

Information Sheet on Ramsar Wetlands (RIS) – 2009-2012 version



Available for download from http://www.ramsar.org/ris/key_ris_index.htm.

Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX.22 of the 9th Conference of the Contracting Parties (2005).

Notes for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 14, 3rd edition). A 4th edition of the Handbook is in preparation and will be available in 2009.
3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

1. Name and address of the compiler of this form:

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Designation date

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Site Reference Number

2. Date this sheet was completed/updated:

December 15, 2010

3. Country:

USA

4. Name of the Ramsar site:

The precise name of the designated site in one of the three official languages (English, French or Spanish) of the Convention. Alternative names, including in local language(s), should be given in parentheses after the precise name.

Horicon Marsh

5. Designation of new Ramsar site or update of existing site:

This RIS is for (tick one box only):

- a) Designation of a new Ramsar site ; or
b) Updated information on an existing Ramsar site

6. For RIS updates only, changes to the site since its designation or earlier update:

a) Site boundary and area

The Ramsar site boundary and site area are unchanged:

or

If the site boundary has changed:

- i) the boundary has been delineated more accurately ; or
ii) the boundary has been extended ; or

iii) the boundary has been restricted**

and/or

If the site area has changed:

i) the area has been measured more accurately ; or

ii) the area has been extended ; or

iii) the area has been reduced**

**** Important note:** If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

In 1994, an additional impoundment (Frankfurth Marsh) was constructed on the Horicon National Wildlife Refuge, creating a managed 435-acre/176-hectare pool with a 6,828 foot/2,081 meter long dike and water control structure. In the last couple of years, the Horicon Marsh Wildlife Area also added a 300 acre/121 hectare impoundment, Chaya Marsh. The construction of these impoundments segregates the marsh, but allows for more control regarding water management, carp, and invasives.

By 2006, Invenergy Corporation began the construction of a 200 megawatt wind farm known as the Forward Energy Wind Farm in Dodge County, Wisconsin. As of this date, 88 turbines are operational with an additional 45 proposed but not constructed. Each turbine is 398 feet/121 meters tall, located about 2 miles/3.2 kilometers from the marsh along the Niagara escarpment (or "Ledge") on the east side. An avian survey was conducted during one season prior to construction to determine the bird use of the area. In 2008, a two-year study was begun by a graduate student from the University of Wisconsin-Madison for Invenergy. The focus of the study was to monitor the wind turbine area for avian mortality. Minimal avian mortality was found; however, excessive bat mortality was reported.

The following pertains to the northern two-thirds of the Horicon Marsh, managed by the U.S. Fish and Wildlife Service as the Horicon National Wildlife Refuge (Refuge):

As a result of a wetland workshop on September 13, 2005, Refuge staff initiated phase one of a marsh restoration project in 2006. Phase one involved the plugging of three lateral ditches and removal of spoil banks (Schaumburg, Lehner, and Townline). Some of the spoil bank material was used to create islands in place while the remainder of the material was hauled out of the wetland.

The work began on Schaumburg Ditch northwest of the refuge office where a series of four small islands were created. The ditch was then plugged by creating a 150 foot/45 meter island. The next 300 feet/91 meters of material was excavated, resulting in immediate open water. This was continued as the crew worked to the east, creating a total of four larger islands, removing approximately .67 miles/1.07 kilometers of spoil bank.

At Lehner Ditch three small 40 foot/12 meter islands were built on the west end, then six large, 150 foot/46 meter islands were built with about 300 feet/91 meters between each island until a total distance of .53 miles/.85 kilometers was excavated.

The Townline Ditch renovation involved creating a series of 23 small islands, about 40 feet/12 meters in size with 40 foot/12 meter openings, and four larger islands, 150 feet/45 meters in size with 300 foot/91 meter openings. Townline Ditch was completed for a total distance of .96 miles/1.5 kilometers.

A total of 43,000 cubic yards of dirt from the three ditch banks was removed from the marsh.

In 2007, phase two was completed by removing almost 32,000 cubic yards/24,466 cubic meters of dirt from Neitzel and Sommers Ditch on the Horicon National Wildlife Refuge. The project involved the plugging of the two lateral ditches on the west side and removal of adjacent spoil. Some of the spoil bank material was used to create islands in place while the remainder of the material was moved to create additional uplands. In addition, a spoil bank (Luebke) was removed from the north side of the Main Pool spillway.

The Refuge also purchased a "Swamp Devil" machine in 2007. This machine, with a set of six point cutter blades, easily cuts through submergent, emergent and floating vegetation. The two independently operated, variable speed steel blades provide the cutting action, propulsion and steering for the Swamp Devil. The blades carve through the vegetative (cattail) mat creating an open water channel up to three feet/.91 meter deep and eight feet/two meters wide. This capability allows the Swamp Devil to maneuver at about 4 miles/6 kilometers per hour in very shallow environments. The machine needs a minimum of 12 inches/30 centimeters of water to operate in. The first cutting will cut the material into square chunks, but several passes over the material will chop it into smaller pieces. The swamp devil has been used since 2007 in the marsh (both Refuge and State Wildlife Area) to facilitate flow of water across the marsh by reducing the amount of cattail and opening up channels.

7. Map of site:

Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:

- i) a **hard copy** (required for inclusion of site in the Ramsar List): **X**;
- ii) an **electronic format** (e.g. a JPEG or ArcView image) **X**;
- iii) a **GIS file providing geo-referenced site boundary vectors and attribute tables** **X**.

b) Describe briefly the type of boundary delineation applied:

e.g. the boundary is the same as an existing protected area (nature reserve, national park, etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The boundary follows the acquisition boundary of the protected area.

8. Geographical coordinates (latitude/longitude, in degrees and minutes):

Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

88 38' W longitude and 43 30' N latitude

9. General location:

Include in which part of the country and which large administrative region(s) the site lies and the location of the nearest large town.

Horicon Marsh is located in south central Wisconsin, USA, in Dodge and Fond du Lac counties. Milwaukee lies 65 miles (105 kilometers) to the southeast and Lake Michigan is located 40 miles (64 kilometers) due east.

10. Elevation: (in metres: average and/or maximum & minimum)

850 feet (259 meters) in the wetland and 860 feet (262 meters) in the uplands

11. Area: (in hectares)

Current acreage is 33,000 acres/13,355 hectares (21,955 acres/8,885 acres Horicon National Wildlife Refuge and 11,045 acres/4,470 hectares Horicon Marsh State Wildlife Area)

12. General overview of the site:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Horicon Marsh is one of the largest intact freshwater wetlands in the USA and ranks among the largest cattail (*Typha* spp) marsh anywhere in the world. The marsh is an internationally important staging area for more than 80 percent of the Mississippi flyway population of Canada geese (*Branta canadensis*), estimated at 1.1 million birds. Up to a million geese are recorded in the vicinity of Horicon Marsh each fall migration. Staging geese are normally present in fall, between mid-September and mid-December, depending on weather conditions, and in spring, from early March until mid-April. Two percent of the biogeographic population of mallards (*Anas platyrhynchos*) migrates through during fall, with impressive numbers of other waterfowl. The marsh is the largest nesting area for Redhead ducks (*Aythya americana*) east of the Mississippi River, with an estimated 2,000 to 3,000 nesting redheads. The marsh also provides habitat for many species of other wetland birds, including cranes, pelicans, herons, egrets, and shorebirds. Since the late 1990s, the American white pelican (*Pelecanus erythrorhynchos*) has begun nesting on the marsh. Whooping cranes (*Grus americana*) have frequented the marsh in recent years, but to date have not nested.

13. Ramsar Criteria:

Tick the box under each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11). All Criteria which apply should be ticked.

1	•	2	•	3	•	4	•	5	•	6	•	7	•	8	•	9
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14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region: Horicon Marsh represents one of the largest intact freshwater marshes in the United States. As a cattail marsh, it ranks among the largest in the world.

