Mackinaw River Project

Mackinaw River Subwatershed Management Plan
Walnut Creek

Printed January 2000

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Prepared for:
Financial Assistance Agreement Number 95-01
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This report was prepared using U.S. Environmental Protection Agency funds under Section 319 of the Clean Water Act distributed through the Illinois Environmental Protection Agency. The findings and recommendations herein are not necessarily those of the funding agencies.

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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

Walnut Creek is a fourth order tributary of the Mackinaw River. It flows through Woodford County with a small portion of its basin extending into Tazewell County. The source of the creek is near Metamora and it flows through Eureka. The mouth of the creek is located near Congerville, at Mackinaw River mile 58.9 (Short et al. 1996).

The Walnut Creek subwatershed is approximately 72.0 square miles in area (46,092 acres), or approximately 6.4% of the entire Mackinaw River drainage (IDNR CTAP 1997). The Creek is 23.40 miles long (Illinois EPA 1996). There are 93.3 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 waterbody identification number is ILDKJ01 (Illinois EPA 1996). The watershed delineation includes the Woodford and Tazewell counties hydrologic unit river basin number 07130004, watershed number 060, Tazewell county subwatershed number 12, and Woodford County subwatershed numbers 18 and 19 (USDA SCS 1985, 1986).

The largest lake in the watershed is Lake Eureka. Constructed in 1941 it has a surface area of approximately 27.6 acres and though used for public water supply until 1995, it is primarily used for recreation today (IDNR CTAP 1997). The state waterbody identification is ILSDS (Illinois EPA 1996). There are several smaller lakes scattered throughout the subwatershed, including 6.9-acre Rich Lake near the Woodford/Tazewell county line.

The watershed is almost entirely in private ownership. Public land includes Eureka City Park. There is access to the creek at Eureka City Park and county highway bridges.

Component #3
Watershed Activities

The Mackinaw River Watershed Council identified the Walnut 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 Section 319 nonpoint source pollution control program of the Clean Water Act. 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 implement 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 downstream portion of Walnut Creek subwatershed to its confluence with the main stem of the Mackinaw River 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 best management practices (BMPs) through installing appropriate 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. Three waterways in the Walnut Creek area were cost-shared under this program (J. Schuler, Woodford County NRCS District Conservationist, personal communication 1999). During this period other cost share programs in Woodford County were directed to areas outside the Mackinaw River watershed (Schuler, personal communication 1999).

Other federal and state programs available to landowners wishing to improve conservation practices on their land are promoted and administered through the Woodford and Tazewell County Soil and Water Conservation Districts (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 by entering the state program (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.

Cooperative efforts between the SWCD and the City of Eureka began in 1998 to restore a woodland prairie and wetland in the City Park using funds from the Conservation 2000 program (Schuler, personal communication 1999). An application for additional funds to continue this work with C2000 funds has been made through the Mackinaw River Watershed Council. Proposed work will include further restoration and protection through prescribed burning and planting of prairie grasses, flowers, and native trees. A walkway/platform will be built over the restored wetland. Ultimately the area will serve as a handicap accessible outdoor classroom and a demonstration of restoration and protection efforts.

Portions of the watershed near Congerville may be studied as part of an effort to identify and quantify the consequences of climate change on natural and human systems (Herricks et al. 1999). The study will take an integrated approach to examining system reactions to potential changes, and may increase understanding of how the system functions.

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

The largest lake in the Walnut Creek (ILDKJ01) subwatershed is Lake Eureka (ILSDS). It has a surface area of approximately 27.6 acres and though used for public water supply until 1995, it is primarily used for recreation today (IDNR CTAP 1997). Lake Eureka is a eutrophic lake with a mean trophic state index (TSI) of 69 (Illinois EPA 1996). It has several identified sources of impairment, which are noted in the Impairment section below. However, the trend in water quality is improving (Illinois EPA 1996). There are four smaller lakes scattered throughout the subwatershed, including 6.9-acre Rich Lake near the Woodford/Tazewell County line.

Walnut Creek is 23.40 miles long (Illinois EPA 1996). There are 93.3 river miles within the watershed (IDNR CTAP 1997). Walnut Creek is a fourth order tributary of the Mackinaw River. Stream monitoring has periodically taken place at station DKJ-01, located three miles northeast of Goodfield (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), an index based on habitat characteristics, calculated at station DKJ-01 was 43.3 in 1987 and 43.0 in 1994, indicating that the creek has the biotic potential of a highly valued aquatic resource (Short 1988; Short et al. 1996).

Table 1. Habitat characteristics of Walnut Creek station DKJ-01. (Sources: Short 1988;Short et al. 1996)

	1987	**1994**
Hydraulic Features		
Stream order	4	4
Station length (ft.)		680
Increment width		3
Mean stream width (ft.)	35.0	30
Mean stream depth (ft.)	1.7	0.75
Mean thalweg velocity (ft/s)	0.04	0.31
Discharge (cfs)	2.5	2.49
Mean discharge (ft/s)		0.71
Channel width (ft.)		78
Pool (%)	4	53

Riffle (%)	40	13
Substrate		
Silt/mud (%)	1	16.5
Sand (%)	6	20.4
Fine gravel (%)	14	10.7
Medium gravel (%)	13	10.7
Coarse gravel (%)	23	20.4
Small cobble (%)	29	13.6
Large cobble (%)	11	3.9
Boulder (%)	0	1.9
Bedrock (%)	0	0
Claypan (%)	0	0
Plant detritus (%)	0	0
Vegetation (%)	3	0
Submerged logs (%)	0	1.9
Other (%)	0	0
Other		
Instream cover (%)	4	1.21
Shading (%)	2	23
Predicted IBI	43.3	43
Biotic Potential Category	B	B

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 Walnut Creek was 102 (see Table 2). 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 DKJ-01, 1994. (Source: Short et al. 1996)

Metric	**Score**	**Assessment**
Bottom substrate	16	excellent
Deposition	7	good
Substrate stability	9	good
Instream cover	4	fair
Pool substrate	15	good
Pool quality	7	fair
Pool variability	12	good
Canopy cover	4	fair
Bank vegetation	5	fair
Bank land use	1	poor
Flow refugia	4	fair
Channel alteration	4	fair
Channel sinuosity	4	fair
Width/depth	1	poor
Hydrologic diversity	9	good
Total score	102	

Water quality is another important parameter in understanding the stream and any changes over time due to natural or human causes. Walnut Creek had a water quality index of 41.0 when sampled in 1987, indicating that there were minor 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). Additionally, water quality downstream of the sewage treatment plant in Eureka has been evaluated. This is elaborated on below.

