

1 Introduction

The Paw Paw River Watershed (PPRW) is all of the land that drains into the Paw Paw River. Wetlands, lakes, streams, other surface water bodies on this land and groundwater are also part of the watershed. Water is a critical resource for recreation, irrigation, and increasing the value of adjacent real estate. These uses depend on good water quality, but they can also be a threat to it.

A watershed is all of the land that drains into a common body of water. Watersheds surpass political boundaries and connect communities with a common resource.

The PPRW is a priority for protection and preservation among southern Michigan watersheds because a relatively high percentage of its natural land cover remains in spite of increasing development pressure throughout the region. The PPRW Management Plan is intended to guide individuals, businesses, organizations and governmental units working cooperatively to ensure the water and natural resources necessary for future growth and prosperity are improved and protected. It can be used to educate watershed residents on how they can improve and protect water quality, encourage and direct natural resource protection and preservation, and develop land use planning and zoning that will protect water quality in the future. Implementation of the plan will require stakeholders to work across township, county, and other political boundaries.

Chapters 2 and 3 of the management plan provide an overview of the watershed. Chapter 4 outlines the role governmental units play in protecting water quality. Chapter 5 describes the natural features of the watershed. The process used to develop the plan is reviewed in Chapter 6. Chapter 7 summarizes water quality throughout the watershed and Chapter 8 prioritizes the areas, pollutants and sources impacting it. Chapter 9 offers goals for the watershed and Chapter 10 provides strategies for achieving them. Lastly, Chapter 11 suggests a strategy for evaluating the progress toward the goals of the plan.

Watershed management involves identifying and prioritizing problems, promoting involvement by stakeholders, developing solutions and measuring success through monitoring and data collection.

The State of Michigan protects all water bodies for designated uses such as water supply, fisheries and for partial and total body contact for recreation. This management plan was created as part of the PPRW planning project, which was funded with a Clean Water Act Section 319 grant administered by the Michigan Department of Environmental Quality (MDEQ), Nonpoint Source Program. The Southwest Michigan Planning Commission in collaboration with several partners was awarded the grant in January of 2006. Development of the PPRW Management Plan relied heavily on stakeholder input and agency support, as well as professional services and other partnerships. The overall health of a river system can be difficult to determine. Characterizations and recommendations in this plan are based on the best available data.

