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DEPARTMENT OF NATURAL RESOURCES

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Carlos Avery Wildlife Management Area Master Plan 2025-2034

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DEPARTMENT OF NATURAL RESOURCES

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4 Notice is hereby given that the Carlos Avery Wildlife Management Area Master Plan, 2025-2034 for the
5 Minnesota Department of Natural Resources has been completed and is now adopted.

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11 Sarah Strommen, Commissioner   Date
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17 Kelly Straka, Fish and Wildlife Division Director   Date
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22 David Trauba, Acting Wildlife Section Manager   Date

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I.   Executive Summary

Department of Natural Resources Mission Statement

The mission of the Minnesota Department of Natural Resources (DNR) is to work with Minnesotans to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.

Fish and Wildlife Division Vision and Purpose

The Fish and Wildlife Division (FAW) is responsible for managing fish and wildlife populations and providing related outdoor recreational opportunities in Minnesota. We conserve and enhance water and land habitats; regulate hunting, trapping, and fishing; foster environmental stewardship; and work with partners and the public to accomplish shared goals. Our work is informed by biological and social sciences, cultural and economic values, and our public trust obligation to manage fisheries and wildlife in perpetuity.

WMA System Description and Purpose

Wildlife Management Areas (WMAs) are part of Minnesota's outdoor recreation system and are established to protect those lands and waters that have a high potential for wildlife production, public hunting, trapping, fishing, and other compatible recreational uses. They are a key component of the DNR's wildlife management efforts and help ensure wildlife habitat for future generations by providing Minnesotans with opportunities for hunting, fishing, and wildlife watching, and by promoting important wildlife-based tourism in the state.

Carlos Avery WMA Vision Statement

Carlos Avery WMA will be managed to provide quality hunting, trapping, angling, foraging, and wildlife viewing, as well as other outdoor recreational experiences compatible with the statutory purpose of WMAs. Carlos Avery WMA is the largest WMA in the Twin Cities Metropolitan Area and provides about 25,000 acres of fish and wildlife habitat and convenient recreational opportunities at the urban/rural interface. Central to the Carlos Avery WMA is a diverse wetland system that transitions to an upland forest system as well as two Wildlife Sanctuaries totaling 4,050 acres. Management priority will be given to providing a balanced range of wildlife habitat conditions by promoting a diversity of wetland and forest habitats and successional stages. Plant communities and habitats will be managed to sustain ecological health and support species sought by hunters, trappers, anglers, foragers, wildlife viewers, and those exercising reserved treaty rights.

Carlos Avery WMA Master Plan Summary

This plan summarizes management activities for Carlos Avery WMA, an approximately 25,000-acre WMA in the northern part of Twin Cities Metropolitan Area. The last master plan for Carlos Avery WMA was written in 1977 and was intended to cover a 10-year period. This is the first formal updating of the master plan since 1977.

Significant changes in this plan reflect: a greater emphasis on enhancing native plant communities, increased knowledge of the habitat needs of flora and fauna in the Carlos Avery WMA, changing wildlife and human use of the area, more explicit acknowledgment of reserved treaty rights, and new challenges like invasive species and climate change. This plan reaffirms the commitment to provide healthy terrestrial and aquatic systems that support biodiversity. Planned management actions will benefit a variety of wildlife species and improve human use, as described below.

White-tailed deer, ruffed grouse, woodcock, turkey, and hunters will benefit by the creation of early-successional aspen habitat and by managing oak to maximize acorn production.

Black bear, white-tailed deer, squirrel, ruffed grouse, turkey, wood ducks, and hunters will benefit by increasing the production of raspberries, acorns, and other foods through appropriate thinning of hardwood stands to increase sunlight penetration to the forest floor.

Gray squirrel, turkey, and rabbit hunters will benefit from upland forest habitat management and brush management.

Waterfowl hunters and species such as Canada geese, mallards, blue-winged teal, wood ducks, ring-necked ducks, and hooded mergansers will benefit from managing impoundments for a mix of open water and emergent vegetation conditions (i.e., hemi-marsh conditions).

Hunters will also benefit from the production of snipe, sora, and other rails that occur in the grassed wetland fringes and in the wild rice stands prevalent on Carlos Avery WMA.

Trappers will benefit from ensuring there is quality wetland habitat (hemi-marsh) for aquatic furbearers.

Anglers will benefit by the presence of fish species such as black crappie, northern pike, walleye, smallmouth bass, white sucker, largemouth bass, bluegill, and yellow perch present in the Sunrise River and its impoundments.

Wildlife viewers and foragers will benefit from the maintenance of roads, trails, and habitats that support access to a rich diversity of plants and wildlife.

Wildlife species located downstream of the Carlos Avery WMA will benefit from the water quality, water temperature, and water quantity provided by the management actions on the Carlos WMA.

Those exercising reserved treaty rights will benefit from the above actions as well as from managing to increase the acreage of wild rice and verifying, locating, and protecting cultural sites within the Carlos Avery WMA.

The plan spells out existing conditions, strategic consideration, as well as management goals and the objectives and strategies needed to achieve them. Techniques are presented for management of the different habitat types, including water level management, prescribed fire, brush treatments, forest habitat enhancement through targeted timber harvest, and riparian and wetland protection and restoration. An annual calendar of management activities is included, as is a discussion of current and potential research and monitoring efforts.
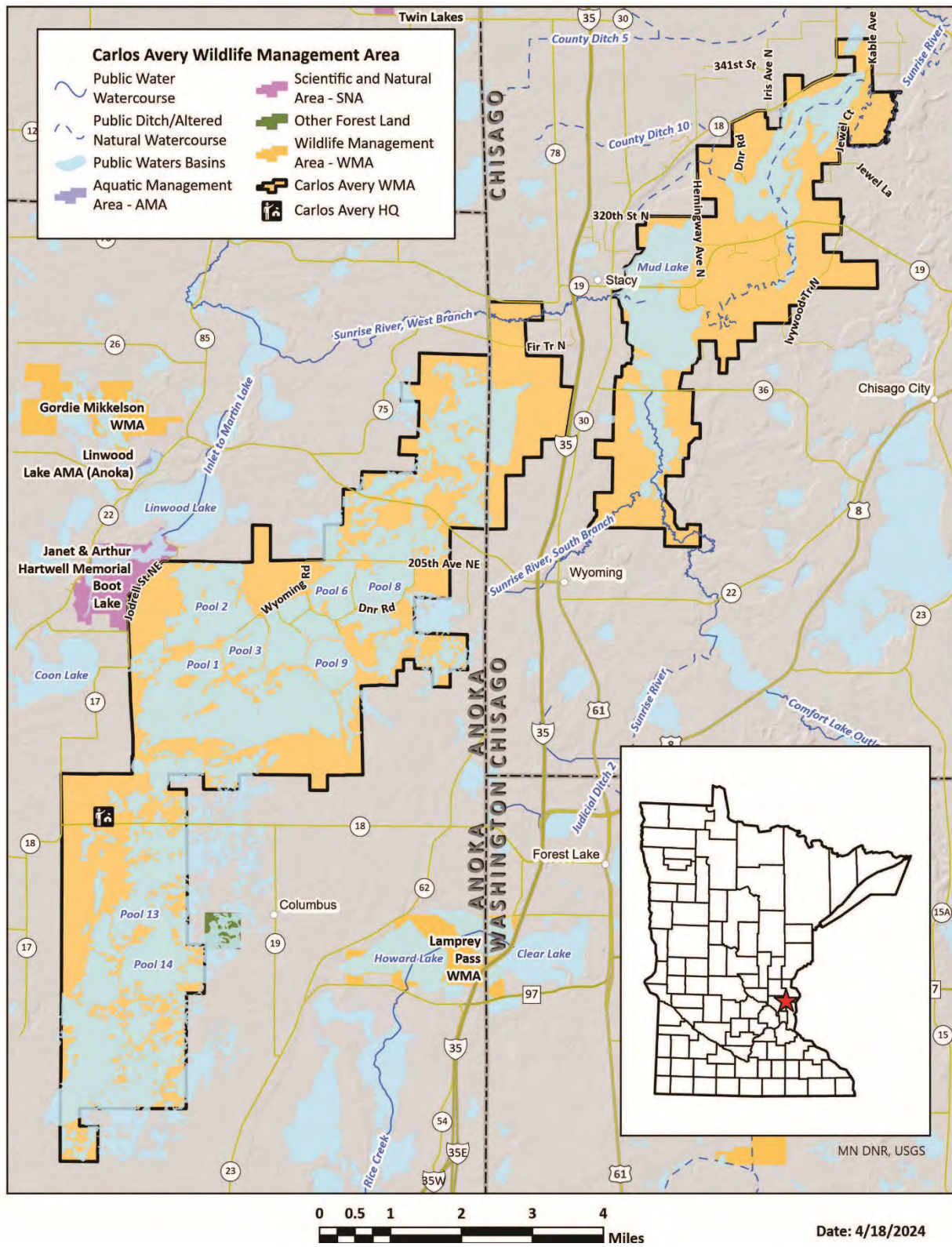
2   Figure 1: Map of Carlos Avery WMA. Detailed visitor map can be found here.

Table of Contents

22   List of Figures

List of Tables

4

II.   Introduction

Major Unit Definition

Minnesota currently has over 1,500 Wildlife Management Areas (WMAs) distributed across the state, totaling nearly 1.4 million acres. These WMAs are managed out of 37 local offices, and eight of them are classified as "major units": Carlos Avery (24,600 acres), Lac qui Parle (32,981 acres), Mille Lacs (38,729 acres), Red Lake (324,699 acres), Roseau River (75,206 acres), Thief Lake (54,957 acres), Vermillion Highlands (2,838 acres) and Whitewater (27,403 acres). Each of these major units manages a large WMA but may also manage other units within their work area. Major units are typically distinguished by having resident staff (Wildlife Area Supervisor and Assistant Wildlife Area Supervisor), although not all have resident staff. They also typically have greater acreage that is more intensively managed than most WMAs; more fleet assets including heavy equipment such as bulldozers, tractors, and graders; larger staff complements; and more capital improvements.

Purpose of Plan

This master plan outlines the management of Carlos Avery WMA through 2034 in accordance with the Minnesota Outdoor Recreation Act of 1975, specifically 86A.05, subd. 8. The plan's purpose is to provide management guidance, a basis for allocating staff and fiscal resources, direction for annual work planning, and metrics for measuring management accomplishments.

The previous master plan was prepared in 1977, and many environmental and social changes have occurred since then. Minnesota's population has grown, scientific knowledge has advanced, the climate has changed and continues to change, invasive species have proliferated, new state and federal policies have been enacted, recreation demands and preferences have changed, and many wildlife and plant populations have declined throughout the state. A revised management plan is needed to address and manage for these changing conditions. The plan update process also provides an opportunity to engage with a wide variety of Minnesotans using modern engagement tools and techniques. This plan is one of seven comprehensive management plans the DNR is updating for the state's WMA major units. They are 10-year management plans, which will continue to be revised as new management practices develop, resource paradigms evolve, and new challenges are encountered. Any mapped occurrence data provided within this plan is current as of January 2024. Any listing status, S-rank, SGCN status are current to January 2024 and are subject to change.

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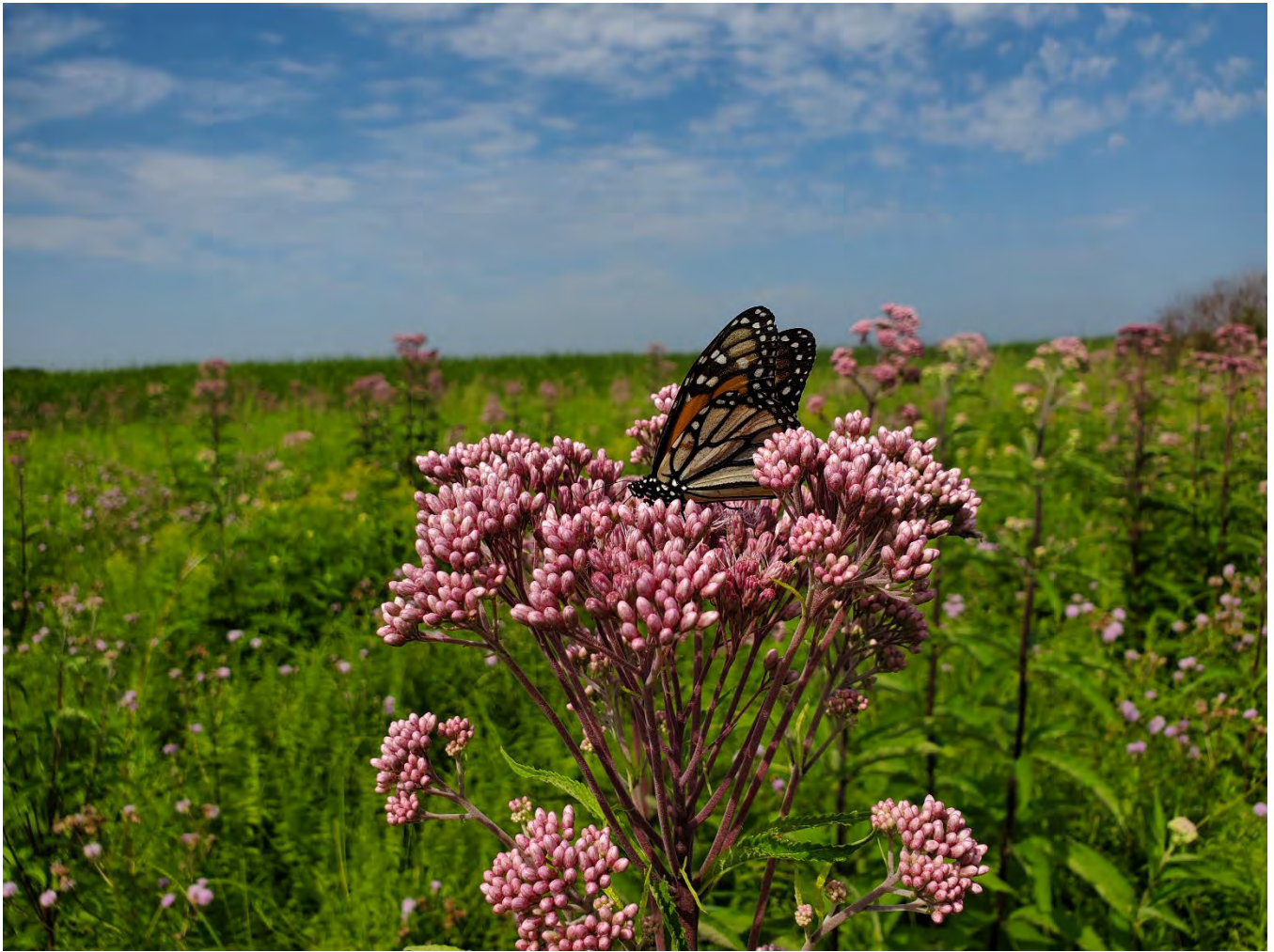
Figure 2: Photo of a monarch butterfly (*Danaus plexippus*) on a spotted joe-pye weed (*Eutrochium maculatum*) in pool 3 of
the Carlos Avery WMA. This photo was taken in the summer following a spring prescribed burn of pool 3.

Long-range Goals

For Carlos Avery WMA, the overarching long-range goals outlined in this plan are:

1. Maintain or enhance wildlife habitat and biodiversity.
2. Maintain or enhance hunting, fishing, trapping, other compatible outdoor recreational opportunities, and the exercise of reserved treaty rights.

Planning Process

The planning process used to develop this plan involved an interdisciplinary DNR project team made up of staff from multiple DNR divisions (Appendix A) and insights provided by tribal partners, external stakeholders, and members of the public.

In October 2023, a DNR project team (Appendix A) started meeting to begin the work of scoping and drafting the Carlos Avery WMA plan.

In February 2024, a public scoping process began to help identify what topics should be addressed in the Carlos Avery WMA plan. From February 8 to March 15, 2024, an online scoping questionnaire was available to stakeholders and the public that asked people to describe their use of, desires for, and concerns about the Carlos Avery WMA. This questionnaire was announced via a DNR news release and open to anyone who wanted to take it. The scoping questionnaire was completed by approximately 360 individuals. In addition to the online questionnaire, two public meetings were held to identify what topics participants wanted to see addressed in the WMA and how they wanted to be involved going forward. The in-person public meeting was held at the Carlos Avery WMA on February 28th and 18 people participated. The online public meeting was held on March 6th and 5 people participated. Findings from this scoping engagement are provided in Appendix H.

To provide Tribal Nations with treaty rights on the WMA the opportunity to influence the scope and content of the WMA plan, Tribal coordination was conducted with representatives of both the Mille Lacs Band of Ojibwe and the Great Lakes Indian Fish and Wildlife Commission. One individual from the Mille Lacs Band of Ojibwe and one individual from the Great Lakes Indian Fish and Wildlife Commission served as technical advisors to the project. These technical advisors provided guidance and feedback during the planning process.

The review process for the full draft of the Carlos Avery WMA plan started in the summer of 2024, with comments being received and revisions being made during each round of revision. In July 2024, a complete draft of the plan was distributed for internal DNR staff review. The formal Tribal review process took place from August 5th to August 16th, 2024.

From September 16th to November 1st, 2024, a public comment period was held to provide stakeholders and the public an opportunity to review the draft Carlos Avery WMA plan. Comments were accepted via mail, email, an online survey, and two public meetings. An in-person public meeting was held on October 15th and an online public meeting was held on October 21st, 2024. All comments were reviewed and responded to by the project team. A list of the comments received, and the responses provided to these comments, can be found in Appendix H.

Guiding Documents

Management at Carlos Avery WMA is informed and guided by an array of federal and state statutes, rules, directives, operational orders, and plans. A list of many of these documents is included in Table 1. The management objectives and strategies in this plan were developed within the context of these existing statutes, rules, directives, and plans. Due to the interdisciplinary nature of DNR's work, individual management decisions are often context-dependent and require close and consistent coordination beginning at the local level and attention to multiple applicable guidance documents. When appropriate and relevant, the DNR considers plans developed by other agencies and organizations. This coordination helps ensure that all management decisions and actions taken within Carlos Avery WMA will be made to the benefit of wildlife, wildlife habitats, and compatible outdoor recreation.

Select WMA Statutes and Rules

Carlos Avery WMA habitat management and operations are typically supported through federal Pittman-Robertson Wildlife Restoration Act grants (16 U.S.C. 669 et seq.). Wildlife Restoration grants require that habitat management and operation activities serve wildlife management purposes (50 CFR 80.50). A large portion of Carlos Avery WMA was acquired with Wildlife Restoration grant funds and must, therefore, comply with federal regulation 50 CFR 80.134. These grant-acquired properties must continue to serve the purpose for which they were acquired, and grant acquired property may not be sold without USFWS approval. For these grant-acquired portions of the Carlos Avery WMA, management must first adhere to relevant federal laws and rules and then secondarily to relevant state statutes and rules.

Minnesota Statues, Chapter 84 Department of Natural Resources, Section 84.942 Fish and Wildlife Resources Management Plan states that the commissioner shall prepare fish and wildlife management plans designed to accomplish the policy of section 84.941.

Minnesota Statutes, Chapter 86A Outdoor Recreation System, Section 86A.05 Classification and Purposes defines the purpose of state WMA as "to protect those lands and waters that have a high potential for wildlife production and to develop and manage those lands and waters for the production of wildlife, for public hunting, fishing, and trapping, and for other compatible outdoor recreation uses." It also states that WMAs need to be administered in a manner that will "perpetuate, and if necessary, reestablish quality wildlife habitat for maximum production of a variety of wildlife species." Finally, "public hunting, fishing, trapping, and other uses shall be consistent with the limitations of the resource, including the need to preserve an adequate brood stock and prevent long-term habitat injury or excessive wildlife population reduction or increase. Physical development may provide access to the area but will be developed to minimize intrusion on the natural environment."

Minnesota Statute Section 86A.09 Development and Establishment of Units describes the requirements that apply to the development of the master plan.

Minnesota Statute Section 97A.135 Acquisition of Wildlife Lands, Subdivision 1, Public Hunting and Wildlife Areas states that the commissioner may designate land acquired under this subdivision as a wildlife management area for the purposes of the outdoor recreation system.

Minnesota Rule Chapter 6230 Wildlife Management has general and specific rules that apply to wildlife management areas.

Additional Documents

There are several existing federal, state, and local documents and statutes that guide or complement the management objectives and strategies outlined in this plan (see Table 1).

1   Table 1. Additional documents and statutes used to guide the development of the Carlos Avery WMA Master Plan.

2   Acronyms used in this plan are listed in Appendix G.

Document Name	Plan Year	Document Owner
American Woodcock Conservation Plan	2008	Multiple
Audubon Minnesota Blueprints for Bird Conservation	2014	Audubon Minnesota
Conservation Agenda	2015-2025	DNR
Deer Plan	2019-2028	DNR
Deer Population Goal Setting	2023	DNR
Duck Action Plan	2020-2023	DNR
Endangered Species Statutes • Minnesota's Endangered Species Statute • Federal Endangered Species Act • Federal Balk and Golden Eagle Protection Act		Minnesota and Federal Statutes
Executive Order 11990, Protection of Wetlands	1977	Federal Executive Order
FAW Directive No. 070605: Outdoor Recreation Area Unit Administrative Handbook	2010	DNR
Forest Resource Management Plan • Sustainable timber harvest analysis, decisions, and planning • Current 10-Year Stand Exam List • Anoka Sand Plain Subsection Forest Resource Management Plan • Mille Lacs Uplands Subsection Forest Resource Management Plan		DNR
Lakes States Forest Management Bat Habitat Conservation Plan	2023	DNR

Document Name	Plan Year	Document Owner
Managing Minnesota's Shallow Lakes for Waterfowl and Wildlife: Shallow Lakes Program Plan	2010	DNR
Minnesota Wolf Management Plan	2023	DNR
Minnesota's Wildlife Management Area Acquisition	2002	The Citizens' Advisory Committee
Ruffed Grouse in Minnesota: A Long-Range Plan for Management	2012	DNR
Sunrise River Watershed Management Plan	2019	Sunrise River Watershed Management Organization
Surveillance and Management Plan for Chronic Wasting Disease	2019	DNR
Tomorrow's Habitat for the Wild & Rare: An Action Plan for Minnesota Wildlife – Anoka Sand Plain Subsection Profile	2006	DNR
Wetland Conservation Statutes • Wetland Conservation Act • CHAPTER 8420, WETLAND CONSERVATION • CHAPTER 103G. WATERS OF THE STATE • CHAPTER 6115, PUBLIC WATER RESOURCES		Minnesota Statute
Working with Partners for Wildlife Conservation: Minnesota's Wildlife Action Plan	2015-2025	DNR

III. History

Area History

The Carlos Avery WMA area is rich in natural resources, with a long history of different communities using these resources for socially, culturally, and economically important reasons. The area has undergone a variety of human and ecological changes, especially since European American settlement. The Carlos Avery area has been home to indigenous communities for many hundreds of years. Long before Europeans arrived, the Dakota and, shortly thereafter, the Ojibwe (Anishinaabe) lived here.

1   Despite initial peace and cooperation between the Dakota and the Ojibwe, competition for resources
2   led to decades of conflict that gradually displaced the Dakota from the region.

3   In 1837, before Minnesota was a state, the Mille Lacs Band of Ojibwe, the Fond du Lac Band of Lake
4   Superior Chippewa, and six Ojibwe tribes from Wisconsin[1] signed a treaty that ceded lands, including a
5   large section of east-central Minnesota that contains the northern half of Carlos Avery WMA, to the
6   United States government and opened the area to European American immigration and economic
7   development. The tribes signed the Treaty of 1837 on the condition that they would still have the right
8   to hunt, fish, and gather in the ceded territory — rights that have been upheld by the U.S. Supreme
9   Court. In Minnesota vs. Mille Lacs Band of Chippewa Indians et al., 526 U.S. 172 (1999), the Supreme
10 Court affirmed that the Mille Lacs Band, Fond du Lac Band, and the six Ojibwe tribes from Wisconsin
11 retained their off-reservation treaty rights to hunt, fish, and gather throughout the 1837 ceded
12 territory. Exercising these rights remains important to the Ojibwe people as they pass these traditions
13 on to future generations. In the late 1800s, many Ojibwe in Minnesota were forcibly moved by the U.S.
14 government to the White Earth reservation. But some, including the Non-Removable Mille Lacs Band
15 of Ojibwe, resisted relocation and remained. As outlined in the Existing Conditions section of this plan,
16 tribal members continue to use the Carlos Avery WMA for hunting, fishing, and gathering.

17 In the late 19th century, the Crex Carpet Company (initially called the American Grass Twine Company)
18 purchased more than 8,000 acres of marsh in what is now the Carlos Avery WMA to grow the raw
19 material to manufacture grass rugs. From about 1895 to 1930, Crex Carpet Company employed a
20 seasonal crew of people to harvest wire-grass (*Carex lasiocarpa*) and transport it to Saint Paul for
21 processing into rugs and other products (Smith 2017). The factory in Saint Paul employed
22 approximately 900 people in 1903 and about 300 people in 1910s and 1920s. Marsh vegetation was
23 managed by mowing, prescribed burning, and water level manipulation to aid in the growing of
24 wiregrass. In an attempt to use heavy agriculture machinery to harvest wiregrass, the Crex Carpet
25 Company lowered water levels through a system of drainage ditches. Repeated cutting, coupled with
26 lowered water levels, allowed broad-leaved forbs and grass to invade the wetlands and replace
27 wiregrass. Competition from imported rugs and rugs made from synthetic materials caused the Crex
28 Carpet Company to stop being profitable. The company's losses began in 1926, and the last wire grass
29 harvest took place in 1931, with the factory closing soon after. The 8,000 acres of land became tax
30 delinquent and the Crex Carpet Company filed for bankruptcy.

Carlos Avery WMA History

31
32 The Minnesota Conservation Commission (now the Department of Natural Resources) realized the
33 potential of this abandoned marshland as wildlife habitat and for public hunting. Land acquisition
34 began in 1933 after project approval from the Anoka County and Chisago County commissioners. The

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[1] These include the Bad River Band of Lake Superior Chippewa, Lac Courte Oreilles Band of Lake
Superior Ojibwe, Lac du Flambeau Band of Lake Superior Chippewa Indians, Mole Lake Band of Lake
Superior Chippewa, Red Cliff Band of Lake Superior Chippewa, and St. Croix Chippewa Indians of
Wisconsin.

initial purchase of 8,478 acres was tax delinquent Crex Carpet Company land. In 1935, an additional 120 acres were purchased, and 800 acres leased. During the 1941 and 1942 biennium, 5,577 acres were acquired. In 1952, the Carlos Avery WMA started adding the Sunrise Unit in Chisago County, with 7,100 acres purchased by 1963.

The Carlos Avery WMA was named after Carlos Avery (1868-1930), the first commissioner of the Minnesota Game and Fish Commission, a precursor to the Minnesota Department of Natural Resources.

Initially, the Carlos Avery WMA was surveyed, developed, and managed by an Emergency Conservation Work camp. The Works Project Administration (WPA) constructed buildings and a game farm in 1935. A resident manager was hired in 1936 to provide coordinated development and planning for wildlife management projects. In 1938, 120 acres within Carlos Avery were designated as a nursery for the propagation of shrubs and trees for wildlife habitat improvement projects. The WPA continued to provide assistance for the construction of buildings, roads, dikes, and with wildlife habitat improvement until 1942.

During the 1930's, hand-reared birds were released, and exotic species such as ring-necked pheasant introduced on wildlife lands in Minnesota to increase both hunter success and existing wildlife populations. Accordingly, game farm operations and stocking on Carlos Avery began in 1937 with a quail propagation program. Propagation of quail was discontinued in 1955 due to unsuitable habitat. In 1938, a chukar partridge stocking program was initiated but was abandoned in 1947 also due to unsuitable habitat. Ring-necked pheasant propagation began in 1947 and continued to 1981. For ring-necked pheasants, approximately 50,000 day-old chicks were distributed each year from the game farm to school groups and sportsmen's clubs throughout the state. From 1950 to 1970, Canada geese were raised for distribution to state-owned management areas for the purpose of establishing resident goose flocks. In 1976, a prairie-chicken propagation program was initiated to provide birds for release on the Lac qui Parle WMA in west-central Minnesota. In 1981, the management philosophy changed, and the Minnesota DNR discontinued large-scale gamebird breeding programs and changed its focus to improving habitat.

The tree nursery was operated by the Game and Fish Division (now the Division of Fish and Wildlife) until 1956 when the Forestry Division assumed responsibility. Nursery stock was raised for wildlife management purposes, soil and water conservation, and forest restoration on all state-owned lands. Stock was also provided to private landowners. Between 4 and 6 million trees and shrubs were produced each year from 1956 to 1973, when nursery operations were phased out. In 1976 all operations ceased, and the stock was moved to other state-owned nurseries. The 90 acres of seedbeds are presently used as wildlife food plots and for the propagation of native prairie grasses for habitat and seed collection. The Minnesota Department of Natural Resources Division of Forestry currently maintains a wildfire suppression base at the former nursery.

The Carlos Avery contains three State Wildlife Sanctuaries, currently totaling 4,600 acres, which provide undisturbed areas for migrating waterfowl and resident wildlife. The total acreage of the State Wildlife Sanctuary has increased over time, and the initial Wildlife Sanctuary included the WMA headquarter buildings and the game farm. The Wildlife Sanctuaries are closed to all public use (including hunting, fishing, hiking, birdwatching) without a permit.

Archaeological and Other Historic Aspects

There are eight verified cultural resource sites on the Carlos Avery WMA, which include evidence of both Native American and European presence. These sites were verified during a 1978 survey by the University of Minnesota and during 15 investigations conducted by the Cultural Resource Programs from the DNR's Division of Forestry and Division of Fish and Wildlife between 2007 and 2022. WMA staff adhere to state and federal guidelines to protect and preserve these cultural resources.

Eleven buildings and three structures on the Carlos Avery WMA are listed on the National Register of Historic Places. The 1991 application to the National Register of Historic Places states their significance as "one of the largest and best equipped game farms in the nation at the time the facility was first placed in operation in 1937" and a "picturesque collection of buildings and structures designed in an unusual adaptation of the Colonial Revival Style." WMA staff ensures that the repair and upkeep of these structures aligns with the requirements of the National Register of Historic Places. For example, to keep buildings exteriors looking as close to the original as possible, windows, doors, and siding cannot be updated to low-maintenance varieties. As a result, staff conduct regular maintenance on buildings such as staining and painting wood doors, windows, and siding. In addition, staff coordinate with contractors to ensure all building maintenance projects comply with historical requirements.

Figure 3: Photo of entrance gateway to the Carlos Avery WMA. Photo taken in 1989 and included within application to the National Register of Historic Places.

IV. Existing Conditions

Land Ownership

The type of land ownership and associated policies strongly influence natural resource management on state-owned lands. The management goals and designation type are affected by the acquisition history, present land ownership patterns, the sources of acquisition funds, and federal, state, and county policies. Ownership type is further described and discussed in the following sections.

Acquisition of Wildlife Lands

The Commissioner of Natural Resources, or their designee, such as the Director of the Fish and Wildlife Division, is authorized to acquire lands for wildlife management purposes. A regional Strategic Land Asset Management team meets twice a year to prioritize existing and new proposed acquisition projects. After approval through this regional process, the Division of Fish and Wildlife may attempt to acquire lands from willing sellers. The division must also obtain approval from the appropriate county board before land can be purchased for a WMA. Newly acquired WMAs are designated by the Commissioner and the public notified through the State Register.

Multiple funding sources are used for wildlife land acquisition, including the state's Game and Fish Fund, which is funded by proceeds of hunting and fishing licenses, and federal matching funds from the Pittman-Robertson Wildlife Restoration Act. In addition, wildlife land acquisition has been through state bonding funds, and through the Environment and Natural Resources Trust Fund as recommended by an administrative committee, the Legislative-Citizen Commission on Minnesota Resources (LCCMR). Since 2011, wildlife land acquisitions have also been funded through a Legislative appropriation known as the Outdoor Heritage Fund, through its administrative body, the Lessard-Sams Outdoor Heritage Council (LSOHC).

Lands purchased with federal dollars and most purchased with state dollars have use restrictions. The land must be bought for a wildlife conservation purpose and continue to be used for a wildlife conservation purpose. Examples of such programs include the federal Pittman-Robertson Fund (50CFR Part 80.134), the Outdoor Heritage Fund, and the state Game and Fish Fund. Currently, 12,608 acres, or approximately half, of the Carlos Avery WMA was acquired using the Pittman-Robertson Fund, and 362 acres (~1.5%) was acquired using the Outdoor Heritage Fund. It is important these lands are not used for a non-conservation purpose, since doing so could put these funds at risk statewide. Any necessary, non-conservation uses of wildlife lands, for example, a road-widening easement through a WMA must be approved by the funding organization through an extensive divestiture process. Generally, approved wildlife conservation activities in the Carlos Avery WMA include the operation of public hunting grounds and the improvement of wildlife habitats.

Acquisition of the Present Carlos Avery WMA

The Carlos Avery WMA was established in 1933 and land acquisition for the Carlos Avery WMA began in 1933 with the acquisition of 8,478 acres of tax delinquent Crex Carpet Company land. In 1942, another 5577 acres was acquired. In 1952, Carlos Avery WMA started adding the Sunrise Unit in Chisago County, with 7,100 acres of this unit purchased by 1963. Tax forfeited lands along with private

1 land acquisitions, comprised the bulk of the acquisitions. There have been minimal acquisitions since
2 the completion of the 1977 plan, and most recent acquisitions have been funded through the Outdoor
3 Heritage Fund. The current acquisition plan map, created in 2017, identified an overall acquisition goal
4 of almost 27,000 acres and the Carlos Avery WMA currently encompasses approximately 24,600 acres
5 of that total approved project boundary.

6 The highest priority acquisitions for the Carlos Avery WMA include inholdings and round-outs along the
7 existing WMA boundary. Priority for future acquisitions will be given to lands resolving boundary issues
8 or containing rare habitats, plants, or animal species. The purchase of additional lands is only
9 completed with willing sellers.

10

11 Figure 4: Southern Dry-Mesic Oak (maple) Woodland at Carlos Avery WMA.

Area Description

Landscape Context

Carlos Avery WMA is located in Anoka and Chisago counties. Anoka County is part of the 7-county Metropolitan Area and Chisago County is directly adjacent. Carlos Avery WMA is an important wildlife habitat corridor that brings wildlife into the core of the Twin Cities Metropolitan Area and increases local biodiversity.

Carlos Avery WMA is near the headwaters of the Sunrise River which drains into the St. Croix River. The South Branch of the Sunrise River originates just west of the WMA near Coon Lake. The West Branch also originates west of the WMA before flowing into the Sunrise Unit of the WMA, where the two branches unite to form the Sunrise River. The St. Croix River is designated as a Wild and Scenic River and supports numerous state and federally listed species of mussels. Therefore, the WMA is critical for protecting and regulating water quality near the headwaters of the system. The WMA is also the headwaters for Coon Creek, which flows into the Rum River and then the Mississippi River. As the highpoint of the landscape, the drainage systems are typically poorly developed, so water is retained on the landscape. Water storage bodies at the top of watersheds are usually shallow marshes and wetlands rather than deep water bodies. This allows the Carlos Avery WMA to potentially store water within the landscape without flooding neighboring properties.

Several other public lands are located in close proximity to Carlos Avery WMA, including Boot Lake Scientific and Natural Area (SNA) (660 acres), Gordie Mikkelson WMA (860 acres), and Lamprey Pass WMA (1,277 acres). These tracts of public land provide important habitat for rare species and habitats in this unique landscape.

Boot Lake SNA, in particular, abuts the northwest corners of the Carlos Avery WMA and is home to a 79 acre stand of designated old growth white pine. It is estimated that this old growth stand became established around 1780, and it is the sixth oldest white pine stand in Minnesota, and the oldest patch of forest of any species south of Aitkin County. Designated Old Growth stands each have a mandated "Special Management Zone" (SMZ) surrounding them to ensure that the Old Growth stand is adequately buffered from disturbance. Part of the (SMZ) for Boot Lake SNA Designated Old Growth stand extends onto Carlos Avery WMA and overlaps with the Victor Hill Forest Management Area (Figure 5). The Victor Hill Forest Management Area includes several relatively unique Native Plant Communities locally that are habitat for red-shouldered hawks. These plant communities are managed with an emphasis on maintaining the forest and wetland plant communities and ensuring that habitat for red-shouldered hawks is sustained.

