

Artistic green infrastructure for improved sense of place and ecological education

by

Cody Kloeppel

A REPORT

submitted in partial fulfillment of the requirements for the degree

MASTER OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture and Regional & Community Planning
College of Architecture, Planning, and Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2024

Approved by:

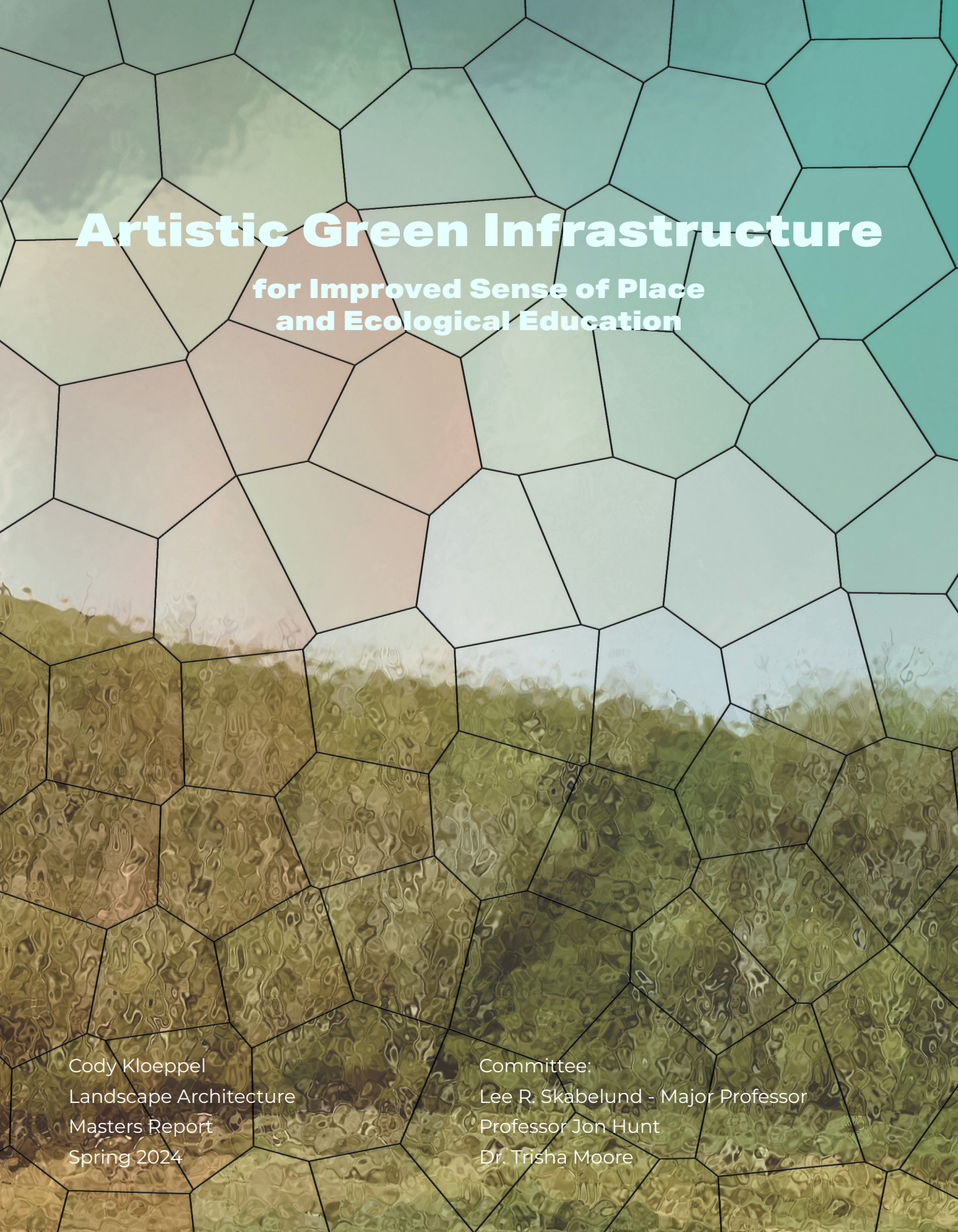
Major Professor
Lee R. Skabelund

Copyright

© Cody Kloeppel 2024.

Abstract

Over the past century, worldwide rapid urbanization has caused a loss of green space which has led to the further disconnect between people and place. The disconnect of people and place also contributes to negative climatic effects such as flooding and water quality degradation. People who are not physically and emotionally attached to the land have less affinity to protect it. Studies have shown that reconnecting people to the environment around them can create a collective stewardship of the land and help preserve and protect these areas. Utilizing green infrastructure in an artful way through public space draws people in and allows for ecological education opportunities. This study addresses how artistic green infrastructure can be utilized to enhance the sense of place and provide ecological education opportunities in green spaces. The area being studied is the First Christian Church property and the adjacent residential apartment complex landscape across Grand Mere Parkway in Manhattan, Kansas. This area was chosen as it contains a natural drainageway that is considered a quasi-public space given church and day-care uses. Methodologies used to collect and assess data included a literature review analysis, a comparative precedent study and matrix, a site inventory and analysis, followed by an exploratory projective design process. Data collected included terms, concepts, and ideas from the artful rainwater and eco-revelatory design literature; precedents that sought art and education into green infrastructure and landscape design; and characteristics and attributes of precedents. Analysis of this data helped create a set of design guidelines and a precedent matrix that assisted in making design decisions. These findings offer insights into how green infrastructure can be used artistically and educationally to reconnect people to nature and contribute to the existing body of knowledge about placemaking. This study can also be used as a reference for projects attempting to accomplish similar goals.

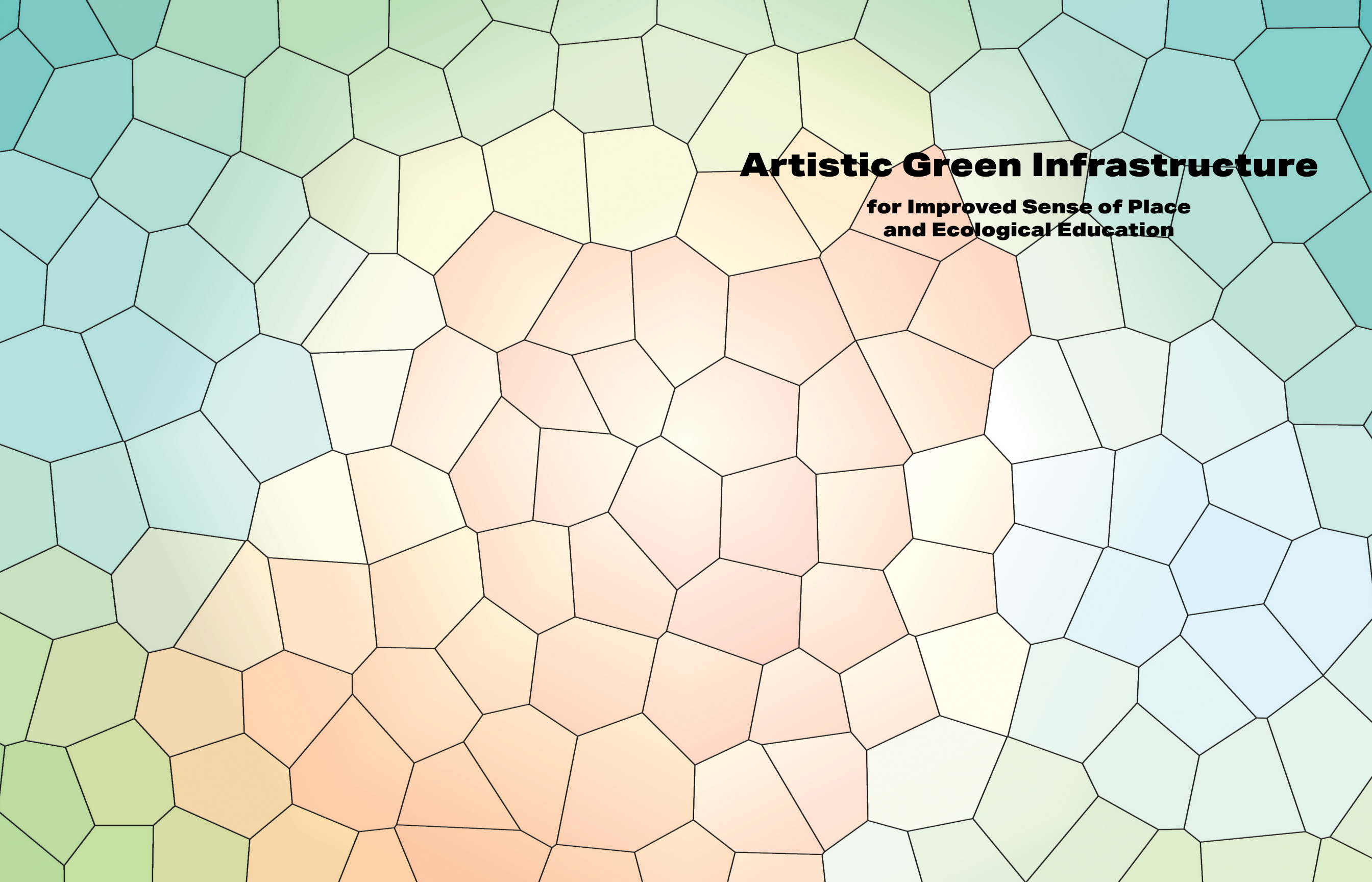


Artistic Green Infrastructure

**for Improved Sense of Place
and Ecological Education**

Cody Kloeppel
Landscape Architecture
Masters Report
Spring 2024

Committee:
Lee R. Skabelund - Major Professor
Professor Jon Hunt
Dr. Trisha Moore



Artistic Green Infrastructure

**for Improved Sense of Place
and Ecological Education**

Acknowledgments

I would like to thank everyone for all the help and support along the way.

I would especially like to thank my Major Professor, Lee Skabelund, for helping me. Thank you for your constant dedication and motivation to help me continue and make this the best project I could. I would not have accomplished this without your continuous ideas and feedback and keeping me on track. I would also like to thank my committee, Professor Jon Hunt and Dr. Trisha Moore. Your feedback, comments, and ideas really pushed me and helped me think outside the box. I could not have achieved what I have without your input. Thank you for your time and dedication these past two semesters.

I would also like to thank my peers. You have all helped me think in new and innovative ways and given me feedback and help when needed. Thank you for all the memories these past five years.

To my fiancé, Keaton, thank you for all the love and support along the way. You encouraged me to keep going even when I did not feel like it.

I would also like to thank my family and friends; you have all kept me motivated and supported me along this journey. To my mom, dad, and Joanna, your support and encouragement kept me going through the past five years, and I could not have done it without you all. And to my siblings, thank you for always encouraging me.

Abstract

Over the past century, worldwide rapid urbanization has caused a loss of green space which has led to the further disconnect between people and place. The disconnect of people and place also contributes to negative climatic effects such as flooding and water quality degradation. People who are not physically and emotionally attached to the land have less affinity to protect it. Studies have shown that reconnecting people to the environment around them can create a collective stewardship of the land and help preserve and protect these areas. Utilizing green infrastructure in an artful way through public space draws people in and allows for ecological education opportunities. This study addresses how artistic green infrastructure can be utilized to enhance the sense of place and provide ecological education opportunities in green spaces. The area being studied is the First Christian Church property and the adjacent residential apartment complex landscape across Grand Mere Parkway in Manhattan, Kansas. This area was chosen as it contains a natural drainageway that is considered a quasi-public space given church and day-care uses. Methodologies used to collect and assess data included a literature review analysis, a comparative precedent study and matrix, a site inventory and analysis, followed by an exploratory projective design process. Data collected included terms, concepts, and ideas from the artful rainwater and eco-revelatory design literature; precedents that sought art and education into green infrastructure and landscape design; and characteristics and attributes of precedents. Analysis of this data helped create a set of design guidelines and a precedent matrix that assisted in making design decisions. These findings offer insights into how green infrastructure can be used artistically and educationally to reconnect people to nature and contribute to the existing body of knowledge about placemaking. This study can also be used as a reference for projects attempting to accomplish similar goals.

Table of Contents

01	Introduction	16
02	Background	24
03	Site Selection	50
04	Literature Review Analysis	56
05	Comparative Precedent Analysis	70
06	Site Analysis	110
07	Projective Design	162
08	Conclusion	216

List of Figures

Chapter 1		Chapter 6	
Figure 1.1. FCC Entrance and Loading Area	23	Figure 6.1. Walk to Grand Champions Apartments	112
Chapter 2		Figure 6.2. 1991 Grand Mere Development Conditions	114
Figure 2.1. KSU International Student Center Rain Garden	39	Figure 6.3. 2002 Grand Mere Development Conditions	114
Figure 2.2. Linkages and Frameworks	48	Figure 6.4. 2014 Grand Mere Development Conditions	115
Chapter 3		Figure 6.5. 2023 Grand Mere Development Conditions	115
Figure 3.1. Primary Site	54	Figure 6.6. FCC from Grand Mere Pkwy	117
Figure 3.2. Future Research Potentials	55	Figure 6.9. View of Drainageway	117
Chapter 4		Figure 6.12. FCC Entry Signage	117
Figure 4.1. Expanded Glossary	60	Figure 6.15. Residential Vegetation in Winter	117
Figure 4.2. Concept Map	67	Figure 6.7. Stair Conditions in Winter	117
Chapter 5		Figure 6.10. Loading Area in Winter	117
Figure 5.1. Precedent Map	73	Figure 6.13. Grand Champions SFH	117
Figure 5.2. Growing Vine Street Signage	75	Figure 6.16. Residential Vegetation	117
Figure 5.3. Beckoning Cistern and Cistern Steps	76	Figure 6.8. FCC Loading Area	117
Figure 5.4. Dan Corson’s “Water Drums”	79	Figure 6.11. Roundabout in Winter	117
Figure 5.5. Cedar River Watershed Education Center	80	Figure 6.14. Grand Mere Pkwy in Winter	117
Figure 5.6. Constructed Wetland at Tanner Springs Park	83	Figure 6.17. Retaining Wall around Parking Lot	117
Figure 5.7. Walkway and Art Walls over Wetland	84	Figure 6.18. Large Scale Site Contours	119
Figure 5.8. Sculpture at San Jacinto Plaza	87	Figure 6.19. Large Scale Site Slope	119
Figure 5.9. El Paso Pedestrian Pathways	88	Figure 6.20. Large Scale Site Hillshade	119
Figure 5.10. Ridge & Valley Plaza	91	Figure 6.21. Large Scale Site Elevation	119
Figure 5.11. Spring Creek Watershed Plaza Incision	92	Figure 6.22. Small Scale Site Contours	120
Figure 5.12. Queens Botanical Garden	95	Figure 6.23. Small Scale Site Slope	120
Figure 5.13. Water Feature at Queens Botanical Garden	96	Figure 6.24. Small Scale Site Hillshade	120
Figure 5.14. Amenity & Purpose Precedent Matrix	98	Figure 6.25. Small Scale Site Elevation	120
Figure 5.15. Feature & Functions Precedent Matrix Part 1	100	Figure 6.26. Snow-covered Northern Cuestas	121
Figure 5.16. Feature & Functions Precedent Matrix Part 2	102	Figure 6.27. Winter Parking Lot Conditions	121
Figure 5.17. Location Precedent Matrix	104	Figure 6.28. FCC Entry/Exit Drive and Sidewalk	121
Figure 5.18. Overall Design Guidelines	107	Figure 6.29. Swale to the North of Grand Champions Apartments	121
Figure 5.19. Design Guidelines for Place-Specific Green Infrastructure	108	Figure 6.30. Site Hydrology	123
		Figure 6.31. Riley Country Watersheds	124
		Figure 6.33. Manhattan, Kansas Waterways and Site Connections	125
		Figure 6.32. Little Kitten Creek-Wildcat Creek Watershed and Waterways	125

Figure 6.34. Site Ground Coverage	127
Figure 6.35. Grand Mere Soil Conditions	130
Figure 6.36. Site Specific Soil Conditions	132
Figure 6.37. Disturbed Soils	132
Figure 6.38. Large Scale Utilities	135
Figure 6.39. Site Specific Utilities	135
Figure 6.40. Existing Trails	138
Figure 6.41. Outdoor Gathering Space for Artistic Expression	139
Figure 6.42. Manhattan, Kansas Average Temperatures	141
Figure 6.43. Manhattan, Kansas Average Precipitation	141
Figure 6.44. Manhattan, Kansas Average Wind Speed	142
Figure 6.45. Manhattan, Kansas Average Hours of Daylight	143
Figure 6.46. Shade from Trees on the Grand Champions Side of Site	145
Figure 6.47. Slope Surrounding FCC	145
Figure 6.48. FCC Axonometric Construction Drawings	147
Figure 6.49. FCC Site and Planting Plan	148
Figure 6.50. FCC General Layout Plan	149
Figure 6.51. FCC Grading Details	150
Figure 6.52. FCC Drainage Area Map	151
Figure 6.53. FCC Roof Drain Plan	152
Figure 6.54. FCC Floor Plan Level 1	153
Figure 6.55. Main Research Topics	155
Figure 6.56. Public Green Space Design Opportunities	156
Figure 6.57. Green Infrastructure Design Opportunities	157
Figure 6.58. Ecological Education Design Opportunities	158
Figure 6.59. Placemaking Design Opportunities	159
Figure 6.60. Artful Rainwater Design Opportunities	160
Figure 6.61. Eco-Revelatory Design Opportunities	161

Chapter 7

Figure 7.1. Existing and Proposed Programming	165
Figure 7.2. Design Process 2-8-24 Plan 1	167
Figure 7.3. Design Process 2-8-24 Plan 2	167
Figure 7.4. Design Process 2-8-24 Plan 3	168
Figure 7.5. Design Process 2-8-24 Plan 4	168
Figure 7.6. Design Process 2-12-24	169
Figure 7.7. Design Process 2-26-24	169
Figure 7.8. Design Opportunities Response and Programming	172
Figure 7.9. Public Green Space Design Opportunities	173
Figure 7.12. Placemaking Design Opportunities	173
Figure 7.10. Green Infrastructure Design Opportunities	173
Figure 7.13. Artful Rainwater Design Opportunities	173
Figure 7.11. Ecological Education Design Opportunities	173
Figure 7.14. Eco-Revelatory Design Opportunities	173
Figure 7.15. Master Planned Site	174
Figure 7.16. FCC Classroom and Recreation Center Expansions	177
Figure 7.17. Views and Opportunities	178
Figure 7.18. Trail Improvements	179
Figure 7.19. Existing Stream Corridor and Connection	181
Figure 7.20. Focused Site Plan	183
Figure 7.21. Plaza and Outdoor Classroom Location	184
Figure 7.22. Plaza and Outdoor Classroom Perspective and Usage	185
Figure 7.23. Plaza-Classroom Section Cut	186
Figure 7.24. Transition from Outdoor Classroom down to Drainageway	186
Figure 7.25. Plaza and Outdoor Classroom Isometric	187
Figure 7.26. Experiential Boardwalk Location	188
Figure 7.27. Boardwalk Section Cut	189
Figure 7.28. Boardwalk Relationship to FCC and Drainageway	189
Figure 7.29. Experience of Traversing Boardwalk	190
Figure 7.30. Check Dams and Pocket Wetlands Locations	192
Figure 7.31. Wetland & Streamline Functionality	193
Figure 7.32. Experience Walking along Revitalized Drainageway	194
Figure 7.33. Check Dam and Wetlands Section Cut	196
Figure 7.34. Check Dam and Pocket Wetland Progression Section	196
Figure 7.35. Northern Check Dam Oblique	197

Figure 7.36. Eco-Education Art Walls Locations	198
Figure 7.37. Eco-Education Art Walls Oblique	199
Figure 7.38. Walking Along and Throughout the Eco-Education Art Walls	200
Figure 7.39. Location of Gallery Forest and Introduced Prairie	203
Figure 7.40. Eco-Revelatory Wildcat Water Sculpture Location	204
Figure 7.41. Wildcat Water Sculpture and Crosswalk Oblique	205
Figure 7.42. Wildcat Water Section Cuts	206
Figure 7.43. Grand Mere Parkway Crossing Transition (Section A-A)	206
Figure 7.44. Wildcat Water Sculpture Section (Section B-B)	207
Figure 7.45. Existing i-Tree Metrics and Benefits	209
Figure 7.46. Proposed i-Tree Metrics and Benefits	209
Figure 7.47. Wetland and Stream Corridor Metrics and Benefits	211
Figure 7.48. Tree Canopy Introduced	212
Figure 7.49. Additional Prairie Land	212
Figure 7.50. Outdoor Social Space Created	213
Figure 7.51. Permeable Pavement Added	213
Figure 7.52. Design Synthesis	215

A landscape photograph taken at sunset. The sun is low on the left horizon, casting a warm orange glow. The sky is filled with scattered, small white clouds. In the foreground, there is a field of tall grass and some small plants with reddish leaves. In the middle ground, a line of houses is visible on a slight rise. The overall scene is peaceful and scenic.

01:

INTRODUCTION

Introduction

How can artistic green infrastructure be implemented to enhance the sense of place and ecological education in public green space in the Grand Mere area of Manhattan, Kansas? This study aims to answer this research question. Within the Grand Mere area of Manhattan, Kansas there are many similar-looking developments being built with meandering roads and it is easy to get lost while driving or walking. There are also limited public green spaces in the area. The main public spaces include the sidewalks, the First Christian Church (FCC), the Golf Clubhouse, and the main parking and plaza at the entrance. Throughout these public open spaces are opportunities for ecological education and creating a sense of place and community throughout the neighborhoods. Education can be explored through the local ecosystems in the large drainage and waterways that cannot and should not be built upon for residential developments. However, features that slow, filter, and infiltrate stormwater runoff from developed areas are needed and they can be artistic, engaging, functional, and fit with the ecosystems to be protected or recreated. As noted by many different authors, combining public open space, green infrastructure, placemaking, and public art, there is the potential to reconnect people to nature, educate the public about

ecological concerns, create a sense of place and identity within communities, mitigate climatic issues, and provide health and well-being benefits to the residents of the Grand Mere area (Courage & McKeown 2018; Echols and Pennypacker 2015; Green Nylen & Kiparsky 2015; Kim et al 2018; Paul et al 2020; Razi & Ziminski 2022; Sadeghi et al 2019; van Vliet & Hammond 2021). The Grand Mere area of Manhattan, Kansas was chosen as it is also the primary focus of my Fall 2023 studio.

It is said that over the past hundred years, ecologically productive land has been negatively fragmented and transformed by urbanization and the continental U.S. has lost 150 million acres of agricultural and habitat land from urban sprawl ("Why Native Plants Matter" | Audubon n.d.). The loss of public green space due to rapid urbanization has led to a disconnect between people and place – specifically the ecoregion and watershed they inhabit. This leads residents to less interaction with nature, a lower understanding of the surrounding ecosystems, and higher noise and air pollution (Kim et al 2018, 71; Parker & Simpson 2018).

Along with the disconnect of people and place, rapid urbanization has also exacerbated climatic issues such as flooding and water pollution. Traditional grey stormwater infrastructure cannot handle large storm events and water is simply conveyed and untreated in these systems (Li et al 2020, 2-11; Suppakittpaisarn et al 2019). A technique that can help alleviate these issues and reconnect people to place is the use of green infrastructure in public open spaces that serve as a means of ecological education and placemaking. Green infrastructure can be accomplished through bioswales, rain gardens, bioretention cells or basins, permeable paving, green roofs or walls, and other stormwater harvesting systems (Suppakittpaisarn et al 2019; US EPA 2011). The use of green infrastructure in public spaces allows people to interact and learn from these systems and reconnect to nature. It also provides public health benefits and creates a more livable city.

Ecological education has been shown to be most effective when people are able to make their own discoveries through various outdoor field studies. This helps connect people to their environment. Green infrastructure has also been proven to reduce blood pressure and stress and improve mental well-being (Paul et al 2020). It has also been shown to provide social and economic benefits such as foreign business, housing investments, local community involvement, and an increased sense of pride (Parker & Simpson 2018, 23; Paul et al 2020, 2; Smith & Williams 1999; Song 2008).

These concepts and ideas are explored and utilized through projective design in the Grand Mere area of Manhattan, Kansas. The site is located at the FCC and the adjacent residential apartment complex landscape across Grand Mere Parkway. This site was chosen as it contains a natural drainageway and is a quasi-public space. A literature review analysis, comparative precedent study and matrix, design guidelines, and site analysis informed the design decisions of the project. The guidelines focus on green infrastructure functionality, artistic expression, creating a sense of place, and providing ecological education opportunities.



Figure 1.1. FCC Entrance and Loading Area



02:

BACKGROUND



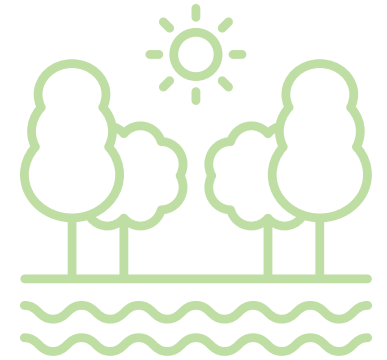
Dilemmas

Rapid Urbanization

Across the nation and worldwide is the issue of rapid urbanization of green space (Kim et al 2018, 71; Panagopolous 2019, 1; van Vliet & Hammond 2021, 145). Kim et al (2018) has stated that the United Nations expects that by 2050, 68% of the world's population will live in urban areas. Panagopoulos (2019) has also said "The global population is projected to grow from 7.7 billion in 2019 to almost 10 billion by the middle of the century, with urban areas to absorb all of the future growth." (1). It has also been said that by 2025, 65% of the worldwide population will be living in urban areas. In China, the urban population is said to reach 1.5 billion by the end of 2020. The two main factors for this rapid urbanization are the natural population growth and the migration of people from rural areas to urban areas (Zhao & Wang 2011, 268). Rapid urbanization frequently leads to serious impacts related to stormwater runoff, leading to flooding and water quality impairments (Miller & Hutchins 2017; O'Driscoll et al 2010).

Loss of Public Green Space

This rapid urbanization and minimized green space leads to residents having limited contact with nature and a higher exposure to noise and air pollution (Kim et al 2018, 71). Urbanization does not only affect humans, but unsustainable, non-resilient patterns have also been shown to degrade ecosystem and their services. (Panagopolous 2019, 1). The loss or degradation of green space causes a loss of habitat space for native wildlife, reduces biodiversity, and disrupts natural ecosystem structures and processes. However, preservation of this green space has the potential to moderate urban heat island effects and clean air and water. It is said that urban populations may be vulnerable to non-communicable diseases due to their sedentary lifestyles and physical inactivity. However, these spaces also allow humans aesthetic enjoyment, recreational opportunities, and physical and psychological well-being (Paul et al 2020, 8; Zhou & Wang 2011, 268). Public green space is highly important in urbanized areas at both the individual and community levels. These spaces allow people to recreate, socialize, exercise, engage with nature, and engage in spiritual reflection which are all essential for the human psyche and overall health and well-being. The Biophilic Hypothesis states that people have a deep biological need and want to engage with nature to thrive as a species (Parker & Simpson 2018, 2). Therefore, public green space is essential for the health and well-being of communities and is necessary to create resilient urban communities. Sedentary lifestyles and physical inactivity in urban populations lead to obesity, hypertension, diabetes, and mental health issues. However, visiting and engaging with public open spaces helps alleviate these health issues (Parker & Simpson 2018, 2; Paul et al 2020, 8).



Disconnect of People and Place & Ecological Education

The lack of public green space and urban lifestyles in general has also led to a disconnect of people and place (Parker & Simpson 2018, 22). Urbanized lifestyles have led to people rapidly disengaging from nature and their surrounding environment. This has also led to an increased social disconnection between people and places. Engaging with nature provides positive psychological, physiological, and spiritual well-being. However, this is becoming lost with each generation of humanity as our environment becomes more urbanized. This disconnect between people and place has led to a lower understanding of the ecosystems that surround them (Parker & Simpson 2018). Ecological education can reconnect people to their environment. There are many different methods of teaching about ecosystems and their services. It is important to begin ecological education at a young age and have children actively participate and explore on their own. Smith and Williams (1999) have stated that it is important to let children make their own discoveries of their ecoregion with various outdoor field studies. There are also opportunities for using public art as ecological education that enhances the sense of place in an area and educates people that are no longer in a school setting (Song 2008).





Green Infrastructure

A possible solution that addresses the issues of the disconnect between people and nature, flooding, poor water quality, and the lack of public open space is the use of green infrastructure and green stormwater infrastructure. Green infrastructure defined by the United States Environmental Protection Agency (US EPA) “involves the use of landscape features to store, infiltrate, and evaporate stormwater. This reduces the amount of water draining into sewers and helps reduce the discharge of pollutants into area water bodies. Examples of green infrastructure include rain gardens, swales, constructed wetlands, and permeable pavements.” (US EPA 2011). Green stormwater infrastructure is a category of green infrastructure with the main purpose of managing stormwater and decreasing water pollution. This includes rain gardens, bioswales, and green roofs. Green infrastructure creates both ecological and human benefits. It can prevent or reduce flooding, reduce the urban heat island effect, and provide wildlife habitat (Suppakittpaisarn et al 2019). Green infrastructure also creates human benefits such as reduced blood pressure, reduced stress, improved mental well-being, and more (Paul et al 2020, 2). High city livability is another outcome of green infrastructure

as it provides social and economic benefits such as foreign business, housing investments, local community involvement, and an increased sense of pride (Parker & Simpson 2018, 23).

Techniques & Methods

There are also many different techniques and methods for implementing green infrastructure. One technique is bioretention systems. These use “vegetation and soils to filter, infiltrate, and evapotranspire stormwater runoff” (Green Nylen & Kiparsky 2015, 5). Bioretention systems also include bioretention cells and basins which are shallow planted depressions in the ground that have substantially amended or engineered soils below them that contribute to stormwater infiltration and evapotranspiration. They are often used to collect runoff from downspouts, parking lots, and roads. Another bioretention technique is bioswales. Bioswales are vegetated drainage channels often placed along roads and parking lots that slow, filter, and infiltrate runoff.

Another green stormwater infrastructure method is unvegetated infiltration systems. These include permeable or pervious pavements and infiltration trenches. Permeable pavements have large pore spaces that allow water to drain. Infiltration trenches are surface trenches lined with rock that receive and infiltrate runoff and introduce collected stormwater to native soils or to deeper gravel storage beds or areas having engineered soils. Green roofs are another method of green stormwater infrastructure. They intercept and slow stormwater from rooftops or retain it for evapotranspiration through vegetation and soils.

Stormwater harvesting systems are a technique for capturing water that can then be reused in the landscape or for other purposes. These employ rain barrels and cisterns to collect stormwater from roofs for reuse such as landscape irrigation. (Green Nylen & Kiparsky 2015). Another technique of green infrastructure is rain gardens. These are shallow, depressed, and vegetated areas with native soils or minimal amendments that contain plants such as perennial plants, tall grasses, and native plantings rich in biodiversity to capture and slow the runoff of stormwater (Suppakittpaisarn et al 2019). Some other green infrastructure methods include infiltration planters, trees, and tree boxes (Zaljeska-Jonsson et al 2020).

Benefits

Green infrastructure provides a variety of benefits for both the ecosystems and social and human well-being (Sadeghi et al 2019; van Vliet & Hammond 2021). Social benefits of green infrastructure include enhanced community aesthetics, livability, and property values; improved community gathering opportunities; increased public safety; safe walking and biking routes for the community and more community activities; social inclusion; an increased sense of place; and overall improved productivity of a community (Green Nylen & Kiparsky 2015, 4; Sadeghi et al 2019, 266-279; van Vliet & Hammond 2021, 150). Green infrastructure also creates economic benefits through decreased municipal capital, operations, maintenance, and energy costs. (Green Nylen & Kiparsky 2015, 4).

Physical, spiritual, and psychological health benefits are also derived from green infrastructure. This includes

an overall improved public health, reduced stress, lower blood pressure, lower risk of chronic health conditions like obesity and cardiovascular disease, improved mental well-being, positive effects on cognitive functions including psychophysiological states, inspirational spaces, educational opportunities, recreational spaces, and aesthetic richness (Green Nylen & Kiparsky 2015, 4; Kim et al 2018, 71; Paul et al 2020, 2; van Vliet & Hammond 2021, 150). One very important benefit gained from green infrastructure is the improved harmony between urban and natural ecosystems. Utilizing multidisciplinary design creativity from natural systems to enhance users' health, satisfaction, well-being, and more helps reconnect urban dwellers to nature and to their overall ecoregion (Panagopoulos 2019, 1).

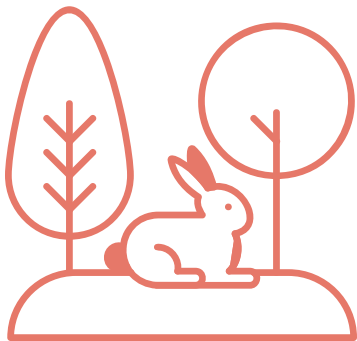
Green infrastructure also provides many different ecological benefits. These include improved wildlife habitat, improved air quality, food production, genetic resources, increased biodiversity, water purification and regulation, pollination, temperature regulation, and climate mitigation (Green Nylen & Kiparsky 2015, 4; Suppakittpaisarn et al 2019, 2; van Vliet & Hammond 2021, 150). Green stormwater infrastructure creates benefits such as reduced stormwater runoff volume and flood risk, helps cities reduce combined sewer overflow discharges, replenishes groundwater, contributes to stream base flow, and treats surface water (Green Nylen & Kiparsky 2015, 4; Suppakittpaisarn et al 2019, 2; United States Environmental Protection Agency 2011; van Vliet & Hammond 2021, 150). Green infrastructure is also capable of reducing urban heat island effects, energy use, and greenhouse gases, as well as lowering noise pollution, creating wind and fire protection, and controlling pests (Brzoska & Spage 2020, 7-9; Green Nylen & Kiparsky 2015, 4; Suppakittpaisarn et al 2019, 2).

Perception of Green Infrastructure

Green infrastructure can be present in a wide variety of scales and areas. This includes entire ecoregions, to small-scale plantings in an urban area. They can be conventional landscapes and elements such as parks and street trees or any other type of functional landscape like bioswales and rain gardens (van Vliet & Hammond 2021). It has been shown that people prefer landscapes that have many trees and shrubs, but green stormwater infrastructure plantings such as perennial plants, tall grasses, long-stemmed flowers, large sedges, sedums, and native plantings rich in biodiversity can be seen as messy or weedy (Suppakittpaisarn et al 2019). Habitat selection states that animals prefer the types of environments in which they thrive. This can also be applied to people as they prefer landscapes that are useful and supportive of human functioning (Suppakittpaisarn et al 2019).

Suppakittpaisarn et al (2019) discussed a study where people looked at images of urban settings and natural environments after stress. The ones who looked at natural environments were shown to have reduced stress quicker than the ones who looked at urban environments. It is also said that people spend time and accept landscapes that they prefer – known as “cultural sustainability” (Suppakittpaisarn et al 2019, 2). This means that small cues that show care for a landscape will lead to a collective stewardship of the land. Designers and laypeople also have different preferences for landscapes. Designers prefer the ecological functions and services of the “messier” landscapes, while laypeople may see the space as somewhere to relax (Brzoska & Spage 2020; Suppakittpaisarn et al 2019).

Public green infrastructure is also vital to creating a highly livable city (Panagopoulos 2019; Parker & Simpson 2018). A highly livable city contains social and economic benefits, local and international economic stimulus, a high level of local community involvement and personal connections, and an increased sense of pride from residents. Green infrastructure offers this through an increased sense of place and attachment to a community and provides opportunities for residents to interact with each other. Parker and Simpson (2018) have stated there are six public green infrastructure attributes that contribute to a highly livable city. These include the presence and persistence of green infrastructure in the urban landscape, the quality of those spaces, easy and equitable access, the opportunity for urban dwellers to experience and engage with nature, internal walkability, and the need for tree canopy cover (Panagopoulos 2019; Parker & Simpson 2018).



Ecological Education

Grade School Education Related to Ecological Systems

Ecological education is a way to reconnect people to nature. When people understand and have an emotional connection to the land and ecosystems around them, they are more likely to take care of it (Smith & Williams 1999; Song 2008; van Vliet & Hammond 2021). However, this concept seems to be best instilled at a young age which is why I think grade school ecological education is essential. This is also applicable to the First Christian Church (FCC) site as churches have a wide range of ages of members and educational experiences need to occur in public spaces, so the site is suitable for learning opportunities. The FCC also offers childcare services which relates to the grade school education aspect.

An issue with many environmental education curricula is that they are often generic and are intended to be used by teachers across the United States. This removes the personal connection with peoples' immediate surroundings and creates the ability for children to be completely isolated from the natural world (Smith & Williams 1999). Many teachers themselves also lack

knowledge of the ecosystems around their school because they teach in an area where they did not grow up and have possibly never learned to view the natural world with intellectual wonder. Another issue with traditional ecological education is that it is often problem-centered and has a negative perception, focusing on subjects such as pollution, extinction, and global warming instead of celebrating and honoring the wonders of the environment (Smith & Williams 1999, 47-48; Song 2008, 13-14).

Smith and Williams (1999) conducted ecological education teaching methods with fourth to eighth-grade children. They focused on the school grounds as other ecological sites were not available to the school. Focusing on the school grounds allowed students to participate in the landscape more deeply by continuing their ecological education during lunch and recess while also educating their peers. During field exercises, the relationship between teachers and students is more collegial. Instead of a question-and-answer format, dialogues and discussions are created that stem from previous experiments. In this environment, both students and teachers can revel in nature. It has also been shown that students respond better to the complexity of nature than a simplification. This allows them to ask questions and create follow-up investigations. An emotional connection to nature encourages students to want to learn, helps people become more aware and conscious of their environment, and reconnects people to place (Smith & Williams 1999, 50-55).

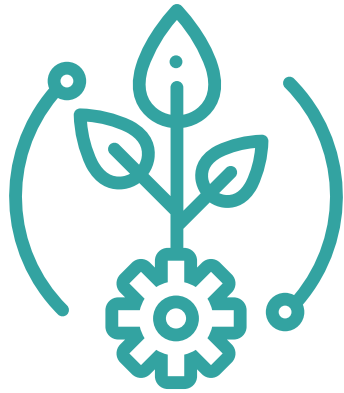
Public Art as Ecological Education

“Art is one of the most powerful tools for enhancing environmental education for K-8 students. Art makes environmental education more experiential and helps to build appreciation, awareness, and a sense of shared responsibility for nature that students may carry throughout their lives. Both environmental and art educators have developed approaches that unite these fields to foster powerful cognitive, personal, and moral development in exciting, innovative ways” (Song 2008, 13).

The discussions by Smith and Williams (1999) and Song (2008) show just how impactful public art can be in the educational context. Many ecological artists try to alert viewers to issues through shock, humor, or educational signage. Other artists attempt to educate people on the character of ecoregions through ritual, performance, and process drama. A newer method of ecological education is directly engaging community members through “ecological public art projects”. This creates a sense of connection with community members and the environment and creates a deeper connection between people and place (Song 2008, 13-17). Utilizing public art as a means of ecological education allows people to “nurture an appreciation and love for the environment, reflect on its value, understand human interdependency, and strive for improvement in ecological conditions” (Song 2008, 19). Art also helps people learn about nature in a fun, stimulating, and hands-on way that many traditional ecological education techniques lack (Song 2008, 19). This can be applied to artistic green infrastructure in Grand Mere as it can utilize public art pieces to help educate users.