2 Watershed Description

2.1 Geography

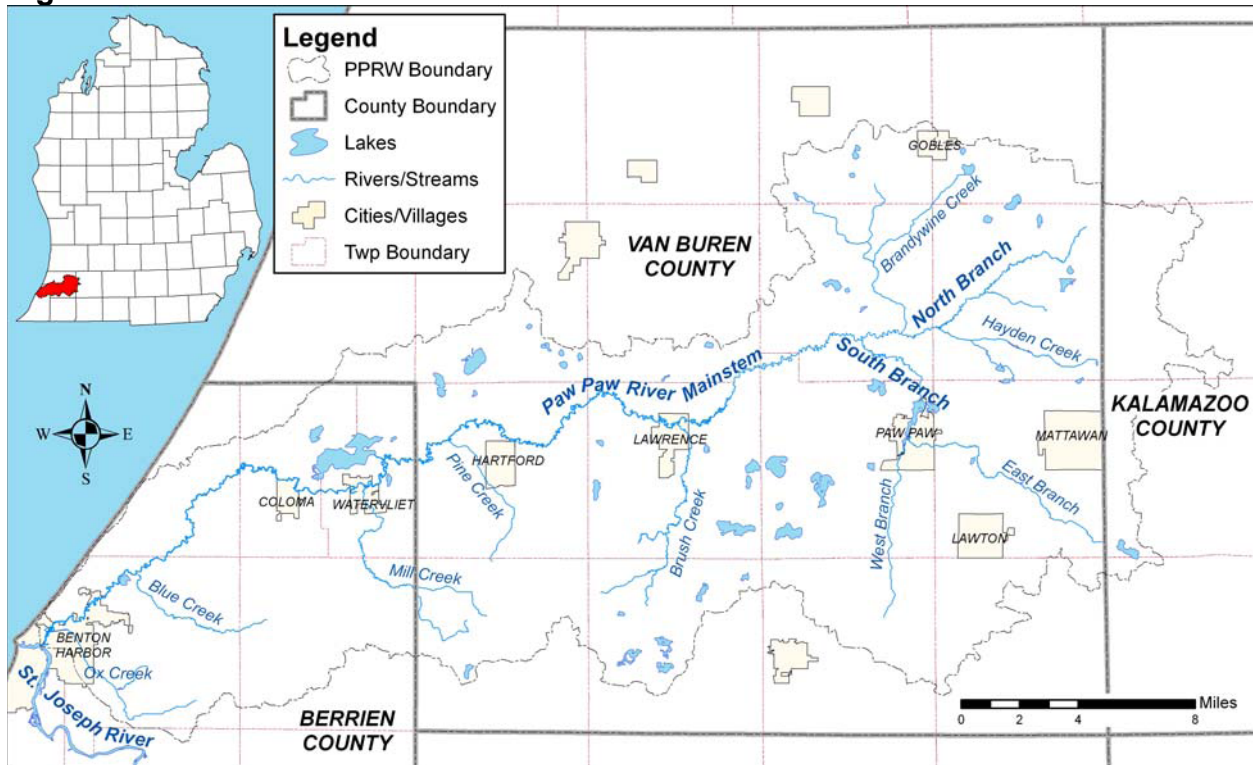
The term watershed describes an area of land that drains down slope to the lowest point. It includes all of the land, in which any drop of water falling within it, will leave in the same stream or river. Watersheds can be large or small and can traverse county, state or national boundaries. Every stream, tributary or river has an associated watershed; and small watersheds join to become larger watersheds. For example, within the Great Lakes watershed, the PPRW is part of the St. Joseph River watershed, which is part of the larger Lake Michigan watershed.



Pennsylvania Department of Environmental Protection

The Paw Paw River flows westward through southwestern Lower Michigan before joining the St. Joseph River and emptying into Lake Michigan near the City of Benton Harbor. The PPRW encompasses approximately 285,557 acres (446 square miles) in Kalamazoo, Van Buren and Berrien Counties with the largest portion in Van Buren County (203,720 acres). In the eastern portion of the watershed, the North Branch joins the South Branch to become the mainstem of the Paw Paw River. Other significant tributaries include Brandywine Creek, Hayden Creek, the East Branch, the West Branch, Brush Creek, Pine Creek, Mill Creek, Blue Creek and Ox Creek. The total length of the Paw Paw River and these significant tributaries is approximately 145 miles. The PPRW includes 5,818 acres of lakes and ponds.

Figure 1. Paw Paw River Watershed



Watersheds are typically identified by Hydrologic Unit Codes (HUCs). HUCs were developed by the United States Geologic Society to provide official boundaries for watersheds. HUCs identify a geographic area, which includes part or all of a surface drainage basin. The United States is divided into successively smaller hydrologic units. The units are classified into six levels starting with large areas such as the Great Lakes Region (2-digit) down to small areas like the Brandywine Creek subwatershed (14-digit). Often for management purposes, agencies focus on the smaller 14-digit HUC subwatershed level.

Each subwatershed has slopes, soils and other conditions, which direct runoff to the Paw Paw River or one of its tributaries. Figure 2 identifies the 17 subwatersheds (14-digit HUCs) of the PPRW. Table 1 lists the acreage and 14-digit HUC for each subwatershed, as well as, the percentage of each governmental unit included in the subwatershed. Throughout the plan, the HUCs are labeled as subwatersheds 1-17 and the HUCs are not referenced except for in Table 1. The specific water bodies located in each subwatershed can be found in Table 8 (major streams) and Table 9 (lakes).

