THE ***ILLINOIS*** PATH

A natural landscape promoting sustainable connections across campus communities

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Executive Summary

Project Overview & Vision

Citing campus sustainability and enhancement, Interim Chancellor Robert Easter asked a graduate class to provide a strategic assessment and implementation plan for a managed natural landscape on the Military Axis, a site located on the campus of the University of Illinois at Urbana-Champaign, in a manner consistent with the University's mission and Master Plan.

The students, faculty and staff colleagues, technical experts and practitioners, administrators, and members of the general public who participated throughout the process inspired a vision (termed ***Illinois*** Path) for the site –

> A beautiful and sustainable managed natural landscape in the heart of campus to promote connections among people, their institutions, and their communities while merging academic inquiry and the enjoyment of nature.

Illinois Path has four areas of major significance for the University of Illinois at Urbana-Champaign: environmental, educational, socio-ecological, and economical. The four areas of significance generate goals that are interrelated and mutually beneficial. The environmental goal is to reveal the landscape as an important provider of ecological services, native biological diversity, and wildlife habitat, interceptor and filter of stormwater runoff and gaseous air pollutants, and sequester of carbon. More than a stormwater conveyance system or diorama of historic habitat, ***Illinois*** Path reveals the landscape as simultaneously part of a learning community and a residential community. Within the former, the landscape can model scholarship, inquiry, participatory education, and the study of sustainability knowledge – its structure and its limits. As a residential community, the landscape uncovers a range of socio-ecological benefits: it models a way-of-living, provides a restorative environment that facilitates interaction and contemplation, and symbolizes the opportunity to unite groups, institutions, and programs from among our communities. The economic goal of ***Illinois*** Path is to expose and display the cost savings of a landscape that allows ecological processes and organization appropriate for this place.

The Illinois Path Proposal & Recommendations

The primary recommendation is to transform the Military Axis from its current use into a landscape that incorporates prairie, savanna, a wet prairie swale, and woodland. A phased implementation is recommended beginning with the natural habitat complex of prairie, a wet prairie swale, and savanna between 4th Street and 6th Street. The second phase develops the woodland east of 6th Street and extending to the McFarland Memorial Bell Tower.

Greenways are important contributors to a community's quality of life and enduring sense-of-place. They also provide a wide range of ecological services that contribute to environmental stewardship and sustainability. ***Illinois*** Path may best be understood as the first phase of a proposed greenway (managed natural landscape corridor) extending eastward from 4th Street to Lincoln Avenue where it may intersect with another greenway extending southward through Illini Grove, the Arboretum, Pollinatarium, and beyond. The east-west alignment follows the original campus Military Axis.

With implementation of the ***Illinois*** Path, the University has an opportunity to explicitly link the prairie ecosystem and the richness of its soils to the early agricultural legacy of this Land-Grant University represented by the Mumford House and the Morrow Plots. A renovated Mumford House could host important interpretive and educational functions.

The landscape cuts across all aspects of an institution's structure, outreach, educational programs, recreation, and more. Yet it doesn't fit within any single category. In consequence, it has no champions and its contributions and benefits go unrecognized. No landscape can be sustained as long as it remains isolated from the programs and structures that depend on it. Thus it is essential to forge strong connections between the landscape and its maintenance and with the instructional and research activities of the institution. Such connections assure appropriate management and maintenance of natural landscapes campus wide, securing both ecological health and personal safety while facilitating programmatic immersion within the sites.

Landscapes are a major part of the University's fabric, and thus are an institutional obligation rather than the responsibility of any individual academic unit. Plants in young prairie and savanna plantings develop mostly below ground, while the above ground portions tend to be temporarily over-taken by various "weeds." Recent experience with young prairie plantings has shown that management at this stage – coupled with on-going educational programming – is crucial. Appropriate education for those charged with maintaining natural landscapes will enhance the institution's

capacity to capture the environmental benefits of sustainable landscape design.

Benefits that Advance Campus Sustainability

Through meetings with stakeholders, observations, interviews, and review of the academic literature, it became clear there was strong and widespread support for incorporating managed natural landscapes within the campus fabric. ***Illinois*** Path triggered this support because of its capacity to demonstrate environmentally responsible practices; educate and engage students, University employees, and public visitors via accessible exhibits and interpretive gardens; provide a range of physical, cognitive, psychological, and social benefits; serve as a model for other large public institutions; and provide tangible benefits that advance campus sustainability:

- Energy reduction and air quality improvement,
- Carbon sequestration (above- and below-ground) and reduced greenhouse gas emissions,
- Reduced fertilizer and pesticide usage,
- Stormwater management and water quality improvement, and
- Increased biological diversity, productivity, and resilience through time.

The presence of a wet prairie swale enables stormwater to be retained on site. This helps the University reduce its portion of municipal stormwater fees. Rainwater runoff from future buildings along ***Illinois*** Path can be directed into the wet prairie bioswale as well, contributing toward an even larger fee reduction. Reduced fossil fuel combustion and associated pollutant emissions, fewer applications of pest-control chemicals and fertilizers, greater carbon sequestration in soil and biomass, and lower emissions of greenhouse gases and air pollutants, and enhanced groundwater infiltration generate modest savings on an annual basis. The benefits are likely to become substantial, however, when longer time scales and/or the full greenway are considered.

Issues Encountered

Seven major areas of concern were identified: personal safety and crime prevention, use of fire, play space, infrastructure, accessibility, aesthetics, and resource limitations.

Personal Safety and Crime Prevention – Evidence from the primary literature and testimony of public safety offices at peer institutions who have managed natural landscapes on campus confirm natural landscapes are correlated with lower rates of crime. The reason for this is thought to be that natural landscapes are generally more welcoming for people to use and occupy. Places that are regularly occupied by people are statistically safer places to use and walk through. The ***Illinois*** Path design incorporates Crime Prevention through Environmental Design (CPTED) principles.

Use of Fire – Illinois prairie and savanna ecosystems are fire-dependent. The use of

fire as a management tool is the best way to maintain healthy and safe native landscapes. Annual burns improve safety by keeping leaf litter and fuel levels low at all times, both reducing the fire intensity during planned burns as well as reducing the dangers of an unplanned or accidental burn. The experiences of the natural landscape managers interviewed and publicly available statistics indicate it is difficult to start a fire accidentally or even intentionally in such landscapes. Because of the prevailing wind direction, prescribed burns are anticipated to move across the site from the southwest toward the northeast. Although the Krannert Art Museum is not in the direct line of anticipated movement, it would be prudent to close HVAC intakes during the few minutes of a prescribed burn.

Play Space – Given the proximity of play space across campus relative to the primary student residential complexes, it is evident the ***Illinois*** Path site does not provide any more access to play space than already exists on campus. Furthermore, many aspects of the natural landscape will provide recreational spaces more unique to campus: places for contemplation, personal reflection, and restoration.

Infrastructure – The ***Illinois*** Path design is flexible; it can be planted around existing walkways, utility lines, and exterior lighting. This helps to reduce costs and allows work to be completed within a more streamlined schedule.

Accessibility – Pathways or walkways intended to bring students closer to experience the natural landscape will be completely accessible to people with disabilities. Areas within the ***Illinois*** Path will provide unique ways for people with sensory impairments to experience the landscape.

Aesthetics – Definitions of aesthetics abound. For some within the campus community, aesthetics may be a critical reflection on art, culture, and nature. The views of others may be more properly described as a judgment of sentiment or taste. And still others are concerned about the lack or order or 'weediness' of a landscape that lacks carefully and uniformly trimmed turf bounded by like-sized trees. Communicating broadly and frequently about natural landscapes in an on-going process of education is a prerequisite to a critical reflection on nature in our campus landscape. By tethering academic programs and public engagement to the landscape, it is conceivable a new aesthetic will become imbued on campus. In the interim, it is essential the natural landscape plantings are appropriately tended to avoid an unkempt appearance and invasion of non-native species.

Resource Limitations – The class was not charged with developing a budget for the ***Illinois*** Path project.

Summary

The Illinois Path vision combines a few grand ideas with easy to implement measures. There is no need to wait until the resources for larger greenway vision are in place before beginning the implementation—smaller scale aspects of the plan can and should begin as soon as possible. Illinois Path is about creating a landscape that is more than just a tool for managing storm water or efficient foot travel between structures. It offers an opportunity to create a community that is revitalized environmentally, economically, and socio-culturally. Rethinking our relationship to the surrounding landscape defines our concern and respect for the natural world and evidences our commitment and attitude toward sustainability and sense-of-place. It provides environmental benefits to downstream habitats, future generations, and the larger region while embracing the inevitable evolution of our campus in this critical century.

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1.0 Project Overview

The campus landscape is both the University's front porch and its backyard. It is where we greet visitors, hold celebrations, chat with friends, mix with people from different places and cultures, nurture ideas, store our tools, collect and recycle refuse, and otherwise ensure this neighborhood is a public place where community matters. In short, landscapes are an extension of the University community. The UIUC campus is a learning and residential community that annually hosts thousands of visitors. Its landscape is the most immediate and visible expression of the University's attitude and commitment to sustainability and sense-of-place.

Citing campus sustainability and enhancement, Interim Chancellor Robert Easter and Vice Chancellor for Public Engagement Steven Sonka asked a graduate class to investigate how to successfully advance the development of a managed natural landscape on the Military Axis, a site located on the campus of the University of Illinois at Urbana-Champaign, in a manner consistent with the University's mission and Master Plan (University of Illinois at Urbana-Champaign Campus Master Plan Update March 2007).

The purpose of this report is to detail our recommendations to develop the Military Axis site, document our understanding of the benefits, issues and concerns of developing the site as a managed natural landscape, and describe the process used to gather information and generate recommendations.

2.0 Vision

The students, faculty and staff colleagues, technical experts and practitioners, administrators, and members of the general public who participated throughout the process inspired a vision for the site – a beautiful and sustainable managed natural landscape in the heart of campus to promote connections among people, their institutions, and their communities while merging academic inquiry and the enjoyment of nature. Termed ***Illinois*** Path, this place will enrich lives, enhance its surroundings, and contribute academically, socially, culturally, environmentally, and economically to our collective health. It will be a place where individuals may exercise, relax, meditate, and become inspired by nature. And by bringing its backyard to the front porch, ***Illinois*** Path will demonstrate leadership in sustainability through thoughtful action.

3.0 Recommendations

3.1 Implement the managed natural landscape

The primary recommendation is for the University of Illinois to transform the Military Axis site from its current use into a managed natural landscape (termed ***Illinois*** Path) that incorporates prairie, savanna, a wet prairie swale, and woodland. While consultation with more experienced landscape architects, ecologists, and engineers will be necessary as implementation advances, our recommendation is detailed in subsequent sections and graphical appendices. In addition to the benefits mentioned previously, the recommended design also

- Reduces stormwater runoff with bioretention practices,
- Creates new habitat for pollinators,
- Reduces maintenance costs with native plant species,
- Reduces greenhouse gas emissions,
- Sequesters carbon, and
- Approximates the historic placement of prairie, savanna, and woodland habitats once present in East-Central Illinois.

3.2 Maintain the landscape

Landscapes are a major part of the University's fabric, and thus are an institutional obligation rather than the responsibility of any individual academic unit. Plants in young prairie and savanna plantings develop mostly below ground, while the above ground portions tend to be temporarily over-taken by various "weeds." Recent experience with young prairie plantings has shown that management at this stage – coupled with on-going educational programming – is crucial. Appropriate education for those charged with maintaining natural landscapes will enhance the institution's capacity to capture the environmental benefits of sustainable landscape design.

3.3 Connect the landscape to institutional mission

The landscape cuts across all aspects of the institution: structural, programmatic, and recreational. Yet it doesn't fit within any single category. In consequence, it has no champions and its contributions and benefits go unrecognized. No landscape can be sustained as long as it remains isolated from the programs and structures that depend on it. Thus it is essential to forge strong connections between the landscape and the instructional and research activities of the institution. Such connections assure appropriate management and maintenance of natural landscapes campus wide, securing both ecological health and personal safety while facilitating programmatic immersion within the sites.

3.4 Inter-link agricultural and ecological legacies with Mumford House

Implementation of the ***Illinois*** Path project should incorporate restoration of the Mumford House, a University landmark, and its immediate surroundings. A renovated Mumford House could be used as:

- An interpretive center for historic Illinois ecosystems,
- An education center focused on ecological or whole system design or
- An education center focused on early agricultural research at this Land-Grant University (Morrow Plots) and its close dependence on prairie ecology, or
- Additional program space in support of landscape and architectural design and/or the arts.

*3.5 Extend future **Illinois** Path eastward to Illini Grove and Arboretum*

Expanding managed natural landscapes eastward throughout the entirety of the historic Military Axis will generate an ecologically-rich green corridor from 4th Street to Illini Grove where there exists a further opportunity to connect southward with the Arboretum corridor, Pollinatarium, and nearby native plantings. Existing and newly developed campus green spaces integrated throughout the campus and interconnected with bikeways and pedestrian corridors in adjacent communities enhances the quality of life for everyone and contributes to a strong sense of **this** place.

4.0 Methods

Recommendations stem from an extensive review of the relevant primary literature; interviews with academic and personal safety staff at other universities having natural landscapes; the advice and guidance of technical experts in restoration ecology, landscape architecture, and natural area management; ideas and counsel from UIUC students, faculty, staff, and administrators; and a design charrette held on campus. NRES 507 met weekly to discuss and analyze the gathered information.

