computer lab. These two areas will have many shared spaces, for instance, art room, classrooms, and a resource area that has homework spaces for individual and groups of kids. The building also uses biophilic design principles, like vegetation, daylight, and images of 'nature', to improve the health of both the students and the natural environment. Plants and daylight are going to be the two main biophilic design elements that are used throughout the building. Images of 'nature' can be found through the building. Natural materials will be used for the building along with colors that can be found in 'nature'. The overall hope and goal for this project is to create a youth center where kids are able to go to after school and on the weekends. The spaces that are provided in

this project are meant to encourage healthy lifestyles and improve the kid's overall well-being. Simultaneously working to improve the quality of the natural environment of the site and surrounding area.

4.2. Project Objectives

Below are the project objectives that Elk River Community Corner has aimed for and accomplished, each are explained. The first one is to form a connection between children and nature, this was accomplished by providing ample outdoor green space, vegetation indoors and outdoors, bringing images of nature, using colors that can be found in nature, and have windows that allow for views to nature. A place for children kindergarten through 12th grade to go after school, on the weekends, and in the summer is the next objective. It was achieved by programming the building in a way that focused on providing spaces that geared towards that age group. The next objective is to improve the natural environment, this was done by focusing on increasing biodiversity which in turn will improve the air and water quality. Wood is used as a natural material because it is renewable, have little embodied energy, and releases non-toxic fumes. Natural ventilation is also used to further lower the amount of energy that the building consumes along with providing fresh air to the people in the building. Using biophilic design elements is the final projective objective Elk River Community Corner accomplishes, although there are many different elements, this project focuses on five main elements, vegetation, daylight and views, natural materials, colors found in nature, and images of nature. Elk River Community Corner also uses two secondary elements of natural ventilation and refuge. These four objectives come together to create a youth center that using biophilic design principles to benefit youth and the natural environment.

4.3. Project Design and Documentation

The following images show the final design of Elk River Community Corner. Starting with the site and floor plans to give an understanding of how the building relates to the site and the surrounding context and the organization of the spaces and rooms within Elk River Community Corner. Next renderings of both interior and exterior spaces are shown to gain a further understanding of how the projective objectives were achieved. Building section cuts are provided next shown the relationship between spaces and show the biophilic design elements that can be found in each view. Lastly elevations are shown to show the façade of the building and the vegetation that is a part of the building and that surrounds the building.

