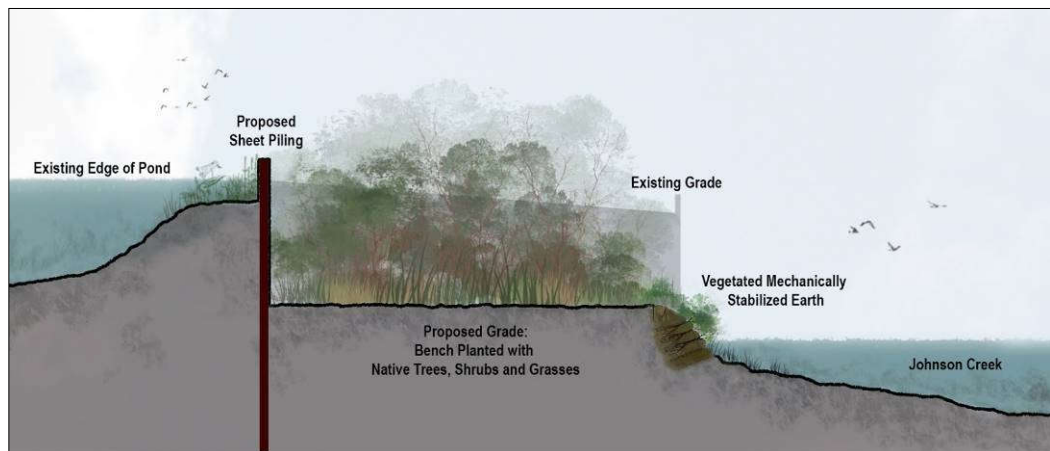
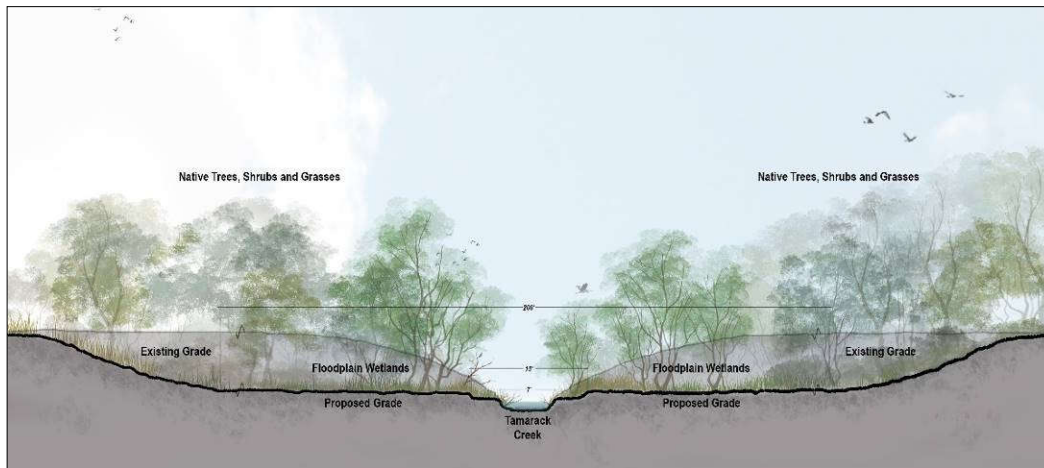


ROUGE RIVER AOC HABITAT DESIGN PROJECTS

US EPA GRANT: GL-00E02344

FINAL DESIGN REPORT

Tamarack Creek and Johnson Creek-Fish Hatchery Park



March 2021

ROUGE RIVER AOC HABITAT RESTORATION DESIGN PROJECTS

EPA Grant Number: GL-00E02344

Grantee: Alliance of Rouge Communities

Community Partners: City of Southfield
City of Northville
Northville Charter Township

Award Amount: \$583,220.00

Project Location: Southfield, Michigan (48075),
Northville, Michigan (48167 and 48168)
Oakland and Wayne Counties
Congressional Districts: M11 and M14

Waterbody: Rouge River tributaries Tamarack Creek
and Johnson Creek

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
SUMMARY	1
1.0 INTRODUCTION	2
2.0 PROJECT BACKGROUND	3
3.0 PROJECT SCOPE	5
3.1 Grant Reporting/Administration/Public Outreach	5
3.2 Preliminary Engineering and Field Investigation	5
3.3 Design/EGLE Permitting	10
3.4 Contract Documents/Contractor Selection	13
4.0 PROJECT OUTCOMES	17
4.1 Project Highlights	17
4.2 Obstacles Encountered	18
4.3 Next Steps	18

List of Figures

Figure 1. Rouge River Watershed	4
Figure 2. Extent of Topographical Surveys	6
Figure 3. Sample observations from ECT’s stream stability assessments.	7
Figure 4. Wetland and Vegetative Mapping	8
Figure 5. Sediment Core Locations	9
Figure 6. Brown trout sampled during electrofishing conducted in Johnson Creek in June 2019	9
Figure 7. Tamarack Creek Bid Tab	15
Figure 8. Johnson Creek Habitat Restoration Bid Tab	16

List of Appendices

Appendix A:	Health and Safety Plans
Appendix B:	Public Education Project Flyers
Appendix C:	Geomorphic Assessment Memo
Appendix D:	Vegetation and Wetland Characterization Summaries
Appendix E:	Threatened & Endangered Species Reviews
Appendix F:	Geotechnical Investigation Reports
Appendix G:	Soil/Sediment Summaries
Appendix H:	Fish Monitoring Summaries
Appendix I:	Basis of Design Report – Tamarack Creek
Appendix J:	Michigan Department of Transportation Construction Permit – Tamarack Creek
Appendix K:	Michigan Department of Environment, Great Lakes, and Energy (EGLE) Construction Permits
Appendix L:	Bid Package – Johnson Creek
Appendix M:	Bid Package – Tamarack Creek

SUMMARY

The Alliance of Rouge Communities (ARC), using the \$583,220 Great Lakes Restoration Initiative (GLRI) grant from United States Environmental Protection Agency (USEPA), completed the design of habitat restoration at Tamarack Creek in Southfield, Michigan and Johnson Creek at Fish Hatchery Park in Northville, Michigan. The purpose of these projects is to provide habitat features that will address three of the Beneficial Use Impairments (BUIs) associated with fish and wildlife habitat in the Rouge River, namely Degraded Fish and Wildlife Populations, Degradation of Benthos, and Loss of Fish and Wildlife Habitat. As a result, work towards delisting the Rouge River watershed as an Area of Concern (AOC) as designated by the Great Lakes Water Quality Agreement (GLWQA). The ARC engaged Environmental Consulting & Technology, Inc. (ECT) as the firm that would complete the design, permitting, and construction documents. A general history of the grant issuance and amendments is as follows:

- Grant issued 5/30/18
- Grant time extension – end date 7/31/20, approved 9/27/19
- Grant time extension 2 – end date 12/31/20, approved 7/2/20
- Grant time extension 3 – end date 4/15/21, approved 11/9/20
- Grant metrics/MoPs updated to align with Implementation Grant (GL - 00E02478) – November 2020

Tamarack Creek Habitat Restoration Summary

The Tamarack Creek project includes efforts such as expanding the floodplain to allow Tamarack Creek to convey large stormwater flow without causing excessive velocities which carry away substrate; stabilizing the bed and bank of Tamarack Creek using woody debris habitat structures; and adding native plants and trees to the new floodplain to add habitat diversity and value. Additionally, the project will restore an adjacent wetland to improve hydrology and in-stream flows. Wetland restoration will include the repair of wetland hydrology, management of invasive species, and planting of native wetland plants to diversify the flora.

