

# Chapter 17

## Protecting the Nippersink Creek's Green Infrastructure

### 17.1 What is a Green Infrastructure Plan?

The infrastructure of a community is often defined as the network of roads, power, communications, water and sewer systems, integral to maintaining a standard of living and economic vitality.

Green Infrastructure is the interconnected network of both publicly and privately owned open spaces and natural areas, such as greenways, stream corridors, wetlands, woodlands, grasslands, parks, conservation district lands, and remnant / restored native plant communities. Collectively, these natural features support native flora and fauna, maintain natural ecological processes which can protect and improve water quality, sustain air and water resources, provide areas essential to groundwater recharge, convey and store stormwater runoff, and reduce flooding risk and damage.

Quite simply, Green Infrastructure significantly contributes to the health and quality of life of the people who live, work, and recreate in the watershed. As many of these benefits arise from having clean water, it is not surprising that water resources, both surface and subsurface, form the framework of a Green Infrastructure Plan. By protecting our streams, ponds, and wetlands, surface water quality is protected. By protecting areas where groundwater resources can be replenished from surface infiltration and shallow groundwater resources can discharge cool, clear water into our streams, major components of the hydrologic cycle benefit. These water resources also sustain our biological resources as well, including native wildlife species, as well as diverse native plant communities.

The purpose of a Green Infrastructure Plan is to clearly define those areas that must be preserved, protected, re-connected, and integrated into our developed landscapes, whether they are agricultural farm fields, pastures, or suburban development.

It is known that land disturbances, such as agriculture, land development, and mining can all generate pollutants that are washed off the landscape and into our streams, lakes, and wetlands. The creation of traditional stormwater detention basins with manicured turfgrass edges, can provide preferred habitat for large flocks of waterfowl, and result in large increase in fecal coliform levels resulting from waterfowl droppings. Stormwater Best Management Practices that involve the creation of dense stands of native vegetation, to provide filtering and nutrient uptake benefits, can alleviate many of these potential water quality impairments.

The increase in stormwater runoff that comes from the new pavement and roof tops generated by land development, even when first detained to comply with stormwater regulations, can also create highly unstable conditions in the receiving streams. The overall increase in the volume of stormwater runoff can lead to stream channels downcutting and widening, leading to accelerated stream bank erosion, and sediment delivery. These impacts contribute to the sediment pollution in streams, threaten public infrastructure such as bridges and culverts, cause safety concerns for adjacent property owners, and are aesthetically unappealing.

However, natural systems such as wetlands, floodplain forests, and prairies are extremely capable of reducing the volume of stormwater runoff through infiltration and evapotranspiration. These natural systems are also very efficient at removing pollutants from the runoff that passes through them.

A Green Infrastructure Plan is divided into two components – the first is the protection of existing high-quality natural areas. The second is the preservation and expansion of natural landscape systems to buffer the high quality natural areas from future development.

## **17.2           Need for a Green Infrastructure Plan**

While existing government regulations involving wetlands, floodplains, land use, and stormwater management can collectively provide a measure of protection against direct impacts to surface water resources, regulations protecting woodlands, native prairie remnants, lowland soils, or wildlife habitat are often inadequate or non-existent.

To provide a more comprehensive level of protection, it is necessary to consider the benefits these areas collectively provide, and determine how to integrate a reasonable, higher level of protection.

From a watershed perspective, the landscape feature that ties everything together is the mosaic of soils deposited by the glacial advances. These soil associations have the most significant influence on land development. For example, a gravel pit will only be sited where there are sufficient reserves of gravel available, and ideally a sanitary landfill would be sited in an area of thick, impermeable clays. Similarly, early farmers recognized the tremendous productivity of prairie soils, and only needed to develop a plow to cut through the dense root systems, or install drainage improvements to allow hydric soils to be cultivated.

Within the Illinois portion of the Nippersink Creek watershed, approximately 23,700 acres of land (24% of the Illinois watershed area) is comprised of hydric soils, which in pre-European settlement times, were comprised of wetlands, wet prairies, or shallow drainage swales. Most of these hydric soil areas were converted to cropland by the installation of subsurface drain tiles, construction of drainage ditches, or the channelization of streams.

While now suitable for agricultural purposes, and not necessarily considered regulatory wetlands, these converted hydric soils were not a location where you would want to build a home, or expect to have a functioning septic system.