Figure 2. Subwatersheds of the Paw Paw River

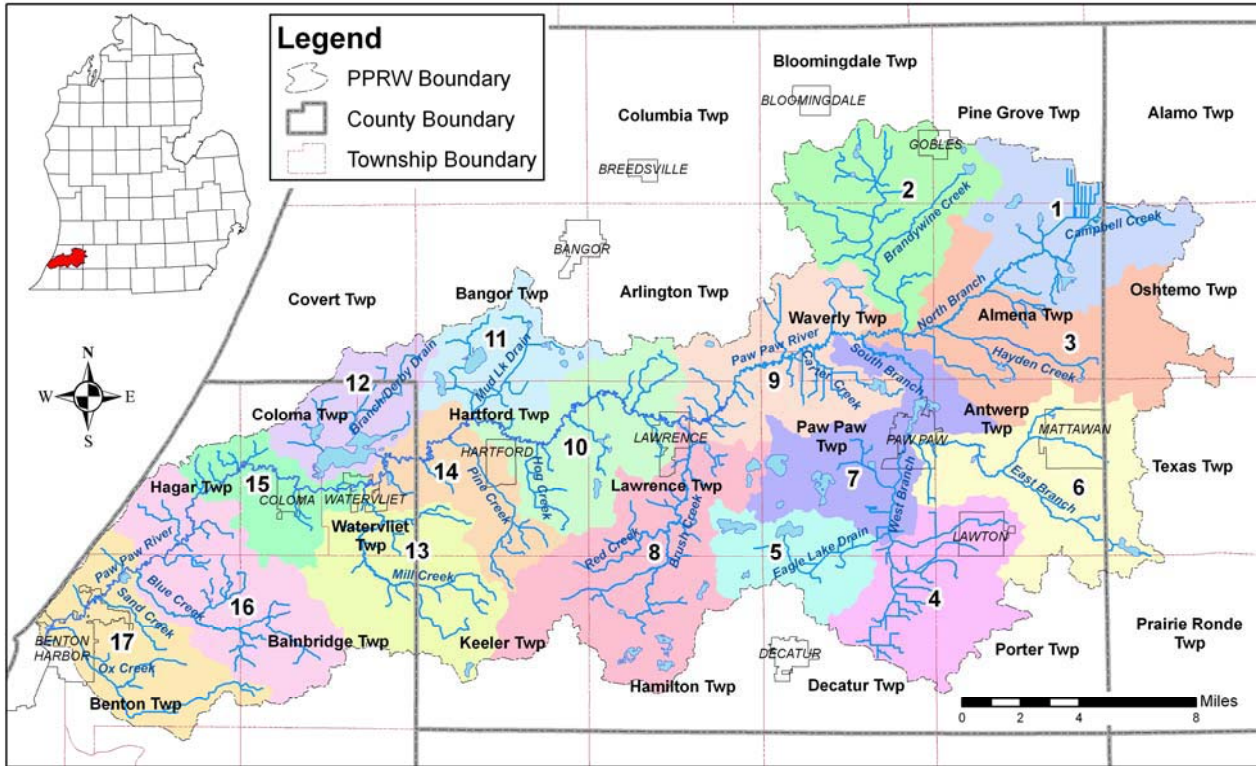


Table 1. Paw Paw River Subwatersheds

Map ID #	14-Digit HUC* (subwatershed name)	Total Area (Acres)	Governmental Units (% of Subwatershed)
1	04050001260010 (Campbell Creek and North Branch)	17,204	Almena Twp (53.45%), Oshtemo Twp (24.68%), Pine Grove Twp (21.53%), Alamo Twp (.34%)
2	04050001260020 (Brandywine Creek)	19,718	Waverly Twp (43.54%), Bloomingdale Twp (37.03%), Pine Grove Twp (12.09%), Almena Twp (4.83%), Gobles (2.51%)
3	04050001260030 (Hayden Creek and North Branch)	23,844	Almena Twp (50.30%), Oshtemo Twp (25.13%), Antwerp Twp (11.73%), Waverly Twp (7.65%), Texas Twp (5.19%)
4	04050001260040 (Lawton Drain and West Branch)	16,767	Decatur Twp (40.21%), Porter Twp (31.76%), Antwerp Twp (11.29%), Lawton Village (9.11%), Paw Paw Twp (7.63%)
5	04050001260050 (Eagle Lake Drain)	9,733	Decatur Twp (36.86%), Paw Paw Twp (31.98%), Lawrence Twp (18.32%), Hamilton Twp (12.85%)
6	04050001260060 (East Branch)	21,636	Antwerp Twp (54.54%), Texas Twp (18.02%), Mattawan Village (12.17%), Porter Twp (7.68%), Prairie Ronde Twp (2.66%), Paw Paw Twp (2.44%), Paw Paw Village (2.41%), Almena Twp (.07%)
7	04050001260070 (Maple Lake and South Branch)	16,875	Paw Paw Twp (67.57%), Waverly Twp (12.40%), Antwerp Twp (9.93%), Paw Paw Village (7.63%), Lawrence Twp (1.55%), Almena Twp (.91%)
8	04050001270010 (Brush Creek)	26,322	Hamilton Twp (40.23%), Lawrence Twp (36.55%), Keeler Twp (19.28%), Hartford Twp (1.92%), Lawrence Village (1.50%), Paw Paw Twp (.51%)
9	04050001260080 (Carter Creek and Mainstem)	18,907	Waverly Twp (38.20%), Paw Paw Twp (28.39%), Lawrence Twp (19.23%), Arlington Twp (13.63%), Lawrence Village (.54%)
10	04050001270020 (Hog Creek and Mainstem)	17,908	Hartford Twp (44.52%), Lawrence Twp (36.05%), Arlington Twp (12.83%), Lawrence Village (3.69%), Hartford City (1.73%), Bangor Twp (1.18%)