Johnson Creek Fish Hatchery Park Habitat Restoration Summary

The Johnson Creek Fish Hatchery Park project includes de-channelization and naturalization of the banks of Johnson Creek; removal of accumulated sediment from a pond with flows into Johnson Creek to create deeper water for fish habitat; modification of the pond outlet to enable fish passage between the pond and creek; and installation of a vegetated swale to filter stormwater from an unimproved parking lot before it enters the pond.

1.0 INTRODUCTION

During the last century, tributaries of the Rouge River have suffered from declining water quality, loss and impairment of aquatic habitat, and increased frequency and magnitude of peak flood flows. The flat river slope and the meandering channel could not pass the large flows associated with major precipitation events. Increasing urbanization within the watershed as well as urbanization upstream exacerbated this problem by increasing impervious surfaces, leading to frequent flooding within downstream local communities.

Fortunately, water quality has improved since 1992 thanks to the federally-funded Rouge Project. For example, 89 of the 127 miles of the larger streams and tributaries in the watershed are now free from public health threats associated with uncontrolled combined sewer overflow discharges. Water quality improvement is exhibited by increased dissolved oxygen levels needed to sustain fish and aquatic life. Increased populations and diversity of benthos, fish, and wildlife have been measured along the river since 1999. The USEPA Office of Inspector General declared the Rouge Project “a blueprint for success” (EPA OIG report number 2002-P-00012).

The ARC is the Rouge River Public Advisory Committee’s (PAC) fiduciary and coordinating organization. Many of the previously completed reports [Ex: Habitat Delisting Targets (2008), Rouge River Delisting Strategy (2012), Upper Rouge Delisting Strategy (2012), and Rouge River BUI Report Card (2013)] listed project types, in addition to specific projects, that needed to be completed in the watershed to remove the Habitat BUIs and delist the AOC have been implemented by the ARC and Wayne County. The USEPA, Michigan Department of Environmental, Great Lakes and Energy (EGLE), Michigan Department of Natural Resources (MDNR), Rouge River Advisory Council (RRAC), ARC and our local members began facilitating the development of the formal list for removal of the Habitat BUIs in 2015. This work resulted in the development of a final Rouge AOC Habitat list that was approved by the PAC/RRAC and submitted to EGLE in March 2016. On that list were two projects that were considered by EGLE (formerly Michigan Department of Environmental Quality) (MDEQ), MDNR and USEPA to be top priority projects:

- *Tamarack Creek Stream and Wetland Restoration*
Restoration of Tamarack Creek is necessary in conjunction with wetland restoration to help improve hydrology and in-stream flows. Wetland restoration will repair wetland hydrology, manage invasive species, and plant native wetland plants to diversify the flora.
- *Johnson Creek Fish Hatchery Park Restoration*
Restoration of fish and wildlife habitat associated with Johnson Creek will reverse effects of sedimentation, loss or conversion of riparian vegetation, and streambank armoring. This will improve the stream’s viability as a cold-water fishery; the only remaining cold water fishery in the Rouge River.

2.0 PROJECT BACKGROUND

Tamarack Creek Stream and Wetland Restoration

Tamarack Creek, a tributary of Evans Creek (and the Middle Rouge River), receives uncontrolled stormwater runoff from a large portion of its drainage area. As a result, Tamarack Creek has been eroded by excessive channel velocity associated with peak flows. Bank erosion is leading to excessive sediment loading and sedimentation of instream habitat. Sedimentation is also exacerbated by nonpoint sources of sediment delivered to Tamarack Creek via stormwater. Excessive channel velocity is also destabilizing large woody debris and gravel/cobble substrates that are important fish and macroinvertebrate habitat.

In order to address the habitat impairments, restoration of Tamarack Creek is necessary in conjunction with wetland restoration to help improve hydrology and in-stream flows. Wetland restoration will repair wetland hydrology, manage invasive species, and plant native wetland plants to diversify the flora. Tamarack Creek will flow through the wetlands. Sediment will be dredged to increase storage volume and create deep open water wildlife habitat. Shallow islands and shelves will be constructed to establish emergent wetland vegetation, which will add wildlife habitat diversity and value. Stream restoration will increase channel and habitat stability by altering the channel cross-section. Native riparian plant communities will be established along both side of the channel following construction. Streambanks will be graded to create a two-stage channel capable of conveying flood flows on stable flood terraces adjacent to the channel. The flood terraces will be planted with native riparian vegetation, including trees. Rock riffles will be installed in the creek bottom to stabilize the streambed and create habitat diversity. Trees cleared from the corridor for construction will be salvaged and used to construct large woody debris complexes.

Johnson Creek Fish Hatchery Park Restoration

Fish and Wildlife habitat associated with Johnson Creek have been lost and impacted by sedimentation, loss or conversion of riparian vegetation, and streambank armoring, reducing its viability as a cold-water fishery; the only remaining cold water fishery in the Rouge River. A spring-fed pond, which flows into Johnson Creek, has been degraded by sediment-laden stormwater runoff from the unimproved parking lot at Fish Hatchery Park. The resulting sediment has been deposited into the pond to a point where it is less than 18 inches deep. This sediment escapes from the pond through the outlet structure and is impairing the stream bottom habitat in Johnson Creek. In addition, the earthen wall separating the pond from Johnson Creek is failing. In time, the wall will collapse which will eliminate the potential cleansing properties of the pond and transfer the accumulated sediment into the creek. Streambanks in the park have been impacted by the removal of native vegetation and the lining with concrete.

Fish Hatchery Park is the only public access point to Johnson Creek. The park was once a federal registered fish hatchery facility – the first in the nation. The community would like to celebrate the history of the park by restoring habitat while creating an environmental education opportunity for its residents.

To address the ecosystem issues the following improvements were proposed:

1. Remove additional accumulated sediment in the pond to create a deeper and wider pool and structural habitat for fish;
2. Modify the outlet of the pond to create a fish passage channel between the pond and the creek;

3. Naturalize the replaced wall between the pond and the creek;
4. Remove of the concrete wall lining the creek and naturalize the streambanks; and
5. Install a bioswale adjacent to the unimproved parking lot to improve the quality of runoff and reduce the amount of sediment, nutrients, and other pollutants delivered to the pond and Johnson Creek. Water quality is important to the sustainability of the cold-water system as these pollutants reduce the productivity of fish and wildlife populations.