Radio Dunes SMA includes dune formations, Dry Barrens Oak Savanna, and two state-listed rare species, beach heather and northern barrens tiger beetle. This area is managed to sustain the oak savanna plant community and its component rare communities.

Nearly all the Main Unit of Carlos Avery WMA has been identified as an area of Outstanding Biodiversity Significance by the Minnesota Biological Survey (Figure 6). In addition, 667 acres of the southwestern corner of the Sunrise Unit have been designated as an area of High Biodiversity Significance.

The Minnesota Wildlife Action Plan (MNWAP) identifies this area as having medium-high quality habitats and species presence in the Wildlife Action Network, which indicates that this area provides important habitats for Species of Greatest Conservation Need (SGCN). MNWAP identified the majority of Carlos Avery WMA and much of its surrounding landscape (i.e., the St. Croix River Watersheds) as a Conservation Focus Area. Conservation Focus Areas are places with the need and/or opportunity to focus conservation activities on habitat restoration or enhancement for SGCN. Conservation Focus Areas are based on mutual priorities of both the DNR and conservation partners active within them.

Carlos Avery WMA is located at the boundary of two distinct Ecological Classification System (ECS) provinces: the Eastern Broadleaf Forest and Laurentian Mixed Forest. Below the province-level, the WMA is positioned primary in the Anoka Sand Plain Subsection; only a few acres of the Sunrise Unit abut and extend into the Mille Lacs Uplands Subsection.

Certain wildlife species are considered Ecosystem Engineers or Ecological Keystone Species because of the role they play in shaping the landscape, vegetation, and/or influencing other species' ranges. Carlos Avery WMA is within the range of several of these species, including gray wolf, white-tailed deer, beaver, plains pocket gopher and numerous woodpecker species (especially pileated woodpecker). These species are widespread and abundant, except for the gray wolf, which is at the southern periphery of its continental range. Climate change is expected to shift some species ranges farther north, while other species from the south have already moved north and others will likely as well. These northward migrators include wild turkey, red-bellied woodpecker, northern cardinal, and Virginia opossum.
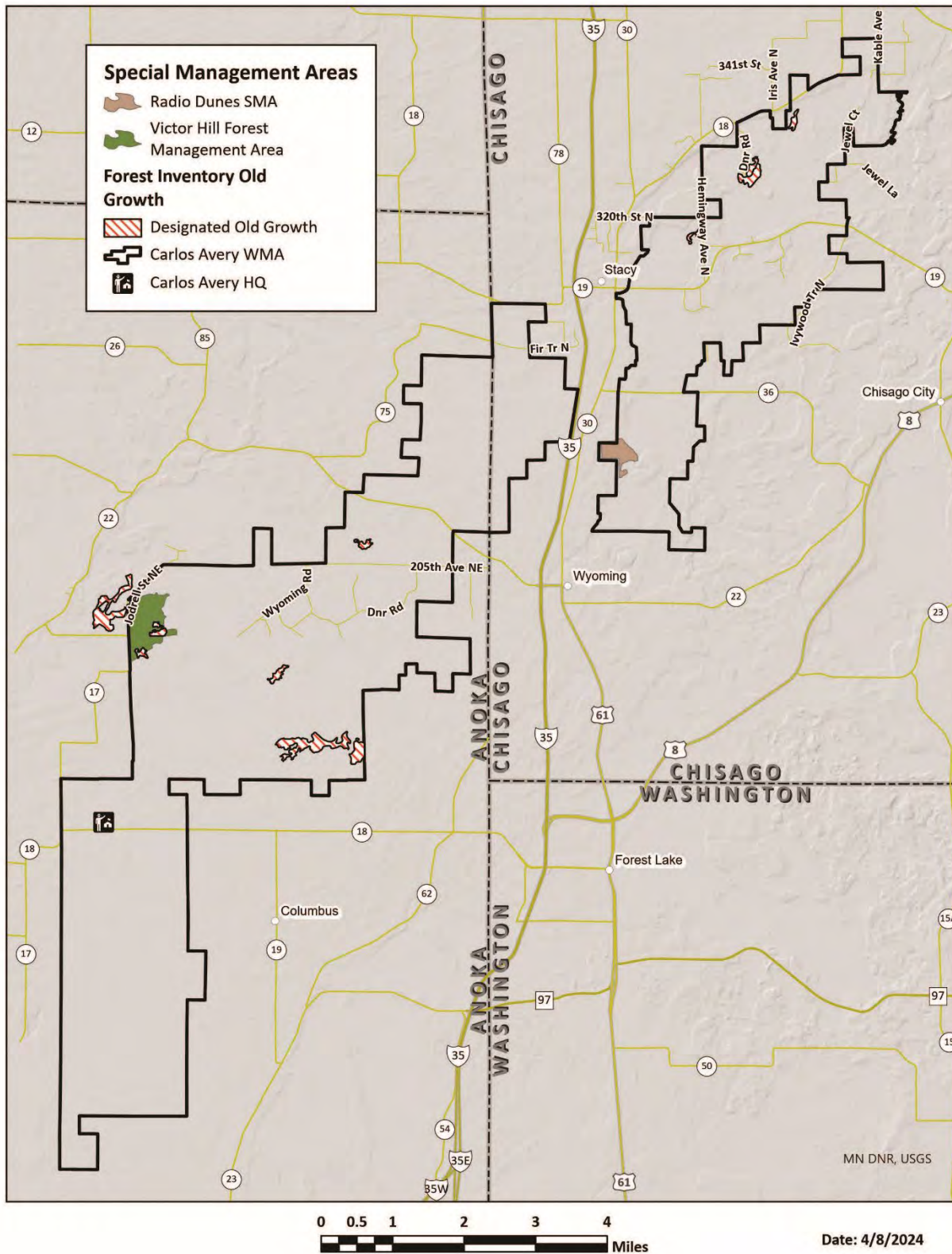
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2   Figure 5: Special Management Areas and Designated Old Growth stands in Carlos Avery WMA.
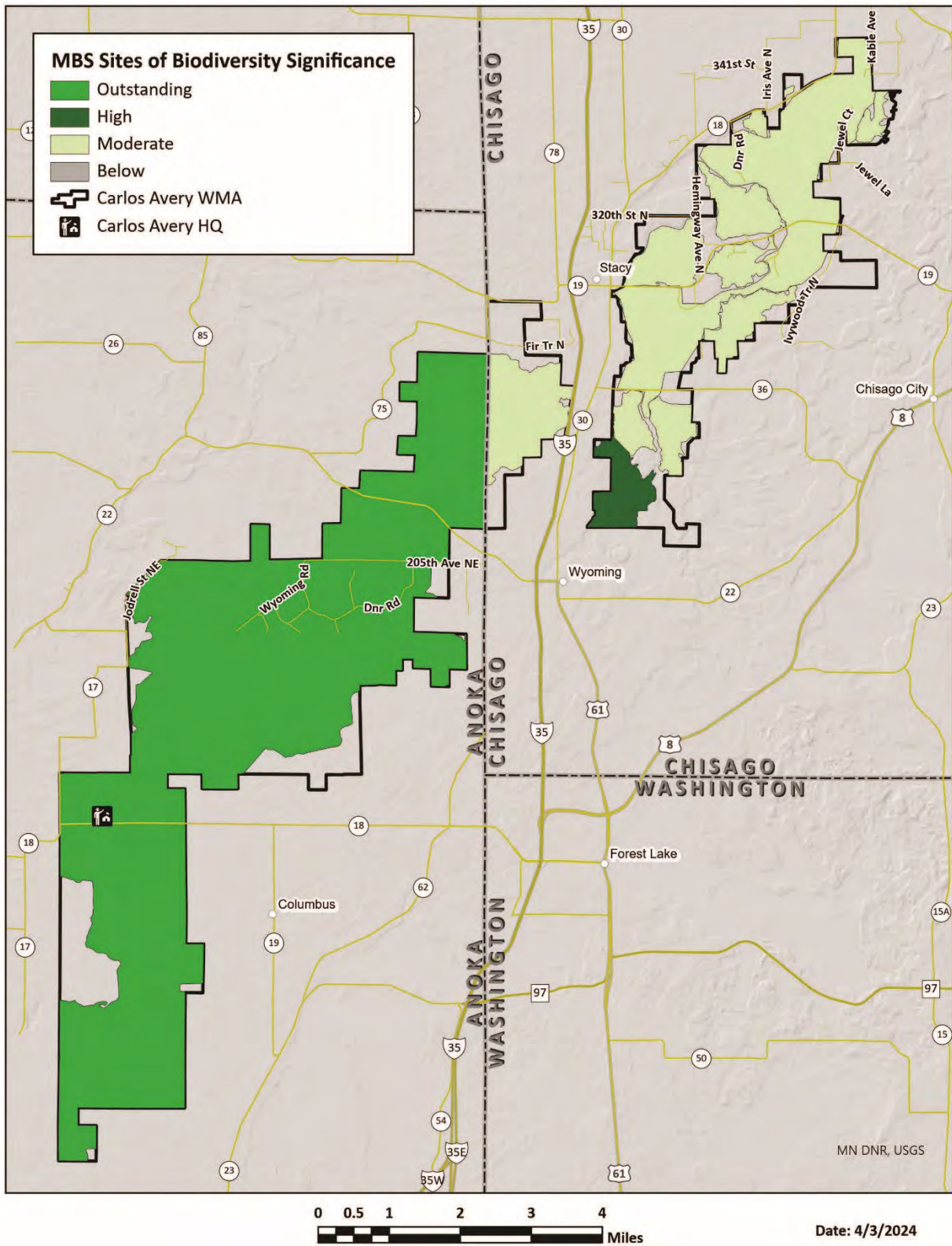
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2　　　Figure 6: MBS Sites of Biodiversity Significance in Carlos Avery WMA.

1

Socioeconomic Context

3   Carlos Avery WMA is unique among Minnesota's major unit WMAs, being located only 30 miles from
4   Saint Paul and Minneapolis, bisected by a major interstate highway, and adjacent to growing suburban
5   communities. The Carlos Avery WMA is one of largest blocks of contiguous public land within the
6   greater Twin Cities seven county metropolitan area. Over half of Minnesota's total population can
7   make a day trip to utilize the resources that this unit has to offer. Carlos Avery WMA serves as an
8   important public land base for hunting, trapping, fishing and other compatible uses in the Twin Cities
9   metropolitan area.

10   Carlos Avery WMA is located in both Anoka County (pop. 372,441; $92,133 Median Household Income)
11   and Chisago County (pop. 58,535; $97,446 Median Household Income). These two counties have
12   grown significantly since 1990 with Anoka county growing 53% and Chisago county growing 92%,
13   whereas the overall population of Minnesota has grown 31%. The cities directly adjacent to Carlos
14   Avery have experienced similar growth (Table 2).

15   Table 2: Population, population growth since 1990, and Median Household Income of cities adjacent to Carlos Avery WMA
16   (census.gov). Median Household Income for the entire state of Minnesota is $82,338. The population of Minnesota has
17   grown 31% since 1990.

City	Current Population	Population growth since 1990	Median Household Income (2022)
Columbus	4,231	+13%	$103,906
East Bethel	12,189	+51%	$116,453
Ham Lake	16,726	+87%	$112,854
Stacy	1,703	+37%	$71,389
Wyoming	8,057	+276%	$99,821

18

19   Carlos Avery WMA has a long and relatively narrow shape, running from southwest to northeast, and
20   as a result it has a long boundary. This long border, in its mixed suburban/rural location, leads the
21   WMA to have a high number of neighboring landowners relative to its size – overall Carlos Avery WMA
22   has about 527 neighbors who share a border with the WMA (Table 3). This number of neighboring
23   landowners is almost as large as the number for the Red Lake WMA, which is the largest WMA in the
24   state and more than 13 times the size of Carlos Avery WMA. The interests and concerns of these
25   neighbors can differ greatly, especially given that the land use varies from new, high-end housing
26   developments to long-standing homesteads, agriculture, commerce, and industry. This large number of

1 neighbors and diverse set of neighboring land use increases the interest in and demands on the WMA,
2 as further discussed in the Human Activities and Operational Context sections of the plan.

3 Table 3: Major unit WMAs, their acreage, and their number of adjacent landowners. Number of adjacent landowners is
4 approximate given it is a number that is constantly changing.

WMA	Area (acres)	Number of adjacent landowners
Carlos Avery	24,600	527
Lac qui Parle	32,981	236
Mille Lacs	38,729	153
Red Lake	324,699	560
Roseau River	75,206	157
Thief Lake	54,957	302
Vermillion Highlands	2,838	27
Whitewater	27,403	275

5

Geology and Soils

Geology

8 The surficial geologic deposits and landforms of the Carlos Avery WMA are the result of unconsolidated
9 sediment deposited by glacial ice and meltwater toward the end of the most recent glaciation
10 (Wisconsin Episode). During the Wisconsin Episode, an enormous ice sheet advanced from the
11 northeast out of the Lake Superior Basin. This ice advanced and receded multiple times into what is
12 now Minnesota. After the ice sheet completely receded, an offshoot of a separate immense ice sheet
13 that originated from the northwest in Canada advanced into the Twin Cities area (Meyer, 2010; 2012).
14 The offshoot, referred to as the Grantsburg sublobe of the Des Moines lobe, covered the area with ice
15 one final time. The Grantsburg sublobe blocked drainage in the St. Croix River valley creating a large
16 glacial lake, glacial Lake Grantsburg, that inundated a vast area of east-central Minnesota and west-
17 central Wisconsin. Over time, the Grantsburg sublobe receded and glacial Lake Grantsburg drained via
18 the St. Croix River valley. Subsequent stagnation of ice created ice-walled lakes and large volumes of
19 meltwater. A major blockage of drainage by the Barrens fan in the St. Croix River valley created
20 another vast glacial lake, glacial Lake Anoka, which covered large portions of Anoka and Chisago
21 counties and portions of the surrounding region (Meyer, 2010; 2012). Meltwater from stagnate glacial
22 lobes began to fill glacial Lake Anoka with mostly fine-grained sand. Ice blocks entrained within the
23 sand melted, creating low spots on the land surface where the water table was exposed as lakes and

1 open-water wetlands. In more recent time, organic-rich deposits (peat and decaying plant matter)
2 accumulated in some of these low-lying areas and in abandoned drainageways.

3 Unconsolidated glacial sediment at Carlos Avery WMA varies in thickness from approximately 100-400
4 feet. Maximum thicknesses occur where buried valleys cut into the underlying Paleozoic bedrock
5 (Runkel, 2010; Mossler, 2013). Bedrock units underlying the WMA consist of Cambrian-aged
6 formations ranging from the Jordan Sandstone to the Mt. Simon Sandstone (Runkel and Boerboom,
7 2010; Mossler, 2012).

8   *Soils*

9 The Carlos Avery WMA has deep, moderately dark, sandy soils of glacial origin interspersed in very
10 poorly drained, organic soils. Most of the management area is located in the Rifle-Isanti soil
11 association. Isanti soils consist of black, fine sandy loam underlain by fine sand. These soils occur on
12 uplands and as islands surrounded by poorly drained organic soil. Rifle soils are organic muck and
13 marsh soils. The surface layer is black, mucky peat 10 inches to 10 feet deep with a water table at or
14 near the surface and underlain by brown, mucky peat and sand.

15 Drainage classes range from very poorly drained (66.8% of the WMA) to Excessively drained (3.9% of
16 the area) (Figure 7). The majority of the WMA is somewhat poorly drained or wetter (79.8%) and
17 therefore the water table is at or near the surface on the majority of the unit. Upland soils are subject
18 to drought due to their sandy texture, and soil textures of somewhat excessively drained and
19 excessively drained account for the 14.7% of the unit. Well drained soils account for a very small
20 portion of the unit (0.2%). Table 4 has summary data on drainage class for the WMA.

21 Similar to the soil drainage classes, soil surface textures tend to be on either end of the texture
22 extremes—muck or mucky peat (55.9%) or some kind of fine sand or texture with a sandy designator
23 (38.8%). A few areas on the WMA have loam soils (0.1%) but nothing finer in texture than this. Table 5
24 has summary data for soil texture on the WMA.

25 The soils on the Sunrise Unit of the Carlos Avery WMA had aggregate mapping completed in 2001. The
26 soil here was classified mostly as "Less desirable sand and gravel deposits" which consist primarily of
27 sand and gravelly sand.

28 Table 4: Soil drainage class summary at the Carlos Avery WMA.

Drainage Class	Acres	Percentage of WMA (%)
Very poorly drained	16,422	66.8
Somewhat poorly drained	3,056	12.4
Somewhat excessively drained	2,661	10.8
Unknown	1,302	5.3
Excessively drained	947	3.9

Drainage Class	Acres	Percentage of WMA (%)
Poorly drained	150	0.6
Well drained	61	0.2
Total	24,599	

1

2   Table 5: Surface soil texture summary at Carlos Avery WMA.

Surface soil texture	Acres	Percentage of WMA (%)
Muck	7,405	30.1
Mucky peat	6,338	25.8
Fine sand	5,612	22.8
Fine sandy loam	2,188	8.9
Loamy fine sand	1,564	6.4
Unknown	1,302	5.3
Sandy loam	148	0.6
Loamy sand	21	0.1
Loam	21	0.1
Total	24,599	

3

4

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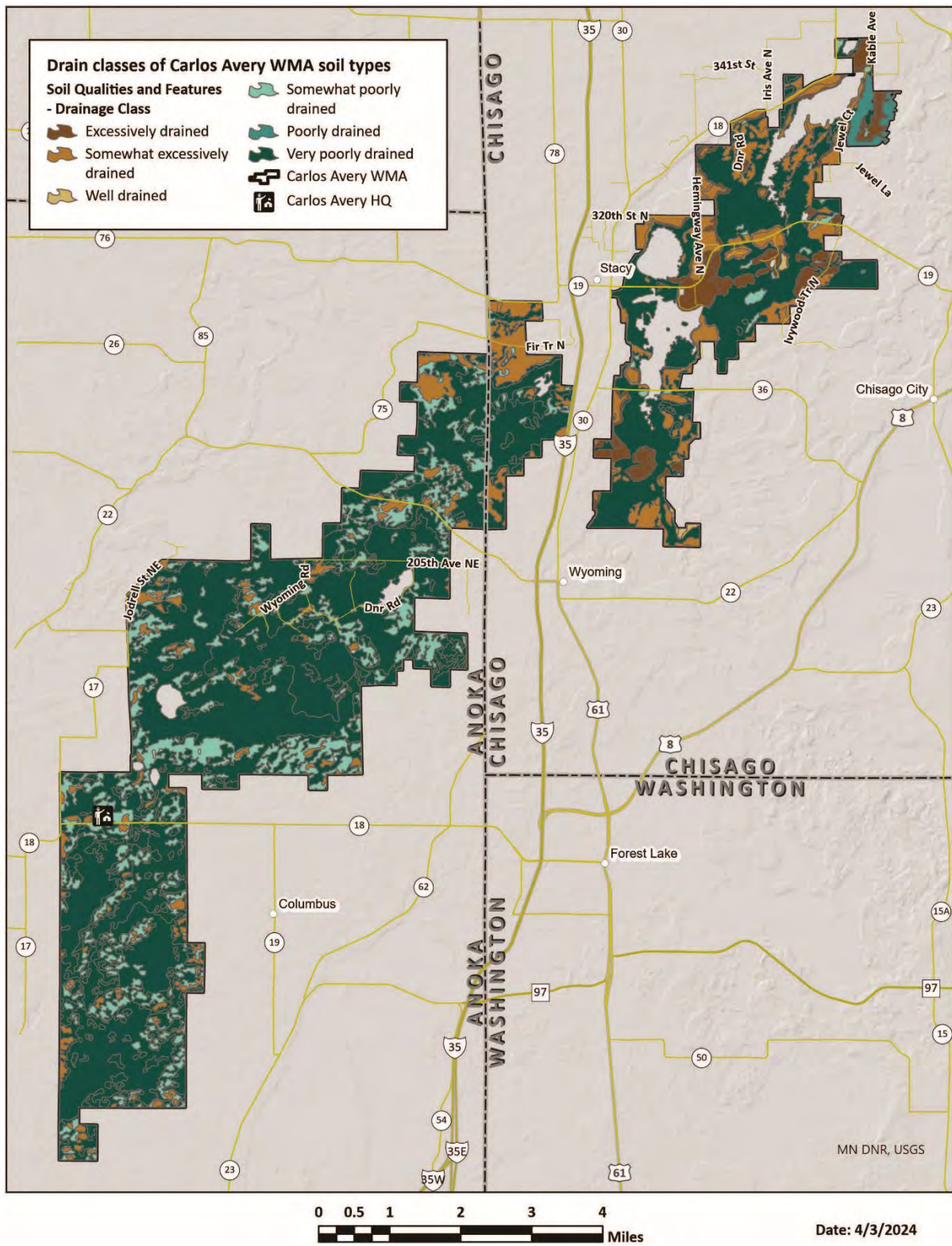
Figure 7: Drainage classes of Carlos Avery WMA soil types. These drain classes are from the Soil Survey Geographic Database (SSURGO).

Hydrology

There are two main watersheds that encompass the Carlos Avery WMA (Figure 8). The Sunrise River Watershed drains an area of 1,022 square miles, including 70% of the WMA. The Sunrise River Watershed is part of the Lower St. Croix River Watershed and empties into the St. Croix River. The Sunrise River Watershed has completed a watershed management plan. The other main watershed is Coon Creek Watershed and it includes 30% of Carlos Avery WMA. The Coon Creek Watershed is approximately 107 square miles and is located completely within Anoka County. Coon Creek Watershed is part of the Twin Cities portion of the Upper Mississippi River Watershed. The Coon Creek watershed outlets to the Mississippi River approximately 21 miles upstream from where it joins the Minnesota River. A very small portion (18 acres or 0.1%) of the Carlos Avery WMA is located within the Rice Creek Watershed. This parcel is located on the eastern side of the southern unit, just south of the Camp Three Road parking area.

The two main watersheds are further described below.
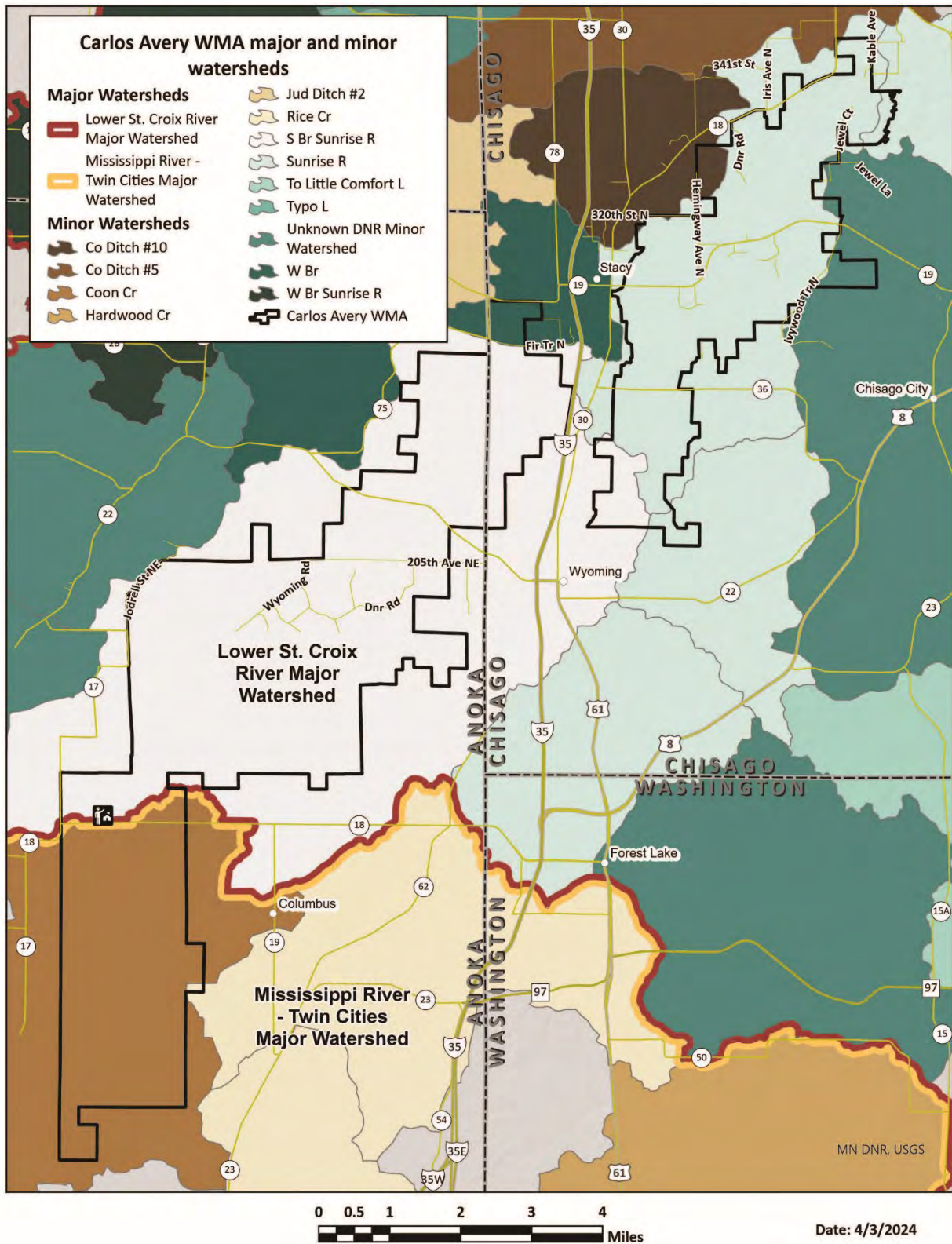
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2 Figure 8: Carlos Avery WMA major and minor watersheds.

1

Sunrise River Watershed

3 The Sunrise River Watershed is approximately 385 square miles (246,400 acres) and is located within
4 four counties (Anoka, Chisago, Isanti, and Washington). It is a relatively undeveloped watershed, as
5 only 8% is developed. The remaining landcovers include forest (26%), cropland (24%), grassland (18%),
6 wetland (17%), and open water (7%).

7 Approximately 80%, or 19,598 acres, of the Carlos Avery WMA is located within the Sunrise River
8 Watershed. The Sunrise River flows into the St. Croix River, which flows into the Mississippi River. The
9 larger rivers that occur on the WMA within this watershed include the Sunrise River, West Branch of
10 the Sunrise River, and South Branch of the Sunrise River, while larger lakes include the South Sunrise
11 Pool, North Sunrise Pool, Mud Lake, and Little Coon Lake. Smaller water bodies within this watershed
12 include Peterson Slough, and Pools 1-4, 6-10, 22, 23, and 26. All lakes are classified as eutrophic.

13 Water quality monitoring has occurred at eight locations on the east side of Highway 35 and six
14 locations on the west side of Interstate 35 throughout the Sunrise River Watershed on the Carlos Avery
15 WMA by the Minnesota Pollution Control Agency (Appendix B; Figure 27). Specific surface water data is
16 located at https://webapp.pca.state.mn.us/surface-water/search. Data summaries are contained
17 within the 2014 Sunrise River Watershed: Watershed Restoration and Protection Strategy Report.

18 The Sunrise River Watershed has two sub-watersheds within the Carlos Avery WMA. Those include the
19 Carlos Avery and the West Branch of the Sunrise River sub-watersheds. The Carlos Avery sub-
20 watershed is located primarily on the east side of Highway 35, while the South Branch of the Sunrise
21 River sub-watershed is located primarily west of Highway 35. MPCA concluded that stressors to aquatic
22 life within the Carlos Avery sub-watershed included dissolved oxygen, phosphorus, fish passage, and
23 altered habitat (channelization). While there were no point sources of pollution indicated, non-point
24 sources included agricultural runoff including manure and fertilizer, soil erosion, lake and stream
25 sediment phosphorous release, and failing septic systems.

26 MPCA concluded that stressors to aquatic life within the West Branch of the Sunrise River sub-
27 watershed included nitrate and phosphorus. Point sources of pollution included four municipal
28 wastewater locations, while non-point sources of pollution included agricultural runoff including
29 manure and fertilizer, failing septic systems, and lake and stream sediment phosphorous release.

Coon Creek Watershed

31 The Coon Creek Watershed is approximately 107 square miles (68,480 acres) and is located in Anoka
32 County. It is a relatively developed watershed, as 58% is developed. The remainder of the landcover in
33 the watershed is forest (16%), grassland (12%), and wetland (14%).

34 Approximately 20%, or 4,982 acres, of the Carlos Avery WMA is located within the Coon Creek
35 Watershed. Coon Creek flows directly into the Mississippi River. No rivers or lakes occur on the WMA
36 within the Coon Creek Watershed. Smaller water bodies include Pools 13 through 17.

37 Water quality monitoring has occurred at four locations throughout the Coon Creek Watershed on the
38 Carlos Avery WMA by the Minnesota Pollution Control Agency (MPCA). Specific surface water data is
39 located at https://webapp.pca.state.mn.us/surface-water/search. Data summaries are contained

1   within the [2016 Coon Creek Watershed District: Watershed Restoration and Protection Strategy](#)
2   [Report](#).

3   The Coon Creek Watershed contains four sub-watersheds. The sub-watershed that contains the Carlos
4   Avery WMA is also called the Coon Creek sub-watershed. The Coon Creek sub-watershed is located
5   primarily south of Highway 18 (West Broadway Avenue). It is noteworthy that the Carlos Avery WMA is
6   located at the upstream most reaches of this sub-watershed and most point and non-point sources of
7   pollution are located downstream. MPCA concluded that stressors to aquatic life within the Coon
8   Creek sub-watershed included dissolved oxygen, excess sediment, phosphorus, altered habitat
9   (channelization), and altered hydrology. Point sources of pollution included nine municipal wastewater
10 locations, while non-point sources of pollution included agricultural runoff including manure and
11 fertilizer, poor pet waste management, failing septic systems, stormwater runoff, in channel stream
12 bank erosion, and lake and stream sediment phosphorous release.

13 *Impoundments*

14 Management actions at Carlos Avery WMA impact downstream water quality in both watersheds.
15 Carlos Avery WMA has 23 actively managed pools on or near the Sunrise River, as well as the South
16 Branch (Table 6 and Figure 9). These pools provide waterfowl habitat across more than 11,700 acres of
17 surface water and wetlands and flow into each other as described in Appendix B (Table 21). Overall,
18 wetlands cover nearly two-thirds of the WMA. The presence of these wetlands, along with the ongoing
19 management of pools, influences water quality, sediment transport and other aspects of habitat within
20 the watersheds. The next section of this plan describes the water management that occurs on the
21 Carlos Avery WMA.

22 Table 6. Impoundments and ponds on the Carlos Avery WMA. Surface water acreage is the area that is open surface water
23 at least part of the year during normal water elevations.

Impoundment	Surface Water Area (acres)	Number of Water Control Structures	Year Water Control Structure(s) Constructed
North Pool	875	1	1964
South Pool	1480	1	1964
Mud Lake	400	1	1979; Updated 2009
Pool 1	11	1	Pre-1936
Pool 2	32	2	2A: 1975; Updated 2009 2B: 1976
Pool 3	144	1	Pre-1936
Pool 4	130	2	4a: Pre-1936; Updated 2022

Impoundment	Surface Water Area (acres)	Number of Water Control Structures	Year Water Control Structure(s) Constructed
			4B: Pre-1936
Pool 5	10	2	5A: Pre-1936 5B: 1978
Pool 6	105	2	6A: 1987; Updated 2019 6B: 1987; Updated 2019
Pool 7	5	1	~1970
Pool 8	160	1	Pre-1936; Updated 2001
Pool 9	116	Originally 5 Currently 4	9A: 1973; Updated 2023 9B: 1976; Updated 2023 9C: 1978; Removed 2023 9D (formally 9E): Unknown 9W: Unknown
Pool 10	150	2	10A: 1991 10B: 1991
Pool 13	59	2	13A: 1975 13B: 1976; Updated 2010
Pool 14	110	2	14A: 1974 14B: 1975; Updated 2010
Pool 15	12	2	15A: 1975 15B: 1976; Updated 2010
Pool 16	20	2	16A: 1969; Updated 2009 16B: 1969; Updated 2009
Pool 17	10	1	1976; Updated 2003
Pool 18	0	1	1979
Pool 22	14	2	22A: 1974 22B: 1983; Updated 2006

Impoundment	Surface Water Area (acres)	Number of Water Control Structures	Year Water Control Structure(s) Constructed
Pool 23	80	1	1977
Pool 24	8	1	1977
Pool 26	17	1	1987; Updated 2017
Total	*3948*	*36*	
Ponds			
East Twin	16		
West Twin	12		
Little Coon Lake	84		
Peterson Slough	20		
Total	*132*		
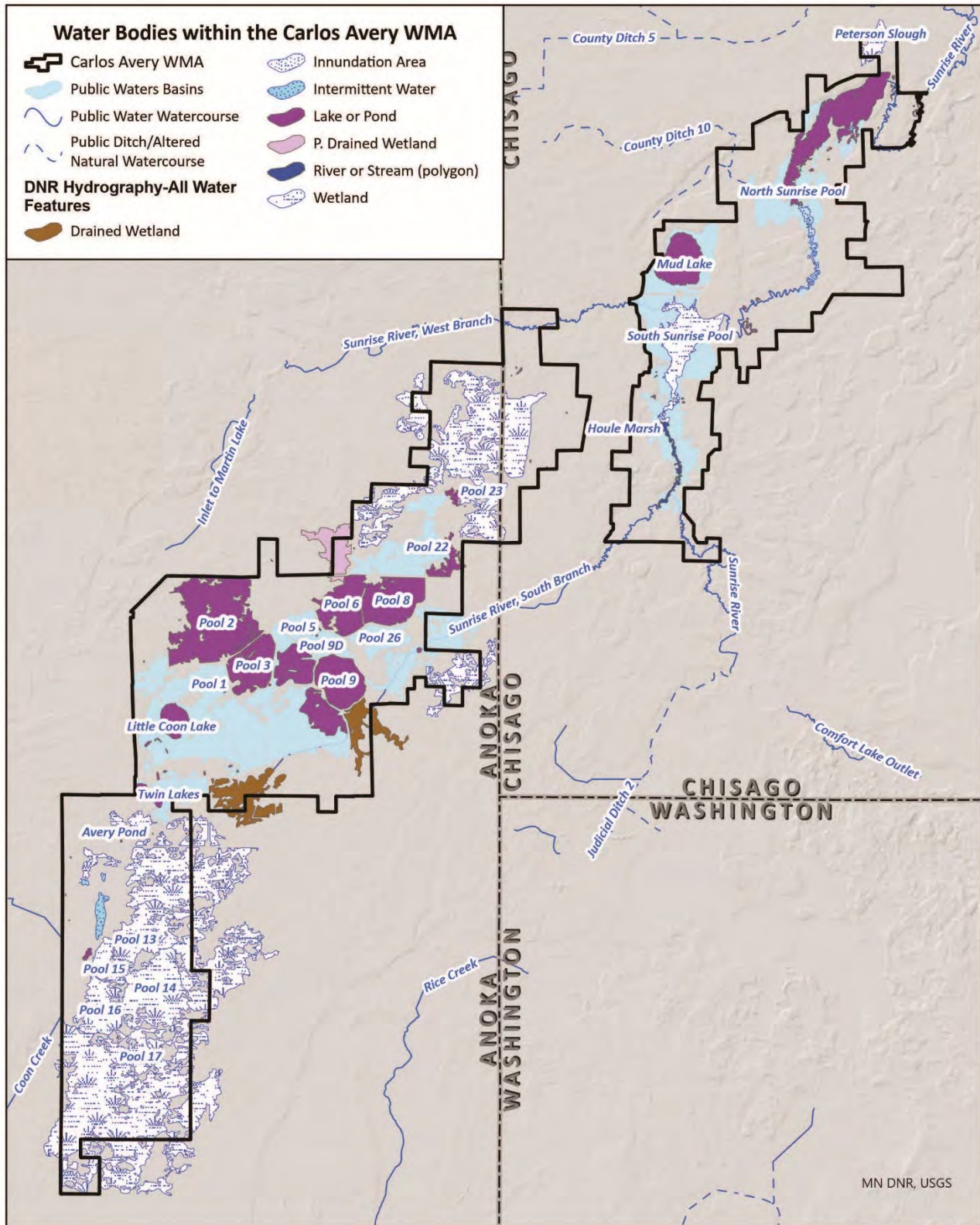
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2   Figure 9: Waterbodies within the Carlos Avery WMA.

