GREEN INFRASTRUCTURE MAPPING PROJECT

Funded by Boeing

Lead collaborators:
- Illinois Department of Natural Resources
- The Field Museum
- The Wetlands Initiative
- Geosyntec Consultants
- Conservation Design Forum
- Northeast Illinois Invasive Plant Partnership
Chicago Wilderness

Chicago Wilderness is a regional alliance leading strategy to preserve, improve, and expand nature and quality of life. By connecting leaders in conservation, health, business, science, and beyond, we tackle challenging issues to ensure a resilient region.

Building on a 20-year legacy of collaboration, our broad alliance of member organizations advance work in Illinois, Indiana, Wisconsin, and Michigan.

Chicago Wilderness leverages members’ collective strengths to drive one regional strategy through the following focused efforts:

**Oak Ecosystems:** ensuring a future for oaks and their ecosystems

**Priority Species:** conserving a targeted group of species to benefit our region’s lands and waters

**Water as a Resource:** addressing regional water issues through conservation action

**Landowners:** engaging landowners in conservation actions

**Beyond the Choir:** building and sustaining a broad, representative, and active constituency

**Data:** applying technology and data to accelerate collaboration

Using this cross-disciplinary and measurable approach, Chicago Wilderness addresses critical challenges and inspires meaningful change. We harness adaptive and innovative thinking, apply solid science, and connect diverse constituencies.

Learn more at: [www.chicagowilderness.org](http://www.chicagowilderness.org)

The Des Plaines River Communities Project was funded by:

[Boeing]
[ Table of Contents ]

BACKGROUND

Overview 03
What is Green Infrastructure? 04
Green Infrastructure Benefits 06
Green Infrastructure & Climate 08

MAPPING PROCESS

Mapping the Core Green Infrastructure Network 12
Mapping Opportunity Areas for Localized Green Infrastructure 15

RESULTS

Map Products 23
Recommendations 27

RESOURCES & REFERENCES

Resources 44
References 46
Acknowledgements 46

APPENDICES
BACKGROUND
[ Overview ]

This project used the Chicago Wilderness Sustainable Watershed Action Team (SWAT) process, to develop cross-jurisdictional green infrastructure maps and recommendations for two sub-regions of the Des Plaines River basin. The goal was to help increase awareness of local natural assets and build the foundation for long-term natural resource protection and stewardship through sustainable land-use strategies.

The project evaluated green infrastructure at two levels. The first level included the mapping of the existing network of core green infrastructure comprised of public and private open space and natural resources that conserves ecosystem functions, sustains clean air and water, and provides trails and greenways that benefit people and wildlife. The second level involved the delineation of opportunity areas for the implementation of sustainable localized green infrastructure strategies such as bioretention basins and planters, permeable paving, and naturalized parks that utilize natural processes to reduce watershed impacts to the Des Plaines River, its tributaries, and other aquatic resources as well as to reduce the nuisance and damage caused by flooding.

STUDY AREA

The study area for this project includes two sub-regions within the Des Plaines River corridor, comprising a total of 13 communities. For reference to map, see Appendix A.

North Project Area
- City of Des Plaines
- Village of Glenview
- Village of Mount Prospect
- Village of Niles
- Village of Northbrook
- City of Park Ridge
- City of Prospect Heights
- Village of Wheeling

South Project Area
- Village of Riverside
- Village of Brookfield
- Village of Lions
- Village of North Riverside
- Village of LaGrange Park

Chicago Wilderness Sustainable Watershed Action Team

The Sustainable Watershed Action Team (SWAT) was created in 2004 in response to an extensive municipal needs assessment conducted by a Chicago Wilderness (CW) taskforce in conjunction with the Northeastern Illinois Planning Commission (now the Chicago Metropolitan Agency for Planning).

While land-use decisions are made at the local level, many municipalities and local units of government acknowledge their lack of technical capacity to strengthen their planning infrastructure (plans and ordinances) and to promote sustainable development and protection of natural resources.

SWAT was developed to deliver customized, cost effective direct technical assistance in developing local plans, adopting protective ordinances, and assisting with other sustainability projects.
For information on previous SWAT projects:

https://chicagowilderness.site-ym.com/?SWATProjects.

[ What is green infrastructure? ]

Both nationally and regionally, the term “green infrastructure” has a range of meanings. That range is simplified here into three categories. Across these categories, green infrastructure can also be conceptualized at four different scales.

**LANDSCAPE-BASED GREEN INFRASTRUCTURE**

This is perhaps the meaning most commonly applied to green infrastructure. It is based in the idea that certain lands have an inherent value that can be made even greater when a part of a network. The Conservation Fund defines it this way:

Strategically planned and managed networks of natural lands, working landscapes and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations. Under this definition, the foundation of green infrastructure networks are the natural elements – river corridors, woodlands, wetlands, grasslands – that work together as a whole to sustain ecological values and functions. But green infrastructure also can include working lands, trails and other recreational features, and cultural and historic sites.

**BIODIVERSITY-BASED GREEN INFRASTRUCTURE**

In its Green Infrastructure Vision, Chicago Wilderness adopts a related meaning for green infrastructure—one that focuses on the goal of supporting biodiversity. Chicago Wilderness defines green infrastructure as:

“The interconnected network of land and water that supports biodiversity and provides habitat for diverse communities of native flora and fauna at the regional scale. It includes large complexes of remnant woodlands, savannas, prairies, wetlands, lakes, stream corridors and related natural communities. Green infrastructure may also include areas adjacent to and connecting these remnant natural communities that provide both buffers and opportunities for ecosystem restoration.”

This definition reflects both existing green infrastructure – forest preserve and park district holdings, state parks, and designated natural areas – as well as opportunities for expansion, restoration, and connection.

**NATURE-BASED ALTERNATIVES TO GRAY INFRASTRUCTURE**

This definition of green infrastructure focuses on nature-based alternatives to conventional “gray infrastructure” technology and engineering.

In this context, green infrastructure can be used to describe products, technologies, and practices that use natural systems – or engineered systems that mimic natural processes – to enhance overall environmental quality and provide utility services. The U.S. Environmental Protection Agency identifies green infrastructure techniques, such as green roofs, porous pavement, rain gardens, and vegetated swales, which use soils and vegetation to infiltrate, evaporate, and/or recycle stormwater run-off. In addition to effectively retaining and infiltrating rainfall, these technologies also can filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon.

This plan integrates each of these meanings into a single comprehensive view of green
infrastructure. It encourages not only sustainable land use and open space protection but also innovative, green technology to restore and protect water and other natural resources.

This plan emphasizes mapping, protection, and restoration of green infrastructure in the very diverse Des Plaines River region. It recognizes that implementation of green infrastructure plans and policies should be undertaken at multiple spatial scales, from small sites to large regions. The figure below highlights the range of scales. It also recognizes that effective green infrastructure implementation requires coordination and involvement by local governments, other government agencies, private organizations, developers, and private landowners in order to maximize the benefits.

**SCALES OF GREEN INFRASTRUCTURE**

The following are some examples of green infrastructure planning and implementation at various geographic scales.

**At the Regional Scale**

The Chicago Wilderness Green Infrastructure Vision provides a regional framework for green infrastructure mapping and planning (www.chicagowilderness.org). The current project that is the focus of this report mapped an integrated network of green infrastructure elements, such as stream corridors, wetlands, and open space. The extensive land acquisitions of the Forest Preserve Districts of Cook County are another example of regional GI implementation that spans numerous municipalities and townships across the county.

**At the Community Scale**

At the community level, efforts can be made to incorporate GI maps and recommendations into municipal, county, and park district land use plans and maps. GI principles can be used to shape land use and zoning maps and provide a framework for more sustainable zoning, subdivision, stormwater, and landscaping codes as well as conservation design ordinances. This can apply to new development as well as redevelopment and capital improvement plans. GI principles also can influence land acquisition and trail priorities of local park and open space agencies.

**At the Neighborhood Scale**

Neighborhoods, both existing and new, can be transformed to incorporate conservation design principles. This means the subdivision review process includes open space protection, natural landscaping, and stormwater best management practices that preserve biodiversity and natural resource functions in the design of the neighborhood. Not only does this preserve and enhance the natural environment, it also brings nature closer to families and children.

A number of local governments in northeastern Illinois, including McHenry County, Woodstock, Crystal Lake, and Algonquin, have developed comprehensive conservation design ordinances for new development on sensitive sites. The new Watershed Management Ordinance adopted by the Metropolitan Water Reclamation District (MWRD) provides for protecting natural hydrology and water quality from the adverse impacts of development throughout Cook County. Similar ordinances have been in place for a number of years in DuPage, Kane, Lake, and McHenry Counties.

**At the Site Scale**

Small sites, including residential yards,
businesses, school grounds, and parks can incorporate practices that treat stormwater as a resource and provide habitat for native species. This is accomplished through practices like bioswales, rain gardens, permeable paving, and natural landscaping. As an example, Blue Island has recently become a local leader in the installation of green infrastructure demonstration projects such as rain gardens and rain barrels.

Green infrastructure is a vital and important resource to every community. Green infrastructure helps protect existing ecological and water resource systems and their associated social and economic functions. Preserving green infrastructure and managing it properly can provide numerous related benefits. Some of the key green infrastructure purposes and benefits identified in the Des Plaines River planning area include:

**ENVIRONMENTAL**
- Biodiversity and habitat protection
- Improved water quality
- Enhanced groundwater recharge
- Reduced flood damage
- Reduced erosion
- Carbon sequestration
- Resiliency to changing climate

**ECONOMIC**
- Resiliency to changing climate
- Reduced life-cycle costs of infrastructure
- Reduced flooding
- Reduced erosion
- Potential for expedited permitting
- Green industry jobs
- Green marketing potential
- Green architecture

**SOCIAL**
- Greenway, trail, and open space connections
- Enhanced recreational opportunities
- Community health and mobility

**COMMUNITY**
- Contributing to communities' identity and sense of place.
- Enhancing property values.
- Expediting the development planning process by identifying resource areas and corridors before development is proposed.
- Creating a vision of the future to guide a community’s long-term planning goals and objectives.
- Providing a better means of evaluating economic and environmental factors when making land use decisions.
- Ensuring that development and open space activity are encouraged and established in appropriate and compatible locations.

**Water Benefits**
Green infrastructure provides a more sustainable, and often less expensive, alternative to managing water quantity and quality. In contrast to grey infrastructure, green infrastructure utilizes soils and vegetation to infiltrate, evaporate, and recycle precipitation and stormwater runoff. The U.S. Environmental Protection Agency and others have thoroughly documented many of these benefits, which are summarized below.

http://water.epa.gov/infrastructure/greeninfrastructure/gi_why.cfm

**Flooding** - Conventional stormwater infrastructure quickly sheds rain water and drains stormwater to rivers and streams,
increasing peak flows and flood risk. Green infrastructure can mitigate flood risk by slowing and reducing stormwater discharges. Through practices like permeable paving and rain gardens, this is accomplished by holding water in the soil, storing it temporarily in sand or gravel, and using vegetation to return water vapor to the atmosphere.

A notable example of how green infrastructure reduces stormwater discharges is a demonstration project in Burnsville, Minnesota. An entire neighborhood was retrofitted with rain gardens and compared to a neighborhood where no retrofits occurred. After two years, researchers showed that runoff volumes were reduced by approximately 90 percent due to the infiltration, storage, and evaporation of water provided by the rain gardens.

Most of Chicago and some nearby suburbs are served by combined sewers. While MWRD’s Tunnel and Reservoir Plan (TARP) will eventually eliminate most combined sewer overflows, some basement flooding and other local flooding concerns will remain due to inadequate capacity of local sewers. Green infrastructure can be used as a complement to grey infrastructure in these areas to reduce the load on local sewers to address basement flooding while further reducing combined sewer overflows and basement flooding. As it reduces the quantity of runoff entering combined sewers, green infrastructure also can reduce the amount of flow that requires pumping and treatment at MWRD’s treatment plans.

Equally important to the flood prevention benefits of engineered green infrastructure are the natural benefits of protected floodplains, wetlands, and stream corridors in slowing, storing, and absorbing floodwaters.

