Mackinaw River Project

Mackinaw River Subwatershed Management Plan

Henline Creek

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Table of Contents

Component #1
Mission Statement

> *We intend to preserve and enhance the natural resources of the Mackinaw River watershed through education, good management practices and voluntary cooperation while respecting property owner rights.*

The Mackinaw River Watershed Council adopted this mission statement in 1996. Restoration is a strong component of enhancement and is included in the goals, objectives, and strategies of this subwatershed plan.

Component #2
Watershed Description

Henline Creek is a third order tributary of the Mackinaw River (Short et al. 1996). The Creek flows through McLean County, though the watershed extends into Ford and Livingston Counties. The mouth of the Creek is located about four miles west of Colfax at Mackinaw River mile 105.4 (Short et al. 1996). The major portion of the length of the creek was constructed by digging a channel and creating spoil berms on the sides (J. Rutherford, McLean County SWCD, personal communication 1999). The open ditch stops at the McLean/Ford County line; there is only field tile drainage in Ford County.

The drainage area of Henline Creek is approximately 40.6 square miles (25,951 acres), or about 3.6% of the drainage area for the entire Mackinaw River (IDNR CTAP 1997). The creek is 14.42 miles long (Illinois EPA 1996). There are 38.9 river miles within the watershed (IDNR CTAP 1997). The watershed and its location within the larger Mackinaw River watershed are illustrated in Map 1.

The state waterbody identification number is ILDKV01 (Illinois EPA 1996). The watershed delineation includes the McLean, Ford and Livingston counties' hydrologic unit river basin number 07130004; McLean county watershed number 080 and subwatershed number 6, Ford county watershed number 010 and subwatershed number 13, and Livingston county watershed numbers 020 and 050 and subwatershed number 39 (USDA SCS 1985, 1986, 1987).

There are no major lakes in the subwatershed. Though there is a small pond (2.1 acres) near the northernmost reach of the main Creek stem.

The area is almost entirely in private ownership.

Component #3
Watershed Activities

The Mackinaw River Watershed Council identified the Henline Creek watershed as a priority area for work under the Section 319 of the Clean Water Act.

Since 1994 the Illinois Environmental Protection Agency (Illinois EPA) has been the primary funding source for the planning phase of the Mackinaw River Project through the Section 319 of the Clean Water Act program for nonpoint source pollution. This funding has been used for project staff through The Nature Conservancy, and the facilitation of a community-based process to develop and write the Mackinaw River Watershed Management Plan (MRP 1998). Extensive community outreach and education has been done within the entire Mackinaw River watershed, and watershed management planning tools such as a watershed management planning handbook and a project video have been produced to assist other watershed planning efforts within Illinois. The funding from the Illinois EPA has also been used to establish fifteen demonstrations of best management practices within the Mackinaw River watershed. These demonstrations provide watershed residents with on-the-ground examples of conservation practices recommended in the watershed management plan.

The entire Henline Creek watershed has been designated a Zone A priority site by The Nature Conservancy (TNC 1999). Potential work in the area may include protection and restoration of habitat for target communities and species, threat abatement, focused outreach, and demonstrating the potential of BMPs (best management practices) through installing appropriate conservation practices and providing opportunities for others to learn from them.

In 1997 and 1998 the entire Mackinaw River watershed was designated an EQIP (Environmental Quality Incentives Program) priority area. Over $400,000 were made available for cost share programs to install conservation structures or implement conservation practices through this United States Agriculture Department (USDA) program.

Other federal and state programs available to landowners wishing to improve conservation practices on their land are promoted and administered through the McLean County Soil and Water Conservation District (SWCD) and the Natural Resources Conservation Service (NRCS). These include:

- The *Conservation Practices Cost-Share Program* (CPP), a part of the state's Conservation 2000 (C2000) initiative. The objective is to assist landowners in installing conservation practices designed to conserve soil, protect water quality, and reduce flooding. Up to 60% of the cost may be covered under the cost share program (INRCC 1997).

- The *Conservation Reserve Program* (CRP) is a federally funded program designed to reduce soil erosion and reduce farming on fragile lands. This program assists landowners in establishing permanent cover on fragile lands and providing cash incentives for removing land from production. Contracts are established for 10 to 15 years (INRCC 1997).

- When landowners enroll in the CRP program they have the option of extending their commitment to the conservation measures by enrolling in the state-funded *Conservation Reserve Enhancement Program* (CREP). Landowners can elect to continue their participation in the program for 15 or 35 years, or in perpetuity (Myers, personal communication 1999).

- The *Streambank Stabilization and Restoration Program* (SSRP) is an Illinois Department of Agriculture (IDOA) program administered through the SWCD that provides technical assistance and cost sharing to demonstrate and encourage low-cost streambank restoration practices such as planting willow posts (INRCC 1977).

- The *Wildlife Habitat Incentives Program* (WHIP) provides cost-share funds for non-traditional conservation works including wetland restoration, native grassland plantings, or provision of water for livestock. Structural works are not included (Myers, personal communication 1999).

- The SWCD and NRCS provide technical assistance to all landowners that request it. These projects may or may not come under one of the cost share programs. For example, agricultural producers desiring technical advice on gully erosion control may seek counsel and undertake action independent of state or federal cost share programs.

Three demonstration projects were completed in the Henline Creek subwatershed in 1998 with funds from Illinois EPA and C2000. One project included the planting of a buffer of prairie grasses and forbs along both sides of the riparian corridor. The timber stand in the corridor was treated to encourage growth of the understory and manage for native species such as hackberry and oak. In an effort to reduce streambank erosion, slow surface water runoff, and filter sediment a second project was carried out on a 20-acre site in partnership with the Parklands Foundation. The tract was treated to encourage existing walnut and hackberry trees, and planted with shellbark hickory and butternut to restore bottom timber composition. Streambank stabilization with willow and cottonwood posts was completed along 40 feet of the banks. A third project, carried out with a local landowner, was designed to retain stormwater runoff, replace a natural backwater slough environment that provides suitable habitat for small native fishes, and provide treatment of nutrients. A historical wetland adjacent to the creek was restored to an oxbow slough configuration. Surface water runoff is directed to the wetland, which also holds floodwater.

In 1998, C2000 funds were used to restore a floodplain forest on 20 acres of land recently purchased by The Nature Conservancy. The site will serve as a demonstration of a functioning floodplain forest. Non-native tree species are being removed and gaps planted with native species. Streambank stabilization is being effected through live staking of appropriate tree species. Gully stabilization will be done with woody debris. The total cost of the project is $21,182, work will be completed in mid June.

The Mackinaw River Watershed Council activities for 1999 include a demonstration project in conjunction with a local agricultural producer to repair and improve stormwater runoff handling on upper Henline Creek. An existing subsurface tile outlet will be repaired, and surface and subsurface stormwater runoff will be directed into a constructed wetland. The project will demonstrate the efficiency of retaining surface and subsurface runoff for nutrient management. The project is being carried out under the section 319 program. Partial cost share money will be made available through USDA's EQIP and CRP programs. The total cost of the project is $18,684, and work should be completed by October.

Beginning in the summer of 1999, focused outreach will be conducted through the McLean County SWCD and the Lawndale Cropsey Drainage District to promote cost-share programs and assist individual landowners/operators in implementing BMPs that deal with nutrient management. This work is being carried out with the financial assistance of a Kellogg Foundation Grant. The practices to be promoted have not yet been decided (D. Rudin, Project Manager, The Nature Conservancy, personal communication, 1999). In addition, an automated stream gauging station and water quality monitoring probe will be installed in the lower reach of Henline Creek near its confluence with the main stem of the Mackinaw River. Data collected will be used to improve understanding of the hydrology and water quality of this high quality resource (T. Tear, Conservation Science Director, The Nature Conservancy, personal communication 1999).

The Mackinaw River Watershed Management Plan provides information on the federal, state, and local entities, and existing legislation and ordinances that serve to promote the protection of the river and its environs (MRP 1998).

Component #4
Watershed Resource Inventory

Waterbodies

Henline Creek (ILDKV01) is 14.42 miles long (Illinois EPA 1996). There are 38.9 river miles within the watershed (IDNR CTAP 1997). Henline Creek is a third order tributary of the Mackinaw River. Stream monitoring has periodically taken place at station DKV-01, located on Henline Creek approximately four miles northwest of Colfax (Short et al. 1996).

An understanding of the characteristics of the stream habitat are important to understanding the make up of the ecosystem and any changes over time. Physical characteristics may be measured in several ways (see Table 1 and Table 2). The Predicted Index of Biotic Integrity (PIBI) calculated at station DKV-01 was 41.7 in 1987 and 38.2 in 1994. The most recent measurement indicates that the creek has the biotic potential of a moderate aquatic resource (Short 1988; Short et al. 1996). This decrease in the calculated PIBI, which is based on habitat characteristics, may suggest a slight deterioration in stream habitat quality.

Table 1. Habitat characteristics of Henline Creek station DKV-01. (Source: Short 1988; Short et al. 1996)

	1987	**1994**
Hydraulic Features		
Stream order	3	3
Station length (ft.)		680
Increment width		2
Mean stream width (ft.)	20.0	21
Mean stream depth (ft.)	0.8	0.59
Mean thalweg velocity (ft/s)	0.13	0.37
Discharge (cfs)	2.1	1.74
Mean discharge (ft/s)		0.62
Channel width (ft.)		74
Pool (%)	24	5
Riffle (%)	5	17
Substrate		
Silt/mud (%)	7	30.3
Sand (%)	52	20.2
Fine gravel (%)	13	14.14
Medium gravel (%)	4	15.15
Coarse gravel (%)	13	5.05
Small cobble (%)	2	3.03
Large cobble (%)	0	1.01
Boulder (%)	1	1
Bedrock (%)	0	0
Claypan (%)	3	2
Plant detritus (%)	0	5.1
Vegetation (%)	4	0
Submerged logs (%)	0	3
Other (%)	0	0
Other		
Instream cover (%)	14	4.1
Shading (%)	2	61
Predicted IBI	41.7	38.2
Biotic Potential Category	B	C

During the 1994 intensive survey data were collected for the qualitative stream habitat assessment procedure (SHAP). The overall stream habitat assessment score in 1994 for Henline Creek was 135 (see Table 2). As the sampling site is towards the mouth of the Creek this data may not accurately reflect some of the habitat characteristics of the upstream portion of the creek. Values in the entire Mackinaw River watershed ranged from 67 to 169 (Short et al. 1996).

