Upper Rabbit River Watershed Planning Project

Watershed Management Plan

Allegan Conservation District
1668 Lincoln road
Allegan, MI 49010

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EXECUTIVE SUMMARY

The Upper Rabbit River Watershed is located primarily in Allegan County, with parts extending into Barry, Ottawa and Kent Counties. The watershed encompasses approximately 96,500 acres of agricultural, urban and forested land. A large majority of the Upper Rabbit River Watershed is rural. The Rabbit River originates east of Wayland, MI, in Leighton Township, and flows westerly to join the Kalamazoo River at New Richmond, which then flows on to Lake Michigan.

The Watershed Management Plan was written as part of a 319 Planning Project grant. This plan is specific to the Upper Rabbit River Watershed, the region inclusive of the Rabbit River Watershed upstream from the confluence of the Little Rabbit River and the Rabbit River. The Watershed Management Plan is a document that belongs to the residents and landowners of the Rabbit River Watershed. It contains information stakeholders found to be important, and the goals and decisions within it reflect what the community wants for the watershed. The Watershed Management Plan was put together with the assistance of the watershed coordinator, and many members of the steering committee. Comments, suggestions, and assistance provided from all interested people were incorporated.

The preliminary goals and objectives of the watershed project were formulated at public meetings early in the planning process, and were refined by the Rabbit River Watershed Planning Project's Steering Committee as the process continued. The threats and impairments to the watershed, the sources and causes of the threats, and the desired and designated uses were combined with the personal experiences of the watershed project participants to develop crucial goals to reduce non-point source pollution in the watershed. Reducing non-point source pollution will protect and restore the designated and desired uses of coldwater/warmwater fishery, partial body contact recreation, and native wildlife habitat. Reducing and preventing non-point source pollution will also maintain the designated use of agricultural irrigation, and the secondary use as water conveyance. The following are the major goals and objectives:

Develop and implement township-specific land-use recommendations using a watershed protection approach. Work one-on-one with townships, local officials, planning commissions to protect water quality and reduce NPS pollution.

Implement Best Management Practices from Watershed Management Plan: Implement the needed BMPs indicated in the Watershed Management Plan.

Serve as a clearinghouse of information: Gather and disseminate information to township and city officials, planning commissions, and other planners for use as tools for planning

Implement information and education strategies in accordance with the Watershed Management Plan. Continue educational programs and information, such as the Student Stream Science Program, the quarterly newsletter, encouraging the adoption of watershed programs and topics in school curricula and other information distribution and educational outlets. Take advantage of service learning opportunities and develop outdoor educational trails and facilities.

Preserve high quality natural areas in partnership with local land trusts, township officials and planning commissions. The Rabbit River watershed is blessed with many natural areas that are still intact. These areas are worth preserving not only for their habitat significance, but also for the physical and chemical functions they serve. There are some drainage issues in the Upper Rabbit River Watershed, and preservation of wetlands, the natural water storage areas, is very important.

In addition to reducing non-point source pollution, a major goal of the Rabbit River Watershed Project and stakeholders is to increase recreational opportunities in the watershed. **Improve recreation opportunities in the watershed**, including public access, partial body contact recreation, and recreation associated with wildlife and aquatic habit.

The objectives will be accomplished by harnessing existing positive community awareness, utilizing locally driven experienced agency resources, retaining qualified staff, utilizing contractors, and by completing the following tasks:

The Upper Rabbit River Watershed Implementation Project will combine both agricultural BMPs with land-use planning and ordinance review. This combination will reduce NPS pollution and improve water quality on both a site-specific basis through installation of BMPs, and on a large-scale township basis, through land-use planning, zoning and ordinance review. Local water quality conditions will be improved by installing traditional systems of

BMPs including livestock exclusion, streambank stabilization, filter strips, and erosion control. NPS pollution will be reduced on a multi-township or countywide basis through the revision of master plans, the addition of ordinances for natural resource protection, and zoning to protect water quality.

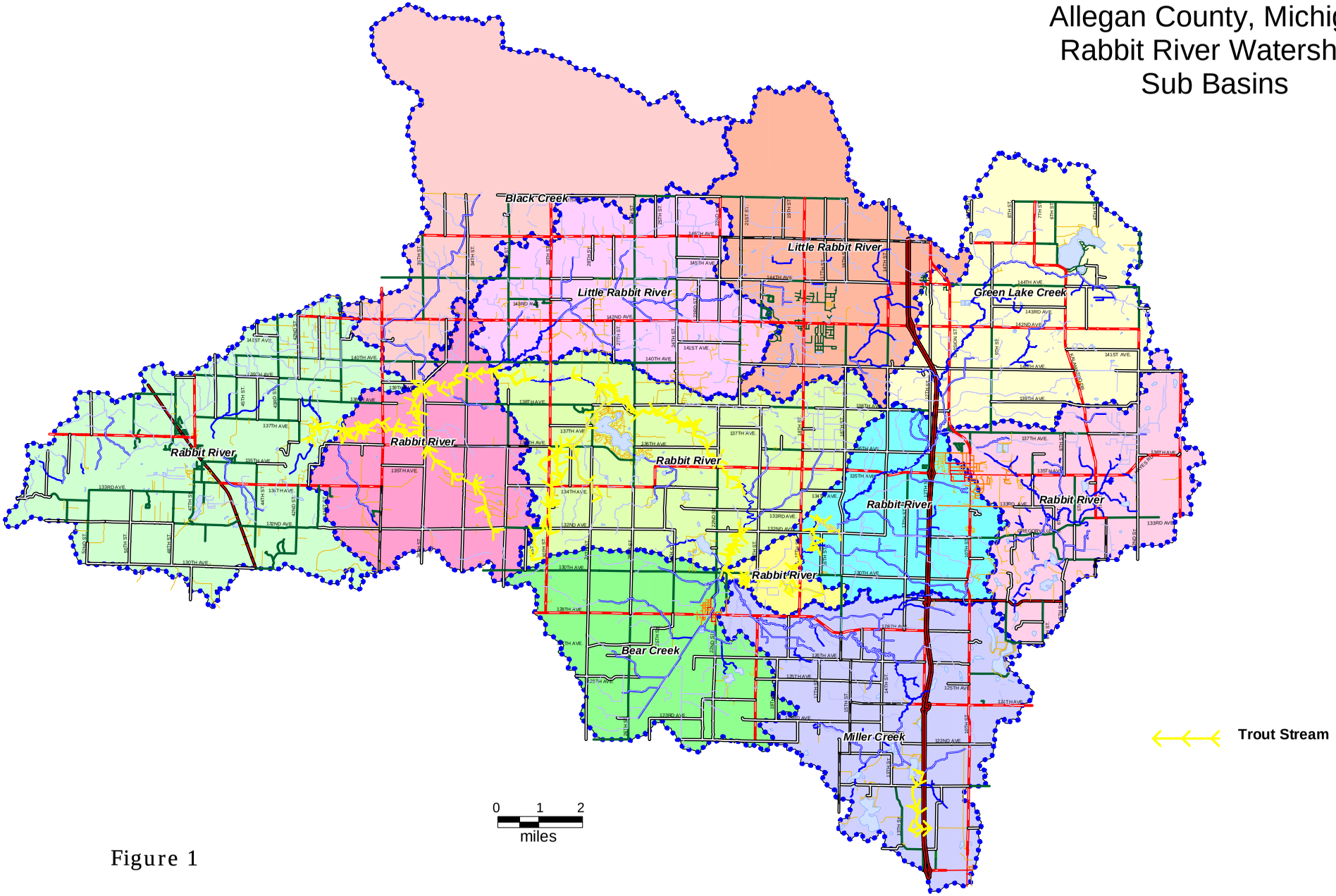

Allegan County, Michigan
Rabbit River Watershed
Sub Basins
Black Creek
Little Rabbit River
Little Rabbit River
Green Lake Creek
Rabbit River
Rabbit River
Rabbit River
Rabbit River
Rabbit River
Rabbit River
Bear Creek
Miller Creek
Trout Stream
0 1 2
miles

Figure 1

INTRODUCTION

In the beginning there was the land. Shaped by wind, waves, waters, ice, and fire over eons of time, the land was here. The land will be here after we are gone. How we choose to leave the land, however, is our legacy. We have shaped the land enormously in a very small amount of time, a geologic heartbeat. We, as humans, as no other species has, have shaped the land. We have done amazingly marvelous things. We have fed our population. We have devised new technologies. We have provided homes, clothes, entertainment, as well as food from our land. We owe much to the lots of ground that have helped us throughout our years on this earth. Unfortunately, we have not always been as kind to the land in return. Erosion, chemicals, and improper management have taken their toll. Now we have a chance to return the favors that our land has given us: to become stewards of the land. We can make and keep a promise to the earth that supports us, to repair our damage, and to prevent continued destruction, and in turn, the land will continue to support us, to provide us with food, water to drink, clothing, shelter, a way of life, and a sense of place.

The Watershed Management Plan is a document that belongs to the residents and landowners of the Rabbit River Watershed. It contains information stakeholders found to be important, and the goals and decisions within it reflect what the community wants for the watershed: our land, our neighborhood, and our future.

The Watershed Management Plan was put together by the watershed coordinator and many members of the steering committee. Comments, suggestions, and assistance provided from all interested people were incorporated. There was an attempt to make this a consensus document, with the steering committee and project participants mostly agreeing as to what to include. However, the suggestions and voices of dissenting and minority opinions were included as well.

The Rabbit River Watershed Project is dedicated to protecting and improving water quality. We will do this by protecting land, preventing erosion, run-off, and encouraging stewardship and land-use planning.

This watershed Management Plan was written as part of a 319 Planning Project grant. This plan is specific to the Upper Rabbit River Watershed, the region inclusive of the Rabbit River Watershed upstream from the confluence of the Little Rabbit River and the Rabbit River. Most of the information included in this plan relates to this portion of the Rabbit River Watershed. However, since many of the issues, problems, and tasks associated with watershed planning and implementation are similar, an effort was made to include the entire Rabbit River Watershed wherever possible, especially in maps. Inventory, Best Management Practices, and other information include the Upper Rabbit River watershed only.

BACKGROUND

Location

The Upper Rabbit River Watershed is located primarily in Allegan County, with parts extending into Barry, Ottawa and Kent Counties. The watershed encompasses approximately 96,500 acres of agricultural, urban and forested land. A large majority of the Upper Rabbit River Watershed is rural. The Rabbit River originates east of Wayland, MI, in Leighton Township, and flows westerly to join the Kalamazoo River at New Richmond, which then flows on to Lake Michigan. (Figure 1 Rabbit River Watershed and Sub-basins)

Precipitation Characteristics

Precipitation in the Rabbit River Watershed ranges from around 32-38 inches per year, and is well distributed through out the year. The growing season, from May-October, receives about 19 inches of rain, 55-60% of the total precipitation. June is typically the wettest month of the year, with nearly four inches of rain on average. A large part of annual snowfall may be influenced by the lake effect belt, which extends eastward from the shores of Lake Michigan.

Geology and Landforms

The geology and landforms of the Rabbit River were formed and influenced most heavily by glacial action. The most recent glaciating of the watershed area took place approximately 10, 000 years ago. Glacial action produced several landforms, and the soil of the area. Parts of the watershed soils were water deposited, resulting in well sorted layers of sands, loams, and gravel, and parts were glacially deposited, resulting in unsorted glacial till. (See Figure 2 Regional Geography or Figure 2a Slopes)

Topography and Soils

Slopes in the watershed range from nearly level (0 percent) to steep hills (45 percent). Different areas of the watershed have widely varying slopes. Regions such as the Bear Swamp Drain sub-watershed, a former wetland, now drained and farmed, have very little topography, and large expanses of flat land. Monterey Township, in contrast, has many hills and a rolling topography, with one hill rising more than 300 feet above the surrounding landscape. (See Figure 3 Topography and Figure 2a Slopes)

Soils in the watershed vary greatly, depending on glacial development, and position in the landscape. Well-drained soils make up approximately 48% in the watershed, somewhat poorly drained soils make up 35%, and poorly and very poorly drained soils make up about 12%. Water areas, urban and miscellaneous make up the remaining 5% (Allegan County Comprehensive Growth Management Plan. 1983 soils.) (See Figure 4 Soils Series and Key) Hydric soils are defined as poorly drained or somewhat poorly drained soils in the watershed. Hydric soils are one of the indicators of wetlands, however many hydric soils have been dredged and drained for building or agriculture purchases. Hydric soils are usually nutrients rich and productive when drained for agricultural purposes, but are usually seasonally flooded, and so may be poorly suited for farming. In addition, many hydric soils are protected under wetlands regulations. Hydric soils are poorly suited for development, especially for septic fields. (See Figure 5 Hydric Soils)

KEY TO FIGURE 4: GENERAL SOILS OF THE RABBIT RIVER WATERSHED

Code	Soils Series	Slope range (Percent)	Hydric Area	Description
2	Glendora loamy sand	Level	Yes	Poorly drained, high water table, rapid permeability
5	Houghton Muck	Level	Yes	Black organic (12”), poorly drained
6	Adrian Muck	Level	Yes	Black organic (13-32”), poorly drained, ponded
7	Palms Muck	Level	Yes	Black organic, (20-24”), poorly drained, run-off slow
8	Glenwood clay loam	1-12	No	Level to undulating. Moderately well drained. Slow permeability
10	Oakville fine sand	0-45	No	Gently rolling, undulating, fine sand, well drained
11	Oshtemo-Chelsea complex	0-35	No	Rolling, on hills, knolls, ridges, well-drained to excessively drained, loamy sand
12	Ockley Loam	1-30	No	Rolling, well-drained, side slopes, hills, ridges, sandy clay loam
14	Marlette Loam	6-35	No	Hilly and very hilly areas, well-drained, loam, clay loam
15	Morocco-Newton	0-3	Yes	Nearly level, on plains, depressions, drainageways. Poorly drained, black sand or mucky sand, rapid permeability.
16	Capac Loam	0-6	Yes	Undulating on flats, low ridges or foot slopes. Loam, clay loam and firm clay loam. Permeability slow to moderate.
17	Brookston loam	Level	Yes	Depressions, frequently ponded. Gray clay loam.
18	Pits	N/A	N/A	Open excavations, actively mined, may be ponded
19	Brady sandy loam	0-3	Yes	Nearly level, on plains, small depressions and drainageways, somewhat poorly drained. Brown sandy loam.
21	Capac-Wixom	1-4	Yes	Nearly level and undulating, on plains and small depressions, somewhat poorly drained. Sandy to sandy clay loam.
22	Matherton loam	0-3	Yes	Somewhat poorly drained. Dark gray loam. Permeability rapid.
23	Sebewa loam	Level	Yes	Poorly drained, low flats, depressions. Black loam, clay loam, Run-off slow, frequently ponded.

Code	Soils Series	Slope range (Percent)	Hydric Area	Description
26	Pipestone Sand	0-4	Yes	Nearly level or undulating, somewhat poorly drained, flats and small depressions. Gray and mottled sand.
27	Metea loamy fine sand	1-12	No	Undulating and gently rolling, well drained. Loamy fine Sand, bands of loamy sand.
28	Rimer loamy sand	0-4	Yes	Nearly level, undulating, slightly convex ridges, knolls and short side slopes. Somewhat poorly drained. Dark brown loamy sand.
29	Cohoctah silt loam	Level	Yes	Poorly drained, floodplains and along rivers and streams. Frequently flooded. Dark silt loam. High water table.
30	Colwood silt loam	Level	Yes	Poorly drained, flats and depressions, frequently ponded. Dark gray silt loam, fine sandy loam.
31	Tekenink loamy fine sand	2-35	No	Undulating, gently rolling, or very hilly, well drained soil. Slopes, hills, ridges. Dark brown loamy fine sand.
33	Kibbie fine sandy loam	0-3	Yes	Nearly level, somewhat poorly drained. Fine sandy loam, silt loam, silty clay loam.
34	Aquents, sand and loam	N/A	N/A	Areas that have been filled and leveled. Poorly drained areas.
36	Corunna sandy loam	Level	Yes	Poorly drained, flats and depressions. Frequently ponded. Dark gray sandy loam.
39	Granby loamy sand	Level	Yes	Poorly drained. Broad flats and depressions. Gray loamy sand, mottled sand.
41	Blount silt loam	1-4	Yes	Nearly level, undulating, convex slopes, depressions, somewhat poorly drained. Gray brown silt loam, and mottled silty clay loam.
42	Metamora sandy loam	1-4	Yes	Undulating, slightly convex plains. Somewhat poorly drained. Gray to mottled sandy loam.
45	Pewamo silt loam	Level	Yes	Poorly drained, drainageways and narrow to broad depressions. Frequently ponded. Dark gray silt loam.
47	Napoleon Muck	Level	Yes	Very poorly drained. Depressions. Brown-black muck.
48	Belleville loamy sand	Level	Yes	Poorly drained. Low flats and depressions. Black loamy sand.
49	Tedrow fine sand	0-4	Yes	Somewhat poorly drained, flats, convex areas. Dark fine sand.
50	Aquents and Histosols	Level	Yes	Marshes and swamps, ponded
51	Thetford loamy fine sand	0-4	Yes	Somewhat poorly drained. Broad depressions. Loamy fine sand.
53	Oakville fine sand	0-6	No	Moderately well drained. Flats and knolls. Dark brown loamy sand.
57	Covert sand	0-4	Yes	Moderately well drained, broad flats, narrow ridgetops. Black-gray sand.
60	Seward loamy fine sand	1-6	No	Moderately well drained. Knolls, convex plains, side slopes. Brown loamy fine sand.
62	Sloan silt loam	Level	Yes	Very poorly drained. Floodplains. Dark silt loam.
63	Riddles loam	1-12	Yes	Well-drained. Undulating to rolling. Loam and clay loam.
64	Belleville-Brookston	Level	Yes	Poorly drained. Broad drainageways, depressions. Black loamy sand.
66	Udipsamments	N/A	N/A	Areas where soil has been removed or mined. Sandy. Well-drained.
67	Martisco Muck	Level	Yes	Poorly drained. Frequently ponded. Black muck.
69	Newton mucky fine sand	Level	Yes	Very poorly drained. Broad flats, depressions. Black mucky fine sand. High water table, frequently ponded.
70	Morocco fine sand	0-3	Yes	Somewhat poorly drained. Broad flats, depressions. Black fine sand.
72	Urban land-Oakville	0-6	N/A	Urban land, well-drained Oakville soil. Streets, houses, etc.
73	Algansee loamy sand, protected	0-3		On floodplains, poorly drained, but protected by flooding due to channelization, dredged streams, drains. Black loamy sand.
74	Glendora loamy sand, protected	Level	Yes	Poorly drained. Floodplains. Protected from flooding by dredged streams or drains. Black loamy sand.
75	Marlette-Capac loams	1-6	Yes	Moderately well to poorly drained. Plains, knolls, small depressions. Brown loam, clay loam.

Source: Soil Survey of Allegan County, 1987

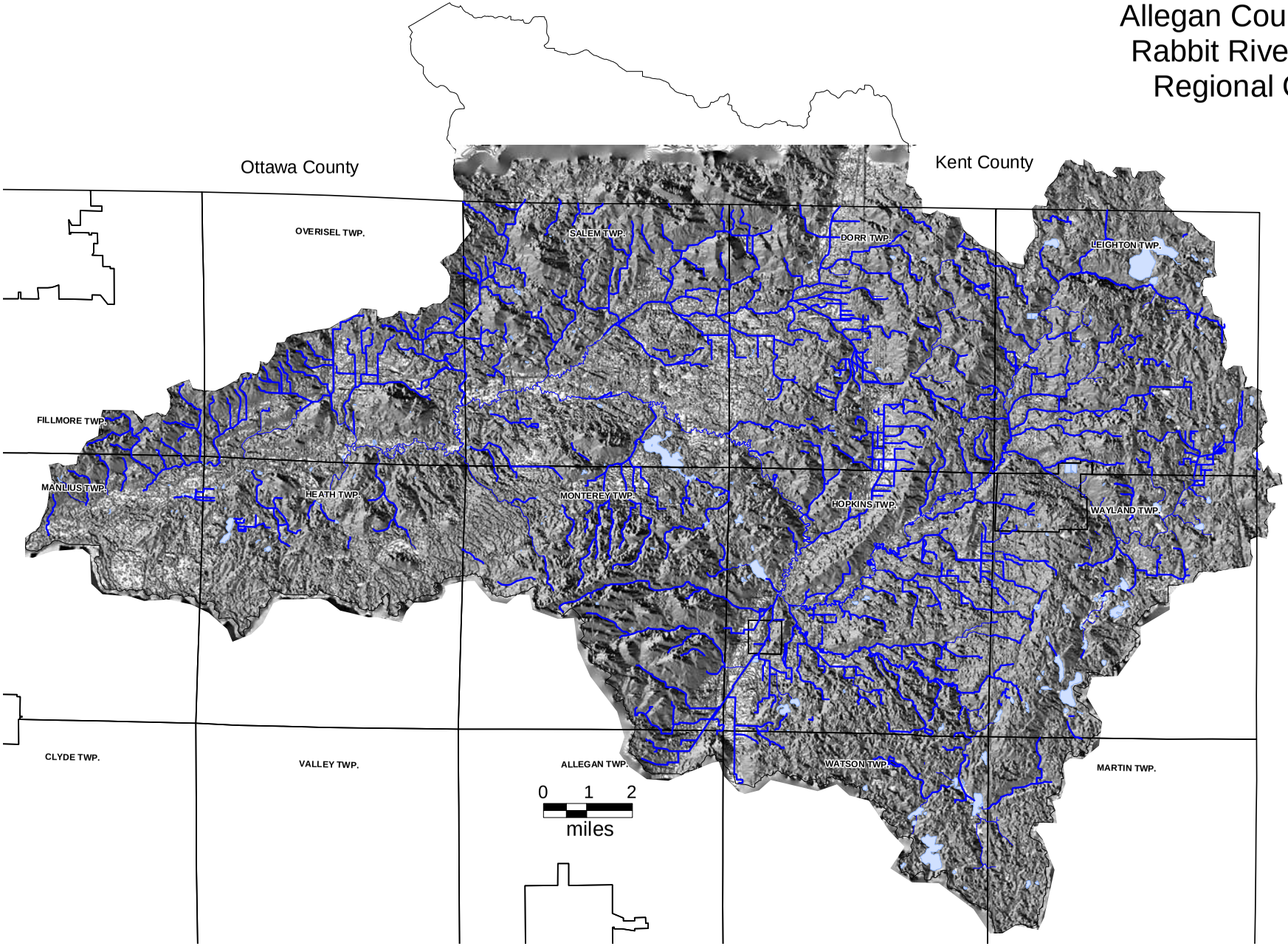

Allegan County, Michigan
Rabbit River Watershed
Regional Geography
Ottawa County
Kent County
OVERISEL TWP.
SALEM TWP.
DORR TWP.
LEIGHTON TWP.
FILLMORE TWP.
MANLIUS TWP.
HEATH TWP.
MONTEREY TWP.
HOPKINS TWP.
WAYLAND TWP.
CLYDE TWP.
VALLEY TWP.
ALLEGAN TWP.
WATSON TWP.
MARTIN TWP.
0 1 2
miles