5.0 Site Description

The Military Axis is currently characterized in the Campus Master Plan as a "civic landscape" located between 4th Street and the McFarland Memorial Bell Tower. Civic spaces are an extension of the community in which they are found (Project for Public Spaces nd). When they work well, they serve as a stage for our public lives. Once used as a parade ground, the 2.63 ha site is surrounded by buildings that house multiple academic units and is sub-divided by 6th Street into two sections**.** The portion of the Military Axis examined by the NRES 507 class is shown in green in Figure 1.

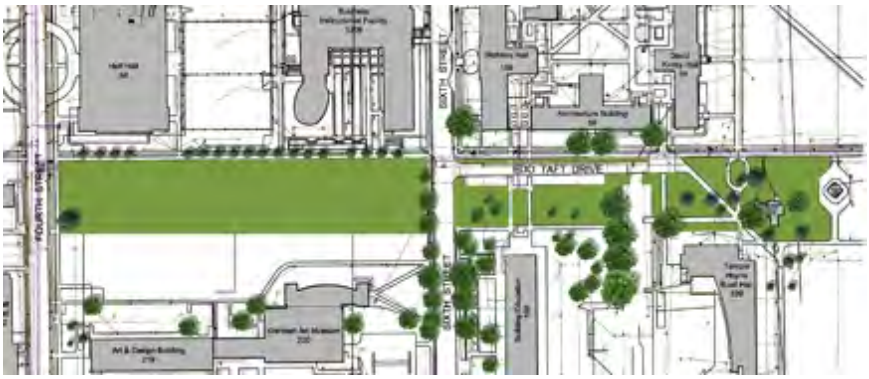

Figure 1. The portion of the Military Axis examined is an elongate rectangle bounded on the west by 4th Street and on the east by the McFarland Memorial Bell Tower. The original Military Axis continued eastward to Lincoln Avenue.

5.1 West of 6th Street

The portion of the Military Axis located west of 6th Street has been used for the Illini marching band practices and for informal soccer recreation. In 2008, the site was a staging area for the construction of the new LEED-certified Business Instructional Facility. During construction, gravel was placed on top of the entire site and machinery compacted the soil layer (See Soil, Section 7.2.7). While much of the gravel was removed following completion of construction, isolated gravel patches remain on the site. Since the site is occasionally used for recreation, the residual gravel offers some risk of physical injury (A. Petri personal observation, September 12, 2011). On the far west end of the site, the University of Illinois Division of Intercollegiate Athletics uses the area for event-related automobile parking (R. Welch personal communication, September 12, 2011,).

5.2 East of 6th Street

The portion of the Military Axis located east of 6th Street contains a mix of parking area and mown lawn. There have been no significant changes in structure for at least 20 years at the site (Google Earth 2008), although the addition of the Temple Buell Hall, directly south, has led to some off-site and underground utility changes. Planted trees, primarily oaks and maples, are scattered throughout this area. The Mumford House (described in Section 6.1 of this report) anchors the east end of the project site.

6.0 Site History

6.1 The Mumford House

The Mumford House, built around 1870, lies within the ***Illinois*** Path corridor, immediately west of the McFarland Memorial Bell Tower. Designed by J.S. Searfoss as a model Illinois farmhouse, it is named after Herbert Mumford, former Dean of the

College of Agriculture who lived in the house for almost 33 years (Unknown newspaper, 1947). Two other noteworthy former Deans of the College of Agriculture, George Morrow and Eugene Davenport, also lived in Mumford House. In 1939, the College of Fine and Applied Arts converted Mumford House into a studio for artists in residence (Courier 11/20/1968). In 1989, the Mumford House was added to the National Register of Historic Places. The house is currently unoccupied and in disrepair.

The Morrow Plots, another historical landmark on the southern end of campus, is the oldest continuously used experimental agricultural field in the United States. Manley Miles, a professor in agriculture, and George Morrow, the first dean of agriculture at the University, founded these research plots in 1876. They are also the second oldest in the world, second only to the Rothamsted Field in England (UIUC Agronomy Website) Of the 10 original 0.2 ha plots, only three survive today (UIUC Agronomy Website). After nearly 150 years of continuous research use, the plots have provided invaluable data on the effects of crop rotation, depletion of soil nutrients, and effects of fertilizers on crop yield. The plots were designated a National Historic Landmark on May 23, 1968 (National Historic Landmarks).

The capacity of prairie vegetation to sequester large quantities of carbon and other nutrients below ground led directly to the high fertility and friability of tallgrass prairie soils. In many ways, the agricultural productivity of this region is due to the prairie that once grew here. The linkage between the early history of this University, of agriculture, and the legacy of native systems that once occupied this land is a powerful story that can be told through the close proximity of the Morrow Plots, and Mumford House with ***Illinois*** Path.

6.2 Regional Ecosystem History

Tallgrass prairies were historically found from Manitoba to Texas and extending into Illinois and Indiana as a kind of "prairie peninsula." With the influence of moisture and fire, the pre-settlement Midwest was a shifting mosaic of prairie, savanna, and woodland; the density of trees often determined one ecosystem type from another (Schwartz 1997). Prairie and savanna depend on fire, and woodlands on its absence (Abrams 1992, Taft et al. 1997). Where fire and grazing have been altered, non-native and woody species displace native herbaceous species (Kraszewski and Waller 2008) leaving them vulnerable to physical and genetic degradation (Taft et al. 1995).

Prairies are ecosystems dominated by a mixture of forbs and grasses. Trees are generally absent from prairies. Savannas are areas with scattered, open grown trees (typically oaks) and a ground layer that is a prairie-like mixture of forbs and grasses, while woodlands refer to areas with a partially closed canopy (up to about 80% overstory cover), and a ground layer of forbs, woody species, and grasses (Taft et al. 1997). Both savannas and woodlands may have an understory layer of shrubs.

Much of the tallgrass prairie once present in Illinois has been converted to agriculture due to its productive soils, the result of the deep-rooted prairie plants. Illinois formerly was about 55% prairie, but now only about 0.01% remains in remnant condition (White and Madany 1978, IDNR Natural Heritage Database 2009, Taft et al. 1995).

7.0 Design

7.1 Design Charrette

The evaluative process began with a series of interviews of campus stakeholders (students, staff, faculty, administrators) and experts from other universities. The interviews revealed concerns, challenges and interests that may not have been evident at first. The challenges of the task were promptly underscored — not everyone agreed with the project goal, the process, or its relevance. A design charrette was organized in October 2011 to aid the further development of design ideas, air concerns and challenges of stakeholders, and finalize a list of design principles (Section 7.1.1) and design goals (Section 7.2.1).

7.1.1 Design Principles

The following principles were identified to guide the development of site designs:

1. Employ simplicity in means, achieve richness in ends.
2. Know and interpret cultural, historical, socio-economic and ecological processes associated with the site.
3. Go beyond remediation, generate ecological consciousness.
4. Anticipate change - a natural landscape occurs when living and non-living elements are free to move and change.
5. Design for the eloquence of the interplay of its generative forces.
6. Engage the mind, heart, and soul of the community.

7.1.2 Design Themes and Goals

Participants in the design charrette were divided into two teams. Each team was encouraged to consider the ***Illinois*** Path site, its context, history, and institutional mission. The teams developed concepts that reflected the design principles (above) and the following themes and goals, which were presented at the beginning of the design charrette:

1. Will be a centerpiece of the University's commitment to ecological landscape design.
    a. Consistent with vision of the future campus.

   b. Aesthetically pleasing; avoiding an “unkempt” look.
   c. Sensitive to adjacent architecture and landscape in the design.
2. Will be ecologically sound.
   a. Use native species whenever possible; encourage biodiversity (attractive to native birds, pollinators).
   b. Reduce stormwater runoff, maximize water infiltration.
   c. Minimize edges and their negative effects on native species.
   d. Prevent erosion and other soil degradation.
3. Will be an educational resource.
   a. Maximize possibility of academic research.
   b. Allow for learning about native plants and ecological systems through signage.
   c. Use possible high-tech app for detailed information about prairie plants, etc.
4. Will be safe.
   a. Incorporate features that enhance personal safety.
   b. Minimize risks from prescribed and unintentional fire.
5. Will be beneficial to the campus human community.
   a. Maximize psychological benefits: available space for encouraging the restorative effects of natural settings.
   b. Maximize social benefits: meeting areas for classes and conversations.
   c. Maximize physical benefits by encouraging hiking, biking, and jogging.
   d. Consider trails and a possible "play area".
6. Will be accessible to all.
   a. Fully compliant with Americans with Disabilities Act (ADA) requirements.
   b. Wheelchair accessible where possible.
   c. Utilize signage for seeing- and hearing-impaired.
7. Will reflect local ecological history.
   a. Focus on biomes of central Illinois (prairie, savanna and forest).
   b. Consider creating a wetland.
8. Will reflect local human history.
   a. Re-purpose the Mumford House as a possible center for ecological education.
   b. Consider the linkage of the Morrow Plots to the natural landscape.
9. Will be economical.
   a. Estimate costs of implementation.
   b. Estimate maintenance costs, especially compared with traditional landscape.
   c. Plan for minimization of costs.
   d. Reduce relocation of infrastructure (underground utilities).

These design principles and goals guided the creation of the final recommended design.

7.2 Site Analysis

The conceptual design process began with a site analysis – taking inventory of the site’s features and noting current opportunities and challenges. The analysis revealed the current utility infrastructure, lighting, access points, buildings, topography, soils, and nearby site amenities such as play space. This analysis led to several design iterations

that primarily followed the two schools of thought identified in the charrette: the inclusion or exclusion of explicit play space.

7.2.1 Site Boundaries

The Military Axis is formally shown as a thin strip of land identified in Figure 1. For design purposes, the site boundaries were extended as shown in Figure 2. There are several reasons for the proposed extension. Ecologically, the extension provides a much larger habitat patch and the opportunity for increased microsite heterogeneity. Aesthetically, the larger patch offers more design potential i.e. opportunities to create views into and out from the landscape. A larger site also presents an opportunity to use a larger palette of plant material that, when applied properly, can be used to sculpt views.

7.2.2 Infrastructure

The design approach minimizes removal or disturbance of existing walkways, utility lines, and exterior lighting. This keeps infrastructure and engineering costs lower and allows for a more streamlined work schedule. From these design goals,

1. The area east of 6th Street is designated as woodland because of the existing trees and abundant underground utilities occurring there. So that root systems are not disrupted during construction and that they do not create future maintenance issues, new trees will be planted at least 15 ft. from the existing utility grid as shown in Figure 3.

2. Utilities needed for future buildings in and around the site should be anticipated as much as possible to minimize disruption of established vegetation.

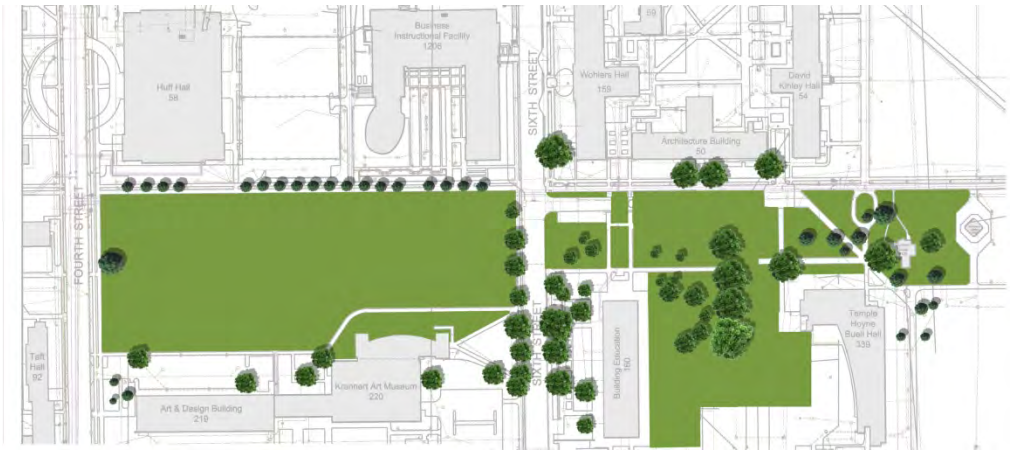

Figure 2. The expanded Military Axis offers greater aesthetic, ecologic, and programmatic benefits, thus increasing the opportunity to build enduring connections campus-wide.

Figure 3. The grey areas indicate locations of under-ground utilities plus 15 ft. buffers around them.

7.2.3 Accessibility

Access nodes along the periphery of the site mark public access and influence pathway planning. Well-designed pathways will ensure a safe, scenic experience for the user. The following suggestions should be considered in the final design:

1. Pathways or walkways should allow people of all abilities close contact with the natural landscape.
2. Areas within the landscape should be planned to provide unique ways for people with sensory impairments to experience the landscape.
3. For safety reasons, lower stature species should be grown around pathways and taller species toward the center of the site. Doing this helps site accessibility by creating easily identifiable entries and paths.

7.2.4 Play Space

The current play space on campus (areas, for example, used for informal soccer games) was examined. As shown in Figure 4, significant play space of this kind already exists near University-operated student residence halls. In fact, the current campus landscape favors informal play across its numerous tree-lined turf quadrangles.

Formal play space was also evaluated, and according to information contained with a UCLA (2003) study, the University of Illinois has adequate formal play space as well. The kind of play space provided by an open field would not be a compatible fit with the campus master plan and its designation for a managed natural area.

What seems to be most lacking from our “multi-use” campus landscape is space suitable for contemplation and personal reflection and restoration?

