

Biotic Inventory of Five Wildlife Flowages Within the Chippewa County Forest



“Stewardship for Sustainability”

March 2015



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Introduction

Project Purpose and Objectives

The Chippewa County Forest contains 18 impoundments, or flowages, that are accessible to the public by county forest roads. Most of these impoundments were created in the late 1960s/early 1970s to benefit wildlife, but have not been actively managed for more than a decade.

Most of the impoundments contain mechanical water control structures at the outlets; however water levels have been largely unmanaged. Information about the history, physical, hydrological, and biological characteristics of the impoundments and the associated watersheds is limited, which has prevented the development of defined management objectives and implementation plans.

Lack of management has resulted in significant unmet potential to produce important ecological and environmental functional values, such as habitat for waterfowl and other wetland-dependent wildlife species, including many Natural Heritage Inventory special concern species, as well as maintenance of water quality/quantity. The Chippewa County Department of Land Conservation and Forest Management (LCFM) is working towards a sustainable resolution to the problem described above.

It is believed that implementing a documented management regime, based on site-specific characteristics gained through comprehensive on-site inventory and long-term monitoring, will substantially increase the ecological, environmental, and cultural values provided by these impoundments (Dahlby, 2015).

To address the gap in knowledge of the biological characteristics of the impoundments the LCFM contracted Beaver Creek Reserve Citizen Science Center (CSC) to conduct macrophyte, aquatic macro-invertebrate, waterfowl and shorebird, and wildlife surveys. This information will assist LCFM achieve their two project objectives:

1. “To classify wildlife flowages into management categories that are based on their potential to provide essential life cycle requirements for waterfowl and other wetland dependent wildlife, and hydrological characteristics.”
2. “To develop and implement operation and maintenance plans for each flowage, which increase benefits to wildlife, public safety, and opportunities for nature-based outdoor recreation, and can be implemented by trained volunteers or program staff.”

The biological information the CSC collected for this report allows LCFM to establish their management objectives. It also provides LCFM baseline data that can be used for comparison in future surveys to determine if the moist soil management plans in place are succeeding in accomplishing the overarching goals for these specific flowages.

The primary objectives of this project include:

- Biological inventory of macrophytes, macro-invertebrates, wildlife, waterfowl and shorebirds,
- Documentation of any rare species, or species of concern within these flowage sites,
- and to provide all baseline biological information to LCFM, the management planning team, and any other stakeholders involved with the management or use of these wildlife flowages.

Description of the Study Area

The Chippewa County Forest is 33,000 acres of diverse habitat and over 100 lakes (Appendix A). According to the U.S. Forest Services National Hierarchical Framework of Ecological Units (Bailey, 1995), the Chippewa County Forest lies within the North Central Forest and Forest Transition ecological landscapes (Figure 1). The North Central Forest landscape supports northern hardwood species and large wetlands with Tamarack, white cedar, black ash and black spruce. The Forest Transition landscape supports northern hardwoods, agriculture and conifer species near swamps. Lakes within the county forest are generally small with a median of five acres (Garrison et al., 2006). The Chippewa County Forest and its flowages are primarily used for commercial forestry and recreational activities including hiking, horseback riding, ATV, hunting, fishing, wildlife viewing and paddling.



Figure 1: Ecological Landscapes of Wisconsin. Chippewa County Forest lies within the North Central Forest and Forest Transition ecological landscapes.

The study area received an exceptionally high amount of rainfall during the study period, and also experienced cooler than previous years' temperatures (Table 1). Even though Chippewa County staff removed all the boards in the water control structures at each flowage during the study months, water levels were generally too high to expose mudflats large enough for shorebirds to land on and walk around on to any great extent. Spring Creek Flowage #2 and Hay Meadow Flowage #2 (Figure 2) had the most exposed mud available for sampling, while the remaining three flowages did not support exposed mudflats to any notable extent.

Date	Average Mean Temperature	Precipitation Sum
1 July - 1 September 2012	73 Degrees Fahrenheit	3.66 in
1 July - 1 September 2013	72 Degrees Fahrenheit	1.65 in
1 July - 1 September 2014	70 Degrees Fahrenheit	9.95 in

Table 1: Average mean temperature and precipitation sum for the study area over the same time period in 2012, 2013 and 2014 (Weather Underground).



Figure 2: Exposed mudflat at Hay Meadow Flowage #2.

Methods

The Citizen Science Center was contracted to conduct biological inventory surveys on five flowages within the Chippewa County Forest in 2014. Flowages surveyed include: Birch Creek Flowage #1 (BC1), Spring Creek Flowage #2 (SC2), Willow Creek Flowage #3 (WC3), Hay Meadow Flowage #2 (HM2) and Horseshoe Flowage (HF) (Figure 3). The surface area of the five flowages surveyed combined is 74.46 acres, but the total survey area is larger as flora and fauna observed on land surrounding the flowages, as well as flying overhead, were also documented. These flowages were chosen for this study because they have water control structures making it possible to manipulate water levels for management.



Figure 3: Five wildlife flowages surveyed within the Chippewa County Forest.

Macrophyte Surveys

A macrophyte is an emergent, submergent, or floating aquatic plant that grows in or near water. Two macrophyte surveys were conducted on each of the five flowages during July and August 2014 by CSC staff. Surveys were conducted from a canoe. Point Intercept (PI) maps were created for each flowage prior to surveys that determined where macrophyte samples were taken (Appendix B). One surveyor took rake samples similar in methods to Jessen and Lound (1962). A second surveyor recorded the information onto a plant data sheet (Appendix C). A 12 foot telescoping pole with a double-headed rake attached was submersed into the water until it hit the bottom substrate. Depth, dominant sediment type and presence/absence of filamentous algae was collected and recorded before pulling the rake to the surface. At the surface, macrophyte species attached to the rake were identified and given a density rating of 1-3. Plants visually observed at the immediate shoreline were recorded under the closest PI survey point on the data sheet. One specimen was collected for each species documented and was later pressed and mounted on herbarium paper. Specimens unable to be identified by surveyors were sent to the Robert W. Freckmann Herbarium in Stevens Point, Wisconsin for verification. Simpson's Diversity, Mean Coefficient of Conservatism (C) and Floristic Quality Index (FQI) values were calculated for each flowage. Simpson's Diversity is a measure of diversity, while FQI is a measure of vegetative quality. A Simpson's Diversity value closer to 1 indicates high diversity, while a value closer to 0 indicates low diversity. An FQI higher than 20 for a wetland is

considered high quality (Swink et al., 1994). Floristic Quality Index is determined using C, which represents the likelihood a plant is found in an unaltered environment. Wetlands with a mean C value over 3.5 are considered high quality (Swink, et al., 1994). Macrophyte surveys were conducted two times at each flowage. Therefore, the averages of the two surveys were used to determine the Simpson's Diversity, Mean C and Floristic Quality Index values.

Aquatic Macro-invertebrate Surveys

An aquatic macro-invertebrate is an organism without a backbone that is big enough to see without using a microscope and that lives in the water. Aquatic macro-invertebrate surveys were conducted on each of the five flowages on 30 and 31 July 2014 by CSC staff. Survey methods were adapted from Eldridge (1992). Using a 250ml graduated cylinder with a diameter of 7cm, a core sample was taken 3cm deep in the mud and washed through a screen. Samples were meant to be taken from exposed mudflats (the benthic zone), but most samples were collected from very minimal patches of mud between shoreline vegetation (Figure 4). These patches would not be ideal for shorebirds to land and forage on, as majority of shoreline had no intermediate zone between the water and emergent vegetation (Figure 5).



Figure 4: Example of shoreline habitat displaying minimal patches of mud between vegetation at Hay Meadow Flowage #2.



Figure 5: Shoreline at Horseshoe flowage exhibiting no intermediate zone or exposed mudflats between water and emergent vegetation.

After surveying two flowages with minimal exposed mudflats, surveyors, not following any specific protocol, began collecting nektonic samples. Nektonic invertebrates are free swimming aquatic organisms. Nektonic samples were conducted by scooping two full samples of water from a 250ml graduated cylinder with a diameter of 7cm and washing it through a screen. Midge larvae was counted immediately on site and later extrapolated to estimate the number of midge larvae per square meter. Macro-invertebrate density is more pertinent information than diversity when determining capability to attract and sustain shorebirds and waterfowl. According to Eldridge, a density of at least 100 midge larvae per square meter is needed to succeed in attracting and holding shorebirds (1992). To collect information on the macro-invertebrate density at each flowage, a convenience sampling method was used. Convenience sampling is a type of sampling used for convenience rather than for formal representativeness (Heyer et al., 1994). While this method introduces bias and likely will not allow for scientific replication, it was the only suitable option with limited time and limited mudflats available for collecting samples. Surveyors paddled the shoreline in a canoe and took core samples wherever they found exposed mud. In cases where no mud could be found, nektonic samples were taken at sites randomly chosen by surveyors around the shoreline of the flowage. For both benthic and nektonic samples, surveyors tried to collect samples equidistant along the shoreline perimeter. GPS coordinates were taken at each sample location.

Benthic samples were extrapolated to macro-invertebrates per square meter. Nektonic samples were not evaluated and utilized to determine habitat suitability for waterfowl and shorebirds because a consistent sampling method was not followed and not all flowages were sampled for nektonic invertebrates. Raw numbers are reported on for nektonic surveys. Benthic data was collected for WC3 and HM2, benthic and nektonic data were collected for SC2, BC1 and HF whenever possible.

Waterfowl and Shorebird Surveys

Waterfowl and shorebird surveys were conducted at each flowage on 17 September and 17 and 21 October, 2014 by CSC staff and citizen science volunteers. On 17 September two surveyors went to three of the five flowages and surveyed for waterfowl and shorebirds from shore. On 17 and 21 October three surveyors visited all five flowages and surveyed for waterfowl and shorebirds from a canoe. All species encountered were aged and sexed if possible. Occasionally waterfowl and shorebirds were observed during macrophyte and macroinvertebrate surveys. These encounters have been added to the waterfowl and shorebird observation tables rather than placed on the “wildlife survey” data sheets.

Wildlife Surveys

Citizen Science Center staff and citizen science volunteers documented all wildlife observations made during official macrophyte, aquatic macro-invertebrate and waterfowl/shorebird surveys. Species and life stage information, if known, was recorded on a Wildlife Observation data sheet (Appendix D). Waterfowl and shorebirds encountered during wildlife surveys have been added to the waterfowl and shorebird survey data sheets.

Overview and Site Specific Summary of Findings

Overview

Macrophytes

Seventy four macrophyte species total were documented for all five flowages during the course of this study (Appendix E). Several macrophyte species were commonly observed in all five flowages surveyed including: bottle brush sedge, coontail, spikerush, common waterweed, small and large duckweed, white water-lily, leafy and small pondweed, common and sessile-fruited arrowhead and softstem bulrush. Two Natural Heritage Inventory working list species of special concern were documented during surveys including yellow pond-lily and water-thread pondweed. Simpson’s Diversity was high for all five flowages with the lowest values at 0.90 on a scale of 0-1 (WC3 and HM2). This indicates high diversity within each flowage. The flowage with the highest total number of species was HF, with 45 species. The Mean Coefficient of Conservatism was above 3.5 for each flowage, meaning on average, species within each flowage had C values indicative of high quality (>3.5). Floristic Quality Index was also above the “high quality” threshold value for wetlands (20) for each flowage, with the highest FQI at HF (Table 2).

Flowage	WBIC	Simpson's Diversity	Total # of Species	Mean Coefficient of Conservatism	FQI
Birch Creek #1	2185700	0.92	31	6.19	26.62
Spring Creek #2	2177300	0.93	38	5.89	27.93
Willow Creek #3	2345400	0.90	41	5.13	22.64
Hay Meadow #2	2180100	0.90	39	6.08	28.46
Horseshoe	2186500	0.94	45	6.13	34.39
High Quality Wetland Site Value		1	N/A	>3.5	> 20
Low Quality Wetland Site Value		0	N/A	<3.5	<20

Table 2: Simpson's Diversity, Mean Coefficient of Conservatism and Floristic Quality Index values for five flowages in the Chippewa County Forest.

