2015

Spring Creek Valley

Section 206 Aquatic Ecosystem Restoration

Detailed Project Report - Alternative Formulation Briefing Document

Chicago District
US Army Corps of Engineers
10/14/2015

Executive Summary

The Forest Preserve District of Cook County (FPDCC) holds many natural areas within Cook County, many of which have remnant habitats that exemplify the historic ecology of the Chicago Region. The FPDCC has in turn requested that the Chicago District, USACE initiate a study under Section 206 WRDA 1996 Aquatic Ecosystem Restoration authority to ascertain the feasibility of restoring important migratory bird and wildlife habitat at the Spring Creek natural area.

The Detailed Project Report documents whether or not a project is warranted for Federal participation based on a feasibility level assessment of estimated costs, potential benefits, and possible environmental impacts of various alternatives, all of which follow the United States Army Corps of Engineers (USACE) planning and policy guidelines. The main purpose of the DPR is to recommend a plan, including consideration of the No Action Plan, for ecological restoration of the Spring Creek natural area. The need is to restore wetland, floodplain, stream and buffering habitats, while addressing invasive species issues in order for the Spring Creek natural area to provide important habitat for mussels, fishes, amphibians, reptiles, migratory birds and small and large mammals within a highly industrialized area. If an alternative is found to be worth the investment, the next steps include approval of the decision document, signing of a Project Partnership Agreement (PPA) and development of a contract set of Plans and Specifications (P&S) and project implementation. The non-Federal sponsor is the FPDCC.

The site lies 3 miles west of Barrington and one mile east of Carpentersville in the northwest corner of the county, adjacent to the small Chicago suburb of Barrington Hills. Spring Creek's headwaters originate just east of the eastern boundary of the site near the southern boundary line of the project, and flow generally north though the project site into Lake County and eventually the Fox River.

Historically, the Spring Creek watershed was topographically and ecologically diverse, driven by the rolling West Chicago Moraine. Gravel outwash deposits, peat-filled kettles, and a stream valley cut by the northward flowing glacial Spring Creek added to the site's topographic complexity. Vast areas throughout Spring Creek watershed held impressive mosaics of high quality sedge meadow, marsh, fen, prairie, savanna, and kettle lakes. Since the onset of agriculture, the study area was adversely affected by hydrologic, geomorphic and soil alterations via subsurface drain tile systems and ditches, tilling, fire suppression, nutrient enrichment and invasion by noxious weed species. The FPDCC began assembling the nearly 4,000-acre tract in 1955, which encompasses a greater portion of the watershed. Today, the study area holds various areas of remnant high quality habitats; however, most of the study area still remains degraded in terms of wetland and floodplain hydrology, stream hydraulics, geomorphology, and native plant communities.

Specific problems with primary ecosystem drivers include:

- Altered hydrology stemming from drain tile and ditch system
  - Streams run dry during droughty periods
  - Wetland hydroperiods no longer occur
  - Surface water wetlands have disappeared
  - Groundwater recharge prevented
- Altered riverine hydraulics stemming from increased urban runoff
  - Minor issue which has caused the streams to become a bit larger than they should naturally be if the whole watershed was in native vegetation
- Altered riverine hydraulics stemming from invasive plant species
  - Major issue which has caused stream morphology to degrade
  - Stream habitat has become degraded

- Altered riverine hydraulics stemming from historic channelization
  - A few reaches of stream and floodplain still suffer from being channelized for agricultural purposes
  - No recovery of heavily channelized sections provides minimal if any viable stream habitat
- Habitat fragmentation
  - Two dams on the mainstem Spring Creek may prevent recolonization of fishes and mussels to a 7-mile reach
  - Large plots of ruderal plant communities and domination of invasive plant species could be adversely affecting movement of amphibians, reptiles and small mammals
- Lack of large mammal keystone species
  - Buffalo to maintain and diversify the prairie/savanna habitat mosaic
  - Wolves to keep the deer and browsing species' populations in check
  - Beavers to maintain stream and floodplain hydrologic and structural diversity
- Cessation of natural processes
  - Fire
  - Fluvial / Floodplain Interactions
  - Wetland Hydro-periods
  - Large Mammal Absence

Based on these problems with the ecosystem drivers above, the following are resulting ecological problems for the Spring Creek natural area:

- Reduced acres (quantity) of healthy native plant communities and structurally viable habitats
- Reduced richness and abundance (quality) of native plant species per community type
- Reduced richness and abundance of fishes and mussels
- Reduced richness and abundance of wetland, grassland, shrubland and woodland resident and migratory bird species
- Reduced richness and abundance of higher level organisms including insects, amphibians, reptiles and mammals

Two (2) planning objectives were identified by the study team, including the non-Federal sponsor and various stakeholders, to address resource problems listed above:

Objective 1 – Reestablish Hydrology to Support Natural Communities

Currently, Spring Creek Valley is recovering from decades of intensive agriculture. This included altering the site's hydrology via installing vast drain tile networks, excavating ditches, channelizing streams, and grading-out micro-topography. Desired changes to the current hydrologic regime will reestablish hydroperiods and rehydrate former hydric soil units. These affects would be sustained over the life of the project and optimistically in perpetuity. This objective seeks to reestablish natural hydrologic and hydraulic parameters to support critical wetland and riparian habitats within the Spring Creek natural area. Improvement is predicted via the increase in quantity (acres) and increase in quality (Mean C Value of the FQA) of native plant communities.

Objective 2 – Reestablish Wetland, Riparian & Buffering Native Plant Communities

Currently, Spring Creek wetland, riparian and important buffering habitats are dominated by non-native and invasive plant species. This condition resulted from alteration to the natural hydrologic regime, disturbance to native soils, prevention of natural processes, and the sowing of non-native and native

weedy (ruderal) plants. The domination of riparian plant communities by certain species such as buckthorn, honeysuckle and multiflora rose have also caused stream hydraulics and geomorphology to degrade, further exacerbating floodplain hydrologic issues. The desired changes to the native plant community will reestablish a base native plant community that will diversify overtime. These affects would be sustained and increased over the life of the project and maintained by the project sponsor. This objective seeks to reestablish native plant community richness and structure to support critical wetland and riparian habitats within the Spring Creek natural area. Improvement is predicted via the increase in quantity (acres) and increase in quality (Mean C Value of the FQA) of native plant communities.

The following Alternatives were prescribed for cost and benefit analysis:

- Alternative 0 is the No Action Plan and obviously takes no action. The outcome of this alternative is described by the Future Without-Project conditions.

- Alternative 1 would restore 931 acres of habitat immediately impacted by the disablement of drain tiles and filling in the ditch along the western portion of Spring Creek Valley; however critical hydraulic restoration would not be performed within portions of channelized stream to rehydrate the channel and floodplain (**Plate 9**). This alternative also would not restore additional areas with hydric soils that would further support critical wetland and riparian habitats. This alternative does address the eradication of invasive plant species and establishment of native riparian communities within the 931 acre area, but neglects critical hydraulic restoration that may negatively impact species richness and the ability to fully eradicate invasive species.

- Alternative 2 would restore 1064 acres of habitat which includes all hydrologic and native plant community restoration identified within Alternative 1, but would also perform critical hydraulic restoration within portions of channelized stream to rehydrate the channel and floodplain (**Plate 10**). This alternative also restores additional areas with hydric soils that would further support critical wetland and riparian habitats.

- Alternative 3 would restore 1270 acres of habitat which includes all hydrologic, hydraulic, and native plant community restoration identified within Alternative 2, but would also restore additional areas further downstream and hydric areas further away from the immediate riparian zone that would support wetland and riparian habitats (**Plate 13**).

- Alternative 4 would restore 1997 acres of habitat which includes all hydrologic, hydraulic, and native plant community restoration identified within Alternative 3, but would restore all remaining hydric areas not identified for restoration within Alternative 3 that are further away from immediate riparian zones, however would further support wetland and riparian habitats (**Plate 12**). This alternative also includes restoration of a significant portion of buffering upland habitat consisting of savanna, woodland, and prairie communities that would have direct benefits to adjacent wetland and riparian habitats.

- Alternative 5 would restore 3841 acres of habitat which includes all hydrologic, hydraulic, and native plant community restoration identified within Alternative 4, but would also restore all remaining upland areas not identified for restoration within Alternative 4 (**Plate 13**).

The plan that reasonably maximizes net National Ecosystem Restoration benefits and is consistent with the Federal objective, authorities and policies, is identified as the NER plan. This NER Plan is considered as the Preferred Plan for direct, indirect and cumulative effects assessment under NEPA in the following Chapter. The NER/Preferred Plan was determined to be Alternative 4 (**Plate 14**).

Alternative Plan 4 consists of the following measures presented in Section 4.1: (DTD) Drain Tile Disablement, (D) Ditch, (SMI) Stream Meander Induction, (MSI) Native Plant Establishment in Areas with Monotypic Stands of Invasive Species, (C) Native Plant Establishment in Areas with Existing Stands of Rhizomatous *Carex* spp., (ISC) Invasive Shrub Clearance, (ITSC) Invasive Tree and Shrub Clearance, (QITSC) Invasive Tree and Shrub Clearance of Red Oak Afforestation, (QISC) Invasive Shrub Clearance in Areas with Open-grown Oaks, (EM) Eurasian Meadow, (EP) Existing Prairie.

The implementation of all of these measures would restore riverine and flowage lake fish habitat, streamside marsh, basin marsh, sedge meadow, graminoid fen, seep, wet/wet-mesic prairie, and savanna/open woodland, all of which are riparian to Spring Creek. The implementation of these features is generally described as follows and according to the measures descriptions in Section 4.1. More detail would be added to the plan should this project commence to the design and implementation phase, for example, specifying spatial distribution of native plugs within a given zone and species clumping, planting centers, temporary predator controls, and establishment activities.

An Environmental Assessment was completed for the proposed habitat restoration at Spring Creek Valley. The Environmental Assessment has found that there would be no adverse affects resulting from implementation of the NER/Preferred Plan. A 30-day Agency and Public Review period was held from _____ to ____. Agency and public review comments were addressed as they were received with pertinent comments incorporated into the document.

The estimated total project cost of the NER Plan is $_____ and the estimated annual operations, maintenance, repair, replacement and rehabilitation (OMRR&R) cost is $_____. The Federal portion of the estimated total project cost is $_____. The non-Federal share of the estimated first cost of the project is about $_____and will be covered by lands, easements, rights-of-way, utility or public facility relocations, and dredged or excavated material disposal areas (LERRDs).

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CHAPTER 1 – STUDY PURPOSE & SCOPE

1.1 – Report Organization

This Detailed Project Report (DPR) presents the results of the Spring Creek Valley Section 206 Aquatic Ecosystem Restoration study. This report consists of eight (8) parts including a main report and eight appendices with photos, plates, figures and tables. The report is structured as follows:

Detailed Project Report
Appendix A – Hydrology & Hydraulics Analysis
Appendix B – Cost Engineering
Appendix C – Civil Design
Appendix D – Hazardous, Toxic, and Radioactive Waste (HTRW) Report
Appendix E – Real Estate Plan
Appendix F – Monitoring Plan
Appendix G – Compliance, FONSI, Permitting & Planning Info

1.2 – Study Authority

33 USC § 2330 – Aquatic ecosystem restoration

(a) General authority.
(1) In general. The Secretary may carry out a project to restore and protect an aquatic ecosystem or estuary if the Secretary determines that the project--
(A) (i) will improve the quality of the environment and is in the public interest; or
(ii) will improve the elements and features of an estuary (as defined in section 103 of the Estuaries and Clean Waters Act of 2000 (33 U.S.C. 2902)); and
(B) is cost-effective.
(2) Dam removal. A project under this section may include removal of a dam.
(b) Cost sharing.
(1) In general. Non-Federal interests shall provide 35 percent of the cost of construction of any project carried out under this section, including provision of all lands, easements, rights-of-way, and necessary relocations.
(2) Form. Before October 1, 2003, the Federal share of the cost of a project under this section may be provided in the form of reimbursements of project costs.
(c) Agreements.
(1) In general. Construction of a project under this section shall be initiated only after a non-Federal interest has entered into a binding agreement with the Secretary to pay the non-Federal share of the costs of construction required by this section and to pay 100 percent of any operation, maintenance, and replacement and rehabilitation costs with respect to the project in accordance with regulations prescribed by the Secretary.
(2) Nonprofit entities. Notwithstanding section 221 of the Flood Control Act of 1970 (42 U.S.C. 1962d-5b), for any project carried out under this section, a non-Federal interest may include a nonprofit entity, with the consent of the affected local government.
(d) Cost limitation. Not more than $ 10,000,000* in Federal funds may be allotted under this section for a project at any single locality.
(e) Funding. There is authorized to be appropriated to carry out this section $ 50,000,000 for each fiscal year.

HISTORY: (Oct. 12, 1996, P.L. 104-303, Title II, § 206, 110 Stat. 3679; Aug. 17, 1999, P.L. 106-53, Title II, § 210. 113 Stat. 287.) (As amended Nov. 8, 2007, P.L. 110-114, Title II, § 2020, 121 Stat. 1078.)

*modified WRRDA 2014

1.3 – Purpose & Need

The Forest Preserve District of Cook County (FPDCC) holds many natural areas within Cook County, many of which have remnant habitats that exemplify the historic ecology of the Chicago Region. The FPDCC has in turn requested that the Chicago District, USACE initiate a study under Section 206 WRDA 1996 Aquatic Ecosystem Restoration authority to ascertain the feasibility of restoring important migratory bird and wildlife habitat at the Spring Creek natural area.

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1.4 – Study Area

The site lies 3 miles west of Barrington and one mile east of Carpentersville in the northwest corner of the county, adjacent to the small Chicago suburb of Barrington Hills (Figure 1). It includes parts of Sections 5, 6, 7, 8, 17, 18, 19, 20, 28, 29, 30, 31, and 32 of T42N, R9E. Spring Creek's headwaters originate just east of the south east corner of the project, and flow generally north though the project site into Lake County and eventually the Fox River (Figure 2).

Figure 1: Study Area Location within the Greater Chicago Region

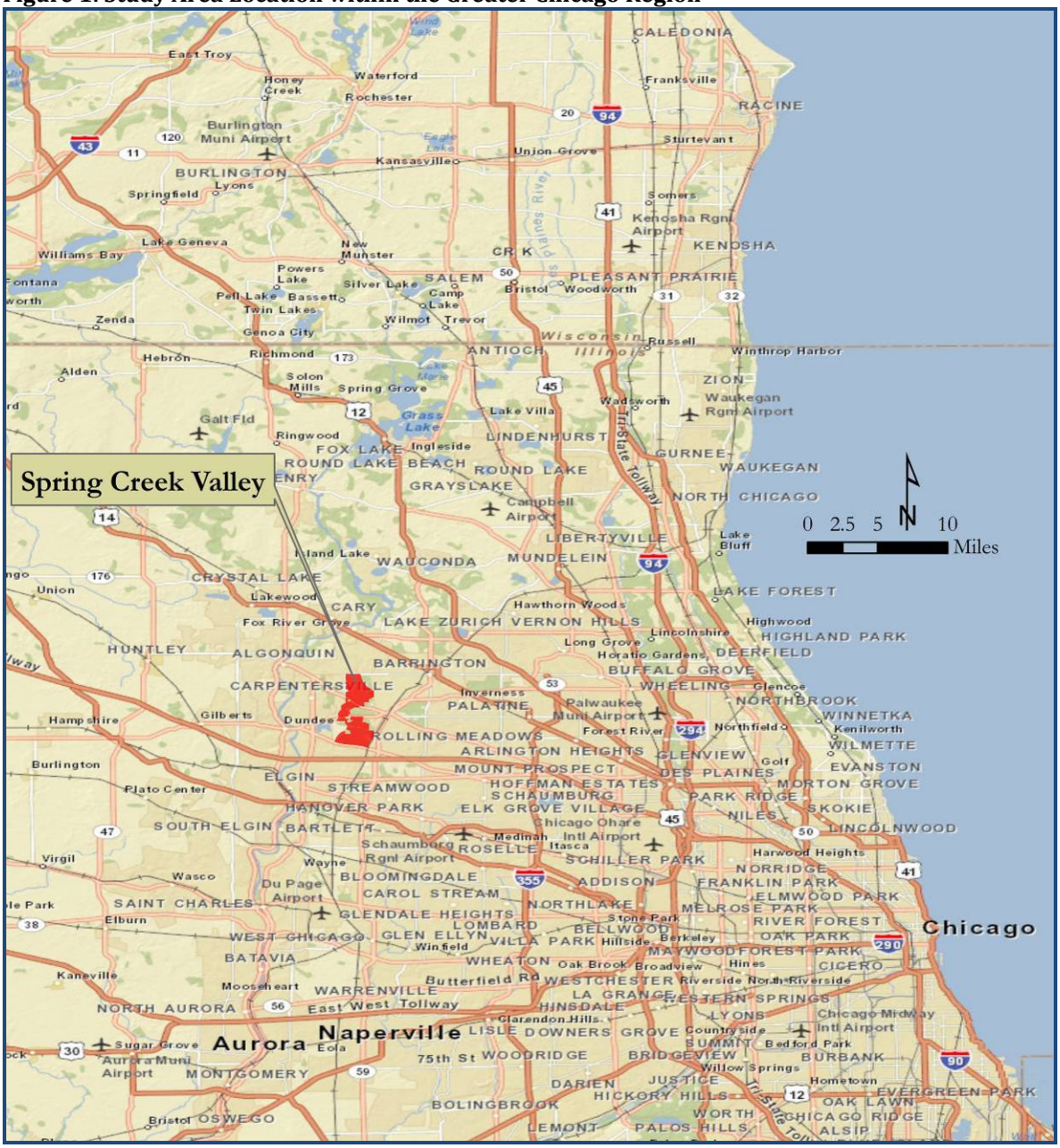
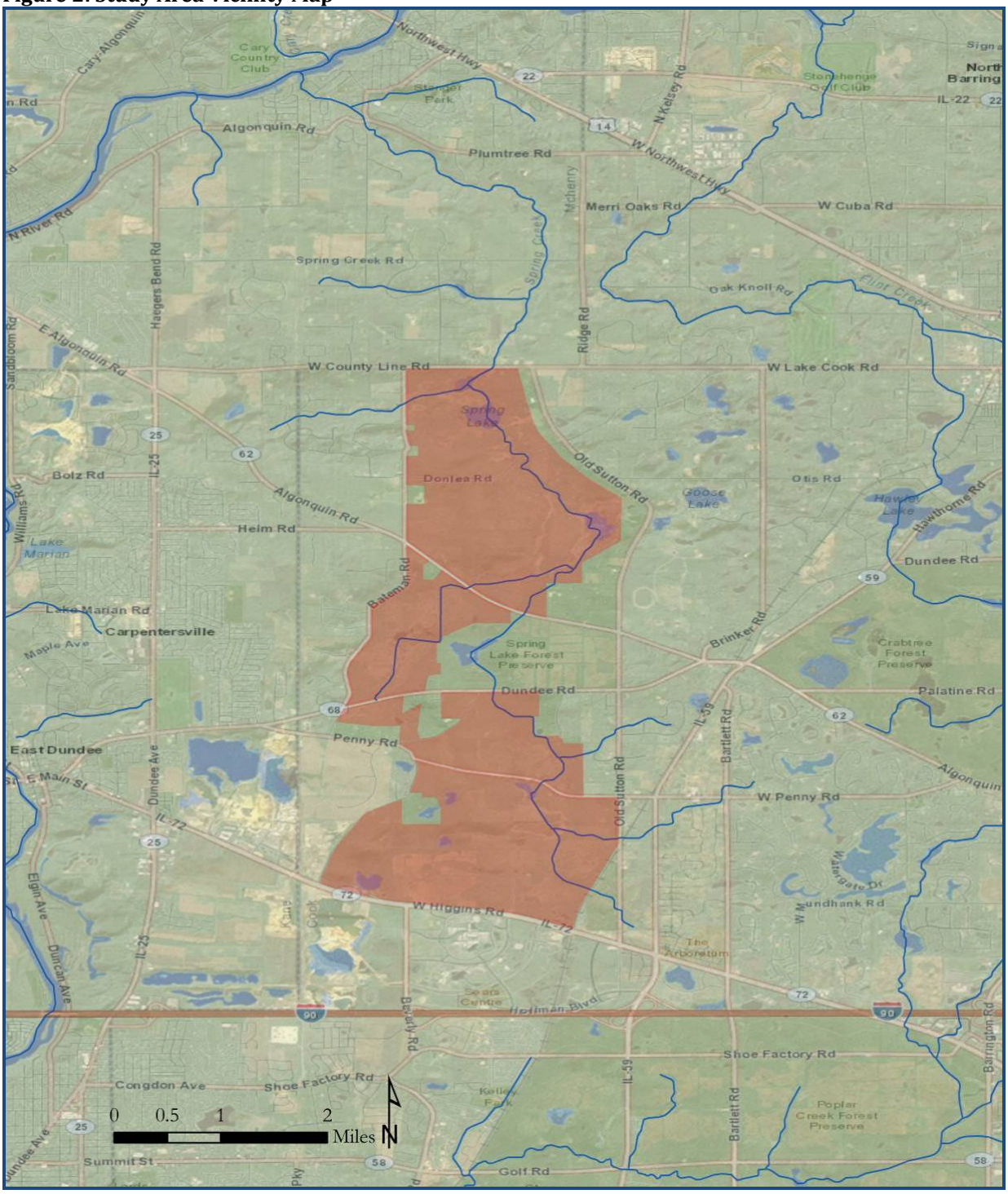


Figure 2: Study Area Vicinity Map



1.5 – Pertinent Reports, Studies, Programs & Projects

1.5.1 – Existing Reports & Data

- Schenum & Woodson. 1999. Ecological Evaluation of Spring Creek Forest Preserve.

The formal study presented was a thorough ecological and biological analysis of the northern 1,500-acre portion of the 4,500-acre Spring Creek Forest Preserve. It includes that FPDCC land lying between Lake-Cook Road and Algonquin Road (Route 62). Contained within it are the 560-acre Spring Lake Nature Preserve and nearly 1,000 acres of multiple use land from the south border of the nature preserve (old Donlea Road) to Route 62. The purpose of the 1999 study was two-fold. First, it provides the most current and complete data on the type and quality of natural communities present; plant species occurring in those portions of the site still resembling pre-European settlement vegetation composition; breeding birds occurring in selected large contiguous habitat blocks; and the fish community occupying Spring Creek. Secondly, this study identifies specific management problems threatening the ecological value of the natural communities and their floral and faunal components across the 1,500-acre study area. It then proposes a set of detailed management and restoration actions necessary to maintain, improve, and sustain the natural heritage elements actually and potentially occurring on this large diverse site. Execution of these recommendations will preserve and enhance Spring Creek Forest Preserve's contribution to the Chain O' Lakes-Fox River Resource Rich Area in Illinois.

- Spring Creek Watershed Partnership & ILEPA. Spring Creek Watershed Based Plan. 2012.

The Spring Creek Watershed Based Plan (SCWBP) was developed to protect and improve the existing integrity of Spring Creek watershed. The ecologically-based plan focuses on protecting and improving water quality as the primary goal with secondary goals to enhance green infrastructure, improve habitat, reduce structural flooding, and implement watershed education strategies. The plan also addresses requirements to be considered an approved USEPA “Watershed-Based Plan”. The primary purpose of the plan is to spark interest and give stakeholders a better understanding of the watershed to promote and initiate plan recommendations that will accomplish goals and objectives. The plan also provides detail on watershed characteristics and how restoration plans could be implemented. This plan may be found here: http://www.barringtonhills-il.gov/SpringCreekWatershed.html

1.5.2 – Current Programs & Completed Projects

- Volunteer Organizations

The Spring Creek Stewards were organized by the Audubon Chicago Region in 2003 and authorized by the FPDCC to remove invasive species, help with controlled burns, conduct community outreach and wildlife monitoring, and annually gather and plant more than one hundred species of native plants. More information can be found at http://springcreekstewards.org/. The Spring Creek Stewards mission statement: “To restore the ecological health of the Spring Creek Forest Preserves. We strive to increase public awareness, participation and appreciation of the preserves.”

The Friends of Spring Creek Forest Preserves are made up of preserve neighbors, birders, conservationists, hikers, and others who value natural lands and support the long-term restoration and conservation efforts at the Spring Creek Forest Preserves. They support many educational programs and work with local schools to foster nature-based learning opportunities. More information can be found at http://www.friendsofspringcreek.org/About_.html. Friends of Spring Creek Forest Preserves mission statement: “We support the long-term restoration and conservation of healthy woodlands, prairies and

wetlands in the Spring Creek Forest Preserves. To this end, we foster the understanding, appreciation and compatible use of this landscape of extraordinary peace and beauty."

The Citizens for Conservation (CFC) own and actively restore land within Barrington, IL and also work in selected critical areas in local Forest Preserves. CFC volunteers work within the Spring Creek Forest Preserves by removing invasive species, clearing brush, collecting seed, and assisting with controlled burns. They have also donated rare local seed for restoration projects within Spring Creek through their Native Seed Gardeners (NSG) program developed by both the Friends of Spring Creek Forest Preserves and CFC with support from Audubon Chicago Region which seeks to increase the amount of seed available to restore ecological health and diversity to the area's prairie and woodlands. More information can be found at http://www.citizensforconservation.org. CFC mission statement: "'Saving Living Space for Living Things' through protection, restoration and stewardship of land, conservation of natural resources, and education."

- Mitigation Projects

Mitigation projects within the southeast portion of the site totaling approximately 200 acres involve ecosystem restoration planning, disablement of drain tile systems, removal of invasive species, and establishment of native plant communities.

1.5.3 – Study Specific Investigations

The following investigations were specifically conducted by the Chicago District, USACE in order to determine the functionality and structure of aquatic habitats. These included investigations into the current subsurface draining of hydrology, surficial draining of hydrology, effectiveness of stream hydraulics at providing suitability for riverine obligate organisms, condition of physical in stream habitat, riverine habitat fragmentation and riverine processes in relation to the riparian zone health and the amount of water entering the site.

- USACE. Drain Tile Survey & Abandonment Plan. Huddleston-MacBride. 2011

The objectives of this study were to 1) identify and locate all subsurface drainage features (agricultural drain tiles), 2) provide an abandonment plan for active drain tile fields and 3) install temporary valves to perform hydrologic resurgence testing. Drain tile valves were installed during the summer of 2011 to physically model the site. These valves were toggled on and off to assess extent of wetland recovery, and to identify any off site flooding affects. To date, off site impacts of subsurface hydrology resurgence are not apparent. Based on the physical modeling and field verifications, it was determined that subsurface and surficial hydrologies will be successfully recovered if this measure were to be implemented.

- USACE. Riverine Function and Habitat Surveys. 2010 - 2013.

The objectives of this investigation related to riverine habitat restoration were to 1) determine the fluvial geomorphic conditions of Spring Creek, 2) determine the suitability of in stream habitat and fluvial hydraulics for riverine organisms, 3) identify fragmenting riverine structures and 4) determine unnatural watercourses that may be impairing wetland hydrology. Various days in the field over the course of a few years (2010 – 2013) walking the stream and waterway corridors revealed both suitable and unsuitable conditions. Suitable conditions observed include an acceptable amount of offsite water entering Spring Creek, naturally meandering sections of Spring Creek, failing reaches of former agricultural ditch, meander recovery in certain reaches and valuable reaches of riparian zone. Unsuitable conditions are caused primarily by: unhealthy riparian zones of European thicket forming species, former

channelization, 2 impounding structures on private property fragments 7-miles of Spring Creek, and a semi-functioning ditch impairs the large marsh in the western central section of the preserve. It was also noted that various sections of headwater stream previously affected by channel incision and buckthorn thickets were being repaired by beaver dams. Stormwater entering the south side of the study area originates from the commercial land use.

CHAPTER 2 – INVENTORY & FORECASTING

This step of the planning process is to develop an inventory and forecast of critical resources (physical, demographic, economic, social, etc.) relevant to the problems and opportunities under consideration in the planning area. This information is used to define and characterize the problems and opportunities. A quantitative and qualitative description of these resources is made, for both current and future conditions, and is used to define existing and future without-project conditions. Existing (EX) conditions are those at the time the study is conducted. The forecast of the future without-project (FWOP) condition reflects the conditions expected during the 50-year period of analysis. The future without-project condition provides the basis from which alternative plans are formulated and impacts are assessed. Since impact assessment is the basis for plan evaluation, comparison and selection, clear definition and full documentation of the without-project condition are essential. Gathering information about historic and existing conditions requires an inventory. Gathering information about potential future conditions requires forecasts, which should be made for selected years over the period of analysis to indicate how changes in economic and other conditions are likely to have an impact on problems and opportunities. Information gathering and forecasts will most likely continue throughout the planning process. Chapter 2 contains the following information:

- An inventory of relevant historic conditions
- An inventory of relevant current conditions and the studies that have been completed to identify those conditions, and
- A forecast of future without-project conditions

2.1 – Historic Setting

Historically, the Spring Creek watershed was topographically and ecologically diverse, driven by the rolling West Chicago Moraine. Gravel outwash deposits, peat-filled kettles, and a stream valley cut by the northward flowing glacial Spring Creek added to the site's topographic complexity. Vast areas throughout Spring Creek watershed held impressive mosaics of high quality sedge meadow, marsh, fen, prairie, savanna, and kettle lakes. Since the onset of agriculture, the study area was adversely affected by hydrologic, geomorphic and soil alterations via subsurface drain tile systems and ditches, tilling, fire suppression, nutrient enrichment and invasion by noxious weed species. The FPDCC began assembling the nearly 4,000-acre tract in 1955, which encompasses a greater portion of the watershed. Today, the study area holds various areas of remnant high quality habitats, and in particular the 560-acre north section of the project area is an Illinois Nature Preserve, a legal protection given by the state only to the highest quality natural areas. However, most of the study area still remains degraded in terms of wetland and floodplain hydrology, stream hydraulics, geomorphology, and native plant communities.