Water Management

The goal of water management is to provide optimum conditions for wetland wildlife, especially waterfowl, on a seasonal basis. Water levels are currently managed in accordance with various agreements with partnering agencies such as watershed organizations, drainage law 103E, and county conservation districts. Operational water levels vary based on annual pool objectives for various habitat purposes while considering upstream and downstream effects. Carlos Avery WMA staff use gauges located at control structures to monitor water levels in individual pools, normally on a weekly basis.

There are a variety of water management constraints on the Carlos Avery WMA. First, precipitation, especially spring runoff, is the primary source of water for management on the Carlos Avery WMA. Only the North and South Pools receive consistent water supplies in the form of stream flows from branches of the Sunrise River. Second, gravity is the only means of moving water among pools. Pumping water has been determined to be prohibitively expensive. Third, overtopping and washout of sand dikes from sudden inflows of water into pools is a major concern during spring runoff and heavy rains. Staff must be available during extreme conditions to monitor water levels and dewater pools if necessary. Fourth, purple loosestrife (*Lythrum salicaria*) is established along the West Branch of the Sunrise River and in most pools and wetlands in and around Carlos Avery WMA. Presence of purple loosestrife may require more conservative water management strategies, for example, minimizing exposure of mudflats where seedlings can become established, to control its spread into new areas.

A fifth water management constraint are floating bog mats that reduce the amount of open water habitat in wetlands. Bog mats often break loose and cover desirable aquatic vegetation or plug water control structures. This occurs most commonly in the South Pool. A machine called the Swamp Devil is used to dispose of bog mats when sufficient water levels exist to operate it. The Swamp Devil is basically a boat with vertically held mower-type blades which grind up vegetation.

A sixth water management constraint is that flooding of adjacent private land must be considered during management activities. Normal spring water management activities reduce the amount of runoff that would be discharged through the Sunrise River system, however water can backup onto private land by holding some pools at high level. There is currently an agreement to hold Pool 13 at or below 901.6 feet to avoid backing water onto private land.

General Water Management Strategies

Annual water management is oriented to take advantage of prevailing precipitation conditions, whether dry, wet, or average. Detailed annual water management plans are developed in the spring in conversation with DNR Area Hydrologists. The juxtaposition of pools, especially in relation to location in the watershed, largely determines what types of management can be used. For example, Pools 1 and 13, and to a lesser degree Pools 2 and 22, are at the headwaters of their watersheds, and their area is insufficient for them to capture much water. Therefore, these headwaters pools are usually used as catchment basins in order to divert water to maintain sufficient levels in downstream pools. The downstream pools (4, 8, 9, 10, North and South and others) are typically managed as deeper water habitats for production of submerged aquatics and/or wild rice.

1 A major tool of wetland management for waterfowl is the use of "drawdowns" to partially or
2 completely drain an impoundment. Drawdowns mimic the natural wet/dry cycles that occurred
3 historically in wetlands which are critical to maintaining water quality, wetland health, and wildlife
4 habitat. Changes in the landscape such as artificial drainage and increased nutrient runoff have
5 impacted wetlands by altering nutrient inputs, altering hydroperiods, changing connectivity between
6 basins allowing for invasion of non-native fish, and causing generally higher or lower water levels than
7 occurred historically. Drawdowns allow managers to mimic the natural wetland cycles which often no
8 longer occur or occur infrequently due to these altered states. Drawdowns can accomplish a variety of
9 things, including: stimulate growth of certain moist soil plants that are important waterfowl foods on
10 exposed mudflats; help to create open water areas by consolidating bottom sediments; recycle
11 nutrients; help control invasive fish and muskrat; provide opportunity for maintenance.

12 Water management is a normal annual procedure in pools managed for wild rice production, such as
13 Pools 2, 3, 4, 6, 8, 9, 10, 14, 16, 17 and South Pool and North Pool. Water is discharged over the winter
14 to increase capacity for spring runoff and reduce the potential for flooding. During the wild rice
15 growing season, water levels are held stable to avoid uprooting plants by a sudden inflow of water.

16 ### *Seasonal Water Management - Average Precipitation*

17 **Spring**. The goal of spring water management is to maximize the amount and diversity of wetlands
18 available to breeding waterfowl, primarily mallards, blue-winged teal, ringnecks, wood ducks, and
19 Canada geese. Most wetlands fill as a result of spring runoff, and pools are managed near their upper
20 limits of their goal elevations to maximize open water area. Heterogeneity of wetland sizes, depths,
21 and vegetation creates a wetland complex that is beneficial for wildlife habitat (Patterson 1974). Basin
22 irregularity in all pools provides natural diversity in pond sizes and water depths. As soon as spring
23 runoff has ended, drawdowns are initiated for wild rice and moist soil plant production or
24 maintenance.

25 **Summer.** Precipitation in drier years is inadequate to compensate for the losses of water due to
26 evapotranspiration. Maintaining sufficient brood-rearing and molting cover in summer is accomplished
27 by salvaging water into downstream pools, typically the wild rice producing pools (4, 6, 8, 9, 10, 14,
28 South, North). Management activities to create additional open water, such as mowing, burning,
29 chemical treatment, and vegetation chopping, can be accomplished in pools that have been drawn
30 down.

31 **Fall.** After wild rice seed heads have developed and begin to ripen, water levels are raised in pools, if
32 possible, to provide access to wild rice and moist soil plants for feeding waterfowl, and later to
33 improve access for hunting and ricing. After hunting season in November, and following freeze-up,
34 pools are lowered in order to create air pockets to overwinter muskrats and provide storage capacity
35 for spring runoff.

36 ### *Seasonal Water Management - Drought Year*

37 Water management in very dry years entails diverting water into downstream pools (3, 4, 6, 8, 9, 10,
38 16, 26) to maintain wild rice stands for brood-rearing, molting cover, and waterfowl food. Historically,
39 drought conditions made it possible to create additional open water areas not normally accessible by
40 heavy equipment or fire. This rarely occurs due to wetland permits and prescribed fire permit

1 limitations. Also, lower water levels in pools allows for the encroachment of undesirable vegetation,
2 such as purple loosestrife, willow (Salix spp.), and cattail (Typha spp.), which then must be treated
3 and/or flooded-out when adequate precipitation is available. In many cases, it has proven to be very
4 difficult or impossible to flood-out this unwanted vegetation.

5 *Seasonal Water Management - Wet Year*

6 In wet years, extensive effort is needed to divert and dispose excess water to protect sand dikes from
7 washouts, especially during spring runoff and following heavy rains. This has to be accomplished while
8 not flooding downstream landowners. Water is held in pools to flood-out cattail and willow, and the
9 Swamp Devil is used to open areas in bog mats. The swamp devil is also used to remove floating bog
10 mats that plug water control structures (most often at the South dam). Floating bog mats consistently
11 become unrooted during high water and float down to the structures and plug them, causing water
12 levels to become higher and cause flooding. Adequate water allows additional flexibility in allowing
13 drawdown of some downstream pools, as open water and cover is available in upstream areas.

14

15 Figure 10: South Dam Bog on Carlos Avery WMA.

16 # Habitats and Plant Communities

17 ## Introduction

18 Habitat is the term often used to describe everything a species needs to survive and reproduce. Animal
19 species typically require food, water, shelter and space in order to persist on the landscape. Some
20 animal species can usually find everything they need in small areas of habitat of the same general type,

1　other species require different types of habitat (e.g. a lake and a prairie) to survive and reproduce.
2　Carlos Avery WMA is a diverse site that provides many different habitat types for a large number of
3　wildlife species. At the time of the original public land survey in the early 1900s, the WMA was 47%
4　wet prairie, 32% oak woodland and brushland (with 39% of that classified as aspen-oak and 61%
5　characterized as oak openings and barrens), 21% peatlands, and less than 1% as maple-basswood
6　forest (Wendt and Coffin 1988; see also Marschner's Pre-European Settlement Vegetation Map, Figure
7　11).

8　Minnesota DNR uses three habitat classification systems: the Ecological Classification System Native
9　Plant Communities, Forest Inventory cover types, and the Wildlife and Aquatic Habitat Management
10　Application. The Forest Inventory cover types is reflective of forest current conditions and helps guide
11　forest management decisions. The Ecological Classification System Native Plant Communities is more
12　detailed classification system and used to understand potential outcomes of management decisions.
13　The Wildlife and Aquatic Habitat Management Application system is a high-level description of habitat
14　conditions.
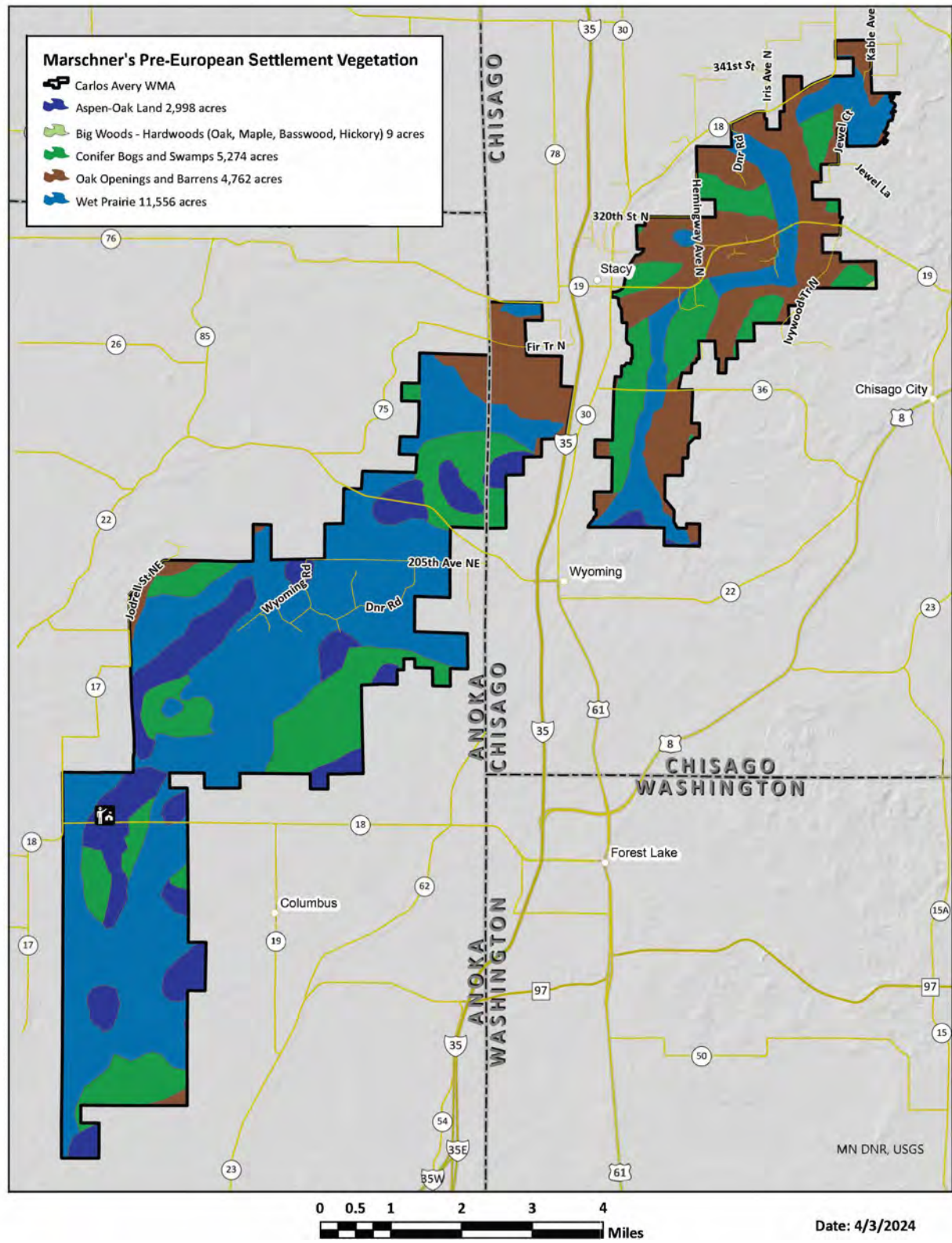
Figure 11: Marschner's map of pre-European settlement vegetation.

Native Plant Communities

Native plant communities (NPC) provide habitat that support fish and wildlife populations on the Carlos Avery WMA. These plant communities have been formed and shaped by climate, hydrology, geology, topography, fire, other physical aspects, and anthropogenic changes. The information and data available on Carlos Avery WMA NPCs has recently been developed using vegetation data collected in the 1990's, early 2000's and most recently in the summer of 2023. Approximately 82% of the unit is mapped for native plant communities. Areas of the WMA that do not qualify as a native plant community still provide necessary habitats and habitat components for some species of wildlife.

Carlos Avery WMA is a diverse site with several high-quality state and/or globally rare NPCs throughout the unit. The WMA contains ten NPCs mapped at the broadest level, the ecological system: (1) Acid Peatland System; (2) Fire-Dependent Forest/Woodland System; (3) Forested Rich Peatland System; (4) Marsh System; (5) Mesic Hardwood Forest System; (6) Open Rich Peatland System; (7) Upland Prairie System; (8) Wet Forest System; (9) Wet Meadow/Carr System; and (10) Wet Prairie System (Figure 12). Table 7 shows the relative percentage of NPCs found at Carlos Avery WMA.
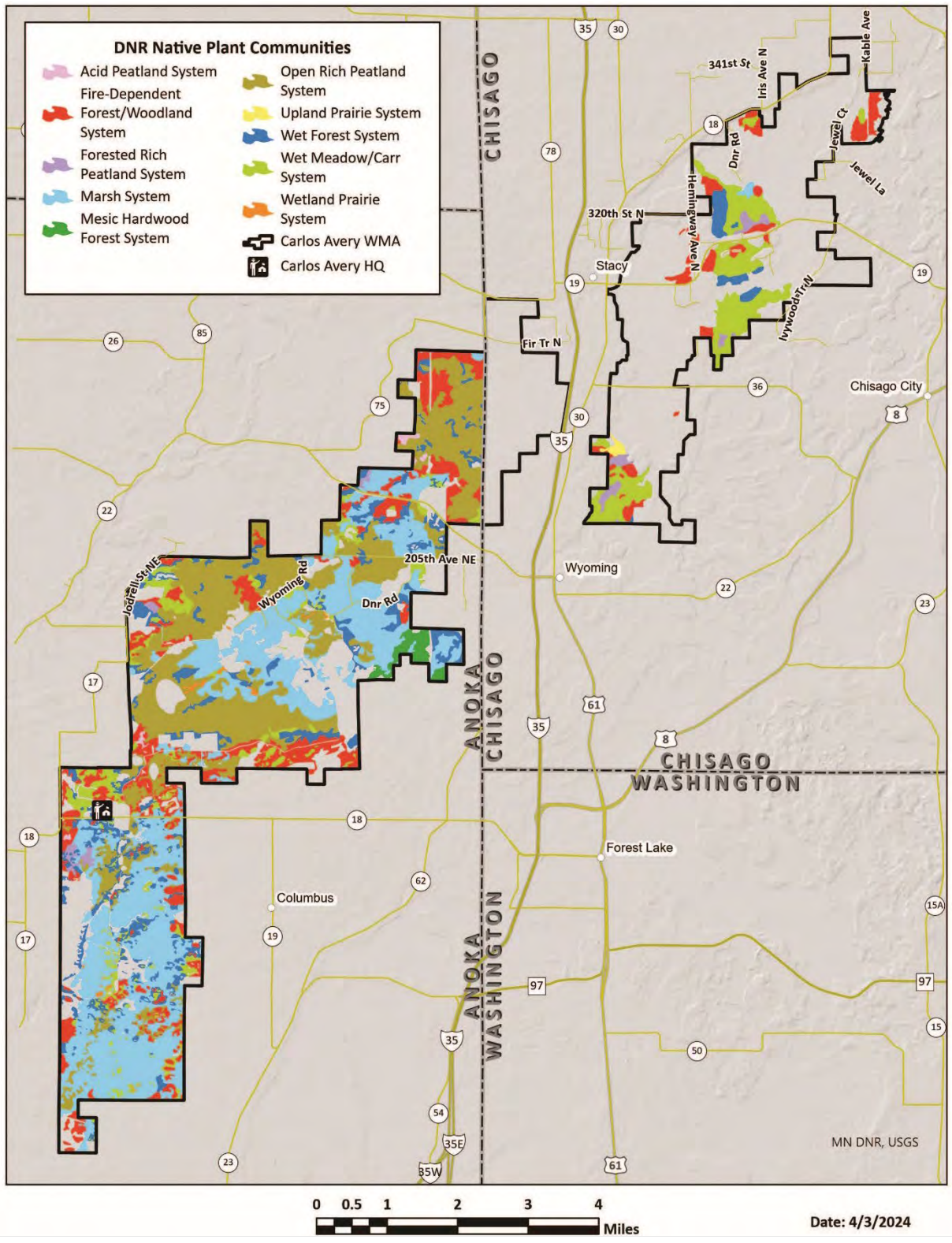
Figure 12: Carlos Avery WMA native plant communities.

1   Table 7. Relative percentage of native plant communities found at Carlos Avery WMA.

NPCs	Acres	Percentage of WMA
Acid Peatland System	281	1%
Fire Dependent Forest/Woodland System	2,793	11%
Forested Rich Peatland System	529	2%
Marsh System	5,906	24%
Mesic Hardwood Forest System	169	< 1%
Open Rich Peatland System	5,012	20%
Upland Prairie System	30	< 1%
Wet Forest System	2,278	9%
Wet Meadow/Carr System	2,740	11%
Wet Prairie	135	<1%
Not mapped as an NPC (including open water, human disturbed wetland, old fields, plantations, disturbed uplands, developed lands, restored prairies)	4,678	19%
Total	24,551	100%

2

3

4   The following sections provide an overview of the native plant communities found in the Carlos Avery
5   WMA.

6   *Fire Dependent Forest/Woodland*

7   Fire Dependent Forest/Woodland plant communities are upland forested sites that are or have been
8   strongly influenced by fires and are generally found on sandy, gravelly, or droughty sites. However,
9   other features in addition to soil texture can be important too, such as landscape position, distribution
10   of water bodies, slope, aspect, and the vegetation itself. The relatively flat landscape of Carlos Avery
11   WMA and the extensive lakes and wetlands in the area are also important for the development of fire
12   dependent forests and woodlands in the WMA. Some of the many wildlife species associated with this
13   habitat type are red-shouldered hawks, eastern whip-poor-wills, bald eagles, several of Minnesota's
14   native bat species, northern barrens tiger beetles, American badgers, eastern hog-nosed snakes, wild
15   turkey, fox squirrels, gray squirrels, ruffed grouse, and white-tailed deer. The transition areas between

these upland fire dependent forests and abutting wetlands are important habitat for state-listed rare plants such as huckleberry and several species of bristle berries. There is only 1 class of Forest Dependent Forest/Woodland known to occur in Carlos Avery WMA:

- [Southern Dry-Mesic (Maple) Woodland (FDs37)](#) - Dry mesic hardwood forests on undulating sand flats and flat to undulating sandy lake plains. Historically, fires were common in this community, and many stands are on sites occupied by brushlands 100–150 years ago. The rotation of catastrophic fires was about 110 years and milder surface fires was 10 years. Young forests tend to be dominated by bur oak, northern red oak, white oak, with quaking aspen, northern pin oak, and black cherry. Mature forests are dominated by a mix of oak species and in the past included minor amounts of American elm. This particular native plant community is likely more densely treed than it has been in past due to fire suppression. Due to increasing land development and conversion as well as fire suppression, Southern Dry-Mesic Oak (Maple) Woodland is state and globally-listed as rare and vulnerable to extirpation.

Mesic Hardwood Forest

Mesic Hardwood Forest plant communities are upland sites with moist soils usually in settings protected from fire. They are characterized by continuous, often dense, canopies of deciduous trees, including sugar maple, basswood, paper birch, and northern red oak, and understories with shade-adapted shrubs and herbs. Some of the wildlife species associated with this type of habitat are: red-shouldered hawks, veery, least flycatcher, northern long-eared bats, red-backed salamanders, garter snakes, gray squirrels, wild turkeys, white-tailed deer, black bear, and red fox. Mesic hardwood forests are known to support state-listed rare plant species like American ginseng, several species of grape fern, and occasionally butternut in forest openings and edges. In Carlos Avery WMA, because of the sandy soils, there is only 1 class of Mesic Hardwood Forest known to occur:

- [Central Wet-Mesic Hardwood Forest (MHc47)](#) - Wet-mesic hardwood forests on somewhat poorly drained sandy loam soils on till plains and stream terraces, often on broad flats and gentle slopes adjacent to wetlands and in ecotones between upland forests and wetlands. Soils are saturated for prolonged periods, because high local water tables. This NPC maintains a relatively stable tree species composition throughout its growth stages, dominated by black ash and basswood, with red and sugar maple, bur and red oak, and green ash (with some aspen and birch in its younger stages). Due to land development, earthworm invasion, and past overlogging, Central Wet-Mesic Hardwood Forest is state and globally-listed as rare and vulnerable to extirpation.

Figure 13: This blue tooth mushroom (*Hydnellum caerulem*) was growing from the forest floor in early July 2024 in an upland forest at Carlos Avery WMA. It is a mycorrhizal associate with plant roots.

Upland Prairie

Upland Prairie communities are dominated by graminoid species, with a species-rich forb component that can approach codominance with the graminoids. The herbaceous dominance of prairie communities in Minnesota is closely tied to the frequent occurrence of fire. In circumstances where fire frequency or intensity is reduced, more fire-tolerant shrubs and trees can persist, forming brush-prairie and savanna communities that are considered members of the Upland Prairie System. This is particularly true along the transition zone where Carlos Avery is located. The higher annual precipitation here, compared to western Minnesota, favors woody vegetation. Savannas typically have scattered trees, sometimes clumps of trees, growing in a prairie matrix.

Due to land development and conversion as well as fire suppression and introduction of non-native plants, fewer than 1% of the state's native prairies remain; prairies have been similarly lost throughout the U.S. and world. As such, they are a state and globally-listed rare plant community considered imperiled or critically imperiled. Due to this rarity, all upland prairie plant communities are managed in support of the ecological processes that maintain them. Wildlife species associated with this habitat type include nesting blue-winged teal and mallard, ring-necked pheasant, northern harrier, willow flycatcher, eastern kingbird, loggerhead shrike, eastern bluebird, eastern meadowlark, grasshopper sparrow, lark sparrow, savannah sparrow, clay-colored sparrow, vesper sparrow, Blanding's turtle, and rusty-patched bumble bee. Unique rare plants associated with this type of habitat include beach heather, bastard toadflax, and a variety of annual graminoids like seaside three awn. In Carlos Avery WMA, there are two classes of Upland Prairies:

- Southern Dry Prairie (UPs13) - Grass-dominated herbaceous communities on level sites with droughty soils. Moderate growing-season moisture deficits occur most years, and severe moisture deficits are frequent, especially during periodic regional droughts. Historically, fires probably occurred every few years. - Grass-dominated herbaceous communities on level sites with droughty soils. Moderate growing-season moisture deficits occur most years, and severe moisture deficits are frequent, especially during periodic regional droughts. Historically, fires probably occurred every few years.
- Southern Dry Savanna (UPs14) - Sparsely treed communities with grass-dominated herbaceous ground layers on nearly level to steeply sloping sites with droughty soils. Moderate growing-season moisture deficits occur during most years, and severe moisture deficits are frequent, especially during periodic regional droughts. Trees are open grown, typically small and gnarled.

Wet Forest

Wet Forest plant communities occur commonly in narrow zones along the margins of lakes, rivers, and peatlands; they also occur in shallow depressions or other settings where the water table is almost always within reach of plant roots but does not remain above the mineral soil surface for long periods during the growing season. Some of the many wildlife species associated with this habitat type are northern long-eared bats and several species of native turtle. Unique plants of wet forests include herbaceous wildflowers like trillium, jack-in-the pulpit, naked miterwort and dwarf raspberry. These wet forests also tend to support stands of black ash trees, which are traditionally used for the making of baskets and pack-baskets. Due to the recent invasion of emerald ash borer, it is likely that these communities will change significantly in composition and structure as the ash component is lost. While there are a few other tree species that are capable of surviving in the soils and hydrology present in areas dominated by black ash (e.g., elm, silver maple, swamp white oak, bur oak), significant staff capacity would be required to conduct the supplemental plantings for them to establish. Without such supplemental planting the stands comprised primarily or entirely of ash will likely transition from palustrine forested wetland communities to different wetland types. As the ash dies, the transpiration that the ash provided will be lost and water levels may increase.

In Carlos Avery WMA, there are 2 classes of Wet Forest:

- Northern Wet Ash Swamp (WFn55) - Wet hardwood forests on mucky mineral soils in shallow basins and groundwater seepage areas and on low, level terrain near rivers, lakes, or other wetlands. Typically with standing water in the spring but draining by late summer.
- Northern Very Wet Ash Swamp (WFn64) - Wet hardwood or hardwood-conifer forests on peaty soils in small closed depressions or around the edges of large peatlands. Typically with standing water present throughout spring and summer.

Acid Peatland

Non-forested Acid Peatland Communities are dominated by sparse conifer, low-shrub, or graminoid populations that develop in association with peat-forming *Sphagnum.* Acid Peatland communities are acidic (pH < 5.5), extremely low in nutrients, and have hydrological inputs dominated by precipitation rather than groundwater. Because this is a limited resource on Carlos Avery WMA, management

focuses on maintaining appropriate hydrology. Wildlife species associated with this type of habitat include sandhill crane, yellow rail, alder flycatcher, sedge wren, bobolink, common yellowthroat, and swamp sparrow. These habitats may also support more northern species at the southern end of their breeding range, but the extent of bird use of these habitats on Carlos Avery WMA are poorly known. Management also benefits plants like sundews, bog birch, leather leaf and cottongrass. There is one non-forested Acid Peatland community classes in the Carlos Avery WMA:

- Northern Poor Fen (APn91) - Open Sphagnum peatlands with variable development of hummocks and hollows. Dominated either by fine-leaved sedges or low ericaceous shrubs. Present in small basins and on floating mats near lakes and ponds.

Forested Rich Peatland Forest

Forested Rich Peatland Forest communities are conifer or tall shrub dominated wetlands on deep (> 15 in), actively forming peat. They are characterized by mossy ground layers, often with abundant shrubs and forbs. This plant community is considered state and globally imperiled due to threats from climate change and diseases that impact tamarack trees, which are the primary overstory tree. There is one class of Forest Rich Peatland Forest in the Carlos Avery WMA:

- Southern Rich Conifer Swamp (FPs63) - Tamarack-dominated swamps on shallow to deep peat in basins on moraines and outwash plains. Occasionally on floating mats at edges of ponds or lakes.

Non-forested Rich Peatland

Rich Peatland communities are conifer or tall shrub dominated wetlands on deep (>15 in), actively forming peat. They are characterized by mossy ground layers, often with abundant shrubs and forbs. Wildlife species associated with this type of habitat include American woodcock, alder flycatcher, veery, sedge wren, yellow warbler, common yellowthroat, song sparrow, and swamp sparrow. There is one non-forested Rich Peatland community class in the Carlos Avery WMA:

- Northern Rich Alder Swamp (FPn73) - Tall shrub wetlands dominated by speckled alder on mineral, muck, or peat soils. Present in wetland basins on glacial moraines and till plains, along streams and drainage ways, and along peatland and upland borders.

Open Rich Peatland

Open Rich Peatland communities are graminoid or low shrub dominated wetland on actively forming deep (>16 in) peat. Wildlife species associated with this type of habitat include nesting waterfowl (mallard, blue-winged teal), sandhill crane, yellow rail, sedge wren, bobolink, common yellowthroat, and swamp sparrow. Native plant species associated with this type of habitat include wire-grass sedge, bog willow, arrowhead, and wild cranberry. There is one class of Open Rich Peatlands in the Carlos Avery WMA:

- Northern Rich Fen (Basin) (OPn92) - Open peatlands on deep, well-decomposed peat or floating peat mats in basins, often adjacent to lakes and ponds. Dominated by fine-leaved graminoids or shrubs.

Wet Meadow/Carr

Wet Meadow/Carr plant communities are graminoid or shrub dominated wetlands that are subjected annually to moderate inundation following spring thaw and heavy rains and to periodic drawdowns during the summer. Wet meadows were historically maintained with fire and periodic flood management/drawdown to support wire-grass sedge, a native plant used in rug making. Beaver activity has also played a role in perpetuating this plant community. Focal wildlife species for management purposes include sandhill crane and nesting waterfowl (mallard, blue-winged teal). Other wildlife species associated with this type of habitat include alder flycatcher, veery, sedge wren, yellow warbler, common yellowthroat, song sparrow, swamp sparrow, and Blandings's turtle. State-listed rare plant populations associated with this habitat type include tubercled rein-orchid, lance-leaved violet, and yellow-eyed grass.

There is one class of Wet Meadow/Carr in the Carlos Avery WMA:

- Northern Wet Meadow/Carr (WMn82) - Open wetlands dominated by dense cover of broad-leaved graminoids or tall shrubs. Present on mineral to sapric peat soils in basins and along streams.

Wet Prairie

Wet Prairie communities are herbaceous plant communities dominated by graminoid species with a forb component that can approach codominance with the graminoids. The herbaceous dominance of these communities is closely tied to the frequent occurrence of fire. Where fire frequency or intensity is reduced, these communities tend to form wet-brush prairie communities. Wet prairies can be one of the showiest plant communities and often put on a beautiful display of wildflowers in late summer, including blazing star, wild sunflowers, goldenrods, and asters. Because wet prairie, like upland prairie, is a state and globally-listed imperiled or critically imperiled plant community, it is managed to support its ecological processes rather than specific wildlife species.

There is one class of Wet Prairie in the Carlos Avery WMA:

- Southern Wet Prairie (WPs54) - Grass-dominated but forb-rich herbaceous communities on poorly drained to very poorly drained loam soils formed in lacustrine sediments, unsorted glacial till, or less frequently outwash deposits. Typically, in slight depressions, sometimes on very gentle slopes. Flooded for brief periods at most; upper part of rooting zone is not saturated for most of growing season, but saturation usually persists in lower zone for much of season.

Marsh

Marshes are tall forb and graminoid dominated wetland communities that have standing, or in the case of riverine marshes, slow flowing water present through most of the growing season. Due to climate change, historical ditching and draining, general hydrologic impairment, and threats from invasive plant species, all Minnesota marsh communities are considered state and globally rare. Wildlife species associated with this habitat type include river otter, mink, muskrat, beaver, Canada goose, trumpeter swan, wood duck, mallard, blue-winged teal, green-winged teal, American wigeon, redhead, ring-necked duck, northern harrier, Virginia rail, sora, Wilson's (common) snipe, black tern, bald eagle, yellow-headed blackbird, and Blandings turtle. Plants that benefit from this management

1   include native cattail, manna grass, lake sedge, bullrushes, water smartweed, and water

2   plantain. There are two classes of Marsh in the Carlos Avery WMA:

3   • [Northern Mixed Cattail Marsh (MRn83)](#) - Emergent marsh communities, typically dominated by

4   cattails. Present on floating mats along shorelines in lakes, ponds, and river backwaters or

5   rooted in mineral soil in shallow wetland basins.

6   • [Northern Bulrush-Spikerush Marsh (MRn93)](#) - Emergent marsh communities, typically

7   dominated by bulrushes or spikerushes. Present mainly along lakeshores and stream borders.

8 ## Forest Inventory Cover Types

9 DNR forest inventory is based on different cover types than NPCs (Figure 14). There are large age-class

10 imbalances in the three cover types on Carlos Avery WMA that make up the fire-dependent and mesic

11 hardwood NPCs: aspen, oak, and northern hardwoods (Table 8, Figure 15, Figure 16, Figure 17). As

12 further discussed in the Desired Conditions section below a relatively balanced age class distribution is

13 desired in order to provide diverse habitat for wildlife species. Balanced age classes ensure that

14 multiple age classes are present continuously available on the WMA, ensuring that there is habitat

15 available for young forest/early successional obligates such as woodcock, ruffed grouse, and golden

16 winged warblers, while also ensuring that older age classes are present to provide habitat for species

17 requiring more mature forest conditions such as woodpeckers, cavity nesting waterfowl, and tree

18 denning furbearers (fisher). Some species (ruffed grouse) require multiple growth stages, from young

19 to mature, in close proximity to meet their various life cycle needs.

20 The largest imbalance in aspen is in the 30–39-year age range, and the majority of these are in 35–37-

21 year range, reflecting events on the ground that occurred circa 1987-1989 time period, perhaps related

22 to drought. The largest missing aspen component on the landscape is older aspen (trees greater than

23 80 years old). These old aspen communities provide critical habitat for a variety of wildlife species from

24 woodpeckers and owls to a wide variety of mammal species.

25 The oak and northern hardwood cover types are equally imbalanced (Table 8). Part of this is due to

26 thinning stands but not resetting their age in forest inventory – because they are multi-aged. Currently

27 the largest oak age-class imbalance is in the 80-109-year range. The current largest northern hardwood

28 age-class imbalance in the 70-99-year range. Strategies for navigating these current imbalances are

29 discussed in the Desired Conditions section.
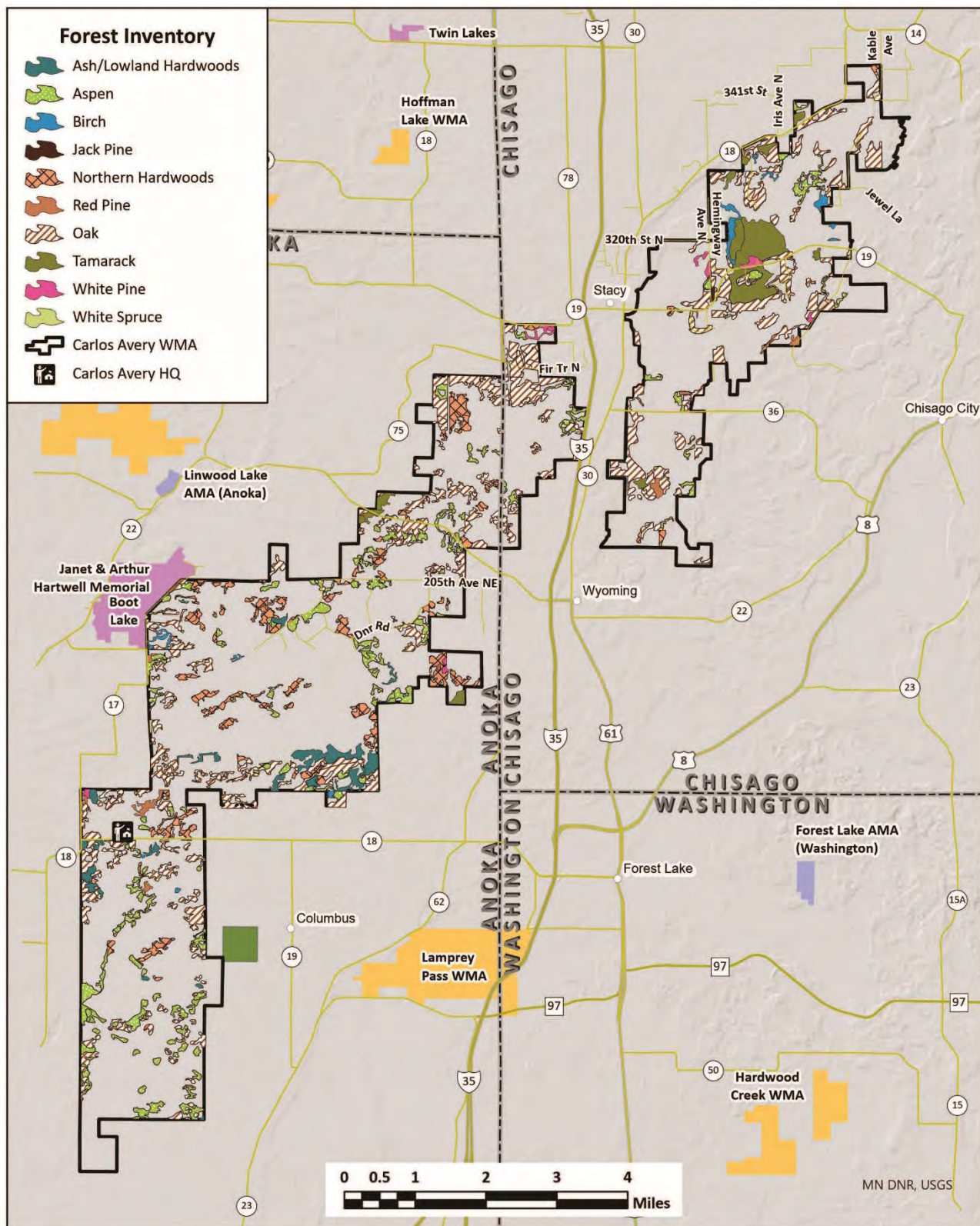
1

2 Figure 14: Forest Inventory for Carlos Avery WMA.

1 Table 8: Age class distributions of aspen, oak, and northern hardwoods in 10-year increments on Carlos Avery WMA as of
2 2024.