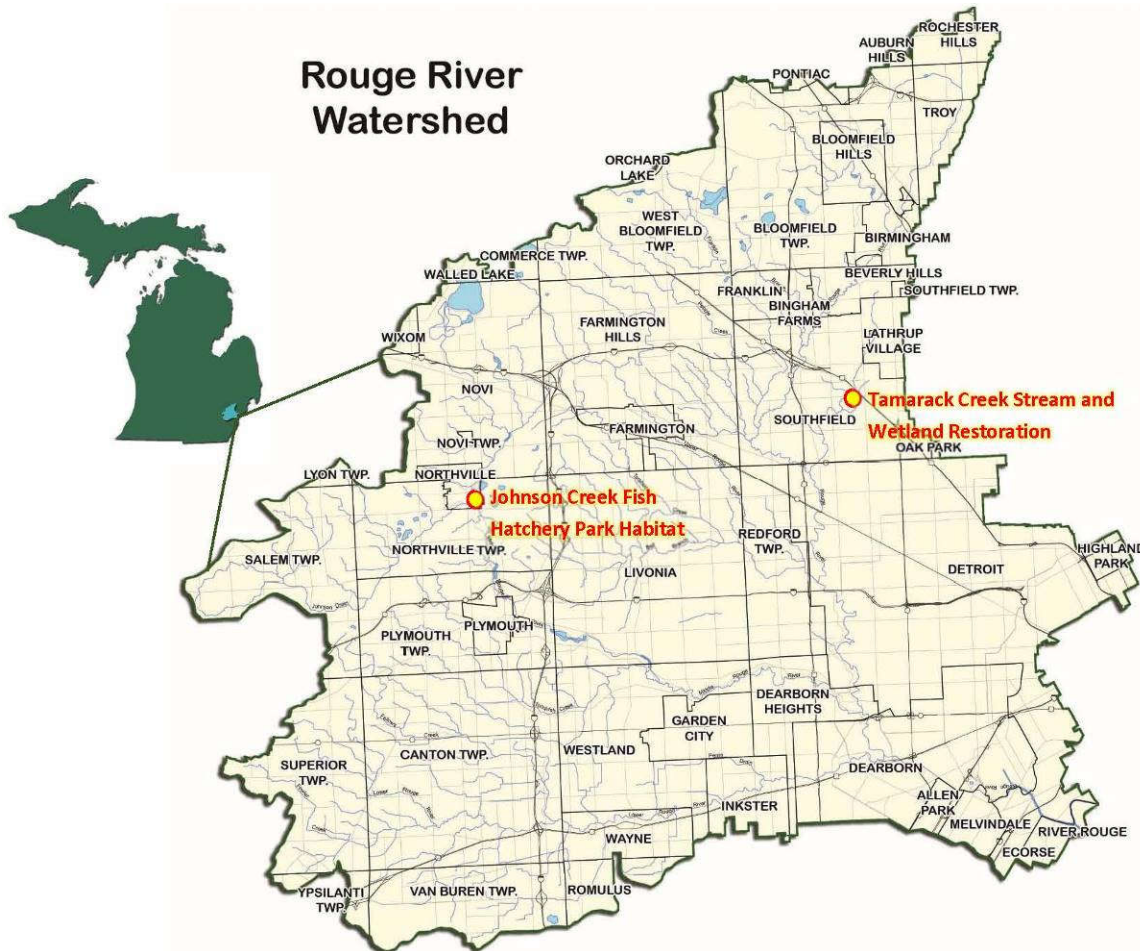


Figure 1. Rouge River Watershed

3.0 PROJECT SCOPE

Within the grant, the project was divided into the following tasks:

- Task 1: Grant Reporting/Administration/Public Outreach
- Task 2: Preliminary Engineering and Field Investigation
- Task 3: Design/EGLE Permitting, and
- Task 4: Contract Documents/Contractor Selection.

3.1 Grant Reporting/Administration/Public Outreach

Following the grant award, the project began with the development of site-specific Health and Safety Plans (HASPs). Potential hazards were identified, and steps were outlined to reduce risk to employees and visitors at each project site. Each HASP also details steps for emergency response, including directions and maps to the nearest emergency room/urgent care. The HASPs for Tamarack and Johnson Creek are included in Appendix A.

Quality Assurance Project Plans (QAPPs) were also developed as required by the USEPA to ensure environmental data collection was conducted under a formal management protocol. To simplify the process, separate QAPPs were developed for the Tamarack Creek and Johnson Creek projects. In September 2018 both QAPPs were approved by the USEPA and data collection required for design commenced.

Project partners reached out to the public to inform them of the proposed activities and to obtain input. For the Johnson Creek project, social media was heavily utilized to inform the public about activities proposed in Fish Hatchery Park and answer questions. For the Tamarack Creek project, ECT circulated information adjacent landowners directly. The Alliance of Rouge Communities posted information related to each project on the ARC web site and site-specific informational flyers were distributed to interested organizations and the public at large. See Appendix B for the distributed flyers.

Throughout the project, the ARC completed semiannual status reports and other documentation required by the USEPA. This document serves as the final project report as required under this task.

3.2 Preliminary Engineering and Field Investigation

Between the fall of 2018 and the summer of 2019, a series of data collection activities were completed. A summary of the critical information obtained is as follows:

Topographic Survey

A topographic survey of each property was conducted by a registered land surveyor. The spatial scope of the surveys is shown in Figure 4. The topographic survey played an essential role in the design of the project and the preparation of the permit application and contract documents. The Johnson Creek survey was completed in November 2018, and the Tamarack Creek survey was completed December 2018.



Figure 2. Extent of Topographical Surveys

Stream Stability Assessment

ECT used qualitative and quantitative evaluations to assess the scope of stream stability problems at Tamarack and Johnson Creek Fish Hatchery Park. These evaluations included taking pebble counts, performing the Ribbon Test, and taking measurements to find the Bank Erosion Hazard Index (BEHI) on representative banks. Results from the stream stability assessment were used to target problem areas in habitat restoration design. Using the Rosgen morphological classification system, it was determined that the stream types for all reaches of Tamarack Creek are E-5 streams and Johnson Creek is an E6 stream. Assessment was completed in November 2018 for Tamarack Creek and in December 2018 for Johnson Creek. A memo detailing results of the stream stability assessment for both sites is included in Appendix C.



Figure 3. Sample observations from ECT's stream stability assessments.

(Left photo shows exposed tree roots and high slumping bank indicating erosion at toe. Right photo shows flagged bankfull elevation as well as large woody debris blocking channel flow)

Wetland Delineation and Vegetative Mapping

ECT conducted surveys of each the project area to map the location of different plant communities that occur on site. Major vegetative boundaries were delineated and recorded using a GPS with sub-meter accuracy. Information on the dominant vegetation types were used to inform habitat restoration design and the permitting process. Characterization of site vegetation and wetlands was completed in December 2018 for the Tamarack Creek and Johnson Creek Fish Hatchery Park sites.

Eight wetlands were identified at the Tamarack Creek site, including emergent wetlands (Wetlands 1-3), scrub-shrub wetlands (Wetlands 4, 7, and 8), and forested wetlands (Wetlands 5 and 6). Primarily, upland characteristics were consistent with a disturbed southern forest with some areas consistent with some areas consistent with undisturbed southern forest.

At the Johnson Creek site, one emergent/scrub-shrub wetland was identified. Primarily, upland characteristics were consistent with a disturbed southern forest with some areas consistent with some areas consistent with undisturbed southern forest.

Memos containing more detailed results of the vegetation and wetland characterization efforts are included in Appendix D.