Figure 2

Allegan County, Michigan
Rabbit River Watershed
Slopes

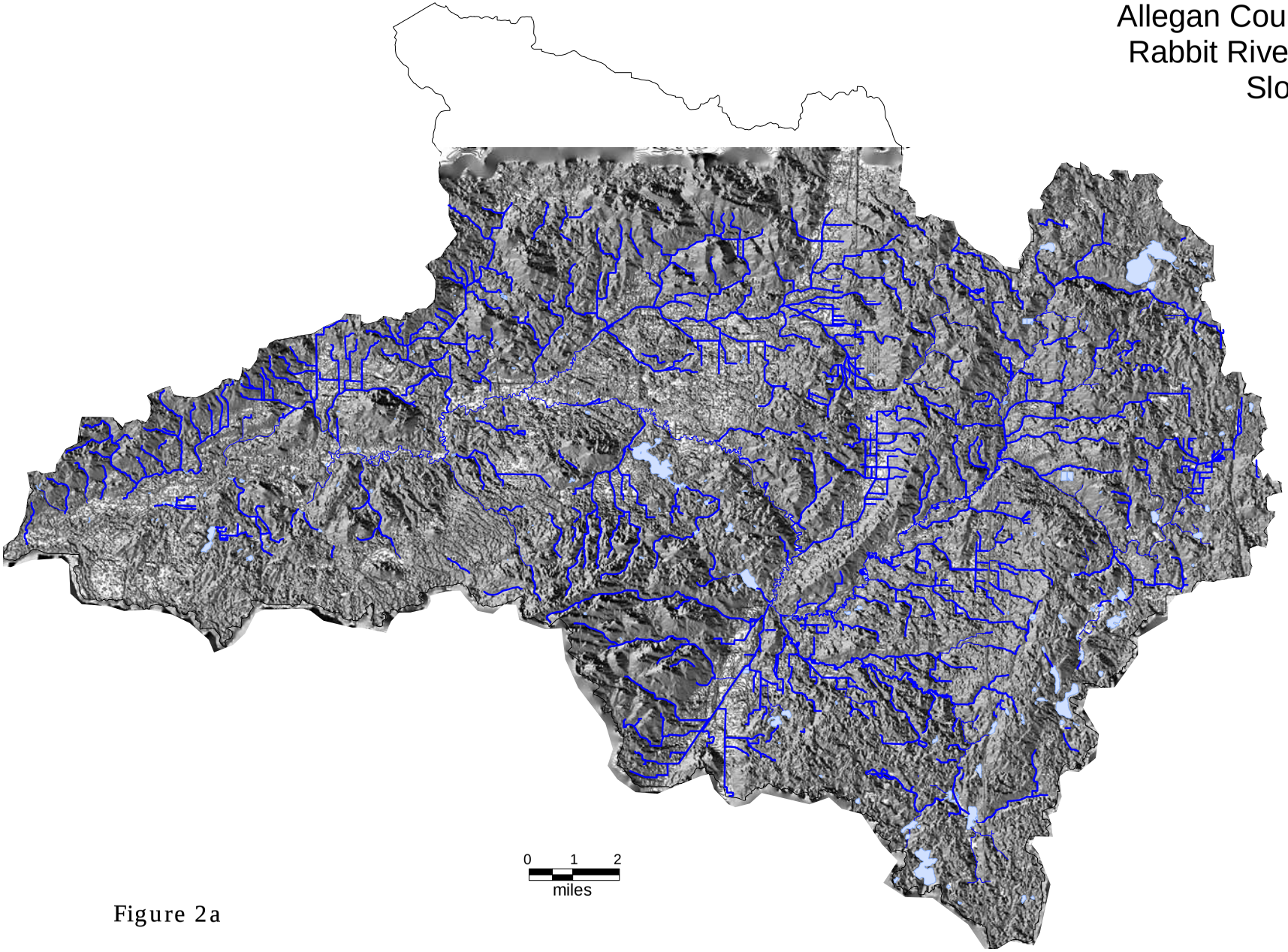


Figure 2a

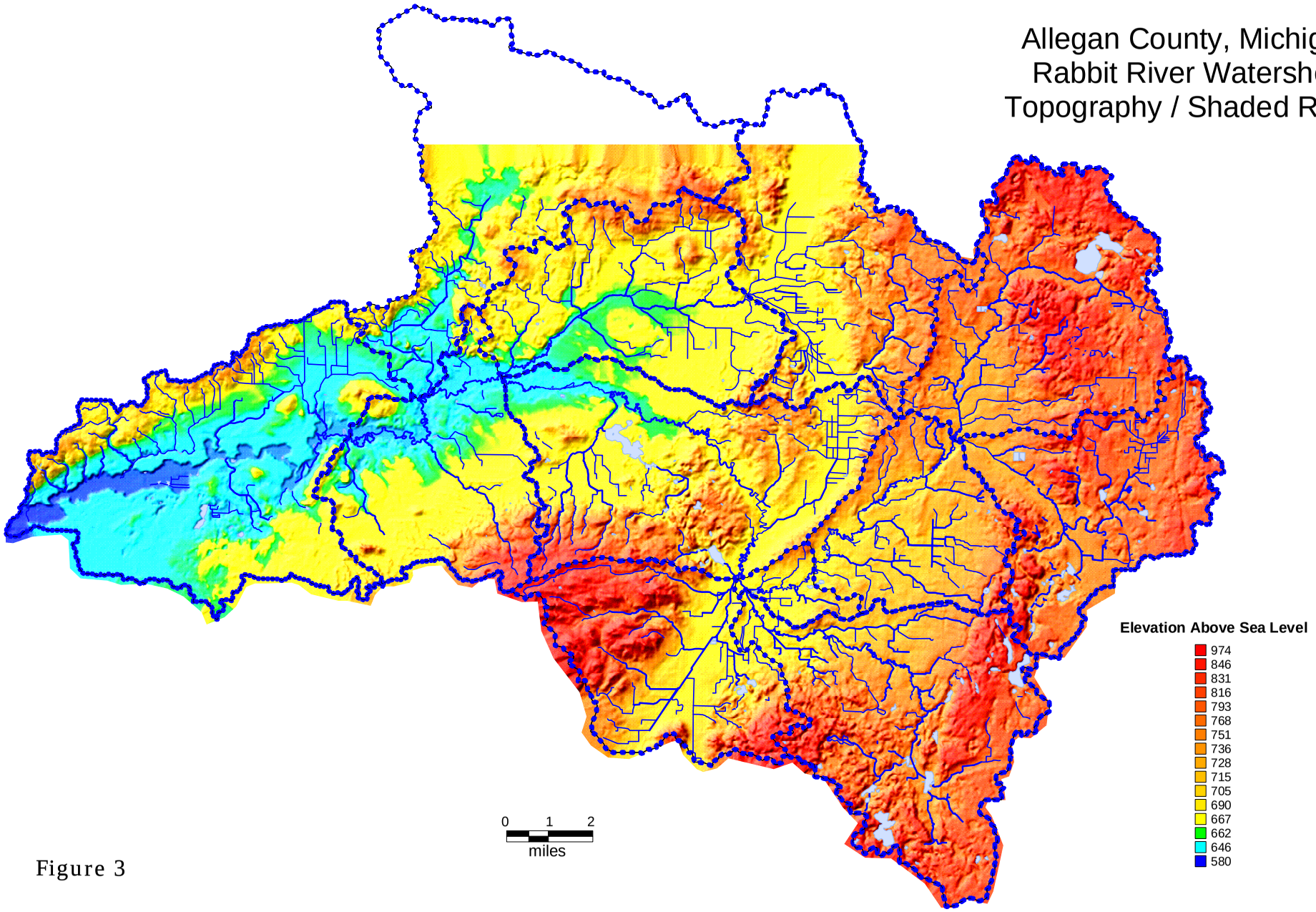
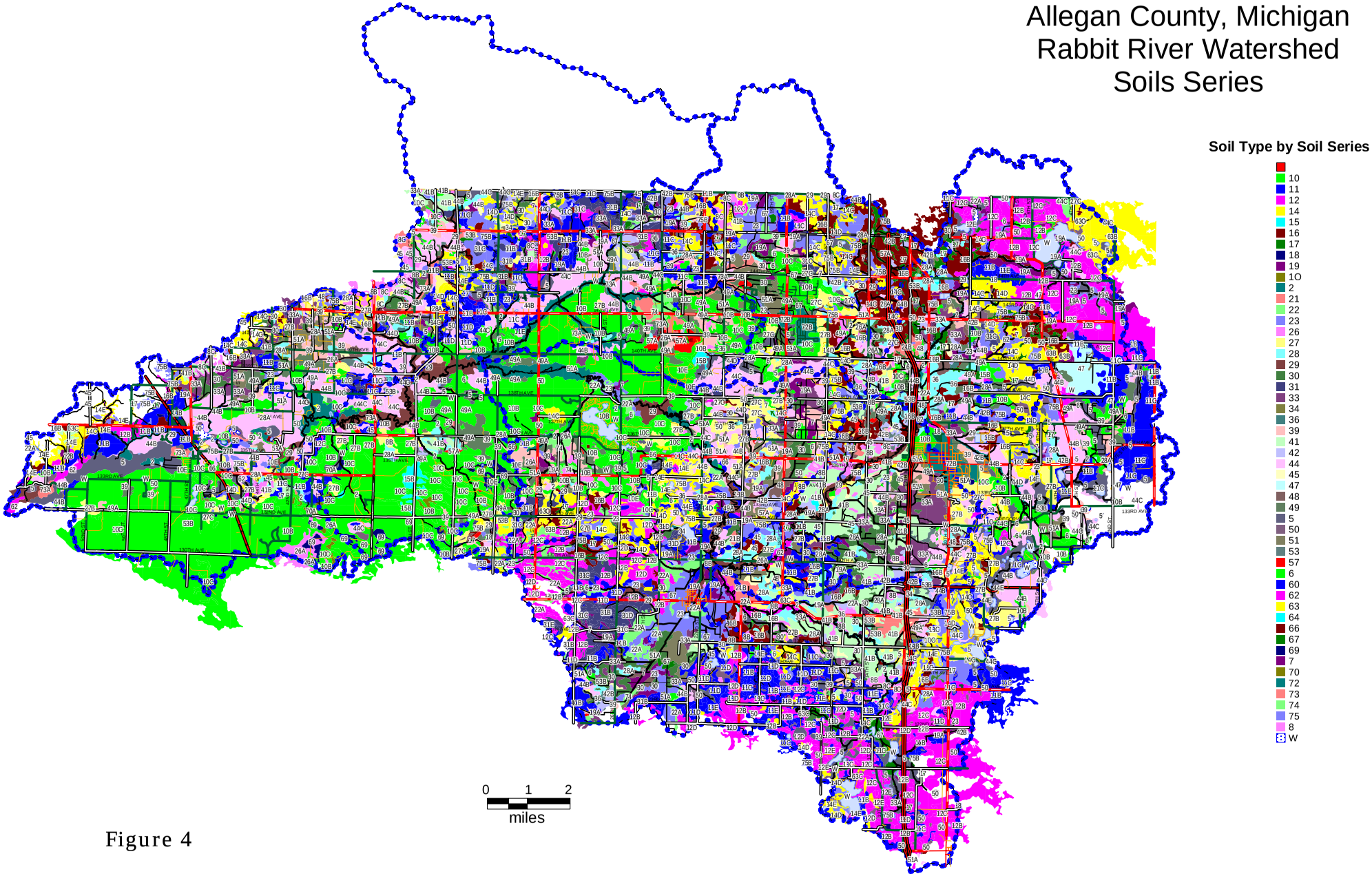

Allegan County, Michigan
Rabbit River Watershed
Topography / Shaded Relief
Elevation Above Sea Level
974
846
831
816
793
768
751
736
728
715
705
690
667
662
646
580
0
1
2
miles

Figure 3


Allegan County, Michigan
Rabbit River Watershed
Soils Series
Soil Type by Soil Series
10
11
12
14
15
16
17
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1O
2
21
22
23
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29
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45
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48
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5
50
51
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57
6
60
62
63
64
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67
69
7
70
72
73
74
75
8
W
0
1
2
miles

Figure 4

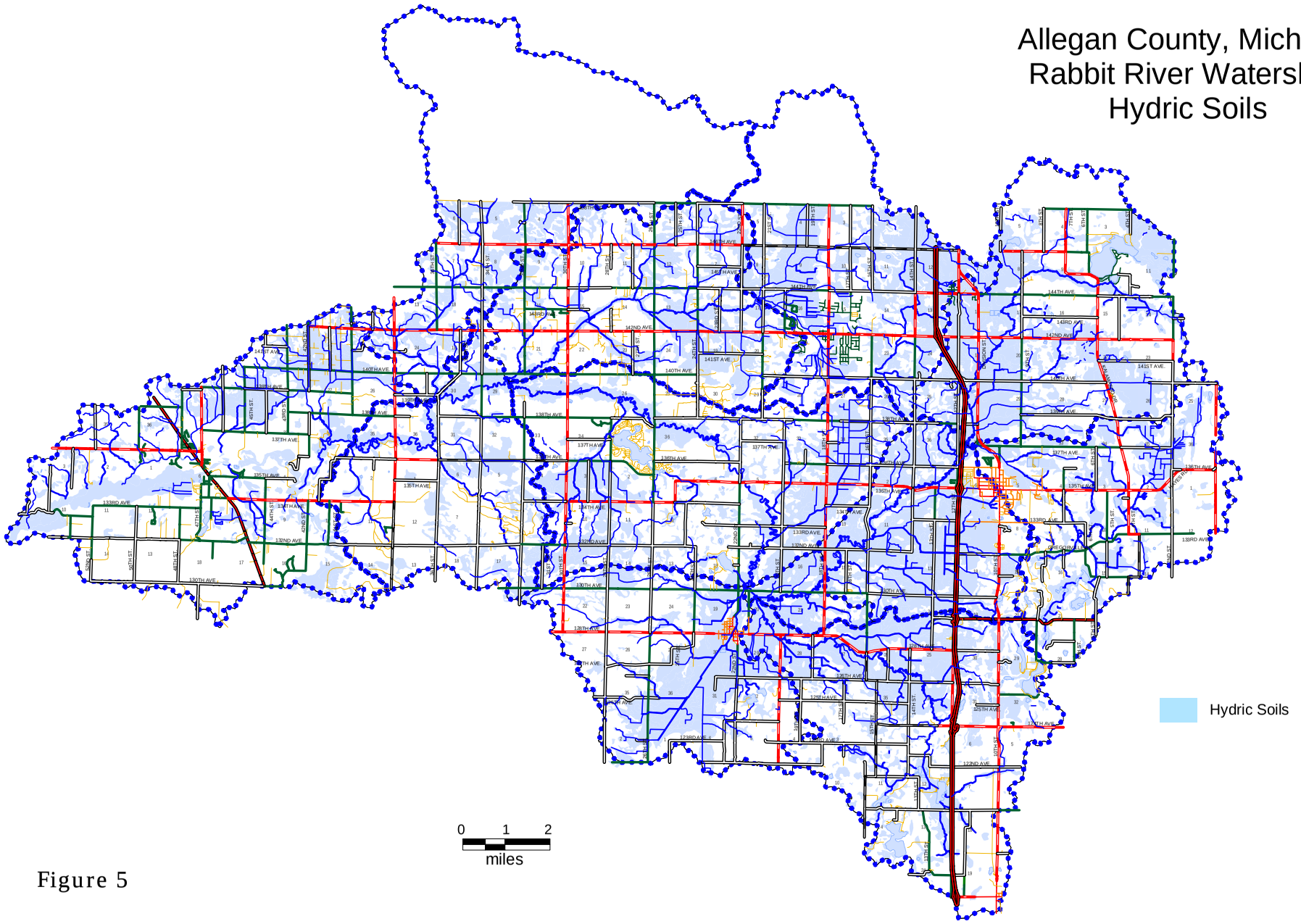
Allegan County, Michigan
Rabbit River Watershed
Hydric Soils
Hydric Soils
0 1 2
miles

Figure 5

Hydrology

Surface Water

The Rabbit River Watershed has an extensive network of stream, creeks, and constructed drainage ways. Many formerly natural streams or creeks have been altered dramatically through channelization or other straightening, dredging, deepening, widening or other methods. Many drains have also been constructed, both public and private. The Rabbit River Watershed also has many inland lakes, of all sizes. Several of the major lakes include Green Lake, East Lake, Selkirk Lake, and Miller Lake. Monterey Lake is a large man-made lake, constructed from former extraction services, and now harbors a large recreational/residential community.

Ground Water (recharge areas)

Ground water is a crucial part of a watershed. While this project deals mostly with surface water and the problems associated with non-point source pollution, ground water and surface water are intimately connected, and will have great influence on each other. Groundwater in the Rabbit River Watershed is found in glacial deposits of sand and gravel below the surface of the land. These water-storing deposits are called aquifers. The most productive aquifers are the thickest, and those that have little or no mud, silt, or clay in them, thus allowing for more water storage. Groundwater and surface water interact in areas know as recharge or discharge zones. The Rabbit River has both recharge and discharge areas. Groundwater discharge is very important in coldwater streams. Groundwater is consistent in temperature and amount, thus providing a stable stream environment. Streams become flashy when more runoff from the surface enters, as runoff varies greatly in both temperature and amount. Groundwater recharge areas are usually upland areas with sandy or gravelly soils. Rain and snow that falls on these areas infiltrates into the ground and makes its way into the aquifer. These recharge areas are critical to protecting our drinking water sources, but also to maintain our high quality streams. Recharge areas in the Rabbit River Watershed are found in the headwater areas, and in areas with higher elevation, mostly around the edges of the watershed.

Significant Natural Resources

Wetlands

The Rabbit River Watershed is home to numerous types of wetlands, a majority of which are classified as palustrine by the National Wetland Inventory. Palustrine wetlands are associated with streams, creeks, swales, or are separate wetland features in the landscape. Other types of wetlands in the watershed are riverine, associated with river systems, and lacustrine, associated with or adjacent to lakes. Wetlands in the Rabbit River Watershed range from forested wetlands like hardwood swamps, cedar or tamarack, to emergent vegetation such as cattail marshes, and prairie fens. Many shrub-scrub wetlands are also present, including buttonbush 'kettles' of glacial origin.
Figure 6 is a map of the wetlands designated by the National Wetlands Inventory. (See Figure 6 NWI Wetlands) The NWI classifies wetlands based on vegetation, hydrologic cycle, and soils. Hydric soils are closely associated with wetlands, and many areas overlap (compare Figure 6 with Figure 5: Hydric Soils).

Natural Features, Communities and Threatened and Endangered Species

Michigan Natural Features Inventory keeps records of element occurrences for rare, endangered threatened or species of special concern throughout the state. In the Rabbit River Watershed, over 100 element occurrences are present. These include plants, animals, and natural communities. Several species of note include elements at Jackson Lake, an undeveloped inland lake owned by the Lansing School District in the headwaters of the Rabbit River. One notable species present in the watershed is the Massasauga Rattlesnake, Michigan's only rattlesnake, and an inhabitant of wetlands, fens, and wet prairies. (See Figure 7 Rare Species and Table 1 MNFI Rare Species Occurences) The Rabbit River Watershed is home to several state threatened or endangered species, and one federally listed species, as tracked by Michigan Natural Features inventory. The Karner Blue Butterfly is a federally listed species that lives in dry upland prairies in the Rabbit River Watershed. Other federal species include the Bald Eagle, over part of its range, and the Eastern Massasauga, a federal candidate. State Threatened or Endangered species include a marsh bird, the King Rail, the Red-shouldered Hawk, a forest bird of prey that inhabits river floodplain forest and adjacent uplands, two species of butterflies, including the Karner Blue Butterfly, the Frosted Elfin, and many rare and special plants and wildflowers.

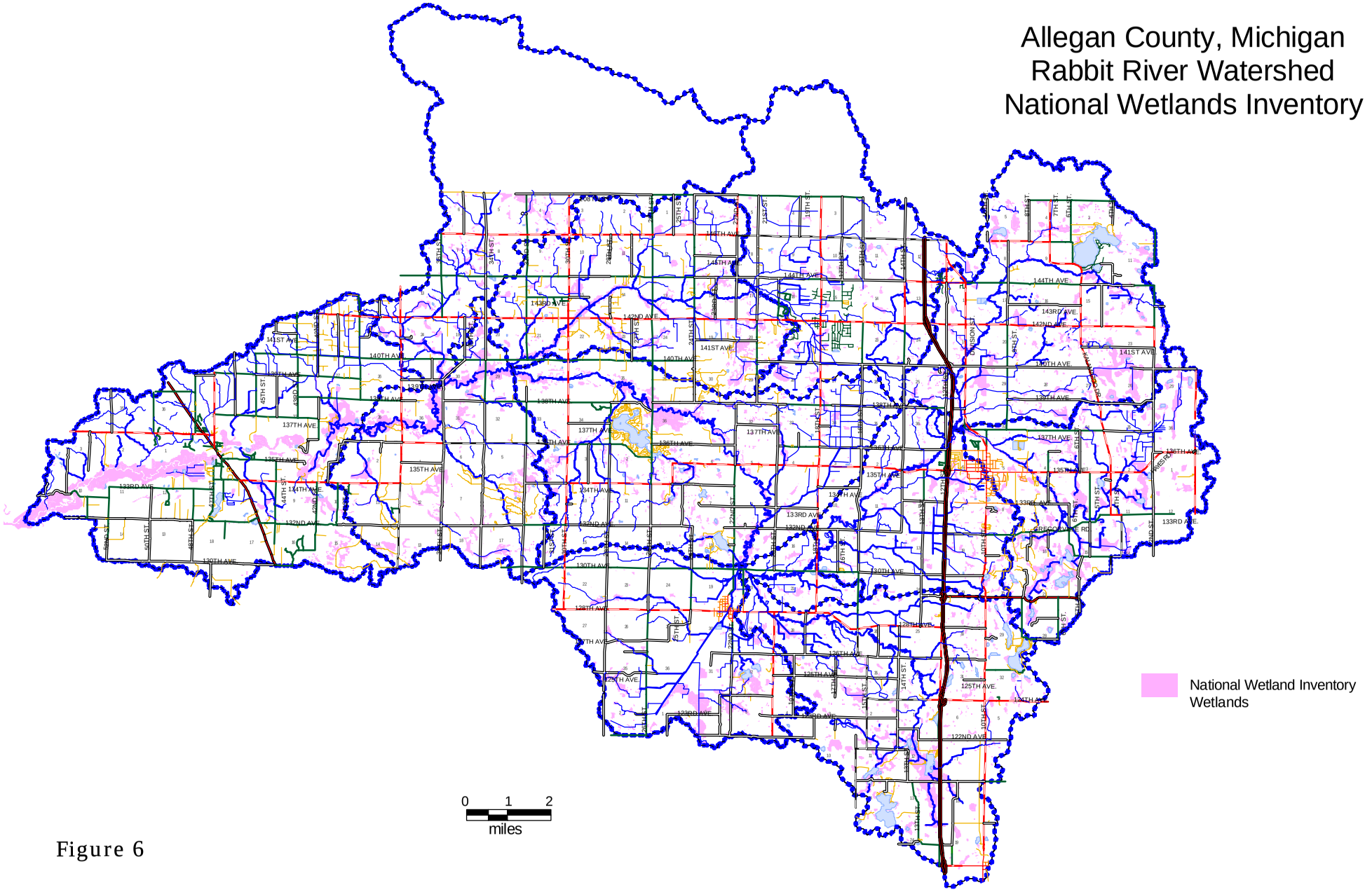
Allegan County, Michigan
Rabbit River Watershed
National Wetlands Inventory
National Wetland Inventory Wetlands
0 1 2
miles

Figure 6

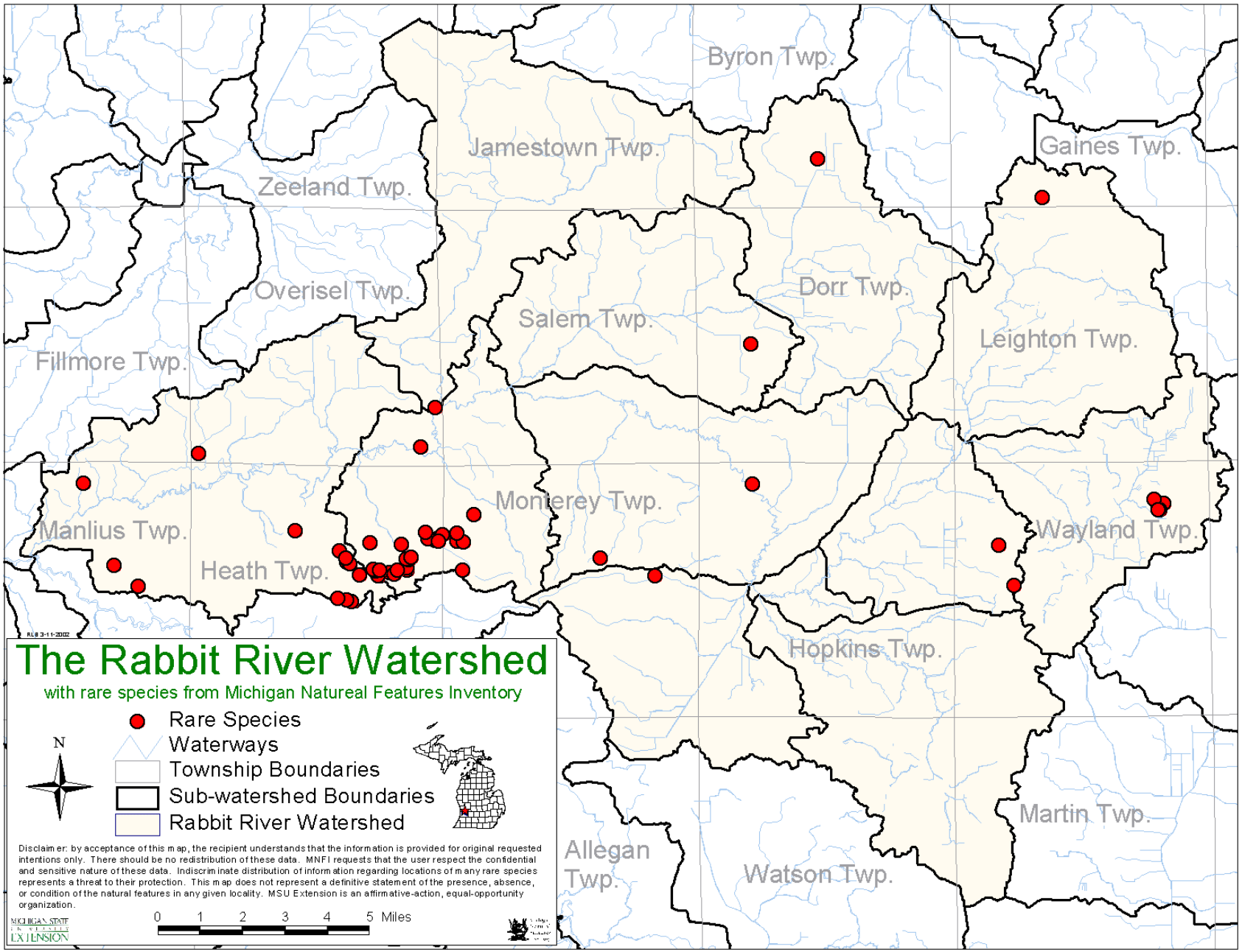
Byron Twp.
Jamestown Twp.
Gaines Twp.
Zeeland Twp.
Overisel Twp.
Dorr Twp.
Salem Twp.
Leighton Twp.
Fillmore Twp.
Monterey Twp.
Manlius Twp.
Wayland Twp.
Heath Twp.
Hopkins Twp.
Martin Twp.
Allegan Twp.
Watson Twp.
The Rabbit River Watershed
with rare species from Michigan Natureal Features Inventory
Rare Species
Waterways
Township Boundaries
Sub-watershed Boundaries
Rabbit River Watershed
N
Disclaimer: by acceptance of this map, the recipient understands that the information is provided for original requested intentions only. There should be no redistribution of these data. MNFI requests that the user respect the confidential and sensitive nature of these data. Indiscriminate distribution of information regarding locations of many rare species represents a threat to their protection. This map does not represent a definitive statement of the presence, absence, or condition of the natural features in any given locality. MSU Extension is an affirmative-action, equal-opportunity organization.
0 1 2 3 4 5 Miles
MICHIGAN STATE UNIVERSITY EXTENSION

Figure 7

Table 1: Rare Species Occurences in the Rabbit River Watershed

Scientific Name	Common Name	Federal Status	State Status	Last Observed	Element Category	Township	SECTION	TOWN	RANGE
RALLUS ELEGANS	KING RAIL		E	1949-12-04	Animal	Martin	5	02N	11W
PANAX QUINQUEFOLIUS	GINSENG		T	1982-09-04	Plant	Wayland	2	03N	11W
CHAMPION TREE	HACKBERRY (CELTIS OCCIDENTALIS)			1981-05-30	Other	Wayland	8	03N	11W
SISTRURUS CATENATUS CATENATUS	EASTERN MASSASAUGA	C	SC	1995-08-24	Animal	Wayland	11	03N	11W
TERRAPENE CAROLINA CAROLINA	EASTERN BOX TURTLE		SC	1980-10-01	Animal	Wayland	11	03N	11W
PRAIRIE FEN	ALKALINE SHRUB/HERB FEN, MIDWEST TYPE			1981-08-19	Community	Wayland	11	03N	11W
OECANTHUS LARICIS	TAMARACK TREE CRICKET		SC	2000-08-14	Animal	Wayland	11	03N	11W
TRADESCANTIA BRACTEATA	LONG-BRACTED SPIDERWORT		X	1938-06-17	Plant	Wayland	17	03N	11W
SISTRURUS CATENATUS CATENATUS	EASTERN MASSASAUGA	C	SC	1997-07-08	Animal	Hopkins	5	03N	12W
ELEOCHARIS ENGELMANNII	ENGELMANN'S SPIKE-RUSH		SC	1989-09-26	Plant	Monterey	7	03N	13W
OAK-PINE BARRENS				1989-09-26	Community	Monterey	7	03N	13W
ECHINODORUS TENELLUS	DWARF BURHEAD		E	1989-10-06	Plant	Monterey	7	03N	13W
SCIRPUS HALLII	HALL'S BULRUSH		T	1989-10-06	Plant	Monterey	7	03N	13W
LAKEPLAIN WET-MESIC PRAIRIE	ALKALINE TALLGRASS PRAIRIE, MIDWEST TYPE			1989-10-06	Community	Monterey	7	03N	13W
COASTAL PLAIN MARSH	INFERTILE POND/MARSH, GREAT LAKES TYPE			1989-10-06	Community	Monterey	7	03N	13W
ROTALA RAMOSIOR	TOOTH-CUP		SC	1989-09-26	Plant	Monterey	7	03N	13W
ELEOCHARIS TRICOSTATA	THREE-RIBBED SPIKE-RUSH		T	1989-10-06	Plant	Monterey	7	03N	13W
JUNCUS SCIRPOIDES	SCIRPUS-LIKE RUSH		T	1989-09-26	Plant	Monterey	7	03N	13W
DRY SAND PRAIRIE	DRY SAND PRAIRIE,			1989-09-29	Community	Monterey	7	03N	13W

