

Signs of sustainability:
promoting the environmental and aesthetic impact of green infrastructure on campus

by

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A REPORT

submitted in partial fulfillment of the requirements for the degree

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Department of Landscape Architecture and Regional and Community Planning
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Abstract

Cities have struggled to integrate green infrastructure solutions due to an underwhelming lack of support and acceptance. A typical social barrier that causes this slow integration is the lack of general public education and awareness of green infrastructure systems. This lack of education also affects many other barriers, including funding green infrastructure projects and political barriers. A need has been expressed to encourage educational opportunities that people can easily access and understand. As landscape architects, we should be one of the main contributors to this cause, helping increase public acceptance through educational opportunities. This research aims to aid in collecting and organizing information on local green infrastructure projects to create an educational tour with informative and engaging signage. To collect and organize the information, site inventory and observational photography were used to support a projective design of tour fliers and signage. The result will include projective signage for six sites on the Kansas State University campus and a coordinating tour flier to inform people about the tour and sites.

Signs of Sustainability

Promoting the Environmental and
Aesthetic Impact of Green Infrastructure
on Campus



A dedication to,

- My friends and family
- Studio classmates
- My Committee: Howard Hahn, Lee Skabelund, and Scott Barton

I appreciate all the support, advice, and knowledge given to me. Thank you for helping me be able to complete this project and make it to graduation!

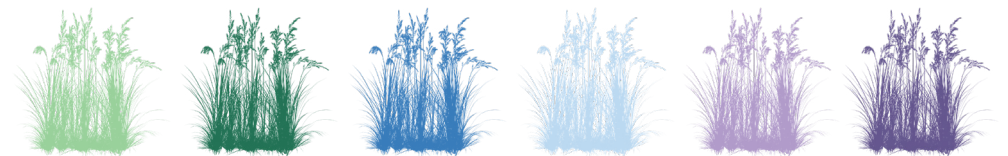


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01.

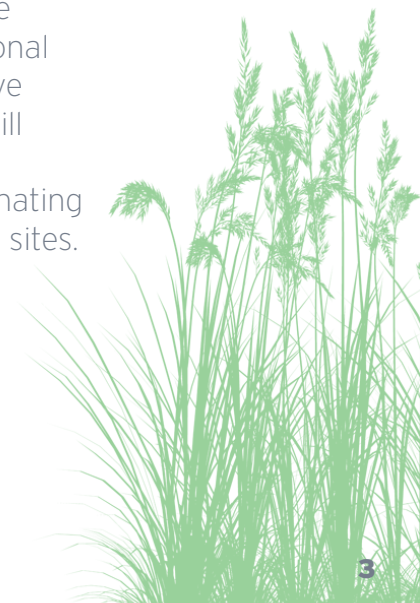
Introduction



Fig. 1.1 Northern Sea Oats
reflecting in the sun (Goold 2024)

Abstract

Cities have struggled to integrate green infrastructure solutions due to an underwhelming lack of support and acceptance. A typical social barrier that causes this slow integration is the lack of general public education and awareness of green infrastructure systems. This lack of education also affects many other barriers, including funding green infrastructure projects and political barriers. A need has been expressed to encourage educational opportunities that people can easily access and understand. As landscape architects, we should be one of the main contributors to this cause, helping increase public acceptance through educational opportunities. This research aims to aid in collecting and organizing information on local green infrastructure projects to create an educational tour with informative and engaging signage. To collect and organize the information, site inventory and observational photography were used to support a projective design of tour fliers and signage. The result will include projective signage for six sites on the Kansas State University campus and a coordinating tour flier to inform people about the tour and sites.



Research Question

Where is green infrastructure currently integrated into the Kansas State University landscape design, and how can educational interpretation features enhance public awareness and understanding of green infrastructure?



Secondary Questions

- What specific green infrastructure elements (e.g., rain gardens, permeable pavements, green roofs) are currently present on the Kansas State University campus?
- How can educational signage encourage students and visitors to engage with and appreciate green infrastructure?
- How does Kansas State University currently use its green infrastructure as an educational tool for students and the broader public?

Dilemma and Opportunities

There is a need for more widespread acceptance of green infrastructure solutions to help mitigate the adverse effects caused by unsustainable development and pollution (Zuniga-Teran et al. 2020). Along with helping to minimize those adverse effects, green infrastructure helps provide needed green space for recreation in cities, helping to create healthier communities (Benedict et al. 2006). Green infrastructure education plays a vital role in developing the acceptance of green infrastructure (Zuniga-Teran et al. 2020). The lack thereof often times blocks it from being implemented, leaving communities with less green space and more health issues (Fernández Galeote et al. 2024). Creating more educational opportunities will allow for further public acceptance of green infrastructure and break through many barriers that hold its implementation back (Dhakal and Chevalier 2017).

Goals

- Spread awareness of green infrastructure through a tour of green infrastructure systems on Kansas State University campus
- Create a positive outlook on the aesthetics of green infrastructure and increase appreciation
- Encourage engagement in learning and stewardship of green infrastructure

Project Importance and Purpose

Creating a tour that highlights physical examples can help create a way to spread information to people who might not understand what they are walking past. Green infrastructure education is essential for creating a deeper understanding and respect for the benefits and needs of green infrastructure systems (Zuniga-Teran et al. 2020). Engaging educational signage is a way to spread an understanding of green infrastructure outside a classroom or professional setting.

Project Extent

This project centers around a tour of green infrastructure systems within a specific area of the K-State Campus and projective educational signage that informs visitors and the Kansas State Community. The stops on the tour will be used as learning opportunities to create an understanding and appreciation of the green infrastructure systems. Learning goals include the benefits of green infrastructure, how the example systems work, and the aesthetic benefits of the systems.



Fig. 1.2 Monarch education in The Meadow (Goold 2024)

Glossary

- **Bioretention Basins/Cells:** “are filled with plants to help absorb excess stormwater from rooftops, sidewalks, and streets. Layers of rock and soil store the water. A buried underdrain system drains the excess water, controlling the slow release of water back to the sewer system.” (smartsewer)
- **Bioswales:** “are channels designed to move stormwater downhill from one location to another. They include plants which help filter the stormwater and absorb some of it into the ground.” (smartsewer)
- **Combined Sewer Overflow (CSO):** “A combined sewer system collects rainwater runoff, domestic sewage, and industrial wastewater into one pipe. Normally, it can transport all of the wastewater to a treatment plant. Sometimes the amount of runoff exceeds the capacity of the system. When that happens, untreated stormwater and wastewater flows into nearby waterbodies” (US EPA 2015)
- **Community Citizen Science (CCS):** “including the range of participatory ways of doing science that involve members of the public in some or all parts of scientific research or monitoring projects for which the data or results are used for monitoring, decision-making, or basic research” (Ballard et al. 2024)
- **Detention Basins:** “are excavated areas that hold stormwater temporarily. They may be located at the surface and filled with plants. They may also be a concrete structure located underground.” (smartsewer)
- **Green Infrastructure:** “an interconnected network of natural and restored ecosystems, landscapes, and open spaces that conserves ecological values, sustains clean air and water, and provides a broad range of benefits to both people and wildlife” (Benedict et al. 2006)
- **Green Roof:** “is a roof covered with a layer of grass and plants with a drainage system, which work together to slow and absorb stormwater as it falls.” (smartsewer)
- **Grey Infrastructure:** “conventional stormwater infrastructure designed to prevent flooding and convey rainfall and snowmelt as quickly as possible through drainage and water treatment systems such as pipes, tanks, or underground storage facilities” (Keeley et al. 2013)
- **Permeable Pavers:** “capture stormwater runoff by collecting water through the joints between pavers. The water moves through layers of gravel below the pavers and then soaks into the ground. Excess water is sometimes carried away through a perforated pipe and slowly released back to the sewer system.” (smartsewer)
- **Pervious Concrete:** “absorbs stormwater through pores on the surface. The water then moves through layers of gravel below the pavement before soaking into the ground.”
- **Wetlands:** “might look like an average pond, but are specially designed to hold stormwater for long periods of time. Plants are specifically chosen to keep the water clean in the wetlands.” (smartsewer)

02.

Background

Overview

There is a critical need to rethink how stormwater is managed, with a focus on reconnecting to natural waterways and ecosystems (Keeley et al. 2013). However, this is just one aspect of a broader challenge: the development of urban infrastructure itself must take a more sustainable approach (Benedict et al. 2006). Unfortunately, many people lack awareness of sustainable practices, specifically green infrastructure solutions. Sometimes this includes those involved in designing and constructing infrastructure, as studies have shown they often don't feel well enough informed on the topic (Hurlimann et al. 2024). To address this gap, it's essential to raise awareness and educate stakeholders about green infrastructure solutions, fostering both acceptance and understanding. This knowledge can help create healthier environments for plants, animals, and humans, promoting long-term sustainability. Landscape architects, in particular, have a key role to play in leading these educational initiatives (Im and Yoon, 2024). By implementing targeted education programs, we can bridge the gap in green infrastructure knowledge and pave the way for more widespread adoption and acceptance.



Fig. 2.1 The Meadow on the K-state campus (Kingerly-Page n.d.a.)

Green Infrastructure (GI)

One of the challenges in understanding green infrastructure is that it is defined in different ways by different people, making it difficult to communicate a clear and consistent meaning. The definition used in *Green Infrastructure: Linking Landscapes and Communities* by Mark Benedict, Edward McMahon, and Lydia Bergen helps create a clear understanding, which is “an interconnected network of natural and restored ecosystems, landscapes, and open spaces that conserves ecological values, sustains clean air and water, and provides a broad range of benefits to both people and wildlife” (Benedict et al. 2006). This web of green infrastructure can include a variety of spaces, including wetlands, woodlands, waterways, urban parks, wildlife corridors, nature preserves, national and state parks, farms, forests, ranches, and greenways (Benedict et al. 2006). Understanding what qualifies as green infrastructure is essential, not only for recognizing its many forms, but also for appreciating how it differs from grey infrastructure.

A green infrastructure approach creates an interdisciplinary effort that involves more than just civil engineers, whereas grey infrastructure often includes only one to three disciplines (Keeley et al. 2013). There are more differences than just the type of experts who work on infrastructure projects between grey and green infrastructure, including their purposes. Green infrastructure is designed to hold the water onsite to treat and infiltrate it, and grey infrastructure's purpose is to move the water as quickly as possible off-site (Keeley et al. 2013). Both of the infrastructure systems' purposes are to prevent flooding, but the grey infrastructure can often end in more flooding further down the chain where the water piped off-site ends up (Dhakal and Chevalier 2017). Grey infrastructure examples include pipes, tanks, or underground storage facilities that act as drainage and treatment systems (Keeley et al. 2013). These systems often reduce the amount of space vegetation could have and add to the amount of paved surfaces (Dhakal and Chevalier 2017). The increase of paved surfaces takes away the environment's ability to mitigate stormwater, working actively against the natural processes of the earth. Green infrastructure is able to work in tandem with the environment to support it rather than detract from it.

Green Infrastructure Benefits

Green infrastructure provides important ecological benefits that help mitigate negative effects typically caused by development (Zuniga-Teran et al. 2020). This is because green infrastructure uses less manufactured materials to utilize natural materials that will support natural processes (Dhakal and Chevalier 2017). The natural processes of the soil and vegetation that green infrastructure leverages create improvements in air quality, conserve animal habitats, and reduce flood risks (Zuniga-Teran et al. 2020). Temperatures in areas with green infrastructure can also be lowered due to the use of vegetation, which can then help to reduce energy consumption in buildings (Zuniga-Teran et al. 2020) (Im and Yoon 2024). When leveraged effectively, green infrastructure also helps to reverse land fragmentation, introducing more green spaces to urban areas and restoring green connections (Benedict et al. 2006). Green infrastructure also helps to create resiliency in the environment by supporting biodiversity, and creating more green space (Zuniga-Teran et al. 2020).

Green infrastructure also provides a vast amount of social benefits, from well-being improvements to increased community connections. For schools and college campuses, specifically, green spaces can be really important to improve mental health. Academic achievement and mental health are also closely linked for students, making it essential to provide spaces that support their mental well-being. Some studies suggest green spaces might even be able to improve students' academics (Liu et al. 2022). Campus design can affect graduation and retention rates as well, so designing an attractive campus is important (Walshe and Law 2022). Creating masterplans that incorporate more green infrastructure leads to more green space in general. Trails and riverfront parks can be designed to complement green infrastructure, allowing for more recreational spaces that can improve human health (Benedict et al. 2006). Green infrastructure is also unique in its design as it can be incorporated into vacant or abandoned lots, improving the communities environment and creating more pride in their community (Keeley et al. 2013).

Green Infrastructure Types

Bioswales

“are channels designed to move stormwater downhill from one location to another. They include plants which help filter the stormwater and absorb some of it into the ground.” (smartsewer)



Fig. 2.2 (Goold 2024)

Bioretention Basin

“are filled with plants to help absorb excess stormwater from rooftops, sidewalks, and streets. Layers of rock and soil store the water. A buried underdrain system drains the excess water” (smartsewer)



Fig. 2.3 (Goold 2024)

Detention Basins

“are excavated areas that hold stormwater temporarily. They may be located at the surface and filled with plants. They may also be a concrete structure located underground.” (smartsewer)



Fig. 2.4 (Tilley 2024)

Wetlands

“might look like an average pond, but are specially designed to hold stormwater for long periods of time. Plants are specifically chosen to keep the water clean in the wetlands.” (smartsewer)

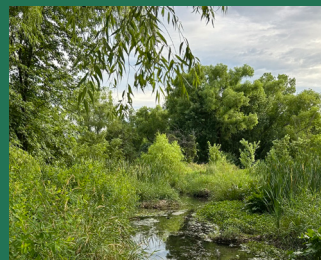


Fig. 2.5 (Ramirez 2024)

Green Roof

“is a roof covered with a layer of grass and plants with a drainage system, which work together to slow and absorb stormwater as it falls.” (smartsewer)



Fig. 2.6 (Goold 2024)

Rain Gardens

“collect and absorb stormwater from rooftops, sidewalks, and streets, allowing it to soak into the ground with the help of deeply rooted plants” (smartsewer)



Fig. 2.7 (Goold 2024)

Permeable Pavers

“capture stormwater runoff by collecting water through the joints between pavers. The water moves through layers of gravel below the pavers and then soaks into the ground.” (smartsewer)

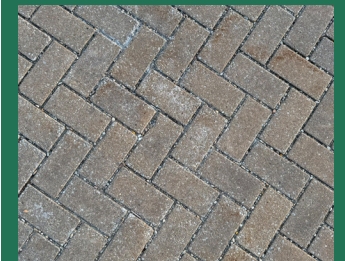


Fig. 2.8 (Goold 2025)

Pervious Concrete

“absorbs stormwater through pores on the surface. The water then moves through layers of gravel below the pavement before soaking into the ground.” (smartsewer)



Fig. 2.9 (Goold 2025)

Implementation Challenges

Green infrastructure has been shown to be an effective means of improving environments and handling stormwater, but cities have not fully embraced green infrastructure in development plans due to many barriers (Dhakal and Chevalier 2017). The most common barrier green infrastructure faces is the lack of education and social acceptance, which has affected some of the other barriers it faces (Dhakal and Chevalier 2017). Barriers other than education and social acceptance include policy and laws, funding, availability of expertise and skilled personnel, lack of formalized standards and guidelines, personal values, equitable distribution, innovation, implementation, maintenance and upkeep, and political influence (Dhakal and Chevalier 2017) (Keeley et al. 2013) (Fernández Galeote et al. 2024) (Zuniga-Teran et al. 2020). These barriers can be organized into three categories: political, technical, and social.

Political Barriers

Starting with a closer look at political barriers, the first issue is policy and laws. There are typically many steps involved in changing laws and policies, which can take time, and the same can be said for creating new ones. New laws and policies could help to ensure more green infrastructure is worked into development and master plans, while current laws and policies might be holding green infrastructure back (Dhakal and Chevalier 2017) (Im and Yoon 2024). This can be hard to deal with as many experts need to be involved, along with advocacy from community members. Even knowing whether or not a new law is needed or if there is one that needs to be changed can be difficult and time-consuming. Political influence is another potential barrier to green infrastructure implementation, as politicians are often the ones who hold the most influence on creating or changing laws and policies. It is common for politicians to have their own values, and those values might not align with green infrastructure implementation. Outside influences on politicians can also affect whether or not a politician wants to make sure that laws and policies affecting green infrastructure are positive.

Technical Barriers

One of the big technical barriers to green infrastructure implementation is funding (Keeley et al. 2013) (Zuniga-Teran et al. 2020). Not only do government organizations worry if green infrastructure costs less to build and maintain, but everyday people do as well. People have genuine concerns about whether the money they pay in taxes that goes to infrastructure updates is being used efficiently (Keeley et al. 2013). There is also the issue of finding and obtaining funding for a green infrastructure project. Many publicly funded projects, including grants, are competitive for what project might get picked. Privately funded projects mean being able to convince the client that implementing green infrastructure into the project is a good idea and worth the money. Funding also is connected to the issue of equitable distribution. Only so many projects can be funded, and those with more resources are more likely to be able to have theirs funded. Maintenance of green infrastructure is important so that the system can keep working at its best ability. Sometimes, maintenance is a barrier due to the lack of funds for maintenance (Im and Yoon 2024). It also might be the perception that green infrastructure requires high maintenance. The designing phase can also be a barrier as there is a lack of widespread standards and guidelines (Dhakal and Chevalier 2017). This can make designing green infrastructure hard to regulate and hard to understand how it should be designed.

Social Barriers

Lastly, there are social support barriers, including the lack of education and awareness of green infrastructure. Built environment professionals plan, design, and manage green infrastructure projects. Further education and training for built professionals, as well as those planning to go into built environment professions, are immensely important (Hurlimann et al. 2024). Students will become future leaders and trailblazers for green infrastructure and should have a thorough understanding of green infrastructure (Dhakal and Chevalier 2017) (Hurlimann et al. 2024). Furthering the education of students may mean a change in the curriculum, which has many constraints (Hurlimann et al. 2024). This also means that teachers have to be educated on the topic (Im and Yoon 2024). Professors within built environment fields likely already have some knowledge of the topic, but it is important to build on that. Professors outside of the built environment fields, however, might not have much knowledge on the topic, nor educators not in college. It is important for them also to be educated to help further educate people not going into built environment professions (Hurlimann et al. 2024). It is important for younger generations to understand sustainability and green infrastructure; learning about it when one is young can help them advocate for it later (Dhakal and Chevalier 2017). Teachers who are educated on the topic would also be able to educate the public, helping to communicate and break down barriers to green infrastructure (Im and Yoon 2024). Another way to reach community members is to have informative community engagement events about green infrastructure plans (Im and Yoon 2024). These would not only spread awareness and educate the community members but also allow them to feel like they are a part of the project and more accepting (Benedict et al. 2006). Informing community members will also allow for green infrastructure projects to be further legitimized in the community's eyes, increasing the chance of gaining funding for projects (Keeley et al. 2013; Zuniga-Teran et al. 2020).

The overall improvement of green infrastructure education and awareness can create more social acceptance. Another social barrier to green infrastructure is the perception of aesthetics. Clean-cut lawns and highly maintained gardens are more socially accepted, so a positive outlook on green infrastructure beauty needs to be built up (Im and Yoon 2024). With more acceptance of green infrastructure and its aesthetics, there could be more collaboration for the maintenance of green infrastructure (Zuniga-Teran et al. 2020). Another reason it is so important for the public to be informed is the misinformation, like safety concerns and the idea that stormwater isn't a problem (Keeley et al. 2013). It is immensely important to spread awareness and education about green infrastructure as social barriers affect many of the political and technical barriers and can be the tool to break through those (Dhakal and Chevalier 2017). The public being informed is the path to improving sustainability and mitigating climate change effects, which will lead to human health improvements (WHO 1948).

Education and Awareness Initiatives

Efforts to improve green infrastructure education and awareness are important to reach overarching climate change goals. The United Nations Paris Agreement states in Article 12 that “Parties shall cooperate in taking measures, as appropriate, to enhance climate change education, training, public awareness, public participation and public access to information, recognizing the importance of these steps with respect to enhancing actions under this Agreement” (United Nations 2015). Green Infrastructure is an important part of mitigating climate change and slowing worsening effects. Increasing the public’s acceptance of green infrastructure requires a focused effort on the education and awareness of the public, as well as current and future leaders. These efforts can be broken down into four categories: to inform, to appreciate, to learn, and to engage.

To Appreciate

The to-appreciate category is about growing the public's tolerance to the aesthetics of green infrastructure and showing its beauty. This can be done through in-person or online photo galleries showcasing the beauty of green infrastructure. Acceptance of green infrastructure partially relies on people's perceptions and biases, so showing that green infrastructure can work to fit multiple styles can be important (Im and Yoon 2024). A photo gallery highlighting green infrastructure in a positive light in a variety of ways could help to improve people's appreciation. Showing green infrastructure throughout different seasons, highlighting its interaction with the senses, capturing the colors of the plants, and featuring the wildlife it attracts are a few different themes to explore. Much of green infrastructure is also surrounded by natural beauty that it interacts with, such as waterways. Highlighting the connection and how they support each other or framing the view of an image to include something that is already found to be aesthetically pleasing could be helpful as well.



Fig. 2.10 The beauty of pollinators (Smith 2024)

To Inform

The to-inform category is focused on a more passive education that someone can come across by themselves to learn more about green infrastructure. This can include signage, posters and pamphlets, and self-guided and online tours of green infrastructure. Passive education relies on these things to communicate information instead of a person, so the information needs to be clear and engaging to catch people's attention (Ballantyne and Hughes 2003).

Signage, if designed well, should be able to connect with the user so that they care about the subject (Ballantyne and Hughes 2003). To attract the user's attention, themed messaging, a range of communication techniques, movement, contrast, or surprising information placement could be used (Ballantyne and Hughes 2003). A good way to keep the user's attention is by using interactive activities, such as quizzes and tactile signs that engage the sense of touch, which gives users a way to make their experience unique when used appropriately and with consideration (Ballantyne and Hughes 2003). The layout of the signage is also important to make sure the information displayed is concise and comprehensive. The information displayed should be written with the most important information in the largest font and then, as it gets into more detail, a smaller font, allowing visitors a varied engagement level (Ballantyne and Hughes 2003). Keeping a balance of text and images is needed not to overwhelm users (Unger et al. 2024). Careful consideration for phrasing and how the story or message is communicated is needed so that users are not confused or lose interest as they don't have someone there explaining the topic to them (Ballantyne and Hughes 2003). Keeping it interesting with fun facts and avoiding technical terms can help to ensure users don't get confused about the topic of the signage (Unger et al. 2024).

Thinking of the target users is also important when designing the signage and picking the locations. Local green infrastructure examples can help people understand the topic better because the example is in a familiar place, so utilizing signage in these places can help improve understanding (Im and Yoon 2024). Signage around natural outdoor campus locations can support in-classroom learning and university activities by including interchangeable parts of the signage that can hold schedules or event announcements that can lead to further engagement in the topic (Unger et al. 2024). Signage can also support in-classroom learning topics and be used as a resource or activity for students while also informing community members and visitors (Unger et al. 2024).



Fig. 2.11 This sign is just one example of the educational and informative signage that The K-State Beach Museum Meadow has included throughout the site (Goold 2024)

To Learn

The to-learn category focuses on active education, such as in-person teaching and guided lessons, and provides educators with the resources and materials to do so. Creating demonstrations and introducing examples of green infrastructure can also support this category. Not everyone has the opportunity to find examples of green infrastructure they can visit. Outdoor classrooms that integrate green infrastructure can help provide an opportunity for more people to experience green infrastructure and connect with nature (Unger et al. 2024). For students specifically, outdoor learning and classrooms can provide a connection to the outdoors and connect students with local environments while creating the opportunity for a local field trip (Unger et al. 2024). Creating a connection to local environments can create a deeper appreciation for student's outdoor environments and lead to a better understanding of various environmental scientific topics (Unger et al. 2024). Outdoor teaching, in general, can help students as it's been found to boost motivation and communication and reinforce indoor learning (Unger et al. 2024). A great benefit to outdoor learning is students increased interest in careers in disciplines related to their outdoor learning (Im and Yoon 2024). These benefits are still dependent on how the topic they are learning is presented and taught and the level of engagement throughout the lesson (Unger et al. 2024). The way lessons are formatted and taught can impact a person's learning experience and takeaways, so the way lessons are created matters.



Fig. 2.12 Students learning about plant systems and GI performance in the K-State Engineering Bioretention Courtyard (Skabelund 2016)

Interdisciplinary learning within the education field can help teachers be informed on new topics. The integration of landscape architecture into the STEM (Science Technology Engineering and Mathematics) field provides teachers with a better chance to learn about green infrastructure when learning new material (Im and Yoon 2024). When teachers are knowledgeable about green infrastructure, they can then improve lesson plans from experts on the topic to better fit who they are teaching. In a recent study, students studying to be secondary science teachers helped to improve a lesson on green infrastructure (Im and Yoon 2024). They recommended incorporating more discussions throughout the lesson, having local examples, activities that are interactive, having an enthusiastic teacher, and an end-of-session knowledge test (Im and Yoon 2024). A more engaging lesson should include a lot of visuals and a way for them to engage with others or with an activity, making video formats for online learning a stronger option than only online web pages (Im and Yoon 2024).

Creating lessons for green infrastructure has the chance to become an interdisciplinary initiative in which landscape architects can get involved (Im and Yoon 2024). Landscape architects generally have a solid understanding of green infrastructure systems, how they work, the benefits, and examples that could greatly contribute to lesson-making. Depending on the age level and detail of the lesson, landscape architects can also provide graphics of how a system works in local examples. It is important to be able to inform people how the system works and allow the students to connect it to a place they know (Im and Yoon 2024). However, the lessons should first be able to engage the student and create an interest in the topic, so detailed diagrams might not be needed (Im and Yoon 2024). Overall, the lesson needs to be clear and concise and inspire students to dive deeper into the topic themselves, which is why lesson planning should be interdisciplinary (Im and Yoon 2024). Allowing educators to improve the lesson to fit students creates a clearer and more informative lesson.

To Engage

The to-engage category is another form of active green infrastructure education through activity-based learning. Engaging activities can create a deeper understanding and a further appreciation for the environment (Im and Yoon 2024). This can include activities like group weeding, learning how to plant your own garden, or participating in research. These activities could be used as an instruction method to create learning from physical activities to create further understanding (Fernández Galeote et al. 2024). Maintenance instruction could be taught through demonstrations and group cleanups led by facilities, environmental clubs, or community groups. It is important to provide opportunities that can help increase green infrastructure education. Activity-based education can help create stewardship and encourage people to understand the impact and benefits green infrastructure can have on the environment (Ballard et al. 2024). Landscape architects and environmental educators can help plan and involve community members in projects and create learning events.