Figure 2.1. KSU International Student Center Rain Garden



Eco-revelatory Design

Public art can also be used in a multitude of ways. An existing design concept within the field of landscape architecture is eco-revelatory design. Eco-revelatory can be described as “a design strategy that attempts to enhance site ecosystems as well as engage users by revealing ecological and cultural phenomena, processes and relationships affecting a site” (Konakl 2013, 209). This design concept has also been shown to reconnect people to nature – a goal that this proposal aims to achieve (Konakl 2013). There are two methods that are used to accomplish this: mimic nature and use nature. Mimicking nature allows designers to demonstrate ecological processes and relationships. Native shrubs mimic adjacent near ones, and water features can draw attention to the overall watershed. Using existing nature also shows users the functionality of local ecosystems (Konakl 2013). There are also different principles behind eco-revelatory design. These include:

“Abstraction and simulation of natural processes; New uses of landscapes producing deeper caring for life and ecological processes; Signifying features that speak for natural/cultural processes that might otherwise remain invisible; Expose infrastructure and process; Reclaim landscapes so that the past is remembered; and

Change perspectives by structuring how we interact with the Landscape” (Konakl 2013, 219).

Other important criteria for eco-revelatory design include visibility, sustainability, use of native plants, observability, multifunctionality, legibility, and the ability to raise curiosity (Konakl 2013). Visibility pertains to being able to showcase natural processes to users and that can be accomplished using native plants. The sustainability aspect aims to integrate human society with the natural environment to benefit both. This can be done by moderating resources. Observability and visibility are connected they aim to showcase natural processes and need to be observable by users. Multifunctionality is said to be the most important characteristic of eco-revelatory design. It leads to efficient use of the land as users can interact in recreation and education, while the site itself provides wildlife habitat and stormwater management. Multifunctional sites also provide social, environmental, and economic advantages. Legibility refers to how a message is created throughout the design. It is said that people experience spaces with all the senses and can create a spiritual connection with the environment through effective eco-revelatory design (Konakl 2013). Another important aspect is the ability to raise curiosity. If a design can pique users’ interests, they are more likely to explore and learn about their ecosystem. This also relates to ecological education and how personal exploration leads to a deeper understanding of the environment. This is why eco-revelatory design aims to encourage user interaction with natural processes. (Konakl 2013). This is directly applicable to the FCC site as these concepts can be used to better engage users and encourage them to interact with the environment.



Placemaking

Placemaking Overview

With the loss of public green space through rapid urbanization, along with the disconnect between people and place and lowered understanding of ecological functions, placemaking can help create a sense of pride, place, and community in an area. Placemaking can be described as processes and strategies used to revitalize and activate urban spaces that often focus on using art as a tool to bring communities together (Loh et al 2022, 1; Razi & Ziminski 2022, 22-23). These strategies are used to create sociable, active, public spaces, which also bring increased neighborhood desirability and a sense of identity and attachment. This creates a quality living environment in which people want to live, work, play, and learn. People are drawn to these kinds of places that create a sense of place, which are areas that people recognize and identify and where they feel a sense of belonging. Having a sense of place and belonging in a community also leads to collective care for the land, including green infrastructure implementations (Loh et al 2022, 1-2; Razi & Ziminski 2022, 22-23). Another, more specific, form of placemaking is creative placemaking. Creative placemaking specifically engages art and

culture to beautify, regenerate, and revitalize public spaces and use art as a tool to bring stakeholders and communities together. It also aims to attract new workers and private investment. It also has the potential to bring diverse people together to celebrate and inspire the community (Courage & McKeown 2018, 11-12; Loh et al 2022, 1-4; Razi & Ziminski 2022, 22). This can be accomplished through artistic green infrastructure in Grand Mere to help create a sense of place in the area since it has also been shown that green infrastructure creates a sense of place.

Public Art as Placemaking

Art and public art are often a priority in creative placemaking as they intentionally beautify and create a sense of identity and attachment to an area. This level of attachment to place and the arts can “measured through language and photos that users take of a place, generating meaning of a piece of art specifically, or a place generally” (Razi & Ziminski 2022, 22). Razi & Ziminski (2022) stated that “Art is a medium to make meaning and activate civic action, and placemaking uses art to brand a place and engage residents. The more a project is in line with stories of a place's history and local residents are reflected in the placemaking project, the better the art can promote a sense of belonging, ownership, and enhance a sense of place.” (23). This shows how placemaking can use art effectively to create attachment and a sense of belonging to an area.



Artful Rainwater Design

Placemaking is essential when it comes to highly livable cities. Green infrastructure is a method of creating a sense of place because it creates socio-cultural meanings and emotional attachments to a spatial setting. Green infrastructure provides space for informal social interaction and shared well-being and creates visual quality, spatial character, and an aesthetic perception. Recent placemaking initiatives provide the potential to create a sense of place and identity within communities. Placemaking through public art has been shown to create outdoor public spaces that connect people to their community and environment. This connection of ideas such as public outdoor space, reconnecting people to nature, and creating opportunities for people to engage with each other lends the opportunity to create artistic green infrastructure spaces for people to learn and gather (Courage & McKeown 2018, 12; Parker & Simpson 2018, 2; Razi & Ziminski 2022, 28-36; van Vliet & Hammond 2021, 146). These concepts are directly applicable to the FCC site as the area has a natural drainageway and can use art to reconnect people to nature.

A prime example of artistic green infrastructure is artful rainwater design. Artful rainwater design combines amenity and utility for stormwater management through education, recreation, safety, public relations, aesthetic richness, and green and gray infrastructure techniques to create spaces for people to gather, learn, and reconnect to the environment they live in. These categories are used to celebrate rain and encourage visitors to learn about and enjoy the rainwater-focused landscape. This type of stormwater management aims to be sustainable, visually appealing, and informative about how water is managed (Echols & Pennypacker 2015).

Conclusion

Worldwide rapid urbanization has led to the loss of public open space, heightened climatic and storm conditions, and sedentary lifestyles of urban dwellers. This in turn has created a growing disconnect between people and the natural environment. These issues call for new techniques to reconnect people to nature and create a sense of place in built environments.

Public open space with the implementation of green infrastructure addresses climate and stormwater management issues as well as the disconnect between people and place. Green infrastructure and green stormwater infrastructure create ecological benefits such as reduced stormwater runoff volume and flood risk, replenishment of groundwater, contribution to stream base flow, treatment of surface water, and more. Public green space provides the potential for people to recreate, socialize, exercise, engage with nature, and engage in spiritual reflection which is all essential for the human psyche and overall health and well-being. Individual exploration and investigation of natural environments lead to a deeper emotional and intellectual connection to the environment. This can be further enhanced through public ecological education using public art, educational gathering spaces, and nonformal education.

Placemaking and public art also address the issue of the disconnection between people and place while simultaneously creating a sense of place and addressing environmental issues. Creative placemaking often utilizes the arts to create spaces for people to engage with each other and their environment. These environmental art pieces raise awareness and educate visitors on issues such as water quality, pollution, and more. While placemaking has had a history of gentrification and displacement, when executed correctly it can enhance city livability, beautify the community, promote the economy, and more. Overall, public open space, green infrastructure, and creative placemaking all aim to create health and social well-being benefits for communities. Artful rainwater design encapsulates many of these ideas by creating public space for stormwater utility and amenities. The combination of these ideas and goals has the potential to reconnect people to nature, educate the public about ecological concerns, create a sense of place and identity within communities, mitigate climatic issues, and provide health and well-being benefits. Figure 2.1 illustrates linkages, frameworks, and maps between these concepts and ideas.

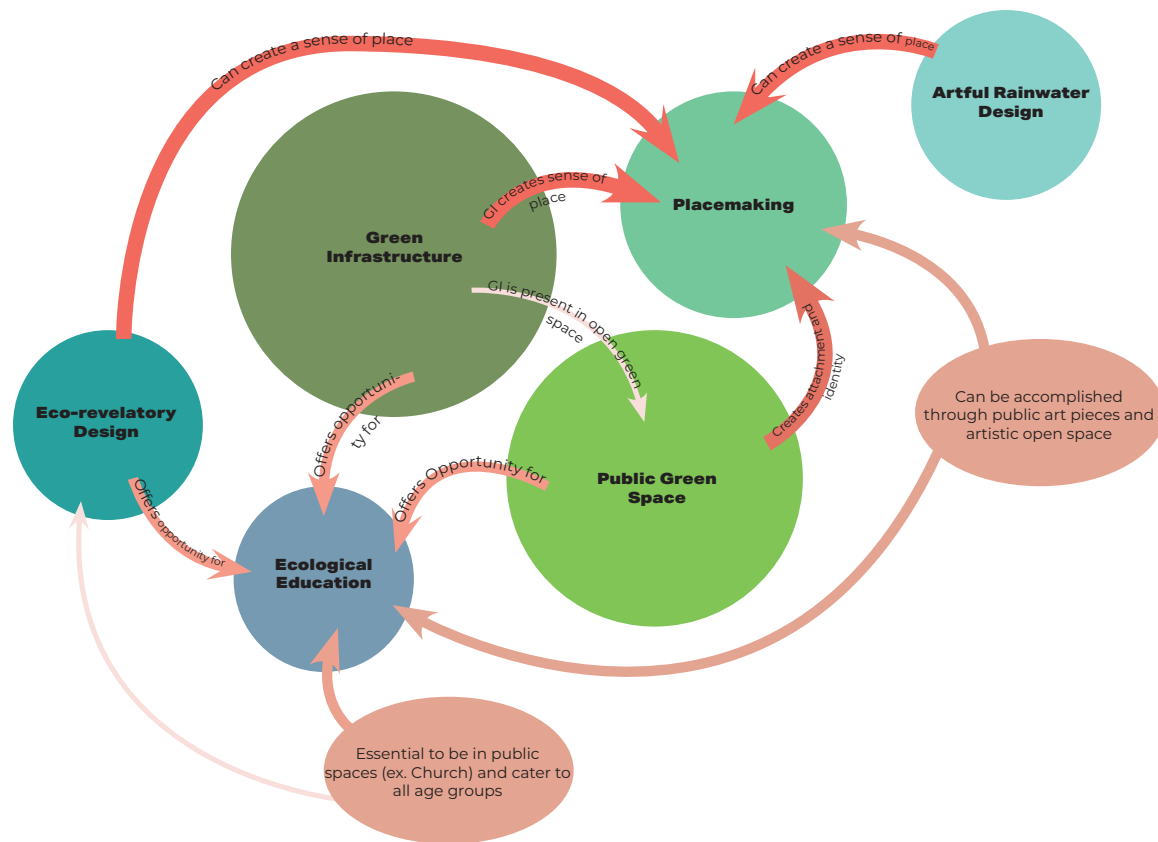
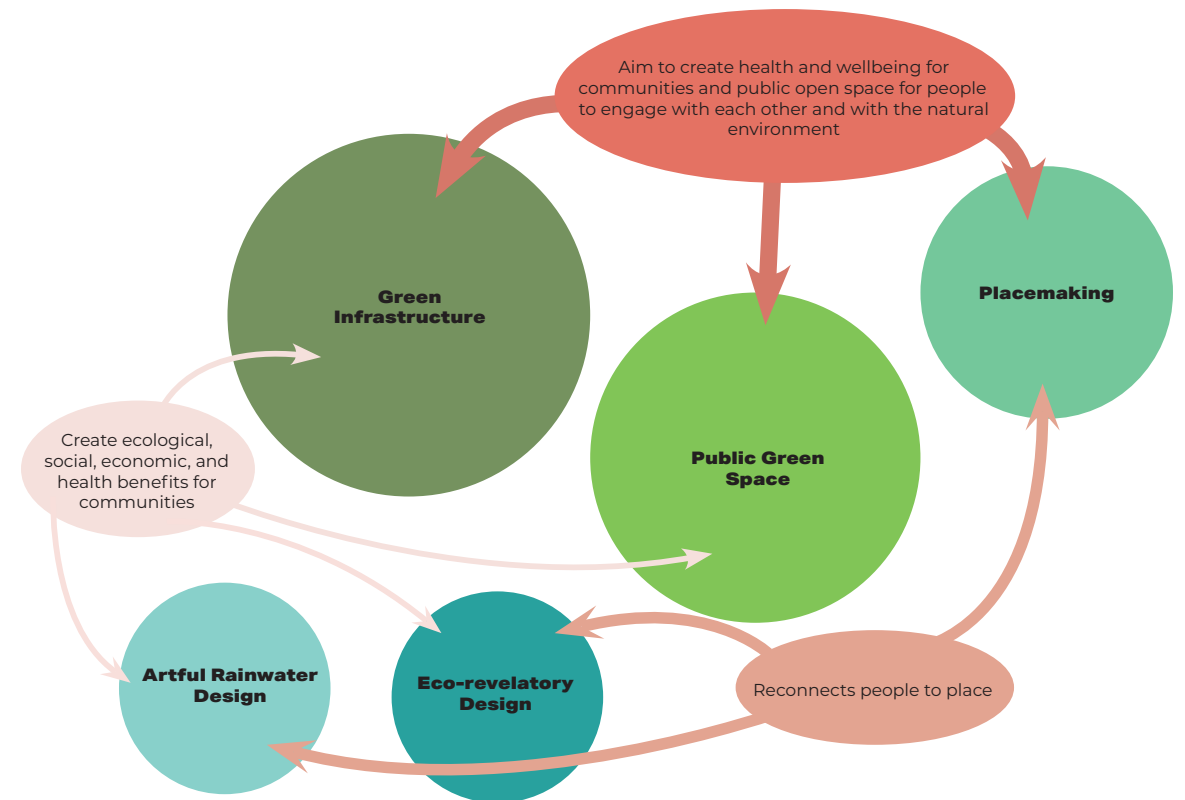


Figure 2.2. Linkages and Frameworks



A photograph of a rocky hillside covered in dry, yellowish-brown grass and scattered light-colored rocks. The hill slopes upwards from the foreground towards the right. The sky is a clear, pale blue. In the upper right corner, there are some small, dark, leafless shrubs. The overall lighting suggests a bright, sunny day.

03: SITE SELECTION

Site Selection

The site is located at the First Christian Church and the adjacent residential development complex across Grand Mere Parkway in Manhattan, Kansas. This site is also located on a natural drainageway fragmented by development. The existing drainageway can be expanded into a green infrastructure element and serve as an artistic and educational space. The existing prairie on site, behind the church and around the apartments, is a means of green infrastructure and can be explored more closely through personal exploration and observations. Ecological education can take place as the site is quasi-public which allows for visitors to explore and make their own observations. An artistic element in this site would also help create a sense of place in the Grand Mere area and draw people to the church and outdoor gathering area focused on green infrastructure. This artistic element can utilize local, contextual materials, forms, and eco-revelatory aspects to create a sense of place in an established neighborhood.

The site is divided by a major road in the neighborhood and offers visibility to anyone driving or walking past. This road also offers an opportunity to strengthen the ecological and visual connection of the fragmented drainageway. Future potential connections to the project include the Colbert Hills Clubhouse green space, the Workforce housing addition, and the older residential neighborhoods in the area. These three other sites were chosen for future research potentials because the project could be implemented in three different ways: existing open green space, new residential developments, and retrofit. These potential future sites are also at different scales and can show how this sort of project could be adapted in different ways. See Figures 3.1-3.2 for site locations.

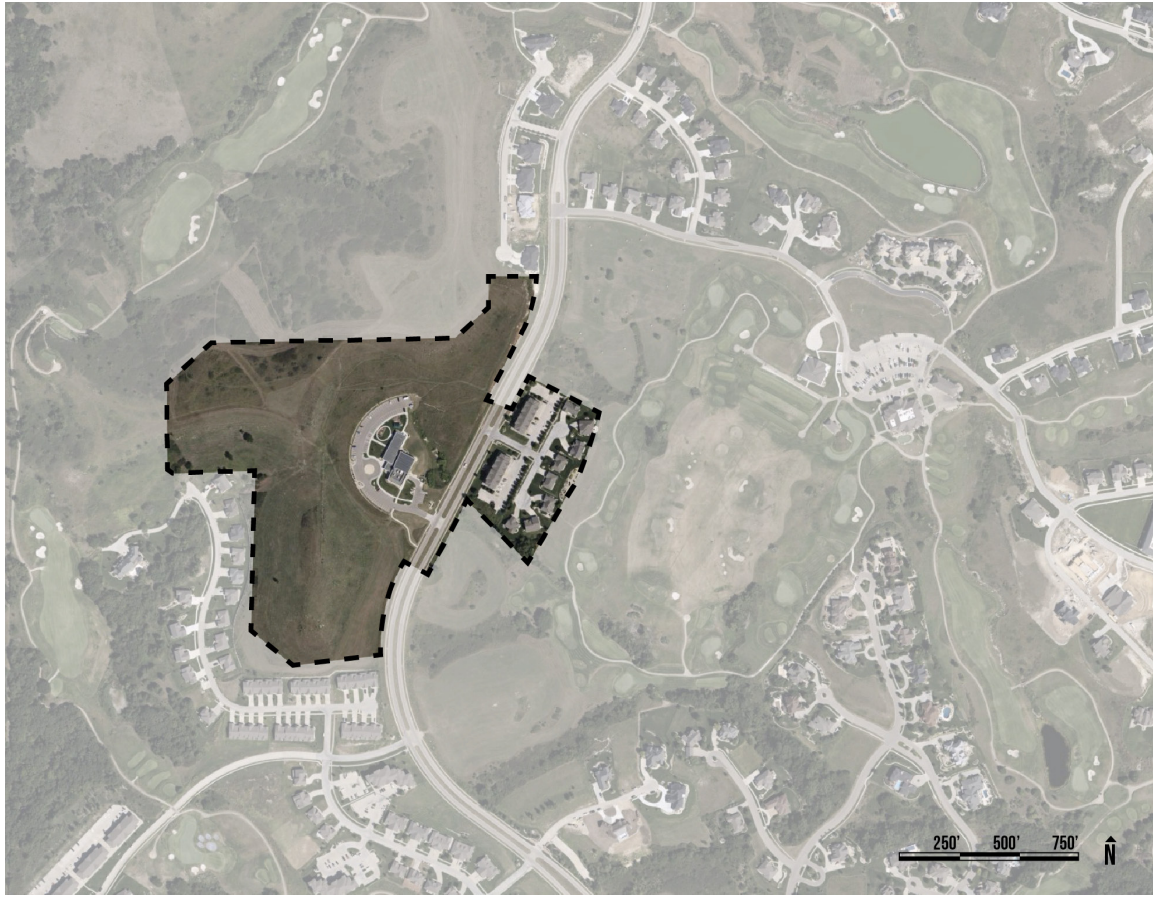


Figure 3.1. Primary Site



Figure 3.2. Future Research Potentials

A landscape photograph featuring a barbed wire fence on the left, with dense autumn foliage in shades of orange and red. The background shows a rocky, grassy hill under a clear blue sky.

04:

**LITERATURE
REVIEW
ANALYSIS**

Expanded Glossary

Rationale

Analyzing the literature on artistic green infrastructure, ecological education, placemaking, and public open space is important to find precedents and learn how these ideas and concepts have been discussed and utilized in the past and theory. It is also important to find key terms, themes, and relationships within the literature. This data was collected using the digital search and find tool, which helped produce the expanded glossary. Forty papers, articles, and other documents were searched. They included the articles used in the literature review and other more informal forms of literature such as the American Society of Landscape Architecture interview with Herbert Dreiseitl and Ecological Landscape Alliance case study of Artful Rainwater Design (Sundberg 2017; Green n.d.). This search was guided by the following concepts: green infrastructure, artistic expression, sense of place, and opportunities for ecological education. These terms and concepts helped inform design guidelines and determine relevant precedents to base these guidelines on. The literature review analysis produced a more extensive and in-depth glossary as well as a concept map that graphically represents how the ideas connect

and the importance of key terms and concepts. Through the map and expanded glossary, precedents were chosen. Figure 4.1 is the final expanded glossary.

Terms and concepts investigated include:

- Artful Rainwater Design
- Artistic Green Infrastructure
- Creative Placemaking
- Eco-revelatory Design
- Ecological Education
- Green Infrastructure
- Green Stormwater Infrastructure
- Grey Infrastructure
- Placemaking
- Public Green Infrastructure
- Public Open Space
- Urban Green Infrastructure
- Urban Greenspace

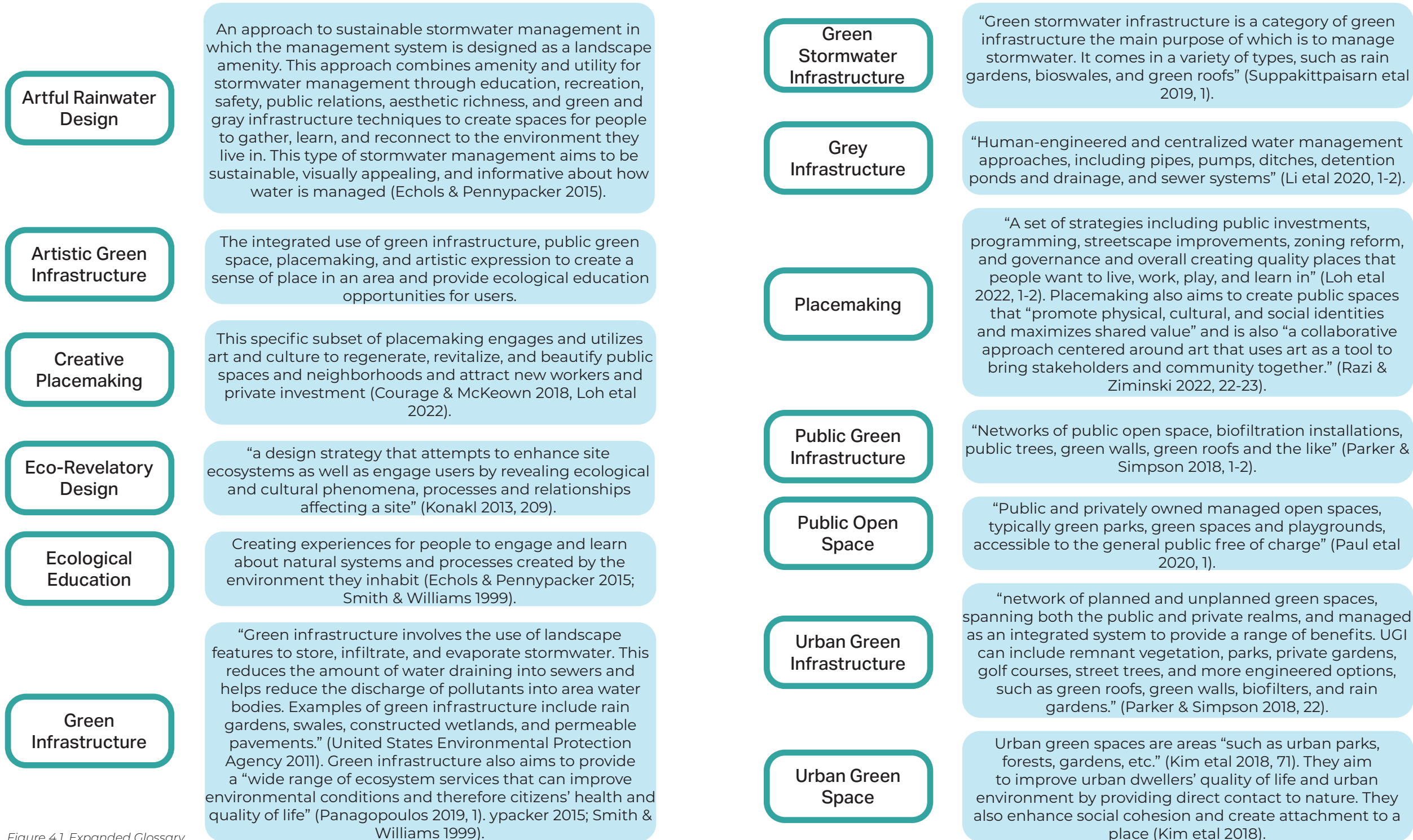


Figure 4.1. Expanded Glossary

Analysis & Discussion

Listing and defining these terms has helped organize the concepts across the literature. Writing these down and organizing them helped to better understand what each of the topics consisted of. Understanding what each topic consists of is essential to applying these ideas in a meaningful way to the First Christian Church (FCC) site. The listing and defining of these terms also laid a framework for the concept map, which sorts and breaks down the topics further.

Concept Map

Rationale

The main topics of the project were broken down into Green Infrastructure, Public Green Space, Placemaking, Ecological Education, Artful Rainwater Design, and Eco-revelatory Design. These topics were then broken down further into the main goals and related terms to the topics. These goals and related terms were then further broken down into goals, key terms and principles, functions, and components. This helped to further understand what each topic consists of and how they can work together. It also shows how the topics overlap and achieve similar goals or have the same functions or components. The relationships are also more easily distinguished when they are shown visually. Figure 4.2 is the final concept map and illustrates the relationships between topics.

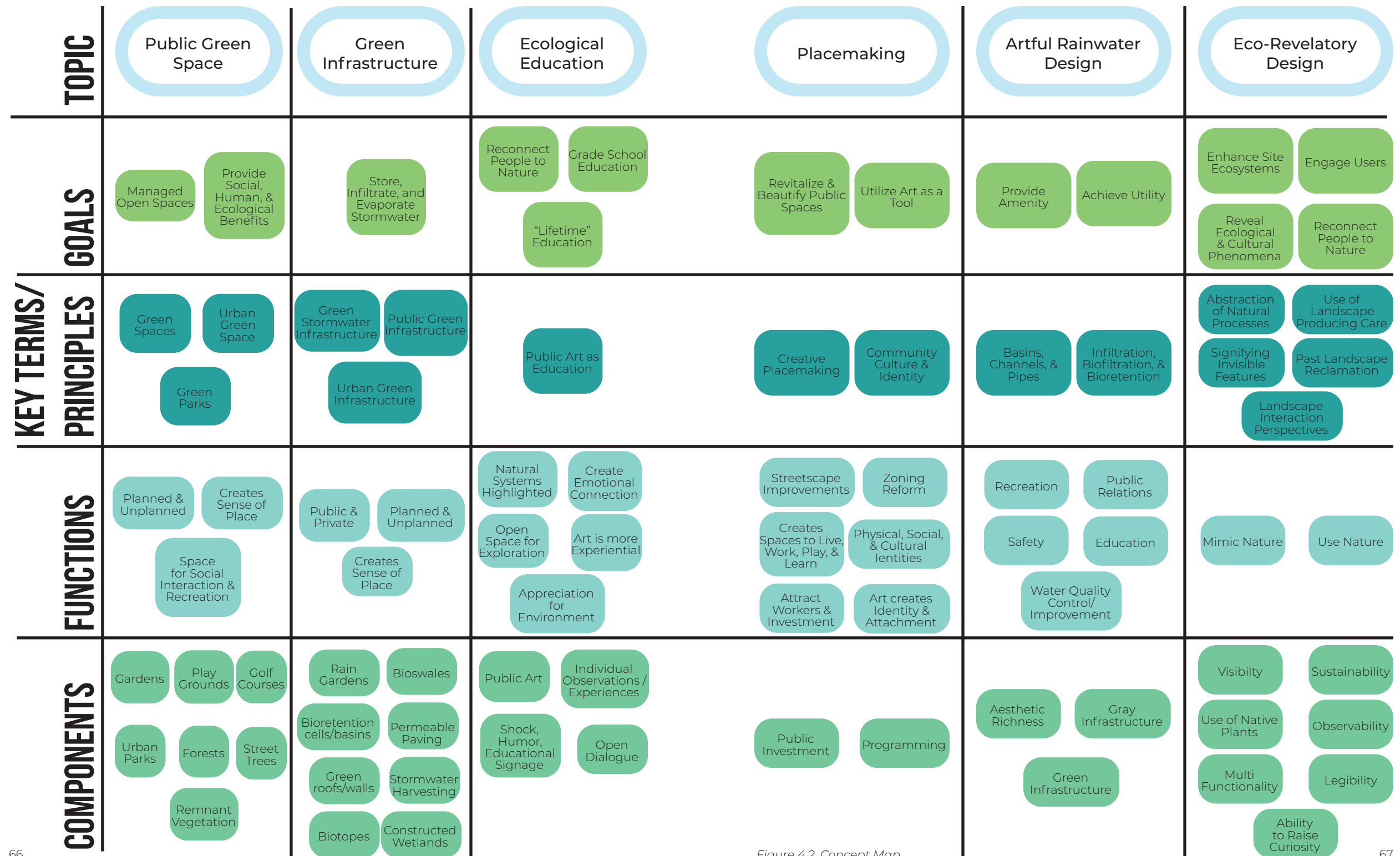


Figure 4.2. Concept Map

Analysis & Discussion

The concept map helped visualize just how each topic was related and how they can work together. This allows for the data to be analyzed visually and compare terms and phrases across the literature. Through this map, it was revealed that many of the terms overlapped and connected in some way.

Public green space, green infrastructure, and eco-revelatory design all include some sort of ecological process and can highlight those. Green infrastructure and public green space also contain many similar key terms and principles, functions, and components. Green infrastructure can be present in almost any public green space, but green infrastructures focus on the storage, infiltration, and evaporation of stormwater.

Ecological education, placemaking, eco-revelatory design, and artful rainwater design were all shown to help reconnect people to nature and have an emphasis on public space. It was also shown that those topics can also utilize public art to achieve their goals including reconnecting people to nature, creating a sense of place, revitalizing and beautifying public space, enhancing site ecosystems, or achieving amenity.

Eco-revelatory design and artful rainwater design were also quite similar. Both focus on natural, ecological processes and highlight those to help educate users. They also both use native plants and attempt to achieve multi-functionality.

If combined and utilized correctly, these topics can be applied to the FCC site to create a public space that utilizes art to educate users of the larger ecosystem they inhabit and utilize green infrastructure functions to store, infiltrate, and evaporate stormwater. These connections and concepts have helped me choose and analyze precedents and aid my own design thinking.

A scenic landscape at sunset. The sun is a large, bright yellow orb in the upper left corner, casting a warm glow over the scene. The sky is a mix of orange, yellow, and light blue with scattered clouds. In the background, a row of houses is visible on a distant ridge. The middle ground features rolling hills covered in green grass and clusters of trees with green and yellowing leaves. The foreground is dominated by dense foliage with vibrant autumn colors, including reds, oranges, and yellows.

05:

**COMPARATIVE
PRECEDENT
ANALYSIS**

Criteria for Precedents

Important criteria essential to artistic green infrastructure are amenity and utility. Amenity according to Echols & Pennypacker (2015, 24) includes education, recreation, safety, and aesthetic richness. To encapsulate artistic green infrastructure, artistic expression and sensory richness have been added to this list to replace aesthetic richness. Utility includes green infrastructure features and how they function. The list of features includes bioswales, rain gardens, bioretention cells or basins, permeable pavers with underground storage, green roofs and/or walls, and stormwater harvesting systems. The selection of precedents was based on the type, location, and setting of projects. This includes geographic location along with contextual location. Finally, precedents were analyzed for the sense of place and how the project creates that. Information was analyzed through Google Earth exploration, project drawings and goals, and information from designers such as programming. Figure 5.1 shows where each precedent is located geographically, and Figures 5.14-5.17 are the Comparative Precedent Matrix broken down into different sections.

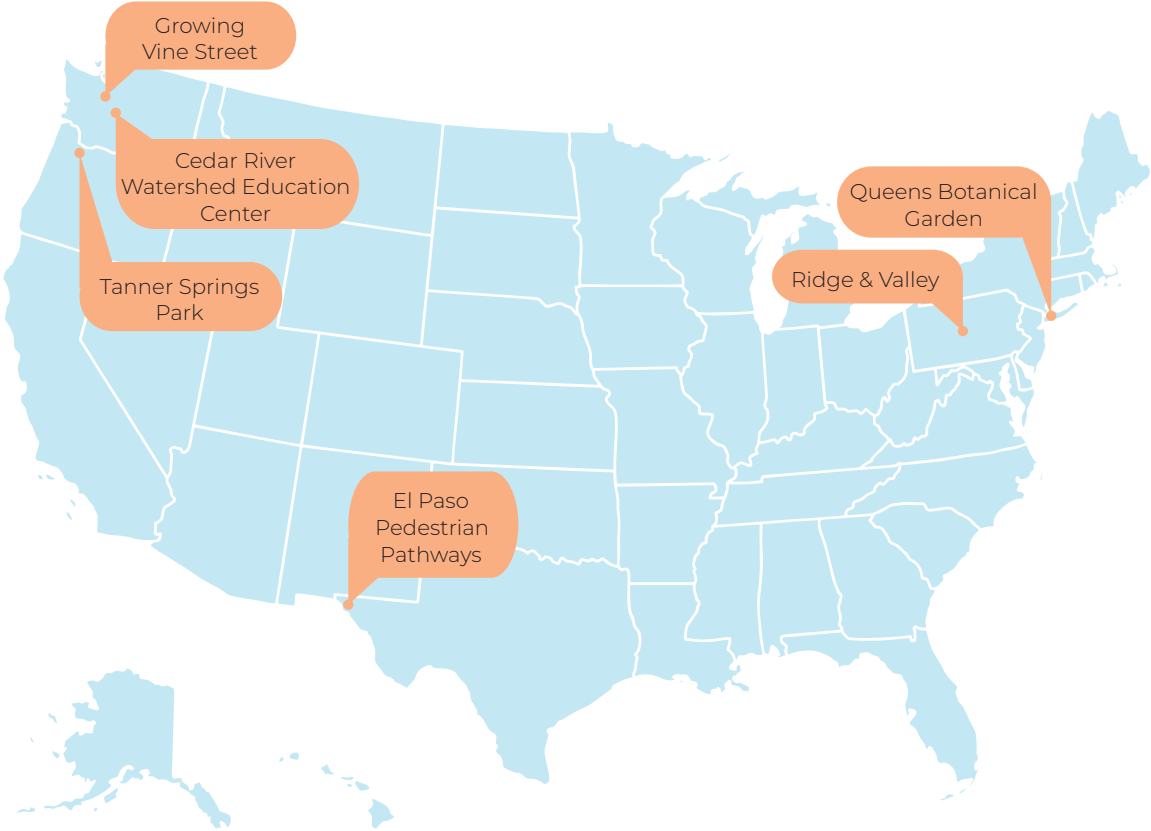


Figure 5.1. Precedent Map

Growing Vine Street: Seattle, WA

Precedent Analysis

Growing Vine Street is located in Seattle, Washington, and is an urban watershed and street park. It was chosen as a precedent as it achieves goals of green infrastructure, ecological education, placemaking, and public art. Green infrastructure is accomplished through the various rooftop planters, vegetated downspouts, bioretention planters, and the “Beckoning Cistern” – an artistic rainwater harvesting system created by Buster Simpson. The “Cistern Steps” also act as bioretention and filtration as the tiered steps catch and collect runoff from the roofs and overflow from the “Beckoning Cistern”. The candelabra downspouts also act as green infrastructure as they are vegetated systems that filter and catch runoff while directing it to the “Cistern Steps”. It also creates an opportunity for visitors to engage with the water cycle, learn how water gives life to plants and adjacent community gardens, and overall celebrate water.

Sensory richness is accomplished through the scents, textures, and colors of native planting materials and the tactile richness of the water. Artistic expression can also be seen through the “Beckoning Cistern” which mimics Michelangelo’s Sistine Chapel Adam painting, “Cistern Steps”, and the candelabra downspouts. The area also provides public space to meander and creates safety with the water on-site being engineered to stay consistently at a shallow depth. There is also a strong sense of place within Growing Vine Street. This is accomplished by the heavily vegetated site in combination with the candelabra downspouts, the “Beckoning Cistern” (177-181), and “Cistern Steps” (177-181) bioretention planters that convey water from terrace to terrace (Echols & Pennypacker 2015, 177-181).



Figure 5.2. Growing Vine Street Signage
Tone Walker. 2010.



Figure 5.3. *Beckoning Cistern and Cistern Steps* Tone Walker. 2010.

Applicability

Growing Vine Street is applicable to the First Christian Church (FCC) site as it utilizes existing buildings for green infrastructure and ecological education – similar to what could happen at the FCC site. The idea of tiered steps would apply well to the FCC site as the topography is a bit extreme in front of the building. The site at the FCC also has a large roundabout behind the building that could serve as an area for a sculptural element and focal point. Similar green infrastructure elements could be implemented in the fragmented drainageway to store, filter, and evapotranspire stormwater.

Inspiration for Projective Design

- Artistic Cistern for Water Collection
- Tiered Element Due to Site Topography
- Artistic Downspouts for Water Conveyance
- Sensory Richness in Native Plantings and Water Usage

Cedar River Watershed Education Center: North Bend, WA

Precedent Analysis

The Cedar River Watershed Education Center located in North Bend, Washington, specifically near Rattlesnake Lake in the Cascade Foothills. It was selected as a precedent as it utilizes green infrastructure through green roofs, various kinds of water collection areas, and native plantings around the buildings. A constructed stream and restored native plant community is used to show the role of soil, plants, fungi, mosses, and microbes in purifying water and creating habitat for both aquatic and terrestrial life. Living roofs also filter and retain runoff while the Rain Drums store water. The project also accomplishes the goals of ecological education through the five connected buildings that educate and engage users with the water cycle and watershed protection. There is a “Look and Lichen Learning Lab” that allows students and visitors to study water samples and other natural processes under microscopes and perform their own explorations. The site also offers field explorations of Rattlesnake Lake Watershed. The education center includes a research library and auditorium where visitors can further their education about the watershed they inhabit.

Another relevant aspect of the education center is the “Water Drums” – an eco-revelatory art installation by Dan Corson. These drums urge visitors to listen and learn about the water cycle through a computerized irrigation system that drops water onto the drums and then surrounding garden. The site also includes a root system etched onto the floor of the main entry building and root ball sculptures with strands of gas-filled glass to mimic the flow of water and energy. A central stone fireplace and forest court also offer sensory richness and an area for recreation (“Education Center Features & Exhibits - Utilities | Seattle.Gov.” n.d.).



Figure 5.4. Dan Corson's
“Water Drums”
Dan Corson. N.d.



Figure 5.5. Cedar River Watershed Education Center Dan Corson, 2003.

Applicability

Cedar River Watershed Education Center is applicable to the FCC site in several ways. The education center contains buildings, similar to the FCC. Green infrastructure can be built around the building as the education center does through the green roofs, vegetated and rock swales, a courtyard where rainfall and movements of water are made visible in artistic ways, and a forest court. A planted, interactive area could be beneficial for the Church site as it provides an area for recreation and education for users. An artistic element such as the “Water Drums” could be implemented at the site as a source of artistic expression and sensory richness that reveals more about the ecosystems present. For an outdoor space created at the church – an engraving that speaks to the larger watershed or ecosystem would be beneficial.

Inspiration for Projective Design

- Eco-Revelatory Artistic Element such as “Water Drums”
- Green Infrastructure Elements such as Restored Native Plant Communities
- Etching in Floor that Represents Local Ecosystems
- Sculptural Element Similar to Root Ball Sculptures
- Forest Court for Recreation and Education

Tanner Springs Park: Portland, OR

Precedent Analysis

Tanner Springs Park in Portland, Oregon in the Pearl District is an urban waterscape and public park. It was chosen as a precedent as it utilizes green infrastructure, creates a sense of place, utilizes artistic expression, and offers opportunities for ecological education. Green infrastructure is used in the form of a wetland ecosystem for rainwater collection from adjacent buildings and paved surfaces. Water on site is infiltrated by the different plant communities and migrates to a subgrade cistern where water is cleansed via ultraviolet light. The site contains a wetland pond that is reminiscent of the previous ecological conditions before industrialization.

The project also used placemaking in the design process as the team held three different public engagement events. Artistic expression is shown through the “Art Wall”. This wall is made of historic railroad tracks and contains glass inserts with painted images of local wildlife that once flourished in the area. Sensory richness is achieved through the colors, textures, and smells from native plantings, along with the textures and materials used in the “Art Wall” and constructed wetland ecosystem. The public open space of the site also allows visitors to make their own ecological discoveries of the area. The wetland ecosystem was created to honor the natural ecosystem of the area before industrialization and the glass inserts depict wildlife that were once present, which also contributes to the educational aspect of the site (“Tanner Springs Park.” 2010).



