FINAL

Ecological Restoration Monitoring Plan
Habitat Restoration Design Projects
St. Clair River Area of Concern, Michigan

Great Lakes Architect-Engineer Services
Contract: EP-R5-11-10
Task Order: 0011

Prepared for
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1. INTRODUCTION

EA Science and Technology and its affiliate EA Engineering, Science and Technology, (MI) PLC\(^1\) (EA) received the Statement of Work (SOW) for the St. Clair River Habitat Restoration Design from the U.S. Environmental Protection Agency (EPA) under the Great Lakes Architect-Engineer Services Contract No. EP-R5-11-10. The SOW was issued by the EPA Region 5 Contracting Specialist dated 13 November 2012, with revised scopes being obtained on 08 January 2013 and 27 February 2014.

This Ecological Restoration Monitoring Plan (ERMP) is a required element of the Work Plan (EA 2013) for the St. Clair Habitat Restoration as a means of establishing restoration monitoring methodologies.

1.1. PURPOSE AND OBJECTIVE

EA is presenting methodologies in this ERMP for ecological monitoring of five habitat restoration sites, included with other projects, to remove the Loss of Fish and Wildlife Habitat beneficial use impairment (BUI) in the St. Clair River Area of Concern (AOC). The ERMP was prepared in consultation with federal, state, and local authorities and the St. Clair River Bilingual Public Advisory Council.

Design plans were developed for the five sites, and implementation of design plans will lead to removal of the Loss of Fish and Wildlife Habitat BUI in the AOC.

Habitat restoration design plans were prepared for each of the following five sites (Figure 1) for the St. Clair River AOC:

- **Port Huron St. Clair River Shoreline Restoration – South**
  Location: 42.982092°N; -82.420914°W

- **Cuttle Creek Restoration**
  Location: 42.891066°N; -82.474864°W

- **Cottrellville Township St. Clair River Shoreline Restoration**
  Location: 42.658247° N, -82.514383° W

- **Marine City Drain Habitat Improvements**
  Location: 42.631697° N, -82.518803° W

- **Harsens Island/Krispin Drain Habitat Restoration**
  Location: 42.599111°N; -82.571303°W

\(^1\) EA Engineering, Science, and Technology, Inc. does business as EA Science and Technology in the State of Michigan and EA is affiliated with EA Engineering, Science and Technology, (MI) PLC.
2. ECOLOGICAL RESTORATION MONITORING

The ecological restoration monitoring (ERM) proposed in this plan is intended as a guide to assist in the design of future projects, to measure long-term effectiveness of implemented practices, to form a basis for adaptive management, and to understand how restored habitats change through time in the St. Clair River and its sub-watersheds. ERM is founded in the watershed-wide goals governing restoration in the Great Lakes watersheds.

The intent of this ERMP is to give local stakeholders and monitoring agencies a starting point to continue the monitoring of the projects where EPA and the Michigan Department of Environmental Quality (MDEQ) leave off, and monitoring parameters to ensure consistency with the original baseline data utilized in the pre-construction field assessment to support BUI de-listing of the sites. These data can be used to implement adaptive management of the sites to enhance or diversify biological response; to serve as references for the design and implementation of other projects; and to assist in the documentation of Great Lakes shoreline and tributary habitats for the purposes of scientific research.

As-built compliance performed by the construction contractor would continue and would be monitored through visual inspection of structures and substrates, monitoring of cross sections, or other simplified assessments to establish projects remaining within established ranges of variability in support of biological data. The project specific contacts listed in Section 2.3 should be contacted to obtain the as-built survey prior to completing field assessments. Other goals would be included as identified; however, additional parameters may be modified or established. An example would be monitoring the development of plants into canopy and understory coverage rather than monitoring plant survivability.

The overriding goal of ERM is to observe that the restoration sites are stable and self-sustaining habitats, self-forming and self-maintaining, and in support of removing established BUIs. In support of that goal, implementation of adaptive management is proposed to facilitate stakeholders identifying issues or instabilities; identifying unexpected circumstances or changes to climatological, physical, or hydrologic boundary conditions; and utilizing ERM data to make informed decisions to assist the system in seeking a stable but dynamic equilibrium. In this way, a variety of quality habitats can be made available in the St. Clair watershed with long-term reliability.