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

			1994		
Category	**Parameter**	**1987**	9/7	10/20	11/22
Temperature	temperature (°C)	26	17.4	16.0	4.5
Oxygen	dissolved oxygen (mg/l)	5.2	6.8	6.7	12.6
pH	pH	7.6	7.6	7.8	8.3
Trophic/Nutrients	total phosphorus (mg/l)	0.35	0.16	0.18	0.31
Turbidity	total suspended solids (mg/l)	43	32	40	17
Dissolved solids	conductivity (umhos/cm)	695	558	635	787
Inorganic toxicity	un-ionized ammonia (mg/l)	0.0073	0.000	0.002	0.008
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	<100	<100	<100
Water quality index		41.0	na	na	na

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

No water quality violations were found in Walnut Creek in 1994 and there were no elevated levels of pollutants or measured chemicals in the sediment (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 a 1994 intensive survey of the Mackinaw River, Walnut Creek had an Index of Biotic Integrity (IBI) of 54. 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). (Please see Designated Use section below for a fuller explanation of IBI and PIBI.)

A facility related stream survey (FRSS) was conducted on Walnut Creek in 1991 near the sewage treatment plant at Eureka (Hefley 1991). The municipal wastewater treatment plant there uses an activated sludge process (Short 1988). During the 1991 survey the macroinvertebrate biotic index (MBI) ranged from 5.0, or excellent, 0.2 miles upstream of the wastewater treatment plant to 7.1, or fair, 1.3 miles downstream of the plant (Hefley 1991). Based on these results, the discharge at Eureka appeared to be having a moderate impact on macroinvertebrates, though there were no recorded violations of general use water quality standards (Hefley 1991). Downstream from the sewage treatment plant reduced dissolved oxygen and elevated phosphorus levels were also recorded (Hefley 1991). See below for further information.

Designated Use/ Designated Use Support

The Illinois Environmental Protection Agency has designated Walnut 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 as well as volunteer data (Illinois EPA 1996). Testing was primarily done at site DKJ-01 on the downstream portion 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 Walnut 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 Walnut Creek during the 1994 assessment was 54, while the PIBI was 43. The IBI value of 54 indicates a Biological Stream Classification (BSC) rating of “A” or unique aquatic resource. The Macroinvertebrate Biotic Index (MBI) for the Creek was 5.5 (Illinois EPA 1996; Short et al. 1996). (But see above concerning lower MBI near the Eureka sewage treatment plant.)

Eureka Lake was assessed in 1994 with citizen data less than five years old. It was designated as full support for aquatic life use and drinking water use; partial/moderate use for swimming use and recreational use; and partial/minor support for overall use (Illinois EPA 1996). Fish consumption use support was not assessed.

Impairments

The Illinois Environmental Protection Agency assessed Lake Eureka in 1994. The aquatic life use impairment index (ALI) was 60, due to none/minimal suspended sediments and moderate macrophytes. The recreation use impairment index (RUI) was 79 due to moderate suspended sediments and macrophytes (Illinois EPA 1996). Causes of impairment identified for the lake were: moderate nutrients, slight siltation, slight organic enrichment/low dissolved oxygen, and moderate noxious aquatic plants. The sources of impairment and the magnitude of their contribution to impairment noted were: agriculture (high); non-irrigated crop production (high); hydromodification (slight); lake shoreline erosion and/or streambank modification/destabilization (slight); and contaminated sediments (moderate).

The Illinois Environmental Protection Agency water quality report does not list any causes or sources of impairment for Walnut 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 the wastewater treatment facility, storm sewers, or other selected identifiable locations. 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 Walnut 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. See Retzer (1997a) for a more detailed list of other potential stresses.

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

Stress	Biological Implications
Agriculture	
Excess phosphorus and nitrogen	Directly toxic, indirectly reduces community diversity
Drainage or filling in of wetlands	Loss of habitat

and bottomland lakes and oxbows	
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

The wastewater treatment plant at Eureka uses an activated sludge process, which may be having a negative impact on macroinvertebrates (see Waterbodies above). The Illinois Environmental Protection Agency recently issued a water pollution permit (NPDES Permit No. IL0025119) designating a portion of Walnut Creek as EMW or effluent modified waters, allowing higher levels of ammonia in the 2.5 miles of Walnut Creek downstream of the sewage treatment plant.

The Eureka urban area negatively impacts Walnut Creek. Gough (1997) notes that some portions of Walnut Creek passing through Eureka show signs of "serious abuse." He specifically notes channelization and dumping of trash and construction debris. A sampling site near the city showed signs of recent channel incision that is leading to large amounts of sediment (Gough 1997). Further information on the structural, biological, and chemical impacts of activities in and around Eureka on Walnut Creek are needed.

In 1994, 35 potential sources of impairment (Short et al. 1996) were identified in the Walnut Creek subwatershed. Six of these sources had a high potential as a source of impairment, seven were identified as having moderate potential, while 22 had a slight 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). Distribution throughout the watershed is relatively uniform for moderate and slight potential sites, three of the six sites with a high potential as a source of impairment are located in Eureka. The potential sources of impairment included 29 agricultural sites (82.9%), five municipal sites (14.3%), and one other site (2.9%) (Short et al. 1996). Agricultural impairments are from livestock sources only, cropland is not included. 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. Table 5 lists the location and permit numbers of surface impoundments in the Walnut Creek subwatershed.

