

# **Stony Island Habitat Restoration Herpetofauna Assessment**

September 2018



**Prepared For:**  
**Friends of the Detroit River**  
20600 Eureka Rd #313  
Taylor, MI 48180

**Prepared By on Behalf of Environmental Consulting and Technology, Inc.:**  
**Herpetological Resource and Management, LLC**  
P.O. Box 110  
Chelsea, MI 48118

**Suggested Citation:** Herpetological Resource and Management. 2018. Stony Island Habitat Restoration Amphibian and Reptile Assessment Report. Herpetological Resource and Management, Chelsea MI. 46 pp.

**Contents**

Executive Summary..... 1

Introduction..... 3

Site Description..... 3

Methods..... 4

Results..... 4

Discussion..... 6

Conclusion..... 9

Maps..... 10

Tables..... 16

Photos..... 18

Appendix ..... 44

    Herpetofaunal Species Profiles ..... 44

References..... 46

## Executive Summary

In 2014, Herpetological Resource and Management, LLC (HRM) was contracted by Environmental Consulting and Technology (ECT) to conduct field studies and assist in habitat restoration targeting amphibians and reptiles on Stony Island. Work was funded through the National Oceanic and Atmospheric Administration (NOAA). An analysis of historic herpetofauna records, with a preliminary survey and habitat assessment was conducted in 2014 to identify habitat restoration targets. Several opportunities were identified for improving amphibian and reptile habitat and later incorporated into the overall restoration of Stony Island. Pre-restoration monitoring was conducted in 2016 to establish baseline data of species richness, abundance and distribution. Habitat restoration on the island and surrounding shoals was initiated in 2016 and continued through 2017. Post-restoration herpetofauna monitoring was conducted in spring and summer 2018. Significant findings from this study included:

- A total of 12 species of herpetofauna including 4 amphibians and 8 reptiles were documented within the project area.
- One threatened species, Eastern Fox Snake (*Pantherophis gloydi*) and two Special Concern species, Mudpuppy (*Necturus maculosus*) and Blanding's Turtle (*Emydoidea blandingii*) were recorded from Stony Island during HRM's assessments.
- Four species were officially documented for the first time on the island over the course of this study including Bullfrog (*Rana catesbeiana*), Green Frog (*Rana clamitans melanota*), Blanding's Turtle, and Midland Painted Turtle (*Chrysemys picta marginata*).
- Habitat conditions on Stony Island for supporting herpetofauna improved following restoration. The addition of several habitat features targeting amphibians and reptiles has increased the amount of overall available habitat.
- Reptile hibernacula were observed being used by three species of snake; Eastern Garter Snake, Northern Brown Snake, and Eastern Fox Snake, as well as Eastern American Toads.
- Nesting sites created on the island were inundated during the course of the monitoring due to record water levels and not used during the 2018 nesting season. Other areas on the island were utilized representing additional opportunities for restoration targeting herpetofauna. Additionally, several turtles were observed using the shoals and the gravel sandy areas and may likely be using these areas for nesting.
- A 20% increase in species richness was detected between pre- and post-restoration monitoring.
- Increased spatial distribution of herpetofauna was recorded and several species were documented using the created habitat structures on numerous occasions.
- Additional post-restoration monitoring is strongly encouraged to continue to assess species response to restoration measures.

Overall findings indicate, this restoration project has been effective at improving habitat quality within a substantial portion of Stony Island. The island supports several species of herpetofauna considered rare and imperiled in Michigan and represents an important source of habitat and refugia for populations within the Detroit River. This project has contributed to restoring lost habitats and degraded fish and wildlife populations within the Detroit River. These actions will help address measures needed for the removal of Beneficial Use Impairments and ultimately delisting this region as an Area of Concern. Long-term monitoring of the herpetofauna is warranted to better understand the response of species to restoration measures and assess these areas as breeding and nursery sites for amphibians and reptiles based on habitat features implemented.



## **Introduction**

The Detroit River is one of several major waterways connecting the Great Lakes. The river historically contained extensive areas of coastal marsh that supported a diversity of fish and wildlife species. Over 100 years of development have degraded the river, eliminating areas of natural habitat and introducing various sources of pollution, contributing to high levels of bacteria, PCBs, and other contaminants. As a result, it is now one of 43 contaminated sites designated as an Area of Concern (AOC) under the 1987 Great Lakes Water Quality Agreement. Urbanization in the watershed has caused the loss of more than 90% of the river's coastal wetlands (United States Environmental Protection Agency 1996). The loss of fish and wildlife habitat was listed among the multiple Beneficial Use Impairments (BUIs) for the system. A substantial portion of the remaining Detroit River wetlands and coastal marshes are found among its islands, which support a considerable amount of suitable habitat for both resident and migratory fish and wildlife. Within recent years, binational efforts have been placed on conducting restoration that will contribute to the removal of BUIs on the Detroit River and aid in the overall delisting as an AOC.

Beginning in 2013, a project was developed to explore habitat improvement options for Stony Island in the lower Detroit River. The natural habitat on the island had become degraded over the last twenty years due to erosion as well as invasive vegetation and restoring this unique Great Lakes ecosystem was identified as a high priority. In 2014, Herpetological Resource and Management (HRM) was contracted by Environmental Consulting and Technology (ECT) as part of a grant from the Friends of the Detroit River (FODR) with funding provided by the National Oceanic and Atmospheric Administration (NOAA) to evaluate Stony Island for potential restoration opportunities targeting amphibians and reptiles. Initial site assessments associated with this project were conducted in May 2014 and recommendations from these assessments were provided to assist in guiding restoration actions to be taken on Stony Island. Since 2005, HRM has been working on Stony Island conducting periodic herpetological surveys.

Overall amphibian and reptile presence, represented age classes, spatial distribution, and relative abundance can be important tools in identifying the need for, and success of, habitat restoration. Through additional funding provided by NOAA, HRM conducted pre- and post-restoration monitoring to evaluate the success of restoration measures on Stony Island. Pre-restoration monitoring was conducted between May and August of 2016. Restoration activities were completed on the island between 2016 and 2017 and HRM conducted final post-restoration monitoring between April and August 2018. The results of these monitoring efforts were intended to help provide data that may lead to the removal of the Loss of Fish and Wildlife Habitat BUI for the Detroit River AOC.

## **Site Description**

Stony Island is an uninhabited 52-acre island located in the Lower Detroit River in the township of Grosse Ile. Historically, the island was owned by a dredging company. While the Livingston Shipping Channel was being excavated during the early 1900's, construction buildings and equipment as well as dozens of homes were located on the island. The construction of limestone shoals protected the island from current and wave action, allowing two large wetland areas to form. The interior portion of the island supports additional coastal marsh, wet meadow, deciduous forest, and forested wetlands (Photos 1-6). Stony Island also supports the Detroit River's largest Great Blue Heron rookery, containing over 200 nests (Photo 7). Prior to restoration activities, a portion of the upper bay shoal, as well as the shoal that protects the lower bay wetlands,

were reduced to below the current water level from decades of erosion. With these structures reduced or absent, wave action from the Detroit River continued to further erode the island shoreline.

## Methods

Prior to initial site assessments in 2014, a historical review was conducted to determine herpetofauna species that may occur on the island. The review utilized records from museum collections, Michigan Department of Natural Resources Wildlife, Fisheries, and Parks and Recreation Divisions (MDNR), United States Fish and Wildlife Service (USFWS), Michigan Natural Features Inventory (MNFI), HerpMapper, and the Michigan Herp Atlas Project. Additionally, historical data was utilized from previous HRM surveys conducted on the island in 2005.

Over one day in May 2014, HRM conducted a habitat assessment targeting herpetofaunal species on Stony Island within the proposed restoration areas. Time constrained ground searches were utilized to assess both aquatic and terrestrial habitat, and identify potential restoration opportunities targeting amphibians and reptiles. Emphasis was placed on potential nesting, foraging, basking, and overwintering sites and identifying where these features were lacking. No specimen vouchers were taken; however, photographs were taken when possible to document habitat conditions and species observed. Site conditions were recorded using a Kestrel 3000 pocket weather meter.