	MIDWEST TYPE								
GENTIANA PUBERULENTA	DOWNY GENTIAN		E	1990-09-18	Plant	Monterey	7	03N	13W
GREAT BLUE HERON ROOKERY	GREAT BLUE HERON ROOKERY			1983-06-18	Other	Monterey	14	03N	13W
BAPTISIA LACTEA	WHITE OR PRAIRIE FALSE INDIGO		SC	1981-SU	Plant	Monterey	15	03N	13W
PAPAIPEMA MARITIMA	MARITIME SUNFLOWER BORER		SC	1997-09-30	Animal	Monterey	18	03N	13W
LAKEPLAIN WET-MESIC PRAIRIE	ALKALINE TALLGRASS PRAIRIE, MIDWEST TYPE			1989-09-16	Community	Monterey	18	03N	13W
ELEOCHARIS TRICOSTATA	THREE-RIBBED SPIKE-RUSH		T	1989-10-06	Plant	Monterey	18	03N	13W
JUNCUS SCIRPOIDES	SCIRPUS-LIKE RUSH		T	1989-10-06	Plant	Monterey	18	03N	13W
SISYRINCHIUM ATLANTICUM	ATLANTIC BLUE-EYED-GRASS		T	1989-10-06	Plant	Monterey	18	03N	13W
PAPAIPEMA BEERIANA	BLAZING STAR BORER		SC	1994	Animal	Monterey	18	03N	13W
PAPAIPEMA SCIATA	CULVERS ROOT BORER		SC	1992	Animal	Monterey	18	03N	13W
ARABIS MISSOURIENSIS VAR DEAMII	MISSOURI ROCK-CRESS		SC	1972-05-04	Plant	Heath	9	03N	14W
OAK-PINE BARRENS				1989-09-30	Community	Heath	11	03N	14W
INCISALIA IRUS	FROSTED ELFIN		T	1997-05-22	Animal	Heath	12	03N	14W
FLEXAMIA DELONGI	LEAFHOPPER		SC	1995-08-15	Animal	Heath	12	03N	14W
LAKEPLAIN WET-MESIC PRAIRIE	ALKALINE TALLGRASS PRAIRIE, MIDWEST TYPE			1990-10-10	Community	Heath	12	03N	14W
ROTALA RAMOSIOR	TOOTH-CUP		SC	1989-09-26	Plant	Heath	12	03N	14W
POLYGALA CRUCIATA	CROSS-LEAVED MILKWORT		SC	1989-09-26	Plant	Heath	12	03N	14W
RHYNCHOSPORA MACROSTACHYA	TALL BEAK-RUSH		SC	1989-09-26	Plant	Heath	12	03N	14W
RHYNCHOSPORA GLOBULARIS	GLOBE BEAK-RUSH		E	1995-09-26	Plant	Heath	12	03N	14W
ELEOCHARIS TRICOSTATA	THREE-RIBBED SPIKE-RUSH		T	1989-09-26	Plant	Heath	12	03N	14W
ROTALA RAMOSIOR	TOOTH-CUP		SC	1989-09-26	Plant	Heath	12	03N	14W

COASTAL PLAIN MARSH	INFERTILE POND/MARSH, GREAT LAKES TYPE			1989-09-26	Community	Heath	12	03N	14W
SISYRINCHIUM ATLANTICUM	ATLANTIC BLUE-EYED-GRASS		T	1989-09-26	Plant	Heath	12	03N	14W
PYCNANTHEMUM VERTICILLATUM	WHORLED MOUNTAIN-MINT		SC	1989-09-26	Plant	Heath	12	03N	14W
JUNCUS SCIRPOIDES	SCIRPUS-LIKE RUSH		T	1989-09-26	Plant	Heath	12	03N	14W
SCLERIA TRIGLOMERATA	TALL NUT-RUSH		SC	1989-09-26	Plant	Heath	12	03N	14W
SCLERIA TRIGLOMERATA	TALL NUT-RUSH		SC	1989-09-26	Plant	Heath	12	03N	14W
RHEXIA MARIANA VAR MARIANA	MARYLAND MEADOW-BEAUTY		T	1990-08-31	Plant	Heath	12	03N	14W
JUNCUS BRACHYCARPUS	SHORT-FRUITED RUSH		T	1989-09-26	Plant	Heath	12	03N	14W
POTAMOGETON BICUPULATUS	WATERTHREAD PONDWEED		T	1989-09-26	Plant	Heath	12	03N	14W
JUNCUS VASEYI	VASEY'S RUSH		T	1989-09-26	Plant	Heath	12	03N	14W
ELEOCHARIS TRICOSTATA	THREE-RIBBED SPIKE-RUSH		T	1989-09-26	Plant	Heath	12	03N	14W
LECHEA PULCHELLA	LEGGETT'S PINWEED		T	1990-09-18	Plant	Heath	12	03N	14W
RHEXIA VIRGINICA	MEADOW-BEAUTY		SC	1989-09-26	Plant	Heath	12	03N	14W
ELEOCHARIS ENGELMANNII	ENGELMANN'S SPIKE-RUSH		SC	1989-09-26	Plant	Heath	12	03N	14W
PAPAIPEMA SCIATA	CULVERS ROOT BORER		SC	1995-09-10	Animal	Heath	12	03N	14W
ECHINODORUS TENELLUS	DWARF BURHEAD		E	1989-09-26	Plant	Heath	13	03N	14W
ROTALA RAMOSIOR	TOOTH-CUP		SC	1989-09-26	Plant	Heath	13	03N	14W
ELEOCHARIS TRICOSTATA	THREE-RIBBED SPIKE-RUSH		T	1989-09-09	Plant	Heath	13	03N	14W
PANICUM LONGIFOLIUM	LONG-LEAVED PANIC-GRASS		T	1989-09-26	Plant	Heath	13	03N	14W
COASTAL PLAIN MARSH	INFERTILE POND/MARSH, GREAT LAKES TYPE			1989-09-09	Community	Heath	13	03N	14W
LAKEPLAIN WET-MESIC PRAIRIE	ALKALINE TALLGRASS PRAIRIE, MIDWEST TYPE			1989-09-09	Community	Heath	13	03N	14W

RHEXIA MARIANA VAR MARIANA	MARYLAND MEADOW-BEAUTY		T	1989-09-26	Plant	Heath	13	03N	14W
ELEOCHARIS ENGELMANNII	ENGELMANN'S SPIKE-RUSH		SC	1989-09-26	Plant	Heath	13	03N	14W
SPOROBOLUS HETEROLEPIS	PRAIRIE DROPSEED		SC	1989-04-09	Plant	Heath	13	03N	14W
RHEXIA VIRGINICA	MEADOW-BEAUTY		SC	1989-09-26	Plant	Heath	13	03N	14W
ROTALA RAMOSIOR	TOOTH-CUP		SC	1989-09-09	Plant	Heath	13	03N	14W
PANICUM LONGIFOLIUM	LONG-LEAVED PANIC-GRASS		T	1989-09-26	Plant	Heath	13	03N	14W
COASTAL PLAIN MARSH	INFERTILE POND/MARSH, GREAT LAKES TYPE			1989-09-09	Community	Heath	13	03N	14W
ISOETES ENGELMANNII	APPALACHIAN QUILLWORT		E	1989-09-26	Plant	Heath	13	03N	14W
ELEOCHARIS MELANOCARPA	BLACK-FRUITED SPIKE-RUSH		SC	1989-09-09	Plant	Heath	13	03N	14W
POTAMOGETON BICUPULATUS	WATERTHREAD PONDWEED		T	1989-09-26	Plant	Heath	13	03N	14W
JUNCUS SCIRPOIDES	SCIRPUS-LIKE RUSH		T	1989-09-26	Plant	Heath	13	03N	14W
ELEOCHARIS TRICOSTATA	THREE-RIBBED SPIKE-RUSH		T	1989-09-09	Plant	Heath	13	03N	14W
COASTAL PLAIN MARSH	INFERTILE POND/MARSH, GREAT LAKES TYPE			1990-09-02	Community	Heath	14	03N	14W
INCISALIA IRUS	FROSTED ELFIN		T	1993-05-21	Animal	Heath	14	03N	14W
POTAMOGETON BICUPULATUS	WATERTHREAD PONDWEED		T	1989-09-09	Plant	Heath	14	03N	14W
COASTAL PLAIN MARSH	INFERTILE POND/MARSH, GREAT LAKES TYPE			1989-09-09	Community	Heath	14	03N	14W
LAKEPLAIN WET-MESIC PRAIRIE	ALKALINE TALLGRASS PRAIRIE, MIDWEST TYPE			1989-09-13	Community	Heath	14	03N	14W
RHYNCHOSPORA MACROSTACHYA	TALL BEAK-RUSH		SC	1989-09-09	Plant	Heath	14	03N	14W
ELEOCHARIS MELANOCARPA	BLACK-FRUITED SPIKE-RUSH		SC	1989-09-09	Plant	Heath	14	03N	14W

RHEXIA VIRGINICA	MEADOW-BEAUTY		SC	1989-09-09	Plant	Heath	14	03N	14W
ELEOCHARIS TRICOSTATA	THREE-RIBBED SPIKE-RUSH		T	1989-09-26	Plant	Heath	14	03N	14W
ELEOCHARIS MELANOCARPA	BLACK-FRUITED SPIKE-RUSH		SC	1989-09-09	Plant	Heath	14	03N	14W
RHEXIA MARIANA VAR MARIANA	MARYLAND MEADOW-BEAUTY		T	1990-05-01	Plant	Heath	14	03N	14W
COASTAL PLAIN MARSH	INFERTILE POND/MARSH, GREAT LAKES TYPE			1989-09-13	Community	Heath	15	03N	14W
JUNCUS SCIRPOIDES	SCIRPUS-LIKE RUSH		T	1989-09-13	Plant	Heath	15	03N	14W
RHEXIA VIRGINICA	MEADOW-BEAUTY		SC	1980-08-21	Plant	Heath	15	03N	14W
PYCNANTHEMUM VERTICILLATUM	WHORLED MOUNTAIN-MINT		SC	1989-09-13	Plant	Heath	15	03N	14W
TERRAPENE CAROLINA CAROLINA	EASTERN BOX TURTLE		SC	1995-06-15	Animal	Heath	22	03N	14W
PANICUM LONGIFOLIUM	LONG-LEAVED PANIC-GRASS		T	1989-09-29	Plant	Heath	22	03N	14W
COASTAL PLAIN MARSH	INFERTILE POND/MARSH, GREAT LAKES TYPE			1989-09-29	Community	Heath	22	03N	14W
ELEOCHARIS TRICOSTATA	THREE-RIBBED SPIKE-RUSH		T	1989-09-29	Plant	Heath	22	03N	14W
ELEOCHARIS MELANOCARPA	BLACK-FRUITED SPIKE-RUSH		SC	1989-09-09	Plant	Heath	23	03N	14W
RHEXIA MARIANA VAR MARIANA	MARYLAND MEADOW-BEAUTY		T	1989-09-09	Plant	Heath	23	03N	14W
RHEXIA VIRGINICA	MEADOW-BEAUTY		SC	1990-08-31	Plant	Heath	23	03N	14W
COASTAL PLAIN MARSH	INFERTILE POND/MARSH, GREAT LAKES TYPE			1989-09-09	Community	Heath	23	03N	14W
SCIRPUS HALLII	HALL'S BULRUSH		T	1989-09-09	Plant	Heath	24	03N	14W
PYCNANTHEMUM VERTICILLATUM	WHORLED MOUNTAIN-MINT		SC	1989-09-09	Plant	Heath	24	03N	14W
SISYRINCHIUM ATLANTICUM	ATLANTIC BLUE-EYED-GRASS		T	1995-08-22	Plant	Heath	24	03N	14W
SCLERIA TRIGLOMERATA	TALL NUT-RUSH		SC	1989-09-26	Plant	Heath	24	03N	14W
BUTEO LINEATUS	RED-SHOULDERED		T	2001-05-30	Animal	Heath	24	03N	14W

	HAWK								
INCISALIA IRUS	FROSTED ELFIN		T	1984	Animal	Manlius	3	03N	15W
DRY-MESIC SOUTHERN FOREST				1989-07-18	Community	Manlius	14	03N	15W
LYCAEIDES MELISSA SAMUELIS	KARNER BLUE	LE	T	1992	Animal	Manlius	14	03N	15W
BUTEO LINEATUS	RED-SHOULDERED HAWK		T	2000-05-01	Animal	Manlius	23	03N	15W
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	PS	T	1998	Animal	Manlius	24	03N	15W
SISTRURUS CATENATUS CATENATUS	EASTERN MASSASAUGA	C	SC	1995-06-29	Animal	Dorr	20	04N	12W
NOTROPIS TEXANUS	WEED SHINER		X	1939-09-23	Animal	Overisel	25	04N	14W
HELIANTHUS HIRSUTUS	WHISKERED SUNFLOWER		SC	1894-08-21	Plant	Overisel	31	04N	14W
CLEMMYS INSCULPTA	WOOD TURTLE		SC	1975-09	Animal	Overisel	36	04N	14W
BOG				1991-08-15	Community	Gaines	33	05N	11W
MERTENSIA VIRGINICA	VIRGINIA BLUEBELLS		T	1889-05-07	Plant	Byron	26	05N	12W
GYMNOCLADUS DIOICUS	KENTUCKY COFFEE-TREE		SC	1889-07-10	Plant	Byron	26	05N	12W
MERTENSIA VIRGINICA	VIRGINIA BLUEBELLS		T	1901	Plant	Byron	36	05N	12W

Data Guidelines: (Source: Michigan Natural Features Inventory (MNFI)) These data are a list of Element Occurrences (EO) at the section level. The sections contain the centroid of the EO. In some cases, the extent of an animal's range or a community type may extend past the section containing the centroid. These data represent the best available information regarding elements tracked by MNFI. This list, however, is not a definitive statement on the presence, absence, or condition of the natural features in any given locality. Plant and animal populations and natural communities change with time. Also, not every site has been specifically surveyed. Therefore, the information provided should not be regarded as a complete statement on the occurrence of special natural features of the area in question.

SOURCE:
Michigan Natural Features Inventory
P.O. Box 30444
Lansing, MI 48909-7944
PH: (517) 373-1552
FAX: (517) 373-9566

The recipient(s) of the data understand that state endangered and threatened species are protected under state law (Act 451 of 1994, the Natural Resources and Environmental Protection Act, Part 365, Endangered Species Protection). Any questions, observations, new findings, violations or clearance of project activities should be conducted with the Michigan Department of Natural Resources, Wildlife Division. Contact Lori Sargent or Pat Lederle at (517) 373-1263. The recipient(s) of the data understand that federally endangered and threatened species are protected under federal law (Endangered Species Act of 1973). Any questions, observations, new findings, violations or clearance of project activities should be conducted with the U.S. Fish and Wildlife Service in East Lansing. Their phone number is (517) 351-2555. Recipients of the data are responsible for ensuring the protection of protected species and obtaining proper clearance before project activities begin.

These data are used to guide conservation and land management activities. Some of the data records are historical. While these data may not be important for regulatory purposes, they are important for management and restoration purposes and for scientific use.

The following codes are used for the Federal and State status:

Federal Status:

C = Candidate - species being considered for federal status
LE = Listed endangered
LT = Listed threatened
LELT = Listed endangered in part of the range, threatened in a different part.
PE = Proposed endangered
PT = Proposed threatened
PS = Partial status - status in only a portion of the range

State status:

E = Endangered (Legally protected)
T = Threatened (Legally protected)
SC = Special Concern (Rare or status uncertain; not legally protected)
X = Presumed extirpated (Legally threatened if rediscovered)

For questions about MNFI and the data, contact Ed Schools, MNFI, (517) 373-0798, or schoolse@michigan.gov.

Natural Rivers

The State of Michigan has designated the lower reaches of the Kalamazoo River as a Wild and Scenic River. Included in this stretch is where the Rabbit River empties into the Kalamazoo River. The State of Michigan has established that the Rabbit River is a critical tributary in the protection of this important natural resource. (See Figure 8 Natural Rivers)

Fisheries and macroinvertebrate populations

The Rabbit River is a State Designated Trout Stream, as are several of its tributaries. Very few rivers in southwestern Michigan are designated trout streams, making the Rabbit River a unique resource in our area. The designated trout streams of the Rabbit River Watershed include the entire mainstem of the Rabbit River from its mouth at the Kalamazoo to the source in Wayland Township, tributaries upstream from 131, and parts of Miller Creek in Watson and Martin Township, Pigeon Creek (west branch), Silver Creek, and Miller Creek in Monterey Township. Designated trout streams are open to trout fishing at all or certain parts of the year, according to rules set forth by the DNR. Trout stream designations took into consideration water temperature, habitat, fish population structure, and others. (See Figure 9 Trout streams)

Fisheries in the Rabbit River are underused resources. Throughout the Rabbit River Watershed, there are very few public access areas, so most fishing occurs on private lands. In fact, there is only one public access on the whole of the Rabbit River, located near Hamilton, below the dam. This access is in the lower Rabbit River, so the Upper Rabbit River, a coldwater trout stream, has no public access.

Macroinvertebrates are excellent indicators of local water quality conditions. Benthic macroinvertebrates are stationary, that is, they move very little in relation to a stream. The populations are generally abundant, and they are easy to catch and identify. Many macroinvertebrates are very sensitive to water conditions. Species that are filter feeders will be sensitive to suspended solids and sediment in the water column. Many species with exposed gills need very high levels of dissolved oxygen. Sampling macroinvertebrates to determine species composition, diversity and abundance will give a "snapshot" of the stream conditions at a given moment in time. Areas in the Rabbit River were found to have a wide variety of stream quality ratings, from poor to excellent. (MDEQ, A Biological and Physical Assessment of the Rabbit River Watershed. 2000.)

The Rabbit River Watershed's Student Stream Science Program also samples macroinvertebrate populations in the watershed. Sites sampled have ranged from poor to excellent quality. (See Appendix 6a Student Stream Science Newsletter)

Protected Lands

Protected lands in Allegan County are a mix of methods and levels of protection. At the highest level, there are over 90,000 acres of State Game Area in Allegan County, some of which is in the Rabbit River Watershed. The Watershed also has protected lands in the form of county, township, city, and village parks. Some private land has also been protected, including efforts by local land trusts, and other private acquisitions. Land in the watershed is also enrolled in the PA-116 program, a state program to protect farmland from development. Lands in these programs are not at quite as high a level of protection, as there are methods to remove lands from PA 116.

Another program that has recently been signed into law is the PDR program, or Purchase of Development Rights. The governor recently eliminated the penalties associated with transferring lands in PA 116 programs to the Purchase of Development Rights program. This is an excellent step towards more permanent land protection measures.

Figure 8

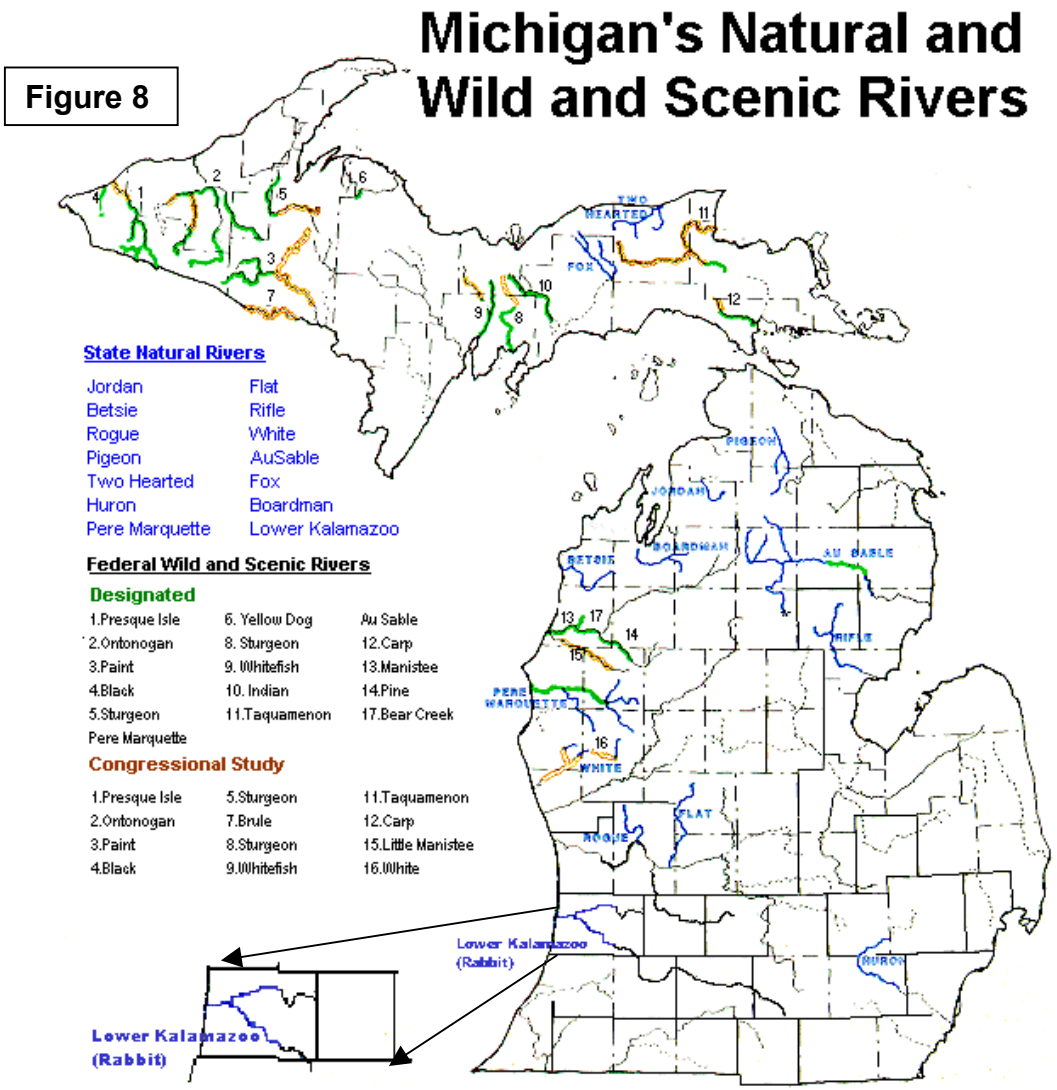

Figure 8: Michigan's Natural and Scenic and Wild Rivers. Michigan has designated the lower Kalamazoo River as a State Natural River System. The protection of the Rabbit River is vital to the protection of this wild and scenic river. (Source: MDNR website, www.michigan.gov/dnr)

The Lower Kalamazoo is part of Michigan's designated State Natural River system. The majority of the designated section runs through the Allegan State Game Area. The river corridor there is heavily forested with little development due to the remoteness of its location in southwestern Michigan. Large holdings of public land along the river contain campgrounds and hiking and cross-country skiing trails. The river can be traveled by boat from Lake Michigan upstream to the Allegan Dam. Furthermore, the river is a productive fishery resource. Walleye and other warm-water fisheries are found along the Kalamazoo and it also has significant fall and spring runs of steelhead, sucker and salmon. Many wildlife viewing, hunting and trapping opportunities exist along the river within the Allegan Game Area and the Pottawatomi Marsh. The Game Area is also intensively managed for Canada geese and wild turkey and contains observation areas for viewing wildlife.

The state of Michigan considers the following tributaries vital to the protection of the mainstem, including the Rabbit River, Bear Creek, Sand Creek, Swan Creek, and Mann Creek. Designated stretch: From Calkins Bridge Dam in T.O2N., R.14W., Sec.10 downstream to the Hacklander Landing in T.O3N, R.16W., Sec.14.

