PROJECT COMPLETION FINAL REPORT

WATERVLIET DAMS REMOVAL
PAW PAW RIVER, MICHIGAN

Great Lakes Restoration Initiative
National Oceanic and Atmospheric Administration
Fisheries Habitat Conservation Program

March 5, 2014

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Prepared for
Berrien County
Brownfield Redevelopment Authority

This project final report was prepared and submitted in fulfillment of grant administration requirements for a Great Lakes Restoration Initiative (GLRI) grant awarded to Berrien County by the National Oceanic and Atmospheric Administration (NOAA), Fisheries Habitat Conservation Program Office, for removal of two dams on the Paw Paw River in Watervliet, Berrien County, Michigan.

Project Name

GLRI NOAA - Watervliet Dams Removal, Paw Paw River, Michigan

NOAA Award Number

NA10NMF4630411

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1.0 INTRODUCTION

1.1 Project Background

The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) awarded a Great Lakes Restoration Initiative (GLRI) grant to Berrien County's Brownfield Redevelopment Authority for removal of two related dams on the Paw Paw River, located in the City of Watervliet (Award #NA10NMF4630411). NOAA's stated goals for the Great Lakes Habitat Restoration Program as they specifically apply to the Watervliet Dams Removal project are 1) benefit native diadromous fish and their habitat, particularly projects that remove in-stream migration barriers; 2) restore habitats limiting productivity; and 3) restore natural systems. The Watervliet Dams Removal project was conceived and designed to accomplish all three of those goals.

The Watervliet Dams were originally constructed in the early 1900s in various forms and locations in support of the lumber industry. The dams are located in Section 23 of Watervliet Township (T3S, R17W, Figure 1). The dams were refurbished and rebuilt throughout their histories, but were most recently owned and operated by the former Watervliet Paper Company. The dams provided process water and electricity for the former paper mill that was located on the south shoreline of the Paw Paw River west of M-140. Both dams are located east of M-140. The exact date when the dams were no longer actively used to dam the Paw Paw River and generate electricity for the mill is unknown. The dams were largely inoperable and in a state of disrepair when Berrien County acquired the dams and surrounding property in 2000.

The Watervliet Dams Removal project was originally conceived and spearheaded by the Michigan Department of Natural Resources, Fisheries Division, Southern Lake Michigan Management Unit. In partnership with the Southwest Michigan Planning Commission, The Nature Conservancy, and Berrien County Brownfield Redevelopment Authority, the MDNR awarded an Inland Fisheries Grant to Berrien County in March of 2009. The United States Fish & Wildlife Service awarded a Fish Passage Program grant to Berrien County in 2008. Total project funding available in 2009 was not

sufficient to allow Berrien County to remove both structures, which was the best outcome for the Paw Paw River and citizens of Berrien County. Therefore, Berrien County pursued additional funding in 2010 through the Great Lakes Restoration Initiative and NOAA's Great Lakes Habitat Restoration Program. NOAA awarded Berrien County a grant in July of 2010, allowing the project to be implemented based on removal of both dam structures.

Project design began in July 2010. Construction began in August 2011 and was completed on November 23, 2011. Ecological monitoring was 100% funded by the NOAA GLRI grant. Baseline monitoring began in March of 2011 and was completed in July 2011, prior to the start of construction in August 2011. Post-construction monitoring started in March of 2012 and was completed in June 2012. Due to lower than anticipated construction costs, a portion of the NOAA GLRI grant was not 100% utilized by the original grant end date of June 30, 2012. Therefore, NOAA granted a no-cost extension until September 30, 2013 and approved utilization of the remaining grant funds to extend post-construction monitoring into 2013.

1.2 Project Site and Description

The Watervliet dams were formerly located on the Paw Paw River, a major tributary of the St. Joseph River. The Paw Paw River watershed is 446 square miles and encompasses 435 miles of streams, including 99 miles of the mainstem Paw Paw River and 435 miles of tributaries. The Paw Paw River joins the St. Joseph River in downtown Benton Harbor, just downstream of the West Main Street Bridge over the St. Joseph River. The mouth of the Paw Paw River is located approximately 2,000 feet upstream of Lake Michigan and there are no fish migration barriers on the St. Joseph River downstream of the Paw Paw River. The Watervliet dams were located in Section 23 of Watervliet Township (T3S, R17W, approximately 25 river miles upstream of the St. Joseph River (Figure 1).