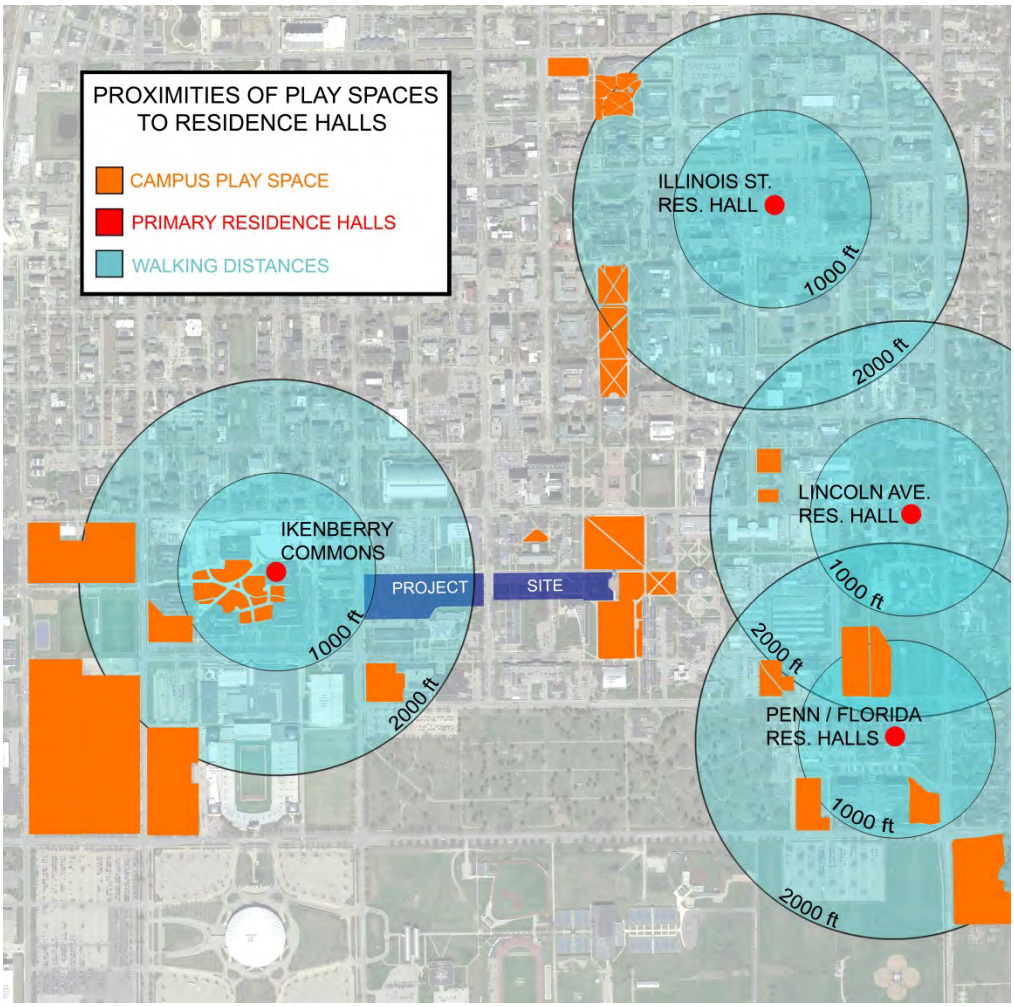

Figure 4. Play space on campus within walking distance (1,000 and 2,000 ft.) of major dormitory complexes is shown. The ***Illinois*** Path site is indicated in dark blue. Dormitory residences are illustrated in orange.

7.2.5 Lighting

Current lighting conditions were studied and areas needing additional lighting for enhanced safety were identified (Figure 5). Lighting that utilizes renewable technology to demonstrate the University's dedication to sustainability is recommended. Avoiding sharp contrasts between illuminated and unlit areas contributes to an individual's sense of security. Additionally, all new lighting should direct light downwards to minimize light pollution.

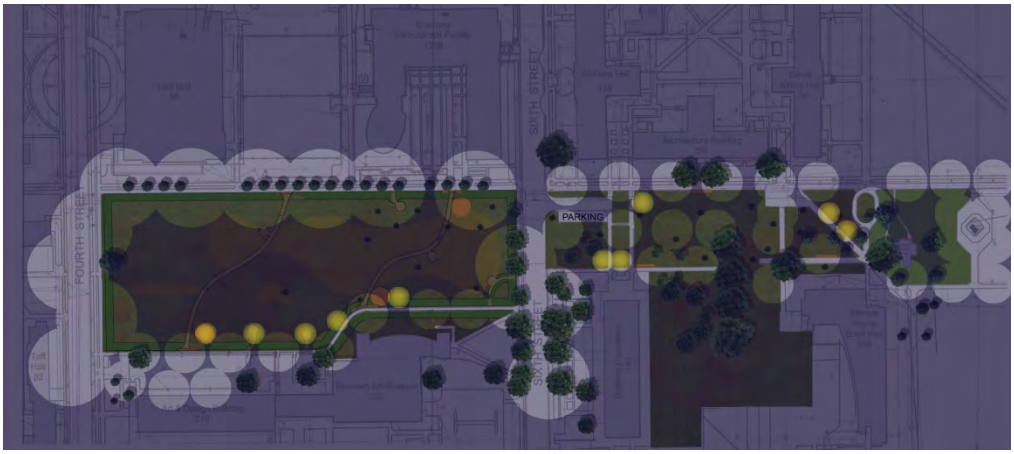

Figure 5. Current lighting and recommended additional solar lighting (yellow) are shown.

7.2.6 Buildings

Current and proposed future buildings on the site were included in the design process. A member of the design team met with the leadership representing each of the campus units around the site to solicit their input and to share information about the design process. The interests and goals of these academic stakeholders were and are vital to the success of the project. Consequently, the final design, implementation, and management of the ***Illinois*** Path should include:

1. Minimal disturbance of the site by future building infrastructure (sewer, electric, chilled water, etc.) and
2. Provision for securely closing outside air dampers at the Krannert Art Museum to eliminate any risk of smoke damage to building contents.

7.2.7 Topography

While subtle, the landscape topography of the site dictates the directional flow of surface water, which impacts erosion during site establishment as well as the ideal location of specific habitat types such as wet-prairie. Currently, the low elevation point (743 ft.) within the prairie and savanna habitats is along the sidewalk on the west side of 4th Street, The highest elevation, 747 ft., lies between 4th Street and 6th Street on the eastern one-half of the site (Figure 6).

For the woodland portion, east of 6th Street, the high and low elevation points depend on the specific boundaries considered. For the most part, the high point is at ~752 ft., near Mumford House, and the lowest point is ~746 ft., near 6th Street. While re-grading will allow for some adjustment to the site's hydrology, aspects of the current topography will increase the difficulty of executing some design alternatives, likely making their implementation prohibitively expensive. Final design recommendations involving elevation characteristics should include:

1. The location of a wetland, if included, should not be located east of 6th Street because of the large landscape depression near the Education building (elevation 740 ft.).
2. The portion between 4th and 6th Streets lends itself to reversing the grading and hydrology, if desired, to allow a wetland or wet prairie at either the east or west end. The future College of Law building will anchor the west end of this section.
3. Sidewalk elevations and re-grading of the site must account for surface flow and potential soil erosion impeding other site functions, such as pedestrian traffic on sidewalks.

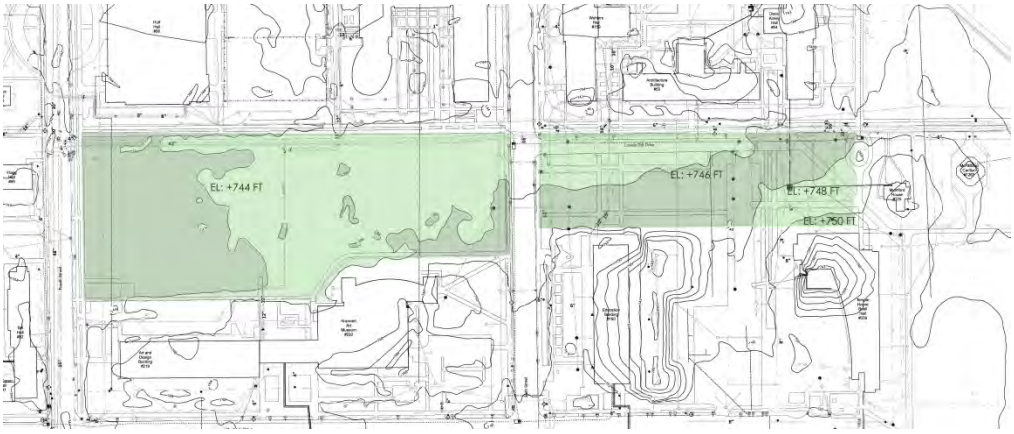

Figure 6. The site's elevation gently decreases to the west.

7.2.8 Soils

The condition of its soils is important to the ready establishment of a healthy native planting. The current site is littered with construction debris from the Business Instructional Facility (mostly gravel) that has been heavily compacted (Appendix A). It needs amendment prior to planting, which can be done when re-grading the site, and protection from injury and erosional loss during future construction.

7.3 Design Study

Informed by the site analysis, primary literature, practitioner advice, stakeholder comments, and the elaborated design principles, themes, and goals, a series of design concepts was generated. These included several design components, orientations, and ultimately generated the final concept and recommendations found in this report.

7.3.1 Play Space

Interim Chancellor Easter asked the group to consider "play" space. The term "play" refers to the inclusion of open green space that could be used for sporting activities

such as Frisbee, soccer, catch, football, etc. As outlined in section 7.2.4, adequate play space is currently present on campus. Nonetheless, design concepts incorporating explicit play space continued to be explored. Section 7.4.1. and 7.4.2 discuss the play space design options in greater detail.

7.3.2 Wetland

The final design recommendation does not include a wetland. This decision was not made lightly. Wetlands were historically one of the most prevalent ecosystems on the Illinois landscape. While a great idea in concept, the wetland idea was modified to wet prairie for the following reasons:

1. An ephemerally wet site is easier to convince potential stakeholders who may be concerned with mosquitoes, trash accumulation, flooding, or other issue associated with standing water. While wetlands are not necessarily wet at all times, these are the concerns that arose frequently during our interviews. Because of stakeholder concern, the possible exclusion of wetlands from the final design was entertained.
2. Cost was also a significant issue. When consulting with technical experts, it became evident that wetlands are among the most expensive ecosystems to properly establish. What often happens is that depressions are dug and plants planted without first establishing the proper hydrology. It can be done, but requires more substantial financial resources and site engineering than a wet prairie. It is also important to note the financial investment is not only an additional up-front cost, but increased maintenance cost is also necessary.
3. A wetland would need to be created on the west end of the Military Axis between 4th and 6th Streets because of the depression near the Education building on the east end. A wetland east of 6th Street would need to be constructed carefully to avoid subsurface hydrology from causing seepage to the depression area or flooding.

The best location for a wetland is the lowest point on site, along 4th Street where the Law building is to be constructed. Re-grading could move this wetland to the east end, however. Merging the construction of the Law building with the wetland could generate a visually impactful design. However, since design of the future Law building is already underway, this option may not be feasible, and if it is, it will certainly involve additional design and engineering costs.

7.3.3 Ecosystem Orientation (woodland/savanna, wetland, prairie)

The first iteration considered is what some stakeholders believe to be the ideal orientation of ecosystems: woodland, savanna, wetland, and prairie. In this scheme, the woodland/savanna would be located on the site near 4th Street with a wetland bordering the savanna to the east. The prairie habitat would be located east of this,

extending to and across 6th Street between the Education and Architecture buildings. This scheme is possible, but not ideal for the following reasons:

1. Woodland along 4th Street would hinder the development of the future College of Law building. Roots of trees that would be planted there would be at serious risk from construction injury. The woodland portion of this scheme could be possible if a design for the Law building was finalized and construction was imminent. With a known building footprint, trees comprising the new woodland could be safely positioned and planted.
2. In keeping with the University's new construction standards for LEED certification, the presence of a woodland adjacent to the Law building will hinder the energy production potential if renewables are to be used in the building.
3. Proposing prairie east of 6th Street is counter productive considering the number of established and mature trees already present at that location. While not necessarily representing the most ideal species, the site has several excellent specimen trees that warrant preservation.
4. One alternative within this scheme is to limit manipulation of the current wooded area east of 6th Street, thereby decreasing the size of the prairie by limiting it a small area west of 6th Street. This alternative compromises the effect of the most affordable and easiest to establish landscape: the prairie. Its visual impact will be compromised by its small size and project resource allocation (the other ecosystems will require greater investments of time and money).

7.3.4 Ecosystem Orientation (prairie, savanna, woodland)

This design scheme, illustrated in Figure 7, became the recommended concept. This concept is discussed in greater detail in section 7.4.2. The reason for advancing this design was that it works best with the current and future landscape conditions with the lowest anticipated cost. This scheme considers a prairie landscape starting along 4th Street moving into a savanna along 6th Street. The woodland is proposed for the portion of the site east of 6th Street because there are already several mature trees in this area. This scheme was advanced, in part, because it:

1. Is the easiest to establish from start to finish, especially since future landscape development east of 6th Street may not be feasible for some time.
2. Accommodates construction of the future law building and works around the utility grid.
3. Minimizes the amount of earthwork necessary for hydrological gradients and proposes a wet prairie (another landscape ecosystem that was historically prominent in this area) to manage surface water flows along a bioswale.

Figure 7. This early design concept organized prairie, savanna, and woodland along a west to east gradient. It became the foundation of the final recommended design.

7.4 Advanced Design Schemes

Two designs, one with and one without play space, were developed in response to design objectives, Chancellor Easter's charge to the team, and stakeholder comments. In these designs, "play" refers to the inclusion of open green space that could be used for sporting activities such as Frisbee, soccer, catch, football, etc. Ultimately the two alternatives were merged to create the final concept.