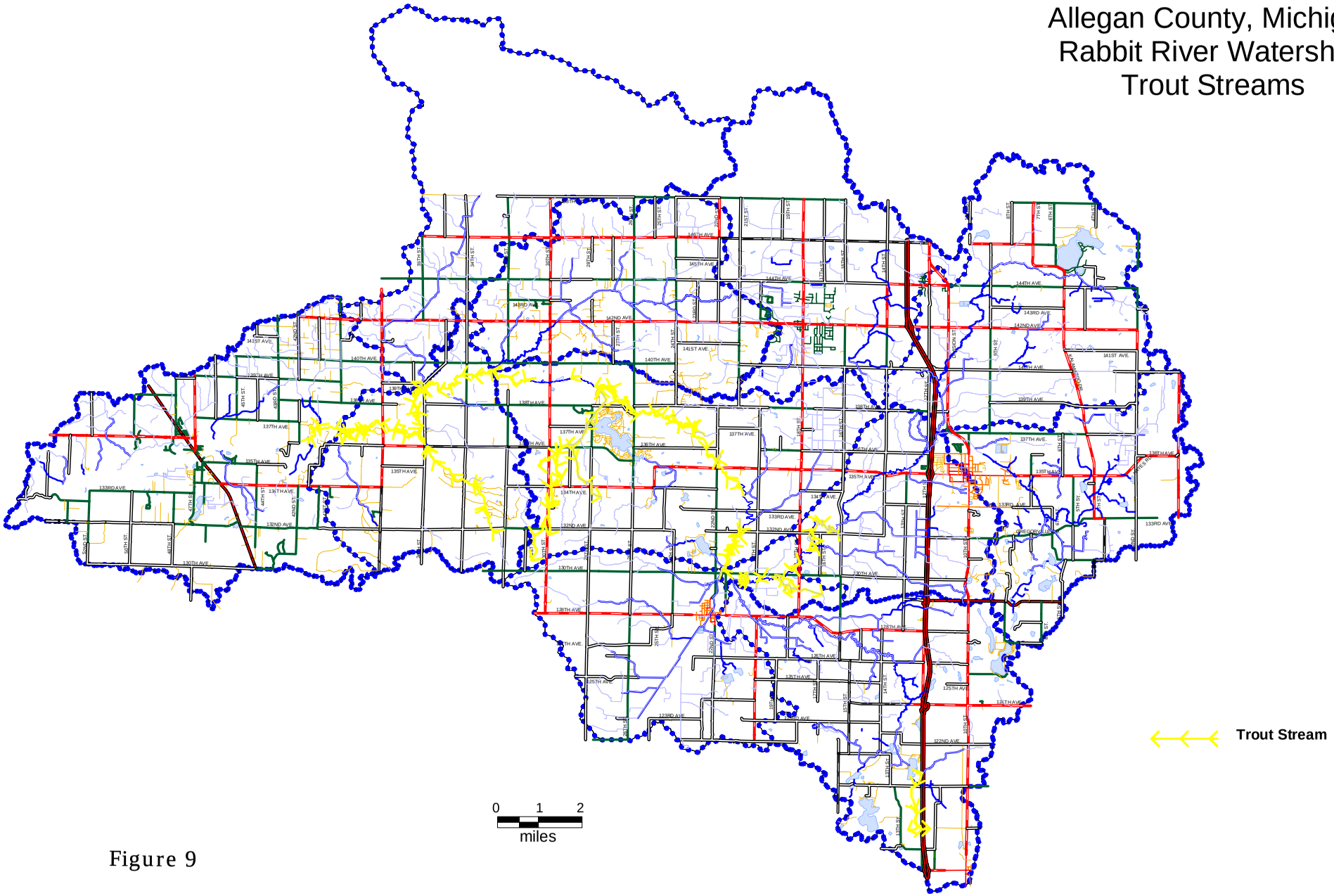
Allegan County, Michigan
Rabbit River Watershed
Trout Streams
Trout Stream
0 1 2
miles

Figure 9

Recreation

Recreation, partial body recreation, is one of the desired designated uses for the Rabbit River Watershed Project. Partial body recreation includes fishing, canoeing, and other activities other than swimming. The Rabbit River also offers a variety of recreational opportunities related to the designated use of native wildlife habitat including bird watching, wildlife observation, walking, and hiking. See Appendix 1: Guidelines to Navigable Waters (Appendix1)

Fishing recreation

Fishing is a recreational opportunity available throughout the Rabbit River Watershed. Including many coldwater and designated trout streams. (See Figure 9 Trout streams) However, in some areas of the Rabbit River Watershed, the fishing opportunities have declined (personal communications John Schimmel, Ebersole Environmental Center). This may be due to a variety of reasons, but increasing amounts of sediments and nutrients, and loss of habitat have definite effects on fish and macroinvertebrate populations and aquatic ecosystems.

Land-use Recreation Opportunities

Area of Public Land in the Rabbit River Watershed varies greatly depending on township. In the lower reaches of the watershed, the Allegan State Game Areas provide a plethora of public land recreation opportunities, from hunting, canoe access, to bird and wildlife watching, and so on. In the Upper Rabbit River Watershed, public lands are fewer, but there are still some excellent possibilities.

Current Park Recreation Opportunities in the Rabbit River Watershed

The Rabbit River Watershed has a variety of parks that focus on a variety of recreational uses. Parks range from primitive equestrian parks, to manicured baseball fields and picnic area. The Rabbit River Watershed Project has increased recreational opportunities as one of its important goals for implementation in the watershed.

Brief summary of parks in the Rabbit River Watershed:

Silver Creek County Park: primitive camping, equestrian park. Access to Silver Creek, a high quality coldwater trout stream. Very Scenic.

Allegan State Game Area: large area of public land, many recreation opportunities.

Bysterveld County Park: currently undeveloped park. Slated for use as a natural area and educational natural park. Parking open, no trails or facilities. (See **Figure 10 Bysterveld County Park**, Bysterveld Park's Master Plan.)

Wayland Parks: Currently working on Master Parks Plan. Goals include linear parks and buffers, natural park along river, public access.

Dorr Parks: North and South Dorr park along Little Rabbit River. Picnic and recreation facilities. Need for streambank restoration/protection and erosion control.

Hopkins Village Park: Park along Bear Creek (Bear Swamp Drain) Recreational facilities. Need for streambank restoration/protection, native plantings.

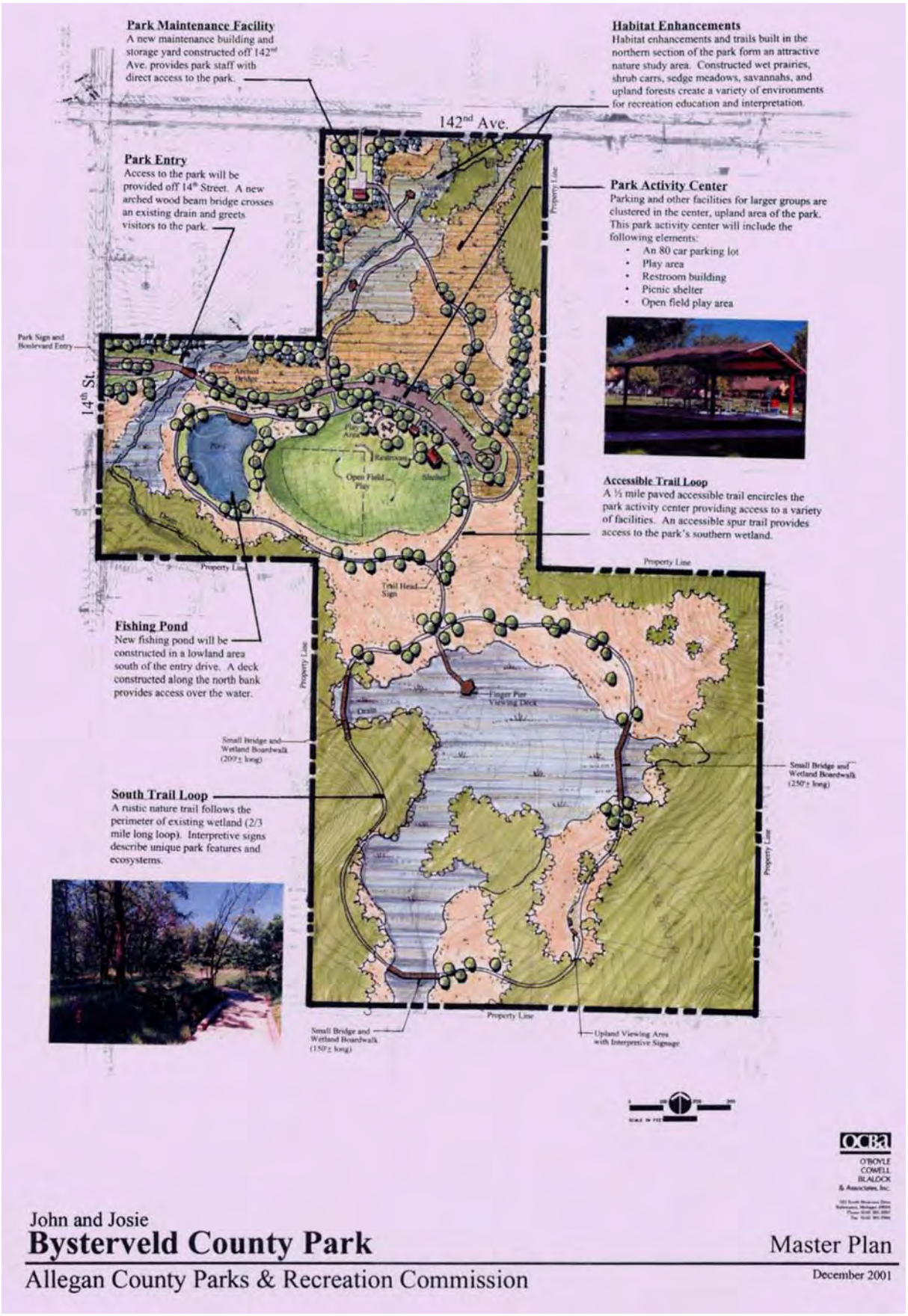
Park Maintenance Facility
A new maintenance building and storage yard constructed off 142nd Ave. provides park staff with direct access to the park.
Habitat Enhancements
Habitat enhancements and trails built in the northern section of the park form an attractive nature study area. Constructed wet prairies, shrub carrs, sedge meadows, savannahs, and upland forests create a variety of environments for recreation education and interpretation.
142nd Ave.
Park Entry
Access to the park will be provided off 14th Street. A new arched wood beam bridge crosses an existing drain and greets visitors to the park.
Park Activity Center
Parking and other facilities for larger groups are clustered in the center, upland area of the park. This park activity center will include the following elements:
• An 80 car parking lot
• Play area
• Restroom building
• Picnic shelter
• Open field play area
Park Sign and Boulevard Entry
14th St.
Arched Bridge
Play Area
Restroom
Shelter
Open Field Play
Accessible Trail Loop
A ½ mile paved accessible trail encircles the park activity center providing access to a variety of facilities. An accessible spur trail provides access to the park's southern wetland.
Property Line
Trail Head Sign
Fishing Pond
New fishing pond will be constructed in a lowland area south of the entry drive. A deck constructed along the north bank provides access over the water.
Finger Pier Viewing Deck
Small Bridge and Wetland Boardwalk (209± long)
Small Bridge and Wetland Boardwalk (250± long)
South Trail Loop
A rustic nature trail follows the perimeter of existing wetland (2/3 mile long loop). Interpretive signs describe unique park features and ecosystems.
Small Bridge and Wetland Boardwalk (150± long)
Upland Viewing Area with Interpretive Signage
OCBA
O'BOYLE COWELL BLALOCK & Associates, Inc.
John and Josie
Bysterveld County Park
Master Plan
Allegan County Parks & Recreation Commission
December 2001

Figure 10

Social and Economic

History

Humans inhabited the area comprised of the Rabbit River Watershed as early as 5,00-7,000 years ago, shortly after the last ice sheets retreated from the area. Later inhabitants consisted of several waves of Native tribes, most recently including the Ottawa, Ojibwa and Pottawatomi. Europeans in the form of trappers and traders were present in Allegan County, primarily along Lake Michigan, the Kalamazoo River, and the lower reaches of the Rabbit as early as the late 1600's. European settlers moved into the area as early as 1830, officially forming Allegan County in 1831. At this time, lumber was king, and lumber and logging camps dotted the streams and rivers of the Rabbit River Watershed. After the lumber boom ended, families began to clear land for farming, thus beginning Allegan County's long association with agriculture as a way of life. Many of the small towns and communities in Allegan County and the Rabbit River Watershed were founded in the late 1800's, and many have preserved their rural character into the 21st century.

Community Profile

The Rabbit River Watershed is almost entirely contained within northwestern Allegan County, a mosaic of rural, and small urban areas, mostly agricultural and rural residential. Allegan County sits in southwestern Lower Michigan near to counties with larger population centers: Kent, Ottawa, and Kalamazoo, with increased job opportunities, shopping centers and cultural programming available all within close driving distance. Allegan County has retained a low population base, and a small-town and rural atmosphere. This rural and small-town atmosphere within driving distance of larger population centers has dramatically increased the development pressure in Allegan County, and has made the Rabbit River Watershed a prime target for development.

Population

Population continues to increase in rural and residential areas of the Rabbit River Watershed. The population in Allegan County increased by over 10% from the 1990 census to the 2000 census. The population in the Rabbit River Watershed is projected to increase by more than ten percent over the next ten years. (See Table 3 Population Trends) The 10 % increase in population reflects an overall county trend, but many townships in the watershed have a much more dramatic increase. Hopkins Township population increased nearly 40% from 1990-1996, but decreased overall from 1990-2000. Dorr Township population increased 18% from 1990-1996, and another 2-3% from 1996-2000. Monterey Township population increased 12%, while Wayland and Leighton increased 8% and 9%, respectively, over a six year period.

Land Use and Development Trends

Land-use in the Rabbit River Watershed is primarily agricultural. Nearly 60% of land in the Rabbit River Watershed is classified as agricultural, and this figure is changing rapidly. (Over 40% of the Rabbit River Watershed in Allegan County is agricultural) (See Figure 11 1996 Land Use and Table 2 for land-use percentages by sub-watershed.)

Another development issue that will closely affect water quality in the Rabbit River Watershed is development along the US-131 corridor. In September 2001, ACEDA invited representatives from nine local units of government (Dorr, Hopkins, Leighton, Martin, Watson and Wayland Townships; the City of Wayland, the Villages of Hopkins and Martin) located along US-131 to an informational meeting to discuss and strategize the scope and implications of the US-131 development trends. Graphics detailing land use and other physical characteristics along the 15-mile north/south and 6-mile east/west stretch of the US-131 corridor were prepared and presented by the Allegan County Geographic Information Systems. Issues for discussion included the development implications of land sale offerings along the corridor, the Coordinated Planning Act, and 2000 Census data per governmental unit among others. Attendees agreed to meet on a quarterly basis for the continuing dialogue regarding the development and land uses along the corridor.

Loss of Farmland and Open Space

The loss of farmland and open space in the Rabbit River Watershed and in Allegan County is increasing. Farmland prices have increased to over $3000 per acre in prime developable areas, and these high prices show no signs of decreasing. Programs such as PA 116, Purchase of Development Rights, and other land protection measures need to be implemented to protect water quality in the Rabbit River Watershed. Hopkins Township recently initiated a survey of residents to determine attitudes and perceptions about farmland preservation and the possibilities of a Purchase of Development Rights Program. A township PDR program could work with the watershed project, local land trusts, and other organizations to significantly impact the amount of farmland and open space being developed in the Rabbit River Watershed.

Table 2 Land Use Acres by Sub-Watershed (In ALLEGAN COUNTY)

Watershed	Residential	Commercial	Industrial	Trans/ Com	Extract	Agriculture	Nonforest/ Open Land	Forest	Water	Wetlands	Barren	Totals
Red Run Drain	1245.6	84.8	42.5	77.8	24.9	5651.8	3330.9	981.6	24.0	460.7	22.8	11947.3
Little Rabbit	1237.5	58.8	0.0	7.8	80.5	6545.1	3481.8	2035.1	37.1	1402.2	36.5	14922.3
Bear Swamp Drain	584.1	38.2	14.2	21.0	34.8	7270.3	1892.3	823.6	44.9	817.6	24.8	11565.9
Green Lake Stream	1264.2	31.9	64.3	118.5	6.4	7342.6	3066.3	1689.4	469.6	2031.2	45.5	16130.0
Upper Rabbit/ Headwaters	1546.6	125.6	38.9	74.3	27.5	3344.6	3097.1	1660.0	160.8	2158.9	116.0	12350.4
Buskirk Creek	747.7	110.6	44.1	120.0	69.7	4907.1	2504.4	600.5	30.4	776.2	7.7	9918.4
Miller Creek	961.4	36.4	29.5	224.5	156.4	9120.7	3437.6	2017.2	459.3	2382.7	57.1	18882.8
Unnamed Creek	74.5	0.0	0.0	0.0	0.0	1037.0	255.9	214.9	0.2	171.7	0.0	1754.2
Middle Rabbit	1963.0	12.6	13.2	1.8	123.8	8941.6	4027.4	3126.0	336.8	2180.9	48.8	20775.9
Black Creek	419.3	13.4	7.9	0.0	0.0	3458.2	1447.1	540.2	22.6	757.0	29.4	6695.2
Silver/Miller Creek	665.6	2.6	9.9	0.0	9.1	2772.3	2230.4	5365.3	26.0	1741.1	23.4	12845.8
Lower Rabbit/Mouth	1724.9	86.1	177.0	39.0	24.8	9406.4	2705.3	5443.5	93.9	2257.4	37.4	21995.7
Totals:	12434.4	601.0	441.6	684.9	557.9	69797.7	31476.6	24497.3	1705.4	17137.5	449.3	159783.7
Percent:	**7.8**	**0.4**	**0.3**	**0.4**	**0.3**	**43.7**	**19.7**	**15.3**	**1.1**	**10.7**	**0.3**	**100.0**

Total Developed:	12434.4	601.0	441.6	684.9	557.9	**14719.9**						
				Percent:		**9.2**						
Total Agriculture:	69797.7					**69797.7**						
				Percent:		**43.7**						
Total Undeveloped:	31476.6	24497.3	1705.4	17137.5	449.3	**75266.2**						
				Percent:		**47.1**		**100%**				

Table 3 Population Trends and Projections through 2020 for Allegan County

Population Trends: Percentage and Numeric Based Trend Projections (*Actual counts, based on census tallies.)

	1970*	1980*	1990*	2000*	2005	2010	2015	2020	Approx. % change (Projected 1990-2020)
Allegan County	66,575	81,555	92,557	105,665	113,918	122,993	133,045	144,266	56%
City of Wayland	2054	2023	2751	3939	4568	5279	6091	7025	108%
Village of Martin	502	447	462	435	426	417	409	400	-17%
Village of Hopkins	566	536	546	592	606	621	636	651	17%
Allegan Township	2970	3464	3976	4050	4186	4326	4470	4619	35%
Dorr Township	3055	5014	5453	6579	7246	7971	8765	9638	92%
Fillmore Township	2126	2307	2710	2756	2845	2936	3030	3126	41%
Heath Township	1450	1962	2297	3100	3523	3992	4514	5098	85%
Hopkins Township	1518	1573	2350	2079	2122	2170	2223	2281	5%
Leighton Township	2354	2772	3069	3652	3935	4233	4547	4878	39%
Martin Township	1623	1884	2487	2079	2063	2049	2040	2033	-10%
Monterey Township	1148	1320	1534	2065	2320	2598	2902	3238	58%
Overisel Township	1881	2248	2324	2594	2720	2849	2983	3121	40%
Salem Township	1744	2183	2708	3486	3920	4396	4919	5496	103%
Watson Township	1331	1658	1897	2086	2213	2346	2484	2629	25%
Wayland Township	1661	2131	2569	3013	3288	3581	3895	4231	46%

Source: West Michigan Regional Planning Commission; 2000 U.S. Census of Population. Projections are based entirely on trends and may not be the best indicator of a community's future population.

WMRPC Mission Statement: To support local planning efforts in community and economic development, provide a regional forum in which to share information and ideas, and foster cooperative solutions to issues that are common and regional.

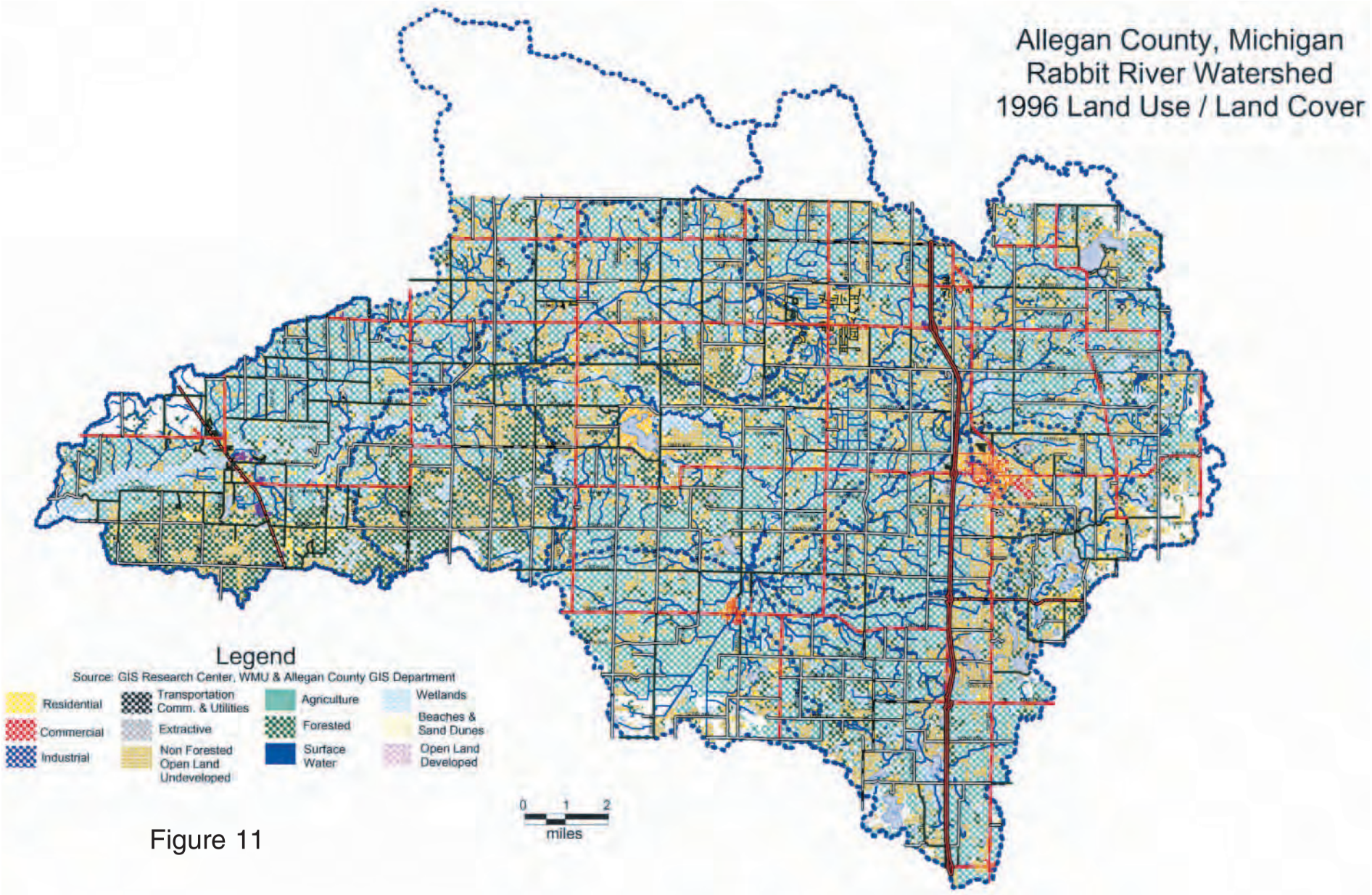
Allegan County, Michigan
Rabbit River Watershed
1996 Land Use / Land Cover
Legend
Source: GIS Research Center, WMU & Allegan County GIS Department
Residential
Commercial
Industrial
Transportation Comm. & Utilities
Extractive
Non Forested Open Land Undeveloped
Agriculture
Forested
Surface Water
Wetlands
Beaches & Sand Dunes
Open Land Developed
0 1 2
miles

Figure 11

WATER QUALITY SUMMARY

The Rabbit River Watershed is an important and valuable resource for our community. Portions of the Rabbit River Watershed are seriously impacted by non-point source pollution, and water quality is severely degraded. Streams in the Upper Rabbit River Watershed have suffered impairments due to human derived land based activities. Biosurveys conducted by the Michigan Department of Environmental Quality (MDEQ) indicate that habitat and biological communities in the Rabbit River and tributaries are significantly degraded due to nonpoint source pollution. Streams in the watershed are included on MDEQ non-attainment list. The Rabbit River Watershed is listed as one of eight watersheds on MDEQ's Michigan's Unified Watershed Assessment and Watershed Restoration Priorities. In addition, the Rabbit River Watershed is ranked third out of twenty-eight in the sate of Michigan as a Conservation Priority Area for the USDA's Environmental Quality Incentive Program (EQIP) to reduce non-point source pollution. Significant water quality impairments include degraded indigenous aquatic habitat and biotic diversity, reduced fish populations and flooding. Major nonpoint source pollutants include sediment, excessive nutrients, and high flow. Occasional spikes in fecal coliform bacteria have also been noted, raising concerns about water-body contact. Development is steadily increasing in the watershed as open space and agricultural land is re-zoned to residential and industrial. Allegan County's population has increased more than ten percent since 1990 (according to the 2000 census).

Designated Uses

The surface waters of the Rabbit River Watershed have four important designated uses: coldwater/warmwater fishery, indigenous aquatic life and wildlife, partial body contact recreation, and agricultural (irrigation). The agricultural designated use, which is primarily for irrigation, is not currently threatened or impaired. (For the methods to determine the designated uses of the watershed see Planning Process and Public Participation, and Appendix 4a Designated Uses Worksheet).

Desired Uses

In addition to these designated uses, the Rabbit River Watershed Steering Committee also includes general recreation as an important use. This category includes partial body contact recreation, such as canoeing, fishing. However, it also includes recreational access in the forms of boardwalks, river and stream access sites or launches, linear parks, natural areas, wildlife and bird watching, and other recreational not necessarily immediate associated with water to body contact. Another use of the Rabbit River is as stormwater conveyance and drainage.

Impaired and Threatened Uses

The designated uses that are impaired include fisheries (warm water and cold water), and other indigenous aquatic life and wildlife. These uses are also threatened with further degradation. The designated uses that are threatened include partial body contact recreation, and other recreation.

Impaired:	Coldwater/warmwater fishery
	Indigenous aquatic life and wildlife
Threatened:	Partial body contact recreation
	Other Recreation (parks, etc.)

Threats and Impairments to the Watershed

Major threats to water quality in the watershed

Major threats to the water quality of the watershed include a variety of impacts. The first major threat is the use of Non-Generally Accepted Agriculture Management Practices. Although many producers and farmers are excellent stewards of the environment, agriculture can be a very significant threat to water quality. Using generally accepted management practices, and the installation of filters trips, buffers, and preventing field run-off will protect water quality. When these practices are absent, water quality is severely impacted.

Suburban sprawl and increased development add impervious surfaces, contribute to increased run-off, and increase the flashiness (dramatic fluctuation in streamflow) of a system. Poorly planned development or site placement may also impair water quality by removing riparian buffers, vegetation, and recharge areas.

Loss of farmland and open space will influence water quality because it reduces the amount of permeable areas, reduces groundwater recharge areas, and may decrease wildlife habitat. Loss of wetlands, riparian buffers and vegetation impacts water quality by reducing filtering capabilities, and has an adverse impact on wildlife.

Water Quality Impairments

Water quality impairments in the Rabbit River Watershed are related to the designated uses of the watershed. Coldwater and warmwater fisheries are impaired by large amounts of sediment, high flow, high nutrient levels, and invasive or exotic species. Indigenous aquatic life and wildlife are negatively impacted by sediment, high flows and flashy systems, high nutrient levels, and loss of habitat (both aquatic and terrestrial). Partial body contact recreation such as fishing and canoe are impaired by the presence of pathogens/bacteria, the lack of access to surface water and obstructions. Other recreation opportunities in the watershed, including parks and open space are in danger due to loss of open space and lack of public land.

Cause of impairments (Pollutants)

Sediment

The most significant non-point source pollutant in the watershed is sediment. In every habitat and site surveyed by the Michigan Department of Environmental Quality, high amounts of fine sediment were found in stream substrate. Sediment brings large amounts nutrients, bacteria, pesticides, and other contaminants with it as it enters surface water. Reducing sediment inputs will improve fisheries, recreation (canoeing and fishing) and habitat for other indigenous aquatic life and wildlife. The sources of sediment inputs to surface water include agriculture (pastures and crop fields), road/stream crossings, development and construction.

