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Pucker Street Dam Removal and Dowagiac River Restoration

Environmental Assessment

Berrien County, Michigan

U.S. Fish and Wildlife Service

Green Bay Fish and Wildlife Conservation Office

6644 Turner Road

Elmira, MI 49730

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List of Abbreviations and Acronyms

BMP	Best Management Practices
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
CISMA	Cooperative Invasive Species Management Area
CWA	Clean Water Act of 1972
CY	Cubic Yard
DO	Dissolved Oxygen
DOR	Depth of Refusal
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
ESA	Endangered Species Act of 1973
IACWD	Interagency Advisory Committee on Water Data
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MNFI	Michigan Natural Features Inventory
msl	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NREPA	Natural Resources and Environmental Protection Act
NRHP	National Register of Historic Places
PCB	Polychlorinated Biphenyl
ppb	Parts Per Billion
RCRA	Resource Conservation and Recovery Act
SHPO	State Historic Preservation Office
USC	United States Code
USCB	U.S. Census Bureau
UCL	Upper Confidence Limits
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey

1 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 Background and Project Setting

The Pucker Street Dam is located on the Dowagiac River in Niles Township, Berrien County, Michigan (Figure 1-1). The City of Niles (City) owns, operates and maintains the Pucker Street Dam. The existing hydroelectric dam was constructed in 1928 and had generated power up until 1995. However, in 1996 the City announced that the generators were no longer operational after silt and sand had caused major damage to the turbines. Other factors contributing to the decision to abandon the hydropower operations of the dam included excessively high maintenance costs and sedimentation within the reservoir immediately upstream of the dam. Structural issues also created safety concerns at the dam and downstream, which prompted the City to permanently drawdown the dam in 1999 and thereby diminish the safety issue.

The Pucker Street Dam consists of a short left earthen embankment, a gated concrete principal spillway, a powerhouse section, a concrete and earth fill needle section, an abandoned millrace/spillway and a short right earthen embankment (Figure 1-2). The dam is about 100 feet long and has a structural height of 38 feet. The abandoned spillway consists of two approximately 12-foot wide gated concrete spillway bays and a severely deteriorated concrete-lined channel. The powerhouse has a concrete substructure and a brick masonry superstructure and is 28 feet wide along the axis of the dam.

A “legacy” log dam was built in 1828 approximately 100 feet upstream of the existing Pucker Street Dam. The legacy dam was constructed to power a mill and consisted of a timber dam and fish ladder. The top of the dam was built to elevation 679.7 feet; however, no information is available regarding the current state of the legacy dam under the sediments.

1.2 National Environmental Policy Act

The National Environmental Policy Act ([NEPA], 42 United States Code [USC] § 4321-4347) is a federal law that establishes a national environmental policy and provides a framework for planning and decision making by federal agencies. Specifically, NEPA requires that federal agencies integrate an interdisciplinary environmental review process that evaluates a range of alternatives, including the No Action alternative, as part of the decision-making process. This process also establishes a need to include interagency coordination and public participation in the process. In summary, NEPA is intended to promote informed decision making by federal governmental agencies and public participation in the process, as appropriate. Because federal funds administered by the Department of Interior are anticipated for use in the removal of Pucker Street Dam, the United States Fish and Wildlife Service (USFWS) is the lead federal agency for this proposed action.

1.3 Proposed Action

The proposed action considered in this Environmental Assessment (EA) is to remove the Pucker Street Dam and promote the restoration of the Dowagiac River channel and floodplain. The Pucker Street Dam on the Dowagiac River is an aging structure that represents a safety concern and is having an adverse impact on the ecosystem of the project area. The proposed action would increase habitat continuity and restore the hydrologic regime of the Dowagiac River. At Pucker Street Dam, it is estimated that the restored river channel would be approximately 7,000 linear feet, with total functional benefits (e.g., flow and sediment transport processes upstream of the dam location) to at least 10,000 linear feet of river.

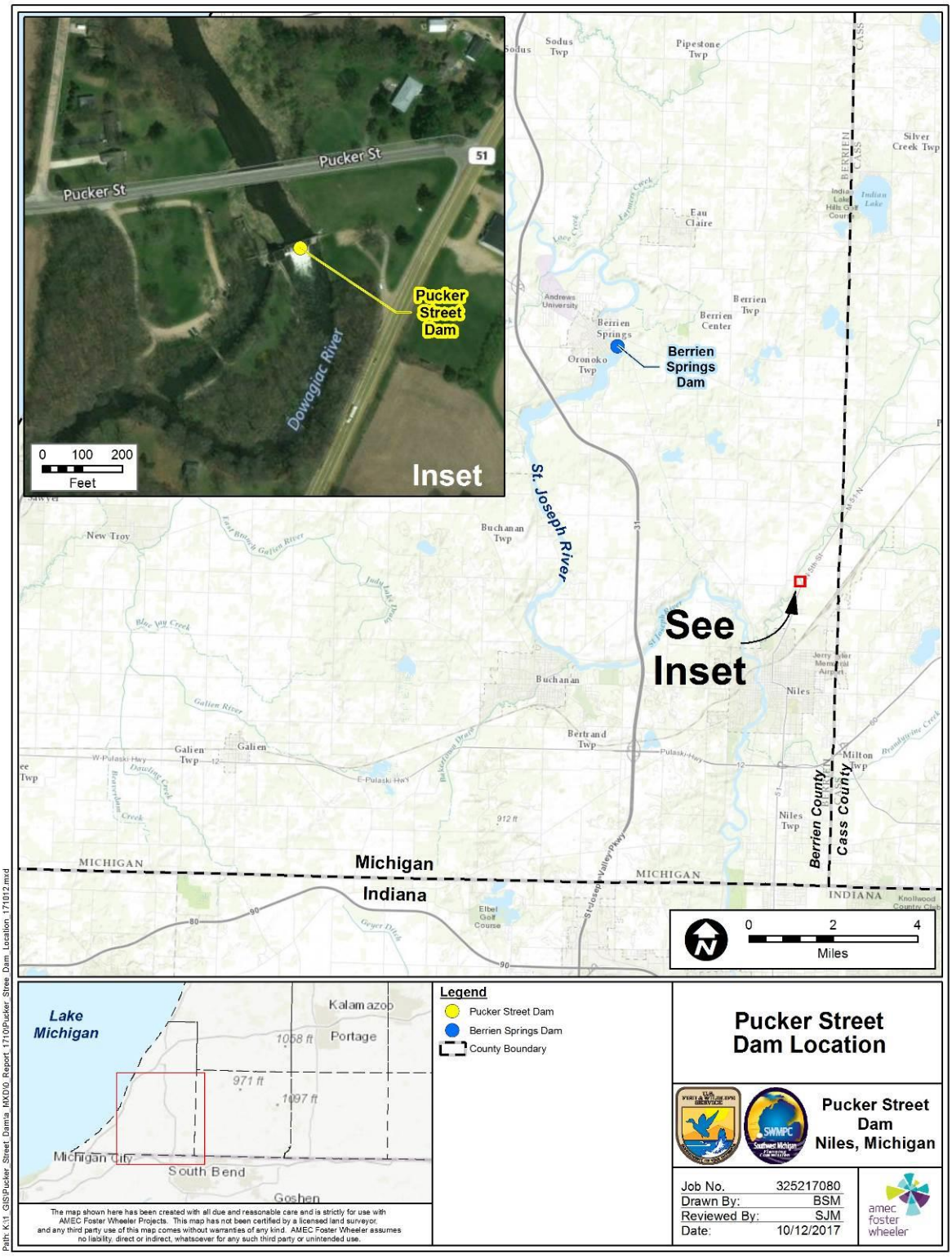


Figure 1-1. Pucker Street Dam Location

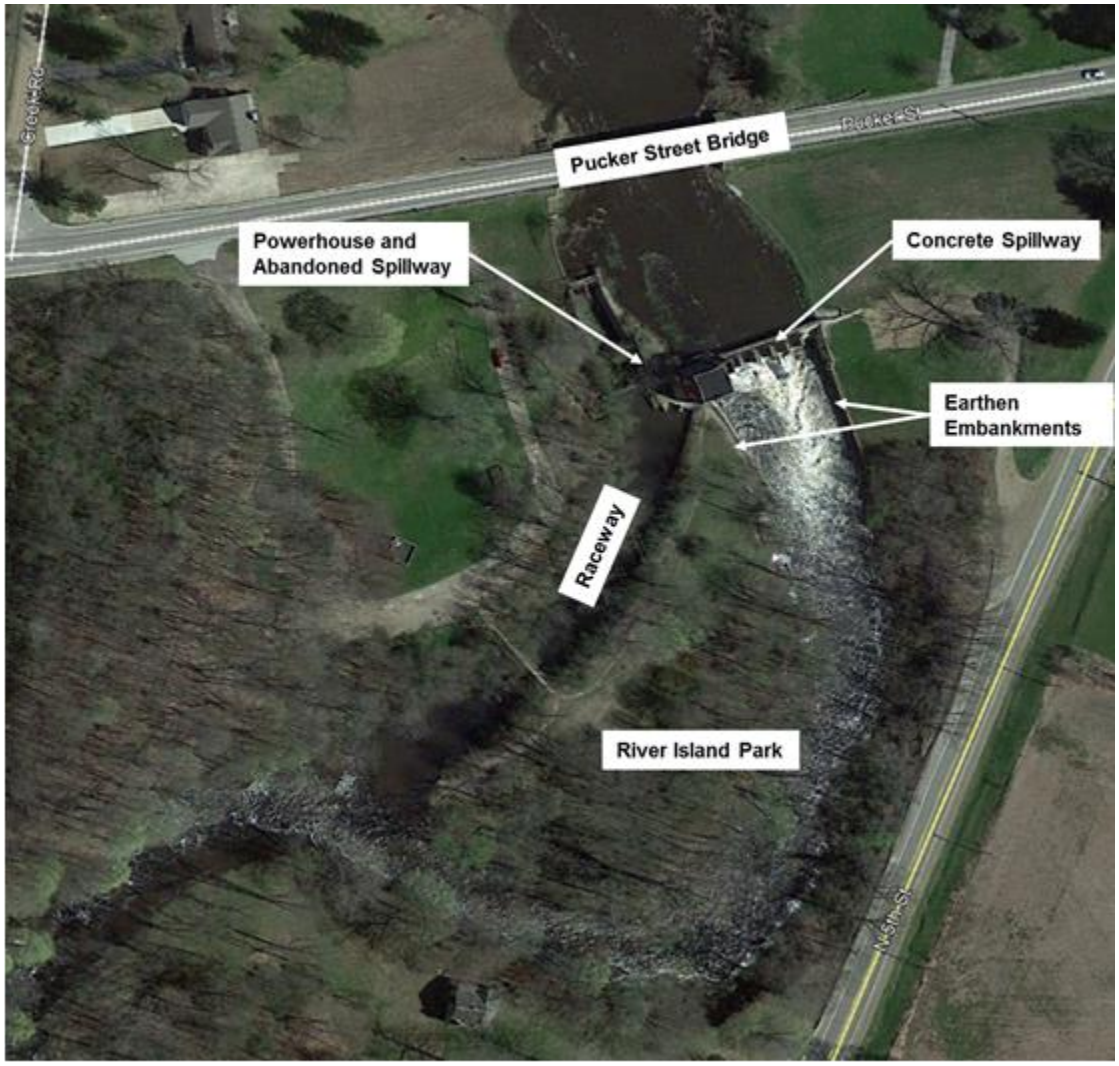


Figure 1-2. Pucker Street Dam Elements

1.4 Purpose and Need of the Proposed Action

The purpose of the proposed action is to promote and enhance fish passage as an overall benefit to the river system. This primary purpose is coupled with other secondary objectives, including increased habitat continuity, restoring the hydrologic regime of the Dowagiac River, and addressing the Pucker Street Dam stability and safety issues.

Several key issues contribute to the need for the removal of the Pucker Street Dam. These needs include those regarding the negative effects of the dam and associated impoundment on the local ecosystem, and the opportunities for ecosystem restoration of the Dowagiac River, and the age and current condition of the dam.

1.4.1 Ecosystem Degradation

Barrier to Fish Passage. The Pucker Street Dam is the only main stem barrier blocking all fish and aquatic species passage on the Dowagiac River. The three miles of river downstream of the dam have naturally reproducing populations of steelhead, coho, and Chinook salmon that are supplemented by stray fish from stocking in the St. Joseph River. Above the dam, the fish species composition consists primarily of non-game species such as redhorses, suckers, and shiners, with low densities of wild game fish species such as smallmouth bass and bluegills. MDNR annually stocks brown trout upstream and downstream of the dam. The dam currently blocks the upstream migrations of fish species such as steelhead, Chinook salmon, coho salmon, shorthead redhorse, and walleye to more than 159 miles of main stem and tributary habitat in the Dowagiac River. The proposed action would increase habitat contiguity and restore the thermal and hydrologic regime of the Dowagiac River.

Habitat Fragmentation: The Pucker Street Dam is located approximately 3-miles upstream from the confluence with the St. Joseph River. As such, it disconnects approximately 98 percent of the Dowagiac River system (main stem and all tributaries) from the lower Dowagiac and St. Joseph River. Three additional dams located on tributaries of the Dowagiac River include the Lower Mill Pond Dam and Upper Mill Pond Dam (Dowagiac Creek) and the Barron Lake Road Dam (McKinzie Creek) (Figure 1-3). Discounting the effect of these dams, the Pucker Street Dam disconnects 187 miles of streams and approximately 20,000 acres of wetlands within the Dowagiac River Watershed from the St. Joseph River.

Riverine Functions: Nutrients, water, sediment, and organic material are all transported downstream within a river corridor. The Pucker Street Dam creates discontinuity in the movement of these materials that negatively impacts the natural function of the system. Pucker Street Dam impedes the downstream movement of all material including nutrients, sediment and organic material that support fish and other aquatic species.

Hydrology and Geomorphology: The Pucker Street Dam alters hydrologic and geomorphic characteristics of the Dowagiac River several miles upstream and downstream. The dam currently maintains 15 feet of head and 9 feet of freeboard and forms an impoundment with a surface area of 49 acres under normal flow conditions. The Pucker Street Dam impoundment was drawn down in 1999, reducing but not eliminating the pool created by the dam. As such the impoundment area continues to promote sedimentation upstream of the dam that disrupts normal geomorphic processes, water flow, and stream geomorphology.

1.4.2 High Quality River System

The Dowagiac River is a coldwater river system that is uncommon in the region. The Pucker Street Dam is located at a transition along the Dowagiac River from a flatter upstream gradient to steeper gradients leading into the St. Joseph River Valley (Figure 1-4). Due to the history of glaciation in Michigan, high gradient coldwater streams are rare within the region. Within southern Michigan, there is no comparable coldwater river system of this size that has the capacity to support a high quality coldwater fishery. Removal of the Pucker Street Dam would restore approximately 2 miles of this high gradient habitat.

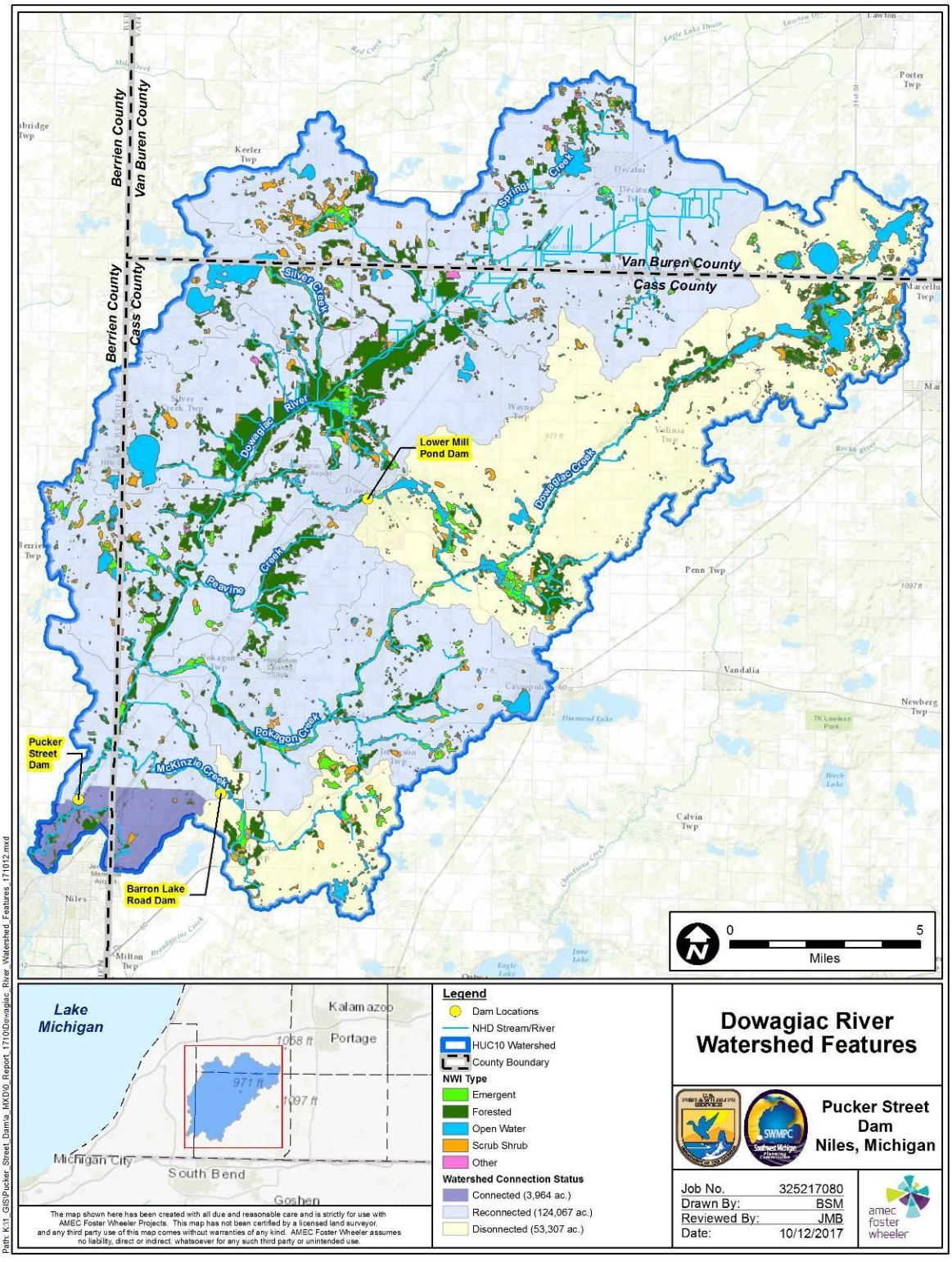


Figure 1-3. Features of the Dowagiac River Watershed

The land use in this watershed is largely dominated by agricultural uses, with urban development more concentrated towards the south. The Dowagiac River was previously dredged and straightened which resulted in extensive degradation of the habitat above the dam. A movement has gained momentum in the past decade, and even more so recently, to restore the Dowagiac system, undoing the comprehensive dredging and straightening projects of the early 20th century. Project partners completed a significant channel restoration and floodplain reconnection project (3/4 mile) upstream of Pucker Street Dam at Arthur Dodd Memorial Park in Cass County. Further, the Pokagon Band of Potawatomi Indians is in final design for a project to re-meander and reconnect an additional three miles of the Dowagiac River upstream from the Pucker Street Dam and Dodd Park. Removing the Pucker Street Dam is a critical component for restoration of the Dowagiac River system. The removal of the dam, along with the re-meandering of the river, would enhance aquatic ecosystem restoration objectives for the Dowagiac River.

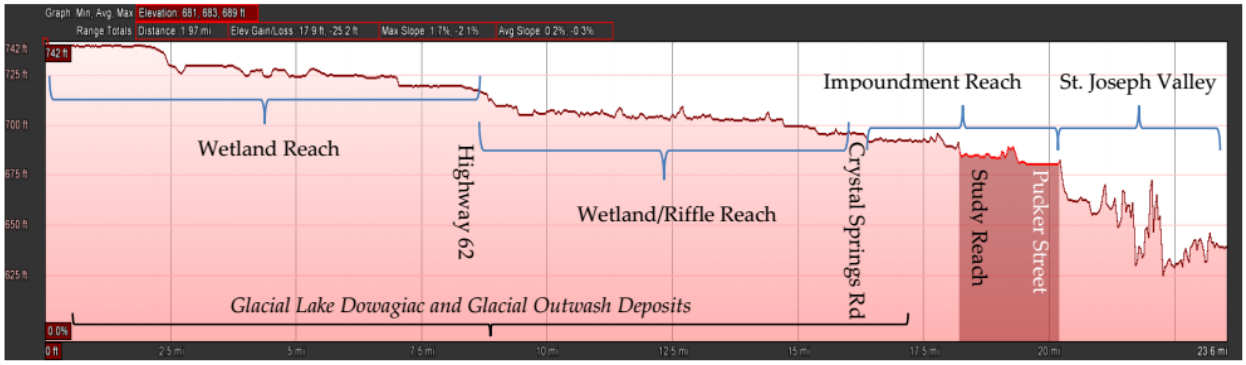


Figure 1-4. Longitudinal Profile of the Dowagiac River

1.4.3 Dam Age and Condition

The existing Pucker Street concrete dam, wing walls and powerhouse were built in 1928. In 1828, Eli Ford built the log dam and grist mill at this site. In 1891, Bascom Parker, Sr, bought the mill (known as the old Yellow Mill) and dismantled the grist mill to establish a private power plant. In 1894, the City purchased the log dam and 17 acres from the Niles Electric Company. The last major modifications and improvements to the dam were made in 1928 when the concrete dam was built and the generators were converted from horizontal water wheels to a turbine type drive system with an automatic control and switching equipment. The dam produced power from the late 1800's until 1995.

Various repairs to the existing concrete structure have been completed over the years, including repairs to the principal spillway structure in 1939. In 1949, the foundation of the log structure collapsed underneath the west wing wall. The City had a very difficult time repairing it and substantially modified the timber structure with large amounts of concrete. The City installed steel sheet piling along the right auxiliary spillway abutment in the vicinity of the previous timber-crib structure. In 1951, the left downstream abutment wall failed and was reconstructed. In 1996, the City filled a void underneath the spillway apron with concrete.

The City announced in 1996 that the generators were no longer operational after silt and sand had caused major damage to the turbines. In accordance with permitting by the Michigan

Department of Natural Resources (MDNR), the City reduced the pool elevation by 5 feet, to 680 feet above mean sea level (msl).

A series of structural problems associated with the dam have been reported in 1931, 1944, 1996 and 2008. A 2009 Dam Safety Inspection Report by Collins Engineers, Inc. classified the dam as a significant hazard. This report cites problems with the principal spillway structure, tainter gates, embankments, overflow spillway and powerhouse foundation. A 2013 letter from the Michigan Department of Environmental Quality (MDEQ) Dam Safety Program was sent to the City with results from an inspection to evaluate the dam's structural condition and hydraulic capacity as required by Part 315 Dam Safety, of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 45 as amended. MDEQ determined that the principal spillway structure and downstream concrete channel, powerhouse structure, tainter gates and auxiliary spillway were all in extremely poor condition. Significant cracking, spalling, delamination, and efflorescence were found throughout the structural concrete. Vegetation had begun to grow from many cracks in the abutment walls, overflow spillways, and spillway bay piers. MDEQ also indicated that major repairs would not be necessary if the dam was removed within five years, and that monitoring should continue coupled with intermediate repairs as necessary to prevent dam failure. MDEQ also indicated that if the dam was in place beyond five years from the date of inspection, major repairs, replacement, or removal of the structure should be implemented. In accordance with these recommendations, the City continues to monitor the dam and make minor repairs as needed.

1.5 Decision to Be Made

This EA has been prepared to inform USFWS decision makers and the public about the environmental consequences of the proposed action. The decision USFWS must make is whether or not to deconstruct the Pucker Street Dam and undertake sediment management activities. USFWS will use this EA to support the decision-making process and to determine whether an Environmental Impact Statement (EIS) should be prepared or whether a Finding of No Significant Impact may be issued.

1.6 Scope of the Environmental Assessment and Summary of the Proposed Action

This EA evaluates the potential environmental, cultural, and socioeconomic impacts of the proposed action at the Pucker Street Dam on the Dowagiac River. A detailed description of the proposed action and alternatives considered are provided in Chapter 2.

USFWS prepared this EA to comply with NEPA and regulations promulgated by the Council on Environmental Quality (CEQ), and USFWS's procedures for implementing NEPA. USFWS considered the possible environmental effects of the proposed action and determined that potential effects to the environmental resources listed below were relevant to the decision to be made; therefore, potential impacts on the following resources were assessed in detail in this EA:

- Geology and Soils
- Hydrology and Floodplains
- Sediment Transport
- Water Quality
- Aquatic Ecology
- Terrestrial Ecology
- Sensitive Species
- Invasive Species
- Wetlands
- Socioeconomics and Environmental Justice
- Parks and Recreation
- Cultural and Historic Resources
- Solid Waste and Hazardous Waste
- Visual Resources
- Air Quality

USFWS also considered potential effects related to climate change, noise, land use, groundwater, prime farmland, transportation, wild and scenic rivers, and coastal zones. As described below, these resources were considered but eliminated from detailed analysis.

- *Climate Change.* The proposed project would not result in impacts to the climate. The air quality section identifies impacts of temporary emissions during construction and operation.

- *Noise*. The proposed activities include the short-term use of small-scale construction equipment at locations that are distant from sensitive receptors (residences, churches, etc.). As such, operational noise emissions would attenuate to low levels so as to not be disruptive or impactful. Therefore, no impacts from noise would occur from the proposed project.

- *Land Use*. No significant development or change in current land use is proposed. Removal of the Pucker Street Dam would locally result in the alteration of land use from a deteriorating industrial use to open space. Additionally, river restoration activities would not change land use. As such changes in land use would be entirely beneficial and would not adversely impact any other uses in the project area.

- *Groundwater*. The project area is located in a river valley and would not include any below ground disturbance that would impact groundwater resources.

- *Prime Farmland*. The project area is located entirely within the Dowagiac River valley and lacks prime farmland resources. Therefore, there would be no impact to prime farmland.

- *Wild and Scenic Rivers*. The Dowagiac River is not part of the National Wild and Scenic River System and is not included in Michigan's Natural Rivers Inventory (MDNR 2017). Therefore, there would be no impact to wild and scenic rivers.

- *Coastal Zones*. The project area is not included within designated coastal zones of Lake Michigan. Therefore, there would be no impact to coastal zones.

- *Transportation*. The local transportation network in the vicinity of the project area consists of state Highway 51 along with county and local roads that serve the local residents and communities. Use of the local transportation network is expected to occur in support of movement of workers and for disposal of solid and hazardous wastes in conjunction with dam demolition. However, this magnitude of project related traffic is negligible and is expected to be absorbed by the capacity of the existing transportation network. No impacts are therefore expected on the transportation network.

  Pucker Street crosses the Dowagiac River immediately upstream of the dam and is scheduled for some repairs in the future. As such, these activities are included in the assessment of cumulative effects on other environmental resources.

USFWS's action would satisfy the requirements of Executive Order (EO) 11988 (Floodplain Management), EO 11990 (Protection of Wetlands), EO 12898 (Environmental Justice),

EO 13112 (Invasive Species), and applicable laws including the National Historic Preservation Act, Endangered Species Act (ESA), Clean Water Act (CWA), and Clean Air Act (CAA).

1.7 Public and Agency Involvement

Public involvement and coordination with local, Tribal, state, and federal resource management agencies is a vital component of the NEPA process. The USFWS and the City have engaged the public in a variety of ways during the development of this EA. There is an "interagency" project team that has met periodically as needed since 2013 and during the preparation of this EA. Agencies and organizations that have participated in the planning process have included but are not limited to the following:

- USFWS
- City of Niles
- Berrien County Road Commission
- Pokagon Band of Potawatomi Indians
- MDNR, Fisheries Division
- MDEQ
- Southwest Michigan Planning Commission
- Wightman & Associates
- Inter-Fluve Inc.
- Wightman Environmental
- SME

This working group provided input on the regulatory requirements, environmental resources, and overall direction of the project. Many of these agency representatives were also available at the various public meetings held for the project to answer questions regarding agency involvement and authorizations for the project.

The City hosted landowner/stakeholder meetings in 2014, 2015, and 2018. The USFWS and the City also hosted a public scoping meeting for the EA process on April 14, 2016, which had 52 people in attendance. For these meetings, the City mailed letters to landowners in the project area and placed advertisements in the area newspapers. Presentations were given to communicate the project purpose and need, environmental setting and key project features, project alternatives under consideration, and elements of the NEPA process. Comments were received at the meeting and subsequently by mail and e-mail throughout preparation of the EA. A summary of the scoping meeting and public comments received is included in Appendix A. Key topics raised by respondents included those focused on the potential benefits of the proposed action regarding its restoration of environmental habitats and processes, recreational benefits (canoeing/kayaking), the openness of the public process, and the alternatives under consideration (active restoration, the availability of alternatives, and consideration of sediment management measures). Negative comments pertained to concerns about negative impacts on the higher quality downstream fishery (especially sediment covering habitat or fish kills), negative economic impact to Niles and surrounding areas due to loss of fishing potential, negative impact on brown trout populations upstream of the dam location due to competition from steelhead, loss of opportunities for hydropower, the failure to sufficiently engage the public in the process, a whitewater park not being constructed, and that the schedule for dam removal was not fast enough.

Correspondence was also conducted with representative agencies to solicit input to the NEPA planning process. Agency correspondence is provided in Appendix B. Responses were obtained from the MDNR, MDEQ, Pokagon Band of Potawatomi Indians, and the Berrien

Conservation District. No issues were raised by the agencies, and they were in support of the removal efforts.

This Draft EA has been made available for public review and comment for a period of 30 days that concludes on January 7, 2019 Distribution of the Draft EA includes making hard copies available for public inspection and review at a number of public facilities:

- Niles City Hall, 333 N. 2nd Street, Niles MI 49120
- Niles District Library, 620 E. Main Street, Niles, MI 49120
- Niles Charter Township Hall, 320 Bell Road, Niles, MI 49120
- Berrien County Community Development, 701 Main Street, St. Joseph, MI 49085
- Cass County Parks and Recreation, 120 N. Broadway, Suite 209, Cassopolis, MI 49031
- Berrien County Parks Department, 701 Main Street, 4th Floor, St. Joseph, MI 49085
- Southwest Michigan Planning Commission, 376 W. Main Street Suite 130, Benton Harbor, MI 49022;
- Pokagon Band of Potawatomi, Department of Natural Resources, 32142 Edwards Street, Dowagiac, MI 49047; and
- U.S. Fish and Wildlife Service, Elmira Field Office, 6644 Turner Road, Elmira, MI.