**Water Quality** - Stormwater from developed areas flushes many pollutants to our streams, lakes, and beaches - including pathogens, nutrients, sediment, and heavy metals. In cities with combined sewer systems, high stormwater flows can also send untreated sewage into our waters and basements. By retaining rainfall from small to moderate-sized storms, green infrastructure reduces runoff rates and volumes translating into lower pollutant loads. Green infrastructure also treats stormwater that is not retained, greatly reducing contamination to area waterways and wetlands.

**Water Supply** - Rainwater harvesting and infiltration-based practices increase the efficiency of our water supply system. Water collected in rainwater harvesting systems, like cisterns, can be used for outdoor irrigation and some indoor uses, potentially, significantly reducing municipal water use. Water infiltrated into the soil can recharge groundwater, an important source of water for both public consumption and for maintaining natural baseflows to streams and wetlands.

In addition, using green infrastructure practices like native landscaping can greatly reduce the demand for irrigation of turf grass and conventional landscapes. Irrigation needs can account for as much as 20 to 30 percent of the annual water usage in many communities.

**Biodiversity & Habitat Benefits**

The planning process for Des Plaines River communities that is the subject of this report has led to the development of a green infrastructure network map. Protection of green infrastructure networks, via public and/or private means, is critical to the survival and health of biodiversity in the planning area and the broader Chicago Wilderness Region. Chicago Wilderness has identified several key benefits of protected networks.

**Protection of sensitive species** - Within the planning area are several designated Illinois Natural Areas and other high quality natural remnants provides safe haven for rare or threatened species of plants and animals that
are rarely found outside of the green infrastructure network. Some Nature Preserve in Northbrook and Wolf Road Prairie in Westchester are examples of such high quality habitats.

Support wildlife life-cycle needs - Many important species of insects and animals require diverse natural areas that contain “community mosaics” of wetlands, woodlands, prairies, and stream corridors. These large areas contain a diversity of habitat types that may be needed for mating, reproduction, and foraging. Examples of species that require such diverse habitats are sandhill cranes and the endangered Blanding’s turtles.

Protecting large tracts of land from land use conversion - Chicago Wilderness, in its Biodiversity Recovery Plan, has identified quantitative targets (i.e., acreages) for protecting very large tracts of contiguous woodlands, savannas, prairies, and wetlands.

Large preserves like the Forest Preserve holdings along the Des Plaines River provide large woodland/savanna habitat for sensitive woodland birds, amphibians, and mammals.

Migration Corridors - Functional green infrastructure connections allow for the effective movement and migration of animal and plant species between sites. In the planning area this includes the riparian corridors along the Des Plaines River, as well as the North Branch Chicago River and Salt Creek. Contiguous neighborhood tree canopies can also provide these benefits. These corridors effectively link Forest Preserves, parks, private preserves, and neighborhoods via greenways and landscape buffers. The value of these corridors is enhanced when they include native plant for species such as monarch butterflies.

[ Green Infrastructure & Climate ]

Recognizing the potential for changes in climate to disrupt their social and economic fabric, cities around the world are developing strategies for reducing greenhouse gas emissions, modifying programs to adapt to a warmer future, and engaging civil society in this effort. Green infrastructure, for example, has the opportunity to reduce our carbon footprint by reducing the energy consumption associated with providing potable water for non-potable needs (such as irrigation) and storing and treating stormwater (particularly in combined sewer areas.) In addition trails within green infrastructure corridors provide mobility options, reducing reliance on the automobile.

Because urban areas are responsible for nearly three-quarters of global energy-related carbon emissions (Rosenzweig et al. 2010), the early emphasis of individual cities and these collaborations understandably was on reducing greenhouse emissions (Wheeler 2008).

Only recently, as the inevitability of a rapidly changing climate has become apparent, have cities begun to focus on approaches to reduce risks in the face of climate change as being of equal importance (Bulkeley and Betsill 2013).

However, urban adaptation efforts focus on protecting values like public health, livelihoods, and infrastructure, with little attention paid to protection of urban nature, and the benefits nature provides to urban residents.

At the same time, cities and associated metropolitan areas are becoming increasingly important to global biodiversity conservation. Most cities have been founded in places that are biodiverse and functionally valuable to society, such as in floodplains, along coasts, on islands, or near wetlands. Today, urbanization continues to expand into these
valuable habitats and into the hinterland where society most often placed its biological reserves (McDonald et al. 2008). Species previously outside city limits may need to migrate through urban areas as they adjust to a changing climate (Hellmann et al. 2010). Some metropolitan areas now contain important populations of rare species (e.g., Blanding’s turtle and the Prairie White Fringed orchid occur in the greater Chicago region), made more vulnerable to extirpation by their typically small population sizes and fragmented distribution patterns (McDonald 2013).

Terrestrial natural areas in urban settings provide critical habitat for resident and migratory native species, but tend to be small and isolated remnants of formerly widespread habitats that are increasingly vulnerable to loss and degradation from a host of urban-centric stressors (Kowarik 2011, Cook et al. 2013).

Green infrastructure offers the opportunity to restore and/or enhance the ecological functions of these urban natural areas and other undeveloped or formerly developed spaces to provide increasingly important, but highly threatened, benefits to biodiversity and human communities of metropolitan regions (Goddard et al. 2011, Hostetler et al. 2011, Kattwinkel et al. 2011).

Likewise, freshwater biodiversity is threatened by both water withdrawal for urban consumption (McDonald et al. 2011) and the addition of pollutants from urban stormwater, industrial, and residential sources (Alberti 2005, Blanco et al. 2011).

These biodiversity impacts are all projected to accelerate as global urbanization trends continue to increase (McDonald 2013). Creating green infrastructure plans and projects using a climate lens will help to ensure the resulting resources and recommendations are developed from a perspective of achieving a biodiverse urban ecosystem that can provide benefits to wildlife and to people now and in the future. Making urban natural areas and green spaces as healthy as possible is in itself a climate mitigation strategy because a healthy system will be able to deliver critical functions, including the capture and storage of carbon in soil and plant roots. Improving health and connectivity of urban green spaces also serves as an adaptation strategy, providing critical habitat for wildlife needing to migrate and disperse through a difficult urban matrix, and sustaining ecosystem services such as stormwater capture and reducing the urban heat island effect.

In the absence of actions that adapt protection, planning and management practices, climate change has the potential to jeopardize many biodiversity conservation investments made in the Chicago Wilderness region during the past 30 years.

For the past five years the Chicago Wilderness Climate Action Committee has focused on creating place-based resources to help inform on-the-ground planning and management decisions. This process involved translating downscaled climate change projections developed for the Chicago Climate Action Plan (Hayhoe and Wuebbles 2008) into an understanding of how a warmer, drier and more extreme environment could affect regional biodiversity and, importantly, what actions could be taken to reduce the impacts.

A goal of this green infrastructure planning project for Des Plaines River communities is to include climate in a meaningful way. Toward that end, the co-chair of the Chicago Wilderness Climate Action Committee provided the following information to the natural resource expert stakeholder group and the broader community stakeholder group for their consideration in the planning process: general “climate science 101”; overview of downscaled climate models for the region; overview of anticipated impacts to
biodiversity and people; co-benefits of green infrastructure projects (i.e., urban forest adaptation strategies) to climate mitigation and adaptation; asset-based climate change messaging for communities.

In addition, multiple place-based resources were provided to the stakeholder groups, including the Climate Considerations Guidebook for Natural Areas and Green Spaces in the City of Chicago (https://adapt.nd.edu/resources/1019), the Chicago Community Climate Action Toolkit (http://climatechicago.fieldmuseum.org/), the Climate Change Update to the Chicago Wilderness Biodiversity Recovery Plan (http://climate.chicagowilderness.org/) and the Climate Adaptation Guidebook for Municipalities in the Chicago Region (http://tinyurl.com/l2q57tw).

The information and materials are intended to contextualize climate change impacts for the Chicago Region and provide climate considerations for natural resource experts and decision makers to use and integrate into their green infrastructure planning and management processes.
MAPPING PROCESS
[ Mapping the Core Green Infrastructure Network ]

Mapping green infrastructure for the Des Plaines River planning areas was done at two levels. The first was the mapping of a network of existing core green infrastructure. In this context, green infrastructure includes both existing open space and natural areas such as wetlands, stream corridors, and woodlands.

In brief, the core green infrastructure network map was developed through a three-step process:

1) Developing an inventory of natural resource and open space data using the expertise of the Field Museum and regional geographic information system (GIS) databases

2) Working with natural resource organizations to develop a draft green infrastructure network map

3) Working with communities to review and refine the map

Some of the key purposes of a green infrastructure network map include preserving and connecting habitats for flora and fauna, providing natural storage and filtering of stormwater and flood waters, and connecting people and neighborhoods via trails and greenways. In a green infrastructure network, every connection strengthens the network further. By identifying and mapping a network, areas that have regional significance are revealed and their values are better understood by local community officials and agencies. This knowledge provides an opportunity for communities to think regionally and act locally.

The process used in this project builds on previous green infrastructure mapping approaches used in other SWAT projects, such as McHenry County, Kane County, and the Millennium Reserve area in south Cook County. It also builds on the approach used in the regional Green Infrastructure Vision (GIV 2.0) but tailors it to more current and detailed data from this planning area.

EXISTING NATURAL RESOURCES AND OPEN SPACE INVENTORY MAPPING

The project team assembled a GIS database containing a number of natural resource and open space data sets. Initially, The Field Museum staff compiled relevant data based on the data sets used in the Chicago Wilderness Green Infrastructure Vision (GIV) 2.0 project, as well as other SWAT GI mapping projects. After the initial inventories were assembled, advice and assistance was sought from an advisory committee of experts from regional and local natural resource and conservation organizations. These organizations included the Illinois Nature Preserves Commission, Illinois Department of Natural Resources, Natural Resources Conservation Service, Soil and Water Conservation District, Forest Preserve District of Cook County, Metropolitan Water Reclamation District, and local watershed and conservation groups.

Data sources were then supplemented or replaced by more current local data sets where appropriate, such as the addition of more refined mapping of streams and wetlands.

The most important data layers with respect to habitat, biodiversity, and water resources protection, regardless of whether they are currently protected or regulated, were identified through the advisory committee process. These data layers became the foundation for what is referred to in this plan as core green infrastructure. Core green infrastructure is the backbone of the green infrastructure network, identifying and connecting large clusters of ecologically important areas.
The advisors endorsed several key Chicago Wilderness green infrastructure planning principles, including the principle that the size and connectivity of resource areas are of great importance.

Elements of this approach include:
• Protecting large core reserves (or nodes)
• Linking core areas with corridors (or landscape linkages)
• Protecting complexes of adjacent resource areas (e.g., wetland, woodlands, and prairies)
• Buffering critical areas from conflicting activities or land uses

CORE NATURAL RESOURCE DATA LAYERS

In consideration of previous factors, the following core natural resource data layers were included in the base mapping:

• Water Bodies (Forest Preserves of Cook County and USGS National Hydrography Dataset Water Bodies)
• Wetlands (2011 hyper-spectral refined NWI from Forest Preserves of Cook County)
• Rivers – Forest Preserves of Cook County as polygons and USGS National Hydrography Dataset as line features
• Canals – included in the National Hydrography Dataset features layer
• 100-yr Floodplain (FEMA/IDNR)
• Remnant Oak Woodlands (Chicago Wilderness)
• Illinois Natural Areas Inventory - Feb. 2014
• Threatened & Endangered (T&E) Species locations (IDNR - Feb. 2014)
• Forest Preserves - Cook County and Lake County
• Open Space (CMAP, Field Museum, National Conservation Easement Database)
• Flood Control Projects as Open Space (MWRD)
• Private Open Space – CMAP, Cook County, Cemeteries
• ComEd Right of Ways and ComEd Managed Prairies
• Regional Trails and Greenways (Forest Preserves of Cook County, CMAP)

Note: T&E locations were used for planning purposes but not explicitly shown on the final GI maps.

A buffer of 200 feet, as noted above, was placed on the periphery of the most critical natural resource and forest preserve layers. This buffering approach was based, in concept, on the approach used in mapping the Chicago Wilderness GIV. Buffers signify that it is important to not only protect critical resources, such as important habitat areas, but to also be sensitive to activities and lands uses in adjacent areas. Buffers also provide mapping connections for natural resource areas that appear as separate polygons on a map but actually function as an interconnected complex from a habitat perspective.