One type of activity to involve community members in is Community and Citizen Science (CCS). Heidi Ballard, Amanda Lindell, and Christopher Jadallah use this definition for what CCS projects are “including the range of participatory ways of doing science that involve members of the public in some or all parts of scientific research or monitoring projects for which the data or results are used for monitoring, decision-making, or basic research”. There are a lot of ways that educators, researchers, and designers could involve community members. Involvement could happen in the planning phase by testing and providing feedback on methods, in the data analysis and interpretation phase with group discussions, or in the reporting phase through helping to create outcome posters or presentations (Ballard et al. 2024). Involvement in these can increase community connections, environmental stewardship and education, science inquiry skills, and place attachment or value (Ballard et al. 2024).

Participating in these projects gives community members a reason to participate in their environmental communities and become more educated in the process. These kind of activities also increase awareness of locally implemented green infrastructure projects, and can show how they work with and for their community (Ballard et al. 2024). Community involvement in these projects can also help people understand what role researchers and science educators have in society, hopefully creating more understanding and respect (Ballard et al. 2024). Community involvement in CSS projects and citizen research can increase how much a community is involved in other ways, like masterplans of their communities, and increased care about the sustainability of their communities (Zuniga-Teran et al. 2020).

Future campus designs should incorporate green infrastructure into the campus landscape, creating a teaching resource and possible lab use (Way et al. 2012). Campus landscapes can be an example to learn from about conservation and sustainability, and can engage faculty and students encouraging more use of the campus landscape (Way et al. 2012). Using local public lands to teach students about sustainability, cultural connections to the land, resource management, conservation and more can help prepare those going into environmental science and design careers, or hopefully inspire more to do so (Bowser et al. 2014). It is also important to teach student of other disciplines about sustainability in hopes that as future leaders they carry it as a value in their careers (Bowser et al. 2014). This can also be a way to offer a new setting to learn in, and reconnect students with nature (Bowser et al. 2014). Public lands provide a larger venue for labs and research collection that can help strengthen students connection with nature through working on the land, similar to how participation in cultivating a community garden creates respect and connection to the land (Bowser et al. 2014) (Walshe and Law 2022). Community gardens, however, have the added benefit of crossing cultural and social barriers (Walshe and Law 2022).

Universities' Education Responsibility

College institutions are a place for progress and learning and should be leaders in creating learning opportunities for their students, communities, and visitors. Their purpose of education and preparing future leaders is an important responsibility, and the campus, opportunities, classes, and information they offer should reflect that (Fernández Galeote et al. 2024). Students attending the college will graduate and need to bring with them innovation and new ideas for an ever-changing society. To be able to further implement and study green infrastructure students need the skills, expertise, and knowledge to be able to move green infrastructure forward when they reach the workforce (Dhakal and Chevalier 2017). Younger generations always shape the future the generation after them will live in, and education in sustainability is important for that future (Fernández Galeote et al. 2024).

College campuses have the chance to support students and their communities further by creating sustainable landscapes and outdoor education opportunities (Way et al. 2012). One of the struggles that college institutions have with implementing green infrastructure and sustainability into their campus design is parting with the traditional campus aesthetics that help to brand universities (Way et al. 2012). Campuses are meant to reflect values, and they are used as a marketing tool to attract prospective students, so parting with some campus design choices can be difficult (Walshe and Law 2022). However, sustainable design can be innovative and fit in with current campus aesthetics where deemed important (Way et al. 2012). While more obvious uses of green infrastructure and sustainable design can be used to connect the campus to a wider system and show sustainability as an important value an institution holds (Way et al. 2012). This integration of green infrastructure on campus can then become a beneficial teaching opportunity, lab, and example for the university (Way et al. 2012).



Fig. 2.1 The Meadow on the K-State Campus (Kingerly-Page n.d.b.)

Kansas State University

On the Kansas State Campus, there are multiple examples of green infrastructure that help mitigate the stormwater on campus. These examples are often walked by but not noticed for the functions they perform. Utilizing these systems in a tour of green infrastructure on campus could help educate those who visit the K-State campus and others who take the tour. Understanding the benefits and aesthetics of green infrastructure can help raise awareness of not only landscape architecture but also the importance of green infrastructure and the impacts it has on the climate.

Some of the green infrastructure sites have been used as teaching tools for various classes to learn about plant systems, soil health, construction and grading, and many other topics. The K-State Beach Museum Meadow is used for summer classes and field trips for the local elementary schools. There is also a few signs explaining bioswales functions and what they are around main campus.

Creating a tour can help to further support the education of green infrastructure and natural systems already happening, and create more opportunity for not just students.

Fig. 2.14 All of the green infrastructure on K-State's Campus (Goold 2025)



Site 1: North Seaton GI Collection

In 2018, the green space in front of Kansas State University's English Counseling Services building was redesigned to improve stormwater management. This transformation was driven by the APDesign Expansion project and the conversion of 17th Street—now Martin Luther King Jr. Drive—into a pedestrian corridor, creating an opportunity to implement new bioretention basins.

A notable feature of this site is the distinct yet complementary green infrastructure designs on either side of the sidewalk. The vegetation and infrastructure on the south side were developed as part of the APDesign Expansion project, while those on the north side were incorporated into the K-State English Counseling Services Improvements. Notably, a bioswale on the north side—originally part of the APDesign Expansion project—was positioned just far enough west to remain undisturbed during construction (Fig. 2.15). To maintain aesthetic cohesion, the plant palette for the north side was carefully curated to complement the design of the south side. This area of the K-State campus exemplifies the seamless integration of three projects that collectively enhanced its stormwater infrastructure system.



Fig. 2.15 In this image, you can see the bioswale designed as part of the APDesign Expansion project as well as the construction happening for the English Counseling Services Improvements. (Skabelund 2018)

Site 2: East Engineering Bioswales

In 2014, Kansas State University issued a Request for Proposal to initiate its Chilled Water Expansion Project (Olsson n.d). This large-scale project aimed to update and expand the heating and cooling infrastructure to accommodate both existing and future campus buildings. The expansion was necessary due to student population growth, prompting K-State to construct new buildings and retrofit existing ones to meet evolving needs. This initiative was part of a broader 2025 facilities improvement plan, funded by a state bond (Olsson n.d).

The project took place between 2015 and 2017, requiring road closures and some demolition to access chiller pipes and expand the chilled water loop (Kansas State University n.d.c). This disruption created an opportunity for K-State to begin developing pedestrian malls, not only on North Martin Luther King Jr. Drive (known as 17th Street at the time) but also on Mid Campus Drive. The transformation of these streets into pedestrian-friendly spaces significantly reshaped how students and visitors experience the campus.

Construction on Martin Luther King Jr. Drive began in 2015, with the new pedestrian mall opening to students by the spring semester of 2016. The redesigned space featured branded entrance monuments, newly planted trees, and rain gardens (Olsson n.d). In 2021, 17th Street was officially renamed North Martin Luther King Jr. Drive to honor Dr. Martin Luther King Jr.



Fig. 2.16 One of the MLK Jr. Drive bioswales after a rain event (Goold 2024)

Site 3: West Engineering Bioretention Courtyard

In 2015, construction of the College of Engineering Expansion project was completed, connecting Durland, Rathbone, and Fiedler halls to form a unified complex (Kansas State University n.d.d). Previously the site of a practice football field, the expansion added approximately 107,000 square feet of new facilities (Kansas State University n.d.d). The project aimed to consolidate functions, enhance connectivity, and improve the overall aesthetics of the college.

The expansion introduced new classrooms, teaching and research laboratories, an auditorium, and faculty and administrative offices. It also accommodated the Computing and Information Sciences and Electrical and Computer Engineering departments (Kansas State University n.d.d). To support growing enrollment, additional faculty, and Graduate Teaching Assistants, the project also incorporated small lounges and conversational areas to encourage cross-disciplinary discussions and collaboration (Kansas State University n.d.d).

As part of the renovation, the Engineering "Rain Garden" was created as both a student space and a teaching opportunity. Planned alongside the building expansion, this outdoor courtyard was designed to highlight engineering principles while providing a functional and inviting environment. The building additions, renovations, and the Engineering "Rain Garden" were developed by multi-disciplinary firms and engineers, ensuring an integrated approach to both indoor and outdoor learning spaces.



Fig. 2.17 The Engineering "Rain Garden" before extreme plant decline (Skabelund 2020)

Site 4: Memorial Stadium Green Roofs

To honor Kansas State University (K-State) students and alumni who gave their lives during World War I, K-State constructed Memorial Stadium in the 1920s, dedicating it in 1929. This made Memorial Stadium the first memorial on campus. Plaques were placed at the south ends of both sides of the stadium to permanently honor these veterans (Skabelund and Alam 2020).

Originally, Memorial Stadium served as the home for K-State football games until 1967, when they were relocated to the newly built K-State Football Stadium (now Bill Snyder Family Stadium). Since then, the stadium has been repurposed for various student activities, including marching band practices, pick-up sports games, exercise, and relaxation (Skabelund and Alam 2020). The indoor sections now serve as storage for the K-State Band and house an office for the Career Center, along with various meeting spaces.

By the late 2000s, Memorial Stadium began experiencing structural issues, particularly with the roofs, which also functioned as seating areas. Between 2008 and 2012, landscape architects, architects, engineers, and other professionals explored multiple green roof concepts to address these structural concerns and reduce seating capacity for safety reasons (Skabelund and Alam 2020). The green roofs covered large portions of the seating areas, incorporating a new waterproofing system and insulation to prevent leakage, which was crucial for their sustainability (Skabelund and Alam 2020).

After receiving approval from K-State administration, the green roof project was completed between July 2015 and April 2016 at a total cost of approximately \$2.5 million for both the west and east sections (Skabelund and Alam 2020).



Fig. 2.18 The slope of the green roof creates easy interaction through both sight and touch (Goold 2024)

Site 5: The Meadow

The K-State Meadow (The Meadow) is a vibrant landscape on campus that showcases native plants while fostering learning and relaxation (Garcia 2013). Located outside the Beach Museum of Art, The Meadow enhances the museum's setting by highlighting the natural beauty of native plant life. Once a simple patch of lawn, it was transformed into a thriving meadow landscape for both educational and recreational purposes. Seating has been installed throughout the space, with recent updates made by the 2024 Furniture III design class to create a more welcoming and comfortable environment.

The Meadow's development has been made possible through multiple donations and grants. A memorial donation from the Hummel Family, along with financial support from the John T. Henley Meadow Excellence Fund and the K-State Green Action Fund, has helped sustain the project (Kansas State University n.d.f). Additionally, volunteers have played a crucial role in its success, contributing to maintenance, implementation, design, and research efforts.

The Meadow's history has been well-documented through a blog that began in 2013 and continued until 2020. This platform provided valuable information to the K-State community, promoted learning, and shared volunteer opportunities and community activities. The blog has since transitioned to an Instagram account, which continues to provide updates and engagement opportunities.

In addition to serving as a peaceful retreat, The Meadow hosts various educational and artistic activities. These include art installations in collaboration with the Beach Museum, lessons on natural plant dyes, and guided tours as part of the museum's summer programs.



Fig. 2.19 The plants in The Meadow create a sense of enclosure and safety (Goold 2024)

Site 6: East Seaton Rain Gardens

The Seaton Rain Gardens were part of the broader APDesign Facility renovation and improvement project. The design phase began in 2014, followed by construction in 2015, with completion in 2017—just in time for classes to begin that fall with exciting new amenities (Kansas State University n.d.b). This expansion connected Seaton East and Regnier Hall, enhancing the APDesign Facility with an improved library, expanded studio space, a fabrication laboratory, an auditorium, offices, and open design areas (Confluence n.d).

The addition is classified as a LEED Silver Certified facility, recognizing its commitment to sustainability. The project achieved notable environmental benchmarks, including a 50% reduction in irrigation demand, a 38.3% reduction in potable water use, an 18% reduction in energy consumption, the use of 100% no- and low-VOC finishes, and an 80.1% landfill diversion rate (Kansas State University n.d.a).

Several key design features contributed to these sustainability achievements, including sun-shading fins, rainwater collection cisterns, bioswales, vegetated roof areas, abundant natural daylighting, native plantings, and the use of locally sourced materials (Kansas State University n.d.a). The exterior landscape design played a crucial role in these successes, serving as a strong example of the benefits of green infrastructure.



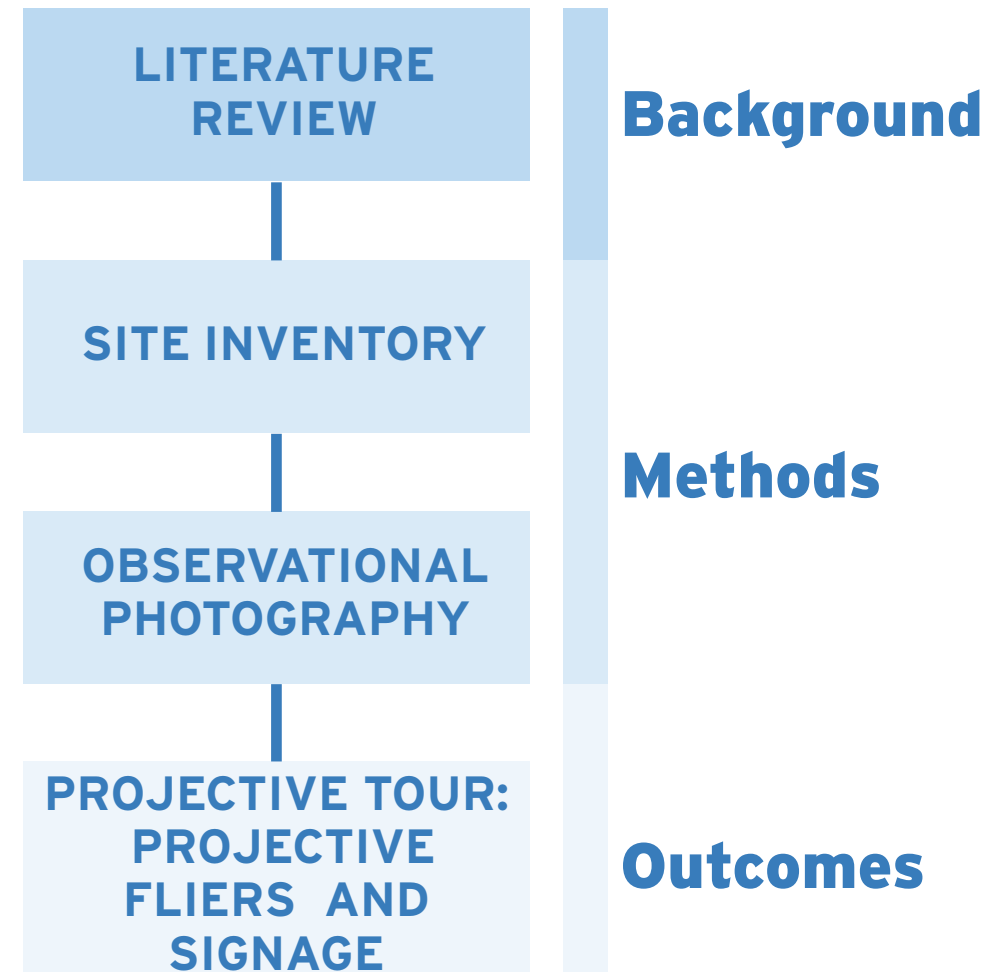
Fig. 2.20 Pollinators in the Seaton rain gardens (Skabelund 2018)

03.

Methods

Methods

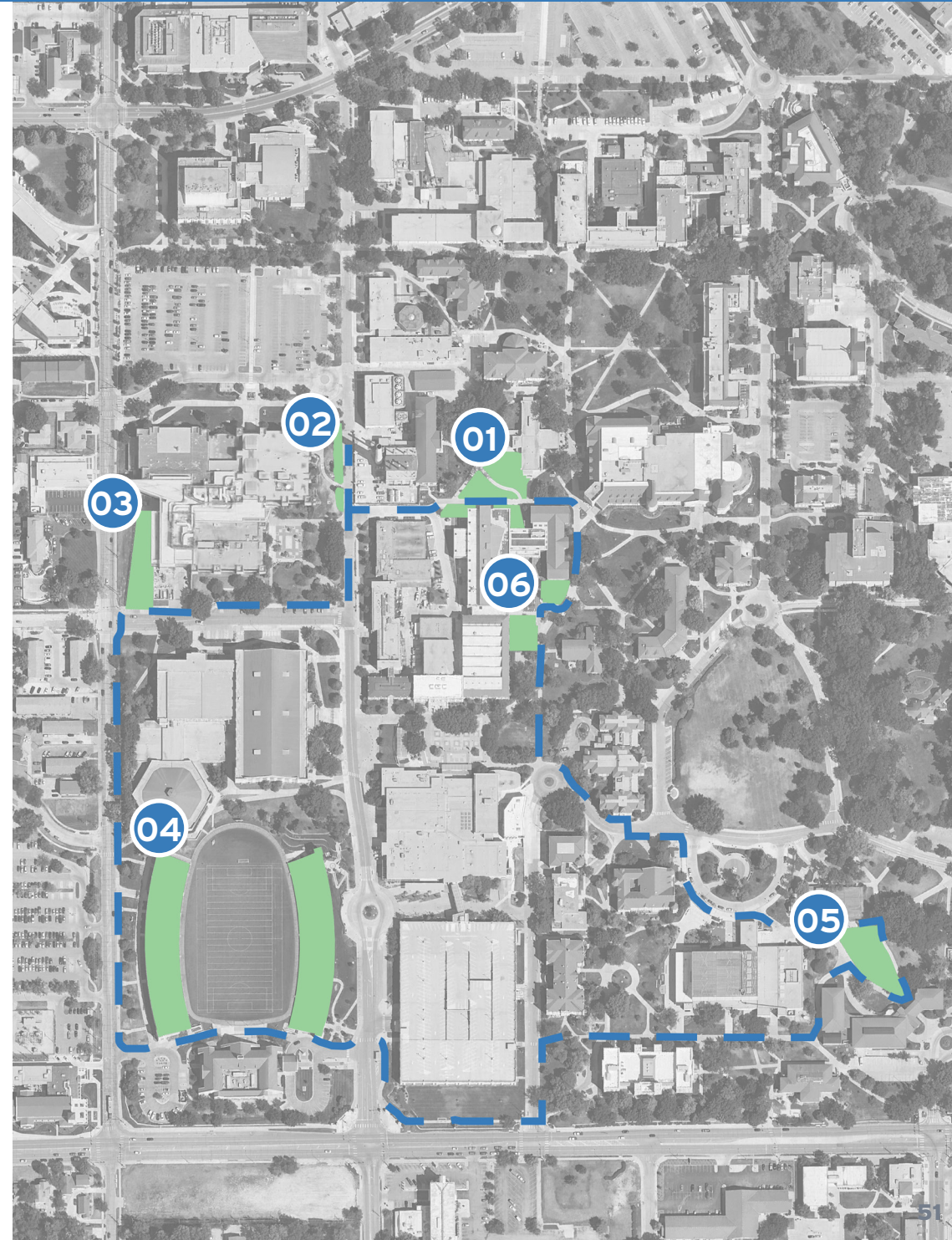
I am conducting applied research with a mixed-methods approach for projective design consisting of projective tour fliers and signage for six sites. The signage aims to increase the education and awareness of green infrastructure for Kansas State University students, community, and visitors. This will help address one of the main barriers: the need for more education and awareness of green infrastructure.



Overview

I conducted an inventory and analysis of six examples of green infrastructure on the Kansas State University Campus. I chose these six green infrastructure systems because of their proximity to each other, to the main campus, and to the Engineering and Architecture buildings. The information collected at each site included the type of green infrastructure system, the goals and benefits, the research opportunities and research in the past, and maintenance and design.

Fig. 3.1 Site location map (Goold 2025)



Site 1: North Seaton GI Collection

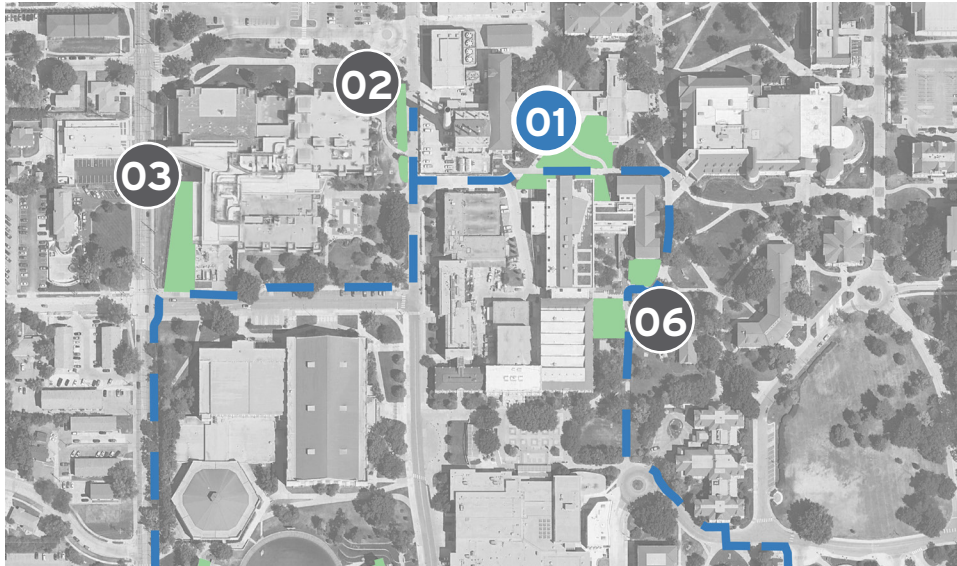


Fig. 3.1 The Seaton Bioretention Area includes multiple green infrastructure examples. There are two bioretention basins, a bioswale, and a nearby terrace garden that acts as a bioretention basin. (Goold 2025)

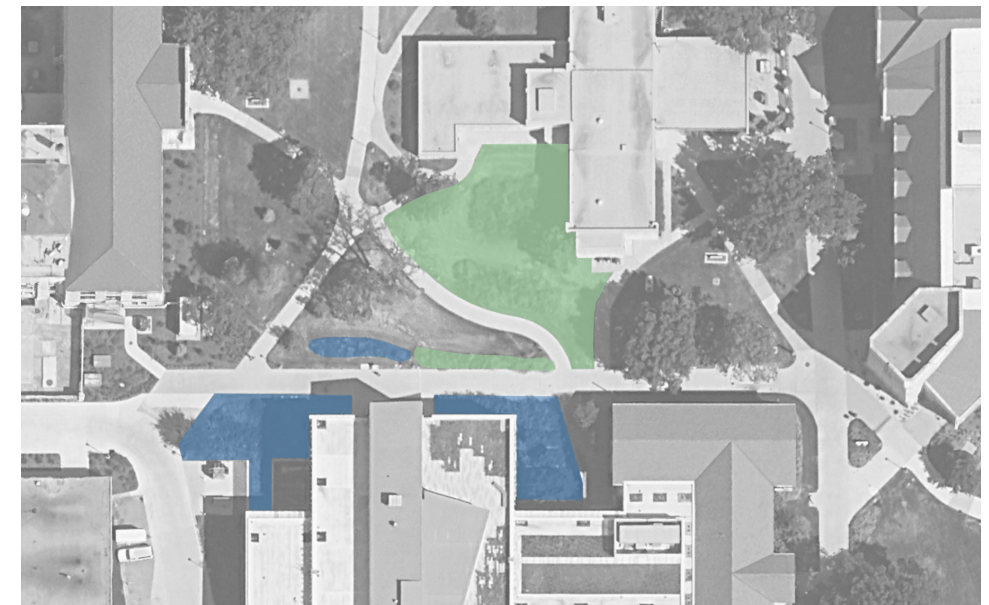
Research

The close proximity of various green infrastructure types provides a unique opportunity to examine their relationships and interactions. Studying these systems together could offer valuable insights into how different green infrastructure elements function as a collective system. Additionally, comparing and contrasting their effectiveness could help evaluate their individual performance and overall impact on stormwater management and environmental sustainability.

Goals and Benefits

When evaluating potential sites for a new water chiller, consultants proposed the English Counseling Services site as an option. However, the university ultimately chose to preserve the site as a green space to align with the sustainability goals of the adjacent APDesign Expansion project (Olsson n.d).

Like many other green spaces on campus, this area plays a vital role in stormwater management, naturally filtering and cleaning runoff while also improving air quality. Additionally, the diverse vegetation enhances biodiversity, providing habitat for a variety of wildlife.



English Counseling Services Improvements | 2018
APDesign Expansion Project | 2017

Fig. 3.2 Years of project implementation (Goold 2025)

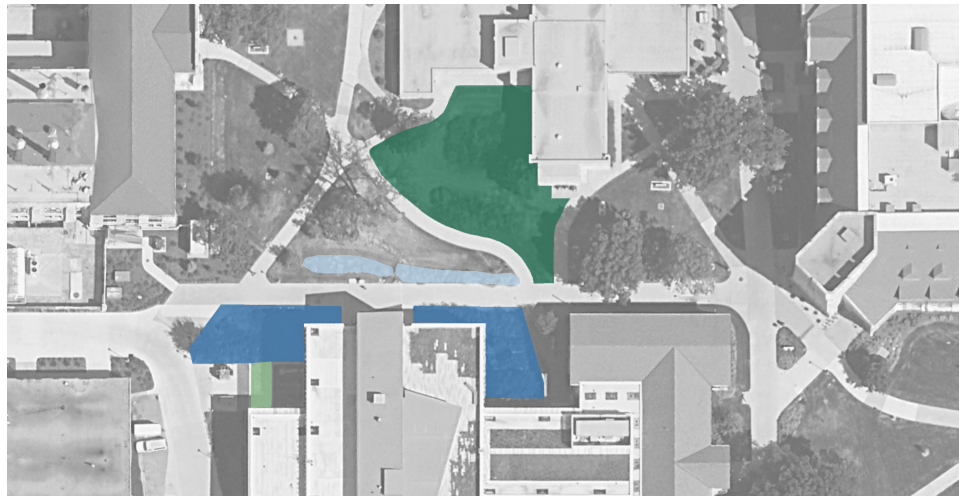


Fig. 3.3 Green infrastructure types at site 1 (Goold 2025)

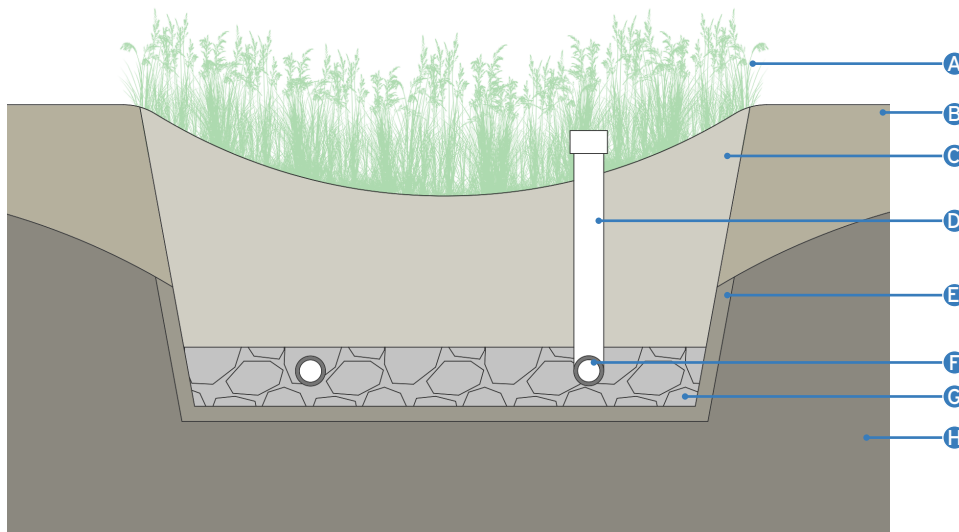


Fig. 3.4 A typical bioretention basin section (Goold 2025)

Maintenance and Design

Within this small section of campus lies a network of green infrastructure systems that work together to manage and filter stormwater. This system includes two bioretention basins, two rain gardens, and one long bioswale—which can be viewed as two connected sections.