Age Class	Current acres 2024 - Aspen	Current acres 2024 - Oak	Current acres 2024 - Northern Hardwood
0-9	14	78	56
10-19	9	164	9
20-29	76	0	8
30-39	414	121	65
40-49	195	88	67
50-59	195	40	22
60-69	123	6	15
70-79	58	144	182
80-89	0	815	168
90-99	0	583	137
100-109	0	600	6
110-119	0	10	15
120-129	0	212	7
130-139	0	184	0
140-149	0	16	0
150-159	0	15	0
160+	0	28	0

3

1
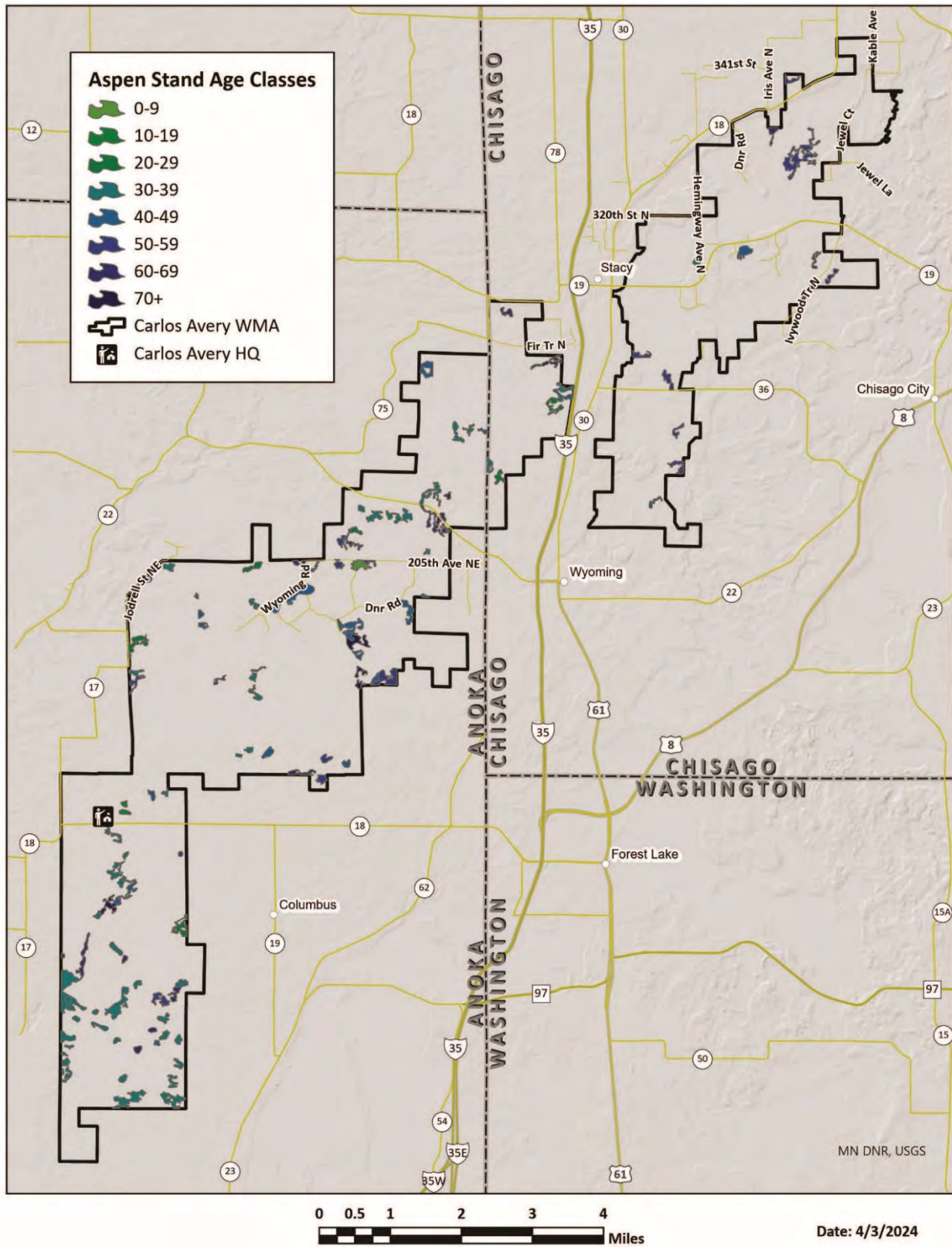
Figure 15: Current aspen distribution.
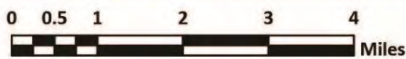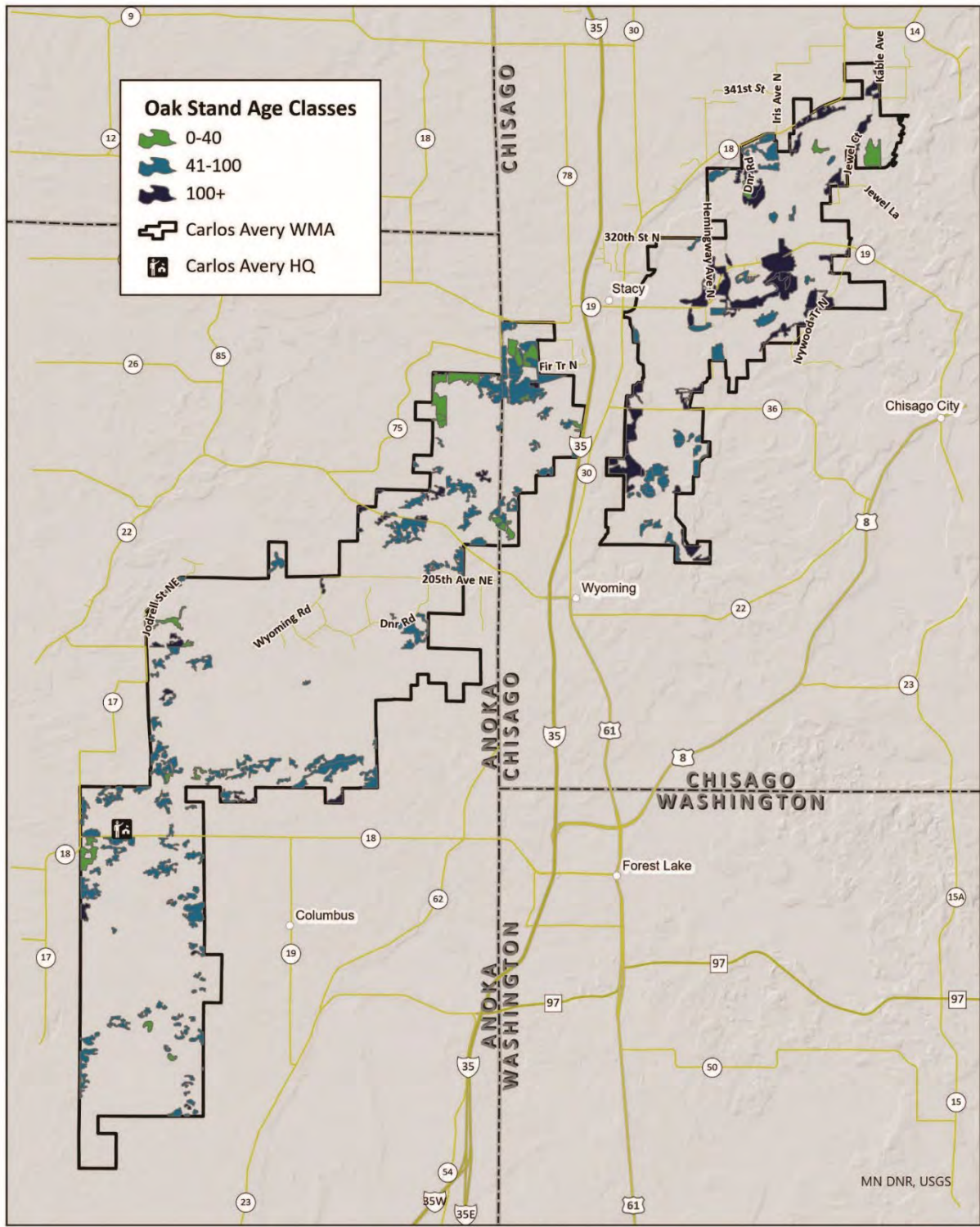
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2   Figure 16: Current oak distribution.

1
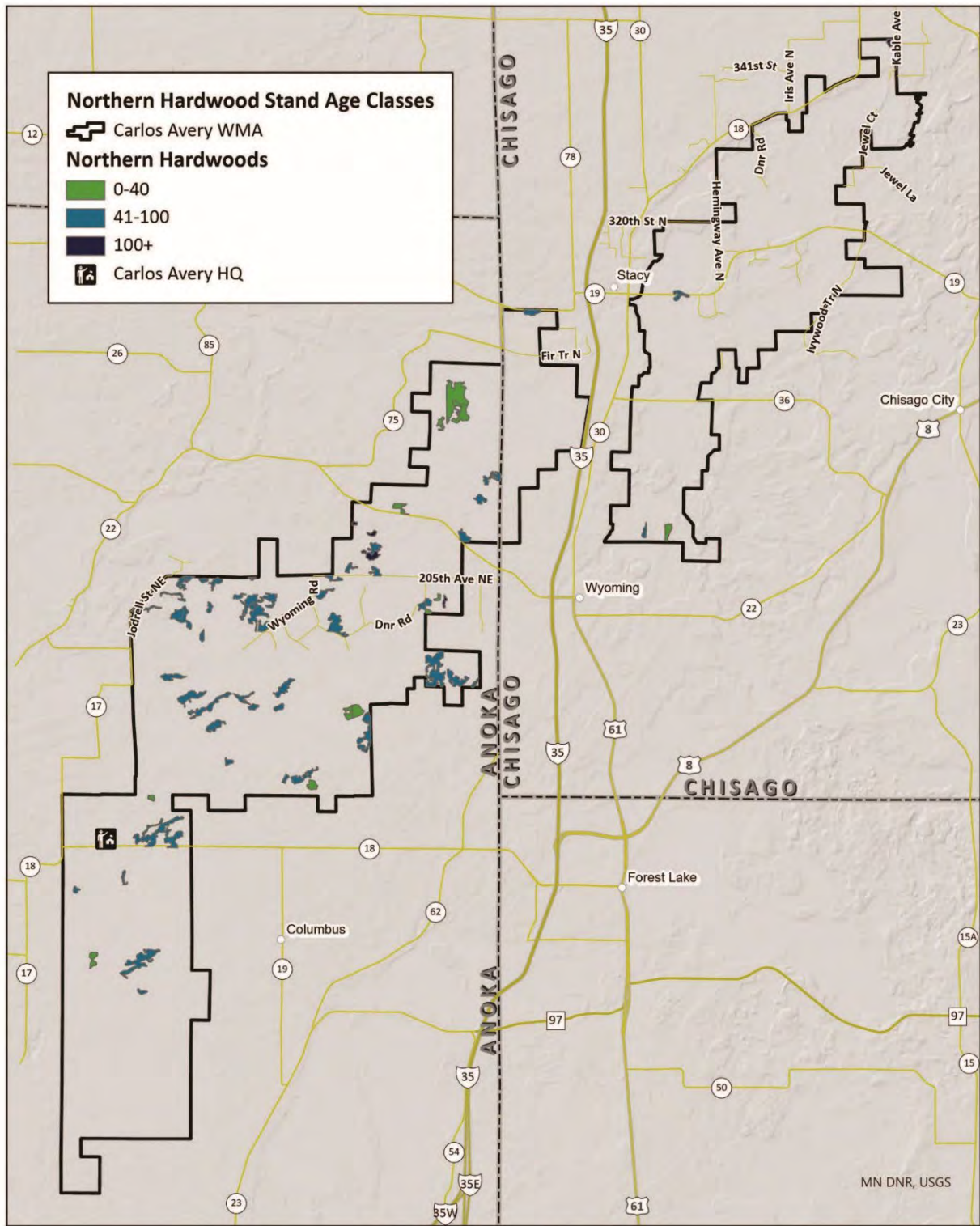
Figure 17: Current northern hardwoods distribution.

Land Cover Types

The Section of Wildlife further classifies land cover types within WMAs using the Wildlife and Aquatic Habitat Management Application (WAHMA). The WAHMA land cover types found within Carlos Avery WMA are shown in Figure 18. Table 9 shows the relative percentage of each land cover type found at Carlos Avery WMA.

1
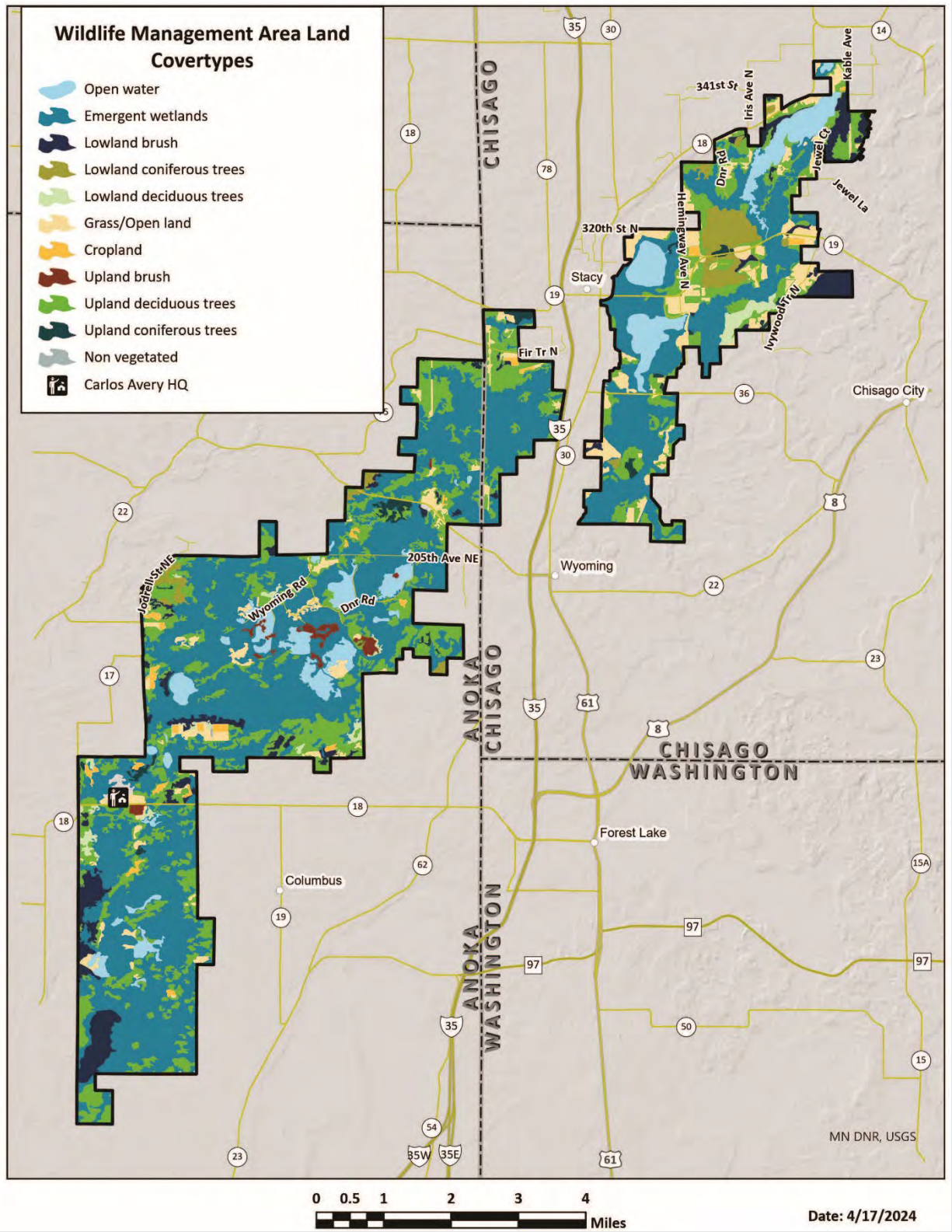
Figure 18: Carlos Avery WMA land cover types.

Table 9. Relative percentage of WAHMA land cover types found at Carlos Avery WMA.

WAHMA land cover type	Acres	Percentage of WMA
Open Water	1769	7%
Emergent Wetlands	12,654	51%
Lowland Brush	1,146	5%
Lowland Coniferous Trees	618	3%
Lowland Deciduous Trees	283	1%
Grass/Open land	1659	7%
Cropland	227	< 1%
Upland Brush	151	< 1%
Upland Deciduous Trees	5,742	23%
Upland Coniferous Trees	237	1%
Non-Vegetated	51	< 1%
Cover type undefined	64	< 1%
Total	24,600	100%

Rare Plants and Plant Communities

The DNR's Minnesota Biological Survey (MBS) completed a systematic survey of native plant communities and rare species within the WMA in the 1990's, early 2000's, and most recently in the summer of 2023. The results of this survey provided increased knowledge of the status and distribution of native and rare plant communities and animal species within the Carlos Avery WMA.

At the conclusion of work in a geographic region, MBS ecologists assign a biodiversity significance rank to each survey site of moderate, high, or outstanding (below threshold means the area was considered for survey work but did not appear to have enough diversity to warrant it). Areas not considered for surveys were primarily agricultural lands or recently harvested forests. These biodiversity rankings put into context the importance of an area compared to the rest of the state. This information helps guide conservation and management on the Carlos Avery WMA.

A site's biodiversity significance rank is based on the presence of rare species populations, the size and condition of native plant communities within the site, and the landscape context of the site. Figure 6 shows the extent of biodiversity ranks within the Carlos Avery WMA. There are four biodiversity significance ranks: outstanding, high, moderate, and below:

- "Outstanding" sites contain the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most ecologically intact or functional landscapes.
- "High" sites contain very good quality occurrences of the rarest species, high-quality examples of rare native plant communities, and/or important functional landscapes.
- "Moderate" sites contain occurrences of rare species, moderately disturbed native plant communities, and/or landscapes that have strong potential for recovery of native plant communities and characteristic ecological processes.
- "Below" sites lack occurrences of rare species and natural features or do not meet MBS standards for outstanding, high, or moderate rank. These sites may include areas of conservation value at the local level, such as habitat for native plants and animals, corridors for animal movement, buffers surrounding higher-quality natural areas, areas with high potential for restoration of native habitat, or open space.

Some of the animals, plants and plant communities found at Carlos Avery WMA are considered rare (Table 10). In the United States, many organizations, including the Minnesota DNR, use the Conservation Status Ranking system developed by The Nature Conservancy and maintained by NatureServe in cooperation with the Natural Heritage Network. The Conservation Status Ranking system ranks and categorizes the relative imperilment of plants, animals, other organisms, and native plant communities on a global, national, and state level.

State-wide Conservation Status Ranks that are frequently used when discussing native plant community management are referred to as S-ranks, which indicate how a native plant community ranks at a statewide level. These ranks are determined using methodology developed by NatureServe and its member natural heritage programs in North America. Descriptions of Conservation Status Ranks can be found in Table 11. S-ranks were assigned to Minnesota's NPC types and subtypes based on information compiled by DNR plant ecologists on: 1) geographic range or extent; 2) area of range occupied; 3) number of occurrences; 4) number of good occurrences, or percent area of occurrences with good viability and ecological integrity; 5) environmental specificity; 6) long-term trend; 7) short-term trend; 8) scope and severity of major threats; and 9) intrinsic vulnerability. More information on Conservation Status Ranks and Condition Ranks and how they are determined can be found at the NatureServe website.

Rare plant species known to occur at Carlos Avery WMA are listed in

Table 12. Detailed information on rare plant species can be found in the DNR Rare Species Guide.

Table 10. Native plant communities ranked as S1 (critically imperiled), S2 (imperiled), and S3 (vulnerable to extirpation) that are known to occur at Carlos Avery WMA. S ranks in parentheses are the potential S rank for that NPC class. Not all NPCs were classified to the type-level at Carlos WMA; most are classified to class only. Status ranks for native plant communities are given to type and subtype level classifications, a finer level of classification than class.

NPC Code	NPC Name	Status Rank	Acres	Description
FDs37; FDs37a	Southern Dry-Mesic Oak (Maple) Woodland; Oak - (Red Maple) Woodland	S3, S4	2,793	Dry-mesic hardwood forests on undulating sand flats, hummocky moraines, and river bluffs. Present mostly on fine sand or sand-gravel soils. Often on south- or west-facing slopes but common also on flat to undulating sandy lake plains. Historically, fires were common in this community, and many stands are on sites occupied by brushlands 100–150 years ago.
FPs63a	Tamarack Swamp (Southern)	S2, S3	477	Intact hydrology; low to negligible levels of natural disturbance such as fire, windthrown and beaver activity. Tamarack are the dominant tree species and form as dense canopy. Gap openings are typically the result of tree loss due to widespread stressors (i.e., drought, climate) and/or natural pests and disease. Openings support tamarack regeneration and recruitment.
WFn55b	Black Ash-Yellow Birch-Red Maple-Basswood Swamp (Eastcentral)	S3	2,250	Intact topography and natural groundwater seepages; flooding with prolonged inundation, occasional windthrown. Catastrophic disturbance such as fire is low to negligible in this system. Black ash is the dominant tree species and forms a closed to patchy canopy, occasionally interspersed with other hardwood tree species. Canopy tree loss due prolonged spring inundation or occasional windthrow create gaps for black ash recruitment. Withdraw can be widespread enough to cause major canopy loss. Downed, rotted woody debris are important for tree germination and growth. The invasive insect, Emerald Ash Borer, which causes rapid and widespread ash mortality poses a major threat to this NPC.
MHc47a	Basswood-Black Ash Forest	S3	169	Intact topography and surrounding hydrology ensure maintenance of overall soil moisture levels and seepages, especially important in the spring. The canopy is composed of mature hardwood species and catastrophic disturbance is near negligible in this system. Canopy gaps are produced primarily by tree maturation windthrow, or minor surface-level fires.

NPC Code	NPC Name	Status Rank	Acres	Description
APn91b	Graminoid Poor Fen (Basin)	S3	1	Low level contact with mineral rich runoff supporting partial alkalization of the system and produces formation of fen conditions within the peatland.
MRn83; MRn83b	Northern Mixed Cattail Marsh; Cattail Marsh (Northern)	S2	5,773	Intact hydrology and natural sedimentation patterns; occasional disturbance events, such as flooding or fire during drought conditions. These events remove thatch and debris from the system, hence lowing the growing surface and making for the required, mucky inundated conditions. Wind and beaver activity can break up or dislodge floating march mats, creating gaps in this dynamic system.
MRn93; MRn93b	Northern Bulrush-Spikerush Marsh; Spikerush - Bur Reed Marsh (Northern)	S2, S3	133	Intact hydrology and natural sedimentation patterns; occasional disturbance events, such as flooding or fire during drought conditions. These events remove thatch and debris from the system, hence lowing the growing surface and making for the required, mucky inundated conditions. Wind and beaver activity can break up or dislodge floating march mats, creating gaps in this dynamic system.
UPs13b	Dry Sand – Gravel Prairie (Southern)	S2	0.46	Grass-dominated herbaceous communities on level to steeply sloping sites with droughty soils. Moderate growing-season moisture deficits occur most years, and severe moisture deficits are frequent, especially during periodic regional droughts. Historically, fires probably occurred every few years.
UPs14a 2	Dry Barrens Oak Savanna (Southern) Oak subtype	S1, S2	30	Sparsely treed communities with grass-dominated herbaceous ground layers on nearly level to steeply sloping sites with droughty soils. Moderate growing-season moisture deficits occur during most years, and severe moisture deficits are frequent, especially during periodic regional droughts. Trees are open grown, typically small and gnarled.
WPs54; WPs54b	Southern Wet Prairie; Wet Prairie (Southern)	S1, S2	135	Grass-dominated but forb-rich herbaceous communities on poorly drained to very poorly drained loam soils formed in lacustrine sediments, unsorted glacial till, or less frequently outwash deposits. Typically in slight depressions, sometimes on very gentle slopes. Flooded for brief periods at most; upper part of rooting zone is not saturated for most of

NPC Code	NPC Name	Status Rank	Acres	Description
				growing season, but saturation usually persists in lower zone for much of season.

Table 11. Conservation status ranks.

Rank Code	Rank Label
S1	Critically imperiled
S2	Imperiled
S3	Vulnerable
S4	Apparently secure; uncommon but not rare
S5	Secure, common, widespread, and abundant

Table 12. State-listed endangered, threatened, and special concern plant species mapped on Carlos Avery WMA.

Species (Common Name)	Species (Scientific Name)	State Status & Conservation Status Rank	Likely NPCs
Least moonwort	*Botrychium simplex*	State special concern (S3)	Fire dependent woodlands
Water-willow	*Decodon verticillatus*	State special concern (S3)	Marshes
Black huckleberry	*Gaylussacia baccata*	State threatened (S2)	Transition zones between fire dependent forests and wetlands
Beach heather	*Hudsonia tomentosa*	State threatened (S2)	Oak savanna on sand dunes
Rhombic evening primrose	*Oenothera rhombipetala*	State special concern (S3)	Dry sand-gravel prairie
Tubercled rein orchid	*Platanthera flava var. herbiola*	State threatened (S2)	Sedge meadows and wet prairies

Species (Common Name)	Species (Scientific Name)	State Status & Conservation Status Rank	Likely NPCs
Snailseed pondweed	*Potamogeton bicupulatus*	State endangered (S1)	Clear-water ponds
Diverse-leaved pondweed	*Potamogeton diversifolius*	State endangered (S1)	Clear-water ponds
Bristle-berry species	*Rubus fulleri*	State threatened (S2)	Transitions zones between upland and wetland plant communities, typically open prairies
Kinnickinnick dewberry	*Rubus multifer*	State special concern (S3)	Openings in oak woodlands
Swamp blackberry	*Rubus semisetosus*	State threatened (S2)	Transitions zones between upland and wetland plant communities, typically open prairies
Blunt-lobed grapefern	*Sceptridium oneidense*	State threatened (S2)	Fire dependent woodlands
St. Lawrence grapefern	*Sceptridium rugulosum*	State special concern (S3)	Fire dependent woodlands
Lance-leaf violet	*Viola lanceolata*	State threatened (S2)	Sedge meadow
Cross-leaved milkwort	*Polygala cruciata*	State endangered (S1)	Sedge meadow
Butternut	*Julgans cinerea*	State endangered (S1)	Forest openings and edges
Tapertip flat sedge	*Cyperus acuminatus*	State threatened (S2)	Sedge meadow
Witch hazel	*Hamamelis virginiana (occurs just outside the WMA boundary)*	State threatened (S2)	Mesic woodlands

1

Shallow and Open Water Communities

Shallow, open water plant communities generally have water depths of less than 6.6 feet, and are dominated by submergent and emergent vegetation, such as wild rice, pondweeds, water milfoil, coontail, and duckweeds as well as cattails and reeds. Size can vary from quarter acre ponds to shallow bays of a lake. The presence or absence of floating vegetation depends upon the effects of the season, wind, availability of nutrients, and water level management (Eggers and Reed, 2015). Wetland impoundments controlled by dikes and water control structures make up most of the shallow, open water communities on the Carlos Avery WMA.

Aquatic communities are important features of the habitat at Carlos Avery WMA. Both DNR Fisheries and the Minnesota Biological Survey (in the Division of Ecological and Water Resources) have sampled aquatic plants within the WMA (Table 22 and Table 23; Appendix B).

Many impoundments have legal mandates for how they are to be managed, but within those constraints focal management species include nesting, molting and migrating waterfowl, fishes, rare mussels, turtles (with focus on rare turtles), and wild rice.

Agricultural Lands

Currently, the Carlos Avery WMA has no agricultural leases and there are approximately 150 acres of actively managed food plots internally with a rotating crop of annuals and perennial food sources for wildlife. Game species benefited by these areas include deer, wild turkey, and ring-necked pheasant.

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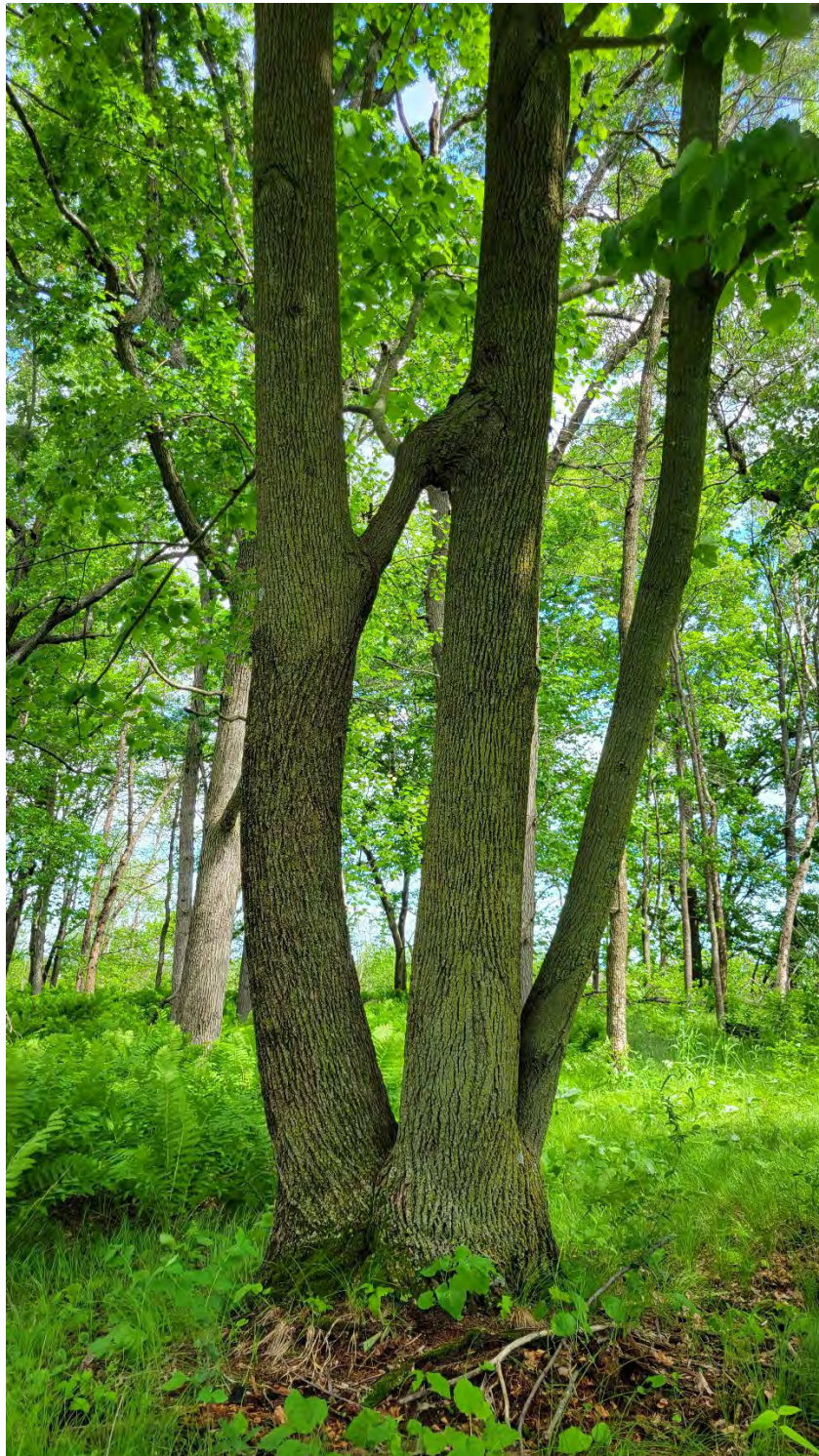
Figure 19: Photo of an unusual aboveground union of two separate basswood stems in an upland forest in the Carlos Avery WMA.

Wildlife

Carlos Avery WMA provides habitat for over 120 species of breeding or likely breeding bird species, 145 species of migratory or visiting birds, 55 species of mammals, and 27 species of reptiles and amphibians. The WMA also hosts a wide variety, but incompletely censused diversity of insect and invertebrate species including rare mussels, butterflies and beetles. Abundant and diverse wildlife species are found in the Carlos Avery WMA due in large part to the wide diversity and quality of habitats and the confluence of two Ecological Provinces.

Birds

Carlos Avery WMA's diverse habitats attract a large variety and number of birds. A list prepared by retired Carlos Avery WMA staff in 1999 lists 273 species by migratory status (migrant, summer resident, permanent resident; Longley 1999). In addition, the Minnesota Breeding Bird Atlas project (2009-2013) documented 35 confirmed breeding species, 41 probable breeding species, and another 23 possible breeding species or summer visitors in and around Carlos Avery WMA. Notable new species were a confirmed nesting of loggerhead shrikes (THR) and confirmed breeding by hooded warblers (SPC). DNR data also lists a record of upland sandpiper during the 2009 spring migration season. Appendix C contains tables with common breeding and game species (Table 24), stewardship species (Table 25), and priority forest bird species (Table 26).

Many species, especially migrants, may be uncommon or rare because preferred habitat on Carlos Avery WMA may be lacking or because the unit lies near the normal limit of a species' range. Of the 273 bird species that may occur on Carlos Avery WMA, some are permanent or summer residents and commonly nest on Carlos Avery WMA, some are fall and spring migrants, and some are winter residents. Of the 273 bird species, 21 species are listed on Minnesota's Endangered, Threatened or Special Concern Species list that was updated in 2013.

In addition to Minnesota's Endangered, Threatened and Special Concern Species list, there is also Minnesota's list of Species of Greatest Conservation Need (SGCN), which are identified in Minnesota's State Wildlife Action Plan. SGCNs contains all of Minnesota's species listed as Endangered, Threatened or Special Concern as well as other vulnerable species. In total, 58 species of SGCNs likely use Carlos Avery WMA for some portion of their annual lifecycle.

All migratory birds, except non-native species such as house sparrows, European starlings, mute swans, and rock pigeons, are protected under the federal Migratory Bird Treaty Act. This Act prohibits, without authorization from USFWS, the take, pursuit, commerce, and trade (among other restrictions) of any migratory bird, bird part (including feathers), nest, or egg. Minnesota also has state regulations that protect birds except those defined as unprotected in Mn Stat 97A.015. Some species unprotected at the state level retain federal protection. Thirty-four bird species may be taken only during authorized hunting seasons.

Waterfowl and Game Birds

Waterfowl. Thirty species of waterfowl have been documented on Carlos Avery WMA. Waterfowl hunting is available on several pools and impoundments across Carlos Avery WMA. However, three sanctuaries are closed to hunting and human trespass in order to relieve hunting pressure on

1   waterfowl and to prevent them from leaving the area shortly after the season opens. Formal bag

2   checks or car counts conducted during the waterfowl season since 1997 indicate blue-winged teal,

3   wood ducks, mallards, and green-winged teal are the most prevalent waterfowl taken. However, far

4   more snipe are taken than those four waterfowl species combined. Priority waterfowl and wetland bird

5   species for management are trumpeter swan, Canada goose, wood duck, mallard, blue-winged teal,

6   sandhill crane, and Wilson's snipe.