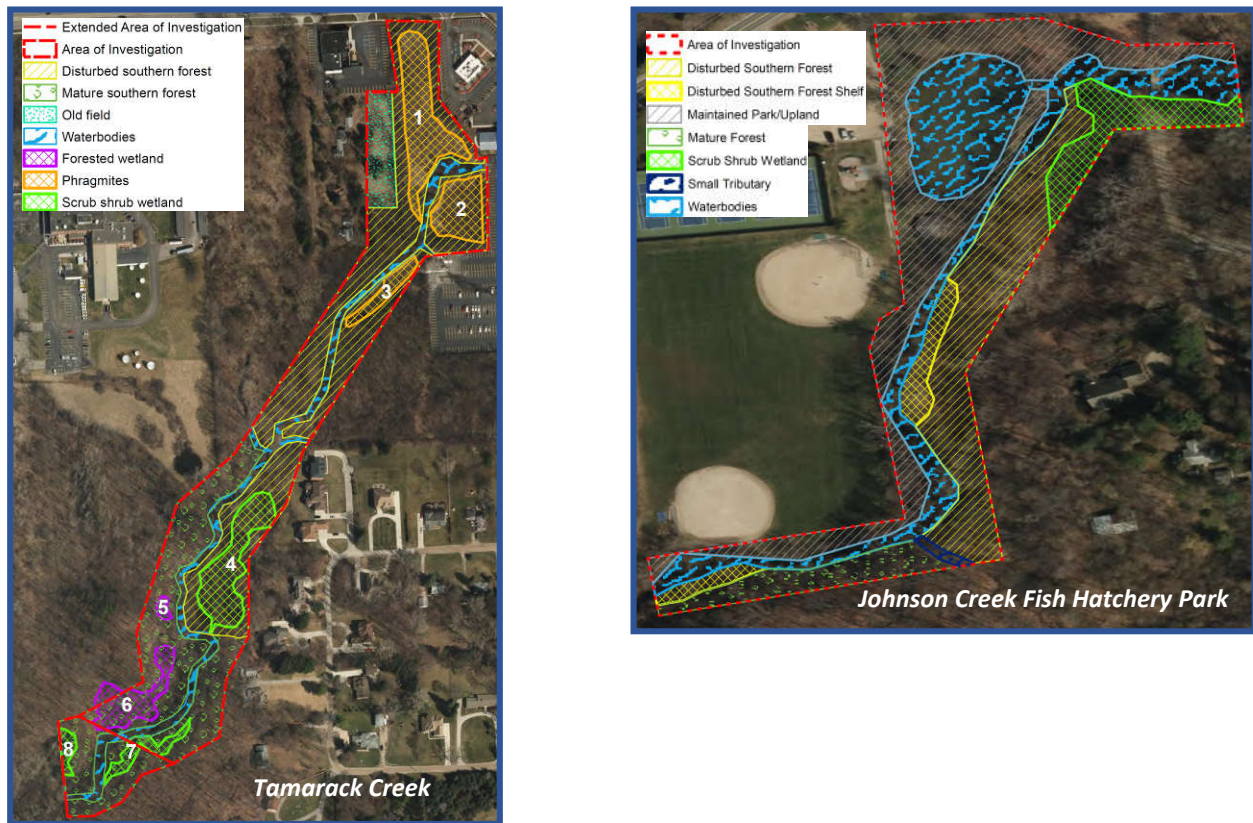


Figure 4. Wetland and Vegetative Mapping

Threatened & Endangered Species (T&E) Review

ECT utilized the Michigan Natural Features Inventory (MNFI) natural heritage database as well as the Information, Planning, and Consultation (IPaC) tool from the United States Fish and Wildlife Service (USFWS) to complete a desktop review and determine possible T&E species in the project area based on habitat suitability. ECT then performed a field review including species-specific surveys where necessary. Based on the results of the field review, accommodations for the Eastern Massasauga Rattlesnake and the Indiana and northern long-eared bat were noted in the design of each site. Field review for the Johnson Creek Fish Hatchery Park site was completed June 2019 and field review for the Tamarack Creek site was completed July 2019. Memos summarizing results of the T&E analyses at both sites are included in Appendix E.

Geotechnical Investigation and Soil/Sediment Analysis

In November 2018, sediment cores were collected from six locations on each site: within the pond at the Johnson Creek Fish Hatchery Park site and focused in Basin Wetlands at the Tamarack Creek site. Two samples were composited from each core and were subjected to laboratory tests for determine physical and chemical properties of the existing substrate. In July 2020, four additional soil borings were taken from the Tamarack site to understand the physical characteristics of the soil found along the existing stream.

The analysis of the laboratory results for Tamarack Creek indicated that should soil be removed from the basin wetland area, the soil should be disposed of in a Type II landfill. Therefore, the design and contract documents reflected this requirement. Based on the results from the lab for the Johnson Creek

Fish Hatchery Pond sediment it was determined that the material may be disposed of on or off site. However, the design of the sediment disposal was for it to be taken to a Type II landfill due to logistical ease and control. The geotechnical reports have been included in Appendix F and the Soil/Sediment Summaries are included in Appendix G.

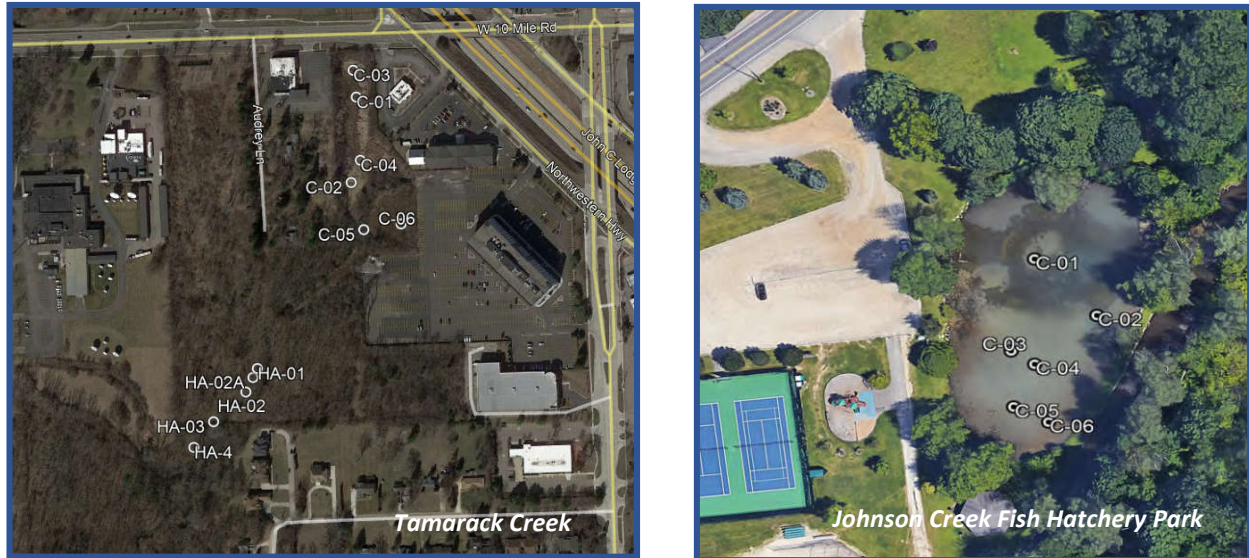


Figure 5. Sediment Core Locations

Fish Analysis

To accurately characterize the fish community to inform project design and establish baseline conditions, sampling of the fish community was conducted at Tamarack Creek and Johnson Creek by Fish Hatchery Park using electrofishing equipment. Commonly reported metrics were used to describe the baseline fish assemblages in the vicinity of the project site. Species richness and abundance, catch per unit effort, and size-frequency distributions were calculated. Ultimately, Tamarack Creek contained very few species and did not have a diverse assemblage, while Johnson Creek contained species typical of cold-water streams and had a moderately diverse assemblage, though overall fish abundance was low. ECT conducted fish analysis field work in June 2019 at Tamarack Creek and Johnson Creek. Summaries of fish sampling efforts at both sites is available in Appendix H.



Figure 6. Brown trout sampled during electrofishing conducted in Johnson Creek in June 2019

Hydrologic/ Hydraulic Analysis Tamarack

The frequency, stage, and velocity of flows in Tamarack Creek were important factors in the design of the restoration plans. The creek is ungauged, therefore, a long-term flow record does not exist. Flow frequencies and magnitude were estimated using numerical runoff calculations for small ungauged watersheds. The results of the hydrologic analysis were used to inform various hydraulic analyses, which are listed below.

- No-Rise Analysis: Hydraulic modeling was performed to evaluate water surface elevations for existing/proposed conditions and to verify no rise in the 100-year water surface elevation as a result of the proposed improvements.
- Bankfull Verification: The hydraulic model was calibrated to bankfull field indicators and the resulting flow rate was compared to the flow frequency results from the hydrologic analysis to verify the reasonableness of the field indicators. The resulting bankfull flow rate was used to design bankfull channel dimensions for the proposed channel relocation.
- Flow Dynamics: Model results were used to estimate velocities and shear stresses to help inform the design of proposed channel dimensions and to size other design measures to minimize the risk of bed and bank erosion, including erosion control blanket and stone sizing.
- Culvert Sizing: The results of the hydrologic analysis was used to develop peak design flow rates and hydraulic modeling was performed for the sizing of a culvert which would allow a maintenance and access path to be placed along Tamarack Creek without disrupting flow of a small tributary.

