East Branch Chagrin River Restoration H2Ohio Project Request for Proposals (RFP) Issued March 15, 2022 Chagrin River Watershed Partners, Inc. (CRWP)

No.	QUESTIONS AND RESPONSES (Issued April 6, 2022)		
1	Date Question Received: 3/18/22 Question: The RFP notes project completion by 5/31/2023 but with the in-water work window for the Chagrin River (7/1-9/14) I just don't see how you could get a permit from the USACE anywhere near that window in 2022 as their review period since COVID has typically been at least 3 months plus you'll have all your assessment, modeling and 30% design work to complete prior to permit submittal. Can I assume that you'd work with ODNR to get an extension through 2023?		
	CRWP Response: H2Ohio projects have an aggressive timeline. ODNR may allow extensions for H2Ohio projects if sufficient justification is provided. If the selected design- build contractor determines that the current project timeline is insufficient to complete the project by May 31, 2023, then CRWP will submit a request to ODNR to extend the project period through December 31, 2023; CRWP will work with the selected contractor to provide sufficient justification for this project extension request as required by ODNR. Approval of a project extension by ODNR is not guaranteed.		
	CRWP consulted with the Ohio Department of Natural Resources (ODNR) Division of Wildlife to obtain information about the Chagrin River restricted in-water work period. The selected Contractor may request a waiver for the Chagrin River restricted in-water work period; however, there is no guarantee that the requested waiver will be granted by permitting agencies or what conditions may apply to the waiver. The Chagrin River is a popular fall and winter steelhead fishery. In addition, the ODNR Division of Wildlife stocks the lower Chagrin River in the spring. Any waiver request must address how the project will not impact fish movement, stocking, and angling opportunities. This information must include how sediment will be kept from entering the stream and how turbidity from project activities will be minimized and controlled. The restricted period for the Chagrin River is September 15 through June 30, and the restricted period on the East Branch is March 15 through June 30. Project activities on the East Branch could take place in a larger unrestricted period but turbidity remains a concern and would still need addressed due to the proximity to the mainstem of the Chagrin River.		
2	Date Question Received: 3/29/22 Question: Who is the Ohio Department of Natural Resources contact for this H2Ohio project?		
	CRWP Response: The Ohio Department of Natural Resources (ODNR) contact for this project is Jeffry Hayes, Assistant Regional Scenic Rivers Manager-Northeast Ohio with the Division of Natural Areas & Preserves.		

3	Date Question Received: 3/29/22 Question: Did Biohabitats develop multiple alternatives for the concept? Were costs included? May we see what the other alternative concepts were in addition to the preferred alternative? Can you provide a larger copy of the Biohabitats concept plan? (Similar questions were combined.)
	CRWP Response: Biohabitats, Inc. developed two alternatives (Alternatives 1 and 2) for the Chagrin River and East Branch restoration components of this project for CRWP in 2018, including cost estimates. Please see the attached factsheet ("Daniels Park Stream Restoration Planning") and attached Technical Memorandum ("River Restoration Concepts") which includes full-page images of these two alternatives and cost estimates. Alternative 1 was incorporated into the H2Ohio project nomination and H2Ohio Grant Agreement/Scope of Work (Exhibit B to the RFP); please note that bidders are encouraged to propose restoration approaches that will meet H2Ohio grant deliverables (described on p. 5 of RFP) within the maximum project cost listed on p. 3 of the RFP.
4	Date Question Received: 3/29/22 Question: What is the total restoration budget?
	CRWP Response: The total maximum cost/price for performance under this contract is \$1,882,258.97. Please note that this is not the total H2Ohio grant amount; the H2Ohio grant is also funding land acquisition/protection components of the project and other grant deliverables.
5	Date Question Received: 3/29/22 Question: What is the best way to access upstream on the mainstem to survey?
	CRWP Response: The best way to access the Chagrin River upstream of the restoration area is from the gravel parking lot at Daniels Park south of State Route 84. Currently, land along the western (left bank) of the Chagrin River immediately upstream of the restoration area is owned by the City of Willoughby and will be transferred to Western Reserve Land Conservancy as part of this H2Ohio project.