7   **Wild Turkey**. Oak forests provide preferred habitat for wild turkeys, but turkeys use a variety of

8   habitats throughout their life cycle. Mature oak forests provide roost trees and hard mast as food.

9   Grasslands and hay fields are used as nesting cover and brood rearing habitat. Agricultural fields can be

10 used for feeding, especially in winter. Wild turkey feed on a wide variety of other vertebrate and

11 invertebrate species so intact and robust communities of nongame wildlife such as snakes, frogs, small

12 mammals and insects is critical to wild turkey populations.

13   **Ruffed Grouse**. Ruffed grouse are scattered throughout Carlos Avery WMA at low abundance in

14 forested areas associated with the younger forest stands. Young forest with stands of high-density

15 saplings provides protection from predation for young broods. Older stands contain diverse shrub

16 layers and ground vegetation for optimal foraging, and older forests produce mast including acorns

17 and buds for winter feeding. Ruffed grouse populations are monitored annually on two drumming

18 count routes (Figure 20).

19

20

21 Figure 20: Carlos Avery WMA cumulative ruffed grouse drumming survey results by year, 1997-2021. Two drumming counts

22 routs are used, Route 30 and Route 66R. Surveys were conducted in all years except 1999, 2000, 2008 (Route 66R), 2009

23 (Route 30), 2012, and 2013.

1

Ring-necked Pheasant. Ring-neck pheasants are a non-native game bird not commonly found on the Carlos Avery WMA, although they were several times noted during ruffed grouse drumming surveys (along with sandhill cranes, wild turkeys and occasionally snipe and rails). The Carlos Avery WMA is very near the northern extent of pheasant range in this part of Minnesota, but some birds can be found each year by hunters focusing on areas with brush and prairie grass fields. The population at Carlos Avery may be at some risk for isolation based on urban growth and less suitable habitat in the adjoining Laurentian Mixed Forest biome.

American Woodcock. American woodcock is the only shorebird that inhabits the forest floor. This species is typically found in moist woodlands and edges of marshes and fields. Woodcock habitat on Carlos Avery WMA is young forest stands, particularly aspen, or other brushy areas located near more open fields, which are used for courtship displays and night roosting. Woodcock are a migratory species in this region and use the Mississippi River Flyway for much of its migration. While American woodcock numbers are stable in Minnesota, numbers have declined across North America, leading this species to be included in Minnesota's State Wildlife Action Plan list of Species in Greatest Conservation Need for the last 20 years. Threats to the species include habitat loss due to urbanization, agricultural development, degradation of wetlands, and succession of young forests to an older age class.

Wilson's Snipe. More Wilson's snipe are taken by waterfowl hunters than are waterfowl, on average since 1997. Wilson's snipe nest on the ground in grasses and sedges on moist ground near water.

Sandhill Crane. Sandhill cranes are migratory birds, using wet meadows and open grasslands. Sandhill cranes are a protected species in Minnesota, and although it is legal to hunt them in part of northwestern Minnesota during the sandhill crane hunting season the sandhill cranes nesting at Carlos Avery are part of the rarer Greater Sandhill Crane population that migrates to the southeastern U.S. for winter and is currently not hunted in Minnesota. Fluctuating water levels may hinder sandhill crane nesting. Impoundments on Carlos Avery WMA are managed to avoid negatively impacting nesting for cranes and other waterfowl.

Nongame Birds

In addition to the common birds listed in Table 24 (Appendix C) other SGCN that may use Carlos Avery WMA for breeding, foraging during breeding, or migration include yellow rail (also SPC), upland sandpiper, Wilson's phalarope (also THR), common tern (also THR), western meadowlark, and Nelson's sharp-tailed sparrow (also SPC). Red-shouldered hawks (also SPC) breed in the Sunrise unit of Carlos Avery.

SGCN that may use Carlos Avery WMA during migration include horned grebe (also END), American black duck, northern pintail, lesser scaup, peregrine falcon (also SPC), greater yellowlegs, Hudsonian godwit, semipalmated sandpiper, short-billed dowitcher, Forster's tern (also SPC), Cape May warbler, bay-breasted warbler, and Connecticut warbler.

Trumpeter swans use and nest in most of the wetlands within Carlos Avery WMA. Minnesota supports the largest population of trumpeter swans south of Alaska and Canada, so maintaining nesting areas throughout the state is important for the long-term continental conservation of this species.

Trumpeter swans eat primarily vegetation, so encouraging a diversity of aquatic plants such as pondweeds and bulrushes, is important. Trumpeter swans also eat fish, fish eggs, and small aquatic animals such as mussels and crayfish. In addition to maintaining adequate forage, swans are large birds requiring a minimum of 30 feet of open water to allow for a running start to become airborne. Thus, swan biology requires larger open areas be maintained within Carlos Avery WMA's wetlands. The pools need to be monitored annually for cattail expansion. If the pools begin to fill in with cattails or other vegetation, it may become necessary to actively manage for larger openings to retain trumpeter swans, and even tundra swans during migration. Nests are typically located closer to shore and are built on muskrat and beaver lodges, and floating vegetation mats.

Mammals

Most mammal species found on Carlos Avery WMA today were present during pre-European settlement times. As European settlement progressed, habitat destruction and unregulated hunting and trapping resulted in the decimation and, in some cases, the elimination of several larger mammals such as elk and woodland caribou from the area. The historical distribution of small, inconspicuous species is unknown. Mammal species present on Carlos Avery WMA were determined from information supplied by Section of Wildlife records and observations from staff working at Carlos Avery WMA (Appendix D, Table 27). Fifty-six mammal species are known to have occurred on or near Carlos Avery WMA (although the snowshoe hare and spotted skunk are believed extirpated). Eighteen of these 56 mammal species are identified as game species, eight are state listed as special concern, four are considered SGCNs, and three species, the gray wolf, northern long-eared bat, and tri-colored bat are federally listed as Threatened, Endangered, and Candidate species, respectively.

Carlos Avery WMA provides important habitat for most of Minnesota's native bat species, some of which are rapidly vanishing from the landscape due to the introduction of a fungal pathogen causing white-nose syndrome. Carlos Avery WMA complies with the requirements of the Lake States Forest Management Bat Habitat Conservation Plan in order to comply with federal legal protections of several native bat species and contribute to the long-term persistence of these critical members of the ecosystem.

Large Mammals and Big Game

Carlos Avery WMA supports a moderate population of deer and accommodates large numbers of deer hunters. Deer are habitat generalists and use almost all the habitats available on Carlos Avery WMA. They tend to feed in early successional and oak forests, and on agricultural crops. They use forested habitat for security and thermal cover. They prefer that these cover types are well interspersed with each other and favor edge habitat. The current approach to management of Carlos Avery WMA deer habitat – retaining oak and managing for diverse native plant community conditions – produces excellent deer habitat. Black bear live in forests, swamps and other areas with dense cover but will wander into clearings to feed. They are found mainly in the northern third of Minnesota, but range as far south as the interface between the forest and agricultural zones, where they utilize corn and other crops for subsistence. The increase in sightings and harvest of black bears in Carlos Avery WMA indicates the population is increasing slightly.

Mid-sized Mammals, Small Game, and Furbearers

Carlos Avery WMA is home to several mid-sized mammals, many of which are classified as small game in hunting regulations or as furbearers in trapping regulations. Common small game hunted on Carlos Avery WMA include raccoons, coyote, red fox, rabbits, and squirrels. Furbearers include a variety of mammals trapped or hunted for their pelts. Important furbearers on Carlos Avery WMA include muskrats, mink, beaver, otter, raccoon, foxes and bobcat. Many furbearers are associated with water and wetlands (e.g., muskrats, otters, beavers, mink). Rabbits, raccoons, and coyotes can be found in a wide variety of habitats, including croplands, open areas, and forests.

Gray squirrels are found throughout the forested areas of Carlos Avery WMA. Gray squirrels use oak forests with large, mast producing trees (Healy and Welsh, 1992). Current forest management on the Carlos Avery WMA supports such mast producing trees and results in abundant squirrel habitat. There is high squirrel hunting pressure on the WMA.

Small Mammals

Small mammals are important to ecosystems, serving as food for predators, distributors of seeds, grazers, and consumers of invertebrates. Although generally inconspicuous, small mammals are representative of deciduous forest, wetland and grassland communities on Carlos Avery WMA. Several species of small squirrels, chipmunks, voles, mice, shrews, bats, and moles are common. Several state listed species of small mammal occur in the WMA.

Fish

Fisheries management within the Carlos Avery WMA is primarily focused on the Sunrise River and its two impoundments east of Highway 35. One small boat landing is located on both the North and South Sunrise Pools, as well as three canoe access points along the river.

DNR Electrofishing surveys were conducted at three locations on the Sunrise River within and just downstream of Carlos Avery WMA in 1998, 2003, and 2008 (Appendix E, Table 28, Figure 28). Thirty-six fish species were sampled at these three locations during these surveys, most of which are warmwater species. The species included 10 Cyprinids (minnows), 8 Centrarchids (sunfishes), 6 Catostomids (suckers), 5 Percids (perch), 4 Ictalurids (catfish), 1 Esocid (pike), 1 Amiid (bowfin), and 1 Umbrid (mudminnow). Popular gamefish species sampled included black crappie, bluegill, largemouth bass, northern pike, smallmouth bass, walleye, and yellow perch. Many of these species are unlikely to occur on the WMA west of Highway 35 in the West Branch and South Branch of the Sunrise River due to reduced flow and habitat availability.

The Minnesota PCA also sampled the Sunrise River just downstream of the Kost Dam in 1998, 1999, and 2000 (Appendix E, Figure 28). Additional species sampled in those surveys included blackchin shiner (*Notropis heterodon*), brook stickleback (*Culaea inconstans*), brown trout (*Salmo trutta*), burbot (*lota lota*), channel catfish (*Ictalurus punctatus*), chestnut lamprey (*Ichthyomyzon castaneus*), creek chub (*Semotilus atromaculatus*), greater redhorse (*Moxostoma valenciennesi*), logperch (*Percina caprodes*), longnose dace (Rhinichthys cataractae), northern redbelly dace (*Chrosomus eos*), and silver lamprey (*Ichthyomyzon unicuspis*).

1 Four other DNR electrofishing stations were sampled on the Sunrise River between the Carlos Avery
2 WMA boundary and the rivers confluence with the St. Croix River in the three surveys referenced
3 above and sampled up to 48 fish species. As a result of the Sunrise River flowing downstream into the
4 St. Croix River, seasonal migrations of numerous other fish species can occur up to the Kost Dam. The
5 dams below the North and South Sunrise Pools form barriers to upstream fish migration.

Herpetofauna

7 Carlos Avery WMA has a high diversity of reptiles and amphibians, influenced by the diversity of
8 habitats and native plant communities and their landscape connections. Herpetofauna species that
9 occur on or near Carlos Avery WMA are listed in Table 31 (Appendix F). Carlos Avery WMA provides
10 habitat for a variety of rare or listed reptiles and amphibians. General management guidelines for
11 reptiles and amphibians can be found in the Habitat Management Guidelines for Amphibians and
12 Reptiles of the Midwestern United States.

Invertebrates

14 Mussel surveys have been conducted on the Sunrise River in six years between 2010 and 2023
15 (Appendix E, Table 29). The Sunrise River watershed has a diverse and abundant assemblage of
16 freshwater mussels, and density below Kost Dam is among the highest known for Minnesota
17 (Hornbach et al. 2014). Impoundment of this river by the Kost Dam, has contributed to this high
18 density as conditions in the reservoir above the dam modulate favorable thermal conditions and food
19 resources downstream (Hornbach et al. 2014). Mussel surveys above and below the dam show a stark
20 contrast in species richness and abundance. Sites upstream of the Kost dam indicated nine species
21 were present, four of which are listed as threatened or special concern (Appendix E, Table 29, Figure
22 28). Sites downstream of the Kost Dam indicated 17 species were present, 7 of which are threatened,
23 endangered, or special concern.

24 The Minnesota Pollution Control Agency (MPCA) has conducted aquatic macroinvertebrate surveys in
25 the Carlos Avery WMA. As reported in Table 30 and Figure 28 (Appendix E), sampling occurred at four
26 sites on the Sunrise River, one site on the West Branch of the Sunrise River, and one tributary to the
27 North Sunrise Pool. Surveys were conducted in 1996, 2004, 2006, 2009, 2011, 2019, and 2020. Surveys
28 were not conducted at all sites in all years. Fourteen orders, 51 families, and 165 species were sampled
29 between all surveys. IBI scores from macroinvertebrate samples collected in the 1990s and 2000s at
30 two of the Sunrise River sites in addition to the site on the West Branch of the Sunrise River resulted in
31 them being on the impaired waters list. However, all samples at all six locations since then resulted in
32 all waters being removed from that list. Therefore, favorable ecological conditions currently exist in
33 these rivers and tributaries to support a healthy and diverse macroinvertebrate community.

34 Numerous other species of rare, common or poorly understood insect species occur on Carlos Avery
35 WMA. Rare butterflies, bees and beetles are known to occupy several of the WMAs habitats and many
36 more are likely present but under-surveyed or undocumented.

Recreational and Tribal Use

38 Minnesota's wildlife management areas are by statute designated for public hunting, trapping, fishing,
39 and other activities compatible with wildlife and fish management. Hunting has always accounted for

the largest share of public use on the Carlos Avery WMA, but over time non-hunting activities such as wildlife watching, foraging, and hiking have seen a significant increase. Hunting, fishing, trapping, and foraging regulations dictate the specific allowances for consumptive use of fish, wildlife, and plant resources on the WMA. All species listed as threatened or endangered are considered protected species and take is not allowed. Carlos Avery WMA is closed to the public from 10:00pm to 4:00am and no overnight camping is allowed.

Current Use of Tribal Communities

Approximately the northern half of Carlos Avery WMA is located within the area of MN ceded to the US in the treaty of 1837, in which Tribal Nations reserved the right to hunt, fish and gather natural resources. These treaty-reserved rights were upheld by the US Supreme Court (1999) and applied to the Mille Lacs and Fond du Lac Bands in Minnesota as well as six Ojibwe Bands in WI (Bad River Band of Lake Superior Chippewa, Lac Courte Oreilles Band of Lake Superior Ojibwe, Lac du Flambeau Band of Lake Superior Chippewa Indians, Mole Lake Band of Lake Superior Chippewa, Red Cliff Band of Lake Superior Chippewa, and St. Croix Chippewa Indians of Wisconsin). Although the Carlos Avery WMA is located at some distance from some of these bands, the rights reserved in the treaty of 1837 apply to all their members.

The usufructuary rights reserved in the treaty of 1837 are described as rights to hunt, fish and gather. While these usufructuary rights were expressed in English (a foreign language to the Ojibwe) as a right to hunt, fish and gather, the intent was to continue their life way. Thus, while current use of the Carlos Avery WMA by tribal communities includes activities such as harvesting wild rice and hunting white-tailed deer and other species, the usufructuary rights are not limited to these activities. Other activities, such as conducting ceremonies and hiking, also fall within the range of treaty-reserved rights.

The extent of current use of the Carlos Avery WMA by tribal communities is not well known but includes activities such hunting large and small game and gathering wild rice and other plants.

Hunting

Waterfowl Hunting

Waterfowl hunting is available on many of the pools, impoundments, and streams across the Carlos Avery WMA and is one of the most popular activities in Carlos Avery WMA. Formal bag checks and car counts are conducted during the opening day of waterfowl season and informal bag checks are conducted periodically. Formal habitat and waterfowl use surveys are conducted weekly during the waterfowl season. Several waterfowl species are present during the hunting season, but most of the harvest consists of blue-winged teal and wood ducks.

Squirrel and Rabbit Hunting

Squirrels and rabbits are the most popular game species on the unit after waterfowl. Current regulations allow for a daily bag limit of seven squirrels and ten rabbits, with the seasons for each running from mid-September through February. Bag counts and harvest estimates do not exist for the Carlos Avery WMA. Sanctuary areas on the WMA and other refugia nearby play an important role in avoiding overharvest in the area.

1   *Deer Hunting*

2   Deer hunting is another popular activity on Carlos Avery WMA, thanks to moderate deer numbers and
3   to the fact that Carlos Avery WMA represents the largest block of public land just north of the
4   Minneapolis/St. Paul metropolitan area. Deer population density is managed almost exclusively
5   through hunter harvest strategies. Annual population modeling and assessment of hunter harvest data
6   helps inform yearly harvest regulations. These regulations are set to help meet deer population goals,
7   which are determined through a stakeholder informed process. Population goals are revisited
8   approximately every five years and were updated in 2023.

9   Since changing the deer hunting regulation to Hunter's Choice in 2020, the fall deer harvest in Carlos
10   Avery WMA (Deer Permit Area 235) has averaged around 175 deer with about 40% antlerless deer
11   taken. Figure 21 shows reported deer harvest by year and method. In the 200 series of DPAs, the
12   firearms deer season is a 9-day season.

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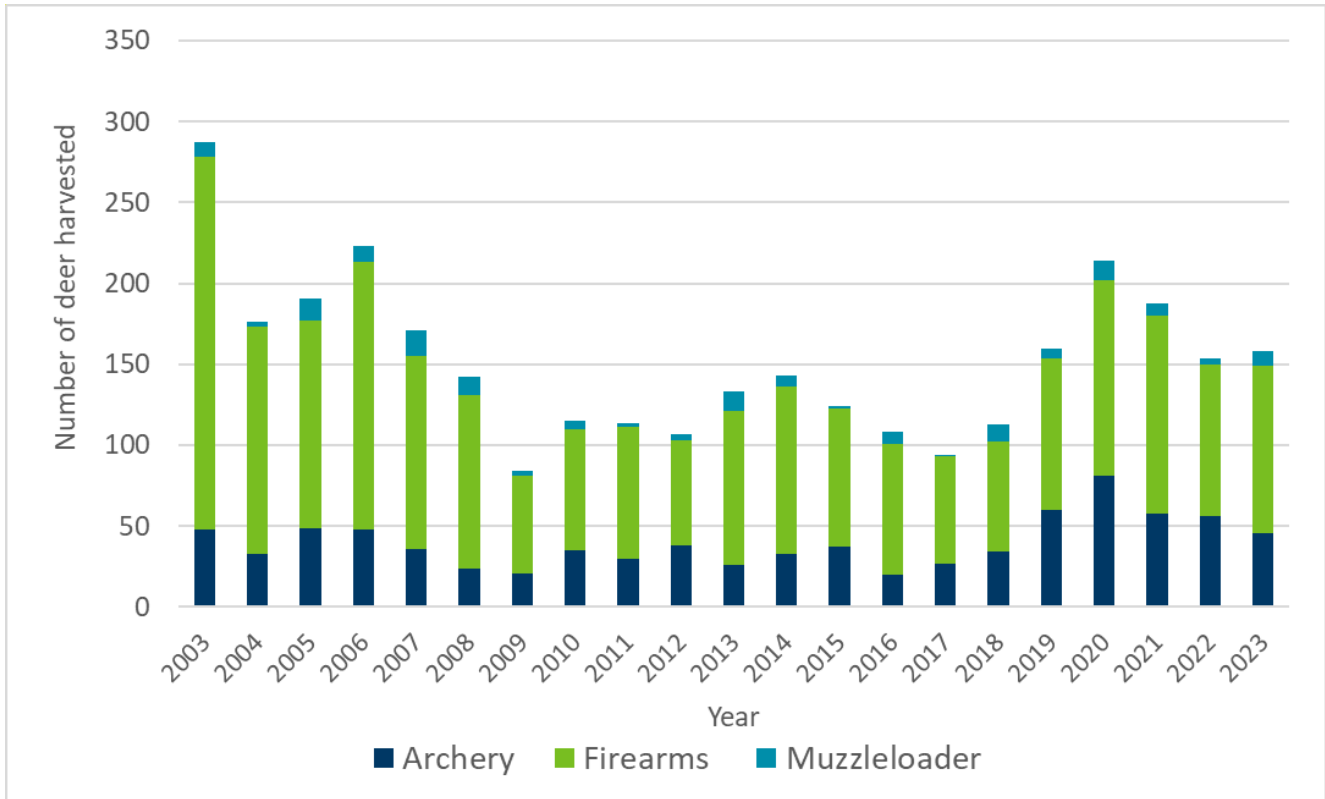
Figure 21: Total deer harvest in Carlos Avery WMA (Deer Permit Area 235) by method, 2003-2023.

15   *Pheasant Hunting*

16   Pheasant hunting occurs on Carlos Avery WMA, but Carlos Avery WMA doesn't have the open
17   grassland habitats pheasants often prefer so hunting is somewhat limited on this WMA. People pursue
18   pheasants primarily due to Carlos Avery WMA's proximity to the metro area and makes for a
19   manageable day trip.

20   *Bear Hunting*

Carlos Avery WMA lies within the bear No Quota Area of the state and over-the-counter licenses are available to anyone. Only 1-4 bears are reported to be harvested from Carlos Avery WMA each year.

Ruffed Grouse and Woodcock Hunting

Ruffed grouse and woodcock hunting is a minimal activity on Carlos Avery WMA, but still occurs due to the proximity to the metro area. Ruffed grouse harvest data for Carlos Avery WMA is not available, but ruffed grouse drumming surveys are conducted in the spring. The survey results are provided in Figure 20. Survey results on the Carlos Avery WMA show diminishing numbers recorded.

Turkey Hunting

The spring turkey harvest in the Carlos Avery WMA has ranged from 50-80 male turkeys a year in recent years. Figure 22 shows the spring harvest in Permit Area 511. Seasons A-C are lottery periods requiring firearms hunters to draw permit. Archery hunters and youth are exempt from the lottery requirements and as a result the unit receives heavy pressure during the first three time periods. Hunter success and hunting pressure gradually decrease as the season progresses. Fall turkey hunting is not popular with hunters, with an average of 5 turkeys of either sex harvested by hunters each fall.
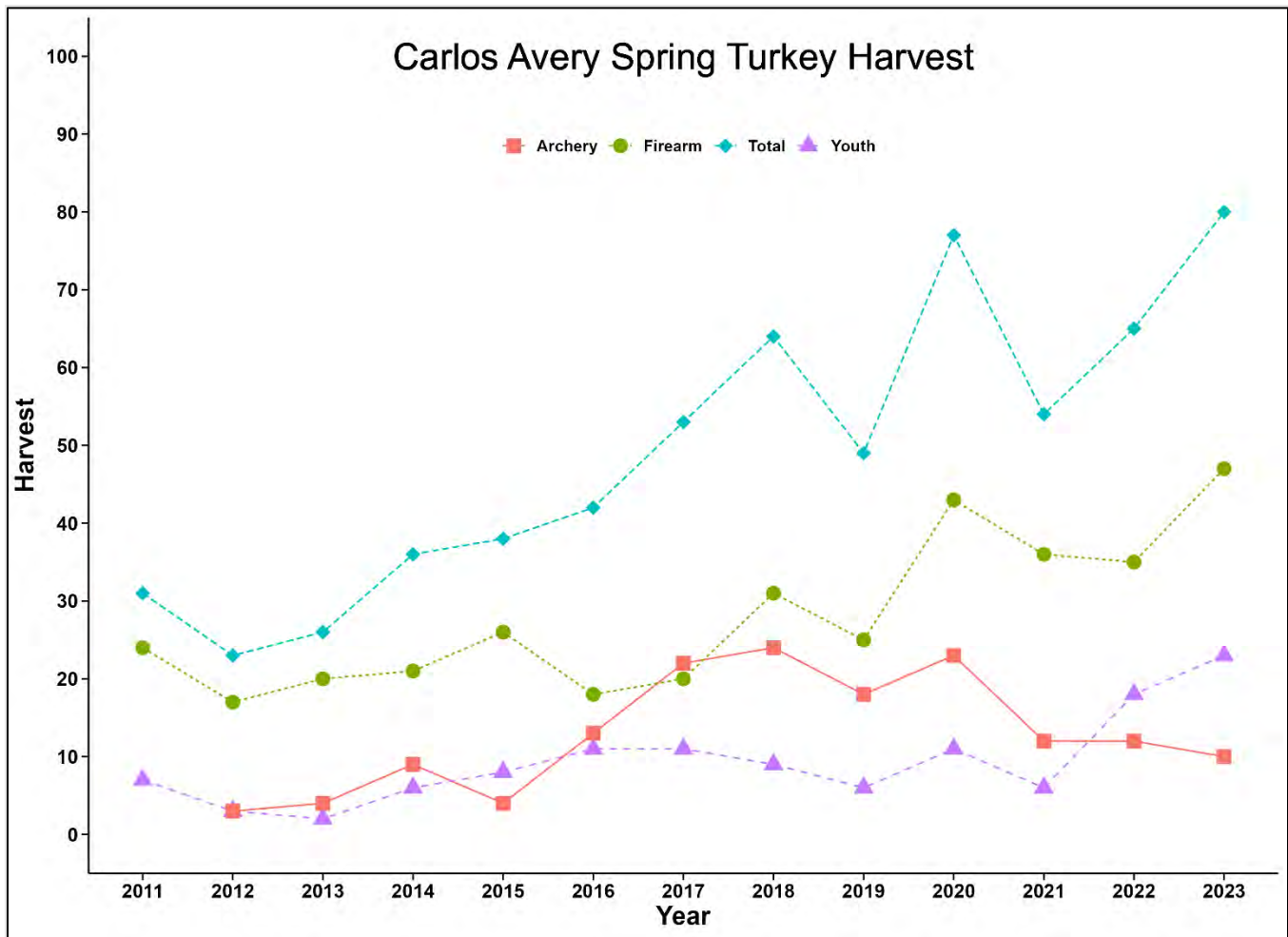
Figure 22: Reported spring turkey harvest for Area 511 by season, 2011 - 2023.

Accessible Hunting

Accessible hunts within the wildlife sanctuaries on the WMA for deer, turkey, and waterfowl are organized and permitted by a not-for-profit organization.

Trapping

Many furbearers on Carlos Avery WMA are dependent on aquatic habitats but there are large number of upland furbearers within the Carlos Avery WMA as well. Aquatic trappers pursue beaver, mink, muskrat, and otter while the upland trappers pursue fisher, bobcat, raccoon, coyote, red fox, and gray fox. Annual fur prices typically dictate trapping pressure. When prices rise the Carlos Avery WMA sees an increase in permit requests with a subsequent decline when prices drop. Approximately 20 trappers are permitted to trap Carlos Avery WMA per year. Annual trapping harvest reports are collected but have not been summarized in recent years. Harvest is highly variable due to furbearer populations, weather, fur prices, etc. All trappers on Carlos Avery WMA are required to obtain a special use permit.

This permit provides managers the ability to monitor trapping pressure within the Carlos Avery WMA boundary.

Fishing

Fishing occurs on Carlos Avery WMA in accordance with statewide fishing regulations. Areas targeted by anglers are predominantly the North and South Sunrise Pools, locations directly below the two dams, and along the Sunrise River riverbanks as it flows downstream toward the St. Croix River. Most anglers target sunfish, crappie, northern pike, and largemouth bass. The Carlos Avery WMA provides angling opportunities using non-motorized boats, as well as shore fishing. Fishing pressure on the WMA is heaviest in June, July, and August, with the highest concentration of anglers present below the two dams. Ice fishing is rare and ice safety needs to be carefully considered as ice thickness will vary due to flowing water and fluctuating pool water levels.

Wildlife Observation

Wildlife observation is another activity that occurs on the Carlos Avery WMA. Carlos Avery WMA is considered a destination site for Twin Cities Metropolitan Area birders and is often mentioned online as a place to visit. WMA staff regularly talk with visitors interested in wildlife observation about WMA regulations and best locations for wildlife observation.

Resource Gathering

Resource gathering, also known as foraging, is an allowed activity on the Carlos Avery WMA where edible plants and other materials are harvested for personal use. No commercial harvest of any animals or plants (except trees) is permitted on the Carlos Avery WMA. A variety of wild foods commonly collected for personal consumption include wild rice, raspberries, blackberries, mushrooms, fiddleheads, chokecherries, nettles, and leeks.

Foraging continues to increase on the WMA which has lead to concerns about overharvest. Illegal activities include, but are not limited to, commercial harvest of edible portions of plants, harvest within the wildlife sanctuaries, and activities such as removing birch bark and burls without permits. Plants that are threatened or endangered are not allowed to be harvested. Foragers should consult current regulations, as permitted activities are subject to change.

Recent permits for wood products include, for example: willow and conifer bough harvest, cones and firewood harvest, dogwood saplings harvest for habitat restoration projects, and maple sap harvest to make maple syrup. For a current list of forest products and their harvest specifications, please contact the Carlos Avery WMA office.

Other Uses

Hiking, dog walking, biking, photography, environmental education, natural resources research, and other compatible recreation activities also occur within Carlos Avery WMA. With its proximity to the Twin Cities Metropolitan Area, Carlos Avery WMA is frequently used for these recreational activities. Given the hunting activity on Carlos Avery WMA, those taking part in hiking, dog walking, biking, and similar activities are encouraged to review current hunting seasons and to wear blaze orange for safety.

Another example of additional recreational activity, frog and turtle harvest occur on the Carlos Avery WMA. Frogs can be harvested for bait purposes with an angling license. People with a fishing license and children younger than 16 can take, use, buy and sell frogs for bait between May 16th and March 31st, as long as they are not listed as threatened or endangered. MN DNR permits are necessary for Minnesota residents to sell native frog and toad species for purposes other than bait (M.S. 97C.601) and non-residents may not sell these species in the State of Minnesota. Snakes and salamanders (including mudpuppies) are protected wildlife and cannot be harvested.

With the exception of the common snapping turtle (*Chelydra serpentina*) and the painted turtle (*Chrysemys picta*) turtles native to Minnesota **may not** be sold as pets in Minnesota (MINN. R. 6256.0500). A turtle seller's or turtle seller's apprentice license is required to take and sell common snapping or painted turtles captured in Minnesota (MINN. R. 6256.0500). Turtle nests are protected.

People with fishing licenses and children younger than 16 may hand-pick or possess up to 24 whole or 48 half native mussel shells of species that are not endangered or threatened and not originating from the St. Croix River if the shells are collected between May 16th and the last day of February the following year. These shells may not be bought or sold. Zebra mussels may not be possessed.

It is illegal to release non-native animals (including domestic species) on state lands in Minnesota. It is illegal to release unused frogs or tadpoles in any Minnesota water.

The Carlos Avery WMA is also utilized by other user groups. Ongoing research permits include USFS emerald ash borer and oak wilt studies and University of Minnesota research on a host of topics including frogs, bumblebees, honeybees, woodcocks, Blanding's turtles, spongy moths, watershed water quality, light pollution, invasive species, and rare species. Local fire districts and the Anoka County Search and Rescue also utilize the property for various training activities.

V. Strategic Considerations

Climate and Climate Change

Carlos Avery WMA has a moist continental mid-latitude climate, typical of the northern part of the Upper Midwest. Summers are warm, and winters are cold (National Oceanic and Atmospheric Administration 2023). According to data from 1991 to 2020, the hottest month is July and the coldest month is January (Minnesota State Climatology Office 2023, data presented only from Carlos Avery WMA's major unit). The median dates for last and first killing frosts (28°F) from 1991–2020 are approximately April 20 and October 11 (Midwestern Regional Climate Center 2023), with a growing season of 174 days spanning the time between those killing frosts (U.S. Department of Agriculture 2023). The wettest month is June (4.55 inches of precipitation), and the driest month is January (0.78 inches of precipitation) (Minnesota State Climatology Office 2023). Carlos Avery WMA receives around 48 inches of snowfall annually from October through April (average of Andover and Forest Lake weather stations, 1991–2020) (NOAA 2023).

The future climate of Carlos Avery WMA is projected to be warmer in all seasons than it is currently, as modeled by the University of Minnesota. Recent decades have been notably wetter than earlier in the 20th century. Projected precipitation varies by season, but the annual precipitation is projected to be

1 slightly higher at the end of the century than it is currently. Table 13 and Table 14 contain the historic
2 (1895-1969) and current (1991–2020) mean seasonal precipitation and temperature values as well as
3 projected end-of-century values under a moderate greenhouse gas emissions scenario.

4 Table 13: Precipitation by season for the Carlos Avery WMA (major unit). (Minnesota State Climatology Office 2023)

Season	1895–1969 mean (inches)	1991–2020 mean (inches)	2080–2099 (inches) (mean under a moderate emissions scenario)
Winter (December–February)	2.64	2.70	2.86
Spring (March–May)	7.33	8.68	7.66
Summer (June–August)	11.64	13.19	12.37
Fall (September–November)	6.87	7.87	9.74

5 Table 14: Temperature by season for the Carlos Avery WMA (major unit). (Minnesota State Climatology Office 2023)

Season	1895–1969 mean (^{o}F)	1991–2020 mean (^{o}F)	2080–2099 (^{o}F) (mean under a moderate emissions scenario)
Winter (December–February)	13.51	17.22	23.67
Spring (March–May)	42.76	44.43	52.20
Summer (June–August)	68.73	69.26	75.16
Fall (September–November)	45.89	47.21	52.52

6

7 Temperature increases likely will affect fish, wildlife, and plant populations—particularly distribution,
8 development, reproduction, and survival. Besides the direct impact of less exposure to colder
9 temperatures and greater exposure to heat, related ramifications such as decreased snow cover, shifts
10 in dissolved oxygen regimes in lakes, and increasing stream temperatures, will impact animals and
11 plants. Some species may benefit from climate change, while many native fish, wildlife, and plant
12 populations could be negatively affected.

13 Besides impacts to wildlife and vegetation, a changing climate will affect resource management. Staff
14 can find climate adaptation and mitigation guidance in DNR Operational Order 131. Warming winters
15 will decrease the window of time suitable for forest management on wetter sites. Less time for actively
16 managing the forest may increase the need for coordination between the harvester, forester, and
17 wildlife staff.

18 ## Winter Severity

19 Temperature in wintertime is predicted to increase more than any other seasonal temperature or
20 precipitation value. Days with snow coverage are also predicted to decrease (Liess et al. 2022). These
21 changes likely will benefit certain wildlife and plant species and harm others. However, nuanced
22 changes to snow quality affected by warmer air temperatures in the winter and early spring can

1   negatively affect wildlife. One example is freezing rain forming a hard icy crust on the snow surface,

2   which can prevent grouse from roosting under snow. Subtle changes in snow quality cannot be

3   predicted to confidently forecast potential impacts to wildlife.