An in-depth explanation of the hydraulic analysis for Tamarack Creek is available in the Basis of Design (BOD) report found in Appendix I.

3.3 Design/EGLE Permitting

Tamarack Creek

After examining site assessment data, habitat restoration design was completed. A summary of project design as well as alternatives considered follows.

Two-Stage Channel

The proposed two-stage channel design limits channel depths, velocities, and shear stresses and improves habitat conditions by providing floodplain access. Tamarack Creek receives large quantities of uncontrolled stormwater runoff from a highly urbanized tributary area, resulting in large peak flows, shear stresses, and channel velocities that have caused excessive bank erosion and channel incision (floodplain disconnection). The excessive erosion and subsequent sedimentation problems have removed instream habitat by destabilizing substrate that is important for fish and macroinvertebrate habitat.

The first stage of the proposed two-stage channel is relatively small, sized for the bankfull flow event (1- to 2-year frequency flow). The relatively small first stage channel, with a V-shaped bottom, will generate sufficient low-flow depths and velocities to minimize sediment deposition during normal flows. Excavating bankfull benches on either side of the first stage channel will create a second stage channel that provides floodplain access, which is needed to increase flow capacity during larger storm events and limit bankfull channel depths, velocities, and shear stresses to promote bed and bank stability. The floodplain beltwidth was designed to be a minimum of 3.5 times the bankfull width based on widely accepted performance standards. The width of the floodplain benches was limited by private land impacts and cost constraints. Other benefits related to increased floodplain connectivity include enhanced hydration of the floodplain to encourage development and/or redevelopment of wetlands, nutrients processing, water quality, groundwater-surface water exchange, and better health of microbial, vegetation, and macroinvertebrate communities.

Hard Armoring

Hard armoring slopes with riprap was considered as a means to minimize bed and bank erosion. Hard armoring was not selected because it provides little or no habitat value and it does not allow the stream to adjust its boundaries and create or modify bed features. Another potential problem with hard armoring along streambanks is that if it is undermined during a large storm event, it may slump into the channel and cause bed and bank instabilities. Furthermore, the soils are predominantly cohesive clay loams that are somewhat resistant to erosion.

Detention Pond Outlet Control Structure

Moderating highly variable flows through installation of an outlet control structure was considered during the design process. The existing Michigan Department of Transportation (MDOT) detention basin at the headwaters of the creek is currently under-utilized for detention purposes. It was thought that an outlet control structure would moderate highly variable storm flows and prevent substrate from washing away during each storm event. However, the outlet control structure was ultimately removed from the proposed design due to site constraints, property ownership patterns, budget limitations, and maintenance concerns.

Do Nothing

The “do nothing” approach was ruled out as it does not accomplish the project goal of creating and restoring habitat for fish and wildlife.

A portion of work for the Tamarack Creek project was proposed to occur on property owned by the MDOT. In order to gain authorization to complete work on MDOT property, an application for an individual construction permit was sought. A permit application was submitted on May 8, 2020 and a permit was issued on June 17, 2020. The MDOT permit for the Tamarack Creek project is attached as Appendix J.

Most of the work for the Tamarack Creek project is located within the 100-year floodplain. This required the issuance of a joint permit from EGLE and United States Army Corps of Engineers (USACE). A pre-application meeting was conducted on February 5, 2020 to review statutory permitting requirements. It also allowed for the exchange of ideas, discussion of concepts and concerns in the development of a prudent, feasible, and permissible project design. A joint permit application was then completed, including all necessary attachments. Quantities of cut and fill within the ordinary high water mark (OHWM) and the 100-year floodplain was calculated from the design drawings and tabulated. The application was submitted on September 4, 2020 and the permit was issued on December 17, 2020. The EGLE permit for the Tamarack Creek project is attached as Appendix K.

Johnson Creek Fish Hatchery Park

After examining site assessment data, habitat restoration design was completed. A summary of project design as well as alternatives considered follows.

Erosion Analysis

The online tool “Erosion Control Material Design Software (ECMDS)” was used to evaluate if proposed channel and bank areas would be stable during high flow conditions.

Floodplain benches

Floodplain terracing is a technique that allows flows to be moved away from the streambank face while creating a natural, stable floodplain surface for conveyance of storm flows at slower velocities. Current deflectors and slope armoring are other approaches to minimize streambank erosion. The disadvantage of current deflectors is that they are inherently discontinuous; that is, portions of the bank between the structures are not protected. Rock vanes, a type of current deflector, are proposed at areas particularly prone to erosive forces, but are not the main protection against bank instability. Slope armoring, while effective, does not provide habitat value to the bank. As the project ultimately aims to naturalize the streambank and increase habitat value, slope armoring was excluded from consideration.

Channel slopes

The slope from the proposed floodplain benches to the existing grade is designed as 1V:3H. Steeper slopes would be possible if additional reinforcement is used, but channel slopes are relatively low and there are not space constraints necessitating this (with the exception of the stream next to the existing pond – see below). Therefore, the most cost-effective option was to set channel slopes at 1V:3H.

Sheet piling

Johnson Creek and Fish Hatchery Pond are separated by a strip of land ranging from 12' to 20'. If 10' wide floodplain benches are to be installed, there will not be enough space to slope the channel back before infringing on the footprint of the pond. Although reducing the size of the pond is a viable alternative, the pond will be accessible to fish and other wildlife, and therefore is adding habitat value to the project. Therefore, in order to install 10' wide floodplain benches and keep the full area of the pond, sheet piling is proposed to be driven along the edge of the existing pond.

To the south of the pond sits a gazebo, approximately 20' from Johnson Creek. The gazebo could be removed from the site to allow for a slope from the bankfull bench to the existing grade. It is proposed to extend the sheet piling past the gazebo, however, so the gazebo can remain in place. This decision was made due to cost and programming considerations.

Point bar trimming

Due to the existing concrete wall, there are locations where the stream channel takes sharp angles that, when the wall is removed, will be subject to high erosive forces. Various options were considered in two areas to mitigate this issue: the area to the northeast of Fish Hatchery Pond, and the area south of the existing pedestrian bridge. Unfortunately, the area to the northeast of Fish Hatchery Pond is privately owned, and project work in this location was not possible. The land to the south of the bridge is owned by the township, so removal of an existing point bar is possible in order to reduce flow velocity in the area and minimize erosive forces.

Stream/pond connection

The spring-fed pond on-site flows directly into Johnson Creek via a steep connection containing riprap and debris. This connection does not allow for fish passage from the stream to the pond, and several alternatives were explored as possible ways to modify the connection so fish passage would be possible. By rerouting the connection, the connection can be extended from 35' to 90', and a slope of 4% is achievable. Different morphologies were considered for the design of the connection, including pool-riffle system, a plane-bed (rock ramp) system, and a cascade-pool system. Of these systems, the step-pool is most appropriate for the proposed slope, so the step-pool system was chosen.

Dredging of the pond

The volume of sediment to be removed was decided based on sediment thickness data. The sediment thickness varies across the pond, ranging from 1.8' on the north side of the pond to 3.6' on the south side of the pond. To remove the accumulated sediment, the proposed sediment removal in the center of the pond is 3.5', with a minimum of 1V:10H slope to the pond edges. Additional removal of sediment was considered, which would provide improved habitat for fish in the pond. Due to economic considerations, however, this alternative was not chosen for this project.

Do Nothing

The "do nothing" approach was ruled out as it does not accomplish the project goal of creating and restoring habitat for fish and wildlife.