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities: The formerly listed Bald Eagle (*Haliaeetus leucocephalus*) and Peregrine Falcon (*Falco peregrines*) both use the marsh. Several active bald eagle nests are located on the Horicon National Wildlife Refuge, producing young each year. Several Whooping Cranes (*Grus americana*) of the Whooping Crane Eastern Partnership re-introduction project have been observed on the marsh each year since the inception of the project. State-listed endangered species on the marsh include the Yellow-throated Warbler (*Dendroica dominica*), Snowy Egret (*Egretta thula*), Red-necked Grebe (*Podiceps grisegena*) Barn Owl (*Tyto alba*), nesting Forster's Tern (*Sterna caspia*), and nesting Trumpeter Swan (*Cygnus buccinator*). State-listed threatened species on the marsh include the Osprey (*Pandion haliaetus*), Red-shouldered Hawk (*Buteo lineatus*), Great Egret (*Casmerodius albus*), Yellow-crowned Night Heron (*Nyctanassa violaceus*), nesting Yellow Rail (*Coturnicops noveboracensis*), and nesting Henslow's sparrow (*Ammodramus henslowii*). In recent years, Black-necked Stilts (*Himantopus mexicanus*) have nested on the marsh. A distinct population of the Plains Garter snake

(*Thamnophis radix*), which is a species of special concern within the State, was discovered on a section of the marsh in 2009, making it one of only two populations confirmed in Wisconsin.

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region: Wisconsin wetlands have declined from 10 million acres in 1850 to only 5.4 million acres today. In some parts of southeastern Wisconsin as much as 90 percent of the wetlands have been destroyed. Horicon Marsh and its representative populations of plant and animal species are an important genetic and ecological resource not only for Wisconsin, but also for the United States.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions: The geese that stop at Horicon Marsh are part of the Mississippi Valley Population, a mid-sized subspecies of Canada goose (*Branta canadensis*) ranging from seven to ten pounds. There are approximately 1.1 million of these geese, of which over 80 percent stop for varying periods of time in the vicinity of Horicon Marsh during the fall migration. They begin arriving in mid-September and stay until mid-December. In the spring, they are on the marsh from early March until mid-April. The marsh and surrounding environs are a staging area that provides critical spring food which will fuel their journey north and supply the energy for reproduction.

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds: During recent years, the peak Canada goose (*Branta canadensis*) population on Horicon Marsh was estimated to be 150,000 to 200,000 birds. Over 85,000 ducks have peaked in the fall.

Criterion 6: A wetland should be considered internationally important if it regularly supports 1 percent of the individuals in a population of one species or subspecies of waterbird: Horicon Marsh has supported 50 to 80 percent of the Mississippi Valley Flyway subspecies of Canada goose. Two percent of the biogeographic population of mallards (*Anas platyrhynchos*) migrates through during fall, with impressive numbers of other waterfowl.

15. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) **biogeographic region:** NA-Nearctic (Udvardy, 1975)

b) **biogeographic regionalisation scheme** (include reference citation): Upper Mississippi (Robin Abell et al. 2008)

16. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Geology - The Niagara Escarpment is a layer of bedrock that consists of limestone cliffs and talus slopes. It abuts the eastern edge of Horicon Marsh and extends further south; north of Horicon Marsh, it reaches into the town of Oakfield and continues all along the eastern shore of Lake Winnebago to Green Bay and Door County. Overall, the Niagara Escarpment extends for a distance of 230 miles/368 kilometers in Wisconsin, continuing across the country until it reappears as a surface feature at Niagara Falls in New York.

The escarpment or "Ledge" just east of the marsh is up to 250 feet/76 meters high, but the maximum thickness of this rock layer varies from 450 to 800 feet/137 to 243 meters. The Ledge's rock - dolomitic limestone - is more than 400 million years old. In comparison, the Appalachian Mountains are about 480

million years old and the Rockies about 70 million. However, the Ledge can be considered even younger because it was reformed at its current location by the last glacier, which receded from this area about 12,000 years ago.

Vast continental glaciers altered Wisconsin's landscape many times during a series of glacial periods over at least the last one million years through four different Ice Ages. Named for the location of their most southerly advance, those Ice Ages are called the Nebraskan, Kansan, Illinoian, and Wisconsin. The Horicon Marsh that we see today was most affected by the Wisconsin Glaciation, the most recent of the Ice Age advances. The Wisconsin Glaciation lasted from 80,000 years ago to about 12,000 years ago, leaving behind a terminal moraine 900 miles/1440 kilometers in length throughout the state. The enormous glaciers, more than a mile thick in places, did not simply come and go, leaving no trace of their existence. Rather, they advanced and retreated gradually and on majestic scale, and in so doing shaped the landscape of today's Wisconsin and the other Great Lakes states. Other glacial features such as bogs, fens, lakes, marshes, erratics, moraines, kames, eskers, drumlins, potholes, and kettles, are quite evident to earthbound observers and serve as constant reminders of Horicon Marsh's icy past.

Specifically, the Green Bay lobe of the Wisconsin Glaciation gripped eastern Wisconsin and scoured out the Horicon Marsh and the Rock River basin reaching as far south as Janesville and Madison. As the glacier lobes receded, flowing meltwater pooled, forming large lakes where silt and clay collected. The glacier receded in stages, creating recessional moraines that mark a temporary, icy delay in their retreat. The City of Horicon on the south end of the Marsh is built on such a recessional moraine. For awhile, it acted as an earthen dam, holding back melting ice waters into Glacial Lake Horicon, 51 square miles in size, and five times larger than Lake Mendota. The headwaters of the Rock River formed near this lake. Rising glacial melt waters eventually wore a path over and down through the moraine. Over time, water flow broke through the dam, and water levels on the lake lowered, draining the lake. The lowering of the glacial lake level stopped abruptly, when the Rock River reached the hard Galena-Dolomite rock strata (layer) in its bed at Hustisford Rapids, 7 miles/11 kilometers downstream from Horicon Marsh. This solid rock strata has acted as a natural dam, maintaining a fairly constant level of water, north to the Fond du Lac County line. As crushed gravel, sand, fine silts and clays were deposited in the Glacial Lake Horicon basin, it evolved into the marsh it is at present. Today, Horicon Marsh is considered an extinct glacial lake

Soils - The major factors in soil formation are parent material, climate, relief, topography, vegetation, and time. Soils in the Horicon Marsh area are the result of atmospheric, chemical, and organic forces modifying the surface of the glacial deposits. The glacial deposits consist of unsorted sand, gravel, boulders, clay, fragments of local limestone and sandstone bedrock, and igneous and metamorphic rock from outside the region. Soils include those of a glacial deposit origin and vary between poorly drained peat and muck types, transition silty loam soils interspersed with sandy loam and clay, to excellent agricultural soils being intensively farmed. Topsoil depths range from 10 to 14 inches/25 to 36 centimeters.

Soil types around the Marsh include Houghton muck and peat soils, which cover about 90 percent of the Marsh and other soils that cover upland areas and margins surrounding the marsh. Soil groups associated with the margins of the marsh include the following:

1. Stoney land wet and maumee sandy loams – found around drainage ways and on foot slopes of moraines on the east side of the Refuge. They are very poorly drained sandy soils with rounded glacial stones one to two feet in diameter. Depth of groundwater is zero to three feet.
2. Pella – Virgil silt loams – transition soils located between the marsh and the uplands. They are gently sloping somewhat poorly drained silty loam soils underlain by sandy loam glacial till at depths of 3 to 4 feet/about a meter. These soils have seasonally high groundwater table and may be inundated for short periods of time.

3. LeRoy – Theresa silt loams – consisting of deep, gently sloping to steep, well-drained soils located in the upland areas. These soils are typical of the farmlands surrounding the Refuge. Groundwater on these soils is at a depth of 6 feet/1.82 meters or greater.

4. Beecher – Morley silt loams – prominent on the uplands along the central eastern border and the northern tip of the Refuge. These soils are poorly to well-drained, level to steep silt loams underlain by calcareous silty clay loam till. Depth to groundwater is 1 to 3 feet (less than a meter).

Surface Hydrology - Horicon Marsh is located in the headwater region of the Upper Rock River Watershed. The marsh occupies a long north-south trending valley excavated by glacial action, with steeply rising terrain of the Niagara escarpment to the east and gently rolling glacial deposits to the north and west. The Rock River rises less than 30 miles/48 kilometers north of the marsh and discharges into the Mississippi River at Rock Island, Illinois. The Upper Rock River Watershed drains a total of 266.5 square miles.

The principle source of runoff to the Refuge is the west branch of the Rock River, which drains a total of 110 square miles above the Refuge before it enters the Refuge 2 miles/3.2 kilometers east of the City of Waupun. The portion of the river within the Refuge was historically channelized by a main ditch running along a north-south line that discharges to a main outlet near the City of Horicon. However, it has reverted back to a meandering river in all reaches on the Refuge except the last half-mile. Other sources of runoff to the Refuge include Plum Creek and Mill Creek, which enter the marsh from the west. These two streams and others entering from the west and northwest drain through gently rolling agricultural lands and have relatively gentle gradients ranging from 5 to 10 feet per mile. Uplands to the east of the Refuge are relatively steep agricultural lands. The above-mentioned sources of runoff combine to yield a total drainage area of approximately 208 square miles above the main dike outlet.