4   A shift towards milder winters can already be seen in data the MN DNR collects. The DNR measures

5   snow depth and cold temperatures from November through May to calculate a winter severity index

6   (WSI), which estimates winter weather impacts on deer survival/population. More days with extreme

7   cold and deep snow result in a higher WSI, correlating to lower deer survival. Winter severity indices

8   for Carlos Avery WMA's deer permit area 235 were calculated back to winter 1981–1982 and are

9   shown in Figure 23. WSIs in permit area 235 are trending downward, primarily due to fewer days with

10 deep snow. The average WSI for the first 21 years in this dataset is 48. The average WSI for the last 21

11 years is 37.
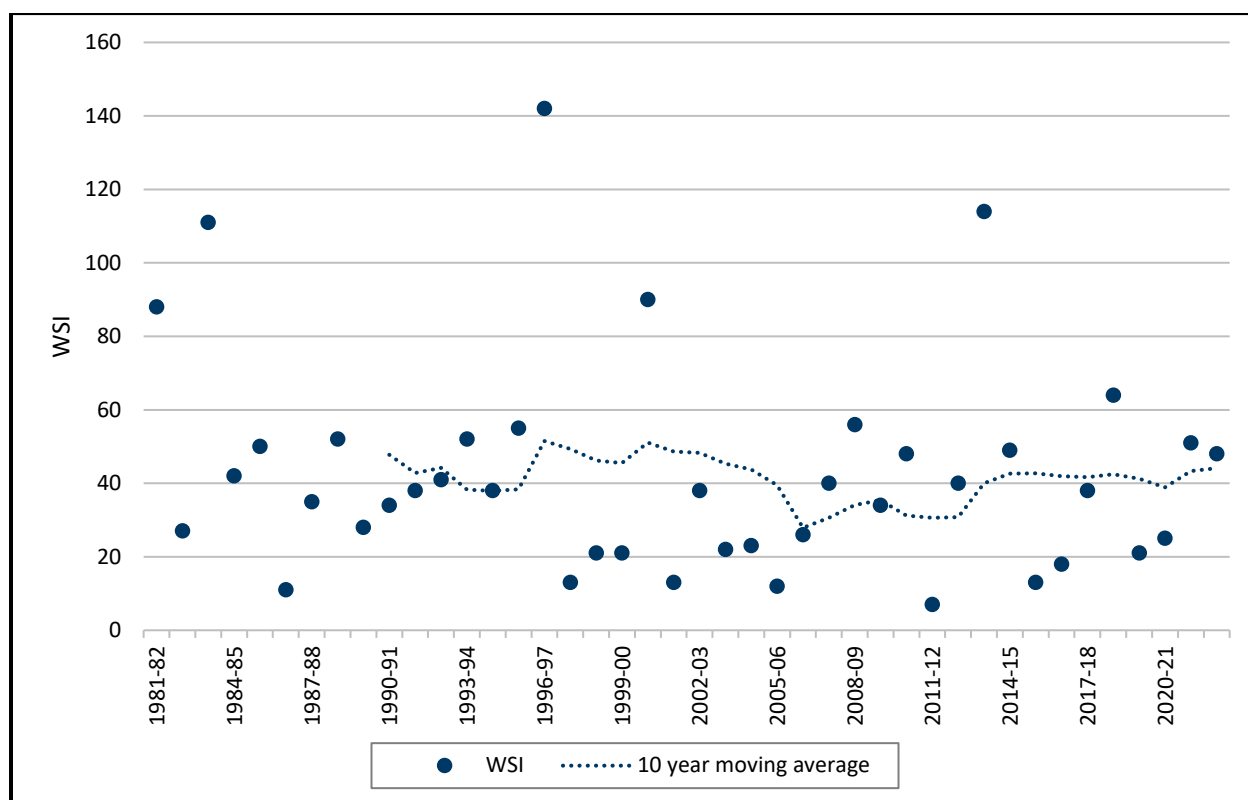
13 Figure 23: Winter severity index for Carlos Avery WMA, 1982-2023

14

15   Extreme weather

16 One result of climate change is more extreme weather, especially heat and heavy precipitation. The

17 frequency of near-record high seasonal temperature and near-record high seasonal precipitation totals

18 are increasing in Carlos Avery WMA. Eight of the 10 wettest summers, 9 of the 10 warmest winters,

19 and 9 of the 10 warmest springs, have all occurred since 1971. In the last 10 years, Carlos Avery WMA

1 experienced 15 seasonal precipitation or average temperatures ranking in the top or bottom 10 on
2 record (1895–2023) (see Table 15).

3 Table 15: Recent extreme weather records, by season, for the Carlos Avery WMA.

Year	Season			
	Winter	Spring	Summer	Fall
2013		3rd Coldest		
2014	5th Coldest		10th Wettest	
2015				Warmest
2016	6th Warmest	8th Warmest	5th Wettest	2nd Warmest
2017	7th Warmest			
2018				
2019				
2020				
2021			7th Driest 4th Warmest	6th Warmest
2022				
2023	Wettest		6th Driest	9th Warmest

4

5 An increasing likelihood of extreme rainfall events suggests managers prepare infrastructure and
6 vegetation in the WMA for greater threats from flooding (Minnesota State Climatology Office 2023b).
7 Mega-rains are defined as 6 inch or greater rainfalls within 24 hours covering at least 1000 square
8 miles with at least one location receiving 8 inches or more. Heavy precipitation events such as these
9 are predicted to increase across the country (USGCRP 2017).

10 ## Invasive Species

11 Invasive plants and animals pose management concerns by, for example, outcompeting native species
12 for sunlight, food, space, and other resources, introducing disease and parasites, altering ecological
13 processes, and direct predation.

14 Based on DNR invasive species monitoring data, there are many invasive plants and animals within and
15 adjacent to Carlos Avery WMA. Although the DNR's monitoring programs have increased recently,
16 there are likely species under reported or not reported at all. It is likely that invasive plants and animals
17 are more widespread than current data indicate. In the future, the number, and abundance, of
18 different invasive species will increase, and these organisms will pose significant risks to many native
19 species.

1 Carlos Avery WMA visitors may also inadvertently spread additional invasive species to the WMA.
2 Given that the WMA is a recreation destination for the public around the state, it's likely that new
3 invasive species will continue to be introduced to the unit. Public education, early detection, and
4 aggressive treatments can be effective tools in minimizing the introductions of, and impacts from,
5 invasive species.

Monitoring and Control

7 The DNR uses proactive tools to help prevent the introduction of new invasive species, including those
8 outlined in Operational Order 113 Invasive Species Prevention and Management and the Division of
9 Fish and Wildlife's guidelines on Operational Order 113. These documents outline how staff should act
10 to minimize spread of invasive species and pathogens on state lands. Protocols include day to day
11 guidelines on preventing intentional movement of invasives species, monitoring, reporting, training,
12 and incorporating invasive species spread prevention in contracts and grants.

13 Staff report new infestations of invasive species to the DNR Invasive Species Program using the
14 EDDMapS Midwest website or app (Early Detection Distribution and Mapping System) or using the
15 Invasive Species Reporting Form. Invasive species reports are verified by DNR invasive species
16 specialists and with the help of these staff, fast action can be taken to manage, and ideally eradicate,
17 new invasive plants and animals found on the WMA.

18 For invasive plant and animals already present in the WMA, the control of limited-sized populations on
19 higher-quality sites in larger project areas is prioritized. Prioritizing these limited-sized invasions will
20 reduce spread into uninvaded areas. Land management such as timber harvest is accompanied by an
21 invasive species treatment and monitoring plan to avoid worsening existing infestations.

22 Below is a listing of plants and animal species present in or nearby the Carlos Avery WMA according to
23 the Minnesota DNR's Invasive Terrestrial and Aquatic Observations data sources and DNR staff
24 specialists. Species that could be potential invaders over the next 10 years are also listed.

Animals

Terrestrial animals

27 Several non-native terrestrial animals are well established in and around Carlos Avery WMA and may
28 or may not be tracked in invasive species databases. These include European starlings (*Sturnus*
29 *vulgaris*), chukar (*Alectoris chukar*), Muscovy ducks (*Cairina moschata*), mute swans (*Cygnus olor*),
30 pigeons (*Columba livia*), house sparrows (*Passer domesticus*), jumping worms (*Amynthas* species) and
31 other invasive earthworms.

32 There are currently no cost-effective control methods for these species. Invasive earthworms and
33 jumping worms have the greatest impact on habitat structure; if new control techniques are developed
34 in the future, they may be implemented. There is concern that more could be introduced by yard
35 waste dumping on the WMA. The other species listed are undesirable because they may spread
36 diseases or compete with native cavity-nesting birds.

Aquatic animals

There are no reports of invasive fish species in the WMA. Common carp (*Cyprinus carpio*), while not present in the pools at the WMA, are present in nearby watersheds. The most likely avenue for introduction is by people transporting baitfish.

There are no reports of zebra mussels (*Dreissena polymorpha*) in the unit, but their potential arrival would likely be from recreation. Zebra mussels are present in Forest Lake and Comfort Lake and have been since at least 2017.

Other invasive aquatic animals nearby that could impact the pools at Carlos Avery WMA include the Chinese mystery snail (*Cipangopaludina chinensis*) and banded mystery snail (*Viviparus georgianus*).

Insects

Invasive insects in or near Carlos Avery WMA include brown marmorated stink bug (*Halyomorpha halys*), emerald ash borer (*Agrilus planipennis*), cabbage white worm (*Pieris rapae*), Japanese beetle (*Popillia japonica*), knapweed root weevil (*Cyphocleonus achates*), lesser knapweed flower weevil (*Larinus minutus*), lily leaf beetle (*Lilioceris lilii*), multicolored Asian lady beetle (*Harmonia axyridis*) and purple carrot-seed moth (*Depressaria depressana*). Emerald ash borer has already infected and/or killed most ash trees on the Carlos WMA.

Terrestrial Plants

Impactful invasive woody species known to occur within the Carlos Avery WMA are common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*Rhamnus frangula*), black locust (*Robinia pseudoacacia*), multiflora rose (*Rosa multiflora*), white aspen (*Populus alba*), Siberian elm (*Ulmus pumila*), winged burning bush (*Euonymus alatus*), white mulberry (*Morus alba*), Amur maple (*Acer ginnala*), common toadflax (*Linaria vulgaris*), spotted knapweed (*Centaurea stoebe*), leafy spurge (*Euphorbia esula L.*), Japanese hedge parsley (*Torilis japonica*), purple crown vetch (*Coronilla varia*), common tansy (*Tanacetum vulgare*), and garlic mustard (*Alliaria petiolate*).

Buckthorn is widespread in Carlos Avery WMA and can outcompete native species in areas of disturbance or in areas of die-off due to oak wilt and Emerald Ash Borer. In the future, the populations of these plants are expected to increase in both abundance and numbers of infestations. Due to its potential impact on forest habitats, buckthorn is the highest priority for detection and treatment on the Carlos Avery WMA. Currently, staff treat sites with higher abundance of buckthorn through chemical or mechanical means, especially during the late fall when it is more easily detected. Staff occasionally work with partners and volunteers on buckthorn removal.

There is an established population of garlic mustard at the Broadway DNR office which is continuing to spread and is being treated by herbicide and removal by hand. There are large known populations of spotted knapweed in the WMA, but there has been a significant decline after several years of herbicide treatment and removal by hand. The known patches of leafy spurge are small and manageable for hand treatment, with eradication possible with several years of follow-up treatment and monitoring. There is a patch of Japanese hedge parsley at the south dam, which has the potential to be eradicated after several years of treatment.

While the most impactful invasive woody plants are discussed above, there are many other woody and herbaceous invasive plant species in the Carlos Avery WMA. A list of invasive plants known to occur in the WMA is included in Table 32 in Appendix G.

Aquatic Plants

There are known invasive aquatic plant species occurring within the WMA; purple loosestrife (*Lythrum salicaria*), curly leaf pondweed (*Potamogeton crispus*), European common reed (*Phragmites australis subsp. Australis*), European water-clover (*Marsilea quadrifolia*), narrow-leaved cattail (*Typha angustifolia*), hybrid cattail (*Typha* x *glauca*), and reed canary grass (*Phalaris arundinacea*).

Reed canary grass is well established throughout the Carlos Avery WMA and is currently managed by prescribed burns. Narrow-leaved and hybrid cattaill are also well established throughout the Carlos Avery WMA and are managed by prescribed burns and aerial herbicide spraying. Purple loosestrife is also widespread and has been treated by herbicide. Two small patches of European water clover were found and treated in 2022 and did not return in 2023.

Threats to Wildlife Health

The diseases and parasites listed below have the potential to impact fish and wildlife populations on the WMA. Responses to diseases and parasites will vary depending on the scale and causative agent. All actions will be closely coordinated with other DNR divisions, FAW's Health Programs, and partners (state, federal, and tribal agencies) as appropriate.

Waterfowl Diseases

Waterfowl are susceptible to several infectious diseases that cause mortality including avian cholera, avian botulism, avian tuberculosis, avian salmonellosis, chlamydiosis, duck plague, aspergillosis, toxoplasmosis, and avian influenza. A common denominator among outbreaks is a concentration of waterfowl, and often poor water quality.

Chronic Wasting Disease

Chronic wasting disease (CWD) is a contagious neurological disease affecting cervid species, including deer, elk, and moose. It causes a characteristic spongy degeneration of the brains of infected animals resulting in emaciation, abnormal behavior, loss of bodily functions, and death. As of the writing of this plan, no CWD-positive wild deer have been detected on Carlos Avery WMA (DPA 235) or within the adjacent DPA's 227 and 236. See the following link for updated DNR CWD response plan.

Epizootic Hemorrhagic Disease

Epizootic hemorrhagic disease (EHD) is a viral disease that occurs naturally and can spread to white-tailed deer by biting *Culicoides* midges. The disease can dramatically reduce a local deer population in the short-term but has a relatively small impact on the overall deer population. There are no management interventions available to combat the disease. EHD is seasonal and most often occurs during drought-like conditions in the late summer and early fall. Frost will kill the virus and midge that carries it, ending the potential infection period. Finding multiple dead, seemingly healthy, deer near

water is typical of an EHD die-off. Fever drives the animals to seek water and they die from internal lesions and hemorrhages. EHD has not been documented at or near Carlos Avery WMA as of late 2023.

Mange

Mange, particularly sarcoptic mange, is a disease transmitted by mites, and affects mainly wild canids (wolves, foxes, coyotes), but also bears, raccoons, porcupines, and some rabbits and squirrels. Sarcoptic mange can also affect domestic animals such as dogs. The mites are transferred from one individual to another through direct contact or transfer at den sites. The disease causes hair loss, and in some cases the exposed skin becomes encrusted or oozes fluids, often resulting in death. Red foxes are particularly susceptible to mange and thousands can die during an outbreak.

Canine Distemper

Canine distemper virus (CDV) is a highly contagious disease caused by a paramyxovirus. It is a widespread disease affecting wild and domestic carnivores and primarily affects raccoons, grey fox and skunks in the spring and fall. Clinical signs begin 10-14 days after infection and include discharge from the eyes and nose, dyspnea (difficulty breathing), coughing, and pneumonia. Fever, anorexia and respiratory tract issues are most common. CDV also causes gastrointestinal illness, thickening of the nose and foot pads, and a neurologic phase that has symptoms similar to rabies and can be difficult to distinguish as a result. Transmission occurs from contact with infected saliva, urine, feces, or respiratory secretions. Animals can shed up to 2 weeks after they recover. The virus can survive long periods in the environment if the temperatures are below freezing.

Rabies

Rabies is an acute infectious disease of the central nervous system caused by a virus that is transmitted in saliva through bites. Rabies is most common in raccoons, skunks, bats, and foxes, but can occur in any mammal. Once signs of the illness manifest themselves, rabies is 100% fatal; however, proper post-bite treatment is nearly 100% effective in preventing onset. Rabies outbreaks in the wild can be controlled by oral vaccinations in food items left out for consumption, but this is difficult and expensive.

White-Nose Syndrome

In 2017, white-nose syndrome (WNS), a fungus affecting hibernating bat species, was confirmed in multiple locations in Minnesota. This fungus causes significant mortality to cave hibernating bats. White-nose syndrome has been confirmed in the following MN native bats: Big brown bats (*Eptesicus fuscus*), Indiana bat (*Myotis sodalis*), Little brown bat (*Myotis lucifugus*), Northern long-eared bat (*Myotis septentrionalis*), and Tricolored bat (*Perimyotis subflavus*). All species confirmed with WNS are suffering population declines in Minnesota.

Northern long-eared bats have been particularly hard hit by habitat loss, direct mortality and WNS combined. Due to threat of global extinction the US Fish and Wildlife Service listed the Northern long-eared bat as federally endangered in 2022. Federal endangered species status comes with many legal protections including protection against take and legal protection of the endangered species habitat. In order to continue some land management actions (timber harvest and related forest management, road and trail construction, maintenance and use, and prescribed fire) while complying with the

federal endangered species act MN DNR applied for an incidental take permit of Northern long-eared bats. Incidental take permits for endangered species carry the requirement of an approved companion Habitat Conservation Plan that outlines how the risk or actual take of the permitted species is being offset by conservation actions for the species. The Lake States Forest Management Bat Habitat Conservation Plan provides management direction for covered activities to all forestlands managed by the DNR. Carlos Avery WMA follows the requirements of the Lake States Forest Management Bat Habitat Conservation Plan during all covered activities.

Waterfowl Intestinal disease from trematodes carried by faucet snail

The faucet snail (*Bithynia tentaculata*) is an aquatic snail native to Europe, introduced to the Great Lakes in the 1870s. The snail is an intermediate host for three intestinal trematodes, or flukes, (*Sphaeridiotrema globulus, Cyathocotyle bushiensis, Leyogonimus polyoon*) that cause mortality in waterfowl. These parasites have a complex life history and require two intermediate hosts to develop, the first of which must be a faucet snail. When waterfowl consume the infected snails, the adult trematodes attack the internal organs and cause lesions and hemorrhage. Infected birds appear lethargic and have difficulty diving and flying before eventually dying. Faucet snails have not been documented on the Carlos Avery WMA.

Newcastle Disease

Virulent Newcastle disease is a contagious and fatal viral disease affecting the respiratory, nervous and digestive systems of birds and poultry. The disease is so virulent that many birds and poultry die without showing any clinical signs. In Minnesota it has occurred periodically in colonial nesting waterbirds (pelicans, cormorants, gulls, terns, and herons).

Bovine Tuberculosis

Bovine tuberculosis is an infectious disease caused by the bacterium *Mycobacterium bovis* that is transmitted by the exchange of respiratory secretions between infected and uninfected animals. Thus, transmission is a function of inter-deer-proximity which is a function of deer density. Transmission is also a function of interactions with domestic cattle. Although bovine tuberculosis transmission to humans is rare, in Michigan it has been transmitted to omnivores and carnivores such as black bear, raccoon, coyote, bobcat and red fox. Bovine tuberculosis has not been found on the Carlos Avery WMA with the last known infection located in NW MN in 2009.

West Nile Virus and Eastern Equine Encephalitis

West Nile virus (WNV) and Eastern Equine Encephalitis are mosquito-borne viruses that can kill some birds (WNV particularly affects loons, ruffed grouse, crows, and jays) and mammals (including elk, moose, and horses). WNV exposure has been documented in fall-harvested ruffed grouse in Minnesota, indicating that some birds do survive West Nile virus infection and live to the fall. Currently, the best option for managing ruffed grouse where West Nile virus is present is to provide quality forest habitat that produces birds in good condition that can survive infection and other challenges.

Blastomycosis

Blastomycosis is a fungal infection that affects people, dogs and occasionally cats. It is caused by a fungal organism known as *Blastomyces dermatitidis*. The fungus is commonly found near waterways in acidic soils that are rich in decaying vegetation. In Minnesota, blastomycosis is most common in St. Louis, Itasca, and Beltrami counties but is present in Washington and Chisago counties. People or animals become infected with blastomycosis by inhaling airborne spores from the mold form of the organism found in the soil or decaying vegetation. The disease is not transmitted directly between animals or people.

Toxoplasmosis

Toxoplasma gondii is a protozoan parasite and is the responsible agent for toxoplasmosis, which considered a major food borne illness in the United States, according to the Center for Disease Control. The parasite can be transmitted to humans by consuming undercooked meat of domestic and wild species (cattle, poultry, bears, waterfowl, etc.).

Ranavirus, Chytridiomycosis, and Ophidiomycosis

There are several diseases that have the potential to have widespread impacts on amphibian and reptile populations: Ranavirus and Chytridiomycosis in amphibians and Ophidiomycosis in snakes. These diseases are mostly related to or transmitted through the trade in exotic pets and have no viable control or treatment methods beyond preventing further spread. Responses to the diseases is typically to prevent the spread by disinfecting footwear, field clothes, and field equipment after use.

Threats to Fish Health

The fish diseases listed below are the most commonly observed diseases and parasites associated with the fish species anglers and bowfishers target on the Sunrise River and its tributaries throughout the WMA. Additional and updated information on fish diseases can be found here on the DNR website.

Neascus

Neascus can be found in all species of fish in Minnesota lakes and rivers. Fish that inhabit shallow areas are most affected. It is parasite - *Uvulifer spp*., *Neascus spp*., and is commonly called black grub. These parasites are small and produce black pigmentation that resembles black pepper sprinkled on fins or flesh (fillets) of fish. The life cycle of Neascus includes eggs being released by fish-eating birds into the water. Eggs develop into intermediate stages of the parasite in snails. These free-swimming parasites penetrate the muscles of fish and encyst. Black pigmentation is deposited onto these cysts. Infected fish are consumed by birds where the life cycle starts all over again. Adult worms are seen in fish-eating birds. Although unsightly, the fillet is safe to eat if it is well cooked.

Yellow Grub/White Grub

Yellow grub/white grub can be found in all species of fish in Minnesota lakes and rivers. Fish that inhabit shallow areas are most affected. It is a parasite (Trematoda) – yellow grub (*Clinostomum*), white grub (*Posthodiplostomum minimum*). These parasites are small and cause yellow or white cysts (spots) in fish skin, muscle tissues and in most internal organs that resembles coarse salt sprinkles. The

1 life cycle includes eggs being released by fish-eating birds into the water. Eggs develop into
2 intermediate stages of the parasite in snails. These free-swimming parasites penetrate the muscles of
3 fish and encyst, taking on the form of the yellow or white grub. Infected fish are consumed by birds
4 where the life cycle starts all over again. Adult worms are seen in fish-eating birds. Although unsightly,
5 the fillet is safe to eat if it is well cooked.

Lymphosarcoma

7 Lymphosarcoma can be found in both northern pike and muskies and is common in Minnesota
8 whenever either species are present. It is a cauliflower like tumor on the skin. Tumors range from pea
9 size to several inches, depending on water temperature. Tumors are more prominent at cooler water
10 temperatures (fall and winter). Tumors may spread to inner organs. It is believed to be a viral disease
11 that may be transmitted by close physical contact, such as spawning. Transmission of the virus may be
12 possible by physical contact during spawning and other close contacts. Due to a lack of concrete
13 scientific knowledge about the disease, consumption is not advised.

Bass Tapeworm

15 Bass tapeworm is found in both largemouth and smallmouth bass throughout Minnesota. It is a coiled,
16 long flat worm intertwined in the fish's digestive tract or abdomen. Sometimes found as a single worm,
17 but often several are found coiled like a ball. This may occur with other parasitic worms as well. The
18 tapeworm matures in the bass. Segments of the worm and eggs are passed from the fish to the body of
19 water. When they reach water, they swell, rupture, and release large numbers of eggs. Eggs are eaten
20 by a variety of crustacean organisms or any fish. A larval stage is formed in the invertebrates or in a
21 fish. Adult tapeworms develop if bass consumes either the invertebrate host or the fish with the
22 intermediate stages. Mature tapeworm makes the bass unappealing for food even though the eating
23 quality of the fish is not affected and there is no human danger if the fillets are cooked thoroughly.

Dermal Sarcoma

25 Dermal Sarcoma is a disease observed in walleye through Minnesota. It is a virus that is a grape cluster
26 like tumor. Walleye dermal sarcoma produces warty growths commonly seen on the fish's skin and
27 fins. Growths are usually gray-white or pinkish in color. Infections occur throughout the year but at a
28 higher rate during the walleye's spring spawning season. Walleyes congregate on their spawning
29 grounds and the virus spreads from fish to fish through physical contact. The disease is not known to
30 infect humans; however, always cook fish thoroughly.

Lymphocystis

32 Lymphocystis is a disease observed most commonly in walleye throughout Minnesota; however, has
33 been documented on several other species. Lymphocystis is a virus that infects the skin of fish.
34 Although the virus occurs naturally in the environment, infections occur at a much higher rate during
35 cold periods in late winter and early spring. The symptoms of this disease are usually described as
36 "warts" or tumors and are commonly seen on the skin and/or fins of adult fish. The virus spreads from
37 fish to fish through physical contact or water transmission. Lymphocystis infections are usually not fatal
38 to fish, although very severe infections can cause damage to vital organs and possibly death. In

addition, secondary bacterial or fungal infections can develop at sites of dislodged growths. This disease is not known to infect humans.

Heterosporis

Heterosporis is a parasite predominantly seen in yellow perch throughout Minnesota. However, this disease has also been detected in walleye, northern pike, burbot, pumpkinseed, and rock bass. It is white or "opaque areas" in the uncooked fish fillet. White regions on the fillet that resemble cooked meat. Heterosporis spreads when fish pick up spores from the water or eat infected fish or carcasses. Little is known about the life cycle. This parasite may spread by infected fathead minnows sold as bait. Based on studies by the Center for Disease Control and Prevention, there is no evidence that heterosporis can infect people. It is thought, but not proven, thorough cooking infected fish will destroy spores. Recommendations include either cooking the fish thoroughly or discard the flesh by burying it – however, do not discard by throwing it back into the lake.

Myofibrogranuloma

Myofibrogranuloma is a virus only seen in walleye throughout Minnesota. Fish look normal on the outside but certain areas of the fillet look semi-translucent, or yellowish brown with knotted muscle fibers. The tissue has a very dry freezer burn appearance. Other areas of the fillet may be even granular with mineral deposits or opaque. The condition is not infectious. Genetic and environmental stressors may play a role in the development of the disease. Due to a lack of concrete scientific knowledge about the spread of the disease, consumption is not recommended.

Threats to Forest Tree Health

The most significant threats to trees on Carlos Avery WMA are emerald ash borer (EAB), oak wilt, floods, droughts, and native pests that take advantage of unnaturally higher levels of stressed, older northern pin oaks. The frequency of flooding and drought has been high in the recent decade. The stress on forests of these environmental events are made worse if trees are concurrently stressed by other factors like overcrowding, low vigor, and defoliation. Informed management can increase forest resiliency and mitigate the potential harm caused by these threats.

Oak Health

Oak-dominated forests comprise over 50% of the WMA's forested acres, and northern pin oak (pin oak) is the predominate oak species in over 90% of these forests. Most of these pin oak-dominated stands have pin oaks that are between 76 and 100 years of age (see Table 8), 9–14.9 inches in trunk diameter (measured 4.5 feet above the ground), and are growing at a density of 111 ft^2/acre. That roughly translates into an inter-tree distance of 21 feet.

Most of these oak forests are part of a fire dependent southern dry-mesic oak (maple) woodland (FDs37) native plant community (NPC). Pre-European settlement, frequent fires kept trees at wider spacings than what is currently present. Historically, the inter-tree distance was estimated to be 68 feet when trees reached 11–19 inches in trunk diameter on FDs37. Pin oak represented less than 10% of tree species at every growth-stage on this NPC.

Therefore, pin oaks currently are at much higher densities and older ages than what occurred pre-settlement. These conditions make these forests highly susceptible to significant tree losses from oak wilt, drought, twolined chestnut borer, and Armillaria root disease. The bulk of the pin oak are also approaching an age where wood decay will become significant. Some of this decay in standing trees is highly desirable for wildlife habitat, but it also increases the likelihood of stem breakage and subsequent oak wilt infection. Moreover, decay in longer-lived trees, like white and bur oak, is more desirable habitat for wildlife, since those trees remain on the landscape, standing longer than pin oak.

Twolined chestnut borer infestation and Armillaria root disease

Twolined chestnut borer is a native cambium-feeding beetle that only causes significant tree loss after severe stresses, such as serious drought, flooding, or consecutive years of heavy leaf feeding. Armillaria root disease is a native fungal root pathogen that attacks stressed trees. Both of these pests frequently attack stressed oaks simultaneously. Older tree age and higher tree densities can be correlated with more damage from twolined and Armillaria. More frequent and severe droughts from climate change are likely to increase outbreaks of both twolined chestnut borer and root disease from Armillaria.

Unacceptable losses in forests from these two pests are very rare, and they only have occurred from twolined outbreaks after extreme droughts or heavy defoliation. Whether tree mortality is acceptable also depends on forest management goals. Losses from such outbreaks can be lessened by lowering tree density, controlling timing of thinnings, promoting more long-lived oak species, and in some instances, reducing stand rotation ages. To reduce risk, oak stands can be thinned, when they are not stressed, to reduce tree density. Lower tree densities allow forests to be more resilient to drought and therefore less susceptible to twolined outbreaks. At the same time, if possible, managers should avoid thinning oak forests for a few years after significant droughts, floods, or defoliation events, since thinning stresses residual trees by mimicking drought conditions for a short period. Again, thinning is highly beneficial over the long-term, as it mimics the frequent fire disturbances on the FDs37 NPC that produced a resilient ecosystem.

Oak wilt

Oak wilt is a serious non-native threat to forests with large proportions of oaks in the red oak section (*Lobatae*), like pin oak. This disease also can kill and spread amongst bur oaks. Ecologically speaking, oak wilt slowly opens gaps in oak forests' canopies, promoting shade tolerant or partially shade tolerant shrubs and trees. At the Carlos Avery WMA, unmanaged oak wilt accelerates woodland infiltration of invasive species such as common buckthorn and shade-tolerant species that may have lower habitat and mast production value for wildlife such as red maple.

This invasive disease has been present on the WMA for decades and can be considered endemic there. The WMA's close proximity to research institutions in the Twin Cities has made it an invaluable spot to carry out oak wilt research. Multiple scientific studies uncovering oak wilt biology and management solutions have been carried out and published on the Carlos Avery WMA. Some oak wilt research projects on the WMA continue today.

Preventing additional infections is the most important aspect of oak wilt management in endemic situations. There are some circumstances though where control could be considered.

Prevention. Human-promoted oak wilt infections can be prevented by not wounding oaks from April through mid-July. Restricting harvesting, thinning and all other activities that could damage trees in or adjacent to oak stands greatly reduces the likelihood of aboveground oak wilt infection.

Control. Controlling oak wilt on a stand by stand basis is possible, but it is expensive and often not realistic. If thinning an oak stand, one or two very small pockets could easily be controlled with the stump extraction control method or the frill-girdle and herbicide method. For any maturing oak forest that has multiple, larger oak wilt pockets, consider treating the stand with a regeneration harvest at an earlier stage than was planned. Such action will lessen the amount of undesirable species proliferating in oak wilt pockets, like common buckthorn and boxelder. Division of Forestry's region forest health specialist can be consulted for oak wilt control advice.

Building Stand Resilience. Oak wilt's most negative impacts occur in woodlands and forests comprised mostly of species in the red oak section, and particularly where most of the oaks arose from stump sprouts and not acorns. Forests and woodlands that have greater tree species diversity, even within the oak genus, are more resilient to the negative impacts of oak wilt. Any silvicultural treatments that promote native tree species diversity make oak woodlands more resilient to oak wilt.

Aspen Health

Aspen-dominated forests comprise about 20% of the WMA's forested acres. Currently, there are no significant threats to aspen forest health in Minnesota. As is true with all tree species, aspen have an age limit, and it is relatively short. As aspens grow older, environmental and biotic stressors negatively impact them more and can start a slow stand-wide decline. These declines are associated with a variety of unmanageable, opportunistic insect pests and diseases. Fortunately, the WMA's current aspen resource is comprised mostly of vigorous age classes, roughly defined as 50 years-of-age or less on the WMA (Table 8).

A variety of stem canker diseases can kill aspen, the most important one for wildlife habitat management being hypoxylon canker. Usually, hypoxylon canker acts as a natural thinning agent in younger aspen forests. In rare circumstances, an aspen forest is extremely susceptible to hypoxylon canker and tree density diminishes to undesirable levels. If this happens with any aspen stand in the WMA, managers could consider allowing forest succession to naturally convert the stand to a different forest cover type.

Northern Hardwood Health

Northern hardwood stands make up about 10% of the WMA's forests. Northern hardwoods are mixed-species forests. Almost 75% of this forest type on the WMA has either basswood or red maple as its most abundant species. There are no current significant threats to these species. About a quarter of the WMA's northern hardwood forests have either green ash or northern red oak as its most abundant species. Both of these species are currently threatened on the WMA by emerald ash borer and oak wilt, respectively, but due to the mixed-species nature of this forest type, these two invasive species do not pose devastating risks to these forests.

Tamarack Health

Tamarack trees make up slightly under 10% of the WMA's forests. They serve a valuable ecological role and are important in the landscape, especially since they represent the southernmost significant block of natural tamarack forest that DNR manages. Floods, droughts, larch sawfly (an invasive), larch casebearer (an invasive), and eastern larch beetle are the greatest current threats to tamarack.

Since 2001, Minnesota has lost a large amount of its mature tamarack cover to the eastern larch beetle, a native bark beetle. This outbreak has affected, to some degree, almost 75% of the state's tamarack cover type. Up until 2001, outbreaks of eastern larch beetle lasted only a few years and they were concentrated on tamarack recently weakened from defoliation or water stress. Larch beetle populations on the WMA have not gone into outbreak. There is no indication that the region-wide larch beetle outbreak will end in Minnesota, so at some point, most of the WMA's mature tamarack could be lost to this bark beetle, but it is not predicable whether or not this will occur.

There are no current methods to manage large-scale larch beetle outbreaks, but some impacted tamarack forests recover naturally, and silvicultural techniques can be used to ensure there is sufficient native tree regeneration present prior to larch beetle outbreaks (small seedling and sapling tamarack are not susceptible to larch beetle attack). Given the lack of tamarack timber demand and unpredictable machine operability on the very wet sites that tamarack grow on, any efforts on the WMA to protect this southern tamarack resource will require investment.

Ash Health

Black and green ash are the most abundant species in over 4% of the WMA's forests. Even though DNR's forest inventory indicates 4%, there are clearly more ash in un-inventoried parts of the WMA, such as islands in wetlands and along the fringes of wetlands. Nearly all of the ash on the WMA are currently infested, or will be infested shortly, by emerald ash borer (EAB).

Emerald ash borer is a non-native cambium feeder of ash trees. It was first confirmed in the southern portion of the WMA in 2020, but it was likely present as early as 2015 (it was confirmed about 1 mile away from the southwestern part of the WMA in 2015). In 2022, it was confirmed in Stacy, so it's likely present in the north unit too. By 2028, nearly all Carlos Avery WMA's ash is predicted to be dead, dying, or noticeably infested with EAB.

Drastic and rapid losses of ash near wetlands and in wet forests can cause a rise in the water table, which can flood out other tree species. Long-term losses of wet forests and conversion to wet meadows or open-water wetlands could happen on the WMA due to heavy ash losses. Also, like oak wilt, expanding canopy gaps from tree losses can allow invasive plants to proliferate.

There currently is not a strong demand for ash timber in the WMA's area, so economical forest management and restoration is not a realistic expectation. Some tree species enrichment plantings could be considered in the short-term to buffer the negative ecological impacts of EAB, and invasive plant monitoring and control could be considered. Also, the WMA is the closest and largest public property to researchers in the Twin Cities, so it represents an excellent place where researchers can study EAB.

Human Activities

The Carlos Avery WMA is one of largest blocks of contiguous public land within the greater Twin Cities seven county metropolitan area. Over half of Minnesota's total population can make a day trip to utilize the resources that this unit has to offer. The Carlos Avery WMA will continue to support its mission of protecting and managing the land for wildlife production and for hunting, fishing, trapping, and other compatible uses such as wildlife viewing and foraging.

While there are a variety of recreational uses that are not allowed on or not well-suited to the WMA, it should be noted other state lands are present locally and have facilities or capacity to address other specific interests. For example, Division of Forestry lands and State Parks have facilities for snowmobile and ATV use and horseback riding. Wild River and William O'Brien State Parks have facilities for camping and hiking.

Hunting, fishing, and trapping are regulated activities and are not a threat to habitat or wildlife populations when conducted in line with regulations. The taking of animals or plants beyond the legal allowance threatens habitat and wildlife. As technology continues to change and grow, new technologies such as drones, e-bikes, and trail cameras are being used for recreational purposes. Rules and regulations related to these new technologies are also being developed and need to be checked before using any such technology on the Carlos Avery WMA.

Neighboring Land Use

Purchase, development, or fragmentation of private lands adjacent to the Carlos Avery WMA may present challenges to WMA management activities, recreational use, and access. These threats include detrimental effects on water quality and land, introduction of invasive species, changes in adjacent land use, misunderstandings of Carlos Avery WMA management activities, and increased human and wildlife conflicts. As people continue to populate the surrounding area, changes in the use of private lands may present challenges to existing land, resource, and infrastructure management activities within Carlos Avery WMA.

These concerns can be viewed as an opportunity for more coordinated land planning efforts to ensure agriculture, natural resources, and other public objectives are addressed. Efforts should identify areas where development or fragmentation would have the most impact and coordinate tools to address or limit this impact. Local communication and coordination are key. Incorporating other private, city, county, and state lands in the area to maintain large areas of natural habitats with travel corridors connecting them is essential. Proper land planning will enhance the value of all lands for wildlife, plants, residents, and visitors.