2.2 – Current Conditions / Affected Area

2.2.1 – Physical Resources

The following are descriptions of the current physical conditions that would be affected by any actions resulting from a potential ecosystem restoration project or are important for determining ecological restoration measures. Those resources determined to be unaffected or not germane are not discussed in order for report focus to remain succinct.

Landscape / Geomorphology

The Fox River watershed landscape was created primarily by glacial activity, which is evident from the rolling topography, pronounced stream valleys, and other glacial features such as kames, eskers, drumlins and moraines. The Spring Creek is currently a low gradient stream that has overtime meandered and cut its way through moraine features to form a marshy valley system, but at least since 1939 has ceased meandering and migrating in the floodplain (see Figure 2 in Appendix G). Topographic relief within the site is pronounced, with the overall elevation change of about 148-ft.; between 767 and 915 feet above sea level (NAVD88). Shading these elevation contours from low (green) to high (red) paints a picture of the site's landforms and illustrates the vast wetland valleys within the study area boundaries (**Plate 01**). The flat nature of the marshy valley is very pronounced as well and in certain areas has resulted in small flowage basins (lakes). This flat stream valley resides atop the Carmi till member, which is sandwiched between the West Chicago moraine on the west and the Valparaiso and Cary moraines on the east (Willman 1971). The West Chicago moraine is part of the Haeger till member, while the Valparaiso and Cary moraines are part of the Wadsworth till member. These till members drive ground water chemistries and provide substrates for streams. The Haegar till primarily consists of yellowish-gray silts mixed with sand and gravel, with gravel lenses more abundant near the Spring Creek preserve. The Wadsworth till consists of grayish clays and gravel, more gravely than clayey near the Spring Creek preserve.

Soils

Soils within Spring Creek Valley are shown on **Plate 02**. Major soil series within the project area were mapped and described by the NRCS 2010 Official Soil Descriptions. It is important to know spatial extent and soil parameters in order to properly restore natural (native) plant communities. These soils provide insight into past geomorphic position, hydrology and native plant community types. Some of the more prevalent soil series within the project area include the following:

Drummer - consists of very deep, poorly drained soils formed in loess or other silty material and in the underlying loamy stratified outwash on nearly level or depressional parts of outwash plains, stream terraces, and till plains. Slope ranges from 0 to 2 percent. In drained conditions, an apparent seasonal high water table is 15 cm (0.5 foot) above the surface to 31 cm (1.0 foot) below the surface at some time between January and May in most years. In undrained conditions, an apparent seasonal high water table is 15 cm (0.5 foot) above the surface to 15 cm (0.5 foot) below the surface at some time between November and June in most years. The potential for surface runoff is negligible to low. Water ponds on these soils for brief periods during the spring. Permeability is moderate.

Muskego - consists of very deep, very poorly drained soils formed in herbaceous organic material over coprogenous limnic material (sedimentary peat) on glacial lake plains and flood plains. Slope ranges from 0 to 2 percent. The potential for surface runoff is low or negligible. Permeability is moderate or moderately rapid in the herbaceous sapric material and slow in the coprogenous material (sedimentary peat). Most Muskego soils have an apparent water table from 31 cm (1 foot) above the surface to 31 cm (1 foot) below the surface in most years for much of the period from November to August.

Houghton - consists of very deep, very poorly drained soils formed in herbaceous organic materials more than 130 cm (51 inches) thick in depressions on lake plains, outwash plains, ground moraines, end moraines, and floodplains. Slope ranges from 0 to 2 percent. Depth to the seasonal high water table ranges from 61 cm (2 feet) above the surface in ponded phases to 30 cm (1 foot) below the surface between September and June in normal years. Potential for surface runoff is very slow or ponded. Permeability is moderately slow to moderately rapid.

Markham - consists of very deep, moderately well drained soils on Wisconsin till plains. They formed in a thin layer of loess or silty material and in the underlying silty clay loam till. Slopes range from 0 to 20 percent. The depth to a perched seasonal high water table is 61 to 107 cm (2.0 to 3.5 feet) at some time during the spring in most years. The potential for surface runoff is low to high. Permeability is slow.

Ozaukee - consists of moderately well drained soils that are moderately deep to a densic contact with till. They formed in thin loess and in the underlying loamy dense till on ground moraines. Slope ranges from 0 to 35 percent. The potential for surface runoff ranges from medium to very high. Permeability is slow. These soils have a perched seasonal high water table at a depth of 46 to 107 cm (1.5 to 3.5 feet) for 1 month or more per year in 6 or more out of 10 years.

Will - consists of poorly drained soils that are moderately deep to sand and gravel on nearly level or depressional parts of outwash plains, stream terraces, lake plains, valley trains, and moraines. These soils formed in loamy outwash overlying calcareous gravel and sand at a depth of 51 to 102 cm (20 to 40 inches). Slope ranges from 0 to 3 percent. An intermittent apparent high water table is 15 cm (0.5 foot) above the surface to 30 cm (1 foot) below the surface at some time during the spring in most years. The potential for surface runoff is negligible. Water will pond on these soils for brief periods during the spring. Permeability is moderate in the upper and middle parts of the series control section and very rapid in the lower part.

Kidder - consists of very deep, well drained soils formed in thin loess and in loamy till or just in loamy till on moraines and drumlins. Slope ranges from 0 to 35 percent. The potential for surface runoff ranges from negligible to very high. Permeability is moderate in the solum and moderately rapid in the substratum.

Kane - consists of very deep, somewhat poorly drained soils formed in as much as 51 cm (20 inches) of silty material and in the underlying loamy outwash over stratified calcareous gravel and sand. These soils are on outwash plains and stream terraces. Slope ranges from 0 to 3 percent. An intermittent apparent high water table is at a depth of 15 to 61 cm (0.5 foot to 2.0 feet) at some time in most years. The potential for surface runoff is low or medium. Permeability is moderate in the solum and very rapid in the underlying material.

Milford - consists of very deep, poorly drained and very poorly drained soils formed in lacustrine sediments. These soils are on glacial lake plains. Slope ranges from 0 to 2 percent. The apparent seasonal high water table is 15 cm (0.5 foot) above the soil surface to 31 cm (1.0 foot) below the surface at some time during the spring in most years. The potential for surface runoff is negligible to low. Permeability is moderately slow.

Harpster - consists of very deep, poorly drained soils formed in calcareous loess or glacial drift. They are on nearly level or depressional parts of outwash plains, till plains, glacial lake plains, or stream terraces. Slope ranges from 0 to 2 percent. Where drained, an apparent seasonal high water table is 15 cm (0.5 foot) above the surface to 31 cm (1.0 foot) below the surface at some time between January and May in most years. In undrained conditions, an apparent seasonal high water table is 15 cm (0.5 foot) above the surface to 15 cm (0.5 foot) below the surface at some time between November and June in most years. The potential for surface runoff is negligible. Permeability is moderate.

Symerton - consists of very deep, moderately well drained soils formed in a thin mantle of loess, loamy outwash, and in the underlying till or lacustrine sediments. They are on till plains or former glacial lake plains. Slope ranges from 0 to 10 percent. A perched seasonal high water table is at a depth of 61 to 107 cm (2 to 3.5 feet) at some time between February and April in most years. The potential for surface runoff

is low or medium. Permeability is moderate in the loess and loamy outwash, and moderately slow or slow in the till or lacustrine sediments.

Warsaw - consists of well drained soils formed in loamy sediments and in the underlying gravelly outwash on outwash plains, terraces, kames, and valley trains. These are very deep soils that are deep or very deep to calcareous, stratified gravelly or very gravelly coarse sand and sand. Potential for surface runoff is low or medium. Saturated hydraulic conductivity is moderately high in the solum and very high in the substratum. Permeability is moderate in the solum and very rapid in the substratum.

Watershed Land Use

The land use of the Spring Creek watershed was obtained from the SCWBP, which utilized CMAP land coverage data along with aerial and on-the-ground validation (**Table 1**). The Spring Creek is different for a Chicago Region watershed due to the fact that there is still about 40 – 50% of the land use is in natural plant community or some type of non-impairing land use (i.e. equestrian, cemetery). Also, adverse land uses such as residential are comparatively less dense than a watershed such as the Des Plaines River. A significant statistic is that the Spring Creek preserve itself is about 23% of the entire watershed. Comparatively, only 12% of the entire Des Plaines River watershed is in natural plant community. This statistic shows significance in terms of opportunity to have a watershed that can nearly be restored. As any Chicago Region watershed, however, it is predicted that there will still be some minor losses of natural community and gains in anthropogenic land uses unless priorities shift.

Table 1: Spring Creek Watershed Land Use

Use	Area (acres)	% of Watershed
Agriculture	1,578.7	9.1%
Residential	6,887.4	39.9%
Industrial/Commercial	754.3	4.4%
Open Space	1,076.8	6.2%
Transportation	911.0	5.3%
Water	331.6	1.9%
Natural Communities	5,718.7	33.1%
Total	17,258.5	

Riverine & Wetland Hydrology

Riverine hydrology was determined to be partially acceptable for supporting native floral and faunal plant communities via qualitative observation. This determination is based on observations of flood waters properly engaging the floodplain, lack of substantial channel incision, substrate size, and erosion patterns/magnitude. Some stream sections are incised enough to prevent smaller floods from connecting with the floodplain, there are large interspersed reaches where this is not an issue. The Spring Creek watershed is comparatively sparse in its urban and residential development; and although flows have somewhat increased, based on channel width observations, they have not increased sufficiently to cause major issues to the stream, its floodplain or its faunal inhabitants. Detailed discussion of stream habitat is provided in Section 2.2.2. **Plate 3** shows the waterways entering and flowing through the Spring Creek preserve.

Wetland hydrology of about 2,800-acres of the 4,000-acres is impaired by the vast subsurficial drain tile system that is in place (**Plate 4**). This drain tile system was designed to dry out the top 3 to 4-feet of the soil in order to grow crops. This in turn dried out and homogenized the entire site. Secondary effects of this drain tile system was the loss of soil characteristics, lower flows during dry periods, and ultimately

the loss of wetland plant and animal species. Once farming ceased in the 1960s, weedy species took advantage of the physical changes and colonized a greater portion of the site creating ruderal (human induced) communities of Eurasian meadow, unassociated woody growth, and monotypic stands of invasive herbaceous species. Drain tile cutoff valves were installed during the summer of 2011 to physically model hydrologic resurgence. These valves were toggled on and off to assess extent of wetland recovery and to identify any off site flooding affects. It is apparent that the hydrology of the Spring Creek preserve is severely impaired based on 1) the observed differences in surficial hydrology with the valves on and off; and 2) the lack of water flowing out of the drain tiles and into the stream during rainfall events while the valves were closed. The Existing Drain Tile Investigation, Modification and Abandonment details are provided in **Appendix C**.

Stream Hydraulics

Riverine hydraulics was determined to be partially acceptable for supporting native floral and faunal plant communities via qualitative observation. This determination is based on observations of meandering (cut & fill alluviation), erosion patterns, floodplain engagement, substrate sorting and size, and water velocities. Overall, there are reaches of healthy meandering stream and reaches of stream that have been repairing themselves (**Plate 3**). Although the increased amounts of water entering the site due to urbanization has had minor impairing effects on the way the stream behaves, past agricultural practices did most of the damage to the preserve's streams. Past effects include channelization, riparian zone clearing, drain tile installation, and introducing plants that have no ability to help regulate and temper floodplain functions.

The two main types of natural surface water conveyance would be large wetland flowages and small, low gradient streams. There is also one large unnatural ditch that was cut through the western flowage marsh to drain it for agriculture. The stream is fragmented by two private land owners via a dam and an on-line pond with modifications to the stream channel as well. The most widespread impairment currently affecting riverine hydraulics and fluvial functions is the massive spatial coverage of European Buckthorn (*Rhamnus cathartica*), Glossy False Buckthorn (*Frangula alnus*), and Honeysuckle (*Lonicera* spp.) dominating the immediate riparian zone. Discussion of stream habitat is provided in Section 2.2.2 Natural Communities.

Water Quality

Section 305 (b) of the Federal Clean Water Act requires Illinois and all other states to submit to the USEPA a biannual report of the quality of the state's surface and groundwater resources called the *Integrated Water Quality Report.* These reports must also describe how Illinois assessed water quality and whether assessed waters meet or do not meet water quality standards specific to each "Designated Use" of a waterbody as defined by the Illinois Pollution Control Board (IPCB). When a waterbody is determined to be impaired, IEPA must list potential reasons for impairment in the 303 (d) impaired waters list. The five "Designated Uses" are: Aquatic Life, Fish Consumption, Primary Contact, Secondary Contact and Aesthetic Quality.

The IEPA does not list Spring Creek as being impaired for any of its Designated Uses because it was not assessed in the *Integrated Water Quality Reports* (IEPA, 2014). Based on observations made during wet and dry weather by Chicago District aquatic ecologists, and qualitative interpretation by the SCWBP, the waterbody is a fair to good aquatic resource. It is the opinion of the Chicago District that hydrology alterations, plant community degradation and fragmentation have caused impairment to the stream.

Air Quality

The local air quality in the Chicago Area including Cook County is considered "non-attainment" under the Clean Air Act for ozone, particulates (PM-10 and PM-2.5), and lead. The project is within the non-attainment zone.

2.2.2 – Natural Communities

Existing conditions within the study area for the following natural communities are shown on **Plate 8.**

Riverine

An effort was made by the Chicago District to investigate all of the waterways that flow through the Spring Creek Valley preserve. Since the site is so large, about 4,000-acres with about 19-miles of waterway (**Table 2 & Plate 3**) to investigate, the entire preserve was divided into four areas for logistical purposes. Photo documentation and general notes were taken to a level sufficient enough to make determinations of the current and future without conditions, as well for recommendations of how to repair stream reaches.

Table 2: Waterway Type & Lengths

Waterway Type	Length (ft)
Channelized	20,145
Ditch	10,044
Old Ditch	1,808
Stream	27,587
Wetland Flowage	40,474
Total	100,058

Stream Survey Area 1

Two small headwater-like streams enter the preserve under a set of railroad tracks at the south eastern boundary of the preserve (**Plate 5**) and become confluent to form Spring Creek proper. The stream then flows into an artificial pond called Penny Road Pond. The northern branch enters the preserve through a winged concrete culvert (**Photo 1**). This culvert is currently controlling the amount of flow entering preserve under the railroad tracks, which is a good service since it attenuates potentially damaging urban/agricultural flash floods. It is noted here that all bridge crossings/culverts within the study area prevent stream migration. When the stream channel's gradient becomes very low, the stream turns into a wetland flowage, which would naturally have ill defined channels, or many channels and change with every major flood event (~25^{+}year events). There is an old ditch scar located through one of the wetland flowages, however, it is no longer adversely affecting hydrology and drainage patterns and has become absorbed by the wetland.

Photo 1: Stream entering preserve under railroad tracks and through concrete culvert

The segments of stream that are not wetland flowages are currently self repairing since they are no longer being maintained as ditches. Cut and fill alluviation is apparent, with riffles and pool sequences formed or forming. There was no apparent mass wasting or bank blowout issues and eroded banks result from natural meandering. **Photo 2** depicts the "cut" part of "cut and fill alluviation". This is the process where the stream erodes one bank and deposits at the toe of the opposite bank, which is termed "point bar" or the "fill". This is how a stream meanders within its floodplain and is a necessary process that provides and replenishes substrates. Also by allowing the stream to meander freely, the moving water will undergo helical flow, which is critical to bring food to water column feeding fishes and caddis flies.

The main impairment in this area is the poor condition of the riparian zone. Some areas are completely bare since they are still maintained as agricultural field. Areas with vegetation are dominated by Eurasian thicket species. **Photo 2** also depicts the lack of ground cover within a buckthorn thicket. Buckthorn disallows understory growth and provides a very poor root structure for holding soils itself. It is also now known that buckthorn also produces a chemical(s) that can have deleterious effects on amphibians. **Photo 3** depicts how natural bank cutting is attenuated by having a riparian zone of herbaceous vegetation as opposed to a buckthorn thicket.

Photo 2: Cut & fill alluviation with buckthorn thicket

Photo 3: Cut & fill alluviation with herbaceous vegetation just downstream

The southern branch enters the preserve under the railroad tracks as well; however, during the inspection, vast beaver impoundments did not allow the entrance point to be viewed (**Photo 4**). The beaver impoundments are not adversely impairing the system; on the contrary, they are repairing channel incision and restoring floodplain habitats, including the elimination of buckthorn thickets (**Photo 5**). It was also apparent that the beaver impoundments did not prevent the migration of fishes, which in turn does not impair mussel distributions. Once these dams naturally dissipate the heterogeneity of the new stream channel and reestablished herbaceous vegetation would be greatly improved. Once again, the only impairments to this reach of stream are the buckthorn thickets and lack of native herbaceous vegetation.

Photo 4: Beaver impoundment in channel and along banks 2011

Photo 5: Buckthorn thicket being drowned by beaver impoundment 2011

The western branch that enters the site via two small rivulets originates from detention ponds constructed by a large commercial development south of Higgins Road. As the water enters the site, it falls quickly down a steep gradient and has blown out the two entrance points. As the two stream rivulets flow away from Higgins Road and the gradient shallows, the stream recovers its natural morphology until it reaches a flat point where a wetland flowage beings.

Photo 6: Western Branch Blowout Reach Looking Down Stream

Stream Survey Area 2

Spring Creek enters Area 2 from Penny Road Pond under Penny Road via a double vaulted box culvert (**Photo 7**). This culvert is currently controlling the amount of flow entering Area 2. A small degraded tributary stream enters the preserve from the east and flows for 10,000 feet before making a confluence with Spring Creek (**Plate 6**). This stream flows through low impact development before entering the preserve. Spring Creek then flows north and leaves Area 2 under Dundee Road (SR 68). The total length of this stream within Area 2 totals about 7,800-feet. The streams for the most part in this area are repairing themselves from when channelization maintenance ended in the late 1960s. The main impairment in this reach of stream is the poor condition of the riparian zone (**Photo 8**). Buckthorn disallows understory growth and provides a very poor root structure for holding soils.

Photo 7: Spring Creek flowing under Penny Road into Area 2

Photo 8: Buckthorn thicket impairing riverine processes and habitat

Stream Survey Area 3

This area never had a flowing stream through it, but a large sluggishly flowing marsh was the most likely natural condition. The land was prepared for agriculture via a drain tile network with a large ditch sliced down the center, which emptied these waters into Area 4, which remained as marsh. The ditch originates from an 18" pipe culvert that discharges from beneath Bateman Road on the west side of the preserve (**Plate 7**). The ditch traverses along the south side of Dundee Road for 1,500-feet before flowing under Dundee Road to the north and discharging into Area 3 via a 36" pipe culvert. The ditch then zigzags through Area 3 for about 8,500-feet and then discharges into Area 4 via two 36" box culverts beneath Algonquin Road. The total length of the ditch is about 10,000-feet.

The ditch reach on the south side of Dundee Road has naturalized itself into a small swale that flows through dense marsh grasses (**Photo 9**). Once the ditch flows under Dundee Road and into Area 3, it again resumes the unnatural trapezoidal channel. The ditch for the most part is filled with fine mucky sediments and has lost most of its capacity for conveying low flows and lowering ground water (**Photo 10**). Swale habitat south of Dundee Road should be preserved, while the lower 8,500-feet have no apparent stream habitat value.

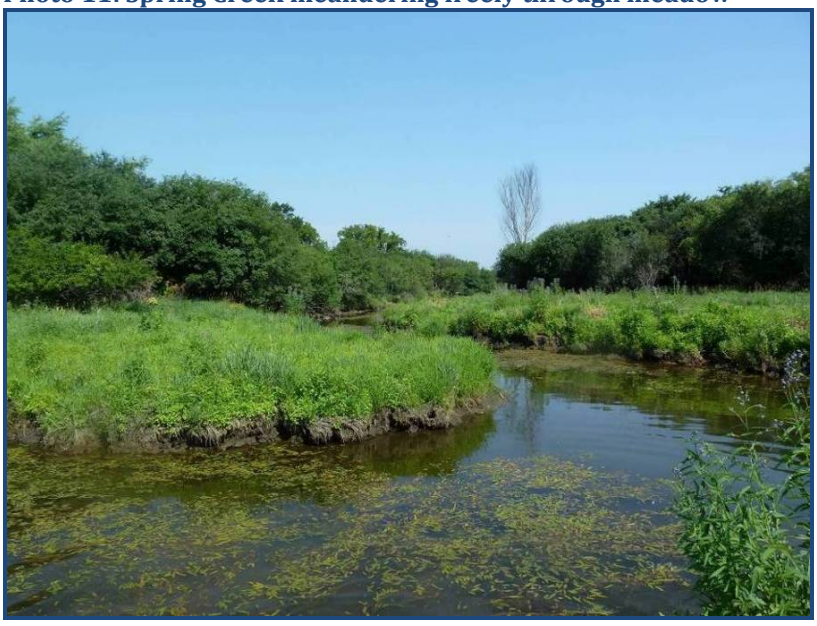
Photo 9: Naturalized swale south of Penny Road

Photo 10: Typical ditch reach showing limited effectiveness due to sedimentation and vegetation. Bars on photo added to show extent of ditch

Spring Creek Area 4

Spring Creek flows into Area 4 from Area 2, just downstream of Algonquin Road (SR 62). Spring Creek also receives water from the Area 3 ditch, but only after it flows through several thousand feet of marsh that was never converted to agricultural lands (**Plate 7**). Spring Creek in this area displays functions of a fully recovered stream (**Photo 11**).

Photo 11: Spring Creek meandering freely through meadow



The stream is meandering in its floodplain with maximum sinuosity and fully developed riffle and pool sequences. The total length of this stream within Area 4 totals about 7,800-feet. The upstream reach above Old Donlea Road Bridge (**Photo 12**) is about 5,100-feet and between the bridge and Spring Lake is about 6,600-feet. All bridges in the study area may disrupt cut and fill alluviation, floodplain engagement and sediment transport. The only other impairment to Spring Creek within Area 4 is the invasion of buckthorn and stormwater runoff from the east entering the site through culverts under Old Sutton Road.

Photo 12: Old Donlea Road Bridge during April 2013 Flood of Record

Flowage Lake

A flowage lake is an open body of water created through the natural or man-made damming of a stream or river (**Photo 13**). Flowages lakes are typically found in riverine systems where there is little or no gradient and topography, allowing the impoundment of water to leave the banks of the river or stream. Disturbance to flowage lake communities is mainly linked to increased sedimentation, erratic hydrology, agricultural practices and invasive species. Flowage lakes can be bordered by streamside marshes and low lying wetland areas. Plants found within the glacial Spring Lake and Mud Lake include Yellow Pond-Lily (*Nuphar lutea*), American White Water-Lily (*Nymphaea odorata*), Coon's-Tail (*Ceratophyllum demersum*), and Sago False Pondweed (*Stuckenia pectinata*).

Photo 13: Vast tile-drained landscape moving water through Spring Creek, within heavily degraded riparian communities, and entering the glacial flow-through Spring Lake

Streamside Marsh

Streamside marsh communities are characterized as being located within a riverine floodplain, having water at or near the surface during most of the growing season and dominated by herbaceous vegetation (**Photo 14**). A streamside marsh would typically be found adjacent to or intermingled with wet prairie and sedge meadows along a riverine system. Disturbance to streamside marsh communities is mainly linked to floodplain disengagement, erratic hydrology, agricultural practices and invasive species. Most species currently within the study area are invasive and form monocultures within the marsh; these species include cattail (*Typha* spp.), common reed (*Phragmites australis* ssp. *australis*), purple loosestrife (*Lythrum salicaria*), and reed canary grass (*Phalaris arundunacea*). Plants found within higher quality areas include Leafy Tussock Sedge (*Carex aquatilis*), Lakebank Sedge (*Carex lacustris*), Hard-Stem Club-Rush (*Schoenoplectus acutus*), Broad-Fruit Burr-Reed (*Sparganium eurycarpum*), Several-Vein Sweetflag (*Acorus americanus*), and Swamp-Loosestrife (*Decodon verticillatus*)**.** Animal species associated with marsh communities include broad-winged skipper, purplish copper, Blanding's turtle, muskrat, yellow-headed blackbird, least bittern, sora, Virginia rail, map turtle, green heron and central mudminnow. Community synonyms of streamside marsh include basin marsh (Chicago Wilderness) and Bulrush-cattail-burreed shallow marsh, Midwest mixed emergent deep marsh, River bulrush marsh (The Nature Conservancy).

Photo 14: Extensive streamside marsh occupied by invasive cattail (*Typha* spp.) and reed canary grass (*Phalaris arundinacea*), surrounded by degraded savanna and sedge meadow communities

Basin Marsh

Basin marsh communities are characterized as having water at or near the surface during most of the growing season and dominated by herbaceous vegetation (**Photo 15**). Basin marsh would typically be found adjacent to or intermingled with wet prairie and sedge meadows. Disturbance to marsh communities is mainly linked to impaired hydrology and periods, agricultural practices and establishment of invasive species. Animal species associated with marsh communities include broad-winged skipper, purplish copper, Blanding's turtle, muskrat, yellow-headed blackbird, least bittern, sora, Virginia rail, map turtle, green heron and central mudminnow. Plants that usually dominate basin marsh communities include Hard-Stem Club-Rush (*Schoenoplectus acutus*), Broad-Fruit Burr-Reed (*Sparganium eurycarpum*), River Club-Rush (*Schoenoplectus fluviatilis*), and Several-Vein Sweetflag (*Acorus americanus*); however, the study area is currently dominated by hybrid cattail (*Typha* X *glauca*)**.** Community synonyms of marsh include Bulrush-cattail-burreed shallow marsh; Midwest mixed emergent deep marsh, River bulrush marsh (The Nature Conservancy).

Photo 15: Marsh overrun by invasive cattail (*Typha* spp.)

Sedge Meadow

Sedge meadow communities are characterized as sedge dominated grasslands, typically located adjacent to wet prairie and marsh communities (**Photo 16**). Soils are saturated throughout most of the year and shallowly inundated for short periods. Fire helps maintain the herbaceous structure of the community, allowing the sedges to build hummocks (mounds), dominated by *Carex stricta*. Additional plants found within the study area include Lakebank Sedge (*Carex lacustris*), Eastern Marsh Fern (*Thelypteris palustris* var. *pubescens*), Hooded Skullcap (*Scutellaria galericulata*), American Wild Mint (*Mentha arvensis*), and Blunt-Leaf Bedstraw (*Galium obtusum*). Disturbance to this community include fire depravation, grazing pressure, altered hydrology excessive siltation from agricultural practices and invasive species infestation. Most sedge meadows within the study area are currently dominated by reed canary grass (*Phalaris arundinacea*) and further stressed by encroaching Glossy False Buckthorn (*Frangula alnus*) and European Buckthorn (*Rhamnus cathartica*). Animal species associated with sedge meadow habitats include Baltimore checkerspot, eyed brown, black dash skipper, dion skipper, american bittern, sandhill crane, sedge wren, swamp sparrow and pygmy shrew. Community synonyms of the sedge meadow community include lake sedge meadow and tussock sedge wet meadow (The Nature Conservancy).

Photo 16: Sedge meadow dominated by Reed Canary Grass (*Phalaris arundinacea*) with remnant pockets of Uptight Sedge (*Carex stricta*), surrounded by dense stands of European Buckthorn (*Rhamnus cathartica*)

Graminoid Fen

Graminoid fen communities are located along a slope or as an elevated island in the middle of either marsh or sedge meadow (**Photo 17**). Fire helps maintain the herbaceous (sedges and grasses) structure of the community. Graminoid fens are composed of a mix of prairie, sedge meadow, and seep species. Unique fen flora within the study area include Brook Lobelia (*Lobelia kalmia*), Bog Goldenrod (*Solidago uliginosa*), Spiked Muhly (*Muhlenbergia glomerata*), and Bog Willowherb (*Epilobium leptophyllum*), and White Turtlehead (*Chelone glabra*). Disturbance to this community include fire depravation, grazing pressure and altered hydrology through artificial drainage systems. Animal species associated with the graminoid fen include Baltimore checkerspot, mulberrywing skipper, swamp metalmark, elfin skimmer and *Nanothemis bella*. Graminoid fens host a variety of rare and unique species. Community synonyms of graminoid fen communities include Cinquefoil-sedge prairie fen (The Nature Conservancy).