HRM conducted pre-restoration surveys over five days between May and August 2016. Post-restoration sampling was conducted over ten days between April and August 2018. During both pre- and post-restoration monitoring, intensive surveys were conducted within the restoration area and opportunistically within other portions of Stony Island by teams of two to three biologists trained in the sampling and identification of amphibians and reptiles. Multiple methods were employed to document herpetofauna species richness and distribution and to account for variability in seasonal habitat use by different age classes and taxa. Sampling incorporated visual encounter surveys through both terrestrial and aquatic habitats using time constrained meander transects which included investigation of potential basking and nesting areas as well as turning over natural and artificial cover (logs, boards, debris, etc.) (Photo 8). Aural surveys took place simultaneously to document calling amphibian breeding activity. Targeted surveys for Mudpuppies (*Necturus maculosus maculosus*) were conducted using baited traps completely submerged in near shore areas and along the man-made shoals (Map 1, Photos 9-10). Each positively identified amphibian and reptile was recorded with the following information collected for each record: (1) species, (2) gender of each individual (when possible), (3) behavior of each individual, and (4) reproductive condition of each individual (if it can be determined). Observation locations were recorded using Tier II spatial accuracy standards. Trimble GPS Units were used during HRM's surveys and observations were mapped using ArcMap® software (Photo 11). No voucher specimens were collected but photographs were taken when possible to document habitat conditions and species observed. Site conditions were recorded for each survey event using a Kestrel 3000 pocket weather meter.

## Results

Ongoing research into the genetics, physiology, behavior, and fossil history of amphibians and reptiles has led to debates about their proper classification. Some biologists have proposed the splitting of established genera like *Rana* (“typical frogs”) and *Bufo* (“true toads”) into the newer genera *Lithobates* and *Anaxyrus*, respectively (Harding and Holman 1999). Some suggestions have

included using the newly proposed groupings as subgenera, allowing recognition of the new divisions while maintaining name stability. For the purposes of this report this system will be followed for the genus of toad *Bufo* (*Anaxyrus*). The genus of “typical frogs” will not include subgenera based on a recent publication which supports the placement of all North American ranid frogs in the genus *Rana* (Yuan, Zhou et al. 2016 ). These classifications are also recognized by the recently revised Amphibians and Reptiles of the Great Lakes Region (Harding and Mifsud 2017).

Based on a review of the several databases described above and data from previous HRM assessments, seven species were historically known to occur on Stony Island prior to this work. These species included Eastern American Toad (*Bufo* [*Anaxyrus*] *americanus americanus*), Mudpuppy (*Necturus maculosus maculosus*), Eastern Fox Snake (*Pantherophis gloydi*), Eastern Garter Snake (*Thamnophis sirtalis sirtalis*), Northern Brown Snake (*Storeria dekayi dekayi*), Northern Water Snake (*Nerodia sipedon sipedon*), and Northern Map Turtle (*Graptemys geographica*) (Table 1, Map 2).

During the 2014 initial rapid site assessment and herpetofaunal survey, two species were observed within the study including Eastern American Toad and Eastern Garter Snake (Table 1, Photos 12-13). Several opportunities for habitat improvement were identified during this site visit and were provided in a report to ECT (Mifsud 2014). Major recommendations were, clearing of woody shrub vegetation from near shore terrestrial areas to increase coastal marsh habitat, removing invasive vegetation, and adding habitat structures targeting amphibians and reptiles including basking logs, terrestrial brush piles, nesting beaches, hibernacula, aquatic woody debris, and Mudpuppy refugia (Table 2).

#### *Pre-restoration Assessments*

During 2016 pre-restoration monitoring, ten species were documented including Eastern American Toad (Photo 14), Bullfrog (*Rana catesbeiana*) (Photo 15), Green Frog (*Rana clamitans melanota*) (Photo 16), Eastern Fox Snake (Photo 17), Eastern Garter Snake (Photo 18), Northern Brown Snake (Photo 19), Northern Water Snake (Photo 20), Eastern Snapping Turtle (*Chelydra serpentina serpentina*), Midland Painted Turtle (*Chrysemys picta marginata*), and Northern Map Turtle.

#### *Restoration*

Major work completed during the restoration activities on Stony Island included the reconstruction of both the upper and lower shoals surrounding the island intended to help protect the interior habitats from wave action and further erosion (Photo 21). The northern shoal was comprised entirely of limestone riprap, while the southern shoals were constructed with both rip rap and planted vegetation (Photos 22-23). The restoration also incorporated several recommendations made by HRM following initial 2014 visits (Map 5). Woody debris was placed in the southern bay off the new artificial shoal as well as adjacent to the southern shoreline that were intended to provide basking for reptiles as well as breeding and reproduction sites for amphibians (Photos 24-25). Numerous Mudpuppy habitat structures were created and placed on both outer and inner portions of the southern shoals, within the bay, and along the southern shoreline. A nesting beach was also created on one of the new shoals (Photo 26). Woody vegetation was cleared from portions of the restoration area where growth had become very dense and in this area, nesting beaches were created, several brush piles were placed to provide basking and cover locations and a hibernaculum was constructed to provide overwintering habitat (Photos 27-30).

#### *Post-restoration Monitoring*

Results from 2018 post-restoration monitoring included the recording of 12 species of herpetofauna, Eastern American Toad, Bullfrog (Photo 31), Green Frog, Mudpuppy (Photo 32),

Eastern Fox Snake (Photo 33), Eastern Garter Snake (Photo 34), Northern Brown Snake (Photo 35), Northern Water Snake (Photo 36), Blanding's Turtle (*Emydoidea blandingii*) (Photo 37), Eastern Snapping Turtle (Photo 38), Midland Painted Turtle (Photo 38), and Northern Map Turtle (Photo 39).

Based on habitat conditions following restoration measures, the study site has the potential to support additional species of herpetofauna not observed during site assessments including Butler's Garter Snake (*Thamnophis butleri*), Eastern Spiny Softshell Turtle (*Apalone spinifera spinifera*), Gray Treefrog (*Hyla chrysoscelis/versicolor*), and Musk Turtle (*Sternotherus odoratus*) (Table 1). With continued restoration of Stony Island interior habitats including the removal of invasive species, additional species including Northern Leopard Frog (*Rana pipiens*), Northern Spring Peeper (*Pseudacris crucifer crucifer*), and Western (Midland) Chorus Frog (*Pseudacris triseriata triseriata*) may occur as well.

## Discussion

Amphibians and reptiles are recognized as key bioindicators (gauges of environmental health), due in part to their high sensitivity to environmental pollutants and habitat disturbance. Their presence, richness, and distribution are important metrics for determining the health of natural communities (Cooperrider, Boyd et al. 1986; Welsh and Droege 2001; Guilfoyle 2010). Herpetofauna are constrained by their physiology to occupy areas that support key specific habitat features such as adequate basking sites and accessible nesting areas. Their distribution can provide important information about habitat conditions within a site and indicate where these critical features are insufficient. Comparing the herpetofaunal species richness and habitat usage of Stony Island before and after restoration measures has been an effective way to evaluate success of these efforts and assess the current overall ecosystem health of the site.

Prior to restoration effort, the habitat conditions on Stony Island were degraded resulting from several factors. The site lacked sufficient features necessary to support healthy populations of several amphibian and reptile species and in general, herpetofauna habitat was considered moderate. Although results from pre-restoration monitoring showed an overall increase in species richness from known historic community composition, the population size for many species was limited and relatively poorly distributed. The habitat features and structures recommended by HRM and incorporated into the large scale restoration project are considered critical for encouraging colonization of new species and maintaining healthy densities of existing populations. Results from post-restoration monitoring suggest these efforts were successful. HRM observed detectable increase in both species richness as well as spatial distribution on the island. Clearing of woody vegetation to create more open habitat within the target restoration area was effective. Prior to restoration, distribution of Northern Brown Snakes was limited to small portions of the island often associated with shoreline riprap. During 2018 assessments, the species was documented within the restoration area at several occasions. Young of year individuals were documented for the first time in 2018 as well (Photo 40).

