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Memo

TO: Kendra Gwin – City of Portage

FROM: Brian L. McKissen, PE, CFM

DATE: November 15, 2019 **PROJECT NO.:** 181663

RE: Hampton Creek Wetland Areas – Environmental Impacts Summary – DRAFT

Baseline assessment of natural features associated with the Hampton Creek Wetland Areas (Project Area) has been completed. Assessments were conducted pursuant to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) June 24, 2019 letter issued after the EGLE preapplication meeting on April 18, 2019. The Project Area consisted of Hampton Creek Bog, Greenspire Bog, Portage Creek and associated wetlands, an upland ridge between the Greenspire Bog and the Portage Creek wetlands, and Hampton Lake (see Figure 1, Location Map).

Information gleaned from the assessments and analysis will aid in development of stormwater design alternatives which mitigate impacts to the greatest extent possible and provide data for permit review. Specifically, baseline assessment was completed to identify and evaluate concerns associated with proposed construction of stormwater outlet that will transfer excess stormwater runoff from the Hampton Creek Bog, through the Greenspire bog, to an infiltration bed and overflow outlet adjacent to the Portage Creek wetland complex and Hampton Lake (see Figure 2, Proposed Outlets).

Provided below is a summary of the assessments, project concerns associated with natural resources, and proposed design strategies to mitigate concerns. The draft reports for each assessment, as noted below, will be finalized after receiving feedback from regulatory agencies during the planned project status meeting. The final reports will be submitted to EGLE as part of the joint permit application submittal.

- Technical Memo 1. Wetland Delineation, Hampton Creek Wetland Areas, City of Portage, Kalamazoo County, Michigan (Draft), completed by Fishbeck, dated November 13, 2019
- Technical Memo 2. Evaluation of Water Chemistry and Physical Parameters, Hampton Creek Wetland Areas, City of Portage, Kalamazoo County, Michigan (Draft), completed by Fishbeck, dated November 15, 2019
- Natural Features Assessment of Hampton Creek Wetlands, completed by the Michigan Natural Features Inventory (MNFI), dated October 8, 2019
- Technical Memo 3. Portage Creek Stream Stability Assessment (Draft), completed by Fishbeck, dated November 15, 2019
- Technical Memo 4. Hampton Creek Wetland Areas Flood Mitigation Hydraulic Report (Draft), completed by Fishbeck, dated November 15, 2019

Assessment Summary

Wetland Assessment

Fishbeck delineated wetland boundaries on August 9, 2019, in the vicinity of the proposed stormwater outlets and outfalls, including: Hampton Creek bog (HC) outlet, Greenspire bog (GS) outlet and outfall, and Portage Creek (PC) outfall. Attachment 1 indicates the locations of the delineated wetland boundaries and wetland determination sampling points. Vegetation, soils, and hydrology data was obtained at sampling points in each wetland and adjacent upland to confirm wetland and upland status. Saturated hydric soils, high groundwater, evidence of inundation and scrub-shrub, emergent, and forested wetlands were observed throughout the assessment areas. Adjacent upland generally consisted up mesic forest or forest remnant. Upland adjacent to the Greenspire bog inlet consisted of a steep embankment and the West Centre Avenue right-of-way.

Hampton Creek bog is approximately 76 acres in size and Greenspire bog is approximately 21 acres in size. The perimeter of both the Hampton Creek bog and the Greenspire bog have natural moats in the vicinity of the proposed outlets and outfalls. The proposed stormwater outlets and outfalls would be constructed near wetland associated with the outer edge of the moats. These wetlands consisted of scrub-shrub wetland (HC outlet), emergent/forested wetland (GS outfall), and forested wetland (GS outlet). These outer fringe plant communities were distinctly different from the plant communities in the bog interior.

The hillside between the Greenspire bog and the wetland contiguous with Portage Creek contained beech-maple forest dominated by sugar maple, American beech, and red oak trees. The proposed stormwater pipe would discharge into a limestone infiltration bed in upland upgradient of the Portage Creek wetland boundary. The adjacent wetland consisted of forested wetland dominated by black tupelo trees.

Michigan's Natural Resources and Environmental Protection Act, Act 451, Section 30301(d), states wetlands "contiguous to the Great Lakes or Lake St. Clair, an inland lake or pond, or a river or stream" or "more than 5 acres in size" are regulated by the State of Michigan. Delineated wetlands within the assessment area are all regulated due to their size. In addition, the Portage Creek wetlands are contiguous to a water feature.

A permit would be required from EGLE for any of the following activities impacting the delineated regulated wetlands:

- Placing fill or permitting the placement of fill.
- Dredging, removing, or permitting the removal of soil or minerals.
- Constructing, operating, or maintaining any use or development.
- Draining surface water.

Critical design considerations

1. Limit the physical disturbance within regulated wetland to the greatest extent possible during construction of the outlet/outfall structures and installation of storm pipes. Restore temporary wetland impact areas to pre-existing conditions.
2. Ensure appropriate sedimentation and erosion control during construction activities to prevent soil from entering wetlands.
3. Design the stormwater management system to ensure no alteration of wetland hydrology resulting in change of wetland type or conversion of wetland to open water. Ensure the stormwater management system does not dewater the bogs to below typical historic levels.
4. Address water quality differences between the bogs and the Portage Creek wetlands to ensure that water entering the Portage Creek wetlands does not impair wetland quality (further discussion of this issue below).

Water Quality Sampling

Sampling was conducted at 16 locations throughout the project area on August 14, 2019, and at three locations in the Hampton Creek bog on December 19, 2018, as noted in Attachment 2 (Sample Location Map). Surface water samples were collected in 2019 at the following locations:

- Hampton Creek bog: three samples within the perimeter moat near the proposed outlet structure
- Greenspire bog: four samples within the perimeter moat near and between the proposed outlet and outfall structures
- Portage Creek wetland: three samples in wetland collected in a transect from the proposed outlet to Portage Creek
- Portage Creek: three samples directly downgradient from the proposed outlet
- Hampton Lake: three samples

Sampling parameters during both sampling events included nutrients (ammonia nitrogen, nitrate nitrogen, nitrate nitrogen, and total phosphorus), pH, temperature, and specific conductance. Additional parameters during the December 2018 sampling event included *E. coli* and total coliforms. Additional parameters in the August 2019 sampling event included total suspended solids (TSS), dissolved oxygen, reduction-oxidation (Eh), and chlorophyll. In addition, Hampton Lake depth and transparency were evaluated. The lake had an average depth of 11 feet at the sampling locations and average transparency depth of 4.93 feet. Surface water data are summarized in Table 1.

The surface water data indicate significant pH differences between the wetlands and water features. pH values measured in the field during sampling consisted of the following:

- Hampton Creek Bog: pH 5.8 to 6.4 standard units (SU)
- Greenspire Bog: 4.2 to 6.1 SU
- Portage Creek wetland: 6.4 to 7.0 SU
- Portage Creek: 8.0 SU (at all three locations)
- Hampton Lake: 8.2 to 8.3 SU

The data confirm surface water in the bogs is acidic, while surface water in the Portage Creek wetland is slightly acidic to neutral, and Portage Creek and Hampton Lake are alkaline.

Surface water temperatures ranged from 18.8 to 24.4, with the warmest water found in Hampton Lake and the coolest water in Hampton Lake bog. Portage Creek water temperatures were similar to those measured in the two bogs.

At eight sample locations, ammonia nitrogen concentrations exceeded the Part 31, Rule 57 Final Chronic Value of 0.029 milligrams per liter (mg/L), the Part 31, Rule 57 Aquatic Maximum Value of 0.16 mg/L, and the Part 31, Rule 57 Final Acute Value of 0.32 mg/L. These exceedances were observed in the Hampton Lake bog (four locations), Greenspire bog (two locations), and Portage Creek wetland (three locations). Hampton Lake and Portage Creek water samples did not contain detectable concentrations of ammonia nitrogen.

EGLE requested evaluation of water chemistry and physical parameters of the contributing wetlands and receiving water bodies. Obtaining surface water samples in the bogs was relatively easy due to the presence of perimeter moats which contained standing water. Collecting water samples in the Portage Creek wetland was more problematic, due to lack of standing water. Field notes indicate the Portage Creek wetland samples were collected in surface water 0.1 to 0.3 foot deep. Water samples were black and contained visible organic matter.

