

UTMC SWAN CREEK RESTORATION DESIGN CONCEPT

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PREPARED FOR:



DESIGNED BY:



FUNDED BY:



Project Description

Stabilize 1,700 feet of eroding streambank via bioengineering techniques
Install locked logs, bendway weirs and hydraulic cover stones
Install 50 feet of riffle habitat

Beneficial Use Impairments (BUI) Addressed

BUI #3a: Degradation of fish populations (target met)
BUI #6: Degradation of benthos (target not met)
BUI #14a: Loss of fish habitat (target not met)

Drainage Area: 189 square miles

County: Lucas **Municipality:** City of Toledo

Location: 83°36'53.17" W, 41°37'19.60" N

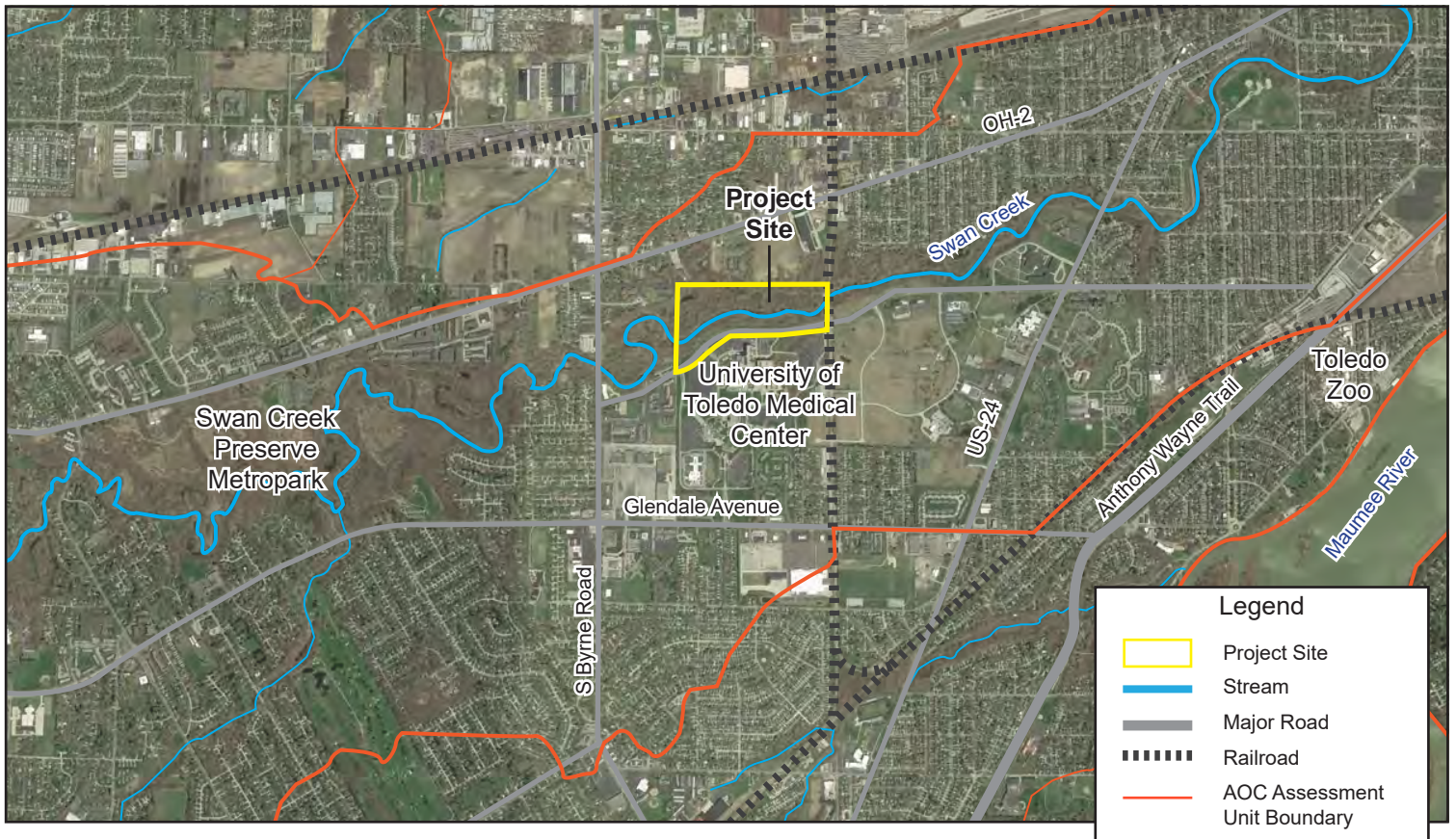
Stream: Swan Creek (QHEI at South Ave = 44.8 (2017))

AOC Assessment Unit (HUC-12): Heilman Ditch-Swan Creek (04100009 08 04)