Table 5. Surface impoundments in the Walnut Creek subwatershed. Source: IDNR CTAP 1997:2-21.

Location	NPDES permit number	Description
Metamora	IL0021521	Sewerage system
Eureka	IL0025119	Sewerage system (see above for more detail)
Eureka	IL0032034	Sewerage system
Eureka	IL0046523	Water supply
Eureka		Beef cattle feedlots

Farrell (1995) provides more specific information on some potential sources of impairment. Using a variety of sources his planning report lists 45 registered underground storage tanks in Eureka and 40 in Metamora, though not all of those in Metamora are necessarily in the Walnut Creek subwatershed. There are 18 reported leaking storage tanks, nine in Eureka and nine in Metamora. There may be other sites that are not reported. Two domestic wastewater treatment plants release effluent from treated domestic waste into Walnut Creek, one in Eureka and one in Metamora (Farrell 1995). A woodworking company in Metamora at the northern extreme of the subwatershed is a registered RCRA (Resource Conservation and Recovery Act) site (Farrell 1995). Any impact this may have on Walnut Creek is unknown.

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, for example the Mackinaw Bedrock Valley to the west of the Walnut Creek subwatershed (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). 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 Woodford County there are a reported 363 large-diameter wells and 417 small-diameter wells (IDNR CTAP 1997). US Census bureau data indicate that of the Woodford County houses which individual wells 85.4% of them use drilled wells while the remaining 14.6% use dug wells (US Census Bureau 1999). Data specific to the Walnut Creek watershed are unavailable.

Public water supply wells are drilled wells that generally tap deposits that range in depth from 35 to over 400 feet. Within the Walnut Creek watershed Eureka has two groundwater wells, one at 338 feet, the other at 340 feet. Together they pumped 88,195,200 gallons in 1995 (IDNR CTAP 1997). The Metamora public water supply is also drawn from the Sankoty-Mahomet Sand Aquifer, though the two wells are located outside of the Walnut Creek watershed (Metamora Water Supply, personal communication 1999). Together the two wells provided 77,781,800 gallons of water in 1995 (IDNR CTAP 1997). Over 67% of houses in Woodford County use a public water system or private company for their water supply (US Census Bureau 1999).

Groundwater 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 Walnut Creek subwatershed (Schuler, personal communication 1999).

Drainage

Although exact figures are not available, subsurface tiling in the Walnut Creek watershed is on the increase as the size of farm operations increases (Schuler, personal communication 1999). 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 leading to increased erosion of the streambank. 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.

There are no active Drainage Districts within this watershed (Schuler, personal communications 1999).

Floodplain Boundaries

Low slope tributaries such as Walnut Creek may be connected to wide, active floodplains (Gough 1997). Based on examination of soil types, a thin floodplain follows most of the Creek, towards the mouth it expands to between one half mile to over one mile wide on either side of the Creek. Flooding is not a regular event in the watershed, though the problem is increasing due to the expansion of housing and the resultant increase in impermeable surfaces (Schuler, personal communication 1999). Flooding occurs both in Eureka and near the mouth of the creek. Spoil berms can be found along some parts of the creek, such as where it passes through parts of Eureka.

Municipal/Industrial

The majority of the watershed is rural with a relatively low population density. Notable exceptions include Eureka, the Woodford County seat and Metamora. Additional information on population and land use may be found in the Land Use and Socioeconomic/Human Resources sections of this report.

Industrial sites within the watershed are potential sources of point source pollution, however there is no evidence to suggest that the establishments referred to here are impacting water quality in Walnut Creek. Past and present small industries in the watershed have been identified for Eureka and Metamora (Table 6). Data on NPDES permits for specific activities were not found. As only part of Metamora is within the watershed not all of its industry is likely to affect Walnut Creek.

Table 6. Industrial activities in Eureka and Metamora (Source: Farrell 1995).

Town	Industries
Eureka	commercial printing, road equipment attachment manufacturing, animal feed blending, manufacturing concrete products, gasoline stations
Metamora	food product manufacturing, culvert manufacturing, gasoline stations

Please refer to the section entitled "Impairments" above for additional information.

A large residential/commercial development is being planned along Route 116, west of Metamora (*Metamora Herald* 3/25/99). This development may have a significant impact on the headwaters of Walnut Creek.

Riparian Corridors

The riparian corridor is less than 25 meters wide along the majority of Walnut Creek, though in some stretches it increases to over 75 meters (Short et al. 1996). Land cover in the riparian corridor is primarily woodland with some grassland for the first 15 miles. Upstream, around mile 15 the percentage of woodland drops dramatically to be replaced with grassland and mixed vegetation (Short et al. 1996). Further away from the stream, in the first 300 meters the land cover is dominated by mixed vegetation with some woodland and grassland (Short et al. 1996).

Hydrologic Modifications

There is reportedly some minor levy construction on Walnut Creek (IDOC 1991 in Short et al. 1996). There are spoil berms evident along some portions of the creek. Ditching and channelization may take place along some of the tributaries. Channeled streams play a role in downstream flooding and sedimentation problems because of their efficiency in carrying stormwater. These channeled ditches do not have floodplains, therefore water storage capacity is limited. Dredging maintenance is a common practice to maintain streambed depth and to keep drain tile outlets clear. Tiling is on the increase in the subwatershed (Schuler, personal communication 1999), and this alters the creek hydrology. Increased water flow after storm events is contributing to increased streambank erosion.

Several roads cross the creek and its tributaries. Culverts are used for some tributary crossings, small bridges are found where Walnut Creek crosses major roads such as Routes 116 and 24. Eureka and Metamora are both expanding towns and this urbanization leads to a greater impermeable surface area within the watershed impacting water flow, particularly after storm events.