4.3.1. Plans

Figure 117. Site Plan of Elk River Community Corner

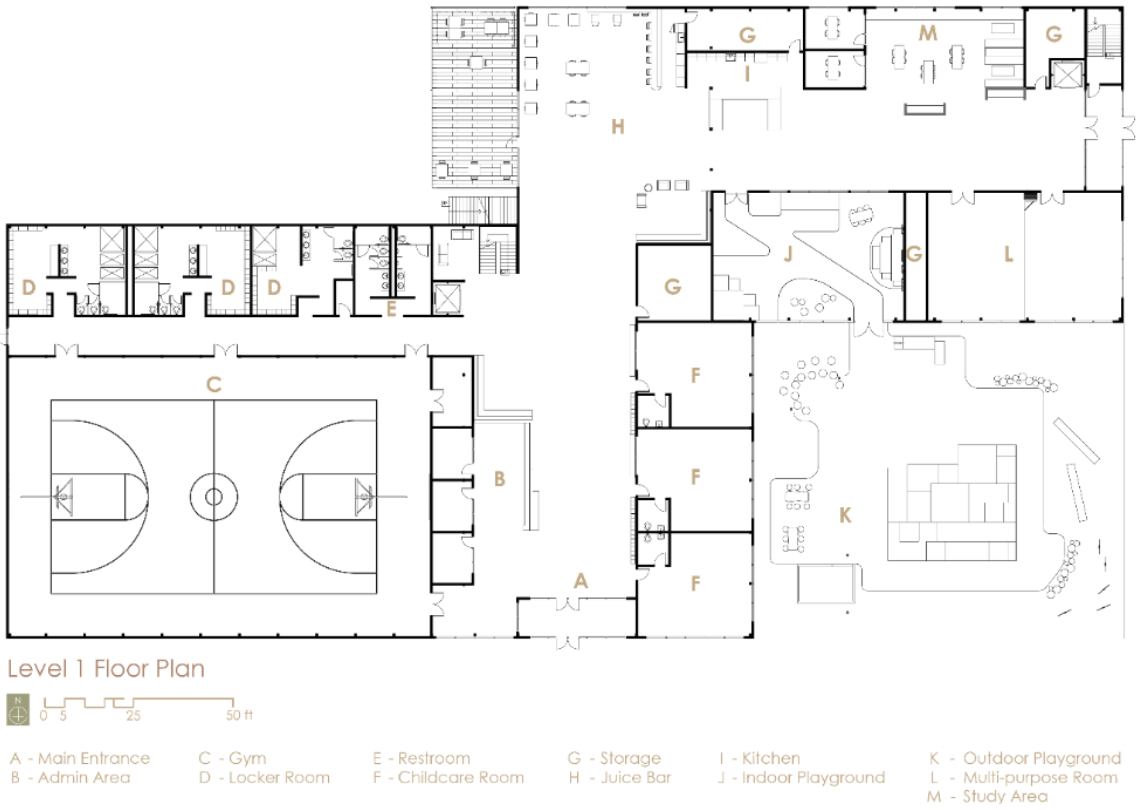

Figure 118. Level 1 floor plan of Elk River Community Corner

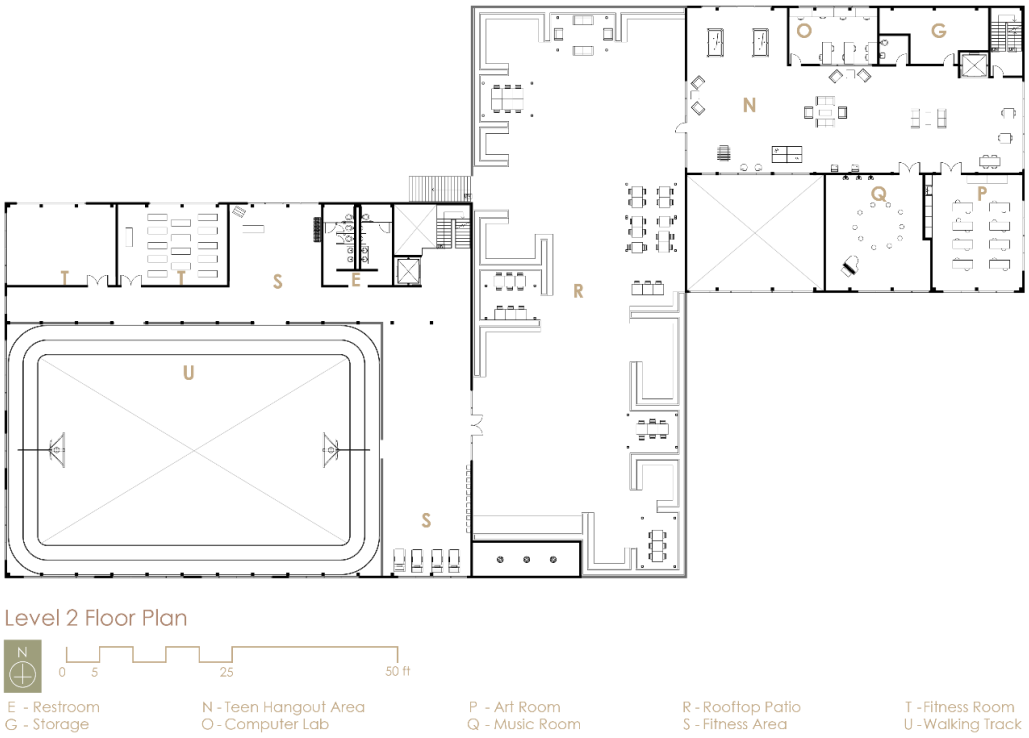

Figure 119. Level 2 floor plan of Elk River Community Corner

4.3.2. Renderings

Figure 120. Entry way of Elk River Community Corner

Figure 121. Juice bar in Elk River Community Corner

Figure 122. Community kitchen in Elk River Community Corner

Figure 123. Study area in Elk River Community Corner

Figure 124. Indoor playground in Elk River Community Corner

Figure 125. Hide out in the indoor playground in Elk River Community Corner

Figure 126. Outdoor playground at Elk River Community Corner

Figure 127. Vertical leaves (L) and Water table (R) in the outdoor playground at Elk River Community Corner