Likewise, Sample SW-10 (in Greenspire Bog) was collected in 0.4 foot of surface water and the sample was dark brown with thick organic matter. All four of these samples had extremely high TSS levels and turbidity.

Total phosphorus concentrations correlated directly with TSS levels in all the water samples. This suggests organic matter was a primary source of phosphorus. Consequently, the presence of suspended solids in these water samples biased the data.

Critical design considerations

1. Routing acidic stormwater from the bogs into alkaline systems (Portage Creek and Hampton Lake) presents a design challenge. The Portage Creek wetland may provide a buffering environment. Surface water collected from this wetland had a neutral pH. Pretreating the discharged stormwater by routing it through a limestone infiltration filter would also assist in raising the water's pH before it reaches alkaline environments.
2. Limiting the amount of stormwater that reaches the receiving waters would also decrease potential pH impacts. Integrating an infiltration system between the bogs and/or between the Greenspire bog and the Portage Creek wetland would provide benefit in limiting pH impact to the receiving water.
3. Infiltrating the stormwater upland of the Portage Creek wetlands will decrease suspended solids and phosphorus inputs to the receiving waters.
4. Although, significant water temperatures variations were not observed at the time of sampling, it should be noted that if the bogs are subject to warming relative to Portage Creek during the summer months, the increase in temperature will be mitigated by infiltrating the excess stormwater upland of the Portage Creek wetlands.

Natural Features Assessment

MNFI completed an extensive survey of Hampton Creek bog, Greenspire bog, the Portage Creek wetland complex, the western edge of Hampton Lake, and a forested ridge between the Greenspire bog and the Portage Creek wetland complex (Figure 1 in Attachment 3). The survey was completed in August 2019 with the intent to identify and document plants, birds, amphibians, reptiles, and natural communities within the respective areas. Key component of the survey focused on evaluating for the presence of state and federal protected (threatened [T] and endangered [E]) species and/or their habitat. The survey also evaluated for the presence of invasive plant species and assessed surficial soil (including pH) within each landscape unit.

MNFI reviewed their database of known occurrences of rare species (including Special Concern [SC] species, which are not legally protected), within one mile of the project area. Table 2 summarizes the rare species historically documented within one-mile of the project area. The list includes one species with a federal status: eastern massasauga snake (*Sistrurus catenatus*), which is federally threatened. The list also contains five state endangered, 12 state threatened, and 14 special concern species. Federal T and E species are protected under the Federal Endangered Species Act, while state T and E species are protected under Part 365 of the Natural Resources and Environmental Protection Act, 451 of 1994. Review and approval of project impacts is necessary for permit issuance. SC species are not protected under federal or state law, but due care and diligence to minimize impacts to these species should be given.

Table 3 summarizes data collected during MNFI's survey, including plant communities, rare species, invasive species, surficial soil type, soil pH, and existing threats observed in each area. Table 4 provides additional information regarding rare species observed during the field survey.

Hampton Creek Bog and Greenspire Bog

Hampton Creek bog and Greenspire bog both exhibit typical characteristics associated with bogs: muck and peat soils overlaid with *Sphagnum* moss, low pH soil, perimeter moats, and low plant diversity. Hampton Creek bog is a high-quality bog dominated by native species, while the Greenspire bog is of lesser quality with more historic

disturbance and well-established colonies of invasive species throughout it. Bogs are less common in southwest Michigan than the rest of Michigan, and when present, are usually small. The Hampton Creek bog is notable due to its relatively large size (approximately 76 acres). No rare species were observed in either bog. Although two protected plant species (whorled pogonia and orange-fringed orchid) may occur in bogs, the MNFI report stated the high density of shrubs in the Hampton Creek and Greenspire bogs do not provide appropriate habitat for these species.

Stormwater has appeared to adversely impact both bogs, although impacts were most notable in the Greenspire bog. Stormwater enters the Hampton Creek bog through an outfall at the southwest end of the bog. This area of the bog contained well-established colonies of invasive species and shallow open water. Similarly, stormwater discharge in the northwest corner of Greenspire bog introduces pollutants from surrounding areas, especially Center Avenue. The plant community observed in this area is not typically found in bogs and contained a high prevalence of invasive species. Pollutant and nutrient loading from stormwater runoff are the biggest threats to the Hampton Creek bog and Greenspire bog. In addition, the Greenspire bog had an area of dead or dying tamarack trees, which may be associated with a rise in water levels from rain events, stormwater runoff, and increased groundwater levels.

Forested Ridge

A forested ridge separates the Greenspire bog and the Portage Creek wetland complex. The ridge contains mature upland forest with a relatively open understory. Invasive shrubs (multiflora rose, autumn olive, and Tartarian honeysuckle) were present in the sparse shrub layer. No rare species were observed in the forested ridge within the project area. However, the ridge may provide nesting habitat for turtles, including for three SC species known to occur in the vicinity of the project area.

Portage Creek Wetland Complex

The Portage Creek Wetland Complex is referred to as the Hampton Creek Wetland Complex in the MNFI report. Approximately 50 acres of the 75-acre wetland complex consists of southern hardwood swamp, which is mostly in the eastern portion of the complex. In addition, the complex contains prairie fen, rich tamarack swamp, southern shrub-carr, southern wet meadow, wet-mesic prairie (see Figure 2 in Attachment 3). A moat of open water 3 to 20 meters wide surrounds the entire wetland complex. Portage Creek traverses through the wetland complex. The wetland complex is groundwater fed and contains an abundance of invasive species, including purple loosestrife, glossy buckthorn, multiflora rose, hybrid cattail, narrow-leaved cattail, and reed canarygrass.

Six rare plant species and one rare animal species were found in the wetland complex during several site visits in August. Cut-leaved water parsnip (state threatened) was found in extensive areas along Hampton Creek, along the edge of wet meadow and prairie fen pockets, and in the open areas of the rich tamarack swamp (see Figure 4 in Attachment 3). Four additional rare species were observed at the west end of the study area. No rare species were observed near the proposed stormwater outfall.

Cut-leaved water parsnip (T)

Hampton Lake Riparian Zone

Hampton Lake is a 20-acre, hard water lake surrounded entirely by wet meadow dominated by a variety of invasive species. The only rare species observed along the edge of the lake was a small patch of cut-leaved water parsnip. The most significant threat to the lake and adjacent wetland was well-established colonies of several highly invasive wetland plant species.

Recommendations for Additional Surveys

MNFI indicated that several plant and animal species have the potential to occur at the site but were not observed during the field investigation due to the time of year in which the survey was conducted. The field survey was limited to late summer, while spring surveys are the optimal time for assessing for the presence of some of the rare species that may be present. Table 5 in Attachment 3 lists species of concern that MNFI recommended be surveyed during April, May, and/or June. The MNFI report also provided a summary of recommended survey methodology for each listed herpetofauna (frog, turtle, or snake species).

Critical design considerations

Impacts on natural resources associated with the proposed construction of the stormwater outlet fall into four categories and are described below:

1. *Movement of Non-Native Invasive Species.* Introduction of water from Hampton Creek bog to downstream areas has potential to transfer invasive species from one area to another. However, of the 26 non-native invasive species observed within the study area, the four most prolific species (purple loosestrife, hybrid cattail, glossy buckthorn, and multiflora rose) are already present in high densities within the Portage Creek wetland complex and the Hampton Lake shoreline. Therefore, installation of the proposed stormwater management system is likely to have a minimal or negligible impact on these wetlands with regards to movement of invasive species. In addition, impacts to Greenspire bog will be neutral to negligible because populations of purple loosestrife and glossy buckthorn are well established.

   If stormwater inputs from the proposed stormwater management system changes site hydrology (volume, pH, and water temperature), these changes may create conditions more suitable for invasive species and less suitable for native species. The changes could facilitate the expansion of existing invasive species populations and associated degradation of small pockets of remnant native-dominated habitats. Therefore, engineering controls should minimize stormwater inputs to the downstream wetlands and water features to the greatest extent possible.

