

**NATURAL FEATURES INVENTORY FOR THE
FLOWING WELL TROUT FARM RESTORATION AREA**



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Michigan Natural Features Inventory
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Cover Photo by Brian Klatt

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EXECUTIVE SUMMARY

The Conservation Resource Alliance (CRA) undertook a restoration project focusing on the former Flowing Well Fish Hatchery, which was closed in approximately 2002, and the land acquired by the Michigan Department of Natural Resources in 2008. The restoration effort consisted of the removal of a number of dams that impeded the flow of Flowing Well Creek and the North Branch of the Manistee River. Removal of the dams was intended to restore natural flow to these water courses, reduce sediment accumulation, allow for fish passage, and reverse the warming effect of the dams on water temperatures of these streams.

To guide future stewardship efforts for this property, CRA contracted with the Michigan Natural Features Inventory (MNFI), a program of Michigan State University Extension, to conduct natural features inventories for the property. As an initial effort, surveys for the following aspects were conducted: natural communities, plants, mussels, and breeding birds. In addition, a search of the MNFI Natural Heritage Database (NHD) was conducted to determine if any known Element Occurrences (EOs) of rare species or high-quality natural communities are present in the vicinity of the Flowing Well Property. Also, based on the findings of the natural community inventory, an assessment for the potential for rare insects was conducted.

The following results were obtained through the desktop and field activities:

- Search of the NHD determined that 7 animal EOs and 1 plant EO occur within 5 miles of the Flowing Well Property, including a Bald Eagle EO from the site itself
- Four broad cover types were identified, that included a total of seven natural communities:
 - Mesic Forest
 - Mesic Northern Forest
 - Swamp Forest
 - Rich Conifer Swamp
 - Hardwood-conifer Swamp
 - Open Wetlands
 - Submergent Marsh
 - Emergent Marsh
 - Northern Wet Meadow
 - Northern Shrub Thicket
 - Old Field
- A total of 387 plant taxa were identified from these cover types, including 315 native species (81%)
- Two new EOs for the MNFI NHD were found: ginseng (*Panax quinquefolius*) and an old-growth stand of Rich Conifer Swamp
- Plant species richness was highest in herbaceous and shrub-dominated open wetlands, followed by swamp forest, old field and early successional habitats, and upland forest
- Floristic Quality Indices (FQI), based on native species only ranged from 31.5 for the old field cover type to 55.5 for swamp forest cover type, with the site scoring an overall FQI of 75.0
- Three unionid mussel species were found, including one represented by a single live individual and two by shell alone:
 - cylindrical papershell (*Anodontoides ferussacianus*)
 - creek heelsplitter (*Lasmigona compressa*)
 - giant floater (*Pyganodon grandis*)
- Four of the five sites surveyed in Flowing Well Creek had unionid mussel shells

- Water quality of the streams, as determined by dissolved oxygen levels, specific conductance, and alkalinity, is good in relation to unionid mussel tolerances
- Two state-listed threatened bird species, the Red-shouldered Hawk and the Louisiana Waterthrush were detected
- The forest interior warbler and thrush species were diverse and only 1 individual invasive bird was detected (Brown-headed Cowbird)
- The Golden-winged Warbler, a species with significantly declining populations, was detected
- The natural communities on the site have the potential to support populations of the state-threatened (Henry's elfin, *Phyciodes batesii*), as well as 12 species identified by MNFI as "special concern"

Based on the above findings and other observations, MNFI would make the following conclusions and recommendations regarding the Flowing Well Property:

- The water quality measures indicate that the CRA restoration efforts are being effective. Consequently, efforts that reinforce or complement these should be carried out, as these may be especially beneficial to the unionid mussel community in the streams.
- While not containing any exceptionally rare natural communities, the site does support unfragmented, high-quality areas of a number of communities. These are exceptional from the standpoint of their FQIs and their level of intactness.
- The natural communities supporting the state-listed species should be managed to insure those species continued existence on the property. This should include maintaining the unfragmented nature of the forests, which provide habitat for a strong community of interior-nesting birds; a situation that is becoming evermore rare in the lower peninsula of Michigan.
- While invasive plant species are not well established in the natural communities, they are so in the area of the former fish hatchery facility. Therefore, an "early detection, rapid response" monitoring program should be established for the entire property to insure invasives do not get a foothold in the natural community areas.
- Evidence of deer browse suggests that the DNR should encourage greater hunting on this property in order to avoid adverse impacts to the wildflowers and other species of preferred browse.
- The site clearly supports a number of rare species, including state-listed, threatened species and high-quality natural communities. Therefore, a carefully crafted stewardship plan should be developed that accounts for the above conclusions.
- This inventory effort is of limited scope and should be expanded to include spring botanical surveys and surveys for the rare insect species potentially occurring on the site, especially for the Henry's elfin (*Phyciodes batesii*) moth.

INTRODUCTION

The Flowing Well Trout Farm is a former private fish hatchery located in Excelsior Township of Kalkaska County, on Highway M-72, approximately 8 miles east of Kalkaska and 15 miles west of Grayling. The hatchery, which closed about 10 years ago, and the property was acquired by the Michigan Department of Natural Resources in 2008, with the aid of the Grand Traverse Regional Land Conservancy. The property included a series of dams that impeded Flowing Well Creek, as well as the North Branch of the Manistee River. Due to the impeded flows, the dams had resulted in a build up of sediment and increased water temperatures in these streams, which support a naturally occurring population of brook trout and brown trout. In order to remedy the adverse effects of these dams, the Conservation Resource Alliance, working with a wide variety of partners, undertook a dam removal project to restore the natural flow in these streams and improve associated habitat.

To provide a sound basis for further stewardship of the property, Conservation Resource Alliance (CRA), contracted with the Michigan Natural Features Inventory (MNFI), a program of the Michigan State University Extension, to conduct a series of biological inventories for the Flowing Well site. Based on initial observations at the property by CRA and its partners, it was determined that the most appropriate initial step would be to conduct the following inventories: 1) a botanical inventory that focused on the identification of the natural communities that occur on the property and which would include a Floristic Quality Assessment; 2) a survey of the mussels occurring in Flowing Well Creek and the North Branch of the Manistee River, in response to reports of high bivalve population in those streams; 3) a breeding bird survey; and 4) a desktop assessment of the potential for rare insects to occur on the property based on the findings of the botanical inventory. This report presents the results of these surveys, as well as the entomological assessment.

METHODS

Natural Heritage Database Search

As the designated Natural Heritage Program for Michigan, MNFI maintains the Natural Heritage Database (NHD) for the state. The NHD is the most comprehensive database regarding the distribution and condition of threatened, endangered, and other rare species, as well as high-quality natural communities for Michigan. The individual records in the NHD are referred to as Element Occurrences (EOs) and represent well-documented occurrences of rare species and communities that meet the Natural Heritage Methodology standards established by NatureServe and the nationwide system of Natural Heritage Programs (NatureServe 2012). The NHD includes not only tabular data concerning the EOs, but MNFI has also spatialized the occurrences, which allows for geographic-based searches. MNFI conducted a search of the NHD to identifying the EOs occurring within 5 miles of the Flowing Well property.

Natural Communities and Floristic Quality Assessment

Meander surveys were conducted in mid-summer (July 10, 11, 12, and 13) and late summer (August 21, 22, 23, and 24) of 2012. Surveys were designed to adequately sample all characteristic habitats on the property, including upland forest, swamp forest,

open and shrub-dominated wetlands, and open fields and early successional upland habitats (Figure 1). July surveys covered the entire 1,720 acre (700 ha) property; August surveys concentrated on a smaller study area of 640 ac (260 ha) in the southeastern portion of the property, where special focus was given to the vegetative communities in the vicinity of dam removal projects along Flowing Well Creek and the North Branch of the Manistee River. The majority of plants were identified in the field. Unknowns were collected and keyed in the office. Several taxa that were not previously documented from Kalkaska County (Voss and Reznicek 2012) were also collected for deposition in the University of Michigan Herbarium (MICH; see Appendix 6).

Species lists were stratified by broad landcover type and entered into the Floristic Quality Assessment for Michigan program (Herman et al. 2001). Nomenclature for the FQAs follows Herman et al. (2001); see Appendix 6 for updated nomenclature (Voss and Reznicek 2012). The FQA is derived from two values, a mean coefficient of conservatism (C) and the floristic quality index (FQI) (Herman et al. 2001). Each native taxon is assigned a C value on a scale of 0-10 based on the probability of its occurrence in a natural versus degraded habitat. In this manner, a taxon that is restricted to a specialized habitat, such as the federally threatened Pitcher's thistle (*Cirsium pitcheri*) that occurs on active sand dunes, is assigned a value of 10, implying that the taxon has extremely strong fidelity to a particular habitat. Native taxa that are not particular to or indicative of natural conditions, such as common milkweed (*Asclepias syriaca*), are assigned low values (in this instance, $C=1$) (Herman et al. 2001). Non-native species are not assigned C values because they are not indicative of native habitats. From the total list of vascular plant taxa for an area, a mean C value is calculated ($\bar{C} = \Sigma C / n$), and that value is multiplied by the square root of the total number of plants (\sqrt{n}) to calculate the FQI ($FQI = \bar{C} \sqrt{n}$) (Herman et al. 2001). Mean C values and FQI values were calculated including native species only (\bar{C} and native FQI) and including both native and non-native species (\bar{C} with adventives and FQI with adventives).

Based on field surveys and interpretation of topographic maps and color infrared and natural color aerial photographs, habitat patches were mapped and typed to MNFI natural community where appropriate (Kost et al. 2007). Maps of natural communities are presented below with the habitat characterizations; more detailed maps with patch-specific classification and notes are provided in a separate shapefile.

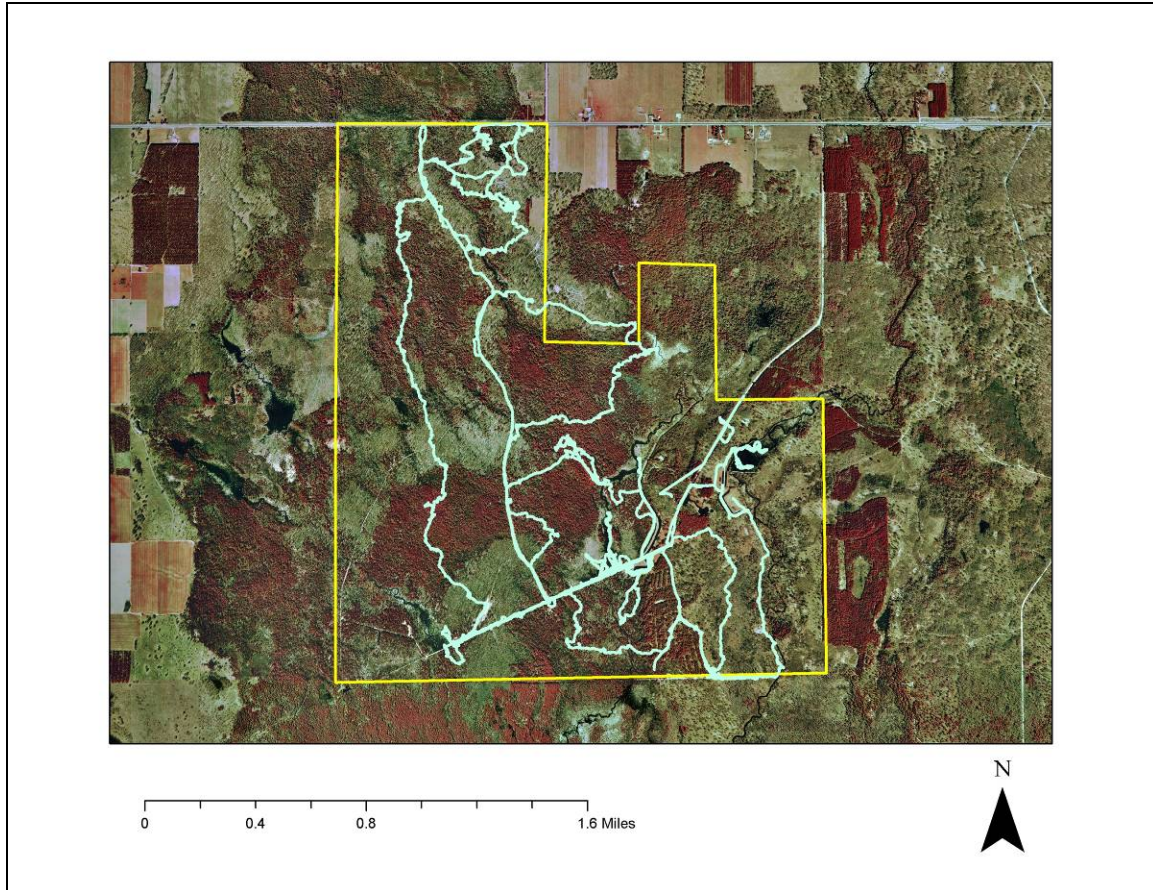


Figure 1. July and August botanical inventory survey lines (blue).

Mussel Surveys

MNFI performed unionid mussel surveys in Flowing Well Creek and the North Branch of the Manistee River, within reaches identified by CRA. The primary purpose of the surveys was to determine unionid mussel species presence/absence and abundance within these reaches.

Surveys were performed in wadeable habitats (less than approximately 70cm depth) and utilized tactile and visual methods of detection. Presence/absence and abundance of unionid mussel species were determined at each site. A measured search area was used to standardize sampling effort among sites and allow unionid density estimates to be made. Eighty square meter search areas provided a good balance between amount of search effort per sample site and the number of sites to be completed within the scope of the project. Slightly more or less area was searched at some sites depending on available habitat. The search area was defined by taking stream width measurements and dividing the average into 80 to get a reach length that would give 80m². When possible, sites were searched from bank to bank so that the full range of micro habitats was covered.

A combination of tactile and visual means was used to locate live mussels and shells within each search area. Glass bottom buckets were used to facilitate visual detection. At sites where visual detection was difficult (e.g. riffles or areas with silt) the entire area

was searched tactilely. Hands were passed through the substrate down to approximately 5cm during tactile searches. Frequent tactile searches through the substrate were also made at sites where visual detection was used to help ensure buried unionids were not overlooked. Live individuals were identified to species and planted back in the substrate anterior end down. Shells were identified to species.

The substrate within each transect was characterized by estimating the percent composition of each of the following six particle size classes (diameter); boulder (>256mm), cobble (256-64mm), pebble (64-16mm), gravel (16-2mm), sand (2-0.0625mm), silt/clay (<0.0625) (Hynes 1970). Percent pool/riffle/run habitat within each survey area was estimated visually. The presence of aquatic vegetation and woody debris was noted, and a rough estimate of current speed was made for each survey site.

Handheld GPS units (Garmin 12XL) were used to document the position of survey sites. Water chemistry measurements were made to describe and document stream conditions at the time of the surveys. Water chemistry data were taken prior to searching for unionids to avoid stirring up silt that could affect measurements. Dissolved oxygen was recorded with a YSI Model 55 handheld meter, and conductivity, pH, and temperature were recorded with an Oakton handheld meter. Alkalinity was measured with a LaMotte kit (model DR-A), and hardness with a Hach kit.

A total of twelve sites were surveyed for mussels, five in Flowing Well Creek and seven in the North Branch of the Manistee (Figure 2). All sites were accessed by foot. Coordinates of survey sites are given in Table 1. A qualitative visual search for shells and live unionid mussels was made while walking in the stream between survey sites. Due to very good visibility (high water clarity and shallow depth) this qualitative search added a substantial amount of sampling effort to the survey. Two incidental finds of empty shells were documented.

Table 1. Way points for mussel survey sites.

Site #	Waterbody	Latitude (N)	Longitude (W)
1	Flowing Well Creek	44.68995	85.00748
A	"	44.68887	85.00736
2	"	44.68874	85.00748
3	"	44.68833	85.00800
4	"	44.69290	85.00813
B	"	44.69347	85.00828
5	"	44.69506	85.00596
	North Branch		
6	Manistee	44.68918	84.99619
7	"	44.69071	84.99540
8	"	44.69364	84.99751
9	"	44.69790	84.99333
10	"	44.69706	84.99605
11	"	44.69903	84.99233
12	"	44.69868	84.98918

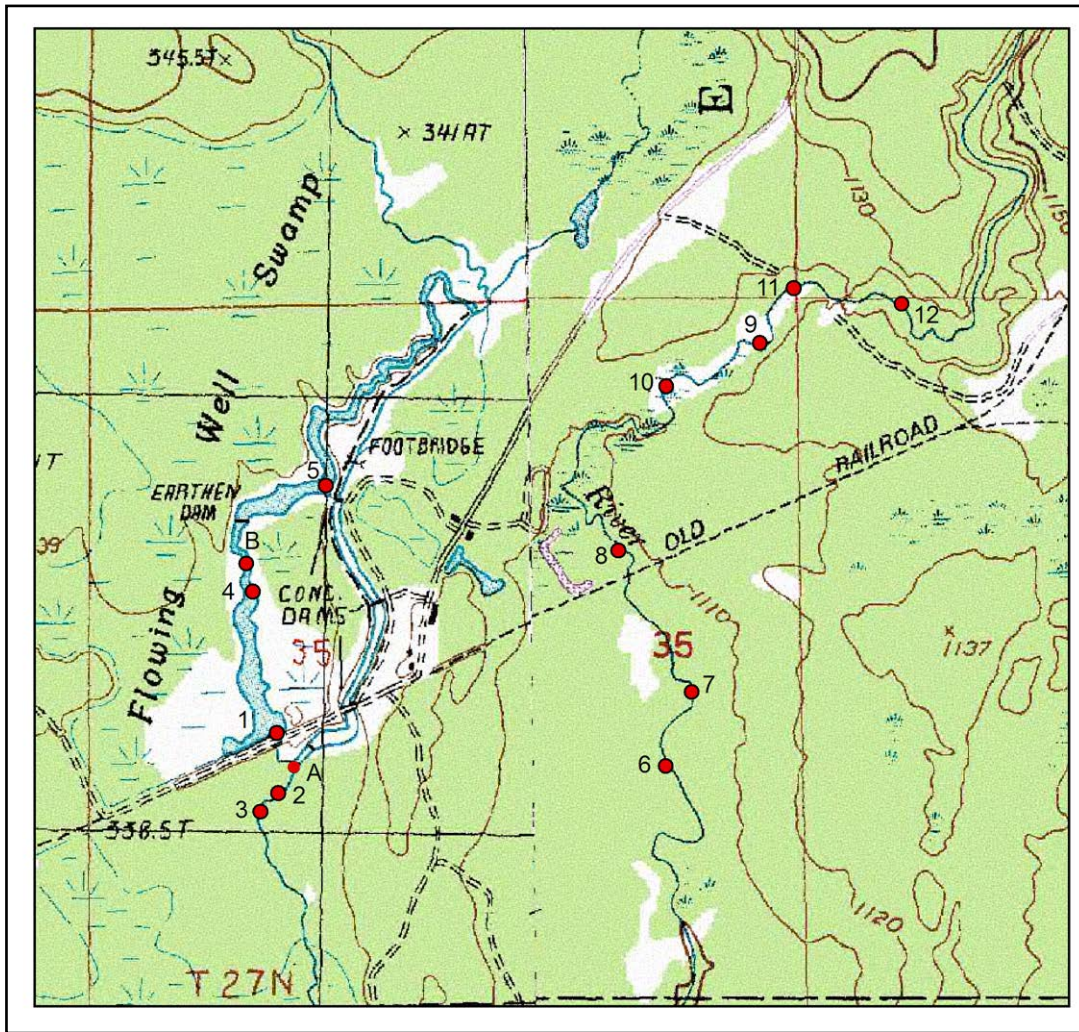


Figure 2. Mussel survey sites on the Flowing Well property.

Breeding Bird Surveys

In an effort to quantify the songbird use of the project area, we collected data using methods similar to those used in studies estimating breeding bird densities (Reynolds 1995, Johnson et al. 2000). Fifteen point count locations were established within the project area (Figure 3). Surveys were conducted once during the breeding season of June 2012.

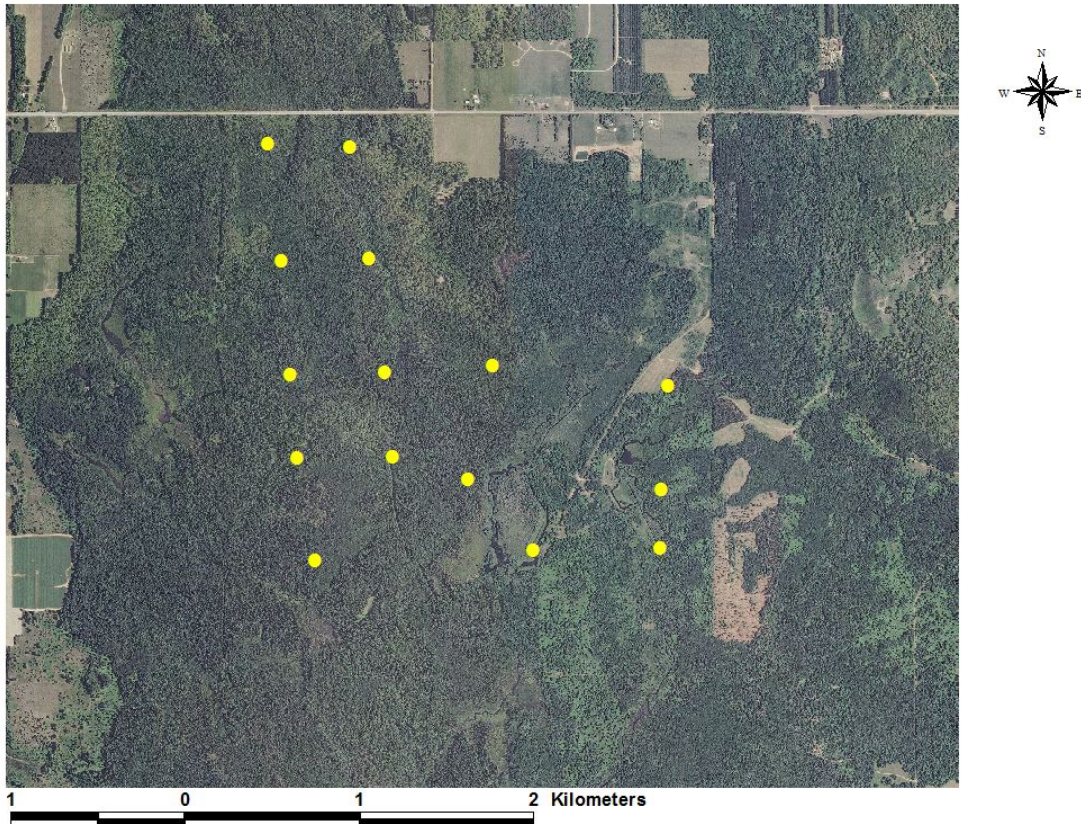


Figure 3. Breeding bird point count sites in the Flowing Well project area (June 2012).

Surveys at point count sites were 13 minutes long (after two minutes of silence) and conducted between 15 minutes before sunrise and 1030 AM EST. Observers recorded the following data: date, survey start time, temperature, wind speed, wind direction, cloud cover. Each individual bird detected during a survey was recorded by species, as well as the azimuth to the bird, gender (if known), distance from the observer, estimated flight height (if applicable), and other comments.

Insect Assessment

Insects are an incredibly diverse group and due to the many different micro-habitats in which they occur and because of their varied and punctuated seasonal activity periods, or their specific host plant associations, can be difficult to detect. The goal of this assessment was to determine which of the terrestrial insects currently listed either by the US Fish and Wildlife Service or the State of Michigan (or designated as “special concern” by the MNFI, have the potential to be located within the project area. This initial assessment will facilitate any future field-based survey efforts for rare insects. In addition, we present the habitat(s) to survey, how to survey, when to survey, and in some cases the particular host plants to sample.

Based on field surveys and interpretation of topographic maps and color infrared and natural color aerial photographs, habitat patches were mapped and typed to MNFI natural community where appropriate (Kost et al. 2007). Site-specific plant lists were

also reviewed for host plants that might be important for the rare insects in question regardless of habitat association. We used the MNFI Rare Species Explorer website (MNFI 2012), and personal knowledge and field experience to determine which species have the potential to occur within the project area (Figure 4).

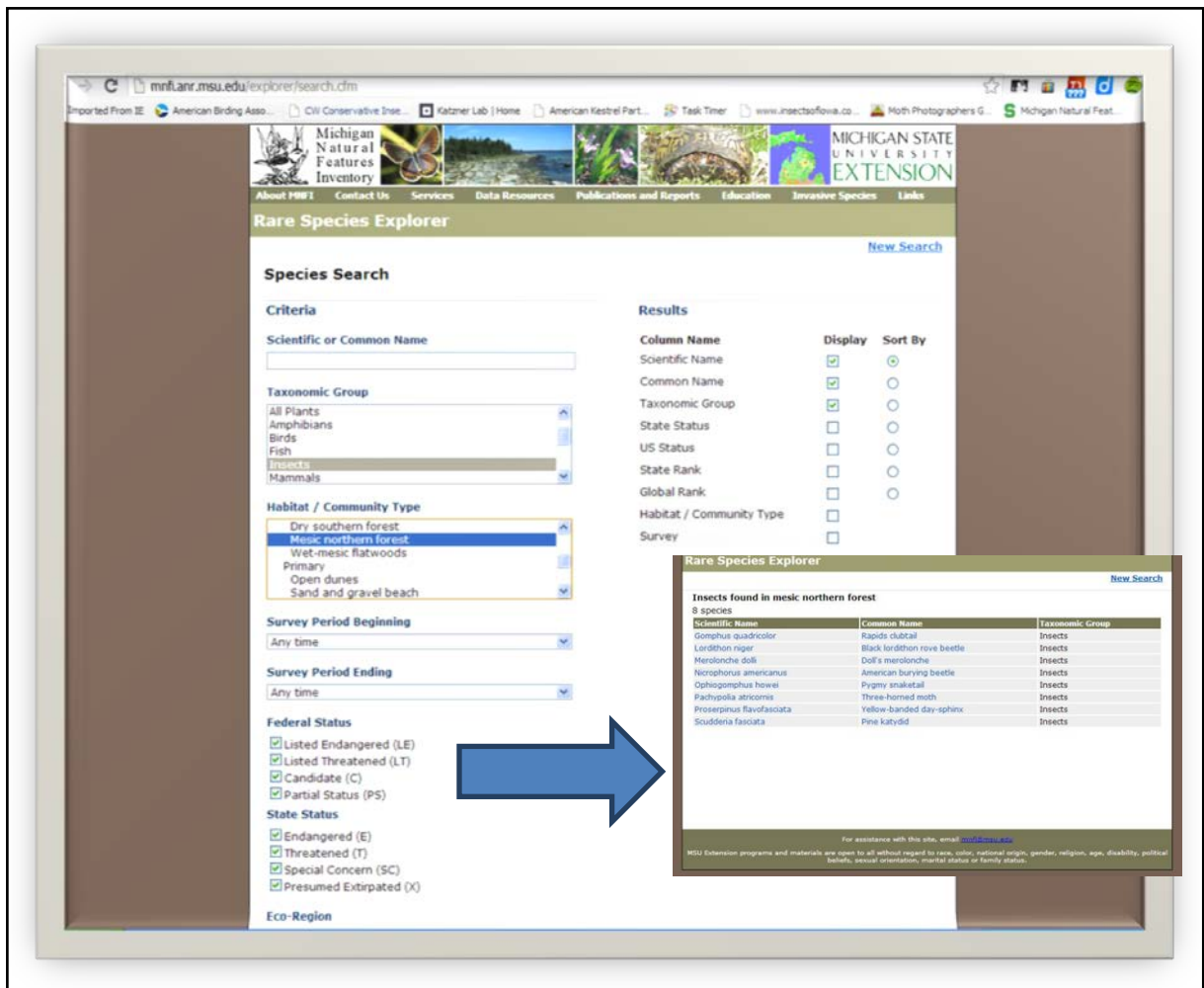


Figure 4. Screen shot of the MNFI Explorer query for insects associated with mesic southern forest.

Each of the natural communities documented at the site including: mesic northern forest, rich conifer swamp, hardwood-conifer swamp, submergent marsh, emergent marsh, northern wet meadow, northern shrub thicket, as well as pine barrens (a surrogate for the old field/early successional habitat type), was queried for associated rare insects. After reviewing this initial list, those species which do not range into the project area were omitted from the table as the likelihood of occurring in the project area is very unlikely. Likewise, those species that are aquatic were also removed from the analysis as aquatic species have already been inventoried at the project area. Nomenclature for the insects follows MNFI 2012. Nomenclature for plants follows Voss and Reznicek 2012.

RESULTS

Natural Heritage Database Search

The NHD search found 7 animal species and 1 plant species as occurring in the vicinity of the Flow Well property (Table 2). Of these EOs, only the Bald eagle is located on the site.

Table 2. Taxa represented by Element Occurrences within 5 miles of the Flowing Well property. (Notes: C – candidate species; T – threatened; SC – Special Concern)

<i>Scientific Name</i>	Common Name	Last Observed Date	Fed. Status	State Status	Global Rank	State Rank
<i>Atrytonopsis hianna</i>	Dusted skipper	2004-06-15		SC	G4G5	S2S3
<i>Botaurus lentiginosus</i>	American bittern	2004-06-01		SC	G4	S3S4
<i>Buteo lineatus</i>	Red-shouldered hawk	2004-06-03		T	G5	S3S4
<i>Emys blandingii</i>	Blanding's turtle	2004-08-19		SC	G4	S3
<i>Gavia immer</i>	Common loon	2004		T	G5	S3S4
<i>Haliaeetus leucocephalus</i>	Bald eagle	2005-05-18		SC	G5	S4
<i>Sistrurus catenatus</i>	Eastern massasauga	1990	C	SC	G3G4	S3S4
<i>Cirsium hillii</i>	Hill's thistle	2004-07		SC	G3	S3

Floristic Quality Assessments

A total of 387 taxa were identified to species, including 315 native species (81%) (Table 3; Appendix 1). Species richness was highest in herbaceous and shrub-dominated wetland, followed by swamp forest, old field and early successional habitats, and upland forest (Table 3; Appendices 2-5). Native mean coefficient of conservatism (\bar{C}) was highest in swamp forest, followed by upland forest and herbaceous and shrub-dominated wetland. Old fields and early successional habitats supported the lowest native \bar{C} and the highest number (59) and percentage (37%) of non-native taxa.

A total of 86 taxa, or 22% of the total number of taxa documented on site, are assigned C values of zero. This number is heavily skewed by the number of weedy taxa documented from old fields and other disturbed plant communities (Figure 4). The majority of taxa in all four broad habitat classes are generalists, or species that are able to tolerate disturbance and persist in disturbed environments. Eighty percent of the taxa documented are comprised of these generalists, which are assigned $C \leq 5$. Nine taxa, or 2% of the flora, are assigned a C of 10, which indicates strict fidelity to natural habitat (Figure 5). Distribution of plant taxa by C value is largely normal for upland and swamp

forests, centered on C of 5, whereas open wetlands and, particularly, old fields and rural habitats skew left, with a high concentration of weedy, opportunistic species (Figure 4).

Table 3. Floristic Quality Assessments by broad cover type. MF = mesic northern forest; SF = swamp forest (rich conifer swamp and hardwood-conifer swamp); OW = herbaceous and shrub-dominated wetlands (submergent marsh, emergent marsh, northern wet meadow, northern shrub thicket); OF = old fields, ruderal areas, roads, and early successional forest.

Cover type	Native species	Total species	\bar{C}	\bar{C} with adventives	Native FQI	FQI with adventives
MF*	106	119	4.4	3.9	45.3	42.7
SF*	165	176	4.3	4.1	55.5	53.7
OW	163	187	3.9	3.4	49.7	46.4
OF	102	161	3.1	2.0	31.5	25.1
Summary	313	385	4.2	3.4	75.0	67.6

*Two additional taxa, *Dendrolycopodium hickeyi* and *Dryopteris X boottii*, were documented from mesic northern forest and swamp forest, respectively, but are not recognized in Herman et al. (2001) and are not included in the FQA.