Table 2. Qualitative stream habitat assessment score for station DKV-01, 1994. Source: Short et al. 1996.

Metric	Score	Assessment
Bottom substrate	15	good
Deposition	9	good
Substrate stability	5	fair
Instream cover	9	good
Pool substrate	15	good
Pool quality	7	fair
Pool variability	9	good
Canopy cover	12	excellent
Bank vegetation	16	excellent
Bank land use	8	excellent
Flow refugia	9	good
Channel alteration	6	good
Channel sinuosity	4	fair
Width/depth	5	fair
Hydrologic diversity	6	fair
Total score	135	

Water chemistry is another important parameter in understanding the stream, its water quality and any changes over time due to natural or human causes. Henline Creek had a water quality index of 20.7 when sampled in 1987, indicating that there were no to minimum water quality problems (Short 1988). The index was not calculated during the 1994 survey, though data on some of the same parameters were collected (Table 3).

Table 3. Water quality data collected at station DKV-01 on Henline Creek in 1987 and 1994 (Source: Short 1988; Short et al. 1996)

			1994		
Category	**Parameter**	**1987**	8/19	9/22	10/20
Temperature	temperature (°C)	23	23.6	19.8	14.8
Oxygen	dissolved oxygen (mg/l)	4.8	6.1	6.0	5.3
pH	pH	7.2	7.7	7.5	7.6
Trophic/Nutrients	total phosphorus (mg/l)	0.06	0.05	0.05	0.04
Turbidity	total suspended solids (mg/l)	36	35	17	8
Dissolved solids	conductivity (umhos/cm)	486	594	656	659
Inorganic toxicity	un-ionized ammonia (mg/l)	0.0012	0.003	0.001	0.000
Metals toxicity*	cadmium (ug/l)	<3	<3	<3	<3
	chromium (ug/l)	<5	<5	<5	<5
	copper (ug/l)	<5	<5	<5	<5
	lead (ug/l)	<50	<5	<5	<5
	mercury (ug/l)	na	<.05	<0.05	<0.05

zinc (ug/l)	<50	150	<100	<100
Water quality index	20.7	na	na	na

* The worst measured value for one of the six metals is used to compute metals toxicity.
na: not available

A violation of the state general use water quality standards occurred for silver during the 1994 survey, no cause for the violation was determined (Short et al.1996). An analysis of sediment chemistry in 1994 found highly elevated levels of Kjeldahl nitrogen and elevated levels of volatile solids. These findings are indicative of nutrients and organic loading (Short et al. 1996). Further data on chemical analyses of water and sediment may be found in *An Intensive Survey of the Mackinaw River Basin 1994* (Short et al. 1996).

During the 1994 intensive survey of the Mackinaw River, Henline Creek had an Index of Biotic Integrity (IBI) of 60, the highest score. This gives the creek a Biological Stream Characterization (BSC) of "A" or unique aquatic resource, meaning that the quality of the biotic resources of the stream are excellent (Short et al. 1996). The discrepancy between the PIBI indicating a moderate resource and the IBI indicating a unique resource may suggest a declining resource. Further study is needed to understand the interrelated nature of the biological, physical, and chemical properties of this unique creek. (Please see Designated Use section below for a fuller explanation of IBI and PIBI.) The Macroinvertebrate Biotic Index (MBI) for the Creek was 5.2, indicating good aquatic conditions (ILLINOIS EPA 1996; Short et al. 1996).

Henline Creek is a valuable aquatic resource. It has a high diversity of fish and mussels and contains populations of threatened and endangered mussels (see below for further details). The majority of Henline Creek is a constructed and maintained drainage ditch, and as such has some unique characteristics that must be considered and mitigated to maintain and improve its value as an aquatic resource. Ditches and draining activities tend to degrade aquatic habitat by creating channels lacking physical characteristics necessary for many species (Gough 1997). The lack of shade along much of the creek is also a considerable problem, leading to potentially higher water temperatures and decreasing the shaded habitats needed by some species.

Designated Use/Designated Use Support

The Illinois Environmental Protection Agency has designated Henline Creek as full support overall and for aquatic life (Illinois EPA 1996). This designated use assessment is based on current ecological and habitat surveys and combined sampling of water, sediment and biota for chemical analyses (Illinois EPA 1996). Other uses (e.g., fish, swimming) were not assessed (IEPA 1996). Testing was primarily done at site DKV-01 on the downstream portion of the creek, not far from the mouth of the creek. Further chemical and biological assessments need to be preformed upstream for a more accurate assessment of water quality within this subwatershed.

Several indices were calculated as part of the assessment of aquatic life use support for Henline Creek. The Index of Biotic Integrity (IBI) is based on analyses of fish species richness and composition, trophic composition, and fish abundance and condition. The Predicted Index of Biotic Integrity (PIBI) is based on habitat assessment criteria, including that outlined above (Waterbodies). The IBI for Henline Creek during the 1994 assessment was 60, while the PIBI was 38.2. The IBI value of 60 indicates a Biological Stream Classification (BSC) rating of "A" or unique aquatic resource. The Macroinvertebrate Biotic Index (MBI) for the Creek was 5.2 (Illinois EPA 1996; Short et al. 1996).

Impairments

The Illinois Environmental Protection Agency water quality report does not list any causes or sources of impairment for Henline Creek (Illinois EPA 1996). However, potential sources are known and can be inferred from surrounding land uses. Both point and nonpoint pollution may influence water quality. For example, nonpoint source pollution such as runoff from agricultural fields, livestock operations, and roads may have detrimental effects on water quality. Point source pollution may come from storm sewers or other selected identifiable locations, though there may only be a few if any point source pollution sources in the Henline Creek subwatershed. Sources identified in this report are only *potential* sources of impairment, and further study is needed to determine how much of an impact each of these sources may have on water quality.

Retzer (1997a) lists potential stressors for the aquatic community types in Henline Creek. He described the upper portion of the creek as a low-slope headwater stream, and the lower portion as a low-slope small creek tributary. Retzer (1997a) identified the latter as a community type in need of protection. Table 4 highlights those stressors considered "high" and their potential impacts. Not all of these stressors are necessarily operating in Henline Creek. See Retzer (1997a) for a more detailed list of other potential stressors.

Table 4. Ecosystem stresses and biological implications on low-slope headwater streams and low-slope small creek tributaries such as Henline Creek. (Source: Retzer 1997a)

Stress	Biological Implications
Agriculture	
Excess phosphorus and nitrogen	Directly toxic, indirectly reduces community diversity
Drainage or filling in of wetlands and bottomland lakes and oxbows	Loss of habitat
Alteration of hydrologic regime	Loss of habitat stability
Sedimentation	Covering and infiltration of gravel and sand substrates which smothers fish eggs and other invertebrates
Increased total suspended solids and turbidity	Stresses sight dependent species; interferes with gills and other filtering processes
Loss of natural riparian zone	Increased water temperatures and loss of nutrient sources

Commercial, residential, and urban land use activities	
Stormwater pollutants from lawns, streets, and parking lots	Sedimentation and chemical pollutants
Stormwater runoff from impermeable roofs, roads, and parking lots	Increased flood flows and lower base flows which increase habitat instability
Industrial wastes (especially barium, boron, strontium, alkaline compounds)	Mortality at high levels; increased susceptibility to disease; lower reproductive output levels
Reservoirs for drinking water and recreation	Permanent loss of stream habitat
Human sewage and septic discharge	Excess nutrients increase eutrophication
Livestock	
Waste discharges	Excess nutrients are toxic; enhances eutrophication process
Stream substrate trampling	Mortality of benthic species; mechanical crushing of substrate
Bank erosion increases sedimentation and turbidity	Sediments smother substrates; turbidity interferes with vision, gill and filtering activities
Exotic species	
Garlic mustard	Competitive with native plants

In 1994 the Illinois Environmental Protection Agency identified two potential sources of impairment in the Henline Creek subwatershed (Short et al. 1996). Both of these sources had a high potential as a source of impairment. Criteria for determining the potential source magnitude were the pollutant source, the pollutant transport process, and the existing water resource (Short et al.1996). One site is located just downstream of the permanent sampling site DKV01, the other is located in McLean County not far from the border with Ford County. One municipal site and one "other" site are the sources for the potential impairments, the exact nature of the sites is not documented. Municipal sources include wastewater treatment facilities and other urban point sources. Other sites may include chemical facilities, rock quarries, landfills and other point or nonpoint sources (Short et al. 1996).

Surface impoundments are lined or unlined lagoons used for storing liquids, or a mixture of liquids and solids. They risk of contamination of groundwater from these lagoons is significant. There are no documented surface impoundments in the Henline Creek subwatershed (IDNR CTAP 1997)

Groundwater

Aquifers in the Mackinaw River watershed are generally sand and gravel, confined and separated by till or clay. Water below the glacial deposits is generally of insufficient

quantity or too mineralized for human use. In some areas sand and gravel aquifers are "cradled" in bedrock valleys (IDNR CTAP 1997). See the Geology section below for further information on geological formations.

The Sankoty-Mahomet Sand Aquifer, part of the Banner Formation, is the most widespread and productive sand and gravel aquifer in the Mackinaw River watershed. The sub-Sankoty-Mahomet and Sankoty-Mahomet units which make up this aquifer are separated by glacial lake deposits, but behave as one aquifer (IDNR CTAP 1997). In the Henline Creek area of the watershed the Sankoty-Mahomet Sand Aquifer gives way to fine-grained backwater and glacial lake silts and clays (IDNR CTAP 1997).

Sand and gravel associated with the Glasford Formation may contribute to the yield of the Sankoty-Mahomet Sand Aquifer, but they are generally too thin and coarse-grained to serve as a source of public water supply (IDNR CTAP 1997). In some areas sand and gravel from the Glasford Formation and Wedron Group may combine to provide small to moderate water supplies (IDNR CTAP 1997).

