Brandenburg Park Shoreline Restoration

Pre-Construction Biological Monitoring 2019

DRAFT

Contents

Introduction

Although Brandenburg Park's shoreline habitat is fully developed and degraded, it is part of the St. Clair-Detroit River System (SCDRS), and as Great Lakes waters, is likely to rebound to some degree from limnetic stresses with the implementation of integrated restoration practices. Because high-quality connected habitats are important for sustained Great Lakes fish production, protecting and improving habitat can directly benefit fish communities. Fish habitat improvement techniques range by scale, and at Brandenburg Park local actions that improve connectivity or restore function of littoral, wetland, and open-water physical and vegetative habitats may have a positive impact on the existing fish population. With the undertaking of shoreline restoration and nearshore habitat creation at Brandenburg Park, The Township of Chesterfield hopes to successfully improve overall habitat complexity and quality. In order to gauge success of the goal to promote growth of Vallisneria americana, which serves as important spawning, nursery, and forage areas for many game fish, biological sampling of vegetation has been conducted. Sampling of fish populations has also been conducted in order to measure effectiveness of this restoration project in promoting the increase of game and juvenile fish populations. The following report is a summary of activities and an update on plant and fish communities sampled at the restoration site prior to implementation of the project.

Vegetation Sampling

An assessment of submergent, emergent, and upland flora within the restoration site was performed on October 12, 2019, during the pre-construction phase of this project. The following summarizes vegetation sampling activities performed in order to establish an understanding of existing conditions and develop a baseline of the current plant community within the project site at Brandenburg Park, in order to perform before-and-after comparisons with post-construction assessments.

Floristic Quality Assessment

Qualitative evaluations were performed using the Universal Floristic Quality Assessment Calculator (FQA) from the Michigan Floristic Quality Assessment Database according to Herbarium, and Michigan Natural Features Inventory, Michigan State University (2014). The FQA assigns a coefficient of conservatism (C) to each plant species; the higher the coefficient of conservatism (1-10), the greater the likelihood the plant occurred in a landscape relatively unaltered from pre-settlement conditions. The Floristic Quality Index (FQI) value is then calculated by multiplying the mean C for the entire plant community by the square root of the total number of species encountered on the site. The FQI score can then be used to assess how significant a plant community is relative to pre-settlement conditions. Most remaining undeveloped lands in Michigan have FQI scores of less than 20 and have minimal significance from a natural quality perspective. Areas having an FQI greater than 35 exhibit sufficient conservatism and species richness to be floristically important and of statewide significance in Michigan. FQI scores greater than or equal to 50 are rare and represent important elements of Michigan's biodiversity. The FQA also provides an average wetness ranking for all plant species present. The wetland scores, ranging from -5 to 5 with -5 representing obligate wetland plants, are based on "coefficients of wetness," which are derived from the five main National Wetland Indicator Categories. During the assessment of submergent vegetation the areal extent of *Vallisneria americana* beds were GPS located in order to ensure they are properly addressed during construction. Six random quadrat locations were established within the restoration site for vegetation sampling, shown in Figure 1. Each of the vegetation sampling plots are to be sampled annually to assess floristic quality of the vegetation of the upland, wetland, and aquatic habitats. Sampling quadrats were randomized along the corridor of extant naturalized vegetation to gauge both quality and variation in plant community quality and hydrologic preferences. Conservation Research Institute and Michigan DNR guidance was utilized for the transect/FQI methods and standard choice of transect determination.

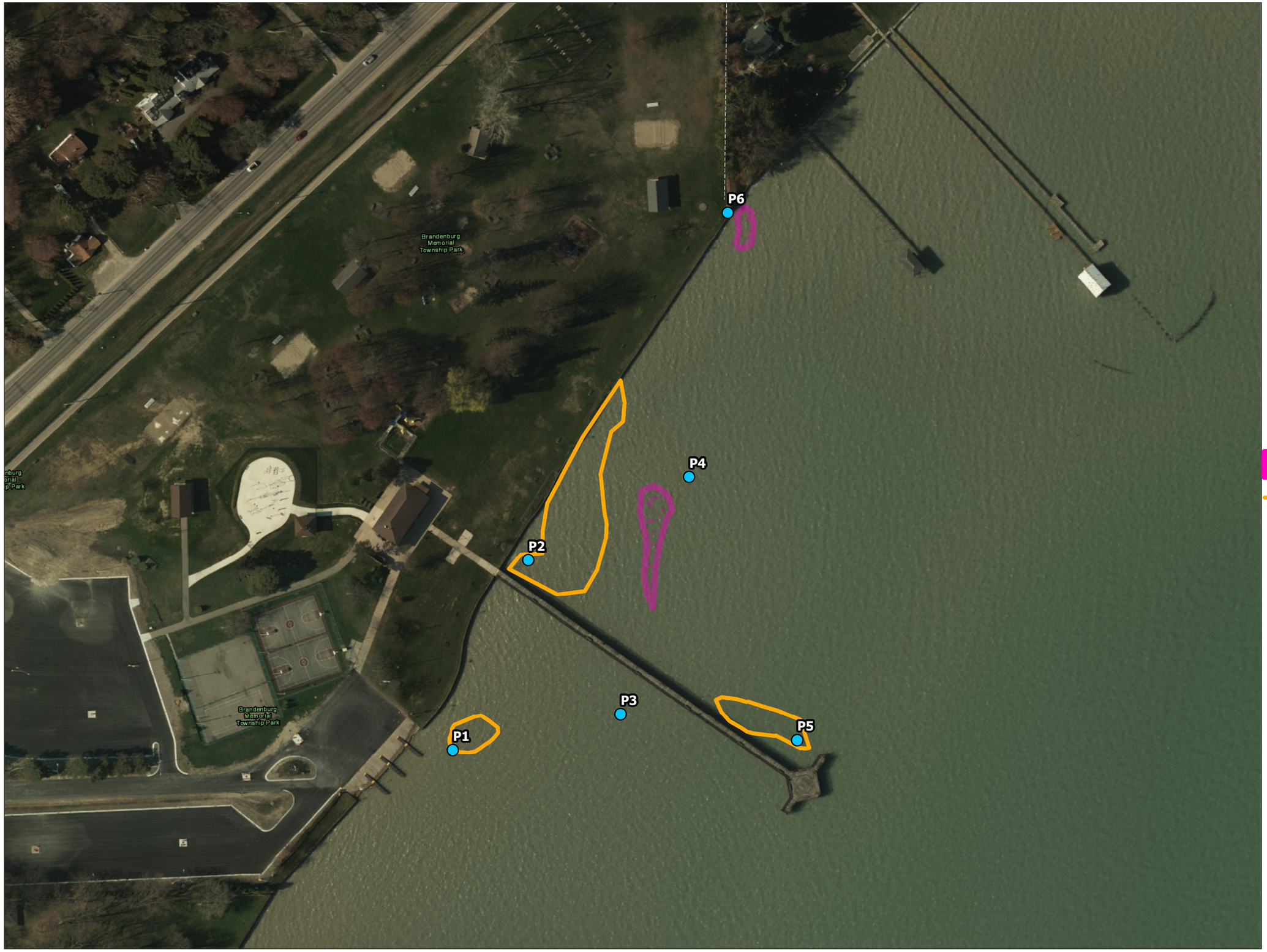
Results

The taxa discovered during this 2019 vegetation assessment can be found below in Table 1. Assessment results found a total of 21 unique species (n) across the six quadrats, eleven of which are native and ten being adventive. Including adventive species in the total species count *n*, the mean coefficient of conservatism (mean-C) was found to be 2.09, and the Floristic Quality Index (FQI) 9.6. When only native species are included in the analysis, native mean-C becomes 4.00, and FQI 13.27. FQI scores of under 20 indicates low vegetative quality, while scores of 35 or more signify floristic importance statewide. These mean-C results characterize a low diversity site, containing comparatively low percent native species and is characterized by mesophytic upland and facultative hydrologic-transitional plants. Mean coefficient of wetness for the transect was slightly greater than -1, which indicates marginal wetland plant dominance, but when calculated using only native species, the coefficient of wetness suggests a greater wetland plant dominance, as the wetness index value drops to -2.5 score.