The soils in the low-lying areas remain undisturbed, and they still provide significant groundwater recharge and flood storage benefits. Some communities, such as the Village of Long Grove, Illinois, have recognized the limitations, as well as benefits, associated with these low-lying areas, and have adopted a “Lowland Conservancy” ordinance.

If residential development in the Nippersink Creek watershed were only comprised of single lot projects, individually developed, there would be a natural tendency for those landowners to avoid the wetter parts of their property. In contrast, when it comes to large-scale urban development projects, the existing soil characteristics become less and less of a factor, as site engineering and large grading equipment moving and rearranging huge volumes of soil can transform areas with significant natural soil limitations into just another development site. Unfortunately, this approach totally ignores the natural benefits of the multi-horizoned organic and mineral soils.

In a natural, undeveloped state, these soils provide tremendous filtering and storage benefits for precipitation. The microscopic void spaces between soil particles can collectively store and gradually release large volumes of water.

If as part of land development activities, these undisturbed soils were subject to compaction (not excavation) from the operation of construction activity, these benefits in the upper soil horizon would be impaired for a period of time, but would naturally return as a result of freeze-thaw cycles, earthworm activity, and other natural processes. However, the typical scenario in large scale development is to strip off the existing organic soil horizons, often two to three feet in depth, and stockpile it. The exposed clay is then graded, formed, and compacted to create the future landscape. Four to six inches of stockpiled topsoil is then respread over the compacted clay to allow a vegetative cover (turfgrass) to be established. The balance of the topsoil is then sold, and leaves the site, and the filter / storage benefits are lost forever.

In reality, these mass graded areas can often exhibit a significant degree of imperviousness due to this compaction, but because they are subsequently planted to turfgrass, they are not included in stormwater detention calculations. More importantly, the natural storage capacity of the pre-disturbance soil horizon has been lost, and not accounted for in stormwater detention calculations. While natural processes may eventually restore some infiltration capacity to the compacted hardpan, it will likely take many decades.

By preserving undisturbed corridors of hydric soils, larger wetlands that remain in the landscape can also be functionally connected to local stream corridors.

Preservation of the existing stream corridor along Nippersink Creek and its major tributaries is a step in the right direction; however, protecting these narrow corridors alone will not adequately protect the ecological integrity or water quality of Nippersink Creek. If development of these areas proceeds according to existing development and stormwater ordinances, there is concern that the remaining green infrastructure left over will be too small, too disturbed, and too fragmented to provide any of the ecological or water quality benefits that are necessary to protect and enhance Nippersink Creek.

**Figure 17.1 Green Infrastructure Corridor**



**Figure 17.2 Typical Residential Development Scenario**

<p>"Pre-Development" photo illustrating agricultural land use. Stream is channelized and stream corridor is very narrow, but could be expanded easily by simply altering agricultural practices</p>	<p>"Post-Development" photo illustrating how stream corridor has now been permanently lost, due to encroachment by residential development and its required stormwater drainage system</p>

The photographs above demonstrate how green infrastructure is often permanently lost when agricultural land is converted to development. In the pre-development photo on the right, the topography and hydric soils (those dark areas on the photo) suggest that the green infrastructure, prior to agricultural development was probably a very wide, flat wetland that drained to the upper right of the photo. To increase agricultural productivity, the wetlands and saturated (hydric) soils were drained by excavating a ditch and installing drain tiles so that row crops could be planted to the very edge of the constructed stream channel. While this had negative impacts to the water quality of the downstream receiving stream (sediment, nutrients from fertilizers, etc.), it still was a "reversible" condition. The problem occurs when these agricultural parcels are planned for development, the development design fails to recognize the water quality and habitat benefits that the landscape had prior to the agricultural land use, and only the narrow agricultural channel is preserved. Stormwater basins are excavated within the green infrastructure area and designed to discharge as point sources directly into the stream system. This type of development layout does not take advantage of the filtering capabilities of the natural soils and historic wetlands and does not preserve or restore the natural habitat that makes the watershed a sustainable place for its residents to live, work and recreate.

## 17.3 Delineating the Green Infrastructure Boundary

The establishment of Green Infrastructure boundaries in the Nippersink Creek Watershed was accomplished by determining appropriate setback guidelines for specific natural features (such as high quality wetlands) and overlaying available GIS datasets on top of one another. These combined data layers of natural resource information created “linkages” of geographic areas.

