

SHIATOWN DAM ASSESSMENT: GUIDING A COMMUNITY DECISION FOR ACTION

PREPARED FOR:

FRIENDS OF THE SHIAWASSEE RIVER

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Abstract

The Shiatown Dam is in disrepair and potentially threatens life and property. It nearly failed during a high water event in February 2001. Shiatown Dam is a run-of-the-river structure in the Shiawassee River, a low gradient, warm water river that drains 1260 square miles of central Michigan. The dam no longer serves an economic purpose, and many of the recreational benefits of the impoundment have disappeared as a result of dam deterioration, sedimentation and poor water quality. County residents and the owner, the Michigan Department of Natural Resources, agree that action is necessary to prevent failure of the dam and to restore the value of the site. We defined the relative merits of dam repair, replacement, and removal by conducting ecological, social, and economic assessments at local and watershed levels. The cornerstone of our social assessment was a mail survey of 1500 people with a 43% response rate. Respondents greatly value the dam and river for historic significance and passive recreational opportunities. Survey results show 78% support restoring the dam despite known problems at the site. The Michigan Department of Environmental Quality, dam safety regulator for the state, has recommended major repairs for all parts of the dam. On average, \$12,000 annually has been spent on reactive repairs over the last 30 years; no funds have been available for preventative maintenance. Issues to consider in any decision about the dam include an unknown amount of PCB contamination in the sediment, human safety, recreational opportunities, historical preservation, aesthetic value, ecological impact and cost. Opportunities exist to increase public education and to improve the adjacent county park. We describe and recommend a collaborative decision process for stakeholders to undertake to reach a decision on the dam. Our project conducted a design charette to demonstrate one creative approach to envisioning a positive future at the site. Our client, Friends of the Shiawassee River, has agreed to initially lead a collaborative process.

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Chapter 1: Shiatown Dam Assessment

The Shiatown Dam has been a community landmark in Shiawassee County for more than a century. Over the years, the structure and its adjacent millpond have served a variety of functions, from power generation to recreation to wildlife habitat. While these uses have evolved over time, the site has remained a well-known feature in Shiawassee County.

In recent years, the future of the Shiatown Dam has become a concern for the many groups and individuals involved with its management and use. As with any building or structure, time has taken its toll on the Shiatown Dam. The structure has not produced power or been regularly maintained for over 50 years. The dam failed during a high water event in 1974 and came very close to failing in 1981 and 2001. Many of the recreational benefits of the impoundment have disappeared in recent years as a result of dam deterioration, sedimentation, and poor water quality. Most seriously, at least five people have drowned at the dam over the past 20 years.

County residents and the current owner of the Shiatown Dam, the Michigan Department of Natural Resources, agree that action at the site is necessary to lessen the risk of a catastrophic failure and to restore the value of this unique site. The dam must be repaired, replaced, or removed. Each option, however, brings different costs and benefits for the local community and the Shiawassee River. Each option also brings potential controversy and raises questions about the long-term future of the site.

This report is intended to support the community in making an informed and collaborative decision about the future of the Shiatown Dam. This report does not recommend a specific outcome at the Shiatown Dam site. Instead, it strives to establish social, economic and ecological contexts for the decision; and describes potential costs and benefits of four currently identified options. We gathered this information over the past year, with help from the Friends of the Shiawassee River, citizens and leaders of Shiawassee County, and literature review. Finally, this report suggests a decision-making process designed to reduce controversy, generate new and better options, and achieve maximum benefits for all of the parties involved.

Major sections of this chapter are:

- Background on Friends of the Shiawassee River
- Description of the Shiatown Dam
- Shiatown Dam's Context: the River and Watershed
- Uses of the Shiatown Dam and Impoundment
- Issues and Interests at Shiatown Dam

- Opportunities at Shiatown Dam
- Options for Shiatown Dam
- How Should a Decision Be Made?

Our study utilized a number of different information-collecting techniques, which are referenced throughout the report. These methods included:

- *Meetings with Stakeholders and Client.* In March, 2002, we assembled a meeting of public agency representatives, elected officials, and other stakeholders to propose our project ideas and hear feedback on our potential contributions. We also met with members of the board of directors of Friends of the Shiawassee River several times throughout the project to report progress and gather suggestions.
- *Ecological and Socioeconomic Research.* During November 2002 – January 2003 we compiled ecological and socioeconomic information on the Shiawassee River watershed using historic documents, scientific journals, census data, and information collected from county and agency officials. This was the first stage of our project and laid the groundwork for each succeeding step.
- *Mail Survey of Shiawassee County Residents.* In January 2003, we sent a mail survey on community use and opinions of the Shiawassee River and the Shiatown Dam and Park to 1500 randomly selected county residents. We used the survey responses to determine the interests and concerns of general river users in any decision on the Shiatown Dam.
- *Design Exercise.* In January 2003 we conducted a one day design “charette.” Local residents and community leaders worked with a group of UM landscape architecture students to brainstorm potential design solutions for the Shiatown site. The exercise produced four different design concepts and uncovered a number of creative options.
- *Individual Interviews.* We conducted one-on-one interviews with a number of community leaders in Shiawassee County, including government officials, agency staff, businesspeople, and members of recreation groups.
- *Focus Groups.* In February, 2003, we convened three focus groups made up of political and business leaders, recreational users, and Shiatown residents. In conjunction with our interviews, the focus groups gave depth and clarity to the issues identified by survey respondents.

Background on Friends of the Shiawassee River

Friends of the Shiawassee River is a nonprofit organization based in Owosso, Michigan, that works to protect the Shiawassee River and improve awareness of the river's value as a natural and recreational resource. The organization includes approximately 200 members and is headed by an 18 member board of directors. The Friends host an annual river celebration, regular river cleanups, tree plantings, and other special events to boost public appreciation for the Shiawassee River's value. These community events usually involve more than 100 volunteers. Members of the organization are often involved in local monitoring and restoration activities in the mid-Shiawassee watershed. The organization also publishes a quarterly newsletter, the RiverView.

The three-part mission of the Friends is to:

- *Care for the River:* Maintain and improve the river's water quality, habitats and natural banks.
- *Enjoy the River:* Increase recreational access and responsible use of the river.
- *Share the River:* Enhance the community's appreciation and knowledge of the river, especially among youth.

Description of the Shiatown Dam

The Shiatown Dam is located on the Shiawassee River in central Shiawassee County, approximately 3½ miles southeast of the city of Corunna (Figures 1.1-1.2) The 19 foot high dam consists of three earthen embankments, a concrete spillway, and an abandoned powerhouse (Figures 1.3-1.5). The west or left embankment is approximately 300 feet long by 12-20 feet wide. The center embankment, located between the concrete spillway structure and the former powerhouse, is approximately 40 feet long. The east or right embankment is approximately 160 feet long and 12-20 feet wide. All three of the embankments are constructed of earth materials, including sand, silt, and clay. These embankments were built on top of an original rock and timber crib structure. The concrete spillway structure consists of four 20 foot wide bays separated by three 4 foot wide concrete weirs.

The Shiatown Dam currently operates as a run-of-the-river structure, which means that the flow of water through the dam is not formally regulated. Water passes over the dam's spillway and through the former powerhouse unimpeded, at a level determined by natural variation in the amount of water flowing in the river. Because Shiatown Dam does not have control structures in operation, it does not have any effect on flows in the river. The dam does not regulate water levels in the river, nor does it provide any degree of flood control for downstream areas.

The water impounded behind Shiatown Dam creates a small lake (Figures 1.6-1.7). As recently as the 1960s, this impoundment covered 123 acres.¹ From 1980 to 1990, the pool area shrank to approximately 75 acres because of sediment accumulation.² At present, the pond covers less than 50 acres.³

Since 1999, the Shiatown Dam has been owned by the Michigan Department of Natural Resources (DNR). The DNR is the state agency charged with stewardship of Michigan's natural resources and the provision of outdoor recreational opportunities. It acquired the Shiatown Dam as a tax-reverted parcel after the previous owner failed to pay state taxes on the property. While the DNR does oversee fisheries protection and recreation in Michigan, its mandate does not include the operation or maintenance of dams. The agency is guided by the seven-member, governor-appointed Natural Resources Commission and is funded by state general fund revenues, federal funds and a variety of restricted funds.

Understanding Dams

There is a great deal of variety in structures that are in place to store and regulate the flow of water in rivers. Broadly speaking, dams can be divided into those that store water and those that do not. Storage dams impound water in reservoirs for release according to other scheduled needs, such as power generation, agriculture, or flood control. Run-of-the-river structures do not regulate the flow of water. Water enters the impounded area at the same rate that it flows out over the dam or spillway, according to natural cycles of high and low water. These structures do not provide any degree of flood control.

It is difficult to say with certainty how many dams are present on Michigan's rivers. A variety of control structures have been built over the last two centuries, ranging from small rock and timber crib structures to large dams of earth and concrete. Formal records do not exist for many of these structures. The most extensive effort to catalog the dams in the United States is the National Inventory of Dams (NID), maintained by the US Army Corps of Engineers and the Federal Emergency Management Agency (FEMA). This database includes dams that are considered high-risk to downstream areas; dams that are larger than 6 feet with more than 50 acre-feet of storage; or dams that are larger than 25 feet with more than 15 acre-feet of storage. The NID identifies 880 dams in Michigan. However, a more comprehensive database compiled by the state of Michigan has identified more than 2,500 structures.⁴ Informal estimates suggest that there may be upwards of 3,000 dams in the state.

Dams can also be categorized according to the size of the structures and/or the amount of water stored behind them. The National Inventory of Dams effectively divides dams into two broad categories: those that are large enough to be included in the database – dams that are taller than 6 feet with more than 50 acre-feet of storage or taller than 25 feet with more than 15 acre-feet of storage – and those dams that are not large enough to be included in the database. In a comprehensive recent review of dams and dam removal, the Heinz Center (2002) categorized dams based on the amount of water that they stored: small (storage of 1-100 acre-feet), medium (100-10,000 acre-feet), large (10,000-1,000,000 acre-feet) and very large (1,000,000+ acre-feet).

Reflecting the national pattern of dam ownership, the majority of Michigan's NID-inventoried dams are in private hands (50%), with local municipalities controlling the next largest share of the structures (21%). The remainder of the dams in Michigan are owned by the state and federal governments (18%).

Description of the Shiatown Dam Site

The DNR property includes the dam and a small buffer of land around the structure. A detailed legal description of the dam property and its associated easements can be found in the deed of transfer for the property. The dam parcel is entirely surrounded by Shiatown Park, East and West, which is owned and operated by the Shiawassee County Parks and Recreation Commission. Together the two park parcels comprise 35 acres.⁵ (Figure 1.8). The park offers a picnic area, grills, shelter, drinking water, toilets, fishing, hiking/nature trail, nature study, playground, and canoeing.⁶ It currently has the most amenities of any Shiawassee County park. The park is bordered by Bancroft Road to the west, Bennington Road to the north, and Newberry Road to the east. The southern boundaries of the park are private properties. On the west side of the river the park property ends just past the left earthen embankment. On the east side of the river the park property extends further along the bank of the reservoir to a wooded private property.

History of the Dam

A dam was first built on the Shiatown site in 1840, and this structure powered multiple mills in the latter half of the nineteenth century. Portions of the original millrace are still visible today. The construction of the original dam followed a pattern of dam construction seen throughout the Midwestern United States. During European settlement of the region in the 19th century, rivers were the most abundant source of power for processing the grains produced in newly established agricultural areas. Dams were constructed to power small, riverside grain mills. In the 20th century railroads and trucking reduced the need for localized grain milling. Many of the mill dams were abandoned or converted to hydroelectric power generation.

In keeping with this pattern, the original Shiatown Dam was replaced in 1904 by the dam that still stands today. Shiawassee Light and Power Company built the structure for hydroelectric power generation and operated the facility until 1911. At that time the company sold the Shiatown Dam to Consumers Power Company (Jackson, MI). Consumers added five feet to the height of the dam and generated power at the site until the 1950s.

In 1955 Consumers transferred ownership to Shiawassee and Vernon Townships; nine years later Vernon Township transferred their share to Shiawassee Township. During this period Shiawassee County operated the dam and impoundment as a recreational facility, and in the late 1960s or early 1970s the county took over formal ownership of the site.

Shiawassee County operated the Shiatown Dam until 1986, when they sold the dam to the Grand River Power Company. This was the first of several ownership transfers to entrepreneurs hoping to restore hydropower generation at Shiatown Dam. A total of four start-up power companies

owned the dam between 1986 and 1999. It appears that none of these companies had assets beyond the dam itself, and during this period there is no documented maintenance of the dam. In 1999 the private owner of the dam defaulted on taxes and the Shiatown Dam reverted to state ownership, under the management of the DNR.

The result of numerous ownership changes at the Shiatown Dam has been a lack of maintenance for the past 30 years. The last documented concrete repairs to the dam occurred in the early and mid 1970s. In 2001 debris clogging the spillways nearly caused the dam to overtop, and later that year the DNR completed \$68,000 worth of emergency repairs as mandated by the Michigan Department of Environmental Quality's (DEQ) Dam Safety Program. There has been no additional maintenance at the dam since that time.

Timeline of Events Related to Shiatown Dam

1836 Shiawassee town is established.

1837 Michigan becomes a state.

1840 A wooden mill dam is constructed at the Shiatown site.

1904 The mill dam is removed and replaced by the current structure, built by Shiawassee Light and Power Company for hydroelectric power generation.

1911 The dam is sold to Consumers Power Company.

1928 Consumers Power Company raises the height of the dam by five feet.

1955 Consumers Power Company transfers ownership to Shiawassee and Vernon Townships and power generation ceases at the Shiatown Dam. Vernon transfers their share to Shiawassee Township in 1964. The county operates the dam for recreational purposes.

1973 Concrete repairs completed in the spillway and the powerhouse. New stoplogs are added. Total cost of repairs is \$36,000.

1974 Right embankment fails during a spring flood and is partially reconstructed.

Description of the Shiatown Dam Site

1975 Report finds that dam spillway capacity is reduced from 6200 to 3700 cubic feet per second by the stoplog system used to control reservoir levels. The county allocates \$9,600 to make the stoplogs operable but the spillway was still limited.

1976 The concrete apron is replaced. A water-formed cavern under the old apron had affected the stability of the dam.

- The outlet through the powerhouse is cleaned out and two steel outlet pipes six feet in diameter are installed.

- A legal lake level is established, raising the level of the reservoir to a point suitable for multiple types of recreation.

1981 During a high water event in October, the earthen dikes of the dam come within inches of overtopping. The dam's stop logs are erroneously down and the reservoir is impounding all the storm water. The volunteer fire department assists Shiawassee County staff in lifting the logs and remains to watch the conditions that night.

1984 The legal lake level is rescinded and all of the stoplogs are removed sometime during 1985 or 1986, drawing down the impoundment.

1986 Shiawassee County sells the dam for \$1,000 to Grand River Power Company, which hopes to resume power generation at the dam. This begins a series of transfers of ownership, all hoping to profit from power generation, that result in decay and complete abandonment of the Shiatown Dam.

1989 The dam is sold to Shiawassee River Power Company for \$2,500.

1993 Shiawassee River Power Company quit-claims the dam to Mackinac Generation, Inc. for \$100.

1996 Mackinac Generation, Inc. is sold in 1996 to a private individual for \$3,000.

1998 A 13 year old boy drowns after falling off of Shiatown Dam, the fifth drowning at the site in the last twenty years.

1999 May 4th. The dam tax-reverts to state ownership.

2001 The DNR spends \$68,000 for repairs recommended by the DEQ.

A 2001 near-failure of the Shiatown Dam was a galvanizing event in the history of the site that brought the issue of structural deterioration into the public eye. The dam nearly overtopped during a high water event on February 13, 2001, when rain combined with snow melt brought the river level to 7 feet 8 inches. The National Weather Service issued a flash flood watch, and at 9 p.m. the river was 2.5 inches from the top of the dam, with an additional 6 inch rise expected.⁷ Concern that the high water would wash out the earthen embankments brought three fire departments, sheriff's deputies, ambulance workers, city and township administrators, police and fire chiefs, the road and drain commissions, private excavators, and a Salvation Army disaster response team to the site.⁸ The workers dug a 75 foot long, 6 inch deep trench on the river's east side to relieve pressure on the dikes, and the Shiawassee County Road Commission used geotextile fabric and rocks to stabilize the channel. Crews also sandbagged the west dike. Fortunately, predicted rainfall held off and water levels dropped several inches in the impoundment by the following morning.

The Shiatown Dam in Context: The Shiawassee River and Watershed

The Shiatown Dam is located on the Shiawassee River, a low gradient, warm-water river that drains approximately 1260 square miles of central Michigan (Figure 1.9).⁹ Beginning in Oakland County, the Shiawassee River flows west and then north to a confluence with the Flint, Cass, and Tittabawassee rivers before ultimately draining into the Saginaw River and Saginaw Bay. The Shiawassee watershed includes portions of seven counties: Shiawassee, Livingston, Oakland, Genesee, Gratiot, Midland, and Saginaw (Figure 1.10). Major tributaries to the Shiawassee River include the South Branch Shiawassee River, Ore Creek, and the Bad River.¹⁰

The Shiawassee River's watershed has been described as two watersheds in tandem, with relatively pronounced differences in climate, landform, and natural character between the upper and lower basins.¹¹ The upper watershed generally includes rolling plains and hilly terrain along the Shiawassee River and its South Branch. The lower watershed encompasses a large, flat expanse of lake plain, drained by the Bad River and the lower Shiawassee River. The Shiatown Dam is located just below where the two basins are narrowly connected, in an area of rolling hills south and east of the Owosso-Corunna area.

The Shiawassee River can be broken into a number of river valley segments that each have distinct patterns of hydrology, geology, land cover, and channel shape (Figure 1.11).¹² The Shiatown Dam is located in the middle segment of the Shiawassee River, which stretches from Byron, where the South Branch joins the Shiawassee River, to just below Owosso, where the river enters the sandy lake plain region. This segment of the Shiawassee River is generally low gradient, with occasional moderate gradient reaches. In general, the Shiawassee River is runoff driven with moderate baseflow and fair peak flows. The middle segment of the river receives less groundwater than the upper reaches of the river, and less runoff than the lower segments. The bed of the river in this area is typically sand, cobble, and small gravel. Although the landscape around the middle segment of the Shiawassee River is largely devoted to agriculture, a wooded buffer is present along most of the river (Figure 1.12).

Numerous dams exist along the length of the Shiawassee River and on many of its tributaries. In addition to the Shiatown Dam, the middle segment of the river is dammed at Corunna and Owosso. The Shiatown Dam is the only dam between Corunna and Byron, and the first barrier downstream from the South Branch Shiawassee River.

The middle segment of the Shiawassee River generally supports diverse and stable cool- and warm water fish communities. Surveys of the Shiawassee River conducted by the DEQ and DNR in 1995 and 2000 provide some information on the condition of the middle segment of the river. In 1995, the fish community was rated as excellent at two sites in the middle segment, one approximately 10 miles upstream of the dam site and one located a few miles downstream of the dam.¹³ Fish sampled at these sites included popular sportfish like smallmouth bass, northern pike, and rock bass. The sites also included species that are generally intolerant of poor water quality, such as northern hog sucker, river chub, and rainbow darter.

Fish populations in the Shiatown Impoundment have not been formally surveyed; the DNR was unable to proceed with data collection planned by for 2002 because of low water levels in the impoundment. In the past, the impoundment has been identified as supporting fish species typical of the Shiawassee River, including smallmouth bass, rock bass, northern pike, and sunfishes.¹⁴ Largemouth bass, a typically lake-dwelling species, have also been reported in the impoundment and in areas immediately downstream of the dam. The diminished water level and elevated water temperature in the impoundment have reduced its value as habitat for cool water, riverine fish like smallmouth bass. Anecdotally, the site is presently dominated by fish species more tolerant of slower, warmer environments, such as common carp and sunfishes.

Geology, Topography, and Soils of the Shiatown Site

Like all of Lower Michigan, the landscape around the Shiatown site is a product of the action of glaciers moving across the earth's surface at the end of the last Ice Age. As the climate warmed between 20,000 and 10,000 years ago, the glaciers that covered the region receded to the north. The central portion of the Shiawassee watershed was covered by the Saginaw Lobe, one large arm of the Wisconsinian Glacier that reached down over Lower Michigan. The retreat of the Saginaw Lobe left an undulating plain of rock, earth and debris known collectively as till. This rolling landscape is punctuated by occasional moraines, ridges of material that were deposited at the margins of the retreating ice sheet each time it stopped. The till plains are also crossed by sandy outwash deposits left by the melting water that flowed off the glaciers and across the landscape.

The upper and middle Shiawassee River and many of its tributary streams generally flow in the channels of outwash materials, with occasional cuts across areas of end moraine. Prehistorically, the Shiawassee River flowed to the west, following an outwash channel into the Looking Glass River, and, ultimately, into Lake Chicago, the predecessor of Lake Michigan. The retreat of the Saginaw Glacial Lobe and the emergence of prehistoric Lake Saginaw

eventually drew the river across the Portland Moraine, a distinct area of medium textured glacial material that forms a low hilly area. After cutting through this moraine, the Shiawassee River followed another outwash channel to the west to the Maple River and into Lake Chicago. Eventually, the river was drawn through one more moraine ridge between what are now the towns of Corunna and Vernon and into its current course down across the Saginaw Lake Plain.¹⁵

The Shiatown Dam site is located on the northern edge of the Portland Moraine, a low hilly area of medium textured glacial till that originally diverted the Shiawassee's flow into the Looking Glass River (Figure 1.13). An area of sandy outwash deposits is located immediately below the dam site. As the Shiawassee River flowed through the area, it carved into the moraine, forming a relatively distinct valley with a low bluff on the western edge and a clear rise along the east. This small, relatively confined valley, combined with a slightly steeper stretch of river, presented early settlers in this flat country with a natural site for a dam.

The soils in the Shiatown area have also influenced how the natural character and human use of the site have evolved over time. The soils in this area generally consist of well drained to poorly drained loamy soils on till plains and moraine ridges. In particular, the area immediately around the Shiatown Dam and its impoundment is characterized by loamy soils that support agricultural use in flatter areas. The soils are generally well suited to agriculture in flat areas, but susceptible to erosion on steep slopes and hills. Reflecting the underlying glacial landscape, many of the areas immediately around Shiatown are relatively higher slopes which accelerate runoff and are more vulnerable to erosion.

Vegetation/Land Cover

Based on reconstruction of early survey records, the site of the Shiatown Dam was probably characterized by oak-hickory forest to the east and beech-sugar maple forest on the higher ground to the north and west (Figure 1.14).¹⁶ Farther from the site, wetlands and lowland forests were present in wetter depressions.

The countryside around the Shiatown Dam has changed substantially over the last 200 years. Native forests were cleared early in the nineteenth century and the modern landscape is dominated by agriculture (Figure 1.15). Scattered patches of forest exist in small woodlots and along the Shiawassee River corridor. Although wetland areas have been substantially drained throughout this portion of the watershed, some lowland areas continue to support fragments of bottomland forests and marshlands.

The Shiatown Dam site features a wooded buffer along the river below the dam and upstream along the edges of the pond. The bluff immediately to the east of the pond is heavily wooded up to the Shiatown East Park. The area immediately to the west of the dam site is largely open, with a few large ornamental trees. A grove of trees also runs along the hills to the east of the impoundment. Wetland areas are present along the impoundment's margin and in areas of accumulated sediment. These wetlands harbor predominantly annual, herbaceous vegetation.

Agricultural activity and rural residential development is present around the immediate area of the site. A small cluster of homes is located immediately below the dam and to the west in the hamlet of Shiatown. More recent development has occurred to the east of the site in the direction of the village of Vernon.

Human History of the Shiatown Site: Native American History

Prior to European settlement, the area around Shiatown (originally called Shiawassee town) was inhabited by a number of native nations, including primarily the Chippewa (Ojibway), Ottawa and Pottowattamie. These nations were largely dislocated from the area by European settlers beginning in the early 19th century. By 1830, two Indian villages remained on the Shiawassee River: Kechewondaugoning and Shigemasking, the latter near Shiawassee town. The Chippewa who inhabited the region raised corn in the area between Vernon and Shiawassee town and harvested maple sugar from the region's many maple groves. The government planned to relocate all the Saginaw Chippewas by 1842, but by that time the tribe had been nearly wiped out by smallpox and the remaining members were too widely scattered for movement to a reservation.¹⁷

Human History of Shiawassee Township and Shiatown

Shiawassee Township was the first to be permanently settled in Shiawassee County. The Williams brothers from Ohio settled on the Shiawassee River, on or near the eastern township boundary in 1833¹⁸. Their original house became a hotel, or public house. After this the building became the Exchange Bank of Shiawassee but this was a short-lived enterprise.

Shiawassee town (now Shiatown) was located on the corner of Bancroft and Bennington Roads in Shiawassee Township. The village was divided into parcels in 1836, the year before Michigan became a state. It originated with Charles Bacon, a land speculator from Ohio. A sawmill and store were built at the base of the Shiawassee River's rapids in the late 1830's. The store was soon converted "in response to the popular need of the time"¹⁹ to a tavern. The Post Office opened in 1837. The first school in Shiawassee County was held in the tavern in 1839. It was run by Lucius Beach and had a class of 40

pupils. A carding mill was soon established along with more houses. There were at the time four churches: First Baptist, Methodist, Episcopal, and Seventh-Day Adventist.²⁰

There were grand hopes of hosting the state capitol and old maps show plans for nearly one hundred city blocks, two town squares, and a park. There is a somewhat debated story that the state records were housed in the village overnight on their way to Lansing in the 1840s, thereby making Shiatown the state capital for a few hours. Mills were built on the river for flour, paper, and lumber. Only Owosso and Byron, where other dams were built, rivaled Shiatown for growth and activity in the mid 1800s.

In the second half of the 19th century, lack of transportation infrastructure limited Shiatown's growth. By 1860, the railroad had bypassed the town and investors were unable to provide rail or river transport to Saginaw and other important destinations. In 1960, I-69 opened and created an easy way for people to travel to Flint or Lansing, again bypassing Shiatown.

The decline of Shiatown continued when hydropower production at the Shiatown Dam ceased in the 1960s. Shortly thereafter the last stores closed and the Corunna School District absorbed Shiatown school children. Currently Shiatown has no community buildings and the few remaining residents commute elsewhere for their livelihoods. The only physical reminders of the original Shiatown are an historic marker from the town square, the old school bell, the Shiatown Park, and the abandoned Shiatown Dam.²¹ Shiatown is currently listed on the county's historical webpage as one of 41 ghost towns.²²

Shiatown Today

It is difficult to ascertain how many people consider themselves residents of Shiatown. The people who live in Shiatown now have Durand mailing addresses. Six respondents to our mail survey (0.3% of all respondents) listed Shiatown as the community they considered to be home. Based on conversations with local residents, we estimate roughly 100 residents reside in Shiatown. There are a few families in the area whose history goes back several generations in the county and whose many descendents own much of the land. Focus group participants said there are new houses being built and there is a sentiment that the area is growing.

Our social assessments revealed a strong sense of history among residents of Shiatown. The typical longevity of residence contributes to this connection with history. Fully half of our survey respondents have lived in the county for more than 30 years. Despite its categorization as a "ghost town," Shiatown is home to people who remember a more thriving community and who are

looking ahead to better times. Local residents frequently mention the story that Shiatown was the Capital of Michigan for a day as a source of pride.

Recreational Uses of the Shiatown Dam and Impoundment

The dam was used for power generation and recreation in the past. Since power generation stopped, the only use of the site has been for recreation. The residents of Shiawassee County value the Shiatown Dam as a quiet spot for reflection, listening to water, remembering history, educating children, and being away from the hustle and bustle of life. Our mail survey of county residents in the Shiawassee watershed gives insight into specific opinions about the dam and river. Most people (85% of survey respondents) agree or strongly agree that the river and the dam are special, unique places, community landmarks, and add to the character of the community.

Historic Recreation

The Shiatown Dam and impoundment have always been important to local residents as a recreational and aesthetic resource. In the first half of the 1900s, people went ice-skating and ice-fishing on the impoundment in wintertime. Summer encouraged picnicking, swimming, fishing, and boating. Local residents report that families came from as far as Flint to enjoy the Shiatown Impoundment after WWII. Boat races held in the 1940s and 1950s brought hundreds of onlookers from Detroit as well as the surrounding area (Figures 1.16-1.17).²³

Current Recreation

The river through the middle Shiawassee watershed is now used primarily for passive recreation. It is appreciated for its aesthetic value and for the wildlife it supports. Based on survey results, area residents perceive water quality as poor for humans and wildlife. However, the river still draws people who walk along it (64% of survey respondents) or observe nature (67%) from the shore. Active recreational activities such as fishing and canoeing were reported less frequently. Swimming/wading, boating/jet skiing, and hunting were reported to be very infrequent occurrences. Based on responses to other questions in the survey, this emphasis on passive recreation is due in part to water quality concerns, low water levels, and the perception of recreational facilities and opportunities along the river being fair to poor.

Our survey found that recreation at the Shiatown Dam did not differ significantly from recreation on the river as a whole. Several respondents added sledding to our list as a popular winter activity next to the dam.

Fishing

Our survey indicated that fishing is currently the most popular type of active recreation along the river in Shiawassee County and at the Shiatown site. The

Context: The Shiawassee River and Watershed

Shiawassee River supports a smallmouth bass fishery of some renown in Michigan, but generally receives light angling pressure.²⁴ Thirty percent of survey respondents reported fishing on the Shiawassee River at least once last year. Half of these reported fishing more than 3 times last year. Fewer people fished at the Shiatown Impoundment; 22% went at least once and 9% went more than three times over the past year.

Canoeing

Canoeing on the river was reported as a once-a-year activity by 30% of survey respondents. One-third of these canoeists went more than 3 times. Again, canoeing on the Shiatown Impoundment was a less frequent occurrence; 14% of respondents went at least once and only 5% of those went more than three times last year.

The river is usually of slow to moderate flow making it a good choice for beginner paddlers. A 65 mile stretch between Byron and the Fergus Road Bridge is easily navigated with 5 portages around Shiatown Dam, Corunna Dam, two low dams in Owosso, and Chesaning dam. The river upstream from Byron is less reliable for canoeing since it is shallower and often choked with debris. Access to the river is difficult in most places, with exceptions being the Geeck Road (Shiawassee) township park, Shiatown Park, Corunna city park, the M-21 bridge, H. Partridge Park below Owosso, Chesaning City parks, and Fergus Road Bridge.²⁵

Only one canoe livery serves boaters on the river. It does most of its rentals during April and May, and primarily sponsors a 2 hour float trip between Geeck Road and the Shiatown Dam. One of the owners said the river was not heavily used for canoeing in part because there was a short window (April and May) of prime paddling conditions. June is too buggy and by July the water is low. While numbers of annual rentals were not available, the owners mentioned that they rent to people from Detroit and Lansing in addition to locals.²⁶

Issues and Interests at Shiatown Dam

The Shiatown Dam is important to the people of Shiawassee County, but the dam and its impoundment also present a significant set of challenges. A decision must be made in the near future about how to preserve the important qualities of the site while also addressing a number of serious concerns. Below we describe in detail the range of issues that must frame and drive the decision. These issues include both logistical and physical considerations as well as important social interests—such as safety and recreation—that are tied to the site. Sidebars are included in this section to show relevant results from our survey of Shiawassee County residents.

Maintenance Needs and Dam Safety

As described earlier, the Shiatown Dam is a combination of earthen embankments connected by concrete spillways and the former powerhouse. Currently each of these dam components requires maintenance.

The earthen embankments are the weakest part of the dam. Often overlooked because they are not as visually dramatic as the concrete structures and they are covered in vegetation, the embankments are the primary structures that hold back water at the Shiatown. The dam failed in 1974 when the river poured over the top of the right embankment and began to erode it away. Currently, the left embankment is overgrown with trees and brush (Figure 1.18). Vegetation with deep root structures, such as trees, increases the permeability of the embankment and the potential for saturation and failure.²⁷ If the dam is to remain and be made safe, the trees and brush along the embankment should be removed.²⁸

The concrete spillways and powerhouse were originally designed to regulate the water level behind the dam, provide power, and prevent overtopping of the embankments, but no longer perform these functions due to deterioration and the removal of the control gates and stoplogs. Continued deterioration of the concrete threatens the stability of the dam. The most serious deterioration of the concrete is along the downstream abutment walls. Seepage - water seeping into the concrete - was identified in the left abutment wall in 1991 (Figure 1.19). Water in the concrete causes damage during the winter freeze-thaw cycle, when it freezes and expands existing cracks. The deterioration becomes progressively worse as more water is allowed into expanding cracks (Figure 1.20). The right abutment wall also has cracking that traverses the length of the wall (Figure 1.21).

Safety Inspections at Shiatown Dam

Since the construction of Shiatown Dam the government's involvement in public safety and regulation has drastically increased. Starting in 1980 the federal government began to inspect dams and evaluate their condition as part of the national dam safety program. The state of Michigan followed suit by passing Michigan's Dam Safety Act in 1989.²⁹ This act requires dams to be regularly inspected at three to five year intervals. The Shiatown Dam has been inspected three times, first in 1980 by the US Army Corps of Engineers, in 1991 for the Shiawassee River Power Company by a professional engineering consultant, and most recently in 2000 by the DEQ. Under the Dam Safety Act, an inspection was also required during the mid 1990s, but it was never commissioned by the dam owners.

The 1991 dam safety report recommended the removal of the deteriorated concrete from the right and left abutment walls and replacement with non-shrink grout.³⁰ This work was never completed and remains a priority.

The concrete of the powerhouse (Figure 1.22) is in equally poor condition. The stability of this part of the structure is questionable due to uncertainty regarding the amount of water flowing through it. According to the 2000 dam safety report, the rate of flow needs to be monitored because increases in flow could indicate increasing deterioration of the structure. The powerhouse also needs to be monitored for further settlement and erosion on a quarterly basis. None of the recommended monitoring has been implemented.

The concrete apron of the dam is eroding due to the force of the water pouring over the spillways. The original apron had to be replaced in 1976 after significant holes were discovered in the concrete. This discovery was made when a victim was trapped and drowned in one of the holes. The new apron has resolved this problem for now, but water also erodes the riverbed underneath the dam. Without proper maintenance of the apron the foundation of the dam can erode, destabilizing the structure to the point of collapse.

The 1980 and 1991 dam safety reports rated Shiatown Dam as having significant hazard potential. The 2000 safety report, completed after the DNR took ownership, states that "there are no indicators of any conditions that represent an immediate threat to the stability of the dam" and lowered the hazard potential rating to low. However, the 2000 report also concluded that the structure is in poor condition. The dam was given a low hazard potential rating primarily because a breach of the dam would flood only a small number of homes, with most of the impact being directed at riparian areas and

agricultural lands. The Bennington Road Bridge and the houses built along the right downstream bank of the river are the only structures at significant risk in the event of a failure at the dam.

The 2000 safety report lists ten repair and improvement recommendations, but to date only one of these has been completed. The problems with the embankments and the concrete will only become worse if left unattended. Lack of monitoring of flow through the powerhouse and cracking along the abutment walls will diminish the ability of the upcoming 2005 inspection to determine if the dam is stable or deteriorating.

Survey Results
78% say the dam should be restored to a better condition.
11% say the dam should be removed.
11% say the dam should be maintained in its current.

Flooding Risk

According to Michigan Dam Safety standards, a dam with a low hazard potential rating must be able to pass a 100-year flood. A 100-year flood is an engineering term used to describe a specific volume of water and not a frequency of flood occurrence. On the Shiawassee River this volume is estimated at 5000 cubic feet per second.³¹ The Shiatown spillways are capable of passing this volume of water, but this is the maximum capacity. In engineering terminology, this means that the dam has no “freeboard,” or ability to handle more than a 100-year flood volume.

The lack of freeboard has important ramifications for maintenance and repair at the Shiatown Dam. Anything clogging the spillways will reduce the dam’s capability to handle a 100-year flood event

Survey Results
58% believe the Shiatown Dam provides flood control.

and put the structure out of compliance with safety standards. This occurred in 2001 when debris in the spillways prevented adequate water flow and nearly led to overtopping. Continued monitoring is necessary to ensure that the spillways remain clear. In addition, lack of freeboard means that control structures such as stoplogs or gates cannot be used on the Shiatown Dam because they could reduce spillway capacities. In fact, the engineers that we consulted recommended increasing the spillway capacity to protect the structure from flood events.

Human Safety Risks

At least five people have drowned at the Shiatown Dam. The rush of water over the structure is one of the few moving water features in Shiawassee County and entices many visitors to the river’s edge. Unfortunately, this power also poses risks due to the powerful hydraulics created by the flow of water over the dam.

All of the drownings at the site have occurred when people fell into the water and were trapped in the current just above or below the dam. The current through the impoundment is at its greatest just before the water flows over the spillway, where the calm lake environment changes to fast-moving water. This creates a dangerous situation when lake recreation such as swimming or boating occurs too close to the dam. People can become trapped behind the dam by the force of the current flowing over the structure. At least one drowning occurred on the apron below the dam, where uneven surfaces and swift currents also pose a risk. While these risks are inherent at any dam, improved maintenance would eliminate unnecessary hazards.

Survey Results

52% agree or strongly agree that the dam is a safety hazard.

Cost

The financial responsibilities of operating and maintaining the Shiatown Dam are considerable, and lack of funding has been a principal driver behind the chronic lack of maintenance at the site over the past 50 years. During this time money has been spent on the structure only for pressing repairs or in times of crisis. The costs of these actions have been significant, and as the dam has continued to deteriorate the expense of maintaining the structure has increased. Cost is a continuing concern for the DNR, local residents, and other parties involved in deciding the future of the dam.

Over the past 30 years the county and state together have spent at least \$149,920 on the Shiatown Dam. This figure reflects only a portion of actual expenses; our research could not determine the costs of some known repairs, most notably the cost of repairing the 1974 failure of the dam. When the known repair costs are adjusted for inflation, the total in 2002 dollars is \$349,779.³² On average, then, even the minimal, reactionary repairs to the dam have averaged nearly \$12,000 per year since 1973. Given the current condition of the dam and the lengthy list of repairs mandated in the 2001 DEQ dam safety report, expenditures in the near future will greatly surpass this average if the Shiatown Dam remains in place.

Survey Results

43% believe the state should pay for actions at Shiatown Dam.

21% believe the county should pay.

18% support cooperation between several groups to pay for changes.

Known Repair Costs at the Shiatown Dam: 1973-2003.

1973 \$36,000 for concrete repair, embankment strengthening, riprap, painting, and miscellaneous items.³³

October 8, 1974 \$3,000 approved by the county commissioners to commission a study of the wheel houses.

1975 \$9,600 allocated by the county to make the control structures on the dam operable to increase spillway capacity.³⁴

November 23, 1976 \$24,647 approved to repair the washed out apron.

April 12, 1977 \$1,233 approved for fencing.

June 13, 1978 \$400 allocated to finish work and buy supplies from the previous summer's work.

August 22, 1978 \$3,000 approved to renovate the powerhouse to be used as a house for the park attendant.

May 24, 1984 \$2,000 Wolverine Engineering and Surveyors contracted for unspecified work at the Shiatown.³⁵

March 1, 2001 \$2,040 allocated by the county for a rock and fabric-lined emergency overflow trench, dug around the right embankment of the dam during the February 2001 flood event.³⁶

November 9, 2001 \$68,000 paid by the DNR to remove debris blocking the spillway, remove fencing, cut H beams (part of the old stoplog control system), remove catwalk, new fencing, and landscaping.

Maintenance of the dam itself is not the only financial concern at the Shiatown site, as basic repairs to the structure will do little to resolve other issues at the site. Recreational improvements, sediment removal in the improvement, and a range of other actions will also require funding.

Inherent in any discussion of cost is the question of who will pay the bills. This question is a complex one at the Shiatown site given the state ownership of the dam and county ownership of the surrounding park. Both parties recognize the importance of the site to the local community but lack the financial resources to make substantial improvements. These financial constraints are likely to remain in the future, and point to a need to identify

other potential funding sources. Any action at the Shiatown site will also have to consider the long term financial ramifications and include financial planning as an essential component.

Sediment in the Shiatown Impoundment

The accumulation of sediment behind the Shiatown Dam also impacts use of the Shiatown Dam area. Rivers naturally lift, transport, and deposit material as they flow, thereby shaping their channels and the landscape. Through a constant process of erosion and deposition, rivers carefully balance the power that is made available by the movement of water downstream, the amount of sediment they are carrying, and the resistance of the channel to erosion.³⁷ Disturbances to this system can provoke a variety of responses as the river attempts to move back into balance. A reduction in power can induce the river to reduce its sediment load, while an increase in power will cause a river to pick up more sediment or carve its channel into a form that releases excess energy.

Barriers to the flow of water in a river, like the Shiatown Dam, alter the balance of energy by trapping sediments in the impounded area and scouring material out of the channel below the dam. As a river enters an impounded area, the velocity of the water drops dramatically. This loss of energy releases suspended material, with larger sediments (gravels and cobbles) falling out in the upstream portion of the pond and finer sediments (sand and silt) accumulating closer to the dam. In general, dams can trap up to 95 percent of the sediment that enters the impoundment from upstream.³⁸ In addition to accumulating material in the impoundment, this can deprive downstream areas of natural sediment flow.

The accumulation of sediment at the Shiatown Dam has followed the pattern that can be expected for a 100 year old structure. When the Shiatown Dam was built, it impounded water to a normal depth of approximately 15 feet. At present, our observations indicate the pond reaches a depth of barely 5 feet. Large amounts of accumulated sediment along backwater areas in the impoundment have become a permanent feature of the site, substantially reducing the surface area of the lake (Figure 1.23). This accumulation of sediment has limited the recreational use of the lake and diminished its value as habitat for fish and other aquatic organisms. Large areas in the upper and middle sections of the impoundment are filled in with sediment. In some cases, substantial vegetation has already established in former pond areas. This volume of sediment stored behind the dam also poses a potentially serious risk for downstream areas in the event of failure or breaching of the structure.

Polychlorinated Biphenyl (PCB) Contamination

Polychlorinated biphenyl (PCB) contamination has been a problem in the Shiawassee River and at the Shiatown Dam site since the late 1960s. The general presence of PCB contamination in the Shiawassee River has limited recreational activity on the river and impoundment and has tarnished the value of the river to local residents. The potential existence of contaminated sediment behind Shiatown Dam may also pose a threat to downstream areas in the event of a failure or breaching of the dam.

PCBs are complex chemical compounds that have been used in a range of industrial applications throughout the 20th century. PCBs are highly toxic substances that pose serious risks to human health and the natural environment. Because they do not naturally break down or decompose, PCBs can accumulate and concentrate over time in the tissue of living things and in sediments and soils. Owing to the region's long industrial history, PCBs are a persistent problem throughout the Great Lakes basin.

Between 1969 and 1979, PCB-containing industrial wastes were released around and into the South Branch Shiawassee River at the former Cast Forge Company facility in Howell, approximately 40 miles upstream from the Shiatown site. Improperly managed wastes were discharged on the Cast Forge Company's property, onto adjacent lands, and into the Shiawassee River on a number of occasions during that time. Until 1973, wastes were disposed directly into the river. After that time, overflows of PCB-containing waste from disposal lagoons resulted in discharges into the river. For more than 20 years, the site has been the subject of investigative and remediation efforts by the United States Environmental Protection Agency (EPA) and the DEQ.

As a result of PCB contamination from the Cast Forge site, fish consumption advisories have been in place along the Shiawassee River for more than 20 years. At present, the state of Michigan recommends that no one consume fish caught between M-59 (near the Cast Forge site) and the town of Byron, where the South Branch Shiawassee River joins the Shiawassee River. From that point to the City of Owosso, in an area that includes the Shiatown Dam and impoundment, the state recommends that women and children limit their consumption of larger smallmouth bass and northern pike to less than one meal per month. Below Owosso, women and children are advised not to eat rock bass or smallmouth bass more than once per week. The consumption of common carp is not recommended for anyone between M-59 and Owosso.³⁹

As the first dam downstream of the Cast Forge site, the Shiatown Impoundment currently acts as a trap for any contaminated sediment that has migrated from the site over the last 30 years. Sediment that is trapped at the site could be expected to mobilize if the dam were breached, accidentally or

deliberately, with potentially serious risks to fish, wildlife, and humans in downstream areas.

Tests for PCB contamination in the sediment of the Shiatown Impoundment have shown mixed results. A single sample taken from the sediment's surface in 1977 showed the presence of one PCB at a level of 600 µg/kg. Another sample, taken in 1981, did not show any PCBs.

However, PCBs were detected when seven additional samples were taken in 1994. Further sampling in 2000 also found PCBs, but at levels below reliable detection limits. These data do not definitely demonstrate presence/absence or

concentration levels of contamination at the site. Clearly, PCBs have been found over the years, but not at reliably dangerous levels. On the other hand, the sampling has been very limited and can not be definitely viewed as evidence that the site is safe. Although the US EPA's cleanup plan for the Howell site does not include any action in the Shiatown area, the DEQ intends to conduct additional testing and cleanup at the site.⁴⁰

Survey Results

89% say the river should be restored to a better condition.

Bacterial Contamination in the Shiawassee River

The use of the Shiatown Dam and impoundment is also affected by the presence of bacterial contamination in the waters of the Shiawassee River. The majority of bacteria, which occur naturally throughout our environment, are harmless and, in many cases, beneficial. Excessive levels of certain kinds of bacteria, however, can pose a threat to human health and safety. Coliform bacteria, such as *Escherichia coli* (*E. coli*), originate in human and animal waste and can cause serious illness in individuals who ingest contaminated waters. The presence of pathogenic bacteria can also serve as an indicator of other waste-related contamination problems. To protect human health and safety, the DEQ sets standards for *E. coli* in the state's rivers and lakes. These standards are generally monitored and reported by county health departments as part of routine water permitting processes.

Bacterial contamination can result from the failure of municipal sewage systems, illicit sewer hookups, animal waste, and the failure of residential septic systems. Residential development in communities can outstrip the capacity of aging sanitary sewage systems, and untreated waste can flow into local waters when wet weather overwhelms sewer capacity. Illicit sewer hookups occur when individuals discharge human or animal waste into storm sewers or drains rather than into septic systems or sanitary sewers. Livestock operations can be a source for bacterial contamination in agricultural runoff. Finally, failing septic systems can also contribute to *E. coli* contamination through direct discharges and groundwater flows.

Elevated levels of *E. coli* have been an issue in the Shiawassee River for several years. At present, the river generally meets the standards set by the DEQ.⁴¹ However, elevated levels have been measured in the past following accidental discharges of untreated sewage and as a result of ongoing non-point source pollution. Extremely high levels of *E. coli* have been found on a number of occasions in drains and creeks that flow into the river. Hot spots for bacterial contamination have included the Durand-Vernon area below Shiatown and the Fenton area upriver of the site. Large sewage discharges have attracted attention to the need to upgrade local wastewater systems in many communities in the Shiawassee watershed. Nonetheless, the Shiawassee County Health Department continues to recommend that individuals limit their contact with river water along much of the Shiawassee River, including the Shiatown Impoundment.

Public health warnings and widespread public concern over *E. coli* contamination have limited the activities that people can engage in along the length of the river and at the Shiatown Impoundment. Perhaps more seriously, the problem has substantially weakened the attachment of local people to the river as a natural and recreational resource. One survey respondent wrote, “My son fell in the river and was infected with *E.coli* which was 5 times what it should have been. We as a family of 6 have nothing to do with any waterways in this and other counties.”

Survey Results
54% of survey respondents said that river water quality is poor for humans.
65% said the river has a fair or poor impact on personal health and safety.

Aesthetic Interests

Passive recreation, such as nature observation and walking near the water, are the most popular activities along the river and at the dam site. Many people seek out the water to find a sense of peace and quiet. The falling water at the Shiatown Dam is a unique feature in Shiawassee County and a powerful draw for all visitors to the site. The impoundment, even in its degraded condition, continues to provide an expansive view over open water, one that is important to both neighboring homeowners and visitors.

At the same time, however, the aesthetic qualities of the Shiatown site have been on the decline for several decades. The dam is visibly crumbling in places. Sediment has filled in large areas of the impoundment, creating areas of exposed soil and allowing encroachment by vegetation. Any action at the Shiatown site will therefore change the

Survey Results
64% agree or strongly agree that the impoundment is visually attractive.
Only 36% agree or strongly agree that the dam is visually attractive.
45% agree or strongly agree that the impoundment draws visitors to the community.

aesthetics of the dam and impoundment, either by restoring the depth of the impoundment or continuing its transition to a vegetated floodplain.

Recreation

Frustration over the decline of recreational possibilities at the Shiatown site—primarily due to water quality problems and sedimentation—was a repeated theme in comments written by our survey respondents. The site is used frequently for fishing and canoeing, and Shiatown Park is a popular spot for social gatherings and passive recreation. But relative to the heyday of the site, recreational opportunities have diminished. Important concerns include the loss of lake recreation, fishing, and the condition of Shiatown Park. Because recreation opportunities are arguably the most important asset of the Shiatown site, these issues must be considered in any decision on the future of Shiatown Dam.

Survey Results

53% participated in wildlife and nature observation at the dam last year.

48% went walking, running, or biking at Shiatown Dam last year.

58% say the dam has a positive or strongly positive impact on river recreation.

48% believe the dam has a positive or strongly positive impact on the quality of fishing.

Lake recreation is a valued amenity, even a cultural expectation, in Michigan. Because Shiawassee County has fewer lakes than most, residents have a great affinity for their lakes and include the Shiatown Impoundment in their inventory. The impoundment is currently too shallow for motorboat recreation, and has lost much of its original size. Many county residents fondly remember the past, when boating was a major activity on the impoundment, and would like to see that revived at the Shiatown site.

Fishing is the most popular type of active recreation at the Shiatown site. While fishing in the vicinity of the Shiatown dam cannot be characterized as bad, overall the dam does have negative impacts on the fishery of the Shiawassee River. The structure has interrupted and degraded a stretch of moderate gradient river, which originally provided a diversity of habitats now rare in the Shiawassee system. The impoundment, presently characterized by warm, shallow water, provides poor habitat for sports fish but good habitat for less desirable species like common carp.

Shiatown Park provides access to the river for both boating and fishing, and also offers other recreational amenities such as picnic pavilions and play structures. A 1995 survey conducted by the County Parks and Recreation Commission identified Shiatown Park as one of the best park sites in the county, and some respondents thought it should be significantly improved. Several of the comments specific to the park referred to the need for

improved restroom facilities and potable water; in response, the restroom facilities were recently improved. Overall, the community and Commission support park improvements, but very little money or staff is available to implement the good ideas. The Parks Commission has applied for grant money several times but was turned down by the Natural Resource Trust Fund.⁴² The dam's state of disrepair, flooding concerns, and non-County ownership of the structure reportedly contributed to the denial of these grant applications.

Historic Preservation and Community Vitality

County residents view the dam as a critical piece of the community's heritage and identity. Many respondents to our survey indicated a sense of nostalgia for the "good old days" of worry-free swimming and fishing. Many of the 218 people who wrote comments on the survey told us about their childhood memories. At one time the impoundment behind Shiatown Dam was the largest body of water in the county. People's perceptions of the dam and impoundment are necessarily supplemented by their memories of the more glorious past, not simply the current status of the dam and impoundment. Nearly all of the focus group participants and phone interviewees commented on the historical importance of the dam to the community, and most cited the popular boat races of the 1940s and 1950s. The dam symbolizes the community's past and the vitality of a different era.

In discussing historical preservation at the Shiatown site, many Shiawassee County residents recall a time when the Shiatown Dam was a working hydroelectric facility, and advocate for restoring power generation at the site. Very little of the original hydropower apparatus remains—the powerhouse is a now a ruin, the turbine and control gates have been removed, and the impoundment is too shallow to store adequate water. In spite of these constraints, many of our survey respondents and focus group participants believe that restoring hydropower production would both restore the history of the site and help offset maintenance costs.

Survey Results

80% said the dam represented the history of the community.

78% said it was a special, unique site.

73% said it added character to the community.

69% said it was important to the community.

Opportunities at Shiatown Dam

Despite problems indicated in the previous section, there are several exciting opportunities for improvement at the Shiatown Dam. People in the region are invested in their communities and are interested in celebrating the history of the dam and river. County residents value the river and enjoy recreation, and also express a strong interest in working to improve water quality and recreational availability.

A Deeply Rooted Community

There is strong local community in the towns surrounding the Shiatown Dam, and many residents have a longtime attachment to Shiawassee County. Our survey found that half of the respondents have lived in the county for more than 30 years. Families often have deep roots and have lived there for generations. People know their neighbors and have an interest in participating in improvement of their surroundings. This is evident from our focus group conversations and by the volume of survey respondents who included their name and address with requests to be more involved.

Telling the History of Shiatown Dam

The historic importance of the Shiatown site and the adjacent Shiatown Park creates the potential for Shiawassee County to commemorate its history at the site. Celebrating history is especially important in a fast growing rural county. County residents already demonstrate pride in their river and its history with the Curwood Castle in downtown Owosso (built by a conservationist author) and the annual river celebration Curwood Days. Proposals⁴³ for the preservation of history at Shiatown Dam include putting some kind of roofing over the old pumphouse and installing an interpretive sign describing hydropower for school groups and interested visitors. A historical walking tour could be established around the site between different exhibits that describe and explain the alterations made to the river, and how this benefited the community and changed the river. Scouting groups already come to Shiatown Park to learn about Native American history and this education could be expanded to include permanent displays or annual festivals. Some important historical events are remembered by keeping the old school bell and a plaque describing the town being state capital for a day.

Valuing the River

There is opportunity to counter negative water quality concerns with existing interest and energy for improvement. Many survey and focus group respondents perceive themselves as a minority for caring about the river, but this is not the case. A vast majority of people care about the Shiawassee River as a community resource. They also have good reason to value the river from

an ecological perspective. Similar to other warm-water rivers in Michigan, the biological integrity of the Shiawassee is good.⁴⁴

Some opportunities presently exist to get involved in river improvement activities. The Friends of the Shiawassee River has already established an annual river clean-up in Owosso and Corunna, and at Geeck Road Park upstream of the Shiatown Dam. Our survey and focus groups identified many individuals who are interested in extending such efforts into other areas of the watershed.

Educating Residents about Shiatown Dam

A decision process to determine the future of Shiatown Dam would create an educational opportunity for county residents. Our social assessments revealed that a great deal of misinformation and uncertainty is circulating about the Shiatown Dam and the impacts of dams in general. Some people believe small dams are unusual and should therefore be preserved or restored. Many (58% of survey respondents) consider the dam to be a functioning flood control structure, although it was never designed for that purpose. Fifty-seven percent believe the dam has a positive or strongly positive effect on the river water level. Some continue to categorize it as a hydroelectric dam despite the fact that power has not been generated there for decades.

Uncertainty and misconceptions about the Shiatown Dam are not associated with survey respondents' educational level or length of residence in the county. As reflected by a comment on one of our surveys, people are curious to know more: "Survey asks for expertise average citizens don't have. How much does the dam affect erosion, water depth, wildlife?" Participants in focus groups and phone interviews asked more questions than we could answer at the time, and many said they were willing to volunteer their time.

Some county residents are skeptical of information from state agencies and assume that the DNR and DEQ will tell the community only what is convenient. These residents are interested in verifying the information they receive, and the decision process can provide a forum for this learning to occur. If the concerned parties for the dam take part in a collaborative learning process, for example by participating in sediment testing, they will be more likely to trust the results and feel invested in decision outcomes.

The opportunity to address these questions and transform community energy into action along the river is one that can be woven into the decision-making process for the Shiatown Dam. In the final section of this chapter we discuss the specifics of this process and describe its educational and community-building benefits.

Improving Shiatown Park

The existing park is a great opportunity because it provides public access to the dam site and river downstream. Some small dams are surrounded completely by private property, which creates an obstacle for improving the dam site for public enjoyment. The presence of Shiatown Park is a real advantage for this community.

The Shiawassee County Parks and Recreation Commission has little information on current use or frequency of visitors to the park or impoundment, except for the fact that the picnic pavilion was reserved six times in 2002.⁴⁵ Anecdotally, we were told families without reservations also used the pavilion nearly every weekend in the summer. We heard conflicting reports during focus groups on the perceived volume of users of the park and impoundment. The survey results indicated a fairly high usage rate – approximately 8 visits per day.⁴⁶

County residents' access to recreational opportunities could be improved. When compared with the DNR's guidelines for community recreation planning, Shiawassee County lacks linear parks and connecting trails for biking, hiking, and cross-country skiing, conservation areas around riparian areas, designated sledding areas, swimming facilities, outdoor ice rinks, campsites, and designated fishing access.

The county has already made progress in thinking about improvements. Objectives specific to Shiatown Park set forth in the 1999 Action Plan by the Parks Commission include:

- Address the particular erosion, security, and vision hazards at Shiatown Park.
- Work to resolve dam safety and public safety issues at Shiatown Dam.
- Reconfigure access to Shiatown Park to address County Road Commission safety concerns.
- Develop canoe launches.
- Develop a network of hiking/biking trails that tie into existing railroad and utility rights-of-ways and the Shiawassee River corridor/parks.
- Provide potable water and flush toilets at Shiatown Park.
- Acquire conservation easements in significant view areas or in environmentally sensitive areas, especially along the Shiawassee River.
- Investigate putting in public phones at Shiatown Park, including signage with emergency phone numbers.
- Beautify parks with more formal plantings of ground cover, perennial beds and flowering trees sponsored and maintained by local gardening groups.

In an effort to identify creative new ideas for site improvement, we explored opportunities for the dam and park with the help of community residents and University of Michigan landscape architecture students during a one-day design charette. The group envisioned the area with and without the dam, and illustrated ideas for park improvements such as connecting the east and west portions with a bridge, adding a loop nature trail, and improving a canoe launch. Historically there were some rapids at the site which could be restored with a removal decision to improve recreational appeal. More community visioning like this could be done to great benefit as the decision process takes shape.

Taking Advantage of Economic Growth

The river offers many amenities that, with attention and improvement, could serve as attractive features for drawing visitors to the community. The Shiawassee River already serves a significant base of recreational users, and as the population of the watershed grows there will be opportunities to attract additional tourist and recreation dollars to Shiawassee County. Population in the watershed grew by over 38,000 people between 1990 and 2000. Two-thirds of this growth occurred in the headwaters areas in Livingston and Oakland counties. The residents of these upper watershed areas are also increasingly affluent.⁴⁷

The current role of the river in attracting tourism to Shiawassee County is uncertain: our survey respondents were evenly split between agreeing and disagreeing that the river and dam encouraged visitors to the county. As we note throughout this report, however, the river offers many amenities that with attention and improvement could serve as attractive features. The Shiatown Dam site is one potential tourist feature. Its location close to the major transportation corridor between Flint and Lansing and its relative proximity to the growing headwaters area make the site an ideal location for well-planned recreational amenities. Any decision on the future of the Shiatown Dam should consider these factors.

Options at the Shiatown Site

The combination of issues and opportunities described above creates a compelling and urgent case for action at the Shiatown Dam. At the most basic level, the deteriorated dam represents a safety hazard for the surrounding community and a financial drain on its current owner, the DNR. A decision must be made to address these issues. At the same time a suite of other factors, including impacts on recreation, preservation of community history, and the ecological health of the Shiawassee River, add complexity to any decision about the future of the site.

Our research has identified four alternatives for the Shiatown Dam. Three of these are proactive choices. First is restoration of the site to its historic condition, which would entail replacement of the dam with a new structure in order to raise the impoundment to its original water level. The second is repair, meaning fortification of the dam to ensure the safety and stability of the structure and improve its appearance. Third is the removal or breaching of the Shiatown Dam and the restoration of a free-flowing river through the site. The fourth alternative would be to take no action and simply maintain the dam in its current state by continuing to perform reactive maintenance. Due to the significant issues and concerns discussed earlier in this report, this status quo scenario is not a truly viable option for the site. Therefore we do not assess it in detail here.