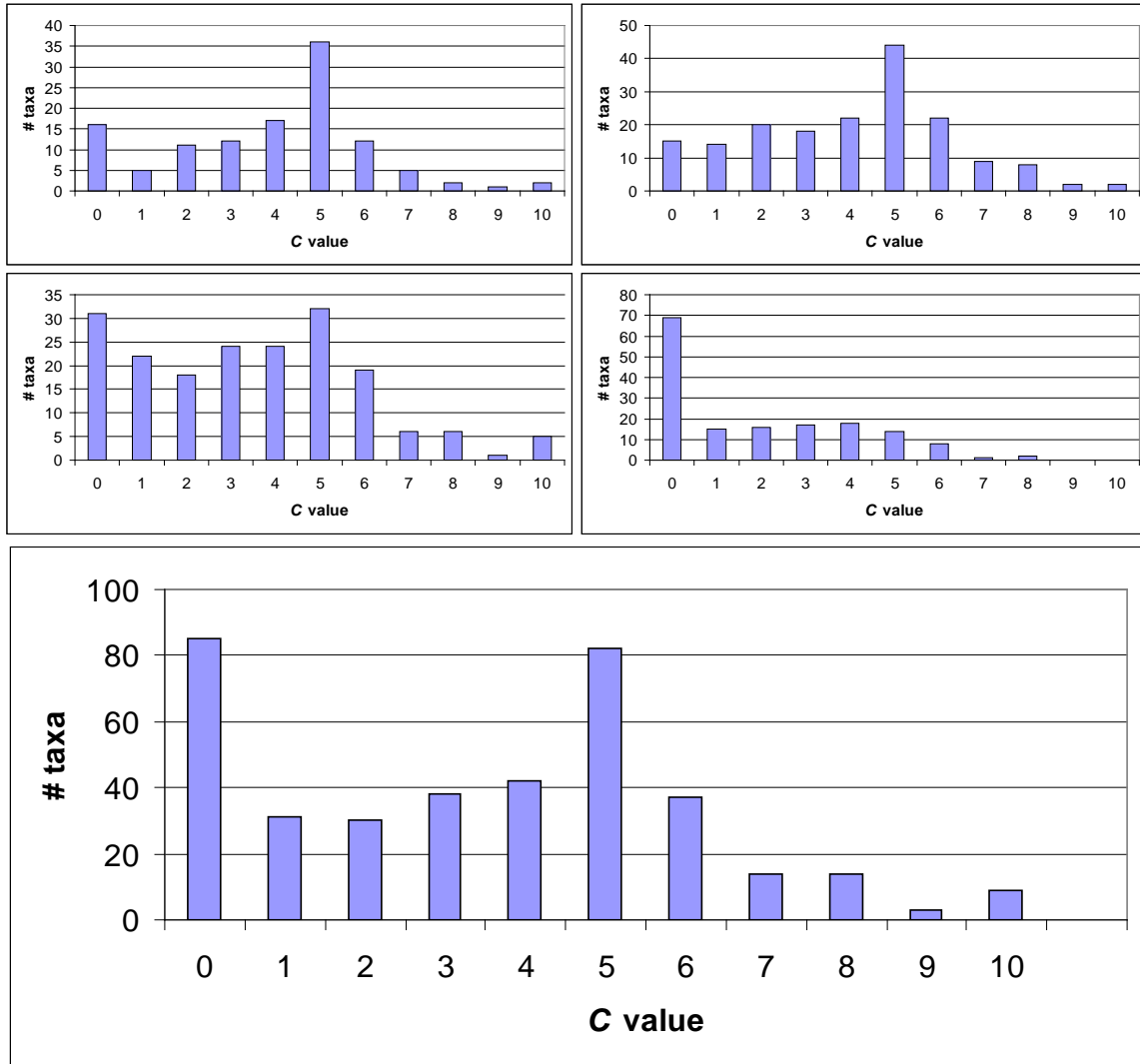


Figure 5. Distribution of C values for vascular plant taxa in MF (upper left), SF (upper right), OW (middle left), OF (middle right), and overall (bottom).

Rare Plant Surveys

One state-listed plant, ginseng (*Panax quinquefolius*), was documented during the floristic inventory (Figure 6). Ginseng is a state threatened plant species that has been documented from approximately 124 sites in Michigan (MNFI 2007). This is the first record for ginseng from Kalkaska County (Voss and Reznicek 2012). The occurrence on the Flowing Well property consists of an apparently small, loosely distributed population in a mesic northern forest stand dominated by sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*). The occurrence was documented and entered into the MNFI statewide database, and a voucher specimen was collected and deposited at the University of Michigan Herbarium (*B.S. Slaughter #759, MICH*).



Figure 6. Ginseng (*Panax quinquefolius*) was local in mesic northern forest dominated by sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*).

Habitat Characterizations

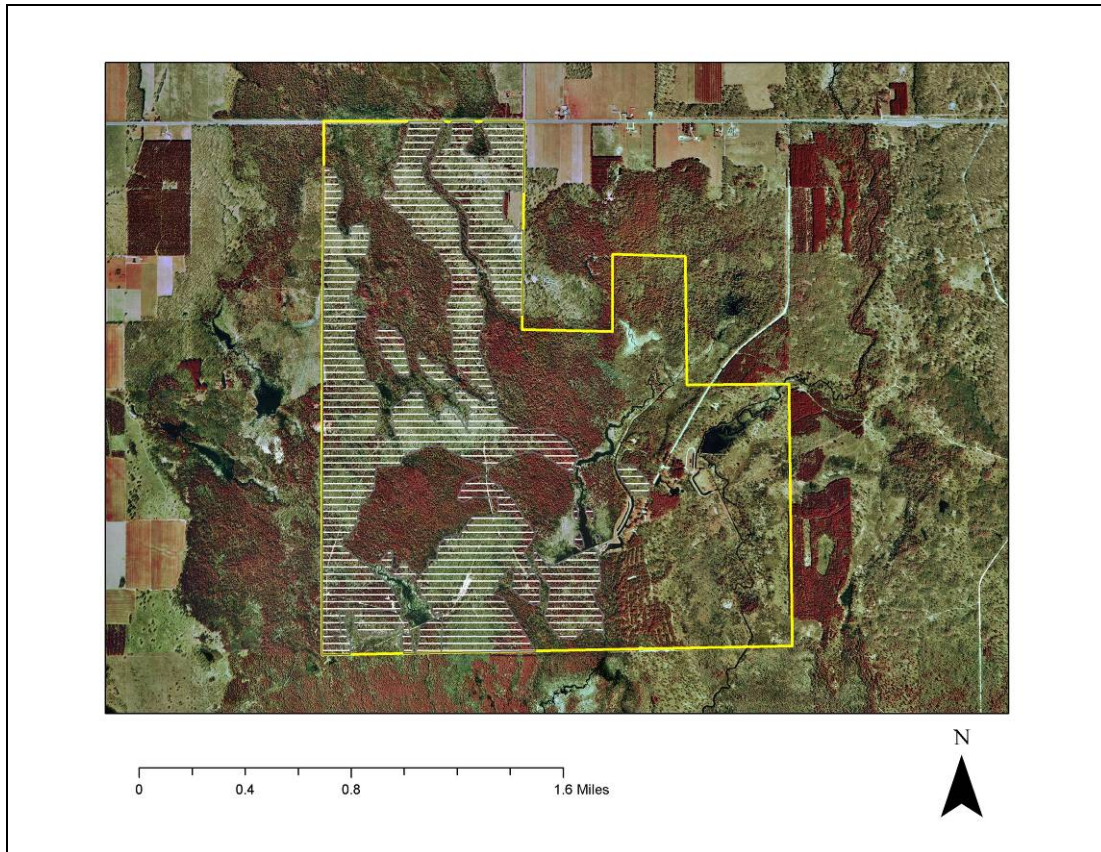


Figure 7. Mesic northern forest and related natural communities (white hatches).

Mesic northern forest (Figure 7, above)

The majority of the uplands on the property support mid-successional to mature mesic northern forest. This natural community is comprised of two primary cover types on the property: hemlock-hardwood forest dominated by hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), and yellow birch (*Betula alleghaniensis*), and hardwood forest dominated by sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*). Other common trees include black cherry (*Prunus serotina*), balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), and ironwood (*Ostrya virginiana*). Characteristic species in the shrub layer include serviceberry (*Amelanchier interior*), American fly honeysuckle (*Lonicera canadensis*), wild red raspberry (*Rubus strigosus*), and common blackberry (*R. allegheniensis*). Common ground layer species include Canada mayflower (*Maianthemum canadense* var. *canadense*), starflower (*Trientalis borealis*), Indian cucumber root (*Medeola virginiana*), goldthread (*Coptis trifolia*), wild sarsaparilla (*Aralia nudicaulis*), northern wood sorrel (*Oxalis acetosella*), violets (*Viola* spp.), northern shorthusk (*Brachyelytrum aristosum*), sedge (*Carex arctata*), evergreen woodfern (*Dryopteris intermedia*), ground-pine (*Dendrolycopodium obscurum*), and stiff clubmoss (*Spinulum annotinum*).

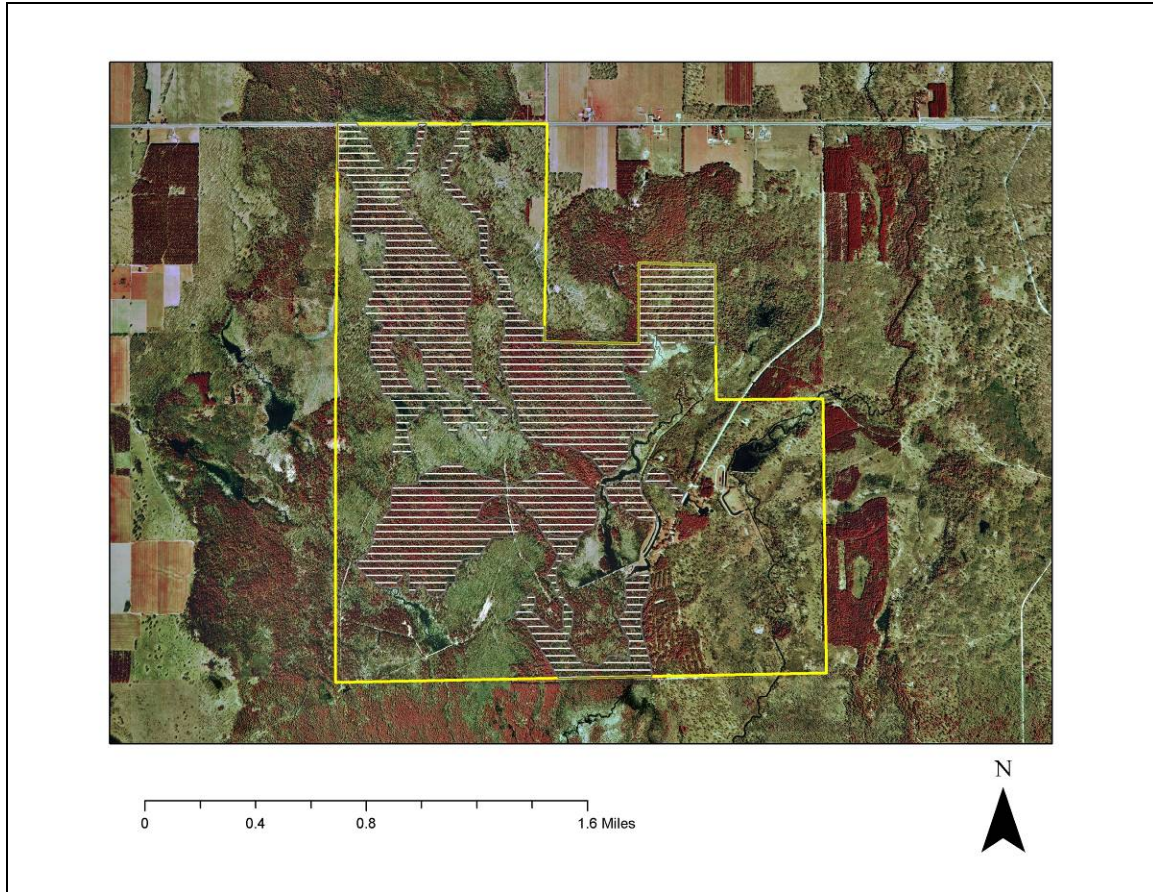


Figure 8. Rich conifer swamp and hardwood-conifer swamp (white hatches).

Rich conifer swamp and hardwood-conifer swamp (Figure 8, above)

The Flowing Well property supports extensive wetlands, mostly characterized by rich conifer swamp dominated by northern white-cedar (*Thuja occidentalis*), associated with black ash (*Fraxinus nigra*), yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), basswood (*Tilia americana*), American elm (*Ulmus americana*), and balsam fir (*Abies balsamea*). Open swamp and canopy gaps support several shrubs, and tend to be dominated by tag alder (*Alnus incana*), associated with elderberry (*Sambucus canadensis*), red-osier (*Cornus sericea*), swamp gooseberry (*Ribes hirtellum*), Michigan holly (*Ilex verticillata*), willows (*Salix* spp.), and alder-leaved buckthorn (*Rhamnus alnifolia*). The ground layer is species-rich and dense where the canopy is open, supporting jewelweed (*Impatiens capensis*), bittersweet nightshade (*Solanum dulcamara*), rough goldenrod (*Solidago rugosa*), side-flowering aster (*Symphyotrichum lateriflorum*), marsh-marigold (*Caltha palustris*), fowl manna grass (*Glyceria striata*), wood reedgrass (*Cinna latifolia*), sedges (including *Carex crinita*, *C. intumescens*, *C. leptalea*, and *C. stipata*), and sensitive fern (*Onoclea sensibilis*). Common species on hummocks and under closed canopy include wild sarsaparilla (*Aralia nudicaulis*), dwarf raspberry (*Rubus pubescens*), naked miterwort (*Mitella nuda*), northern wood sorrel (*Oxalis acetosella*), starflower (*Trientalis borealis*), fragrant bedstraw (*Galium triflorum*), gay wings (*Polygala paucifolia*), and evergreen woodfern (*Dryopteris intermedia*). Of particular note is an area of mature to old-growth rich conifer swamp in the center of the

property, which will be entered into the MNFI statewide database of high quality natural communities.

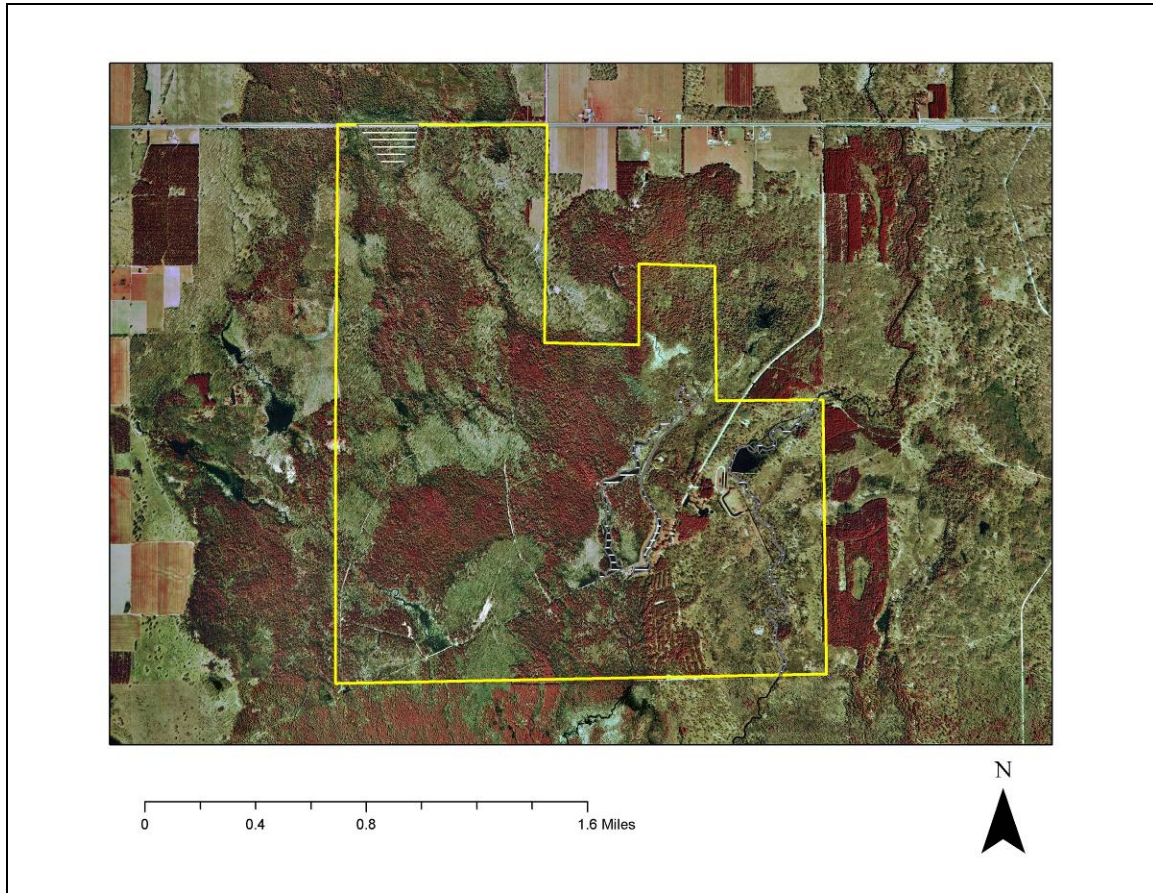


Figure 9. Emergent and submergent marsh (white hatches).

Emergent and Submergent Marsh (Figure 9, above)

Emergent marsh communities developed on recently exposed sediments characterize limited areas of the property, occurring primarily along streams and where man-made or beaver-created dams were removed for wetland restoration. These communities grade to northern wet meadow and northern shrub thicket where inundation was not as extensive or deep, and can be expected to convert to northern wet meadow as perennial sedges colonize and spread across substrates stabilized by the pioneer plant community. Characteristic species of these fairly raw, loosely consolidated sands and mucks include nodding beggar-ticks (*Bidens cernua*), cut grass (*Leersia oryzoides*), ticklegrass (*Agrostis scabra*), water hemlock (*Cicuta bulbifera*), spike-rush (*Eleocharis intermedia*), Canadian rush (*Juncus canadensis*), rush (*J. brevicaudatus*), joint rush (*J. nodosus*), soft-stemmed rush (*J. effusus*), broad-leaved cat-tail (*Typha latifolia*), American bur-reed (*Sparganium americanum*), water-purslane (*Ludwigia palustris*), softstem bulrush (*Schoenoplectus tabernaemontani*), wool-grass (*Scirpus cyperinus*), northern bugleweed (*Lycopus uniflorus*), larger Canada St. John's-wort (*Hypericum majus*), cinnamon willow-herb (*Epilobium coloratum*), boneset (*Eupatorium perfoliatum*), monkey-flower (*Mimulus ringens*), and sedges (including *Carex bebbii*, *C. comosa*, and *C. hystericina*). Seedlings of several woody species are also common. Characteristic

among these are slender willow (*Salix petiolaris*), willow (*S. eriocephala*), Bebb's willow (*S. bebbiana*), shining willow (*S. lucida*), red-osier dogwood (*Cornus sericea*), quaking aspen (*Populus tremuloides*), and balsam poplar (*P. balsamifera*).

Streams, ditches, and ponds on the property support submergent plant communities characterized by several rooted and floating-leaved plants. The most common species in these areas are red duckweed (*Lemna turionifera*), common water meal (*Wolffia columbiana*), marsh horsetail (*Equisetum palustre*), pondweed (*Potamogeton natans*), and common waterweed (*Elodea canadensis*). Shallow stream margins support colonies of common arrowhead (*Sagittaria latifolia*).

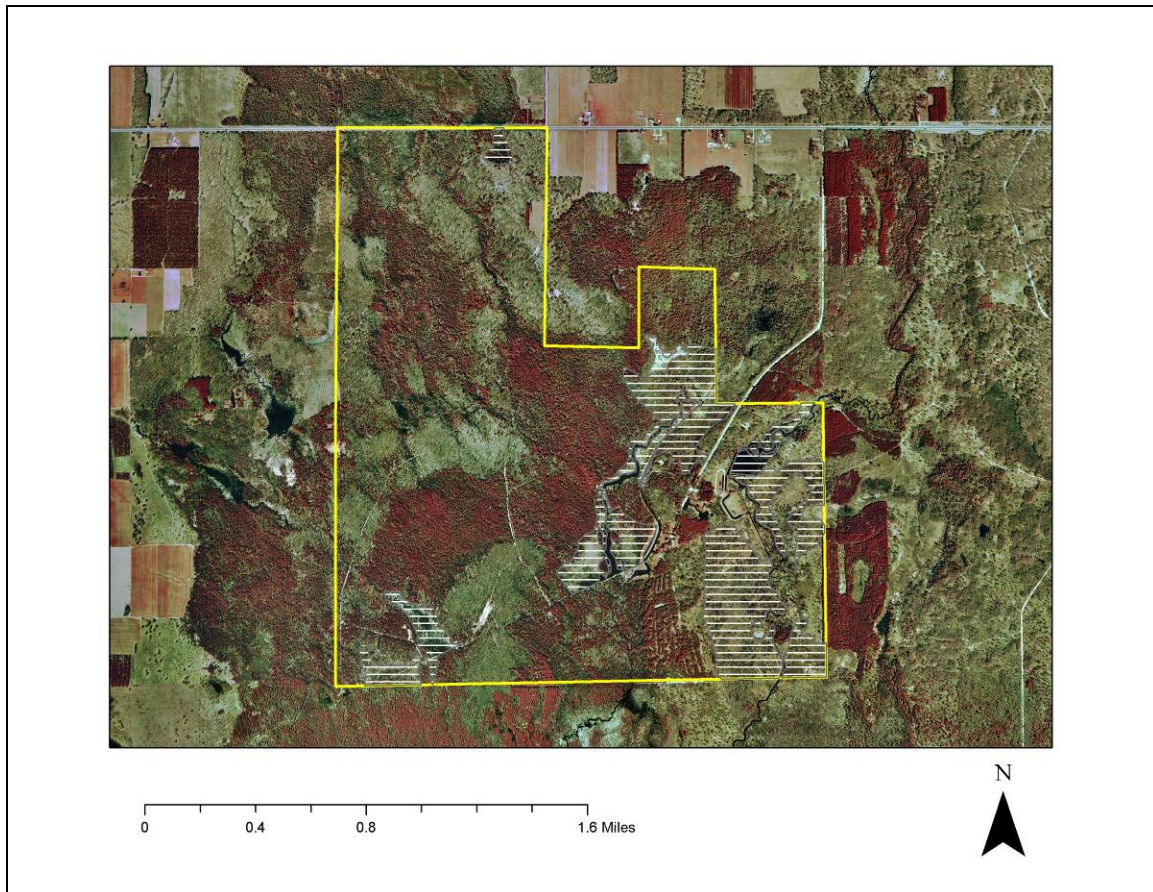


Figure 10. Northern wet meadow and northern shrub thicket (white hatches).

Northern wet meadow and northern shrub thicket (Figure 10, above)

Northern wet meadow and northern shrub thicket are common in the vicinity of Flowing Well Creek and where stream impoundment and beaver flooding has killed stands of northern white-cedar. Tag alder (*Alnus incana*) is generally dominant, and is commonly associated with red-osier dogwood (*Cornus sericea*), slender willow (*Salix petiolaris*), pussy willow (*S. discolor*), Bebb's willow (*S. bebbiana*), shining willow (*S. lucida*), meadowsweet (*Spiraea alba*), and swamp rose (*Rosa palustris*). The ground layer is generally dominated by tussock sedge (*Carex stricta*), associated with bluejoint grass (*Calamagrostis canadensis*), tall goldenrod (*Solidago altissima*), swamp aster

(*Symphotrichum puniceum*), rough cinquefoil (*Potentilla norvegica*), yellow avens (*Geum aleppicum*), Joe-Pye-weed (*Eutrochium maculatum*), boneset (*Eupatorium perfoliatum*), cinnamon willow-herb (*Epilobium coloratum*), common skullcap (*Scutellaria galericulata*), marsh bellflower (*Campanula aparinoides*), northern bugleweed (*Lycopus uniflorus*), swamp milkweed (*Asclepias incarnata*), and marsh fern (*Thelypteris palustris*).

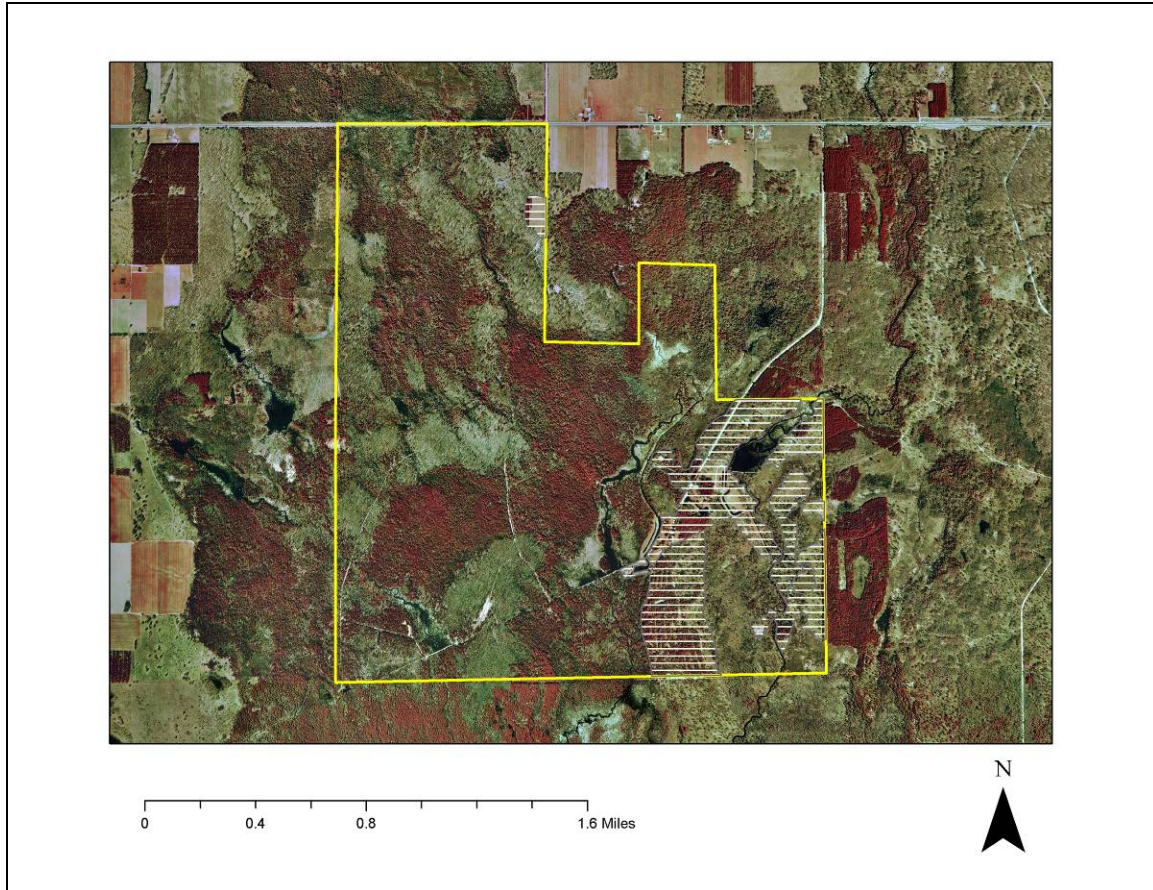


Figure 11. Old field, ruderal habitat, and early successional forest (white hatches).

Old field, ruderal, and early successional forest (Figure 11, above)

Old fields, early successional forests, and former landscaping associated with the developed portions of the Flowing Well property support species-rich communities comprised primarily of weedy native and non-native species. These species are also characteristic of compacted soils on two-tracks that crisscross the area. Characteristic species of these disturbed plant communities include wild red raspberry (*Rubus strigosus*), common blackberry (*R. allegheniensis*), timothy (*Phleum pratense*), redtop (*Agrostis gigantea*), Kentucky bluegrass (*Poa pratensis*), quack grass (*Elymus repens*), smooth brome (*Bromus inermis*), Canada thistle (*Cirsium arvense*), ox-eye daisy (*Leucanthemum vulgare*), common St. John's-wort (*Hypericum perforatum*), spotted knapweed (*Centaurea stoebe*), wild-basis (*Clinopodium vulgare*), yarrow (*Achillea millefolium*), self-heal (*Prunella vulgaris*), hoary alyssum (*Berteroa incana*), tall goldenrod (*Solidago altissima*), grass-leaved goldenrod (*Euthamia graminifolia*), Rugel's plantain (*Plantago rugelii*), English plantain (*P. lanceolata*), daisy fleabane (*Erigeron*

strigosus), path rush (*Juncus tenuis*), and bracken fern (*Pteridium aquilinum*). Less disturbed, cutover forests support quaking aspen (*Populus tremuloides*), black cherry (*Prunus serotina*), bracken fern, poverty grass (*Danthonia spicata*), tall goldenrod, arrow-leaved aster (*Symphyotrichum urophyllum*), and, locally some species typical of sandy barrens habitats, including prairie willow (*Salix humilis*), beaked hazelnut (*Corylus cornuta*), little bluestem (*Schizachyrium scoparium*), northern blazing-star (*Liatris scariosa*), and rough hawkweed (*Hieracium scabrum*).

Mussels

Three unionid mussel species were found, including one represented by a single live individual and two by shell alone. These species were: cylindrical papershell (*Anodontoidea ferussacianus*), creek heelsplitter (*Lasmigona compressa*), and giant floater (*Pyganodon grandis*). Four of the five sites surveyed in Flowing Well Creek had unionid mussel shells. In addition, two incidental finds of mussel shells were made while walking the creek between survey sites. No shells or live individuals were found in the North Branch of the Manistee River. No dreissenid mussels (*Dreissena polymorpha* and *Dreissena bugensis*), or Asian clams (*Corbicula fluminea*) were found. Numerous fingernail clams (Sphaeriidae) and occasional aquatic snails (marsh rams-horn, *Planorbis trivolvis*) were observed throughout Flowing Well Creek, but not the North Branch of the Manistee River. A complete description of the mussel species found at each sampling site is presented in Appendix 7.

A single cylindrical papershell (*Anodontoidea ferussacianus*) shell was found at one site in Flowing Well Creek. Cylindrical papershell is widespread in Michigan, with recent records in at least 18 major watersheds (Badra 2010), as defined by 8 digit Hydrologic Unit Codes (HUCs). This species is usually found in small streams, and is a generalist in its utilization of host fish. It has been determined in laboratory studies to successfully transform on white sucker, mottled sculpin, brook stickleback, spotfin shiner, Iowa darter, Tippecanoe darter, bluegill, common shiner, largemouth bass, blacknose shiner, sea lamprey, bluntnose minnow, fathead minnow, and black crappie (Watters et al. 2009).

Creek heelsplitter (*Lasmigona compressa*) shells were found at four sites in Flowing Well Creek, including two incidental finds. Creek heelsplitter is historically one of the top five most widespread unionid mussel species in Michigan, based on pre-1960 records. When considering recent records (2009-1989), its range in Michigan has dropped substantially down to seven major watersheds (8 digit HUC)(Badra 2010). This species is usually associated with small streams and is a generalist in host fish utilization. It has been documented to transform on black bullhead, yellow bullhead, slimy sculpin, brook stickleback, spotfin shiner, gizzard shad, brassy minnow, guppy, shortnose gar, green sunfish, orangespotted sunfish, bluegill, smallmouth bass, emerald shiner, mimic shiner, yellow perch, black crappie, flathead catfish, longnose dace, and creek chub (Watters et al. 2009).