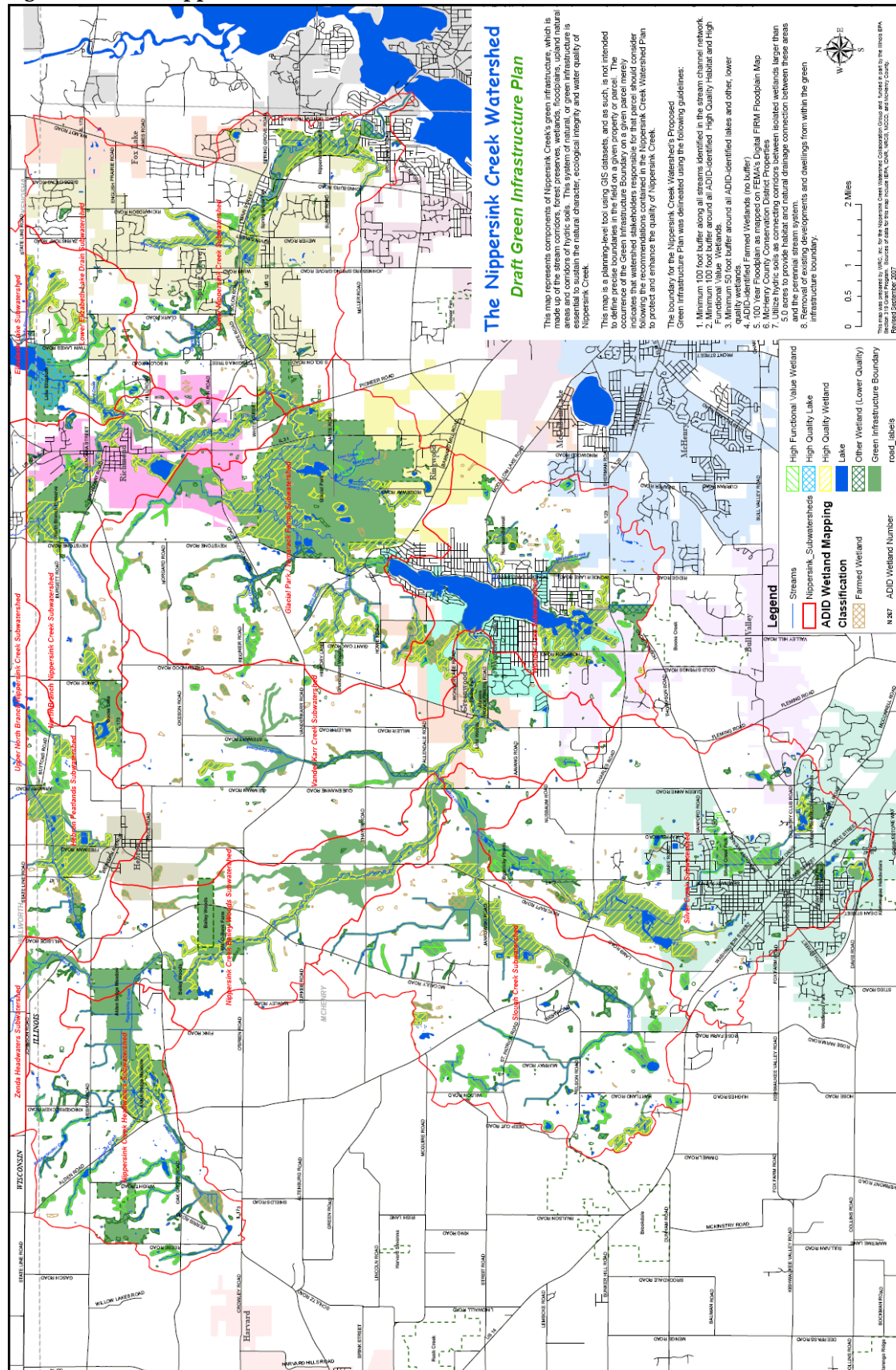
The boundary for the Nippersink Creek Watershed’s Green Infrastructure Plan was delineated using the following guidelines:

- All McHenry County Conservation District Properties (Figure 17.4)
- A 100 foot wide buffer along each side of all streams identified in the stream channel network (Figure 17.4)
- 100-Year Floodplain, as mapped on FEMA’s Digital Flood Insurance Rate Map (FIRM) Floodplain Map (Figure 17.5)
- A 100 foot buffer width around all Advanced Identification (ADID) study identified High Quality Habitat (HQH) Wetlands and High Quality (HQ) Lakes (Figure 17.6)
- A 100 foot buffer around all Advanced Identification (ADID) study identified High Functional Value (HFV) and other, lower quality wetlands (Figure 17.6)
- All Advanced Identification (ADID) study identified Farmed Wetlands one acre or larger in size (with no additional buffer) (Figure 17.7)
- Areas mapped as hydric (wetland) soils that can serve as connecting corridors between isolated wetlands larger than five acres to provide habitat and natural drainage connection between the wetlands and the perennial stream system (Figure 17.8)
- The map was then edited to ensure that existing buildings or developed areas were not included within the green infrastructure boundary (Figure 17.8)