Stream buffers: Moderate to wide, second growth floodplain forest

Surrounding land use: Residential and urban

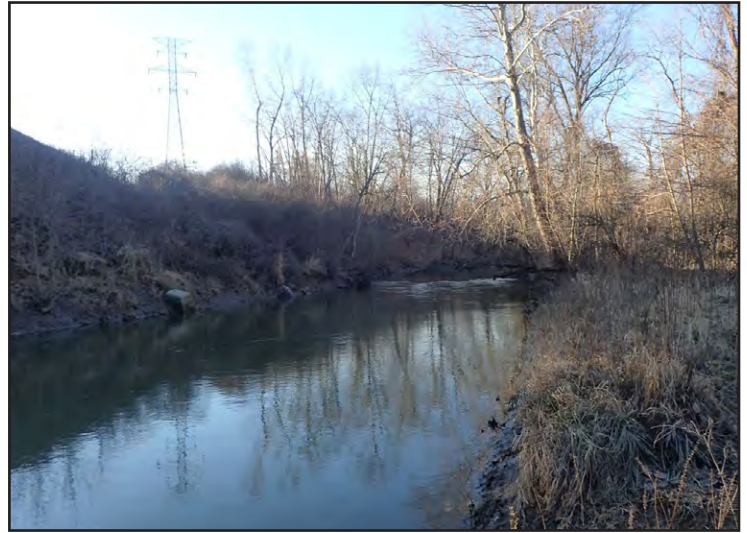
Field-estimated gradient: 5 feet per mile, low



0 0.5 mi 1 mi

PROJECT LOCATION

The project site is located along Swan Creek, north of the University of Toledo Medical Center (UTMC), on University of Toledo-owned land. The site includes Swan Creek, floodplain wetlands, and wooded slopes up to Arlington Avenue. The site is bordered by a steel distribution plant and residential properties to the north, Bowsher High School to the east, Arlington Avenue to the south, and Metroparks Toledo land (developed as Swan Creek Preserve Metropark) to the west.



Swan Creek facing west from beneath the railroad bridge

EXISTING CONDITIONS

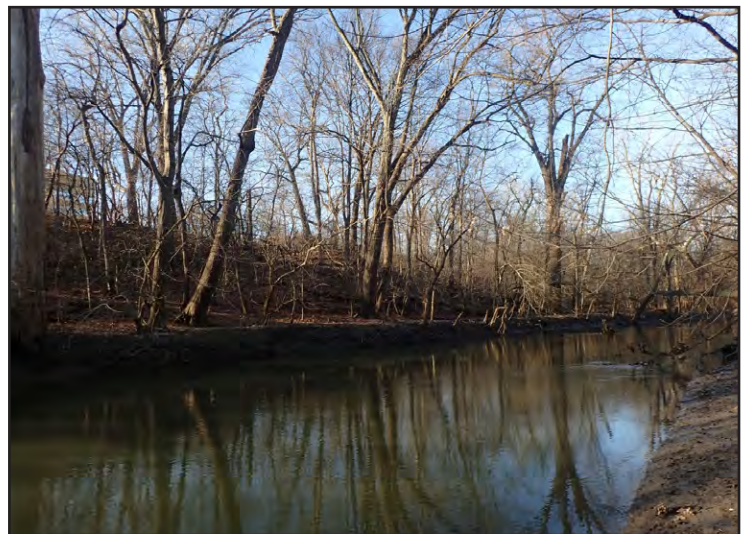
Swan Creek flows from west to east through the project site. With the exception of a few areas where the slope of the bank up to Arlington Avenue is very steep, the banks are generally shallow and do not exhibit signs of erosion. The stream does not appear to be channelized. Existing in-stream cover is moderate to sparse and is predominantly composed of woody debris and root wads. A stretch of approximately 750 linear feet of Swan Creek in the middle of the site is a uniform glide habitat with limited in-stream cover.



Potential wetland area in the floodplain north of Swan Creek

A large floodplain wetland exists on the north side of the stream and several smaller riparian benches with wetland vegetation are located on the south side of Swan Creek. Trash and floating debris were observed behind a few logjams during the site visit in early January 2020.