The English Counseling Services Improvements project contributed two bioretention basins and half of the bioswale, while the APDesign Expansion project incorporated the two rain gardens and the remaining half of the bioswale. Spanning approximately 1,150 square feet, the bioswale directs water through the system before it ultimately enters an inlet drain. Similarly, the bioretention basins collect water, which then drains into inlets after being absorbed by plants and filtered through layers of rock and soil. In contrast, the rain gardens retain water, allowing it to gradually soak into the ground with the help of deep-rooted plants.

To maintain a cohesive aesthetic, many of the same native plant species are used across all systems. K-State University Grounds oversees seasonal maintenance, including trimming and cutbacks, while an irrigation system provides water as needed.

Site 2: East Engineering Bioswales

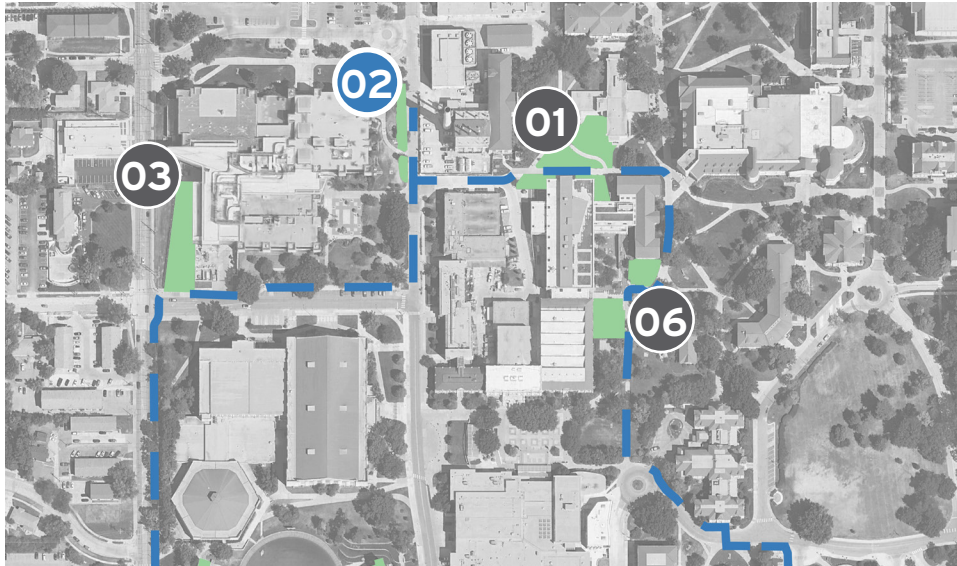


Fig. 3.1 These two bioswales are located in-between K-State's Engineering Hall and the Power Plant. A small sidewalk that leads in to Rathbone Hall separates the two bioswales. (Goold 2025)

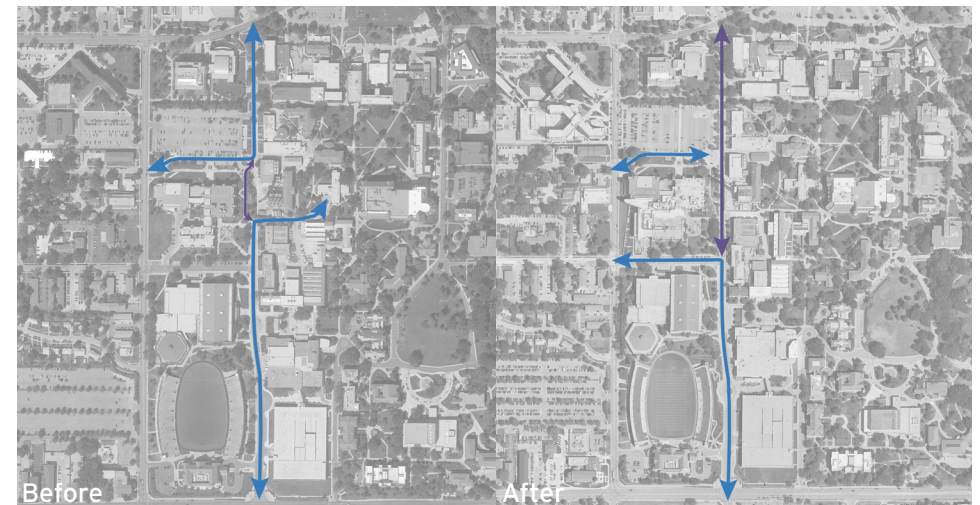
Research

One notable design feature of these bioswales is their strong connection to the adjacent pedestrian walkway. This proximity presents an opportunity to study the interaction between green infrastructure and pedestrian movement, specifically how people engage with and experience bioswales in an urban setting. Additionally, the bioswales are positioned at the bottom of a slope, with a building at the top. This presents another opportunity to analyze stormwater collection efficiency and the importance of site design in managing runoff. Understanding how these bioswales handle water flow from the slope can offer valuable insights into their effectiveness and potential design improvements.

Goals and Benefits

The primary goal of this project was to create an inviting and sustainable pedestrian mall (Olsson n.d). Closing the street to vehicle traffic and redesigning it for pedestrian use provided an opportunity to incorporate green infrastructure and enhance pedestrian-friendly amenities (Olsson n.d).

The addition of bioswales introduces native green space to campus, offering students and visitors a chance to learn about the native prairie ecosystem and sustainable water management. These bioswales play a crucial role along this high-traffic route, as many people pass by them daily. When functioning properly, they capture and filter stormwater, reducing runoff and improving water quality. Additionally, the trees and vegetation contribute to cooling effects, enhancing comfort for pedestrians. However, the effectiveness of these benefits depends on the ongoing performance and maintenance of the system.



Before After

Car Focused Circulation Pedestrian Focused Circulation

Fig. 3.5 Before and after 17th street updates (Goold 2025)

Maintenance and Design

The design of these two bioswales was closely integrated with the overall pedestrian mall layout. They are part of a larger system of bioswales that extend north along North Martin Luther King Jr. Drive. Additional features considered in the pedestrian mall design included shade trees, lighting elements, pathways to university buildings, entrance gateways, fencing to separate the space from the power and chilling plants, and designated gathering areas (Olsson n.d). While the original plans included a seating area next to the bioswales, this feature was ultimately replaced by an extension of the bioswale system (Olsson n.d).

Situated at the bottom of a slope, these bioswales manage a high volume of stormwater runoff. This is likely why River Birch trees were selected, as they thrive in wet conditions. However, the significant water flow has led to erosion issues, including soil displacement, stone washout, and vegetation loss. Regular maintenance of these bioswales includes weeding and winter plant cutbacks to help sustain their function and appearance.



- A** Native Vegetation
- B** Cobbles
- C** Sidewalk
- D** Bioretention Soil
- E** Undisturbed Subsoil

Fig. 3.6 A section cut of the East Engineering Bioswales (Goold 2025)

Site 3: West Engineering Bioretention Courtyard

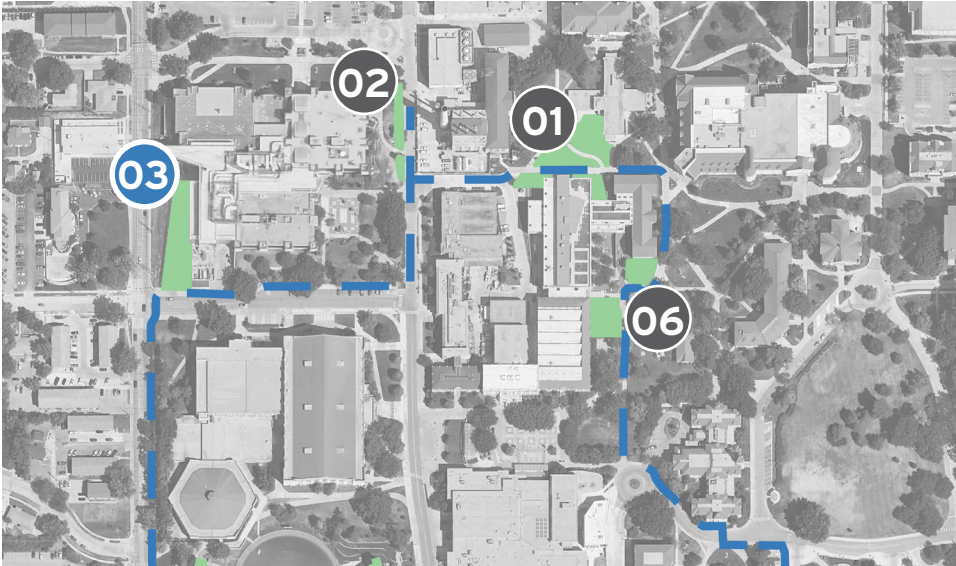


Fig. 3.1 This bioretention courtyard is located off the intersection of Denison Avenue and College Heights Road. The courtyard is a part of the K-State Engineering Complex, with an entrance that leads right to the atrium. (Goold 2025)

Research

Situated right outside the K-State Engineering Complex, this bioretention system is strategically placed to encourage human interaction and learning. Its design fosters engagement, making it an ideal setting for studying how people interact with green infrastructure. The courtyard's bioretention system has also served as a research site for Trisha Moore, an Associate Professor at K-State, supporting studies on stormwater management and sustainability.

Goals and Benefits

The design of the Bioretention Courtyard was closely aligned with the broader goals of the K-State Engineering Expansion Project, ensuring that the indoor and outdoor spaces complemented each other (Kansas State University n.d.d). The project aimed to enhance education and teaching experiences, encourage collaboration, discovery, and innovation, promote communication and interaction, and create an environmentally sustainable facility that exemplifies environmental stewardship (Kansas State University n.d.d).

The effectiveness of the Bioretention Courtyard depends on the proper functioning of its bioretention cells. However, due to vegetation loss, many of the benefits once provided by the system have diminished. When the vegetation was thriving, it contributed to cooling the surrounding area, improving air quality, and filtering and cleaning stormwater runoff.

Despite its current challenges, the Bioretention Courtyard remains a valuable educational tool, serving as an example of green infrastructure and a testing ground for research and learning. With proper restoration and maintenance, it has the potential to once again serve as a model for sustainability and innovation.

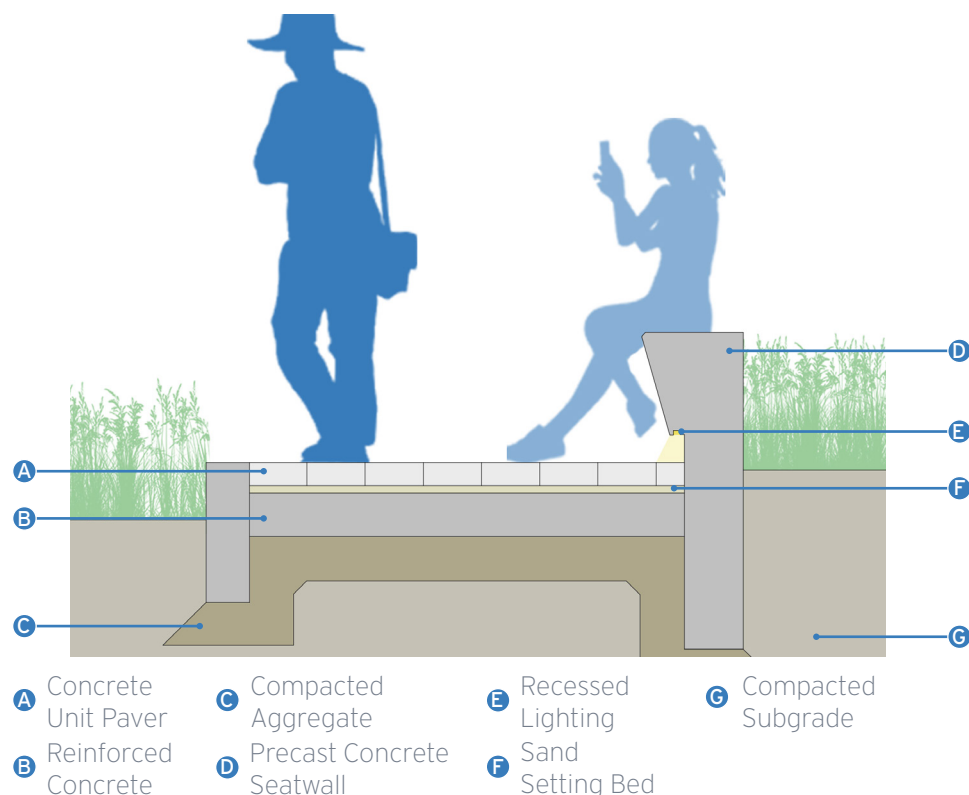
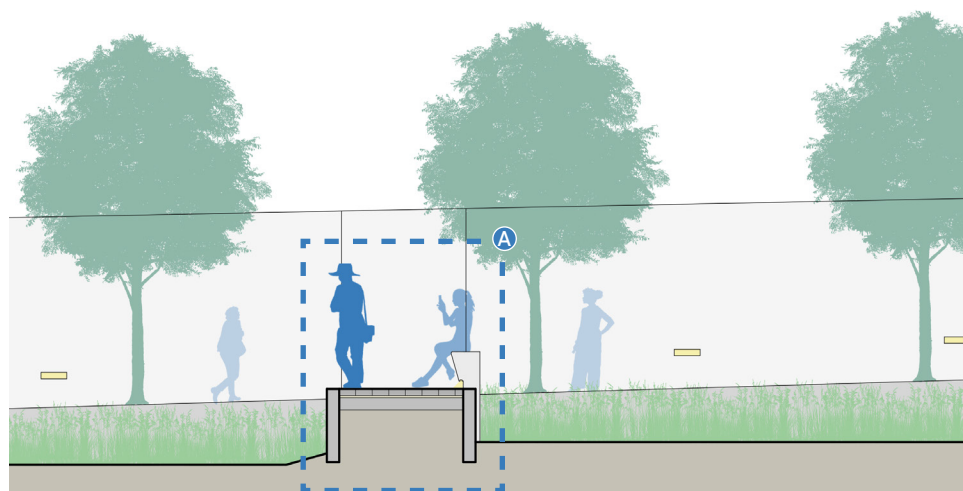


Fig. 3.7 Detail section cut of the West Engineering Bioretention Courtyard Interaction Point (Goold 2025)



A Fig. 3.7

Fig. 3.8 Longitudinal section of the West Engineering Bioretention Courtyard showing the seating and interaction point in context (Goold 2025)

Maintenance and Design

The Bioretention Courtyard is often referred to as a rain garden, but it actually functions as a bioretention system. It consists of six cells that gradually increase in size as they approach College Heights Road. Each cell was designed using only three plant species: Red Twig Dogwood, Blue Flag Iris, and Common Rush. These cells capture stormwater runoff from the nearby building as well as permeable and impervious pavement. The stormwater is intended to be absorbed by the plants, filtered through the soil, and gradually flow toward the southwest corner of the final cell, where it completes its journey.

However, the system has been in decline since regular irrigation was discontinued. Several factors have contributed to this deterioration, including low plant diversity, inadequate soil conditions, and persistent droughts. Additionally, the design and planned maintenance strategies have not aligned effectively, leading to significant plant loss in the cell nearest to College Heights Road, bare patches in others, and visible erosion.

A cohesive design and maintenance plan is essential to ensuring the long-term success of green infrastructure. While adjustments to maintenance plans are sometimes necessary, designs should also account for site conditions and budgetary constraints from the outset. With an updated plan that considers site-specific challenges and required maintenance, the Bioretention Courtyard has the potential to recover and thrive once again.

Site 4: Memorial Stadium Green Roofs

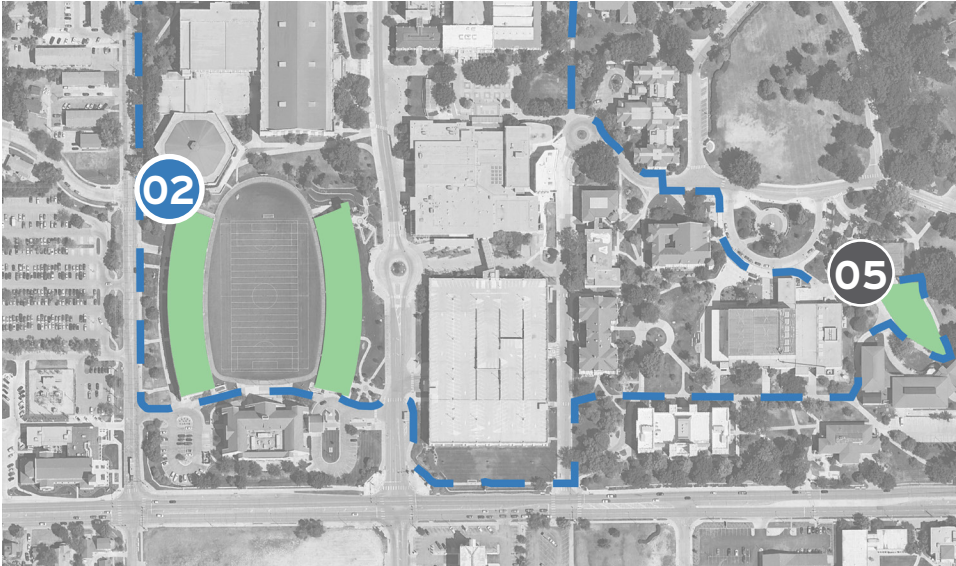


Fig. 3.1 These two green roofs are located by the K-State Alumni Association and the K-State Union. A turf field sits in between the two green roofs allowing for activities surrounded by plants. (Goold 2025)

Research

Extensive research has been conducted by various teams on the Memorial Stadium Green Roofs. The Landscape Architecture Foundation case study provides a comprehensive analysis of the environmental and social impacts of these green roofs. One particularly unique aspect of this project is the sloped design, which presents challenges and opportunities for green roof systems. Despite the slope, integrated stairs maintain accessibility, making it more interactive than most green roofs with similar inclines. Additionally, the ease of public access offers a distinctive opportunity to study how green roofs can engage people and serve as an educational and recreational space.

Goals and Benefits

The goals of this project included urban heat island mitigation, stormwater management, and habitat creation with an emphasis on pollinators, along with the preservation of the two stadium structures (Skabelund and Alam 2020). Another key objective was to increase awareness of native prairie systems through the green roof design.

The two green roofs have successfully enhanced biodiversity, providing habitat for many pollinators and other wildlife. They also help reduce the urban heat island effect and contribute to energy savings compared to traditional dark roofs (Skabelund and Alam 2020). Additionally, these green roofs serve as an educational tool, connecting people to the native prairie ecosystems surrounding Manhattan, Kansas (Skabelund and Alam 2020).

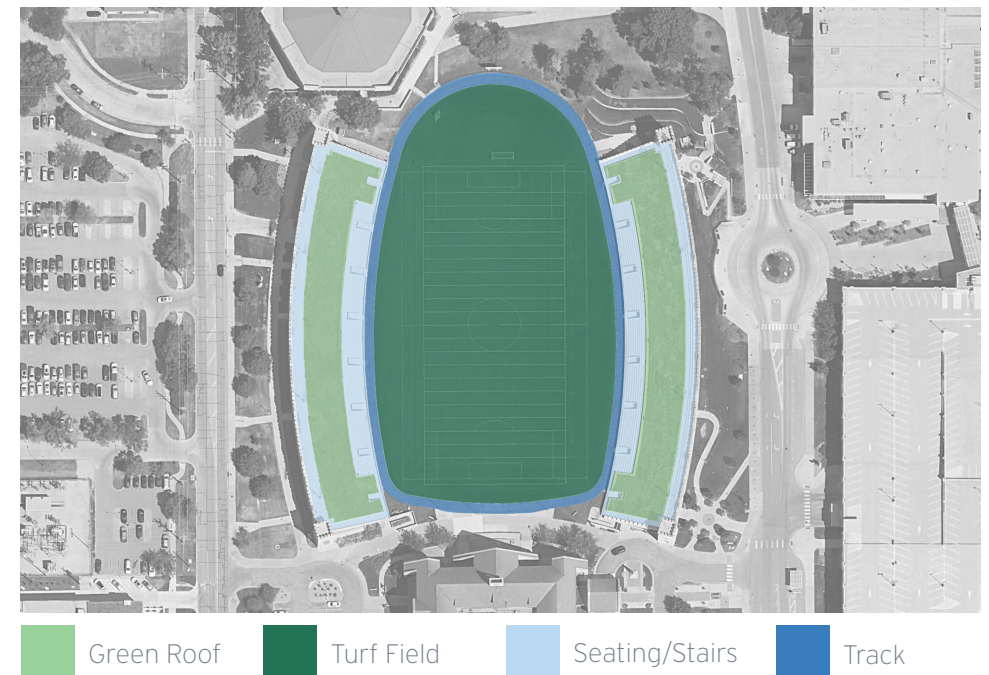
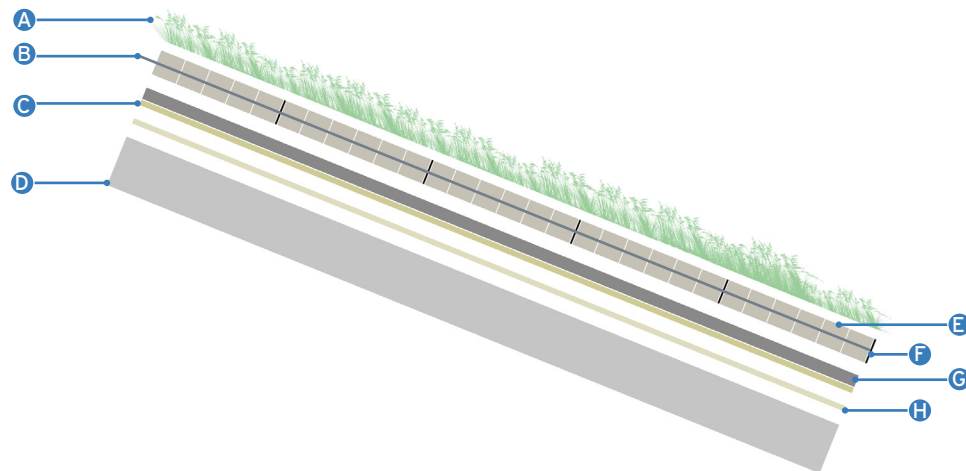


Fig. 3.9 Memorial stadium programming (Goold 2025)



- | | | | |
|--------------------------------|-----------------------|--|---|
| A Native Vegetation | C Root Barrier | E Geo-web with Topsoil | G Hydrodrain 300 Single-sided Geocomposite |
| B Structural Connection | D Cement Board | F Structural Stop Spacing Every 6 Cells | H Waterproof Membrane |

Fig. 3.10 Detail section of memorial stadium green roof (Goold 2025)

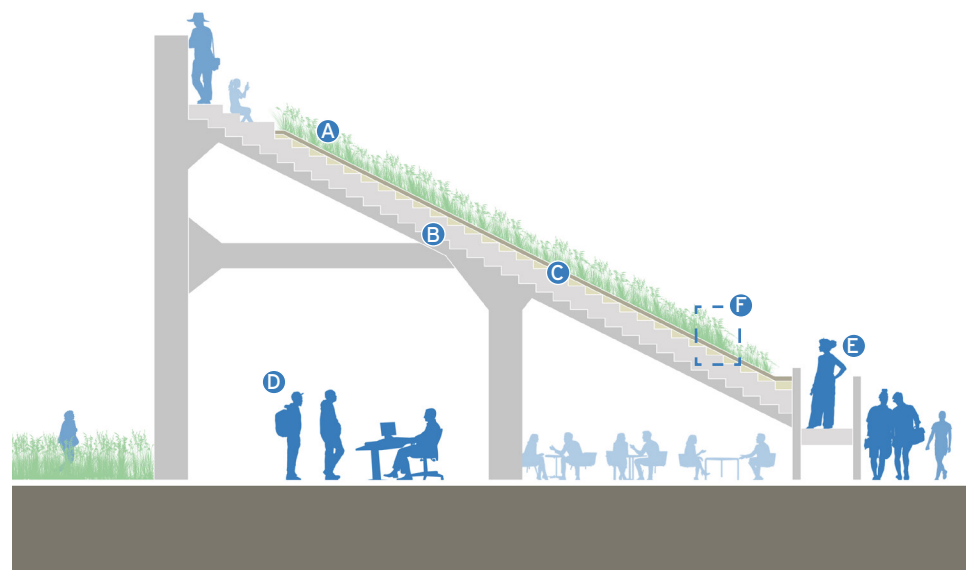


Fig. 3.11 Section of memorial stadium green roof (Goold 2025)

- | | | |
|-----------------------------|--------------------------------|---------------------------------------|
| A Native Vegetation | C Soil Infrastructure | E Walking Track and Turf Field |
| B Original Structure | D Interior of Structure | F Fig. 3.10 |

Maintenance and Design

The green roofs on Memorial Stadium span approximately 43,000 square feet, covering both the east and west sections. To install these green roofs, a sturdy plastic geo-web system was secured to the upper part of each roof using stainless steel cables (Kansas State University n.d.e). A nylon erosion mat holds in place the sandy soil substrate, which was laid at depths of five to six inches over insulated surfaces ("Kansas State" 2021). When planting and seeding the two roofs, 26 native plant species were introduced on the west roof, while 21 species were selected for the east roof (Kansas State University n.d.e). However, due to natural forces such as the wind, non-native plants have also taken root over time, and some additional native species have been introduced naturally (Skabelund and Alam 2020).

To sustain the vegetation, regular irrigation is required due to the high slope and sandy soil composition. Spray irrigation was installed to support initial plant establishment and to provide water during extended droughts (Skabelund and Alam 2020). A winter cutback routine is part of the maintenance plan, ensuring proper seasonal upkeep of the plants. One of the primary maintenance concerns is controlling the growth of invasive and woody plants, as woody plant roots can compromise the structure of the green roof due to the shallow soil depth. Nuisance and invasive species should be removed before their roots establish to prevent long-term issues (Skabelund and Alam 2020).

The K-State Grounds team is responsible for irrigation and general vegetation maintenance, though volunteers and researchers have also assisted with weeding efforts over the years. While the specific plant composition of the green roofs changes over time due to maintenance and natural factors, some notable species include Big Bluestem, Little Bluestem, various milkweed species, Blazing Star, and multiple species of aster.