The final Nippersink Creek Green Infrastructure Map is presented in Exhibit 17.3, in a reduced scale. **The Nippersink Creek Green Infrastructure Map can be viewed, and downloaded as a scalable PDF file, at [www.nippersink.org](http://www.nippersink.org).**

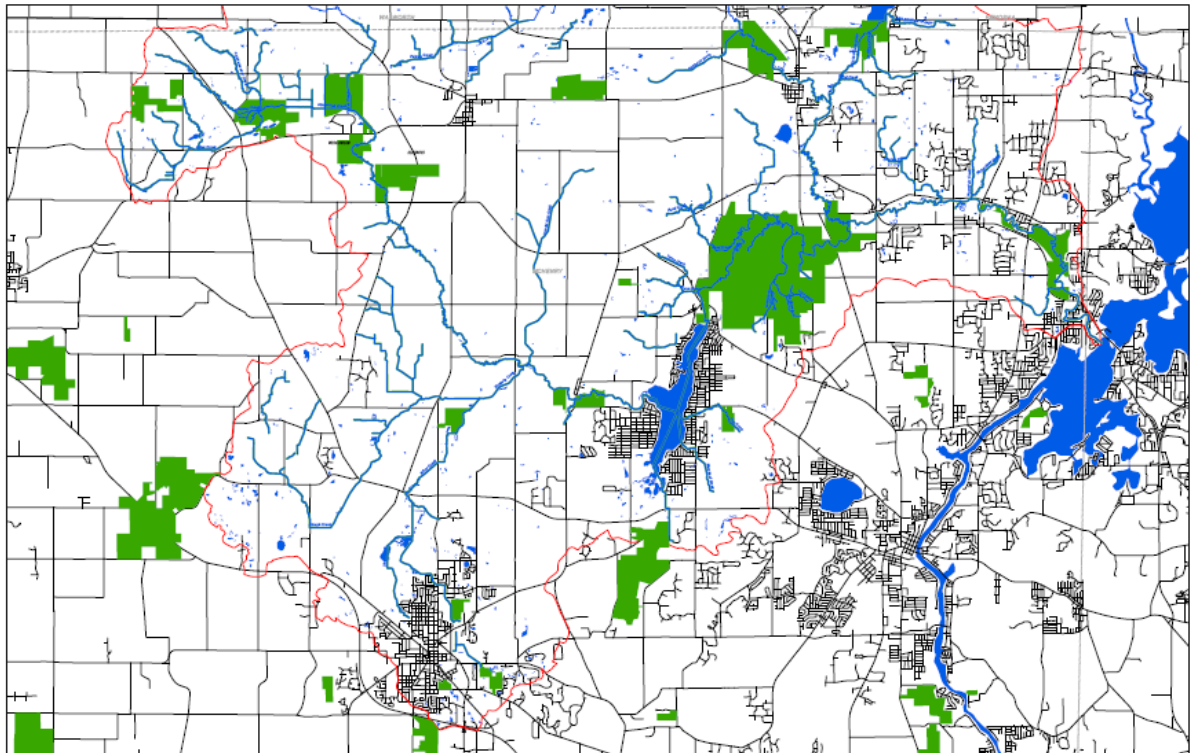


Figure 17.3 Nippersink Creek Green Infrastructure Plan

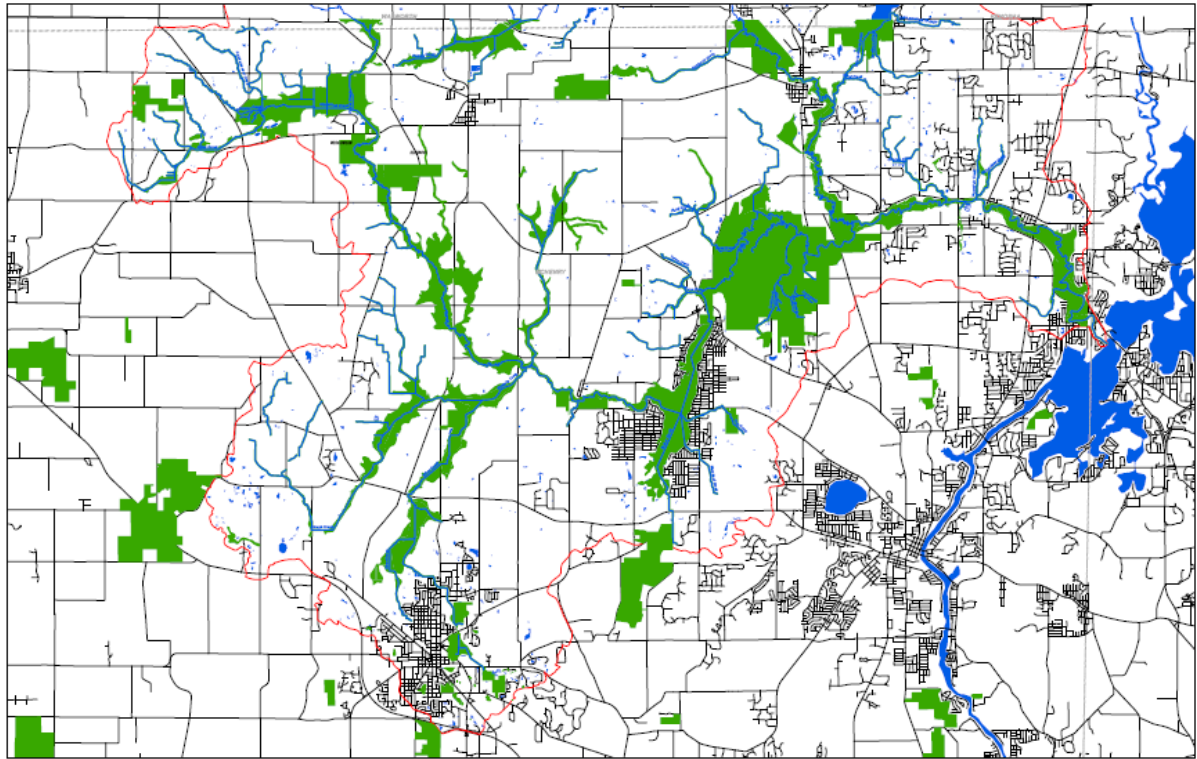


The maps in figures 17.4 – 17.8 illustrate several of the incremental steps using the guidelines above to delineate the boundary of the Green Infrastructure Plan. Priority areas included publicly owned natural open space parcels, stream corridors, and high quality wetlands. The Green Infrastructure Plan recognizes that it is not feasible or practical to protect and connect each and every isolated wetland, regardless of quality, to the integrated green infrastructure network of the watershed. Therefore, only isolated wetlands larger than five acres in size are included in the boundary. This would allow future development the potential leeway to incorporate and reconfigure smaller, low quality wetlands within proposed development areas into their proposed stormwater system, if it is not feasible to preserve them without disturbing their underlying soils.