The document is also available on the Pucker Street Dam Project website, www.swmpc.org/puckerstdam.asp.

The availability of this Draft EA was announced by issuance of a press release. News releases were issued in four newspapers (Niles Daily Star, South Bend Tribune, Herald Palladium, and Chicago Tribune) and two websites (MLive and City of Niles).

Written comments must be submitted by January 7, 2019 to:

Ms. Marcy Hamilton
Southwest Michigan Planning Commission
376 W. Main St, Suite 130
Benton Harbor, MI 49022
Email: hamiltonm@swmpc.org

1.8 Tribal Coordination

The USFWS, the City and the Southwest Michigan Planning Commission have coordinated with the Pokagon Band of Potawatomi Indians throughout the planning process. The Pokagon Band is the most proximate federally recognized Indian Tribe to the project area and is one of five federally recognized 1836 Treaty tribes with adjudicated treaty rights in the project area. The Pokagon Band has participated in some meetings throughout the planning process. Formal correspondence with the Pokagon Band has also been conducted to solicit input to the NEPA process (Appendix B). The Pokagon Band will continue to receive updates through the project period.

Further, as described in Section 3.15 (Cumulative Effects), the Pokagon Band is currently working to restore several miles of the Dowagiac River upstream from the dam site. The dam removal would complement their efforts and result in a significantly improved river system.

1.9 Necessary Permits or Licenses

A number of permits and other authorizations must be obtained to implement the action under consideration. The primary permitting action that governs dam removal is specified by Part 315

of the Michigan Natural Resources Environmental Protection Act and is administered by the MDEQ. After the permit application is submitted and reviewed, a hydraulic review may be requested as it relates to floodplain hydraulic engineering analyses if deemed necessary by the MDEQ. Additional permitting is expected in accordance with Soil Erosion and Sedimentation Control (Part 91) in support of the final drawdown/dam removal and associated ecosystem restoration activities.

Section 106 Historic Review requirements have been met and a determination of no adverse effect on historic properties was issued (see Appendix B for documentation). The USFWS Sea Lamprey Program has issued a letter of concurrence for the dam removal stating that the Berrien Springs Dam on the St. Joseph River blocks sea lamprey migration (see Appendix B for documentation.)

The permits/approvals that may be required for the removal of the dam and ecosystem restoration are listed in Table 1-1.

Table 1-1. Authorizations Required for Pucker Street Dam Removal and Ecosystem Restoration Activities

Agency	Authority	Requirement	Activity Covered
MDEQ	Natural Resources Environmental Protection Act	Part 301	Activities in inland lakes and streams, fill placement/stream alteration
MDEQ	Natural Resources Environmental Protection Act	Part 303	Dredge/fill activities in wetlands
MDEQ	Federal Clean Water Act 33 Code of Federal Regulations (CFR) 330	Section 401 Section 404	Fill activities in “waters of the State”
Michigan State Historic Preservation Office	National Historic Preservation Office	Section 106	Consultation and clearance regarding potential effect to historic properties
U.S. Army Corps of Engineers	Federal Clean Water Act 33 CFR 330	Section 404	Cooperative Consultation with MDEQ on Section 404/401 permitting actions
Berrien County Drain Commissioner	Part 91, Soil Erosion and Sedimentation Control (NREPA 1994 PA 451)	Soil Erosion and Sedimentation Control (Part 91)	Soil erosion and sedimentation control during demolition activities
Niles Charter Township	Niles Charter Township Zoning Ordinance	Demolition Permit	Removal/demolition of Pucker Street Dam and associated structures

2 ALTERNATIVES

2.1 Description of Dam, Associated Structures and Existing Conditions

2.1.1 Existing Condition of Dam and Structures

The Pucker Street Dam (referred to as “Niles Dam” by the MDEQ ID No. 537, Berrien County) has been rated as a dam having a significant hazard potential. It is located on the Dowagiac River approximately 2 miles upstream of the City, Michigan and 3 miles upstream of the confluence of the St. Joseph River. The dam is regulated under Part 315, Dam Safety, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), Sections 31501 through 31529. Information provided in this section is derived from the Dam Safety Inspection Report for the Niles Dam (Trumble 2013). The MDEQ Inspection Report states that the dam is in poor condition overall and will require several remedial actions if it is to remain in place beyond five years from 2013.

The existing high head concrete dam and brick powerhouse were constructed in 1928. The dam has a structural height of 38 feet from the top of the powerhouse to the bottom of the dam; however, the hydraulic height varies depending on how many principal spillway gates are open during the design flood. Because of the partial drawdown that was conducted in 1999, the dam currently maintains 15 feet of head and 9 feet of freeboard.

The associated structures include a short left earthen embankment, a gated concrete principal spillway, a powerhouse section, a concrete and earth fill needle section, an abandoned millrace (or auxiliary spillway), and a short right earthen embankment (see Figure 1-2).

2.1.1.1 Embankments

The left-descending (looking downstream) embankment has a crest width of approximately 10 feet, with upstream and downstream slopes of approximately 3 horizontal to 1 vertical (3H:1V). A concrete core wall extends the entire length of the left embankment along the upstream edge of the embankment crest. There is one area of seepage along the downstream toe of the left embankment that needs to be monitored.

The right-descending embankment has a crest width of approximately 10 feet, with a downstream slope of approximately 3H:1V. A vertical concrete training wall is located along the entire upstream face of the right embankment. A portion of the right embankment was overtopped during a flood event in September 2008. The embankment sustained significant erosion damage and required the placement of large riprap until it could be repaired.

2.1.1.2 Spillways

The principle spillway structure is approximately 100 feet long and consists of five gated spillway bays (numbered 1 through 5 from right to left) and an overflow spillway section at the left end. Bay 1 houses a radial tainter gate that is 10.5 feet wide by 7 feet high. The remaining four bays house tainter gates that are 11 feet wide by 7 feet high. Since 1999, three of the five gates have been permanently opened in bays 3, 4 and 5. The concrete overflow section of the principle spillway is approximately 18 feet wide and 7 feet higher than the concrete crest of the gated section. The principle spillway is in poor condition overall with significant cracking, spalling, delamination and efflorescence found throughout the structural concrete. Vegetation growth continues to accelerate the deterioration of the concrete surfaces.

The auxiliary spillway (former millrace) consists of two approximately 12-foot-wide gated concrete spillway bays and a concrete lined channel. All gate-operating equipment was removed from the auxiliary spillway, rendering the gates inoperable in the closed position. The auxiliary spillway and concrete channel are in extremely poor condition overall.

2.1.1.3 Powerhouse

The powerhouse section is approximately 28 feet wide and consists of a concrete foundation and a brick masonry superstructure. Electric generating equipment has been abandoned in place inside the powerhouse since 1994 due to bearing issues with the turbine. The powerhouse gates were permanently closed to prevent flow through the structure. The powerhouse has exhibited significant settling and is in overall poor condition. A concrete and earth fill needle section exists between the powerhouse and auxiliary spillway structures.

2.1.2 Impoundment

The three of the five gates being permanently opened in 1999 resulted in a permanent drawdown of the impoundment by approximately 5 feet. The impoundment currently has a surface area of 49 acres under normal flow conditions.

The 5,900-foot-long impounded area upstream of Pucker Street Dam has promoted sediment detention such that approximately 1,000,000 cubic yards (CY) of sediment is estimated to be contained within the former previous impoundment (Inter-Fluve 2016).

Suburban homes line the edge of the valley, some within 50 feet of the channel. Most of the upland areas more distant from the river are farmed. With the exception of the developed areas in the vicinity of Pucker Street, much of the floodplain is undeveloped.

The lower impoundment section extending approximately 6,000 feet upstream of the dam is flanked by high, steep, wooded valley walls that delineate the adjacent flat floodplain of the former reservoir. In this lower section, the channel is straighter than upstream, despite the wide flat valley. Channel widths are variable, ranging from around 70 feet to 100 feet wide (at estimated bankfull conditions), and channel depths (i.e., impounded sediment surface to channel bed) vary from around 4 feet to around 8 feet (Inter-Fluve 2016). Wetlands and small side channels are common where groundwater seeps from the adjacent slopes and where side channels were abandoned after the impoundment was partially drawn down in 1999. Much of the floodplain has become vegetated in native and non-native plants, with occasional thick stands of willows and small stands of cottonwood, ash, and alder.

Below Kinzie Road, the valley upstream of the former impoundment includes more woodland and narrower valley widths relative to the lower two-thirds of the study area. The channel is relatively sinuous, steep, and gravelly, and large woody debris is present in the stream. Downstream of Kinzie Road the channel transitions to the lower gradient, formerly impounded section of the channel.

Five pipes are currently buried across the channel: one abandoned water supply line 250 feet downstream of the dam, and two abandoned and two new gas lines approximately 3,050 feet upstream from the dam. The water supply line is exposed at low flows. In contrast, the two abandoned gas lines are buried below the existing channel and are covered by approximately 3 to 4 feet of sediment. The two new gas lines were installed by the owner in 2018 at a depth of 30 feet below the river channel.

2.2 Alternative Development

This section describes the process used by USFWS to develop and consider a range of alternatives consistent with the requirements of NEPA. The project area is shown in Figure 2-1.

In addition to the No Action alternative, USFWS considered what reasonable alternatives could address the purpose and need in light of the objectives established for the proposed action and in consideration of public scoping comments. The formulation of alternatives has progressed using a step-wise process that included the following:

1. Data review and analysis
2. Identification of project needs
3. Formulation of initial alternative concepts
4. Solicitation of stakeholder input (public, resource/regulatory agencies, other)
5. Development of design concepts
6. Development of EA alternatives

The following sections provide an overview of the alternatives considered in this process and a description of the alternatives retained for detailed analysis within this EA.

2.2.1 Design Concept Alternatives

Initial planning for options related to dam removal and ecosystem restoration was initiated at the conceptual level and then refined to four design concepts. Several considerations and key inputs contributed to the development of project alternatives including the following:

- Objectives associated with the project Purpose and Need:
  - Need for ecosystem restoration to address: fish passage, habitat fragmentation, and habitat degradation;
  - Opportunity to improve a high-quality river system; and
  - Address public safety concerns related to the age and condition of the dam and associated structures.
- Comments/input from the public scoping process.
- Field reconnaissance activities to identify and assess characteristics of the Dowagiac River fluvial geomorphology (channel characteristics, channel stability, sediment transport and depositional patterns, habitat characteristics, etc.).
- Field reconnaissance activities to identify and assess characteristics of the wetlands in the Pucker Street Dam project area (community type, hydrologic relationships to Pucker Street Dam area and groundwater discharge, etc.).
- Engineering studies regarding site topography/bathymetry, river profile and cross-sectional information, sediment depth and chemical composition, hydrologic analysis of the Dowagiac River, biological/ecological data, and other information.

Based on these considerations, four preliminary design concept alternatives, as presented below, were developed and presented to project stakeholders for input (Inter-Fluve 2016). Concepts were developed that included dam removal (common to all “action” alternatives under consideration) and varying ecosystem restoration approaches.

Figure 2-1. Pucker Street Dam Removal and River Restoration Project Area

2.2.1.1 Dam Removal

Dam removal is common to all “action” alternatives. Dam removal concepts consists of the construction of a dewatering structure to facilitate the controlled removal of water from the impoundment, demolition of the existing powerhouse, removal of construction debris for off-site disposal, and grading the embankment to provide for channel development and flood conveyance.

2.2.1.2 Ecosystem Restoration

Options for ecosystem restoration are distinctive for each of the four design concepts and ranged from active to passive restoration as follows:

- Design Concept 1 – Dam Removal with 100 Percent Passive Restoration
- Design Concept 2 – Dam Removal with Blended Active/Passive Restoration using existing channel alignment
- Design Concept 3 – Dam Removal with Blended Active/Passive Restoration creating pre-dam channel alignment
- Design Concept 4 – Dam Removal with 100 Percent Active Restoration creating pre-dam channel alignment and 40-foot floodplain.

Table 2-1 summarizes the key elements of each restoration alternative.

Active restoration involves the construction of a restored channel and its associated floodplain within a short-time period following dam removal. As such, all attendant features are constructed in-place for the development of a functioning river channel, along with the installation of plant materials to establish plant communities that are intended to meet long-term objectives regarding restored habitats and composition. In contrast, passive restoration includes limited, if any, active restoration within the channel and typically limited management of the resulting colonizing vegetation. The passive approach allows the river itself to act as the mechanism to re-establish the river channel and its attendant floodplain. The following sections describe the differences in restoration approaches for each of the Design Concept alternatives presented above.

Table 2-1. Summary of Design Concept Alternatives

Alternatives	Description	Active Sediment Removal Quantity	Passive Sediment Removal Quantity	Pros/Cons	Cost (2018 dollars)
1 (100% passive)	Extended staged drawdown to allow passive (natural) processes to trap sediments near dam. No work above Pucker Street Bridge.	+/-100,000 CY (delivered to near dam for removal) MIN: Zero	140,000 CY (min)	• Lowest cost (depends on costs for long term staged drawdown) • No habitat restoration in short-term • Greater downstream sedimentation and adverse impacts to fishery. Long recovery time • Poor aesthetics in short term	$2.5M* (includes trapping and removing 100,000 CY of material)
2 (Blended Active/Passive Restoration using existing channel alignment)	Excavate along existing channel alignment and 20 feet average (total) floodplain in some areas.	MAX: 240,000 CY (including partial floodplain excavation) MIN: 71,000	Varies Incidental – 132,000 CY	• Greater vertical and horizontal stability than Alternative 1 • Reduces rate of sediment delivery downstream • Improvement of habitat (substrate) vs. Alternative 1	$4.7M (all channel and some floodplain sediment removed)
3 (Blended Active/Passive Restoration creating pre-dam channel alignment)	Excavate along pre-dam channel alignment and a 20 feet average floodplain.	MAX: 315,000 CY MIN: 183,000 CY	MAX: 132,000 CY MIN: Incidental	• Greater stability • Improvement of habitat (pool and riffle formation) vs. Alternative 2 • More sediment released downstream in short term vs. Alternative 2 • Potential landowner concern with changing alignment of channel	$4.5M (all channel sediment removed)
4 (100% Active Restoration creating pre-dam channel and 40-foot floodplain)	Excavate along pre-dam channel alignment. Excavate channel and 40 feet (total) floodplain.	MAX: 430,000 CY	Minor	• Expanded floodplain habitat • Greatest stability • Lowest quantity of sediment delivered downstream • Highest cost • Lowest banks and better aesthetics • Potential landowner concern with changing alignment of channel	$6.3M (all channel and floodplain sediment removed)

*A staged drawdown approach is not reflected in the cost, it may add or reduce demolition costs which are currently about $1M for all 4 options.
Source: Inter-Fluve 2016

2.2.1.2.1 Design Concept 1 – 100 Percent Passive Restoration

The passive restoration of the area above Pucker Street Dam involves only the removal of the dam without any active restoration above Pucker Street Bridge. Under this alternative, the channel above the dam would be allowed to freely adjust its slope and form via incision, widening, and meandering, and the resulting eroded sediment would be allowed to flush downstream with capturing and removing 100,000 CY of material near the dam with sediment traps. These adjustments would continue until the channel develops a form consistent with the flows and sediment regime imposed on it.

If passive management is utilized and the Dowagiac River follows post-dam removal patterns of incision, adjustment through the accumulated sediment would likely generate steep, un-vegetated slopes as the channel cuts away sediment to return to a more natural bed level. Based on the depth of accumulated sediments within the Dowagiac River impoundment determined from a Depth of Refusal (DOR) survey, the riverbed occupied after incision would likely have elevations similar to the bed prior to building the dam. The banks would be approximately 10 to 18 feet high and would likely be too steep and unstable to establish vegetation. With no vegetation for long-term stabilization, the channel would likely widen over time and form a new floodplain inset into the impoundment sediments. It is estimated that over 400,000 CY of sediment would be mobilized from the channel and floodplain area over time if no active excavation is undertaken to reestablish the river channel and associated floodplain. The exact nature of sediment transport and downstream depositional patterns associated with this sediment evacuation is difficult to predict.

No active floodplain or wetland development would be performed under this alternative. With the 1999 drawdown, a new floodplain area was created that includes floodplain wetlands, remnant side channels and floodplain features.

2.2.1.2.2 Design Concept 2 – Blended Active/Passive Restoration Using Existing Channel Alignment

Under the Blended Active/Passive restoration using the existing channel alignment approach, the existing river channel would be excavated to the pre-dam riverbed elevation based on the results of the DOR study. The pre-dam historical channel and the existing channel alignment begin to diverge in their location approximately 4,000 feet upstream of the dam. Using the existing channel alignment would result in a straighter and steeper channel than the historical pre-dam channel alignment. However, using the existing channel would reduce costs in excavation and sediment management efforts. With this alternative, a maximum of 203,000 CY of sediment would be excavated from the existing channel and 37,000 CY would be excavated in the floodplain for a total of 240,000 CY. Sediment traps would be used near the dam to capture and remove sediment that is mobilized from the construction site during the excavation.

Under this alternative the excavated floodplain bench would be an average of 20 feet on either side of the established river channel (40 feet total). These floodplain benches would not be constructed where they would impact structures or where the channel abuts the valley wall. Depending on the extent to which the channel and floodplain are excavated, the sediment removal for floodplain bench creation could be as high as 115,000 CY. The cost estimate shown in Table 2-1 assumes 37,000 CY of material would be excavated in the floodplain. According to modeling of flood events, the relatively low magnitude of flood flow rates in the Dowagiac River suggests that the floodplain bench may function largely for ecological value and safety, rather than as a conveyance for flood energy. However, the need to establish vegetation as a resisting

element to channel migration is a critical stabilization component along the river corridor that would be limited without a bench.

Under this alternative re-vegetation efforts would be concentrated within the 20-foot floodplain corridor paralleling each side of the river channel. Following drawdown and the completion of site grading activities, active seeding with native seed mix along the floodplain corridors on either side of the channel would supplement natural re-vegetation.

In addition to the constructed floodplain benches, topographical features may develop naturally over time due to overbank deposition of material during flooding. Wetlands would also naturally develop in areas with a low landscape position and sufficient source of hydrology (groundwater or surface water) to promote the development of a wetland community dominated by hydrophytic species.

2.2.1.2.3 Design Concept 3 – Blended Active/Passive Restoration Creating Pre-Dam Channel Alignment

The Blended Active/Passive restoration option to recreate the pre-dam channel alignment above Pucker Street Dam is very similar to Design Concept 2. However, under Design Concept 3 the pre-dam channel would be excavated rather than utilizing the existing channel alignment. The pre-dam channel alignment deviates from the existing channel alignment in the upper reaches of the impoundment area.

The historic pre-dam channel alignment features a set of meanders that abut the opposing valley walls and traverse the entire valley floor. Taking advantage of this meandering form would maximize channel length resulting in 1,000 additional feet of channel. The additional length and sinuosity would provide opportunities for the development of scour holes and instream woody debris that would promote habitat improvement. The meander bends would reduce overall channel gradient and provide temporary sediment storage on point bars. The amount of sediment excavation to create the pre-dam channel is estimated at 315,000 CY. All or a portion of that quantity could be excavated, while the balance would be allowed to mobilize passively. Under this alternative, however, it is expected that additional sediment entrainment and transport would occur from scour and erosion of outer bends of the created meanders.

This alternative would have the same 20-foot floodplain bench construction along a portion of the channel. The excavation volume for the floodplain bench would be 115,000 CY. Again, this floodplain bench would be a benefit for habitat and have a reduced effectiveness for flood conveyance. Wetland development would occur naturally in areas having a low landscape position and sufficient source of hydrology (groundwater or surface water) to promote the development of a wetland community dominated by hydrophytic species.

2.2.1.2.4 Design Concept 4 – 100 Percent Active Restoration Creating Pre-Dam Channel Alignment and 40-Foot Floodplain

Active restoration of channel and floodplain above the Pucker Street Dam involves the active construction of the physical attributes of the pre-dam river corridor. This approach focuses largely on the use of earth moving equipment to remove accumulated sediment in the impoundment area. Floodplains would be excavated on either side of the channel to a distance of 40 feet. Wetland development would be the same as in Alternatives 2 and 3.

2.2.2 Ecosystem Restoration Concepts Eliminated from Further Consideration

USFWS conducted an analysis of the above design concepts for which project stakeholders identified and recommended those alternatives that warrant further consideration as part of this EA. This analysis integrated an interdisciplinary process that considered all appropriate elements of alternative attributes including their effectiveness in meeting the project purpose and need, engineering factors, cost, and factors related to the environment. Specific environmental factors considered in this analysis included hydrology, water quality, sedimentation potential, aquatic and terrestrial ecology, wetlands, sensitive species, cultural resources, hazardous waste, recreation, visual quality/aesthetics, natural area development, and other factors. As a result of this process, USFWS determined that three design concepts did not warrant further consideration. Alternatives eliminated from further consideration include the following:

Design Concept 1 – Dam Removal with 100 Percent Passive Restoration. This alternative was eliminated based on the depth and extent of sediment stored behind Pucker Street Dam. The absence of sediment management measures would result in significant impacts to downstream areas where sediment deposition would result in in-stream habitat alteration. Because of the negative impact to the high-quality fishery downstream of the dam, passive restoration is not an option. Such impacts are inconsistent with the objectives of the project Purpose and Need and are therefore a basis for the elimination of this alternative.

Design Concept 3 – Dam Removal with Blended Active/Passive Restoration Creating Pre-Dam Channel Alignment. This alternative was eliminated as it does not offer significant advantages in addressing the elements of the Purpose and Need (relative to Design Concept 2) and was not reasonable in consideration of available funding. Further, it is expected that this alternative would result in more sediment being released downstream than with Design Concept 2. The negative impact to the downstream high-quality fishery is undesirable. In addition, changing the channel alignment would introduce riparian landowner opposition to the project.

Design Concept 4 – Dam Removal with 100 Percent Active Restoration Creating Pre-Dam Channel Alignment and 40-foot floodplain. This alternative was eliminated as it does not offer significant advantages in addressing the elements of the Purpose and Need (relative to Design Concept 2) and was not reasonable in consideration of the available funding. This alternative would have greater landowner opposition to the project based on a change in channel alignment. The benefits of this alternative relate to the additional construction effort that could be expended to install additional project features, thereby shortening restoration timelines. However, it was determined that such a greater level of construction is not fiscally feasible.

2.2.3 Other Potential Concepts

2.2.3.1 Dam Removal with Whitewater Park Construction

During the public scoping process, it was proposed that another alternative could include dam removal coupled with the construction of a whitewater park. The project team eliminated this alternative from further consideration based on the following reasons: increased project costs, increased rock and structures needed in-stream, decreased fish passage, landowner opposition to the project, jeopardizing grant funding because grants were based on natural channel restoration design concepts, increased future liability and maintenance for the City, and potentially reducing other recreational opportunities such as fishing from a small boat. The MDNR Fisheries division shared a whitepaper with the project team produced by the MDNR and MDEQ that describes several adverse effects of whitewater parks on stream ecosystems. For

these reasons, the construction of a whitewater park is not feasible and was eliminated from further consideration.

2.2.3.2 Dam Repaired for Hydropower Generation

The City has intensively investigated repairing the dam for hydropower generation. However, after several studies and a request for proposal process, it was determined that the use of the dam for hydropower is not an option. The City has made a determination that hydropower at this facility is not economically feasible due to the costs associated with the required repairs and maintenance of the dam. The City received two offers by private companies to take ownership of the dam and begin hydroelectric generation. Both offers were evaluated, and it was determined that transferring the dam to private ownership was not prudent or feasible because of the associated costs and risks. Further, the City's wholesale contract with Indiana Michigan Power does not allow the City to generate power (Appendix C). Consequently, this concept is not feasible and was eliminated from further consideration.

2.2.4 Alternatives Retained for Detailed Consideration

Further alternative development was conducted to clarify the action represented within a blended approach. As a result, the following two alternatives warrant detailed consideration in this EA:

- Alternative A – No Action
- Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment (Design Concept 2)

The major components of these alternatives are provided in Table 2-2.

The action alternative is reasonable and representative of a range of actions that integrate varying degrees of active restoration with a sufficient level of sediment management to minimize off-site (downstream) impacts. USFWS coordinated with the City, as owners of the Pucker Street Dam, to develop plans for this alternative to assess its likely environmental impacts, as well as both short- and long-term costs.

Table 2-2. Summary of Alternative Elements

Project Element	Alternative A – No Action	Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment
Pucker Street Dam	All dam elements remain, including spillway and powerhouse	Powerhouse and dam removed completely Embankment removal except the concrete wall along the east bank that will be left in place.
Fish Passage	Barrier in-place, no fish passage	Complete restoration of fish passage
Aquatic Ecosystem Type	Partially drawn down Impoundment – 49 acres	10,000 linear feet of free-flowing river

Project Element	Alternative A – No Action	Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment
Excavation/Sediment Management	No sediment management/ excavation	Excavation of channel and 20-foot floodplain bench Total sediment excavation around 240,000 cubic yards for 6,300 feet
In-channel Habitat	No enhancements to in-channel habitat	Bedforms such as pools, riffles, and runs are likely presented but muted due to deposition in the impoundment but should develop quickly during subsequent flood events.
Riparian Zone/ Wetlands/Uplands	No active riparian zone/wetland/upland enhancements	Active seeding with native seed mix along 20-foot corridor on either side of channel
Construction Staging	Not applicable	Construction operations would occur at dam/ powerhouse and upstream for about 6,000 linear feet.

2.2.4.1 Alternative A – No Action

Under CEQ regulations (40 CFR Parts 1500 to 1508), consideration of a No Action alternative is required in this EA. The No Action alternative sets a baseline of existing impacts continued into the future against which to compare impacts of action alternatives. This is important context information in determining the relative magnitude and intensity of impacts.

Under the No Action alternative, the USFWS would take no immediate action to remove the dam to improve fish passage and habitat, which would also not resolve the City's cost and safety liabilities associated with ownership of Pucker Street Dam. Existing facilities would remain in-place and would continue to impede fish passage and sustain the fragmented habitats within the Dowagiac River system. Additionally, the structural deterioration of the dam would continue to persist and be a safety hazard for river users.

Based on the 2013 safety inspection, the MDEQ has mandated that the City either remove the dam within 5 years or make extensive repairs to ensure its stability and minimize the risk of failure. In response to the MDEQ mandate, the estimated cost of rehabilitation to mitigate the identified safety issues and prevent failure was estimated to be approximately $301,600 for engineering and $928,600 for the repairs (in 2018 dollars). In addition, the City would also incur about $72,000 for inspections required every 4 years.

The No Action alternative would not support USFWS' goal of removing barriers to fish passage or the City's goal of cost effectively promoting safety and reducing the liability of the existing dam. Consequently, this alternative would not satisfy the project purpose and need and, therefore, is not considered viable or reasonable. It does, however, provide a benchmark for comparing the environmental impacts of implementation of Alternative B.

2.2.4.2 Alternative B - Dam Removal with Blended Restoration Using Existing Channel Alignment

Under Alternative B, the proposed project would include the removal of Pucker Street Dam and a blend of active and passive restoration within the existing channel alignment. Figure 2-2 identifies the primary activities planned within the project area. The details of each component of this alternative are provided below.

The project site includes the Dowagiac River valley from about 300 feet downstream of Pucker Street Dam to the Kinzie Road Bridge, approximately 11,000 feet upstream of the dam. Within that reach, the focus is on Pucker Street Dam and its 5,900-foot long impoundment. The Dowagiac River valley width ranges from about 200 feet to 700 feet wide. The wider sections are included in the impoundment area.

2.2.4.2.1 Proposed Changes at Pucker Street Dam Location

The dam and the area around it (Figure 2-3) pose both constraints and opportunities for the project. First, channel position would be maintained under the Pucker Street Bridge and through the dam site. The concrete wall along the east bank at the dam would be left in place, but it would be hidden and the vertical drop would be eliminated by creating a stone toe with fabric-encapsulated lifts on top. The upper portion of the slope would be vegetated with native plants that would not require mowing. On the west side of the river, the bank would be shifted to the east enough to accommodate the material placed along the eastern wall while maintaining the conveyance capacity of the upstream reach. The bank would slope up to the existing ground surface at the island to create a natural bank that allows for access to the water by both people and wildlife. Both banks would tie into the existing topography within a few hundred feet downstream of the dam.

