Chapter 6
Glacial Park / Tamarack Farms Subwatershed Assessment

This section presents a summary of the characteristics of the Glacial Park / Tamarack Farms Subwatershed, as well as specific issues and challenges in this subwatershed that must be addressed in the Nippersink Creek Watershed Management Plan.

6.1 Subwatershed Characteristics

The following section provides an overview of the physical characteristics of the subwatershed.

6.1.1 Subwatershed Location

The Glacial Park / Tamarack Farms subwatershed is located downstream of Wonder Lake, in the eastern portion of the Nippersink Creek Watershed. This subwatershed has an area of 12,588 acres (19.67 square miles), comprising about 9.7% of the overall Nippersink Creek watershed. The boundary of the subwatershed is shown in Figure 6.1. The subwatershed is located within Richmond, McHenry, Hebron, and Greenwood Townships, and is roughly bordered by Wonder Lake on the south, Greenwood Road on the west, Illinois Route 173 on the north, and South Solon Road on the east.

Figure 6.1

Glacial Park / Tamarack Farms Subwatershed Location Map

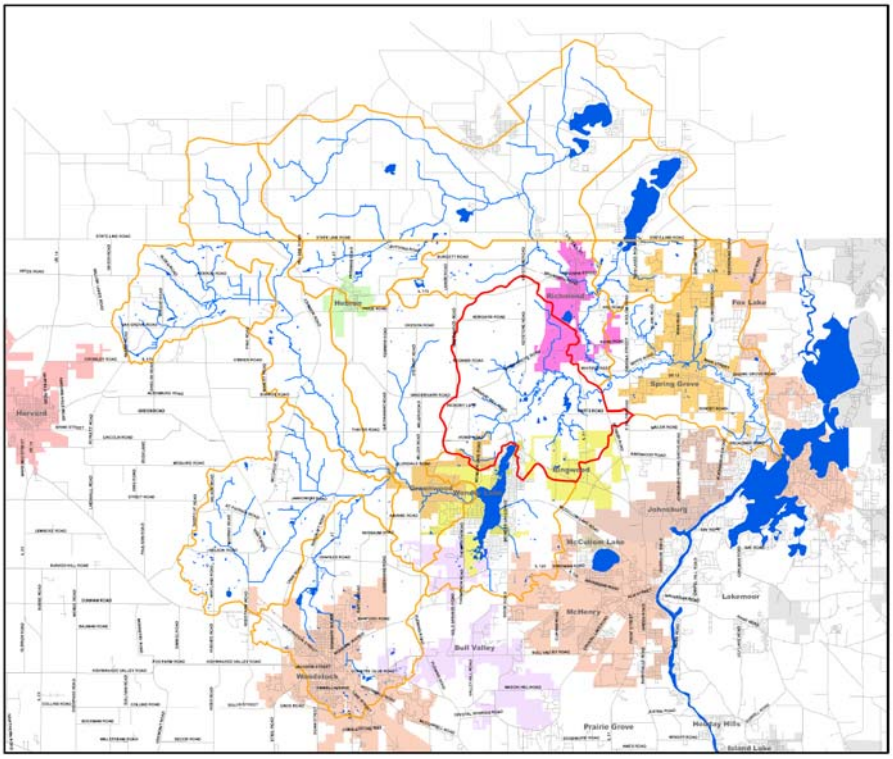
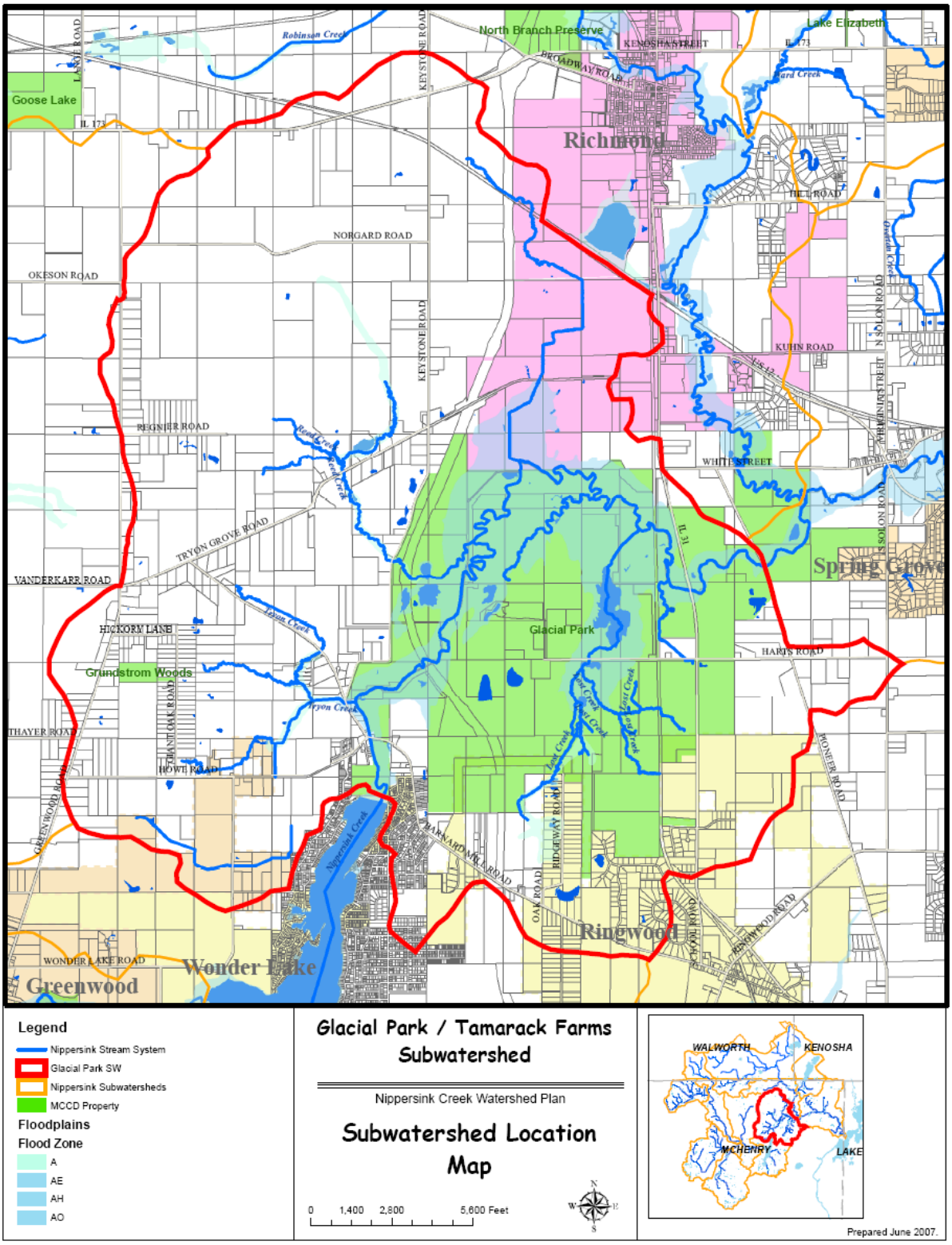