Site 5: The Meadow



Fig. 3.1 The Meadow is located by The Beach Museum of Art. The paths surrounding The Meadow lead either further into K-States campus or to nearby parking lots. (Goold 2025)

Research

In 2016, research funded by an EPA grant and led by K-State Professor Jessica Canfield examined the impact of on-campus green infrastructure on research, teaching, and outreach. This study highlighted the role of The Meadow as more than just a sustainable landscape—it also serves as a dynamic space for learning and community engagement. One of the unique aspects of The Meadow is its blend of ecology, community involvement, and artistic expression. The integration of artful elements and public participation sets it apart from traditional green infrastructure projects, making it a valuable subject for further research and exploration. The Meadow's ability to inspire creative and interdisciplinary studies adds another layer to its significance on campus.

Goals and Benefits

The creation of The Meadow involved careful planning with clearly defined goals, many of which have been successfully met, demonstrating The Meadow's lasting impact on campus. One key achievement was showcasing a sustainable landscape while increasing awareness of prairie conservation (Garcia 2013). Additionally, The Meadow has become a valuable teaching resource for various courses focused on plants, ecosystems, and sustainability, as well as a site for research projects. Another important goal was creating a connection between The Meadow and the Beach Museum, supporting experiential learning and enhancing both locations' educational missions (Garcia 2013).

The native plants used in The Meadow require significantly less water and pesticides than the conventional lawn that previously occupied the space. This shift has helped increase biodiversity and provide habitat for pollinators and wildlife. The Meadow also serves as a calming green space, offering students and visitors a chance to rest and connect with nature.

To enhance accessibility and engagement, multiple walking paths and seating areas were incorporated, allowing visitors to explore and experience The Meadow comfortably. Informational signage along the paths provides insight into The Meadow's ecological functions and significance, furthering its role as an educational resource.

Maintenance and Design

The Meadow was developed with a five-year plan, beginning with pre-installation in 2012, planting in 2013, and three years of maintenance from 2014 to 2016 to ensure successful establishment (Kingery-Page 2018). During these early years, K-State University Grounds and volunteers played a crucial role in upkeep, providing essential maintenance to help The Meadow thrive. Since then, volunteers have taken on much of the responsibility, aligning with one of The Meadow's key goals—public engagement through hands-on learning and connection (Garcia 2013). Volunteers assist with weeding, trimming, trash removal, and plant monitoring, contributing to both maintenance and education.

Compared to a traditional lawn of the same size (14,300 square feet), The Meadow requires significantly less irrigation, reducing maintenance costs. Additionally, extensive research ensured that chemical fertilizers, pesticides, and herbicides were unnecessary in maintaining The Meadow (Kingery-Page 2013).

Although not originally designed as green infrastructure, The Meadow functions as an informal rain garden, helping to absorb and filter stormwater. Inspired by the nearby Konza Prairie, the plant selection aimed to replicate native prairie conditions. To accommodate the site's varied conditions, five distinct seed mixes were developed, ensuring a diverse and resilient plant community (Prudenti and Kingery-Page 2015). Some of the dominant plants within The Meadow include, Little bluestem, Prairie bee balm, False indigo, and Side-oats grama.

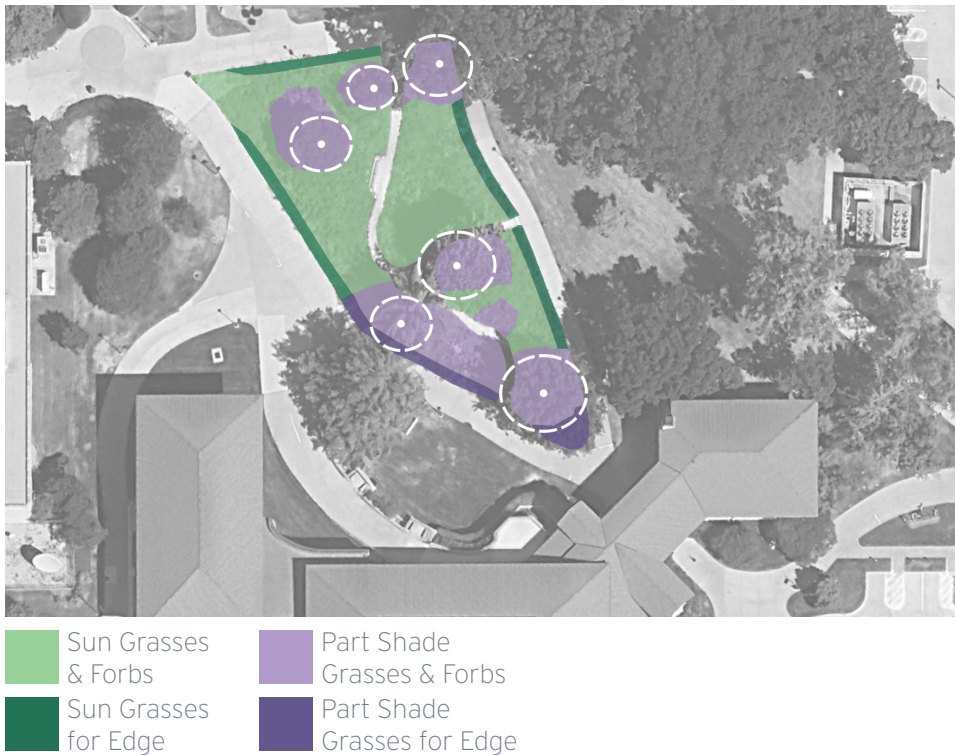


Fig. 3.12 Five distinct seed mixes were used according to sun and shade patterns, ensuring each plant could thrive (Goold 2025)



Fig. 3.13 The Meadow features eight distinct signage topics placed throughout the site. These topics include Chemical-Free Landscape (A), Volunteers (B), Water Saving (C), Pollinator Insects (D), Biomass (E), The Meadow Overview (F), Stormwater Benefits of Native Plants (G), The Meadow's Mission (H), and Monarch Waystation (I). (Goold 2025)

Site 6: East Seaton Rain Gardens

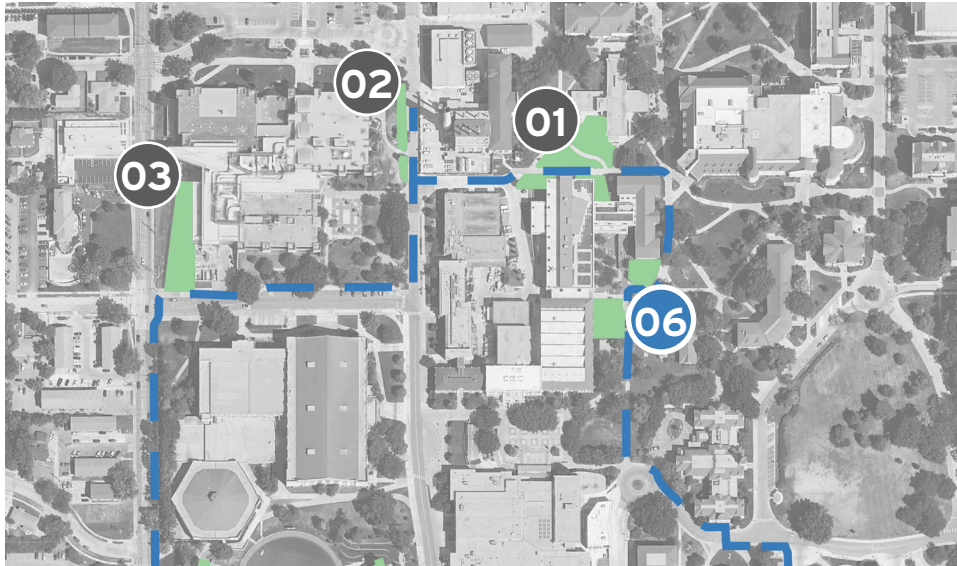


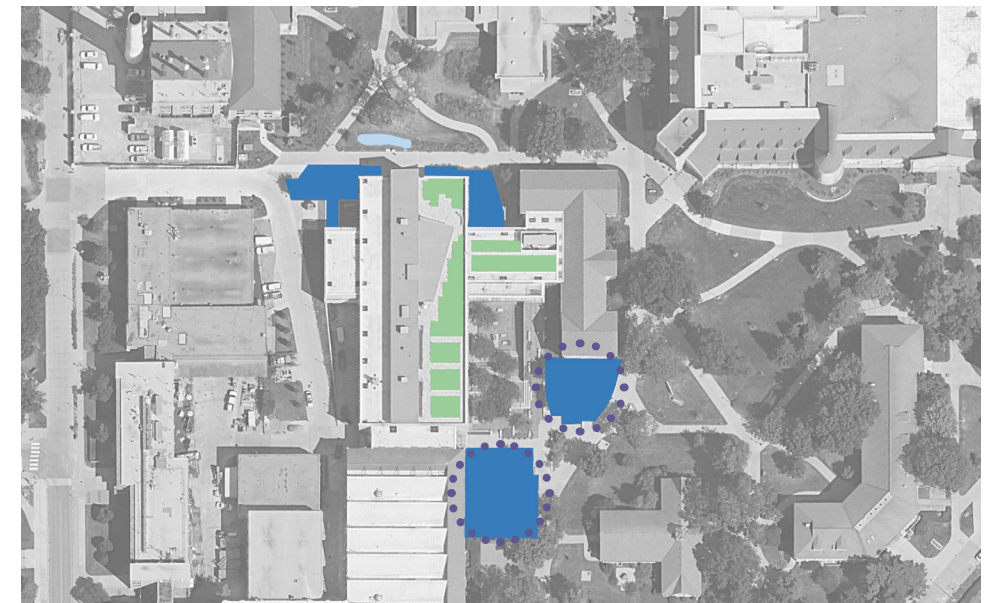
Fig. 3.1 These two rain gardens are situated along the Seaton Hall building, separated by the pathways to two of the entrances. They are still within close proximity to each other and help to surround and buffer the Kemper Amphitheater. (Goold 2025)

Research

The two rain gardens, located in close proximity to one another, present an excellent opportunity for comparison. A potential study could explore the impact of the cistern on the southern rain garden's stormwater management and plant health compared to the northern garden without one. Additionally, researching the biodiversity supported by both rain gardens would provide valuable insights into their role in enhancing urban ecosystems on a campus setting, particularly in terms of supporting pollinators, wildlife, and other forms of plant and animal life within a highly developed area.

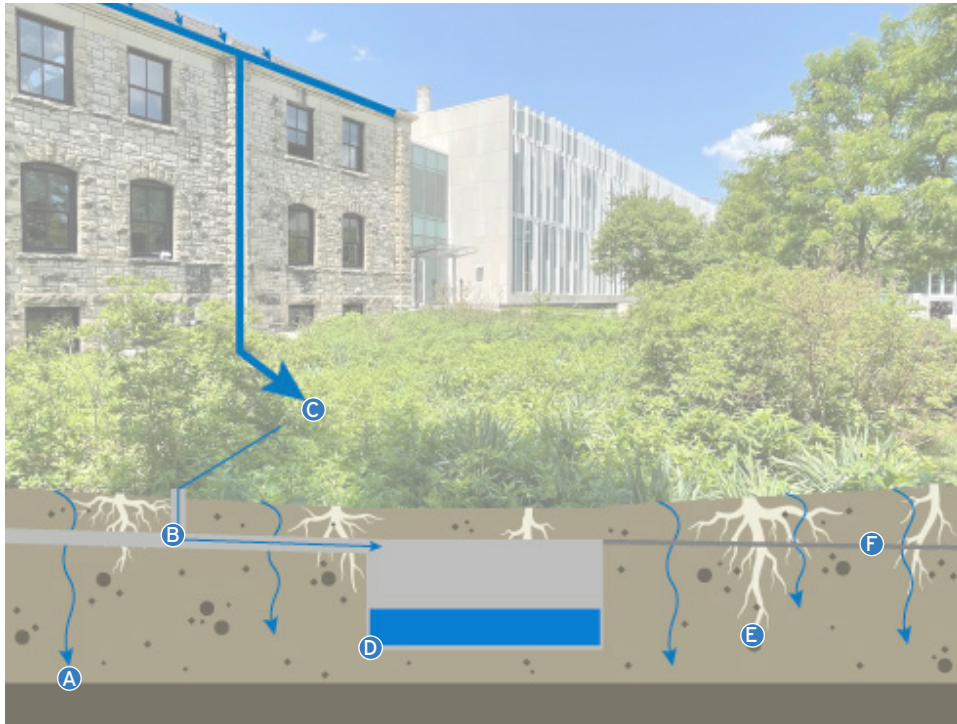
Goals and Benefits

The two rain gardens were a key part of the APDesign Expansion project and played a significant role in the facility's achievement of LEED Silver Certification (Kansas State University n.d.a). A primary focus of the design was on sustainability, emphasizing the use of vegetation that not only helps to filter stormwater but also integrates with the green infrastructure system. Together with other rain gardens on the north side of the building, these rain gardens contributed to significant resource savings, including a 50% reduction in irrigation demand and a 38.3% reduction in potable water use (Kansas State University n.d.a). Beyond their functional benefits, the vegetation in the rain gardens also provides habitat for pollinators and other wildlife, contributing to the overall biodiversity of the area.



Green Roof Rain Garden Bioswale Site Locations

Fig. 3.14 Types of green infrastructure designed for the APDesign Expansion Project. (Goold 2025)



- A** Stormwater Soaking into the Soil
- B** Overflow Drain
- C** Stormwater Runoff from the Roof
- D** Cistern
- E** Deep Roots Soaking in the Stormwater
- F** Cistern Overflow Pipe

Fig. 3.15 Rain gardens rely on the deep roots of native plants to absorb and filter water. Beneath this particular rain garden, a cistern collects excess water and pumps it into the stormwater overflow pipe (Goold 2025)

Maintenance and Design

When designing the rain gardens as part of the APDesign Expansion, careful attention was given to the overall aesthetic vision of the project. The rain gardens were strategically placed to buffer the space and create a more comfortable atmosphere around the amphitheater. Both rain gardens were planted with the same mix of native plants, which includes species like Blue Star, Swamp Milkweed, Purple Coneflower, Soft Rush, and Switchgrass. In addition to these, Thornless Honeylocusts were planted in both gardens. The north rain garden also features Lacebark Elm and American Linden trees, while Prairie Dropseed was used as a buffer along part of the sidewalk in the south rain garden. Both rain gardens included turf as a buffer for most of the areas.

To manage the stormwater, the south rain garden has an underground cistern that collects water, which is then used for non-potable purposes. The K-State University Grounds team is responsible for the maintenance, including seasonal trimming, cutbacks, and irrigation as needed. Additionally, the gardens require occasional weeding to prevent the spread of invasive species.

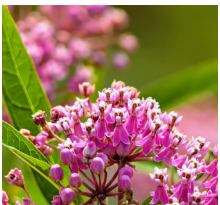


Fig. 3.16 Swamp Milkweed (Dee Gee fifteen 2021)



Fig. 3.18 Prairie Dropseed (carex_grayii 2009)



Fig. 3.17 Joe Pye Weed (Victor To 2018)

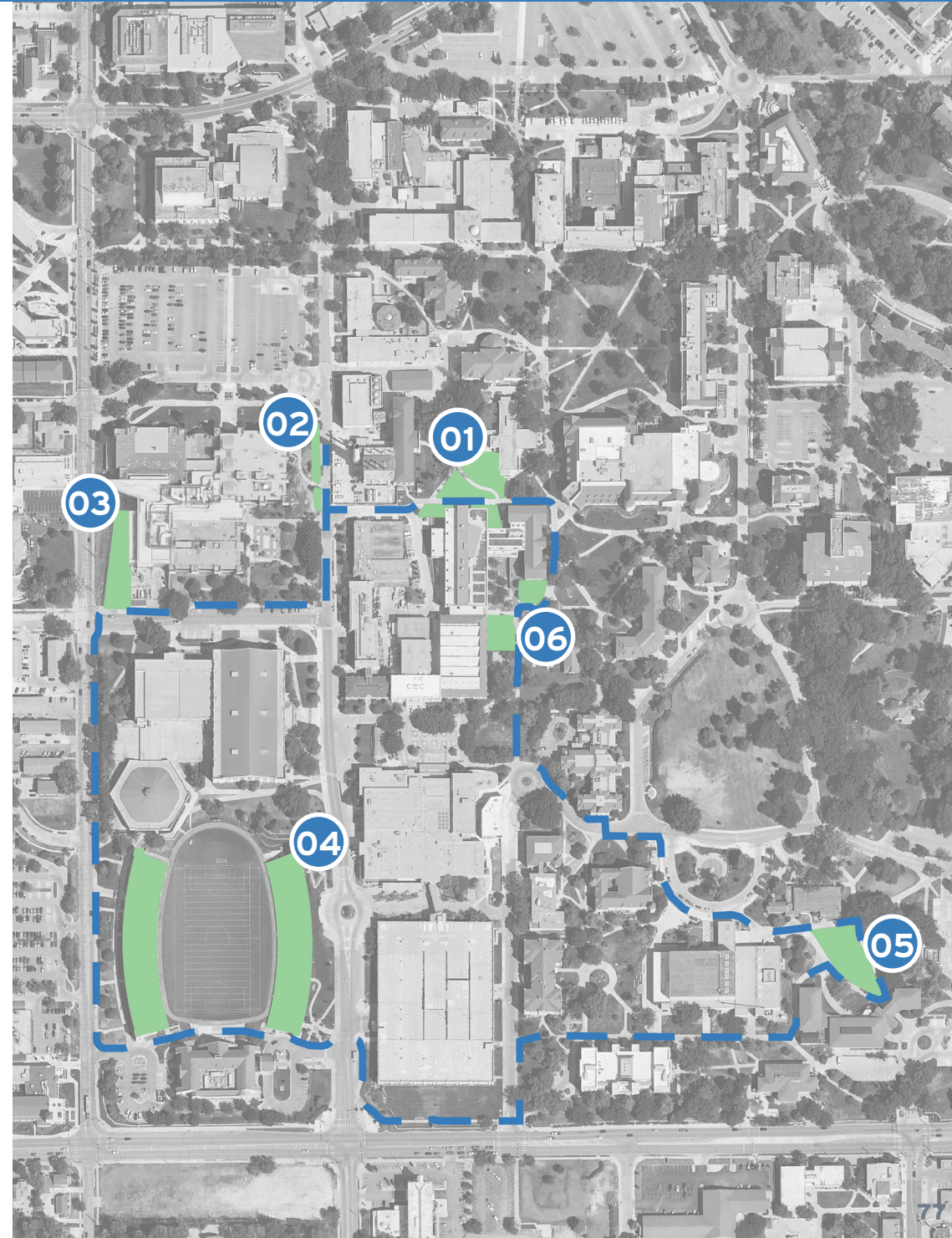


Fig. 3.19 Rattle Snake Master (Lively 2015)

Overview

This method was used to help analyze the similarities and differences between seasons, years, and different years. These themes include the seasonality of the colors of the plants, the movement the plants create, and the texture of the plants. These photographs also help showcase the aesthetics of green infrastructure around Kansas State's campus. These photographs also support the design of the projective signage, adding visual interest to capture viewers' interest and make them see green infrastructure positively.

Fig. 3.1 Site location map (Goold 2025)



Site 1: North Seaton GI Collection

Highlights

The implementation of these green infrastructure systems enhances the landscape with vibrant colors and visual interest that complement the surrounding buildings.

Issues Over Time

Over time, some migration of plant species has occurred, but the overall health of these systems remains strong. The placement of some of the plants can make it difficult to reach and use some of the infrastructure.

Maintenance

Attention to plant species and growth is crucial to ensure pedestrian safety and maintain the proper functioning of the green infrastructure systems.

Public Interaction

The design of most of these green infrastructure systems encourages passive interaction through views rather than creating a deep, immersive experience within the landscape. However, the tiered garden does provide some seating, bringing people closer to the plants for a more immersive experience.



Fig. 3.1 (Goold 2025)

Creation of Green Space

Converting the parking lot into two bioretention basins increased green space, created new habitat, and improved stormwater filtration. It also improved the aesthetic quality of the space.



Fig. 3.20 New bioretention basin (Goold 2024)



Fig. 3.21 K-State English Counseling Services parking lot (Skabelund 2018)

Seasonal Views Through Vegetation

As the seasons change and plants are cut back, the landscape transforms, revealing unexpected and dynamic views.



Fig. 3.22 The view through the winter vegetation (Skabelund 2025)

Native Vegetation Texture and Color

Throughout the seasons, native plants introduce dynamic textures and colors that enhance the landscape's visual appeal.



Fig. 3.24 Winter vegetation in shades of brown (Skabelund 2025)



Fig. 3.23 Vegetative screening (Goold 2024)



Fig. 3.25 Waves of color and texture (Goold 2024)

Bioswale and Walkway Relationship

The bioswales along the walkway enhance pedestrian interest and naturally guide the eye down the path. If too close, however, it can create a tripping hazard if not properly maintained.



Fig. 3.26 A natural edge (Goold 2024)



Fig. 3.27 Creating pedestrian interaction (Goold 2024)

"These approaches emphasized the need to go beyond adding isolated sustainable elements to a static campus to developing complementary, interconnected infrastructural networks" (Way et al. 2012)

Site 2: East Engineering Bioswales

Highlights

The high-traffic location of these bioswales increases awareness of native plants and green infrastructure. They also play a crucial role in capturing the large volume of stormwater that flows down from Rathbone Hall and surrounding areas.

Issues Over Time

Due to the large volume of water these bioswales capture, some erosion has become an issue. There has also been a loss in the diversity of plants, creating a loss of color and interest.

Maintenance

The high-profile location of these bioswales raises safety concerns related to maintenance due to the cobbles lining the edges. The cobbles create challenges for mowing, and weeding must be done by hand to prevent the cobbles from being flung.

Public Interaction

The signage and bioswales are located along a popular pathway on campus, so many people walk by these bioswales daily. The interaction with these systems is primarily visual and auditory, with no direct physical engagement.



Fig. 3.1 (Goold 2025)

Aesthetic Tree Qualities

The varying textures of the tree bark and leaves provide visual interest, while the movement and sounds created as they sway in the wind also capture the attention of onlookers.



Fig. 3.28 Fraying bark on a River Birch tree (Goold 2024)



Fig. 3.29 Thin leaves draping over a bioswale (Goold 2024)

Growth of Trees in a Mesic Condition

The slope directs a significant amount of water into the bioswales, providing an abundance of water so the trees within the two bioswales thrive.



Fig. 3.30 Supported trees (Skabelund 2017)



Fig. 3.31 Growing tall (Skabelund 2021)

Implications of Cobbles in Bioswales

The cobbles along the bioswale edge provide separation from the pathway and help mitigate the effects of erosion.



Fig. 3.32 A swale full of water (Skabelund 2017)



Fig. 3.33 A view along the bioswale (Goold 2024)

Bioswales After a Rain Event

After rainfall, the bioswale captures and holds water, allowing it to slowly percolate into the soil while being filtered by native plants. Within a single growth season, the water collected by the bioswale significantly supports plant growth.



Fig. 3.34 Draining water (Goold 2024)



Fig. 3.35 After the storm (Skabelund 2017)

**"In this environment,
learning occurs in multiple
settings, from the classroom
and laboratory to chance
encounters on the quad."
(Way et al. 2012)**

Site 3: West Engineering Bioretention Courtyard

Highlights

The multiple bioretention cells create a unique green infrastructure system on campus, complementing the aesthetics of the Engineering Complex. It also provides a great teaching resource opportunity for soil testing and other various activities.

Issues Over Time

Over time there has been extreme plant loss likely due to large amounts of sediment filling the cells. There have also been issues with the plant choices in terms of water and sun-shade needs, and low biodiversity.

Maintenance

Currently improvement options are being investigated design wise to help all the cells thrive again. The plants are also still being cut back and cleared.

Public Interaction

The seating that is placed between the bioretention cells provides strong interaction points, and when the plants are tall makes someone feel as if they are surrounded. These cells have also been frequently used for class demonstrations, further enhancing engagement. When the system functions properly, public interaction is both active and passive.

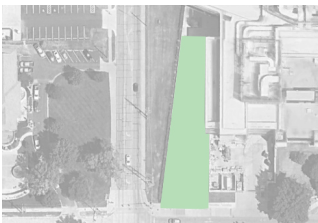


Fig. 3.1 (Goold 2025)

Plant Migration and Loss Over Time

These two images, taken approximately two years apart, show how plant density has shifted from left to right, along with some noticeable plant loss.



Fig. 3.36 A plant sound buffer (Skabelund 2021)



Fig. 3.37 Tall unflower moves into lowest bioretention cell (Skabelund 2023)

Foliage Colors in Summer and Fall

The changing colors of the plants add seasonal interest, transforming the aesthetic look of the bioretention system as the plants grow and change.



Fig. 3.38 Growing green (Skabelund 2022)



Fig. 3.39 Color shining bright (Skabelund 2020)

Enhancing the Space with Light

The lighting gives a warm glow that attracts your eye and makes the space seem inviting, while wall lights along the two paths lead you toward the building entrance. The trees are also uplit, providing more light to the space and further enhancing the space.



Fig. 3.40 In the dark (Goold 2025)



Fig. 3.41 A warm glow (Goold 2025)

Connecting with Green Infrastructure

The design of this system was able to integrate seating in a way that allows connection with the plants. It also serves as a valuable resource for learning about green infrastructure and understanding the importance of thoughtful and interdisciplinary design.



Fig. 3.42 Sitting within the plants (Skabelund 2016)



Fig. 3.43 Learning from the landscape (Skabelund 2021)

“Moreover, as learning landscapes, such campuses actively promote sustainable design by engaging faculty, staff, and students in the design and implementation process as a part of the pedagogy of place.” (Way et al. 2012)

Site 4: Memorial Stadium Green Roofs

Highlights

This green roof's unique design offers numerous learning opportunities, provides proven environmental benefits, and enhances the area's aesthetic appeal.

Issues Over Time

The long roots of the native vegetation, along with the strong roots of migrating woody plants, have the potential to penetrate the membrane, leading to leaks. The structure's age is also part of the leaking issue.

Maintenance

The incline and the depth of the green roof means that large equipment can't be used. This puts more work on the maintenance crew as only small equipment and hand weeding can be done. Weeding is an important aspect of the maintenance for both the health of the system and the health of the building.

Public Interaction

The green roof has been shown to increase awareness of native prairie systems through passive and active interaction. The green roof creates stunning views that people can see from the field, up-close, or while walking by. Being able to get up-close and touch the plants and see some of the infrastructure creates interest as well.

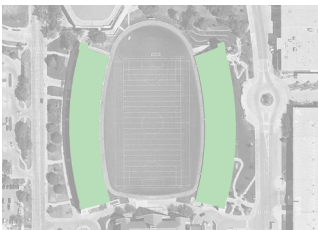


Fig. 3.1 (Goold 2025)

Interaction with the Green Roof

Various activities, from band practices to pick-up soccer games, take place on the field, all while being surrounded by views of native plants. Research by professors and aided by students as well as weeding events, have allowed for close interaction with the green roof as well.