Giant floater (*Pyganodon grandis*) was found at four locations in Flowing Well Creek, including one live individual at site 2 (Figure 12). This species is historically the most widespread mussel species in Michigan, having been documented in 56 Michigan watersheds (8 digit HUC) pre-1960. Based on recent records (1989-2009), giant floater is one of the top five most widespread mussel species in Michigan (Badra 2010). It is adapted to living in both streams and lakes, and relative to other unionid mussel species,

is tolerant of siltation and non-flowing water conditions. This species is a generalist known to utilize at least 41 host fish species in several different families (Watters et al. 2009).



Figure 12. Flowing Well Creek near mussel survey site 2.

The substrate in Flowing Well Creek was composed mainly of sand with some silt, except for two sites which were dominated by fine and coarse particulate organic material. The substrate in the North Branch of the Manistee River was dominated by sand with some silt (Figures 13 and 14, except for one site with a substantial amount of organic muck, and two sites with a mix of sand, silt, and gravel (Table 4). Current speed was slightly faster in the North Branch of the Manistee River than in Flowing Well Creek. Aquatic vegetation and woody debris was present at all sites except site 6 in the North Branch. Physical and chemical habitat measures are given in Table 5.



Figure 13. North Branch of the Manistee River near site 7. The heavily sand dominated substrate was typical of this river within the study area.

Table 4. Composition of each substrate size class, estimated visually as a percentage within each mussel survey area.

Site #	Waterbody	Boulder	Cobble	Pebble	Gravel	Sand	Silt	Other
1	Flowing Well Creek				5	65	30	
2	"					80	20	
3	"					85	15	
4	"					15		85 fine/coarse organic
5	"							100 fine/coarse organic
6	North Branch Manistee					95	5	
7	"					90	10	
8	"					95	5	
9	"					80		20 organic muck
10	"					85	15	

Table 4. Composition of each substrate size class, estimated visually as a percentage within each mussel survey area.

Site #	Waterbody	Boulder	Cobble	Pebble	Gravel	Sand	Silt	Other
11	"				15	70	15	
12	"			5	60	30	5	

Table 5. Physical and chemical habitat characteristics, including percent pool/riffle/run estimated visually within each mussel survey area.

Site #	Waterbody	Current speed (approx. m/s)	Aquatic vegetation?	Woody debris?	DO (%)	pH	Conductivity (µS)
1	Flowing Well Creek	0.20	Y	Y	97	8.71	280
2	"	0.25	Y	Y	97	8.16	277
3	"	0.20	Y	Y	92	8.19	278
4	"	0.13	Y	Y	91	8.06	283
5	"	0.20	Y	Y	85	7.90	285
6	North Branch Manistee	0.33	N	N	100	8.48	304
7	"	0.33	Y	Y	100	8.54	302
8	"	0.33	Y	Y	100	8.50	304
9	"	0.33	Y	Y	100	8.32	304
10	"	0.33	Y	Y	100	8.36	309
11	"	0.33	Y	Y	100	8.35	309
12	"	0.50	Y	Y	100	8.27	308

Table 5. Cont'd.

Site #	Waterbody	Alkalinity (mg/l CaCO ₃)	Hardness (mg/l)	Water temp. (C)	%Pool	%Riffle	%Run
1	Flowing Well Creek	168	160	23.7			100
2	"	160	160	24.4			100
3	"	160	160	24.5			100
4	"	150	160	17.2			100
5	"	160	140	19.8			100
6	North Branch Manistee	180	180	20.2			100
7	"	180	180	20.3			100
8	"	180	180	19.9			100
9	"	180	180	15.2			100
10	"	160	180	15.9			100
11	"	180	160	16.0			100

Table 5. Cont'd.							
Site #	Waterbody	Alkalinity (mg/l CaCO ₃)	Hardness (mg/l)	Water temp. (C)	%Pool	%Riffle	%Run
12	"	164	160	16.1		50	50



Figure 14. North Branch of the Manistee River near mussel survey site 9.

Breeding Birds

A total of 281 birds, representing 54 species, were detected during the point counts, with a mean of 16.7 individual birds detected per survey. Table 6 presents a list of groups and their mean abundance per survey. Of the individual species, two that were detected are of particular note; the Red-shouldered Hawk and the Louisiana Water Thrush, are both state-listed as threatened. A complete list of species is presented in Appendix 9.

Table 6. Mean bird abundance in the Flowing Wells Project Area.	
Group	Mean Abundance
Blackbirds	1.0
Buntings	0.3
Chickadees/Nuthatches	1.4
Corvids	1.4
Creepers	0.1
Doves	0.1
Finches	0.5
Flycatchers	1.0
Grosbeak	0.5
Invasives	0.1
Other Passerine	0.1
Raptors	0.5
Sparrows	2.3
Thrushes	3.0
Vireos	0.6
Warblers	3.8
Waterbird	0.1
Waterfowl	0.1
Woodpeckers	1.3
Wren	0.3
^a Mean Abundance = mean number of individuals observed per survey	

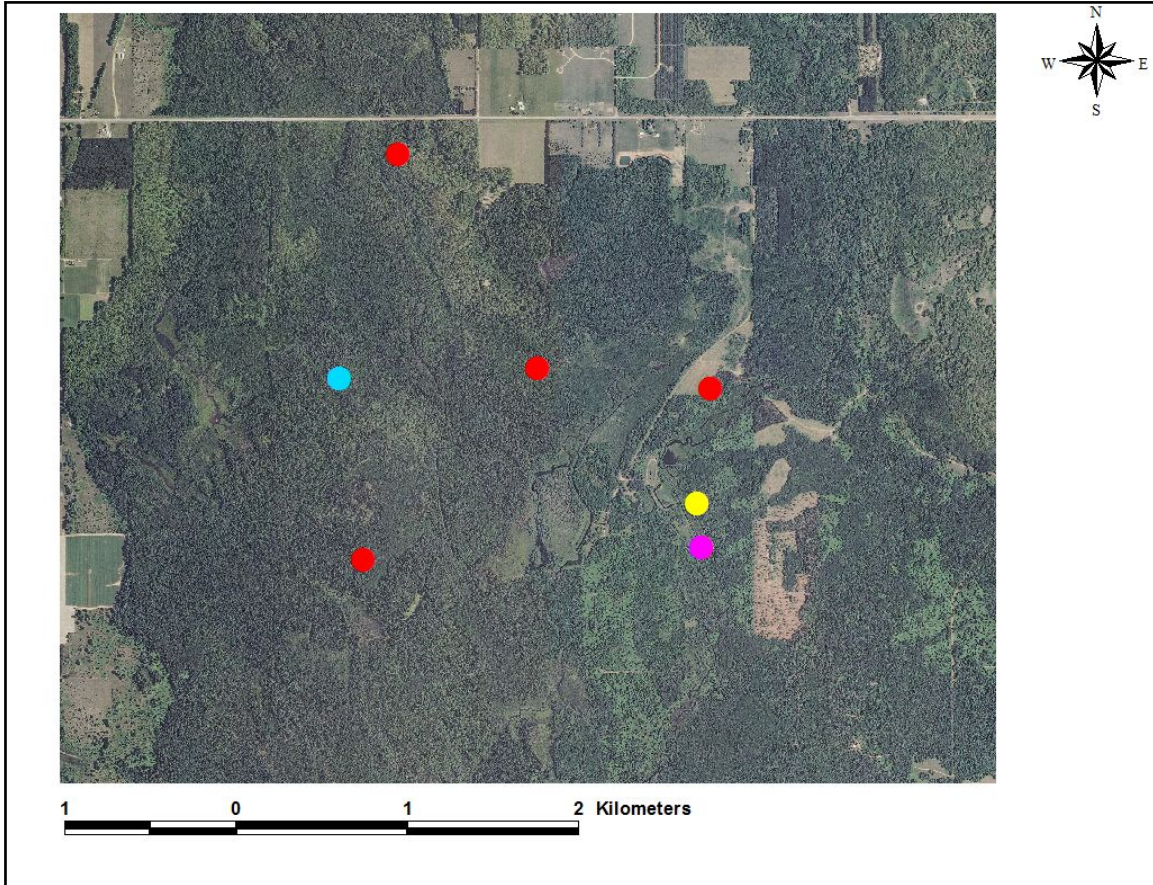


Figure 15. The Flowing Wells Project Area is in north-central Michigan and is predominantly forested wetland. Point count sites were established and surveyed in the summer of 2012 for breeding bird use. Red dots designate the point counts where Red-shouldered hawks were detected, the blue dot represents Louisiana Waterthrush, the pink dot represents the Kentucky Warbler, and yellow is the Golden-winged Warbler.

Insect Assessment

A total of 13 species of listed insects were identified as potentially occurring within the project area (Table 7). The list includes one insect listed as threatened in Michigan (Tawny crescent, *Phyciodes batesii*) and 12 species identified by MNFI as “special concern”.

Table 7. Rare insect species potentially occurring at the Flowing Well Property.

Insect Species	Scientific Name	MI Status	Habitat/plant community	Survey window	survey technique	Hostplant
Doll's merolonche	<i>Merolonche dolli</i>	SC	Mesic Northern Forest, Rich Conifer Swamp	Flight from third week of April to third week of May	blacklighting	blueberry (<i>Vaccinium angustifolium</i> , <i>Vaccinium myrtilloides</i>)
Three-horned moth	<i>Pachypolia atricornis</i>	SC	Mesic Northern Forest, Rich Conifer Swamp, Hardwood-Conifer Swamp	Flight from third week of September to fourth week of October	blacklighting	Unknown at this time but may be a Vaccinium species or other member of the Ericaceae family.
Henry's elfin	<i>Incisalia henrici</i>	T	Hardwood-Conifer Swamp	Flight from first week of May to first week of June	Visual, aerial net	Maple-leaved viburnum. They are also reported to feed on holly (<i>Ilex opaca</i>), huckleberry (<i>Gaylussacia baccata</i>) and redbud (<i>Cercis canadensis</i>).
Cantrall's bog beetle	<i>Liodessus cantralli</i>	SC	Submergent Marsh, Emergent Marsh	Active from first week of April to fourth week of November	bottle traps	unknown
Newman's brocade	<i>Meropleon ambifusca</i>	SC	Emergent Marsh	Flight from third week of August to fourth week of September	blacklighting	unknown
3-striped oncocnemis	<i>Oncocnemis piffardi</i>	SC	Emergent Marsh, Northern Wet Meadow	Flight from third week of August to third week of September	blacklighting	Spiraea alba , <i>Spiraea tomentosa</i>
Tawny crescent	<i>Phyciodes batesii</i>	SC	Northern Wet Meadow	Flight from first week of May to fourth week of July	Visual, aerial net	Aster species (Aster spp.)
Barrens buckmoth	<i>Hemileuca maia</i>	SC	Northern Shrub Thicket	Flight from fourth week of September to fourth week of October	Visual, aerial net	black oak (<i>Quercus velutina</i>), other oaks (<i>Quercus</i> spp.), willow (<i>Salix</i> spp.), aspen (<i>Populus</i> spp.), Spiraeas and even birches.
Dusted skipper	<i>Atrytonopsis hianna</i>	SC	Old fields/degraded barrens	Flight from fourth week of May to fourth week of June	Visual, aerial net	big bluestem (<i>Andropogon gerardii</i>), little bluestem (<i>Schizachyrium scoparium</i>)
Leafhopper	<i>Flexamia delongi</i>	SC	Old fields/degraded barrens	From third week of July to fourth week of September	Sweep netting	little bluestem (<i>Schizachyrium scoparium</i>)
Red-legged spittlebug	<i>Prosapia ignipectus</i>	SC	Old fields/degraded barrens	From third week of July to fourth week of September	Sweep netting	big bluestem (<i>Andropogon gerardii</i>), little bluestem (<i>Schizachyrium scoparium</i>)
Grizzled skipper	<i>Pyrgus wyandot</i>	SC	Old fields/degraded barrens	Flight from first week of May to second week of June	Visual, aerial net	wild strawberry (<i>Fragaria virginiana</i>)
Blazing star borer	<i>Papaipema beeriana</i>	SC	Old fields/degraded barrens	Flight from fourth week of July to third week of October	blacklighting	Blazing-star species, Liatris spp.

DISCUSSION

Natural Communities and Flora

The 387 vascular plant taxa and 315 native taxa documented at the Flowing Well property represent 14% and 17% of the total vascular flora and native vascular flora, respectively, of Michigan. All three broadly defined natural community types (upland forest, swamp forest, and open wetlands) have *FQI* values that surpass the threshold of 35 that is identified as the number that represents areas that “possess sufficient conservatism and richness that they are floristically important from a statewide perspective” (Herman et al. 2001). In addition, the swamp forest *FQI* (53.7 with adventives) is in the range that qualifies an area as “extremely rare and...a systematic component of Michigan’s native biodiversity and natural landscapes” (Herman et al. 2001). Despite these moderate to high *FQI* values, modest \bar{C} values for these natural community types and the property as a whole are indicative of an area characterized by widespread, common natural communities (primarily mesic northern forest and rich conifer swamp) that are characterized by relatively disturbance-tolerant native and non-native plant species. The lack of unusual or ecologically unique natural communities (e.g., savannas and peatlands) is illustrated by the relative scarcity of conservative plant taxa; only nine taxa (3% of the Flowing Well native flora) are assigned C of 10, compared to 432 taxa, or 24%, of the statewide native flora assigned C of 10 (Herman et al. 2001). (Following the release of Voss & Reznicek [2012], the FQA for Michigan is being updated, and modifications to the statewide list of vascular plants and changes in C values will necessitate the recalculation of these and other figures).

The majority of the Flowing Well property supports mid-successional to mature upland and lowland forest and relatively high quality herbaceous and shrub-dominated wetland communities. The highest quality natural community documented during surveys was an area of rich conifer swamp in the center of the property (outside the boundaries of the study area) that is characterized at least partly by old-growth conditions. This area exhibits significant structural diversity and species richness, and approximates pre-settlement conditions. High levels of deer browse and activity here and elsewhere on the property threaten to alter community structure and successional processes by reducing woody regeneration (or, in the case of preferred browse such as hemlock, essentially eliminating regeneration) and reducing populations of favored ground layer species, including orchids and trilliums. Management of the deer population is an essential component of any long-term conservation plan for the area. Additional recommendations for conservation and management of rich conifer swamp are detailed in Kost (2002).

Invasive plant species are generally not important in the natural communities on the Flowing Well property, although infestations of marsh thistle (*Cirsium palustre*), willow-herb (*Epilobium parviflorum*), and bittersweet nightshade (*Solanum dulcamara*) were noted especially in the swamp forests. Reed canary grass (*Phalaris arundinacea*) was local and patchy along Flowing Well Creek and the North Branch of the Manistee River, and dominant in a small former beaver flooding at the northern boundary of the property (see white hatch marks in Figure 8). Some of these colonies were treated with herbicide in 2012; efforts to identify and eradicate populations of this species should continue. Approximately one-third of vascular plant taxa documented from old fields and early successional habitats were non-native, but most of these taxa pose little threat to intact natural communities, although many of them are adapted to disturbances created by

logging activities and should be monitored in conjunction with forest management activities.

To augment this study, a spring survey to document the early season flora is recommended. The mid-summer and late summer surveys in 2012 likely missed many taxa, particularly spring ephemerals that senesce in late spring and spring-flowering sedges that shed perigynia by June. An additional recommendation is to monitor successional changes in recently restored habitats along Flowing Well Creek and the North Branch of the Manistee River. The vegetative composition of these communities will likely change as small-statured annuals are outcompeted by coarser perennials typical of the adjacent northern wet meadow and northern shrub thicket communities.

Mussels

A total of 13 species of unionid mussels have been documented in the Manistee River Watershed in recent surveys and historic records from the University of Michigan Museum of Zoology Mollusk Collection (Appendix 7) (Badra 2010). These include one state endangered species, one state threatened species, and two species of special concern. Two of these, the state threatened slippershell (*Alasmidonta viridis*) and special concern elktoe (*Alasmidonta marginata*), were documented in a 2011 MNFI survey of sites in the Pine River and Manistee River (Badra 2012a).

The number of unionid mussel species present in a river can be influenced by the number fish species, the size of the watershed, or both (Watters 1992). Small streams, like Flowing Well Creek and the upper North Branch of the Manistee River within the survey area tend to have fewer fish species and mussel species than large watersheds. Though streams of this size can support important mussel populations, including listed species. The slippershell, for example, is a state threatened species that is strongly associated with smaller headwater streams.

Damage was observed on the posterior end of nearly all mussel shells found in this study (Figure 16). This is indicative of predation from muskrats or raccoons. The posterior end is the thinnest part of the shell and easiest to break through. Giant floaters have particularly thin shells, and muskrats have been documented to selectively prey upon this species (Diggins and Stewart 2000).



Figure 16. Empty shell of a creek heelsplitter (*Lasmigona compressa*) from Flowing Well Creek, an incidental find at site B. Damage at the posterior end of the shell (left side in photo) may have been due to predation by a muskrat or raccoon.

MNFI has performed unionid mussel surveys in many of the major watersheds in Michigan, and documented the presence/absence of zebra mussels (*Dreissena polymorpha*) at each survey site. One pattern in the distribution of zebra mussels that is clear, is their association with large impoundments and lakes commonly used for boating. Zebra mussels tend to be absent from small rivers without impoundments (e.g. Belle and Looking Glass Rivers) and present in larger rivers with impoundments (e.g. Manistee, Huron, and Muskegon Rivers). This observation matches patterns seen in Wisconsin that impoundments have facilitated the invasion of zebra mussel and other aquatic invasive species (Johnson et al. 2008).

Zebra mussels have free swimming larvae (veligers). Unlike unionid mussels, which have larvae that attach to host fish, zebra mussels are poorly suited to maintaining populations in flowing river habitat. Free swimming larvae drift downstream with the river current. Zebra mussels cannot travel upstream without being transported. Unionid mussel larvae (glochidia) are transported to new habitats, including upstream habitats while they are attached to host fish. Inadvertent transport of zebra mussel larvae (on boats, trailers, live wells, etc.) facilitates the establishment and maintenance of zebra mussel populations in Michigan's rivers.

Flowing Well Creek and the upper North Branch of the Manistee River within the survey area were zebra mussel free. This is most likely due to relatively little boat traffic compared to the main stem of the Manistee, where zebra mussels are abundant (Badra and Goforth 2003, Badra 2005), and the absence of any established zebra mussel populations upstream. Similarly, other upstream sections of the Manistee River Watershed were found to be largely zebra mussel free in a 2011 survey of Hinton Creek and Pine Creek (Badra 2012b).

Fingernail clams have an almost ubiquitous distribution and can often be very abundant in a wide variety of habitats, from streams and lakes to ephemeral wetlands and pools. Identification of species in this group can be challenging and time consuming due to their small size (usually <10mm) and need for dissection under a microscope. The marsh rams-horn is a fairly common aquatic snail that is found in marshes, ponds, and slow moving areas of streams.

Fast to medium flowing streams with shallow riffles and/or runs usually have close to 100% oxygen saturation. Certain mussel species, e.g. giant floater, are tolerant of low current and low oxygen levels typical of lakes and impoundments. Most native mussel species however have adapted to flowing river habitat with higher current and oxygen levels. The low current/low oxygen tolerant species are less vulnerable to impacts such as dams and impoundments in rivers, since these impacts change the river into habitat that is similar to what is found in lakes.

The ability of water to carry an electrical current, is determined by the amount of inorganic dissolved substances including chloride, nitrate, sulfate, and phosphate (negatively charged ions), and sodium, magnesium, calcium, iron, and aluminum (positively charged ions). The geology of a given watershed is normally a strong factor in determining the amount of these substances present in river water. Streams that run through clay soils pick up materials in the clay that ionize in water resulting in higher conductivity, while streams that run through areas dominated by granite have lower conductivity because granite has an abundance of materials that do not ionize in water. Conductivity can be affected by point and non-point discharges into streams as well. Input of chlorides, phosphate, and nitrates can raise conductivity in rivers and lakes. Unusually high conductivity measures can be indicative of impacts such as excessive input of fertilizer or sewage overflows. Conductivity of rivers in the United States typically range between 50 and 1500 μ S. Streams supporting good fisheries often measure between 150 and 500 μ S. Conductivity measures at all mussel survey sites in this study were within this range.

Alkalinity, a measure of how much calcium carbonate (mg/l of CaCO₃) is present in water, is one factor in determining how much acid can be added to water without causing a change in pH. In this way it buffers against rapid changes in pH. Alkalinity is influenced by the surficial geology of the watershed. Streams flowing through areas with limestone tend to have high alkalinity. The U.S. EPA has suggested that 20mg/l CaCO₃ is a minimum to support aquatic life. Hardness is a similar measure that accounts for other minerals such as magnesium and iron, in addition to calcium carbonate. Alkalinity and hardness at all mussel survey sites were well above 20mg/l.

Breeding Birds

The three most abundant bird groups per survey were the warblers (3.8 birds / survey), followed by thrushes (3.0 birds / survey) and then sparrows (2.3 birds / survey, Table 6). These species groups are often associated with forested areas located near wetlands, like the Flowing Well Property. The forest interior warbler and thrush species were diverse and only 1 individual invasive bird was detected (Brown-headed Cowbird). In heavily fragmented and disturbed areas invasive species tend to be common and can negatively impact nesting productivity of the native forest interior species. The paucity of invasive species is consistent with the quality wetland and forest bird habitat. No federally listed species were observed in the project area during the songbird surveys. However, the following Michigan state-listed species were detected: Red-shouldered Hawk (Threatened) and Louisiana Waterthrush (Threatened) (Appendix A). The Kentucky Warbler and Golden-winged Warbler are also rare species in Michigan, though neither are listed-species. The Golden-winged Warbler has suffered more steep declines than most other songbirds. In 2003 the Golden-winged Warbler Working Group was developed, and subsequently the Golden-winged Warbler Breeding Conservation Plan was written (<http://gwwa.org/>). The restoration and continued protection of the Flowing Wells Property provides habitat for a diversity of unique species, including guilds of woodland warblers and wetland songbirds.

Insects

As noted, a total of 13 species of listed insects were identified as potentially occurring within the project area. The list includes one insect listed as threatened in Michigan (Tawny crescent, *Phyciodes batesii*) and 12 species identified by MNFI as “special concern”. It is recommended that surveys for these species be conducted as part of future stewardship efforts. Three different survey methods (black-lighting, visual meander surveys with aerial nets, and sweep netting) were identified as the main survey techniques for any future rare terrestrial surveys in the project area.

Black-lighting would be the method of choice for the five moth species. This technique is where a sheet is stretched across two trees or poles and an ultraviolet light is used to attract moths to the sheet. Moths can be collected directly from the sheet. Insects come to light usually in largest numbers on still, dark, cloudy nights when both temperature and humidity are high. Visual meander surveys consist of checking for the target species near known larval food plants, on adult nectar sources, and near mud puddles. Sweep netting consists of an individual using a standard insect sweep net in suitable habitat. Several sweep samples may be needed to detect adults of this species. Vegetation is sampled while meandering through appropriate habitat. A standard sample consists of approximately sixty swings of a sweep net, with one swing taken with each step. The contents of the net are then emptied into a large killing jar charged with ethyl acetate. When the specimens stop moving they are transferred to a zip-lock plastic bag and placed into a cooler. Bagged samples are then frozen until they can be processed.

In addition to studying the best methods for insect surveys it is also very important to determine the best time of the year to survey for the target species and near appropriate host plants. For example, if looking for Dusted skippers, surveys should take place from late May through middle of June in areas with big or little bluestem grasses in order to optimize the chances of detection. Likewise if searching for Blazing star borers, black-

lighting should occur in late August through early October in areas with Blazing stars (*Liatris* spp.).

If future insect surveys find of any rare insects it will be important to document these occurrences. The best way to do this is by completing MNFI Special Animal Survey forms (available online at: <http://mnfi.anr.msu.edu/contact/surveyforms.cfm>) and submitting them to the MNFI.

CONCLUSIONS AND RECOMMENDATIONS

Based on the above findings and other observations, MNFI would make the following conclusions and recommendations regarding the Flowing Well Property:

- The water quality measures indicate that the CRA restoration efforts are being effective. Consequently, efforts that reinforce or complement these should be carried out, as these may be especially beneficial to the unionid mussel community in the streams.
- While not containing any exceptionally rare natural communities, the site does support unfragmented, high-quality areas of a number of communities. These are exceptional from the standpoint of their FQIs and their level of intactness.
- The natural communities supporting the state-listed species should be managed to insure those species continued existence on the property. This should include maintaining the unfragmented nature of the forests, which provide habitat for a strong community of interior-nesting birds; a situation that is becoming evermore rare in the lower peninsula of Michigan.
- While invasive plant species are not well established in the natural communities, they are so in the area of the former fish hatchery facility. Therefore, an “early detection, rapid response” monitoring program should be established for the entire property to insure invasives do not get a foothold in the natural community areas.
- Evidence of deer browse suggests that the DNR should encourage greater hunting on this property in order to avoid adverse impacts to the wildflowers and other species of preferred browse.
- The site clearly supports a number of rare species, including state-listed, threatened species and high-quality natural communities. Therefore, a carefully crafted stewardship plan should be developed that accounts for the above conclusions.
- This inventory effort is of limited scope and should be expanded to include spring botanical surveys and surveys for the rare insect species potentially occurring on the site, especially for the Tawny crescent (*Phyciodes batesii*) butterfly.

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Appendix 1 – Summary FQA of Flowing Well Property

Appendix 1. Summary FQA of Flowing Well property.

Site: Flowing Well property
 Locale: Kalkaska Co., MI
 Date: August 24, 2012 - hours
 August 23, 2012 - hours
 August 22, 2012 - hours
 August 21, 2012 - hours
 July 13, 2012 - hours
 July 12, 2012 - hours
 July 11, 2012 - hours
 July 10, 2012 - hours
 By: Brad Slaughter
 File: s:\NFI\Projects\flowing well\botanical inventory\Flowing Well_master.inv
 Notes: Also: Carex spp., Dichanthelium sp., Brassica sp., Viola sp., Utricularia sp., Dendrolycopodium hickeyi, Dryopteris xboottii. Agrostis hyemalis = A. scabra. Brachyelytrum erectum = B. aristosum. Lemna minor = L. turionifera.

FLORISTIC QUALITY DATA		Native		Adventive	
313 NATIVE SPECIES	Tree	27	7.0%	Tree	3 0.8%
385 Total Species	Shrub	40	10.4%	Shrub	4 1.0%
4.2 NATIVE MEAN C	W-Vine	4	1.0%	W-Vine	0 0.0%
3.4 W/Adventives	H-Vine	0	0.0%	H-Vine	0 0.0%
75.0 NATIVE FQI	P-Forb	127	33.0%	P-Forb	31 8.1%
67.6 W/Adventives	B-Forb	6	1.6%	B-Forb	9 2.3%
-1.2 NATIVE MEAN W	A-Forb	24	6.2%	A-Forb	15 3.9%
-0.5 W/Adventives	P-Grass	27	7.0%	P-Grass	7 1.8%
AVG: Faculative (+)	A-Grass	1	0.3%	A-Grass	3 0.8%
	P-Sedge	34	8.8%	P-Sedge	0 0.0%
	A-Sedge	1	0.3%	A-Sedge	0 0.0%
	Fern	22	5.7%		

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ABIBAL	3 Abies balsamea	-3 FACW	Nt Tree	BALSAM FIR
ACERUB	1 Acer rubrum	0 FAC	Nt Tree	RED MAPLE
ACESAU	5 Acer saccharum	3 FACU	Nt Tree	SUGAR MAPLE
ACESPI	5 Acer spicatum	3 FACU	Nt Tree	MOUNTAIN MAPLE
ACHMIL	1 Achillea millefolium	3 FACU	Nt P-Forb	YARROW
ACTRUB	7 Actaea rubra	5 UPL	Nt P-Forb	RED BANE BERRY
ADIPED	6 Adiantum pedatum	1 FAC-	Nt Fern	MAIDENHAIR FERN

AGRGRY	2 Agrimonia gryposepala	2 FACU+	Nt P-Forb	TALL AGRIMONY
AGRREP	0 AGROPYRON REPENS	3 FACU	Ad P-Grass	QUACK GRASS
AGRTRA	8 Agropyron trachycaulum	0 FAC	Nt P-Grass	SLENDER WHEAT GRASS
AGRGIT	0 AGROSTEMMA GITHAGO	3 FACU	Ad P-Forb	CORN COCKLE
AGRGIG	0 AGROSTIS GIGANTEA	0 FAC	Ad P-Grass	REDTOP
AGRHYE	4 Agrostis hyemalis	1 FAC-	Nt P-Grass	TICKLEGRASS
AGRPER	5 Agrostis perennans	1 FAC-	Nt P-Grass	AUTUMN BENT GRASS
ALIPLA	1 Alisma plantago-aquatica	-5 OBL	Nt P-Forb	WATER PLANTAIN
ALNRUG	5 Alnus rugosa	-5 OBL	Nt Shrub	TAG ALDER
AMBART	0 Ambrosia artemisiifolia	3 FACU	Nt A-Forb	COMMON RAGWEED
AMEINT	4 Amelanchier interior	5 UPL	Nt Tree	SERVICEBERRY
ANDSCO	5 Andropogon scoparius	3 FACU	Nt P-Grass	LITTLE BLUESTEM GRASS
ANEQUI	5 Anemone quinquefolia	0 FAC	Nt P-Forb	WOOD ANEMONE
ANTHOW	2 Antennaria howellii	5 UPL	Nt P-Forb	SMALL PUSSYTOES
APOAND	3 Apocynum androsaemifolium	5 UPL	Nt P-Forb	SPREADING DOGBANE
ARAHIS	3 Aralia hispida	5 UPL	Nt Shrub	BRISTLY SARSAPARILLA
ARANUD	5 Aralia nudicaulis	3 FACU	Nt P-Forb	WILD SARSAPARILLA
ARCMIN	0 ARCTIUM MINUS	5 UPL	Ad B-Forb	COMMON BURDOCK
ARITRI	5 Arisaema triphyllum	-2 FACW-	Nt P-Forb	JACK IN THE PULPIT
AROPRU	5 Aronia prunifolia	-3 FACW	Nt Shrub	BLACK CHOKEBERRY
ASCINC	6 Asclepias incarnata	-5 OBL	Nt P-Forb	SWAMP MILKWEED
ASCSYR	1 Asclepias syriaca	5 UPL	Nt P-Forb	COMMON MILKWEED
ASPOFF	0 ASPARAGUS OFFICINALIS	3 FACU	Ad P-Forb	ASPARAGUS
ASTLAE	5 Aster laevis	5 UPL	Nt P-Forb	SMOOTH ASTER
ASTLAN	2 Aster lanceolatus	-3 FACW	Nt P-Forb	EASTERN LINED ASTER
ASTLAT	2 Aster lateriflorus	-2 FACW-	Nt P-Forb	SIDE FLOWERING ASTER
ASTMAC	4 Aster macrophyllus	5 UPL	Nt P-Forb	BIG LEAVED ASTER
ASTPUN	5 Aster puniceus	-5 OBL	Nt P-Forb	SWAMP ASTER
ASTSAG	2 Aster sagittifolius	5 UPL	Nt P-Forb	ARROW LEAVED ASTER
ATHFIL	4 Athyrium filix-femina	0 FAC	Nt Fern	LADY FERN
BARVUL	0 BARBAREA VULGARIS	0 FAC	Ad B-Forb	YELLOW ROCKET
BERINC	0 BERTEROA INCANA	5 UPL	Ad A-Forb	HOARY ALYSSUM
BETALL	7 Betula alleghaniensis	0 FAC	Nt Tree	YELLOW BIRCH
BETPAP	2 Betula papyrifera	2 FACU+	Nt Tree	PAPER BIRCH
BIDCER	3 Bidens cernuus	-5 OBL	Nt A-Forb	NODDING BUR MARIGOLD
BIDFRO	1 Bidens frondosus	-3 FACW	Nt A-Forb	COMMON BEGGAR TICKS
BOECYL	5 Boehmeria cylindrica	-5 OBL	Nt P-Forb	FALSE NETTLE
BRAERE	7 Brachyelytrum erectum	5 UPL	Nt P-Grass	LONG AWNED WOOD GRASS
BROCIL	6 Bromus ciliatus	-3 FACW	Nt P-Grass	FRINGED BROME
BROINE	0 BROMUS INERMIS	5 UPL	Ad P-Grass	SMOOTH BROME
BROJAP	0 BROMUS JAPONICUS	3 FACU	Ad A-Grass	JAPANESE BROME
BROLAT	6 Bromus latiglumis	-2 FACW-	Nt P-Grass	EAR LEAVED BROME