7.4.1 Design Scheme with "Play" Space

The concept including "play" space includes a small portion of green space along the southern edge, framing the managed natural landscape into a rectangle bordered by sidewalk on three of the four sides (the fourth side being bordered by the green space).

1. This concept utilizes existing hardscape, but will require re-grading of the site. However, unless the site is going to remain in its current state, grading and soil amendments will be necessary even for turf. Species richness on the site is achieved through vegetation selection, which is a diverse mix of grasses, forbs, and woody material.
2. This concept reflects cultural, historical, and ecological processes associated with the site by considering cultural and historical processes that once dominated the Illinois landscape. By incorporating mown burn-breaks through the landscape, this design encourages prescribed fire as part of the management strategy. Ecological processes are restored in the concept through each facet of the design, e.g. the wet prairie swale encourages natural management of site hydrology and water infiltration and species selection facilitates habitat creation, soil stabilization, soil growth, and carbon sequestration.

3. By drawing people into the site and utilizing necessary signage (not shown in the image), this design concept encourages ecological consciousness among all visitors. It is meant to engage the heart, minds, and soul of the community – although its measuring may be difficult until the concept becomes a reality.
4. The concept demonstrates a landscape that embraces the future. Potential building sites have been left clear, which is one of the primary concerns of the University.

7.4.2 Design Scheme Without "Play" Space

After extensive deliberation, the team decided to advance a design that excludes play space (schematic diagram of site progression over 20 years can be found in Appendix D). Key factors in the decision were the proximity of the study site to dormitories and the product of a green space analysis that illustrated how much campus recreation space there was within a walkable range of the dormitories. A managed natural landscape is itself a form of recreation space—an alternative not familiar to most and not found anywhere else on the campus. As this concept was refined, it merged elements of the two concepts together into one.
Figure 8 illustrates the design concept recommended.

The elements of the concept reflect each of our design principles and goals:

1. *Employs simplicity* – The design utilizes easily mown pathways, little new hardscape, slight grading, and two seed mixes. The portion of the site east of 6th Street proposes tree plantings within the current utility grid.
2. *Restores a historic landscape and ecological processes* – The design utilizes native vegetation and a swale to convey and absorb stormwater. The seed mixes and trees combined create two historic and cultural ecosystems.
3. *Encourages ecological consciousness* – The pathways through the site and the educational nodes encourage use of the site. Signage located throughout will encourage comprehension of the restoration process as well as the ecological function the plants and ecosystems serve.
4. *Anticipates change* – The concept responds to the future needs of the campus by leaving potential future building sites free of any major obstructions.

The design incorporates tall- and short-grass seed mixes, a wet prairie swale, woodland, savanna, prairie, educational nodes, and mowed pathways. It utilizes shorter species near paths to create a safe environment for users and add to the depth of the landscape's architecture. Taller species of vegetation will be located toward the center of the site.

Figure 8. The proposed Illinois Path incorporates a diverse mix of prairie species, a wet prairie swale, savanna, woodland, educational nodes, and mown pathways.

Trees are strategically placed to provide shade, habitat, provide a sense of scale, texture, and filtered light necessary for understory plants. The concept outlined focuses on incorporating the woodland to the portion of the site east of 6th Street because of the existing trees. New trees are proposed for planting safely amidst the existing utility grid to build upon the existing canopy architecture.

The mown paths that cross through the site connect access nodes from the north to the south. The wet prairie cuts through these paths adding to the educational component as it carries surface water from the west to east ending in a slight depression on the northeast corner. This feature provides another ecosystem to the site as well as a means of conveying, filtering, and storing stormwater.

Educational nodes are located along the paths and are meant to act as meeting locations, outdoor classrooms, and educational gardens. Features of these sites remain in thought and have not been fully designed on paper, but are conveyed in this report. Combined there should be a variation of seating, vegetative material, and educational components among the nodes.

This design also anticipates future construction of the law building and art building additions by leaving these sites open. While rough, the concept proposes how the site will respond to the future buildings by changes in access and navigation of the site.

The team has prepared an implementation document to accompany this concept. It can be found in Appendix C. It provides the team's recommendations for how the University might proceed with the construction of this site.

8.0 Benefits of This Managed Natural Landscape

8.1 Sustainability

8.1.1 Energy Reduction and Air Quality Improvement

Electricity demand in cities increases by 2 to 4% for each 1° C increase in temperature; this represents 5 to 10% of the current urban electricity demand spent to cool buildings to compensate for the increased temperatures in urban settings (Akbari and Konopacki 2005). Also, nearly one sixth of electricity used in the United States is for air conditioning (Rosenfeld et al. 1998). Reducing outside temperatures may help decrease the quantity of coal burned to generate electricity. By incorporating vegetation within the I***llinois*** Path, overall outside temperature can decrease, allowing for less energy use in the surrounding buildings. This outdoor cooling is caused by evapotranspiration from plants. The more complete a system is, such as grass and shade trees versus only exposed grass, the larger is the cooling effect (Akbari 2002, Shashua-Bar et al. 2011). Natural vegetation also affects the quality of air by removing of O_3, PM10, NO_2, SO_2, and CO. Annual removal of pollutants by trees and shrubs by U.S. urban trees was estimated at 711,000 metric tons and valued at $3.8 billion (Nowak et al. 2006).

8.1.2 Hydrology and Water Quality Improvement

The benefits of managed natural landscapes also include hydrological benefits. Incorporating onsite water management reduces the need for offsite retention basins, thereby decreasing the amount of overland flow of pollution particulates and reducing the cost of basin construction. Precipitation is then reintroduced into the water table by flowing through soil pores created by the deeply penetrating native trees and herbaceous plant roots, an action that improves water quality for the incorporated watershed and reducing overall nonpoint pollution. Retaining water onsite and allowing natural processes to occur have shown benefits to water quality by removing herbicides, metals, and other nutrients such as phosphorous and nitrogen. Extensive documentation and regulatory information is available from the U.S. Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES) (http://cfpub.epa.gov/npdes/stormwater/ swbasicinfo.cfm).

8.1.3 Carbon Sequestration and Reduction

Carbon sequestration by plants can also lead directly to less carbon in the atmosphere. A single young tree averages about 4.6 kg of C per year of sequestration while a large more mature tree averages 11.4 kg of C per year (Akbari, 2002).

Along with the ability of trees and prairie plants to sequester carbon, a large sustainable component of this landscape is the sequestration of carbon into organic material in the soil. Nearly 20% of the atmospheric C fixed by plants is incorporated

into the soil (Angers, 2002). It can be assumed that at one time native tallgrass prairie soils contained 50 g C kg^{-1} in the surface 20 cm of soil (Huggins et al. 1998). Historically, prairie soils in this region often stored as much C below ground as temperate hardwood forests store above ground (Schlesinger 1997). The nature of the vegetation cover, the type of soil, and the climate of the area have a major effect on the C balance and a more complete ecosystem has shown to have larger quantities of soil carbon compared to transformed landscapes (Ellert and Gregorich, 1996).

The more complete a managed natural landscape can be, the more carbon can be stored in this landscape. Across time as the managed natural landscape matures and grows, carbon sequestration will continue. Carbon storage in a forty-year study of a system composed of an old field and forest had a net gain of 10 Mg C ha^{-1} (Johnston et al. 1996) and this may be possible with the ***Illinois*** Path.

The combined benefits of C sequestration along the ***Illinois*** Path and reduced C emission resulting from altered management activities (reduced mower usage for example) were estimated. The primary literature provided information for the Net Primary Production (NPP) measured in a range of natural and highly managed ecosystems. Accumulation of C within soils is dependent on the removal of C from the atmosphere via photosynthesis (NPP) (Figure 9). For an oak savanna similar to that proposed for ***Illinois*** Path, NPP was estimated at 4.9 Tg C ha^{-1} yr^{-1} and the annual soil C input was estimated at 2.2 Tg C ha^{-1} yr^{-1}. The three recommended habitat areas are

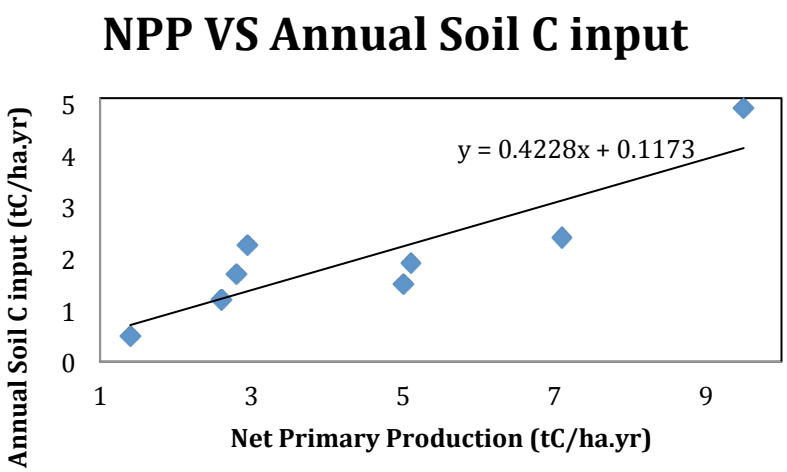

Figure 9. Carbon sequestration in soil is correlated with net primary productivity, a measure of photosynthetic C acquisition from the atmosphere.

0.58, 0.36, and 0.38 ha respectively for prairie, savanna, and woodland and their combined annual C sequestration rate is estimated at 1.35 Tg C ha^{-1} yr^{-1} following the approaches described by De Nobil et al. (2009) and Ahmet (2010).

8.2 Human and Community Health

Our design allows students, faculty and staff contact with the natural world in ways that promote the overall health of the campus community. It allows not only for visual contact with nature, but for interactions with nature in more direct ways. Students can stroll through the area, dash through on the way to class, walk through at their leisure, jog around the perimeter as part of an exercise routine, or simply sit in a peaceful, natural setting and enjoy the sun (in winter) or the shade (in summer). Staff can eat lunch or take a few minutes to enjoy nature during their breaks or after work. Faculty can interact with students in a relaxed atmosphere or find innovative ways to utilize meeting space during class. This ability to be in nature throughout the day and across the seasons provides health benefits to the entire campus community (Velarde et al. 2007, Abram et al. 2010, Bowler et al. 2010, Largo-Wright et al. 2011, Tsoulas and Greening 2011).

8.2.1 Physical Benefits

Sedentary lifestyles are a contributing factor in the worldwide obesity epidemic (World Health Organization, 2002). Children between the ages of 8 and 18 years of age spend an average of nearly 6.5 hours a day with electronic media (Roberts et al. 2005). College students likely spend even more time in front of a screen. The consequent obesity is associated with numerous health problems, including diabetes, sleep apnea, high blood pressure and cardiovascular disease (Bell et al. 2008). Greener neighborhoods may help solve this costly health crisis by providing opportunities for greater physical activity. (Ewing et al. 2003, Jackson 2003, Humpel et al. 2004, Pretty et al. 2007). Our design intentionally encourages healthy physical activity. Trails crossing the site permit easy, though not necessarily direct, access to classroom buildings.

8.2.2 Cognitive Benefits

The cognitive benefits of green space should be of great interest to university policy makers. The pattern of the literature suggests that more exposure to nature can benefit cognitive functioning and attention (Faber Taylor et al. 1998, Wells 2000). Recent research has shown that views from the windows of high schools are associated with academic performance of the students (Matsuoka 2010). Matsuoka (2010) suggests the impact of views on students is so significant that "the landscape should not be considered just an aesthetic amenity, but as important as the school buildings themselves." One important finding of the study significantly impacted our design. Landscapes lacking trees and shrubs (large expanses of lawn or parking lots, for example) are negatively associated with student performance. A view of an athletic field or an undifferentiated prairie is not going to do the trick. For that reason, among others, we determined an athletic field was incompatible with the kind of natural area that would maximize cognitive benefits to the university population. Similarly, we

eliminated a prairie-only design partly because it likely would not provide the cognitive benefits shown in the study.

8.2.3 Benefits to ADHD Students

Attention-Deficit Hyperactivity Disorder (ADHD) may affect up to 8% of the college population (DuPaul et al. 2009, Weyandt and DuPaul 2008). Attention Restoration Theory (Kaplan, 1995) proposes that exposure to natural environments can improve attention by restoring fatigued directed attention (fatigued by prolonged and intense use). A recent study by Faber Taylor and Kuo (2008) further suggests that children with ADHD were better able to concentrate after a walk in a park than after a walk in a neighborhood or a downtown setting. The effect was as large as the effect of an extended-release methylphenidate, a common pharmaceutical treatment for ADHD. While there are many unanswered questions about the result of this research, there are grounds for suggesting that college students with ADHD could also improve concentration after a walk in our natural landscape.

8.2.4 Psychological Benefits

The most recent data collected by the American College Health Association indicates depression is a major psychological condition for college students (Buchanan 2011). Specific data from the survey reveal the severity of the problem. Nine percent of students reported seriously considering suicide at least once during the previous school year. Sixty-two percent reported feeling hopeless (indicating they may be at risk for depression) at least once during the previous school year. While additional green space will not solve the very complex problem of student depression, the psychological benefits of green space are well documented (Ulrich 1984, Kaplan and Kaplan 1989, Rubenstein 1997, van den Berg et al. 2010). Wells and Evans (2003) suggest nature may moderate the effects of life stress on children:

> "The psychological effects of stressful life events such as family relocation, being picked on or punished as school, or being subject to peer pressure varied depending on the amount of nearby nature to which the children, aged 6 to 12 had access."

Access to green space has also been associated with a decreased risk of mental health problems in Scandinavia and the Netherlands (de Vries et al. 2003). Some have suggested that certain design features (including variety of spaces, prevalence of green material, encouragement to exercise and minimal intrusions) should be incorporated into green space to improve the psychological benefits (Larson and Kreitzel n.d.). While the research evidence supporting such features is not especially strong, we have incorporated these features into our design nevertheless.