Nutrients (Phosphorus and Nitrogen)

Another goal of this project is to protect and improve fisheries and indigenous wildlife by reducing the amount of **nutrients** (nitrogen and phosphorus) that enter the surface water. The Rabbit River Watershed Project will reduce local concentrated areas of nutrient pollutant input by prioritizing unrestricted cattle access sites, and immediate run-off concerns. Other possible sources of nutrients include over-application of fertilizer (residential and agricultural) and manure, residential and municipal sewage or wastewater discharge.

High Flow

Improve fisheries, other indigenous aquatic life and wildlife, and restoring partial body contact recreation by reducing increased **hydrologic flow** (flow based on land characteristics and land cover), creating fast moving and/or high water. Sources of increased hydrologic flow include municipal and residential stormwater run-off, agricultural run-off, and wastewater discharge. Large areas of impervious surfaces, such as parking lots, rooftops and roads cause large stormwater run-off events. Filling wetlands, developing floodplains (especially floodplain forest), removing retention ponds, and other stormwater storage will all increase hydrologic flow. The goal of Rabbit River Watershed Project is to educate and assist residents and townships with land-use issues, smart growth, methods of low impact development, farmland preservation and ways to prevent high levels of run-off. Protecting and restoring riparian areas (wetlands and floodplains) and other retention areas will decrease flooding and high flow.

Other Pollutants

Several pollutants are considered secondary pollutants in the watershed, but may be important in localized areas of high run-off, or in specific conditions.

Pesticides and Chemicals

Pesticides, such as herbicides and insecticides, may have negative impacts on indigenous aquatic wildlife. Certain chemicals may also cause other environmental problems such as increased health risks or drinking water problems.

Preventing these chemicals from reaching surface water by using proper application methods and amounts and use of filter and buffer strips will prevent these problems.

Pathogens/Bacteria

Pathogens and bacteria are present in manure and septic run-off, and may reach surface water from septic run-off, over application and field run-off, and run-off from feedlots and barnyards. Bacteria and pathogens over certain concentrations present in surface water may pose severe health risks. Fecal coliform bacteria, a bacteria found in manure or septic waste, can be a health problem on it's own, and is also an indicator of other serious pathogens and disease-carrying organisms.

Inventory

In the spring of 2001, the watershed coordinator for the Rabbit River Watershed Planning Project conducted a physical inventory of the watershed. The purpose of the inventory was to determine the sources and causes of non-point source pollutants that are causing threats or impairments to the watershed and to determine the Best Management Practices (BMPs) needed to alleviate or reduce the impairments. The inventory was intended to narrow the scope of the project, to zero in on specific non-point source pollutants causing water quality problems, and to formulate solutions to those problems.

Inventory Rationale

This inventory is being conducted as a part of the Rabbit River Watershed Planning Project. The inventory took place in fall 2000 and spring 2001.

The method for the inventory uses a two-pronged approach. One focus of the inventory would be to find the areas of the watershed that are contributing the most non-point source pollutants. The known and suspected pollutants in the watershed included sediment, nutrients, and pesticides. To focus on these, the non-point source focus of the inventory concentrated on road-stream crossings and agricultural lands. The other priority was to locate and "keep track of" the high quality areas of the watershed. High quality areas are natural areas that have specific qualities (see section on high quality natural areas, below) and are areas on which to concentrate land protection and conservation.

The initial watershed inventory information includes some suggestions for ideal best management practices, which were included to get an idea of what is possible in the watershed. These Best Management Practices include riparian buffers, wetland restorations, permanent easements, and others. Since sediment is the pollutant determined to be most detrimental in the watershed, by observations, complaints, and the steering committee, the inventory and the resulting report concentrated on management practices to reduce erosion and sediment. Most notably, filter strips, grassed waterways roadside erosion sites, and cattle exclusion (which will also reduce nutrient inputs) were the focus. No-till was included where it was able to be determined that it would be beneficial, and did not already exist. However, since a majority of the inventory was completed before plowing and planting, some areas with crop residue may not have actually been a part of no-till practices.

Priority Inventory Areas

Several priority sub-watershed of the Rabbit River were chosen with this two-pronged approach in mind. Priority inventory areas, based on known and suspected non-point source pollution, and the need to catalogue high quality natural areas, were determined by the steering committee. The priority inventory sub-watersheds are Green Lake Stream, Bear Swamp Drain, and the upper reaches of the Rabbit River, the headwaters region, east of US-131. Other areas that were not high priority, but were investigated at least partially included Buskirk Creek, Pigeon Creek, and East Lake area. Any other areas that were observed or reported to have water quality problems over the course of the inventory period were also included.

Green Lake Stream sub-watershed

This subwatershed is agricultural and forested with residential areas, especially around Green Lake. Green Lake Stream is one of the only major tributaries to the Rabbit River that is still a "natural" stream. It has not been dredged, is not a designated drain, and has had no major drainage alterations performed on it. This may change if stewardship is not made a priority.

Bear Swamp Drain sub-watershed

This sub-watershed is nearly all agricultural. The inventory revealed a few high quality natural areas with well-vegetated streambanks, and some decent habitat, even in agricultural drains. This sub-watershed needs many filter strips, as every drain surveyed had some field erosion and/or run-off present. In many areas, because the water table is so high, the drain channels are dug very deeply and banks are cut steeply incised. This topography produces large amounts of field erosion into drains. Another common occurrence is "slumping," where a streambank slides downward, similar to a mudslide, and sediment and run-off empties into surface water through a saddle or a low spot in a field. In these cases, the surface layer of the streambank becomes saturated and heavy, causing it to slide down a steep bank slope. It is often caused by a large amount of surface runoff passing over the streambank, saturating the surface layer of soil on the bank. A steep slope will exacerbate the problem, and this heavy surface layer will slide. Some areas need streambank reinforcement or regrading in addition to filter strips, although, in many cases, adding vegetation with complex root systems both on the bank and adjacent to it may solve the problem.

Upper Rabbit River (headwaters) sub-watershed

The actual river corridor has many high quality floodplains, wetlands, and the river itself is a small meandering stream. The actual source of the Rabbit River is a system of drainage ditches through a large muck farm. Historically, the origins of the Rabbit River were the wetlands surrounding Aubil Lake. Much of this area has been ditched and dredged, and is currently being farmed. This area has many muck farms, and other soils with poor drainage. This area of the watershed has a very low relief, with much of the land having little or no slope. Slightly further downstream, streamside vegetation and habitat improves. One of the major tributaries to the upper Rabbit River is Pickerel Lake Drain, which more than doubles the base flow of the Rabbit where it joins it in Wayland Township. The inventory found many high quality areas of vegetation, habitat, and excellent stream corridor and condition along the actual Rabbit River, but virtually all tributaries are designated, maintained drains, which flow almost exclusively through agricultural fields.

Inventory Methods

The inventory method used relied on protocol and information from the Michigan Department of Environmental Quality's watershed analysis and road-stream crossing form. This form was filled out based on observations made at road/surface water crossings. Within priority inventory areas, places where roads crossed streams, drains, ditches, and ephemeral drainage were surveyed. This information included stream conditions, substrates, vegetation, and land-use. In addition to looking at the immediate environs of the road-stream crossings, the land-use and conditions of the surrounding areas were also noted. Drains and surface water channels were observed through binoculars, and some areas that were difficult to observe were walked for short stretches. The size and scope of the watershed and the priority inventory areas prevented every mile of every drainage system from being walked. Road-stream crossings were selected in the priority sub-watershed because of ease of access, and potential for non-point source pollution. Areas also selected within priority sites included agricultural areas, areas with large farms operations, industrial or high density residential, and areas with highly erodible land. These areas were pinpointed using information from soil maps, aerial photos, and from visual observations.

Prior to the inventory, aerial photos and drain maps of the subwatershed were obtained from Farm Services Agency and drain maps. Drains and tributaries were recorded on the photos to help determine the route of the inventory. The inventory was conducted by walking many of the county drains and tributaries within in the priority areas. Some inventory of farming practices was conducted by visual observation while standing in or near drains or from the roadways. Field notes were recorded on Single Site Watershed Survey forms, maps and aerial photos. Some areas were difficult to inventory because there were no designated county drains to access and the view from the roadways was very limited. The inventory focused primarily on agricultural areas. Thus, the residential, commercial, and industrial portions were not addressed in this inventory.

Conclusions

Watershed-wide, the greatest non-point source pollutant is sediment. Watershed-wide, large areas of field erosion are the greatest contributors to sediment. In specific local areas, the largest sources of non-point source pollution are livestock access, roadside erosion, local field erosion, and streambank erosion. Reducing the amount of sediment that enters surface water will also reduce the amounts of other non-point source pollutants, such as nutrients and pesticides. Local inputs of nutrients in the watershed are very high, from heavily manured fields, farm run-off, and

feedlot run-off. The most commonly needed Best Management Practice in the watershed is filter strips. Most of the sites inventoried need some form of buffer practice, and virtually every designated county drain has no buffer between surface water and other land-uses. There are also a large number of livestock access sites in the watershed, which require exclusion fencing and either a crossing or an alternate water source. The BMPs recommended in this report are by no means comprehensive. Not all areas of the watershed were inventoried, and certain obstacles, such as private property access, prevented every area from being investigated.

In Allegan County, filter strips, grade stabilization structures, crop residue management, cover crops and grassed waterways will be critical BMPs in reducing erosion, runoff, and phosphorus delivery into surface water tributaries. Nutrient management and waste utilization plans would also be very effective in reducing nutrient input into surface water. Detention / retention basins and wetland restoration will be effective in reducing flashiness and flooding of watercourses throughout the watershed. Table 4 is a total compiled chart of the needed BMPs in the watershed. Inventory was conducted by sub-watershed. The chart also includes totals by section and township. (See Table 4 BMP Chart)

The recommended BMPs in Table 4 do not represent **all** agricultural areas, or all land uses of the watershed, or all of the BMPs needed within the watershed. However, a large cross-section of the watershed was inventoried. Inventorying the different sub-watersheds concentrated on several different land-use patterns and mosaics: agricultural, residential, industrial, and urban. Some land areas and BMPs may not be included in this report because of inventory limitations, such as private property access, flooding, or other restrictions. Additional BMPs may be needed on these areas; however, the needed BMPs that were observed were recorded. The BMP chart in Table 4 will provide areas on which to focus to reduce non-point source pollution effectively. It is likely that additional BMPs will be identified as contacts are made with landowners and additional sites are observed.

BMPs: Solutions for Water Quality

Best Management practices are solutions to water quality problems, and the sources and causes of nonpoint source pollution. A BMP is described as any structural, vegetative, or managerial practice used to treat, prevent or reduce water pollution. BMPs are applied collectively to reduce or prevent the detachment, transport and delivery of sediment, nutrients, and other pollutants from the watershed into the water resources. In addition to improving water quality, agricultural BMPs are also designed to sustain producer profitability and maximize the conservation aspect of farming. BMPs are also used to protect and restore streambank erosion sites, roadside erosion and run-off, or to protect and preserve high quality natural areas. Appendix 5 is a description of the common Best Management Practices that would benefit water Quality in the Rabbit River Watershed. (See Appendix 5 BMPs.)

Sources and Causes

Many sources (and associated causes) of non-point source pollution exist in the Rabbit River Watershed. To identify the sources, (including land-uses and locations), of the causes (the pollutants themselves) several methods were used. Third party input, such as observations and knowledge of the steering committee members and general public, as well as right to farm complaint sites, were included in the plan, some with additional investigation . Second hand observations made use of sources such as aerial photos. Lastly, and most accurately, first hand observations were recorded in the physical inventory. As the inventory progressed it became very clear that every drain, creek, stream, and river stretch in the Rabbit River Watershed has some problem with non-point source pollution, especially sediment, and that many of the pollutants have multiple sources. Some of these issues are small, but the problem exists. Many drains, creeks, or other surface water also had obvious sources of nutrients (livestock access, manure run-off, etc.), but these were much more localized (although serious) issues. Watershed-wide, sediment was the major pollutant, and agriculture was a major source. Sediment comes from direct field run-off, through tiled fields, through gullies and washouts, and from field slumping to drains.

Another major source was roadside and road/stream crossing erosion. The Rabbit River Watershed has many miles of dirt and gravel road. These are also large contributors of sediment and run-off. In short, in nearly every designated drain, there was evidence of sediment and erosion. Sources identified from the inventory report are detailed in the following section.

Table 4: Upper Rabbit River Watershed Recommended Best Management Practices

Sub-Watershed	Township/ Section	Recommended Resource Management System & Best Management Practices											
Green Lake Stream	Leighton Township	Filter Strips (acres)	Crop Residue Management /No Till (acres)	Grassed Waterways (feet / acres)	Exclusion Fencing (feet)	Alternate Water Source/ Stream Crossings (#)	Waste Management System (Nutrient Mgmt.(acres)	Riparian Buffer (acres)	Urban/ rural run-off areas (#)	Wetland Restoration/ Protection (#)	High Quality Natural Areas (#)	Roadside Erosion/ Culvert Problems (#)	Stream-bank Erosion
	1	0											
	2	0											
	3	0							1	1			
	4	2.24					1	0.47	1				
	5	0											
	6	7.72		1083.08 / 0.74	270.8	1	1		1				
	7	3.07					1		1				
	8	5.22					1						
	9	4.1					1						
	10	0.47								1		1	
	11	0.93							1			1	
	14	0										1	
	15	2.24								1			
	16	6.9	92.8	1624.6 / 1.11								1	
	17	0	30								1	1	
	18	0			541.5	1						1	
	19	1.86							1	1			
	20	3.73		812.31 / .56	3140.9	1					1		
	21	3.17	74	1218.46 / .84									
	22	3.36			541.54	1							
	23	0								1			

	24	0											
	25	1.49									1		
	26	0.75					1		1				
	27	2.79										1	
	28	1.86											
	29	10.1			595.7	1	1					1	
	30	0				1							
	31	2.24		812.31 / .56									
	32	0.75		541.54 / .37									
	33	0.75			1191.39	1							
	34	3.9			1083							1	
	35	10.7	75										
	36	2.98		216.6 / .15									
Leighton	**Subtotals**	**83.32**	**271.8**	**6308.9 / 4.33**	**7364.83**	**7**	**7**	**0.47**	**7**	**5**	**3**	**9**	

	Township/ Section			**Recommended Resource Management System & Best Management Practices**									
Upper Rabbit River	**Wayland Township**	**Filter Strips (acres)**	**Crop Residue Management /No Till (acres)**	**Grassed Waterways (feet / acres)**	**Exclusion Fencing (feet)**	**Alternate Water Source/ Stream Crossings (#)**	**Waste Management System (Nutrient Mgmt.(acres)**	**Riparian Buffer (acres)**	**Urban/ rural run-off areas (#)**	**Wetland Restoration/ Protection (#)**	**High Quality Natural Areas (#)**	**Roadside Erosion/ Culvert Problems (#)**	**Stream-bank Erosion**
	1	0								1	1		
	2	0											
	3	5.22					1						
	4	0.56		2139.08 / 1.47					1				
	5	0							1				
	6	0											
	7	7.27		406.15 / .28									
	8	1.23					1 (26.2)						

	9	0			541.5	1							
	10	0.78			50						1		1
	11	0											
	14	1.57											
	15	3.2											
	16	0										1	
	17	0											
	18	3.23		1922.47 / 1.32			1						
	19	0							1				
	20	0										1	
	21	0							1				
	28	0							1				
	29	0									1		
	30	0							1				
	31	0		352 / .24						1			
	32	0											
Wayland	**Subtotals**	**23.06**	**0**	**4819.7 / 3.31**	**591.5**	**1**	**3 (26.2)**		**6**	**2**	**3**	**2**	**1**

	Township/ Section			**Recommended Resource Management System & Best Management Practices**									
Bear Swamp Drain/ Miller Creek	**Hopkins Township**	**Filter Strips (acres)**	**Crop Residue Management /No Till (acres)**	**Grassed Waterways (feet / acres)**	**Exclusion Fencing (feet)**	**Alternate Water Source/ Stream Crossings (#)**	**Waste Management System (Nutrient Mgmt.(acres)**	**Riparian Buffer (acres)**	**Urban/ rural run-off areas (#)**	**Wetland Restoration/ Protection (#)**	**High Quality Natural Areas (#)**	**Roadside Erosion/ Culvert Problems (#)**	**Stream-bank Erosion**
	19	6.32					1					1	
	20	4.82			5090.5	1			1				
	22	0					1(77.5)						
	23	6.1					1					1	
	24	11.23		2112.4 / 1.45			1						

	25	8.82			108.4	1						1	
	26	0.54		379.1 / .26									
	27	4.72										1	1
	28	0.53			5469.5	2							
	29	9.2			974.8	1	1					1	
	30	2.16										1	
	31	4.41		622.77 / .43			1				1	2	
	32	1.41											
	33	0											
	34	0		352 / .24									
	35	3.29										1	
	36	0.15										2	
Hopkins	**Subtotals**	**63.7**	**0**	**3466.27 / 2.38**	**11643.2**	**5**	**6(77.5)**	**0**	**1**	**0**	**1**	**10**	**1**

	Township/ Section			**Recommended Resource Management System & Best Management Practices**									
Bear Swamp Drain	**Monterey Township**	**Filter Strips (acres)**	**Crop Residue Management /No Till (acres)**	**Grassed Waterways (feet / acres)**	**Exclusion Fencing (feet)**	**Alternate Water Source/ Stream Crossings (#)**	**Waste Management System (Nutrient Mgmt.(acres)**	**Riparian Buffer (acres)**	**Urban/ rural run-off areas (#)**	**Wetland Restoration/ Protection (#)**	**High Quality Natural Areas (#)**	**Roadside Erosion/ Culvert Problems (#)**	**Stream-bank Erosion**
	13	1.86											1
	14	5.9											
	15	6.564					1 (57)						
	16	1.97											
	21	5.32											
	22	1.83								1	1		
	23	0									1		
	24	2.94									1		
	25	3.87					1 (59.1)						

	26	0									1		
	34	0											
	35	4.58											
	36	6.89											1
Monterey	**Subtotals**	**41.724**	**0**	**0**	**0**	**0**	**2 (116.1)**	**0**	**0**	**1**	**4**	**0**	**2**

	Township/ Section			**Recommended Resource Management System & Best Management Practices**									
Bear Swamp Drain	**Allegan Township**	**Filter Strips (acres)**	**Crop Residue Management /No Till (acres)**	**Grassed Waterways (feet / acres)**	**Exclusion Fencing (feet)**	**Alternate Water Source/ Stream Crossings (#)**	**Waste Management System (Nutrient Mgmt.(acres)**	**Riparian Buffer (acres)**	**Urban/ rural run-off areas (#)**	**Wetland Restoration/ Protection (#)**	**High Quality Natural Areas (#)**	**Roadside Erosion/ Culvert Problems (#)**	**Stream-bank Erosion**
	1	2.08			649.85	1						1	
	2	1.8					1						
	3	0											
	10	2.03		622.77 / .43									
	11	6.06								1		1	
	12	0							1				
	13	0											
	14	0											
	15	0											
Allegan	**Subtotals**	**11.97**	**0**	**622.77 / .43**	**649.35**	**1**	**1**	**0**	**1**	**1**	**0**	**2**	

	Township/ Section			Recommended Resource Management System & Best Management Practices									
Miller Creek	Watson Township	Filter Strips (acres)	Crop Residue Management /No Till (acres)	Grassed Waterways (feet / acres)	Exclusion Fencing (feet)	Alternate Water Source/ Stream Crossings (#)	Waste Management System (Nutrient Mgmt.(acres)	Riparian Buffer (acres)	Urban/ rural run-off areas (#)	Wetland Restoration/ Protection (#)	High Quality Natural Areas (#)	Roadside Erosion/ Culvert Problems (#)	Stream-bank Erosion
	1	0.39											
	2	0											
	3	0				1							
	5	0									1		
	6	0.39											
	7	0											
	11	0.93											
	12	0		947.7 / .65	3195.1	1	1						
Watson	**Subtotals**	**1.71**	**0**	**947.7 / .65**	**3195.1**	**2**	**1**	**0**	**0**	**0**	**1**	**0**	

	Township/ Section			Recommended Resource Management System & Best Management Practices									
Miller Creek	Martin Township	Filter Strips (acres)	Crop Residue Management /No Till (acres)	Grassed Waterways (feet / acres)	Exclusion Fencing (feet)	Alternate Water Source/ Stream Crossings (#)	Waste Management System (Nutrient Mgmt.(acres)	Riparian Buffer (acres)	Urban/ rural run-off areas (#)	Wetland Restoration/ Protection (#)	High Quality Natural Areas (#)	Roadside Erosion/ Culvert Problems (#)	Stream-bank Erosion
	5	0		324.9 / .22			1						
	7	3		650 / 4.28									
	8	0		325 / .23			1						
Martin	**Subtotals**	**3**	**0**	**1299.9 / 4.73**			**2**						

Watersheds	Township	Filter Strips (acres)	Crop Residue Management /No Till (acres)	Grassed Waterways (feet / acres)	Exclusion Fencing (feet)	Alternate Water Source/ Stream Crossings (#)	Waste Management System (Nutrient Mgmt.(acres)	Riparian Buffer (acres)	Urban/ rural run-off areas (#)	Wetland Restoration/ Protection (#)	High Quality Natural Areas (#)	Roadside Erosion/ Culvert Problems (#)	Stream-bank Erosion
Leighton	Subtotals	83.32	271.8	6308.9 / 4.33	7364.83	3	7	0.47	7	5	1	9	
Wayland	Subtotals	23.06		4819.7 / 3.31	591.5	3	3 (26.2)		6	2	3	2	1
Hopkins	Subtotals	63.7		3466.27 / 2.38	11643.2	5	6(77.5)	0	1	0	1	10	1
Monterey	Subtotals	41.724		0	0	0	2 (116.1)	0	0	1	4	0	2
Allegan	Subtotals	11.97		622.77 / .43	649.35	1	1	0	1	1	0	2	
Watson	Subtotals	1.71		947.7 / .65	3195.1	2	1	0	0	0	1	0	
Martin	Subtotals	3		1299.9 / 4.73	0		2					0	
Dorr	Subtotals											0	
	Totals	228.48	271.80	17465.24 / 15.83	23443.98	14	22 (219.8)	0.47	15	9	10	23	4
		X $300/ acre	X $5/acre	X $6000 / acre	X $2 / foot	X $4000* each	X $1000 / site	X $900/ acre	[Depends on acreage]			X $2000/ site (avg.)	X $1500 each
	Costs	$68,544	$1,359	$9,498	$46,888	$56,000	$22,000	$423				$46,000	$6,000
Grand Total Costs for All BMPs:							$256,712						

Table 7 includes a summary of the recommended BMPs that would prevent or reduce non-point source pollution, including sediment and nutrient inputs to surface water in the Rabbit River Watershed. Cost estimates for each BMP are given according to United States Department of Agriculture (USDA), Natural Resources Conservation Service Standards (NRCS) and estimates used in similar watershed projects.

The recommended BMPs are described using different units. The units describing them were used according to what is used in determining cost share. Each township has subtotals to quantify the amounts of cropland, priority fields, and units of BMPs. Finally, at the end of the chart are running totals of all townships combined.

* $4000 Total includes stream crossing AND alternate water source.

Source: Erosion and Field Run-off (Agriculture)

Sediment from agriculture may enter surface water from cropland, feedlots, or pastures. Lack of crop residue, filter strips, cover crops, or plowing too close to surface water are causes of sediment. Feedlots or pastures adjacent or sloped towards surface water are also causes of sedimentation. Pastures with unrestricted cattle access to streams cause streambank erosion, sedimentation, and direct deposition of nutrients into surface water.

Suggested BMPs:

Waterways:
Grassed waterways reduce sediment and fertilizer, pesticide inputs, and stop cropland erosion. Waterways are one of the most effective ways to reduce crop and field erosion. Gully erosion and other field run-off were observed in many areas of the inventory areas. (See spreadsheet for locations, linear feet, and acreage)

No-till/filter strips:
Almost every agricultural drain in Allegan County would benefit from filter strips. In many cases, because of the size and shape of agricultural drains, some run-off and erosion is inevitable. However, most of this erosion could be reduced or prevented with a BMP system of filter strips and/or no-till. In many cases, no-till could be a part of this filter strip, and in all cases, filter strips should be part of no-till. No-till will reduce sediment, but it should be a part of a system of BMPs. No-till as a BMP is difficult to quantify, as the inventory was conducted before some fields with residue may have been plowed, and so on. (See spreadsheet for locations and acreage of filter strip and no-till)

Nutrient/waste Management Systems:
Waste management systems are noted in sites where heavy spreading was evident, but these sites may be spreading according to a plan, or they may be over spreading. In many cases, it is difficult to ascertain. Large farm operations with obvious manure stockpiles, run-off, or over-spreading were also noted. In areas where heavy manure spreading was observed, the acreage was figured (usually from aerial photos). Of all spreading observed during inventory, little or no incorporation was observed, and in several cases, spreading was observed close to or at very edge of stream, county drain, or other surface water. (See spreadsheet for locations)

Source: Roadside Erosion

Each of these sources of sediment has several associated causes. At road/stream crossings, sediment may enter surface water from erosion caused by improper culvert placement, if the culvert does not follow the same angle as the stream flow. Short culverts with steep side slopes are susceptible to erosion if not armored properly. Heavy traffic, improper road grading techniques, and direct washouts from dirt roads are also causes of sedimentation. Sediment from dirt and gravel roads, and other roadside erosion is a major contributor to the sediment in surface water. Culvert placement, slope to water, and vegetation are all crucial factors in the condition of the stream crossing. Run-off is also an issue at road-stream crossings, especially where it runs directly to stream or drain, instead of channeled through vegetation or filter. Many roadside sites had some erosion, or some run-off. This is especially pronounced, where ditches and drains run along side roads. Many sites have culverts that may be better aligned. Moreover, many sites, especially twin or triple culverts, have sediment deposits filling up one side, thus further interfering with stream flow, and in some occasions causing stream bank erosion. A detailed list of roadside erosion sites is complete, and will be passed on to the Road Commissioner, with the purpose of informing the office of the problems, and possibly for applying for funding to address some of the issues. (See Table 5 Road Erosion sites and Appendix 7 Road Erosion).