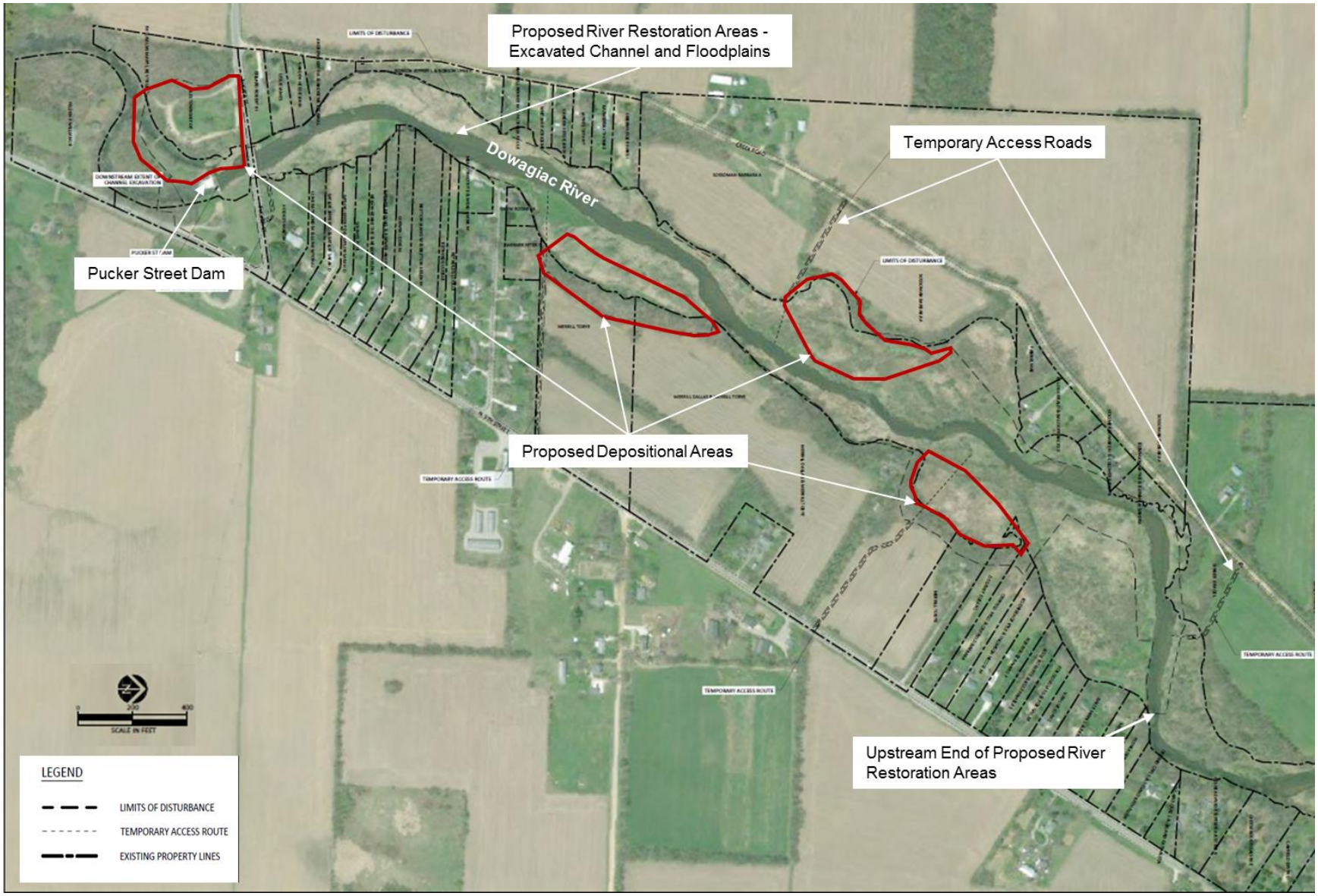


Figure 2-2. Alternative B Project Activity Areas

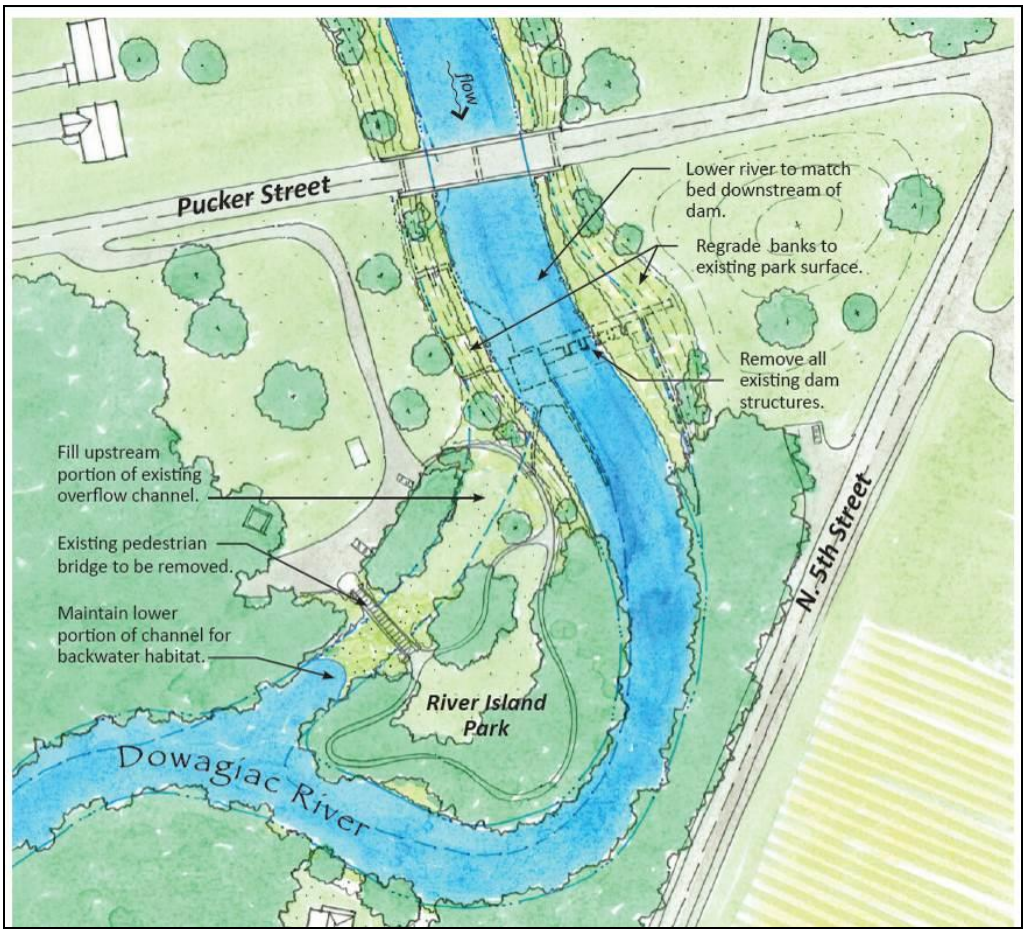


Figure 2-3. Proposed Dam Removal Plan

Some of the material excavated from the impoundment would be used to fill the raceway adjacent to the dam. The raceway is currently spanned by a footbridge that would be replaced by a wider land bridge created from fill material. The lower end of the raceway may be left open for additional backwater habitat or perhaps to accommodate recreational access.

2.2.4.2.2 Dam Removal and Dewatering

Prior to the start of demolition, dredging of the area behind the dam would be performed to act as a sediment basin during the drawdown of the river. Dredged material will be disposed of in the spoil area nearest the dam (Figure 2-2).

Demolition and ecosystem restoration activities would be undertaken in accordance with the sequence of work outlined in Table 2-3. The demolition of the dam includes the entire structure down to the lower floor elevation of 659.5 feet. Once the bracing is in place, the cofferdam would be fully dewatered and the spillway demolished down to the concrete apron elevation of approximately 663.41 feet. Within the vicinity of the delta, the drawdown of the impoundment would proceed slowly (approximately 0.5 feet per day), such that minimal sediment would be released downstream.

Table 2-3. Sequence of Events for Alternative B

Step	Description	Days Duration	Start Date	End Date
1	Start of construction	0	1	1
2	Securing of site	1	1	1
3	Soil erosion & soil control	2	1	2
4	Hazardous waste cleanup and disposal in powerhouse	10	1	10
5	Demolition of upper powerhouse above main floor	15	11	25
6	Demolition of powerhouse equipment	15	11	25
7	Hydraulic dredging of basin from bridge to dam	15	11	25
8	Create sediment basin	5	26	30
9	Remove tainter gates & lower overflow spillway to top of dam	10	11	20
10	Remove concrete walkway from dam	5	21	25
11	Install sheeting & king piles to isolate west portion of spillway upstream of dam	15	26	40
12	Isolate west portion of spillway downstream of dam	5	36	40
13	Start dewatering of cofferdam	1	41	41
14	Add bracing, most likely rakers, attached to apron slab during dewatering	10	41	50
15	Finish dewatering of cofferdam	1	50	50
16	Demo west concrete spillway down to apron slab	15	51	65
17	Add bulkhead gates to downstream edge of sheeting	10	56	65
18	Pull sheeting upstream of gates	2	66	67
19	Drawdown reservoir to top of bottom gate	15.5	69	82
20	Mechanically dredge, restoration, and seeding along river	78	83	160
21	Clean out sediment trap as needed during dredging	1	161	161
22	Drawdown reservoir to bottom of bottom gate	19.5	162	181
23	Remove cofferdam sheeting, gates, and king piles	7.5	181	187
24	Direct stream flow through western portion of demolished spillway	0.5	187	187
25	Reinforce bridge pier	10	182	191
26	Isolate east portion of spillway upstream of dam	3	187	189
27	Isolate east portion of spillway downstream of dam	3	187	189
28	Demo east concrete spillway	15	190	204
29	Remove isolation of east portion of spillway	2	205	206
30	Isolate west dam spillway apron	2	205	206
31	Remove west dam spillway apron	5	207	211
32	Remove powerhouse below main floor	20	185	204
33	Remove concrete wingwall west side of river downstream of dam	5	189	193
34	Remove structures that extend above final grade along banks	15	189	203
35	Back fill and remove drainage structures along bank on east side of river	5	200	204
36	Restore east bank on east side of river	18	200	217
37	Additional seeding and punchlist items as needed	5	218	222

* Some of the tasks listed may be performed simultaneously in order to complete the work within the scheduled time frame and based on professional judgement of contractor.

On the ground activities are expected to begin in the spring 2019, with in-stream work beginning in spring or summer 2019 and channel/floodplain restoration activities continuing into fall 2019. No construction activities would take place until all permits have been issued. Further, work in the Dowagiac River is limited by MDNR regulations to avoid spawning times. Any large rain events could also delay project initiation. Phasing of work at the dam would be integrated with the needs for water level management as part of river restoration and sediment management.

2.2.4.2.3 Restoration and Sediment Management Measures

Under this alternative restoration activities would consist of the integration of active sediment management practices upstream of the dam coupled with channel and floodplain redevelopment.

It is expected that the majority of the restoration activities would be conducted over a 60- to 90-day timeframe during the summer and fall of 2019 and any follow up restoration would occur in the spring of 2020. This schedule would depend on securing permits and favorable weather conditions (water levels).

Earth moving equipment would be used to remove accumulated sediment within the reach above the dam. Figure 2-4 illustrates the typical cross section of the reconstructed river channel. Equipment operating in water would be required to utilize vegetable oil (e.g., rapeseed or canola) as a lubricant to reduce potential impacts to water quality. Floodplains would be excavated along the 82-foot wide channel to an average of 20 feet on each side of the river upstream of the dam for a distance of approximately 1,400 feet.

A number of methods were applied to estimate stable cross-sectional geometry for the Dowagiac River through the project reach, including using reference reaches as guides to channel sizing, estimating widths and depths based on regional hydraulic geometry studies, and using bankfull flow estimates to refine the final dimensions. The bankfull discharge was predicted using the estimated annual flood data from the Sumnerville stream gage and then transferring the data downstream by the ratio of drainage area.

Based on the channel geometry analyses summarized by Inter-Fluve (2016) that considered both unimpacted reference reaches and the characteristics of the Dowagiac River channel downstream, bankfull channel dimensions are proposed as summarized in Table 2-4 and illustrated in Figure 2-4. The excavation volume for the channel configuration along the existing alignment, with no floodplain bench construction, is about 199,000 CY (Figure 2-4A). A similar amount, at least, would be expected to evacuate naturally over time if no channel excavation is conducted.

Table 2-4. Alternative B Restoration Characteristics

Attribute	Value
Length of channel excavation	6,300 feet
Excavation volume	240,000 CY
Channel bed width	82 feet
Channel bankfull width	94 feet
Channel depth	3 feet
Side slope dimension	2:1 slope
Floodplain bench width	20 feet (each side)
Floodplain bench length	1,400 feet
Bankfull flow capacity	1,015 cfs

Source: Inter-Fluve 2016

In the case of a 20-foot bench, the lower surface would extend 20 feet from the top of the design channel before starting up the slope to the top of the impounded sediment (Figure 2-4B). Benches would not be constructed where they would impact adjacent structures, or where the channel abuts the valley wall and are often wider on the inside of bends to replicate point bars. The floodplain benches will be excavated between the dam and extend 1,400 feet upstream. Excavating 20-foot benches along the lower portion of the impoundment will add approximately 40,000 CY to the excavation quantity, bringing the total excavation to approximately 240,000 CY of sediment.

Based on the characteristics of the material at the proposed channel excavation site within the impoundment, hydraulic dredging may be used to remove some material. The immediate work area would be isolated from the flow of the Dowagiac River and silt curtains would be used in the immediate dredge work area to control turbidity. Dredged materials would be disposed of in the spoil area nearest the dam (see Figure 2-2). Because the dredged material would consist predominantly of sands, these materials are expected to drain readily. Decanted water would be returned from the disposal site using best management practices (BMP) such as sandbags, turbidity curtains and other means to ensure good water quality. Following the completion of the dredging process, material would be graded in-place and seeded with a native plant species mix consisting of various grass and rush species, such as Virginia wild rye, hardstem bulrush, softstem bulrush, common bur reed, river bulrush, and prairie cordgrass, and forbs such as swamp milkweed, swamp aster, boneset, sneezeweed, and ironweed to promote rapid vegetative recovery. Tables 2-5 and 2-6 list plant species proposed to be seeded within floodplain and upland transition zones.

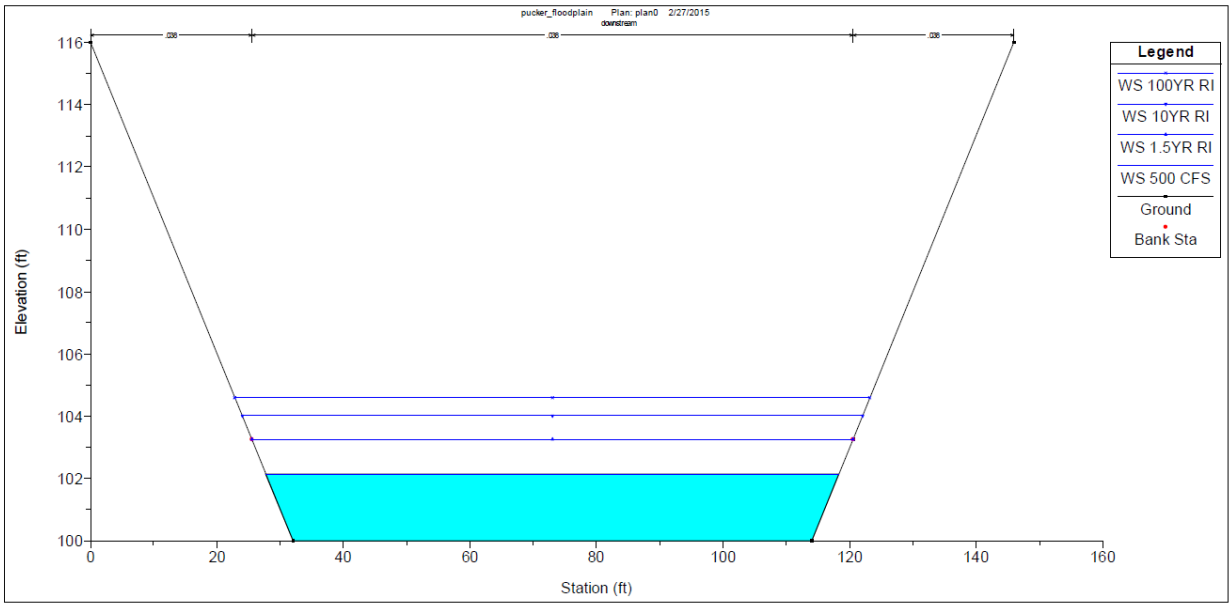


Figure 2-4A

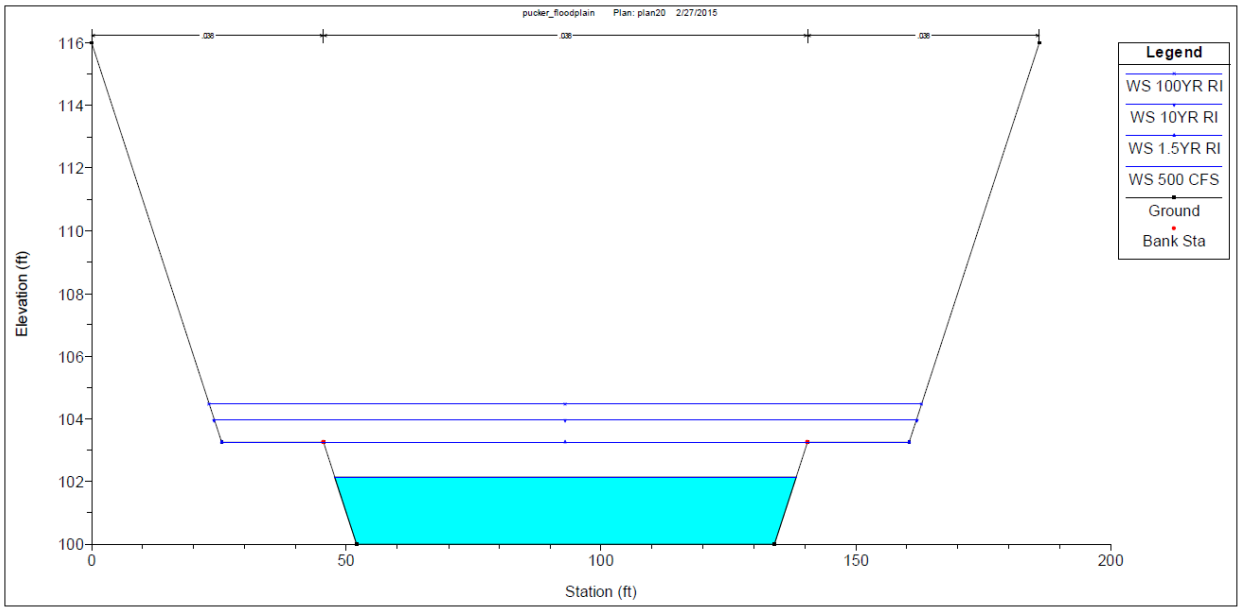


Figure 2-4B

Figure 2-4. Typical Cross Section of the Reconstructed River Channel

(Figure A: Without floodplain bench, B: with floodplain bench)

Table 2-5. Proposed Floodplain Seed Mix

Scientific Name	Common Name
Grasses/sedges/rushes	
Carex spp.	Sedges
Elymus virginicus	Virginia Wild Rye
Schoenoplectus acutus	Hardstem bulrush
Schoenoplectus tabernaemontani	Softstem bulrush
Sparganium eurycarpum	Common Bur Reed
Scirpus fluviatilis	River bulrush
Spartina pectinata	Prairie cordgrass
Cover Crop	
Avena sativa	Seed Oats
Lolium multiflorum	Annual Rye
Forbs	
Asclepias incarnata	Swamp Milkweed
Asclepias syriaca	Common Milkweed
Aster puniceus	Swamp Aster
Eupatorium maculatum	Joe-Pye Weed
Eupatorium perfoliatum	Boneset
Helenium autumnale	Sneezeweed
Solidago graminifolia	Grassleaved Goldenrod
Solidago patula	Swamp Goldenrod
Vernonia missurica	Ironweed

Table 2-6. Proposed Seed Mix for Transitional Upland Zones

Scientific Name	Common Name
Native Grass Mix	
Andropogon gerardii	Big Bluestem
Panicum virgatum	Switch Grass
Schizachyrium scoparius	Little Bluestem
Sorghastrum nutans	Indian Grass
Cover Crop	
Avena sativa	Seed Oats
Lolium multiflorum	Annual Rye
Forbs	
Achillea millefolium	Yarrow
Asclepias syriaca	Common Milkweed
Asclepias tuberosa	Butterflyweed
Aster laevis	Smooth Aster
Aster novae-angliae	New England Aster
Aster pilosus	Hairy Aster
Coreopsis lanceolata	Sand Tickseed
Echinacea purpurea	Purple Coneflower
Monarda fistulosa	Wild Bergamot
Rudbeckia hirta	Black-eyed Susan
Solidago rigida	Stiff Goldenrod

Additional techniques would be incorporated into the restoration approach to minimize downstream sediment transport. In particular, a sediment trap would be installed and maintained just above the dam location to trap sediments mobilized by the drawdown from upstream areas (see Figure 2-5). The sediment trap would be approximately 150 feet long by 80 feet wide by 12 feet deep, and it is expected to collect sediment at a rate of 30 tons per day. Based on this, it would need to be cleaned when 1/3 full, or approximately every 2 to 3 months. The sediment build-up would be monitored weekly during active dredging and cleaned out as needed with the material disposed of in the adjacent raceway and park areas.

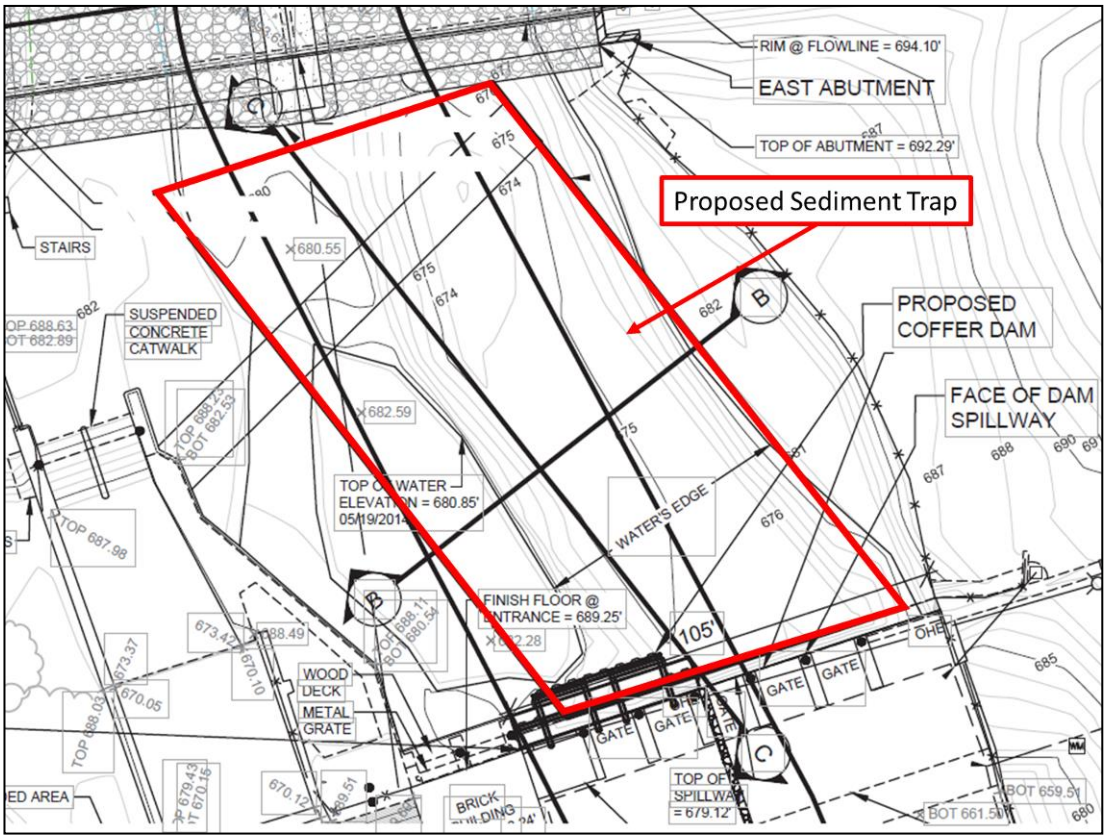


Figure 2-5. Proposed Sediment Trap Location

This alternative also incorporates a number of elements that would promote natural community establishment including:

- Active seeding and management of the associated vegetation community using native species appropriate for floodplain and upland/steep slope stabilization. Following drawdown, and subject to project funding, seeding would be conducted for all exposed areas using a native seed mix.
- Active seeding of exposed areas around the former dam site with native vegetation that is ecologically appropriate for the riparian area.

Several potential environmental enhancements may also be implemented in the future, subject to the availability of funds. Such potential future enhancements may include:

- Aggregates of large woody debris could be installed at regular intervals along the length of the river channel to provide rapid development/enhancement of in-stream habitat.
- Active wetland development by shallow excavation and planting within floodplain areas to promote shallow/deep marsh community development.
- Streambank stabilization using live stakes to promote riparian zone establishment.
- Riparian/wetland zone plantings using potted plants to promote wetland community development.

Access can be achieved at the dam site and at privately owned locations that have been secured by the City for access and staging areas along the valley. Potential locations of access roads are shown in Figure 2-6.

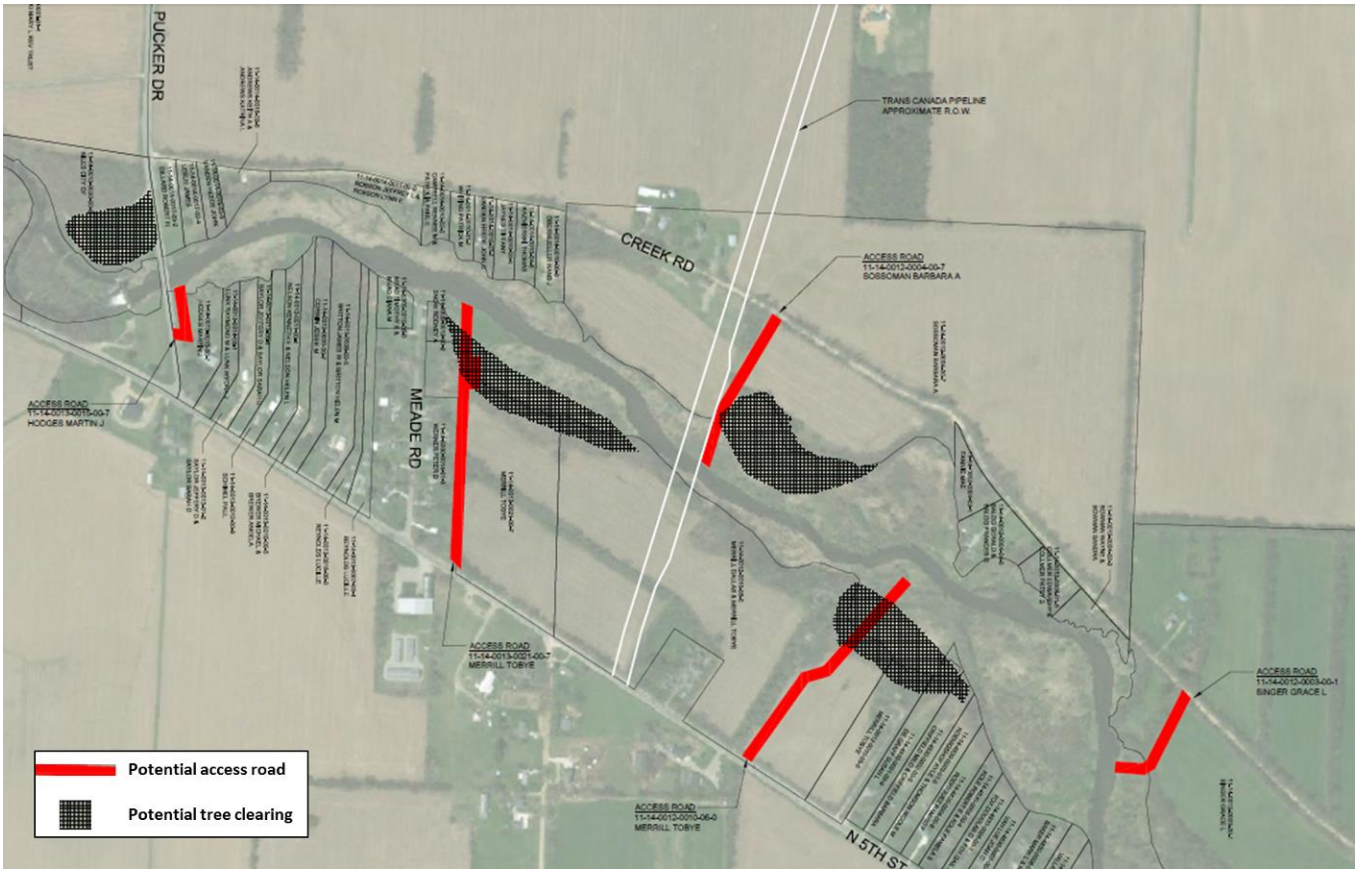


Figure 2-6. Potential Access Roads and Tree Clearing

2.2.4.2.4 Legacy Dam

In 1828, Eli Ford built a log dam and gristmill just upstream of the current Pucker Street Dam. In 1891, Bascom Parker, Sr., bought the mill (known as the old Yellow Mill) and dismantled the gristmill to establish a private power plant to supply electricity for street lights. In 1894, the City purchased the dam and 17 acres from the Niles Electric Company. The last major modifications and improvements to the dam were made in 1928 when the concrete dam was built, and the generators were converted from horizontal water wheels to a turbine type drive system with an automatic control and switching equipment.

It is believed that portions of the legacy dam may still be under the sediments upstream of the current dam. Any portion of the legacy dam that would be uncovered during restoration of the river would be removed during construction to one foot below final grade and therefore would not have potential for retaining sediments, altering flow, impacting recreational users, or preventing fish passage.

2.2.4.3 Pipeline Relocation and Removal

Two abandoned TransCanada/ANR natural gas pipelines cross the Dowagiac River approximately 3,000 feet upstream of the dam (see Figure 2-6). The pipes consist of a 24-inch diameter line and a 22-inch diameter line running parallel to each other. Both are buried below the channel, and a 2015 inspection indicated a minimum cover of 3.9 feet over the 22-inch pipe and 3.1 feet over the 24-inch pipe. Depth-of-refusal probing in this section of river suggests the pre-dam channel bed is likely 5 to 7 feet below the existing bed, which indicates the pipes were buried in post-dam reservoir sediment. If the channel is allowed to passively achieve its pre-dam bed elevations, the pipes would eventually be exposed and elevated above the bed. This would be an unacceptable condition that risks the integrity of the pipes, particularly given the likelihood of debris accumulating on them to an unpredictable degree, and it risks the safety of recreational users. Therefore, TransCanada has relocated approximately 1,400 feet of both pipes adjacent to the existing pipes at a depth of approximately 30 feet below the expected grade of the proposed channel. As part of the project the City's dredging contractor would expose the pipelines and cooperate with TransCanada's piping subcontractor who would remove and dispose of the abandoned pipelines and appurtenances in the river channel according to regulations. The pipeline removal would be conducted in conjunction with sediment management activities to minimize impacts downstream from disturbing the channel. The abandoned pipelines to remain in place would be isolated and capped.

2.2.4.4 Cost Estimate

The estimated construction cost, including engineering and contingency, of dam removal and restoration for this alternative is approximately $3.6 million (2018 dollars) (subject to refinement through detailed design and refinement of methods).

2.2.5 Comparison of Alternatives and Project Objectives

The ability of these alternatives to meet the project objectives (the objectives identified in the Purpose and Need) are compared in Table 2-6. Alternative B meets each of the objectives identified for this project, while Alternative A (No Action alternative) does not address the objectives.

Based upon the analyses of each resource described in Chapter 3, the anticipated environmental impacts for the project alternatives under consideration are summarized in Table 2-7.

2.3 Preferred Alternative

The environmentally preferred alternative is determined by applying the six criteria suggested in the NEPA (1969), which guides the CEQ. The CEQ provides direction that the environmentally preferable alternative is the alternative that would promote the national environmental policy as expressed in NEPA §101.

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Assure for all generations safe, healthful, productive, and aesthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.

- Preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Table 2-7. Summary of Alternative Consistency with Project Objectives

Project Objectives	Alternative A – No Action	Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment
Habitat Fragmentation	Fragmentation imposed by dam and barrier to aquatic species movement unchanged.	Barrier to aquatic species movement and aquatic habitat fragmentation removed.
Habitat Degradation	On-going interruption of downstream transport processes, sediment transport processes, alteration of surface water and groundwater flow patterns, and interruption and alteration of sedimentation processes.	Downstream transport of propagules, woody debris and other materials enabled.
Induced Species Disruptions	Composition and abundance of coldwater fish communities remain distinct between Dowagiac River upstream and Dowagiac River downstream of the dam.	Composition and abundance of coldwater fishes above and below Pucker Street Dam to become more consistent and uniform due to restoration of thermal regime and removal of fish movement barrier.
Opportunity for Expansion of High Quality River System	No additional opportunity to expand high quality, high gradient river system.	Opportunity to expand a high quality, high gradient river system to include 10,000 feet of restored river at and upstream of the dam removal location.
Address Dam Stability/Safety Issue	Dam to remain in-place, safety issue unresolved.	Dam removed, safety issue resolved.