Most of the work for the Johnson Creek project is located within the 100-year floodplain. This required the issuance of a joint permit from EGLE and USACE. A pre-application meeting was conducted on July 26, 2019 to review statutory permitting requirements. It also allowed for the exchange of ideas, discussion of concepts and concerns in the development of a prudent, feasible, and permissible project design. A joint permit application was then completed, including all necessary attachments. Quantities of cut and fill within the OHWM and the 100-year floodplain was calculated from the design drawings and tabulated. The application was submitted on October 19, 2019 and the permit was issued on February 17, 2020. The EGLE permit for the Johnson Creek project is attached as Appendix K.

3.4 Contract Documents/Contractor Selection

For both projects, the design plans and technical specifications were finalized into the contract bid documents. All contractual front-end specifications, payments, bonding, supplemental conditions, project conditions, contract forms and EPA grant requirements were developed and incorporated into bidding documents. The front-end portion of the documents was developed in coordination with the community within which the work was being conducted. This way, the individual community's requirements could be incorporated into the contract with the construction contractor. The bid packages for Tamarack Creek and Johnson Creek Fish Hatchery are included in Appendix L and Appendix M.

The contractor bidding processes were completed for the Projects, including issuing the bid packages and selection of the construction contractor. This task involved completing the following subtasks to aid in the procurement of qualified contractors for each of the construction projects.

- Preparation of advertisement;
- Submittal of documents to contractor clearing houses;
- Preparation of a pre-bid meeting agenda;
- Pre-bid meeting;
- Response to questions for clarification on the contract documents;
- Preparation of addendums for the bid process, as needed;
- Review/analysis of contractor's bids;
- Budget vs. bid analysis;
- Engineer's recommendation for contractor selection; and
- Approval of construction contract.

Tamarack Creek Habitat Restoration Bidding

The pre-bid meeting was held for the Tamarack Creek project on February 8, 2021. Bids were received and publicly opened on February 23, 2020. After bids were received, a bid tab was developed and reviewed. The lowest bidder's references were checked, and on February 26, 2021, the ARC approved the award of the construction contract to Anglin Civil, LLC for \$1,867,200.67. The Bid Tab for Tamarack Creek is shown in Figure 7.

Johnson Creek Habitat Restoration Bidding

The pre-bid meeting was held for the Johnson Creek project on April 7, 2020, hosted via webinar due to the COVID-19 pandemic. Bids were received and publicly opened May 6, 2020. After bids were received, a bid tab was developed and reviewed. The lowest bidder's references were checked, and on May 15, 2020, the ARC approved the award of the construction contract to Anglin Civil, LLC for \$963,089.94. The Bid Tab for Johnson Creek is shown in Figure 8.