These taxa formed a patchy vegetative community with turf species upland of the seawall with very limited diversity of species and physiognomies present. Quadrat P6, located in the northeastern corner of the site, is a small sheltered area with some characteristic riparian herbs, trees, and shrubs, as well as a handful of conservative aquatic emergent and submergent plants, of which *Vallisneria americana* (eelgrass) is by far the most dominant across the open water at the site. Eelgrass is the only aquatic submergent species and is a monitoring priority for the project. The emergent sedges and rushes and shoreline shrub populations can be monitored to determine if hydrologic gradient specialists colonize after restoration. *Vallisneria* beds very important consideration as the only high-C value species (7) present on the site, as well as being food for fish and other aquatic herbivores.

Vallisneria americana

Eelgrass beds were GPS located with submeter accuracy with the intent of properly protecting or transplanting during construction and comparison with post construction extents. For the purpose of this assessment, an eelgrass bed is defined as a minimum of 3 rooted shoots per 0.25 m^2 found within 1 meter of any adjacent rooted shoots. To identify the bed boundary, investigators proceeded in a linear direction and found the last shoot within 1 meter of an adjacent shoot along that transect. The bed boundary (edge) is defined as the point 0.5 meters past that last shoot, in recognition of the average length of the roots and rhizomes extending from an individual shoot. Since *Vallisneria americana* actively roots into shallow littoral substrates, assume rooted clumps will not dislodge with light surveyor tugging. When shoot frequency was difficult to see in wave-action, investigators performed a grab/tug-test to determine if surface foliage was in fact rooted at the point it was discovered. While *Vallisneria americana* survey initially followed the chosen transects, final work established complete and intensive population delineation throughout the site, in order to differentiate rooted material from foliage and shoots sloughing off as part of wind-wave action. Extents of free-floating and rooted *Vallisneria americana* beds found at the project site are depicted in Figure 1.



Brandenburg Park Restoration
--
Figure 1 Vegetation Sampling

- Plant Sampling Quadrats
- Vallisneria Bed
- Vallisneria (floating)

N

0 100 200

Feet

1" = 125'

Source: Data provided by /INSERT DATA SOURCE\. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 IntlFeet

Map Published: January 15, 2020

Table 1: Pre-Construction Floristic Quality index Vegetation Sampling Results, October 12, 2019

Taxonomic source: MICHIGAN FLORA ONLINE. A. A. Reznicek, E. G. Voss, & B. S. Walters. February 2011.

Point	BOTANICAL NAME	COMMON NAME	Coefficient of conservatism	Coefficient of wetness	Wetness index	Nativity	Life cycle	Physiognomy	Pop.Density	Community	Note
P1	Vallisneria americana	WILD-CELERY, EEL-GRASS	7	-5	OBL	Native	Perennial	Forb	Patchy	Submergent	Rooted
P1	Lemna minor	Duckweed	5	-5	OBL	Native	Perennial	Forb	Dense	Submergent	
P2	Elymus repens	Quack grass	*	3	FACU	Adventive	Perennial	Grass	Sparse	Terrestrial	
P2	Lolium arundinaceum	Tall fescue	*	3	FACU	Adventive	Perennial	Grass	Sparse	Terrestrial	
P2	Lolium perenne	Ryegrass	*	3	FACU	Adventive	Perennial	Grass	Sparse	Terrestrial	
P2	Lythrum salicaria	Purple loosestrife	*	-5	OBL	Adventive	Perennial	Forb	Sparse	Emergent	
P2	Plantago lanceolata	Narrow-leaved plantain	*	3	FACU	Adventive	Perennial	Forb	Sparse	Terrestrial	
P2	Poa pratensis	Kentucky bluegrass	*	3	FACU	Adventive	Perennial	Grass	Sparse	Terrestrial	
P2	Vallisneria americana	WILD-CELERY, EEL-GRASS	7	-5	OBL	Native	Perennial	Forb	Patchy	Submergent	Not rooted
P3	Lemna minor	Duckweed	5	-5	OBL	Native	Perennial	Forb	Dense	Submergent	
P3	Schoenoplectus pungens	Threesquare	5	-5	OBL	Native	Perennial	Sedge	Patchy	Emergent	
P4	Lemna minor	Duckweed	5	-5	OBL	Native	Perennial	Forb	Dense	Submergent	
P4	Najas flexilis	Slender naiad	5	-5	OBL	Native	Annual	Forb	Patchy	Submergent	
P5	Lemna minor	Duckweed	5	-5	OBL	Native	Perennial	Forb	Patchy	Submergent	
P5	Vallisneria americana	WILD-CELERY, EEL-GRASS	7	-5	OBL	Native	Perennial	Forb	Patchy	Submergent	Not rooted
P6	Asclepias syriaca	Milkweed	1	5	UPL	Native	Perennial	Forb	Sparse	Terrestrial	
P6	Carex comosa	Sedge	5	-5	OBL	Native	Perennial	Sedge	Sparse	Emergent	
P6	Calamagrostis canadensis	Bluejoint grass	3	-5	OBL	Native	Perennial	Grass	Sparse	Emergent	
P6	Cornus ammomum	Silky dogwood	2	-3	FACW	Native	Woody	Shrub	Sparse	Emergent	
P6	Melilotus albus	White sweet-clover	*	3	FACU	Adventive	Biennial	Forb	Sparse	Terrestrial	
P6	Oenothera biennis	Common evening-primrose	2	3	FACU	Native	Biennial	Forb	Patchy	Terrestrial	
P6	Phalaris arundinacea	Reed canary	0	-3	FACW	Adventive	Perennial	Grass	Sparse	Emergent	
P6	Phragmites australis	Phragmites	*	-3	FACW	Adventive	Perennial	Grass	Patchy	Emergent	
P6	Pinus sylvestris	Scotch pine	*	3	FACU	Adventive	Perennial	Tree	Sparse	Terrestrial	
P6	Poa pratensis	Kentucky bluegrass	*	3	FACU	Adventive	Perennial	Grass	Sparse	Terrestrial	
P6	Salix sericea	Silky willow	6	-5	OBL	Native	Woody	Shrub	Sparse	Emergent	
P6	Schoenoplectus pungens	Threesquare	5	-5	OBL	Native	Perennial	Sedge	Patchy	Emergent	
P6	Symphyotrichum ericoides	Heath aster	3	3	FACU	Native	Perennial	Forb	Sparse	Terrestrial	
P6	Vallisneria americana	WILD-CELERY, EEL-GRASS	7	-5	OBL	Native	Perennial	Forb	Sparse	Submergent	Rooted

Fish Sampling

A pre-construction assessment of fish populations in the nearshore zone at Brandenburg Park was conducted in October and November of 2019 utilizing an array of methods to gather a representative sample and create a baseline which can then be used to conduct before-and-after comparison with further fish assessment conducted in the post-construction phase.

Field sampling of fish was performed utilizing electroshocking equipment by Michigan Department of Natural Resources (MDNR) and also using seine and fyke nets, which was performed by Natural Community Services (NCS). A total of 500 individual fish comprised of nineteen unique species were sampled during efforts, compared to 65 fish species existing within the SCRDRS, according to MDNR. During the field collection several game fish, including Smallmouth and Rock Bass, Freshwater Drum, and White Crappie were found, as well as Sculpins, Gizzard Shad, several species of Shiners, and other minnows which sustain predators. In addition, some forage species such as yellow perch were discovered, which provide recreational and commercial fishing opportunities. Below are results from pre-construction fish sampling at mapped interval sampling locations in shoreline and nearshore open water habitats within the proposed habitat restoration area.

Electroshocking Results

MDNR field staff conducted electrofishing in the nearshore zone of Brandenburg park on October 25, 2019 for 30 continuous minutes. Beginning at the northeast side of the pier and ending north of the park (Figure 2), the first and last 10 minutes of the effort all species were targeted, while for the middle 10 minutes only muskellunge were targeted. The objective of the effort was to cover varying effective depths and habitat as much as possible during the 30 minutes. All fish collected were held in a tub on the boat for processing upon completion of the sample collection activities. All fish were identified and measured to the centimeter group (i.e. 1.0-1.9 cm = 1 cm) and the result can be found in Table 2. As with any fisheries gear, environmental factors can have an impact on the efficiency. The water temperature was 51.4°F and visibility was poor as evidenced by a Secchi reading of 1 ft. Conductivity was measured at 190 micro-Siemens per centimeter. Setting for the electrofishing output was 60 pulses per second, 290 volts, 17.5 amps (max) and a duty of 18%.