2.1. LIMITATIONS AND EXCEPTIONS

In view of the rapidly changing status of environmental laws, regulations, and guidelines, this ERMP cannot include changes in laws, regulations, or guidelines that occur after the project implementation has been completed and that may affect the subject sites, or the monitoring and compliance of these sites. Revisions to the ERMP may be required in such an event.
2.2. **APPLICABILITY**

This ERMP is applicable only to the subject sites as identified in this plan. The methodologies, techniques, and durations of this methodology are applicable only to the project and site-specific goals identified.

2.3. **MONITORING PLAN STAKEHOLDERS**

The following table identifies the monitoring plan stakeholders.

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<th>Contact</th>
<th>Project Contact and Role</th>
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3. MONITORING PERIOD OF PERFORMANCE

3.1. INITIATION AND FREQUENCY OF MONITORING

Monitoring for specific long-term habitat components requires seasonal coordination; therefore, multiple monitoring events may occur as necessary within a single monitoring year. Monitoring should commence the growing season following construction.

3.2. PROJECT AND REGULATORY-SPECIFIC PERFORMANCE PERIODS

The ERMP incorporates data collected from the pre- and post-construction field assessments and baseline condition assessments established for the projects.

A pre-construction field assessment was conducted prior to project site disturbance and included data for site assessment and design. The assessment was completed between June 2013 and October 2013, and the results of this pre-construction field assessment are included in Appendix A.

ERM may occur on an annual basis, or more frequently as required.
4. MONITORING METHODOLOGY

The fundamental monitoring methodology is presented in this section of the ERMP. Project-specific variations of this approach are presented in Section 5; including any variations or evolution of monitoring protocol which may be required as ERM continues.

4.1. QUALITY ASSURANCE / QUALITY CONTROL

All monitoring data should be collected in accordance with EA’s May 2013 document, *Quality Assurance Project Plan, Habitat Restoration Design Projects, St. Clair River Area of Concern, Michigan*. This document is attached as Appendix B, and includes the Field Sampling Plan with relevant sampling and monitoring locations and methodology information.

4.2. NEW DATA SOURCES

Anticipated new data sources to assist in the ERMP include:

- New monitoring from stakeholders.
- As-built surveys following construction. The project specific contacts listed in Section 2.3 should be contacted to obtain the as-built survey prior to completing field assessments.
- Vegetative establishment data following construction.

4.3. PHOTOGRAPHIC MONITORING

Photographic monitoring shall be taken from similar vantage points for post-construction monitoring. A minimum 5 megapixel camera with built in Global Positioning System (GPS) should be used to document all aspects of the restoration. If a GPS camera is not available, a GPS unit should be used in conjunction with a camera to collect the location of the photos. The use of polarized filters to see submerged features may be necessary.

Diving and underwater camera surveys are proposed for shoreline sites. These surveys should take place to demonstrate seasonal utilization of habitat and should occur in day as well as night monitoring events.

4.4. WETLAND MONITORING

Wetlands and streams identified and delineated will be assessed using the methods and procedures included in Section A.6.1.4 of Appendix B and the Michigan Rapid Assessment Method for Wetlands (MiRAM) included in Appendix C.

Additional characteristics of the existing and restored wetlands will be documented in the field, such as observed disturbances, pollution, or other characteristics which may be impacting the success of restored wetlands and the functions and values of existing wetlands. Vegetation cover
and type, the presence of invasive species, and survivability of installed wetland plantings will be evaluated. Soil color, presence of hydrology and observed depth to groundwater will be recorded.