CALCAN	3	Calamagrostis canadensis	-5	OBL	Nt	P-Grass	BLUE JOINT GRASS
CALINE	8	Calamagrostis inexpansa	-4	FACW+	Nt	P-Grass	BOG REEDGRASS
CALTPA	6	Caltha palustris	-5	OBL	Nt	P-Forb	MARSH MARIGOLD
CAMAPU	7	Campanula aparinoides ssp. uliginosa	-5	OBL	Nt	P-Forb	MARSH BELLFLOWER
CAMROT	6	Campanula rotundifolia	1	FAC-	Nt	P-Forb	HAREBELL
CARPEN	1	Cardamine pensylvanica	-4	FACW+	Nt	B-Forb	PENNSYLVANIA BITTER CRESS
CXARTT	3	Carex arctata	5	UPL	Nt	P-Sedge	SEDGE
CXBEBB	4	Carex bebbii	-5	OBL	Nt	P-Sedge	SEDGE
CXBRUN	5	Carex brunnescens	-3	FACW	Nt	P-Sedge	SEDGE
CXCOMO	5	Carex comosa	-5	OBL	Nt	P-Sedge	SEDGE
CXCRIN	4	Carex crinita	-4	FACW+	Nt	P-Sedge	SEDGE
CXCRI5	3	Carex cristatella	-4	FACW+	Nt	P-Sedge	SEDGE
CXCryp	10	Carex cryptolepis	-5	OBL	Nt	P-Sedge	SEDGE
CXDWE	3	Carex deweyana	4	FACU-	Nt	P-Sedge	SEDGE
CXDISP	10	Carex disperma	-5	OBL	Nt	P-Sedge	SEDGE
CXGRAA	4	Carex gracillima	3	FACU	Nt	P-Sedge	SEDGE
CXHYST	2	Carex hystericina	-5	OBL	Nt	P-Sedge	SEDGE
CXINTE	3	Carex interior	-5	OBL	Nt	P-Sedge	SEDGE
CXINTU	3	Carex intumescens	-4	FACW+	Nt	P-Sedge	SEDGE
CXLEPA	5	Carex leptalea	-5	OBL	Nt	P-Sedge	SEDGE
CXLUPA	4	Carex lupulina	-5	OBL	Nt	P-Sedge	SEDGE
CXPEDU	5	Carex pedunculata	5	UPL	Nt	P-Sedge	SEDGE
CXPROJ	3	Carex projecta	-4	FACW+	Nt	P-Sedge	SEDGE
CXPSEU	5	Carex pseudo-cyperus	-5	OBL	Nt	P-Sedge	SEDGE
CXRETS	3	Carex retrorsa	-5	OBL	Nt	P-Sedge	SEDGE
CXSCAB	4	Carex scabrata	-5	OBL	Nt	P-Sedge	SEDGE
CXSTIP	1	Carex stipata	-5	OBL	Nt	P-Sedge	SEDGE
CXSTRI	4	Carex stricta	-5	OBL	Nt	P-Sedge	SEDGE
CXSWAN	4	Carex swanii	3	FACU	Nt	P-Sedge	SEDGE
CXTRIS	9	Carex trisperma	-5	OBL	Nt	P-Sedge	SEDGE
CXTUCK	8	Carex tuckermanii	-5	OBL	Nt	P-Sedge	SEDGE
CXUTRI	5	Carex utriculata	-5	OBL	Nt	P-Sedge	SEDGE
CXVULP	1	Carex vulpinoidea	-5	OBL	Nt	P-Sedge	SEDGE
CENMAU	0	CENTAUREA MACULOSA	5	UPL	Ad	B-Forb	SPOTTED BLUET
CERFON	0	CERASTIUM FONTANUM	3	FACU	Ad	P-Forb	MOUSE EAR CHICKWEED
CERSEM	0	CERASTIUM SEMIDECANDRUM	5	UPL	Ad	A-Forb	SMALL MOUSE EAR CHICKWEED
CHEGLB	7	Chelone glabra	-5	OBL	Nt	P-Forb	TURTLEHEAD
CHEALB	0	CHENOPODIUM ALBUM	1	FAC-	Ad	A-Forb	LAMB'S QUARTERS
CHRLEU	0	CHRYSANTHEMUM LEUCANTHEMUM	5	UPL	Ad	P-Forb	OX EYE DAISY
CHRAM	6	Chrysosplenium americanum	-5	OBL	Nt	P-Forb	GOLDEN SAXIFRAGE
CICINT	0	CICHORIUM INTYBUS	5	UPL	Ad	P-Forb	CHICORY
CICBUL	5	Cicuta bulbifera	-5	OBL	Nt	P-Forb	WATER HEMLOCK

CINLAT	5	Cinna latifolia	-4	FACW+	Nt	P-Grass	WOOD REEDGRASS
CIRALP	4	Circaea alpina	-3	FACW	Nt	P-Forb	SMALL ENCHANTER'S NIGHTSHADE
CIRLUT	2	Circaea lutetiana	3	FACU	Nt	P-Forb	ENCHANTER'S NIGHTSHADE
CIRARV	0	CIRSIUM ARVENSE	3	FACU	Ad	P-Forb	CANADIAN THISTLE
CIRMUT	6	Cirsium muticum	-5	OBL	Nt	B-Forb	SWAMP THISTLE
CIRPAL	0	CIRSIUM PALUSTRE	-4	FACW+	Ad	B-Forb	MARSH THISTLE
CIRVUL	0	CIRSIUM VULGARE	4	FACU-	Ad	B-Forb	BULL THISTLE
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
CLEVIR	4	Clematis virginiana	0	FAC	Nt	W-Vine	VIRGIN'S BOWER
CLIVUL	3	Clinopodium vulgare	5	UPL	Nt	P-Forb	WILD BASIL
CLIBOR	5	Clintonia borealis	-1	FAC+	Nt	P-Forb	BLUEBEAD LILY; CORN LILY
CONCAN	0	Conyza canadensis	1	FAC-	Nt	A-Forb	HORSEWEED
COPTRI	5	Coptis trifolia	-3	FACW	Nt	P-Forb	GOLDTHREAD
CORCAA	6	Cornus canadensis	0	FAC	Nt	Shrub	BUNCHBERRY
CORFOE	1	Cornus foemina	-2	FACW-	Nt	Shrub	GRAY DOGWOOD
CORSTO	2	Cornus stolonifera	-3	FACW	Nt	Shrub	RED OSIER DOGWOOD
CORCOR	5	Corylus cornuta	5	UPL	Nt	Shrub	BEAKED HAZELNUT
CRAPUN	1	Crataegus punctata	5	UPL	Nt	Tree	DOTTED HAWTHORN
CYPACA	5	Cypripedium acaule	-3	FACW	Nt	P-Forb	PINK LADY'S SL...CCASIN FLOWER
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DAUCAR	0	DAUCUS CAROTA	5	UPL	Ad	B-Forb	QUEEN ANNE'S LACE
DIAARM	0	DIANTHUS ARMERIA	5	UPL	Ad	A-Forb	DEPTFORD PINK
DIRPAL	8	Dirca palustris	0	FAC	Nt	Shrub	LEATHERWOOD
DRYCAR	5	Dryopteris carthusiana	-2	FACW-	Nt	Fern	SPINULOSE WOODFERN
DRYCRI	6	Dryopteris cristata	-5	OBL	Nt	Fern	CRESTED SHIELD FERN
DRYINT	5	Dryopteris intermedia	0	FAC	Nt	Fern	EVERGREEN WOODFERN
ELAUMB	0	ELAEAGNUS UMBELLATA	3	FACU	Ad	Shrub	AUTUMN OLIVE
ELEERY	4	Eleocharis erythropoda	-5	OBL	Nt	P-Sedge	SPIKE RUSH
ELEINT	7	Eleocharis intermedia	-3	FACW	Nt	A-Sedge	SPIKE RUSH
ELESMA	5	Eleocharis smallii	-5	OBL	Nt	P-Sedge	SPIKE RUSH
ELOCAN	1	Elodea canadensis	-5	OBL	Nt	P-Forb	COMMON WATERWEED
ELYCAN	7	Elymus canadensis	1	FAC-	Nt	P-Grass	CANADA WILD RYE
ELYVIR	4	Elymus virginicus	-2	FACW-	Nt	P-Grass	VIRGINIA WILD RYE
EPIREP	7	Epigaea repens	5	UPL	Nt	Shrub	TRAILING ARBUTUS
EPICOL	3	Epilobium coloratum	-5	OBL	Nt	P-Forb	CINNAMON WILLOW HERB
EPILEP	6	Epilobium leptophyllum	-5	OBL	Nt	P-Forb	FEN WILLOW HERB
EPIPAR	0	EPILOBIUM PARVIFLORUM	3	FACU	Ad	P-Forb	WILLOW HERB
EPIHEL	0	EPIPACTIS HELLEBORINE	5	UPL	Ad	P-Forb	HELLEBORINE
EQUARV	0	Equisetum arvense	0	FAC	Nt	F...Ally	COMMON HORSETAIL
EQUPAL	10	Equisetum palustre	-3	FACW	Nt	F...Ally	MARSH HORSETAIL
EQUSYL	5	Equisetum sylvaticum	-3	FACW	Nt	F...Ally	WOODLAND HORSETAIL
ERASPE	3	Eragrostis spectabilis	5	UPL	Nt	P-Grass	PURPLE LOVE GRASS

EREHIE	2	Erechtites hieracifolia	3	FACU	Nt	A-Forb	FIREWEED
ERIANN	0	Erigeron annuus	1	FAC-	Nt	B-Forb	ANNUAL FLEABANE
ERISTR	4	Erigeron strigosus	1	FAC-	Nt	P-Forb	DAISY FLEABANE
EUPMAM	4	Eupatorium maculatum	-5	OBL	Nt	P-Forb	JOE PYE WEED
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt	P-Forb	COMMON BONESET
EUPESU	0	EUPHORBIA ESULA	5	UPL	Ad	P-Forb	LEAFY SPURGE
EUTGRA	3	Euthamia graminifolia	-2	FACW-	Nt	P-Forb	GRASS LEAVED GOLDENROD
FAGGRA	6	Fagus grandifolia	3	FACU	Nt	Tree	AMERICAN BEECH
FRAVIR	2	Fragaria virginiana	1	FAC-	Nt	P-Forb	WILD STRAWBERRY
FRAAME	5	Fraxinus americana	3	FACU	Nt	Tree	WHITE ASH
FRANIG	6	Fraxinus nigra	-4	FACW+	Nt	Tree	BLACK ASH
FRAPEN	2	Fraxinus pennsylvanica	-3	FACW	Nt	Tree	RED ASH
GALTET	0	GALEOPSIS TETRAHIT	5	UPL	Ad	A-Forb	COMMON HEMP NETTLE
GALASP	5	Galium asprellum	-5	OBL	Nt	P-Forb	ROUGH BEDSTRAW
GALTIN	5	Galium tinctorium	-5	OBL	Nt	P-Forb	STIFF BEDSTRAW
GALTRD	6	Galium trifidum	-4	FACW+	Nt	P-Forb	SMALL BEDSTRAW
GALTRR	4	Galium triflorum	2	FACU+	Nt	P-Forb	FRAGRANT BEDSTRAW
GAUHIS	8	Gaultheria hispidula	-3	FACW	Nt	Shrub	CREEPING SNOWBERRY
GAUPRO	5	Gaultheria procumbens	3	FACU	Nt	Shrub	WINTERGREEN
GERBIC	4	Geranium bicknellii	5	UPL	Nt	A-Forb	NORTHERN CRANE'S BILL
GEUALE	3	Geum aleppicum	-1	FAC+	Nt	P-Forb	YELLOW AVENS
GEUCAN	1	Geum canadense	0	FAC	Nt	P-Forb	WHITE AVENS
GEURIV	7	Geum rivale	-5	OBL	Nt	P-Forb	PURPLE AVENS
GLYCAN	8	Glyceria canadensis	-5	OBL	Nt	P-Grass	RATTLESNAKE GRASS
GLYGRA	6	Glyceria grandis	-5	OBL	Nt	P-Grass	REED MANNA GRASS
GLYSTR	4	Glyceria striata	-5	OBL	Nt	P-Grass	FOWL MANNA GRASS
GNAOBT	2	Gnaphalium obtusifolium	5	UPL	Nt	A-Forb	OLD FIELD BALSAM
GYMDRY	5	Gymnocarpium dryopteris	0	FAC	Nt	Fern	OAK FERN
HAMVIR	5	Hamamelis virginiana	3	FACU	Nt	Shrub	WITCH HAZEL
HIEAUR	0	HIERACIUM AURANTIACUM	5	UPL	Ad	P-Forb	ORANGE HAWKWEED
HIEPIS	0	HIERACIUM PILOSELLOIDES	5	UPL	Ad	P-Forb	GLAUCOUS KING DEVIL
HIESCA	3	Hieracium scabrum	5	UPL	Nt	P-Forb	ROUGH HAWKWEED
HYDAME	6	Hydrocotyle americana	-5	OBL	Nt	P-Forb	WATER PENNYWORT
HYPBOR	5	Hypericum boreale	-5	OBL	Nt	P-Forb	NORTHERN ST. JOHN'S WORT
HYPMAJ	4	Hypericum majus	-3	FACW	Nt	P-Forb	LARGER CANADA ST. JOHN'S WORT
HYPPER	0	HYPERICUM PERFORATUM	5	UPL	Ad	P-Forb	COMMON ST. JOHN'S WORT
HYPRAD	0	HYPOCHAERIS RADICATA	5	UPL	Ad	P-Forb	SPOTTED CAT'S EAR
HYSPAT	5	Hystrix patula	5	UPL	Nt	P-Grass	BOTTLEBRUSH GRASS
ILEVER	5	Ilex verticillata	-4	FACW+	Nt	Shrub	MICHIGAN HOLLY
IMPCAP	2	Impatiens capensis	-3	FACW	Nt	A-Forb	SPOTTED TOUCH ME NOT
IRIVER	5	Iris versicolor	-5	OBL	Nt	P-Forb	WILD BLUE FLAG
JUNART	3	Juncus articulatus	-5	OBL	Nt	P-Forb	JOINTED RUSH

JUNBRE	8	Juncus brevicaudatus	-5	OBL	Nt	P-Forb	RUSH
JUNBUF	2	Juncus bufonius	-4	FACW+	Nt	A-Forb	TOAD RUSH
JUNCAN	6	Juncus canadensis	-5	OBL	Nt	P-Forb	CANADIAN RUSH
JUNEFF	3	Juncus effusus	-5	OBL	Nt	P-Forb	SOFT STEMMED RUSH
JUNNOD	5	Juncus nodosus	-5	OBL	Nt	P-Forb	JOINT RUSH
JUNTEN	1	Juncus tenuis	0	FAC	Nt	P-Forb	PATH RUSH
LACBIE	2	Lactuca biennis	0	FAC	Nt	B-Forb	TALL BLUE LETTUCE
LACCAN	2	Lactuca canadensis	2	FACU+	Nt	B-Forb	TALL LETTUCE
LAPCAN	4	Laportea canadensis	-3	FACW	Nt	P-Forb	WOOD NETTLE
LARLAR	5	Larix laricina	-3	FACW	Nt	Tree	TAMARACK
LEDGRO	8	Ledum groenlandicum	-5	OBL	Nt	Shrub	LABRADOR TEA
LEEORY	3	Leersia oryzoides	-5	OBL	Nt	P-Grass	CUT GRASS
LEMMIN	5	Lemna minor	-5	OBL	Nt	A-Forb	SMALL DUCKWEED
LEPDEN	0	LEPIDIUM DENSIFLORUM	0	FAC	Ad	A-Forb	SMALL PEPPERGRASS
LIASCA	5	Liatris scariosa	5	UPL	Nt	P-Forb	NORTHERN BLAZING STAR
LINBOR	6	Linnaea borealis	0	FAC	Nt	P-Forb	TWINFLOWER
LOBCAR	7	Lobelia cardinalis	-5	OBL	Nt	P-Forb	CARDINAL FLOWER
LOBINF	0	Lobelia inflata	4	FACU-	Nt	A-Forb	INDIAN TOBACCO
LOLPER	0	LOLIUM PERENNE	3	FACU	Ad	P-Grass	PERENNIAL RYE GRASS
LONCAN	5	Lonicera canadensis	3	FACU	Nt	Shrub	AMERICAN FLY HONEYSUCKLE
LONDIO	5	Lonicera dioica	3	FACU	Nt	W-Vine	RED HONEYSUCKLE
LONMOR	0	LONICERA MORROWII	5	UPL	Ad	Shrub	MORROW HONEYSUCKLE
LONOBL	8	Lonicera oblongifolia	-5	OBL	Nt	Shrub	SWAMP FLY HONEYSUCKLE
LONTAT	0	LONICERA TATARICA	3	FACU	Ad	Shrub	SMOOTH TARTARIAN HONEYSUCKLE
LUDPAL	4	Ludwigia palustris	-5	OBL	Nt	P-Forb	WATER PURSLANE
LYCANN	5	Lycopodium annotinum	0	FAC	Nt	F...Ally	STIFF CLUBMOSS
LYCCLA	4	Lycopodium clavatum	0	FAC	Nt	F...Ally	RUNNING GROUND PINE
LYCDEN	5	Lycopodium dendroideum	0	FAC	Nt	F...Ally	TREE CLUBMOSS
LYCOBS	5	Lycopodium obscurum	3	FACU	Nt	F...Ally	GROUND PINE
LYCAME	2	Lycopus americanus	-5	OBL	Nt	P-Forb	COMMON WATER HOREHOUND
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
LYSCIL	4	Lysimachia ciliata	-3	FACW	Nt	P-Forb	FRINGED LOOSESTRIFE
LYSTER	6	Lysimachia terrestris	-5	OBL	Nt	P-Forb	SWAMP CANDLES
LYSTHY	6	Lysimachia thyrsiflora	-5	OBL	Nt	P-Forb	TUFTED LOOSESTRIFE
MAICAC	4	Maianthemum canadense	0	FAC	Nt	P-Forb	CANADA MAYFLOWER
MATDIS	0	MATRICARIA DISCOIDEA	3	FACU	Ad	A-Forb	PINEAPPLE WEED
MATSTR	3	Matteuccia struthiopteris	-3	FACW	Nt	Fern	OSTRICH FERN
MEDVIR	10	Medeola virginiana	5	UPL	Nt	P-Forb	INDIAN CUCUMBER ROOT
MEDLUP	0	MEDICAGO LUPULINA	1	FAC-	Ad	A-Forb	BLACK MEDICK
MEDSAT	0	MEDICAGO SATIVA	5	UPL	Ad	P-Forb	ALFALFA
MELLOF	0	MELILOTUS OFFICINALIS	3	FACU	Ad	B-Forb	YELLOW SWEET CLOVER
MENARV	3	Mentha arvensis	-3	FACW	Nt	P-Forb	WILD MINT

MILEFF	8	Milium effusum	4	FACU-	Nt	P-Grass	WOOD MILLET
MIMRIN	5	Mimulus ringens	-5	OBL	Nt	P-Forb	MONKEY FLOWER
MITREP	5	Mitchella repens	2	FACU+	Nt	P-Forb	PARTRIDGE BERRY
MITDIP	8	Mitella diphylla	2	FACU+	Nt	P-Forb	BISHOP'S CAP
MITNUD	8	Mitella nuda	-3	FACW	Nt	P-Forb	NAKED MITERWORT
MONOUN	5	Monotropa uniflora	3	FACU	Nt	P-Forb	INDIAN PIPE
MUHMEX	3	Muhlenbergia mexicana	-3	FACW	Nt	P-Grass	LEAFY SATIN GRASS
MYRGAL	6	Myrica gale	-5	OBL	Nt	Shrub	SWEET GALE
NEPCAT	0	NEPETA CATARIA	1	FAC-	Ad	P-Forb	CATNIP
NUPVAR	7	Nuphar variegata	-5	OBL	Nt	P-Forb	YELLOW POND LILY
ONOSEN	2	Onoclea sensibilis	-3	FACW	Nt	Fern	SENSITIVE FERN
ORTSEC	7	Orthilia secunda	-1	FAC+	Nt	P-Forb	ONE SIDED PYROLA
ORYASP	6	Oryzopsis asperifolia	5	UPL	Nt	P-Grass	ROUGH LEAVED RICE GRASS
OSMCIN	5	Osmunda cinnamomea	-3	FACW	Nt	Fern	CINNAMON FERN
OSMCLN	6	Osmunda claytoniana	-1	FAC+	Nt	Fern	INTERRUPTED FERN
OSMREG	5	Osmunda regalis	-5	OBL	Nt	Fern	ROYAL FERN
OSTVIR	5	Ostrya virginiana	4	FACU-	Nt	Tree	IRONWOOD; HOP HORNBEAM
OXAACE	7	Oxalis acetosella	3	FACU	Nt	P-Forb	NORTHERN WOOD SORREL
OXASTR	0	Oxalis stricta	3	FACU	Nt	P-Forb	COMMON YELLOW WOOD SORREL
PANQUI	10	Panax quinquefolius	5	UPL	Nt	P-Forb	GINSENG
PANCAP	1	Panicum capillare	0	FAC	Nt	A-Grass	WITCH GRASS
PANIMP	3	Panicum implicatum	0	FAC	Nt	P-Grass	PANIC GRASS
PANXAN	6	Panicum xanthophysum	5	UPL	Nt	P-Grass	PANIC GRASS
PARQUI	5	Parthenocissus quinquefolia	1	FAC-	Nt	W-Vine	VIRGINIA CREEPER
PHAARU	0	Phalaris arundinacea	-4	FACW+	Nt	P-Grass	REED CANARY GRASS
PHLPRA	0	PHLEUM PRATENSE	3	FACU	Ad	P-Grass	TIMOTHY
PICABI	0	PICEA ABIES	5	UPL	Ad	Tree	NORWAY SPRUCE
PICMAR	6	Picea mariana	-3	FACW	Nt	Tree	BLACK SPRUCE
PILFON	5	Pilea fontana	-3	FACW	Nt	A-Forb	BOG CLEARWEED
PINRES	6	Pinus resinosa	3	FACU	Nt	Tree	RED PINE
PINSTR	3	Pinus strobus	3	FACU	Nt	Tree	WHITE PINE
PINSYL	0	PINUS SYLVESTRIS	5	UPL	Ad	Tree	SCOTCH PINE
PLALAN	0	PLANTAGO LANCEOLATA	0	FAC	Ad	P-Forb	ENGLISH PLANTAIN
PLAMAJ	0	PLANTAGO MAJOR	-1	FAC+	Ad	P-Forb	COMMON PLANTAIN
PLARUG	0	Plantago rugelii	0	FAC	Nt	A-Forb	RED STALKED PLANTAIN
PLACLA	6	Platanthera clavellata	-4	FACW+	Nt	P-Forb	SM. GREEN WOOD ORCHID
POAANN	0	POA ANNUA	1	FAC-	Ad	A-Grass	ANNUAL BLUEGRASS
POACOM	0	POA COMPRESSA	2	FACU+	Ad	P-Grass	CANADA BLUEGRASS
POAPAS	3	Poa palustris	-4	FACW+	Nt	P-Grass	FOWL MEADOW GRASS
POAPRA	0	POA PRATENSIS	1	FAC-	Ad	P-Grass	KENTUCKY BLUEGRASS
POLPAU	7	Polygala paucifolia	3	FACU	Nt	P-Forb	GAY WINGS
POLPUB	5	Polygonatum pubescens	5	UPL	Nt	P-Forb	DOWNY SOLOMON SEAL

POLAMP	6 Polygonum amphibium	-5 OBL	Nt P-Forb	WATER SMARTWEED
POLAVI	0 POLYGONUM AVICULARE	1 FAC-	Ad A-Forb	KNOTWEED
POLCIL	3 Polygonum cilinode	5 UPL	Nt P-Forb	FRINGED FALSE BUCKWHEAT
POLCON	0 POLYGONUM CONVULVULUS	1 FAC-	Ad A-Forb	FALSE BUCKWHEAT
POLCUS	0 POLYGONUM CUSPIDATUM	3 FACU	Ad P-Forb	JAPANESE KNOTWEED
POLHYR	1 Polygonum hydropiper	-5 OBL	Nt A-Forb	WATER PEPPER
POLLAP	0 Polygonum lapathifolium	-4 FACW+	Nt A-Forb	NODDING SMARTWEED
POLORI	0 POLYGONUM ORIENTALE	5 UPL	Ad A-Forb	KISS ME OVER THE GARDEN GATE
POLPEN	0 Polygonum pensylvanicum	-4 FACW+	Nt A-Forb	BIGSEED SMARTWEED
POLPER	0 POLYGONUM PERSICARIA	-3 FACW	Ad A-Forb	LADY'S THUMB
POLPUN	5 Polygonum punctatum	-5 OBL	Nt A-Forb	SMARTWEED
POLSCA	2 Polygonum scandens	0 FAC	Nt P-Forb	FALSE BUCKWHEAT
POPBAL	2 Populus balsamifera	-3 FACW	Nt Tree	BALSAM POPLAR
POPGRA	4 Populus grandidentata	3 FACU	Nt Tree	BIG TOOTHED ASPEN
POPTRE	1 Populus tremuloides	0 FAC	Nt Tree	QUAKING ASPEN
POTNAT	5 Potamogeton natans	-5 OBL	Nt P-Forb	PONDWEED
POTARE	0 POTENTILLA ARGENTEA	3 FACU	Ad P-Forb	SILVERY CINQUEFOIL
POTNOR	0 Potentilla norvegica	0 FAC	Nt A-Forb	ROUGH CINQUEFOIL
POTREC	0 POTENTILLA RECTA	5 UPL	Ad P-Forb	ROUGH FRUITED CINQUEFOIL
POTSIM	2 Potentilla simplex	4 FACU-	Nt P-Forb	OLD FIELD CINQUEFOIL
PRUVUL	0 PRUNELLA VULGARIS	0 FAC	Nt P-Forb	LAWN PRUNELLA
PRUSER	2 Prunus serotina	3 FACU	Nt Tree	WILD BLACK CHERRY
PRUVIR	2 Prunus virginiana	1 FAC-	Nt Shrub	CHOKE CHERRY
PTEAQU	0 Pteridium aquilinum	3 FACU	Nt Fern	BRACKEN FERN
PYCVIR	5 Pycnanthemum virginianum	-4 FACW+	Nt P-Forb	COMMON MOUNTAIN MINT
PYRELL	6 Pyrola elliptica	5 UPL	Nt P-Forb	LARGE LEAVED SHINLEAF
QUEALB	5 Quercus alba	3 FACU	Nt Tree	WHITE OAK
QUERUB	5 Quercus rubra	3 FACU	Nt Tree	RED OAK
RANABO	0 Ranunculus abortivus	-2 FACW-	Nt A-Forb	SMALL FLOWERED BUTTERCUP
RANACR	0 RANUNCULUS ACRIS	-2 FACW-	Ad P-Forb	TALL or COMMON BUTTERCUP
RANHIS	5 Ranunculus hispidus	0 FAC	Nt P-Forb	SWAMP BUTTERCUP
RANPEN	6 Ranunculus pensylvanicus	-5 OBL	Nt A-Forb	BRISTLY CROWFOOT
RANREC	5 Ranunculus recurvatus	-3 FACW	Nt A-Forb	HOOKED CROWFOOT
RANSCE	1 Ranunculus sceleratus	-5 OBL	Nt A-Forb	CURSED CROWFOOT
RHAALN	8 Rhamnus alnifolia	-5 OBL	Nt Shrub	ALDER LEAVED BUCKTHORN
RIBAME	6 Ribes americanum	-3 FACW	Nt Shrub	WILD BLACK CURRANT
RIBCYN	4 Ribes cynosbati	5 UPL	Nt Shrub	PRICKLY or WILD GOOSEBERRY
RIBGLA	5 Ribes glandulosum	-3 FACW	Nt Shrub	SKUNK CURRANT
RIBHIR	6 Ribes hirtellum	-3 FACW	Nt Shrub	SWAMP GOOSEBERRY
RIBTRI	6 Ribes triste	-5 OBL	Nt Shrub	SWAMP RED CURRANT
RORPAL	1 Rorippa palustris	-5 OBL	Nt A-Forb	YELLOW CRESS
ROSPAL	5 Rosa palustris	-5 OBL	Nt Shrub	SWAMP ROSE

RUBALL	1	Rubus allegheniensis	2	FACU+	Nt	Shrub	COMMON BLACKBERRY
RUBFLA	1	Rubus flagellaris	4	FACU-	Nt	Shrub	NORTHERN DEWBERRY
RUBHIS	4	Rubus hispidus	-3	FACW	Nt	Shrub	SWAMP DEWBERRY
RUBOCC	1	Rubus occidentalis	5	UPL	Nt	Shrub	BLACK RASPBERRY
RUBPUB	4	Rubus pubescens	-4	FACW+	Nt	P-Forb	DWARF RASPBERRY
RUBSTR	2	Rubus strigosus	-2	FACW-	Nt	Shrub	WILD RED RASPBERRY
RUDHIR	1	Rudbeckia hirta	3	FACU	Nt	P-Forb	BLACK EYED SUSAN
RUMACL	0	RUMEX ACETOSELLA	0	FAC	Ad	P-Forb	SHEEP SORREL
RUMCRI	0	RUMEX CRISPUS	-1	FAC+	Ad	P-Forb	CURLY DOCK
RUMOBT	0	RUMEX OBTUSIFOLIUS	-3	FACW	Ad	P-Forb	BITTER DOCK
RUMORB	9	Rumex orbiculatus	-5	OBL	Nt	P-Forb	GREAT WATER DOCK
SAGLAT	1	Sagittaria latifolia	-5	OBL	Nt	P-Forb	COMMON ARROWHEAD
SALBEB	1	Salix bebbiana	-4	FACW+	Nt	Shrub	BEBB'S WILLOW
SALDIS	1	Salix discolor	-3	FACW	Nt	Shrub	PUSSY WILLOW
SALERI	2	Salix eriocephala	-3	FACW	Nt	Shrub	WILLOW
SALFRA	0	SALIX FRAGILIS	-1	FAC+	Ad	Tree	CRACK WILLOW
SALHUM	4	Salix humilis	3	FACU	Nt	Shrub	PRAIRIE WILLOW
SALLUC	3	Salix lucida	-4	FACW+	Nt	Shrub	SHINING WILLOW
SALPET	1	Salix petiolaris	-4	FACW+	Nt	Shrub	SLENDER WILLOW
SAMCAN	3	Sambucus canadensis	-2	FACW-	Nt	Shrub	ELDERBERRY
SCHPUP	5	Schizachne purpurascens	2	FACU+	Nt	P-Grass	FALSE MELIC
SCHACU	5	Schoenoplectus acutus	-5	OBL	Nt	P-Sedge	HARDSTEM BULRUSH
SCHTAB	4	Schoenoplectus tabernaemontani	-5	OBL	Nt	P-Sedge	SOFTSTEM BULRUSH
SCIATR	3	Scirpus atrovirens	-5	OBL	Nt	P-Sedge	BULRUSH
SCICYP	5	Scirpus cyperinus	-5	OBL	Nt	P-Sedge	WOOL GRASS
SCRLAN	5	Scrophularia lanceolata	2	FACU+	Nt	P-Forb	EARLY FIGWORT
SCUGAL	5	Scutellaria galericulata	-5	OBL	Nt	P-Forb	COMMON SKULLCAP
SCULAT	5	Scutellaria lateriflora	-5	OBL	Nt	P-Forb	MAD DOG SKULLCAP
SENAUR	5	Senecio aureus	-3	FACW	Nt	P-Forb	GOLDEN RAGWORT
SETVIR	0	SETARIA VIRIDIS	5	UPL	Ad	A-Grass	GREEN FOXTAIL
SILPRA	0	SILENE PRATENSIS	5	UPL	Ad	A-Forb	WHITE CATCHFLY
SILVUL	0	SILENE VULGARIS	5	UPL	Ad	P-Forb	BLADDER CAMPION
SIUSUA	5	Sium suave	-5	OBL	Nt	P-Forb	WATER PARSNIP
SMIRAC	5	Smilacina racemosa	3	FACU	Nt	P-Forb	FALSE SPIKENARD
SMITRI	10	Smilacina trifolia	-5	OBL	Nt	P-Forb	FALSE MAYFLOWER
SOLDUL	0	SOLANUM DULCAMARA	0	FAC	Ad	P-Forb	BITTERSWEET NIGHTSHADE
SOLALT	1	Solidago altissima	3	FACU	Nt	P-Forb	TALL GOLDENROD
SOLCAN	1	Solidago canadensis	3	FACU	Nt	P-Forb	CANADA GOLDENROD
SOLGIG	3	Solidago gigantea	-3	FACW	Nt	P-Forb	LATE GOLDENROD
SOLJUN	3	Solidago juncea	5	UPL	Nt	P-Forb	EARLY GOLDENROD
SOLNEM	2	Solidago nemoralis	5	UPL	Nt	P-Forb	OLD FIELD GOLDENROD
SOLRUG	3	Solidago rugosa	-1	FAC+	Nt	P-Forb	ROUGH GOLDENROD