The two dams are identified by their original function (Figure 2). The furthest downstream dam is called the spillway dam. The spillway dam was located within the City of Watervliet, but was wholly owned by Berrien County. It was used primarily to impound the Paw Paw River and direct flow into the mill race and through the former power house. The furthest upstream dam was called the diversion dam. The

diversion dam was located within Watervliet Township, but was wholly owned by Berrien County. The spillway and diversion dams were co-operated to impound the Paw Paw River upstream of the spillway dam and, while operational, direct river flow through a small power house located immediately west of the spillway dam. The two dams were linked by a continuous earthen berm running parallel to the natural flow of the river. The earthen berm is located on the island created by the north and south channels.

The Paw Paw River appears to have been split into two natural channels upstream of M-140; both channels are present in a 1887 plat map (Figure 3). The diversion dam was used to direct or divert river flow away from the northern channel. Therefore, the former impoundment was located in the southern channel and extended southward into the City of Watervliet and eastward into Watervliet Township. The northern channel is referred to in this report as the "historic channel" because continuous flow had been diverted from that channel for approximately 100 years (since the dams were constructed and operated in their most recent configurations). As a result of the flow diversion, the northern historic channel had filled with sediment, supported an abundance of wetland vegetation, contained warmer water temperatures, and shallower water depths, and supported a warm water fishery. The southern channel is called the "mill race" even though it technically is a natural channel and part of the former impoundment. The actual mill race was located west of the spillway dam and ran east-to-west under M-140 and south of the former paper mill.

At the time of project conception and funding in 2010, the dams and related infrastructure had been substantially altered to address public safety concerns and conduct brownfield remediation activities. The spillway dam supported a road deck and utilities above the concrete spillway in addition to supporting stop logs (Figure 4-1). The steel super structure and utilities were removed in 2002. The remaining structural components in 2010 included the concrete spillway, concrete abutments, and cobble-stone/concrete wing walls (Figure 4-2). Portions of the steel super structure embedded in the concrete abutments and spillway were still present and protruded from the concrete. The former power house and mill race located west of the spillway dam had been demolished and the mill race filled with soil. The spillway

dam could not be used for impounding water above the spillway elevation at the start of the project in 2010.

The diversion dam also supported a steel super structure and utilities, although the structure appears to have only supported a catwalk for foot traffic (Figure 5-1). By 2010 the utilities and catwalk had been removed. The remaining structural components present in 2010 included the concrete spillway, concrete abutments, concrete wing walls, catwalk support framing, and guardrail (Figure 5-2). The diversion dam was not used for impounding water; therefore, it did not contain a steel superstructure for support gates or stoplogs.

The earthen berm connecting the two dams was still present in 2010 and had not been altered along its entire length. The earthen berm extended from M-140 eastward across the island (between the north and south channels) and eastward beyond the diversion dam several hundred feet (Figure 2). The earthen berm prevented the former impoundment from extending north of the southern channel except during large flood events that caused over topping of the diversion dam and backwater conditions on the southern historic channel.

2.0 PROJECT FUNDING

In addition to the NOAA grant, Berrien County had acquired project funds from two other sources and provided cash match. All project funding sources are summarized in the following sections.

2.1 NOAA Great Lakes Restoration Initiative

Major funding for design, permitting, construction, and monitoring were provided by NOAA under Great Lakes Restoration Initiative appropriations through the FY10 congressional appropriation. NOAA provided $922,754 in funding to Berrien County for contractual services. The NOAA funds were applied toward engineering, design, permitting, construction, and monitoring activities.

2.2 Michigan Department of Natural Resources

The Michigan Department of Natural Resources (MDNR), Fisheries Division provided an Inland Fisheries Grant in the amount of $56,198. All of the MDNR funds were applied toward removal of the spillway dam with the exception of $7,817 applied toward collection and analysis of historical channel sediment samples. One-hundred percent of the MDNR grant funds were used to complete the project. Berrien County submitted a final report prepared by ECT to the MDNR on November 30, 2011 in fulfillment of grant requirements. The report is attached as Appendix A.