Figure 5.6. Constructed Wetland at Tanner Springs Park Cord Rodefeld. 2007



Figure 5.7. Walkway and Art Walls over Wetland
Kyle Gradinger, 2007.

Applicability

Tanner Springs Park is applicable to the FCC site as it is designed with public space near other public buildings to artistically utilize green infrastructure and connect people to their ecoregion and nature. An element like the “Art Wall” could be implemented to show and educate users about previous ecological conditions in the area. Historic plant communities are also used in Tanner Springs Park, which could be applied to the FCC site to further connect users to their ecosystem. These plant communities could be highlighted in the fragmented drainageway and could visually invite users to traverse the area.

Inspiration for Projective Design

- Artistic Element such as the “Art Wall”
- Historic Native Plant Communities
- Invite Users to Interact with Drainageway

El Paso Pedestrian Pathways: El Paso, TX

Precedent Analysis

The El Paso Pedestrian Pathways in El Paso, Texas were selected as a precedent because the sites are interconnected and focus on public green space, and placemaking and artistic expression were important in the design process. The sites consist of three different areas: San Jacinto Plaza, the Mills Avenue Promenade, and Durango Street Improvements. The sites are located in the Arts District of El Paso which is why artistic expression was essential in the design process. Multiple local artists were involved in creating sculptures for the project. The project also includes axial pathways, fountains, and seating. The site achieves sensory richness through the bright-colored streetscape paintings, the textures and colors of native plantings, and the various water features. Placemaking also played an important role as multiple community engagement events were held during the process. The project contains a major public plaza where people can learn and recreate. There are also life-size games and a table tennis courtyard, chess courtyard, bocce court, splash deck, and a stage with amphitheater seating. Green infrastructure was less prevalent than in other precedents, but native plants introduced through the site reduced stormwater peak runoff rates by 15% with 273 new plantings of Chihuahuan desert natives ("El Paso Pedestrian Pathways." 2023).



Figure 5.8. Sculpture at San Jacinto Plaza
Visit El Paso. 2016.



Figure 5.9. El Paso
Pedestrian Pathways
Johna Singleton/SWA Group. N.d.

Applicability

The El Paso Pedestrian Pathways are applicable to the FCC site as these areas are interconnected and show potential future connections to the area – just as the FCC site could possibly be connected to the clubhouse site in the future. Artistic elements such as the sculptures at the El Paso Pedestrian Pathways could help create a sense of place at the FCC site. The focus on public green space can also be applied to the FCC site as those spaces allow people to gather and interact with each other.

Inspiration for Projective Design

- Sculptural Elements to Increase Sense of Place
- More Public Green Space for Visitors and Nearby Resident Interaction. Learning/ Exploration, and Recreation
- Planting Beds that Provide Seating

Ridge & Valley at the Penn State Arboretum: University Park, PA

Precedent Analysis

The Ridge and Valley project is located at the Penn State Arboretum in University Park, Pennsylvania. It is at a University Arboretum within the Spring Creek Watershed and is a free plaza. It was selected as a precedent as it utilizes green infrastructure and ecological education through a plaza attached to a public building. On the face of the plaza is an incised map of the Spring Creek Watershed. This map acts as a rainwater conveyance system as all water on the terrace follows the carved tunnels to a hidden inlet. This incised watershed map acts as artistic expression, sensory richness, ecological education, and creates a sense of place. The map educates users about the larger ecosystem and watershed they inhabit, while providing tactile interest with the flow of water and space to explore.

Surrounding the plaza are native planting beds which act as a wet meadow for biofiltration and infiltration. The project also achieves sensory richness through the smells and textures of surrounding native plants and the texture of the bluestone terrace. Stormwater is conveyed to the surrounding wet meadow through the runnels of the watershed map, and during large storm events, sheet flow sends the water to the plantings. The sense of place is emphasized in the map within the terrace and the material of the terrace itself. The map is designed to represent the larger watershed and bluestone is a local material in Pennsylvania (Echols & Pennypacker 2015, 182-185).



Figure 5.10. Ridge & Valley Plaza
Stacy Levy, 2009.



Figure 5.11. Spring Creek Watershed Plaza Incision
Laura Waldhier, 2019.

Applicability

Ridge and Valley is relevant to the FCC site as it creates public open space – an essential piece in ecological education for a wide range of visitors. This could be applied to the FCC site as it is also a quasi-public building that can provide public outdoor space. The map of the Spring Creek Watershed could also be applied to the FCC site, as that is a way to make people aware of the watershed. A terraced gathering area would also be ideal at the FCC site as the slope in the front of the building is a bit extreme. Native plantings should also be used and can act as green infrastructure surrounding an impermeable surface.

Inspiration for Projective Design

- Incised Watershed Map
- Terraced Gathering Area
- Native Plantings Surrounding Impervious Areas

Queens Botanical Garden: Flushing, NY

Precedent Analysis

Queens Botanical Garden is located in Flushing, New York, and is situated where Mill Creek once was. It was revealed through the matrix that the Queens Botanical Garden has the most extensive green infrastructure system. It utilizes biotopes (artificial shallow ponds with vegetation and gravel substrate) to capture and store runoff from dirty areas of the site, which is then transferred to a cistern that uses ultraviolet radiation to destroy bacteria in the runoff, the clean water is then pumped to a fountain at the entry plaza which feeds a manmade stream that returns to the biotope. In the parking lot, there is the Parking Garden. This area accommodates parking and uses pervious paving and Parking Fingers (islands) to biofilter and infiltrate water. A green roof on the auditorium roof also infiltrates water from the roof of the building. There are also various rain gardens throughout the site used to infiltrate runoff from larger storm events that other green infrastructure implementations cannot handle.

For the Amenity & Purpose section, sensory richness is achieved through the different colors and textures of plants and water such as a frothy fountain, burbling stream, and clear pools. The water conveyance system highlights the water cycle and the main spine recalls Mill Creek. Along with signage, pamphlets, and an interactive touch screen, ecological education is explored at length. The site also allows for recreation through interaction with rainwater features and provides safety with shallow depths of water. Artistic expression is evident as the central spine recalls Mill

Creek and a water trail line guides visitors through the site. The entry fountain is designed to be a focal point, where treated water reemerges to the system. A sense of place is created through the diverse water harvesting and reuse system, along with the reference to Mill Creek and the water line that guides users through the site (Echols & Pennypacker 2015, 212-216).



Figure 5.12. Queens Botanical Garden
Queensbotanicalgarden, 2015.



Figure 5.13. Water Feature
at Queens Botanical
Garden
Kristy Albano and Matt
Pickering. 2015.

Applicability

Queens Botanical Garden is applicable to the FCC site as it contains public buildings as well. Education is explored through pamphlets and interactive signage which the FCC site could provide. The church has provided prairie walk pamphlets in the past, which could be made a permanent installation. The project also provides ample space to meander and walk around, which can be provided through the trails behind the church and along the cuesta. Trails can include educational signage areas to sit, rest, and explore. Queens Botanical Garden is also designed to emphasize and recall Mill Creek, which was the spine of the project. A similar objective can be achieved with the fragmented drainageway within the FCC site; this area can be highlighted and made important. Queens Botanical Garden fountain is a focal point on the site. A water feature or sculptural piece could be added as a focal point at the FCC.

Inspiration for Projective Design

- Intensive Green Infrastructure System
- Parking Garden and Fingers
- Paths Throughout the Site
- Educational Signage and Interactivity
- Guiding Water Trail

Figure 5.14. Amenity & Purpose
Precedent Matrix

	Sensory Richness	Artistic Expression	Safety	Recreation	Ecological Education
Growing Vine Street	Materials used for plantings, native planting textures and smells, tactile richness through wetness - invites users to engage with water	Beckoning Cistern: mimics Michelangelo's Sistine Chapel Adam painting through the use of a hand to collect water Cistern Steps: tiered sequence of native plantings Candelabra Downspout: two plant-topped arms make water flow obvious and fun	Containment of water is safe in the Cistern and any remaining runoff engineered to be shallow on site	Provides public space to meander	Showcases the water cycle in various cycles throughout the site and overall celebrates water
Cedar River Watershed Education Center	Central stone fireplace; Forest Court; Water Drums	Tree root system etched on floor Water Drums: computerized rhythm of water droplets dropped onto drum heads Root Ball Sculptures: with strands of gas-filled glass to mimic flow of water and energy	Water droplets turn off in winter to prevent freezing	Forest Court; Stream; Rattlesnake Lake Watershed field exploration	Loon and Lichen Learning Lab: study water samples, bugs, and plants under microscope; Rattlesnake Lake Watershed field explorations Heritage Research Library: 9,400 years of artifacts, documents, maps, and photographs of watershed
Tanner Springs Park	Achieved through the colors, textures, and smells from native plantings; Also achieved through the textures and materials used in the art wall and constructed wetland ecosystem	Art Wall: Made of historic railroad tracks and contains glass inserts painted as local wildlife which once flourished in the area	Water depth of wetland area is kept at a shallow depth	Public open space allows users to explore and the constructed wetland area allows for interaction	A natural wetland ecosystem was created to honor the natural ecosystem of the area prior to industrialization; Wildlife painted on glass inserts pays homage to previous conditions
El Paso Pedestrian Pathways	Achieved through bright colored streetscape painting; texture, color, and smells of native plantings; Various water features; and life size games	Multiple local artists were involved to create sculptural pieces for the sites; Axial pathways, fountains, and seating	Bridge railings; street improvements include bright painted shapes as traffic calming efforts; Fountain, reflection pool, and splash deck depth maintained shallow	Public open space and seating allows for people to explore the sites freely; Table tennis courtyard, chess courtyard, bocce court, splash deck, stage with amphitheater seating	Public open space allows users to explore sites and local ecosystems and make personal explorations
Ridge & Valley at the Penn State Arboretum	Achieved through sounds and feel of running water, texture of the bluestone terrace, and smells and texture of surrounding native plantings	Etched map of the Spring Creek Watershed in the ground plane of the terrace	Runnel depths are shallow so it is safe to walk on even in rain events	Provides open space and seating to explore the watershed map	The incised terrace maps the Spring Creek Watershed to scale and allows users to follow the rivers and learn about the watershed they inhabit
Queens Botanical Garden	Color and texture of plants and water are evident through different water features and native plantings (frothy fountain, bubbling stream, clear pools, etc.)	Central spine recalls Mill Creek and the water trail line guides visitors through the site; Fountain at entry plaza acts as focal point, where treated water reemerges to the system	Water throughout the site is at a shallow depth	The site creates many opportunities for users to interact with rainwater features and open space for personal exploration	Water conveyance systems highlights water cycle and main spine recalls Mill Creek; Signs, pamphlets, and interactive touchscreens provide educational experiences

Growing Vine Street

Cedar River Watershed Education Center

Tanner Springs Park

El Paso Pedestrian Pathways

Ridge & Valley at the Penn State Arboretum

Queens Botanical Garden

Figure 5.15. Feature & Functions Precedent Matrix Part 1

Features & Function		
Bioswale	Rain Garden	Bioretention Cells/Basins
		Bioretention/Filtration achieved through the tiered Cistern Steps which are planted with native plantings and receive the runoff from roofs and Beckoning Cistern
Constructed Stream and Restored Native Plant Communities: Used to show the role of soil, plants, fungi, mosses, and microbes in purifying water and create habitat for both aquatic and terrestrial life		
Constructed wetland ecosystem is used for rainwater collection from adjacent buildings and paved surfaces; water from cistern reappears as fountain in the native grassland and meanders a runlet back to the pond		
Native plants introduced throughout the sites reduces stormwater peak runoff rates by 15% by introduction of 273 new plantings of Chihuahuan desert natives		
A wet meadow surrounding the terrace biofilters runoff from the building and flow from the terrace		
Biotopes used to capture runoff from dirty areas of the site (artificial shallow pond with vegetation and gravel substrate) Entire site drains toward depressed central spine, referencing Mill Creek	Multiple rain gardens created to infiltrate water from large storm events that other green infrastructure cannot handle	Parking Fingers (islands) biofilter and infiltrate water

Growing Vine Street

Cedar River Watershed
Education Center

Tanner Springs Park

El Paso Pedestrian
Pathways

Ridge & Valley at the
Penn State Arboretum

Queens Botanical
Garden

Figure 5.16. Feature & Functions
Precedent Matrix Part 2

Features & Function		
Green Roofs/Walls	Stormwater Harvesting	Permeable Paving
Planted Candelabra Downspouts and rooftop planters on 81 Vine	Beckoning Cistern	
Living roofs: filter water, retain runoff	Rain Drums: Store water	
	Water on site is infiltrated by the different plant communities on site and migrates to a subgrade cistern where water is cleansed via ultraviolet light	
	Stormwater conveyed to the surrounding wet meadow via incised runnels and during large storm events, sheet flow; Downspout moves water from roof to terrace	
Green Roof on auditorium roof	Cistern collects dirty water from biotope where ultraviolet radiation destroys bacteria, which is then pumped to a fountain at entry plaza, which feeds a stream that flows back to the biotope	Parking Garden infiltrates rain through pervious paving

	Geographical Location	Contextual Location	Sense of Place
Growing Vine Street	Seattle, Washington	Urban Watershed and Street Park; Public and free	Created through the use of art pieces such as the Beckoning Cistern, Cistern Steps, and Candelabra Downspouts which highlight and showcase the water cycle and invite users to engage. Sense of place is also created by the native plantings and vegetation.
Cedar River Watershed Education Center	North Bend, Washington	Regional Education Facility; Rattlesnake Lake in Cascade foothills; Public and free	Created through natural surrounding landscape, Water Drums, Rootball Sculptures, etched floor, and Forest Court. The Campus and Landscape designed to reflect importance of the watershed and relationship between the city and the environment. Created "Spring" flows throughout the site.
Tanner Springs Park	Portland, Oregon; Pearl District	Willamette River Valley; Urban Waterscape; Public park; Public and free	Achieved through the art wall, historic plant communities, and water system on site; Art wall uses historic railroad tracks and glass inserts painted with historic local wildlife; Oak savannah prairie, native grassland, and wetland mimic historic plant communities
El Paso Pedestrian Pathways	El Paso, Texas; Arts District	Courtyard/Plaza Streetscape; Cold Desert climate; Public and free Three Sites: San Jacinto Plaza, Mills Avenue Promenade, and Durango Street Improvements	Created through public sculptures, gaming areas, Arts Festival Plaza, bright colored traffic calming efforts, corten planters and seating, and many new native plants introduced
Ridge & Valley at the Penn State Arboretum	Penn State Arboretum Overlook Pavilion, Park Avenue and Bigler Road, University Park, Pennsylvania	University Arboretum; Spring Creek Watershed; Public and free; Plaza/terrace	Incised watershed map emphasizes the importance of the water cycle and local watershed. Sense of place also created by native plantings and context of the Penn State Arboretum.
Queens Botanical Garden	Flushing, New York	Botanical Garden; Mill Creek as spine of site; Public but costs money to enter	Created through the diverse water harvesting and reuse system. Callback to Mill Creek through central spine and the water line that guides users through the site creates a sense of place.

Figure 5.17. Location Precedent Matrix

Design Guidelines

The design guidelines created from the synthesis of what was learned from the literature review analysis and precedents focus on creating safe and functional green infrastructure, creating a sense of place, integrating artistic expression into water-sensitive stormwater design, and providing opportunities for ecological education. These design guidelines are shown in Figure 5.18. Green infrastructure focuses on the features of the site and how those function for stormwater management. Sense of place examines how the project creates a unique user experience and benefits the community. Artistic expression focuses on detailed elements within the site that have different functions and solve or address issues creatively and in ways that engage all who see or experience artful features and elements. Opportunities for ecological education are considered for public open space, informative and thought-provoking signage, and exploration of natural and created ecosystems. Figures 5.18-5.19 further illustrate the concepts that frame the design guidelines.

Design Guidelines

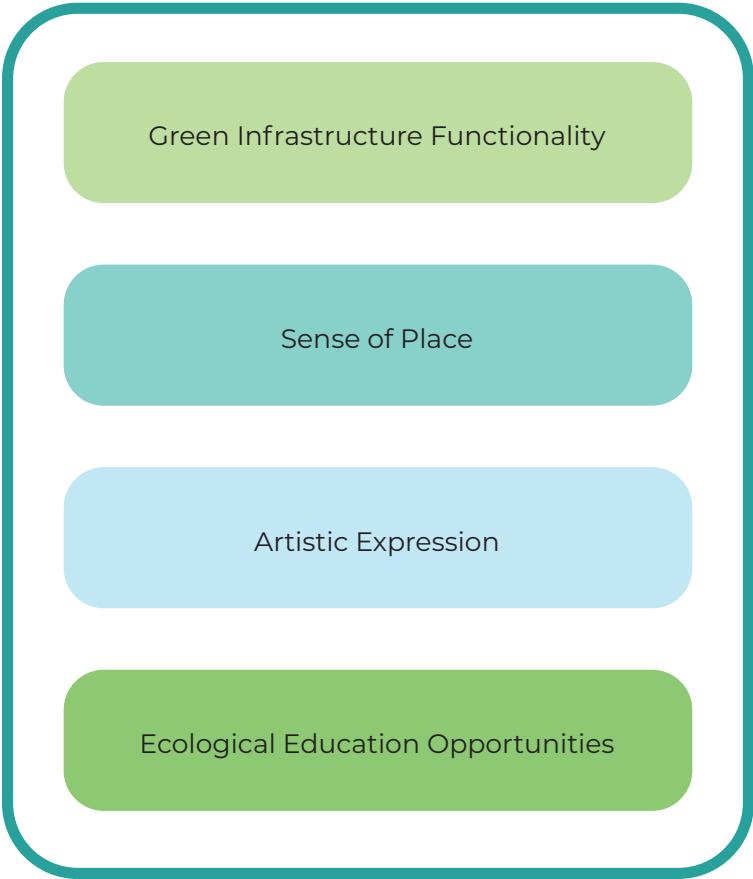


Figure 5.18. Overall Design Guidelines



Figure 5.19. Design Guidelines for Place-Specific Green Infrastructure

These guidelines aim to create Well-Functioning Stormwater Management using Green Infrastructure, help develop a Strong Sense of Place, provide Artistic Expression that is Multi-Sensory and Reveals Ecological Connections, and offer Interactive Ecological Education Opportunities



06: SITE ANALYSIS



Figure 6.1. Walk to Grand Champions Apartments

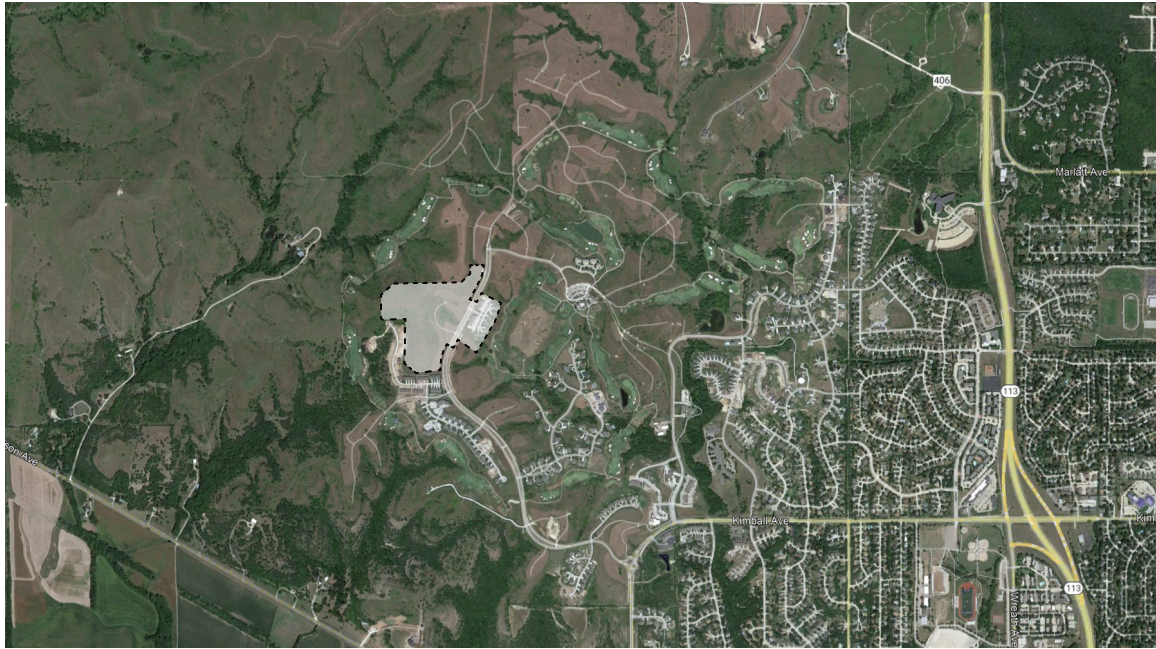
Grand Mere Development History

The Grand Mere area has been under development for more than two decades. The area was originally an open prairie with rolling *cuestras* and deep-cut valleys. In the early 2000s, the Colbert Hills Golf Course began construction. This cleared much of the prairie land out but preserved the larger *cuestras* and ridges. Eventually, in the 2010s, residential development began with apartments, townhomes, and, most prominently, single-family homes. This trend has rapidly continued with even more residential developments today, along with a small shopping center at the entrance to the area. The rapid development of residential homes in the area has left limited buildable space in Grand Mere. It is very important to help retain and reveal ecosystem processes given the amount of change that has happened to this once prairie-dominated landscape. Figures 6.2-6.5 show the history of development in Grand Mere and show traces of 2023 roads for orientation.



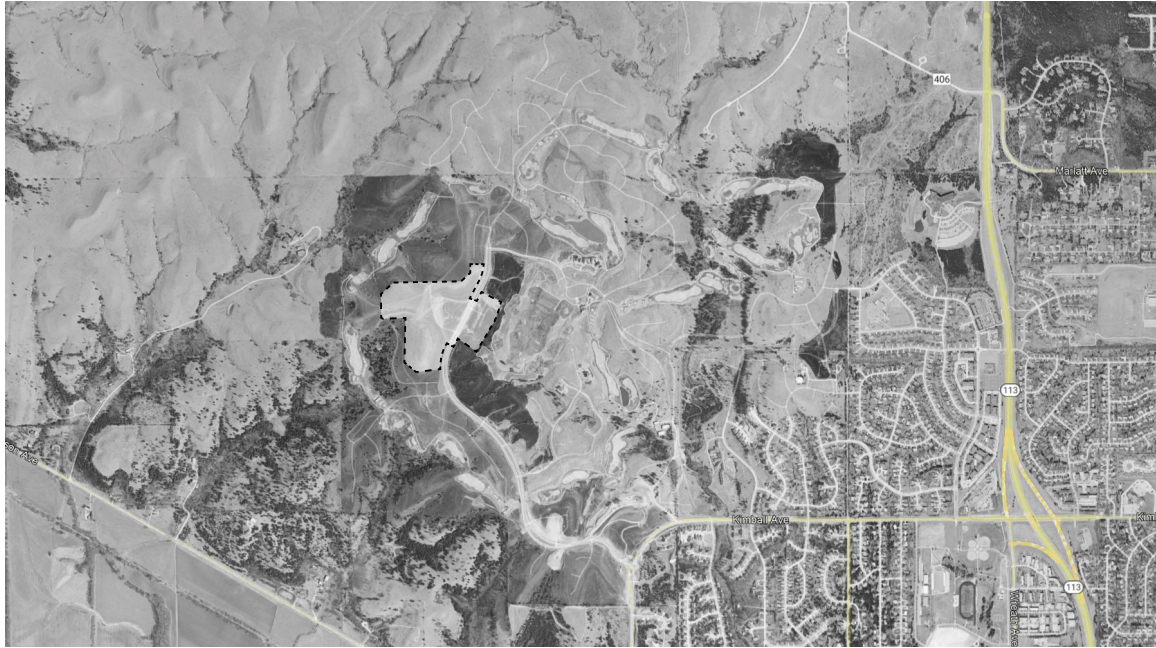
1991

Figure 6.2. 1991 Grand Mere Development Conditions



2014

Figure 6.4. 2014 Grand Mere Development Conditions



2002

Figure 6.3. 2002 Grand Mere Development Conditions



2023

Figure 6.5. 2023 Grand Mere Development Conditions

Overall Context

The selected study area is located in the Grand Mere area of Manhattan, Kansas. This area is located on the northwest side of Manhattan and has views of the Colbert Hill Golf Course. It is characterized by beautiful views of the Flint Hills and quiet neighborhoods. Within this area, the selected site consists of the First Christian Church (FCC) and Grand Champions residential development across Grand Mere Parkway. This site contains a natural drainageway that has been fragmented by development. The FCC sits along this drainageway, Grand Mere Parkway runs through the drainageway, and the residential development sits along the drainageway. The site is fairly hilly with a large slope to the southwest, west, and northwest. The drainageway is occasionally cleared of woody plants and mowed back along the north and northeast sides of the church. Much of the landscape surrounding the church is a manicured lawn, with managed and unmanaged prairie to the west of the church. The surrounding prairie areas around the church consist of a fairly expansive trail network, which is managed by Church personnel and is available to the public to traverse. The residential area across Grand Mere Parkway consists of two 18-unit apartment buildings and eight single-family homes. Within this area are parking lots and driving lanes/roadways for vehicle access. Much of the parking lot seems to be vacant at any given time. Figures 6.6-6.17 give a general character of the area.



Figure 6.6. FCC from Grand Mere Pkwy



Figure 6.7. Stair Conditions in Winter



Figure 6.8. FCC Loading Area



Figure 6.9. View of Drainageway



Figure 6.10. Loading Area in Winter



Figure 6.11. Roundabout in Winter



Figure 6.12. FCC Entry Signage



Figure 6.13. Grand Champions SFH



Figure 6.14. Grand Mere Pkwy in Winter



Figure 6.15. Residential Vegetation in Winter



Figure 6.16. Residential Vegetation



Figure 6.17. Retaining Wall around Parking Lot

Terrain

The terrain surrounding the site is fairly hilly, as it is situated in the Flint Hills Ecoregion. The lowest elevation within the site boundary is around 1,220' and the highest elevation is at 1,340' with an elevation change of about 120'. The high point is located on the cuesta to the north of the church, and the low point is within the drainageway adjacent to the residential development. The slopes around the church are fairly steep with much of the site being within the 15-30% slope range. The hilliest areas are towards the back of the church and going up towards the cuestas and the flattest areas are on top of the cuestas. The topography is also fairly flat (0-15%) around Grand Mere Parkway and the buildings due to the earthwork for parking, roads, walkways, and building pads. Figures 6.18-6.29 illustrate at two different scales where the high and low points are located, the slopes of the area, the hillshade, and the character of the surrounding cuestas.



Figure 6.18. Large Scale Site Contours

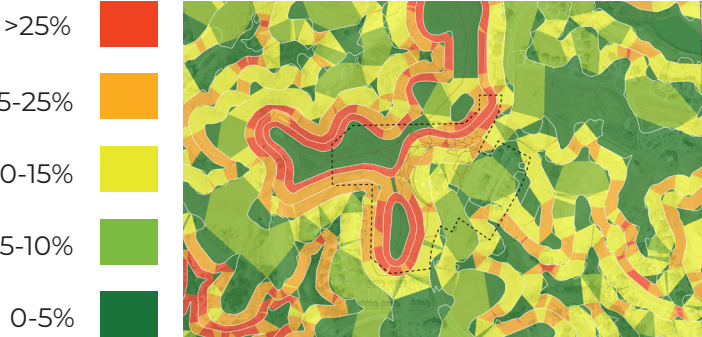


Figure 6.19. Large Scale Site Slope



Figure 6.20. Large Scale Site Hillshade

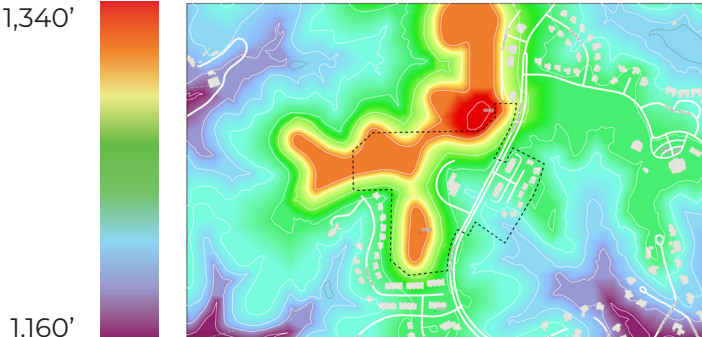


Figure 6.21. Large Scale Site Elevation

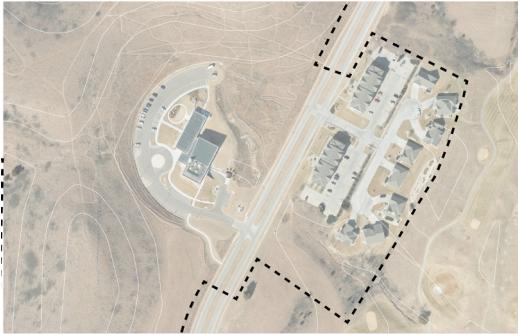


Figure 6.22. Small Scale Site Contours

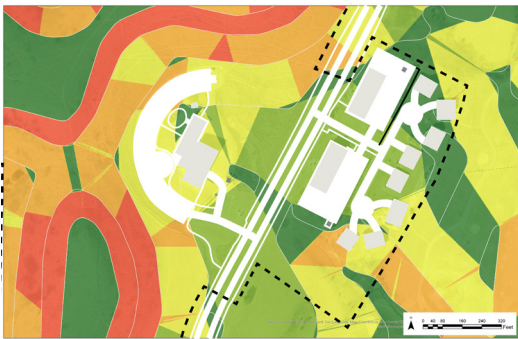


Figure 6.23. Small Scale Site Slope



Figure 6.24. Small Scale Site Hillshade

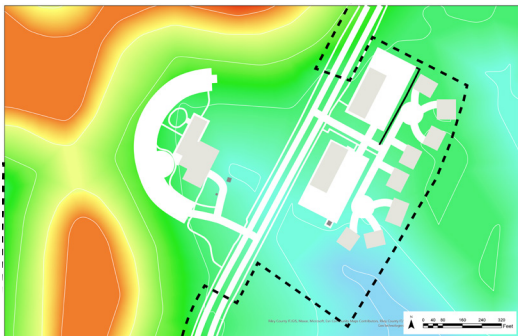


Figure 6.25. Small Scale Site Elevation

Figure 6.26. Snow-covered Northern Cuestas



Figure 6.27. Winter Parking Lot Conditions



Figure 6.28. FCC Entry/Exit Drive and Sidewalk



Figure 6.29. Swale to the North of Grand Champions Apartments



Hydrology

The site is fairly hilly as it is located in the Flint Hills and the major drainageway associated with the selected project site has been fragmented. The accompanying analysis map shows how drainage flows within the site. The church is situated below two cuestas, with a saddle between them. This saddle drains towards the church, along with the northern drainageway fragmented by development. The church is located where these two drainages converge. In Figure 6.30, the red arrows are used to illustrate the ridgelines, or high points, and the water drainage patterns. The two drainageways come together and continue along the residential development, behind the golf course, and eventually to Little Kitten Creek. The site is located within the Little Kitten Creek-Wildcat Creek Watershed, illustrated through Figure 6.31, in context with Riley County. Figure 6.32 shows the site in context within the Little Kitten Creek-Wildcat Creek Watershed and the included waterways. Figure 6.33 illustrates the site in context with surrounding waterways in Grand Mere and Manhattan and how it connects to Little Kitten Creek and, eventually, Wildcat Creek.

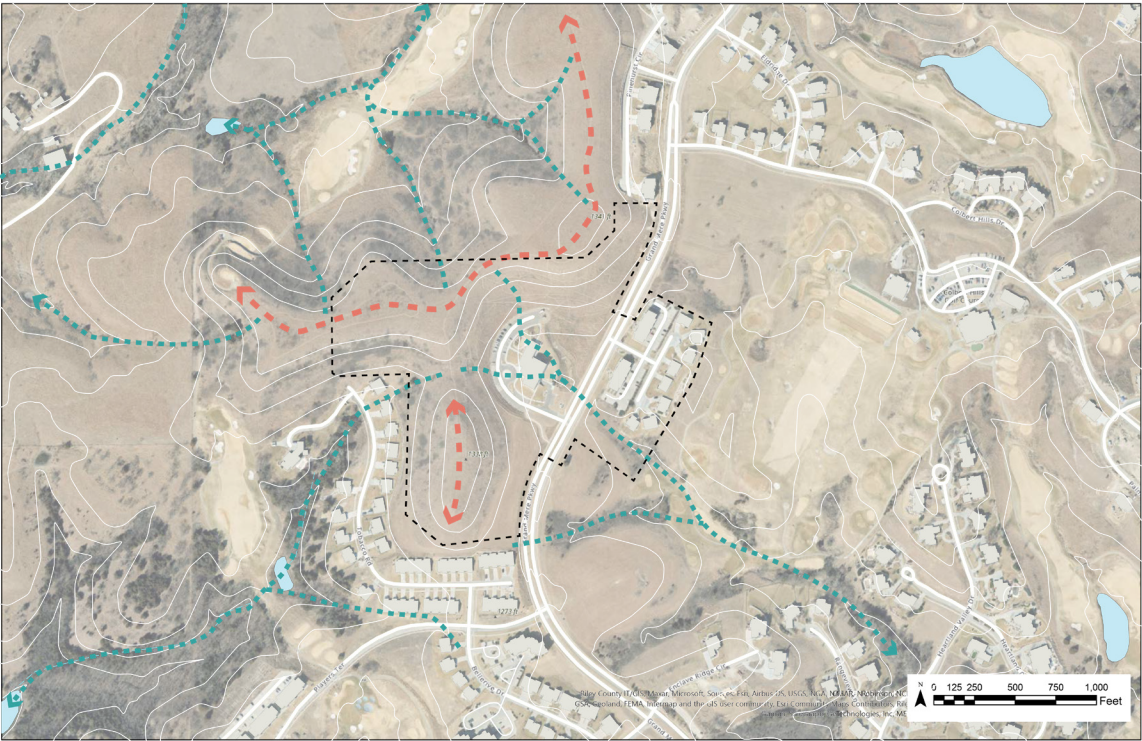


Figure 6.30. Site Hydrology

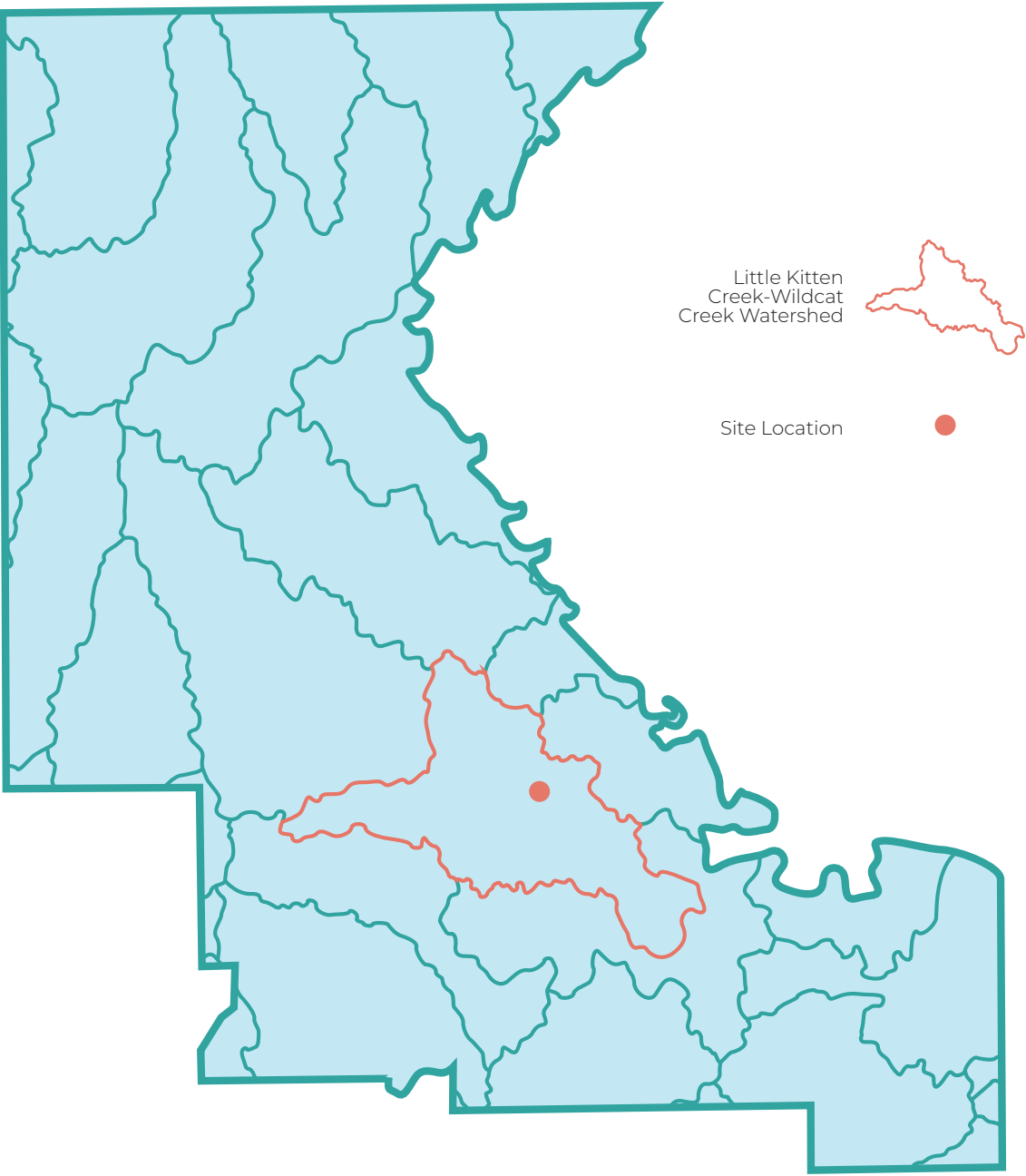


Figure 6.31. Riley Country Watersheds



Figure 6.32. Little Kitten Creek-Wildcat Creek Watershed and Waterways

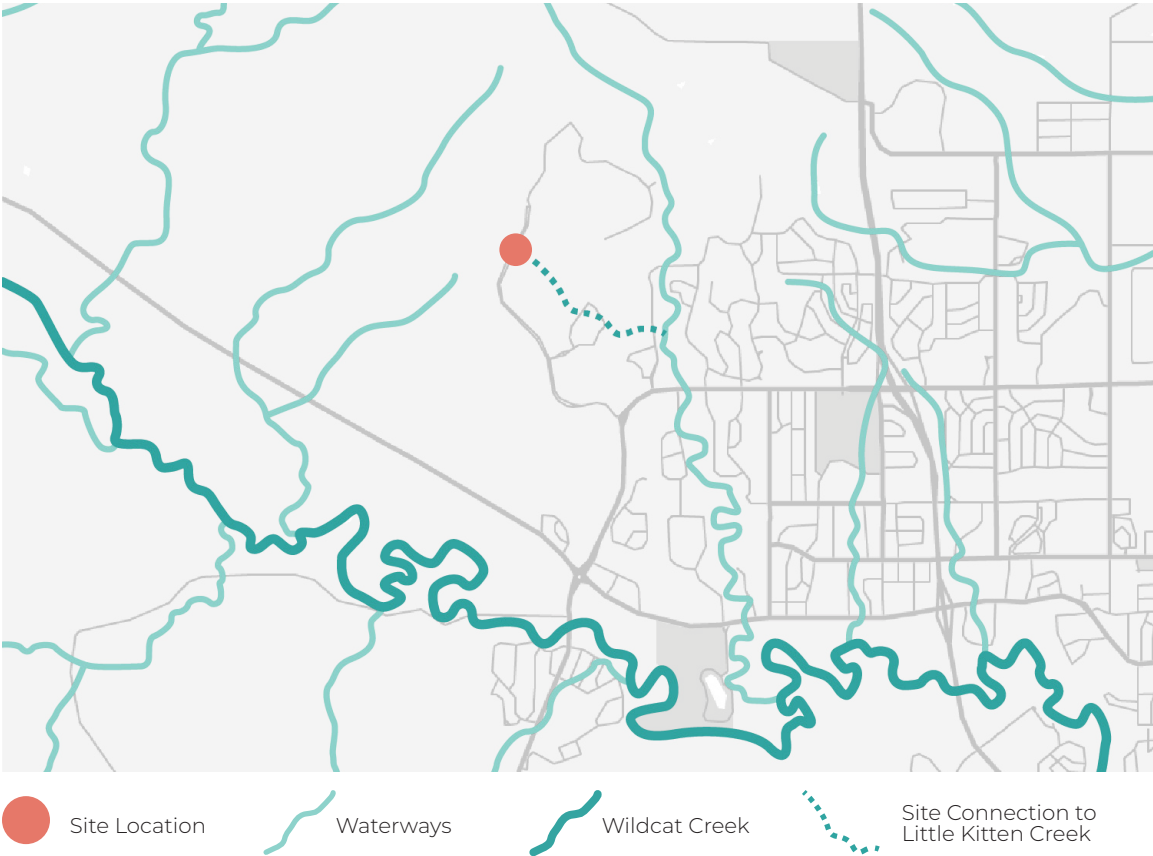


Figure 6.33. Manhattan, Kansas Waterways and Site Connections

Vegetation Coverage and Species

Vegetation Coverage

The vegetation coverage found within the selected site can be separated into the following four categories: Manicured Lawn, Managed Prairie, Unmanaged Prairie, and Drainageway and Naturalized Vegetation. The Manicured Lawn areas consist of regularly mowed turfgrass. The Managed Prairie areas are occasionally mowed areas consisting of grasses and forbs, while the Unmanaged Prairie is not mowed, and consists of many of the same grasses and forbs, along with perennials such as aster, beebalm, coneflowers, and goldenrod. The Drainageway and Naturalized Vegetation contain much denser and taller vegetation. These include plants such as wildflowers, perennials, ornamental grasses, and native shrubs and trees such as willow (which is regularly cut back). This is illustrated in Figure 6.34.