Aquatic macro-invertebrates

Despite the lack of exposed mudflats, after extrapolating samples to macro-invertebrates per square meter, the majority of sites showed the ability to attract and support waterfowl and shorebirds with greater than 100 midge larvae per square meter.

Waterfowl and Shorebirds

Two Wisconsin Wildlife Action Plan Species of Greatest Conservation Need were documented during surveys including the American Black Duck and Blue-winged Teal.

Wildlife

Four Wisconsin Wildlife Action Plan Species of Greatest Conservation Need were documented during surveys including Bald Eagle, Mink Frog, Veery and Wood Thrush.

Site Specific Summary of Findings

Birch Creek Flowage #1

Location

County: Chippewa County
WBIC: 2185700
Town-Range-Section: T32N R07W S22

Description of Site

Birch Creek Flowage #1 covers an approximate surface area of five acres and drains 148 acres of Chippewa County Forestland. Its maximum depth has been recorded at eight feet (Figure 6).

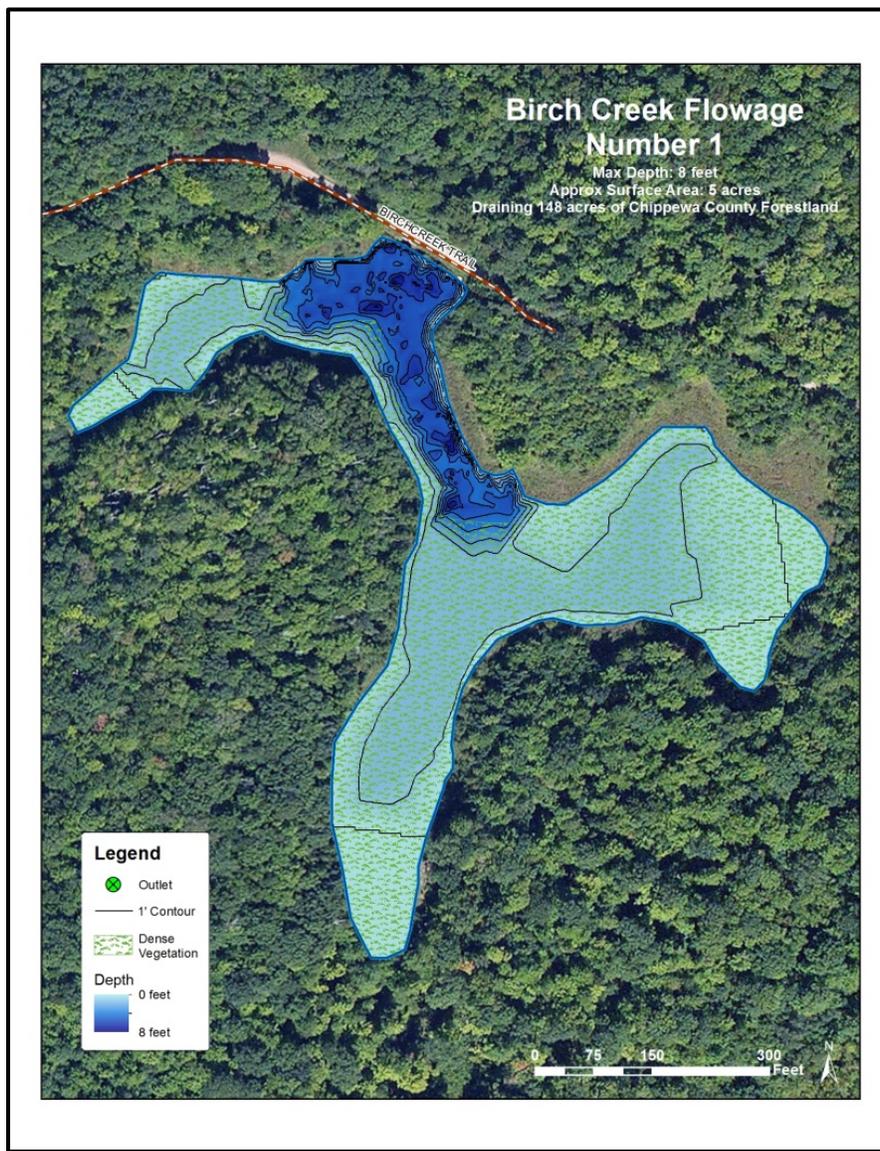


Figure 6: Bathymetric map of Birch Creek Flowage #1.

Water levels can be manipulated at this site with the water control structure in place. Time spent at this site was significantly less than the other four sites due to its small size and fewer survey points. Thick concentrations of white water-lily (*Nymphaea odorata*) made access to some of the survey points impossible with a canoe (Figure 7).



Figure 7: White water lily on the water's surface at Birch Creek Flowage #1.

Macrophyte Surveys

Thirty one species of aquatic plants were identified at BC1 (Appendix E). Two Wisconsin Natural Heritage Working List species of special concern were documented including yellow pond-lily and water-thread pondweed. Aquatic plants with the highest frequency of occurrence are white water-lily and short-stemmed bur reed. Wild rice was planted by Chippewa County at BC1 in previous years (L. Olson, personal communication, September 9, 2014) and two very small patches of wild rice (*Zizania sp*) were found during 2014 surveys. Simpson's Diversity Index for BC1 is 0.92. The Mean C is 6.19 and FQI is 26.62, indicating high diversity and high quality for BC1 (Table 2).

Aquatic macro-invertebrate Surveys

Seven sites were sampled at BC1 for aquatic macro-invertebrates (Figure 8).



Figure 8: Aquatic macro-invertebrate sampling locations at Birch Creek Flowage #1.

Of the seven sites sampled for macro-invertebrates, three benthic samples were collected and only one held more than 100 larvae per square meter, enough to attract and support waterfowl and shorebirds. The other two samples contained no macro-invertebrate. Nektonic samples were collected at all seven sites at BC1, with the most macro-invertebrates in one sample being nine (Table 3).

Survey Point	Benthic macroinvertebrate count	Benthic macroinvertebrates per m ²	Nektonic macroinvertebrate count
BCI 1	N/A	N/A	2
BCI 2	N/A	N/A	9
BCI 3	0	0	4
BCI 4	0	0	3
BCI 5	1	226	1
BCI 6	N/A	N/A	0
BCI 7	N/A	N/A	2

Table 3: Aquatic macro-invertebrate survey results from Birch Creek Flowage #1.

Waterfowl and Shorebird Surveys

Over the course of this project a total of seven wood ducks were documented at BC1. No other species of waterfowl or shorebird was documented and no Wisconsin Wildlife Action Plan Species of Greatest Conservation Need were documented.

Wildlife Surveys

Nine species of wildlife were seen at BC1 over the course of four visits to this site (Table 4). No Wisconsin Wildlife Action Plan Species of Greatest Conservation Need were observed.

Wildlife Observations at Birch Creek Flowage #1 (23 and 31 Jul, 17 Aug and 17 Oct 2014)			
Common Name	Species	# of Individuals	Life Stage Present
American Goldfinch	<i>Spinus tristis</i>	2	Adult
American Robin	<i>Turdus migratorius</i>	1	Adult
Eastern Wood-Pewee	<i>Contopus virens</i>	1	Adult
Green Frog	<i>Lithobates clamitans</i>	2	Adult
Painted Turtle	<i>Chrysemys picta</i>	3	Juvenile
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	1	Adult
Scarlet Tanager	<i>Piranga olivacea</i>	1	Adult
Song Sparrow	<i>Melospiza melodia</i>	1	Adult
White-tailed Deer	<i>Odocoileus virginianus</i>	1	Adult

Table 4: Wildlife species observed at Birch Creek Flowage #1.

Spring Creek Flowage #2

Location

County: Chippewa County
WBIC: 2177300
Town-Range-Section: T32N R07W S33

Description of Site

Spring Creek Flowage #2 covers an approximate surface area of 28 acres and drains 920 acres of Chippewa County Forestland. Its maximum depth has been recorded at 10 feet (Figure 9).

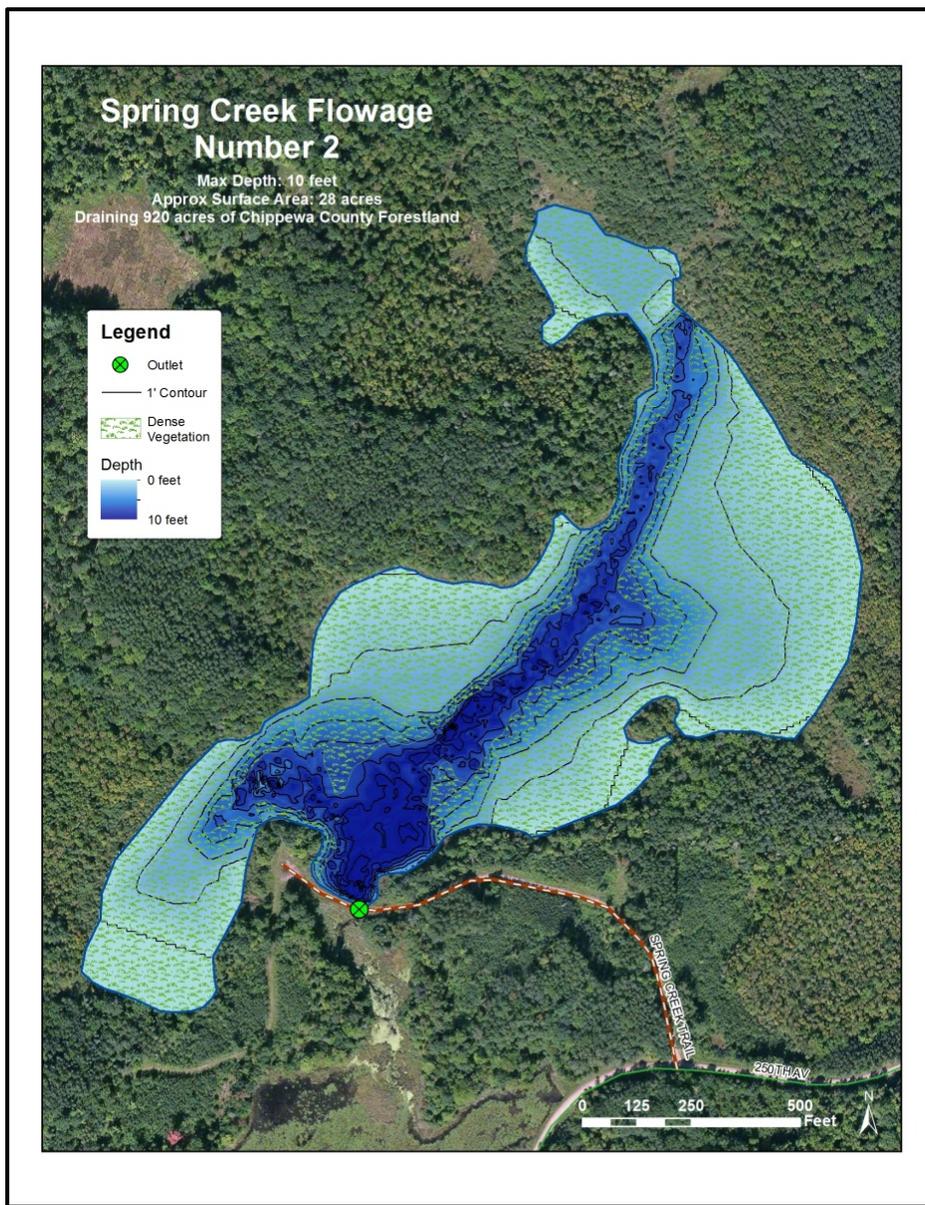


Figure 9: Bathymetric map of Spring Creek Flowage #2.