Two types of wells are used to extract groundwater for domestic and farm use: large-diameter wells dug to depths of less than 100 feet and small-diameter drilled wells that tap deposits at depths greater than 100 feet. In the McLean County portion of the Mackinaw River watershed there are a reported 1,130 large-diameter wells and 698 small-diameter wells (IDNR CTAP 1997). Census data for McLean County show that of the almost 11% of housing units using individual wells as a water source 89.4% were drilled and 10.6% were dug (US Census Bureau 1999). In the Ford County portion of the Mackinaw River watershed there are a reported 54 large-diameter wells and 42 small-diameter wells (IDNR CTAP 1997). Data specific to the Henline Creek watershed are unavailable. In the Livingston County portion of the Mackinaw River watershed, all of which lies in the Henline Creek subwatershed, there are 13 large-diameter wells and 10 small-diameter wells (IDNR CTAP 1997).

Public water supply wells are drilled wells that generally tap deposits that range in depth from 35 to over 400 feet. Within the Henline Creek watershed there are no confirmed public water supply wells. However, Colfax and Anchor are south of the watershed boundary. Between them they have three groundwater wells that supplied 38,548,000 gallons of water in 1995 (IDNR CTAP 1997). In all of McLean County 88.8% of housing units are supplied with water from public systems or private companies (U.S. Census Bureau1999).

Ground water studies have demonstrated no degradation of the water within the entire Mackinaw River watershed in respect to iron, total dissolved solids, sulfate, nitrate, chloride, and hardness (IDNR CTAP 1997). However, local contamination may still be present and must be examined at a site-specific level (IDNR CTAP 1997).

Irrigation

No irrigation is being practiced in the Henline Creek subwatershed (Meiner, personal communication 1999; Rutherford, personal communication 1999).

Drainage

Subsurface tiling is extensive, however tile maps do not exist for many areas. The purpose of tiling is to remove water from saturated fields and farmed wetlands in order to facilitate agricultural activity and increase productivity. The effect of this is to increase river discharge after a storm event. Tiles serve to drain the land after the peak event and therefore contribute to a higher sustained discharge. This then lowers the general water table in the area, effectively reducing base flows during dry periods. Historically, wetlands would have held water on the land and probably contributed significant amounts of water to the river during periods of low precipitation. Further study of the effects of subsurface tiling on the river after a storm event and during base flow periods is needed.

The Lawnsdale-Cropsey Drainage District is active in the Henline Creek subwatershed and extends into parts of all three counties. The taxing district is 22,000 acres (Meiner, personal communication 1999). The drainage district is responsible for keeping the creek excavated. The open ditch portion of the creek extends to the county line. In Ford County there is only tile drainage directing the water towards the creek bed (Meiner, personal communication 1999).

More information on the effects of subsurface drainage on hydrology is needed (Gough 1997). Drainage tiles may increase nonpoint source pollution as subsurface drainage encourages the transport of fertilizers to drainage channels (Gough 1997).

Floodplain Boundaries

Flooding does not appear to be a significant issue in the Henline Creek subwatershed. The creek is bordered on either side by a "spoil berm" developed when the ditch was constructed (Rutherford, personal communication 1999). Based on an examination of soil types, a thin floodplain borders the first few miles of the Creek. The ditched area of the Creek is not bordered by a floodplain. There are no flood structures within this subwatershed.

Municipal/Industrial

The Henline Creek subwatershed is in a rural setting, with no population centers within the watershed. Industries and other potential sources of point source pollution are few or nonexistent and no listings could be found. No record of NPDES permits within the watershed was located. See the section entitled "Impairments" above for further information.

Sibley in Ford County is located near the headwaters of the Upper Mackinaw River, and Colfax and Anchor in McLean County are located south of the Henline Creek subwatershed. Drainage from all three areas is into the Upper Mackinaw River and therefore industrial activity in those areas likely does not directly affect Henline Creek. The small town of Cropsey in McLean County is located just north of the subwatershed

and is in the Vermillon River watershed. Local topography may suggest that some areas drain into Henline Creek. The watersheds do share the same aquifer, so any groundwater impacts may be shared.

Riparian Corridors

The riparian corridor along Henline Creek is less than 25 meters wide for the majority of the stream length. The only deviation from this is along the first three stream miles where less than half of the riparian corridor is over 75 meters wide (Short et al. 1996). Land cover in the riparian corridor is predominantly woodland at the mouth gradually changing to predominantly grassland after a few miles and continuing that way for the full extension. In the larger 300 meters bordering the creek the area near the mouth of the creek is a mixture of woodland and cropland, changing to predominantly cropland for the majority of the stream length (Short et al. 1996). Streambanks along the creek are fairly stable (Rutherford, personal communication 1999).

Hydrologic Modifications

The first few miles of Henline Creek are a natural hydrologic feature; the remainder of the creek is channelized. The creek was extended to the county line through the excavation of a ditch to facilitate drainage. The construction of the ditch drained wetlands on either side. Channelized streams can lead to increased sedimentation problems because of their efficiency in moving storm water. Spoil berms line parts of the creek. Within Ford County drainage is facilitated through tiling, though the ditch does not extend into that county (Rutherford, Meiner, personal communication 1999). Several small bridges span the creek.

Stormwater Management

County stormwater control ordinances exist for Ford and McLean Counties. In the Henline Creek subwatershed stormwater control practices include drainage through surface and subsurface tiling. Tile outlets direct water into the creek and its tributaries. There are no urban areas within the watershed that drain into the creek.

Wetlands

Wetlands are an important part of the landscape because they provide critical habitat for many plants and animals and serve an important role in mitigating the effects of storm flow in streams. The hydrogeology of wetlands allows water to accumulate in them longer than in the surrounding landscape, with far-reaching consequences for the natural environment. Wetland sites are important to organisms that require or can tolerate moisture for extended periods of time, and the wetland itself becomes the breeding habitat and nursery for many organisms that require water for early development.

The configuration of wetlands enables them to retain excess rainwater, extending the time the water spends on the upland area. The effect of this retention on the watershed is to delay the delivery of water to the main stream. This decreases the peak discharges of storm flow or floods, thus reducing flood damages and the resulting costs. Wetlands also

provide valuable water to the stream during periods of low flow. Water seeps from the wetland into the stream, increasing base flows and reducing elevated stream temperatures. The destruction of wetland areas has the opposite effect, increasing peak flood flows and thereby increasing flood damages and associated costs. During periods of low flow, water does not seep into the stream from upland areas. In-stream temperatures increase, and base flows of the stream decrease.

The Henline Creek watershed contains 48 acres of wetlands, or approximately 0.2% of the total drainage area. Just over half of the wetlands are forested (IDNR CTAP 1997). These wetlands represent less than 1% of the wetlands within the entire Mackinaw River watershed (IDNR CTAP 1997). Much of the land bordering the creek may have been wetland, but it was drained when the ditch was dug (Gough 1997).

Fish

The Mackinaw River has 66 known fish species (IDNR CTAP 1997). During an intensive survey of the watershed in 1994 only 59 species and two hybrids were recorded (Short et al. 1996). The 26 species found in Henline Creek are listed in Table 5. The blacknose shiner (*Notropis heterolepis*) was last recorded in the river in 1880 and is assumed to be extirpated (IDNR CTAP 1997). No other state endangered or threatened fish species have been recorded in the river.

Table 5. Abundance of fish species recorded in Henline Creek, 1994 (Source: Short et al. 1996).

Common name	Scientific name	Abundance
northern pike	*Esox lucius*	1
carp	*Cyprinus carpio*	1
creek chub	*Semotilus atromaculatus*	16
hornyhead chub	*Nocomis biguttatus*	110
central stoneroller	*Campostoma anomalum*	52
striped shiner	*Luxilus chrysocephalus*	122
redfin shiner	*Lythrurus umbratilus*	8
bluntnose minnow	*Pimephales notatus*	9
rosyface shiner	*Notropis rubellus*	31
bigmouth shiner	*Hybopsis dorsalis*	48
sand shiner	*Notropis ludibundus*	17
quillback	*Carpiodes cyprinus*	11
river carpsucker	*Carpiodes carpio*	5
white sucker	*Catostomus commersoni*	21
northern hogsucker	*Hypentelium nigricans*	30
golden redhorse	*Moxostoma erythrurum*	63
silver redhorse	*Moxostoma anisurum*	2
blackstripe topminnow	*Fundulus notatus*	3
rock bass	*Ambloplites rupestris*	41
smallmouth bass	*Micropterus dolomieui*	10

green sunfish	*Lepomis cyanellus*	6
longear sunfish	*Lepomis megalotis*	16
blackside darter	*Percina maculata*	1
Johnny darter	*Etheostoma nigrum*	7
banded darter	*Etheostoma zonale*	2
orangethroat darter	*Etheostoma spectabile*	2

Priority Waterbody

The Mackinaw River Watershed Council identified the Henline Creek watershed as a priority area for work under the Section 319 of the Clean Water Act.

The entire Henline Creek watershed has been designated a Zone A priority site by The Nature Conservancy (TNC 1999). Potential work in the area may include protection and restoration of habitat for target communities and species, threat abatement, focused outreach, and demonstrating the potential of BMPs (best management practices) through installing appropriate conservation practices and providing opportunities for others to learn from them. Information on work already accomplished or planned is included in the Watershed Activities section of this report.

Soil Classification

Five soil associations have been identified within the Henline Creek subwatershed. The Parr-Lisbon-Drummer association covers 10,813 acres in the western portion of the watershed. It is found on near level to sloping ground. The association is used primarily for cultivation and pasture and hay and is moderately well suited to well suited for those uses. The soils are poorly to moderately suited for dwellings and septic tank fields (USDA NRCS 1998). The Chenoa-Drummer-Graymont Association is found on 10,092 acres in the eastern and northern portions of the watershed. Slopes range from 0-5%. Soils are used primarily for cultivation and pasture and are well suited to those uses. Soils are poorly to moderately suited to dwellings and septic tanks. The Chenoa-Ashkum-Varna Association covers 3,604 acres of the subwatershed in the northeast portion of the watershed. It is found on slopes of 0 to 10%. The association is well suited or moderately suited to cultivation and pasture and those are its primary uses. It is poorly to moderately suited to dwellings and septic tanks (USDA NRCS 1998).