Fig. 3.44 Working on the green roof (Skabelund 2019)



Fig. 3.45 Band practice among native plants (Skabelund 2021)

Visible Green Roof Infrastructure

The easy access to the irrigation system makes it easier for maintenance crews to reach them. It also provides a unique learning opportunity by showcasing the infrastructure and irrigation system, often hidden in other green infrastructure systems.



Fig. 3.46 A close look at the irrigation heads and cobble (Goold 2024)



Fig. 3.47 Easy access to infrastructure (Goold 2024)

Exploring Views from Different Distances

Perspective can influence the experience of the green roof. Up close, you see the texture of the plants and the animals that land on them. From further away, you see how the plants move as a group, the wind blowing them in waves.



Fig. 3.48 Waves of vegetation (Goold 2024)



Fig. 3.49 A close-up of goldenrod (Skabelund 2023)

The Changing Faces of Green Roofs

Throughout the seasons, the vegetation all changes colors creating a new dynamic face on the green roofs.



Fig. 3.50 The green roof in fall (Smith 2024)



Fig. 3.51 The green roof in summer (Goold 2024)

**"Campus landscapes can serve as living laboratories for reducing carbon footprints, conserving water and aquatic resources, supporting biodiversity, and building active, equitable social communities."
(Way et al. 2012)**

Site 5: The Meadow

Highlights

The Meadow provides an exemplary showcase of the beauty of native plants and their valuable place on campus. It blends artful planting with educational signage, offering both an invaluable learning resource and a peaceful retreat from the busy campus.

Issues Over Time

Invasive plants can sometimes pose an issue, however dutiful volunteers and workers are often able to dedicate the time necessary to weed out these plants. It changes year to year and requires monitoring, but overall has thrived through the years.

Maintenance

There is heavy weeding that has to happen throughout the year, and to do that plant identification skills are necessary. It is also important to ensure biodiversity and that no plant is taking over too much space.

Public Interaction

There are field trips and classes taught in The Meadow for a large variety of ages. Volunteer groups for weeding are also a yearly occurrence. This creates direct active interaction with The Meadow. The seating throughout The Meadow also offers some passive interaction, and its location invites people to walk through and experience the plants.



Fig. 3.1 (Goold 2025)

The Meadow in the Winter

In the winter, as the trees lose their leaves and the vegetation turns to shades of brown, The Meadow takes on a more open feel, revealing views beyond its boundaries while still providing a sense of enclosure.



Fig. 3.52 Seating in the clearing (Goold 2025)



Fig. 3.53 Snow in The Meadow (Skabelund 2022)

Blending Seating with Nature

The new seating in The Meadow blends effortlessly with the native plantings, creating artful elements that feel like a natural extension of the landscape.



Fig. 3.54 Seating as a natural extension (Goold 2024)

Aesthetics of Native Vegetation

The native vegetation introduces vibrant colors and diverse textures that contrast with the surrounding campus landscape, resulting in a striking and artistic environment.



Fig. 3.56 Vibrant textures of native flora (Goold 2024)



Fig. 3.55 Harmonizing furniture and landscape (Goold 2024)



Fig. 3.57 Eye-catching native vegetation (Goold 2024)

A Palette of Native Colors

In the fall the trees in The Meadow transforms to striking colors, where as in the summer they are cool tones of green with pops of color from the vegetation.



Fig. 3.58 The vibrant colors of the trees (Goold 2024)



Fig. 3.59 Waves of green with pops of color (Goold 2024)

“In the process, landscape architecture, both as a profession and an academic discipline, has the opportunity to take the lead and push the boundaries of traditional campus design and planning to engage new visions of how campus landscapes look and perform.” (Way et al. 2012)

Site 6: East Seaton Rain Gardens

Highlights

The two rain gardens frame the building and create a buffer from the busy pathway allowing refuge in the amphitheater. These rain gardens also add habitat for pollinators, and bees are often seen flying around these areas.

Issues Over Time

There has been some loss in biodiversity, however it does not seem to have been detrimental to the rain gardens. Plant migration can also be a problem for the formal plantings near by, as the native plants sometimes would take over the area.

Maintenance

It can be hard to weed invasive plants and make sure they don't spread further. The placement of the vegetation also makes it a struggle to get to some of the valve boxes near the building.

Public Interaction

The rain gardens are located along a main campus pathway, making them visible to many passersby and offering an interesting view from inside the buildings. However, there isn't a lot of physical interaction with the rain gardens. The signage does offer an opportunity to stop and learn more and could be something that draws people in.



Fig. 3.1 (Goold 2025)

Varied Signage Locations

There are two different signs in this one small area. The first one becomes a little lost in the vegetation and can be hard to read due to the small size. The second is just off the sidewalk and main path, making it a good location for people passing by to stop and read.



Fig. 3.60 Lost in the vegetation (Goold 2024)



Fig. 3.61 Take a look (Goold 2024)

Views From Summer to Winter

After the vegetation is cut back for winter and the trees lose all their leaves, the view of Seaton Hall becomes very clear. In the summer, the vegetation blocks the view of most of the building, which is a good example of the importance of seasonal interest.



Fig. 3.62 Vegetation screening views (Goold 2024)

Growth of Vegetation in a Short Time

Within just two short months, the vegetation in this rain garden grew to a couple of feet and started to gain more color. The rapid seasonal changes in native vegetation create ever-evolving views, keeping the landscape engaging for those walking by.



Fig. 3.64 Growing in spring (Skabelund 2023)



Fig. 3.63 Space opens up (Goold 2025)



Fig. 3.65 Growing tall (Skabelund 2023)

Vegetation Changes Seen in Winter

In the winter, with all the plants cut back you can see how the Red Twig Dogwood has disappeared, something hard to see with the dense vegetation in the summer. Sometimes winter reveals details often hidden in other seasons.



Fig. 3.66 A blank canvas (Goold 2025)



Fig. 3.67 Pops of red (Skabelund 2021)

**“... a paradigm shift in campus design processes to facilitate the role of campus landscapes as places that inspire and model environmental stewardship in meaningful ways while also affording diversely beautiful places in which to learn.”
(Way et al. 2012)**

04.

**Projective
Design**

Overview

The projective tour design includes projective informational fliers and signage, as well as concepts for signage gathering areas and interactive features to engage visitors at each site. Increasing engagement and capturing people's interest is essential. The proposed interactive features and signage are designed to support this by creating a more inviting and memorable experience.

The projective tour flyer is formatted on a standard 8.5x11" sheet. The front side provides an overview of the tour and details for the first two sites, while the back covers the remaining four. The projective signage is designed to match existing campus signage dimensions, ensuring visual cohesion across the landscape. Each sign includes an overview of the green infrastructure system's design, maintenance needs, and environmental benefits, accompanied by relevant images, diagrams, and an interactive activity section to boost engagement. The selected materials—such as limestone in various forms and wood—were chosen to complement the surrounding campus aesthetics. Signage for Sites Two and Three will require future updates as the green infrastructure systems are redesigned, to ensure the information remains accurate and relevant.

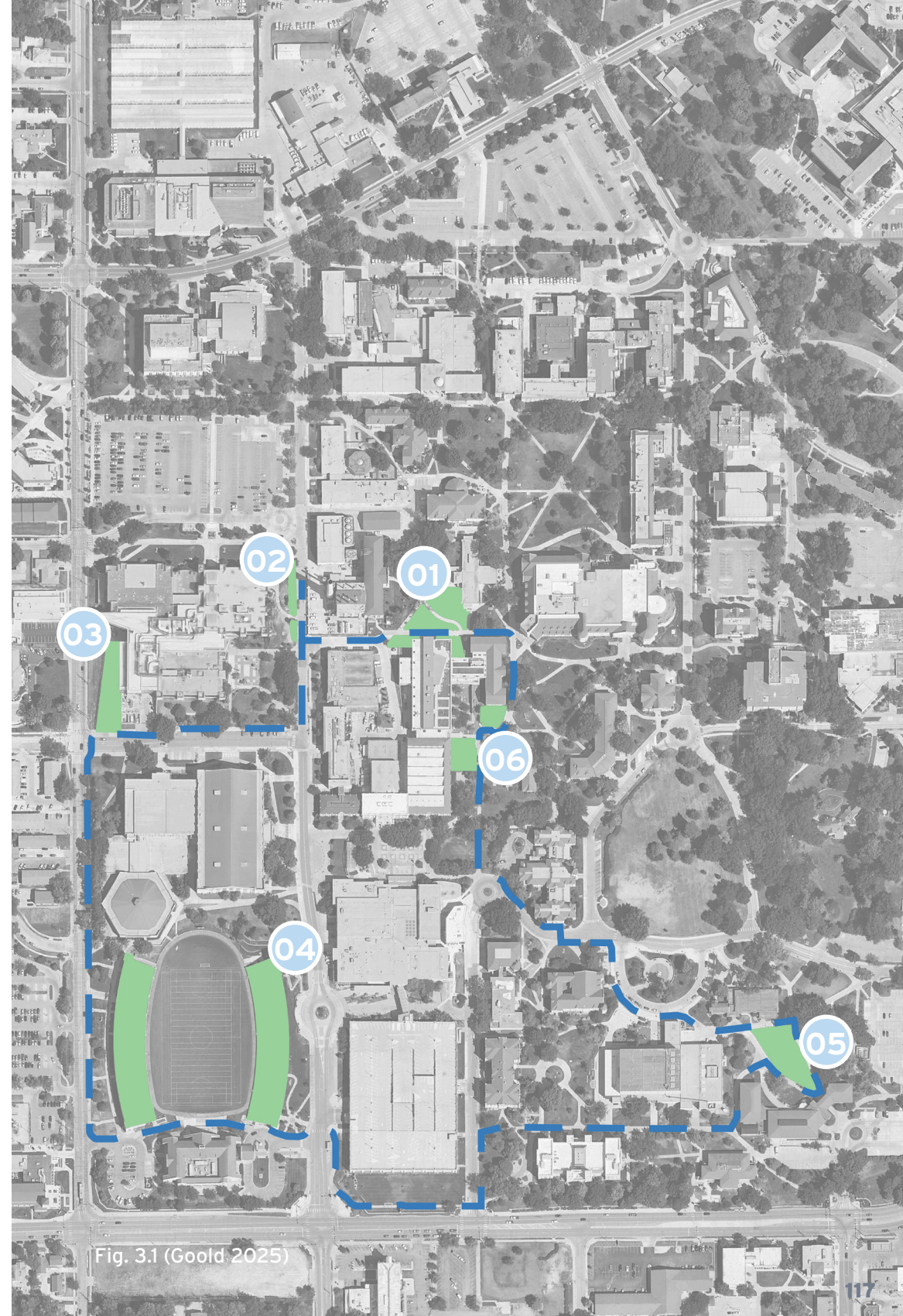


Fig. 3.1 (Goold 2025)

★ Signage Placement

North Seaton GI Collection



Fig. 4.1 (Goold 2025)

East Engineering Bioswales



Fig. 4.2 (Goold 2025)

West Engineering Bioretention Courtyard



Fig. 4.3 (Goold 2025)

Memorial Stadium Green Roofs

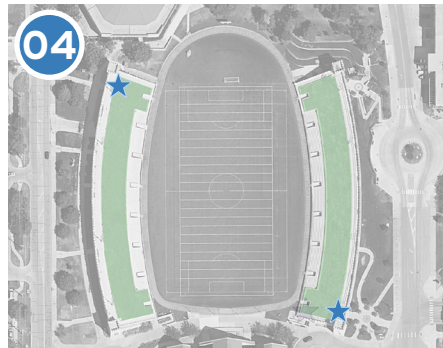


Fig. 4.4 (Goold 2025)

The Meadow



Fig. 4.5 (Goold 2025)

East Seaton Rain Gardens



Fig. 4.6 (Goold 2025)

Projective Tour Flier Box

Flier Boxes can be found from various stores and sites and could be purchased from any of them, price dependent, then attached to the signage. The flier boxes could also be made in the APDesign Fabrication shop depending on the skill level of the person fabricating it and materials available. Below is general front, side, and back profiles of what a typical flier box looks like.

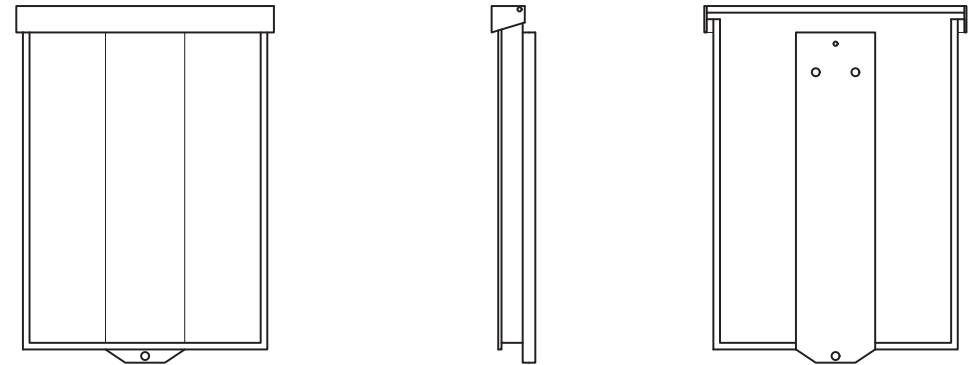
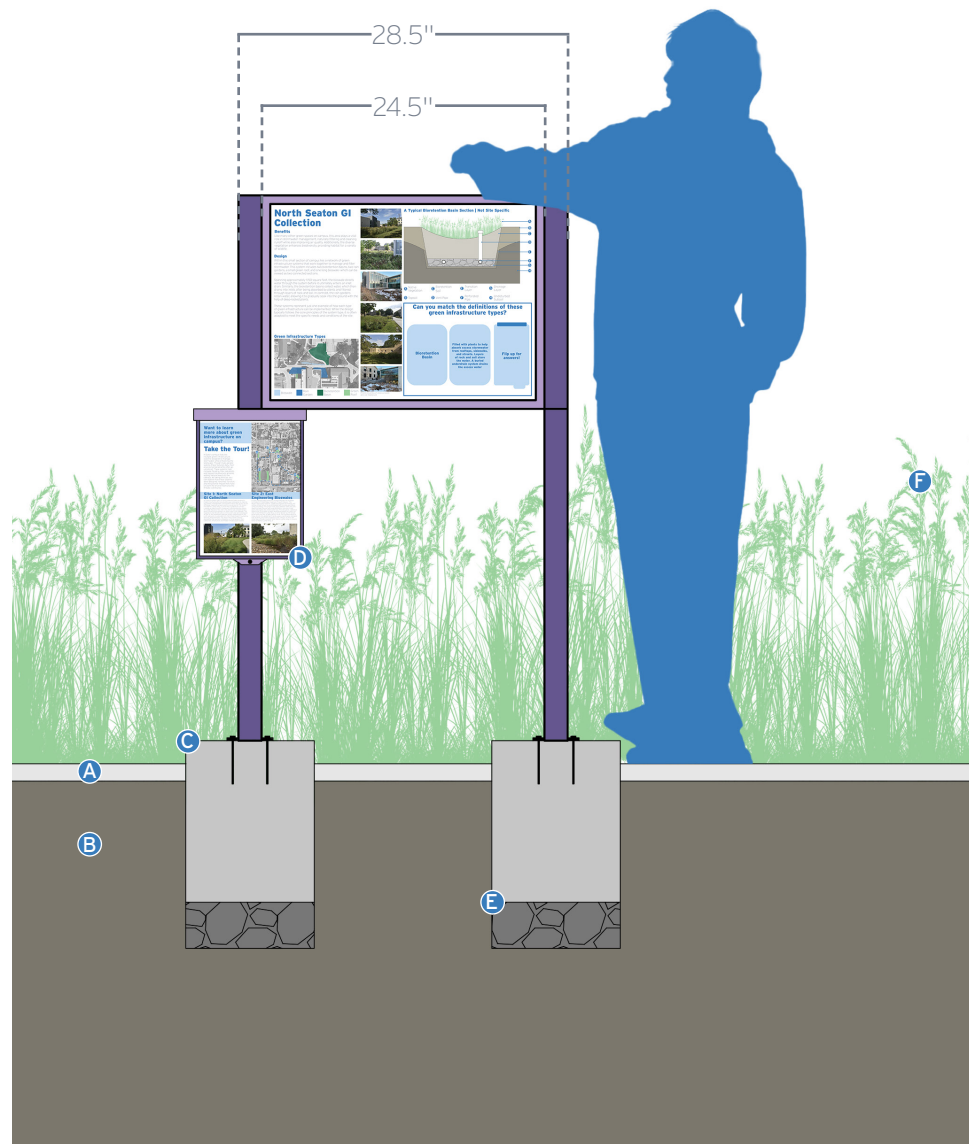


Fig. 4.7 Front, side, and back of a typical flier box (Goold 2025)



- A** Signage Gathering Area Materials Vary
- B** Compacted Subgrade
- C** Limestone Signage Base Block
- D** Tour Flier Box
- E** Footing
- F** Native Vegetation

Fig. 4.8 Side view of what the signage could look like with the flier box attached (Goold 2025)

Projective Signage and Tour Flier Box

The signage was modeled after existing signage, so the same manufacture could possibly produce it. Another option is Outside Studio, a signage focused design and build company. Outside Studio has a portfolio of interactive pieces they have included in their signage, making them a good fit for these projective designs. The flier boxes can then be attached to the signage, which is typically done with screws or zip-ties. This gives the option of removing the flier box if need be.

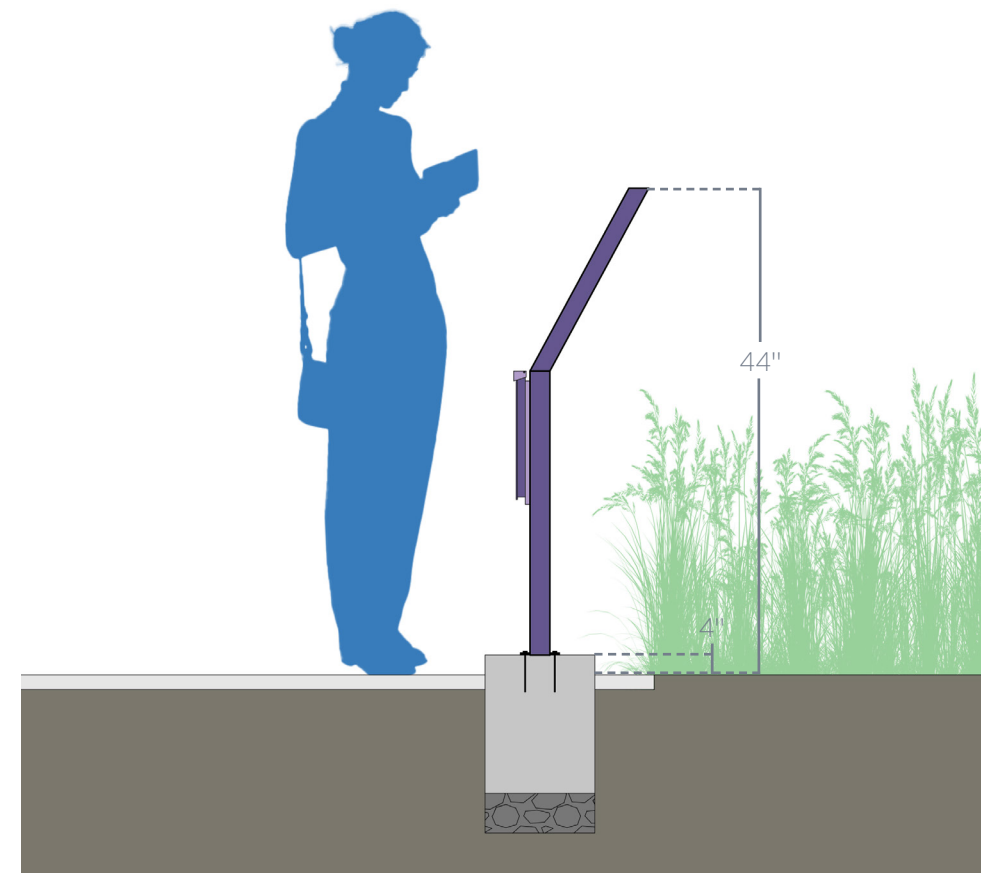


Fig. 4.9 Front view of what the signage could look like with the flier box attached (Goold 2025)

Interactive Signage Activity

★ Flip

These are additional panels that can be attached to a sign and lifted to reveal hidden information. They provide a way to include extra details while keeping the main signage uncluttered. They also are able to create a way to make an engaging activity. Outside Studio incorporates these as one of their interactive tools.



Fig. 4.10 Flip (Outside Studios n.d)

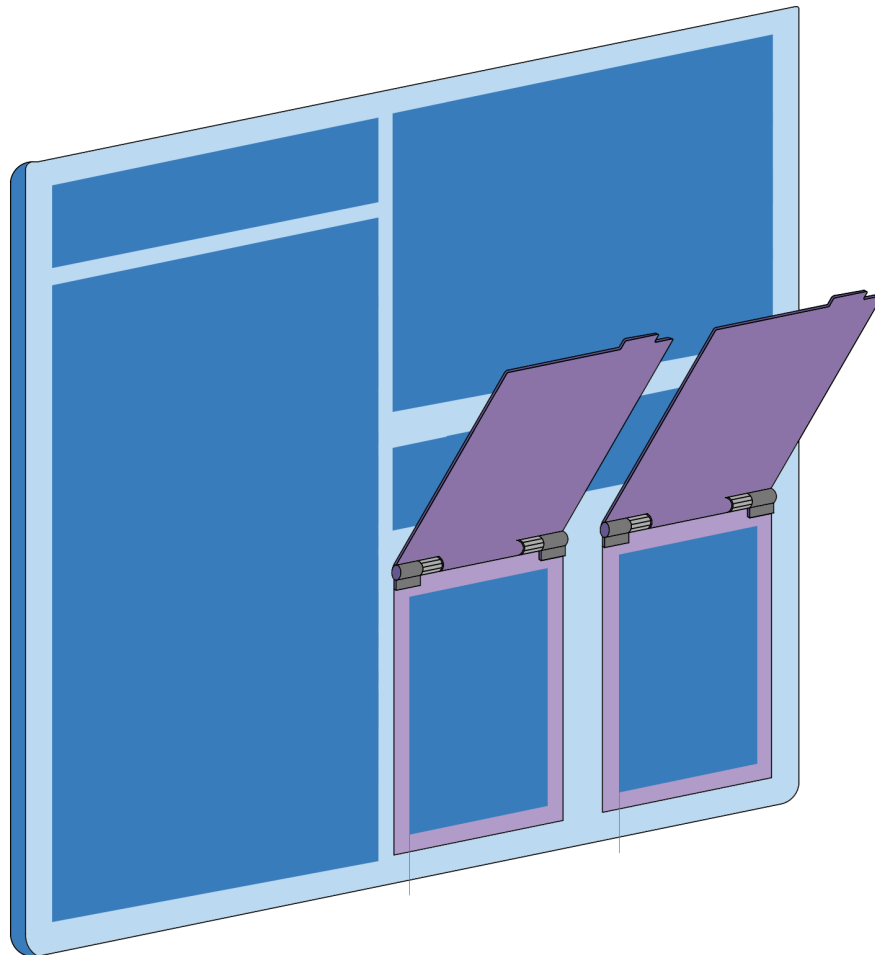


Fig. 4.11 Flip interactive tool on signage (Goold 2025)

★ Roll

These panels can rotate through different slides of information, including text and images. This interactive feature allows for the presentation of more content in an engaging and dynamic way. Outside Studio incorporates these as one of their interactive tools.



Fig. 4.12 Roll (Outside Studios n.d)

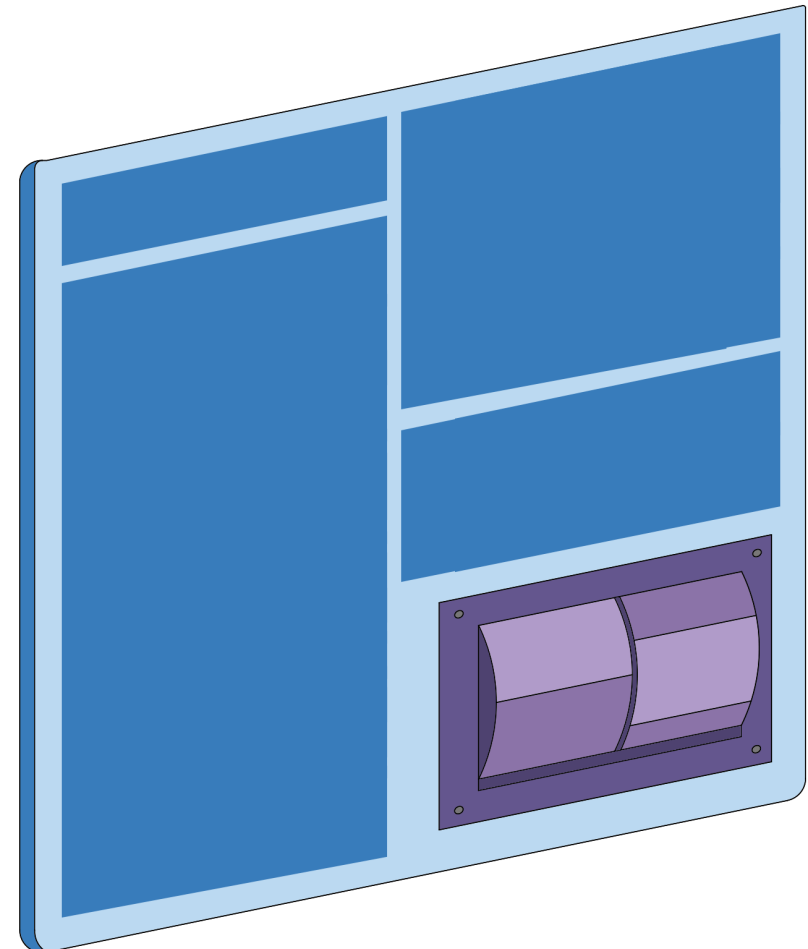


Fig. 4.13 Roll interactive tool on signage (Goold 2025)

Interactive Signage Activity

★ Rub

These wax tethers are used to create artistic pictures from raised impressions, encouraging interaction and creativity. They provide a way for visitors to create a tangible keepsake from their experience. Outside Studio incorporates them as one of their interactive tools, offering multiple colors of wax inserts as options.