SPAAME	6	Sparganium americanum	-5	OBL	Nt	P-Forb	AMERICAN BUR REED
SPIALB	4	Spiraea alba	-4	FACW+	Nt	Shrub	MEADOWSWEET
SPICAS	8	Spiranthes casei	3	FACU	Nt	P-Forb	CASE'S LADIES' TRESSES
SPICER	4	Spiranthes cernua	-2	FACW-	Nt	P-Forb	NODDING LADIES' TRESSES
STELOF	5	Stellaria longifolia	-4	FACW+	Nt	P-Forb	LONG LEAVED CHICKWEED
STRROS	5	Streptopus roseus	0	FAC	Nt	P-Forb	ROSE TWISTED STALK
TAROFF	0	TARAXACUM OFFICINALE	3	FACU	Ad	P-Forb	COMMON DANDELION
THADAS	3	Thalictrum dasycarpum	-2	FACW-	Nt	P-Forb	PURPLE MEADOW RUE
THENOV	5	Thelypteris noveboracensis	-1	FAC+	Nt	Fern	NEW YORK FERN
THEPAL	2	Thelypteris palustris	-4	FACW+	Nt	Fern	MARSH FERN
THEPHE	5	Thelypteris phegopteris	5	UPL	Nt	Fern	NORTHERN BEECH FERN
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TIACOR	9	Tiarella cordifolia	1	FAC-	Nt	P-Forb	FOAMFLOWER
TILAME	5	Tilia americana	3	FACU	Nt	Tree	BASSWOOD
TOXRYD	3	Toxicodendron rydbergii	0	FAC	Nt	W-Vine	POISON IVY
TRADUB	0	TRAGOPOGON DUBIUS	5	UPL	Ad	B-Forb	GOAT'S BEARD
TRIFRA	6	Triadenum fraseri	-5	OBL	Nt	P-Forb	MARSH ST. JOHN'S WORT
TRIBOR	5	Trientalis borealis	-1	FAC+	Nt	P-Forb	STARFLOWER
TRIHVB	0	TRIFOLIUM HYBRIDUM	1	FAC-	Ad	P-Forb	ALSIKE CLOVER
TRIPRA	0	TRIFOLIUM PRATENSE	2	FACU+	Ad	P-Forb	RED CLOVER
TRIREP	0	TRIFOLIUM REPENS	2	FACU+	Ad	P-Forb	WHITE CLOVER
TRICER	5	Trillium cernuum	0	FAC	Nt	P-Forb	NODDING TRILLIUM
TSUCAN	5	Tsuga canadensis	3	FACU	Nt	Tree	HEMLOCK
TYPLAT	1	Typha latifolia	-5	OBL	Nt	P-Forb	BROAD LEAVED CATTAIL
ULMAME	1	Ulmus americana	-2	FACW-	Nt	Tree	AMERICAN ELM
URTDIO	1	Urtica dioica	-1	FAC+	Nt	P-Forb	NETTLE
VACANG	4	Vaccinium angustifolium	3	FACU	Nt	Shrub	BLUEBERRY
VACMYR	4	Vaccinium myrtilloides	-2	FACW-	Nt	Shrub	CANADA BLUEBERRY
VERTHA	0	VERBASCUM THAPSUS	5	UPL	Ad	B-Forb	COMMON MULLEIN
VERBRA	0	VERBENA BRACTEATA	3	FACU	Ad	A-Forb	CREEPING VERVAIN
VERHAS	4	Verbena hastata	-4	FACW+	Nt	P-Forb	BLUE VERVAIN
VERSTR	4	Verbena stricta	5	UPL	Nt	P-Forb	HOARY VERVAIN
VERANA	4	Veronica anagallis-aquatica	-5	OBL	Nt	B-Forb	WATER SPEEDWELL
VERBEA	10	Veronica beccabunga var. americana	-5	OBL	Nt	P-Forb	AMERICAN BROOKLIME
VEROFF	0	VERONICA OFFICINALIS	5	UPL	Ad	P-Forb	COMMON SPEEDWELL
VIBOPO	0	VIBURNUM OPULUS	0	FAC	Ad	Shrub	EUROPEAN Highbush CRANBERRY
VICVIL	0	VICIA VILLOSA	5	UPL	Ad	A-Forb	HAIRY VETCH
VIOCON	3	Viola conspersa	-2	FACW-	Nt	P-Forb	DOG VIOLET
VIOCUC	5	Viola cucullata	-5	OBL	Nt	P-Forb	MARSH VIOLET
VIOMAC	6	Viola macloskeyi	-5	OBL	Nt	P-Forb	SMOOTH WHITE VIOLET
VIOREN	6	Viola renifolia	-3	FACW	Nt	P-Forb	KIDNEY LEAVED VIOLET
WOLCOL	5	Wolffia columbiana	-5	OBL	Nt	A-Forb	COMMON WATER MEAL

Appendix 2 FQA of Flowing Well property upland forests
(generally, mesic northern forest)

Appendix 2. FQA of Flowing Well property upland forests (generally, mesic northern forest).

Site: Flowing Well property- mesic northern forest
 Locale: Kalkaska Co., MI
 Date: August 22, 2012 - hours
 August 24, 2012 - hours
 July 13, 2012 - hours
 July 12, 2012 - hours
 July 11, 2012 - hours
 July 10, 2012 - hours
 By: Bradford Slaughter
 File: s:\NFI\Projects\flowing well\botanical inventory\Flowing Well FQA_mesic northern forest.inv
 Notes: Also: Dendrolycopodium hickeyi.

FLORISTIC QUALITY DATA		Native		Adventive			
106	NATIVE SPECIES	Tree	17	14.3%	Tree	0	0.0%
119	Total Species	Shrub	13	10.9%	Shrub	0	0.0%
4.4	NATIVE MEAN C	W-Vine	1	0.8%	W-Vine	0	0.0%
3.9	W/Adventives	H-Vine	0	0.0%	H-Vine	0	0.0%
45.3	NATIVE FQI	P-Forb	41	34.5%	P-Forb	9	7.6%
42.7	W/Adventives	B-Forb	0	0.0%	B-Forb	1	0.8%
0.5	NATIVE MEAN W	A-Forb	1	0.8%	A-Forb	1	0.8%
0.8	W/Adventives	P-Grass	8	6.7%	P-Grass	2	1.7%
AVG:	Faculative (-)	A-Grass	0	0.0%	A-Grass	0	0.0%
		P-Sedge	9	7.6%	P-Sedge	0	0.0%
		A-Sedge	0	0.0%	A-Sedge	0	0.0%
		Fern	16	13.4%			

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ABIBAL	3 Abies balsamea	-3 FACW	Nt Tree	BALSAM FIR
ACERUB	1 Acer rubrum	0 FAC	Nt Tree	RED MAPLE
ACESAU	5 Acer saccharum	3 FACU	Nt Tree	SUGAR MAPLE
ACTRUB	7 Actaea rubra	5 UPL	Nt P-Forb	RED BANE BERRY
ADIPED	6 Adiantum pedatum	1 FAC-	Nt Fern	MAIDENHAIR FERN
AGRPER	5 Agrostis perennans	1 FAC-	Nt P-Grass	AUTUMN BENT GRASS
AMEINT	4 Amelanchier interior	5 UPL	Nt Tree	SERVICE BERRY
APOAND	3 Apocynum androsaemifolium	5 UPL	Nt P-Forb	SPREADING DOGBANE
ARANUD	5 Aralia nudicaulis	3 FACU	Nt P-Forb	WILD SARSAPARILLA
ARITRI	5 Arisaema triphyllum	-2 FACW-	Nt P-Forb	JACK IN THE PULPIT
ASCSYR	1 Asclepias syriaca	5 UPL	Nt P-Forb	COMMON MILKWEED
ASTLAE	5 Aster laevis	5 UPL	Nt P-Forb	SMOOTH ASTER

ASTLAT	2 Aster lateriflorus	-2 FACW-	Nt P-Forb	SIDE FLOWERING ASTER
ASTMAC	4 Aster macrophyllus	5 UPL	Nt P-Forb	BIG LEAVED ASTER
ATHFIL	4 Athyrium filix-femina	0 FAC	Nt Fern	LADY FERN
BETALL	7 Betula alleghaniensis	0 FAC	Nt Tree	YELLOW BIRCH
BETPAP	2 Betula papyrifera	2 FACU+	Nt Tree	PAPER BIRCH
BRAERE	7 Brachyelytrum erectum	5 UPL	Nt P-Grass	LONG AWNED WOOD GRASS
CXARTT	3 Carex arctata	5 UPL	Nt P-Sedge	SEDGE
CXBRUN	5 Carex brunnescens	-3 FACW	Nt P-Sedge	SEDGE
CXCRIN	4 Carex crinita	-4 FACW+	Nt P-Sedge	SEDGE
CXDEWE	3 Carex deweyana	4 FACU-	Nt P-Sedge	SEDGE
CXINTU	3 Carex intumescens	-4 FACW+	Nt P-Sedge	SEDGE
CXPEDU	5 Carex pedunculata	5 UPL	Nt P-Sedge	SEDGE
CXPROJ	3 Carex projecta	-4 FACW+	Nt P-Sedge	SEDGE
CXSWAN	4 Carex swanii	3 FACU	Nt P-Sedge	SEDGE
CHRLEU	0 CHRYSANTHEMUM LEUCANTHEMUM	5 UPL	Ad P-Forb	OX EYE DAISY
CHROME	6 Chrysosplenium americanum	-5 OBL	Nt P-Forb	GOLDEN SAXIFRAGE
CINLAT	5 Cinna latifolia	-4 FACW+	Nt P-Grass	WOOD REEDGRASS
CIRLUT	2 Circaea lutetiana	3 FACU	Nt P-Forb	ENCHANTER'S NIGHTSHADE
CIRARV	0 CIRSIUM ARVENSE	3 FACU	Ad P-Forb	CANADIAN THISTLE
CIRVUL	0 CIRSIUM VULGARE	4 FACU-	Ad B-Forb	BULL THISTLE
CLEVIR	4 Clematis virginiana	0 FACU	Nt W-Vine	VIRGIN'S BOWER
CLIBOR	5 Clintonia borealis	-1 FAC+	Nt P-Forb	BLUEBEAD LILY; CORN LILY
COPTRI	5 Coptis trifolia	-3 FACW	Nt P-Forb	GOLDTHREAD
CORCAA	6 Cornus canadensis	0 FAC	Nt Shrub	BUNCHBERRY
CORCOR	5 Corylus cornuta	5 UPL	Nt Shrub	BEAKED HAZELNUT
CYPACA	5 Cyripedium acaule	-3 FACW	Nt P-Forb	PINK LADY'S SL...CCASIN FLOWER
DANSPI	4 Danthonia spicata	5 UPL	Nt P-Grass	POVERTY GRASS; OATGRASS
DIRPAL	8 Dirca palustris	0 FAC	Nt Shrub	LEATHERWOOD
DRYCAR	5 Dryopteris carthusiana	-2 FACW-	Nt Fern	SPINULOSE WOODFERN
DRYINT	5 Dryopteris intermedia	0 FAC	Nt Fern	EVERGREEN WOODFERN
EPIREP	7 Epigaea repens	5 UPL	Nt Shrub	TRAILING ARBUTUS
EQUSYL	5 Equisetum sylvaticum	-3 FACW	Nt F...Ally	WOODLAND HORSETAIL
EUTGRA	3 Euthamia graminifolia	-2 FACW-	Nt P-Forb	GRASS LEAVED GOLDENROD
FAGGRA	6 Fagus grandifolia	3 FACU	Nt Tree	AMERICAN BEECH
FRAVIR	2 Fragaria virginiana	1 FAC-	Nt P-Forb	WILD STRAWBERRY
FRAAME	5 Fraxinus americana	3 FACU	Nt Tree	WHITE ASH
FRANIG	6 Fraxinus nigra	-4 FACW+	Nt Tree	BLACK ASH
GALTET	0 GALEOPSIS TETRAHIT	5 UPL	Ad A-Forb	COMMON HEMP NETTLE
GALTRR	4 Galium triflorum	2 FACU+	Nt P-Forb	FRAGRANT BEDSTRAW
GAUPRO	5 Gaultheria procumbens	3 FACU	Nt Shrub	WINTERGREEN
GLYSTR	4 Glyceria striata	-5 OBL	Nt P-Grass	FOWL MANNA GRASS
GYMDRY	5 Gymnocarpium dryopteris	0 FAC	Nt Fern	OAK FERN

HAMVIR	5	Hamamelis virginiana	3	FACU	Nt	Shrub	WITCH HAZEL
HIEAUR	0	HIERACIUM AURANTIACUM	5	UPL	Ad	P-Forb	ORANGE HAWKWEED
HIEPIS	0	HIERACIUM PILOSELLOIDES	5	UPL	Ad	P-Forb	GLAUCOUS KING DEVIL
HYPPER	0	HYPERICUM PERFORATUM	5	UPL	Ad	P-Forb	COMMON ST. JOHN'S WORT
IMPCAP	2	Impatiens capensis	-3	FACW	Nt	A-Forb	SPOTTED TOUCH ME NOT
JUNEFF	3	Juncus effusus	-5	OBL	Nt	P-Forb	SOFT STEMMED RUSH
LONCAN	5	Lonicera canadensis	3	FACU	Nt	Shrub	AMERICAN FLY HONEYSUCKLE
LYCANN	5	Lycopodium annotinum	0	FAC	Nt	F...Ally	STIFF CLUBMOSS
LYCCLA	4	Lycopodium clavatum	0	FAC	Nt	F...Ally	RUNNING GROUND PINE
LYCDEN	5	Lycopodium dendroideum	0	FAC	Nt	F...Ally	TREE CLUBMOSS
LYCOBS	5	Lycopodium obscurum	3	FACU	Nt	F...Ally	GROUND PINE
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
LYSCIL	4	Lysimachia ciliata	-3	FACW	Nt	P-Forb	FRINGED LOOSESTRIFE
MAICAC	4	Maianthemum canadense	0	FAC	Nt	P-Forb	CANADA MAYFLOWER
MEDVIR	10	Medeola virginiana	5	UPL	Nt	P-Forb	INDIAN CUCUMBER ROOT
MILEFF	8	Milium effusum	4	FACU-	Nt	P-Grass	WOOD MILLET
MITREP	5	Mitchella repens	2	FACU+	Nt	P-Forb	PARTRIDGE BERRY
MONOUN	5	Monotropa uniflora	3	FACU	Nt	P-Forb	INDIAN PIPE
ONOSEN	2	Onoclea sensibilis	-3	FACW	Nt	Fern	SENSITIVE FERN
ORYASP	6	Oryzopsis asperifolia	5	UPL	Nt	P-Grass	ROUGH LEAVED RICE GRASS
OSMCIN	5	Osmunda cinnamomea	-3	FACW	Nt	Fern	CINNAMON FERN
OSMCLN	6	Osmunda claytoniana	-1	FAC+	Nt	Fern	INTERRUPTED FERN
OSTVIR	5	Ostrya virginiana	4	FACU-	Nt	Tree	IRONWOOD; HOP HORNBEAM
OXAACE	7	Oxalis acetosella	3	FACU	Nt	P-Forb	NORTHERN WOOD SORREL
OXASTR	0	Oxalis stricta	3	FACU	Nt	P-Forb	COMMON YELLOW WOOD SORREL
PANQUI	10	Panax quinquefolius	5	UPL	Nt	P-Forb	GINSENG
PHLPRA	0	PHLEUM PRATENSE	3	FACU	Ad	P-Grass	TIMOTHY
PINSTR	3	Pinus strobus	3	FACU	Nt	Tree	WHITE PINE
PLACLA	6	Platanthera clavellata	-4	FACW+	Nt	P-Forb	SM. GREEN WOOD ORCHID
POAPRA	0	POA PRATENSIS	1	FAC-	Ad	P-Grass	KENTUCKY BLUEGRASS
POLPUB	5	Polygonatum pubescens	5	UPL	Nt	P-Forb	DOWNY SOLOMON SEAL
POLSCA	2	Polygonum scandens	0	FAC	Nt	P-Forb	FALSE BUCKWHEAT
POPTRE	1	Populus tremuloides	0	FAC	Nt	Tree	QUAKING ASPEN
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
PRUSER	2	Prunus serotina	3	FACU	Nt	Tree	WILD BLACK CHERRY
PTEAQU	0	Pteridium aquilinum	3	FACU	Nt	Fern	BRACKEN FERN
PYRELL	6	Pyrola elliptica	5	UPL	Nt	P-Forb	LARGE LEAVED SHINLEAF
RANACR	0	RANUNCULUS ACRIS	-2	FACW-	Ad	P-Forb	TALL or COMMON BUTTERCUP
RIBCYN	4	Ribes cynosbati	5	UPL	Nt	Shrub	PRICKLY or WILD GOOSEBERRY
RIBTRI	6	Ribes triste	-5	OBL	Nt	Shrub	SWAMP RED CURRANT
RUBALL	1	Rubus allegheniensis	2	FACU+	Nt	Shrub	COMMON BLACKBERRY
RUBPUB	4	Rubus pubescens	-4	FACW+	Nt	P-Forb	DWARF RASPBERRY

RUBSTR	2	Rubus strigosus	-2	FACW-	Nt	Shrub	WILD RED RASPBERRY
RUMOBT	0	RUMEX OBTUSIFOLIUS	-3	FACW	Ad	P-Forb	BITTER DOCK
SCHPUP	5	Schizachne purpurascens	2	FACU+	Nt	P-Grass	FALSE MELIC
SCIATR	3	Scirpus atrovirens	-5	OBL	Nt	P-Sedge	BULRUSH
SMIRAC	5	Smilacina racemosa	3	FACU	Nt	P-Forb	FALSE SPIKENARD
SOLGIG	3	Solidago gigantea	-3	FACW	Nt	P-Forb	LATE GOLDENROD
SOLRUG	3	Solidago rugosa	-1	FAC+	Nt	P-Forb	ROUGH GOLDENROD
SPIALB	4	Spiraea alba	-4	FACW+	Nt	Shrub	MEADOWSWEET
STRROS	5	Streptopus roseus	0	FAC	Nt	P-Forb	ROSE TWISTED STALK
TAROFF	0	TARAXACUM OFFICINALE	3	FACU	Ad	P-Forb	COMMON DANDELION
THENOV	5	Thelypteris noveboracensis	-1	FAC+	Nt	Fern	NEW YORK FERN
THEPHE	5	Thelypteris phegopteris	5	UPL	Nt	Fern	NORTHERN BEECH FERN
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TIACOR	9	Tiarella cordifolia	1	FAC-	Nt	P-Forb	FOAMFLOWER
TILAME	5	Tilia americana	3	FACU	Nt	Tree	BASSWOOD
TRIBOR	5	Trientalis borealis	-1	FAC+	Nt	P-Forb	STARFLOWER
TRICER	5	Trillium cernuum	0	FAC	Nt	P-Forb	NODDING TRILLIUM
TSUCAN	5	Tsuga canadensis	3	FACU	Nt	Tree	HEMLOCK
ULMAME	1	Ulmus americana	-2	FACW-	Nt	Tree	AMERICAN ELM
VACMYR	4	Vaccinium myrtilloides	-2	FACW-	Nt	Shrub	CANADA BLUEBERRY
VEROFF	0	VERONICA OFFICINALIS	5	UPL	Ad	P-Forb	COMMON SPEEDWELL
VIOMAC	6	Viola macloskeyi	-5	OBL	Nt	P-Forb	SMOOTH WHITE VIOLET
VIOREN	6	Viola renifolia	-3	FACW	Nt	P-Forb	KIDNEY LEAVED VIOLET

Appendix 3 FQA of Flowing Well property swamp forests

Appendix 3. FQA of Flowing Well property swamp forests.

Site: Flowing well property- swamp forest
 Locale: Kalkaska Co., MI
 Date: August 24, 2012 - hours
 August 23, 2012 - hours
 August 22, 2012 - hours
 July 13, 2012 - hours
 July 12, 2012 - hours
 July 11, 2012 - hours
 July 10, 2012 - hours
 By: Bradford Slaughter
 File: s:\NFI\Projects\flowing well\botanical inventory\Flowing Well FQA_swamp forest.inv
 Notes: Also: Dryopteris xboottii. Agrostis hyemalis = A. scabra.

FLORISTIC QUALITY DATA		Native		Adventive	
165	NATIVE SPECIES	Tree	19	Tree	0
176	Total Species	Shrub	23	Shrub	0
4.3	NATIVE MEAN C	W-Vine	3	W-Vine	0
4.1	W/Adventives	H-Vine	0	H-Vine	0
55.5	NATIVE FQI	P-Forb	66	P-Forb	7
53.7	W/Adventives	B-Forb	3	B-Forb	3
-1.4	NATIVE MEAN W	A-Forb	7	A-Forb	1
-1.2	W/Adventives	P-Grass	9	P-Grass	0
AVG:	Faculative (+)	A-Grass	0	A-Grass	0
		P-Sedge	20	P-Sedge	0
		A-Sedge	0	A-Sedge	0
		Fern	15		

ACRONYM	C	SCIENTIFIC NAME	W	WETNESS	PHYSIOGNOMY	COMMON NAME
ABIBAL	3	Abies balsamea	-3	FACW	Nt Tree	BALSAM FIR
ACERUB	1	Acer rubrum	0	FAC	Nt Tree	RED MAPLE
ACESAU	5	Acer saccharum	3	FACU	Nt Tree	SUGAR MAPLE
ACESPI	5	Acer spicatum	3	FACU	Nt Tree	MOUNTAIN MAPLE
ACTRUB	7	Actaea rubra	5	UPL	Nt P-Forb	RED BANE BERRY
ADIPEP	6	Adiantum pedatum	1	FAC-	Nt Fern	MAIDENHAIR FERN
AGRGRY	2	Agrimonia gryposepala	2	FACU+	Nt P-Forb	TALL AGRIMONY
AGRHYE	4	Agrostis hyemalis	1	FAC-	Nt P-Grass	TICKLEGRASS
ALNRUG	5	Alnus rugosa	-5	OBL	Nt Shrub	TAG ALDER
AMEINT	4	Amelanchier interior	5	UPL	Nt Tree	SERVICE BERRY
ANEQUI	5	Anemone quinquefolia	0	FAC	Nt P-Forb	WOOD ANEMONE

ARANUD	5	Aralia nudicaulis	3	FACU	Nt	P-Forb	WILD SARSAPARILLA
ARCMIN	0	ARCTIUM MINUS	5	UPL	Ad	B-Forb	COMMON BURDOCK
ARITRI	5	Arisaema triphyllum	-2	FACW-	Nt	P-Forb	JACK IN THE PULPIT
ASCINC	6	Asclepias incarnata	-5	OBL	Nt	P-Forb	SWAMP MILKWEED
ASCSYR	1	Asclepias syriaca	5	UPL	Nt	P-Forb	COMMON MILKWEED
ASTLAN	2	Aster lanceolatus	-3	FACW	Nt	P-Forb	EASTERN LINED ASTER
ASTLAT	2	Aster lateriflorus	-2	FACW-	Nt	P-Forb	SIDE FLOWERING ASTER
ASTMAC	4	Aster macrophyllus	5	UPL	Nt	P-Forb	BIG LEAVED ASTER
ASTPUN	5	Aster puniceus	-5	OBL	Nt	P-Forb	SWAMP ASTER
ATHFIL	4	Athyrium filix-femina	0	FAC	Nt	Fern	LADY FERN
BETALL	7	Betula alleghaniensis	0	FAC	Nt	Tree	YELLOW BIRCH
BETPAP	2	Betula papyrifera	2	FACU+	Nt	Tree	PAPER BIRCH
BIDFRO	1	Bidens frondosus	-3	FACW	Nt	A-Forb	COMMON BEGGAR TICKS
BOECYL	5	Boehmeria cylindrica	-5	OBL	Nt	P-Forb	FALSE NETTLE
BRAERE	7	Brachyelytrum erectum	5	UPL	Nt	P-Grass	LONG AWNED WOOD GRASS
CALTPA	6	Caltha palustris	-5	OBL	Nt	P-Forb	MARSH MARIGOLD
CARPEN	1	Cardamine pensylvanica	-4	FACW+	Nt	B-Forb	PENNSYLVANIA BITTER CRESS
CXARTT	3	Carex arctata	5	UPL	Nt	P-Sedge	SEDGE
CXCRI	4	Carex crinita	-4	FACW+	Nt	P-Sedge	SEDGE
CXCRI	3	Carex cristatella	-4	FACW+	Nt	P-Sedge	SEDGE
CXDEWE	3	Carex deweyana	4	FACU-	Nt	P-Sedge	SEDGE
CXDISP	10	Carex disperma	-5	OBL	Nt	P-Sedge	SEDGE
CXGRAA	4	Carex gracillima	3	FACU	Nt	P-Sedge	SEDGE
CXHYST	2	Carex hystericina	-5	OBL	Nt	P-Sedge	SEDGE
CXINTE	3	Carex interior	-5	OBL	Nt	P-Sedge	SEDGE
CXINTU	3	Carex intumescens	-4	FACW+	Nt	P-Sedge	SEDGE
CXLEPA	5	Carex leptalea	-5	OBL	Nt	P-Sedge	SEDGE
CXLUPA	4	Carex lupulina	-5	OBL	Nt	P-Sedge	SEDGE
CXPEDU	5	Carex pedunculata	5	UPL	Nt	P-Sedge	SEDGE
CXPROJ	3	Carex projecta	-4	FACW+	Nt	P-Sedge	SEDGE
CXRETS	3	Carex retrorsa	-5	OBL	Nt	P-Sedge	SEDGE
CXSCAB	4	Carex scabrata	-5	OBL	Nt	P-Sedge	SEDGE
CXSTIP	1	Carex stipata	-5	OBL	Nt	P-Sedge	SEDGE
CXTRIS	9	Carex trisperma	-5	OBL	Nt	P-Sedge	SEDGE
CXTUCK	8	Carex tuckermanii	-5	OBL	Nt	P-Sedge	SEDGE
CXVULP	1	Carex vulpinoidea	-5	OBL	Nt	P-Sedge	SEDGE
CHEGLB	7	Chelone glabra	-5	OBL	Nt	P-Forb	TURTLEHEAD
CHROME	6	Chrysosplenium americanum	-5	OBL	Nt	P-Forb	GOLDEN SAXIFRAGE
CINLAT	5	Cinna latifolia	-4	FACW+	Nt	P-Grass	WOOD REEDGRASS
CIRALP	4	Circaea alpina	-3	FACW	Nt	P-Forb	SMALL ENCHANTER'S NIGHTSHADE
CIRLUT	2	Circaea lutetiana	3	FACU	Nt	P-Forb	ENCHANTER'S NIGHTSHADE
CIRMUT	6	Cirsium muticum	-5	OBL	Nt	B-Forb	SWAMP THISTLE

CIRPAL	0	CIRSIUM PALUSTRE	-4	FACW+	Ad	B-Forb	MARSH THISTLE
CLEVIR	4	Clematis virginiana	0	FAC	Nt	W-Vine	VIRGIN'S BOWER
COPTRI	5	Coptis trifolia	-3	FACW	Nt	P-Forb	GOLDTHREAD
CORCAA	6	Cornus canadensis	0	FAC	Nt	Shrub	BUNCHBERRY
CORSTO	2	Cornus stolonifera	-3	FACW	Nt	Shrub	RED OSIER DOGWOOD
CORCOR	5	Corylus cornuta	5	UPL	Nt	Shrub	BEAKED HAZELNUT
DRYCAR	5	Dryopteris carthusiana	-2	FACW-	Nt	Fern	SPINULOSE WOODFERN
DRYCRI	6	Dryopteris cristata	-5	OBL	Nt	Fern	CRESTED SHIELD FERN
DRYINT	5	Dryopteris intermedia	0	FAC	Nt	Fern	EVERGREEN WOODFERN
ELYVIR	4	Elymus virginicus	-2	FACW-	Nt	P-Grass	VIRGINIA WILD RYE
EPIREP	7	Epigaea repens	5	UPL	Nt	Shrub	TRAILING ARBUTUS
EPICOL	3	Epilobium coloratum	-5	OBL	Nt	P-Forb	CINNAMON WILLOW HERB
EPILEP	6	Epilobium leptophyllum	-5	OBL	Nt	P-Forb	FEN WILLOW HERB
EPIPAR	0	EPILOBIUM PARVIFLORUM	3	FACU	Ad	P-Forb	WILLOW HERB
EPIHEL	0	EPIPACTIS HELLEBORINE	5	UPL	Ad	P-Forb	HELLEBORINE
EQUARV	0	Equisetum arvense	0	FAC	Nt	F...Ally	COMMON HORSETAIL
EQUSYL	5	Equisetum sylvaticum	-3	FACW	Nt	F...Ally	WOODLAND HORSETAIL
EREHIE	2	Erechtites hieracifolia	3	FACU	Nt	A-Forb	FIREWEED
EUPMAM	4	Eupatorium maculatum	-5	OBL	Nt	P-Forb	JOE PYE WEED
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt	P-Forb	COMMON BONESET
FAGGRA	6	Fagus grandifolia	3	FACU	Nt	Tree	AMERICAN BEECH
FRAVIR	2	Fragaria virginiana	1	FAC-	Nt	P-Forb	WILD STRAWBERRY
FRANIG	6	Fraxinus nigra	-4	FACW+	Nt	Tree	BLACK ASH
FRAPEN	2	Fraxinus pennsylvanica	-3	FACW	Nt	Tree	RED ASH
GALTET	0	GALEOPSIS TETRAHIT	5	UPL	Ad	A-Forb	COMMON HEMP NETTLE
GALASP	5	Galium asprellum	-5	OBL	Nt	P-Forb	ROUGH BEDSTRAW
GALTIN	5	Galium tinctorium	-5	OBL	Nt	P-Forb	STIFF BEDSTRAW
GALTRD	6	Galium trifidum	-4	FACW+	Nt	P-Forb	SMALL BEDSTRAW
GALTRR	4	Galium triflorum	2	FACU+	Nt	P-Forb	FRAGRANT BEDSTRAW
GAUHS	8	Gaultheria hispidula	-3	FACW	Nt	Shrub	CREEPING SNOWBERRY
GERBIC	4	Geranium bicknellii	5	UPL	Nt	A-Forb	NORTHERN CRANE'S BILL
GEUCAN	1	Geum canadense	0	FAC	Nt	P-Forb	WHITE AVENS
GEURIV	7	Geum rivale	-5	OBL	Nt	P-Forb	PURPLE AVENS
GLYSTR	4	Glyceria striata	-5	OBL	Nt	P-Grass	FOWL MANNA GRASS
GYMDRY	5	Gymnocarpium dryopteris	0	FAC	Nt	Fern	OAK FERN
HIEAUR	0	HIERACIUM AURANTIACUM	5	UPL	Ad	P-Forb	ORANGE HAWKWEED
HYDAME	6	Hydrocotyle americana	-5	OBL	Nt	P-Forb	WATER PENNYWORT
HYSPAT	5	Hystrix patula	5	UPL	Nt	P-Grass	BOTTLEBRUSH GRASS
ILEVER	5	Ilex verticillata	-4	FACW+	Nt	Shrub	MICHIGAN HOLLY
IMPCAP	2	Impatiens capensis	-3	FACW	Nt	A-Forb	SPOTTED TOUCH ME NOT
IRIVER	5	Iris versicolor	-5	OBL	Nt	P-Forb	WILD BLUE FLAG
LACBIE	2	Lactuca biennis	0	FAC	Nt	B-Forb	TALL BLUE LETTUCE