6	Date Question Received: 3/29/22			
	Question: Are both sides of the mainstem owned by the City of Willoughby?			
	CRWP Response: As for the restoration area south of State Route 84, the western side			
	(left bank) of the Chagrin River is currently owned by the City of Willoughby. The eastern			
	side (right bank) of the Chagrin River is currently owned by Western Reserve Land			
	Conservancy but will be transferred to the City of Willoughby as part of this H2Ohio			
	project			
	As for the restoration area north of State Route 84 (dam remnant removal area), the City			
	of Willoughby owns the western side (left bank) of the Chagrin River and Andrews			
	Osborne Academy owns the eastern side (right bank) of the Chagrin River. Andrews			
	Osborne Academy owns a portion of the dam remnants and streamhed and bank at that			
	location: CRWP has obtained written site access permission from all property owners to			
	complete the Project			
7	Date Question Received: 3/29/22			
	Question: Does this project help Andrews Osborne Academy? What is the Academy's			
	interest in this project?			
	CRWP Response: The Academy's primarily interests in this project are to steward the			
	Chagrin River and provide educational opportunities for students.			
8	Date Question Received: 3/29/22			
	Question: Are there any physical survey boundaries showing the project limits?			
	CRWP Response: There are currently no survey boundaries showing the project limits.			
9	Date Question Received: 3/29/22			
	Question: Is the contractor required to completely remove the water intake			
	structure/intrastructure at mouth of east branch?			
	CPWP Personnes: The selected Contractor's design should remove the hydraulic impact of			
	the water intake structures at the mouth of the East Branch. At a minimum, the			
	the water intake structures at the model of the Last branch. At a minimum, the			
	to the maximum extent nessible			
10	Date Ouestion Received: 3/29/22			
	Question: Is it the contractor's responsibility to maintain the concrete stormwater			
	channel along State Route 84?			
	CRWP Response: The City of Willoughby will maintain stormwater infrastructure located			
	within the right-of-way along State Route 84 as maintenance of this infrastructure is not			
	included in the Project scope; however, the Project site should be designed to accept			
	stormwater flows in a manner which will minimize erosion within the Project site			

11	Date Question Received: 3/29/22			
	Question: Is a concept plan required to be in the proposal?			
	CRWP Response: A concept plan was not required per the RFP, but proposals that do not include a simple concept plan/map may be less competitive than proposals which include a simple concept/map.			
12	Date Question Received: 3/29/22			
	Question: Should the public input inform the design or shape the design?			
	CRWP Response: Public input obtained during the public information meeting(s) should inform the design to the maximum extent possible within time constraints and while ensuring the project meets H2Ohio grant deliverables (described on p. 5 of RFP) within the maximum project cost (p. 3 of the RFP).			
13	Date Question Received: 3/29/22			
	Question: Can you share the pre-bid meeting sign-in sheet?			
	CRWP Response: A copy of the pre-bid meeting sign-in sheet is attached.			
14	Date Question Received: 3/29/22; 4/1/22			
	Question: Are there previous studies on the dam that can be provided? Are any previous studies on the Daniels Dam removal, previous survey of the Dam, or any design documents related to the Dam available? Are any previous studies on the Daniels Dam removal, previous survey of the Dam, or any design documents related to the Dam available? Are there any pre-existing plans or design information about the dam that you can provide? (<i>Similar questions were combined.</i>)			
	CRWP Response: A preliminary assessment of the dam remnants was completed by			
	Biohabitats, Inc. in 2018; please see attached Technical Memorandum. A hydraulic analysis of the dam as a Chagrin River lamprey barrier was completed in 2009; please see attached memorandum by Wenck Associates, Inc. Neither CRWP nor the City of Willoughby are aware of additional previous studies on the dam.			
15	Date Question Received: 3/29/22			
	Question: Please clarify the extent of the project on the left bank of the East Branch.			
	CRWP Response: The upstream extent of restoration on the East Branch is 700 linear feet from the East Branch's confluence with the Chagrin River, as measured along the stream centerline; restoration shall be limited to property owned by the City of Willoughby (or transferred to the City from Western Reserve Land Conservancy as part of this H2Ohio project) and shall not extend into adjacent private properties.			

16	Date Question Received: 3/29/22			
	Question: Are linear footage deliverables measured from the stream centerline?			
	CRWP Response: Yes, linear footage deliverables can be measured from the stream			
	centerline.			
17	Date Question Received: 3/29/22			
	Question: Are there any issues with ice floes along this stretch of the river?			
	CRWP Response: Ice floes and ice scour do occur through the Chagrin River within the			
	City of Willoughby. There is typically one significant ice floe after each winter, dependent			
	on the extent of ice cover and weather associated with ice breakup event.			
18	Date Question Received: 3/29/22			
	Question: Is Biohabitats, Inc. allowed to bid on the project since they developed concept plans for the site?			
	CRWP Response: ODNR's policies do not preclude a firm from bidding on an H2Ohio-			
	funded RFP if the firm was involved in project development or conceptual planning. Local			
	implementers of H2Ohio-funded projects must follow their own procurement policies.			
	CRWP staff have reviewed CRWP's policies with CRWP's legal counsel and determined			
	that CRWP's policies do not preclude Biohabitats, Inc. from bidding on the project.			
19	Date Question Received: 4/1/22			
	Question: Is CT Consultants, Inc. able to bid on the project?			
	CRWP Response: As the City of Willoughby's municipal engineer, CT Consultants will			
	provide engineering oversight and approval for this project. CRWP and its partners,			
	including the City of Willoughby, will not permit CT Consultants to bid on this project.			
20	Date Question Received: 4/1/22			
	Question: Can the specific prevailing wage rates required for this project be provided?			
	CRWP Response: Per ODNR requirements, the selected Contractor must follow prevailing			
	wage requirements pursuant to Ohio Revised Code Chapter 4115. The selected			
	Contractor (prime) will be required to certify wages for all subcontractors. The			
	subcontractor shall comply with all other applicable provisions of Chapter 4115 of the			
	Onio Revised Code including making the required reports to the Prevailing Wage			
	wage rates for the class of work called for by the project in the locality where the work is			
	to be performed.			