The use of a 200-foot buffer is intended for planning purposes, and is not necessarily intended as a regulatory recommendation. For comparison, various county stormwater management ordinances stipulate stream and wetland buffer requirements ranging from 25 to 100 feet, depending on resource quality and size. In comparison, recommended habitat buffers reported in some publications on green infrastructure can exceed 300 feet for sensitive wetland habitats or sites containing certain endangered or threatened species.

In addition to the core natural resource layers, the project planning area has a wealth of
additional natural resource mapping. These additional resource data were characterized as supporting green infrastructure. It was established that the supporting data would be used on a case-by-case basis to inform decisions about core green infrastructure mapping. The following are examples of supporting natural resource data layers and information were available for the mapping process:

- Hydric soils
- GIV 2.0 Layers
- Combined sewer service areas

**CORE GREEN INFRASTRUCTURE MAPPING WORKSHOP**

Using the mapping data and assumptions described above, the project team and representatives of natural resource and conservation organizations participated in a half-day green infrastructure mapping workshop. The foci of the workshop were very large printed maps – 10 feet by 10 feet in size for the north cluster of communities and 6 by 6 feet for the southern cluster. The maps were color coded with all of the referenced core natural resource data layers, including buffers, all overlain on a screened aerial photo base. Supporting this map was the capability to digitally project additional supporting natural resources data on a screen.

This map was used to guide resource experts in the mapping of an interconnected green infrastructure network. At the workshop, the experts were engaged in three specific tasks.

1) Add any missing resources, such as newly protected open spaces.

2) Remove any mapped resources that don’t meet the definition of GI. An example is public land parcels that are primarily impervious and/or developed.

3) Make connections to adjacent isolated GI resources to establish connectivity. Generally if adjacent resources were within 200 feet, a connection was made.

The maps were marked up and notes were taken to describe the referenced changes, additions, deletions, and connections.

After the mapping workshop, the mark-ups were digitized and a refined core green infrastructure maps was prepared. The revised map was then shared with local governments in two workshops – one for the southern cluster of communities and one for the northern cluster. Invited participants included municipalities, park districts, MWRD, and Cook County departments.

To make the maps easier to interpret and understand, the various core green infrastructure base layers were aggregated into several categories. These were:

- Public parks and preserves
- Private open space
- Other environmental resource areas
- Regional trails

Underlying resources, including floodplains, wetlands, and woodlands, were depicted using cross-hatching and shadings. The local government participants were asked to review the maps and focus primarily on two types of possible revisions:

- Open space or parks
- Regional trails or connections to regional trails

One category that was recommended for addition, included parts of several school campuses that were either in or adjacent to certain resource areas, such as floodplains or wetlands. There also were a number of bikeways suggested for addition. The recommended changes and mark-ups from the local government workshops then were digitized and a refined core green infrastructure map was prepared.
[Mapping Opportunity Areas for Localized Green Infrastructure]

The Opportunity Area mapping followed a similar three-step process as the Core Green Infrastructure mapping.

1) Develop an inventory of relevant grey infrastructure and capital improvement planning information using data provided by the participant communities and agencies.


3) Work with participant communities to expand and refine the opportunity areas identified by the natural resource organizations. Since the participant communities will be largely responsible for implementation of the opportunities in their communities, this was the key step to the process.

There were two primary purposes for the opportunity area mapping. The first was to identify open spaces that could be restored to expand the core green infrastructure network. These are generally categorized as Ecological Opportunity Areas. The second was to identify opportunities to retrofit and integrate technology based green infrastructure practices into urban areas of the watershed to reduce runoff rates, volumes, and water quality impacts to the core green infrastructure elements. This second group is generally categorized as Technology-Based Opportunity Areas.

**ECOLOGICAL OPPORTUNITY AREAS**

Restoration is the purposeful recovery and management of plant and animal communities in order to develop an ecosystem that is compositionally, structurally, and functionally similar to what originally existed. Investments in restoring "natural" infrastructure in urban areas are not only ecologically and socially desirable but often economically feasible based on the increase in ecosystem services and benefits. There are exceptional opportunities to enhance and restore the functions and services of key ecosystems (e.g., floodplains, wetlands, prairies, oak savannas) within the Des Plaines River watershed. These opportunity areas include the river corridor and its floodplain, tributary streams and creeks, open or vacant spaces contiguous to other habitat areas, existing habitat areas with infested with invasive species, and threatened and endangered species habitats.

*Everything Upstream Affects Everything Downstream.* The successful restoration of any aquatic and/or terrestrial ecosystems depends entirely on making improvements elsewhere in the watershed. Floodplain ecosystems and features (e.g., groundwater, surface water, etc.) do not function as independent and isolated components of the watershed, instead they are part of a single integrated natural system. Hydrologically, it is necessary to capture and manage runoff where it is produced in order to reduce runoff and peak discharges. Stormwater runoff is the number one cause of stream impairment in urban areas. Urban stormwater runoff picks up and carries with it many different pollutants such as sediment, nitrogen, phosphorus, bacteria, salt, oil and grease, trash, pesticides, and metals. The increased velocity and volume of water from upper watershed areas increases flooding, erosion, sedimentation, and nutrient enrichment and causes changes in stream morphology downstream. Ecologically, changes in stream morphology (shape or physical structure) lead to degraded stream and floodplain habitats and biological communities. The presence or abundance of birds and other mobile animals in the restored ecosystem depends largely on
the health of other ecosystems in the watershed that are within their ranges or territories.

Floodplain Restoration. Riparian and floodplain areas can be among the most diverse ecosystems due to the interface between aquatic and upland terrestrial ecosystems. Floodplain restoration involves restoring a stream’s access, fully or partially, to its floodplain to recover health (functional processes), integrity (species composition and community structure), and sustainability (resistance to disturbance and resilience).

Floodplain functions have been degraded or lost in many urban watersheds, and it is often a direct trade-off between restoring these floodplain benefits and the need for public living spaces and services.

Dam removals on the Des Plaines River provide unique ecological opportunities to restore valuable habitat within the floodplain (or riparian) zone and in the section of free flowing river that was formally impounded. Dam removals can result in changes to physical or structural components and to flow dynamics (i.e., variability, duration, frequency, timing, etc.), which both influence riparian vegetation structure. Integrating the restoration of key physical processes (e.g., natural flow variability and channel morphology) and active revegetation enhances long-term sustainability.

Floodplain Re-vegetation. Dam removal and drawdown will expose bare sediment that can be colonized rapidly by riparian vegetation. These “mudflat” areas include the downstream deposits that are released and transported from the impoundment and upstream sources and the newly exposed surfaces within the former impoundment area. Rapid vegetation establishment on the nutrient rich bare soils is dependent on the presence of a viable seed bank or seed transport from upstream sources, the timing of seed dispersal, and the new hydrologic regime, particularly the extent of hydrologic connectively, duration of flooding, and baseflow conditions. The physical conditions may be more favorable for weedy, non-native species. Non-native invasive species that initially colonize the exposed areas can have a long-term impact on plant community composition as they tend to grow rapidly, produce high levels of seed, and disperse these seeds effectively.

Once established, the invasive species may inhibit the establishment of native species, thereby reducing plant and animal biodiversity and influencing community succession. Dam removals may contribute to or reinforce a regional invasive species problem as they provide passage of seeds and propagules to downstream riparian areas.

In areas where the risk of non-native plant establishment is high, a more active and managed approach to vegetation establishment after dam removal is needed, particularly if species richness and biodiversity are restoration goals. Active restoration should aim at stabilizing the exposed sediment with native vegetation and preventing the establishment of non-native invasive species. Plantings of early successional native species and weedy native annuals can be an effective method of starting natural succession processes and minimizing the establishment of undesirable species. Seeding should be done over several years to accommodate climate and hydrology variability, and the seed mixes should include species with a diversity of generalist species that can adapt to the micro environmental conditions that exist over a floodplain restoration site.

Floodplain Reconnection. Channel erosion occurs as a result of fast moving and turbulent water coming into contact with vulnerable and unstable soil surfaces. In urban areas, increases in erosion and decreases in stream channel stability is typically associated with the high volume and
rate of storm runoff. Down cutting or channel incision results in floodplain loss and/or lower connectivity. The loss of connectivity leads to a loss of floodplain functions. There are opportunity areas where floodplain reconnection (or expansion) can restore the interactions between the stream and its floodplain by increasing the frequency of inundation.

Reconnection can occur by lowering bank height, terracing, benching, contouring or excavating to create lower floodplains, and raising the streambed through in-stream structures (e.g., creation of riffle-pool sequences, varying sized rock, and large woody debris). Reconnection should be applied where the stream is entrenched and disconnected from its floodplain and there is enough area to restore sufficient floodplain width and habitat.

**Site Evaluation and Planning**

Prior to any restoration, a site evaluation process is needed to assess the suitability of a selected site and the feasibility of restoration. Criteria for evaluation should include the appropriateness of landscape and land use setting, land use development regulations, hydrologic analyses for reconnection, desired benefits, accessibility to the site, soil properties for water retention and vegetation, potential seedbank, control of invasive species, continuous habitat potential, and opportunities for financial (Illinois Environmental Protection Agency Section 319, Waters of the U.S. mitigation, etc.) and community support.

Any restoration project should have a long-term management plan to confirm the ecosystem’s structure and function is being maintained or restored. A management plan needs to include monitoring and evaluation methods to determine the conditions and/or restoration progress of the project area. Adaptive management, a flexible management approach, is highly recommended as it provides for alternative actions in response to actual conditions as they develop in the field, and addresses underperformance relative to project objectives in order to improve the probability of restoration success.

For determining restoration direction and goals, it is helpful to consider the following benefits of floodplains:

**Flood Control** - Floodplains provide a vegetated area where floodwaters can be slowed, stored, and then gradually released back to the river or stream. The reduced velocity and volume of water means reduced flood peaks and improved base flow conditions due to the slow release of water stored in floodplain soils. The reduced velocity and volume of water can be linked directly to reduced risk and property damage.

**Erosion Control** - Channel erosion occurs as a result of fast moving and turbulent water coming into contact with vulnerable and unstable soil surfaces. In urban areas, the uncontrolled volume and rate of storm runoff directly increases erosion, decreases stream channel stability, undermines infrastructure, and destroys habitat. Deep-rooted riparian vegetation can effectively dissipate flow energy, slow velocities, and promote soil infiltration. Floodplain Reconnection as described above can also help to reduce erosion by allowing the flow to spread across the floodplain, reducing velocities.

**Water Quality Improvement** - Surface flow is slowed by the vegetation, causing larger sediments and the pollutants attached or adsorbed to sediment particles to settle out. Smaller sediments, nutrients (nitrogen and phosphorus), and pesticides will be removed through vegetation uptake, geochemical processes (sequestration, chemical precipitation, sorption), and microbial processes in the sediment. Without a naturally vegetated floodplain area, urban pollutants such as pesticides and fertilizers...
would flow directly into the receiving rivers and lead to their impairment.

Habitat - Floodplains can provide continuous habitat corridors that are critical for wildlife movement and access in urban area where the corridors have become fragmented, which limits the range of key species and encourages the presence of opportunistic invasive species. Restoring floodplains in urban areas can decrease fragmentation and help sustain important aquatic and terrestrial plant and animal populations on both a local and regional scale.

**Invasive Species**

The goal for any restoration project is to develop a diverse and self-sustaining ecosystem that requires minimal maintenance. However, the biggest threat to any restoration or preservation project is the presence of non-native and aggressive plants species. Non-native invasive species (e.g., buckthorn, reed canary grass, phragmites, garlic mustard, teasel, etc.) can destroy native landscapes by outcompeting native species for light, nutrients, and moisture, because they begin their growing season sooner in the year, grow rapidly, produce high levels of seed, and disperse these seeds effectively, and they do not have natural competitors to keep their populations low. Invasive plants impact ecosystem functions by altering habitat structure (e.g., shifting from herbaceous to woody plants) and architecture (e.g., canopy height), changing nutrient cycles and productivity, reducing the availability of food and shelter resources, modifying food webs, and lowering community biodiversity in terms of the number and quality of species present.

Unless the opportunity area is in an isolated area, the complete eradication of invasive species is often not realistic. Once established, invasive species are very difficult and costly to eradicate. It is more realistic to control invasive species by reducing the density and abundance to a level that does not compromise the ecological integrity and allows the native species to succeed. Control involves suppressing, reducing, or managing invasive species populations and preventing the spread of invasive species from area where they are present.