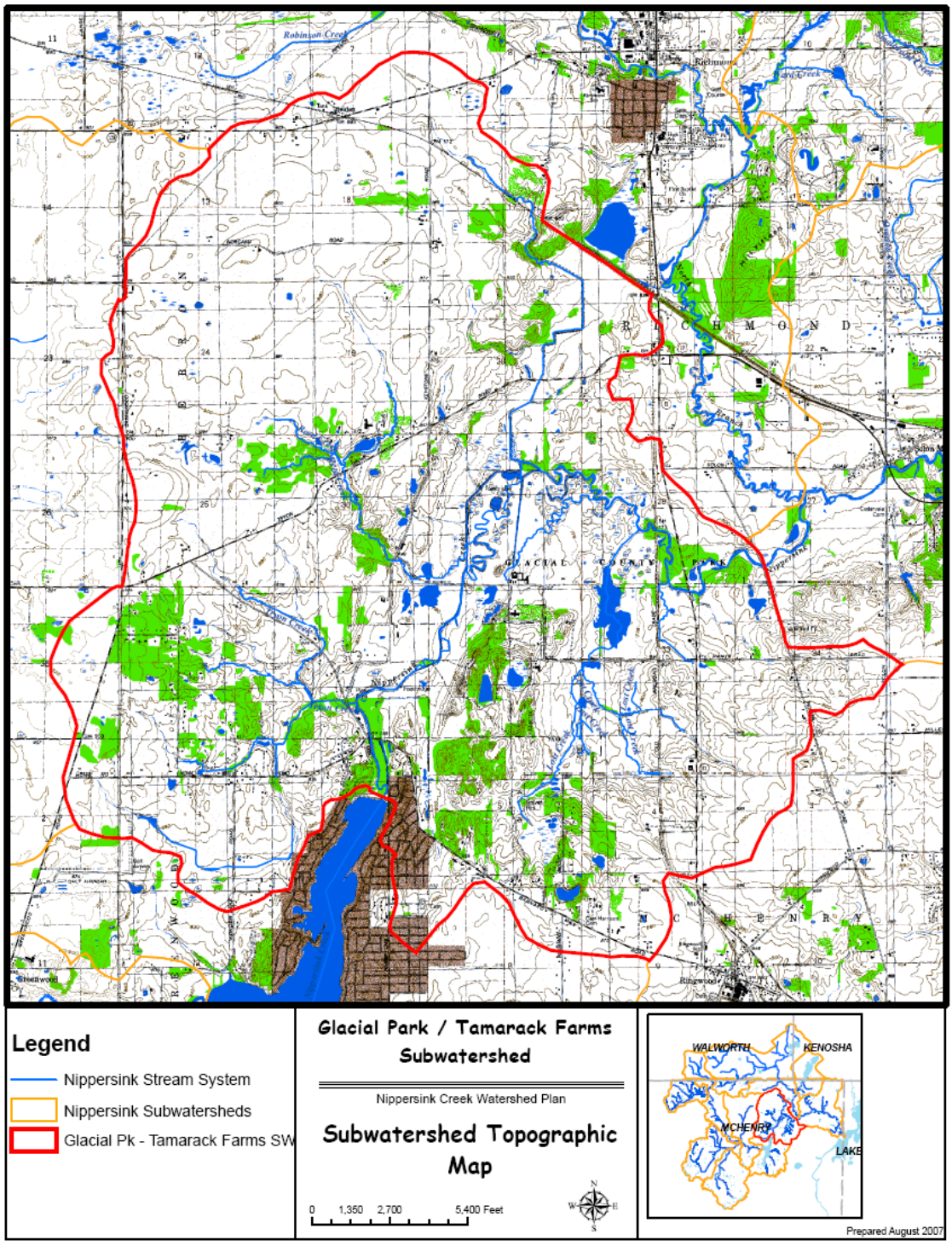
Figure 6.2 Glacial Park / Tamarack Farms Subwatershed Map



6.1.2 Topography & Geology

The topography of the Glacial Park / Tamarack Farms subwatershed is moderately sloping, generally between 2% and 4%, with a maximum elevation of 928 feet near Greenwood and Vander Karr Road, and a minimum elevation of 764 feet at the subwatershed outlet near Pioneer Road.

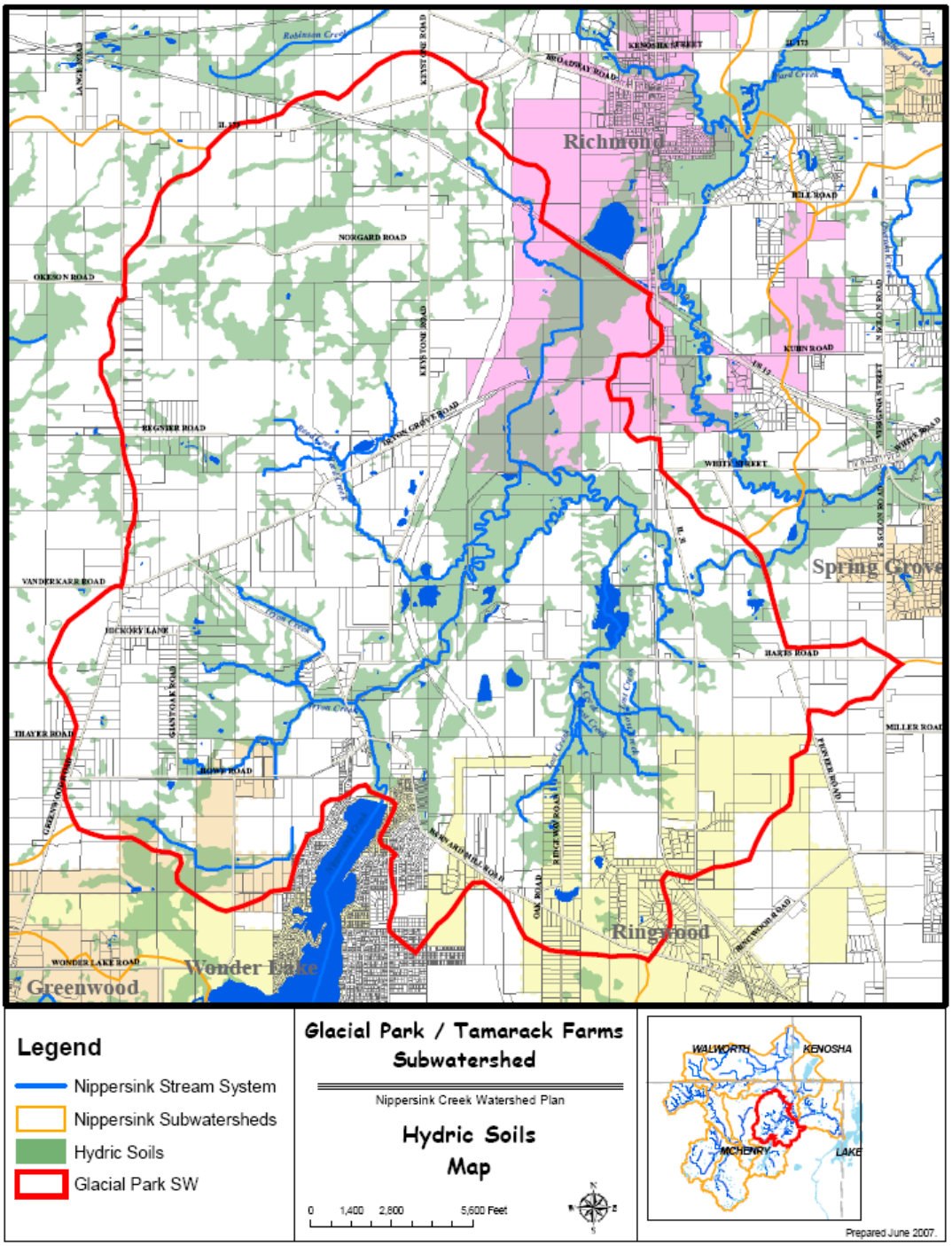
Figure 6.3 USGS Topographic Map of Glacial Park / Tamarack Farms Subwatershed



6.1.3 Soil Characteristics

The glacial advances across McHenry County resulted in a wide variety of soil associations. Each major grouping of soil associations has potential impact on current and future land uses within the subwatershed. For example, hydric (wetland) soils constitute 3,579 acres, or 34.3% of the 12,588 acre subwatershed, and indicate those areas that contain functional wetlands, or former / degraded wetland areas that could be restored or enhanced.