Poor visibility likely limited the catch, especially for smaller species that might not have been near the surface. There were multiple times when investigators needed to back up for fish floating to the surface after we went through. The Brandenburg Park site had low species diversity collected through electroshocking, with a total of 9 unique fish species, when compared to13 other electroshocking sites on Lake St. Clair with an overall average of 13 species. For all 14 sites the 25th percentile mark was 10 fish species, slightly higher than what was found at Brandenburg Park.

Table 2: MDNR Catch summary of the electrofishing effort at Brandenburg Park, October 2019.

Species	Common Name	Adult	Fry	Juvenile	Total
Aplodinotus grunniens	Freshwater Drum	1	0	0	**1**
Cyprinus carpio	Common Carp	0	0	1	**1**
Dorosoma cepedianum	Gizzard Shad	2	0	4	**6**
Labidesthes sicculus	Silverside	29	0	33	**62**
Micropterus salmoides	Largemouth Bass	3	0	2	**5**
Notropis atherinoides	Emerald Shiner	4	0	0	**4**

Species	Common Name	Adult	Fry	Juvenile	Total
Perca flavescens	Yellow Perch	31	0	19	**50**
Pimephales notatus	Bluntnose Minnow	1	0	0	**1**
Pomoxis annularis	White Crappie	1	0	0	**1**
TOTAL		**72**	**0**	**59**	**131**

Seine and Fyke Netting Results

Utilizing both fyke and seine nets, NCS sampled sixteen unique species of fish, including several game fish and an array of minnows and prey fish, which were documented at the project site. Seine netting was conducted on October 14th and 28th, 2019 at six separate locations and fyke netting was conducted on November 5th and 6th, 2019 at four separate locations in both shoreline and open water areas of Brandenburg Park (Figure 2). Please see the QAPP document for further details on these methods employed (Appendix A). All fish were identified and measured to the centimeter group (i.e. 1.0-1.9 cm = 1 cm) and the result can be found in Table 3, below. A representative individual from each species sample was also photographed and catalogued (See Appendix B). Individual fish listed by species and size class at each seine and fyke netting can be found in Appendix C.

Table 3: Seine and Fyke Netting Results from October and November 2019.

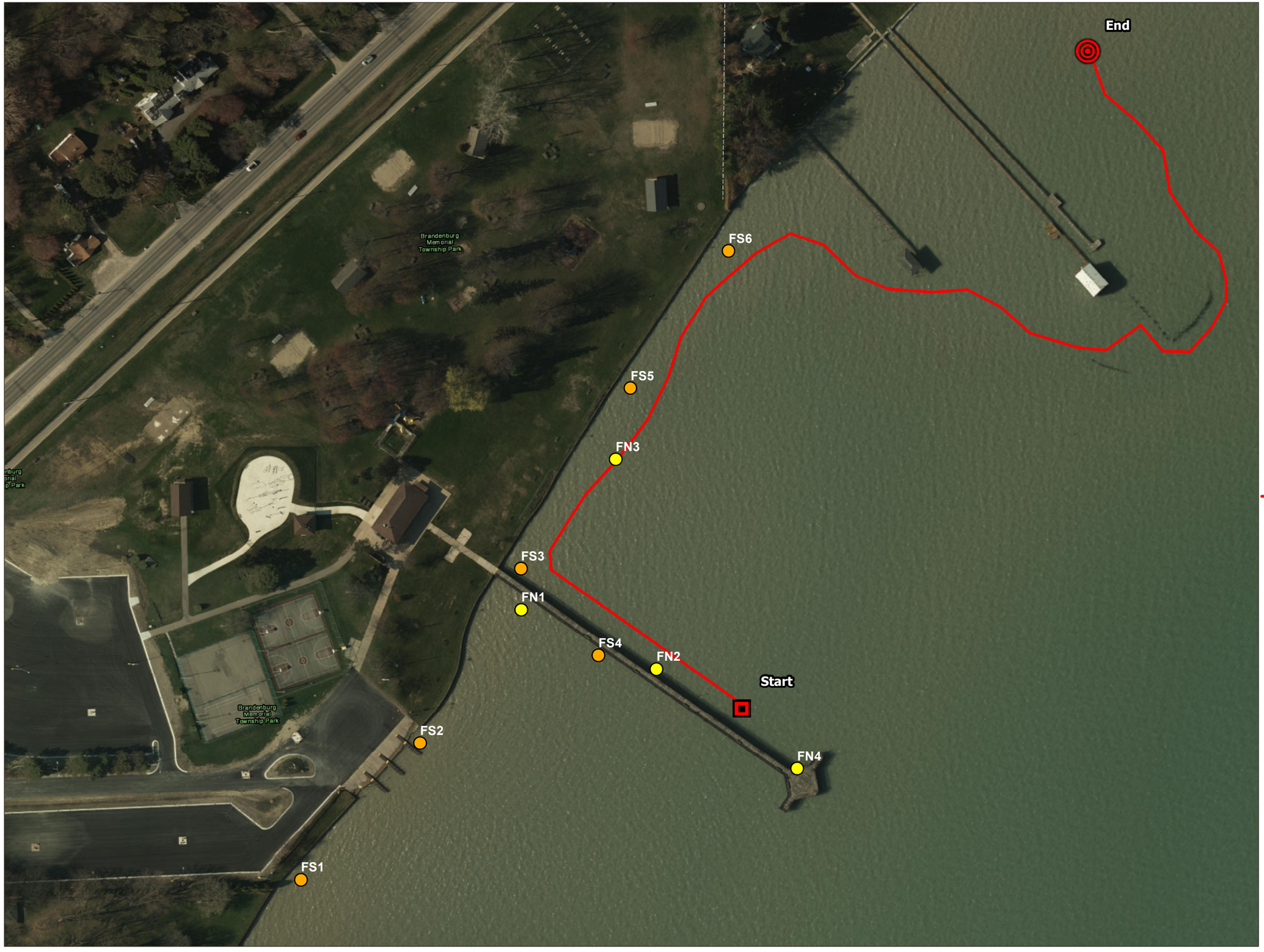
Species	Common Name	Adult	Fry	Juvenile	Total
Ambloplites rupestris	Rock Bass	8	0	12	20
Cyprinella spiloptera	Spotfin Shiner	4	0	2	6
Dorosoma cepedianum	Gizzard Shad	29	0	3	32
Fundulus diaphanus	Banded Killifish	2	0	7	9
Labidesthes sicculus	Brook Silverside	29	0	10	39
Lepomis macrochirus	Bluegill	2	19	30	51
Menidia beryllina	Inland Silverside	4	0	3	7
Micropterus dolomieu	Smallmouth Bass	1	0	1	2
Micropterus salmoides	Largemouth Bass	0	0	1	1
Nacomis biguttatus	Hornyhead Chub	1	0		1
Neogobius melanostomus	Round Goby	25	3	16	44
Notropis atherinoides	Emerald Shiner	1	0	8	9
Notropis volucellus	Mimic Shiner	23	0	14	37
Perca flavescens	Yellow Perch	16	0	47	63
Percina caprodes	Logperch		0	2	2
Pimephales notatus	Bluntnose Minnow	33	0	13	46
GRAND TOTAL		**178**	**22**	**169**	**369**

Overall Pre-Construction Fish Sampling Results

Of the 500 individual fish sampled at the restoration site through all methods, exactly 250 of these were adult, representing 50% of the sampled population, while juvenile fish numbered 228, or 46%, and fry numbered 22, or 4% of the total population. Juvenile Yellow Perch were the most numerous (66), followed by adult Brook Silverside (58), and adult Yellow Perch (47). A total of 44 individual invasive Round Goby were also sampled during activities. Nine of the total 19 unique species discovered are considered minnows or small prey fish and account for 302 of 500 individuals (61%). Below are sampling totals by species and age class, and associated fish sampling map. A quantification of each species collected at each unique sampling point can be found in Table 4, below.

Table 4: Overall Fish Sampling Results from October and November 2019.