2.3 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) provided a Fish Passage Program grant in the amount of $100,000. All of the USFWS grant funds were applied toward physical removal of the spillway and diversion dams. One-hundred percent of the funds were used to complete the project. Berrien County submitted a final report prepared by ECT to the USFWS on January 4, 2013 in fulfillment of grant requirements. The report is attached as Appendix B.

2.4 Berrien County Brownfield Redevelopment Authority

Berrien County matching cost-share under the MDNR and USFWS grants above totaling $11,678.74. Those funds were applied toward design and engineering tasks prior to award of the NOAA grant to initiate project planning and surveying in June 2010, and historic channel sediment sampling (to match the MDNR grant for that same purpose).

3.0 PROJECT IMPLEMENTATION

3.1 Timeline

Table 1 provides a complete project timeline based on project milestones and completion dates. The project was completed on schedule. All construction work and post-construction monitoring were completed by June 30, 2013. Construction started approximately three months later in 2011 than scheduled, but it was also completed earlier than expected. Construction was originally scheduled to begin in June of 2012, but all construction was completed by November 22, 2011.

Construction started later than scheduled due to issuance of the permit by the Michigan Department of Environmental Quality approximately three months later than anticipated.

The original grant end date was June 30, 2012. All scheduled work was completed prior to that date. Due to lower than expected construction costs, over $100,000 of the NOAA grant had not been used. ECT submitted a request for a no-cost extension on May 31, 2012 to allow time for exploring options for utilizing remaining grant funds with NOAA. NOAA granted the no-cost extension with a new grant end date of September 30, 2013.

Between May of 2012 and January of 2013 ECT explored additional restoration options with Berrien County and NOAA, including floodplain restoration near the dam removal site, riparian buffer plantings, and debris removal (associated with the former mill site). The remaining available funding was not sufficient to support the floodplain restoration option (fill removal from the historical floodplain at the former mill site). An agreement to establish additional buffer plantings on City-owned park land could not be worked out with the City of Watervliet. Due to concerns of possible sediment contamination and contents of pipes, and alignment with NOAA restoration goals, NOAA chose not to pursue the debris removal option.

Given other restoration options could not be identified within a reasonable time frame, NOAA opted to use remaining funding to collect additional monitoring data. Therefore, ECT prepared a 2013 monitoring plan and costs for NOAA approval. ECT's plan was submitted to NOAA on January 3, 2013 and subsequently approved by NOAA. Implementation of the additional monitoring began on March 27, 2013.

Due to availability of existing funding prior to award of the NOAA grant, some project activities occurred before July 1, 2010. ECT and Berrien County initiated a partnership meeting on May 5, 2010 to discuss project implementation strategies and get input on project engineering and permitting requirements. A steering committee was established at that meeting by representatives of the various project partner organizations to provide strategic guidance. The steering committee met again on May 11, 2010 before NOAA awarded the GLRI grant to Berrien County. The second

meeting included representatives from the Michigan Department of Environmental Quality (MDEQ) that were able to discuss permitting requirements. The result of existing funding and partner steering committee meetings was initiation of surveying work in June of 2010, although surveying field work began after July 1, 2010. ECT and Berrien County attended a Watervliet City Council meeting on May 11, 2010 to discuss the project concept and request permission to access City-owned park property.

Table 1. Table of project implementation milestones.