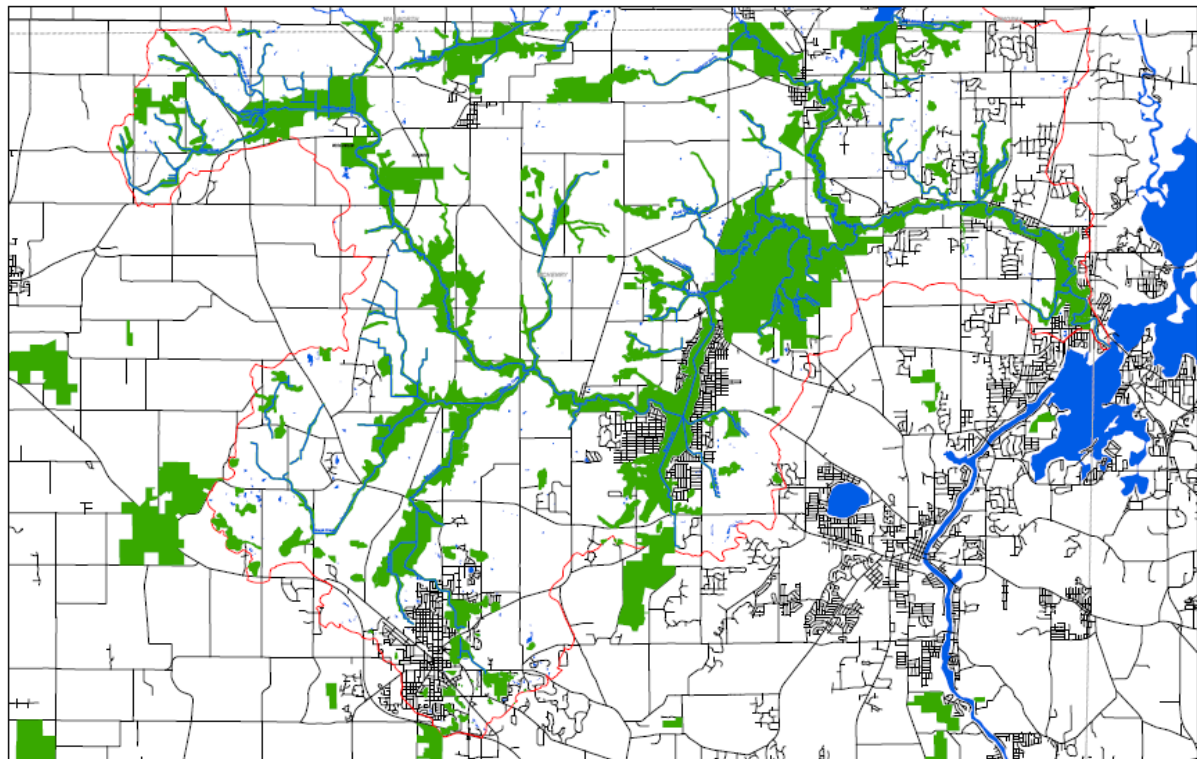
**Figure 17.4**      **MCCD properties and streams buffered 100 feet**