Fauna

Fauna in the area includes bats, beaver, birds, blackbirds, chipmunks, cottontail rabbits, coyotes, crows, deer, lesser prairie chicken, mice, moles, muskrats, opossum, prairie dogs, raccoons, skunks, snakes, tree squirrels, voles, woodchucks, woodpeckers,

and woodrats ("Wildlife Species."n.d.). These species are indicative of Manhattan, Kansas, and Riley County but do not represent the exact species to be seen at the FCC site. Some common species that could be found include cottontail rabbits, tree squirrels, snakes, birds, and raccoons. After the implementation of site design, however, riparian species such as dragonflies and some frog species could be observed. Although some wildlife may be seen as (or become) a nuisance to residents, golf course and development managers, and visitors, these animals have an intrinsic right to exist and they help to create dynamic, biodiverse ecosystems and larger landscapes.



Figure 6.34. Site Ground Coverage

Soil Survey

Ivan Silt Loam, Channeled

- Channels on Floodplains; 0-3%
- Parent material: Calcareous alluvium
- 3 layers of topsoil; 0-30"
- Well drained, low runoff class
- Hydrologic soil group B
- >80" to bedrock; >80" to water table

Benfield-Florence Complex

- Hillslopes; 5-30%
- Parent material: Pedisediment over residuum weathered from calcareous shale
- 1 layer of topsoil; 0-10"
- Well drained, high runoff class
- Hydrologic soil group D
- 22-39" to bedrock; >80" to water table

Clime-Sogn Complex

- Hillslopes; 3-20%
- Parent material: Calcareous alluvium
- 1 layer of topsoil; 0-10"
- Well drained, high runoff class
- Hydrologic soil group D
- 20-40" to bedrock; >80" to water table

Dwight Irwin Complex

- Hillslopes; 1-3%
- Parent material: Residuum weathered from limestone and shale
- 1 layer of topsoil; 0-6"
- Moderately well drained, high runoff class
- Hydrologic soil group D
- 39-59" to bedrock; >80" to water table

Tully Silty Clay Loam

- Hillslopes; 3-7%
- Parent material: Colluvium
- 1 layer of topsoil; 0-10"
- Well drained, high runoff class
- Hydrologic soil group C
- >80" to bedrock; >80" to water table

Reading Silt Loam

- Stream Terraces; 1-3%
- Parent material: Alluvium
- 2 layers of topsoil; 0-14"
- Well drained, low runoff class
- Hydrologic soil group C
- >80" to bedrock; >80" to water table

Wymore-Kennebec Complex

- Hillslopes; 11-17%
- Parent material: Loess
- 2 layers of topsoil; 0-10"
- Moderately well drained, medium runoff class
- Hydrologic soil group D
- >80" to bedrock; >12-36" to water table

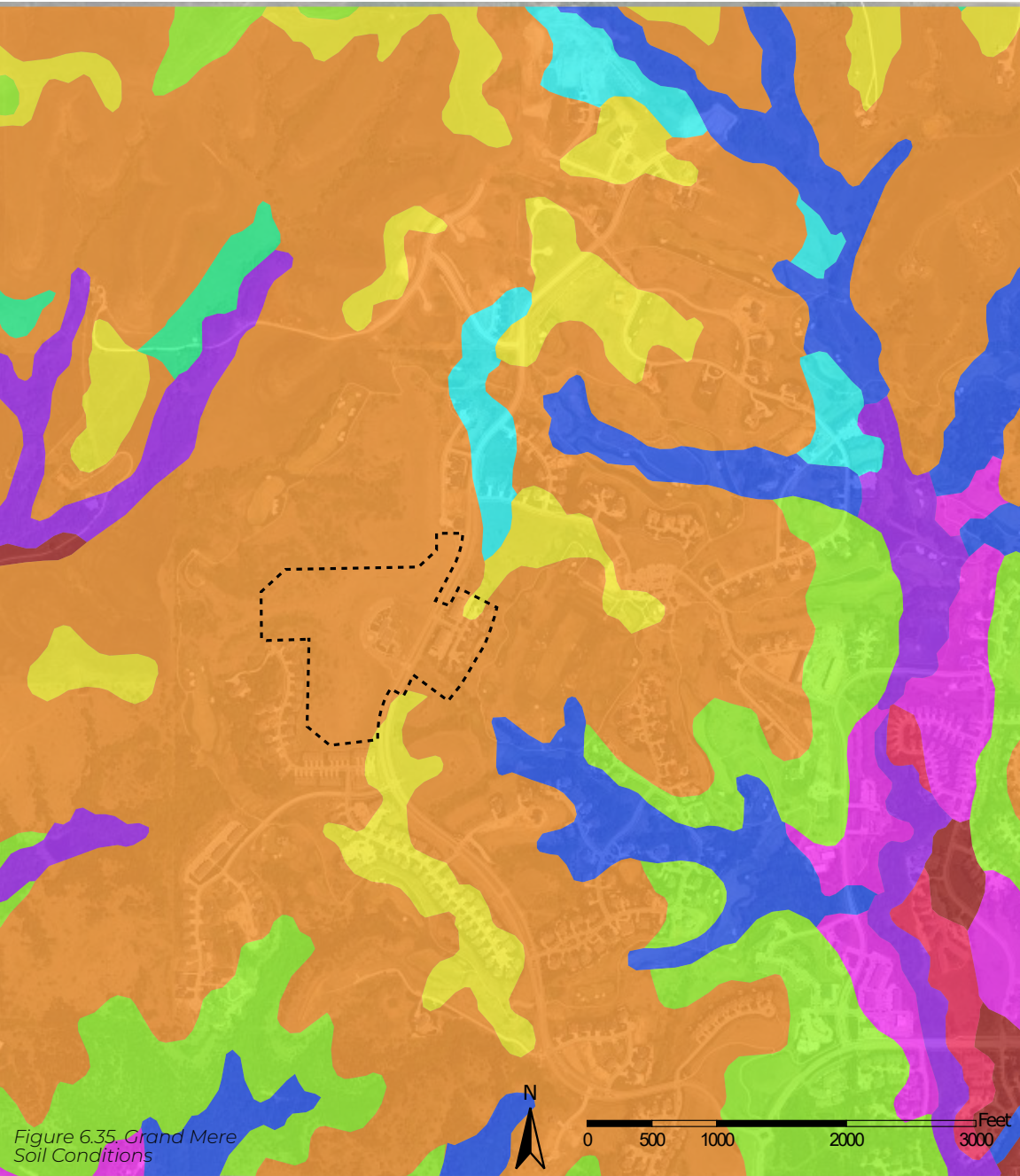


Figure 6.35. Grand Mere Soil Conditions

Figure 6.35 shows the soil coverage within the context of Grand Mere, and Figure 6.36 shows site-specific soil conditions. The soil composition of the selected site only shows a part of the soil types that the overall area contains. The majority of the area is Benfield-Florence complex, with Ivan Silt Loam, Tully Silty Clay Loam, Reading Silt Loam, and Ivan & Kennebec Silt Loams in areas along riparian corridors and waterways. Much of this would also more closely resemble urban soil since much of the land has been developed and disturbed. It is important to protect undisturbed soils and help disturbed soils heal by minimizing erosion and creating conditions to lead to healthy, living soils that support soil-holding and soil-nourishing vegetation.



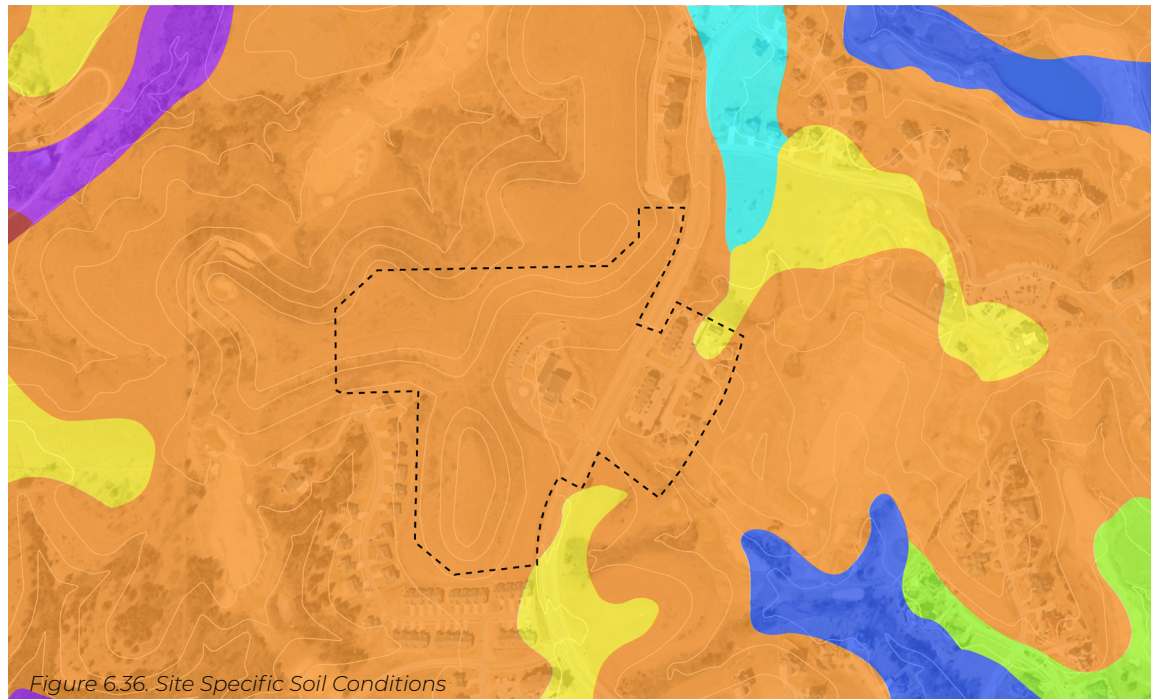


Figure 6.36. Site Specific Soil Conditions

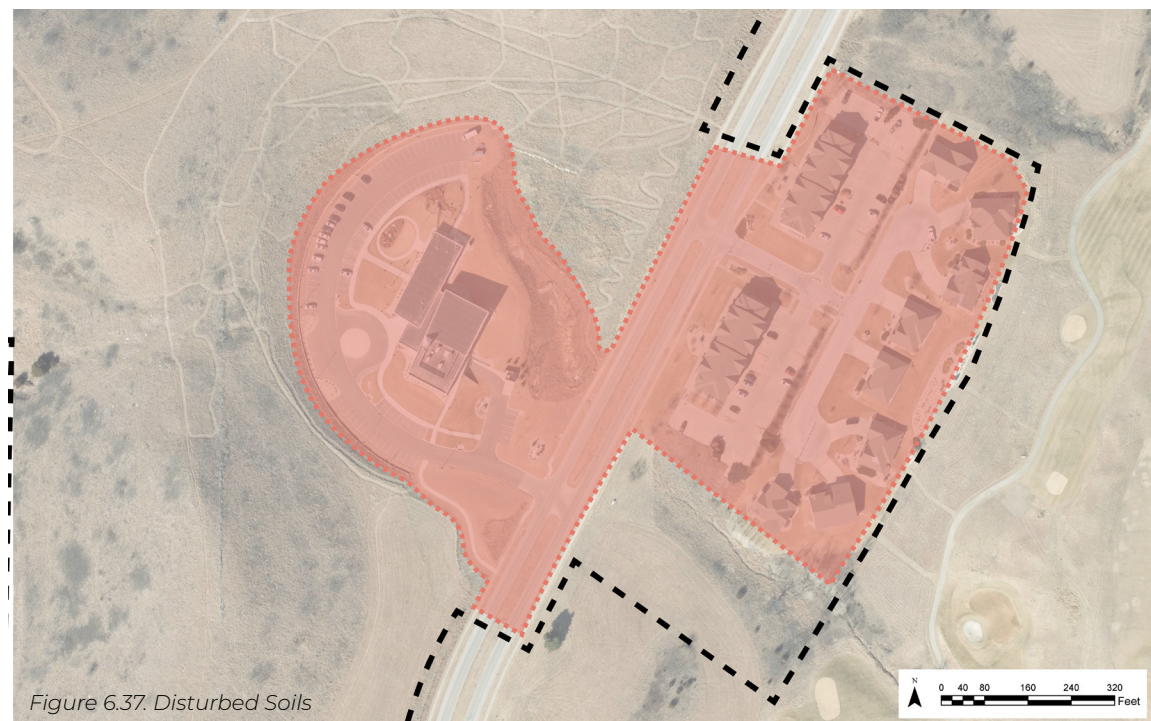


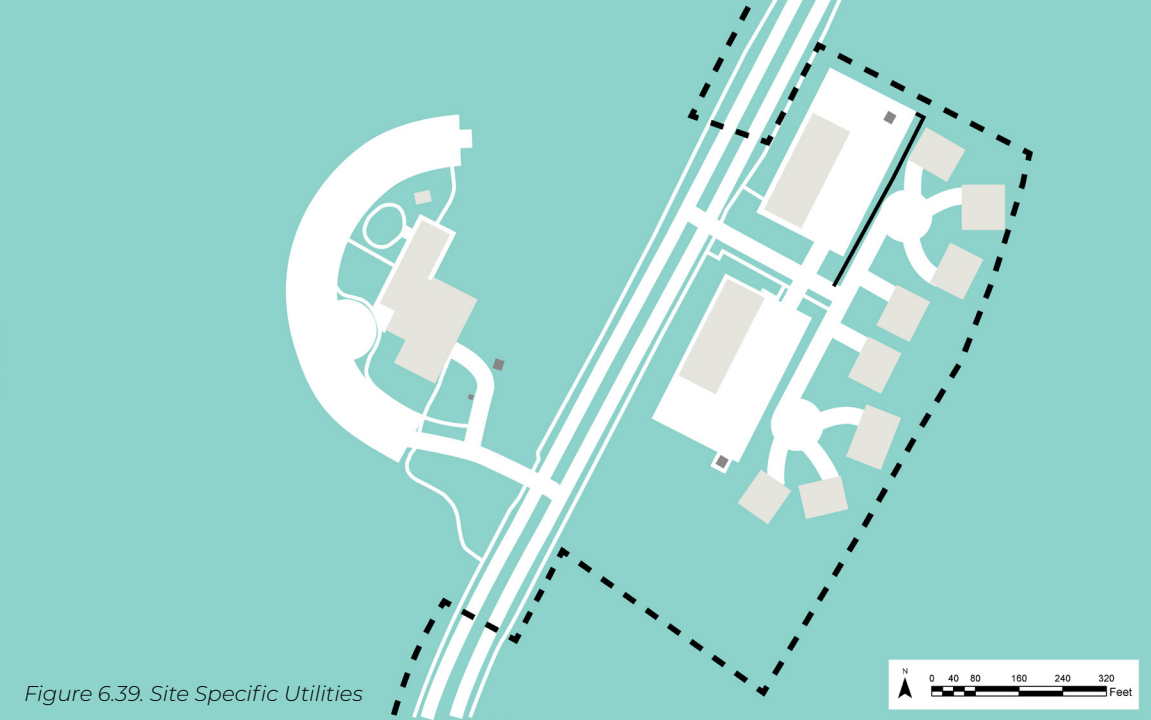
Figure 6.37. Disturbed Soils



Much of the soil around the church has been disturbed and modified and some of these areas may now more closely resembles urban soil. Figure 6.37 shows which area of the site would be considered disturbed and modified.

Existing Buildings and Infrastructure

Grand Mere has been a highly developed area in the past few decades. More residential developments appear each year and with that comes roads, sewer, water, electric, internet, and other infrastructure in the area. The main infrastructure present and affecting the selected site are arterial and collector roads and the buildings. The church site contains one building while the residential complex contains two apartment buildings and eight single-family homes. Grand Mere Parkway is an arterial road in the area that bisects the site and the drainageway. Collector roads that enter the residential complex to the east include Grand Champions Drive and Champions Circle. In front of the FCC, there is a trash enclosure, an electrical box, and a loading area. Behind the church, there is a fence enclosing the child play area along with a shade structure within. Within the residential complex, there are multiple air conditioning units and two trash enclosures on either end of Grand Champions Drive. There are also sidewalks and walkways along either side of Grand Mere Parkway and on both sides of the site. Figures 6.38-6.39 depict where throughout the site there is existing infrastructure.



Existing and Potential Public Outdoor Gathering Space for Artistic Expression

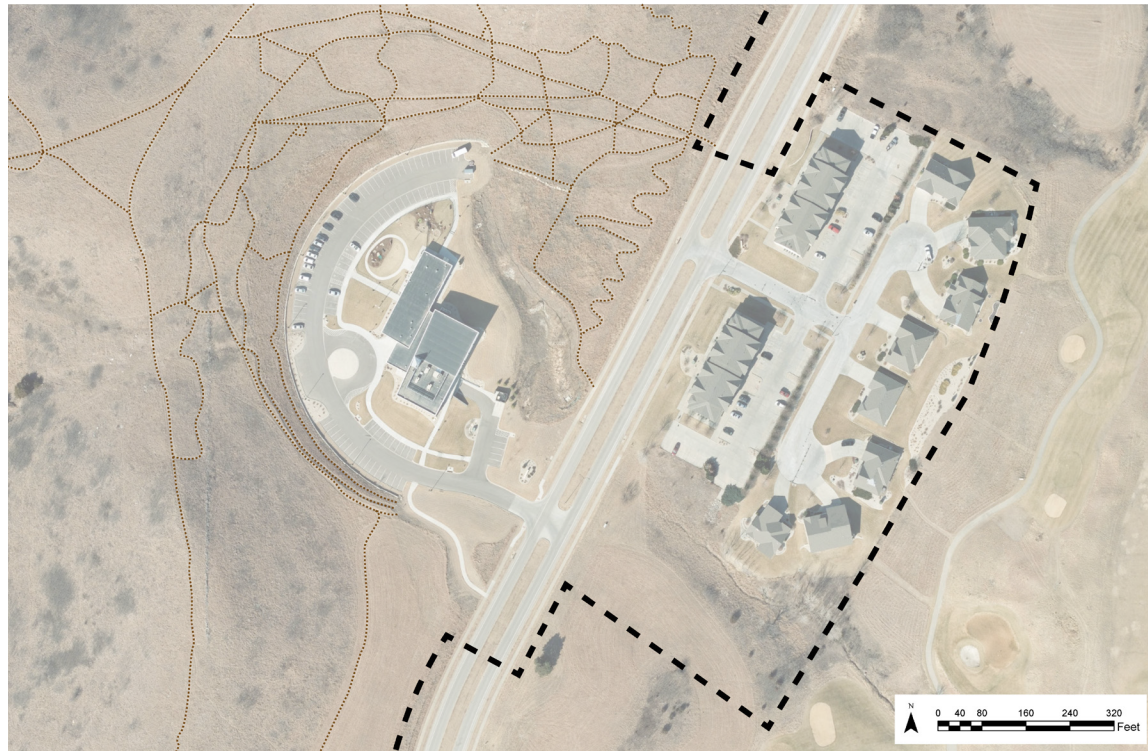
The FCC has an extensive trail network to the northwest of the building. This area is managed by church personnel and is open to the public. This is a prime area for recreation and education as the prairie is a form of green infrastructure and can connect people to nature. Along these trails, there are opportunities for small, intimate seating and gathering areas as well as lookout points towards the church and throughout the views of the Flint Hills and City of Manhattan, Kansas.

Another existing outdoor space within the grounds of the church is the From Cradles to Crayons Children's Center. This area is fenced off for safety and includes play features and a shade structure. The remaining open green space around the church is a manicured lawn and has the potential to offer more programming in those areas.

A specifically prominent area of open green space is immediately east of the church. This area contains both a manicured lawn and the riparian vegetation of the drainageway. The area here is also very steep due to the earthwork done during development. Due to this, there is an opportunity here to provide a terraced gathering element that speaks to the greater watershed and waterways of the area.

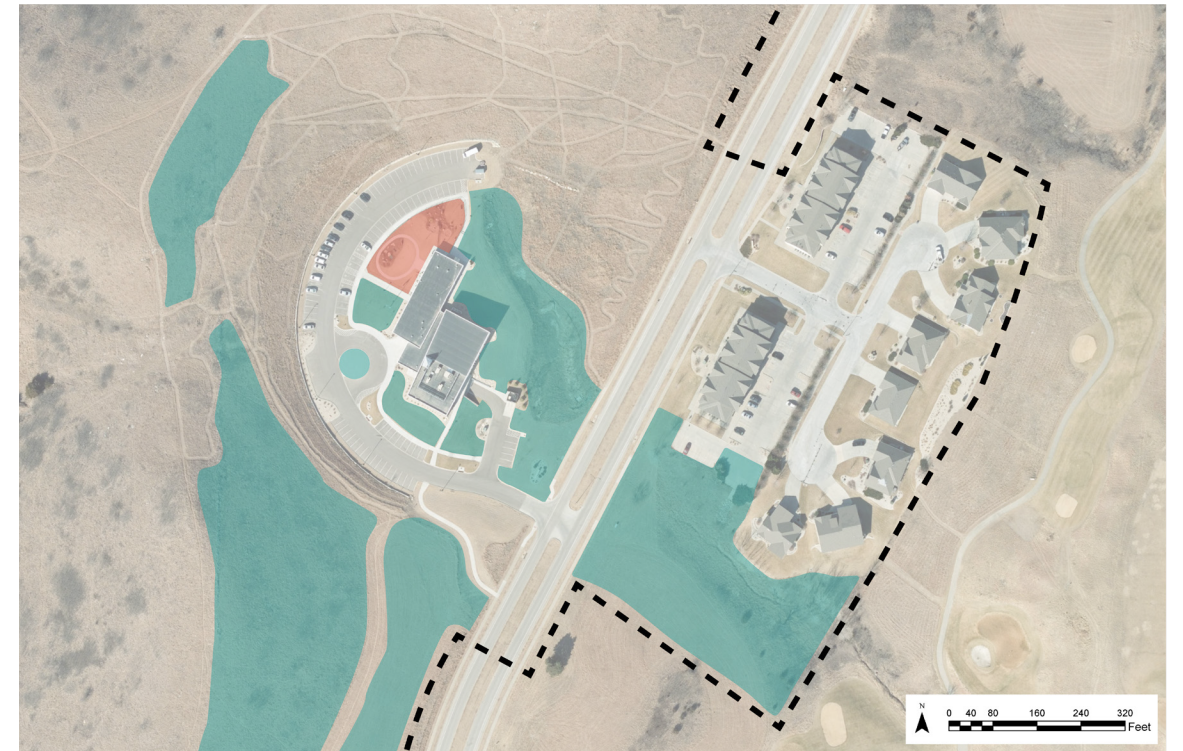
Across Grand Mere Parkway in the residential development, there is no formal outdoor gathering space besides the parking lot and sidewalks. However, there is a small portion of the southern end of the parking lot that is often vacant. This area has the potential to be transformed into a formal, outdoor space for the residents of the development. This area also leads into the riparian vegetation of the drainageway and the managed prairie further up the slope. This space is in direct view when people are leaving the church parking lot. The visibility, observability, and fact that the space ties the two sides of the site together offer the potential for this space to become an eco-revelatory focal point or sculptural piece. This space would also be focused around both the church and residential communities as it ties them together.

The entirety of the drainageway also has the potential to offer non-invasive trails throughout to provide opportunities for ecological education. Figures 6.40-6.41 illustrate the existing trail network and the spaces discussed in this section.



Existing Trail Network

Figure 6.40. Existing Trails



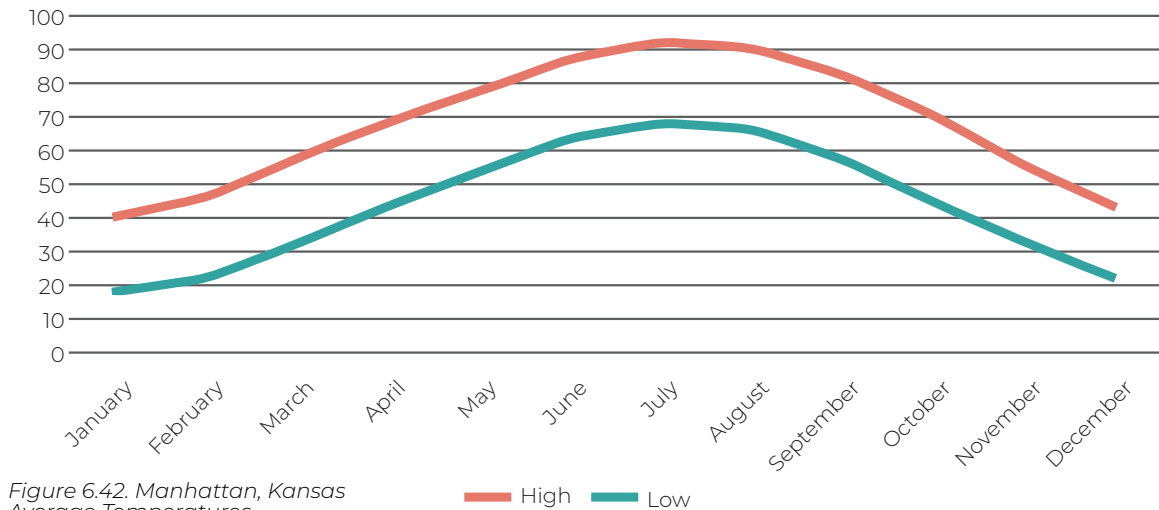
Potential Outdoor Gathering Space Existing Outdoor Gathering Space

Figure 6.41. Outdoor Gathering Space for Artistic Expression

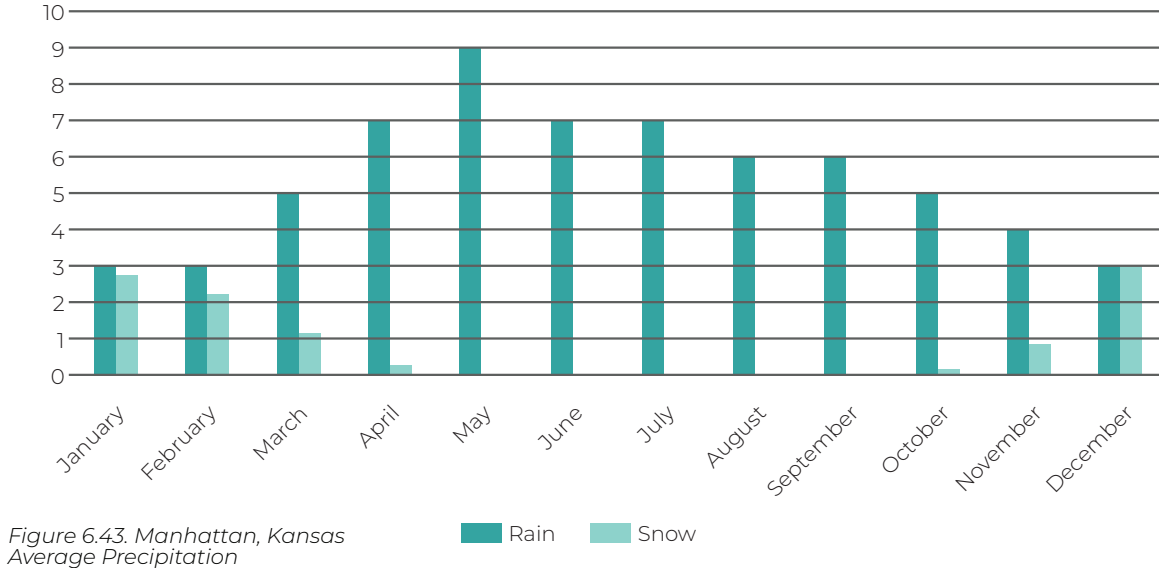
Climatic and Microclimatic Conditions

Another important aspect to consider when designing is the climate of the area. The FCC site is located in Manhattan, Kansas, so climate data from the area is relevant. Temperature, precipitation, wind speed, and hours of daylight were investigated. Temperature is important to note as this indicates when and where the most shade is needed, and when people would be most comfortable visiting. Precipitation is important, especially for artful rainwater design, to show when water would be visible on the site. Wind speed would also be important for an eco-revelatory element and when people would want to visit. Hours of daylight would also show when people would be visiting. The temperature, on average, reaches a high of 92° F in July and a low of 18° F in January. The most rain received during the year is in May with an average of 9 inches. Snowfall occurs, on average, from October to April with an average high of 2.9 inches in December. The area is fairly windy with April being the windiest month with speeds up to 12.7 miles per hour on average. Daylight is another factor, with June having an average of 14.9 hours of daylight as a high, and December having 9.5 hours on average as a low. Figures 6.42-6.45 illustrate these averages.

Temperature (Degrees) by Month



Precipitation (Inches) by Month



Wind Speed (MPH) by Month



Figure 6.44. Manhattan, Kansas
Average Wind Speed

Hours of Daylight by Month

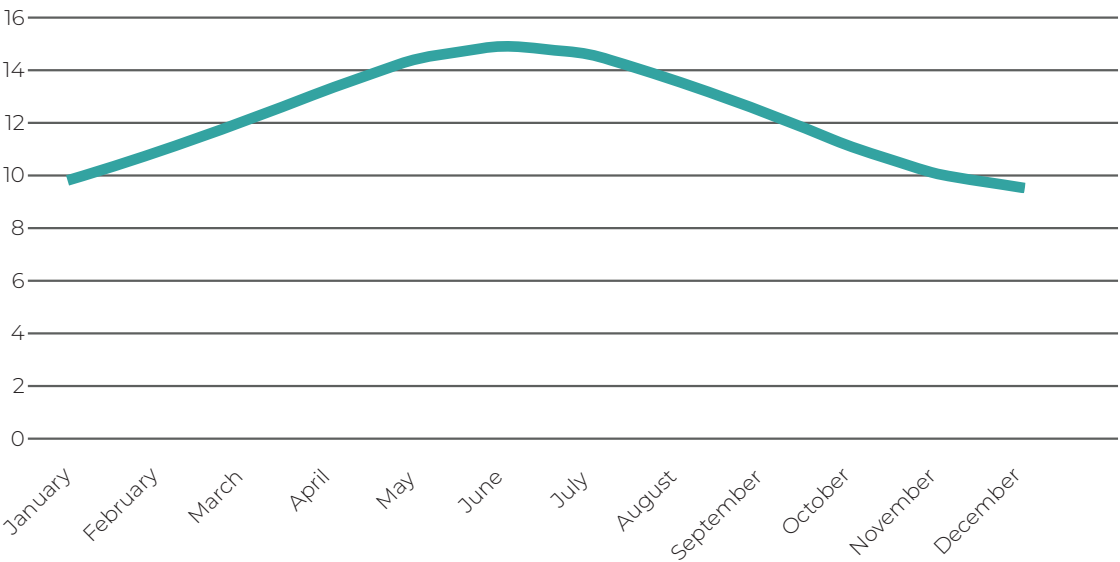


Figure 6.45. Manhattan, Kansas
Average Hours of Daylight

The FCC site has a southeast-facing slope, which means it will receive more sun in the morning when temperatures are cooler. It will also receive a peak of incoming solar radiation around midday. The site is fairly exposed, with some vegetation in the drainageway. However, the irrigated lawn surrounding the church cools temperatures slightly. Turfgrass, which is present on both sides of road, is pleasing to most residents and visitors as it allows space for picnics or relaxation near buildings and other outdoor gathering spaces. It also acts as a buffer in case of a wildfire. Prairie provides numerous ecological functions such as stormwater management and bird and pollinator habitat if well managed. Figures 6.46-6.47 show some of these conditions.



Figure 6.46. Shade from Trees on the Grand Champions Side of Site



Figure 6.47. Slope Surrounding FCC

Construction Documents

These documents and the church design were created by Gould Evans (now Multistudio) and were shared by Richard Gallagher, the chair of the building committee during the construction of the FCC. These documents show in detail how the site works. It provides drainage patterns and plans, erosion control details, grading of the site, and more. These documents were used when making design decisions and helped to learn more details about the site. An integral detail within these documents was the fact that, at one point, an outdoor performance space was proposed in the area immediately east of the church and west of the drainageway. These documents and comments from Richard also note that the church plans to construct additional space for classrooms and a recreation center in the future. These ideas were also used for programming inspiration in design iterations. Floor plans of the building were used to situate site programming and spaces for a cohesive flow between indoor and outdoor spaces. Figures 6.48-6.54 show important selected pages used during design.