8.2.5 Social Benefits

Kuo (2003) found green spaces are associated with healthier social interactions (more social interactions, stronger social ties, lower levels of graffiti, fewer violent crimes, among others). Similarly, Kim and Kaplan (2004) found a positive correlation between urban green space and residents' feelings of attachment towards the community and their interactions with other residents. Faber Taylor et al. (1998) found similar improved social interactions among children in green spaces. Our design incorporates elements (outdoor classroom space, casual meeting space) that should encourage those positive interactions (Sullivan et al. 2004, Nordh et al. 2009).

9.0 Education and Innovation

9.1 Interactive research space

The campus has interactive research space dedicated to crops, animal husbandry, art and more, but how many of these spaces are readily accessible and actively encourage use? ***Illinois*** Path offers a research space that is, at our suggestion, open and interactive. This is a space designed to facilitate research, but also transcends this by allowing visitors to interact with the space by reading signs, feeling the rough texture of compass plant, smelling the mountain mint, or studying the hummingbird moth that seek out this space as a refuge from the city and the cornfields of Illinois agriculture. The ***Illinois*** Path, in concept, is a space that is an interactive learning laboratory for all to experience.

9.2 Classroom Opportunities

In addition to research, this space offers interactive classroom opportunities, such as growing plant material, site maintenance and management techniques, planning and executing site modifications, spreading seed, and planting plugs and trees. These are activities that will likely endure as long as the site exists. The University has the facilities to execute such activities. This site offers students the chance to learn hands-on and follow a project from start to finish, an experience that will provide students with an edge in the job marketplace.

9.3 Trans-disciplinary and multi-disciplinary explorations of research

A landscape such as this on campus offers several trans-disciplinary research opportunities. As ecological processes and sustainability play an increasingly important role in education, corporate image, business practices, and our daily lives, a landscape such as this no longer appeals to just academics in the natural resources fields, opening up opportunities for research collaboration between several fields. A managed natural landscape on campus presents a hands-on, interactive research site in the heart of campus, much like the Morrow Plots.

9.4 Initiates a new ecological mindset

The addition of a managed natural landscape on campus also nurtures a new ecological mindset for campus users and helps portray an ecologically conscious image for the University. This project is tangible, an ecological statement for the University that all will see. A project such as this will aid outreach to students and faculty that want to be at a school where sustainability is important. A project such as this can be used as a teaching tool for current faculty using sustainability and ecological principles as course material. A project such as this is not a lecture or slide series on ecology, it is ecology and a place students, faculty, staff, and the community can go to witness it and learn from it.

10.0 Future Sustainability

10.1 Expectations of Growth

As the campus changes over time, incorporating new buildings and infrastructure, the natural landscape must be able to adapt (Figure 10). New pathways may need to be built to navigate between new buildings. New ways to engage students and their needs may become apparent over time. It is important that the landscape be able to evolve with the physical and social changes that occur in the future. Extending the ***Illinois*** Path eastward to intersect with Illini Grove illustrates the opportunity to generate green corridors that interconnect elements of the campus community with nearby neighborhoods.

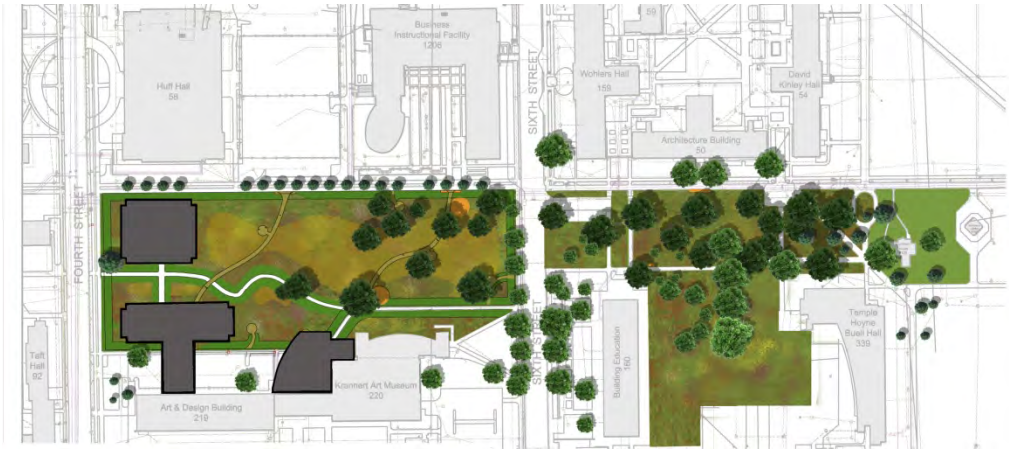

Figure 10. Future campus growth is accommodated by the design.

11.0 Opportunities and challenges

11.1 Challenges and Concerns

Locating a managed natural landscape in the center of a major university campus presents certain challenges that must be addressed with careful and thoughtful

planning and management. Reducing potential safety risks to our campus community was of paramount importance in the recommended design.

11.2 Human Safety and Campus Security

The long-standing debate of whether there is a correlation between highly vegetated landscapes and the occurrence of crime is one that needs to be explored through a few constituent issues: fear, fear of crime, fortress mentality, and actual statistical incidence of criminal acts in areas having dense vegetation. Research shows that densely vegetated areas offering limited visibility of the entire vicinity do, in fact, trigger responses of fear in many people present or within view of these areas. This is a response that has been common in people for centuries, in one case, leading to a decree to keep vegetation cleared along publicly travelled roads in 13th Century England (Kuo and Sullivan 2001). The fear instinct is caused by the perception that there may be unknown threats hidden from their view. If considered independently of other contextual elements, this seems to indicate the responsible action is to remove vegetation occurring near walkways or areas used by people on campus. Yet, there are several other factors that determine the safety of public areas. The presence of other people, for example, has a powerful self-policing effect on a given area, since criminals will generally avoid areas where they can be seen and potentially caught (Crewe 2001). Furthermore, people often sense the lack of other people present in a landscape signals an increased threat to their own safety. Considering opportunities to create places that are sources of activity generation can contribute to a landscape being used more frequently and by more people, enhancing safety through continued widespread use by people (Luymes and Tamminga 1995).

Fear is an element that can contribute significantly to conditions that create the very threat that is the source of the initial fear. If students and staff were afraid to occupy or utilize portions of the campus, their absence would certainly result in some measure of diminished security. Because of this relationship, it is of great importance to address the issue of fear as it bears on the subject of campus landscapes. The perceptions must be managed in such a way that fears can be allayed and people can feel comfortable using the landscape. Specific design principles have been employed to improve the way a landscape is perceived and ultimately used. These are typically articulated as Crime Prevention Through Environmental Design (CPTED), developed by the International CPTED Association and promoted by the National Crime Prevention Council (NCPC 2006). The primary areas of focus of CPTED are: Natural Surveillance, Natural Access Control, Territorial Reinforcement, and Maintenance.

11.2.1 Principles of Crime Prevention Through Environmental Design (CPTED)

1. **Natural Surveillance** is the desired state of a landscape where the people who occupy the space have a clear view of all others people within the given area. The consideration of visibility must be considered when planning the

types of vegetation used and their specific location relative to sight lines, buildings, walkways and streets.

2. **Natural Access Control** involves the thoughtful and deliberate way the walkways and other landscape element guide people though the landscape in an orderly and logical manner, with consideration given to particular areas that may create conditions of lower security.
3. **Territorial Reinforcement** is achieved by creating conditions in the landscape that clearly define public and private areas, allow the users of the landscape to feel welcome and have a sense of belonging in the area. The presence of people actively using the space creates a territorial space that is less likely to be targeted by criminals due to the increased chance that they cannot remain hidden from many observing eyes of the public.
4. **Maintenance** is important in the safety within landscapes as well as buildings. A landscape or building that is regularly maintained and kept to a high standard of order and cleanliness will aid in the safety. When property is in poor condition or generally neglected, it send a message to people that it is not being monitored.

11.2.2 Safer Landscapes with Planning and Design

There are a host of design strategies that can be implemented after developing an understanding of some of the basic requirements that must exist for crimes to occur. At the most basic level, there must be the presence of a criminal and a victim along with the absence of an effective authority able to interrupt the crime or apprehend the criminal. Along with these necessary requirements, the criminal will often evaluate whether the benefits of a particular crime are worth the associated risk and effort. The objective through design is to raise a criminal's perceived level of effort and risk by providing spatial and visual cues that communicate to the criminal that the landscape is either too well monitored or that it provides too few places of concealment or escape. We can utilize this knowledge through a wide range of design steps that, if considered in the early phases of planning, can be affordable and effective tools in deterring crime. Decisions as simple as the location and size of a tree can assist in creating a landscape that is welcoming without presenting opportunities for concealment or loss of visual communication between people using the landscape. Larger trees with canopies well above the human sight lines are safer than vegetation that has a predominant density in the zone between the ground plane and the human lines of sight, such as hedges and shrubs (Donovan and Prestemon 2010). Locating prairie and savanna plant species that are taller in stature well away from walkways is also an easy and effective way to increase both the security and the psychological comfort level of pedestrians. Fortunately, by creating buffer zones between pedestrian walkways and the natural landscapes, we can also achieve the appearance of a landscape that is planned, deliberate and intentional (Figure 11). When a landscape is thought of as deliberate, it communicates a message that it is maintained and monitored, which is also a common goal outlined by the maintenance principle of CPTED.

In addition to the research of academic literature, we also interviewed law enforcement officers, students, faculty and staff on other university campuses. The overwhelming response received was positive. Among those interviewed, none had the impression that the natural landscape on their campus detracted from their safety. Two students from Northeastern Illinois University (NEIU), an urban campus situated in Chicago, emphasized the last mugging on campus had occurred far from the naturally landscaped part of campus. During a phone interview with NEIU police officer, Lt. India Moore, she informed us that, "There have been no crime in the natural areas at all. There have been incidents on other parts of campus." Rick Matus, the Safety Coordinator for the Facilities Management unit at NEIU, shared that sidewalks through the natural areas are well lighted at night and there is a 15 foot mown grass boundary between walkways and the natural landscapes. The Grounds Foreman at NEIU shared some of his insights:

> "Security was an early initial concern with the natural landscape, but the species of plants were not changed as a result. They notified the campus police and security staff about what was going to happen with the landscape, so they could be aware of any additional risks. None of the dangers have transpired. Grounds crews will occasional find a wallet or purse that was thrown into the tall grass, but they also find them in trashcans around campus as well. No effort was made to keep the tall grasses toward the middle of the areas and away from the edges."

Figure 11. The Northeastern Illinois University managed natural landscape provides a good example of a turf buffer between the pathway and the native landscape.

11.2.3 Management with Prescribed Fire

Illinois prairie and savanna plant species are historically adapted to regular and frequent burns (Anderson 2006, Grant et al. 2010). The primary literature indicates, and interviews with landscape planners and managers confirm, the use of prescribed fire as a management tool is the best way to maintain healthy and safe native landscapes. Annual burns improve safety by keeping leaf litter and fuel levels low at all times, both reducing the fire intensity during planned burns as well as reducing the dangers of an unplanned or accidental burn. All of those interviewed about the use of fire to manage landscapes expressed their view that it is difficult to start a fire in these landscapes either accidentally or intentionally. Figure 12 demonstrates a prescribed burn on the Northeastern Illinois University Campus.

Figure 12. Northeastern Illinois University students actively participate in maintaining their campus prairie, including the use of prescribed fire.

The prairie and savanna landscapes on the NEIU campus are managed by prescribed fire. Dr. Erick Howenstine, Department Chair of Geography and Environmental Studies at NEIU, said his department and the Biology Department at NEIU work together to manage the natural landscapes and plan the prescribed burns. He admitted that while they would like to conduct burns annually, sometimes weather and other conditions do not cooperate. The planning for a prescribed burn on an urban campus involves informing the appropriate personnel and obtaining the necessary state and city permits and even obtaining aldermanic approval. The police and fire departments are notified as well as all of the surrounding residents. Students are informed so they can participate in the event if they want to learn how prescribed

burns are safely performed and the amount of precautions that must be taken. Wind conditions are watched closely.

Where fire risks are determined to be too high, landscape managers may use alternative management tools such as grazing or mowing to maintain native landscapes. While these are often more labor and resource intensive, they have been used to effectively manage natural landscapes.

12.0 Regulatory Requirements

The following environmental regulatory requirements apply to the ***Illinois*** Path project. Refer to Appendix B for a complete discussion of the applicable regulatory requirements and the associated regulatory materials.

12.1 Storm Water Pollution Prevention

Construction sites larger than 1 acre must submit a Notice of Intent (NOI) for permit coverage, and, develop and implement a Storm Water Pollution Prevention Plan (SWPPP) pursuant to the University's Clean Water Act National Pollution Discharge Elimination System (NPDES) permit. The SWPPP identifies potential construction site pollution and prescribes soil erosion control methods to reduce storm water pollution.

12.2 Prescribed Burning / Open Burning

Prescribed burning is defined as the planned application of fire to naturally occurring vegetative fuels under specified environmental conditions and following appropriate precautionary measures, which causes the fire to be confined to a predetermined area and accomplish the planned land management objectives. If prescribed burns are chosen as a management tool at the ***Illinois*** Path, the University must obtain an open burning permit from the Illinois Environmental Protection Agency, adhere to Illinois prescribed burning requirements, and observe applicable City of Champaign ordinances.