Stormwater Management

Woodford County has adopted the *Model Soil Erosion Ordinance* developed by the Tri-County Regional Planning Commission. This ordinance, called the Woodford County Erosion, Sediment, and Storm Water Control Ordinance, was put in to place in April 1996. The ordinance describes the types of land projects that are subject to the requirements of a permit, and describes specific standards for the design and maintenance of control measures for soil erosion, sediment, and stormwater. The ordinance states that "no land surface shall be disturbed unless an erosion and sediment control permit, or an erosion, sediment and storm water control permit, has been issued for that project." Exceptions to this are:

1. Land disturbing activities which do no involve the construction of any new single or two-family dwellings, and for which the disturbed area is less than 5,000 square feet.
2. Normal agricultural practices.
3. Routine maintenance of roads, accesses, and utility service lines.

Furthermore, "the Erosion Control Administrator reserves the right to require any non-agricultural, construction development activity, regardless of disturbed area or type of activity, to comply with this article if it is determined to be the cause of or a contributor to an existing or potential erosion, sediment, or storm water impact. "

Those applying for a permit must file the application with the County, in addition to paying a fee and providing a site-specific plan. Any commercial, institutional, multi-family, or industrial project with an area of more than one-half acre, or a project requiring subdivision approval by a unit of local government with an area of more than one-half acre must also provide the additional information listed below:

1. Existing site conditions map
2. Plan of final site conditions
3. Sediment and erosion control practices
4. Storm water management plans and controls
5. Schedule or sequence of development of installation of the elements of the site management control measures proposed
6. A detailed estimate of quantities and estimated costs
7. A plan of the continued management and maintenance of such permit control structures

The issuance of permits, the inspection of control measures, and the enforcement of the ordinance is the duty of an appointed Erosion Control Administrator. The Erosion Control Administrator can revoke any permit if the rules, regulations, or standards of the permit issued are being violated. Any violation is subject to a fine no to exceed $500 per day. There is an Appeals Board of five members appointed by the County Board Chairman, the Soil and Water Conservation District, and the Tri-County Regional Planning Commission.

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 Walnut Creek watershed contains 360 acres of wetlands, or approximately 0.8% of the total drainage area. Nearly two-thirds of the wetlands are forested (IDNR CTAP 1997). These wetlands represent 4.2% of the wetlands within the entire Mackinaw River watershed (IDNR CTAP 1997).

Fish

The Mackinaw River has 66 known fish species (IDNR CTAP 1997). During an intensive survey of the watershed in 1994, 59 species and two hybrids were recorded (Short et al. 1996). The 31 species found in Walnut Creek are listed in Table 7. A similar survey in 1987 found 36 fish species in the creek (Short 1988); the reason for the decline from 36 fish in 1987 to 31 fish in 1994 is unknown. The blacknose shiner (*Notropis heterolepis*) was last recorded in the Mackinaw River in 1880 and is assumed to be extirpated (IDNR CTAP 1997). No other state endangered or threatened species have been recorded in the river.

Table 7. Abundance of fish species recorded in Walnut Creek, 1994 (Source: Short et al. 1996).

Common name	Scientific name	Abundance
gizzard shad	*Dorosoma cepedianum*	36
creek chub	*Semotilius atromaculatus*	187
hornyhead chub	*Nocomis biguttatus*	23
central stoneroller	*Campostoma anomalum*	728
suckermouth minnow	*Phenacobius mirabillis*	44
striped shiner	*Luxilus chrysocephalus*	22
redfin shiner	*Lythrurus umbratilus*	3
red shiner	*Cyprinella lutrensis*	137
bluntnose minnow	*Pimephales notatus*	29
bigmouth shiner	*Hybopsis dorsalis*	7
sand shiner	*Notropis ludibundus*	62
quillback	*Carpiodes cyprinus*	29
river carpsucker	*Carpiodes carpio*	6
white sucker	*Catostomus commersoni*	23
northern hogsucker	*Hypentelium nigricans*	127
shorthead redhorse	*Moxostoma macrolepidotum*	59
black redhorse	*Moxostoma duquesnei*	36
golden redhorse	*Moxostoma erythrurum*	145

silver redhorse	*Moxostoma anisurum*	31
channel catfish	*Ictalurus punctatus*	1
yellow bullhead	*Ameiurus natalis*	3
stonecat	*Noturus flavus*	34
blackstripe topminnow	*Fundulus notatus*	2
smallmouth bass	*Micropterus dolomieui*	22
green sunfish	*Lepomis cyanellus*	2
bluegill	*Lepomis macrochirus*	4
longear sunfish	*Lopomis megalotis*	75
Johnny darter	*Etheostoma nigrum*	2
banded darter	*Etheostoma zonale*	36
orangethroat darter	*Etheostoma spectabile*	63
freshwater drum	*Aplodinotus grunniens*	3

Priority Waterbody

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

Approximately 21.2 miles of Walnut Creek from Eureka to its confluence with the Mackinaw River has been classified a biologically significant stream segment (IDNR CTAP 1997).

The downstream portion of Walnut Creek subwatershed to its confluence with the main stem of the Mackinaw River 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 practices and providing opportunities for others to learn from them. Additional information may be found in the Watershed Activities section of this report.

Soil Classification

Four soil associations are identified within the watershed. There are 19,359 acres of the Ipava-Sable-Tama association, 18,898 acres of the Tama-Catlin-Ipava association, 4,148 acres of the Clinton-Fayette-Hennepin-Strawn association, and 3,687 acres of the Lawson-Sawmill association. Table 8 provides descriptive data on the soil types found in the Walnut Creek subwatershed.