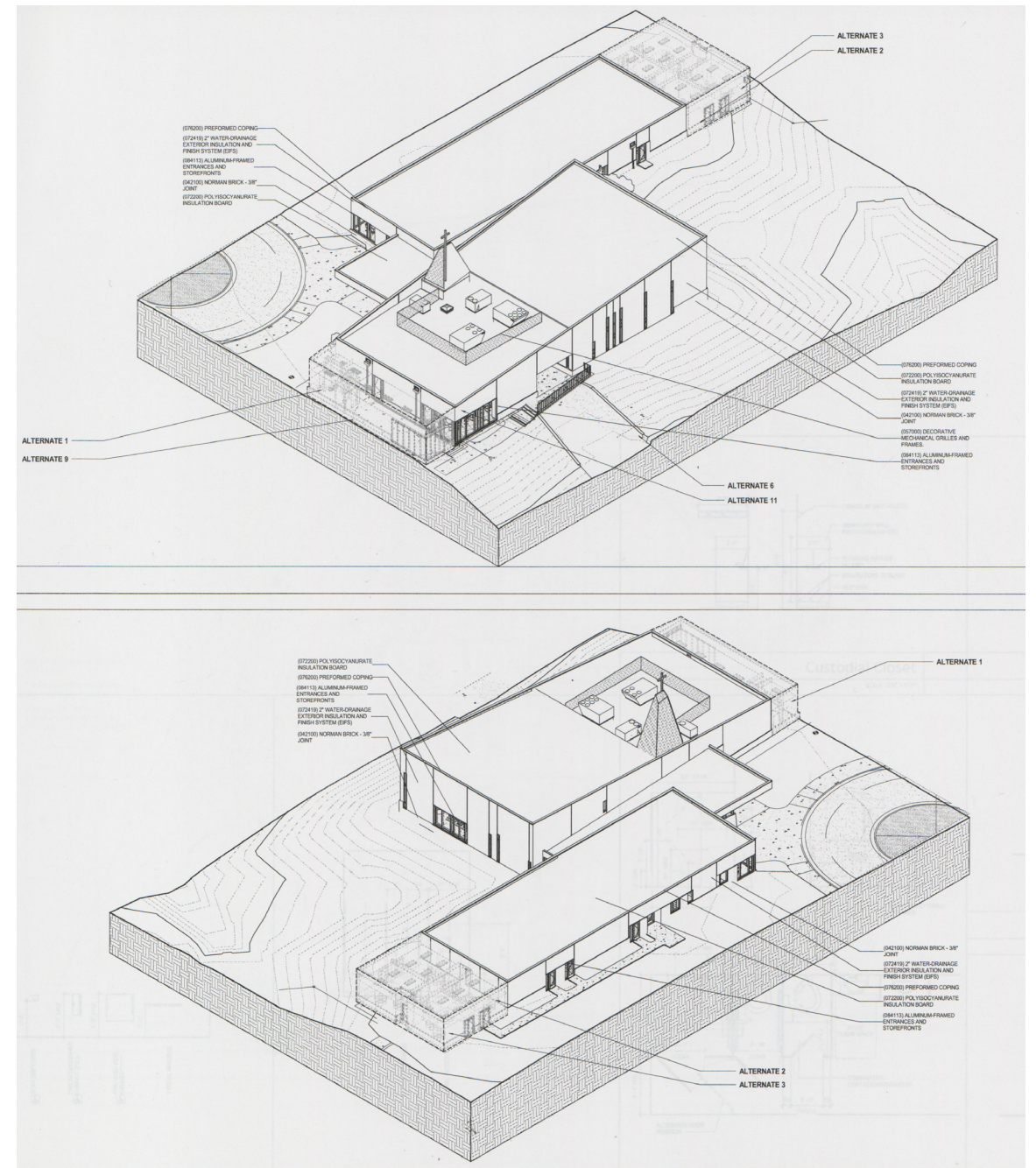
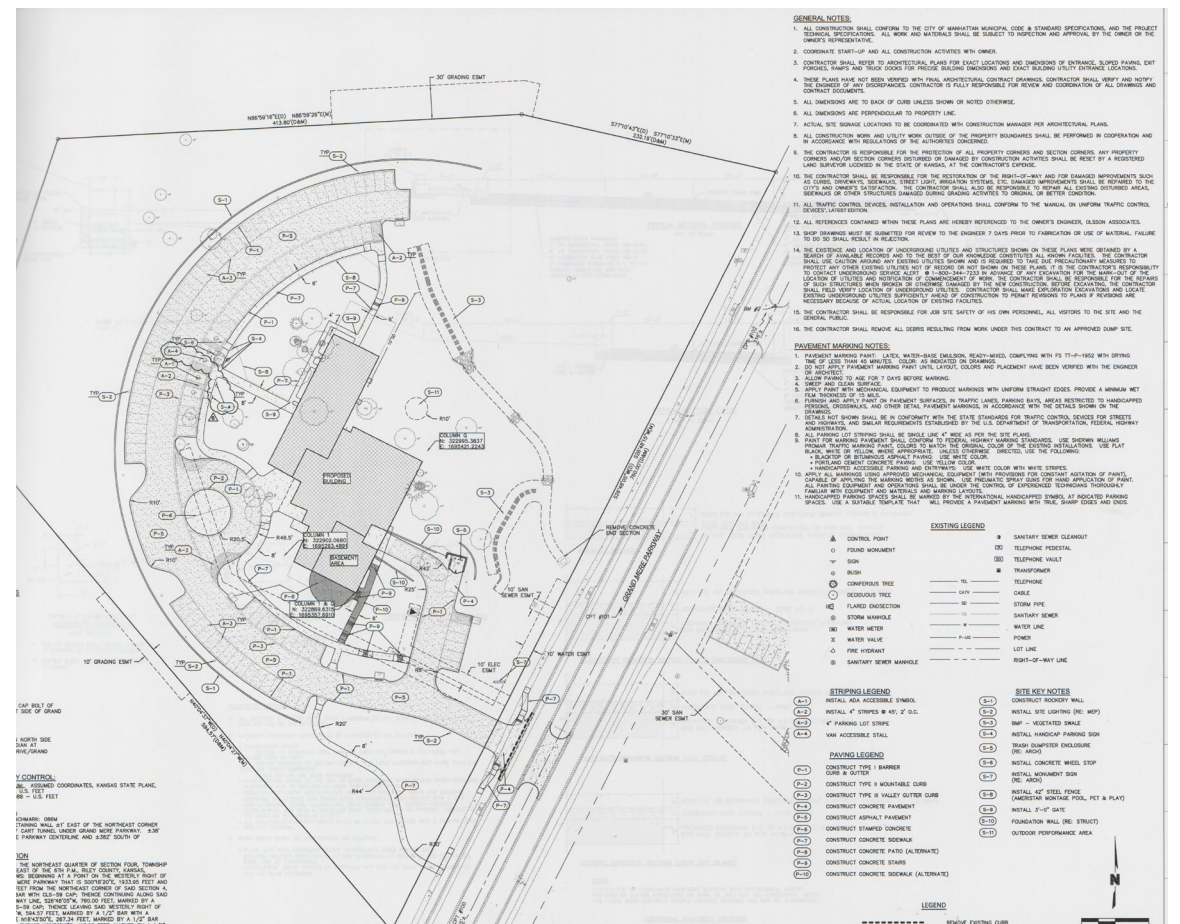
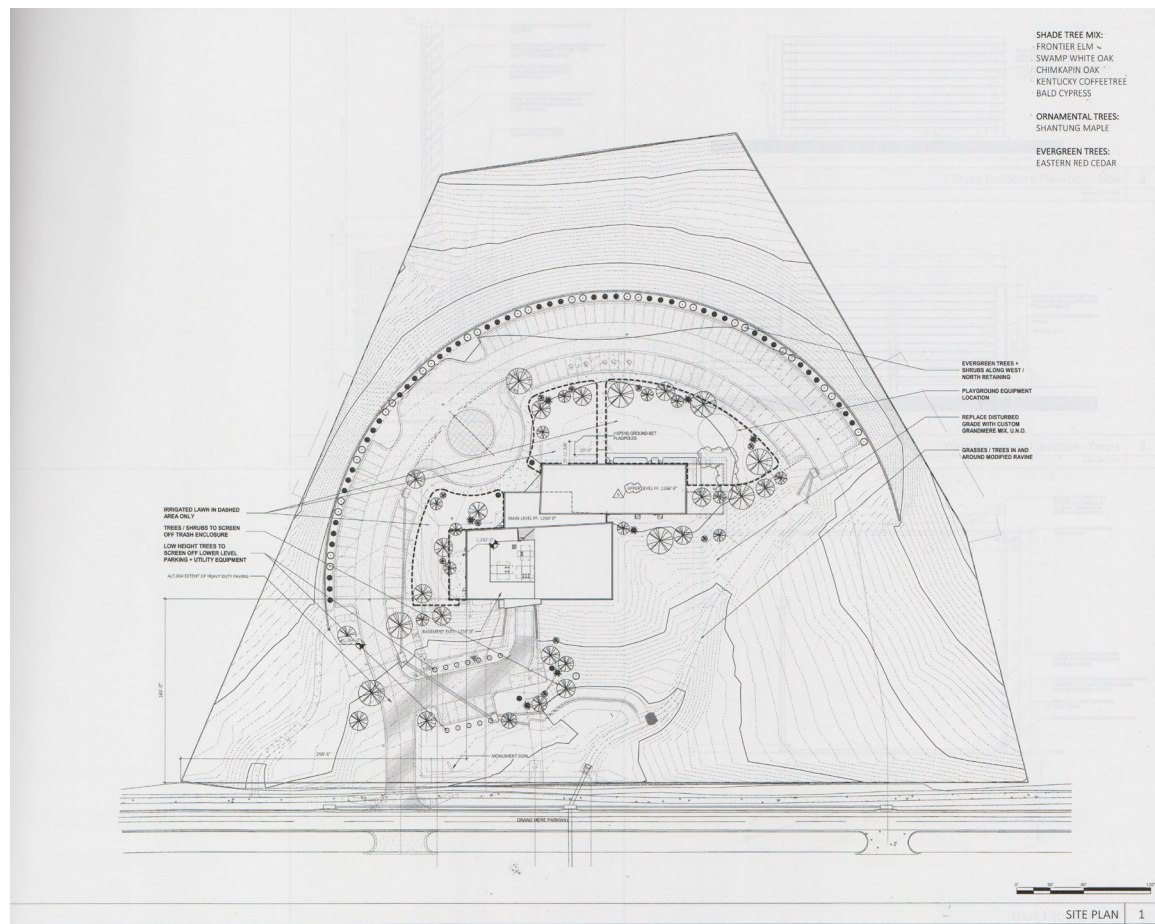


Figure 6.48. FCC Axonometric Construction Drawings



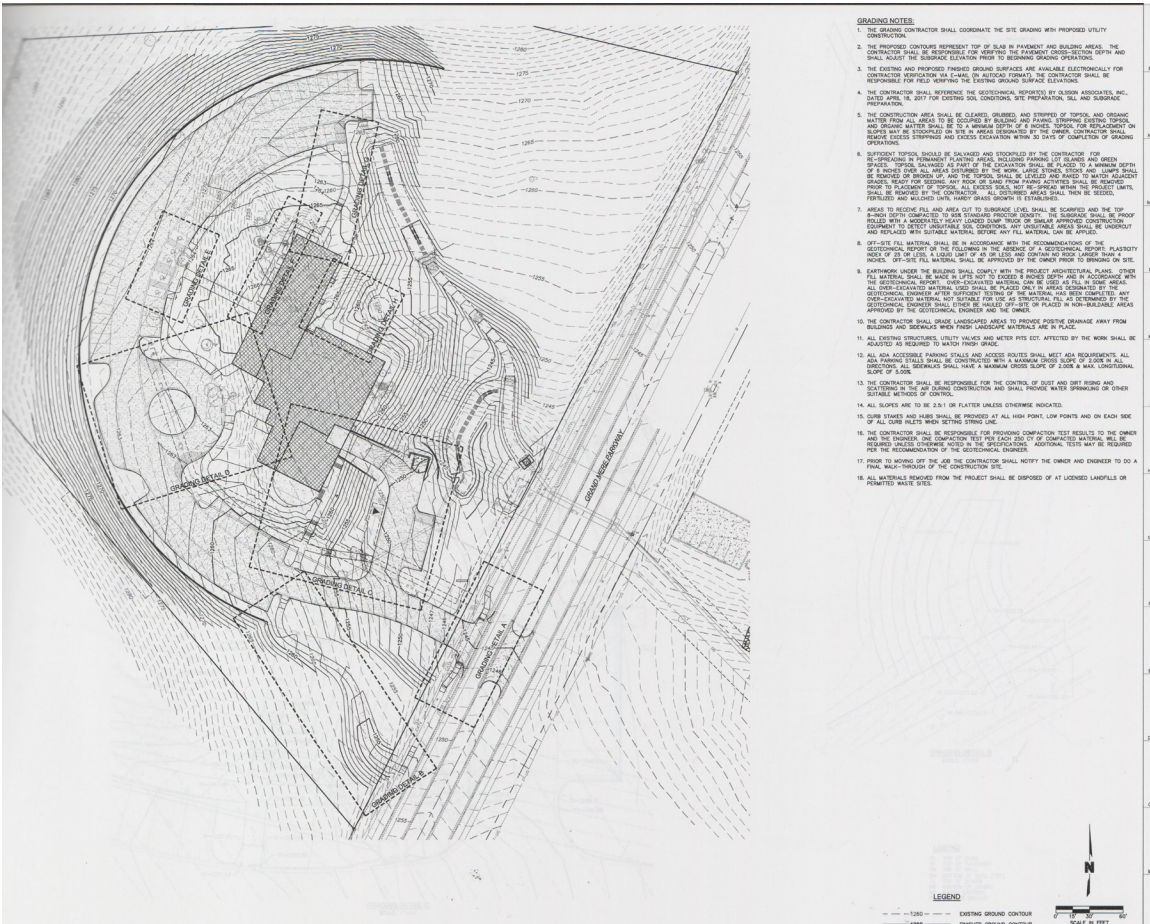


Figure 6.51. FCC Grading Details

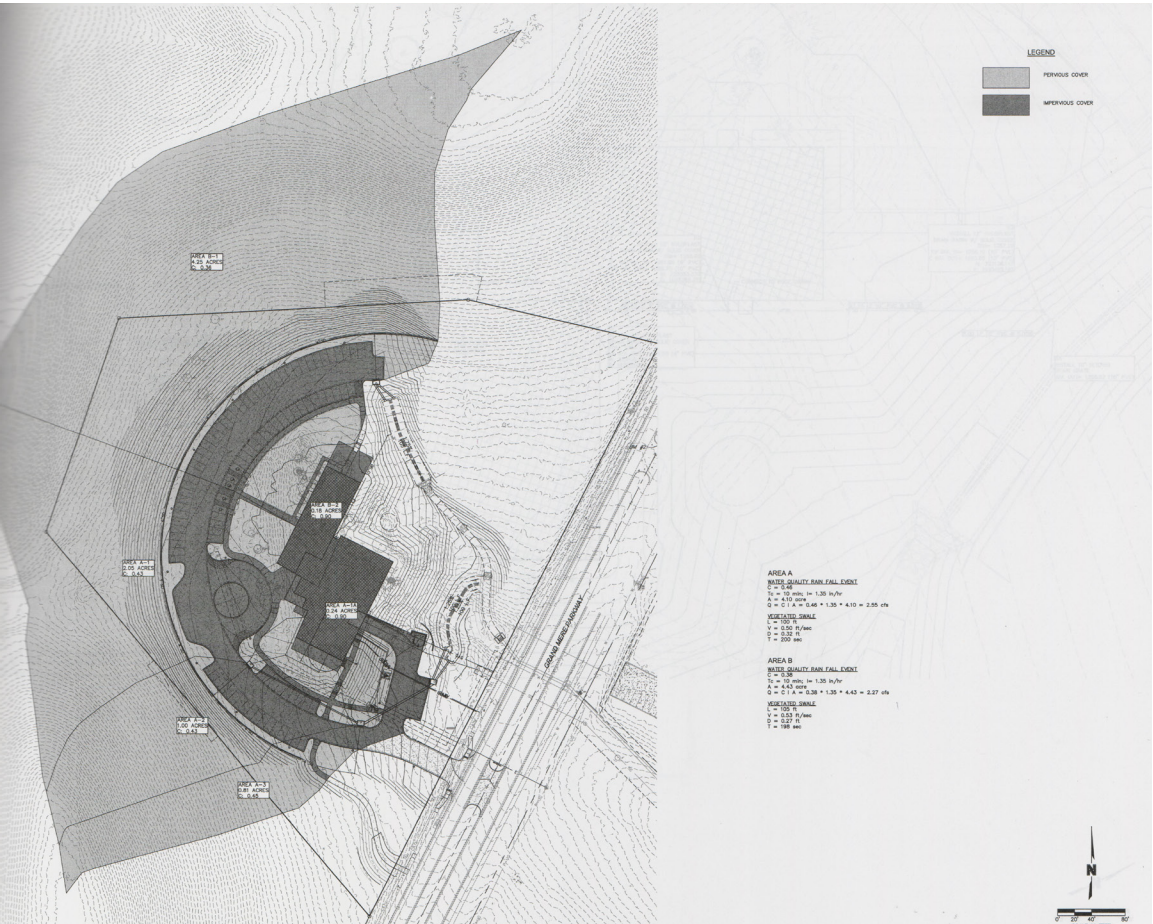


Figure 6.52. FCC Drainage Area Map

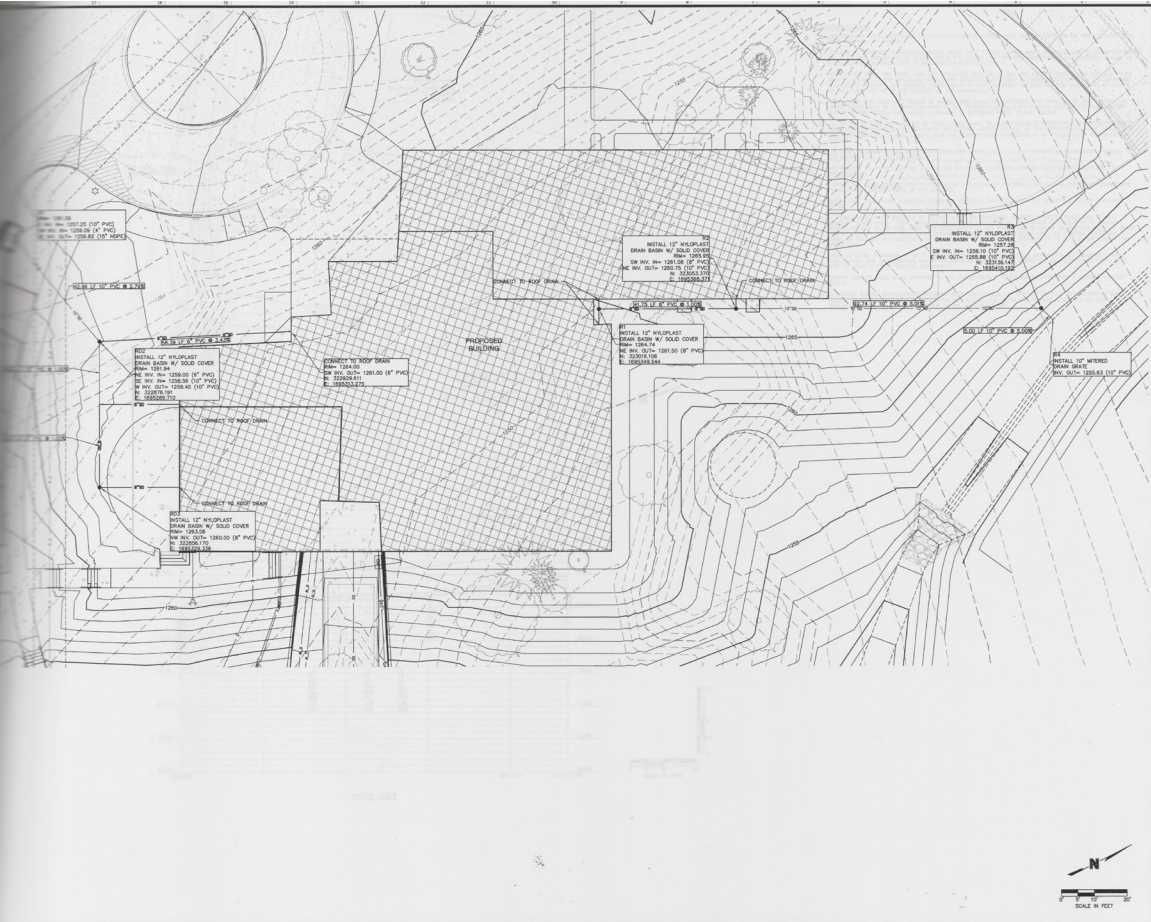


Figure 6.53. FCC Roof Drain Plan

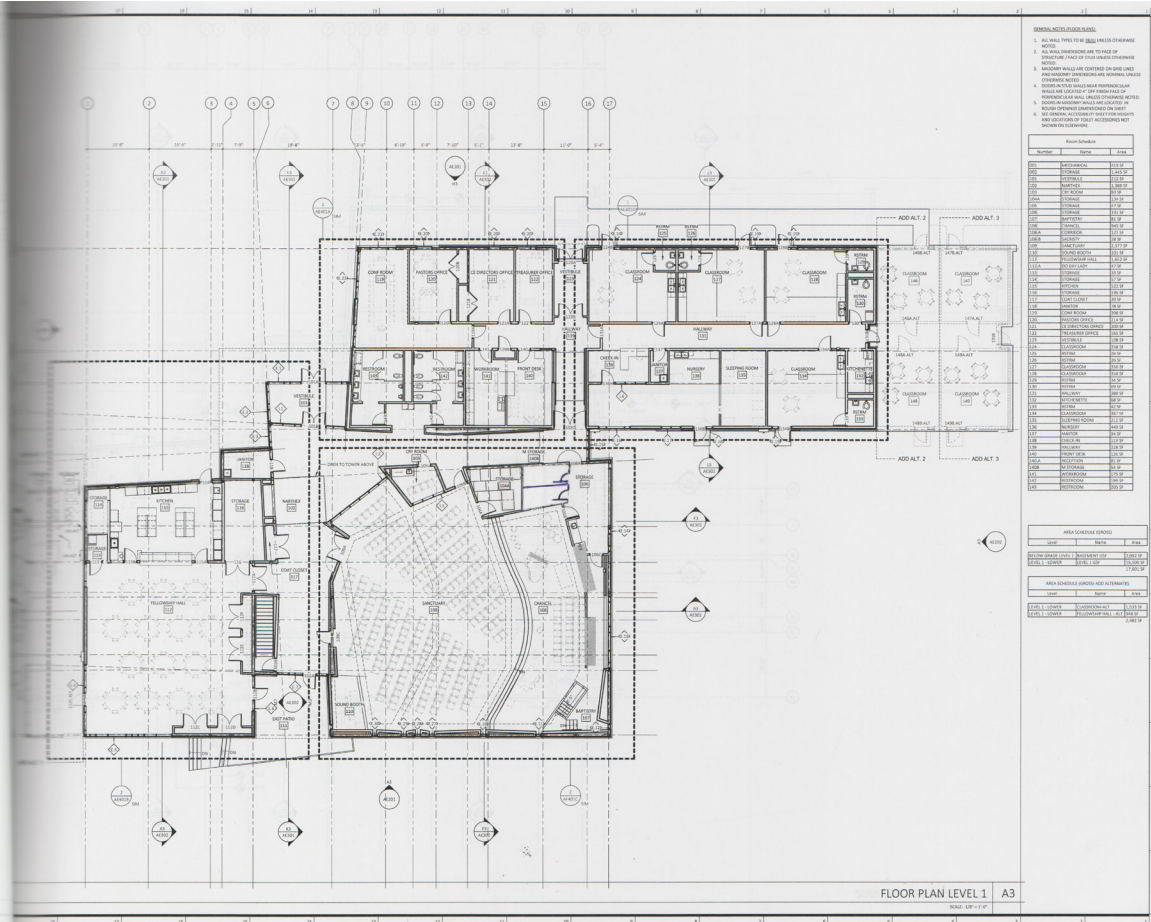


Figure 6.54. FCC Floor Plan Level 1

Design Opportunities

Investigating and analyzing site conditions allows for the revelation of possible spaces and opportunities for implementation. The literature review analysis also provided overarching topics and ideas for projective design. These include public green space, green infrastructure, ecological education, placemaking, artful rainwater design, and eco-revelatory design. Figures 6.56-6.61 illustrate the most suitable areas within the FCC site for the implementation of these concepts and why.

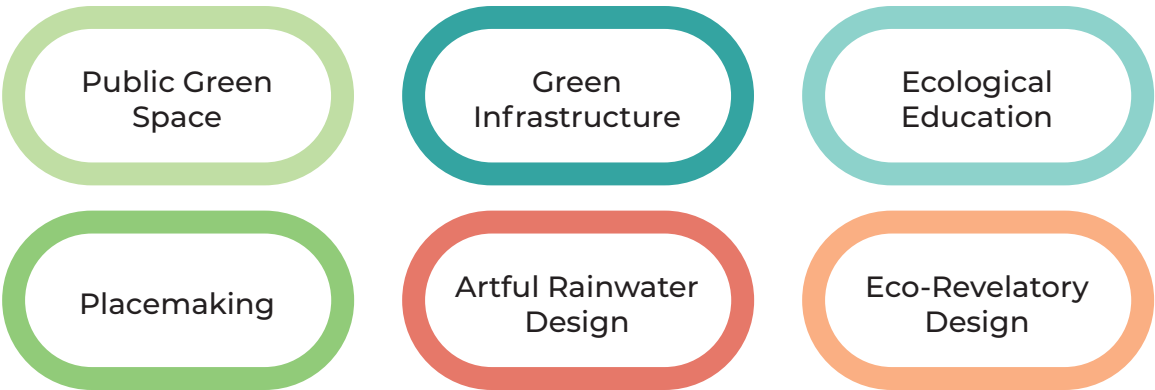


Figure 6.55. Main Research Topics

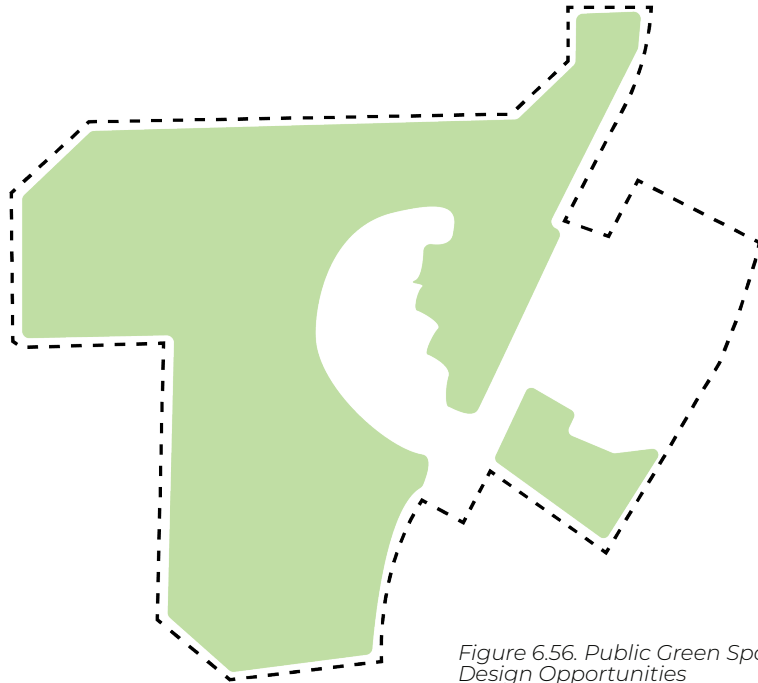


Figure 6.56. Public Green Space Design Opportunities

Public Green Space

Opportunities for public green space within the site include the fragmented drainageway on both sides of Grand Mere Parkway and the prairie surrounding the church and the trails within.

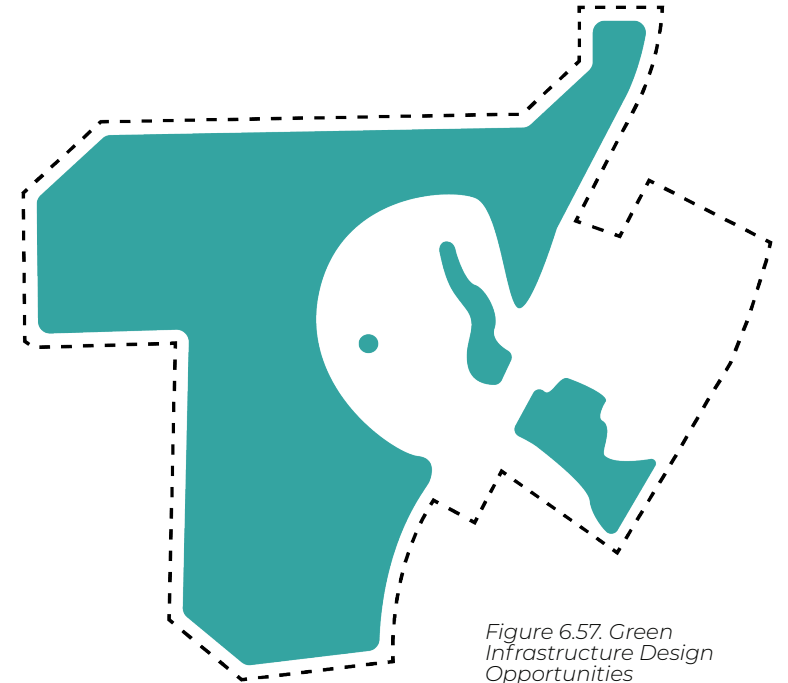


Figure 6.57. Green Infrastructure Design Opportunities

Green Infrastructure

Opportunities for green infrastructure are most prominent in the drainageway within the site. This area can become more vegetated. The prairie surrounding the church also acts as a means of green infrastructure as well as it contains native plantings. The parking area in the residential complex can contain some sort of permeable paving and storage basin for stormwater. There is also an opportunity for a sort of artistic cistern at the roundabout.

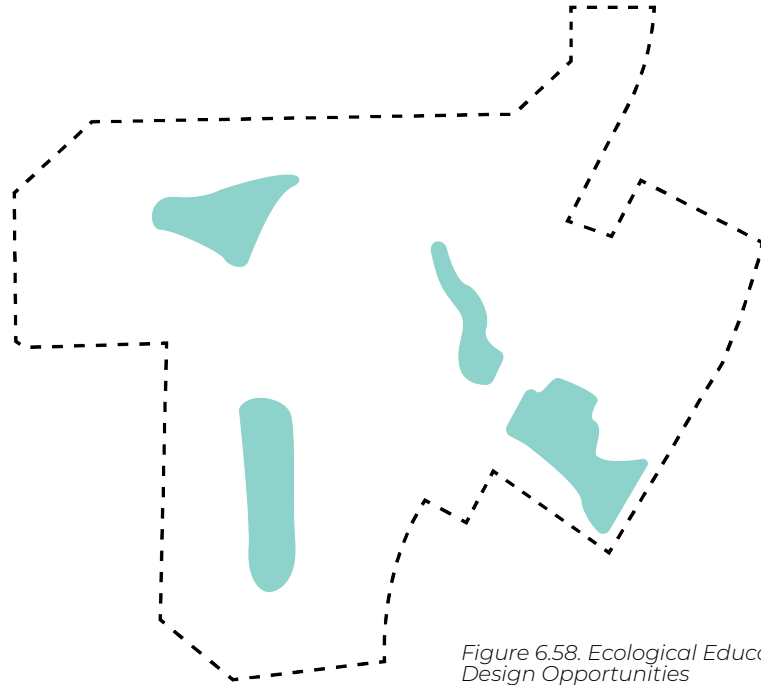


Figure 6.58. Ecological Education Design Opportunities

Ecological Education

Ecological education opportunities include the fragmented drainageway and areas along the trail within the prairie. The drainageway can be explored and personal observations and discoveries can be made along the trail within the prairie.

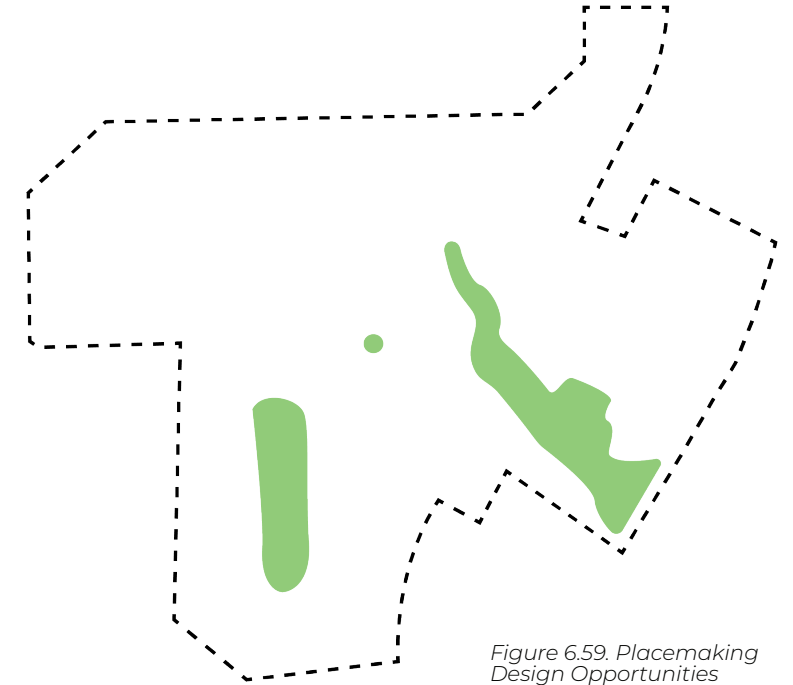


Figure 6.59. Placemaking Design Opportunities

Placemaking

Placemaking can be achieved within the drainageway, visible spots on the cuestras, and the prominent roundabout in the parking area. The drainageway can be visually connected on either side of the road to alert people that there is a connection. The southern cuesta is highly visible when driving or walking along the sidewalk, which makes it a prominent area. The roundabout is another highly visible and prominent area which can offer opportunities for implementation of placemaking strategies.

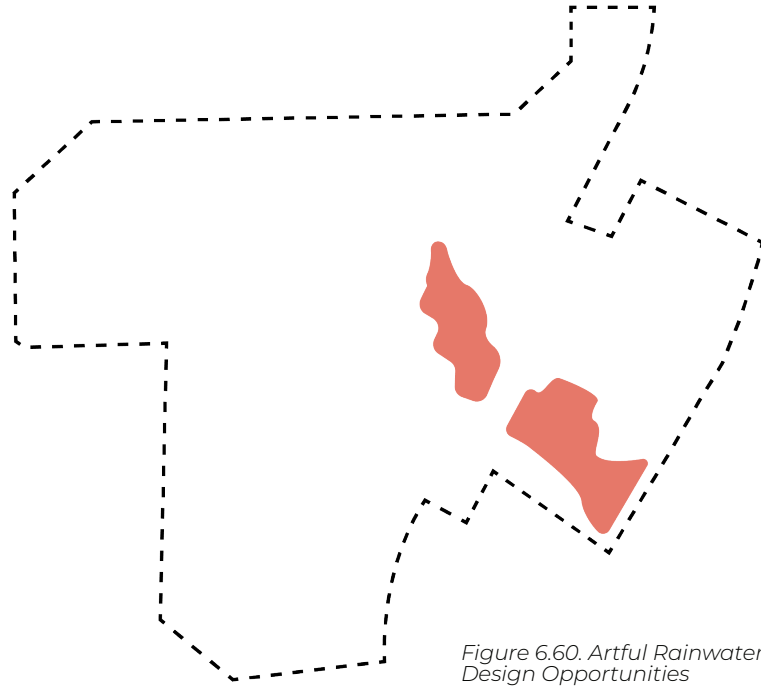


Figure 6.60. Artful Rainwater Design Opportunities

Artful Rainwater Design

Artful rainwater design would be best situated in the fragmented drainageway, as this area receives water and is highly visible. The area is best suited to provide opportunities for both recreation and education.

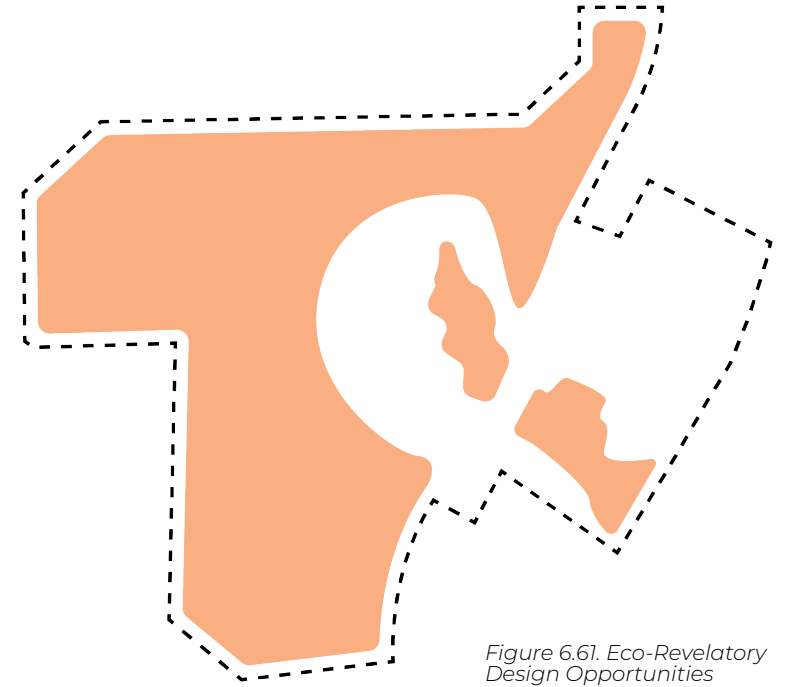


Figure 6.61. Eco-Revelatory Design Opportunities

Eco-Revelatory Design

Eco-revelatory design can also be present in the drainageway. This area can be observed and explored while serving multiple functions. Another space for eco-revelatory design would be within the prairie and the trails. This area can be explored and educate users to the context of the landscape.

07:
**PROJECTIVE
DESIGN**

Existing Programming

Existing programming within the First Christian Church (FCC) includes the church and its services, the From Cradles to Crayons childcare center, the outdoor play center attached to the childcare center, hiking trails behind the church, and parking areas. The church also has utility areas to the southeast of the site. This includes an electrical box, trash enclosure, and loading dock. When first being designed, the church also had proposed areas for a patio and outdoor performance area. The residential complex across Grand Mere Parkway includes both apartments and single-family homes, providing two different living styles. Within this area are ample parking areas, trash enclosures, and both native and invasive plantings.

Proposed Programming

In addition to the existing programming, the proposed design provides a tiered plaza space, a restored riparian corridor, an introduced gallery forest, an interactive boardwalk and art wall, a waterfall seating feature, interactive eco-nodes, cantilevered outlooks, education stations, and a shaded gathering area atop a cuesta. These spaces allow for ecological education opportunities, recreation, social interaction, and an increased sense of place. Figure 7.1 illustrates the existing and proposed programming.

Existing



Proposed

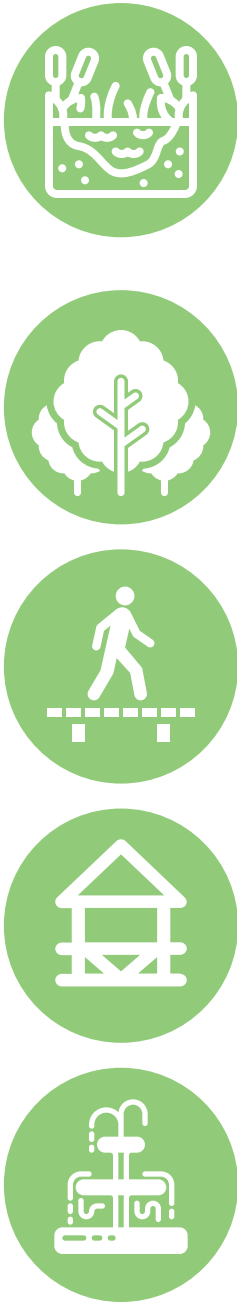


Figure 7.1. Existing and Proposed Programming

Process

The design process for the FCC’s outdoor space was iterative, with various design alternatives. Early designs focused more on a master-planned, large-scale site, which was later focused on the primary focal area of the site. Many initial ideas were inspired by elements from the precedents. Initial ideas included a plaza space and an experiential walkway to interact with the drainageway. The plaza was intended to work with the steep topography to the northeast of the church and act as a tiered element leading to the drainageway. The idea behind the boardwalk was to allow people to have more direct access and interaction with the drainageway, allowing for both educational and recreational experiences. These two programming elements quickly evolved and intertwined so that there could be both a plaza and outdoor classroom space, along with an experience with the drainageway. Along with those two main programming pieces, shade structures, outlook decks, and eco-education art walls were proposed and quickly refined and detailed as well. An ephemeral wetland was also originally proposed, but that eventually transformed into a series of pocket wetlands with micro-topography along with check dams to slow the conveyance of water. Figures 7.2-7.7 illustrate some of the many different design iterations throughout the design process.



Figure 7.2. Design Process 2-8-24 Plan 1



Figure 7.3. Design Process 2-8-24 Plan 2



Figure 7.4. Design Process 2-8-24 Plan 3



Figure 7.6. Design Process 2-12-24

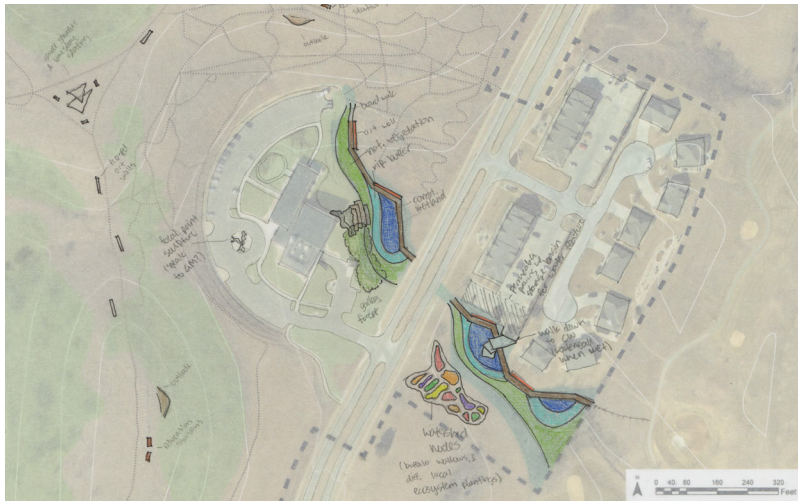


Figure 7.5. Design Process 2-8-24 Plan 4

Figure 7.7. Design Process 2-26-24

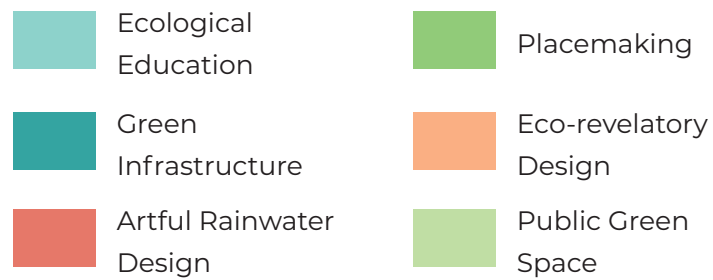
Master Plan

The overall conceptual design (Figure 7.15) of the site contains broader programmed elements that are less refined than the focused site. This master plan includes the prairie surrounding the church and the trails within. It also includes more of the residential side of Grand Mere Parkway and that drainageway. The master plan contains different programmed elements than the focus area. These include the recreation field and prairie biodiversity experiments, the eco-nodes, prairie outlooks, shade structure, and the tiered waterfall and seating area. The recreation area is intended to be a naturalized prairie that is occasionally mowed for recreational use, such as informal sports and play space. The space would not be mown during colder months as it would not be in use then. It is surrounded by the prairie biodiversity experiment areas. These are study areas that focus on increasing biodiversity in the Flint Hills. There are both formal experiment plots and informal seeded areas. The formal experimental plots are intended to be monitored and measured for ecosystem, species, genetic, and behavioral biodiversity.

The eco-nodes will also include different native plant mixes and micro-topography such as buffalo wallows. The idea behind the tiered waterfall and seating area was to capture stormwater and use that to feed the constructed wetland in the drainageway. These elements in the master-planned site will mimic the shapes, forms, materials, and colors of the focused site. The overall geometry of the site aligns with the angles of the church building to better situate each of the programmed areas. The boardwalk runs along the inner edge of the drainageway to not further degrade the space. The overall master plan also responds to the opportunity diagrams created for the six main topics of the research (Figures 7.8-7.14).