Photo 17: Fen with blooming Brook Lobelia (*Lobelia kalmia*), Bog Goldenrod (*Solidago uliginosa*), and Spiked Muhly (*Muhlenbergia glomerata*), among tussocks of Uptight Sedge (*Carex stricta*) with invasive cattail (Typha spp.) and Glossy False Buckthorn (*Frangula alnus*) in the background.

Seep

Seep communities are located along lower slopes of moraines, ravines and terraces. Seeps are characterized as small areas where ground water slowly discharges to the surface (**Photo 18**). The boundary of the seep is delineated by the area of saturation of the soil. There are different types of seeps depending on the type of material the ground water flows through**.** Because of the small areas designated as seep communities, seeps are generally seen as inclusions contained in other larger habitats such as sedge meadows, marshes, forests, fens and wet to wet-mesic prairie. Calcareous seeps within the study area are occupied by sedges including Uptight Sedge (*Carex stricta*), Inland Sedge (*Carex interior*), and Prairie Sedge (*Carex prairea*) as well as Meadow Spike-Moss (*Selaginella apoda*), Golden Groundsel (*Packera aurea*), and Brook Lobelia (*Lobelia kalmia*)**.** Disturbance to this community may include altered hydrology, excessive siltation from agricultural practices, grazing pressure and invasive species infestation. Animal species associated with the seep habitat include brook stickleback (*Culaea inconstans*) and mottled sculpin (*Cottus bairdii*) (when seeps collect into runs flowing into headwater streams). Community synonyms of the seep community include neutral seep (Chicago Wilderness) and Skunk cabbage seepage meadow (The Nature Conservancy).

Photo 18: Seep with native tussock sedges surrounded by invasive species

Wet/Wet-mesic Prairie

Wet prairie communities occur on poorly drained and slowly permeable soils, while wet-mesic prairie's soil moisture is intermediate, poorly drained, with shorter inundation periods than wet prairie communities (**Photo 19**). Wet-mesic prairie communities occur between mesic prairie and wet prairie. Wet-mesic prairie and wet prairie would typically be found adjacent to or intermingled with sedge meadows, marshes and fens forming a mosaic of communities across the landscape. As with other prairie communities, it often occurs as a zone within a broader matrix of fire-dependent communities. Fire regimes and water fluctuations maintain diversity and open conditions by reducing tree/shrub encroachment, reducing exotic and invasive plant species, creating a broad range of moisture tolerances, facilitating seed germination, and releasing plant and soil nutrients. Anthropogenic disturbances and potential restoration activities for the wet/wet-mesic prairie communities are consistent with other prairie community types, although altered hydrology does poise a larger threat to this system then dry prairie communities. Areas within the study area have become occupied by reed canary grass (*Phalaris arundinacea*) and cattail (*Typha* spp.) with encroaching stands of opportunistic and invasive woody species including Glossy False Buckthorn (*Frangula alnus*), European Buckthorn (*Rhamnus cathartica*), and Sandbar Willow (*Salix interior*). Remaining remnant areas are occupied by plants such as Freshwater Cord Grass (*Spartina pectinata*), Woolly Sedge (*Carex pellita*), Bluejoint (*Calamagrostis canadensis*), Late Goldenrod (*Solidago gigantea*), Big Bluestem (*Andropogon gerardii*), Four-Flower Yellow-Loosestrife (*Lysimachia quadriflora*), Stiff Cowbane (*Oxypolis rigidior*), Swamp Lousewort (*Pedicularis lanceolata*), and Spotted Trumpetweed (*Eutrochium maculatum*). Community synonyms of the wet-mesic prairie include wet fine-textured-soil prairie (Chicago Wilderness) and Central wet-mesic prairie / cordgrass wet prairie (The Nature Conservancy).

Photo 19: Wet/Wet-mesic prairie with blooming Spotted Trumpetweed (*Eutrochium maculatum*), Late Goldenrod (*Solidago gigantea*), and Stiff Cowbane (*Oxypolis rigidior*)

Savanna/Open Woodland

Savanna and open woodland communities are typically a mix of woodland and grassland species, described as an intermediate community type between closed canopy woodland and open prairie (Photo 20). Features that are characteristic of savannas include open-canopied structures, canopy dominance by a few species of oak, ground cover usually rich in species associated with tall grass prairie and fire dependence. Impacts to savanna and open woodland communities include habitat fragmentation and fire suppression, which have caused a shift in species composition within this community type. The absence of a natural fire regime has allowed woody growth to crowd out the herbaceous cover and change the structure and composition of savanna and open woodland communities to more of a typical forest community. Most of the savanna and open woodlands within the study area are heavily degraded with a dense understory of invasive shrubs, particularly European Buckthorn (*Rhamnus cathartica*) and restoration efforts should focus on removal of subcanopy/shrub growth, invasive species, interseeding of conservative native species, and establishment of a managed fire regime.

Photo 20: Transition between recently cleared invasive shrub understory and an unmanaged, degraded remnant oak savanna

2.1.3 – Ruderal Floral Communities

Unassociated Woody Growth

Unassociated woody growth is a mix of shrubs and trees that established as a result of human-induced disturbances and fire suppression. These woody plants do not occur together under natural conditions as associates within self-sustaining communities. The diversity of herbaceous ground cover within these areas are either very low or non-existent (i.e. bare ground) (**Photo 21**). Areas with unassociated woody growth within the study area support a mix of opportunistic native species such as Ash-Leaf Maple (*Acer negundo*), Black Cherry (*Prunus serotina*), Green Ash (*Fraxinus pennsylvanica*), and Beggar's-Lice (*Hackelia virginiana*) as well as non-native and invasive species including European Buckthorn (*Rhamnus cathartica*), White Mulberry (*Morus alba*), and Garlic Mustard (*Alliaria petiolata*). Equally prevalent within the study area are dense thickets of either European Buckthorn (*Rhamnus cathartica*) or Glossy False Buckthorn (*Frangula alnus*) with little to go herbaceous groundcover; these areas are labeled as Rhamnus/Frangula/Lonicera thickets on **Plate 8.**

Photo 21: Degraded prairie overgrown with invasive and opportunistic trees and shrubs and little to no herbaceous ground cover

Photo 22: Dense thickets of European Buckthorn (*Rhamnus cathartica*) before leaf-out within the riparian zone during April 2013 Flood of Record

Red Oak Afforestation

Afforestation efforts in the past have created unnatural communities made up of invasive and opportunistic trees and shrubs within historic prairie and savanna communities that have further degraded as a result of fire suppression (**Photo 23**). Plant communities dominated by woody vegetation resulted from a certain level of protection from the intensity and frequency of pre-European settlement fires, which allowed the development of structural and compositional features characteristic of forests. Forests primarily exist along slopes, ravines and floodplains and other protected areas. Disturbance to forest communities includes habitat fragmentation, establishment of invasive species, altered hydrology and water quality, and fire absence. Direct habitat degradation is typically associated with overgrazing by not only domesticated livestock but also native deer. Typical species include red oak (*Quercus rubra*), honeylocust (*Gleditsia triacanthos*), oriental bittersweet (*Celastrus orbiculatus*), cottonwood (*Populus deltoides*), common buckthorn (*Rhamnus cathartica*), and exotic honeysuckle (*Lonicera* spp.).

Photo 23: Degraded prairie composed of planted Red Oaks (*Quercus rubra*) with an understory of exotic Honeysuckle (*Lonicera* spp.), European Buckthorn (*Rhamnus cathartica*), and Asian Bittersweet (*Celastrus orbiculatus*)

Eurasian Meadow

Eurasian meadows are comprised of former agricultural fields which were drained by tiles and have been left fallow. Dominant plants within the study area include Smooth Brome *(Bromus inermis*), Chinese Cup Grass (*Eriochloa villosa*), Meadow Fescue (*Festuca pratensis*), Creeping Wild Rye (*Elymus repens*), Orchard Grass (*Dactylis glomerata*), and Queen Anne's Lace (*Daucus carota*). Invasive species such as Yellow and White Sweet-Clover (*Melilotus* spp.), Garden Bird's-Foot-Trefoil (*Lotus corniculatus*), and Parsnip (*Pastinaca sativa*) may also be found in this community.

Photo 19: Eurasian meadow hayed every year through a hay lease with the FPDCC

2.1.4 – Faunal Communities

Fishes

An examination of fish species collected from 1941 through 2013 (**Table 3**) in Spring Creek and associated lake and marsh flowages indicates missing groups of species that occur in other healthy streams confluent to the Fox River. These include the absence of sucker (Catostomidae) species, lack of certain darter (Percidae) species, lack of sensitive species, and lack of insectivorous cyprinids (*Notropis* spp., *Cyprinella* spp., *Phoxinus erythrogaster*). The last time the redbelly dace (*Phoxinus erythrogaster)* was collected in Spring Creek was in 1970 and the only sand shiner (*Notropis stramineus*) record is from 1941. One juvenile white sucker (*Catostomus commersonii*) was collected at the above dam site on 15 August 2013.

Spring Creek, for the most part, is a low gradient stream that flows through a series of wetland and lake flowages, which may naturally limit fish species richness by excluding those species that require more complex hydraulics that are achieved in higher gradient streams. However, there are significant stretches of mid-gradient stream that possess small cobble riffles and runs within the preserve. Also, the creek is well buffered and does not appear to suffer from unnatural erosion or sedimentation aside from the buckthorn thicket issues. The low gradient well vegetated pools, and the permanent wetlands are naturally

more attractive to lacustrine and generalist species rather than riverine specialists, which is apparent via the abundance of largemouth bass, bluegill, pumpkinseed, grass pickerel, and blackstripe topminnow.

In hydrologically (not hydraulic) stable second order streams of the Fox River system, there should be several conservative headwater species present due to the adequate groundwater or hyporheic discharge, which include American brook lamprey (*Lampetra appendix*), blacknose dace (*Rhinichthys obtusus*), southern redbelly dace (*Phoxinus erythrogaster*), fantail darter (*Etheostoma flabellare*), orangethroat darter (*Etheostoma spectabile*), mottled sculpin (*Cottus bairdii*), brook stickleback (*Culaea inconstans*), and at some point back in history, brook char (*Salvelinus fontinalis*). Hydrologically unstable streams that lack groundwater support are usually colonized by generalist and tolerant species such as creek chub (*Semotilus atromaculatus*), fathead minnow (*Pimephales notatus*), bluntnose minnow (*Pimephales notatus*), green sunfish (*Lepomis cyanellus*), and Johnny darter (*Etheostoma nigrum*), which is what has been documented to be present within the Spring Creek system.

Table 3: Fishes collected in Spring Creek between 1941 and 2013

Species	Common name	FCR*	MCCD**	USACE†	Riverine	Generalist
Amia calva	bowfin		x			x
Cyprinus carpio	common carp	x				x
Notemigonus crysoleucas	golden shiner	x		x		x
Semotilus atromaculatus	creek chub	x		x		x
Nocomis biguttatus	hornyhead chub	x			x	
Phoxinus erythrogaster	southern redbelly dace	x			x	
Luxilus chrysocephalus	striped shiner	x			x	
Luxilus cornutus	common shiner	x			x	
Lythrurus umbratilis	redfin shiner	x			x	
Pimephales notatus	bluntnose minnow	x	x	x		x
Pimephales promelas	fathead minnow	x				x
Notropis stramineus	sand shiner	x			x	
Catostomus commersonii	white sucker			x		x
Ictalurus punctatus	channel catfish		x	x		x
Ameiurus melas	black bullhead	x	x	x		x
Ameiurus natalis	yellow bullhead	x	x	x		x
Noturus exilis	slender madtom	x			x	
Noturus flavus	stonecat	x			x	
Noturus gyrinus	tadpole madtom	x		x		x
Esox americanus	grass pickerel	x	x			x
Labidesthes sicculus	brook silverside	x				x
Fundulus notatus	blackstripe topminnow	x	x	x		x
Micropterus salmoides	largemouth bass	x	x	x		x
Pomoxis nigromaculatus	black crappie	x				x
Ambloplites rupestris	rockbass	x				x
Lepomis cyanellus	green sunfish	x	x	x		x
Lepomis gibbosus	pumpkinseed	x	x	x		x
Lepomis gulosus	warmouth	x				x
Lepomis humilis	orangespotted sunfish	x		x		x
Lepomis macrochirus	bluegill	x	x	x		x
Perca flavescens	yellow perch	x				x
Etheostoma flabellare	fantail darter	x			x	
Etheostoma nigrum	Johnny darter	x	x	x		x

*Fishes of Chicago Region Database Collections 1941 – 2003
** McHenry County Conservation District Fish Survey 1999
†USACE/Shed Aquarium/FPDCC Fish Survey August 2013

A possible cause for the lack of riverine specialist species was suggested by the McHerny County Conservation District (MCCD) during their 1999 inventory of fishes within the preserve. The MCCD stated that the upper reaches of the stream had little to no flow due to drought or hydrologic modification. During their sampling in early August 1999 of riffle habitats, it was noted that the stream was drying up and only isolated pools remained. The remainder of the summer was dry, and by mid September much of the stream had dried up. The Chicago District USACE concurs and has verified these hydrologic conditions identified by the MCCD via observation conducted from 2011 to 2013. It is suspected that the extensive drain tile system in place (over 2000-acres) drains away groundwater that is crucial to maintaining adequate stream flows for riverine specialists during late summer months and dry spells. To compound the matter, there may be no ability for fishes to recolonize past two private dams just off of Forest Preserve property that fragments 7-miles of stream. The three main problems causing an impaired fish assemblage within Spring Creek is the lack of groundwater support, stream fragmentation by a private dam and the encroachment of buckthorn thickets into the stream's active floodplain. The fish survey conducted 15 August 2013 confirms the results garnered by the 1999 MCCD fish study.

Macroinvertebrates

A group of volunteers led by Audubon Chicago Region conducted a Butterfly Blitz on July 2, 2011 throughout the wetlands of Spring Lake Nature Preserve and the surrounding woodlands. Species found that are considered to be of conservation concern are the Banded Hairstreak (*Satyrium calanus*), Pearly Eye (*Enodia anthedon*), Grey Comma (*Polygonia progne*), Dion Skipper (*Euphyes dion*), Baltimore Checkerspot (*Euphydryas phaeton*), and Eyed Brown (*Satyrodes Eurydice*). Other species found within the wetlands include the Great Spangled Fritallary (*Speyeria Cybele*), Northern Broken Dash (*Wallengrenia egeremet*), Silver-spotted skipper (*Epargyreus clarus*), Least Skipper (*Ancyloxypha numitor*), Question Mark (*Polygonia interrogationis*), Tiger Swallowtail (*Papilio glaucus*), Red Admiral (*Vanessa atalanta*), and Mourning Cloak (*Nymphalis antiopa*). Additional species found within the study area include Eastern Pond Hawk (*Erythemis simplicicollis*), Dot-tailed Whiteface (*Leucorrhinia intacta*), Halloween Pennant (*Celithemis eponina*), Green Darner (*Anax junius*), Widow Skimmer (*Libellula luctuosa*), Common Whitetail (*Plathemis lydia*), Twelve-spotted Skimmer (*Libellula pulchella*), Pecks Skipper (*Polites peckius*), Buckeye (*Junonia coenia*), European Skipper (*Thymelicus lineola*), Summer Azure (*Celastrina neglecta*), wood satyr (*Megisto cymela*), and the Monarch (*Danaus plexippus*).

Crayfish populations include sensitive burrowing species, such as the devil crayfish (*Cambarus diogenes*) and the prairie crayfish (*Procambarus gracilis*), the latter the more abundant species on the site. Crayfish and their burrows also provide both food and hibernacula for the Graham's crayfish snake, as well as other species (**Photo 24**). Sensitive perched fen and sedge meadow communities exist in Spring Creek Preserve in several areas, which provides microhabitat for these burrowing crayfish.

The federally endangered Hine's Emerald Dragonfly (*Somatochlora hineana*, HED) occurs within the project limits of Spring Creek Valley. Species life requisites include groundwater fed wetlands dominated by graminoid species (e.g., grasses, rushes, sedges) and the burrows of the crayfish *Cambarus diogenes*. Groundwater discharge forms small thin slow moving intermittent streams referred to as rivulets or streamlets. The crayfish burrowing species is important to HED, which utilize the crayfish's burrows for overwintering and development, typically from late fall to early spring when water temperatures are cooler.

The IDNR conducted several mussel surveys within Spring Creek beginning in 1988 with the most recent survey occurring in 1997 (SCWBP 2012). Weathered shells of four species found at the mouth of the stream where it enters the Fox River include three ridge (*Amblema plicata*), plain pocketbook (*Lampsilis cardium*), creek heelsplitter (*Lasmigona compressa*), and ellipse (*Venustaconcha ellipsiformis*). Live

specimens of white heelsplitter (*Lasmigona complanata*) and giant floater (*Pyganodon grandis*) (**Photo 25**) were also present. Weathered shells of spike (*Elliptio dilatata*) and plain pocketbook were found in the meandering portions of Spring Creek. Live specimens of five species were also found including slippershell, round pigtoe, giant floater, creeper, and ellipse. The presence of mussels in any stream is a sign of at least fair water quality and good habitat conditions.

Photo 24: Prairie Crayfish Constructing Chimney at Spring Creek November 2011

Photo 25: Giant Floater Feeding Just Below Old Donlea Road Bridge July 2011

No current aquatic macro invertebrate data was acquired for this study; however, there is sufficient information available for fishes and mussels to indicate that the macroinvertebrate community is in fair condition.

Amphibians & Reptiles

Overall, 22 species of amphibians and reptiles were observed at Spring Creek Valley, with 13 species observed again, photographed or salvaged as voucher specimens in 2010. Nine of these are believed to occur at the preserve, or their occurrence is considered a possibility. The state endangered Blanding's turtle (*Emydoidea blandingii)* has been observed within the study area as well as juvenile female Blanding Turtles near Penny Road just east of Old Sutton Road. Sensitive perched fen and sedge meadow communities exist in Spring Creek Preserve in several areas, which provides shallow water foraging habitat and possible hibernacula for the Blanding's turtle, *Emydoidea blandingii*. There was an unconfirmed observation of a Graham's crayfish snake (*Regina grahami*) alive on Rt. 68 in 2002, and the presence of suitable habitat at Spring Creek suggests that this species of conservation concern may occur on the site.

An active group of volunteer citizen scientists have been participating in the Chicago Wilderness Calling Frog Survey at Spring Creek Valley for several years and six species were identified within the site: northern leopard frog (*Rana pipiens*), western chorus frog (*Pseudacris triseriata*), green frog (*Rana clamitans*), bullfrog (*Rana catesbeiana*), Cope's gray treefrog (*Hyla chrysoscelis*), American toad (*Bufo americanus*).

Table 4: Amphibians & Reptiles Observed from Spring Creek Valley

Scientific Name	Common Name	Current Status	Habitat
Ambystoma laterale	Blue-spotted salamander	Undocumented – possible	Forest/open woodland
Ambystoma tigrinum	Eastern tiger salamander	Present at Spring Creek	Forest/open woodland
Bufo americanus	American toad	Present at Spring Creek	Generalist
Hyla versicolor	Eastern gray treefrog	Undocumented, possible	Forest/open woodland
Pseudacris triseriata	Western chorus frog	Present at Spring Creek	Marsh/wet prairie/wetlands
Rana catesbeiana	Bullfrog	Present at Spring Creek	Wetland/riparian generalist
Rana clamitans	Green frog	Present at Spring Creek	Wetland/creek-pond margin
Rana pipiens	Northern leopard frog	Present at Spring Creek	Marsh/wet prairie
Apalone spinifera	Spiny softshell turtle	Probably present	Creek/river/lake generalist
Chelydra serpentina	Common snapping turtle	Present at Spring Creek	Wetland/riparian generalist
Chrysemys picta	Painted turtle	Present at Spring Creek	Wetland/riparian generalist
Emydoidea blandingii	Blanding's turtle	Present at Spring Creek	Emergent/open-water marsh
Trachemys scripta	Red-eared slider	Probably present	Creek/river/lake generalist
Elaphe vulpina	Western fox snake	Present at Spring Creek	Open woodland/prairie
Lampropeltis triangulum	Eastern milk snake	Probably present	Open woodland/savanna
Nerodia sipedon	Northern watersnake	Probably present	Wetland/riparian generalist
Opheodrys vernalis	Smooth greensnake	Undocumented – possible	Old field/mesic prairie
Regina grahami	Graham's crayfish snake	Undocumented – possible	Marsh/prairie pond edges
Storeria dekayi	DeKay's brownsnake	Present at Spring Creek	Generalist-open woodland
Storeria occipitomaculata	Northern redbellied snake	Undocumented – possible	Open woodland/savanna
Thamnophis radix	Plains gartersnake	Present at Spring Creek	Old field, prairie
Thamnophis sirtalis	Common gartersnake	Present at Spring Creek	Generalist – open woodland

Birds

Spring Creek Valley is one of 25 areas in Illinois to be named an Important Bird Area, including three in Cook County. The Important Bird Area (IBA) program is an international effort led by BirdLife International with the National Audubon Society being its U.S. partner. Spring Creek's designation is primarily due to its value as a habitat for a number of globally rare grassland bird species.

Organized by the Bird Conservation Network in cooperation with the Audubon Chicago Region, Spring Creek Stewards, FPDCC, and the USACE Chicago District, the largest and most comprehensive bird blitz in the Chicago Region occurred in 2011 at Spring Creek Valley with nearly 100 volunteers covering 40 units at approximately 100-acres throughout the almost 4,000-acre project area. Given the size and diverse habitats at Spring Creek it should be expected that the site supports a wide diversity of birds. A total of 99 species of birds were found, 25 species of conservation concern. Birds of Concern can be categorized by habitat and are reported on as such below; birds of concern are designated based on the Bird Conservation Network's review of national and state bird conservation priority lists to develop a list for the Chicago Wilderness area. Chicago Wilderness species of concern are all listed in **Table 5**; habitat type, species occurrence at Spring Creek and species that would be expected to use Spring Creek is identified.

Table 5: Spring Creek Bird Occurrences & Species of Concern

Species	Grassland	Wetland	Shrubland	Woodland	SC Recorded	SC Target
American Bittern		X				X
Bell's Vireo			X			
Black-billed Cuckoo			X		11	X
Black-crowned Night-Heron		X			1	X
Blue-winged Warbler			X		9	X
Bobolink	X				100	X
Brown Thrasher			X		21	X
Cerulean Warbler				X		
Chimney Swift				X	43	X
Common Moorhen		X				
Dickcissel	X				75	X
Eastern Kingbird			X		58	X
Eastern Meadowlark	X				35	X
Eastern Whip-poor-will				X		
Field Sparrow			X		191	X
Grasshopper Sparrow	X				56	X
Great Crested Flycatcher				X	67	X
Henslow's Sparrow	X				33	X
King Rail		X				X
Least Bittern		X				
Little Blue Heron		X				
Marsh Wren		X			16	X
Northern Flicker				X	19	X
Northern Harrier	X					X
Orchard Oriole			X		11	X
Peregrine Falcon		X				
Prothonotary Warbler				X		
Red-headed Woodpecker				X	1	X
Rose-breasted Grosbeak				X	54	X
Sandhill Crane		X			7	X
Sedge Wren	X				2	X
Short-eared Owl	X					
Snowy Egret		X				
Swainson's Hawk	X					
Upland Sandpiper	X					
Veery				X	5	X
Vesper Sparrow			X		1	X
Western Meadowlark	X					
Willow Flycatcher			X		43	X
Wood Thrush				X	17	X
Yellow-billed Cuckoo				X	25	X
Yellow-breasted Chat			X		1	X
Yellow-headed Blackbird		X				

Wetland Birds of Concern – Based on the relatively poor showing (Figure 3) at Spring Creek Valley by nesting wetland birds of conservation concern and the goals of this project, it is quite likely that great improvements can be made in the quality of the habitat for wetland birds.

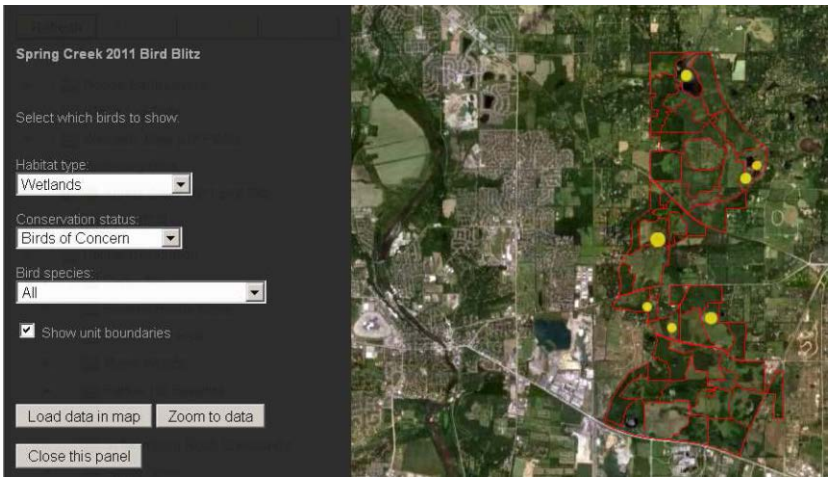


Figure 3: Occurrence of Wetland Birds of Concern at Spring Creek

Grassland Birds of Concern – According to The State of the Birds 2011 Report on Public Lands and Water, more than 97% of the native grasslands of the U.S. have been lost (mostly having been converted to agriculture), making grassland bird populations the nation's fastest declining species. While only 13% of U.S. grasslands are publicly owned (less than 2% being publicly owned and managed primarily for conservation), public lands support 17% of the U.S. distribution of breeding and 20% of wintering grassland-dependent birds; the only four grassland species which have 5% or less of their distribution on public lands (breeding Dickcissels, Scissor-tailed Flycatchers, Eastern Meadowlarks, and wintering Harris's Sparrows) are all found predominantly in the Midwest (North American Bird Conservation Initiative 2011). At Spring Creek Valley, the grassland birds can be broken down into two subsets. While all are area restricted, some require even larger contiguous tracts for nesting. These include Upland Sandpiper, Northern Harrier, and Short-eared Owl, none of which were detected among the grassland birds of concern observed during the bird blitz (Figure 4). Of these especially the Northern Harrier might be considered a sort of "stretch goal" target species. In order to restore nesting habitat for other species, efforts should be made to expand and connect locations where grassland obligate species are currently nesting.

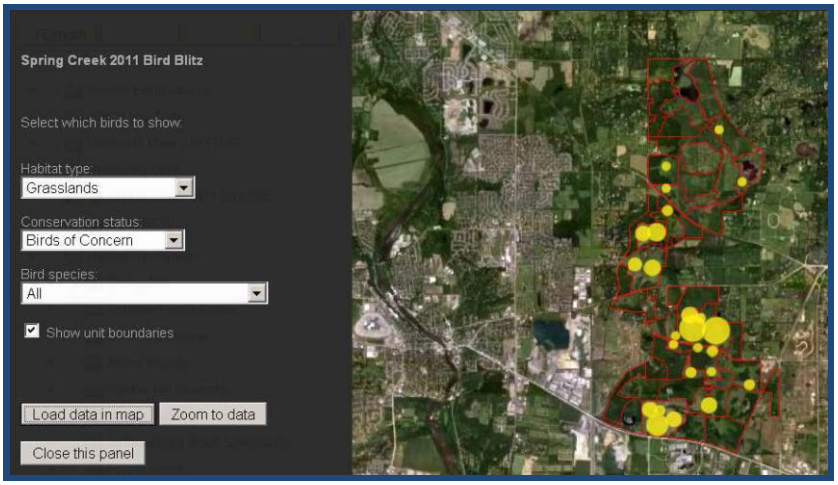


Figure 4: Occurrence of Grassland Birds of Concern at Spring Creek

Shrubland Birds of Concern – Spring Creek is a regionally important location for shrubland birds of concern which are the group of species showing the second most significant, sustained population declines. Occurrences of shrubland birds of concern in 2011 are shown in Figure 5. The size and scope of Spring Creek allows for both grassland birds and shrubland birds to coexist, but not necessarily on the same acres.