Figure 6.4 Hydric Soils of the Glacial Park / Tamarack Farms Subwatershed



6.1.4 Pre-Settlement Vegetation

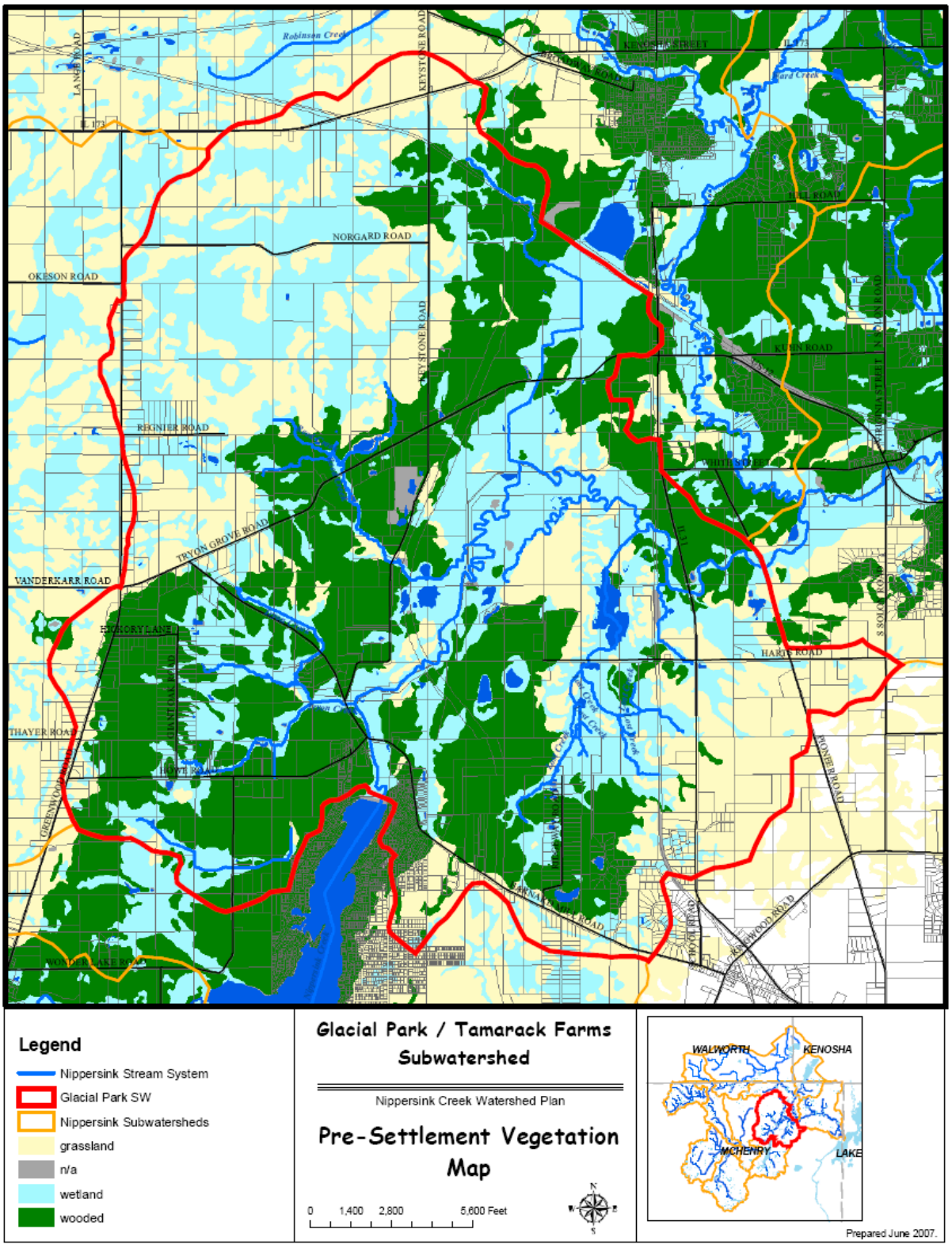
To guide future land management or restoration efforts, it is important to recognize the native plant communities that naturally evolved subsequent to the last glacial advances. Prior to European settlement in the 1830's, the Glacial Park / Tamarack Farms Subwatershed was roughly divided between grassland, woodlands, and wetlands, as depicted in Figure 6.5, The woodlands, largely comprised of oak / hickory woodland and savannah, were bisected with wetlands and grassland along the drainageways as shown in Table 6.1.

Table 6.1 Pre-Settlement Land Cover Conditions

Cover Type	Area	Percent of Subwatershed
Grasslands	3,475.0 acres	28 %
Wooded	4,542.5 acres	36 %
Wetlands	4,472.6 acres	36 %
n/a	97.9 acres	1 %

Source: MCCD Soils Analysis using GIS data

Figure 6.5 **Pre-settlement Vegetation Map in the Glacial Park / Tamarack Farms Subwatershed**



6.1.5 Subwatershed Drainage Features

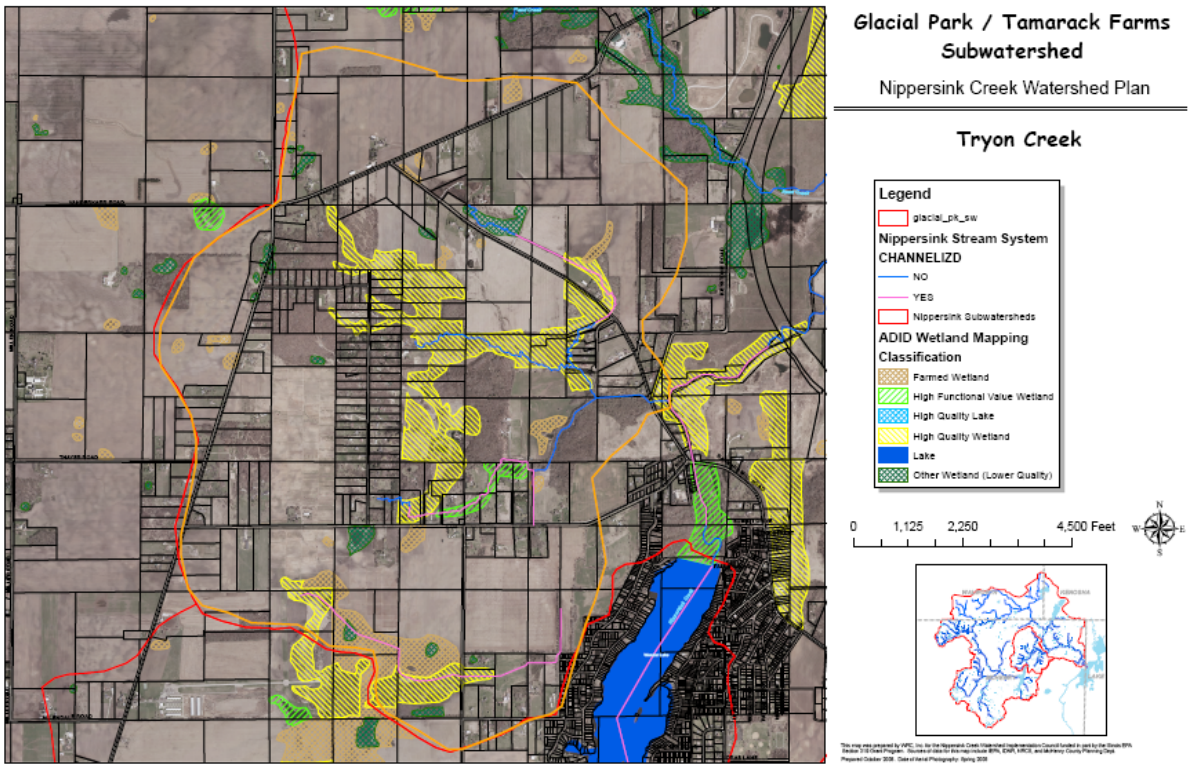
Streams

The principal stream in the Glacial Park / Tamarack Farms subwatershed is Nippersink Creek. There are four tributaries in the subwatershed: Lost Creek, Reed Creek and Tryon Creek, as well as two unnamed tributaries. This section describes the physical conditions of the streams in this subwatershed, including the stream corridor through which they flow.