Water levels can be manipulated at this site with the water control structure in place. Thick concentrations of white water-lily made access to some of the survey points impossible with a canoe. Water levels increased between the first and second macrophyte survey, and when we conducted a waterfowl survey on 17 September, the water had flooded a portion of the road running between the principle spillway and the flowage. Despite high water levels this flowage supported small areas with exposed mudflats (Figure 10) and had one shorebird, possibly a solitary sandpiper, observed during one of the surveys.



Figure 10: Mudflat on Spring Creek Flowage #2.

Macrophyte Surveys

Thirty eight species of aquatic plants were identified at SC2 (Appendix E). Water-thread pondweed was the only Wisconsin Natural Heritage Working List species of special concern documented at SC2. Aquatic plants with the highest frequency of occurrence are white water-lily, flat-stemmed pondweed, and small and large duckweed which blanketed the far north part of the flowage. Simpson's Diversity Index for SC2 is 0.93. The Mean C is 5.89 and FQI is 27.93, indicating high diversity and high quality for SC2 (Table 2).

Aquatic Macro-invertebrate Surveys

Twenty two sites were sampled at SC2 for aquatic macro-invertebrates (Figure 11).

Spring Creek Flowage No. 2 Invertebrate Survey

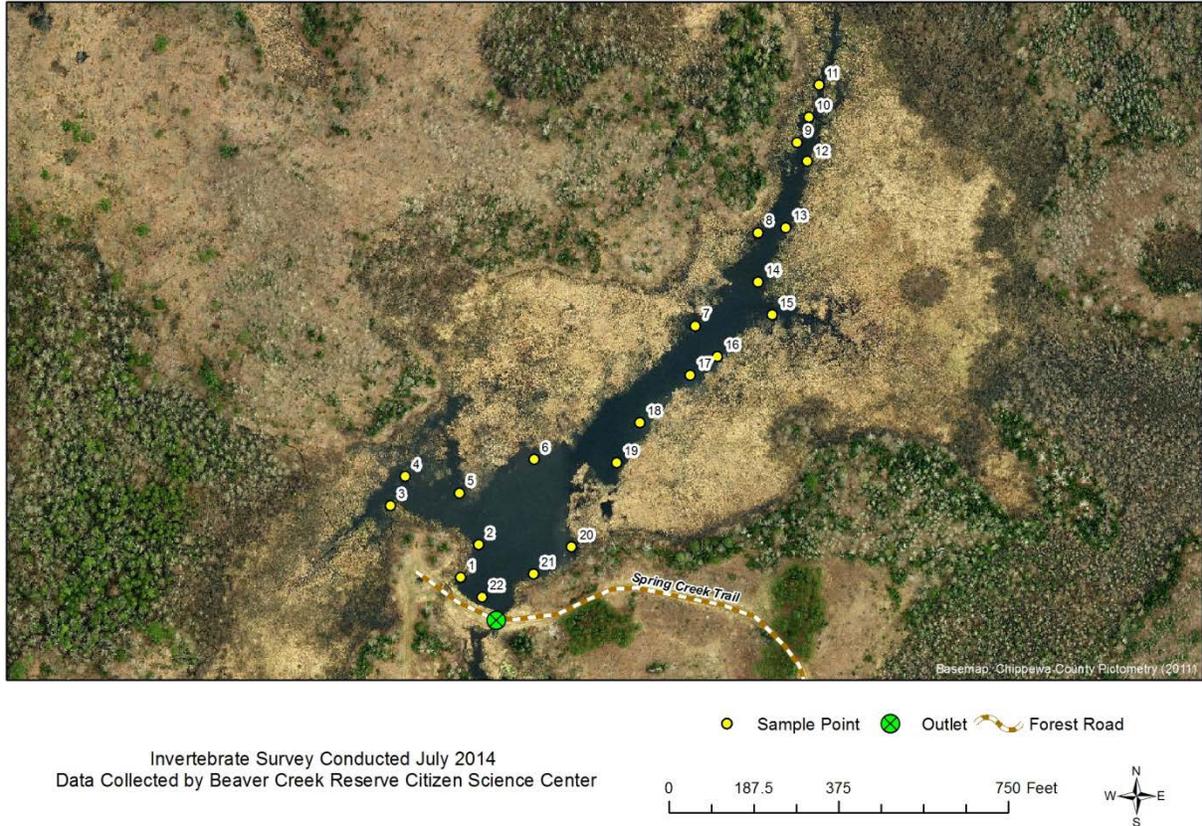


Figure 11: Aquatic macro-invertebrate sampling locations at Spring Creek Flowage #2.

Of the 22 sites sampled for macro-invertebrates, 21 benthic samples were collected. Seventeen held more than 100 larvae per square meter, enough to attract and support waterfowl and shorebirds. The other four samples contained no macro-invertebrates. Nektonic samples were collected at all 22 sites at SC2, with the most aquatic macro-invertebrates in one sample being 28 (Table 5).

Survey Point	Benthic macroinvertebrate count	Benthic macroinvertebrates per m ²	Nektonic macroinvertebrate count
SCI 1	0	0	5
SCI2	3	679	8
SCI3	0	0	1
SCI4	2	453	0
SCI5	0	0	10
SCI6	0	0	1
SCI7	1	226	3
SCI8	11	2,490	17
SCI9	4	906	5
SCI10	3	679	7
SCI11	5	1,132	2
SCI12	3	679	5
SCI13	1	226	2
SCI14	2	453	28
SCI15	1	226	4
SCI16	2	453	5
SCI17	3	679	1
SCI18	2	453	0
SCI19	4	906	1
SCI20	N/A	N/A	12
SCI21	8	1,811	12
SCI22	4	906	4

Table 5: Aquatic macro-invertebrate survey results from Spring Creek Flowage #2.

Waterfowl and Shorebird Surveys

Over the course of this project five Mallards, two Wood Ducks and four unknowns were documented. No Wisconsin Wildlife Action Plan Species of Greatest Conservation Need was documented.

Wildlife Surveys

Twenty one species of wildlife were seen at SC2 over the course of the project (Table 6), including one Wisconsin Wildlife Action Plan Species of Greatest Conservation Need, the Mink Frog (*Lithobates septentrionalis*) (Figure 12). The Virginia rail (*Rallus limicola*), a secretive marsh bird more often heard than seen, was also documented at SC2 (Figure 13).

Wildlife Observations at Spring Creek Flowage #2 (23 and 31 July and 18 August 2014)			
Common Name	Species	# of Individuals	Life Stage Present
American Goldfinch	<i>Spinus tristis</i>	6	Unknown
Barred Owl	<i>Strix varia</i>	2	Adult
Blue Jay	<i>Cyanocitta cristata</i>	1	Unknown
Bullfrog	<i>Lithobates catesbeianus</i>	1	Adult
Cedar Waxwing	<i>Bombycilla cedrorum</i>	1	Unknown
Chestnut-sided Warbler	<i>Setophaga pensylvanica</i>	1	Adult
Common Yellowthroat	<i>Geothlypis trichas</i>	2	Unknown
Great Blue Heron	<i>Ardea herodias</i>	1	Adult
Grey Catbird	<i>Dumetella carolinensis</i>	1	Adult
Leech	<i>Class Hirudinea</i>	Many	Unknown
Green Frog	<i>Lithobates clamitans</i>	1	Adult
Mink Frog	<i>Lithobates septentrionalis</i>	1	Adult
Minnnows	<i>Family Cyprinidae</i>	Many	Unknown
Monarch	<i>Danaus plexippus</i>	1	Adult
Painted Turtle	<i>Chrysemys picta</i>	1	Adult
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	1	Unknown
Sandhill Crane	<i>Grus canadensis</i>	4	Adult
Snails	<i>Unknown</i>	Many	Unknown
Song Sparrow	<i>Melospiza melodia</i>	1	Unknown
Virginia Rail	<i>Rallus limicola</i>	1	Juvenile
Warbler species	<i>Unknown</i>	1	Unknown

Table 6: Wildlife species observed at Spring Creek Flowage #2.



Figure 12: Mink Frog.



Figure 13: Virginia Rail.

Willow Creek Flowage #3

Location

County: Chippewa County
WBIC: 2345400
Town-Range-Section: T32N R07W S20

Description of Site

Willow Creek Flowage #3 covers an approximate surface area of 36 acres and drains 1,342 acres of Chippewa County Forestland. Its maximum depth has been recorded at eight feet (Figure 14).

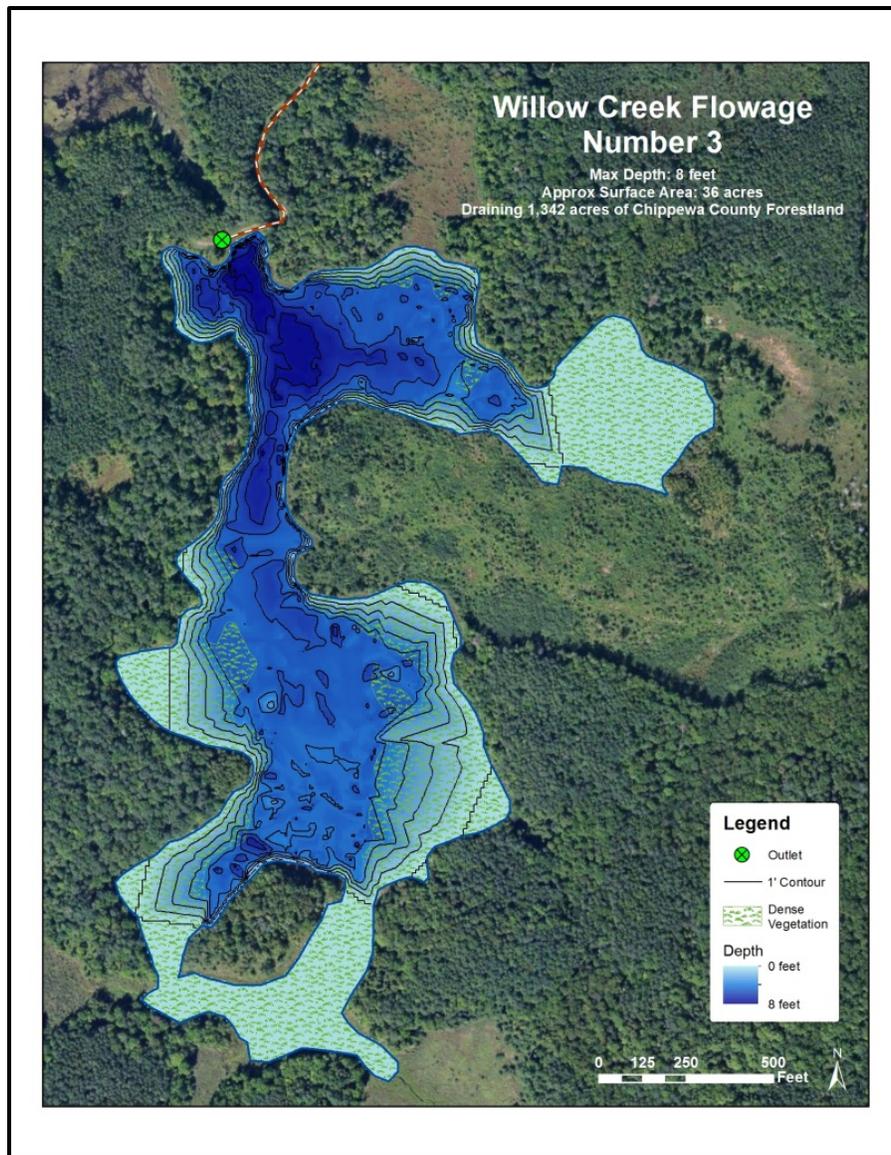


Figure 14: Bathymetric map of Willow Creek Flowage #3.