12.3 Facility Standards

The University of Illinois at Urbana-Champaign Facility Standards includes design requirements that are unique to the Urbana campus. The Architect/Engineer intends the Facility Standards for use during Contract Documents development. The relevant Facility Standards applicable to the ***Illinois*** Path project include sections on Crime Prevention; Lighting, Exterior; Planting and Landscape; and Streets, Sidewalks and Bicycle Paths.

12.4 Americans with Disabilities Act (ADA)

The ***Illinois*** Path must comply with the Illinois Accessibility Code. The purpose of the Illinois Accessibility Code is to ensure that the built environment, including all spaces and elements of all applicable buildings and facilities in the State of Illinois, are designed, constructed, and/or altered to assure the safety and welfare of all members of society and to be readily accessible to, and usable by, environmentally limited persons.

13.0 Acknowledgments

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Content of Appendices

Appendix A - Soil Analysis

Bulk soil samples were collected from the open space extending between 4th Street and 6th Street. Future prairie and savanna habitats will be located on this portion of the project site. Soil samples were collected and evaluated by Matthew Rundquist, NRES undergraduate student, using facilities and equipment kindly provided by Dr. Robert Darmody. The paint chip method was used to estimate % organic matter.

Sample	Volume (ml)	Gravel Volume (ml)	Mass (g)	Gravel Mass (g)	Mass Less Gravel (g)	Bulk Density Less Gravel (g ml^{-1})	% Gravel (Volume)	% Sand	% Silt	% Clay	Texture Class	% Organic Matter
1	347.5	19.6	544.5	46.3	498.2	1.52	5.64	20	55	25	Silt loam	3.5
2	347.5	19.9	531.5	44.3	487.2	1.49	5.73	32	44	24	Loam Gravelly coarse sandy	3.5
3	347.5	117.5	706.6	297.6	409.0	1.78	33.81	70	20	10	Loam	1.5
4	347.5	19.1	476.0	41.1	434.9	1.32	5.50	15	60	25	Silt loam	3.5
5	347.5	51.2	473.7	144.4	329.3	1.11	14.73	32	44	24	Silt loam	4.0

Appendix B - Relevant Regulations Available on Supplemental CD

Introduction:	Regulatory Requirements Discussion
Document 1:	Storm Water Pollution Prevention Plan (SWPPP) Template
Document 2:	Storm Water Permit Application
Document 3:	Soil Erosion and Sedimentation Control Facility Standards
Document 4:	Environmental Requirements Site Enforcement Facility Standards
Document 5:	MS4 Storm Water General NDPES Permit No. ILR40
Document 6:	General NPDES Permit for Storm Water Discharges from Construction Site Activities
Document 7:	Illinois Prescribed Burning Act [525 Illinois Compiled Statutes 37 (525 ILCS 37/)]
Document 8:	The Illinois Prescribed Burning Act [17 Illinois Administrative Code Section 1565 (17 Ill. Adm. Code 1565)]
Document 9:	Champaign Code of Ordinances Chapter 35 Section 35
Document 10:	The Illinois Environmental Protection Agency (IEPA) Standard Conditions for Open Burning Permits
Document 11:	Certified Prescribed Burn Manager Application
Document 12:	Open Burning Permit Application
Document 13:	Crime Prevention Facility Standards
Document 14:	Lighting, Exterior Facility Standards
Document 15:	Planting and Landscape Facility Standards
Document 16:	Approved Plant List
Document 17:	Streets, Sidewalks and Bicycle Paths Facility Standards
Document 18:	Illinois Accessibility Code Requirements for Public Facilities, New Construction

Introduction: Regulatory Requirements Discussion

As with any construction project on campus, the University must comply with Federal, State and local regulatory requirements. The following section discusses the environmental regulatory requirements that must be fulfilled in the planning, construction and maintenance phases of the ***Illinois*** Path project.

B.1 Storm Water Pollution Prevention

The University of Illinois holds a Clean Water Act (CWA) Municipal Separate Storm Sewer System (MS4) Permit with the Illinois Environmental Protection Agency (EPA). The permit allows the University to discharge water from campus storm sewers into receiving streams. Run off from construction activities, including uncontrolled dirt, debris and other construction wastes are a major source of pollution to state surface waters. The best ways to control storm water runoff from a construction site is through the use of Best Management Practices (BMPs). The University has a Storm Water Management Program that is composed of BMPs that are designed to reduce pollutants, protect water quality, and satisfy MS4 annual permit requirements.

The National Pollution Discharge Elimination System (NPDES) permit requires construction sites larger than 1 acre to write and implement a Storm Water Pollution Prevention Plan (SWPPP). The Division of Safety and Compliance (S&C) within Facilities & Services has developed a SWPPP template for use by the Professional Services Consultant (PSC). The SWPPP template can be found in Document 1 available on the supplemental CD. The purpose of the SWPPP is to identify potential sources of pollution from the construction site that may affect water quality. The Plan describes soil erosion control methods that the contractor will utilize on site to reduce storm water pollution.

The University's General NPDES Permit No. ILR40 requires six control measures as part of the storm water management program. The ***Illinois*** Path will assist the University in achieving compliance with the Public Outreach and Education portion of this requirement which requires the University to provide educational materials regarding, among other activities, green infrastructure strategies such as green roofs, rain gardens, rain barrels, and bioswales that mimic natural processes and direct storm water to areas where it can be infiltrated.

To comply with the Storm Water Pollution Prevention regulations, the following documents are required:

1. SWPPP – The PSC writes the SWPPP according to the template provided by S&C. The contractor completing the work on the ***Illinois*** Path is required to implement and maintain the engineering practices documented in the SWPPP.

2. Storm Water Permit Application – The Facilities & Services Project Coordinator assigned to the ***Illinois*** Path project will be required to complete the Storm Water Permit Application. The Division of Safety and Compliance will use the information on the application to submit a Notice of Intent (NOI) to the Illinois EPA. The Storm Water Permit Application is found in Document 2 available on supplemental CD.

The following regulatory requirements applicable to storm water protection are found in Documents 3-6:

1. Soil Erosion and Sedimentation Control Facility Standards (Document 3 on supplemental CD)
2. Environmental Requirements Site Enforcement Facility Standards (Document 4 on supplemental CD)
3. MS4 Storm Water General NDPES Permit No. ILR40 (Document 5 on supplemental CD)
4. General NPDES Permit for Storm Water Discharges from Construction Site Activities (Document 6 on supplemental CD)

B.2 Prescribed Burning / Open Burning

The following regulatory requirements applicable to prescribed burning / open burning are found in Documents 7-10:

1. Illinois Prescribed Burning Act [525 Illinois Compiled Statutes 37 (525 ILCS 37/)] (Document 7 on supplemental CD)
2. The Illinois Prescribed Burning Act [17 Illinois Administrative Code Section 1565 (17 Ill. Adm. Code 1565)] (Document 8 on supplemental CD)
3. Champaign Code of Ordinances Chapter 35 Section 35 (Document 9 on supplemental CD)
4. The Illinois Environmental Protection Agency (IEPA) Standard Conditions for Open Burning Permits (Document 10 on supplemental CD)

Each of the regulatory requirements listed above contain conditions that must be met by the University in the event prescribed burns are chosen as a management tool at the ***Illinois*** Path. Please refer to the Prescribed Burning Regulations found in Documents 7-10 for the full text of the regulations. A summary of the applicable requirements is as follows:

B.2.1. Illinois Prescribed Burning Act [525 Illinois Compiled Statutes 37 (525 ILCS 37/)]

According to the Illinois Prescribed Burning Act [525 Illinois Compiled Statutes 37 (525 ILCS 37/)], prescribed burning is a land management tool that benefits the safety of the

public, the environment, and the economy of the State. "Prescribed burning" is defined as the planned application of fire to naturally occurring vegetative fuels under specified environmental conditions and following appropriate precautionary measures, which causes the fire to be confined to a predetermined area and accomplish the planned land management objectives. The purpose of the Prescribed Burning Act is to authorize and to promote the continued use of prescribed burning for ecological, forest, wetland, wildlife management, and grassland management purposes.

1. The General Assembly finds that most of the State's natural communities require periodic fire for maintenance of their ecological health. Prescribed burning is essential to the perpetuation, restoration, and management of many plant and animal communities. Significant loss of the State's biological diversity will occur if fire is excluded from these fire-dependent communities.
2. Proper training in the purposes, use, and application of prescribed burning is necessary to ensure maximum benefits and protection for the public.
3. A public education program is necessary to make citizens and visitors aware of the public safety, natural resource, and economic benefits of prescribed burning and its use as a land management tool.
4. Before conducting a prescribed burn under this Act, the University will be required to:
    a. Obtain the written consent of the landowner.
    b. Have a written prescription approved by a certified prescribed burn manager.
    c. Have at least one certified prescribed burn manager present on site with a copy of the prescription while the burn is being conducted.
    d. Notify the local fire department, county dispatcher, 911 dispatcher, or other designated emergency dispatcher on the day of the prescribed burn.
    e. Make a reasonable attempt to notify all adjoining property owners and occupants of the date and time of the prescribed burn.

B.2.2. The Illinois Prescribed Burning Act [17 Illinois Administrative Code Section 1565 (17 Ill. Adm. Code 1565)]

The Illinois Prescribed Burning Act contains regulations regarding prescribed burning program implementation, burn prescription standards and provisions for conducting prescribed burns.

Under this act, Prescribed Burning is defined as the planned application of fire to naturally occurring vegetative fuels, under specified environmental conditions and following appropriate precautionary measures that causes the fire to be confined to a predetermined area and accomplishes the planned land management objectives.

Certified Prescribed Burn Manager:

1. Certified Prescribed Burn Manager: A certified prescribed burn manager is

required to write and/or approve burn prescriptions, serves as the direct supervisor of the burn personnel at the scene of a prescribed burn and is responsible for implementing a burn prescription, and supervises and trains an apprentice prescribed burn manager. The Illinois Prescribed Burning Act outlines the requirements necessary to become a Certified Prescribed Burn Manager as well as an Apprentice Prescribed Burn Manager.

Burn Prescriptions:

1. The burn prescription is required to include the following information:
    a. A site name or other designation for the prescribed burn area.
    b. Location of the prescribed burn, including county, civil township, township range and section, and a map showing the location of the burn, firebreaks, hazards, staging area and other features specific to the execution of the burn.
    c. The name, address and phone number of the owner or manager of the land where the burn is to take place.
    d. The time frame when the prescribed burn is to take place.
    e. The purpose and objectives for the prescribed burn.
    f. A description of the area to be burned, including, but not necessarily limited to, size in acres, fuel type, topography, known presence of endangered or threatened species, and presence of peat or high organic soils and mitigation measures to prevent or control ignition of those soils.
    g. The range of acceptable pre-ignition weather factors, including, but not limited to, air temperature, relative humidity, wind direction and wind velocity.
    h. The minimum number of burn personnel required.
    i. An outline of smoke sensitive areas and smoke mitigation methods.
    j. The equipment required, other than standard hand tools.
    k. A communication plan and equipment for the prescribed burn.
    l. A method of fire line construction.
    m. Copies of required permits.
    n. Plans for making notifications.
    o. Contingency plans for escaped fires, including water sources, rendezvous location for fire departments and paramedics, other fire fighting resources available, vulnerable infrastructure, escape routes and safety zones.
    p. Emergency contact information, including, at a minimum, the closest intersection, fire, paramedic and police emergency and non-emergency dispatch contact information.
    q. Name, certificate number and contact information for the certified prescribed burn manager approving the burn prescription.
    r. A signature of a certified prescribed burn manager approving the burn prescription and the date of the signature.
    s. The signature of a landowner approving the use of prescribed burning on the property.

Notifications and Permits:

1. The certified prescribed burn manager is responsible for making a reasonable attempt to notify all adjoining landowners and occupants of the approximate time and date of the burn.
2. On the day of the burn, the certified prescribed burn manager is required to notify the local fire departments, county dispatcher, 911 dispatcher or the University of Illinois Public Safety Office.
3. Furthermore, the certified prescribed burn manager is responsible for insuring that all local, State and federal permits that are needed are obtained before a prescribed burn is conducted.

Conducting Prescribed Burns:

1. A certified prescribed burn manager shall be present at the scene of all prescribed burns to ensure the safety of personnel and the public.
2. The certified prescribed burn manager is responsible for reviewing and implementing the burn prescription, reviewing it with the burn personnel and the timely completion of the prescribed burn report.
3. The certified prescribed burn manager shall discuss emergency procedures and plans with burn personnel and modify procedures and contingency plans if necessary.
4. In the case of an escaped fire, the certified prescribed burn manager or his or her designee shall assess burn personnel status, contact outside agencies if necessary, and share information (e.g., aerial photos, burn prescription, resources available and access routes) with other agencies at the scene.

Records and Reporting:

1. After each prescribed burn, the certified prescribed burn manager for the burn must submit a prescribed burn report.
2. The certified prescribed burn manager shall maintain a file of all prescribed burn prescriptions and prescribed burn reports for completed burns for a period of not less than five years after the completion of a burn.
3. A prescribed burn report must include:
    a. A copy of the prescribed burn prescription.
    b. A map showing the area actually burned, control lines, wind direction, fire mosaic and other features specific to the execution of the burn.
    c. The date and time the prescribed burn took place, including ignition time, time of significant events and final mop up time.
    d. An evaluation of the burn, including a discussion of meeting burn objectives, changes or deviations from the prescribed burn prescription, injuries or damage to property if any, any emergency actions taken and other significant events.
    e. An evaluation of the performance of any apprentice prescribed burn manager that served on the burn.
    f. The pre-ignition weather factors and any other weather observations

collected to verify conditions were within the burn prescription.

g. The number of burn personnel involved.
h. Documentation of all notifications and permits obtained.
i. Information on any fire, paramedic and police emergency agencies that were requested and arrived on scene.
j. Name, certificate number and contact information for the certified prescribed burn manager.
k. A dated signature of the certified prescribed burn manager and any apprentice prescribed burn manager serving at the burn.