4.5. TERRESTRIAL PLANT MONITORING

The terrestrial plant monitoring will be completed utilizing the methods and procedures included in Section A.6.1.2 of Appendix B. A timed meander search procedure will be used to conduct terrestrial plant monitoring. During the surveys of each distinct habitat area, as identified in the pre-construction field assessment (illustrated in Figures 12 through 16 of Appendix A), the overall species composition will be determined and the presence of invasive plant species, if any, will be documented. Threatened and endangered plant species which may have been located during the initial habitat assessments will be verified. The plant species observed within each habitat area will be recorded on a field data sheet as they are encountered. Field data sheets will contain entries for habitat type, location within project area, date, name of investigator(s), observed plant or wildlife species, observation times, photographs, and other notes.

Riparian and upland plantings will be evaluated for survivability as part of this monitoring activity.

4.6. HERPETOLOGICAL MONITORING

The herpetological monitoring will be completed utilizing the methods and procedures included in Section A.6.1.6 of Appendix B. A reconnaissance-level monitoring survey will be utilized to compare pre-construction field assessment data (including baseline data collected by others) to post-construction herpetological data. Evidence of herpetological species presence or direct observations will be documented during monitoring, along with documenting the existing and restored habitat present at each site and the physical habitat components available.

4.7. STREAM HABITAT AND MACROINVERTEBRATE MONITORING

The stream habitat and macroinvertebrate monitoring will be completed utilizing the methods and procedures included in Section A.6.1.7 of Appendix B. A rapid habitat and visual-based stream assessment will be performed in accordance with MDEQ Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers (Appendix D) within the wadeable portions of each of the sites. Locations of these assessments will be consistent with pre-construction field assessment sampling locations (illustrated in Figures 7 through 11 of Appendix A), and will document representative restored habitats in terms of their physical components. Biological assessments will be conducted as qualitative macroinvertebrate monitoring. This will be performed concurrently with the physical habitat component monitoring.

A semi-quantitative monitoring survey will also be conducted for any known mussel beds in the project areas. Photo-documentation will be conducted of the species collected, and observations
of river conditions (e.g., water clarity, approximate flow rate, depth) will be recorded. During the mussel surveys, habitat data will also be collected. Substrate type and percent composition estimates will be made at each site using the Wentworth scale of substrate particle size (e.g., sand, gravel, cobble, etc.).

4.8. **FISH COMMUNITY MONITORING**

Fish community monitoring will follow MDEQ’s Great Lakes and Environmental Assessment Section (GLEAS) Procedure #51 Survey protocols (Appendix E) utilizing a backpack shocking unit. Other methods may be substituted for the Port Huron St. Clair River Shoreline Restoration – South, Cottrellville Township St. Clair River Shoreline Restoration, and Marine City Drain Habitat Improvements sites under the direction of the Michigan Department of Natural Resources (MDNR), United State Geological Survey (USGS), or other appropriate agency. Fish shocking should be done at similar stations and locations as collected previously by stakeholders, including MDNR. At each station the following data must be recorded:

- Location of the sampling station including but not limited to identification on a detailed map of study area and necessary comments or descriptions in field notes.
- Name and number of species collected with a length of greater than 1 inch, as well as the total number of fish collected.
- Observable anomalies on species including, but not limited to, scoliosis (bent spine), open lesions, severely eroded fins, fungus patches, growths on skin or fins, tumors and poor physical condition. This only applies to extreme and obvious cases; common parasites such as copepods, black spot, and yellow grub do not need recording.
- Time spent electrofishing, including number of passes through sampling station, number of shocking probes used, average stream width, and distance of reach electrofished.

Data analysis will follow the procedure outlined in GLEAS #51 by creating a Fish Score for 10 metrics.

Additionally, documentation of the positions of woody debris, point bars, overhead cover and other physical habitat components will be collected as relating to fish species utilization or potential utilization of the reach. A video diving survey of these resources is proposed. This should occur to observe day as well as night utilization of the submerged habitat features.