Table 2-8. Environmental Impact Summary by Alternative

Impact Topic	Alternative A – No Action	Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment
Water Resources		
Hydrology and Floodplains	Sustained disparity in hydrology of natural riverine hydrology due to impounded system.	No significant alteration in hydrology or increase in peak flood levels.
Water Quality	Water quality within the impounded reach will continue to be negatively affected by altered flows, sedimentation, and reduced riparian cover.	Short-term increase in turbidity and suspended sediments during dam construction and initial post-construction phase. Direct, long-term benefits that include the restoration of approximately 6,300 feet of aquatic habitat and the elimination of habitat fragmentation within the Dowagiac River system.
Sediments	Continued accretion of sediments within channel with sediment and silt going over the dam impacting the downstream fishery.	Restoration of naturalized sediment transport processes; potential adverse impacts of sediment remobilization and transport mitigated through extensive sediment management measures (excavation, sediment traps, etc.).
Ecology		
Aquatic Ecology	Sustained induced species disruptions due to modified thermal regime; continued fragmentation of habitat and disruption of natural transport of biotic and abiotic materials.	Restoration of coldwater thermal regime and naturalization of river aquatic biotic communities; reduced abundance of warmwater, lentic fish species and associated habitats in the impounded area above Pucker Street Dam.
Terrestrial Ecology	Sustained terrestrial plant and animal communities for short- to moderate-term.	Restoration of floodplain habitats. No significant adverse impact on terrestrial fauna/wildlife.
Sensitive Species	No impact.	No impact to listed species. Establishment of a riparian area and the enhancement of wetland and upland habitats along the Dowagiac River will likely provide a more ecologically diverse and contiguous habitat.
Wetlands	Perpetuation of artificial wetlands created by dam.	Loss of artificial wetlands created by dam. Restoration of more natural riverine system with associated fringe wetland

Impact Topic	Alternative A – No Action	Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment
		areas.
Noxious/Invasive Species	On-going management needs for invasive species.	Intermediate term needs for management of invasive species due to exposed soils. Decontamination practices used during construction to limit invasive species introduction.
Land Use	No impact.	No impact.
Socioeconomics		
Demographics	No impact.	No impact.
Community Facilities/Services	No impact.	No impact.
Recreation	No impact.	Potential impacts to angling below dam, but increases in tourism and recreational expenditures associated with paddling and fishing within broader watershed.
Economics	No impact.	Positive economic benefit due to increase uses associated with fishing and paddling within broader watershed.
Property Ownership	No impact.	Modification of property ownership to expand legal limits of property boundaries to waters edge based on original plat
Environmental Justice	No impact.	No impact.
Cultural and Historic Resources	No impact.	No impacts to historic structures or other cultural resources.

Impact Topic	Alternative A – No Action	Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment
Visual Quality and Aesthetics	No impact.	Improvement of visual landscape due to removal of dilapidated powerhouse and associate structures, progressive re-vegetation of banks and exposed areas. The river corridor would be returned to near natural, pre-dam flow conditions.
Transportation	No impact.	Limited impact with brief closure of Pucker Street during bridge stabilization.
Air Quality	No impact.	Minor short term localized emissions. No regional air quality impacts.
Noise	No impact.	Minor short term localized noise emissions.
Human Health and Safety	Does not resolve potential liability associated with existing structure.	Removes existing structure and eliminates liability. Construction related safety issues to be mitigated using good health and safety practices/management.

Alternative A, No Action, only minimally meets the above six evaluation factors because it retains the existing facilities and does not address the components of the project Purpose and Need. The No Action alternative does not remove the barrier to fish passage and fails to resolve the observed fragmentation of the existing aquatic ecosystem. Additionally, the No Action alternative does not address the existing dam safety issue of the Pucker Street Dam.

Alternative B, Dam Removal with Blended Restoration Using Existing Channel Alignment, is the environmentally preferred alternative because this alternative best addresses these six criteria/evaluation factors. This alternative meets the objectives of the project Purpose and Need, and integrates significant mitigative commitments (e.g., sediment management measures, ecosystem restoration and enhancement, etc.) that will ensure that impacts of this action are minimized.

No new information was identified from public scoping or consultation with other agencies to necessitate the development of any new alternatives, other than those described and evaluated in this document. Because it meets the Purpose and Need for the project, the project objectives, and is the environmentally preferred alternative, Alternative B - Dam Removal with Blended Restoration Using Existing Channel Alignment is also recommended as the USFWS Preferred Alternative.

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Geology and Soils

3.1.1 Affected Environment

3.1.1.1 Geology and Topographic Setting

The surface geology within the Dowagiac River Watershed consists almost entirely of thick glacial sands, silts, and gravels, along with limited post-glacial stream deposits, which have buried the shale bedrock by hundreds of feet. The Kalamazoo Moraine and the Valparaiso Moraine, which are large piles of river and delta sand deposited along the edge of the Michigan Lobe during ice retreat, demarcate the east and west side of the watershed near Niles. The moraines mark periods of glacial equilibrium, before melting withdraws the ice front to the next moraine position (Stone et al. 2003; Kincare 2010).

The Dowagiac River runs along the former Glacial Lake Dowagiac bed between the Kalamazoo and Valparaiso Moraines (Figure 3-1). Lake Dowagiac formed when ice and sediment blocked spillway outlets to the south. The flat terrain of the former lakebed results in a generally low gradient of the upper Dowagiac River and the river's associated wetlands upstream of Sumnerville, MI. The glacial lake spillway is largely filled with gravelly, sandy delta deposits from upstream (north) and from the adjacent moraines. These sands and gravels are now the dominant material in the modern channel and floodplain (Stone et al. 2003; Kincare 2010). They also make up the sandy and loamy soils found in the region (e.g. Ockley/Kalamazoo Loams, Oshtemo Sandy Loam, Cohoctah Sandy Loam). The sands and silts stored behind Pucker Street Dam are derived from these materials.

The glacial materials associated with the outwash plains and moraines are relatively permeable, allowing precipitation to infiltrate and travel in subsurface pathways through the deposits. The coarse glacial material of the watershed is responsible for storing large volumes of cold groundwater which maintains the Dowagiac River, even in the heat of summer, as a coldwater river. Within the study reach, floodplain wetlands have formed along the valley walls where groundwater seeps into the valley. Infiltration also reduces surface runoff in the system, thereby limiting flow fluctuations.

The downstream end of the Dowagiac River is characterized as having a steeper gradient as compared to the upper reaches. Pucker Street Dam is located within the upper section of the reach containing this steeper gradient (see Figure 1-4). Survey data suggests the steeper slope extends under the Pucker Street impoundment sediments to near Kinzie Road.

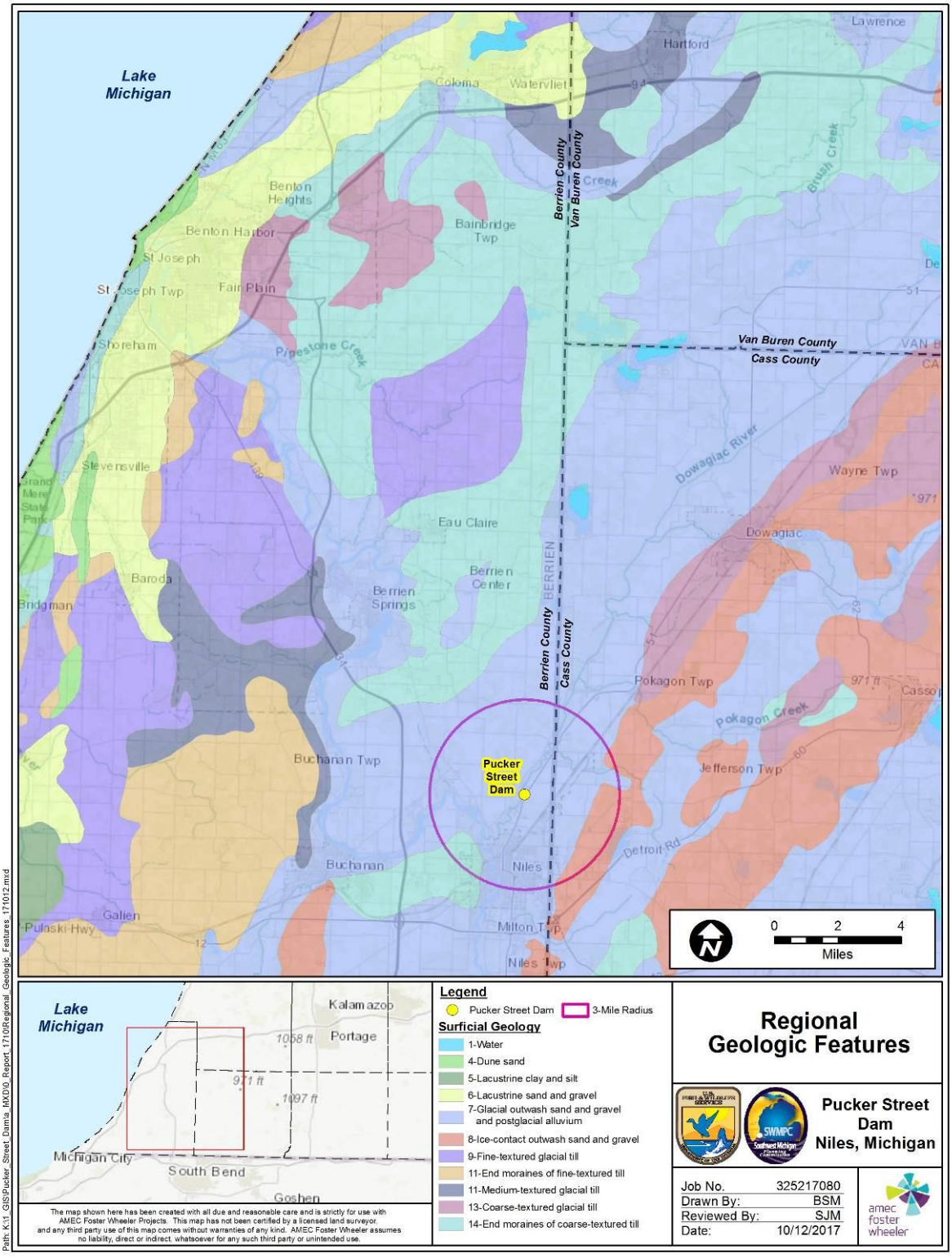


Figure 3-1. Regional Geologic Features

3.1.1.2 Soils

Soils within the immediate project area are summarized in Table 3-1. The dominant mapped soil types within the project area are Cohoctah sandy loam, Oshtemo sandy loam, and Ockley loam (Figure 3-2). Among the nine mapped soil types, three hydric soils are identified from the project area: Brady sandy loam, 0 to 2 percent (19A), Cohoctah sandy loam (29), and Shoals silty loam, 0 to 2 percent (67A). Brady sandy loam is a somewhat poorly drained soil formed in depressions and drainageways; Cohoctah sandy loam is a poorly drained soil formed in elongated areas of floodplains of rivers and streams; and Shoals silt loam, 0 to 2 percent is a somewhat poorly drained soil that forms on broad-flat areas of floodplains and bottomlands along streams and rivers (USDA NRCS 2017).

Table 3-1. Soils of the Project Area

Symbol	Soil Map Unit Name	Drainage Class	Hydric
19A	Brady sandy loam, 0-2%	Somewhat poorly drained	Yes
29	Cohoctah sandy loam	Poorly drained	Yes
67A	Shoals silt loam, 0-2%	Somewhat poorly drained	Yes
11B	Oshtemo sandy loam, 0-6%	Well drained	No
11C	Oshtemo sandy loam, 6-12%	Well drained	No
11E	Oshtemo sandy loam, 18-35%	Well drained	No
12A	Ockley loam, 0-2%	Well drained	No
13B	Spinks loamy find sand, 0-6%	Well drained	No
82B	Oshtemo-Ockley complex, 0-4%	Well drained	No

Source: USDA NRCS 2017

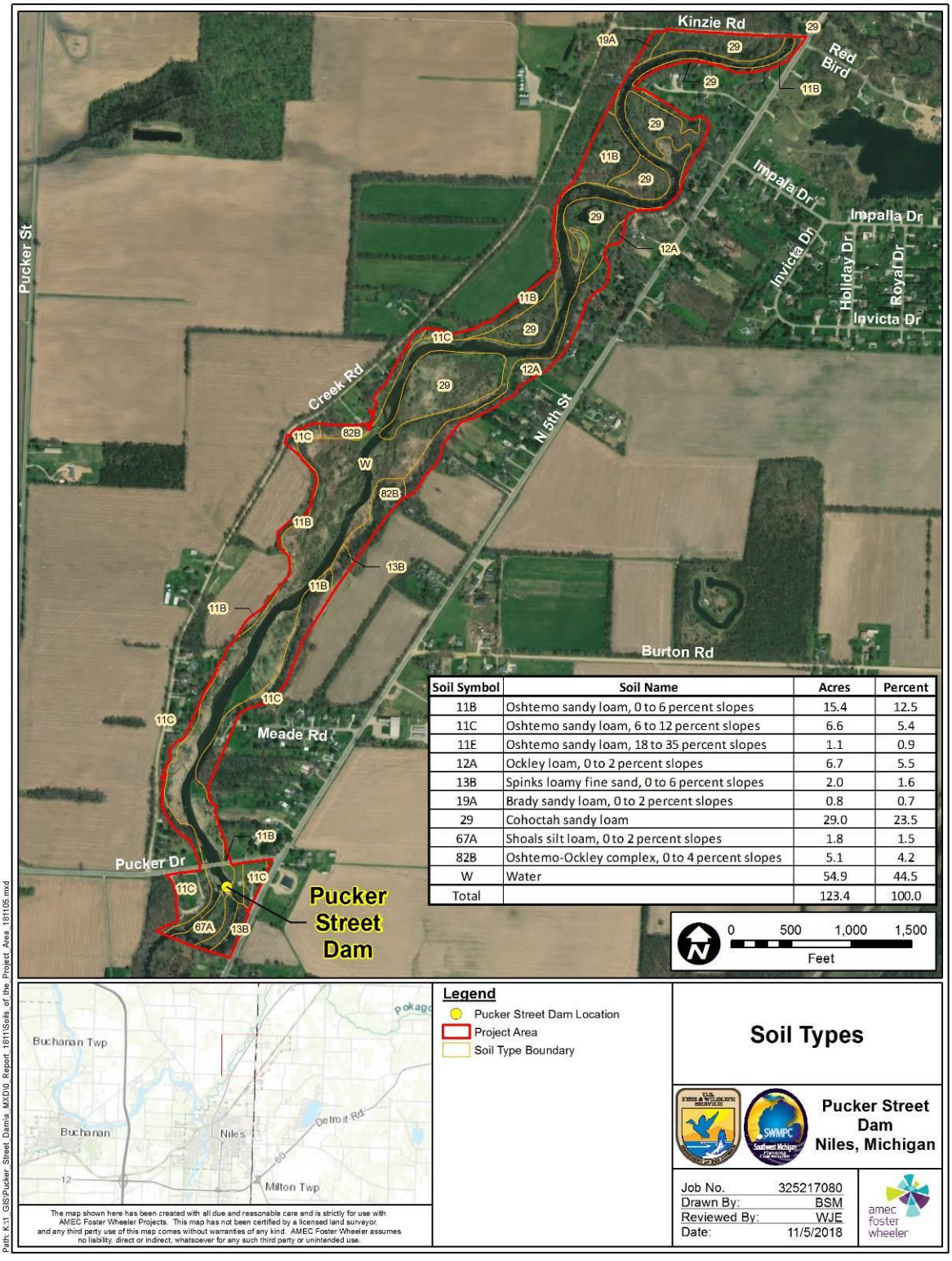


Figure 3-2. Soils within the Project Area

3.1.2 Environmental Consequences

3.1.2.1 Alternative A – No Action

Under this alternative, the dam would remain in place and sandy sediment would continue to build up above Pucker Street Dam. The sedimentation is a soil-forming process and would continue to expand the delta, eventually filling the impounded area.

3.1.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

Removal of the Pucker Street Dam would result in soil disturbance from activities associated with dam removal and sediment management within the impoundment. In the vicinity of the dam, the existing soil embankment would be partially removed and would be graded to facilitate the restored river channel. Grading would result in 2H:1V bank slopes that would be stabilized by seeding. In some areas near the bridge, the slope may be decreased to accommodate landowner preferences.

The drawdown of the impoundment would proceed slowly (approximately 0.5 feet per day), such that minimal sediment would be released downstream. The sediment consists primarily of sand and does not remain suspended in the water column once flow velocities are reduced. However, the silt would continue to move downstream.

Under this alternative, a stream channel and adjacent floodplain would be actively restored for a portion of stream channel. The floodplains on each side of the channel would initially be constructed as 20 feet wide on average but would adjust over time based on river flow. As a result of these activities, soils (sediments) within the existing channel and associated floodplain would be excavated and placed in appropriate areas above the 100-year floodplain of the Dowagiac River. This would result in the development of approximately 14.5 acres of upland areas with soils that are slightly elevated (approximately 5 to 7 feet) relative to the surrounding terrain. Slopes of these upland areas, however, are designed to be gentle and not subject to erosion. These soils would be stabilized by seeding.

3.2 Hydrology and Floodplains

3.2.1 Affected Environment

3.2.1.1 Hydrologic Setting

The Dowagiac River Watershed encompasses approximately 286 square miles and is located within the St. Joseph River Basin in the southwestern corner of Michigan's lower peninsula (see Figure 1-2). The Dowagiac River flows diagonally across Cass County in a southwesterly direction to its confluence with the St. Joseph River in Berrien County. The largest tributary is the Dowagiac Creek (formerly known as the south branch of the Dowagiac River). Other tributaries include the Lake of the Woods and Osborn drains and Silver, Peavine, Pokagon and McKinzie "Kinzie" creeks (Cass County Conservation District 2002). The floodplain longitudinal profile surveys within the project area are illustrated in Figure 3-3.

The Dowagiac River is classified as a relatively large, coldwater system with a high connection to groundwater. The highly permeable soils and glacial deposits of the surrounding morainal landscape described in Section 3.1 provide for substantial groundwater contributions to the Dowagiac River and its tributaries. It is estimated that 90 percent of the flow in the Dowagiac River and its tributaries is fed by groundwater and only 10 percent of the flow comes from surface run-off. The average flow at the Sumnerville gauge station for the period of record

(October 1960-present) is 299 cubic feet per second (cfs), which is equivalent to 15.94 inches/year of runoff from the 255 square mile watershed. High groundwater contributions along much of the Dowagiac River's length provide cold temperatures and steady base flow throughout the summer season (Cass County Conservation District 2002).

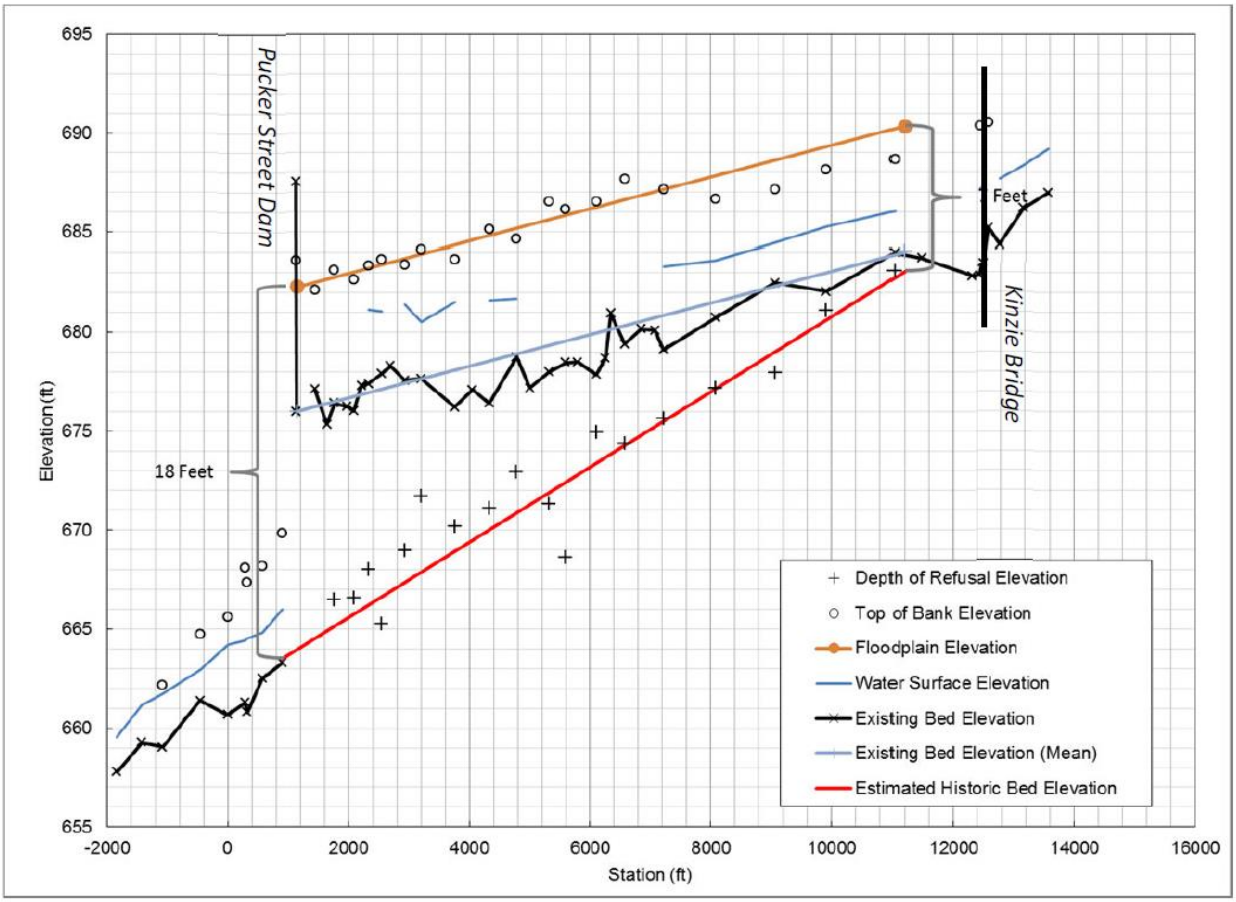


Figure 3-3. Floodplain Longitudinal profile of the Dowagiac River from Kinzie Road to Pucker Street Dam

(Source: Inter-Fluve 2016)

3.2.1.2 Flow Characteristics

Flow characteristics of the Dowagiac River are important considerations for restoration design and for evaluating the potential for flooding from dam removal.

Within the Dowagiac River, base flow is primarily associated with the groundwater portion of the river discharge. Groundwater contribution is important to the Dowagiac River, providing a stable source of cold water that provides suitable habitat for coldwater species, such as trout. Surface water runoff when added to base flow induces flow increases of various magnitudes, including floods. Base flow, although relatively constant, varies in magnitude with precipitation and snow melt within and between years.

To understand the changes between wet years and dry years in the magnitude of base flow, it is useful to consider the exceedance probability, which is expressed as the percentage of time that a given flow rate is exceeded. For example, the driest day would have a 100 percent exceedance flow value, indicating flow has never dropped below this value during the period of record. A 10 percent exceedance value was used to estimate typical low flows in extremely wet years. A plot of average flow, 10 percent exceedance and 100 percent exceedance flows at the Sumnerville gaging station (U.S. Geological Survey [USGS] gage 04101800) is shown in Figure 3-4. Similar recurrence interval data are presented in tabular form for the Sumnerville gage and at Pucker Street Dam (Table 3-2). As shown in Table 3-2, base flows as indicated in the 90 percent exceedance value were determined to be 162 cfs at Sumnerville and 179 cfs at Pucker Street during summer months. Base flow is somewhat higher during other seasons as indicated in Figure 3-4.

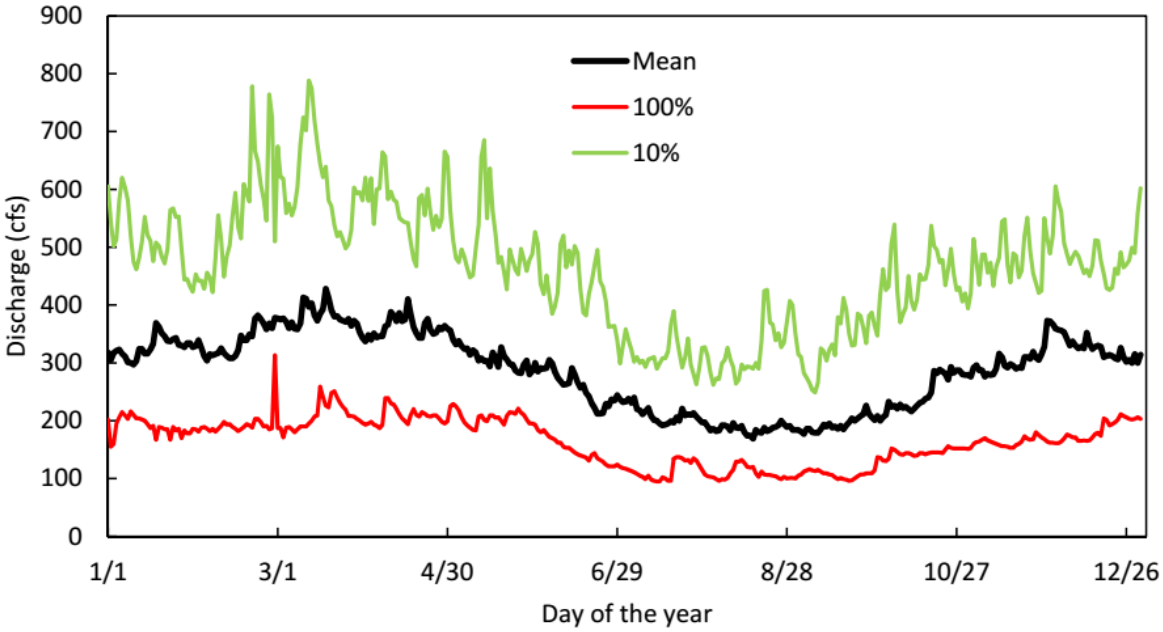


Figure 3-4. Daily Probability of Flows on the Dowagiac River Near Sumnerville

(Source: USGS gage 04101800; IACWD 1983, Sumnerville MI, Inter-Fluve 2016)

To estimate flood magnitudes, a Log-Pearson Type III (LP3) probability distribution was fit to the Dowagiac River at Sumnerville, MI, flow gaging station data (USGS gage 04101800). This gage is located 4.5 miles upstream of the project site. The Sumnerville gage recorded larger floods (>1,250 cfs) in 1968, 1985, 1986, 1990, 1993, 1997, 2008, and 2009. The smallest annual peak flow was 629 cfs in 2000 and the largest annual peak was 2,300 cfs in 2008. An additional flow gaging station at State Highway 51 (USGS gage 04101535, installed in 2012) was not utilized for flood magnitude analysis given its short period of record. In general, the high infiltration rates throughout the watershed and subsequent high groundwater supply to the Dowagiac River results in a relatively stable flood hydrology as summarized in Table 3-3. The range of flood flows is relatively small, with the difference between a frequently occurring peak flow (<2 year return interval) and an infrequent peak flow (>50 year return interval) less than a factor of two.

Table 3-2. Low Flow Statistics at the Sumnerville Gage and at Pucker Street Dam

Return Interval (Years)	Discharge (cfs)	
	Sumnerville Gage	Pucker Street Dam
1	777	859
5	541	598
10	458	506
50	276	305
75	205	227
90	162	179

Source: USGS gage 04101800; IACWD 1983, Sumnerville MI (Values at Pucker Street Dam adjusted based on watershed area)

Table 3-3. Predicted Flood Magnitudes at Pucker Street

Return Interval (Years)	Pucker Street Dam Discharge (cfs)
1.43	1,008
1.5	1,017
2	1,125
5	1,347
10	1,483
25	1,646
50	1,762
100	1,874

Source: USGS gage 04101800; IACWD 1983, Sumnerville MI (Values at Pucker Street Dam adjusted based on watershed area, Inter-Fluve 2016)

As a federal agency, USFWS is subject to the requirements of EO 11988, Floodplain Management. The objective of EO 11988 is to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances. The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative.

The portion of the Dowagiac River within the project area is mapped as Zone A for the National Flood Insurance Program. The 100-year floodplain elevation is 688.0 feet (NGVD 29) at the upstream side of dam (Inter-Fluve 2016).

3.2.2 Environmental Consequences

3.2.2.1 Alternative A – No Action

Under the No Action alternative, hydrologic conditions currently evident on the Dowagiac River in the vicinity of Pucker Street Dam would remain unaltered. As such the natural flowing regime of the river is interrupted by a still water (lentic) system. Accordingly, the slower flowing water

evident upstream from the dam would continue to promote sedimentation. The impounded area would gradually become shallower due to sedimentation and even more sediment would be carried over the dam as the impounded area fills up. Similarly, the extent of the 100-year floodplain would remain unchanged from the existing condition.

3.2.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

Hydrologic and hydraulic analyses indicate that removal of Pucker Street Dam would not significantly change flood flow rates and, therefore, flood elevations downstream of the dam. At Pucker Street Dam, the current flood volume during the 2-year flood is around 16,900 acre-ft compared to a storage volume of just 79 acre-ft (0.5 percent). For the 200-year flood, the current flood volume is 10,233 acre-ft compared to a storage volume of 226 acre-ft (2.2 percent). Both comparisons indicate that under existing conditions, there is little flood attenuation. Under Alternative B, the design channel would store 42 acre-ft during the 2-yr flood and 70 acre-ft during the 200-year flood, which amount to 0.3 percent and 0.7 percent of flood volume, respectively. Although the storage volumes available in the proposed design are smaller than existing storage, the storage-to-flood volume ratios are less than the 15 percent required to produce a noticeable impact. Therefore, dam removal should have no impact on flood storage and peak discharge magnitudes downstream.