Examples of land planning tools include the following:

- Communication and outreach through public education on the unique high biodiverse areas, unique wildlife, and rare plant communities located in the area.
- Encouraging private landowners to enroll their lands in permanent conservation easements to protect use and habitat.
- Encouraging other DNR Divisions to engage with private landowners to establish stewardship, or other management plans, and develop habitat management projects. This includes Forest

1   Stewardship Plans, Firewise Minnesota, Landowner Wildlife Habitat Planning, and Aquatic
2   Management Areas, among others.
3   • Working with local government units to promote the protection and use of important wildlife
4   habitats.

5 In addition, given the fact that Carlos Avery WMA exists in a suburban environment, with many
6 residential and business neighbors, there are a variety of boundary and access issues that need to be
7 regularly addressed by WMA staff. As of 2024, there are 527 different property owners who have land
8 adjacent to the WMA, the highest number of neighboring property owners relative to its size of any
9 major unit WMA in Minnesota. Adjacent land uses include residential, agricultural, industrial,
10 commercial, and other recreational land not managed as Carlos Avery WMA. Neighboring and within
11 land uses also include several utility easements (power, gas line, etc.) and multiple substations. Regular
12 issues that arise with neighboring landowners involve topics such as trespass, access easements, road
13 easements and locations, and right-of-way issues.

14 Navigating these complex and sometimes conflictual interactions requires significant time and effort.
15 Examples of these issues include:

16   • Navigating conflicts concerning adjacent landowners trying to prevent members of the public
17   from using public access easements near their property (e.g., moving WMA boundary signs,
18   illegally placing no trespassing signs, harassment of WMA users).
19   • Navigating conflicts concerning adjacent landowners inappropriate use of the WMA (e.g.,
20   placing buildings, compost piles, or ATV trails on WMA land).
21   • Responding to depredation complaints from nearby businesses (e.g., pumpkin farms, tree
22   farms).

Unwanted Pets and Nuisance Animals

24 Pet and wild animal dumping occurs frequently on Carlos Avery WMA and is illegal. Dogs and cats are
25 the most common pets released. Both can have a negative impact on wildlife in the WMA. Free-
26 roaming domestic cats kill birds and small mammals and spread disease and parasites. This is an
27 entirely avoidable source of mortality for Minnesota wildlife. Feral cats are known to roam the WMA,
28 but no known breeding populations have been noted. Free-roaming cat (from neighbor's yard, etc.)
29 can also have a negative impact on WMA ecosystems. If possible, domestic animals are surrendered to
30 shelters. This can pose a safety risk to staff if they are injured and/or exposed to diseases.

31 Other species have the potential to become problematic on the Carlos Avery WMA. For example, red-
32 eared slider turtles (*Trachemys scripta*) are a non-native pond turtle commonly kept as a pet. As a
33 large, long-lived water turtle keeping of red-eared sliders often appeals to hobbyists only for a short
34 time, resulting in the need to dispose of an unwanted pet. Red-eared sliders have been documented as
35 invasive outside of Minnesota and are known to be overwintering successfully in Minnesota. Dumping
36 unwanted pets of any kind on the Carlos Avery WMA is illegal, and managers seek to quickly locate and
37 remove any such pets such as red-eared sliders. While red-eared sliders are one of the best studied
38 and most commonly reported naturalized dumped reptile pet, Carlos Avery WMA's proximity to highly
39 populated areas requires continued vigilance for occurrences of non-native reptiles and amphibians
40 due to the release of unwanted pets.

Also due to the WMA's proximity to many urban areas, nuisance animals (e.g., raccoons, opossum, skunk) are often brought to the WMA for what is thought to be a humane release back into the wild. Nuisance animals are dropped by homeowners, removal contractors, and others. This should not be considered a humane release as many animals are hit by vehicles trying to get back to where they came from or must compete with naturally occurring wildlife already established. Nuisance wild animals can also have a negative impact on WMA ecosystems and are potential disease vector.

Enforcement Issues

The Carlos Avery WMA faces a variety of enforcement issues, which are addressed in coordination with Division of Enforcement personnel. Illegal activities create challenges for local staff and enforcement officers on a regular basis. Illegal activities include, but are not limited to, boundary trespass issues, after-hours trespass issues, fish and game violations, damage to public property, theft, dumping, and release of domestic and wild animals. Boundary trespass issues take considerable time and staff commitments and often involve enforcement and survey efforts. Fish and game violations are frequent. Since 2015, there have been more than 400 citations and warnings written on Carlos Avery WMA for a variety of offenses. This number of citations and warnings is far higher than that of major unit WMAs. Damage to property, and dumping of household trash, furniture, boats, landscaping, and construction materials is a common occurrence, detrimental to wildlife habitat, and a strain on WMA resources.

Operational Context

Administrative and Fiscal

The Carlos Avery WMA is managed by the Section of Wildlife, within the DNR's Division of Fish and Wildlife, and is in the DNR's Central Region, also known as Region 3. WMA operations are funded primarily through the Game and Fish Fund, which is supported by the sale of hunting, fishing, and trapping licenses and federal aid from surcharges on hunting and fishing equipment. Game and Fish funding is used primarily to cover salary and operational costs, such as maintenance. Some wildlife management projects on the Carlos Avery WMA are funded through dedicated wildlife accounts (deer, wild turkey, waterfowl, and pheasant stamp), and most of the current project funding is through the Minnesota Outdoor Heritage Fund, or other grant funding, such as the Competitive State Wildlife Grant and Legislative-Citizen Commission on Minnesota Resources. Additional project funding is brought to the WMA through partnerships with non-government organizations such as The Nature Conservancy, National Wild Turkey Federation, Pheasants Forever, MN Deer Hunters Association, Ruffed Grouse Society, and others. These organizations apply for grants and help administer habitat projects on the Carlos Avery WMA to achieve combined organizational and resource goals.

Staffing

The Carlos Avery WMA staff consists of one Area Supervisor, two Assistant Area Managers (Natural Resource Specialists), a Technician, a Buildings and Grounds Lead Worker (B&G), a shared Office Administrative Specialist, and one Seasonal Labor Trades & Equipment (LTE). It should be noted that this staff is also responsible for the management of 11 additional WMAs within the Twin Cities North Metro, nuisance wildlife management for much of the Twin Cities Metro Area, and municipal permit

and coordination responsibilities covering four counties. The Area Supervisor is responsible for supervision, work planning, budgets and administrative tasks but also assists with habitat and facility projects as needed. Assistant managers, Technician, B&G, and the LTE are responsible for implementing day to day operations and field project work. Staffing levels are an important factor in implementing plan strategies and priority work. The Area Supervisor, Technician, B&G, and LTE also participate heavily in the site coordination and management of the facilities located at the two office/shop locations. This includes landscaping, snow removal, HVAC management, well and septic management, site inspections, staff access, coordination of storing equipment, vehicles, and fuels. Refer to Site Safety Plan and Site Coordinator Tasks for Details.

Operational Orders, Policies, Guidelines, and Directives

The DNR has Operational Orders, which direct the internal management of the department. Policies, guidelines, and directives are the divisions' way of further defining the ways that specific work is undertaken on state lands. Periodic review and updating of existing guidance documents occur and new documents are developed as new policy needs are identified.

Intradepartmental Coordination

The division of Fish and Wildlife Carlos Avery WMA staff participate in annual coordination meetings with the divisions of Forestry and Ecological and Water Resources. In addition to these annual meetings, Carlos Avery WMA staff work in coordination with other divisions continuously throughout the year. Carlos Avery WMA staff also communicate with the DNR Regional Management Team on ongoing or emerging WMA issues. Annual coordination also occurs with local municipalities, specialty crop growers, local businesses, and residents to issue shooting permits and other wildlife management permits.

Capital Improvements

The Carlos Avery WMA has two building sites. One at 5463 W. Broadway Ave. and another at 18310 Zodiac St. NE. Both are in Columbus, MN. Combined, these headquarters consist of two residences each with a garage, three office buildings, and 8 cold storage buildings. Thirty-five water control structures regulate water levels in the impoundments. Water control structures include screw gates, drop inlet structures, and concrete dams with stoplog bays. Two concrete dams were installed on the Sunrise Unit in 1965. Capital improvements used for recreation are parking areas, hunter walking/access trails, and carry-in water accesses. Hunting blinds owned and operated by Capable Partners are positioned inside the Carlos Avery WMA Sanctuary for use during special deer, waterfowl, and turkey hunts. The Carlos Avery WMA staff maintains 33 miles of improved DNR roads, 21 miles of dikes, and more than 25 miles of hunter walking/access trails and firebreaks.

Equipment

Heavy equipment stored at Carlos Avery WMA is used primarily on the area but is occasionally loaned to other Minnesota DNR divisions in Region 3. Farm equipment is used to prepare and plant wildlife food plots. Other heavy equipment is used to construct and maintain roads and firebreaks, manipulate wildlife habitat, and build dikes and water control structures. Heavy equipment includes a road grader, backhoe/loader, skid steer, tractors and implements. In addition to Section of Wildlife equipment, the

Division Ecology and Water Resources, the Division of Forestry, the Division of Parks and Trails, and the Division of Enforcement all store equipment in and around the two headquarters located on Carlos Avery WMA.

Game Refuges

Two waterfowl sanctuaries were established and are posted in accordance with game and fish laws. Trespass is prohibited, except when trapping on a special permit, disabled hunting by special permit, or during the controlled waterfowl hunting in Carlos Avery WMA Pool 2 by special permit. The controlled waterfowl hunting in Carlos Avery WMA Pool 2 is geared towards youth and senior hunters that receive preference. The Carlos Avery and Sunrise sanctuaries are approximately 3,520 and 520 acres, respectively.

WMA Infrastructure

In addition to public highways and roads that border the unit, the Carlos Avery WMA uses a network of WMA roads to maintain the unit, facilitate management activities, and provide public access. WMA staff maintain this internal road network. Over time, it will be imperative to prioritize maintenance needs and identify consistent sources of funding to ensure access is maintained for ongoing management and public recreation activities.

The Carlos Avery WMA maintains a vast array of infrastructure requiring continued and ongoing maintenance, including:

- Roads and Trails
  - 77 miles of WMA boundary line
  - 52 miles of interior trails and roads
  - 44 miles of vehicle accessible roads
  - 26 miles of interior dikes
- Facilities
  - More than 1000 WMA boundary signs & posts
  - More than 100 informational signs & posts
  - More than 300 sanctuary signs & posts
  - 41 parking lots
  - 53 gates
  - 12 culverts
  - 53 water control structures
  - 18 wood routed signs
- Water features
  - 1,769 acres of open water
  - 6 named lakes (969 acres)
  - 3 named rivers (19 miles)
  - 25 miles perennial and intermittent streams
  - 20 pools (753 acres)
  - 3 concrete boat ramps
  - 6 carry-in boat access locations

1

2 Water control structures are important infrastructure and resource management components of
3 Carlos Avery WMA. These structures include public road and unit road culverts, dikes on
4 impoundments, and associated impoundment water control structures. These elements serve multiple
5 purposes for managing water during high water and significant precipitation events, managing runoff
6 during spring snow melt, and maintenance or adjustment of water levels on the pools managed for
7 wildlife.

8 Water control structures are vulnerable to extreme precipitation events, deferred maintenance due to
9 funding limitations, and degradation over years of use. Periodic maintenance, repair, replacement, or
10 removal of water control structures is needed to ensure that surface water management is effective
11 and resilient to future weather events.

12

13

14 Figure 24: Photo of an oak savannah on the Radio Dunes SMA in the Carlos Avery WMA in fall.

VI.   Desired Conditions

The desired conditions for Carlos Avery WMA are described through thirty-one objectives grouped under two goals:

1. Maintain or enhance wildlife habitat and biodiversity.
2. Maintain or enhance hunting, fishing, trapping, other compatible outdoor recreational opportunities, and the exercise of reserved treaty rights.

Goal 1 is further categorized by habitat type. Each goal contains specific management objectives (bolded and numbered) and strategies (listed by lowercase letter) for achieving these objectives. While many management objectives are specified in terms of acreages, the exact goals may not be reached due to environmental conditions, catastrophic natural events, climate change and other factors that are outside the DNR's control.

Habitats in Carlos Avery WMA are recognized as vitally important for sustaining wildlife populations and biological diversity in central Minnesota. Many habitats in Carlos Avery WMA require active attention and management to maintain appropriate amounts and successional states and to sustain them in healthy condition over time. Treatments require an adaptive management approach as prescriptions are developed, results are evaluated, and follow-up treatments are designed.

Management decisions will consider and protect rare, threatened, and endangered species and habitats prior to implementation of management actions. Individual management actions will align with necessary requirements for protection of endangered species.

Forest stands are included in the DNR's forest modeling and planning processes so that timber harvest can be used as a tool to advance goals that include sustaining diverse age classes and habitat types across the landscape. Timber harvest can be used to advance stand-level wildlife management objectives such as increasing the amount of mast-producing oak or maintaining high-quality ruffed grouse and woodcock habitat. Other site level interventions may include invasive species treatments with herbicides, mechanical cutting, and prescribed burning. Prescribed fire and mowing may be used to maintain open habitats or to reduce invasive species presence and prevalence.

One of the tools used to develop yearly Carlos Avery WMA forest management-specific work plans is the DNR's annual stand exam list process. The annual stand exam lists for fiscal years 2021-2030 (Table 16 and Figure 25) were identified using modelling criteria developed by FAW as part of DNR's most recent 10-year forest modeling effort. These stands will be field visited and will serve as the starting point for meeting the habitat objectives articulated in this plan. DNR intends to conduct another 10-year forest modeling effort that will identify stands for examination and potential treatment beginning with fiscal year 2029.

It is important to note that this plan uses both stand and NPC growth stage to describe forested habitats. It is also important to note that stand age and NPC growth stage are not necessarily equivalent. The annual stand list will identify, for example, a 65-year-old aspen stand for field review. Field review will identify NPC type (or types) and growth stage (or growth stages) present in that stand.

1   Upon field examination, management actions selected to meet the goals and objectives of this plan
2   may include timber harvest, no treatment, prescribed burning, understory planting, thinning, seeding,
3   or scarification. In selecting among potential management actions, considerations will include
4   effectiveness in achieving goals, available resources, local conditions, and spatial considerations.

5   Table 16: Carlos Avery WMA stand examination acres for fiscal years 2021-2030.

Cover Types	Number of Examination Stands 2021-2030	Total Examination Acres 2021-2030	Total Acreage of Cover Type on WMA
Ash	1	4	4
Aspen	38	400	1,028
Birch	5	55	85
Jack Pine	1	4	4
Lowland Hardwoods	3	77	214
Northern Hardwoods	6	78	1,152
Oak	48	554	3,424
Red Pine	4	60	111
White Pine	3	34	3,424
White Spruce	1	3	126

6
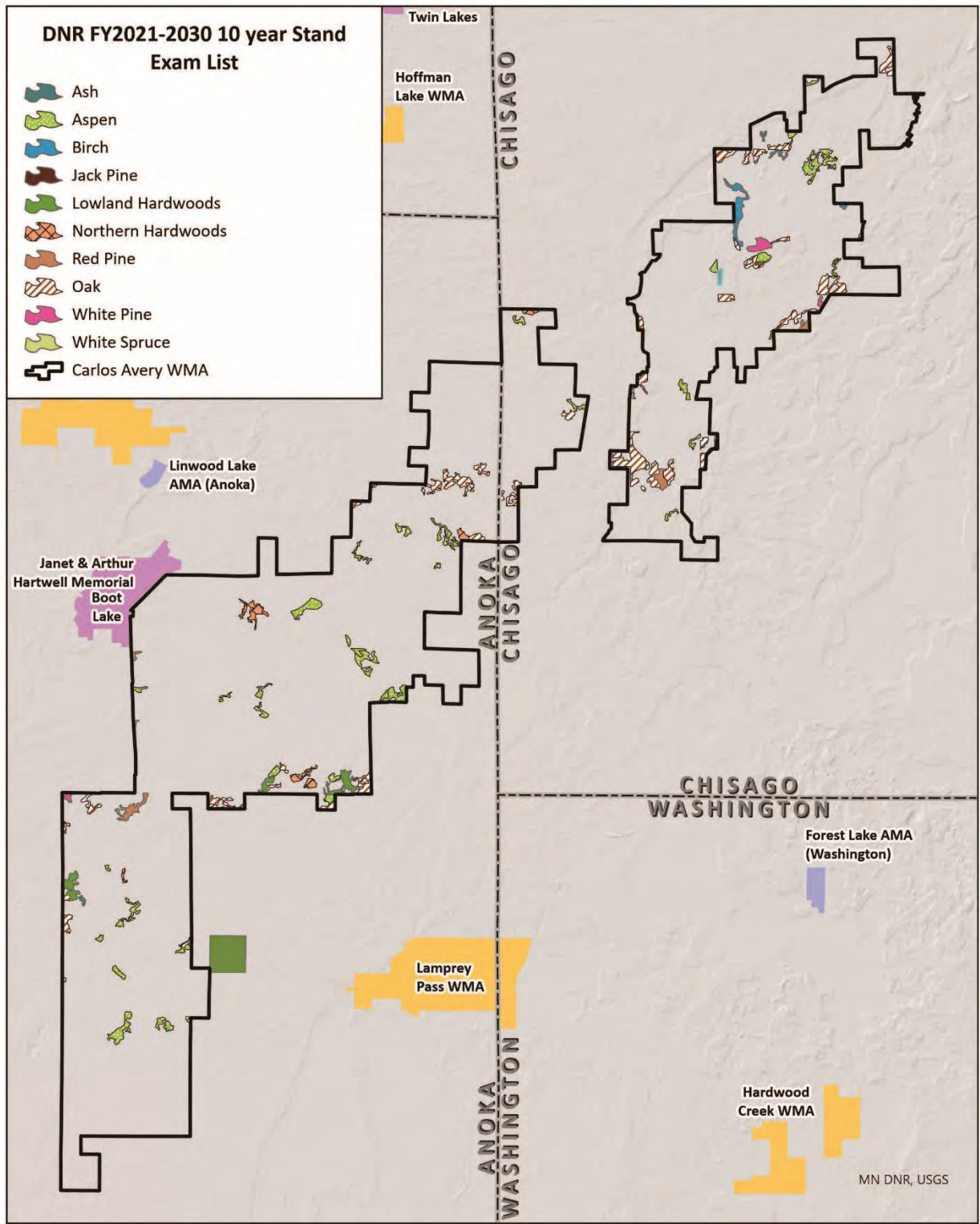
Figure 25: Stand locations for the FY 2021-2030 Carlos Avery WMA forest stand exam list. Upon field examination, management actions selected for these stands to meet the goals and objectives of this plan may include timber harvest, no treatment, prescribed burning, understory planting, thinning, seeding, or scarification.

Goal 1: Maintain or enhance wildlife habitat and biodiversity.

Objectives for All Habitat Types

1. **Manage native plant communities and watersheds to ensure a sustainable landscape that supports healthy fish, wildlife, and plant populations.**
   a. Assess wetland and upland NPC mapping and update as necessary.
   b. Prescribe management that maintains or enhances rare NPCs (see Table 10).
   c. Maintain or increase within-forest stand species and structural diversity to benefit wildlife and ecosystem resilience.

2. **Maintain or increase coverage of forest habitats, components, and growth stages that are under-represented on the surrounding landscape to promote species biodiversity.**
   a. Maintain or enhance designated old growth stands within the WMA.
   b. Map the Special Management Zones around designated old growth stands and record them in the forest management inventory 4Trees.
   c. Propose the creation of an Old Forest Management Complex around the Victor Hill Forest Management Area.
   d. Maintain a diverse age structure of forest cover types across the WMA to provide species-specific wildlife benefits at all growth stages.
   e. Perform a spatial analysis of age-classes and growth stages within forest cover types every 10 years or in alignment with future DNR forest planning.

3. **Maintain or increase rare native plant communities, rare plants, rare animals, and their associated habitats.**
   a. Consider rare species guidance and follow policies and statutes when proposing and implementing projects.
   b. Report rare plant and animal sightings to the Natural Heritage Information System.
   c. Consult Natural Heritage Information System and other DNR policies and guidelines before taking management actions.
   d. Evaluate the effect of management activities, such as prescribed fire, on rare species populations where they are known to occur. Adapt management activities as appropriate.
   e. Reference Minnesota Biological Survey information to assist in managing rare plant communities and sites of outstanding, high, and moderate biodiversity significance.
   f. Partner with EWR to document and verify rare plant locations, assess threats to each population's viability, and develop long term monitoring protocols.
   g. Continue to implement the established management actions for Victor Hill Forest Management Area and Radio Dunes SMA.

h. Consult with EWR partners and contract with subject matter experts to release threatened and endangered plant species that persist in the seedbank under invasive reed canary grass mats.

4. **Encourage and accommodate monitoring and research to address pertinent management questions.**
   a. As needed, develop and implement habitat and wildlife monitoring protocols to inform and assess the effectiveness of management actions.
   b. Attend conferences and workshops to foster continuous improvement learning for staff.
   c. Incorporate citizen science into wildlife monitoring programs.
   d. Continue existing research and monitoring projects and consider conducting new projects, as opportunities arise. (see Research, Monitoring, and Adaptive Management section below)

5. **Protect existing hydrology and, where possible, manage for a more dynamic flow regime to support resilient wetland and aquatic habitats and to help protect the watersheds.**
   a. If conducting a draw down on pools, consult with Fisheries and EWR colleagues to protect downstream habitat for state-listed mussels and other threatened and endangered species.
   b. Maintain upland forested buffers around interior wetlands, vernal pools, and riparian areas by meeting or exceeding MFRC site level guidelines in areas where tree harvest will occur.
   c. Maintain forested wetlands using site-specific management evaluations.
   d. Manage impoundment water at levels to support wild rice abundance and a diversity of wildlife habitats for species including waterfowl, other waterbirds, muskrats, beaver, otter, and turtles.
   e. Manage wildlife species where they are causing issues with flooding and threatening local native plant communities and infrastructure.
   f. Assure culverts are maintained and/or replaced with appropriate sizes and bottom placements to manage fish and wildlife passage and more extreme rain events.
   g. Maintain dikes and other water control structures. When necessary, work with fisheries and engineering to evaluate structures to repair, remove, or replace them with new structures that are safe, cost efficient, capable of handling extreme precipitation events, and beneficial to fish and wildlife passage. The highest priorities for water control structure replacement include Pool 1, Pool 3, Pool 9 east, North Sunrise Pool Dam and South Sunrise Pool Dam.
   h. Consider and communicate with downstream stakeholders when making water management decisions that impact downstream discharge.

6. **In response to Minnesota's changing climate, develop strategies to enhance ecosystem resiliency and mitigate impacts to WMA resources and infrastructure.**

a. Use Native Plant Community silvicultural interpretations and tree suitability tables to guide timber harvesting, open plantings, and under plantings that support diverse, adaptable forest communities.

b. Continue maintenance, repair, and replacement of water control structures to withstand high precipitation and/or water events.

c. Favor timber harvest strategies that promote natural regeneration. However, when appropriate, facilitate climate change and ecosystem health resiliency by planting a diversity of trees appropriate for a site's characteristics that are native to the WMA or have a seed source capable of adapting to a warmer climate but still are relatively winter hardy. Partner with the Division of Forestry and EWR to monitor climate-adapted plantings on Carlos Avery WMA.

7. **Minimize the introduction, establishment, and spread of invasive species.**

a. Monitor high quality native plant communities to ascertain whether they are being invaded or degraded by terrestrial or aquatic invasive species.

b. Report new invasive species confirmations through appropriate channels. Consult with other invasive species specialists for identification, monitoring, and financial resources as well as management guidance.

c. Treat at least 10 acres of common and glossy buckthorn a year.

d. Continue to treat all known infestations of spotted knapweed, garlic mustard, parsnip, and tansy.

e. Continue to manage all known infestations of purple loosestrife and curly-leaf pondweed, where feasible and where resources allow.

f. Consider the use of interns, the Conservation Corps, and volunteers for early detection invasives surveys.

g. Continue coordinating with USFS on oak wilt management research.

h. Time oak forest management and timber sales to avoid high risk oak wilt period. Consult with the Region Forest Health specialist for oak wilt control strategies.

i. Identify and secure funding resources for annual invasives monitoring and management.

j. Use Best Management Practices to prevent soil compaction and rutting to maintain soil structure.

k. Clean and inspect equipment used on-site to prevent the spread of invasive species.

l. Use only weed-free erosion-control materials, soil, mulch, and seed mixes.

m. When needed to address invasive species and nuisance plants, use herbicides in accordance with DNR Operational Order 59 on pesticide use and related Division guidelines. When using herbicides, mark treatment area with a temporary sign.

8. **Maintain or increase the number of natural and woodpecker-created cavities for cavity nesting waterfowl (wood ducks, mergansers; sometimes mallards) in deciduous forests.**

a. When harvesting stands near open wetlands, manage for tree species and tree characteristics that promote cavities.

b. Consider placing harvest reserves adjacent to riparian management zones.

c. Retain large aspen with conks and other large trees with broken branches and tops as leave trees.

d. Identify a subset of forested islands with poor access in the marsh to designate for no or limited management. Remove from timber pool but allow management on an as—needed basis.

Objectives for Upland Forests

Objectives for Oak

Oak trees and the acorns they produce are a crucial and common food source for a wide variety of both game and non-game wildlife species on Carlos Avery WMA. In general, the more oaks with large, healthy crowns that are fully exposed to sunlight, the more acorns will be produced for wildlife species. This is the rationale for the oak management objectives described below.

9. **Manage oak forests to maximize mast production to benefit wildlife species such as deer, black bear, ruffed grouse, gray squirrel, racoons, wild turkeys, wood ducks, and red-headed woodpeckers.**

a. To begin working towards a balanced age class distribution, conduct 194 acres of regeneration harvest a decade (Table 17). A balanced age class distribution with a natural disturbance stand replacing rotation of 140 years (based on MHc47 NPC) would have 194 acres in each of 14 ten-year age classes plus another 194 acres dispersed across two or more additional decades post 140 years. The oak age class distribution is currently so imbalanced that it will take over a century of disciplined planned management to bring into balance.

b. Remove 188 acres of small oak stands on poor-access islands in the marsh from the management pool (Table 17). Allow them to succeed naturally to create older forest successional habitat that benefits wildlife such as fisher, wood ducks, and bats. Implement management on an as-needed basis.

c. Manage stands with a variety of regeneration techniques (clearcut with reserves, irregular shelterwood, large gap, and small gap regeneration harvests), thus providing vertical and horizontal structural habitat diversity within the stands. Implement new management guidance that may emerge and support oak regeneration.

d. Monitor oak age-class distributions on Carlos Avery WMA via FIM/4Trees assessments at least once every 10 years and ensure age class imbalances are not being exacerbated.

e. Thin overly dense oak stands to improve stand vigor (and thus acorn production) and resilience. When thinning do the following (Johnson et al. 2002):

i. Leave healthy oaks with dominant crowns to maximize acorn production.

1   ii.   Retain a mixture of oak species to minimize the impact of year-to-year
2   fluctuation in acorn production in any one species.
3   iii.   Favor removing non-mast-producing tree species, while retaining oaks in the
4   intermediate and overtopped crown classes.
5   iv.   Do three- or four-sided release on some co-dominant oaks to improve sun
6   exposure and increase acorn production.
7   v.   Retain bur (white) oaks >16" dbh and red oaks 16-28" dbh.

8   f. Discuss planned timber stand improvement (TSI) needs during or before the initial stand
9   evaluation process. Identify TSI funding before planned harvest management actions
10   are implemented. TSI could include timber harvest, prescribed burning, planting,
11   seedling protection and release or other activities as determined by forest habitat
12   managers.
13   g. Plant or maintain native fruit/mast producing shrubs and trees to increase food
14   production.

15

16   Table 17: Current oak age class distribution by acres, acres to remove from timber management pool, and age class
17   distribution of final managed acres. The acres highlighted to be removed from the timber pool exist on islands in
18   marshlands and are not feasible for forest management.

Age Class	Current acres 2024 - Oak	Remove from Timber Pool	New Acres	Goal acres - 2034
0-9	78		78	194
10-19	164		164	78
20-29	0		0	164
30-39	121	12	109	0
40-49	88		88	109
50-59	40	30	10	88
60-69	6		6	10
70-79	144	22	122	6
80-89	815	85	730	122
90-99	583	27	556	656
100-109	600	10	590	496

Age Class	Current acres 2024 - Oak	Remove from Timber Pool	New Acres	Goal acres - 2034
110-119	10		10	530
120-129	212	2	210	10
130-139	184		184	210
140-149	16		16	184
150-159	15		15	16
160+	28		28	43
Totals	3105	188	2917	

10. Maintain or increase the oak cover type to provide multi-seasonal habitats for wildlife species including black bear, wild turkey, grey squirrel, red shouldered hawk, broad-winged hawk, eastern wood pewee, scarlet tanager, bats, salamanders, and shade-dependent plant species.

    a. Plant a diversity of oak species, along with other site-appropriate tree species, prior to or after harvest if advanced regeneration is not abundant enough or if the oak species diversity is low.

    b. Consult the Division of Forestry's 2023 oak evaluation guidelines when planning a supplemental planting or release project.

    c. Where necessary, protect natural and artificial oak regeneration from deer browse using methods such as bud-capping, fencing, or chemical deterrents.

    d. Protect natural and artificial oak regeneration from competing vegetation through prescribed fire, brush saw release, and herbicide application.

    e. Increase the use of prescribed burning over multiple years prior to regeneration harvest and concurrent with thinning operations or shelterwood creation. Pause burning during mast years and for several years while oak seedlings and saplings are maturing.

    f. If an oak stand is declining (i.e., canopy dieback is widespread and worsening over time, and/or scattered death is occurring), regenerate the stand with techniques described above to increase acorn production over the long-term across the landscape.

    g. Identify and obtain funding for pre- and post-harvest oak management actions.

    h. Continue to seek funding to reforest old agricultural fields with a diversity of oak species, along with other site-appropriate, mast producing tree and shrub species.

    i. To make oak forest more resilient to climate and pest pressure, utilize practices including but not limited to thinning, prescribed fire, planting, or other appropriate

1   silvicultural or management techniques to address issues including but not limited to
2   mesophication and invasive species.

3   *Objectives for Aspen*

4 A diversity of aspen age classes provides habitat for a suite of species, some requiring young forest
5 habitat while others are dependent on old forest characteristics such as snags and cavities. The existing
6 aspen age class distribution is so imbalanced that achieving a balanced age class distribution will be
7 prolonged and can only be accomplished by using multiple strategies. This is the rationale for the
8 aspen objective described below.

9   **11. Manage aspen in multiple-age classes for ruffed grouse breeding and winter habitat, deer**
10   **browse, woodpecker nesting, and other cavity-dependent wildlife.**
11   a. Use multiple strategies to begin to move towards a balanced aspen age class
12   distribution of 107 acres in each decade from 0-59, with another 107 acres distributed in
13   the 60-79 year age range (Table 18).
14   i. Begin by addressing the age class distribution (30-39) with the greatest
15   imbalance. Between 2024 and 2034, harvest 124 acres of aspen currently in the
16   30-39 age range, and 10 acres in each of the 40-49 and 50-59 age ranges (Table
17   18). These harvests are necessary to begin to remedy the current age class
18   imbalance. Leave 20% reserves in each harvest for cavity-dependent wildlife
19   needing larger aspen.
20   ii. Between 2034 and 2044, harvest 131 acres in the 60-69 year age category, 10
21   acres in the 50-59 year age category, and 19 acres in the year age category.
22   Leave 20% reserves in each harvest for cavity-dependent wildlife needing larger
23   aspen.
24   iii. Between 2044 and 2054, harvest 121 acres in the 60-69 year age category, and
25   38 acres in the 70-79 year age category. Leave 20% reserves in each harvest for
26   cavity-dependent wildlife needing larger aspen.
27   iv. Between 2054 and 2064, harvest all acres in the 60-69 year age category. Leave
28   20% reserves in each harvest for cavity-dependent wildlife needing larger aspen.
29   b. Classify 157 acres of aspen located on isolated upland rises or islands in the marsh as
30   inoperable (Table 18). Work with Forestry to indicate these in the forest inventory as
31   inoperable, or alternatively, to remove them from the inventory and GIS layers and
32   allow them to be simple inclusions in the marsh. These acres will be considered a
33   natural succession management strategy, responding to wind and fire and water level
34   fluctuations. That does not preclude them from being managed if an opportunity or
35   need arises. As these stands age and grow they will become suitable habitat for cavity
36   nesting waterfowl (wood ducks and hooded mergansers), which in that setting is a
37   higher ecological value than providing young aspen habitat for deer and grouse.
38   c. Allow 177 acres of aspen currently over 60 years old to succeed (passively convert) into
39   northern hardwoods. Attempting to harvest these acres now will only create a greater

1   imbalance in the new younger age classes, which will prolong the ultimate goal of
2   attaining a balanced age class distribution.
3   d. When determining which aspen stands to harvest within each age class, attempt to
4   select stands along the road system where hunters will benefit; also attempt to harvest
5   stands that have an average diameter-at-breast height of >40 cm (15.75 inches). With
6   20% leave trees, this will assure breeding habitat for pileated woodpeckers and the
7   species that reuse their old cavities (wood ducks, mergansers, gray squirrels, fishers,
8   owls, American kestrels). If sufficient 40 cm dbh stands are not available, then target
9   stands that have an average dbh of >35 cm (13.75 inches); this will assure stands have
10   provided a few years of appropriate breeding habitat for smaller woodpeckers and the
11   species that use their old cavities; and with 20% leave trees, some aspen will grow into
12   the size necessary to support pileated woodpeckers.
13   e. Encourage tree species diversity within or among regenerating stands.

14 Table 18: Current and future desired aspen age class distributions on Carlos Avery WMA. Acres recommended to be
15 removed from timber pool are located on islands in marshlands and not feasible for forest management. Given that the
16 middle age classes (30-60) are the highest priority for regeneration management to work towards a balanced age class,
17 additional acres in the 60+ age classes are also recommended for conversion/succession to northern hardwoods.

Age Class	No. Stands (2024)	Acres (2024)	Remove from timber pool	Convert / Succeed	Manage Acres	DC	2034	2044	2054	2064	2074	2084
0-9	2	14			14	107	144	160	159	160	103	100
10-19	2	9			9	107	14	144	160	159	160	103
20-29	6	76	10		66	107	9	14	144	160	159	160
30-39	51	414	111		303	107	66	9	14	144	160	159
40-49	22	195	16		179	107	179	66	9	14	107	107
50-59	17	195	16		179	107	169	160	66	9	14	107
60-69	19	123	4	119	0	70	169	159	160	66	9	14
70-79	5	58		58	0	38	0	38	38	38	38	0
>80						>0.1	0	0	0			
Totals	124	1083			750							

18

19   *Objectives for Northern Hardwoods*

Northern hardwood forests in Carlos Avery WMA are made up of a diversity of tree species with a varied age structure and provide a variety of habitat needs to many wildlife species. In addition to their benefits to wildlife, northern hardwood stands with greater species and age class diversity also show more resilience when faced with insect, disease, fire, drought, and climate change-related forest stressors. This is the rationale for the objective and strategies below.

12. **Maintain northern hardwood acreage and maintain or increase existing species and age structure diversity within northern hardwood stands to provide multi-seasonal habitats for species including black bear, wild turkey, gray squirrel, red shouldered hawk, broad-winged hawk, eastern wood pewee, scarlet tanager, yellow-bellied sapsucker, bats, salamanders, and shade-dependent plant species (Table 19).**

    a. Evaluate potential management sites to confirm existing NPCs, tree species, age structure, and stand boundaries and to assess other landscape considerations.

    b. Utilize site-appropriate disturbance when needed to maintain or increase species and age structure diversity within northern hardwoods stands.

        i. Utilize best management practices such as selective thinning, group selection, shelterwood, seed tree, and clearcut with reserves to promote species and age structure diversity within stands.

        ii. Maintain or increase tree species diversity through regeneration techniques listed in (i.) above and through planting seedlings, invasive species control, and tree release treatments.

        iii. Utilize prescribed fire when seeking to promote fire-resistant species within a stand.

        iv. During management entries into stands, retain greater amounts of climate-adapted and wildlife benefitting tree species like basswood, bur oak, white oak, sugar maple, red maple, and white pine.

    c. Remove 62 acres of northern hardwoods on poor-access islands in the marsh from the management pool. Allow them to succeed naturally to create older forest successional habitat that benefits wildlife such as fisher, wood ducks, and bats. Implement management on an as-needed basis.

    d. Manage Victor Hill SMA (a.k.a. Boot Lake SMA) forests and wetland interfaces with an emphasis on maintaining the forest and wetland plant communities and ensuring that habitat for red-shouldered hawks is sustained.

    e. Retain naturally-occurring conifers in stands.

    f. Promote and protect natural white pine regeneration in the forest understory by protecting from deer browse and releasing from competition once white pine have grown to reach the base of the hardwood canopy.

    g. Maintain red pine plantations while they continue to provide winter cover for wildlife species including deer and wild turkey. After they reach limited utility, remove and replace with site-appropriate northern hardwood cover type tree species.