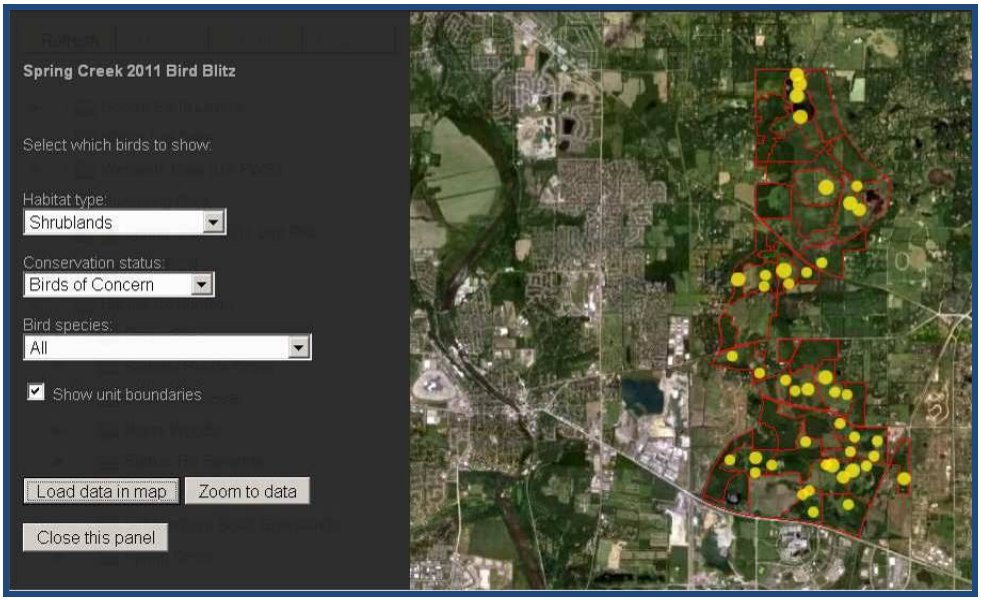


Figure 5: Occurrence of Shrubland Birds of Concern at Spring Creek

Woodland & Savanna Birds of Concern – Woodland birds are not likely to be a major indicator of success for this project. With a bit of specific planning, it is possible that the brush control associated with this project could improve habitat for Red-headed Woodpeckers which are more commonly associated with savanna and open woodland habitats especially those near water. This site historically supported nesting Red-Headed Woodpeckers especially in the nature preserve. Occurrences of woodland and savanna birds of concern in 2011 are shown in Figure 6.

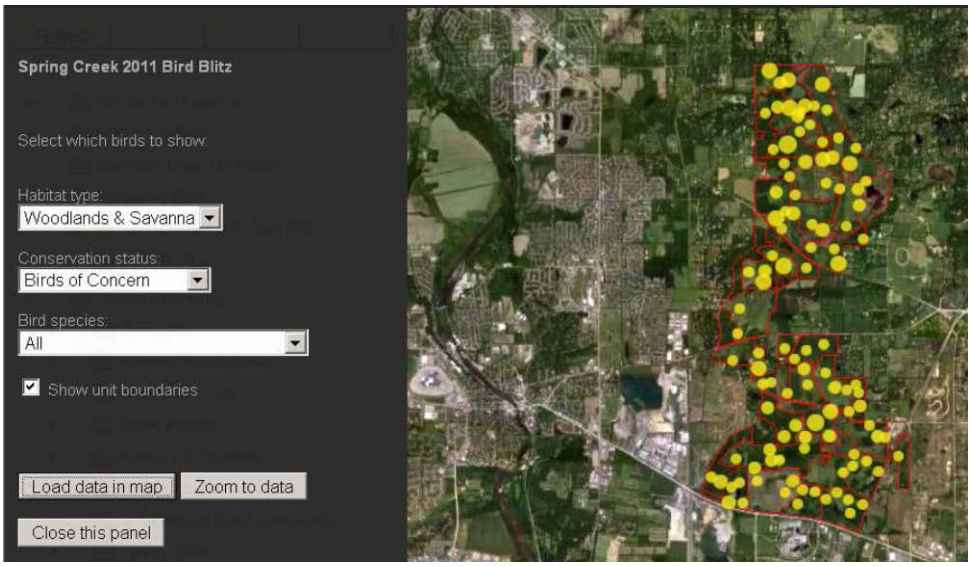


Figure 6: Occurrence of Woodland & Savanna Birds of Concern at Spring Creek

Mammals

Mammals currently recorded within the Spring Creek natural area by FPDCC biologists include Opossum Masked Shrew, Pygmy Shrew, Northern Short-tail Shrew, Big Brown Bat, Little Brown Bat, Eastern Cottontail, Chipmunk, Gray squirrel, Fox squirrel, Southern Flying Squirrel, Beaver, Whitefooted mouse, Meadow Vole, Muskrat, Meadow Jumping Mouse, Coyote, White Tail Deer, Red fox, Raccoon, Long-tail Weasel, Mink, and Skunk.

Threatened & Endangered Species

The County Distribution of Federally-listed Threatened, Endangered, and Candidate Species for Cook County (List Revised April 30, 2015) was reviewed on the USFWS website by the Chicago District (http://www.fws.gov/midwest/Endangered/lists/illinois-cty.html). The following federally listed species, their status, and critical habitat are identified by the USFWS as occurring within Cook County:

- Piping Plover (*Charadrius melodus*) – Endangered – Wide, open, sandy beaches with very little grass or other vegetation
- Eastern Massasauga (*Sistrurus catenatus*) – Candidate – Graminoid dominated plant communities (fens, sedge meadows, peatlands, wet prairies, and shrublands)
- Hine's Emerald Dragonfly (*Somatochlora hineana*) – Endangered – Spring fed wetlands, wet meadows, and marshes
- Eastern Prairie Fringed Orchid (*Platanthera leucophaea*) – Threatened – Moderate to high quality wetlands, sedge meadow, marsh, and mesic to wet prairie
- Leafy-Prairie Clover (*Dalea foliosa*) – Endangered – Prairie remnants on thin soil over limestone
- Mead's Milkweed (*Asclepias meadii*) – Threatened – Late successional tallgrass prairie, tallgrass prairie converted to hay meadow, and glades or barrens with thin soil
- Northern Long-eared Bat (*Myotis septentrionalis*) – Threatened – Hibernates in caves and mines – swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests and woods.
- Rufa Red Knot (*Calidris canutus rufa*) – Threatened - Only actions that occur along coastal areas or large wetland complexes during migratory window of May 1 – September 30
- Rattlesnake Master Borer Moth (*Papaipema eryngii*) – Candidate – Undisturbed prairie and woodland openings that contain their only food plant, Rattlesnake Master (*Eryngium yuccifolium*)
- Prairie Bush Clover (Lespedeza leptostachya) – Threatened – Dry to mesic prairies with gravelly soil

The only Federally listed species known to inhabit the study area is the Hine's emerald dragonfly (*Somatochlora hineana,* HED). The species was listed as endangered in 1995 with extant populations only occurring in Illinois, Wisconsin, Michigan, and Missouri. Critical habitat for the species includes marshes and sedge meadows fed by calcareous groundwater seepage and underlain by bedrock. Threats to HED include habitat loss, habitat degradation, habitat succession, and disruption of ecological and

hydrological processes. High quality wetlands within the study area may also support the Federally threatened Eastern Prairie Fringed Orchid (*Platanthera leucophaea*).

The Illinois Natural Heritage Database was queried on 27 March 2015 for important resource areas and State Listed Species. The IDNR EcoCAT Report, (project number 1510887) shows the following protected sites are within the vicinity of Spring Creek Valley: Barrington Hills Botanical Area INAI Site, Crabtree Nature Center INAI Site, Spring Creek Prairie INAI Site, Spring Lake – Cook INAI Site, Trout Park Class III Groundwater Site, Helm Woods Nature Preserve, Kemper Park Nature Preserve, Spring Lake Nature Preserve. The EcoCAT Report also names the following State Listed Species that are known to occur within the potential project site's vicinity: Black-Billed Cuckoo (*Coccyzus erythropthalmus*), Common Moorhen (*Gallinula chloropus*), Least Bittern (*Ixobrychus exilis*), Osprey (*Pandion haliaetus*) Yellow-Headed Blackbird and (*Xanthocephalus xanthocephalus*). EcoCAT Report 1510887 may be found in **Appendix G**. State Listed species not identified on the EcoCAT Report but are known to occur within Spring Creek Valley include Spike (*Eliptio dilatata*), Slippershell (*Alasmidonta viridis*), Black Sandshell (*Ligumia recta*), and Blanding's turtle (*Emydoidea blandingii).*

2.1.3 – Cultural Resources

Archaeological & Historic Properties

The National Register of Historic Places has no listed properties within the Village of Barrington Hills. The closest listed properties are the Octagon House (listed 1977) and the Barrington Historic District (listed 1986) both located to the northeast in the town of Barrington. None of these properties are near the project area.

The project area is within Cook County-Potawatomi Woods Forest Preserve, including the Spring Lakes Nature Preserve, operated by the Forest Preserve District of Cook County. The project area is primarily former farm land. Drainage tiles and ditches were installed across large areas, and some banks and slopes were graded to allow the area to be used for farming and livestock grazing. No intact archaeological deposits are present in the project location. However, intact cultural deposits may be present in undisturbed areas.

Native American groups with historic ties to the project area were consulted about the potential project. A list of Native American groups consulted and responses can be found in **Appendix G.** Tribal consultation requires the federal government to provide tribes a reasonable opportunity to identify their concerns about historic properties; advise on the identification and evaluation of historic properties, including those of traditional religious and cultural importance to them; articulate their views on the undertaking's effects on such properties; and participate in the resolution of adverse effects. Letters requesting comments and consultation were sent to 10 Federally recognized tribes. The Kickapoo Tribe of Oklahoma responded and advised they had no objection to the proposed project. See **Appendix G**.

Land Use History

Settlements in Cook County began after 1814, but were located in the southern portion of the county. Although Cook County was organized in 1831, settlers didn't begin began arriving in northwestern Cook County until 1836 when the land was opened for settlement. The first settlers were primarily from Germany. The area developed into a farming and livestock region, with these industries continuing to dominate the local economy until the 1950s. Country estates and horse farms came to dominate the general project area and Barrington Hills in particular became known for its genteel equestrian based lifestyle. Other surrounding towns, such as Hoffman Estates, were created by post-WWII suburban residential development into commuter communities tied into the growing Chicago metropolitan area.

Originally farmland, the Village of Barrington Hills was incorporated in 1957. The Forest Preserve District of Cook County began acquiring land for the Cook County-Potawatomi Woods Forest Preserve in 1955. Additional land purchases have expanded the forest preserve to approximately 3,800 acres.

Social Setting

The Village of Barrington Hills is located in northeastern Illinois. It is primarily in northwestern Cook County, but its 30 square miles also extends into portions of Lake, Kane, and McHenry Counties. Barrington Hills has a population of 3,940 (2000), with very little racial or ethnic diversity. Median household income for Barrington Hills is $145,530 (2000), and the median home cost is $661,500 (2000). The main communities surrounding Barrington Hills include Barrington, Carpentersville, and South Barrington.

Recreation

Cook County Potawatomi Woods Forest Preserve includes miles of hiking, biking, cross-country skiing, and bridle trails. The forest preserve also contains the Spring lake Equestrian Center. It is a popular bird watching area. Other recreational facilities in Barrington Hills are provided by the park districts of the surrounding towns of Barrington and Carpentersville.

Hazardous, Toxic & Radioactive Waste (HTRW) Analysis

This investigation was performed to determine if the selected measures for the Spring Creek Valley project will have an impact on any RECs that may exist in the surrounding areas, and if any RECs will have an impact on the implementation of the project. According to ER 1165-2- 132, non-HTRW issues that do not comply with federal, state, and local regulations should be discussed in the HTRW evaluation along with HTRW issues.

Historical aerial photographs of the site were obtained in-house, and USGS topographic maps of the site were obtained from Environmental Data Resources (EDR). These imagines generally reflected little change in land use over the years. The area has remained primarily agricultural, with increasing amounts of parkland in recent years. No sites were identified in the historical images that would likely impact the project area.

Data presented in the EDR Database Report did not indicate any surrounding sites that are likely to pose concerns to the project resulting from federal or state regulated facilities within the ASTM established search distances. One underground storage tank (UST) and two Leaking Underground Storage Tanks (LUSTs) were identified in the area according to the database search. Further investigation showed that neither the UST nor the LUSTs were on the project site and that they were unlikely to affect the project. Due to the location of these sites, it is not anticipated that they will affect the project. No other issues were identified in the database review.

No investigation can wholly eliminate uncertainty regarding the potential for encountering RECs associated with a project area. Performance of this investigation is intended to reduce, but not eliminate, uncertainty regarding the potential for encountering a REC in connection with a project area. As a result of this analysis, it was concluded that there is sufficient information to demonstrate that the work proposed for the Spring Creek Valley project has little potential for encountering a REC.

2.2 – Habitat Quality Forecasting

The purpose of this study was to identify problems and corresponding solutions to address the altered and degraded ecosystem of Spring Creek. To calculate change in habitat quality, the level of habitat suitability was calculated by developing a Habitat Suitability Index (HSI). The HSI is an algebraic function that typically uses various habitat structure components as indicators, such as species richness and cover. One HSI that has been certified by the USACE's Center of Expertise for Ecosystem Restoration that reflects a plant community's quality is the Floristic Quality Assessment (FQA). This HSI was used to quantify Existing Ecological (EX) conditions, Future Without-Project conditions (FWOP) and Future With-Project (FWP) conditions for the Spring Creek study area. Plant communities are highly indicative of habitat quality for animals since plants are the secondary driver to ecosystem biodiversity. Plant communities are defined as a secondary driver to ecosystem structure and function because they respond to primary drivers of (a) hydrogeomorphic and soil conditions and (b) relay to tertiary drivers by providing structure, food, and cover for all fish and wildlife, both directly and in indirectly.

2.2.1 - Habitat Suitability Index

Many methods are available to measure current ecosystem resource conditions and to predict future conditions of those resources. Habitat assessment methods developed for individual species may have limitations when used to assess ecosystem restoration problems and objectives. They do not consider communities of organisms and typically consider habitat in isolation from its ecosystem context. The assessment methodology selected for this study is community based and was chosen by how well the technique meets the needs of the study goals, objectives, and level of detail. The assessment methodology, or Floristic Quality Assessment (FQA), focuses on composition and function of the plant community. This was chosen to assess the ecological value of the proposed future without-project condition and any ecosystem level changes that result from the proposed management measures for Spring Creek Valley. There was no weighting per community type since each part of the ecosystem is just as important as the other. The FQA is a regionally approved model for USACE planning use.

Floristic Quality Assessment

The determination of "quality" with respect to plant assemblages has been the subject of much research and development since the mid 1970's. Quality, as used in this study, is essentially an assessment of the degree to which native plant species are present within defined plant communities. Plants are exceptional indicators of short and long term disturbance in terms of habitat function and structure. Vegetation influences most aquatic functions such as net annual primary productivity. Plants are the largest primary producers in most systems, which make them the primary vector of energy flow through an ecosystem. In addition, research has shown there to be strong correlations between vegetation and water chemistry. Most importantly for restoration, vegetation provides resources and habitat for entire suites of species, that than indirectly influence the entire food web of an ecosystem (e.g., insects, fish, birds, mammals, etc.). Out of the approximate 2,500 plant species known to occur in the Chicago Region, around one-third were not present before European colonization. Non-native species did not evolve within the same environmental conditions as the native species, and their persistence indicates a certain degree of functional disablement. Numerically describing the quality of an area using vegetation reflects the level of disturbance to the biological integrity of the site. In the Chicago Region, there is one commonly used approach that attempts to describe plant community quality with a simple numerical metric, which is the FQA (Swink and Wilhelm 1979). This assessment tool was designed to be used as an all inclusive method, not just as a way to identify high quality sites. The FQA was originally developed for the Chicago Region, but has since been developed for regions and states throughout North America. This

method has been extensively studied and shows great promise as a quick and easily understood method of assessing the quality of plant communities.

The FQA method specifically excludes the use of "indicator" species, instead assessing the sensitivity of all individual plant species that inhabit an area. Species "conservatism" is used as its basis for assessment; conservatism being defined as a level of tolerance each plant species exhibits to disturbance type, amplitude, and frequency, as well as fidelity to specific habitat types. As an area's equilibrium is disturbed, the habitat's capacity to absorb disturbance is weakened and the first plants lost will come from the high end of the conservatism spectrum. Therefore, what is being measured is the extent to which an area supports conservative native plants.

Based on species inventory, the FQA generates two essential metrics for an area inventoried: the Mean C, which is the average coefficient of conservatism, and the FQI, which is derived by multiplying Mean C by the square root of the number of native species inventoried, where C is the coefficient of conservatism and N is the number of species. The FQI, therefore, is a function of both conservatism (function) and species richness (structure).
Each native species has been assigned a coefficient of conservatism (C), ranging from 0 to 10. C values were assigned to species within a predefined geographic area by Swink and Wilhelm (1979). A 0 is assigned to species that are highly tolerant to human disturbance and are considered general in their habitat distribution and a 10 is assigned to species with a very low tolerance to human activities which display very specific relationships to certain habitat types. The following descriptions of categories were used to assign coefficients of conservatism to all plant species within the Chicago Region:

- 0-3 Wide range of ecological tolerance and found in a variety of conditions
- 4-6 Mid range of ecological tolerance and a smaller variety of conditions
- 7-8 Low range of ecological tolerance and associated with specific environmental conditions
- 9-10 Very low range of ecological tolerance and a narrow ecological niche

It has been demonstrated that sites with Mean C and Floristic Quality Index (FQI) values less than 2.8 and 20 respectfully, as surveyed during the growing season, are degraded or derelict plant communities. Sites with mean C values that approach 3.2 are considered to be moderately disturbed. When site inventories yield mean C values greater than 3.4 or higher, one can be confident that there is sufficient native character present for the area to be at least regionally noteworthy - such landscapes are essentially irreplaceable in terms of their unique composition of remnant biodiversity. Sites with mean C and FQI values greater than 4.0 and 50, respectively, are rare and indicate highly significant natural areas of statewide importance.

With an active land management plan and time, the mean C and FQI values will reflect the extent to which conservative species are being recruited and the floristic quality is improving. In this way, the FQA method can be used to assess restoration management decisions, as well as to document floristic changes (positive or negative) in the landscape over time. In addition, the FQA has been shown to be highly correlated with other biological assemblages in their response to disturbance and restoration actions. For example, Shuey et al. (2012) found that the FQA predicted the response of moth species to amount of degradation across a gradient of human disturbance within prairie ecosystems. Their results show the same pattern as a variety of other research projects on other insects groups such as Hemiptera and Lepidoptera (Grabas et al. 2012, Panzer and Schwartz 1998, Panzer et al. 2010 and Wallner et al. 2013). Finally, the FQA is also correlated with physical and chemical characteristics of lakes (Radomski and Perlberg 2012), as well as, fish assemblages in lake systems (Garrison et al. 2008). The FQA is a reliable indicator of other aspects of ecosystem function and structure.

2.2.2 - FQI Value as the Habitat Suitability Index (HSI)

Habitat outputs for the future without and future with project condition were estimated over the entire 50 year period of analysis. In order to restore the ecosystem within the study area, both ecosystem function and structure were addressed through the FQA method described above. The data required was gathered and quality checked by USACE botanists. Baseline floristic quality was surveyed during the growing season of 2012/2013 (see Appendix G), which will serve as a comparison for predictions of changes to the plant community based on alternative future scenarios. The Floristic Quality Index is calculated using the following equation:

$$FQI = \bar{C}\sqrt{N}$$

Where:

FQI	=	Floristic Quality Index
$\bar{C}$	=	Sum of the Coefficient of Conservatism / # of Species
N	=	Total # of Species

2.2.3 - Plant Community Average Annual Habitat Units (AAHUs)

In order to equally assess measures, alternatives or plans, the benefit portion of the analysis must be annualized just as the costs are. The method per USACE planning guidelines typically assigns benefits over a 50-year period of analysis, or project life. This study will use 50-years as a reasonable period of analysis, noting that the benefits may actually be accrued in perpetuity. Habitat Units (HUs) are calculated by:

- HSI x Plant Community Acres Affected = Habitat Units (HUs)

FWOP and FWP HSI are calculated by:

- FQAI / 93.6* = HSI
  *highest attainable FQI based on FWP FQI in 50yrs

Average Annual Habitat Units (AAHUs) are calculated by:

- $\sum_{n=50}^{HU} /50 = AAHU$

Even though there may be apparent benefits to be gained, there are still benefits existing in the Future-Without Project condition within the existing plant communities, as evident by the FQI values. To ensure that existing benefits are not claimed by potential actions, only the net benefits gained are utilized. This unit is called the Net Average Annual Habitat Unit (NAAHU), which is represented as:

- FWP AAHUs – FWOP AAHUs = Net Average Annual Habitat Units (NAAHU)

2.3 – Future Without-Project Conditions

The FWOP condition forecasted for Spring Creek is that diverse native plant and animal communities would not restore naturally on their own, but would remain relatively static within most communities in terms of floristic quality for the foreseeable next 50 years. Invasive species would continue to dominate and keep native plant communities from reestablishing, creating habitats that favor generalists over specialists, thereby decreasing or eliminating foraging and breeding habitat for native fauna. Acreage of invasive woody growth would continue to increase and further reduce nationally and regionally significant native grasslands, of which more than 97% has already been lost in the U.S. (North American Bird Conservation Initiative, U.S. Committee 2011). In particular, the Midwest is classified as a 'critically endangered' ecoregion with a ratio of converted native vegetation (to other vegetation types such as croplands) to protected land being >25:1 (Hoekstra et al. 2005; Hirsh et al. 2013). Native seed banks would become depleted as altered hydrology and fire-suppressed areas with resultant woody growth would continue inhibition of their germination. The area's ability to supply migratory and resident birds with resting, foraging, and breeding habitat would decline.

FQI species inventory and calculation sheets for existing and FWOP conditions are provided in **Appendix G**. This analysis shows that the existing and FWOP conditions for native plant communities, which are the basis for fish and wildlife habitat, are considered ruderal and weedy due to the lack of native conservative plant species which are indicative of healthy native habitats. This is the result of eradication of native plant species and seed bank, a drained hydrology; and the domination of invasive Eurasian shrub and grass species.

CHAPTER 3 – PROBLEMS & OPPORTUNITIES

This chapter provides a description of identified problems within the study area along with opportunities for improvement. It also outlines the overall project goal along with specific planning objectives and constraints.

3.1 – Problems and Opportunities

3.1.1 – Study Area Problems

Historically, the Spring Creek natural area was comprised of several naturally occurring communities including wetlands, woodland, savannas and prairies. By the late 1800s, many of these communities, particularly prairies, savannas and wetlands, were converted to agricultural, urban or industrial use. Subsequently, there was a significant loss of biodiversity and adverse physical effects such as a decrease in dry weather stream flows, decrease in spatial coverage of native plant communities and a decrease in habitat suitability for various assemblages of species, including the federally endangered Hine's Emerald Dragonfly. Furthermore, the remnant patches of native community types are under pressure from continued human activities. Human induced disturbances to the remaining natural processes include fire suppression, altered hydrology and hydraulics, increased colonization of invasive species, urbanization pressures and fragmentation. While plant communities can be described in terms of dominant organisms, the quality of their habitat is directly related to the level at which these natural processes function. Habitat quality generally displays a negative relationship to the amount of human disturbance in direct or indirect ways.

Agriculture and urban development has had a major influence on the physical structure of habitat and the processes that created and sustained these habitats. This has allowed invasive and nonnative species to colonize these altered areas. There is also a negative feedback loop in some stream sections where altered hydrology and lack of fire has induced the riparian structure to fail, in turn causing the stream to degrade, which feeds back to more altered hydrology and hydraulics. The following discussion illustrates the intrinsic ecosystem problems that are driven by the alteration of the water cycle and introduction of invasive plant species.

Vast areas of tile-drained hydric soils and channelized stream reaches have severely reduced the extent of Spring Creek's hyporheic zone and have severed the stream from its floodplain (Warrner et al. 2009; Riple 2010). One of the most significant impacts drain tiles have on a landscape is drastically reducing nutrient-retention capabilities of a stream and its riparian zone by swiftly transporting both subsurface and surface waters directly to and quickly through the stream (Riple 2010). Naturally, waters would flow through the hyphoreic zone and over the active floodplain, consequently being relieved of its nutrients; however, the altered state allows greater quantities of nutrients (Warrner et al. 2009) to reach downstream wetlands and water bodies. Higher nutrient levels likely have a significant negative effect on native vegetation by altering soil chemistry and the balance of competition between species (Horswill et al. 2008; Bobbink et al. 1998). Reed canary grass (*Phalaris arundinacea*), cattail (*Typha spp.*), and other invasive plants have been shown to be reliant on nutrient-rich conditions which increase their frequency and biomass (Perry et al. 2004; Kercher and Zedler 2004; Blumenthal et al. 2003; Wetzel and Van Der Valk 1998; Morghan 1999). As an agriculturally influenced watershed with other ongoing anthropogenic inputs of nutrients, Spring Creek Valley has likely experienced a lack of nutrient relief as a limiting resource, where all the nutrients are being conveyed and trapped in flowage lakes and marshes. This also drives invasive species' increased distribution, abundance and dominance (Wedin & Tilman 1996; Rickey, et al. 2004). Compounded with a considerable amount of organic carbon stripping from soils (Warrner et al. 2009; Royer and David 2005) and suppressed processes of stream migration/meandering

and fire, this condition allows for native species to be outcompeted and have their establishment suppressed, which ultimately results in species richness declines.

Woody vegetation comprised of opportunistic and invasive shrubs and trees as well as dense stands of invasive herbaceous plants have significantly changed the structure and vegetative composition of the site. This has resulted in the significant disruption of natural water levels through increased evapotranspiration. Evapotranspiration is one of the most important output fluxes in wetlands and plant communities, in many cases accounting for up to 100% of annual water losses (Frank & Inouye 1994; Souch et al. 1998). A study by Paul K. Doss (1993) within northwest Indiana found that the hydrologic regime of wetlands is predominantly controlled by evapotranspiration of wetland flora as well as the evapotranspiration of upland phreatophytic vegetation. It was found that significant shifts in hydrological regimes as well as ground water depletion during daylight hours were controlled by the evapotranspirative demands of wetland and nearby upland vegetation (Doss 1993).

Dense monotypic stands of invasive hydrophytes and woody invasion of riparian hydric soils and important upland buffers are significant disruptors to the hydrologic regimes of the site's wetlands. A change in a plant community's species composition and structure drive changes in water balances (Sun et al. 2008). Woody vegetation alters water availability by intercepting precipitation, increasing infiltration via stemflow and root channels, and/or transpiring water that would otherwise reach the soil and recharge groundwater (Huxman et al. 2005; Farley et al. 2005). When compared to open water evaporation, cattail (*Typha latifolia*) evapotranspiration was shown to be 0.6 to 2.1 times greater than other native wetland vegetation (Brezny et al. 1973).

A site at the Indiana Dunes National Lakeshore, with similar conditions of invasive cattail and common reed encroachment on remnant wetland vegetation, has been shown to exhibit higher evapotranspiration rates when compared to an undisturbed site (Souch et al. 1998). Also, standing water at both the undisturbed and disturbed wetland was shown to be a very important heat sink, where 90% of heat exchanges occurred in the water when water depths were more than 50mm, in less than 30mm of water the heat exchanges in the water and sediment were about equal, and heat exchanges occurred in the uppermost sediments when the water fell below the surface. With increasingly higher evapotranspirative demands as invasive and woody species become more dominant, the altered temperature fluctuations within the water and sediment of Spring Creek Valley may be driving the ecology of its wetlands just as these water/sediment temperatures drive the solubility of dissolved oxygen, nutrient cycles, the metabolism and respiration of living organisms, and microbial biomass and activities (McCulley et al. 2004; Souch et al. 1998).

Specific problems with primary ecosystem drivers include:

- Altered hydrology stemming from drain tile and ditch system
  - Streams run dry during droughty periods
  - Wetland hydroperiods no longer occur
  - Surface water wetlands have disappeared
  - Groundwater recharge prevented
- Altered riverine hydraulics stemming from increased urban runoff
  - Minor issue which has caused the streams to become a bit larger than they should naturally be if the whole watershed was in native vegetation
- Altered riverine hydraulics stemming from invasive plant species
  - Major issue which has caused stream morphology to degrade
  - Stream habitat has become degraded

- Altered riverine hydraulics stemming from historic channelization
  - A few reaches of stream and floodplain still suffer from being channelized for agricultural purposes
  - No recovery of heavily channelized sections provides minimal if any viable stream habitat
- Habitat fragmentation
  - Two dams on the mainstem Spring Creek may prevent recolonization of fishes and mussels to a 7-mile reach
  - Large plots of ruderal plant communities and domination of invasive plant species could be adversely affecting movement of amphibians, reptiles and small mammals
- Lack of large mammal keystone species
  - Buffalo to maintain and diversify the prairie/savanna habitat mosaic
  - Wolves to keep the deer and browsing species' populations in check
  - Beavers to maintain stream and floodplain hydrologic and structural diversity
- Cessation of natural processes
  - Fire
  - Fluvial / Floodplain Interactions
  - Wetland Hydro-periods
  - Large Mammal Absence

Based on these problems with the ecosystem drivers above, the following are resulting ecological problems for the Spring Creek natural area:

- Reduced acres (quantity) of healthy native plant communities and structurally viable habitats
- Reduced richness and abundance (quality) of native plant species per community type
- Reduced richness and abundance of fishes and mussels
- Reduced richness and abundance of wetland, grassland, shrubland and woodland resident and migratory bird species
- Reduced richness and abundance of higher level organisms including insects, amphibians, reptiles and mammals

3.1.2 – Project Opportunities

Spring Creek Wetland & Floodplain Hydrology

Currently, there are vast areas of degraded wetland and riparian zone due to hydrologic alteration. Based on large areas allowable for flooding within the site, the intent of the non-Federal sponsor and the expertise of the USACE in altering hydrology, great opportunity exists to manipulate existing water control features and geomorphology to successfully reestablish an acceptable hydrology for native plant communities.