Date	Description
7/1/2010	NOAA Grant Start Date
9/29/2010	Final Project Monitoring Protocol
12/1/2010	Steering Committee Meeting - 90% Design
12/23/2010	Michigan Application for Permit Submitted
2/8/2011	QAPP Approved
2/27/2011	ISRAP Approved
4/14/2011	Start Pre-removal Baseline Monitoring
5/13/2011	Michigan Application for Permit Public Notice
6/16/2011	Michigan Permitting Public Hearing
7/5/2011	Construction Advertisement for Bids
7/6/2011	City of Watervliet Counsel Meeting
7/11/2011	Construction Pre-bid Meeting
7/25/2011	Construction Bids Received
8/31/2011	Michigan Permit #11-11-003-P Issued
9/8/2011	Pre-construction Meeting
9/12/2011	Construction Start
9/28/2011	Spillway Dam Removed
10/7/2011	Spillway Dam Restoration Substantially Complete
10/10/2011	Diversion Dam Removed
10/11/2011	Diversion Dam Restoration Substantially Complete
11/22/2011	Construction Complete
2/24/2012	Start Year 1 Post-construction Monitoring
5/31/2012	No-cost Extension Request (requested 6/30/2013 end date)
6/30/2012	End Year 1 Post-construction Monitoring
3/27/2013	Start Year 2 Post-construction Monitoring
5/29/2013	No-cost Extension Request (requested 9/30/2013 end date)
9/30/6013	End Year 2 Post-construction Monitoring
9/30/6013	Grant End Date (by no-cost extension)

3.2 Design

The Watervliet dams removal and restoration project included complete removal of both dam structures below the streambed, concrete abutments, and concrete/cobble stone wing walls (Figures 6-1 and 6-2). Streambanks, constructed bankfull benches, and disturbed areas were planted with native grasses, forbs, shrubs, and trees. Due to removal of the diversion dam, continuous flow under all flow regimes was restored to the historic channel. Three constructed riffles and armored bankfull benches were used to fix the bed elevations and channel dimensions at the two former dam locations and at the downstream end of the historic channel. The width of the channel at the two former dam sites was greater than the bankfull width of the Paw Paw River in the vicinity of the project. The riffles and armored bankfull benches fixed the dimensions (i.e. width and depth) of the channels and the amount of flow that would naturally split between the two channels. The design channel dimensions and bed elevations were based on a flow split of 20% to the historic channel and 80% to the southern channel under the bankfull discharge. However, the flow split will vary with total stream discharge and stage. Based on design, target fish species should be able to freely swim through all three riffles, the historic channel, and the mill race. Monitoring was conducted to confirm successful restoration of fish passage. Monitoring results are document in a separate monitoring report.

3.3 Permitting

An application for permit was submitted to the Michigan Department of Environmental Quality (MDEQ) on December 23, 2010. The project required a permit under Parts 301 (lakes and streams), 303 (wetlands), 31 (floodplain), and 315 (dam safety) of Michigan's Natural Resource and Environmental Protection Act (Michigan P.A. 451 of 1994, as revised). ECT subsequently responded to two separate requests from the MDEQ for additional information and application corrections on February 9, 2011 and April 20, 2011 before the application was accepted by MDEQ as administratively complete. Major components of the application as accepted by the MDEQ included a hydraulic modeling report (and hydraulic model files), Engineer's flood certification, basis of design information, wetland delineation report, project assessment, and construction drawings.

Subsequent to submittal of a complete application, two additional submittals were required by MDEQ. First, permitting required obtaining an authorization letter from one private land owner adjacent to the diversion dam. The authorization letter allowed MDEQ to issue a permit for work that impacted or altered private property not owned by the applicant (i.e. Berry County). Berrien County subsequently executed a separate access agreement with that land owner that is not part of the permitting process, but is a necessary part of construction. Second, the hydraulic model showed a slight increase in the 100-year flood profile at two cross-sections on the historic channel (0.3 to 0.1-feet or less). The FEMA 100-year base flood elevation was previously incorrectly determined based on the presence of only one dam, but the presence of both dams affects the water surface profile in the historic channel. Furthermore, removal of the dams had the potential to increase the 100-year flood profile by increasing the water surface slope of the historic channel. Given the slight increase and topography adjacent to the historic channel, MDEQ determined that the flood stage increase would not adversely affect property. However, MDEQ did require notification to the potentially affected land owners due to the slight increase in the 100-year flood stage. ECT and Berrien County prepared and distributed flood notification letters to four adjacent land owners in July of 2013 with attached flood waiver forms for signature by the land owners. MDEQ received signed waivers from all four land owners.