As specified in EO 11988 the lead federal agency must provide leadership in reducing the risk of flood loss, minimizing the impact of floods on human safety, health, and welfare, and in restoring and preserving the natural and beneficial values served by floodplains. In accordance with this EO and as demonstrated above, the proposed action does not adversely increase the risk of flooding. However, in concert with the proposed removal of Pucker Street Dam and the associated restoration of a natural river channel, it does provide some benefits in restoring and preserving the natural and beneficial values of floodplains by virtue of the constructed floodplain benches along 1,400 feet of the restored channel. In total, this alternative has the potential to restore up to 4.1 acres of effective floodplain along the reconstructed river channel. Natural functions and values offered by floodplains and provided by Alternative B include natural flood storage, sediment retention, nutrient retention/removal, wildlife support, fish spawning and reproduction, natural heritage values (sensitive species support), and other functions. Consequently, Alternative B is consistent with the requirements of EO 11988.

3.3 Sediment Transport

3.3.1 Affected Environment

3.3.1.1 Existing Conditions

Based on observations in the upper watershed, the Dowagiac River gains sand and finer material from tributaries within the upland wetland reaches, but the sands cannot be transported easily due to the reduced velocities associated with the low gradient of the upper watershed (see Figure 1-4). Once the landscape slope increases, sediment is delivered to the river from tributaries, and to a lesser extent, from erosion along the channel margins. Bed material begins to include more gravels and small cobbles, which form occasional riffles along the channel; however, sand appears to be the dominant bed material along most of the river. Sand moves nearly continuously within the Dowagiac River system and is eventually delivered to the impoundment behind the dam. Some gravel is also transported through the system, but currently appears to settle at the upstream end of the study reach (downstream of Kinzie Road), while the smaller sand and fine particles can be carried farther downstream into the impoundment.

During the 1999 drawdown, the upstream streambed adjusted to the lowered pool level by down-cutting to a new equilibrium profile, which was achieved approximately three years later. Because sediment transport processes are interrupted by the dam and its associated impoundment, little sediment is carried to the Dowagiac River below the dam. Smaller particles suspended within the water column are, however, transported downstream of the dam during high flow events. As a result, the streambed upstream of the dam is primarily sand with some gravel. Downstream of the dam, the stream sediments are significantly coarser, consisting of gravel and small cobble. As such, the river downstream of Pucker Street Dam may be characterized as sediment starved and as such is exhibiting some reduced channel stability as evidenced by its greater width relative to reference reaches. Additionally, potential changes in the Dowagiac River Watershed have occurred since the dam was constructed that could potentially cause fluvial processes to be different from the pre-dam condition. Channelization and development, as well as climate changes, may have altered the hydrology and the sediment load from the watershed upstream of the Kinzie Road bridge.

3.3.1.2 Sediment Contamination

A total of 42 sediment samples were collected in 2014 and analyzed for grain size and chemical parameters (PCB's, PNA's, arsenic, cadmium, copper, lead, mercury, nickel, selenium and zinc). A total of 14 transects were conducted, with sediment samples collected from the left, center and right side of the stream when looking downstream. Sediment samples from transects one through 9 were collected by Great Lakes Environmental Center using vibracore methods. The first transect was 25 feet upstream of the dam, with each successive transect 500 feet upstream.

The results are presented in detail in Appendix D and show that only concentrations of arsenic, selenium and zinc in some samples exceed the statewide default background levels. However, the Upper Confidence Limits (UCL) for arsenic and zinc are below the accepted state background levels for this area. Although the UCL for selenium at 480 parts per billion (ppb) exceeded the default background limit of 410 ppb, this is still a low enough concentration to not exceed the Part 201 (environmental remediation) criteria.

Results of the sediment analysis were submitted to the MDEQ for review and concurrence. Based on this review it was determined that the dredged sediment is considered inert and suitable for unrestricted upland disposal and can be used as unrestricted fill material. The appropriate federal and state permits from U.S. Army Corps of Engineers and MDEQ would still need to be acquired to place this material in streams and wetlands.

3.3.1.3 Sediment Depth

Field studies in support of river restoration design included completing a DOR study within the Dowagiac River upstream of Pucker Street Dam. Fieldwork included noting general geomorphic characteristics and collecting topographic and DOR surveys at transects across the river and along the existing channel alignment. The DOR survey was conducted by pushing a rod through accumulated impoundment sediment until a firm layer (e.g., clay or gravel) "refuses" further penetration. DOR surveys allow an initial interpretation of former vertical and horizontal channel position and depth of sediment.

Data collected as part of the DOR and longitudinal profile surveys are illustrated in Figure 3-4 and presented in detail in Appendix D. Results indicate that the average channel depth from the existing river bed to impounded sediment surface (i.e., floodplain) is approximately 6 feet throughout the study reach. The DOR data, however, suggest the valley is filled with sediment

up to 18 feet deep in the vicinity of the dam, and that the channel gradient prior to dam construction was more than double the existing gradient.

3.3.2 Environmental Consequences

3.3.2.1 Alternative A – No Action

Under the No Action Alternative, Pucker Street Dam is expected to remain in-place for some indeterminate short-term period, during which the current sediment conditions would remain unchanged. The river downstream of Pucker Street Dam would continue to be sediment starved and the stream sediments downstream of the dam would be dominated by gravel and small cobble.

3.3.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

A HEC-RAS sediment transport analysis was completed to assess the stability of the proposed channel restoration plan and rate of sediment transport dynamics associated with the dam removal. The model used the available streamflow data at the USGS Dowagiac River at Sumnerville for the period from January 2005 through June 2010, which included the flood of record at this station that occurred in 2008. The existing conditions model predicted an average annual sediment discharge from the downstream end of the modeled reach (approximately 2,000 feet downstream of the dam) of 4,721 tons/year, which was generated mostly due to a large discharge during 2008. For the years other than 2008, the average annual sediment discharge was 3,324 tons/year. The sediment inflow at the upstream boundary of the model was 2,166 tons/year and 1,956 tons/year for years excluding 2008.

This analysis indicates that, based on project plans, a large increase in sediment discharge within approximately 2,000 feet downstream of the dam is not anticipated. The sandy streambed is expected to adjust relatively rapidly with water level lowering. The model predicted a relatively uniformly occurring sediment load of approximately 118 tons/day during a five-month channel adjustment period following dam removal and water level lowering before returning to a sediment discharge rate of approximately 1,818 tons/year for the next four years.

Additionally, the HEC-RAS model analysis indicated that while significant channel degradation (down-cutting) occurred in the upper portion of the modeled stream reach, some deposition of sediment occurred in the lower portion of the modeled reach, downstream of the former dam, reducing the sediment load to the stream reach further downstream.

It was noted that the channel upstream of the location where the dredged channel bed departs from the identified historic river bed (estimated by the DOR probes) responded immediately to the water level lowering, with down-cutting of the streambed by up to approximately 1.5 to 2.0 feet, trending to a flatter slope closer to the 0.21 percent slope estimated from the DOR profile. A sand bed stream would be expected to adjust to the change relatively quickly. The model indicates that active restoration (excavation) of the future channel down to the profile of the historic streambed at which an armored bed had developed is important to the stability of the streambed and sediment discharge resulting from the dam removal. Actual sediment load discharged would vary from the model based on the streamflow rates that occur in the months following the dam removal. In order to reduce sediment load to the furthest extent possible, the removal of the dam would be scheduled for a typical low flow period of the year. The installation and operation of a sediment trap upstream of the dam to capture and remove sediment during the period of channel adjustment would even further reduce the amount of sediment transported downstream.

3.4 Water Quality

3.4.1 Affected Environment

The Dowagiac River is a coldwater stream (Lyons et al. 2009; Gunderman 2011) that flows southwest from its headwaters in Van Buren County to its mouth at the St. Joseph River near Niles, MI (see Figure 1-3). The St. Joseph River eventually links the Dowagiac River to Lake Michigan near Benton Harbor, MI. Major tributaries to the Dowagiac River include Lake of the Woods and Osborn drains and Silver, Peavine, Pokagon, McKinzie, and Dowagiac creeks. Mean daily streamflow in the Dowagiac River is 300 cfs based on 58 years of existing data (USGS Streamgage No. 04101800 near Sumnerville, MI). Cobble, gravel, sand, and occasional boulder are the major substrate types found throughout the system. Coarse textured glacial deposits allow substantial groundwater contributions to the Dowagiac River system, which keep the Dowagiac River and its tributaries at a lower temperature year-round.

The Dowagiac River Watershed has a history of land use change that contributed to water quality degradation in the basin. Settlements near Niles, MI in the late 1820s and 1830s resulted in large swaths deforested for agriculture (Rogers 1875 as cited in Inter-Fluve 2016). Stream temperatures have been affected by the removal of riparian corridors that provide shading and an increase of surface water runoff, which reduces the influence of cold groundwater (Clarke et al. 1998; Cass County Conservation District 2002). The conversion of lands to agricultural use also increases sediment load runoff, which increases turbidity and causes sedimentation along the stream bottom.

Anthropogenic changes directly to the Dowagiac River have also contributed to water quality degradation. For example, a section of the Dowagiac River was dredged and channelized in the 1900s to facilitate drainage of the surrounding floodplain and free more land for agriculture (Clarke et al. 1998; Cass County Conservation District 2002). Straightening and dredging the river resulted in increased surface water delivery to the system, increased river velocities, and increased sediment transport downstream. Dredging also caused the river banks to become incised and reduced the connectivity of the Dowagiac River from its floodplain, resulting in reduced nutrient delivery and increased the severity of downstream flooding. Ultimately, the channelization succeeded in draining more of the watershed and converting it into farmland—exacerbating sedimentation and surface runoff issues. Additionally, the construction of Pucker Street Dam in the 1920s acts as a barrier separating the middle and upper sections of the Dowagiac River from its lower segment and the St. Joseph River (see Figure 1-3). The combination of land use changes and channelization upstream of the dam led to an increase in the volume of sediment, which was trapped behind Pucker Street Dam. Since its inception, the impounded area behind Pucker Street Dam has filled with approximately 1,000,000 cubic yards of material (Inter-Fluve 2016).

Despite the damage caused by habitat alteration, the large amount of groundwater contribution to the Dowagiac River helps maintain good surface water quality. It is estimated that 90 percent of the flow in the Dowagiac River is groundwater (Cass County Conservation District 2002). Groundwater contributions provide cool, stable base flows. The Dowagiac River's temperatures in the month of July average in the mid to upper sixties with diurnal temperature fluctuations at a minimum (Cass County Conservation District 2002). Overall, the pH is slightly alkaline and the amount of suspended sediments is relatively low (Clarke et al. 1998). Point source pollution sources (e.g., heavy industries and waste-water treatment) are relatively few in the watershed. As of 1998, there were only eight MDEQ permitted outflows in the watershed (Cass County Conservation District 2002). However, a high water table and high infiltration rates in the watershed make groundwater resources vulnerable to non-point source pollution of fertilizers,

pesticides, animal waste, and human waste (i.e., leachate from septic systems). For example, agricultural activities appear to be contributing increased nutrients to both the groundwater and surface water in several locations (Cummings et al. 1984; Brennan and Stamm 1991). Nutrients (e.g., phosphorus) easily bind to fine sediments (Allan and Castillo 2007), which accumulate behind the Pucker Street Dam.

Water temperatures, concentrations of dissolved oxygen (DO), and levels of suspended sediments are adequate to support trout (MDEQ 1997a, 1997b). However, the State has listed the Dowagiac River as impaired in MDEQ's Clean Water Section 303(d) list of impaired waterbodies for not meeting the fish consumption designated use due to polychlorinated biphenyl (PCB) found in the water column and in fish tissue (MDEQ 2016). Manufacture of PCB ended in 1979, but they are a persistent organic pollutant and are still found in the Great Lakes region where they bioaccumulate in sportfish. However, the concentrations of PCB in Great Lakes fish have declined since the 1990s (Salamova et al. 2013).

3.4.2 Environmental Consequences

3.4.2.1 Alternative A – No Action

Under the No Action alternative, Pucker Street Dam would remain as a barrier separating the middle and upper sections of the Dowagiac River from its lower segment and the St. Joseph River. Water quality within the impounded reach would continue to be negatively affected by altered flows, sedimentation, and reduced riparian cover. Reduced stream velocity allows sediments and nutrients to settle out of suspension in the impoundment. Sediment would continue to accumulate behind the dam, to the detriment of upstream and downstream water quality. Eventually the impounded area would gradually become shallower due to sedimentation and warming would occur more rapidly, resulting in increased water temperatures.

3.4.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

Under Alternative B, natural flow regimes and sediment transport processes would be restored to both upstream and downstream habitats. Long-term water quality would also improve with the removal of fine sediments that accumulate higher proportions of pollutants. The return of shallow, high-velocity habitats (e.g., riffles and runs) would improve dissolved oxygen concentrations throughout the system. Riparian habitat establishment and enhancement would act as erosion controls along banks and as filters for pollutants in surface-water runoff.

Removal of the Pucker Street Dam and restoration of a free-flowing river would return the Dowagiac River to its natural thermal regime. The decrease in channel width upstream of the dam would reduce the residence time of water, therefore resulting in a slightly lower summer water temperature. Additionally, under Alternative B, restoration activities would have the indirect effect of lowering stream temperatures through vegetation reestablishment that would provide shading along the banks.

Under Alternative B short-term effects to water quality are anticipated. Removal of the dam would mobilize accumulated sediments behind the dam and increase downstream turbidity. Some increases in turbidity are also expected to occur in conjunction with headcutting (i.e., the scouring of the stream channel to a more natural slope). Extensive sediment management efforts using both active excavation of the river channel and passive collection using instream-sediment traps would minimize downstream sediment transport. Sediment removals would reduce adverse effects to water quality, but increased turbidity and sediment deposition would nonetheless occur. Active construction in the channel would also increase turbidity but would be

limited to the construction phase of this alternative. Additionally, revegetation and erosion BMPs would be used to limit surface runoff of sediments from upland construction areas. Overall, dam removal is expected to increase downstream turbidity in the short-term, but such effects would be temporary and be offset by the improvements in water quality in restored habitats upstream.

Alternative B would result in direct, long-term benefits that include the restoration of approximately 6,300 feet of aquatic habitat and the elimination of habitat fragmentation within the Dowagiac River system. Removal of Pucker Street Dam would reconnect 159 miles of streams within the Dowagiac River Watershed to the St. Joseph River (Clarke et al. 1998). Extensive sediment management activities would reduce the potential for extensive downstream transport of sediments that can affect water quality. Short-term sedimentation in the lower Dowagiac River would occur but is expected be reduced by seasonal flooding. Overall, this alternative would result in an overall improvement of water quality for the Dowagiac River.

3.5 Aquatic Ecology

3.5.1 Affected Environment

3.5.1.1 Existing Conditions

The Dowagiac River is a coldwater stream that flows approximately 31 miles from its headwaters in Van Buren County to its mouth in the St. Joseph River near Niles, MI (see Figure 1-3). The St. Joseph River eventually links the Dowagiac River to Lake Michigan near Benton Harbor, MI. Major tributaries to the Dowagiac River include Lake of the Woods and Osborn drains and Silver, Peavine, Pokagon, McKinzie, and Dowagiac creeks. Cobble, gravel, sand, and occasional boulder are the major substrate types found throughout the system. Consistent groundwater inflows keep the Dowagiac River and its tributaries at a lower temperature year-round. For example, monitoring at several sites along the mainstem Dowagiac River during 2013-2014 revealed mean July water temperatures from 63.5^{o}F to 68.8^{o}F.

Habitat is degraded throughout the Dowagiac River system largely due to historical channelization, land use impacts, and dam operations. The Dowagiac River has a history of channelization to facilitate wetland drainage for agricultural and urban use. Channelization eliminates important spawning and rearing habitats by reducing stream meanders, instream habitats (e.g., riffles, pools, snags), and riparian vegetation (Gordon et al. 1992). More impervious surfaces (e.g., parking lots) also increase surface runoff, which reduces the influence of cold groundwater and increases river temperatures. Furthermore, the loss of riparian vegetation along the river channel increases stream temperatures by reducing shade on the river.

Pucker Street Dam acts as a barrier separating the middle and upper sections of the Dowagiac River from its lower segment and the St. Joseph River (see Figure 1-3). Dams often result in a range of effects on a river system including fragmentation coupled with the alteration of natural flow regimes, stream temperatures, and sediment transport processes (see Section 1.4.2).

3.5.1.1.1 Fish Composition

Stable groundwater inflows make the Dowagiac River and its tributaries recreationally important coldwater fisheries. The entire Dowagiac River mainstem is classified as a second quality coldwater stream and major tributaries to the Dowagiac River are classified as top or second quality coldwater systems (Wesley and Duffy 2003). The MDNR has completed fisheries surveys on the Dowagiac River on multiple occasions from 1939 through 2011. Brown trout is the primary game fish species upstream of the dam. The brown trout population consists of a

mixture of stocked fish and wild fish from tributary streams (e.g., Pokagon and Peavine creeks). The fishery downstream of the dam is dominated by potamodromous fish species, with rainbow trout (steelhead), Chinook salmon, and coho salmon being the most abundant fish harvested during MDNR creel surveys conducted during 1992-2004 (Gunderman 2017). Brown trout were the most common river resident species observed during the creel surveys in the lower river. Throughout all MDNR surveys, 42 fish species were captured downstream of the dam and 39 species were collected upstream of the dam (Table 3-4). Notable fish species missing from upstream sites include potamodromous salmonids (rainbow trout, Chinook salmon, and coho salmon), walleye, logperch, and shorthead redhorse.

Table 3-4. Fish Species Composition in the Dowagiac River

Common Name	Scientific Name	Upstream of Pucker Street Dam	Downstream of Pucker Street Dam
American brook lamprey	*Lethenteron appendix*	X	X
Black crappie	*Pomoxis nigromaculatus*	X	
Blacknose dace	*Rhinichthys atratulus*	X	X
Blackside darter	*Percina maculata*	X	X
Bluegill	*Lepomis macrochirus*	X	X
Bluntnose minnow	*Pimephales notatus*	X	X
Bowfin	*Amia calva*	X	
Brook silverside	*Labidesthes sicculus*	X	
Brown trout	*Salmo trutta*	X	X
Central mudminnow	*Umbra limi*	X	X
Central stoneroller	*Campostoma anomalum*		X
Chinook salmon	*Oncorhynchus tshawytscha*		X
Coho salmon	*Oncorhynchus kisutch*		X
Common carp	*Cyprinus carpio*	X	X
Common shiner	*Luxilus cornutus*	X	X
Creek chub	*Semotilus atromaculatus*	X	X
Emerald shiner	*Notropis atherinoides*	X	
Golden redhorse	*Moxostoma erythrurum*	X	X
Golden shiner	*Notemigonus crysoleucas*	X	X
Grass pickerel	*Esox americanus*	X	X
Greater redhorse	*Moxostoma valenciennesi*	X	
Green sunfish	*Lepomis cyanellus*	X	X
Hornyhead chub	*Nocomis biguttatus*	X	X
Iowa darter	*Etheostoma exile*	X	
Johnny darter	*Etheostoma nigrum*	X	X
Lake chubsucker	*Erimyzon succetta*	X	
Largemouth bass	*Micropterus salmoides*	X	X
Logperch	*Percina caprodes*		X
Longear sunfish	*Lepomis megalotis*		X
Longnose dace	*Rhinichthys cataractae*		X
Mimic shiner	*Notropis volucellus*		X
Mottled sculpin	*Cottus bairdi*	X	X

Common Name	Scientific Name	Upstream of Pucker Street Dam	Downstream of Pucker Street Dam
Northern Hog Sucker	*Hypentelium nigricans*	X	X
Northern madtom	*Noturus stigmosus*		X
Pirate perch	*Aphredoderus sayanus*	X	
Pumpkinseed	*Lepomis gibbosus*	X	X
Rainbow darter	*Etheostoma caeruleum*	X	X
Rainbow trout	*Oncorhynchus mykiss*		X
Rock bass	*Ambloplites rupestris*	X	X
Rosyface shiner	*Notropis rubellus*		X
Sand shiner	*Notropis stramineus*	X	X
Shorthead redhorse	*Moxostoma macrolepidotum*		X
Slimy sculpin	*Cottus cognatus*	X	
Smallmouth bass	*Micropterus dolomieu*	X	X
Spotfin shiner	*Cyprinella spiloptera*	X	X
Stonecat	*Noturus flavus*	X	X
Walleye	*Sander vitreus*		X
Warmouth	*Lepomis gulosus*	X	X
White sucker	*Catostomus commersoni*	X	X
Yellow bullhead	*Ameiurus natalis*	X	X
Yellow perch	*Perca flavescens*	X	X
Total Species		**39**	**42**

Source: MDNR surveys conducted during 1939-2011

Before construction of dams in the greater St. Joseph River Watershed, lake sturgeon (*Acipenser fulvescens)* and lake trout (*Salvelinus namaycush)* were also noted to historically spawn upstream of Niles, MI (Wesley and Duffy 2003).

3.5.1.1.2 Stocked fish

Dowagiac River as well as Peavine, Pokagon, McKinzie, and Dowagiac creeks are actively managed as a coldwater fishery by the MDNR Fisheries Division. Brown trout have been stocked for decades as natural recruitment in the mainstem Dowagiac River is not sufficient to maintain the existing fishery even though some tributaries to the Dowagiac River support naturally reproducing brown trout populations (Wesley and Duffy 2003). The total annual stocking target for six sites on the Dowagiac River mainstem upstream of the Pucker Street Dam is 7,000 fish (75 fish per acre) and the annual stocking target for downstream of the Pucker Street Dam is 6,800 fish (200 fish per acre) (Gunderman 2011). From 2014 to 2018, MDNR stocked 70,880 yearling brown trout (14,176 per year) in the Dowagiac River. Additionally, MDNR stocks steelhead, Chinook salmon, and coho salmon in the St. Joseph River. The annual stocking target for steelhead is 63,000 yearlings. Chinook and coho salmon stocking numbers are adjusted based on prey abundance in Lake Michigan. MDNR also stocks approximately 100,000 spring fingerling walleyes in the St. Joseph River between Niles and Benton Harbor on a biennial schedule, and the Indiana Department of Natural Resources stocks steelhead and coho salmon in the Indiana portion of the river.

3.5.1.1.3 Macroinvertebrates

Aquatic macroinvertebrates are often used as indicators of water quality because they are less mobile than fish and are sensitive to pollution and siltation. Mussels are particularly important indicator species because they are long lived and can better reveal the water quality history of a stream segment. Aquatic macroinvertebrates have been repeatedly sampled by MDEQ and MDNR within the St. Joseph River Watershed including sections of the Dowagiac River (e.g., MDEQ 1997 and Walterhouse 2012). More recent macroinvertebrate surveys found the Dowagiac River had fair to good invertebrate communities in the headwaters and excellent communities below the dam (MDEQ 1997 as cited in Wesley and Duffy 2003 and Walterhouse 2012). Assemblages of mayflies, stoneflies, and caddisflies were present, which is consistent with a coldwater system and indicative of good water quality.

Historic mussel surveys through the Dowagiac River found five mussel species below the Pucker Street Dam at Niles, MI (Table 27 in Welsey and Duffy 2003). The five species below the dam included: elktoe (*Alasmidonta marginata*), ellipse (*Venustaconcha ellipsiformis*), creek heelsplitter (*Lasmigona compressa*), cylindrical papershell (*Anodontoides ferussacianus*), and spike (*Elliptio dilatata*). Elktoe, ellipse, and creek heelsplitter are all currently listed as species of concern in Michigan (Michigan Natural Features Inventory [MNFI] 2017). No mussel species were found above the Pucker Street Dam. The inability of fish below the dam that may carry larval forms of mussels (glochidia) to move to aquatic habitats upstream of Pucker Street Dam likely contributes to the apparent lack of mussels in upstream habitats. No invasive mussel species (e.g., zebra mussel or Asian clam) were found in any samples from the Dowagiac River.

3.5.2 Environmental Consequences

3.5.2.1 Alternative A – No Action

Under the No Action alternative, Pucker Street Dam would remain as a barrier separating the middle and upper sections of the Dowagiac River from its lower segment and the St. Joseph River. At its current drawdown level, the Pucker Street Dam has a remaining 15-foot concrete sill impounding approximately 6,000 feet of the Dowagiac River. Habitats within the impounded reach would continue to be negatively affected by altered flows, shallower depths and reduced substrate quality due to sedimentation, wider channels, and reduced riparian cover. Habitats downstream of the dam would continue to be negatively impacted by variable flows and depths. Potamodromous fish species would continue to be excluded by the dam from potential spawning habitats in the Dowagiac River system. Important recreational species such as steelhead, Chinook salmon, walleye, and coho salmon and rare species such as lake sturgeon would remain excluded from areas above the dam. Additionally, individual local fish could continue to be displaced behind the dam through the spillway during high flows. Macroinvertebrate populations would remain largely unchanged due to the continued barrier to fish movements and subsequent upstream dispersal of glochidia that may be attached to host fish (i.e., mussel larvae).

3.5.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

Alternative B would result in the restoration of approximately 6,300 feet of high-gradient habitat in the Dowagiac River. Natural flow regimes would be restored to both upstream and downstream habitats. Sediment accumulation above the dam would be eliminated and natural sediment transport processes would be returned to this section of the Dowagiac River. Instream habitat quality would also improve with the removal of fine sediments covering more coarse substrates (e.g., gravel and cobble) underneath. Riffle, run, and pool complexes would establish

with a return of natural river meandering and would directly benefit fish and macroinvertebrates. Upstream aquatic communities would also be reconnected to those downstream. Riparian habitat establishment and enhancement would also directly benefit stream temperatures, add energy inputs into the system in the form of leaves, add instream habitat in the form of woody debris, add habitat for adult stages of macroinvertebrates, and act as erosion control along banks.

Short-term effects would include some sediment deposition within downstream habitats. However, extensive sediment management efforts using both active excavation of the river channel and passive collection/removal from instream traps would minimize downstream sediment transport. Such deposition may occur and adversely affect spawning and feeding habitats below the dam and may result in direct mortality of less mobile organisms. However, these impacts are expected to be short-term until the natural sediment transport processes are restored. In the long-term, the overall habitat conditions within the stream would be improved and allow for the return of upstream fish movements. For example, the recent restoration work completed to expose coarse substrate in an old meander at Dodd Park resulted in a river wide high of 37 macroinvertebrate taxa collected (MDEQ 2011). Additionally, removal of the barrier could allow for the natural distribution of native mussel glochidia by upstream fish movements. Long-term improvements in macroinvertebrate stocks would also likely improve fish stocks.

Under this alternative potamodromous fish (e.g., steelhead, Chinook, and coho salmon) would expand their use of the Dowagiac River within the watershed above Pucker Street Dam. Additionally, native fish such as walleye, logperch, and shorthead redhorse would also benefit from the re-opening of historic spawning locations. Fragmented populations of river resident species (e.g., smallmouth bass and northern hog suckers) would be re-connected.

Brown trout are likely to remain an important game fish in the Dowagiac River system. Overall, there is limited potential for Chinook salmon to interact with brown trout as they have short residence periods in streams. Adult Chinook quickly spawn and die, and the fry emerge from the redds (i.e., salmon nests) from March through April and migrate to Lake Michigan from May through June of the same year.

Similar to Chinook, adult coho salmon move quickly upstream and die following spawning, but juvenile coho typically reside in their natal stream for at least one year prior to moving out of the system. During this time, they will directly compete with brown trout. Natural productions would be limited by the amount of summer and winter rearing habitat preferred by juvenile coho based on MDNR sampling other streams where coho are able to spawn. Steelhead are most likely to interact with brown trout as the adults may remain in the Dowagiac River and tributary streams for months before spawning. During this time, large steelhead may feed directly on resident brown trout. Additionally, juveniles will reside in the natal stream much like the coho salmon. Steelhead are expected to be more abundant in the Dowagiac River and its tributaries than coho salmon. During the 1992-2004 creel surveys, the number of steelhead harvested in the river downstream of the Pucker Street Dam were approximately 2.6 times greater than for coho salmon (Gunderman 2017). However, steelhead are expected to have only minor effects on the brown trout population in the Dowagiac River because competition between these species is thought to be greatest in small streams with high trout population densities and high-quality spawning habitat (Nuhfer et al. 2014). Other large coldwater rivers (such as the Pere Marquette and Little Manistee rivers in the northern Lower Peninsula) support excellent fisheries for both brown trout and steelhead. Additionally, any negative effects to brown trout due to competition from other salmonids would be offset by the continued stocking by the MDNR. Stocking has

been modified in the past to account for any changes in brown trout populations and could be modified in the future if necessary.

Some adult walleyes from the St. Joseph River will move into the Dowagiac River in the spring to spawn over gravel and cobble riffles. Most of the adult walleyes are expected to return to the St. Joseph River after spawning. Creel data collected on the portion of the Dowagiac River downstream of the Pucker Street Dam during 1992-2004 supports this hypothesis. Only 310 walleyes were harvested during this period, compared to 4,427 steelhead. Walleye fry drift downstream after emergence, and juveniles most commonly are found in slow-moving water with aquatic vegetation or logs for cover (Kerr et al. 1997). Spatial overlap and competition for resources between brown trout and juvenile walleyes likely will be minimal. The Muskegon River downstream of Croton Dam is characterized by one of the largest walleye spawning runs in the state and is one of the walleye egg collection sites for MDNR's walleye rearing and stocking program. Despite this large seasonal influx of adult walleyes, the Muskegon River supports popular fisheries for brown trout, river resident rainbow trout (Eagle Lake strain), and steelhead (O'Neal and Kolb 2015).

Alternative B would result in notable long-term direct beneficial effects that would include the restoration of approximately 6,300 feet of aquatic habitats of the river and would reconnect 159 miles of streams within the Dowagiac River Watershed to the St. Joseph River. Extensive sediment management activities would reduce the potential for extensive downstream transport and deposition of sediments. Short-term sedimentation in the lower Dowagiac River would occur but is expected to be reduced by seasonal high flow events. Removal of the dam would result in changes in the composition of aquatic communities as potamodromous fish, native fish, and unionid mussel populations are expected to expand their use of the Dowagiac River within the watershed above Pucker Street Dam. Impacts to aquatic ecosystems, therefore, are considered to be adverse but minor in the short-term due to sedimentation effects, but beneficial and notable in the long-term.

3.6 Terrestrial Ecology

3.6.1 Affected Environment

3.6.1.1 Vegetation

The project area is located within the Battle Creek Outwash Plain, a sub-ecoregion of the Southern Michigan/Northern Indiana Drift Plains. This region is characterized by broad, flat plains and streams and rivers occupy some of the main outwash channels. Presettlement vegetation was diverse and consisted of a large concentration of dry tallgrass prairies and wet prairies. Oak savannas historically grew on gently sloping terrain where fires were more frequent and oak-hickory forests grew in steeper terrain or where moisture conditions did not favor frequent fires. The outwash deposits provide stable flows in the region's streams and rivers; however, stream quality has become lower due to the channelization and removal of riparian vegetation (Omernik and Bryce 2007).