Before restoration, herpetofauna were commonly observed basking on artificial structures due to the lack of woody debris throughout the site (Photo 41). Large trees placed in open water habitats now provide basking sites for turtles and aquatic snakes, while brush piles constructed in terrestrial communities provide basking and cover for species in upland areas (Photo 42). The hibernaculum constructed as part of this project was observed being used by multiple snake species and age classes during spring and summer months (Photos 43-44). This structure will continue to provide critical habitat during winter months for various amphibian, reptile, and small mammal

species. Future restoration work should include construction of additional and larger hibernacula including on the east end of the island to improve the overall spatial use of the island as habitat and increase overall habitat availability.

Other habitat features that appear to have directly impacted herpetofauna abundance were the several Mudpuppy structures placed along the new lower island shoals. Mudpuppies were not documented during HRM's 2016 pre-restoration assessments and only one individual observed by ECT staff while conducting electrofishing. Post-restoration sampling resulted in significant numbers of Mudpuppies captured during sampling efforts and importantly, various age classes were captured demonstrating multiple life stages occupying the restoration area (Photo 45).

Suitable reptile nesting sites were noted as extremely limited during preliminary assessments and restoration designs included several nesting structures to be placed within the target area (Photo 46). During post-restoration sampling, HRM did not directly observe any of the nesting areas proposed for the interior portion of the island. Water levels were particularly high during 2018 sampling events, which may have impacted the nesting sites and reduced their visibility. Any future efforts should include incorporating nesting habitat on higher ground to ensure their viability through high water years. During one of HRM's sampling events, several Northern Map Turtle females were observed attempting to nest in sub-optimal habitat on the eastern end of the island. This use of poor habitat suggests that this habitat feature remains inadequate for meeting the needs of species present on Stony Island (Photo 47). Future restoration effort should consider incorporating more nesting areas and utilizing the east end of the island already being used for this purpose.

Prior to restoration, Stony Island was known to historically support seven species of herpetofauna. Work conducted by HRM on Stony Island in 2014 resulted in the documentation of only two species. The objective of this rapid assessment was to document the overall conditions of habitat on the island for herpetofauna and the emphasis on habitat condition was likely the reason for low overall amphibian and reptile detection. Inventories performed in 2016 and restoration monitoring in 2018 was conducted over several months between spring and summer to improve detection rate and better understand seasonal activity and spatial distribution. During these assessments, twelve species were observed including multiple rare and sensitive species that are protected in Michigan.

HRM documented the presence of Eastern Fox Snakes throughout both pre- and post-restoration monitoring of Stony Island. Listed as Threatened in Michigan, the range of this species lies entirely within the Great Lakes basin where it is found in coastal marshes and other near-shore habitats. Prior to 2016, this sensitive species had not been reported on Stony Island in several years. Multiple age classes were observed indicating the species is likely reproducing on the island (Photo 48). During pre-restoration assessment observations of Eastern Fox Snakes were largely limited to the existing shoals. Following restoration, the species was observed using interior habitats for the first time during HRM's assessments. The use of multiple habitat structures on the island by Eastern Fox Snakes is encouraging and has demonstrated the value of incorporating these features into the restoration (Photo 49). Particularly encouraging was the documentation of multiple Eastern Fox Snakes using the created hibernacula.

Following placement of aquatic habitat structures targeting Mudpuppies, this species was recorded for the first time by HRM in 2018. The fully aquatic salamander was recently elevated to Special Concern in Michigan and are also identified as focal species of the St. Clair-Detroit River System (SCDRS) in the 2015 Michigan Wildlife Action Plan (Derosier, Hanshue et al. 2015) They



are the obligate host to the state Endangered Salamander Mussel (*Simposonais ambigua*), making it an integral component of this aquatic ecosystem. Prior to restoration, habitat for Mudpuppies within near-shore areas of the island was limited. Historically prior to dredging activities, the Detroit River supported large expanses of limestone with breaks and gaps, which allowed Mudpuppies and multiple fish species to utilize the area. Supplementing offshore areas with large, flat surfaces has improved opportunities for Mudpuppies on Stony Island as well as several species of fish and other wildlife.

Results of HRM's assessments included several herpetofauna not previously documented for Stony Island (Bullfrog, Green Frog, Blanding's Turtle and Midland Painted Turtle). Two of the newly documented species, Bullfrog and Blanding's Turtle can be considered particularly significant. Bullfrogs have experienced local declines over the last several decades. Extirpation of populations from sites in the Great Lakes region including the Detroit River have been attributed to habitat loss, environmental contaminants, and overharvesting (Harding and Mifsud 2017). Arguably the most significant observation was the detection of Blanding's Turtle in 2018. This species is currently protected in all Great Lakes States as either Threatened or Endangered and is listed as Endangered by the IUCN Red List. In Michigan, population declines appear to be less severe and the species is listed as Special Concern (Herpetological Resource and Management 2014). However, even in Michigan the loss and degradation of wetland habitat has greatly reduced or eliminated local populations (Harding and Mifsud 2017). The species is known for being particularly mobile over terrestrial habitat and the restoration which has created more open coastal wetland habitat will likely be beneficial as it provides better access to interior habitat from the river. Future management should consider the introduction of native species that likely historically occurred on the island and supplementing of species such as Blanding's Turtles given the very small population size that was indicated by only one observation over several years.

While the overall quality of habitat for amphibians and reptiles on Stony Island has greatly improved following restoration, a major threat that remains is the excessive presence of invasive species. One species in particular, *Phragmites australis* *ssp.*, the Eurasian common reed presents the greatest risk. Besides eliminating suitable habitat directly, this and other invasive species severely fragment amphibian and reptile habitat by creating physical barriers and preventing their dispersal through the landscape (Westbrooks 1998; Tulbure, Johnston et al. 2007; Bolton and Brooks 2010). Dense, mature stands of *Phragmites* are present along the shorelines and within coastal marsh habitat surrounding Stony Island (Photo 50). During HRM's assessments, the density of *Phragmites* on the island inhibited staff ability to effectively transect through the much of the coastal marsh habitat. Within the restoration area, limited corridors are present where *Phragmites* was cleared, presumably to provide access to interior habitat for construction crews. While these small pathways currently provide access through the thick stands of *Phragmites* from the river to the island, without further measures the plant will recolonize within a short period time. During late summer assessments in 2018, new growth *Phragmites* was beginning to establish in the restoration area where other vegetation was cleared prior (Photo 51). Invasive vegetation also threatens habitat within interior portions of Stony Island including garlic mustard (*Alliaria petiolate*), multiflora rose (*Rosa multiflora*), and Asian bittersweet (*Celastrus orbiculatus*) (Photo 52). The older shoals are currently established with invasive shrubs including glossy buckthorn (*Frangula alnus*) and white mulberry (*Morus alba*) and without long-term management of the site, these may spread and establish on the newly created shoals in the future. Invasive plant management should be a central focus of future restoration efforts on the island and will substantially increase the overall viability of this island for herpetofauna and other organisms.