The MDEQ held a public hearing at the request of Berrien County (as suggested by the steering committee) on June 16, 2011. Approximately fifteen members of the community attended the event. ECT provided a brief overview of the project after MDEQ opened the meeting with formal hearing proceedings to establish the administrative record. Following ECT's presentation, MDEQ opened the meeting to oral comments and questions from the public. Approximately four people spoke, most of which supported the project. The end of the meeting was informal time for questions and answers. The MDEQ did not record any substantial concerns or comments from the public during the meeting that would affect DEQ's decision to issue a permit.

MDEQ issued a permit to Berrien County on August 31, 2013, allowing construction to commence thereafter. At that time, Berrien County had already awarded a

construction contract and was working on contract execution with the selected construction contractor.

3.4 Public Education

A portion of the NOAA GLRI grant was used for several public education activities:

1) Creating and maintaining a project website
2) Fish sampling and electrofishing demonstration project
3) Project fact sheet
4) Public presentation and site tour
5) Public hearing requested as part of the permitting process
6) Temporary and permanent education signs

The Southwest Michigan Planning Commission hosted project web pages on its website, wrote content for the web pages, updated web page content throughout the project, posted announcement for public education events, and posted photographs and other information. Events were well attended by interested members of the public, members of the Pokagon Band of Potawatomi Indians, elected public officials, state agency employees, members of local non-profit organizations, and members of local press. The fish sampling and electrofishing demonstration project was used to demonstrate the fisheries techniques and equipment used to monitor dam removal projects. The public hearing and picnic event at the park were used to disseminate accurate information about the project, address known concerns, and answer questions. Temporary project signs were design and posted by the Southwest Michigan Planning Commission during project implementation to share information about project funding and contact information. Two final signs were designed and installed at the park entrance off of M-140 south of the Paw Paw River where the City already posts signs about important water resource projects. One of the signs provides information on the history of the former paper mill and dams, which were once important fixtures of the community. The other sign shares information specific about the project and what was accomplished through the NOAA GLRI grant.

3.5 Construction Bidding and Contracting

Berrien County advertised the construction project conventionally through various media outlets. The advertisement was issued on July 5, 2011. Bids were originally due on July 18, 2011. However, more than 50% of the contractors attending the pre-bid meeting requested an extension of time to prepare their proposals. Therefore, Berrien County issued an addendum extending the bid due date to July 25, 2011. Berrien County received three qualifying bids. A bid tab is provided under Appendix A. The three total bid prices were $650,701, $837,975, and $622,867. The engineer's estimate was $769,000, so two of the bids were under the engineer's estimate and one was over. Berrien County awarded the construction contract to Bayshore Contractors of Grand Rapids, MI as the low bidder. The starting contract value was $622,867.

3.6 Construction

A series of construction photographs is provided in Appendix B along with a CD containing all construction photographs. Table 3.6-1 provides a chronology of all major construction activities. ECT and Berrien County held a pre-construction meeting with Bayshore Contractors on September 8, 2011. Construction started on September 12, 2011 with equipment mobilization and temporary facilities (site trailer etc.). Site clearing, grubbing, and access/staging preparation were completed September 13 through September 16. The temporary historic channel crossing was installed September 19 and 20. By September 20, 2011 all site preparation work was complete and the contractor was ready to start dam demolition.

Dam demolition work began at the east end of the spillway dam on September 21 with excavation of the earthen dike and demolition of the wing walls and headwall to the elevation of the concrete spillway.

4.0 MONITORING

NOAA provided funding under GLRI to monitor the project before and after dam removal, primarily to verify successful restoration of fish passage. ECT prepared a Project Monitoring Protocol with input from NOAA, USFWS, and MDNR. Project monitoring included fish community monitoring in the historic channel, target fish

species mark-and-recapture, pebble counts in a natural riffle downstream of M-140, macroinvertebrate sampling in the three constructed riffles and the natural riffle downstream of M0140, cross-section surveying, and velocity measurements at the three constructed riffles. A Project Performance Monitoring Report dated September 27, 2013 was prepared and submitted to NOAA with this report.

5.0 FINANCIAL SUMMARY

The NOAA GLRI grant award was for $922,759, all under the contractual line item. The funds were requested for project engineering, design, permitting, construction, and monitoring. Other project funding from other project partners was also used for construction. Berrien County expended a total of $890,301.37 of the grant funds: $427,174.35 for public education, engineering, design, permitting, and monitoring; and $463,127.02 for construction.