Table 8. Soil types found in the Walnut Creek watershed. (Source: USDA NRCS soil maps of Woodford County)

Soil Classification	Soil Composition	Water Table (ft)	Land Use Capability Class	Hydric Soils	Slope	Permeability	Erodibility Index
Keomah	silt loam	2-4	IIw	no	0-2%	MS	2.54
Tama	silt loam	4->6	I, IIe, IIIe	no	1-10%	M	2.19
Ipava	silt loam	1-3	I	no	0-2%	MS	1.92
Atterberry	silt loam	1-3	I	no	0-2%	M	2.19
Sable	silty clay loam	0.5-2	IIw	yes	0-2%	M	1.21
Camden	silt loam	>6	IIIe	no	2-5%	M	4.93
Saybrook	silt loam	>6	IIIe	no	2-12%	M to MS	4.61
Flanagan	silt loam	1.5-3.5	I	no	0-2%	M to MS	1.92
Catlin	silt loam	3.5-6	IIIe	no	1-10%	M	4.61
Varna	silt loam	3-6	IIe	no	2-5%	MS to S	5.04
Strawn	loam	>6	IVe	no	10-15%	M to MS	40.00
Birkbeck	silt loam	3-6	IIIe	no	10-15%	M to MS	na
St. Charles	silt loam	>6	IIIe	no	0-2%	M	2.54
Rozetta	silt loam	4-6	IIe	no	1-5%	M	3.86
Russel	silt loam	>6	IIe, IIIe	no	5-15%	M to MS	13.60
Graymont	silt loam	4-6	IIe	no	2-10%	M to MS	na
Elkhart	silt loam	4-6	I	no	2-4%	M	na
Pits, gravel	gravel			no			na
Miami Hennipen complex		>6	VIe, VIIe	no	20-60%	M to MS	na
Radford	silt loam	1-3	IIIw	no	0-2%	M	1.21
Huntsville	silt loam	>6	IIw	no	0-2%	M	1.92
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 severe limitations that make soils generally unsuitable for cultivation; VII very sever 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

Soil Erosion

Erosion in the Walnut 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 Walnut 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 the sloughing of banks due to streamflow (sometimes intensified after storm events), unstable banks or channel bottoms, channel obstructions, livestock trampling, heavy equipment or a combination of factors (USDA/NRCS 1997).

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 Walnut Creek watershed are given in Table 9; while sedimentation estimates, by type of erosion are given in Table 10.

Table 9. Erosion rate and land affected in Walnut Creek (Data are extrapolated from USDA/NRCS 1997).

Erosion rate	**Acres of land affected**
0 – 1T	38,507
1T – 2T	4,770
Over 2T	1,161
Total	44,438

Table 10. Annual erosion and sedimentation estimates for Walnut 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	187,965	0.70	131,575.5		
Ephemeral	17,360	0.80	13,888		
Gully	15,500	0.85	13,175		
Streambank erosion	4,900	1.00	4,900		
Total	225,725		163,538.5	0.25	40,884.63

Urban development may be a significant contributing factor to erosion in the Walnut Creek area due to the expansion of Eureka and Metamora. It is estimated that erosion rates may be as much as 300 tons per acre during construction (USDA NRCS 1997). After construction, increased runoff volumes and higher water velocity can contribute to erosion downstream of the development site (USDA NRCS 1997).

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 Walnut Creek subwatershed is of relatively recent Pennsylvanian age (320-286 million years ago). The Bond, Modesto, and Carbondale Formations are found in the watershed. Several thick, pure limestones characterize the Bond Formation, the Modesto Formation contains widespread relatively thick clayey limestones and thin coals, while the Carbondale formation has the thickest coal beds in Illinois (IDNR CTAP 1997).

Buried valleys, lowlands, and uplands are part of the complex topographic surface of the bedrock. The Walnut Creek subwatershed is on the eastern side of the buried Mackinaw Valley. The bedrock ranges from 650 to 350 feet above sea level, sloping from east to west. This bedrock may have had little 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 Walnut 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 in a small area to 300-400 feet in some parts (IDNR CTAP 1997).

Construction sand and gravel are produced in the Mackinaw River watershed. Significant deposits are located along the lower two thirds of Walnut Creek and there was an active pit located in the watershed in 1992 (IDNR CTAP 1997).

Topography

The Walnut Creek subwatershed drains an area of 46,092 acres or approximately 72 square miles. The terrain within the watershed is gently rolling, and numerous small shallow streams and channels serve as tributaries to the main Creek. The main Creek flows from north to south in the central portion of the area (see Map X). The elevation varies from 800 feet in the headwaters to approximately 610 feet at the mouth (Short et al. 1996). The average stream gradient is 7.6 feet/mile (Short et al. 1996).

The drainage density of the Walnut Creek subwatershed was calculated by dividing the total acreage for the watershed by the total stream length. The resultant drainage density is approximately 494.0 acres of watershed per mile of stream.

Land Use

Land cover in the Walnut 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 11 provides data on major land use categories. Also see Map X.

Table 11. Land cover by percent in the Walnut Creek subwatershed. (Source: IDNR CTAP 197:1-16).

Land Cover	**Acres**	**Percent of subwatershed**
Agricultural Land	**41,892**	**90.9**
Cropland	36,178	78.5
Rural grassland	5,714	12.4
Forest & Woodland	**1,723**	**3.7**
Urban & Built-up Land	**1,791**	**3.9**
Urban/Built-up	1,254	2.7
Urban grassland	537	1.2
Wetland	**360**	**0.8**
Forested	224	0.5
Non-forested	136	0.3
Lakes & Streams	**333**	**0.7**

The primary agricultural crops in the subwatershed are soybeans and corn. In 1994 it was estimated that 141,500 acres of corn and 122,300 acres of soybeans were planted in Woodford County. This represented approximately 1.2% of the Illinois land area planted to corn that year and 1.3% of the land area planted to soybeans (IDNR CTAP 1997). Similarly, it was estimated that 152,900 acres of corn and 129,000 acres of soybeans were planted in Tazewell County in 1994. This represented approximately 1.3% of the Illinois land area planted to corn that year and 1.4% 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 Woodford County was 175 bushels and in Tazewell County172 bushels, compared to a state average of 156, while the average soybean production was 53 and 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.