11	04050001270030 (Mud Lake Drain)	10,044	Bangor Twp (66.2 %), Hartford Twp (24.79 %), Pokagon Band of Potawatomi Indians (6.65 %), Arlington Twp (2.36 %)
12	04050001270040 (Paw Paw Lake)	10,280	Coloma Twp (41.70%), Watervliet Twp (33.87%), Covert Twp (18.59%), Bangor Twp (4.58%), Hartford Twp (1.25%), Watervliet City (.01%)
13	04050001270050 (Mill Creek)	18,499	Bainbridge Twp (35.11%), Keeler Twp (34.54%), Watervliet Twp (16.63%), Hartford Twp (10.83%), Watervliet City (1.98%), Coloma Twp (.91%)
14	04050001270060 (Pine Creek and Mainstem)	11,958	Hartford Twp (64.13 %), Watervliet Twp (16.38 %), Keeler Twp (8.18 %), Hartford City (5.67 %), Pokagon Band of Potawatomi Indians (4.55 %), Watervliet City (1.09 %)
15	04050001270070 (Ryno Drain and Mainstem)	9,732	Coloma Twp (55.39%), Hagar Twp (24.08%), Watervliet Twp (7.76%), Coloma City (5.85%), Bainbridge Twp (4.00%), Watervliet City (2.93%)
16	04050001270080 (Blue Creek and Mainstem)	20,720	Bainbridge Twp (40.42%), Benton Twp (30.97%), Hagar Twp (27.63%), Coloma Twp (.98%)
17	04050001270090 (Ox Creek and Mainstem)	15,421	Benton Twp (77.03%), Benton Harbor (14.12%), Hagar Twp (3.90%), Bainbridge Twp (3.04%), Sodus Twp (1.23%), St. Joseph City (.67%)

*HUC – Hydrologic Unit Code (Also see Tables 8 and 9 for water bodies in each subwatershed.)

2.2 Climate

The proximity of the PPRW to Lake Michigan and prevailing westerly winds moderate the climate and produce lake effect precipitation during the fall and winter months. The climate is also influenced by the Maritime Tropical air mass, which tends to be a relatively warm and humid air mass. The average growing season (consecutive days with low temperatures greater than or equal to 32 degrees) is 148 days. Total annual precipitation is approximately 38.3 inches including approximately 81 inches of snowfall. (Berrien & Van Buren Soil Surveys) According to the National Climatic Data Center, the average winter temperature in Benton Harbor was 26.56 degrees F and the average summer temperature was 68.93 degrees F from 1971 to 2000.