Berrien County worked with NOAA in 2012 and 2013 to identify additional restoration work at the project site. However, suitable restoration work was not identified.

6.0 LESSONS LEARNED

5.1 Monitoring

Biological data typically have substantial variability. Therefore, sampling to detect changes in biological populations or communities is difficult with before and after data sets. Multiple years of sampling following dam removal is necessary to provide truly meaningful monitoring results. Due to available funding, two years of monitoring after removal was possible. The results demonstrated the value in sampling over multiple years, as the first year of post-removal sampling did not reveal all of the changes in the fish community of the historic channel or the presence of longnose sucker upstream of the dams. Additional change in the historic channel fish community was detected in 2013 sampling data and longnose suckers were captured upstream of the dams in 2013, but not in 2012.

5.2 Utilization of Funding

Identifying potential project components upfront in the project development process would assist in achieving 100% utilization of available grant funds. Due to favorable construction bids and actual construction efficiencies, construction costs were lower than expected. The additional funding could have been used to add work to the existing project and construction contract if alternatives project components had been identified up front. As is, efforts to identify projects in the vicinity in 2012 and 2013 (after construction was completed) were unsuccessful.

5.3 Public Education

While this project did not generate as much public discord as some dam removal projects, the public education opportunities did help disseminate accurate information and offered opportunity for some concerned citizens to be heard and dialogue directly with project partners. Even with limited public participation, accurate information was shared with a wider audience by word of mouth and written public education materials that were shared by those who did attend. Those public education efforts helped address the limited public concerns directly and most likely minimized public discord that is often generated by miss-information.

6.0 FIGURES

Figure 1. Watervliet Dams Removal project location, Paw Paw River, Berrien County, Michigan.