In general, the Mackinaw River watershed has a small number of cattle (44,800 head) and a relatively large number of hogs [(304,000) IDNR CTAP 1997]. The trend in Woodford and Tazewell Counties has been toward increased hog production (IDNR CTAP 1999). Cattle are raised in the subwatershed and there are also two to three hog operations (Schuler, personal communication 1999). It is not known how the recent slump in hog prices has impacted the number of animals or operations.

The average farm size in both Woodford and Tazewell County is just over 300 acres and there are approximately 1,000 farms in each county (Farrell 1995). There are an estimated 140 farms in the Walnut Creek watershed (M. Jacob, District Conservationist, personal communication 1999). Over 75% of agricultural producers in the county have been on their current farm for more than 10 years (Farrell 1995).

Agricultural land in the subwatershed sells for between $3,300 and $3,800 per acre, and is rented for between $130 and $150 per acre. Prices had been going up, but have begun to drop down to lower levels (Schuler, personal communication 1999). Crop sharing is not a major means of land management in the subwatershed (Schuler, personal communication 1999). Urban expansion around Metamora and Eureka may contribute to higher land prices in some areas. In Woodford County approximately 20% of agricultural producers lease all of the land they farm, over 40% own some land and lease the rest, while just under 40% own all of the land they farm (Farrell 1995).

Transect survey data from the Bureau of Soil and Water Conservation (IDOA) revealed that in 1995 no-till was practiced on 18% of the land in Woodford County. Conservation tillage in which 30% or more of the crop residue remained on the field was practiced on 17% of the land and reduced tillage where 15-30% of the crop residue is left on the field was practiced on another 27% of the land in Woodford County (USDA NRCS 1997). No-till was practiced on 23% of the land in Tazewell County, while only 1% of the land was in conservation tillage and reduced tillage was practiced on 17% of the land (USDA NRCS 1997).

In Woodford County over 2,100 acres were enrolled in the Conservation Reserve Program by 1997, though over half of those contracts have ended (Table 12).

Table 12. Conservation Reserve Program enrollment in Woodford County (Source: USDA NRCS 1997).

Year contract ends	No. of contracts	Acres
1997	29	763.1
1998	20	375.2
1999	7	171.3
2000	3	49.1
2001	7	226.7
2002	12	333.4
2005-6	10	204.9
Total	88	2,123.7

Updated information on numbers of farms, landowners, and acreage participating in various state and federally sponsored conservation programs has been requested from the Woodford County Soil and Water Conservation District office.

There are no Natural Areas or Nature Preserves within the subwatershed (IDNR CTAP 1997). Eureka Park provides a site for outdoor recreation and education.

Fishing is a popular sport along Walnut Creek. 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 and its tributaries such as Walnut Creek.

Forest and woodlands cover over 1,700 acres in the subwatershed. Though data specific to Walnut 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. In numerous areas roads cross Walnut Creek and its tributaries. Both a north-south and an east-west state highway pass through the watershed, as does US Highway 24. Smaller roads cover the subwatershed in a near-grid pattern (see MapX). The number of miles of road in Woodford County increased from 1,088 miles in 1973 to 1,128 miles in 1993, the smallest increase in the three counties that include the Mackinaw River watershed (IDNR CTAP 1997).

There are no large airports within the subwatershed, though there may be landing strips for crop planes. A small railroad crosses the far southeastern tip of the subwatershed.

Two urban centers are located in the Walnut Creek subwatershed. Eureka, the county seat, had an estimated population of 4,603 in 1996 (US Census Bureau 1999). Part of the village of Metamora is located within the subwatershed. The village had an estimated population of 2,676 in 1996 (US Census Bureau 1999). Both areas are growing. Please see the section on socioeconomic characteristics of the watershed for further information on population.

A major powerline and a pipeline traverse the watershed between Eureka and the mouth of the creek.

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. In 1995 there were 45 registered underground storage tanks in Eureka and 40 in Metamora. Of those there were nine reported leaking underground storage tanks in Eureka and nine in Metamora (Farrell 1995). Not all of the tanks in Metamora are in the Walnut Creek subwatershed, though the aquifer is the same on both sides of the ridge.

The 1990 U.S. Census data shows 6,221 housing units, or 52% of Woodford County using public sewers, another 5,606 housing units or 47% using septic tanks or cesspools. The remaining 1% use other methods which are not specified (US Census Bureau 1999).

There are two sand and gravel pits located north of Goodfield.

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 Woodford County (see Table 13). Woodford County had by far the fewest pollutants of the three counties in which the Mackinaw River watershed is located (IDNR CTAP 1997).

Table 13. Estimated 1995 point source emissions in Woodford County (Source IDNR CTAP 1997).

Pollutant	**Tons/year**
particulate matter	283
sulfur dioxide	0
nitrogen oxides	19
volatile organic matter	167
carbon monoxide	4

A woodworking company in Metamora made 11 toxic releases between 1987 and 1992 (Farrell 1995). The impact of these releases, and any more recent ones, on overall air quality is not known.

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 0 to 6 (IDNR CTAP 1997).

Wildlife

Threatened or Endangered Species

Table 14 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 14. Threatened and endangered species occurring in the Mackinaw River watershed (Sources: IDNR CTAP 1997; Retzer 1997)

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 15) 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 Walnut Creek watershed.

Table 15. 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 16 lists the 20 species known to occur in the Mackinaw River watershed in Woodford County. These species may be found in the Walnut Creek subwatershed. The Mackinaw River Area Assessment lists other species likely to occur in the area (IDNR CTAP 1997:Table 4-13).