Control strategies include a variety of manual, mechanical, chemical, and biological methods.

Manual methods are effective but resource intensive. Hand pulling, digging, flooding, mulching, controlled or prescribed burns of invasive plant species must be persistent over several years to reduce or eliminate the target species population.

Mechanical methods include hoeing, cutting, tilling, mowing, girdling, and chopping.

Chemical control is the use of pesticides (herbicides, insecticides, fungicides). Herbicides are among the most effective and resource-efficient tools, and the choice of herbicide (typically glyphosate or triclopyr) depends on the target population, stage of growth, presence of desirable species, and proximity to water resources. State application requirements for the use of pesticides must be followed.

Biological methods range from the use of grazing animals to the introduction of natural (non-native) enemies (e.g., parasites, pathogens, predators, etc.) of the invasive species. The long-term effectiveness and the environmental impacts of releasing one organism to control another are not fully understood, and rigorous safety and regulatory protocols need to be developed prior to use of biological controls.

An integral part of a project’s long-term management plan should be invasive species control. The control plan should be based on the resources available (i.e., money, manpower, and equipment) and on the best
available science to determine the control methods or combination of methods that will be most effective and economical for the target species. In addition, the plan should include a list of native replacement species, if a sufficient seed bank is not available, and a management schedule based on the life-cycle characteristics of target species.

Engaging volunteers in the fight against invasive species on both public and private lands can increase awareness of the impacts on native communities, build public support for the challenge posed by invasive species, and provide additional labor for controlling them.

Ecological Opportunity Area Descriptions

Streams

Streams and creeks within areas of poor water quality and low flows are subject to heavy erosion and sedimentation. Invasive species are frequently introduced to these areas and the natural wildlife diminishes. Stream restoration reestablishes the natural environment of the stream and adjacent banks. In-stream structure can be restored or enhanced to provide a variety of velocity regimes and functional aquatic habitat by introducing a variety of sized rock, large woody debris, creation of pool-riffle sequences, and in-stream vegetation plantings. Stream banks can be reshaped and/or stabilized with vegetation to help achieve a self-sustaining, functional flow that would not require frequent maintenance. Invasive species are removed and native plantings are installed to create the intended natural habitat for wildlife.

Floodplain

Floodplains are the flat or nearly flat bottomlands bordering a stream or river that experience occasional or periodic flooding. Floodplains provide cost effective and reliable ecosystem services such as flood control, erosion control, water quality improvement, groundwater recharge, and habitat that would otherwise cost communities significant amounts of money through engineered structures and systems. Floodplains can be restored or enhanced through replanting the appropriate native plant communities, reconnection to the stream or river, or habitat improvement for wildlife.

Wetlands

Wetlands comprise seasonally inundated ponds, marshes, sedge meadows, wet prairies, and flooded woodlands. Wetland restoration enhances and expands existing wetlands within a specific area. Excavation for expanding the wetlands would follow the natural topography of the land and hydrology would be established in a manner to minimize construction costs. These expanded wetlands would be capable of volume control and may mitigate some of the flooding issues nearby and possibly further upstream. Invasive species of plants would be removed and the appropriate native plantings would be established.

Prairie

Prairies once dominated more than 60% of the Illinois landscape, but today, less than 0.01% of high-quality tallgrass prairie remains in the state, most of which is due to the restoration or preservation of remnant areas (small pieces of land that were never cultivated). A prairie is a mostly treeless landscape dominated by grasses and wildflowers (or forbs). Prairies are composed of plants seldom found in other habitats, and provide rare habitats for native insects, butterflies and other pollinators, reptiles, birds, and small wildlife.

Prairie plants have complex, deep root systems that are drought resistant, store carbon, serve as habitat for of
microorganisms, absorb significant rainfall, improve water quality and groundwater recharge, and reduce erosion and storm runoff. Many of the wildlife species that depend on prairie habitats have experienced serious population declines due to the degradation and fragmentation of prairies. Over several years, invasive and non-native species would be controlled and managed and native plants reintroduced by seeding or plugs.

Oak Savanna

An oak savanna is a community of scattered oak trees within a diverse matrix of forbs and grasses. Savannas may be defined by tree cover that ranges on average between 10% and 50%, where the canopy is not closed so that the herbaceous species receive plentiful amounts of sunlight. Since oak savannas serve as a transition ecosystem between the tallgrass prairie and woodland environments, they have an extremely high flora and fauna diversity. Savannas rely on periodic disturbances such as fire, grazing, and drought to retain their ecological integrity. Prescribed fires are needed in savanna restoration projects, otherwise tree saplings begin to grow unimpeded in the savanna taking over, shading out and eliminating the grass and forb species.

TECHNOLOGY-BASED GREEN INFRASTRUCTURE

Infrastructure Mapping

Prior to the workshops with the resource experts and communities, existing data was requested from each of the communities. The data included:

1) Topography. Topography can be used to locate potential green infrastructure practices and determine the tributary area to the practices.

2) Storm and combined sewer and inlet locations. Green infrastructure should be located to intercept runoff prior to draining to storm inlets so that the runoff can be stored and treated prior to overflowing to the storm or combined sewer system.

3) Vacant parcels. Vacant parcels in the proper locations can be used to create “Stormwater Parks” used to manage stormwater in a manner that is attractive to the neighborhood.

4) Planned major capital development and utility infrastructure projects, including sewer main, water main, storm sewer, etc. Green infrastructure practices integrated into the right of way such as permeable paving and bioretention planters can be combined with other major capital improvements that already require significant pavement removal and earth excavation.

5) Planned major road and parking lot construction and reconstruction projects, including full depth pavement replacement, curb replacement and similar major work. As with the major capital improvements, these projects provide the opportunity to integrate permeable surfaces into pavement projects.

6) Planned streetscape projects. Streetscape projects provide an ideal opportunity to implement permeable paving and bioretention planters.

7) Stormwater problem areas, including flooding, nuisance ponding areas, etc.

The above data were intended to be used to screen for potential opportunity areas. For example vacant parcels with tributary areas and located in the drainage area of a flood problem location could be flagged for potential stormwater parks. Similarly, areas of planned road or parking lot reconstruction or streetscape improvements within the drainage area of a flood problem location
could be flagged for incorporation of stormwater storage into permeable paving and other ROW systems. However, obtaining the information in a format that readily supported GIS screening proved difficult and instead the workshops with agency experts and community officials were used to identify opportunity areas.

**Agency Workshop**

A workshop was conducted with resource and stormwater infrastructure experts to help identify opportunity areas. Very large scale maps (approximately 10 foot by 10 foot) were prepared for each of the two project areas. On the maps, the experts identified opportunity areas based on their knowledge of the region. Each of the opportunity areas were captured on a datasheet that recorded a location code, the name of the identifier, a description of the location, and a description of the opportunity. The experts largely focused on Ecological Opportunities. However, a number of technology-based opportunities were also identified.

**Community Workshops**

Similar to the Agency workshop, two workshops were conducted with municipal officials and stakeholders. Separate workshops were conducted for the two project focus areas. The participants were directed to verify the opportunity areas identified by the agency experts and then to identify technology-based opportunities based on their intimate familiarity with their respective communities. As part of the exercise, the participants were directed to categorize each of the opportunity areas into a number of defined templates and to list the potential green infrastructure practices applicable to the location. As in the previous workshop, the recommendations were captured on data sheets.
RESULTS
[Map Products]

CORE GREEN INFRASTRUCTURE NETWORK MAP

The green infrastructure mapping process, described above, resulted in the creation of the Green Infrastructure Network Map (See Appendices B – D). It is the intent of this plan that this map serves as the basis for spatial green infrastructure planning in the 13 communities and unincorporated areas throughout the larger planning area. The Network Map provides an awareness of where important environmental resources lie and reveals the interconnectedness of those resources.

This map is dominated by the three shades of green that represent the principal, aggregated categories of green infrastructure network.

1. Publicly Protected Parks and Preserves (with buffer)

These areas are drawn in dark green. They are comprised of Forest Preserves of Cook County, MWRD holdings, IDNR Nature Preserves and IDNR Land and Water Reserves, state parks, and municipal and district parks. These areas represent the portions of the planning area that are protected and managed by state or local agencies. These areas may or may not be open to the public.

2. Private Open Space

These areas are drawn in light green. They are comprised of land that is privately owned but either precluded from development or is unlikely to be developed based on its current use. Private open space includes golf courses, private conservation easements, Commonwealth Edison rights of way, and camps.

3. Environmental Resource Areas (with buffer)

These areas are drawn in yellow green. They are comprised of waterways/lakes/streams, wetlands, oak woodlands, Illinois Natural Areas Inventory (INAI) sites, and 100-year floodplains that do not otherwise fit into the private or public open space categories. These areas were chosen to be included here because they provide, or have the potential to provide, valuable natural functions such as storm water management, aquifer recharge, water filtration, and flora and fauna habitat. Included in this category is a 200-foot buffer around the outside edge of the original mapped areas. Buffering was applied to forest preserves, Illinois Natural Area Inventory sites, Illinois Nature Preserve Commission sites, wetlands, remnant oak populations, and waterbodies.

In addition to these categories, the map also highlights some of the important underlying green infrastructure components. Specifically, it includes symbology for floodplains, water, wetlands, and oak woodlands, as well as regional trail information.

Wetlands: This category is mapped in a pale blue pattern over the environmental resource areas in yellow green (above) and identifies areas of wetlands that were mapped in the National Wetland Inventory (NWI).

100-year floodplains: Floodplains are mapped in a blue cross hatch and reflect the official 100-year boundaries adopted by the Illinois DNR and FEMA.

Remnant oak woodlands: This category identifies areas of oaks woodlands and savannas that were mapped in 2013 by The Morton Arboretum following a protocol adopted by Chicago Wilderness. These areas are the last remnants of the vast woodlands that predated European settlement in the county.
Regional trails: These trails are highlighted in red dashed lines and represent trails identified by existing trails plans collected during the process. Many of these trails are owned and managed by the Forest Preserves of Cook County. Some of the more notable trails within the planning area include the systems along the Des Plaines River, North Branch Chicago River, and Salt Creek. In addition, the regional trails mapping includes trail loops that are largely contained within some of the larger forest preserves as well as community bikeways that link to regional trails.

OPPORTUNITY AREAS MAP

The opportunity area mapping process previously described, resulted in the creation of the Green Infrastructure Opportunity Area mapping (see Appendices E – G). To assist in the mapping and to ease understanding of the proposed green infrastructure, the opportunity areas were organized into the following categories below. During the previously described workshops, presentations were prepared to ensure a common understanding of the template categories and then the participants were directed to assign a template category to each of the recommendations. The template categories are listed below, followed by more detailed descriptions and illustrations.

- Single Family Residential
- Urban Multi-Family Residential
- Downtown Commercial District
- Big Box Commercial / Industrial / Institutional
- Campus / Suburban Multi-Family
- Stormwater Park
- Right-of-Way Retrofit
- Detention Retrofitting / Naturalization
- Ecological Restoration

Single Family Residential (SFR) - The single family residential land use dominates the study area. This template as shown is intended to illustrate green infrastructure practices that could be utilized within this land use. Practices could be implemented within the right-of-way as well as within individual private lots. The template shows permeable paving that could be installed in driveways or within the street, either over the entire section or within the parking lanes. The template also illustrates bioretention in the right-of-way, either in the parkway between the sidewalk and street or, potentially, in medians where they exist or created where overly wide street widths would allow. Bioretention rain gardens could be also be developed on individual lots through municipal rain garden technical and/or financial assistance programs.

Urban Multi Family Residential (UMFR) - Multi-family residential is also a common land use within the study area and can occur in either a more dense urban form as discussed here or as a lower intensity suburban form with more open space as discussed under a subsequent template. For the urban form, the
lot is largely covered by building and paving with smaller landscape zones. Within this land use, practices such as green roofs, permeable paving, and bioretention are appropriate. Due to the tight spaces, bioretention are likely to be in the form of planters that can accept runoff from building downspouts or adjacent pavement areas. Permeable paving can be used for parking, patios, and walkways. A variation on permeable paving can also be used for playgrounds where the permeable rubber surface that provides fall protection is underlain by open graded stone similar to permeable paving.