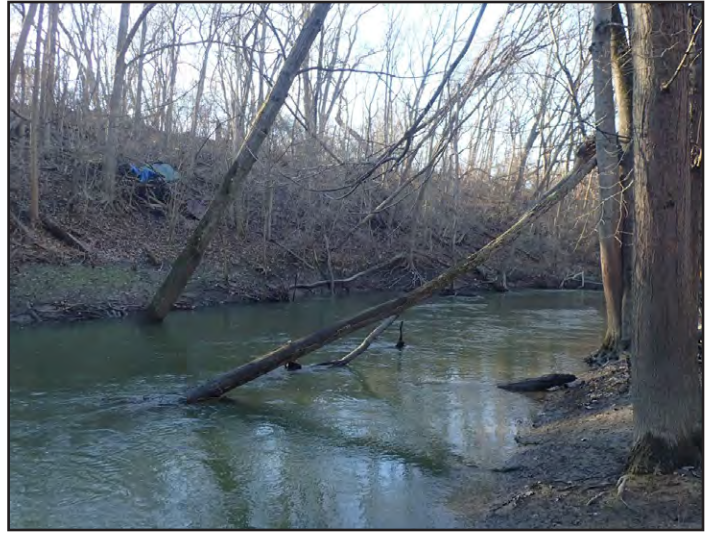
Three UTMC storm sewer outfalls are located along Swan Creek within the project site. A leak in the western-most outfall that has since been remedied resulted in a segment of the pipe failing and the bank below the outfall eroding into the stream. Large pieces of concrete were placed in the resulting empty space to prevent further erosion. However, longterm stability of the bank and riparian habitat could be improved in the area.



Glide habitat in the middle of the site



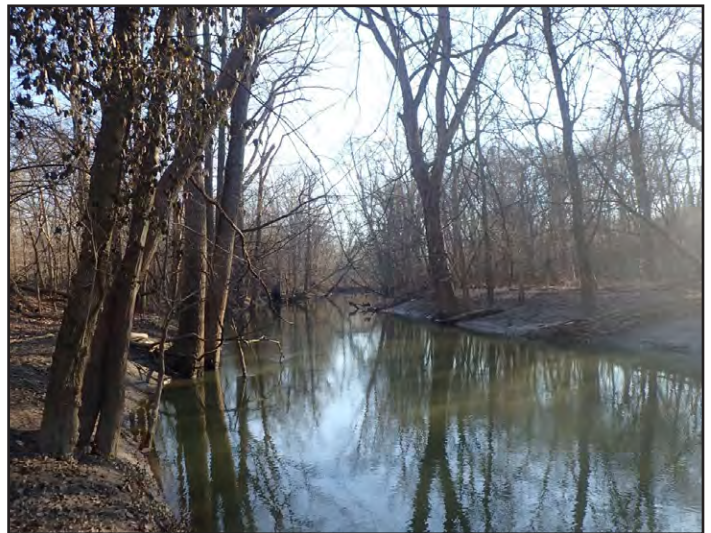
Tributary facing south toward Swan Creek