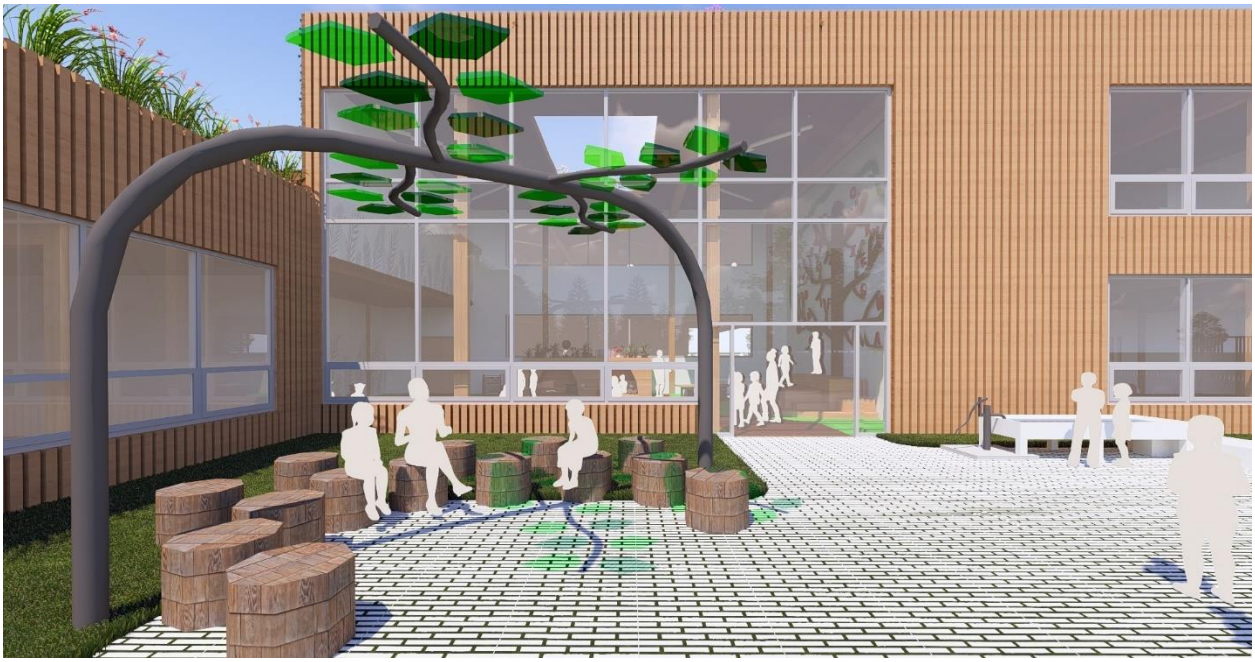

Figure 128. Reading area in the outdoor playground at Elk River Community Corner

Figure 129. Rooftop patio at the Elk River Community Corner

Figure 130. Seating area on the rooftop patio at the Elk River Community Corner

Figure 131. Teen hangout area in the Elk River Community Corner

Figure 132. Gym and walking track in the Elk River Community Corner

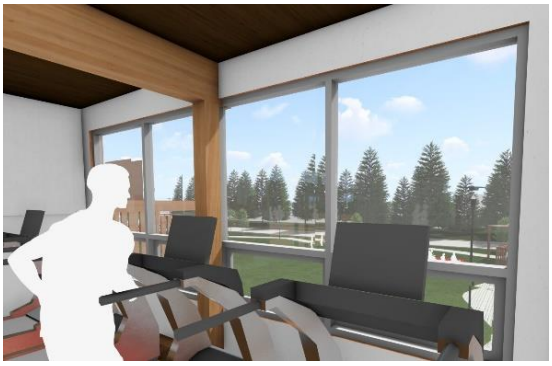

Figure 133. View from treadmill (L) and outdoor exercise area (R) at the Elk River Community Corner

Figure 134. Butterfly Garden on the Elk River Community Corner

Figure 135. Front view of the Elk River Community Corner

4.3.3. Section Cuts

Figure 136. Section cut 1 of Elk River Community Corner. Looking East

Figure 137. Section cut 2 of Elk River Community Corner. Looking South

4.3.4. Elevations

Figure 138. North elevation of Elk River Community Corner

Figure 139. East elevation of Elk River Community Corner

Figure 140. South elevation of Elk River Community Corner

Figure 141. West elevation of Elk River Community Corner

4.4. Conclusions

The Elk River Community Corner achieved its goals of using biophilic design principles to create a youth center that focuses on improving the lives of not only the people using the space but also the health of the surrounding natural environment. The implementation of vegetation could have been taken further, while there way some within the building there could have been more. This could have been done by creating a green wall inside and adding more places for vegetation in areas like the gym, teen hangout space, juice bar, and the indoor playground. More natural light could have been brought into the central hallways of the building, with the lower

single-story height. This would allow the space to feel more open and the floor and ceiling would not have such a heavy presence. Adding elements like a water fountain, water wall, or even a fish tank would have provided another element of biophilic design to the project. Because they windows were large and almost floor to ceiling, shading devices should be added to help block out some of the hot summer sun and heat. This would help the building's mechanical system run smoother too. Adding more passive design strategies along with sustainable/green design feature would aid in further reducing the impact that this building would have on the natural environment. The implementation of these would hopefully be able to lead to LEED gold or platinum certification, meet the WELL building standards and be part of the living building challenge. Proving that it is possible to design a youth center that benefits the youth and the natural environment though the implementation of biophilic design.

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APPENDIX

2nd year	fall: 2020 - Emily Guo Land Artist Studio Boat House Ancient & Honorable Hiawathan Rowing Society	spring:2021 - Charlott Greub Cripple Creek House Bay House Retirement Community Housing Chambray Retirement Community
3rd year	fall: 2021 - Ronald Ramsay Chicken Coop Wiley Coop Shaker Barn The Great Shaker Barn Concert Hall	spring:2022 - Jennifer Brandel Native American Cultural Center NDSU Native American Cultural Center Fargo Moorhead Honor Guard Project Eagles View Memorial & Native Garden
4th year	fall: 2022 - Amar Ali Capstone Mid-rise Mixed Use Fusion	spring:2023 - Kristi Hanson Marvin Windows Project Kliman Korner Urban Design Imagining Minot
5th year	fall: 2023 and spring 2024 - Charlott Greub Thesis Project - Youth Center Elk River Community Corner	