The Strawn-Mayville-Birbeck Association covers 1,081 acres near the mouth of Henline Creek. This association can be found on slopes ranging from 0-50%. The primary uses of this association are for woodland, pasture, dwellings, and septic fields. The soils are well suited to woodland and moderately suited for other uses, except in very steep areas (USDA NRCS 1998). The Drummer-Brenton Association covers only a small portion of the southeast portion of the watershed (360 acres). It is found on slopes ranging from 0 to 2%. This association is well suited to cultivated crops and pasture and hay and is primarily used for those purposes. It is poorly suited to dwellings and septic tanks (USDA NRCS 1998).

Table 6 provides descriptive data on the soil types found in the Henline Creek subwatershed.

Table 6. Soil types found in the Henline Creek subwatershed. Source: USDA NRCS 1998.

Soil Classification	Soil Composition	Water Table (ft)	Land Use Capability Class	Hydric Soils	Slope	Permeability	Erodibility Index
Miami	silt loam	>6	IIIe, IVe	no	5-15%	M to MS	11.80
Lisbon	Silt loam	1-3	I	no		M to MS	2.39
LaRose	Silt loam	>6	IIe, IIIe	no	2-10%	M to MS	3.8
Harpster	Silty clay loam	.5-2	IIw	yes		M	1.21
Saybrook	Silt loam	>6	IIIe	no	2-5%	M to MS	1.21
Proctor	silt loam	>6	I, IIe	no	0-5%	M to MR	2.19
Brenton	Silt loam	1-3	I	no		M	1.92
Drummer	Silt loam	.5-2	IIw	yes		M	1.21
Flanagan	Silt loam	1.5-3.5	I	no	0-2%	M to MS	1.92
Elburn	silt loam	1-3	I	no	0-2%	M	1.92
Plano	silt loam	3->6	I, IIe	no	2-5%	M	2.19
Parr	Silt loam	>6	IIe, IIIe	no	2-10%	M to MS	2.19
Varna	Silt loam	3-6	IIe	no	2-5%	M	5.04
Strawn	loam	>6	IIIe, VIIe	no	5-10%; 30-50%	M to MS	17.0 78.4
Strawn	Silt loam	>6	IIIe	no	10-15%	M to MS	17.0
Ashkum	Silty clay loam	1-2	IIw	yes		MS	1.21
Edington	silt loam	.5-2	IIw	yes	0-2%	S	na
Warsaw	Silt loam	>6	IIe, IIIe	no	2-10%	M to VR	4.41
Symerton	Silt loam	3.5-6	IIe	no	2-5%	M to MS	4.18

Fox	Silt loam	>6	IIe	no	2-5%	M to R	4.33
Peotone	Silty clay loam	.5-1	IIw	yes		MS	1.21
Raub	Silt loam	1-3	IIw	no		M to MS	2.19
Fincastle	Silt loam	1-3	IIw	no		M to MS	1.21
Graymont	Silt loam	4-6	IIe	no	2-5%	M to MS	na
Martinsville		>6	IVe	no	8-18%	M	24.00
Chenoa	Silt loam	1-3	IIe	no	1-3%	M to MS	2.52
Darroch	Loam	1-3	IIw	no		M to MR	1.92
Radford	silt loam	1-3	IIIw	yes	0-2%	M	1.21
Sawmill	silty clay loam	0-2	IIIw	yes	0-2%	M	1.21
Lawson	Silt loam	1-3	IIw	no		M	1.21

Land Capability classes: I – few limitations that restrict use; II – moderate limitations that reduce plant choice or require moderate conservation practices; III – severe limitations that reduce plant choice or require conservation measures, or both; IV – very severe limitations that reduce plant choice or require careful management or both; VI – very severe limitations that make soils unsuitable for cultivation; an "e" indicates that erosion is the main potential hazard, a "w" indicates that water may interfere with cultivation; **Permeability**: S—slow 0.06-0.2 inches/hour; MS – moderately slow 0.2-0.6 inches/hour; M – moderate – 0.6-2.0 inches/hour; MR – moderately rapid – 2.0 –6.0 inches/hour; R – rapid – 6.0-20 inches/hour; VR – very rapid – more than 20 inches/hour.

Soil Erosion

Erosion in the Henline Creek subwatershed is largely due to row crop agricultural practices that expose soil. Several different types of erosion occur within the Mackinaw River watershed, and by extension, the Henline Creek subwatershed. Sheet and rill erosion are the most significant (USDA/NRCS 1997). Sheet erosion occurs when soil is detached by the impact of raindrops and moves uniformly downhill. Rill erosion occurs when stormwater runoff concentrates in shallow channels or rills, often between crop rows or in tillage channels. These rills can sometimes form into gullies. Sheet and rill erosion on farmland can often be controlled through appropriate tillage operations.

Ephemeral gully erosion also occurs in areas where stormwater runoff concentrates, though gullies are larger than rills. Ephemeral gullies can still be controlled through appropriate farming practices. Gully erosion is the formation of channels too deep to cross with farm equipment. Significant and increasing damage can occur where gullies become established. Streambank erosion is not considered a problem in this watershed (D. Rudin, personal communication 1999).

In 1996 erosion rates were estimated for the Mackinaw River watershed (USDA/NRCS 1997). Erosion rates were based on "T" (tolerable soil loss), the rate at which soil is formed. While "T" will maintain soil productivity those rates of erosion may contribute to sedimentation in waterways. In the Mackinaw River watershed "T" is most commonly 5 tons/acre/year (USDA/NRCS 1997). Estimates of rates of erosion in the Henline Creek watershed are given in Table 7; while sedimentation estimates, by type of erosion are given in Table 8.

Table 7. Erosion rate and land affected in Henline Creek (Data are extrapolated from USDA/NRCS 1997).

Erosion rate	Acres of land affected
0-1T	21,738

1-2T	2,693
Over 2T	655
Total	25,086

Table 8. Annual erosion and sedimentation estimates for Henline Creek (Data are extrapolated from USDA/NRCS 1997).

Erosion type	**Erosion (tons)**	**Sediment delivery rate**	**Sedimentation (tons)**	**Sediment transport rate (%)**	**Sedimentation transported (tons)**
Sheet and rill	106,106	0.70	74,274.2		
Ephemeral	9,800	0.80	7,840		
Gully	8,750	0.85	7,437.5		
Total	124,656		89,551.7	0.25	22,387.93

Geology

The geologic foundation of the entire Mackinaw River watershed is bedrock and glacially derived sediments that lie directly beneath the soils and modern sediments of the land surface. The topography of the bedrock surface partly determines the type and distribution of the overlying glacial deposits. These sediments, in turn, determine the area's groundwater resources, form the parent material of the region's soils, and play a role in the development of the watershed's wetland areas. Together these geologic factors govern the development of the entire range of plant and animal communities within the watershed.

The underlying bedrock in Henline Creek subwatershed is mostly of relatively recent Pennsylvanian age (320-286 million years ago). Both the Mattoon and Bond Formation are found in the western portion of the watershed. Several thick, pure limestones characterize the Bond Formation, while the younger Mattoon Formation has widespread, thin limestones and discontinuous, thin coals. In the easternmost portion of the watershed older (438-360 million years ago) Silurian- and Middle Devonian-age dolomite or limestone subcrop (IDNR CTAP 1997).

Buried valleys, lowlands, and uplands are part of the complex topographic surface of the bedrock. In eastern McLean County and the headwaters of the Henline Creek watershed minor buried bedrock valleys are tributaries to the buried Mahomet Valley. The physical characteristics of this bedrock have an influence on the geochemistry of the groundwater (IDNR CTAP 1997).

The bedrock is overlaid by glacial sediments (or glacial drift) deposited by a succession of glaciers during the Pleistocene epoch. Glacial till is made up of particles of all sizes deposited at the base of the glacier. Outwash, or sand and gravel that washed off the glacier, is a potential source of construction sand and gravel found in certain areas within the Mackinaw River watershed. Lacustrine, or lake deposits, are fine-grained sediments

deposited in temporary lakes. Windblown silt (loess) from the late- and post-glacial age overlays these glacial deposits, and is the parent material for the areas productive soils.

Successive glaciers passed over the area. Tills of pre-Illinois glacial episodes are called the Banner Formation. Glaciers of the Illinois Episode, referred to as the Glasford Formation, followed these. The surface of the Henline Creek watershed was primarily influenced by till deposited during the Wisconsin Episode of glaciation belonging to the Wedron Group. The deposits of glacial origin in the watershed vary in thickness from less than 100 feet near the mouth of the Creek to 100-200 feet near the headwaters. In a small area the glacial drift is 200-300 feet thick (IDNR CTAP 1997).

Construction sand and gravel are produced in the Mackinaw River watershed. Significant deposits are located near the mouth of Henline Creek and north of the northernmost extension of the Creek, there do not appear to be any active or recent pits in the watershed (IDNR CTAP 1997).

Topography

The Henline Creek subwatershed drains an area of 25,951 acres or approximately 40.6 square miles. The creek flows generally from east to west, most of the tributaries enter from the northern side of the ditch (see Map X). The elevation varies from approximately 785 feet at the headwaters to just over 700 feet at the mouth. The stream gradient is 4.7 feet per mile (Short et al. 1996)

The drainage density of the Henline Creek watershed was calculated by dividing the total acreage for the watershed by the total stream length. The resultant drainage density is approximately 667.1 acres of watershed per mile of stream.

Land Use

Land cover in the Henline Creek subwatershed gives an initial indication of land use activities. The vast majority of the land is devoted to agriculture, with grasslands that may support livestock as next greatest in area. Table 9 provides data on major land use categories. Also see Map X.

Table 9. Land cover by percent in the Henline Creek subwatershed. (Source: IDNR CTAP 197:1-18).

Land Cover	Acres	Percent of subwatershed
Agricultural Land	**25,547**	**98.5**
Cropland	24,121	93.0
Rural grassland	1,427	5.5
Forest & Woodland	**88**	**0.3**
Urban & Built-up Land	**113**	**0.4**
Urban/Built-up	113	0.4
Urban grassland	1	0.0
Wetland	**48**	**0.2**
Forested	25	0.1

Non-forested	23	0.1
Lakes & Streams	**151**	**0.6**

The primary agricultural crops in the subwatershed are soybeans and corn. In 1994 it was estimated that 357,900 acres of corn and 308,200 acres of soybeans were planted in McLean County. This represented approximately 3.1% of the Illinois land area planted to corn that year and 3.2% of the land area planted to soybeans (IDNR CTAP 1997). Per acre yields are variable, but generally higher than the state average. For example, in 1994 the average corn production per acre in McLean County was 166 bushels, compared to a state average of 156, while the average soybean production was 49 bushels per acre compared to a state average of 46 (IDNR CTAP 1997). Wheat, hay, and other crops are also grown in the watershed. Yield data specific to Ford and Livingston Counties were unavailable, but likely are comparable to that for McLean County.