Water levels can be manipulated at this site with the water control structure in place. The water control structure at WC3 had logs and vegetation blocking the opening on the flowage end, but not enough to manipulate water levels. Water levels decreased between the first and second macrophyte surveys, and thick concentrations of white water-lily and spatterdock made access to some of the survey points impossible with a canoe (Figure 15).



Figure 15: White water lily and spatterdock on the water's surface at Willow Creek Flowage #3.

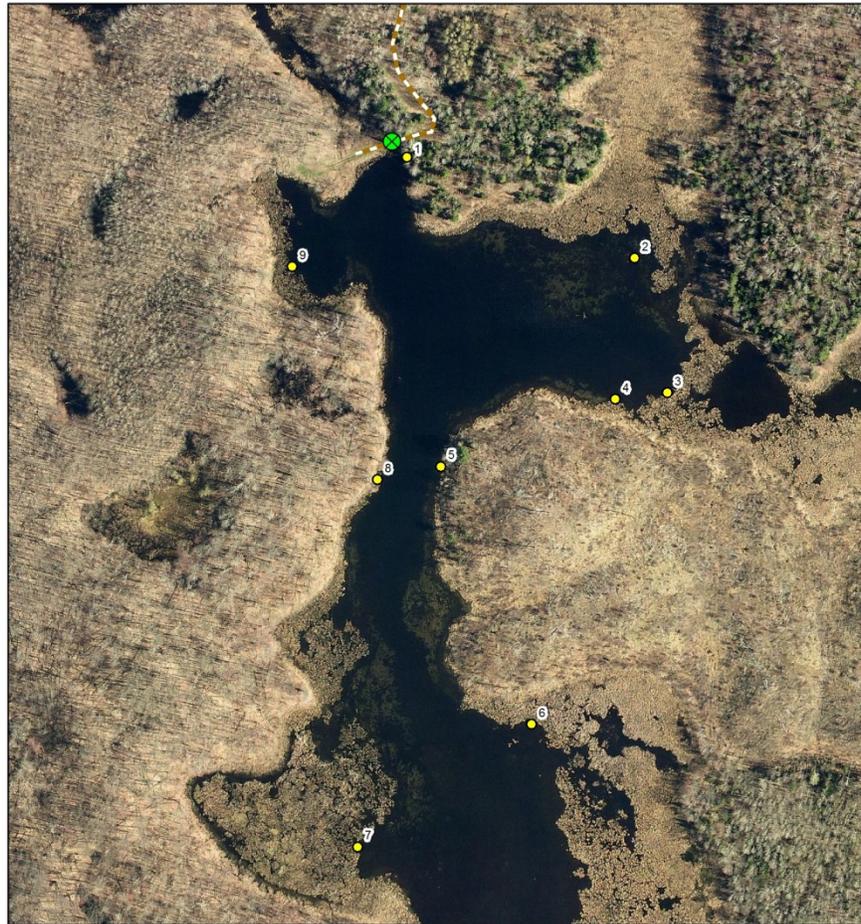
Macrophyte Surveys

Forty one species of aquatic plants were identified at WC3 (Appendix E). No Wisconsin Natural Heritage Working List species of special concern were documented. Aquatic plants with the highest frequency of occurrence were coontail, flat-stem pondweed and common bladderwort. Simpson's Diversity Index for WC3 is 0.90. The Mean C is 5.13 and FQI is 22.64, indicating high diversity and high quality for WC3 (Table 2).

Aquatic Macro-invertebrate Surveys

Nine sites were sampled at WC3 for aquatic macro-invertebrates (Figure 16).

Willow Creek Flowage No. 3 Invertebrate Survey



Invertebrate Survey Conducted July 2014
Data Collected by Beaver Creek Reserve
Citizen Science Center

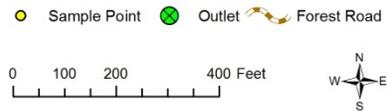


Figure 16: Aquatic macro-invertebrate sampling locations at Willow Creek Flowage #3.

All nine sites held more than 100 larvae per square meter, enough to attract and support waterfowl and shorebirds. Nektonic samples were not collected at WC3 (Table 7).

Survey Point	Benthic macroinvertebrate count	Benthic macroinvertebrates per m ²
WCI 1	17	3,849
WCI 2	6	1,358
WCI 3	8	1,811
WCI 4	56	12,678
WCI 5	8	1,811
WCI 6	10	2,264
WCI 7	9	2,038
WC8	3	679
WCI 9	14	3,170

Table 7: : Aquatic macro-invertebrate survey results from Willow Creek Flowage #3.

Waterfowl and Shorebird Surveys

Over the course of this project four species of waterfowl were documented including eight Wood Ducks, seven Mallards, three Pie-billed Grebe and one American Coot. No Wisconsin Wildlife Action Plan Species of Greatest Conservation Need were documented.

Wildlife Surveys

Twenty two species of wildlife were seen at WC3 over the course of the project (Table 8) including three Wisconsin Wildlife Action Plan Species of Greatest Conservation Need, the Veery, Bald Eagle, and Mink Frog. Two interesting wildlife observations were a single Tundra swan and several freshwater bryozoans that sieve food particles out of the water (Figure 17).



Figure 17: Freshwater bryozoan at Willow Creek Flowage #3.

Wildlife Observations at Willow Creek Flowage #3 (8 and 30 July and 13 August 2014)			
Common Name	Species	# of Individuals	Life Stage Present
American Goldfinch	<i>Spinus tristis</i>	2	Adult
Bald Eagle	<i>Haliaeetus leucocephalus</i>	1	Adult
Belted Kingfisher	<i>Megaceryle alcyon</i>	2	Unknown
Blue Jay	<i>Cyanocitta cristata</i>	1	Unknown
Freshwater Bryozoan	<i>Unknown</i>	Many	Unknown
Cedar Waxwing	<i>Bombycilla cedrorum</i>	2	Unknown
Common Yellowthroat	<i>Geothlypis trichas</i>	1	Unknown
Downy Woodpecker	<i>Picoides pubescens</i>	1	Adult
Eastern Wood-Pee-wee	<i>Contopus virens</i>	1	Unknown
Gray Catbird	<i>Dumetella carolinensis</i>	2	Unknown
Mink Frog	<i>Lithobates clamitans</i>	Many	Adult
Minnow	<i>Family Cyprinidae</i>	Many	Unknown
Northern Crescent	<i>Phyciodes cocyta</i>	1	Adult
Northern Flicker	<i>Colaptes auratus</i>	3	Adult
North American Porcupine	<i>Erethizon dorsatum</i>	1	Adult
Red-tailed Hawk	<i>Buteo jamaicensis</i>	3	Adult
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	1	Unknown
Ruffed Grouse	<i>Bonasa umbellus</i>	1	Adult
Tree Swallow	<i>Tachycineta bicolor</i>	1	Unknown
Tundra Swan	<i>Cygnus columbianus</i>	1	Adult
Veery	<i>Catharus fuscescens</i>	1	Unknown
Woodpecker sp.	<i>Family Picidae</i>	1	Unknown

Table 8: Wildlife species observed at Willow Creek Flowage #3.

Hay Meadow Flowage #2

Location

County: Chippewa County
WBIC: 2180100
Town-Range-Section: T31N R08W S11

Description of Site

Hay Meadow Flowage #2 covers an approximate surface area of 43 acres and drains 2,091 acres of Chippewa County Forestland. Its maximum depth has been recorded at 14 feet (Figure 18).

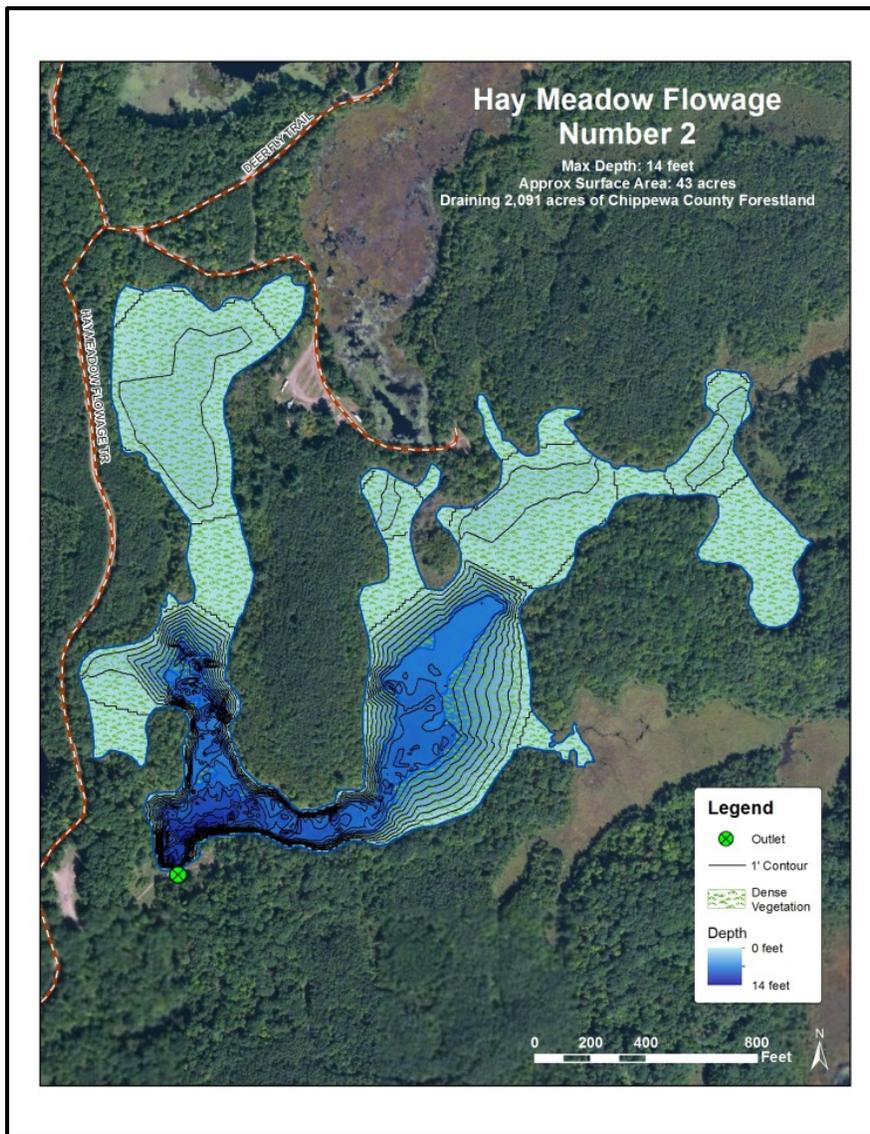


Figure 18: Bathymetric map of Hay Meadow Flowage #2.

Water levels can be manipulated at this site with the water control structure in place. Beaver sign was apparent at HM2 with vegetation piled up in front of the water control structure. Water levels stayed primarily the same between the first and second macrophyte surveys, and this flowage supported some mudflat habitat possibly suitable for shorebirds, despite not seeing any during surveys (Figure 19).



Figure 19: Exposed mudflat at Hay Meadow Flowage #2.

Macrophyte Surveys

Thirty nine species of aquatic plants were identified at HM2 (Appendix E). No Wisconsin Natural Heritage Working List species of special concern were documented. Aquatic plants with the highest frequency of occurrence at HM2 were coontail and white water-lily. Simpson's Diversity Index for HM2 is 0.90. The Mean C is 6.08 and FQI is 28.46 indicating high diversity and high quality for HM2 (Table 2).

Aquatic Macro-invertebrate Surveys

Fourteen sites were sampled at HM2 for aquatic macro-invertebrates (Figure 20).