TABLE 5 ROAD EROSION IN ALLEGAN COUNTY

BMP summary includes the most severe sites, as determined by inventory. From BMP Summary, totals:

Township:	Subtotals:
Leighton	9
Wayland	2
Hopkins	10
Monterey	0
Allegan	2
Watson	0

Total: 23

Roadside Erosion (at stream crossings) sites in Allegan County, by Township:

Township	Section	Site Number	Waterbody/Road name	Description
Leighton	30	35	Sooy Drain and 12th Street	Northwest Corner
Leighton	16/21	37	Hackett/Frey Drain and 142nd St	Extensive roadside erosion
Leighton	17	18	Hinkeley Drain and 9th St.	Severe erosion on both sides
Leighton	18	32	Green Lake Stream and 142nd St	Failing silt fence, erosion along edge
Leighton	6	47	Bisbee Drain and 146th St	Roadside erosion, lots of sediment in drain
Leighton	6	50	Johnson Drain origin at 147th Ave and 10th St	
Leighton	6	50a	12th St	Entrance to Park, severe erosion, run-off to ditches
Leighton	10	42-44		Culverts plugged in several places
Leighton	10	43	Tollenaar Drain on 44th St.	Southwest corner, badly eroded culvert
Leighton	11/14	42	Tollenaar Drain on 134th Ave	
Leighton	35	29	Ditch along 137th on south side	Erosion from field and road
Leighton	34	19	Unnamed drain just south of 137th Ave on 6th St.	

Leighton	27	11	Haney Drain and Kalamazoo Dr.	
Leighton	29	22	Smith Corning Drain and 139th Ave	Roadside ditch, some erosion
Leighton	29	23	Haney Drain and 90th St.	
Wayland	7/8	10	Damoth Drain	Erosion around culvert
Wayland	9	5	Rabbit River and 133rd Avenue	Small road washout
Wayland	16	16	McIntire Lake Drain and 8th St	
Wayland	9	19	McIntire Lake Drain and Gregorville Road	Culvert has erosion and sediment problems
Wayland	20	4	Unnamed drain on 8th St. before 129th (south)	
Hopkins	4a	19	Krug Drain and 22nd St	
Hopkins		30	Herlon Drain and 22nd St	Erosion. Banks need armoring
Hopkins	5, 9	31	Herlon Drain and unnamed drain along 22nd St.	Lots of erosion along road, especially where drain turns directly into bank. Whole field slumping into drain
Hopkins	10	31	Section 31 drain, branch 2 and 124th Ave	Erosion at sharp curve in road. Heavy traffic from gravel trucks. Small forested natural creek.
Hopkins		35	Spring run drain and 15th St.	Roadside erosion
Hopkins		23	Pierce Drain and 16th St.	Severe erosion at crossing, culvert directing flow at bank
Hopkins		29	Krug Drain ext. and 20th St.	
Hopkins		27	Spring Run Drain and 126th St.	Culvert erosion
Hopkins		19		
Hopkins	4	35/36	Rhinehart Drain and 26th St.	Culvert installed diagonally, bank unstable.
Monterey	0	15	Unnamed tributary and 28th St, north of 130th Ave	Slight erosion around culvert
Monterey		25	Field drainage	Culvert from field empties into front yard of house (under porch)
Allegan		1	Agan Drain and 26th St	Erosion where runs under road
Allegan	1	11	Setler Drain and 120th Ave	Blocked culvert, sediment problems
Allegan		1	Bear Swamp Drain and 26th St	
Watson		1	Butternut Drain and 122nd St.	Roadside erosion

Source: Livestock Access

Areas where livestock have direct access to surface waters are a source of sediment through streambank erosion where the animal traffic destroys the banks and stirs up stream bottoms. These sites are also sources of nutrients through direct deposit of manure and through pasture run-off. Livestock access sites are most often intense localized problems, rather than watershed wide phenomena. Repairing such a site will have immediate and noticeable effects for that particular area, both for water quality and for fisheries habitat. The system of BMPs for a livestock exclusion site will include preventing livestock access, most often through fencing; providing an alternate water source; and constructing a proper stream crossing where applicable. In areas where exclusion already exists, the recommendation would be to increase the buffer/filter strip between the fencing and the stream.

Suggested BMP sites

See Appendix 8 Livestock Exclusion for BMP sites.

Suggested BMPs:

Exclusion Fencing
Livestock of any kind can cause serious streambank erosion and nutrient deposition into streams. Cows, horses, geese, and even the family dog can all be significant contributors to non-point source pollution if left to roam the streambanks unchecked.

Alternate Water Source
Providing an alternate water source for livestock or other animals will not only protect surface water from erosion or run-off, it will be a more consistent, safer source of water.

Buffer and Filter Strips
Buffers and filter strips are the most effective way to prevent sediment and nutrients from entering surface water in the form of run-off. Soil within the buffer and filter strip, the section of the field adjacent to the waterbody is kept intact with the complex root mass of herbaceous plants. They also act to slow water and therefore the erosive power of runoff as well as filtering some of the larger suspended sediment that reaches the waterbody.

Source: Construction

Sediment may enter surface water from development or construction projects if proper erosion controls, run-off mitigation, or storm-water storage methods are not used. Improper siting of construction and/or development projects may also result in sediment or erosion problems.

Suggested BMPs:

Information and Education
Soil erosion and sedimentation control permits are required for most construction sites. Most developers and contractors desire to follow standards and be good stewards. Cost effective methods need to be communicated to them, as well as ensuring that they know the proper way of installing these methods.

Source: Stormwater Run-off (Urban/rural run-off)

The land in and around the Rabbit River Watershed is under increasing amounts of development pressure. Urban and suburban sprawl is increasing dramatically. Development, in addition to destroying open space, agricultural land, and ecological communities, also increases water quality problems. Water quality issues associated with development include increased impermeability and stormwater management problems, septic and sewage problems and residential run-off. Areas of the watershed that are developed or that are under significant development pressure were noted, as were areas with existing stormwater run-off, impervious surfaces, suspected residential run-off (green fertilized lawns right to edge of stream or river), suspected sewage issues, and so on. Many of these issues can be addressed through land-use planning, ordinances, tax breaks, etc. However, for existing developments, a program of

residential information and education about riparian buffers filter strips, septic management, and water conservation will be most effective. Retention, detention and proper stormwater storage and treatment should be encouraged.

Suggested BMP sites:

Dorr Park/Red Run Drain
Hopkins Park
Rabbit River on 135th St.
Miller Creek on 136th
Rabbit in several other places
Wayland, north side

Suggested BMPs:

Streambank Stabilization
High flow amounts and velocity can cause increased streambank erosion and sediment delivery. Appropriate streambank protection can be effective in reducing the negative effects of high flow, including erosion and bank sloughing. However, in a flashy system, streambank repair and restoration must be used with caution, as a high flow or flooding event may destroy the protective measures. This should be taken into account before the installation of this type of Best Management Practice.

Critical Site treatment
Areas with high erosion, lack of riparian vegetation, or need for additional buffers and riparian wildlife habitat are critical sites to implement BMPs. These areas are where the most benefits will be incurred.

Buffers and filter strips
Buffers and filter strips create riparian vegetation through tree and native grass plantings. Native grass buffers or filters will both protect against erosion and allow stormwater to infiltrate more easily. Native grasses also require less general maintenance than lawn, after an initial establishment phase. Buffers around wetlands, surface water, parks, and other natural areas will prevent run-off, non-native species, and habitat disturbance, and will maintain high quality of recreation opportunities.

Wetland Restoration
Wetland restoration is an effective land-use planning tool to increase flood storage, to improve wildlife habitat, and to protect and improve water quality. However, wetland restoration is a difficult sell, and may not be practical in the end. The inventory of areas of the watershed indicated that there are several likely places. Wetland restoration is more successful in areas that were formally wetlands, known as prior converted wetlands, and are usually now agricultural land. Several areas around the watershed that are prior converted wetlands, and are adjacent to existing wetlands are prime examples of wetland restoration areas. In addition to increasing the wildlife and plant habitat in the watershed, wetlands are excellent land-use planning tools for flood storage, and improving certain water quality issues. The criteria for wetland restoration sites are threefold. The site must be prior converted wetlands, must provide some benefits to flood storage, or drainage improvement, and must be adjacent to existing wetlands. Restoring wetlands that are adjacent to existing wetlands improves the benefits for wildlife, the seed source and probability of a high quality wetland.

Suggested BMPs (Summary and Totals)

TABLE 6 SUMMARY OF SUGGESTED BMPS

These Best Management Practices were recorded in the watershed inventory. While each site will require its own design, general BMP solutions to address the nonpoint source pollution problems are suggested in this summary. (A complete table may be found here: Table 6 BMP Chart)

Watershed	Filter Strips (acres)	Grassed Waterways (feet / acres)	Exclusion Fencing (feet)	Alternate Water Source/ Stream Crossing (#)	Waste Management System (# (acres))	Urban run-off areas (#)	Wetland Restore / Protect (#)	High Quality Natural Areas (#)	Roadside Erosion/ Culvert Problems (#)	Stream Bank Erosion sites (#)
Green Lake Stream	**83.32**	**6308.9 / 4.33**	**7364.83**	**3**	**7**	**7**	**5**	**1**	**9**	**0**
Upper Rabbit River	**23.06**	**4819.7 / 3.31**	**591.5**	**3**	**3 (26.2)**	**6**	**2**	**3**	**2**	**1**
Bear Swamp Drain/ Miller Creek	**63.7**	**3466.27 / 2.38**	**11643.2**	**5**	**6(77.5)**	**1**	**0**	**1**	**10**	**1**
Bear Swamp Drain	**41.72**	**0**	**0**	**0**	**2 (116.1)**	**0**	**1**	**4**	**0**	**2**
Bear Swamp Drain	**11.97**	**622.77 / .43**	**649.35**	**1**	**1**	**1**	**1**	**0**	**2**	**0**
Miller Creek	**1.71**	**947.7 / .65**	**3195.1**	**2**	**1**	**0**	**0**	**1**	**0**	**0**
Miller Creek	**3**	**1299.9 / 4.73**	**0**		**2**	**0**	**0**	**0**	**0**	**0**
Totals:	**228.48**	**17465.24 / 15.83**	**23443.98**	**14**	**22 (219.8)**	**15**	**9**	**10**	**23**	**4**

Critical/Priority Areas

Critical Areas of the Watershed

Using the inventory results and discussions from meetings over the course of a year, the steering committee has determined the critical area of the watershed to be the entire watershed. (For the methods to determine the critical areas see Planning Process and Public Participation, and Appendix 4b Critical Areas Worksheet). Due to Allegan County's, and the Rabbit River Watershed's extensive network of drains, tiles, and other drainage, nearly every quarter section is adjacent to some form of surface water or drainage. Since many of the serious problems in the watershed come from very small tributaries, or from immediate field drainage, simply designating a buffer zone around surface water misses much of this source. Sediment and nutrients can come from nearly any field, construction site, or road in the watershed; therefore, we felt it unwise to exclude any areas from being "Critical." Any site that is contributing nonpoint source pollution is "critical," and should be treated as such. Certain sources, however, within the watershed have been selected as priority, and sites have been selected along with this. The steering committee recognizes that sediment is the number one pollutant throughout the watershed, and that agriculture is one of the major sources. One of the major causes of sediment from agriculture is field run-off. Thus, the prevention or reduction of this run-off is a priority for the project.

In addition to determining the entire watershed to be a critical area for reducing non-point source pollution, the inventory and steering committee and local stakeholders selected several priority areas. These are high quality areas for protection, the road-stream interface, and several priority sites to install BMPs.

High Quality Area Protection Sites:

In addition to locating non-point source pollution areas and the locations for needed BMPs, the inventory located areas that were high quality natural areas. This was mostly done through observations on aerial photographs, and then observations in person of the presence or absence of vegetation, habitat, stream condition, and presence of wildlife, etc. While wetlands and floodplains are more obvious areas to protect to insure high surface water quality, large open areas of land, such as forest or prairies, are also critical for groundwater recharge and areas of infiltration, and for wildlife habitat. Examples of high quality areas to protect include a large wetland at the headwaters of Haney Drain, wetland areas around lakes and undeveloped areas and several small coldwater streams in the upper headwaters of the Rabbit River watershed.

Road/Stream Interface

Roads and streams are connected where a ditch or a drain runs along road and especially where a road and a stream cross each other. Because of the "perpendicular" nature of the stream road/crossing interface, and because of the need to build the road up to prevent flooding, extreme slopes or topography may exist. High steep banks that slope to the stream culvert will be prone to erosion. Road/stream crossings contribute a large amount of sediment delivery to the streams.

BMP Site Priorities

An inventory was conducted to determine the need for BMPs. A large number of BMPs are recommended to solve non-point source pollution problems in the watershed, however, certain specific BMPs will be critical to meeting the goals of the watershed project.

The method to prioritize these particular BMP sites included prioritization within each priority sub-watershed, and prioritized within each Best Management Practices. The main needed BMPs were filter strips, grassed waterways and grade control structures, livestock unlimited access, and critical site treatments. We selected approximately one site to install a needed system of BMPS from each of three priority sub-watersheds. Essentially, these were the "worst" or most heavily polluting sites in each sub-watershed. Spreading the priority BMP sites across sub-watersheds allows us to address water quality issues across a large cross-section of the watershed, and involve different areas and landowners or organizations throughout the watershed. The priority BMPs selected also achieve

several goals of the watershed management plan, including reduction of nonpoint source pollution, local township involvement, and education through high visibility BMPs (parks, public areas). The following is a list of priority sites for BMP installation. The site numbers are followed by the section and the priority sub-watershed where the sites are located.

BMP System: Filter Strip System Sites FS1-FS5
FS1 (Hopkins Sec. 29, Bear Swamp Drain), FS2 (Hopkins Sec. 30, Bear Swamp Drain), FS3 (Monterey Sec. 25, Bear Swamp Drain), FS4 (Wayland Sec. 8, Upper Rabbit/Headwaters), FS5 (Leighton Sec. 35, Upper Rabbit/Headwaters)
Practices: Filter Strips
These sites were selected to do filter strips because of the large need for sedimentation control. In many areas of the watershed, filter strips will be installed using federal or other sources of funding. Watershed funds will only be used in very special specific cases where federal funds may be ineligible.

BMP System: Pasture Management System (Livestock Exclusion) Sites A1-A3
A1 (Hopkins Sec. 20, Rabbit River/Miller Creek), A2 (Leighton Sec. 29, Green Lake Stream), A3 (Hopkins Sec. 12, Miller Creek)
Practices: Pipeline, Trough or Tank, Fencing, Pasture and Hayland Planting, Water Well
The Rabbit River Watershed has many sites with unlimited livestock access, and it has been determined to be a significant local source of nonpoint source pollution. The sites selected for this system are three of the most intensive and/or largest areas of impact.

BMP System: Sediment, Erosion or Water Control System Sites E1-E5
E1 (Hopkins Sec. 22, Miller Creek), E2 (Hopkins Sec. 27, Miller Creek), E3 Monterey Sec. 36, Bear Swamp Drain), E4 (Leighton Sec. 16, Green Lake Stream), E5 (Leighton Sec. 7, Green Lake Stream)
Practices: Grade Stabilization Structure, Heavy Use Protection, Lined Waterway or Outlet, Water Control System, Sediment Basin
The sites selected for these systems are in high production areas, and are significant contributors to nonpoint source pollution. This general area has a history of Right-to-Farm complaints.

BMP System: Critical Site Treatment
Sites: Hopkins Village Park (Hopkins Sec. 19, Bear Swamp Drain), North Dorr Park (Dorr Sec. 16, Little Rabbit River)
Streambank Protection, Tree Planting, Critical Area Planting
In addition to remedying serious nonpoint source pollutant inputs from streambank and recreation erosion, these two site treatments are in highly visible public locations, and will be excellent demonstration and educational opportunities.

(See Table 7 Priority BMPs and Costs for a further summary of these BMP Priority sites and associated costs)

Water Quality Summary Matrix

Table 7: PRIORITY BEST MANAGEMENT PRACTICES FOR IMPLEMENTATION

Project Name: **Upper Rabbit River Watershed Implementation Project**

SITE NAME/ NUMBER	#	POLLUTANT SOURCE	PROPOSED SYSTEM OF BMPS	ESTIMATED COST/SITE OR TOTAL/SOURCE	GRANT FUNDS	LOCAL MATCH	OTHER FUNDS
A1-3	3	Agriculture	**Pasture Management System (Livestock Exclusion)** Fencing Trough or Tank Well Pipeline Pasture and Hayland Planting	31,262.60	23,446.95	7,815.65	
FS1-5	5	Agriculture	**Filter Strip System (only if not eligible from other funding sources)** Filter Strip	1,500.00	1,125.00	375.00	
E1-5	5	Agriculture	**Sediment, Erosion or Water Control System** Grade Stabilization Structure Heavy Use Protection Critical Area Treatment	21,737.40	16,303.05	5,434.35	
Hopkins Village Park Dorr Park	2	Streambank, Recreation	**Critical Site Treatment** Critical Area Planting Streambank Protection Tree Planting	1,875.00	1,406.25	468.75	
Sources of Other Funds: CRP, EQIP and PL-566 funds as available, based on eligibility, will be use to fund additional systems of practices including animal waste systems, grassed waterways and filter strips. Since 1997, the Rabbit River Watershed has received $200,000 annually in federal EQIP funds.				This is the "cost-share" amount on the budget sheet →	42,281.25	14,093.75	

Table 8: Critical Areas, Uses, Pollutants and corresponding Sources, Causes, and Solutions				
Critical and Priority Areas	**Impaired or Threatened Uses**	**Pollutants**	**Source: Causes**	**Solutions**
Upper Rabbit River Watershed	**Coldwater/ warmwater fisheries** **Indigenous aquatic life and wildlife**	**Sediment**	**Agricultural run-off**: field erosion, lack of buffers, gully erosion	Best Management Practices like filter strips, riparian buffers, grassed waterways
			Road Erosion: water improperly channeled, culverts not aligned, road washouts, steep banks, ditch clean-outs	Proper run-off channels and utilization, culvert placement and size, grading and armoring or planting of steep slopes, seed and mulch ditches
			Streambank Erosion: high flow, livestock or human access, removal of riparian vegetation	Streambank restoration, critical site plantings, riparian forest buffer, land-use planning and zoning, exclusion fencing, armoring
			Construction: improper siting, lack of or improperly installed erosion controls	proper erosion controls, run-off mitigation, or storm-water storage methods, proper siting, increased enforcement, zoning and ordinance
			Unlimited Livestock Access: eroded streambanks, trails, paths, removal of riparian vegetation	Exclusion fencing, alternate water source, armored access point, buffers, filter strips, streambank restoration
		Nutrients (Phosphorus and Nitrogen)	**Agricultural run-off:** fertilizer/manure over-application, application too close to surface water or on hills	Buffers, filter strips, Riparian Buffers, soil tests
			Unlimited Livestock Access: direct deposition of nutrients, manure run-off	Exclusion fencing, alternate water source, armored access point, buffers
		High Flow	**Improved drainage, agricultural run-off:** no delay on water conveyance, flashy stream systems	Best Management practices like filter strips, riparian forest buffers, wetland restoration, run-off storage, retention or detention
			Residential and urban stormwater: increased impervious surfaces, stormwater discharge to streams, lack of storage, loss of wetlands, floodplains, and groundwater recharge areas	Land-use planning and zoning, stormwater storage, rain barrels, wetland restoration, preservation of wetlands, floodplains, groundwater recharge and natural areas, reduce or cap percent impervious areas
		Pesticides/ Herbicides	**Lawn or Agricultural application:** over application chemicals, lack of buffers, intensive lawn treatments(like golf courses) adjacent to surface water	Soil tests, proper application, site specific amounts, buffer zones between application and surface water
	Partial body contact recreation	**Pathogens**, *(E.coli)* Bacteria	**Manure:** over application to fields, run-off, lack of storage, storage failure	Filter strips, Waste Utilization Plans, soil tests, site specific application
			Septic systems: failing septic systems, development around surface water, lack of sewage treatment	Increase maintenance of septic, replace outdated systems, proper siting of development and septic systems
		Pesticides/ Chemicals	**Lawn or Agricultural application:** over application of pesticides or other chemicals	Soil tests, proper application, site specific amounts, buffer zones between application and surface water

High Quality Natural Areas	**Coldwater/warmwater fisheries** **Indigenous aquatic life and wildlife**	**All pollutants**	**All sources and causes**	Land-use planning and zoning, open space preservation, wetland restoration, preservation of wetlands, floodplains, groundwater recharge and natural areas
Road/Stream Interface	**Coldwater/warmwater fisheries** **Indigenous aquatic life and wildlife**	**Sediment**	**Road Erosion**: water improperly channeled, culverts not aligned, road washouts, steep banks, ditch clean-outs, re-grading	Best Management Practices, realign culverts, box culverts, re-grade steep banks, armor, critical site planting, seed and mulch roadside ditches and erosion sites
		High Flow	**Road stormwater run-off:** impervious surfaces	Reduce run-off through storage, vegetation filtering, porous road surfaces
		Other (Oil/gas, salt)	**Road run-off:** run-off running directly to surface water, application of salt or other chemicals	Filter or treatment of run-off with vegetation or other means, reduce or eliminate use of salt, chemicals where run-off to surface water occurs
Priority BMP sites:				
Sites FS1—FS5	**Coldwater/warmwater fisheries** **Indigenous aquatic life and wildlife**	**Sediment** **Nutrients** **High Flow**	**Agricultural run-off**: field erosion, manure spreading too close to surface water, lack of buffers,	Filter Strips
Sites A1—A3	**Coldwater/warmwater fisheries** **Indigenous aquatic life and wildlife** **Partial body contact recreation**	**Sediment** **Nutrients** **Pathogens**	**Unlimited Livestock Access:** direct depostion of nutrients, manure run-off	Livestock Exclusion fencing, Alternate Water Source, and buffer area.
Site 1: Hopkins Village Park **Site 2: North Dorr Park**	**Warmwater fishery** **Indigenous aquatic life and wildlife** **Partial body contact recreation** (access to surface water)	**Sediment**	**Streambank Erosion:** high flow, livestock or human access, removal of riparian vegetation	Critical site planting, streambank restoration, exclusion or bank armoring

WATERSHED GOALS AND OBJECTIVES

The preliminary goals and objectives of the watershed project were formulated at public meetings early in the planning process, and were refined as the process continued (See Goals and objectives from 9/27/2000). Additional input to the watershed's goals and objectives was solicited at a large public meeting in January of 2002.

Combining the identified threats and impairments to the watershed, the sources and causes of the threats, the desired uses, and personal experiences of the watershed project participants, the Rabbit River Watershed Planning Project's Steering Committee has developed one crucial goal for the watershed: to reduce non-point source pollution. Reducing non-point source pollution will protect and restore the designated and desired uses of coldwater/warmwater fishery, partial body contact recreation, and native wildlife habitat. Reducing and preventing non-point source pollution will also maintain the designated use of agricultural irrigation and the secondary use as water conveyance, which are inhibited by sediment build up. The methods that will be used to reduce non-point source pollution are as follows:

- Land-use planning, zoning review and changes
- Installation of Best Management Practices
- Information and education strategies and programs, and
- Preserving high quality areas.

In addition to reducing non-point source pollution, a major goal of the Rabbit River Watershed Project and stakeholders is to increase recreational opportunities in the watershed.

Goal: I. Reduce Non-point source pollution

Objective:

1.0 Reduce non-point source pollution and protect water quality through watershed focused land-use planning.

The watershed project will reduce flooding and high flow, reduce unplanned wastewater or sewage run-off, reduce erosive overland runoff with excessive sediment and nutrient input through land-use planning. It will help residents, landowners, and especially townships and planning commissions with land-use issues, smart growth, low impact development, and ways to prevent high levels of run-off. Land-use planning and zoning tools will be used to protect riparian wetlands, floodplains, and other retention areas.

Action/Tasks:

1.1 Develop lists of township-specific land-use issues related to watershed protection: Facilitate a working relationship between community, watershed steering committee, developers, real estate representatives, township and city officials, and planning commissions to determine what township-specific land-use needs exist. For example, Hopkins Township officials have expressed a need for natural resource information to be more readily available, to be used as a tool in day to day land-use decisions.

a. Draft letter of invitation to townships
b. Schedule and conduct meetings with township and city officials and stakeholders
c. Provide summaries of meetings to townships and city

Partners: ACD, Watershed Coordinator, Township Officials, Planning Commissions (Townships include Hopkins, Leighton, Wayland, Monterey, Salem and Dorr; and Wayland is the only city)

Products: A watershed protection approach to planning, List of township issues on which to concentrate planning and zoning efforts, Enhanced ownership of planning for water quality protection and reduction of nonpoint source pollution

1.2 Facilitate and coordinate the hiring of a professional planner: Planner will be selected according to specific requests and needs of township, city, and planning commission officials. These needs may include protecting water resources and their associated up land areas, as well as stormwater

management and development. The process will foster ownership in the implementation of water quality and watershed land-use planning and zoning.

a. Conduct meetings with township officials, stakeholders, and potential planners
b. Devise method to choose planner
c. Contract with planners

Partners: ACD, Watershed Coordinator, Township Officials, Planning Commissions

*Product*s: Contract with a professional planner chosen and accepted by the township officials and local planners

1.3 Serve as a liaison between townships, planning commission, and planner: Meet and collaborate with township officials, planning commissions on a one-on-one basis to encourage communication and collaboration. Establish overview of township "status": what planning documents exist, what are needed, what current zoning is, and what changes are desired.

a. Establish and maintain close communication with townships, stakeholders and planner
b. Meet regularly with townships and planners
c. Determine status and desired changes for each township

Partners: ACD, Watershed Coordinator, Township Officials, Planning Commissions, and Contracted Planner

Products: Township "status" information, desired or recommended changes or actions for master plans and ordinances, Increased communication between and among townships

1.4 Implement desired land-use changes to reduce Nonpoint source pollution and increase watershed protection: Enhance township capacity for utilizing desired land-use planning tools. Draft master plan revisions and update master plans, develop and incorporate specific ordinance language. Two particular issues that townships are interested in are stormwater management and farmland preservation.

a. Continue close communication with townships, stakeholders and planner
b. Meet regularly with townships and planners
c. Publish notices and hold public meetings

Partners: Allegan Conservation District, Watershed Coordinator, Township Officials, Planning Commissions, and Contracted Planner

Products: Updated master plans, new zoning ordinances, increased land protection and introduction of new programs (Transfer of Development Rights, Purchase of Development Rights, conservation easements, riparian/floodplain protection)

Objective:

2.0 Reduce nonpoint source pollution through Implementation of Best Management Practices

In every habitat and site surveyed by Michigan's Department of Environmental Quality, high amounts of fine sediment were found in the stream. Sediment, in addition to being a major problem itself, brings large amounts of fertilizers and other nutrients, bacteria, pesticides, and other contaminants with it as it enters surface water. Installing Best Management practices reduces run-off and erosion, thus reducing sediment and other non-point source pollution from reaching surface water. [See Appendix 5: Best Management Practices]

Action/Tasks:

2.1 Develop site plans for systems of Best Management Practices to address water quality problems and reduce nonpoint source pollution. Sites chosen will be based on data gathered during inventory of watershed and landowner interest.

a. Communicate with landowners, engineers
b. Gather necessary information
c. Produce plans, narrative, necessary permits
d. Publicize cost-share: Advertise availability of cost-share through information and education program

Partners: Watershed Coordinator/ Engineering firm

Products: Site plans for systems of Best Management Practices installation sites

2.2 Provide engineering and design of Best Management Practices, including residential/suburban, demonstration sites, agricultural and road/drain BMPs.
a. Communicate with landowners, watershed coordinator
b. Survey sites
c. Produce engineering design

Partners: Engineering firm

Products: BMP design plans

2.3 Implement Best Management Practices, including residential/suburban, demonstration sites, agricultural and road/drain BMPs
a. Communicate with landowners, contractors, engineer, or installers
b. Submit designs and documents
c. Inspect completed practices

Partners: Watershed Coordinator, landowners or installers, Road Commission, Drain Commission

Products: Before and after photos, evaluation forms, and pollutant reduction calculations

2.4 Coordinate other sources of funding to implement BMPs (Other available funds include Conservation Reserve Program, Environmental Quality Incentive Program)
a. Communicate and collaborate with federal partners (including Natural Resource Conservation Service, Farm Service Agency)

Partners: Watershed Coordinator, NRCS, FSA

Products: Increased availability and flexibility of funds, programs, and BMPs

Goal: II. Implement Information and Education Strategies

[See also Appendix 2: Information and Education Strategy]
Objective:
1.0 Provide information about watersheds, water quality, and natural resources.