Species	Common Name	Adult	Fry	Juvenile	Total
Ambloplites rupestris	Rock Bass	8	0	12	20
Cyprinella spiloptera	Spotfin Shiner	4	0	2	6
Dorosoma cepedianum	Gizzard Shad	31	0	7	38
Fundulus diaphanus	Banded Killifish	2	0	7	9
Labidesthes sicculus	Brook Silverside	58	0	43	101
Lepomis macrochirus	Bluegill	2	19	30	51
Menidia beryllina	Inland Silverside	4	0	3	7
Micropterus dolomieu	Smallmouth Bass	1	0	1	2
Micropterus salmoides	Largemouth Bass	3	0	3	6
Nacomis biguttatus	Hornyhead Chub	1	0	0	1
Neogobius melanostomus	Round Goby	25	3	16	44
Notropis atherinoides	Emerald Shiner	5	0	8	13
Notropis volucellus	Mimic Shiner	23	0	14	37
Perca flavescens	Yellow Perch	47	0	66	113
Percina caprodes	Logperch	o	0	2	2
Pimephales notatus	Bluntnose Minnow	34	0	13	47
Pomoxis annularis	White Crappie	1	0	0	1
Cyprinus carpio	Common Carp	0	0	1	1
Aplodinotus grunniens	Freshwater Drum	1	0	0	1
GRAND TOTAL		**250**	**22**	**228**	**500**



Brandenburg Park Restoration

--

Figure 2 Fish Sampling Locations

- Fyke Net Location
- Seine Net Location
- Electrofishing Transect

N

0 100 200

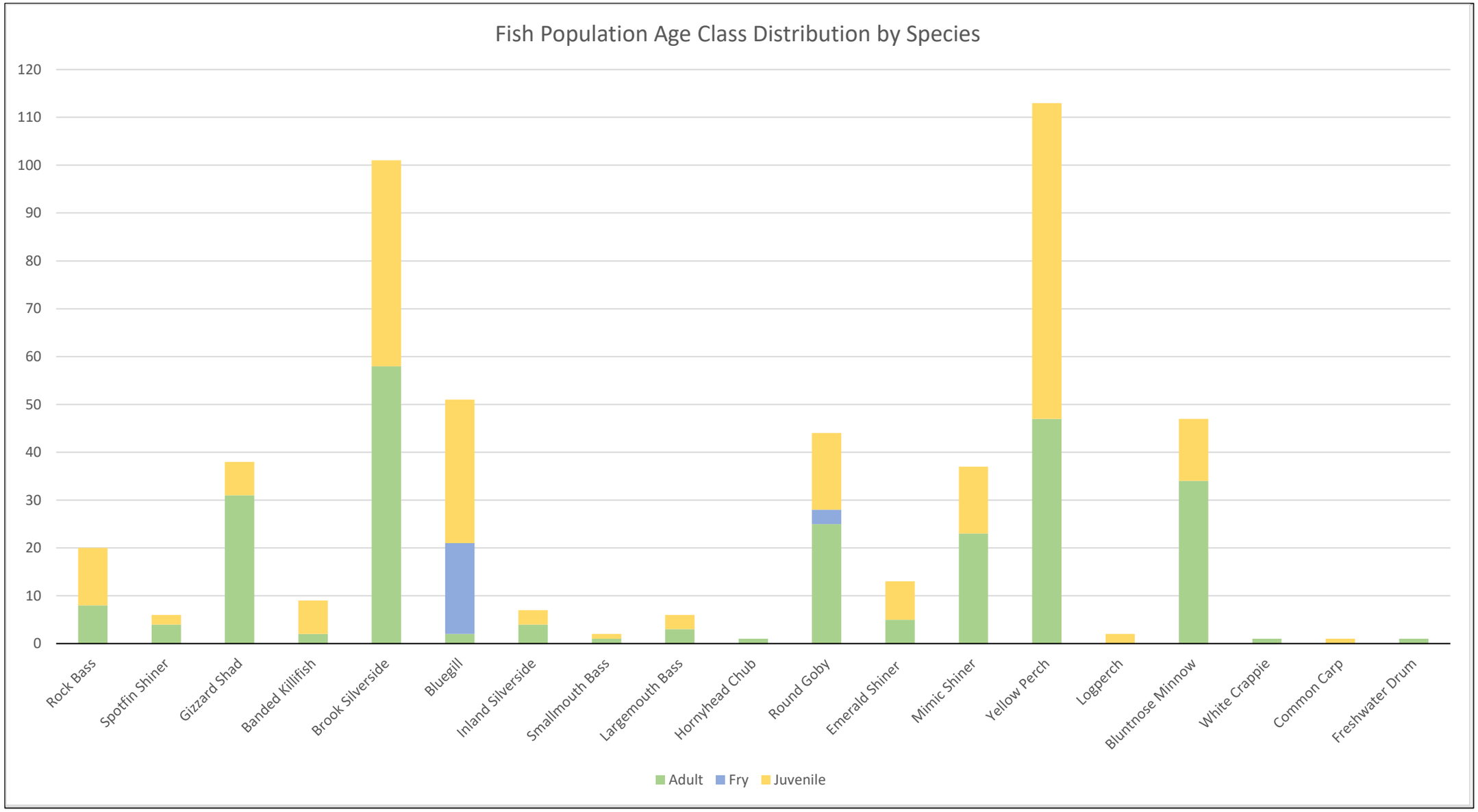
Feet

Source: Data provided by /INSERT DATA SOURCE\. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 IntlFeet

Map Published: January 15, 2020

Table 5: Fish Population Age Class by Species



APPENDIX A:

Brandenburg Park Shoreline Restoration
St Clair-Detroit River System Coastal Restoration Initiative
Cooperative Agreement No. GLC-3529

Quality Assurance Project Plan (QAPP)

October 2019

Charter Township of Chesterfield

Great Lakes Commission

Required Signatures for GLRI Quality Assurance Project Plan

The signatories have reviewed and approved of the Quality Assurance Project Plan for the Charter Township of Chesterfield and the Great Lakes Commission for the project titled "Brandenburg Park Shoreline Restoration".

Daniel Acciavatti
Charter Township of Chesterfield, Township Supervisor

10/10/2019
Date

Josh Sonnenberg
Charter Township of Chesterfield, Operations and Facilities Maintenance Director

10/10/2019
Date

Mitch O'Connor, P.E.
Charter Township of Chesterfield, Township Engineer

10/10/19
Date

Terry Heatlie
NOAA Technical Monitor

10/16/2019
Date

Rina Studds
NOAA Federal Program Officer

10/16/19
Date

Table of Contents

I. Distribution List

Charter Township of Chesterfield

- Daniel Acciavatti, Township Supervisor
- Josh Sonnenberg, Operations and Facilities Maintenance Director
- Mitch O'Connor, Township Engineer

Great Lakes Commission (GLC)

- Eric Ellis, Habitat Project Manager
- Jillian Estrada, Habitat Program Specialist

National Oceanic and Atmospheric Administration (NOAA)

- Terry Heatlie, Technical Monitor
- Rina Studds, Federal Program Officer

Office of the Great Lakes (OGL)

- Michelle Selzer

OHM Advisors

- Steve Siklich, P.E.
- Valerie Novaes, P.E.
- John Deslippe

II. Project Organization

Table 1. Personnel and Responsibilities

Category	Personnel	General Responsibilities
Federal Program Officer	Rina Studds, NOAA	Provides overall project/program oversight and ensures all contract issues are properly addressed.
Technical Monitor	Terry Heatlie, NOAA	Ensure monitoring efforts are performed according to this QAPP and provide technical input on monitoring objectives and methods.
Project Management	Valerie Novaes, OHM Advisors	Oversee project team to ensure all project work is performed at a high quality, and within the agreed upon timeline
QA/QC	John Deslippe, OHM Advisors	Perform quality control review of sampling protocol, field efforts and data analysis/recommendations
Field Activities	John DeLisle, Natural Community Services (NCS)	Perform fieldwork for biological monitoring and prepare summary of findings
Data Analysis	John Deslippe (OHM) and John DeLisle (NCS)	Review fieldwork data and prepare summary of results and implications for project design/implementation
Clerical	Dana Pulver, OHM Advisors	Provide administrative support for file and report formatting and review

Table 2. Contact information for the main personnel is provided below:

Valerie Novaes, P.E. 34000 Plymouth Road Livonia, MI. 48150 Direct: 734-466-4567 Mobile: 248-935-8557 Valerie.novaes@ohm-advisors.com	John Deslippe 34000 Plymouth Road Livonia, MI. 48150 Direct: 734-466-4565 Mobile: 248-979-3543 John.deslippe@ohm-advisors.com
John DeLisle, PWS West Bloomfield, Mi. 48324 248-672-7611 john@naturalcommunityservices.com	Dana Pulver 34000 Plymouth Road Livonia, MI. 48150 Direct: 734-466-4424 Dana.pulver@ohm-advisors.com

III. Problem Definition and Background

Since 1976, Brandenburg Park has been the recreational crown jewel of Chesterfield Township. Located off Jefferson Avenue a quarter-mile south of 23 Mile Road, this 17-acre parcel is positioned along the shore of Anchor Bay and serves the recreational needs of the township and the greater Lake St. Clair area with a unique assortment of facilities. Owned and maintained by Chesterfield Township, the park sees a steady stream of visitors and features four open-air pavilions, a splash pad, and a multipurpose building. The park's 500 ft pier is one of only a few in Metro Detroit from which individuals can fish and view wildlife. Located five miles from I-94, this park's public boat launch attracts boating and fishing enthusiasts from all over the county and throughout the region.