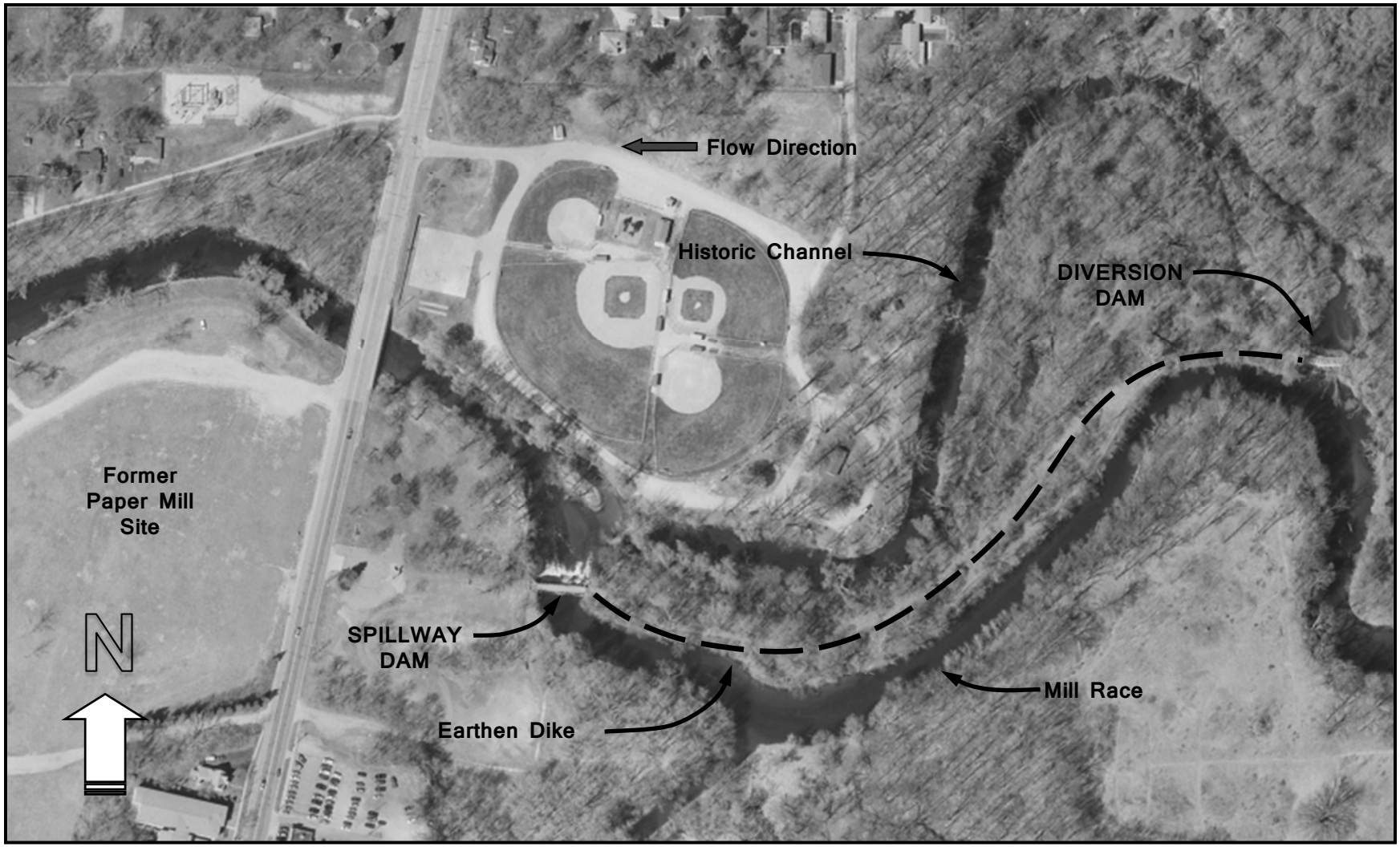

Figure 2. Watervliet Dams Removal, project vicinity map, City of Watervliet, Berrien County, Michigan.

Atlas of Berrien County, Michigan / compiled from actual surveys and the county records by W. W. Graves.
Author: Graves, W. W. (Washburn W.)