Each of these alternatives, if implemented, would entail a different set of short and long term costs and require different management at the Shiatown site into the future. In consultation with engineers and other experts, and through our own research, we have developed a rough picture of the costs and ramifications of each scenario. However, our research has also demonstrated that a solution at the Shiatown Dam will not be as simple as picking among repair, replacement, or removal of the structure. Each of these options will entail tradeoffs between the issues and opportunities described in the two preceding sections of this report. To make a truly effective and successful decision about the future of the Shiatown Dam, the stakeholders must work together to identify and prioritize their concerns, and then reflect on how any potential action will solve, or fail to solve, these concerns.

The options presented here describe some estimated costs and preliminary details, along with potential future costs. We developed the cost estimates listed in this section by researching case studies of similar facilities and through conversations with engineers and contractors. More accurate estimates will require the commissioning of specific engineering studies for replacement, repair or removal.

Implementation of any option will have to follow applicable federal and state laws. In Michigan, dams are regulated by the DEQ's Dam Safety program. The DEQ regulates all dams greater than 6 feet in height that are designed to impound over 5 acres of water. The Shiatown is one of 935 dams in Michigan currently monitored by the DEQ. DEQ permits are necessary for the construction and repair of all regulated dams, and inspection reports are required every three to five years for dams based on hazard potential rating. The Shiatown Dam was last inspected in 2000; the next inspection will be in 2005.

Federal laws that affect decisions for the Shiatown Dam are the Clean Water Act and the Department of Energy Organization Act, which initiated federal hydropower licensing through the Federal Energy Regulatory Commission (FERC). These permits are specific to the replacement option and are discussed in more detail below.

Option 1: Replace Shiatown Dam with a New Structure

The Shiatown Dam can no longer be used to raise the lake level behind the dam because of the condition of the structure and its inability to pass flood flows with control structures such as stoplogs or gates in place. As a result, restoring the impoundment to its historic extent and depth would require the construction of a new dam. Resumption of hydropower generation at the site would also require a new structure. If a new dam were constructed, the current Shiatown Dam would be used as a cofferdam while a new structure is constructed just downstream. When the new dam was complete, the present Shiatown Dam would be demolished.

Our research and analysis has revealed a less than promising cost-to-benefit ratio for the replacement scenario. A replacement dam would restore the ability to control the reservoir level and potentially generate power. The raised reservoir levels would improve the recreation opportunities and the lake aesthetics of the Shiatown site. A new structure would also be markedly more stable than the current dam and would eliminate many of the current safety hazards.

However, replacement also raises a number of significant and costly complexities. Cost estimates for a new structure at the site range between 1 and 3 million dollars, depending on the function of the new dam (recreation, flood control, hydropower, or a combination of these elements). A detailed engineering assessment, which is outside the scope of this report, will be necessary to determine the feasibility and exact costs of a new dam.

Sediment issues at the Shiatown site add another potential cost to replacing the dam. A new dam alone will not restore the original depth of the Shiatown

Options at the Shiatown Dam Site

Impoundment unless the sediment currently filling the lake is removed. The sheer volume of this sediment, combined with potential PCB contamination, makes this action an expensive one. The DEQ is currently working to resolve the issue of sediment contamination in the Shiatown Dam impoundment; these questions must be answered before sediment removal and dam replacement could move forward.

In our social assessments, many local residents stated that hydropower generation at Shiatown Dam would offset and potentially even cover the costs of replacing or repairing the dam. However, the electrical generation capabilities of the site are uncertain. Dams of the era and size of the Shiatown Dam have been abandoned by power companies because of their inability to compete with other forms of electricity generation, and Michigan as a whole currently receives less than two percent of its electricity from hydroelectric production.⁴⁸ Resuming generation at the Shiatown site would require a Federal Energy Regulatory Commission license in addition to the installation of power generation and transmission equipment.

Regulatory Requirements for Hydropower Generation

The Federal Energy Regulatory Commission (FERC) regulates private, municipal, and state hydroelectric dams in the United States. A FERC license, granted for periods of 30-50 years, is required for the operation of any hydropower facility. The Shiatown Dam does not have a current FERC license, and would be required to undergo the relicensing process before power could again be generated at the site. FERC decisions on relicensing must comply with several federal laws, including the Federal Power Act, Electric Consumers Protection Act, Endangered Species Act, and National Environmental Policy Act. FERC has the regulatory authority to decommission, and require the removal of, hydroelectric dams at the end of the license period.

Given the costs of replacing the Shiatown Dam, the most significant current impediment to this option is the question of ownership and financing. The DNR will not build a new dam, so a new owner would have to be found to make this option a possibility. This new owner, beyond building the dam, would be responsible for the ongoing operation and maintenance costs of the structure, as well as liability, permitting, and required inspections. The local community has expressed an interest in county ownership of the Shiatown Dam, but this option is not feasible for the county at this time.

The final issue to be considered is that the lifespan of dams is generally fifty years. Before a new dam is built, the owner and surrounding community

should develop an anticipated life cycle for the structure to inform future management decisions. This plan would provide a guide to anticipated management costs and should take into account the eventual retirement of the dam. As Shiatown Dam has demonstrated, the resolution of these issues often falls to generations far removed from the original construction. A management plan is one tool for ensuring that a new structure would not suffer from neglect and decay as the Shiatown Dam has.

Option 2: Repair Shiatown Dam to Meet Minimal Needs

Repair of the Shiatown Dam was frequently advocated by our survey respondents and focus group participants, and lack of maintenance at the site is responsible for many of the present safety concerns. Repair is a viable option for lengthening the life of the Shiatown Dam and restoring and maintaining certain aesthetic aspects of the Shiatown site. Repair also has limitations that must also be considered with this option.

The main benefits of repairing the Shiatown Dam are relatively low cost and preservation of the reservoir for the community. Repair would cause the smallest alteration to the current river and site, and would avoid problems with sediment releases or changes in hydrology. As compared to replacement and removal, repair is the quickest and cheapest option—in the short term—and does not eliminate the possibility of pursuing other options in the future. A repaired dam would require only minimum management. The portions of the structure that currently pose a threat to safety would be removed or fortified, and the capabilities of the dam would be increased to allow flood flows to pass with more room for error.

The repair option has several drawbacks, however. Repair will not allow for the restoration of the impoundment to a lake; nor will it improve recreation at the site or alter anything—including continuing sediment build-up—in the impoundment. Consequently, building support and funding for this option could be difficult. The other problem is the cost of maintaining the dam in the river. As documented above, repairs to the dam are expensive, and these costs will continue into the future. It is likely that costs will increase as the dam becomes older.

The goal of repair work at the Shiatown Dam would be to stabilize the structure and improve safety. The three piers between the spillways should be removed to increase the dam's ability to deal with flood flows. This would add an additional 13.5 feet of spillway width, allowing more spillway capacity and reducing the possibility of debris piling up behind the dam. Our cost estimate for this action, in addition to minimal concrete repairs, is \$100,000 to \$200,000.

Options at the Shiatown Dam Site

The 2000 Dam Safety Report made ten recommendations to address the structural problems with the dam. These recommendations are listed in order or priority. As of this writing the first recommendation is the only one that has been implemented. The recommendations are the following:

1. Remove debris from in front of the principal spillway by July 1, 2001, and as needed thereafter.
2. Remove trees and brush from the left embankment by July 1, 2001.
3. Repair sloughed area on the left upstream embankment by July 1, 2001.
4. Monitor rate of flow through the abandoned powerhouse. If flow rate significantly increases, notify the Dam Safety Program.
5. Repair cracks and deteriorated concrete on the right and left downstream spillway abutment walls by November 1, 2001.
6. Investigate the feasibility of passing flood flows through the powerhouse by November 1, 2001.
7. Monitor settlement along the right abutment wall on a quarterly basis.
8. Monitor settlement and holes just to the right of the powerhouse on a quarterly basis.
9. Repair the right downstream abutment wall prior to next inspection in 2005.
10. Prepare an Operation and Maintenance (O&M) Plan, providing a copy to the Dam Safety Program by July 1, 2001.

To restore the structural integrity of the dam, the recommendations of the 2000 dam safety report should be carried out. A slight variation from the recommendations that might be considered would be to fill the powerhouse with concrete, blocking the flow through the structure and preventing future deterioration. This would eliminate the need to monitor flows through the powerhouse. The cost range stated above does not include cost of implementing the safety report recommendations.

Future costs associated with this option would be consistent with past costs of the Shiatown Dam. The level of operation and management would remain the same, but with regular monitoring of the dam to catch problems as they are developing and before they can become large economic burdens. Given the poor track record for maintenance at the site, a decision about repair should be made with careful consideration of the long term implementation of these monitoring and repair protocols.

The decision to keep the dam could also invoke concern from local homeowners. The current deteriorating condition of the Shiatown Dam may be hurting their property values due to questions of safety and diminished recreation in an impoundment filled with sediment. The abandoned structure can be an eyesore. Improvements need to be made to the structure to prevent a negative impact upon property values.

Option 3: Remove or Breach the Shiatown Dam

Of the three options for the Shiatown Dam, removing or breaching the structure would most significantly alter the site. A removal decision could entail a number of different actions, ranging from complete removal of the structure to breaching the dam, that would initially leave most of the concrete and earthen embankments in place. Between these two ends are a number of intermediate actions, each of which would bring different costs and benefits.

This option is considered in more detail than the other options because removal would be the most different scenario from the status quo and because this option generates more questions among concerned stakeholders.

Based on dam removal case studies and conversations with local engineers, the cost of removal or breaching of the Shiatown Dam structure would start at \$250,000. This cost estimate is for the breaching or removal of the structure only. A number of additional points should be taken into consideration when evaluating this option:

- Costs associated with dam removal or breaching are generally overestimated. In most dam removals throughout the country, the estimate for demolition activity was significantly higher than the actual cost of removal.⁴⁹
- Conversely, the cost of removal or breaching can be much higher if action is needed to manage and dispose of sediment. As discussed below, these activities can greatly amplify the potential cost of removal or breaching.
- Restoration activity, including the stabilization of the banks of the channel that would emerge through the impoundment and the re-vegetation of exposed sediment, could also require additional expenditures. The development of any additional recreational or interpretative facilities will also increase costs. The specific level of these expenses would be dictated by the community's interests and objectives.

Options at the Shiatown Dam Site

The specific process of removing or breaching a dam can range from breaching the structure with heavy construction equipment to a carefully engineered process. While some small dams are removed all at once, many dam removals take place over a longer period of time. The Grayling Dam on the Au Sable River, for example, is being modified over the course of 4 years, with the dam being reduced in height no more than 3 inches each year.⁵⁰ While this structure is considerably smaller than the Shiatown Dam, it demonstrates the implementation of a slow process to reduce potential negative effects associated with sediment transport and sudden modifications to the impoundment. Given the sediment issues and concern over the aesthetic issues at the Shiatown site, a gradual step-down approach would also be appropriate for the Shiatown Dam. This process would allow for bank sediment stabilization and allow a gradual reclamation of the impoundment.

A removal decision would require working with an engineer or a contractor to plan how the removal would proceed and to coordinate restoration plans after removal. It would also require a Section 404 permit from the US Army Corps of Engineers, as mandated by the Federal Clean Water Act, and a permit from the DEQ under part 301, Inland Lakes and Streams Act (NREPA). This law regulates the rate at which the impoundment can be drained in order to not adversely affect the river downstream.

The most significant benefit of a removal would be the elimination of the long term financial and liability responsibilities associated with the dam. Removal would also restore a free-flowing river through the site, improve the local smallmouth bass fishery, and allow unhindered canoe passage. In the eyes of the majority of local residents, however, removing Shiatown Dam would bring negative consequences, including the loss of the impoundment and many of the historic and aesthetic values associated with the site.

Impact on Property Values

The Shiatown Dam is located in a rural area and the majority of adjacent lands to the river are agricultural lands. There are few residential properties along the impoundment that would be considered lake frontage, but the agricultural land along the river could be developed for this use. There is a small residential community in the immediate area around the dam. The houses in this area on the river are just downstream of the dam or built on a hill with a view of the impoundment. The community benefits from the recreation provided by the park and the impoundment, and their property values will be affected by any of the options for the dam.

Access to open space and recreational opportunities increase property values regardless of the type of open space or the kinds of recreational options.⁵¹ A house benefiting from access to an impoundment will also benefit from access

to a river. On the AuSable River the DNR found that river frontage property was at least equal to, if not more valuable than, properties on a reservoir.⁵² If property values are diminished by a removal, available evidence shows that losses to locals will recover or even improve as the former impoundment re-vegetates and transitions back to a river environment.⁵³

With a dam removal decision the property boundaries along the impoundment would adjust to the new high water mark, extending the property lines as the impoundment constricts to a naturally flowing river. The county planning board would need to establish building restrictions for the new floodplain. Protecting the floodplain from development would prevent damage to new houses and protect access and views of the site for existing properties. Existing properties' value could be undermined if new developments alter the amenities of access and views of the Shiatown Park. These amenities improve the value of nearby homes and should be protected to avoid an unfair burden on these stakeholders.

Ecological Impacts of Removal or Breaching

Removing or breaching the Shiatown Dam would convert the lake-like environment of the Shiatown Impoundment back into a flowing river. As this occurs, the river would undergo a series of changes in its physical, chemical, and biological structure and function. The changes to the river would occur at many different spatial and temporal scales. The specific process and consequences of this transformation would vary depending on how removal or breaching was managed and what specific restoration activities were undertaken.⁵⁴

The river's response to dam removal is an emerging topic in aquatic ecology. While we have considerable knowledge on how dams impact rivers, we have relatively little information on the specific short and long term effects of dam removal. Only a handful of dam removal or breaching projects have been covered in published scientific studies.⁵⁵ These studies, along with anecdotal evidence from individuals and organizations that have participated in dam removal projects, can suggest some general outcomes. Some of the critical issues to manage in this process would include:

- The evolution and stability of the new river channel
- The release of sediment from the site
- The re-vegetation of exposed, former lake bed areas
- Fish and wildlife management.

River Channel Evolution and Sediment Management

Breaching the Shiatown dam would release the water that is currently stored in the Shiatown Impoundment and set in motion a dynamic process of channel

evolution. When a dam is breached or removed, the river begins carving a new channel through the sediment that has accumulated in the impounded area behind the dam. A river does not necessarily assume its pre-dam channel following dam removal or breaching.⁵⁶ Instead, it can be expected to carve a new channel through the gravel, sand, and other sediment that has accumulated in the impounded area over the last 100 years. The evolution of a new river through the former impoundment could be expected to occur through a process of vertical erosion, followed by the horizontal expansion and movement of the channel as the steepened banks of the river begin to erode.⁵⁷ This process would occur dynamically as the river attempts to restore the balance between water, sediment, and energy. Over time, the river could be expected to form a stable channel that resembles other sections of the river.

As the river carves its new channel through the impoundment, it would mobilize a large volume of the sediment currently stored in the impoundment. This sediment would be deposited at various locations downstream of the structure as the evolution of the channel progresses. The rate at which sediment moves downstream following dam breaching can vary greatly depending on hydrology, site characteristics, and specific removal methods. Most of the sediment impounded behind the Woolen Mills Dam on the Baraboo River in Milwaukee, Wisconsin was transported within 6 months.⁵⁸ Similarly, 70-80 percent of the sediment from a reservoir release on the North Fork of the Cache La Poudre River in Colorado was moved downstream within six months.

Contaminated Sediments

Over time, a variety of contaminants can accumulate in the sediment stored in an impounded river.⁵⁹ As noted earlier, PCB contamination has been a problem in the Shiawassee River and at the Shiatown Impoundment for the last three decades. Although the data are inconclusive, it is likely that PCB-contaminated sediments are present in the sediment of the Shiatown Impoundment. Breaching the dam could mobilize this sediment, potentially posing a risk to downstream flora, fauna and human river users. The removal of the Fort Edwards Dam on the Hudson River is one widely cited example of the impact that contaminated sediment can have on downstream areas. Following the removal of that structure in 1973, large amounts of PCB-laden oils and other contaminants were released into downstream areas. Additional contaminants were mobilized when part of the structure was removed in 1991.⁶⁰

In addition to industrial contaminants, impoundment sediments can also contain high levels of nutrients from agricultural activity, primarily phosphorus and nitrogen. The mobilization of impounded sediments can

introduce these nutrients into the water column, enriching downstream areas and promoting a range of potentially undesirable ecological effects such as excessive algal and plant growth.⁶¹ In a river system, like the Shiawassee River, that is already heavily impacted by high nutrient levels dam removal could aggravate efforts to control nonpoint source pollution and high nutrient levels.

It is possible to manage sediment in order to minimize adverse impacts of removal, through slow drawdown, the removal of contaminated material, or the use of stabilization techniques.⁶² However, these activities can dramatically increase the cost and complexity of a dam removal project. Because of the wide variety of issues and outcomes associated with sediment mobilization, sediment management can be the most significant issue in any dam removal or breaching project.⁶³

Vegetation in the Former Impoundment

The removal of the Shiatown Dam would have a range of impacts on vegetation at the site and in downstream areas. Changes in the structure and patterns of plant communities would have implications for long term recovery of the site and the use of the area by people and wildlife. Research suggests that the vegetation impacts of removal can be managed to promote the development of desired plant communities, minimize other negative consequences of removal, like erosion, and enhance the value of the site for human use and as habitat.

When a dam is removed or breached, large areas of formerly submerged land are exposed behind the dam. Experience has shown that these formerly flooded areas revegetate quickly, through the activation of seeds stored in impounded sediments and colonization from adjacent riparian areas.⁶⁴ The sediments that are found in impounded ponds tend to be rich in nutrients and organic matter, making them fertile ground for vegetation. In many instances of dam removal, significant plant growth has emerged within a matter of weeks.⁶⁵ In addition to the aesthetic benefits, this early vegetation can help control the erosion of sediment from the former impoundment. Grasses with strong root systems and woody plants can stabilize banks and minimize erosion.⁶⁶

Unmanaged natural re-vegetation of a former impoundment can be a risky approach, however. Aggressive, weedy plants, both native and exotic, can take over formerly flooded sites if they are not managed appropriately. These early colonizers can have long term implications for plant composition at the site. Studies of dam removals in Wisconsin have found that former impoundments can become dominated by a few species relatively soon after removal.⁶⁷ Older sites were often found to have higher diversity of species,

Options at the Shiatown Dam Site

but also higher levels of nonnative species, like reed canary grass.⁶⁸ Purple loosestrife is another nonnative plant that out-competes native plants for space and is of lesser value to wildlife. Further, the species that colonize a site might not necessarily provide the desired benefits to erosion control.⁶⁹ Ultimately, the plant communities that emerge in the former impoundment may not resemble native vegetation or the pre-dam condition.

In addition to the re-vegetation of the impoundment, dam removal can also be expected to have impacts on vegetation in downstream areas. The sediment released by a dam removal can create new surfaces downstream for riparian and aquatic vegetation. A large release of sediment can bury vegetation in downstream areas.⁷⁰

Fortunately, research and experience suggest a number of strategies that can be used to manage the vegetation around in an impoundment and around a dam removal site to control invasion by undesirable plants and achieve other restoration objectives. Active re-vegetation can include reseeding with a cover crop or planting trees or shrubs.⁷¹ Native species should be used, where possible, for active re-vegetation in formerly impounded areas. Particularly at this early stage, the use of native plants can inhibit the establishment of invasive plants and prevent long term management problems at the site.⁷²

Biological Impacts: Fish and Invertebrates

Research and experience have demonstrated that the removal or breaching of a dam can be expected to reduce habitat for lake organisms in the impoundment area and create habitat for river organisms. The removal of the Woolen Mills Dam on the Milwaukee River was followed by increases in smallmouth bass populations and declines in common carp populations in the former impoundment area.⁷³ The removal of the Waterworks Dam on the Baraboo River, Wisconsin, was followed by a dramatic increase in the population of smallmouth bass in the formerly impounded section of the river.⁷⁴

Given the fish communities that characterize this segment of the Shiawassee River, the removal of the Shiatown Dam could be expected to create habitat for smallmouth bass and other river fish common to the system and to reduce habitat for common carp, sunfishes, largemouth bass and other slow water fishes. Most evidence indicates that the removal of the dam would restore a steeper, faster moving section of the river that includes the variety of pools and riffles and coarser substrate favored by riverine fish and other organisms. Based on elevation data, there is an approximate drop of 6 feet per mile from the crest of the impoundment to the dam. A drop in elevation between four to ten feet per mile will provide good smallmouth bass habitat.

It is important to consider the potential impacts on invasive species. Zebra mussels are one example where removal would have a positive impact by decreasing available habitat. Zebra mussels thrive only in lake environments—they will not colonize flowing rivers. Dams and the impoundments they create therefore provide spawning habitat for zebra mussels. This species is a problem because it can out-compete resident aquatic species or kill native mussels by suffocation or starvation. Zebra mussels exhibit the trademark characteristics of invasive exotics: high fecundity, rapid dispersal, and lack of competitors or predators.⁷⁵ They travel in the veliger stage by attaching to boats and then they colonize any hard surface, such as dams.

Removing the Shiatown Dam can also restore connectivity between different areas of fish habitat. Like many dams, the Shiatown Dam physically blocks the movement of fish and other organisms between upstream and downstream areas. While a fish ladder has existed at the site, it has not been in operation since 1954 and is too deteriorated to provide any fish passage.⁷⁶

Experiences at other sites suggest that the removal or breaching of a dam can restore connections between different habitat areas, reestablishing migratory pathways and facilitating local movements by resident fish. Within a year after the removal of Edwards Dam, migratory species moved up the Kennebec River in Maine for the first time in 150 years.⁷⁷ Eighteen months after the removal of the Waterworks Dam in Wisconsin, the number of fish species found upstream of the dam nearly doubled, from 11 to 24.⁷⁸ The removal of the Welch Dam on the Cannon River in Minnesota was followed relatively rapidly by the movement of muskellunge, flathead catfish, bowfin, and a range of other river fishes above the former impoundment, in areas where they had not been seen since the dam's construction.⁷⁹

Removal of the Shiatown Dam could also be expected to restore connections between different areas of fish habitat in the Shiawassee River above and below the structure. The removal of the dam would not, on its own, restore large scale migratory fish runs. Although the Shiawassee River historically supported migratory fish from Saginaw Bay, including large runs of walleye, dams at lower points on the river block the movement of these fish as far as the Shiatown Dam. However, the removal of this dam could be expected to restore connectivity for resident fish populations. Specifically, removing this structure would open up twelve miles of river, between the dams in Corunna and Byron.

Negative Impacts on Biota

While removal or breaching of a dam can potentially enhance habitat for some river organisms, it can also have short-term negative consequences for many

flora and fauna. The release of a large amount of stored sediment can be severely disruptive to local biota. In some cases the immediate effects of breaching a dam can result in close to 100 percent mortality for some species in the immediate area of a dam.⁸⁰ In addition to the short term harm, this can have long term effects on the entire system. While recovery of free-flowing rivers can be generally predicted to be positive, it should be recognized that shifts and disturbances are possible.⁸¹ A large sediment plume should not be permitted in any case.

Considering the Options

When considered in light of the issues and interests presented earlier in this report, none of the three options for addressing the problems at the Shiatown site represents an ideal solution. Removal would eliminate the burden of long-term structural maintenance and safety concerns, but in the eyes of many local residents would have a detrimental impact on the aesthetic and historic qualities of the site. Replacement would restore lake recreation but come at significant financial cost. Repair will preserve the current structure but fail to avoid continuing questions of safety and maintenance.

A focus solely on these tradeoffs will likely result in an immediate deadlock in any decision process regarding Shiatown Dam. Instead, the complex suite of problems and options facing the site necessitate creative problem solving. While the options of replace, repair, and remove may appear black and white, they are simply categories of action. There are many different ways to manifest these actions which can satisfactorily address stakeholder interests.

Our research included a small example of this process, in the form of a design “charette” held in January, 2003. The charette brought together a group of landscape architecture students from the University of Michigan and a group of Friends of the Shiawassee River members for a day of brainstorming possible options for the Shiatown site. After a visit to the dam, the group developed four different scenarios for the site. Each scenario represented a combination of different options and interests, ranging from recreation to aesthetics to historic preservation.

The results of the charette demonstrated the positive possibilities for a successful decision on the Shiatown Dam, and highlighted the importance of a creative, collaborative approach. One design, for example, refurbished the existing dam by removing the concrete spillway piers and installing a rock ramp to enhance the waterfall effect (Figure 1.24). The design also included a footbridge connecting the two portions of Shiatown Park and a number of other recreational improvements. A second design breached the dam while retaining the concrete spillways, maintaining the aesthetics and historic values of the site while allowing the river to flow freely and eliminating safety and

maintenance concerns (Figure 1.25). These designs, developed by small groups over the course of a single afternoon, are only an initial indicator of what a thorough collaborative approach could achieve. Creative problem solving is an essential component of this approach, which is described in more detail in the following section of this report.

How Should a Decision Be Made?

Local residents, local officials, representatives of state agencies, and other interested parties broadly agree that something needs to be done at the Shiatown Dam. However, the complex issues that surround the dam, impoundment, and river evade easy decisions. High stakes, complexity, and uncertainty about management outcomes create the potential for sustained, unproductive controversy and conflict. Many in the community believe that a removal decision has already been made and will be implemented without their input. At the same time, public authorities lack the resources and public support to move forward with any chosen solution. Without a clear direction or a process for managing the site, the situation will only get worse. Actions taken to address Shiatown Dam's needs will continue to be driven by crisis, with adverse impacts for the local community, public authorities, and other stakeholders.

Instead of letting the site continue to decline and waiting for the worst, the people and organizations interested in the Shiatown Dam need to take positive action to move forward with a decision on how to manage the dam and impoundment. A collaborative decision making approach represents one effective way to move beyond the current inaction and develop and implement creative strategies for managing the dam. This approach would address the issues at the site through a process that engages all parties and individuals who care about Shiatown Dam in the development of sound, supportable options for management.

What is Collaborative Resource Management?

In recent years, a new style of resource management has emerged that draws on older ideas, such as town hall meetings, which encourage active participation by all interested parties instead of a top-down bureaucratic decision. Communities, public agencies, and nonprofit organizations have been developing a range of collaborative consensus-based approaches to managing complicated natural resource management issues. This is in response to increasing complexity about natural resources and greater public interest in the policy process. By working together and moving beyond traditional disagreements and disputes, people have discovered that they can craft enduring solutions to difficult problems.⁸²

Collaborative processes give participants the opportunity to develop a shared understanding of a problem and creatively generate solutions. By working together to identify and address issues, parties test their assumptions and stereotypes, develop a fuller appreciation for the realities of the problem, and generate realistic alternative solutions.⁸³

Why Collaboration? The Benefits for the Shiatown Decision

Collaboration Produces Creative, Effective Solutions

At the most basic level, a collaborative approach will help parties that have an interest in the Shiatown Dam move beyond the current state of inaction and decide on a way to manage the site. Currently, many of the Shiatown Dam stakeholders are focused on a win-lose decision: the dam either stays or goes. This perspective encourages parties to take positions but does not move toward a meaningful resolution of the issue. By helping participants move beyond a narrow, positional view of the dispute, a collaborative approach will generate options for the dam that genuinely meet the interests of multiple stakeholders. It will create a venue for identifying interests and determining how they can be satisfied.

Moving from Positions to Interests

A central tenet of effective conflict resolution is that creative solutions are based on interests rather than positions. Positions are the public stances that people take on issues. Positions are often polarized, absolute, and focused on final outcomes: “we want this dam to stay here” or “we want this dam to come out.” Interests are the underlying needs that motivate people. They generally speak to underlying beliefs, such as “we want to protect a symbol of our community” or “we need to stay within our budget” or “we want to protect the river from contamination.”

An interest-based approach can generate creative options and legitimate solutions. In fact, it is the differences in interests between parties that actually facilitates positive outcomes. Differences in interests and resources give parties the ability to make trades and deals that mutually advance goals.⁸⁴

“Most interests are reasonable and can be described. The realization that the other side’s needs are not as outrageous as their position seems to be can awaken hope that there may be a way to solve the problem. Cooperative efforts to solve the problem can be built on the realization that interests are not necessarily in conflict.”⁸⁵

Each party in the Shiatown Dam decision will come to the table with different goals and interests at stake in the decision. Public agencies and local governments will also have legal mandates and clear fiscal limits. The DNR, for example, is charged with stewardship of natural resources; the DEQ must assure dam safety and water quality; and the county must maintain the Shiatown Park and represent the interests of county residents. Each group can flex only a certain amount with their respective requirements. The challenge is therefore identifying areas of overlap wherein these groups can all

How Should a Decision Be Made?

fulfill their responsibilities while at the same time benefiting each other and the people of the local communities and Shiawassee County.

The public can help in meeting this challenge by practicing patience and acknowledging that public agencies must juggle myriad responsibilities within the bounds of established policies and procedures. The information collection and sharing process will take time, and will be one of many concurrent decisions in which the agencies and county government are involved. All parties must exercise patience, but not at the expense of losing focus or momentum.

Collaboration Builds Understanding

Collaborative approaches foster information sharing between parties, giving organizations, agencies, and the public the ability to learn from and educate each other about their interests, limitations, and resources. High quality, accurate information is essential. Bringing in experts to present some kinds of information to everyone at once may be beneficial for elevating its legitimacy. Working together, parties can also develop new information about disputed issues to inform management options. This collective pool of shared information becomes a resource that all the parties “own,” contributing to a collective understanding of the issue and informing the decision process.⁸⁶

A collaborative process gives stakeholders the opportunity to be heard. In a respectful, open forum, this exchange of information can change the emotionally charged nature of the decision process and reduce counterproductive controversy. Community members can share with the DNR, for example, their childhood experiences at the Shiatown Dam, giving depth to what might otherwise be a bureaucratic decision.

In turn, the DNR can explain the financial realities of managing and maintaining the Shiatown as well as share knowledge of contrasting pond and river ecosystems. The open exchange of information and opinions can help all parties come to a mutual understanding of the challenges that they face, collectively, in managing this dam.

When people understand how decisions were reached and how their interests have been balanced with the needs of other people, they are more likely to support and promote the final decision.

Collaboration Builds Support for Decisions

Traditional public agency decision processes are perceived by many affected groups as “black boxes.” Even if decision makers solicit ideas from constituent communities, there is rarely any clear indication how, why, or to what extent they were actually incorporated into the final decision. People do not understand why tradeoffs were made, they only see the results. This can engender distrust and provoke adversely affected parties to resist decisions

and seek recourse in other venues.⁸⁷ In contrast, involving concerned parties in decisions builds support for the final outcome of that process.

A collaborative decision for Shiatown Dam, in which each party is vested, will lead to improved implementation and a better chance of success over the long term. When people understand how decisions were reached and how their interests have been balanced with the needs of other people, they are more likely to support and promote the final decision. A decision from which local residents are excluded, or which is perceived as top-down or not inclusive of community opinion, will create controversy and challenges to implementation. In contrast, a decision that county residents can be excited about, for example, might be sped along by volunteer labor and lack of legal challenges.

Development of Collaborative Processes

Three essential stages characterize the development of effective collaborative processes: problem setting, direction setting, and implementation.⁸⁸ First, stakeholders need to agree to work together.

Second, they move through a process of jointly learning about the problem and cooperatively developing creative solutions. Finally, they take steps to implement agreed upon actions.

The challenge of maintaining interest in a collaborative Shiatown Dam decision could become an opportunity to address several issues through a single decision process.

Getting Started: Deciding to Work Together

Framing the Problem

Effective collaborative processes are built around a shared understanding of the problem facing the participants. Problem definition plays a critical role in determining if, and how, a potential conflict can be resolved.⁸⁹ How a problem is described dictates how much room parties have to work together to find an interest-based solution. Questions like “Should we *fix* the dam?” or “Should we *remove* the dam?” implicitly focus on particular outcomes, worsening the situation by driving the parties apart and focusing them on positional bargaining. Instead of focusing on specific, pre-determined solutions, the parties should frame the problem in terms of their collective interests.

A shared sense of place can create a powerful foundation for a collaborative, problem-focused approach.⁹⁰ The Shiawassee River exists as a potent unifying theme for the people, organizations, and agencies that have a stake in the dam and its management. One participant in our design exercise suggested addressing this challenge by “elevating the significance” of the Shiatown site in the eyes of county residents. She recognized that while the river and the Shiatown Dam site are concerns for most people, they are only peripheral issues in comparison to things like the economic health of the county and education. To secure the interest level and resources necessary to support a

How Should a Decision Be Made?

collaborative decision process, the Shiatown Dam will have to be linked to other issues of importance in Shiawassee County. Our study uncovered a number of potential opportunities to forge these links, particularly on the issues of recreation, water quality, and economic growth. If framed in the context of these larger issues, the challenge of maintaining interest in a collaborative Shiatown Dam decision could become an opportunity to address several issues through a single decision process.

Overcoming Mistrust

Another set of challenges for a collaborative process will revolve around the different attitudes and perceptions that each party brings to the table. As discussed above, issues of mistrust, high emotion, and controversy will impact the decision process from the very beginning. Even in a cooperative environment, difficult individuals and particularly sensitive issues will cause problems. The design of the decision process will go a long way toward meeting these challenges and controlling the difficulties that might otherwise arise from them. A well structured process will help the decision participants keep stakeholder satisfaction high, thereby reducing the impacts of differing attitudes and allowing the group to move toward a decision.

Finding Resources

A challenge to a collaborative decision on the Shiatown Dam is limited resources. All stakeholders are constrained by the amount of time, personnel, and money they can contribute to the process. These issues are chronic at the Shiatown Dam, where little attention has been paid to the structure or the impoundment for over 50 years. Resources are devoted to the site only in times of crisis. There are a variety of funding sources to be explored for grants or in-kind assistance (listed in Appendix B).

Leadership

The incentives and leadership for encouraging stakeholders to participate must come from members of the community. We have spoken with many parties who support the idea of a collaborative decision. State and county agencies lack the financial and personnel resources necessary to convene and manage the process. Most local groups and citizens are relatively unorganized and feel unprepared to accept such a responsibility. Identifying a facilitator and the incentives that will bring each party to the table must be the first step. The Friends of the Shiawassee River has stepped forward to begin the process. Their first step will be to convene stakeholders in the Shiatown Dam decision and objectively search for and engage a neutral facilitator. Friends of the Shiawassee River will then change roles to participate in the collaborative decision process as a stakeholder advocating for the health of the river.

Learning Together and Deciding

Sharing Information and Joint Learning

An effective collaborative approach will give the parties the opportunity to jointly find credible answers to pressing questions of fact about the situation. A resolution-oriented joint learning process needs to be open, inclusive and collectively directed by all parties. The process should be structured to include and share all of the information that parties have available and involve all parties in directing additional needed research. Many questions remain about the dam and the impoundment. The level of PCB contamination in the pond sediments, the structural integrity of the dam, the severity of sewage impacts, and the amount of sediment behind the dam are examples of areas where the parties lack information and agreement on the facts. This uncertainty can be a roadblock that stops a decision from moving forward. A collaborative decision addresses questions of fact through a joint learning process. Parties share information in a common forum, with care taken to determine accuracy, allowing each stakeholder to develop a shared understanding of the issues.

A joint learning process also serves to build trusting relationships among the involved parties. This factor will be very important in the Shiatown Dam decision. In focus groups, local residents expressed skepticism over the dam safety reports, PCB contamination information, and repair estimates presented in county, DNR, and DEQ documents related to the dam. Similarly, public agencies often regard local populations as uninformed on the realities related to management decisions. This distrust can be overcome only if all of the parties develop baseline information together. Without the buy-in and understanding of all affected parties, even the most rigorously collected data will be questioned. Joint learning provides the mechanism to accomplish this alignment and move a decision forward.

Exploring Options

Complex management questions that involve multiple parties with diverse interests rarely lend themselves to single, silver bullet solutions that satisfy every party at the table.⁹¹ Effective collaborative processes invest time and energy in developing and exploring a range of different proposals and options for action before making final decisions. Conflict resolution practitioners stress the importance of separating option *creation* from option *evaluation* and *decision-making*.⁹² During the creation phase of the process, parties are encouraged to invent ways of meeting their own interests and meeting the interests of other parties. At this point, no ideas or plans should be judged or evaluated: the emphasis is on coming up with many diverse proposals. A range of ideas will give participants the opportunity to evaluate and make trades between different proposals.

Making Decisions

How Should a Decision Be Made?

After a thorough exploration of the interests and options on the table, a collaborative process turns to evaluation and decision making. In this phase, the parties consider the range of information before them and begin to weigh the pros and cons of the options identified during the creation stage of the process. The evaluation of options is drawn from the common base of knowledge developed through joint learning, a fact that will serve to lessen potential conflicts over the options. A common knowledge base also allows for creative tradeoffs between options that result in benefits for all parties. One example of such a tradeoff is the scenario discussed above developed during our design charette. This scenario preserved the concrete spillways of the dam while allowing the river to flow freely around them. This option considered both the history of the dam as well as the concerns about river health and maintenance costs.

Through this process of evaluating and trading off, a collaborative process reaches decisions by consensus. Consensus gives each party a stake in the decision and also the assurance that they have a degree of authority in advocating for their interests. A consensual decision also ensures that no one party will come to dominate the process.

Stakeholders in the Shiatown Dam Decision

Throughout this discussion, we have referred to the “stakeholders” at the Shiatown Dam. What does it mean to be a stakeholder? Put broadly, stakeholders include “those parties with an interest in the problem.”⁹³ Anyone who is concerned about the Shiatown Dam deserves a place at the table. An effective process and an enduring decision will not exclude anyone from participating.

While all citizens of Shiawassee County can rightfully claim some interest in Shiatown Dam and the surrounding park, decision-making and active interest in the site is limited to several distinct groups of stakeholders. Our project has devoted effort to identifying these parties and learning about their interests and concerns. Here we describe the five most evident stakeholders in the process so far. Other groups will certainly emerge as the process moves forward, but currently the following five groups are most engaged in the process and concerned about its outcome.

Residents of Shiatown and Shiawassee Township

The Shiatown Dam and impoundment are focal points for the community of Shiatown. A rich history surrounds the site and residents value the rush of water over the dam. Several homes overlook the impoundment and Shiatown Park serves as a communal backyard for the community.

Shiatown residents are concerned that any decisions about the future of the dam acknowledge the history of the site and its value to their community. In our meetings they described vivid memories of how the site used to be, emphasized the cultural value of the dam, and lamented its decline. Their principal interest is preserving the history of the site and restoring the cultural and aesthetic qualities it once had.

Local residents, including many outside the community of Shiatown, fear that removing the dam and impoundment would mean a loss of community history. They are also concerned that dam removal would negatively impact recreation potential at the site and on the river as a whole. As a result, the Shiatown residents we spoke with are strongly opposed to removal.

Shiatown residents are considering forming a local governance structure that would serve to represent community interests in a collaborative decision process. The individuals we spoke with expressed willingness to help in all aspects of the project, including the volunteering of equipment and material for restoration work at the dam. They also supported a joint learning process to resolve uncertainty over sediment contamination issues.

Shiawassee County Government

Shiawassee County has a long history of involvement at the Shiatown Dam. The county owns and manages Shiatown Park through its Parks Commission, and owned the dam itself for a brief time in the 1990s. The County Emergency Services Department and County Roads Commission shored up the dam when it nearly overtopped in 2001. County officers also respond to safety incidents and drownings at the dam.

County government officials recognize that Shiatown Dam is important to county residents, and are interested in responding to and representing this interest. However, the county does not have the financial resources to purchase and restore the dam to adequate safety standards. They would be interested in assuming ownership only after restoration work had been completed.

The poor condition and non-county ownership of the dam has been cited in the rejection of several county grant applications for funding to improve Shiatown Park. The county is interested in assuring that any decision regarding the dam be tied to improving the park and the quality of recreational options available to county residents.

Michigan Department of Natural Resources (DNR)

Shiatown Dam is one of over 200 dams owned by the Michigan DNR. Managing and maintaining these structures is not part of the DNR's mandate; like Shiatown Dam, many of them defaulted to state ownership after their owners failed to make tax payments. The DNR is responsible for liability associated with Shiatown Dam.

The DNR has two primary interests in any Shiatown Dam decision. The most important is cost. Because the DNR is not in the business of owning dams, it has no funding to improve the structure. In its current state the dam is a continuing financial drain due to maintenance and liability concerns. With no other parties expressing interest in purchasing the structure, the DNR is looking for other options to reduce their financial responsibility and liability exposure at the site.

The second important interest for the DNR is their diverse mandates of natural resources stewardship and encouraging recreational use. Any action at the Shiatown must be consistent with this directive. DNR Fisheries staff are interested in the Shiatown Dam site because it is located in what was historically a high gradient stretch of the river. High gradient sections are rare in the Shiawassee; restoring the Shiatown stretch would attract and support fish species not currently found there.

Based on these interests, the DNR has taken the position that removal is their most viable option for the Shiatown Dam. The agency is aware, however, of Shiatown Dam's importance in the community and the controversy that will arise from a unilateral removal decision. The DNR strongly prefers that any decision be a consensual one. Community relations are important to the agency and they are willing to be a part of a collaborative decision. The DNR is not committed to removal. They simply need a decision that absolves them of long-term financial responsibility at the site, improves public safety and maintains the ecological health of the river.

The DNR has expressed interest and optimism about seeking state funding for removal, but does not believe that there would be state money appropriated for repair or replacement. They have also offered expertise in restoring the site after a removal.

Michigan Department of Environmental Quality (DEQ)

The DEQ is tasked with overseeing environmental regulatory, permitting and related enforcement functions in Michigan. These duties include dam safety inspections and reporting. As described above, the DEQ has been involved at the Shiatown for some time, and required the repairs and improvements completed by the DNR in 2001. By law, the DEQ must be involved in permitting any action at the Shiatown. Construction, modification, or removal at the dam would require DEQ licensing; dam removal would require streambed alteration permits and impact reports. The DEQ is also overseeing PCB testing in the Shiawassee and must be involved in any decision related to sediment management.

At the same time, the DEQ also has responsibility for protecting the water quality in the Shiawassee River. This gives the agency a substantial interest in the contaminated sediment in the impoundment and in impact that various dam management options would have on water quality in the river.

River Users

River users make up the largest of the Shiatown stakeholder groups. Some river users are represented by organizations such as the Conservation Club and Friends of the Shiawassee River. The majority, however, are individuals belonging to no particular group. As such, the interests of this group cannot be summarized. It contains advocates of both restoration and removal, recreational users of all types, and residents from all parts of Shiawassee County.

Ensuring the representation of river users will be a challenge for the collaborative decision process. The diverse interests of this group will have to

be determined in appropriate forums where river users have the opportunity to express their views and ask questions. Individual leaders may step forward to represent these interests. In the absence of a single representative for river users, however, the other stakeholders in the decision must work to understand the interests of this group and incorporate them in to the decision process. The responses and comments collected by our survey can be a starting point for this information collection.

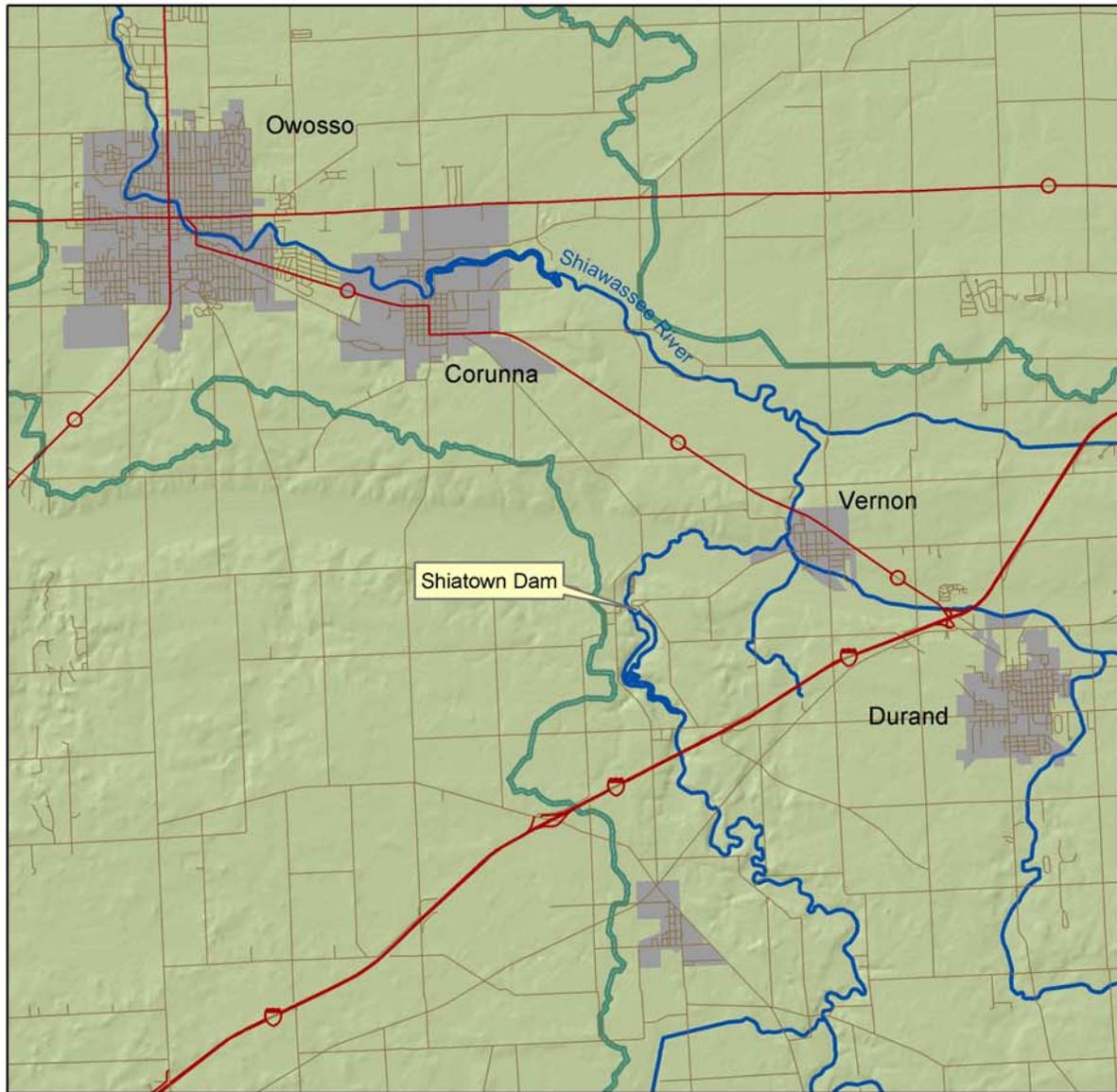
New participants in the collaborative decision process are likely going to emerge from the river users group. The process must be designed to solicit the opinions of river users and identify potential decision participants as early as possible. Perspectives emerging after the collaborative process is well underway may prove difficult to accommodate and could even derail a decision.

Concluding Thoughts

The information presented in this report lays the foundation for the Shiatown Dam decision process. We hope that this report begins to frame possibilities and limitations for the site, and will enable the residents of Shiawassee County to better understand the set of challenges before them. We firmly believe that a successful resolution to these issues is possible through a collaborative decision process. Our research has demonstrated that the people of Shiawassee County care deeply about the Shiawassee River and the future of the Shiatown site. A process that captures and focuses this interest will not fail to generate positive, successful decisions.

The decision on the future of the Shiatown Dam is in many ways about much more than the dam itself. Many of the problems facing the dam also impact the rest of the Shiawassee River watershed. Sedimentation, *E.coli* and PCB contamination, as well as concern over lost recreational opportunities, are issues that extend far beyond the dam. Addressing the issues at the Shiatown site creates an opportunity to move toward solutions to these larger-scale problems. A decision on the dam can serve as a catalyst for positive changes and improvements to the Shiawassee River throughout its watershed.

Figure 1.1. Shiatown Dam: General Location



Legend

-  Cities
-  Roads
-  Major Highways
-  Rivers and streams
-  Shiawassee watershed boundary

0 1 2 4 Miles



Data Sources: MI DNR Watershed Boundary (1998)
MI DNR Michigan Rivers Inventory
MI DNR Base Map Data
Map prepared by Dave Chadwick (wick@umich.edu)
Shiawassee River Masters Project

Figure 1.2. Shiatown Dam Site



0 0.125 0.25 0.5 Miles



Data Sources: MI DNR Shiawassee County Orthophoto (1998)
Map prepared by Dave Chadwick (wick@umich.edu)
Shiawassee River Masters Project



Figure 1.3. Shiatown Dam: Powerhouse foundation (right), center embankment (center), spillway weirs (left/center), and left embankment (left) *(Photograph by Mike Schuller, 2002)*



Figure 1.4. Below Shiatown Dam spillway looking upstream.
(Photograph by Mike Schuller, 2002)



Figure 1.5. Shiatown Dam spillway (left), center embankment (right), and powerhouse foundation (far right) looking downstream from the impoundment. *(Photograph by Mike Schuller 2002)*



Figure 1.6. Shiatown Impoundment, looking upstream (south)
(Photograph by Mike Schuller, 2002)

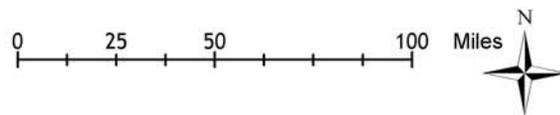
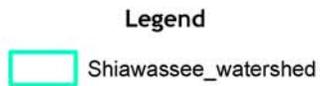
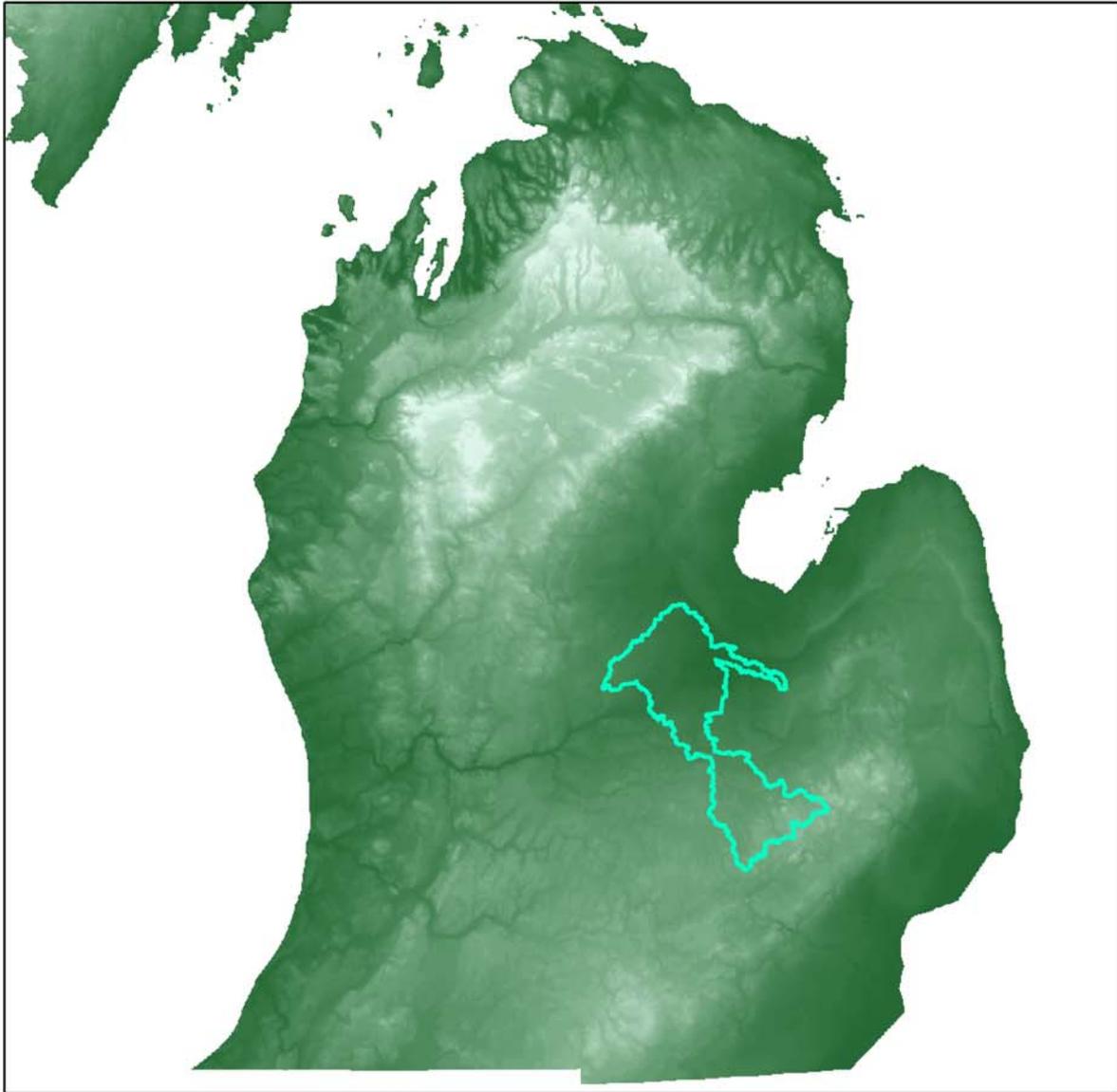


Figure 1.7. Shiatown Impoundment, looking upstream (south)
(Photograph by Mike Schuller)



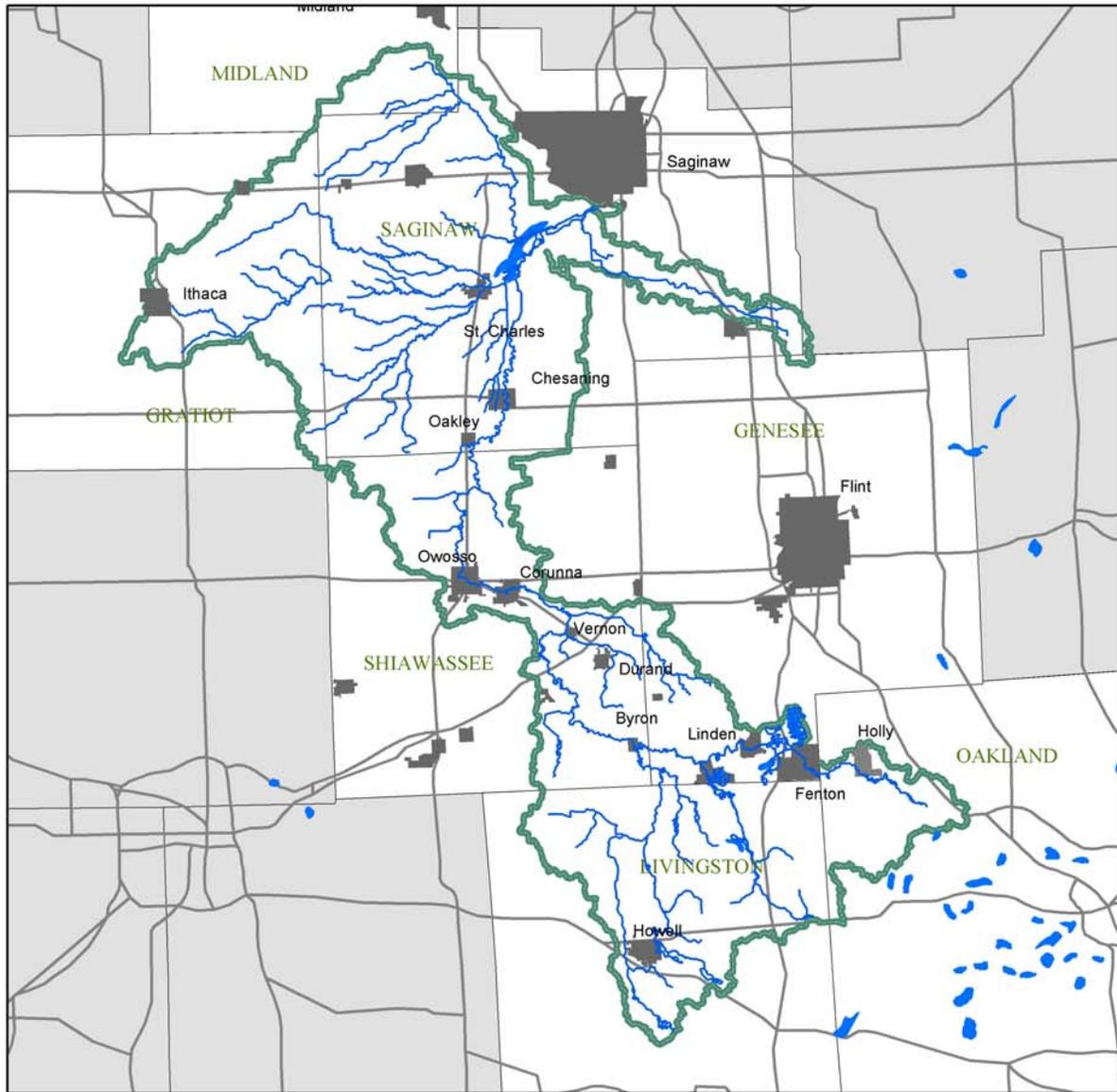
Figure 1.8. Shiatown Park
(Photograph by Dave Chadwick, 2003)

Figure 1.9. Shiawassee Watershed: General Location



Data Sources: MI DNR Watershed Boundary (1998)
Map prepared by Dave Chadwick (wick@umich.edu)
Shiawassee River Masters Project

Figure 1.10. Shiawassee Watershed: Political Geography



Legend

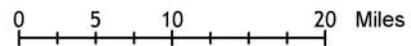
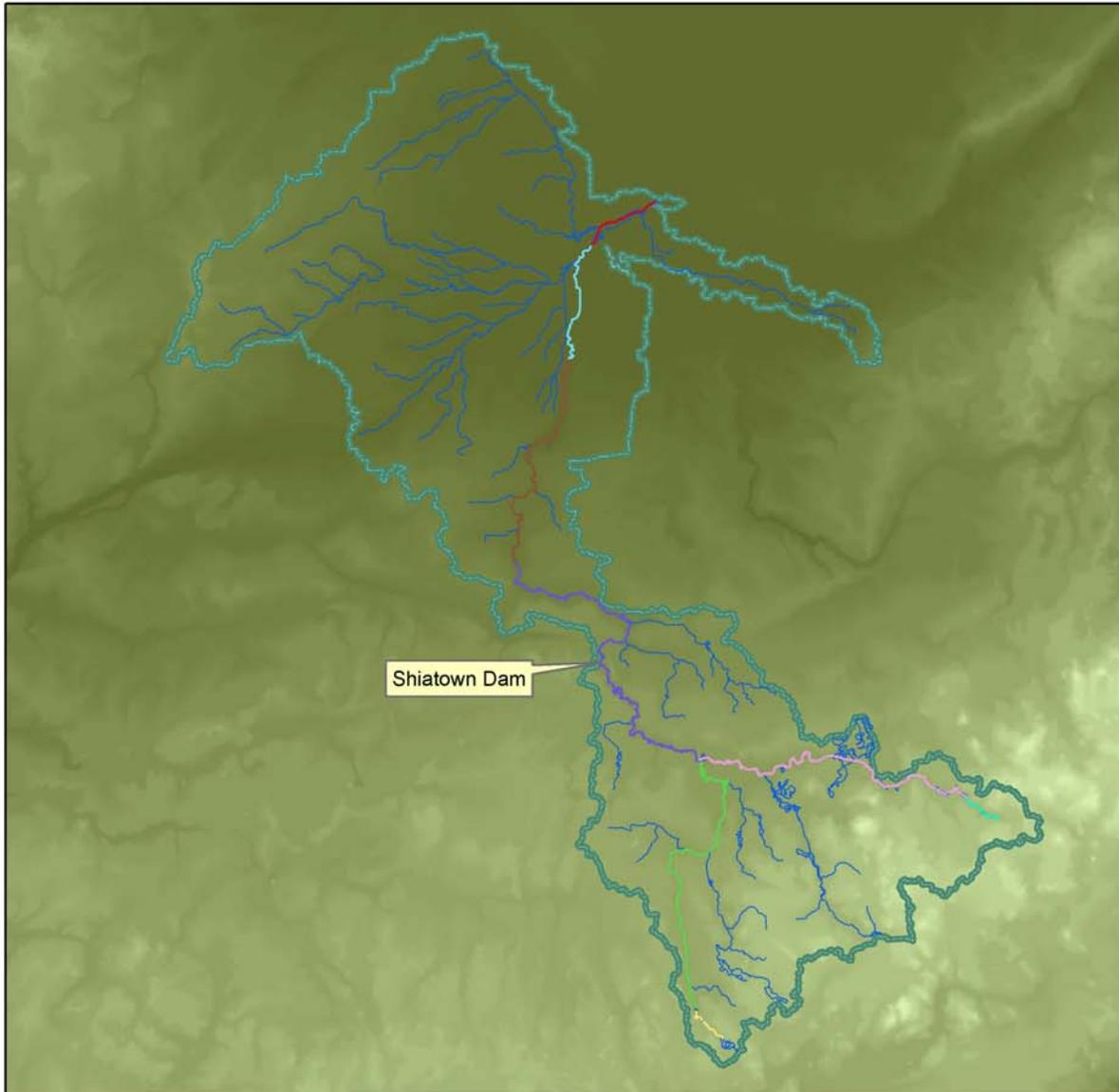
-  Cities and Towns
-  Roads
-  Rivers and streams
-  Shiawassee Watershed