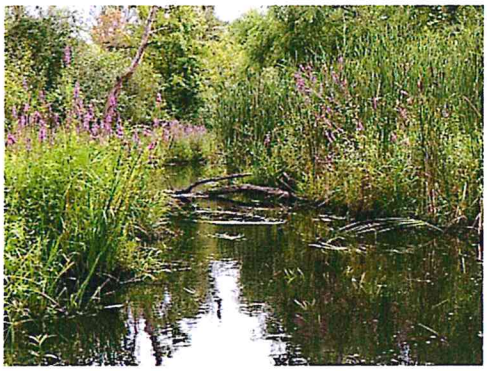
2. *Impacts to Rare Plants.* Rare plants are highly sensitive to changes in hydrology, pH, erosion, pollution, soil alterations, and invasive plants. No rare plants were identified near the proposed outfall locations. The closest and most prolific rare plant identified in the study was cut-leaved water parsnip, located approximately 150 feet from the upland ridge outfall to the shores of Hampton Lake. Cut-leaved water parsnip is also located along Portage Creek approximately 200 feet from the outfall. This species requires cold, calcareous water. Therefore, the pH difference between water originating in the bogs (pH 4.5) and the pH in Pigeon Creek and Hampton Lake (pH 6.5 to 8.0) is of concern. The MNFI report inaccurately states the pH in the bogs is almost 10,000 times higher than in the Hampton Creek wetland complex. Due to the exponential nature of the pH scale, the difference is 100 to 3,162 times greater. In addition, the MNFI report did not take into consideration the buffering capacity of the natural environment within the study area. Regardless, providing pretreatment of the acidic stormwater to neutralize it and limiting the volume of stormwater discharge to the alkaline environments provides strategies to reduce the threat to rare species and their environment.

3. *Impacts to Rare Animal.* The MNFI report expressed concern that the proposed stormwater inputs will increase in water levels (flooding), sedimentation, pollutants, and turbidity in the downstream receptors. This, in turn, could adversely impact animal habitat, foraging, resting, and breeding areas. These impacts can only be understood once details regarding timing, duration, and volume of water that will be added to the wetland complex are understood. Fishbeck's *Hampton Creek Wetland Areas Flood Mitigation Hydraulic Report* investigated these concerns (see below).

4. *Impacts to Water Chemistry and Hydrology*. The MNFI report stated that introduction of highly acid water from the bogs to the wetland complex, Portage Creek and Hampton Lake has potential to modify plant

composition, including reduction in cut-leaved water parsnip. Changes in hydrology could alter soils, plant species, animal behavior, aquatic habitat, and increase the prevalence of invasive species. Increased variability in water level fluctuations has the potential to adversely impact the ecology in the Portage Creek wetland complex, Portage Creek, and Hampton Lake. Therefore, completing a thorough hydrologic and hydraulic analysis of the proposed stormwater inputs is essential for mitigating unacceptable impacts.

Stream Assessment – Portage Creek



Fishbeck conducted a stream stability assessment on Portage Creek on August 19, 2019. The assessment extended approximately 2,000 lineal feet upstream of Hampton Lake and 5,217 lineal feet downstream from the lake to Oakland Drive (see map in Attachment 4). Sections of Portage Creek upstream of the assessment area were not inspected due to accessibility constraints but were determined to be similar to those sections visually inspected given the expansive natural area the Creek traverses.

Geomorphic indicators of stream stability, including but not limited to erosion, sediment transport, floodplain connectivity, channel pattern, and vegetation were evaluated. Topographic survey of channel cross section and profile was not conducted. Two distinct geomorphic units, 1) upstream of Hampton Lake and 2) downstream of Hampton Lake, were identified based upon difference in channel pattern, the creek's corridor (i.e. wooded or wetland), and unique morphologic features. Historic straightening, dredging, and maintenance activities downstream of Hampton Lake are the most significant differences between the two areas.

Both reaches of the creek have stable channel morphology, good sediment transport, little to no impairments, and are supporting a variety of fish and aquatic wildlife. Upstream of Hampton Lake, the creek is very stable and flows through and adjacent to large wetland complexes and has direct connection with wetland and floodplain areas. Downstream of Hampton Lake, the creek traverses primarily wooded corridors, and has somewhat limited floodplain connectivity. Intermittent areas of erosion and bank slumps were also noted in this area due to groundwater seeps.

Critical design considerations

To prevent impacts to Portage Creek, project design should address the following:

1. Maintain existing stream hydrology and water temperature to ensure fish and aquatic wildlife species continue to be supported.
2. Prevent increased sediment loading to sustain stable channel morphology and preserve existing fish and aquatic habitats.
3. Provide minimal to no increase in peak discharge to Portage Creek to ensure no channel bed scour or streambank erosion.
4. Maintain existing water quality to support fisheries and aquatic habitat.

Hydrologic and Hydraulics Assessment

The Hampton Creek Wetlands, a 76-acre wetland bog with an another approximately 9 acres of open water, is located northeast of the West Center Avenue/US-131 intersection and has been subject to sustained abnormally high-water levels. The high-water levels can be attributed to sustained high groundwater table, significant stormwater runoff volumes, and the lack of a natural stormwater outlet from the bog. A typical characteristic of bogs is that they do not have a natural stormwater outlet. The surrounding contributing watershed to the Hampton Creek Wetland is fully developed and includes residential, commercial, recreational, and highway areas which contribute to excess stormwater runoff levels. The result of these conditions is flooding impacts to

residential homes and flooding of the Moors Golf Club. This hydrologic/hydraulic analysis evaluated whether a proposed stormwater outlet from the Hampton Creek Wetlands would result in adverse flooding to downstream receiving waters.

Proposed Outlet

In general, site topography within the project area slopes down to the south toward Portage Creek, which is approximately 0.25 mile south of the Hampton Creek Wetlands. Portage Creek was identified as a natural outlet for the Hampton Creek Wetlands, although it was recognized that the proposed stormwater outfall may discharge stormwater to the creek at rates and volume above what the creek currently receives, if not properly managed. The proposed stormwater outlet would need to mitigate any potential increases to the peak discharge of the creek during storm events to prevent any increases to flooding and impacts to stream stability.

In addition to the hydraulic impacts, the proposed outlet must address potential environmental impacts previously discussed in the above sections.

The proposed outlet consists of a restricted riser structure at the south end of the Hampton Creek Wetlands, which then discharges through an enclosed storm sewer and outfall into the north end of the Greenspire Wetland near an existing storm sewer outfall. A small weir and open ditch will serve as the outlet from the south end of the Greenspire Wetland within the Gourdneck State Game Area. The open ditch will then be collected into an enclosed storm sewer that discharges into a limestone infiltration bed. The limestone infiltration bed will be located in an upland ridge between the Greenspire Wetland and the Portage Creek Wetland. It will infiltrate the stormwater into the ridge's naturally occurring sandy soils. The stone infiltration bed will have an overflow pipe that will discharge to the Portage Creek Wetland for storm events that are 50-year, 24-hour events or greater.

The overflow elevations of the Hampton Creek Wetlands and Greenspire Wetlands were determined by Fishbeck's hydraulics engineer and wetland specialist. Indicators such as ordinary high-water marks, soils, and plant communities were evaluated to determine the normal high-water elevations within the bogs. Two locations on opposite sides of each wetland (four total) were evaluated to set the high-water elevations. Stakes were placed at the apparent high-water elevation at each location. The stake locations and elevations were surveyed by Fishbeck surveyors.

A hydrologic/hydraulic model of the proposed outlet was prepared in HydroCAD. Watersheds for the Hampton Creek Wetland, Greenspire Wetland, and Portage Creek were delineated based on available two-foot contours. Field inspections were completed to verify stormwater connectivity and confirm several depressional areas within the watersheds that are not contributing to stormwater runoff.

Overflow elevations at the outlets for the two bogs were set at the normal high-water levels. Several storm events were routed through the HydroCAD model, including 2-, 10-, 50-, and 100-year, 24-hour storm events. The model indicated the limestone infiltration bed was able to infiltrate the 2- and 10-year events but began overflowing at the 50-year event. An overflow pipe will discharge excess water to an outfall constructed at the base of the hillside adjacent to the Portage Creek Wetland.

The limestone infiltration bed serves to mitigate water quality concerns by infiltrating the more frequent storm events. Also, the infiltration system mitigates the potential migration of invasive species to downstream receptors by trapping seeds and other propagules. When larger, more infrequent events do occur and the stormwater overflows to the Portage Creek Wetlands, it is routed through the limestone infiltration bed prior to overland discharge to reduce the acidity of the bog water before entering the Portage Creek wetland complex.