In general, the Mackinaw River watershed has a small number of cattle (44,800 head in 1994) and a relatively large number of hogs [304,000 head in 1994 (IDNR CTAP 1997)]. The trend in McLean County has been toward decreasing hog production (IDNR CTAP 1997). Livestock production is not a major activity in the Henline Creek subwatershed (Rutherford, personal communication 1999).

The average farm size in McLean County is approximately 450 acres and there are approximately 1,600 farms in the county (Farrell 1995). It is estimated that there are approximately 100 farms in the Henline Creek watershed (Rutherford, personal communication 1999). About 75% of agricultural producers have been on their current farm for more than 10 years (Farrell 1995). Subwatershed specific data were not available.

Agricultural land in the subwatershed sells for between $2,800 and $3,500 per acre, and is rented for between $140 and $170 per acre (Rutherford, personal communication 1999). In McLean County over 25% of agricultural producers lease all of the land they farm, approximately 40% own some land and lease the rest, while just under 35% own all of the land they farm (Farrell 1995). It is estimated that in the Henline Creek subwatershed over 50% of the land is tenant farmed (Meiner, personal communication 1999).

Transect survey data from the Bureau of Soil and Water Conservation (IDOA) revealed that in 1995 no-till was practiced on 14% of the land in McLean County. Conservation tillage in which 30% or more of the crop residue remained on the field was practiced on 24% of the land and reduced tillage where 15-30% of the crop residue is left on the field was practiced on another 29% of the land in McLean County (USDA NRCS 1997). Soybean agricultural producers in Henline Creek are increasingly practicing no till (Meiner, personal communication 1999).

In McLean County over 3,700 acres were enrolled in the Conservation Reserve Program by 1997, though nearly 40% of those contracts have ended (Table 10). In the Henline

Creek watershed some agricultural producers along the creek have enrolled, though the ten-year commitment is a disincentive to some. Land away from the creek is less likely to be enrolled due to its high agricultural potential (Meiner, personal communication 1999).

Table 10. Conservation Reserve Program enrollment in McLean County (Source: USDA NRCS 1997).

Year contract ends	No. of contracts	Acres
1997	27	702.0
1998	21	920.5
1999	7	235.0
2000	9	592.0
2001	9	217.2
2002	13	461.0
2005-10	40	586.2
Total	126	3713.9

There are no Natural Areas or Nature Preserves within the subwatershed (IDNR CTAP 1997). Henline Creek is an Illinois Natural Areas Inventory Site.

Fishing is a popular sport along the Mackinaw River. In 1993 nearly 24,000 fishing licenses were sold in the three counties that contain the majority of the Mackinaw River watershed. The number of licenses sold to non-residents was lower than the state average (IDNR CTAP 1997). This suggests that local county residents do the vast majority of fishing in the Mackinaw River. No estimates of fishing in Henline Creek were available.

Forest and woodlands cover only 88 acres in the subwatershed, most near the mouth of the creek. Though data specific to Henline Creek are not available, in the whole of the Mackinaw River watershed only 0.1% of the forest is considered to be of high ecological quality (IDNR CTAP 1997). Habitat degradation and fragmentation, the introduction of exotic species, and altered fire regimes contribute to ecological problems in forested areas. Overgrazing can be a serious factor in forest degradation through alteration of species composition and structure (IDNR CTAP 1997).

Road density in the subwatershed insures that most areas are reached relatively easily by road. Roads cross Henline Creek at regular intervals. State Highway 165 passes through the southeast portion of the subwatershed connecting Sibley and Anchor. Roads in McLean County increased from 2,581 miles to 2,744 miles between 1973 and 1993, few if any of those roads are located in the subwatershed (IDNR CTAP 1997).

There are no large airports within the subwatershed, though there may be landing strips for crop planes.

There are no urban centers within the subwatershed. The towns of Cropsey, Sibley, Anchor, and Colfax are located outside the watershed. Please see the section on socioeconomic characteristics of the watershed for information on population.

There are no landfills in the subwatershed. There may, however, be illegal dumping in some areas. No documentation on the magnitude of this could be found.

The 1990 U.S. Census data shows 39,459 housing units, or 80% of McLean County using public sewers, another 9,558 housing units or 19% use septic tanks or cesspools. The remaining 1% use other methods which are not specified (US Census Bureau 1999). It is likely that residents of the Henline Creek subwatershed use septic tanks, cesspools, or other means of sewage disposal.

Air Quality

There are no USEPA air quality measurement stations in the Mackinaw River watershed (IDNR CTAP 1997). Data on estimated annual stationary point source emissions of selected pollutants do however provide a measure of air quality. In 1995 point source emissions estimates were calculated for McLean County (see Table 11). Much of this pollution may be due to activity outside the Henline Creek subwatershed.

Table 11. Estimated 1995 point source emissions in McLean County (Source IDNR CTAP 1997).

Pollutant	Tons/year
particulate matter	1,103
sulfur dioxide	37
nitrogen oxides	904
volatile organic matter	3,807
carbon monoxide	132

Most climatic data for the Mackinaw River watershed are from the Bloomington-Normal National Weather Service Coop site, which has the longest continuous weather records in the vicinity. The area has a continental climate with temperature highs averaging between 80˚F and 90˚F in the summer months and 30-40˚F in the winter months. Average monthly temperature lows range from 15.5˚F in January to 65.4˚F in July (IDNR CTAP 1997).

Precipitation is heaviest during the growing season, with mean annual precipitation at 37.75 inches. Average precipitation ranges from 1.61 inches per month in January to 4.41 inches in July. The average number of days per month with precipitation ranges from 8-12 (IDNR CTAP 1997). The watershed averages 48 thunderstorms each year, with a range of 35 to 60 (IDNR CTAP 1997). Since data were collected beginning in 1959, the Mackinaw River watershed has received, on average, two tornadoes per year, with a range of from 0 to 6 tornadoes per year (IDNR CTAP 1997).

Wildlife
Threatened or Endangered Species

Table 12 lists threatened and endangered species known or thought to occur in the Mackinaw River watershed. Specific locations of many of these organisms were not provided in order to protect their existence.

In 1996 28 state endangered river otters (*Lontra canadensis*) were released into the Mackinaw River watershed, though there has been no systematic monitoring of the population (IDNR CTAP 1997). The Indiana bat (*Myotis sodalis*) and the bobcat (*Lynx rufus*), two state threatened or endangered species, may occur in forested parts of the Mackinaw River watershed, though no sightings within the watershed have been confirmed (IDNR CTAP 1997).

Table 12. Threatened and endangered species occurring in the Mackinaw River watershed (Sources: IDNR CTAP 1997; Retzer 1997b)

Plants	**Scientific Name**	**Status**
heart-leaved plantain	*Plantago cordata*	*state endangered*
spreading sedge	*Carex laxiculmis*	*state threatened*
tall sunflower	*Helianthus giganteus*	state endangered
Birds		
long-eared owl	*Asio otus*	state endangered
short-eared owl	*Asio flammeus*	state endangered
veery	*Catharus fuscescenc*	state threatened
loggerhead shrike	*Lanius ludovicianus*	state threatened
Mammals		
river otter	*Lontra canadensis*	state endangered
Reptiles		
Kirtland's snake	*Clonophis kirtlandii*	state threatened
Illinois chorus frog	*Pseudacris streckeri*	state threatened
Illinois mud turtle	*Kinosternon flavescens*	state endangered
western hognose snake	*Heterodon nasicus*	state threatened
Musssels		
slippershell mussel	*Alasmidonta viridis*	state endangered
rainbow mussel	*Villosa iris*	state endangered
round pigtoe mussel	*Pleurobema sintoxia*	state endangered
elktoe mussel	*Alasmidonta marginata*	state endangered

Birds

At least 264 of the 299 bird species that regularly occur in Illinois are found in the Mackinaw River watershed. Of those, 134 or 50.8% have been recorded as breeding in the watershed. Of the breeding birds, 37 or 27.6% are locally extinct or extremely rare during the breeding season. Habitat loss may be a major contributing factor (IDNR

CTAP 1997). The passenger pigeon (*Ectopistes migratorius*) and Carolina parakeet (*Conuropis carolinensis*), both globally extinct, once occurred in the Mackinaw river watershed. Other species which are extinct or nearly extinct in Illinois which formerly occurred in the Mackinaw include Bachman's sparrow (*Aimophila awstivalis*), Bewick's wren (*Thryothorus bewickii*), and the American swallow-tailed kite (*Elanoides forficatus*) (IDNR CTAP 1997). For a complete list of bird species found in the Mackinaw River watershed, with a description of their associated habitat, please see the Mackinaw River Area Assessment, Volume 1 (IDNR CTAP 1997).

Mammals

There have not been any systematic surveys of mammals in the Mackinaw River watershed. Forty-five mammal species are expected to occur in the Mackinaw River watershed (Table 13) based on range maps and records contained in Hoffmeister (1989 in IDNR CTAP 1997) and the Illinois Natural Heritage database (IDNR CTAP 1997). Their occurrence is dependent upon adequate habitat and the population status of these species is unknown. Data were not available as to which species are known to occur within the Henline Creek watershed.