21	Date Question Received: 4/1/22				
	Question: Tasks and Deliverable in Exhibit A do not align with the Tasks presented on the				
	proposal form. Our team plans to present all costs using the proposal form Task format,				
	please indicate if this is acceptable or not.				
	CRWP Response: This is acceptable.				
22	Date Question Received: 4/1/22				
	Question: Is some loss of parking (gravel lot) and the field area allowed for riparian buffer				
	planting upstream of the Johnnycake Ridge Rd Bridge?				
	CRWP Response: The City of Willoughby has indicated that it is acceptable for the				
	restoration and riparian plantings to encroach into the existing gravel parking lot and the				
	ball field area, thereby reducing some space for parking. The City has indicated plans to				
	abandon the small ballfield and possibly convert the area to a meadow habitat (for areas				
	outside the H2Ohio restoration footprint). The City will be involved in all stages of design				
	review to ensure that the proposed restoration design aligns with the City's desires for				
	Daniels Park. The City can assist by reviewing parking patterns and capacity to find the				
	proper balance with grading and buffer.				
22					
23	Date Question Received: 4/1/22				
	Question: Are as-built plans available for the two upstream bridges?				
	CPWD Personance: As built plans for the two unstream bridges are not currently available				
	at the PED stage of this project, but the project partners will coordinate with the Objo				
	Department of Transportation (ODOT) to request as built plans to inform restoration				
	design at the request of the selected Contractor				
24	Date Question Received: 4/1/22				
	Question: Is data available regarding depth to bedrock within the site limits of				
	disturbance?				
	CRWP Response: The project partners are not aware of any depth to bedrock data within				
	the site limits of disturbance.				
25	Date Question Received: 4/1/22				
	Question: Has any sediment testing been conducted just upstream of the dam, and if so				
	can we get a copy of the results? If not, are there specific sediment criteria that the				
	client, the state or the federal agencies will want the sediment to be compared to?				
	CRWP Response: The project partners are not aware of any sediment testing upstream of				
	the dam remnants. There are no known specific sediment criteria that apply to this				
	project. The selected contractor will be responsible for preparing, filling, paying all required fees for and obtaining all necessary local, state, and federal nermits				
	certifications, and authorizations for the Project. This includes all required surveying and				
	data collection to prepare and submit permit applications and payment of all required				
	fees to obtain permit or agency authorizations to proceed				
	ices to obtain permit of agency autionzations to protecta.				

26	Date Question Received: 4/1/22 Question: Will the park be open during construction? Can the gravel lot be closed off for construction access?
	CRWP Response: Daniels Park will remain open during construction. Portions of the gravel lot may be closed off for construction access in coordination with the City of Willoughby. The selected Contractor shall install a temporary construction fence surrounding publicly-accessible work areas at the Project Site and maintain such fence in good and sightly condition during construction. The selected Contractor should prepare a one-page project summary document for the City's website and sign board(s) posted at Daniels Park for communication to the public during construction.



Daniels Park Stream Restoration Planning



East Branch Restoration Plan

 Prevent 274.7 tons/yr. sediment & 329.6 lbs./ yr. phosphorous from entering Chagrin River

Alternative I:

- Restore 700 ft. of East Branch
- Restore I acre of oxbow wetland
- \$842,050

Alternative 2:

- Restore 720 ft. of East Branch
- Restore 0.6 acres of oxbow wetland
- \$1,105,100

Mainstem Restoration Plan

- Stabilize 685 feet of eroding streambank
- Restore 1.5 acres of riparian buffer
- Prevent 140.2 tons/yr. sediment & 168.3 lbs./ yr. phosphorous from entering Chagrin River
- \$485,000 \$511,000

Current Conditions

At the City of Willoughby's Daniels Park, both the Chagrin River south of State Route 84 and the East Branch of the Chagrin River near the confluence with the Chagrin River have been experiencing substantial erosion for several years. Both streams have 10.5 feet bank heights. In June 2018 both streams scored as having High erosion using Rosgen's Bank Erosion Hazard Index. The East Branch had Very High Near Bank Stress and the Chagrin River had High Near Bank Stress. About 685 feet of streambank on the western bank of the Chagrin River and 475 feet on each bank of the East Branch are eroding.