The PPRW lies within the Southern Michigan, Northern Indiana Till Plains (SMNITP) ecoregion. Ecoregions are delineated by their climates, soils, vegetation, land slope and land use. The Paw Paw River is typical of rivers in the SMNITP ecoregion in that it: 1.) has good quality headwaters, 2.) is generally slow flowing, and 3.) is often bordered by extensive wetlands. Ditching and channelizing has been used throughout this ecoregion to drain areas that are too wet for settlement and agriculture. The PPRW is a priority for conservation because it contains more wetland and natural stream channel than many other rivers in the SMNITP ecoregion. (Chapter 6, MDEQ Integrated Report 2006)

2.3 Geology, Hydrology and Soils

The geological features, hydrology and soils of the PPRW combined with the current lack of impervious surface and abundance of intact natural land cover make the Paw Paw River one of the most hydrologically stable river systems in southern lower Michigan.

Geology and Hydrology

Virtually all of Michigan's topography and hydrology has been influenced by glacial action. Repeated advances of continental ice sheets eroded the pre-existing rock and soils and then re-deposited these materials as sediments as the ice advanced, melted and retreated during several cycles. These glacial materials were deposited as sands, gravels, silts and clays, as well as various mixtures, and vary in thickness within the watershed area from approximately 130 feet to over 400 feet. Ice movement and its meltwater influenced the patterns and distributions of various landforms, such as moraines and stream valleys. The meltwater created large rivers, which deposited glacial materials throughout the region. These glacial deposits and their associated landforms provide a foundation for the hydrology, soil types and land cover that exist today.

Soils

The National Cooperative Soil Survey publishes soil surveys for each county within the U.S. These soil surveys contain predictions of soil behavior for selected land uses, and also highlight limitations and hazards inherent in the soil, general improvements needed to overcome the limitations, and the impact of selected land uses on the environment. The soil surveys are designed for many different users. Planners, community officials,

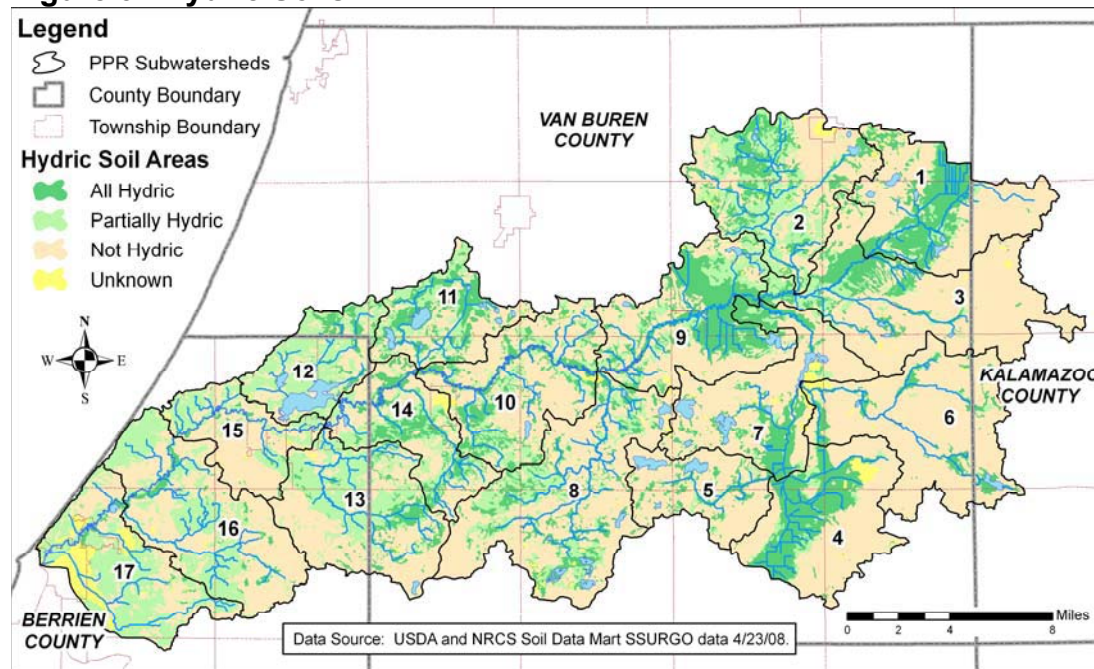
engineers, developers, builders, etc., use the surveys to help plan land use, select sites for construction, and identify special practices needed to ensure proper performance.