The vegetation within the project area and within a 3-mile radius surrounding the project area was evaluated using land use/land cover information obtained from the National Land Cover Database (Homer et al. 2015). Land cover within the immediate project area was delineated by direct photo interpretation of aerial photography. Land cover is summarized in Table 3-5 and illustrated in Figure 3-5.

Table 3-5. Land Use/Land Cover in the Pucker Street Dam Project Area and Vicinity

Land Cover Type	Pucker Street Dam Project Area (acres)	3-mile Radius[1] (acres)
Barren Land	--	101
Cultivated Crops	1.0	7,303
Deciduous Forest	24.8	2,844
Developed, High Intensity	--	238
Developed, Medium Intensity	--	550
Developed, Low Intensity	3.0	1,994
Developed, Open Space	--	1,947
Emergent Herbaceous Wetlands	27.3	37
Evergreen Forest	--	31
Hay/Pasture	--	1,114
Herbaceous	9.4	249
Mixed Forest	--	61
Open Water	24.5	241
Shrub/Scrub	0.3	37
Woody Wetlands	33.2	1,348
Total	**123.4**	**18,095**

[1]Source: Homer et al. 2015

The predominant land cover types within the project area include emergent herbaceous wetlands (27.3 acres), open water (24.5 acres), deciduous forest (24.8 acres), and woody wetlands (33.2 acres). Land cover in the vicinity consists primarily of cultivated crops (7,303 acres), developed land (3,940 acres), deciduous forest (2,844 acres), woody wetlands (1,348 acres), and hay/pasture (1,114 acres).

The majority of the immediate project area is represented by a low-lying river corridor along the Dowagiac River valley. Plant communities within the river valley consist of a mosaic of palustrine emergent and forested wetlands associated with the floodplain of the Dowagiac River. Dominant herbaceous species in emergent wetland communities include reed canary grass (*Phalaris arundinacea),* spotted-touch-me-not (*Impatiens capensis),* wood nettle (*Laportea canadensis),* side-flowering aster (*Symphyotrichum lateriflorum),* narrow-leaved cattail (*Typha latifolia),* common arrowhead (*Sagittaria latifolia),* and smartweed (*Persicaria pensylvanica).* In addition, dominant species in forested wetland communities include green ash (*Fraxinus pennsylvanica),* red maple (*Acer rubrum),* box elder (*Acer negundo),* American hornbeam (*Carpinus caroliniana),* and American elm (*Ulmus americana).* Upland conditions within the project area include mowed lawns of adjoining properties, as well as vegetative communities associated with higher landscape positions within the Dowagiac River valley. Common vegetation observed in the upland portions of the project area included basswood (*Tilia americana)*, black cherry (*Prunus serotina*), hackberry (*Celtis occidentalis*), red oak (*Quercus rubra*), black oak (*Q. vetulina*), sycamore (*Platanus occidentalis*), American beech (*Fagus grandifolia*), box elder, common buckthorn, honeysuckle (*Lonicera spp.*), river bank grape (*Vitis riparia*), poison ivy (*Toxicodendron radicans*), and Virginia creeper (*Parthenocissus quinquefolia*) (Environmental Consulting & Technology, Inc. 2016).

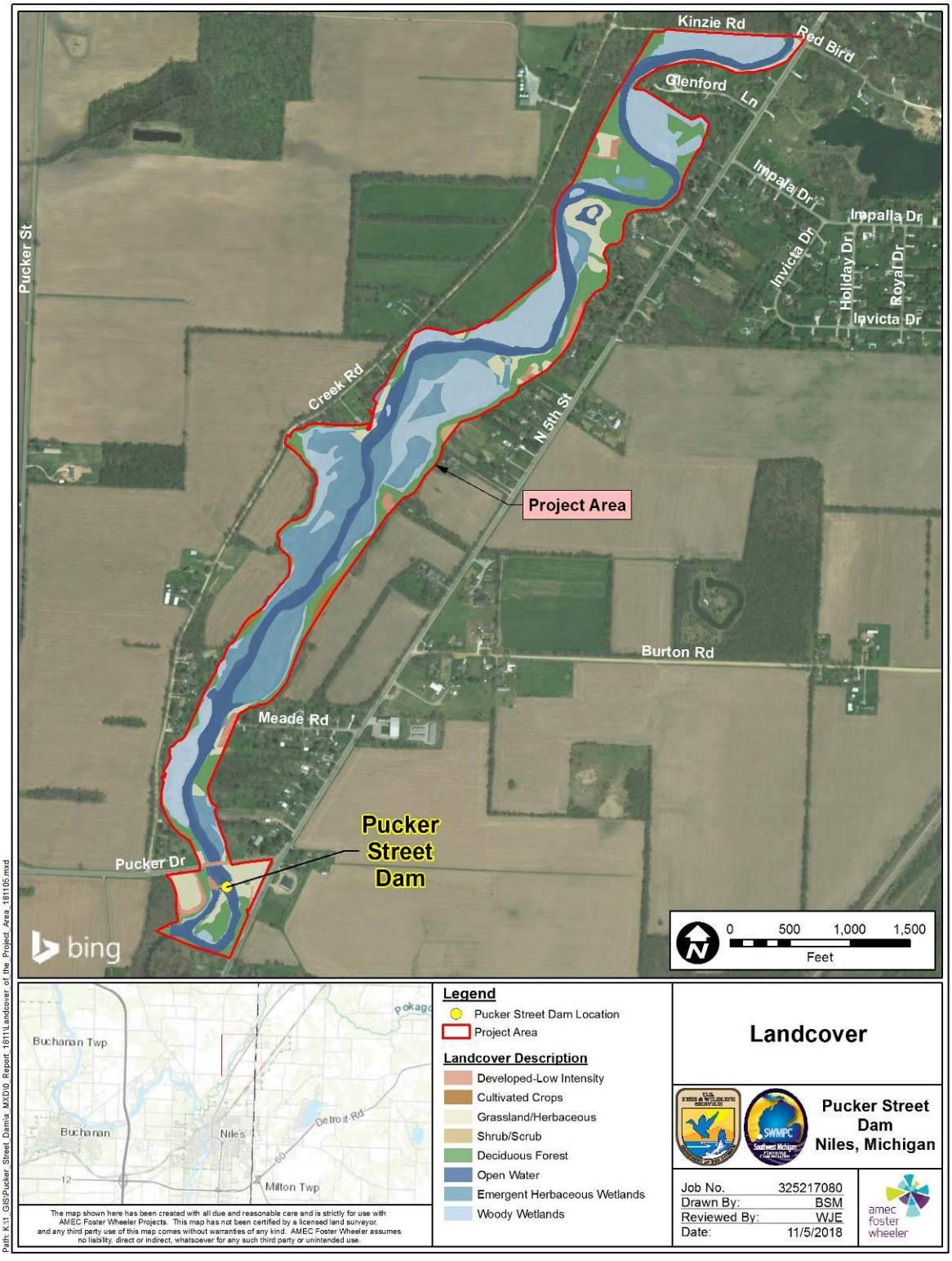


Figure 3-5. Land Cover Types Associated with the Pucker Street Dam Project Area

3.6.1.2 Wildlife

Wildlife communities associated with the emergent and wooded wetlands of the Dowagiac River valley are relatively diverse and are represented by waterfowl (ducks, geese), swans, wading birds (herons), shorebirds (sandpipers), raptors (hawks, bald eagle), wild turkey, pheasant, various mammal species (whitetail deer, cottontail rabbit, and other rodents), and herpetofauna (snakes, frogs, toads, turtles, salamanders).

The upland communities in the vicinity of the Dowagiac River also support a diversity of wildlife but are characterized by fewer water-dependent species and more taxa that are typically associated with more mesic (moist) upland habitats. Bird communities in these areas are dominated by species that frequent trees and shrubs such as songbirds, woodpeckers and other cavity-nesting species, as well as neotropical migratory birds (warblers) and upland game birds (wild turkey). Additionally, these uplands support a different assemblage of mammals including a variety of bat species, rodents (groundhog, squirrels, chipmunks, white-footed mouse, etc.), and carnivorous species (red and gray fox, raccoon, striped skunk, etc.).

No communal wading bird colonies are known to occur in the immediate vicinity of the project site. Therefore, work activity would not affect heron rookeries or other aggregations of migratory birds. In addition, no caves have been documented at the Pucker Street Dam project area and none are known to occur within 3 miles of the project area.

3.6.2 Environmental Consequences

3.6.2.1 Alternative A – No Action Alternative

Under the No Action alternative, the dam would remain in place and current maintenance operations of the dam would continue. Under this alternative open water within the upper delta of the impounded area would continue to accrete sediment and create additional exposed bars and substrates. Over time, more stable lateral bars would develop additional fringe plant communities. As sediment accretion would continue, the plant community characteristics would gradually change in response to the transition in habitat types from emergent and woody wetland habitats to more upland habitats.

Wildlife species composition and usage within the project area are expected to shift in response to the anticipated changes in plant communities from aquatic dominated to more upland plant dominated habitats. However, most of the common wildlife present in the area utilize a variety of habitat types and would likely continue to utilize the area as it continues to undergo successional change.

3.6.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

Removal of the Pucker Street Dam would result in both direct and indirect conversion of vegetation communities and wildlife habitats. In conjunction with dam removal and river restoration activities, sediment removed from the excavated river channel would be placed within selected areas of the former impoundment for disposal. As a result, sediments would be deposited on approximately 14.5 acres of existing vegetation resulting in general plant community mortality (see Figure 2-2). Mobile wildlife may be expected to avoid construction areas during ecosystem restoration activities, whereas less mobile species would be directly impacted by spoil placement. Subsequent to restoration activities, exposed spoil areas would undergo successional transition to re-establish upland plant and wildlife communities.

As part of channel reconstruction, a 20-foot wide floodplain bench would be constructed on both sides of the excavated river channel from the dam to a distance of 1,400 feet upstream. These areas would be seeded with approved native seed mixes designed to aid in the establishment of up to 4.1 acres of naturalized floodplain and wetland habitats.

Expansion of the distribution of terrestrial fauna into newly established habitats is anticipated for Alternative B. These species are expected to utilize the newly exposed bottomland on an intermittent basis immediately after drawdown and dam removal but would establish themselves within new habitats as riparian restoration progresses. Once vegetation is re-established, wildlife species are likely to make use of the project area again. Semi-aquatic species including frogs, toads, turtles, and wading birds may also be impacted by the removal of the dam and associated river restoration activities. The aquatic and semi-aquatic habitats that would be restored along with associated wetlands are expected to provide suitable habitat for many of these species.

Indirect impacts are also expected to occur following the removal of the dam. Lands within the former impoundment area upstream of the dam that are unaffected by spoil placement would undergo varying degrees of dewatering (depending on their distance from Pucker Street Dam) that would result in a shift to a community comprised of more upland plant and animal species. However, because of the demonstrated importance of groundwater as part of the base flow of the Dowagiac River (see Section 3.2), and because groundwater discharging along the valley wall is known to support existing floodplain communities, such indirect effects are expected to be reduced with increasing distance upstream of the dam.

Potential indirect impacts on nearby vegetation communities and wildlife could result from the transportation of sediment material and building material from the dam and powerhouse. Trucks hauling these materials along existing or constructed access routes would potentially result in minor increases of fugitive dust and exhaust emissions that could cause disturbance in terrestrial environments due to deposition. However, BMPs such as covering soil material and equipment maintenance would be followed to minimize impacts. Therefore, indirect impacts to wildlife and their habitats from the transport of soil material would be minor.

Both vegetation and wildlife are expected to benefit from indirect impacts associated with reduced habitat fragmentation associated with dam removal. Elimination of the dam and the associated impounded areas above the dam, coupled with the restoration of contiguous riverine habitats would benefit faunal species that use stream and river corridors as corridors for migration, foraging and dispersal. Consequently, biotic communities both downstream and upstream would be rejoined to result in an overall enhancement of the riverine ecosystem.

Overall, Alternative B is expected to result in short-term and localized adverse impacts to existing vegetation communities and wildlife habitats, but in the long-term the habitat restoration of the riparian floodplain forest would result in more ecologically diverse and contiguous plant and animal communities. Additionally, in context with the abundance and availability of similar habitats within the Dowagiac River Watershed, and the improved ecosystem function provided by dam removal and river restoration activities, overall impacts to terrestrial resources is small.

3.7 Sensitive Species

3.7.1 Affected Environment

The ESA; 16 USC §§ 1531-1543 was passed to conserve the ecosystems upon which endangered and threatened species depend, and to conserve and recover those species. An

endangered species is defined by the ESA as any species in danger of extinction throughout all or a significant portion of its range, whereas threatened species are those that are at risk of becoming endangered within the foreseeable future throughout all or a significant part of its range. The ESA establishes programs to conserve and recover endangered and threatened species and makes their conservation a priority for federal agencies.

The state of Michigan provides protection for species considered threatened and endangered under the Endangered Species Act of the State of Michigan (Part 365 of PA 451, 1994 Michigan Natural Resources and Environmental Protection Act). The list of state protected species is developed and maintained by MDNR. This list also includes species of special concern, which are not afforded legal protection but are of concern due to their declining or relict populations in the state. MDNR also identifies extirpated species, which are those that can no longer be found in the state of Michigan, but which can be found elsewhere in the world. Within Berrien County, MDNR has identified 178 protected plant and animal species (MNFI 2017) (Table 3-6). Of these species in Berrien County, 26 are endangered, 78 are threatened, 65 are species of special concern, and 9 are presumed extirpated.

According to the MNFI database (2018), there are no known occurrences of state or federally listed endangered or threatened species within the area extending from Kinzie Road downstream to the confluence of the Dowagiac River with the St. Joseph River.

The following table lists the federally and state listed species in Berrien County and indicates which species could potentially have suitable habitat near the Pucker Street Dam project area.

Table 3-6. Species of Conservation Concern within Berrien County

Common Name	Scientific Name	Status		Suitable Habitat Present[4]
		Federal[1]	State[2] (Rank[3])	
Birds				
Cerulean warbler	*Setophaga cerulea*	--	T (S3)	N
Dickcissel	*Spiza americana*	--	SC (S3)	N
Grasshopper sparrow	*Ammodramus savannarum*	--	SC (S4)	N
Henslow's sparrow	*Ammodramus henslowii*	--	E (S3)	N
Hooded warbler	*Setophaga citrina*	--	SC (S3)	P
King rail	*Rallus elegans*	--	E (S2)	N
Least bittern	*Ixobrychus exilis*	--	T (S3)	P (limited)
Louisana waterthrush	*Parkesia motacilla*	--	T (S2)	N
Marsh wren	*Cistothorus palustris*	--	SC (S3)	P (limited)
Osprey	*Pandion haliaetus*	--	SC (S4)	N
Piping plover	*Charadrius melodus*	LE	E (S2)	N
Prothonotary warbler	*Protonotaria citrea*	--	SC (S3)	P
Prairie warbler	*Setophaga discolor*	--	E (S3)	N
Red-shouldered hawk	*Buteo lineatus*	--	T (S4)	N
Rufa red knot	*Calidris canutus rufa*	LT	--	N
Western meadowlark	*Sturnella neglecta*	--	SC (S4)	N
Yellow-throated warbler	*Setophaga dominica*	--	T (S3)	N
Mammals				

Common Name	Scientific Name	Status		Suitable Habitat Present[4]
		Federal[1]	State[2] (Rank[3])	
Eastern pipistrelle	*Perimyotis subflavus*	--	SC (S1)	P
Indiana bat	*Myotis sodalist*	LE	E (S1)	P
Little brown bat	*Myotis lucifugus*	--	SC (S1)	P
Northern long-eared bat	*Myotis septentrionalis*	LT	SC (S1)	P
Prairie vole	*Microtus ochrogaster*	--	E (S3)	N
Woodland vole	*Microtus pinetorum*	--	D (S4)	N
Reptiles				
Blanding's turtle	*Emydoidea blandingii*	--	SC (S2S3)	N
Eastern box turtle	*Terrapene carolina*	--	SC (S2S3)	P
Eastern massasauga	*Sistrurus catenatus*	LT	SC (S3)	P
Gray ratsnake	*Pantherophis spiloides*	--	SC (S2S3)	N
Kirtland's snake	*Clonophis kirtlandii*	--	E (S1)	P
Spotted turtle	*Clemmys guttate*	--	T (S2)	N
Insects				
American burying beetle	*Nicrophorous americanus*	LE	X (SH)	N
Blazing star borer	*Papaipema beeriana*	--	SC (S2)	N
Culvers root borer	*Papipema sciata*	--	SC (S3)	N
Dune cutworm	*Euxoa aurulenta*	--	SC (S2S3)	N
Golden borer	*Papaipema cerina*	--	SC (S2)	N
Grey petaltail	*Tachopteryz thoreyi*	--	T (S1)	N
Maritime sunflower borer	*Papipema maritima*	--	SC (S2)	N
Mitchell's satyr	*Neonympha mitchellii*	LE	E (S1)	N
Regal fritillary	*Speyeria Idalia*	--	E (SH)	N
Silphium borer moth	*Papaipema silphii*	--	T (S1)	N
Spartina moth	*Photedes inops*	--	SC (S2S3)	N
Swamp metalmark	*Calephelis mutica*	--	SC (S1)	N
Tamarack tree cricket	*Oecanthus laricis*	--	SC (S3)	N
Amphibians				
Blanchard's cricket frog	*Acris blanchardi*	--	T (S2S3)	P
Marbled salamander	*Ambystoma opacum*	--	E (S1)	N
Mollusks				
Black sandshell	*Ligumia recta*	--	E (S1)	N
Brown walker	*Pomatiopsis cincinnatiensis*	--	SC (SH)	N
Campeloma spire snail	*Cincinnatia cincinnatiensis*	--	SC (S3)	N
Deertoe	*Truncilla truncata*	--	SC (S2S3)	P
Elktoe	*Alasmidonta marginata*	--	SC (S3)	N
Ellipse	*Venustaconcha ellipsiformis*	--	SC (S3)	N
Foster mantleslug	*Pallifera fosteria*	--	T (S1)	N
Kidney shell	*Ptychobranchus fasciolaris*	--	SC (S2)	N
Lilliput	*Toxolasma parvum*	--	E (S1)	P
Paper pondshell	*Utterbackia imbecillis*	--	SC (S2S3)	P
Proud globe	*Mesodon elevates*	--	T (SH)	N

Common Name	Scientific Name	Status		Suitable Habitat Present[4]
		Federal[1]	State[2] (Rank[3])	
Purplecap valvata	*Valvata perdepressa*	--	SC (SNR)	N
Purple wartyback	*Cyclonaias tuberculata*	--	T (S2)	P
Rainbow	*Villosa iris*	--	SC (S3)	N
Round pigtoe	*Pleurobema sintoxia*	--	SC (S3)	P
Slippershell	*Alasmidonta viridis*	--	T (S2S3)	N
Snuffbox	*Epioblasma triquetra*	LE	E (S1S2)	P
Threehorn wartyback	*Obliquaria reflexa*	--	E (S1)	P
Watercress snail	*Fontigens nickliniana*	--	SC (S2S3)	N
Fish				
Lake herring	*Coregonus artedi*	--	T (S3)	N
Lake sturgeon	*Acipenser fluvescens*	--	T (S2)	N
River redhorse	*Moxostoma carinatum*	--	T (S2)	N
Shortjaw cisco	*Coregonus zenithicus*	--	T (S2)	N
Starhead topminnow	*Fundulus dispar*	--	SC (S1)	N
Plants				
American lotus	*Nelumbo lutea*	--	T (S2)	N
Annual hedge hyssop	*Gratiola virginiana*	--	T (S1)	N
Annual wildrice	*Zizania aquatic*	--	T (S2S3)	N
Bald-rush	*Rhynochospora scirpoides*	--	T (S2)	N
Beach three-awned grass	*Aristida tuberculosa*	--	E (S1)	N
Beaked agrimony	*Agrimonia rostellata*	--	T (S2)	N
Beak grass	*Diarrhena obovate*	--	T (S2)	N
Black-fruited spike-rush	*Eleocharis melanocarpa*	--	SC (S3)	N
Bladderwort	*Utricularia sublata*		T (S1)	N
Blue-eyed Mary	*Collinsia verna*	--	SC (SNR)	N
Broad-leaved sedge	*Carex platyphylla*	--	E (S1)	N
Canadian milk vetch	*Astragalus canadensis*	--	T (S1S2)	N
Chestnut sedge	*Fimbristylis puberula*	--	X (SX)	N
Climbing fumitory	*Adlumia fungosa*	--	SC (S3)	N
Compass plant	*Silphium laciniatum*	--	T (S1S2)	N
Cranefly orchid	*Tipularia discolor*	--	E (S1)	N
Creeping whitlow grass	*Draba reptans*	--	T (S1)	N
Cross-leaved milkwort	*Polygala cruciate*	--	SC (S3)	N
Cup plant	*Silphium perfoliatum*	--	T (S2)	P
Cut-leaved water parsnip	*Berula erecta*	--	T (S2)	N
Davis's sedge	*Carex davisii*	--	SC (S3)	P
Downy sunflower	*Helianthus mollis*	--	T (S2)	N
Dwarf bulrush	*Lipocarpha micrantha*	--	SC (S3)	N
Eastern few-fruited sedge	*Carex oligocarpa*	--	T (S2)	N
Edible valerian	*Valeriana edulis var. ciliate*	--	T (S2)	N
Engelmann's spike rush	*Eleorcharis engelmannii*	--	SC (S2S3)	N
False boneset	*Brickellia eupatorioides*	--	SC (S2)	N

Common Name	Scientific Name	Status		Suitable Habitat Present[4]
		Federal[1]	State[2] (Rank[3])	
Few-flowered nut rush	*Scleria pauciflora*	--	E (S1)	N
Field dodder	*Cuscuta campestris*	--	SC (S1)	N
Floating bladderwort	*Utricularia inflata*	--	E (S1)	N
Frost grape	*Vitis vulpine*	--	T (S1S2)	N
Gentian-leaved St. John's wort	*Hypericum gentiancoides*	--	SC (S3)	N
Ginseng	*Panax quinquefolius*	--	T (S2S3)	N
Globe-fruited seedbox	*Ludwigia sphaerocarpa*	--	T (S1)	N
Goldenseal	*Hydrastis canadensis*	--	T (S2)	N
Goosefoot corn salad	*Valerianella chenopodiifolia*	--	T (S1)	N
Greenwhite sedge	*Carex albolutescens*	--	T (S2)	N
Green violet	*Hybanthus concolor*	--	SC (S3)	N
Hairy-fruited sedge	*Carex trichocarpa*	--	SC (S2)	N
Hairy mountain mint	*Pycnanthemum pilosum*	--	T (S2)	N
Hairy skullcap	*Scutellaria elliptica*	--	SC (S3)	N
Heavy sedge	*Carex gravida*	--	X (SX)	N
Hemlock-parsley	*Conioselinum chinense*	--	SC (SNR)	N
Hill's thistle	*Cirsium hillii*	--	SC (S3)	N
Hollow-stemmed Joe-pye weed	*Eutrochium fistulosum*	--	T (S1)	N
Jacob's ladder	*Polemonium reptans*	--	T (S2)	N
Leadplant	*Amorpha canescens*	--	SC (S3)	N
Leggettt's pinweed	*Lechea pulchella*	--	T (S1S2)	P
Marbleweed	*Lithospermum molle*	--	X (SX)	N
Meadow beauty	*Rhexia virginica*	--	SC (S3)	N
Missouri rock-cress	*Boechera missouriensis*	--	SC (S2)	N
Mountain mint	*Pycnanthemum muticum*	--	T (S1)	N
Needlepod rush	*Juncus scirpoides*	--	T (S2)	N
Netted nut rush	*Scleria reticularis*	--	T (S2)	N
Nodding pogonia	*Triphora trianthophora*	--	T (S1)	N
Northern appressed clubmoss	*Lycopodiella subappressa*	--	SC (S2)	N
Orange-or-yellow fringed orchid	*Platanthera ciliaris*	--	E (S1S2)	N
Panicled hawkweed	*Hieracium paniculatum*	--	T (S2)	N
Pitcher's thistle	*Cirsium pitcher*	LT	T (S3)	N
Prairie coreopsis	*Coreopsis palmata*	--	T (S2)	N
Prairie indian-plantain	*Arnoglossum plantagineum*	--	SC (S3)	N
Prairie trillium	*Trillium recurvatum*	--	T (S2S3)	P
Pumpkin ash	*Fraxinus profunda*	--	T (S2)	N
Purple milkweed	*Asclepias purpurascens*	--	T (S2)	N
Queen-on-the-prairie	*Filipendula rubra*	--	T (S2)	N

Common Name	Scientific Name	Status		Suitable Habitat Present[4]
		Federal[1]	State[2] (Rank[3])	
Rattlesnake-master	*Eryngium yuccifolium*	--	T (S2)	N
Raven's-foot sedge	*Carex crus-corvi*	--	E (S1)	N
Red mulberry	*Morus rubra*	--	T (S2)	P
Rock-jasmine	*Androsace occidentalis*	--	E (SX)	N
Rope dodder	*Cuscuta glomerata*	--	SC (SH)	N
Rosepink	*Sabatia angularis*	--	T (S2)	N
Rosinweed	*Silphium integrifolium*	--	T (S2)	N
Round-seed panic-grass	*Dichanthelium polyanthes*	--	E (S1)	N
Sand grass	*Triplasis purpurea*	--	SC (S2)	N
Shooting star	*Primula meadia*	--	E (S1)	N
Short-fruited rush	*Juncus brachycarpus*	--	T (S1S2)	N
Showy orchis	*Galearis spectabilis*	--	T (S2)	N
Soapwort gentian	*Gentiana saponaria*	--	X (SX)	N
Slender dayflower	*Commenlina erecta*	--	X (SX)	N
Smaller whorled pogonia	*Isotria medeoloides*	--	X (SX)	N
Small-fruited panic-grass	*Dichanthelium microcarpon*	--	SC (SX)	N
Small log fern	*Dryopteria celsa*	--	T (S2)	N
Spotted pondweed	*Potamogeton pulcher*	--	E (S1)	N
Squarrose sedge	*Carex squarrosa*	--	SC (S1)	P
Starry campion	*Silene stellata*	--	T (S2)	N
Stiff gentian	*Gentianella quinquefolia*	--	T (S2)	N
Swamp cottonwood	*Populus heterophylla*	--	E (S1)	N
Tall beakrush	*Rhynchospora macrostachya*	--	SC (S3S4)	N
Three-awned grass	*Aristida longespica*	--	T (S2)	N
Tinted spurge	*Euphorbia commutata*	--	T (S1)	N
Toadshade	*Trillium sessile*	--	T (S2S3)	P
Trailing wild bean	*Strophostyles helvula*	--	SC (S3)	N
Twinleaf	*Jeffersonia diphylla*	--	SC (S3)	N
Violet wood sorrel	*Oxalis violacea*	--	X (SX)	N
Virginia flax	*Linum virginianum*	--	T (S2)	N
Virginia snakeroot	*Endodeca serpentina*	--	T (S2)	P
Walking fern	*Asplenium rhizophyllum*	--	T (S2S3)	N
Waterthread pondweed	*Potamogeton bicupulatus*	--	T (S2)	N
Watermeal	*Wolffia brasiliensis*	--	T (S1)	N
Weak stellate sedge	*Carex seorsa*	--	T (S2)	N
Whiskered sunflower	*Helianthus hirsutus*	--	SC (S3)	N
White false indigo	*Baptisia lactea*	--	SC (S3)	N
White lady slipper	*Cypripedium candidum*	--	T (S2)	N
Whorled mountain mint	*Pycnanthemum verticillatum*	--	SC (S2)	N
Whorled pogonia	*Isotria verticillate*	--	T (S2)	N
Wild hyacinth	*Camassia scilloides*	--	T (S2)	N
Wild oats	*Chasmanthium latifolium*	--	E (S1)	N

Common Name	Scientific Name	Status		Suitable Habitat Present[4]
		Federal[1]	State[2] (Rank[3])	
Wild potato	*Ipomoea pandurate*	--	T (S2)	P (limited)
Wild sweet William	*Phlox maculate*	--	T (S1)	N
Winged monkey flower	*Mimulus alatus*	--	X (S1)	N
Wisteria	*Wisteria frutescens*	--	T (S1)	N
Yellow-flowered leafcup	*Smallanthus uvedalia*	--	T (S1)	N
Yellow fumewort	*Corydalis flavula*	--	T (S2)	N

Sources: MNFI 2017 and USFWS IPaC 2017
[1] Federal Status Codes:
LE = Listed Endangered
LT = Listed Threatened
-- = Not Listed by USFWS
[2] State Status Codes:
E = Listed Endangered
T = Listed Threatened
SC = Species of special concern
[3] State Rank:
S1 = Critically Imperiled S2 = Imperiled
S3 = Vulnerable S4 = Apparently Secure
S#S# = Denotes a range of ranks because the exact rarity of the element is uncertain (e.g., S1S2)
Migratory Species may have separate ranks for different population segments (e.g. S1B, S2N, S4M);
[4] Habitat Codes:
Y = Yes, species has been documented in existing habitats in study area and suitable habitat is present
N = No, no records of species within study area and no suitable habitat is present
P = Potentially suitable habitat is present, but no records of species in study area

In Michigan, MDNR has reported 178 state threatened or endangered species from Berrien County including 66 animal species and 112 plant species (MNFI 2017). Even though there is potential suitable habitat for some state listed terrestrial and aquatic fauna within the vicinity, habitats of the immediate project area are either disturbed/developed habitats associated with Pucker Street Dam, or are disturbed areas recently exposed by the drawdown of the impoundment in 1999. Additionally, a previous vegetation survey did not find any state listed plant species within the Pucker Street Dam project area (Environmental Consulting & Technology, Inc. 2016).

USFWS has reported nine federally threatened or endangered species from Berrien County including seven animal species and two plant species (USFWS 2017) (Table 3-6). However, five species (piping plover, rufa red knot, Mitchell's satyr butterfly and pitcher's thistle) are limited to specific habitats including the Great Lakes shoreline and rare wetlands such as bogs and fens (MNFI 2007). Additionally, the American burying beetle and small whorled pogonia are more typically associated with grasslands and/or rich mesic woodlands and are not characteristic of floodplain environments. Therefore, these species are not expected to occur in the project area. Species potentially present in the vicinity of the project area include the eastern massasauga rattlesnake, Indiana bat, and northern long-eared bat. A description of the federally listed species and their preferred habitat is discussed below. It should be noted that no designated critical habitats for any listed species of ecologically sensitive areas have been documented within the project area.

Eastern Massasauga Rattlesnake: This species is federally listed as threatened and is a species of special concern in Michigan. Populations in southern Michigan are typically associated with open wetlands, particularly prairie fens, while those in northern Michigan are known from open wetlands and lowland coniferous forests, such as cedar swamps. Eastern massasauga habitats generally appear to be characterized by (1) open, sunny areas intermixed with shaded areas, presumably for thermoregulation; (2) presence of the water table near the surface for hibernation; and (3) variable elevations between adjoining lowland and upland habitats. This species was last observed in Berrien County in 2016 (MNFI 2017).