A remnant wooden dam and concrete intake structure and associated pipes and rubble from the City of Willoughby's former water supply intake are having a large impact on the hydraulics of the East Branch of the Chagrin River near its confluence with the Chagrin River. These structures have resulted in unnatural and variable deposition and erosion patterns. This reach is an extremely dynamic, unstable meander S-curve. The instability and hydromodification is negatively impacting the channel morphology and bank erosion and riparian zone components of the Qualitative Habitat Evaluation Index. The nearest assessment point on the East Branch was in nonattainment of its coldwater habitat aquatic life use when last assessed by Ohio EPA in 2004.

Factors causing erosion on the western bank of the Chagrin River between State Route 84 and I-90 include: collapse of the downstream dam which lowered the base level, lack of adequate riparian buffer, and accumulation of sediment along the eastern bank. The erosion and migration of the western bank has resulted in deposition and aggradation of the eastern bank. The point bar on the eastern bank and associated transverse riffle are forcing flow into the western bank. Despite this ongoing erosion problem, the Chagrin River near this location has been able to maintain healthy fish and macroinvertebrate communities, and overall habitat quality is good. These erosion problems should be addressed to ensure that the Chagrin River in this area continues to support healthy aquatic communities.



Eroding streambanks on East Branch near remnants of City of Willoughby's former water supply intake.



The East Branch at Daniels Park has been unstable for a long time.



Eroding streambank on Chagrin River south of State Route 84 at Daniels Park.



The restored oxbow wetland will provide nursery areas for native fish.



After restoration, the East Branch at Daniels Park will look more like this stable reach upstream.



Bendway weirs would help stabilize the western bank of the Chagrin River south of SR 84.



Bendway weirs need to be keyed into the bank to prevent the river from cutting behind them.

Restoration Plan for the East Branch

The conceptual plan restores the East Branch by realigning the channel to a more stable configuration and removing the influence of the former water intake structures on the flow hydraulics. In both alternatives, most or part of the old channel will become an oxbow wetland. Oxbow wetlands provide nursery areas for young fish and can be good waterfowl habitat. Fish habitat in the channel will also be improved by improving channel morphology and addressing bank erosion. Implementing the restoration plan for the East Branch would prevent 274.7 tons of sediment and 329.6 pounds of phosphorous per year from entering the Chagrin River.

The preferred alternative (Alternative I) is a new channel alignment with one meander located in the low area in the floodplain between the East Branch and the mainstem of the Chagrin River. Toe wood will help stabilize the meander. Alternative I would restore 700 feet of the East Branch and I acre of oxbow wetland at an estimated implementation cost of \$842,050.

Alternative 2 is a channel configuration with two meanders with a smoother, more stable curve than is currently present. Alternative 2 would require more excavation and fill than Alternative 1. Alternative 2 would restore 720 feet of the East Branch and 0.6 acres of oxbow wetland at an estimated implementation cost of \$1,105,100

Bank Stabilization & Riparian Restoration Plan for the Chagrin River

The restoration plan stabilizes 685 feet of the eroding western bank of the Chagrin River south of State Route 84 using bioengineering methods and restores 1.5 acres of riparian vegetation. The native tree and shrub species will help stabilize the banks with their roots and help filter runoff before it reaches the river. Implementing the bank stabilization and riparian restoration plan for the Chagrin River at Daniels Parks would prevent 140.2 tons of sediment and

168.3 pounds of phosphorous per year from entering the river.

The preferred restoration alternative (Alternative I) combines bendway weirs, a bankfull bench, and riparian restoration along the western bank with removal of the point bar on the eastern bank and realigning the transverse riffle. Bendway weirs are rock structures that direct flow into the center of the channel. A bankfull bench is a floodplain area that water overtops in common high flow events which allows for flood storage and velocity dissipation. The estimated implementation cost for Alternative I is \$485,000.

Alternative 2 would replace the bendway weirs with a boulder toe (boulders at the bottom of the streambank near the water) while retaining the other components of the bioengineered streambank stabilization plan. The estimated implementation cost for Alternative 2 is \$511,000





About Chagrin River Watershed Partners (CRWP)



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Chagrin River Watershed Partners (CRWP) has been helping the communities that drain to the Chagrin River with flooding and erosion problems since 1996. We assist local governments with adopting and implementing regulations to protect natural resources and promote balanced growth, secure and manage grants to help fund restoration projects, and provide advice to landowners to address erosion and flooding problems. Through the Central Lake Erie Basin Collaborative, we assist other watershed groups and communities across the Central Lake Erie Basin from Sandusky to Conneaut.