Effective educational programs and distribution of educational materials can reach a wide audience. The Rabbit River Watershed's Information and Education program has three main audiences: the general public and watershed residents; local producers, farmers or landowners; and the educational community (students, teachers, and other educators.)

Action/Tasks:
1.1 Serve as a clearinghouse of existing information. Compile and distribute natural resources information as tools for land-use planning on the Rabbit River Watershed, including Natural Features Inventory data, soils, pre-settlement vegetation, floodplains, wetlands, and other data. The data will

be used to develop appropriate tools for planners/local officials to use when creating land-use ordinances.

a. Collect relevant information
b. Communicate and collaborate with other information holders

Partners: ACD, Watershed coordinator, Allegan County Geographic Information Systems, other organizations

Products: Land-use planning tools for local planners and townships to use to protect water quality (computer databases, maps, reports, papers, sample ordinances)

1.2 Work Product Sustainability/Accessibility: Ensure a high level of accessibility to information and maintain project sustainability.

a. Make information readily available to public
b. Update information regularly, to maintain accuracy and relevance

Partners: ACD/Watershed Coordinator

Products: Information in a useable, day-to-day accessible form (For townships with computer access, this may be electronic or web based.)

Objective:

2.0 Increase public awareness of watershed and water quality issues.

Action/Tasks:

2.1 Implement communication strategies to reduce nonpoint source pollution

a. Develop and distribute educational materials (brochure, fact sheets, radio spots, coloring book, etc.) to increase stakeholder awareness of water quality issues in the watershed.
b. Publicize agricultural and residential BMPs.
c. Develop highly visible demonstration sites for BMPs within context targeting further landowners.

Partners: Watershed Coordinator

Products: Educational materials (brochure, fact sheets, coloring book), increased awareness (radio spots, Public Service Announcements), highly visible BMPs as demonstration sites

2.2 Newsletter: Develop and distribute the quarterly "Rabbit River Hoppenings" Newsletter

a. Write and/or collect and edit articles
b. Manage mailing lists
c. Distribute newsletter quarterly

Partners: Watershed Coordinator, ACD

Products: Quarterly newsletter

2.3 Conduct and participate in joint educational events

a. Organize workshop with and for townships, riparian landowners, or other interested groups
b. Work with Math Science Center and educators on area events such as Eco-Expo and Envirothon
c. Organize and conduct monthly steering committee meetings

Partners: ACD, Watershed Coordinator, Allegan Math and Science Center

Products: Workshops, training and other events, and increased awareness of watershed and water quality issues

2.4 Rabbit River Watershed Student Stream Science Program

The Student Stream Science Program began in the fall of 2000 with a teacher training to get Allegan Area educators involved in macroinvertebrate sampling. Since then, more than 7 school districts and over 200 students have participated. [See Appendix 6a Student Stream Science Newsletter]

a. Recruit and train interested educators and community members
b. Choose and sample at specific sites around the watershed.
c. Coordinate teacher/student groups, equipment and data collection
d. Compile data, photos, samples and maintain in database. Assist students with data interpretation and presentation. Maintain samples as a teaching collection.
e. Design and maintain website about Rabbit River Watershed Project and Stream Science program. Include photos, macroinvertebrate data and analyses, and water quality data. Distribute as a teaching/education tool. Include project updates and information.
f. Create a curriculum to accompany sampling

Partners: Watershed Coordinator, Allegan Math and Science Center, educators and students

Products: Educators, administrators, and community members involved in watershed science. Macroinvertebrate and land-use/stream condition data from the watershed. Collaboration with DEQ, Macroinvertebrate teaching collection. Database of stream and macroinvertebrate data. Website with data, project info, photos, etc. (Website will be maintained by Math and Science Center)

Goal: III. Protect high quality areas

Objective:
1.0 Reduce or prevent non-point source pollution and protect water quality, aquatic habitat, and recreational opportunities by preserving open space and protecting riparian land.

The presence of natural, undeveloped areas is critical to protect the designated uses of the Rabbit River Watershed, especially coldwater fisheries, aquatic habitat and other native wildlife populations. Natural areas and open space also provide recharge for groundwater and drinking water, recreation opportunities, and preserve the rural character of an area.

Action/Tasks:

1.1 Identify areas with good to excellent water quality or aquatic habitat, and areas to protect and preserve to improve or protect water quality. Many sites have been identified in the inventory, such as Silver Creek County Park, the Rabbit River headwaters in Wayland, and the Rabbit River corridor. There are many more sites on public and private land that should be preserved when possible.

a. Assist with or provide inventory information
b. Maintain good communication with land trusts about local conditions and sites

Partners: Watershed coordinator, Allegan Conservation District, Southwest Michigan Land Conservancy, West Michigan Land Conservancy, other local land trusts, Allegan County Parks and Recreation, Allegan State Game Area, West Michigan Alliance

Products: Expanding list of high quality areas in the Rabbit River Watershed

1.2 Contact landowners and residents about conservation options. Information and education program on how land-use influences water quality. Assist local land trusts with contacts, education, and federal or state programs available (i.e. Purchase of Development Rights (PDR) or Transfer of Development Rights (TDR), Farmland and Open Space Preservation Program (PA 116), or other conservation easement program)

a. Share newsletter articles, educational information.
b. Provide technical assistance with state and federal programs

Partners: Watershed coordinator, ACD, Southwest Michigan Land Conservancy, West Michigan Land Conservancy, other local land trusts

Products: Increased knowledge and awareness of land protection options.

1.3 Assist with conservation options that protect and improve water quality. Encourage townships to enact local conservation easement or land protection initiatives, zoning or funding

a. Act as liaison between townships, planning commissions, and local parks and local land trust organizations

Partners: ACD, SWMLC, WMLC, other local land trusts, Allegan County Parks and Recreation, other parks, townships, other planning organizations

Products: Conservation easements protected lands, information and education

Goal: IV. Improve recreational opportunities

Objective:
1.0 Improve recreation opportunities in the watershed

Recreation is included in the list of designated uses for the Rabbit River Watershed. This recreation includes partial body contact recreation such as fishing, canoeing or other boating, but many people are increasingly interested in wildlife observation, bird watching, hiking, or walking as types of recreation. Riparian areas are excellently suited for wildlife and bird observations because of the variety and diversity of species that make use of an intact riparian corridor. Hiking and walking are extremely popular activities when a trail or greenway exists along a river, stream, lake or creek. Outdoor recreation near the rivers and streams encourages good stewardship and is an opportunity for outdoor education. Currently, the only public access that exists on the Rabbit River itself is located in Hamilton, very near the mouth of the river. The Rabbit River Watershed Project recognizes the need for increased recreational opportunities to protect this designated use.

Action/Tasks:

1.1 Encourage and improve recreation opportunities in the Rabbit River Watershed, especially partial body contact recreation such as fishing, canoeing or other related to riparian recreation and public access.

a. Meet and communicate regularly with parks groups in the watershed. Form recreation partnerships between and among park groups.
b. Work with park and recreation groups and residents to determine recreation needs
c. Implement increased recreation opportunities
d. Take advantage of service learning and outdoor education opportunities

Partners: Allegan County Parks and Recreation, Ebersole Environmental Center, Allegan 4-H, Camp Kidwell, Wayland Parks, Dorr Parks, Hopkins Parks, Salem Parks, Allegan State Game Lands, Allegan Tourist Council, Allegan Drain Commission, Local Scouting Programs, Trout Unlimited, and Anglers Associations

Products: Improved recreational opportunities, fishing access, canoe access, outdoor education, service learning, increased communication between and among parks groups, recreation partnerships

Goals Specific to certain Partnering Parks or Organizations:

Silver Creek County Park
Goals: Maintain high quality recreation opportunities, access to designated trout stream
Partners: Allegan County Parks and Recreation, Allegan County Commissioners

Allegan State Game Area
Goals: Add public access to Rabbit River, increase public land in Allegan State Game Area.
Partners: MDNR Biologists, Allegan County Parks, Rabbit River Steering Committee and Stakeholders,

Bysterveld County Park
Goals: Provide environmental education opportunities, interpretive environmental signs and trials, and recreation facilities.
Partners: Allegan County Parks and Recreation, Allegan County Commissioners, Allegan Conservation District

Wayland Parks
Goals: Provide recreational access, nature park on or near Rabbit River, establish greenways, trails, and linear parks to provide wildlife habitat, water quality protection, and to link communities
Partners: Wayland Parks and Recreation, Wayland Township, City of Wayland

Dorr Parks
Goals: Increase recreational opportunities, repair eroded streambanks, provide recreational access while protecting water quality, encourage native plantings and buffers, install educational BMPs
Partners: Dorr Parks and Recreation, Dorr Township, Allegan Conservation District

Hopkins Parks
Goals: Increase recreational opportunities, provide recreational access while protecting water quality, encourage native plantings and buffers, install educational BMPs
Partners: Hopkins Parks, Hopkins Village, Hopkins Township, Allegan Conservation District

Scouting and Other Community Service Groups
Goals: Provide opportunities for service learning – making improvements to community assets while providing personal growth opportunities.
Partners: Boy Scouts, Girl Scouts, 4-H, United Way

Local Golf Courses
Goals: Seek out opportunities for buffer installation, native grass plantings, and low impact turf grass management BMP installation.
Partners: Golfers, owners, pro-shops, Michigan Turf grass Stewardship Program, Kalamazoo Nature Center

Goal: V. Sustainability

Objective:
1.0 Provide long-term water quality protection through project sustainability

Action/Tasks:

1.1 Educational projects: The Student Stream Science Program will be an ongoing project. Work to get watershed and water quality issues included in area school curricula.

a. Work with teachers and educators on curricula, benchmarks, and other resources

b. Encourage expansion of Student Stream Science Program into other programs, including school districts, community groups, or other interested parties.

Partners: ACD, Watershed Coordinator, Allegan Math and Science Center

Products: Educational programs and lesson plans, increased knowledge of watershed and water quality issues, curricula changes, website continuity

1.2 Local involvement: Steering Committee, "Friends of the Rabbit River Watershed" organizations to act on a local level to address watershed issues. Local organizations include the Kalamazoo Watershed Council, East Lake Association, and others.

a. Coordinate groups interested (Friends of the Rabbit, Rabbit River Association, Lake Association, scouting groups)
b. Facilitate communication among groups

Partners: ACD, steering committee and local volunteer groups

Products: Improved recreational opportunities, fishing access, canoe access, increased knowledge of parks, increased communication between and among parks groups

1.3 Continued Funding: Continued sources of funding are available for non-point source pollution reduction. Maintenance of BMPs and unforseen issues will need to be supported. While these should be institutionalized and partnering agencies will need to take responsibilities for programs, many systems of BMPs can be costly. Funding programs tend to change over time, so partners will need to be aware of what is and will be available.

a. Coordinate federal funding sources
b. Instiutionalize procedures for maintaining responsibilities and finding funding.

Partners: ACD, steering committee, local organizations, NRCS, Kalamazoo River Watershed Council

Products: Federal, State and local funds, staff, and involvement to continue to reduce nonpoint source pollution in the watershed

1.4 Long-term maintenance agreements: Long-term Maintenance contracts on Best Management Practices installed provide project sustainability.

a. Coordinate groups interested (Friends of the Rabbit, Rabbit River Association, Lake Associations)
b. Facilitate communication among groups

Partners: Allegan Conservation District, landowners or installers, Natural Resources Conservation Service

Products: Long-term continuation of project's Best Management Practices

1.5 More informed township officials, planning commissions, and landowners: The best way to obtain sustainability is to provide the knowledge and tools needed to allow the decision makers to adapt to changing conditions on their own. Armed with basic principles, these individuals will shape what is to become of the watershed. The Upper Rabbit River Watershed Management Plan is intended to be used as a guide to assist with decision making on a local level for years to come. A guide for "How to Use the Watershed Management Plan" is a useful partner to highlight the valuable components of the plan and how to apply them. With elections and other obstacles, not all local officials have been involved with the planning phase, so a guide would be a good tool for those who are not familiar with the plan.

Partners: Allegan Conservation District, Michigan State University Extension, Township Officials, Planning Commissions

Products: "How to Use the Watershed Management Plan" guide, better informed decision-makers, supported by plans and principles that may be adapted to changing conditions.

Goal: VI. Evaluation

Objective:
1.0 Evaluate watershed project and accomplishments

Evaluating the watershed project will allow participants to judge the effectiveness of the plan in addressing watershed goals. Evaluation helps steer the project, and will single out things that work, and things that fail. Evaluation provides a means to quantify the actions, and will be useful for future projects.

Action/Tasks:

1.1 BMP Evaluation: Evaluation of BMP performance

a. Meet with landowners
b. Perform pollutant reduction calculations for each site
c. Take before and after photographs of implemented BMPs

Partners: Watershed Coordinator

Products: Before and after photos, a list of implemented BMPS, and pollution reduction calculations

1.2 Land-Use Planning: As part of the land-use planning process, township "status" will be investigated to determine baseline of planning documents, ordinances, and zoning. This will be compared to the status of master plans, zoning and ordinances at the end of the project.

a. Obtain copies of master plans, ordinances, zoning
b. Meet regularly with townships, planner
c. Compare master plans, zoning and ordinances at end of project

Partners: Watershed Coordinator, Planner

Products: Comparison of before and after status of Master Plans, zoning, and ordinances

1.3 Education Evaluation: Students involved in macroinvertebrate sampling program, number of sites sampled (representative of the watershed) increased awareness of watershed and water quality issues. Targeted outreach to secondary educational community.

a. Report on number of students, locations, and results.
b. Site locations throughout the watershed

Partners: Watershed Coordinator, Allegan Math and Science Center

Products: Comparison of student/teacher involvement, number of sites that provide data, increased awareness and education.

1.4 Other evaluation tools will be used as necessary. Steering committee will be apprised of project status at the steering committee meetings, and will make use of evaluation data to make adjustments to project as necessary.

Partners: Watershed Coordinator, Steering Committee, ACD

Products: Locally led process

ACTION PLAN

The Rabbit River Watershed action plan includes the main goals of the Watershed Plan, and details the actions and tasks needed to accomplish the goals. Partners, products estimated timeframe, and costs of implementation activities are included.

Table 9: Upper Rabbit River Watershed Action Plan for Implementation						
I.	**Goal: Reduce non-point source pollution watershed wide**					
1.0	**Objective: Reduce non-point source pollution and protect water quality through watershed focused land-use planning**					
	Action/Tasks:	**Partners**	**Products**	**Timeframe**	**Cost**	**Funding Sources**
1.1	**Develop lists of township-specific land-use issues related to watershed protection:** Facilitate a working relationship between community, watershed steering committee, developers, real estate representatives, township and city officials, and planning commissions to determine what township-specific land-use needs exist. For example, Hopkins Township has expressed a need for natural resource information to be more readily available, to be used as a tool in day-to-day land-use decisions.	ACD, Watershed Coordinator, Township Officials, Planning Commissions (Townships include Hopkins, Leighton, Wayland, Monterey, Salem and Dorr)	A watershed protection approach to planning. List of township issues on which to concentrate planning and zoning efforts, Enhanced ownership of planning for water quality protection and reduction of NPS pollution	2002	$100 per meeting, twice a month, 9 months = $1800; 235 hours watershed coordinator salary = $3290	319 grant, land-use planning grants, townships and municipalities
1.2	**Facilitate and coordinate the hiring of a professional planner**: Planner will be selected according to specific requests and needs of township, city, and planning commission officials. The process will foster ownership in the implementation of water quality and watershed land-use planning and zoning.	ACD, Watershed Coordinator, Township Officials, Planning Commissions	Contract with a planner chosen and accepted by the township officials and planners	2002	$100 per meeting, twice a month, 7 months = $1400; 235 hours watershed coordinator salary = $3290	319, townships and municipalities

1.3	**Serve as a liaison between townships, planning commission, and planner**: Meet and collaborate with township officials, planning commissions on a one-to-one basis to encourage communication and collaboration. Establish overview of township "status": what planning documents exist, what are needed, what current zoning is, and what changes are desired.	ACD, Watershed Coordinator, Township Officials, Planning Commissions, Planner	Township "status" information, Desired or recommended changes or actions for master plans and ordinances, Increased communication between and among townships	2002-2005	704 hours watershed coordinator salary = $9,853; costs also contained in $50,000 to professional planner	319, ACD, townships, municipalities
1.4	**Implement desired land-use changes to reduce NPS pollution and increase watershed protection:** Enhance township capacity for utilizing desired land-use planning tools. Draft master plan revisions and update master plans, develop and incorporate specific ordinance language. Two particular issues that townships are interested in are stormwater management and farmland preservation.	ACD, Watershed Coordinator, Township Officials, Planning Commissions, Planner	Updated master plans, new zoning ordinances, increased land protection and introduction of new programs (TDR, PDR, conservation easements, riparian/floodplain protection)	2003-2005	$50,000 to sub-contracted professional planner(s)	319 grant, land-use planning grants, townships and municipalities
2.0	**Objective: Reduce NPS Pollution Through Implementation of Best Management Practices**					
	Action/Tasks:	**Partners**	**Products**	**Timeframe**	**Cost**	**Funding Sources**
2.1	Develop site plans of BMP sites based on inventory of watershed, landowner interest, and reduction of NPS pollution. Advertise availability of cost-share through I and E program.	Watershed Coordinator/ Engineering firm	Site plans for BMP installation sites	Continuous	165 hours watershed coordinator salary = $2307	CMI
2.2	Provide engineering and design of Best Management Practices, including residential/suburban, demonstration sites, agricultural and road/drain BMPs.	Subcontracted to engineering firm	BMP design plans	Continuous	$8,000	CMI

2.3	Implement Best Management Practices, including residential/suburban, demonstration sites, agricultural and road/drain BMPs	Watershed Coordinator	Before and after photos, evaluation forms, and pollutant reduction calculations	Continuous	$42,000 to implement priority BMPs ($256,711.96 to implement all BMP solutions in watershed); 412 hours watershed coordinator salary = $5768	CMI
2.4	Coordinate other sources of funding to implement BMPs. Other available funds include CRP, EQIP, PL-566, and possibly CREP.	Watershed Coordinator	Increased availability and flexibility of funds, programs, and BMPs	Continuous	cost depending on program availability	319, CMI, ACD, NRCS, other federal programs
II.	**Goal: Implement Information and Education Strategies**					
1.0	**Objective: Provide information about watersheds, water quality, and natural resources.**					
	Action/Tasks:	**Partners**	**Products**	**Timeframe**	**Cost**	**Funding Sources**
1.1	**Serve as a clearinghouse of existing information:** Compile and distribute natural resources information as tools for land-use planning on the Rabbit River Watershed, including Natural Features Inventory data, soils, pre-settlement vegetation, floodplains, wetlands, and other data. The data will be used to develop appropriate tools for planners/local officials to use when creating land-use ordinances.	ACD, Watershed coordinator, Allegan County GIS, other organizations	Land-use planning tools for local planners and townships to use to protect water quality (computer databases, maps, reports, papers, sample ordinances)	Continuous	187 hours watershed coordinator salary = $2627; 140 hours executive director salary = $1807; maps and map products $1200	319, Allegan GIS
1.2	**Work Product Sustainability/Accessibility:** Ensure a high level of accessibility to information and maintain project sustainability.	ACD/Watershed Coordinator	Information in a useable, day-to-day accessible form (For townships with computer access, this may be electronic or web based.)	Continuous	140 hours executive director salary = $1807	ACD

2.0	**Objective: Increase public awareness of watershed and water quality issues.**					
	Action/Tasks:	**Partners**	**Products**	**Timeframe**	**Cost**	**Funding Sources**
2.1	**Implement communication strategies to reduce NPS pollution:** Develop and distribute educational materials (brochure, fact sheets, radio spots, coloring book, etc.) to increase stakeholder awareness of water quality issues in the watershed. Publicize agricultural and residential BMPs. Develop highly visible demonstration sites for BMPs within context targeting further landowners.	Watershed Coordinator	Educational materials (brochure, fact sheets, coloring book), increased awareness (radio spots, PSA's), highly visible BMPs as demonstration sites	Continuous	$2500 for communication and education strategies, workshops, and other events; see BMPs for educational BMP costs; $1300 for postage	319, CMI, ACD
2.2	**Newsletter**: Develop and distribute the quarterly "Rabbit River Hoppenings" Newsletter	Watershed Coordinator, ACD	Quarterly newsletter	Quarterly, on-going	$3000 (12 newsletters at $250 each), $1000 postage	319, ACD
2.3	**Conduct and participate in joint educational events:** Workshops for townships, riparian landowners, eco-expo, Envirothon, and others as deemed needed or available by townships, steering committee, local groups.	ACD, Watershed Coordinator, Allegan Math and Science Center	Workshops/events, increased awareness of watershed and water quality issues	Continuous	$1000 (4-5 workshops, at $200 each)	319, ACD, townships, local organizations
2.4	**Rabbit River Watershed Student Stream Science and Monitoring Program**					
a.	Recruit and train interested educators and community members	Watershed Coordinator, Allegan Math and Science Center	Educators, administrators, and community members involved in watershed science	Twice yearly, (early Spring and Fall)	Use newsletters, website, $1000 Math& Science Center facilities and communications	319, ACD, Math and Science Center

b., c.	b. Choose and sample at specific sites around the watershed. c.Coordinate teacher/student groups, equipment and data collection	Watershed Coordinator, Allegan Math and Science Center, educators and students	Macroinvertebrate and land-use/stream condition data from the watershed	Twice yearly, (Spring and Fall)	$28,000 in student and teacher match; 188 hours watershed coordinator salary = $2627	ACD, Math Science Center, local schools, educators, teachers, students, Ebersole Environmental Center, Camp Kidwell, Allegan County Parks and Recreation
d.	Compile data, photos, samples and maintain in database. Assist students with data interpretation and presentation. Maintain samples as a teaching collection.	Watershed Coordinator	Collaboration with DEQ. Macroinvertebrate collection. Database of stream and macroinvert data.	As needed, or twice yearly after sampling	188 hours watershed coordinator salary = $2627, equipment costs, $1000 Math& Science Center facilities	319, ACD, Math and Science Center
e.	Design and maintain website with about Rabbit River Watershed Project and Stream Science program. Include photos, macroinvertebrate data and analyses water quality data. Distribute as a teaching/education tool. Include project updates and information.	Watershed Coordinator, Allegan Math and Science Center	Website with data, project info, photos, etc. Website will be maintained by Math and Science Center	Continuous	$6000 to create website, video, maintain data, website hosting costs from ACCN $300/month,	319 grant, Math Science Center, ACCN
III.	**Goal: Protect high quality areas**					
1.0	**Objective: Reduce or prevent non-point source pollution and protect water quality, aquatic habitat, and recreational opportunities by preserving open space and protecting riparian land.**					
	Action/Tasks:	**Partners**	**Products**	**Timeframe**	**Cost**	**Funding Sources**

1.1	Identify areas with good to excellent water quality or aquatic habitat, and areas to protect and preserve to improve or protect water quality	Watershed coordinator, ACD, Southwest Michigan Land Conservancy, West Michigan Land Conservancy, other local land trusts, Allegan County Parks and Recreation, Allegan State Game Area	List of high quality areas in the Rabbit River Watershed	Continuous	watershed coordinator and land steward salary	319, local land trusts (Southwest Michigan Land Conservancy, West Michigan Land Conservancy)
1.2	Contact landowners, residents, about conservation options. Information and education program on how land-use influences water quality. Assist local land trusts with contacts, education, and federal or state programs available (i.e. PA 116 or other conservation easement program)	Watershed coordinator, ACD, Southwest Michigan Land Conservancy, West Michigan Land Conservancy, other local land trusts	Increased knowledge and awareness of land protection options	Continuous	watershed coordinator and land steward salary	319 (education), local land trusts (Southwest Michigan Land Conservancy, West Michigan Land Conservancy)
1.3	Assist with conservation options that protect and improve water quality. Encourage townships to enact local conservation easement or land protection initiatives, zoning or funding.	Watershed coordinator, ACD, SWMLC, WMLC, other local land trusts, Allegan County Parks and Rec, other parks, townships, planning.	Conservation easements, protected lands, information and education	Continuous	watershed coordinator and land steward salary	319 (education), local land trusts (Southwest Michigan Land Conservancy, West Michigan Land Conservancy)
IV.	**Goal: Improve Recreational Opportunities**					
1.0	**Objective: Improve recreation opportunities in the watershed**					
	Action/Tasks:	**Partners**	**Products**	**Timeframe**	**Cost**	**Funding Sources**

1.1	Encourage and improve recreation opportunities in the Rabbit River Watershed, especially partial body contact recreation such as fishing, canoeing or other related to riparian recreation and public access. Meet and communicate regularly with parks groups in the watershed and work with park and recreation groups and residents to determine recreation needs and then implement increased recreation opportunities.	Allegan County Parks and Recreation, Allegan 4-H and Camp Kidwell, Ebersole Environmental Center, Wayland Parks, Dorr Parks, Hopkins Parks, Salem Parks, Allegan State Game Lands, Allegan Tourist Council, Allegan Drain Commission, Local Scouting Programs, Trout Unlimited	Improved recreational opportunities, fishing access, canoe access, increased knowledge of parks, increased communication between and among parks groups	Continuous	watershed coordinator salary, newsletter articles, postage costs	local parks and recreation, townships
V.	**Goal: Watershed Protection and Sustainability**					
1.0	**Objective: Improve recreation opportunities in the watershed**					
	Action/Tasks:	**Partners**	**Products**	**Timeframe**	**Cost**	**Funding Sources**
1.1	**Educational projects:** Volunteer Monitoring Program will be an ongoing indefinite project. Work to get watershed and water quality issues included in area school curricula.	ACD, Watershed Coordinator, Allegan Math and Science Center	Educational programs and lesson plans, increased knowledge of watershed and water quality issues, curricula changes, website continuity	Continuous	$5000 per year in student teacher participation. Equipment costs.	ACD, Math & Science Center, DEQ monitoring grants, Local school districts, Ebersole Environmental Education Center
1.2	**Local involvement:** Steering Committee, "Friends of the Rabbit River Watershed" organizations to act on a local level to address watershed issues. Local organizations include the Kalamazoo Watershed Council, East Lake Association, and others.	ACD, steering committee and local volunteer groups	Local groups addressing watershed issues, continuing watershed protection	Continuous	no cost/volunteer efforts	watershed residents, local organizations
1.3	**Continued Funding:** Continued sources of funding are available for non-point source pollution reduction	ACD, steering committee, local organizations, NRCS	Federal, State and local funds, staff, and involvement to continue to reduce NPS pollution in the watershed	Continuous, depending on funding availability	cost dependant on participation	PL-566, EQUIP, CRP, CREP designation, other federal funds

1.4	**Long-term maintenance agreements**: Long-term Maintenance contracts on BMPs installed provide project sustainability.	ACD, landowners, NRCS	Long-term continuation of project Best Management Practices	Continuous, and on-going	no cost	local landowners, producers
1.5	**1.5 More informed township officials, planning commissions, and landowners**: Better informed individuals are armed to make better decisions	ACD, MSUE, Township Officials, Planning Commissions	"How to Use the Watershed Management Plan" Guide	Guide in 2003, Continuous, and on-going support	$1500-3000	319, ACD, townships and municipalities
VI.	**Goal: Evaluation**					
1.0	**Objective: Evaluate watershed project and accomplishments**					
	Action/Tasks:	**Partners**	**Products**	**Timeframe**	**Cost**	**Funding Sources**
1.1	**BMP Evaluation:** Evaluation of BMP performance	Watershed Coordinator	Before and after photos, a list of implemented BMPS, and pollution reduction calculations	Continuous, as needed	$250 (10 rolls of film/slides at $25 each)	CMI, ACD
1.2	**Land-Use Planning:** As part of the land-use planning process, township "status" will be investigated to determine baseline of planning documents, ordinances, and zoning. This will be compared to the status of master plans, zoning and ordinances at the end of the project.	Watershed Coordinator, Planner	Comparison of before and after status of Master Plans, zoning, ordinances	2002-2003, 2004-2005	235 hours of watershed coordinator salary = $3284; planner costs within land-use planning process	319, townships and municipalities
1.3	**Education Evaluation:** Students involved in macro-sampling program, number of sites sampled (representative of the watershed) increased awareness of watershed and water quality issues. Targeted outreach to secondary educational community.	Watershed Coordinator, Allegan Math and Science Center	Comparison of student/teacher involvement, number of sites that provide data, increased awareness and education.	Continuous	118 hours of watershed coordinator salary = $1645	319, ACD, Math Science Center
1.4	Other evaluation tools will be used as necessary. steering committee will be apprised of project status at the steering committee meetings, and will make use of evaluation data to make adjustments to project as necessary.	Watershed Coordinator, Steering Committee, ACD	Locally led process	2002-2005	no cost	steering committee, local organizations, ACD

PLANNING PROCESS AND PUBLIC PARTICIPATION

History of Rabbit River Project

The Rabbit River Watershed has a history of involved, interested citizens who have come together during times of need to protect and improve the river. In the late 1980's, residents in the upper Rabbit River bonded together to prevent areas of the Rabbit from being dredged and straightened, to keep the Rabbit River a natural system. In 1992, citizens formed the Friends of the Rabbit River to perform some clean-ups of logjams that were impeding flow and causing flooding on nearby property.