Certified Prescribed Burn Manager Application:

1. The Certified Prescribed Burn Manager Application is located in Document 11 on supplemental CD.

B.2.3. Champaign Code of Ordinances Chapter 35 Section 35

The Champaign Code of Ordinances outlines the requirements applicable to prescribed burning. According to the ordinance, no person shall cause or permit burnings of an alternative landscape on his/her property unless the following conditions are met:

1. Firebreaks are in place of a minimum ten (10) feet from wooden fences, trees, vehicles or other combustible objects to contain the prescribed burn.
2. Acceptable weather conditions as determined by the Fire Chief exist, including winds of less than fifteen (15) miles per hour.
3. The permit holder or agent has been issued an open burning permit from the Illinois Environmental Protection Agency for the burning.
4. Written permission from the Champaign Fire Chief has been issued, including a prescribed time for burning to allow oversight by Fire Department personnel.
5. Provision for adequate manpower and tools to control the burn are present.
6. Access to a water source adequate to control the burn is present.

B.2.4. The Illinois Environmental Protection Agency (IEPA) Standard Conditions for Open Burning Permits

The Illinois Pollution Board and the IEPA regulate open burning. The IEPA issues open burning permits for Prairie and Ecological Landscape Burns. The application can be found in Document 12 on supplemental CD. There are no fees associated with IEPA Open Burning Permit applications.

If the open burning application is approved, the permit contains seventeen Standard

Conditions (unless superseded by special permit conditions) including:

1. The open burning site shall be established on a cleared area and access by unauthorized personnel shall be restricted.
2. The open burning site shall be provided with adequate fire protection and with such equipment as is necessary to control the fire. Open burning shall be conducted with appropriate safety conditions.
3. Materials to be open burned are expressly limited to those stated in the application for a permit to open burn and shall be confined to the smallest possible area.
4. The materials used to promote combustion shall be of no lesser quality than number 2 fuel oil.
5. The open burning of any material capable of producing obnoxious odors or emitting an excessive amount of particulate matter is expressly forbidden.
6. Open burning shall be conducted only between the hours of 8:00 AM and 4:00 PM during those months that Central Standard Time is in effect and 9:00 AM and 5:00 PM during those months Central Daylight Savings Time is in effect.
7. Open burning shall be conducted only when the wind velocity exceeds 5 miles per hour.
8. Open burning shall be conducted in such a manner as to not create a visibility hazard on roadways, railroad tracks or airfields.
9. Open burning conducted under this permit shall be supervised at all times.
10. Ashes, residue, etc., shall be disposed on in a manner consistent with requirements of the Environmental Protection Act and regulations promulgated thereunder.
11. If this permit is for open burning of landscape waste with the aid of an air curtain destructor or comparable device, the following additional conditions shall apply:
    a. access to the burning site shall be restricted to prevent the dumping of refuse or waste; and
    b. the operation and maintenance of the air curtain destructor or comparable device shall be in accordance with the manufacturer's instructions.
12. The Agency has issued this permit based upon information submitted by the permittee in the permit application. Any misinformation, false statement or misrepresentation in the application shall be grounds for revocation.
13. There shall be no deviations from the approved application unless a written request for a revised permit has been submitted to the Agency and a revised written permit issued.
14. The permittee shall allow any duly authorized agent of the Agency upon the presentation of credentials, at reasonable times to:
    a. enter the permittee's property where actual or potential effluent, emission or noise sources are located where any activity is to be conducted pursuant to this permit,
    b. have access to and to copy any records required to be kept under the

terms and conditions of this permit,

c. inspect the open burning authorized under this permit, or any equipment required to be kept, used, operated, calibrated and maintained under this permit,
d. obtain and remove samples of any discharge or emission of pollutants, and
e. enter and utilize any photographic, recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring or recording any activity, discharge or emission authorized by this permit.

15. This permit is subject to revision by the Illinois Environmental Protection Agency as deemed necessary to fulfill the intent and purpose of the Environmental Protection Act and regulations promulgated thereunder.
16. The issuance of this permit covers open burning taking place on or after the effective date of the permit. The issuance of this permit does not cover and in no way condones or approves open burning which took place before the effective date of the permit.
17. The issuance of this permit:
    a. shall not be considered in any manner affecting the title of the premises upon which the permitted open burning is conducted,
    b. does not release the permittee from any liability for damage to person or property caused by or resulting from open burning,
    c. does not release the permittee from compliance with other applicable statutes and regulations of the United States, of the State of Illinois, or with applicable local laws, ordinances or regulations,
    d. does not take into consideration or attest to the structural stability of any equipment or facilities associated with the open burning,
    e. in no manner implies or suggests that the Agency (or its officers, agents or employees) assumes any liability, directly or indirectly, for any loss due to open burning.

B.3. Facility Standards

The University of Illinois at Urbana-Champaign Facility Standards were updated in July 2010 to include the most up to date design requirements for the Urbana campus. The Architect/Engineer intends the Facility Standards for use during Contract Documents development. These Standards contain information that is unique to the Urbana campus. Full text versions of the applicable Facility Standards are located in Documents 13-17.

The following Facility Standards are applicable to the ***Illinois*** Path project:

B.3.1. Crime Prevention

The Crime Prevention Facility Standard (Document 13 on supplemental CD) discusses

design of the physical environment to ensure a safe and secure University campus. Crime Prevention Through Environmental Design (CPTED) principles are utilized to create a space where authorized users more comfortable. CPTED is based on the following three principles:

1. Natural access control—influencing pedestrian patterns via design of physical environment as compared to organized (guards) or mechanical (locks) means.
2. Natural view — facilitating observation through windows as compared to organized (guards) or mechanical (closed circuit television) means.
3. Territorial reinforcement—creating a proprietary zone or sphere of influence with subtle boundary definition such as ground cover, setbacks and surface changes as compared to more traditional mechanisms like fences or hedges.

The Crime Prevention Facility Standard lists examples of general applications such as providing adequate lighting, creating sight lines or making provisions for natural view and providing adequate access controls. The Facility Standard discusses exterior applications in a bit more detail. Exterior applications applicable to the ***Illinois*** Path project include:

1. Install landscaping that is consistent with CPTED principles. For example, landscaping that will not grow to block lighting, will not provide "ambush points" near walkways/doorways, and will not impair natural view to bike racks, gathering areas (benches, tables) or parking lots.
2. Accommodate/support the "designated entrance" concept. For interior applications, this means to design-in the potential for a "designated entrance" to each building for use "after hours" by all users without key/card access privileges.
3. Provide emergency telephones. Select location(s) with maximal sight-line value.
4. Plan lighting to provide maximum visibility along walkways and near entrances.
5. Provide adequate lighting and make provision for the natural view of "gathering areas" such as benches, tables and smoking areas.
6. Provide adequate lighting and make provision for the natural view of bike racks and trash collection / pick-up locations.
7. If project work requires outages of any exterior lighting, including building, sidewalk or street lighting, provide adequate temporary lighting for the entire duration of the outage as part of the project.
8. Provide close proximity and/or a direct path to bike racks and/or parking lots.
9. Provide building glazing so as to promote the natural view of outdoor areas from indoors.
10. Utilize "rolling" berms (i.e. elevation changes to allow some natural view while still softening visual impact) rather than "straight" berms (i.e. constant elevation that blocks all natural view) around parking lots.

B.3.2. Lighting, Exterior

The Lighting, Exterior Facility Standard (Document 14 on supplemental CD) is a technical document that identifies specific guidelines to provide maximum visibility along walkways and near entrances. This Facility Standard provides guidelines for proper exterior lighting for the following applications:

1. Exterior Lighting (General): Planning lighting to provide maximum visibility along walkways and near entrances.
2. Street/Roadway Lighting: Provides specifications for light pole design and luminaires.
3. Pedestrian Walkway Lighting: Provides specification for pedestrian walkways including details of pole and internal louver requirements.
4. Parking Lot Lighting: Simple and efficient lighting consisting of a full cutoff luminaire on a concrete pole.
5. Exterior Lighting Controls: Describes requirements for controlling campus central lighting system.

B.3.3. Planting and Landscape

The Planting and Landscape Facility Standard (Document 15 on supplemental CD) describes the quality expectations and the acceptable methods for establishing lawns and trees and shrubs. The University requires a certificate of inspection to accompany plant shipments to ensure receipt of high quality materials. The following standards are applicable to the ***Illinois*** Path:

Lawns:

- This section provides the preference between sodding or seeding, the optimal planting dates, discusses the preferred implementation methods and drainage installation.

Trees and Shrubs:

- The trees and shrubs section discuss approved plant selection process along with guidelines for the planting beds, preferred implementation methods and drainage installation. Plants for the ***Illinois*** Path will be required to be selected from the list of approved plants or accepted by the F&S Horticulturist. Native species are preferred. The Approved Plant List and External Plant facility standards are located in Documents 16a and 16b on supplemental CD.

B.3.4. Streets, Sidewalks and Bicycle Paths

The University strives to provide a safe, user-friendly environment for pedestrians and bicyclists along with other forms of transit. Safety of pedestrians is a top priority. When designing streets, sidewalks and bicycle paths, access for emergency vehicles to all campus buildings must be incorporated. The Streets, Sidewalks and Bicycle Paths Facility Standard is found in Document 17 on supplemental CD.

The University owns some streets and right-of-ways and others are owned by the City of Champaign or the City of Urbana. Project design consultants should research University records (that can be obtained from F&S Planning Resources) to determine ownership. Use of non-University owned right-of-ways must be negotiated with the respective owner to achieve the necessary licensing agreements. Construction permits are required from the respective jurisdiction. Compliance with the following external documents is required when conducting street construction activities:

- Standard Specifications for Road and Bridge Construction, published by IDOT.
- Access Management Guidelines for the Urbanized Area established by Champaign-Urbana Urbanized Area Transportation Study (CUUATS).
- University District Crosswalk Markings and Signage guidelines established by CUUATS.
- Illinois Manual of Uniform Traffic Control Devices for Streets and Highways, also published by IDOT.

The Facility Standard discuss construction technical details including standards for width and depth of materials, type of approved materials, curbing specifications, and drainage requirements.

Sidewalks must be constructed to meet the Facility Standards width (6 feet wide) and slope requirements (maximum cross slope of 2%) and the requirements of the Illinois Accessibility Code.

Bicycle paths should be constructed according to the following documents:

- Campus Bike Plan (available through the F&S Transportation Demand Management)
- Champaign County Greenways and Trails Design Guidelines, developed by CUUATS

B.4. Americans with Disabilities Act (ADA)

The 1990 Americans with Disabilities Act is a federal civil rights law that prohibits discrimination on the basis of disability. Among other areas, the ADA law ensures individuals with disabilities equal opportunity to public accommodations. In 2010, the

ADA Standards were adopted by the Department of Justice. The ***Illinois*** Path is required to follow ADA regulations under Title III: Places of Public Accommodations.

The ***Illinois*** Path must also comply with the Illinois Accessibility Code. The purpose of the Illinois Accessibility Code is to ensure that the built environment, including all spaces and elements of all applicable buildings and facilities in the State of Illinois, is so designed, constructed, and/or altered to assure the safety and welfare of all members of society and to be readily accessible to, and usable by, environmentally limited persons.

The Illinois Accessibility Code requires accessible routes for newly constructed public facilities in the State of Illinois. The consultant hired to design the ***Illinois*** Path is responsible for ensuring that all ADA regulatory requirements are met and incorporated into the final design. The complete versions of the Illinois Accessibility Code requirements for Public Facilities, New Construction are located in Document 18 on supplemental CD.

To incorporate accessible walkways into the ***Illinois*** Path design, the following Illinois Accessibility Code standards should be followed:

B.4.1. Accessible Route

Accessible routes on an accessible site and for any new site improvements shall be provided to serve all accessible spaces or elements. Accessible routes include exterior routes, at least one accessible entrance, a means of egress, and interior horizontal (e.g., corridors) and vertical (e.g., elevators) circulation routes. Accessible routes shall meet the following requirements:

Location:

1. At least one accessible route within the boundary of the site shall be provided from public transportation stops, accessible parking, accessible passenger loading zones, if provided, taxi stands, public streets or sidewalks, and accessible facilities on non-contiguous sites, to an accessible building entrance.
2. At least one accessible route shall connect accessible buildings, facilities, elements, and spaces that are on the same site.
3. At least one accessible route shall connect accessible building or facility entrances with all accessible spaces and elements and with all accessible dwelling units within the building or facility.
4. An accessible route shall connect at least one accessible entrance of each accessible dwelling unit with those exterior and interior spaces and facilities that serve the accessible dwelling unit.

Width: The minimum clear width of an accessible route shall be 36 inches.

Passing Space: If an accessible route has less than 60 in. (1525 mm) clear width, then passing spaces at least 60 in. by 60 in. (1525 mm by 1525 mm) shall be located at reasonable intervals not to exceed 200 ft. (61 m). A T-intersection of two corridors or walks is an acceptable passing place.

Ground and Floor Surfaces: Ground and floor surfaces along accessible routes and in accessible rooms and spaces including floors, walks, ramps, stairs, and curb ramps, shall be stable, firm, and slip-resistant.

Slope: An accessible route with a running slope greater than 1:20 is a ramp and shall comply with the Ramps subsection (below). Nowhere shall the cross slope of an accessible route exceed 1:50.