4.9. **FLUVIAL GEOMORPHIC MONITORING**

The fluvial geomorphic monitoring will be completed utilizing the methods and procedures included in Section A.6.1.9 of Appendix B. Survey elements of the monitoring plan will include the assessment of tributary sites using a Watershed Assessment of River Stability and Sediment Supply (WARSSS) (Rosgen 2006) methodology. In addition, Wolman pebble counts, Bank Erosion Hazard Index (BEHI), and Near Bank Stress (NBS) assessments will be required.
(Rosgen 2006). BEHI/NBS will be completed for all restored project reaches, with representative facet surveys for particle size and channel geometry cross sections for each distinct stream design reach as identified in the design report. Surveys of a representative riffle, run, pool, and glide will be conducted at permanently-monumented monitoring cross sections. Longitudinal profile monitoring surveys will be conducted at restored stream reaches. These surveys will be stored in a database, such as Excel. Facet feature slopes, lengths, and depths will be recorded. Reach characteristics will include percent riffle habitat, percent pool habitat, woody debris and substrate, and other parameters as necessary.

4.10. REPORTING

Upon conclusion of a monitoring event, monitoring reporting will be completed and will include the following:

- Individual sections depicting each of the monitoring elements identified for each site including data, data sheets, and appropriate appendices supporting that data.
- Comparative sections analyzing monitoring elements with pre-construction field assessment and baseline data.
- Existing conditions including river hydrograph analysis, precipitation data, and relevant storm, pollution, or other disrupting events which may have occurred since the collection of pre-construction field assessment and baseline data.
- Sources of collected data.
- Conclusions and recommendations.

All monitoring reporting and data will be submitted in hard and electronic soft copy.
5. PROJECT SITES AND GOALS

The following section presents background information relating to the site descriptions and physical settings for the performance of monitoring. All project locations are depicted in relation to each other in Figure 1.

5.1. PORT HURON ST. CLAIR RIVER SHORELINE RESTORATION – SOUTH

5.1.1. Description

The Port Huron St. Clair River Shoreline Restoration – South is owned by the City of Port Huron, Michigan and includes the western shore of the St. Clair River between the existing seawall at Bard Street, north towards the existing house and garage at Glenwood Avenue (Figure 2). The habitat restoration design included approximately 2 acres along approximately 495 linear feet of shoreline, and construction of two river substrate areas and two submerged root wad structures.

5.1.2. Goals and Objectives

The objectives of the Port Huron St. Clair River Shoreline Restoration – South project were to improve stream biodiversity measurements for fish, macroinvertebrates, and herpetofauna diversity/population. Specific elements included:

- The establishment of a permanent 25-foot buffer of native vegetation, including trees and vegetation that provides shade and habitat for fish;
- Removal of select concrete debris and vegetation and habitat restoration of the river shoreline;
- Preservation and restoration of habitat for birds, small mammals, amphibians, and reptiles; and
- Limited bank stabilization using bioengineering and other techniques to enhance habitat.

5.1.3. Ecological Restoration Monitoring

Project specifics for ERM are proposed to mimic that of pre-construction field assessments for each of the described methodologies, but be expanded to include additional elements. Emphasis should shift to development of riparian buffer, including canopy cover and understory, and continued monitoring of physical habitats and biological utilization. Additional methodologies for ERM are proposed below.

5.1.3.1 Photographic Monitoring

Photographic monitoring will be conducted with the same methodologies established in Section 4.3. Photos detailing the installed plantings and habitat elements, the shoreline, and any installed substrates and structures should be included.
5.1.3.2 Wetland Monitoring

No specific wetland monitoring is proposed for this site.

5.1.3.3 Terrestrial Plant Monitoring

Terrestrial plant monitoring will be conducted with the same methodologies established in Section 4.5. Monitoring will focus on the retention of existing trees, the survivability of installed trees, and natural recruitment of native plants.

5.1.3.4 Herpetological Monitoring

Herpetological monitoring will be conducted with the same methodologies established in Section 4.6.

5.1.3.5 Aquatic Habitat and Macroinvertebrate Monitoring

Aquatic habitat and macroinvertebrate monitoring will be conducted with the same methodologies established in Section 4.7. Emphasis will be placed on presence of physical habitat. Macroinvertebrate or mussel biological monitoring will be conducted in similar locations as the pre-construction field assessments.

5.1.3.6 Fish Community Monitoring

Fish community monitoring will be conducted with the same methodologies established in Section 4.8. As no direct baseline data exists for this site and this monitoring element will be coordinated with stakeholders. Divers and photographic study of submerged aquatic habitat is proposed to aid in assessment of habitat utilization.