Fig. 4.14 Rub (Outside Studios n.d)

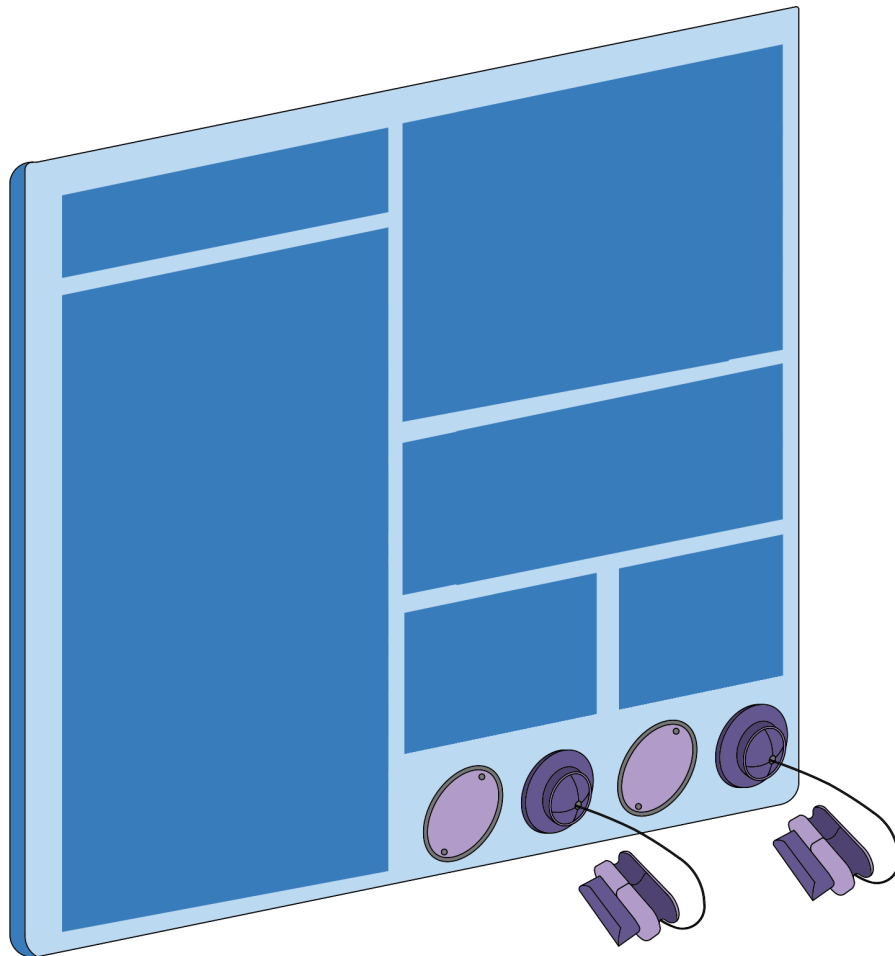


Fig. 4.15 Rub interactive tool on signage (Goold 2025)

★ Peep

This interactive tool from Outside Studio is a peephole magnifier that enhances engagement by providing a detailed view of an image. It operates without batteries, relying solely on sunlight for illumination.



Fig. 4.16 Peep (Outside Studios n.d)

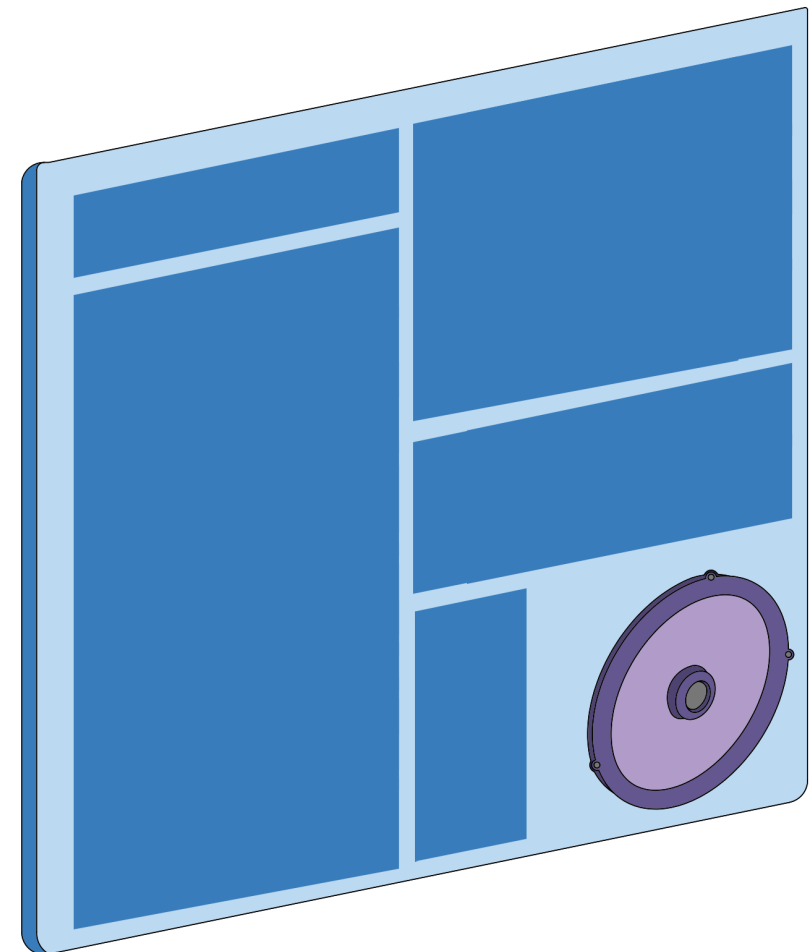


Fig. 4.17 Peep interactive tool on signage (Goold 2025)

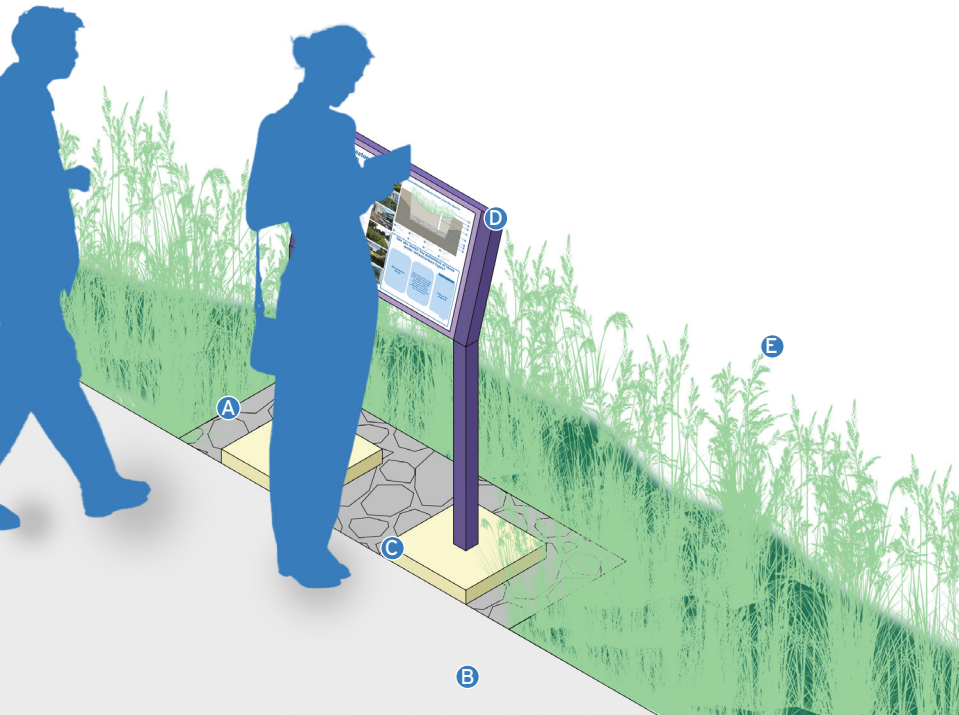
Signage Gathering Area

Adjacent Sidewalk

In this instance the signage would be placed next to the existing sidewalk for high visibility to those passing by. It is also good for areas that might not have a lot of room in the green space. This also means less construction in the area.



Fig. 3.26 A natural edge (Goold 2024)



- A Gravel Buffer
- B Sidewalk
- C Limestone Signage Base Block
- D Signage
- E Native Vegetation

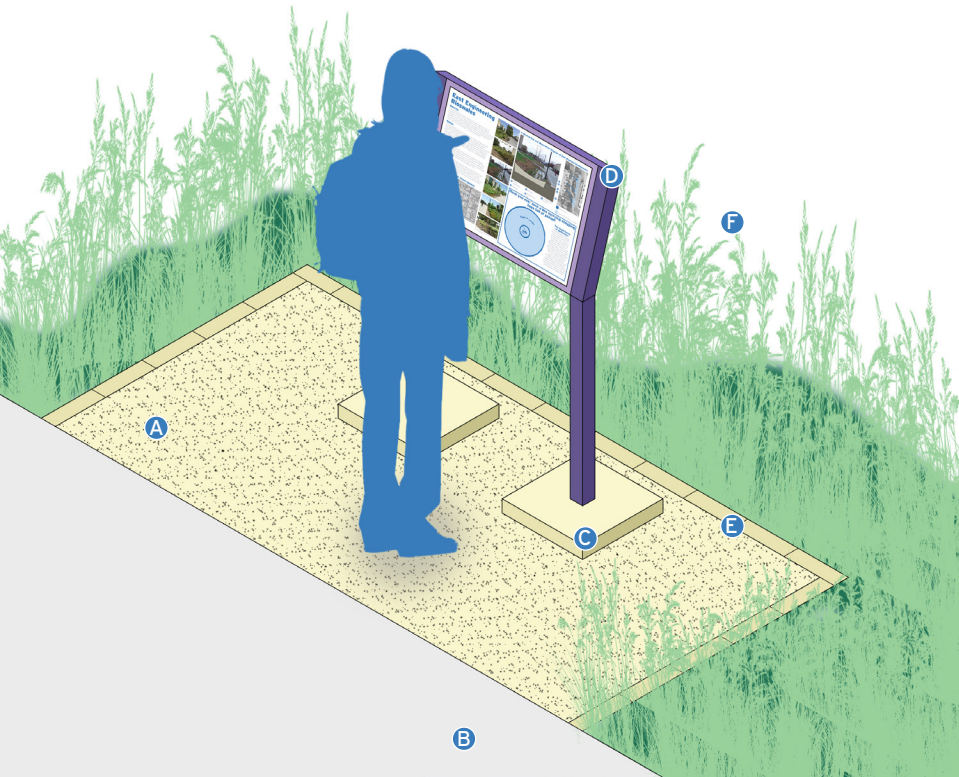
Fig. 4.18 Signage gathering area adjacent sidewalk (Goold 2025)

Crushed Limestone Chips

In this instance the area around the signage would consist of crushed limestone chips to create more space for viewing both the signage and the site. The material adds a natural feel while still matching aesthetics of campus because of the matching limestone around campus.



Fig. 4.19 Crushed limestone (Goold 2025)



- A Signage Gathering Area: Crushed Limestone
- B Sidewalk
- C Limestone Signage Base Block
- D Signage
- E Limestone Paver Buffer
- F Native Vegetation

Fig. 4.20 Signage gathering area crushed limestone chips (Goold 2025)

Signage Gathering Area

Limestone Permeable Pavers

In this instance the area around the signage would consist of limestone permeable pavers to create more space for viewing both the signage and the site. The permeable pavers help to add a clean look, while matching the aesthetics of campus and providing stormwater benefits.



Fig. 4.21 Permeable pavers (Goold 2025)



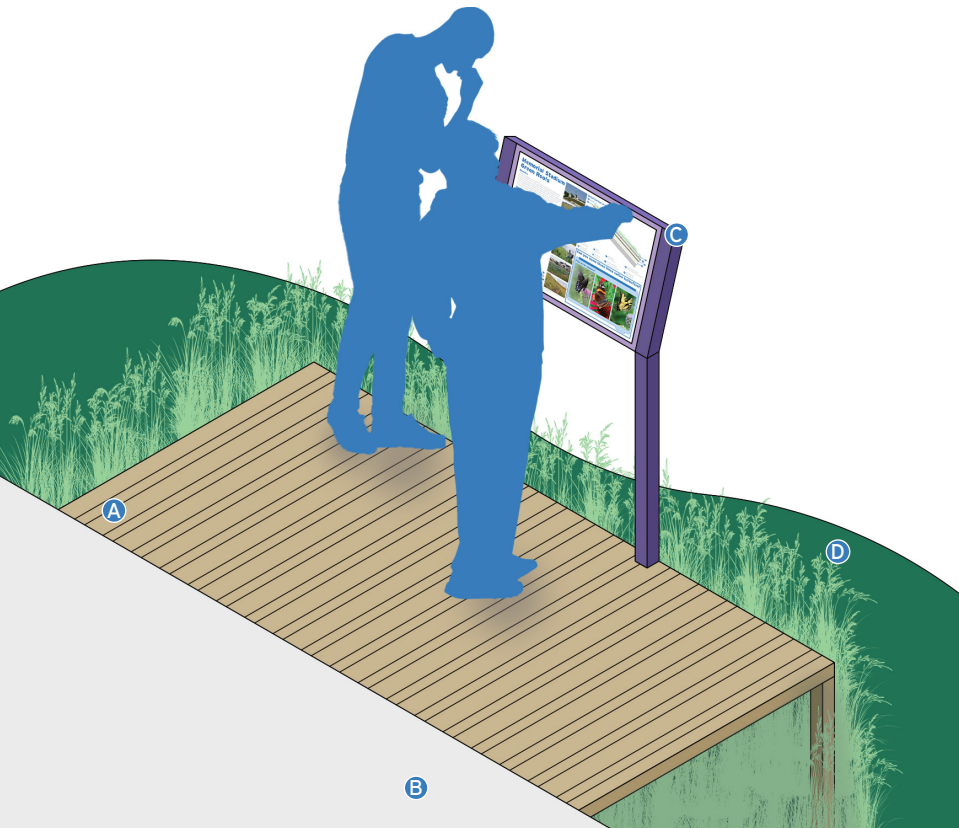
- A Signage Gathering Area: Limestone Permeable Pavers
 - B Sidewalk
 - C Limestone Signage Base Block
 - D Signage
 - E Gravel Buffer
 - F Native Vegetation
- Fig. 4.22 Signage gathering area limestone permeable pavers (Goold 2025)

Wood Deck Platform

In this instance the signage would be placed on a wooden observation platform so that observers could get a closer look at the system and vegetation. The platform will help to immerse the onlooker further into the system and give a better view of the elevation changes.



Fig. 4.23 Wood decking (Goold 2025)



- A Signage Gathering Area: Wood Decking
 - B Sidewalk
 - C Signage
 - D Native Vegetation
- Fig. 4.24 Signage gathering area wood deck platform (Goold 2025)

Interactive Paths

— — — Limestone Permeable Pavers

In this instance, the interactive path would be made of limestone permeable pavers, aligning with campus aesthetics while also supporting proper water flow. The use of permeable pavers ensures that stormwater management remains a key consideration in the design.



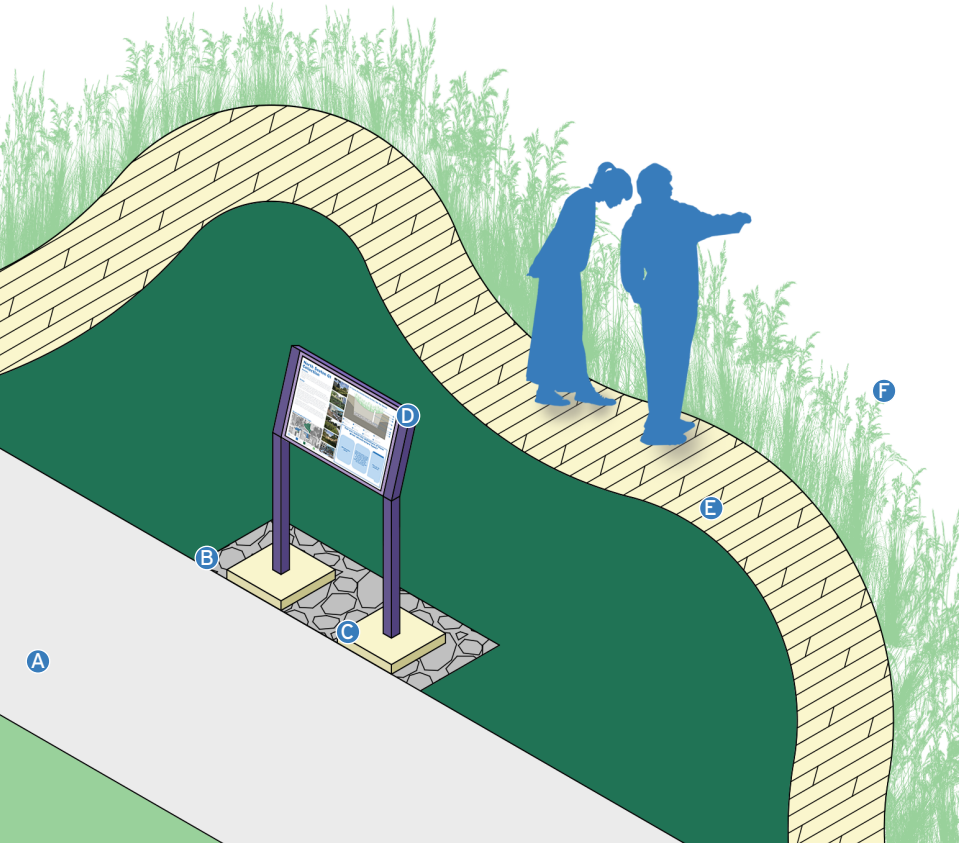
Fig. 4.21 Permeable pavers (Goold 2025)

— — — Crushed Limestone Chips

In this instance, the interactive path would be made of crushed limestone chips, still aligning with campus aesthetics while also supporting proper water flow. The use of a permeable material ensures that stormwater management remains a key consideration in the design.

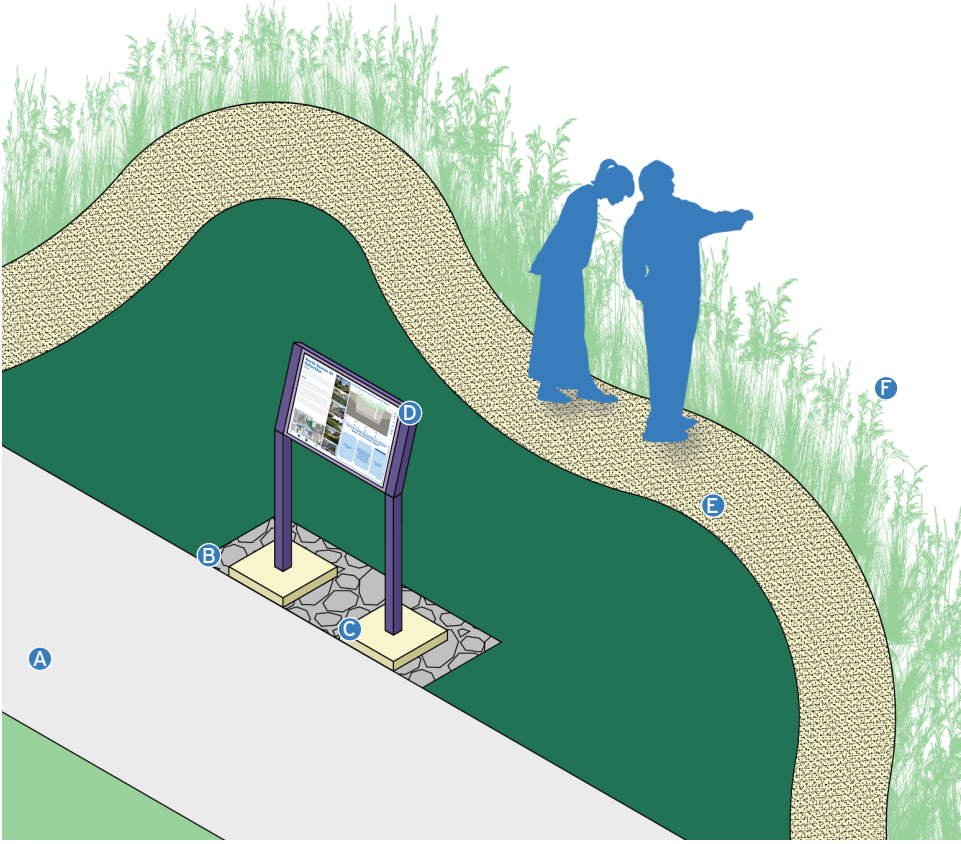


Fig. 4.19 Crushed limestone (Goold 2025)



- A Sidewalk
- B Gravel Buffer
- C Limestone Signage Base Block
- D Signage
- E Limestone Permeable Paver Trail
- F Native Vegetation

Fig. 4.25 Interactive paths limestone permeable pavers (Goold 2025)



- A Sidewalk
- B Gravel Buffer
- C Limestone Signage Base Block
- D Signage
- E Crushed Limestone Chips Trail
- F Native Vegetation

Fig. 4.26 Interactive paths crushed limestone chips (Goold 2025)

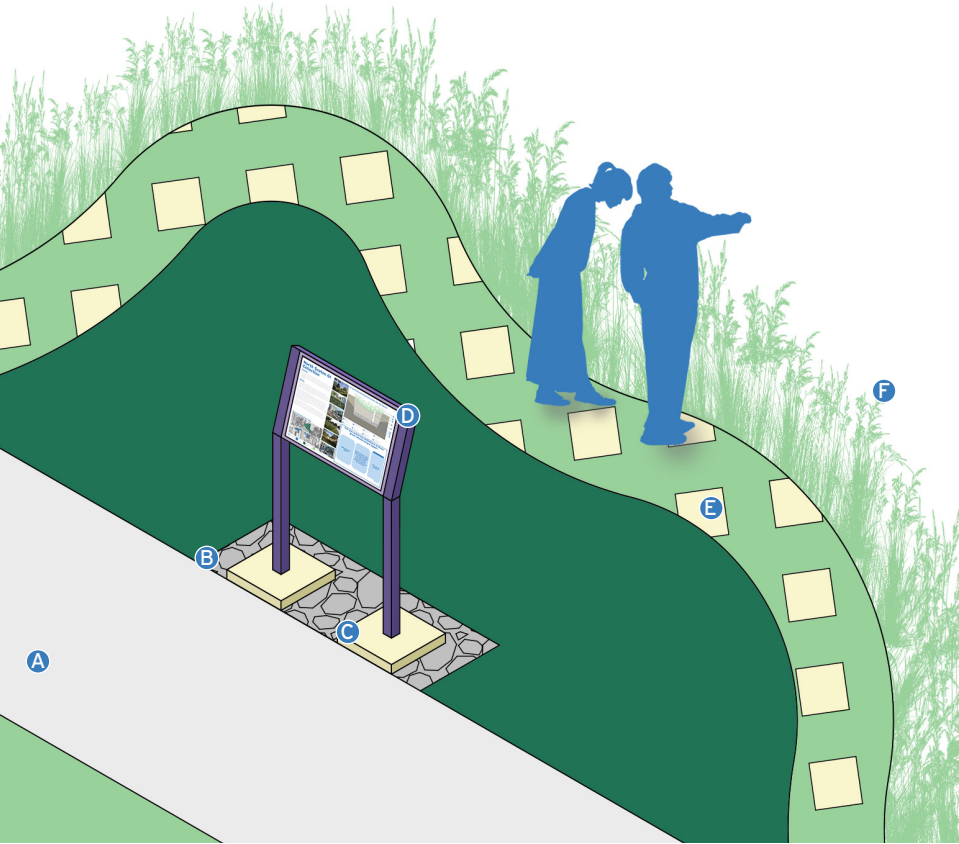
Interactive Paths

Limestone Stepping Stones

In this instance, the interactive path would be made of limestone stepping stones, aligning with campus aesthetics while also minimizing the addition of a new material. The stepping stones would be spaced out and lead the eye around the GI system.



Fig. 4.27 Stepping stones (Goold 2025)



- A Sidewalk
- B Gravel Buffer
- C Limestone Signage Base Block
- D Signage
- E Limestone Stepping Stone Trail
- F Native Vegetation

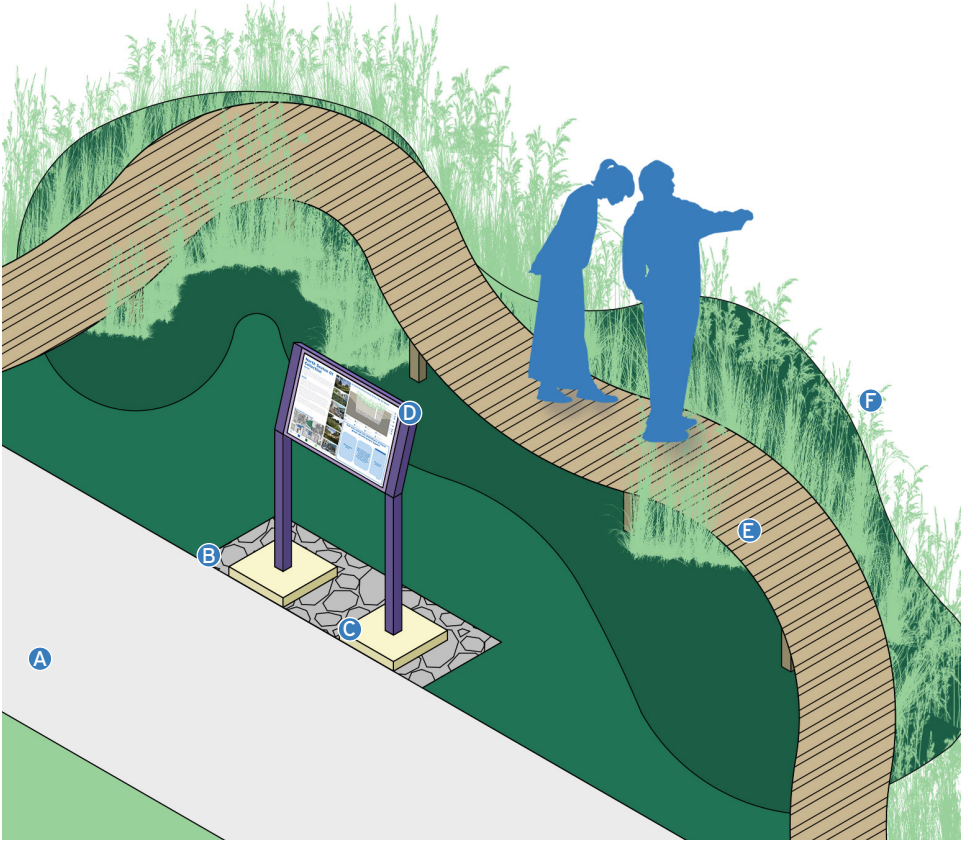
Fig. 4.28 Interactive paths limestone stepping stones (Goold 2025)

Wood Boardwalk

In this instance, the interactive path would take the form of a wooden boardwalk trail, inviting visitors to walk among the vegetation while protecting the plants from foot traffic. These also are good for instances where there might be extreme elevation changes, making sure the path stays an appropriate slope.