Indiana Bat: The Indiana bat is listed both federally and by the state as endangered. Indiana bats roost and form maternity colonies under loose bark or in hollows and cavities of mature trees in the floodplain forest. In Michigan, the Indiana bat usually roosts in trees in riparian, bottomland, and upland forests that range from highly altered landscapes to intact forests. Southern Michigan maternity roost trees are typically in open areas exposed to solar radiation to maximize warmth (USFWS 2007). In winter, Indiana bats primarily hibernate in caves in Kentucky, Indiana, and Missouri (USFWS 2006).

Northern Long-Eared Bat: This bat species is listed as federally threatened and as a species of special concern in Michigan. In general, habitat use by northern long-eared bat is thought to be similar to that by Indiana bat, although northern long-eared bats appear to be more opportunistic in selection of summer habitat. Suitable winter habitat includes underground caves and cave-like structures (e.g., abandoned or active mines, railroad tunnels). During summer, this species roosts singly or in colonies in cavities, underneath bark, crevices, or hollows of both live and dead trees. The northern long-eared bat forages in upland and lowland woodlots, tree-lined corridors, and water surfaces, feeding on insects (USFWS 2015).

3.7.2 Environmental Consequences

3.7.2.1 Alternative A – No Action

Under the No Action alternative, there would no impacts to threatened and endangered species. Pucker Street Dam is expected to remain in place and no construction activities are expected to occur that would potentially result in the disturbance of sensitive species habitats.

3.7.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

The eastern massasauga rattlesnake is a species of special concern in Michigan and there have been reported occurrences in Berrien County. While this species has not been observed within the project area, there is potential suitable habitat in the emergent wetlands and low areas adjacent to the Dowagiac River and in adjacent upland areas. The removal of the Pucker Street Dam would likely not alter the upland areas near the project site but would impact wetlands and associated habitats from the placement of sediments during ecosystem restoration on the river. However, ecosystem restoration efforts after dam removal would restore up to 4.1 acres of naturalized floodplain and wetland habitats that the eastern massasauga may use. Project related impacts to the eastern massasauga are expected to be minor in the short-term due to potential disturbance from construction activities but would provide minor benefits in the long-term with the development of additional wetland habitat areas.

Both the Indiana bat and northern long-eared bat are federally and state listed. No hibernacula for these species occur within Berrien County; however, potential summer roosting trees may exist within the project area. Tree removal activities would be required for the project and would be limited to the October to March timeframe to avoid the bat roosting season. Locations where

tree removal may be required are shown in Figure 2-6, however the vegetation in some of these areas may be dominated by scrub/shrub and saplings.

In the long-term, the establishment of a riparian area and the enhancement of wetland and upland habitats along the Dowagiac River would likely provide a more ecologically diverse and contiguous habitat for listed species. In addition, the reconnection of the upstream and downstream reaches of the Dowagiac River would expand potential habitat for some threatened and endangered aquatic species.

3.8 Invasive Species

3.8.1 Affected Environment

Invasive species, as defined by EO 13112, are any species that are not native to a particular ecosystem and whose introduction does or is likely to cause economic or environmental harm to human, animal, and plant health. Invasive species are often common in previously disturbed areas. Invasive plants can include trees, shrubs, vines, grasses, ferns and forbs. These species have the potential to affect the native plant communities adversely because of their ability to spread rapidly and displace native vegetation. According to EO 13112, each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, prevent the introduction of invasive species; detect and control populations of such species; monitor invasive species populations; and provide for the restoration of native species in ecosystems that have been invaded.

Invasive plant species within wetland portions of the project area include reed canary grass, purple loosestrife *(Lythrum salicaria)*, and common reed (*Phragmites australis*). During the wetland delineation survey, reed canary grass was observed to be the dominant species within emergent wetlands. Purple loosestrife and common reed were also noted to be occasionally common. Common buckthorn *(Rhamnus cathartica)*, autumn olive *(Elaeagnus umbellata)*, multiflora rose (*Rosa multiflora*), and dames rocket *(Hesperis matronalis)* are commonly encountered within upland areas adjacent to the project area (Environmental Consulting & Technology, Inc. 2016).

Several invasive aquatic species have been intentionally or inadvertently introduced into the Great Lakes system and have a strong influence on aquatic communities through predation or competition. Round goby, sea lamprey, zebra mussel, and Asian clam are examples of invasive species that could access the St. Joseph River Watershed and its tributaries. The only invasive fish species currently in the project area is the common carp *(Cyprinus carpio)* (Wesley and Duffy 2003). Common carp inhabit a wide variety of habitats and in Michigan, they are found in the Great Lakes, large inland lakes and reservoirs, large and small rivers, swamps, canals, and drains (MDNR 2017). Common carp occurs both upstream and downstream of the Pucker Street Dam. Sea lampreys cannot move upstream past the first dam on the St. Joseph River (Berrien Spring Dam) and do not have access to the Dowagiac River.

3.8.2 Environmental Consequences

3.8.2.1 Alternative A – No Action

Under the No Action alternative, the dam would remain in place and current maintenance operations of the dam would continue. In the short-term, there would be no change in current conditions of invasive species under this alternative. However, over time, sediment accretion within the impoundment would continue to occur resulting in a gradual successional change from open aquatic habitats, emergent, and woody wetland habitats to more upland habitats. The

exposure of backwater areas and bare soil would likely support the continued establishment of invasive plant species throughout the project area. Distribution and abundance of invasive fish species populations would not change as their populations are currently established both upstream and downstream of the dam.

3.8.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

Removal of the Pucker Street Dam would result in the disturbance of plant and fish communities due to the excavation of sediments, grading of the streambank, inundation of previously terrestrial areas, and land disturbance by heavy equipment use. Due to the disturbance of soil in the project area, there is potential for the introduction and/or spread of invasive species. Exposed sediment disposal areas represent the largest potential for establishment of invasive species due to the predominance of relatively low fertility substrates within the disposal sites.

BMPs consisting of erosion control measures and the use of approved seed mixes designed to aid in establishing desirable native vegetation would mitigate for the potential spread of invasive plant species throughout the area. Following construction, the riparian areas and steep streambanks would be restored with an approved, native seed mix to prevent the introduction and/or spread of invasive plant species.

Common carp are already present upstream and downstream of the dam and it is not expected that increased colonization of invasive fish species would occur after the dam is removed. The project partners plan to work with the SW x SW Corner Cooperative Invasive Species Management Area (CISMA) staffed by the Berrien, Cass and Van Buren County Conservation Districts and a volunteer strike team to monitor any spread of invasive species during construction and following dam removal. The CISMA staff and volunteer strike team will be instrumental in preventing invasive species from becoming a serious threat to native ecosystems.

Potential indirect impacts could result from the transportation of demolition material from the dam and powerhouse. Additionally, construction equipment used to reconstruct the river and manage sediment (excavators, trucks, etc.) would be used within construction zones and along access routes. Such equipment use would potentially result in the inadvertent transport of invasive plant propagules (seeds) across the project area. However, BMPs such as covering building material, equipment maintenance, and decontaminating equipment after use would minimize conditions that would support the introduction and/or spread of invasive species throughout the project area. Therefore, indirect impacts on invasive species from the transport of construction material would be minor.

Overall, Alternative B is expected to result in potential short-term conditions where areas of soil are exposed that may be conducive to the establishment of invasive plant species. However, in the long-term, the establishment of native plant communities and the routine monitoring and management of invasive plant species would reduce the presence of invasive species within the project area. Additionally, the invasive fish communities present in the Dowagiac River are expected to remain stable due to their population presence upstream and downstream of the dam. Therefore, impacts associated with invasive species from the implementation of Alternative B are considered to be minor.

3.9 Wetlands

3.9.1 Affected Environment

Wetlands are those areas inundated by surface or groundwater such that vegetation adapted to saturated soil conditions is prevalent. Examples include swamps, marshes, bogs, and wet meadows. Wetland fringe areas are also found along the edges of most watercourses and impounded waters (both natural and man-made). Wetland habitat provides valuable public benefits including flood/erosion control, water quality improvement, wildlife habitat, and recreation opportunities.

In the state of Michigan, the MDEQ regulates the discharge of fill material into wetlands under Part 303, Wetlands Protection, of the Natural Resources and Environmental Policy Act, 1994 PA 451, as amended. In accordance with the rule, wetlands are regulated by the state of Michigan if they are:

- Connected to one of the Great Lakes or Lake St. Clair.
- Located within 1,000 feet of one of the Great Lakes or Lake St. Clair.
- Connected to an inland lake, pond, river, or stream.
- Located within 500 feet of an inland lake, pond, river or stream.
- Not connected to one of the Great Lakes or Lake St. Clair, or an inland lake, pond, stream, or river, but are greater than 5 acres in size.
- Not connected to one of the Great Lakes or Lake St. Clair, or an inland lake, pond, stream, or river, and less than 5 acres in size, but the MDEQ has determined that these wetlands are essential to the preservation of the state's natural resources and has notified the property owner.

In 1984, Michigan received authorization from the federal government to administer Section 404 of the Clean Water Act in most areas of the state. As such, wetlands in the project area are regulated at both the state and federal level by the MDEQ. Additionally, the purpose of EO 11990 (Protection of Wetlands) is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands." To meet these objectives, the Order requires federal agencies to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided.

The MDEQ defines a wetland as “land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support, wetland vegetation or aquatic life, and is commonly referred to as a bog, swamp, or marsh” (Act 451 of 1994 Part 303 Section 324.30301). This protection and definition applies to both public and private lands regardless of zoning or ownership.

Construction of the dam was completed in 1928, resulting in the impoundment of over 60 acres of open water between the dam and the Kinzie Road crossing. Based on photo interpretation from 1980 and 1996, it is estimated that between 23-26 acres of vegetated wetlands were found within or adjacent to the river system prior to the drawdown (Environmental Consulting & Technology, Inc. 2018). The partial and permanent drawdown of the dam in 1999 resulted in a 5-foot reduction of water surface elevation, a decrease in the surface water area, and an increase in wetlands due to new areas being exposed (Figure 3-6).

A wetland delineation of the project area was conducted on July 15 and July 28, 2016 to identify, delineate, and characterize wetlands and water features and assess their regulatory status (Environmental Consulting & Technology, Inc. 2016). In total, apart from the Dowagiac River, approximately 60.8 acres of wetlands were delineated within the project area (Figure 3-7).

The Dowagiac River valley includes a mix of emergent and forested wetlands that create a large, contiguous wetland associated with the floodplain on both banks. The dominant plant species observed within the wetland areas are common wetland species generally found in riparian corridors and typical of disturbed landscapes, such as the bank of a river. Dominant herbaceous species in emergent communities included reed canary grass, spotted touch-me-not, wood nettle, side-flowering aster, narrow-leaved cattail, common arrowhead, and smartweed. Forested portions of the wetland were found in the northern portion of the project area, just south of Kinzie Road and in the peninsula south of Pucker Street Dam. Dominant species in these areas included green ash, red maple, box elder, American hornbeam, and American elm. In addition, wetland shrub species observed included elderberry, spicebush, and gray dogwood. Based on the species observed, wetlands within the project area are considered to be of low to moderate quality.

Wetland communities near the Dowagiac River, but outside of the floodplain, are supported by direct rainfall and surface water runoff and in certain areas, surficial groundwater. In particular, based on an analysis of well logs from local residential wells, static water levels within nearby wells are relatively shallow, ranging from 13 to 21 feet below ground surface. When interpreted by USGS topographic mapping it is evident that groundwater levels intersect with the valley wall at or near the base elevation of the valley. This was evident during field reconnaissance activities in which wet and saturated soils were evident at the base of the valley wall nearly 500 feet from the edge of the river. As such, it is expected that groundwater discharge represents an important contributor to wetland development within the Dowagiac River valley.

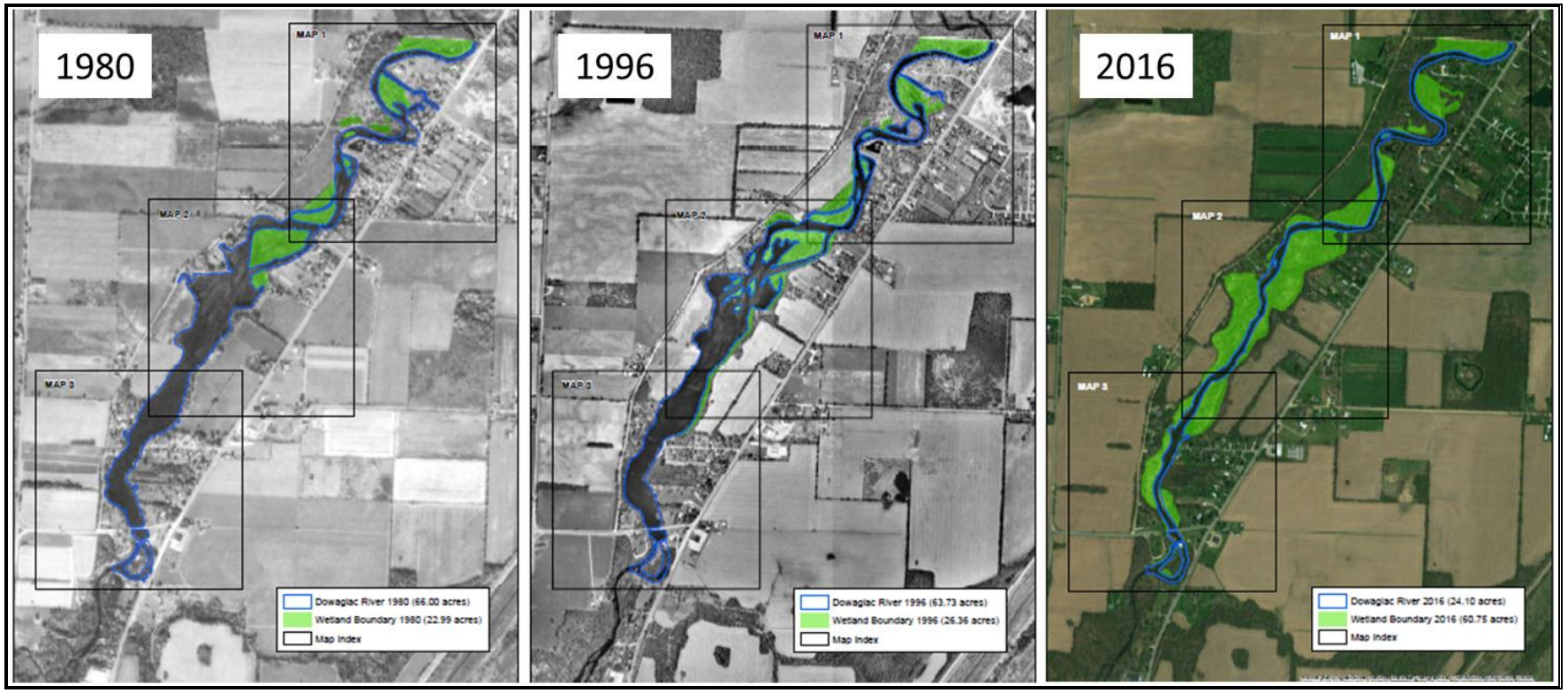


Figure 3-6. Pre- and Post- Drawdown Wetland Conditions Upstream of Pucker Street Dam

Source: Environmental Consulting & Technology, Inc. 2018

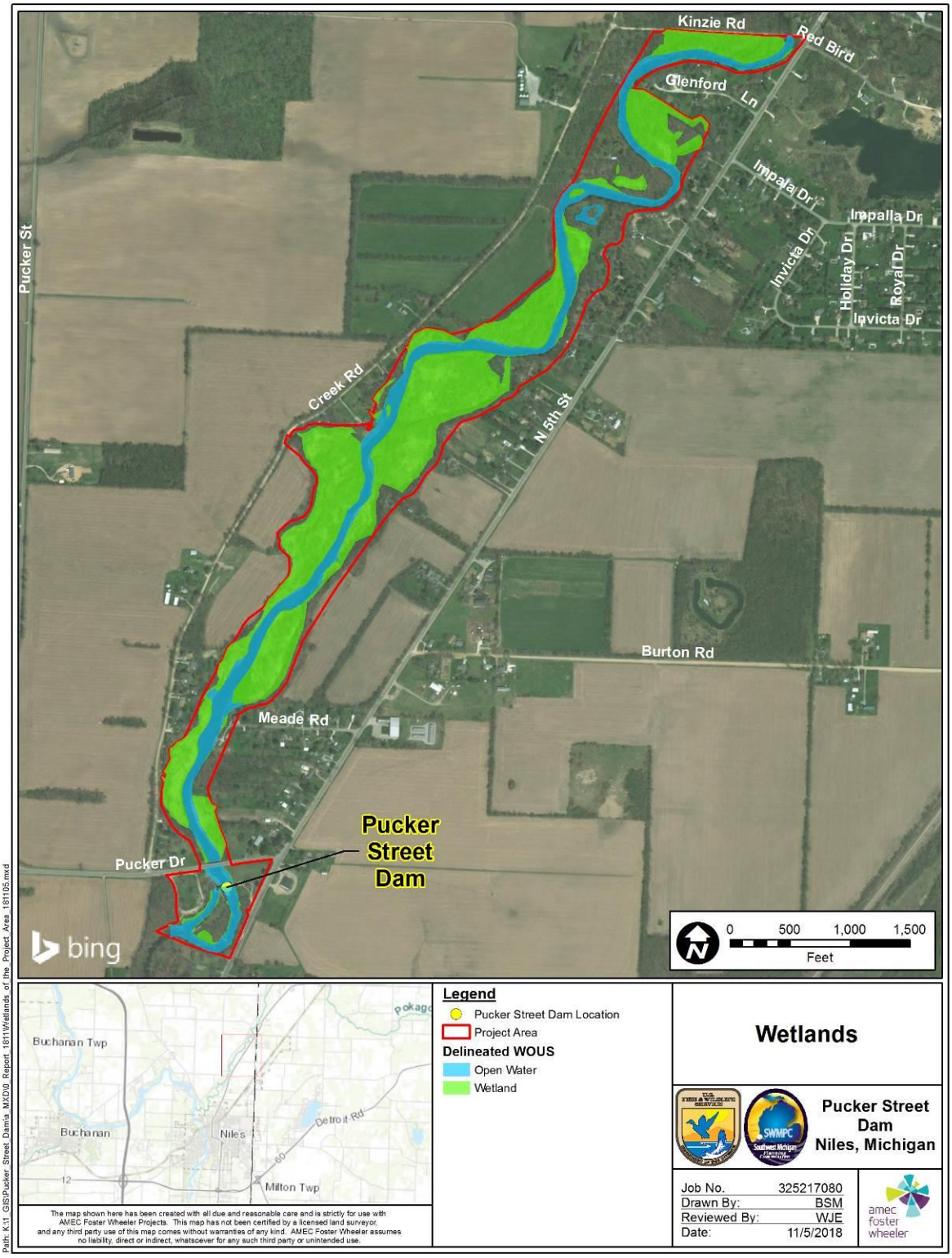


Figure 3-7. Delineated Wetlands within the Project Area

Source: Environmental Consulting & Technology, Inc. 2016

3.9.2 Environmental Consequences

3.9.2.1 Alternative A – No Action

Under the No Action alternative, Pucker Street Dam is expected to remain in-place for some indeterminate period. Additionally, no construction activities within wetlands or reduction of water levels would occur with this alternative. Therefore, no impacts to wetlands would occur under the No Action alternative.

3.9.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

Under this alternative, direct wetland impacts would result from placement of fill material obtained from sediment management activities within wetlands associated with the valley floor of the former impoundment area. Approximately 8.7 acres of lands previously mapped as wetlands are located within the proposed disposal areas (Figure 3-8). However, those wetlands did not preexist the development of the Pucker Street dam nor would they have become established if continued drawdown of the impoundment or immediate removal of the dam had occurred in 1999 or shortly thereafter. These recently exposed areas represent an artificial landform that has effectively been created by nearly 90 years of dam-related sedimentation. As such, these lands support wetland communities that have adapted and naturalized to the unnatural conditions created by impoundment of the Dowagiac River.

Fill areas identified in Figure 2-2 represent a minimized footprint of potential impact. Two other options for reducing the areas of direct wetland were considered. One option included more expanded fill areas that were more suitable for ease of construction. Under this alternative, fill depths would be between 1 and 5 feet and would encompass virtually all exposed lands of the former impoundment. This alternative, however, was eliminated from further consideration based on the desire to preserve as many lands for future wetland development as possible. Another alternative considered, but eliminated from further consideration, included excavation of sediments and transport by trucking to an offsite disposal facility. While this option would have reduced the area of wetland impact, it would result in excessive project costs that would undermine project feasibility.

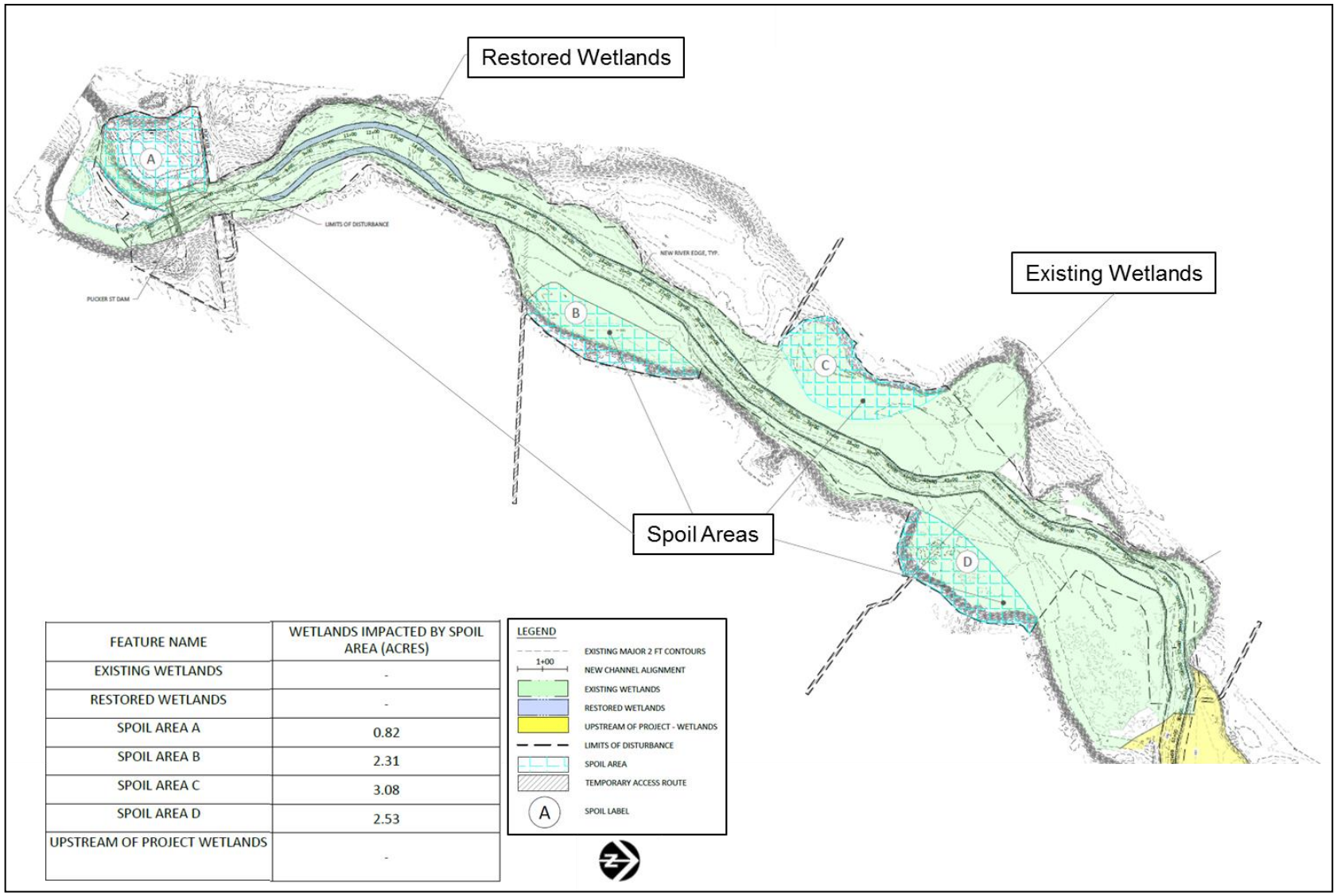
In an effort to further reduce wetland impacts, staging areas and temporary access roads would be sited to avoid the dredging of or placement of fill material in existing wetlands (see Chapter 2). Accidental fuel/oil tank leaks and stormwater runoff that could enter wetlands and impair water quality and damage wetland plants and wildlife would be mitigated by implementation of appropriate BMPs and establishment of staging/refueling areas in uplands.

Removal of Pucker Street Dam would eliminate the pool behind the dam and would restore the natural flow line of the river. The indirect impacts of this action would cause a shift in composition or loss of lateral fringing wetlands that have a river-dependent hydrology. With the reduction in water elevation within the river, it is possible that the groundwater table providing baseflow to the Dowagiac River would adjust and drop accordingly with the channel depth. Emergent wetlands found near the southern extent of the project area would experience a significant lowering in water elevation and would likely lose hydrology capable of supporting wetlands. The forested wetlands found in the northern portion of the project area near Kinzie Road would likely see no change in the current hydrology and remain unaffected by the removal of the dam. Wetland areas located between these two areas may still receive enough water from flooding events and groundwater seeps to maintain sufficient wetland hydrology, though

the plant community and species compositions may shift from standing water emergent communities towards scrub-shrub and forested conditions.

In contrast, it is expected that up to 4.1 acres of additional wetlands would be created along the revealed river shoreline along the length of the excavated river channel, which includes the newly constructed floodplain benches (Figure 3-8). Given the low profile (see Figure 2-4) of the 20-foot benches along the channel bankline, these areas are expected to benefit from a reestablished potentiometric surface and develop as wetlands. Wetlands would naturally develop in areas having a low landscape position and sufficient source of hydrology (groundwater or surface water) to promote the development of a wetland community dominated by hydrophytic species. No spoil materials would be placed in areas where these wetlands are expected to be formed (Figure 3-8).

Alternative B therefore, while undergoing unavoidable wetland losses from river restoration activities (excavated spoil deposition), includes measures for impact minimization and restoration that would preserve and restore wetlands. Furthermore, losses are associated with wetlands that are located on an artificial landform that has been created as a result of the long-term alteration of sediment transport processes. Such losses are considered to be minor in the context of the wetland resource within the watershed (approximately 17,000 acres after dam removal). Consequently, impacts to wetlands are considered minor and would be offset by re-creation of fringing wetlands along the excavated river channel, overall improvements in ecosystem health and functionality, and restored connectivity between both upstream and downstream reaches of the Dowagiac River Watershed that would provide overall improvements in wetland quality and function. Therefore, based on consultation with MDEQ, mitigation is not expected to be required due to the overall benefits of the project and that no spoil materials would be placed in areas where the wetlands are expected to be formed.



FEATURE NAME	WETLANDS IMPACTED BY SPOIL AREA (ACRES)
EXISTING WETLANDS	-
RESTORED WETLANDS	-
SPOIL AREA A	0.82
SPOIL AREA B	2.31
SPOIL AREA C	3.08
SPOIL AREA D	2.53
UPSTREAM OF PROJECT WETLANDS	-

Figure 3-8. Proposed Wetland Restoration and Spoil Placement Areas

Source: Inter-Fluve

3.10 Socio-Economic Environment

3.10.1 Affected Environment

Socioeconomic characteristics of resident populations are assessed using 2010 Census and 2011-2015 American Community Survey (ACS) 5-year estimates provided by the U.S. Census Bureau (USCB) (USCB 2017a and 2017b). Employment and housing data are provided by the 2011-2015 ACS.

Data were used from a spatial extent and scale sufficient to characterize socioeconomic conditions in the vicinity of the proposed actions. Socioeconomic data are assessed for Niles Charter Township and the City. This geographic area provides an appropriate context for analysis of the socioeconomic conditions in the vicinity of the proposed action. Additionally, Berrien County, Cass County, and the state of Michigan is included as a secondary geographic area of reference.

3.10.1.1 Demographics

Table 3-7 summarizes the demographic characteristics of the project area and project setting. There are approximately 25,458 people located within Niles Charter Township and the City. This represents 16.4 percent of the population of Berrien County (155,565 people), but only 0.3 percent of the population of Michigan (9,900,571 people). From 2010 to 2015, the populations of Niles Charter Township and the City have declined 1.1 percent and 1.3 percent, respectively. Similarly, the populations of Berrien and Cass counties have declined 0.8 percent and 0.7 percent, respectively, in the same time frame, while the statewide population was relatively static (USCB 2017a and 2017b).

Numbers of persons younger than 18 years old within Niles Charter Township (22.4 percent), Berrien County (22.7 percent), Cass County (21.8 percent), and the state of Michigan (22.7 percent) are comparable, while Niles Charter Township has a larger population of people under 18 (27.6 percent). Niles Charter Township (16.9 percent) and the City (16.2 percent) have slightly smaller populations of persons 65 years and older than Berrien County (17.3 percent) and Cass County (18.4 percent), but slightly higher than that of the state of Michigan (15.0 percent) (USCB 2017b).

As shown in Table 3-7, populations within Niles Charter Township and the City are predominantly white (88.5 percent and 85.2 percent, respectively). This is comparable to Cass County (88.3 percent white), but slightly more than Berrien County (78.1 percent white) and the state of Michigan (79.0 percent white). Black or African Americans make up 4.5 percent and 8.9 percent of the populations in Niles Charter Township and the City, respectively, which is lower than Berrien County (15.0 percent) and statewide (14.0 percent). Niles Charter Township and the City have slightly larger populations of people identifying as Two or More Races (4.2 percent and 3.9 percent, respectively) than Berrien County (2.8 percent), and the state of Michigan (2.6 percent). Populations of Hispanic or Latino people within Niles Charter Township (4.8 percent) are comparable to those within Berrien County (5.0 percent) and statewide (4.7 percent), while the City has a slightly larger population of Hispanic or Latinos (6.1 percent). Native American populations within most geographic and political reference areas account for 0.5 percent or less of the total population. Within Cass County however, Native Americans represent 1.1 percent of the county population and are represented by members of the Pokagon Band of Potawatomi Indians.