Hydrologic soil groups can help determine, which portions of the watershed are more important for groundwater recharge. The upper and middle sections of the PPRW are mostly made up of Group A soils. Group A soils are mostly sandy and loamy types of soils with a low runoff potential and high infiltration rate even when thoroughly wetted. These coarse soil types allow water to infiltrate and recharge the groundwater supply. As a result of these soils and a relative lack of impervious surface, the Paw Paw River system receives moderate groundwater inputs. Groundwater inputs are important for maintaining stream temperatures and flow throughout the system. The lower sections of the watershed mostly consist of Group C soils. Group C soils are sandy clay loam with a low infiltration rate when thoroughly wetted. (St. Joseph River Assessment, 1999) Protection of areas with high infiltration capacity (Group A soils) is important for maintaining hydrology and temperature regimes within the watershed.

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Another important characteristic of soils is whether they are considered hydric. Hydric soils are defined as poorly or somewhat poorly drained soils. These soils are one of the indicators of wetlands, but many have been drained for building or agricultural purposes. Although wetland regulations do not apply to all hydric soil areas, they are poorly suited for development, especially for septic fields. Septic systems installed in areas with unsuitable soils are prone to failure, which can lead to nutrient and bacteria pollution of groundwater and surface water. Figure 3 shows the hydric and partially hydric soils in the PPRW, which are mostly found in the eastern part of the watershed in low-lying areas and along river and stream segments.

Figure 3. Hydric Soils



2.4 Land Cover

Prior to European settlement in the early-to-mid-1800's, much of the PPRW was forested. Beech-sugar maple forests were dominant, and oak-hickory forests, mixed hardwood swamps, mixed conifer swamps, white pine-mixed hardwood forests, and black ash swamps were all represented. There were openings in the forest as well, consisting primarily of mixed oak savanna and open wetlands.

Today, natural land cover in the PPRW has become fragmented by agricultural practices, as well as residential and commercial development. However, despite the increasing pressure from these competing land uses, significant portions of natural land cover remain. The forested floodplain corridor along the main stem of the Paw Paw River from Benton Harbor to the Village of Paw Paw in particular remains largely intact.

As seen in Figures 4 and 5 and Table 2, the watershed contains mostly agricultural (47%) and natural (45%) land cover. In Table 3, the amount of land cover (urban, agricultural, natural and other) is listed for each subwatershed. Subwatersheds 15 and 17 have the highest percentage of urban land. Subwatersheds 5 and 13 have the highest percentage of agriculture. Subwatersheds 1, 3 and 6 (the headwaters) have the highest percentage of natural land cover. Detailed land cover by subwatershed can be found in Appendix 1.

Preservation and restoration of natural land cover, as well as proper management of agricultural lands, will be critical to protecting and improving water quality in the PPRW.

The relatively high percentage of natural land cover in the PPRW is threatened by increasing development pressure. An estimated 50% of wetlands have been lost in the PPRW in the last 200 years. Preservation and restoration of natural land cover, as well as proper management of agricultural lands will be critical to protecting and improving water quality in the PPRW.