Fig. 4.23 Wood decking (Goold 2025)



- A Sidewalk
- B Gravel Buffer
- C Limestone Signage Base Block
- D Signage
- E Wooden Boardwalk Trail
- F Native Vegetation

Fig. 4.29 Interactive paths wood boardwalk (Goold 2025)

Engagement Tools on Site

North Seaton GI Collection

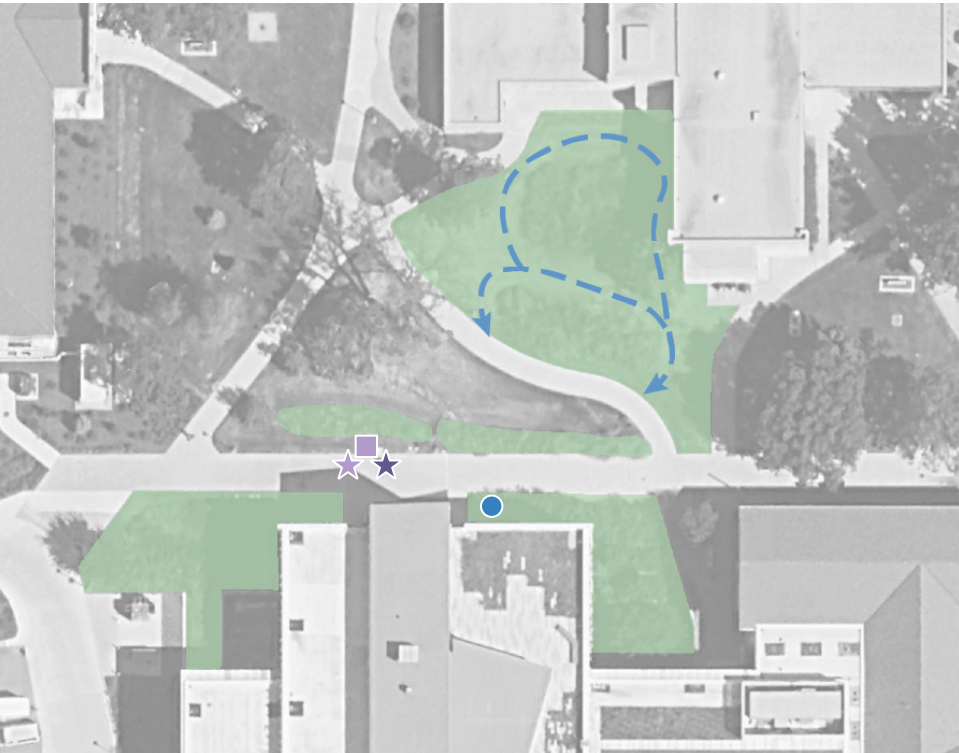


Fig. 4.30 (Goold 2025)

Interactive Signage Activity

- ★ Roll
- ★ Flip

Signage Gathering Area

- Adjacent Sidewalk

Artistic Engagement

- Visual Art

Interactive Path

- — — Limestone Stepping Stone

East Engineering Bioswales



Fig. 4.31 (Goold 2025)

Interactive Signage Activity

- ★ Peep

Signage Gathering Area

- Limestone Permeable Paver

Artistic Engagement

- Auditory Art

Engagement Tools on Site

West Engineering Bioretention Courtyard

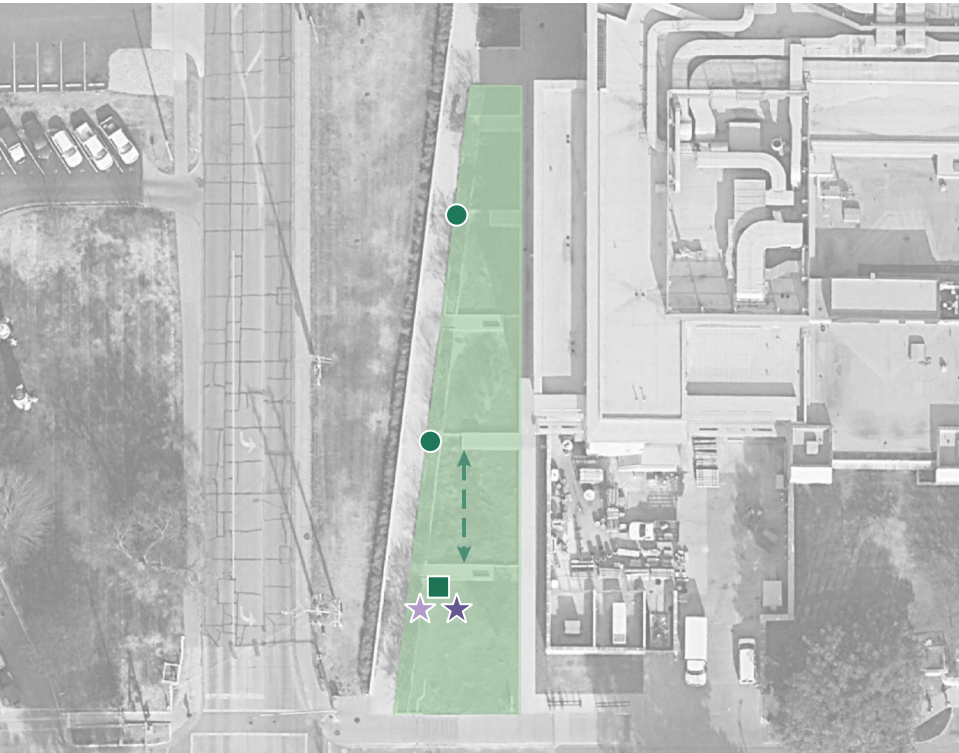


Fig. 4.32 (Goold 2025)

Interactive Signage Activity

- ★ Roll
- ★ Flip

Signage Gathering Area

- Wood Deck Platform

Artistic Engagement

- Auditory Art

Interactive Path

- Wood Boardwalk

Memorial Stadium Green Roofs

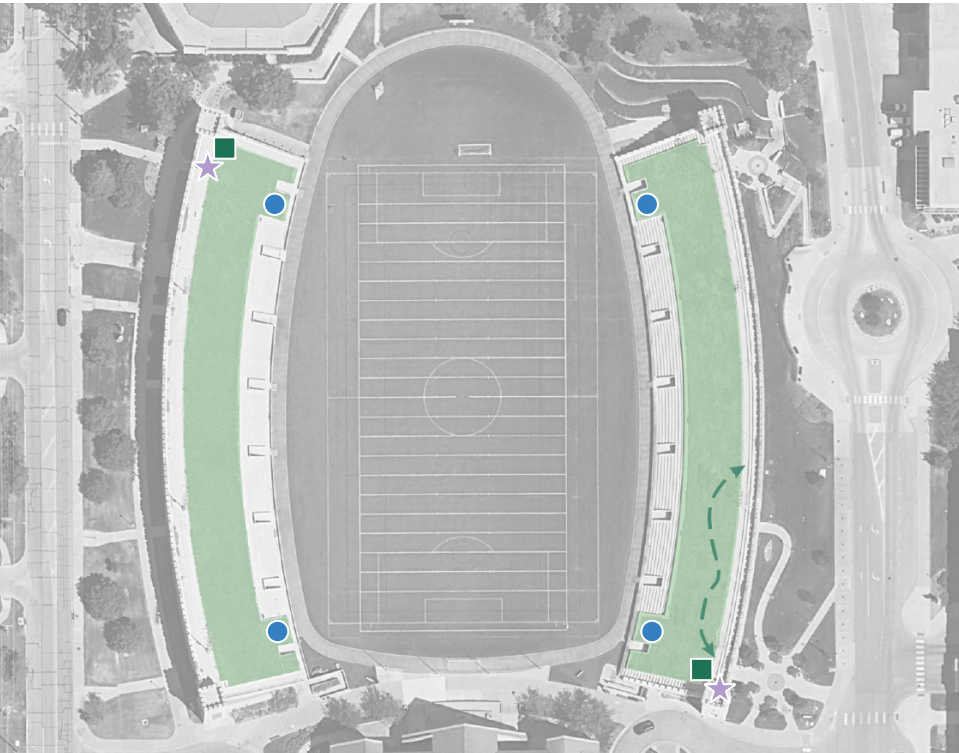


Fig. 4.33 (Goold 2025)

Interactive Signage Activity

- ★ Flip

Signage Gathering Area

- Wood Deck Platform

Artistic Engagement

- Visual Art

Interactive Path

- Wood Boardwalk

Engagement Tools on Site

The Meadow



Fig. 4.34 (Goold 2025)

Interactive Signage Activity



Rub

Interactive Path



Crushed Limestone Chips (Existing)

Signage Gathering Area



Crushed Limestone Chips

Artistic Engagement



Visual Art

East Seaton Rain Gardens

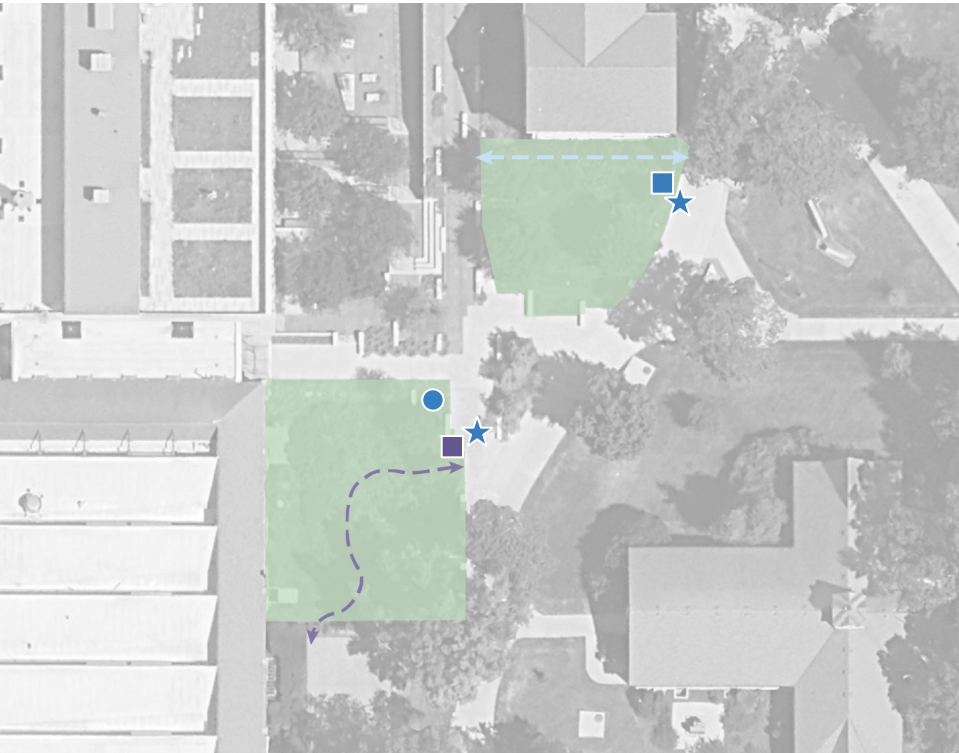


Fig. 4.35 (Goold 2025)

Interactive Signage Activity



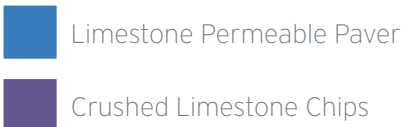
Rub

Interactive Path



Limestone Permeable Pavers
Crushed Limestone Chips

Signage Gathering Area



Limestone Permeable Paver
Crushed Limestone Chips

Artistic Engagement



Visual Art

Site 1: North Seaton GI Collection

This activity uses the roll interactive tool to match definitions to various types of green infrastructure. The flip interactive tool is then used to reveal the correct answers, allowing participants to check their matches.

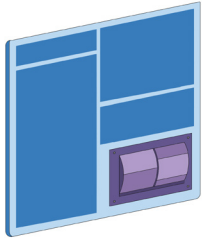


Fig. 4.13 Roll interactive tool on signage (Goold 2025)

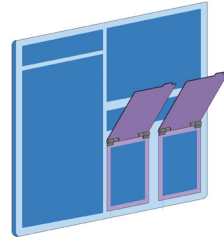


Fig. 4.11 Flip interactive tool on signage (Goold 2025)

Site 2: East Engineering Bioswales

This activity uses the peep interactive tool to provide a close up view of a bee carrying pollen. It highlights the importance of pollinators in green infrastructure while creating an engaging and interactive experience.

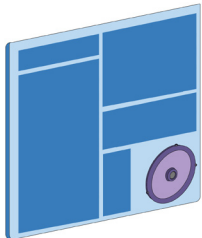


Fig. 4.17 Peep interactive tool on signage (Goold 2025)

Site 3: West Engineering Bioretention Courtyard

This activity uses the roll interactive tool to match professions with their roles in green infrastructure. The flip interactive tool is then used to reveal the correct answers, allowing participants to check their matches.

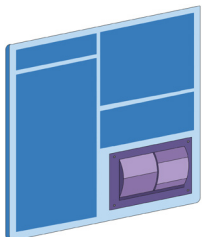


Fig. 4.13 Roll interactive tool on signage (Goold 2025)

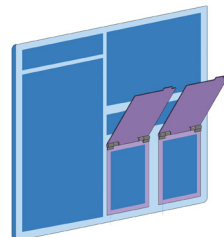


Fig. 4.11 Flip interactive tool on signage (Goold 2025)

Site 4: Memorial Stadium Green Roofs

This activity uses the flip interactive tool to display pictures of three native butterflies. On the reverse side, their names are revealed, allowing participants to check their guesses.

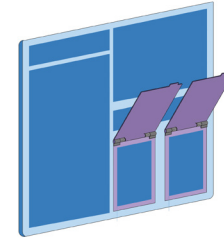


Fig. 4.11 Flip interactive tool on signage (Goold 2025)

Site 5: The Meadow

This activity highlights three native plants used on the site and utilizes the rub interactive tool to create impressions of each plant. Participants can use a worksheet alongside this activity, adding plant impressions as they identify them in the environment.

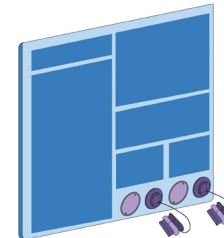


Fig. 4.15 Rub interactive tool on signage (Goold 2025)

Site 6: East Seaton Rain Gardens

This activity highlights three native plants used on the site and utilizes the rub interactive tool to create impressions of each plant. Participants can use a worksheet alongside this activity, adding plant impressions as they identify them in the environment.

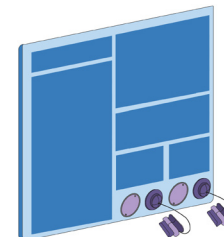


Fig. 4.15 Rub interactive tool on signage (Goold 2025)

Signage For Site 1

North Seaton GI Collection

Benefits

Like many other green spaces on campus, this area plays a vital role in stormwater management, naturally filtering and cleaning runoff while also improving air quality. Additionally, the diverse vegetation enhances biodiversity, providing habitat for a variety of wildlife.

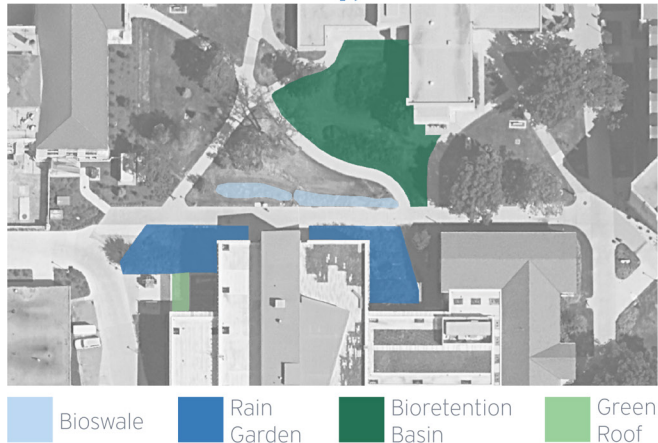
Design

Within this small section of campus lies a network of green infrastructure systems that work together to manage and filter stormwater. This system includes two bioretention basins, two rain gardens, a small green roof, and one long bioswale—which can be viewed as two connected sections.

Spanning approximately 1,150 square feet, the bioswale directs water through the system before it ultimately enters an inlet drain. Similarly, the bioretention basins collect water, which then drains into inlets after being absorbed by plants and filtered through layers of rock and soil. In contrast, the rain gardens retain water, allowing it to gradually soak into the ground with the help of deep-rooted plants.

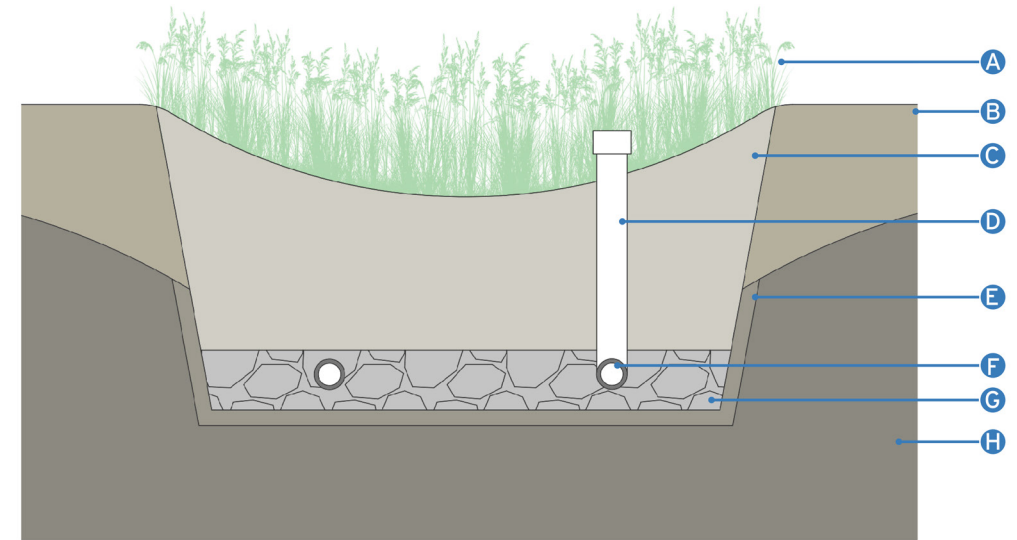
These systems represent just one example of how each type of green infrastructure can be implemented. While the design typically follows the core principles of the system type, it is often adapted to meet the specific needs and conditions of the site.

Green Infrastructure Types



Photos Courtesy of Alexina Goold and Lee Skabelund

A Typical Bioretention Basin Section | Not Site Specific



- | | | | |
|----------------------------|----------------------------|---------------------------|------------------------------|
| A Native Vegetation | C Bioretention Soil | E Transition Layer | G Drainage Layer |
| B Topsoil | D Vent Pipe | F Perforated Pipe | H Undisturbed Subsoil |

Can you match the definitions of these green infrastructure types?

Bioretention Basin

Filled with plants to help absorb excess stormwater from rooftops, sidewalks, and streets. Layers of rock and soil store the water. A buried underdrain system drains the excess water

Flip up for answers!

Fig. 4.36 Signage for site 1 (Goold 2025)

Signage For Site 2

East Engineering Bioswales

Benefits

The addition of bioswales introduces native green space to campus, offering a chance to learn about the native prairie ecosystem and sustainable water management. When functioning properly, they capture and filter stormwater, reducing runoff and improving water quality. Additionally, the trees and vegetation contribute to cooling effects, enhancing comfort.

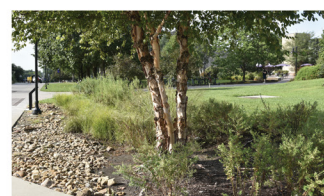
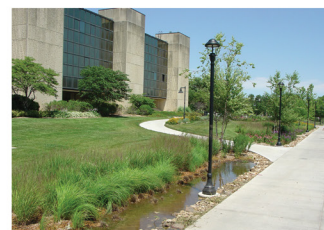
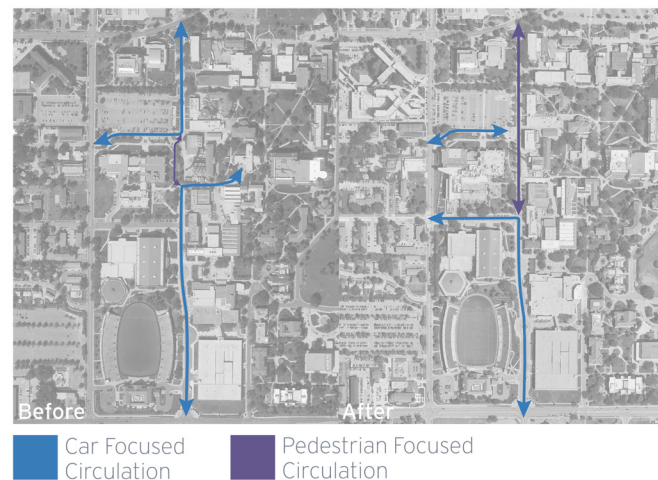
Design

The design of these two bioswales was closely integrated with the overall pedestrian mall layout. They are part of a larger system of bioswales that extend north along North Martin Luther King Jr. Drive. Additional features considered in the pedestrian mall design included shade trees, lighting elements, pathways to university buildings, entrance gateways, fencing to separate the space from the power and chilling plants, and designated gathering areas (Olsson).

Situated at the bottom of a slope, these bioswales manage a high volume of stormwater runoff. This is likely why River Birch trees were selected, as they thrive in wet conditions. However, the significant water flow has led to erosion issues, including soil displacement, stone washout, and vegetation loss.

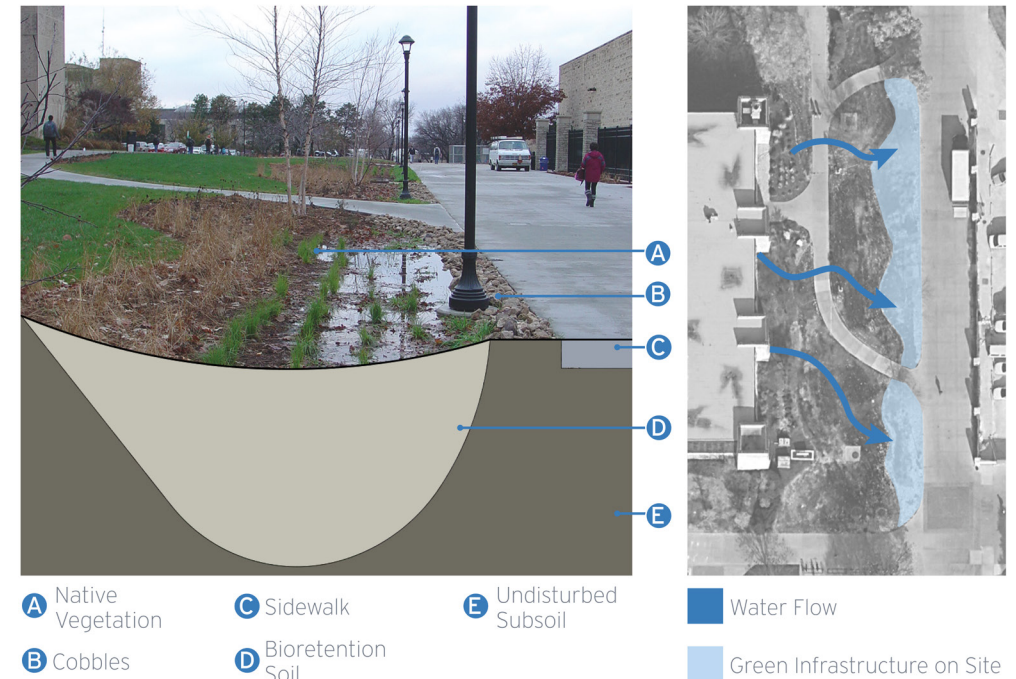
This system represents just one example of how bioswales can be implemented. While the design typically follows the core principles of the system type, it is often adapted to meet the specific needs and conditions of the site. This particular system requires design updates to better suit the site conditions and improve its overall functionality.

Before and After 17th Street Updates

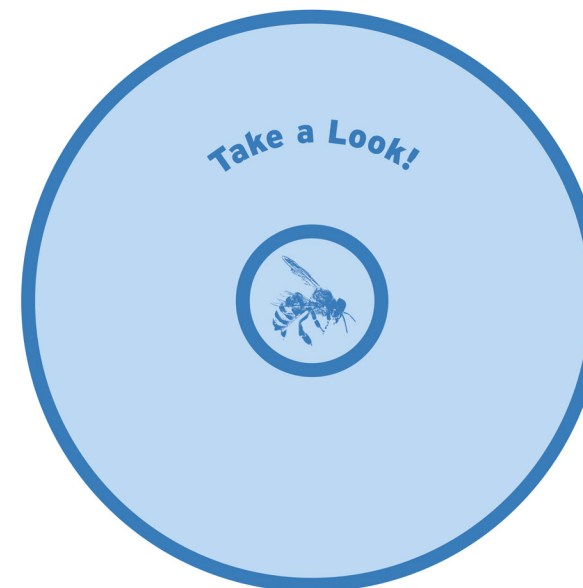


Photos Courtesy of Alexina Goold and Lee Skabelund

A Section Cut and Water Flow Diagram of East Engineering Bioswales



Have you ever seen a bee carrying shopping bags full of pollen?



The importance of pollinators

Pollinators play a crucial role in maintaining healthy and resilient plant life. In turn, these thriving plants contribute significantly to green infrastructure by absorbing stormwater runoff, reducing erosion, and filtering pollutants before they reach local waterways. By supporting pollinators, we enhance the ability of plants to improve water quality, regulate temperature, and create more sustainable and ecologically balanced urban environments. Looking at this bee you can see firsthand how a bee contributes to the process of pollination.

Fig. 4.37 Signage for site 2 (Goold 2025)

Signage For Site 3

West Engineering Bioretention Courtyard

Benefits

Despite its current challenges, the Bioretention Courtyard remains a valuable educational tool, serving as a testing ground for research and learning. With proper restoration and maintenance, it has the potential to once again serve as a model for sustainability and innovation.

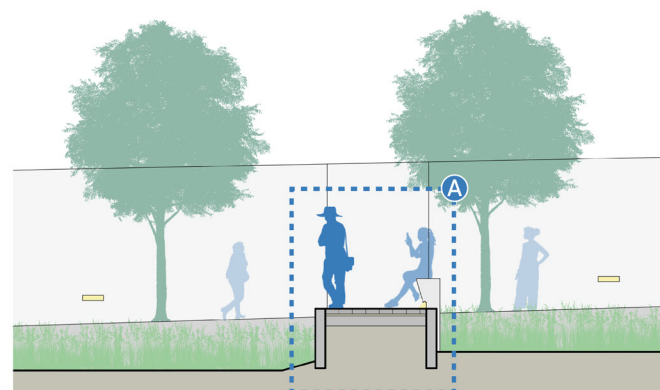
Design

The Bioretention Courtyard is often referred to as a rain garden, but it actually functions as a bioretention system. It consists of six cells that gradually increase in size as they approach College Heights Road. Each cell was designed using only three plant species: Red Twig Dogwood, Blue Flag Iris, and Common Rush. These cells capture stormwater runoff from the nearby building as well as permeable and impervious pavement. The stormwater is intended to be absorbed by the plants, filtered through the soil, and gradually flow toward the southwest corner of the final cell, where it completes its journey.