A composite hydrograph was developed for Portage Creek at the entrance to Hampton Lake to evaluate the flood flow impacts to the creek from the proposed stormwater outlet discharge. The hydraulic model demonstrated that the proposed outlet would not begin discharging to the Portage Creek Wetlands until after the flood flows

from the storm event have been routed through the creek. Therefore, the proposed outlet will not increase flood flows downstream of the outlet. The composite hydrograph for a 100-year, 24-hour storm event is shown in Figure 3.

Project Concerns and Mitigating Measures

Unique and important ecological features exist within the Project Area. Project design must maintain critical features, such as hydrology and water chemistry, or minimize these impacts to the greatest extent possible. A summary of potential resource impacts and design alternatives to mitigate impacts are provided below.

Summary of Concerns and Design Approaches

Concern	Potential Impacts on Resources	Mitigating Design	Purpose
Acidification of alkaline surface water (Portage Creek and Hampton Lake) and groundwater (Portage Creek Wetland)	Change in plant communities; loss of rare species; spread of invasive species	Rock limestone infiltration bed with geotextile fabric upland of Hampton Creek wetland complex.	Infiltrate and neutralize acidic stormwater
Changes in hydrology	Alteration of plant species; increased water temperature; alteration of animal and aquatic species behavior and habitats; increased invasive species; increased sediment load	Maintain existing hydrology using release rates designed to support existing vegetation, aquatic and wildlife behaviors and habitats, and soil. Maintain historic high-water levels at bogs. Infiltrate stormwater upland of the Hampton Creek wetlands to mitigate increases in stormwater runoff to wetlands.	Ensure no modification of plant species, loss or alteration of aquatic and wildlife habitat and behaviors
Increase in flood flow values of Portage Creek	Increased flooding to properties. Adverse impacts to channel.	Rock infiltration bed with geotextile fabric upland of Portage Creek wetlands.	Infiltrate water to ensure no increase in runoff to the Portage Creek wetlands and Portage Creek.
Increased pollutants/nutrients	Decreased water quality; increased invasive species; degraded aquatic and wildlife habitat	Rock limestone infiltration bed with geotextile fabric upland of Portage Creek wetlands.	Capture/infiltrate pollutants and nutrients to protect downstream areas
Transfer of invasive species	Overtake native species; decreased wetland values and functions	Maintain existing hydrology. Rock limestone infiltration bed with geotextile fabric upland of Portage Creek wetlands.	Ensure soils and environment are not degraded such to promote increase in invasive species
Increased sediment load	Impair aquatic habitat; create instability in Portage Creek; degraded water quality	Rock limestone infiltration bed with geotextile fabric upland of Portage Creek wetlands.	Capture sediment to minimize transport to downstream areas; maintain stability in Portage Creek; promote good water quality and dissolved oxygen levels in water column; prevent covering of substrate and aquatic habitat areas. Control release rates to reduce flashiness and opportunity for scour.

Summary of Concerns and Design Approaches

Concern	Potential Impacts on Resources	Mitigating Design	Purpose
Increased water temperature	Alter aquatic/fish habitat; impair water quality; alter plant species	Maintain existing hydrology through designed release rates. Rock limestone infiltration bed with geotextile fabric upland of Portage Creek wetlands.	Maintain existing water levels to prohibit vegetative growth and maintain exiting aquatic habitat

By email

Tables

Table 1 - Surface Water Data Summary
Portage Creek Wetland Assessment - Evaluation of Water Chemistry and Physical Parameters
City of Portage, Kalamazoo County, Michigan

Compound: / *CAS Number:* / *Units:*		Nitrogen, Ammonia 7664-41-7 mg/L	Nitrogen, Nitrate 14797-55-8 mg/L	Nitrogen, Nitrite 14797-65-0 mg/L	Phosphorus, Total 7723-14-0 mg/L	Solids, Total Suspended mg/L	E. coli -- CFU/100 mL	Total Coliforms -- CFU/100 mL	pH -- S.U.	Temperature -- °C	Specific Conductance -- umhos/cm	Eh -- mV	Dissolved Oxygen -- mg/L	Turbidity -- NTU	Chlorophyll -- mg/L
Monitoring Location	Collection Date														
SW-01 Hampton Lake Bog	12/19/2018	0.10 U	0.050 U	0.010 U	0.18	--	122.4	260.3	7.3	2.1	90	--	--	--	--
SW-02 Hampton Lake Bog	12/19/2018	**0.10**	0.050 U	0.010 U	0.50	--	60.5	143.0	5.6	0.0	320	--	--	--	--
SW-03 Hampton Lake Bog	12/19/2018	0.10 U	0.050 U	0.010 U	0.10	--	36.9	165.8	6.4	1.0	250	--	--	--	--
SW-04 Hampton Lake Bog	8/14/2019	**1.2**	0.050 U	0.010 U	0.25	14	--	--	6.4	18.9	130	280	1.0	3.8	0.03092
SW-05 Hampton Lake Bog	8/14/2019	**1.1**	0.050 U	0.014	0.39	20	--	--	6.0	19.0	130	280	1.0	2.5	0.2478
SW-06 Hampton Lake Bog	8/14/2019	**1.4**	0.050 U	0.012	0.38	20	--	--	5.8	18.8	140	290	1.3	4.7	0.09343
SW-07 Greenspire Bog	8/14/2019	0.10 U	0.050 U	0.010 U	0.33	325	--	--	6.1	20.1	270	280	1.0	20	0.18469
SW-08 Greenspire Bog	8/14/2019	0.10 U	0.050 U	0.012	0.17	102	--	--	5.8	22.7	110	280	3.9	27	0.04807
SW-09 Greenspire Bog	8/14/2019	**0.35**	0.050 U	0.015	0.11	7.0	--	--	4.8	20.0	40	330	1.6	1.1	0.36134
SW-10 Greenspire Bog	8/14/2019	**1.2**	0.050 U	0.049	3.70	1,380	--	--	4.2	18.7	50	370	0.8	1,090	0.10013
SW-11 Portage Creek Wetland	8/14/2019	**2.8**	0.050 U	0.010 U	6.50	3,640	--	--	6.4	20.5	190	220	0.4	820	0.01684
SW-12 Portage Creek Wetland	8/14/2019	**2.4**	0.050 U	0.010 U	19.1	5,120	--	--	6.7	21.3	380	150	0.2	OR	0.00562
SW-13 Portage Creek Wetland	8/14/2019	**1.5**	0.050 U	0.010 U	42.1	27,700	--	--	7.0	21.6	340	140	0.1	OR	0.00268
SW-14 Hampton Lake	8/14/2019	0.10 U	0.30	0.018	0.050 U	12	--	--	8.2	24.7	560	240	11.1	3.1	0.000920
SW-15 Hampton Lake	8/14/2019	0.10 U	0.32	0.018	0.050 U	9.0	--	--	8.3	23.9	570	240	8.1	3.6	0.002477
SW-16 Hampton Lake	8/14/2019	0.10 U	0.40	0.017	0.050 U	8.0	--	--	8.2	24.4	570	240	7.1	2.6	0.00284
SW-17 Portage Creek	8/14/2019	0.10 U	0.96	0.010 U	0.050 U	8.0	--	--	8.0	20.4	620	250	7.4	0.7	0.000268
SW-18 Portage Creek	8/14/2019	0.10 U	0.97	0.010 U	0.11	59	--	--	8.0	19.6	600	250	6.8	6.8	0.00892
SW-19 Portage Creek	8/14/2019	0.10 U	0.97	0.010 U	0.050 U	5.0 U	--	--	8.0	19.7	600	250	7.6	0.7	0.00156
Drinking Water HNV[(1)]		*ID**	*10*	--	--	--	--	--	--	--	--	--	--	--	--
Non-Drinking Water HNV[(1)]		*ID**	*NLS*	--	--	--	--	--	--	--	--	--	--	--	--
Wildlife Value[(1)]		*NA*	*NA*	--	--	--	--	--	--	--	--	--	--	--	--
Drinking Water HCV[(1)]		*NA*	*NA*	--	--	--	--	--	--	--	--	--	--	--	--
Non-Drinking Water HCV[(1)]		*NA*	*NA*	--	--	--	--	--	--	--	--	--	--	--	--
Final Chronic Value[(1)]		*0.029*	*NLS*	--	--	--	--	--	--	--	--	--	--	--	--
Aquatic Maximum Value[(1)]		*0.16*	*NLS*	--	--	--	--	--	--	--	--	--	--	--	--
Final Acute Value[(1)]		*0.32*	*NLS*	--	--	--	--	--	--	--	--	--	--	--	--

Bolded values exceed an applicable criterion.