Item No.	Description	Unit	Qty	Anglin Civil		Catskill		Erie Construction		Job Site Services		Premier Group Associates		Technical Service Providers		VIL Construction		White Lake Dock & Dredge	
				Bid Unit Price	Item Cost	Bid Unit Price	Item Cost	Bid Unit Price	Item Cost	Bid Unit Price	Item Cost	Bid Unit Price	Item Cost	Bid Unit Price	Item Cost	Bid Unit Price	Item Cost	Bid Unit Price	Item Cost
1	Mobilization	LS	1	\$95,000.00	\$95,000.00	\$102,952.00	\$102,952.00	\$112,000.00	\$112,000.00	\$91,000.00	\$91,000.00	\$75,000.00	\$75,000.00	\$93,000.00	\$93,000.00	\$89,000.00	\$89,000.00	\$131,156.98	\$131,156.98
2	Audio Visual Recording	LS	1	\$2,300.00	\$2,300.00	\$2,410.00	\$2,410.00	\$15,000.00	\$15,000.00	\$2,900.00	\$2,900.00	\$10,000.00	\$10,000.00	\$2,725.00	\$2,725.00	\$4,000.00	\$4,000.00	\$2,291.65	\$2,291.65
3	Construction Staking/Surveying	LS	1	\$8,625.00	\$8,625.00	\$23,921.00	\$23,921.00	\$32,000.00	\$32,000.00	\$58,000.00	\$58,000.00	\$25,000.00	\$25,000.00	\$20,500.00	\$20,500.00	\$24,500.00	\$24,500.00	\$26,737.20	\$26,737.20
4	Traffic Control	LS	1	\$1,495.00	\$1,495.00	\$3,950.00	\$3,950.00	\$22,000.00	\$22,000.00	\$3,400.00	\$3,400.00	\$5,000.00	\$5,000.00	\$3,270.00	\$3,270.00	\$48,000.00	\$48,000.00	\$31,368.85	\$31,368.85
5	Soil Erosion and Sedimentation Control	LS	1	\$11,671.35	\$11,671.35	\$20,900.00	\$20,900.00	\$52,000.00	\$52,000.00	\$29,700.00	\$29,700.00	\$32,000.00	\$32,000.00	\$10,000.00	\$10,000.00	\$15,000.00	\$15,000.00	\$56,095.30	\$56,095.30
6	Staging and Access	LS	1	\$51,750.00	\$51,750.00	\$149,541.00	\$149,541.00	\$169,000.00	\$169,000.00	\$186,000.00	\$186,000.00	\$65,000.00	\$65,000.00	\$100,000.00	\$100,000.00	\$15,000.00	\$15,000.00	\$95,069.83	\$95,069.83
7	Temporary At-Grade Stream Crossing	LS	1	\$8,555.91	\$8,555.91	\$18,588.00	\$18,588.00	\$12,000.00	\$12,000.00	\$25,700.00	\$25,700.00	\$30,000.00	\$30,000.00	\$12,000.00	\$12,000.00	\$5,000.00	\$5,000.00	\$31,661.83	\$31,661.83
8	Tributary Culvert	LS	1	\$2,919.80	\$2,919.80	\$10,555.00	\$10,555.00	\$5,000.00	\$5,000.00	\$11,400.00	\$11,400.00	\$15,000.00	\$15,000.00	\$5,000.00	\$5,000.00	\$3,000.00	\$3,000.00	\$7,292.72	\$7,292.72
9	Water Control	LS	1	\$50,600.00	\$50,600.00	\$95,392.00	\$95,392.00	\$39,000.00	\$39,000.00	\$44,500.00	\$44,500.00	\$15,000.00	\$15,000.00	\$8,175.00	\$8,175.00	\$264,000.00	\$264,000.00	\$50,020.27	\$50,020.27
10	Tree Removal 6-12"	EA	60	\$230.00	\$13,800.00	\$432.00	\$25,920.00	\$270.00	\$16,200.00	\$290.00	\$17,400.00	\$400.00	\$24,000.00	\$410.00	\$24,600.00	\$100.00	\$6,000.00	\$381.56	\$22,893.60
11	Tree Removal >12"	EA	80	\$517.50	\$41,400.00	\$756.00	\$60,480.00	\$475.00	\$38,000.00	\$520.00	\$41,600.00	\$800.00	\$64,000.00	\$955.00	\$76,400.00	\$350.00	\$28,000.00	\$603.63	\$48,290.40
12	Bat Habitat Felling (after April 1, 2021)	EA	50	\$287.50	\$14,375.00	\$624.60	\$31,230.00	\$690.00	\$34,500.00	\$470.00	\$23,500.00	\$725.00	\$36,250.00	\$750.00	\$37,500.00	\$100.00	\$5,000.00	\$1,037.41	\$51,870.50
13	Clearing	AC	4.5	\$4,600.00	\$20,700.00	\$10,389.82	\$46,754.19	\$8,650.00	\$38,925.00	\$9,800.00	\$44,100.00	\$5,000.00	\$22,500.00	\$12,000.00	\$54,000.00	\$5,000.00	\$22,500.00	\$17,892.00	\$80,514.00
14	Culvert Removal	LS	1	\$575.00	\$575.00	\$1,247.00	\$1,247.00	\$7,500.00	\$7,500.00	\$500.00	\$500.00	\$8,000.00	\$8,000.00	\$600.00	\$600.00	\$2,500.00	\$2,500.00	\$494.49	\$494.49
15	Crossing Removal	LS	1	\$25,875.00	\$25,875.00	\$5,399.00	\$5,399.00	\$28,000.00	\$28,000.00	\$1,400.00	\$1,400.00	\$9,500.00	\$9,500.00	\$93,000.00	\$93,000.00	\$2,500.00	\$2,500.00	\$21,847.88	\$21,847.88
16	Bridge Abutment Removal	LS	1	\$5,750.00	\$5,750.00	\$4,292.00	\$4,292.00	\$5,000.00	\$5,000.00	\$700.00	\$700.00	\$18,000.00	\$18,000.00	\$2,500.00	\$2,500.00	\$5,000.00	\$5,000.00	\$4,938.61	\$4,938.61
17	Fence Removal	LF	600	\$3.45	\$2,070.00	\$4.32	\$2,592.00	\$4.00	\$2,400.00	\$4.00	\$2,400.00	\$8.00	\$4,800.00	\$4.00	\$2,400.00	\$5.00	\$3,000.00	\$3.63	\$2,178.00
18	Basin Excavation - Remove from site	CY	4,100	\$34.51	\$141,491.00	\$39.45	\$161,745.00	\$45.00	\$184,500.00	\$56.00	\$229,600.00	\$28.00	\$114,800.00	\$40.00	\$164,000.00	\$25.00	\$102,500.00	\$40.69	\$166,829.00
19	Phragmites/ Cattail Treatment	AC	2	\$1,437.50	\$2,875.00	\$2,827.00	\$5,654.00	\$1,250.00	\$2,500.00	\$2,200.00	\$4,400.00	\$2,400.00	\$4,800.00	\$1,360.00	\$2,720.00	\$5,000.00	\$10,000.00	\$2,374.39	\$4,748.78
20	Floodplain Excavation- Remove from site	CY	8,500	\$33.36	\$283,560.00	\$37.76	\$320,960.00	\$44.50	\$378,250.00	\$61.00	\$518,500.00	\$28.00	\$238,000.00	\$36.70	\$311,950.00	\$25.00	\$212,500.00	\$47.73	\$405,705.00
21	Floodplain Excavation- Use onsite	CY	3,000	\$12.73	\$38,190.00	\$10.99	\$32,970.00	\$9.50	\$28,500.00	\$47.00	\$141,000.00	\$8.00	\$24,000.00	\$9.00	\$27,000.00	\$10.00	\$30,000.00	\$9.50	\$28,500.00
22	Basin Clean Fill	CY	4,100	\$28.61	\$117,301.00	\$54.09	\$221,769.00	\$34.00	\$139,400.00	\$40.00	\$164,000.00	\$28.00	\$114,800.00	\$33.90	\$138,990.00	\$20.00	\$82,000.00	\$45.09	\$184,869.00
23	At-Grade Rifle	EA	2	\$7,953.98	\$15,907.96	\$12,316.46	\$24,632.92	\$4,000.00	\$8,000.00	\$8,800.00	\$17,600.00	\$1,200.00	\$2,400.00	\$4,000.00	\$8,000.00	\$7,500.00	\$15,000.00	\$6,314.42	\$12,628.84
24	Whole Tree Revetment	LF	265	\$22.58	\$5,983.70	\$113.49	\$30,074.85	\$85.00	\$22,525.00	\$88.00	\$23,320.00	\$100.00	\$26,500.00	\$56.00	\$14,840.00	\$100.00	\$26,500.00	\$38.56	\$10,218.40
25	Scour Pool Log	EA	5	\$1,524.90	\$7,624.50	\$1,393.60	\$6,968.00	\$900.00	\$4,500.00	\$1,500.00	\$7,500.00	\$975.00	\$4,875.00	\$355.00	\$1,775.00	\$2,500.00	\$12,500.00	\$1,291.41	\$6,457.05
26	Woody Habitat	EA	3	\$1,121.25	\$3,363.75	\$1,407.67	\$4,223.01	\$950.00	\$2,850.00	\$547.00	\$1,641.00	\$1,030.00	\$3,090.00	\$580.00	\$1,740.00	\$5,000.00	\$15,000.00	\$1,076.17	\$3,228.51
27	Staggered Wing Logs	EA	1	\$632.50	\$632.50	\$4,763.00	\$4,763.00	\$3,100.00	\$3,100.00	\$2,300.00	\$2,300.00	\$3,500.00	\$3,500.00	\$365.00	\$365.00	\$10,000.00	\$10,000.00	\$807.13	\$807.13
28	Horizontal Log Sill	EA	1	\$575.00	\$575.00	\$3,710.00	\$3,710.00	\$2,200.00	\$2,200.00	\$460.00	\$460.00	\$2,500.00	\$2,500.00	\$365.00	\$365.00	\$10,000.00	\$10,000.00	\$807.13	\$807.13
29	Rootwad Revetment	EA	1	\$7,383.00	\$7,383.00	\$6,120.00	\$6,120.00	\$4,800.00	\$4,800.00	\$2,900.00	\$2,900.00	\$5,000.00	\$5,000.00	\$3,900.00	\$3,900.00	\$10,000.00	\$10,000.00	\$1,614.26	\$1,614.26
30	Topsoil	CY	4000	\$18.40	\$73,600.00	\$28.10	\$112,400.00	\$35.00	\$140,000.00	\$44.00	\$176,000.00	\$30.00	\$120,000.00	\$28.65	\$114,600.00	\$13.00	\$52,000.00	\$43.47	\$173,880.00
31	Wetland Basin- ECB S75BN	SY	11000	\$1.90	\$20,900.00	\$1.90	\$20,900.00	\$1.30	\$14,300.00	\$2.00	\$22,000.00	\$2.00	\$22,000.00	\$1.40	\$15,400.00	\$1.50	\$16,500.00	\$2.23	\$24,530.00
32	Wetland Basin- Emergent Wetland Seed Mix	AC	2.3	\$4,025.00	\$9,257.50	\$4,885.91	\$11,237.59	\$3,750.00	\$8,625.00	\$1,500.00	\$3,450.00	\$4,800.00	\$11,040.00	\$4,000.00	\$9,200.00	\$3,500.00	\$8,050.00	\$1,635.62	\$3,761.93
33	Floodplain Bench- ECB C700BN	SY	9500	\$8.30	\$78,850.00	\$8.48	\$80,560.00	\$7.50	\$71,250.00	\$10.25	\$97,375.00	\$10.00	\$95,000.00	\$8.00	\$76,000.00	\$7.00	\$66,500.00	\$11.09	\$105,355.00
34	Floodplain Bench- Forested Wetland Seed Mix	AC	2	\$4,025.00	\$8,050.00	\$4,717.00	\$9,434.00	\$3,700.00	\$7,400.00	\$1,136.00	\$2,272.00	\$4,800.00	\$9,600.00	\$4,000.00	\$8,000.00	\$3,500.00	\$7,000.00	\$1,216.71	\$2,433.42
35	Floodplain Slopes- ECB C700BN	SY	7000	\$9.20	\$64,400.00	\$8.54	\$59,780.00	\$7.50	\$52,500.00	\$10.39	\$72,730.00	\$10.00	\$70,000.00	\$8.10	\$56,700.00	\$7.00	\$49,000.00	\$11.13	\$77,910.00
36	Floodplain Slopes- Mesic Woodland Seed Mix	AC	1.5	\$4,600.00	\$6,900.00	\$6,495.00	\$9,742.50	\$3,900.00	\$5,850.00	\$1,300.00	\$1,950.00	\$4,800.00	\$7,200.00	\$4,200.00	\$6,300.00	\$3,000.00	\$4,500.00	\$1,382.95	\$2,074.43
37	Disturbed Upland- ECB S75BN	SY	5000	\$1.40	\$7,000.00	\$1.93	\$9,650.00	\$1.30	\$6,500.00	\$2.15	\$10,750.00	\$2.00	\$10,000.00	\$1.40	\$7,000.00	\$1.50	\$7,500.00	\$2.30	\$11,500.00
38	Disturbed Upland- MDOT THM Mix	AC	1	\$4,025.00	\$4,025.00	\$6,950.00	\$6,950.00	\$4,000.00	\$4,000.00	\$930.00	\$930.00	\$6,000.00	\$6,000.00	\$4,360.00	\$4,360.00	\$1,500.00	\$1,500.00	\$2,600.82	\$2,600.82
39	Live Stakes	EA	2,300	\$4.60	\$10,580.00	\$5.43	\$12,489.00	\$3.98	\$9,154.00	\$9.44	\$21,712.00	\$6.00	\$13,800.00	\$4.30	\$9,890.00	\$7.00	\$16,100.00	\$10.11	\$23,253.00
40	Shrubs	EA	2000	\$40.83	\$81,660.00	\$45.22	\$90,440.00	\$37.00	\$74,000.00	\$48.00	\$96,000.00	\$48.00	\$96,000.00	\$40.00	\$80,000.00	\$51.00	\$102,000.00	\$51.40	\$102,800.00
41	Trees	EA	500	\$448.50	\$224,250.00	\$484.94	\$242,470.00	\$389.00	\$194,500.00	\$478.00	\$239,000.00	\$475.00	\$237,500.00	\$424.00	\$212,000.00	\$400.00	\$200,000.00	\$511.86	\$255,930.00
42	Fence Replacement	LF	600	\$39.10	\$23,460.00	\$29.18	\$17,508.00	\$15.15	\$9,090.00	\$22.00	\$13,200.00	\$30.00	\$18,000.00	\$8.00	\$4,800.00	\$20.00	\$12,000.00	\$37.56	\$22,536.00
43	Site Restoration	LS	1	\$23,000.00	\$23,000.00	\$22,879.00	\$22,879.00	\$22,200.00	\$22,200.00	\$930.00	\$930.00	\$27,000.00	\$27,000.00	\$13,800.00	\$13,800.00	\$28,500.00	\$28,500.00	\$65,868.72	\$65,868.72
44	As-Built Survey and Drawings	LS	1	\$3,162.50	\$3,162.50	\$7,675.00	\$7,675.00	\$5,800.00	\$5,800.00	\$4,000.00	\$4,000.00	\$10,000.00	\$10,000.00	\$6,300.00	\$6,300.00	\$28,500.00	\$28,500.00	\$7,459.52	\$7,459.52
45	Vegetation Maintenance	MON	14	\$3,268.30	\$45,756.20	\$3,463.00	\$48,482.00	\$2,850.00	\$39,900.00	\$4,800.00	\$67,200.00	\$3,500.00	\$49,000.00	\$3,100.00	\$43,400.00	\$1,500.00	\$21,000.00	\$5,134.90	\$71,888.60
46	Unforeseen Site Conditions	LS	1	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00	\$200,000.00
	Total				\$1,867,200.67		\$2,392,310.06		\$2,274,719.00		\$2,726,920.00		\$2,005,455.00		\$2,089,065.00		\$1,877,650.00		\$2,644,916.64
A-1	Alternate 1- Bat Habitat Felling (Before April 1, 2021)	EA	50	\$287.50	\$14,375.00	\$696.00	\$34,800.00	\$800.00	\$40,000.00	\$117.00	\$5,850.00	\$900.00	\$45,000.00	\$190.00	\$9,500.00	\$100.00	\$5,000.00	\$553.95	\$27,697.50