Erosion has led the original seawall to crumble and breakaway, resulting in portions of the land being unsafe for park users, increased sediment flow into the lake, and reduced access for fishing. The primary goal of this project is to improve fish habitat at the park while eliminating a shoreline safety hazard and improving coastal recreation, especially fishing. Strong local government and community support will help sustain the proposed restoration activities and support healthy populations of native fish species into the future. Fish species found in Anchor Bay and the area near Brandenburg Park include: smallmouth bass, Great Lakes muskellunge, northern pike, perch, lake sturgeon, and walleye. Historically, spawning, migration, feeding, and nursery habitat was plentiful along the coast of Lake St. Clair. However, urban development and armoring along the shore, including Brandenburg Park, has significantly reduced available habitats for these, and other fish species.

In order to assess if the project is implemented as planned, a monitoring plan has been developed that contains pre- and post-construction fish and vegetation assessments to evaluate the short term structural changes at the project site and basic success of the work conducted. Reptiles, amphibians, birds, macroinvertebrates, and water quality may also be assessed at a future time should funding be available to do so. These parameters are included in this quality assurance plan so that appropriate methodology is used for herpetofauna and/or macroinvertebrates monitoring. General NOAA Tier 1 monitoring guidelines will be used as a reference guide and project outcomes and success will be assessed via before and after comparison (BAC) using standardized data collection methods.

IV. Biological Monitoring at Brandenburg Park

The monitoring contractor will conduct an on-the-ground inspection before and after construction to ensure that the project has been constructed according to the restoration plans and has achieved habitat metrics. As mentioned above, this QAPP will cover both planned and potential pre- and post-construction evaluations to document changes in fish, herpetofauna, bird, and macroinvertebrate populations, as well as water quality and aquatic and terrestrial vegetation at the restoration site.

Fish Sampling Design

The fish assemblage across the restoration area will be investigated in a pre- and post –restoration assessment. Using a combination of seine and fyke nets, both shallow and constructed deep water habitat will be sampled to gauge the proposed restoration littoral zone community before and after implementation. All netting material and fixtures will be inspected by field technician prior to each deployment, and appropriate repairs or replacement made before commencement of survey activities.

Four fyke transects will be placed at designated locations, with two being placed on either side of the existing pier, where deeper water habitat construction is proposed. Fyke nets will be left in place for

approximately 24 hours. Seine nets will be deployed at six locations across the project site at shallower water locations. Sample locations will be recorded using handheld GPS units. Netting activities will take place twice within each of the pre- and post –construction monitoring phases. Sampling occurrences will take place in the months of September and October of 2019 to establish a baseline for existing fish community pre-construction. Post-construction monitoring occurrences will take place in September and October of 2020 to measure success of project implementation.

Fish identification will be made in the field by a professional with sufficient training and/or experience required to effectively operate fishing devices and positively identify fish common to Great Lakes waters. An example of each species encountered will be photographed for reference and catalogued for inclusion in reports. Any fish not readily identifiable will be photographed and compared to accepted secondary resources for positive identification and cataloging off site.

Analysis

Geographic information system map layers will be produced from field monitoring data to visualize habitat utilization and species distribution at the sampled points across the restoration site. GIS layers will be attributed with all field-collected biological characteristics. Maps will be prepared as necessary to appropriately display data collected pre- and post- construction. Tabulation of data including species composition, richness, and distribution will be prepared for all fish monitoring results. Preliminary reports will be produced at the end of each field season, summarizing the work completed to date. The preliminary report will include updates and results investigation to-date. A final report detailing the findings of monitoring will be produced at completion of this project.

Herpetofauna Sampling Design

In order to determine herpetological distribution, richness, and relative abundance, sampling will be conducted before and after restoration of the site to determine biologically significant changes to amphibian and reptile populations within the restored areas. A sampling design of integrated techniques will be employed to maximize effectiveness in determining success of the project implementation. Changes in the composition of species and use of habitat and restoration design features will be determined through this monitoring effort, including maps of herpetofauna locations. Collected data will serve to create a baseline for determining further restoration and monitoring at the project site.

A professional with the requisite educational/experiential background will conduct field surveys of herpetofauna at the project pre- and post- restoration. A series of equipment including baited hoop traps and coverboards will be used in conjunction with time-constrained transect surveys utilizing dip nets and funnel traps. Amphibians and reptiles discovered at the site will be examined in order to determine sex age class, and general health, when possible. Photographs will be used to document each individual herpetofauna specimen. All traps, nets, and other devices employed in this survey will be thoroughly inspected before deployment and any defects discovered will be rectified before commencement.

All coverboards will be placed on site before surveys at a time interval sufficient to allow for wildlife utilization to become established. Area underneath coverboards will be surveyed for herpetofauna during field survey after traps have been placed. Funnel nets will then be used during transect surveys. After completing other phases of field survey, traps will be monitored for capture. Coverboards and traps will be placed on site in a manner consistent with public safety, low impact on target species, and device effectiveness.

Analysis

Geographic information system map layers will be produced from field monitoring data to visualize habitat utilization and species distribution at the sampled points across the restoration site. GIS layers will be attributed with all field-collected biological characteristics. Maps will be prepared as necessary to appropriately display data collected pre- and post- construction. Tabulation of data including species composition, richness, and distribution will be prepared for all amphibian monitoring results. Preliminary reports will be produced at the end of each field season, summarizing the work completed to date. The preliminary report will include updates and results of the investigation to-date. A final report detailing the findings of monitoring will be produced at completion of this project.

Aquatic Macroinvertebrate Sampling Design

The proposed restoration site will be surveyed for community composition using static point dip net surveys in nearshore habitat for comparison of pre-restoration and post-restoration aquatic macroinvertebrate presence. All equipment is checked for tear, holes, or damage. When possible, all observed aquatic macroinvertebrates will be collected and documented to level of family and their position recorded based on sample point location. Sample points will be recorded using GPS units and stakes established to reference sample point locations. Dip net surveys will be used to detect and identify aquatic macroinvertebrate families and number of individuals observed within each family. Survey points will be at approximately 150 feet apart and located in areas along the shoreline. Stones, rocks, wood, and leaf litter, and other debris will also be sampled where they occur. Organisms will be identified on site by a qualified professional using microscopy and appropriate field guides. Macroinvertebrates not identified to family will be stored in 95% ethanol for identification off site. Results of survey will be used to determine number of individuals and composition of community. Microscopes will be checked for functionality and lenses cleaned to assure accurate identification. This survey method is effective for detecting shifts in community composition, taxa richness, and provides data to assess biologically significant changes. Data collected will be used to map locations across the restoration site, assess utilization of created habitat, and establish a baseline for future monitoring and restoration.

Analysis

Geographic information system map layers will be produced from field monitoring data to visualize habitat utilization and species distribution at the sampled points across the restoration site. GIS layers will be attributed with all field-collected biological characteristics. Maps will be prepared as necessary to appropriately display data collected pre- and post- construction. Tabulation of data including species composition, richness, and distribution will be prepared for all macroinvertebrate monitoring results. Preliminary reports will be produced at the end of each field season, summarizing the work completed to date. The preliminary report will include updates and results investigation to-date. A final report detailing the findings of monitoring will be produced at completion of this project.