LAPCAN	4	Laportea canadensis	-3	FACW	Nt	P-Forb	WOOD NETTLE
LEDGRO	8	Ledum groenlandicum	-5	OBL	Nt	Shrub	LABRADOR TEA
LINBOR	6	Linnaea borealis	0	FAC	Nt	P-Forb	TWINFLOWER
LONCAN	5	Lonicera canadensis	3	FACU	Nt	Shrub	AMERICAN FLY HONEYSUCKLE
LONDIO	5	Lonicera dioica	3	FACU	Nt	W-Vine	RED HONEYSUCKLE
LONOB	8	Lonicera oblongifolia	-5	OBL	Nt	Shrub	SWAMP FLY HONEYSUCKLE
LYCUNI	2	Lycopus uniflorus	-5	OBL	Nt	P-Forb	NORTHERN BUGLE WEED
LYSTHY	6	Lysimachia thyrsiflora	-5	OBL	Nt	P-Forb	TUFTED LOOSESTRIFE
MAICAC	4	Maianthemum canadense	0	FAC	Nt	P-Forb	CANADA MAYFLOWER
MATSTR	3	Matteuccia struthiopteris	-3	FACW	Nt	Fern	OSTRICH FERN
MENARV	3	Mentha arvensis	-3	FACW	Nt	P-Forb	WILD MINT
MILEFF	8	Milium effusum	4	FACU-	Nt	P-Grass	WOOD MILLET
MITREP	5	Mitchella repens	2	FACU+	Nt	P-Forb	PARTRIDGE BERRY
MITDIP	8	Mitella diphylla	2	FACU+	Nt	P-Forb	BISHOP'S CAP
MITNUD	8	Mitella nuda	-3	FACW	Nt	P-Forb	NAKED MITERWORT
MONOUN	5	Monotropa uniflora	3	FACU	Nt	P-Forb	INDIAN PIPE
ONOSEN	2	Onoclea sensibilis	-3	FACW	Nt	Fern	SENSITIVE FERN
ORTSEC	7	Orthilia secunda	-1	FAC+	Nt	P-Forb	ONE SIDED PYROLA
OSMCIN	5	Osmunda cinnamomea	-3	FACW	Nt	Fern	CINNAMON FERN
OSMCLN	6	Osmunda claytoniana	-1	FAC+	Nt	Fern	INTERRUPTED FERN
OSMREG	5	Osmunda regalis	-5	OBL	Nt	Fern	ROYAL FERN
OXAACE	7	Oxalis acetosella	3	FACU	Nt	P-Forb	NORTHERN WOOD SORREL
PARQUI	5	Parthenocissus quinquefolia	1	FAC-	Nt	W-Vine	VIRGINIA CREEPER
PHAARU	0	Phalaris arundinacea	-4	FACW+	Nt	P-Grass	REED CANARY GRASS
PICMAR	6	Picea mariana	-3	FACW	Nt	Tree	BLACK SPRUCE
PILFON	5	Pilea fontana	-3	FACW	Nt	A-Forb	BOG CLEARWEED
PINSTR	3	Pinus strobus	3	FACU	Nt	Tree	WHITE PINE
PLAMAJ	0	PLANTAGO MAJOR	-1	FAC+	Ad	P-Forb	COMMON PLANTAIN
POAPAS	3	Poa palustris	-4	FACW+	Nt	P-Grass	FOWL MEADOW GRASS
POLPAU	7	Polygala paucifolia	3	FACU	Nt	P-Forb	GAY WINGS
POLPUB	5	Polygonatum pubescens	5	UPL	Nt	P-Forb	DOWNY SOLOMON SEAL
POPBAL	2	Populus balsamifera	-3	FACW	Nt	Tree	BALSAM POPLAR
POPTRE	1	Populus tremuloides	0	FAC	Nt	Tree	QUAKING ASPEN
PRUVUL	0	PRUNELLA VULGARIS	0	FAC	Nt	P-Forb	LAWN PRUNELLA
PRUSER	2	Prunus serotina	3	FACU	Nt	Tree	WILD BLACK CHERRY
PRUVIR	2	Prunus virginiana	1	FAC-	Nt	Shrub	CHOKE CHERRY
PYRELL	6	Pyrola elliptica	5	UPL	Nt	P-Forb	LARGE LEAVED SHINLEAF
QUEALB	5	Quercus alba	3	FACU	Nt	Tree	WHITE OAK
RANABO	0	Ranunculus abortivus	-2	FACW-	Nt	A-Forb	SMALL FLOWERED BUTTERCUP
RANHIS	5	Ranunculus hispidus	0	FAC	Nt	P-Forb	SWAMP BUTTERCUP
RANREC	5	Ranunculus recurvatus	-3	FACW	Nt	A-Forb	HOKED CROWFOOT
RHAALN	8	Rhamnus alnifolia	-5	OBL	Nt	Shrub	ALDER LEAVED BUCKTHORN

RIBAME	6	Ribes americanum	-3	FACW	Nt	Shrub	WILD BLACK CURRANT
RIBGLA	5	Ribes glandulosum	-3	FACW	Nt	Shrub	SKUNK CURRANT
RIBHIR	6	Ribes hirtellum	-3	FACW	Nt	Shrub	SWAMP GOOSEBERRY
RIBTRI	6	Ribes triste	-5	OBL	Nt	Shrub	SWAMP RED CURRANT
RUBHIS	4	Rubus hispidus	-3	FACW	Nt	Shrub	SWAMP DEWBERRY
RUBOCC	1	Rubus occidentalis	5	UPL	Nt	Shrub	BLACK RASPBERRY
RUBPUB	4	Rubus pubescens	-4	FACW+	Nt	P-Forb	DWARF RASPBERRY
RUBSTR	2	Rubus strigosus	-2	FACW-	Nt	Shrub	WILD RED RASPBERRY
RUMOBT	0	RUMEX OBTUSIFOLIUS	-3	FACW	Ad	P-Forb	BITTER DOCK
SALERI	2	Salix eriocephala	-3	FACW	Nt	Shrub	WILLOW
SALPET	1	Salix petiolaris	-4	FACW+	Nt	Shrub	SLENDER WILLOW
SAMCAN	3	Sambucus canadensis	-2	FACW-	Nt	Shrub	ELDERBERRY
SCICYP	5	Scirpus cyperinus	-5	OBL	Nt	P-Sedge	WOOL GRASS
SCUGAL	5	Scutellaria galericulata	-5	OBL	Nt	P-Forb	COMMON SKULLCAP
SCULAT	5	Scutellaria lateriflora	-5	OBL	Nt	P-Forb	MAD DOG SKULLCAP
SENAUR	5	Senecio aureus	-3	FACW	Nt	P-Forb	GOLDEN RAGWORT
SMITRI	10	Smilacina trifolia	-5	OBL	Nt	P-Forb	FALSE MAYFLOWER
SOLDUL	0	SOLANUM DULCAMARA	0	FAC	Ad	P-Forb	BITTERSWEET NIGHTSHADE
SOLALT	1	Solidago altissima	3	FACU	Nt	P-Forb	TALL GOLDENROD
SOLCAN	1	Solidago canadensis	3	FACU	Nt	P-Forb	CANADA GOLDENROD
SOLGIG	3	Solidago gigantea	-3	FACW	Nt	P-Forb	LATE GOLDENROD
SOLRUG	3	Solidago rugosa	-1	FAC+	Nt	P-Forb	ROUGH GOLDENROD
SPAAME	6	Sparganium americanum	-5	OBL	Nt	P-Forb	AMERICAN BUR REED
TAROFF	0	TARAXACUM OFFICINALE	3	FACU	Ad	P-Forb	COMMON DANDELION
THADAS	3	Thalictrum dasycarpum	-2	FACW-	Nt	P-Forb	PURPLE MEADOW RUE
THEPAL	2	Thelypteris palustris	-4	FACW+	Nt	Fern	MARSH FERN
THEPHE	5	Thelypteris phegopteris	5	UPL	Nt	Fern	NORTHERN BEECH FERN
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TIACOR	9	Tiarella cordifolia	1	FAC-	Nt	P-Forb	FOAMFLOWER
TILAME	5	Tilia americana	3	FACU	Nt	Tree	BASSWOOD
TRADUB	0	TRAGOPOGON DUBIUS	5	UPL	Ad	B-Forb	GOAT'S BEARD
TRIBOR	5	Trientalis borealis	-1	FAC+	Nt	P-Forb	STARFLOWER
TRICER	5	Trillium cernuum	0	FAC	Nt	P-Forb	NODDING TRILLIUM
TYPLAT	1	Typha latifolia	-5	OBL	Nt	P-Forb	BROAD LEAVED CATTAIL
ULMAME	1	Ulmus americana	-2	FACW-	Nt	Tree	AMERICAN ELM
VACMYR	4	Vaccinium myrtilloides	-2	FACW-	Nt	Shrub	CANADA BLUEBERRY
VIOCON	3	Viola conspersa	-2	FACW-	Nt	P-Forb	DOG VIOLET
VIOCUC	5	Viola cucullata	-5	OBL	Nt	P-Forb	MARSH VIOLET
VIOMAC	6	Viola macloskeyi	-5	OBL	Nt	P-Forb	SMOOTH WHITE VIOLET

Appendix 4 FQA of Flowing Well property herbaceous and shrub-dominated wetlands

Appendix 4. FQA of Flowing Well property herbaceous and shrub-dominated wetlands.

Site: Flowing Well property- open and shrub-dominated wetlands
 Locale: Kalkaska Co., MI
 Date: August 24, 2012 - hours
 August 23, 2012 - hours
 August 22, 2012 - hours
 August 21, 2012 - hours
 July 13, 2012 - hours
 July 12, 2012 - hours
 July 11, 2012 - hours
 July 10, 2012 - hours
 By: Bradford Slaughter
 File: s:\NFI\Projects\flowing well\botanical inventory\Flowing Well FQA_open wetlands.inv
 Notes: Also: Utricularia sp., Brassica sp., Viola sp. Agrostis hyemalis = A. scabra. Lemna minor = L. turionifera.

FLORISTIC QUALITY DATA		Native		Adventive			
163	NATIVE SPECIES	Tree	15	8.0%	Tree	1	0.5%
187	Total Species	Shrub	20	10.7%	Shrub	2	1.1%
3.9	NATIVE MEAN C	W-Vine	1	0.5%	W-Vine	0	0.0%
3.4	W/Adventives	H-Vine	0	0.0%	H-Vine	0	0.0%
49.7	NATIVE FQI	P-Forb	60	32.1%	P-Forb	10	5.3%
46.4	W/Adventives	B-Forb	3	1.6%	B-Forb	2	1.1%
-3.1	NATIVE MEAN W	A-Forb	18	9.6%	A-Forb	4	2.1%
-2.5	W/Adventives	P-Grass	14	7.5%	P-Grass	5	2.7%
AVG:	Fac. Wetland	A-Grass	1	0.5%	A-Grass	0	0.0%
		P-Sedge	21	11.2%	P-Sedge	0	0.0%
		A-Sedge	1	0.5%	A-Sedge	0	0.0%
		Fern	9	4.8%			

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ABIBAL	3 Abies balsamea	-3 FACW	Nt Tree	BALSAM FIR
ACERUB	1 Acer rubrum	0 FAC	Nt Tree	RED MAPLE
AGRREP	0 AGROPYRON REPENS	3 FACU	Ad P-Grass	QUACK GRASS
AGRTRA	8 Agropyron trachycaulum	0 FAC	Nt P-Grass	SLENDER WHEAT GRASS
AGRGIG	0 AGROSTIS GIGANTEA	0 FAC	Ad P-Grass	REDTOP
AGRHYE	4 Agrostis hyemalis	1 FAC-	Nt P-Grass	TICKLEGRASS
ALIPLA	1 Alisma plantago-aquatica	-5 OBL	Nt P-Forb	WATER PLANTAIN
ALNRUG	5 Alnus rugosa	-5 OBL	Nt Shrub	TAG ALDER
AMBART	0 Ambrosia artemisiifolia	3 FACU	Nt A-Forb	COMMON RAGWEED
AMEINT	4 Amelanchier interior	5 UPL	Nt Tree	SERVICEBERRY

AROPRU	5	Aronia prunifolia	-3	FACW	Nt	Shrub	BLACK CHOKEBERRY
ASCINC	6	Asclepias incarnata	-5	OBL	Nt	P-Forb	SWAMP MILKWEED
ASCSYR	1	Asclepias syriaca	5	UPL	Nt	P-Forb	COMMON MILKWEED
ASTLAN	2	Aster lanceolatus	-3	FACW	Nt	P-Forb	EASTERN LINED ASTER
ASTLAT	2	Aster lateriflorus	-2	FACW-	Nt	P-Forb	SIDE FLOWERING ASTER
ASTPUN	5	Aster puniceus	-5	OBL	Nt	P-Forb	SWAMP ASTER
ATHFIL	4	Athyrium filix-femina	0	FAC	Nt	Fern	LADY FERN
BETPAP	2	Betula papyrifera	2	FACU+	Nt	Tree	PAPER BIRCH
BIDCER	3	Bidens cernuus	-5	OBL	Nt	A-Forb	NODDING BUR MARIGOLD
BIDFRO	1	Bidens frondosus	-3	FACW	Nt	A-Forb	COMMON BEGGAR TICKS
BROCIL	6	Bromus ciliatus	-3	FACW	Nt	P-Grass	FRINGED BROME
BROLAT	6	Bromus latiglumis	-2	FACW-	Nt	P-Grass	EAR LEAVED BROME
CALCAN	3	Calamagrostis canadensis	-5	OBL	Nt	P-Grass	BLUE JOINT GRASS
CALINE	8	Calamagrostis inexpansa	-4	FACW+	Nt	P-Grass	BOG REEDGRASS
CALTPA	6	Caltha palustris	-5	OBL	Nt	P-Forb	MARSH MARIGOLD
CAMAPU	7	Campanula aparinoides ssp. uliginosa	-5	OBL	Nt	P-Forb	MARSH BELLFLOWER
CXBEBB	4	Carex bebbii	-5	OBL	Nt	P-Sedge	SEDGE
CXCOMO	5	Carex comosa	-5	OBL	Nt	P-Sedge	SEDGE
CXCRI	4	Carex crinita	-4	FACW+	Nt	P-Sedge	SEDGE
CXCRYP	10	Carex cryptolepis	-5	OBL	Nt	P-Sedge	SEDGE
CXHYS	2	Carex hystericina	-5	OBL	Nt	P-Sedge	SEDGE
CXINTU	3	Carex intumescens	-4	FACW+	Nt	P-Sedge	SEDGE
CXLUPA	4	Carex lupulina	-5	OBL	Nt	P-Sedge	SEDGE
CXPSEU	5	Carex pseudo-cyperus	-5	OBL	Nt	P-Sedge	SEDGE
CXRETS	3	Carex retrorsa	-5	OBL	Nt	P-Sedge	SEDGE
CXSTIP	1	Carex stipata	-5	OBL	Nt	P-Sedge	SEDGE
CXSTRI	4	Carex stricta	-5	OBL	Nt	P-Sedge	SEDGE
CXTUCK	8	Carex tuckermanii	-5	OBL	Nt	P-Sedge	SEDGE
CXUTRI	5	Carex utriculata	-5	OBL	Nt	P-Sedge	SEDGE
CXVULP	1	Carex vulpinoidea	-5	OBL	Nt	P-Sedge	SEDGE
CHEGLB	7	Chelone glabra	-5	OBL	Nt	P-Forb	TURTLEHEAD
CHEALB	0	CHENOPODIUM ALBUM	1	FAC-	Ad	A-Forb	LAMB'S QUARTERS
CHRLEU	0	CHRYSANTHEMUM LEUCANTHEMUM	5	UPL	Ad	P-Forb	OX EYE DAISY
CICBUL	5	Cicuta bulbifera	-5	OBL	Nt	P-Forb	WATER HEMLOCK
CIRARV	0	CIRSIUM ARVENSE	3	FACU	Ad	P-Forb	CANADIAN THISTLE
CIRMUT	6	Cirsium muticum	-5	OBL	Nt	B-Forb	SWAMP THISTLE
CIRVUL	0	CIRSIUM VULGARE	4	FACU-	Ad	B-Forb	BULL THISTLE
CLAMAR	10	Cladium mariscoides	-5	OBL	Nt	P-Sedge	TWIG RUSH
CLEVIR	4	Clematis virginiana	0	FAC	Nt	W-Vine	VIRGIN'S BOWER
CLIVUL	3	Clinopodium vulgare	5	UPL	Nt	P-Forb	WILD BASIL
CONCAN	0	Conyza canadensis	1	FAC-	Nt	A-Forb	HORSEWEED
CORSTO	2	Cornus stolonifera	-3	FACW	Nt	Shrub	RED OSIER DOGWOOD

CRAPUN	1 Crataegus punctata	5 UPL	Nt Tree	DOTTED HAWTHORN
DRYINT	5 Dryopteris intermedia	0 FAC	Nt Fern	EVERGREEN WOODFERN
ELEERY	4 Eleocharis erythropoda	-5 OBL	Nt P-Sedge	SPIKE RUSH
ELEINT	7 Eleocharis intermedia	-3 FACW	Nt A-Sedge	SPIKE RUSH
ELESMA	5 Eleocharis smallii	-5 OBL	Nt P-Sedge	SPIKE RUSH
ELOCAN	1 Elodea canadensis	-5 OBL	Nt P-Forb	COMMON WATERWEED
ELYVIR	4 Elymus virginicus	-2 FACW-	Nt P-Grass	VIRGINIA WILD RYE
EPICOL	3 Epilobium coloratum	-5 OBL	Nt P-Forb	CINNAMON WILLOW HERB
EPILEP	6 Epilobium leptophyllum	-5 OBL	Nt P-Forb	FEN WILLOW HERB
EPIPAR	0 EPILOBIUM PARVIFLORUM	3 FACU	Ad P-Forb	WILLOW HERB
EQUARV	0 Equisetum arvense	0 FAC	Nt F...Ally	COMMON HORSETAIL
EQUPAL	10 Equisetum palustre	-3 FACW	Nt F...Ally	MARSH HORSETAIL
EQUSYL	5 Equisetum sylvaticum	-3 FACW	Nt F...Ally	WOODLAND HORSETAIL
ERHIE	2 Erechites hieracifolia	3 FACU	Nt A-Forb	FIREWEED
ERIANN	0 Erigeron annuus	1 FAC-	Nt B-Forb	ANNUAL FLEABANE
EUPMAM	4 Eupatorium maculatum	-5 OBL	Nt P-Forb	JOE PYE WEED
EUPPER	4 Eupatorium perfoliatum	-4 FACW+	Nt P-Forb	COMMON BONESET
EUTGRA	3 Euthamia graminifolia	-2 FACW-	Nt P-Forb	GRASS LEAVED GOLDENROD
FRAVIR	2 Fragaria virginiana	1 FAC-	Nt P-Forb	WILD STRAWBERRY
FRANIG	6 Fraxinus nigra	-4 FACW+	Nt Tree	BLACK ASH
GALTET	0 GALEOPSIS TETRAHIT	5 UPL	Ad A-Forb	COMMON HEMP NETTLE
GALASP	5 Galium asprellum	-5 OBL	Nt P-Forb	ROUGH BEDSTRAW
GALTRD	6 Galium trifidum	-4 FACW+	Nt P-Forb	SMALL BEDSTRAW
GEUALE	3 Geum aleppicum	-1 FAC+	Nt P-Forb	YELLOW AVENS
GLYCAN	8 Glyceria canadensis	-5 OBL	Nt P-Grass	RATTLESNAKE GRASS
GLYGRA	6 Glyceria grandis	-5 OBL	Nt P-Grass	REED MANNA GRASS
GLYSTR	4 Glyceria striata	-5 OBL	Nt P-Grass	FOWL MANNA GRASS
HYPBOR	5 Hypericum boreale	-5 OBL	Nt P-Forb	NORTHERN ST. JOHN'S WORT
HYPMAJ	4 Hypericum majus	-3 FACW	Nt P-Forb	LARGER CANADA ST. JOHN'S WORT
ILEVER	5 Ilex verticillata	-4 FACW+	Nt Shrub	MICHIGAN HOLLY
IMPCAP	2 Impatiens capensis	-3 FACW	Nt A-Forb	SPOTTED TOUCH ME NOT
IRIVER	5 Iris versicolor	-5 OBL	Nt P-Forb	WILD BLUE FLAG
JUNART	3 Juncus articulatus	-5 OBL	Nt P-Forb	JOINTED RUSH
JUNBRE	8 Juncus brevicaudatus	-5 OBL	Nt P-Forb	RUSH
JUNBUF	2 Juncus bufonius	-4 FACW+	Nt A-Forb	TOAD RUSH
JUNCAN	6 Juncus canadensis	-5 OBL	Nt P-Forb	CANADIAN RUSH
JUNEFF	3 Juncus effusus	-5 OBL	Nt P-Forb	SOFT STEMMED RUSH
JUNNOD	5 Juncus nodosus	-5 OBL	Nt P-Forb	JOINT RUSH
LARLAR	5 Larix laricina	-3 FACW	Nt Tree	TAMARACK
LEEORY	3 Leersia oryzoides	-5 OBL	Nt P-Grass	CUT GRASS
LEMMIN	5 Lemna minor	-5 OBL	Nt A-Forb	SMALL DUCKWEED
LOBCAR	7 Lobelia cardinalis	-5 OBL	Nt P-Forb	CARDINAL FLOWER

LONMOR	0 LONICERA MORROWII	5 UPL	Ad Shrub	MORROW HONEYSUCKLE
LONTAT	0 LONICERA TATARICA	3 FACU	Ad Shrub	SMOOTH TARTARIAN HONEYSUCKLE
LUDPAL	4 Ludwigia palustris	-5 OBL	Nt P-Forb	WATER PURSLANE
LYCAME	2 Lycopus americanus	-5 OBL	Nt P-Forb	COMMON WATER HOREHOUND
LYCUNI	2 Lycopus uniflorus	-5 OBL	Nt P-Forb	NORTHERN BUGLE WEED
LYSTER	6 Lysimachia terrestris	-5 OBL	Nt P-Forb	SWAMP CANDLES
MAICAC	4 Maianthemum canadense	0 FAC	Nt P-Forb	CANADA MAYFLOWER
MENARV	3 Mentha arvensis	-3 FACW	Nt P-Forb	WILD MINT
MIMRIN	5 Mimulus ringens	-5 OBL	Nt P-Forb	MONKEY FLOWER
MUHMEX	3 Muhlenbergia mexicana	-3 FACW	Nt P-Grass	LEAFY SATIN GRASS
MYRGAL	6 Myrica gale	-5 OBL	Nt Shrub	SWEET GALE
NUPVAR	7 Nuphar variegata	-5 OBL	Nt P-Forb	YELLOW POND LILY
ONOSEN	2 Onoclea sensibilis	-3 FACW	Nt Fern	SENSITIVE FERN
OSMCIN	5 Osmunda cinnamomea	-3 FACW	Nt Fern	CINNAMON FERN
OSMREG	5 Osmunda regalis	-5 OBL	Nt Fern	ROYAL FERN
PANCAP	1 Panicum capillare	0 FAC	Nt A-Grass	WITCH GRASS
PHAARU	0 Phalaris arundinacea	-4 FACW+	Nt P-Grass	REED CANARY GRASS
PHLPRA	0 PHLEUM PRATENSE	3 FACU	Ad P-Grass	TIMOTHY
PICMAR	6 Picea mariana	-3 FACW	Nt Tree	BLACK SPRUCE
PILFON	5 Pilea fontana	-3 FACW	Nt A-Forb	BOG CLEARWEED
PINSTR	3 Pinus strobus	3 FACU	Nt Tree	WHITE PINE
PLAMAJ	0 PLANTAGO MAJOR	-1 FAC+	Ad P-Forb	COMMON PLANTAIN
POACOM	0 POA COMPRESSA	2 FACU+	Ad P-Grass	CANADA BLUEGRASS
POAPAS	3 Poa palustris	-4 FACW+	Nt P-Grass	FOWL MEADOW GRASS
POAPRA	0 POA PRATENSIS	1 FAC-	Ad P-Grass	KENTUCKY BLUEGRASS
POLAMP	6 Polygonum amphibium	-5 OBL	Nt P-Forb	WATER SMARTWEED
POLCIL	3 Polygonum cilinode	5 UPL	Nt P-Forb	FRINGED FALSE BUCKWHEAT
POLCUS	0 POLYGONUM CUSPIDATUM	3 FACU	Ad P-Forb	JAPANESE KNOTWEED
POLHYR	1 Polygonum hydropiper	-5 OBL	Nt A-Forb	WATER PEPPER
POLLAP	0 Polygonum lapathifolium	-4 FACW+	Nt A-Forb	NODDING SMARTWEED
POLORI	0 POLYGONUM ORIENTALE	5 UPL	Ad A-Forb	KISS ME OVER THE GARDEN GATE
POLPEN	0 Polygonum pensylvanicum	-4 FACW+	Nt A-Forb	BIGSEED SMARTWEED
POLPER	0 POLYGONUM PERSICARIA	-3 FACW	Ad A-Forb	LADY'S THUMB
POLPUN	5 Polygonum punctatum	-5 OBL	Nt A-Forb	SMARTWEED
POPBAL	2 Populus balsamifera	-3 FACW	Nt Tree	BALSAM POPLAR
POPTRE	1 Populus tremuloides	0 FAC	Nt Tree	QUAKING ASPEN
POTNAT	5 Potamogeton natans	-5 OBL	Nt P-Forb	PONDWEED
POTNOR	0 Potentilla norvegica	0 FAC	Nt A-Forb	ROUGH CINQUEFOIL
PRUSER	2 Prunus serotina	3 FACU	Nt Tree	WILD BLACK CHERRY
PRUVIR	2 Prunus virginiana	1 FAC-	Nt Shrub	CHOKE CHERRY
PYCVIR	5 Pycnanthemum virginianum	-4 FACW+	Nt P-Forb	COMMON MOUNTAIN MINT
RANACR	0 RANUNCULUS ACRIS	-2 FACW-	Ad P-Forb	TALL or COMMON BUTTERCUP

RANPEN	6	Ranunculus pensylvanicus	-5	OBL	Nt	A-Forb	BRISTLY CROWFOOT
RANSCE	1	Ranunculus sceleratus	-5	OBL	Nt	A-Forb	CURSED CROWFOOT
RHAALN	8	Rhamnus alnifolia	-5	OBL	Nt	Shrub	ALDER LEAVED BUCKTHORN
RIBAME	6	Ribes americanum	-3	FACW	Nt	Shrub	WILD BLACK CURRANT
RIBHIR	6	Ribes hirtellum	-3	FACW	Nt	Shrub	SWAMP GOOSEBERRY
RORPAL	1	Rorippa palustris	-5	OBL	Nt	A-Forb	YELLOW CRESS
ROSPAL	5	Rosa palustris	-5	OBL	Nt	Shrub	SWAMP ROSE
RUBALL	1	Rubus allegheniensis	-2	FACU+	Nt	Shrub	COMMON BLACKBERRY
RUBPUB	4	Rubus pubescens	-4	FACW+	Nt	P-Forb	DWARF RASPBERRY
RUBSTR	2	Rubus strigosus	-2	FACW-	Nt	Shrub	WILD RED RASPBERRY
RUMCRI	0	RUMEX CRISPUS	-1	FAC+	Ad	P-Forb	CURLY DOCK
RUMOBT	0	RUMEX OBTUSIFOLIUS	-3	FACW	Ad	P-Forb	BITTER DOCK
RUMORB	9	Rumex orbiculatus	-5	OBL	Nt	P-Forb	GREAT WATER DOCK
SAGLAT	1	Sagittaria latifolia	-5	OBL	Nt	P-Forb	COMMON ARROWHEAD
SALBEB	1	Salix bebbiana	-4	FACW+	Nt	Shrub	BEBB'S WILLOW
SALDIS	1	Salix discolor	-3	FACW	Nt	Shrub	PUSSY WILLOW
SALERI	2	Salix eriocephala	-3	FACW	Nt	Shrub	WILLOW
SALFRA	0	SALIX FRAGILIS	-1	FAC+	Ad	Tree	CRACK WILLOW
SALLUC	3	Salix lucida	-4	FACW+	Nt	Shrub	SHINING WILLOW
SALPET	1	Salix petiolaris	-2	FACW+	Nt	Shrub	SLENDER WILLOW
SAMCAN	3	Sambucus canadensis	-4	FACW-	Nt	Shrub	ELDERBERRY
SCHACU	5	Schoenoplectus acutus	-5	OBL	Nt	P-Sedge	HARDSTEM BULRUSH
SCHTAB	4	Schoenoplectus tabernaemontani	-5	OBL	Nt	P-Sedge	SOFTSTEM BULRUSH
SCIATR	3	Scirpus atrovirens	-5	OBL	Nt	P-Sedge	BULRUSH
SCICYP	5	Scirpus cyperinus	-5	OBL	Nt	P-Sedge	WOOL GRASS
SCUGAL	5	Scutellaria galericulata	-5	OBL	Nt	P-Forb	COMMON SKULLCAP
SCULAT	5	Scutellaria lateriflora	-5	OBL	Nt	P-Forb	MAD DOG SKULLCAP
SIUSUA	5	Sium suave	-5	OBL	Nt	P-Forb	WATER PARSNIP
SOLDUL	0	SOLANUM DULCAMARA	0	FAC	Ad	P-Forb	BITTERSWEET NIGHTSHADE
SOLALT	1	Solidago altissima	3	FACU	Nt	P-Forb	TALL GOLDENROD
SOLGIG	3	Solidago gigantea	-3	FACW	Nt	P-Forb	LATE GOLDENROD
SOLRUG	3	Solidago rugosa	-1	FAC+	Nt	P-Forb	ROUGH GOLDENROD
SPAAME	6	Sparganium americanum	-5	OBL	Nt	P-Forb	AMERICAN BUR REED
SPIALB	4	Spiraea alba	-4	FACW+	Nt	Shrub	MEADOWSWEET
SPICER	4	Spiranthes cernua	-2	FACW-	Nt	P-Forb	NODDING LADIES' TRESSES
STELOF	5	Stellaria longifolia	-4	FACW+	Nt	P-Forb	LONG LEAVED CHICKWEED
TAROFF	0	TARAXACUM OFFICINALE	3	FACU	Ad	P-Forb	COMMON DANDELION
THADAS	3	Thalictrum dasycarpum	-2	FACW-	Nt	P-Forb	PURPLE MEADOW RUE
THEPAL	2	Thelypteris palustris	-4	FACW+	Nt	Fern	MARSH FERN
THUOCC	4	Thuja occidentalis	-3	FACW	Nt	Tree	ARBOR VITAE
TILAME	5	Tilia americana	3	FACU	Nt	Tree	BASSWOOD
TRIFRA	6	Triadenum fraseri	-5	OBL	Nt	P-Forb	MARSH ST. JOHN'S WORT

TYPLAT	1 Typha latifolia	-5 OBL	Nt P-Forb	BROAD LEAVED CATTAIL
ULMAME	1 Ulmus americana	-2 FACW-	Nt Tree	AMERICAN ELM
URTDIO	1 Urtica dioica	-1 FAC+	Nt P-Forb	NETTLE
VACMYR	4 Vaccinium myrtilloides	-2 FACW-	Nt Shrub	CANADA BLUEBERRY
VERTHA	0 VERBASCUM THAPSUS	5 UPL	Ad B-Forb	COMMON MULLEIN
VERHAS	4 Verbena hastata	-4 FACW+	Nt P-Forb	BLUE VERVAIN
VERANA	4 Veronica anagallis-aquatica	-5 OBL	Nt B-Forb	WATER SPEEDWELL
VERBEA	10 Veronica beccabunga var. americana	-5 OBL	Nt P-Forb	AMERICAN BROOKLIME
WOLCOL	5 Wolffia columbiana	-5 OBL	Nt A-Forb	COMMON WATER MEAL

Appendix 5 FQA of Flowing Well property old fields and successional habitats

Appendix 5. FQA of Flowing Well property old fields and successional habitats.