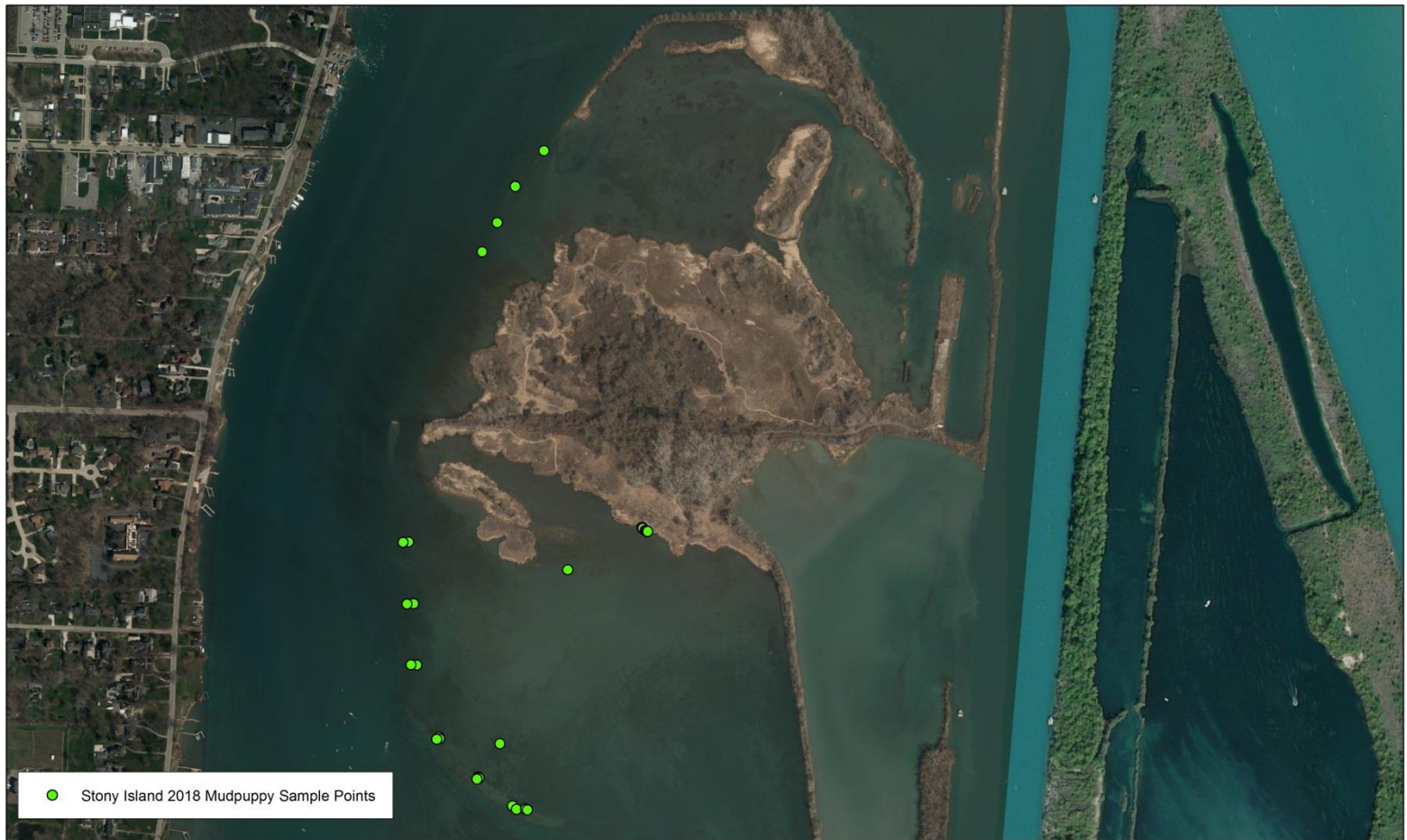
## Conclusion

Stony Island contains a significant amount of coastal wetland habitat that is limited within the Detroit River Watershed following decades of habitat loss and degradation. This region supports a number of rare and sensitive fish and wildlife species and restoration in the AOC is essential to the long-term viability of the ecosystem. The efforts to restore habitat on Stony Island while protecting the site from further erosion and wave action appear to have been successful. HRM recorded a total of 12 species of herpetofauna between 2016 and 2018. Four species were officially documented for the first time on the island through this work including Bullfrog, Green Frog, Blanding's Turtle and Midland Painted Turtle. Following placement of habitat features targeting amphibians and reptile, habitat conditions have improved for herpetofauna and an increase in species richness and distribution was recorded including the documentation of multiple state protected species. Importantly, rare and imperiled species were observed actively using created habitat features including Eastern Fox Snakes occupying the hibernaculum and Mudpuppies captured from the aquatic structures along the new shoals. Opportunities for future restoration efforts include additional nesting beaches targeting other locations on the island and more widespread invasive species management. The initial results of this work are encouraging and have demonstrated the value in placing efforts on improving overall quality of habitat on Detroit River islands for amphibians and reptiles. This work is a valuable step toward the removal of the loss of fish and wildlife habitat BUI and will help ultimately lead to the delisting of the Detroit River AOC. Continued long-term monitoring of this location is strongly recommended to better understand the community composition of herpetofauna as well as measure their response to restoration activities.

## Maps



Map 1. Locations of 2016 Stony Island Mudpuppy sampling.