Climate - As would be expected from its location in the northern Midwest, deep in the heart of the continent and far from the moderating sea coasts, Horicon Marsh's climate is typically continental, with cold winters and warm summers. The Marsh has an average annual temperature of 46 degrees Fahrenheit/8 degrees Celcius. July is the warmest month with an average temperature of 73 degrees Fahrenheit/22 degrees Celcius. The coldest month is January with an average temperature of 21 degrees Fahrenheit/- 6 degrees Celcius.

Annual precipitation is about 28 inches/71 centimeters, with approximately 20 inches/51 centimeters of this occurring between April and September, and falling as rain. Snowfall averages 34 inches/86 centimeters annually. Freezing usually begins around October 1 and lasts until May 12, making the length of the growing season an average of 142 days. Wind speeds average about 10.6 miles/17 kilometers per hour throughout the year. March, April, and November have the highest wind speeds with an average of 12 miles/19 kilometers per hour. Winds are normally from the south in the summer and the west in the winter.

17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

See answer to #16

18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

See answer to #16

The Refuge is significantly impacted by sediment and phosphorus loading from agricultural lands based upon a three year study and collection of water samples in the Rock River Watershed. In 2006, a Cooperative Agreement was signed between the U. S. Fish and Wildlife Service and the Fond du Lac

County Conservation District to hire an individual to address stream sedimentation and high phosphorus and nitrogen concentrations from farm lands upstream of the Refuge and to facilitate restoration of the Rock River Watershed in Fond du Lac County. This project will increase implementation of water quality improvement practices within the watershed through targeted farmer outreach. Each farmer in defined critical source areas is being contacted and asked about their current efforts, needs, and attitudes related to sediment and phosphorus management on their farms. They are being informed about the different programs available. Based upon that interaction, farm-specific strategies will be designed that address farmer needs and technical assistance to implement various management plans.

Since initiation of the project in 2006, 726 tracts have been evaluated which included contacts with 316 individuals. More than 16 miles of buffers have been installed and over 47,200 acres now have a conservation or nutrient management plan in place.

Also, a 2-year water monitoring study began in October 2009. The study follows the initial protocol from the original water monitoring conducted ten years ago. Partners include the Fish and Wildlife Service, US Geological Survey, Wisconsin Department of Natural Resources, Rock River Coalition, Friends of Horicon National Wildlife Refuge and Trout Unlimited. Water samples are collected monthly and after each precipitation event and submitted to the Wisconsin State Laboratory for analysis of phosphorous and sediment. The results will be compared to those collected in the initial study. It is hoped the results will show a substantial reduction in sediment and phosphorous loads to the marsh as a result of all the conservation practices completed in the watershed.

Also in 2009, meetings were initiated between the Corps, Refuge staff, Wisconsin Department of Natural Resources, and Lake Sinissippi, forming the start of a new partnership in 2009. The U.S. Army Corps of Engineers, Rock Island, Illinois Field Office Staff had previously worked with the Lake Sinissippi District, south of the Refuge, to prepare a restoration plan for the Lake. Refuge Staff felt the Corps might also provide useful expertise dealing with ditches and sediment issues for restoration of Horicon Marsh. Plans are to involve more partners in the next year and work toward improving marsh habitat.

19. Wetland Types

a) presence:

Circle or underline the applicable codes for the wetland types of the Ramsar "Classification System for Wetland Type" present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp • Ts • U • Va •
Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

b) dominance:

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

Dominant type listed in order for Horicon Marsh: Tp, M, O, P, U, W, Xf

20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14, Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare,

endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Addressed in question #14.

22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Addressed in question #14

23. Social and cultural values:

- a) Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

Land in the area of Horicon Marsh was important to prehistoric peoples and to Euro-American settlers. Horicon Marsh has been an exceptionally rich resource for subsistence cultures since the glaciers left, and this long and heavy use by prehistoric people is recorded in the numerous archeological sites on and around the marsh. For Euro-Americans, the marsh and its outlet were important resources for commercial and light industrial development, and later for commercial and recreational hunting.

An archeological site near the marsh in Fond du Lac County shows evidence of people during the late PaleoIndian period. The PaleoIndian period extends from 10000 B.C. to about 8000 B.C. and represents the culture of the earliest known peoples in Wisconsin. The evidence for these people is usually associated with mega-fauna (i.e., bison) kill and butchering sites. Any sites containing evidence of people from this period would be considered very important.

Several archeological sites on and near the Marsh contain evidence of people from the next cultural period, known as the Archaic, covering the period 8000 to 1000 B.C. These people appear to have been hunters and gatherers, making a seasonal round of subsistence resource locations. Late in the period (or early in the next cultural period) these people began burying their dead in natural mounds and commenced using pottery. Very little is known about this long and early culture, so intact sites containing Archaic period material could be very important. During the altithermal, a hot and dry period extending from 4700 to 3000 B.C., people appear to have clustered around the few remaining (and shrunken) bodies of water such as Horicon Marsh. But overall, populations grew substantially as the people exploited increasingly varied habitats.

The Woodland period extended from 1000 B.C. to A.D. 1600. Most archeological sites on and around the marsh contain Woodland period components. The people of this culture are mostly identified by their burial mounds and by their use of pottery. Late in the period they began using the bow and arrow; prior to that time "arrowheads" were spearpoints. Although hunting and gathering continued with its seasonal round of resource areas, they also had larger permanent seasonal villages and grew corn, beans, and squash in gardens.

The Mississippian culture centered in the St. Louis, Missouri, vicinity, covered the period A.D. 1000 to 1600. Wisconsin was in the northern periphery and just two sites near Horicon marsh are reported to contain evidence of this late prehistoric culture.

European arrival in the Caribbean and on the Atlantic coast introduced Western culture and resulted in severe disruption of the prehistoric cultures in Wisconsin long before the first European entered Wisconsin. European-introduced diseases spread ahead of Caucasian population advances and decimated

the native populations with reports of up to 90% mortality. Horses and guns made some tribes powerful and led to westward movements of eastern tribes. The fur trade with Europeans further disrupted native cultures. These and many other events led to consolidation and disintegration and relocation of Indian tribes so that identifying historical tribal antecedents in the archeological record is almost impossible.

The historic period tribes encountered by Europeans in Wisconsin generally and in the Horicon Refuge area specifically included the Winnebago (some of which are known as the Ho-Chunk) as well as the Potawatomi and Menominee. Other tribes within Wisconsin that may have visited the marsh area include the Ottawa, Huron, Fox, Sauk, Miami, Mascouten, and Ojibwa. Historic tribal archeological sites are located on and near Horicon Marsh.

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

If Yes, tick the box and describe this importance under one or more of the following categories:

- i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:
- ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:
- iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:
- iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

24. Land tenure/ownership:

a) within the Ramsar site: The northern two thirds of the Horicon Marsh is owned and managed by the U.S. Fish and Wildlife Service (Federal) as the Horicon National Wildlife Refuge. The southern one-third of the Horicon Marsh is owned and managed by the Wisconsin Department of Natural Resources (State) as the Horicon Marsh Wildlife Area.

b) in the surrounding area: private land abuts the Horicon Marsh, but four Waterfowl Production Areas managed by Leopold Wetland Management District (U.S. Fish and Wildlife Service) are within close proximity. These Federal lands total 1,177 acres/476 hectares.