0 5 10 20 Miles



Data Sources: MI DNR Watershed Boundary (1998)
MI DNR Michigan Rivers Inventory
MI DNR Michigan Base Map Data
Map prepared by Dave Chadwick (wick@umich.edu)
Shiawassee River Masters Project

Figure 1.11. Shiawassee River: Valley Segments

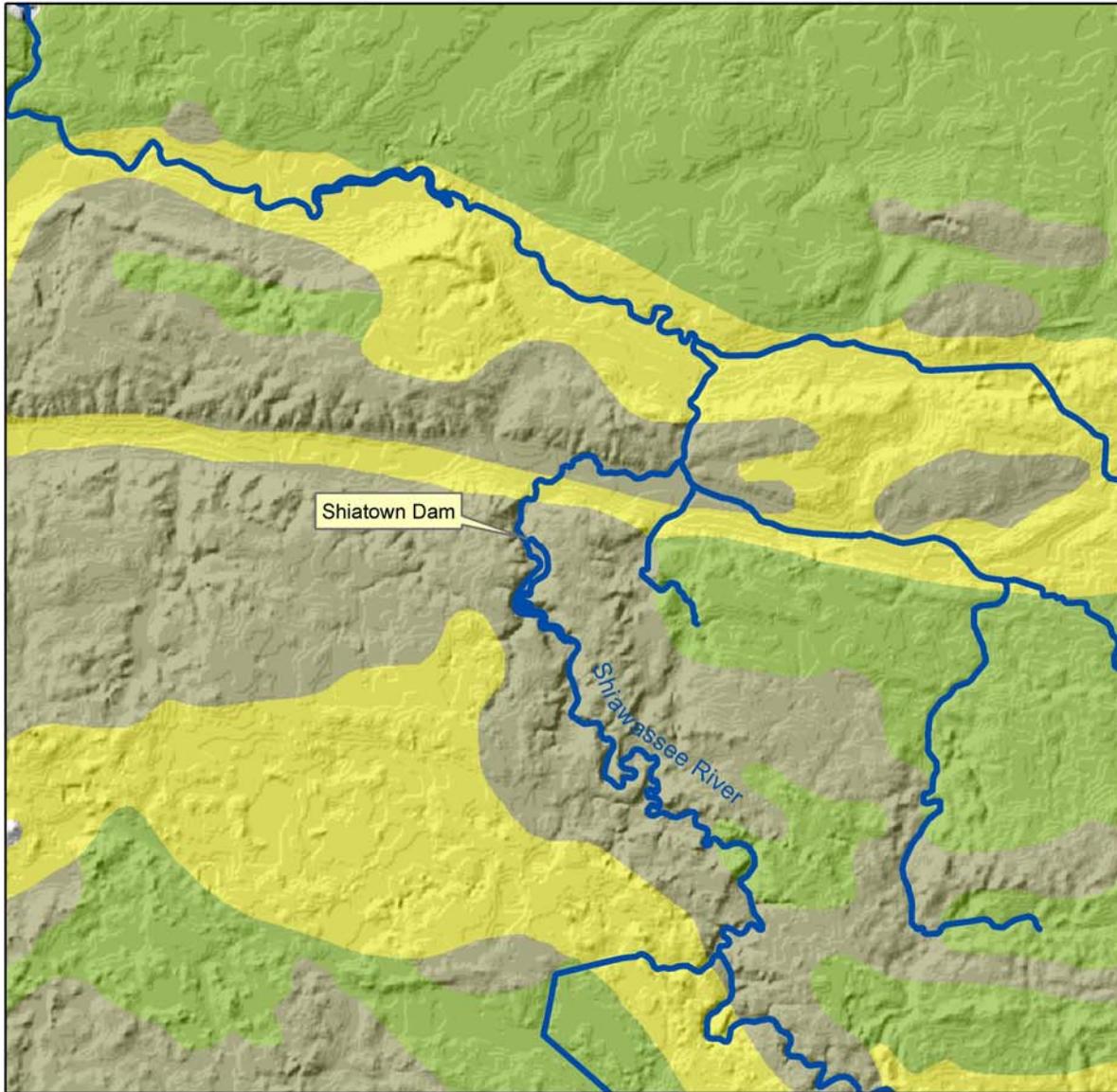


Data Sources: MI DNR Watershed Boundary (1998)
 MI DNR Michigan V-SEC (1.0)
 Map prepared by Dave Chadwick (wick@umich.edu)
 Shiawassee River Masters Project



Figure 1.12. Middle Shiawassee River
(Photograph by Mike Schuller 2002)

Figure 1.13. Shiatown Dam Site: Glacial Geology



Legend

 Rivers and Streams

Glacial Geology

-  Medium-textured end moraines
-  Glacial outwash sand and gravel
-  Medium-textured glacial till

0 1 2 4 Miles



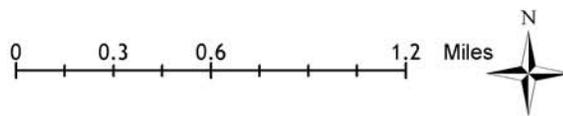
Data Source: MI DNR Quaternary Geology of Michigan (1982)
Map prepared by Dave Chadwick (wick@umich.edu)
Shiawassee River Masters Project

Figure 1.14. Shiatown Site: Vegetation Circa 1800



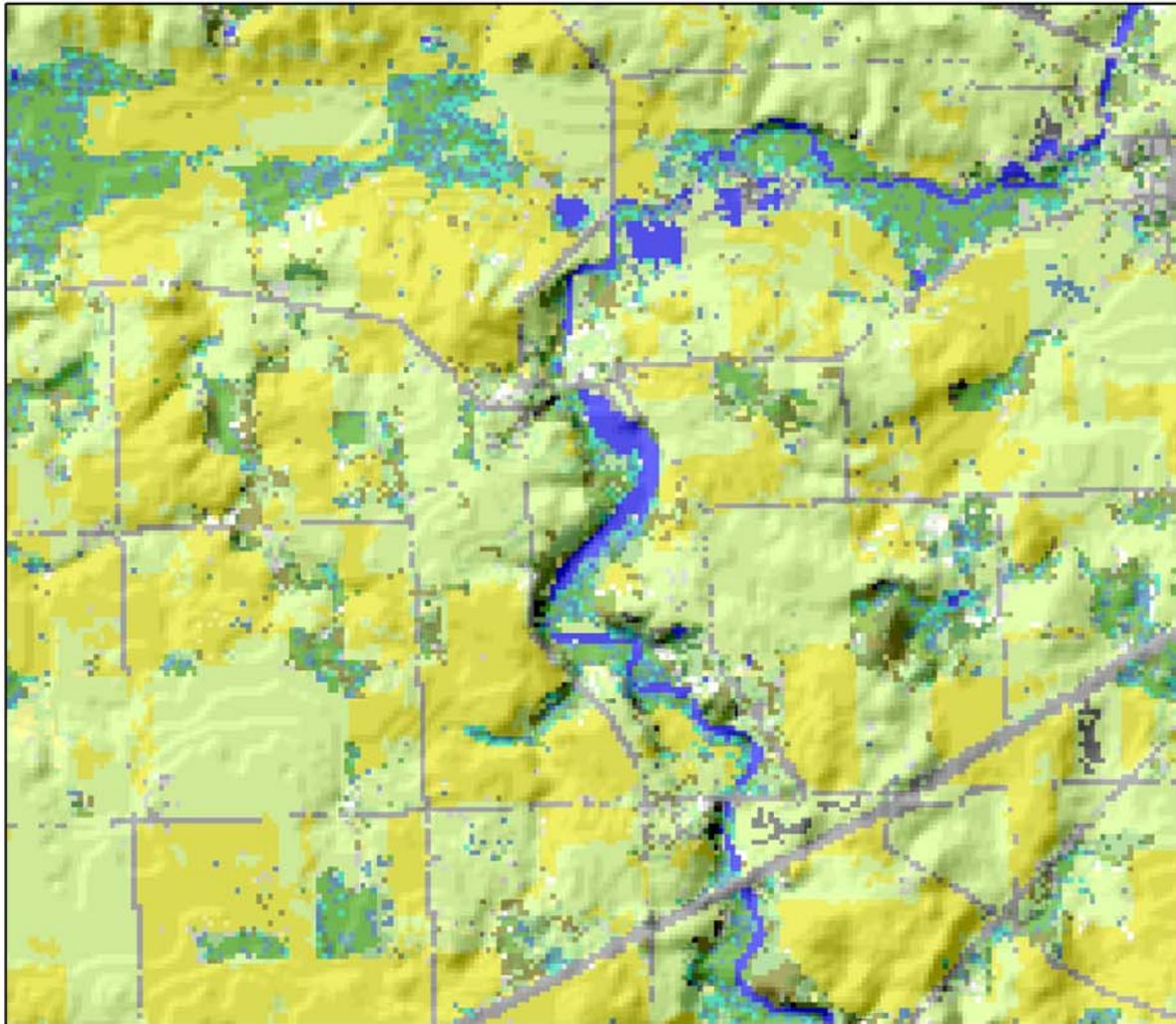
Legend

-  Beech-Sugar Maple Forest
-  Water
-  Mixed Hardwood Swamp
-  Oak-Hickory Forest
-  Shrub Swamp/Emergent Marsh
-  Wet Prairie



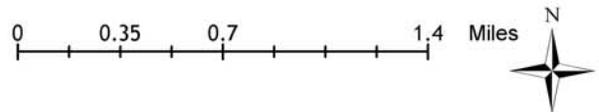
Data Source: MI DNR Land Cover Circa 1800 Map
Map prepared by Dave Chadwick (wick@umich.edu)
Shiawassee River Masters Project

Figure 1.15. Shiatown Site: 2000 Land Cover



Legend

 Emergent Wetland	 Mixed Upland Deciduous
 Floating Aquatic	 Non-vegetated agriculture
 Forage Crops	 Northern Hardwoods
 Herbaceous Openland	 Oak Type
 High Intensity Urban	 Other Conifers
 Low Intensity Urban (Residential)	 Other Upland Deciduous
 Lowland Coniferous Forest	 Parks, Golf Courses
 Lowland Deciduous Forest	 Pines
 Lowland Mixed Forest	 Roads / Pavement
 Lowland Shrub	 Row Crops
 Mixed Non-forest Wetland	 Upland Mixed Forest
	 Upland Shrub
	 Water



Data Sources: MI DNR Southern Michigan LP Land Cover 2000
 Map prepared by Dave Chadwick (wick@umich.edu)
 Shiawassee River Masters Project



Figure 1.16. Boat Races at Shiatown Impoundment, circa 1947.
(Photographer unknown; Provided by Mark Beach, 2003)



Figure 1.17. Boat Races at Shiatown Impoundment, circa 1947.
(Photographer unknown; Provided by Mark Beach, 2003)



Figure 1.18. Left Embankment
(Photo by Mike Schuller, 2003)



Figure 1.19. Seepage in Left Embankment
(Photo by Mike Schuller, 2003)



Figure 1.20. Left Abutment Wall
(Photo by Mike Schuller, 2003)



Figure 1.21. Right Abutment Wall
(Photo by Mike Schuller, 2003)



Figure 1.22. Powerhouse
(Photo by Mike Schuller, 2003)



Figure 1.23. Accumulated sediment in Shiatown Impoundment.
(Photograph by Mike Schuller, 2002)

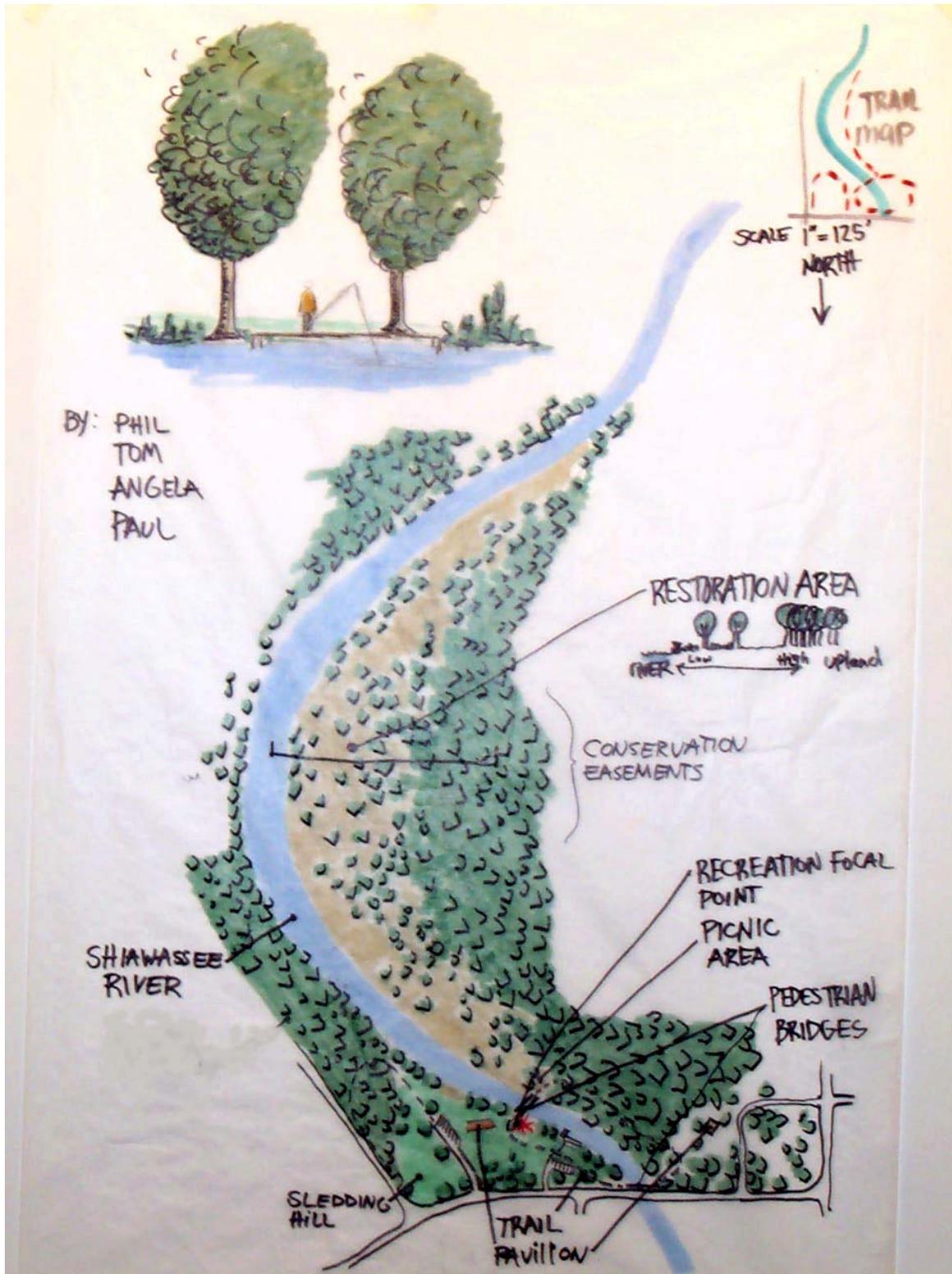


Figure 1.24. Charette Design.

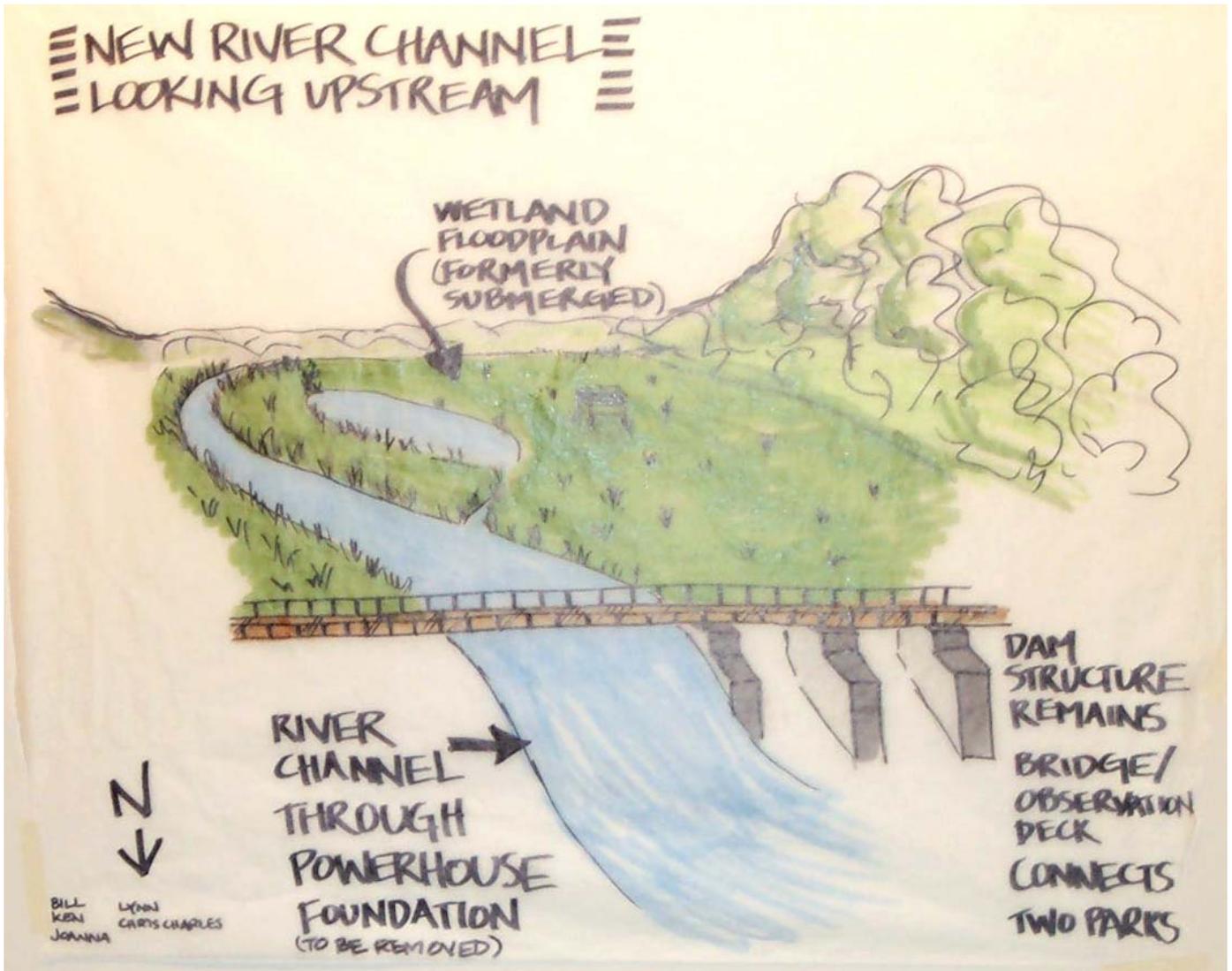


Figure 1.25. Charette Design.

Chapter 2: Ecological Overview of the Shiawassee Watershed

Like all river systems, the Shiawassee River is a complex, landscape-scale ecological system defined by interacting biological and physical processes. The character of the river is a reflection of a range of natural and human influences, occurring at a range of temporal and spatial scales. An understanding of the entire river and its landscape context can provide a useful baseline for management decisions on the river and throughout the watershed.

Basic Geography

The Shiawassee River is a low gradient, warm-water river that drains approximately 1260 square miles of central Michigan.⁹⁴ Beginning in Oakland County, the Shiawassee River flows west and then north to a confluence with the Flint, Cass and Tittabawassee Rivers to form Saginaw River, which ultimately drains into Saginaw Bay of Lake Huron. The Shiawassee watershed includes portions of seven counties: Shiawassee, Livingston, Oakland, Genesee, Gratiot, Midland, and Saginaw (Figure 2.1).⁹⁵

The Shiawassee River's watershed has been described as two watersheds in tandem with relatively pronounced differences in climate, landform, and natural character between the upper and lower basins.⁹⁶ The upper watershed generally includes rolling plains and low hilly terrain along the Shiawassee River and the South Branch Shiawassee River. The lower watershed encompasses a large, flat expanse of lake plain, drained by the Bad River and the lower Shiawassee River. The two basins are narrowly connected where the river passes through an area of hills southeast of the Owosso-Corunna area.

The Shiawassee River is nested in a structure of landscape-scale ecosystems. These large ecosystems are hierarchical, functioning units made up of the interaction between physical and biological features in a region.⁹⁷ The Shiawassee River's watershed spans three major subsections of the Southern Lower Michigan Regional Landscape Ecosystem (Figure 2.2). The far southeastern corner of the watershed, including the headwaters of the river, captures a small portion of the Jackson Interlobate subdivision. Most of the upper watershed along the Shiawassee River and South Branch Shiawassee River is situated in the Lansing Subdivision. The lower portion of the watershed encompasses a large expanse of the Saginaw Bay Lake Plain Subdivision.

Like all river systems, the Shiawassee River is a large, complex feature of the landscape. This system can be easier to understand if it is broken it into smaller units, or segments, that share broad patterns in geology, hydrology,

Ecological Overview of the Shiawassee River and Watershed

climate, and other ecological dynamics.⁹⁸ Using this approach, the Shiawassee River can be broken into eight distinct valley segments (Figure 2.3).

- Shiawassee Headwaters
- Upper Shiawassee
- Middle Shiawassee
- Lake Plain Shiawassee
- Lower Shiawassee
- Shiawassee Flats
- South Branch Headwaters
- South Branch Shiawassee River

Shiawassee Headwaters Segment

The headwaters segment of the mainstem Shiawassee River includes the uppermost reaches of the river, above the town of Holly in the southeastern corner of the watershed. The river in this short (3 miles) segment of the river is cooler than other sections of the river, has a moderately high gradient, and has a fair degree of baseflow.

Upper Shiawassee Segment

The upper segment begins just above Holly and proceeds approximately 29 miles to just beyond the town of Byron. The river flows through a number of lake areas and gains some flow from tributaries. This segment has moderately higher groundwater flow than the headwaters and lower segments of the river. The river is moderately warmer and lower gradient than the headwaters segment, but is still cooler than lower reaches of the river.

Middle Shiawassee Segment

At Byron, the mainstem of the Shiawassee River gains a considerable amount of water from the confluence with the South Branch. From Byron to just below Owosso, the Shiawassee River has a moderate gradient and warmer water. This segment of the river is approximately 36 miles in length. Groundwater flow is moderate, but with increasing contributions of runoff.

Lake Plain Shiawassee Segment

Just beyond Owosso, the Shiawassee enters a broad plain. The lake plain segment of the river proceeds for approximately 27 miles. The gradient of the river is somewhat higher in this segment. Groundwater inputs are markedly lower, with surface runoff dominating the river and generally 'flashier' flows.

Lower Shiawassee River Segment

Below Chesaning, the gradient of the river drops dramatically. For the next 11 miles, the river flows through low areas and bottomlands. The confluence of

the Bad River boosts the size of the river somewhat. The river remains predominantly runoff driven, with flashy flows. The dominance of surface water keeps the river warmer.

Shiawassee Flats Segment

The Shiawassee River gets wider and slower in the Shiawassee Flats segment, a large expanse of marshland that includes the river's confluence with the Flint River. The river has virtually no gradient in this segment, as it flows lazily to the north through meandering sloughs and wetlands. This segment of the river runs for approximately 6 miles, until the Shiawassee, Flint, Tittibawassee, and Cass Rivers all merge to form the Saginaw River.

South Branch Shiawassee River Headwaters Segment

The South Branch of the Shiawassee River includes a small, approximately 3 mile segment that is cooler than lower sections of the river, has a moderately high gradient, and has a fair degree of baseflow.

South Branch Shiawassee River Segment

The main segment of the South Branch Shiawassee River runs from just above the community of Howell to the confluence with the mainstem at Byron. This 27-mile segment of the river has low groundwater inputs, drawing predominantly on surface runoff. The gradient is moderately low, comparable to the upper segment of the mainstem Shiawassee River.

Climate

Climate is a fundamental influence on the character of a river system and its watershed. The Shiawassee watershed is located in the east-central region of Michigan's Lower Peninsula, which tends to have a milder and less variable climate than the northern portions of the state. The growing season across the lower portion of the state is longer and generally more stable, and variations in rainfall and temperature across the region are generally less pronounced than in northern and western parts of Michigan.⁹⁹ At the same time, some variation is evident in the Shiawassee Watershed. In particular, the upper portion of the watershed, in the Lansing and Jackson Interlobate subsections, tends to be cooler and wetter than the lower watershed, which rests in the Saginaw Bay Lake Plain Subsection.¹⁰⁰

Air temperatures in the Shiawassee watershed have generally varied seasonally with lower average temperatures in the winter months and higher temperatures in the summer months (Table 2.1). The 30-year mean annual air temperature at Owosso, located at the center of the watershed, was 46.4°F. During this period, mean monthly temperatures ranged from 21.2°F in January to 69.9°F in July.¹⁰¹ This is generally moderate compared to other

parts of the state (Table 2.2). The growing season (period between the last frost of the spring and the first frost of the autumn) in the Shiawassee Watershed ranges from 140 – 160 days, with some variation between the upper watershed and the lower watershed.¹⁰² The growing season tends to be shorter in upper reaches of the watershed and longer in the lower watershed.

The Shiawassee watershed receives a moderate amount of precipitation compared to the rest of Michigan. Over the last fifty years, the entire watershed received, on average, 30.4 inches of precipitation per year.¹⁰³ The 30 year mean annual precipitation at Owosso was 30.54 inches. This is somewhat lower than locations on the western side of the state, which tend to receive higher levels of rain and snow (Table 2.3). Precipitation in the Shiawassee watershed is generally lowest in January and highest in May. About half of the year's precipitation comes in the form of rain between May and September. Annual precipitation in the upper watershed is generally somewhat higher than the watershed average, while precipitation is typically lower on the Saginaw Bay Lake Plain, which receives some of the lowest amounts of rain and snow in the state.¹⁰⁴

Geology

Along with climate, geology acts as an underlying influence on the structure and function of the natural systems in the Shiawassee watershed. Like all of lower Michigan, the landscape through which the Shiawassee River flows is a product of the movement of the Wisconsinian Glacier across the earth's surface at the end of the last Ice Age. The pattern and timing of this glacier's movement scoured and shaped the landscape, leaving deposits that define the region's topography and soils and drive the movement of water through and across the landscape (Figure 2.4). Underlying differences in the geology along the length of the watershed explain variation in the character of the river and its landscape.

At its greatest extent, approximately 18,000 years ago, the Wisconsinian glacier covered all of Michigan and portions of Indiana and Ohio.¹⁰⁵ As the climate warmed, the glacier retreated to the north. Three large lobes extended down from the glacier: the Michigan Lobe, roughly following the current location of Lake Michigan, the Saginaw Lobe along Lake Huron, and the Erie Lobe along Lake Erie.¹⁰⁶ These lobes advanced and receded as the glacier made its halting retreat across the landscape. The movement of the Saginaw Lobe across the Shiawassee basin left deposits of rock, earth, and debris known collectively as till. Till deposited at the base of the glacier formed expanses of ground moraine, an undulating layer of unsorted rock and earth. End moraines formed as material deposited at the margins of the retreating ice sheet, creating conspicuous ridges of unsorted till. The pattern of ground and

end moraines is broken up by sandy outwash deposits left by the melting water that flowed off of the glaciers and across the landscape. In contrast to the unconsolidated material in the moraine deposits, the material in these outwash channels was well-sorted by the movement. Finally, thick sediment was left in much of the lower Shiawassee by the emergence of prehistoric Lake Saginaw as the glacier continued to retreat.

Headwaters/Upper Shiawassee River

The upper reaches of the Shiawassee River and the South Branch Shiawassee originate in the area where the three glacial lobes diverged between 13,000 and 16,000 years ago.¹⁰⁷ This “interlobate” area is characterized by low ridges, rolling hills, and wet lowlands. This region is the birthplace of many of central and southeastern Michigan’s most important rivers, including the Huron River, Cass River, Flint River, Clinton River, and Rouge River. The underlying glacial material in this area consists of coarse and medium textured gravel and rock material arranged in ground moraine and end moraine features.

Flowing to the west from Byron, the Shiawassee River and many of its tributary streams generally follow glacial outwash channels, areas of well-sorted material that readily convey water. At the town of Byron, the Shiawassee River is joined by the South Branch. The topography in this section of the river is generally low, but end moraine features do form loose ridges and depressions that break up the landscape. The underlying material in both the end moraines and till plains is predominantly medium-textured till.

South Branch Shiawassee River

Like the main river, the South Branch emerges in an area of coarse till end moraine deposits. Flowing to the north, the river passes through alternating areas of medium textured till plains and medium textured end moraines. Topography in the upper portion of the South Branch includes some isolated spots of relatively high relief amid rolling plains.

Middle Shiawassee River

Between Byron and Owosso, the watershed is characterized by medium-textured till plains and end moraines. Flowing across moraine ridges, the river features areas of somewhat high gradient and narrower valleys. Prehistorically, the Shiawassee River flowed to the west, into the Maple River drainage, and, ultimately, into Lake Chicago, the predecessor of Lake Michigan.¹⁰⁸ The retreat of the Saginaw Lobe and the emergence of prehistoric Lake Saginaw eventually drew the river through an opening in a narrow patch of hills around Durand and Vernon. Here the watershed narrows to only a few miles, as the river flows through a small notch in a relatively hilly area. The river continues

Ecological Overview of the Shiawassee River and Watershed

through an outwash channel in an area of rolling till plain made up of medium textured material.

Lake Plain/Lower Shiawassee/Shiawassee Flats

Beyond the City of Owosso, the watershed widens as the Shiawassee River enters the Saginaw Bay Lake Plain, taking in the Bad River's drainage area. The broad, flat Saginaw Bay Lake Plain was formed by the retreat of the Saginaw Lobe and the emergence of prehistoric Lake Saginaw. Fine clays and sediments settled to the bottom of the lake, creating deep (300 feet) deposits of fine sand, clay, and gravel. This expansive plain is crossed by some broad, shallow sand channels, remnants of prehistoric beaches, and several scattered patches of dune deposits.

Influence of Glacial Geology on the Shiawassee Watershed and River

The composition and pattern of glacial deposits in the watershed exert a powerful influence the structure and function of the Shiawassee river system. Coarse textured glacial deposits, consisting of larger pieces of gravel and rock, tend to be more permeable to groundwater flow. Areas characterized by these deposits, such as the headwaters of the Shiawassee River, tend to have relatively higher inputs of groundwater. Medium and fine tills tend to have finer spaces between the particles of gravel and sand, facilitating relatively less groundwater flow. Areas characterized by these deposits, such as the river's middle and lower reaches, tend to receive higher inputs of surface runoff. Outwash deposits, because they were sorted by flowing water, tend to be among the most permeable of glacial deposits, creating localized groundwater inputs and generally providing an area for the river to flow. At the opposite extreme, the fine-textured lakebed sediments that characterize the lower half of the watershed tend to resist groundwater flow. The river in this area is heavily dominated by surface runoff, and flows in the lower Shiawassee River and Bad River tend to be driven by surface water movement. By affecting the routing of water to the river and the relative proportion of groundwater to surface runoff, glacial geology is one factor that shapes the physical and biological character of the river.

Land Cover

At the start of the 19th century, prior extensive European settlement, the Shiawassee watershed was characterized by a rich, diverse collection of natural vegetation, including forests, swamps, and expanses of wet prairie and marsh (Figure 2.5).¹⁰⁹ The upper Shiawassee watershed featured oak-hickory forests in upland areas and wet meadows and fens in depressions. Scattered oak savannahs and oak barrens existed across the region. Moving north, beech-sugar maple forests become more prevalent on upland areas, intermixed with oak-hickory forest. Swamp forests were typical in the lowlands. Moving

down into the lower watershed, wet prairies existed on poorly drained areas of till plain, and meadow wetlands were common along rivers, streams, and lakes.

The flat, poorly-drained lake plain region at the lower end of the watershed was characterized by large areas of unforested wetlands and lowland forests. Poor drainage and low gradients supported expansive marshlands and wet prairies. Inland of the marshes, lowland hardwood forests and swamps dominated. Beech and sugar maple forests were typical in scattered areas with better drainage.¹¹⁰

The modern Shiawassee watershed reflects 200 years of settlement and development (Figure 2.6; Table 2.4). Much of the watershed was cleared and converted to agricultural use by the late 19th century. Today, 55.7% of the land base is dedicated to crop production or pasture. Agriculture is most intensive in the lower portion of the watershed, where extensive areas of prairie and marshland have been drained and converted to crop production. Urban development in the watershed has been concentrated in a handful of small towns and cities. While towns in the central and lower watershed emerged independently, the upper portion of the watershed has been experiencing increasing residential growth from the Flint and Detroit metropolitan areas.

Despite considerable development, portions of the watershed remain in a relatively natural state. Approximately 16.2% of the watershed is forested, and wetlands (open and forested) cover an additional 12.8%. These natural areas are highly fragmented, existing mostly in small patches of forest or marsh. Woodlands are more prevalent in the upper Shiawassee watershed and in small, isolated spots of abandoned agricultural lands throughout the middle and lower watersheds. Relatively larger areas of wetlands persist in the western reaches of the Bad River drainage and along the lower Shiawassee River.

Valuable representatives of native ecological systems persist in the watershed, particularly in the upper reaches of the Shiawassee River. Numerous small lakes exist through the headwaters region, which also includes globally significant prairie fen complexes and tamarack swamps.¹¹¹ Although much of the lower Shiawassee watershed has been drained and converted to agricultural use, some areas of marshlands have been preserved in the Shiawassee Flats area.

Soils

The soils in a watershed shape the character of the landscape and have direct and indirect influences on hydrologic pattern and function. The permeability

of soils directly influences groundwater and surface water flow rates. Permeable, sandy soils permit greater flows of groundwater, while finer grained, clayey soils can limit groundwater flow. In addition, soils also exert a powerful influence on human use and modification of the landscape. The soils that are present at a site can determine, for instance, whether an area is used for agricultural or residential development or left in a less developed state.

Soils are classified into broad associations of soil types that commonly occur together in predictable patterns. In general, the upper watershed is characterized by a mixture of well-drained coarse and medium soils, on slopes ranging from steep to moderate to level.¹¹² These soils tend to be more permeable to water, moderating surface runoff and permitting moderate groundwater flows. Moving downstream, the watershed includes larger proportions of less well-drained, loamy soils.¹¹³ The lower watershed is dominated by poorly drained soil associations.¹¹⁴

Hydrology

The movement of water in a river is an expression of the interaction of multiple natural processes, including climate, geology, and land cover. It is also closely bound with human activity: how we interact with our environment has many direct and indirect influences on how water moves through the landscape.

Surface Water

Stream flow has been called the “master variable” that governs the structure and function of river ecosystems.¹¹⁵ Rivers evolve and exist as uniquely balanced arrangements of physical, chemical, and biological characteristics that are all controlled by natural patterns of variation and stability.¹¹⁶ Patterns of flow structure habitat in rivers for fish and other organisms and determine the character of aquatic and riparian vegetation.

Streamflow on the Shiawassee River is measured by the US Geological Survey (USGS) at four gauges on the Shiawassee River (Table 2.5) and a handful of tributary stations. Like many rivers, the Shiawassee shows a pattern of gradually increasing discharge as it moves downstream and gains water from tributaries. In the river’s upper reaches, at the Linden station, the mean annual discharge over the period of record was 63 cubic feet per second (cfs). The flow of the river picks up dramatically below Byron, where the South Branch joins the river. At this point, the mean annual flow was 251 cfs. Farther downstream, at Owosso, the mean annual flow was 355 cfs. In the Lower Shiawassee, at the Fergus station, mean annual discharge was 442 cfs.

Seasonal Flow Variability

Seasonal variation in a river's flows reflects the geology, climate, natural topography, and land use in the watershed. Flows in the Shiawassee River vary considerably over the course of the year (Figure 2.7). Snowmelt and precipitation generally induce high water levels in the spring months, with peak flows occurring in March and April. Low flows occur in the dry, warm late summer months.

Variability in a river's flow regime can be understood by examining exceedence values, which express the percent of time a given flow on the river is met or exceeded. The distribution of exceedence values can give us a good sense of how widely the river's high and low water levels differ from each other. The 5% exceedence flow represents the discharge that is exceeded 5% of the time in a given year. In other words, this represents a relatively rare high water condition. At the opposite extreme, a 95% exceedence flow represents a very low water condition. This number, commonly known as the baseflow, describes the volume of water that is virtually always present in the river. Exceedence values can be used to construct a flow duration curve, which plots measured stream flows against the percent of time each level of flow is met or exceeded on the river. Speaking generally, a river that experiences more extreme high and low flow events will have a steeper flow duration curve. A relatively flatter curve reflects a river with more regular, consistent flows. Flow duration values can be standardized for comparison between different rivers or different points in the same river systems by dividing each discharge value by the median discharge.¹¹⁷ This gives a measure of how much a given exceedence flow varies from the river's average flow.

The character of the river at high flow periods, represented by 5% exceedence values, can provide insight on the relative stability of a river's flows (Table 2.6, Figure 2.8). At periods of high flow, the upper reaches of the Shiawassee River system appear to be somewhat more stable over the course of the year than the lower stations. The standardized high flow at the uppermost gauging station, in Linden, is 3.0. This means that flood flows at this station are approximately three times as great as median flows in the river. In contrast, flows at the Byron, Owosso, and Fergus stations were 5.4, 5.8, and 6.4 respectively. These data suggest that the Shiawassee is a moderately flashy river, and that the river's flashiness increases as it moves downstream. In comparison, two of Michigan's most stable rivers, the AuSable River and Manistee Rivers have standardized 5% flows of 1.9 and 1.7 respectively, while the River Raisin, one of the state's flashier rivers, has a standardized 5% flow of 7.8.¹¹⁸

Ecological Overview of the Shiawassee River and Watershed

Low flow periods can also yield useful information about a river's character. The 95% exceedence value describes the baseflow of the river, which strongly reflects groundwater inputs to a river system and gives a general picture of its overall stability (Table 2.6; Figure 2.9). Standardized 95% flows in the Shiawassee River ranged from 0.2 to 0.3 at the Linden, Byron, Owosso, and Fergus stations. Comparison with other Michigan rivers again suggests a relatively high degree of flashiness in the Shiawassee River. The stable AuSable River and Manistee Rivers had standardized 95% flows of 0.7 and 0.8, while the River Raisin had a standardized value of 0.2.

Variability in a river's flow pattern reflects both the underlying geology and the type and character of land cover. The presence of slightly more permeable outwash channels and moraines, along with correspondingly porous soils, typically provides for higher groundwater storage and groundwater flow in the upper reaches of the Shiawassee River, making flows slightly more stable. A somewhat higher proportion of land in natural cover also moderates seasonal variation in the river's flows. In contrast to the upper watershed, the lower Shiawassee watershed is characterized by fine lake plain deposits, which generally do not hold large amounts of groundwater. The river is much more responsive to the runoff and precipitation that rolls relatively quickly off the lower Shiawassee watershed's clayey and silty landscape. Intense agricultural development and drainage in this portion of the watershed also facilitates the rapid movement of water into the river, further accounting for higher flood flows.

Gradient

Gradient, or slope, describes the drop in elevation over the length of a river. It is typically expressed in terms of the elevation loss over a distance, such as feet per mile. Gradient is an important factor in a river's ecology. To the extent that it structures the diversity of pools, riffles, and other river structures, gradient can dictate the availability and diversity of habitat for fish and other organisms.¹¹⁹

Gradient varies greatly over the length of a river. The gradient in any given reach is dynamically related to the amount of energy that the river has available to erode and shape its channel. High gradient areas increase water velocity, which increases the river's energy. At the same time, the river is constantly expending its energy and carving down its channel to reduce water velocity. This balancing act between force and gradient happens in a context determined by the river's placement in the landscape. The interplay of topography and geology consequently create a diverse collection of low, moderate, and high gradient areas, which in turn provide habitat for a wide range of fish and other aquatic organisms.

The Shiawassee River has an average gradient of 3.4 feet per mile over the length of the river. However, considerable variability exists along the length of the river (Figure 2.10). The Shiawassee River generally has higher slopes in the upper watershed, which has more relief and greater structural variability. The headwaters segment of the river, above Holly, has an average drop of 11.6 feet per mile. In the upper Shiawassee river segment, from just above Holly to Byron, the gradient is approximately 3.4 feet per mile. The river maintains approximately the same gradient through the middle Shiawassee river segment, which runs until just below Owosso. The river steepens below Owosso, averaging 4 feet per mile through the lower Shiawassee, just beyond Chesaning. Below this point, the river flattens dramatically, with a slope of less than 1 foot per mile for the next 15 miles.

Hydrologic Alteration: Dams, Land Use, and Drainage

There are at least 83 dams or other major water control structures in the Shiawassee River watershed (Figure 2.11).¹²⁰ These include relatively large dams on the mainstem of the river that create significant impoundments, as well as numerous smaller structures on tributaries throughout the watershed. The first few dams in the watershed were built with the arrival of European settlers in the mid-nineteenth century to power sawmills and grain mills for the region's emerging agricultural economy. Dams in the watershed were also built to create artificial lakes and regulate the level of naturally occurring ponds.

The majority (46) of the dams in the watershed are privately owned. The federal government operates seven structures to regulate water levels in the Shiawassee National Wildlife Refuge, which includes a large portion of the Shiawassee Flats area at the mouth of the river. The state of Michigan owns ten of the structures. Dams owned by local governments (20) are situated mostly along the mainstem of the river.

Dams have played an important role in human development of the Shiawassee watershed, providing power and recreation for nearly 200 years of settlement. At the same time, they have had a considerable impact on the Shiawassee River and other streams in the watershed. The ecological effects of dams on rivers have been studied extensively over the last few decades.¹²¹ By disrupting the flow of water, dams fragment habitat and migratory patterns of fish and other river wildlife. This affects both large scale migratory movements and local habitat use. Dams also alter the chemical and physical characteristics of the water that flows through impounded areas. Shallow impoundments and those that release water from closer to the surface tend to raise the temperature of a river. On the other hand, deeper reservoirs with intakes at the bottom of the structure can dramatically reduce water

temperature. In addition, dams can reduce levels of dissolved oxygen, with deleterious effects on fish in impounded rivers and in downstream areas.¹²²

At the most basic level, dams disrupt the natural variability in water levels that characterizes a healthy river system. The pattern of fluctuating highs and lows in a river's discharge, known as the river's flow regime, has been identified as the 'master variable' that governs the structure and function of running water ecosystems.¹²³ Flow regime can be broken down into five key components that structure and define ecological processes: the magnitude of discharge, the frequency of discharge, the duration of discharge, the timing of discharge, and the rate of change, or flashiness of a river's flow regime. The unique combination of these components dictates patterns of sediment and energy movements, as well as the availability of habitat for fish and other organisms.¹²⁴ Storing and releasing water according to human needs for irrigation, energy, and other uses can substantially interfere with normal variation in river flow, with a range of effects on the structure of the river system.

Particularly serious impacts on a river can result from the disruption of normal sediment dynamics and geomorphic processes. As water velocities drop, suspended sediments settle out. Even small, run-of-the river dams can create impoundments that are capable of trapping substantial volumes of sediment. The release of sediment-starved water can result in increased scouring and bed armoring in downstream areas. The alteration of normal patterns of channel-forming high flows can further impair the evolution of the river.¹²⁵

In addition to dams and barriers, the hydrology of the Shiawassee watershed has been heavily impacted by the widespread alternation and modification of stream channels to support agricultural drainage. River surveys by the DNR and DEQ have noted extensive alteration of stream channels throughout the Shiawassee watershed.¹²⁶ This development but it is most intense in the middle and lower sections of the watershed, where agricultural development has been most intense and where natural drainage is the poorest. These alterations include the widening and straightening of stream channels, as well as the removal of streamside vegetation and woody debris. By accelerating the movement of water off the landscape, these alterations increase the flashiness of a river system, boosting peaks and reducing low water levels.

Water Quality

Water Quality Standards

Under the Federal Water Pollution Control Act of 1972 (the "Clean Water Act") and the Michigan Natural Resources and Environmental Protection Act, the State of Michigan sets water quality standards to protect the integrity of

the rivers, lakes, and streams of the state for designated uses. The uses includes agriculture, navigation, industrial water supply, public water supply, warmwater fishery, aquatic life and wildlife, partial body contact recreation, and total body contact recreation.¹²⁷ Progress toward attainment of water quality standards is monitored by the DEQ under a strategic plan developed in 1997. This plan requires the assessment of the state's rivers on a five year rotating basis for chemical quality, habitat, and biological resources.¹²⁸ The Shiawassee Watershed was assessed in the summer of 2000. Of the 388 miles of rivers and streams in the Shiawassee River system that were assessed that year, 42 miles were found to be meeting water quality standards. An additional 163 miles were not in attainment and 157 miles were identified as 'highly modified.'

Point Source Pollution

The most direct and obvious source of pollution is the direct release of a pollutant or contaminated material into a river or stream. To address these 'point sources' of pollution, the Clean Water Act and the Michigan Natural Resources and Environmental Protection Act require that specific technological controls be in place before any individual or organization can discharge material into any of the state's rivers, lakes or streams. These requirements are implemented through the National Pollution Discharge Elimination System (NPDES), which is administered by the DEQ Surface Water Quality Division. This system issues permits that allow the release of wastewater from industrial, residential and other uses only after it has been treated to eliminate pollutants.

As of October 2002, there are 131 permitted dischargers in the Shiawassee River watershed. This total includes 83 stormwater permits, which are required for certain industrial facilities that discharge storm runoff from their facility into rivers and streams directly or through a stormwater sewer (industries that gather their stormwater and send it to a wastewater treatment facility are not required to obtain permits). The permitted dischargers in the Shiawassee River watershed also include 49 individual non-stormwater dischargers. These dischargers in the Shiawassee watershed include sixteen public wastewater treatment facilities, along with nine private wastewater treatment facilities and 23 industrial permittees.¹²⁹

Nonpoint Source Pollution

In addition to direct releases of pollution into rivers and streams, water quality can be degraded by activities that occur across the landscape. Pollutants that enter the water from the atmosphere, surface runoff, or other indirect means are known as 'nonpoint source' pollution because they can not necessarily be traced to a single location or incident. Sources of nonpoint source pollution

include land use practices, soil erosion, septic systems, animal wastes, residential fertilizer usage, and other broad-scale activities on the landscape.

Because it comes from activities across the landscape, nonpoint source pollution is difficult to control through the technological requirements imposed by the NPDES. As a result, some rivers, streams, and lakes can fail to meet state water quality standards even when the maximum level of controls are imposed on permitted point source dischargers. To address nonpoint source pollution, the Clean Water Act requires the State of Michigan to monitor water quality and report annually on the rivers that fail to meet water quality standards or are likely to fall below the threshold in the near future. To improve the quality of these waters, the state is required to develop “Total Maximum Daily Load” (TMDL) plans that described steps that need to be taken to reduce nonpoint pollution. These steps can include the use of best management practices, including controls on fertilizer use, changes in agricultural waste management techniques, erosion control and bank stabilization, and better management of urban stormwater.

Major Water Quality Issues

Elevated Nutrient Levels

Excessive nutrients can originate from both point sources and nonpoint sources. Wastewater treatment plants are the most prominent point source of nutrients, particularly phosphorus. Conventional treatment strategies (primary and secondary treatment) do not generally remove all of the excess phosphorus from water, resulting in increases when treated wastewater is released into the river. The dominant nonpoint sources of elevated nutrient levels are land disturbing activities like agriculture and urban development. Phosphorus, in particular, is linked to land use practices. Because phosphorus chemically binds with suspended particles of sediment, phosphorus levels are closely linked with runoff from agricultural and urban/suburban areas.

Water quality surveys by the DEQ have found elevated nutrient levels throughout the Shiawassee watershed, reflecting both point sources and nonpoint sources.¹³⁰ In general, nutrient concentrations generally increase as the Shiawassee flows north, with larger increases occurring immediately downstream from urbanized areas.¹³¹ Elevated levels of phosphorus and nitrate are also evident in the central portion of the watershed, much of which can be traced to agricultural runoff. The South Branch also contributes significantly to the river’s phosphorus load below Byron. This has been attributed to flows from the Marion and Genoa Drains in the headwaters of the South Branch and agricultural runoff along the river.¹³² In addition, concentrations of nitrate and phosphorus increase immediately below the Owosso Wastewater Treatment Plant.¹³³ Agricultural erosion and urban

runoff, both containing higher levels of sediment, are also likely contributors to nonpoint source pollution in the watershed.

Bacteria

Bacteria naturally occur throughout our environment. The majority of bacteria are harmless and, in many cases, beneficial. Excessive levels of certain kinds of bacteria, however, can pose a threat to human health and safety. Coliform bacteria, such as *Escherichia coli* (*E.coli*) originate in human and animal waste and can bring about serious illness in individuals who ingest contaminated waters. The presence of pathogenic bacteria can also serve as an indicator of other waste-related contamination problems. To protect human health and safety, the DEQ sets standards for *E.coli* in the state's rivers and lakes. These standards are generally monitored and reported by county health departments and as part of routine water permitting processes.

Bacterial contamination can result from the failure of municipal sewage systems, illicit sewer hookups, and the failure of residential septic systems. Residential development in communities can outstrip the capacity of aging sanitary sewage systems, and untreated waste can flow into local waters when wet weather overwhelms sewer capacity. Illicit sewer hookups occur when individuals discharge human or animal waste into storm sewers or drains rather than septic systems or sanitary sewers. Finally, failing septic systems can also contribute to *E.coli* contamination through direct discharges and groundwater flows.

Elevated levels of *E.coli* have been an issue in the Shiawassee River for several years. At present, the river generally meets the standards set by the DEQ.¹³⁴ However, elevated levels have been measured in the past following accidental discharges of untreated sewage and as a result of ongoing non-point source pollution. Extremely high levels of *E.coli* have been found on a number of occasions in drains and creeks that flow into the river. Hot spots for bacterial contamination have included the Durand-Vernon area below Shiatown and the Fenton area upriver of the site. Large sewage discharges have attracted attention to the need to upgrade local wastewater systems in many communities in the Shiawassee watershed. The Shiawassee County Health Department continues to recommend that individuals limit their contact with the river's water along much of the Shiawassee River

Toxic Contamination/Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyl (PCB) contamination has been a problem in the Shiawassee River since the late 1960s. PCBs are complex chemical compounds that have been used in a range of industrial applications throughout the 20th century. PCBs are highly toxic substances that pose serious risks to human health and the natural environment. Because they do

not naturally break down or decompose, PCBs can accumulate and concentrate over time in the tissue of living things and in sediments and soils. Owing to the region's long industrial history, PCBs are a persistent problem throughout the Great Lakes basin.

Between 1969 and 1979, PCB-containing industrial wastes were released around and into the South Branch of the Shiawassee River at the former Cast Forge Company facility in Howell, approximately 40 miles upstream from the Shtatown site. Improperly managed wastes were discharged on the Cast Forge Company's property, onto adjacent lands, and into the Shiawassee River on a number of occasions during that time. Until 1973, wastes were disposed directly into the river. After that time, overflows of PCB-containing waste from disposal lagoons resulted in discharges into the river. For more than 20 years, the site has been the subject of investigative and remediation effort by the United States Environmental Protection Agency (EPA) and the Michigan Department of Environmental Quality (DEQ).

As a result of PCB contamination from the Cast Forge site, fish consumption advisories have been in place along the Shiawassee River for more than 20 years. At present, the state of Michigan recommends that no one consume fish caught between M-59 (near the Cast Forge site) and the town of Byron, where the South Branch Shiawassee River joins the Shiawassee River. From that point to the City of Owosso the state recommends that women and children limit their consumption of larger smallmouth bass and northern pike to less than one meal per month. Below Owosso, women and children are advised not to eat rock bass or smallmouth bass more than once per week. The consumption of common carp is not recommended for anyone between M-59 and Owosso.¹³⁵

Biota

Original Fish Communities

Fish communities in the Great Lakes basin date back only 14,000-10,000 years ago, when the Wisconsinian Glacier receded from the region and created large new areas of lake and river habitat.¹³⁶ These areas were colonized by fish from adjacent drainage basins, primarily the Mississippi basin and, to a much lesser extent, the Atlantic coast region. Of the 159 species that are native to the Great Lakes basin, 99 species are native to tributaries to Lake Huron. Little descriptive information is available on the fish communities of the Shiawassee River and its tributaries prior to widespread European settlement. Early surveyors and settlers in the Shiawassee watershed did not give much notice to aquatic biota. Original habitat can be inferred somewhat from early descriptions of land cover. Extensive woodlands in the upper and middle portions of the watershed, described above, would have provided

reliable shade for the river and a supply of woody debris for fish habitat. Ample wetlands would have provided spawning and nursery areas along the river, especially in the lower watershed.

Accounts of historic commercial fishing activity in the Saginaw basin describe yellow perch, northern pike, black bass, and walleye in the lower Shiawassee River and Saginaw rivers in the 19th century.¹³⁷ The lower Shiawassee River and Shiawassee Flats areas, in particular, were critical habitat resources for the Saginaw Bay fishery, providing spawning areas for strong populations of potamodromous (migrate within freshwater) fish, including large runs of walleye. Prior to extensive alteration of the river, these fish may have utilized habitat higher in the Shiawassee watershed.

Modern Fish Communities

Based on records from the DNR and the University of Michigan's Museum of Zoology, more than 70 species of fish have been collected from the Shiawassee River since the early 1900s.

An extensive survey of the Shiawassee River was conducted by the DNR in 1987. Fish were sampled at 14 stations, including 11 on the mainstem of the river, one on Ore Creek, and two on the South Branch. The survey found a total of 54 species of fish, representing a range of game fish, rough fish, and forage species. Bluntnose minnows were the most common fish smaller than 3 inches sampled during this survey. Centrarchids, including rock bass, bluegill, and other sunfish, were the most numerous larger species, followed by red horse species and bass species. Smallmouth bass, northern pike, and rock bass were found throughout the river. In addition, walleye, channel catfish, and white bass were found in the lower river, below the Chesaning Dam.

Fish community assessments in the Shiawassee River and some of its tributaries also occurred during the DEQ's 1995 and 2000 assessments. The 1995 assessment of the river found some areas of generally good fish communities and habitat, predominantly in the middle segment of the river, and poorer quality communities and habitat in the uppermost and lower portions of the river. The fish community in the headwaters and upper segments of the mainstem of the river were generally rated acceptable. Habitat was rated fair (moderately impaired) at one site in the headwaters and one site at the lower end of the upper segment, and good (slightly impaired) at three other sites in the upper segment. In the middle segment of the river, from Byron to Owosso, the fish community was rated from good to excellent, and habitat was also rated good (slightly impaired) to excellent (non-impaired). In the lower segments of the river, fish communities were rated excellent, while habitat was rated fair (moderately impaired) to good (slightly impaired).

The poor quality of habitat, resulting from channel modifications, riparian vegetation removal, and highly unstable flows, depressed populations in these lower areas.¹³⁸ The 1995 survey found that fish communities and habitat in tributaries to the Shiawassee were generally in poorer condition than the mainstem of the river. This was largely the result of poor quality physical habitat, a result of channel modification, the removal of vegetation, and other alteration to tributaries. Many of the tributaries featured high degrees of embedded siltation, poor cover, and low habitat diversity.

Fish of the Shiawassee River

The Shiawassee River is classified as a warm water river but contains some cool water species. The fish in warm run-off fed rivers tend to be habitat generalists that can tolerate slow warm water in impoundments as well as cooler more oxygen rich segments of the river.

Centrarchidae, the sunfish family, includes bluegills, *Lepomis macrochirus*, rock bass, *Ambloplites rupestris*, smallmouth bass, *Micropterus dolomieu* and largemouth bass, *Micropterus salmoides*. They generally prefer warm water and are nesting fishes that form colonies in gravel, sand or mud. Males guard the eggs until the fry can swim. Bluegills favor shallow warm waters (64-70°F) with plenty of cover (weed beds, underwater logs, or drop-offs). Bluegills are insectivorous and feed at the surface, midwater, and also can be a competitor with bottom feeding fish. Rock bass are a heavy bodied fish that live in rocky areas of lake shallows. Adults live in groups, often in association with smallmouth bass. They are piscivorous and compete with smallmouth bass for food; only occasionally do they take food from the surface. Rock bass predators include largemouth bass, northern pike, muskellunge, and walleyes. Smallmouth bass are top game fish. They live in cool clear water with a rock or gravel bottom. Ideal habitat includes protective cover like shoal rocks, talus slopes, and submerged logs. Their preferred water temperature is 68-70°F (cooler than largemouth bass).

The DEQ's 2000 assessment of the river generally confirmed the pattern identified in the 1995 assessment: habitat in the mainstem ranged in quality from poor to excellent, with generally higher quality areas found in the middle

Fish of the Shiawassee River (*continued*)

Walleye, *Sander vitreus*, are the largest member of the perch family. They are sight feeders and therefore avoid bright light, seeking shade during the middle of the day. Walleye prefer the water temperature to be 55-68°F. They compete for food with yellow perch, *Perca flavescens*, smallmouth bass, and lake whitefish, *Coregonus clupeaformis*. Predators include northern pike and muskellunge, *Esox masquinongy*.

Northern pike, *Esox lucius*, live in the cover of vegetation in the clear warm shallows of lakes during all but the midsummer. They eat primarily other fish that are one-third to one-half their size. Adult pike have two predators, lampreys and humans.

Redhorse species are in *Catostomidae*, the sucker family. They are bottom-feeding fish that spend most of their lives in shallow warm water. They live in holes and areas around windfalls. This group of fish lays eggs in pebble and gravel beds in lake and river shallows. Suckers are a sport fish with potential value. They are sometimes marketed as freshwater mullet and are also often used as bait.