5.1.3.7 Fluvial Geomorphic Monitoring

Fluvial geomorphic monitoring will be conducted with the same methodologies established in Section 4.9. Emphasis will be placed on WARSSS methodology describing sediment size, distribution, and bank erosion assessments. A minimum of two bank cross sections will be surveyed using differential leveling techniques.

5.2. CUTTLE CREEK RESTORATION

5.2.1. Description

The Cuttle Creek Restoration site is owned by the City of Marysville, Michigan, and located at the municipal golf course between River Road and Busha Highway (Figure 3). The Cuttle Creek site extends from the western railroad culvert to the culvert under River Road adjacent to the St. Clair River, and includes a pond, pond outfall, and existing concrete culvert connecting the golf course with an adjacent cemetery. The site consists of approximately 3,000 linear feet of
stream over approximately 13 acres of riparian and upland habitat, as well as multiple swales and drainages flowing in from the golf course fairways.

5.2.2. Goals and Objectives

The objectives of the Cuttle Creek Restoration were to improve the macroinvertebrate monitoring score from “poor” to “good”; increase fish diversity, connectivity, passage, taxa richness, and population; and improve habitat for reptiles and amphibians. Specific elements included:

- Removal of a concrete weir, perched culvert, and in-line pond that inhibits fish passage from the St. Clair River to upper reaches of Cuttle Creek.
- Restoration of eroding banks through soft-engineering practices, removal of invasive plants, re-vegetation of banks with native plants, and in-stream habitat enhancement.
- Creation of connected floodplain wetlands, sheltered from ice scour and wake-erosion influence of the St. Clair River.
- Institution of best management practices to limit associated non-point source pollution from the golf course.

5.2.3. Ecological Restoration Monitoring

Project specifics for ERM are proposed to mimic that of pre-construction field assessments for each of the described methodologies. Emphasis should shift to development of riparian buffer and forested wetlands, and include canopy cover and understory. Continued monitoring of physical habitats and biological utilization should be incorporated, as well as long-term performance of fish passage and structural elements. Methodologies for ERM are detailed below.

5.2.3.1 Photographic Monitoring

Photographic monitoring will be conducted with the same methodologies established in Section 4.3. Photos detailing the restored stream, structures, grading, and golf course elements will be included, as well as photos at the mouth to the St. Clair depicting structures, obstructions, and culverts. Culvert replacement photos and fish passage structures shall be documented.

5.2.3.2 Wetland Monitoring

Wetland monitoring will be conducted with the same methodologies established in Section 4.4. Monitoring will focus on the constructed wetland and existing enhanced wetlands as identified in the as-built survey.
5.2.3.3 Terrestrial Plant Monitoring

Terrestrial plant monitoring will be conducted with the same methodologies established in Section 4.5. Monitoring will focus on the retention of existing trees, the survivability of installed trees, and natural recruitment of native plants.

5.2.3.4 Herpetological Monitoring

Herpetological monitoring will be conducted with the same methodologies established in Section 4.6. Restored wetlands will be examined for physical habitat elements as a special focus.

5.2.3.5 Stream Habitat and Macroinvertebrate Monitoring

Stream habitat and macroinvertebrate monitoring will be conducted with the same methodologies established in Section 4.7. Emphasis will be placed on the presence of physical habitat, quantities of riffles, overhead cover, and other goals as defined in the stream restoration design plans and specifications. Macroinvertebrate or mussel biological monitoring will be conducted in locations similar to those of the pre-construction field assessments.

5.2.3.6 Fish Community Monitoring

Fish community monitoring will be conducted with the same methodologies established in Section 4.8. Effort will be made to sample in the same locations where the baseline data were collected by MDNR, as well in restored portions of the site.

5.2.3.7 Fluvial Geomorphic Monitoring

Fluvial geomorphic monitoring will be conducted with the same methodologies established in Section 4.9. A full WARSSS assessment mimicking the pre-construction field assessment will be conducted for this site.