**Downtown Commercial District -** Most of the suburbs within the study area were founded and developed prior to the turn of the previous century and include historic downtown commercial districts. As many communities are moving towards streetscape and other projects to revitalize their downtowns, significant opportunities exist to incorporate green infrastructure practices into these plans. West Union Iowa provides an excellent case study for integrating green infrastructure into downtown revitalization. West Union and other projects have incorporated permeable paving into the streets, sidewalks, and parking lots; bioretention into sidewalk planters and protected parking bumpouts; and green roofs onto individual buildings. Another more local example is in Riverside where an existing downtown parking lot was repaved in permeable pavers.

**Big Box Commercial/Industrial/Institutional** - The big box form of development is ubiquitous throughout the suburbs, including within the study area. Although the land use may be retail or commercial, industrial or manufacturing, or institutions such as libraries, the basic form of a large building with a large parking lot is common to them all. The large parking lot areas that are often over-sized provide excellent opportunities to incorporate bioretention landscape islands. Further pavement reconstruction that is necessary from time to time provides an opportunity to convert from asphalt to more durable permeable paver systems.

**Campus/Suburban Multi-Family Residential** - Institutions such as communities colleges and suburban multi-family residential developments are often
developed in the form of a campus with multiple buildings, distributed parking areas, and large areas of open space. The large open space areas can often benefit from increased landscape that can also serve as bioretention for roof and pavement runoff. Parking lots can often be retrofit with bioretention landscape islands and/or permeable paving as illustrated in the template graphic.

**Stormwater Parks** - Cities and suburbs often have small land areas of either vacant parcels or small, underutilized parks. Depending on their topographic position in the landscape, drainage systems can often be modified to accept runoff from adjacent properties or rights of way. Through generous bioretention landscapes mixed with community amenities such as public art, permeable playgrounds (see Urban Multi-family), and small gathering areas, the spaces can be enlivened while also filtering and retaining runoff.

**Right-of-Way Retrofit** - In many suburbs, up to 25% of the land cover is transportation right of way. Further electrical transmission right of ways abound. Aging streets in many older communities are often in need of major rehabilitation or even complete reconstruction. This presents opportunities to reconstruct the streets in permeable pavers, to introduce bioretention into parkways and medians, and implement other measures to reduce the runoff impact of what is often considered the most polluting land use.

**Drainage and Detention Naturalization** - Detention has been required within northeastern Illinois since the middle 1970s and many of the older facilities are dry bottom detention basins where attempts are made to maintain a turf landscape. Even within wet detention basins, turf vegetation maintained to the waters edge has led to significant shoreline erosion. In many cases these dry and wet bottom detention basins can be naturalized with native species better adapted to the wet conditions and with denser root
systems that can better protect shorelines from erosion.

Ecological Restoration - As part of the mapping process, many areas of open space were identified as opportunities to implement native landscapes to improve habitat and water quality as well as expand the core green infrastructure network.

[ Recommendations ]

The green infrastructure mapping process resulted in a number of implementation recommendations. These are organized into the following three broad categories:

1. COORDINATE IMPLEMENTATION BETWEEN LOCAL GOVERNMENTS, AGENCIES, AND LANDOWNERS

One of the central themes of the Des Plaines River Communities Green Infrastructure Plan is the opportunity, and need, for coordination between the local governments, agencies, and landowners to achieve many of the goals and objectives of the Plan. This is particularly true because green infrastructure resources do not observe political boundaries. Recommended, coordinated planning actions and opportunities follow.

Low Impact Development Ordinances

Protection of river, stream, and wetland resources that are sensitive to changes in watershed hydrology is best achieved if all of the communities in a watershed work together to develop consistent ordinances that support sustainable stormwater management and green infrastructure designs for new development and redevelopment. Working with ordinances and education programs, local governments can maximize the opportunity for every drop of water to be treated with green infrastructure practices, such as rain gardens, before it moves offsite.

Low impact development (LID) employs a combination of creative site planning and innovative stormwater management practices to reduce stormwater runoff, protect water quality, and protect natural resources and habitat. This recommended approach embraces green infrastructure designs as well as principles of “conservation design”. The objectives recommended here can be accomplished through updates to traditional development codes, particularly zoning, subdivision, stormwater, and landscaping ordinances.

The recent adoption by the Metropolitan Water Reclamation District (MWRD) of the Watershed Management Ordinance provides for protection of natural hydrology and water quality from the adverse impacts of development throughout Cook County. This ordinance, which requires compliance by local governments throughout Cook County, also offers new protections for floodplains, riparian areas, and isolated wetlands. (https://www.mwrd.org/irj/portal/anonymous/managementordinance)

In contrast to the new requirements of the MWRD ordinance, in most communities the related development ordinances are out of date. In particular, it is common to find incompatibilities between advanced stormwater ordinances and outdated zoning, subdivision, and landscaping codes. It is recommended that local development codes
be evaluated and updated regarding their provisions for natural area protection, natural landscaping standards, impervious area reduction, and standards that recognize and incentivize creative designs for parking lots and roadways, such as permeable paving, bioswales, and rain gardens.

To assist local governments in reviewing and updating their ordinances for consistency with green infrastructure principles, a comprehensive ordinance checklist (developed by Geosyntec Consultants and the Chicago Metropolitan Agency for Planning) is included as an Appendix to this plan. The checklist was derived from regional and national sources and has been applied to several dozen communities’ ordinances as part of recent watershed planning projects. The checklist addresses ordinance provisions for:

- Stormwater drainage and detention
- Soil erosion and sediment control
- Floodplain management
- Stream and wetland protection
- Natural areas and open space
- Conservation design
- Landscaping
- Roads and transportation
- Parking
- Water efficiency and conservation
- Pollution prevention

Recommendations:

Local governments should use the ordinance checklist in the Appendix to review and revise their local zoning, subdivision, landscaping, and stormwater ordinances to encourage and/or require low impact development approaches, consistent with the new stormwater requirements of the Watershed Management Ordinance.

Where appropriate, local governments should consider lowering the thresholds for the size of development projects that are subject to the new MWRD stormwater requirements. Local governments should also consider requiring that stormwater controls be applied to address the full impact of site development rather than only to the change in hydrologic conditions. For example, for a redevelopment project, stormwater controls should mitigate for the full area of imperious cover rather than only the increase in impervious cover. This will facilitate the design of advanced runoff volume reduction and detention designs for smaller projects, thereby reducing flooding and water quality problems throughout existing communities over time.

Further, local governments should review and amend their codes to incorporate adequate protections for natural resource areas identified in the green infrastructure network map. In particular, protections for remnant woodlands, wetlands, and other natural areas should be provided.

Local Examples:

The Village of Brookfield recently updated its stormwater ordinance to formally adopt provisions of the MWRD Watershed Management Ordinance. In reviewing and adopting the new requirements, the Village lowered some of the thresholds for when/where the ordinance will apply. This will ensure that smaller residential and commercial development and redevelopment projects become opportunities for progressive runoff volume reduction and storage designs. See: [https://www.municode.com/library/il/brookfield/codes/code_of_ordinances?nodeId=COOR_CH48DEIMSU_ARTVIWAMAOR](https://www.municode.com/library/il/brookfield/codes/code_of_ordinances?nodeId=COOR_CH48DEIMSU_ARTVIWAMAOR)

With the newly adopted Stormwater Management Ordinance in place, the Village also sponsored a “Stormwater Summit” to discuss new construction methods for managing, preventing, and mitigating flooding. The Stormwater Summit’s purpose was to do outreach to builders and developers who invest in the community, to get them up to speed on the new ordinance, and to share ideas for best practices. The
Village’s Community and Economic Development Department targeted training toward commercial and multi-family contractors, developers, and brokers who do business in town. Attendees included a variety of business and real estate sectors. The Village has additional meetings and outreach planned for the coming year.

The City of Chicago requires that stormwater control be provided and the ordinance standards be met for all development projects regardless of existing land use or cover. Thus, through infill and redevelopment projects, the City will eventually be retrofit to meet current stormwater standards. This is consistent with building codes that typically require an entire building be retrofit to meet existing building code if the building is improved by more than 50%.

Integrate Green Infrastructure into Regional Grey Infrastructure Plans

The MWRD has already developed watershed based stormwater plans and the Tunnel and Reservoir Plan (TARP) to address combined sewer overflow problems. These plans, which rely primarily on traditional grey infrastructure practices, go a long way to solving regional flooding problems. However, green infrastructure implemented on a dispersed basis throughout local watersheds could further reduce local flooding and drainage concerns, keep water out of basements, and reduce flows into the TARP system that will eventually require pumping and treatment at a wastewater reclamation facility. In addition to local governments, transportation agencies, residents, and businesses can be part of green infrastructure solutions that are described in the later section on Institutionalization of Green Infrastructure Implementation.

2. PROTECT CORE GREEN INFRASTRUCTURE

There is an array of techniques that can be used protect, restore, and expand green infrastructure within the broader planning area and individual communities. These techniques should be targeted specifically to lands mapped in the green infrastructure network, but also should be used in a dispersed fashion on smaller areas throughout the planning area (e.g., wetlands, woodlands, greenways, etc.) that have local importance. Recommendations are provided for each of the following techniques:

Acquisition by Public Agencies

Open space and natural area acquisition is one of the principal methods recommended for protection of areas identified in the green infrastructure network map. It is a method that has been used with great success by the Forest Preserves of Cook County (FPCC), Illinois Department of Natural Resources, and other open space agencies in protecting thousands of acres of open space within the planning area.

While the FPCC and IDNR have been leaders in natural area protection, other entities also play a significant role. Local park districts and departments and the MWRD also have substantial holdings in the core green infrastructure network.

Recommendations:

The FPCC, IDNR, park districts and municipal park departments, townships, and other state and federal agencies should continue to acquire natural open space, with a priority placed on areas identified in the green infrastructure network map. In particular, these entities should focus on opportunities to protect Environmental Resource Areas that provide connectivity between already protected natural lands.

Park districts, park departments, municipalities, and townships should identify
green infrastructure priorities in their master plans. In particular, they should identify and implement opportunities for protecting local Environmental Resource Areas that are part of the green infrastructure network and educate their constituents about the value of natural resources.

Where appropriate, open space entities should strive for intergovernmental partnerships to leverage resources and to create “mosaics” of natural communities for protection of plants and animals that require connected tracts of land to survive. In particular, assemblages of wetlands, stream corridors, prairies, savannas, and woodlands should be targeted.

FPCC, IDNR local park districts, Cook County and other local agencies should coordinate their efforts to promote ecotourism resources, such as parks, natural resources, and similar points-of-interest.

Local Example

Kent Fuller Air Station Prairie and Evelyn Pease Tyner Interpretive Center, Glenview: The Village of Glenview and the Glenview Park District have been regional leaders in protecting and managing natural areas. Perhaps the most notable example is the protection and restoration of the Kent Fuller Air Station Prairie, 32-acre remnant of a tallgrass prairie. The prairie contains over 160 native plant species and is being actively managed to control invasive species. The adjacent Evelyn Pease Tyner Interpretive Center is an award winning facility. The Tyner Center illustrates the many aspects of the prairie environment and leads visitors to pathways through the property to experience the changes in the prairie through the various seasons. The Tyner Center serves as a showcase for “green technology,” featuring a number of innovative practices including a geothermal heating and cooling system, solar panels and a “green roof”. The Tyner Center has been certified by the U. S. Green Building Council as LEED Platinum, the highest possible designation under the Leadership in Energy and Environmental Design rating system. For more information, see: http://www.glenviewparks.org/facilities-parks/kent-fuller-air-station-prairie-tyner-center/.

Conservation Easements and Nature Preserve Dedications

Privately owned natural areas and open spaces can be voluntarily dedicated for long-term protection under a conservation easement provision. Under this provision, these areas remain in private ownership, but the rights to change the use are given to a controlling agency, usually an entity whose mission includes the protection of open spaces. Conservation easements provide an effective method to preserve open space for future generations. Another option for private landowners is protection of land through the Illinois Nature Preserves Commission (INPC). Land enrolled in the Illinois Nature Preserves System (either dedicated as an Illinois Nature Preserve or registered as an Illinois Land and Water Reserve) confers the highest level of protection for land in Illinois. The landowner retains title to the property and neither
The INPC partners with landowners to protect land that has been recognized for its high ecological value or otherwise serves to buffer or protect such land. Land with high ecological value could include a prairie, woodland, or wetland that has largely survived undisturbed or supports populations of 1 or more of the State’s list of endangered and threatened species. The two land-protection programs available through the INPC provide flexibility in working with landowners who wish to voluntarily protect their land. A number of FPCC holdings, such as Wolf Road Prairie (see above) and Somme Nature Preserve in Northbrook, are dedicated Nature Preserves.