Daniels Park Stream Restoration Planning Process

The City of Willoughby has been concerned about erosion occurring on the Chagrin River and its East Branch at Daniels Park for several years. The City shared these concerns with CRWP, and CRWP began applying for grants to assist with stream restoration planning for the park. In 2017, CRWP received a \$15,000 Great Lakes Restoration Initiative grant from the Ohio Environmental Protection Agency and the United States Environmental Protection Agency to develop conceptual stream restoration plans. Through a competitive request for proposals process, CRWP hired Biohabitats in 2018 to assist with conceptual plan development. CRWP has consulted with the City of Willoughby, Lake County Stormwater Management Department, Lake Soil and Water Conservation District, Western Reserve Land Conservancy, Ohio Environmental Protection Agency, and Ohio Department of Natural Resources to facilitate plan development. Stakeholder outreach will continue to gain support for the stream restoration plan and cultivate partnerships to assist with project implementation. CRWP will incorporate components of the stream restoration plan for Daniels Park into Nonpoint Source Implementation Strategy (NPS-IS) Plans for Chagrin River subwatersheds, so that they will be eligible for implementation funding from Ohio Environmental Protection Agency and the United States Environmental Protection Agency. After securing approval from project stakeholders, CRWP will seek grants to help fund project implementation.



Biohabitats and CRWP assessing current conditions.



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TECHNICAL MEMORANDUM

Subject:	River Restoration Concepts
RE:	DANIELS PARK, WILLOUGHBY, OHIO
From:	Vince Sortman, Senior Fluvial Geomorphologist
То:	Keely Davidson-Bennett, Chagrin River Watershed Partners
Date:	August 6, 2018, revised October 25, 2018

On June 28, 2018 Biohabitats staff performed a site assessment of the Chagrin River and East Branch at Daniels Park in Willoughby, Ohio. The assessment included a Bank Erosion Hazard Index (BEHI) on the Chagrin River and the East Branch. The focus of the assessment was on the mainstem from the I-90 bridge to the Route 84 bridge (about 800 linear feet) and approximately 1000 linear feet of the East Branch from its confluence with the Chagrin River.

CHAGRIN RIVER

The left bank (looking downstream) of the Chagrin River is actively eroding. The bank is about ten feet high and composed of mostly silty clay soil with some alternating layers of river bed material in the lower portion of the bank. It appears that the bank erosion was initiated by a combination of factors:

Removal of vegetation from the left bank for the park

Accumulation of sediments along the right bank due to the confluence of the East Branch Collapse of the downstream dam which lowered the base level.

The erosion and migration of the left bank provides the hydraulic opportunity for continued deposition and aggradation of sediments on the right bank. The growth of the bar along the right bank provides positive feedback to force flows toward the left bank. A distinct thalweg has formed along the left side of the river which has created a transverse riffle in this reach which directs flows into the left bank. The typical erosion process on channel banks is for the toe of the channel to erode away, because this is where the highest shear stresses occur, and then the bank material above slumps down into the channel and is eventually eroded away also. Several bank slumps were noted at the toe of the left bank during our site assessment.

Our preferred alternative to control the rapid erosion and migration of the left bank is to install bendway weirs along the toe of the left bank and excavate the left bank to create a gentle slope that would allow riparian trees and shrubs to grow as well as provide pedestrian access to the river. The excavated material from the bank would be used to create a bankfull bench between the bendway weirs. The bench would be about 2' high at the front (river edge) and taper up to about 3' high at the back next to the existing bank. The bench would be about 20' wide and would be vegetated with willow stakes and other native riparian trees and shrubs. The vegetated bankfull bench and slope would re-establish a forested riparian buffer along the left bank which would improve habitat and water quality. The gravel/cobble bar on the right bank would be excavated back to where vegetation has started to grow on the bar. This material would be used as base between the bendway weirs before the excavated bank material is placed to form the bankfull bench. The transverse riffle should also be graded to center the flow through this reach.

A second alternative to control migration of the left bank would be very similar to the first alternative but it would use boulder toe to stabilize the toe of the new bankfull bench rather than bendway weirs. We prefer the bendway weirs in this scenario because they would function to keep the thalweg from migrating to the west and would require less material than the boulder toe.

We estimated construction costs (including revegetation) for both alternatives using very preliminary quantity estimates. Due to the preliminary nature of these estimates we added a 20% contingency to the estimates.

ALTERNATIVE 1: \$358,880 ALTERNATIVE 2: \$384,880

We performed a Bank Erodibility Hazard Index (BEHI) during our site assessment. We calculated a BEHI Rating of High and a Near Bank Stress Rating of High for the left bank. Using erosion rates from North Carolina (rates most applicable to NE Ohio) we estimated the following pollutant loading from bank erosion in the study area:

Chagrin River	TN	ТР	TSS
Predicted Annual Load Reduction (NC) (Ib/yr)	94.1	44	72,421



Chagrin River at Daniels Park looking downstream. Transverse riffle forcing flow into left bank.



View of left bank on mainstem showing slumped bank material in channel after toe erosion.



Looking upstream at eroding left bank of mainstem.



Looking upstream at large cobble/gravel bar forming along right bank of mainstem.