Figure 7.8. Design Opportunities Response and Programming



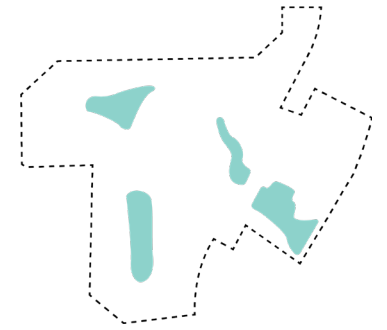
Public Green Space

Figure 7.9. Public Green Space Design Opportunities



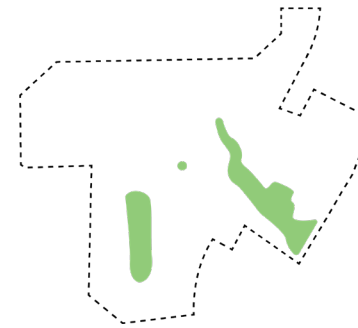
Green Infrastructure

Figure 7.10. Green Infrastructure Design Opportunities



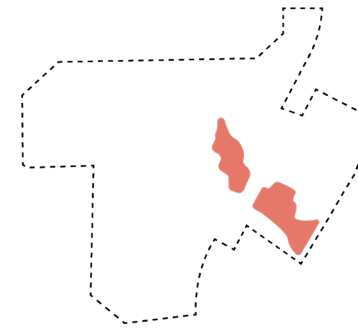
Ecological Education

Figure 7.11. Ecological Education Design Opportunities



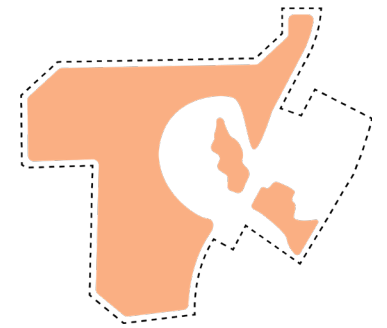
Placemaking

Figure 7.12. Placemaking Design Opportunities



Artful Rainwater Design

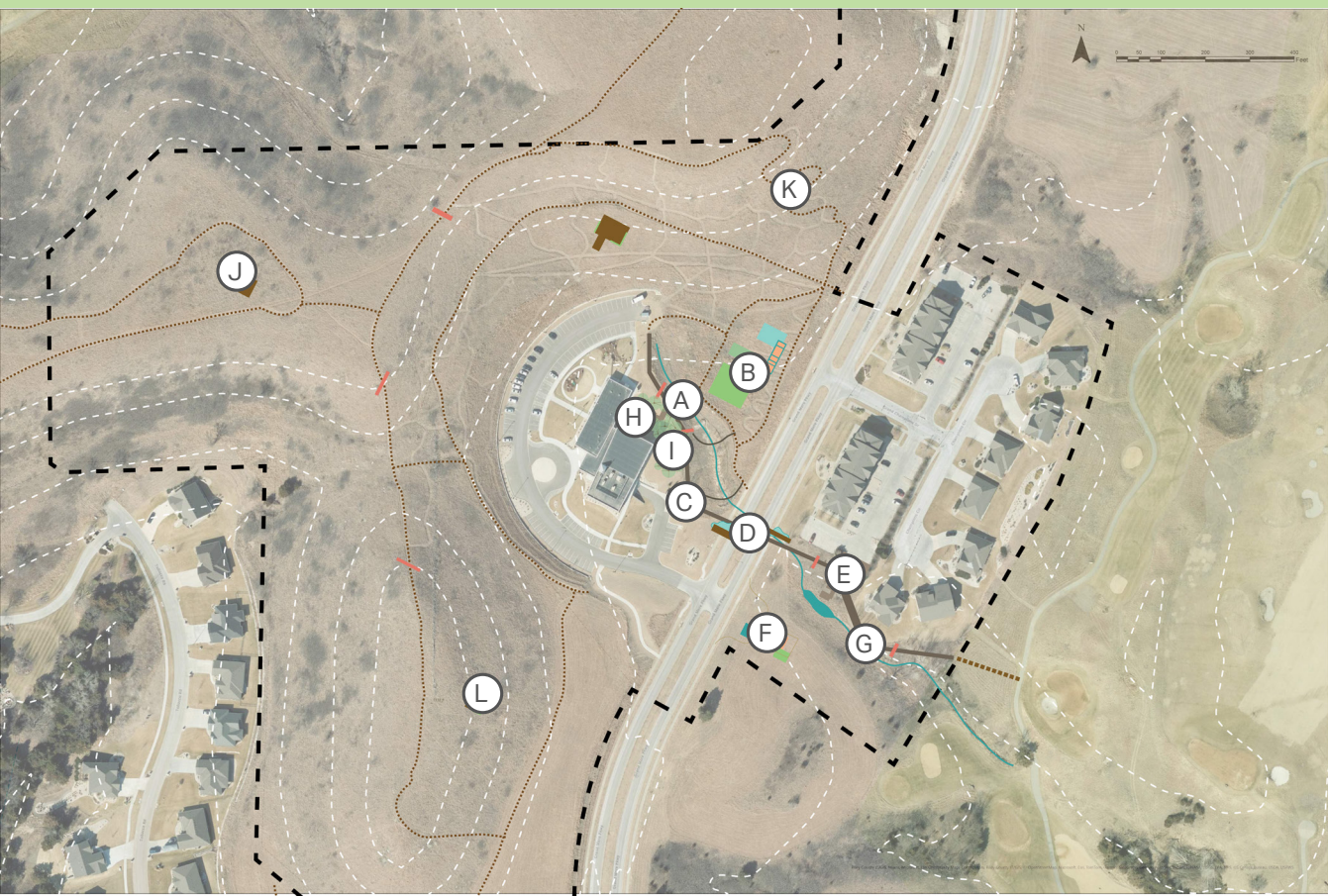
Figure 7.13. Artful Rainwater Design Opportunities



Eco-Revelatory Design

Figure 7.14. Eco-Revelatory Design Opportunities

Figure 7.15. Master Planned Site



- | | | |
|---|---|--------------------------|
| A Pocket Wetlands | E Tiered Waterfall/
Seating Feature | I Gallery Forest |
| B Rec. Field & Prairie
Biodiversity | F Eco-Nodes | J Shade Structure |
| C Eco-Education Art
Walls | G Experiential
Boardwalk | K Improved Trails |
| D "Wildcat Water"
Light Feature | H Plaza and Outdoor
Classroom | L Prairie Outlook |

Users

- Church Members
- Grand Mere Residents
- Day Care Children and Faculty

Stakeholders

- FCC Faculty & Congregation
- From Cradles to Crayons Children, Parents, and Faculty
- Grand Champions Apartments Residents
- Grand Mere Land Developers

Events

- Outdoor Performances
- Classes
- Recreation & Exploration
- Socialization

Site Condition Responses

Within and around the site, there are opportunities for exceptional views, improved trail conditions, and a protected and functional drainageway. The FCC Building Chair also commented on the future plans to add a recreation center and additional classroom space to the building. Figure 7.16 shows where a recreation center and additional classroom space may be best situated. The recreation center would not impact site design as it would be situated on the western side of the church. However, the additional classroom space may impede slightly towards the boardwalk. This could also be an opportunity – as the classrooms could lead directly to the boardwalk and plaza to create a seamless indoor-outdoor learning experience. Figure 7.17 illustrates highly visible areas within the site and where is best to capitalize on those views. Important views includes the entrance and exit experience within the site. These include the main drive, views from Grand Mere Parkway, along with views of the church from the surrounding prairie trails. The trail diagram (Figure 7.18) simplifies the complex trail network surrounding the church. This also allows access to key points surrounding the church and connections to the golf course trails.

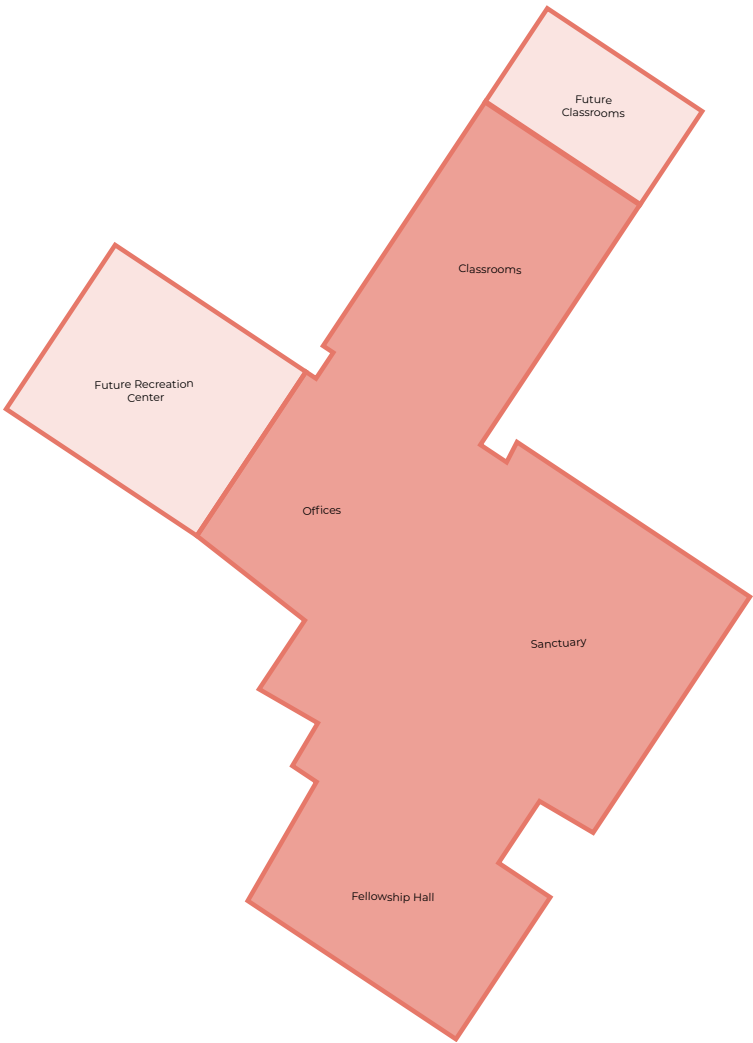


Figure 7.16. FCC Classroom and Recreation Center Expansions

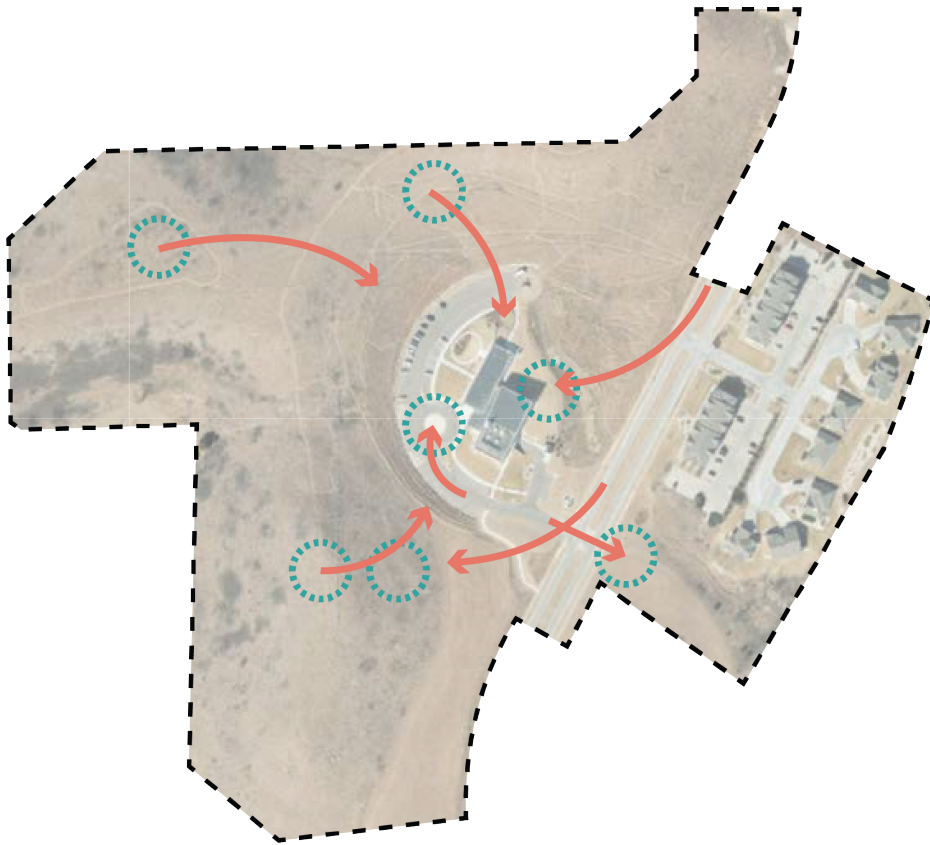


Figure 7.17. Views and Opportunities

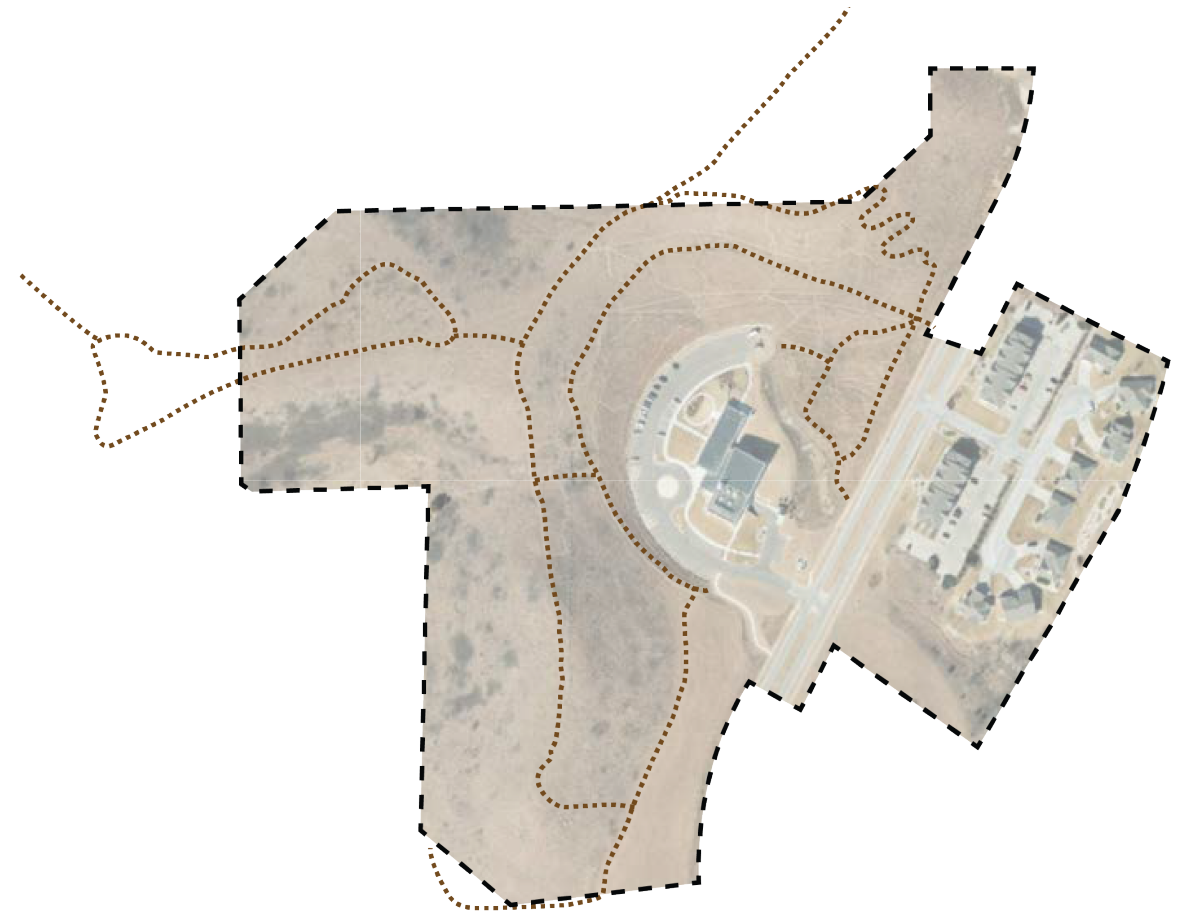


Figure 7.18. Trail Improvements

Figure 7.19 highlights the current streamline, and where it is channeled underground. This shows where to have the least development so as not to further degrade the area. This means that there should be less construction and manipulation of this space. However, the proposed design does interact with this space at key points. This is to help further the stormwater holding capacity and slow flow rates downstream. The proposed design also makes this stream corridor more meandering in order to treat and slow stormwater. Existing and proposed paving also have to ability to hold a good portion of the water that falls upon them, instead of sheet flows down to the drainageway. This can be done through permeable paving with infiltration basins below grade.

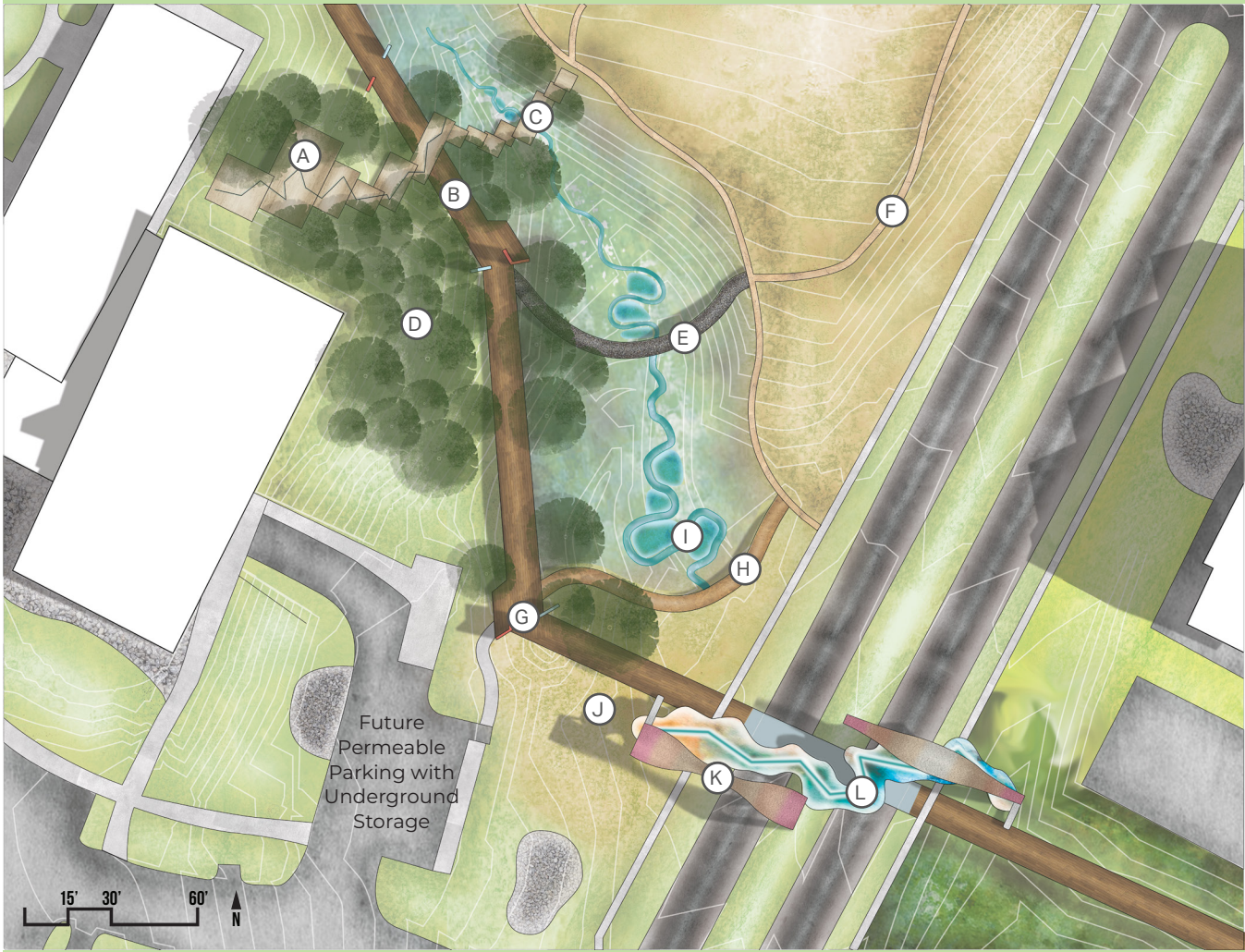


Figure 7.19. Existing Stream Corridor and Connection

Figure 7.20. Focused Site Plan

Focused Site Design

The following site plan (Figure 7.20) illustrates where each new programmed element is located within the site. The major elements of the design are the experiential boardwalk with eco-education art walls, the plaza and outdoor classroom space, and the “Wildcat Water” lighting and crosswalk feature. Other programmatic elements include the introduced gallery forest and prairie area, the pocket wetlands, and check dams. The goal behind these elements is to reference and emphasize the importance of water and where it comes from locally.



- | | | |
|-------------------------------|-------------------------------------|--|
| A Plaza and Outdoor Classroom | E Gravel Naturalized Check Dam Path | I Re-Routed Stream and Pocket Wetlands |
| B Experiential Boardwalk | F Prairie Trails | J Introduced Prairie |
| C Tiered Limestone Check Dam | G Eco-Ed Art Walls and Seating | K Thermochromic Support Structures |
| D Gallery Forest | H Mowed Check Dam Path | L “Wildcat Water” Light Feature |

Plaza and Outdoor Classroom

The plaza and outdoor classroom space are located to the north of the site, where the original outdoor performance space was once proposed during the architect’s design of the church (See Figure 7.21). This area can be used for outdoor classes and demonstrations, as well as socializing and gathering before and after church services. The material of the plaza is permeable limestone paving and is incised with an abstracted line of Wildcat Creek. The plaza slows the movement of stormwater and stores it below grade in basins. The space is also accessible to people with all abilities, as it includes ADA ramps. The plaza slopes down to the boardwalk where the final tier meets the walkway at grade. This allows for connections directly from the church to the boardwalk and finally to the prairie trails surrounding the church.

Figure 7.22 depicts how the space would be used and what it would look like.



Figure 7.21. Plaza and Outdoor Classroom Location

Precedent Inspiration

- Plaza at Ridge & Valley
- Tiered Element at Growing Vine Street
- Forest Court at Cedar River Watershed

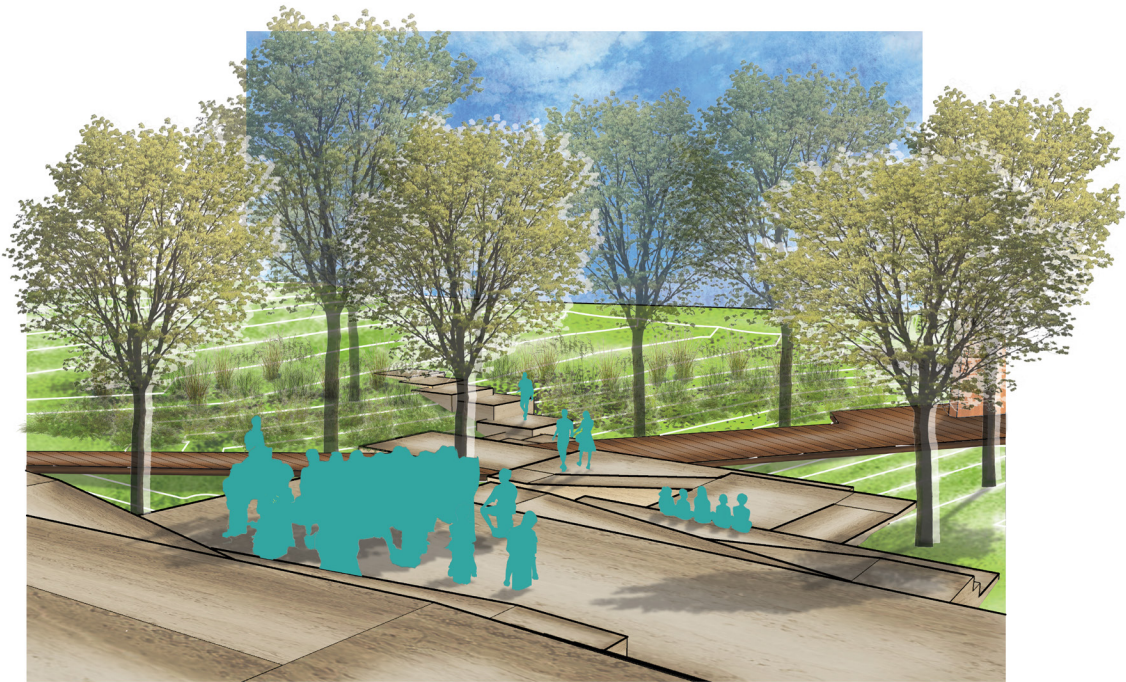


Figure 7.22. Plaza and Outdoor Classroom Perspective and Usage

Figure 7.24 below shows how the plaza tiers down to the boardwalk and how the steps and ramps are integrated into the design.

Figure 7.25 to the right shows an isometric view of the space and how users can interact within and navigate through the space. This shows where classes can take place and how the introduced gallery forest provides shade for classes and social events.

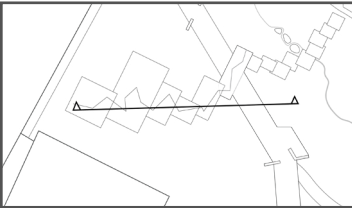


Figure 7.23. Plaza-Classroom Section Cut

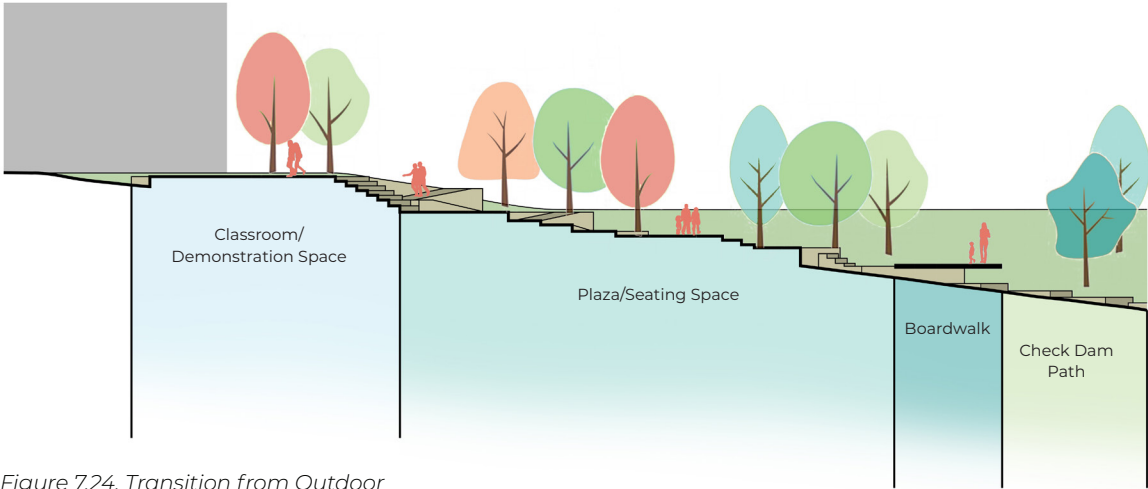


Figure 7.24. Transition from Outdoor Classroom down to Drainageway

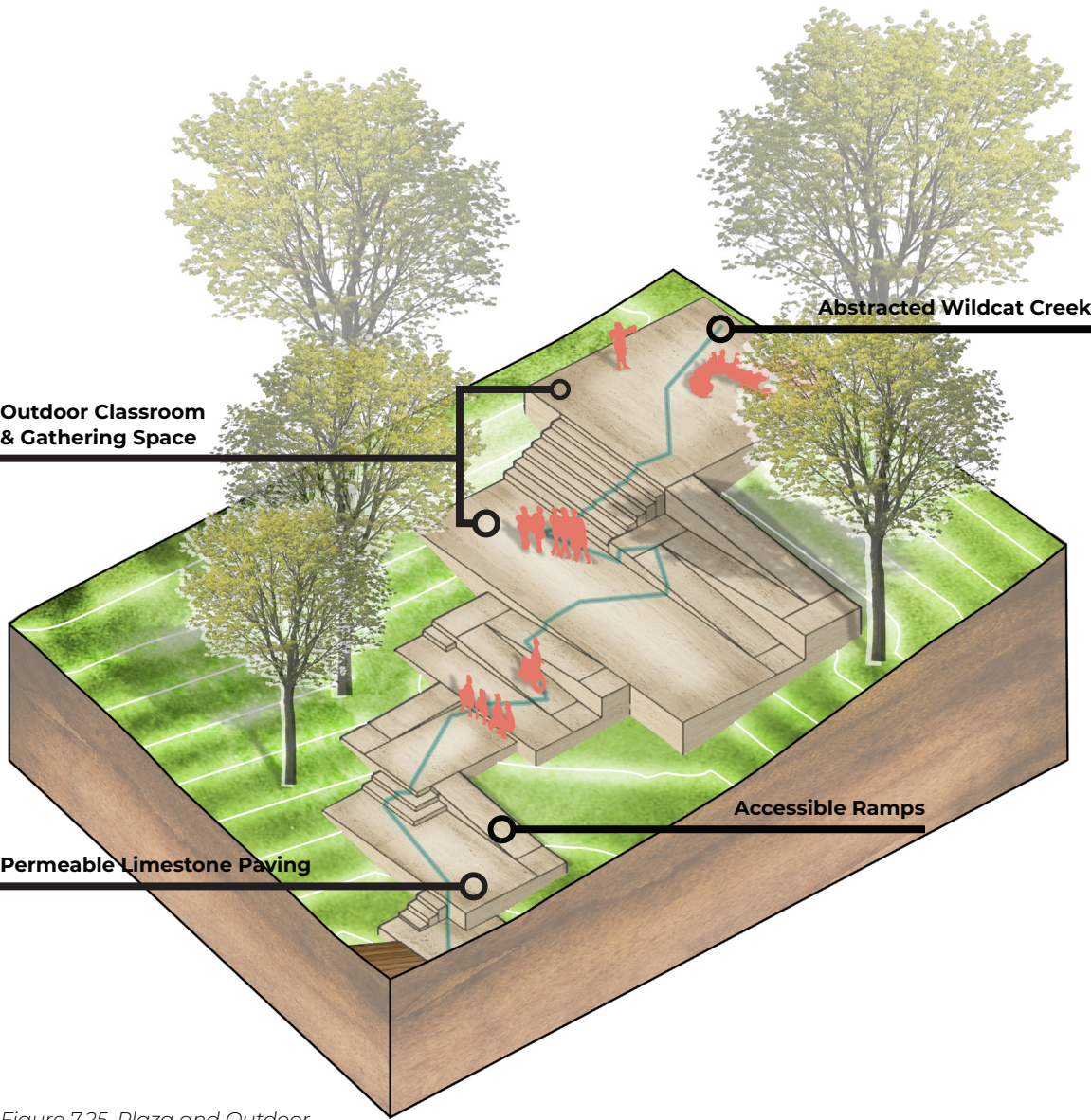


Figure 7.25. Plaza and Outdoor Classroom Isometric

The plaza and outdoor classroom offers space for students, church congregation, and childcare children and faculty to gather. This space allows opportunities for classes and demonstrations; socialization before and after church events; and overall relaxation, enjoyment, and learning.

Experiential Boardwalk

The boardwalk is located along the western edge of the drainageway, as shown in Figure 7.26. It is situated here to not further degrade and disturb the ecosystems and plant life within. The boardwalk is intended to be constructed with local cedar wood that has been cleared from infringing prairie areas. It is 12' wide and includes 4' wide rest points along the eco-education art wall installations with limestone bench seating. The boardwalk is also located at an intersection with the plaza space as the final tier is designed to transect the boardwalk. The trail system surrounding the church also connects to the boardwalk at the north of the site, and to the eastern edge of the drainageway with new check dam paths. It is intended in the master plan that the boardwalk would continue south into the residential part of the site and conclude with a ramp that leads to the golf course trail to the east of the single-family homes. Figure 7.28 shows the boardwalk in relationship to the FCC and drainageway, and Figure 7.29 shows the experience of walking along the boardwalk.



Figure 7.26. Experiential Boardwalk Location

Precedent Inspiration

- Guiding Trail at Queens Botanical Garden
- Walkway at Tanner Springs Park
- Seating at El Paso Pedestrian Pathways

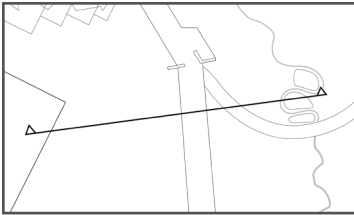


Figure 7.27. Boardwalk Section Cut

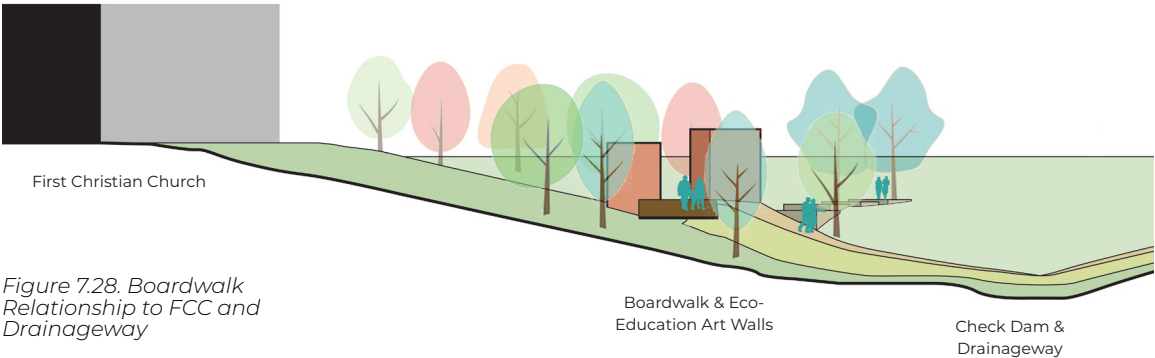


Figure 7.28. Boardwalk Relationship to FCC and Drainageway



Figure 7.29. Experience of Traversing Boardwalk

The boardwalk offers opportunities to interact with nature, learn about nature through the art walls, and make personal discoveries traversing the connected check dam paths. These activities create ecological education opportunities, placemaking objectives, and artistic green infrastructure goals.

Trail Connections, Check Dams, and Pocket Wetlands

The boardwalk and plaza spaces are connected to the surrounding trail system. This is accomplished through the implementation of check dams that double as walking paths. Figure 7.30 shows where these are located, and Figures 7.31-7.35 illustrate how they can be used, the functionality of the spaces, and what they look like. There are three check dams within the drainageway: one that follows the geometry and materiality of the plaza, one created with local gravel, and one as a mown/bare ground path. They all have a hard edge to catch and slow water but consist of different materials. Behind each of these check dams are a new, re-routed streamline and pocket wetlands. The streamline consists of a more meandering shape to slow, catch, infiltrate, and treat as much water as possible. Within the curves are pocket wetlands with micro-topography to hold water and lower the runoff quantity into the stormwater sewer system. Each of the check dams meets the boardwalk or pathway at grade, where there is a bend in the path and an eco-education art wall installation to signify and represent the movement of water. These check dam paths then connect to the trail system to the east of the drainageway.