Bird Sampling Design

In order to determine species diversity, relative abundance, age structure, and distribution of species of birds within the restoration areas pre- and post- restoration monitoring will take place at the project site. Monitoring will work to identify use of the site resulting from habitat restoration and creation and determine changes in species composition. This data can be used to assess habitat features created to benefit bird species as well as establish a baseline data for future monitoring and restoration efforts at the project site.

A professional with the requisite educational/experiential background will conduct field surveys of birds at the project pre- and post- restoration.

The proposed restoration site will be surveyed for species presence using time constrained, static point-count surveys for comparison of pre-restoration and post-restoration avian communities. All birds will be documented and their position recorded based on sample point location. Sample points will be recorded

using GPS units and stakes established to reference sample point locations. Point-count surveys ten minutes in duration will be used to detect and identify bird species and number of birds within the project area. Survey points will be located adjacent to the shoreline at strategically determined points in order to provide best survey coverage. Numbers of individuals and species composition will be determined. Counts will be conducted beginning approximately at sunrise on each field survey instance and will be completed before noon. Binoculars will be used to observe birds across the project site on land and water, as well as in the air. This method is effective for detection of waterfowl, shorebirds, songbirds, and migrating birds. This survey will provide data to determine species diversity, relative abundance, age structure, and distribution of bird species within the proposed restoration areas, create maps of locations of birds across the restoration site, assess use of created habitat, and establish a baseline for future monitoring and restoration.

Analysis

Geographic information system (GIS) map layers will be produced from field monitoring data to visualize habitat utilization and species distribution at the sampled points across the restoration site. GIS layers will be attributed with all field-collected biological characteristics. Maps will be prepared as necessary to appropriately display data collected pre- and post- construction. Tabulation of data including species composition, richness, and distribution will be prepared for all bird monitoring results. Preliminary reports will be produced at the end of each field season, summarizing the work completed to date. The preliminary report will include updates and results investigation to-date. A final report detailing the findings of monitoring will be produced at completion of this project.

Vegetation Sampling Design

A qualitative and quantitative assessment of submergent, emergent, and upland flora within the restoration site will be performed pre- and post- construction. Qualitative evaluations will be performed using the Universal Floristic Quality Assessment Calculator (FQA) from the Michigan Floristic Quality Assessment Database according to Herbarium, and Michigan Natural Features Inventory, Michigan State University (2014). Quantitative evaluations involve assessing the character and quality of the restoration site using data from quadrat sampling.

The FQA assigns a coefficient of conservatism (C) to each plant species; the higher the coefficient of conservatism (1-10), the greater the likelihood the plant occurred in a landscape relatively unaltered from pre-settlement conditions. The Floristic Quality Index (FQI) value is then calculated by multiplying the mean C for the entire plant community by the square root of the total number of species encountered on the site. The FQI score can then be used to assess how significant a plant community is relative to pre-settlement conditions. Most remaining undeveloped lands in Michigan have FQI scores of less than 20 and have minimal significance from a natural quality perspective. Areas having an FQI greater than 35 exhibit sufficient conservatism and species richness to be floristically important and of statewide significance in Michigan. FQI scores greater than or equal to 50 are rare and represent important elements of Michigan's biodiversity. The FQA also provides an average wetness ranking for all plant species present. The wetland scores are based on "coefficients of wetness," which are derived from the five main National Wetland Indicator Categories.

Quantitative Sampling

Six random quadrat locations will be established within the restoration site. Each of the vegetation sampling plots are to be sampled annually to assess floristic quality of the vegetation of the restoration site.

Analysis

Geographic information system (GIS) map layers will be produced from field monitoring data to visualize habitat utilization. Maps will be prepared as necessary to appropriately display data collected. Project

before and after comparison results will be documented based on aerial photography acquired through unmanned aerial vehicles (UAVs). Photos will document project outcomes and can be used to map increase in habitat and vegetative cover across the restoration site. Preliminary reports will be produced at the end of each field season, summarizing the work completed to date. The preliminary report will include updates and results of the investigation to-date. A final report detailing the findings of monitoring will be produced at completion of this project.

Water Quality Sampling Design

In order to quantify water quality at the restoration site, sampling design will be adapted from the Coastal Wetland Monitoring Program (CWMP) Sampling Protocols, and as such will follow guidelines provided in CWMP Standard Operating Procedure: Water Quality Sampling and Laboratory Processing (updated 03/19) for all sample collection, QA/QC, and processing. Parameters measured will include temperature, pH, dissolved oxygen, and turbidity. In order to collect water quality data an YSI EXO2 sonde will be employed, and sampling will be coordinated with fish netting locations across the restoration site. Water quality monitoring will occur in conjunction with biological sampling events and monitoring results will be used to evaluate the effects of the habitat restoration on biological communities. Table 3 below outlines field sampling methods and totals.

Table 3. Water Quality Sampling

Task	Method	Parameter	Number of Samples	Field QC Duplicates	Total Samples
Field Sampling	YSI EXO2	Dissolved oxygen, turbidity, pH, temperature, specific conductivity	10	2	12
	Secchi	Turbidity	10	2	12
	Grab Sample	alkalinity, chloride, nitrate and nitrite, total nitrogen, total phosphorus, color	3	1	4

Analysis

Data resulting from water quality sampling and laboratory processing will be compiled for ease of before-and-after comparison across the site. Sampling locations will be referenced on GIS maps in conjunction with habitat restoration features and biological sampling locations.

Table 4. Project Timeline

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	5th Quarter	6th Quarter
	Jul-Sept 2019	Oct-Dec 2019	Jan-Mar 2020	Apr-Jun 2020	Jul-Sept 2020	Oct-Dec 2020
Task 1: Develop QAPP	X					
Task 2: Field Sampling	X	X			X	X

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	5th Quarter	6th Quarter
	Jul-Sept 2019	Oct-Dec 2019	Jan-Mar 2020	Apr-Jun 2020	Jul-Sept 2020	Oct-Dec 2020
Task 3: Project Administration	X	X	X	X	X	X
Year-end Reports		X				X
Final Project Report						X

V. Documentation and Records

Reports

Preliminary reports will be produced for year-end 2019 and 2020 summarizing the work completed to-date. The year-end reports will include updates and preliminary results from all monitoring and assessments. A final report of project assessment will be produced upon completion of all tasks in this project. The report will include details of sampling methods, results of monitoring, analysis of species composition and species richness, and with maps of important habitat use. Electronic copies of the reports will be forwarded to project managers. All reports that contain data collected with funding from NOAA must include the following disclaimer: This report was prepared by The Charter Township of Chesterfield using Federal funds under award [number] from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the [name of operating unit] or the U.S. Department of Commerce.

Data Management

All field work conducted will include the use of a field survey book to document the activities including start and end time, participants, weather conditions, species observed, and site conditions. GPS equipment will be checked on each sampling event to confirm equipment accuracy using reference points. At the end of each sampling event field notebooks will be reviewed for accuracy, errors, or omissions. GPS files will be downloaded and verified for accuracy and completion. Critical data will also be properly documented in hardcopy. All GPS point files will be downloaded into a project folder, as well as a backup folder.

Field data will then be reviewed again in-office for errors and rectified. Any errors that are rectified are noted in the project file, along with a description of action taken. All field survey records will be reviewed at the end of the field day by another project team member, and Quality Assurance/Quality Control (QA/QC) performed. Errors or omissions will be noted and corrected.

All data shall be saved electronically in the project file within 48 hours of collection. Original data collected in hard copy format will be scanned and saved in electronic format. This electronic project file shall be backed up each time data is saved or changes to the data file occur. All field data will be entered into a spreadsheet or GIS geodatabase. All data entered manually will be reviewed by a team member other than the one initial processor entering the data. Processed data will be submitted for QA/QC review to the project manager and other project partners according to QAPP guidelines. Any deviations from the monitoring plan and/or QAPP document will be recorded.

GPS and GIS Mapping

GPS units will be used to collect spatial data during monitoring events at the restoration site. GPS units are inspected for proper functionality before the start and at the end of each field survey day. Collected data is reviewed for accuracy using desktop software. If discrepancies are discovered equipment is recalibrated by a qualified technician. Units are powered by batteries that are sufficient for an 8 hour work day, additional batteries will be available to field technicians and can be swapped without affecting data accuracy. Additional GPS units will be available as a backup in the event of on-site failure.