5.3. COTTRELLVILLE TOWNSHIP ST. CLAIR RIVER SHORELINE RESTORATION

5.3.1 Description

The Cottrellville Township St. Clair River Shoreline Restoration site is owned by Cottrellville Township, Michigan, and is located along Marsh Road within a 1.5-acre municipal park (Figure 4). Habitat restoration was completed within the riparian areas and along 500 linear feet of shoreline of the St. Clair River. The project included construction of offshore segmented breakwaters, root wad structures, boulder clusters, substrate restoration, installation of rock toe, and general site grading.
5.3.2. Goals and Objectives

The objectives of the Cottrellville Township St. Clair River Shoreline Restoration were to improve native vegetation and riparian buffer; improve fish, macroinvertebrate, and herpetofauna diversity/population; reduce erosion; improve stability of the shoreline to enhance the shallow water and near shore habitat; and establish wetlands.

5.3.3. Ecological Restoration Monitoring

Project specifics for ERM are proposed to mimic that of the pre-construction field assessment but include additional methodologies described below. Emphasis should shift to development of riparian buffer and include canopy cover and understory. Continued monitoring of physical habitats and biological utilization should be incorporated, as well as long-term performance of structural elements.

5.3.3.1 Photographic Monitoring

Photographic monitoring will be conducted with the same methodologies established in Section 4.3. Photos detailing the restored shoreline, wetland, and near-shore subaqueous habitat elements will be included, as well as photos depicting structures and wetland habitat elements.

5.3.3.2 Wetland Monitoring

Wetland monitoring will be conducted with the same methodologies established in Section 4.4. Monitoring will focus on the constructed wetland and existing enhanced wetlands as identified in the as-built survey.

5.3.3.3 Terrestrial Plant Monitoring

Terrestrial plant monitoring will be conducted with the same methodologies established in Section 4.5. Monitoring will focus on the retention of existing trees, the survivability of installed trees, and natural recruitment of native plants.

5.3.3.4 Herpetological Monitoring

Herpetological monitoring will be conducted with the same methodologies established in Section 4.6. Restored wetlands will be examined for physical habitat elements as a special focus.

5.3.3.5 Stream Habitat and Macroinvertebrate Monitoring

Stream habitat and macroinvertebrate monitoring will be conducted with the same methodologies established in Section 4.7. Emphasis will be placed on the presence of physical habitat. Macroinvertebrate or mussel biological monitoring will be conducted in similar locations as the pre-construction field assessments.
5.3.3.6 Fish Community Monitoring

Fish community monitoring will be conducted with the same methodologies established in Section 4.8. As no specific fish data is available as a baseline for the site, this element will be coordinated with stakeholders.

5.3.3.7 Fluvial Geomorphic Monitoring

Fluvial geomorphic monitoring will be conducted with the same methodologies established in Section 4.9. Monitoring will focus on substrate depositional patterns. A full WARSSS methodology is not proposed and was not completed in the pre-construction field assessment; however, elements of the monitoring are anticipated to be coordinated with stakeholders.

5.4. MARINE CITY DRAIN HABITAT IMPROVEMENTS

5.4.1. Description

The Marine City Drain (also known as the Marine City Dredge Cut) is a large, low-gradient open drain, about 6.5 miles in length that flows into the St. Clair River at the north boundary of the City of Algonac, Michigan (Figure 5). The drain is under the jurisdiction of the St. Clair County Drain Commissioner, with easements of 100 feet on each side of the drain centerline. The habitat improvement project area included the confluence of Marine City Drain and the St. Clair River, and shallow submerged areas of the Marine City Drain near St. Clair River Road and Virginia Avenue. Habitat improvements were completed within 1,000 feet of the mouth and along 100 linear feet of the St. Clair River shoreline, encompassing approximately 4 acres. In addition, approximately 1 mile of the drain, up to the boundary of Algonac State Park, underwent common reed (*Phragmites australis*) management. The project included installation of root wad structures, boulder clusters, offshore segmented breakwaters, substrate restoration areas, rock toe, and bank grading.