EAST BRANCH CHAGRIN RIVER

The project reach of the East Branch is characterized by an extremely dynamic, unstable meander Scurve. The hydraulics in this S-curve have been highly altered by man-made structures. There is the remnant of a wooden dam that crosses the channel near the upstream end of the downstream meander which is connected to the remnant of a concrete intake structure on the edge of the downstream meander. There are also exposed pipes and concrete rubble in the channel. These structures alter the storm flow hydraulics such that the deposition and erosion patterns are not natural and appear to change from flow to flow.

The eroding banks on the East Branch are quite similar to the eroding bank on the mainstem. The banks are about 10' high and composed of mostly silty clay soil with some alternating layers of river bed material in the lower portion of the bank. The erosion process is also similar with the toe eroding and bank material slumping down into the channel.

Our preferred restoration alternative for the East Branch is to realign the channel to cutoff the downstream meander. This would eliminate the influence of the man-made structures on the flow hydraulics and provide a better approach of the East Branch into the mainstem. There is a low area in the floodplain between the East Branch and the mainstem that appears to be the best location for the new channel alignment. The material excavated for the new channel would be used to create a plug between the new channel and the old channel; however, most of the old channel would remain open as a backwater/oxbow wetland. The new channel alignment would have one meander. This meander could be stabilized with toe wood using trees removed from the excavated area. Using toe wood to stabilize the meander will greatly reduce sediment loading and improve aquatic habitat. Creating the backwater/oxbow wetland will provide habitat and plant communities that are lacking in this area.

A second restoration alternative would be to remove all of the man-made structures and smooth the Scurve to a more stable plan geometry. The "smoother" S-curve would require excavation to create new point bar areas on both meanders. The trees removed from the excavated area could be used for toe wood protection on the new meander banks. Much of the downstream meander could remain open to create an oxbow wetland.

We estimated construction costs (including revegetation) for both alternatives using very preliminary quantity estimates. Due to the preliminary nature of these estimates we added a 20% contingency to the estimates.

ALTERNATIVE 1: \$687,048 ALTERNATIVE 2: \$950,076

We performed a Bank Erodibility Hazard Index (BEHI) during our site assessment of the East Branch study reach. We calculated a BEHI Rating of High and a Near Bank Stress Rating of Very High for both banks. Using erosion rates from North Carolina (rates most applicable to NE Ohio) we estimated the following pollutant loading from bank erosion in the study area:

East Branch of Chagrin River	TN	ТР	TSS
Predicted Annual Load Reduction (NC) (lb/yr)	176.3	81.4	135,650



Actively eroding bank on the East Branch along Route 84. Concrete curb/gutter slumped into the channel from the top of bank.



Remnant of concrete intake structure with eroding bank along Route 84,



Remnant of wooden dam structure just upstream of old intake structure.



Looking downstream at low area in floodplain at upstream meander where new channel could be cut through to the mainstem.

DANIELS PARK DAM

We also performed a preliminary assessment of the collapsed, concrete, low-head dam at the lower end of Daniels Park. We understand that one concern with the collapsed dam is that it may be a fish barrier to smaller native fish and another concern is that it may be causing channel instability by creating an over-wide channel section.

Because the dam collapsed into a deep scour hole, a large section of the top of dam is close to water level during low flow conditions and therefore does not appear to be a fish barrier. However, most of the base flow is concentrated at two low areas of the collapsed dam. This situation does elevate flow velocities through the two low areas which could hinder smaller native fish. There is a section of concrete that is slightly higher than the two low areas but is low enough for base flow to flow over in a thin stream. If this section of concrete could be lowered several inches it would increase the flow area and reduce the velocities at the two low areas increasing the potential for small native fish to pass. Also, most of the scour hole downstream of the dam is still intact and provides good pool habitat.

The river channel in this area is not unstable. No mid-channel bars have formed. There is a wide riffle just downstream of the scour hole but even during low flow conditions there was about 12 inches of depth in the thalweg. Also the reach just below the dam appears to be depositing sediments along both banks. There appears to be some active erosion on the right bank but it's relatively small and looks like some strategically placed large woody debris would help create deposition there.

We spoke with a grading contractor, experienced with river restoration work, about the cost to lower a portion of the dam to provide better native fish passage. Based on our photos of the collapsed dam he recommended using \$150,000 for planning purposes. This estimate could be lower or higher depending on a number of factors such as: can the channel bed upstream of the dam support heavy equipment, what type of flow diversion is required, does the concrete need to be removed from site, etc.



View of collapsed dam from west bank. Notice two low areas with elevated velocities. Also notice deep scour pool just downstream of dam.



Wide riffle downstream of collapsed dam. Notice deposition along right bank.

	March 29, 2022	9:00 AM - 10:00 AM	NUNY
Name (please print)	Organization	Email	Phone number
Kein Chinsharituria	5xcs	Hearptfled & Yohnas	abb-124-026 ma
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Mins Davis	Tueson Inc.	mdavis & tucsonship, com	3056-970-915
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CHAGRIN RIVER WATERSHED PARTNERS, INC.