Data Qualifiers:

U Not detected

Footnotes/Abbreviations:

[(1)] Act 451, Part 31, Rule 57 Water Quality Values, Surface Water Assessment Section, MDEQ, March 15, 2018.

* the lowest HNV, Wildlife Value, HCV or Final Chronic Value given for this chemical will adequately protect the uses identified with an ID*

HCV human cancer value

HNV human noncancer value

ID insufficient data to derive value

NA not applicable

NLS no literature search has been conducted

NTU nephelometric turbidity units

OR over range

SU standard units

Table 2 – Summary of Rare Species Documented within One-Mile Radius of Project Area
Michigan Natural Features Inventory Rare Species Database Review
Hampton Creek Wetland
City of Portage, Kalamazoo County, Michigan

Scientific Name	Common Name	Category	Federal Status	State Status
Acris blanchardi	Blanchard's cricket frog	Animal		T
Amorpha canescens	Leadplant	Plant		SC
Arnoglossum plantagineum	Prairie Indian-plantain	Plant		SC
Asclepias purpurascens	Purple milkweed	Plant		T
Berula erecta	Cut-leaved water parsnip	Plant		T
Boechera missouriensis	Missouri rock-cress	Plant		SC
Calamagrostis stricta ssp. Stricta	Narrow-leaved reedgrass	Plant		T
Callophrys irus	Frosted elfin	Plant		T
Carex straminea	Straw sedge	Plant		E
Cirsium hillii	Hill's thistle	Plant		SC
Clemmys guttata	Spotted turtle	Animal		T
Clonophis kirtlandii	Kirtland's snake	Animal		E
Coreopsis palmata	Prairie coreopsis	Plant		T
Cuscuta pentagona	Dodder	Plant		SC
Cuscuta polygonorum	Knotweed dodder	Plant		SC
Cypripedium candidum	White lady slipper	Plant		T
Draba reptans	Creeping whitlow grass	Plant		T
Emydoidea blandingii	Blanding's turtle	Animal		SC
Eryngium yuccifolium	Rattlesnake-master	Plant		T
Gentiana alba	White gentian	Plant		E
Isotria verticillata	Whorled pogonia	Plant		T
Lygodium palmatum	Climbing fern	Plant		E
Penstemon pallidus	Pale beard tongue	Plant		SC
Platanthera ciliaris	Orange-fringed orchid	Plant		E
Scleria triglomerata	Tall nut rush	Plant		SC
Silphium integrifolium	Rosinweed	Plant		T
Sistrurus catenatus	Eastern massasauga	Animal	T	SC
Sphaerium fabale	River fingernail clam	Animal		SC
Stenelmis douglasensis	Douglas stenelmis riffle beetle	Animal		SC
Terrapene carolina carolina	Eastern box turtle	Animal		SC
Viburnum prunifolium	Black haw	Plant		SC

Notes: T = Threatened, E = Endangered, SC = Special Concern

Table 3 – Summary of Data Obtained during MNFI's Field Survey, August 2019
Hampton Creek Wetland Study Area
City of Portage, Kalamazoo County, Michigan

Survey Area	Plant Communities	Observed Rare Species	Invasive Species	Surficial Soil	Surficial Soil pH	Existing Threats
Hampton Creek Bog	High quality bog	None	Glossy buckthorn, hybrid cattail and purple loosestrife, low in abundance and restricted to margins of bog.	Sphagnum moss and peat	4.5	Surrounding urban development, stormwater inputs at southwest corner.
Greenspire Bog	Bog, more disturbed and invaded than the Hampton Creek bog	None	Glossy buckthorn throughout, purple loosestrife in perimeter moat	Sphagnum moss and peat	4.5	Stormwater from Centre Avenue and adjacent residential property. Loss of forest buffer from new apartment complex. Invasive buckthorn throughout bog.
Forested Ridge	Dry-mesic southern forest	None	Multiflora rose, autumn olive, and Tartarian honeysuckle	Fine sand	6.5	Historic disturbance from development of dirt road and parking area. Red pine plantation.
Portage Creek Wetland Complex	Southern hardwood swamp (dominant), prairie fen, rich tamarack swamp, southern shrub-carr, southern wet meadow, wet-mesic prairie	Cut-leaved water parsnip along Hampton Creek. Four additional rare species at west end of study area. None near proposed stormwater outfall.	Most of the complex was dominated by purple loosestrife, glossy buckthorn, multiflora rose, hybrid cattail, narrow-leaved cattail, and reed canarygrass.	Sapric peat and muck	8.0 in fen, tamarack swamp, and hardwood swamp; 6.5 at the east end of the hardwood swamp.	Extensive presence of invasive plants. Historic ditching, logging, fire suppression, channelization, and stormwater runoff impacts.
Hampton Lake Riparian Zone	Southern wet meadow	Cut-leaved water parsnip	Glossy buckthorn and multiflora rose (dense thickets); Purple loosestrife, narrow-leaved cattail, and hybrid cattail (dominant). Small populations of curly pondweed and common reed.	Muck	8.0	Extensive presence of invasive plants

Table 4 – Rare Species Observed During MNFI Field Survey, August 2019
Hampton Creek Wetland Study Area
City of Portage, Kalamazoo County, Michigan

Scientific Name	Common Name	State Status	Description
Amorpha canescens	Leadplant	SC	Several small populations found outside study area
Berula erecta	Cut-leaved water parsnip	T	Extensive population found throughout open, wet areas in Portage Creek wetland complex. Small population on north side of Hampton Lake.
Eryngium yuccifolium	Rattlesnake-master	T	Three individual plants in wet-mesic prairie on the north edge of the Hampton Creek wetland complex
Scleria triglomerata	Tall nut rush	SC	A few individuals found in wet-mesic prairie on the north edge of the Hampton Creek wetland complex
Silphium integrifolium	Rosinweed	T	Two small populations in two small openings along Portage Creek
Terrapene carolina carolina	Eastern box turtle	SC	One adult in seepy rivulet, south of Portage Creek