5.4.2. Goals and Objectives

The objectives of the Marine City Drain Habitat Improvements project were to improve native vegetation and riparian buffer; improve fish, macroinvertebrate, and herpetofauna diversity/population; reduce erosion; and improve shoreline stability and near shore habitat. Specific elements included:

- Restoration of shoreline and near/shore habitat for fisheries, birds, reptiles, and amphibians on the north side of the mouth of the drain and approximately 1,000 feet upstream.
- Treatment of invasive common reed along the drain up to Algonac State Park border (approximately 1 mile).
5.4.3. **Ecological Restoration Monitoring**

Project specifics for ERM are proposed to mimic that of the pre-construction field assessment. Emphasis should shift to development of riparian buffer and include canopy cover and understory. Continued monitoring of physical habitats and biological utilization should be incorporated, as well as long-term performance of structural elements.

5.4.3.1 **Photographic Monitoring**

Photographic monitoring will be conducted with the same methodologies established in Section 4.3. Photos detailing the restored shoreline, wetland, and near-shore subaqueous habitat elements will be included, as well as photos depicting structures and work in the drain proper.

5.4.3.2 **Wetland Monitoring**

Wetland monitoring will be conducted with the same methodologies established in Section 4.4. Monitoring will focus on the constructed shallow shoreline wetlands and submerged habitats.

5.4.3.3 **Terrestrial Plant Monitoring**

Terrestrial plant monitoring will be conducted with the same methodologies established in Section 4.5. Monitoring will focus on the retention of existing trees, the survivability of installed trees, and natural recruitment of native plants.

5.4.3.4 **Herpetological Monitoring**

Herpetological monitoring will be conducted with the same methodologies established in Section 4.6, with an emphasis on physical habitat elements.

5.4.3.5 **Stream Habitat and Macroinvertebrate Monitoring**

Stream habitat and macroinvertebrate monitoring will be conducted with the same methodologies established in Section 4.7. Emphasis will be placed on presence of physical habitat. Macroinvertebrate or mussel biological monitoring will be conducted in locations similar to those of the pre-construction field assessments.

5.4.3.6 **Fish Community Monitoring**

Fish community monitoring will be conducted with the same methodologies established in Section 4.8. Emphasis will be made to mimic the locations where baseline data were collected by MDNR, and observe utilization of the restored elements.

5.4.3.7 **Fluvial Geomorphic Monitoring**

Fluvial geomorphic monitoring will be conducted with the same methodologies established in Section 4.9. Monitoring will focus on substrate depositional patterns. A full WARSSS
methodology is not proposed; however, elements of the monitoring are anticipated to be coordinated with stakeholders.

5.5. **HARSEN’S ISLAND/KRISPIN DRAIN HABITAT RESTORATION**

5.5.1. **Description**

Krispin Drain is under the jurisdiction of the St. Clair County Drain Commissioner. Krispin Drain is approximately 4 miles in length, and traverses the middle of Harsens Island (Figure 6). The project area includes a 200-foot wide easement along the centerline of the drain from the mouth of the drain at the St. Clair River and extends upstream approximately 2 miles to Krispin Road. The proposed project includes dredging and re-shaping the drain with 10:1 sloped benches and a defined thalweg, substrate enhancement, riparian planting, and invasive species control.

5.5.2. **Goals and Objectives**

The objectives of the Harsen’s Island/Krispin Drain Habitat Restoration project were to remove invasive species and reestablish native vegetation, and to improve flow through the Harsens Island/Krispin Drain from the North Channel to the MDNR managed wetland facility. Additional objectives were to promote vegetation diversity, composition, and stem density; and improve fish, macroinvertebrate, herpetofauna, and avian diversity/population. Specific elements included:

- Remove invasive species and replant with native vegetation.
- Reestablish flow and restore tributary habitat in Harsens Island/Krispin Drain.
- Dredge internal waterways to hydraulically re-connect the drain to the MDNR managed wetland facility.

5.5.3. **Ecological Restoration Monitoring**

Project specifics for ERM are proposed to mimic that of pre-construction field assessments. Emphasis should shift to development of riparian buffer, and include canopy cover and understory. Continued monitoring of physical habitats and biological utilization should be incorporated, as well as long-term performance of structural elements.