Steep slope in the southwest portion of the site



Woody debris spanning Swan Creek



Swan Creek facing east along glide habitat

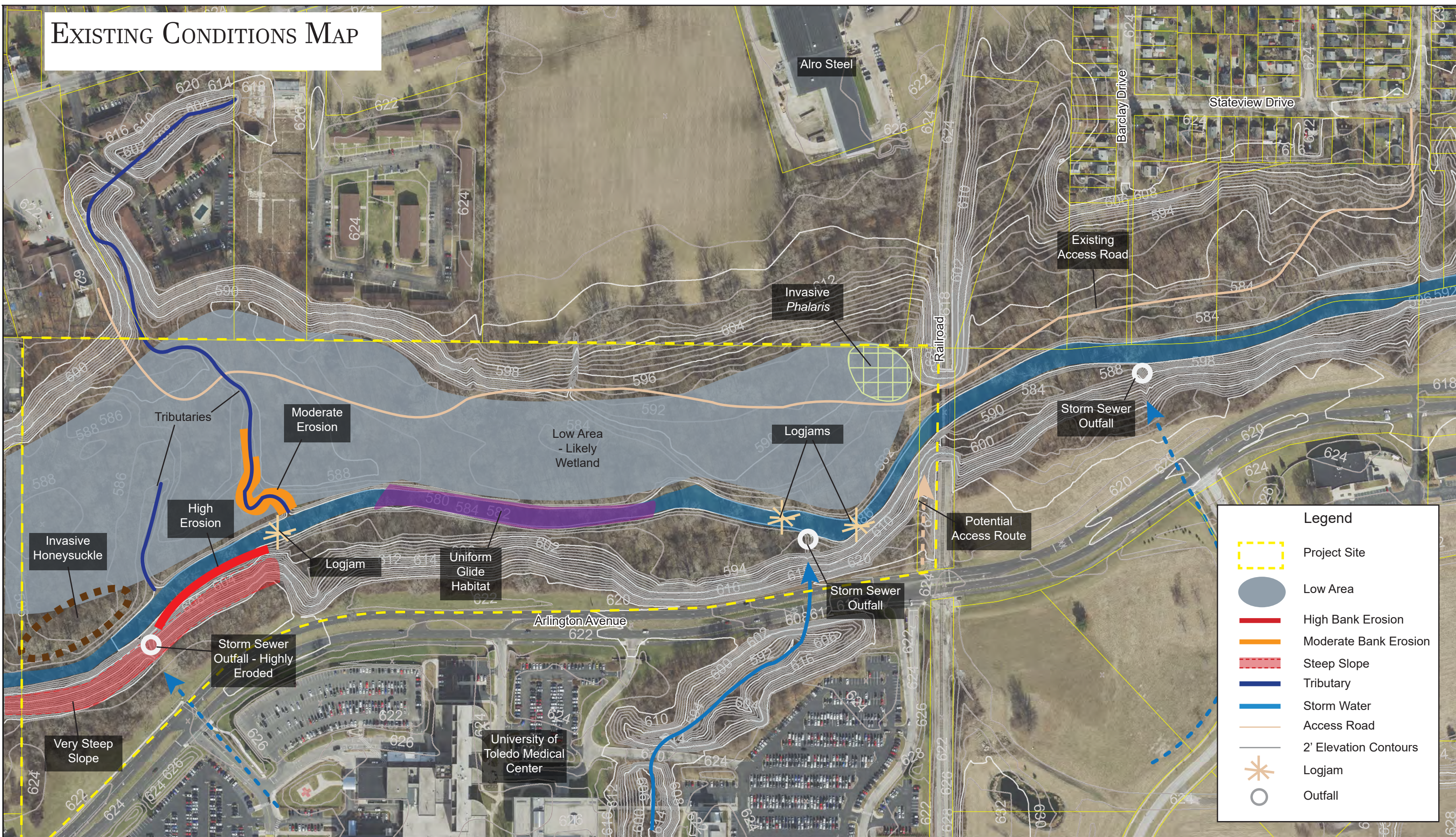


Storm sewer outfall in the middle of the site (left) and minor logjam catching litter



Existing access road north of Swan Creek

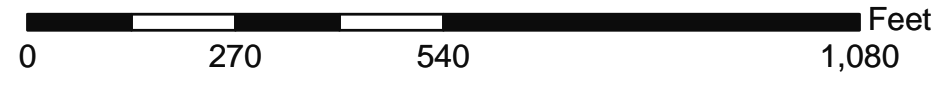
EXISTING CONDITIONS MAP



Legend

- Project Site
- Low Area
- High Bank Erosion
- Moderate Bank Erosion
- Steep Slope
- Tributary
- Storm Water
- Access Road
- 2' Elevation Contours
- Logjam
- Outfall

Flow Direction



BIOLOGIC AND HABITAT DATA

Ohio EPA evaluated biological and habitat conditions¹ of Swan Creek in 2017. Two monitoring sites (Table 1) are near the project site. Site P11P05 at South Avenue is downstream of the project site, while Site P11P08 at Reynolds Road is upstream of the project site.

Table 1. Monitoring Sites and Attainment Status

Monitoring Sites		
Site Name	Swan Creek West of Toledo at Reynolds Road	Swan Creek at Toledo at South Avenue
Site ID	P11P08	P11P05
Stream Type	riverine	riverine
Drainage Area (mi ²)	192	200
Aquatic Life Use	WWH	WWH
ALU* Attainment Determination		
Sample Year	2017	2017
Attainment	NON	NON
IBI	36	41
MIwb	6.52	9.95
ICI	36	20
QHEI **	66.5	44.8

Narrative attainment of biological criteria and habitat targets: **very poor**, **poor**, **low-fair**, **fair**, **marginally good**, **good**, **very good**, and **excellent**. The narrative of good is equivalent to meeting the biological criteria or habitat target.

* ALU refers to Aquatic Life Use as determined by the Ohio Administrative Code 3745-1 Water Quality Standards

**QHEI is not a water quality standard but is used to identify potential causes of impairment to aquatic life.



Sample points in relation to the project site

¹ Fish community health was evaluated using the Index of Biotic Integrity (IBI) and Modified Index of well-being (MIwb), and macroinvertebrate community health was evaluated using the Invertebrate Community Index (ICI). Fish habitat was evaluated using the Qualitative Habitat Evaluation Index (QHEI).

The fish community of Swan Creek was evaluated at both sites. Between two sampling events, a total of 37 species and two hybrids were collected at downstream Site P11P05 (Table 2). No intolerant species were captured. Tolerant fish species comprised a low amount of the population (7-9%), with the percentage of omnivores ranging between 16% and 39% of the population. A total of 23 species were collected at the upstream P11P08 site during two sampling events. One intolerant species was captured. Tolerant fish species comprised a moderate amount of the population (21-45%), with a very low percentage (0-3%) of the fish species being omnivores.

In 2017, downstream Site P11P05 obtained an ICI score of *low-fair* while upstream Site P11P08 obtained a score of *good*. Qualitative macroinvertebrate sampling at Sites P11P05 and P11P08 captured 37 and 61 total taxa, respectively. Seven EPT taxa (refers to *Ephemeroptera*, *Plecoptera*, and *Trichoptera*, three orders of macroinvertebrates that have a low tolerance for water pollution) and two sensitive taxa were identified at each site.