Notes: T = Threatened, E = Endangered, SC = Special Concern

Table 5 – Rare Species Recommended by MNFI to be Surveyed in Spring 2020

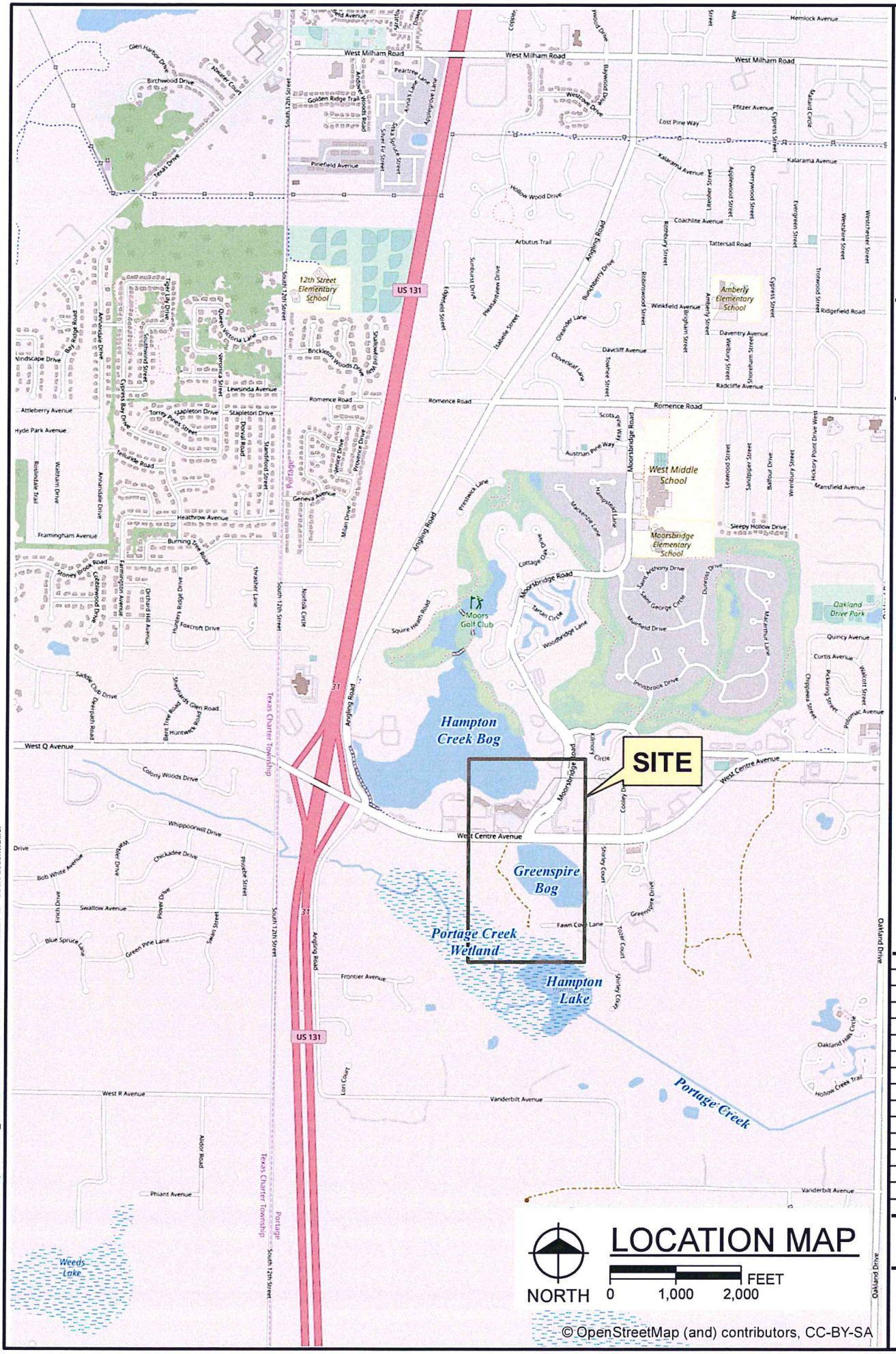
Hampton Creek Wetland Study Area

City of Portage, Kalamazoo County, Michigan

Scientific Name	Common Name	Category	Federal Status	State Status
Acris blanchardi	Blanchard's cricket frog	Animal		T
Carex straminea	Straw sedge	Plants		E
Clemmys guttata	Spotted turtle	Animal		T
Clonophis kirtlandii	Kirtland's snake	Animal		E
Cypripedium candidum	White lady slipper	Plant		T
Emydoidea blandingii	Blanding's turtle	Animal		SC
Isotria verticillate	Whorled pogonia	Plant		T
Lgodium palmatum	Climbing fern	Plant		E
Sistrurus catenatus	Eastern massasauga	Animal	T	SC
Terrapene carolina carolina	Eastern box turtle	Animal		SC

Notes: T = Threatened, E = Endangered, SC = Special Concern

Figures



LOCATION MAP

fishbeck, thompson, carr & huber, inc.

engineers
scientists
architects
constructors

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City of Portage
Kalamazoo County, Michigan
Hampton Creek Wetland Area Evaluation

PROJECT NO.
181663

FIGURE NO.
1

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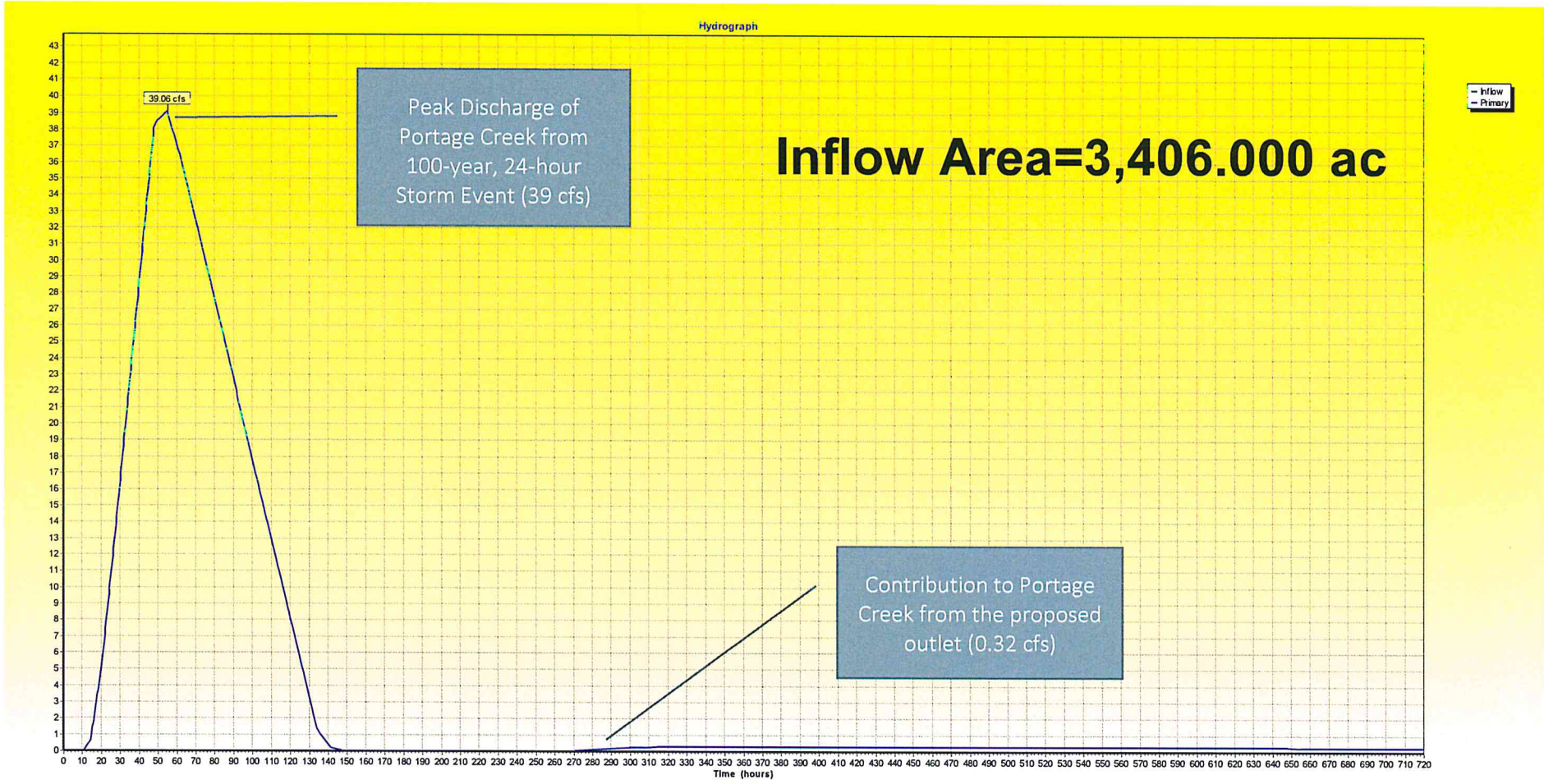
RESTRICTED OUTLET
MOORSBRIDGE RD
W CENTRE AVE
Greenspire Bog
OUTLET
STORM WATER INFILTRATION BED
FOX COVE LN
Portage Creek Wetland
Portage Creek

Figure 3. Portage Creek Composite Hydrograph, 100-year, 24-hour Storm Event



Attachment 1


HC WET
HC UP
GSI WET
GSI UP
OUTFALL
Greenspire Bog
OUTLET
GSO WET
GSO UP
STORM WATER INFILTRATION BED
PC UP
PC WET
OUTFALL
Portage Creek Wetland

Attachment 2


SW-01
SW-02
SW-03
SW-04
SW-05
SW-06
SW-07
SW-08
SW-09
SW-10
SW-11
SW-12
SW-13
SW-14
SW-15
SW-16
SW-17
SW-18
SW-19
Storm Water Infiltration Bed
Hampton Creek Bog
Greenspire Bog
Portage Creek Wetland
Hampton Lake
Portage Creek
Moors Bridge Rd
W Centre Ave
Old Centre Ave
Angling Rd
US-131 N
US-131 S
Oak Shore Dr
Cottage Oak Dr
Oak Shore Dr S
Tartan Cir
Moors Golf Club
St Anthony Dr
Turnberry Ct
St George Cir
Muirfield Dr
Innisbrook Dr
Hillsmoor Ln
Wadsworth Ln
Heather Ridge Dr
Kilmory Cir
Wimbledon Dr
Cooley Ct
Cooley Dr
Shirley Ct
Stonebridge Ct
Greenspire Dr
Fawn Cove Ln
Tozer Ct
Squire Heath Rd
W St Andrews Cir
E St Andrews Cir
Woodbridge Ln
Glenkerry Ct
Geneva Ave
Blackburn Ave
Salzburg Cir
Oldenburg Ln
Salerno Cir
Milan Dr
Norfolk Cir
Prestwick Ln
Mackenzie Ln
Hampstead Ln
Moors Bridge
Frontier Ave
Hunterstead Ln
Conestoga St
Wishing Well Ct
Portage
12th St S