In this subwatershed, Nippersink Creek flows for about 7.5 miles between the Wonder Lake Dam and Pioneer Road. Nearly the entire length of Nippersink Creek in this subwatershed is contained within the McHenry County Conservation District's (MCCD) 3,200 acre Glacial Park property. Historically, this stream had been subjected to extensive channelization to improve agricultural productivity, but in 2001, MCCD de-channelized and re-meandered several miles of the Nippersink. Most of the remaining channelization is located immediately upstream and downstream of Barnard Mill Road at the upstream end of the subwatershed.

Tryon Creek drains an area of 2,500 acres in the southwest region of the subwatershed. Tryon Creek originates in the agricultural field east of Greenwood Road, north of Tryon Grove Road. Tryon Creek has two tributaries which also drain the land south of Barnard Mill Road down to the farm fields on the south side of Howe Road.

Figure 6.6 Tryon Creek Area of Interest



Lost Creek, located in the eastern half of the subwatershed, drains about 1,900 acres north of the Village of Ringwood (west of Pioneer Road).

Reed Creek drains about 2,400 acres in the northwestern section of the subwatershed; generally the area between Greenwood Road, Tryon Grove Road, and Keystone Road. The stream corridor along Reed Creek is primarily wooded, except for the first mile which bordered by wetland and prairie on the Glacial Park property.

Manmade Drainage Systems

Analysis of land uses and aerial photography indicates that nearly all (90 %+) of the developed land is drained by a system of open channel turf grass swales and culverts. Limited field investigations suggest that the existing man-made storm water system was not designed or constructed to treat the runoff from developed areas prior to discharge to the sensitive streams and wetlands in the subwatershed.

Agricultural Tile Systems

Due to the predominantly agricultural nature of the subwatershed, it is likely that there many functioning underground drain tile systems remaining in the subwatershed, particularly in the western half of the subwatershed. Historically, these were the areas that had poor drainage characteristics, but that farmers could successfully convert to agricultural usage by the installation of agricultural drain tile systems.

Identifying agricultural drain tile networks is important in watershed planning because current local flooding and drainage problems can often be linked to damage or age-related failure of drain tile systems. From a watershed preservation / restoration perspective, it is important to identify functional drain tile systems to determine opportunities for their removal or reconfiguration for the purposes of restoring valuable wetland habitat, and water quality benefits.

It is probable that many of the depressional and low lying areas in the subwatershed that are now drained by tile systems were once wetland and wet prairie ecosystems that supported very diverse habitats.

6.1.6 Population

The use and analysis of population data in watershed planning is critical because there is a direct correlation between the number of people residing in a watershed and the degree of impacts to the quality and quantity of the watershed natural resources. In 1990, the population in the subwatershed was estimated at 2,235, or 115 persons per square mile.

According to the 2000 US Census, the population in the Glacial Park subwatershed was about 2,550 people, or about 131 persons per square mile. This represents a 14% increase in population over 10 years.

6.1.7 Land Cover

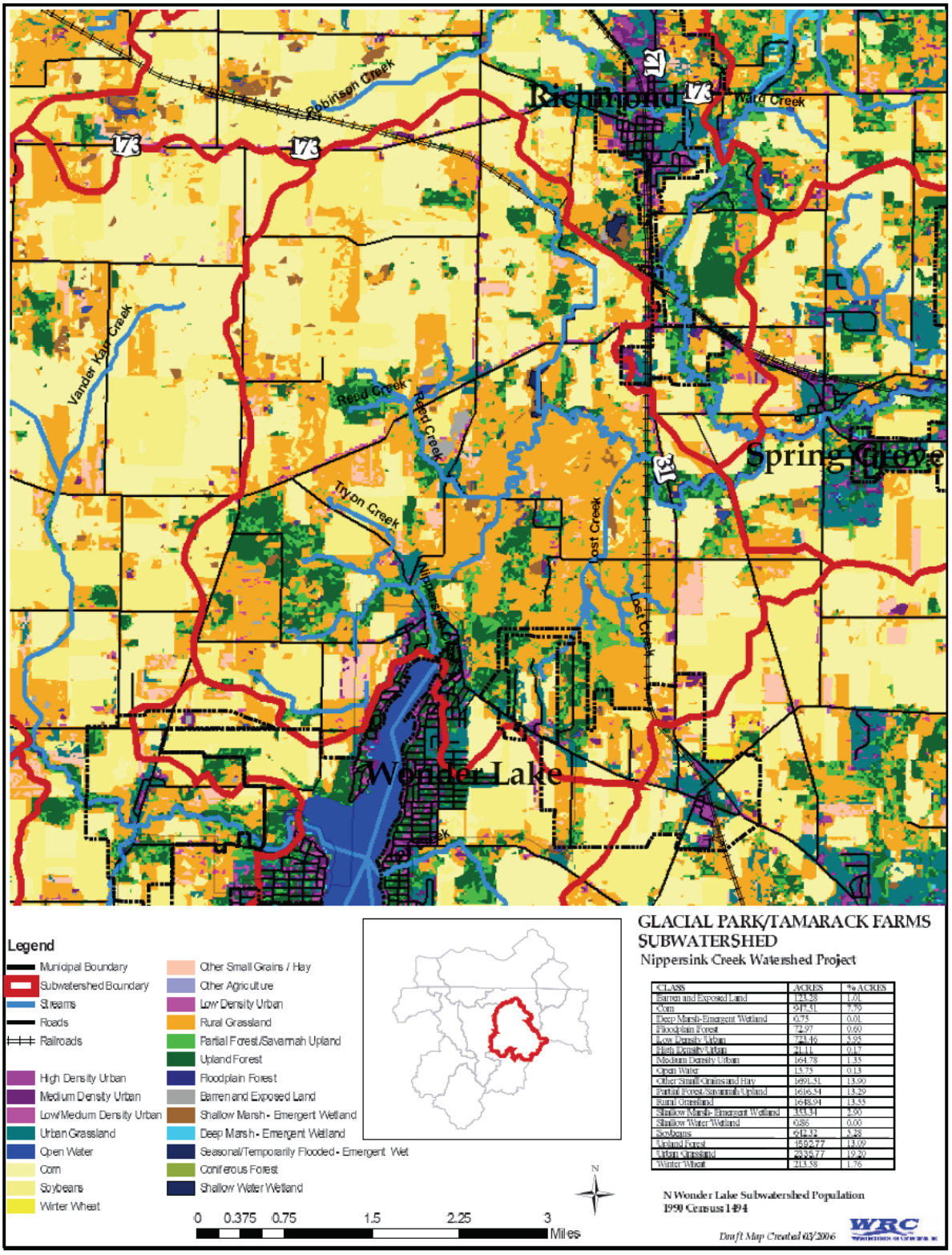
Often, the terms Land Cover and Land Use are used interchangeably. However, there are differences. Land Cover refers to the vegetation, structures, or other features that cover the land. On the other hand, Land Use (as discussed in Section 6.1.8) refers to how land is used by humans.

Land cover data for the Nippersink Creek Watershed are available from the Illinois Department of Natural Resources using LANDSAT data collected between 1998 and 1999. The dominant land cover, according to this data, was rural grasslands and agricultural row crops (78%). Urban landscapes accounted for roughly 4.5% of the Glacial Park / Tamarack Farms subwatershed area while wooded areas and wetlands account for an additional 7.5% of the subwatershed.