Common carp, *Cyprinus carpio*, are heavy-bodied minnows that are generally considered a nuisance. They are native to Asia. Common carp does very well in warm, muddy, eutrophic waters. Adults are omnivorous.

segment of the river. While some tributaries in the upper watershed had almost excellent habitat ratings, most in the middle and lower portions of the watershed were rated fair to poor.

Stresses on the Biological Integrity of the Shiawassee River

In general, the fish and macroinvertebrate communities of the Shiawassee River are in good shape relative to other similarly situated rivers. At the same time, the biological integrity of the river is clearly affected by external stresses. According to the surveys conducted by the DNR and DEQ, the biological quality of the river is impacted primarily by habitat degradation associated with physical alteration.¹³⁹ This alteration includes channel modifications, dredging, vegetative removal, and other direct changes to the structure of the Shiawassee River and, to a greater extent, its tributaries.

Critical Plants, Animals, and Communities

The Michigan Natural Features Inventory (MNFI) was established by the

Ecological Overview of the Shiawassee River and Watershed

Nature Conservancy in 1980 to inventory and monitor Michigan's biological diversity. The program currently operates as a collaborative initiative of the Michigan Department of Natural Resources and the Michigan State University Extension. MNFI maintains a database of more than 11,000 records of plants, animals, natural communities, and other important natural features that occur in Michigan. Collected by field researchers, scientists, and other resource management experts, these records present a portrait of the current state of Michigan's biological resources.

According to the MNFI the Shiawassee River watershed contains three endangered species, 15 threatened species, and 20 species of special concern. These include a range of plants and animals, including several invertebrates, birds, and reptiles.

One species that could be adversely affected by changes in the Shiawassee River is the snow trillium (*Trillium nivale*). This state threatened species occurs within the watershed only in Shiawassee County. It is found in Lower Michigan's floodplains and mesic forests. The Owosso YMCA property on the Shiawassee River near Bancroft supports the largest population of three known occurrences in the state.¹⁴⁰ The plants occur in the second terrace and are distributed in a narrow strip parallel to the river. Snow trilliums need stable hydrology of the Shiawassee River. While occasional flooding is beneficial, too frequent floods could be harmful. Effective management for the species also includes maintaining healthy, intact, mature forests with minimal fragmentation and protection from invasive species such as garlic mustard.¹⁴¹

The Nature Conservancy has named several sensitive conservation targets in the Shiawassee Watershed. The Eastern fox snake is globally rare with little known about its life history. The Shiawassee National Wildlife Refuge and the Shiawassee State Game Area, located in the lower watershed, host this species. The Eastern Massasauga snake occurs in the swamp-fen complex and is threatened by habitat loss and harassment or poaching. Several rare insects occur in the tamarack swamp-prairie fen complexes. More information is needed but the list includes the Powesheik Skipperling, Tamarack Tree Cricket, Blazing Star Stem Borer, and a leafhopper, *Flexamia buroni*, known at only one site in the world.¹⁴² The threat to these insects is primarily habitat loss.

Invasive Species

Nonnative, or exotic, plants and animals can be characterized as invasive when they disturb the balance of native communities. Nonnative is not synonymous with invasive. Invasive species can also be native. Species that

become invasive often are released from predator control mechanisms that occurred in their original environments. This lack of control combined with the common invasive characteristics can lead to successful dominance in their new habitat. Invasive characteristics include primary colonizer, high fecundity, short life cycles, self-fertilization (in plants), and adaptability to a wide variety of conditions.

Invasive aquatic animals collected in the Shiawassee watershed include:

- Oriental Weatherfish, *Misgurnus anguillicaudatus*, are omnivorous eel-like fish that live in shallow slow-moving water with mud bottoms. They are escaped from the aquarium trade. Oriental weatherfish impact native species through direct predation or disease transmission.¹⁴³
- Round Goby, *Neogobius melanostomus*, are an aggressive, bottom-dwelling exotic fish introduced from Eurasia. They are highly fecund and compete for food and spawning resources with native fish, particularly small and largemouth bass. Round gobies were probably introduced into the Shiawassee River during an accidental bait release in 1996. They are indiscriminate in preying on bait and therefore dominate anglers' catch. They also eat zebra mussels, which isn't bad by itself, but the potential for bioconcentration of harmful substances is an added negative.¹⁴⁴
- Zebra mussel, *Dreissena polymorpha*, is a small fingernail-sized mussel recently (1988) introduced from the Caspian Sea in Asia. They are extremely prolific and have severe ecological and economic impacts. Young zebra mussels are planktonic and so small they are invisible to the human eye. They can travel long distances on water currents or aided by human activity.¹⁴⁵
- Rusty crayfish, *Orconectes rusticus*, are native crustaceans spread by anglers' use of them for bait. They are very fertile, reduce lake and stream vegetation and deprive native species of cover and food. They out-compete native crayfish populations. Environmentally sound methods of control have not been developed.¹⁴⁶
- Sea lamprey, *Petromyzon marinus*, are predaceous, parasitic, eel-like fish native to the coastal regions of both sides of the Atlantic Ocean. They contributed greatly to the decline of whitefish and lake trout in the Great Lakes. Adults swim up rivers to spawn and larvae develop in stream bottoms and, as adults, return to the Great Lakes. Physical barriers, such as dams, or chemical control, such as lampricide, can check lamprey dispersal.¹⁴⁷

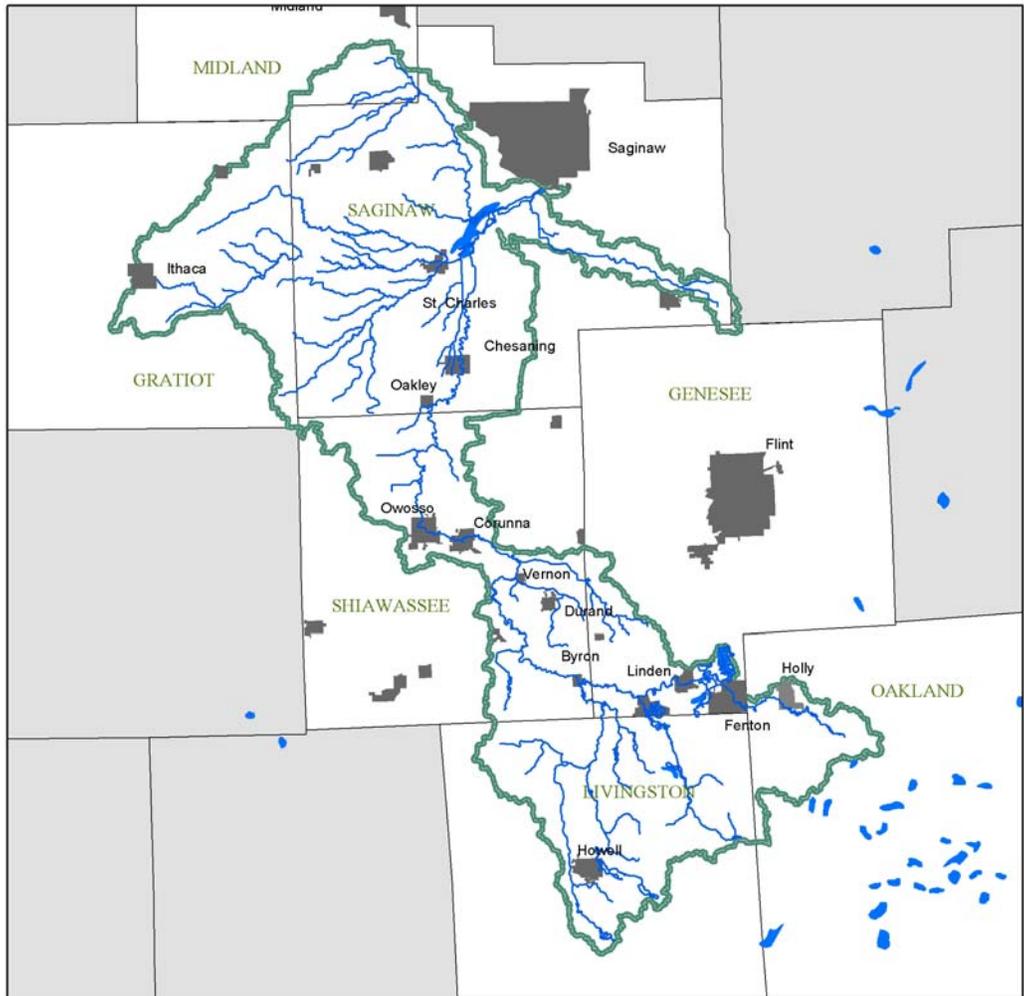
Invasive plants in the Shiawassee watershed include:

Ecological Overview of the Shiawassee River and Watershed

- Purple loosestrife, *Lythrum salicaria*, is a perennial herb that can reach 8 feet in height. It was introduced from Europe and Asia and was valued as an ornamental and medicinal herb. It occurs on open stream margins, alluvial floodplains, and freshwater marshes. It can completely replace native plant communities. However, it is still being sold in nurseries in many states as a nectar plant for honey production. Purple loosestrife spreads vegetatively and by seed dispersal in water. Eradication is difficult; mechanical and chemical controls have met with little success. Biological control is being investigated.¹⁴⁸
- Yellow iris, *Iris pseudacorus*, is a showy plant that lives in freshwater wetlands or very near water. It is introduced from Europe and is still being sold for ornamental landscaping and wastewater treatment in the U.S. It reproduces primarily from broken rhizomes and can form an impenetrable thicket that out-competes native plants in a similar way to cattail. Mechanical control has limited success.¹⁴⁹
- Garlic mustard, *Alliaria petiolata*, is a biennial herb introduced from Europe that is widely occurring in the northeastern and midwestern U.S. It spreads rapidly in woodlands and edge sites, out-competing native forbs. Its seeds are dispersed on the fur of animals, in water, and by human activities. Controlling the spread of garlic mustard is difficult because the seeds can remain viable for at least five years. Mechanical and chemical methods have been used as control agents, and biological control is being investigated at Cornell.¹⁵⁰
- Common Reed, *Phragmites australis*, is a native tall perennial wetland grass that thrives in sunny brackish and freshwater marshes, on the edges of rivers, and in disturbed or polluted soils. The plant spreads by sprouting from rhizome fragments (created by farm or road machinery) or by seed dispersal. Once established it is very difficult to eliminate; herbicide combined with burning has been most effective method of control.¹⁵¹
- Multiflora Rose, *Multiflora rosa*, is a thorny, perennial shrub introduced from Japan for use as rootstock for ornamental roses. It is a problem because it can form dense thickets that exclude native vegetation. Soil conservation and wildlife conservation services once promoted its spread for prevention of soil erosion and provision of habitat. Birds disperse the seeds after eating the fruits. Mechanical and chemical controls are used.¹⁵²
- Eurasian water-milfoil, *Myriophyllum spicatum*, is an aquatic plant introduced from Europe, Asia, and North Africa. It can out-compete native aquatic plants, severely reducing diversity in lakes. It spreads quickly, forming dense surface mats. The plant reproduces vegetatively. This process occurs naturally but is increased by boat traffic and other human activity.¹⁵³

- Autumn olive, *Elaeagnus umbellata*, is a deciduous shrub or small tree introduced from Asia. Its roots can fix nitrogen, allowing it to colonize poor soils along roadsides or in pastures and fields. Birds eat its prolific fruits and disperse the seeds widely. Autumn olive produces heavy shade which stunts the growth of understory species requiring full sunlight. Control is difficult; cutting and burning make it sprout even more vigorously. Only pulling it by the roots when it is small or applying herbicide will eliminate it.¹⁵⁴

Figure 2.1. Shiawassee Watershed: Political Geography



- Legend**
-  Cities and Towns
 -  Rivers and streams
 -  Shiawassee Watershed

0 5 10 20 Miles



Data Sources: MI DNR Watershed Boundary (1998)
MI DNR Michigan Rivers Inventory
MI DNR Michigan Base Map Data
Map prepared by Dave Chadwick (wick@umich.edu)
Shiawassee River Masters Project

Figure 2.2. Shiawassee Watershed: Landscape Ecosystems



Legend

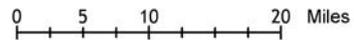
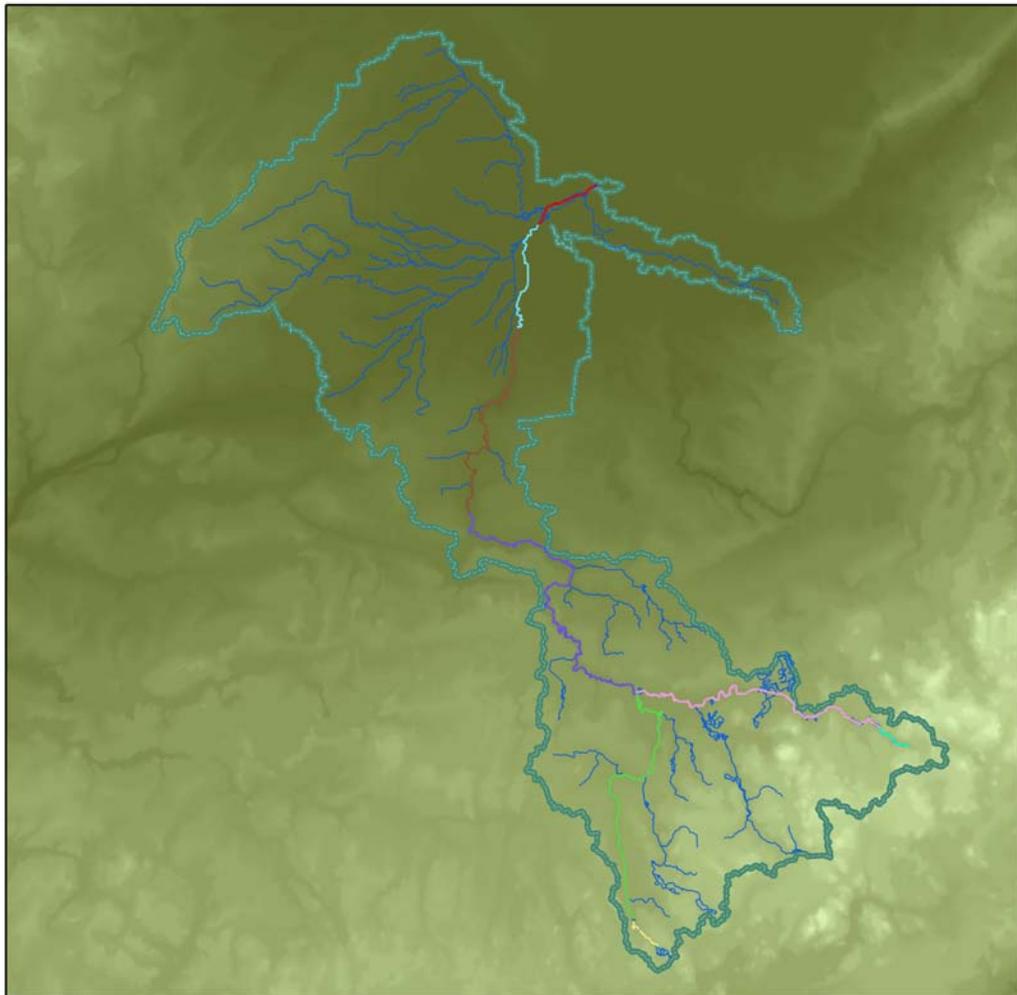
-  Rivers and streams
-  Shiawassee watershed
-  Washtenaw: Jackson Interlobate (VI.1.3)
-  Ionia: Lansing VI.4.1
-  Huron: Sandusky Lake Plain (VI.5.1)
-  Huron: Lum Interlobate (VI.5.2)
-  Saginaw Bay Lake Plain (VI.6)

0 5 10 20 Miles



Data Sources: MI DNR Regional Landscape Ecosystems of MI
(after Albert 1994)
MI DNR Watershed Boundary (1998)
Map prepared by Dave Chadwick (wick@umich.edu)
Shiawassee River Masters Project

Figure 2.3. Shiawassee River: Valley Segments



Data Sources: MI DNR Watershed Boundary (1998)
 MI DNR Michigan V-SEC (1.0)
 Map prepared by Dave Chadwick (wick@umich.edu)
 Shiawassee River Masters Project

Figure 2.4. Shiawassee Watershed: Quaternary Geology

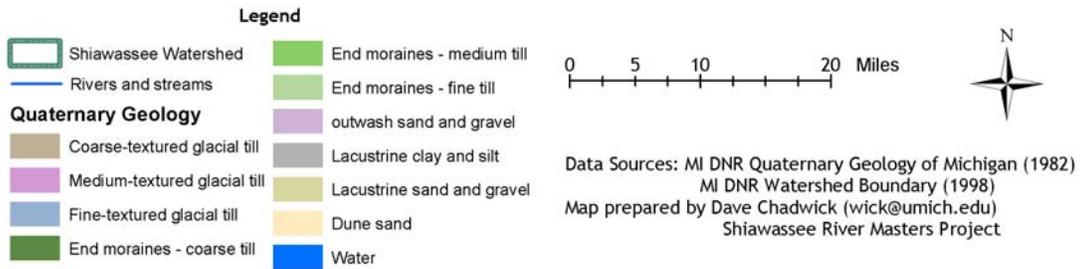
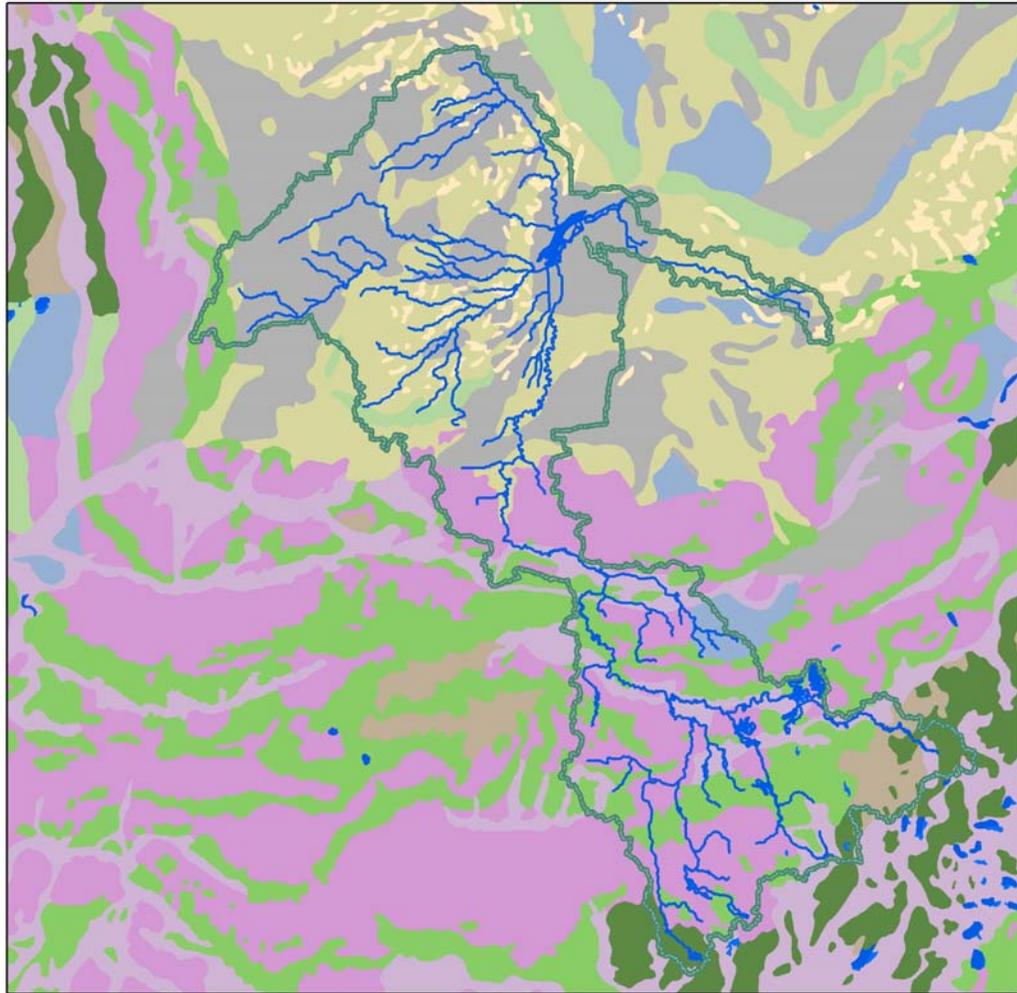


Figure 2.5. Shiawassee Watershed: 1800 Land Use

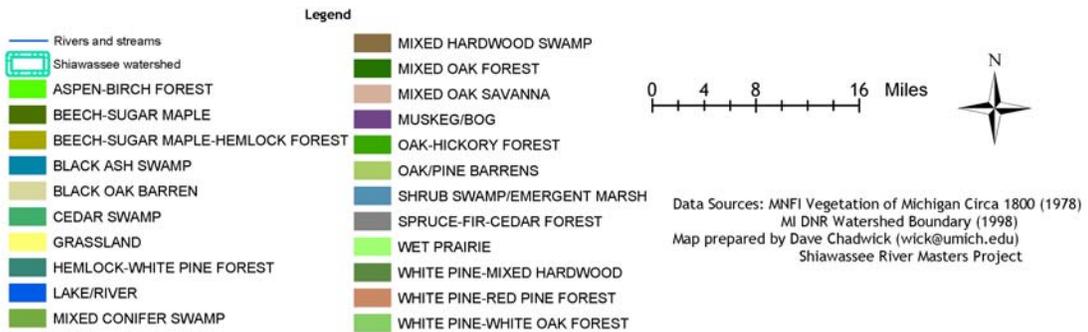
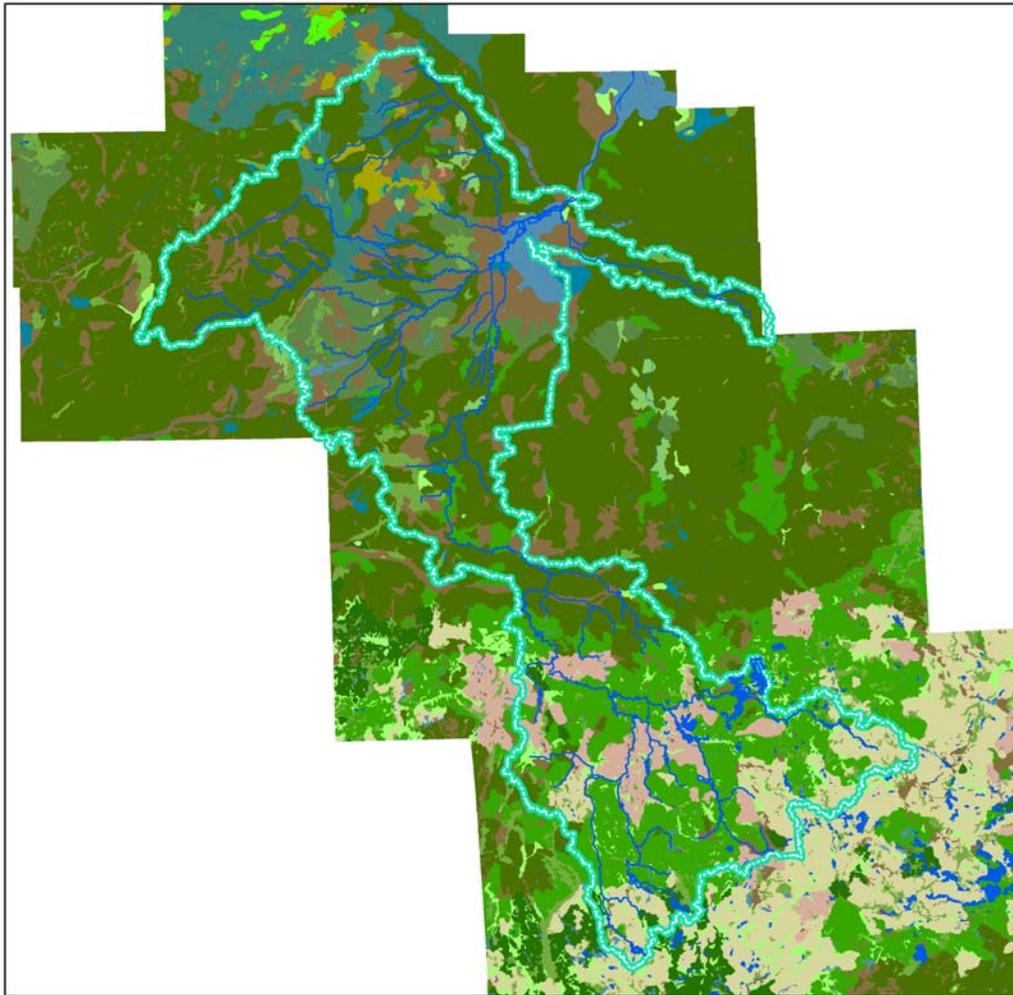


Figure 2.6. Shiawassee Watershed: 2000 Land Use

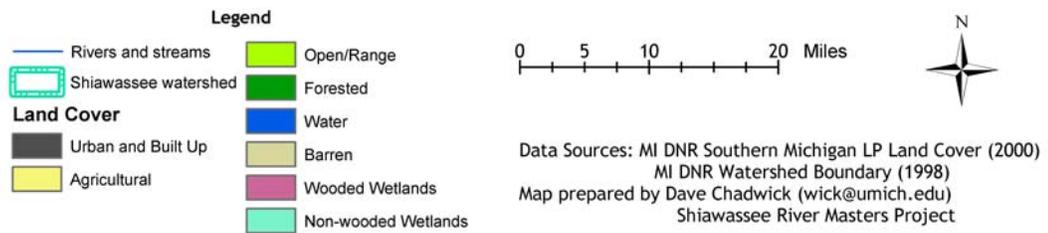
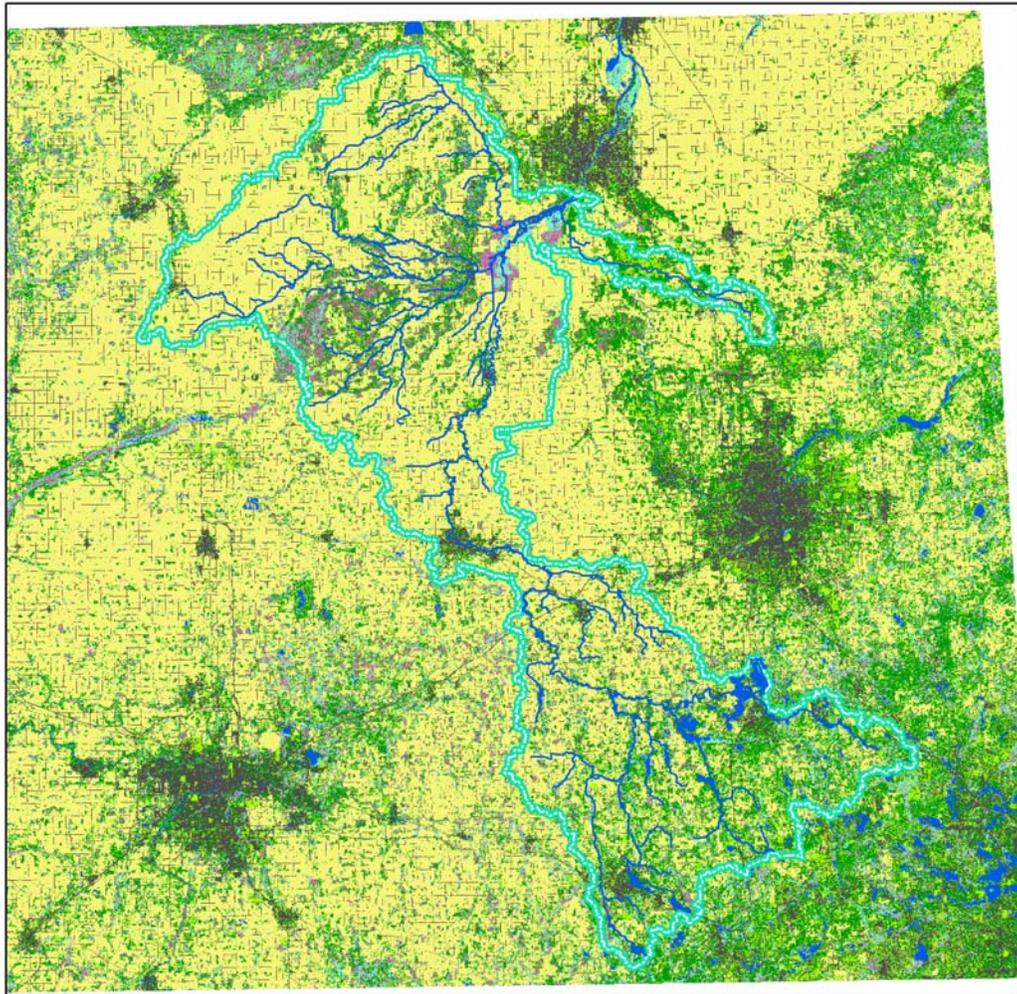


Figure 2.7. Shiawassee River mean monthly discharge (period of record).

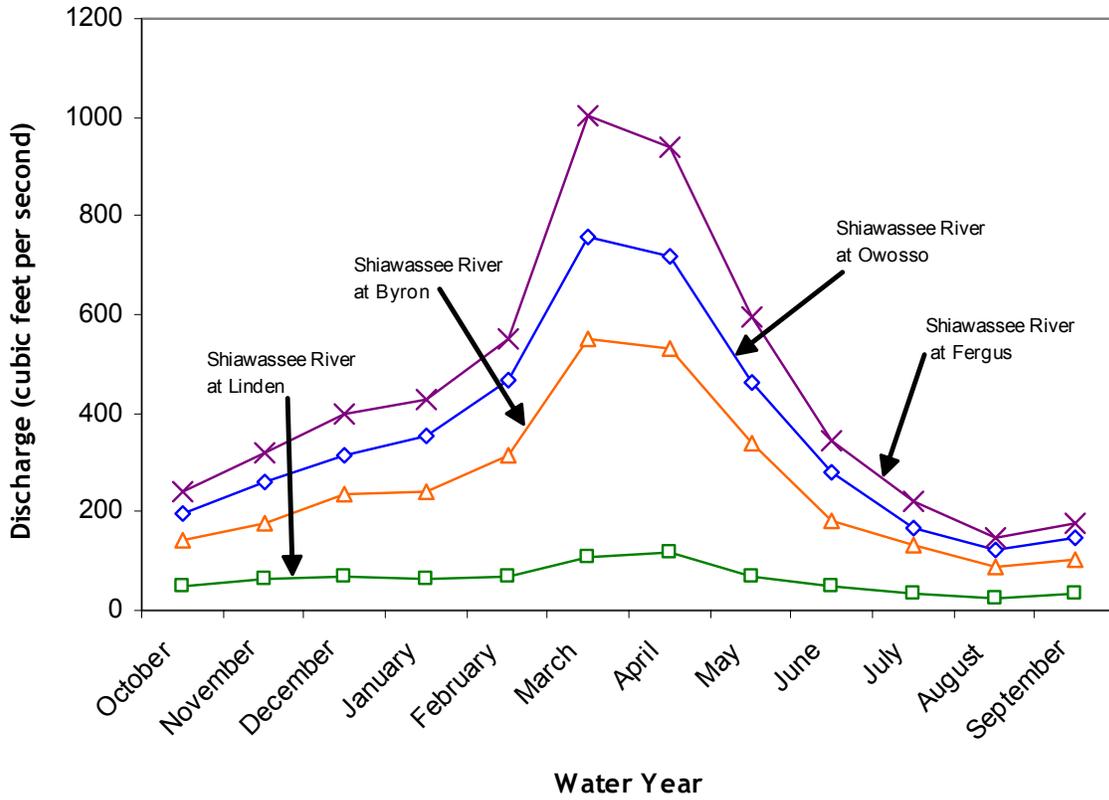


Figure 2.8. Standardized high flow exceedence curves for Shiawassee River.

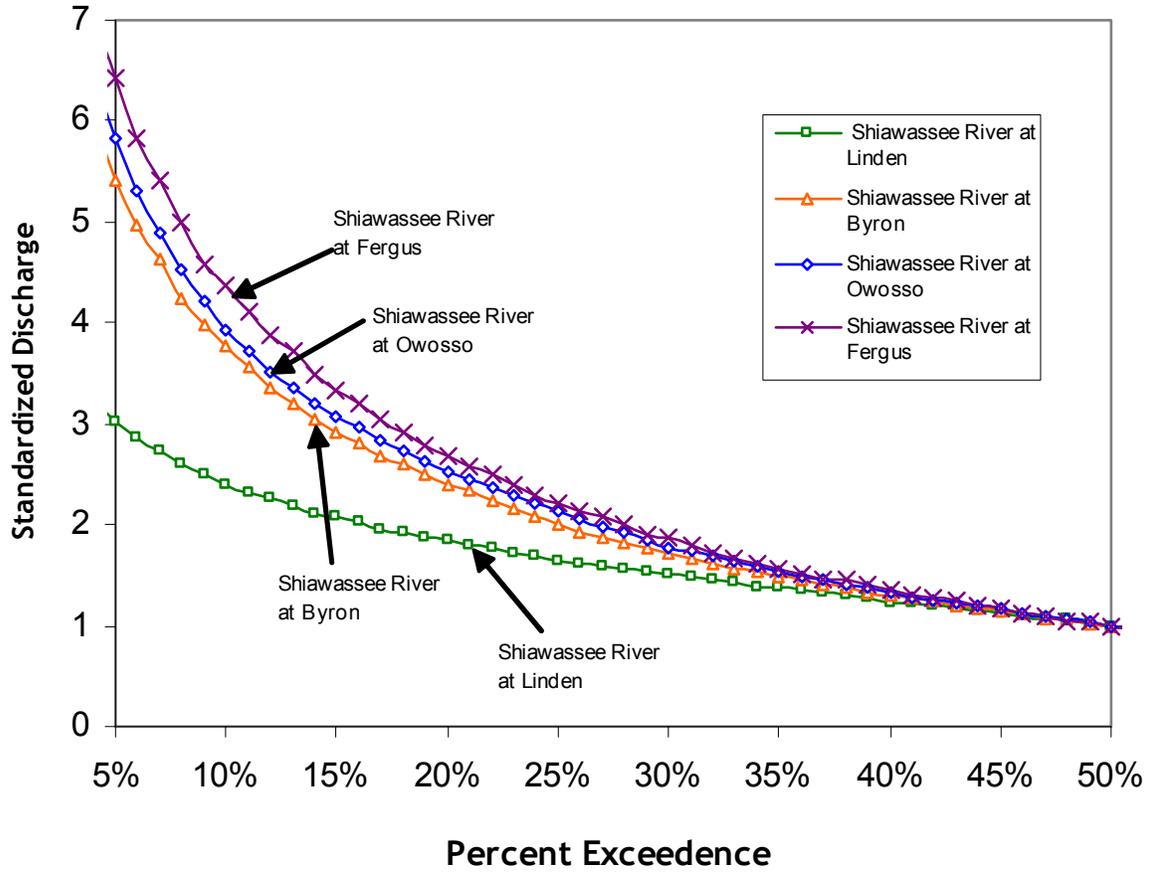


Figure 2.9. Standardized low flow exceedence curves for the Shiawassee River.

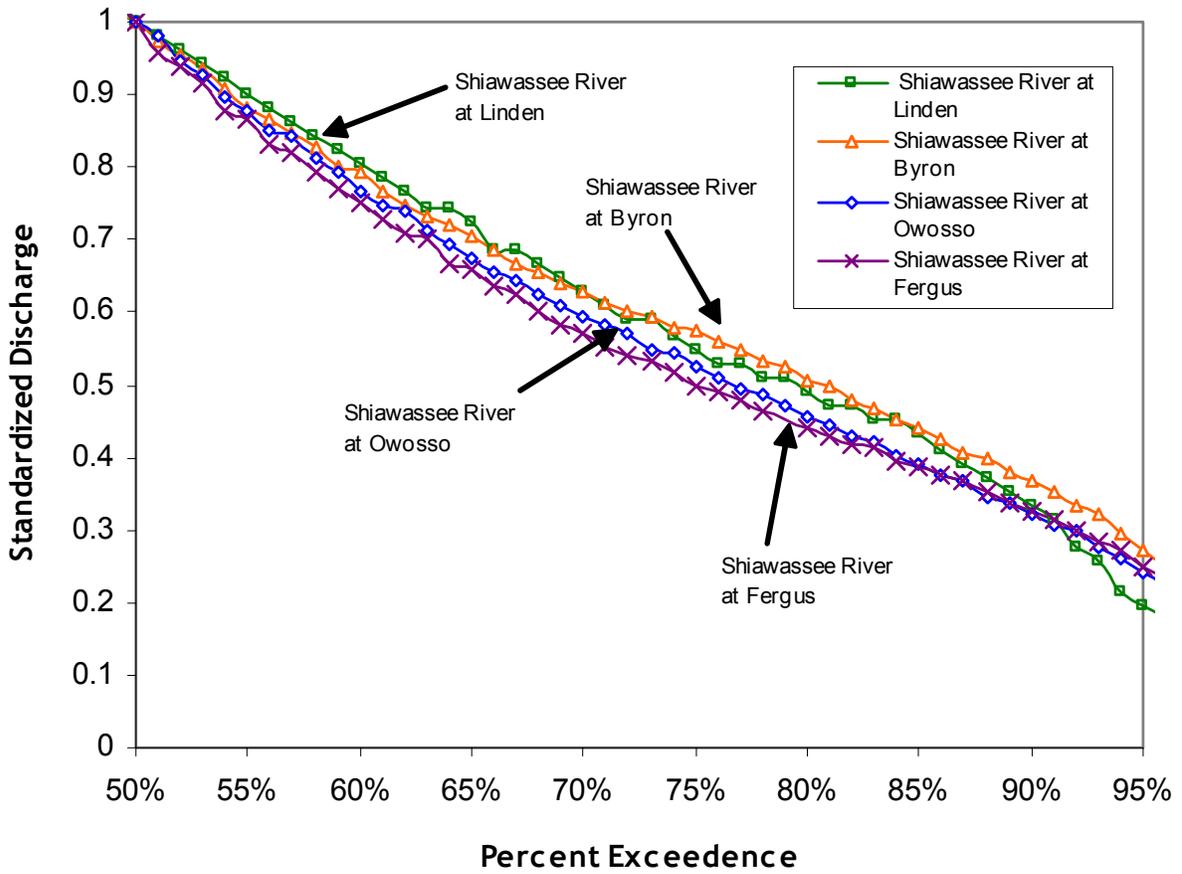


Figure 2.10 Shiawassee River Elevation

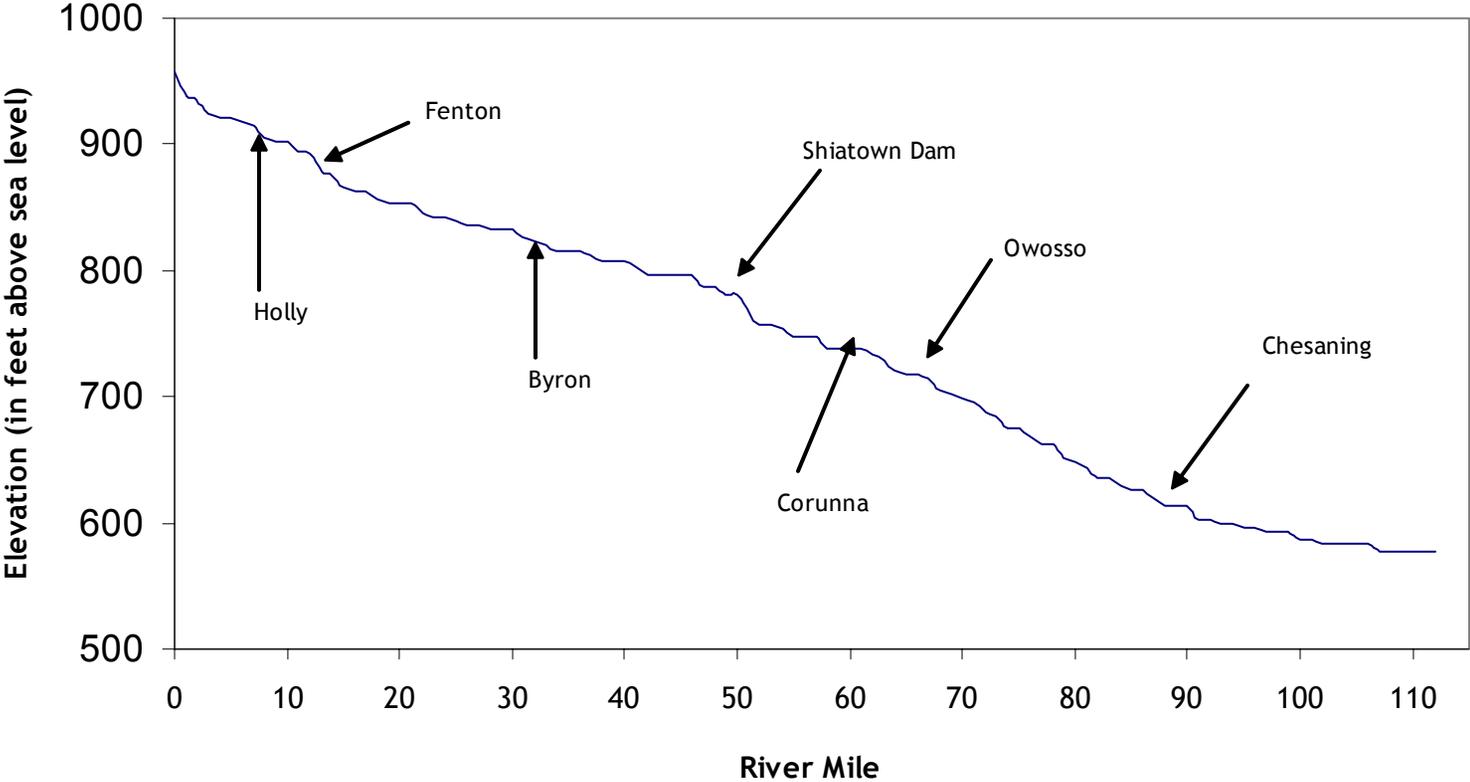
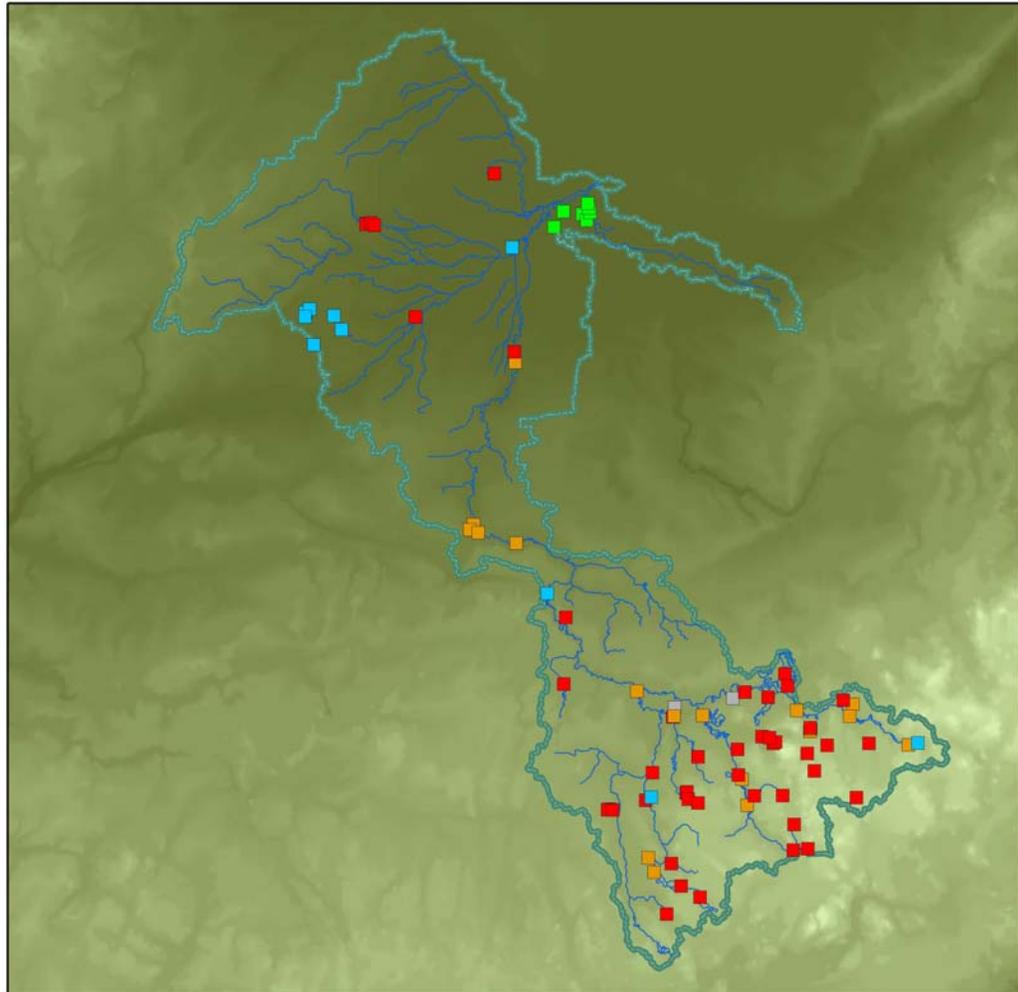


Figure 2.11. Shiawassee Watershed: Dams



- Legend**
- Rivers and streams
 - Shiawassee Watershed
 - Dam - Ownership**
 - Unknown
 - Federal
 - Local Government
 - Private
 - State

0 5 10 20 Miles



Data Sources: MI DNR Watershed Boundary (1998)
MI DNR Michigan V-SEC (1.0)
MI DNR Dams and Barriers database
Map prepared by Dave Chadwick (wick@umich.edu)
Shiawassee River Masters Project

Table 2.1. Monthly temperature normals (1971-2000) for locations in the upper, middle, and lower Shiawassee Watershed

Month	Normal Mean Temperature			Normal Maximum Temperature			Normal Minimum Temperature		
	Milford (Upper)	Owosso (Middle)	St Charles (Lower)	Milford (Upper)	Owosso (Middle)	St Charles (Lower)	Milford (Upper)	Owosso (Middle)	St Charles (Lower)
January	22.1	21.2	21	29.9	28.7	29.1	14.3	13.7	12.8
February	24.5	23.5	22.8	32.9	31.7	32	16	15.2	13.6
March	33.9	33.4	33	43.3	42.7	42.9	24.5	24.1	23.1
April	45.6	44.8	45.5	55.9	55.7	56.5	35.2	33.8	34.5
May	57.5	56.5	57.7	68.4	68.6	69.9	46.5	44.3	45.5
June	66.6	65.6	66.4	77.2	77.5	78.7	56	53.6	54.1
July	71	69.9	70.7	81.7	81.7	83.1	60.3	58.1	58.2
August	69.1	67.7	68.1	79.5	79.1	80.1	58.6	56.3	56.1
September	61.4	60.5	60.5	71.6	71.8	72.8	51.2	49.1	48.2
October	49.8	49.3	48.9	59.3	59.6	60.4	40.2	38.9	37.4
November	38.4	37.9	37.4	46.1	45.6	45.9	30.7	30.1	28.9
December	27.2	26.8	26.9	34.4	33.6	34.1	20	20	19.6
Annual	47.3	46.4	46.6	56.7	56.4	57.1	37.8	36.4	36

Data Source: National Climatic Data Center, Climatology of the United States No. 81 Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 Michigan (02.2002)

Table 2.2. 30-year (1971-2000) normal air temperatures for select Michigan cities

		Mean Temperature (°F)		
City/Station Location	Watershed	Annual	January	July
Owosso	Shiawassee	46.4	21.2	69.9
Detroit (Metro Airport)	?	49.7	26.4	65.5
Sault Ste Marie	?	40.1	13.2	63.9
Marquette	?	43.0	18.1	66.4
Kalamazoo	?	49.9	24.3	73.2
Grand Rapids	?	47.6	22.4	71.4

Data Source: National Climatic Data Center, Climatology of the United States No. 81 Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 Michigan (02.2002)

Table 2.3. 30-year (1971-2000) normal precipitation for select Michigan cities

City/Station Location	Watershed	Mean annual precipitation (inches)
Owosso	Shiawassee	30.54
Detroit (Metro Airport)	?	32.89
Sault Ste Marie	?	34.67
Marquette	?	30.03
Kalamazoo	?	37.41
Grand Rapids	?	37.13

Data Source: National Climatic Data Center, Climatology of the United States No. 81 Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 Michigan (02.2002)

Table 2.4. Land Cover (2000) in the Shiawassee watershed

Land Cover	Total area (square miles)	Percent
Urban and Built Up	86.6	6.8%
Agricultural (Crop and Pasture)	704.1	55.7%
Open Lands - Park	86.9	6.9%
Forest	204.5	16.2%
Water	17.2	1.4%
Barren	3.4	0.3%
Wooded Wetlands	79.8	6.3%
Non Wooded Wetlands	82.4	6.5%
<i>Total</i>	<i>1,264.8</i>	<i>100.0%</i>

*Source: MI DNR 2000 Southern LP Land Cover, clipped to
Shiawassee watershed*

Table 2.5. United States Geological Survey (USGS) Gauging Stations on the Shiawassee River

Site Number	City/Station Location	Latitude/ Longitude	County	Period of Record	Drainage Area (square miles)	Mean Annual Stream Flow (cubic feet/second)
4143900	Linden	42°48'57" N 83°48'07" W	Genesee	1967-2001	83.7	63
4144000	Byron	42°49'25" N 83°56'45" W	Shiawassee	1947-1983	365	251
4144500	Owosso	43°00'54" N 84°10'52" W	Shiawassee	1931-2001	538	355
4145000	Fergus	43°15'17" N 84°06'20" W	Saginaw	1940-2001	637	442

Source: United States Geological Survey (water.usgs.gov)

Table 2.6. Flow data on the Shiawassee River, the Manistee River, The Au Sable River, and The Raisin River.

USGS Site Number	City/Station Location	Period of Record	Drainage Area (square miles)	95% exceedence flow	median exceedence flow	5% exceedence flow	Standardized 95% flow	Standardized 5% flow
4143900	Linden	1967-2001	83.7	10	51	154	0.2	3.0
4144000	Byron	1947-1983	365	41	150	810	0.3	5.4
4144500	Owosso	1931-2001	538	49	202	1180	0.2	5.8
4145000	Fergus	1940-2001	637	60	240	1540	0.3	6.4
4124000	Manistee/Sherman Au Sable/ Red	1900		784	980	1670	0.8	1.7
4136000	Oak	1900		531	750	1440	0.7	1.9
4176500	Raisin/Monroe	1900		80	362	2820	0.2	7.8

Chapter 3: Socioeconomic Assessment of the Shiawassee River Watershed

The landscape of the Shiawassee River watershed is shaped by human development. Approximately 300,000 people live within its borders, in a mix of communities large and small, urban and rural. Land uses range from agricultural fields, to residential neighborhoods, to heavy industry, reflecting the rich variety of resources contained in the watershed. The river and its valley together are a resource, watering and draining farmland, feeding industry, and providing recreation.

This chapter focuses on the human context of the Shiawassee watershed and the surrounding region. Our social assessment examines the shifting demographics of the area, current and historic land uses, and development trends. It also discusses the regional and local political frameworks of the watershed. This larger social context of the Shiawassee watershed lays the foundation for analyzing the specific issues at the Shiatown Dam. It has informed our more site-specific research, including a community survey and focus groups, which are discussed in following chapters.

We gathered the data presented in this chapter from a variety of sources. Unless otherwise noted, the demographic data are taken from the 1990 and 2000 U.S. Censuses and comparison tables prepared by the Northwest Michigan Council of Governments. We created our demographic estimates for the watershed by aggregating data from townships covered or partially covered by the watershed. Agricultural data are drawn from the USDA's 1997 Census of Agriculture. Other sources are footnoted in the text.

Watershed boundaries do not typically align with the political boundaries used in the collection of social data. Our social assessment therefore defines the watershed and the surrounding region as follows:

Watershed: Our analysis of U.S. Census data defines the Shiawassee watershed as the 64 townships and cities contained entirely or partially by the watershed boundary (Figure 3.1). While not a perfect surrogate for the watershed, this method of aggregating the available data gives the best possible approximation of watershed demographics.

Surrounding region: We define the larger region surrounding the Shiawassee watershed as the "seven county" region comprised of Genesee, Gratiot, Livingston, Midland, Oakland, Saginaw, and Shiawassee Counties.

Watershed Demographics

Watershed Overview and Regional Context

The Shiawassee River watershed encompasses 1,264 square miles across portions of seven counties in east-central Michigan. Together these counties cover 8% of Michigan’s land area and contain 2,194,133 people - 22% of the state’s population. Saginaw, Livingston, and Shiawassee Counties hold the largest percent-areas of the watershed, encompassing the lower, upper, and middle reaches of the river, respectively (Figure 3.2).

The Shiawassee watershed is a relatively rural region surrounded by a developing urban fringe. Approximately 300,000 people live in the watershed, a population density of roughly 250 people/mi². In comparison, the population density of the surrounding seven county region is 477 people/mi². The upper watershed is bounded by some of the most populous, developed counties in the state. It has experienced significant growth in both population and affluence over the past decade. The lower watershed lies in a more rural region, where indicators of population growth and wealth have remained relatively constant.

Livingston, Genesee, and Oakland Counties encompass the headwaters of the Shiawassee River. These counties are classified as urban along the Office of Management and Budget’s (OMB) rural-urban continuum. By this definition they contain or border on metropolitan areas with populations of 250,000 to over 1,000,000. Despite an urban classification, however, the upper watershed contains few urban centers in comparison with the surrounding region—the area is better classified as urban fringe. The city of Fenton is the largest city in the upper watershed. Howell and Holly are the next most populous cities; the remainder of the towns in the upper watershed have a population under 4,000 people.

In contrast, numerous large urban areas are located just outside the upper watershed boundaries. Oakland County, with a population of 1,194,156, is a part of the seven-county Detroit metropolitan area and the second-most populous county in the state. The city of Flint, population 124,943, is located in the center of Genesee County, 10 miles from the Shiawassee watershed boundary. In Ingham County to the west, 20 miles outside the upper watershed, is the state capital of Lansing, population 119,128. In

Population of Watershed Cities and Villages.

CITY	POPULATION
Owosso	15,713
Fenton	10,582
Howell	9,232
Holly	6,135
Durand	3,933
Corunna	3,381
Ithaca	3,098
Linden	2,861
Chesaning	2,548
Vernon	847
Byron	595

addition to Howell, Livingston County contains the city of Brighton (population 6,701) and borders on the Ann Arbor metropolitan area.

The transition from upper to lower watershed in central Shiawassee County also marks a transition to a more rural character. The cities of Owosso and Corunna are the largest cities in the lower watershed. Agriculture predominates in this region, accounting for 62% of land cover in Shiawassee County, 58% in Saginaw County, and 76% in Gratiot County.

The lower watershed is not free from urban influences. Saginaw County, which contains most of the lower watershed, is classified as an urban county and is the 5th most populous county in the state. Most of this population is centered around the city of Saginaw (population 61,799), which lies outside the Shiawassee watershed in the northeastern part of the county.

The outer fringes of the lower Shiawassee watershed lie in Gratiot and Midland counties. Gratiot County contains the headwaters of the Bad River and is the most rural county in the watershed. Midland County is more urban, due to its proximity to the cities of Saginaw and Bay City.

Several interstate highways and other major roads cross the Shiawassee watershed. I-69, I-75, I-96, and US 23 ring and traverse the upper watershed. State Highway 52 parallels the river from Owosso north. These transportation corridors impact development trends within the watershed.

Based on these general geographic and demographic descriptors, the picture that emerges of the Shiawassee watershed is one of a relatively rural area surrounded and influenced by urban pressures in many of the surrounding counties. Our detailed examinations of specific socioeconomic indicators in the watershed, presented below, reveal the broader implications of this context. The human face of the Shiawassee watershed is changing, creating opportunities to focus new attention and resources on the river, but bringing as well potentially serious impacts for the health of the Shiawassee.

Population and Trends

The population of the Shiawassee watershed and its surrounding counties is growing at a faster rate than that of the state as a whole. Michigan's population grew by 6.9% between 1990 and 2000. During this same time period the watershed population increased 14.9% - 38,490 people - and the total population of the seven county region rose 8.3%. These averaged growth rates do not reveal the finer pattern of population growth within the Shiawassee watershed however. Much of the growth can be attributed to distinct geographic areas, while other areas have experienced little or even negative population growth since 1990 (Figure 3.3).

The most significant population growth has occurred in the upper watershed. Livingston County was the fastest-growing county in the state between 1990 and 2000, with a population increase of 35.7%. Growth within the watershed during this time was even more significant. Over 20,000 new residents moved into the watershed, a 44% increase. This expansion is most notable in the townships surrounding the cities of Howell and Brighton. The population of Oceola Township for example, grew 73.3%, from 4,825 in 1990 to 8,362 in 2000.

The headwaters regions of the watershed in other counties also experienced significant population growth between 1990 and 2000. While the total population of Oakland County increased 10.2%, the 4 townships that encompass the Shiawassee headwaters grew by 34.4% - over 7,100 people. In the southwest corner of Genesee County, which covers 82 square miles of the upper Shiawassee watershed, the population rose by over 8,400 people, or 27.4%. In contrast, Genesee County as a whole grew by only 1.3%.

The 1990-2000 growth rate was much slower in lower Shiawassee watershed. In Shiawassee County, growth within the watershed resulted in an increase of only 1.1%, a net gain of 554 people. County population as a whole increased just 2.7%. The population of the city of Owosso declined by 609 people while the surrounding Owosso Township grew by 549 people. Five other Shiawassee townships within the watershed also experienced population declines. Antrim and Burns Townships saw the largest population gains, with 22.1% and 15.9% increases, respectively.

Saginaw County was the only county in the watershed to experience a population decline between 1990 and 2000, losing 0.9% of its population. In the portion of the county within the Shiawassee watershed, the population decline was almost identical, -0.8%. Only nine Saginaw townships in the watershed saw increases in population.

Gratiot and Midland Counties grew at rates just slightly above the state average. The only growth in the Midland County portion of the watershed was in Ingersoll Township, where the population increased 8.2% to 3,018. In Gratiot County, population within the watershed declined to 11,693, a 1.4% loss, while the county population as a whole grew 8.5%.

Housing

In tandem with increasing population, the number of housing units in the Shiawassee watershed increased significantly between 1990 and 2000. 21,422 new units were constructed—a 22.8% increase in the watershed housing

stock. Again, most of the increase occurred in the upper watershed—73% of these new homes were built in Livingston, Oakland, and Genesee Counties.

More than 8,300 new units were constructed in the Livingston County portion of the watershed. Genoa, Hartland, and Oceola Townships accounted for over half of this total. In Genesee County 4,115 new units went up in the watershed, half of these in the city of Fenton and the surrounding Fenton Township. 3,345 new units were added in the Oakland County portion of the watershed, with 40% of these constructed in Springfield Township.

Housing increases in Shiawassee County were more moderate and spread more evenly throughout the townships in the watershed. Owosso, Burns, Caledonia, Shiawassee, and Antrim Townships, and Corunna City all gained between 115 and 315 new housing units. Vernon Township saw the largest housing increase due the construction of mobile home parks containing over 800 hookups. In total, 2,209 new housing units were built in the watershed between 1990 and 2000, an 11.4% increase.

Saginaw, Gratiot, and Midland Counties also experienced more moderate increases in housing stock during this time period. 1,803 new units were built in the Saginaw County portion of the Shiawassee watershed, with the largest concentrations of new residences occurring in Thomas, Chesaning and Richland Townships. A total of 136 new housing units were added in the eight Gratiot County townships that intersect the Shiawassee watershed; in Midland County 194 new residences were built in the watershed.