Figure 7.30. Check Dams and Pocket Wetlands Locations

Precedent Inspiration

- Green Infrastructure System at Queens Botanical Garden
- Sensory Richness at Growing Vine Street
- Additional Public Green Space at El Paso Pedestrian Pathways

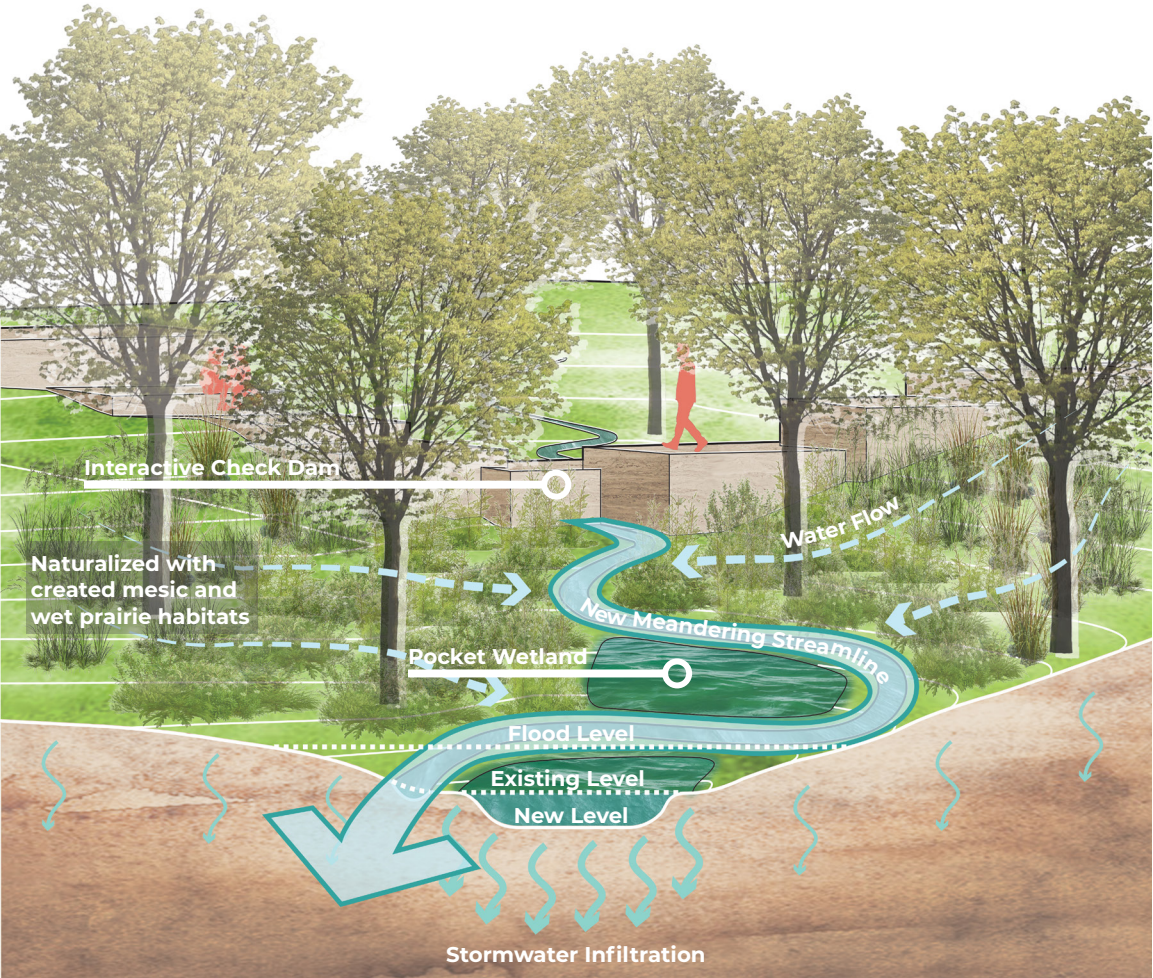


Figure 7.31. Wetland & Streamline Functionality

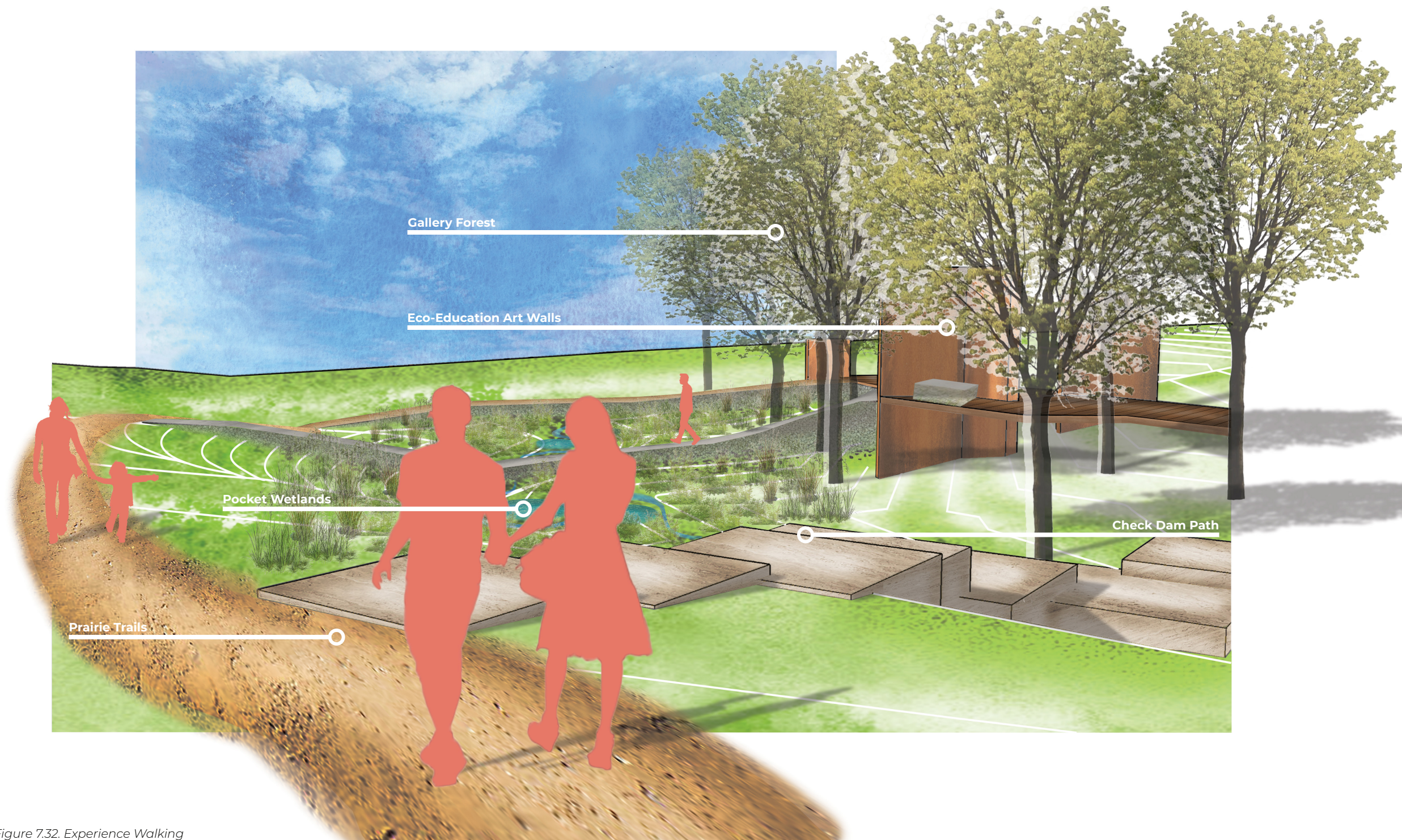


Figure 7.32. Experience Walking along Revitalized Drainageway

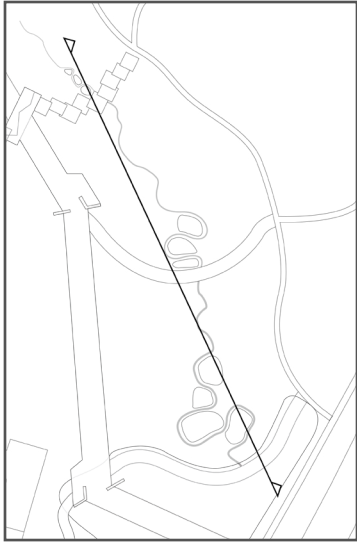


Figure 7.33. Check Dam and Wetlands Section Cut

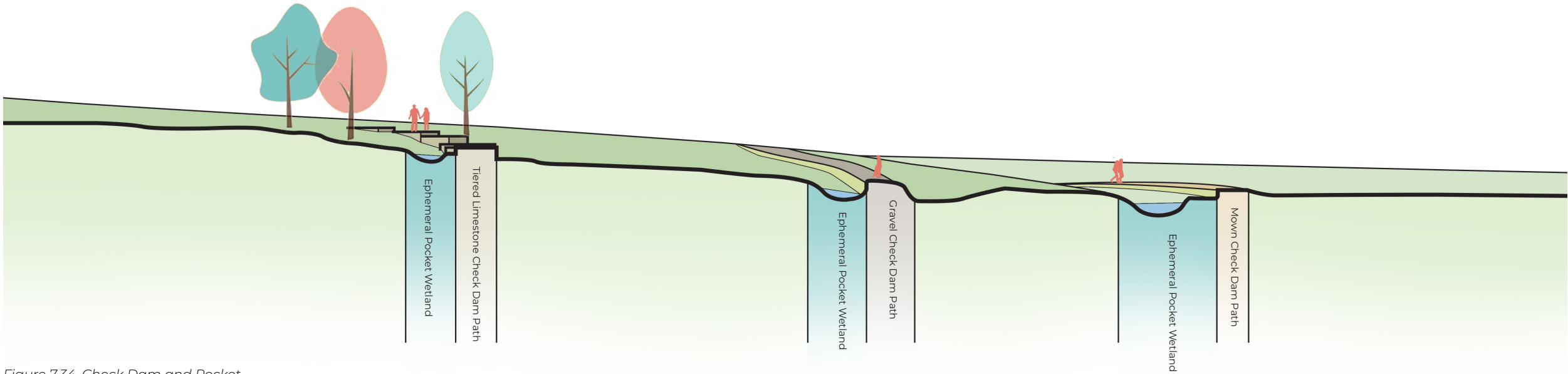


Figure 7.34. Check Dam and Pocket Wetland Progression Section

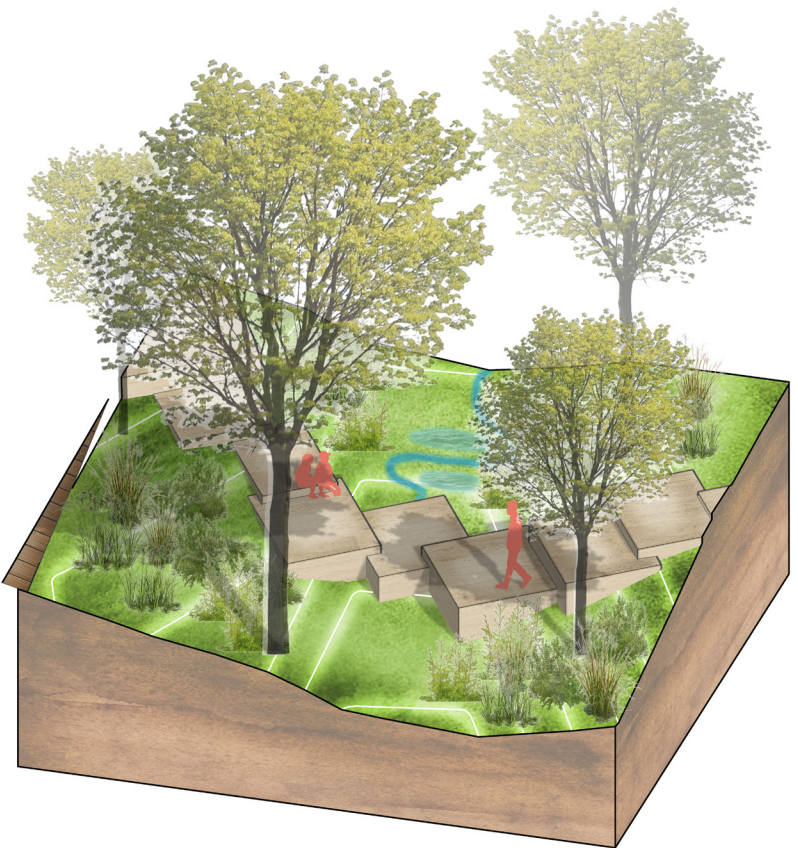


Figure 7.35. Northern Check Dam Oblique

The check dams and pocket wetlands act as green infrastructure as they minimize flow rates downstream and the surrounding naturalized vegetation acts as a sort of rain garden to slow water from entering the stream corridor.

Eco-Education Art Walls and Seating

The eco-education art walls and rest spots are located along the boardwalk, where the path bends and there is a check dam path present (See Figure 7.36). This location is intentional to signify to people the bend and movement of water. The walls are designed to intrude on the path to slow people down and learn about their environment. The main material of the walls is intended to be limestone, with corten steel covering the stone. The walls will have educational text and imagery that discuss the flora and fauna of the area, the Little Kitten Creek-Wildcat Creek Watershed and other watersheds within Riley County, the Flint Hills Ecoregion, and the indigenous relationship to the lands. This text and imagery will be etched into the corten steel, exposing the limestone underneath. Seating within these areas will consist of native limestone benches that also represent the regional materials.

Figures 7.37-7.38 show the experience of walking through these eco-education art walls, along with the materiality and images that may be present.

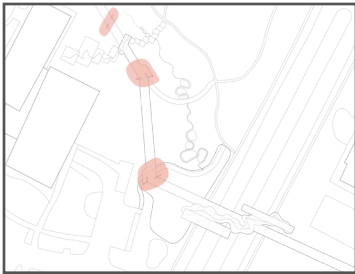


Figure 7.36. Eco-Education Art Walls Locations

Precedent Inspiration

- Art Walls at Tanner Springs Park
- Seating at Ridge & Valley
- Etchings at Cedar River Watershed

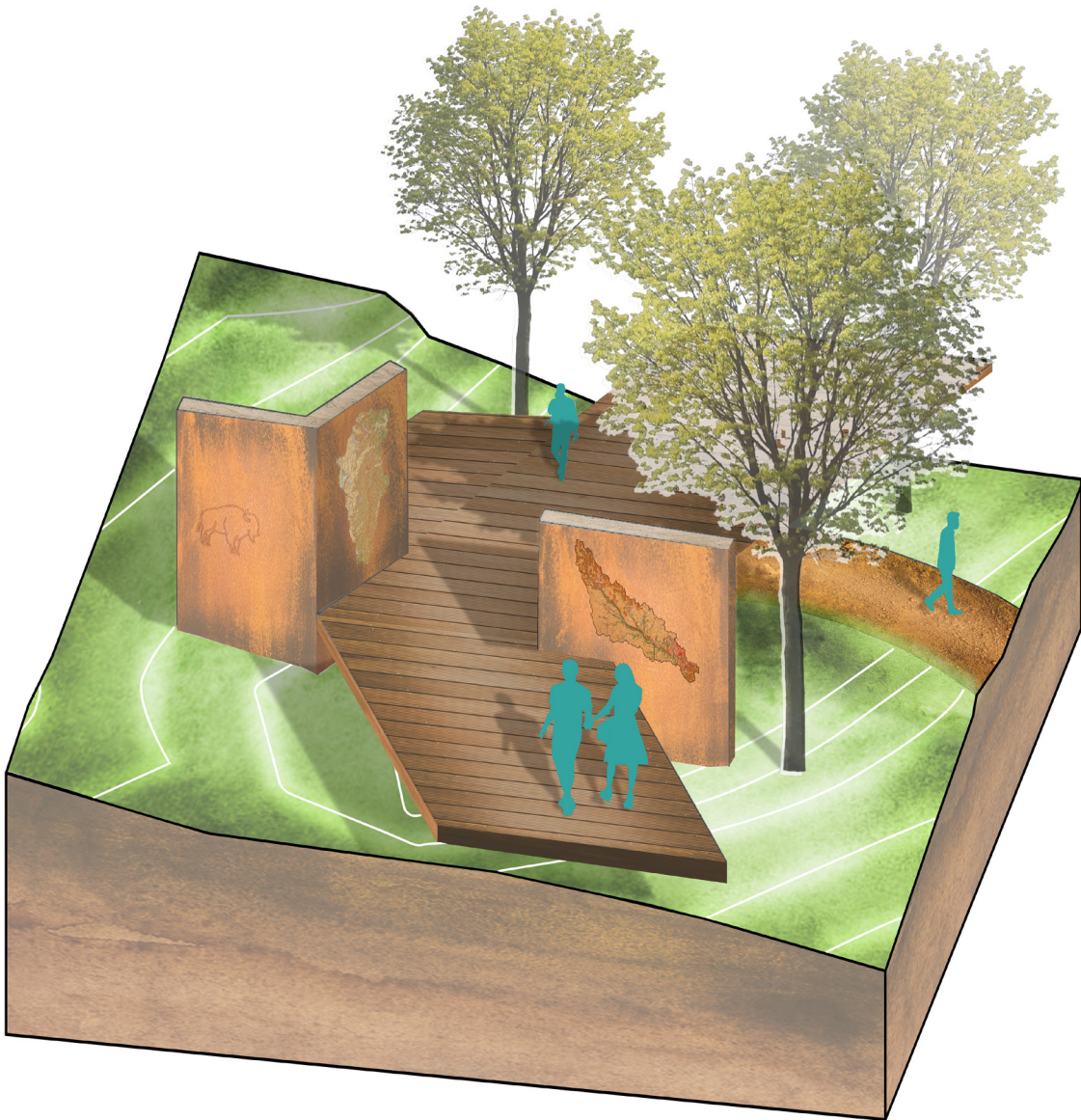


Figure 7.37. Eco-Education Art Walls Oblique



Figure 7.38. Walking Along and Throughout the Eco-Education Art Walls

Introduced Prairie and Gallery Forest

The introduced prairie plantings and gallery forest are located immediately east of the church and throughout the drainageway, as seen in Figure 7.39. The prairie plantings will continue from the trail areas and surround the southern portion of the boardwalk. This allows for a more naturalized experience while walking along the boardwalk and preparing to cross Grand Mere Parkway. This will also transition into the gallery forest further north. This is intended to help shade the boardwalk and plaza, as well as sequestering carbon and providing animal habitat. The forest will consist of existing native willows and burr oaks with chinkapin oak and other drought-tolerant trees at higher elevations. This will provide needed shade and create a unique experience throughout each season while walking along the boardwalk.

Precedent Inspiration

- Green Infrastructure System at Queens Botanical Garden
- Restored Native Plant Communities at Cedar River Watershed
- Historic Plant Communities at Tanner Springs Park

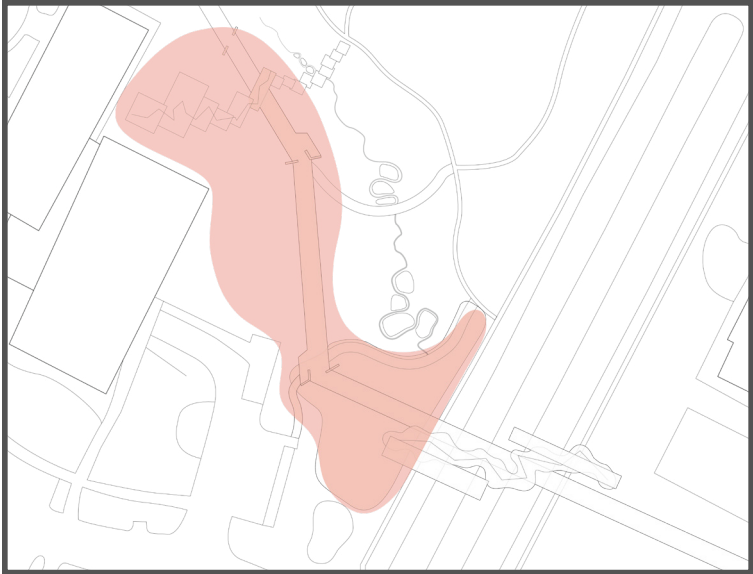


Figure 7.39. Location of Gallery Forest and Introduced Prairie

Wildcat Water Connection

The “Wildcat Water” feature will be located at the southern portion of the site, where the drainageway has been transected by Grand Mere Parkway (See Figure 7.40). This structure will span across the road to symbolize the connection of the drainageway. Two sculptural pieces designed to symbolize sunrise and sunset patterns will help support the lighting feature. They would be constructed with fiberglass and a thermochromic metal surrounding the top parts, which will reveal temperature conditions through colors. The underside will be covered in corten steel with etchings of historical ecological aspects such as cattle, bison, and ecological knowledge of indigenous tribes. The light takes the form of an abstracted Wildcat Creek and is made of a neon lighting tube. The tube is surrounded by a billowing, reflective textile fabric held together with a wire frame at the bottom. The light feature will utilize sensors and is intended to change color when water is flowing underneath and indicate water quality with different colors. The textile fabric will also indicate wind conditions while being durable enough during strong wind events. Along with these features, there will also be an introduced crosswalk so people can safely cross to the other side of the boardwalk. Figures 7.41-7.44 show the forms and functionality of these components.

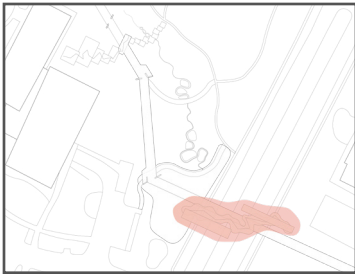


Figure 7.40. Eco-Revelatory Wildcat Water Sculpture Location

Precedent Inspiration

- Sculptures at El Paso Pedestrian Pathways
- Eco-Revelatory Cistern at Growing Vine Street
- Eco-Revelatory “Water Drums” at Cedar River Watershed

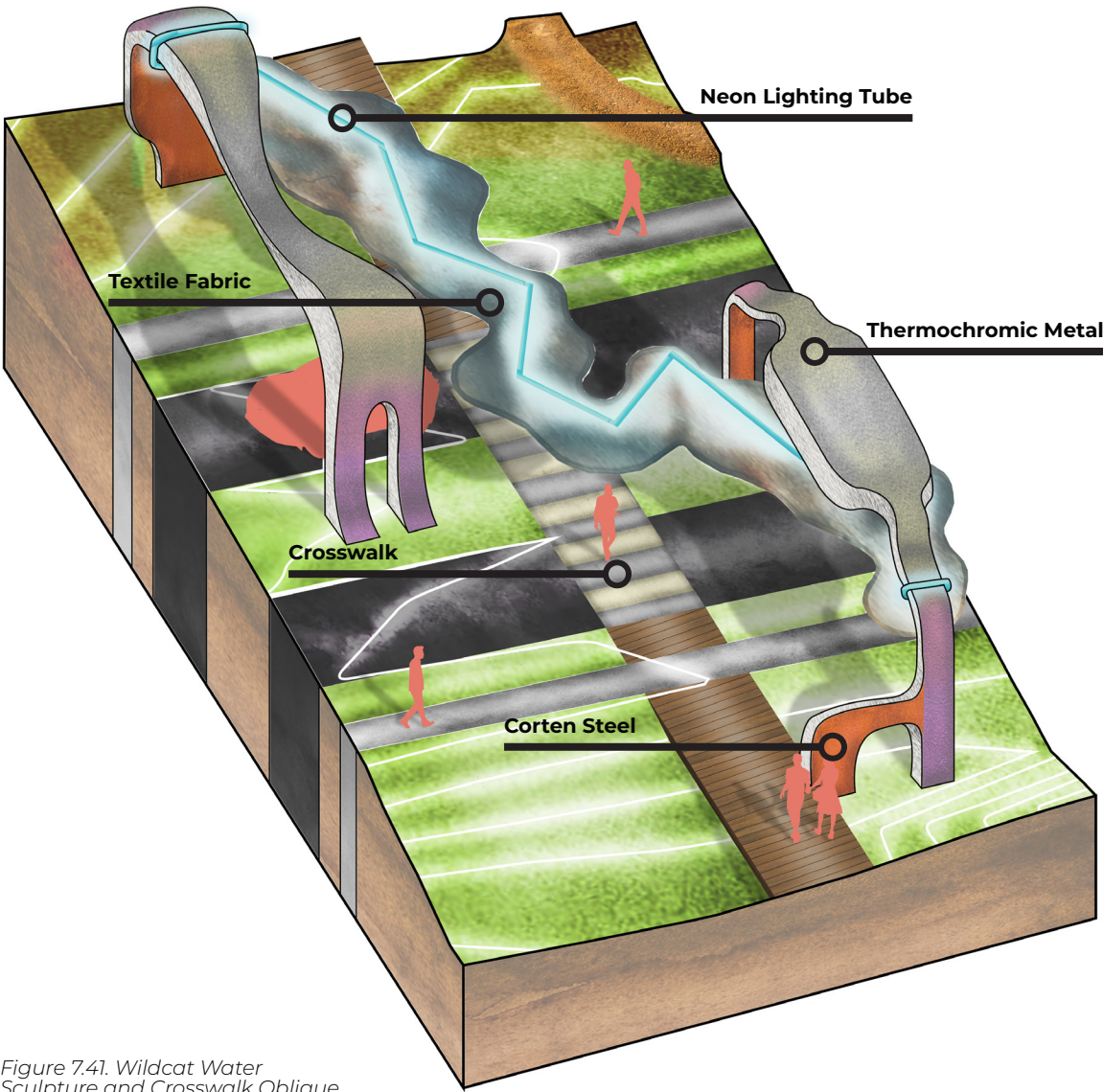


Figure 7.41. Wildcat Water Sculpture and Crosswalk Oblique

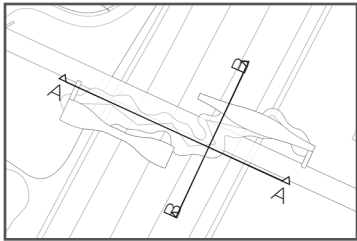


Figure 7.42. Wildcat Water Section Cuts

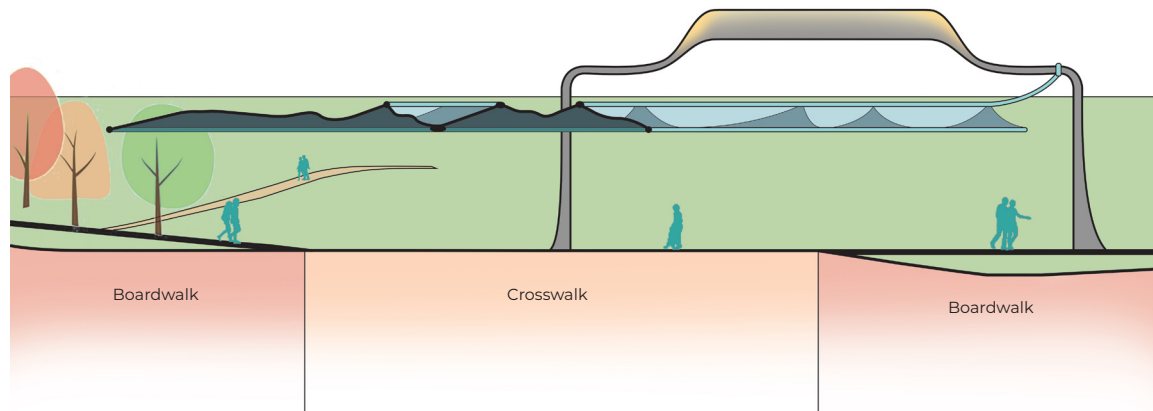


Figure 7.43. Grand Mere Parkway Crossing Transition (Section A-A)

These sections cut perpendicular to each other to show form and weight of every part of the light feature and sculptural supports. The thermochromic material on top of the support structures is meant to reveal temperature conditions, with bright white being the hottest, and a dark purple being the coolest. Water quality and wind conditions are revealed through the light of the tube and the movement of the textile fabric.

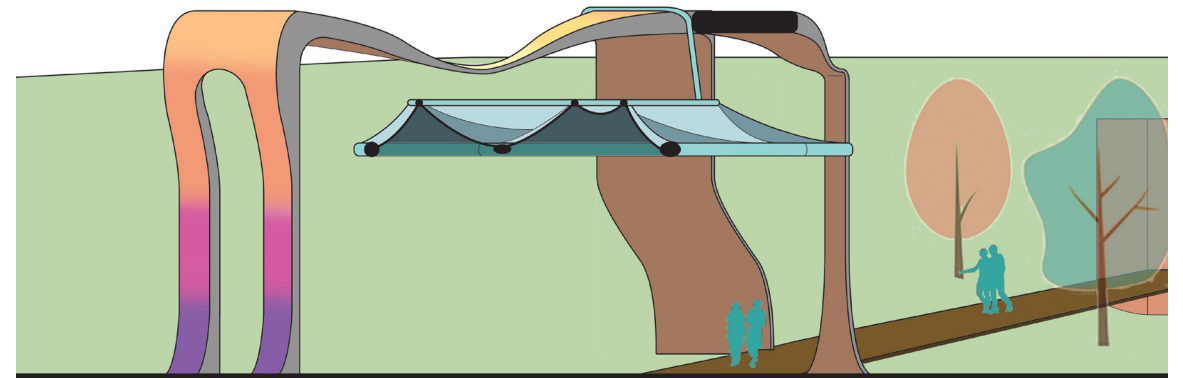
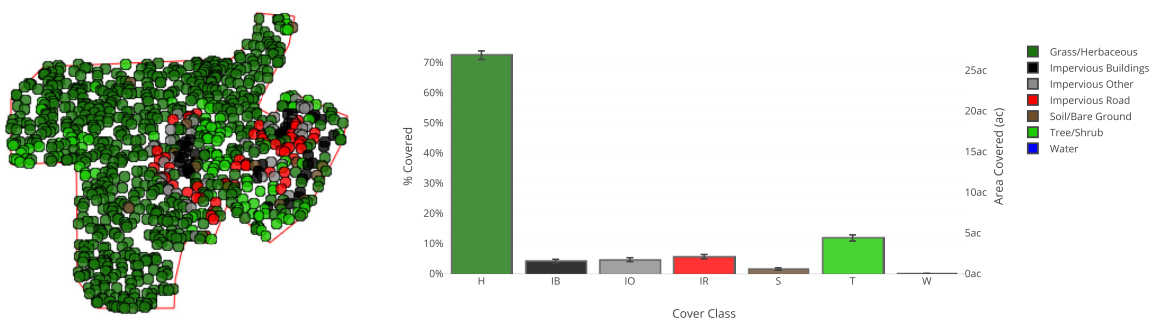


Figure 7.44. Wildcat Water Sculpture Section (Section B-B)

Metrics

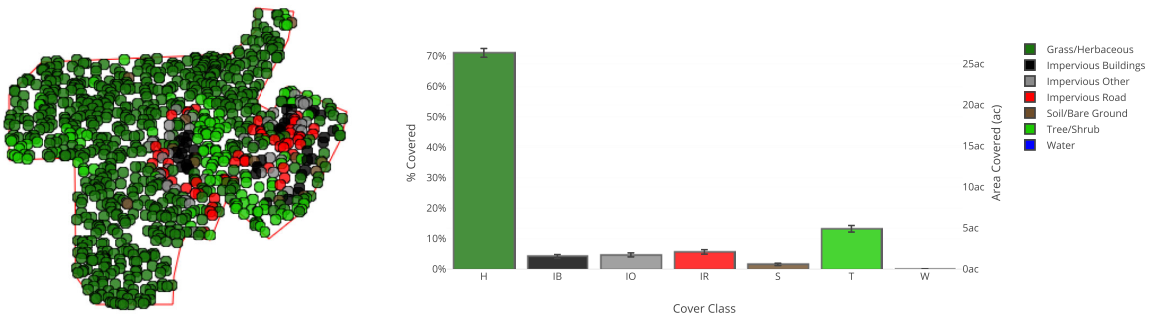
Metrics measured include land coverage before and after implementation, carbon sequestered before and after implementation, the new stormwater holding capacity of the drainageway, tree canopy introduced, additional prairie land, new permeable paving, and introduced outdoor social space. i-Tree Canopy was used to measure the land coverage and the benefits derived from that. 1,000 data points were used to create a more accurate representation estimate of the study area. This tool creates a ‘resolution’ of the land by coverage type and measures benefits from those coverages. The majority of the site before implementation was grass/herbaceous, which includes the prairie and manicured lawn. The second most abundant land coverage class was tree/shrub, which included plantings in the drainageway along with woodier areas in the prairie. This is still true with the site post-implementation, with grass/herbaceous being 72.4% before, and 71% after. Tree/shrub cover increased from 11.8% to 13.2%. This resulted in .78 more tons of carbon sequestered annually and 12% more stormwater runoff avoided. Figures 7.45-7.46 show i-Tree metrics.

i-Tree Canopy also has its limitations. There are seven programmed coverage classes with associated benefits for each. These classes include grass/herbaceous, impervious buildings, impervious other, impervious road, soil/bare ground, tree/shrub, and water. The names of these coverage classes can be changed; however, it is not possible to change the programmed benefit data of each. The i-Tree program also suggests 500-1000 data points be collected for a more accurate representation. Too few points leads to a higher level of standard error. This is why 1,000 points were used.



Existing
4.38 Acres of Tree/Shrub
5.97 Tons of Carbon Sequestered Annually

Figure 7.45. Existing i-Tree Metrics and Benefits



Proposed
4.9 Acres of Tree/Shrub
6.68 Tons of Carbon Sequestered Annually
12% More Stormwater Runoff Avoided

Figure 7.46. Proposed i-Tree Metrics and Benefits

Total Stormwater Holding Capacity of 1,796 ft.³

Decreases Runoff Volume by 13,435 Gallons when Wetlands are Full

~405' of Naturalized Stormwater Treatment

The new pocket wetlands in the drainageway have a holding capacity of almost 1,800 cubic feet, which means almost 13,000 gallons redirected from the stormwater sewer system when the wetlands are full. The check dams and meandering streamline also slow the movement of water and treat and infiltrate it naturally. 14,000 square feet of tree canopy and 7,800 square feet of prairie are introduced which creates environmental benefits such as carbon sequestered, lowered heat island effect, biodiversity increased, and additional habitat provided. Figures 7.47-7.51 illustrate these metrics.

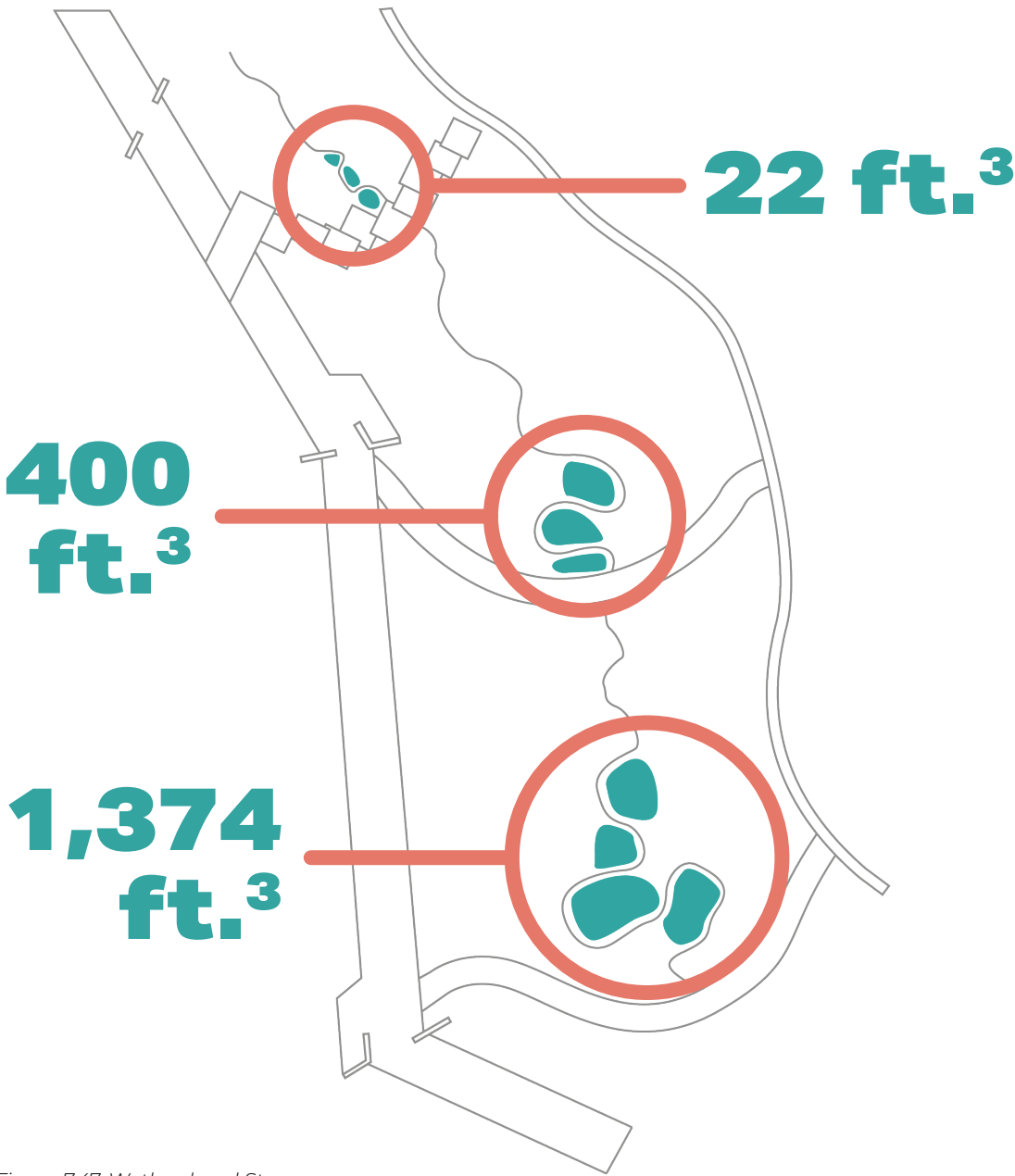
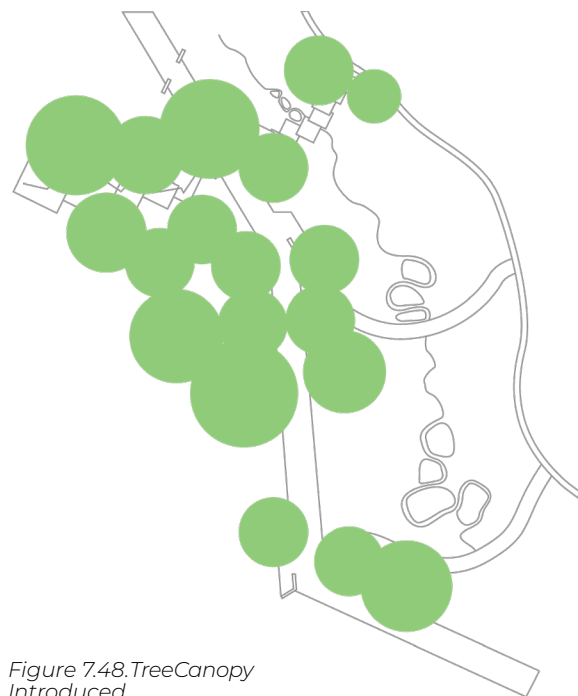
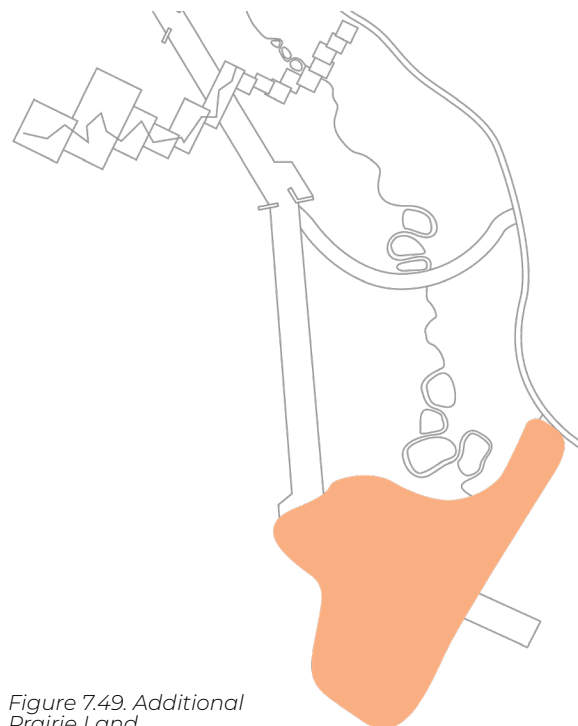


Figure 7.47. Wetland and Stream Corridor Metrics and Benefits



14,000 ft.²
of Tree Canopy Introduced

Figure 7.48. Tree Canopy Introduced



7,800 ft.²
of Additional Prairie

Figure 7.49. Additional Prairie Land

3,000 ft.²
of Outdoor Social Space Created

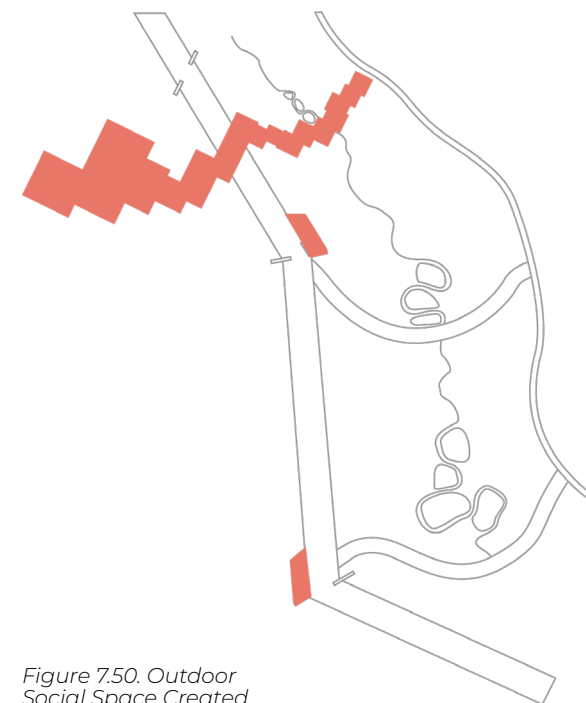


Figure 7.50. Outdoor Social Space Created

1,500 ft.²
of Permeable Pavement Added

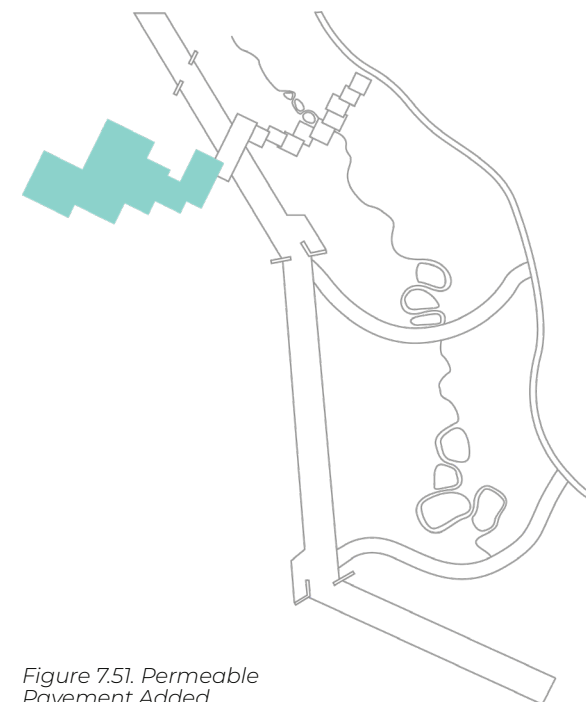


Figure 7.51. Permeable Pavement Added

Overarching Topics

Public Green Space:

- Gallery Forest
- Introduced Prairie
- Prairie Trails

Green Infrastructure:

- Pocket Wetlands & Check Dams
- Gallery Forest
- Introduced Prairie
- Permeable Plaza

Ecological Education:

- Eco-Education Art Walls
- Limestone Pillars

Placemaking:

- Wildcat Water Connection
- Plaza and Outdoor Classroom
- Experiential Boardwalk with Eco-Education Art Walls

Artful Rainwater Design:

- Permeable Plaza
- Pocket Wetlands & Check Dams

Eco-Revelatory Design:

- Wildcat Water Connection
- Experiential Boardwalk with Eco-Education Art Walls

Design Guidelines

Green Infrastructure
Functionality:

- Drainageway acts as a form of Rain Garden
- Pocket Wetlands act as Bioswlaes that Infiltrate water
- Basin below Permeable Plaza collects water

Sense of Place:

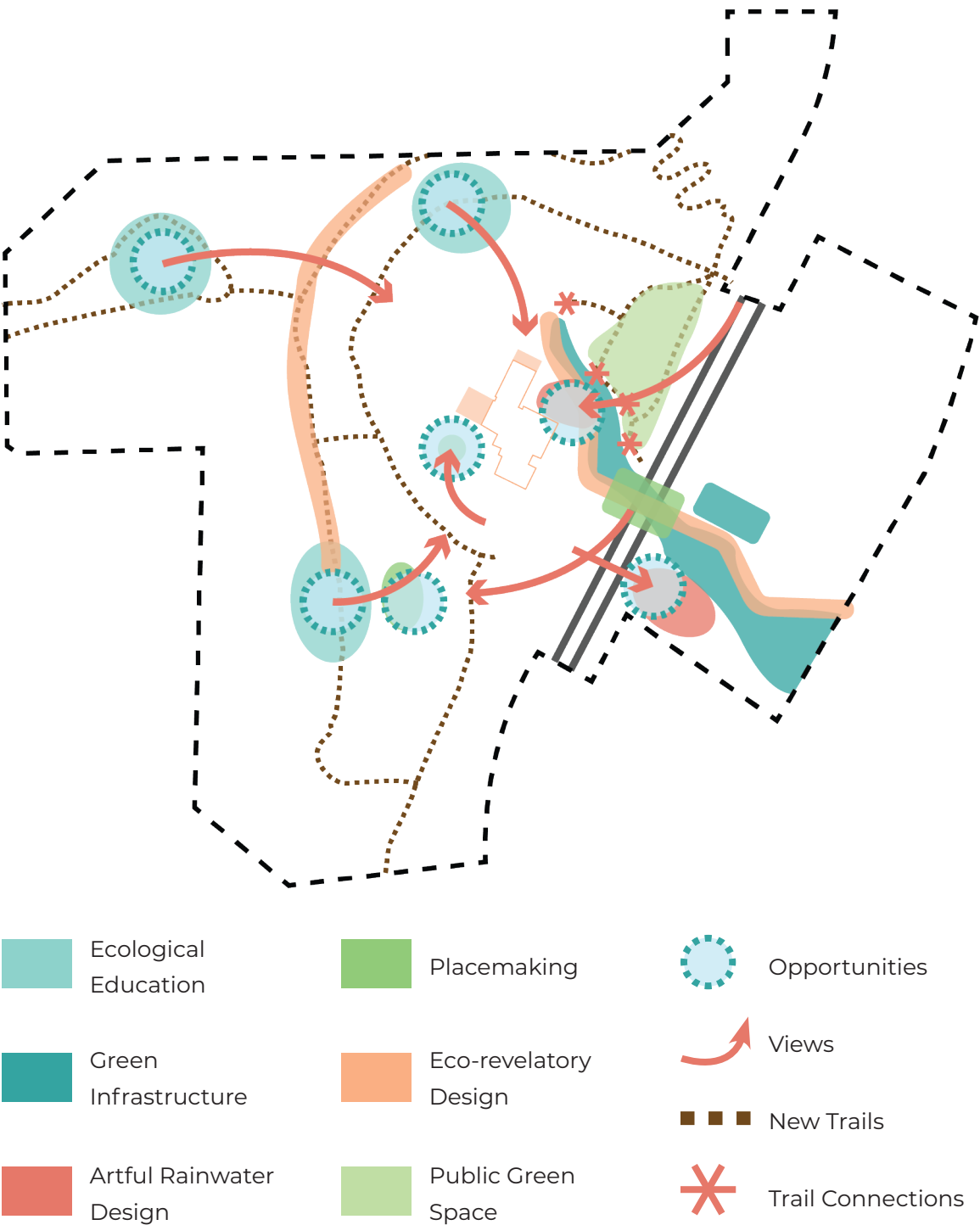
- Eco-Education Art Walls discuss local ecoregion
- Wildcat Water Connection creates unique focal point

Artistic Expression:

- Eco-Education Art Walls give unique experience on boardwalk
- Wildcat Water Connection uses different textures, materials, and colors

Ecological Education
Opportunities:

- Eco-Education Art Walls show environmental conditions
- Check Dams and Trails offer Personal Exploration of Ecosystems



Ecological Education	Placemaking	Opportunities
Green Infrastructure	Eco-revelatory Design	Views
Artful Rainwater Design	Public Green Space	New Trails
		Trail Connections

Figure 7.52. Design Synthesis



08:

CONCLUSION

Overview

Overall, this project aimed to learn how green infrastructure could be implemented to enhance the sense of place and ecological education in public green space and apply that knowledge to a local site in the Grand Mere area of Manhattan, Kansas. This area of town was chosen because it does not have a strong sense of place, it is easy to get lost in the area, and it does not contain many public green spaces. The study area was the First Christian Church and Grand Champions Residential Complex. The research combines public open space, green infrastructure, placemaking, and public art to reconnect people to nature, educate the public about ecological concerns, create a sense of place within communities, mitigate climatic issues, and provide health and well-being benefits to nearby residents.