25. Current land (including water) use:

- a) within the Ramsar site: The northern two thirds of the Horicon Marsh, managed as the Horicon National Wildlife Refuge includes over 15,500 acres/6,273 hectares of marsh and 5,600 acres/2,266 hectares of associated upland habitat. Marsh habitat is seasonally to permanently flooded and dominated by cattail, river bulrush, common reed grass, sedges, and reed canary grass. Uplands include near 3,600 acres/1,457 hectares of grasslands and 2,000 acres/809 hectares of woodlands. Of the nearly 16,000 acres/6,475 hectares of wetlands on the Refuge, approximately 3,000 acres/1,214 hectares are seasonally flooded (Type I) basins, 12,000 acres/4,856 hectares are deep (Type IV) freshwater marshes, and 1,000 acres/405 hectares are sub-impoundments. Roughly half of the Refuge consists of dense stands of cattails, either in solid stand or mixed with other species. Other species include soft-stemmed bulrush, hard-stemmed bulrush, slender bulrush, river bulrush, burreed, various sedges, smartweeds, chufas,

pigweeds, millets, and sagittaria. There are approximately 2,000 acres/809 hectares of moist soil plants found in and around the edges of the water areas during drawdown condition. These include chufas, smartweeds, pigweeds, etc. About half of the aquatic areas consist of fairly deep lakes, ditches, and other water areas in which stands of submersed aquatics are found. These include various pondweeds, coontail, elodea, duckweeds, and milfoil. Grasslands consist of approximately 57 percent introduced grasslands, 24 percent forbs, 17 percent are native grasslands, and 3 percent are wet meadows. Woodlands are willow-dominated (55 percent), mixed hardwoods (22 percent), aspen dominated (12 percent), willow-cattail (8 percent), and oak savanna (3 percent). From these figures, it is evident that almost two-thirds (63 percent) of the Refuge's woodlands are lowland or bottomland and a little more than one-third (37 percent) are upland woodlands.

b) in the surroundings/catchment:

Dodge County mostly consists of agricultural production of corn, soybeans, alfalfa and winter wheat with 439,000 acres/177,657 hectares in cropland. The remainder of land use consists of 111,000 acres/44,920 hectares of wetland; 28,000 acres/11,331 hectares forest; and 25,000 acres/10,117 hectares pasture.

Fond du Lac County mostly consists of agricultural production of corn, soybeans, alfalfa and winter wheat with 343,000 acres/138,807 hectares in cropland. The remainder of land use consists of 70,000 acres/28,328 hectares of wetland; 35,000 acres/14,164 hectares forest; and 38,000 acres/15,378 hectares pasture.

26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

a) within the Ramsar site: Refer to question # 6b

b) in the surrounding area: Refer to question # 6b

27. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia ; Ib ; II ; III ; IV ; V ; VI

c) Does an officially approved management plan exist; and is it being implemented?:

Horicon National Wildlife Refuge Comprehensive Conservation Plan, April 2007 is in effect for the northern two thirds of the Horicon Marsh and yes, the 15 year plan is being implemented.

d) Describe any other current management practices:

The following pertains to the northern two-thirds of the Horicon Marsh, managed by the U.S. Fish and Wildlife Service as the Horicon National Wildlife Refuge (Refuge):

Many of the current management efforts on the Refuge focus on restoring valuable wildlife habitats that have declined regionally since the advent of intensive habitat modification and destruction wrought by Euro-American settlement, agricultural development and drainage projects. Refuge staff carries out wetland and upland habitat restoration projects on the Refuge.

Habitat restoration efforts at Horicon Refuge focus on both upland and wetland habitats. Within the last several years, upland habitat restoration has focused on improving the quality and quantity of oak savanna habitats. Brush and other tree species have choked out oak savanna habitat. Several methods are used to remove the brush and other trees to allow for the resurgence of oaks. Refuge staff issue firewood-cutting permits to remove larger trees that have encroached on the historic oak savannah openings. Staff and contractors will also remove larger trees. Staff will use specialized equipment to mow brushy areas to reclaim the grass component of the oak savannah habitat. Staff will also be experimenting with particularly hot prescribed burns as a means of restoring and maintaining oak savanna.

Efforts are also under way to restore native prairie grasslands on the Refuge. Restoration typically involves treatment of degraded grasslands, those that have become dominated by non-native, invasive, or woody species like willows. Fields with nonnative or invasive species are sprayed with the herbicides Round-Up and 2-4D. The area is then burned to provide good seed-to-ground contact. The seed mix includes 21 forb species and five grass species, all Wisconsin Genotype. The seedings are usually initiated in late fall or early winter, dependant on a light snow cover. A seed blower attached to the hitch of a vehicle is used to plant the seed. Fields invaded by small woody vegetation are mowed using a Fecon mower. Most upland fields on the Refuge have been invaded and dominated with reed canary grass, sweet clover or wild parsnip.

Although native to North America, reed canary grass has hybridized with introduced European strains to create a highly aggressive and invasive strain that is spreading at the expense of other native species. Reed canary grass is flood-tolerant, resistant to burning, a prolific seed producer, spreads rapidly through rhizomes, and quickly forms virtual monocultures in wet meadows by shading out native grasses and forbs. Control requires aggressive measures. Horicon Refuge is experimenting with using grazing as a tool to reduce the amount of reed canary grass. This is a form of adaptive management, and in the spirit of adaptive management, we are always experimenting with different methods to enhance native grasslands.

Managed impoundments give opportunities to restore wetland habitat to more desirable conditions. In 2005 and 2007, five of the lateral ditches, originally dug in the early 1900s to drain the marsh, were plugged, with the spoil banks either removed or made into large islands. The idea being to reestablish sheet flow of water and prevent ground and surface water flow from being transported down the ditches.

Horicon Refuge's water management program is very complex and involves 17 impoundments. Pools are frozen for about 4 months of the year, from December to April. During periods of "ice-out," May to November, water management not only must balance competing considerations of wildlife and habitats on the Refuge itself, but it must deal with the requests of off-Refuge neighbors downstream as well as other township, county, state, watershed, and flood control agencies. Regulating water levels – whether at maximum pool levels or in drawdown (emptying pools almost entirely of water) – is a vital management tool for waterfowl, shorebirds, and wading birds. Over the years, water management has been further complicated by increased land clearing and development on private lands upstream of the Refuge, which increase nutrient and sediment transport onto the Refuge. Within the last several years, the Refuge has experienced severe flooding, which results in rapid pool level increase, or "bounce," of 2 to 3 feet. Bounces during the breeding season negatively affect nesting efforts of many species. For instance, the flood that began in May of 2004 essentially wiped out a production year for many species. Managers must be cognizant of conditions throughout the watershed, exercise good judgment, and at times be willing to deviate temporarily from Refuge objectives when downstream cities and towns are experiencing extreme flooding events.

Refuge management is continually adjusting scheduled water manipulation in response to the vagaries of the weather or maintenance of water control structures. For instance, in 2004 a leak in the

culvert leading to the pump house in the Potato impoundment was discovered. Potato then had to be drained to fix the problem, resulting in an unexpected drawdown. Continual maintenance and repair of aging water control facilities such as gates, pilings, gauges, dikes, bridges, riprap, and channels are necessary to keep facilities and controls operable, and thus to meet water and marsh habitat management objectives.

Moist Soil management on the Refuge is conducted annually. The I-5 impoundment has been drawn down for the past 7 years during spring and summer to promote emergent vegetation. During the fall and winter of 1997 to 1999 all the emergent vegetation was wiped out due to reflooding of the unit. In 2000, the unit was drawn down for the fall and winter as well, in hopes of sustaining an emergent vegetation cover and compacting the very deep mud layer that may have been the cause of the vegetation decline after reflooding.

Mowing is used in grasslands and certain wetlands like sedge meadow to cut willows and prevent their encroachment. If left alone, hardy, aggressive willows would invade and dominate nearly all wetland areas on the Refuge except for the cattail marsh areas. Mowing maintains a mosaic of willow age classes, ensuring winter browse for deer. It also reduces the willow canopy layer and improves the understory of sedges and grasses that foster deeper penetration of fire into willow stands. Increased willow control and better cover for nesting marsh and upland birds that use these areas are the ultimate result of this mowing. Typically, about 100 acres/40 hectares a year are mowed on the Refuge.

The Refuge has a small haying program with three benefits: 1) reduces seed source of reed canary grass; 2) reduces thick litter layer that inhibits nesting; 3) it attracts visually impressive birds like Sandhill Cranes (*Grus canadensis*), and concentrations of waterfowl to areas where they can be observed by the public. In a typical year, 30 to 40 acres/12 to 16 hectares of reed canary grass is hayed and removed from the Refuge, providing grazing areas for waterfowl and other animals.

Fires were once a natural disturbance that helped maintain upland prairies and lowland marshes by decreasing the presence of harmful invading plants. Today prescribed fires are used to setback woody and herbaceous plants that invade prairies and wetlands. The suppression of fire that naturally occurred prior to European settlement allows undesirable fire intolerant species to exist where they otherwise would not have. Many native species of plants and trees are fire resistant, while others require fire to exist. By using prescribed fire as a management tool we can mimic a natural ecosystem function helping to maintain the habitat characteristics which our local plants and animals have evolved from.