Attachment 3

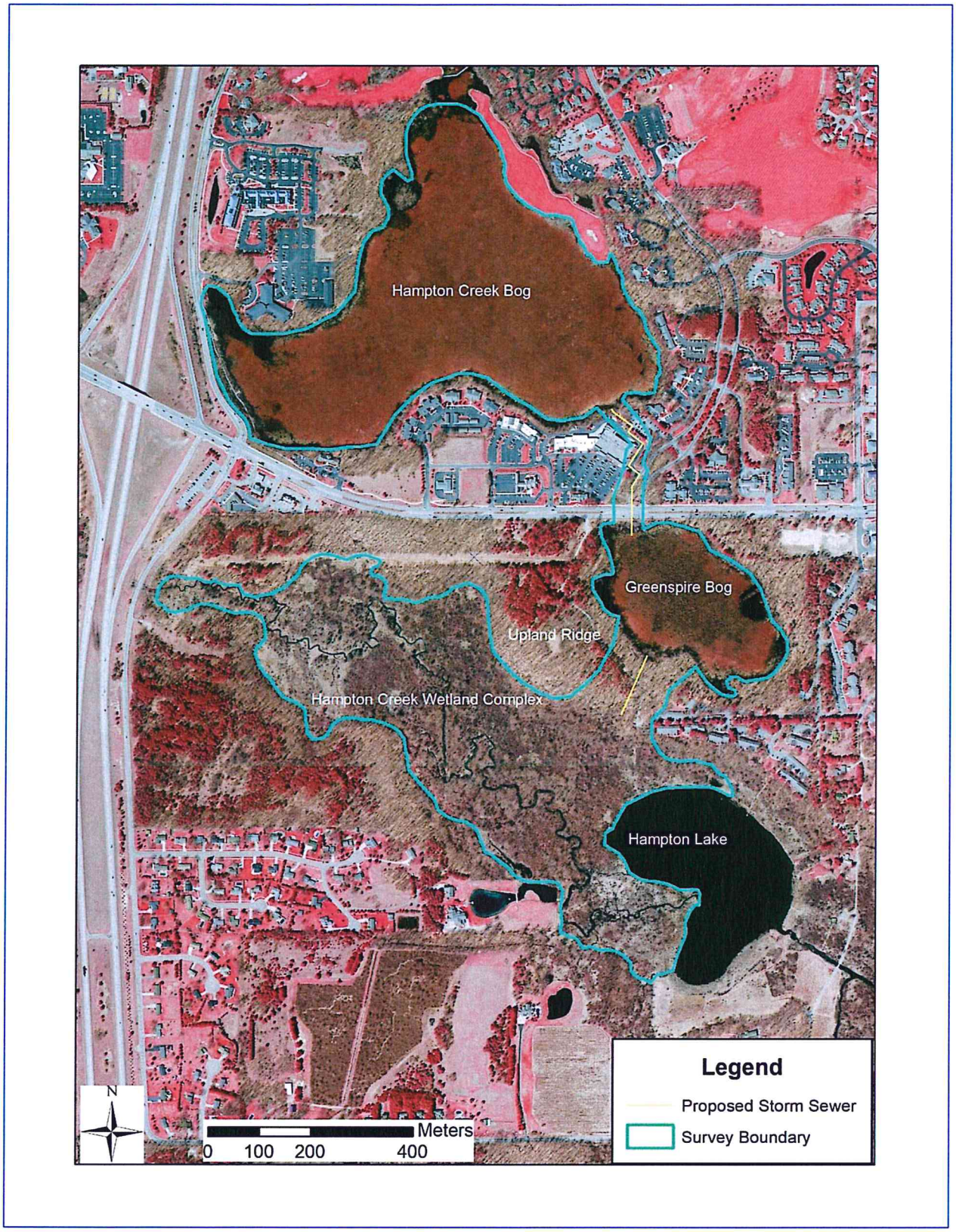


Figure 1. Boundary of the Hampton Creek Wetlands Study Area.

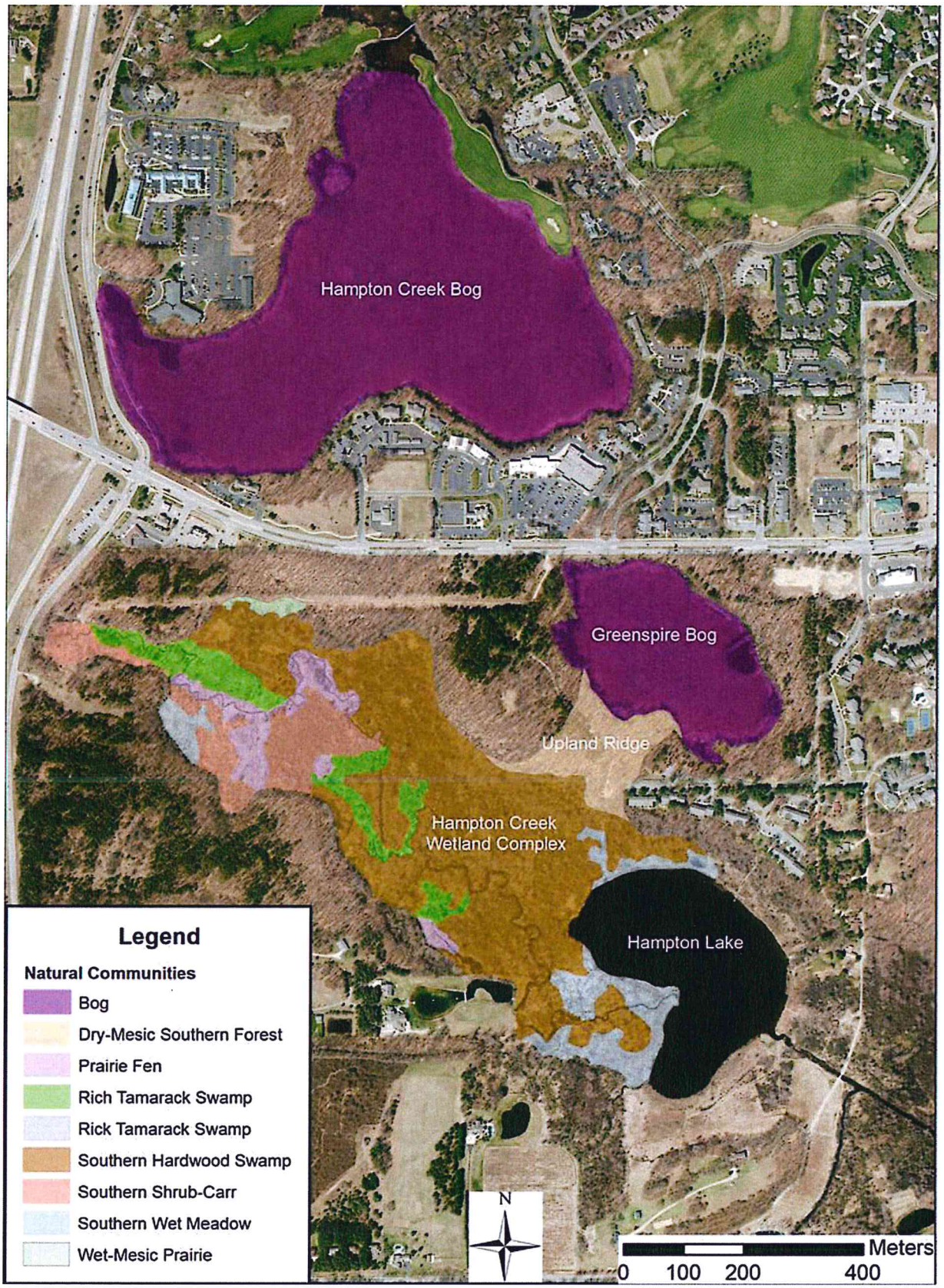


Figure 2. Map of natural communities delineated within the study area.