Table 16. Butterflies and skippers known to occur in Woodford County in the Mackinaw River watershed (adapted from IDNR CTAP 1997:4-72—4-76)

Common name	Scientific name
black swallowtail	*Papilio polyxenes*

tiger swallowtail	*Papilio glaucus*
spicebush swallowtail	*Papilio troilus*
checkered white	*Pontia protodice*
cloudless sulphur	*Phoebis sennae*
little sulphur	*Eurema lisa*
sleepy orange	*Eurema nicippe*
eastern tailed blue	*Everes comyntas*
red-spotted purple	*Limenitis arthemis*
viceroy	*Limenitis archippus*
painted lady	*Vanessa cardui*
buckeye	*Junonia coenia*
question mark	*Polygonia comma*
silvery checkerspot	*Chlosyne nycteis*
pearl crescent	*Phyciodes tharos*
tawny-edged skipper	*Polites themistocles*
least skipper	*Ancyloxypha numitor*
common sooty wing	*Pholisora catullus*
scalloped sooty wing	*Staphylus hayhurstii*
silver-spotted skipper	*Epargyreus clarus*

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 1999). Freshwater mussel populations were sampled at three locations within Walnut Creek in 1995-96. A total of 10 species were found within the Creek (Retzer 1997b). Table 17 presents a list. One of the highest areas of mussel species diversity in the Mackinaw River is just below the mouth of Walnut Creek (Retzer 1997b).

Table 17. Mussels species recorded in Walnut Creek 1995-96 (Source: Retzer 1997b; IDNR CTAP 1997).

Common name	Scientific name	Number of live individuals
threeridge	*Amblema plicata*	shells only
cylindrical papershell	*Anodontoides ferussacianus*	shells only
plain pocketbook	*Lampsilis cardium*	shells only
fatmucket	*Lampsilis siliquoidea*	2
yellow sandshell	*Lampsilis teres*	1
white heelsplitter	*Lasmigona complanata*	3
creek heelsplitter	*Lasmigona compressa*	shells only
giant floater	*Pyganodon grandis*	1
squawfoot	*Strophitus undulatus*	shells only
pondhorn	*Uniomerus tetralasmus*	shells only

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 18 lists amphibians and reptiles known or likely to occur in the Mackinaw River watershed, no information on presence within Walnut Creek is available.

Table 18. 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 Woodford County was 32,653 people living in 11,451 households. In 1996 the US Census Bureau estimated the County population at 34,798 people (US Census Bureau 1999). The vast majority (78%) of Woodford County is rural (Farrell 1995). In 1989 persons living on farms totaled 2,556. The racial make-up of the population is primarily white (99.3%), with 228 individuals or <0.7% being of black, Native American, or other minority races. Nearly two-thirds of the population (63.1%) did not change their residence between 1985 and the census, while another 16.7% lived within the county but at a different residence. Over 20.2% of county residents moved into the county between 1985 and 1990, the vast majority of them from elsewhere in Illinois (US Census Bureau 1999).

Over 80% of adults over the age of 25 have a high school diploma or equivalent, with over one quarter of those individuals (28.5%) having obtained an Associate degree or higher. Eureka College is located in the subwatershed. Nearly 6.4% of employed persons over 16 years old work in agriculture, forestry, or fisheries (see Table 19).

Table 19. Woodford County employment by industry, 1989. (Source: US Census Bureau 1999)

Industry	**No. of people over 16 years old**
Agriculture, forestry and fisheries	977
Mining	16
Construction	993
Manufacturing, nondurable goods	587
Manufacturing, durable goods	2842
Transportation	615
Communications and public utilities	303
Wholesale trade	763
Retail trade	2485

Finance, insurance, real estate	901
Business and repair services	608
Personal services	282
Entertainment and recreation services	122
Health services	1438
Educational services	1409
Other professional and related services	680
Public administration	286

Per capita income in 1989 was $13,516. Median household income in 1989 was $34,375, it was estimated at $45,233 in 1995. Only 44.5% 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 5.8% of the population was living in poverty (US Census Bureau 1999).

The median value of owner-occupied housing units in 1989 was $57,400 (US Census Bureau 1999).

In 1989 80% of households had wage or salary income. In 1989 10% of households had some farm self-employment income (US Census Bureau 1999). In 1993 farm cash receipts for Woodford county totaled $102,534,000 (see Table 20)

Table 20. 1993 Farm cash receipts, Woodford County (in thousand dollars). Adapted from IDNR CTAP 1997 Table 1-31).

	Receipts (in thousand dollars)
Corn	35,668
Soybeans	32,253
Wheat	608
Other	1281
Crop total	**69,810**
Cattle	6,800
Hogs & pigs	21,984
Other	3,940
Livestock total	**32,724**

A variety of state and local organizations have outreach programs operating within Woodford County, and by extension within the Walnut 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 Eureka, 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 Woodford County Farm Bureau is also headquartered in Eureka. Similar programs are also available in Tazewell County. The

Nature Conservancy through the Mackinaw River Watershed Council continues to conduct outreach activities in the entire Mackinaw River watershed.

There are no conservancy districts and no drainage districts within this subwatershed.

Media outlets include the weekly *Woodford County Courier* and *Metamora Herald*. Watershed residents also have access to the daily *Peoria Journal Star*, which does carry some news specific to the watershed, and weekly agriculture features.

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 Walnut Creek subwatershed the information collected does represent an average over the entire watershed and is of particular importance in gaining a better understanding of farm operators' 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 21, 22, and 23.

Table 21. 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 22. 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 23. Identified solutions to river, creek and stream problems

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 some of the 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

High velocity and volume of water entering Walnut Creek after storm events is leading to an increase in streambank erosion and sedimentation and a concurrent decrease in water quality. The proximate causal factor is altered hydrology due to channelization, increased tiling and urban expansion.

Problem #2

Water quality in Walnut Creek has decreased due to point and nonpoint source pollution, the lack of wetlands, and the degradation of riparian areas. This decreased water quality has a negative impact on aquatic biota.