Today prescribed fire is one of Horicon Refuge's most useful tools for maintaining prairie and marsh vegetative characteristics. Since many upland birds and waterfowl require open areas for nesting, prescribed fire helps maintain habitat necessary for migratory species. By choosing burn units based on needs of the wildlife habitat we can maintain a combination of prairie, savanna, marsh, sedge meadow and woodland habitats required by native wildlife species.

Prescribed fires can help reduce the danger of uncontrolled wildfires by reducing the buildup of hazardous fuel loads in and around the Refuge. Horicon Refuge has a fire management plan that facilitates prescribed burns in the spring and fall seasons. In 2010, prescribed fire was used on 3,970 acres/1,607 hectares. The spring season was exceptionally successful in terms of acreage and most importantly ecological objectives. The annual average over the last 10 years has been 826 acres/334 hectares. Burns are scheduled on a 3- to 5-year rotation and timed to meet specific vegetative goals. Post-fire monitoring is conducted to measure the success of each burn, in ecological terms.

A large amount of time and money is spent on treating invasive species on the Refuge. The exotic and invasive species of most concern and the extent of their infestation on the Refuge are common reed (*Phragmites australis* 300 acres/121 hectares), wild parsnip (*Pastinaca sativa*, 600 acres/243 hectares), reed canary grass (*Phalaris arundinace* 1,900 acres/769 hectares), purple loosestrife (*Lythrum salicaria* 100

acres/40 hectares), European buckthorn (50 acres/20 hectares), and leafy spurge (*Euphorbia esula* 3 acres/1 hectare).

Wild parsnip (*Pastinaca sativa*) is an aggressive, Eurasian weed that frequently invades and modifies a variety of open habitats. Wild parsnip slowly invades an area in waves following initial infestation. Once the population builds, it spreads rapidly. Wild parsnip can cause phytophotodermatitis to the skin. If the plant juices come in contact with skin in the presence of sunlight, a rash and/or blistering can occur, as well as skin discoloration that may last several months. Staff has had a difficult time controlling the spread of this invasive. Fire has no effect on wild parsnip since plants simply resprout. Due to the large acreage that is affected, hand pulling is not an option. In 2005, mowing fields just as the seed heads turned color, had mixed results. Some fields had effective control while others were mowed too early and the wild parsnip resprouted and flowered. Staff is continuing to make adjustments and monitor the spread.

Reed canary grass (*Phalaris arundinace*) is native to North America, but has hybridized with introduced European strains to create a highly aggressive and invasive strain that is expanding at the expense of other native species. It is flood-tolerant, resistant to burning, produces seeds prolifically, spreads rapidly via rhizomes, and quickly forms virtual monocultures in wet meadows by shading out native grasses and forbs. Aggressive measures are needed to control it.

Purple loosestrife (*Lythrum salicaria*) is a wetland herb that was introduced as a garden perennial from Europe during the 1800s. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars. Purple loosestrife can spread rapidly, eventually taking over an entire wetland and almost entirely eliminating the open water habitat. Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. The Refuge continues to monitor the purple loosestrife infestation. Refuge staff stopped raising Galerucella spp beetles several years ago. Several beetle surveys in early spring showed poor survival of beetles in the areas of original release. It was hoped that the beetles would be self-sustaining and that some of the beetles could be translocated to new areas of infestation. Refuge staff will continue to monitor the changes around the Refuge where beetles were released to see if additional beetles will need to be raised and released to combat the purple loosestrife. The original release sites have shown encouraging results over the last 6 years.

Leafy spurge (*Euphorbia esula*) is an aggressive, exotic, perennial weed that is especially pernicious in western grasslands. It out-competes desirable native vegetation, growing in dense clumps with one or more shoots emerging from a woody root crown. This weed contains irritating chemicals that many animals avoid eating. Previous measures to control the leafy spurge included spraying it with the herbicide Plateau; however, the weed can be resistant to chemical control. It has a pervasive root system and appears able to block the downward movement of herbicides. Still another problem with chemicals is that herbicides sprayed to kill spurge also kill desirable broadleaved plants. It should be noted that prescribed fire does not control leafy spurge. In 2005, biological control of the leafy spurge was initiated. Several species of beetles totaling 100,000 specimens were collected from the Trempealeau Refuge. This included three varieties of Aphthona flea beetles: *Aphthona nigriscutis*, *Aphthona cyparissiae*, *Aphthona czwalinae* and a long-horned stem miner called *Oberea erythrocephala*. Monitoring of leafy spurge and beetle survival continues.

There are several other plant species, both on and off the Refuge, that threaten the vegetative integrity of the Refuge. On the Refuge, the spread of common reed or phragmites (*Phragmites australis*) is of concern. The use of fire and chemical treatment using HABITAT are methods of control being explored. European buckthorn (*Rhamnus cathartica*) has a very rapid growth rate and resprouts vigorously after being cut. Typical of several non-native understory shrub species, buckthorns leaf out very early and retain their leaves late in the growing season, thereby shading out native wildflowers. Currently, management of this species includes pulling young seedlings and/or cutting and spraying stumps with 2-4D. Garlic mustard

(*Alliaria petiolata*) is a rapidly spreading woodland weed that is displacing native woodland wildflowers in Wisconsin. A combination of pulling and spraying is a management tool for controlling this invasive. Also, spotted knapweed (*Centaurea maculosa*), an aggressive, non-native invader of grasslands, grows on roadsides near the Refuge.

Staff is continually monitoring the health and condition of wildlife populations on the Refuge and staying abreast of the regional status of diseases that affect the health of wildlife, humans, or both. Through monitoring and preventive measures, it is possible to prevent isolated cases from triggering major outbreaks of disastrous epidemics. Historically the Refuge had a type C Avian botulism outbreak every year with a couple of hundred birds picked up in the various impoundments. Staff would routinely conduct surveillance in mid-July and continue until December. Since 1992, the number of dead birds has dropped dramatically to less than a dozen per year and the surveillance has been limited to observations during daily refuge functions. If mortality of birds is suspected, then further searches in the impoundments are conducted by airboat. In 2005, the Refuge experienced the first major outbreak in many years. Certain environmental factors can contribute to the botulism spores germinating, producing the toxin, and resulting in an outbreak. These environmental factors, such as high temperatures, low water levels with exposed mudflats, and the presence of decaying organic matter (fish), which support the toxin production, were all present in 2005. About 1,200 ducks, mostly Mallards, were retrieved and buried by Refuge staff. This number does not reflect the total loss of birds, since only a percentage of the birds are picked up.

In 2002, the Wisconsin DNR found the first confirmed case of Chronic Wasting Disease (CWD) within the State's deer herd in the southwestern part of Wisconsin. Horicon NWR is not located within the area of Wisconsin where CWD has been detected. However, in preparation for an outbreak, in 2005 Refuge staff wrote a Chronic Wasting Disease Surveillance and Management Plan, along with an Environmental Assessment (EA). The Plan identifies the strategies for CWD management on the Refuge, which mirror the strategies identified in the State Plan. These strategies include Disease and Population Management measures, Surveillance and Coordination measures, Testing and Handling of CWD Suspect Animals, and Baiting and Feeding measures. In summary, Refuge staff will rely on hunter harvest during established seasons to approach the Wisconsin DNR population goals and will conduct active, opportunistic observations of deer on Refuge lands. Baiting and feeding will not be allowed on Refuge lands and any deer suspected of CWD will be euthanized.

West Nile Virus was found in Wisconsin for the first time in 2001 in infected wild birds. Spread by mosquitoes, this exotic virus infects mammals, including humans, and birds. Members of the Corvidae family (crows and jays) seem to be especially vulnerable. In 2005, three pelicans on the Refuge tested positive for West Nile Virus. Staff continues to monitor for West Nile.

The Refuge has 57 Wood Duck houses that are checked and maintained annually by staff and volunteers. Two volunteers checked and maintained 97 Bluebird nest boxes at various sites around the Refuge. Fifteen Prothonotary Warbler boxes were also installed along wet forest dikes. Two Osprey platforms, installed in 2000, are also present on the Refuge and in 2005 a pair of Osprey were observed bringing sticks to the Frankfurth platform. Unfortunately, with only a few dozen sticks on the platform they abandoned the site.