1887

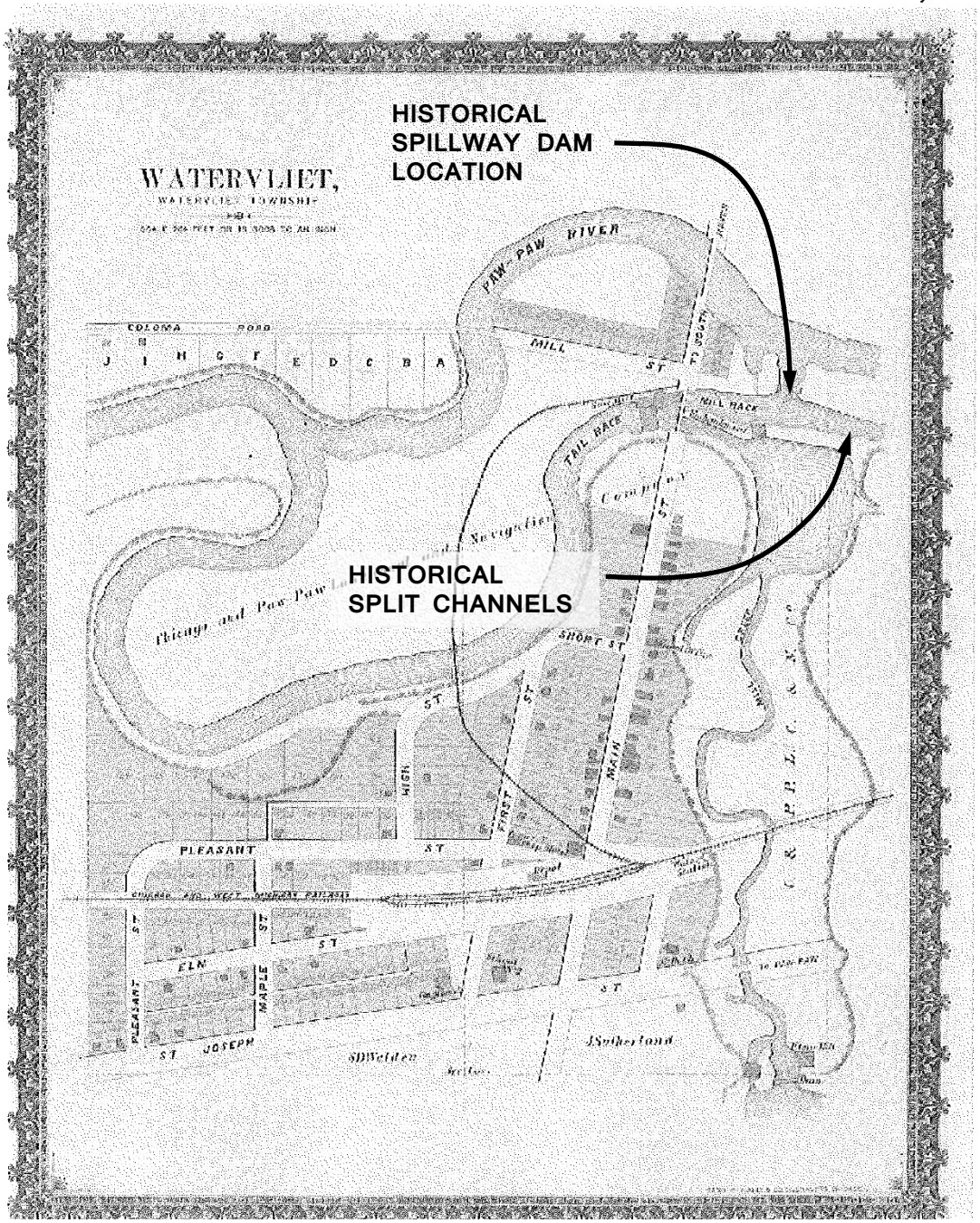

Figure 3. City of Watervliet 1887 plat map, Berrien County, Michigan.

Figure 4-1. Spillway dam prior to acquisition by Berrien County in 2000 showing infrastructure that was removed prior to dam removal.

Figure 4-2. Spillway dam at initiation of dam removal design/funding.

Figure 5-1. Diversion dam prior to acquisition by Berrien County in 2000 showing utilities that had been removed prior to dam removal.

Figure 5-2. Diversion dam at initiation of dam removal design/funding.

Figure 6-1. Historic channel (left) and spillway dam (center) constructed riffles and bankfull benches after dam removal.

Figure 6-2. Diversion dam (center) constructed riffle and bankfull benches after dam removal.

APPENDIX A

Construction Bid Tabulation

Michigan Department of Natural Resources Final Grant Report

APPENDIX B

Construction Photographs

Site access, job trailer, and staging area preparation.

Tree clearing and access preparation.

Historic channel crossing preparation – culvert installation.

Historic channel crossing.

Start of spillway dam east wingwall and abutment demolition.

Spillway dam east wingwall and abutment demolition to sill.

Installation of upstream and downstream rock cofferdams at spillway dam.

Start of spillway dam removal, east half - 9/28/2011.

Removal of spillway dam, west half - 9/28/2011.

Installation of spillway dam riffle.

Removal of east wingwalls and abutment at spillway dam.

Completed spillway dam cross-section after removal – 9/30/2011.

Spillway dam start of streambank grading and stabilization.

Spillway dam bankfull bench grading can construction.

Spillway dam restoration completed, prior to landscaping.

Start of spillway dam landscaping - 10/25/2011.

Completed streambank stabilization and landscaping - 11/18/11.

Completed spillway dam landscaping (background) - 11/22/11.

Diversion dam tree clearing and access preparation – 9/22/11.

Diversion dam upstream rock cofferdam installation – 10/8/11.

Start of diversion dam removal – 10/8/11.

Start of diversion dam cofferdam breach – 10/8/11.

Diversion dam riffle installation – 10/8/11.

Diversion dam cross-section following removal – 10/18/11.

Start of diversion dam landscaping - 11/7/11.

Completion of diversion dam landscaping - 11/8/11.

Completed diversion dam landscaping – 11/21/11.

Start of historic channel bankfull bench and riffle construction – 10/18/11.

Start of historic channel landscaping - 11/21/11.

Completed historic channel restoration - 11/22/11.

Start of site restoration - 11/21/11.

Completed site restoration - 11/22/11.