Hay Meadow Flowage No. 2 Invertebrate Survey



Invertebrate Survey Conducted July 2014
Data Collected by Beaver Creek Reserve Citizen Science Center

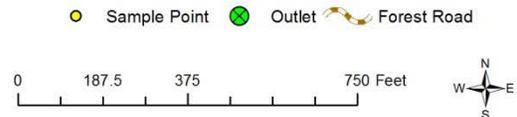


Figure 20: Aquatic macro-invertebrate sampling locations at Hay Meadow Flowage #2.

Of the 14 sites sampled, nine sites held more than 100 larvae per square meter, enough to attract and support waterfowl and shorebirds. Nektonic samples were not collected at HM2 (Table 9).

Survey Point	Benthic macroinvertebrate count	Benthic macroinvertebrates per m ²
HMI 1	1	226
HMI 2	0	0
HMI 3	1	226
HMI 4	5	1,132
HMI 5	0	0
HMI 6	2	453
HMI 7	6	1,358
HMI 8	3	679
HMI 9	0	0
HMI 10	2	453
HMI 11	2	453
HMI 12	4	906
HMI 13	0	0
HMI 14	0	0

Table 9: Aquatic macro-invertebrate survey results from Hay Meadow Flowage #2.

Waterfowl and Shorebird Surveys

Over the course of this project two species of waterfowl and zero species of shorebird were documented at HM2. Waterfowl observed included four Wood Duck, and three unknown individuals. No Wisconsin Wildlife Action Plan Species of Greatest Conservation Need were documented.

Wildlife Surveys

Twenty six species of wildlife were seen at HM2 over the course of the project (Table 10) including one Wisconsin Wildlife Action Plan Species of Greatest Conservation Need, the Veery.

Wildlife Observations at Hay Meadow Flowage #2 (8 and 30 July and 13 August 2014)			
Common Name	Species	# of Individuals	Life Stage Present
American Goldfinch	<i>Spinus tristis</i>	1	Adult
Beaver Sign	<i>Castor canadensis</i>	N/A	Unknown
Belted Kingfisher	<i>Megaceryle alcyon</i>	3	Unknown
Black-capped Chickadee	<i>Poecile atricapillus</i>	1	Unknown
Blue Jay	<i>Cyanocitta cristata</i>	4	Adult
Bullfrog	<i>Lithobates catesbeianus</i>	1	Adult
Cedar Waxwing	<i>Bombycilla cedrorum</i>	1	Unknown
Chestnut-sided Warbler	<i>Setophaga pensylvanica</i>	1	Unknown
Common Yellowthroat	<i>Geothlypis trichas</i>	1	Unknown
Downy Woodpecker	<i>Picoides pubescens</i>	1	Adult
Eastern-wood Pewee	<i>Contopus virens</i>	1	Unknown
Great Blue Heron	<i>Ardea herodias</i>	1	Adult
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	1	Adult
Green Frog	<i>Lithobates clamitans</i>	1	Adult
Green Heron	<i>Butorides virescens</i>	1	Adult
Leech	(Class <i>Hirudinea</i>)	Many	Unknown
Monarch Butterfly	<i>Danaus plexippus</i>	1	Adult
Ovenbird	<i>Seiurus aurocapilla</i>	1	Unknown
Raven	<i>Corvus corax</i>	2	Adult
Red-eyed Vireo	<i>Vireo olivaceus</i>	1	Unknown
Ruffed Grouse	<i>Bonasa umbellus</i>	1	Adult
Sandhill Crane	<i>Grus canadensis</i>	1	Adult
Song Sparrow	<i>Melospiza melodia</i>	1	Unknown
Tree Swallow	<i>Tachycineta bicolor</i>	1	Unknown
Veery	<i>Catharus fuscescens</i>	1	Unknown
White-breasted Nuthatch	<i>Sitta carolinensis</i>	2	Unknown

Table 10: Wildlife species observed at Hay Meadow Flowage #2.

Horseshoe Flowage

Location

County: Chippewa County
WBIC: 2186500
Town-Range-Section: T32N R07W S34

Description of Site

Horseshoe Flowage covers an approximate surface area of 14 acres and drains 288 acres of Chippewa County Forestland. Its maximum depth has been recorded at eight feet (Figure 21).

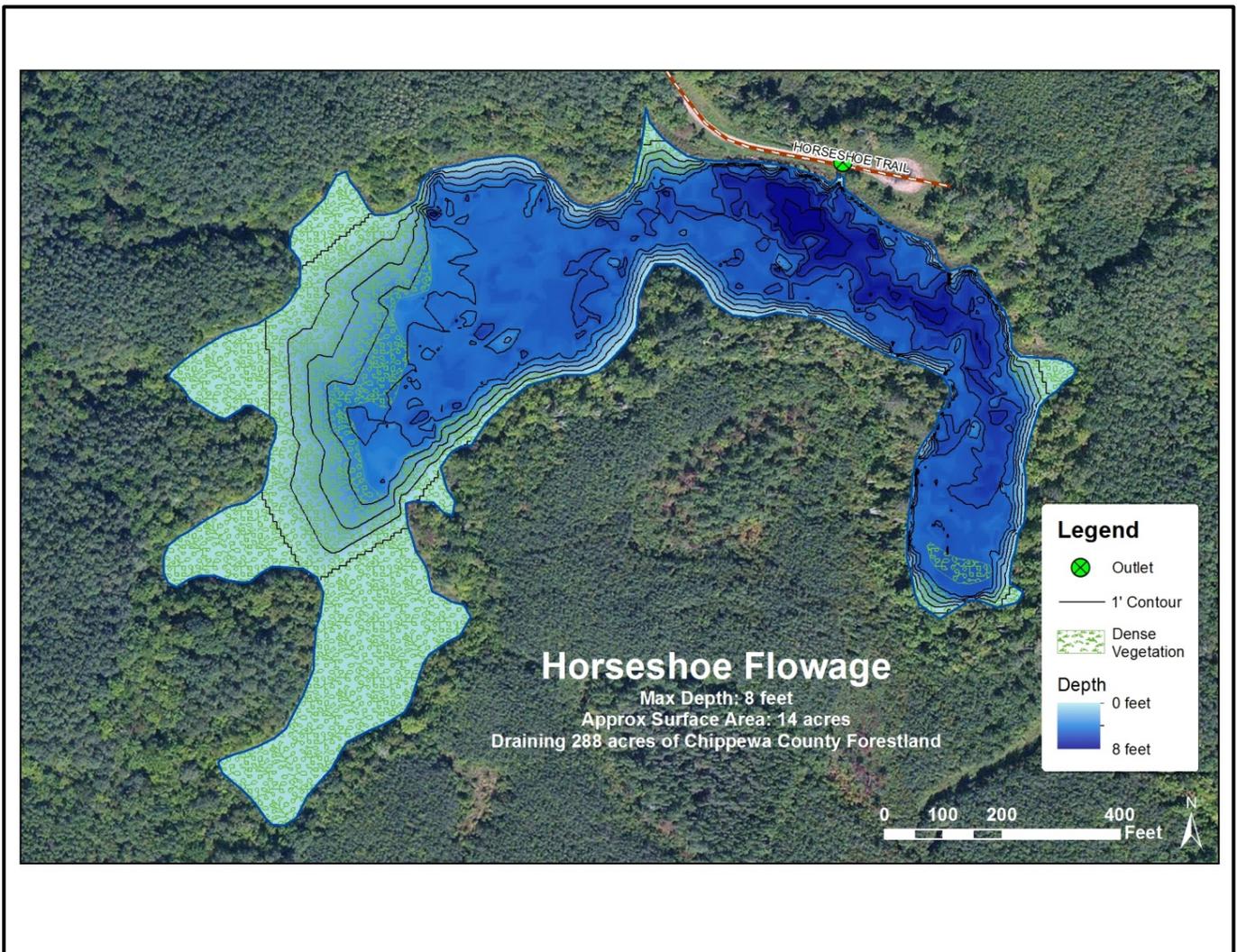


Figure 21: Bathymetric map of Horseshoe Flowage.

Water levels can be manipulated at this site with the water control structure in place. No significant changes in water levels were detected between macrophyte survey one and two. A large beaver lodge is located in the very center of HF directly across from the water control structure (Figure 22).



Figure 22: Horseshoe Flowage

Macrophyte Surveys

Forty five species of aquatic plants were identified at HF (Appendix E). One Wisconsin Natural Heritage Working List species of special concern was documented, water-thread pondweed. Aquatic plants with the highest frequency of occurrence at HF were watershield and coontail. Simpson's Diversity Index for HF is 0.94. The Mean C is 6.13 and FQI is 34.39, indicating high diversity and high quality for HF (Table 2).

Aquatic Macro-invertebrate Surveys

Twenty sites were sampled at HF for aquatic macro-invertebrates (Figure 23).

Horseshoe Flowage Invertebrate Survey

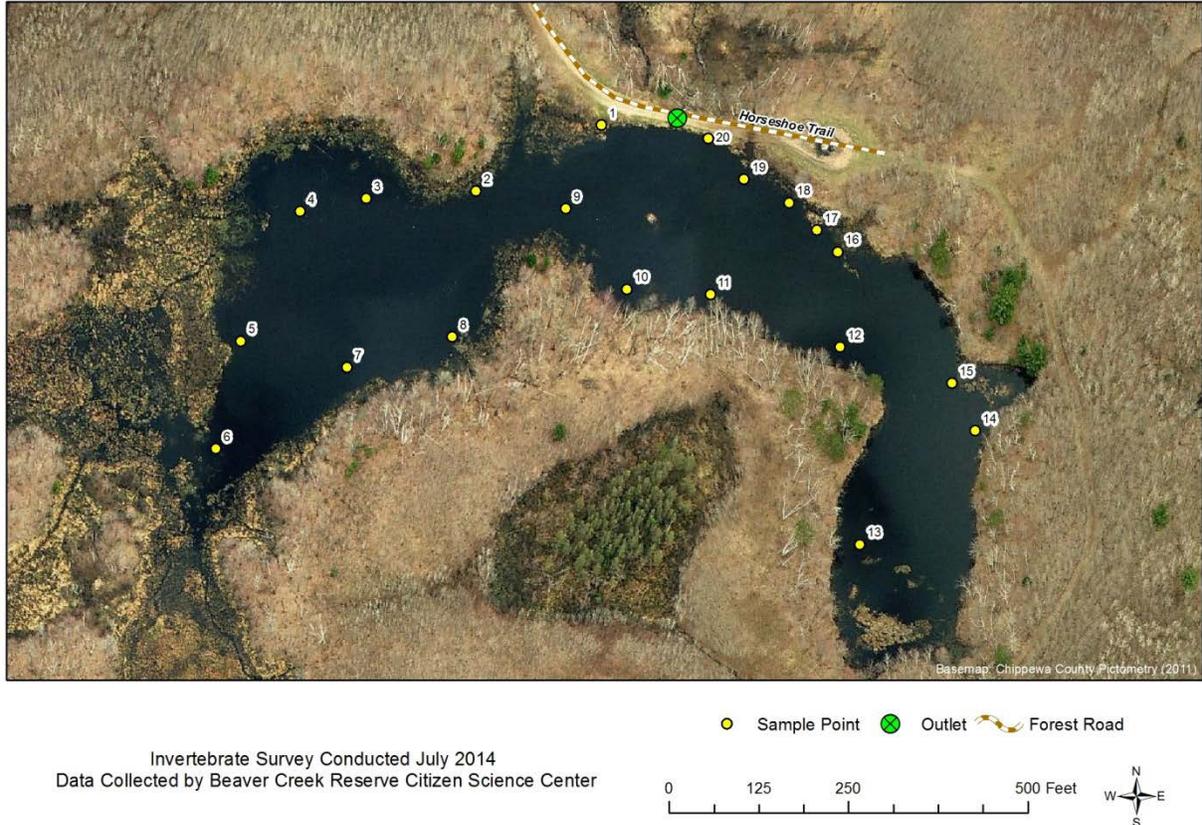


Figure23: Aquatic macro-invertebrate sampling locations at Horseshoe Flowage.