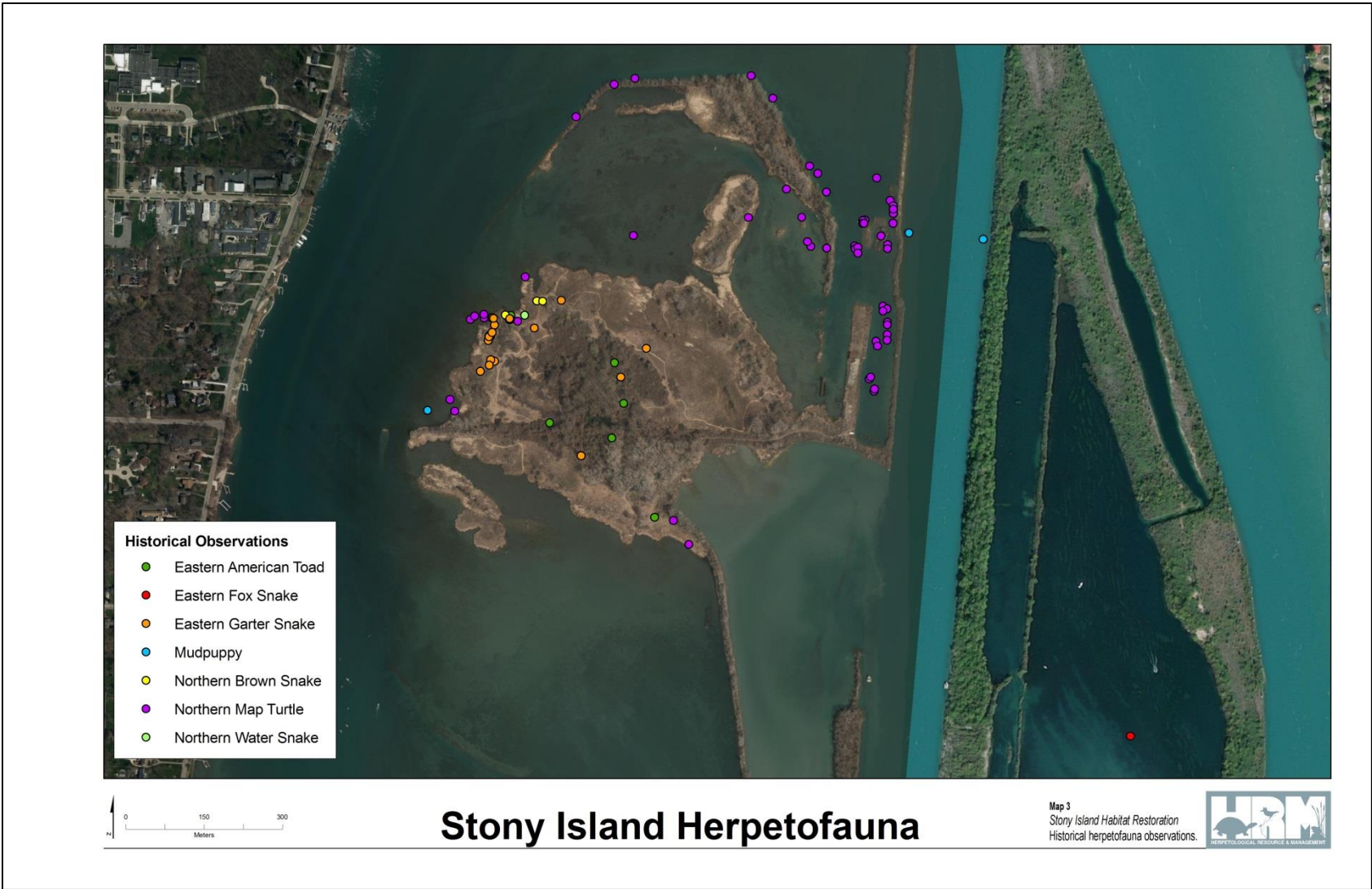
## Stony Island Habitat Restoration

Map 2  
Stony Island Habitat Restoration  
2018 Mudpuppy Sample Points

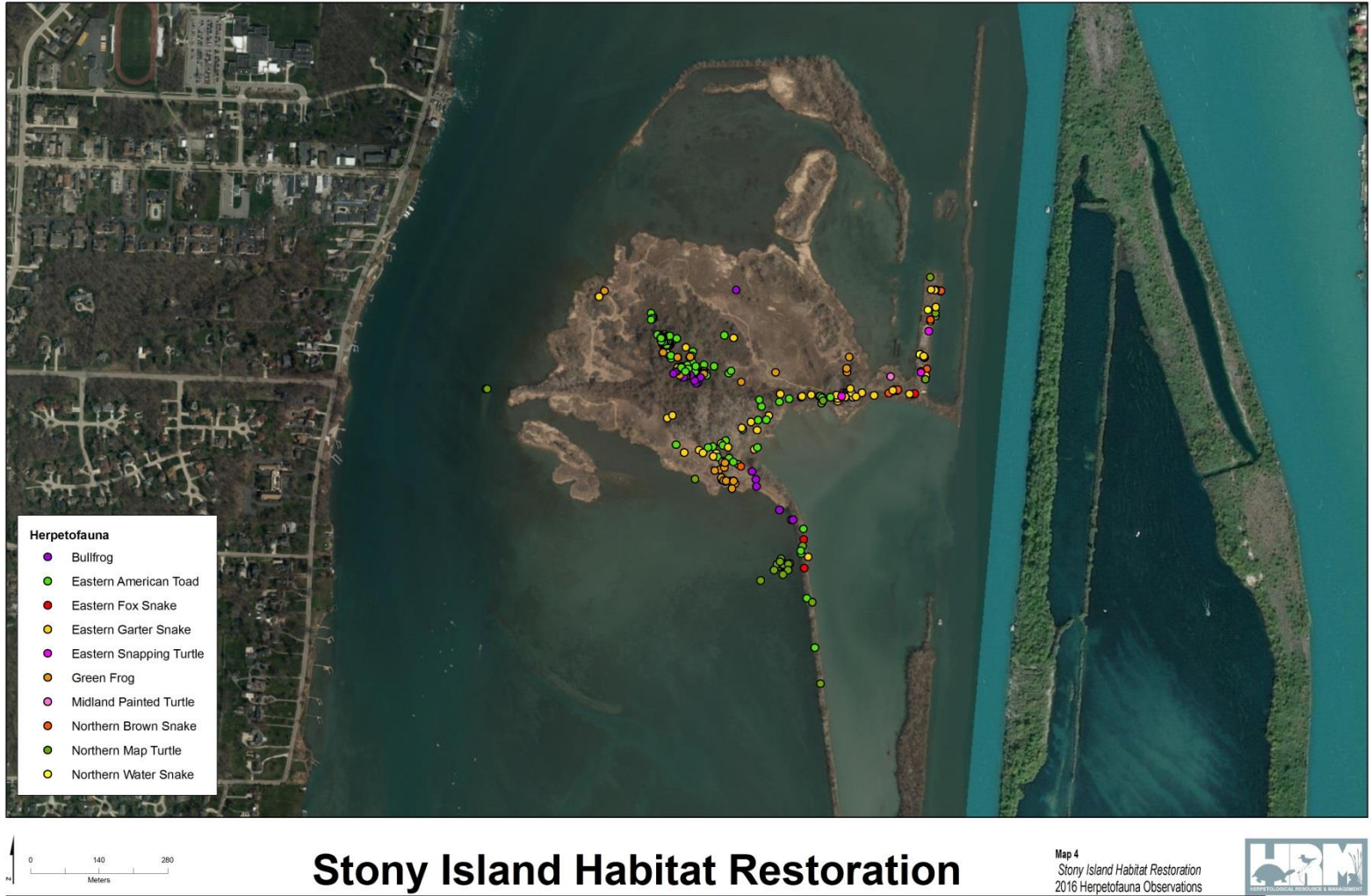


Map 2. Locations of 2018 Stony Island Mudpuppy sampling.



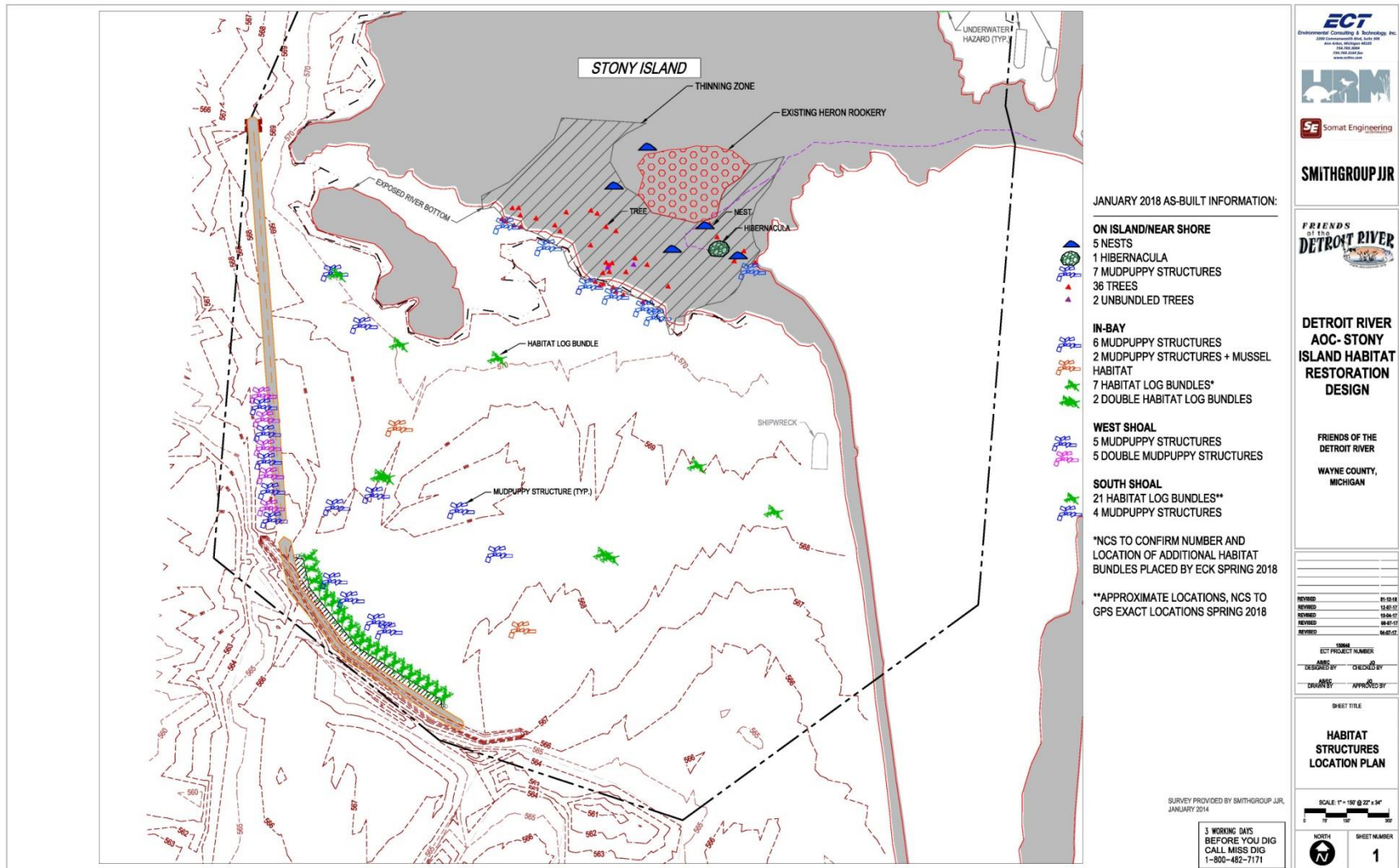


Map 3. Historic observations of herpetofauna found on Stony Island prior to 2016 pre-restoration monitoring.



Map 4. 2016 Stony Island Herpetofauna observations. Observations are limited in the northern portion due to dense *Phragmites* stands





Map 5. Stony Island restoration designs including habitat structures targeting amphibian and reptile species. (Credit: Environmental Consulting and Technology)







Map 6. 2018 Stony Island Herpetofauna observations. Assessments were focused on southern portions of the island where restoration was conducted.