Table 13. Mammal species known or likely to occur in the Mackinaw River watershed. (Adapted from IDNR CTAP 1997:4-55--4-56)

Common Name	**Order** ***Scientific name***	**Status**
Marsupials	***Didelphimorphia***	
Virginia opossum	*Didelphis Virgiana*	common
Insectivores	**Insectivora**	
masked shrew	*Sorex cinereus*	common
northern short-tailed shrew	*Blarina brevicauda*	common
Least shrew	*Cryptotis parva*	common
Eastern mole	*Scalopus aquaticus*	common
Bats	**Chiroptera**	
little brown bat	*Myotis lucifugus*	common
northern long-eared bat	*Myotis septentrionalis*	common
silver-haired bat	*Lasionycteris noctivagans*	? uncommon
eastern pipistrelle	*Pipistrellus subflavus*	common
big brown bat	*Eptesicus fuscus*	common
red bat	*Lasiurus borealis*	common
hoary bat	*Lasiurus cinereus*	? uncommon
evening bat	*Nycticeius humeralis*	? uncommon
Rabbits	**Lagomorpha**	
eastern cottontail	*Sylvilagus floridanus*	common
Rodents	**Rodentia**	
eastern chipmunk	*Tamius striatus*	common
woodchuck	*Marmota monax*	common
thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	common

Franklin ground squirrel	*Spermophilus franklinii*	? uncommon
gray squirrel	*Sciurus carolinensis*	common
fox squirrel	*Sciurus niger*	common
southern flying squirrel	*Glaucomys volans*	common
plains pocket gopher	*Geomys bursarius*	common
beaver	*Castor canadensis*	common
western harvest mouse	*Reithrodontomys megalotis*	common
deer mouse	*Peromyscus maniculatus*	common
white-footed mouse	*Peromyscus leucopus*	common
meadow vole	*Microtus pennsylvanicus*	common
prairie vole	*Microtus ochrogaster*	common
pine vole	*Microtus pinetorum*	? uncommon
muskrat	*Ondatra zibethicus*	common
southern bog lemming	*Synaptomys cooperi*	common
Norway rat*	*Rattus norvegicus*	common
house mouse*	*Mus musculus*	common
meadow jumping mouse	*Zapus hudsonius*	? uncommon
Carnivores	**Carnivora**	
coyote	*Canis latrans*	common
red fox	*Vulpes vulpes*	common
gray fox	*Urocyon cinereoargenteus*	? uncommon
raccoon	*Procyon lotor*	common
least weasel	*Mustela nivalis*	? uncommon
long-tailed weasel	*Mustela frenata*	common
mink	*Mustel vison*	common
badger	*Taxidea taxus*	uncommon
striped skunk	*Mephitis mephitis*	common
river otter	*Lontra canadensis*	uncommon
Even-toed ungulates	**Artiodactyla**	
White-tailed deer	*Odocoileus virginianus*	common

* exotic species

Butterflies and Skippers

There have not been any systematic surveys of butterflies in the Mackinaw River watershed. Though there are known collections by county, population status is unavailable (IDNR CTAP 1997). Table 14 lists the 21 species known to occur in the Mackinaw River watershed in McLean County. These species may be found in the Henline Creek subwatershed. The Mackinaw River Area Assessment lists other species likely to occur in the area (IDNR CTAP 1997:Table 4-13).

Table 14. Butterflies and skippers known to occur in McLean County in the Mackinaw River watershed (adapted from IDNR CTAP 1997:4-72—4-76)

Common name	Scientific name
black swallowtail	*Papilio polyxenes*
zebra swallowtail	*Eurytides marcellus*
cabbage butterfly*	*Pieris rapae*
clouded sulphur	*Colias philodice*
bronze copper	*Lycaena hyllus*
Dione copper	*Lycaena dione*
eastern tailed blue	*Everes comyntas*
spring azure	*Celastrina argiolus*
harvester	*Feniseca tarquinius*
hackberry butterfly	*Asterocampa celtis*
tawny emperor	*Asterocampa clyton*
viceroy	*Limenitis archippus*
question mark	*Polygonia interrogationis*
hop merchant	*Polygonia comma*
silvery checkerspot	*Chlosyne nycteis*
pearl crescent	*Phyciodes tharos*
regal fritillary	*Speyeria idalia*
great spangled fritillary	*Speyeria cybele*
variegated fritillary	*Euptoieta claudia*
monarch	*Danaus plexippus*
dun skipper	*Euphyes vestris*

* exotic species

Freshwater Mussels

Historically the Mackinaw River watershed has supported 31 species of mussels; some species may have been extirpated in the last few decades (IDNR CTAP 1997). Freshwater mussels were sampled in Henline Creek during 1995-96. A total of 13 species were recorded in the creek (Retzer 1997b). See Table 15 for a complete list of species found.

Slippershell (*Alasmidonta viridis*), a state endangered species thought to be extinct in the Mackinaw River watershed was recorded from Henline Creek during the recent survey (Retzer 1997b). Ellipse (*Venustaconcha ellipsiformis*), also found in the creek, is a globally rare mussel (Miller 1998).

Table 15. Mussels found in Henline Creek, 1995-95, and abundance (Source: Retzer 1997b).

Common name	Species	Number of live individuals
slippershell	*Alasmidonta viridis*	3
elktoe	*Alasmidonta marginata*	1
threeridge	*Amblema plicata*	5

cylindrical papershell	*Anodontoides ferussacianus*	6
Wabash pigtoe	*Fusconaia flava*	11
plain pocketbook	*lampsilis cardium*	15
fatmucket	*lampsilis siliquoidea*	304
white heelsplitter	*lasmigona complanata*	1
	pleurobema coccineum	1
giant floater	*pyganodon grandis*	shells only
pimpleback	*Quadrula pustulosa*	shells only
squawfoot	*Strophitus undulatas*	10
ellipse	*Venustaconcha ellipsiformis*	9

Amphibians and Reptiles

There are 13 amphibian species and 25 reptile species known or likely to occur in the Mackinaw River watershed (IDNR CTAP 1997). The eastern massasauga (*Sistrurus massasauga*) has been extirpated from the watershed, probably due to loss of prairie wetland habitat (IDNR CTAP 1997). State threatened or endangered species known to occur in a small portion of the Mackinaw watershed include the Illinois chorus frog, Illinois mud turtle and Illinois hognose snake. The state threatened Kirtland's snake and smooth softshell turtle (*Apalone mutica*) have both been located near the Mackinaw River watershed and may also occur there (IDNR CTAP 1997). Table 16 lists amphibians and reptiles known or likely to occur in the Mackinaw River watershed, no information on presence within Henline Creek is available.

Table 16. Amphibian and reptile species known or likely to occur in the Mackinaw River watershed. (Adapted from IDNR CTAP 1997:4-63)

Common name	Scientific name	Abundance
Amphibians		
smallmouth salamander	*Ambystoma texanum*	common
tiger salamander	*Ambystoma tigtinum*	uncommon
eastern newt	*Notophthalmus viridescens*	uncommon
American toad	*Bufo americanus*	common
Fowler's toad	*Bufo woodhousii*	common
cricket frog	*Acris crepitans*	common
striped chorus frog	*Pseudacris triseriata*	common
Illinois chorus frog	*Pseudacris streckeri*	rare
Cope's gray treefrog	*Hyla chrysoscelis*	common
eastern gray treefrog	*Hyla versicolor*	common
bullfrog	*Rana catesbeiana*	common
northern leopard frog	*Rana pipiens*	uncommon
plains leopard frog	*Rana blairi*	uncommon
Reptiles		
snapping turtle	*Chelydra serpentina*	common
painted turtle	*Chrysemys picta*	common

Blanding's turtle	*Emydoidea blandingii*	rare
Illinois mud turtle	*Kinosternon flavescens*	rare
map turtle	*Graptemys geographica*	uncommon
spiny softshell turtle	*Apalone spinifer*	uncommon
ornate box turtle	*Terrapene ornata*	rare
slender glass lizard	*Ophisaurus attenuatus*	rare
six-lined racerunner	*Cnemidophorus sexlineatus*	rare
eastern hognose snake	*Heterodon platirhinos*	uncommon
western hognose snake	*Heterodon nasicus*	rare
racer	*Coluber constrictor*	uncommon
smooth green snake	*Opheodrys vernalis*	uncommon
rat snake	*Elaphe obsoleta*	uncommon
fox snake	*Elaphe vulpina*	common
bullsnake	*Pituophis catenifer*	uncommon
milk snake	*Lampropeltis triangulum*	uncommon
prairie kingsnake	*Lampropeltis calligaster*	common
western ribbon snake	*Thamnophis proximus*	uncommon
plains garter snake	*Thamnophis radix*	common
common garter snake	*Thamnophis sirtalis*	common
brown snake	*Storeria dekayi*	common
red-bellied snake	*Storeria occipitomaculata*	uncommon
Graham's crayfish snake	*Regina grahamii*	uncommon
northern water snake	*Nerodia sipedon*	common

Socioeconomic/Human Resources

At the time of the 1990 census the population of McLean County, including the Bloomington/Normal urban area, was 129,180 people living in 46,896 households. In 1996 the US Census Bureau estimated the county population at 139,133 people (US Census Bureau 1999). The vast majority (75%) of McLean County is urban (Farrell 1995). In 1989 persons living on farms totaled 4,002. The racial make-up of the county population is primarily white (93.8%), with the remainder of individuals being of black, Native American, or other minority races. Less than half of the county population (44.0%) did not change residence between 1985 and the census, while another 24% lived within the county in 1985 but had changed housing unit between 1985 and the census date. Nearly 32% of county residents moved into the county between 1985 and 1990, over two-thirds of them from elsewhere in Illinois (US Census Bureau 1999).

Over 84% of adults over the age of 25 have a high school diploma or equivalent, with over 61% of those individuals having obtained an Associate degree or higher. Just over 3.2% of employed persons over 16 years old work in agriculture, forestry, or fisheries (see Table 17). Many of the employed persons in the Henline Creek subwatershed work in agriculture.

Table 17. McLean County employment by industry, 1989. (Source: US Census Bureau 1999)

Industry	**No. of people over 16 years old**
Agriculture, forestry and fisheries	2216
Mining	21
Construction	3054
Manufacturing, nondurable goods	2415
Manufacturing, durable goods	5048
Transportation	2156
Communications and public utilities	1975
Wholesale trade	2501
Retail trade	12905
Finance, insurance, real estate	11066
Business and repair services	2701
Personal services	1876
Entertainment and recreation services	695
Health services	4312
Educational services	9305
Other professional and related services	3785
Public administration	2027

Median household income in McLean County in 1989 was $31,366, it was estimated at $43,207 in 1995. Over 91% of the workforce works within the county. The majority of others commute to other counties in Illinois, with only a few working outside of the state (US Census Bureau 1999). In 1995 it was estimated that 7.9% of the county population was living in poverty (US Census Bureau 1999).