Figure 7. Tamarack Creek Bid Tab

Rouge River AOC Habitat Final Design Report
Tamarack Creek and Johnson Creek-Fish Hatchery Park Projects

4.0 PROJECT OUTCOMES

The primary goal of this project was to improve the water quality in the Rouge River and support the removal of three BUIs associated with fish and wildlife habitat: Degraded Fish and Wildlife Populations, Degradation of Benthos, Loss of Fish and Wildlife Habitat.

As a result of this Rouge River AOC Habitat Restoration Design Grant the achieved outputs were:

- Design Plans, Technical Specifications, EGLE Permit, and Construction Contractor Contract for Tamarack Creek restoration
- Design Plans, Technical Specifications, EGLE Permit, and Construction Contractor Contract for Johnson Creek restoration

However, the outputs, outcomes, and measures to be expected when implementation of both projects are complete are as follows:

Short-term outputs:

- 2.2 acres of restored wetland
- 1,800 lft of stream corridor restored
- 20 constructed habitat structures
- Naturalize 1,050 feet of streambank
- Restore and connect 0.5 acres of backwater habitat (the pond) to Johnson Creek
- Restore 0.5 acres of riparian habitat

Long-term outcomes:

- More diverse and intact wetland wildlife habitat.
- Restored wetland functions, especially water quantity and quality.
- Greater wildlife diversity and productivity.
- Increase in channel stability and reduced sediment loading from bank erosion.
- Aid in the removal of three of the Rouge River AOC BUIs: Loss of Fish and Wildlife Habitat, Degradation of Fish and Wildlife Populations, and Degradation of Benthos.

Measures:

Great Lakes Restoration Initiative Action Plan II, Measures of Progress (MoPs) for the overall project when the Implementation Grant (GL-00E02478) is completed are:

- 4.1.2- Number of miles of Great Lakes shoreline and riparian corridors protected, restored and enhanced by GLRI-funded projects: Restore 2,850 lft feet of Rouge River tributary
- 4.1.4 - Number of acres of other habitats in the Great Lakes basin protected, restored and enhanced by GLRI-funded projects: 3.2 acres of habitat restoration

4.1 Project Highlights

The success of these projects, and a notable highlight, was the commitment and involvement of various partners on either project. The Tamarack Creek project involved the USEPA, ARC, City of Southfield, MDOT and other private property owners. The Johnson Creek project involved the USEPA, ARC, City of Northville, and Northville Township.

The municipalities provided many in-kind services that aided in the successful design of each project, particularly at the Johnson Creek site where property ownership was split by two parties (City of Northville and Northville Township).

Also, at the Johnson Creek site, the City of Northville connected the design team with SME, a consultant previously involved with design of an emergency fix when a section of the concrete wall at Johnson Creek began to fail. SME's insight on existing conditions was extremely helpful during project design.

4.2 Obstacles Encountered

As mentioned above, a number of groups had input into project design at either site. While this was ultimately a benefit to the project, coordination between partners slowed project progress, particularly at the Tamarack Creek site. A portion of the proposed work was on MDOT property, so to get permission to complete proposed work an MDOT permit was required which ultimately was made to serve as property owner authorization for the EGLE permit. Not being able to obtain each permit concurrently caused unexpected delays in the project timeline.

Project bidding for the Johnson Creek project happened in April/May of 2020 amidst stay-at-home orders in Michigan for most nonessential workers due to the COVID-19 pandemic. In order to keep the bid process moving, an online pre-bid webinar was held instead of a conventional in-person pre-bid meeting. Municipal government buildings were closed to the public at the time, so the project team coordinated contactless drop-off of bid packages at the Northville city clerk office. The Johnson Creek project was able to stay on schedule despite these obstacles.

4.3 Next Steps

The designs will be implemented by the contractors selected under this grant. The implementation will be advanced under the Rouge AOC Habitat Restoration Implementation- Tamarack/Johnson Fish Hatchery GLRI Grant Number GL-00E02478.