Average scores in the *Heilman Ditch-Swan Creek* subwatershed achieve some, but not all, of Ohio's BUI restoration targets (Table 3). Fish habitat is impaired along Van Fleet ditch, a headwaters stream located 12 miles upstream of the project site, and in the lacustrine portion of Swan Creek. Improvement of stream habitat at these sites will be necessary to increase the QHEI average scores to meet Ohio BUI #14a restoration targets. Improvement of the benthic populations is necessary throughout the subwatershed to achieve Ohio BUI #6 targets.

Table 2. Catch Summaries

Fish Community Health			
Site ID	P11P08	Site ID	P11P05
23 species		34 species & 2 hybrids	
round goby (40%), green sunfish (23%), greenside darter (11%), rock bass (6%), bluegill sunfish (4%) and spotfin shiner (4%)		gizzard shad (24%), bluegill sunfish (13%), spotted sucker (9%), yellow perch (9%), largemouth bass (7%) and emerald shiner (6%)	
Macroinvertebrate Community Health			
Site ID	P11P08	Site ID	P11P05
36 quantitative taxa		24 quantitative taxa	
7 qualitative EPT taxa		7 qualitative EPT taxa	

Table 3. Achievement of BUI Restoration Targets in Subwatershed

Assessment Unit	# of Sites	Average Score	Target Score
<i>Degradation to Fish Populations (BUI #3a) - IBI</i>			
WWH-Lacustrine-Boat	3	46	42
WWH-Riverine-Boat	2	41.5	30
WWH-Riverine-Wade	1	34	28
WWH-Riverine-Headwaters	5	26*	24
<i>Degradation to Fish Populations (BUI #3a) - MIwb</i>			
WWH-Lacustrine-Boat	3	9.4	8.6
WWH-Riverine-Boat	2	10	8.1
WWH-Riverine-Wade	2	7.5	6.8
WWH-Riverine-Headwaters	5	N/A	N/A
<i>Degradation to Benthos (BUI #6) - ICI</i>			
WWH-Lacustrine	1	34	34
WWH-Riverine	9	22*	30
<i>Loss of Fish Habitat (BUI #14a) - QHEI</i>			
WWH-Lacustrine	1	54.5	55
WWH-Riverine	4	61	60
WWH-Riverine-Headwaters	5	38	55

Average scores in green achieve BUI restoration targets, and average scores in red do not achieve BUI restoration targets.

*At least one sample point is at or below 50% of its target score. Unless these sites can be improved to over 50% of their targets, the whole watershed will remain impaired for fish and benthic community health.

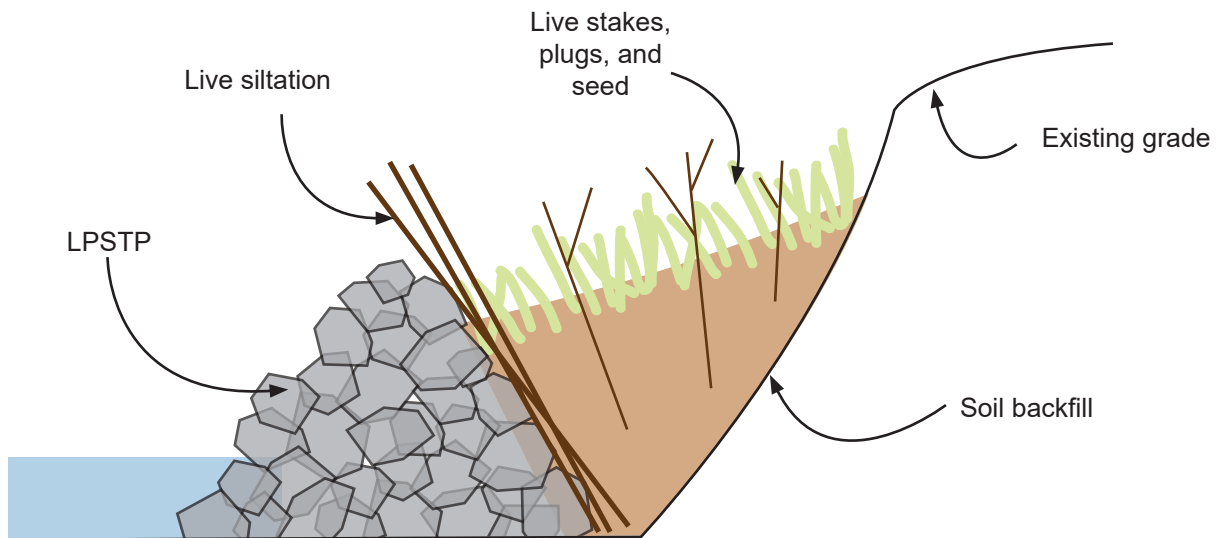
PROJECT DESCRIPTION

Swan Creek is impaired for benthic populations and fish habitat. The channel has limited in-stream cover throughout the project area. Bank regrading along the southern bank is not feasible due to the proximity of Arlington Avenue and the presence of a very steep forested slope. This restoration concept design focuses on stabilizing banks to reduce erosion and sedimentation, creating habitat for fish and macroinvertebrates and improving stream development. Several bioengineering techniques are proposed and outlined in more detail below.