The median value of owner-occupied housing units in 1989 was $65,400 (US Census Bureau 1999).

In 1989 83.6% of households had wage or salary income. In 1989 12.2% of households had some farm self-employment income (US Census Bureau 1999). In 1993 farm cash receipts for McLean county totaled $239,504,000 (see Table 18)

Table 18. 1993 Farm cash receipts, McLean County (in thousand dollars). Adapted from IDNR CTAP 1997 Table 1-31).

Commodity	**Receipts** (in thousand dollars)
Corn	122,754
Soybeans	85,834
Wheat	420
Other	2,774
Crop total	**211,783**
Cattle	7,440

Hogs & pigs	15,769
Other	3,830
Livestock total	**27,721**

A variety of state and local organizations have outreach programs operating within McLean County, and by extension within the Henline Creek subwatershed. Some of the specific programs available to landowners are highlighted in the Watershed Activities section of this report. The United States Department of Agriculture Natural Resources Conservation Service county headquarters is in Normal, as is the Soil and Water Conservation Service headquarters. The University of Illinois Extension Service also operates in the watershed. The state Department of Natural Resources is also an important resource for county residents. The McLean County Farm Bureau is also a source of valuable information. These offices also exist in Ford and Livingston Counties and serve as resources to agricultural producers in those counties. The Nature Conservancy through the Mackinaw River Watershed Council continues to conduct outreach activities in the entire Mackinaw River watershed, with a focus in the Henline Creek area.

The Lawndale/Cropsey Drainage District is active in this subwatershed. Information on this organization was included in the section entitled "Drainage."

Watershed residents also have access to the *Bloomington Pantagraph* as well as a newspaper from Champaign/Urbana. These papers provide national, state, and local news. Small newspapers from Sibley and Colfax are also available with items of local relevance.

A study of farm operators' perceptions and attitudes concerning the Mackinaw River was completed in 1995 (Rendziak 1995; Farrell 1995). A mail survey was carried out watershed wide and in-depth interviews were held with some landowners. While the data are not specific to the Henline Creek subwatershed the information collected does represent an average over the entire watershed and is of particular importance in gaining a better understanding of farmer attitudes. The information reported below was all collected as part of this effort (see Rendziak 1995 and Farrell 1995 for additional information on study design and results).

Farm operators identified a number of problems with waterways in the Mackinaw River watershed, their causes and potential solutions. These are highlighted in Tables 19, 20, and 21.

Table 19. Identified river, creek, and stream problems

Flooding (mostly along the main stem)
Increased water velocity
Sedimentation
Crop residue deposited on farm land after flood events
Land lost to the river

Chemicals in the river

Table 20. Identified causes of river, creek and stream problems

Natural weather patterns
Natural river features
Inadequately maintained levees
Traditional farming practices
Urbanization
Tree removal from the riparian zone
Agricultural chemicals

Table 21. Identified solutions to river, creek and stream problems

Levee construction and maintenance
Construction of detention basins
Conservation farming practices
Proper chemical application
Tree planting
Setting aside land for conservation
Streambank stabilization
Conservation easements
Increasing fish and wildlife populations

While farm operators are able to identify some key issues affecting the waterways in the Mackinaw River watershed, on average farm operators do not feel that the problems associated with the waterways have increased or decreased recently, though there was variation in responses. Those who felt the river has changed cited that the river has become higher and faster with a deeper channel; that flooding was more rapid and there was increased crop residue; and that meandering had increased.

Farm operators are generally knowledgeable about causes of river problems. Though the desire to blame events on "natural causes" beyond their control exists. Most farm operators agreed that conservation measures could be beneficial. However, farm operators generally support structural measures such as channelization and streambank stabilization with rip-rap, rather than more ecologically-based solutions such as planting trees or creating wetlands. Farm operators expressed mixed opinions on activities such as conservation easements or taking land out of production. While farm operators expressed an interest in technical advice, most were not interested in receiving assistance.

Farm operators are interested in maximizing the long-term productivity, efficiency and profitability of their farms while also maximizing the quality of their products. Protection of private property rights is a paramount concern of all farm operators.

Component #5
Problem Statement

Problem #1
Excessive nitrogen and volatile solids are entering the water through surface and subsurface drainage systems and are threatening water quality.

Problem #2
Wetland habitat within the subwatershed is extremely limited and riparian zones are poorly developed. Unique habitats necessary to continue to sustain the species assemblages in the creek may be at risk. In the medium to long term reduced water quality and lower quality habitat may lead to reduced or extirpated populations of the endangered and threatened mussels and other aquatic biota found in Henline Creek.

Problem #3
There is a general lack of awareness among watershed residents of the relationship between land management practices and creek conditions, coupled with a lack of appreciation of this unique aquatic resource. This lack of awareness leads to land management practices that do not protect, and may degrade, Henline Creek.

Component #6
Goals and Objectives

Goal #1
To reduce excessive nutrients being deposited in the creek and sedimentation in order to maintain and improve water quality.

Objective #1
- Reduce and retain surface and subsurface runoff by promotion of such best management practices as conservation tillage, water and sediment control basins, contouring, waterways, filter strips, stormwater detention basins, and wetlands on 60% of agricultural land.
- Restore appropriate areas to wetlands or wet prairie.
- Increase the use of nutrient management techniques.

Goal #2
To increase the number and acreage of functioning wetlands and to develop the riparian corridor in such a way that they protect and promote unique Creek habitats.

Objective #2

- Restore appropriate areas to wetlands or wet prairie through dialogue with landowners and encouraging the use of appropriate cost share measures where available.
- Purchase land or acquire easements to restore areas to wetland or wet prairie.
- Improve the riparian zone through land amelioration practices, including woodland management, woodland development, diversification of vegetation types, promotion of indigenous tree species, and other appropriate means, encouraging the use of appropriate cost share measures where available.

Goal #3

To increase awareness and pride among land managers and other residents of the importance of this unique water resource and to increase the use of appropriate land management practices to maintain and improve the resource.

Objective #3

- Provide educational opportunities for watershed residents to learn more about the natural resources in their midst and their present and future value.
- Increase participation in programs providing technical and financial assistance for the implementation of best management practices.

Component #7
Implementation Strategies

Strategies

Addressing the objectives outlined in Component #6 demands an integrated approach that includes the sensitization of agricultural producers and the implementation of appropriate land management practices. A variety of strategies need to be employed taking into account the conditions in different portions of the subwatershed and the willingness of agricultural producers to participate. Planning farm-based activities based on individual farm conditions is essential, and integrating several practices into one farm management plan may sometimes be desirable. The strategies outlined below are not exclusive[*], other practices may also be appropriate to individual situations and should be employed when needed. Flexibility in implementation is essential if sustainable, long-term results are to be realized.

Strategy #1: Nutrient Management

Provide and promote nutrient management techniques for livestock producers and work with agricultural producers and chemical dealers to reduce over application of fertilizers and pesticides. Nutrient management will be practiced by one-third of the livestock

[*] Further information on many appropriate land management practices, including some included in these strategies, may be found in *Conservation Choices,* USDA SCS 1993.

operations and on one-half of the agricultural land in row crop production (approximately 12,000 acres) by the end of the five-year period.

Implementation of this strategy will lead to a reduction in nutrient loading and a consequent improvement in water quality as well as improved soils for farming. Proper practice will also reduce crop management costs. This strategy addresses Objective #1.

Strategy #2: Conservation tillage
Promote conservation tillage on 6,000 acres of agricultural land. Leaving crop residue on the fields provides benefits directly to agricultural producers in reduced management costs and improved soils while also improving water quality.

Implementation of this strategy will lead to a reduction in sheet and rill erosion and consequent sedimentation leading to improved water quality. Farm management costs will also be reduced and soil texture and fertility improved. This strategy addresses Objective #1.

Strategy #3: Contouring and terracing
Promote contouring on 100 acres of agricultural land and the construction of 5,000 feet of terraces on agricultural land. Contour farming helps to reduce water flow over agricultural lands and aids in infiltration. Combining contour farming with the planting of buffer strips or construction of terraces along the contour can increase the potential benefits from these practices. In addition, constructing terraces in combination with water and sediment control basins (see below) can further help to control soil erosion and water movement.

Implementation of this strategy will lead to a reduction in the volume and velocity of water entering the stream after storm events, reduction in sheet and rill erosion, and consequently reduced sedimentation, leading to improved water quality. This strategy addresses Objective #1.

Strategy #4: Water and sediment control basins
Install 75 water and sediment control basins. By trapping water and sediment being carried across farmland water and sediment control basins assist in controlling erosion and reduce the quantity of water entering waterways after storm events. These basins may be combined with contour farming and terracing or buffer strips for maximum advantage.

Implementation of this strategy will lead to a reduction in the volume and velocity of water entering the stream after storm events, reduction in sheet and rill erosion, and consequently reduced sedimentation, leading to improved water quality. This strategy addresses Objective #1.

Strategy #5: Waterways
Protect natural waterways on farmland through smooth-grading the area and planting appropriate grasses. Waterways will be established on 120 acres of agricultural land.

The implementation of this strategy will reduce soil erosion and protect cropland from gully formation, leading to reduced sedimentation and improved water quality. This strategy addresses Objective #1.

Strategy #6: Filter strips
On lands with a gentle slope filter strips of grasses and trees or shrubs will be planted adjacent to waterways. Filter strips will be established on 240 acres of agricultural land.

Implementation of this strategy will reduce soil erosion and filter potential contaminants before they reach the waterway. This strategy addresses Objective #1.

Strategy #7: Wetlands
Wetlands provide a variety of benefits to the rural landscape, protecting soil and water and promoting wildlife. By constructing wetlands in areas where they once existed naturally diverse benefits may be realized by the landowner and all subwatershed residents. In some areas land will be purchased or easements obtained for the construction and promotion of wetlands and wet prairie. Wetlands will be constructed, restored, and/or protected on 1200 acres of land.

Implementation of this strategy will reduce runoff and provide water storage after storms, remove contaminants from water, collect sediment, and ultimately improve water quality and promote biodiversity. This strategy addresses Objectives #1 and #2.

Strategy #8: Riparian zone management
Establish or enhance riparian zones along ten percent of the waterways within 5 years. Approximately 200 acres will be managed for native vegetation. Practices will vary depending on the specific areas chosen for this effort but may include the establishment of wetland, woodland, prairie, or savanna areas or the restoration or management of existing riparian areas.