East Branch Chagrin River Restoration H2Ohio Project Mandatory Pre-Bid Meeting



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Phone number	PARTNERS

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September 9, 2009
Final Draft - Hydraulic Analysis for Chagrin River Lamprey Barrier
Bill Holman, P.E., Stanley Consultants, Inc.

The basis of this memo is to evaluate two locations for their potential and block sea lamprey migration in the Chagrin River. Several site characteristics were investigated as part of the scope of work including flow variation throughout the year, peak flow analysis, and hydraulic analysis of the separation between the tailwater and weir elevation over several flow regimes. The results of the analysis are summarized in the following paragraphs.

INTRODUCTION

The locations evaluated were the Daniels Park Dam (Chagrin River), and the Kirtland Country Club dam (East Branch of Chagrin River) in Willoughby, Ohio. The Daniels Park Dam site was investigated as part of Phase I of this project, and the Kirtland Country Club site was identified after the report as a potential location. The Daniels Park Dam site would require the installation of a fixed crest weir with a sea lamprey trap, while the Kirtland Country Club site already has a fixed crest weir. The effectiveness of each site was based on an ability to create at least a 1-foot separation during migration periods (March through July) when sea lamprey would access upstream areas for spawning. The two sites are described in more detail below.

Daniels Park Dam

The Daniels Park Dam (formerly Willoughby Waterworks Dam) was a five-foot high fixed crest weir which failed in January 2005. The proposed project would be to reconstruct the dam as a fixed crest weir with a crest elevation of 601.0. The installation of the dam with this configuration is to replicate the previous hydraulics of the stream as much as possible. The river has a drainage area of 249mi² and is located just downstream of Highway 84 in the City of Willoughby.

Kirtland Country Club Dam

Kirtland Country Club operates a dam approximately 2.2 miles upstream of the Daniels Park Dam on the East Branch of the Chagrin River in the City of Willoughby. The dam is approximately 6.3 feet high and might restrict sea lamprey migration in the Each Branch of the Chagrin River. The river has a drainage area of 50mi²

METHOD

Hydrology

The hydrology for the Chagrin River was evaluated using peak flow and average daily flow from 1971 and 2009 collected at a USGS monitoring station (Station #04209000). This site is located 50 feet downstream of the Daniels Park Dam and has been in operation since 1925. Data from the Station was analyzed with HEC-SSP 1.1 to complete frequency and determine average flow information. HEC-SSP is a frequency analysis software program provided by the US Army Corp of Engineers. The results are provided in Tables 1 and 2.

Table 1 – Flood Frequency Curve for Chagrin River at Daniels Park Dam

Peak Flows (cfs)					
1-yr 2-yr 5-yr 10-yr					
3,350	8,920	13,800	17,400		

As part of the analysis flow records were evaluated for seasonal variation and an average was established for the period which sea lamprey migrate (March - July). Table 2 provides a summary of this data.

Table 2 – Average Daily Flow for Chagrin River at Daniels Park Dam

Average Monthly Flow (cfs)						
March	March April May June July March/April/May					
721 565 387 255 189 558						

There were no flow records available for the Kirtland Country Club site. Flows for this site were developed by correlating flows from City of Willoughby FIS between the East Branch of the Chagrin to the Main Stem of the Chagrin. The correlation of the 10, 50, 100, and 500-year storm events are shown in Figure 1.



Chagrin and East Branch Chagrin Flow Correlation - Data from the City of Willoughby FIS

Figure 1: Correlation of Flows between Daniels Park Dam Site and Kirtland Country Club Site.

The results of the correlation demonstrate a good fit (R2 = 0.9971), which enables flows developed at the Daniels Park Dam to be correlated to the Kirtland Country Club Site. The results of the correlation are provided in Tables 3 and 4.

Table 3 – Flood Frequency Curve for East Branch of Chagrin River at Kirtland Country Club

Peak Flows (cfs)					
1-yr 2-yr 5-yr 10-yr					
1,149	2,960	4,445	5,500		

Table 4 – Average Daily Flow for Chagrin River at Kirtland Country Club

Average Monthly Flow (cfs)					
March April May June July March/April/May					
251	195				

The results of the hydrologic analysis provided the necessary flows to determine water surface elevations upstream and downstream of the dam sites.

Hydraulics

Using the flow rates established for the site a hydraulic analysis was completed to determine the elevation difference between weir elevations and the tailwater elevation. Impacts to the headwater elevation were also evaluated.

River geometry and structure information for the sites were taken from the 1980 Flood Insurance Study for the City of Willoughby. The hydraulic data was contained in HEC-2 data cards which were provided only in hard copy by the Federal Emergency Management Agency (FEMA). Additional information on the Kirtland Country Club Dam was provided in a report by Hydrosphere Engineering (2007). Hydraulic information was then used to model flow separation at the dam and headwater impacts.