Table 6.2 1999 Land Cover for the Glacial Park / Tamarack Farms Subwatershed

Land Cover Description	Total Acres	Percent of Subwatershed
Barren & Exposed Land	54.1	0.4%
Corn, Soybeans, Other Small Grains & Hay	5,296.9	42.1%
Winter Wheat	7.2	0.1%
Rural Grassland	4,533.3	36.0%
Low Density Urban	131.6	1.0%
Medium Density Urban	93.9	0.7%
High Density Urban	11.7	0.1%
Urban Grassland	339.6	2.7%
Shallow Marsh – Emergent Wetland	180.2	1.4%
Shallow Water Wetland	18.8	0.1%
Partial Forest / Savanna Upland	681.2	5.4%
Upland Forest	1,182.5	9.4%
Floodplain Forest	36.1	0.3%
Deep Marsh / Emergent Wetland	2	0.0%
Open Water	19.1	0.2%
TOTAL	**12,588.2**	**100.0%**

Figure 6.7 1999-2000 Land Cover Map for Glacial Park / Tamarack Farms Subwatershed



CLASS	ACRES	% ACRES
Barren and Exposed Land	123.28	1.01
Corn	947.51	7.79
Deep Marsh-Emergent Wetland	6.75	0.01
Floodplain Forest	72.97	0.60
Low Density Urban	723.46	5.95
High Density Urban	21.11	0.17
Medium Density Urban	164.78	1.35
Open Water	15.75	0.13
Other Small Grains and Hay	1691.51	13.90
Partial Forest/Savannah Upland	1616.54	13.29
Rural Grassland	1648.94	13.55
Shallow Marsh- Emergent Wetland	333.34	2.50
Shallow Water Wetland	0.86	0.00
Soybeans	642.32	5.28
Upland Forest	1592.77	13.09
Urban Grassland	2335.77	19.20
Winter Wheat	213.58	1.76

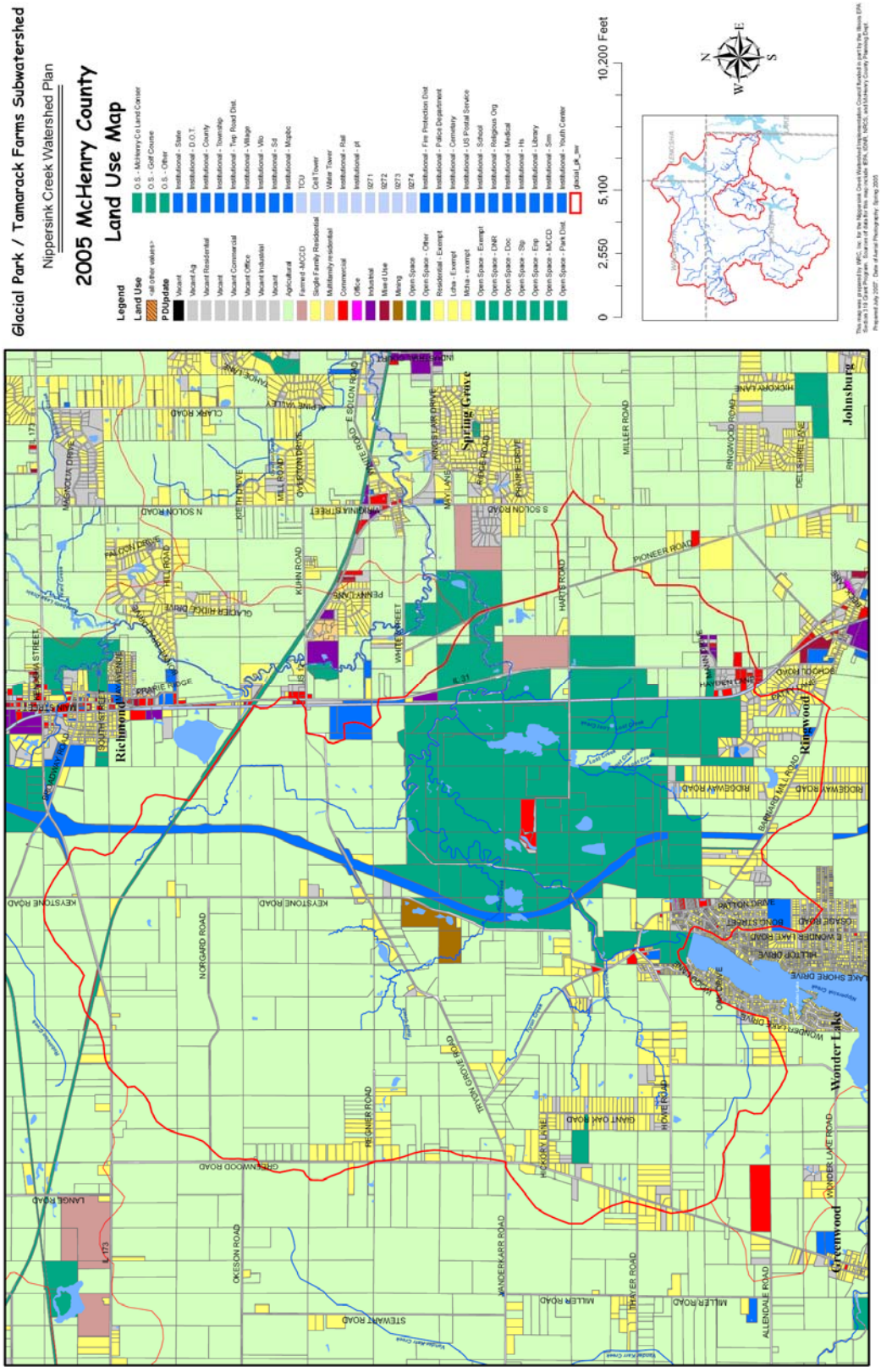
6.1.8 Land Use / Existing Watershed Development

According to the 2005 McHenry County Land Use / Zoning map, 63% of the subwatershed is zoned for agricultural use, while about 16% is either already developed or zoned for development in the future. Almost 21% is classified as open space.

Table 6.3 McHenry County 2005 Land Use for the Glacial Park / Tamarack Farms Subwatershed

Land Use	Total Acres	Percent of Subwatershed
Vacant	0.15	0.0%
Vacant; Zoned Residential	226.4	1.8%
Vacant; Zoned Commercial	31	0.2%
Vacant; Zoned Office	0.6	0.0%
Vacant; Zoned Industrial	9.1	0.1%
Agricultural	7,939.2	63.1%
Single Family Residential	982.8	7.8%
Multi-Family Residential	0	0.0%
Commercial	60.6	0.5%
Office	0.9	0.0%
Industrial	13.3	0.1%
Mixed Use	1.5	0.0%
Mining	69.7	0.6%
Open Space	2611	20.7%
Institutional	284.1	2.3%
Right of Way	357.8	2.8%
TOTAL	**12,588.2**	**100.0%**

Figure 6.8 **2005 McHenry County Land Use Map for Glacial Park / Tamarack Farms Subwatershed**



Development in the subwatershed has occurred principally through municipal annexation, in the form of low density development (1/2 acre to 1 acre lots).

Table 6.4 Municipal Areas in the Glacial Park / Tamarack Farms Subwatershed

Municipality	Area (acres)	Percent of SW
Village of Ringwood	946	7.5%
Village of Richmond	875	7.0%
Village of Greenwood	286	2.3%
Village of Wonder Lake	46	0.4%
Unincorporated McHenry County	10,435	82.9%

There are 40.2 miles of roads in the subwatershed, which equates to more than 135 acres of impervious cover (roadway pavement only – excludes parking lots, sidewalks, and driveways).

Point Source Discharges

There is no point source discharges into Nippersink Creek in the Glacial Park / Tamarack Farms Subwatershed.

6.1.9 Natural Resources

McHenry County Conservation District Properties

There are four McHenry County Conservation District properties in the subwatershed, totaling about 2,955 acres, or 23% of the Glacial Park / Tamarack Farms subwatershed area.

Table 6.5 MCCD Properties in the Glacial Park / Tamarack Farms Subwatershed

Name	Area in SW (acres)	Total MCCD Property Area
Glacial Park	2,932.5	3,264.2
Gunderstrom Woods	22.8	22.8
Total	**2,955.3**	

Other Publicly Protected Land

There is a proposed roadway alignment running north-south through the center of the subwatershed that was assembled to allow a divided highway linkage to Route 12 at the Wisconsin state line. Much of this alignment, owned by the State of Illinois, passes through Glacial Park.