Housing Types

Over 79% of housing in the watershed is detached, single-family homes. Mobile homes are the next-largest housing sector, accounting for 9% of homes in the watershed. All other housing types make up no more than 2% of the housing stock (Figure 3.4). This breakdown is consistent with the rural character of the Shiawassee watershed and the relatively low percentage of urbanized areas, where multi-unit housing development usually takes place. The relative percentages of housing types changed little between 1990 and 2000, despite the significant increase in overall housing units.

The breakdown of housing types in the watershed closely resembles that of the larger seven county region, where 75% of the housing is single family detached and 8% mobile homes, with the remaining categories each accounting for 2-3%. Across Michigan as a whole, 70% of the housing stock is single-family detached.

Housing Values

The median value for owner-occupied housing units in the Shiawassee watershed varied widely from \$224,900 in Genoa Township, Livingston County, to \$60,000 in Hamilton Township, Gratiot County. Watershed housing values lagged slightly behind the state median housing value of \$115,600 (Figure 3.5).

The urban fringe areas of the upper Shiawassee watershed contained a high proportion of the high-end housing in the watershed (Figure 3.6). Most of the occupied housing units in the upper watershed are worth significantly more than the state median value. In contrast, the townships that make up the lower watershed, with only 2 exceptions, all have median housing values below the state median (Figure 3.5).

The higher home values in the upper watershed can be explained in large part by the proximity of these areas to large urban centers. The watershed portions of Livingston, Oakland, and Genesee Counties are located along major highway corridors; many residents of these areas commute to lucrative jobs in Flint, Lansing, and even Detroit. In essence the upper watershed is suburbanized, despite the lack of sizeable cities within the watershed itself.

Income

The average per capita income (PCI) across all of the townships that comprise the Shiawassee watershed is \$21,285. This figure lags slightly behind the average PCI across the larger seven-county region (\$22,951) and the state as a whole (\$22,168). PCI varies significantly between the upper and lower watershed. Across the townships of the upper watershed, PCI is \$26,041. In the lower watershed the figure is \$19,124. Figure 3.7 displays this range of PCI in the watershed.

There is greater parity between the upper and lower watersheds in the percent change in PCI between 1990 and 2000. In fact, the greatest increases in PCI during this time period occurred in the lower watershed. Standardizing to 1999 dollars, PCI increased 32% between 1990 and 2000 in the watershed portion of Midland County, 30% in Saginaw County, and 29% in Gratiot County. In contrast, PCI increase in the Genesee, Livingston, and Oakland County portions of the watershed ranged between 23% and 25%. The smallest growth in the watershed occurred in Shiawassee County, where PCI increased by 20%.

The range of median household incomes across the townships in the Shiawassee watershed displays a pattern similar to PCI. The median household income for the state of Michigan is \$50,161; many of the townships

in the upper watershed exceed this figure while those in the lower watershed generally fall below it (Figure 3.8).

Employment and Industry

The workforce in the Shiawassee watershed totals approximately 163,000 people, or 67% of the total watershed population over the age of 16. This workforce is almost entirely civilian—less than 1/10th of one percent of the watershed population serves in the armed forces. In 2000, 4.4% of the watershed workforce was unemployed. Unemployment in the seven county region stood at 4.8%; across Michigan as a whole 2000 unemployment was 5.8%.

The overall picture of employment by industry in the Shiawassee watershed is consistent with the patterns seen in the surrounding region and state (Figure 3.9). Manufacturing and educational, health and social services are the two largest employment sectors in the watershed, together employing 42% of the workforce. Retail trade accounts for 13% of employment. Despite the significant land cover in the watershed dedicated to farmland, agriculture and other natural resource industries are the smallest employment sector, employing only 1% of the workforce.

The employment patterns observed for the watershed as a whole hold relatively constant for the individual townships and county sub-regions of the watershed, but several variations merit mention. Figure 3.10 groups employment by industry for the portions of the seven counties contained within the watershed. Manufacturing employment is highest in the Shiawassee County portion of the watershed and agricultural employment in the Gratiot County portion is markedly higher than the rest of the watershed. Employment in white collar industries such as finance and insurance, as well as professional and scientific sectors, is higher in the upper watershed than in the lower.

As stated above, unemployment in the Shiawassee watershed is lower than in the region and state as a whole. This figure masks a discrepancy between the upper and lower watersheds however. In the lower watershed unemployment was higher than the state average in 2000. The watershed portions of Midland, Saginaw, and Shiawassee Counties all had unemployment rates above 5%. In contrast, 2000 unemployment was no higher than 3.6% in the portions of Genesee, Oakland, and Livingston Counties covered by the watershed.

The difference in unemployment between the upper and lower watershed largely holds true for the surrounding seven county region as a whole. One exception is Genesee County, where in 2000 county-wide unemployment was

7.1%. In the Shiawassee watershed portion of Genesee, unemployment was 3.6%. This fact further reinforces the current economic vitality of the upper Shiawassee watershed.

Agriculture

Agriculture is one of many components of the overall economy of the Shiawassee River watershed, but deserves special attention due to the historic and current influence of farming in the watershed. As discussed in the land use section of Chapter 1, crop and pasture lands account for 55.7% of present land use across the watershed. While agriculture employs only a fraction of the watershed workforce, it produces millions of dollars of products each year. Farmland defines the character of the lower Shiawassee watershed and many attributes of the river itself. The current and future health of agriculture in the region thus has great importance to our assessment of the Shiawassee watershed.

The data presented below were taken from the USDA's 1997 Census of Agriculture. It is important to note that while the U.S. Census demographic data discussed above were available to the township level and therefore enabled an analysis specific to the watershed itself, agricultural data were available only by county. As a result the discussion here refers to the larger seven county region surrounding the watershed, not the watershed itself.

Agricultural Lands: Extent, Distribution, and Trends

In total, 39.1% of the land in the seven counties that encompass the Shiawassee watershed is in agriculture (Table 3.1). Agricultural lands are concentrated in Saginaw, Gratiot and Shiawassee Counties, where they account for well over half of the county land area. Agriculture is a less prominent part of the landscape in the more metropolitan counties. Farmland averages 26.6% of the total land area across Genesee, Livingston, and Midland Counties. Oakland County, home to over 1 million people, contains 5,366 acres of farmland, just 8.1% of its total land area.

Number and size of farms follow a similar distribution pattern (Tables 3.2 & 3.3). Across the seven counties there are 5,346 farms, with an average size of 198 acres—slightly less than the state average of 215 acres. Saginaw County contains the largest number of farms while Gratiot County has the highest average farm size. 72.5% of the farms in the 7 counties are less than 180 acres in size.

Agriculture in the seven watershed counties is declining at rates significantly greater than the state average. Across all seven counties, 95,453 acres of farmland were lost between 1992 and 1997, and the total number of farms

dropped 6.6% (Table 3.1). Not surprisingly, the greatest declines in agriculture occurred in the counties with the greatest population growth. Farmland acreage declined 17.2% in Livingston County, and 13.9% in Genesee County. But a loss of 9.6% also occurred in the more rural Shiawassee County. Only Gratiot County maintained constant farmland acreage. Large farms experienced the largest overall decline in numbers—across all 7 counties farms 180-499 acres in size declined over 19%, while farms over 500 acres declined 8.5%. Small farms—less than 50 acres in size—were the only size category that saw increases between 1992 and 1997, reflecting an increase in hobby farming and the parcelization of larger farms.

Value of Land, Buildings, and Equipment

As agriculture within the seven watershed counties gives way to residential development and other land uses, the value of farms and farmland is increasing (Table 3.4). Based on a sample of farms, the average farm value including land and buildings increased 53% between 1992 and 1997 to \$401,567, outpacing the 12.1% increase expected through inflation alone. Average value of farmland increased 59%, from \$1,474/acre to \$2,345/acre. The sharpest increases in both categories occurred in Oakland County. The estimated market value of all machinery and equipment per farm rose 41% between 1992 and 1997. Higher investment in equipment corresponds with the occurrence of large farms and the resulting need for larger machinery. Gratiot, Shiawassee, and Saginaw Counties contain most of the large farms and a large portion of the capital invested in equipment. Average equipment value per farm in these three counties is over \$85,000, compared to \$59,000 in Livingston, Oakland, Genesee, and Midland Counties.

Cropland

There are a total of 965,873 acres of cropland in the seven county region, of which 882,373 acres are harvested (Table 3.5). The distribution of these lands is very similar to that of agricultural lands in general, with the majority of them located on the Saginaw lake plain in Saginaw, Gratiot, and Shiawassee Counties. Saginaw County alone contains 268,428 acres of cropland, as much as the totals of Genesee, Livingston, Oakland, and Midland Counties combined.

In all of the counties, the rate of cropland loss exceeded the rate of farmland loss between 1992 and 1997. In Livingston County, for example, total land in farms declined 50,485 acres or 17.2%, while total cropland declined 17,752 acres, or 19.1%. This trend indicates that while the conversion of agricultural lands is affecting all types of farmland, croplands are being impacted at a faster rate. This is likely due to the ease of converting farm fields and the high suitability of agricultural soils for development.

Irrigated lands account for a tiny portion, 0.08%, of the total farmland in the seven counties, with Saginaw and Gratiot Counties containing the largest acreages. Several counties experienced a significant increase in irrigated acreage between 1992 and 1997. In Saginaw County irrigated acres increased over 80%; in Shiawassee County the increase was 39%. Genesee, Gratiot, Midland, and Oakland Counties saw a reverse trend, losing a total of 2,558 irrigated acres.

Farm Economics

The combined market value of agricultural products produced in the seven Shiawassee watershed counties is nearly \$338 million (Table 3.6). Seventy-five percent of this total is generated by crop production, the remainder by livestock production.

County-by-county totals are shown in Table 3.6. Gratiot and Saginaw Counties outpace all the others in both the overall value of their agricultural products and in the average value sold per farm. Saginaw and Oakland Counties stand out as being particularly dependent on the sale of crops, and Gratiot and Livingston Counties place more of an emphasis on livestock.

The number and percentage of farms in the seven counties, by value of sales, is shown in Tables 3.7 and 3.8.

Watershed History

Native American history

The first Europeans to travel through 18th century southeastern Michigan surveyed the land and described prairies, prairie land, rolling hills, and woodland. They found bands of the Saginaw tribe, of the Chippewa Nation. There were also some Ottowas and a few Pottawattamies. The French depended on the Native Americans for their role as middlemen in the exchange of furs with distant groups. The presence of these Native Americans in the fur trade around Detroit added to the Lower Peninsulas' cosmopolitan frontier landscape.¹⁵⁵

The regionally dominant Saginaw Chippewas described the earlier inhabitants as the Sauk tribe. About 3 generations prior, the Sauks, a very warlike people, controlled the hunting on prime land in what is now Shiawassee County. For many years, their control was not challenged but finally the Chippewas decided to take control of this prized land. They called on the Ottowas to be allies and together they attacked the Sauks. There was an indiscriminate slaughter; all the villages on the Shiawassee River were destroyed and the Sauks were nearly exterminated.¹⁵⁶

The Chippewas were distinguished by their aggressive dispositions and cruelty and fought a prolonged war against the United States. After their leader Tecumseh was killed at the Battle of the Thames in 1813 they lost their will to fight. In 1819 General Lewis Cass set aside an Indian Reservation of 3,000 acres called Ketchewaundaugenink. By 1830 the Indian villages on the Shiawassee River were Kechewondaugoning and Shigemasking (near Shiawassee town). These were the only villages on the river within current county lines. The Chippewas planted extensive cornfields between Vernon and Shiawassee town and one of their main industries was creating maple sugar from the abundant maple groves.¹⁵⁷

General Cass (who became Governor when Michigan attained statehood in 1837) realized white settlers were immigrating in such numbers that the Indians would have to be pushed farther west to make room. At any rate, it was considered a favor that they were granted reservation lands after 1819. All the Saginaw Chippewas were to be ousted by 1842 but the government never had to remove them because they were nearly wiped out by smallpox.¹⁵⁸

Early Settlement of the Region

The frontier offered a variety of incentives for potential immigrants, including cheap land, freedom from religious and political persecution in the eastern U.S. and Europe, and opportunity for freed blacks immigrating from the South. Communities often formed around religious or family groups, however economic factors, such as arable land and good trading locations, were the driving force behind regional settlement patterns.¹⁵⁹

The Territory of Michigan was formed by Congress in 1805. At the end of the War of 1812, Congress pronounced that 2 million acres be surveyed for America in Louisiana, Illinois, and Michigan. Louisiana and Illinois were surveyed accordingly, but the federal surveyors reported no suitable land for cultivation in Michigan. Years passed before some pioneers went to Michigan anyway despite the bad reputation and proved the surveyors wrong. There was a marshy belt around Detroit but further inland the soil was fertile and suitable for cultivation.¹⁶⁰

Southeast Michigan was permanently settled first because it was geographically most convenient to those traveling up from Ohio and west on the Erie Canal from New York State and points east. Detroit was in a central position for trade between the East and the Michigan frontier in the early 1800s. Settlement was hampered in the early 1800's partly by the presence of Native Americans. As the federal government continued to obtain lands from the tribes, the way was cleared for immigration to increase rapidly and fan out from Detroit's ports. Farmers from the East found the soil good for agriculture, if the land was first cleared of trees. The climate of the Lower

Peninsula was well suited to a variety of cultivars. In particular, Shiawassee, Gratiot, and Genesee Counties had a majority of first-class soil for agriculture.¹⁶¹ Oakland and Livingston Counties, while having less valuable soil overall, had more open land that could be easily cleared for agriculture and plentiful hydraulic power opportunities.¹⁶²

Michigan farmers grew a wide variety of crops, but relied most heavily on corn and wheat that had to be processed before shipment to markets.

Consequently, gristmills sprang up in most population centers. Sawmills to support the timber industry were also common but did not coincide as closely with towns. Oakland and two other counties outside the watershed hosted more than a third of all gristmills in Lower Michigan. By 1854, Oakland had 25 gristmills and 46 sawmills; Livingston had 15 and 26; Genesee had 11 and 26; Shiawassee had 3 and 5, respectively.¹⁶³

Howell, Flint, Pontiac, and Saginaw were the biggest population and trade centers in the 1840's. Corunna and Milford ranked in the second largest category. However, growth was restricted by an inability to employ large numbers of people and a relatively small number of nearby farmers. Even the larger frontier towns hovered at around 1,000 residents until the 1950's with the advent of the railroad and subsequent transition to a more networked economy.¹⁶⁴ By 1860, a rail line connected Detroit with Grand Haven by way of Pontiac and Owosso.

County Histories

Genesee County

The county was laid out in 1835 and, like most young counties, had its share of problems with land speculators and wildcat banking operations. Much of its original population immigrated from northwestern New York. Agriculture was a dominant land use in the county and some towns had distinguished specialties. Linden was known for its cooperative creamery and Gaines for its maple sugar; Montrose was an especially rich agricultural area. Swartz Creek boasted sugar beet production, Goodrich was a dairy town, and Atlas was known for excellent waterpower.¹⁶⁵

Flint, the county seat, was already an industrial center by 1837. Local businessmen were quick to build a railroad line to boost commerce and Flint quickly bloomed from a township to a city. Early industries included boot and show manufacturing, ironworks, lumbering, and wool carding. All newspapers in the county were published in Flint until 1854. The lumber industry was exhausted in 1876 but Flint soon set a new growth record for industrialization. The population exploded from 13,000 to 85,000 in the twelve years between 1904 and 1916. The Flint Wagon Works Company

made gasoline engines but then Mr. Buick formed the Buick Motor Company, designed the Model F, and began expansion of automobile factories. Soon other factories flooded in, such as Flint Axle Works, Weston-Mott Co., Imperial Wheel Works Plant, Champion Ignition Co., Michigan Motor Castings Co., Chevrolet Motor Co., and General Motors.¹⁶⁶

Gratiot County

The county formed in 1831 and was named for General Charles Gratiot. It is very close to the geographical center of Lower Michigan, far from navigable water, so settlement was somewhat delayed and sparse. There was bitter contest for several years over which town would win the county seat. Ithaca eventually won, but was not platted until 1857 and the other sizeable town, Alma, was platted the following year. In 1857 there were only 9 post offices in the county. It was primarily an agricultural county. Ithaca had the best farmland in the county and had a renowned creamery that shipped its produce to New York State. Alma had the first and most extensive sugar beet factory. It also had the first Sanitarium in Michigan, which opened in 1886. Alma is home to Alma College, a Presbyterian school that opened in 1887. The college was one of the most important assets to the town and county.¹⁶⁷

Livingston County

The earliest non-native people in Livingston County came from Detroit by way of Ann Arbor. The first permanent settler to the area, in 1828, was Colonel Solomon Peterson. Livingston County was carved out of Shiawassee and Washtenaw Counties in 1833. Its namesake was Edward Livingston, Secretary of State for President Andrew Johnson and Minister to France. Howell became the county seat. In the 1840's Howell gained the reputation of being a very fun town whose inhabitants were ready to drop anything for hilarity and practical jokes.¹⁶⁸ The county had the usual assortment of commerce and manufacturing such as hotels, mills, ironworks, and wagon shops. Livingston County had many grist- and sawmills for processing grain and timber products. Wheat was by far the most prevalent crop. The county had one of the highest proportions of cattle in Michigan because of the availability of high quality marsh grasses for pasture. Sheep were also a major livestock animal. Brighton, Howell and Fowlerville thrived because they were on the Detroit, Lansing and Northern Railroad line.¹⁶⁹

Midland County

The first permanent white settler in Midland County was John A. Whitman in 1836. The county was attached to Saginaw County for municipal and judicial purposes until 1850. The soils were particularly good for cereal crops and vegetables. The main industries were timber and salt. Midland County is at the center of the great salt basin of Michigan. The Mineral Well was a great attraction; it was bored in 1867. Shares were sold to build a large bathhouse

and the health benefits of coming to the mineral baths were widely recognized.¹⁷⁰

Oakland County

General Cass announced the Oakland County boundaries in 1819 but it was not organized until 1827. The first permanent settler was James Graham, a Revolutionary soldier. Pontiac became the county seat in 1820 and was incorporated in 1837. Oakland County men had a prominent role in the formation and revision of the state constitution because it was the oldest and most settled county¹⁷¹ of the territorial government. The county was a leader in humane treatment of the poor and in 1903 changed the “Poorhouse” to the “County Home”. Holly was the other major town besides Pontiac. Carriage and wagon factories were numerous even before automobile factories came. Many auto manufacturers had their businesses in Oakland County. By 1912, Pontiac plants were producing a gasoline engine vehicle every ten minutes. It became home to the General Motors Truck Company, one of the best-equipped factories in the country with power supplied by one of the largest independent power plants in Michigan.¹⁷²

Saginaw County

The county was organized in 1835 and at the time included Bay County. William McCormick was the first permanent settler. Saginaw City became the county seat. Fishing was an important business and in particular gained significance during the spring sturgeon runs. In 1858 the fishing industry was economically surpassed only by the ship yard trade and the lumber trade. Fires were suffered by many young towns in the 1800's, but Saginaw City placed more emphasis than most on training fire-fighters and developing fire-fighting equipment in the mid to late 1800s. The Saginaw Valley was the Sugar Bowl of Michigan, so named for the excellent sugar beet crops, and also excelled in the coal and salt industries.¹⁷³

Shiawassee County

The county was organized in 1822 and included parts of Ingham and Genesee Counties. Its present boundaries were delineated in 1836. The same year, Elias Comstock became the first permanent settler. Early settlers were from New York, Vermont, Massachusetts, Ireland and Scotland. Wheat and potatoes were the most lucrative crops. Livestock was generally less important in Shiawassee County than surrounding areas. Corunna became the county seat in 1840; it was settled by a group of businessmen called the Shiawassee County Seat Company. It was named by one member of that group for Corunna, Spain after his trip there to buy sheep. Owosso missed becoming the state capital by one vote in 1847. Owosso supported the wood fabrication industry and specialized in caskets, furniture, carriages, and sleighs.¹⁷⁴

Political structure for the watershed

Land survey system

According to the Northwest Ordinance of 1787, counties of Midwestern states were divided into townships of approximately 36 square miles. Each township was referenced according to township and range numbers within a grid of the state. The origin of the grid for Michigan is on the border of Jackson and Ingham counties. Within each township, there are 36 sections of approximately one square mile. These are further divided into quarter sections and then quarter-quarter sections that equal 40 acres.

Political divisions

The Shiawassee watershed covers parts of seven counties; Gratiot, Genesee, Livingston, Oakland, Saginaw, and Shiawassee. These in turn encompass all or part of 67 townships. There are eight cities and 11 villages incorporated in the watershed. (*Cities:* Corunna, Durand, Fenton, Howell, Ithaca, Linden, Owosso, Saginaw. *Villages:* Bancroft, Birch Run, Breckenridge, Byron, Chesaning, Gaines, Holly, Merrill, Oakley, St. Charles and Vernon)

Elected representative structure within county jurisdictions

The Board of Commissioners is the chief policy making body of county government. The county is divided by population size into districts in which there is one commissioner elected. Other county offices include Prosecuting Attorney, Sheriff, County Clerk, Treasurer, Register of Deeds, and Drain Commissioner. There is a county court, district court, and probate court. There are also numerous boards and commissions for specific services within the county. Each township has a Supervisor, Clerk, Treasurer, Trustees, and an Assessor. Each city has a Mayor, City Manager, Clerk, Treasurer, and Assessor. Villages have a President, Clerk, Treasurer, and Assessor.

Congressional districts

The watershed covers five congressional districts. Districts 4 and 8 cover a large majority of the area while small portions of 5, 9, and 11 are included. Representative Dave Camp (R) serves the 4th district, Representative Mike Rogers (R) serves the 8th district, Representative Dale Kildee (D) serves the 5th district, Representative Joseph Knollenberg (R) serves the 9th district, Representative Thaddeus McCotter (R) serves the 11th district.

Public Lands

The Shiawassee watershed totals 809,444 acres. There are five categories of public lands comprising only 4.6% of the area. The Shiawassee National Wildlife Refuge total area is 8,849 acres. State Game Areas make up 21,723 acres and include Shiawassee State Game Area, Oak Grove State Game Area,

and Gratiot-Saginaw State Game Area. The State of Michigan owns 6,559 acres. Holly State Recreation Area acreage equals 344. Seven Lakes State Park is 127 acres. Boating, swimming, fishing, hunting, hiking, picnicking, and biking are available in the Recreation Area and State Park. Within Shiawassee County itself, there are two areas of public land; holdings of the State of Michigan totaling 75 acres.¹⁷⁵

Figure 3.1. Townships and Cities in the Shiawassee Watershed

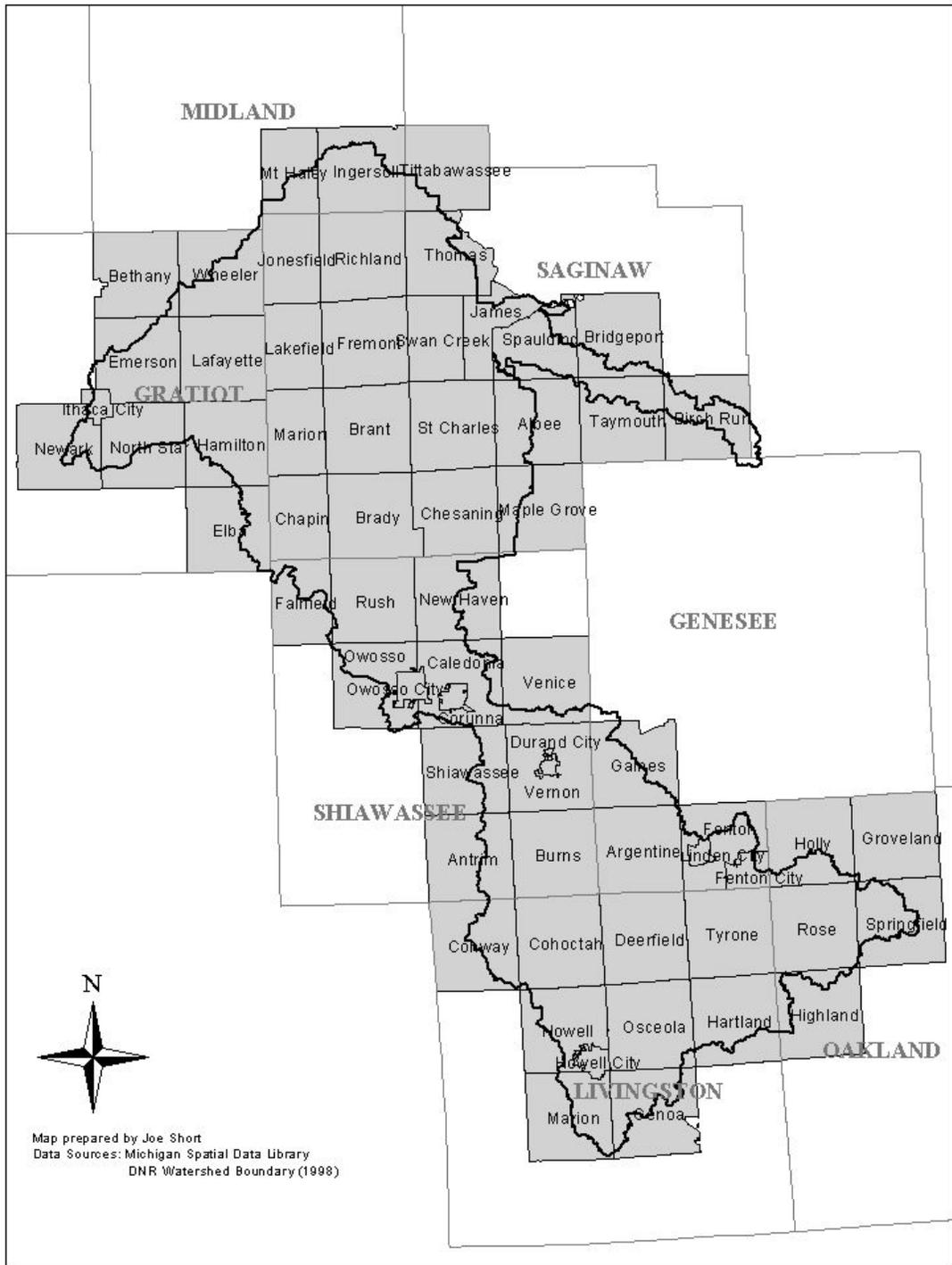


Figure 3.2. Watershed Area by County.

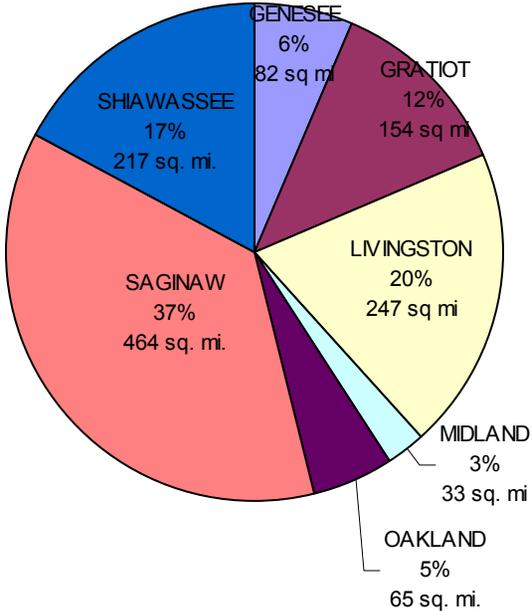
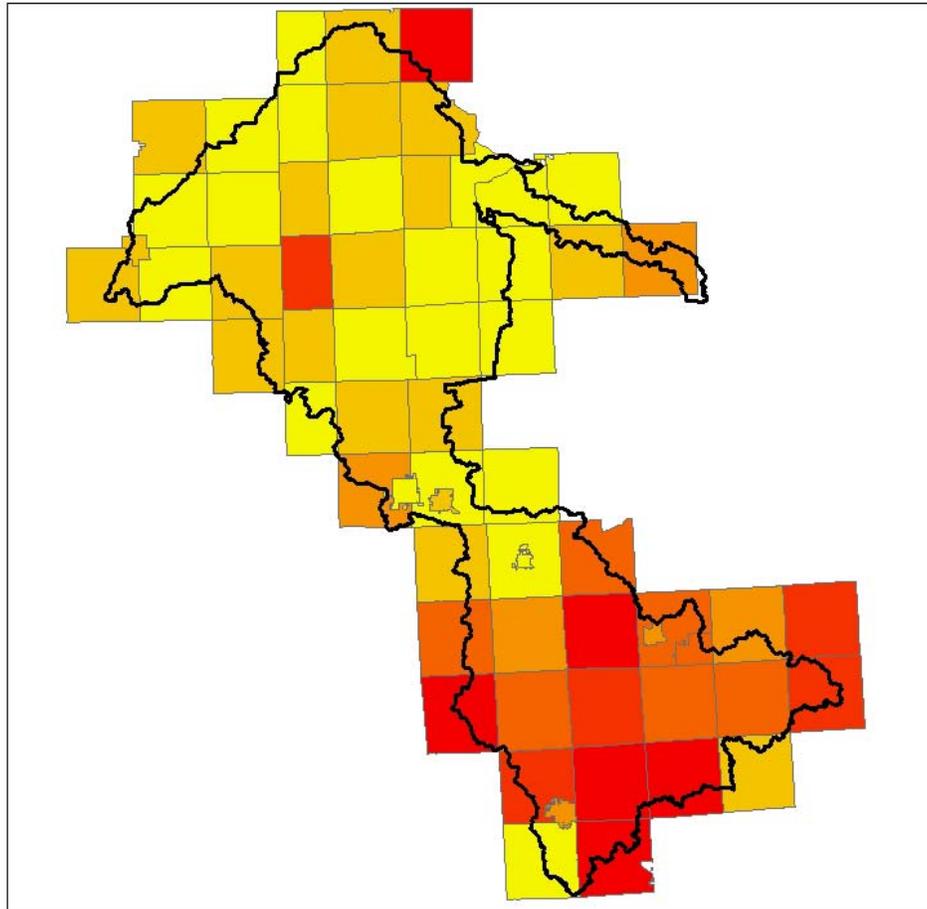


Figure 3.3. Watershed Population Growth 1990-2000.



Percent Growth

-  Population Loss
-  0.0 - 10.0%
-  10.1 - 20.0%
-  20.1 - 30.0%
-  30.1 - 40.0%
-  >40%

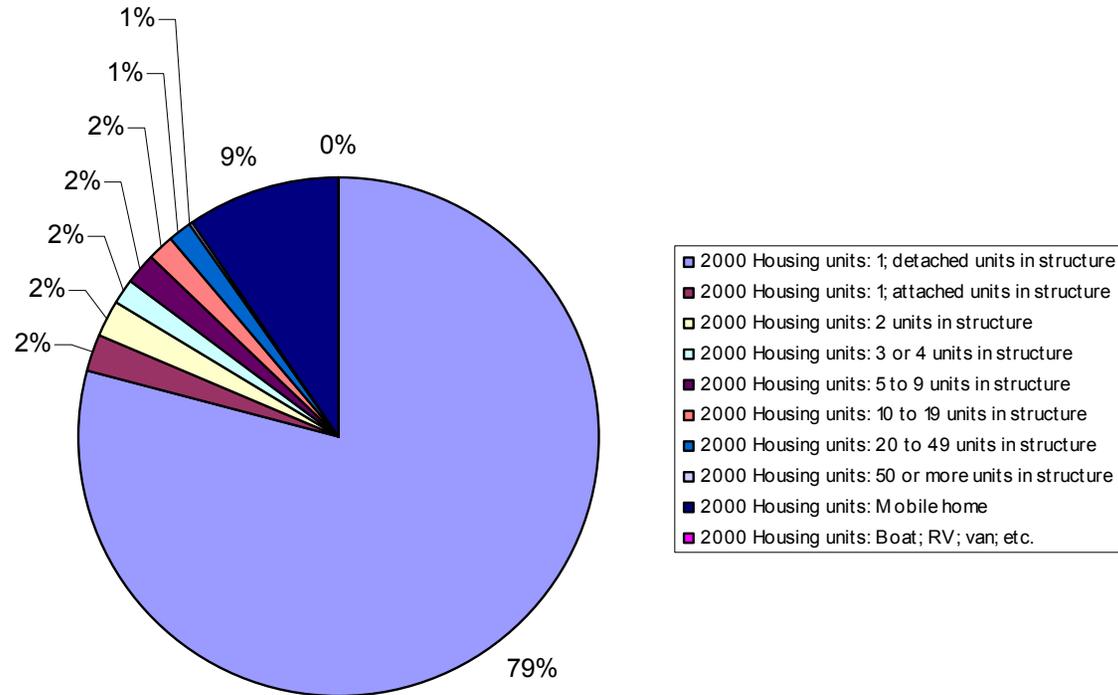
0 4 8 16 Miles



Data Sources: 2000 U.S. Census

Map prepared by Joe Short (shortj@umich.edu)
Shiawassee River Masters Project

Figure 3.4. Housing Types in the Shiawassee Watershed.



Source: 2000 U.S. Census

Figure 3.5. Median Value of Housing Units in the Shiwassee Watershed

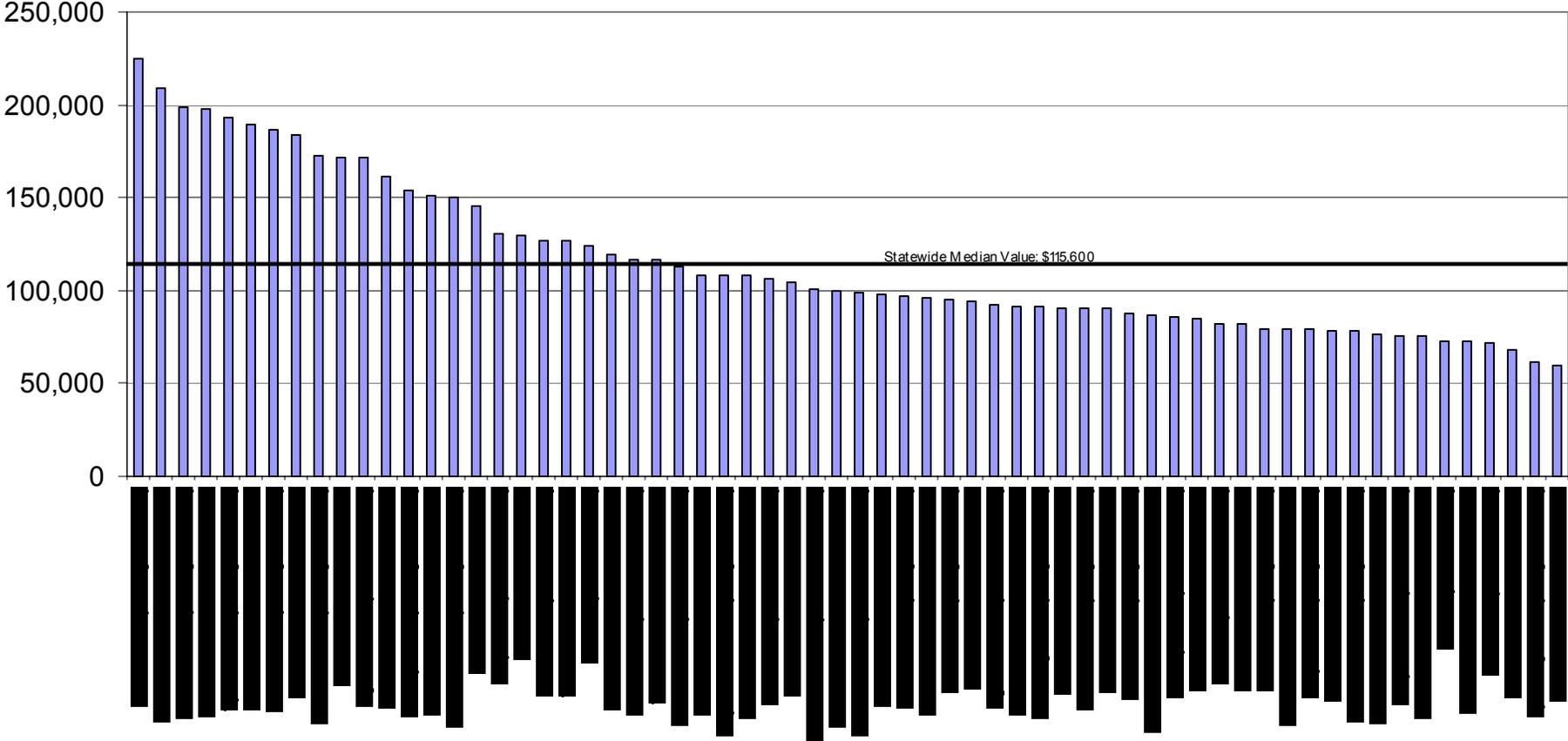


Figure 3.6. Watershed Housing Values by County.*

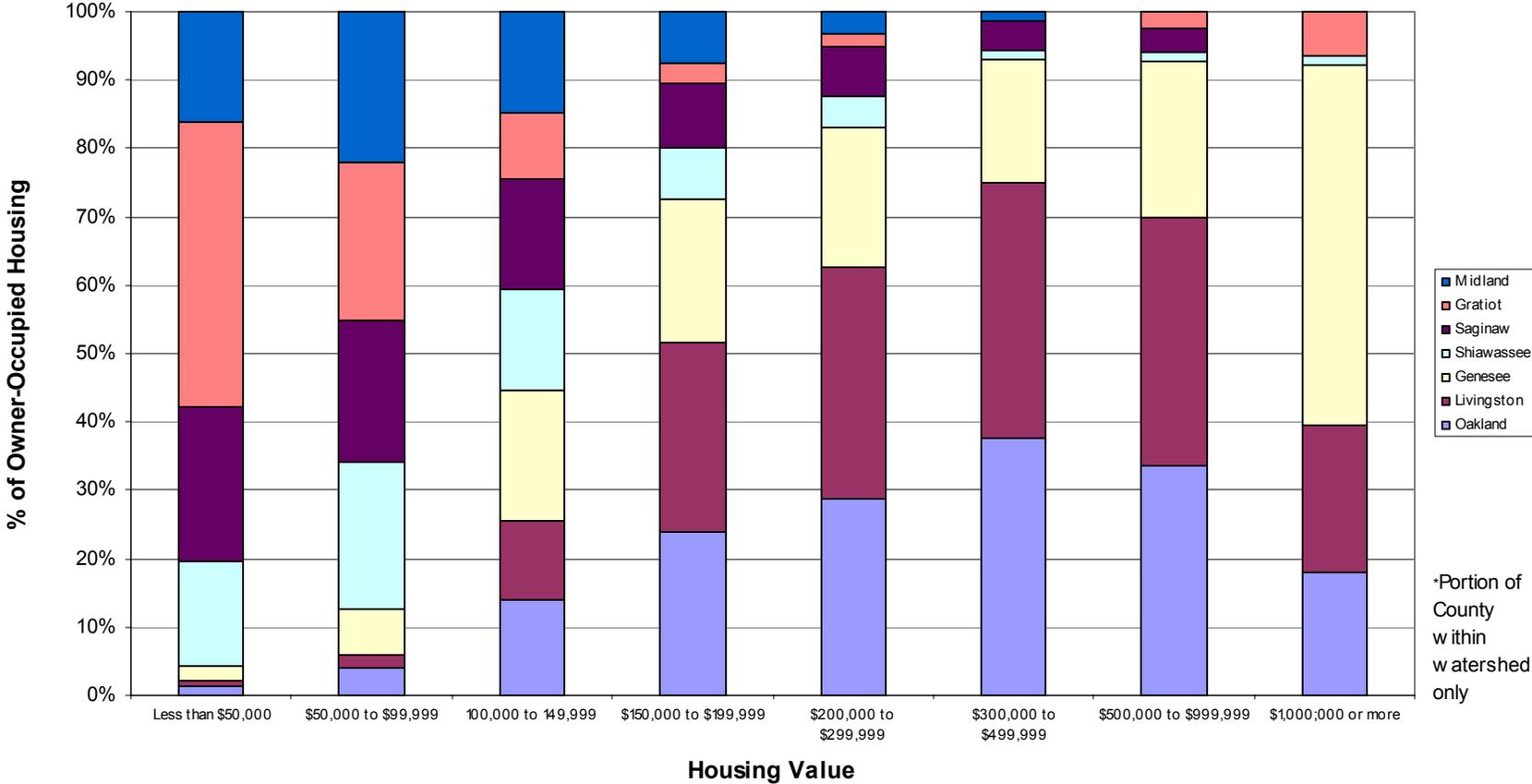


Figure 3.7. 1999 Per capita income by Watershed Township.

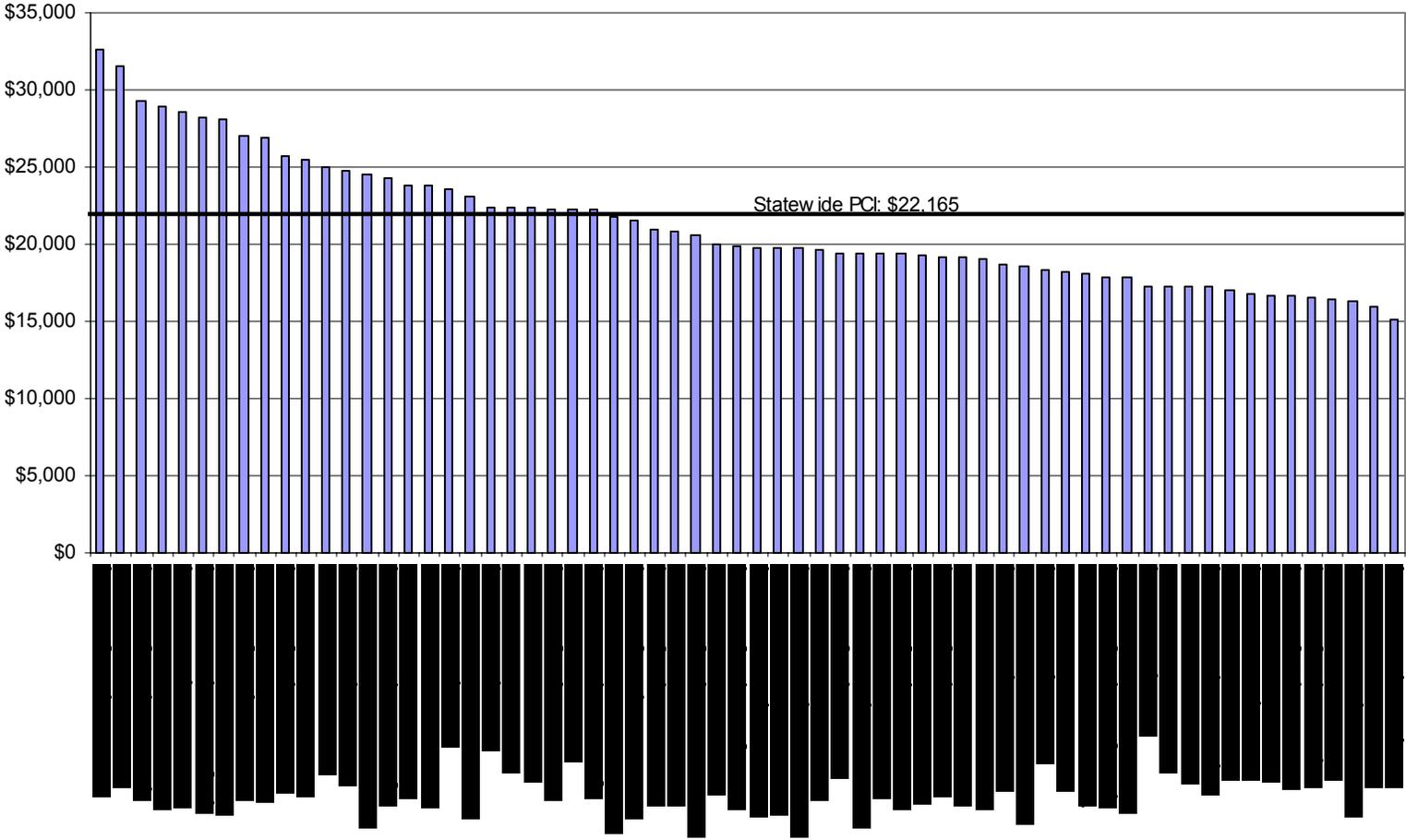


Figure 3.8. 1999 Median household income by Watershed Township.

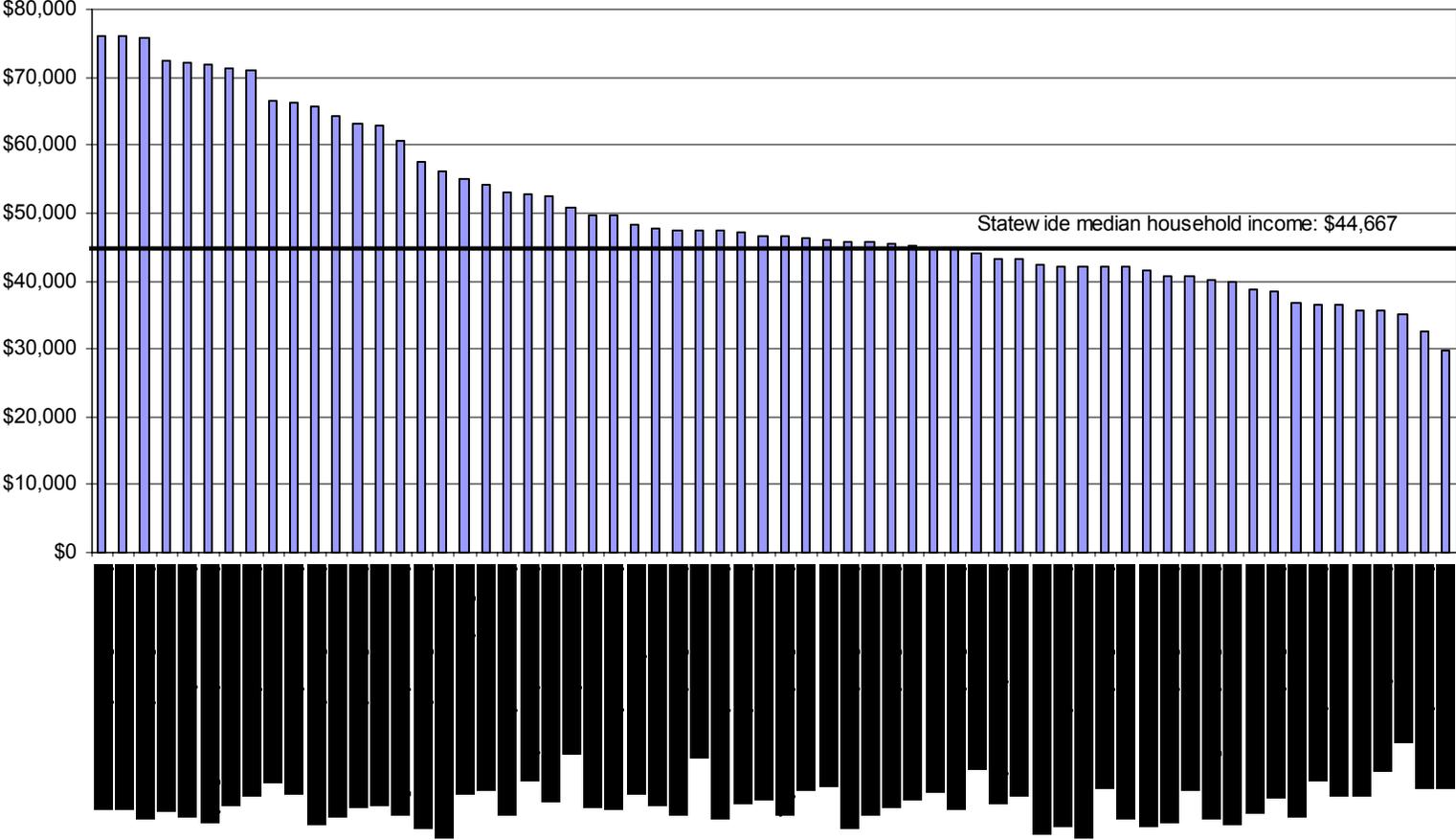


Figure 3.9. Watershed, Region, and State Employment Comparison.

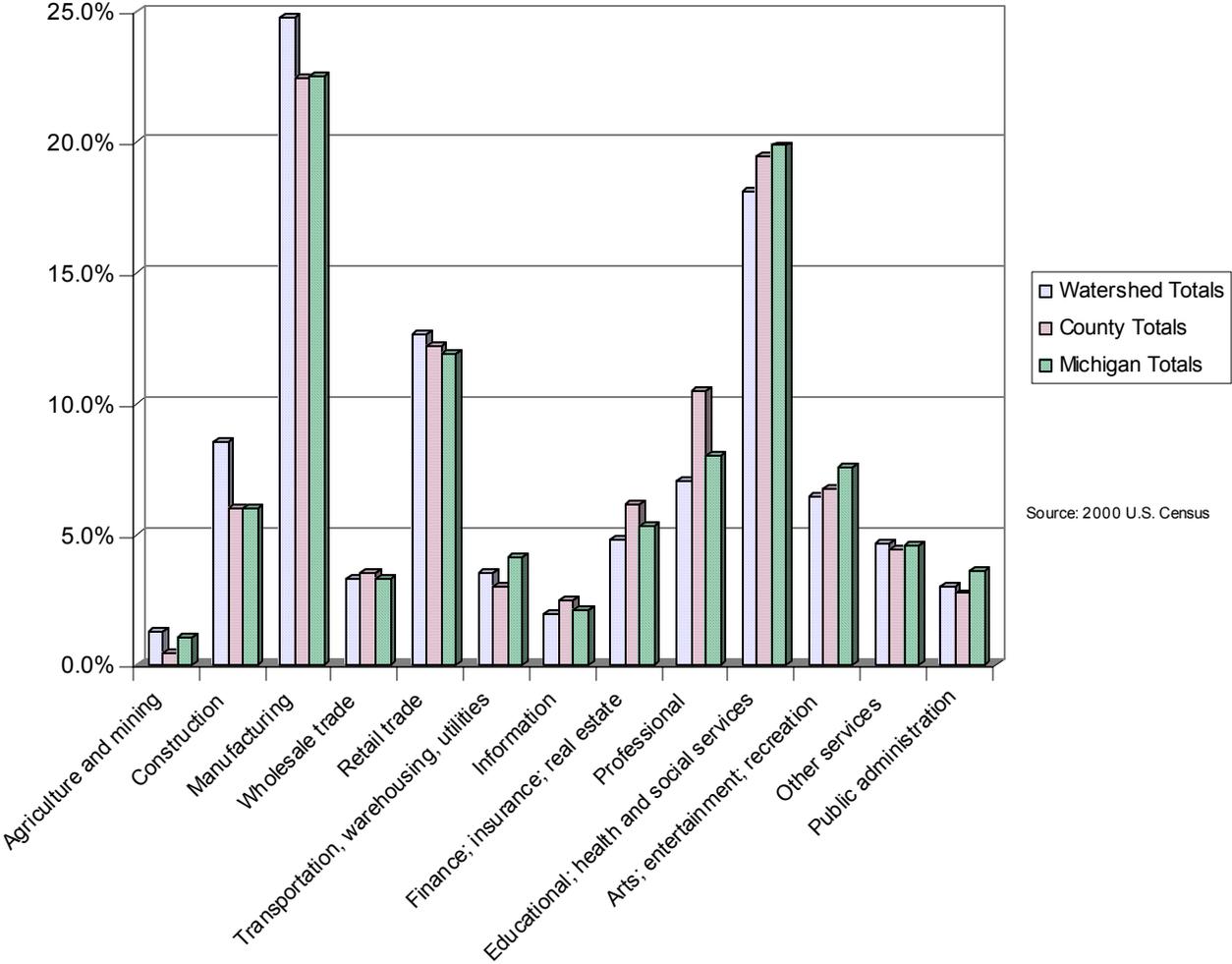
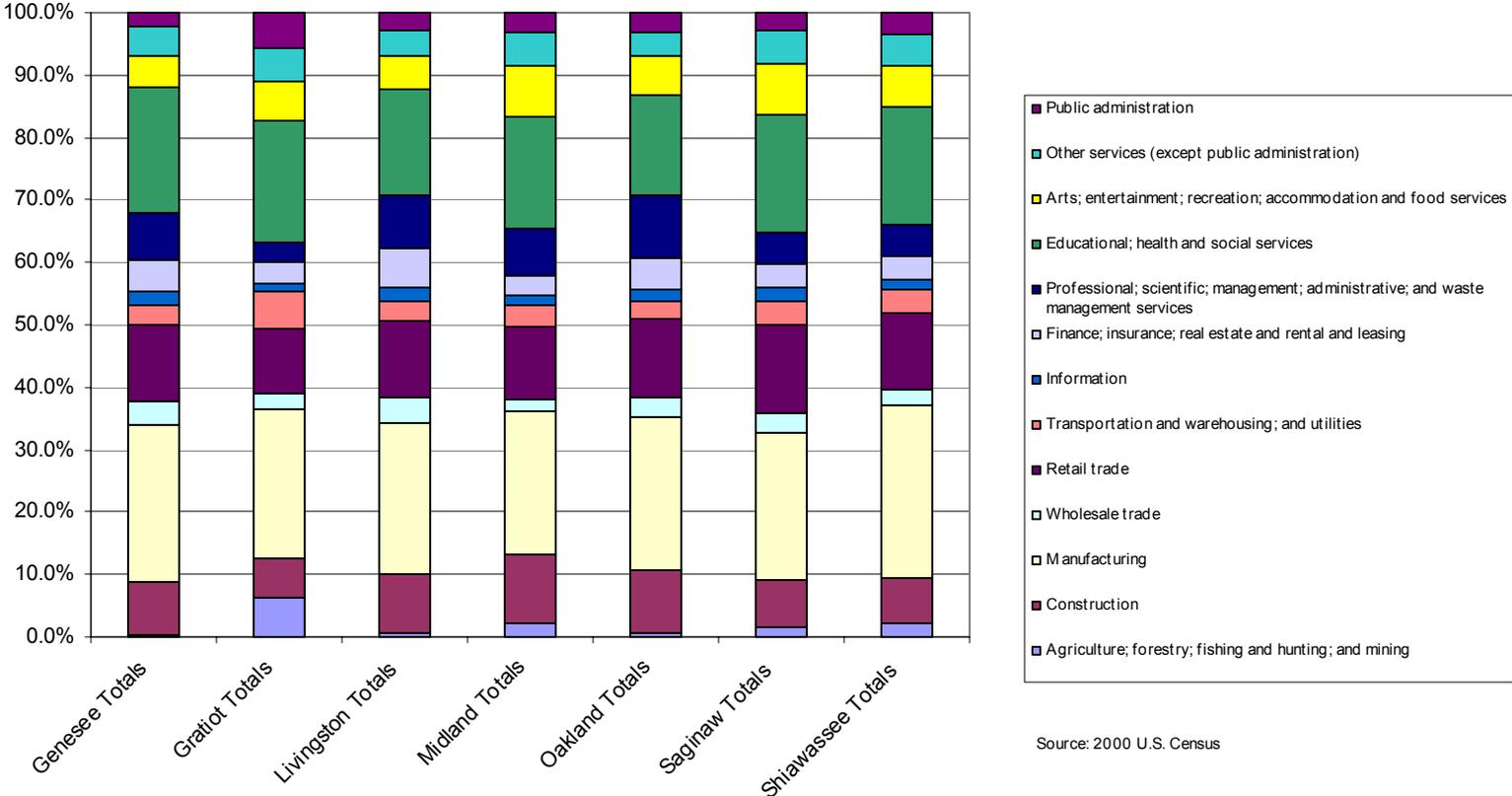


Figure 3.10. Percent Employment by Sector. County Areas Within Watershed Boundary.



Source: 2000 U.S. Census

Table 3.1. Farms and Farmland Totals, 1992-1997 and Percent Change.

County		Number of Farms	Land in Farms (acres)	Average size of farm (acres)	% County land in farms
Genesee	1997	796	117,968	148	28.8%
	1992	799	137,082	172	33.5%
	% Change	-0.4%	-13.9%	-14.0%	-4.7%
Gratiot	1997	873	276,833	317	75.9%
	1992	914	277,400	304	76.0%
	% Change	-4.5%	-0.2%	4.3%	-0.2%
Livingston	1997	637	98,297	154	27.0%
	1992	683	118,764	174	32.7%
	% Change	-6.7%	-17.2%	-11.5%	-5.6%
Midland	1997	418	79,667	191	23.9%
	1992	442	89,173	202	26.7%
	% Change	-5.4%	-10.7%	-5.4%	-2.9%
Oakland	1997	544	45,366	83	8.1%
	1992	503	48,236	96	8.6%
	% Change	8.2%	-5.9%	-13.5%	-0.5%
Saginaw	1997	1,163	297,842	256	57.5%
	1992	1,294	318,125	246	61.4%
	% Change	-10.1%	-6.4%	4.1%	-3.9%
Shiawassee	1997	915	214,153	234	62.1%
	1992	1,086	236,799	218	68.6%
	% Change	-15.7%	-9.6%	7.3%	-6.6%
Totals	1997	5,346	1,130,126	198	39.1%
	1992	5,721	1,225,579	202	42.4%
	% Change	-6.6%	-7.8%	-2.1%	-3.3%

Source: 1997 USDA Census of Agriculture.

Table 3.2. Number of Farms by Size.

County	1 to 9 acres	10 to 49 acres	50 to 179 acres	180 to 499 acres	500 to 999 acres	1,000 acres or more
Genesee	56	338	269	82	26	25
Gratiot	53	174	321	167	91	67
Livingston	56	274	179	84	27	17
Midland	18	123	170	67	30	10
Oakland	93	271	115	53	6	6
Saginaw	70	279	419	235	91	69
Shiawassee	43	232	325	197	83	35
Total	389	1,691	1,798	885	354	229

Table 3.3. Percentage of Farms by Size.

County	1 to 9 acres	10 to 49 acres	50 to 179 acres	180 to 499 acres	500 to 999 acres	1,000 acres or more
Genesee	7.0%	42.5%	33.8%	10.3%	3.3%	3.1%
Gratiot	6.1%	19.9%	36.8%	19.1%	10.4%	7.7%
Livingston	8.8%	43.0%	28.1%	13.2%	4.2%	2.7%
Midland	4.3%	29.4%	40.7%	16.0%	7.2%	2.4%
Oakland	17.1%	49.8%	21.1%	9.7%	1.1%	1.1%
Saginaw	6.0%	24.0%	36.0%	20.2%	7.8%	5.9%
Shiawassee	4.7%	25.4%	35.5%	21.5%	9.1%	3.8%
Total	7.3%	31.6%	33.6%	16.6%	6.6%	4.3%

Source: 1997 USDA Census of Agriculture.

Table 3.4. Value of Land, Buildings, and Equipment, 1992-1997 and Percent Change.

County		Average Value per Farm	Average Value per Acre	Est Value of all Machinery & Equipment, Average per Farm
Genesee	1997	\$301,229	\$2,106	\$51,684
	1992	\$241,367	\$1,416	\$41,436
	% Change	24.8%	48.7%	24.7%
Gratiot	1997	\$453,741	\$1,401	\$89,884
	1992	\$307,824	\$1,017	\$67,868
	% Change	47.4%	37.8%	32.4%
Livingston	1997	\$398,766	\$2,360	\$70,608
	1992	\$268,868	\$1,504	\$40,420
	% Change	48.3%	56.9%	74.7%
Midland	1997	\$345,912	\$1,642	\$64,081
	1992	\$242,242	\$1,165	\$41,920
	% Change	42.8%	40.9%	52.9%
Oakland	1997	\$486,079	\$5,645	\$49,275
	1992	\$250,153	\$2,990	\$38,821
	% Change	94.3%	88.8%	26.9%
Saginaw	1997	\$459,033	\$1,711	\$80,319
	1992	\$286,240	\$1,212	\$64,633
	% Change	60.4%	41.2%	24.3%
Shiawassee	1997	\$366,206	\$1,547	\$85,339
	1992	\$233,064	\$1,017	\$53,274
	% Change	57.1%	52.1%	60.2%
Totals	1997	\$401,567	\$2,345	\$70,170
	1992	\$261,394	\$1,474	\$49,767
	% Change	53.6%	59.0%	41.0%

Source: 1997 USDA Census of Agriculture.