Daniels Park Dam Site

The hydraulic information provided in the HEC-2 data was modified to represent a fixed crest weir at elevation 601.0 ft across the Chagrin River.

A rating curve was also developed for this site based on stage data collected by the USGS to supplement information provided by the Flood Insurance Study for the City of Willoughby. Stage data from the USGS monitoring station was only used from 1971 to 2002, since there was concern elevation data after that time would not be representative of having a fixed crest weir at that location. The rating curve for the location is shown in Figure #2.



Figure #2 – Rating Curve for Daniels Park Dam based on USGS Gauging information (1971-2002)

Based on this information a HEC-RAS model was developed to determine elevations upstream and downstream of the dam along with separation. The results of this analysis are provided in Tables 5 & 6. A negative number in the separation column indicates the weir is submerged and sea lamprey would be able to migrate past the weir.

Event	Water Surfac	Separation	
	Upstream	Downstream	(ft)*
1-yr	605.6	601.1	-0.1
2-yr	608.4	605.9	-4.9
5-yr	609.7	608.5	-7.5
10-yr	610.6	609.9	-8.9
March Avg. Flow	602.8	598.3	2.7
April Avg. Flow	602.6	598.1	2.9
May Avg. Flow	602.2	597.7	3.3
March – May Avg. Flow	602.5	598.0	3.0

*Separation measured as the distance between the weir crest (601.0ft) and tailwater elevation.

The results of the modeling demonstrate backwater impacts associated with higher events limit the separation needed to prevent sea lamprey from migrating upstream, making the site vulnerable during times of high flow. The hydraulic modeling results were then used to determine on average how many days per month there would be less than a 1-foot drop per month from March to July. The results of this analysis are provided in Table 6.

Table 6 - Summary of Daily Flow Exceedence at the Daniels Park Dam Site

Flow at which	Average Number of Days Per Month with < 1 foot Drop					
there is less than a 1 ft drap (cfa)	March	April	Мау	June	July	
arop (cis)						
2,285	1.5	1.0	0.6	0.4	0.3	

These results demonstrate the site would be vulnerable on average 4 days per year to sea lamprey passage due to a lack of 1 ft separation.

Kirtland Country Club Site

A similar analysis was done for the Kirtland Country Club site. HEC-2 information gained from FEMA and Hydrosphere Engineering was used to develop a HEC-RAS model for the existing weir. The results of the analysis are provided in Table 7 & 8.

Event	Water Surfac	Separation	
	Upstream	Downstream	(ft)*
1-yr	625.6	621.1	1.9
2-yr	627.3	623.8	-0.8**
5-yr	627.9	625.2	-2.2**
10-yr	628.3	626.7	-3.7**
March Avg. Flow	624.0	618.4	4.6
April Avg. Flow	623.9	618.1	4.9
May Avg. Flow	623.7	617.8	5.2
March – May Avg. Flow	623.9	618.1	4.9

Table 7 – Kirtland Country Club Site Water Surface Elevations

*Separation measured as the distance between the weir crest (623.0ft) and tailwater elevation.

** When the upstream elevation is above 626.7ft water is able to bypass the dam allowing lamprey to migrate around the dam.

The results of the modeling demonstrate the dam is able to provide the required 1-foot separation up to the 1-year event. Above elevation 626.7ft (2,350cfs) water is able to go around the dam creating a route for sea lamprey to migrate upstream. The hydraulic modeling results were then used to determine on average how many days per month there

would be less than a 1-foot drop per month from March to July. The results of this analysis are provided in Table 8.

Flow at which	Average Number of Days Per Month with < 1 foot Drop				
there is less than	March	April	May	June	July
a 1 ft drop (cfs)		-	-		
1,750	0.2	0.03	0.09	0.06	0.03

 Table 8 - Summary of Daily Flow Exceedence at the Kirtland Country Club

These results demonstrate the site would be vulnerable on average less than 1 day per year. There increase a slight increase in the average number of days there is less than a 1 ft drop from April to May based on the review of past monitoring records demonstrating April had more daily flows above 1,750cfs. However, on average May has lower flows compared to April. This could be attributed to storm events.

While it would protect a smaller area of the watershed than Daniels Park Dam it is already constructed and only a sea lamprey trap would need to be installed.

SUMMARY

Sites evaluated in this phase would serve as good locations for sea lamprey barriers. The Daniels Park Dam would be exposed to sea lamprey passage on average 3 days more per year than the Kirtland Country Club, making it a little less desirable of a site. However, the ability of the Daniels Park Dam to protect four times the watershed area creates a scale factor which also makes is viable location.

RECOMMENDATION

Consideration should be given if the cost of construction of a new dam at the Daniels Park Dam provides the benefits the USFWS desires, or if retrofitting the Kirtland Country Club with a sea lamprey trap is a better use of dollars.