Changes in Level: Changes in level up to 1/4 inch may be vertical and without edge treatment. Changes in level between 1/4 inch and 1/2 inch shall be beveled with a slope no greater than 1:2. If an accessible route has changes in level greater than 1/2 inch, then a curb ramp, ramp, elevator, or platform lift shall be provided. An accessible route does not include stairs, steps, or escalators. (ADAAG 4.3.8)

Egress: Accessible routes serving any accessible space or element shall also serve as a means of egress for emergencies or connect to an accessible area of rescue assistance.

Protruding Objects: Protruding objects with their leading edges between 27 inches and 80 inches above the finished floor shall protrude no more than 4 inches into walk. Objects mounted with their leading edges at or below 27 inches above the finished floor may protrude any amount. Freestanding objects mounted on posts or pylons may overhang 12 inches maximum from 27 inches to 80 inches above the ground or finished floor. Protruding objects shall not reduce the clear width of an accessible route or maneuvering space.

Gratings: If gratings are located in walking surfaces, then they shall have spaces no greater than 1/2 inch wide in one direction. If gratings have elongated openings, then they shall be placed so that the long dimension is perpendicular to the dominant direction of travel.

Ramps: Any part of an accessible route with a slope greater than 1:20 shall be considered a ramp and shall comply with the following requirements unless another means of accessible vertical access (e.g., accessible elevator or accessible platform lift) is provided:

Slope and Rise: The least possible slope shall be used for any ramp. The maximum slope of a ramp in new construction shall be 1:12. The maximum rise for any run shall be 30 inches. Curb ramps and interior or exterior ramps to be constructed on existing sites or in existing buildings or facilities where space limitations prohibit the use of a 1:12 slope or less may have slopes and rises as follows:

- A slope between 1:10 and 1:12 is allowed for a maximum rise of 6 inches.
- A slope between 1:8 and 1:10 is allowed for a maximum rise of 3 inches. A slope steeper than 1:8 is not allowed.

Clear Width: The minimum clear width of a ramp shall be 36 inches.

Landings: Ramps shall have level landings at bottom and top of each ramp and each ramp run. Landings shall have the following features:

- The landing shall be at least as wide as the ramp run leading to it.
- The landing length shall be a minimum of 60 inches clear.
- If ramps change direction at landings, the minimum landing size shall be 60 inches by 60 inches.

Handrails: If a ramp run has a rise greater than 6 inches or a horizontal projection greater than 72 inches, then it shall have handrails on both sides. Handrails are not required on curb ramps or adjacent to seating in assembly areas. Handrails shall have the following features:

1. Handrails shall be provided along both sides of ramp segments. The inside handrail on switchback or dogleg ramps shall always be continuous.
2. If handrails are not continuous, they shall extend at least 12 inches beyond the top and bottom of the ramp segment and shall be parallel with the floor or ground surface.
3. The clear space between the handrail and the wall shall be 1-1/2 inches.
4. Gripping surfaces shall be continuous.
5. Top of handrail gripping surfaces shall be mounted between 34 inches and 38 inches above ramp surfaces.
6. Ends of handrails shall be either rounded or returned smoothly to floor, wall, or post.
7. Handrails shall not rotate within their fittings.
8. Size and Spacing of Handrails: The diameter or width of the gripping surfaces of a handrail shall be 1-1/4 inches to 1-1/2 inches, or the shape shall provide an equivalent gripping surface. If handrails are mounted adjacent to a wall, the space between the wall and the grab bar shall be 1-1/2 inches. Handrails may be located in a recess if the recess is a maximum of 3 inches deep and extends at least 18 inches above the top of the rail.
9. Eliminating Hazards: A handrail or grab bar and any wall or other surface adjacent to it shall be free of any sharp or abrasive elements. Edges shall have a minimum radius of ⅛ inch.

<u>B.4.2. Applicable ADA regulations:</u>

1. 71 Ill. Adm. Code Part 400 Illinois Accessibility Code (Section 400.310 Public Facilities, New Construction – Minimum Requirements)
2. ADA Standards for Accessible Design
3. 28 CFR 36 Nondiscrimination on the Basis of Disability in Public Accommodations and Commercial Facilities

Appendix C - Implementation plan

The implementation recommendations summarized in this section originate from several sources as reviewed by Packard and Mutel (1997). Clearly defined objectives for a prairie planting are necessary. Deciding how large or small each particular representation of Illinois landscape will be, how many species are desired, future management decisions and responsibilities are all things to consider so that cost and energy can be efficiently applied to make the managed landscape successful. All depends on the final design chosen, thus the following are general guidelines for restoration implementation. Objectives that do not depend on design are site characteristics that develop a safe landscape and these concerns and solutions are addressed previously in the document.

C.1 Site Preparation

Depending on constraints, it is best to start the restoration by herbicide with a general use herbicide or plowing the existing area. This will eliminate the standing vegetation, although a seed bank of unwanted species may be released. If regulations allow, it is sometimes best to herbicide, wait a few weeks and repeat to eliminate the nearly germinated seeds.

C.2 Planting

The next phase of implementation is putting the native seeds into the ground. This should be done in fall if seeds have not been scarified or cold stratified, although seeds, for an increased cost, can be pre scarified/cold stratified so planting in spring is possible. This may be done by hand broadcasting or using a seed drill. For this particular design, it is important to follow the design guidelines and stages of implementation. These guidelines include the seed mix for each of the areas, woodland, savanna and prairie. Also, species mix will change depending on the position in the landscape. Areas near sidewalks and paths are to be seeding with lower growing species.

C.3 Species

Site selection dictates the species planted. Soil moisture can determine which species do best in the landscape. Some plants do better in areas close to water and others require drier places. Other considerations are number of species, determined usually by funds, and the ecology of the species, common or rare. A good mixture will include forbs that will provide flowering color from May to October for aesthetic and ecological reasons. For this project, a higher abundance of fall flowering plants may be important as students' presence increases at this time.

C.4 Seed Drill

A seed drill uses mechanized sowing to get seeds into the ground. A typical seed drill consists of a hopper of seeds placed above a series of tubes. Depending on the species being planted, the tubes can be set at selected distances from each other to allow optimum growth of the resulting plants. In front of the tubes are blades, or coulters, that cut open the soil. Depth of seed placement depends on the soil type, ½ inch for clay, silt or loam and ¾ inch in sandy soil. As the soil is opened, a mechanism on the hopper allows a specific number seeds to fall through the tubes into the cut soil. Small, dense, and fluffy seeds all are able to drop at a controlled rate from the hopper into a seed trench. Then a rake pushes soil on top of the seeds and covers the seeds. During the seeding, the hopper is kept full to keep seeding efficient, and the machine is run at around 2-3 miles an hour. Seed tubes are closely monitored to watch for clogs due to the different size seeds and forms. To prevent the prairie from having neatly spaced rows, most practitioners go perpendicular to their previous sowing to eliminate the visual rows.

C.5 Broadcast Seeding

Broadcast seeding should be done immediately after tilling. Seeds should be mixed perlite as an inert carrier. It also helps broadcasters see where they have spread seeds. Seeds should be applied North to South and then East to West to insure total coverage of site. Immediately after seeding, rake or chain drag the seed and roller pack. Seed path is the same as drilling.

C.6 Seed Rates

Many practitioners suggest applying forty to sixty seeds per square foot, although as low as 30 seeds may be sufficient on well-prepared sites. Consider using broadcast seeding methods in the dormant season with local ecotype, high diversity, forb-dominated ratio in forb/grasses species mixes.

C.7 Cover Crops

Along with planting your prairie seeds, it may be beneficial to plant a cover crop. A cover crop is a fast growing species with the purpose of providing shade on the soil to retain surface moisture, outcompeting annual weeds and providing quick soil holding capabilities on slopes or in light soils. Over time, cover crops will become less dominant as prairie plants take their place.

Canada wild rye is a frequently suggested cover crop species. It is native and competes well with weeds. Evidence has shown some other species, such as rye and wheat, interfere with germination of native seed via allelopathy, the suppression of growth of one plant species by another due to a release of toxic substances.

C.8 Maintenance and Monitoring

Management plans are essential for maintaining a prairie. Removal of unwanted species and species interseeding can add to the aesthetic enjoyment and ecological functionality of a prairie. In some cases, only one method is available either due to function or cost, but in most cases a combination of management techniques, fire, mechanical, or chemical, will provide the best overall results.

C.8.1 Mowing

During the first couple years of a recently seeded prairie restoration when unwanted weed species are abundant and potentially constraining native species, mowing helps reduce competition for light and improve seedling establishment. Mowing also helps to control woody encroachment until the prairie can be burned. Some prairie restoration practitioners have indicated that mowing can also be used as a short-term measure to cut biennial or perennial invasive plants before they go to seed. Eventually, prairies will no longer need mowing.

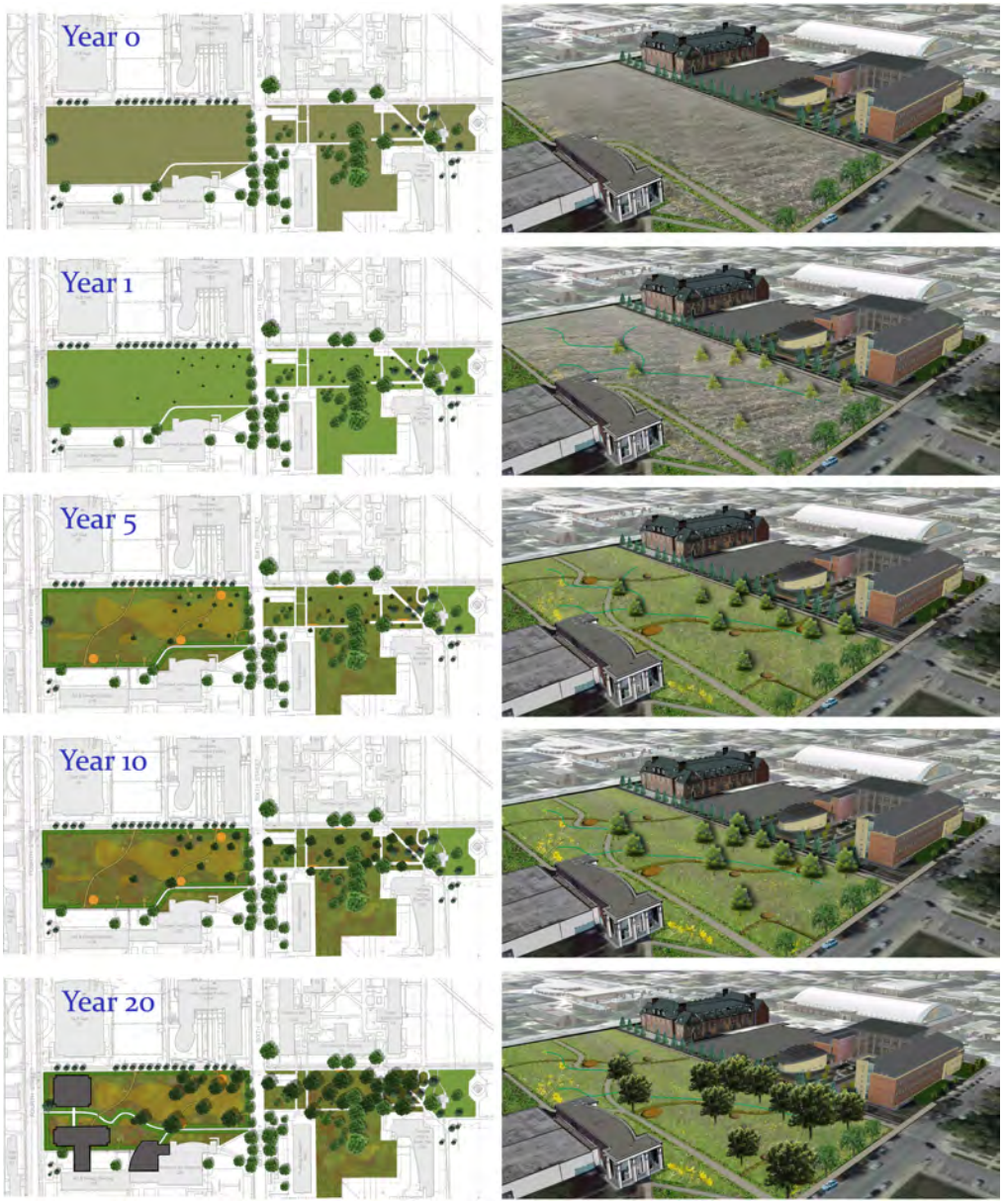
C.8.2 Herbicide

The type, concentration, and amount of herbicide used depend on the target species. Herbicides can be selective use or broad use and have long or short-term activity. There are risks of harming non-target plant species when applying herbicide, so care must be taken to minimize drift or unwanted application. You should always read the label provided by the manufacturer to understand how to use the herbicide safely. The Environmental Protection Agency monitors and is tasked with determining whether an herbicide is likely to have unreasonable effects on humans, the environment, or non-target species.

C.8.3 Weed Species

The word 'weed' can be applied to two groups of species, the classic weeds and invasive species. In most cases, classic weed species will eventually be replaced by native prairie species across time. They do not need any type of management. Examples of classic weeds include the non-native Queen Anne's lace and the native common ragweed. Invasive plant species are able to out-compete native species and even seriously degrade or even destroy high-quality prairies. Examples of invasive species include yellow and white sweet clover, teasel and buckthorn. The best defense against invasive plants is vigilance, and preventive measures such as pulling or herbiciding them before they become established. Remember, if a species is present near or in your prairie, there is a very large possibility there are seeds from this plant present in the seed bank and management may require many years.

Appendix D – Site Progression Over 20 Years



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