Recommendations:

Save the Prairie Society, Openlands, the Illinois Nature Preserves Commission, and related organizations should continue to identify private land opportunities for protecting critical natural areas, buffers, and connections within and supporting the mapped green infrastructure network.

Local governments and conservation organizations should continue to educate private landowners and developers about opportunities to set aside land for conservation as well as farmland protection purposes.

Local Example:

Wolf Road Prairie, Westchester: Wolf Road Prairie has been characterized as one of the highest quality black soil prairies east of the Mississippi River. At its core is an 80-acre dedicated Illinois Nature Preserve that includes high quality prairie, oak savanna, and wetland remnants. The Preserve has been protected through cooperative efforts of Save the Prairie Society, FPCC, and IDNR. In recent years, with the support of grants from the Open Land Trust and Natural Areas Acquisition Fund and the Land and Water Conservation Fund (LAWCON), additional land has been protected in an expanding buffer on the east side of the preserve. For more information, see: http://savetheprairiesociety.org/about-2/about-the-prairie/.

Targeted Land Use Planning and Zoning

Some communities in the planning area have adopted goals in their land use and comprehensive plans that emphasize wise land use and development decisions that protect green infrastructure. The more forward-thinking plans focus on protection of natural resources and the environment, preserving environmentally sensitive areas, preserving farmland, providing aesthetically pleasing places, and preserving and enhancing existing surface and groundwater resources.

Some of these plans, like the Des Plaines River Communities Green Infrastructure Plan, further identify and map key elements of green infrastructure, including:

- Existing open space
- Regional Trails and Bikeways
- Greenways
- Wetlands
- Floodplains
- Lakes and streams
- Remnant woodlands
One of the primary ways to implement land use policy is through zoning and other ordinances. In that vein, it is important that Cook County and local cities and villages review and revise their zoning, subdivision, and other development related ordinances to be consistent with the policies and recommendations of their land use plans and the Des Plaines River Communities Green Infrastructure Plan. Ideally, the county, municipalities, and other local governments will work cooperatively to achieve a consistent approach to natural resource protection at local, watershed, and regional scales.

Recommendations:

Cook County, municipalities, townships, and other local governments should develop local green infrastructure maps and plans consistent with the principles and mapping of this plan. The development of local green infrastructure maps should consider small-scale opportunities for resource protection and greenways.

Local governments should incorporate green infrastructure elements into their land use plans and zoning maps, with a priority on protection of critical natural resources, open space, and linked greenways.

Local governments should link development and redevelopment priorities to natural resource constraints and opportunities, particularly streams, lakes, floodplains, wetlands, and woodlands. Development should be avoided in the most sensitive natural resource areas.

Tools such as overlay protection districts should be implemented to clearly identify sensitive areas where development intensities should be limited. Overlay districts can be structured to provide advance knowledge of site constraints to developers as well as to identify creative design techniques such as lot clustering and conservation development (discussed below).

The North Cook County and Will-South Cook County Soil and Water Conservation Districts (SWCD) should utilize the Des Plaines River Communities green infrastructure maps as they advise local governments, private land owners, and agricultural producers on natural resource issues. In particular, the SWCDs should incorporate green infrastructure maps in its Natural Resource Information reports for all zoning and land use changes that it reviews.

Local Example:

The Village of Brookfield has updated its zoning ordinance to address opportunities to reduce the impact of residential development and redevelopment on existing stormwater and flooding problems. One of their zoning requirements is to limit the maximum amount of imperviousness in residential lots and developments. They require a minimum of 40% green or open space for all properties zoned single family residential. See: https://www.municode.com/library/il/brookfield/codes/code_of_ordinances?nodeId=COOR_CH62ZO_ARTIIDI.

Greenway Connections

A greenway refers to public or private open space that is concentrated in a linear manner along a natural or artificial corridor. Greenways can provide connectivity between adjacent natural areas, provide buffers for linear features such as streams, and sometimes serve as corridors for recreational or trails.

In the creation of the green infrastructure network map, a number of greenway corridors were mapped along existing stream and river corridors and regional trails, particularly highlighting the Des Plaines River, North Branch Chicago River, and Salt Creek.
corridors. In addition, advisors from natural resource agencies and organizations identified a number of potential smaller-scale connections between existing open spaces and mapped natural areas. Protection and enhancement of greenway opportunities can be achieved by a variety of mechanisms including public acquisition, conservation easements, developer donations, natural landscaping, and ecological stewardship.

Recommendations:

The County, local governments, park districts, the FPDCC, Openlands, and other open space organizations should collaborate to link local parks and open spaces to existing and planned portions of the Des Plaines River Communities green infrastructure and open space networks.

The FPCC and local park districts and departments should be leaders in establishing new and expanded public greenways, particularly along the Des Plaines River, North Branch Chicago River, and Salt Creek, and their tributaries. Where appropriate, the organizations should collaborate with the MWRD to improve public access and ecological functionality to MWRD land holdings.

Local governments should identify and utilize a suite of creative greenway preservation tools such as linkages identified in land use plans, intergovernmental agreements, community buffers, and natural resource overlay districts.

Local governments should encourage the interconnection of open space and greenways during the zoning and subdivision approval process. Further, they should work with landowners and developers to encourage the permanent preservation of greenway connections to provide opportunities for habitat enhancement, recreation, and environmental education.

Local governments, in cooperation with conservation organizations like Openlands should identify and offer incentives for private landowners to donate lands (or cash in lieu of land) or conservation easements to protect important greenways such as stream corridors and wetlands.

Greenway planning and preservation entities should promote public awareness and provide technical assistance regarding greenway protection to private landowners and homeowners associations.

Trails, Bikeways, and Water Trails

A remarkable regional trail and open space network has been planned and largely implemented under the leadership of the forest preserve district and its local partners. This Green Infrastructure Plan identifies opportunities for municipal and park district trails, bike lanes, and greenways to interconnect to these regional facilities. Connectivity can be further enhanced when residential redevelopment, parks, businesses, and commercial developments incorporate local greenways, trail linkages, and bikeways where people live, work, recreate, and shop.

Trail connectors are key elements of the green infrastructure network. Trails are the primary facilitator of time spent in nature in America’s urban areas, and in Illinois trails are the most desired recreational and non-motorized transportation amenity. They promote active communities, improve health and well-being, link communities and open spaces, and connect people to schools, jobs, and commercial centers. The Plan maps the regional trail network and some municipal bikeways and promotes the development of an interconnected network of non-motorized trails. It advocates access for a variety of users, including pedestrians, bicyclists, and equestrians where appropriate. It also supports implementation of an expanded water trails system for non-motorized watercraft.
Much like greenways, successful trail planning and implementation requires extensive coordination between local governments, open space agencies, regional planners, transportation agencies, and private land owners and developers. With the leadership of CMAP, Openlands, the FPCC, the Active Transportation Alliance, and others, efforts within the Des Plaines River Communities planning area to implement regional trail corridors have been very successful. Notable examples are the previously referenced trails along the Des Plaines River, North Branch Chicago River, and Salt Creek corridors.

Recommendations:

Local governments, Cook County Highway Department, FPCC, Chicago Metropolitan Agency for Planning (CMAP), Northwest Municipal Conference, West Central Municipal conference, Openlands, IDNR, IDOT, and other agencies should continue coordinating their efforts to plan and implement trail corridors and bikeways throughout the planning area to provide effective, safe connections between communities and existing and future open space areas.

Representing regional consensus, trail and bikeway connections within the planning area identified in the Northeast Illinois Regional Trails & Greenways Plan and recent CMAP-led plans should receive priority in trail development efforts. A formal process for including new trails in the plans should be clarified for local agencies to accommodate both new opportunities and changes that affect existing recommendations.

Local governments should promote, incentivize or require connecting new residential and commercial development to local and regional trails within their land use approval process.

Municipalities should promote and plan for walking and biking throughout their communities, including improving the safety, accessibility, and convenience of non-motorized travel.

When looking for project funding, trail planners and implementers should cast widely for resources, beyond the traditional federal transportation programs. In recent years, tens of millions of dollars from public health agencies and health-related industry, such as health insurance companies, have funded non-motorized transportation plans, facilities and amenities in the Chicago area. Examples such as The 606 and the Cal-Sag Trail demonstrate private interests funding public trails.

While identifying and appealing to non-traditional trail funding sources is critical to complete an interconnected trail network in the Des Plaines River Communities planning area, trail planners and implementers may lack the experience and capacity to do so. The Chicago Metropolitan Agency for Planning and IDNR should partner with area non-profits working in trails and greenways to bring non-traditional trail funding sources to the table. They should also develop workshops to expand local agencies’ ability to leverage non-traditional funding for trail and bikeway development.

In the identification of priority trail and bikeway corridors, planners should identify riparian, utility, and abandoned rail line corridors as multiple use greenway opportunities to accommodate trails, wildlife corridors, and vegetative buffers.

Water Trails

Local governments, park departments, and FPCC should utilize the Northeastern Illinois Regional Water Trails Plan as a guide in the development and expansion of a network of stream and river canoe access facilities.
Coordinated efforts should be undertaken to expand opportunities and eliminate constraints to expanded water trail access. Where appropriate, multi-objective approaches that benefit aquatic habitat, water quality, flood relief, and paddling access should be pursued.

**Ecological Restoration of Degraded Landscapes**

The Des Plaines River Communities planning area contains a number of high quality natural areas. Most of the best areas are mapped as Illinois Natural Area Inventory (INAI) sites and are protected and managed by the FPCC. However, most of the local landscapes and natural areas have been greatly altered since the beginning of settlement by Euro-Americans in the 1840s. Notably, large areas of former wetlands have been drained, largely to facilitate agricultural production and urban development. Similarly, the region has lost the majority of its original oak-hickory woodlands and savannas. Only a tiny fraction, less than 1 percent, of Illinois’ original prairies have survived intact.

While these losses are a cause of concern, they also present opportunities for restoration and expansion of existing green infrastructure. With respect to wetland restoration, there have been very successful projects involving the removal of subsurface drainage tiles and closing of drainage ditches in altered “hydric soils”. These actions restore the hydrology, or natural water saturation and inundation conditions, thereby allowing native wetland vegetation and wildlife to return. Similarly, the removal of the Hoffman Dam on the Des Plaines River has restored aquatic habitat and improved water quality in the vicinity of the dam and also opened upstream reaches of the river to fish migration. The mapped green infrastructure network identifies thousands of acres of altered floodplains and stream and wetland buffers that present an important opportunity for the re-introduction of native vegetation to cleanse water and enhance wildlife habitat.

A prairie restoration includes reestablishing native forbs and grasses on a site that was once there prior urban development or managing an existing native prairie remnant, a small piece of prairie that has never been completely altered, to improve the native plant community. Prairie restoration is a labor of love, as it requires three to five years to remove and control invasive species, perform prescribed burns (around year 3), and establish a healthy, diverse prairie plant community through seeding and planting a complete range of species over multiple years.

Woodland/savanna restoration can be a more challenging task, and it can take many years to re-establish woodland that has been cut down. Nonetheless, woodland replanting and restoration are can have substantial benefits if undertaken in the vicinity of remnant woodlands that are in good ecological condition. For example, planting oaks in a residential neighborhood or open space that borders an oak-hickory woods can effectively expand the habitat for certain bird and mammal species that need extensive native tree cover and travel corridors between wooded remnants.

Recommendations:
Des Plaines River GI Mapping Project | www.chicagowilderness.org

Forest Preserves of Cook County, park districts, and other local governments should target opportunities for ecological restoration of degraded landscapes (small and large-scale) in their comprehensive plans, with a particular focus on areas within the green infrastructure network and within identified greenway corridors.

Forest Preserves of Cook County, park districts, and other local governments should identified ecological opportunity areas where restoration could be funded by serving as Waters of the U.S. mitigation sites or through federal and state grants, such as the Section 319(h) nonpoint source pollution grant.