A variety of furbearer species are traditionally trapped on the Refuge: muskrat, mink, raccoon, opossum, red fox, skunk, coyote, and weasel. These species cause problems for the Refuge because the upland predators prey on the ground-nesting birds and the muskrat cause damage to the dikes.

The carp trap installed along the Rock River at the north side of the Refuge is emptied several times each spring. Carp start filling the trap in early April. In 2005, over 100 tons of carp were removed. Other game fish and desirable species caught in the trap and released included northern pike, walleye, crappie, yellow perch, bluegill, and white suckers. In addition, another 200 tons of carp were treated with Rotenone.

28. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

29. Current scientific research and facilities:

e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

The following pertains to the northern two-thirds of the Horicon Marsh, managed by the U.S. Fish and Wildlife Service as the Horicon National Wildlife Refuge (Refuge):

Two basic types of inventories and investigations are conducted at Horicon Refuge: 1) surveys and censuses of selected species or species groups, which are typically made on an annual basis; and 2) basic research into wildlife biology and ecology, which have no specific schedule.

The surveys and censuses are generally made by staff and volunteers, and consist of organized surveys and/or censuses, or a compilation of observations and recorded sightings made over the course of the year. Research studies are usually undertaken in cooperation with university professors and their students or other agencies, often with the direct participation and cooperation of Refuge staff and assisted by volunteers.

Surveys and censuses at Horicon Refuge are guided by a 1990 Wildlife Inventory Plan. Breeding waterfowl, including Canada Geese (*Branta canadensis*) and ducks, are inventoried every spring and summer. By using waterfowl surveys and brood surveys Refuge staff are able to estimate the number of ducks and geese present as well as an estimate of production. Numbers of several species of waterfowl are also estimated during the fall migration, including Mallard, Blue-winged Teal, Green-winged Teal, Ruddy and Ring-necked Ducks and Canada and Snow Geese.

Bird banding has been a tool of wildlife managers for decades. Banding enables biologists to identify and track movement and timing patterns of migratory bird populations. Metal bands or rings with identification information are affixed to the leg of the bird. The bird must be recaptured or killed and held in hand to record the information on the band. Horicon Refuge, in partnership with the Wisconsin Department of Natural Resources, banded 504 mallards and 351 wood ducks in 2010.

Horicon Refuge conducts censuses and observations of many water-dependent avian species. Estimates of nest numbers are obtained for the three predominant colonial nesting birds (i.e., birds that nest in colonies) on the Refuge: White Pelican, Black-crowned Night-heron, and Double Crested Cormorant. Over the years, averages of 350 pairs of White Pelicans, 100 pairs of Black-crowned Night-herons, and 150 pairs of Double Crested Cormorants have nested at Horicon Refuge.

Six species of marsh birds – American Bittern, Least Bittern, Sora, Virginia Rail, Yellow Rail and King Rail – are typically surveyed several times a year using passive call and call playback techniques. Point counts are also made of migratory songbirds during the breeding season. Seven of 32 sites were surveyed in 2005 with 44 species found. Henslow's Sparrows continue to be found on the surveys, as well as an increased numbers of Bobolinks.

During years when management activities create extensive mudflats and moist soil units, Horicon Refuge is a popular stopover area for shorebirds. These birds are often observed in the spring and/or summer by volunteer birding enthusiasts. Fifteen to 20 species of shorebirds and thousands of individual birds have been observed by staff and visitors.

The Annual Crane count, sponsored by the International Crane Foundation (ICF) in Baraboo, Wisconsin, continues as an annual survey, both on and off the Refuge. In 2009, the 34th Annual Crane count was held on April 18. This year only four of the thirteen Refuge sites were counted. Six participants counted eight nesting pairs and a total of 35 cranes.

A roadkill survey has been conducted along Highway 49 since 2001. The roadkill survey is conducted daily most of the year, less frequently in winter. Results from 2009 included a total of more than 656 individuals killed which included the frogs and toads. At least 38 different species were recorded on the survey. The changes in habitat on both sides of the highway influence what species are using the area.

Electro-shocking fish surveys are conducted every 3 to 5 years. Previous fish surveys showed that carp numbers were increasing, composing more than 95 percent of the fish in the marsh. In 2009, Common Carp were the most abundant fish species caught (74 individuals) followed by Black Bullhead (47), Northern Pike (25), Yellow Bullhead (11), Black Crappie (11), Brown Bullhead (8), Yellow Perch (6), Golden Shiner (5), Bluegill (4), Big Mouth Buffalo (3), Walleye (2), and Large Mouth Bass (1).

Horicon Refuge has had aerial infrared photography taken in 1996, 1999, 2000, 2001 and annually since 2003. The 2005 photos were digitized into a vegetation classification. The primary purpose of the photos is monitoring habitat changes that occur either naturally or due to management. In the past, visual comparisons of photos between years were done to make these evaluations. In 1999, Horicon NWR used a Geographic Information System (GIS) to make quantitative evaluations of open water to cattail growth and germination. GIS technology is used to compare infrared photos taken in different years to determine the changes in habitat that are taking place due to management activities such as water level manipulation and prescribed burning.

The annual grassland surveys, initiated in 2001 using plant community associations at point count sites, continue. These surveys were developed and tested in 1999 on several points at Horicon Refuge based on a similar grassland survey conducted at J. Clark Salyer Refuge. In addition to several association changes based on local habitat, visual obstruction readings (VOR) using a Robel pole and litter depths were taken at each site. It is hoped that eventually the grassland survey will be correlated to grassland bird surveys and guide the Refuge grassland management program including prescribed burning. Many staff days and hours are required to monitor each site every year. Survey methods are being reviewed to see if they can be simplified to reduce the time involved on each plot by reducing the individual points down from 800 per plot.

Other surveys conducted on and off the Refuge include Mourning Dove, breeding bird survey routes, midwinter waterfowl, frog survey, and the Christmas bird count.

The Refuge is the site of a variety of wildlife research studies, ranging from life history studies to disease effects. Horicon Refuge initiates, encourages and cooperates with these studies in a number of ways, including the use of housing, equipment and other facilities by guest researchers, by subsidizing volunteers, and by direct collaboration in the field.

Recent and ongoing studies include the following:

Rock River Suspended Solids and Phosphorus Sampling

This is a two year cooperative project with the US Geological Survey (USGS), Wisconsin Department of Natural Resources, and other non-government organizations to collect and analyze water samples at three sites along the Rock River which flows through Horicon National Wildlife Refuge and Horicon State Wildlife Area. USGS gauging stations were installed at the Highway 49 rest area, the county park in Kekoskee and at the bridge in Horicon. Manual water samples will be taken at the 14-Bay water control structure and the fishing pier on Main Dike Road. Water-quality parameters including suspended solids and phosphorus will be monitored at each site. These results will be compared to load and concentration data that was collected in this very same manner between 1998 and 2000. Sites will be sampled for two years and then the USGS will compile and publish data reports on the third year summarizing the sediment loads and annual phosphorus concentrations that are coming into the Horicon National Wildlife Refuge and Horicon State Wildlife Area.

By replicating a study that was conducted 10 years ago, we can determine if current conservation techniques are working or if we need to change methods and try something new. Either way we need to know whether or not the time and money we are spending now is actually benefiting the Horicon Marsh by reducing sediment loads and phosphorus concentrations that are coming into the Marsh.

Data published by the USGS (if shown that these conservation techniques have worked to reduce suspended solids and phosphorus coming into the Horicon Marsh) will be used to educate stakeholders in the watershed and hopefully increase the number of conservation projects in the watershed.

Bathymetric study of Main Pool and Teal Pool

On August 4-5, 2009, Regional Hydrologist Josh Eash assisted Refuge staff with the collection of bathymetry data in Big Lake, Main Ditch, and other open water portions of Main Pool, as well as Teal Pool. Data collected during this survey included water level (referenced from staff gauge at Main water control structure on Main Ditch and at Teal Pool water control structure), sonar readings of depth at approximately 1 second intervals (Syqwest Hydrobox transducer and software), manual depth soundings with a standard survey rod, and position data collected at 10 second intervals with a standard handheld GPS unit connected to a laptop. Due to shallow depths, vegetation, and dense concentrations of suspended sediments, the sonar data may not correctly profile some depths. During post processing the manual soundings will be used to replace sonar data where necessary. The data from this survey has yet to be processed.