## Tables

Table 1. Stony Island herpetofauna species historically recorded, source of historical observation, species observed during HRM's most recent survey, and herpetofauna that were not observed recently but may potentially occur on the island.

Common Name	Species Name	Historical Data	Observed 2014	Observed 2016	Observed 2018	Potential Species
Eastern American Toad	<i>Bufo [Anaxyrus] americanus americanus</i>	X <sup>1</sup>	X		X	
Bullfrog	<i>Rana catesbeiana</i>			X	X	
Green Frog	<i>Rana clamitans melanota</i>			X	X	
Gray Treefrog	<i>Hyla chrysoscelis/ versicolor</i>					X
Mudpuppy	<i>Necturus maculosus maculosus</i>	X <sup>3</sup>			X	
Eastern Fox Snake	<i>Pantherophis gloydi</i>	X <sup>1,2</sup>		X	X	
Butler's Garter Snake	<i>Thamnophis butleri</i>					X
Eastern Garter Snake	<i>Thamnophis sirtalis sirtalis</i>	X <sup>1</sup>	X	X	X	
Northern Ribbon Snake	<i>Thamnophis sauritus septentrionalis</i>					X
Northern Brown Snake	<i>Storeria dekayi dekayi</i>	X <sup>1</sup>		X	X	
Northern Water Snake	<i>Nerodia sipedon sipedon</i>	X <sup>1</sup>		X	X	
Blanding's Turtle	<i>Emydoidea blandingii</i>				X	
Eastern Spiny Softshell Turtle	<i>Apalone spinifera spinifera</i>					X
Eastern Snapping Turtle	<i>Chelydra serpentina serpentina</i>			X	X	
Midland Painted Turtle	<i>Chrysemys picta marginata</i>			X	X	
Musk Turtle	<i>Sternotherus odoratus</i>					X
Northern Map Turtle	<i>Graptemys geographica</i>	X <sup>1</sup>		X	X	

1. Herpetological Resource and Management (HRM)

2. Michigan Natural Features Inventory (MNFI)

3. U.S. Fish and Wildlife Service (USFWS)

Table 2. Habitat restoration recommendations generated based on the preliminary 2014 site assessment.

<b>Stony Island Initial Habitat Improvement Recommendations</b>	
<b>Action</b>	<b>Target</b>
Remove invasive species with emphasis on <i>Phragmites</i>	Increase ecological integrity of the site and provide opportunities for increased spatial distribution of wildlife.
Provide basking logs	Aid in thermoregulation of reptiles
Place small multi-branched limbs in near shore habitat	Provide adherence points for amphibian eggs and cover during mating
Create terrestrial nesting areas on both the island and surrounding shoals	Increase recruitment and population viability of turtle populations
Place flat basking structures on the shoals	Aid in thermoregulation of reptiles
Provide small gravel and cobble in potential turtle nesting locations	Prevent turtles from becoming trapped in large riprap
Install Mudpuppy habitat structures	Provide critical breeding, nesting, and nursery sites.
Control over-populated mesopredators such as raccoons	Reduce nest predation rates and increase nesting success of turtles and State Threatened Eastern Fox Snake on the island



## Photos



Photo 1. Southern portion of Stony Island and associated coastal marsh.



Photo 2. Coastal marsh habitat that is separated from the dense *Phragmites* surrounding the majority of Stony Island.





Photo 3. Wet meadow and coastal marsh habitat on the southern portion of Stony Island with dense *Phragmites* in background.



Photo 4. Interior forested habitat on Stony Island with dense understory of garlic mustard.





Photo 5. Forested wetland on Stony Island in early spring.



Photo 6. Forested wetland on Stony Island in late summer.





Photo 7. Large Great Blue Heron rookery centrally located on Stony Island.



Photo 8. HRM staff performing meander surveys documenting amphibians and reptiles and assessing habitat conditions.





Photo 9. HRM staff placing baited Mudpuppy trap along one of the newly created shoals in 2018.



Photo 10. Placement of a baited trap targeting Mudpuppies along a Stony Island shoal.



Photo 11. HRM staff recording herpetofauna observations on Stony Island during restoration assessments.



Photo 12. Eastern Garter Snake observed on Stony Island during the 2014 rapid site assessment.





Photo 13. Eastern American Toad observed on Stony Island during the 2014 rapid site assessment.



Photo 14. Eastern American Toad observed during 2016 pre-restoration monitoring.





Photo 15. Bullfrog observed on Stony Island in 2016. The species was documented on the island for the first time during these pre-restoration surveys.



Photo 16. Green Frog observed in an interior wetland on Stony Island during 2016 pre-restoration monitoring.





Photo 17. Eastern Fox Snake observed basking on the existing riprap shoal during 2016 pre-restoration monitoring..



Photo 18. Eastern Garter Snake observed in upland forest habitat during 2016 pre-restoration monitoring.





Photo 19. Northern Brown Snake observed under metal debris during 2016 pre-restoration monitoring.

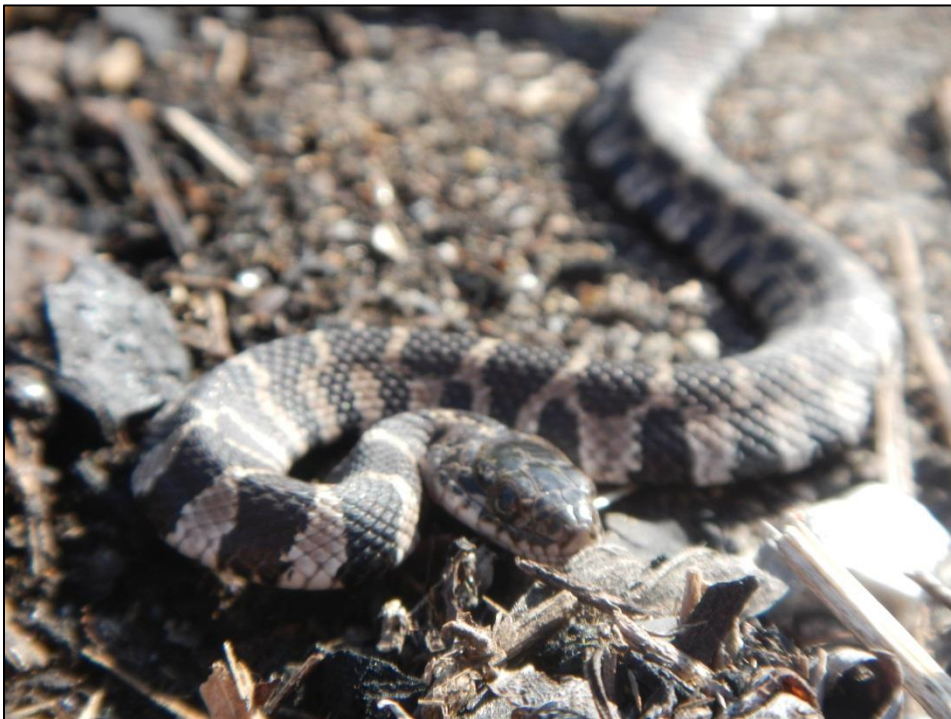


Photo 20. Juvenile Northern Water Snake observed under debris during 2016 pre-restoration monitoring.



Photo 21. Restoration work underway on the northern portion of Stony Island to construct shoals to reduce further erosion to shorelines caused by heavy wave action.



Photo 22. Newly constructed replacement shoal on northern portion of Stony Island.





Photo 23. Newly constructed shoal on southern portion of Stony Island including both concrete riprap and planted wetland vegetation.



Photo 24. Basking structure placed in southern bay adjacent to newly constructed shoal.





Photo 25. Large basking log placed on shoreline of restoration area on southern portions of Stony Island.



Photo 26. Nesting beach created on the newly constructed southern shoal.





Photo 27. Target restoration area where vegetation was cleared from the southern portions of Stony Island including a newly placed brush pile.



Photo 28. One of several large brush piles created in the restoration area intended to provide basking and cover habitat.





Photo 29. Restoration area following clearing of vegetation including hibernaculum.