Forest Preserves of Cook County, Openlands, relevant county, state and federal agencies, and watershed groups should provide technical and policy assistance to local governments and land owners to identify, plan, implement, and monitor opportunity areas for landscape restoration.

Forest Preserves of Cook County, park districts, local governments, and volunteer groups should develop management plans to enhance and protect habitats with conservative (or rarer) plant species and threaten and endangered species.

Note: Additional site-specific recommendations for ecological areas are considered in more detail in a later section of this report (see Advance Strategies for Opportunity Areas) as part of the discussions during the opportunity area mapping process.

Local Example:

The Prospect Heights Natural Resources Commission, with the support of the Prospect Heights Park District and the City of Prospect Heights, started to restore a treasured wetland in the heart of their community in the summer of 2014. Original land surveys from 1838 show that the 30 acre Slough is a natural wetland, having been saved from development and filling for decades by residents and community members who valued its importance.

Although well intentioned, lack of natural areas management allowed impenetrable thickets of invasive buckthorn to choke out desirable plant species and a monoculture of invasive reed canary to occupy almost 5 acres of wetland soils before restoration efforts began. The Prospect Heights Natural Resources Commission initiated a volunteer effort by holding workdays every other Sunday year round to remove invasive plants, collect and distribute native seed and plant thousands of native plant plugs made possible through a ComEd Green Regions grant administered through Openlands. The Prospect Heights Natural Resources Commission and volunteers will continue with their hard work to increase storm water retention and filtration and improve biodiversity and habitat for the abundant wildlife that calls the Slough their home. See: http://phnrc.com/the-slough-restoration.html.

3. ADVANCE STRATEGIES FOR OPPORTUNITY AREAS

Ecological Opportunity Areas

Natural resource experts and representatives from the communities identified many opportunities throughout the north and south project areas. A few of the identified ecological opportunity areas are highlighted below.

Forest Preserves of Cook County is restoring and repairing the ecological communities within a number of the forest preserves as part of their vision of restoring and conserving native landscapes. Local natural resource experts would like to see the current turf areas within Westchester Woods and Brezina Woods restored to the appropriate native habitats or ecological communities (e.g.,
wetland, mesic prairie, savanna, etc.) to allow for greater biodiversity of native species.

Local natural resource experts indicated that the expansion of the reservoir in Mayfield Park (Westchester Park District) by the Metropolitan Water Reclamation District of Greater Chicago provides an opportunity to develop native ecological communities to allow for greater biodiversity of native species.

Local natural resource experts would like to see the quarry area in the Village of Lyons developed into recreational open space with native ecological communities, such as wetlands, prairies, and woodlands.

Roadsides can serve as corridors for the spread of invasive plant species as windblown seeds are scattered up and down the road allowing for the establishment of new populations that can spread to adjacent areas. Roadside areas, such as I-294 near Route 34 (Ogden Avenue) and Route 171, were identified by natural resource experts as the main areas for invasive species management and/or removal with on-going monitoring.

The North Branch of the Chicago River riparian buffer areas within Glencoe were identified by natural resource experts as areas for invasive species management and/or removal.

The Commonwealth Edison right of way presents an excellent opportunity for native habitat restoration. A remnant prairie and sedge meadow exist within the right of way that can be protected by removing invasive species and restoring the surrounding areas. Restoration would include:

- Restoration that allows for the greater biodiversity of native species within the different habitats (e.g., wetlands, sedge meadows, and prairie).
- Invasive species removal with on-going monitoring in the area.

The former landfill with Mount Prospect is an opportunity to create native habitat areas. Restoration would include:

- Introduction of native vegetation to increase biodiversity.
- Invasive species removal with on-going monitoring in the area.

Local natural resource experts see an opportunity to restore areas of the Des Plaines River floodplain with the planned removal of the Dempster Street Dam (Des Plaines), Touhy Dam (Park Ridge), and Dam #4 (Rosemont). Elements may include:

- Riparian buffer reconnection by lowering bank height, benching, contouring or excavating to create lower floodplains, and raising the streambed through in-stream structures.
- Riparian buffer, wetland, and upland habitat restoration that allows for the greater biodiversity of native species.
- Active native plant reestablishment on newly exposed sediment.
- Invasive species removal with on-going monitoring in the area.

The City of Des Plaines indicated an interest in floodplain restoration where homes are being acquired within the flood zone. Restoration would include:

- Riparian buffer reconnection by lowering bank height, benching, contouring or excavating to create lower floodplains, and raising the streambed through in-stream structures.
- Riparian buffer, wetland, and upland habitat restoration that allows for the greater biodiversity of native species.
- Invasive species removal with on-going monitoring in the area.

The City of Prospect Heights would like to restore three different areas (McDonald Creek near Walnut Woods, McDonald Creek near Somerset Park, and the tributary of McDonald
Creek between the public library and Lions Park) to improve riparian habitat and functionality and reduce erosion. Restoration practice may include:

- Streambank stabilization using native vegetation to reduce erosion.
- Riparian buffer reconnection by lowering bank height, benching, contouring or excavating to create lower floodplains, and raising the streambed through in-stream structures.
- Riparian buffer, wetland, and upland habitat restoration that allows for the greater biodiversity of native species.
- Invasive species removal with ongoing monitoring in the area.

The Village of Mount Prospect would like to restore the streambank and buffer area along Weller Creek to introduce riparian habitat and provide recreational opportunities.

- Streambank stabilization using native vegetation to reduce erosion.
- Riparian buffer, wetland, and upland habitat restoration that allows for the greater biodiversity of native species.
- Invasive species removal with ongoing monitoring in the area.

The habitat areas adjacent to the roadways and railways near Busse Woods Forest Preserve District were identified by natural resource experts as areas for invasive species management and/or removal.

Forest Preserves of Cook County is restoring and repairing the ecological communities within a number of the forest preserves as part of their vision of restoring and conserving native landscapes. Local natural resource experts identified a specific area for restoration within the Forest Preserves. There is an opportunity within Camp Pine Woods to restore the floodplain hydrology to develop sedge meadow and wet mesic wood habitats with native vegetation.

Urban Farming and Community Gardens

There is a growing movement to support “local food” through urban farming and community gardens. CMAP has been at the forefront of identifying municipal strategies for local food through comprehensive land use plans and urban agriculture ordinances. Beyond the local food benefits, these types of initiatives help preserve or restore permeable, functioning landscapes that help maintain water infiltration, reduce stormwater runoff and basement flooding, and reduce urban heat island effects.

Recommendations:

Local governments are encouraged to work with CMAP, NRCS, North Cook and Will-South Cook County SWCDs, and other organizations to develop policies, plans, and ordinances to protect local farms and to expand opportunities for urban farming and community gardens.

Local Examples:

Chicago Advocates for Urban Agriculture (AUA): Chicago AUA is a coalition that supports sustainable urban agriculture and community gardens in the Chicago area. They have developed a web-based Urban Agriculture Resource Guide and an online Urban Agriculture Directory that lists dozens of urban farms and gardens in and around Chicago.

http://auachicago.org/resources/chicago-urban-agriculture-directory/

City of Chicago Urban Agriculture Zoning: Recently adopted changes to the Chicago Zoning Ordinance allow agricultural uses like community gardens and urban farms in many parts of the city. The zoning amendments define community garden and urban farm uses, identify where each use is permitted, and establish regulations designed to minimize potential impacts on surrounding
property and help maintain the character of Chicago’s neighborhoods. More information is available through the City’s Department of Planning and Development:

The City of Chicago has implemented a number of urban agricultural plots. Princeton Farms is a recent example that incorporates stormwater management to fully meet the Chicago Stormwater Ordinance while also incorporating a passive irrigation system to reduce the demand on the City potable water system.

**Technology-based Green Infrastructure Opportunity Areas**

Implementation of technology-based green infrastructure practices can be conducted using a two pronged approach. The first prong would be to move forward with specific projects identified during the mapping process. A selection of those opportunities are discussed further below. The second prong would be to institutionalize exploration of stormwater green infrastructure opportunities as part of the planning and design of every significant capital improvement plan.

1. **Implementation of Identified Green Infrastructure Opportunities**

   Representatives from the communities identified many opportunities throughout the north and south study areas. A few of the identified areas are highlighted below.

   **Brookfield Streetscape Improvements:** The Village of Brookfield identified streetscape improvements. The project is identified in their Comprehensive Plan and could include a range of green infrastructure practices such as bioretention sidewalk planters, bioretention bumpouts, and green roofs.

   **Brookfield Public Library:** The library is a highly visible location with a large number of visitors. Identified potential improvements included converting the diagonal parking stalls to permeable paving and installing bioretention within the landscape islands surrounding the parking stalls.

   **Ogden Avenue Streetscape Improvements:** Ogden Avenue passes through the Communities of Brookfield, Lyons, and Berwyn and is largely older commercial uses throughout its length within these communities. Enhanced landscapes integrated with bioretention systems and areas of permeable paving within parking lots and cross streets could greatly improve the quality of stormwater runoff that discharges directly to Salt Creek while providing significant visual enhancement to the corridor.

   **Des Plaines Redevelopment Parcels:** A number of parcels that have vacant or otherwise underutilized buildings were identified as being opportunities for redevelopment as urban multi-family or commercial using green infrastructure practices such as permeable paving and bioretention.

   **In Niles, a number of Right-of-way locations were identified for introduction of green infrastructure practices consistent with Illinois**
DOT’s ILAST principles. These included Oakton Street and Milwaukee Avenue.

In Glenview, a number of areas were identified in the general vicinity of the Glen View Naval Air Station site. The identified templates were right-of-way, downtown, and commercial.

Examples

- Riverside permeable paving parking lot. The Village of Riverside recently installed a new parking lot in their downtown area on East Burlington Street. The lot includes permeable interlocking concrete pavers and native landscaping.

- West Union Iowa downtown green streets project. With funding from the Iowa Economic Development Authority, CDF assisted West Union Iowa in developing an integrated main street revitalization and green streets project. Based on the plan, funding was obtained from a wide range of sources to assist in implementation of the plan that includes permeable paving streets and sidewalks, bioretention sidewalk planters, and intersection and midblock bioretention bumpouts. The project also features a geothermal districtwide heating and cooling system that many of the historic buildings in the downtown area are tap into.

2. Institutionalization of Green Infrastructure Implementation

Technology based green infrastructure practices are most cost effective when integrated into larger capital improvement plans such as repaving, streetscape, and major capital improvement plans. This can be facilitated by developing a process for evaluating green infrastructure components as part of every capital improvement project and preparing engineering standards for typical elements of green infrastructure. While every project may not lend itself to the incorporation of green infrastructure practices, a deliberate evaluation process should be followed to inform the decision making process.

Recommendations

Through a deliberative process, review short and long term capital improvement plans and identify opportunities to incorporate green stormwater management elements into the projects.

Conduct an inventory of flooding and drainage problem areas and/or develop stormwater assessments of the community drainage and detention systems to identify locations where the system is inadequate along with their tributary areas. In combined sewer areas, also identify and map locations of basement backups.

Overlay the capital improvement plans with the flood problem and tributary area maps to assist in prioritizing projects with integrated green infrastructure practices.

Develop guidance for sizing and designing green infrastructure practices. The guidance should identify key factors to be incorporated into the sizing process, including drainage area, soils, site context, both regional and site specific performance standards, and hydrologic and hydraulic sizing procedures.

Assemble and prepare standard engineering details for green infrastructure practices such as permeable paving and bioretention systems in different contexts such as parking lot islands, street bumpouts, and sidewalk.
and building planters. Example engineering details and specifications that could be developed are listed below. Many of these already exist within various manuals and documents.

- Curb cuts (with energy dissipation) to allow gutter flow to be diverted into swales and bioretention areas
- Permeable pavement cross sections
- Permeable pavement mixes (for pervious asphalt and pervious concrete)
- Bioretention cross sections
- Bioretention soil mix and gravel specifications
- Filter fabric specifications for use in various green infrastructure components

Examples

CMAP has recently expanded their Local Technical Assistance Program to include assessment of stormwater issues into their planning processes.