Fourteen sites held more than 100 larvae per square meter, enough to attract and support waterfowl and shorebirds. One sample contained zero macro-invertebrates. Nektonic samples were collected at all 20 sites at HF, with the most macro-invertebrates in one sample being 16 (Table 11).

Survey Point	Benthic macroinvertebrate count	Benthic macroinvertebrates per m ²	Nektonic macroinvertebrate count
HSI1	0	0	11
HSI2	4	906	2
HSI3	2	453	9
HSI4	1	226	9
HSI5	2	453	13
HSI6	4	906	7
HSI7	7	1,585	3
HSI8	2	453	8
HSI9	N/A	N/A	7
HSI10	1	226	16
HSI11	4	906	8
HSI12	3	679	6
HSI13	N/A	N/A	2
HSI14	7	1,585	4
HSI15	1	226	5
HSI16	N/A	N/A	2
HSI17	2	453	7
HSI18	3	679	2
HSI19	N/A	N/A	2
HSI20	N/A	N/A	6

Table 11: Aquatic macro-invertebrate survey results from Horseshoe Flowage.

Waterfowl and Shorebird Surveys

Over the course of this project four species of waterfowl, one unknown waterfowl nest and one unknown species of shorebird were documented. Waterfowl observed included eight Wood Duck, two Mallard, one American Black Duck and six Blue-winged Teal. Two Wisconsin Wildlife Action Plan Species of Greatest Conservation Need were documented, the American Black Duck and the Blue-winged Teal.

Wildlife Surveys

Thirty species of wildlife were seen at HF over the course of the project (Table 12) including two Wisconsin Wildlife Action Plan Species of Greatest Conservation Need, the Veery and Wood Thrush.

Wildlife Observations at Horseshoe Flowage (9, 23 and 31 July and 12 August 2014)			
Common Name	Species	# of Individuals	Life Stage Present
American Goldfinch	<i>Spinus tristis</i>	1	Unknown
Beaver Sign	<i>Castor canadensis</i>	N/A	Unknown
Belted Kingfisher	<i>Megaceryle alcyon</i>	3	Unknown
Blue Jay	<i>Cyanocitta cristata</i>	3	Unknown
Bullfrog	<i>Lithobates catesbeianus</i>	1	Adult
Butterfly sp.	<i>Unknown</i>	1	Adult
Cedar Waxwing	<i>Bombycilla cedrorum</i>	1	Unknown
Common Yellowthroat	<i>Geothlypis trichas</i>	1	Unknown
Downy Woodpecker	<i>Picoides pubescens</i>	1	Unknown
Eastern Wood Pewee	<i>Contopus virens</i>	2	Unknown
Great Blue Heron	<i>Ardea herodias</i>	3	Adult
Green Frog	<i>Lithobates clamitans</i>	2	Adult
Gray Catbird	<i>Dumetella carolinensis</i>	1	Unknown
Leech	<i>Class Hirudinea</i>	Many	Unknown
Snail	<i>Unknown</i>	Many	Unknown
Monarch Butterfly	<i>Danaus plexippus</i>	1	Adult
Northern Flicker	<i>Colaptes auratus</i>	1	Unknown
Ovenbird	<i>Seiurus aurocapilla</i>	1	Unknown
Raven	<i>Corvus corax</i>	1	Adult
Red-eyed Vireo	<i>Vireo olivaceus</i>	1	Unknown
Sandhill Cranes	<i>Grus canadensis</i>	3	Adult
Scarlet Tanager	<i>Piranga olivacea</i>	1	Unknown
Song Sparrow	<i>Melospiza melodia</i>	1	Unknown
Turtle sp.	<i>Unknown</i>	5	Juvenile
Warbler sp.	<i>Family Parulidae</i>	1	Unknown
Veery	<i>Catharus fuscescens</i>	1	Unknown
Vireo sp.	<i>Family Vireonidae</i>	1	Unknown
White-tailed Deer	<i>Odocoileus virginianus</i>	2	Juvenile and Adult
Wood Thrush	<i>Hylocichla mustelina</i>	1	Unknown
Yellow Warbler	<i>Setophaga petechia</i>	1	Unknown

Table 12: Wildlife species observed at Horseshoe Flowage.

Conclusions and Management Considerations

All five flowages surveyed within the Chippewa County Forest support a high diversity of macrophyte species, and exhibit high quality characteristics, based on the Simpson's Diversity and Floristic Quality Index values. Waterfowl, especially Wood Ducks, utilize these flowages, along with many other species of wildlife.

Chippewa County received above average amounts of rainfall in 2014 which influenced water levels despite all boards being removed from the water control structures. This may have been the reason for the minimal shoreline with exposed mudflats available. The aquatic macro-invertebrate surveys indicate sufficient densities to attract and support waterfowl and shorebirds with greater than 100 midge larvae per square meter at most sampling locations, but the survey method used had limitations and biases and future surveys should be done with someone who has experience conducting macro-invertebrate surveys. It would also be beneficial to conduct a formal nektonic macro-invertebrate study at each flowage if the goal is to assess habitat suitability for waterfowl and shorebirds. Benthic core samples fail to detect mobile organisms found in shallow water that is also a substantial part of shorebird diet (Sherfy, et al., 1999). Surveyors for this study only prepared for benthic surveys, but after evaluating the shorelines and realizing the lack of exposed mudflats, they improvised and took nektonic samples without following a formal protocol.

It is recommended Chippewa County conduct macrophyte, aquatic macro-invertebrate, waterfowl, and shorebird and wildlife surveys on a regular basis to assess the usefulness of moist soil management in this region. This report serves as baseline data that can be used for comparison to assess how management efforts are changing the characteristics of these flowages over time.

Acknowledgements

I would like to thank Mike Dahlby for coordinating this study and for his guidance throughout the project. I would also like to thank Lindsay Olson for her assistance throughout the project and for her amazing cartography skills. A large thank you is in order to Anna Mares for being my field partner all summer and for sharing her immense aquatic plant knowledge. Lastly I would like to thank Jodi Lepsch and Robert Freckmann for their assistance identifying unknown plants.

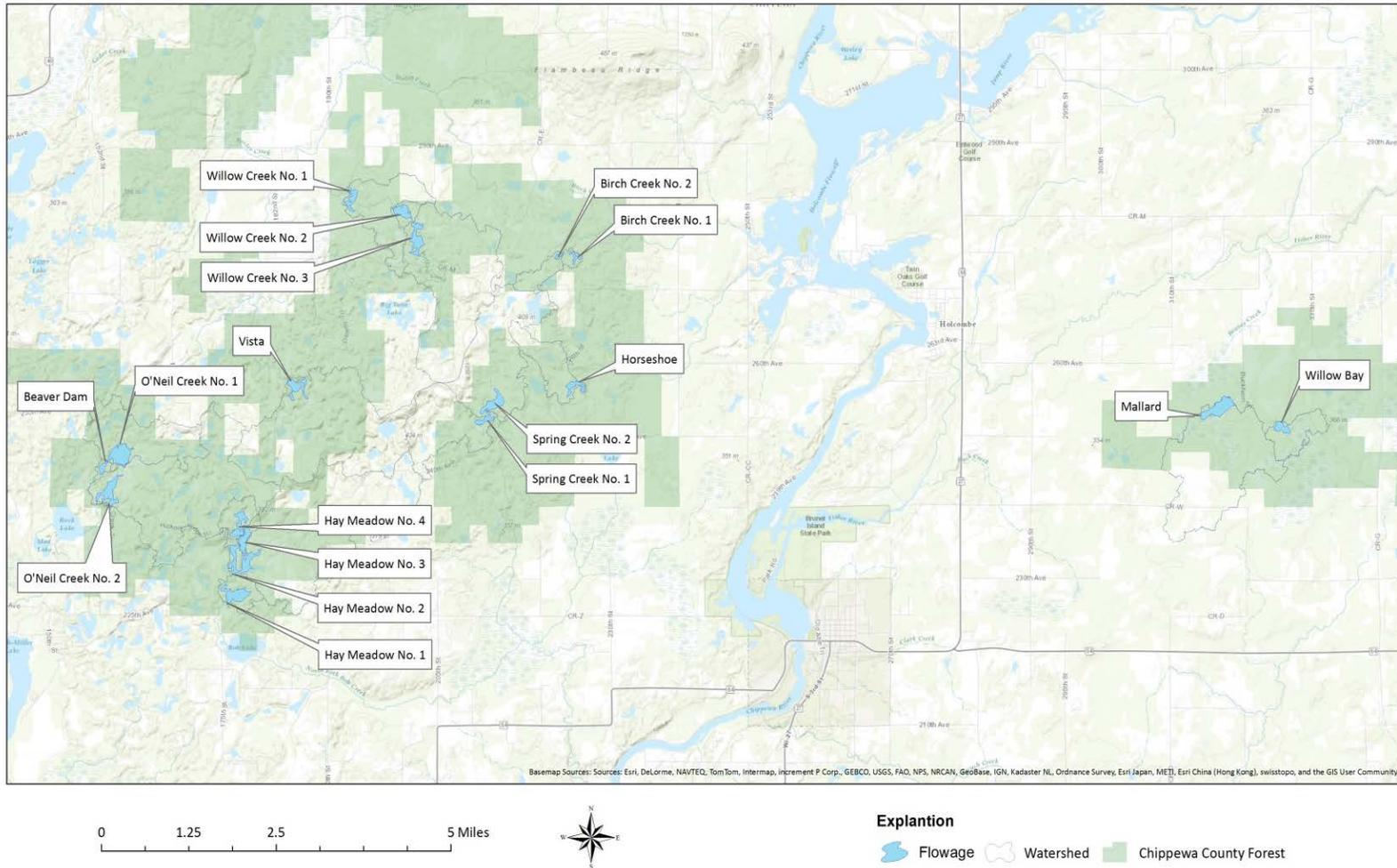
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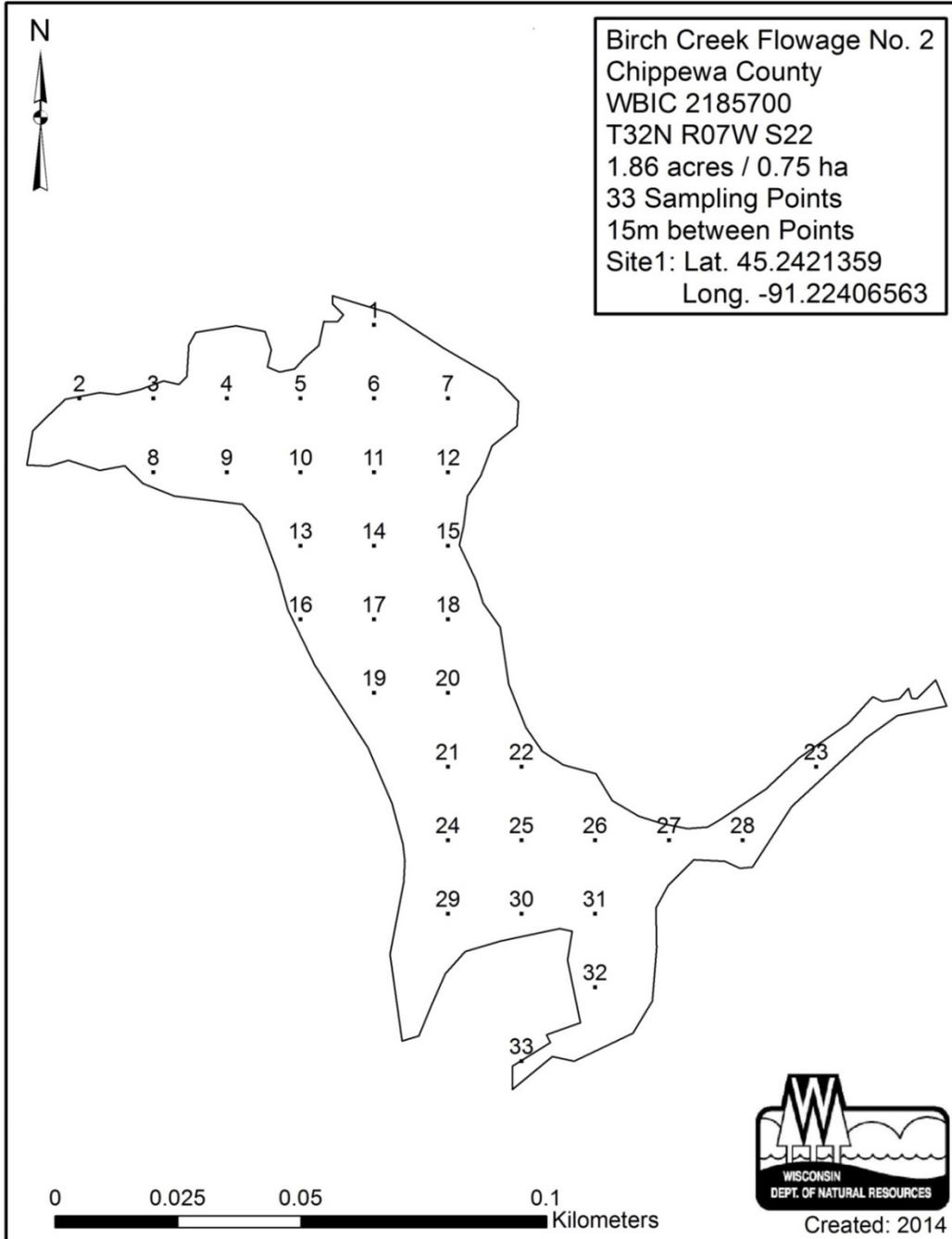
Appendices