Developing a Model for Birds and Wind Development using Portable Radar

This is a cooperative project with the US Geological Survey (USGS) Northern Rocky Mountain Science Center, USGS Upper Midwest Environmental Science Center, Leopold Wetland Management District, Horicon National Wildlife Refuge, University of Southern Mississippi, International Crane Foundation (ICF) and National Park Service using the study plan *Evaluating Wind Energy Development On a Landscape Level Near Horicon National Wildlife Refuge, WI*. The study will try and determine how Sandhill Cranes staging on Horicon NWR in Fall and Spring use the landscape surrounding the Refuge in relation to the wind development project to the Northeast. The intent is to provide a probability distribution of cranes by individual quarter section based on a multivariate analysis of crop field type and condition, other habitat types, seasonality, weather, and turbine locations. The study involves using portable radar to determine the elevation of Sandhill Cranes during flight, conducting surveys of cranes flying out of and back into the Refuge and roadside surveys of cranes on the ground in the wind turbine area. The primary product of the larger study (not this small preliminary effort) will be a 3D model that simulates how Sandhill Cranes use the Horicon landscape, which contains a major wind energy project. The preliminary model constructed the first year will be mechanistic and based on GIS along with habitat preference knowledge from ICF, roadside surveys and preliminary short-range marine radar data. The model will include the ability to adjust system knowledge as new information is collected about bird behavior in relation to the turbines and weather. The eventual system will have the ability to simulate adding more turbines, feathering of individual turbines, and managing habitats on the Refuge. All products will provide an assessment of the uncertainties associated with the data and knowledge underlying the system.

Plains Gartersnake Research

The Refuge participated in a morphological and genetic gartersnake study this past fall, conducted by the Wisconsin Department of Natural Resources (DNR). The purpose of the study was to help better understand the genetic relationship between Butler's and Plains gartersnakes, help refine state ranges for both species and help establish physical characteristics consistent with genetic identification.

Wisconsin is home to five types of gartersnakes. Common Gartersnakes are common on the Refuge especially near the entrance to the auto tour where a hibernacula is located. In the spring of 2009, the Wisconsin Department of Natural Resources contacted Refuge staff to ask if they could initiate a cover board survey near the hibernacula, as well as several other sites on the Refuge, to determine if the Refuge was home to Plains Gartersnakes. The coverboard survey quickly revealed that Plains Gartersnakes were indeed abundant at the auto tour site. Although their range includes most of southern Wisconsin and a

small part of northwestern Wisconsin, this study showed that only two populations of Plains Gartersnakes have been confirmed in Wisconsin, one in Dane County and the one at the Refuge. They are a species of special concern within the State.

The study was taken to the next step in the fall of 2009 when drift fencing was placed around the hibernacula at the auto tour. Seventeen funnel traps were placed along the fencing in order to capture the snakes. Traps were checked each day and snakes were identified. Fifty-six Plains Gartersnakes were found and kept for further analysis and then returned to the site.

Swamp Sparrow Research

Rob Lachlan, Postdoctoral Associate from Duke University, conducted part of a research project exploring the broad theme of how Swamp Sparrows learn their songs. Lachlan conducted a survey of the songs of *M. georgiana georgiana* by recording large samples of songs from different populations across its range including Horicon Marsh. The survey was conducted at dawn and ran from June 25 through July 10. No results have been received as of this publication date.

Post-breeding Movements of Radio-marked Hens to Horicon Marsh

Ron Gatti, Waterfowl Research Biologist with the Wisconsin Department of Natural Resources (WI DNR) placed radios on Mallard and Blue-winged Teal hens on study sites that ranged from 4 to 26 miles away from Horicon Marsh. Research was conducted during the years 2000-2003 and 2007-2009. Every month Gatti would search by plane for all missing birds, within 10 miles of the study sites and up and down Horicon Marsh. Information gathered shows general pattern of post-breeding movements from the 12 sites studied. For all 38 Mallard hens and 13 Blue-winged Teals hens making post-breeding moves to Horicon Marsh, ALL of them used only the federal area and NONE used the state area. Most (70%) of the study sites with bird moves were north of the state end of the Marsh, so the shortest flight to the Marsh would put them at Horicon Refuge first causing them to move farther to get to the state area. But all 5 of the hens that started south of the Marsh overflowed the state area to end up at Horicon Refuge.

Information also showed the actual hen locations for Mallards and Blue-winged Teal. Mallards moved an average of 7.8 miles (range = 2.0-24.7 miles) to come to Horicon Refuge after they were through breeding. Blue-winged Teal moved an average of 16.4 miles (range = 7.8-30.4 miles) to come to Horicon Refuge post-breeding.

On average 39% of the duck hens moved to Horicon Marsh after their last nesting attempt of the year failed. On average 28% of the duck hens moved to Horicon Marsh after they successfully hatched a nest (post brood-rearing; this is significantly lower than for failed nesters). Pooling the two groups = 31% of post-breeding hens moved to the Marsh. The data also shows the relation between the study site's distance from Horicon Marsh to the % of hens from that site that made post-breeding moves to Horicon Refuge. Data shows the obvious: that the farther away from Horicon Marsh, the less likely they are to make the move to the Marsh. The sites ranged from having 0-69% of their hens move to the Marsh post-breeding. The trend line suggests that 50% of the hens 5 miles from the Marsh move here, but this drops quickly to 5% at 20 miles out. So Horicon Marsh is definitely valuable as a molting area, preferred by ducks from quite a distance away.

Blue-winged Teal (BWT) Telemetry Study

Ron Gatti, Waterfowl Research Biologist with the Wisconsin Department of Natural Resources continued his study, *Evaluating Factors Limiting Blue-winged Teal Production and Survival in the Great Lakes Region*. The study involved catching hens in live hen decoy traps set in wetlands and then following the birds with radios in eastern Fond du Lac County. Gatti followed 5 hens during post-season movements in 2009 (mean=98 days tracked/hen). Two hens were followed through their post-breeding molts on large impounded wetlands (0.9 km and 17.4 km from their nests). Three hens moved to large impounded wetlands briefly before moving on without molting there: Sheboygan Marsh (2.9 km and 14.1 km from their capture sites) and Horicon Marsh (45.2 km from her nest). Pooling 2002-2009 nest data showed that blue-winged teal hens nested an average of 135 m from open water, and strongly preferred to nest in

blocks of idle grass, followed by wet meadow wetlands, strips of grasslands, and alfalfa fields, in that order.

Forster's and Black Tern Research

Dr. David Shealer from Loras College in Dubuque, IA, did not continue his tern research this year. He did return to the Marsh as a paid contractor for the Wisconsin Department of Natural Resources and conducted the Wisconsin Black Tern Roadside Survey. Route 12 of the survey included Horicon Marsh. While at the Marsh he did band nine adult Black Terns and 18 chicks. He also banded six Forster's Tern chicks and no adults. This information will be included in his prior research data.

Reed Canary Grass Grazing Study

The Refuge staff has continued participating, since 2006, in a small sheep grazing study on the Zuelke tract. This piece of property was purchased as an access lane to the Radke impoundment on the northeast side of the Refuge. The Zuelke tract is dominated by reed canary grass (RCG) that would have required numerous chemical treatments prior to restoration. Rotational grazing is being attempted with initial assistance provided by the Natural Resources Conservation Service, Baraboo, WI to determine if grazing of sheep could be a successful alternative method to chemical control of reed canary grass. Prairie restoration practitioners have a strong understanding of how to establish prairie, but no information is available about grazing management as a tool for achieving desirable plant communities and ecosystem services in the Upper Midwest. Managed grazing is an increasing fraction of the agricultural sector in Wisconsin and may mutually benefit the environment, farmers, and society at-large, but a scientific understanding of how livestock grazing management positively and negatively affects natural resources must be developed.

Three grazing paddocks of differing sizes due to wet soil conditions were constructed in 2007 by sheep owner Don Schindel. This year, twenty sheep were placed in the east paddock (3 acres) and grazing began on May 7 and ended on May 21. The sheep were moved to the middle paddock (2 acres) on June 27 and continued to graze until July 25. The sheep were moved to the west paddock (4 acres) on July 25 and continued to graze until August 25.