Table 6.6 Other Publicly Protected Land in the Glacial Park / Tamarack Farms Subwatershed

Name	Area (acres)	# of Parcels
State of Illinois	182.5	8

McHenry County Natural Areas Inventory

There are four McHenry County Natural Area Inventory Sites within the subwatershed, representing about 35% of the entire subwatershed.

Table 6.7 McHenry County Natural Areas Inventory Sites in the Glacial Park / Tamarack Farms Subwatershed

MCNAI Site ID	Name	Area in SW (acres)	Total NAI Site Area	Ownership
GRE02	Blanding's Turtle Meadow	28.9	28.9	Private
GRE04	Galt Airport Sedge Meadow	15.8	47.9	Private
HEB07	Tryon Creek Wetlands	186.4	186.4	Private
RIC01	Cowpie Creek Fen	12.5	12.5	Private
RIC06	Glacial Park	4,153.7	4,673.8	Public / Private
	TOTAL	**4,397.3**		

Wetlands

McHenry County completed an Advanced Identification (ADID) Wetland Study in 2003. This study identified a total of 129 wetlands, totaling 1,725 acres, or 13.7% of the Glacial Park / Tamarack subwatershed. Of these wetlands, 1,310 acres (76%) were determined to be of High Quality.

Table 6.8 Mapped Wetland Summary for Glacial Park / Tamarack Farms Subwatershed

ADID Code	Wetland Type	Number of Wetlands	Total Area (acres)
HFV	High Functional Value	11	190.3
HQW	High Quality Wetland	12	1,309.8
FW	Farmed Wetland	56	190.3
W	Other Wetlands (lower quality)	50	225.3
	TOTAL	**129**	**1,725.4**

Threatened & Endangered Species

Threatened and Endangered (T&E) species data were extracted from T&E data records documented in the McHenry County Natural Areas Inventory Database. The data were collected by the McHenry County Conservation District during field studies undertaken at subwatershed Natural Area Inventory Sites. The data indicate that there are at least eighteen threatened or endangered animal species living in the subwatershed and at least nine different T&E plant species.

Table 6.9 Threatened and Endangered Species in the Glacial Park / Tamarack Farms Subwatershed

Common Name	Scientific Name	Type	Status	MCNAI Site
Henslow's Sparrow	Ammodramus henslowii	Bird	St Threatened	RIC06
Upland Sandpiper	Bartramia longicauda	Bird	St Endangered	RIC06
Black Tern	Chlidonias niger	Bird	St Endangered	RIC06
Northern Harrier	Circus cyaneus	Bird	St Endangered	RIC06
Common Moorhen	Gallinula chloropus	Bird	St Threatened	RIC06
Sandhill Crane	Grus Canadensis	Bird	St Threatened	RIC06
Least Bittern	Ixobrychus exilis	Bird	St Threatened	RIC06
Black-Crowned Night-Heron	Nycticorax nycticorax	Bird	St Endangered	RIC06
King Rail	Rallus elegans	Bird	St Endangered	RIC06
Forster's Tern	Stema forsteri	Bird	St Endangered	RIC06
Yellow-Headed Blackbird	Xanthocephalus xanthocephalus	Bird	St Endangered	RIC06
Regal Fritillary	Speyeria idalia	Butterfly	St Threatened	RIC06
River Redhorse	Moxostoma carinatum	Fish	St Threatened	RIC06
Blacknose Shiner	Notropis heterolepis	Fish	St Endangered	RIC06
Slippershell Mussel	Alasmidonta viridis	Mussel	St Threatened	RIC06
Purple Wartyback Mussel	Cyclonaias tuberculata	Mussel	St Threatened	RIC06
Spike Mussel	Elliptio dilatata	Mussel	St Threatened	RIC06
Blanding's Turtle	Emydoidea blandingii	Reptile	St Threatened	RIC06
White Lady's Slipper	Cypripedium candidum	Plant	St Threatened	RIC06
Round-Leaved Sundew	Drosera rotundifolia	Plant	St Endangered	RIC06
Rusty Cotton Grass	Eriophorum virginicum	Plant	St Endangered	RIC06
Tamarack	Larix laricina	Plant	St Threatened	RIC06
Pale Vetchling	Lathyrus ochroleucus	Plant	St Threatened	RIC06
Savanna Pinweed	Lechea intermedia	Plant	St Threatened	RIC06
Eastern Prairie Fringed Orchid	Platanthera leucophaea	Plant	St Endangered / Fed Threatened	RIC06
Large Cranberry	Vaccinium macrocarpon	Plant	St Endangered	RIC06
Dog Violet	Viola conspersa	Plant	St Threatened	RIC06

Source: McHenry County Natural Areas Inventory Database, 2005

Existing Greenways

Although there are no formal greenways in the Glacial Park Subwatershed, more than 13 miles of Nippersink Creek and its tributaries are protected from disturbance due to acquisition by the McHenry County Conservation District. There is also a regional bicycle trail created from a former railroad alignment that runs roughly parallel to Route 31. Called the "Prairie Trail", this path extends across McHenry County from Kane County on the south to Wisconsin on the north. This trail connects eight McHenry County communities, and links to over 100 mile of other trails.

6.2 Analysis of Subwatershed Data and Problem Identification

6.2.1 Water Quality Data & Identified Problems

The Illinois Environmental Protection Agency (IEPA) is tasked with assessing the quality of the surface water resources of Illinois. The IEPA has determined Nippersink Creek's designated uses are:

- Aquatic Life
- Fish Consumption
- Primary Contact
- Secondary Contact
- Aesthetic Quality

The IEPA periodically produces a 303(d) list, which identifies waterways that are not achieving certain designated uses. In the 2006 IEPA 303(d) list, Nippersink Creek is identified as being in Full Support of its Aquatic Life Designated Use, which is notable for a stream in northeastern Illinois.

However, Nippersink Creek was also determined to be Non-supporting of its Primary Contact Designated Use, due to excessive levels of fecal coliform. This pollutant, associated with human and animal waste, was listed as coming from an unknown source. The IEPA also identified fish consumption, secondary contact and aesthetic quality as designated uses for Nippersink Creek, although the ratings for these uses were classified as "not assessed".

The Illinois Environmental Protection Agency maintains one water quality sampling station in the Glacial Park / Tamarack Farms subwatershed.

Table 6.10 IEPA Water Quality Sampling Stations in the Glacial Park / Tamarack Farms Subwatershed

Station	Stream	Location
DTK02	Nippersink Creek	Nippersink Creek at Barnard Mill Road

The Fox River Watershed Monitoring Network (FRWMN), administered by the not-for-profit group, *Friends of the Fox River*, maintains four volunteer stream monitoring sites on Nippersink Creek; one is located in the Glacial Park / Tamarack Farms subwatershed at the Keystone Landing on the southwest side of Glacial Park. During 2005 and 2006 monitoring periods, FRWMN volunteers reported water quality index values (based on macroinvertebrate sampling) as Fair (Taxa rating between 14 and 20).

6.2.2 Flooding Problems

At the time of this writing, no data were provided by the County or municipalities regarding existing flooding problems. Analysis of available floodplain information suggests that there may be as many as six homes in the FEMA 100-year Floodplain. The majority of these homes are located along Barnard Mill Road, at the upstream end of the subwatershed.

6.2.3 Projected Development & Growth

Development in the Glacial Park / Tamarack Farms subwatershed is expected to increase from 4.5% in 2000 to at least 15% in the near future. The Village of Greenwood has about 150 acres of undeveloped land within its current municipal boundary. The Village of Richmond has more than 860 acres of undeveloped land within its current boundaries in the subwatershed. The Village of Ringwood has more than 380 acres of undeveloped land within its borders in the subwatershed. This additional 1,400 acres represents about 11% of the subwatershed that is currently in agricultural use.

NIPC population projections for 2030 indicate that Ringwood's population will increase from 471 (2000 census) to 1,890 (300% increase). Richmond's population is expected to increase from 1,091 to 15,059 (1,280% increase). It is reasonable to expect that at least one-third of the additional 15,387 future residents of these municipalities will reside within the subwatershed.