Site: Flowing Well property- old fields, cutover forests, ruderal
 Locale: Kalkaska Co., MI
 Date: August 24, 2012 - hours
 August 23, 2012 - hours
 August 22, 2012 - hours
 August 21, 2012 - hours
 July 13, 2012 - hours
 July 12, 2012 - hours
 July 11, 2012 - hours
 July 10, 2012 - hours
 By: Bradford Slaughter
 File: s:\NFI\Projects\flowing well\botanical inventory\Flowing Well_old fields and successional.inv
 Notes: Old fields, roads, cut-over areas. Also: Carex sp., Dichanthelium sp. Agrostis hyemalis = A. scabra.

FLORISTIC QUALITY DATA		Native		Adventive		
102 NATIVE SPECIES	Tree	19	11.8%	Tree	2	1.2%
161 Total Species	Shrub	16	9.9%	Shrub	4	2.5%
3.1 NATIVE MEAN C	W-Vine	2	1.2%	W-Vine	0	0.0%
2.0 W/Adventives	H-Vine	0	0.0%	H-Vine	0	0.0%
31.5 NATIVE FQI	P-Forb	39	24.2%	P-Forb	25	15.5%
25.1 W/Adventives	B-Forb	3	1.9%	B-Forb	6	3.7%
1.2 NATIVE MEAN W	A-Forb	7	4.3%	A-Forb	12	7.5%
1.9 W/Adventives	P-Grass	11	6.8%	P-Grass	7	4.3%
AVG: Faculative (-)	A-Grass	0	0.0%	A-Grass	3	1.9%
	P-Sedge	4	2.5%	P-Sedge	0	0.0%
	A-Sedge	0	0.0%	A-Sedge	0	0.0%
	Fern	1	0.6%			

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ABIBAL	3 Abies balsamea	-3 FACW	Nt Tree	BALSAM FIR
ACERUB	1 Acer rubrum	0 FAC	Nt Tree	RED MAPLE
ACESAU	5 Acer saccharum	3 FACU	Nt Tree	SUGAR MAPLE
ACHMIL	1 Achillea millefolium	3 FACU	Nt P-Forb	YARROW
AGRGRY	2 Agrimonia gryposepala	2 FACU+	Nt P-Forb	TALL AGRIMONY
AGRREP	0 AGROPYRON REPENS	3 FACU	Ad P-Grass	QUACK GRASS
AGRTRA	8 Agropyron trachycaulum	0 FAC	Nt P-Grass	SLENDER WHEAT GRASS
AGRGIT	0 AGROSTEMMA GITHAGO	3 FACU	Ad P-Forb	CORN COCKLE
AGRGIG	0 AGROSTIS GIGANTEA	0 FAC	Ad P-Grass	REDTOP
AGRHYE	4 Agrostis hyemalis	1 FAC-	Nt P-Grass	TICKLEGRASS

ALNRUG	5	Alnus rugosa	-5	OBL	Nt	Shrub	TAG ALDER
AMBART	0	Ambrosia artemisiifolia	3	FACU	Nt	A-Forb	COMMON RAGWEED
AMEINT	4	Amelanchier interior	5	UPL	Nt	Tree	SERVICEBERRY
ANDSCO	5	Andropogon scoparius	3	FACU	Nt	P-Grass	LITTLE BLUESTEM GRASS
ANTHOW	2	Antennaria howellii	5	UPL	Nt	P-Forb	SMALL PUSSYTOES
APOAND	3	Apocynum androsaemifolium	5	UPL	Nt	P-Forb	SPREADING DOGBANE
ARAHIS	3	Aralia hispida	5	UPL	Nt	Shrub	BRISTLY SARSAPARILLA
ASCINC	6	Asclepias incarnata	-5	OBL	Nt	P-Forb	SWAMP MILKWEED
ASCSYR	1	Asclepias syriaca	5	UPL	Nt	P-Forb	COMMON MILKWEED
ASPOFF	0	ASPARAGUS OFFICINALIS	3	FACU	Ad	P-Forb	ASPARAGUS
ASTLAE	5	Aster laevis	5	UPL	Nt	P-Forb	SMOOTH ASTER
ASTLAT	2	Aster lateriflorus	-2	FACW-	Nt	P-Forb	SIDE FLOWERING ASTER
ASTMAC	4	Aster macrophyllus	5	UPL	Nt	P-Forb	BIG LEAVED ASTER
ASTSAG	2	Aster sagittifolius	5	UPL	Nt	P-Forb	ARROW LEAVED ASTER
BARVUL	0	BARBAREA VULGARIS	0	FAC	Ad	B-Forb	YELLOW ROCKET
BERINC	0	BERTEROA INCANA	5	UPL	Ad	A-Forb	HOARY ALYSSUM
BETPAP	2	Betula papyrifera	2	FACU+	Nt	Tree	PAPER BIRCH
BIDFRO	1	Bidens frondosus	-3	FACW	Nt	A-Forb	COMMON BEGGAR TICKS
BRAERE	7	Brachyelytrum erectum	5	UPL	Nt	P-Grass	LONG AWNED WOOD GRASS
BROCIL	6	Bromus ciliatus	-3	FACW	Nt	P-Grass	FRINGED BROME
BROINE	0	BROMUS INERMIS	5	UPL	Ad	P-Grass	SMOOTH BROME
BROJAP	0	BROMUS JAPONICUS	3	FACU	Ad	A-Grass	JAPANESE BROME
CAMROT	6	Campanula rotundifolia	1	FAC-	Nt	P-Forb	HAREBELL
CXARTT	3	Carex arctata	5	UPL	Nt	P-Sedge	SEDGE
CXVULP	1	Carex vulpinoidea	-5	OBL	Nt	P-Sedge	SEDGE
CENMAU	0	CENTAUREA MACULOSA	5	UPL	Ad	B-Forb	SPOTTED BLUET
CERFON	0	CERASTIUM FONTANUM	3	FACU	Ad	P-Forb	MOUSE EAR CHICKWEED
CERSEM	0	CERASTIUM SEMIDECANDRUM	5	UPL	Ad	A-Forb	SMALL MOUSE EAR CHICKWEED
CHRLEU	0	CHRYSANTHEMUM LEUCANTHEMUM	5	UPL	Ad	P-Forb	OX EYE DAISY
CICINT	0	CICHORIUM INTYBUS	5	UPL	Ad	P-Forb	CHICORY
CIRARV	0	CIRSIUM ARVENSE	3	FACU	Ad	P-Forb	CANADIAN THISTLE
CLIVUL	3	Clinopodium vulgare	5	UPL	Nt	P-Forb	WILD BASIL
CONCAN	0	Conyza canadensis	1	FAC-	Nt	A-Forb	HORSEWEED
CORFOE	1	Cornus foemina	-2	FACW-	Nt	Shrub	GRAY DOGWOOD
CORSTO	2	Cornus stolonifera	-3	FACW	Nt	Shrub	RED OSIER DOGWOOD
CORCOR	5	Corylus cornuta	5	UPL	Nt	Shrub	BEAKED HAZELNUT
CRAPUN	1	Crataegus punctata	5	UPL	Nt	Tree	DOTTED HAWTHORN
DANSPI	4	Danthonia spicata	5	UPL	Nt	P-Grass	POVERTY GRASS; OATGRASS
DAUCAR	0	DAUCUS CAROTA	5	UPL	Ad	B-Forb	QUEEN ANNE'S LACE
DIAARM	0	DIANTHUS ARMERIA	5	UPL	Ad	A-Forb	DEPTFORD PINK
ELAUMB	0	ELAEAGNUS UMBELLATA	3	FACU	Ad	Shrub	AUTUMN OLIVE
ELYCAN	7	Elymus canadensis	1	FAC-	Nt	P-Grass	CANADA WILD RYE

ERASPE	3	Eragrostis spectabilis	5	UPL	Nt P-Grass	PURPLE LOVE GRASS
ERIANN	0	Erigeron annuus	1	FAC-	Nt B-Forb	ANNUAL FLEABANE
ERISTR	4	Erigeron strigosus	1	FAC-	Nt P-Forb	DAISY FLEABANE
EUPPER	4	Eupatorium perfoliatum	-4	FACW+	Nt P-Forb	COMMON BONESET
EUPESE	0	EUPHORBIA ESULA	5	UPL	Ad P-Forb	LEAFY SPURGE
EUTGRA	3	Euthamia graminifolia	-2	FACW-	Nt P-Forb	GRASS LEAVED GOLDENROD
FAGGRA	6	Fagus grandifolia	3	FACU	Nt Tree	AMERICAN BEECH
FRAVIR	2	Fragaria virginiana	1	FAC-	Nt P-Forb	WILD STRAWBERRY
GNAOBT	2	Gnaphalium obtusifolium	5	UPL	Nt A-Forb	OLD FIELD BALSAM
HIEPIS	0	HIERACIUM PILOSELLOIDES	5	UPL	Ad P-Forb	GLAUCOUS KING DEVIL
HIESCA	3	Hieracium scabrum	5	UPL	Nt P-Forb	ROUGH HAWKWEED
HYDAME	6	Hydrocotyle americana	-5	OBL	Nt P-Forb	WATER PENNYWORT
HYPMAJ	4	Hypericum majus	-3	FACW	Nt P-Forb	LARGER CANADA ST. JOHN'S WORT
HYPPER	0	HYPERICUM PERFORATUM	5	UPL	Ad P-Forb	COMMON ST. JOHN'S WORT
HYPRAD	0	HYPOCHAERIS RADICATA	5	UPL	Ad P-Forb	SPOTTED CAT'S EAR
JUNART	3	Juncus articulatus	-5	OBL	Nt P-Forb	JOINTED RUSH
JUNEFF	3	Juncus effusus	-5	OBL	Nt P-Forb	SOFT STEMMED RUSH
JUNTEN	1	Juncus tenuis	0	FAC	Nt P-Forb	PATH RUSH
LACBIE	2	Lactuca biennis	0	FAC	Nt B-Forb	TALL BLUE LETTUCE
LACCAN	2	Lactuca canadensis	2	FACU+	Nt B-Forb	TALL LETTUCE
LARLAR	5	Larix laricina	-3	FACW	Nt Tree	TAMARACK
LEPDEN	0	LEPIDIUM DENSIFLORUM	0	FAC	Ad A-Forb	SMALL PEPPERGRASS
LIASCA	5	Liatris scariosa	5	UPL	Nt P-Forb	NORTHERN BLAZING STAR
LOBINF	0	Lobelia inflata	4	FACU-	Nt A-Forb	INDIAN TOBACCO
LOLPER	0	LOLIUM PERENNE	3	FACU	Ad P-Grass	PERENNIAL RYE GRASS
LONDIO	5	Lonicera dioica	3	FACU	Nt W-Vine	RED HONEYSUCKLE
LONMOR	0	LONICERA MORROWII	5	UPL	Ad Shrub	MORROW HONEYSUCKLE
LONTAT	0	LONICERA TATARICA	3	FACU	Ad Shrub	SMOOTH TARTARIAN HONEYSUCKLE
MAICAC	4	Maianthemum canadense	0	FAC	Nt P-Forb	CANADA MAYFLOWER
MATDIS	0	MATRICARIA DISCOIDEA	3	FACU	Ad A-Forb	PINEAPPLE WEED
MEDLUP	0	MEDICAGO LUPULINA	1	FAC-	Ad A-Forb	BLACK MEDICK
MEDSAT	0	MEDICAGO SATIVA	5	UPL	Ad P-Forb	ALFALFA
MELLOF	0	MELILOTUS OFFICINALIS	3	FACU	Ad B-Forb	YELLOW SWEET CLOVER
NEPCAT	0	NEPETA CATARIA	1	FAC-	Ad P-Forb	CATNIP
OSTVIR	5	Ostrya virginiana	4	FACU-	Nt Tree	IRONWOOD; HOP HORNBEAM
OXASTR	0	Oxalis stricta	3	FACU	Nt P-Forb	COMMON YELLOW WOOD SORREL
PANIMP	3	Panicum implicatum	0	FAC	Nt P-Grass	PANIC GRASS
PANXAN	6	Panicum xanthophyllum	5	UPL	Nt P-Grass	PANIC GRASS
PHAARU	0	Phalaris arundinacea	-4	FACW+	Nt P-Grass	REED CANARY GRASS
PHLPRA	0	PHLEUM PRATENSE	3	FACU	Ad P-Grass	TIMOTHY
PICABI	0	PICEA ABIES	5	UPL	Ad Tree	NORWAY SPRUCE
PINRES	6	Pinus resinosa	3	FACU	Nt Tree	RED PINE

PINSTR	3 Pinus strobus	3 FACU	Nt Tree	WHITE PINE
PINSYL	0 PINUS SYLVESTRIS	5 UPL	Ad Tree	SCOTCH PINE
PLALAN	0 PLANTAGO LANCEOLATA	0 FAC	Ad P-Forb	ENGLISH PLANTAIN
PLAMAJ	0 PLANTAGO MAJOR	-1 FAC+	Ad P-Forb	COMMON PLANTAIN
PLARUG	0 Plantago rugelii	0 FAC	Nt A-Forb	RED STALKED PLANTAIN
POAANN	0 POA ANNUA	1 FAC-	Ad A-Grass	ANNUAL BLUEGRASS
POACOM	0 POA COMPRESSA	2 FACU+	Ad P-Grass	CANADA BLUEGRASS
POAPRA	0 POA PRATENSIS	1 FAC-	Ad P-Grass	KENTUCKY BLUEGRASS
POLAVI	0 POLYGONUM AVICULARE	1 FAC-	Ad A-Forb	KNOTWEED
POLCIL	3 Polygonum cilinode	5 UPL	Nt P-Forb	FRINGED FALSE BUCKWHEAT
POLCON	0 POLYGONUM CONVOLVULUS	1 FAC-	Ad A-Forb	FALSE BUCKWHEAT
POLCUS	0 POLYGONUM CUSPIDATUM	3 FACU	Ad P-Forb	JAPANESE KNOTWEED
POLPER	0 POLYGONUM PERSICARIA	-3 FACW	Ad A-Forb	LADY'S THUMB
POPBAL	2 Populus balsamifera	-3 FACU	Nt Tree	BALSAM POPLAR
POPGRA	4 Populus grandidentata	3 FACU	Nt Tree	BIG TOOTHED ASPEN
POPTRE	1 Populus tremuloides	0 FAC	Nt Tree	QUAKING ASPEN
POTARE	0 POTENTILLA ARGENTEA	3 FACU	Ad P-Forb	SILVERY CINQUEFOIL
POTNOR	0 Potentilla norvegica	0 FAC	Nt A-Forb	ROUGH CINQUEFOIL
POTREC	0 POTENTILLA RECTA	5 UPL	Ad P-Forb	ROUGH FRUITED CINQUEFOIL
POTSIM	2 Potentilla simplex	4 FACU-	Nt P-Forb	OLD FIELD CINQUEFOIL
PRUVUL	0 PRUNELLA VULGARIS	0 FAC	Nt P-Forb	LAWN PRUNELLA
PRUSER	2 Prunus serotina	3 FACU	Nt Tree	WILD BLACK CHERRY
PRUVIR	2 Prunus virginiana	1 FAC-	Nt Shrub	CHOKO CHERRY
PTEAQU	0 Pteridium aquilinum	3 FACU	Nt Fern	BRACKEN FERN
QUERUB	5 Quercus rubra	3 FACU	Nt Tree	RED OAK
RIBAME	6 Ribes americanum	-3 FACW	Nt Shrub	WILD BLACK CURRANT
RIBCYN	4 Ribes cynosbati	5 UPL	Nt Shrub	PRICKLY or WILD GOOSEBERRY
RUBALL	1 Rubus allegheniensis	2 FACU+	Nt Shrub	COMMON BLACKBERRY
RUBFLA	1 Rubus flagellaris	4 FACU-	Nt Shrub	NORTHERN DEWBERRY
RUBHIS	4 Rubus hispidus	-3 FACW	Nt Shrub	SWAMP DEWBERRY
RUBOCC	1 Rubus occidentalis	5 UPL	Nt Shrub	BLACK RASPBERRY
RUBSTR	2 Rubus strigosus	-2 FACW-	Nt Shrub	WILD RED RASPBERRY
RUDHIR	1 Rudbeckia hirta	3 FACU	Nt P-Forb	BLACK EYED SUSAN
RUMACL	0 RUMEX ACETOSELLA	0 FAC	Ad P-Forb	SHEEP SORREL
RUMCRI	0 RUMEX CRISPUS	-1 FAC+	Ad P-Forb	CURLY DOCK
SALHUM	4 Salix humilis	3 FACU	Nt Shrub	PRAIRIE WILLOW
SCIATR	3 Scirpus atrovirens	-5 OBL	Nt P-Sedge	BULRUSH
SCICYP	5 Scirpus cyperinus	-5 OBL	Nt P-Sedge	WOOL GRASS
SCRLAN	5 Scrophularia lanceolata	2 FACU+	Nt P-Forb	EARLY FIGWORT
SETVIR	0 SETARIA VIRIDIS	5 UPL	Ad A-Grass	GREEN FOXTAIL
SILPRA	0 SILENE PRATENSIS	5 UPL	Ad A-Forb	WHITE CATCHFLY
SILVUL	0 SILENE VULGARIS	5 UPL	Ad P-Forb	BLADDER CAMPION

SOLALT	1 Solidago altissima	3 FACU	Nt P-Forb	TALL GOLDENROD
SOLCAN	1 Solidago canadensis	3 FACU	Nt P-Forb	CANADA GOLDENROD
SOLJUN	3 Solidago juncea	5 UPL	Nt P-Forb	EARLY GOLDENROD
SOLNEM	2 Solidago nemoralis	5 UPL	Nt P-Forb	OLD FIELD GOLDENROD
SOLRUG	3 Solidago rugosa	-1 FAC+	Nt P-Forb	ROUGH GOLDENROD
SPICAS	8 Spiranthes casei	3 FACU	Nt P-Forb	CASE'S LADIES' TRESSES
SPICER	4 Spiranthes cernua	-2 FACW-	Nt P-Forb	NODDING LADIES' TRESSES
TAROFF	0 TARAXACUM OFFICINALE	3 FACU	Ad P-Forb	COMMON DANDELION
THUOCC	4 Thuja occidentalis	-3 FACW	Nt Tree	ARBOR VITAE
TILAME	5 Tilia americana	3 FACU	Nt Tree	BASSWOOD
TOXRYD	3 Toxicodendron rydbergii	0 FAC	Nt W-Vine	POISON IVY
TRADUB	0 TRAGOPOGON DUBIUS	5 UPL	Ad B-Forb	GOAT'S BEARD
TRIHYP	0 TRIFOLIUM HYBRIDUM	1 FAC-	Ad P-Forb	ALSIKE CLOVER
TRIPRA	0 TRIFOLIUM PRATENSE	2 FACU+	Ad P-Forb	RED CLOVER
TRIREP	0 TRIFOLIUM REPENS	2 FACU+	Ad P-Forb	WHITE CLOVER
TSUCAN	5 Tsuga canadensis	3 FACU	Nt Tree	HEMLOCK
VACANG	4 Vaccinium angustifolium	3 FACU	Nt Shrub	BLUEBERRY
VACMYR	4 Vaccinium myrtilloides	-2 FACW-	Nt Shrub	CANADA BLUEBERRY
VERTHA	0 VERBASCUM THAPSUS	5 UPL	Ad B-Forb	COMMON MULLEIN
VERBRA	0 VERBENA BRACTEATA	3 FACU	Ad A-Forb	CREEPING VERVAIN
VERHAS	4 Verbena hastata	-4 FACW+	Nt P-Forb	BLUE VERVAIN
VERSTR	4 Verbena stricta	5 UPL	Nt P-Forb	HOARY VERVAIN
VEROFF	0 VERONICA OFFICINALIS	5 UPL	Ad P-Forb	COMMON SPEEDWELL
VIBOPO	0 VIBURNUM OPULUS	0 FAC	Ad Shrub	EUROPEAN Highbush Cranberry
VICVIL	0 VICIA VILLOSA	5 UPL	Ad A-Forb	HAIRY VETCH

Appendix 6 – Flowing Well Vascular Plants Inventory

Appendix 6. Flowing Well property vascular plant species inventory. MF = mesic northern forest; SF = swamp forest (rich conifer swamp and hardwood-conifer swamp); OW = herbaceous and shrub-dominated wetlands (submergent marsh, emergent marsh, northern wet meadow, northern shrub thicket); OF = old fields, ruderal areas, roads, and early successional forest. # = B. S. Slaughter *collection number*; specimens deposited at University of Michigan Herbarium (MICH). Nomenclature and family treatment generally follows Voss & Reznicek (2012); synonymy in Herman et al. (2001) is indicated in parentheses where applicable. * denotes non-native species (including species that were deliberately introduced); species not documented from Kalkaska County in Voss & Reznicek (2012) are listed in **bold**.

FAMILY Species	MF	SF	OW	OF	#
PTERIDOPHYTES					
ATHYRIACEAE					
<i>Athyrium filix-femina</i> (L.) Roth	•	•	•		
CYSTOPTERIDACEAE					
<i>Gymnocarpium dryopteris</i> (L.) Newm.	•	•			
DENNSTAEDTIACEAE					
<i>Pteridium aquilinum</i> (L.) Kuhn	•			•	
DRYOPTERIDACEAE					
<i>Dryopteris X boottii</i> (Tuck.) Underw.		•			852
<i>D. carthusiana</i> (Vill.) H. P. Fuchs	•	•			853
<i>D. cristata</i> (L.) A. Gray		•			
<i>D. intermedia</i> (Willd.) A. Gray	•	•	•		
EQUISETACEAE					
<i>Equisetum arvense</i> L.		•	•		
<i>E. palustre</i> L.			•		
<i>E. sylvaticum</i> L.	•	•	•		
LYCOPODIACEAE					
<i>Dendrolycopodium dendroideum</i> (Michx.) A. Haines (<i>Lycopodium d.</i>)	•				
<i>D. hickeyi</i> (W. H. Wagner, Beitel & R. C. Moran) A. Haines	•				
<i>D. obscurum</i> (L.) A. Haines (<i>L. o.</i>)	•				820
<i>Lycopodium clavatum</i> L.	•				
<i>Spinulum annotinum</i> (L.) A. Haines (<i>L. a.</i>)	•				

FAMILY Species	MF	SF	OW	OF	#
ONOCLEACEAE					
<i>Matteuccia struthiopteris</i> (L.) Todaro		•			
<i>Onoclea sensibilis</i> L.	•	•	•		
OSMUNDACEAE					
<i>Osmunda cinnamomea</i> L.	•	•	•		
<i>O. claytoniana</i> L.	•	•			
<i>O. regalis</i> L.		•	•		
PTERIDACEAE					
<i>Adiantum pedatum</i> L.	•	•			
THELYPTERIDACEAE					
<i>Phegopteris connectilis</i> (L.) Slosson (<i>Thelypteris phegopteris</i>)	•	•			
<i>Thelypteris noveboracensis</i> (L.) Nieuwl.	•				
<i>T. palustris</i> Schott		•	•		851
GYMNOSPERMS					
CUPRESSACEAE					
<i>Thuja occidentalis</i> L.	•	•	•	•	
PINACEAE					
<i>Abies balsamea</i> (L.) Mill.	•	•	•	•	
<i>Larix laricina</i> (Du Roi) K. Koch			•	•	826
*<i>Picea abies</i> (L.) H. Karst.				•	
<i>P. mariana</i> (Mill.) Britton, Sterns & Poggenb.		•	•		811
<i>Pinus resinosa</i> Aiton				•	
<i>P. strobus</i> L.	•	•	•	•	
<i>P. sylvestris</i> L.				•	
<i>Tsuga canadensis</i> (L.) Carrière	•			•	842
DICOTYLEDONS					
ADOXACEAE					
<i>Sambucus canadensis</i> L.		•	•		840
*<i>Viburnum opulus</i> L.				•	

FAMILY Species	MF	SF	OW	OF	#
AMARANTHACEAE					
* <i>Chenopodium album</i> L.			•		
ANACARDIACEAE					
<i>Toxicodendron rydbergii</i> (Rydb.) Greene				•	
APIACEAE					
<i>Cicuta bulbifera</i> L.			•		
* <i>Daucus carota</i> L.				•	
<i>Sium suave</i> Walter					
APOCYNACEAE					
<i>Apocynum androsaemifolium</i> L.	•			•	
<i>Asclepias incarnata</i> L.		•	•	•	
<i>A. syriaca</i> L.	•	•	•	•	
AQUIFOLIACEAE					
<i>Ilex verticillata</i> (L.) A. Gray		•	•		
ARALIACEAE					
<i>Aralia hispida</i> Vent.				•	
<i>A. nudicaulis</i> L.	•	•			
<i>Hydrocotyle americana</i> L.		•		•	
<i>Panax quinquefolius</i> L.	•				759
ASTERACEAE					
<i>Achillea millefolium</i> L.				•	
<i>Ambrosia artemisiifolia</i> L.			•	•	
<i>Antennaria howellii</i> Greene				•	
* <i>Arctium minus</i> Bernh.		•			
<i>Bidens cernua</i> L.			•		809
<i>B. frondosa</i> L.		•	•	•	
* <i>Centaurea stoebe</i> L. (<i>C. maculosa</i>)				•	
* <i>Cichorium intybus</i> L.				•	
* <i>Cirsium arvense</i> (L.) Scop.	•		•	•	
<i>C. muticum</i> Michx.		•	•		

FAMILY	MF	SF	OW	OF	#
Species					
* <i>C. palustre</i> (L.) Scop.		•			
* C. vulgare (Savi) Ten.	•		•		
<i>Conyza canadensis</i> (L.) Cronq.			•	•	
Erechtites hieraciifolius (L.) Raf.		•	•		
Erigeron annuus (L.) Pers.			•	•	778
<i>E. strigosus</i> Muhl.				•	
<i>Eupatorium perfoliatum</i> L.		•	•	•	
<i>Eurybia macrophylla</i> (L.) Cass. (<i>Aster macrophyllus</i>)	•	•		•	
<i>Euthamia graminifolia</i> (L.) Nutt.	•		•	•	
<i>Eutrochium maculatum</i> (L.) E. E. Lamont (<i>Eupatorium m.</i>)		•	•		
* <i>Hieracium aurantiacum</i> L.	•	•			
* <i>H. piloselloides</i> Vill.	•			•	
H. scabrum Michx.				•	843
* Hypochaeris radicata L.				•	844
<i>Lactuca biennis</i> (Moench) Fernald		•		•	
<i>L. canadensis</i> L.				•	
* <i>Leucanthemum vulgare</i> Lam. (<i>Chrysanthemum leucanthemum</i>)	•		•	•	
<i>Liatris scariosa</i> (L.) Willd.				•	
* Matricaria discoidea DC.				•	770
Packera aurea (L.) Á. Löve & D. Löve (Senecio aureus)		•			
Pseudognaphalium obtusifolium (L.) Hilliard & B. L. Burtt (Gnaphalium o.)				•	
<i>Rudbeckia hirta</i> L.				•	
<i>Solidago altissima</i> L.		•	•	•	
<i>S. canadensis</i> L.		•		•	
<i>S. gigantea</i> Aiton	•	•	•		
<i>S. juncea</i> Aiton				•	
<i>S. nemoralis</i> Aiton				•	
<i>S. rugosa</i> Mill.	•	•	•	•	
<i>Symphotrichum laeve</i> (L.) G. L. Nesom (<i>Aster laevis</i>)	•			•	
<i>S. lanceolatum</i> (Willd.) G. L. Nesom (<i>A. lanceolatus</i>)		•	•		

FAMILY	MF	SF	OW	OF	#
Species					
<i>S. lateriflorum</i> (L.) Á. Löve & D. Löve (<i>A. lateriflorus</i>)	•	•	•	•	
<i>S. puniceum</i> (L.) Á. Löve & D. Löve (<i>A. puniceus</i>)		•	•		839
<i>S. urophyllum</i> (DC.) G. L. Nesom (<i>A. sagittifolius</i>)				•	
* <i>Taraxacum officinale</i> F. H. Wigg.	•	•	•	•	
* <i>Tragopogon dubius</i> Scop.		•		•	
BALSAMINACEAE					
<i>Impatiens capensis</i> Meerb.	•	•	•		
BETULACEAE					
<i>Alnus incana</i> (L.) Moench (<i>A. rugosa</i>)		•	•	•	
<i>Betula alleghaniensis</i> Britton	•	•			855
<i>B. papyrifera</i> Marshall	•	•	•	•	822
<i>Corylus cornuta</i> Marshall	•	•		•	
<i>Ostrya virginiana</i> (Mill.) K. Koch	•			•	
BRASSICACEAE					
* <i>Barbarea vulgaris</i> R. Br.				•	
* <i>Berteroa incana</i> (L.) DC.				•	
<i>Brassica</i> sp.				•	
<i>Cardamine pensylvanica</i> Willd.		•			
* <i>Lepidium densiflorum</i> Schrad.				•	
<i>Rorippa palustris</i> (L.) Besser			•		772
CAMPANULACEAE					
<i>Campanula aparinoides</i> Pursh var. <i>grandiflora</i> Holz.			•		817
<i>C. rotundifolia</i> L.				•	
<i>Lobelia cardinalis</i> L.			•		
<i>L. inflata</i> L.				•	
CAPRIFOLIACEAE					
<i>Lonicera canadensis</i> Marshall	•	•			
<i>L. dioica</i> L.		•		•	
* <i>L. morrowii</i> A. Gray			•	•	848
<i>L. oblongifolia</i> (Goldie) Hook.		•			