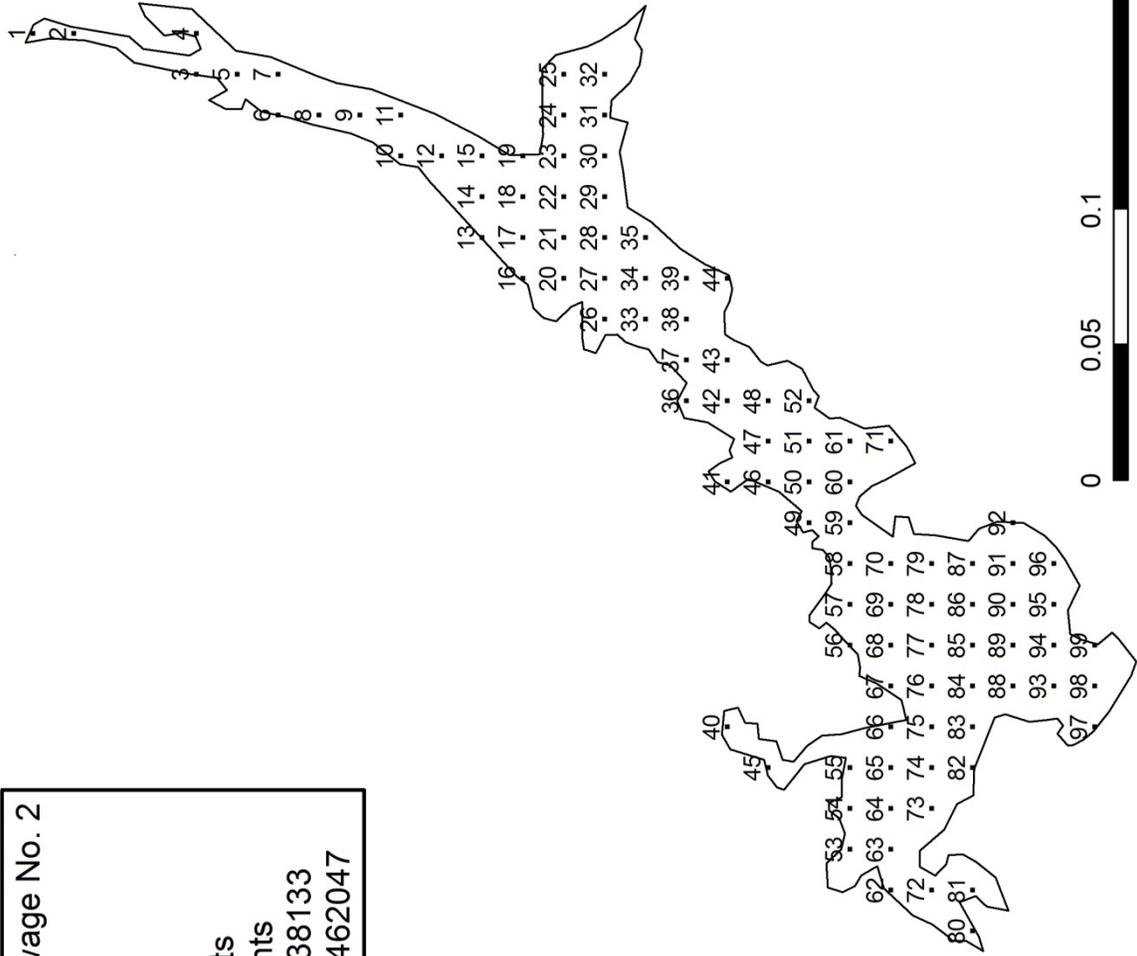
Appendix A. Wildlife Flowages in the Chippewa County Forest.

Wildlife Flowages of the Chippewa County Forest



Appendix B. Point intercept maps indicating where macrophyte samples were taken. Point intercept maps were created by the Wisconsin Department of Natural Resources.

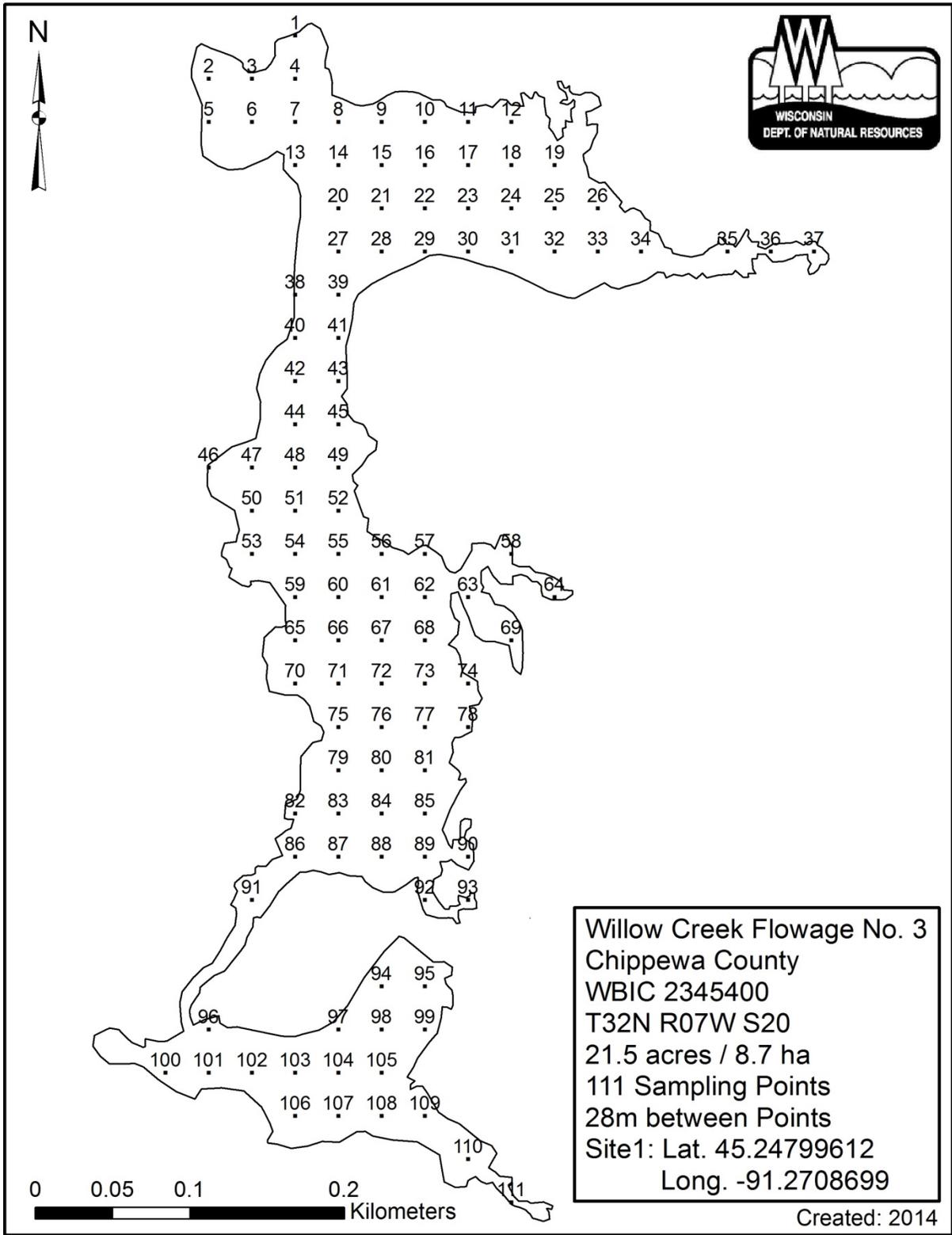




Spring Creek Flowage No. 2
Chippewa County
WBIC 2177300
T32N R07W S33
5.4 acres / 2.2 ha
99 Sampling Points
15m between Points
Site1: Lat. 45.21438133
Long. -91.2462047