6.2.4 Natural Area Protection / Preservation Issues

McHenry County Natural Area Inventory Sites

In the Glacial Park / Tamarack Farms subwatershed, about 60% of the high quality ADID wetlands are protected through public ownership (791 of 1,308 acres on MCCD property). In addition, a 330 acre parcel within the MCCD property was dedicated as an Illinois Nature Preserve in 1992.

Glacial Park / Tamarack Farms (MCNAI RIC06) is the largest MCNAI site in the Nippersink Watershed. About 90% of this 4,674 acre site is in the subwatershed; however, only 58% of the MCNAI site is protected within the MCCD Glacial Park property. This site has natural features such as mesic, dry mesic, and wet silt loam prairies; silt loam barrens; basin and streamside marshes; graminoid fens; sedge meadows; a low shrub bog; and a dry mesic silt loam woodland.

The MCNAI database indicates that the Glacial Park / Tamarack Farms NAI site is currently impaired by bank erosion along Nippersink Creek and its tributaries; siltation; carp; water table alteration; brush encroachment; invasive species (Garlic Mustard, Purple Loosestrife and Reed Canary Grass) and development – particularly on the north end of the MCNAI site.

Cowpie Creek Fen (MCNAI RIC01) is a 12.5 acre, privately owned graminoid fen located near Tryon Grove Road in Richmond Township. The MCNAI database indicates that this natural area is being degraded due to water table alteration, siltation, and brush encroachment.

The Galt Airport Sedge Meadow (MCNAI GRE04) is 48 acre sedge meadow located at the east end of the Galt Airport in Greenwood Township. About 16 acres of this MCNAI site is in the subwatershed and none of the MCNAI site has any type of permanent protection from future disturbances. The MCNAI database lists this wetland as being impacted by water table alteration and brush encroachment.

Blanding's Turtle Meadow (MCNAI GRE02), is a 29 acre wetland just east of the Galt Airport Sedge Meadow. This MCNAI site is on private property and is listed as being degraded due to water table alteration and brush encroachment.

Tryon Creek Wetlands (MCNAI HEB07) is a 186 acre sedge meadow complex that spans the stream corridors of Tyron Creek and its tributaries near Giant Oak Road. The natural areas at this site are located on private property (mostly large-lot / rural residential) and according to the MCNAI database are not actively managed and therefore are being overgrown with brush. Water table alteration was also listed as an on-going management problem at this site.

6.3 Subwatershed-Specific Recommendations to Protect Water Resources

The following section discusses the Best Management Practices (BMP's) identified for this subwatershed that should be implemented to address existing or potential water quality impairments. The location of each recommended BMP project is presented in Figure 6.9

Pollutant Loading Modeling, as discussed in Chapter 3, identified current and future pollutant loadings, based upon land use, soils, slopes, etc., and quantified these loadings. The results of this Pollutant Loading modeling were then used to identify the types of BMP's that should be implemented to create a loading reduction of those pollutants. Table 6.11 presents a summary of the recommended BMP projects, as well as the expected pollutant loading reductions expected if the BMP's are implemented, and function as intended.

Table 6.12 presents detailed cost and logistical information on each of the recommended BMP projects. Below is a summary list of recommendations for the subwatershed to help stakeholders and decision makers meet the Goals and Objectives set forth for Nippersink Creek. Background information regarding how each type of recommendation addresses watershed concerns and/or impairments (existing or future) can be found in Chapter 4.

Type:	Education / Outreach; Regulatory; Site Restoration; Monitoring; Permanent Habitat Protection, Water Quality
Target Goals:	Which watershed plan goals the recommendation is intended to address.
Initial Implementation Cost:	The initial cost, in 2007 dollars to initiate the recommended action, if applicable.
Initial Outreach Cost:	The initial cost, in 2007 dollars to initiate the recommended action, if applicable.
Annual Cost:	The long term expected annual cost (in 2007 dollars) to successfully implementation of the recommendation
Responsible Party:	Identifies the LEAD agency, entity, or landowner who will ultimately have to execute the recommendation. SUPPORTING parties, such as government agencies, grant sources, etc. may also be identified here.
Priority:	A ranking of the BMP recommendations, based upon the nature / urgency of the existing / potential impairment; the availability of willing landowners)/ partners; short-term vs. long-term development pressure; and whether the project is a new effort, or a retrofit of an existing practice.

The project cost estimates contained in this report should be considered preliminary, and are only presented to identify the potential magnitude of cost, from a watershed scale perspective. No site-specific investigation, analysis, or design of any recommended project, from which accurate cost information could be obtained, was completed as part of the preparation of the 2008 Nippersink Creek Watershed Plan.

If a watershed stakeholder decides to apply for grant funding assistance to implement any of the recommended projects presented in this report, they should first undertake any additional studies / research needed to determine an updated / accurate project cost. They should not solely rely on the cost estimates presented in the NCWP report as the basis for their grant request.

Note: The following acronyms for responsible parties identified in Table 6.12 are presented below:

NCWPC	Nippersink Creek Watershed Planning Committee
NRCS	Natural Resource Conservation Service
SWCD	McHenry County Soil and Water Conservation District
MCCD	McHenry County Water Conservation District
TLC	The Land Conservancy of McHenry County
MCDEF	McHenry County Defenders
MPOA	Wonder Lake Master Property Owners Association
USFWS	U.S. Fish and Wildlife Service
NPS	National Park Service

Figure 6.9 **Glacial Park / Tamarack Farms Subwatershed Site Recommendations Map**