Spring Creek Invasive Species Domination

Currently, there are vast areas of degraded native plant communities and completely changed plant communities (ruderal) due to domination by both non-native and native invasive species. Based on the intent of the non-Federal sponsor, Federal Objectives for the control and eradication of invasive species and the expertise of the Chicago District, USACE in eradicating and containing invasive species, great opportunity exists to eliminate or reduce invasive plant species in order to successfully reestablish native plant community species richness and structure.

Restoring the hydrology and a diverse array of herbaceous plant species will increase the coverage of the herbaceous layer that will further reduce the area of bare soil within the riparian area and streamlets and provide a critical component of vegetation structure for the Hine's Emerald Dragonfly.

2.2.3 – Opportunities for Other Entities

Storm Water – Currently, the USACE is not able to participate in alleviating local storm drainage issues for the purposes of ecological restoration. Based on a previous investigation, it was determined that USACE's Policy Digest, ER1165-2-21, Chapter 13, Flood Damage Reduction precludes implementing projects that would alleviate small, localized point sources, and that these should be addressed through municipal or county drainage ordinances. The minor issues at Spring Creek do not warrant great alarm in terms of ecological degradation; however, there are obvious issues stemming from the discharge of storm water from the commercial area south of Higgins Road. The FPDCC also believes that there are storm water fluxes into the eastside of the preserve. Opportunity exists for local and county agencies to collaborate and provide solutions to these issues. A Federal opportunity would be to request a Section 22 Planning Assistance to States Study where the USACE could identify storm water problems and recommend solutions that local agencies could implement under their own programs and funding streams.

Galvin Lake & Dam – Currently, there is a large online excavated pond fitted with a dam-like control structure located on private property. Opportunity exists for the FPDCC to collaborate with supportive groups and the dam owner to eliminate the fish passage and potential water quality issues.

Private Dam – Currently, there is a stone dam located on private property that fragments Spring Creek. Opportunity exists for the FPDCC to collaborate with supportive groups and the dam owner to eliminate the fish passage and potential water quality issues.

Non-aquatic, Non-riparian & Dry Plant Communities – The Spring Creek Valley roughly totals about 4,000-acres, with less than half as drier, non-riparian habitats such as dry shrub prairie and dry oak savanna. In addition to restoration work already occurring in these areas, there exists great opportunity for the FPDCC and volunteer groups to increase restored acres that would buffer and improve a habitat project resultant of this study. Also, if this study would result in a project that restored hydrology throughout the vast wetland areas, there would be beneficial affects to the drier soil regions and phreatophytic vegetation. This would provide great opportunity again for the FPDCC and volunteer groups to target these areas for restoration.

3.2 – Goals, Objectives and Constraints

3.2.1 – Project Goal

The principal goal of a resulting project is to restore stream, riparian, wetland and buffering plant communities to provide habitat for migratory birds and local fish and wildlife.

3.2.2 – Objectives

Federal Ecosystem Objectives

The Federal objective of water and related land resources planning is to contribute to national economic and/or ecosystem development in accordance with national environmental statutes, applicable executive orders, and other Federal planning requirements and policies. The use of the term "Federal objective" should be distinguished from planning/study objectives, which are more specific in terms of expected or

desired outputs whereas the Federal objective is considered more of a National goal. Water and related land resources project plans shall be formulated to alleviate problems and take advantage of opportunities in ways that contribute to study objectives and to the Federal objective. Contributions to national improvements are increases in the net value of the national output of goods, services and ecosystem integrity. Contributions to the Federal objective include increases in the net value of those goods, services and ecosystems that are or are not marketable.

Restoration of the Nation's environment is achieved when damage to the environment is reversed, lessened, eliminated or avoided and important cultural and natural aspects of our nation's heritage are preserved. Various environmental statutes and executive orders assist in ensuring that a water resource planning is consistent with restoration of the environment. The objectives and requirements of applicable laws and executive orders are considered throughout the planning process in order to meet the Federal objective. The following laws, executive orders, and presidential memorandums that specifically provided guidance for this study are not limited to, but include:

- Endangered Species Act of 1973, as amended (16 USC 1531 et seq.)
- Fish and Wildlife Coordination Act, as amended (16 USC 661)
- Migratory Bird Treaty Act of 1918, as amended (16 USC 703 et seq.)
- Responsibilities of Federal Agencies to Protect Migratory Birds (E.O. 13186)
- Clean Water Act of 1977, as amended (33 USC. 1251 et seq.)
- Safe Drinking Water Act of 1986 as amended (42 USC 201)
- National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.)
- Invasive Species (E.O. 13112)
- Nonindigenous Aquatic Nuisance Prevention & Control Act of 1990, as amended (16 U.S.C. 4701 et seq.)
- National Invasive Species Act of 1996 (Public Law 104 – 332)
- Protection of Wetlands (E.O. 11990)
- Protection and Enhancement of Environmental Quality (E.O. 11514)
- Protection and Restoration of the Great Lakes (E.O. 13340)
- Floodplain Management (E.O. 11988)
- Federal Water Project Recreation Act, as amended (16 USC 460 (L),(12))
- Presidential Memorandum -- Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators
- Preparing the United States for the Impacts of Climate Change (E.O. 13653)

Planning Objectives

As part of the USACE Civil Works mission, the federal objective of ecosystem restoration projects is to restore the structure, function and dynamic processes of degraded ecosystems to a less degraded, more natural condition. The non-Federal sponsor has an ecosystem program that partners well with the federal objective stated above. Study objectives are statements that describe the desired results of the planning process by solving the problems associated with the study purpose and need. These objectives were used for the development and evaluation of alternative plans. Objectives must be clearly defined and provide information on the effect desired, the subject of the objective (what will be changed by accomplishing the objective), the location where the expected result will occur, the timing of the effect (when would the effect occur) and the duration of the effect.

Objective 1 – Reestablish Hydrology to Support Natural Communities

Currently, Spring Creek Forest Preserve is recovering from decades of intensive agriculture. This included altering the site's hydrology via installing vast drain tile networks, excavating ditches, channelizing streams, and grading-out micro-topography. Desired changes to the current hydrologic regime will reestablish hydroperiods and rehydrate former hydric soil units. These affects would be sustained over the life of the project and optimistically in perpetuity. This objective seeks to reestablish natural hydrologic and hydraulic parameters to support critical wetland and riparian habitats within the Spring Creek natural area. Improvement is predicted via the increase in quantity (acres) and increase in quality (Mean C Value of the FQA) of native plant communities.

Objective 2 – Reestablish Wetland, Riparian & Buffering Native Plant Communities

Currently, Spring Creek wetland, riparian and important buffering habitats are dominated by non-native and invasive plant species. This condition resulted from alteration to the natural hydrologic regime, disturbance to native soils, prevention of natural processes, and the sowing of non-native and native weedy (ruderal) plants. The domination of riparian plant communities by certain species such as buckthorn, honeysuckle and multiflora rose have also caused stream hydraulics and geomorphology to degrade, further exacerbating floodplain hydrologic issues. The desired changes to the native plant community will reestablish a base native plant community that will diversify overtime. These affects would be sustained and increased over the life of the project and optimistically in perpetuity. This objective seeks to reestablish native plant community richness and structure to support critical wetland and riparian habitats within the Spring Creek natural area. Improvement is predicted via the increase in quantity (acres) and increase in quality (Mean C Value of the FQA) of native plant communities.

3.2.3 – Planning Constraints

The PDT has identified the following planning constraints, in no particular order, for this project:

- Avoid flooding impacts to offsite land owners
- Avoid adverse impacts to high quality remnant areas, endangered species and rare species
- Avoid/minimize adverse impacts to horse and biking trails

CHAPTER 4 – PLAN FORMULATION

The formulation, evaluation, and comparison of alternative plans comprise the third, fourth, and fifth steps of the Corps' planning process. These steps are often referred to collectively as plan formulation. Plan formulation is an iterative process that involves cycling through these steps to develop a reasonable range of alternatives, and then narrow those plans down to a final plan, which is feasible for implementation.

Plan formulation for ecosystem restoration (ER) presents a challenge because alternatives have non-monetary benefits. To facilitate the plan formulation process, the methodology outlined in the Corps' Engineering Circular 1105-2-404, "Planning Civil Work Projects under the Environmental Operating Principles," 1 May 2003 was used. The steps in the methodology are summarized below:

1. Identify a primary project purpose. For this portion of the study, ecosystem restoration (ER) is identified as the primary purpose.
2. Formulate management measures to achieve planning objectives and avoid planning constraints, where measures are the building blocks of alternative plans.
3. Identify and select those sites most beneficial for ecological restoration.
4. Formulate, evaluate, and compare an array of alternatives to achieve the primary purpose (ER) and identify cost effective plans.
5. Perform an incremental cost assessment on the cost effective plans to determine the NER plan.

4.1 – Measure Identification

Measures were developed with the intent to restore habitat structure and function in a sustainable fashion, while protecting existing high quality habitats.

Hydrology

(DTD) Drain Tile Disablement - Back Water Valves - This measure seeks to restore natural groundwater and surface water hydrology to all areas that have been previously drained for agricultural purposes. During this feasibility phase, a drain tile survey was performed to locate and map all drain tiles within the preserve's boundaries (**Appendix B**). Once the drain tiles were mapped, temporary valves were installed to perform on site hydrologic simulation of what would happen if the drain tiles were permanently disabled. This step was deemed necessary in order to determine if there would be adverse effects to surrounding neighbors, roads and infrastructure, to delineate the extent and type of wetland communities, and to accurately prescribe the amount of native plugs and seed necessary for reestablishing these new wetland areas. Once these items were assessed, the valves were opened again to restore the current condition of the site.

Since the temporary valves are already in place, permanent disablement would require each valve to be grouted shut with bentonite clay. Permanently grouting these shut will not only prevent water from draining through the tiles at first, but over a period of years, will cause the tiles to fill with soil and collapse on themselves. This methodology is more cost effective and has a much less impact to the soils and environment than if all of the drain tiles were to be physically smashed in place or pulled out.

- Fill all designated temporary valves with bentonite clay
- Place gravel release structure on those valves identified as exterior drains to prevent off site flooding effects
- Fill in blow outs due to ruptured drain tiles

(D) Ditch - This measure seeks to restore surface hydrology along the western portion of the Spring Creek Preserve. An 8,400 foot ditch was once constructed to drain this portion of the preserve for agricultural purposes. The ditch, for the most part, is not fully functioning since maintenance has not been performed since farming ceased in the 1960s. This condition is evident from the amount of silt that has accumulated within the ditch; therefore, is not effectively impacting ground water, but does disallow surface water from naturally spreading and inundating areas that were formerly wetland. To remedy this remaining surface water issue, it is proposed to strategically grade approximately 4881 LF out of the total ditch length of 8400 LF, as depicted in **Appendix A** H&H Analysis, to allow these former wetland areas to become inundated. Removal of these side cast berms would allow these former wetland areas to become inundated. Also, this measure would remove hydraulic forces during storms that keep the ditch channelized. Eventually, native vegetation will overcome the ditch foot print and transform it into a small meandering swale, which is evident in the upper most reaches of this same ditch.

- Grade side cast berms down to ditch water elevation by pushing material back into the ditch
- Maintain grading activities within 50-feet from each ditch bank
- Utilize low impact equipment to avoid soil rutting and compaction
- Avoid grading in areas designated as high quality wetland

Hydraulics & Geomorphology

(SH) Stream Habitat – About 300 small woody debris jams of various designs would be placed in Spring Creek in the sections where the stream is not recovering on its own, has incised too much or exhibits a lack of water longevity. These woody structures would be positioned to start to provide localized habitat, increase water longevity within the stream channel, rehydrate the floodplain areas and promote the meandering process. These woody structures would be sacrificial as they will be assimilated once they decompose and/or natural cut and fill alluviation takes over. All the woody structures would have varying crests, ranging between 3 inches to 2 feet high, and between 5 and 20-feet wide, but various designs would be fleshed out during design to achieve the needs of the particular stream reach.

Primary Design - Log Weirs: A log weir consists of a header log and a footer log placed in the bed of the stream channel, perpendicular or at an angle to stream flow, depending on the size of the stream. The logs extend into the stream banks on both sides of the structure to prevent erosion and bypassing of the structure. The logs are installed flush with the channel bottom upstream of the log. The footer log is placed to the depth of scour expected, to prevent the structure from being undermined. This weir structure creates a “step” – or abrupt drop in water surface elevation – that serves the same functions as a natural step created from bedrock or a log that has fallen into the stream. The weir typically forms a very deep pool just downstream, due to the scour energy of the water dropping over the step. Weirs are typically installed with a maximum height of 3 to 6 inches so that fish passage is not impaired. Log weirs provide bedform diversity, maintain channel profile, and provide pool and cover habitat.

Secondary Design - Cover Logs: A cover log is placed in the outside of a meander bend to provide cover and enhanced habitat in the pool area. The log is buried into the outside bank of the meander bend; the opposite end extends through the deepest part of the pool and may be buried in the inside of the meander bend, in the bottom of the point bar. The placement of the cover log near the bottom of the bank slope on the outside of the bend encourages scour in the pool, provides cover and ambush locations for fish species, and provides additional shade. Cover logs are often used in conjunction with other structures, such as vanes and root wads, to provide additional structure in the pool.

Plant Communities

(MSI) Native Plant Establishment in Areas with Monotypic Stands of Invasive Species - This measure seeks to remove all invasive species with herbicide applications and prescribed burns within wetland communities where no coverage of rhizomatous *Carex* spp. or conservative native vegetation currently exist; invasive species include reed canary grass (*Phalaris arundinacea*), cattail (*Typha* spp.), and common reed (*Phragmites australis* ssp. *australis*). Diverse native plant communities will be established by allowing native seed bank to express itself and supplemental seeding with species of local genotype; species harder to establish from seed will be introduced as plugs. Spot applications of herbicide and additional prescribed burns will continue throughout the establishment period to further suppress invasive species and promote the establishment of native vegetation.

- During the first year, treat invasive species with herbicide applications
- Perform complete prescribed burn
- Allow recovery of native seed bank and plant 10,000 plugs/acre of rhizomatous native hydrophitic vegetation as necessary, primarily *Carex* spp.
- Spot herbicide invasive species for remainder of project
- Perform two additional prescribed burns over a five year period

(C) Native Plant Establishment in Areas with Existing Stands of Rhizomatous *Carex* spp. - This measure seeks to remove all invasive species with herbicide applications and prescribed burns within wetland communities containing remnant stands of rhizomatous *Carex* spp.; invasive species include reed canary grass (*Phalaris arundinacea*), cattail (*Typha* spp.), and common reed (*Phragmites australis* ssp. *australis*). Spot applications of herbicide and additional prescribed burns will continue throughout the establishment period to further suppress invasive species and promote the establishment of native vegetation.

- During the first year, treat invasive species with herbicide applications
- Perform complete prescribed burn
- Allow establishment of rhizomatous *Carex* spp. and native seed bank
- Spot herbicide invasive species for remainder of project
- Perform two additional prescribed burns over a five year period
- Preserve existing stands of native common reed (*Phragmites australis* ssp.*americanus*)

(ISC) Invasive Shrub Clearance - This measure seeks to remove invasive shrubs within degraded prairie and savanna habitats, including riparian communities. Shrub species to be removed include common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*Frangula alnus*), exotic honeysuckle (*Lonicera* spp.), Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), and multiflora rose (*Rosa multiflora*).

- Clear all shrubs listed above and herbicide stumps
- Allow recovery of native seed bank and seed with appropriate native species
- Spot herbicide all invasive herbaceous species and woody resprouts for remainder of project
- Perform complete prescribed burn
- Mow area twice the first year following seeding

(ITSC) Invasive Tree and Shrub Clearance - This measure seeks to remove invasive and opportunistic trees (8"-12" average dbh) and shrubs within degraded prairie and savanna communities, including riparian communities. Species to be removed include black cherry (*Prunus serotina*), white mulberry (*Morus alba*), black locust (*Robinia pseudoacacia*), box elder (*Acer negundo*), green ash (*Fraxinus lanceolata*), common buckthorn (*Rhamnus cathartica*), and exotic honeysuckle (*Lonicera* spp.)

- Clear all trees and shrubs listed above and herbicide stumps
- Allow recovery of native seed bank and seed with appropriate native species
- Spot herbicide all invasive herbaceous species and woody resprouts for remainder of project
- Perform complete prescribed burn
- Mow area twice the first year following seeding

(QITSC) Invasive Tree and Shrub Clearance of Red Oak Afforestation - This measure seeks to remove invasive and opportunistic trees (12"-18" average dbh) and shrubs planted within historic prairie and savanna communities that have further degraded as a result of fire suppression. Species to be removed include red oak (*Quercus rubra*), honeylocust (*Gleditsia triacanthos*), oriental bittersweet (*Celastrus orbiculatus*), cottonwood (*Populus deltoides*), common buckthorn (*Rhamnus cathartica*), and exotic honeysuckle (*Lonicera* spp.)

- Clear all trees and shrubs listed above and herbicide stumps
- Allow recovery of native seed bank and seed with appropriate native species
- Spot herbicide all invasive herbaceous species and woody resprouts for remainder of project
- Perform complete prescribed burn.
- Mow area twice the first year following seeding

(QISC) Invasive Shrub Clearance in Areas with Open-grown Oaks

This measure seeks to clear dense thickets of invasive shrubs within degraded savanna communities containing large open-grown bur oaks (*Quercus macrocarpa*) and white oaks (*Quercus alba*). Invasive shrubs within these areas include common buckthorn (*Rhamnus cathartica*), exotic honeysuckle (*Lonicera* spp.), Japanese barberry (*Berberis thunbergii*), and multiflora rose (*Rosa multiflora*).

- Clear all invasive shrubs and herbicide stumps, ensuring not to damage existing bur and white oaks
- Allow recovery of native seed bank and seed with appropriate savanna species
- Spot herbicide all invasive herbaceous species and woody resprouts for remainder of project
- Perform complete prescribed burn

(EM) Eurasian Meadow - This measure seeks to replace Eurasian meadows with prairie communities.

- Perform complete prescribed burn
- Seed appropriate native species
- Spot herbicide invasive herbaceous species for remainder of project
- Perform two additional prescribed burns over a five year period

(EP) Existing Prairie - This measure seeks to preserve and enhance existing prairie communities.

- Spot herbicide invasive species for project duration
- Perform complete prescribed burn

4.2 – Alternative Plan Generation

Six (6) alternative plans were manually generated, including the No Action alternative, using the measures described above. Spring Creek requires many specific and dependent measures to address the problems, opportunities, goals and objectives of the study; therefore, it was determined that use of the IWR Plan "Generator" would not be effective since the large volume of iterations would need to be broken down into sub-analyses and the dependencies would be cumbersome to manage. The following Alternatives were prescribed for cost and benefit analysis:

- Alternative 0 is the No Action Plan and obviously takes no action. The outcome of this alternative is described by the Future Without-Project conditions.

- Alternative 1 would restore 931 acres of habitat immediately impacted by the disablement of drain tiles and filling in the ditch along the western portion of Spring Creek Valley; however woody debris structures would not be installed within portions of channelized stream to rehydrate the channel and floodplain (**Plate 9**). This alternative also would not restore additional areas with hydric soils that would further support critical wetland and riparian habitats. This alternative does address the eradication of invasive plant species and establishment of native riparian communities within the 931 acre area, but neglects critical hydraulic restoration that may negatively impact species richness and the ability to fully eradicate invasive species. Alternative 1 consists of the following measures presented in Section 4.1: (DTD) Drain Tile Disablement, (D) Ditch, (MSI) Native Plant Establishment in Areas with Monotypic Stands of Invasive Species, (C) Native Plant Establishment in Areas with Existing Stands of Rhizomatous *Carex* spp., (ISC) Invasive Shrub Clearance, (ITSC) Invasive Tree and Shrub Clearance, (QITSC) Invasive Tree and Shrub Clearance of Red Oak Afforestation, (QISC) Invasive Shrub Clearance in Areas with Open-grown Oaks, (EM) Eurasian Meadow, (EP) Existing Prairie.

- Alternative 2 would restore 1064 acres of habitat which includes all hydrologic and native plant community restoration identified within Alternative 1, but would also install woody debris structures (SMI – Stream Meander Induction) within portions of channelized stream to rehydrate the channel and floodplain (**Plate 10**). This alternative also restores additional areas with hydric soils that would further support critical wetland and riparian habitats.

- Alternative 3 would restore 1270 acres of habitat which includes all hydrologic, hydraulic, and native plant community restoration identified within Alternative 2, but would also restore an additional stretch of Spring Creek and hydric areas further away from the immediate riparian zone that would support wetland and riparian habitats (**Plate 13**).

- Alternative 4 would restore 1997 acres of habitat which includes all hydrologic, hydraulic, and native plant community restoration identified within Alternative 3, but would restore all remaining hydric areas not identified for restoration within Alternative 3 that are further away from immediate riparian zones, however would further support wetland and riparian habitats (**Plate 12**). This alternative also includes restoration of a significant portion of buffering upland habitat consisting of savanna, woodland, and prairie communities that would have direct benefits to adjacent wetland and riparian habitats.

- Alternative 5 would restore 3841 acres of habitat which includes all hydrologic, hydraulic, and native plant community restoration identified within Alternative 4, but would also restore all remaining upland areas not identified for restoration within Alternative 4 (**Plate 13**).

4.3 – Alternative Costs and Assumptions

Detailed analysis of measure costs is presented in **Appendix B**. Conceptual, planning level cost estimates were prepared for measures/features that were identified by the study team. The measures were used to provide an economic basis for the development and analysis of project alternatives via the IWR-Planning Suite software. Once a recommended alternative plan was identified, additional design information was developed for the recommended plan and a more detailed cost estimate was performed; therefore, the planning level and NER Plan costs will not match exactly. Estimates were developed via the MII cost estimating software. Unit costs were placed into a matrix to utilize the different costs for each measure of work (**Table 7**).

Table 6: Average Annual Costs per Alternative

Measure	Code	AA Cost
Alternative 1	ALT1	$ 449,019
Alternative 2	ALT2	$ 499,058
Alternative 3	ALT3	$ 628,509
Alternative 4	ALT4	$ 978,929
Alternative 5	ALT5	$ 2,362,113

Cost Annualization: Annualizing costs is a method whereby the project costs are discounted to a base year then amortized over the period of analysis. The base year for this project was determined to be the year in which the first phase of the project is to be completed (calendar year 2014). Costs that occur prior to this year need to be compounded to the base year, while those occurring after the base year need to be discounted to the base year. The period of analysis for the Section 206 project is 50 years. Discounting to the base year is the present value method. Costs are compounded or converted to present value for the base year then amortized over the 50-year period of analysis to give the annual cost. Discount rate was determined by the appropriate Economic Guidance Memorandum 08-01, Federal Interest Rates for Corps of Engineers Projects, which is 3.375%. The method shown in the above table does this for each measure. The individual measures of the project have the construction period spread out over 1 to 5-years, depending on magnitude or redundancy. Each year of every measure is either compounded or discounted to the base year. Calculation of the measures annual cost is completed by multiplying the present value to the 50-year amortization factor.

Real Estate: An Initial Value Estimate (IVE) of the lands necessary to implement measures for this ecosystem restoration project was included in the Average Annual costs per alternative. The IVE provided by the real estate section for plan formulation determined a $3,500 per acre. This number is preliminary and does not constitute the gross appraisal.

4.4 – Alternative Habitat Benefits

The evaluation of habitat benefits is a comparison of the with-project and without-project conditions for each measure (**Table 8**). Environmental outputs are the desired or anticipated measurable products or results of restoration measures and plans. The term “outputs” is often used interchangeably with “benefits” or “habitat units (HUs).” Ecosystem restoration proposals may possess multiple output categories, as well as other effects that may need to be considered, but the evaluation must at least address cost and an output category that has been determined to represent reasonable ecosystem restoration benefits. A comparison of the future without-project and future with-project HUs was performed in order to determine if an alternative, or group of measures, will actually have beneficial effects to the Spring Creek Valley ecosystem. The alternatives for this study were evaluated with the HSI methodology

described in Section 2.2. Floristic inventories were performed within each area identified on Plates 8-13. Areas identified as "C-Carex" were considered to be relatively intact high quality remnant communities that could be reasonably replicated in other areas of the site; therefore, these areas were used for calculating future with-project conditions.

Table 7: Total & Net Average Annual Habitat Units per Alternative

Measure	Code	Current Conditions AAHSI	FWOP AAHSI	FWP AAHSI	Acres	NAAHUs
Alternative 1	ALT1	0.38	0.35	0.84	931	423.0
Alternative 2	ALT2	0.38	0.35	0.86	1064	506.6
Alternative 3	ALT3	0.38	0.35	0.86	1270	604.7
Alternative 4	ALT4	0.51	0.44	1.00	1997	1041.7
Alternative 5	ALT5	0.51	0.44	1.00	3841	2003.5

4.5 – Cost Effectiveness / Incremental Cost Analysis

Cost effectiveness and incremental cost analysis (CE/ICA) are two distinct analyses that must be conducted to evaluate the effects of alternative plans according to USACE policy. First, it must be shown through cost effectiveness analysis that a restoration plan's output cannot be produced more cost effectively by another alternative. *Cost effective* means that, for a given level of non-monetary output, no other plan costs less and no other plan yields more output at a lower cost. Subsequently, through incremental cost analysis, a variety of alternatives and various-sized alternatives are evaluated to arrive at a "best" level of output within the limits of both the sponsor's and the USACE's capabilities.

The subset of cost effective plans are examined sequentially (by increasing scale and increment of output) to ascertain which plans are most efficient in the production of environmental benefits. Those most efficient plans are called "best buys." As a group of measures, they provide the greatest increase in output for the least increases in cost. They have the lowest incremental costs per unit of output. In most analyses, there will be a series of best buy plans, in which the relationship between the quantity of outputs and the unit cost is evident. As the scale of best buy plans increases (in terms of output produced), average costs per unit of output and incremental costs per unit of output will increase as well. The incremental analysis by itself will not point to the selection of any single plan. The results of the incremental analysis must be synthesized with other decision-making criteria (i.e., significance of outputs, acceptability, completeness, effectiveness, risk and uncertainty, reasonableness of costs) to help the study team select and recommend a particular plan.

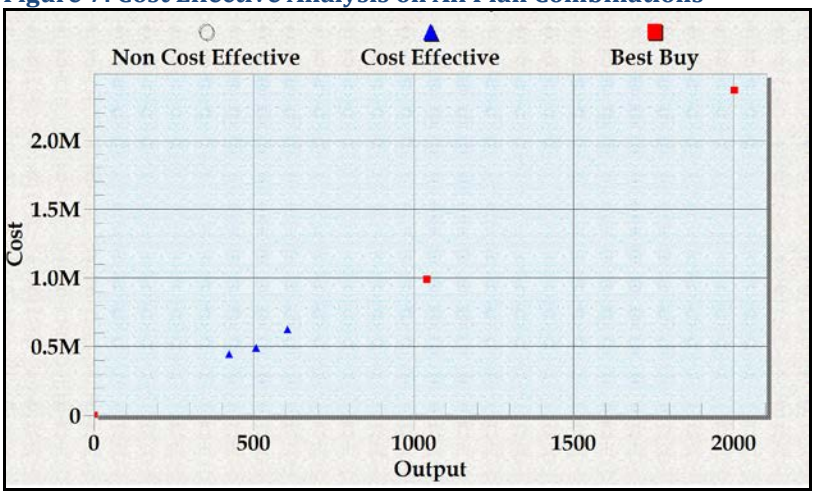
Table 8: Alternative Plans

Generated Plan	AAHUs	AACost	Cost/HU	Type
No Action Plan	0	0	-	-
Alternative 1	423.0	$ 449,019	$ 1,062	Cost Effective
Alternative 2	506.6	$ 499,058	$ 985	Cost Effective
Alternative 3	604.7	$ 628,509	$ 1,039	Cost Effective
Alternative 4	1,041.7	$ 978,929	$ 940	Best Buy
Alternative 5	2,003.5	$ 2,362,113	$ 1,179	Best Buy

Cost Effectiveness

The cost effectiveness analysis was used to ensure that certain options would be screened out if they produced the same amount or less output at a greater cost than other options with a lesser cost. All Six alternatives analyzed, including the No Action Plan, were identified as cost effective.