Photo 30. Newly constructed hibernaculum intended to provide critical refugia and overwintering habitat for herpetofauna and other wildlife on Stony Island.





Photo 31. Bullfrog observed during 2018 post-restoration monitoring.

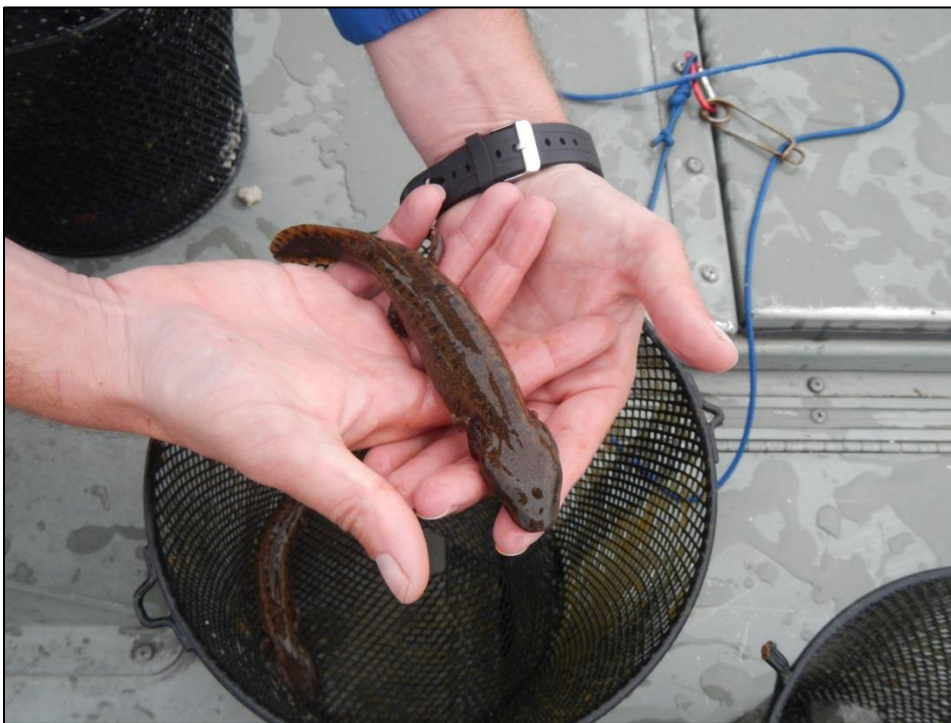


Photo 32. Mudpuppy captured from trapping efforts during 2018 post-restoration monitoring.





Photo 33. Eastern Fox Snake observed on hibernaculum during 2018 post-restoration monitoring.



Photo 34. Eastern Garter Snake observed during 2018 post-restoration monitoring.





Photo 35. Northern Brown Snake observed during 2018 post-restoration monitoring.



Photo 36. Northern Water Snake observed during 2018 post-restoration monitoring.





Photo 37. Blanding's Turtle observed during 2018 post-restoration monitoring representing the first time the species has been officially documented on the island.



Photo 38. Eastern Snapping Turtle and Midland Painted Turtle observed basking in interior wetland during 2018 post-restoration monitoring.



Photo 39. Several Northern Map Turtles observed basking in the river during 2018 post-restoration monitoring.



Photo 40. Young of year Northern Brown Snake observed in the restoration area during 2018 monitoring.





Photo 41. Northern Map Turtles basking on metal debris during 2016 pre-restoration monitoring. Restoration has increased basking opportunities around the island and reduced the need for their use of artificial materials.



Photo 42. Eastern Garter Snake observed basking on brush pile in project area during 2018 post-restoration monitoring.



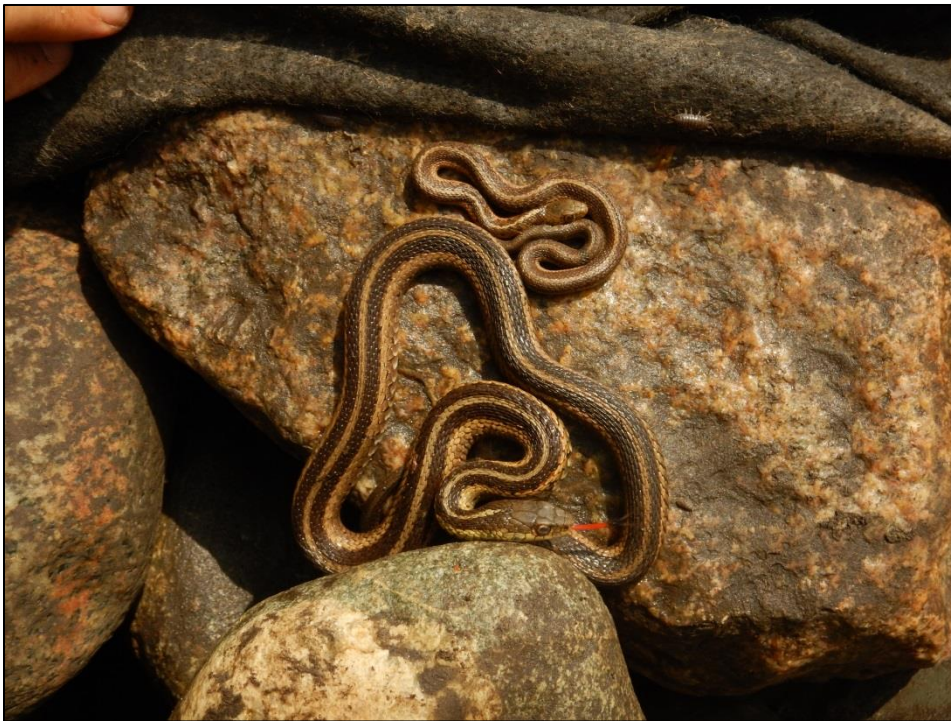


Photo 43. Eastern Garter Snake observed using hibernaculum during 2018 post-restoration monitoring.



Photo 44. Eastern Fox Snake observed seeking cover under hibernaculum during 2018 post-restoration monitoring.



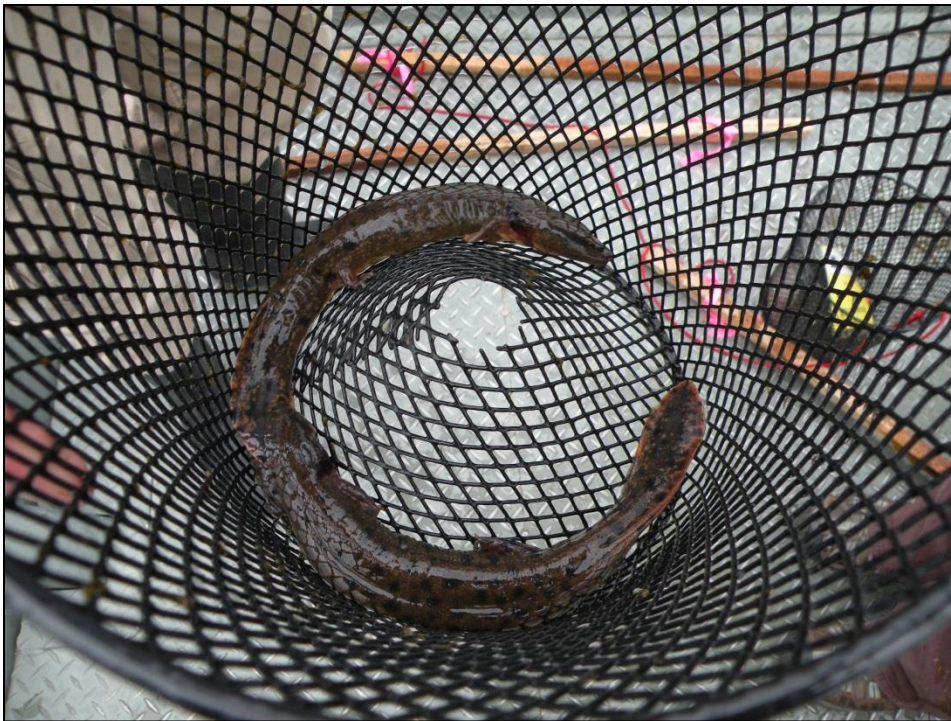


Photo 45. Pair of Mudpuppies representing a portion of those captured during a single sampling event from 2018 post-restoration monitoring.