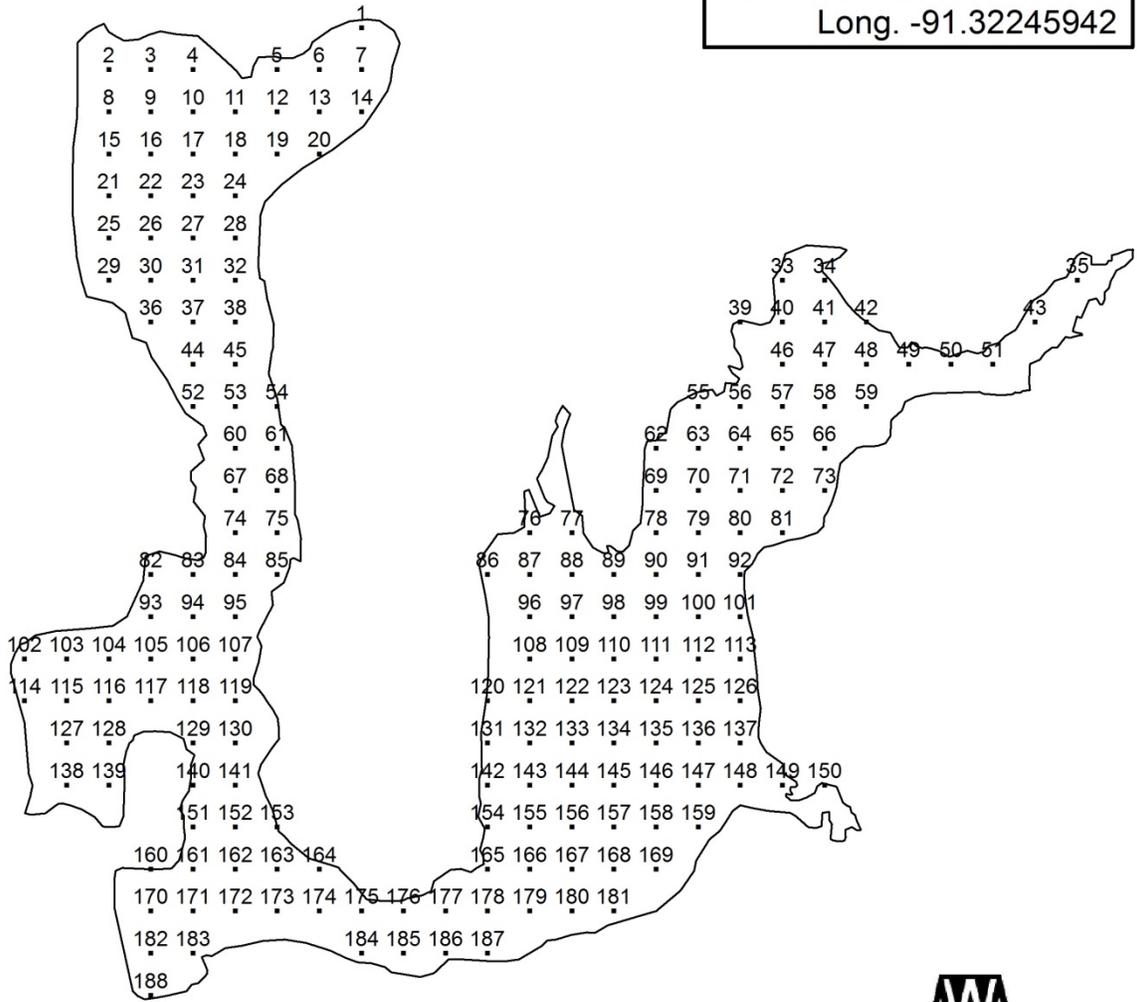


Created: 2014

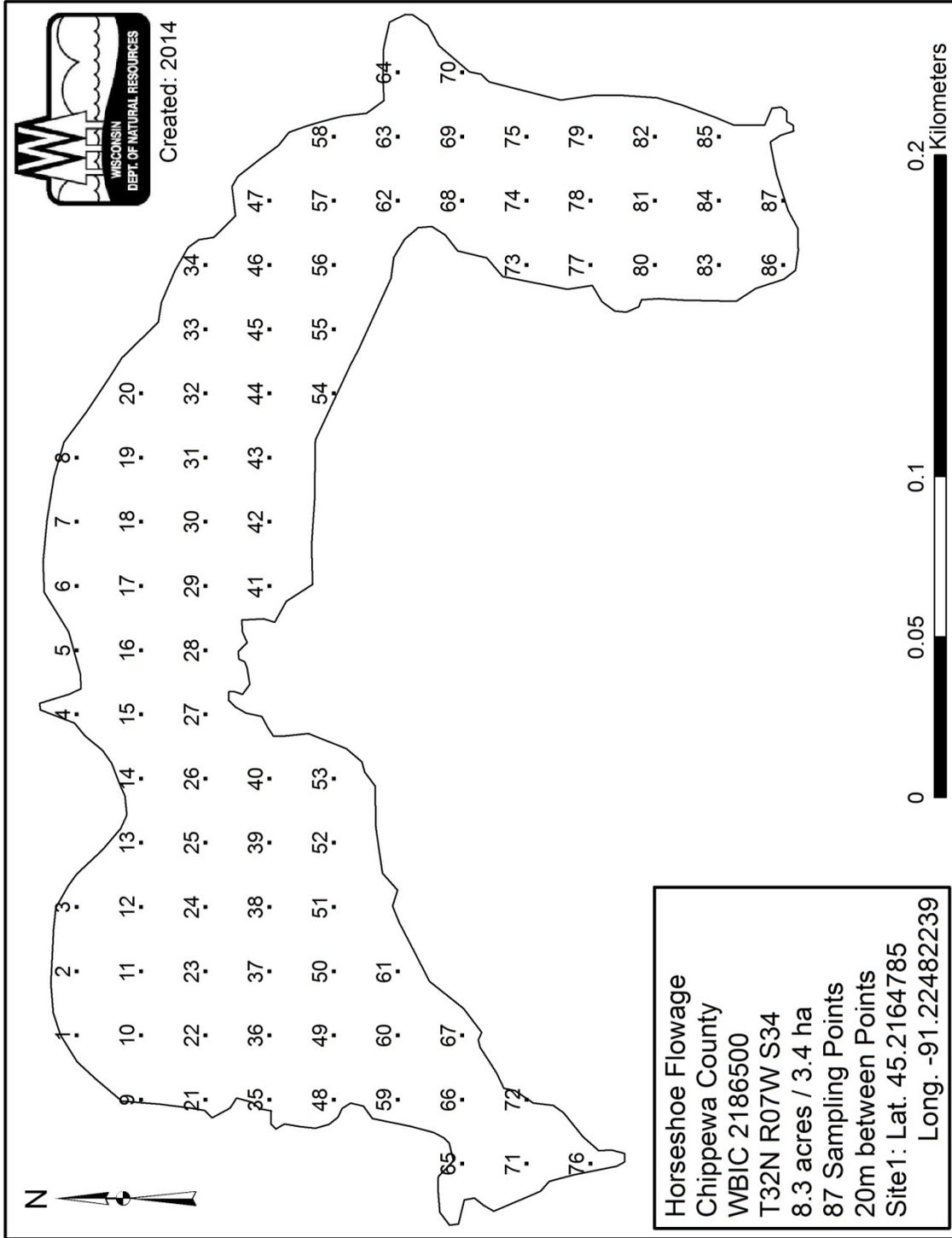




Hay Meadow Flowage
Chippewa County
WBIC 2180100
T31N R08W S11
37.4 acres / 15.1 ha
188 Sampling Points
28m between Points
Site1: Lat. 45.18437581
Long. -91.32245942



Created: 2014



Appendix D. Example of wildlife observation data sheet.

Wildlife Flowage Management Project 2014					
Wildlife Sightings for Birch Creek No. 1					
Date: _____					
Names of people conducting survey: _____					
Start Time: _____		End Time: _____		Weather: _____	
#	Species Name	Life Stage	#	Species Name	Life Stage
1			31		
2			32		
3			33		
4			34		
5			35		
6			36		
7			37		
8			38		
9			39		
10			40		
11			41		
12			42		
13			43		
14			44		
15			45		
16			46		
17			47		
18			48		
19			49		
20			50		
21			51		
22			52		
23			53		
24			54		
25			55		
26			56		
27			57		
28			58		
29			59		
30			60		
Additional Notes: _____					

Appendix E. Macrophyte species documented at each flowage.

Scientific	Common Name	Birch Creek #1	Spring Creek #2	Willow Creek #3	Hay Meadow #2	Horseshoe
<i>Asclepias incarnata</i>	Swamp milkweed	X	X	X		X
<i>Athyrium filix-femina</i>	Lady fern			X		
<i>Brasenia schreberi</i>	Watershield	X		X	X	X
<i>Calla palustris</i>	Wild calla		X			X
<i>Callitriche palustris</i>	Common water-starwort		X			
<i>Carex comosa</i>	Bottle brush sedge	X	X	X	X	X
<i>Carex diandra</i>	Bog-panicled sedge			X		
<i>Carex pellita</i>	Woolly sedge			X	X	
<i>Ceratophyllum demersum</i>	Coontail	X	X	X	X	X
<i>Ceratophyllum echinatum</i>	Spiny hornwort	X	X		X	X
<i>Cicuta bulbifera</i>	Bulb-bearing water hemlock		X	X		
<i>Cicuta maculata</i>	Water hemlock			X		
<i>Comarum palustre</i>	Marsh cinquefoil			X		
<i>Cyperaceae sp.</i>	Sedge	X	X		X	X
<i>Dulichium arundinaceum</i>	Three-way sedge	X	X	X	X	X
<i>Eleocharis acicularis</i>	Needle spikerush				X	X
<i>Eleocharis canadensis</i>	Common waterweed				X	
<i>Eleocharis palustris</i>	Creeping spikerush			X	X	
<i>Eleocharis sp.</i>	Spikerush	X	X	X	X	X
<i>Elodea canadensis</i>	Common waterweed	X	X	X	X	X
<i>Elodea nuttallii</i>	Slender waterweed		X		X	
<i>Filamentous algae</i>	Filamentous algae			X	X	X
<i>Galium aparine</i>	Bedstraw		X	X		
<i>Galium trifidum</i>	Small bedstraw			X		
<i>Hypericum majus</i>	Larger Canadian St. John's-wort					X
<i>Impatiens capensis</i>	Jewelweed			X		
<i>Iris versicolor</i>	Northern blue flag			X		
<i>Juncus effusus</i>	Common rush	X			X	
<i>Leersia oryzoides</i>	Rice cut grass					X
<i>Lemna minor</i>	Small duckweed	X	X	X	X	X
<i>Lemna trisulca</i>	Forked duckweed		X	X		
<i>Lysimachia thyrsiflora</i>	Tufted yellow loosestrife			X		
<i>Najas flexilis</i>	Slender naiad					X
<i>Najas gracillima</i>	Northern naiad					X
<i>Nitella sp.</i>	Nitella	X	X			X
<i>Nuphar advena</i>	Yellow pond lily	X				
<i>Nuphar variegata</i>	Spatterdock	X		X	X	X
<i>Nymphaea odorata</i>	White water lily	X	X	X	X	X
<i>Onoclea sensibilis</i>	Sensitive fern			X		X

<i>Penthorum sedoides</i>	Ditch stonecrop		X			
<i>Persicaria amphibia</i>	Water smartweed		X	X	X	X
<i>Potamogeton amplifolius</i>	Large-leaf pondweed					X
<i>Potamogeton diversifolius</i>	Water-thread pondweed	X	X		X	X
<i>Potamogeton epihydrus</i>	Ribbon-leaf pondweed				X	X
<i>Potamogeton foliosus</i>	Leafy pondweed	X	X	X	X	X
<i>Potamogeton illinoensis</i>	Illinois pondweed					X
<i>Potamogeton natans</i>	Floating-leaf pondweed		X	X		X
<i>Potamogeton nodosus</i>	Long-leaf pondweed		X			
<i>Potamogeton pusillus</i>	Small pondweed	X	X	X	X	X
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	X	X	X	X	X
<i>Potamogeton sp.</i>	pondweed		X			
<i>Riccia fluitans</i>	Slender riccia	X	X		X	X
<i>Sagittaria latifolia</i>	Common arrowhead	X	X	X	X	X
<i>Sagittaria rigida</i>	Sessile-fruited arrowhead	X	X	X	X	X
<i>Sagittaria sp.</i>	Arrowhead		X	X	X	X
<i>Schoenoplectus acutus</i>	Hardstem bulrush			X	X	X
<i>Schoenoplectus smithii</i>	Smith's bulrush				X	
<i>Schoenoplectus subterminalis</i>	Water bulrush				X	
<i>Schoenoplectus tabernaemontani</i>	Softstem bulrush	X	X	X	X	X
<i>Scirpus cyperinus</i>	Wool-grass				X	
<i>Sparganium angustifolium</i>	Narrow-leaved bur-reed					X
<i>Sparganium emersum</i>	Short-stemmed bur-reed	X		X		X
<i>Sparganium eurycarpum</i>	Common bur-reed		X			X
<i>Sparganium sp.</i>	Bur-reed		X	X	X	X
<i>Spiraea tomentosa</i>	Steeplebush	X				
<i>Spirodela polyrhiza</i>	Large duckweed	X	X	X	X	X
<i>Tradenum fraseri</i>	Fraser's St. John's-wort			X		
<i>Typha latifolia</i>	Broad-leaved cattail		X	X	X	X
<i>Utricularia gibba</i>	Creeping bladderwort	X	X		X	X
<i>Utricularia minor</i>	Small bladderwort	X			X	
<i>Utricularia vulgaris</i>	Common bladderwort	X	X	X	X	X
<i>Utricularia sp.</i>	bladderwort		X			
<i>Verbena hastata</i>	Blue vervain	X				X
<i>Zizania sp.</i>	Wild rice	X				
Total =		31	38	41	39	45