Figure 7: Cost Effective Analysis on All Plan Combinations



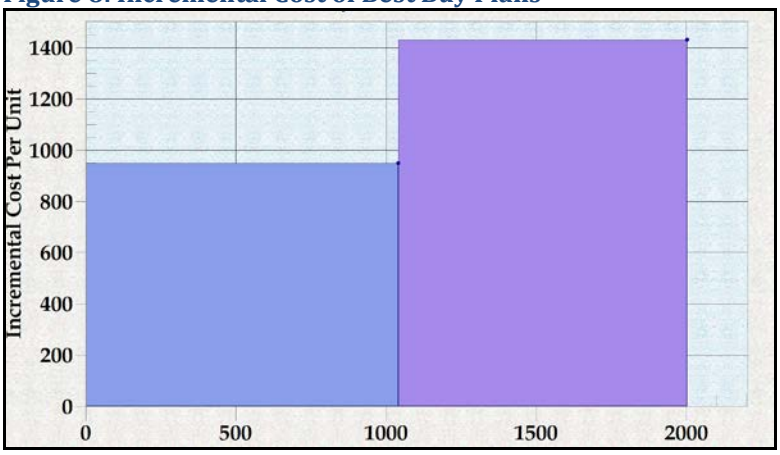
Incremental Cost Analysis

An incremental cost analysis was performed on those plans deemed cost effective. The objectives of the incremental cost analysis are to provide information to assist in determining whether the additional output provided by each successive cost effective plan is worth the additional cost that must be incurred for implementation; that is, to assist in determining the scale of the recommended plan. This incremental cost analysis has identified 3 alternative plans that would be considered as best buys, including the no action plan. These are presented in Tables 9 & 10 and Figures 10 & 11.

Table 9: Incremental Cost Analysis of Best Buy Plans

Plan	AAHUs	AACost	AACost/HU	Inc.AACost	Inc.AACost/HU
No Action Plan	0				
Alternative 4	1,041.7	$ 978,929	$ 940	$ 978,929	$ 940
Alternative 5	2,003.5	$ 2,362,113	$ 1,179	$ 1,383,184	$ 1,438

Figure 8: Incremental Cost of Best Buy Plans



4.6 – NER Plan Justification

The alternative plan(s) that qualified for further consideration were assessed in order to identify whether the benefits are worth Federal investment. The effects include a measure of how well the plan(s) does with respect to planning objectives, benefits and costs. Previously in the evaluation process, the positive effects of each plan on Spring Creek's ecosystem were considered individually and compared to the without-project condition. In this step, supportive facts are presented to determine if it is worthwhile to select a plan as the NER Plan. The supportive facts include the reality of the ecosystem outputs; significance of the ecosystem outputs; completeness, acceptability, effectiveness and efficiency of the potential plan, and any associated risks or uncertainties that may affect or result from the potential plan.

4.6.1 – Validity of Ecological Benefits

The following provides discussion on how each of the Best Buy Plans meets the objectives of the study followed by a presentation of facts and engineering results that validate the feasibility of restoring stream, wetland, riparian and other buffering habitats within the Spring Creek study area.

Planning Objectives

The following are the two planning objectives used to assess whether or not alternatives would accomplish the intent of this ecosystem restoration study.

Objective 1 – Reestablish Hydrology to Support Natural Communities

This objective seeks to reestablish natural hydrologic and hydraulic parameters to support critical wetland and riparian habitats within the Spring Creek natural area. Improvement is predicted via the increase in quantity (acres) and increase in quality (Mean C Value of the FQA) of native plant communities.

Objective 2 – Reestablish Wetland, Riparian & Buffering Native Plant Communities

This objective seeks to reestablish native plant community richness and structure to support critical wetland and riparian habitats within the Spring Creek natural area. Improvement is predicted via the increase in quantity (acres) and increase in quality (Mean C Value of the FQA) of native plant communities.

- No Action Plan takes no action, and therefore does not meet the two planning objectives since the future without-project conditions do not foresee natural recovery of this system.

- Alternative 1 would restore 931 acres of habitat immediately impacted by the disablement of drain tiles and filling in the ditch along the western portion of Spring Creek Valley; however woody debris structures would not be installed within portions of channelized stream to rehydrate the floodplain. This alternative also would not restore additional areas with hydric soils that would further support critical wetland and riparian habitats. This alternative does address the eradication of invasive plant species and establishment of native riparian communities within the 931 acre area, but neglects critical hydraulic restoration that may negatively impact species richness and the ability to fully eradicate invasive species; therefore this alternative only partially meets Objective 2 and does not fully address Objective 1.

- Alternative 2 would restore 1064 acres of habitat which includes all hydrologic and native plant community restoration identified within Alternative 1, but would also install woody debris structures within portions of channelized stream to rehydrate the floodplain. This alternative also restores additional areas with hydric soils that would further support critical wetland and riparian habitats. This alternative meets the intent of Objective 1 and 2 since it provides all of the components to sufficiently establish native plant community richness and structure to support critical wetland and riparian habitats; however, while this alternative restores additional wetland and riparian restoration within upstream portions of the headwaters, it does not include additional areas further downstream with hydric soils that would support wetland and riparian habitats.

- Alternative 3 would restore 1270 acres of habitat which includes all hydrologic, hydraulic, and native plant community restoration identified within Alternative 2, but would also restore restore an additional stretch of Spring Creek and hydric areas further away from the immediate riparian zone that would support wetland and riparian habitats. This alternative is very effective at meeting the intent of Objectives 1 and 2 since it provides all of the components to establish native plant community richness and structure to support critical wetland and riparian habitats.

- Alternative 4 would restore 1997 acres of habitat which includes all hydrologic, hydraulic, and native plant community restoration identified within Alternative 3, but would restore all remaining hydric areas not identified for restoration within Alternative 3 that are further away from immediate riparian zones, however would further support wetland and riparian habitats. This alternative also includes restoration of a significant portion of buffering upland habitat consisting of savanna, woodland, and prairie communities that would have direct benefits to adjacent wetland and riparian habitats. Alternative 4 most effectively meets the intent of Objectives 1 and 2 by fully restoring all hydric areas within the study boundary as well as strengthening the resiliency of restored wetlands and riparian habitats.

- Alternative 5 would restore 3841 acres of habitat which includes all hydrologic, hydraulic, and native plant community restoration identified within Alternative 4, but would also restore all remaining upland areas not identified for restoration within Alternative 4. Alternative 5 meets the intent of Objectives 1 and 2 just as Alternative 4 does, but does not further benefit wetland and riparian habitats within the study area to an extent that would justify the additional cost for an aquatic ecosystem restoration.

Engineering & Ecology Validation

Hydrologic – Physical, real time modeling of the site's hydrology was performed during the Feasibility Phase to ensure off site impacts would not occur and to provide spatial extent information for plant community boundaries. This physical modeling concluded that there would be no offsite impacts and has provided strong evidence for surficial hydrology resurgence. Hydrologic and hydraulic modeling will be performed during the design phase to ensure no flood impacts offsite. The hydrologic and restoration ecology components of the PDT are in concurrence that the disablement of drain tiles will restore hydrology should a project be implemented.

Hydraulic – Hydraulic modeling was not completed for this project during the Feasibility Phase. Modeling is not necessary for the design of the specified woody debris structures since they are very small and would have effects confined to the study area boundaries. Hydrologic and hydraulic modeling will be performed during the design phase to ensure no flood impacts offsite. The hydraulic and restoration ecology components of the PDT are in concurrence that utilizing woody debris structures to slightly raise the water table and to induce stream meandering is an acceptable and tried measure.

Environmental – Adverse environmental conditions stemming from water quality and HTRW materials were not identified as issues for this project. However, reconnecting the stream with its vast natural filtering systems (i.e. riparian zones) by disabling subsurface water-intercepting drain tiles, restoring altered riverine hydraulics, and clearing invasive woody vegetation (e.g *Rhamnus cathartica*/*Frangula alnus*) that sustain bare soil and thus limit biogeochemical processes within the hyporheic zone (Vought et al. 1994; Knight et al. 2007), while inputting erosive sediment-bound phosphorus (Riple 2010), should decrease the downstream transport of nutrients, allow establishment of native plant communities and higher soil organic carbon levels, and increase the site's resiliency to ongoing human-induced disturbances such as urban runoff. The environmental and restoration ecology components of the PDT are in concurrence that the project's instream restoration features would have incidental water quality benefits.

4.6.2 – Significance of Ecosystem Outputs

Due to the challenges associated with comparing non-monetized benefits, the concept of output significance plays an important role in ecosystem restoration evaluation. Along with information from cost effectiveness and incremental cost analyses, information on the significance of ecosystem outputs will help determine whether the proposed environmental investment is worth its cost and whether a particular alternative should be recommended. Statements of significance provide qualitative information to help decision makers evaluate whether the value of the resources of any given restoration alternative are worth the costs incurred to produce them. The significance of the Spring Creek restoration outputs are herein recognized in terms of institutional, public, and/or technical importance.

Institutional Recognition

Institutional recognition means that the important of an environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies, tribes, or private groups. Sources of institutional recognition include public laws, executive orders, rules and regulations, treaties, and other policy statements of the Federal Government; plans, laws, resolutions, and other policy statements of states with jurisdiction in the planning area; laws, plans, codes, ordinances, and other policy statements of regional and local public entities with jurisdiction in the planning area; and charters, bylaws, and other policy statements of private groups.

Migratory Bird Treaty Act (1918) - The Migratory Bird Treaty Act is the domestic law that implements the United States' commitment to four international conventions for the protection of migratory birds and their habitats. The Act protects species or families of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle.

The Mississippi Flyway

There are 4 principal North American flyways, the Atlantic, Mississippi, Central and Pacific. Except along the coasts, such as Lake Michigan, the flyway boundaries are not always sharply defined. Its eastern boundary runs along western Lake Erie and the western boundary is ambiguous, as the Mississippi Flyway merges unnoticeably into the Central Flyway. The longest migration route in the Western Hemisphere lies in the Mississippi Flyway; from the Arctic coast of Alaska to Patagonia, spring migration of some shorebird species fly this nearly 3,000 mile route twice. Parts of all four flyways merge together over Panama. This route is ideal for migratory waterfowl because it is uninterrupted by mountains, dotted with tens of thousands of lakes, wetlands, ponds, streams and rivers, and is well timbered in certain reaches. The Fox River Valley is located in the Mississippi Flyway and more than 250 species of birds pass through annually. This flyway path is also known for Whooping Crane migration, which is evident from several confirmed landings at the Glacial Park in McHenry County just 23-miles to the north. Large natural areas like Glacial Park and Spring Creek provide critical habitat in the midst of farmland that consists of corn and soybean fields, which do not provide the type and variety of food and shelter required by nearly all migrating birds. In comparison, the Fox River Valley provides vast acres of wetland and prairie habitats for resting and refueling. The restoration of riparian buffers along water bodies is critical to the survival of millions of birds that migrate this flyway path every spring and fall. The Spring Creek restoration project has great potential to provide critical migratory bird habitat as identified by the National and Chicago Audubon Societies.

Spring Creek Valley is one of 25 areas in Illinois to be named an Important Bird Area. The Important Bird Area (IBA) program is an international effort led by BirdLife International with the National Audubon Society being its U.S. partner. Spring Creek's designation is primarily due to its value as a habitat for a number of globally rare grassland bird species. Alternative Plan 4 is in full support of the Migratory Bird Treaty Act and Spring Creek as an Important Bird Area.

Responsibilities of Federal Agencies to Protect Migratory Birds (E.O. 13186) - "Federal agencies shall restore or enhance the habitat of migratory birds and prevent or abate pollution or detrimental alteration of the environment for migratory birds." This project will restore wetland, riparian plant communities, and amphibian and fish habitat, thus providing forage and shelter for numerous migratory bird species. Alternative Plans 1 - 5 fulfill the USACE's role and responsibility by utilizing its Ecosystem Restoration Mission, authority and supporting polices to restore wetland and riparian plant community habitat for migratory birds.

Fish and Wildlife Conservation Act of 1980 – all Federal departments and agencies to the extent practicable and consistent with the agency's authorities should promote the conservation of non-game fish, wildlife, and their habitats. Alternative Plans 1 - 5 would restore physical characteristics of stream, marsh, meadow, and woodland, which is in full support of this Act.

EO 11514 Protection and Enhancement of Environmental Quality – the Federal Government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Improving both the habitat and water quality of Spring Creek would be achieved by implementing Alternative Plans 1 - 5. This project would provide leadership by providing an example to other large metropolis and urban areas that large tracts of natural lands can be restored to enhance environmental quality.

E.O. 11990 Protection of Wetlands – each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Alternative Plans 1 - 5 would restore Spring Creek to a physically and visually healthy ecosystem, which takes action to further support the enhancement of the Fox River Valley.

E.O. 13112 Invasive Species – prevent the introduction of invasive species and provide for their control and to minimize associated economic, ecological, and human health impacts. Implementation of Alternative Plans 1 - 5 would remove nonnative and invasive plant species from hundreds of acres and along thousands of feet of stream.

Endangered Species Act of 1973 – all Federal departments and agencies shall seek to conserve endangered species and threatened species. The purpose of the act is to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved and to provide a program for the conservation of such endangered and threatened species. Implementation of Alternative Plans 1 - 5 would improve foraging and nesting habitat for the state listed Common Moorhen, Least Bittern and Yellow-Headed Blackbird.

Clean Water Act – restore the chemical and biological integrity of the Nation's waters. Although water quality improvement is not within the USACE Mission, policy acknowledges that habitat restoration provides incidental water quality improvements most of the time. The Clean Water Act also has provisions for wetland and biological integrity protection. The No Action Alternative does not support this Act by denying opportunity to improve water quality and increase viable wetland acres. Alternative Plans 1 - 5 is in full support of the Clean Water Act.

Public Recognition

Public recognition means that some segment of the general public recognizes the importance of an environmental resource, as evidenced by people engaged in activities that reflect an interest or concern for that particular resource. Such activities may involve membership in an organization, financial contributions to resource-related efforts, and providing volunteer labor and correspondence regarding the importance of the resource.

The Non-Federal Sponsor

The FPDCC is highly supportive of Alternatives 3 and 4, which create the best opportunities to repair and revitalize this critical watershed. As the FPDCC owns major portions of the creek's course, and desires to see ecological improvement to the creek and surrounding watershed, this project will make major improvements. The FPDCC, other landowners in the watershed, and downstream landowners, such as Lake County Forest Preserves should all receive a benefit. The proposed work will also improve the environs around the creek, making them more accessible to the public, and increasing public use.

Stakeholder Support

Partners in support of the Spring Creek Ecosystem Restoration Project and Alternative Plans 1 - 5 presented in this Feasibility Study include, but are not limited to: Barrington Area Council of Governments, Citizens for Conservation, Flint Creek Watershed Partnership, Friends of the Fox River, Friends of Spring Creek Forest Preserve, Illinois Department of Natural Resources, Township of Dundee, Village of Barrington Hills, Village of South Barrington, Village of Carpentersville, Village of Fox River Grove and the U.S. Fish & Wildlife Service are all critical and involved stakeholders. The National &

Chicago Audubon Society, Field Museum of Natural History, and the Shedd Aquarium have National and Global interests in persevering and restoring biodiversity.

There is an extraordinary level of support for ecological restoration and compatible recreation within the watershed, expressed through Regional, State and Local groups. Volunteer organizations such as the Spring Creek Stewards and Friends of Spring Creek Forest Preserves immerse themselves in a variety of activities including wildlife monitoring, working with local schools and educational programs, and field work such as invasive species removal and seed collection. The Spring Creek Stewards mission statement is "[t]o restore the ecological health of the Spring Creek Forest Preserves. We strive to increase public awareness, participation and appreciation of the preserves", while the Friends of Spring Creek Forest Preserves "support the long-term restoration and conservation of healthy woodlands, prairies and wetlands in the Spring Creek Forest Preserves."

The Riding Club of Barrington Hills is very active within Spring Creek Valley, which is an all-volunteer, social, riding organization formed in 1937 who seek "to maintain the old tradition of neighbors riding to visit neighbors". The Riding Club of Barrington Hills, the Fox Valley Pony Club, hikers, birders, and all sorts of nature lovers are found roaming through over 60 miles of trails found within Spring Creek Valley.

Non-profit organizations working over a broader area have placed significant resources within Spring Creek Valley because of its large size and ecological complexity. Such organizations include the Citizens for Conservation who protect over 2,500 acre of public land in the Barrington area, inform the community about the value of natural resources, and actually restore native plant communities, among them being Spring Creek Valley. Audubon Chicago Region partners with public agencies to restore large complexes of prairie, shrubland, and woodland, among them being Spring Creek Valley. The Barrington Countryside Park District is also involved by coordinating with other organizations to maintain trails and facilities as well as organizing a series of guided walks.

Technical Recognition

Technical recognition means that the resource qualifies as significant based on its "technical" merits, which are based on scientific knowledge or judgment of critical resource characteristics. Whether a resource is determined to be significant may of course vary based on differences across geographical areas and spatial scale. While technical significance of a resource may depend on whether a local, regional, or national perspective is undertaken, typically a watershed or larger (e.g., ecosystem, landscape, or ecoregion) context should be considered. Technical significance should be described in terms of one or more of the following criteria or concepts: scarcity, representation, status and trends, connectivity, limiting habitat, and biodiversity.

Scarcity is a measure of a resource's relative abundance within a specified geographic range. Generally, scientists consider a habitat or ecosystem to be rare if it occupies a narrow geographic range (i.e., limited to a few locations) or occurs in small groupings. Unique resources, unlike any others found within a specified range, may also be considered significant, as well as resources that are threatened by interference from both human and natural causes.

Representation is a measure of a resource's ability to exemplify the natural habitat or ecosystems within a specified range. The presence of a large number and percentage of native species, and the absence of exotic species, implies representation as does the presence of undisturbed habitat.

Status and Trend measures the relationship between previous, current and future conditions.

Connectivity is the measure of a resource's connection to other significant natural habitats.

Limiting Habitat is the measure of resources present supporting significant species.

Alternative Plans 1 - 5 focus on various buffers of habitat riparian to Spring Creek and adjacent wetlands. Spring Creek and the Spring Creek Valley natural area is representative of scarce meadow, seep, fen and prairie habitats.

4.6.3 – Acceptability, Completeness, Effectiveness & Efficiency

Acceptability, completeness, effectiveness, and efficiency are the four evaluation criteria USACE uses in evaluating alternative plans. Alternatives considered in any planning study, not just ecosystem restoration studies, should meet minimum subjective standards of these criteria in order to qualify for further consideration and comparison with other plans.

Acceptability

An ecosystem restoration plan should be acceptable to state and Federal resource agencies and local governments. There should be evidence of broad-based public consensus and support for the plan. The tentatively recommended plan must be acceptable to the non-Federal cost-sharing partner.

The Spring Creek study was developed in a collaborative fashion in which planning and design meetings screened and refined habitat restoration measures. The Federal, State and local groups that participated in these activities are discussed in the previous section. The No Action Plan provides no ecosystem improvements and is not acceptable to the Federal Objective, the non-Federal sponsor's goals and stakeholder desires. Alternatives 4 and 5 are the most acceptable in terms of the Federal Objective and non-Federal sponsor/stakeholder vision for reestablishing a sustainable and viable ecosystem within the Spring Creek study area. Alternatives 1-3 provide limited benefits but generally leave Spring Creek in a degraded state. Taking the Federal Objective, study objectives, and non-Federal sponsor/stakeholder needs into consideration, Alternative 4 provides the most diverse habitat possible and therefore would be the most acceptable.

Completeness

A plan must provide and account for all necessary investments or other actions needed to ensure the realization of the planned restoration outputs. This may require relating the plan to other types of public or private plans if these plans are crucial to the outcome of the restoration objective. Real estate, operations and maintenance, monitoring, and sponsorship factors must be considered. Where there is uncertainty concerning the functioning of certain restoration features an adaptive management plan should be proposed and must be accounted for in the implementation plan.

All of the factors were considered in the development or post formulation assessment of alternative plan costs/outputs, consistency with other Federal and non-Federal Plans, real estate, O&M, monitoring and non-Federal sponsorship. The No Action Plan does not provide any action to restore degraded habitats and therefore is incomplete in realization of ecosystem improvements. Alternatives 1 - 3 are incomplete in terms of restoring the entire Spring Creek system and are inconsistent with State and local plans for reestablishing a healthy Fox River system. Alternatives 4 and 5 are the most complete in that they would change Spring Creek from a ruderal amalgam to a native and diverse riverine system. Alternatives 4 and 5 would have the least O&M and adaptive management features since the alternatives are complete from ecological systems points of view.

Effectiveness

An ecosystem restoration plan must make a significant contribution to addressing the specified restoration problems or opportunities (i.e. restore important ecosystem structure or function to some meaningful degree). The problems identified for this study are provided in Section 3.1.2 Study Area Problems. These problems generally include those adverse affects resulting from the lack of physical hydrologic and plant based habitat within the aquatic and riparian zones of the system. In addition to focusing on the identified problems, opportunities were also considered when establishing study objectives. Section 4.8.1 Validity of Ecological Benefits states how each Best Buy Plan (Alternative) meets the study objectives and provides discussion how engineering analyses were utilized to validate that habitat features would be functional and sustainable. Taking these discussions, concepts and analyses into consideration, Alternative 4 and 5 would be the most effective at restoring habitat that makes a significant contribution to Migratory Bird, fish and wildlife habitat within a biogeographically significant region.

Efficiency

An ecosystem restoration plan must represent a cost-effective means of solving habitat problems and seizing opportunities to improve the environment. It must be determined that the plan's restoration outputs cannot be produced more cost effectively than any other plan via the USACE's Six-Step Planning Process.

Initial screening of habitat restoration measures removed those measures and concepts that would have high costs and intensive operation and maintenance activities and associated costs. Twelve measures were then refined to seize site specific opportunities, address Spring Creek Valley problems and were further honed by targeting two ecosystem objectives. Using the USACE Institute for Water Resources Planning Suite Software 6 Alternatives were assessed with the CE/ICA programming, 3 alternatives were identified as cost-effective. All inefficient options were removed from consideration and only the "best buy" plans having the least incremental increase in cost per unit habitat output were retained for further consideration. As identified through this habitat benefit / cost analysis, any of the Alterative Plans are efficient at producing ecological benefits.

4.6.4 – Risk and Uncertainty

When the costs and outputs of alternative restoration plans are uncertain and/or there are substantive risks that outcomes will not be achieved, which may be the case, the selection of a recommended alternative becomes more complex. It is essential to document the assumptions made and uncertainties encountered during the course of planning analyses. Restoration of some types of ecosystems may have relatively low risk. For example, removal of drainage tiles to restore hydrology to a wetland area. Other activities may have higher associated risks such as restoration of coastal marsh in an area subject to hurricanes. When identifying the NER plan, the associated risk and uncertainty of achieving the proposed level of outputs must be considered. For example, if two plans have similar outputs but one plan costs slightly more, according to cost effectiveness guidelines, the more expensive plan would be dropped from further consideration. However, it might be possible that, due to uncertainties beyond the control or knowledge of the planning team, the slightly more expensive plan will actually produce greater ecological output than originally estimated, in effect qualifying it as a cost effective plan. But without taking into account the uncertainty inherent in the estimate of outputs, that plan would have been excluded from further consideration.

Overall, there is very low risk associated with the preferred alternative not performing as predicted. Sufficient field investigations into hydrologic, hydraulic, geomorphic and the associate biological communities was performed to ensure that a) hydrology will be resurged as tested by physical hydrologic

modeling, b) lessons learned from 19 ecosystem projects constructed or being constructed (2,600-acres & 60-miles of stream and river, c) designing habitat structures and plant communities to the hydrology and hydraulics instead of fighting it, and d) a dedicated non-Federal sponsor that will maintain the project as constructed with intended ecological benefits.

Complete eradication of invasive species always presents a certain level of risk and uncertainty as the chances of reinvasion are likely to occur without proper management, increasingly so when native species have not yet established. A prominent issue is that invasive plant species are adapted for colonizing areas that are hydrologically disturbed and/or have highly altered soils. Immediate changes in hydrology from invasive species and woody species removal, as proposed in Alternative Plans 1 - 5, may disrupt native species that have adapted to disturbed conditions. However, high quality areas within the project limits thriving under relatively undisturbed conditions contain conservative and rare species not found in disturbed areas where restoration efforts would be greatest. Therefore, in addition to planting efforts within highly degraded areas, it is expected that species from high quality areas and ones suppressed within native seed banks will colonize most newly restored areas during the establishment period. While invasive species may find a new niche within areas radically changed/disturbed temporarily by restoration activities, spot herbicide applications during the establishment period will prevent invasive species from establishing, thereby allowing native species to outcompete invasive ones.

Native plantings also have an associated risk of not establishing due to a variety of unforeseen events. Predation from herbivorous animals is likely since common carp and Canada geese are quite abundant in the Fox River system. Weather also plays a large role in the establishment success of new plantings. Periods of drought, flood or early frost can alter the survival percentage of plantings. To mitigate these risks, planting over several years, overplanting and/or adaptive management and monitoring may be incorporated into the overall plan. In addition, climate change may or may not affect project outcomes. Increased temperatures or rainfall may lead to changes in the ecosystem of the project area; however, Lake Michigan primarily drives the weather in the Chicagoland area and may partly mitigate climate change concerns for the near future. This climate concern is alleviated by having a broader pallet of adaptive plant species to compensate for climatic shifts.

There is concern by some that when allowing a stream to meander it will become uncontrollable and destructive; however, the desired affect is to have Spring Creek erode and move around in its floodplain. The induction of stream meandering will be maintained within the project boundaries by establishing a general meandering direction during construction by strategically placing woody debris structures within the channel. Currently there is no concern that streams would meander into private properties based on the fact that the active floodplain valleys are completely contained within the study area boundaries that owned by the FPDCC. If for some reason a stream begins to head toward a residential area, it will be closely watched, for it may switch directions and go the other way; however, if the threat becomes imminent, adaptive management measures would be employed. These measures include the use of wood debris to push the stream back the other way.

The Hine’s Emerald Dragonfly inhabits the rivulets of their birth for many years as in a juvenile larval state. There is a risk associated with working within the rivulets at Spring Creek Valley. Risks include workers walking over areas that contain juveniles and may crush individuals. Additionally, vibrations from machinery near the habitat may make some individuals release their hold on the substrate and drift downstream of in the rivulet. These risks will be mitigated through careful surveying of the rivulets and areas that contain juveniles to keep workers and machinery out of these areas. Also, restoration activities will be limited to certain seasons to limit risk or mortality and stress on juveniles. The USACE and their contractor will work closely with the USFWS to determine best practices to minimize contact and stress to juveniles.

4.8 – National Ecosystem Restoration (NER) Plan Recommendation

When selecting a single alternative plan for recommendation from those that have been considered, the criteria used to select the NER plan include all the evaluation criteria discussed above. Selecting the NER plan requires careful consideration of the plan that meets planning objectives and constraints and reasonably maximizes environmental benefits while passing tests of cost effectiveness and incremental cost analyses, significance of outputs, acceptability, completeness, efficiency, and effectiveness.

This restoration project was planned in cooperation with the Forest Preserve District of Cook County and various Federal, State and local stakeholders. Also, this restoration project makes a significant contribution to regional, national, and international programs that include the North American Waterfowl Management Plan, the Important Bird Area (IBA) (international), and the National Audubon Society. This plan included an opportunity for open comment to ensure all stakeholder parties have had equal contribution.

All costs associated with a plan were considered, and tests of cost effectiveness and incremental cost analysis have been satisfied for the alternatives analyzed. The cost estimates were based on current ecosystem restoration projects that are in construction and design phases. Having established confidence in the estimated implementation costs, the remaining test of reasonableness is to assess the value of the resource to be improved based on the cost to implement the improvement. The importance of Migratory Birds in terms of human uses and aesthetics has been documented through numerous sources, most importantly the Migratory Bird Treaty Act (1918) and Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds.

Non-monetary values associated with the Spring Creek restoration project include a variety of ecological benefits. The project will provide important stop-over habitat for birds traveling along Fox River Valley portion of the Mississippi Flyway, a migratory route recognized as significant by the Audubon Society. In addition, the native habitat types planned will benefit native resident species. A variety of aquatic species such as fish, macroinvertebrates, and amphibians will greatly benefit through the addition of important foraging, refuge, and spawning habitat. The restoration of Spring Creek will markedly increase the ecological integrity of the surrounding area and is well worth the investment.

The plan that reasonably maximizes net National Ecosystem Restoration benefits and is consistent with the Federal objective, authorities and policies, is identified as the NER plan. This NER Plan is considered as the Preferred Plan for direct, indirect and cumulative effects assessment under NEPA in the following Chapter. The NER/Preferred Plan was determined to be Alternative 4 (**Plate 14**).

CHAPTER 5 – ENVIRONMENTAL ASSESSMENT

5.1 – Alternatives & Recommended Plan

Five Alternatives, including the No Action Alternative were considered for study implementation and are presented in Section 4.2. See Section 4.1 for measure details, which are the building blocks of the alternatives.