The methods used were a literature review analysis, comparative precedent study, and projective design. The literature review created an expanded glossary of terms and concepts, which helped inform a concept map, revealing precedents that utilize those terms and concepts. Those precedents were then analyzed with a matrix for the most relevant elements. An analysis of existing site conditions was done, and an iterative design process began. Many programmed elements were introduced to the site, such as a boardwalk, outdoor plaza and classroom space, and eco-education art walls to educate and create a stronger sense of place. Through this process, the First Christian Church's surrounding landscape transformed into a unique learning, recreation, and socialization space.

Takeaways

One of the most essential takeaways from this project is how new development can negatively affect functional ecosystems. Before the church was built, this landscape was a productive riparian corridor surrounded by prairie. However, the church's construction in 2019 drastically fragmented this drainageway. This shows just how crucial a landscape architect's role is in helping assess sites and find suitable places for development. However, past ecological conditions can still be restored and celebrated, which can help reconnect people to nature and create a stronger sense of place.

Another important takeaway from this project is how green infrastructure can be used in multiple ways. The goal of green infrastructure in this project was to slow, capture, and infiltrate stormwater to minimize the amount of runoff reaching the stormwater sewer system. There are countless ways to do this, and a combination of multiple may be best.

Limitations

A limitation of this study is that there was no human interaction with community members or stakeholders to gauge responsiveness to ideas such as these. Another limitation was acquiring data for current site conditions since the church’s construction was so recent.

Another limitation was that I had not visited most of the precedents. Having a better understanding of each of the six precedents could have helped me understand how to implement different elements better.

The range of topics within the project was vast, which limited how in-depth each aspect could be explored and utilized. The project accomplishes each topic, yet they could be further explored and organized.

A final limitation of the project was the timeframe. Although there were many quick turnarounds, more time could have further developed the project and made it a reality.

Future Research Opportunities

In the future, community outreach could be done to enhance the placemaking aspect of the project. Having community members involved in the decision-making and design process could better reflect the community’s identity.

Another future opportunity would be a more expansive investigation of precedents. There could be more compelling precedents that I was not able to explore. These precedents could also be visited in person to gain a deeper understanding of the elements present.

Focusing on one or two topics or elements of the project in the future could create a more in-depth and detailed site design. This may be more appealing to developers as it would be less work for them to figure out the details and would be more realistic to implement.

Personal Reflections

Overall, I found this process to be very fulfilling and accomplishing. I think this taught me even more time management skills and strengthened my education in landscape architecture. I chose a wide range of topics, including public green space, green infrastructure, placemaking, and ecological education, as they were all something I was interested in. I am glad I did, as I gained a much deeper understanding of each topic. Using projective design to apply my knowledge was a beneficial way to understand further how they can work together.

A tall, slender plant with a cluster of bright yellow flowers stands prominently in the foreground of a grassy field. The plant has green, rounded leaves. In the background, a cow is grazing on the grass, and a utility pole is visible on the horizon under a clear sky.

09: REFERENCES & FIGURES

References

- "Cedar River Watershed Education Center." n.d. Saving Water Partnership. Accessed September 14, 2023. <https://www.savingwater.org/students-teachers/cedar-river-watershed-education-center/>.
- "CUFR Tree Carbon Calculator (CTCC) | Climate Change Resource Center." n.d. Accessed December 11, 2023. <https://www.fs.usda.gov/ccrc/tool/cufr-tree-carbon-calculator-ctcc>.
- "Education Center - Utilities | Seattle.Gov." n.d. Accessed September 7, 2023. <https://www.seattle.gov/utilities/protecting-our-environment/our-water-sources/cedar-river-watershed/education-center>.
- "Education Center Features & Exhibits - Utilities | Seattle.Gov." N.d. Accessed October 23, 2023. <https://www.seattle.gov/utilities/protecting-our-environment/our-water-sources/cedar-river-watershed/education-center/features-and-exhibits>.
- "El Paso Pedestrian Pathways," 2023. Accessed October 23, 2023. <https://www.landscapeperformance.org/case-study-briefs/el-paso-pedestrian-pathways>.
- "Green Infrastructure Evaluation Framework | National Recreation and Park Association." n.d. Accessed December 11, 2023. <https://www.nrpa.org/our-work/partnerships/initiatives/greener-parks/green-infrastructure-framework/>.
- "Tanner Springs Park." 2010. Accessed October 23, 2023. <https://www.dreiseitlconsulting.com/tanner-springs-park>.
- "Wildlife Species." n.d. Accessed February 5, 2024. <https://www.wildlife.k-state.edu/species/>.
- "Why Native Plants Matter | Audubon." n.d. Accessed September 14, 2023. <https://www.audubon.org/content/why-native-plants-matter>.
- Brzoska, Patrycia, and Aiga Späße. 2020. "From City-to Site-Dimension: Assessing the Urban Ecosystem Services of Different Types of Green Infrastructure." *Land (Basel)*, 9, no. 5. 150: 1-18. <https://doi.org/10.3390/LAND9050150>.
- Corson, Dan. 2011. "Rain Drums | Dan Corson." November 28, 2011. <http://dancorson.com/rain-drum-courtyard>.
- Courage, Cara and Anita McKeown. 2018. "Creative placemaking: Reflections on a 21st-century American arts policy initiative." In *Creative placemaking: Research, theory, and practice*, edited by Ann Markusen and Anne Gadwa Nicodemus, 11-28. ABINGDON: Routledge. <https://doi.org/10.4324/9781315104607>.
- Courage, Cara and Anita McKeown. 2018. "Turning local interests into local action: Community-based art and the case of *Wrecked! On the Intertidal Zone*." In *Creative placemaking: Research, theory, and practice*, edited by Dominic Walker, 43-55. ABINGDON: Routledge. <https://doi.org/10.4324/9781315104607>.
- Echols, Stuart., and Eliza Pennypacker. 2015. "Part 2: Achieving Amenity with Artful Rainwater Design." In *Artful Rainwater Design. 1st ed*, edited by Stuart Echols and Eliza Pennypacker, 23-94. Washington, DC: Island Press/Center for Resource Economics. <https://doi.org/10.5822/978-1-61091-318-8>.
- Echols, Stuart., and Eliza Pennypacker. 2015. "Part 3: Achieving Utility with Artful Rainwater Design." In *Artful Rainwater Design. 1st ed*, edited by Stuart Echols and Eliza Pennypacker, 95-103. Washington, DC: Island Press/Center for Resource Economics. <https://doi.org/10.5822/978-1-61091-318-8>.
- Echols, Stuart., and Eliza Pennypacker. 2015. "Part 4: Case Studies of Artful Rainwater Design." In *Artful Rainwater Design. 1st ed*, edited by Stuart Echols and Eliza Pennypacker, 153-253. Washington, DC: Island Press/Center for Resource Economics. <https://doi.org/10.5822/978-1-61091-318-8>.
- Green Nylen, Nell, and Michael Kiparsky. 2015. "Accelerating Cost-Effective Green Stormwater Infrastructure: Learning From Local Implementation." 4-6. <https://escholarship.org/uc/item/3w0613m7>
- Green, Jared. n.d. "Interview with Herbert Dreiseitl, International ASLA, on Designing With Water | Asla.Org." Accessed November 6, 2023. <https://www.asla.org/ContentDetail.aspx?id=24482>.
- Kim, Minseo and Christoph D.D. Rupprecht and Katsunori Furuya. 2018. "Residents' Perception of Informal Green Space – A Case Study of Ichikawa City, Japan." *Land*, 7, no. 102: 71-90. <https://doi.org/10.3390/land7030102>.
- Konakl, Nurgul. 2013. "Eco-Revelatory Design". *Advances in Landscape Architecture*: 209-226. InTech. <https://doi.org/10.5772/55764>.
- Li, Luyuan, Pieter Uyttenhove, and Veerle Van Eetvelde. 2020. "Planning Green Infrastructure to Mitigate Urban Surface Water Flooding Risk – A Methodology to Identify Priority Areas Applied in the City of Ghent." *Landscape and Urban Planning*, 194, 103703: 1-12. <https://doi.org/10.1016/j.landurbplan.2019.103703>.

- Loh, Ashley, A. J., Kim, R., Durham, L., & Bubb, K. 2022. Placemaking in Practice: Municipal Arts and Cultural Plans' Approaches to Placemaking and Creative Placemaking. *Journal of Planning Education and Research*, 739456. <https://doi.org/10.1177/0739456X221100503>
- Miller, James D., and Michael Hutchins. 2017. "The Impacts of Urbanisation and Climate Change on Urban Flooding and Urban Water Quality: A Review of the Evidence Concerning the United Kingdom." *Journal of hydrology. Regional studies* 12, no. C: 345–362. <https://doi.org/10.1016/j.ejrh.2017.06.006>.
- O'Driscoll, Michael, Sandra Clinton, Anne Jefferson, Alex Manda, and Sara McMillan. 2010. "Urbanization Effects on Watershed Hydrology and In-Stream Processes in the Southern United States" *Water* 2, no. 3: 605-648. <https://doi.org/10.3390/w2030605>.
- Panagopoulos, Thomas. 2019. "Special Issue: Landscape Urbanism and Green Infrastructure." *Land*, 8, no. 112: 1-5. <https://doi.org/10.3390/land8070112>.
- Parker, Jackie and Greg D. Simpson. 2018. "Public Green Infrastructure Contributes to City Livability: A Systematic Quantitative Review." *Land*, 7, no. 134: 48-70. <https://doi.org/10.3390/land7040161>.
- Parker, Jackie, and Greg D. Simpson. 2018. "Visitor Satisfaction with a Public Green Infrastructure and Urban Nature Space in Perth, Western Australia." *Land (Basel)* 7, no. 4, 159: 1-17. <https://doi.org/10.3390/land7040159>.
- Paul, Alak, Tapan Kumar Nath, Sharifa Jahan Noon, Mohammad Mohaiminul Islam, and Alexander Mark Lechner. 2020. "Public Open Space, Green Exercise and Well-Being in Chittagong, Bangladesh." *Urban forestry & urban greening* 55: 126825. 1-10. <https://doi.org/10.1016/j.ufug.2020.126825>.
- Razi, Lili, and Devon Ziminski. 2022. "Physical and Digital Placemaking in a Public Art Initiative in Camden, NJ." *Cosmopolitan Civil Societies* 14, no. 2: 21–39. <https://doi.org/10.5130/ccs.v14.i2.8201>
- Sadeghi, K. Majid, Shahram Kharaghani, Wing Tam, Natalia Gaerlan, and Hugo Loáiciga. 2019. "Green Stormwater Infrastructure (GSI) for Stormwater Management in the City of Los Angeles: Avalon Green Alleys Network." *Environmental Processes* 6, no. 1: 265–81. <https://doi.org/10.1007/s40710-019-00364-z>.
- Smith, Gregory A., and Dilafruz R. Williams. 1999. "Creating a Public of Environmentalists: The Role of Nonformal Education." in *Ecological Education in Action: on Weaving Education, Culture, and the Environment*, edited by Gregory A. Smith, 207-228. Albany, NY: State University of New York Press. ISBN : 0585067384 (electronic bk.)
- Smith, Gregory A., and Dilafruz R. Williams. 1999. "Deepening Children's Participation through Local Ecological Investigations." in *Ecological Education in Action: on Weaving Education, Culture, and the Environment*, edited by Paul Krapfel, 47-64. Albany, NY: State University of New York Press. ISBN : 0585067384 (electronic bk.)
- Song, Young Imm Kang. 2008. "Exploring Connections Between Environmental Education and Ecological Public Art." *Childhood Education*, 85, no. 1: 13–19. <https://doi.org/10.1080/00094056.2008.10523051>.
- Sundberg, Maureen. 2017. "Artful Rainwater Design: A Case Study." *Ecological Landscape Alliance* (blog). January 16, 2017. <https://www.ecolandscaping.org/01/designing-ecological-landscapes/landscape-design/artful-rainwater-design-case-study/>.
- Suppakittpaisarn, Pongsakorn, Linda Larsen, and William C. Sullivan. 2019. "Preferences for Green Infrastructure and Green Stormwater Infrastructure in Urban Landscapes: Differences Between Designers and Laypeople." *Urban Forestry & Urban Greening* 43. 126378: 1-7. <https://doi.org/10.1016/j.ufug.2019.126378>.
- United States Environmental Protection Agency, ORD. 2014. "National Stormwater Calculator." Data and Tools. March 25, 2014. <https://www.epa.gov/water-research/national-stormwater-calculator>.
- United States Environmental Protection Agency. 2011. "Land Revitalization Fact Sheet: Green Infrastructure."
- United States. Environmental Protection Agency, Office of Solid Waste and Emergency Response. 2011. *Green Infrastructure*. Washington, D.C.: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response <https://permanent.fdlp.gov/gpo21365/fs-green-infrastructure.pdf>
- van Vliet, Kaeren, and Catherine Hammond. 2021. "Residents' Perceptions of Green Infrastructure in the Contemporary Residential Context: a Study of Kingswood, Kingston-Upon-Hull, England." *Journal of environmental planning and management*, 64, no. 1: 145–163. <https://doi.org/10.1080/09640568.2020.1756757>.

Zalejska-Jonsson, Agnieszka, Sara J. Wilkinson, and Richard Wahlund. 2020.

“Willingness to Pay for Green Infrastructure in Residential Development-a Consumer Perspective.” *Atmosphere* 11, no. 2, 152: 1-20. <https://doi.org/10.3390/atmos11020152>.

Zhou, Xiaolu, and Yi-Chen Wang. 2011. “Spatial-temporal Dynamics of Urban Green Space in Response to Rapid Urbanization and Greening Policies.” *Landscape and Urban Planning* 100, no. 3: 268–277. <https://doi.org/10.1016/j.landurbplan.2010.12.013>.

Figures

Cover Image: Kloeppel, Cody. 2024. Stained Glass Prairie Montage. Digital Art.

Chapter 1 Page Break Image: Skabelund, Lee. 2023. IMG_1984. Digital Photograph.

Figure 1.1: Skabelund, Lee. 2022. FCC Colbert Hills LRS Aug2022. Digital Photograph.

Chapter 2 Page Break Image: Skabelund, Lee. 2023. Grand Mere Willis site 28Sep2023
Irs. Digital Photograph

Figure 2.1: Skabelund, Lee. 2008. ISC-Rain-Garden-Oct-2008-1a. Digital Photograph.

Figure 2.2: Kloeppel, Cody. 2023. Linkages and Frameworks. Digital Graphic.

Chapter 3 Page Break Image: Skabelund, Lee. 2023. IMG_2005. Digital Photograph

Figure 3.1: Kloeppel, Cody. 2023. Primary Site. Source Map: Apple Maps. Grand Mere,
Manhattan, KS. 39.21270° N, -96.64712° W. Accessed 14 September 2023.

Figure 3.2: Kloeppel, Cody. 2023. Future Research Potentials. Source Map: Apple Maps.
Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed 14 September
2023.

Chapter 4 Page Break Image: Skabelund, Lee. 2023. IMG_1979. Digital Photograph.

Figure 4.1: Kloeppel, Cody. 2024. Expanded Glossary. Digital Graphic.

Figure 4.2: Kloeppel, Cody. 2024. Concept Map. Digital Graphic.

Chapter 5 Page Break Image: Skabelund, Lee. 2023. IMG_2020. Digital Graphic.

Figure 5.1: Kloeppel, Cody. 2024. Precedent Map. Digital Graphic.

Figure 5.2: "Cistern Steps of Vine Street." 2010. Photograph by Tone Walker.

Accessed February 21, 2024. Reproduced from Flickr, <https://www.flickr.com/photos/41949246@N00/4925552246/in/photolist-8vfTTY-8vfRHU-8vfS23-8vfTfS-8vfH7J-8vfK5A-8vcEGt-8vgsf5-8vfJa7-8vcF3P-8vfJBQ>

Figure 5.3: "Vine Street Sculpture." 2010. Photograph by Tone Walker. Accessed
February 21, 2024. Reproduced from Flickr, <https://www.flickr.com/photos/41949246@N00/>

Figure 5.4: "Artist Dan Corson's Rain Drum Courtyard." N.d. Photograph by Dan Corson.
Courtesy of Seattle Public Utilities. Accessed March 24, 2024. Reproduced from
"Visit the Education Center From Anywhere," <https://www.seattle.gov/utilities/protecting-our-environment/our-water-sources/cedar-river-watershed/online-learning/education-center-visit>

Figure 5.5: "Rain Drum Courtyard." 2003. Photograph by Dan Corson. Courtesy of
Public Art Archive. Accessed March 24, 2024. Reproduced from "Rain Drum
Courtyard," <https://publicartarchive.org/art/Rain-Drum-Courtyard/2960922d>

Figure 5.6: "Tanner Springs Park." 2007. Photograph by Cord Rodefild. Accessed March

24, 2024. Reproduced from Flickr, <https://www.flickr.com/photos/61248430@N00/1501337604>

Figure 5.7: "Tanner Springs Park." 2007. Photograph by Kyle Grading. Accessed
March 24, 2024. Reproduced from Flickr, <https://www.flickr.com/photos/kgrading/2098791725>

Figure 5.8: "Our historical San Jacinto Plaza in downtown has been beautifully
restored recently - have you gotten a chance to visit? Also known as "La Plaza
de los Lagartos", the pond was once home to several LIVE alligators! 🐊 This lovely
fiberglass sculpt." 2016. Photograph by Visit El Paso. Accessed March 24, 2024.
Reproduced from Flickr, <https://www.flickr.com/photos/visitelpaso/27187025844/in/photolist-2mVSwwm-bmvxZd-HqqBAU-G4oji4-FJoa4B-r6WdmC-MykZ2M-GhnhWo-qWkWrX-pZkPnL-qDTzXx-qU3UgS-qWkVsH-pZypwH-qWkY18-q8866e>

Figure 5.9: "A pedestrian bridge over the arroyo at San Jacinto Plaza serves as a
gathering place." N.d. Photograph by Jonnu Singleton/SWA Group. Courtesy of
Landscape Performance Series. Accessed 24 October 2023. Reproduced from "El
Paso Pedestrian Pathways,"
<https://www.landscapeperformance.org/case-study-briefs/el-paso-pedestrian-pathways>

Figure 5.10: "When it rains, the map creates a watershed in miniature." 2009.
Photograph by Stacy Levy. Courtesy of Stacy Levy. Accessed March 24, 2024.
Reproduced from "Ridge and Valley," <https://www.stacylevy.com/projects/ridge-%26-valley>

Figure 5.11: "A closeup of Stacy Levy's "Ridge and Valley" sculpture at The Arboretum at
Penn State. The sculpture, made of Pennsylvania bluestone, illustrates the flow of
water through the Spring Creek Watershed by using rainwater to animate creeks,
streams and other landscape features carved into a stone map." 2019. Photograph
by Laura Waldhier. Courtesy of PennState. Accessed March 24, 2024. Reproduced
from "Sculptor of 'Ridge and Valley' in The Arboretum at Penn State to speak
April 24," <https://www.psu.edu/news/campus-life/story/sculptor-ridge-and-valley-arboretum-penn-state-speak-april-24/>

Figure 5.12: "Main Street, Entrance Plaza, Queens Botanical Garden, Flushing, NY."
2015. Photograph by Queensbotanicalgarden. Courtesy of Wikimedia Commons.
Accessed March 24, 2024. Reproduced from "File:Entrance Plaza, Queens
Botanical Garden.jpg," https://commons.wikimedia.org/wiki/File:Entrance_Plaza,_

[Queens_Botanical_Garden.jpg](#)

Figure 5.13: “Travel the East.” 2015. Photograph by Kristy Albano and Matt Pickering. Courtesy of Travel the East. Accessed March 24, 2024. Reproduced from “Queens Botanical Garden – Flushing, NY,” <http://www.traveltheeast.com/2015/05/queens-botanical-garden-flushing-ny.html>

Figure 5.14: Kloeppel, Cody. 2024. Amenity & Purpose Precedent Matrix. Digital Graphic.

Figure 5.15: Kloeppel, Cody. 2024. Feature & Functions Precedent Matrix Part 1. Digital Graphic.

Figure 5.16: Kloeppel, Cody. 2024. Feature & Functions Precedent Matrix Part 2. Digital Graphic.

Figure 5.17: Kloeppel, Cody. 2024. Location Precedent Matrix. Digital Graphic.

Figure 5.18: Kloeppel, Cody. 2024. Overall Design Guidelines. Digital Graphic.

Figure 5.19: Kloeppel, Cody. 2024. Design Guidelines for Place-Specific Green Infrastructure. Digital Graphic.

Chapter 6 Page Break Image: Skabelund, Lee. 2022. FCC LRS Aug2022 overview. Digital Photograph.

Figure 6.1: Skabelund, Lee. 2023. GrandMere apartments area 28Sep2023 lrs 1m. Digital Photograph.

Figure 6.2: Kloeppel, Cody. 2024. 1991 Grand Mere Development Conditions. Source map: Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed February 19, 2024.

Figure 6.3: Kloeppel, Cody. 2024. 2002 Grand Mere Development Conditions. Source map: Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed February 19, 2024.

Figure 6.4: Kloeppel, Cody. 2024. 2014 Grand Mere Development Conditions. Source map: Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed February 19, 2024.

Figure 6.5: Kloeppel, Cody. 2024. 2023 Grand Mere Development Conditions. Source map: Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed February 19, 2024.

Figure 6.6: Skabelund, Lee. 2023. GrandMere apartments area 28Sep2023 lrs 1v. Digital Photograph.

Figure 6.7: Kloeppel, Cody. 2024. Stair Conditions in Winter. Digital Photograph.

Figure 6.8: Skabelund, Lee. 2023. GrandMere apartment area 28Sep2023 lrs 1n. Digital

Photograph.

Figure 6.9: Skabelund, Lee. 2022. FCC LRS Aug2022 view towards Grand Mere Pkwy 1b. Digital Photograph.

Figure 6.10: Kloeppel, Cody. 2024. Loading Area in Winter. Digital Photograph.

Figure 6.11: Kloeppel, Cody. 2024. Roundabout in Winter. Digital Photograph.

Figure 6.12: Skabelund, Lee. 2022. FCC LRS Dec2022 entry sign. Digital Photograph.

Figure 6.13: Skabelund, Lee. 2023. GrandMere apartments area 28Sep2023 lrs 1u. Digital Photograph.

Figure 6.14: Kloeppel, Cody. 2024. Grand Mere Pkwy in Winter. Digital Graphic.

Figure 6.15: Kloeppel, Cody. 2024. Residential Vegetation in Winter. Digital Graphic.

Figure 6.16: Skabelund, Lee. 2023. GrandMere apartments area 28Sep2023 lrs 1g. Digital Graphic.

Figure 6.17: Skabelund, Lee. 2022. FCC LRS Aug2022 1f bird box. Digital Graphic.

Figure 6.18: Kloeppel, Cody. 2024. Large Scale Site Contours. Source data: City of Manhattan. “20’ Contours.” Accessed January 26, 2024.

Figure 6.19: Kloeppel, Cody. 2024. Large Scale Site Slope. Source data: City of Manhattan. “20’ Contours.” Accessed January 26, 2024.

Figure 6.20: Kloeppel, Cody. 2024. Large Scale Site Hillshade. Source data: ESRI database. “World Hillshade.” Accessed January 26, 2024.

Figure 6.21: Kloeppel, Cody. 2024. Large Scale Site Elevation. Source data: City of Manhattan. “20’ Contours.” Accessed January 26, 2024.

Figure 6.22: Kloeppel, Cody. 2024. Small Scale Site Contours. Source data: City of Manhattan. “20’ Contours.” Accessed January 26, 2024.

Figure 6.23: Kloeppel, Cody. 2024. Small Scale Site Slope. Source data: City of Manhattan. “20’ Contours.” Accessed January 26, 2024.

Figure 6.24: Kloeppel, Cody. 2024. Small Scale Site Hillshade. Source data: ESRI database. “World Hillshade.” Accessed January 26, 2024.

Figure 6.25: Kloeppel, Cody. 2024. Small Scale Site Elevation. Source data: City of Manhattan. “20’ Contours.” Accessed January 26, 2024.

Figure 6.26: Kloeppel, Cody. 2024. Snow-covered Northern Cuestas. Digital Photograph.

Figure 6.27: Kloeppel, Cody. 2024. Winter Parking Lot Conditions. Digital Photograph.

Figure 6.28: Kloeppel, Cody. 2024. FCC Entry/Exit Drive. Digital Photograph.

Figure 6.29: Kloeppel, Cody. 2024. Swale to the North of Grand Champions Apartments. Digital Photograph.

Figure 6.30: Kloeppel, Cody. 2024. Site Hydrology. Source map: Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed January 29, 2024.

Figure 6.31: Kloeppel, Cody. 2024. Riley Country Watersheds. Source map: Riley County Community GIS Viewer. Manhattan, KS. 39.21270° N, -96.64712° W. <https://gis.rileycountyks.gov/>. Accessed January 29, 2024.

Figure 6.33: Kloeppel, Cody. 2024. Manhattan, Kansas Waterways and Site Connections. Source map: Riley County Community GIS Viewer. Manhattan, KS. 39.21270° N, -96.64712° W. <https://gis.rileycountyks.gov/>. Accessed January 29, 2024.

Figure 6.32: Kloeppel, Cody. 2024. Little Kitten Creek-Wildcat Creek Watershed and Waterways. Source map: Riley County Community GIS Viewer. Manhattan, KS. 39.21270° N, -96.64712° W. <https://gis.rileycountyks.gov/>. Accessed January 29, 2024.

Figure 6.34: Kloeppel, Cody. Site Ground Coverage. Source map: Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed January 29, 2024.

Figure 6.35: Kloeppel, Cody. 2024. Grand Mere Soil Conditions. Source map: Web Soil Survey. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. <https://websoilsurvey.nrcs.usda.gov/app/>. Accessed January 29, 2024.

Figure 6.36: Kloeppel, Cody. 2024. Site Specific Soil Conditions. Source map: Web Soil Survey. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. <https://websoilsurvey.nrcs.usda.gov/app/>. Accessed January 29, 2024.

Figure 6.37: Kloeppel, Cody. 2024. Disturbed Soils. Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed January 29, 2024.

Figure 6.38: Kloeppel, Cody. 2024. Large Scale Utilities. Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed January 29, 2024.

Figure 6.39: Kloeppel, Cody. 2024. Site Specific Utilities. Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed January 29, 2024.

Figure 6.40: Kloeppel, Cody. 2024. Existing Trails. Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed January 29, 2024.

Figure 6.41: Kloeppel, Cody. 2024. Outdoor Gathering Space for Artistic Expression. Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed January 29, 2024.

Figure 6.42: Kloeppel, Cody. 2024. Manhattan, Kansas Average Temperatures. Digital Graphic.

Figure 6.43: Kloeppel, Cody. 2024. Manhattan, Kansas Average Precipitation. Digital Graphic.

Figure 6.44: Kloeppel, Cody. 2024. Manhattan, Kansas Average Wind Speed. Digital

Graphic.

Figure 6.45: Kloeppel, Cody. 2024. Manhattan, Kansas Average Hours of Daylight. Digital Graphic.

Figure 6.46: Skabelund, Lee. 2023. FCC from GrandMere apartments 28Sep2023 lrs 1b. Digital Photograph.

Figure 6.47: Skabelund, Lee. 2022. FCC LRS Dec2022 prairie slopes 1b. Digital Photograph.

Figure 6.48: Gould Evans Architecture. 2019. FCC Axonometric Drawings. Construction Drawings.

Figure 6.49: Gould Evans Architecture. 2019. FCC Site and Planting Plan. Construction Drawings.

Figure 6.50: Gould Evans Architecture. 2019. FCC General Layout Plan. Construction Drawings.

Figure 6.51: Gould Evans Architecture. 2019. FCC Grading Details. Construction Drawings.

Figure 6.52: Gould Evans Architecture. 2019. FCC Drainage Area Map. Construction Drawings.

Figure 6.53: Gould Evans Architecture. 2019. FCC Roof Drain Plan. Construction Drawings.

Figure 6.54: Gould Evans Architecture. 2019. FCC Floor Plan Level 1. Construction Drawings.

Figure 6.55: Kloeppel, Cody. 2023. Main Research Topics. Digital Graphic.

Figure 6.56: Kloeppel, Cody. 2024. Public Green Space Design Opportunities. Digital Graphic.

Figure 6.57: Kloeppel, Cody. 2024. Green Infrastructure Design Opportunities. Digital Graphic.

Figure 6.58: Kloeppel, Cody. 2024. Ecological Education Design Opportunities. Digital Graphic.

Figure 6.59: Kloeppel, Cody. 2024. Placemaking Design Opportunities. Digital Graphic.

Figure 6.60: Kloeppel, Cody. 2024. Artful Rainwater Design Opportunities. Digital Graphic.

Figure 6.61: Kloeppel, Cody. 2024. Eco-Revelatory Design Opportunities. Digital Graphic.

Chapter 7 Page Break Image: Skabelund, Lee. 2022. FCC LRS Aug2022 1g hiking trail. Digital Photograph

Figure 7.1: Kloeppel, Cody. 2024. Existing and Proposed Programming. Digital Graphic.

Figure 7.2: Kloeppel, Cody. 2024. Design Process 2-8-24 Plan 1. Graphite on Trace Paper.

Figure 7.3: Kloeppel, Cody. 2024. Design Process 2-8-24 Plan 2. Graphite on Trace Paper.

Figure 7.4: Kloeppel, Cody. 2024. Design Process 2-8-24 Plan 3. Graphite on Trace Paper.

Figure 7.5: Kloeppel, Cody. 2024. Design Process 2-8-24 Plan 4. Graphite and Colored Pencil on Trace Paper.

Figure 7.6: Kloeppel, Cody. 2024. Design Process 2-12-24. Graphite and Colored Pencil on Trace Paper.

Figure 7.7: Kloeppel, Cody. 2024. Design Process 2-26-24. Graphite on Trace Paper.

Figure 7.8: Kloeppel, Cody. 2024. Design Opportunities Response and Programming. Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed February 16, 2024.

Figure 7.9: Kloeppel, Cody. 2024. Public Green Space Design Opportunities. Digital Graphic.

Figure 7.10: Kloeppel, Cody. 2024. Green Infrastructure Design Opportunities. Digital Graphic.

Figure 7.11: Kloeppel, Cody. 2024. Ecological Education Design Opportunities. Digital Graphic.

Figure 7.12: Kloeppel, Cody. 2024. Placemaking Design Opportunities. Digital Graphic.

Figure 7.13: Kloeppel, Cody. 2024. Artful Rainwater Design Opportunities. Digital Graphic.

Figure 7.14: Kloeppel, Cody. 2024. Eco-Revelatory Design Opportunities. Digital Graphic.

Figure 7.15: Kloeppel, Cody. Master Planned Site. Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed February 16, 2024.

Figure 7.16: Kloeppel, Cody. 2024. FCC Classroom and Recreation Center Expansions. Digital Graphic.

Figure 7.17: Kloeppel, Cody. 2024. Views and Opportunities. Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed February 16, 2024.

Figure 7.18: Kloeppel, Cody. 2024. Trail Improvements. Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed February 16, 2024.

Figure 7.19: Kloeppel, Cody. 2024. Existing Stream Corridor and Connection. Google Earth. Grand Mere, Manhattan, KS. 39.21270° N, -96.64712° W. Accessed February 16,

2024.

Figure 7.20: Kloeppel, Cody. 2024. Focused Site Plan. Digital Rendering.

Figure 7.21: Kloeppel, Cody. 2024. Plaza and Outdoor Classroom Location. Digital Graphic.

Figure 7.22: Kloeppel, Cody. 2024. Plaza and Outdoor Classroom Perspective and Usage. Digital Rendering.

Figure 7.23: Kloeppel, Cody. 2024. Plaza-Classroom Section Cut. Digital Graphic.

Figure 7.24: Kloeppel, Cody. 2024. Transition from Outdoor Classroom down to Drainageway. Digital Rendering.

Figure 7.25: Kloeppel, Cody. 2024. Plaza and Outdoor Classroom Isometric. Digital Rendering.

Figure 7.26: Kloeppel, Cody. 2024. Experiential Boardwalk Location. Digital Graphic.

Figure 7.27: Kloeppel, Cody. 2024. Boardwalk Section Cut. Digital Graphic.

Figure 7.28: Kloeppel, Cody. 2024. Boardwalk Relationship to FCC and Drainageway. Digital Rendering.

Figure 7.29: Kloeppel, Cody. 2024. Experience of Traversing Boardwalk. Digital Rendering.

Figure 7.30: Kloeppel, Cody. 2024. Check Dams and Pocket Wetlands Locations. Digital Graphic.

Figure 7.31: Kloeppel, Cody. 2024. Wetland & Streamline Functionality. Digital Rendering.

Figure 7.32: Kloeppel, Cody. 2024. Experience Walking along Revitalized Drainageway. Digital Rendering.

Figure 7.33: Kloeppel, Cody. 2024. Check Dam and Wetlands Section Cut. Digital Graphic.

Figure 7.34: Kloeppel, Cody. 2024. Check Dam and Pocket Wetland Progression Section. Digital Rendering.

Figure 7.35: Kloeppel, Cody. 2024. Northern Check Dam Oblique. Digital Rendering.

Figure 7.36: Kloeppel, Cody. 2024. Eco-Education Art Walls Locations. Digital Graphic.

Figure 7.37: Kloeppel, Cody. 2024. Eco-Education Art Walls Oblique. Digital Rendering.

Figure 7.38: Kloeppel, Cody. 2024. Walking Along and Throughout the Eco-Education Art Walls. Digital Rendering.

Figure 7.39: Kloeppel, Cody. 2024. Location of Gallery Forest and Introduced Prairie. Digital Graphic.

Figure 7.40: Kloeppel, Cody. 2024. Eco-Revelatory Wildcat Water Sculpture Location.

Digital Graphic.

Figure 7.41: Kloeppel, Cody. 2024. Wildcat Water Sculpture and Crosswalk Oblique.

Digital Rendering.

Figure 7.42: Kloeppel, Cody. 2024. Wildcat Water Section Cuts. Digital Graphic.

Figure 7.43: Kloeppel, Cody. 2024. Grand Mere Parkway Crossing Transition (Section

A-A). Digital Rendering.

Figure 7.44: Kloeppel, Cody. 2024. Wildcat Water Sculpture Section (Section B-B).

Digital Rendering.

Figure 7.45: i-Tree. I-Tree Canopy. Software. I-Tree, 2006. <https://canopy.itreetools.org/>.

Figure 7.46: i-Tree. I-Tree Canopy. Software. I-Tree, 2006. <https://canopy.itreetools.org/>.

Figure 7.47: Kloeppel, Cody. 2024. Wetland and Stream Corridor Metrics and Benefits.

Digital Graphic.

Figure 7.48: Kloeppel, Cody. 2024. Tree Canopy Introduced. Digital Graphic.

Figure 7.49: Kloeppel, Cody. 2024. Additional Prairie Land. Digital Graphic.

Figure 7.50: Kloeppel, Cody. 2024. Outdoor Social Space Created. Digital Graphic.

Figure 7.51: Kloeppel, Cody. 2024. Permeable Pavement Added. Digital Graphic.

Figure 7.52: Kloeppel, Cody. 2024. Design Synthesis. Digital Graphic.