**Figure 17.5      Figure 17.4 with FEMA 100-Year Floodplain (mapped + Zone A floodplains)**

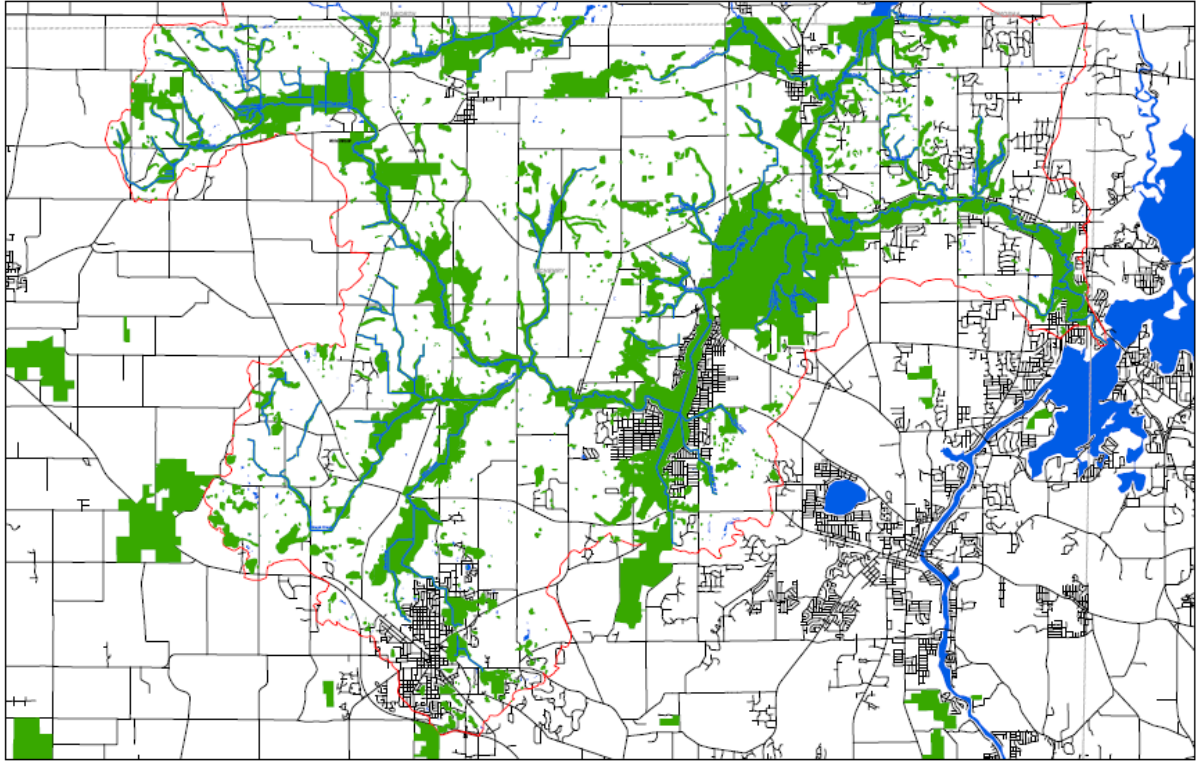


**Figure 17.6      Figure 17.5 with HQH & HFV Wetlands and HQ Lakes buffered 100 feet**

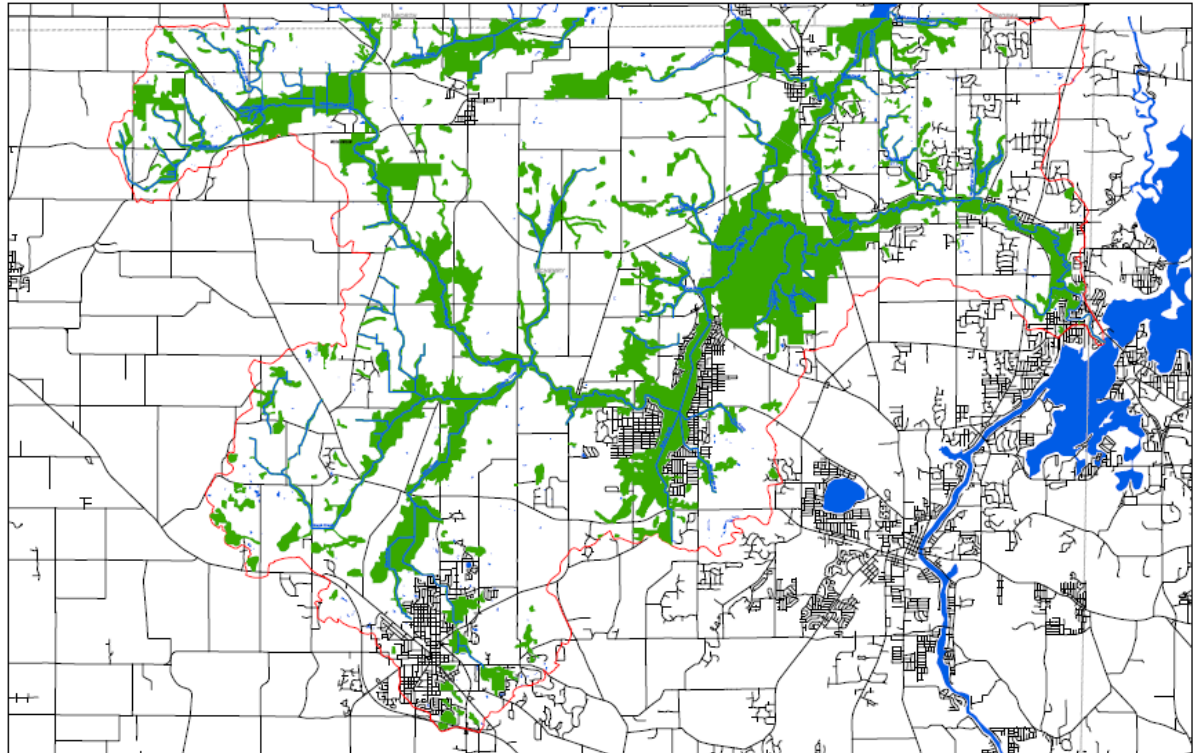




**Figure 17.7**      **Figure 17.6 with remaining ADID identified wetlands larger than one acre.**



**Figure 17.8**      **Proposed Green Infrastructure Boundary created from composite GIS datasets.**



## 17.4 Guidelines for Interfacing with and Utilizing Nippersink Creek's Green Infrastructure

Where development has already occurred in or immediately adjacent to existing natural areas or the stream corridor, the Green Infrastructure Plan can be used as a guide to promote the installation of modest sized buffers to protect those sensitive areas. More importantly, the presence of GIP areas on or adjacent to a particular parcel can make any proposed buffer creation / enhancement project more attractive to outside funding sources.

On parcels in which development is proposed for future construction, the Green Infrastructure Plan indicates the areas where the existing land features should be preserved and perhaps enhanced to receive and transport runoff much as it did in its natural, pre-development / pre-agricultural state.