5.2 – Affected Environment

The affected environment, including the current conditions, No Action Alternative, and future-without project conditions are detailed in the Inventory & Forecasting Chapter 2. Although, Spring Creek Valley holds impressive mosaics of high quality sedge meadow, marsh, fen, stream, prairie, savanna, and kettle lakes, the majority of the site suffers from past hydrological alterations by subsurface drain tile systems and ditches, farming, fire suppression, and invasive species. Much of these altered areas consist of highly disturbed wetlands, unassociated woody growth, and Eurasian meadows resultant of artificially drained hydric soils.

5.3 – Direct & Indirect Effects

5.3.1 – Physical Resources

Landscape / Geomorphology

The NER Plan would have beneficial preservation effects associated with implementation. Geologic features and deposits would be preserved through restoring the site to native plant communities and disallowing development to occur, which would have the potential to change geology at those particular sites. Since the implementation of the NER plan does not disturb geologic features or deposits, no significant adverse effects resultant from implementing the NER plan are expected.

Soils

The proposed project would result only in beneficial effects to natural soils within the project area. The existing drain tile system was designed to dry out the top 3 to 4-feet of the soil in order to grow crops. The drain tiles dried out the soil while A horizons became homogenized due to years of tilling, fertilization, carbon stripping, and overwatering. Through the reestablishment of natural flow regimes, return of native plant communities, and return of mycorrihizzal fungi/bacterial interactions, overtime the A horizons of these soils would heal and diversify the native plant and animal assemblages of those restored soils. Since the proposed project would be implemented in a fashion as to facilitate the return of natural soils structure, no significant adverse affects resultant from implementation of the project are expected.

Watershed Land Use

The land use of the Spring Creek watershed was obtained from the SCWBP, which utilized CMAP land coverage data along with aerial and on-the-ground validation as presented in **Table 1**. Spring Creek is different for a Chicago Region watershed due to the fact that there is still about 40 – 50% of the land use is in natural plant community or some type of non-impairing land use (i.e. equestrian, cemetery). Also, adverse land uses such as residential are comparatively less dense than a watershed such as the Des Plaines River. A significant statistic is that the Spring Creek preserve itself is about 23% of the entire

watershed. Comparatively, only 12% of the entire Des Plaines River watershed is in natural plant community. This statistic shows significance in terms of opportunity to have a watershed that can nearly be restored. As any Chicago Region watershed, however, it is predicted that there will still be some minor losses of natural community and gains in anthropogenic land uses unless priorities shift.

Riverine & Wetland Hydrology

Implementation of the proposed project would result in positive changes to the current hydrology of the project area that would promote a more healthy and diverse ecosystem. The Spring Creek watershed is comparatively sparse in its urban and residential development; therefore, flows have not increased sufficiently enough to cause major issue to the stream, its floodplain or its faunal inhabitants. However, there are specific measures that can be addressed to improve the wetland and floodplain hydrology within Spring Creek Preserve. Wetland hydrology of about 2,800-acres of the 4,000-acres is impaired by the vast subsurficial drain tile system that is in place. The removal of the subsurface drain tile and filling the large on-site ditch seeks to restore natural groundwater and surface water hydrology to all areas that have been previously drained for agricultural purposes. These actions are both necessary and beneficial to both the Hine's Emerald Dragonfly (*Somatochlora hineana*, HED) and the wetland plant communities by naturalizing the hydrologic regime. The proposed plan would be implemented to all areas for the return of a naturalized surface and subsurface hydrologic regime that would allow the inundation of hydric wetland soils in the project area.

Stream Hydraulics

Implementation of the proposed project would result in changes to the current hydraulics of the agricultural ditch to promote a more healthy and diverse ecosystem. The natural hydraulics of the ditch was impaired due to the side casting of excavated sediment along its banks. The inability of water to overtop the banks during storm events prevented adjacent wetland areas from becoming inundated. This also allowed hydraulic forces during storms to erode the banks, channelizing it. The natural hydraulics of the ditches will be repaired by installing woody debris structures and reconnecting ditched segments with the surrounding floodplain, which will aid in rehydrating the stream channel and floodplain. This will also allow native vegetation to establish within a small meandering swale and increase species richness and abundance.

Water Quality

The NER Plan would have the incidental water quality benefits that instream restoration features provide. Instream restoration features have the potential to increase dissolved oxygen and provide substrate for denitrifying bacteria. Short term affects are expected since the project necessitates structural and biological change within the stream. Long term, adverse effects to water quality stemming from construction activities is not anticipated.

Air Quality

Any of the alternative plans would not adversely affect long term air quality since machinery for construction activities would be limited to several months of total time. The local air quality in the Chicago area including Cook County are considered 'non-attainment' under the Clean Air Act for ozone, particulates (PM-10 and PM-2.5), and lead. The project is within the non-attainment zone. Once implemented, the project itself will be neutral in terms of air quality, with no features that either emit or sequester air pollutants to a large degree. During the project construction, equipment would cause minor, temporary air quality impacts, however all equipment will be in compliance with current air quality control requirements for diesel exhaust, fuels, and similar requirements. The short term effects of this

project from petroleum fueled machines used during construction are considered de minimis; therefore, a general conformity analysis is not needed. The NER Plan would have short term temporary impacts to air quality. The NER Plan would have no long term impacts to air quality as construction activities would be limited to several months of total time.

5.3.2 – Biological Resources

Plant Communities

The Preferred Plan would ultimately improve native floristic species richness and abundance of the restored areas by removing invasive species and seeding areas with native vegetation exhibiting local genotypes. Wetlands would not be filled or disturbed under this project, but would have their natural hydrology restored. By restoring natural hydrology, eradicating invasive species, improving areas containing rhizomatous *Carex* spp, and reducing the succession of woody vegetation, the native plant species would directly benefit and flourish within the project area, including the Federally threatened Eastern Prairie Fringed Orchid (*Platanthera leucophaea*) which high quality wetlands within the study area may support.

Fishes

When inventoried between 1941 and 2003 (Table 3), the species of fish found in the stream represented generalist and tolerant species typical found in hydrologic unstable streams that lack groundwater. Although there are significant stretches of higher gradient stream that possess small cobble riffles and runs within the preserve, fishes species indicative of these habitats are currently absent. The addition of woody debris structures to the stream would provide fish with increased water longevity within the channel, cover, food and spawning habitat. Overall, the proposed plan would not have any adverse effects to the study area's fish population, but would instead increase species richness and abundance through improved riverine hydraulics by removing non-native plant species which promote erosion along the streambanks, and disabling drain tiles; therefore, reestablishing groundwater in the stream flow, which is necessary for riverine specialists.

Macroinvertebrates

Herbicide use to control invasive species within this project presents negligible, if any, adverse effects on macroinvertebrate population structure (Henry, 1992; Kulesza et al., 2008; Monheit, 2003). In fact, replacement of invasive species with a more complex habitat structure of native herbaceous species should increase the diversity, biomass, and density of macroinvertebrates (Linz, 1999; Kostecke, 2005). Native species within high quality areas of the project footprint should quickly colonize adjacent recently treated stands of invasive species, while repopulating or enhancing macroinvertebrate population structure. Areas with monotypic stands of invasive species that may harbor greater diversities and densities of macroinvertebrates do not benefit most migratory birds as they avoid areas with dense vegetation, thus the benefits to migratory birds and waterfowl through the restoration of degraded habitat outweigh the negligible adverse impacts that herbicide treatments may have on macroinvertebrate populations (Henry, 1992; Linz, 1999; VanRees-Siewert and Dinsmore, 1996). The addition of woody debris structures to the channelized segments of stream will provide diverse habitats for macroinvertebrate colonization on the wood itself, and in the new hydraulic zones formed in the channel.

The most important of all macroinvertebrates for this study is the Hine's Emerald Dragonfly, which is expected to benefit from the proposed restoration measures and any potential temporary impacts from construction activities will be minimized through continuing coordination with the USFWS and

implementing best management practices developed by the UFWS (http://www.fws.gov/midwest/endangered/section7/s7process/plants/epfos7guide.html) .

Amphibians & Reptiles

The NER Plan would not have any adverse effects to the herpetofauna assemblage of the riparian corridor of the Spring Creek Valley area. The state endangered Blanding's turtle (*Emydoidea blandingii)* occurs at the adjacent Crabtree Preserve, and is the subject of ongoing studies by FPDCC. There was an unconfirmed observation of a Graham's crayfish snake (*Regina grahami*) alive on Rt. 68 in 2002, and the presence of suitable habitat at Spring Creek suggests that this species of conservation concern may occur on the site. Through native plant community restoration along banks and riparian zone, and addition of instream habitat, aquatic reptiles and amphibians would benefit through an increase in food and refuge.

Birds

The NER Plan would improve habitat through removal of invasive species and allow rare and conservative plant species to recover. The NER Plan would not have any adverse effects to the resident and migratory bird assemblage within the project site, but provide additional food and refuge.

Mammals

The NER Plan would not have any adverse effects to the mammal assemblage of the project site. Through native plant community restoration along banks and riparian zone, and addition of instream habitat, mammals would benefit through an increase in food and refuge.

Threatened & Endangered Species

Federal – The County Distribution of Federally-listed Threatened, Endangered, and Candidate Species for Cook County (List Revised April 30, 2015) was reviewed on the USFWS website by the Chicago District (http://www.fws.gov/midwest/Endangered/lists/illinois-cty.html). The only Federally endangered species known to inhabit the study area is the Hine's Emerald Dragonfly. Threats to Hine's Emerald Dragonfly include habitat loss, habitat degradation, habitat succession, and disruption of ecological and hydrological processes. High quality wetlands within the study area may also support the Federally threatened Eastern Prairie Fringed Orchid (*Platanthera leucophaea*). The proposed project would restore dragonfly habitat and wetlands that may support the Eastern Prairie Fringed Orchid (*Platanthera leucophaea*) within the study area and would greatly benefit populations of these Federally listed species. For these reasons, we conclude there would be no effect on listed species or proposed or designated critical habitat resulting from the implementation of the Preferred Plan/NER Plan.

State – The Illinois Natural Heritage Database was queried on 27 March 2015 for important resource areas and State Listed Species. The IDNR EcoCAT Report, (project number 1510887) shows the following protected sites are within the vicinity of Spring Creek Valley: Barrington Hills Botanical Area INAI Site, Crabtree Nature Center INAI Site, Spring Creek Prairie INAI Site, Spring Lake – Cook INAI Site, Trout Park Class III Groundwater Site, Helm Woods Nature Preserve, Kemper Park Nature Preserve, Spring Lake Nature Preserve. The EcoCAT Report also names the following State Listed Species that are known to occur within the potential project site's vicinity: Black-Billed Cuckoo (*Coccyzus erythropthalmus*), Common Moorhen (*Gallinula chloropus*), Least Bittern (*Ixobrychus exilis*), Osprey (*Pandion haliaetus*) Yellow-Headed Blackbird and (*Xanthocephalus xanthocephalus*). State Listed species not identified on the EcoCAT Report but are known to occur within Spring Creek Valley include Spike (*Eliptio dilatata*), Slippershell (*Alasmidonta viridis*), Black Sandshell (*Ligumia recta*), and Blanding's Turtle (*Emydoidea blandingii*).

The USACE's intentions are to restore sustainable, native plant community. This is undertaken by ensuring hydrogeomorphic features are sufficient and that invasive plant species no longer have a dominating affect. The USACE provides specific language within the contracting documents to ensure observance and subsequent protection of both State and Federally listed species are adhered to. Based on this, there would be no adverse effects to state Threatened and Endangered Species Spring Creek Valley resulting from implementation of the Preferred Plan/NER Plan. Effects to State listed species resulting from the implementation of the Preferred Plan/NER Plan are considered to be beneficial.

5.3.3 – Cultural Resources

Archaeological & Historic Properties

The NER Plan would not have any effect on historic structures or landscapes since none are present.

Land Use History

The NER Plan would not have any effect on the land use history of the site.

Social Setting

During construction, increased traffic congestion would be localized and intermittent. Employment could increase slightly during construction. Noise levels would not be noticed during construction from passing trucks since Rt. 53 is a highly utilized road by vehicles already. Any aesthetic impacts would be negligible and temporary, with resultant long term improvements in aesthetics. The project would have no significant adverse effect on human health or welfare, municipal or private water supplies, recreational or commercial fisheries, property values or aesthetic values.

Recreation

The proposed project would not have any long-term adverse effects to recreation. Implementation of the plan would be planned so as to minimize interference between recreational opportunities and construction activities related to the project. Any impacts to recreational opportunities from construction of the proposed project would be temporary in nature.

Hazardous, Toxic & Radioactive Waste (HTRW) Analysis

Based on the results of the phase I investigation conducted for this study, it is not anticipated that the NER plan would affect or be impacted by HTRW. No RECs were identified that would impact or be impacted by this project.

5.3.4 – 17 Points of Environmental Quality

The 17 points are defined by Section 122 of Rivers, Harbors & Flood Control Act of 1970 (P.L. 91-611) from (ER 1105-2-240 of 13 July 1978). The 17 points include noise, displacement of people, aesthetic values, community cohesion, desirable community growth, tax revenues, property values, public facilities, public services, desirable regional growth, employment, business and industrial activity, displacement of farms, man-made resources, natural resources, air and water. Impacts to these identified points are not expected. All of these are discussed below.

Noise – None of the alternative plans would cause increases in noise levels beyond the current conditions since the area is a major trucking thoroughfare.

Displacement of People – None of the alternative plans would displace any local residents within the township of the study area since restoration areas do not require private lands for work or staging areas.

Aesthetic Values – None of the alternative plans would reduce the aesthetic values of forest preserve lands. Temporary deteriorations in aesthetics may occur from applying herbicide to stands of invasive species or piles of woody debris. These impacts to aesthetics are minor and temporary as native species quickly revegetate areas where invasive species have been removed and woody debris piles are removed from site once clearing activities have finished. The restored plant communities at the end of construction activities will provide an increase in aesthetic values by providing a heterogeneous mix of native wildflowers and grasses as well as attracting wildlife that would otherwise not have been present within areas currently occupied by invasive species.

Community Cohesion – None of the alternative plans would disrupt community cohesion, but provide restored open space for community activities.

Desirable Community Growth – None of the alternative plans would adversely affect community growth and would potential attract people to a more aesthetically pleasing area based on project restoration measures.

Desirable Regional Growth – None of the alternative plans would adversely or beneficially affect regional growth.

Tax Revenues – None of the alternative plans would adversely or beneficial affect tax revenues.

Property Values – None of the alternative plans would have adverse affects on property values, but has the potential to increase surrounding land values since the aesthetics would improve to do project restoration measures.

Public Facilities – None of the alternative plans would adversely affect public facilities, but would provide natural open space for future public amenities such as nature trails and signage.

Public Services – None of the alternative plans would adversely or beneficially affect public services.

Employment – None of the alternative plans would adversely affect employment and would temporarily increase employment during construction activities.

Business and Industrial Activity – None of the alternative plans would adversely or beneficial affect local commerce.

Displacement of Farms – None of the alternative plans would adversely affect farmland since restoration areas do not occur on agricultural fields. Restored native vegetation may benefit declining bee populations and increase crop pollination while promoting natural enemies of insect pests.

Man-made Resources – None of the alternative plans would adversely or beneficially affect man-made resources.

Natural Resources – The No Action Alternative allows for the continued degradation of native species, rare communities, and significant habitats. The NER Plan would not adversely affect natural resources, but improve them greatly.

Air – None of the alternative plans would adversely affect air quality since machinery for construction activities would be limited to several months of total time.

Water – None of the alternative plans would adversely affect water quality; however, instream restoration features have the potential to increase dissolved oxygen and provide substrate for denitrifying bacteria.

5.4 – Cumulative Effects

Consideration of cumulative effects requires a broader perspective than examining just the direct and indirect effects of a proposed action. It requires that reasonably foreseeable future impacts be assessed in the context of past and present effects to the important resource. Often it requires consideration of a larger geographic area than just the immediate "project" area. One of the most important aspects of cumulative effects assessment is that it requires consideration of how actions by others (including those actions completely unrelated to the proposed action) have and will affect the same resources. In assessing cumulative effects, the key determinant of importance or significance is whether the incremental effect of the proposed action will alter the sustainability of resources when added to other present and reasonably foreseeable future actions.

Cumulative environmental effects for the proposed ecosystem restoration project were assessed in accordance with guidance provided by the President's Council on Environmental Quality (USEPA, EPA 315-R-99-002, May 1999). This guidance provides an eleven-step process for identifying and evaluating cumulative effects in NEPA analyses.

The overall cumulative impact of the Spring Creek Valley ecosystem restoration project is considered to be beneficial environmentally, socially, and economically. The restoration and preservation of approximately 1997-acres of plant communities, which is part of a unique topography formed by the Wisconsinan glaciations, will contribute to preservation of habitat within the Chicago Region. The most significant cumulative effect is the restoration of a portion of stream within a watershed where there is a high level of effort in terms of restoring riverine and riparian corridors.

5.4.1 – Scoping

In this environmental assessment, the cumulative effects issues and assessment goals are established, the spatial and temporal boundaries are determined, and the reasonably foreseeable future actions are identified. Cumulative effects are assessed to determine if the sustainability of any of the resources is adversely affected with the goal of determining the incremental impact to key resources that would occur should the proposal be permitted.

The spatial boundary for the assessment has been broadened to consider effects beyond the footprint of Spring Creek Valley and Forest Preserve lands. The spatial boundary being considered is normally in the general area of the proposed ecological restoration; however, this area may be expanded on a case-by-case basis if some particular resource condition necessitates broadening the boundary.

The temporal boundaries considered are:

- Past –1830 because this is the approximate time that the surrounding landscape was changed from its natural state.
- Present – 2015 when the decision is being made on the beneficial ecological restoration.
- Future – 2065, the year used for determining project life end, although the ecological restoration should last until a geologic event disturbs the area.

Projecting the reasonably foreseeable future actions is difficult at best. Clearly, the proposed action (ecological restoration) is reasonably foreseeable; however, the actions by others that may affect the same resources are not as clear. Projections of those actions must rely on judgment as to what are reasonable based on existing trends and where available, projections from qualified sources. Reasonably foreseeable does not include unfounded or speculative projections. In this case, reasonably foreseeable future actions include:

- Sowing of native plants to return plant communities across the landscape
- Stable growth in both population and water consumption near the study area
- Continued increase in tourism/recreation in the open spaces of the region
- Continued application of environmental requirements such as the Clean Water Act
- Implementation of various programs and projects to deal with runoff and waste water pollution and to restore degraded environments
- Community will increasingly value not only the open space but the biodiversity as well
- Restoration of the Spring Creek and associated floodplains
- Restoration of nearby natural areas

5.4.2 – Cumulative Effects on Resources

Physical Resources

The past has brought some alteration to the physical resources of the Spring Creek Valley watershed. Geology, soils, topography, hydrology, and lacustrine parameters have for the most part been modified to suit man's needs for purposes of habitation and recreation. As a result, water and habitat quality have suffered greatly do to these specific and watershed-wide alterations. It is reasonably foreseeable that agricultural land will be converted to small residential subdivisions or purchased and restored by environmental agencies and groups. In some cases this can potentially improve water quality in terms of nutrient loading, but in other instances it may introduce other types of contaminants such as oils and grease, surfactants and nutrients (sewage and lawn fertilizers). The Forest Preserve District of Cook County is a forerunner in environmental sustainability. They have also encouraged best management practices where applicable to prevent the development of wetlands and significant natural areas. Although future development is projected, sound local regulations, such as those recently adopted, can reduce future adverse effects to water quality. Given regulations are enforced; natural areas around the town of Barrington, Illinois can justifiably be restored through the removal of manmade structures and invasive species, and through physical habitat restoration. Cumulative beneficial effects to the area are anticipated in terms of physical resources.

Biological Resources

Spring Creek Valley contains segments of ecologically diverse habitats, some of which provide critical life requisites for the Federally Endangered Hine's Emerald Dragonfly. Until recently, most of the study area was in crop production and extensive agricultural drainage systems that utilize ditches and tiles are found through much of the site. While the nature preserve and other vast areas throughout Spring Creek Valley hold impressive mosaics of high quality sedge meadow, marsh, fen, stream, prairie, savanna, and kettle lakes, the majority of the site suffers from past hydrological alterations by subsurface drain tile

systems and ditches, farming, fire suppression, and invasive species. Many of these altered areas consisting of highly disturbed wetlands, unassociated woody growth, and Eurasian meadows consistent with artificially drained hydric soils. The Forest Preserve District of Cook County and other local interests have shown a willingness to protect and restore the area through various restoration and policy actions. These actions will hopefully offset associated adverse effects of future projected increases in population and recreational activities directly affecting the Fox River watershed as a whole. The actions of the preferred alternative plan would have a cumulative beneficial effect in terms of ecological function and diversity.

Cultural & Archaeological Resources

Cumulative effects are not expected to archaeological or cultural resources. This assessment is consistent with the SHPO letter dated July 06, 2015, which is located in Appendix G.

5.4.3 – Cumulative Effects Summary

Along with direct and indirect effects, cumulative effects of the proposed restoration were assessed following the guidance provided by the President's Council on Environmental Quality. There have been numerous effects to resources from past and present actions, and reasonably foreseeable future actions can also be expected to produce both beneficial and adverse effects. In this context, the increments of effects from the proposed ecological restoration are relatively minor. Assessment of cumulative effects did reveal that long-term sustainability of any of the resources would be beneficially affected. Based on the expectation of continued sustainability of all resources, cumulative effects are not considered significant.

5.5 – Environmental Statues Compliance

The plans presented in this Integrated Environmental Assessment are in compliance with appropriate statutes and executive orders including the Natural Historic Preservation Act of 1966; the Endangered Species Act of 1973; the Fish and Wildlife Coordination Act; Executive Order 12898 (environmental justice); Executive Order 11990 (protection of wetlands); Executive Order 11988 (floodplain management); and the Rivers and Harbors Act of 1899. The potential project is in compliance with the Clean Air Act; the Clean Water Act, and the National Environmental Policy Act of 1969.

5.5.1 – Clean Air Act

The local air quality in the Chicago area including Cook County are considered ‘non-attainment’ under the Clean Air Act for ozone, particulates (PM-10 and PM-2.5), and lead. The project is within the non-attainment zone. Once implemented, the project itself will be neutral in terms of air quality, with no features that either emit or sequester air pollutants to a large degree. During the project construction, equipment would cause minor, temporary air quality impacts, however all equipment will be in compliance with current air quality control requirements for diesel exhaust, fuels, and similar requirements. The short term effects of this project from petroleum fueled machines used during construction are considered de minimis; therefore, a general conformity analysis is not needed. The NER Plan would have short term temporary impacts to air quality. The NER Plan would have no long term impacts to air quality as construction activities would be limited to several months of total time.

5.5.2 – Section 404 of the Clean Water Act

A 404(b)(1) Determination was completed to assess effects of fill into the waters of the US (Attachment A). The current findings of compliance are as follows:

- No adaptation of the Section 404(b) (1) guidelines was made for this evaluation.
- No practical alternatives are available that produce fewer adverse aquatic impacts than the proposed plan.
- The proposed project would comply with applicable water quality standards.
- The project is in compliance with the Endangered Species Act of 1973 and the National Historic Preservation Act of 1966.
- The proposed fill activity would have no significant adverse impact on human health or welfare, including municipal and private water supplies, recreational and commercial fisheries, plankton, fish, shellfish, or wildlife communities (including community diversity, productivity, and stability), special aquatic sites, or recreational, aesthetic, and economic values.
- Measures will be taken to minimize construction impacts such as: construction sequencing, stone stabilizing materials, erosion control matting and coir logs, and rapidly revegetate disturbed earth.
- On the basis of the Guidelines, the proposed site for the discharge of fill material is specified as complying with the requirements of these guidelines with the inclusion of appropriate and practical conditions to minimize pollution or adverse impacts to the aquatic ecosystem.

5.5.3 – Section 401 of the Clean Water Act

This project would be considered to be in compliance with Section 401 of the Clean Water Act, as all of the proposed measures fit within the Regional 404 Permit established by the Chicago District Corps of Engineers and endorsed by the Illinois EPA. No permit would be sought for construction; however, documentation of compliance with Section 401 would be provided during the design phase once necessary plan sheets are drafted.

5.5.4 – State of Illinois Floodway Permitting

A State of Illinois Floodway permit will not be obtained for this project; however, hydrologic modeling during the design phase would be completed to ensure no off site flooding effects are induced. The current 2,800 acre drain tile system was temporarily disabled with reversible valves in order to assess the effects and extent of wetland rehydration within the Spring Creek study area. The valves have been closed since 2011 and have shown no adverse affects to adjacent residents, roads, paths, or horse trails.

5.5.5 – State of Illinois Historic Preservation Act

Pursuant to Section 106 of the National Historic Preservation Act (16 U.S.C. § 4701) and 36 C.F.R. Part 800, the staff of the Illinois State Historic Preservation Officer (Illinois SHPO) has conducted an analysis of the materials dated 15 December, 2010 and received on 11 January, 2011. Based upon the documentation available, the staff of the Illinois SHPO has not identified any historic buildings, structures, districts, or objects listed in or eligible for inclusion in the National Register of Historic Places within the probable area of potential effects. The SHPO has no objection to the work being performed under the NER Plan.

All areas affected by ground disturbance under this project have already been previously disturbed; therefore, an archaeological survey is unnecessary. This assessment is consistent with the SHPO letter dated July 06, 2015, which is located in Appendix G.

5.5.6 – IDNR & USFWS Coordination

Coordination with the Illinois Department of Natural Resources (IDNR) was initiated with a project Scoping Letter dated December 6, 2010. The USACE has concluded in this report that the project is not likely to adversely affect state listed species. It is expected that the Illinois DNR will provide clearance in response to the public/agency release of the NEPA document.

Coordination with the USFWS was initiated with a project Scoping Letter dated December 30, 2010. The Chicago District of the USACE is committed to continue working closely with the USFWS staff during design, construction and monitoring of this project. The past and current level of coordination has been very helpful and we have built a solid working relationship between our offices.

5.5.7 – Environmental Justice EO12898

To the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands. The NER Plan would not have any adverse effects to any minority populations and low-income populations.

5.5.8 – Climate Change EO 13653

The impacts of climate change — including an increase in prolonged periods of excessively high temperatures, more heavy downpours, an increase in wildfires, more severe droughts, permafrost thawing, ocean acidification, and sea-level rise — are already affecting communities, natural resources, ecosystems, economies, and public health across the Nation. These impacts are often most significant for communities that already face economic or health-related challenges, and for species and habitats that are already facing other pressures. Managing these risks requires deliberate preparation, close cooperation, and coordinated planning by the Federal Government, as well as by stakeholders, to facilitate Federal, State, local, tribal, private-sector, and nonprofit-sector efforts to improve climate preparedness and resilience; help safeguard our economy, infrastructure, environment, and natural resources; and provide for the continuity of executive department and agency (agency) operations, services, and programs. The Federal Government must build on recent progress and pursue new strategies to improve the Nation's preparedness and resilience. In doing so, agencies should promote: (1) engaged and strong partnerships and information sharing at all levels of government; (2) risk-informed decision-making and the tools to facilitate it; (3) adaptive learning, in which experiences serve as opportunities to inform and adjust future actions; and (4) preparedness planning.

The NER plan supports this Executive Order via the sequestration of carbon and carbon dioxide by increasing the acreage and biomass of native plant material above and below ground throughout the project area. Dead plant material in the form of wood snags and debris, peat, detritus and mucks also prevents carbon from entering the atmosphere.

5.5.9 – Finding of No Significant Impact

A draft Finding of No Significant Impact (FONSI) of the Spring Creek Section 206 project as it is currently considered by USACE is attached at the end of this report. After public review and comment of this project USACE will evaluate all comments received and modify the environmental assessment and project, if necessary, and document in the FONSI. If the evaluation concludes this action does not significantly affect the quality of the human environment the FONSI will be signed. If the evaluation concludes the project does significantly affect the quality of the human environment the project may be modified and if the impacts of the modified project are not reduced to a level that will not significantly affect the quality of the human environment, an environmental impact statement will be prepared for public review and comment.

CHAPTER 6 – PLAN IMPLEMENTATION

6.1 – Project Authorization

The project would be implemented under S33 USC § 2330 – Section 206 of the Water Resources Development Act of 1986, as amended. Construction authority is provided by this law in addition to study authority. The 206 Aquatic Ecosystem Restoration Authority detail is provided in Section 1.2.

6.2 – NER Plan Description & Design

Alternative 4 was selected as the National Ecosystem Restoration (NER) Plan, which for the purposes of this Environmental Assessment is termed the Preferred Plan. Rationale for selecting the NER/Preferred Plan is presented in Section 4.6. Alternative Plan 4 consists of the following measures presented in Section 4.1: (DTD) Drain Tile Disablement, (D) Ditch, (SMI) Stream Meander Induction, (MSI) Native Plant Establishment in Areas with Monotypic Stands of Invasive Species, (C) Native Plant Establishment in Areas with Existing Stands of Rhizomatous *Carex* spp., (ISC) Invasive Shrub Clearance, (ITSC) Invasive Tree and Shrub Clearance, (QITSC) Invasive Tree and Shrub Clearance of Red Oak Afforestation, (QISC) Invasive Shrub Clearance in Areas with Open-grown Oaks, (EM) Eurasian Meadow, (EP) Existing Prairie.