Table 2. Paw Paw River Watershed Land Cover (2000)

Land Cover Category	% of Watershed	Area (acres)
Low Intensity Urban	1.91%	5,468
High Intensity Urban	0.87%	2,488
Airports	0.08%	234
Roads/Paved	4.12%	11,775
Total Urban	6.99%	19,965
Non-vegetated Farmland	0.24%	680
Row Crops	15.14%	43,241
Forage Crops	21.99%	62,789
Orchards/Vineyards/Nursery	10.22%	29,179
Total Agriculture	47.59%	135,889
Upland Open Land	9.75%	27,848
Upland Forest	20.02%	57,184
Lowland Forest	8.23%	23,501
Wetland	6.09%	17,383
Water	1.02%	2,912
Total Natural	45.11%	128,828
Other/Unknown	0.31%	886
Total Watershed		285,568

Figure 4. Land Cover in the Paw Paw River Watershed (percent)

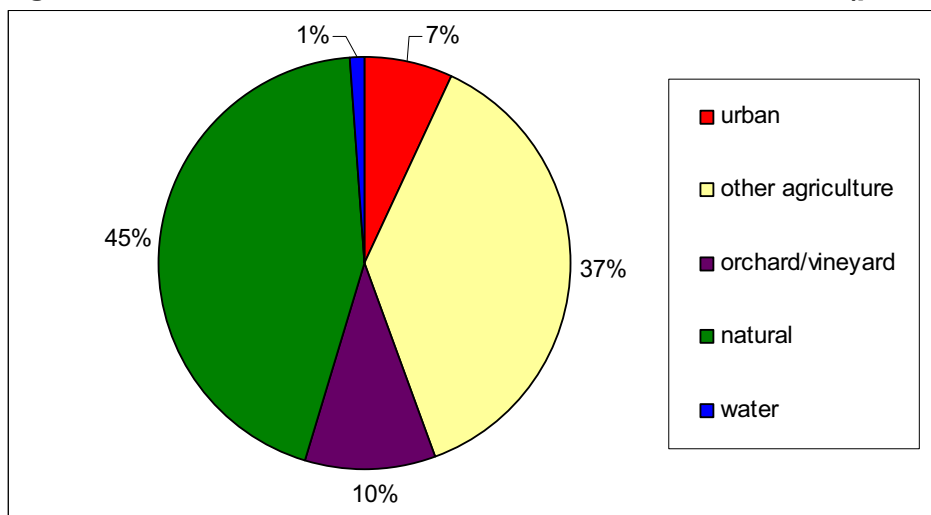


Figure 5. Paw Paw River Watershed Land Cover (2000)