Quality Control

All survey data, including photographic imagery and drone footage, will be subjected to a quality control reviewed by a qualified professional. Any secondary data used to support the project will come solely from validated studies. Any additional supplemental data will come from trusted professional organizations such as Audubon Society, Michigan Natural Features Inventory (MNFI), USGS, and accepted peer-reviewed studies. For this project, a validated study and accepted peer-reviewed studies are documents prepared by an individual or organization that has produced the study based on quantified information either collected by the author or other cited professional that have the same or greater credentials.

VI. References

Boase, J.C., and Kennedy, G.W. 2009. Post-Construction Assessment of Fighting Island as a Restoration Site for Lake Sturgeon Spawning Habitat in the Detroit River: 2009 Annual Report Update.
Submitted to; Matthew Child, Director, Essex Region Conservation Authority, Essex, ON, CA. March, 2009

Duffy, W.G., T.R. Batterson, and C.D. Mcnabb. 1987. The St. Marys River, Michigan: An ecological profile. U.S. Fish and Wildlife Service Biological Report 85(7.10).

Breen, M.J., & C.R. Ruetz III. 2006. Gear bias in fyke netting: evaluating soak time, fish density, and predators. North American Journal of Fisheries Management 26:32-41.

Janetski, D.J., & C.R. Ruetz III. 2014. Spatiotemporal patterns of fish community composition in Great Lakes drowned river mouths. Ecology of Freshwater Fish doi: 10.1111/eff.12161.

Central Michigan University Institute for Great lakes Research, 2019. Standard Operating Procedure: Water Quality Sampling and Laboratory Processing. Website. https://www.greatlakeswetlands.org/docs/QAPPs_SOPs/GLCWMP_Water_Quality_SOP_2019.pdf

AVIAN
Static point for birds
http://wsobirds.org/images/atlas/WBBA_II_Handbook.pdf
http://www.michigandnr.com/FTP/parks/Stewardship_Volunteers/Bird_Surveys/Bird%20Surveying%20Instructions.pdf
https://ecos.fws.gov/ServCat/DownloadFile/28030?Reference=29127

HERPS
Justification for coverboards, supported by call-survey (non-trapping, simple) of herpetofauna
https://mnfi.anr.msu.edu/reports/MNFI-Report-2012-11.pdf
https://www.epa.gov/sites/production/files/documents/wetlands_12amphibians.pdf

FISH
Fyke
https://www.michigan.gov/documents/deq/deq-ogl-mglpf-burton_249369_7.pdf
Seines
http://www.michigandnr.com/publications/pdfs/ifr/ifrlibra/research/reports/2055rr.pdf

Appendix B:

Images From Seine and Fyke Netting Fish Survey at Brandenburg Park

PRE-CONSTRUCTION MONITORING PERFORMED OCTOBER AND NOVEMBER 2019

Surveyed Fish

Emerald Shiner

Brook Silverside

Hornyhead Chub

Yellow Perch

Smallmouth bass

Bluntnose Minnow

Banded Killifish

Bluegill

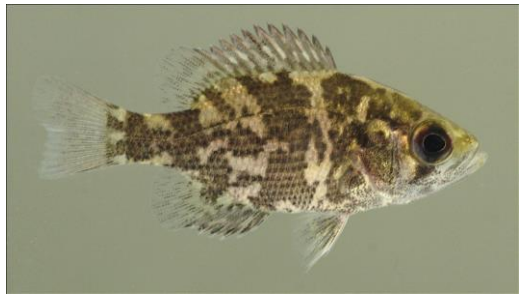
Surveyed Fish cont.

Round Goby

Largemouth Bass

Gizzard Shad

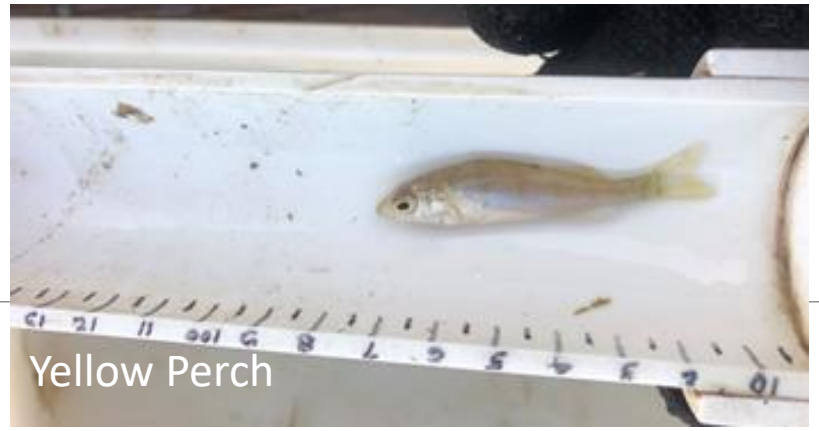
Spotfin Shiner



Rock Bass

Mimic Shiner


Round Goby


Yellow Perch


Mimic Shiner


Brook Silversade


Gizzard Shad


Rock Bass


Spotfin Shiner


Largemouth Bass


Bluegill


Banded Killifish

Largemouth Bass


Rock Bass


Largemouth Bass


Brook Silverside


Yellow Perch

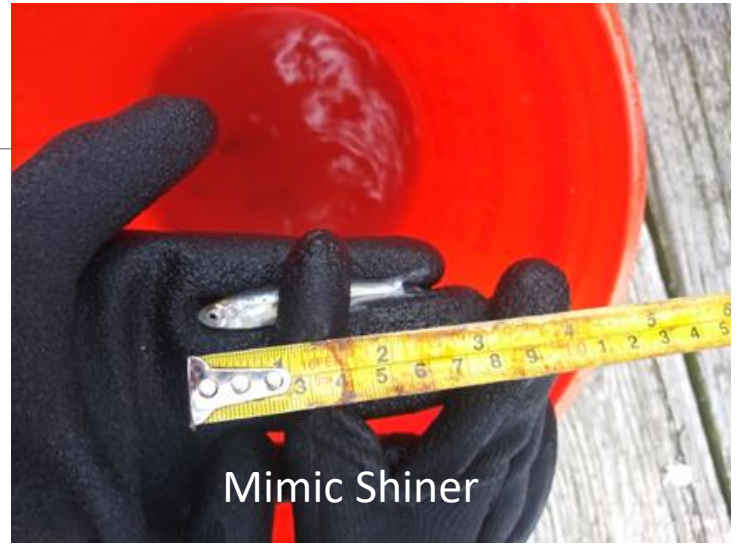

Bluegill


Mimic Shiner


Brook Silverside

Round Goby

Yellow Perch



Mimic Shiner


Largemouth Bass

Bluegill

Appendix C: Fish Sampled by Point, Species, and Size Class - Seine and Fyke Netting

Brandenburg Fish data		SAMPLING PT# FS1											10/14/2019
Temp. 17˚ C.		3 Siene Hauls											
Species	Common	Size Class cm											Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	
Notropis volucellus	Mimic Shiner					2	3	2	1	7				15
Ambloplites rupestris	Rock Bass							1	1	1	1	4		8
Lepomis macrochirus	Bluegill						1			1				2
Neogobius melanostomus	Round Goby							1						1
Notropis volucellus	Mimic Shiner			7										7
Ambloplites rupestris	Rock Bass			4										4
Lepomis macrochirus	Bluegill		1	1										2
Neogobius melanostomus	Round Goby		1											1
Lepomis macrochirus	Bluegill	1												1
Total Fishes Sampled														41

Adult =	26
Juvenile =	14
Fry =	1
	41

Brandenburg Fish data		SAMPLING PT# FS1														10/28/2019
Temp. ˚ C. 10		3 Siene Hauls														
Species	Common	Size Class cm														Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10<	
Dorosoma cepedianum	Gizzard Shad									6	7	5	1	1	2		22
Dorosoma cepedianum	Gizzard Shad							1	2								3
Labidesthes sicculus	Silverside							2	3	1	2	1					9
Labidesthes sicculus	Silverside					1											1
Perca flavescens	Yellow Perch									3	1	2	1	1		1	9
Perca flavescens	Yellow Perch				1	3	7	5	4								20
Cyprinella spiloptera	Spotfin Shiner											2					2
Cyprinella spiloptera	Spotfin Shiner									1							1
Lepomis macrochirus	Bluegill					1											1
Lepomis macrochirus	Bluegill	4															4
Notropis atherinoides	Emerald Shiner							1									1
Notropis atherinoides	Emerald Shiner					2											2
Neogobius melanostomus	Round Goby						1	3	2								6
Neogobius melanostomus	Round Goby	1															1
Pimephales notatus	Bluntnose Minnow							4	1	3	2	4	6	1			21
Pimephales notatus	Bluntnose Minnow					4											4
Micropterus salmoides	Largemouth Bass										1						1
Ambloplites rupestris	Rock Bass	2		1													3
																	0
Total Fishes Sampled																	111