The implementation of this strategy will enhance aquatic and terrestrial habitats, stabilize streambanks, reduce erosion, and contribute to improved water quality. This strategy addresses Objective #2.

Strategy #9: Workshops and field trips
Promote and encourage regular workshops and meetings to introduce the above mentioned practices to agricultural producers and encourage their participation. Workshops and meetings will be conducted in cooperation with the appropriate agencies (e.g., NRCS and SWCD). One workshop will be held each year with agricultural producers from the subwatershed. Two formal meetings will he held each year, and informal meetings will take place on an as needed basis. Provide opportunities for agricultural producers to view existing conservation practices and discuss costs and benefits with participating agricultural producers. At least two field trips per year will be organized.

Implementation of this strategy will lead to greater awareness among landowners of alternative land management strategies and available assistance; an increased number of agricultural producers adopting best management practices and other appropriate land management techniques; increased enrollment in cost share programs; and a regular and productive dialogue between the Mackinaw River Watershed Council (MRWC), agricultural producers, and concerned government agencies. The long-term implications of this strategy will be the maintenance and improvement of water quality, the enhancement of aquatic habitats, and the conservation of the land and water resource. This strategy directly addresses Objective #3.

Strategy #10: Newsletters
Produce a newsletter three times per year for distribution to agricultural producers within the watershed. Provide other appropriate mailings as needed to inform agricultural producers of activities and events within the watershed and provide them with additional information.

Implementation of this strategy will lead to greater awareness among landowners of activities going on in their area and in other parts of the Mackinaw River watershed. It will serve as another method for encouraging the adoption of land management practices that serve to conserve the water, soil, and other natural resources. This strategy directly addresses Objective #3.

Strategy #11: Extension personnel
Increase the availability of competent extension personnel in the subwatershed by employing a qualified individual to provide outreach assistance. This person is not meant to replace employees of state and federal agencies, but rather to supplement their activities and increase the presence of technical assistance in the subwatershed. The individual employed will work in close collaboration with the government agencies. Their role will be to increase the awareness of subwatershed residents of the value of their local resources and promote the adoption of appropriate land management practices, when appropriate using the assistance of available cost share programs. The Mackinaw River Watershed Council would employ one person who would work in several areas within the Mackinaw River watershed, thus providing approximately four person months per year of technical assistance in this subwatershed.

Implementation of this strategy will increase the adoption rate of the strategies listed above and therefore insure the conservation of the waterways, soils, riparian vegetation and other natural resources in the watershed. This strategy addresses Objective #3 directly and all of the subwatershed management plan objectives indirectly.

Strategy #12: Monitor progress
Monitor progress on a regular basis by collecting pertinent data and other information needed to assess the implementation of the above detailed strategies. Data to be collected is outlined below in Component #9 – Measuring Progress/Success.

Implementation of this strategy will ensure that this subwatershed management plan is being used to its best advantage and that knowledge gained is used to evaluate and modify targets as needed. This strategy is essential to the success of the implementation of this subwatershed management plan and indirectly addresses all of the objectives.

Timetable

A tentative five-year timetable for strategy implementation has been developed (Table 22). The number of acres, feet, participants, or events for each strategy has been projected. The overall approach relies on regular outreach efforts leading to the adoption of specific techniques and, by the fifth year, the spontaneous adoption of particular practices by land managers. Once a farmer has adopted a certain practice, such as nutrient management or conservation tillage, it is assumed they will continue with that practice indefinitely.

Table 22. Timetable for subwatershed management plan strategy implementation.

Strategy	Year 1	Year 2	Year 3	Year 4	Year 5
#1 Nutrient management (acres)	1,200	2,400	3,600	4,800	
#2 Conservation tillage (acres)	1,000	1,500	1,500	2,000	
#3 Contouring & terracing (acres/,000feet)	25/1	25/1.5	25/1.5	25/1	
#4 Water & sediment control basins (#)	15	15	15	15	15
#5 Waterways (acres)	24	24	24	24	24
#6 Filter strips (acres)	48	48	48	48	48
#7 Wetlands (acres)		300	300	300	300
#8 Riparian zones (acres)		50	50	100	
#9 Workshops & field trips (#)	3+2	3+2	3+2	3+2	3+2
#10 Newsletter (#)	3	3	3	3	3
#11 Extension (FT person/months)	4	4	4	4	4
#12 Monitoring (ongoing)	X	X	X	X	XX

Agencies and Organizations

The agencies and organizations mentioned in Component #3 Watershed Activities would continue to coordinate and collaborate on the implementation of these strategies in the subwatershed. Specifically, the Mackinaw River Watershed Council would employ an extension person and oversee their activities. The MRWC would coordinate with The Nature Conservancy to produce the newsletter and other pertinent mailings, responsibility for this activity will shift toward independent implementation by the MRWC by Year 4. Workshops and other meetings would be organized and advertised by the MRWC with assistance from TNC. Agency personnel would be an integral part of the workshop process and their active participation is essential for success. In some instances meetings already planned by agencies may serve the purposes of this plan.

The Soil and Water Conservation Districts and Natural Resources Conservation Service will continue to provide technical support and administer cost share programs. In an effort to realize the ambitious goals of this plan, The Nature Conservancy, in consultation

with the Mackinaw River Watershed Council and government agencies will continue to seek available funds for these activities. Funding sources include the Illinois Environmental Protection Agency, the US Environmental Protection Agency, special program funds through the US Department of Agriculture, the Illinois Department of Natural Resources, the Farm Bureau, private foundations, and private business. Landowners will also provide funding, labor and equipment as appropriate for the activities being undertaken.

Effectiveness and long-term maintenance

The implementation strategies described above are based on current best available information. As new information becomes available plan implementers and funding agencies must remain flexible and integrate new technologies into management of this subwatershed. The Nature Conservancy, through its work in part of the Mackinaw River watershed, will be examining the effectiveness of these types of measures in improving water quality and protecting aquatic habitats. This information will be invaluable as these strategies are implemented.

The long-term maintenance of activities will fall to the landowners. Through providing technical assistance and utilizing cost share programs where available agricultural producers' risk levels are reduced. This should help to encourage implementation. During the initial phases of this subwatershed management effort it will be crucial that agricultural producers see tangible results that provide direct benefits to them and their farm management while also improving the waterways in the subwatershed. This will help to increase the rate of adoption of conservation practices while also encouraging agricultural producers to maintain and improve existing conservation practices.

Component #8
Cost Summary

Costs of implementing the detailed strategies are outlined in Table 23. Present costs are used and no allowances for inflation or price changes have been included. Time sensitive costs must be calculated as implementation proceeds.

Table 23. Estimated costs of strategy implementation.

Strategy	**Quantity**	**Unit**	**Cost per unit**	**Five year Total cost**
#1 Nutrient management (soil testing per acre)[1]	12,000	acre	$6	72,000
#2 Conservation tillage	6,000	acre	$10	60,000
#3 Contouring	100	acre	No cost	
Terracing	5000	feet	$5	25,000
#4 Water & sediment control basins	75	each	$1,000	75,000
#5 Waterways	120	acre	$1,300	156,000
#6 Filter strips	240	acre	$150	36,000

#7 Wetlands[2]	1,200	acre	$5,400	6,480,000
#8 Riparian zones	200	acre	$1000	200,000
#9 Workshops & field trips (3+2 per year)		year	$4,000	20,000
#10 Newsletters & mailings (3+ per year)		year	$1,000	5,000
#11 Extension (4 FT person/months/year)		year	$20,000	100,000
#12 Monitoring (most expenses in year 5)		year	$5,000	25,000
Total Cost				**$7,122,000**

Notes: [1] – cost is for soil testing to determine nutrient needs; [2] – costs include land acquisition, wetland design and construction, earth works, water level control structures, field tile removal, and seeding

Available cost share programs are detailed in Component #3 of this report – Watershed Activities. Those cost share programs would continue to be utilized as appropriate to realize the implementation strategies. Participating agricultural producers would provide labor, equipment, and materials as required. The costs of technical assistance from state and federal agencies are not calculated here, but are substantial. The Nature Conservancy will continue to provide technical assistance to the Mackinaw River Watershed Council.

Component #9
Measuring Progress/Success

Monitoring the implementation of this subwatershed management plan is essential to ensuring its success. Monitoring will be done at two temporal scales building on knowledge accumulated to date. Based on realized progress and unforeseen impediments to implementation, targets may be adjusted as needed. Estimates of monitoring costs have been integrated into this proposal.

A yearly summary of realized activities in the Henline Creek subwatershed will be compiled. It will consist of details of the numbers of BMPs and other activities implemented, the distance or acreage covered, and the number of individuals participating. Soil testing will be used to assess changes in nutrient levels and pesticide/herbicide use. Pertinent information as to what worked and what did not will be collected to assist in evaluating and "fine tuning" the approach to better reach implementation goals. As new practices are found promising for meeting the goals of this subwatershed management plan they will be integrated into the plan and included in the monitoring activities.

Relevant information compiled by government agencies will be collected and used in evaluating progress. This will include estimates of soil erosion or soil loss, water quality data, land use data, and others.

Where appropriate surveys to measure water quality or aquatic biota will be undertaken with the assistance of professionals and/or volunteer groups.

The Nature Conservancy's work to monitor the impacts of BMPs on the water resource will be key to developing a better understanding of the impact of different activities on the water resource. This work is being carried out as part of a grant from the Kellogg Foundation, it will be of relevance to activities carried out in all watersheds within the Mackinaw River watershed.

Towards the end of Year 5 a social survey designed to reassess knowledge, attitudes, and practices related to resource management and its affects on the water resource will be carried out. The social survey discussed under Component # 4 – Watershed Resource Inventory will be used as a baseline to assess changes in landowner attitudes. Additional attitudinal data are being collected in 1999 in a small portion of the Mackinaw River watershed as part of the Nature Conservancy program being carried out under the grant from the Kellogg Foundation. That data will be integrated with the original survey. The results of this monitoring activity are key to the long-term success of subwatershed management. Only by enlisting the active participation of watershed residents and land managers in conservation activities will the Henline Creek resource and its surroundings be conserved.

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