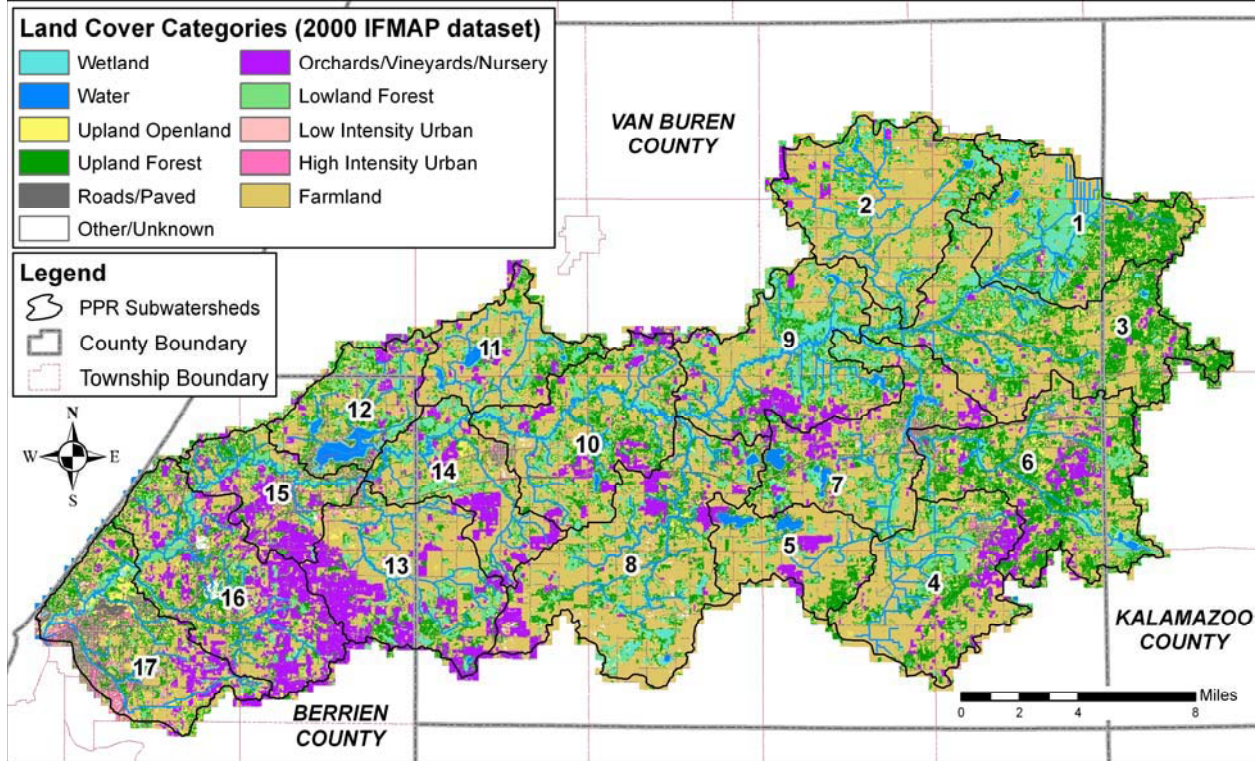


Table 3. Generalized Land Cover by Subwatershed (2000)

Sub watershed ID#	Urban		Agricultural		Natural		Other/Unknown	
	% of WS	Acres	% of WS	Acres	% of WS	Acres	% of WS	Acres
1	3.42%	589	31.13%	5,355	65.43%	11,257	0.02%	3
2	4.48%	883	55.62%	10,968	39.79%	7,845	0.11%	22
3	4.87%	1,162	38.04%	9,070	57.05%	13,603	0.04%	9
4	4.92%	825	54.40%	9,121	40.59%	6,806	0.09%	15
5	3.64%	354	65.18%	6,344	31.08%	3,025	0.10%	10
6	7.65%	1,656	34.87%	7,544	57.37%	12,412	0.11%	24
7	8.69%	1,467	45.13%	7,615	45.99%	7,761	0.19%	32
8	4.50%	1,184	56.68%	14,918	38.12%	10,035	0.70%	185
9	3.05%	577	45.99%	8,696	50.94%	9,631	0.02%	3
10	5.48%	982	47.86%	8,570	46.42%	8,312	0.25%	44
11	3.89%	391	53.51%	5,375	42.49%	4,268	0.10%	10
12	9.70%	997	36.16%	3,717	54.03%	5,554	0.12%	12
13	5.12%	947	65.80%	12,172	28.94%	5,354	0.14%	26
14	7.38%	883	54.99%	6,576	37.30%	4,460	0.33%	39
15	13.67%	1,330	44.28%	4,309	41.63%	4,051	0.43%	42
16	7.85%	1,627	52.36%	10,848	38.49%	7,976	1.30%	269
17	26.66%	4,111	30.42%	4,691	42.01%	6,478	0.91%	141
Total	6.99%	19,965	47.59%	135,889	45.11%	128,828	0.31%	886

2.5 Dams and Barriers

Dams and barriers in the watershed pose issues with recreational use and also with the fragmentation of habitat. Dams can restrict the movement of fish in river systems. There are 22 registered dams in the PPRW. Many of these dams are obsolete (not serving any function) and they are generally low head and found in remote areas. Low head dams are artificial structures, which are less than 15 feet in height and extend across the river channel. There are no active hydroelectric dams; many of the dams are being used for recreational lake level control structures. (St. Joseph River Assessment, 1999) The Michigan Department of Natural Resources, U.S. Fish and Wildlife Service, Berrien County, Watervliet City, The Nature Conservancy and the Southwest Michigan Planning Commission have been partners on an effort to remove a dam on the Paw Paw River east of Watervliet City. This project will eliminate the only major barrier on the Paw Paw River mainstem.