RECORD Adult/Juvenile/Fry

Adult =	67
Juvenile =	39
Fry =	5
	111

Brandenburg Fish data		SAMPLING PT# FS2											10/14/2019
Temp. 17˚ C.		3 Siene Hauls											
Species	Common	Size Class cm											Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	8.0	8.5	9>	
Perca flavescens	Yellow Perch											1	1	2
Neogobius melanostomus	Round Goby							1	1	1	2		3	8
Neogobius melanostomus	Round Goby			1										1
Neogobius melanostomus	Round Goby	1												1
Total Fishes Sampled														12

Adult =	10
Juvenile =	1
Fry =	1
	12

Brandenburg Fish data		SAMPLING PT# FS2														10/28/2019
Temp. ˚ C. 10		3 Siene Hauls														
Species	Common	Size Class cm														Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10<	
Notropis atherinoides	Emerald Shiner	1														1
Dorosoma cepedianum	Gizzard Shad												1			1
Perca flavescens	Yellow Perch				2	9		2	2							15
Perca flavescens	Yellow Perch									1						1
Lepomis macrochirus	Bluegill		10	10	5											25
Lepomis macrochirus	Bluegill	5														5
Labidesthes sicculus	Silverside							2	2	2						6
Labidesthes sicculus	Silverside				1	2	1									4
Neogobius melanostomus	Round Goby							2						1		3
Neogobius melanostomus	Round Goby					1	2									3
Pimephales notatus	Bluntnose Minnow							2	1	1			1	2		7
Pimephales notatus	Bluntnose Minnow					1	3									4
Ambloplites rupestris	Rock Bass		2	1												3
																0
																0
																0
Total Fishes Sampled																78

Adult =	18
Juvenile =	55
Fry =	5
	78

Brandenburg Fish data		SAMPLING PT# FS3														10/14/2019
Temp. 17˚ C.		3 Siene Hauls														
Species	Common	Size Class cm														Total Number of Fish
		< 3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10>	
Nacomis biguttatus	Hornyhead Chub															1	1
Micropterus dolomieu	Smallmouth Bass											1					1
Perca flavescens	Yellow Perch									1	1			1			3
Neogobius melanostomus	Round Goby								1	1	1	1	4		1		9
Micropterus dolomieu	Smallmouth Bass			1													1
Neogobius melanostomus	Round Goby		1														1
Total Fishes Sampled																	**16**

Adult =	**14**
Juvenile =	**2**
Fry =	**0**
	16

Brandenburg Fish data		SAMPLING PT# FS3														10/28/2019
Temp. ˚ C. 10		3 Siene Hauls														
Species	Common	Size Class cm														Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10<	
Labidesthes sicculus	Silverside							5	3	4	2						**14**
Labidesthes sicculus	Silverside					3	2										**5**
Dorosoma cepedianum	Gizzard Shad											1	2	2			**5**
Lepomis macrochirus	Bluegill		1														**1**
Lepomis macrochirus	Bluegill	2															**2**
Cyprinella spiloptera	Spotfin Shiner												1	1			**2**
Cyprinella spiloptera	Spotfin Shiner										1						**1**
Fundulus diaphanus	Banded Killifish		1	2	2	2											**7**
Fundulus diaphanus	Banded Killifish							2									**2**
Notropis atherinoides	Emerald Shiner			1													**1**
Perca flavescens	Yellow Perch						1										**1**
Neogobius melanostomus	Round Goby						1										**1**
Neogobius melanostomus	Round Goby							2									**2**
																	0
Total Fishes Sampled																	**44**

Adult =	**26**
Juvenile =	**16**
Fry =	**2**
	44

Brandenburg Fish data		SAMPLING PT# FS4														10/14/2019
Temp. 17˚ C.		3 Siene Hauls														
Species	Common	Size Class cm														Total Number of Fish
		< 3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10>	
No data - water too choppy to pull seine																0
																0
Total Fishes Sampled																0

No data - water too choppy to pull seine

Adult =	0
Juvenile =	0
Fry =	0
	0

Brandenburg Fish data		SAMPLING PT# FS4														10/28/2019
Temp. ˚ C. 10		3 Siene Hauls														
Species	Common	Size Class cm														Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10<	
Lepomis macrochirus	Bluegill	2														2
Total Fishes Sampled																2

Adult =	0
Juvenile =	0
Fry =	2

Brandenburg Fish data		SAMPLING PT# FS5														10/14/2019
Temp. 17˚ C.		3 Siene Hauls														
Species	Common	Size Class cm														Total Number of Fish
		< 3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10>	
No data - water too choppy to pull seine																0
																0
Total Fishes Sampled																0

No data - water too choppy to pull seine

Adult =	0
Juvenile =	0
Fry =	0
	0

Brandenburg Fish data		SAMPLING PT# FS5														10/28/2019
Temp. ˚ C. 10		3 Siene Hauls														
Species	Common	Size Class cm														Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10<	
Dorosoma cepedianu	Gizzard Shad												1				1
Perca flavescens	Yellow Perch					9		2									11
Perca flavescens	Yellow Perch									1							1
Lepomis macrochirus	Bluegill	2															2
Menidia beryllina	Silverside					2	1										3
Menidia beryllina	Silverside							2		2							4
Neogobius melanosto	Round Goby							2									2
Neogobius melanosto	Round Goby					1	2										3
Pimephales notatus	Bluntnose Minnow							2	1	1			1				5
Pimephales notatus	Bluntnose Minnow					1	3										4
																	0
																	0
Total Fishes Sampled																	36

Adult =	13
Juvenile =	21
Fry =	2
	36

Brandenburg Fish data		SAMPLING PT# FS6														10/14/2019
Temp. 17˚ C.		3 Siene Hauls														
Species	Common	Size Class cm														Total Number of Fish
		< 3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10>	
Lepomis macrochirus	Bluegill	1														1
																0
Total Fishes Sampled																1

Adult =	1
Juvenile =	0
Fry =	0
	1

Brandenburg Fish data			SAMPLING PT# FS6													10/28/2019
Temp. ˚ C 10		3 Siene Hauls														
Species	Common	Size Class cm														Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10<	
Mimic Shiner	*Notropis volucellus*					2	3	2								7
Mimic Shiner	*Notropis volucellus*								1	7						8
Lepomis macrochirus	Bluegill	2														2
Neogobius melanostomus	Round Goby	1														1
Total Fishes Sampled																18

Adult =	8
Juvenile =	7
Fry =	3
	18

Brandenburg Fish data													
	11/5/19 and 11/16/19	Fyke #1 (hoop net)											
Species	Common	Size Class cm											Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	~	13.0	
	no fish caught													
Total Fishes Sampled														0

Brandenburg Fish data													
	11/5/19 and 11/16/19	Fyke #2											
Species	Common	e Class cm											Total Number of Fish
		< 3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	~	13	
	no fish caught													
Total Fishes Sampled														0

Brandenburg Fish data													
	11/5/19 and 11/16/19	Fyke #3											
Species	Common	Size Class cm											Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	~	13.0	
Lepomis macrochirus	Bluegill		1											1
Pimephales notatus	Bluntnose Minnow			1										1
Ambloplites rupestris	Rock Bass	2												2
Percina caprodes	Logperch			1										1
Notropis atherinoides	Emerald Shiner					1								1
Total Fishes Sampled														6

Adult =	
Juvenile =	6
Fry =	
	6

Brandenburg Fish data													
	11/5/19 and 11/16/19	Fyke #4											
Species	Common	e Class cm											Total Number of Fish
		< 3	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	~	13.0	
Notropis atherinoides	Emerald Shiner					2		1						3
Percina caprodes	Logperch					1								1
Total Fishes Sampled														4

Adult =	
Juvenile =	4
Fry =	
	4