The implementation of all of these measures would restore riverine and flowage lake fish habitat, streamside marsh, basin marsh, sedge meadow, graminoid fen, seep, wet/wet-mesic prairie, and savanna/open woodland, all of which are riparian to Spring Creek. The implementation of these features is generally described as follows and according to the measures descriptions in Section 4.1. More detail would be added to the plan should this project commence to the design and implementation phase, for example, specifying spatial distribution of native plugs within a given zone and species clumping, planting centers, temporary predator controls, and establishment activities. General construction activities and sequencing would include:

(1) Site Preparation – The first task would be to install any necessary safety fencing, signage and other safety features in order to keep the public out of the site during heavy construction. Staging areas and access roads would be demarcated. Instructive signage for workers would be set up as well to signify off limit work areas and site restrictions.

(2) Invasive Species Eradication – All invasive plant species would be chemically and physically eradicated, including prescribed burns. Invasive species eradication would be a multi-year effort.

(3) Geomorphic Contouring and Hydrological Restoration – Once targeted woody and invasive species are removed, drain tile and ditch disablement as well as stream meander induction would commence to provide suitable hydrology for establishing native plant communities. Temporary valves installed onsite would be permanently disabled to restore natural groundwater and surface water hydrology. A large portion of the ditch would be filled in and side cast berms along the ditch removed via strategic grading to allow former wetlands to become inundated. These areas will be contoured and all excess soils will be incorporated into the landscape within the Spring Creek Valley project site. Woody debris jams will be placed in channelized portions of the stream to start the meandering process and rehydrate the floodplain. In general, these woody debris jams will be strategically placed to drive flows into one back and deposits on the other to induce the meandering process.

(4) Native Plant Community Establishment – Next would be to establish native plant communities of riverine, flowage lake, streamside marsh, basin marsh, sedge meadow, graminoid fen, seep, wet/wet-mesic prairie, and savanna/open woodland over the remainder of the construction period. Planting of plugs and supplemental seeding would be performed in areas where simply allowing the recovery of native seed banks will not establish sustainable native plant communities. Again, the duration of the construction contract would primarily be for spot herbicide application, additional planting, and prescribed burns.

(5) BMPs – Soil erosion and sediment control measures will be designed during design phase and will comply with local and federal environmental requirements. The minimum measures required at the project site may include:

- Seeding to stabilize disturbed areas
- Installation of silt fences around graded slopes and stockpile areas
- Stabilizing construction entrances to limit soil disturbance at the ingress/egress from the site
- Installing erosion blanket over unprotected finished grades that are to be unplanted for at least two weeks

6.3 – Real Estate Considerations

The Real Estate Plan Appendix E was prepared in support of the AFB-level feasibility study of the Spring Creek Valley ecosystem restoration study. The Real Estate Plan identifies and describes the area proposed for construction, operation and maintenance of the Project, in addition to the real estate requirements and procedures for implementation of a recommended Plan. The non-Federal sponsor has voluntarily agreed to waive reimbursement for the value of project LERRDs that exceeds its share of total project costs.

Estimated LERRDs Credit – $_____

6.4 – Permit Requirements

The following required permits are anticipated and will be obtained prior to implementation of plan components:

- Section 401 Water Quality Certification (WQC) – Illinois Environmental Protection Agency – This project would be considered to be in compliance with Section 401 of the Clean Water Act, as all of the proposed measures fit within the Regional 404 Permit established by the Chicago District Corps of Engineers and endorsed by the Illinois EPA. No permit would be sought for construction; however, documentation of compliance with Section 401 would be provided during the design phase once necessary plan sheets are drafted.
- National Pollutant Discharge Elimination System (NPDES) General Permit (ILR10) – ILEPA

6.5 – Monitoring

Monitoring details are provided in **Appendix F**. Monitoring goals will center around collecting data on the plant, fish and avian community. The project goals are to increase plant richness by removing woody species, invasive species and reestablishing plants through seeds and plugs. Therefore, the objectives of monitoring will be to collect data on the number of native plant species, the coverage of native plant species along with the amount of coverage of canopy trees and invasive plant species found within each distinctive habitat type (e.g., prairie, savanna, and marsh).

6.6 – Operation & Maintenance Considerations

The O&M costs of the project are estimated to total an annual cost of $_____with a 4.875% interest rate over 50 years. Slope maintenance includes the addition of stone or soil in certain areas that experienced minor erosion. Natural plant community maintenance includes the prevention of non-native and exotic species colonization and the addition of native species overtime. A detailed O&M Manual containing all the duties will be provided to the non-Federal sponsor after construction is closed out. The O&M for Chicago District ecosystem projects are practical, straightforward and minimal due to initial project design efforts, design targets for sustainability and all of the O&M activities are no different than ones that would take place during construction.

6.7 – NEPA Compliance

The Spring Creek section 206 Aquatic Ecosystem Restoration project was determined to be in incompliance with NEPA and all other appropriate statutes, executive orders and memoranda (Section 5.6 Compliance with Environmental Statutes). Coordination and compliance for this FS included comprehensive public involvement, agency coordination, and review of and has included compliance with applicable Federal statues per the USACE Engineering Regulation 1105-2-100, Planning Guidance Notebook. Among other guidelines, the President's Council on Environmental Quality guides public participation opportunities with respect to Feasibility Reports and Environmental Assessments, Engineering Regulations, and procedures for implementing NEPA.

6.7.1 – Mitigation Requirements

Since this is an ecosystem restoration project once lost resources would be recovered by the Federal Action; therefore, mitigation is not warranted.

6.7.2 – Public/Agency Comments & Views

Public and Agency Scoping Coordination

Public scoping letters dated December 1, 2010 were mailed to governmental agencies that have interest in Spring Creek. A copy of this letter along with the distribution list can be found in **Appendix G.** Various stakeholder meetings were held during the Feasibility Phase to garner information and stakeholder desires for the Spring Creek study area. Formal coordination and agency views will be summarized in this section after the NEPA public/agency review is completed.

Public Review of the Draft EA

This section will be furnished when the public input generated is analyzed.

Public Meeting on the Draft EA

This section will be furnished when the public input generated is analyzed.

Publication of the Finding of No Significant Impact (FONSI)

This section will be furnished when the public NEPA review is completed and the District Commander signs a FONSI.

6.8 – Project Schedule & Costs

Table 10: Study & Tentative Project Schedule

Action	Date
AFB Submittal	2015 July
Alternative Formulation Briefing (AFB)	2015 Sep
Public Review Period	2015 Oct
DPR Submittal	2015 Dec
DPR Approval	2016 Feb
Execute PPA	2016 July
P&S Initiation	2016 July
P&S Completion	2016 Nov

6.8.1 – Total Project Costs

The project has undergone a successful Cost Agency Technical Review (Cost ATR) of remaining costs, performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The cost products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering. Total project costs include costs for study, design, implementation, contingencies, construction management, engineering during construction (EDC) and project management. Costs for design and management are estimated based on a percentage of estimated implementation costs and contingencies. These costs will be revised prior to the execution of a Project Partnership Agreement (PPA) and actual costs for these activities will be used to remedy final cost sharing responsibilities during project close-out. Total project costs were escalated to the mid-point of estimated construction using factors contained in EM 1110-2-1304, Civil Works Construction Cost Index System (CWCCIS). Table 11 provides a summary of total project costs for the NER Plan in both current and escalated price levels. Using the fully funded escalated costs and the implementation schedule, a summary of funding requirements by fiscal year was developed as presented in Tables 11 and 12 for the NER Plan.

Table 11: Summary of NER Fully Funded Total Project Costs

6.8.2 – Cost Apportionment

Feasibility costs and the required non-Federal share of 35 percent are included in the total project costs. Reimbursement of feasibility study costs will be sought through execution of the Project Partnership Agreement (PPA). The total project cost is estimated to be about $_____.

The estimated Federal cost share of the project is about $_____. The USACE would accomplish the plans and specifications phase, which includes additional design studies and plans and specifications, contract for construction, overall supervision during construction, prepare an operation and maintenance manual, and participate in a portion of the post construction monitoring.

Prior to initiation of the design phase, the Federal Government and the non-Federal sponsors will execute a PPA. The LERRDs and OMRR&R of the project will be the responsibility of the non-Federal sponsors for the proposed project. The estimated non-Federal share of the total first cost of the project is about $_____and will be covered by LERRDs. The non-Federal sponsor has voluntarily agreed to waive

reimbursement for the value of project LERRDs that exceeds its share of total project costs. In addition to the total first cost, the feasibility level operations and maintenance costs of the project are estimated to total an annual cost of $_____. The non-Federal sponsors shall, prior to implementation, agree to perform the following items of local cooperation:

A summary of the fully funded total project costs and a breakdown of Federal and non-Federal contributions to the total project cost for NER Plan are shown in Table 12.

Table 12: Cost Apportionment of NER Plan

6.8.3 – Financial Capability of Non-Federal Sponsor

In accordance with regulation ER1105-2-100, Appendix D, where the non-Federal sponsor's capability is clear, as in the instances where the sponsor has sufficient funds currently available or has a large revenue base and a good bond rating, the statement of financial capability need only provide evidence of such. The non-Federal sponsor is committed to its specific cost share of the Design & Implementation (D&I) Phase, and expresses willingness to share in the costs of construction to the extent that can be funded.

In accordance with the CECW-PC Memorandum dated 12 June 2007, Non-Federal Sponsor's Self-Certification of Financial Capability, the Cook County Forest Preserve District certifies they are aware of the financial obligations of the non-Federal sponsor and have the financial capability to satisfy obligations for the project. The non-Federal sponsor is committed to its specific cost share of the plans and specifications and construction.

CHAPTER 7 - RECOMMENDATION

I have considered all significant aspects of the problems and opportunities as they relate to the project resource problems of Spring Creek in Barrington, Illinois. Those aspects include environmental, social, and economic effects, as well as engineering feasibility.

I recommend that the National Ecosystem Restoration (NER) Plan be authorized for implementation as a Federal project, with such modifications thereof as in the discretion of the Commander, USACE may be advisable. The estimated total project cost of the NER Plan is $_____and the estimated annual operations, maintenance, repair, replacement and rehabilitation (OMRR&R) cost is $_____. The Federal portion of the estimated total project cost is $_____. The non-Federal share of the estimated first cost of the project is about $_____ and will be covered by lands, easements, rights-of-way, utility or public facility relocations, and dredged or excavated material disposal areas (LERRDs).

As established in PL99-662, as amended, project costs are shared with the non-Federal sponsor in accordance with project outputs. The Forest Preserve District of Cook County has agreed to serve as the local cost-sharing sponsor for the Spring Creek Section 206 Aquatic Ecosystem Restoration project. The cost-sharing requirements and provisions will be formalized with the signing of the Project Partnership Agreement (PPA) between the local sponsor and USACE prior to initiation of contract award activities. In this agreement, the local sponsor will agree to pay 35 percent of the total project costs. Federal implementation of the recommended project would be subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including but not limited to:

a. Provide a minimum of 35% of the separable project costs allocated to ecosystem restoration as further specified below:

    (1) Enter into an agreement that provides, prior to construction, 35% of preconstruction engineering and design (PED) costs;

    (2) Provide, during construction, any additional funds needed to cover the non-Federal share of PED costs;

    (3) Provide all LERRDs, including suitable borrow and excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project; and,

    (4) Provide, during construction, any additional costs as necessary to make its total contribution equal to 35% of the ecosystem restoration costs.

b. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the project, at no cost to the Government, in accordance with applicable Federal and state laws and any specific directions prescribed by the Government.

c. Grant the Government a right to enter, at reasonable times and in a reasonable manner, upon land that the local sponsor owns or controls for access to the project for the purpose of inspection or monitoring, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

d. Assume responsibility for OMRR&R the project or completed functional portions of the project, including mitigation features, without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

e. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

f. Hold and save the Government free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterment, except for damages due to the fault or negligence of the Government or the Government's contractors.

g. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

h. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on LERRDs that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

i. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under LERRDs that the Government determines necessary for the construction, operation, or maintenance of the project.

j. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA. As between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability.

k. Prevent future encroachments on project LERRDs that might interfere with the proper functioning of the project.

l. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled “Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army,” and Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b 12), requiring non Federal preparation and implementation of flood plain management plans

m. Comply with all applicable Federal and state laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled “Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army.”

n. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public law 91-646, as amended by title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring LERRDs and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

o. Comply with Executive Order 11644, “Use of Off-Road Vehicles on the Public Lands,” dated 8 February 1972 as amended by Executive order 11989, dated 24 May 1997, which established policies and provides for procedures to ensure that the use of off-road vehicles on public land is controlled to protect the resources, promote safety of all users, and minimize conflicts among the various uses.

p. Provide the required non-Federal share of total cultural resource preservation mitigation and data recovery costs allocable to each project purpose that are in excess of 1% of the total amount authorized to be appropriated for each project purpose.

q. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

r. Prevent obstructions of or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) which might reduce the ecosystem restoration, hinder its operation and maintenance, or interfere with its proper function, such as any new development on project lands or the addition of facilities which would degrade the benefits of the project.

s. Comply with Public Law 90-483, as amended, which provides that fair and equitable fees will be assessed the users of specialized sites, facilities, equipment or services provided at substantial Federal expense.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch.

_____
CHRISTOPHER T. DREW
COL, EN
Commanding

CHAPTER 8 – BIBLIOGRAPHY

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Finding of No Significant Impact
Spring Creek Valley Ecosystem Restoration

Background

The non-Federal sponsor, the Forest Preserve District of Cook County, has requested that the Chicago District, USACE initiate a study under Section 206 Water Resources Development Act 2014, Great Lakes Fishery and Ecosystem Restoration to ascertain the feasibility of techniques to restore the ecological integrity of Spring Creek Valley. This study evaluates the feasibility and environmental effects of restoring the various plant communities and streams within the project area. The scope of this study addressed the issues of altered hydrology and hydraulics, native plant community preservation, invasive species, connectivity, rare wetland communities, native species richness. The Feasibility Report and Integrated Environmental Assessment assessed and identified problems and opportunities, identified and evaluated measures, and recommended the most cost effective and feasible solution to the ecological problems currently existing within the area of study.

Agriculture and urban development has had a major influence on the physical structure of habitat and the processes that created and sustained these habitats. This has allowed invasive and nonnative species to colonize these altered areas. There is also a negative feedback loop in some stream sections where altered hydrology and lack of fire has induced the riparian structure to fail, in turn causing the stream to degrade, which feeds back to more altered hydrology and hydraulics. Specific problems include:

- Altered hydrology stemming from drain tile and ditch system
- Altered riverine hydraulics stemming from increased urban runoff, invasive plant species, historic channelization
- Habitat fragmentation
- Cessation of natural processes

Brief Summary of Findings

Six (6) alternative plans were manually generated, including the No Action alternative, using the measures described above. Spring Creek requires many specific and dependent measures to address the problems, opportunities, goals and objectives of the study; therefore, it was determined that use of the IWR Plan "Generator" would not be effective since the large volume of iterations would need to be broken down into sub-analyses and the dependencies would be cumbersome to manage.

The NER/Preferred Plan

Alternative 4 was selected as the National Ecosystem Restoration (NER) Plan, which for the purposes of this Environmental Assessment is termed the Preferred Plan. The implementation of all of these measures would restore riverine and flowage lake fish habitat, streamside marsh, basin marsh, sedge meadow, graminoid fen, seep, wet/wet-mesic prairie, and savanna/open woodland, all of which are riparian to Spring Creek. Alternative 4 consists of the following measures:

Hydrology

(DTD) Drain Tile Disablement - Back Water Valves - This measure seeks to restore natural groundwater and surface water hydrology to all areas that have been previously drained for agricultural purposes. During this feasibility phase, a drain tile survey was performed to locate and map all drain tiles within the preserve's boundaries (**Appendix B**). Once the drain tiles were mapped, temporary valves were installed to perform on site hydrologic simulation of what would happen if the drain tiles were permanently disabled. This step was deemed necessary in order to determine if there would be adverse effects to surrounding neighbors, roads and infrastructure, to delineate the extent and type of wetland communities, and to accurately prescribe the amount of native plugs and seed necessary for reestablishing these new wetland areas. Once these items were assessed, the valves were opened again to restore the current condition of the site.

Since the temporary valves are already in place, permanent disablement would require each valve to be grouted shut with bentonite clay. Permanently grouting these shut will not only prevent water from draining through the tiles at first, but over a period of years, will cause the tiles to fill with soil and collapse on themselves. This methodology is more cost effective and has a much less impact to the soils and environment than if all of the drain tiles were to be physically smashed in place or pulled out.

(D) Ditch - This measure seeks to restore surface hydrology along the western portion of the Spring Creek Preserve. An 8,400 foot ditch was once constructed to drain this portion of the preserve for agricultural purposes. The ditch, for the most part, is not fully functioning since maintenance has not been performed since farming ceased in the 1960s. This condition is evident from the amount of silt that has accumulated within the ditch; therefore, is not effectively impacting ground water, but does disallow surface water from naturally spreading and inundating areas that were formerly wetland. To remedy this remaining surface water issue, it is proposed to strategically grade approximately 4881 LF out of the total ditch length of 8400 LF, as depicted in **Appendix A** H&H Analysis, to allow these former wetland areas to become inundated. Removal of these side cast berms would allow these former wetland areas to become inundated. Also, this measure would remove hydraulic forces during storms that keep the ditch channelized. Eventually, native vegetation will overcome the ditch foot print and transform it into a small meandering swale, which is evident in the upper most reaches of this same ditch.

Hydraulics & Geomorphology

(SH) Stream Habitat – About 300 small woody debris jams of various designs would be placed in Spring Creek in the sections where the stream is not recovering on its own, has incised too much or exhibits a lack of water longevity. These woody structures would be positioned to start to provide localized habitat, increase water longevity within the stream channel, rehydrate the floodplain areas and promote the meandering process. These woody structures would be sacrificial as they will be assimilated once they decompose and/or natural cut and fill alluviation takes over. All the woody structures would have varying crests, ranging between 3 inches to 2 feet high, and between 5 and 20-feet wide, but various designs would be fleshed out during design to achieve the needs of the particular stream reach.

Primary Design - Log Weirs: A log weir consists of a header log and a footer log placed in the bed of the stream channel, perpendicular or at an angle to stream flow, depending on the size of the stream. The logs extend into the stream banks on both sides of the structure to prevent erosion and bypassing of the structure. The logs are installed flush with the channel bottom upstream of the log. The footer log is placed to the depth of scour expected, to prevent the structure from being undermined. This weir structure creates a “step” – or abrupt drop in water surface elevation – that serves the same functions as a natural step created from bedrock or a log that has fallen into the stream. The weir typically forms a very deep pool just downstream, due to the scour energy of the water dropping over the step. Weirs are typically

installed with a maximum height of 3 to 6 inches so that fish passage is not impaired. Log weirs provide bedform diversity, maintain channel profile, and provide pool and cover habitat.

Secondary Design - Cover Logs: A cover log is placed in the outside of a meander bend to provide cover and enhanced habitat in the pool area. The log is buried into the outside bank of the meander bend; the opposite end extends through the deepest part of the pool and may be buried in the inside of the meander bend, in the bottom of the point bar. The placement of the cover log near the bottom of the bank slope on the outside of the bend encourages scour in the pool, provides cover and ambush locations for fish species, and provides additional shade. Cover logs are often used in conjunction with other structures, such as vanes and root wads, to provide additional structure in the pool.

Plant Communities

(MSI) Native Plant Establishment in Areas with Monotypic Stands of Invasive Species - This measure seeks to remove all invasive species with herbicide applications and prescribed burns within wetland communities where no coverage of rhizomatous *Carex* spp. or conservative native vegetation currently exist; invasive species include reed canary grass (*Phalaris arundinacea*), cattail (*Typha* spp.), and common reed (*Phragmites australis* ssp. *australis*). Diverse native plant communities will be established by allowing native seed bank to express itself and supplemental seeding with species of local genotype; species harder to establish from seed will be introduced as plugs. Spot applications of herbicide and additional prescribed burns will continue throughout the establishment period to further suppress invasive species and promote the establishment of native vegetation.

(C) Native Plant Establishment in Areas with Existing Stands of Rhizomatous *Carex* spp. - This measure seeks to remove all invasive species with herbicide applications and prescribed burns within wetland communities containing remnant stands of rhizomatous *Carex* spp.; invasive species include reed canary grass (*Phalaris arundinacea*), cattail (*Typha* spp.), and common reed (*Phragmites australis* ssp. *australis*). Spot applications of herbicide and additional prescribed burns will continue throughout the establishment period to further suppress invasive species and promote the establishment of native vegetation.

(ISC) Invasive Shrub Clearance - This measure seeks to remove invasive shrubs within degraded prairie and savanna habitats, including riparian communities. Shrub species to be removed include common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*Frangula alnus*), exotic honeysuckle (*Lonicera* spp.), Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), and multiflora rose (*Rosa multiflora*).

(ITSC) Invasive Tree and Shrub Clearance - This measure seeks to remove invasive and opportunistic trees (8”-12” average dbh) and shrubs within degraded prairie and savanna communities, including riparian communities. Species to be removed include black cherry (*Prunus serotina*), white mulberry (*Morus alba*), black locust (*Robinia pseudoacacia*), box elder (*Acer negundo*), green ash (*Fraxinus lanceolata*), common buckthorn (*Rhamnus cathartica*), and exotic honeysuckle (*Lonicera* spp.)

(QITSC) Invasive Tree and Shrub Clearance of Red Oak Afforestation - This measure seeks to remove invasive and opportunistic trees (12”-18” average dbh) and shrubs planted within historic prairie and savanna communities that have further degraded as a result of fire suppression. Species to be removed include red oak (*Quercus rubra*), honeylocust (*Gleditsia triacanthos*), oriental bittersweet (*Celastrus orbiculatus*), cottonwood (*Populus deltoides*), common buckthorn (*Rhamnus cathartica*), and exotic honeysuckle (*Lonicera* spp.)

(QISC) Invasive Shrub Clearance in Areas with Open-grown Oaks - This measure seeks to clear dense thickets of invasive shrubs within degraded savanna communities containing large open-grown bur oaks (*Quercus macrocarpa*) and white oaks (*Quercus alba*). Invasive shrubs within these areas include common buckthorn (*Rhamnus cathartica*), exotic honeysuckle (*Lonicera* spp.), Japanese barberry (*Berberis thunbergii*), and multiflora rose (*Rosa multiflora*).

(EM) Eurasian Meadow - This measure seeks to replace Eurasian meadows with prairie communities.

(EP) Existing Prairie - This measure seeks to preserve and enhance existing prairie communities.

Discussion of Environmental Compliance

The NER/Preferred Plan are in compliance with appropriate statutes and executive orders including the Natural Historic Preservation Act of 1966; the Endangered Species Act of 1973; the Fish and Wildlife Coordination Act; Executive Order 12898 (environmental justice); Executive Order 11990 (protection of wetlands); Executive Order 11988 (floodplain management); and the Rivers and Harbors Act of 1899. The potential project is in compliance with the Clean Air Act; the Clean Water Act, and the National Environmental Policy Act of 1969.

Environmental Justice EO12898

To the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands. The NER Plan would not have any adverse effects to any minority populations and low-income populations.

Clean Air Act

Any of the alternative plans would not adversely affect long term air quality since machinery for construction activities would be limited to several months of total time. The local air quality in the Chicago area including Cook County are considered ‘non-attainment’ under the Clean Air Act for ozone, particulates (PM-10 and PM-2.5), and lead. The project is within the non-attainment zone. Once implemented, the project itself will be neutral in terms of air quality, with no features that either emit or sequester air pollutants to a large degree. During the project construction, equipment would cause minor, temporary air quality impacts, however all equipment will be in compliance with current air quality control requirements for diesel exhaust, fuels, and similar requirements. These activities would be unnoticeable compared to current surrounding trucking routes within the immediate project area. Short term effects from petroleum fueled machines used during construction are considered negligible. The NER Plan would have short term temporary, although insignificant, impacts to air quality. The NER Plan would have no long term impacts to air quality as construction activities would be limited to several months of total time.

Section 401 & 404 of the Clean Water Act

A 404(b)(1) Determination was completed to assess effects of fill into the waters of the US (Attachment A). The current findings of compliance are as follows:

- No adaptation of the Section 404(b) (1) guidelines was made for this evaluation.
- No practical alternatives are available that produce fewer adverse aquatic impacts than the proposed plan.
- The proposed project would comply with applicable water quality standards.
- The project is in compliance with the Endangered Species Act of 1973 and the National Historic Preservation Act of 1966.
- The proposed fill activity would have no significant adverse impact on human health or welfare, including municipal and private water supplies, recreational and commercial fisheries, plankton, fish, shellfish, or wildlife communities (including community diversity, productivity, and stability), special aquatic sites, or recreational, aesthetic, and economic values.
- Measures will be taken to minimize construction impacts such as: construction sequencing, stone stabilizing materials, erosion control matting and coir logs, and rapidly revegetate disturbed earth.
- On the basis of the Guidelines, the proposed site for the discharge of fill material is specified as complying with the requirements of these guidelines with the inclusion of appropriate and practical conditions to minimize pollution or adverse impacts to the aquatic ecosystem.

This project would be considered to be in compliance with Section 401 of the Clean Water Act, as all of the proposed measures fit within the Regional 404 Permit established by the Chicago District Corps of Engineers and endorsed by the Illinois EPA. No permit would be sought for construction; however, documentation of compliance with Section 401 would be provided during the design phase once necessary plan sheets are drafted.

USFWS Coordination

The County Distribution of Federally-listed Threatened, Endangered, and Candidate Species for Cook County (List Revised April 30, 2015) was reviewed on the USFWS website by the Chicago District (http://www.fws.gov/midwest/Endangered/lists/illinois-cty.html). The only Federally endangered species known to inhabit the study area is the Hine's Emerald Dragonfly. Threats to Hine's Emerald Dragonfly include habitat loss, habitat degradation, habitat succession, and disruption of ecological and hydrological processes. High quality wetlands within the study area may also support the Federally threatened Eastern Prairie Fringed Orchid (*Platanthera leucophaea*). The proposed project would restore dragonfly habitat and wetlands that may support the Eastern Prairie Fringed Orchid (*Platanthera leucophaea*) within the study area and would greatly benefit populations of these Federally listed species. For these reasons, we conclude there would be no effect on listed species or proposed or designated critical habitat resulting from the implementation of the Preferred Plan/NER Plan. Coordination with the USFWS was initiated with a project Scoping Letter dated December 30, 2010. The Chicago District of the USACE is committed to continue working closely with the USFWS staff during design, construction and monitoring of this project. The past and current level of coordination has been very helpful and we have built a solid working relationship between our offices.

State of Illinois Historic Preservation Act

Pursuant to Section 106 of the National Historic Preservation Act (16 U.S.C. § 4701) and 36 C.F.R. Part 800, the staff of the Illinois State Historic Preservation Officer (Illinois SHPO) has conducted an analysis of the materials dated 15 December, 2010 and received on 11 January, 2011. Based upon the documentation available, the staff of the Illinois SHPO has not identified any historic buildings, structures, districts, or objects listed in or eligible for inclusion in the National Register of Historic Places within the probable area of potential effects. The SHPO has no objection to the work being performed under the NER Plan.

All areas affected by ground disturbance under this project have already been previously disturbed; therefore, an archaeological survey is unnecessary. This assessment is consistent with the SHPO letter dated July 06, 2015, which is located in Appendix G.

Public Interest

An Environmental Assessment (EA) was prepared for the project and sent to Federal, State and local agencies along with the general public for review. A 30-day Public Review period was held from ____ 2015 to _____ 2015 for the Environmental Assessment. Significant comments from the Federal, State or local agencies or the public were addressed and are attached to this FONSI. All comments and correspondence are attached to this FONSI.

Conclusion

In accordance with the National Environmental Policy Act of 1969 and Section 122 of the River and Harbor and Flood Control Act of 1970, the U.S. Army Corps of Engineers has assessed the environmental impacts associated with this project. The purpose of this EA is to evaluate the impacts that would be associated with the restoration of Spring Creek Valley. The proposed project has been determined to be in full compliance with the appropriate statutes, executive orders and USACE regulations.

The assessment process indicates that this project would not cause significant effects on the quality of the human environment. The assessment process indicates that this project would have only beneficial impacts upon the ecological, biological, social, or physical resources of this area, and would provide environmental benefits to the Fox River watershed and an important path of the Mississippi Flyway. The findings indicate that that the proposed action is not a major Federal action significantly affecting the quality of the human environment. Therefore, I have determined that an Environmental Impact Statement is not required.

_____
CHRISTOPHER T. DREW
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