The Chicago Department of Transportation has developed their Sustainable Urban Infrastructure Guidelines (SUIG). The intent of this document is to institutionalize use of green infrastructure as well as renewable energy, recycled materials, and may other sustainable practices. The manual provides guidance for the planning, design, and construction of all urban infrastructure within the City. As of this writing, Volume 1 of the Guidelines is complete. Volume 1 outlines the vision, purpose, goals, and objectives of the program as well as a process for integrating sustainable urban infrastructure, including green infrastructure in the planning and design of projects within the City. The document primarily focuses on work within the right-of-way but addresses non-ROW projects as well. The as-yet unpublished Volume 2 outlines standards and specific guidelines for sustainable urban infrastructure.

The Chicago Public Schools, Chicago Department of Water Management, MWRD, Openlands, and Healthy Schools Campaign have partnered to replace deteriorating asphalt school grounds with new and permeable playgrounds, landscape, gardens, athletic fields, and paving at elementary schools around the City. The program has brought needed playground improvements to distressed schools while also providing green infrastructure stormwater storage to assist DWM and MWRD in reducing neighborhood flooding and reducing combined sewer overflows. To date, improvements have been made to ten schools and more schools are planned. The program won an award in 2015 from the Illinois Association for Floodplain and Stormwater Management (IAFSM).

Storm Lake Iowa recently completed their Green Infrastructure Plan for Water with assistance from CDF. As part of the process, CDF’s team conducted a stormwater flooding and pollutant loading analysis. Those analyses along with sampling that was conducted by the City to identify bacterial loading “hot spots”, were used to develop a short to medium term plan to implement specific green infrastructure projects. A long term plan to eventually retrofit most all of the community with green infrastructure practices was also developed, with priority given to land uses that generate the highest runoff volumes and pollutant loads. A green infrastructure toolbox and template land uses were developed similar to what was used for this SWAT project.

Charles City Iowa is an urban village in northcentral Iowa. Although the area surrounding the community is much more rural than the Des Plaines River watershed, the City itself is quite similar to the Des Plaines communities with a downtown urban core and historic single family and multifamily residential neighborhoods all constructed prior to modern detention requirements and storm sewer sizing standards. As a result the community suffers from locations of poor
drainage and undersized storm systems that lead to nuisance flooding problems. Because of the form and density of the neighborhoods, there is no available space to introduce conventional stormwater detention. At the same time, due to the age of the community, many of the streets are in poor condition. To address these conditions, CDF developed stormwater models of a number of its neighborhoods and used these models as well as community input to identify flood and drainage problem areas and locations of under-capacity drainage systems. CDF then utilized a previously prepared pavement condition index mapping of the entire City to select streets most in need of repair that are also located within the drainage areas of flood problem locations to prioritize implementation of permeable paving streets within the City. To date approximately 25 blocks of permeable streets have been constructed and two more blocks are being designed.
[ Resources ]

ECOLOGICAL RESTORATION RESOURCES

Guidelines for developing and managing a restoration project
Society for Ecological Restoration

Prairie establishment and landscaping
Illinois Department of Natural Resources:
http://dnr.state.il.us/conservation/naturalheritage/prairie/table.htm

References on Illinois tall grass prairies
Illinois Natural History Survey:
http://www.illinoiswildflowers.info/

Tools needed to restore oak savannas:
http://www.oaksavannas.org/

User’s guide to wetland restoration, creation, and enhancement
NOAA and U.S. EPA

Engineering Field Handbook on wetland restoration, creation, and enhancement
USDA Natural Resources Conservation Service:

Invasive species identification and control
Midwest Invasive Plant Network:
http://mipn.org/control/
The Nature Conservancy:
http://www.invasive.org/gist/handbook.html

Native plant alternatives when replacing non-native plants

Chicago Botanic Garden:
http://www.chicagobotanic.org/research/identifying_threats/invasive

Native plants and landscaping
Illinois Natural History Survey links:
http://www.inhs.illinois.edu/~kenr/prairienative-links.html

USDA Natural Resources Conservation Service plant database:
http://www.plants.usda.gov/java/
Illinois Wildflowers:
http://www.illinoiswildflowers.info/


GREEN INFRASTRUCTURE RESOURCES

Chicago Wilderness Green Infrastructure Vision
Chicago Wilderness and The Conservation Fund:
https://datahub.cmap.illinois.gov/dataset/green-infrastructure-vision-2-2-qiv-refinement

Des Plaines River GI Mapping Project | www.chicagowilderness.org
Green Infrastructure Vision 2.3: Ecosystem Service Evaluation
CMAP and Chicago Wilderness:
https://datahub.cmap.illinois.gov/dataset/green-infrastructure-vision-2-3-ecosystem-valuation
GIS Data for the CW Green Infrastructure Vision and the Ecosystem Service Valuation
https://datahub.cmap.illinois.gov/dataset/green-infrastructure-vision-data
***It is important to note that the green infrastructure mapping data layers developed for your sub-region of the Des Plaines River watershed as part of this project are a more refined, up-to-date version of the regional dataset available through CMAP***

Interactive Web Map of the CW Green Infrastructure Vision Data
http://maps.fieldmuseum.org/giv/

SUSTAINABLE ROADS RESOURCES
Sustainable Urban Infrastructure, Chicago Department of Transportation

IDOT-ILAST

I-LAST Project Environmental Sustainability Rating System Scorecard

NACTO- National Association of City Transportation Officials
http://nacto.org

CLIMATE CHANGE RESOURCES
Climate Change Update to the Biodiversity Recovery Plan

Chicago Community Climate Action Toolkit
http://climatechicago.fieldmuseum.org

Milkweed for Monarchs Plant Guide

Climate Adaptation Guidebook for Municipalities in the Chicago Region
http://www.cmap.illinois.gov/livability/sustainability/climate-adaptation-toolkit

Climate Considerations for Management of Natural Areas and Green Spaces in the City of Chicago
https://www.academia.edu/6444016/CLIMATE_CONSIDERATIONS_for_MANAGEMENT_of_NATURAL_AREAS_and_GREEN_SPACES_in_the_CITY_of_CHICAGO

ORDINANCE AND CODE RESOURCES
Ordinance checklist for green infrastructure compliance - developed by Geosyntec in partnership with CMAP

Code Review for Blackberry Creek developed by Conservation Design Forum

Supplement to Kane County Stormwater Technical Manual developed by Conservation Design Forum

Example of stormwater ordinance enacted by the Village of Brookfield
https://www.municode.com/library/il/brookfield/codes/code_of_ordinances

Village of La Grange Park Downspout Disconnection Assistance Program
[ References ]


McDonald RI (2013) Implications of urbanization for conservation and biodiversity protection. Encyclopedia Biodivers 7:304-313


[ Acknowledgements ]

This project was made possible by a grant from Boeing.

Project coordinators
Nancy Williamson, Illinois Department of Natural Resources (IDNR)
Chris Mulvaney, Chicago Wilderness

GIS specialist
Mark Johnston, The Field Museum

Climate change information to communities
Abigail Derby Lewis, The Field Museum

Ecological Opportunity Areas Analysis
Jill Kostel, The Wetlands Initiative

Lead Consultants
Dennis Dreher, Geosyntec Consultants
Tom Price, Conservation Design Forum
We also thank the following individuals for their invaluable services throughout the project:

- Mike Walczak, Northwest Municipal Conference
- Tammy Wierciak, West Central Municipal Conference
- Nora Beck, Chicago Metropolitan Agency for Planning
- Carrie Asselmeier, Chicago Wilderness Intern
- Kathleen Falk, Chicago Wilderness Intern
- Elizabeth Braatz, Chicago Wilderness Intern
- Remi Ketchum, Chicago Wilderness Intern

The following agencies and organizations helped to develop the green infrastructure mapping protocols and participated in the workshops to produce the Core Green Infrastructure Network map, shown on the accompanying maps.

- Chicago Metropolitan Agency for Planning, Nora Beck
- Des Plaines River Valley Restoration Project, John Kolar
- Forest Preserves of Cook County, Deborah Antlitz
- Forest Preserves of Cook County, Andrew Donakowski
- Forest Preserves of Cook County, Diana Krug
- Forest Preserves of Cook County, Chip O’Leary
- Forest Preserves of Cook County, Kristin Pink
- Forest Preserves of Cook County, James Ziemba
- Geosyntec Consultants, Mark Willobee
- Illinois Nature Preserves Commission, Steve Byers
- Kane County Development Department, Karen Miller
- Lake County Stormwater Management Commission, Andrea Cline
- Metropolitan Water Reclamation District of Greater Chicago, John Watson
- Northwest Municipal Conference, Christopher Staron
- Northwest Municipal Conference, Mike Walczak
- Oakton Community College, Ken Schaefer
- Oakton Community College, Virginia Stopinski-Donnelly
- Prospect Heights Natural Resources Commission, Kari Spiegelhalter
- Prospect Heights Natural Resources Commission, Agnes Wojnarski
- Salt Creek Greenway Association, Valerie Spale
- The Conservation Foundation, Stephen McCracken
- The Field Museum, Doug Stotz
- Upper Des Plaines River Ecosystem Partnership, Gary Paradoski
- USDA Natural Resources Conservation Service, Rand Briggs
- Village of Glenview, Kelsey Atkinson
- Village of Glenview, Robyn Flakne
- Village of Glenview, Kirsten Triller

The following municipalities, park districts, and other local jurisdictions and organizations participated in workshops or provided information to review the draft Core Green Infrastructure Network map and to help identify green infrastructure Opportunity Areas – shown on accompanying maps.

- Chicago Metropolitan Agency for Planning, Nora Beck
- City of Des Plaines, Scott Mangum
- City of Park Ridge, Kim Alexander
- City of Prospect Heights, Steve Cutiaia
- City of Prospect Heights, Dan Millen
- Northwest Municipal Conference, Mike Walczak
- Prospect Heights Natural Resources Commission, Agnes Wojnarski
For questions and additional information on the Des Plaines River green infrastructure mapping process and products please contact:

Nancy Williamson, IDNR
nancy.williamson@illinois.gov
815-263-9857

Chris Mulvaney, Chicago Wilderness
chris@chicagowilderness.org
312-224-8094
APPENDIX A
PROJECT STUDY AREA
Appendix B - Green Infrastructure Network Map: North Community Cluster
Des Plaines River Watershed: Green Infrastructure Network
South Community Cluster

This map was compiled as part of "Des Plaines River Communities Green Infrastructure Mapping Project" available on the Chicago Wilderness website (www.chicagowilderness.org). See report for detailed information about how this map was developed.
Appendix F - Opportunity Areas Map: North Community Cluster

Des Plaines River Watershed: Opportunity Areas
North Community Cluster

Map Codes and Descriptions: Green Infrastructure Retrofit Templates

- SFR: Single Family Residential
- UMF: Urban Multi-Family
- DTC: Downtown Commercial District
- SCM: Suburban Big Box Commercial/Industrial/Institutional
- CMF: Campus/Suburban Multi-Family
- SWP: Stormwater Park
- ROW: Retrofit of Street and Utility Right Of Way (ROW)
- DRN: Detention Retrofit/Naturalization
- RES: Ecological Restoration (Existing Parks/Open Space)
- BCG: Bike Corridor/Greenway

This map was compiled as part of "Des Plaines River Communities Green Infrastructure Mapping Project" available on the Chicago Wilderness website (www.chicagowilderness.org). See report for detailed information about how this map was developed.
Appendix G - Opportunity Areas Map: South Community Cluster

Des Plaines River Watershed: Opportunity Areas
South Community Cluster

Map Codes and Descriptions: Green Infrastructure Retrofit Templates

- **SFR**: Single Family Residential
- **UMF**: Urban Multi-Family
- **DTC**: Downtown Commercial District
- **SCM**: Suburban Big Box Commercial/Industrial/Institutional
- **CMF**: Campus/Suburban Multi-Family
- **SWP**: Stormwater Park
- **ROW**: Retrofit of Street and Utility Right Of Way (ROW)
- **DRN**: Detention Retrofit/Naturalization
- **RES**: Ecological Restoration (Existing Parks/Open Space)
- **BCG**: Bike Corridor/Greenway

Public Open Space
Private Open Space
Environmental Resource Area
Waterbody

Wetland Area
Remnant Oak Population
Existing Greenway or Trail
Floodplain

This map was compiled as part of "Des Plaines River Communities Green Infrastructure Mapping Project" available on the Chicago Wilderness website (www.chicagowilderness.org). See report for detailed information about how this map was developed.