Photo 46. Old predated turtle nest found in suboptimal nesting habitat during 2016 pre-restoration monitoring.





Photo 47. Northern Map Turtle female observed attempting to nest in sub-optimal habitat dominated by large gravel during 2018 post-restoration monitoring.



Photo 48. Dead juvenile Eastern Fox Snake observed in early 2016. The individual may have died recently after emerging from hibernation.





Photo 49. Eastern Fox Snake observed using newly placed brush pile during 2018 post-restoration monitoring.



Photo 50. Coastal marsh habitat fragmented from the Stony Island shoreline by a dense stand of *Phragmites*.





Photo 51. New growth *Phragmites* observed establishing in the restoration area during 2018 monitoring.



Photo 52. Forest understory dominated by young garlic mustard in 2018



## Appendix

### *Herpetofaunal Species Profiles*

#### Eastern Fox Snake

Eastern Fox Snakes have a small range restricted to areas along and adjacent to the shores of Lake Huron and Lake Erie (Harding and Mifsud 2017). They are a State Threatened species in Michigan (Michigan Natural Features Inventory 2010), and are listed as Endangered in Canada. A large species, Fox Snakes require grassland habitat that is rarely mowed or burned, and often prefer to shelter and overwinter in adjacent riprap or similar habitat. Although they spend much of their time in uplands feeding on small mammals, they are very strong swimmers, and it is not uncommon for them to use waterways to travel significant distances. Despite their size, these snakes are often preyed upon by large raptors and medium-sized mammals. In the fall, Fox Snakes enter hibernacula, which sometimes include communal sites, and do not emerge until mid-April or May. Breeding occurs in spring, and eggs are laid in June or July, hatching about two months later. Fox Snakes are often senselessly killed because they are mistaken for Copperheads (*Agkistrodon contortrix*), a U.S. species not present in Michigan), because of the orange head, or for rattlesnakes because they will vibrate their tail against dry vegetation when threatened, producing a loud buzz.

#### Blanding's Turtle

In Michigan, the Blanding's Turtle is listed as a Species of Special Concern. While still locally common in some parts of Michigan, this species is listed as Threatened and Endangered in other portions of its range, and it is currently being considered for federal protection. Blanding's Turtles requires a mosaic of wetland habitats for its survival. For much of the year, they prefer open water areas with structures such as logs or stumps on which to bask. Females require well drained soils, usually with southern exposure, for nesting and will travel long distances to locate a suitable nesting location. Hibernation occurs within ponds where the animals burrow into the mud below the frost line. The Blanding's Turtle has a life span of approximately 80 years, and does not reach sexual maturity until around 20 years of age. Adults have few natural predators, but hatchling and juvenile turtles suffer very high mortality rates. Annual nest predation by predators, especially raccoons, is often 100%. For this reason, it may take one adult female decades to produce enough turtles to replace herself and her mate and thus maintain a stable population. Due to their very low reproductive rate, it is extremely important to maintain ample nesting areas as well as the shrub swamp wetland habitat that young Blanding's Turtles rely on for shelter (Carl H. Ernst 2009; Harding and Mifsud 2017).

### Mudpuppy

Mudpuppies are large, entirely aquatic salamanders that have recently been elevated to Special Concern in Michigan. They were identified as a focal species of the St. Clair-Detroit River System (SCDRS) in the 2015 Michigan Wildlife Action Plan (Derosier, Hanshue et al. 2015). Mudpuppies are easily recognized by their large size (up to 1.5 feet long) and large external gills just behind the head (Harding and Mifsud 2017). Small Mudpuppies might resemble the larvae of other salamanders, but have only four toes on each foot instead of five. In Southeast Michigan, this species is the only amphibian which normally inhabits the open water of large lakes and rivers, spending most of its time hiding under flat rocks. They are highly carnivorous and are often caught by fishermen, even in winter. Because of their unique appearance and unjustified reputation as predators of game fish, they are often killed when captured, even though they are harmless. Mudpuppies breed in fall, entering shallow water as the temperatures cool, but do not nest until the following spring. Females require moderately shallow water with plenty of large, flat rocks on the bottom beneath which they can deposit their eggs. Mudpuppies are the obligate host species for the larvae of the Salamander Mussel (*Simpsonaias ambigua*), a State Endangered species (Michigan Natural Features Inventory 2010).

### Bullfrog

The largest frog species in North America, Bullfrogs can reach lengths up to 8 inches. They occur throughout the Great Lakes region; however are absent from the northern Lake Superior basin (Holman 2012). Bullfrogs occupy nearly any still, permanent water habitats including lakes, farm ponds, impoundments, marshes, and shallow Great Lakes Bays. Prey can include any animal that can be captured and swallowed such as fish, amphibians, snakes, turtles, young waterfowl, and small mammals. A majority of their adult diet is made up of invertebrates while tadpoles feed on mostly algae and other aquatic plants. This species can be locally common; however populations have recently declined and are even extirpated from some areas of former abundance. Declines are attributed to habitat loss, water pollutions, and overharvesting (Harding and Mifsud 2017).



## References

- Bolton, R. M. and R. J. Brooks (2010). "Impact of the seasonal invasion of *Phragmites australis* (Common Reed) on turtle reproductive success." Chelonian Conservation and Biology **9**(2): 7.
- Carl H. Ernst, J. E. L. (2009). Turtles of the United States and Canada. Baltimore, Maryland, The Johns Hopkins University Press.
- Cooperrider, A. Y., R. J. Boyd, et al. (1986). Inventory and monitoring of wildlife habitat. Service Center, Denver, CO, U.S. Department of the Interior, Bureau of Land Management
- Derosier, A. L., S. K. Hanshue, et al. (2015). Michigan's Wildlife Action Plan. Lansing, MI, Michigan Department of Natural Resources.
- Guilfoyle, M. P. (2010). Implementing herpetofaunal inventory and monitoring efforts on Corps of Engineers project lands. Ecosystem Management and Restoration Research Program. Washington, DC, U.S. Army Corps of Engineers: 43.
- Harding, J. H. and J. A. Holman (1999). Michigan Frogs, Toads, and Salamanders. East Lansing, MI, Michigan State University Museum.
- Harding, J. H. and D. A. Mifsud (2017). Amphibians and Reptiles of the Great Lakes Region, 2nd Ed Ann Arbor, MI University of Michigan Press.
- Herpetological Resource and Management (2014). Amphibian and Reptile Status Review and Recommendations Michigan Amphibian and Reptile Technical Advisory Committee
- Holman, J. A. (2012). The amphibians and reptiles of Michigan: A quaternary and recent faunal adventure. Detroit, MI, Wayne State University Press.
- Michigan Natural Features Inventory. (2010). "Michigan's special animals Endangered, Threatened, Special Concern, and Probably Extirpated." Retrieved 10/27/2011, 2011, from [http://web4.msue.msu.edu/mnfi/data/special\\_animals\\_list\\_categorized.pdf](http://web4.msue.msu.edu/mnfi/data/special_animals_list_categorized.pdf).
- Mifsud, D. A. (2014). Stony and Celeron Islands Habitat Restoration Assessment Chelsea, MI., Herpetological Resource and Management, .
- Tulbure, M. G., C. A. Johnston, et al. (2007). "Rapid Invasion of a Great Lakes Coastal Wetland by Non-native *Phragmites australis* and *Typha*." Journal of Great Lakes Research **33**: 269-279.
- United States Environmental Protection Agency (1996). Detroit River Remedial Action Plan Report.
- Welsh, H. H. and S. Droege (2001). "A case for using Plethodontid salamanders for monitoring biodiversity and ecosystem integrity of North American forests." Conservation Biology **15**(3): 558-569.
- Westbrooks, R. G. (1998). "Invasive plants: changing the landscape of America." US Government Documents (Utah Regional Depository): 490.
- Yuan, Z., W. Zhou, et al. (2016). "Spatiotemporal diversification of the true frogs (genus *Rana*): a historical framework for a widely studied group of model organisms " Systematic Biology.