## 17.5 Implementing the Green Infrastructure Plan

To help achieve the goals of the Nippersink Creek Watershed Plan, watershed units of government should review the Green Infrastructure Plan (GIP) criteria presented in this chapter and adopt their own GIP that their staff and prospective developers can use to design new developments that meet the goals and objectives of the Nippersink Creek Watershed Plan. **Because the green infrastructure boundaries presented in this plan were derived only from digital data layers and not site specific field data, they are intended to only depict the approximate boundary of GIP areas on any given parcel.**

The exact GIP boundary would need to be determined during the site planning process. However, the GIP is still extremely useful at this resolution to:

- inform prospective land buyers of areas on a given parcel that will likely be unavailable for development, allowing them to perhaps negotiate a more realistic purchase price,
- assist land planners and engineers during the concept planning stage of development to help locate areas within the proposed development which should remain undisturbed or require additional stormwater treatment to protect high quality sensitive areas.

The exact boundaries of the green infrastructure on a parcel planned for development should be determined early on during the development design stage using wetland and soil field investigations, and mapping of the true 100-Year floodplain (not Zone A approximations) on the project site using one foot contour interval topography. Wherever possible, isolated depressional areas (such as farmed wetlands) should be preserved and connected to the green infrastructure network using relatively undisturbed overland flow corridors.

### 17.5.1 Suggested Ordinance & Zoning Revisions

The following restrictions and requirements should be considered by the municipalities to incorporate the green infrastructure concepts into their ordinances and zoning designations:

- Review existing subdivision and zoning ordinances to determine if building densities could be offered to developers in exchange for them providing Green Infrastructure Plan elements in their proposed plans.
- Require developers to submit a delineated Green Infrastructure Boundary (GIB) on their development plans and provide a brief explanation of how existing green infrastructure will be protected or how the green infrastructure will be restored to provide enhanced ecological, water quality, and aesthetic benefits to the watershed.
- Restrict encroachment and disturbances in the Green Infrastructure Boundary (GIB) by new development. Allow disturbances only if they are absolutely necessary and in those cases enforce strict guidelines as to the amount of disturbance allowed and degree of site restoration required (along the lines of “put it back to a condition better than you found it”).
- Require stormwater facilities be constructed outside of the green infrastructure boundary and all stormwater discharges to the GIB occur via outlet systems designed to release runoff as sheet flow rather than concentrated point discharges from traditional storm sewer outfalls.
- If new development infrastructure, such as stormwater facilities, must be constructed within the GIB, then such facilities must be designed to maximize habitat and replicate the geometries of natural wetlands (shallow side slopes, native wetland vegetation, etc.)
- Where new development occurs near channelized stream corridors or isolated low quality wetlands, the development should be required to restore or enhance these features to replicate their pre-disturbed vegetative quality and hydrologic function
- Review existing landscape ordinances to ensure that property owners who maintain a GIP buffer are not cited for weed nuisance laws
- Review existing ordinances to ensure that prohibitions on landscape waste or pet waste disposal in GIP buffers exist, and can be enforced.

## **17.5.2 Landowner Outreach & Education on Green Infrastructure**

Outreach and education on the components of and benefits associated with the watershed's green infrastructure should occur at two levels.

### **17.5.2.1 Developers**

The Green Infrastructure Plan should be adopted by the municipal leaders and presented to developers as a guide to illustrate which existing landscapes the municipality values and desires to see them preserved or enhanced as part of development on a given parcel. The GIP should be made available to developers as soon as possible in the concept planning stage and developers should be encouraged to contact and coordinate with municipal staff to discuss the how the development will be designed to fit within the framework of the green infrastructure network.

### **17.5.2.2 Private Landowners**

It is recognized that existing buildings and manicured landscapes have already encroached into the Nippersink Creek's green infrastructure zone. Even in these areas, however, it is still possible for these landowners to implement Best Management Practices to help protect and enhance Nippersink Creek. Simple actions, such as not mowing lawn up to the edge of a stream or wetland, not disposing of yard waste on streambanks, or limiting fertilizer applications, can have beneficial water quality impacts. Going a step beyond and creating a buffer strip of native prairie grasses and wildflowers can provide increased benefits, as can creating rain gardens to capture stormwater runoff and allow it to infiltrate into the ground. Generally speaking, the wider the buffer strip is, the greater the potential water quality / wildlife habitat benefits. Buffer strip widths of 25 to 100 feet are often recommended, which may be feasible on larger parcels. However, even on a small residential lot, a buffer strip of maintained native vegetation, three to five feet in width, can be beneficial. Regardless of the buffer width, footpaths can be provided across the buffer to allow access to the stream or wetland.