5.5.3.1 **Photographic Monitoring**

Photographic monitoring will be conducted with the same methodologies established in Section 4.3. Photos should detail invasive species removal and selected stations along the drain where dredging will occur.
5.5.3.2 Wetland Monitoring

Wetland monitoring will be conducted with the same methodologies established in Section 4.4. Monitoring will focus on the existing wetlands within the work area, and any created or enhanced wetlands within the work area.

5.5.3.3 Terrestrial Plant Monitoring

Terrestrial plant monitoring will be conducted with the same methodologies established in Section 4.5. Monitoring will focus on the retention of the survivability of installed trees and natural recruitment of native plants.

5.5.3.4 Herpetological Monitoring

Herpetological monitoring will be conducted with the same methodologies established in Section 4.6, with an emphasis on physical habitat elements.

5.5.3.5 Stream Habitat and Macroinvertebrate Monitoring

Stream habitat and macroinvertebrate monitoring will be conducted with the same methodologies established in Section 4.7. Emphasis will be placed on presence of physical habitat. Macroinvertebrate or mussel biological monitoring will be conducted in similar locations as the pre-construction field assessments.

5.5.3.6 Fish Community Monitoring

Fish community monitoring will be conducted with the same methodologies established in Section 4.8. As no specific fish data are available as a baseline for the site, this element will be coordinated with stakeholders. Emphasis will be made to monitor areas opened to fish passage through dredging.

5.5.3.7 Fluvial Geomorphic Monitoring

Fluvial geomorphic monitoring will be conducted with the same methodologies established in Section 4.9. Monitoring will focus on substrate depositional patterns. A full WARSSS methodology is not proposed; however, elements of the monitoring are anticipated to be coordinated with stakeholders.
6. ADAPTIVE MANAGEMENT

If significant measures are identified in ERM that cannot be easily accomplished, an adaptive management program is proposed. The key elements of the adaptive management program will include:

- Plans for an alternative approach if some measures are unexpectedly found to be impracticable.
- A trial approach of varying methodologies may be utilized due to the dynamic nature of the St. Clair River.
- Unexpected successes should be documented, and utilized to assist in other portions of the site which are not performing to expectations.

Adaptive management should set forth clear and measureable goals, and a cohesive plan to implement actions. The plan should clearly identify who will perform remedial designs, implementation, and set forth guidelines for monitoring and verifying success.

Adaptive management will be essential in ensuring appropriate habitat uplift in dealing with unexpected conditions at the project sites. These measures should be recorded as part of monitoring reports, and document success and changes in support of removing BUIs.
7. REFERENCES


Figures
Habitat Restoration Design Projects
St. Clair River Area of Concern, Michigan

Figure 1
Vicinity Map

May, 2013
Habitat Restoration Design Projects
St. Clair River Area of Concern, Michigan

Figure 2
Port Huron St. Clair River Shoreline Restoration

April, 2014
Habitat Restoration Design Projects
St. Clair River Area of Concern, Michigan

Figure 3
Cuttle Creek Restoration
Habitat Restoration Design Projects
St. Clair River Area of Concern, Michigan

Figure 4
Cottrellville TWP Restoration

1 inch = 125 feet
Habitat Restoration Design Projects
St. Clair River Area of Concern, Michigan

Figure 5

Marine City Drain Restoration

April, 2014
Habitat Restoration Design Projects
St. Clair River Area of Concern, Michigan

Figure 6
Harsens Island, Krispin Drain

1 inch = 4,000 feet
Appendix A

Ecological Report for the
Habitat Restoration Design Projects
St. Clair River Area of Concern, Michigan
Appendix B

Quality Assurance Project Plan,
Habitat Restoration Design Projects,
St. Clair River Area of Concern, Michigan
Appendix C

Michigan Rapid Assessment Method for Wetlands
Appendix D

Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers
Appendix E

Great Lakes and Environmental Assessment
Section - Procedure #51 Survey Protocols
for Wadeable Rivers