In 1994, William Semeyn of Allegan's Natural Resource Conservation Service, at the request of watershed residents and landowners, began the process of submitting a 319 project. A group of like-minded individuals came together and decided that the Rabbit River Watershed had serious water quality issues. A grant was submitted, and the Little Rabbit River Watershed Project was begun. The first steering committee meeting took place in May of 1995, and was formed of people from the watershed, and a core group "Friends of the Rabbit River" who had been interested in the status and water conditions of the river. This 319 project was a very successful project, especially from the point of view of the partnerships forged. Wendy Ogilvie, now of Fishbeck, Thompson, Carr, and Huber, was the watershed coordinator, and worked closely with numerous local governments and officials.

Projects in the Rabbit River Watershed continued in 1999 with a Clean Water Action Plan Implementation Project. Watershed Coordinator Tim Redder worked to get conservation on the land by installing BMPs to improve water quality. As of the writing of this plan, this grant has been extended, and will continue to provide cost-share and technical assistance to the entire Rabbit River Watershed.

The Upper Rabbit River Watershed Project came together as a natural continuance of the former watershed projects. The steering committee for the Little Rabbit River Watershed Project, and later the Rabbit River Watershed came together to decide what additional steps needed to be taken to continue to improve and protect water quality in the watershed. The next area for focus was the Upper Rabbit River Watershed, a large sub-section of the watershed, encompassing the land and waters upstream from where the Little Rabbit River joins the mainstream of the Rabbit River. This was a very ambitious project. The summer of 2000 proved to be momentous for the Rabbit River Watershed. The Little Rabbit River Watershed Project finalized it's cost-share and produced a DEQ approved Watershed Management Plan, the Clean Water Action Plan grant for the entire watershed was in full swing, and a new 319 planning project began for the Upper Rabbit River. The Upper Rabbit River Planning Project began in earnest with information and education projects in the summer of 2000, and with the hiring of the watershed coordinator in late summer.

Soliciting public comment and participation

Public Meetings

Public meetings have been an important method of public participation in all of the projects in the Rabbit River Watershed. The Upper Rabbit River Watershed Planning project was able to capitalize on this, and formed a natural continuation of the steering committee from the Little Rabbit River and the Rabbit River CWAP Implementation. Meetings took place every month, or every other month, depending on need. Meeting times varied to allow different people with different schedules to attend. Meetings were held in two locations in the watershed: at Hopkins Village Hall, and at Wayland Township Hall, both in the Upper Rabbit River Watershed. Meetings ranged from small working sessions, to large public input meetings. Several meetings also had different agency members available to present topics and answer questions. (See Table 10 Steering Committee/Public Meeting Summary)

TABLE 10 STEERING COMMITTEE/PUBLIC MEETINGS SUMMARY

The Rabbit River Watershed Project Steering Committee is dedicated to assisting the Rabbit River Watershed Project in its efforts to provide encouragement, incentive, assistance, and education to the community in order to protect and improve water quality, and therefore the quality of life, in the Rabbit River Watershed.

Date	Attendance	Agenda Highlights	Results, Products and Actions
08/24/2000	Approx. 25	Project Background and role of steering committee	Distinction between Implementation and Planning. Encourage active involvement.
09/27/2000	28	Ben Zimont, MDEQ. MDEQ-SWQD 1998 Bio-survey report: The report is a survey of the macro-invertebrates found in the Rabbit River, and how the numbers and species present relates to water quality. Critical areas: using worksheets and open comment discussions, the steering committee located sources and causes of non-point source pollution. Designated uses: using worksheets and open comment discussions, the steering committee determined the designated and desired uses of the watershed.	 Determined critical area to be the entire Rabbit River Watershed. Discussed priority areas for investigation and inventory. Discussed designated uses. Determined main designated uses to be agricultural (irrigation), recreation, wildlife and aquatic habitat, and fisheries. Desired uses include recreational opportunities, less flooding
11/29/2000	13	Jay Wesley, MDEQ presented a 1998 MDEQ fisheries report and temperature data on the Rabbit River. Inventory will target sub-watersheds, and will concentrate on the small tributaries. The sub-watershed priorities include Green Lake Stream, Bear Creek, and the headwaters of the Rabbit River. Designated uses for the watershed were determined to be coldwater/warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation and agricultural purposes. The Rabbit River Watershed Project plans to organize a training workshop/seminar on natural resource-friendly planning and zoning to incorporate sample ordinances with training sessions to give township planners realistic and helpful tools toward natural resource friendly land-use planning.	Copies of reports distributed. Discussion about coldwater vs. warmwater, “flashy” vs. stable streams, high flow. Established priority areas for inventory Confirmed designated uses established at last meeting. Discussed land-use planning and zoning
01/10/2001	27	Coldwater Fishery information	Find out more info on Coldwater streams

01/10/2001 (cont.)		CNMP, CAFOs: Presentation on new EPA/MDA and MEAAP program Planning Workshop: survey to gauge interest	Education and awareness of programs, regulations that affect water quality. Land-use planning issues and topics
02/28/2001	19	Coldwater fisheries designation: the entire mainstem of the Rabbit is a designated trout stream, which needs to be taken into account when granting any permits for discharge, temperature data would be helpful to support this CREP designations: Work towards new watershed designation on Rabbit and Kalamazoo River Watershed. Land-Use Planning Workshop: Sponsor or collaborate on a workshop for area planners on natural-resource friendly planning and zoning. Volunteer Stream Monitoring: Teacher training will take place at Match Science Center. Applying for an equipment grant for the project. Bear Swamp Drain: Drain Commissioner presented information about proposed drain project through Hopkins area. An engineer's report was also presented.	Joint effort to collect temperature data from the watershed with MDNR fisheries Steering Committee Members involved in acquiring new projects and funding sources for water quality. Collaborate with Salem Township on workshop. Patricia Birkholz presentation, Transfer of Development Rights information. Education for students and teachers. Collect watershed and macroinvertebrate data; analyze long-term trends, partnership with Allegan Math and Science Center.
05/01/2001	15	Wastewater Issues: DEQ's Wastewater Compliance officer discussed discharges in the watershed, and some of the problems (past, current and anticipated) Preliminary Inventory Findings: Watershed coordinator presented inventory information from Green Lake Creek, Bear Swamp Drain and Upper Rabbit (headwaters). Bear Swamp Drain: Discussion about proposed project, and opportunities for alternate methods and funding, including a possible CMI grant.	Increased knowledge and contacts for point source and compliance issues Pictures and slides of watershed sites. Summary of BMPs presented to steering committee. Partnerships between Allegan Conservation District, Rabbit River Watershed and County Drain Office.
07/10/2001	19	Bear Swamp Drain: presentation by Claire Schwartz, engineer for the project. Discussion on methods, and the process of completing the process, including designating the river as a drain, funding. Final Inventory Findings: presented detailed report of inventory rationale, protocol, and findings. Included table of suggested BMP totals.	Steering Committee involvement. Protection of the river. Distributed inventory report, slides and pictures. Discussion of needed BMPs and which to concentrate on in particular. Information included in implementation goals.

09/18/2001	11	Implementation Grant Summary: Presented summary of the applied for 319 and CMI grants. Summary included watershed goals, timelines, and tasks and action plan. Initial Water Quality Statement: copies were distributed, and comments and suggestions were discussed and incorporated. Bear Swamp Drain/Rabbit River Drain project: Steering Committee decide that this project and search for alternate funding will not be focus of steering committee. Will pass on to District, but with our support towards alternate methods to solve problems, and not drain designation.	Grant includes sections that will be incorporated into watershed management plans. Comments and suggestions will be incorporated. Final draft of Water Quality Statement Partnerships with district and drain office. Decision to protect natural river.
11/06/2001	6	Working session on what to include in watershed management plan. Goals for the plan include making document usable, informative, and helpful. Worksheet and open discussion PL-566: Federal small watersheds program	Additional comments and suggestion on document structure, content, goals, and review of action plan and tasks. Include ideas from a variety of individuals and viewpoints. Written and verbal comments. Additional and alternate source of funding to improve water quality. Awareness of process to acquire programs.
01/29/2002	26	Presented Watershed Management Plan: PowerPoint presentation including the planning processes, inventory results, goals, objectives and actions. Presentation outlined the Watershed Management Plan. Discussion and worksheet/survey occurred during and after presentation. Nitrogen Cycling Research on the Rabbit River: Research staff from Notre Dame will be conducting a study on areas within the Kalamazoo River Watershed, including the Rabbit.	Public comments and suggestion, both written and verbal. Education of public on planning process and resultant document. Data sharing: temperature, sediment core samples, and nitrogen inputs and usage
04/02/2002	12	Watershed Management Plan: Initial Draft Review and Final Comments. Distributed summary of watershed management plan, especially goals and actions. Discussed the main points of the plan, solicited additional suggestions	Final incorporation of steering committee and public input into document, proofreading and editing.

In addition to the general discussion at the watershed project's public meetings, comments were solicited via worksheets and surveys. Public input is important at every stage of the Watershed Planning Process, and steering committee meetings are the venue the Rabbit River Watershed Project most often chose to solicit these opinions. Designated Uses, Critical Areas, and The Watershed Management Plan itself were all subjects discussed at meetings with accompanying worksheets. These completed worksheets were then collected and used to formulate the basis for the Watershed Management Plan, as well as to steer the project in the direction chosen by the watershed residents and stakeholders. (See: Appendix 4a Designated Uses Worksheet, Appendix 4b Critical Areas Worksheet, Appendix 4c WMP Worksheet)

Newspapers and local Publications

Several newspaper articles with information on both the Rabbit River Clean Water Action Plan Implementation program, and the Upper Rabbit River Watershed Planning Project were published. Local newspapers such as the Penasee Globe, Grand Rapids Press, the Allegan County News, and the Kalamazoo Gazette have published news articles on the Rabbit River Watershed. The Student Stream Science Program has been especially helpful in attracting publicity for the watershed project and in recruiting parties interested in water quality. As well as regular articles, steering committee meetings or other events were submitted to community events or calendars in local papers. To see examples of newspaper articles, please see the Information and Education Section of the Watershed Management Plan.

Surveys

Another method that has been useful, both as an educational tool and to gauge interest, is public surveys. The Rabbit River Watershed sent out a land-use planning workshop survey to determine interest in holding a workshop, but also to determine the level of interest of some key members of the watershed community in land-use planning and zoning issues. The survey particularly targeted natural resource friendly and water quality protection. The survey was sent out to around 50 people in the watershed including township supervisors, planning officials, other local government, developers, drain and road commission, local land trusts, environmental groups, residents. We received 20 back, a 40% return rate. The overwhelming majority of the surveys indicated an interest in learning more about these issues even if they were not interested in a workshop at this time. They presented some excellent comments on aspects of natural resource friendly planning and zoning that the watershed project should consider. These comments were used in future meetings to discuss land-use planning issues, and helped shape the direction and composition of the land-use portion of the watershed goals. (See Appendix 3 Land-use Planning Survey)

A survey was also used to gather comments and suggestions on the first draft of the management plan. The Rabbit River Watershed Project held a large public meeting in late January. At this meeting, the Watershed Management plan was summarized, including the planning and Public Participation process, the inventory results, and the sources and causes of non-point source pollution. We also discussed the goals and actions of the watershed project, and the desired next steps. The survey was distributed at the beginning of this steering committee meeting/public meeting to allow participants to write comments during the course of the presentation. Many of the comments were helpful to include additional pollutants, goals, or suggestions and comments from the minority voice, or people who did not feel comfortable voicing opinions or suggestions out load. This survey was also sent out in the next steering committee mailing (to over 100 recipients) to insure that members of the committee and other participants had the opportunity to respond, if desired. Many of the steering committee had been involved in this process the whole time, and so some expressed that they had no additional comments or suggestions, but others sent in or returned some excellent additions. (For survey and results summary, see Appendix 3b Watershed Meeting Survey and Comments.)

Other

Other efforts to involve the public included a more general approach. The watershed coordinator spoke to several local groups or organizations about water quality and the Rabbit River Watershed Project, including the East Lake Association's Annual Meeting, and to Allegan County's 4-H Board. Presentations were also given at many Township meetings, Parks and Recreation Meetings, and to several schools in the watershed. The Rabbit River Watershed also maintained a presence at the Allegan County Fair as part of the joint booth and exhibit between the Allegan Conservation District and the Farm Services Agency. Brochures, flyers, posters, and sign-in sheets were some of the methods used for public outreach.

Partners and Stakeholders Involved

The Rabbit River Watershed Planning Project truly was a group effort. Contributors ranged from local and state governmental agencies to local producers. Each had specific contributions to make, and each offered valuable opinions and advice. (See Table 11 Partners and Stakeholders)

TABLE 11: PARTNERS AND STAKEHOLDERS

Partners and Stakeholders	Organization, Agency or Affiliation	Roles and Responsibilities
Michelle Huffman	Watershed Coordinator, Rabbit River Watershed Project (Upper Rabbit River project start through April 2002)	Coordinate meetings, incorporate comments and suggestions into the watershed plan, perform inventory, information and education, general watershed coordination
AnneMarie Chavez	Executive Director, Allegan Conservation District	General assistance, administrative support, ACD representative, watershed lobby,
Bruce Van Den Bosch	CREP and MAC Technician, Allegan Conservation District (Former director, ACD Board)	Agricultural BMPs assistance, general watershed knowledge, engineering support, meeting assistance
Carl Collier	Chair, Allegan Conservation District Board of Directors, Local landowner and watershed resident	Allegan Conservation District support, represent watershed at MACD meetings
Lon Koops	Natural Resource Conservation Service	Engineering support, technical support, general expertise
Diane Hornbrook	Watershed Coordinator, Rabbit River Watershed Project (effective July 2002)	Coordinate meetings, incorporate comments and suggestions into the watershed plan, information and education, implement BMPs, general watershed coordination
Paul Wylie	Agriculture Agent, MSU Extension	technical support, general expertise, information and education to agricultural community, workshops
Josh Appleby	MDA (formerly Groundwater Stewardship, Allegan Conservation District)	Liaison to MDA, MAEAP information, connections to producers and landowners
Robert Beck	Chair, Kalamazoo River Watershed Council, Local landowner and watershed resident	Lobby for watershed programs, I & E, represent watershed at other meetings, general expertise
Jack Vanderbaan	President, East Lake Association	Represent watershed at Lake Association meetings
Bill Wykhuis	Kalamazoo River Protection Association	Represent watershed at other meetings, facilitate cross-organization communication
Dayle Harrison	Kalamazoo River Protection Association	Represent watershed at other meetings, facilitate cross-organization communication
Jenny Molloy	MDEQ SWQD, Grant Administrator	DEQ representative, equipment access, watershed, 319, and regulatory knowledge, general expertise
Ben Zimont	MDEQ, Permitting	Water quality expertise, informational assistance
Jay Wesley	MDNR Fisheries Department	Fisheries and water quality expertise, informational assistance
Charles Barr	Groundwater Education in Michigan Program, WMU	Represent watershed at other meetings, facilitate cross-organization communication, I & E
Mark DeYoung	Allegan County Commissioner	County representative, parks representative, land-use planning and zoning perspective,
Bill Nelson	Allegan County Road Commission	Road side, roads, stream-road crossing expertise, possible CMI grant recipient, general expertise

Lynn Fleming	Allegan County Drain Commissioner	Drain and drainage expertise, county knowledge, county planning, eminent domain privileges, knowledge of erosion and sedimentation areas and problems
Becky Riniger	Allegan County Drain Office, Deputy Drain Commissioner	Drain and drainage expertise, county knowledge, county planning, eminent domain privileges, knowledge of erosion and sedimentation areas and problems
Chris Reinart	Monterey Township Supervisor	Land-use planning and zoning perspective, local knowledge, general expertise, representative to township meetings
Bob Jones	Salem Township Supervisor	Land-use planning and zoning perspective, local knowledge, general expertise, representative to township meetings
Mark Evans	Hopkins Township Supervisor	Land-use planning and zoning perspective, local knowledge, general expertise, representative to township meetings
Marie Whittemore	Wayland Township Parks and Recreation	Parks and recreation information, representative to city of Wayland, longtime watershed resident
Kevin Ricco	Director, Allegan County Parks and Recreation Commission	Parks and recreation information, representative to city and county of Allegan
Elise DeYoung	Dorr Township Parks	Parks and recreation knowledge and assistance
Stanley Weymouth	Sandy Pines, watershed resident	Water quality knowledge and monitoring, Sandy Pines knowledge and access
Jerry Black	Local landowner and watershed resident	Local knowledge and general expertise
Bernie Schwartz	Local landowner and watershed resident	Local knowledge and general expertise
Darwin Franklin	Local landowner and watershed resident	Local knowledge and general expertise
Henry Blaauw	Local producer and landowner	Local knowledge and general expertise, connections to other producers in the watershed
John Ybema	Dairy Farm and local landowner	Local knowledge and general expertise, connections to other producers in the watershed
Ray Shoemaker	Green Lake Stream Protection, local landowner	Local knowledge and general expertise
Walter Kozlowicz	Watershed resident	Local knowledge and general expertise
Leone Smith	East Lake, watershed resident	Local knowledge and general expertise
Roger Dixon	East Lake Association, watershed resident	Water quality sampling, Local knowledge and general expertise
Carolyn Dixon	East Lake Association, watershed resident	Water quality sampling, Local knowledge and general expertise
Gary and Kathy Syswerda	Watershed residents	Local knowledge and general expertise
Dellas Henke	Local landowner and watershed resident	Local knowledge and general expertise
Tim and Vicki Avery	Watershed residents	Local knowledge and general expertise
John Nowak	Local landowner and watershed resident	Local knowledge and general expertise
Stu Isenhoff	Local landowner and watershed resident	Local knowledge and general expertise
Claire Schwartz	Fishbeck, Thompson, Carr and Huber, consultants	Engineering knowledge, informational support, drain office liaison

Jim Soper	Water Pollution, Environmental Protection, City of Grand Rapids	Water pollution and protection information, representative to Grand Rapids, grants information
Sarah Alldering	AmeriCorps Groundwater Education	Groundwater and project information, general knowledge, I & E
Alicia Marie Belchak	AmeriCorps Groundwater Education	Groundwater and project information, general knowledge, I & E
Amy Oliver	Allegan Math & Science Center	Representative to the educational community, general educational knowledge, Student Stream Science Participant and Organizer, Curricula influence and experience
Martha Zettelmier	Teacher, Wayland SET Program	Student Stream Science Participant, group leader, Eco-Expo organizer and connections, educational knowledge
Students (over 200)	Local School Districts	Sample macroinvertebrates, provide educational connections, target audience for information and education programs
FORMERLY ACTIVE:		
Tim Redder	Watershed Coordinator (former), Rabbit River Watershed CWAP Implementation	319 experience, general watershed knowledge, Agricultural BMPs assistance
Jennifer Boice	Forestry/Wildlife, Allegan Conservation District	Forestry and wildlife information, species details, general knowledge
Jon VenDenend	Watershed Coordinator, Pigeon Creek Watershed Project	319 experience, general watershed knowledge
Chris Sweir	AmeriCorps Groundwater technician	Groundwater information and education, general knowledge, educational support
Jessica Hackman	CREP and MAC Technician	Agricultural BMPs assistance

Existing Projects and Efforts that Affect Water Quality

Several water quality initiatives are being implemented in the area. The Kalamazoo River Watershed has been designated as an Area of Concern (AOC). A Remedial Action Plan has been developed for the Kalamazoo River Watershed Area of Concern. A Total Maximum Daily Load Project is underway for Lake Allegan, an impoundment of the Kalamazoo River Watershed upstream of the confluence of the Rabbit River. The Rabbit River Watershed is a sub-watershed of the Kalamazoo River Watershed, and its vitality is relevant to the entire Kalamazoo River Watershed. A Clean Water Action Plan grant for the Rabbit River Watershed is currently in the final stages of implementation. The Little Rabbit River Watershed (LRRW) project, a sub-watershed of the Upper Rabbit River Watershed, was selected as a success story in a report to the President to demonstrate the effectiveness of partnerships and maximizing federal funding sources such as EQIP.

The Rabbit River Watershed Project will also make maximum use of federal fund sources. The Rabbit River Watershed is a designated EQIP priority area, and has funds available to install a variety of BMPs to reduce nonpoint source pollution. The Rabbit River Watershed also has been designated as a PL-566 watershed, which will increase partnership opportunities with NRCS, as well as provide additional funds and resources for watershed treatments and improvements. Conservation Reserve Program (CRP) funds are also available, and members of the Rabbit River Watershed Steering Committee, and the Allegan Conservation District are making excellent progress towards encouraging the addition of the Kalamazoo River Watershed, and the Rabbit River Watershed in the

Enhanced CRP program, or CREP. These sources of additional funding will maximize the effectiveness of the project, and the steering committee and watershed coordinator's efforts.

Other active organizations in the Rabbit River Watershed:

Kalamazoo River Watershed Council
Kalamazoo River Protection Association
East Lake Association
Many Parks and Recreation Groups

EVALUATION

One of the sub-goals of the watershed, although no less important than the major goals, is to perform a thorough and effective evaluation on the project. Evaluating the watershed project will allow participants to judge the effectiveness of the plan in addressing watershed goals. Evaluation helps steer the project, and will single out things that work, and things that fail. Evaluation provides a means to quantify the actions, and will be useful for future projects.

To evaluate the Rabbit River Watershed Implementation project and accomplishments, we will use several different methods, each specific to the particular goal or task it is evaluating. The first is to evaluate the performance of installed Best Management Practices.

Best Management Practices are intended to reduce or eliminate non-point source pollution. While detailed chemical or sedimentary analysis is impractical at this time, several methods have found success in other projects, and will be useful to tools to determine the effectiveness of the Best Management Practice's performance. The first is to meet with landowners who have been observing the BMPs, and will know what parts are functioning adequately, and what needs to be repaired or maintained. Pollutant reduction calculations based on NRCS specifications and the Universal Soil Erosion Loss equation will quantify the amount of non-point source pollution prevented from entering surface water. Before and after photographs of implemented BMPs will allow qualitative comparisons on each site.

As part of the land-use planning process, township "status" will be investigated to determine baseline of planning documents, ordinances, and zoning. To accomplish this evaluation, copies of initial master plans, ordinance and zoning will be analyzed. Regular meetings and communications will take place between watershed coordinator, townships, local planning organizations, and contracted professional planners. This analysis will be compared to the status of master plans, zoning and ordinances at the end of the project, producing a quantitative result.

To evaluate the success of the Information and Education part of the implementation project, especially the targeted outreach to secondary educational community, the number of students involved in macroinvertebrate sampling program and the number of sites sampled as representative of the watershed will be reported. Success will be shown by a steady increase in student, educator and faculty participation, and an increased number of sites sampled in the Watershed. In addition, as increased awareness of watershed and water quality issues begins to grow, other communities, watersheds, and education organizations will become involved, thus spreading the effects beyond the watershed.

In addition to these evaluation methods, other tools will be used as deemed necessary. The Rabbit River Watershed Steering Committee will be apprised of project status at meetings and will make use of evaluation data to adjust the implementation project as necessary.

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