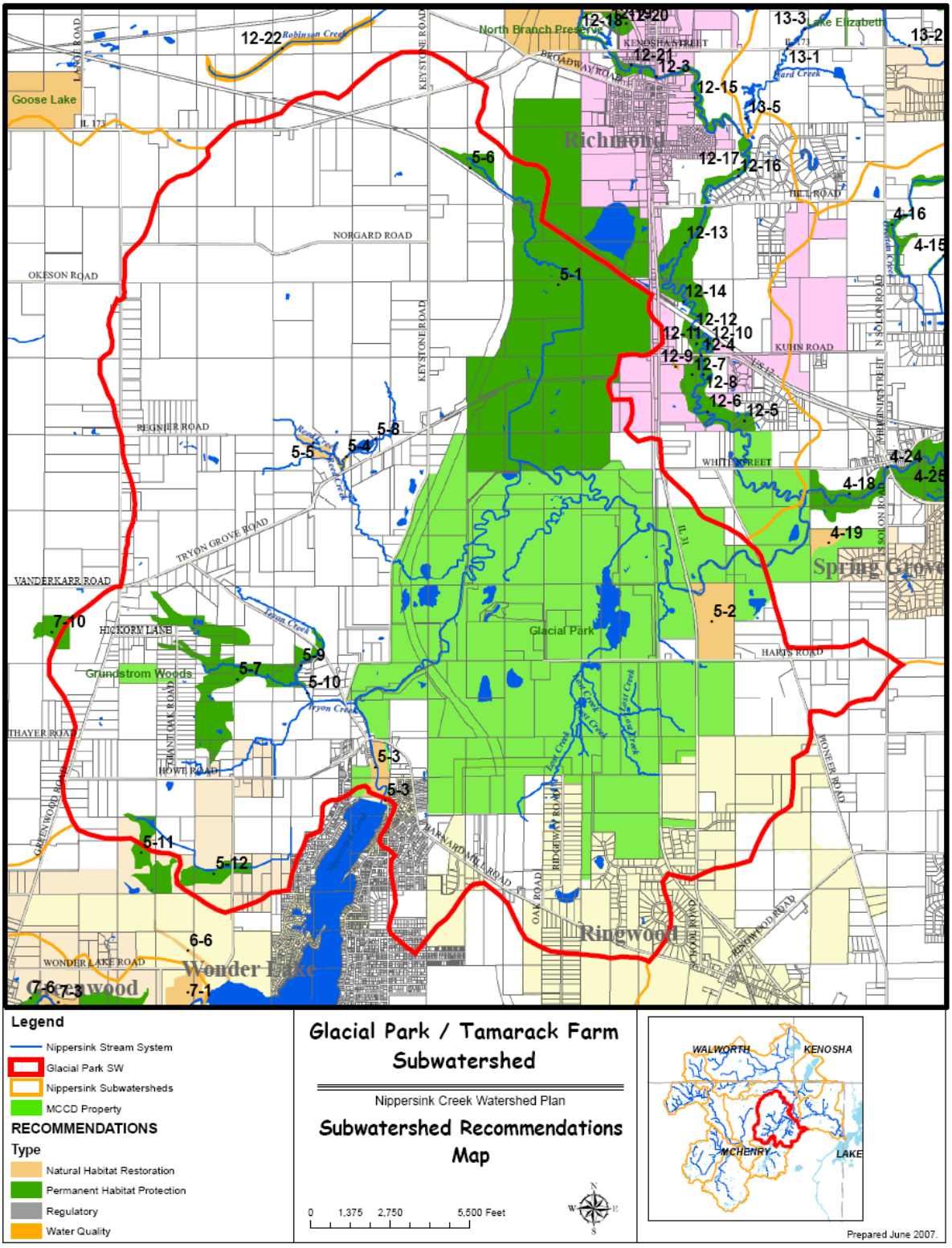


Table 6.11 BMP Selection & Associated Pollutant Load Reduction for the Glacial Park / Tamarack Farms Subwatershed

BMP	Type of BMP	Project Locations**	BMP		Removal Efficiency***			(lbs/year)****			Percentage Reduction		
			Size	Unit	TN	TP	TSS	TN	TP	TSS	TN	TP	TSS
Natural Habitat Protection	Watershed-specific	5-2, 5-3, 5-5, 5-8, 5-10	121	acres	30%	35%	60%	745	46	52	1.4	1.7	2.9
Dam Removal / Modification	Site-specific	5-3, 5-8, 5-10	1	lump sum	0%	0%	0%	0	0	0	0	0	0
Permanent Habitat Protection	Site-specific	5-1, 5-6, 5-7, 5-9, 5-11, 5-12	1,238	acres	53%	51%	88%	13,470	685	774	26.1	25.1	43.3
Regulatory*	Watershed-specific	Subwatershed	1	Water-shed	5%	5%	5%	2,583	137	89	5	5	5
Nutrient Management	Watershed-specific	Subwatershed wide	100	acres	70%	28%	-	1,437	30	-	2.8	1.1	-
Stream Corridor Restoration	Sub-watershed	5-4, 5-6, 5-8, 5-9	27	acres	53%	51%	88%	294	15	17	0.6	0.5	0.9
Total								18,530	913	932	35.9	33.4	52.1

*Regulatory programs are assumed to have nominal pollutant reduction rates of 5%.

** Project locations and details are described in the corresponding chapter.

*** TN = total Nitrogen; TP = total Phosphate; TSS = total suspended solids or Sediment.

**** The unit of “TSS” is “Tons/year”.

***** The cost indicates the review/investigation fee only.

Table 6.12 Recommended Projects in the Glacial Park / Tamarack Farms Subwatershed

SUB WATERSHED	RECOMMENDATION #	TARGET GOAL	DESCRIPTION	RESPONSIBLE PARTY	ACRES	UNIT COST	INITIAL IMPLEMENTATION COST	INITIAL OUTREACH COST	ANNUAL MAINTENANCE COST	PRIORITY	
Glacial / Tamarack	5-1	Permanent Habitat Protection	Possible land acquisition for proposed Hack-ma-Tack National Wildlife Refuge (also may extend into WI part of watershed)	USFWS / NPS							G
Glacial / Tamarack	5-2	Natural Habitat Restoration	**MCCD Glacial Park (Stade Parcel)** ditch closure, brush removal, tile removal, seeding 80 acres	MCCD	79.5	$2,500	$198,745				A
Glacial / Tamarack	5-3	Natural Habitat Restoration	Install fish passage structure at Wonder Lake Dam	NCWPC / MPOA / MCCD			$175,000	$1,500	$8,750		E
Glacial / Tamarack	5-3	Natural Habitat Restoration	**MCCD Glacial Park** Restore the wetlands / stream below the spillway of Wonder Lake dam to Barnard Mill Road.	MCCD	26.4	$2,500	$65,945				A
Glacial / Tamarack	5-4	Water Quality	Landowner Outreach to prevent livestock intrusion into streams and develop a Manure Management Plan	NCWPC / NRCS / SWCD	5.2	$1,500	$7,820	$500			F
Glacial / Tamarack	5-5	Natural Habitat Restoration	Landowner Outreach to manage siltation and brush encroachment at Cowpie Creek Fen (MCNAI RIC01)	NCWPC / TLC / MCDEF	12.7	$3,000	$38,214	$1,000	$1,274		D
Glacial / Tamarack	5-6	Permanent Habitat Protection	Landowner / Government Outreach for Conservation Design for parcel to protect headwater stream corridor	NCWPC / TLC / VILLAGE OF RICHMOND	22.1	$500	$11,049	$1,000	$552		B
Glacial / Tamarack	5-7	Permanent Habitat Protection	Landowner Outreach to protect and restore 186 acre Tryon Creek Wetland (MCNAI HEB07)	NCWPC / TLC / MCDEF	183.2	$2,500	$457,920	$1,500	$18,317		C
Glacial / Tamarack	5-8	Natural Habitat Restoration	Landowner Outreach to identify possible on-stream dam and investigate feasibility of modifying it for fish passage, create Stream Buffer and Conservation Easement	NCWPC			$20,000	$1,000	$1,000		E
Glacial / Tamarack	5-9	Permanent Habitat Protection	Landowner Outreach to create Conservation Easement to protect High Quality ADID Wetland and restore Stream Buffer	NCWPC / TLC	0.2	$3,000	$579	$500	$19		D

Table 6.12 Recommended Projects in the Glacial Park / Tamarack Farms Subwatershed

SUB WATERSHED	RECOMMENDATION #	TARGET GOAL	DESCRIPTION	RESPONSIBLE PARTY	ACRES	UNIT COST	INITIAL IMPLEMENTATION COST	INITIAL OUTREACH COST	ANNUAL MAINTENANCE COST	PRIORITY
Glacial / Tamarack	5-10	Natural Habitat Restoration	Landowner Outreach to identify possible on-stream dam and investigate feasibility of modifying it for fish passage, create Stream Buffer and Conservation Easement	NCWPC / TLC			$20,000	$1,000	$1,000	E
Glacial / Tamarack	5-11	Permanent Habitat Protection	Landowner / Government Outreach to protect and restore 48 acre Galt Airport Sedge Meadow MCNAI GRE04 site	NCWPC / VILLAGE OF GREENWOOD / TLC / MCDEF	47.1	$2,500	$117,798	$1,000	$4,712	C
Glacial / Tamarack	5-12	Permanent Habitat Protection	Landowner / Government Outreach to protect and restore 29 acre Blandings Turtle Meadow MCNAI GRE02 site	NCWPC / VILLAGE OF GREENWOOD / TLC / MCDEF	28.2	$2,500	$70,588	$1,000	$2,824	C
				SW TOTALS	**404.6**		**$1,183,656**	**$10,000**	**$38,448**	

PRIORITY

- **A Projects that have cooperating partners, can move to implementation quickly. Implementation Timeframe 1 to 3 years**
- **B Projects subject to imminent development pressure, Implementation Timeframe 1 to 2 years**
- **C Projects needed to protect sensitive areas. Timeframe 1 to 2 years**
- **D Restoration projects, Timeframe 1 to 5 years**
- **E Retrofit Projects, Timeframe 1 to 5 years**
- **F Existing Pollution Potential, Timeframe 1 to 2 years**
- **G Policy / Opportunity Review Project, Timeframe 1 to 3 years**