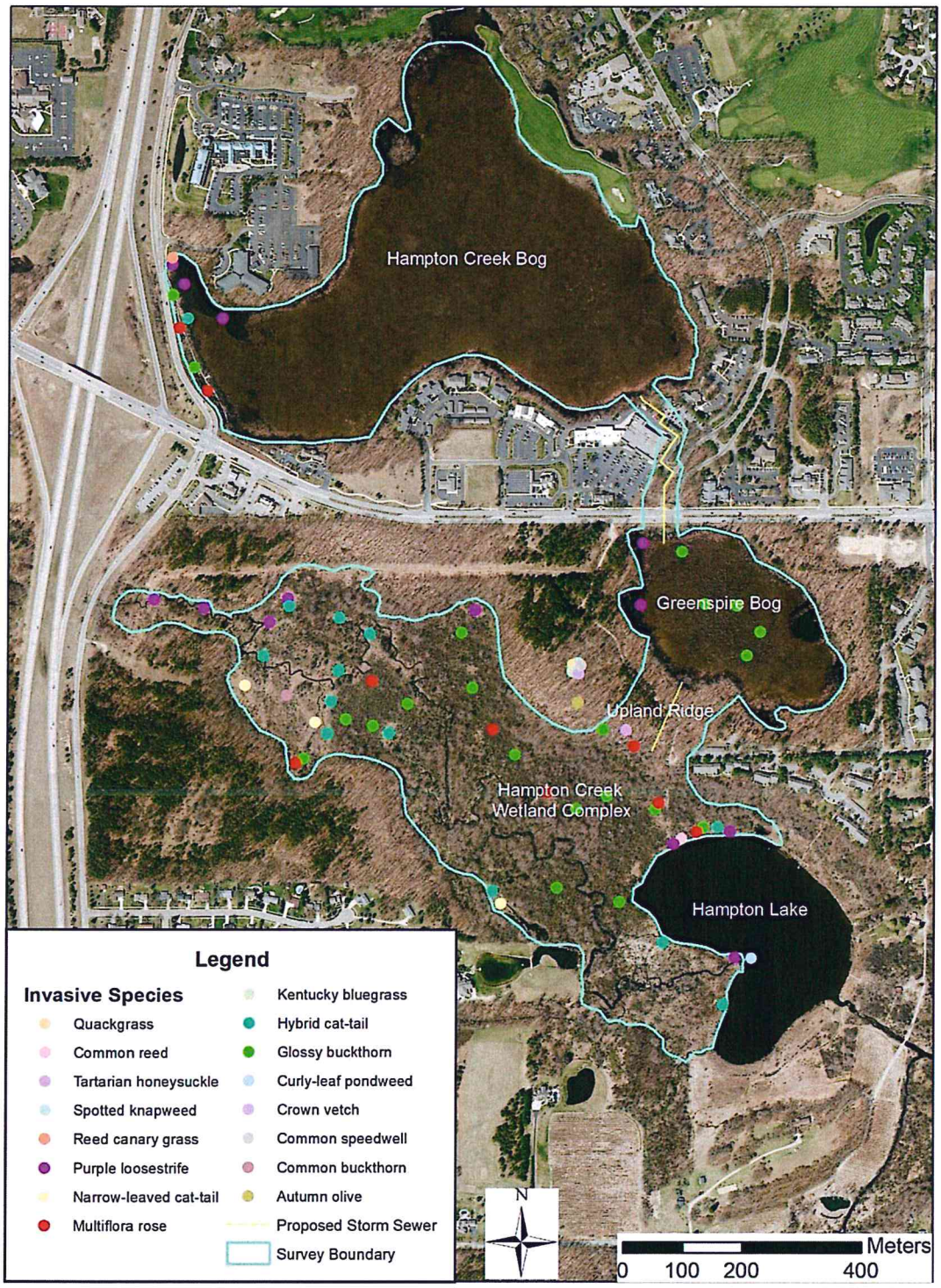


Figure 3. Map of Invasive species observed during the 2019 field surveys. Points indicate an approximate center location. In many instances these occurrences were very extensive.

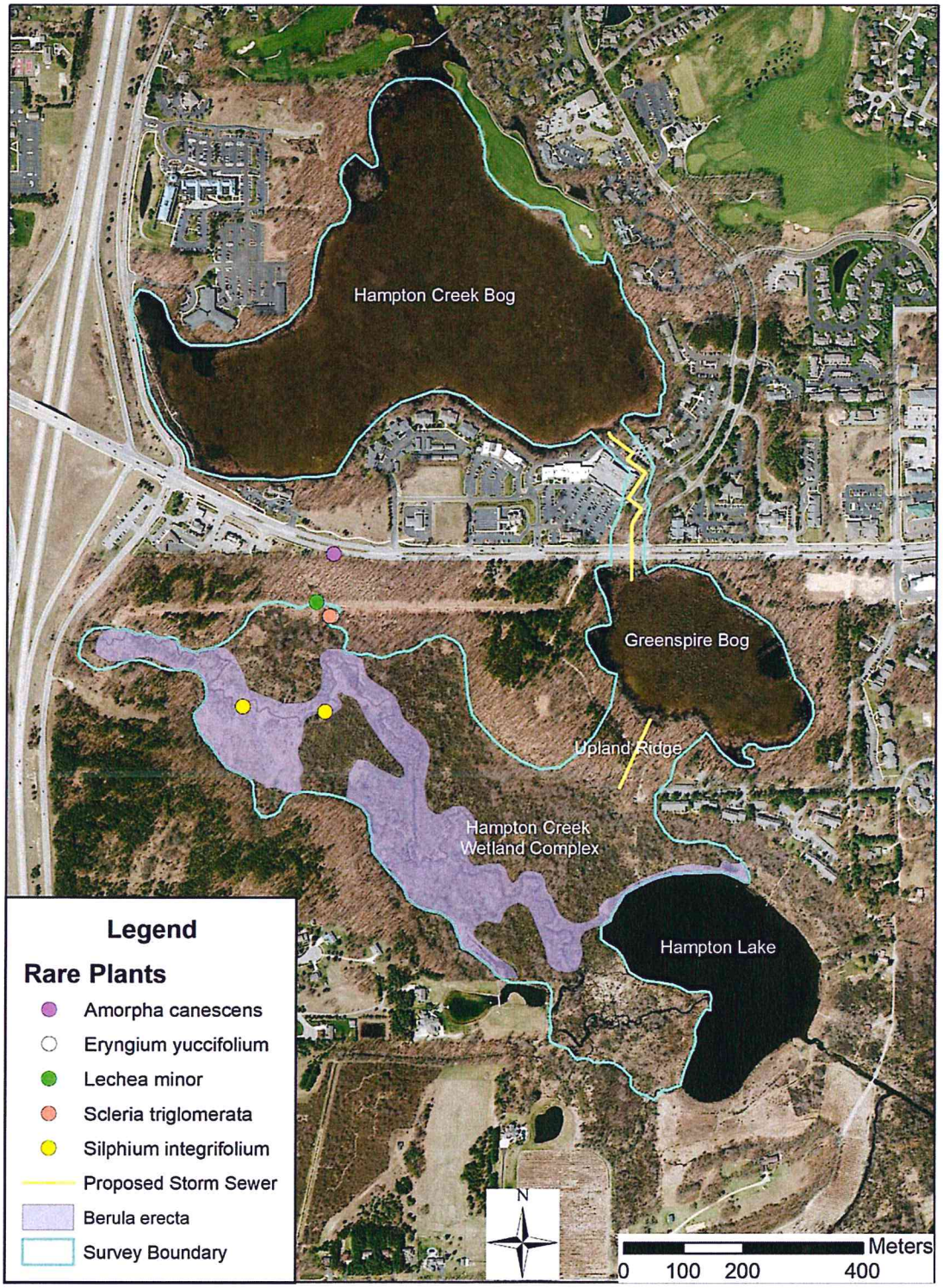


Figure 4. Map of rare plant populations observed during 2019 field surveys.

Attachment 4

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City of Portage

City of Portage, Kalamazoo County, Michigan

Portage Creek Stream Assessment

FIGURE NO. 1

PROJECT NO. 181663

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scientists
architects
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