Table 3.5. Cropland and Irrigated Land Acreages.

County	Total cropland (acres)	Harvested cropland (acres)	Irrigated land (acres)
Saginaw	268,428	257,817	2,919
Gratiot	244,531	226,252	2,012
Livingston	75,367	64,554	1,548
Shiawassee	184,076	170,733	993
Genesee	98,966	84,103	798
Oakland	32,793	24,121	586
Midland	61,712	54,793	551
Total	965,873	882,373	9,407

Source: 1997 USDA Census of Agriculture

Table 3.6. Market Value of Agricultural Products.

	Market Value of Ag Products Sold (x 1000)	Average per farm	Crops, including nursery and greenhouse (x 1000)	% Crops of Total Market Value	Livestock, poultry, and their products (x 1000)	% Livestock of Total Market Value
Gratiot	\$102,439	\$117,342	\$65,499	63.9%	\$36,940	36.1%
Saginaw	\$84,034	\$72,256	\$74,753	89.0%	\$9,281	11.0%
Shiawassee	\$45,200	\$49,399	\$32,637	72.2%	\$12,563	27.8%
Oakland	\$32,452	\$59,654	\$29,719	91.6%	\$2,733	8.4%
Livingston	\$28,455	\$44,671	\$18,519	65.1%	\$9,936	34.9%
Genesee	\$27,995	\$35,169	\$20,496	73.2%	\$7,499	26.8%
Midland	\$17,254	\$41,278	\$13,125	76.1%	\$4,129	23.9%
Total	\$337,829	\$419,769	\$254,748	75.4%	\$83,081	24.6%

Source: 1997 USDA Census of Agriculture.

Table 3.7. Number of Farms by Value of Sales.

	Less than \$2,500	\$2,500 to \$4,999	\$5,000 to \$9,999	\$10,000 to \$24,999	\$25,000 to \$49,999	\$50,000 to \$99,999	\$100,000 or more
Genesee	284	118	106	112	75	39	62
Gratiot	186	68	97	142	95	67	218
Livingston	200	71	96	113	47	40	70
Midland	120	53	68	70	33	29	45
Oakland	233	61	69	69	37	27	48
Saginaw	190	109	125	238	169	122	210
Shiawassee	181	112	118	167	131	80	126
Total	1394	592	679	911	587	404	779

Table 3.8. Percent of Farms by Value of Sales.

	Less than \$2,500	\$2,500 to \$4,999	\$5,000 to \$9,999	\$10,000 to \$24,999	\$25,000 to \$49,999	\$50,000 to \$99,999	\$100,000 or more
Genesee	35.7%	14.8%	13.3%	14.1%	9.4%	4.9%	7.8%
Gratiot	21.3%	7.8%	11.1%	16.3%	10.9%	7.7%	25.0%
Livingston	31.4%	11.1%	15.1%	17.7%	7.4%	6.3%	11.0%
Midland	28.7%	12.7%	16.3%	16.7%	7.9%	6.9%	10.8%
Oakland	42.8%	11.2%	12.7%	12.7%	6.8%	5.0%	8.8%
Saginaw	16.3%	9.4%	10.7%	20.5%	14.5%	10.5%	18.1%
Shiawassee	19.8%	12.2%	12.9%	18.3%	14.3%	8.7%	13.8%
Total	26.1%	11.1%	12.7%	17.0%	11.0%	7.6%	14.6%

Source: 1997 USDA Census of Agriculture.

Chapter 4: Survey Report

Introduction

The cornerstone of the Shiawassee River Project's social assessment was a mail survey of 1,500 watershed residents conducted in January of 2003. The survey targeted residents in postal ZIP codes that most closely matched the watershed boundaries within Shiawassee County. The survey had two purposes. The first was to determine quantitatively how people feel about the river and the dam. In talking to people individually, we heard conflicting opinions about important topics such as level of awareness of the dam's existence, amounts and types of recreation, feelings of nostalgia, and (in light of the dam's state of disrepair) preferences for future management of the Shiatown Dam site. The second reason was to provide baseline data to the Friends of the Shiawassee River (FOSR) in order to compare future awareness of these issues after public education and dialogue has increased.

Methods

The survey consisted of 20 questions and was divided into three sections. Section 1 included a series of five questions about views and opinions about the Shiawassee River as a whole. Section 2 consisted of ten questions gauging familiarity with the Shiatown Dam. Only recipients who had personally visited the site were asked to complete the entire section. The questions in Section 2 covered recreational use, historic value of the site, aesthetic quality, ecological impacts, and opinions on future management options. Section 3 asked five demographic questions for representative-sample comparison with the 2000 U.S. Census.

We developed the survey with the guidance of several reference books.¹⁷⁶ Jody Rendziak, of the Illinois Natural Resource Conservation Service, and Author of the Guide for Watershed Planning¹⁷⁷ supplied some questions and ideas for question topics. The survey was pre-tested for clarity and completion time using 20 people. We submitted all survey material for approval to the University of Michigan, Institutional Review Board's, Behavioral Sciences Committee. Permission to proceed was granted in December 2002.

We sent the survey to a random sample of Shiawassee County residents living within the Shiawassee Watershed. We chose 1,500 survey recipients to ensure an adequate response rate for statistical analysis with minimal sampling error.¹⁷⁸ Using our GIS, we correlated ZIP codes with the watershed boundary to identify appropriate ZIP codes for our sample pool (Figure 4.1). We discussed the list of ZIP codes with FOSR to verify that our sample would target the appropriate geographic area. We then purchased a list of 1,500

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names and addresses, generated randomly from these ZIP codes, through Merit Marketing Group, Inc., of Ann Arbor.

Each individual received three mailings. The first mailing alerted recipients to the purpose of the survey and notified them that they would receive the survey in approximately one week. The second mailing (sent one week later) contained a cover letter, the actual survey, and a stamped return envelope. The third mailing, a postcard, followed a week later to thank recipients for returning the survey or to encourage non-returnees to complete it. Despite the high cumulative cost of postage, we chose to send three mailings to increase the response rate. We also hand-signed each letter to survey recipients, had the envelopes professionally printed with the University seal, and used regular stamps instead of bulk mail to boost response rate.¹⁷⁹

A short public announcement about the upcoming survey was published in the two local papers a week prior to mailing surveys to let people know what to expect and help legitimize the survey.

All survey responses and comments were entered into a Microsoft Access database. We double-checked data entry accuracy to reduce error. Descriptive statistics, two sample independent t-tests, and bivariate correlations were calculated with SPSS version 10.1. T-tests were used to compare means.

Error structure

Sample surveys are inherently imperfect and usually contain biases and errors as discussed below. We took steps to minimize error as much as possible in designing and implementing the survey. The survey results are representative of the survey population (people over 18 whose addresses are in the selected ZIP codes), and should carefully be distinguished from a representation of the entire population of Shiawassee County.

Our coverage error was relatively small. Geographic distribution of returned surveys very closely matched the distribution of the sampled population (Figure 4.2). The purchased address list contained 97 (6.5%) bad addresses. The postal service returned these because of expired forwarding period, addressee was deceased, or the address was incorrect as written. Therefore, the sample size was effectively 1403 instead of the full 1500 that were mailed. All calculations of response rate are based on the effective sample size.

Six hundred three surveys were returned as of March 3, 2003, a return rate of 43% when compared to the effective sample size of 1403. This quantity of returns compared to a sample pool of approximately 40,000 allows 95% confidence that the sampling error was small, no more than $\pm 4\%$.¹⁸⁰

Of the returned surveys, 13% of the questions (n=48,240 with 80 sub-questions per survey) were not answered. The non-response rate varied within the surveys; for questions 8-15 (this whole section was skipped by 18% who never visited the dam) non-response was 21-26% and for the rest of the questions it was 3-5%.

While total measurement error cannot be quantified, measurement error was evident for parts of question 4. This question was about what influences people's use of the river. "Distance to the river", "lack of time", "lack of interest" and "health/safety risks" were to be rated for degrees of positive or negative influence. The wording is ambiguous and therefore the answers to those four subquestions cannot be accurately analyzed.

The address list was compiled from credit reports; therefore all those sampled were at least age 18. This skewed our average respondent age up to 50 years. Shiawassee County is a rural county where families move infrequently compared to more urban areas. We found fully half our respondents had lived in the county for more than 30 years. This fact did not significantly affect responses to any of the questions.

Findings

General

There was a very good return rate of the survey (43%)¹⁸¹, which shows people of Shiawassee County are interested in the Shiatown Dam and the Shiawassee River. Most people (85%) agreed that the river and dam are special, unique places, community landmarks, and add to the character of the community. Nearly everyone (96%) has heard of the dam and 82% reported having visited at some point. The river is used primarily for passive recreation; the most popular activities are walking along the river and nature observation. Many respondents reminisced in the comments section of the survey about the good old days when recreation at the dam and impoundment drew more visitors. They felt strongly that the dam and impoundment represent the history of the community and that the dam should be improved (78%) to a better condition.

Water quality

There was a great desire (89%) to have the river be restored to a better condition. Based on our conversations with people, many people perceived themselves in the minority for caring about the river; but this is not the case. There was very strong concern about poor water quality; it is resoundingly rated as fair or poor (79%) for humans and wildlife. We read many passionate comments from survey respondents about fear of *E.coli* and pollution

Survey Report

impairing their ability to enjoy the river. Forty-two percent say poor water quality is a negative or strongly negative influence on their use of the river.

Recreation

Recreation at the dam is not significantly different from recreation on the river as a whole. Passive recreation is the most popular activity. In addition to our suggestions of recreational activities, sledding was added by 3% of respondents as a popular activity near the dam. Other activities are photography, feeding the ducks, snowmobiling, and ice-skating. The river and dam are appreciated for aesthetic value and for the wildlife they support. The dam brings 53% of respondents to observe nature and 48% to walk at least once a year. The river draws people who walk along it (64%) or observe nature (71%) from the shore at least once a year. Active recreation such as fishing, swimming, and canoeing were reported less frequently than passive activities. This emphasis on passive recreation is due in part to water quality concerns and low water levels.

Fishing on the river was reported by over 30% of respondents; 16% of whom indicated they went 3 or more times last year. Slightly fewer people (22%) said they fished at the dam and impoundment at least 3 times last year. The river is known for its good smallmouth bass fishing. A great many people wrote in the comments section that they would never eat the fish. Some used to fish but stopped because they do not want to be in contact with the water. The dam is widely perceived as having a positive or strongly positive impact on fish and wildlife (64%) and also positively affects the quality of fishing (48%).

Canoeing was done on the Shiawassee River by 30%, and at the impoundment by 14%, of respondents last year; only 11% and 5%, respectively, went more than 3 times. Only very small percentages of people use motorized boats or jet-skis on the river or impoundment.

The survey results indicated a fairly high usage rate. If all the activities reported are added up by the most conservative frequency (i.e., each time a survey was checked “fishing, 3-5 times/year” it was calculated as 3 visits) the grand total is 3,065 visits, or 8 visits per day throughout the year. This is probably a high estimate since one visit may include multiple activities. Not surprisingly, moderate correlations exist between socializing and walking/running, socializing and picnicking, and walking/running and nature observation.

Understanding Functions of the Dam

Overall, the dam is seen as having a positive effect on the river (Figure 4.3). Fish and wildlife are seen as the most positively¹⁸² affected by the dam (64%). Flood control is believed to be a positive function of the dam by 58% of all

respondents. The dam is believed to be a positive influence on the quality of fishing (48%). However, many respondents did not have an opinion on the dam's effects; oxygen level seemed to be the most unknown factor.

These results do not differ when comparing respondents of different education levels. When the results are divided between less than a high school diploma and having at least some college, there was no significant difference between groups.

Safety

The dam was seen as a safety hazard by 52% of total respondents. There was no correlation of positive responses to “the dam is a safety hazard” and “the dam is no longer needed”. The impoundment was not seen as a safety hazard by 50% of respondents, however, 23% did not know or have an opinion on that question.

Future Action

The majority of people (78%) would prefer the dam restored to a better condition while the options of removal or maintaining in its current state were tied at about 10%. Most respondents (61%) would not change their answer even if the option they chose were significantly more expensive.

Characterizing Responses of Restore Versus Removal Supporters

When supporters of restore and removal were divided for analysis, the characteristics of mean age, education level, length of time lived in the county, and whether they live on the river were nearly equal. There were no significant differences found between means.¹⁸³

Proponents of restoration rate the dam's importance to the community (adds character, uniqueness, and visual attractiveness) and the impoundment's visual attractiveness more highly than removal proponents. These respondents also reported regularly¹⁸⁴ using the river for recreation more frequently than removal supporters (Figure 4.4) for every activity except canoeing. Restoration supporters fish and socialize at the dam significantly more than removal supporters.¹⁸⁵ Most respondents who wanted the dam restored (n=362) also believed that the dam has a positive or strongly positive effect on recreation, fish and wildlife, oxygen levels, fishing quality, erosion and water level. Advocates of removal (n=51) believed the dam had either a neutral or negative impact on all the river characteristics; particularly fish and wildlife, recreation and water level (Figure 4.5).

While it appears there is potentially common ground on the ratings of dam safety (Figure 4.6), advocates for removal are more likely to say the dam is a safety hazard and is no longer needed.¹⁸⁶

Who Should Decide and Pay?

The entities most frequently chosen to be responsible for future management decisions were county (32%) and state (29%) governments. Respondents believed the state should pay for changes (43%). A notable percentage (19%) of respondents chose “other” and filled in suggested collaboration among several groups to decide and pay for future changes at Shiatown Dam (see Figure 4.7).

Part One: Your Views on the Shiawassee River

1. Please circle the rating that describes your opinion on each of these statements about the Shiawassee River.

<i>The Shiawassee River:</i>	Strongly agree	Agree	Disagree	Strongly Disagree	Don't Know/ No Opinion
Is a special, unique resource (n=583)	42%	43%	7%	.3%	8%
Is a community landmark (n=584)	43	47	5	.2	4
Encourages people to visit Shia. Co. (n=579)	12	29	32	8	19
Adds to the character of Shia. Co. (n=584)	34	53	7	1	5
Is important to people in Shia. Co. (n=586)	38	47	8	1	7

2. How do you rate the following aspects of the Shiawassee River?

	Excellent	Good	Fair	Poor	Don't Know/ No Opinion
Visual attractiveness (n=577)	12%	38%	31%	16%	3%
Water quality for people (n=578)	1	9	28	54	9
Water quality for fish and wildlife (n=577)	2	15	34	41	8
Condition of the riverbanks (n=581)	1	19	50	24	6
Public access (n=582)	4	27	38	24	7
# of recreational opportunities (n=582)	3	16	35	35	11
Quality of recreational facilities (n=578)	2	14	35	35	14
Impact on personal safety/health (n=579)	1	9	28	37	25

3. How often did you participate in the following activities along the Shiawassee River in the last year?

	Never	1-2 times/year	3-5 times/year	5-10 times/year	More than 10 times/year
Walking/running/biking (n=586)	35.8%	24 %	16%	9%	16%
Fishing (n=577)	66	15	8	4	7
Socializing (n=580)	34	32	17	7	10
Wildlife/nature observ.(n=580)	30	27	15	11	17
Hunting (n=574)	83	9	2	2	4
Canoeing/kayaking/rafting(n=581)	69	19	7	2	2
Motor boating/jet-skiing (n=580)	93	5	1	.3	1
Camping (n=577)	92	5	1	1	1
Picnicking (n=585)	54	27	11	5	3
Swimming/wading (n=580)	87	7	2	2	2

Survey Report

4. How much influence do the following issues have on your use of the Shiawassee River for recreation?

<i>Influences on your use of the river:</i>	Strongly Positive	Positive Influence	Neutral/No Influence	Negative Influence	Strongly Negative	No Opinion/ Don't Know
Types of activ. avail. (n=558)	7%	32%	40%	7%	3%	11%
Distance to the river (n=566)	17	39	33	3	1	7
Access to the river (n=568)	17	37	30	7	2	8
Cond./qual. of river (n=568)	18	17	16	25	17	8
Crowdedness of river (n=561)	9	19	53	6	3	12
Lack of time (n=560)	10	15	50	10	4	12
Lack of interest (n=560)	5	12	56	9	7	12
Health / safety risks (n=567)	18	9	25	21	18	10

5. Do you believe that the Shiawassee River is fine in its current state or should the river be restored to a better condition? (n=573)

- 1 The river is fine in its current state. 11%
- 2 The river should be restored to a better condition. 89%

Part Two: Your Views on the Shiatown Dam

6. Have you heard of the Shiatown Dam and/or the Shiatown Park, located on Bennington Road east of Corunna? (n=590)

- 1 YES 96%
- 2 NO 4%

7. Have you personally visited the Shiatown Dam and/or Shiatown Park? (n=589)

- 1 YES 82%
 - 2 NO 18%
- Skip to Question 16 (page 6)

8. How often did you participate in the following recreational activities at the entire Shiatown Dam area in the past year? Please consider both the pond created by the dam and the park.

	Never	1-2 times/year	3-5 times/year	5-10 times/year	More than 10 times/year
Walking/running/biking (n=471)	52%	31%	10%	3%	4%
Fishing (n=473)	70	19	5	4	3
Socializing (n=473)	50	32	12	4	3
Wildlife/nature observ. (n=470)	47	33	10	6	4
Hunting (n=471)	95	4	.6	.6	.4
Canoe/kayak/raft (n=472)	83	11	4	1	1

Motor boating/jet-skiing (n=470)	98	2	0	0	0
Picnicking (n=470)	64	26	7	2	1
Swimming/wading (n=471)	92	4	2	1	.4
Using the playground (n=473)	63	24	7	4	2

Questions 9 and 10 ask you to consider the Shiatown Dam structure as separate from the pond it creates.

9. To what extent do you agree or disagree with the following statements about the Shiatown Dam (excluding the pond and the park)?

<i>The Shiatown Dam:</i>	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion/ Don't Know
Is visually attractive (n=473)	8%	28%	35%	24%	6%
Is no longer needed (n=470)	4	8	34	32	21
Is a special, unique site (n=473)	26	52	10	4	9
Is a community landmark (n=473)	32	55	5	4	4
Is a safety hazard (n=465)	21	31	23	8	18
Represents history of community (n=476)	32	48	8	2	10
Encourages people to visit river (n=472)	17	42	21	6	14
Encourages visitors to community(n=470)	9	32	32	7	20
Adds to character of community (n=471)	18	55	14	5	8
Is important to community (n=473)	22	47	13	3	15

10. To what extent do you agree or disagree with the following statements about the pond created by the Shiatown Dam (excluding the dam itself)?

<i>The Shiatown Pond:</i>	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion/ Don't Know
Is visually attractive (n=471)	12%	52%	18%	8%	10%
Is no longer needed (n=468)	3	9	42	23	23
Is a special, unique site (n=470)	18	58	12	2	10
Is a community landmark (n=470)	22	58	11	2	8
Is a safety hazard (n=467)	9	18	38	12	23
Represents history of community (n=472)	20	53	12	2	13
Encourages people to visit river (n=467)	14	48	18	4	15
Encourages visitors to community(n=470)	10	35	30	4	21
Adds to character of community (n=474)	18	54	14	3	12
Is important to community (n=468)	21	49	11	3	18

Survey Report

11. How does the Shiatown Dam affect the following qualities of the Shiawassee River?

<i>How does the Shiatown Dam affect:</i>	Strongly Positive	Positive Impact	Neutral/ No Impact	Negative Impact	Strongly Negative	No Opinion/ Don't Know
Recreation on the river(n=472)	14%	44%	17%	4%	1%	20%
Fish and wildlife (n=474)	19	45	11	5	1	18
Flood control (n=474)	22	36	13	5	2	23
Oxygen levels in river (n=470)	12	28	13	4	1	43
Fishing quality (n=473)	11	37	17	6	2	27
Erosion of riverbanks (n=470)	10	30	22	5	2	32
Water level in the river (n=470)	18	39	13	5	2	24

12. Do you believe that the Shiatown Dam should be maintained in its current state, restored to a better condition, or removed? (n=464)

- 1 The dam should be maintained in its current state. 11%
- 2 The dam should be restored to a better condition. 78%
- 3 The dam should be removed. 11%

13. The options you chose from in question #12 all involve financial cost. If the option you chose in question #12 was significantly more expensive than the other options would this change your decision? (n=469)

- 1 YES 15%
- 2 NO 61%
- 3 DON'T KNOW 11%

14. Which of the following groups should be primarily responsible for management decisions at the Shiatown Dam? (please select *one* of the following) (n=475)

- 1 Federal government 6%
- 2 State government 29%
- 3 County government 32%
- 4 Local citizens 11%
- 5 Adjacent landowners 2%
- 6 Other (please specify) 20%

15. Which of the following groups should be primarily responsible for paying for actions at the Shiatown Dam? (please select *one* of the following) (n=475)

- 1 Federal government 14%
- 2 State government 43%
- 3 County government 21%
- 4 Local citizens 3%
- 5 Adjacent landowners 1%
- 6 Other (please specify) 18%

Part Three: Additional Helpful Information

16. What is the name of the community you consider to be your home?

17. How old were you on your last birthday?

(n=577)
Mean=50 years

18. What is the highest level of education you have completed? (n=583)

1	Less than 9 th grade	2%
2	9 th to 12 th grade, no diploma	5%
3	High school graduate	29%
4	Some college	33%
5	Associate degree	14%
6	Bachelor's degree	11%
7	Graduate or professional degree	6%

19. How long have you lived in Shiawassee County? (please select *one* of the following) (n=587)

1	0 – 2 years	4%
2	3 – 5 years	4%
3	6 – 15 years	13%
4	16 – 30 years	23%
5	More than 30 years	56%

20. Do you live on the Shiawassee River? (n=588)

- 1** YES 10%
- 2** NO 90%

Comments Written on Surveys

- In favor of anything which positively influences our watershed area, especially cleaner water. Concern "wooden drain project" we fear any dredging up of contaminates. Concern about septic.
- One of the first things needed to improve the river, is getting control of the pollution
- Would like to see power production at the dam- set up for a self-guided tour- something simple. I fear that the DEQ & DNR have ruined it for anyone to ever use the resources that are on their land
- I feel that the Shiawassee River and Dam System is a big part of Michigan's History. The river running through Byron is Beautiful to see for young and old. Without the dam it would be just an ugly dried up ditch.
- Shiawassee County is one of the only counties in Michigan with no public lakes (except a small "pond" in Owosso called Hopkins Lake). The Shiawassee River is vital to our water recreational opportunities. It was once a beautiful river now it's polluted so much, we are warned not to eat fish or enter the river at times. We need to clean it up and maintain it and the dams that control it.
- I can remember as a young boy when you could swim in the river. It was clear and clean and beautiful all along the river, but between sewage spills all the time, factories dumping in the river, people throwing junk in the river it is no longer the beautiful river it once was. I think it's a real shame that in these times of modern technology that they still have sewage spills so often in summer and it's ruining the river.
- I never go over there. I went once don't remember what it was like. Sorry, I'm not much help.
- Stop the spills, illegal drains- make fines large. To down grade the Shia. dam pond is to down grade the whole Shia. County river basin. Use nondangerous prisoners to clean up cut up fallen trees etc. This rated as one of best bass rivers in US. Why doesn't the average person in Shia. know this?
- The Shiatown dam serves a governor on the river for Shiawassee County Communities down stream. In recent years the volume of water in the spring has diminished. I can remember severe flooding in Corunna, Middle Town Owosso, and other areas. If this volume of run-off ever returns the impact of

the dam would be vital. Also with low volumes of water the dam could keep the water flowing in summer months. With sewage spills and dumping a volume of water would be vital. During my childhood and teenage years we owned (1) mile of river frontage at Lytle road.

- This Shiawassee River needs to be taken care of so it can always be the beautiful river that it is.
- I realize this is a time when both state and local government's have budget constraints. Since there is not a county parks department of any size I don't feel that we would do the best job managing the dam. I feel that we have a great resource that we are wasting from a recreational stand-point. We live in a county that has only 1 public access lake, that being sleepy hollow state park. If Shiatown dam and the pond behind it were developed as a state park and fees charged for its use then maybe it could be returned to what I have only heard it was in the past. With 2 state parks it might encourage more residents to get state park stickers and increase use in both parks. I realize that it will be no small effort to bring the dam and the surrounding park area up to a quality park, but then the dam could serve a purpose other than river water level control. I do feel that a group of county residents should work with the state in the development of the area.
- For years I swam, fished, and enjoyed the Shiatown Dam area. My dad, and grandpa used to take us all the time. Now the river water is terrible so hardly anyone goes there. Its sad that someplace like that has been let go the way it has. The water in the Shia. River is so bad, you can't eat the fish anymore.
- Dam needs repair and is very important to the river.
- I used to use the Shiawassee river when I was younger. As the years have gone by, I've heard from others around the community that the Shiawassee river is dirty and unsafe in parts. Now days, people don't care. They litter and abuse the river. It's a shame because it really is a beautiful thing. I no longer ride down the Shiawassee river in a canoe. I do like to watch the wildlife though. I really don't fish there, because I don't know if the fish would be safe to eat. I'm so glad there are people out there, like yourselves, that care enough to keep it looking better. I hope more and more get involved on this quest to improve the river. Thank you so much!!! You care and it shows!
- Shiawassee River needs cleaned up so you don't have to worry about getting sick after being in it. The Shiatown Dam is one of the older landmarks there is. It needs to be restored before it gets in worse shape. The county has no money for it but state & federal will put it off and then just take it out because its cheaper.

Survey Report

I'd like to see them both cleaned up and restored to their original beauty. Thank you!

- Please maintain & keep the Shiatown dam it is a excellent park & great place to fish & picnic. Thank you.
- In parks the cities do a fair job. Where the river is "wilder" I believe nature does an excellent job. My perception of the rivers health is based on DNR fish consumption advisories & the occasional *E. coli* warning. As I was growing up I tended to use the river based on warnings. More use downstream of the Owosso area. Now, with children, I tend to be a bit more conservative & cautious regarding bodily contact with the water (hands only & use sanitizer lotion often) but my area of use has remained the same.
- Very much enjoy canoeing the river. Water level's been so low, can only canoe 1 or 2 a year. Water dirty, don't even want to step in it.
- My name is XXXXX. My wife and I have been married for 12 years. Shiatown dam is one of the places that we sit and remember once was, friends, family and youth. When my wife XXXX was young her brother was pushed in the river from the top of the dam and drowned under a cement slab at the base of the dam. We go there to sit, some times I think we go to see the sunset, other times we go to say hello to (her dead brother). There are a thousand reasons why Shiatown dam is special. Too many things are gone from our lives, help us save this one. Sincerely XXXX
- I am familiar with the river- only the areas of Curwood Castle and think its beautiful there
- During my youth my father would take the family on Sunday drives to the dam and park. My high school year's the dam and park was a good place to hang out.
- I feel that there are many more important issues that our tax dollars need to be applied to than the project proposed in this survey.
- We don't live on the river, but are less than 1/4 mile away. Very close to us, and easy to walk to and appreciate.
- I don't really think anything will be done by anyone about the Shia River. Pay the Liberals!
- NEED DAM FOR POWER

- In the Shiatown Dam area there should be a ORV park of some sort. The area is the only landmark that I visit. This county offers very little in watercraft recreation or ORV type. Genessee County has the mounds that people can use, but the money spent by Shiawassee residents goes to Genessee when they visit the mounds, and should stay in Shiawassee. A small investment would return large amounts of money for repair of the dam.
- I'm not aware of any activities on the river other than canoeing or fishing; it seems to me that access to the river is rather limited; I live about 1/2 mile from the river. Once in a while I notice a truck parked near the bridge. I assume someone may be fishing on the river. Being crowded at least in our area is not something you have to worry about - it's access.
- The Shiatown Dam is a historic landmark. It should be restored and maintained. I am more concerned about the quality of the water and the quantity. If we allow industry and farmers to remove water from the river and put back their waste, what will we be left with?
- Water is too low to use from Byron to Dam. The river should be clean and higher. I have a canoe but can't use it in the river because of low water and debris. When I was a kid I swam and watched boat racing at the pond, used to fish and canoe the river. They hydroplane racing used to bring lots of people to the park. Now hardly anybody uses it anymore because it's too shallow and the debris in the water.
- I think anything that can be done to improve the river and dam can only be a good thing for the people of Michigan today and in the future.
- I don't believe most of the problems of the Shiatown Dam and the Shiawassee River is the fault of the county. It is my opinion that the state and the public are at fault. The river has been plagued with pollution problems for many years. I don't believe I'm saying this, but I wish the state would raise the price of a fishing license to about \$50.00, with discounts for seniors and low income, and to raise the price of boating licenses also. This would benefit the waterways in 2 ways. 1) would reduce the number of "MEAT FISHERMEN" who go to a lake or river and fish it to death. Have these people never heard of catch and release? 2) would give the state more money to maintain the river, stock it with fish, and ticket violators, litter bugs, and the like.
- As a child we boated, camped, and fished on the river at least 5 times each summer. Now you hear so many contamination reports on the river, I wouldn't want to touch the river.

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- Our family has not been to the Shiatown Dam in quite some time. We should make a trip out there to see the changes. Access to the river is poor. We make 15-20 trips on the bike trail next to the river. I would like to see this trail improved.
- The problem that my area has is that the river level rises and falls to the point that it causes extensive erosion. This is causing our large trees to fall over and this is making massive deadfalls. You are more than welcome to come and see for yourself. Please feel free to contact me. (signature)
- We lived in Vernon, MI for 12 years. Our three sons enjoyed ice-skating in the winter. And fishing some as they grew older. We also had picnics out there - 1950's and 1960's.
- I believe that our waters and forest should be maintained and preserved for the future, anything that can be done, should be done for our use and for the use of future generations. This is the responsibility of everyone that lives in and around these areas. Not only are these things enjoyable for rest and recreation it is essential for our lives. We cannot *live* with out our trees and fresh water ways. Thank you. (signature)
- There is little public land with water in the whole county. I like to go out and look over the mill pond. We took children there recently to go sledding. We hit rocks at the bottom of the hill. Should be better for sledding. Would like to see all the river look and be cleaner.
- I lived near the river in Owosso until I went to college. Then lived out of state with frequent visits to my parents who lived on the banks of the river. Returned to live in my parents' home in Riverbend Subdivision Rush Twp. Have approximately 6 acres with over 1500 feet of riverbank and 4+ acres of floodplain woods. While the water in the river in the 1930's wasn't as sanitary as today in my opinion, it was better in many ways. There was good fishing and good ice in winter for skating etc. Also there was less trash in the river - less sediment. Today there is a great deal more runoff due to roads and parking lots. Loss of fence rows on the farms and all the tiled fields and county drains dumping directly into the river causing sitting rapidly fluctuating flows and resulting bank erosion. It appears that the present chemical content of the rivers causes slush to form when freezing blocking the shallow areas and causing very rough and inconsistent ice formation.
- I drove over to take a look at the dam up close. It looks very unsafe to be around. The park has outdated & very few play things. If there were no dam at all the river would be higher I guess & I really don't know how that would effect

things down the river further. This past summer 2002 I heard there was a ban on swimming or wading in the Shiawassee River because it was contaminated (over by McCurdy Park) The River itself is wonderful & should be cleaned up (river's edge of debris & bottom) no matter what!

- I would like to swim in the Shia-Town pond like I did when I was a child. We would like to eat the fish.
- I think both dams could be restored to produce electrical power, which would help pay for improvements and support maintenance.
- I don't visit either place as I don't take time to use the park or visit the dam.
- I truly believe that the dams along the Shiawassee River lead to a slower river that promotes more stagnant & possibly polluted areas. I feel if the dams were removed that we would have a faster, cleaner river that would be better for wildlife & our communities. I remember also that a couple of years ago, the dam almost broke open during spring thaws & that the water had to be rerouted. This certainly cannot be safe for our homes along the river.
- As a working family with growing children and a cabin in the woods up north- we do not have the time/inclination to spend leisure hours seeking activities close to home- but this area is certainly attractive, in fact, when we moved here 10 years ago we were stunned to find this beautiful city- we parked at the chamber of commerce to get a map and directions to a realtor and they directed us to the castle and park for a look see- we were sold on the city right when we crossed the suspension bridge and toured the arts council located there in that setting.
- I remember my parents water skiing in the pond section. If the dam was rebuilt and the pond was dredged. And the towns up stream watched their waste, the pond would be a lake. Our area would like a lake. Hydro Electric, Why not? Behind the dam for miles the river banks are high. That means with minimum disruption to homes the water level could be high enough to run a couple turbines to make electricity. There has got to be energy grants out there. Or investors. I own a home on the river down stream past Owosso near Henderson Park. Last year there was the problem with towns loosing sewage into the river. This problem should be fixed. If you really would like to make Shiawssee Rive better. Remove the Dam in Chesaning so game fish can make it to our area. It' would allow for miles and miles of Bedding ground for Native Game fish. At least a fish ladder. This would enhance Shiatown Dam area. Fishing would be at its Best. Not to mention Property values going up.

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- I grew up living on the Shiawassee river. & It's been a part of my life, I will never forget, Also the Shiatown dam, for what it use to be & for what it will be.
- The Shiawassee River is no Big Deal. It is very dirty & very smelly.
- I would like to thank you for giving me the opportunity to fill out your survey, and please let me know if there is anything further I can help with.
- The dam & park has a lot of potential. Too bad that politicians who control all the money don't think so.
- They need to have better control on raw sewage contamination spills on the river
- The dam water level has been allowed to go as low as it can go. The water table is so low so the pond is almost gone. The water level behind the dam needs to be raised to restore this water level to what it was. There isn't enough water depth for power boating anymore. In the '60's there were lots of boats out there every weekend. It would be nice to see that kind of use again. If the water was there so would the boaters and fisherman.
- I have actually recently relocated to Northern Michigan but have used the River and Shiatown Dam for my whole life. I will continue to use it. Maybe just not as much. I have fished the river my whole life and the quality of fishing has definitely declined. As a child I caught an abundance of Northern Pike anywhere from Naggs Bridge on Cole Rd. to Corunna. Now the most abundant fish is the Carp. I do Bowfish and that stretch of the river in my opinion is one of the best Bowfishing places in the state. The Northern Pike might not be around much anymore but some excellent small mouth bass fishing can be found along M-52 North of Owosso and through to St. Charles. A lot of the old people still talk about the excellent trout fishing it used to have. Where did they go? I believe the quality of the river and the Shiatown Dam has definitely impacted the use of it by people in a negative way and that the pond provides an excellent resource and would be used more if cleaned up.
- Please keep me informed of this survey! I have 3 kids and I would like to have them experience some of the joys I did when I was a kid! With all the chemicals and garbage dumping into the river, I'm afraid they won't get to! If there is a way for me to participate in this venture please feel free to let me know! Everyone should take responsibility for what goes on with all rivers, lakes, ponds, and streams. Everyone should chip in and do a part!
- The Shiawassee River is very polluted of PCB, sewage, etc. If you start at Byron, MI. follow it south all the way to the beginning of the river, you will find the

sources of the pollutions and who is causing it. You have chemical run off from farmers, cattle and livestock waste run-off, human waste, etc. etc.! Fishing was good in the river and Mill Pond @ Byron up until 3 yrs. Ago. Now no fish at all. Durand and Vernon both are dumping human waste into the river. I know this for a fact. This has got to stop.

- I think the water quality and visual appearance are the most important things that need to be improved.
- Because of health reasons and other commitments I couldn't visit the dam or pond last year. When I was younger my children and I would go boating and swimming and fishing quite often at the pond and dam. I hope it will be preserved.
- As a life-long resident of Shiawassee County, I would like to see the Shiatown dam maintained if possible. My family and I have enjoyed the park and pond area. However I would support what would be best for the water quality of the Shiawassee River. It seems that the water level is always low and stagnant (except after a thunderstorm). Thank you!
- I feel strongly pond should be studied for soil contamination if possible dredge and remove soil buildup repair and maintain spillway.
- A lovely park especially for photography
- You cannot eat the fish. You should not come in contact with the water for reasons set down by the Health Department. Too many deaths caused by the dam. If the dam was removed it would be better all around.
- All rivers can and should be an asset to the communities in the area. Wildlife need the rivers for many reasons. What is scary is just how polluted the rivers have become. People and big corporations dump (or used to) unwanted waste in places that can actually lead to streams and rivers. When the DNR issues special warnings about eating fish, then that tells me something is wrong. There used to be a commercial that showed a Native American Indian looking over the land and water as a big tear rolled down his face. That's how I feel when I look at the litter all over everywhere. American values have changed. Most Americans are more interested in money and what they can buy for themselves. Read Matthew 19 v 23,24
- I have seen some good changes above the dam around Geeck Rd. Park. I canoe from there down during hunting season. Everything from ducks, deer, and trap when I got the time to trap. A lot of things could be better but it's the people

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that have to change because of the trash that me and my kids pick up along our way down. When I say trash trees they will trim, grass clipping, garbage, etc. They put too close to the river and when it floods it take it along the way.

- It is a sad state to have a river with the high quality fishing in this area and it cannot be cleaned up. We should do whatever it takes to clean this river up!
- This is our opinion: When you have 5 or 6 water/sewage treatment plants, dumping into the river daily, not being able to canoe the river because of trash, trees, and the smell, house values dropping along the river, summer is bad. It's a little hard to be optimistic about cleaning up the river. You can't even eat any of the fish, if there is any left.
- I would like to see dams on the lower end of the river rebuilt to raise water levels, so canoeing would be more pleasant. Thank you.
- Using county funds, state funds, Federal funds and/or a millage, we should rebuild the dam to generate electricity as it once did. The power could be used to offset the operating and construction cost. Let's use the power not lose the power. This would also make the park a much larger attraction.
- I'm uncertain what the cause is for the depletion in water levels but the Shiawassee River used to be a safe and beautiful place to enjoy when growing up. Now it is not. If fixing the dam will bring this back to the community I believe it's important.
- We have a beautiful river, park, and dam. Many more people would utilize them if they were cleaned up and maintained. The water is dirty and the parks used to party for teens. I would like to see the river and dam cleaned up and maintained. They can play a very positive role in our community. It would be nice to fish and not have to throw the fish back from fear of contamination.
- I would really like to see the Shiawassee River cleaned up it has not been taken care of in a very long time! The water is very dirty and they no longer mow next to the river!
- Very interesting. Would like to know more background on how this survey came out? Thank you.
- I think the Shiawassee River is a beautiful river. It is a natural river. The quality of the water needs to be better. The scenery and wildlife is great. It's a big river with limited access. It could be and should be used more for recreation and have more access but at the same left alone as a natural beauty.

- Would like to see it be returned to a power plant.
- I'm hoping to hear back from you when the survey is completed! Thank you for your time!
- The only contact with Shiatown was going with my husband a number of years ago when he performed a wedding for a couple of motorcyclists. That was an unforgettable experience. However, in spite of that visit to Shiatown, I did not feel I knew enough about the area to answer a survey, so I asked two businessmen, neighbors separately for help. They looked at the questions, and said to forget it! Your second contact with me (the postcard) happened to come Thursday when a friend drove me to the local hospital's ER. She knew about the Shiawassee, and agreed to meet me today, Sunday, to discuss it. She also suggested that first I should call Tom Cook who is working on this locally. Tom felt I should attempt to fill it out, even if I couldn't answer many questions. The woman who went over this survey with me today asked me to inquire why you consider Shiatown a community. She doesn't feel it is large enough.
- The water quality of the Shiawassee River has everything to do with the answers I have given. The perception by the people is that it is unclean. Allowing homes to dump raw sewage into the river needs to be stopped and any run off by the county in whatever form should also be stopped. A river should be clean and attractive, the Shiawassee is not. As for the Shiatown Dam, as a kid I remember it as a great recreational place. I don't take my kids there because it is unsafe and because of the water quality.
- Something should be done with the group of homeless people that congregate behind the old Bruckman's building in Owosso. (Shiawassee River & Washington Street.) There about 10 of them that just sit and drink whenever the weather permits.
- Questions 14 & 15: I believe should be a mixture of the one's selected. One answer did not apply to me.
- The pond needs to be cleaned. Logs and trash at the dam needs to be removed
- I still can hear, in my memory, the Excited yell of "Yippee!" As A young boy caught his first Bluegill. Many wonderful times has been spent at the Shi-town dam site. Should the dam be removed, memories of the past would be all that would exist.
- Preserving for the future is important to make sure those who will inherit the

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future have wildlife and nature to enjoy.

- I've played on this river as a kid, swimming and ice skating & diving off the Oakwood strut bridge in 42" water from top irons. Never hit bottom. 1943-44 Canoeed Many Times from Lilly Rd to Shiatown and Shiatown to Owosso in 70s 80s. Many Good Memories.
- I used to swim fish and hunt along the Shiawassee River. I would not do any of these things now. It is too polluted I use to swim at Shiatown Dam Newburg and Nagges bridge. The Corunna Dam is very poor condition. If the Dams are taken out the Shiawassee River will be nothing but a stream through this area. We used to catch big bass north the Naggs bridge. And I mean they were big, this was back in the 1940's I would not eat any fish out of this River now. I had a lot of good times on this River but that was a long time ago. I guess this is what they call progress.
- The Shiatown dam may have heavy metal and other hazardous pollutants in the settlement in the pond, which could be washed down stream, if the dam is removed. The old stream, bed should be tested to the depth of the down stream river bed because if the dam is removed the stream bed would likely erode to its original depth
- Dam needs work. Used river a lot in my younger days, not anymore, too old to play in or on the river.
- I live on the river with my family. It is a beautiful area and we love the location but never go in the water without waiters on when fishing because of the *E.coli* levels. The DNR post the water conditions at the park on Lythe road stating if it is safe to be in the water depending on the *E.coli* levels so I won't allow my children to go in the water at all. It's a shame that this river has to be so polluted. Thank you.
- I went over this with someone I work with. Our views on the river are very similar. (including the dam.) However this person lives near the dam in the Vernon area. I myself live in Owosso Twp. near the maple river. The maple needs to be cleaned up also. Thank you
- I feel any dam that has been of dire repair needs to be removed. It is of no use anymore. Let the river go back to its natural flow. The pond is not what it used to be. Tear it down.
- Old landmarks like the dam should be restored and kept looking good.

- Many survey questions require expertise average citizens don't have. How much *does* the dam affect corrosion, water depth, wildlife. *Approximate estimates* should have been included regardless option or most expensive. Are there funds available at any government level? Would any options to dam livelihood affect future flooding conditions. Asking if anyone has used Shiatown Dam area in last year seems ironic - considering present condition of dam and millpond. It would have meant more to show that Shiatown area was used more when it was in better and safer condition.
- My current use is limited more to visual enjoyment because of personal ownership of wild areas with a stream and home ownership on an all sport lake. In 1988 when I purchased my home at Lake Manitou I was prepared to place an offer on a home in Owosso on the Shiawassee River. My deciding factor was location and the community Lake Association's commitment to water quality. Organizations I associate with have been involved in Shiawassee River shoreline cleanup. Although the visual appearance from the road (or atop a Curwood Festival ferris wheel, or from homeowners' windows) is attractive and relaxing the up close view is of concern to many. As a conservationist at heart I am very willing to see community \$ go toward restorations but for many in this relatively economically depressed community it may not be a priority. We have difficulties getting special and general education millages to pass locally. Our own lake has difficulty influencing our largely agricultural surrounding areas regarding green belts and ag products.
- The pollution of the river itself is what has made it unattractive for use. Until that could be restored, I don't see it as a recreation area that could be safe to enjoy. The river would be used, it wasn't polluted. It would be enjoyed more by others outside the community also. It's a shame. Those who polluted it should be held responsible for cleaning it (if it's even possible)
- If the dam cannot be maintained in a reasonable \$ amount, then remove it.
- I do not use the river or dam for any reason.
- It's interesting to me that my name Mrs. XXXX that my name was picked for anything to do with this survey. In August of 1999 my son XXXX (then 8yrs) fell into Three Mile Creek and cut his leg. And because of this he was infected with *E.coli* which was 5 times what it should have been at the time in this Creek which does make its way through the area in which you are surveying. So under these circumstances I can say we as a family of 6 have nothing to do with any waterways in this and other counties. And it was sad that my township of Vernon knew there was a danger but let no one in the township know. Nor did they care about my son's injury or the condition of the creek. Also sad that

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people in the community were concerned about Marcus but not enough to get involved to do something about it. So the paper and television were the reason it even got any publicity to try and do something about the water problem in this county. This should not have happened to my son. So I hope in your project you understand the problem doesn't start at the river it's what's coming to the river that is also a problem and I hope in time our state will realize that if we don't take care of this problem. We will not have any safe water in our *great lakes state* which should be a bigger priority than it is. Thank you.

- To have all the county ditches, runoffs, and/or sewer drains checked that run into or drain into the Shiawassee River to prevent contamination of the water and keep its natural state.
- Some of the things they are trying to do in the Owosso City area to control the pollution level at the river are absurd!! For instance, people have been coming to Lion's park on Jerome St. for yrs. to feed the ducks and geese. But, now because of the over abundance of bird droppings is causing an *E. coli* problem with the river, they (city govt.) is trying to put a stop to it. Mother Nature has been dealing with the birds for yrs. I believe that it is man that is causing the *E coli* problem by dumping everything from human waste to factory chemicals into the river. Mother Nature can and has been for yrs cleaning up herself. But it is hard for her to keep up when we keep adding to her burden. I think the birds on the banks of the river here in the city limits of Owosso are a big draw to city. A place to relax and unwind after a hard day. The birds play a big part of that. Especially! For parents and kids to spend time together.
- The local government should look into any fines for toxins from upriver discharge of PCB dioxins, mercury, and other toxins that did not originate in Shiawassee County.
- It would be neat to restore the dam and power station and see electricity generated again! This park/dam used to be quite a place to visit when I was a kid I would be a bad thing to see it gone for future generations. Restore It!!!
- I think of the dam as being a dangerous structure. I wish the pond and dam would be restored to a safer level so that it could be enjoyed more by the public.
- We need to do something about all the sewage spills from upstream in Genesee County. The towns of Fenton, Linden, and Argentine. I see a lot more sewage flowing down stream past my house then [sic] we should ever have in this river. This river running past me, used to have a lot more wildlife in it. Argentine dumps sewage from its sewage lagoons without anybody really seeing what they are doing or having much oversight by anyone.

- If the county could get a grant to fix the dam up to make it more attractive and safer that would be the way to go. If the tax payers have to pay for it, the least costly would be the way to as us taxpayers are already overtaxed.
- Shi-town bottom (silt) is so polluted with PCBs, Dioxins, and God knows what else! Needs to be cleaned up with Superfunds before I'll ever use it!!!! I am an avid hunter and it scares me to eat anything from the river.
- I am a project superintendent for a large construction co. I specialize in structural steel and conc. I have inspected the dam on several occasions, and have been alarmed at the condition of the dam as well as what appears to be a complete lack of maintenance. I have canoed the river from Byron to Corunna on several occasions and am quite familiar with this area. I would be more than happy to assist this study if the need arises.
- As a child (about 72 years ago) the Shiawassee river ran by our back yard. I spent a good share of my youth on the river I swam above the dam in Corunna. During the depression I used to catch fish and sell them. I did a lot of boating and was familiar with the river from Corunna to the Lytle road bridge. I used to go to the Shiatown dam when they backed the water up and let the water out to generate electricity. About thirty years ago they opened the gates at the dam to drop the level of the river so they could clean it out and haul rocks to fill a big hole below the dam. There had been a drowning.
- At 68 years I have not used the river system for years. In the past we used it for skating, sliding and cook-outs in the winter. Canoeing and socializing in the summer and fall.
- Something needs to be done with the river. That is sure. People who have lived here all their lives say that they used to play in the river but now they would not let there children do the same because it is dirty us as citizen's pay taxes so that is where the money should come from and if finding management for the river is a problem why not elect one
- In the 1950's, I remember watching hydroplane races at the Shiatown Dam. Standing there by Mom and Dads side, the smell of racing fuel, hotdogs and burgers cooking. I go to the Dam at least once a month. It's a place that brings peace to ones soul. The rushing water over the Dam has a way of relaxing a person. My children enjoy the Dam also. We enjoy catch and release fishing, walking trails and skipping rocks or just hanging out there. I would like to see the Dam restored to the point where a operating replica of the generating plan was. Maybe a Museum to show how the Dam provided electricity to the residents of the Shiatown area.

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- The river is a mess and an eyesore. Loaded with trees and all manner of debris, it looks like a tornado hit there. There is no way, myself or my kids, would ever engage in any water activities. Contact with Shia River H2O has been prohibited every summer due to chemical and *Ecoli* contaminants, plus tons of duck, goose and bird guano. It is also polluted with average garbage and waste. The park is frequently vandalized by youth- graffiti, alcohol bottles, dumped waste receptacles, illegal fires. When youth are there, we don't bother to stop in. No see-ums and mosquitoes, hornets and wasps make picnicking or the playground unpleasant and hazardous. The fish are polluted and fishing is prohibited off the damn. Three boys have died from drowning, having fallen of the dam while fishing, since we've lived here.
- Monies collected for fishing licenses, could these be used to help clean/fix and upkeep the dam and area?
- What was the original purpose of the Dam?
- I believe that the dam site represents a potential energy source to feed back to the grid- It also creates a back water marsh that supports migratory fowl & wildlife as well as a breeding ground for the survival of juvenile fish. It's been a gathering site for local people. If it were repaired to its original potential, level of the pond would rise and become a better place for recreational purposes.
- I strongly believe each landowner on the River should be legally responsible for maintaining and preserving their part of Shiawassee River. We Do.
- A cleaner environment and more recreational activities offered to the public- I believe would encourage people to use this resource more often and encourage tourism also.
- I think that the Shiawassee River and the Shaitown Dam and Park are assets to our county and state. I would love to volunteer for any beautification and/or improvement project if any are scheduled in the coming future. Hopefully community involvement can play a positive role in enhancing the appeal and visitor attendance at these sites. Thank you.
- In the state of finances we are in now any \$ used to finance improvements would need to be private donations or Grants. Even grants would be pushing it.
- The Shiawassee River is a valuable water resource. It needs to be kept clean and our recreational areas and parks maintained. We also need to protect the quality of fish, wildlife and soil management along the river.

- I am a father of 3 children ranging in age from 16 to 10 yrs of age. And I like to go camping with my children. But with the current state of the Shiawassee River (sad in my opinion). The water quality and its affect not only on the fish but other related wild life as well. Has made me keep my children away from the river and any activities related to the Shiawassee river. I feel it has been neglected for so long that unfortunately now its going to take a lot of time and money to put the "sparkle" back in the Shiawassee river.
- Too many so called land marks are just destroyed for whatever reason to keep the dam and area would preserve nature a little.
- A new dam should be constructed but if possible move parts of the current dam down river to still be viewed by the public.
- Thank you, for the survey! I would like to be kept up to date on further actions (if any). I think the Shiawassee river, dam and pond could be very useful to people and wildlife. Everyone I know has visited and enjoyed the park and pond, It (the dam) definitely needs some TLC. And definitely should get it. Fishing has always been good there. My father taught me how to fish there and I would like to teach my children the same.
- As a small boy our family would visit the Shiatown Dam. When it was more lake like. There was a bait shop boat rental, and weekend activities. Not knowing the environmental impact. Of restoring it, to a lake, or reservoir like condition. It would be a great thing for the area. This middle spot of Michigan. Is particularly void of bodies of water, for public use. I would like to see a small boat ramp. For bass and pan fishing. The water reserve could help the river level in summer. If the dam was restored to a better condition.
- Learned how to swim at Shiatown Dam in early sixties visited as a child for swimming and fishing.
- I do not use the Shia. River anymore but when the children were small they ice-skated the river. We used to go on picnics and swim out at Shiatown Dam. As a child I grew up on the Shia. River in Corunna. As a young married woman my husband and I owned property on the Shia. River in Owosso. Raised our children there.
- As a child, I used the river (near Oakley) to hunt, fish, camp and swim in. The water in my opinion, has deteriorated to a nearly irreversible condition. I still do catch and release fishing, if I don't wear gloves, the water elicits serious skin conditions. And the healthy condition of some of the fish is beyond anything I would have believed forseeable.

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- Something needs to be done regarding waste facilities over flowing into the River.
- The one thing I don't like about Shia county is there's no swimming access like Genesee County. The Shia river is absolutely beautiful and I would love to be able to canoe without fear of falling in, wade, or swim but feel it is too polluted for people. The river was a very big attraction for me when I moved in and is one of the few reasons that keeps me here, although I am considering moving out.
- I have lived in Shiawassee County for 45 yrs and I can remember, years ago; when the river was a plus for all residents (including Shiatown Dam) in the county and at certain times of each yr; attracted numerous fishermen or persons and hunters of different game animals but recently, because of pollution and lack of access, these activities have certainly fell off as I know the river, in itself; is a big asset to all county residents!
- My concern with the dam is its old and falling apart, water always seems polluted. If dam is necessary something should be done, if not it should be torn down.
- I really would like to be able to have the Shiawassee river clean, able to eat fish out of, and swim/wade in it and not worry about disease. I really enjoy the river as a whole: just want it clean, taken care of. No more "accidental" sewage spills. This needs to be taken care of immediately.
- It would be great to see the river usable both between Byron and the Dam and between the dam and the city of Owosso. There is so much potential for recreational uses for the river and I feel people would be willing to pay for the use.
- It could be a clean river but it has to be cleaned up. Upstream when it comes out of Oakland county it isn't too bad but Genesee County really dumps in the river.
- I would consider myself a nature type person who enjoys the outdoors but I do not usually participate in activities on the Shiawassee River do to its condition. I would like to see it cleaned up even if it meant us paying for some of it. I have not been to the Shiatown Dam since high school (about 9 years ago) so I'm not to sure of its current condition.
- I think where people fish or picnic along the river should have more trash containers to dump their trash. I also think the city of Owosso and Corunna should be more responsible for the clean up of the River after they have festival by the River like Curwood (Canoe, Raft Races. Where lot of junk is left and

thrown in the river.

- The Shiatown dam should be removed, it is 100 years old and in bad condition.
- Shiawassee County is one of very few counties that doesn't have a nice public lake to take your family for swimming or summer activities. Therefore it would be nice to have a clean river in your county to use for swimming, fishing, etc. I have never seen that in my years of living here. The Shiawassee River would be a great asset to the community if it were a river you could actually use instead of look at.
- I have spent very little time using the resources of the river in recent years. In my teen years I used to ride my bike on the trails on the river. Shiawassee River has for as long as I've known had a horrible reputation for being extremely dirty. I have only been to the Shiatown recreation area once in my life in my early teens, and it was a not so impressive experience. I think that there is a lot of potential there, but I'm not sure myself where the most responsibility should fall for bringing out that potential. There is the story of how Shiatown was the capital of Michigan for a day and however unimportant that may be I think it gives Shiatown some significance. I really think it would be worth improving, it's just a question of where the resources for that would come from, and would the residents of the community appreciate that and help to sustain it.
- If the River was cleaned up and the Shiatown Pond dredged. Fishing and all around health of the River would be better. I love to Fish the River but why bother because it's not safe to eat much of the fish. And also most of the time the River is so low and full of seaweed its more of a bother than its worth. I think the River is a great asset to the community if it were in better condition.
- I would like to see the dam, river, pond, and park renovated and updated. I have a 2 year old nephew and a 4 year old niece I would love to spend time with there. I will also be adopting in the future and would like to have a place to spend time with my daughter.
- Swimming/wading: must wear tennies b/c broken glass
- Water quality greatly affects the fishing in the Shiawassee River. There needs to be an all out effort to improve it. This would not only increase fishing and also allow you to eat what you catch.
- The Shiawassee flows through more than Shiawassee County therefore cost should not be directed toward one county.

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- I feel that some of the heavier elements that have been washed into the ponds tributaries could cause a negative effect on the ecology of the river should the dam be removed and these particles and deposits allowed to flush down the river.
- I am not an avid sportsman so the river has little impact on my life, but I realize that others may get pleasure out of river use. I have fond memories of renting canoes in Corunna and spending summer afternoons paddling up river. I wish convenient facilities still existed so my family might know the same joy.
- I am worried about the financial burden that the Shiatown Dam represents, both if nothing is done to correct its decay and it collapses and what it would cost to restore it to a safe dam.
- Don't forget the dam in Corunna!
- The Shia. River walkway is a wonderful resource in our community. My friends and I walk five days a week year round and appreciate the availability it offers (no traffic fumes, it's peaceful, we watch birds, beavers, fish, squirrels, deer and lots of wild flowers) It is a very lovely respite from the busy routines of our lives and a treasure in our community.
- I believe the pond above the dam could use some clean up and some dredging out. That would improve the quality of the water and the fishing.
- As with any dam, the migration of fishes is all but stopped. The pond above the dam is nice, but in the past ten years the water level has definitely fallen, leaving the pond mostly bog. If in the future a dam is needed for flood control, you, I, and anyone that has seen it can attest to the fact that the structure is not strong enough for high water stresses. Thank you for asking for my thoughts.
- Don't Raise Taxes.
- I think it was great that someone finally cleaned the logs, stumps, and trash from the dam. This was an eyesore for longer than I care to remember. There is definitely a hazard when it comes to safety at the dam. If this were addressed, I, along with many people I have talked to in the community would utilize the park and fishing area more.
- Wildlife in the area is substantial and crucial for subsistence. I live within 1/2 mile of the river and we enjoy the benefits! Thank you for your concern.
- During my time here in Owosso, I've not had much occasion to be on or near

the river. The group of people I associate with do not seem to be given to much claim to the river, although some of them are life-long residents.

- I guess for myself, better advertising of the parks along the river, better instructions how to get there (especially Shiatown) would help in some use of the river, even if only for an afternoon of peaceful surroundings.
- There always seems to be a prevailing attitude in this area that life long residents claim the area-- and visitors are not too welcome.
- I would like to see this restored it was capital for one day!
- Was such a pretty place - needs to be cleaned and made safe!
- As a life long resident of Shiawassee County I have used the river for swimming, canoeing, and fishing. I hunted along the riverbanks. I remember many family and group gatherings at the Shi-town dam and when it broke- how the park and everything there changed. The PCB scare downstream stopped all of us from using the river like we did- I personally have not been canoeing on the river in years and I use [sic] to lots. Anything to save this river as a resource in Shiawassee County and surrounding areas makes good sense and if it can be done right the cost should be unimportant- make it work for my grandchildren.
- My wife and I strongly believe that Shiatwon Dam and Corunna Dam should remain. The quality of the water however has kept us from canoeing. We also believe that all of the drainage ditches that have been added in the last 25 yrs. to drain fields and residential properties has had an impact on river water level. (lowering the water level) Once all the water is drained away there is nothing left to feed the river, water wells get low, Irrigation may be have to used more for fields and lawns, pollutants concentrated in lower levels.
- Water quality is very poor. Actual dam area is very dangerous. Real bad undertow. Water levels in pond very low. Cannot eat fish - PCBs, mercury levels. River level always low. Not many access areas.
- I would like to see the old Consumer PO. Plant replaced with a new gate. I would like to see the pond behind the dam dredged and a new boat ramp installed more parking area made. I would like to see the dam returned to the way it was back in the 60's so you could swim, boat and fish like we used to Install a quality fish ladder where the Co.Po. gate is now and raise the water level another 2-3 foot.
- I believe the river would be more appreciated and used more for recreation if just

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the water was not so polluted. That is the biggest problem that no one has taken care of yet.