Table 3-7. Demographic Characteristics

	Niles Charter Township	City of Niles	Berrien County	Cass County	State of Michigan
Population[2]					
Population, 2015 estimate	14,008	11,450	155,565	51,952	9,900,571
Population, 2010[1]	14,164	11,600	156,813	52,293	9,883,640
Population Change 2010-2015	-1.1%	-1.3%	-0.8%	-0.7%	0.2%
Persons under 18 years, 2015	22.4%	27.6%	22.7%	21.8%	22.7%
Persons 65 years and over, 2015	16.9%	16.2%	17.3%	18.4%	15.0%
Racial Characteristics[1]					
White alone, 2015 (a)	88.5%	85.2%	78.1%	88.3%	79.0%
Black or African American, 2015 (a)	4.5%	8.9%	15.0%	4.7%	14.0%
American Indian and Alaska Native, 2015 (a)	0.3%	0.2%	0.3%	1.1%	0.5%
Asian, 2015 (a)	0.7%	1.1%	1.8%	0.8%	2.7%
Native Hawaiian and Other Pacific Islander, 2015 (a)	0.0%	0.0%	0.0%	0.0%	0.0%
Some Other Race, 2015 (a)	1.8%	0.7%	1.9%	1.8%	1.1%
Two or More Races, 2015	4.2%	3.9%	2.8%	3.3%	2.6%
Hispanic or Latino, 2015d (b)	4.8%	6.1%	5.0%	3.3%	4.7%
Housing & Income[2]					
Housing units, 2015	5,739	5,262	76,769	25,849	4,529,311
Median household income, 2011-2015	$43,344	$33,651	$44,993	$46,570	$49,576
Persons below poverty level, 2011-2015	16.1%	27.6%	17.2%	14.6%	16.3%

(a) Includes persons reporting only one race.

(b) Hispanics may be of any race, so also are included in applicable race categories.

Sources: [1]USCB 2017a; [2]USCB 2017b;

3.10.1.2 Economic Setting

The project area is located in a rural portion of Berrien County that is characterized by low-density residential development and agricultural uses. Berrien County has a diverse economic base, including manufacturing, agricultural products, health care and tourism. The closest urban area is the City. The City is an industrial center and has an active economic base that includes over 1,300 businesses. They include a wide variety of firms, wholesale, retail, and manufacturing. In addition, recreational use of the Dowagiac River, including fishing and paddling, contributes to the economic base of the City and Niles Charter Township.

As shown in Table 3-7, median household income in the City is $33,651, which is roughly $11,000 less than the median household income in Berrien County and $16,000 less than the state of Michigan. Median household income within Niles Charter Township is $43,344, which is comparable to the median household income of Berrien County, but roughly $6,000 less than the statewide median. Persons living below the poverty line in Niles Charter Township (16.1 percent) are similar to the statewide average of 16.3 percent, while there are more persons below poverty level within the City (27.6 percent) than within the state of Michigan (USCB 2017b).

Employment characteristics are shown on Table 3-8. In Niles Charter Township and the City, unemployment is 6.3 percent and 7.0 percent of the eligible population (respectively), which is similar to the statewide average of 6.0 percent. Unemployment rates within the civilian labor force for Niles Charter Township (10.4 percent) are similar to the state of Michigan rate of 9.8 percent, while unemployment rates within the civilian labor force for the City (12.0 percent) are slightly higher than the reference geographies (USCB 2017b).

Table 3-8. Employment Characteristics

	Niles Charter Township	City of Niles	Berrien County	Cass County	State of Michigan
Population ≥16 years	11,236	8,452	124,476	42,122	7,925,988
Civilian Labor Force					
Employed	6,110	4,365	68,463	22,556	4,373,518
Unemployed	707	594	7,062	2,435	477,746
Subtotal	6,817	4,959	75,525	24,991	4,851,264
Unemployment					
% of Population ≥16 years	6.3%	7.0%	5.7%	5.8%	6.0%
% of Civilian Labor Force	10.4%	12.0%	9.4%	9.7%	9.8%

Source: USCB 2017b

3.10.1.3 Community Facilities/Services

Community services and facilities refer to those services provided to support residential developments that include law enforcement, fire and emergency services, hospitals, cemeteries, churches, and educational facilities. The City owns Pucker Street Dam and is responsible for the maintenance of the dam and ancillary structures. Other community facilities, such as emergency services, churches, and educational facilities are found within the City and the surrounding area; however, none of these facilities would be directly impacted by the proposed action.

3.10.1.4 Environmental Justice

On February 11, 1994, President Clinton signed EO 12898 federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. EO 12898 mandates some federal-executive agencies to consider Environmental Justice (EJ) as part of the NEPA. EJ has been defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income (EPA 2018) and ensures that minority and low-income populations do not bear disproportionately high and adverse human health or environmental effects from federal programs, policies, and activities.

Guidance for addressing EJ is provided by the CEQ's Environmental Justice Guidance under the National Environmental Policy Act (CEQ 1997). The CEQ defines minority as any race and ethnicity, as classified by the USCB, as: Black or African American; American Indian or Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; some other race (not mentioned above); two or more races; or a race whose ethnicity is Hispanic or Latino (CEQ 1997). Low-income populations are based on annual-statistical poverty thresholds also defined by the USCB.

Identification of minority populations requires analysis of individual race and ethnicity classifications as well as comparisons of all minority populations in the region. Minority populations exist if either of the following conditions is met:

- The minority population of the impacted area exceeds 50 percent of the total population.
- The ratio of minority population is meaningfully greater (i.e., greater than or equal to 20 percent) than the minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ 1997).

Low-income populations are those with incomes that are less than the poverty level, which varies by the size of family and number of related children under 18 years (CEQ 1997). The 2015 USCB Poverty Thresholds states the poverty threshold as an annual household income of $24,257 for a family of four (USCB 2017c). For an individual, an annual income of $12,082 is the poverty threshold. A low-income population exists if either of the following two conditions is met:

- The low-income population exceeds 50 percent of the total population.
- The ratio of low-income population significantly exceeds (i.e., greater than or equal to 20 percent) the appropriate geographic area of analysis.

For this assessment, three geographic areas of analysis (i.e., township/city, county and state) were used to determine potential EJ populations. Potentially affected communities were defined as the region surrounding the project, Niles Charter Township and the City. Demographic data were then compared to county and statewide data.

Total minority populations (i.e. all non-white racial groups and Hispanic or Latino, combined) comprise 14.6 percent of the population of Cass County, 17.2 percent of the population of Berrien County, and 25.7 percent of the population of Michigan. Minorities comprise 16.3 percent of the population of Niles Charter Township and 20.8 percent of the population of the City. Neither Niles Charter Township nor the City exceed EJ thresholds when compared to the reference geographies.

The poverty rate in Cass County is 14.6 percent, Berrien County is 17.2 percent, and statewide is 16.3 percent. Niles Charter Township has a poverty rate of 16.1 percent, and the City has a poverty rate of 27.6 percent. Neither Niles Charter Township nor the City exceed the EJ threshold when compared to the reference geography.

3.10.2 Environmental Consequences

3.10.2.1 Alternative A – No Action

Under the No Action alternative, there would be no change in the demographics, employment, and local economy within the vicinity of the Pucker Street Dam. The City would continue to be financially liable for the dam and, based upon the requirements of the MDEQ, would be obligated to undertake major repairs and maintenance.

3.10.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

3.10.2.2.1 Demographic Impacts

A relatively small labor force (less than 25 workers) would be required to remove the Pucker Street Dam and implement the proposed restoration measures identified for Alternative B. The required labor is expected to be available from the regional area and no changes to resident populations are expected. Consequently, no temporary or long-term impacts to local demographics are expected.

3.10.2.2.2 Economic Impacts

Construction activities would temporarily contribute to employment and associated payrolls and would require the purchase of materials and supplies. Capital costs associated with the proposed action would therefore have a minor, direct economic benefit to the local and regional area. Additionally, some beneficial secondary impacts to the economy are also expected in conjunction with the multiplier effects of construction activities. For example, the hospitality and service industries would benefit from the demands brought by the increased construction work force. However, given the relatively small magnitude of the anticipated construction and workforce, temporary, beneficial impacts under Alternative B would be minor. In addition, if the dam is removed, the City would avoid any future maintenance, environmental, and liability costs associated with the dam.

While the concentrated angler use of the lower Dowagiac River for steelhead or salmon may be transferred to other regional destinations under this alternative, angler use of the Dowagiac River for brown trout is expected to remain stable. In addition, removal of the Pucker Street Dam is expected to increase paddler use of the Dowagiac River. Therefore, adverse economic impacts associated with a potential reduction in angler use are expected to be offset by an increase in paddlers and would be minor overall.

3.10.2.2.3 Community Facilities and Services

Removal of the Pucker Street Dam is expected to be carried out by regionally-based contractors, and no relocations to the area are anticipated. Under the proposed action, local fire, police and medical services would not be affected since no relocations to the area are expected from the removal action. Future uses of the project location would continue to be non-residential recreational/open space. Consequently, there would be no impacts to community services.

3.10.2.2.4 Environmental Justice

No sensitive populations subject to EJ considerations were identified in Niles Charter Township or the City. Therefore, there would be no impacts to low-income or minority populations under this alternative. Notably however, the removal of the Pucker Street Dam is consistent with the objectives established by the Pokagon Band of the Potawatomi Indians with respect to restoration of tribal lands and ecosystems as the band continues to restore the hydrologic and ecological integrity in the watershed of the Dowagiac River (see Appendix B).

3.11 Parks and Recreation

3.11.1 Affected Environment

This section addresses parks and recreational facilities that are on, immediately adjacent to (within 0.5 mile), or within the vicinity of the Pucker Street Dam (3-mile radius). Parks and recreation facilities include open areas, boat ramps, community centers, swimming pools, and other public places.

3.12.1.1 Parks

Several parks are located within the vicinity of Pucker Street Dam. The island adjacent to Pucker Street Dam formed by the spillway was formerly leased by Niles Charter Township for use as Losensky Park. In 2013, the footbridge that provided access to the park was closed for safety reasons. The area is currently known as the Pucker Street Dam Site and is owned by the City (City of Niles, Michigan 2016).

Birkholm Park, Island Park, and Saathoff Park, are all small neighborhood parks within the City that feature playground equipment and picnic areas (City of Niles, Michigan 2016). North Fireman's Park is a small park managed by Niles Charter Township, located approximately 0.7 mile south-southwest of the project area that offers playground equipment and picnic areas (Niles Charter Township 2014).

Arthur Dodd Memorial Park, managed by Cass County, is located approximately 1.6 miles upstream of the project area. Amenities found at this park include picnic areas, playground equipment, fishing, horseshoe pits, a hiking trail, volleyball court, and carry-in boat access (Cass County, Michigan 2017). Recent improvements at Dodd Park include rental cabins, a new bridge, and accessible paths and kayak/canoe launch. An ecosystem restoration project to re-establish a historic channel meander to the Dowagiac River in a once-channelized reach was completed in 2007 with assistance from a local watershed organization called Partnership with Meeting the Ecological and Agricultural Needs of the Dowagiac River System (MEANDRS).

Plym Park is a community park located approximately 1.7 miles southwest of Pucker Street Dam along the Dowagiac River in the City. This 19-acre park features picnic areas, a golf course, sports facilities, and access to the Indiana-Michigan River Valley Trail (City of Niles, Michigan 2016).

Riverfront Park is located approximately 2.5 miles southwest of Pucker Street Dam and is managed by the City. This park stretches two miles along the St. Joseph River and features picnic areas, fishing spots, a skate park, playgrounds, access to the Indiana-Michigan River Valley Trail, and a boat launch (City of Niles, Michigan 2016).

Riverfront Park Campground is a privately-owned camping area located approximately 1.5 miles southwest of Pucker Street Dam along the Dowagiac River. The campground is located on over 50 acres and has approximately one mile of river frontage (Riverfront Park Campground 2017).

The Indiana-Michigan River Valley Trail is an approximately 34-mile bicycle and walking trail that connects Niles, Michigan to Mishawaka, Indiana. This trail connects several cities, universities, business, and attractions (City of Niles, Michigan 2016).

The Dowagiac River and St. Joseph River are both considered Michigan Water Trails. The Michigan Water Trails link regional trail waters to coastal waterways and form a statewide water trail system along the Great Lakes shoreline (Michigan Water Trails 2017a).

3.12.1.2 Recreation

The Dowagiac River is part of the Michigan Water Trails network and includes a 19-mile reach that extends from upstream of the town of Dowagiac to the mouth on the St. Joseph River.

Canoeing and kayaking on the Dowagiac River is currently limited to the areas upstream and downstream of Pucker Street Dam and require portage from Pucker Street to the boat launch downstream of the dam. The presence of the dam represents an impedance in the trail network that deters use. Consequently, little effort has been expended to remove log obstructions across the river within reaches upstream of the dam. Other public boat launches within 3 miles of Pucker Street Dam that provide access to the Dowagiac include a carry-in boat access location downstream at Losensky Park, a small gravel boat ramp at M-139, two boat launches on the St. Joseph River in Niles, and a carry-in boat launch upstream at Arthur Dodd Memorial Park (Michigan Water Trails 2017b and 2017c).

Angling is recognized as an important aspect of recreation that is connected to the Dowagiac River. As described in Section 3.4 important recreational species include steelhead, Chinook salmon, walleye, coho salmon, and brown trout. Anglers who fish the river include both regional fishermen and those who come to Niles as a fishing destination. Because Pucker Street Dam impedes the upstream movement of steelhead and salmon, brown trout is the dominant recreational sport fish above Pucker Street Dam. In contrast, all five species are sought after by anglers within downstream waters.

3.11.2 Environmental Consequences

3.11.2.1 Alternative A – No Action

Under the No Action alternative, the dam would remain in place and current maintenance operations of the dam would continue. Therefore, there would be no direct impacts on parks or recreation. However, under this alternative the interruption in the Dowagiac River trail network would remain.

3.11.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

3.11.2.2.1 Parks

Under Alternative B, the raceway adjacent to the dam would be filled, and the deteriorating footbridge would be replaced by a wider land bridge created from fill material. Because access would be restored to this area, this alternative is anticipated to have a minor beneficial impact to the Pucker Street Dam site. No other parks would be directly impacted under this alternative.

As described in Section 3.2, the proposed action would not have an impact on flood storage and peak discharge downstream of the dam. Therefore, there would be no impacts to the Riverfront Park Campground and Plym Park associated with flooding.

3.11.2.2.2 Recreation

Recreational use of the Dowagiac River within the project area would be restricted during the construction phase. The carry-in boat launch on the City owned property adjacent to Pucker Street Dam would likely be inaccessible during demolition activities. However, additional boat launches are available upstream and downstream of the dam. Access to the boat launch and use of the river by canoers and kayakers would be restored following demolition activities. Therefore, impacts to recreational users and the boat launch would be considered temporary and minor.

Canoeing and kayaking on the Dowagiac River is currently limited to the areas upstream and downstream of Pucker Street Dam and require portage from Pucker Street to the boat launch downstream of the dam. Under Alternative B, the interruption of the water trail on the Dowagiac would be eliminated and paddlers and floaters would be able to expand their use of the river. However, in order to support increased paddling, management activities must be undertaken to eliminate treefalls that obstruct the river channel upstream of Kinzie Road. Subject to such management activities, it is expected that the Dowagiac River would become an attractive destination for paddlers that would bring additional recreators to the local project area.

Under this alternative it is expected that the physical changes in structures and habitat of the Dowagiac River that would be altered by dam removal would have associated effects on the aquatic ecosystems of the project area. In the short-term, some habitat alteration downstream of the dam may be expected as a result of sediment transport and deposition. However, under this alternative extensive sediment management activities would be undertaken to reduce and minimize excessive sedimentation downstream. As described in Section 3.4.2, dam removal is generally considered to result in beneficial long-term effects in terms of ecosystem sustainability and health. With the removal of the Pucker Street Dam, steelhead, walleye and salmon that previously aggregated below Pucker Street Dam would disperse to the upper reaches of the watershed. Consequently, the concentrated angler use of the lower Dowagiac may therefore be expected to be similarly dispersed or transferred to other productive angling destinations. Notably however, the harvestable brown trout populations upstream of Pucker Street are expected to remain relatively stable as these fish are sustained primarily by annual stocking by the MDNR rather than from natural reproduction.

In summary, Alternative B would result in short-term direct effects to the Pucker Street Dam site (formerly known as Losensky Park) that would be restored following dam deconstruction. Additionally, some of the angler use that is driven by steelhead and salmon fishing may be expected to shift to other accessible reaches of the watershed or to other regional destinations. However, the angler use of the Dowagiac River that is based on brown trout is still expected to remain. Finally, it is expected that dam removal may result in an increase in paddler use of the river due to dam removal. However, this increase is dependent upon management measures to remove obstructions in the river upstream of Kinzie Road (treefalls, etc.). Therefore, impacts to recreational use by anglers may be adverse but offset by expanded use by paddlers and would be minor overall.

3.12 Cultural and Historical Resources

3.12.1 Affected Environment

3.12.1.1 Historic Architecture

The Pucker Street Dam and associated powerhouse were reviewed for potential eligibility to the National Register of Historic Places (NRHP). It was not considered eligible for inclusion on the NRHP as it lacks the required level of integrity, design, materials, or association required to meet NRHP listing criteria. Concurrence from the State Historic Preservation Office (SHPO) and USFWS Regional Historic Preservation Officer/ Archaeologist regarding the ineligibility of the dam NRHP listing is included in Appendix B.

3.12.1.2 Archaeological Resources

A review of the state records, as well as the extant professional and historical literature was conducted to identify any previously known cultural resources that may exist with the Dowagiac River Watershed and Pucker Street Dam project area that would be potentially affected by the proposed dam removal.

No previously recorded archaeological sites were identified in the immediate project area. The Pokagon Band of Potawatomi Indians have indicated that the project area is within their traditional tribal lands used by their people.

3.12.2 Environmental Consequences

3.12.2.1 No Action Alternative

There would be no change in the current conditions under this alternative. Therefore, no impacts to cultural resources would occur under the No Action alternative.

3.12.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

In consideration of the absence of both NRHP-eligible archaeological or architectural sites in the project area, no impacts to historic properties are expected under this alternative. In a letter dated November 30, 2016, Mr. Brian Grennell (SHPO) and Mr. James Myster, USFWS Regional Historic Preservation Officer/ Archaeologist concurred that the removal of Pucker Street Dam and the associated ecosystem restoration activities would have no effect on historic properties (see Appendix B).

While no recorded archaeological sites are known from the project area, the Pokagon Band of the Potawatomi requested that they be notified if any artifact was found during construction activities. In response to this request, a procedure will be included in project bid documents describing actions and follow up that should occur if any artifacts are found on site during construction.

3.13 Solid and Hazardous Waste

3.13.1 Affected Environment

Solid waste consists of a broad range of materials that include refuse, sanitary wastes, contaminated environmental media, scrap metals, nonhazardous wastewater treatment plant sludge, nonhazardous air pollution control wastes, various nonhazardous industrial waste and other materials (solid, liquid, or contained gaseous substances). Subtitle D of the Resource Conservation and Recovery Act (RCRA) and its implementing regulations establish minimum

federal technical standards and guidelines for nonhazardous solid waste management. States are primarily responsible for planning, regulating, implementing, and enforcing solid waste management.

Hazardous materials are defined as any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety and property. Hazardous materials include hazardous substances and hazardous waste. Under RCRA, a solid waste is hazardous if it is listed as a known hazardous waste, or meets the characteristics described in 40 CFR Part 261, including ignitability, corrosivity, reactivity, or toxicity.

Hazardous materials are regulated under a variety of federal laws including the Occupational Safety and Health Administration standards, Emergency Planning and Community Right to Know Act, RCRA, the Comprehensive Environmental Response, Compensation and Liability Act of 1980, and Toxic Substances Control Act.

There are no hazardous waste sites or facilities located within the project area. However, asbestos and lead-based-paints were identified within the Pucker Street Dam (Wightman Environmental, Inc. 2014a and Wightman Environmental, Inc. 2014b).

3.13.2 Environmental Consequences

3.13.2.1 Alternative A – No Action Alternative

Under the No Action alternative, Pucker Street Dam is expected to remain in-place for some indeterminate period. For that period, solid and hazardous waste generation would remain unchanged. Materials are considered to be generally stable and not subject to release to the environment. As such, there would be no solid or hazardous waste impacts from this alternative on either human or environmental receptors.

3.13.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

Construction activities would generate solid waste in the form of demolition debris from removal of the Pucker Street Dam. Solid waste generated during project activities would be transported for disposal at a licensed waste management facility.

Asbestos and lead based paints were detected within the Pucker Street Dam and would need to be mitigated as part of the powerhouse demolition process. All hazardous materials would be removed in accordance with all state and federal laws, rules, and regulations in force at the time of the demolition. The hazardous waste cleanup shall take place prior to any other demolition activity.

In addition, various hazardous wastes, such as fuels, lubricating oils, and other hazardous materials could be produced during demolition. Oily wastes generated during servicing of heavy equipment would be managed by off-site vendors who service on-site equipment using appropriate self-contained used oil reservoirs. Notably equipment operating in water would be required to utilize vegetable oil (e.g., rapeseed or canola) as a lubricant to reduce potential impacts to water quality. Appropriate spill prevention, containment and disposal requirements for hazardous wastes would be implemented to protect construction workers, the public and the environment. If leaks or spills of hazardous materials occur, the workers responding to the incident are required to have the appropriate level of training, as mandated by the Occupational Safety and Health Administration at 29 CFR, Part 1910.

There would be a minor increase in solid and hazardous waste generated during demolition. All solid waste and hazardous wastes generated from implementation of this alternative would be handled and disposed of per applicable local, state, and federal requirements.

3.14 Visual Quality and Aesthetics

3.14.1 Affected Environment

The project area contains a combination of human created and natural features that contribute to the overall visual composition of the site. The installation of Pucker Street Dam and associated structures altered the flow of the Dowagiac River creating an impoundment upstream, which reshaped the surrounding natural viewscape. While aesthetics are subjective, it should be noted that long pools are visually pleasing to some individuals. However, the aesthetics of the river corridor upstream of the dam are currently diminished with the formation of large depositional areas within the delta of the former impoundment. The low-lying vegetated islands and bars of fine materials that have formed detract from the pool-like aesthetics typically associated with impoundments.

The dam was originally constructed to provide hydropower for the local community. Though it is no longer actively in use for electricity production, the dam and powerhouse add to the visual interest of the site at a landscape perspective, but detract from the natural aesthetics of the river when viewed up close due to their current state of decay and disrepair. During a dam safety inspection in 2013, it was recorded that the tainter gates exhibited moderate corrosion, the concrete structures had significant cracks and spalling, and that vegetation has begun to grow from the cracks in the abutment walls, overflow spillways, and spillway bay piers (Trumble 2013). Therefore, most viewers of the project site would find that the views of the dam and powerhouse diminish the overall visual quality.

3.14.2 Environmental Consequences

3.14.2.1 Alternative A – No Action

There would be no change in the current conditions under this alternative; therefore, there would be no direct impact to the current aesthetics of the site. However, given the current state of disrepair, the aesthetics of the dam and powerhouse would continue to decline until the required repairs are made by the City.

3.14.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

Aesthetics are often very difficult to quantify and differentiate. For example, while the aesthetics of flowing versus still water may be subjective, and based solely on the opinion of the observer, the change in the quality of the scenery and subsequent appeal will only slightly vary from one group to another. Furthermore, users of and visitors to the Dowagiac River near the Pucker Street Dam generally expect flowing water conditions typical of a river setting, which are currently being reduced by the present conditions. Therefore, under this alternative the Dowagiac River would revert back to a free-flowing stream and the associated natural aesthetics would be restored both at the dam and the upstream impoundment.

The construction equipment, staged materials and construction activities prior to and during dam removal would result in a short-term alteration in the visual quality of the site. Impacts from additional vehicular traffic are expected to be minor as the work would occur in phases. This increase in visual discord would be temporary and only last until construction is completed.

During and following the drawdown of the river, the majority of the land previously submerged along the banks and lands identified as dredge disposal sites would be exposed and would likely be unsightly in the short-term. Early successional species from the seed bank and carried in by wind, water and wildlife would re-vegetate these exposed areas. Slowly over time, these areas would begin to resemble the existing floodplains and riparian zones that presently exist upstream and downstream along the Dowagiac River. Views would transition over time as the exposed bottomland initially characterized as an herbaceous community gives way to scrub shrub and eventually forested communities.

While the removal of the dam and subsequent lowering of the river level would diminish the visual quality of the project site for some visitors, the river corridor would in time be returned to near natural, pre-dam flow conditions, and the natural scenic aesthetics of the river ecosystem would be restored. Additionally, due to the current state of decay of the powerhouse and associated structures, the removal of these components would improve the aesthetics of the project area. Impacts from Alternative B are therefore considered to be somewhat disruptive during the construction period, but beneficial in the long-term.

3.15 Air Quality

3.15.1 Affected Environment

The Clean Air Act regulates the emission of air pollutants and, through its implementing regulations, establishes standards (National Ambient Air Quality Standards [NAAQS]) for several criteria pollutants that are designed to protect the public health and welfare with an ample margin of safety. The criteria pollutants are ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide and lead. Specified geographic areas are designated as attainment, nonattainment or unclassifiable for specific NAAQS. Areas with ambient concentrations of criteria pollutants exceeding the NAAQS are designated as nonattainment areas, and new emissions sources to be located in or near these areas are subject to more stringent air permitting requirements.

According to the U.S. Environmental Protection Agency (USEPA)'s Green Book (USEPA 2018) and MDEQ websites, Berrien County is currently in attainment of the NAAQS for all criteria pollutants with the exception of ozone. Berrien County exceeded the 8-hour ozone levels in 2004, 2005, and 2006 under standards set in 1997. For certain programs like Congestion Mitigation and Air Quality Improvement Program, Berrien County is considered to be a "Maintenance Area", which means that the county previously was non-attainment. Under the revised standard set in October 2015, the ozone measuring station in Coloma exceeded the new ozone standard. As a result, the MDEQ has recommended that Berrien County, along with Allegan and Muskegon counties, each be designated separately as nonattainment for ozone. However, air quality and meteorological data indicate that the elevated ozone levels recorded do not appear to significantly contribute to ozone concentrations in the area and that out-of-state emissions are being transported over Lake Michigan.

3.15.2 Environmental Consequences

3.15.2.1 Alternative A – No Action

There would be no change in the current conditions under this alternative, therefore there would be no impact to air quality.

3.15.2.2 Alternative B – Dam Removal with Blended Restoration Using Existing Channel Alignment

The proposed project would have no long-term impacts on air quality. Construction of the project may cause a temporary reduction in local ambient air quality due to emissions generated by construction equipment. Equipment operating on the site would emit pollutants that contribute to temporary and localized increased levels of criteria pollutants such as carbon monoxide, nitrogen oxides, and ozone. Because equipment use is relatively limited (excavators, trucks, etc.) and of relatively short duration (up to seven months), emissions from construction vehicles and related equipment should have an insignificant, temporary impact to local air quality. Additionally, emissions from construction equipment would be controlled by compliance with any applicable state and local requirements. The emissions are expected to be of short duration, and not result in a degradation of local or regional air quality. Consequently, impacts to air quality are expected to be non-significant and small. Therefore, in accordance with the General Conformity Rule established under CAA Section 176(c)(4), this project would not interfere with the state's plans to attain and maintain national standards for air quality.

3.16 Cumulative Effects

This section supplements analyses in preceding sections that either explicitly or implicitly considered cumulative impacts resulting from the removal of Pucker Street Dam and associated restoration activities. These analyses are based on baseline conditions, which reflect the impacts of past and present actions and how they have shaped the existing environment. The CEQ regulations (40 CFR §§ 1500-1508) implementing the procedural provisions of the NEPA of 1969, as amended (42 USC § 4321 et seq.) define cumulative impact as: "…the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR § 1508.7). Therefore, this section will analyze the incremental impact of the proposed action and any cumulative effects when added to other identified past, present and reasonably foreseeable future actions.

3.16.1 Identification of "Other Actions"

There is one known transportation and one utility improvement project in the vicinity of Pucker Street Dam that would contribute to potentially additive effects on environmental resources impacted by the project. Recently completed improvements to the Sink Road Bridge include replacement of the bridge, approach roadway, and improved safety features. Two TransCanada natural gas pipelines that are 22" and 24" in diameter were relocated where they cross the Dowagiac River. TransCanada has abandoned the current pipelines and has directionally drilled new pipelines further below the river channel with 30 feet of cover. The abandoned pipelines will be removed in consultation with TransCanada and in coordination with the sediment management activities in the river before and during dam removal.

Additionally, the Pokagon Band of Potawatomi Indians are planning to restore the Dowagiac River from Peavine Street to just above Crystal Springs Street at the tribal property boundary. From 1901 to 1928 this section of the river was straightened, lowered, and channelized to drain the surrounding wetlands, making land more suitable for agriculture. The goals of the Pokagon Band restoration include restoring sinuosity and meanders to near pre-channelization conditions, re-establishing more natural patterns of scour and deposition, and increasing the frequency and extent of floodwater accessing the floodplain. By restoring the meanders and lifting the river bottom back to its original channel depth, the hydrologic function in the study area can be restored, leading to improved conditions for native species to thrive.

3.16.2 Analysis of Cumulative Impacts

Cumulative impacts associated with these other identified actions are related to water quality, aquatic ecology, wetlands, and floodplain. Potential cumulative impacts as a result of the bridge improvements include generation of construction debris, sedimentation, and direct impacts to aquatic organisms. Indirect impacts include the temporary reduction in water quality due to re-suspension of sediment that could increase the risk to downstream organisms and/or temporary loss of habitat through deposition and smothering of habitat. However, these impacts would be considered to be temporary and limited to the active phase of the project, which has already been completed. Therefore, there would be no cumulative effects to water quality and aquatic resources as a result of the bridge improvements.

The new TransCanada pipelines have been installed under the river using directional drilling, with the entry and exit points approximately 500 feet away from the stream banks; therefore, there would be no instream work or disturbance to the aquatic environment. The removal of the abandoned pipes would be done in conjunction with dredging and stream restoration activities as part of the proposed project. Therefore, any additional sedimentation or water quality disturbances as a result of this action are expected to be minor and addressed as part of the sediment management practices for the dam removal.

The river restoration efforts planned by the Pokagon Band would complement the proposed action in improving overall stream conditions. The proposed restoration would benefit aquatic organisms by increasing the frequency of pool, riffle, and large woody debris habitats. Water quality would be improved through the re-establishment of natural patterns of scour and sediment deposition. The planned efforts would also help to reestablish the connection to the floodplain by increasing the frequency and extent of floodwater accessing the floodplain. While the final design for this has not been developed, it is likely that it would include measures to stabilize the banks and address sedimentation downstream. Therefore, it is assumed that cumulative impacts would be minor during the construction phase and adhere to all permit requirements. In the long-term, the cumulative impacts would be beneficial to the Dowagiac River Watershed as a whole.

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