FAMILY Species	MF	SF	OW	OF	#
* L. tatarica L.			•	•	
CARYOPHYLLACEAE					
* <i>Agrostemma githago</i> L.				•	
* <i>Cerastium fontanum</i> Baumg.				•	
* C. semidecandrum L.				•	
* <i>Dianthus armeria</i> L.				•	
* <i>Silene latifolia</i> Poir. (<i>S. pratensis</i>)				•	
* <i>S. vulgare</i> (Moench) Garcke				•	
Stellaria longifolia Willd.			•		780
CORNACEAE					
<i>Cornus canadensis</i> L.	•	•			
C. foemina Mill.				•	
<i>C. sericea</i> L. (<i>C. stolonifera</i>)		•	•	•	
ELAEAGNACEAE					
* Elaeagnus umbellata Thunb.				•	
ERICACEAE					
<i>Epigaea repens</i> L.	•	•			
<i>Gaultheria hispidula</i> (L.) Muhl.		•			
<i>G. procumbens</i> L.	•				
<i>Monotropa uniflora</i> L.	•	•			
<i>Orthilia secunda</i> House		•			
<i>Pyrola elliptica</i> Nutt.	•	•			
<i>Rhododendron groenlandicum</i> (Oeder) Kron & Judd (<i>Ledum g.</i>)		•			
<i>Vaccinium angustifolium</i> Aiton				•	
<i>V. myrtilloides</i> Michx.	•	•	•	•	
EUPHORBIACEAE					
* <i>Euphorbia virgata</i> Waldst. & Kit. (<i>E. esula</i>)				•	
FABACEAE					
* <i>Medicago lupulina</i> L.				•	
* M. sativa L.				•	

FAMILY	MF	SF	OW	OF	#
Species					
* <i>Melilotus officinalis</i> (L.) Pall.				•	
* <i>Trifolium hybridum</i> L.				•	
* <i>T. pratense</i> L.				•	
* <i>T. repens</i> L.				•	
* <i>Vicia villosa</i> Roth				•	
FAGACEAE					
<i>Fagus grandifolia</i> Ehrh.	•	•		•	
<i>Quercus alba</i> L.		•			
<i>Q. rubra</i> L.				•	
GERANIACEAE					
<i>Geranium bicknellii</i> Britton		•			
GROSSULARIACEAE					
<i>Ribes americanum</i> Mill.		•	•	•	
<i>R. cynosbati</i> L.	•			•	
<i>R. glandulosum</i> Grauer		•			
<i>R. hirtellum</i> Michx.		•	•		
<i>R. triste</i> Pall.	•	•			
HAMAMELIDACEAE					
<i>Hamamelis virginiana</i> L.	•				
HYPERICACEAE					
<i>Hypericum boreale</i> (Britt.) E. P. Bicknell			•		
<i>H. majus</i> (A. Gray) Britton			•	•	
* <i>H. perforatum</i> L.	•			•	
<i>Triadenum fraseri</i> (Spach) Gleason			•		
LAMIACEAE					
<i>Clinopodium vulgare</i> (L.) Fritsch			•	•	
* <i>Galeopsis tetrahit</i> L.	•	•	•		779
<i>Lycopus americanus</i> Muhl.			•		
<i>L. uniflorus</i> Michx.	•	•	•		

FAMILY Species	MF	SF	OW	OF	#
<i>Mentha canadensis</i> L. (<i>M. arvensis</i>)		•	•		
*Nepeta cataria L.				•	
<i>Prunella vulgaris</i> L.	•	•		•	
<i>Pycnanthemum virginianum</i> (L.) Durand & Jackson			•		814
<i>Scutellaria galericulata</i> L.		•	•		
<i>S. lateriflora</i> L.		•	•		
LENTIBULARIACEAE					
<i>Utricularia</i> sp.			•		
LINNAEACEAE					
<i>Linnaea borealis</i> L.		•			854
MALVACEAE					
<i>Tilia americana</i> L.	•	•	•	•	
MYRICACEAE					
<i>Myrica gale</i> L.			•		
MYRSINACEAE					
<i>Lysimachia ciliata</i> L.	•				
<i>L. terrestris</i> (L.) Britton, Sterns & Poggenb.			•		
<i>L. thysiflora</i> L.		•			
<i>Trientalis borealis</i> Raf.	•	•			
NYMPHAEACEAE					
<i>Nuphar variegata</i> Durand			•		
OLEACEAE					
<i>Fraxinus americana</i> L.	•				
<i>F. nigra</i> Marshall	•	•	•		
<i>F. pennsylvanica</i> Marshall		•			
ONAGRACEAE					
<i>Circaea alpina</i> L.		•			
<i>C. canadensis</i> (L.) Hill (<i>C. lutetiana</i>)	•	•			757
<i>Epilobium coloratum</i> Biehler		•	•		808

FAMILY	MF	SF	OW	OF	#
Species					
<i>E. leptophyllum</i> Raf.		•	•		775
* <i>E. parviflorum</i> Schreb.		•	•		769
<i>Ludwigia palustris</i> (L.) Elliott			•		
OXALIDACEAE					
<i>Oxalis acetosella</i> L.	•	•			
<i>O. stricta</i> L.	•			•	
PHRYMACEAE					
<i>Mimulus ringens</i> L.			•		771
PLANTAGINACEAE					
<i>Chelone glabra</i> L.		•	•		818
* <i>Plantago lanceolata</i> L.				•	
* <i>P. major</i> L.		•	•	•	838
<i>P. rugelii</i> Decne.				•	
<i>Veronica anagallis-aquatica</i> L.			•		773
<i>V. beccabunga</i> Raf. var. <i>americana</i>			•		774
* <i>V. officinalis</i> L.	•			•	841
POLYGALACEAE					
<i>Polygala paucifolia</i> Willd.		•			
POLYGONACEAE					
<i>Fallopia cilinodis</i> (Michx.) Holub (<i>Polygonum cilinode</i>)			•	•	
* <i>F. convolvulus</i> (L.) Á. Löve (<i>P. c.</i>)				•	
* <i>F. japonica</i> (Houtt.) Ronse Decr. (<i>P. cuspidatum</i>)			•	•	
<i>F. scandens</i> (L.) Holub (<i>P. s.</i>)	•				
<i>Persicaria amphibia</i> (L.) A. Gray (<i>P. amphibium</i>)			•		
<i>P. hydropiper</i> (L.) Spach (<i>P. h.</i>)			•		849
<i>P. lapathifolia</i> (L.) Gray (<i>P. lapathifolium</i>)			•		
* <i>P. maculosa</i> A. Gray (<i>P. persicaria</i>)			•	•	
* <i>P. orientalis</i> (L.) Spach (<i>P. orientale</i>)			•		
<i>P. pensylvanica</i> (L.) M. Gómez (<i>P. pensylvanicum</i>)			•		
<i>P. punctata</i> (Elliott) Small (<i>P. punctatum</i>)			•		813

FAMILY	MF	SF	OW	OF	#
Species					
*Polygonum aviculare L.				•	824
*Rumex acetosella L.				•	
*R. crispus			•	•	
*R. obtusifolius L.	•	•	•		
R. orbiculatus A. Gray			•		
RANUNCULACEAE					
<i>Actaea rubra</i> (Aiton) Willd.	•	•			
<i>Anemone quinquefolia</i> L.		•			
<i>Caltha palustris</i> L.		•	•		
<i>Clematis virginiana</i> L.	•	•	•		
<i>Coptis trifolia</i> (L.) Salisb.	•	•			
<i>Ranunculus abortivus</i> L.		•			
*R. acris L.	•		•		
<i>R. hispidus</i> Michx.		•			
<i>R. pensylvanicus</i> L. f.			•		
<i>R. recurvatus</i> Poir.		•			
R. sceleratus L.			•		768
<i>Thalictrum dasycarpum</i> Fisch. & Ave-Lall.		•	•		
RHAMNACEAE					
<i>Rhamnus alnifolia</i> L'Her.		•	•		
ROSACEAE					
<i>Agrimonia gryposepala</i> Wallr.		•		•	
<i>Amelanchier interior</i> Nielsen	•	•	•	•	
<i>Aronia prunifolia</i> (Marshall) Rehder			•		
Crataegus punctata Jacq.			•	•	845
Fragaria virginiana Mill.	•	•	•	•	
Geum aleppicum Jacq.			•		
<i>G. canadense</i> Jacq.		•			
<i>G. rivale</i> L.		•			
*Potentilla argentea L.				•	

FAMILY	MF	SF	OW	OF	#
Species					
<i>P. norvegica</i> L.			•	•	
* <i>P. recta</i> L.				•	
<i>P. simplex</i> Michx.				•	
<i>Prunus serotina</i> Ehrh.	•	•	•	•	
<i>P. virginiana</i> L.		•	•	•	
<i>Rosa palustris</i> Marshall			•		
<i>Rubus allegheniensis</i> Porter	•		•	•	
<i>R. flagellaris</i> Willd.				•	
<i>R. hispidus</i> L.		•		•	
<i>R. occidentalis</i> L.		•		•	
<i>R. pubescens</i> Raf.	•	•	•		
<i>R. strigosus</i> Michx.	•	•	•	•	850
<i>Spiraea alba</i> Du Roi	•		•		
RUBIACEAE					
<i>Galium asprellum</i> Michx.		•	•		
<i>G. tinctorium</i> L.		•			764
<i>G. trifidum</i> L.		•	•		
<i>G. triflorum</i> Michx.	•	•			
<i>Mitchella repens</i> L.	•	•			
SALICACEAE					
<i>Populus balsamifera</i> L.		•	•	•	
<i>P. grandidentata</i> Michx.				•	
<i>P. tremuloides</i> Michx.	•	•	•	•	
<i>Salix bebbiana</i> Sarg.			•		806
<i>S. discolor</i> Muhl.			•		805
<i>S. eriocephala</i> Michx.		•	•		
<i>S. fragilis</i> L.			•		828
<i>S. humilis</i> Marshall				•	
<i>S. lucida</i> Muhl.			•		
<i>S. petiolaris</i> Sm.		•	•		827

FAMILY Species	MF	SF	OW	OF	#
SAPINDACEAE					
<i>Acer rubrum</i> L.	•	•	•	•	821
<i>A. saccharum</i> Marshall	•	•		•	825
<i>A. spicatum</i> Lam.		•			
SAXIFRAGACEAE					
<i>Chrysosplenium americanum</i> Hook.	•	•			
<i>Mitella diphylla</i> L.		•			
<i>M. nuda</i> L.		•			
<i>Tiarella cordifolia</i> L.	•	•			
SCROPHULARIACEAE					
<i>Scrophularia lanceolata</i> Small				•	
* <i>Verbascum thapsus</i> L.			•	•	
SOLANACEAE					
* <i>Solanum dulcamara</i> L.		•	•		
ULMACEAE					
<i>Ulmus americana</i> L.	•	•	•		
URTICACEAE					
<i>Boehmeria cylindrica</i> (L.) Sw.		•			
<i>Laportea canadensis</i> (L.) Wedd.		•			
<i>Pilea fontana</i> (Lunell) Rydb.		•	•		819
<i>Urtica dioica</i> L.			•		815
VERBENACEAE					
* <i>V. stricta</i> Vent.				•	
* <i>Verbena bracteata</i> Lag. & Rodr.				•	
<i>V. hastata</i> L.			•	•	
VIOLACEAE					
<i>V. labradorica</i> Schrank (<i>V. conspersa</i>)		•			
<i>V. macloskeyi</i> F. E. Lloyd	•	•			

FAMILY	MF	SF	OW	OF	#
Species					
<i>V. renifolia</i> A. Gray	•				
<i>Viola cucullata</i> Aiton		•			
<i>Viola</i> sp.		•	•		
VITACEAE					
<i>Parthenocissus quinquefolia</i> (L.) Planch.		•			
MONOCOTYLEDONS					
ALISMATACEAE					
<i>Alisma subcordatum</i> Raf. (<i>A. plantago-aquatica</i>)			•		
<i>Sagittaria latifolia</i> Willd.			•		
ARACEAE					
<i>Arisaema triphyllum</i> (L.) Schott	•	•			
<i>Lemna turionifera</i> Landolt			•		836
<i>Wolffia columbiana</i> H. Karst.			•		835
ASPARAGACEAE					
*<i>Asparagus officinalis</i> L.				•	
<i>Maianthemum canadense</i> Desf. var. <i>canadense</i>	•	•	•	•	
<i>M. racemosum</i> (L.) Link (<i>Smilacina racemosa</i>)	•				
<i>M. trifolium</i> (L.) Sloboda (<i>S. trifolia</i>)		•			
<i>Polygonatum pubescens</i> (Willd.) Pursh	•	•			
CYPERACEAE					
<i>Carex arctata</i> Boott	•	•		•	
<i>C. bebbii</i> (L. H. Bailey) Fernald			•		776, 857
<i>C. brunnescens</i> (Pers.) Poir.	•				765
<i>C. comosa</i> Boott			•		816
<i>C. crinita</i> Lam.	•	•	•		
<i>C. cristatella</i> Britton		•			762
<i>C. cryptolepis</i> Mack.			•		807

FAMILY	MF	SF	OW	OF	#
Species					
<i>C. deweyana</i> Schwein.	•	•			856
<i>C. disperma</i> Dewey		•			
<i>C. gracillima</i> Schwein.		•			
<i>C. hystericina</i> Willd.		•	•		
<i>C. interior</i> L. H. Bailey		•			
<i>C. intumescens</i> Rudge	•	•	•		
<i>C. leptalea</i> Wahlenb.		•			
<i>C. lupulina</i> Willd.		•	•		
<i>C. pedunculata</i> Willd.	•	•			
<i>C. projecta</i> Mack.	•	•			761
<i>C. pseudo-cyperus</i> L.			•		
<i>C. retrorsa</i> Schwein.			•		846
<i>C. scabrata</i> Schwein.		•			
<i>C. stipata</i> Willd.		•	•		
<i>C. stricta</i> Lam.			•		
<i>C. swanii</i> (Fernald) Mack.	•				758
<i>C. trisperma</i> Dewey		•			
<i>C. tuckermanii</i> Dewey		•	•		
<i>C. utriculata</i> Boott			•		
<i>C. vulpinoidea</i> Michx.		•	•	•	
<i>Cladium mariscoides</i> (Muhl.) Torr.			•		
<i>Eleocharis erythropoda</i> Steud.			•		
<i>E. intermedia</i> Schult.			•		767
<i>E. palustris</i> (L.) Roem. & Schult. (<i>E. smallii</i>)			•		
<i>Schoenoplectus acutus</i> (Bigelow) Á. Löve & D. Löve			•		
<i>S. tabernaemontani</i> (C. C. Gmel.) Palla			•		
<i>Scirpus atrovirens</i> Willd.	•		•	•	
<i>S. cyperinus</i> (L.) Kunth		•	•	•	810
HYDROCHARITACEAE					
<i>Elodea canadensis</i> Michx.			•		837

FAMILY Species	MF	SF	OW	OF	#
IRIDACEAE					
<i>Iris versicolor</i> L.		•	•		
JUNCACEAE					
<i>Juncus articulatus</i> L.			•	•	832
<i>J. brevicaudatus</i> (Engelm.) Fernald			•		777
<i>J. bufonius</i> L.			•		829
<i>J. canadensis</i> Laharpe			•		
<i>J. effusus</i> L.	•		•	•	
<i>J. nodosus</i> L.			•		
<i>J. tenuis</i> Willd.				•	
MELANTHIACEAE					
<i>Trillium cernuum</i> L.	•	•			
ORCHIDACEAE					
<i>Cypripedium acaule</i> Aiton	•				
* <i>Epipactis helleborine</i> (L.) Crantz		•			
<i>Platanthera clavellata</i> (Michx.) Luer	•				
<i>Spiranthes casei</i> Catling & Cruise				•	823
<i>S. cernua</i> (L.) Rich.			•	•	
POACEAE					
* <i>Agrostis gigantea</i> Roth			•	•	
<i>A. perennans</i> (Walter) Tuck.	•				
<i>A. scabra</i> Willd.		•	•	•	766
<i>Brachyelytrum aristosum</i> (Michx.) Branner & Coville (<i>B. erectum</i>)	•	•		•	
<i>Bromus ciliatus</i> L.			•	•	
* <i>B. inermis</i> Leyss.				•	
* <i>B. japonicus</i> Murray				•	830
<i>B. latiglumis</i> (Shear) Hitchc.			•		847
<i>Calamagrostis canadensis</i> (Michx.) P. Beauv.			•		

FAMILY	MF	SF	OW	OF	#
Species					
C. stricta (Timm) Koeler (C. inexpansa)			•		
<i>Cinna latifolia</i> (Goepp.) Griseb.	•	•			
Dichanthelium implicatum (Scribn.) Kerguélen (Panicum i.)				•	
<i>Dichanthelium</i> sp.				•	
D. xanthophysum (A. Gray) Freckmann (P. x.)				•	781
<i>Danthonia spicata</i> (L.) Roem. & Schult.	•			•	
<i>Elymus canadensis</i> L.				•	833
<i>E. hystrix</i> L. (<i>Hystrix patula</i>)		•			
* <i>E. repens</i> (L.) Gould (<i>Agropyron r.</i>)			•	•	
E. trachycaulus (Link) Gould (A. trachycaulum)			•	•	
E. virginicus L.		•	•		782
<i>Eragrostis spectabilis</i> (Pursh) Steud.				•	
<i>Glyceria canadensis</i> (Michx.) Trin.			•		
<i>G. grandis</i> S. Watson			•		
<i>G. striata</i> (Lam.) Hitchc.	•	•	•		
<i>Leersia oryzoides</i> (L.) Sw.			•		
Lolium perenne L.				•	804
<i>Milium effusum</i> L.	•	•			
Muhlenbergia mexicana (L.) Trin.			•		803
<i>Oryzopsis asperifolia</i> Michx.	•				
* <i>Poa annua</i> L.				•	
* <i>P. compressa</i> L.			•	•	858
P. palustris L.		•	•		
* <i>P. pratensis</i> L.	•		•	•	
<i>Panicum capillare</i> L.			•		
* <i>Phalaris arundinacea</i> L.		•	•	•	
* Phleum pratense L.	•		•	•	831
Schizachne purpurascens (Torr.) Swallen	•				763
<i>Schizachyrium scoparium</i> Michx. (<i>Andropogon scoparius</i>)				•	
* <i>Setaria viridis</i> (L.) P. Beauv.				•	

FAMILY Species	MF	SF	OW	OF	#
POTAMOGETONACEAE					
<i>Potamogeton natans</i> L.			•		

Appendix 7 – Unionid Mussel Species Found at Each Sampling Site
At Flowing Creek Property

Appendix 7 - Numbers of unionid mussels (#), relative abundance (RA), and density (D, indivs./m²) recorded at each survey site in Flowing Well Creek and the North Branch of the Manistee River. Numbers of mussel shells found are given in parentheses, S(#). No live individuals or shells of non-native bivalves were observed.

		Flowing Well Creek								
		1			A*			2		
Species	Common name	#	RA	D	#	RA	D	#	RA	D
<i>Actinonaias ligamentina</i>	Mucket									
<i>Alasmidonta viridis</i> (T)	Slippershell									
<i>Anodontooides ferussacianus</i>	Cylindrical papershell							S(1)		
<i>Elliptio dilatata</i>	Spike									
<i>Fusconaia flava</i>	Wabash pigtoe									
<i>Lampsilis siliquoidea</i>	Fatmucket									
<i>Lampsilis ventricosa</i>	Pocketbook									
<i>Lasmigona compressa</i>	Creek heelsplitter				S(2)			S(19)		
<i>Lasmigona costata</i>	Fluted shell									
<i>Leptodea fragilis</i>	Fragile papershell									
<i>Ligumia recta</i> (E)	Black sandshell									
<i>Pyganodon grandis</i>	Giant floater	S(1)						1	1	0
<i>Strophitus undulatus</i>	Strange floater									
<i>Truncilla truncata</i> (SC)	Deertoe									
<i>Utterbackia imbecillis</i> (SC)	Paper pondshell									
	Total # live individuals and density	0			0			1		0
	# Species live or shell	1			1			3		
	Area searched (m ²)	80						80		
<i>Corbicula fluminea</i>	Asian clam									
<i>Dreissena polymorpha</i>	Zebra mussel									
* Incidental find										

Appendix 7 - Cont'd.										
		Flowing Well Creek								
		3			4			B*		
Species	Common name	#	RA	D	#	RA	D	#	RA	D
<i>Actinonaias ligamentina</i>	Mucket									
<i>Alasmidonta viridis</i> (T)	Slippershell									
<i>Anodontoides ferussacianus</i>	Cylindrical papershell									
<i>Elliptio dilatata</i>	Spike									
<i>Fusconaia flava</i>	Wabash pigtoe									
<i>Lampsilis siliquoidea</i>	Fatmucket									
<i>Lampsilis ventricosa</i>	Pocketbook									
<i>Lasmigona compressa</i>	Creek heelsplitter	S(7)						S(1)		
<i>Lasmigona costata</i>	Fluted shell									
<i>Leptodea fragilis</i>	Fragile papershell									
<i>Ligumia recta</i> (E)	Black sandshell									
<i>Pyganodon grandis</i>	Giant floater							S(1)		
<i>Strophitus undulatus</i>	Strange floater									
<i>Truncilla truncata</i> (SC)	Deertoe									
<i>Utterbackia imbecillis</i> (SC)	Paper pondshell									
	Total # live individuals and density	0			0			0		
	# Species live or shell	1			0			2		
	Area searched (m ²)	80			76					
<i>Corbicula fluminea</i>	Asian clam									
<i>Dreissena polymorpha</i>	Zebra mussel									
* Incidental find										

Appendix 7 - Cont'd.										
		Flowing Well Creek			North Branch Manistee River					
		5			6			7		
Species	Common name	#	RA	D	#	RA	D	#	RA	D
<i>Actinonaias ligamentina</i>	Mucket									
<i>Alasmidonta viridis</i> (T)	Slippershell									
<i>Anodontooides ferussacianus</i>	Cylindrical papershell									
<i>Elliptio dilatata</i>	Spike									
<i>Fusconaia flava</i>	Wabash pigtoe									
<i>Lampsilis siliquoidea</i>	Fatmucket									
<i>Lampsilis ventricosa</i>	Pocketbook									
<i>Lasmigona compressa</i>	Creek heelsplitter									
<i>Lasmigona costata</i>	Fluted shell									
<i>Leptodea fragilis</i>	Fragile papershell									
<i>Ligumia recta</i> (E)	Black sandshell									
<i>Pyganodon grandis</i>	Giant floater	S(1)								
<i>Strophitus undulatus</i>	Strange floater									
<i>Truncilla truncata</i> (SC)	Deertoe									
<i>Utterbackia imbecillis</i> (SC)	Paper pondshell									
	Total # live individuals and density	0			0			0		
	# Species live or shell	1			0			0		
	Area searched (m ²)	80			80			81		
<i>Corbicula fluminea</i>	Asian clam									
<i>Dreissena polymorpha</i>	Zebra mussel									
* Incidental find										

Appendix 7 - Cont'd.										
		North Branch Manistee River								
		8			9			10		
Species	Common name	#	RA	D	#	RA	D	#	RA	D
<i>Actinonaias ligamentina</i>	Mucket									
<i>Alasmidonta viridis</i> (T)	Slippershell									
<i>Anodontoides ferussacianus</i>	Cylindrical papershell									
<i>Elliptio dilatata</i>	Spike									
<i>Fusconaia flava</i>	Wabash pigtoe									
<i>Lampsilis siliquoidea</i>	Fatmucket									
<i>Lampsilis ventricosa</i>	Pocketbook									
<i>Lasmigona compressa</i>	Creek heelsplitter									
<i>Lasmigona costata</i>	Fluted shell									
<i>Leptodea fragilis</i>	Fragile papershell									
<i>Ligumia recta</i> (E)	Black sandshell									
<i>Pyganodon grandis</i>	Giant floater									
<i>Strophitus undulatus</i>	Strange floater									
<i>Truncilla truncata</i> (SC)	Deertoe									
<i>Utterbackia imbecillis</i> (SC)	Paper pondshell									
	Total # live individuals and density	0			0			0		
	# Species live or shell	0			0			0		
	Area searched (m ²)	83			80			80		
<i>Corbicula fluminea</i>	Asian clam									
<i>Dreissena polymorpha</i>	Zebra mussel									
* Incidental find										

Appendix 7 - Cont'd.		North Branch Manistee River					
		11			12		
Species	Common name	#	RA	D	#	RA	D
<i>Actinonaias ligamentina</i>	Mucket						
<i>Alasmidonta viridis</i> (T)	Slippershell						
<i>Anodontoides ferussacianus</i>	Cylindrical papershell						
<i>Elliptio dilatata</i>	Spike						
<i>Fusconaia flava</i>	Wabash pigtoe						
<i>Lampsilis siliquoidea</i>	Fatmucket						
<i>Lampsilis ventricosa</i>	Pocketbook						
<i>Lasmigona compressa</i>	Creek heelsplitter						
<i>Lasmigona costata</i>	Fluted shell						
<i>Leptodea fragilis</i>	Fragile papershell						
<i>Ligumia recta</i> (E)	Black sandshell						
<i>Pyganodon grandis</i>	Giant floater						
<i>Strophitus undulatus</i>	Strange floater						
<i>Truncilla truncata</i> (SC)	Deertoe						
<i>Utterbackia imbecillis</i> (SC)	Paper pondshell						
	Total # live individuals and density	0			0		
	# Species live or shell	0			0		
	Area searched (m ²)	80			81		
<i>Corbicula fluminea</i>	Asian clam						
<i>Dreissena polymorpha</i>	Zebra mussel						
* Incidental find							

Appendix 8 – Michigan’s Unionid Mussels

Appendix 8 - Michigan's unionid mussel species (Species documented within the Flowing Well Property are noted.)

Scientific Name	Common Name	Documented in Manistee Watershed	MI Status	Federal Status
<i>Actinonaias ligamentina</i>	Mucket			
<i>Alasmidonta marginata</i>	Elktoe	B	SC	
<i>Alasmidonta viridis</i>	Slippershell	B	T	
<i>Amblema plicata</i>	Threeridge			
<i>Anodontoides ferussacianus</i>	Cylindrical papershell	AC		
<i>Cyclonaias tuberculata</i>	Purple wartyback		T	
<i>Elliptio complanata</i>	Eastern elliptio			
<i>Elliptio crassidens</i>	Elephant-ear			
<i>Elliptio dilatata</i>	Spike	BC		
<i>Epioblasma obliquata perobliqua</i>	White catspaw		E	E
<i>Epioblasma torulosa rangiana</i>	Northern riffleshell		E	E
<i>Epioblasma triquetra</i>	Snuffbox		E	E
<i>Fusconaia flava</i>	Wabash pigtoe	C		
<i>Lampsilis fasciola</i>	Wavy-rayed lampmussel		T	
<i>Lampsilis siliquoidea</i>	Fatmucket	BC		
<i>Lampsilis ventricosa</i>	Pocketbook	C		
<i>Lasmigona complanata</i>	White heelsplitter	C		
<i>Lasmigona compressa</i>	Creek heelsplitter	AC		
<i>Lasmigona costata</i>	Fluted-shell			
<i>Leptodea fragilis</i>	Fragile papershell			
<i>Leptodea leptodon</i>	Scaleshell		SC	E
<i>Ligumia nasuta</i>	Eastern pondmussel		E	
<i>Ligumia recta</i>	Black sandshell	C	E	
<i>Obliquaria reflexa</i>	Three-horned wartyback		E	
<i>Obovaria olivaria</i>	Hickorynut		E	
<i>Obovaria subrotunda</i>	Round hickorynut		E	
<i>Pleurobema clava</i>	Clubshell		E	E
<i>Pleurobema sintoxia</i>	Round pigtoe		SC	
<i>Potamilus alatus</i>	Pink heelsplitter			
<i>Potamilus ohioensis</i>	Pink papershell		T	
<i>Ptychobranhus fasciolaris</i>	Kidney-shell		SC	
<i>Pyganodon grandis</i>	Giant floater	ABC		
<i>Pyganodon lacustris</i>	Lake floater		SC	
<i>Pyganodon subgibbosa</i>	Lake floater		T	
<i>Quadrula pustulosa</i>	Pimpleback			
<i>Quadrula quadrula</i>	Mapleleaf			
<i>Simpsonaias ambigua</i>	Salamander mussel		E	
<i>Strophitus undulatus</i>	Strange floater	C		
<i>Toxolasma lividus</i>	Purple lilliput		E	

Appendix 8 - Michigan's unionid mussel species (Species documented within the Flowing Well Property are noted.)

<i>Scientific Name</i>	Common Name	Documented in Manistee Watershed	MI Status	Federal Status
<i>Toxolasma parvus</i>	Lilliput		E	
<i>Truncilla donaciformis</i>	Fawnsfoot		T	
<i>Truncilla truncata</i>	Deertoe		SC	
<i>Utterbackia imbecillis</i>	Paper pondshell	C	SC	
<i>Venustaconcha ellipsiformis</i>	Ellipse		SC	
<i>Villosa fabalis</i>	Rayed bean		E	E
<i>Villosa iris</i>	Rainbow		SC	
<i>Corbicula fluminea</i>	Asian clam		Exotic	Exotic
<i>Dreissena polymorpha</i>	Zebra mussel	B	Exotic	Exotic

Notes:

A= Documented by Michigan Natural Features Inventory (MNFI) in this 2012 Flowing Well survey.

B= Documented in the Manistee Watershed in surveys conducted by MNFI in 2011 (Badra 2012a and Badra 2012b).

C= Manistee Watershed records from previous surveys and/or University of Michigan Museum of Zoology Mollusk Collection.

(E= state endangered; T= state threatened; SC= Species of special concern)

Appendix 9 – Bird Species Decteded During Point Counts

Appendix 9. List of bird species observed during bird surveys conducted in the Flowing Wells Project Area. This site was surveyed in 2012 for bird use.		
Species ^a	AOU code	Status
Sandhill Crane	SACR	
Red-tailed Hawk	RTHA	
Red-shouldered Hawk	RSHA	Michigan Threatened
Mourning Dove	MODO	
Northern Flicker	NOFL	
Hairy Woodpecker	HAWO	
Pileated Woodpecker	PIWO	
Yellow-bellied Sapsucker	YBSA	
Red-breasted Nuthatch	RBNU	
White-breasted Nuthatch	WBNU	
American Crow	AMCR	
Blue Jay	BLJA	
American Robin	AMRO	
Eastern Bluebird	EABL	
Hermit Thrush	HETH	
Wood Thrush	WOTH	
Veery	VEER	
Gray Catbird	GRCA	
Eastern Towhee	EATO	
Ruby-throated Hummingbird	RTHU	
Black-capped Chickadee	BCCH	
Brown Creeper	BRCR	
House Wren	HOWR	
Winter Wren	WIWR	
Red-eyed Vireo	REVI	
Blue-headed Vireo	BHVI	
Ovenbird	OVEN	
American Redstart	AMRE	
Common Yellowthroat	COYE	
Black-and-white Warbler	BWWA	

Appendix 9. List of bird species observed during bird surveys conducted in the Flowing Wells Project Area. This site was surveyed in 2012 for bird use.

Species^a	AOU code	Status
Yellow Warbler	YWAR	
Nashville Warbler	NAWA	
Pine Warbler	PIWA	
Northern Parula	NOPA	
Black-throated Green Warbler	BTNW	
Chestnut-sided Warbler	CSWA	
Golden-winged Warbler	GWWA	
Northern Waterthrush	NOWA	
Louisiana Waterthrush	LOWA	Michigan Threatened
Alder Flycatcher	ALFL	
Eastern Wood-peewee	EAWP	
Great-crested Flycatcher	GCFL	
Least Flycatcher	LEFL	
Red-winged Blackbird	RWBL	
Common Grackle	COGR	
Baltimore Oriole	BAOR	
Brown-headed Cowbird	BHCO	
Red-breasted Grosbeak	RBGR	
Indigo Bunting	INBU	
American Goldfinch	AMGO	
Cedar Waxwing	CEDW	
Chipping Sparrow	CHSP	
Song Sparrow	SOSP	
Swamp Sparrow	SWSP	
White-crowned Sparrow	WCSP	
White-throated Sparrow	WTSP	

^a names of birds follow the AOU Check-list of North American Birds