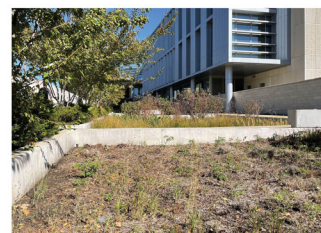
However, the system has been in decline since regular irrigation was discontinued. Several factors have contributed to this deterioration, including low plant diversity, inadequate soil conditions, and persistent droughts, leading to significant plant loss in the final cell, bare patches in others, and visible erosion.

This system represents just one example of how bioretention cells can be implemented. While the design typically follows the core principles of the system type, it is often adapted to meet the specific needs and conditions of the site. This particular system requires design updates to better suit the site conditions and improve its overall functionality.

Longitudinal Section Cut

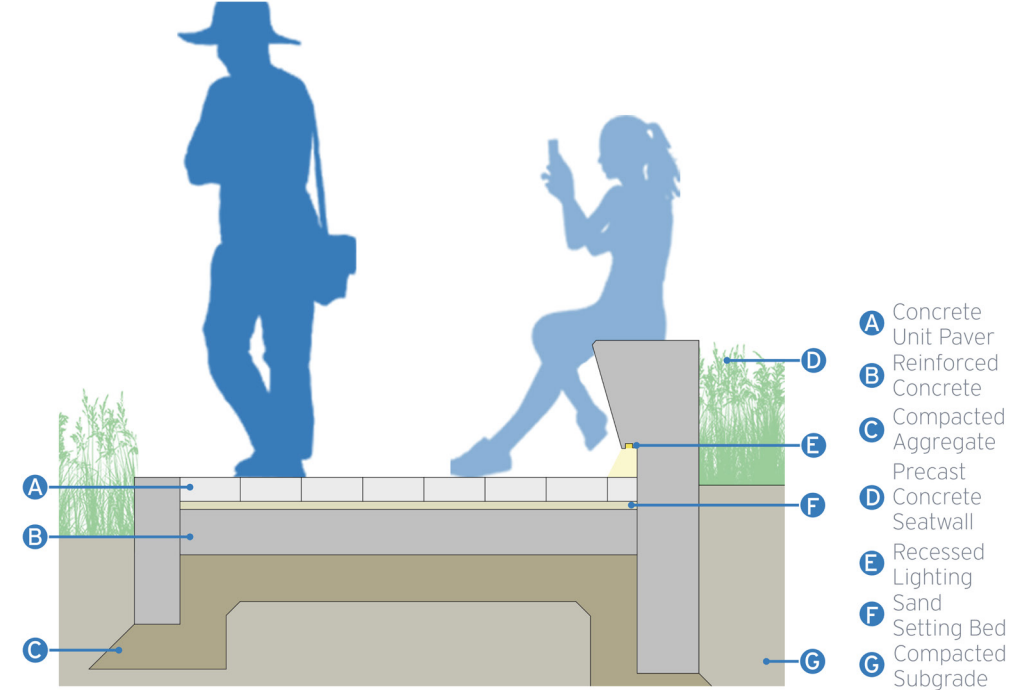


A Interaction Point



Photos Courtesy of Alexina Goold and Lee Skabelund

Section Cut of Interaction Point



Can you pair each profession with its role in green infrastructure?

Landscape Architect

help with the design of the green infrastructure system, creating construction documents, picking plants, and creating renderings

Flip up for answers!

Fig. 4.38 Signage for site 3 (Goold 2025)

Signage For Site 4

Memorial Stadium Green Roofs

Benefits

These two green roofs have successfully enhanced biodiversity, providing habitat for many pollinators and other wildlife. They have also help reduce the urban heat island effect and contribute to energy savings compared to traditional dark roofs (Skabelund 2020). Additionally, these green roofs serve as an educational tool, connecting people to the native prairie ecosystems surrounding Manhattan, Kansas (Skabelund 2020).

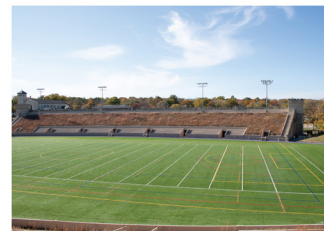
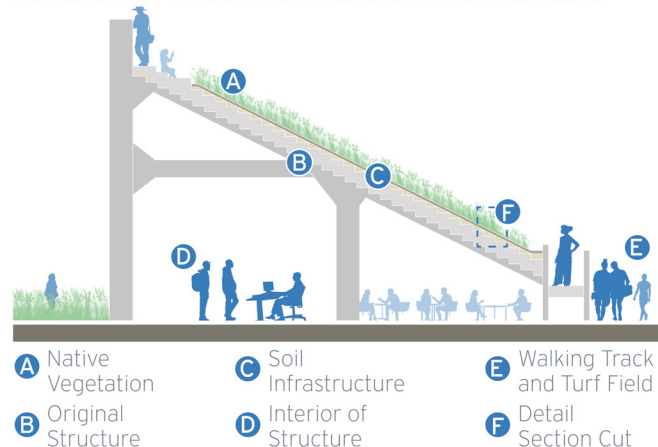
Design

The green roofs on Memorial Stadium span approximately 43,000 square feet, covering both the east and west sections. To install these green roofs, a sturdy plastic geo-web system was secured to the upper part of each roof using stainless steel cables ("Kansas State" 2021). A nylon erosion mat holds in place the sandy soil substrate, which was laid at depths of five to six inches over insulated surfaces ("Kansas State" 2021). When planting and seeding the two roofs, 26 native plant species were introduced on the west roof, while 21 species were selected for the east roof ("Kansas State" 2021).

To sustain the vegetation, regular irrigation is required due to the high slope and sandy soil composition. Spray irrigation was installed to support initial plant establishment and to provide water during extended droughts (Skabelund 2020).

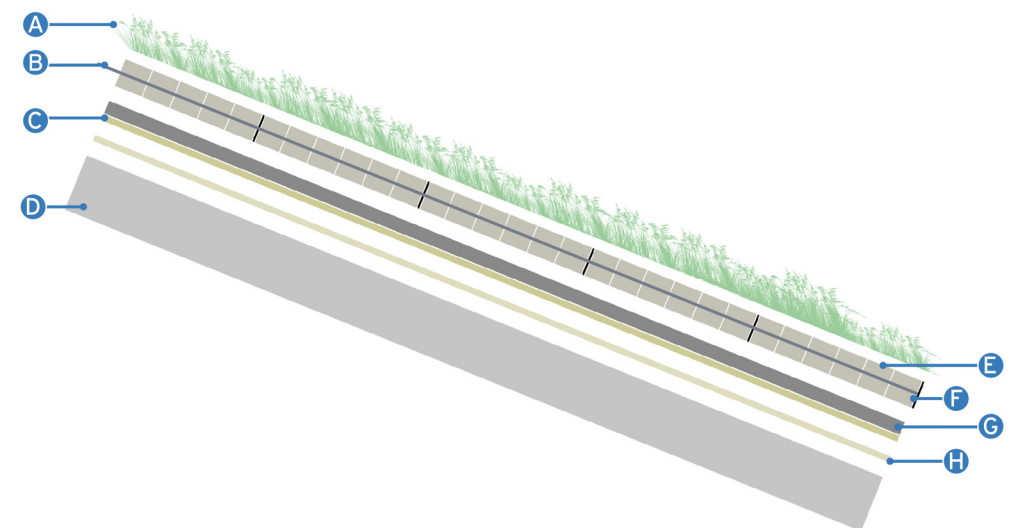
This system represents just one example of how a green roof can be implemented. While the design typically follows the core principles of the system type, it is often adapted to meet the specific needs and conditions of the site. The Memorial Green Roofs are a quite unique version of green roofs.

Section of Memorial Stadium Green Roof



Photos Courtesy of Alexina Goold and Lee Skabelund

Detail Section of the Memorial Green Roofs



Can you name these three native butterflies?

Flip up for answers!

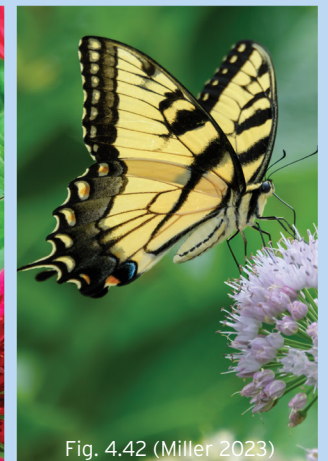
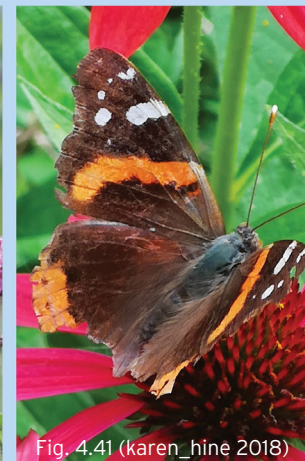
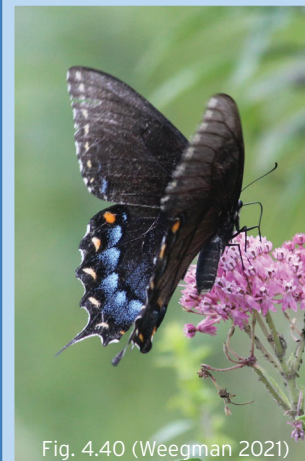


Fig. 4.39 Signage for site 4 (Goold 2025)

Signage For Site 5

The Meadow

Benefits

The native plants used in The Meadow require significantly less water and pesticides than the conventional lawn that previously occupied the space ("The Meadow"). This shift has helped increase biodiversity and provide habitat for pollinators and wildlife. The Meadow also serves as a calming green space, offering students and visitors a chance to rest and connect with nature. Compared to a traditional lawn of the same size (14,300 square feet), The Meadow requires significantly less irrigation, reducing maintenance costs.

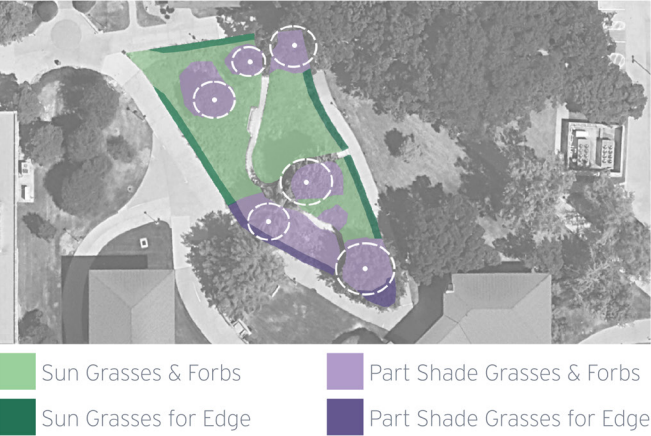
Design

The Meadow was developed with a five-year plan, beginning with pre-installation in 2012, planting in 2013, and three years of maintenance from 2014 to 2016 to ensure successful establishment ("The Meadow"). During these early years, K-State University Grounds and volunteers played a crucial role in upkeep, providing essential maintenance to help The Meadow thrive.

Although not originally designed as green infrastructure, The Meadow functions as an informal rain garden, helping to absorb and filter stormwater. Inspired by the nearby Konza Prairie, the plant selection aimed to replicate native prairie conditions ("The Meadow"). To accommodate the site's varied conditions, five distinct seed mixes were developed, ensuring a diverse and resilient plant community. Some of the dominant plants within The Meadow include, Little bluestem, Prairie bee balm, False indigo, and Side-oats grama.

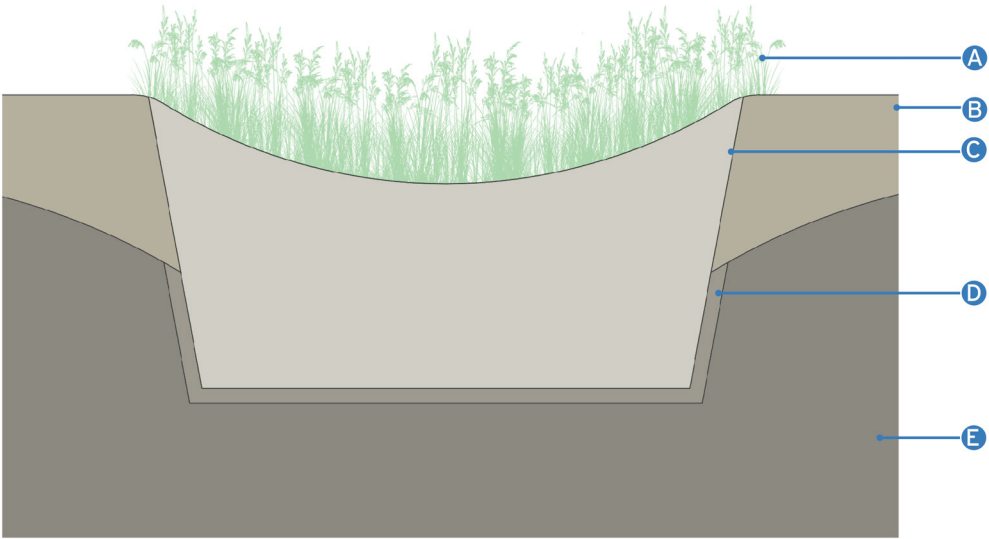
This system represents just one example of how a rain garden can be implemented. While the design typically follows the core principles of the system type, it is often adapted to meet the specific needs and conditions of the site, something The Meadow executed expertly.

Seed Mix Plan



Photos Courtesy of Alexina Goold

A Typical Rain Garden Section | Not Site Specific



A Native Vegetation

C Bioretention Soil

E Undisturbed Subsoil

B Topsoil

D Transition Layer

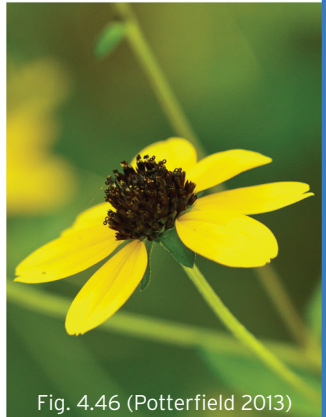
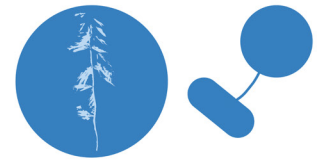
Can you Spot these Plants?



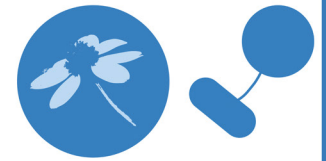
Little Bluestem
Schizachyrium scoparium



Side Oats grama
Bouteloua curtipendula



Brown-eyed Susan
Rudbeckia triloba



Signage For Site 6

East Seaton Rain Gardens

Benefits

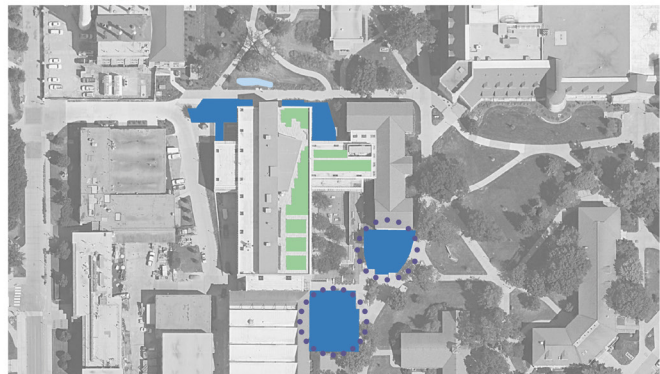
Together with other rain gardens on the north side of the building, these rain gardens contributed to significant resource savings, including a 50% reduction in irrigation demand and a 38.3% reduction in potable water use. Beyond their functional benefits, the vegetation in the rain gardens also provides habitat for pollinators and other wildlife, contributing to the overall biodiversity of the area.

Design

When designing the rain gardens as part of the APDesign Expansion, careful attention was given to the overall aesthetic vision of the project. The rain gardens were strategically placed to buffer the space and create a more comfortable atmosphere around the amphitheater. Both rain gardens were planted with the same mix of native plants, which includes species like Blue Star, Swamp Milkweed, Purple Coneflower, Soft Rush, and Switchgrass. In addition to these, Thornless Honeylocusts were planted in both gardens. The north rain garden also features Lacebark Elm and American Linden trees, while Prairie Dropseed was used as a buffer along part of the sidewalk in the south rain garden. Both rain gardens included turf as a buffer for most of the areas. To manage the stormwater, the south rain garden has an underground cistern that collects water, which is then used for non-potable purposes.

This system represents just one example of how a rain garden can be implemented. While the design typically follows the core principles of the system type, it is often adapted to meet the specific needs and conditions of the site.

APDesign Green Infrastructure Types

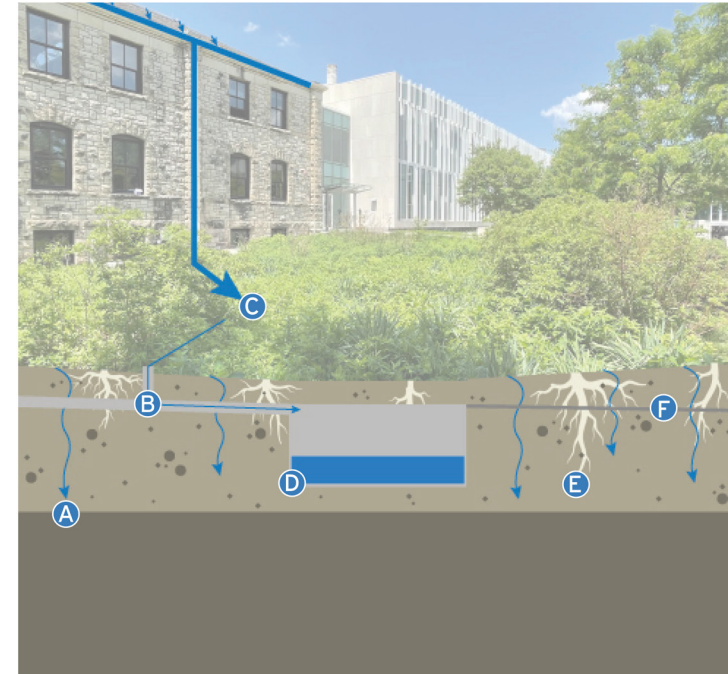


Green Roof Rain Garden Bioswale Site Locations



Photos Courtesy of Alexina Goold and Lee Skabelund

A Typical Rain Garden Section | Not Site Specific



- A Stormwater Soaking into the Soil
- B Overflow Drain
- C Stormwater Runoff from the Roof
- D Cistern
- E Deep Roots Soaking in the Stormwater
- F Cistern Overflow Pipe

Can you Spot these Plants?



Fig. 3.17 (Victor To 2018)
Joe Pye Weed
Eutrochium



Fig. 3.16 (Dee Gee fifteen 2024)
Swamp Milkweed
Asclepias incarnata



Fig. 3.19 (Lively 2015)
Rattlesnake Master
Eryngium yuccifolium



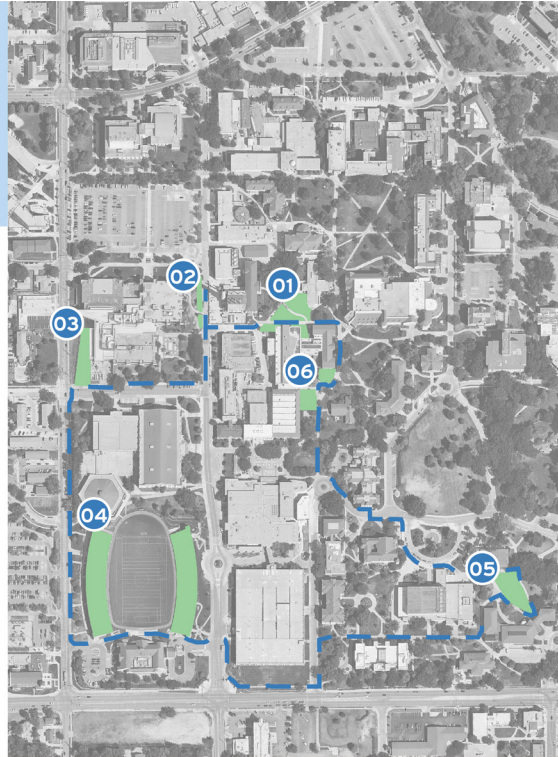
Fig. 4.47 Signage for site 6 (Goold 2025)

Tour Flier Design | Front

Want to learn more about green infrastructure on campus?

Take the Tour!

K-State's campus features multiple green infrastructure systems designed to manage stormwater while enhancing the landscape. Though many people walk by these features daily, their environmental benefits often go unnoticed. These systems help mitigate flooding, filter pollutants, and support biodiversity, all while adding natural beauty to the campus. By taking the tour, you can explore how these systems were designed, how they function, and the positive impact they have on both the environment and the K-State community.



Site 1: North Seaton GI Collection

In 2018, the green space in front of Kansas State University's English Counseling Services building was redesigned to improve stormwater management. This transformation was driven by the APDesign Expansion project and the conversion of 17th Street—now Martin Luther King Jr. Drive—into a pedestrian corridor, creating an opportunity to implement new bioretention basins. A notable feature of this site is the distinct yet complementary green infrastructure designs on either side of the sidewalk. The vegetation and infrastructure on the south side were developed as part of the APDesign Expansion project, while those on the north side were incorporated into the K-State English Counseling Services Improvements. This area of the K-State campus exemplifies the seamless integration of three projects that collectively enhanced its stormwater infrastructure system.

Site 2: East Engineering Bioswales

In 2014, Kansas State University issued a Request for Proposal to initiate its Chilled Water Expansion Project (Olsson). This large-scale project aimed to update and expand the heating and cooling infrastructure to accommodate both existing and future campus buildings. The project took place between 2015 and 2017, requiring road closures and some demolition to access chiller pipes and expand the chilled water loop. This disruption created an opportunity for K-State to begin developing pedestrian malls, not only on North Martin Luther King Jr. Drive (known as 17th Street at the time) but also on Mid Campus Drive. The transformation of these streets into pedestrian-friendly spaces significantly reshaped how students and visitors experience the campus. In 2021, 17th Street was officially renamed North Martin Luther King Jr. Drive to honor Dr. Martin Luther King Jr.



Fig. 4.48 Front of the tour flier (Goold 2025)

Tour Flier Design | Back

Site 3: West Engineering Bioretention Courtyard

In 2015, construction of the College of Engineering Expansion project was completed, connecting Durland, Rathbone, and Fiedler halls to form a unified complex ("Engineering Addition"). The project aimed to consolidate functions, enhance connectivity, and improve the overall aesthetics of the college. As part of the renovation, the Engineering "Rain Garden" was created as both a student space and a teaching opportunity. Planned alongside the building expansion, this outdoor courtyard was designed to highlight engineering principles while providing a functional and inviting environment. The building additions, renovations, and the Engineering "Rain Garden" were developed by multi-disciplinary firms and engineers, ensuring an integrated approach to both indoor and outdoor learning spaces.



Site 4: Memorial Stadium Green Roofs

To honor Kansas State University (K-State) students and alumni who gave their lives during World War I, K-State constructed Memorial Stadium in the 1920s, dedicating it in 1929. By the late 2000s, Memorial Stadium began experiencing structural issues, particularly with the roofs, which also functioned as seating areas. Between 2008 and 2012, landscape architects, architects, engineers, and other professionals explored multiple green roof concepts to address these structural concerns and reduce seating capacity for safety reasons (Skabelund 2020). The green roofs covered large portions of the seating areas, incorporating a new waterproofing system and insulation to prevent leakage, which was crucial for their sustainability (Skabelund 2020). After receiving approval from K-State administration, the green roof project was completed between July 2015 and April 2016 (Skabelund 2020).



Site 5: The Meadow

The K-State Meadow (The Meadow) is a vibrant landscape on campus that showcases native plants while fostering learning and relaxation ("The Meadow"). Located outside the Beach Museum of Art, The Meadow enhances the museum's setting by highlighting the natural beauty of native plant life. Once a simple patch of lawn, it was transformed into a thriving meadow landscape for both educational and recreational purposes. Seating has been installed throughout the space, with recent updates made by the 2024 Furniture III design class to create a more welcoming and comfortable environment. In addition to serving as a peaceful retreat, The Meadow hosts various educational and artistic activities. These include art installations in collaboration with the Beach Museum, lessons on natural plant dyes, and guided tours as part of the museum's summer programs ("The Meadow").



Site 6: East Seaton Rain Gardens

The Seaton Rain Gardens were part of the broader APDesign Facility renovation and improvement project. The design phase began in 2014, followed by construction in 2015, with completion in 2017. The addition is classified as a LEED Silver Certified facility, recognizing its commitment to sustainability. The project achieved notable environmental benchmarks, including a 50% reduction in irrigation demand, a 38.3% reduction in potable water use, an 18% reduction in energy consumption, the use of 100% no- and low-VOC finishes, and an 80.1% landfill diversion rate ("Seaton Hall"). Several key design features contributed to these sustainability achievements, including sun-shading fins, rainwater collection cisterns, bioswales, vegetated roof areas, abundant natural daylighting, native plantings, and the use of locally sourced materials ("Seaton Hall").



Fig. 4.49 Back of the tour flier (Goold 2025)

05.

Conclusion

Project Summary

By featuring real-world examples, the tour helps bridge the knowledge gap for those who may not recognize the purpose of the green infrastructure systems often walked by. Providing accessible, engaging educational signage ensures that learning extends beyond classrooms and professional settings, promoting broader awareness and appreciation of green infrastructure. Each stop along the tour serves as a learning opportunity, fostering a deeper understanding and appreciation of these systems. The tour's educational goals include highlighting the environmental and aesthetic benefits of green infrastructure, explaining how these systems function, and demonstrating their role in sustainable campus design.

Project Limitations

The restraint of budget did not allow to create a physical prototype of the projective signage. If implemented, gaining approval from the university could be a limitation. The tour fliers would also need to be redispersed whenever they run low, finding a reliable person or persons for the job could also be a limitation.



Fig. 5.1 The lavender bloom adds color and texture to the green roof (Goold 2024)

Future Research

To build on this research, developing an online component could be explored to provide broader access to information and resources, allowing the tour to be utilized on a digital platform. Additionally, the tour could be expanded to highlight more green infrastructure examples across K-State's campus and in the surrounding area. Further research could also examine opportunities for expanding green infrastructure on campus, along with potential barriers to new implementation. Understanding what is currently taught about green infrastructure at the university could help identify ways to enhance education and awareness on the topic. Lastly, future research could focus on how existing green infrastructure can be better integrated into hands-on learning experiences for students, visitors, and the surrounding community, ultimately fostering greater acceptance and appreciation of these systems. Some starting research question could include:

- What digital tools or interactive features would be most effective for expanding the reach of green infrastructure education?
- What are the primary challenges or barriers to implementing more green infrastructure on campus?
- How can these barriers be addressed to promote further implementation of sustainable stormwater management systems?
- Are there existing programs, courses, or partnerships that integrate green infrastructure into environmental education?
- How can green infrastructure be leveraged for hands-on learning experiences in different academic disciplines?



Fig. 2.1 The Meadow on the K-State Campus (Kingery-Page n.d. c)

06.



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