RESTORATION RECOMMENDATIONS

Longitudinal Peaked Stone Toe Protection (LPSTP)

LPSTP is a stone dike placed at or adjacent to the toe of the slope along an eroding bank. LPSTP is placed in a triangular formation to allow the dike to shift according to natural scour of the stream, protecting the bottom of the bank against erosion. The void between the top of the LPSTP and the existing bank is then layered with live stakes, backfilled with soil material, and planted. LPSTP must be keyed into the banks to prevent undercutting behind the dike. Placing LPSTP in the project site would be most suitable since regrading the southern bank is not feasible due to the proximity of and elevation differential between Arlington Avenue and Swan Creek. It should be evaluated whether there is opportunity to expand the upstream LPSTP and bendway weirs into Metroparks Toledo property to fully protect the western stream bend.

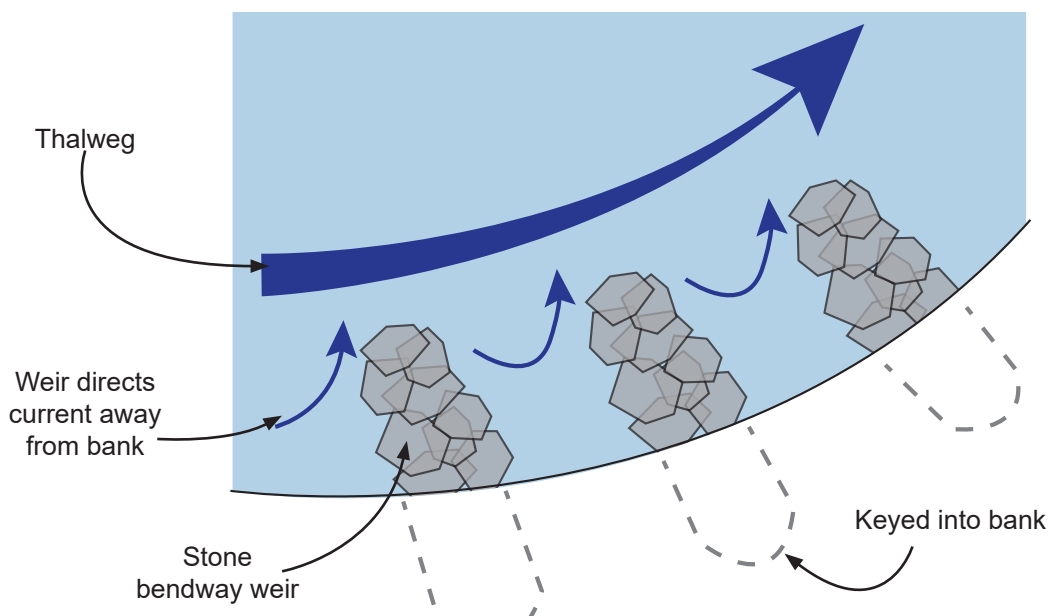


Engineered Rock Riffle

Cobbles and gravel can be placed in the eastern tributary to Swan Creek to create a small portion of riffle habitat. The tributary is well-suited to grade control structures due to its size, gradient, and level of entrenchment. Riffles help oxygenate the water and provide habitat for species of fish and macroinvertebrates that depend on the fast moving water, high oxygen, and rocky substrates. A greater range of physical diversity creates additional aquatic habitats that can then support a more biodiverse collection of taxa.

Bendway Weirs

Bendway weirs are short dikes made of stone that extend from the bank, angled upstream toward the flow. They redistribute the water velocity to prevent bank cutting and encourage the settling of sediments behind them, over time creating riparian wetlands. The redistribution of forces also widens the channel away from the outside bank in areas with steep slopes. The areas of slower current where sediments settle behind the weirs also serve as important habitat for fish and macroinvertebrates. Bendway weirs can be installed at both ends of the project site along the southern bank to help re-direct the thalweg north. Additionally, several single stone bendway weirs can be installed along the smaller eastern tributary to Swan Creek to address bank erosion within the channel.