- I don't live by the river now but I did as a kid - used to wade in river, looking for "treasures". Was young enough at the time to experience the water level as the dam was opened and the water would rise to my knees - when wading I spent many times along by the Shiawassee River - It was a relaxing peaceful time. Beautiful in spring and especially in fall along the riverbank.
- Shiawassee County has a distinct lack of water recreation facilities. In my memory the Shiatown dam and adjacent pond were better utilized 40 years ago than now. I remember beach and boating activities many years ago. Upstream private use has monopolized the river and makes it less available to the public. I feel the dam and water levels should be restored to historic levels for public use.
- We really do not do any activities on the river but many times I've parked the car and ate lunch and watched ducks downtown. I drive by that section and would enjoy it more if it was kept up better.
- Improve water quality
- In its day the dam was a lot of fun to boat on back waters and swim. When water was ok.
- I live about 3/4 - 1 mile from the river on the west side of Owosso, but only for about a year now. I have only fished the river one time, but I would love to fish it more. There are plenty of big smallmouth bass in the river. I am also a longtime member of B.A.S.S. (bass anglers sportsman society). Anything done to disturb the natural ebb and flow of the river may be detrimental to the fish and wildlife that it supports. Unless it can be proven, *without a doubt* that changes will benefit the river, I think it should be left along. Thank you, concerned outdoorsman
- We go all the time to feed the ducks. We have a pretty walkway. But can't see it for the weeds and the flowers they put in and did not take care of.
- never do I keep the fish (when fishing). the river is very polluted.
- I used to love living here, now I can't wait to leave! Visited the dam when I was a kid. I don't use this river anymore.
- I work outside so in my free time I don't spend much time outside. So I wouldn't be at the river no matter what its condition is. I like wildlife therefore

the river is important.

- I feel the Shiawassee River is very unhealthy and is a concern for Shiawassee County. I believe the Shiatown dam and Corunna dam should either be maintained or removed whichever is both better for environment and cost effective.
- Be consistent in checking of the river for contamination regularly.
- Why!! Didn't they keep maintenance on the river from the start? Wait until everything needs repair. The Shi-Town Dam is a disgrace the bridge that was over it has rotted away. Its not a safe place to visit. The Dam in Corunna also just let go trees that have fallen into Dam and river just lay there. The Shiawassee River its self is Beautiful. But needs care. They wait years after the Dams, bridges, and river are in terrible shape. Every year maintenance would have resolved the problems. I wouldn't eat any fish from it. The people work together to keep trash out of it and clean the banks. But they can't do it alone. It just goes on and on.
- I think the river could be a great asset to our community if it were better maintained - as for the dam something needs to be done about it before another child dies there. I feel the river is in very bad condition.
- I went to Shiatown once about 15 years ago and it looked very dangerous to use for swimmer.
- We grew up to respect things around us. They were a great part of our lives. The Shiawassee River starts across two small lakes water comes from huge springs in the lakes. It's a miracle the water has lasted this long. Back in the depression we lived on the rock bass and red fin caught in the river. We had our own swimming hole. Many beautiful spots on the river. Barges came from down Saginaw to Owosso years ago. The Shiawassee is an Indian word. Lived two blocks away (from the river) when I was a boy.
- *E-coli* levels are big concern in using the river for recreation for myself and other people
- If the river was cleaner and had better variety of fish I would use it and appreciate it more.
- I canoe the river from Geek Rd Pk to Shiatown Dam. There still is a lot of garbage and debris along that stretch of river.

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- River cleanliness is a primary concern for our family. We enjoy watching the river and wildlife but are hampered by health concerns because of pollution and sewage contamination. If river can be restored to natural condition with minimal disruption, OK If dam has future value in energy production, perhaps save.
- The water quality in the Shiawassee River is normally quite good however when we have heavy rains in the spring, summer and fall the sewage treatment plant on Bird Road dumps raw sewage in the river. This disrupts all other life along the river. I would like to see this practice stopped. Boat traffic on the river should be permitted to boats with trolling motors only. Jet skiis, motorboats, air boats should be banned. The river has an abundance of wild life along it and these loud, noisy and mostly out of control boats are a nuisance to everyone.
- The Shiawassee River is beautiful; however the water is not safe. I know many people who will not fish nor swim in it, because of all the pollution in it.
- I've lived in Shiaw Co- Owosso all my life 45 years. In my younger years I visited the Shiatown dam several times a year. It would be a loss to the community if the dam was not kept up. I was only able to go to the dam one time this year. But still would like to have remain to visit in years to come.
- My age prohibits me from caring about this and I know it all involves more money and taxation.
- I believe the Shiatown dam would be better cleaned up behind the dam. Boards put in the pond would come back up like it was years ago. Before it was lowered. More fishing and boating would take place.
- I think the dam is important to all Shia County and should be repaired or replaced. There are many places in the river that need to be cleaned up.
- I've lived here all of my life and I can remember when the Shiatown Dam and backwaters were not only a beautiful sight but also a very good source of electric power for the area. If it were to be fixed up a little it could be a nice place for people to come and fish, or run there [sic] boats in the summer. Our state could invest some money into the dam and backwater area, and it would benefit a lot of people, not just the local area but a lot of people from Flint, and Lansing would come and enjoy it.
- The river is a good one with good fishing. Debris at the dam and other locales need to be removed, water flowing back into the river at the water waste treatment plant could be better.

- They should remove the dam. Clean up the nasty-polluted water in the Shiawassee River. Make it more family like, and recreational. More bathrooms (clean), new horseshoe pits, picnic tables, volleyball court. Just make it a nice quiet place to relax from everyday drama.
- It should be cleaned up and maintained as a natural resource. The DNR should help and check activities on the river. I been to this river 1000+ times in the last ten years never saw the DNR there. The factories, farmers, and businesses should also have to help clean and maintain the river. They help destroy its natural condition. If the dam is needed repair and make it safe for the people and animals. It's the largest water source in the area. We need it and we need it clean. I go to the northern part of the state to fish about 20,000 other do too on Pere Marquette its clean the DNR is there. My hunting, fishing monies help pay for that river its clean. My monies help pay for a new DNR office about 3 million dollars that was built in this county with in the last ten years. I have not seen no DNR on the Shia. Suggestions: Clean and Repair = bring people to the area. Develop Camping Area = bring monies and activities to the area. Stock with game and fish = educate the public/entertainment/environment. Boat and canoe rental = tourist and entertainment These could help pay for cleaning and repair of the river. PS I would like to eat fish from this water way again some day.
- The river could use some attention in several areas. If the Shiatown Dam were removed, the pond area would turn into just another lowland area, with not much to offer surrounding areas. If a new dam were to be built, is hydro-electricity going to be a possibility? The old power plant didn't prove itself, but with new technology, I'd like to see the numbers worked on that issue. Thank you.
- The sewer over run is dumped into the river w/ raw sewage which farther pollutes our river. Future birds, ducks, and other wildlife is at risk not to mention future generations of people. A major cleanup project should be started and a stop to sewage run over into the river to make this community grow. The river is very polluted and dirty making fishing and wading completely out of the question. It is bad because the children could learn a lot about nature on the riverbanks but the pollution is too much of a health risk.
- If the dam is to be kept the water flow through the powerhouse should be shut off, the are behind (downstream) from the power house should be filled in. The area in front of the spillway should be filled in with large stone to fill the washout area and eliminate the turbulent undertow that children drown in. The catwalk over the dam should be restored so there is uninhibited access from the park on the east side to the park on the west, also a boat launch and dock should be

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placed on the northeast side of the reservoir. The drive on the east side of the reservoir should have a parking area that you can turn around in. Also the trees and brush should be cleaned up around the dam and northeast corner of the reservoir. I own and operate heavy equipment and would volunteer my time to help. (contact info). Comments on front of survey: Hello, I would like to be notified of the results of your survey and would volunteer my time and services to help restore the Shiatown Dam Area.

- I fish the river and will not keep any fish in the river's current state. There is way too much run-off and the bottom is very silty in spots. But has some good gravel. With some work it could be a good fishery.
- I would use the river more if it was cleaner, if there was someplace to rent a canoe from, if the wastewater plant didn't overflow, if it smelled better in July, if there were more bathroom facilities available.
- I would like to see the amphitheater used more with enhancements made to the riverside.

Correspondence Sent with the Survey

Mailing #1: Introductory Letter

Dear _____:

You are one of a small group of Shiawassee County residents who have been selected to participate in a University of Michigan survey regarding the Shiawassee River and the Shiatown Dam. Knowing how people in your community value and use the Shiawassee is important to current and future decisions on management of the river and its resources.

You will be receiving the survey by mail in approximately one week. It will take 15-20 minutes to complete and your responses will be kept completely confidential. Please take the time to fill out the survey. Your opinions will make a difference!

Sincerely,

Shiawassee River Project Team

Mailing #2: Cover Letter with the Survey

Dear _____:

As a resident of Shiawassee County, you may be familiar with the Shiawassee River and Shiatown Dam. Knowing how people in your community value and use the Shiawassee is important to current and future decisions on management of the river and its resources.

Your household is one of the small number in which people are being asked to give their opinions on the use of the Shiawassee River and the Shiatown Dam. Researchers from the University of Michigan have developed the enclosed questionnaire as one piece of a research project on the river and dam. Your name and address were randomly selected from a list of residents of Shiawassee County. In order that the results of the study truly represent the thinking of the people in your community, it is important that you complete and return the questionnaire in the envelope provided. The opinions of the community will be used to inform management decisions. As a representative of your community, your opinion will make a difference!

As a voluntary participant in this study, you are assured of complete confidentiality. The questionnaire has an identification number for mailing

Survey Report

purposes only. This is so we may check your name off the mailing list when the survey is returned. Your name will never be placed on the questionnaire itself, nor will it ever be associated with your responses. Your identity and answers will not be used in any written or oral discussion of questionnaire results.

The survey should take 15-20 minutes to complete. When you are finished, you can return it in the enclosed stamped envelope. If you have any questions about this study, please contact the Shiawassee River Project Team at (734) 663-3554 ext. 122. Should you have questions regarding your participation in this research, please contact the Behavioral Sciences Institutional Review Board, Kate Keever, 1040 Fleming Building, 503 Thompson Street, Ann Arbor, MI 48109, (734) 936-0933, email: irbhsbs@umich.edu.

Thank you for your assistance!

Shiawassee River Project Team

Mailing #3: Follow-up Postcard

Greetings!

Last week, you were mailed a survey seeking your opinions on the Shiawassee River and the Shiatown Dam. Your name and address were randomly selected from a list of Shiawassee County residents. Because the survey was sent to a limited number of people, it is extremely important that we include your responses in the study if results are to accurately represent the opinions of the community.

If you have already completed and returned your survey, **thank you very much**. Your response will be very useful in informing future management decisions.

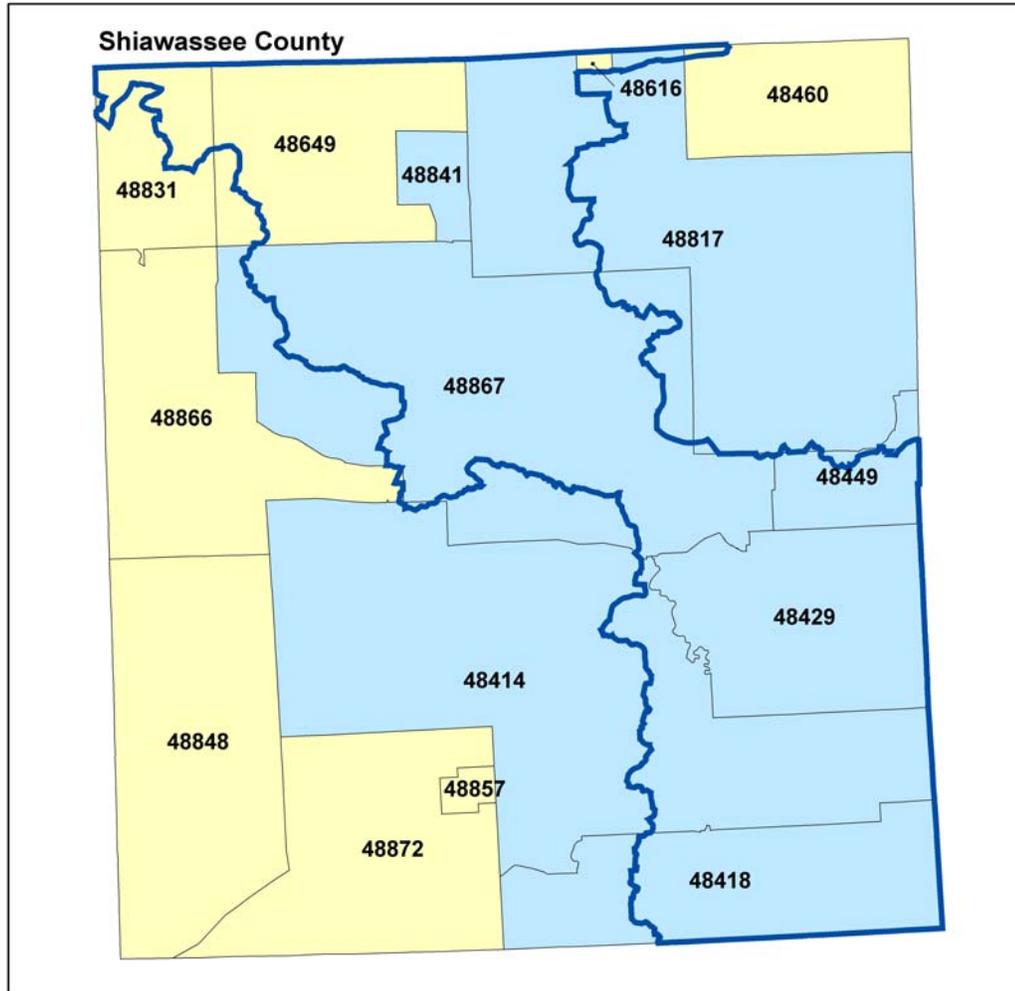
If you have not yet done the survey, we hope that you can give a few minutes of your time to fill it out and return it in the envelope provided.

If you have any questions about this study, please contact the Shiawassee River Project Team at (734) 663-3554 ext. 122 or by email at shiateam@umich.edu.

Thank you!

Shiawassee River Project Team

Figure 4.1. ZIP Codes Chosen for Survey



Legend

Watershed Boundary



ZIP Code Regions



Surveyed



Not Surveyed

0 2 4 8 Miles



Data Sources: U.S. Census TIGER_95

Map prepared by Megan Hearne (mhearne@umich.edu)
Shiawassee River Masters Project

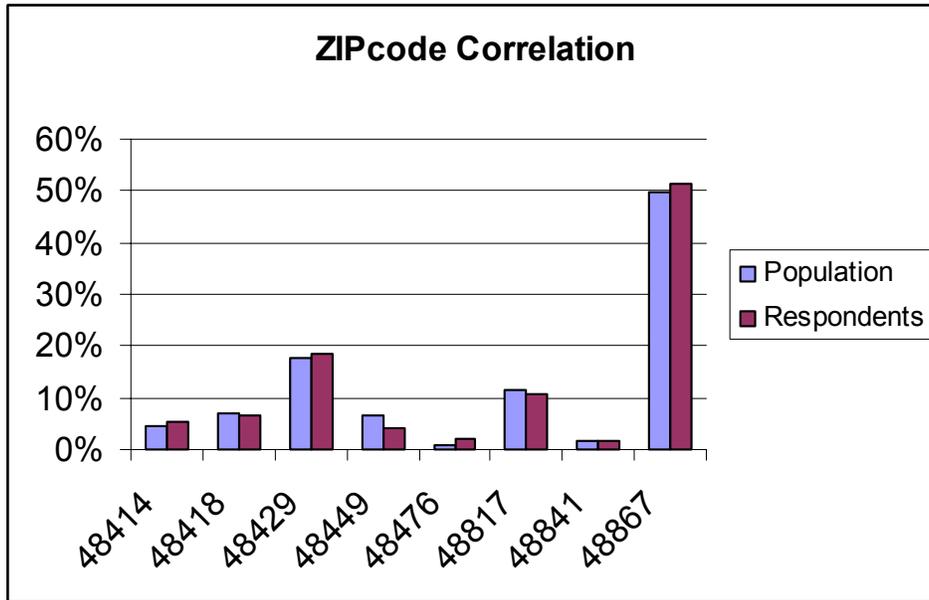


Figure 4.2. Distribution of zipcodes of survey respondents closely matched the population.

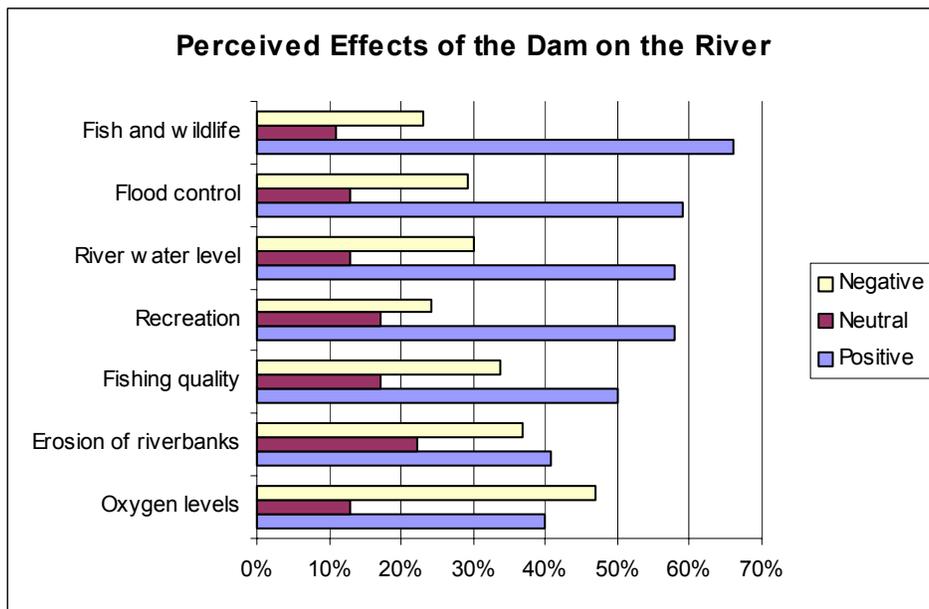


Figure 4.3. The dam is believed to positively affect all characteristics except erosion and oxygen levels.

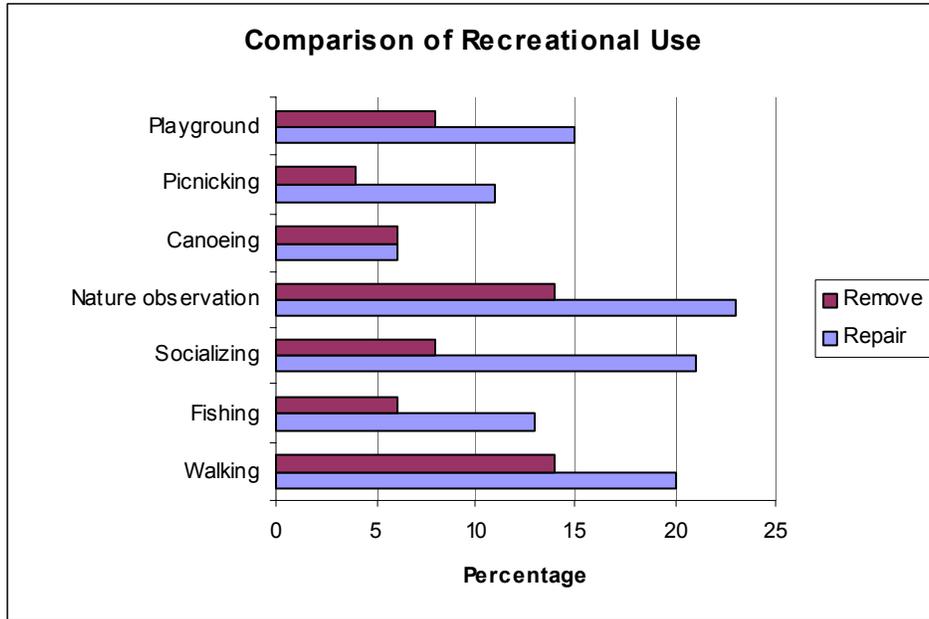


Figure 4.4. Advocates of repairing the dam were more frequent recreational users than advocates of removal, with the exception of canoeing.

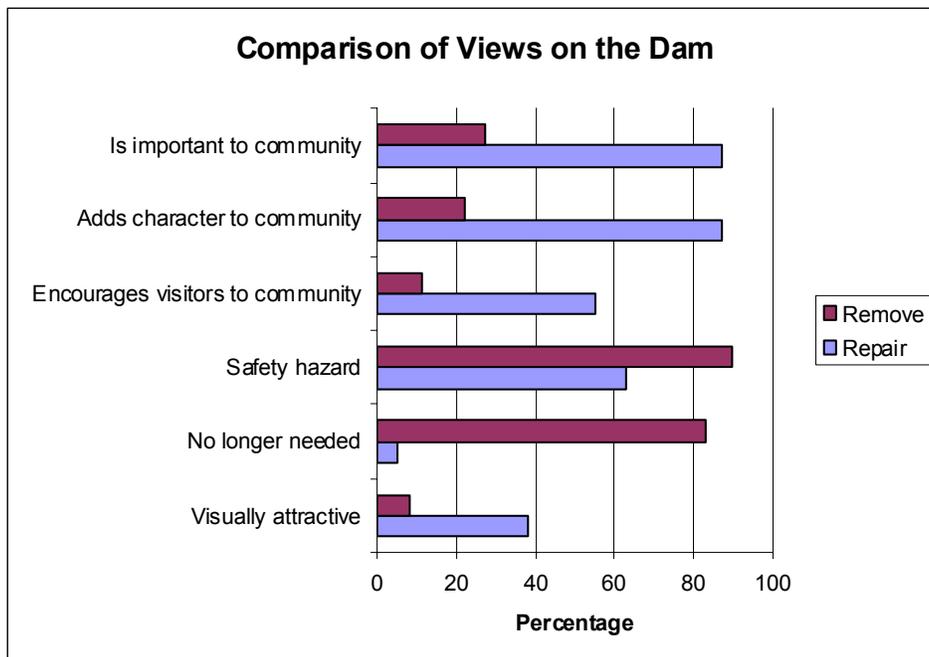


Figure 4.5. Respondents who favor repair feel the dam has a more positive effect on the river than those who favor removal.

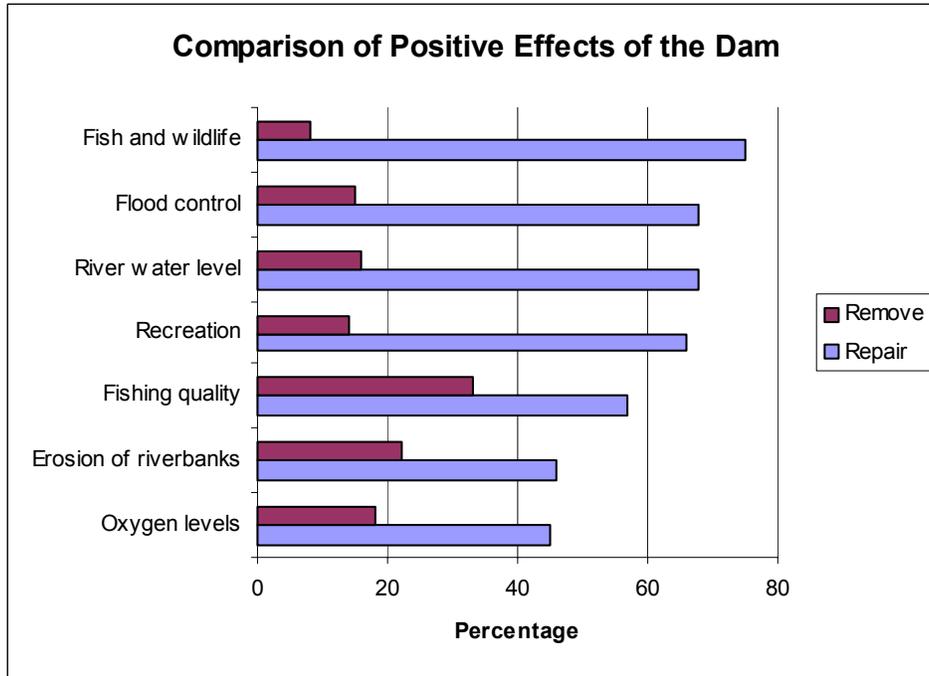


Figure 4.6. Advocates of removal and repair differ on most views. The notable similarity is that the dam is considered to be a safety hazard by both groups.

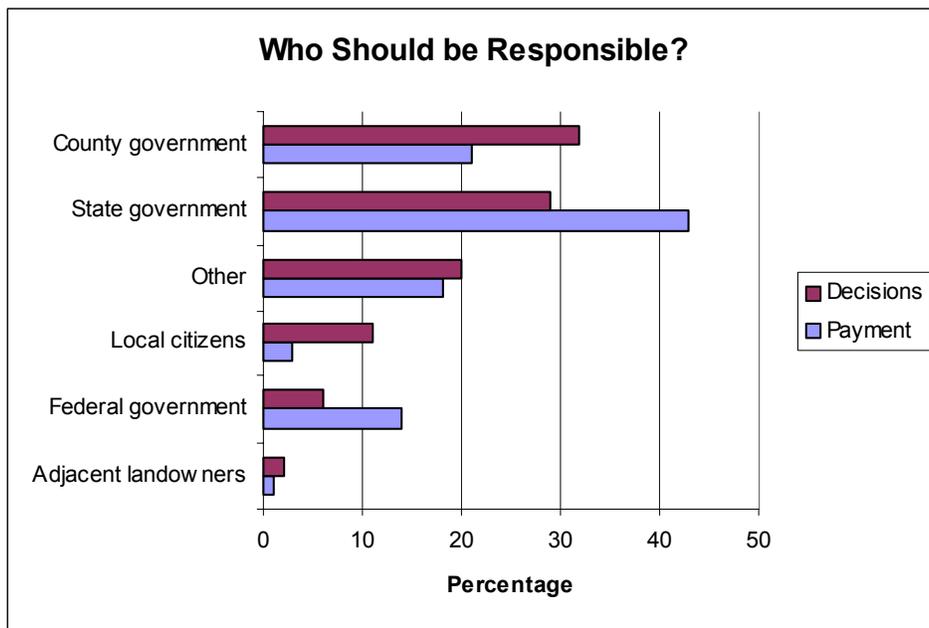


Figure 4.7. Respondents chose county government to decide and state government to pay for the future of the dam.

Chapter 5: Focus Group Report

We conducted three focus groups to deepen our understanding of how Shiawassee County residents feel about the Shiatown Dam and to gauge the level of emotion that surrounds the issue of the dam's future. Combining this with the surveys and phone interviews gives us a well-rounded variety of community input. The focus groups were not meant to be representative or quantitative. We include our Itinerary (with script), Consent Form, Evaluation Form, and Transcript of comments at the end of this chapter.

We developed a few main questions to guide discussion but conversation was not forced to maintain a narrow focus of response. The most frequent topic discussed was cost of future action at the dam site. This was followed by historical value of the dam and fishing.

Key Questions:

1. What needs do you see for the dam? What are the consequences if those needs are not met?
2. The options for the dam are repair, replace, remove. What questions would you want to be answered before making a decision about which choice was best?
3. How do you think a decision should be made about Shiatown? Why do you think that?

Methods

We recruited participants by various methods. Some people were contacted specifically because of a group affiliation for which we sought representation. Some were referred to us by other acquaintances. Some people were self-selected; they gave us their contact information on the survey and asked to be involved. We tried to gather groups by interest; we chose to ask people who would fit with a recreation group, an elected official and local business group, and a "neighbors of the dam" group.

We followed steps for systematic focus groups.¹⁸⁷ We used the same introduction and questions for each group (see Itinerary), audio recorded the conversations as well as took notes manually (see Transcript), gave a verbal summary at the end for participants to agree with or clarify, debriefed among moderators after the group dispersed, and coded the resulting data afterwards for analysis.

Our aim was to bring 6-7 people to each meeting. Despite more commitments to attend, our first group had five, the second had only two, and our third had five participants. The meetings were valuable even though they

were smaller than preferred. At the beginning of each 90 minute meeting we asked participants to read and sign a consent form that explained the purpose of the exercise. There were only five structured questions, beginning with an easy introductory question about favorite memories on the river, then moving on to a slightly more detailed question about what are good and bad things about the river. Our key questions are listed above. At the close of each meeting we asked them to fill out short evaluations to help us learn from the process.

Answers to Key Questions

1. *Needs for the dam and impoundment:* Some say the impoundment needs to be dredged out to make it deeper for fishing and canoeing. Needs for the dam were never really discussed; most people skipped that part and went straight to repair versus removal. The assumption can be made that they realize it can't be left the way it is. One participant said, "it's just a matter of time before that thing breaks."
Consequences if needs not met: The dam could breach unexpectedly and cause damage by a surge of water and unmanaged sediment released downstream.
2. *What questions need answers before a decision can be made?* How much would each option cost? What would it look like after a removal? How would property value be affected? How would a change affect the fishery? What would happen with the sediment in either repair or removal? Is there really contamination in the soil? If so, how much and can the data be trusted? Is renewed hydropower generation a viable option? Does the DNR really want to hear the local opinion? Are there opportunities for creative financial solutions? How long would it take for the riverbed to dry and re-vegetate? What would the impact of a complete failure be?
3. *How should a decision be made and why?* Most participants assumed that the DNR would decide without asking anyone and that the decision would be motivated solely by money. It was suggested that a pro-dam community group be organized to participate actively in the decision and possibly be responsible for maintenance at the site.

Discussion Themes

Each group emphasized different themes during discussion. The "neighbors of the dam" group spent a great deal of time discussing a potential local governing body that would advocate for keeping the dam and participating in the management decision process. This community group would rely on donations of labor and equipment to maintain the area around the dam itself. It was not clear whether this group would seek ownership of the dam; some

concern was raised about accepting liability. While discussing this, the group also expressed concern that the DNR and/or DEQ would make a unilateral decision anyway. The recreation group talked a great deal about the perceived role of the dam as a water-control structure. They expressed concern that the river would become a trickle if the dam were removed. Cost and responsibility of future management of the dam was discussed. In the elected official/local business group, nostalgia was brought up most frequently, but there was also significant time spent discussing the dam and impoundment being obsolete. The complete transcript of comments is included.

We anticipated from the literature and from our survey results that common themes would be nostalgia, misconceptions about dam function (such as it being a flood-control structure), and concern about aesthetic changes in the event of removal.¹⁸⁸ These were verified with the focus groups. Many cited the historical significance of the area; Shiatown being capitol for a day and the boat races of the 1950s were most often mentioned. “That was the capitol of Michigan for 72 hours. Are you just going to throw that away?” “You couldn’t find a place to park, there were so many people there [for the boat races].” Some felt that the quality of fishing would decline without the dam, “if it goes back to its natural state, I don’t think it’s going to support that fishery”. We found that all participants have a deep fondness for the river and want it to be healthy. “It just adds to the beauty of where we live” “My best memories are growing up and playing in the water.” They are concerned about pollution, trash, and habitat availability for fish and wildlife. Most participants were vocal about wanting to keep the dam but one was pro-removal and a few were undecided.

We learned some new things that we did not anticipate. One was the willingness to forge a new local governing body in order to keep the dam. Several people were enthusiastic about it and felt that many others could be recruited to help. This idea came up in two of the three focus groups. Another interesting thing was some were adamant that the Shiatown Dam is a hydropower dam, and a unique dam in the state. Some themes didn’t come up as often as we expected, such as recreation and safety hazards. Recreation was characterized primarily as fishing, passive enjoyment of the view and sounds of water, and canoeing. Many were unhappy with the dropping water levels in the impoundment and the river. This and water contamination were seen as the main reasons recreation is limited.

Categorical Results

Responses were coded by 22 categories of comment. They are listed by order of frequency in the table below. Focus groups varied; for example,

Focus Group Report

hydropower was discussed thoroughly in only one focus group while discussion of fishing was fairly equal across groups.

Categories of Comments	Frequency of Mention
Cost of future action	16
History of area	13
Fishing	13
Pollution/contamination	12
Siltation of impoundment	11
Nostalgia	10
Dam controls water level	9
Hydropower	9
Belief that a top-down decision will be made	7
Sediment release after a removal	7
Concern about potential failure	6
Local governing body	6
Post-removal aesthetics	6
Number of users of the dam/park area	5
Recognition of dam's structural problems	5
Wildlife habitat	5
Canoeing	4
Concern about property value	4
River quality, cleanliness	4
Dam structure is solid	4
Dam is a safety hazard	3

Other comments mentioned only once or twice included the beliefs that the Shiatown site is unique, liability is a concern, park maintenance is poor, erosion and sediment run-off affects the river, where would property lines be if dam were removed, and generally that Shiatown Dam is a nice place that should be restored. The Friends of the Shiawassee River (FOSR) and the scope of their efforts were also discussed in two focus groups. Some participants felt FOSR was an exclusively urban group concerned only with the portion of the river that went through Owosso. Others defended the efforts of FOSR.

Misconceptions

“They’ll spend ten times the money ripping it out as fixing it.” “There wouldn’t be any river to canoe if that dam was out.” “The dam’s there for a reason: not just to generate electricity, it’s there for flood control.” “If they decide to tear that out, I am going to have a house looking at a little creek that is infested with mosquitoes.” “There’s not too many dams around.” These are common misconceptions that we heard during the course of our research.

The abundance of misconceptions provides a great opportunity to encourage group learning and collaboration in decision-making about the Shiatown site. The people wanted to know a lot more information than we could tell them at the time and were willing to volunteer their efforts to this cause. Some also were skeptical of being told things by state agencies; they assumed that the DNR and DEQ would tell the community whatever was convenient. “Could we take core samples? I just want to see what’s there for my own peace of mind.” If the interested residents participated in the learning process, for example, by participating in the sediment testing, they would be more likely to trust the results.

Itinerary

7:00 –Welcome

Intros of Shiasteam

Intros of participants (name, where live, what is your interest in the river)

7:10 – Our purpose/goals/expectations (below), consent forms

7:20 – start questions

1. Most vivid memories on river and/or dam impoundment area
2. What are good things about the river? Bad things?
3. What needs do you see for the dam? What are the consequences if needs not met?
4. Options for dam are repair, replace, remove. What questions would you want to be answered before making a decision about which choice was best?
5. How do you think a decision should be made about Shiatown Dam?
Why do you think that?

8:15 – begin wrap-up. Give summarizing comments, note anything *not* brought up, ask for other things perhaps left out of discussion.

8:25 – This is the first focus group we've done but we're doing more... could you please take a moment and provide feedback about how the evening went on these evaluation forms? Thank you to all for coming and participating!

Script to explain purpose, goals, expectations

The people of Shiawassee County are faced with a problem. The Shiatown Dam is in disrepair and poses a threat for human safety and environmental quality. A decision needs to be made with input from all interested parties – and fairly soon – before the dam breaks or requires other immediate attention just like when it almost failed a couple years ago.

- We are a neutral group collecting information on the ecological, economic, and social aspects of the Shiatown Dam.
- Our client is FOSR; they are neutral concerning the future of the dam but wanted our help to collect information.
- Our final paper will be shared with them, the dam owner, and we'll have a meeting open to the community about what we learned – it will not be a recommendation for a particular management decision for the dam. We hope to set the stage for a good decision to be made by everyone who cares.
- We've worked on this for over a year and the project concludes this April.

Here's where you fit in: we want to be sure we have the best representation possible about what people in the county think about the river and dam.

We want to hear from you in a group setting so you can talk to each other too and therefore have a richer discussion – we aren't looking for “right” answers... just all the opinions... and we hope to hear from each of you equally. I will jump in sometimes to guide the conversation and keep us on track.

In a nutshell, we are here to listen, not to give you information. We are looking for your perspectives on the current use, quality, and needs of the dam and river. Feel free to jot down thoughts as we go on the paper provided.

We will be finished no later than 8:30pm. In accordance with the University's research requirements, we must ask each of you to read and sign the consent forms before we begin. In order to help us remember all the important things covered in our discussion, ___ will take notes and we will audio record the conversation.

Consent Form for Focus Group Participants

Your participation in this focus group is entirely voluntary and you may withdraw from participation at any time. The University of Michigan graduate students are doing a master's project called "Shiawassee River Assessment: Informing a Management Decision for the Shiatown Dam." Their client is the Friends of the Shiawassee River. The purpose of this study is to inform the community and decision makers about all options for the future of Shiatown Dam. This study includes collection of current community opinions, concerns, and suggestions.

The focus group discussion topics will include 1) perceptions of value of the river and dam to the community 2) prioritization of dam concerns compared to other community concerns 3) perception of natural resource issues in the watershed. It should take 1.5 hours.

The conversation will be recorded by one of us taking notes and it will also be audio taped. This tape will be confidential. All information collected will remain confidential except as may be required by federal, state or local law. The results from the focus group will be incorporated into the researchers' final report, to be completed in April, 2003, which will be given to local and state groups who make management decisions.

Should you have questions about the study, please contact the graduate students, Dave Chadwick, Megan Hearne, Joe Short, Mike Schuller at (734)663-3554 ext 122.

Should you have questions about the study's approval by UM or about your rights as a research subject, please contact Kate Keever at Institutional Review Board, Behavioral Science Committee at 1040 Fleming Administration Building, 503 Thompson St., Ann Arbor, MI 48109-1340. Email: IRB-Behavsci-Health@umich.edu
Phone: (734)936-0933.

I understand the above statement and consent to participate in this focus group.

Signature: _____ **Date:** _____

Evaluation Form for Participants

Shiawassee River Project
 Focus Group Discussion # ____
 February ____, 2003

Thank you for participating in today's meeting. Our project will benefit greatly from your insight and opinions. We would also appreciate your feedback on the meeting.

	Very Good	Good	Poor	Very Poor
Scheduling: <i>Was the meeting at a convenient time for you?</i>	1	2	3	4
Format: <i>Was the meeting appropriately structured?</i>	1	2	3	4
Location: <i>Was the location convenient and easy to find?</i>	1	2	3	4
Outcomes: <i>Was the meeting productive? Did you have the opportunity to share your views?</i>	1	2	3	4

Suggestions for ways to improve future focus groups:

Any other comments?

Focus Group Transcripts

Focus Group #1 February 6, 2003

We have four communities dumping into the Shiawassee, I'm talking the area from Byron to the Shiatown dam. There ought to be some kind of a real cleanup.

If the Shiatown Dam goes out, you're going to see a mere trickle of a river from Byron to the Dam.

It will cost a lot of money, however they fix it, however they do it.

At one time, we used to have motorboat races at the Shiatown Dam, we had that much water backed up. Now there's hardly enough water near Geeck Park to get a canoe over there.

A lot of it comes back to the community as a whole. They have slowly perceived the Shiawassee River as a glorified ditch, a drain. All the way from Byron to Oakley. Whether it's the city folks or the rural community or agricultural, the Shiawassee River is nothing more than an outlet to get it downstream. That perception probably has gotten more so after the events of the late 70s, the problems that we had in Fenton, all of a sudden, lets just...all of this stuff coming from upstream, there's nothing wrong with disposing our tires, refrigerators, etc. I'm not saying its right, it's just people's perceptions that slowly led them to that.

People will go up north 200 miles for a coldwater creek. If it's not trout, they won't get tied to it. If it's bass or the fish that are supported in this river system it doesn't give them a warm and fuzzy feeling, yet it is right in their backdoor. It's a beautiful river, it has a lot to offer.

It goes beyond more than the financial. It comes down to the local community and their mindset about what this is.

Geeck Road is one of the most beautiful parks of the Shiawassee River. The river winds and flows, people like to fish there. There's certain spots in the river where there's big fish in it. There's some deep holes in there.

What would ultimately happen with all the dioxins? If they dropped the dam...would that wash out and silt up by Corunna?

The dam provides a valuable backpool [for fishing]. In the summertime we all know that the river goes down. If you take that dam out of there....

There's a fantastic smallmouth fishery. Occasionally we'll get out there with a canoe or wade the thing and it's a fantastic recreational opportunity to be able to use it. It is a great smallmouth fishery. I'm sure it is rated as one of the best in the state of Michigan [Other person: and not just there at the dam] no, if you take that dam out, then it's going to be a very viable resource that will be lost. I don't think you'll be able to maintain that pool. If it goes back to its natural state, I don't think it's going to support that fishery.

I think what you'd do...I'm not a biologist, but you'd rechannel it to its normal state. You'd see a floodplain out there. You've already seen the evidence of this last year. I live about a mile from the dam. We had these marshes coming up. There's great wildlife habitat there. Now, from [the fishing perspective], granted, you'd lose all the backwater benefits.

As a property owner, below the dam, I'd be pretty concerned about the value of the property.

Most of the people at Friends of the Shiawassee river are concerned about the resource from Corunna to really, a mile north of the hospital or maybe beyond Green Meadows. They're "friends" of the river – but the bulk of the people live near Owosso and Corunna, that's where the money's at. We're not a rich county by any means. This is a rural county with limited resources in terms of financial income. Most of the people that support the friends have probably never seen a good chunk of the Shiatown – Byron area. There probably aren't a lot of tires in the stretch [that the friends clean up], but come out in the real world, in Hickville...

I think they do a really good job, maybe turn some heads definitely...but down by me they got to get some focus. Let's get outside the city limits.

I live out in that area. I grew up near Shiatown. There was a privately owned park, our neighbors would charge a quarter, I'd go down there and fish. I'd spend all day. Just down there fish for rock bass, fish for whatever was there, get out in the river. In between Shiatown and Corunna. It's a beautiful stretch of river, it had some deep holes. I'd like to see some people do it. But now, I talk to my wife, "let's go down to bass pro shop, I'll buy you some waders..." She says, "you're not gettin' in that river, you'll get *E.coli*." It's a concern now.

It's the mindset, like I said earlier, we've got to get away from thinking of the river as our own personal dumping ground.

Focus Group Report

I know from riparian corridors, buffers, that's some of the better buffered area down through there.

We used to coon hunt on that river, down by Grand River.

How much sediment is behind the dam? If they were to take that dam out, the sediment that is built up behind it has to go somewhere, it'd come downstream.

That would dry out and you'd have more grassy area, you'd just have a little stream running through there. Some of that [sediment] is pretty hard.

We have what we call 100 year floods. I've been there when we've had one of the floods, I've seen it above the dam. The guy who built the house there, I stopped and talked to him. Water was over the top of Newburg Road. I said your house would be completely underwater. When we have a big flood or big rain, there are going to be a lot of problems with people.

That dam's there for a reason. Not just to generate electricity. It's there for flood control.

There's a lot of concern in the last few years for its ability to manage floods. It's old, it leaks, it has got real structural problems.

If that Shiatown dam blows, you will see tremendous water problem. That dam holds back a lot of water. A 75 acre reservoir can take in a lot of water.

That's ultimately what it comes down to, how much [money].

I personally think that what should happen is that the people in Shiawassee County have to get together in a big group and apply for grants to redo the dam. The other alternative is put accelerators [artificial waterfall] in there, tear out the old dam, use accelerators for a dam-type purpose. Either way would cost money. It will take a tremendous amount of rocks.

The county doesn't have any money. The state of Michigan doesn't have any money. There seems to be money laying around in grants. That's the only way I can see how...unless the county says we'll put on a ballot and everyone can contribute to a millage to restore the dam and rebuild it.

I tell you, they're running on borrowed time. We're just lucky the last few summers. We haven't had a cluster of rain or moisture. It is just a matter of

time before that thing breaks. We've bought some time this winter because we haven't had any snow.

Those of us in Corunna and Owosso don't worry about the dam too much until we get those high rainfalls and then we worry about it breaching.

Would they clean out behind it – if they were to rebuild it?

I was down there [in Lansing] today...I can see where our money is going. Constitution Hall, the DEQ, built in 1991, brand new building.

It's a pretty somber feeling at the state level right now based on where we're at and its no reflection of the prior administration, it's just a reflection of the economy. The DEQ shut down the Maurice office and now they want to lump them back into DNR.

The bottom line is that there is not going to be state funding to take care of it. It's got to be a local initiative or a grants or a possible millage.

There's going to have to be an organization of concerned people. It's going to have to be someone with some expertise in getting grants.

The Shiawassee is [better than it used to be], but there's still a lot of work to be done. I'd like to see all of the drains taken out. Those cow barns drain right into the river.

[discussion of agricultural buffers]

If the state of Michigan has control and they still own the dam, there's one gal that runs the whole outfit, and if she says it's coming out, she don't care [if it is a problem] all she cares is dollars and cents. You'd have to go to her, you'd have to get an attorney, use the legal process. She doesn't want to spend the money to repair the dam. She has authority over that dam, to destroy it. I would say that a group would have to go to her and say this is a vital part of Shiawassee County and this is a flood control type of thing,

I don't think the mindset is that it is already gone, but it's a matter of money. No one wants to see their taxes go up. They don't want to pay a millage to educate their children, why would they want to pay a millage to keep a dam there? Where are you going to get the money to do this? If you were to poll people – just walk down the street – most people would probably say that it provides a benefit to this community and we'd like to see it repaired, we'd like to use it recreationally, but where will you get the money to do that? The

Focus Group Report

Cook Family Foundation? But I don't think people will want to pay more taxes to do that.

If you polled people – “what do you think about the Shiatown Dam?” – “Oh, I think it's beautiful.” “Well are you willing to fund it?” “Well, no...” So let's hope it doesn't break.

I'm almost certain that if that dam was gone I think you would see a tremendous deterioration of the river. You would see, in July and August, a little trickle. If you would've visited Shiatown last year, you would have seen 20 feet of river. Nothing but flat muck bottom.

I don't think people realize. I think people have to be educated that when that dam is gone, it will flood when it rains, and it will dry up to a creek in the summer time. Just like Arizona.

There's no money, so she's going to set on it until something bad happens. There's no money to even tear the dam out.

It would be nice to see some engineering reports on what the cost would be to the taxpayer. What it would take to repair the facility.

It doesn't become a high priority. We've got so many financial problems in the state of Michigan, the dam at Shiatown isn't very far up there. The easiest solution is “it's been breached, take it out.”

Shiatown Michigan is the dead center of Michigan...one time they were going to put the capital there. That's part of Michigan's history.

I'd like to see what it's going to cost. It sounds like whatever will happen, the DNR will decide to rip it out and spend x amount of money. Is there some kind of joint thing we can go into? Take the money the DNR is going to spend and our money and rebuild this thing the best we can.

The other alternative is to tear the dam out and put in a waterfall to accelerate that water down through there.

Has anybody ever looked at it as an additional source of power?

Focus Group #2 February 10, 2003

I played on that river as a child. Me and my friends built rafts, challenged each other to races. Their construction failed but we won't go into that.

When I was older, we had a pontoon boat and used to have river cruises on the river. I've lived on the river all my life. As a child 12-16 we were back there all the time. My parents would come to check on us once a week, we literally lived on the river for three months in the summer. It's a soft spot in my heart. I really like the river

My best memories are growing up and playing in the water

I lived on the north edge of Owosso [across from the river]

We used to spend summer and winter. There was a nice hill back there where we could sled and ski, and a deep water area where we could sweep the snow off and play hockey. Ride ice cakes down the river.

As kids we built a boat. Stole a tire from the highway crew and used it to patch up our boat.

We watched them put the disposal plant in there. They did it all by hand, pick axes and shovels.

The river would freeze with nice ice. Today the river does not freeze at all. High salt content or something like that. It plugs up the whole stream when it freezes. Forms slush and freezes in shallow spots. Solid slush all the way to the bottom. We haven't had any rain, but the river is 18 20 inches higher than it was before it froze over. That's a very strange thing.

It gets a whitish buildup on the rocks and all

As a kid, I don't ever really remember the river going up and down the way it does today. All of the farmland was small farms back then, lots of fence rows, no big drainage ditches. Big areas that used to be swamp are now flat farmfields. In the spring, when the ground is bare, and full of water you get an inch of rain, the river comes up 8 – 10 inches with an inch of rain. In the summertime, you can have 2 inches of rain and it hardly changes. Plus it gets muddy. It never used to get muddy.

I always remember it being muddy.

The fishing is probably better in the river now than it was back then. I don't remember anything but bluegills, pike, now there's lots and lots of smallmouth bass in the river. Always been nice big carp, redhorses, and suckers.

Focus Group Report

Plenty of redhorses. The guys up north say they hardly ever see them, we've got an abundance of them. We've got to protect them, that's ecologically sound.

I'm between the Shiatown and Corunna Dam. The water level since the mid 60s, the average water level is 6-8 inches lower than it has been. I don't know if it is erosion or what, but definitely the water level is lower and the nutrients are higher. The weeds are almost solid in between that stretch.

Back in the 30s there were hardly any weeds in the river, now in the shallow areas they grow like crazy.

The fishing seems to be pretty good. In my stretch of the river the bass are pretty small. A friend of mine lives in Owosso, the fishing is pretty good there, he catches some pretty decent smallmouth. Between Corunna and Shiatown they tend to be 6 - 8 inches long. The fish are clean. Years and years ago they would always have grubs in them. My son fishes, he catches lots of bluegills and sunfish. They don't have grubs in them.

The weeds are a definite problem. They grow like crazy in the shallow areas.

There's a lot more silt in the river.

There's a lot of people that dump their leaves in the river.

In a lot of places, the dams aren't run as dams anymore. The Shiatown dam serves no particular purpose. Other than aesthetics, there's no need for it.

If the dam went out, then it probably wouldn't ever be practical to rebuild it.

It's a completely different river for people that have property. In Corunna, we have people that have built homes along the river [impoundment], thinking about the people at Shiatown I wonder how they would feel if the dam came out.

I have no idea what the natural course the river would look like. What is the river going to look like if the dam is gone?

What are we going to let go downstream if we take it down? Long, short, midterm?

How long will it take for the riverbed to dry? When they drained Corunna for repairs, I remember it, it was rotten leaves and much for more than a mile away from the dam. There is a lot sediment in the river through town.

The Michigan Brick Company is very river-friendly.

As far as [the DNR] is concerned, do the people have a say?

People are afraid to see change. "That dam has been there all my life, I don't want to see it go."

Where are the property lines after it is out? Where are the property lines now? That will all change, too. The river will move itself. People need to know what will happen to their land. Will my 150 feet to the lakeshore become 300 feet to the river or will someone else get it?

Who is going to clean up that mess? How much of a mess will there be? Probably some areas that will dry out and, within 2-3 years, grass and bushes will be growing.

I don't see a problem with sewage in our part of the river. There's plenty of nutrients, though. Corunna just put in a new sewage treatment tank. The river is healthier today than it was in the 1940s.

What happens to the fish if you remove it? If you lower the water to the point that we have no fish, where will the gamefish go? The pike, bluegills, bass. Without a dam, you'd lose the aerated water that the fish need.

What would the impact of a complete failure be?

What it comes down to is I'm afraid of change. I wish I could look at it objectively.

The DEQ's opinion is to put all of the rivers back to a natural, when-time-began condition. But we've changed the river since then, we've built walls around it, structures through it, dumped garbage in it.

It is spooky to say "let's tear it out and see what happens."

If Shiatown Dam blew out or was removed, we'd have a 2 foot water surge and then it'd be gone.

No economic reason to keep it other than the property. It doesn't provide irrigation, or flood control. From a feasibility standpoint, it should go.

Between the dry season and wet season, the level in the river right now will change 2 feet.

Focus Group Report

The big thing is getting down so the people could learn. What kinds of things need to happen so people will know? How will they be affected after it's gone? That information will make it possible to get a little better idea as to what they would like to do or be willing to do.

Whether the dam is redone or not, it will always be a hazard. Even if it is repaired and it is in good shape, it will still be a dangerous place.

Focus Group #3 February 15, 2003

It's our backyard. For thirty years it's been habitat for a lot of wildlife: ducks, geese, cranes, swans, all kinds of wildlife.

It just adds to the beauty of where we live

Years and years ago they used to have boat races, they used to ski, the dam provided power for the whole area. It was a good place to go fishing too.

We'd like to see it back nice like that again. One thing we don't want to see is it taken out or ruined. My personal opinion right now is it is a disgrace to Shiawassee County and the state of Michigan to have something as nice as that was to be in the mess that it is today.

It could be so nice. It could be something that lots of people could get a lot of use out of it. Mow the place, picnic tables for people to come. What do they come to? A swamp. It doesn't have to be that way, it could be nice.

Where do you get the idea that it is in disrepair. The dam structure itself is a good solid structure.

The dam itself I don't think you'll ever see that dam wash out of there. The only reason why you had a problem a couple years ago was all the junk left to build up in front of it for years. That was just a lack of responsibility on the part of the state or whoever owns it.

We moved in in '72. It was a nice place up until that time. One thing I can't figure out is Consumers had it for so many years. They were in the black. And once Consumers Power left it, the county had no idea how to run it. They're not water people. I don't think they had any idea what to do with it.

They poured those paraffin walls in front of the dam to control the silt. 30 years later there's not three foot of water in it. There used to be 20 foot of

water. There used to be boat races in the summertime. There was water going over the dam and they still had boat races.

Now you don't have two foot of water.

You couldn't find a place to park, there were so many people there (for the boat races)

As a child when I was growing up I would walk up to the turbine house and start crying because the ground would be shaking.

There were trails along the river for miles, and people would go fishing. There'd be fifty people down there fishing. Now there's no one, what are you going to catch now, carp?

Can you imagine what we'd have if it wasn't there. A mosquito infested swamp.

Can you imagine the power that thing would make today, with modern technology, if that thing was cleaned out. Water is going that way, why not utilize the power?

That structure has been here for over 100 years. What makes people think it is going to all of a sudden crack off and fall? There's rebar in there this big around. My uncle said those foundations under there are forty feet wide. They filled it with old metal farm equipment all kinds of stuff when they built it. That thing is not going to go anyplace. Anybody that tells you that thing isn't solid doesn't know what they're talking about.

Show me one spot where the water is going underneath the dam. There's 10 feet of sediment there.

Now the deepest spot in the river is right in front of the turbine house.

I always kind of thought I knew that that Army Corps of Engineers. If you have the right connections and the right people, they'd come in there and dredge it. You want to put the silt someplace, put it on my land.

The contamination. Show me that there is a foot of poison down there. I'd say it's down there 15 feet. Why can't we take 10 feet off? Dredge it out, Mother Nature will clean it out, just from the rain and water getting to it.

He (previous owner) was going to fix it all up and put the power plant back in but then the stupid people at the EPA and DNR said he couldn't do it. So he

Focus Group Report

left, he cut the turbine out and went up to the UP. He's up there making electricity right now.

If they decide to tear that out, I am going to have a house looking at a little creek that is infested with mosquitoes. I can't believe they could tear it out. They'd have to blow it up.

Isn't there some deal with the wetlands, some deal to keep those places preserved?

This is a hydroelectric dam. There are not many hydroelectric dams in the state of Michigan. This was a jewel to the state. People would come and look at this dam, they just loved it. This was free power. It always ran in the black.

Electric and diesel generators were getting bigger and the dam ran itself a course.

I work for a construction company, we use a lot of sheet piling. It's inexpensive. You can't tell me that you couldn't sheet pile both sides of the dam. If you needed sand or gravel or stone, you can get all of that from the park. It wouldn't cost you anything to backfill a sheet piling. I can't see spending a million dollars down there.

They spend 65,000 for that. They've already spent \$130,000.

They cut the catwalk and the places where the gates flow. I couldn't believe that they'd do that.

Who makes the decisions for doing that?

I'd like to see it saved. If it is taken out, it will just be a muddy mess down there. I remember when I was a kid they drained it to repair the dam and it was just muck. That stretch of the river. A little skinny tail of water going through the middle, that's what will happen if they take the dam out.

The silt will wash downstream.

All that water will rush over the Corunna Dam, you're not going to have no water nowhere. You tear the dam out, the river will just be a creek, you won't be able to canoe down it. You can barely canoe the millpond now.

A lot of people don't know its there, but the people that do know it's there come there all the time.

Will the DEQ and the DNR meet with the people? And actually have a dialogue or exchange with them? The last time I talked to the DEQ they as much as told me that you might as well plan on it being out of there.

They lifted the gates and completely drained the river and killed all the fish. The contamination could be down there 18 feet. Why can't we go in there and dredge out ten feet and leave that stuff down there. I've got pictures of pike 4-5 feet long in there, there were fish galore, now there's nothing. It's not deep enough to sustain game fish, the water gets too hot. We're talking about an 800 foot stretch that could be widened and deepened.

It takes a community, it takes ten guys to do the volunteer work. I'm willing to do it. If we have to have our own governing body out there I say let's get it going.

You know how much property tax I pay? A bunch. Let's take a little of that and put it into the dam, instead of blowing it for the stupid things that the state spends money on. You say they want to tear it out. Why spend money to tear it out? Take the same money to fix it. Don't spend the money to ruin it, spend the money to fix it.

How many people would come when it is worth coming to. Look at those pictures from 1947, how many people were there then.

I still see people down there on weekends fishing, a lot of people sledding down that hill. Snowmobiles. I have never driven by and not seen people there. There's people there all the time.

They finally got some decent bathrooms

They got some retired guys that are down there everyday. They love it.

People have lost interest because of the condition of the pond.

I would say it would cost you five times as much to rip it out as to fix it. Sheet piling is cheap. There's sand and materials there. What's the cost of ripping it out?

If you know the right people, there's the army corps of engineers.

This is a hydroelectric dam, this was a great thing in the 40s.

Even currently it is good. Where's the other dams that people are at? There's the waterfall. There's not too many dams around.

Focus Group Report

I don't know how many hydroelectric dams there are around here.

There are schoolkids that come out every year. They have Indian people out there, frontier type stuff. The (Boy) scouts come out here. School systems come out here, tell them about the history of the dam. There's a lot of history out there. It's not just us, there were 500 kids out there last year. I would almost like to see some type of roofing over the old pumphouse, a billboard about how they made electricity, for schoolkids to learn and let's get something on that old grist mill. Shouldn't there be a marker down there or something? Some nature trails.

A lot of history there. I'd like to see somebody show me some evidence that there's contamination there, that it's not worth fixing, that its ready to fall over. I want to see some evidence.

I like a lot of these – if they want to get rid of it, they'll say whatever they need to say. "It's this and that, so let's just get rid of it." They don't want to bother, so they come up with half a dozen excuses, oh yeah, this is why we want to get rid of it, so let's go.

They are not even going to mow the parks this year.

How can we think of putting out any money at all?

They could have the prisoners come out. Governing body, buy us a lawnmower. We're not asking for anybody to do anything for us, we'll do it ourselves.

Chapter 6: Phone Interview Report

Phone interviews were conducted in December, 2002 and January, 2003 with four “key informants”. The goals were to confirm and expand our stakeholder list, learn the interviewees’ opinions, and to use the interviewees’ representation to gauge the range and intensity of the community’s opinions. Community is defined broadly here as all people who live in the watershed and identify in some way with the river and/or Shiatown dam. We used the representation of community opinion to help us direct our efforts to include all stakeholders possible and to learn of people who might be interested in participating with the design charette and focus groups. Key informants were selected non-randomly by word of mouth. Tom Cook suggested the first interviewee, A, and A suggested the other three.

Brief interviewee descriptions:

- **A:** Outdoorsman who lives in the county.
- **B:** Historian, lifelong resident of Owosso; lives and works on the river.
- **C:** Avid fisherman, life-long resident of the county.
- **D:** Educator and waterfowl biologist, lives near Lansing.

The interviews began with a scripted introduction, as follows.