A vegetation survey was conducted and photo points collected of each paddock. Reed canary grass still dominates all paddocks, however, the plant composition of the paddocks is changing. The east paddock now has cord grass, sedge species, spike rush, Kentucky bluegrass and brome. The middle paddock has sunflowers, common sneezeweed, Kentucky bluegrass and brome. The third paddock is 90% reed canary grass but is showing some diversity with daisy fleabane, goldenrod, wild carrot, sweet clover, thistle and brome. In the east paddock the sheep do not like the coarse texture of the cord grass or some of the sedges, which is allowing them to spread. In the photo below you can see where the sheep have eaten the reed canary grass area in the east paddock but you can see the sedges still standing. In the west paddock photo, thick reed canary grass dominates in the background. In an attempt to make the area more palatable to the sheep the landowner mowed some of the reed canary grass which you see in the middle of the photo. The light green in the forefront is the grazed area.

Avian Mortality Searches Under Wind Turbines

In addition to a large mortality study that Invenergy is conducting, a smaller study on 9 turbines near the Refuge is being conducted in cooperation with Jeff Gosse in Ecological Services in the Regional Office, Fort Snelling, MN and Steven M. Grodsky a graduate student from University of Wisconsin-Madison, Madison, Wisconsin. The focus of the study is to monitor wind turbines for avian mortality within a migratory pathway leading through the Horicon National Wildlife Refuge and the Horicon Marsh. This is the first year of the study.

Out of 88 turbines, 9 were randomly selected and located along the eastern border of the Horicon National Wildlife Refuge. The turbines selected to be monitored were numbers 18, 24, 27, 28, 44, 46, 47, 49, and 98. The selected wind turbine has a total of 6 transects, randomly placed within a 6.4 acre plot, with the turbine being the central point. Five transects were placed perpendicular to the turbine and the

6th being the access road and the continuation of it. Each transect is 15 feet wide by 528 feet in length. The 9 turbines were divided into two groups and surveyed once every third day, starting 15-20 minutes prior to sunrise. Depending on the type of vegetation cover (corn, alfalfa, soybeans) each turbine took approximately 30 minutes to search. With the help of volunteers, the turbine plots were searched by walking each transect and scanning for any sign of mortality. If mortality was observed, GPS coordinates were taken of the location and plotted on the data sheet map. Then the carcass would be identified, bagged and frozen until Steven retrieved it for necropsy. In 2009, there were two sets of survey dates. The first survey set started on April 15th, 2009 and ended on June 15th, 2009. During the 9 weeks of the spring survey, there was no avian mortality found.

The second survey set should have started on August 15th, 2009 and ended on November 15th, 2009. However, during the fall many crops (mostly corn) were not yet harvested. Transects were checked four times during the survey period to see if crops had been harvested yet. The fall survey was never set up due to crops still standing, which makes surveying the transects very difficult. Funding will determine whether this study will be continued in the future.

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

The following pertains to the northern two-thirds of the Horicon Marsh, which is managed by the U.S. Fish and Wildlife Service.

Facilities include a 6,000-square-foot visitor center with exhibit space, employee offices, and a large multi-purpose room. There is also an observation deck with scopes, a rustic environmental education barn, a viewing area on Highway 49 with interpretive exhibits and restrooms with running water, a paved auto tour route with interpretive kiosks and wayside signs, three hiking trails, a floating boardwalk and a paved link to the Wild Goose State Trail, two grassland hiking trails at the Bud Cook area with kiosk and observation deck with spotting scopes, and accessible fishing platforms at three different locations on the Refuge. Aside from these visitor use areas, the remaining part of the Refuge is closed to public access with the exception of statewide hunting seasons. Annual visitation is approximately 450,000 each year for priority public uses on the Refuge. Specifically in 2010, 331,000 people used the Refuge for wildlife observation, 195,000 people used the auto tour, 135,000 people used the hiking trails, 38,000 people used the Refuge for photography, and almost 11,000 people visited the visitor center.

Currently, numerous interpretive programs are conducted on and off the Refuge for ages ranging from pre-school children to adults. Primary topics include the history of Horicon Marsh, habitat management and resource issues.

Environmental education is the most developed component of the visitor services program to date. The Refuge piloted the Rhythms of the Refuge curriculum for Region 3 and has used activities found in the curriculum in numerous programs for local public, private and home-schooled groups, Scouts groups and community-based service organizations. Program participants range from preschool to adult, with the majority being elementary and middle school students. Activities are conducted at the visitor center, the Environmental Education barn, the Egret Trail and boardwalk, off-site in the classroom and through distance learning sessions. All programs are free and are led by trained volunteers and Refuge staff.

In addition to the standard curriculum, Refuge volunteers participate in the Rolling Readers literacy program and lead classroom activities relating to the Refuge. The Refuge also offers a variety of educational trunks and materials available for check-out such as the wildlife discovery trunk, prairie trunk, aquatic exotics, songbird trunk and wetland trunk.

In 2010, 1,828 people attended on-site environmental education programs and 955 people attended off-site environmental education programs. About 514 people attended on-site interpretive programs and 150 people attended off-site interpretive programs.

31. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

The following pertains to the northern two-thirds of the Horicon Marsh, which is managed by the U.S. Fish and Wildlife Service. The 1997 National Wildlife Refuge System Improvement Act emphasizes wildlife management and that all prospective public uses on any given refuge must be found to be compatible with the wildlife-related refuge purposes before they can be allowed. The Refuge System Improvement Act also identifies six priority uses of national wildlife refuges that in most cases will be considered compatible uses: wildlife observation, wildlife photography, hunting, fishing, environmental education, and (nature) interpretation. Opportunities to participate in all of these wildlife-dependent activities exist at Horicon Refuge.

Activities that are prohibited on the Refuge due to conflicts with wildlife include: camping, boating, canoeing, ATV's, snowmobiles, and fires. Bicycling, hiking, leashed dogs on trails, and trapping on an as-needed basis, are the only other activities that have been determined compatible with the priorities of the Refuge.

Hunting opportunities on the Refuge include Ring-necked Pheasant, Gray Partridge, cottontail rabbit, squirrel, and deer. The Refuge is closed to migratory bird hunting, other than a controlled Youth Waterfowl Hunt. There are also several opportunities for deer hunting for hunters with disabilities. State seasons and regulations apply to all Refuge hunters. The Refuge had about 9,042 people participate in hunting on the Refuge in 2010.

Fishing opportunities are limited to the public due to shallow water conditions and the absence of a variety of game fish. Boats are not allowed on the Refuge. Bank fishing in accordance with Wisconsin State fishing regulations is permissible on the Refuge at three locations: Main Dike Road, Ledge Road and Peachy Road. Main Dike Road and Ledge Road have accessible fishing piers on location, with one planned for installation at Peachy in 2011. Ice fishing is also available to those who are interested. One youth fishing event is held on the Refuge during the summer in celebration of National Fishing Week. The Refuge had about 5,326 people participate in fishing on the Refuge in 2010.

Trapping as a recreational and management tool is also offered to the public through an annual trapping auction held each fall. Interested trappers bid on the available areas and then retain the rights to trap muskrats on that area for the season. Upland trapping permits for muskrat, mink, raccoon, weasel, fox, coyote, opossum, and skunk are available to interested trappers at no charge. About 35 trappers are trapping the Refuge during the 2010/11 trapping season.

Wildlife observation is the most popular activity at the Refuge, with about 331,000 visits for this activity in 2010. At least 267 different species of birds have been documented on the Refuge over the years. The Refuge is recognized as both a state and globally important bird area. Between mid-September and mid-November, visitation is at its peak due to the fall migration of over one million geese that use the Refuge as a stopping point in their nearly 850-mile migration to southern wintering areas. The three mile paved Horicon Ternpike Auto Tour Route is an excellent place for wildlife observation and receives the highest annual visitation of any sites throughout the Refuge (195,000 people in 2010). Many public events and interpretive programs occur on the Refuge that focus on wildlife observation, mainly bird-watching, such as the Horicon Marsh Bird Festival and guided birding tours (see answer to question #30)

Consistent with the opportunities to view wildlife, many Refuge visitors also photograph the many

birds, mammals, and other creatures that they observe on the Refuge (38,000 photography visits in 2010). One photo blinds is available at this time, with another one planned for construction in 2011.

32. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

Department of Interior, U.S. Fish and Wildlife Service, Horicon National Wildlife Refuge, Wisconsin

Wisconsin Department of Natural Resources, Horicon Marsh Wildlife Area, Wisconsin

33. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

U.S. Fish and Wildlife Service
Horicon National Wildlife Refuge
W4279 Headquarters Road
Mayville, WI 53050

Wisconsin Department of Natural Resources
Horicon Marsh Wildlife Area
N7725 Highway 28
Horicon, WI 53032

34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.

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