Locked Logs

Locked logs are branches of trees or entire trees, including the root wad, that are keyed into the streambank. Rock placed on top of the root wad “locks” the log in place. The logs are angled downstream and submerged under the water to provide cover for fish and substrate for macroinvertebrates. They also break up the flow of the stream, create more diversity in current velocity, and help to re-align the thalweg of the stream away from the bank. Locked logs are a suitable option for Swan Creek to increase woody substrate in the stream while also decreasing bank erosion along the relatively straight stretch of bank in the central portion of the project site. Locked logs could likely be harvested on site from the abundant logjams and woody debris in the surrounding floodplain.

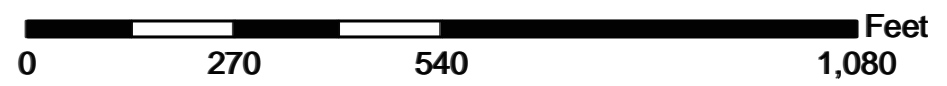
Hydraulic Cover Stones

Hydraulic cover stones are typically large single stones placed in a flowing channel with the crest of the stone near the base flow water surface elevation. These features provide substrate for aquatic macroinvertebrates and refuge for fish. If the stones remain relatively silt-free, they can also be used by certain fish species for spawning. The silty substrate present in Swan Creek could potentially cause the hydraulic cover stones to sink into the stream bed. Reinforcement of the substrate with a gravel bed or other appropriate base is recommended in order for the hydraulic cover stones to remain at the appropriate elevation.

CONCEPT PLAN



Flow Direction



CHALLENGES

There are a few characteristics of the site that make restoration challenging. As previously mentioned, the proximity of Arlington Avenue to the southern bank of the stream has resulted in very steep banks that are exhibiting signs of erosion. Due to the physical conditions in this area, the restoration footprint is restricted, and consequently the potential restoration techniques available are limited. A restoration to return the stream to a more natural morphology with less steep banks along the southern bank would require large-scale tree clearing and impacts to Arlington Avenue.

It is anticipated that Section 404 and 401 Clean Water Act Permitting will be required to construct the proposed project. The Ohio Mussel Survey Protocol lists this portion of Swan Creek as a Group 2 system, which are likely to have federally listed mussels present. Upstream of the project site (RM 15.65), a mussel bed was discovered to contain a large population of the Rayed Bean, a federally endangered freshwater mussel, as well as 10 other species. A mussel survey and relocation will likely be required as part of the permitting process.

The project area is also located within regulated floodway and floodplain. In addition to Clean Water Act Sections 401 and 404 permits, additional floodplain permits will likely be necessary to construct the project. Hydrologic Engineering Center River Analysis System (HEC-RAS) modeling or other floodplain modeling and coordination with the Federal Emergency Management Agency (FEMA) may be required to illustrate that no net rise of the floodway will result from the construction of the proposed project.

Access to the project site is available from the north along Stateview Drive and from the south along Arlington Avenue, adjacent to the railroad bridge. Access from the north will need to be coordinated with adjacent landowners.



Logjam collecting trash and litter



Broken and eroding storm sewer outfall in the western portion of the site

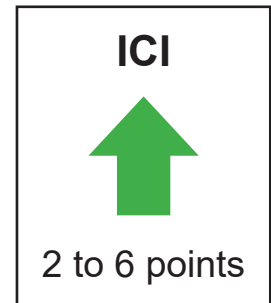
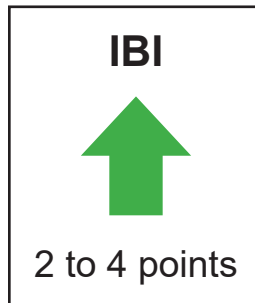
Invasive plant species are present within the northern floodplain adjacent to the stream channel. A long-term maintenance plan with invasive species management will need to be developed as part of the final restoration plan to maintain native vegetation and habitat biodiversity. After initial invasive species treatment, long-term management will be necessary to prevent re-establishment of invasive species. Metroparks Toledo owns land directly upstream of the project site. Opportunities to expand the project footprint or partner to achieve long-term management goals should be explored.

POTENTIAL MEASURABLE IMPROVEMENTS

Implementation of the measures described above will improve the quality of Swan Creek and the adjacent riparian habitat by:

- Stabilizing 1,700 feet of eroding streambank via bioengineering techniques
- Installing locked logs, bendway weirs and hydraulic cover stones
- Installing 50 feet of riffle habitat

These measures should be reflected in:



PRELIMINARY COST ESTIMATE

Below are summaries of the estimated costs to construct the Swan Creek restoration concept designs. Land acquisition and conservation easement costs are not included in the estimate. Project management costs are also not included in the estimate but are estimated at approximately 5-7% of the total project cost. See the following pages for a more detailed estimate.