I am one of a group of researchers at the University of Michigan conducting an assessment of the Shiawassee River and the Shiatown Dam. I'd like to ask you a few questions about the river and the dam. It should take around 30 minutes. While your participation is voluntary, your opinions are highly valued and we would appreciate your help. You were recommended to us by _____. Your name will not be connected with your responses. Would you like to participate now or is there a better time in the future we should arrange to talk?

This introduction was supplemented by further explanation about our project and our connection with FOSR, but all interviewees heard the above statement. While the interview was structured around the following questions, narrative responses were encouraged. Not all interviewees could answer all questions, indicated below by N/A. The interviews were not audio recorded, but notes were carefully written in an effort to capture as many direct quotes as possible; see below.

Several themes came up in the interviews. The out-of-the-way location of the dam and park is seen as being a negative characteristic because the park is not a destination in itself. “It’s not on the way to anywhere,” therefore the feeling from these interviewees is that the Shiatown dam is not a big concern for local

people. Three out of four interviewees have major misconceptions about the functions of the dam; namely that it controls the water level and keeps water in the river. Fishing, hunting, canoeing and walking along the river were identified as being the main recreational activities. Three of four interviewees thought the dam should be enhanced to a better condition and gave that answer quickly without seeming to consider removal. The fourth thought a new dam should be built there. Characteristics of the park are rated as neutral to poor overall. Characteristics of the dam are rated variably. It is agreed to be visually unattractive and not particularly unique. It was rated more positively in the categories of historic, educational, and local importance. Despite reminders to rate characteristics according to current conditions, these ratings seemed to be in response to how interviewees felt the dam *should* be rather than how it currently is. In particular, the dam's "importance to the area" was rated an average of 1.5 (a very high score) which contradicts previous statements by the interviewees regarding community opinion of the dam.

Questionnaire and responses

1. In what ways is the Shiawassee River used by the community?
 - A. canoeing and fishing
 - B. historically – reason for Owosso to be established. It was used for power. Lately more canoeing, fishing activities. Curwood Festival (originally Shiawassee River Days) began 27 years ago. Lots of activities based on the river.
 - C. There is *little* use. In the last five years there has been more fishing – the state record smallmouth bass is in that river. People come from out of the county. Word's out about the good fishing. It's very accessible to get in and float it and fish. River clarity has changed a lot in the last 20 years. Supply of fish in the 1960's declined suddenly; red horse sucker and white sucker were gone suddenly probably because of some type of pollution. The white sucker is back in the last 5 years. There has always been good carp, some pike. Never caught a large mouth bass in that river. "Specs" haven't caught one in a long time.
 - D. Fishing tournaments – not a good idea

2. How would you describe the importance of the river to the community? How important are Shiatown Dam and Shiawassee River issues compared to other community issues?
 - A. People are concerned about the health of the river and to a lesser extent the health of the dam.
 - B. Shiatown Dam is not important to Owosso. It is more important to repair it than remove it. Remember that the river

dried up in the 1930's; there was lots of sewage and it smelled bad; the mosquitoes were huge; the area needed dams for health reasons.

- C. Out of sight out of mind
- D. N/A

3. What impact do you think the dam has on the river?
 - A. The dam controls water levels. It provides areas of recreation that could be improved. If people in the community were posed this question you'd get a lot of affirmative reaction. That question seldom comes up.
 - B. The dam is very necessary and important. We need dams to be able to control the river and keep water in the river.
 - C. The dam keeps the flow higher; the river would be dry if the dam was out.
 - D. The dam changes the flow rate of the river; changes the impacts of erosion.

4. What are some other important issues in the community (Environmental issues and generally).
 - A. N/A
 - B. Small but important environmental issue is burning. She wants a total ban on burning. City council originally banned burning completely but there was such an outcry that they allow burning 3 days a week. Air quality should be improved and water quality should be improved. There's more awareness in the last 20-30 years; residue from chemicals, agriculture is on the radar. People should continue to improve the river's quality
 - C. N/A
 - D. N/A

5. What value do the dam, impoundment, and park have in the area.
 - A. He doesn't think people know the dam and park exists. Few probably use the park as a spot of recreation. Community awareness of the resource is low. He goes to sit at the park. He can't think of the last time he canoed it. Improvements would help with awareness. If people know about the Shiatown, it's probably because of the media coverage of the near-breach in 2001.
 - B. N/A

Phone Interview Report

- C. N/A
- D. N/A

6. Who is most interested in the dam and in the river?
- A. Outdoorsmen; groups such as the Shiawassee Conservation Club, Ducks Unlimited, Pheasants Forever, MSU's Agricultural Extension.
 - B. People who live nearby, along the river. Anyone who cares about the river.
 - C. Fisherpeople
 - D. Fishermen and waterfowl hunters
7. Do people think the dam is a concern? What do people in the community think should be done with the dam?
- A. Awareness is low, and again, if they know about it, it's because of the near-failure recently. There's no organized opposition that he knows of.
 - B. Not high on a priority list.
 - C. N/A
 - D. He doesn't live in the community; but he has friends in St. Charles and he has never picked up on any sense of apprehension or fear or dislike toward the dam.
8. How has the community dealt with other important natural resource issues?
- A. Most natural resource questions in the community have to deal with reclaiming old factory sites. Lots of negative information and perceptions when the words "environment" and "natural resources" are mentioned...particularly when discussing the downtown site. When an article pops up in the paper it's talked about for 3 weeks and then it dies. Not much action is taken, but if there is action it is usually negative. There's lots of opinion but it's individuals who dominate the platform; no organized activism. There's no clear pathway to make changes. The community is slow to change.
 - B. N/A
 - C. N/A
 - D. N/A
9. What types of recreation do you enjoy?
- A. N/A

- B. Walking on the riverside path, bicycling, used to canoe, love to just be around the river, loves to feed the ducks at Jerome St.
- C. Fishing, canoeing
- D. Waterfowl hunting.

10. Please tell me about the following features of the Shiatown Park
 Rating scale: 1=very good, 2=good, 3=neutral, 4=poor 5=very bad

Characteristic to Rate	A	B	C	D	Mean
Visual attractiveness	4	3	3	3	3.25
Number of activities	5	4	5	2	4
Number of trees, amount of wildlife	2	3	2	2	2.25
Quality of river	2	N/A	4	4	3.33
Quality of pond/impoundment	4	N/A	4	4	4
Crowdedness	5	4	4	3	4
Distance to travel to the park	3	3	4	3	3.25
Personal safety	4	4	4	4	4
Overall quality of the park	4	3	3	3	3.25

11. Please tell me about the following features of the Shiatown Dam
 Rating scale: 1=very good, 2=good, 3=neutral, 4=poor 5=very bad

Characteristic to Rate	A	B	C	D	Mean
Visually attractive	5	4	5	3	4.25
Unique	3	4	2	4	3.25
Historically important	2	1	4	2	2.25
Educationally important	2	2	1	1	1.5
Important to the area	2	2	1	1	1.5

12. Do you believe the Shiatown Dam should be preserved in its current condition or should be enhanced to a better condition, or should be removed.

- A. Enhanced to a better condition, make improvements for the impoundment to make it better for fishing, wildlife viewing, hunting.
- B. Enhanced to a better condition
- C. Should build a new dam
- D. Enhanced to a better condition. Ordinarily, as a wildlife biologist, he would support removal, but in

Phone Interview Report

this case he feels the community benefits enough from this dam to fix it up.

Phone Interview Script

Name: _____

Interviewed by: _____

Date: _____

Introduction:

I am one of a group of researchers at the University of Michigan conducting an assessment of the Shiawassee River and Shiatown Dam. We'd like to ask you a few questions about the river and the dam. It should take around 30 minutes. Your opinions are highly valued and we would appreciate your help. You were recommended to us by _____. Your participation in this interview is voluntary. Your name will not be connected with your responses. Would you like to participate now or is there a better time in the future we should arrange to talk? Should you have questions regarding your participation in this research, you can contact the University of Michigan Behavioral Sciences Institutional Review Board. [Would you like this contact information? Kate Keever at the University of Michigan Behavioral Sciences Institutional Review Board, 1040 Fleming Building, 503 Thompson Street, Ann Arbor, MI 48109, 734-936-0933, email: irbhsbs@umich.edu.]

Questions:

1. In what ways is the Shiawassee River used by the community?
2. How would you describe the importance of the river to the community? How important are Shiatown dam and Shiawassee River issues compared to other community issues?
3. What impact do you think the dam has on the river?
4. What are some other important issues in the community? *[Environmental issues and generally]*
5. What value do the dam, impoundment and park have in the area?
6. Who is most interested in the dam and in the river?
7. Do people think the dam is a concern? What do people in the community think should be done with the dam?

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8. How has the community dealt with other important natural resource issues?
9. What types of recreation do you enjoy? [Gardening, birding, picnics, hiking, hunting, fishing, boating, camping, snowmobiling, cross-country skiing, walking, golfing, running, biking, team sports, other?]
10. Please tell me about the following features of Shiatown Dam Park:
[Offer a rating scale if necessary; encourage narrative responses]
 - Visual attractiveness
 - Number of activities
 - Number of trees, amount of wildlife
 - Quality of river
 - Quality of pond/impoundment
 - Crowdedness
 - Distance to travel to park
 - Personal safety
 - Overall quality of the park
12. In what ways is the Shiatown Dam:
 - Visually attractive
 - Unique
 - historically important
 - educationally important
 - important to the area
13. Do you believe that the Shiatown Dam should be preserved in its current condition or should be enhanced to a better condition, should be removed?

In addition to conducting interviews with community members like you, we are also arranging small focus group meetings to ask some of these same questions. Can you recommend anyone else that you know who might be interested in participating in one of these meetings? [Also offer them the option to participate]

Chapter 7: Charette Report

A significant challenge in discussing the future of the Shiatown Dam is that very few people can imagine any substantive changes at the dam site. For the residents of Shiawassee County, the dam has “always been there.” Changes at the site have occurred in gradual increments, and the most significant alterations over the past several decades have been primarily cosmetic. While people remember the dam and impoundment at their heyday in the 1950s, they cannot identify a single event that marked the start of deterioration at the site. In their eyes the dam has been a constant landmark, and while many people acknowledge the need for changes at the Shiatown site, few can identify alternatives outside of maintaining the status quo or returning the site to what it used to be. Reality dictates otherwise, however. The dam cannot safely remain in its current state, and large-scale restoration is not an option under the current state ownership of the structure.

We identified the need to create and explore more options for the Shiatown site in the early phases of our research, and determined that visualization of these options would be essential to generating meaningful discussion within the local community. Ideas discussed in the abstract are often difficult to grasp; with pictures these ideas become concrete and analysis comes more easily. One visualization technique often used by design professionals is a design “charette.” A charette is a brainstorming meeting that brings together multiple points of view and produces options graphically, in the form of drawings, models, or computer generated images. Charette participants are typically drawn from all backgrounds, including design professions, the sciences, government, business, and community organizations. This mix of expertise is brought together for a short period of time—usually no longer than a few days—and the participants focus on brainstorming options for the problem before them. In many situations a charette can produce results better than those that emerge from lengthy planning processes.

We decided that a charette would be a useful exercise as the community begins to think about the future of the Shiatown Dam and convened a one-day exercise on January 18, 2003. The goal for the charette was not to determine absolute, technically sound recommendations for the site. Rather our intent was to expand the range of options and test the waters for creative solutions not yet on the table. The exercise was successful in achieving this result. This chapter reports on the products of the design charette and describes the expanded range of options that emerged from the exercise.

Charette Methodology

The Shiatown charette group contained 23 people: 10 landscape architecture graduate students from the University of Michigan, 9 members of Friends of

Charette Report

the Shiawassee River, and our 4 project team members. The group met at the dam on a bitterly cold Saturday morning for a brief orientation to the site. The landscape architecture students and local residents joined together in small groups to walk around the dam and park, taking notes on the site and discussing observations of the area. The tour was the first time any of the landscape architects had seen the Shiatown site in person, although they had previously been provided with binders detailing the history of the site and the surrounding watershed.

After roughly an hour at the site the group retreated out of the cold to Baker College in Owosso, where we had lunch and began the process of brainstorming design options. Our research team introduced the exercise as one of visioning and expanding the range of options. We then proceeded with self-introductions, where each participant described their background and the thoughts and observations they brought to the charette. A wide range of perspectives was evident in these introductions, reflecting a variety of experiences with the Shiatown Dam and the Shiawassee watershed as a whole. Local residents spoke to the rich history and recreational opportunities of the site, but also acknowledged safety issues and the deteriorated condition of the dam. Many of the landscape architects spoke to the beauty of the landscape surrounding the Shiatown site and remarked on its potential. They also began to share their specific observations and design ideas based on that morning's visit.

The initial options suggested in the introductions were representative of the conversation already occurring in the Shiawassee County community, and revolved around restoration or removal of the dam. Based on these perspectives we asked the local residents and landscape architects to work in small groups to devise hypothetical future scenarios. We asked two of the groups to consider scenarios that left the dam in place, while the other two groups explored what the river and park might look like without the dam.

Each group worked together for approximately 1 ½ hours, first brainstorming and discussing ideas and then developing preliminary sketches and maps of how their ideas might look. In every group, local residents took the lead in proposing thoughts and ideas, and the landscape architects attempted to turn what they heard into graphical representations. At the end of the afternoon we all reconvened in a one group and heard short presentations from each group on the results of their design discussions.

Products and Results

The charette produced three distinct design scenarios. The two designs that left the dam in place were quite similar and are discussed together here

(Figures 7.1-7.4). One removal scenario completely removed the Shiatown Dam and restored the impoundment to river floodplain (Figure 7.5). The third scenario breached the dam but retained the concrete structure of the spillways (Figures 7.6-7.9).

Each of the scenarios addressed differing combinations of issues and interests. The repair design included an historic interpretation area and enhanced recreation areas. It also suggested the restoration of the impoundment through dredging and the construction of a boat dock and canoe livery (Figure 7.2). The repair groups also produced a variety of ideas for enhancing the function and appearance of the dam itself. One drawing depicted the dam as it might look after the repair modifications suggested in Chapter 1 of this document (Figure 7.3). These include removing the concrete piers from the spillways and filling in the current powerhouse. Another design suggested the construction of concrete steps leading down the face of the dam to enhance the appearance and sound of the falling water (Figure 7.4).

The removal scenario developed at the charette included a significant restoration of the current impoundment to a vegetated floodplain (Figure 7.5). This design incorporated a number of nature trails as well as a new pavilion, foot bridges across the river, and recreational spaces. It portrayed the free-flowing river as it might look through the restored impoundment.

The third charette scenario presented an alternative not previously identified in our conversations and research on Shiatown Dam. It breached the dam by removing the current powerhouse and allowing the river to flow freely through the gap. However the design also retained the concrete spillways of the current structure, in response to input from local community members. While the spillways would no longer have water flowing over them in this scenario, they would remain as a strong visual reminder of the history of the Shiatown site.

This third scenario group also presented two options for restoring the impoundment after a breaching of the dam (Figures 7.8 and 7.9). One option restored the impoundment to a lowland wetland and wildlife observation area. The second option created a manmade “bayou” over a small portion of the impoundment as a means of preserving some of the aesthetic appeal of open water at the site.

Creative Problem Solving

Taken together, the designs developed through the charette present a wide range of options for the Shiatown site and demonstrate the potential for creative problem solving. Produced by small groups of people over the course of only a few hours, they are an indicator of what a more in-depth process

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could produce. The designs also demonstrate that there are middle-ground solutions at the site, beyond what are often regarded as the black and white options of replace, repair, and remove. All of the charette participants came away from the exercise feeling inspired and hopeful about the potential for creative solutions to the problems at Shiatown Dam. Even more, they recognized that the site has great potential, and that a decision about the future of the dam can and should lead to improvements over the current status quo. We include the products of the charette in this document not as fixed suggestions for the Shiatown site, but as representative examples of the creative solutions that are possible.

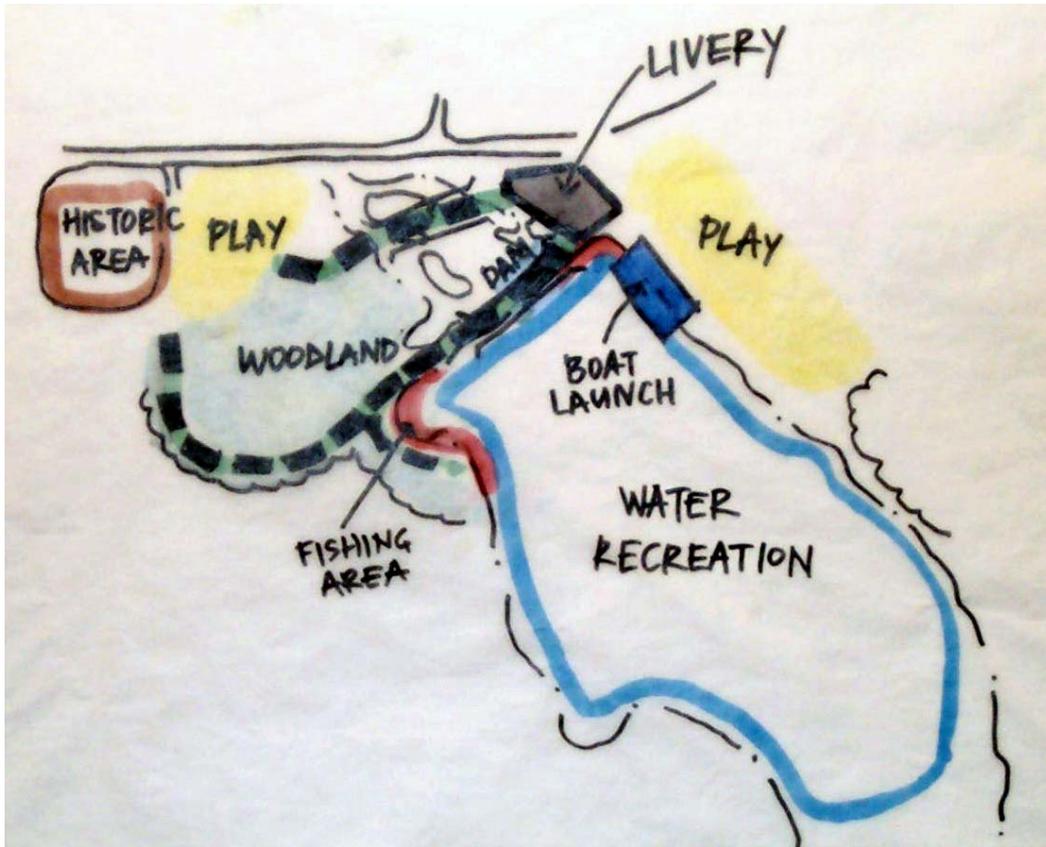


Figure 7.1. This design scenario centers around the repair of the Shiatown Dam and the restoration of the impoundment.

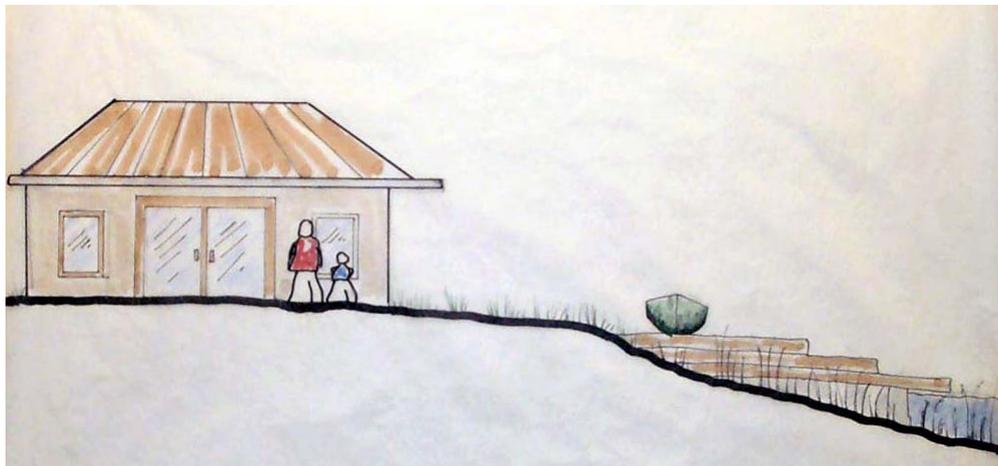


Figure 7.2. In this scenario, one component of the restored impoundment would include the construction of a boat dock and canoe livery.



Figure 7.3. Under this repair scenario the dam would be modified and a bridge constructed between the two halves of Shiatown Park.

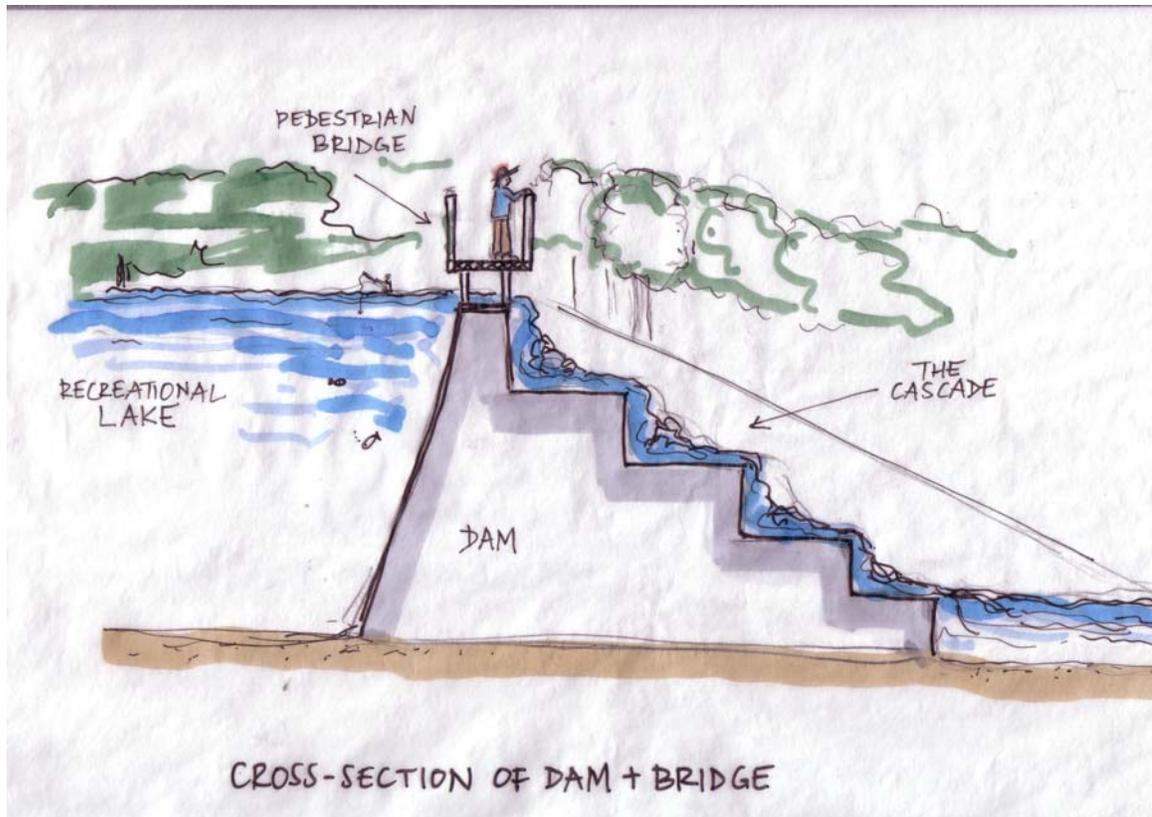


Figure 7.4. This suggested modification to the dam would create a cascade to enhance the falling water effect.

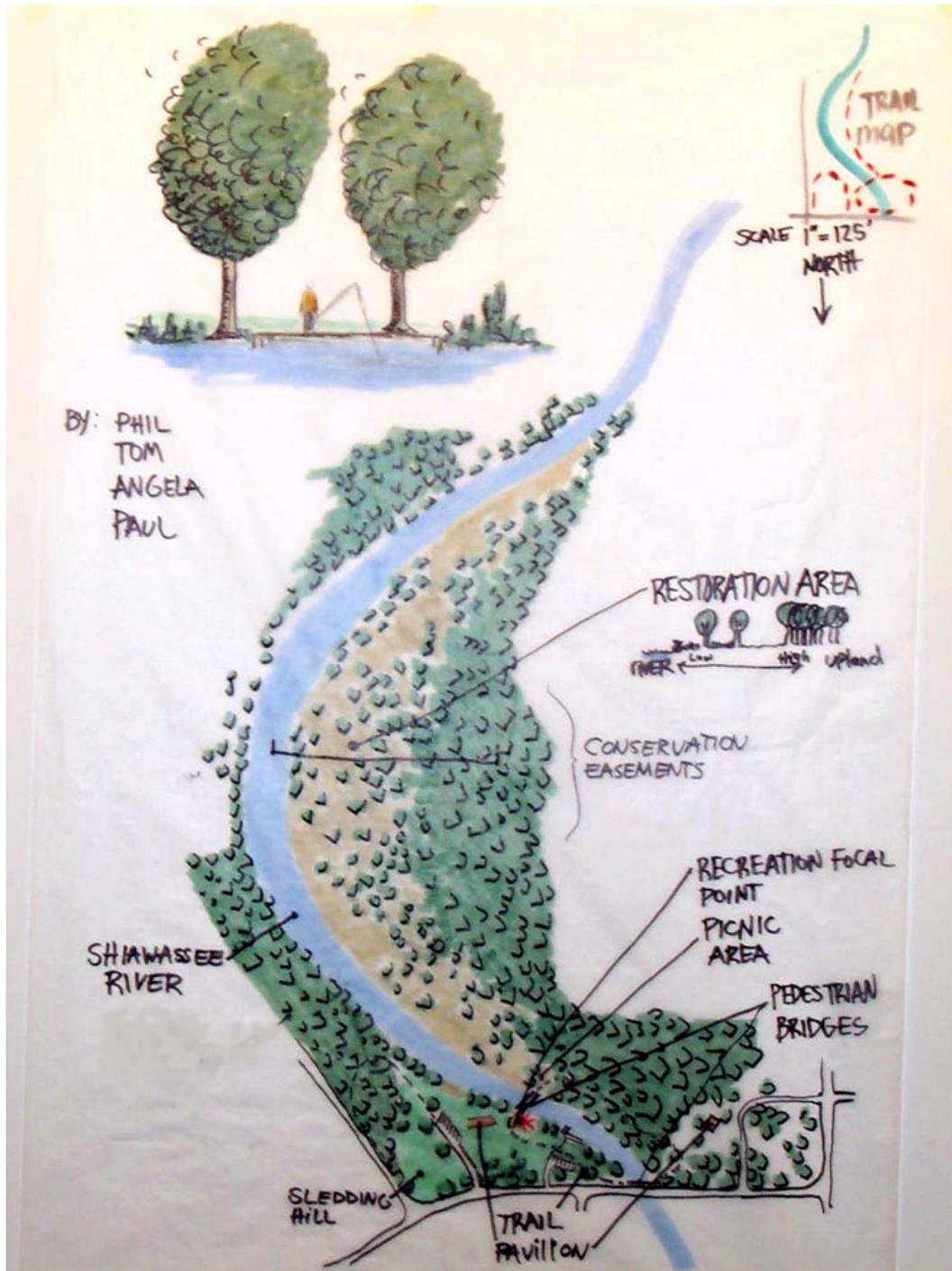


Figure 7.5. This scenario portrays the Shiatown site after a dam removal. It includes improved recreation facilities, nature trails, and a walking bridge across the river.

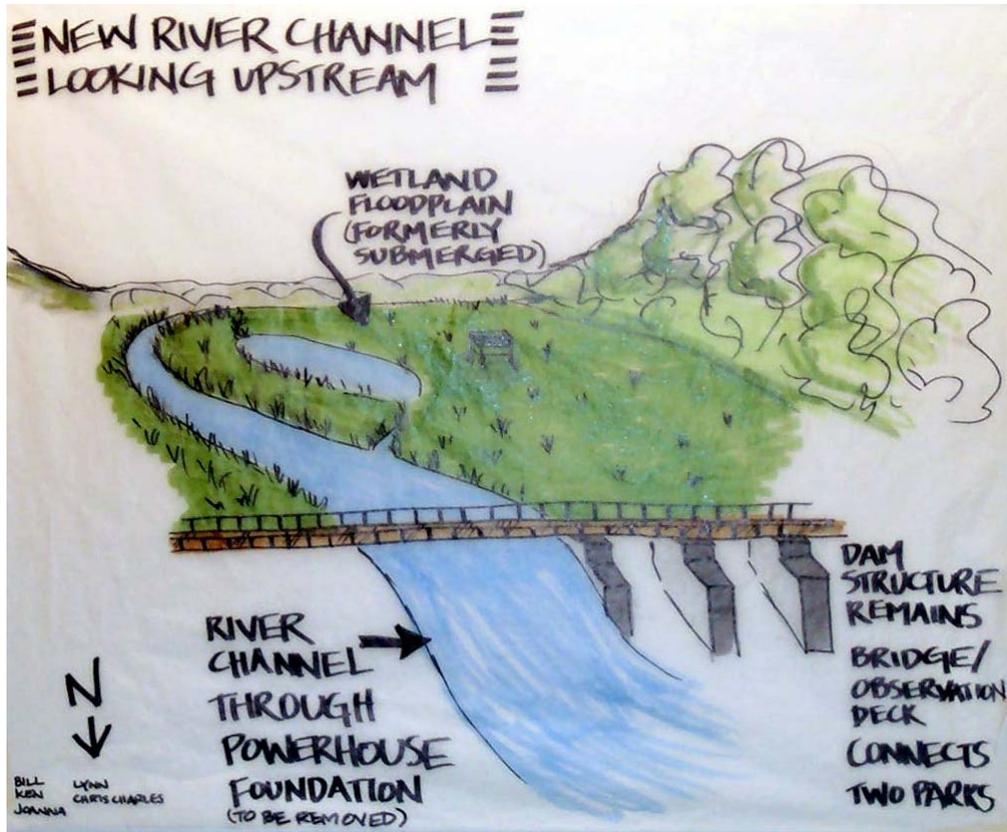


Figure 7.6. This scenario breaches the dam by removing the current powerhouse. It retains the concrete spillway structures as a visual reminder of the history of the site.



Figure 7.7. A drawing of what the removal scenario represented in Figure 7.6 might look like as viewed from upstream of the dam site.

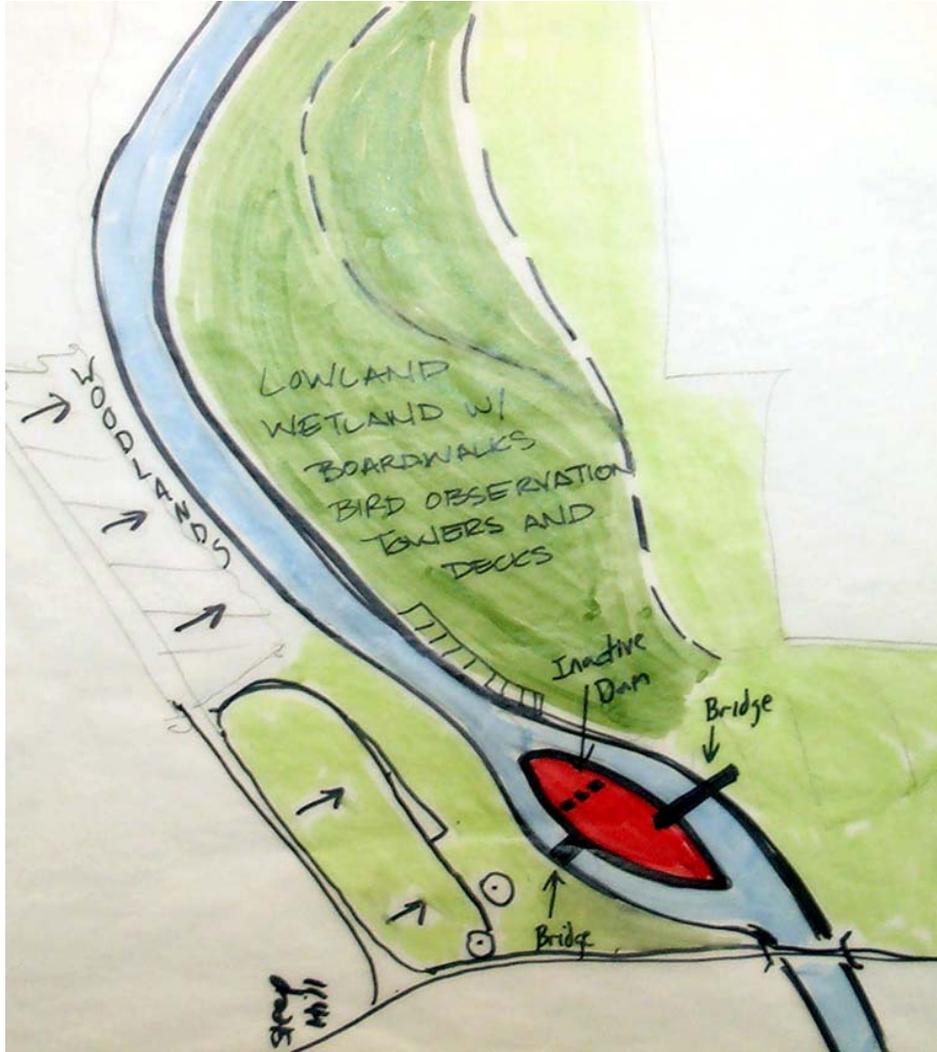


Figure 7.8. Plan view of the Shiatown site based on the Figure 7.6 scenario.

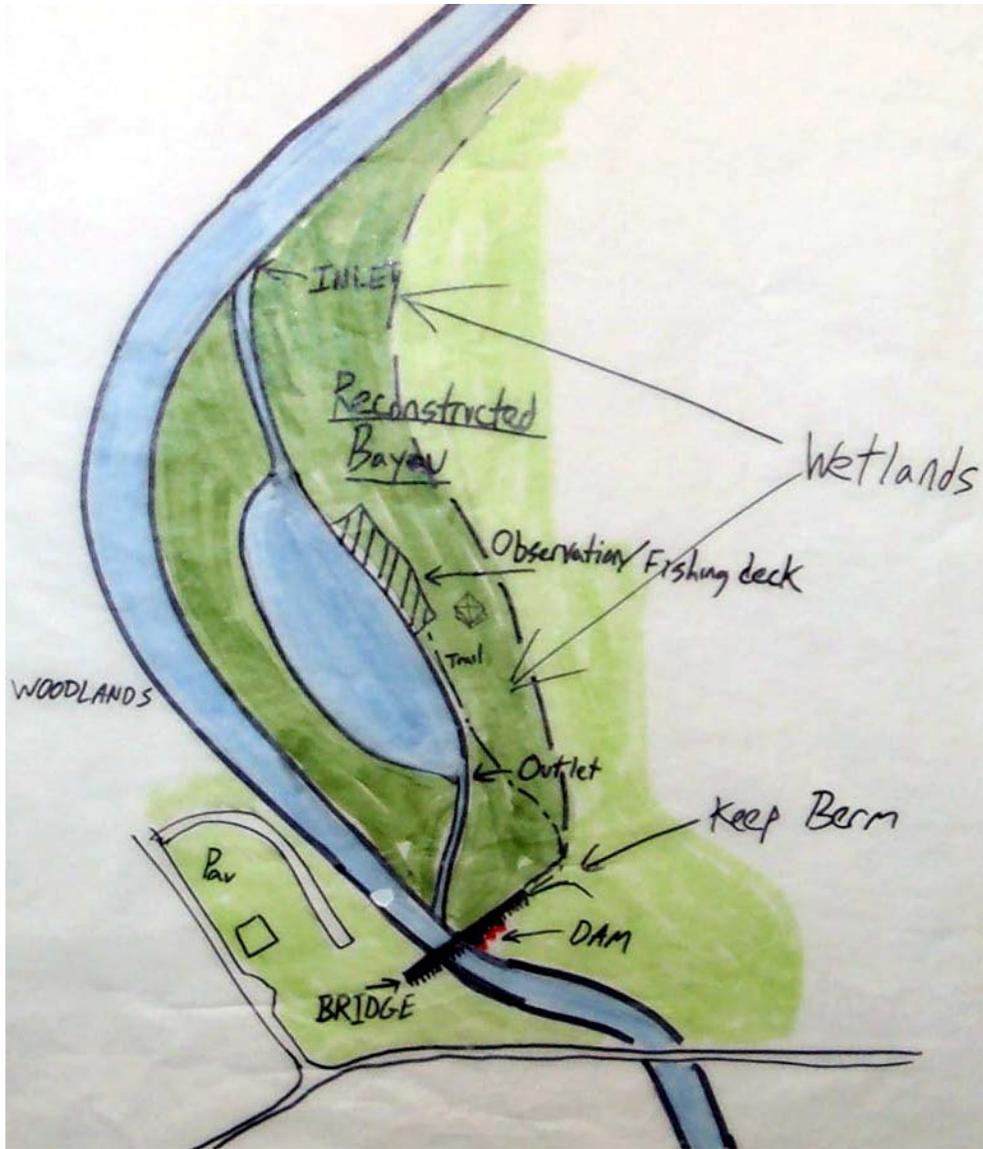


Figure 7.9. An alternative design for the impoundment based on the Figure 7.6 scenario.

Appendix A: Case Study Review

Case studies provide an opportunity to more closely approximate the cost for repair and removal. By highlighting case studies of similar dams that were removed, the costs associated with these examples can be compared to better understand the potential costs associated with options for the Shiatown. Selection for a case study was based upon similar features such as date of construction, height of the structure, purpose of the structure, and (when possible) location. The Shiatown is almost one hundred years old. Other structures of this age would have experienced similar environmental deterioration to the concrete and likely similar amount of sediment accumulation in the reservoir. The height of the structure directly affects the processes used to remove the dam, and a dam of similar height will be roughly the same cost and operation to remove. It should be noted that the cost of removal grows exponentially as the height of the structure grows. The former purpose or use of the structure is not as important as other features, but another hydropower facility will have a similar construction. Similar components of a structure might include spillways, control surfaces, powerhouse, turbine, and maybe a fish ladder. Finally location was taken into consideration when possible because another Midwestern river will have more in physically in common with the Shiatown site than rivers in different regions of the country.

The bulk of literature on small dams concentrates on dam removal. These case studies are all dam removals selected from a document produced by river restoration organizations.¹⁸⁹ This focus was important in addressing the large number of questions surrounding dam removal in addition to the lack of dam repair literature. There are examples of communities in the Lower Peninsula of Michigan that rallied to save their dams. These examples were presented by local community members and members of the Friends of the Shiawassee River. An attempt to recreate these stories would be anecdotal and further research on these communities would be necessary to report specifics surrounding the repair decision. The brief accounts that were reported to us described a mandated dam removal from an outside regulatory agency that the community united against. Such a polarization of opinion on the issues should be avoided at the Shiatown.

Case Study #1

Baraboo River- Waterworks Dam in Wisconsin

This nine foot high mill dam was built in 1848 and was owned by the City of Baraboo. The dam failed a 1994 safety inspection and the State ordered the City to repair or remove the dam. The decision for removal was made because estimates for repair ranged between 3 to 5 times the cost of removal.

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Depending upon the option, repair was estimated to cost between \$694,600 and \$1,091,500. Removal cost \$213,770 in 1998. Removal was an unpopular decision with the local community at first, but realizing the environmental and fishing benefits that could result due to removal, the city was able to gain support. The benefits include improved smallmouth bass fishery, riffle habitat restored, community revitalization, urban riverfront restoration, safety hazard eliminated, and taxpayer savings.

Case Study #2

Cannon River- Welch Dam in Minnesota

The Welch Dam was a hydropower facility built sometime in the 1890s. The structure was only nine feet high and impounded 10 acre feet of water. The dam stopped producing electricity in the early 1960s when productivity dropped below maintenance costs. The Minnesota DNR involved the general public in the decision making process. There was little opposition to removal and one of the reasons for selecting removal was the fact that it was “vastly more expensive to repair the dam than to remove it.” The cost of removal was estimated at \$120,000, but the actual cost was only \$46,000 in 1994. The dam was owned by a private citizen who transferred ownership to the DNR prior to removal. The benefits included opening 12 miles for fish migration, removed safety hazard to downstream interests, enhanced recreation opportunities & improved safety conditions for canoeists, and economic benefits as result of improved recreation.

Case Study #3

Kettle River- Sandstone Dam in Minnesota

The Sandstone Dam was built in 1908 as a hydropower facility. The dam is 20 feet high and generated power until 1963 when the cost of producing power at the site became too expensive. Four years later the power company gifted the site to the Minnesota DNR and became part of a state park. The dam was constructed from cut sandstone. The DNR involved the general public in the decision process and found that within the community there was support for a removal decision. The cost to restore the dam to hydropower production was estimated to be over one million dollars, while removal was estimated to be \$300,000. The actual cost of removal turned out to be \$208,000 in 1995. The dam was dismantled and most of the sandstone was used to stabilize the banks. Beyond the improvements to the fishery, the removal revealed a new stretch of whitewater and an eight foot waterfall. This has increased recreation opportunities for fishermen and paddlers alike in addition to the monetary savings of the removal decision.

Case Study #4

Milwaukee River- Woolen Mills Dam in Wisconsin

The 18 foot high Woolen Mills Dam was built in 1870 to power local mills. It was rebuilt in 1919 as a hydropower facility, which generated power until 1959 when it was no longer economically feasible. At this time the company transferred ownership to the City of West Bend. The structure was found to be structurally insecure in 1980, thus forcing a decision on repair or removal. The impoundment was shallow from built-up sediment and it was a public safety hazard. Despite the decreasing fishery quality, the lack of recreation opportunities, and polluted sediments, local landowners wanted to keep the structure to maintain the scenic quality of the dam. The community decided to keep the dam, but a \$3,300,000 estimate to replace the structure delayed a decision. Funds then became available through the Wisconsin DNR to remove the structure. In order to address the concern regarding how the site would look after a removal advocates took advantage of the University of Wisconsin Landscape Architecture program to create images of the restored river and new parkland. This helped make removal an acceptable option. The cost of removal was \$86,000 in 1988. The benefits included an improved fishery, 61 acres of new park land, improved water quality, return of State threatened fish, and monetary savings.

Case Study #5

Souadabscook Stream- Grist Mill Dam in Maine

The Grist Mill Dam is old. It was built in the late 1700s and is 14 feet high. Originally it powered a mill, but later was converted to a hydropower plant. The owner of the dam purchased the dam to restore power generation, but was unaware of the amount of work required to make the dam safe and restore fish passage. Estimated cost of repair was \$150,000. The Maine Department of Transportation also was putting pressure to remove or repair the dam because the bridge that went over the dam along US Route 1 would be threatened by a dam failure. The owner sold the dam to a conservation group for one dollar and the cost of removal was \$56,000 in 1998. The benefits included an improved river ecosystem and fishery, reduced flooding risk, improved site aesthetics, increased paddling recreation, and elimination of risk to transportation on US Route 1.

Case Study #6

Evans Creek- Alphonso Dam in Oregon

The Alphonso Dam was built in the 1890s for irrigation diversion. The major problems associated with this abandoned dam were sediment loading and fish passage blockage. The BLM assumed responsibility for the dam and decided to remove the defunct structure after completing an EIS to determine it would

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not further impact the stream. Repair was never considered for this structure, so no cost estimates exist. The cost of removal was \$55,000 in 1999. There have been direct benefits opening habitat for spawning salmon with the structure removed.

Appendix B: Funding Sources for Actions at the Shiatown Dam

Identification of funding sources is an important component of any decision about the future of the Shiatown Dam. The options for funding are different dependent upon the action selected. Removal provides the greatest number of options due to the ecological restoration associated with a dam removal. The major sources from money are federal, state and local governments. Any option will most likely include a portion of state money. The state of Michigan budget is suffering in the current economic downturn, which complicates the process of securing funding for the Shiatown Dam.

Funding opportunities for repair and replacement are limited. There are no federal funds available to repair or replace a small, state owned dam such as the Shiawassee. If the dam had been a federal dam or a hydropower dam regulated by the Federal Energy Regulatory Commission, there might be federal funds available for specific repairs, but this does not apply to Shiatown Dam. A special state congressional appropriation for funding is conceivable; but considering the size of the community around the Shiatown and the current strain on the state budget this is not likely, especially given the high cost of replacement. A local millage is possible if the community decides to generate funds to restore the site. Besides tax money, it might be possible to attract private foundations or investors interested in the site.

Another source for repair and removal funding would be to apply for grants or with foundations dedicated to preserving historical sites. Our research was unable to find any such foundations or grants, and it is not certain that this money would be granted for dam repair. Several communities in the state of Michigan are going through the same decision process as the Shiatown. They would like to use historical preservation money to preserve their dams.

Any option to fund a repair or replacement decision will need to secure continued economic support to provide adequate operation and maintenance of the facility. During the past thirty years at least \$12,000 a year has been spent on maintenance of the Shiatown Dam. Without this continued economic support into the future, securing funds for the repair or replacement work is pointless.

Removal does provide more funding opportunities. There are several non-profit organizations dedicated to river restoration that produce documents to assist with a dam removal. American Rivers produced a document "Paying For Dam Removal" that highlights many funding opportunities for removal and this document is intended to be updated as new opportunities are discovered. Contacting American Rivers, Trout Unlimited, The Wisconsin

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Rivers Alliance, or other river restoration organizations are a good way to start researching funding sources for removal.

The federal government offers many grant opportunities for dam removal. The majority of this federal grant money is distributed through the federal agencies associated with restoration and protection of the environment. The majority of this funding is through the United States Fish and Wildlife Service, the Environmental Protection Agency, the National Marine Fisheries Service, and the Natural Resources Conservation Service, although other agencies may have opportunities for grants depending on how the removal is carried out at the Shiatown Dam.

The federal government offers other funding options beyond grant money. The agencies mentioned can also provide funding through their general budgets or a specific congressional appropriation could be made. However, these are unlikely due to the small size of the Shiatown Dam and the community around the dam. More likely would be receiving In Kind Assistance. This would take the form of donated expertise from engineers or biologist, but has also been used to send the Marines to blow up dams as part of a training exercise. Most federal funding, grants or otherwise, are cost sharing programs that require local buy in. This makes securing local funding sources vital.

State assistance for removal is generally through the Michigan Department of Natural Resources (DNR). The DNR has two programs that of grant money that can be used for dam removal. The Michigan Natural Resources Trust Fund is granted for locations that can be improved for better recreational use while providing protection of natural resources. The Inland Fisheries Grant Program is used to improve fisheries in the state. Both of these funds have been used as part of dam removals.

It is also possible to lobby for a state congressional appropriation or generate a local millage, but the same restrictions with this option for repair and replacement exist with removal. Shiawassee County is the only other government that might be a funding source. However, buy in from Shiawassee County will most likely be on a smaller scale than other funding sources mentioned due to the scale of the county budget.

The final source to consider for funding is the private sector. Non-profit organizations can be a source of funding to meet cost sharing obligations with other funds, but because of their limited budgets it is unlikely they represent a source for a substantial portion of the removal costs. Private foundations, such as the Great Lakes Protection Fund, offer a great funding source. There

are many of these foundations that could be a funding source for parts of the removal process.

Appendix C: Flooding Capacity at the Shiatown Dam

The Shiatown Dam was built before the government began to play a regulatory role. Starting with the National Dam Safety Program in 1980 the Federal Government and the State of Michigan began to enact laws governing the capabilities of dams. The capabilities the Shiatown Dam had been constructed for in 1904 suddenly were not necessarily sufficient for the new standards created during the late 1970s and 1980s. The Shiatown Dam has to pass Michigan's Dam Safety Act (Act 300, Public Acts of 1989) to avoid a mandated alteration or removal. The Dam Safety Act regulates the necessary capabilities of a dam according to their hazard potential rating. The Shiatown Dam was rated as a significant hazard potential in 1980 and 1991 dam safety reports. Most recently, the Shiatown was downgraded to a low hazard potential rating in the 2000 safety report. To comply with the law the dam must pass sufficient flood flows for its hazard potential rating.

Michigan's Dam Safety Act mandates that a significant hazard potential rating requires the dam to be able to pass a 200-year flood event. A low hazard potential rating must pass a 100-year flood event. Flood events refer to a quantity of water capable of being generated by the watershed during storms of specific severity. It does not refer to a frequency with which to expect such a storm event. In the 1991 safety report the quantity of water expected during a 100-year and 200-year flood flow, as estimated by the DNR, is 5,000 cubic feet per second (cfs) and 5,500 cfs respectively for the Shiawassee River at the site of the Shiatown Dam.¹⁹⁰ This number was altered for the 2000 dam safety report to 5,100 cfs for the 100-year flood.¹⁹¹ The level of the 200-year flood was not listed in this safety report.

The Shiatown Dam has been rated as having sufficient spillway capacity in each safety report, but with minimal room for error. How the spillway capacity is estimated differs between the safety reports and affects the reported capabilities of the structure. The three dam safety reports each address the capacity of the principal spillway and the flow through the powerhouse, but each reports different estimates. The 1980 report lists the principal spillway capacity as 4,900 cfs with no description of how this figure was found. The flow through the powerhouse was estimated at 1,000 cfs, but they then mention that no construction plans were available and the pipes that pass this flow are submerged. So the estimated 1,000 cfs running through the powerhouse is just assumed. This means that the capacity of the Shiatown Dam ranges between 4,900 cfs and 5,900 cfs. This report classified the dam with a significant hazard potential rating requiring the dam to pass 5,500 cfs. This means the ability of the dam to meet state regulatory requirements is unknown because the capacity could be below the required 5,500 cfs.

The estimates for the Shiatown Dam continue to adjust. In 1991 the principal spillway was estimated at 5,075 cfs with no explanation as to why the spillway capacity was now estimated with an increased capacity of 175 cfs. This is below the required 5,500 cfs, which is addressed again by the flow through the powerhouse. The powerhouse was estimated at 585 cfs, which pushes the capacity above the required 200-year flood level. This report requests that the hazard level rating be reconsidered now that the reservoir is in a drawdown condition. The reservoir has been drawdown since the lake level was rescinded in 1984 and the stoplogs were removed.

In 2000 the hazard potential rating was lowered from significant to low. This reduced the required capacity of the dam from 5,500 cfs to 5,100 cfs. The higher the hazard potential rating of a dam the higher the required capacity of the spillways. The estimate in 2000 for the capacity of the primary spillway again increased and is now estimated at 5,100 cfs. Due to the uncertainty of the flow through the powerhouse, similarly addressed in the previous reports, this amount was not estimated and it was not included in the total spillway capacity. It is assumed by the reader that the hazard level has been dropped due to the drawdown reservoir and the fact that the breach in 1974 caused minimal damage, but it is not addressed in the report. Currently the dam meets state regulations, but with zero freeboard (space between the top of the water and the top of the dam during a flood event) and no capability to address anything beyond the 100-year flood.

All of the safety reports recommended the possibility of increasing flood capacity either through an auxiliary spillway or altering the powerhouse. This is due to the small margin of error existent at the Shiatown Dam. Flood events have come close to overtopping the dam in 1947, 1954, 1981, and 2001 and caused the dam to breach when the water did overtop the dam in 1974. Any future plans for the structure must address the flood flow capacity of the structure and alter the structure to allow flood flows to pass through the structure. A popular misconception found through our survey and focus groups is that the dam provides flood control benefits. On the contrary the dam provides no flood control benefits and represents a significant flood hazard due to the limited capacity of the dam to pass flood flows.

Appendix D: Legal Issues at the Shiatown Dam

Dams are a focal point for possible accidents due to failure of the dam or drowning at the site. When such an accident occurs, all of which have occurred at the Shiatown, the question of liability must be addressed. The state of Michigan has dam safety requirements established through the State Dam Safety Board. If the dam is operated according to these requirements and the dam fails, the assumption is that there is nothing more the owner could have done to prevent the failure and therefore has no liability for downstream damages.

Any state regulations regarding operation of a dam that would limit liability due to accidental drowning at the site are unknown. Actions taken by the DNR, such as posting warning signs and restricting access through fencing, presumably reduce or limit liability from drowning accidents. This would be dependent upon the specific conditions of the accident.

The final legal assumption made is that the county has no legal liability in the event of a failure at the Shiatown Dam due to the fact that they do not have any part in the ownership or management of the facility. Liability resulting from drowning would again be specific to the incident, but it is doubtful that responsibility could be placed on the county for a facility that it does not own. The only reason the thought is presented here is because the county park does border the impoundment and the river downstream. The county maintains canoe ramps and the park is generally an access point to the river and the reservoir.

Notes and References

CHAPTER ONE

- ¹ Michigan Water Resources Commission. 1963. Water Resources Conditions and Uses in the Shiawassee River Basin. Lansing, MI: Michigan Water Resources Commission.
- ² 1980 National Dam Safety Program Inspection Report, U.S. Army Corps of Engineers, submitted to DEQ Dam Safety Board and 1991 Dam Safety Inspection Report, Gary F. Croskey, P.E., submitted to DEQ Dam Safety Board
- ³ This was calculated from a 1998 aerial photograph, before the removal of the debris that had accumulated behind the structure and the stoplogs. The current area of the pond is likely to be even lower.
- ⁴ Michigan Barriers Shapefile from Mark Mackay.
- ⁵ Rick Cleveland, Superintendent of Shiawassee County Facilities and Parks Department (personal communication) February 17, 2003.
- ⁶ Shiawassee County Historical Webpage www.angelfire.com/mi2/shiawassee/class/images/parks.jpg October, 2002
- ⁷ Cromwell, Clarence. *Five Communities Spared Disaster*. Argus Press October, 2001
- ⁸ Ernst, Jerry. *Shiatown Dam fears recede, Shiawassee River above flood stage; officials keep eye on waters*. The Flint Journal. February 14, 2001.
- ⁹ 1264 square miles, based on DEQ 1998 watershed boundary (metadata: http://www.dnr.state.mi.us/spatialdatalibrary/metadata/watershed24k_metadata.htm), calculated 1/16/03; other estimates range from 1100-1300 square miles.
- ¹⁰ There are multiple ways to define the Shiawassee watershed; The Nature Conservancy does not include the Bad River's drainage area in its Shiawassee project boundary. Some MI DNR and DEQ maps have excluded the narrow arm that runs between the Cass and Flint Rivers. For purposes of this project, we're using the basin as delineated by the DEQ and USGS.
- ¹¹ Michigan Water Resources Commission. 1963. Water Resources Conditions and Uses in the Shiawassee River Basin. Lansing, MI: Michigan Water Resources Commission.
- ¹² Seelbach P.W., M.J. Wiley, J.C. Kotanchik, and M.E. Baker. 1997. A landscape-based ecological classification system for river valley segments in Lower Michigan. (MI-VSEC Version 1.0). Michigan Department of Natural Resources, Fisheries Division, Fisheries Research Report 2036. Ann Arbor, Michigan.
- ¹³ 1999 Staff Report Surface Water Quality Division, MDEQ, Biological Assessment of the Shiawassee River and Selected Tributaries
- ¹⁴ undated fish survey data from DNR 1986
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- ¹⁶ Vegetation of Michigan circa 1800 map.
- ¹⁷ *History of Shiawassee and Clinton Counties, Michigan, with illustrations and biographical sketches of their prominent men and pioneers*. D.W. Ensign & Co. Philadelphia. 1880. 541 pages.
- ¹⁸ Han, Lila. *Echoes of Yesteryears: a brief history of Shiawassee County*. 1996. Shiawassee County Historical Society.
- ¹⁹ *History of Shiawassee and Clinton Counties, Michigan* 1880
- ²⁰ Ibid
- ²¹ Ernst, Jerry. *Little Town Briefly Flirted with Fame Before End*. The Flint Journal. December 27, 1996
- ²² The definition of ghost town is they used to have a post office, now they don't. "Shiawassee County Ghost Towns" <http://www.angelfire.com/pop/1954/ghost.htm> [accessed February 12, 2003].
- ²³ Ernst, Jerry. *Little Town Briefly Flirted with Fame Before End*. The Flint Journal. December 27, 1996.
- ²⁴ Bedford, 1999
- ²⁵ Dennis, Jerry, and Craig Date. 2001. *Canoeing Michigan Rivers: A Comprehensive Guide to 45 Rivers*. Friede Publications, Michigan, USA.
- ²⁶ Personal communication, Debbie Cheff, January 27, 2003.
- ²⁷ ASCE. Guidelines for Retirement of Dams and Hydroelectric Facilities. 1997.
- ²⁸ 2000 Dam Safety Inspection Report, Paul T. Wessel, P.E., MDEQ Dam Safety Program
- ²⁹ 1991 Dam Safety Inspection Report, Gary F. Croskey, P.E., submitted to DEQ Dam Safety Board

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- ³⁰ 2000 Dam Safety Inspection Report, Paul T. Wessel, P.E., MDEQ Dam Safety Program
- ³¹ 1991 Dam Safety Inspection Report, Gary F. Croskey, P.E., submitted to DEQ Dam Safety Board
- ³² U.S. Department of Labor, Consumer Price Index, All Urban Consumers, Midwest Urban, All Items, Annual Figure <http://data.bls.gov/cgi-bin/dsrv>, 4/11/03
- ³³ 1991 Dam Safety Inspection Report, Gary F. Croskey, P.E., submitted to DEQ Dam Safety Board
- ³⁴ Ibid
- ³⁵ October 8, 1974 through May 24, 1984 from the county commissioners' meeting minutes from the date given. The information was provided by the county clerk.
- ³⁶ Invoice from Holzhausen Farms to Shiawassee County
- ³⁷ Leopold, L. B. 1994. *A View of the River*. Cambridge, Mass: Harvard University Press.
- ³⁸ Heinz Center Report (2002)
- ³⁹ Michigan Department of Community Health, 2002 Michigan Family Fish Consumption Guide http://www.michigan.gov/documents/Fishing_Advisory_2002_26575_7.pdf
- ⁴⁰ Sunny Krajcovic, personal communication, December 2002
- ⁴¹ personal communication, Erin Gatzke, Shiawassee County Health Department 10/21/02
- ⁴² This fund distributes oil and gas leasing revenue. For scale: The Nature Conservancy received \$17-18 million from them this year.
- ⁴³ Focus group participants suggested these ideas.
- ⁴⁴ Michigan DNR 1995
- ⁴⁵ personal communication, Bernie Butcher, 2002.
- ⁴⁶ If all the activities reported are added up by the most conservative frequency (i.e., each time a respondent checked "fishing, 3-5 times/year," that was calculated as 3 visits) the grand total is 3,065 visits, or 8 visits per day throughout the year. This may be a high estimate since one visit may include multiple activities. This could also be a low overall estimate since this number reflects only survey respondents and does not extrapolate for the entire county population.
- ⁴⁷ All data from U.S. Census Bureau, 1990 and 2000 census.
- ⁴⁸ Energy Information Administration, US Department of Energy. 2001. *Electric Power Annual 2000*, Volume 1. <http://www.eia.doe.gov/cneaf/electricity/epav1/epav1.pdf>
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- ⁵⁰ Michigan DNR, Fisheries Division. Final Environmental Assessment. AuSable River –Grayling Millpond Dam Modifications. February, 2002.
- ⁵¹ Trout Unlimited, *Small Dam Removal: A Review of Potential Economic Benefits*, October 2001
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CHAPTER TWO

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¹⁸¹ Six hundred three surveys were returned from an effective sample of 1,403.

¹⁸² Positive results are the sum of results for “strongly positive” and “positive”.

¹⁸³ For mean age comparison, $p=0.7$; for level of education, $p=0.08$; for time lived in the county, $p=0.3$; for live on the river or not, $p=0.05$. A p value of less than 0.05 is statistically significant.

¹⁸⁴ Regular use means at least 3 times a year

¹⁸⁵ Fishing, $p=0.02$; socializing, $p=0.03$

¹⁸⁶ $p=0.0003$

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