Problem #3

There is a general lack of awareness 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, Walnut Creek.

Component #6
Goals and Objectives

Goal #1

To reduce sediment loads and streambank erosion through the use of participatory best management practices, thereby improving water quality and ensuring long-term adoption of appropriate practices. To encourage responsible development that does not impact 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 watersheds, contouring, waterways, filter strips, stormwater detention watersheds, and wetlands on 60% of agricultural land.
- Restore appropriate areas to wetlands or wet prairie.
- Stabilize ten percent of streambanks within the watershed.
- Establish a constructive dialogue with large-scale developers in the subwatershed.

Goal #2

To reduce the potential of pollutants entering Walnut Creek, increase the number and acreage of functioning wetlands, and restore and improve riparian corridors using participatory approaches, thereby improving the quality of aquatic habitats and stream water and ensuring the long-term adoption of appropriate practices.

Objective #2

- Reduce potential pollution sources through dialogue with concerned parties and the implementation of appropriate practices.
- Increase the use of nutrient management techniques.
- Restore appropriate areas to wetlands or wet prairie through dialogue with landowners and encouraging the use of appropriate cost share measures where available
- Acquire land or buy easements to restore areas to wetland or wet prairie.
- Improve the riparian zone through land amelioration practices, including woodland management, woodland development, streambank stabilization 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 subwatershed 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 in the Walnut Creek subwatershed. 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: Promote Dialogue
Identify potential and known point source pollution sites and begin a dialogue aimed at the mitigation of pollutants entering the waterway. In some instances relatively straightforward nutrient management techniques may be appropriate (see below), while at other times more innovative solutions may be needed. The feasibility of this approach will be dependent on the interest of the concerned parties, the perceived attitudes of subwatershed and other residents, and the cooperation of government bodies when required. Activities will be undertaken on an as-needed basis.

Implementation of this strategy will lead to the formation of new partnerships of individuals and organizations interested in conserving the water resource and the reduction in point source pollutants entering the Creek, thus improving water quality. This strategy addresses Objectives #1 and #2.

Strategy #2: 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 operations and on one-half of the agricultural land (approximately 21,000 acres) by the end of the five-year period.

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

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 #2.

Strategy #3: Conservation tillage
Promote conservation tillage on 10,500 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 #4: Contouring and terracing
Promote contouring on 300 acres of agricultural land and the construction of 20,000 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.

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

Strategy #5: Water and sediment control basins
Install 50 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 water volume entering the Creek after storm events, a reduction in sheet and rill erosion, and consequently reduced sedimentation, leading to improved water quality. This strategy addresses Objective #1.

Strategy #6: Waterways
Protect natural waterways on farmland through smooth-grading the area and planting appropriate grasses. Waterways will be established on 210 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 #7: 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 420 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 #8: 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. Wetlands will be constructed, restored, and/or protected on 2,100 acres of land. Where appropriate land or easements will be acquired.

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 #9: Streambank stabilization
Stabilize streambanks where needed, encouraging the use of natural materials and native vegetation. Approximately ten percent of the streambanks within the subwatershed (9 miles) will be stabilized by the end of five years.

The implementation of this strategy will reduce streambank erosion and subsequent sedimentation. Aquatic and terrestrial habitats will be enhanced. This strategy addresses Objectives #1 and #2.

Strategy #10: Riparian zone management
Establish or enhance riparian zones along ten percent of the waterways within 5 years. Approximately 550 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 #11: 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 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 12: 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 #13: 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 #14: 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 24). 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 24. Timetable for subwatershed management plan strategy implementation.

Strategy	Year 1	Year 2	Year 3	Year 4	Year 5
#1 Establish dialogue (ongoing)	XX	X	X	X	X
#2 Nutrient management (acres)	2,100	4,200	6,300	8,400	
#3 Conservation tillage (acres)	1,500	2,000	3,000	4,000	
#4 Contouring & terracing (acres/,000ft)	75/5	75/5	75/5	75/5	
#5 Water & sediment control basins (#)	10	10	10	10	10
#6 Waterways (acres)	42	42	42	42	42
#7 Filter strips (acres)	84	84	84	84	84
#8 Wetlands (acres)		525	525	525	525
#9 Streambank stabilization (miles)	1.5	2.0	2.0	2.5	1.0
#10 Riparian zones (acres)		100	200	250	
#11 Workshops & field trips (#)	3+2	3+2	3+2	3+2	3+2
#12 Newsletter (#)	3	3	3	3	3
#13 Extension (FT person/months)	4	4	4	4	4
#14 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 The Nature Conservancy, in consultation with the Mackinaw River Watershed Council and the 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 basin, 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 25. 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 25. Estimated costs of strategy implementation.

Strategy	Quantity	Unit	Cost per unit	Five year Total cost
#1 Establish dialogue			na	
#2 Nutrient management (soil testing per acre)[1]	21,000	acre	$6	126,000
#3 Conservation tillage	10,500	acre	$10	105,000
#4 Contouring	300	acre	na	
Terracing	20,000	feet	$5	100,000
#5 Water & sediment control basins	50	each	$1,000	50,000
#6 Waterways	210	acre	$1,300	273,000
#7 Filter strips	420	acre	$150	63,000
#8 Wetlands[2]	2,100	acre	$5,400	11,340,000
#9 Streambank stabilization	9	miles	$110,000	990,000
#10 Riparian zones	500	acre	$1000	500,000
#11 Workshops & field trips (3+2 per year)		year	$4,000	20,000
#12 Newsletters & mailings (3+ per year)		year	$1,000	5,000
#13 Extension (4 FT person/months/year)		year	$20,000	100,000
#14 Monitoring (most expenses in year 5)		year	$5,000	25,000
Total Cost				**$13,466,000**

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 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 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 basins 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 Walnut Creek resource and its surroundings be conserved.

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