Item Description	Total Amount
Invasive species management	\$2,000
LPSTP and vegetated keys	\$69,000
Hydraulic cover stones	\$2,000
Locked logs and logjam removal	\$25,000
Bendway weirs and single stone bendway weirs	\$14,000
Engineered rock riffle	\$10,000
Outfall repair	\$96,000
Construction Subtotal	\$218,000
Mobilization, permits, and environmental allowances	\$68,000
Long-term operations and management plan preparation	\$5,000
QAPP preparation	\$4,000
Engineering & design and construction management	\$49,000
Legal & administrative, post-construction monitoring	\$31,000
Construction contingency	\$33,000
Total Estimated Project Cost	\$408,000

OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH

1468 W. Ninth St. Suite 825, Cleveland, OH 44113

Telephone: (216) 861-2950

PROJECT: Ohio AOC Support
 LOCATION: Maumee Area of Concern
 BASIS FOR ESTIMATE: CONCEPTUAL PRELIMINARY FINAL
 WORK: UTMC Swan Creek Restoration

DATE: 2/27/2020
 PROJECT NO. 100-IWM-T39880
 ESTIMATOR: RPN
 CHECKED BY: DS
 CURRENT ENR: _____

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	UTMC Swan Creek Restoration				
2	Stabilize 1,700 feet of eroding streambank via bioengineering techniques; install locked logs, bendway weirs and hydraulic cover stones; install 50 feet of riffle habitat.				
3					
4	Invasive Species Management	1.8	AC		\$0
5	Spraying (cumulative area with 2 applications)	3.6	AC	\$435.00	\$1,575
6					
7	Vegetated Key	240.0	LF		\$0
8	Excavation With Onsite Disposal	352	CY	\$10.00	\$3,520
9	Live Stakes, 3' O.C.	267	EA	\$3.90	\$1,040
10	Native Wetland Plantings, plugs	267	EA	\$2.51	\$669
11	Native Seed Mix	0.1	AC	\$1,650.00	\$91
12					
13	Longitudinal Peaked Stone Toe Protection (LPSTP)	680	LF		\$0
14	Excavation, 6" Cut	36	CY	\$10.00	\$363
15	Rock Toe Protection	580	TON	\$85.00	\$49,323
16	Live Siltation Layer	680	LF	\$1.23	\$833
17	Soil Backfill	1,360	CY	\$10.00	\$13,600
18					
19	Hydraulic Cover Stones	3	EA		\$0
20	Large Single Boulder, Placed	3	EA	\$500.00	\$1,500
21	Gravel Bed, 1' Depth	2	TON	\$45.00	\$86
22					
23	Locked Logs	300	LF		
24	Tree With Root Wad From Onsite	300	LF	\$20.00	\$6,000
25	Excavation	58	CY	\$10.00	\$578
26	Rock Fill	192	TON	\$85.00	\$16,320
27					
28	Bendway Weirs	12	EA		\$0
29	Smaller Rip rap Rock, Delivered & Machine Placed	172	TON	\$65.00	\$11,186
30	Excavation, Small Volume	10	CY	15	\$147
31					
32	Single Stone Bendway Weirs	4	EA		\$0
33	Large Single Boulders, Placed	4	EA	\$700.00	\$2,800
34	Gravel Bed, 1' Depth	5	TON	\$45.00	\$230
35					
36	Engineered Rock Riffle	30	LF		\$0
37	Gravel Bed, 1' Depth	86	TON	\$45.00	\$3,879

OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH

1468 W. Ninth St. Suite 825, Cleveland, OH 44113

Telephone: (216) 861-2950

PROJECT: Ohio AOC Support
 LOCATION: Maumee Area of Concern
 BASIS FOR ESTIMATE: CONCEPTUAL PRELIMINARY FINAL
 WORK: UTMC Swan Creek Restoration

DATE: 2/27/2020
 PROJECT NO. 100-IWM-T39880
 ESTIMATOR: RPN
 CHECKED BY: DS
 CURRENT ENR: _____

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
38	Rock Riprap, 12" or Larger	74	TON	\$85.00	\$6,324
39					
40	Remove Logjam	3	EA		\$0
41	Remove Logjam	3	EA	\$600.00	\$1,800
42					
43	Repair Outfall, Regrade Bank, Rock Placement	14,780	SF		\$0
44	Excavation Allowance, Assumed Onsite Disposal	657	CY	\$10.00	\$6,569
45	Gravel Bed, 6" Depth	602	TON	\$45.00	\$27,097
46	Riprap, 6" or Larger	963	TON	\$65.00	\$62,623
47					
Construction Subtotal					\$218,152
	Mobilization (15% of subtotal)				\$32,723
	Permits Allowances				\$25,000
	Environmental Allowances				\$10,000
Estimating Subtotal					\$285,875
	Project Engineering and Design (12%)				\$34,305
	Construction Management (5%)				\$14,294
E, D+ C Subtotal					\$334,474
	Post-Construction Monitoring (2 Seasons)				\$25,000
	Legal and Administrative Allowance (2%)				\$5,718
	Construction Contingencies (10%)				\$33,447
Total Estimated Project Cost					\$398,639