Table 19: Northern hardwoods forest stand acres. Tree species included within the northern hardwoods cover type include: basswood, white oak, bur oak, red maple, sugar maple, and black cherry. Acres recommended to be removed from timber pool are located on islands in marshlands and not feasible for forest management. Please note: Given that northern hardwoods will be managed to achieve multi-aged stands and not single-aged stands, the first column of this table highlights the dominant, or prevailing, age of northern hardwood tree species in the stand and not the single age-class of all northern hardwood tree species in the stand. Stands will be assessed, and treatments designed, to promote species and age-class diversity instead of managing a for single stand age which is more common in even-aged cover types. While the dominant age of the tree stands will continue to increase given this multi-aged stand management, management actions will create young patches of northern hardwoods species within these stands, thus achieving the goal of increased age-class diversity.

Dominant age of tree stand	Current 2024 acres	Acres not feasible for forest management to remove from management pool	New 2024 management acres	Aspen acres converting into northern hardwoods
0-9	56		56	
10-19	9		9	
20-29	8		8	
30-39	65		65	
40-49	67		67	
50-59	22	11	11	
60-69	15		15	123 (in 30 years)
70-79	182	16	166	58 (in 20 years)
80-89	168	30	138	
90-99	137	5	132	
100-109	6		6	
110-119	15		15	
120-129	7		7	
130-139	0		0	
140-149	0		0	
150-159	0		0	
160+	0		0	
Totals	757	62	695	181

Objectives for Wetland Forests

13. Employ adaptive management to respond to forest health concerns that may arise due to climate change and tree health threats.
   a. Monitor tamarack stands for larch beetle infestation. Work with DNR Silviculture to respond to infestations if they occur to maintain wet forest.
   b. Monitor how lowland hardwood stands and adjacent upland forests react to loss of ash due to EAB. Consider supplemental planting of swamp white oak to combat potential water table rise and loss of wet forest habitat.
   c. Monitor the response of cavity-dependent wildlife to increases in ash mortality from EAB. If there is a positive response, consider slightly increasing aspen harvest.

Objectives for Upland Grasslands

14. Maintain, enhance, and restore grassland habitat to benefit species that utilize open landscapes including pheasants, turkeys, deer, nesting teal mallards, Blanding's turtle, hognose snakes, and ground-nesting grassland songbirds.
   a. Monitor and assess existing grassland habitat for invasive species, encroaching woody species, and rare and threatened species, to help inform current grassland management needs.
   b. Maintain and enhance plant species diversity in existing prairie fields through prescribed burns (at least 50 acres annually) and inter-seeding forbs (as opportunities arise and funding allows).
   c. Enhance existing native plant restorations through inter-seeding, or other appropriate techniques.
   d. Of existing cool season grasses, convert 20 acres to forest over the next decade. Specific tree species planted will depend upon site characteristics.
   e. Manage Radio Dunes SMA to sustain the oak savanna plant community and its component rare species: beach heather *(Hudsonia tomentosa)* and the northern barrens tiger beetle *(Cincindela patruela patruela).*

Objectives for Wetlands, Shrublands, Marshes and Open Water

15. Monitor and assess existing wetland and riparian areas to inform management actions.
   a. Continue to coordinate with organizations conducting water quality monitoring in and around the WMA, including the Minnesota Pollution Control Agency and watershed management organizations.
   b. Monitor and assess existing wetlands and shallow lakes for invasive species, water chemistry, aquatic vegetation abundance and composition, and fish presence, and implement management actions as appropriate to address wildlife habitat needs.

16. **Protect, maintain, enhance, and restore riparian areas and wetlands to provide habitat for wetland wildlife such as trumpeter swans, teal, mallards, wood ducks, and aquatic furbearers.**
    a. Maintain balance of grass, shrub, and open water cover.
    b. Increase open water cover by conducting 15 acres annually of targeted aquatic vegetation management using prescribed burning, water level management, mechanical vegetation removal, and, where necessary, chemical control.
    c. Pursue opportunities to acquire equipment needed for mechanical vegetation removal and management, such as a Marsh Master.
    d. Enhance existing wetland habitat through cattail management, water lily management, water level manipulation, invasive species management, or fish management.

17. **Maintain existing wild rice beds and increase the acreage of wild rice in the WMA for human use and to benefit wildlife species including teal, mallards, wood ducks, ring-neck ducks, rails, and soras.**
    a. Conduct annual wild rice management activities to protect existing wild rice, including keeping water outlets free flowing, managing cattail bogs, and controlling beaver as needed.

18. **Maintain and improve existing wetland infrastructure, including water control structures, dikes, ditches, channels, and culverts.**
    a. Monitor the condition and function of existing wetland infrastructure and repair or replace as necessary.
    b. Investigate the opportunity to improve the wetland infrastructure for the benefit of wetland habitat or to mitigate the impacts of climate change.

19. **Manage water levels to address identified resource needs and water regime considerations.**
    a. Continue to follow the Carlos Avery WMA Water Management Plan (Appendix X).
    b. Pursue resources to update the Carlos Avery WMA Water Management Plan.
    c. Communicate with partners on water level management plans.

20. **Address aquatic impairments through using best management practices, implementation strategies, and actions outlined in the Sunrise River and Coon Creek watershed Water Restoration and Protection Strategies reports.**
    a. Coordinate and communicate with organizations that monitor impairments.

Objectives for Wildlife Openings and Annual Food Plots

21. **Monitor annually existing wildlife openings across the WMA, and remove encroaching trees as needed, to provide open areas utilized by wildlife species including deer, black bear, woodcock, mourning dove, and turkeys.**

1   a. Manage wildlife openings using mowing, cutting, and prescribed burning.
2

3   **22. Limit annual crop acreage to the existing 150 acres for wildlife use.**
4   a. Utilize low impact farming practices, including minimizing pesticide usage and tillage to
5   promote pollinator friendly management.
6   b. Plant a diversity of crop species to increase soil health and productivity.
7   c. Utilize cover crops to protect soil health and water quality.
8   d. Evaluate utilization of existing food plots by wildlife species.
9

10 **Goal 2: Maintain or enhance hunting, fishing, trapping, other compatible outdoor**
11 **recreational opportunities, and the exercise of reserved treaty rights.**
12

13 **23. Verify, locate, and, when appropriate, protect cultural sites within the WMA.**
14   a. Work with Tribal Historic Preservation Office and State Historic Preservation Office to
15   implement a survey of cultural sites within the WMA.
16

17 **24. Maintain and enhance access to diverse quality hunting, trapping, and fishing opportunities**
18 **in the WMA.**
19   a. Maintain hunter walking trails to facilitate hunting and trapping on the WMA.
20   b. Investigate potential ways to address concerns about overcrowding near popular hunting
21   locations.
22   c. Seek funding to install accessible facilities such as hunting blinds and fishing platforms.
23   d. Continue to regulate trapping pressure and prevent overcrowding by limiting trapping
24   special use permits.
25   e. Survey WMA hunters, trappers, and fishers about how they use the Carlos Avery WMA and
26   their experience.
27   f. Work with outreach to update what hunting, trapping, and fishing information is presented
28   on the Carlos Avery WMA website.
29   g. Consider changes to the WMA access management plan to minimize motor vehicle access
30   at certain times of the year and/or at certain locations to protect wildlife, enhance visitor
31   experience, and minimize damage to infrastructure.
32

33 **25. Provide opportunities for compatible recreation including birdwatching, wildlife viewing,**
34 **photography, biking, hiking, and foraging.**
35   a. Update bird species checklist for the Carlos Avery WMA.
36   b. Pursue funding for accessible outdoor facilities as wildlife observation platforms.
37   c. Continue to collect feedback from Carlos Avery WMA users through the Wildlife Conditions
38   Reporting application on the Carlos Avery WMA website.

d. Update WMA website with current information on sustainable and allowable foraging on the Carlos Avery WMA.

e. To address concerns about the contamination of foraging species, continue to use herbicides only when needed to address invasive species and nuisance plants and do so in accordance with DNR Operational Order 59 "Pesticides and Pest Control" and the Division of Fish and Wildlife Pesticides and Pest Control Guidelines. Guidelines include, for example, mark herbicide treatment area with a temporary sign, use buffer strips to avoid impacts on human use, and use non-pesticide methods when possible.

f. Investigate ways of further clarifying the definition and legal use of Wildlife Sanctuaries.

26. Improve communications with WMA users and surrounding communities about WMA regulations and management.

   a. Develop signage that clarifies the definition, purpose, and safe use of the WMA. Include maps, hunting and trapping season dates, foraging regulations, phone number for illegal activity tip line, recommendations for safe compatible use including wearing blaze orange. Put these signs at the 6-8 key kiosks across the WMA.

   b. To help address user conflict, investigate ways of simplifying access to, and increasing comprehension of, WMA rules by, for example, adding QR codes to parking lot signs to access maps and relevant rules.

   c. Continue to hold regular office hours at the main WMA office building for drop-in visitors.

   d. Conduct additional annual outreach by, for example, attending nearby community meetings, stakeholder group meetings, or holding yearly open houses.

   e. Garner addition resources that allow for staff to spend more time interacting with WMA users across the WMA.

   f. Explore using the DNR's volunteer program to organize volunteers to increase interactions with WMA users across the WMA.

27. Work with the division of enforcement and local law enforcement agencies to improve education concerning WMA rules and to reduce illegal activities.

   a. Build relationships with local law enforcement, fire, and EMS agencies to facilitate effective responses to illegal and emergency activities.

   b. Communicate WMA policies and directives to enforcement staff.

   c. Establish e911 locations in public parking lots for increased public safety.

   d. Explore the feasibility of having Enforcement staff that are dedicated to Carlos Avery WMA.

28. Reduce impacts from unmanaged access and trespass issues on the WMA and adjacent lands.

   a. Work to address boundary trespass issues on the WMA and adjacent lands through boundary line surveys, sign posting, and natural barrier management.

   b. Address agricultural and private land trespass through conversations with nearby landowners to reduce negative impacts to the WMA.

c. In areas where there is reoccurring illegal activity, increase monitoring through, for example, trail cameras to reduce the frequency of illegal activity and assist in prosecution.

d. Install infrastructure, such as parking lot barriers, that deters unmanaged access to the WMA to reduce negative impacts to the WMA and its users, while considering accessibility needs.

29. **Maintain and enhance public facilities on the WMA including parking lots, roads, public water access sites, and signs to facilitate safe and accessible use.**
   a. Maintain and improve signage on the WMA to facilitate a safe user experience.
   b. Pursue opportunities to add additional accessible WMA parking lots and water access sites.
   c. Maintain and improve roads and parking lots to facilitate a safe user experience.
   d. Continue to complete minor maintenance, trash removal, landscaping, and snow removal.
   e. Manage the seasonal timing of road access to reduce damage and improve the quality and safety of visitor's experience.
   f. Coordinate with local government units to manage public roads and parking lots related to their jurisdiction.

30. **Maintain and enhance WMA buildings for safe, reliable use by the public and staff.**
   a. Coordinate with Facility Advisor and Site Coordinator on maintenance and improvement projects.
   b. Communicate safety concerns to Site Coordinator.

31. **Acquire inholdings, round-outs, and other priority parcels as funding and opportunity allows and restore to forest, prairie, or wetlands.**
   a. Respond to inquiries from landowners concerning land acquisitions and work with adjacent landowners to identify potential parcels for acquisition.
   b. Coordinate with regional DNR staff to identify and prioritize potential parcels.
   c. Work within approved project boundary approved in 2017 that prioritized potential parcels to acquire.

VII.   Implementation Process

The management objectives and strategies laid out in this plan describe the "what" and "why" for management intended to occur on the Carlos Avery WMA in the next 10 years, but specific operations at Carlos Avery WMA are dependent on several factors, including weather conditions, funding, and changing priorities. To allow flexibility in the operational plan, the "who," "when," and "how" of specific work activities will be determined annually by unit staff in conjunction with division-wide annual work planning. Table 20 shows an overview of ongoing annual work activities that are performed at Carlos Avery WMA in a typical year.

1   Table 20: Overview of annual work activities performed at Carlos Avery WMA in a typical year.

Activity/Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Boundary posting	Yes	Yes	Yes				Yes	Yes	Yes	Yes	Yes	Yes
CPL & ECP grants									Yes			
Deer goal setting/ public meetings	Yes	Yes	Yes	Yes				Yes				
Deer season/ CWD management	Yes								Yes	Yes	Yes	Yes
Fire suppression		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Food plot development				Yes	Yes	Yes	Yes	Yes	Yes			
Furbearer registration	Yes										Yes	Yes
Gate and sign repairs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grouse surveys				Yes	Yes							
Invasive species control			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Inventory	Yes	Yes	Yes	Yes								Yes
Mow brush	Yes	Yes	Yes						Yes	Yes	Yes	Yes
Mow dikes, trails, roads, & parking lots						Yes	Yes	Yes	Yes	Yes	Yes	
Mow & bulldoze firebreaks		Yes	Yes	Yes					Yes	Yes	Yes	Yes
Nuisance animal trapping					Yes	Yes	Yes	Yes	Yes	Yes		
OHF - Develop proposals				Yes	Yes							
Partner coordination meetings			Yes					Yes				
Predator scent post survey									Yes			
Prairie planting			Yes		Yes	Yes				Yes	Yes	
Prairie management – Mow new prairies						Yes				Yes		
Public use car counts				Yes	Yes				Yes	Yes	Yes	
Road repair/ maintenance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rx burn plans	Yes	Yes	Yes	Yes								Yes
Rx burn equipment inventory & prep		Yes	Yes	Yes						Yes	Yes	
Rx burn reporting												Yes
Rx burning			Yes	Yes	Yes	Yes				Yes	Yes	
Special Hunt Administration			Yes						Yes	Yes	Yes	
Site emergency plan - Review & update	Yes											
Timber harvest	Yes	Yes	Yes					Yes	Yes	Yes		Yes
Timber sale supervision	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes
Timber stand exam reviews	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trapping season/ data entry	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes	Yes
Tree planting				Yes	Yes							
Training – Attend required training	Yes	Yes	Yes	Yes								Yes
Waterfowl counts								Yes	Yes	Yes	Yes	
Waterfowl management - Duck banding								Yes	Yes			

Activity/Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water level monitoring and management	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Water control structure maintenance/ monitoring		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wildlife box maintenance – Wood duck		Yes	Yes									
Wildlife box maintenance – Blue bird		Yes	Yes								Yes	Yes
Wildlife project proposals			Yes	Yes								
Wildlife roadside survey								Yes				

VIII. Research, Monitoring, and Adaptive Management

Current Research and Monitoring Projects

Wildlife Monitoring

- Chronic Wasting Disease (no official monitoring but investigate reports of sick deer)
- Grouse drumming surveys
- Annual August roadside surveys – Including pheasants and small game
- Weekly waterfowl migration report
- Christmas bird counts – In collaboration with National Audubon Society and MN Ornithologists' Union

Public Use Monitoring

- Trapping permits
- Furbearer harvest
- Spring turkey permits
- Car counts

Habitat Monitoring

- Water level and temperature monitoring
- Weather monitoring station (e.g., temperature, precipitation, wind)
- DNR forest canopy health aerial survey
- Light pollution research
- Wildlife lake habitat surveys
- Minnesota Ecological Monitoring Network plots

Invasive Species Monitoring

- Informal buckthorn monitoring
- Informal Japanese knotweed monitoring
- Informal purple loosestrife monitoring
- Informal wild parsnip monitoring

- Informal garlic mustard monitoring
- Informal spotted knapweed monitoring
- Informal tansy monitoring
- Spongy moth monitoring (Minnesota Department of Agriculture)
- Invasive species monitoring using EddMaps (conducted by volunteers, see eddmaps.org)

Research

- Emerald ash borer biocontrol research
- Effects of Timber Harvest on Forest Dependent Wildlife
  - Ongoing study by the MN DNR Nongame Wildlife Program (2021-2026), report will be available here: Research reports | Minnesota DNR (state.mn.us) once published.

Potential Research and Monitoring Projects

- Evaluate opportunities for rare plant salvage and relocation research.
- Evaluate opportunities for conservation seed collection and banking for rare plant species.
- Monitor effects of prescribed burning on habitats and the wildlife responses to those changes/enhancements.
- Use existing and future remote sensing products (aerial imagery, Lidar) to assess and analyze changes in forested and open habitat.
- Monitor the density and distribution of aquatic vegetation.
- Monitor for surviving ash trees after the initial wave of EAB.
- Collaborate with MBS on surveying aquatic plants and rare plants and animals.
- Examine the impact of urbanization on wildlife by incorporating Carlos Avery WMA into future studies.
- Assess the risk of aboveground oak wilt transmission when varying the timing of prescribed burns (e.g., spring versus fall).
- Track the success of ongoing tree seedling project within Carlos Avery WMA.
- Conduct a comprehensive survey of cultural and historic sites on the Carlos Avery WMA.
- Monitor bird frequency, abundance, and trends using a point count network. Explore using volunteers or a contractor.

Adaptive Management

Adaptive management is the process of incorporating new knowledge, techniques, or policy decisions into existing management actions. Many of these changes cannot be planned for, but some can be anticipated. Adaptive management for Carlos Avery WMA will include:

- Continuously reviewing research and monitoring results and building off the results to improve habitat restoration techniques, maximize wildlife benefit, and increase user satisfaction.
- Collaborating with other divisions and partners to continue, improve, and expand research and monitoring projects.

1 - Monitoring advances in climate change predictions and mitigation and implementing
2   management directions accordingly. Example sources of climate change and habitat
3   management information might come from NIACS, MFRC, or various state universities.
4 - Modifying management activities if new species are listed as state or federally threatened or
5   endangered. For example, the tri-colored bat is under consideration for federal listing and
6   habitat management activities will be adjusted as necessary.
7 - Decisions on how to manage forested stands on the DNR 10-year stand exam list will
8   implement adaptive management concepts. For example, treatment options will consider 1)
9   the condition, age, and regeneration success on adjacent stands; 2) missing habitat features in
10 and around the stand; 3) current soil and moisture conditions; 4) invasive species management;
11 4) climate change risks and opportunities – all things that cannot go into a simple stand
12 selection model that operates at a statewide level.

13 The management objectives and strategies set forth in this document will be reviewed annually by
14 regional and area staff and adjusted, as necessary. A revision of the master plan is recommended after
15 10 years.

16

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X. Appendix A. Carlos Avery WMA Planning Team Members

Role	Name	Division	Position	Location
Executive Sponsor	Kelly Straka	FAW	Wildlife Section Manager	St. Paul
Managing Sponsor	Gretchen Miller	FAW	Regional Wildlife Manager	St. Paul
Project Manager	Adam Kokotovich	FAW	Policy and Planning Consultant	St. Paul
Project Manager	Amanda Dirnberger	OSD	R3 Regional Planner	St. Paul
Team Member	Jim LaBarre	FAW	Area Wildlife Manager	Carlos Avery WMA
Team Member	Matt Ward	FAW	Area Fisheries Supervisor	Hinckley
Team Member	Mike North	FAW	NR Specialist Senior Wildlife	Brainerd
Team Member	Michelle Martin	FOR	Regional Forestry Specialist	St. Paul
Team Member	Brian Schwingle	FOR	Forest Health Program Coordinator	St. Paul
Team Member	Lisa Mueller	FOR	Assistant Area Forestry Supervisor	Cambridge
Team Member	Nate Renk	PAT	Area Resource Specialist	Carlos Avery WMA
Team Member	Brandon Schad	FAW	Assistant Regional Wildlife Manager	St. Paul
Technical Advisor	Jordan Williams		Mille Lacs Band of Ojibwe	
Technical Advisor	Jonathan Gilbert		Great Lakes Indian Fish and Wildlife Commission	
Technical Advisor	Craig Wills	EWR	Area Hydrologist	Cambridge
Technical Advisor	Melissa Collins	EWR	NR Specialist Senior Eco Services	Region 3
Technical Advisor	Erica Hoaglund	EWR	Regional Nongame Specialist	St. Paul
Technical Advisor	Amanda Weise	EWR	Regional Plant Ecologist	St. Paul
Technical Advisor	Greg Hoch	FAW	Prairie Habitat Team Supervisor	St. Paul

# XI. Appendix B. Water Management and Aquatic Plants

Table 21: Inflows, outflows, and water depth goal range from each impoundment. Each impoundment also gains water from its surrounding watershed. See Figure 26 for map of these impoundments. The water depth goal range is the typical goal range for these impoundments, however there are factors and actions that cause water levels to exist outside this range such as drawdowns and extreme weather events.

| Impoundment	Water depth goal range for habitat management for each impoundment (feet above sea level)	Inflows from	Outflows to
North Pool	863.48 to 864.48	Sunrise River (South Pool); Mud Lake	Sunrise River
South Pool	873.89 to 875.59	South and West Branches of Sunrise River; Sunrise River	Sunrise River (North Pool)
Mud Lake	871.73 to 873.73	None	North Pool
Pool 1	896.98 to 897.28	Coon Lake Ditch; Larson Ditch; Little Coon Lake	Pool 3
Pool 2	896.98 to 897.28	None	2A: Pool 3
			2B: Pool 6
Pool 3	896.54 to 897.14	Pool 1; Pool 2 structure 2A	Pool 4
Pool 4	894.91 to 895.31	Pool 3	4A: Pool 5
			4B: Pool 9
Pool 5	894.97 to 895.27	Pool 4 structure 4A	5A: Pool 6
			5B: Pool 9(W)
Pool 6	890.50 to 892.00	Skunk Hill culvert; Pool 5 structure 5A; Pool 2 structure 2B;	6A: Pool 26
			6B: Pool 8
Pool 7	Uncontrolled	Culvert under Co. Rd. 22	Pool 22
Pool 8	885.00 to 889.20	Pool 6 structure 6B; Pool 22	South Branch of Sunrise River

Impoundment	Water depth goal range for habitat management for each impoundment (feet above sea level)	Inflows from	Outflows to
Pool 9	889.50 to 890.50	Pool 4 structure 4B; Pool 10B	9A: South Branch Sunrise River
			9B: South Branch Sunrise River
			9E: South Branch Sunrise River
			9W: South Branch Sunrise River
Pool 10	891.53 to 891.93	Little Coon Lake discharge (potentially Coon Lake and Larson Ditches when water is backed into L. Coon Lake from Pool 1)	10A: South Branch Sunrise River
			10B: Pool 9
Pool 13	901.40 to 901.60	None	13A: Pool 15
			13B: Pool 14
Pool 14	900.22 to 900.42	Pool 13 structure 13B	14A: Pool 16
			14B: Pool 17
Pool 15	901.58 to 901.78	Pool 13 structure 13A	15A: Pool 16
			15B: County Ditch 44 (Coon Creek)
Pool 16	898.87 to 899.07	Pool 14 structure 14A; Pool 15 structure 15A	16A: County Ditch 44 (Coon Creek)
			16B: County Ditch 44 (Coon Creek)
Pool 17	898.87 to 899.07	Pool 14 structure 14B	Open marsh then County Ditch 44 (Coon Creek)
Pool 18	Uncontrolled	Pool 17	Open marsh then County Ditch 44 (Coon Creek)

Impoundment	Water depth goal range for habitat management for each impoundment (feet above sea level)	Inflows from	Outflows to
Pool 22	889.93 to 890.43	Pool 24; Pool 7	22A: Pool 8
			22B: Open marsh then South Branch Sunrise River
Pool 23	Uncontrolled	None	Open marsh
Pool 24	Uncontrolled	None	Pool 22
Pool 26	888.00 to 890.00	Pool 6 structure 6A	South Branch of Sunrise River
Ponds			
East Twin	Uncontrolled	None	
West Twin	Uncontrolled	None	
Little Coon Lake	Uncontrolled	Outflows into Pool 1 via Co. Ditch 12 and outflows across land into Pool 10	
Peterson Slough	Uncontrolled	None	

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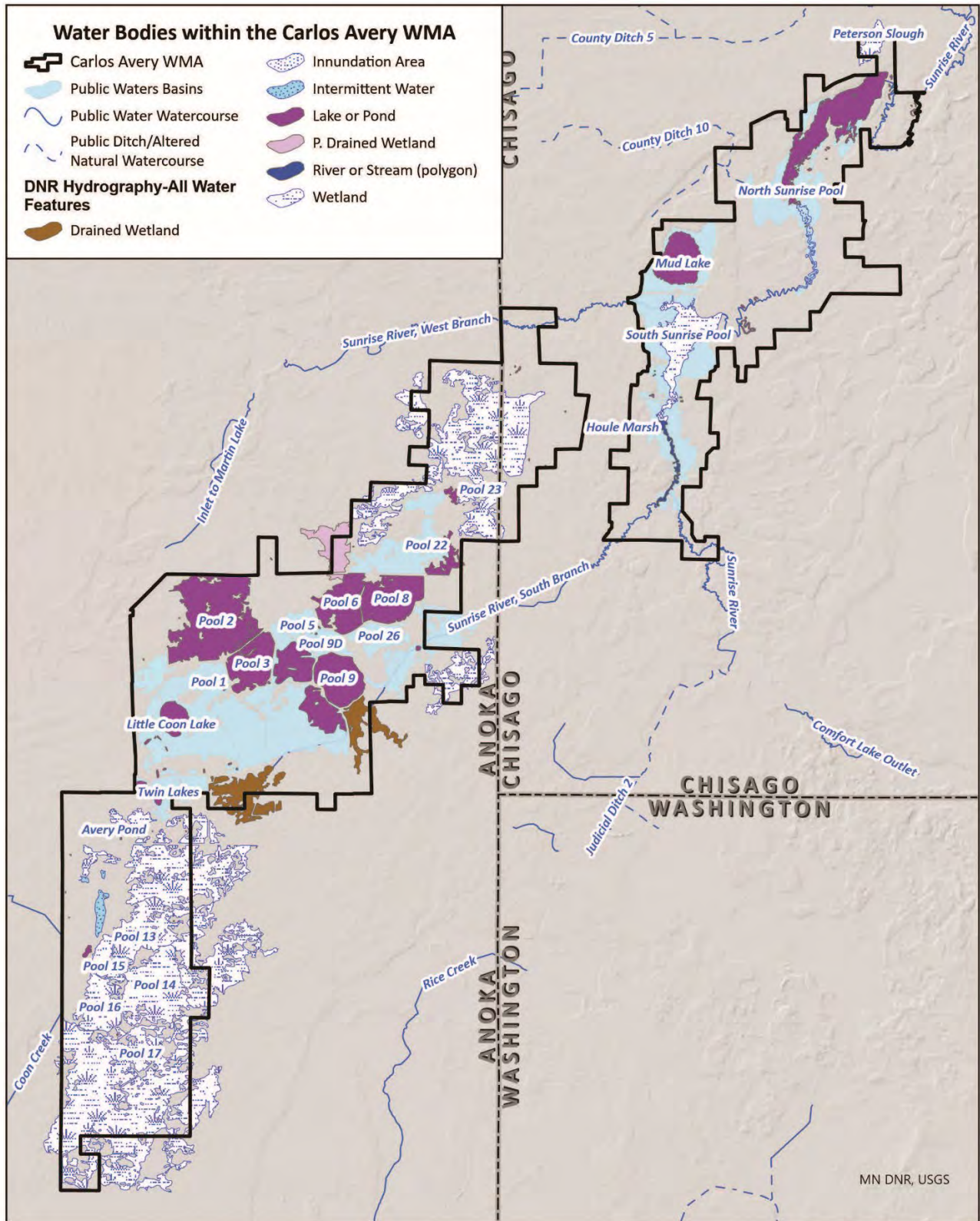
Figure 26: Waterbodies within Carlos Avery WMA.
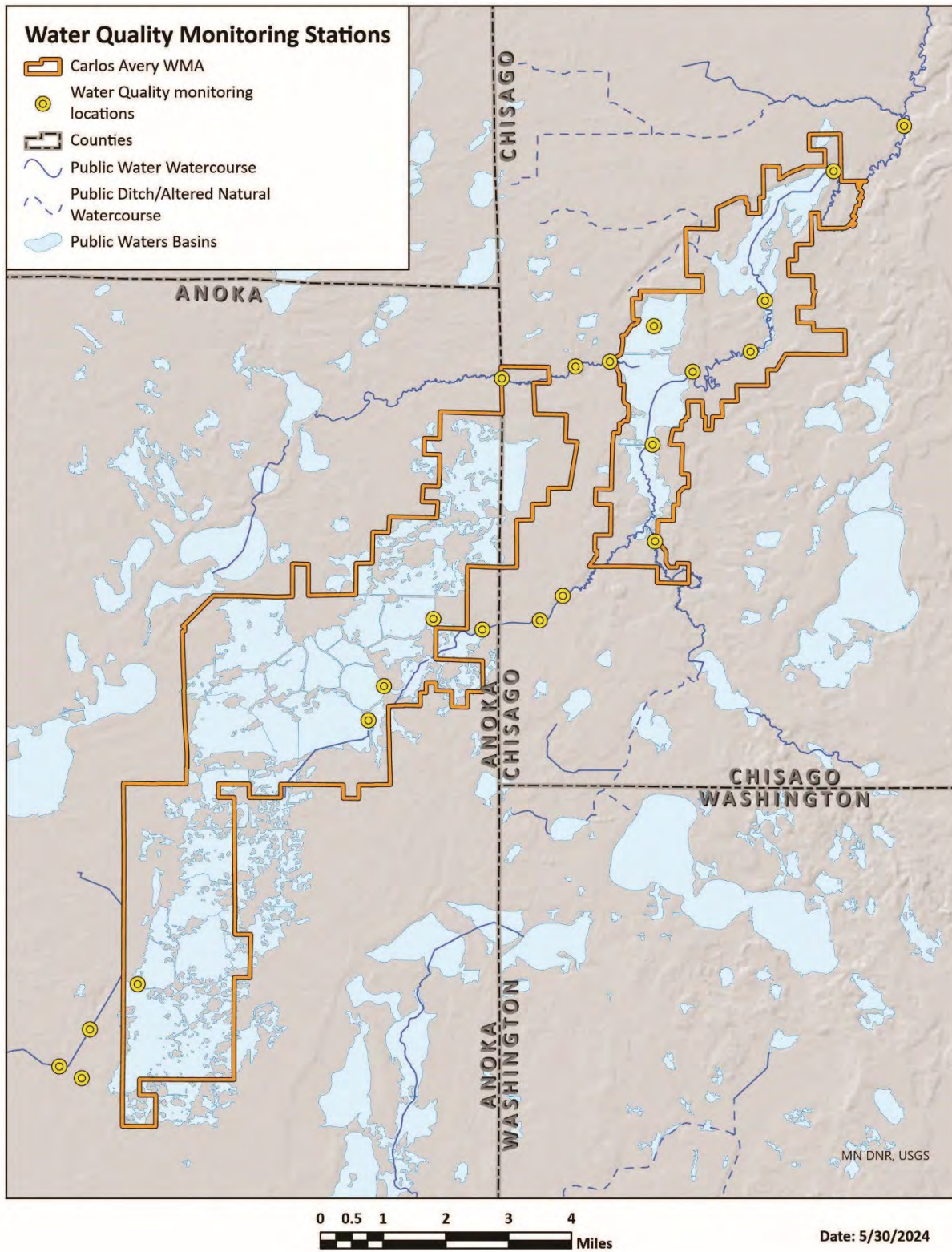
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2   Figure 27: Water quality monitoring stations on or near the Carlos Avery WMA.

Table 22: Aquatic plant taxa sampled at three stations in 1998 and 2008 by the Minnesota Department of Natural Resources, Hinckley Area Fisheries. Sample sites include Station 4 (mile 14.8), Station 5 (mile 21.1), and Station 6 (mile 27.8). The North Sunrise Pool dam is at mile 21.4, while the South Sunrise Pool dam is at mile 28.4. Stations 5 and 6 are just downstream of these two dams, while Station 4 is near the northeastern AMA boundary. Plant types are summarized as Riparian (R), Emergent (E), Floating-leaf (FL), Submersed (S), and Free-floating (FF). Status is indicated as Introduced (I) or Special Concern (SPC). The frequency of occurrence is summarized as Abundant (A), Common (C), Occasional (O), Rare (R), and none observed (-).

Common Name	Scientific Name	Status	Type	Station 4		Station 5		Station 6	
				7/9/98	7/8/08	7/9/98	7/8/08	7/9/98	7/8/08
Canada wild rye	*Elymus canadensis*		*R*	R	-	-	-	-	-
Jewel weed	*Impatiens capensis*		*R*	P	-	-	-	-	-
Reed canary grass	*Phalaris arundinacea*	*I*	*R*	A	O	A	R	A	-
Sedge	*Carex aquatilis*		*R*	-	-	-	R	P	-
Swamp milkweed	*Asclepias incarnata*		*R*	-	-	P	-	P	-
Arrowhead	*Sagittaria* sp.		*E*	-	C	-	C	-	O
Broad-leaved cattail	*Typha latifolia*		*E*	P	-	-	-	R	R
Giant bur-reed	*Sparganium eurycarpum*		*E*	-	-	R	-	-	-
Horsetail	*Equisetum fluviatile*		*E*	-	-	-	-	P	-
Mud plantain	*Alisma* sp.		*E*	C	-	A	-	A	-
Needle-spike rush	*Eleocharis acicularis*		*E*	-	O	-	O	-	-
Phragmites	*Phragmites australis*		*E*	-	-	R	-	P	-
River bullrush	*Bolboschoenus fluviatilis*		*E*	P	O	-	R	-	C
Soft stem bullrush	*Schoenoplectus tabernaemontani*		*E*	R	-	-	-	-	-
Wild rice	*Zizania palustris*		*E*	-	-	P	O	-	O

Common Name	Scientific Name	Status	Type	Station 4		Station 5		Station 6	
				7/9/98	7/8/08	7/9/98	7/8/08	7/9/98	7/8/08
Floating leaf burreed	*Sparganium fluctuans*		*FL*	-	C	-	A	-	C
Water smartweed	*Persicaria amphibia*		*FL*	P	-	O	-	O	-
Canada water weed	*Elodea canadensis*		*S*	C	-	P	R	-	-
Coontail	*Ceratophyllum demersum*		*S*	O	-	R	R	R	R
Curlyleaf pondweed	*Potamogeton crispus*	*I*	*S*	-	-	-	O	P	-
Bushy pondweed	*Najas flexilis*		*S*	-	-	P	-	-	-
Flatstem pondweed	*Potamogeton zosteriformis*		*S*	-	R	P	R	R	-
Large-leaf pondweed	*Potamogeton amplifolius*		*S*	-	O	-	-	-	-
Pusilus pondweed	*Potamogeton pusillus*		*S*	-	-	R	-	-	-
River pondweed	*Potamogeton nodosus*		*S*	C	-	A	-	C	-
Sago pondweed	*Stuckenia pectinata*		*S*	C	-	O	-	-	-
Variable pondweed	*Potamogeton gramineus*		*S*	-	-	-	-	-	O
Water starwort	*Callitriche* sp.		*S*	P	R	-	O	-	O
Wild celery	*Vallisneria americana*		*S*	-	R	-	R	-	R
Duck weed	*Lemna trisulca*		*FF*	C	O	O	O	C	C
Watermeal	*Wolffia* sp.		*FF*	O	-	-	-	-	-

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Table 23: Aquatic plant species sampled by DNR Ecological and Water Resources through the Minnesota Biological Survey, and by the DNR Shallow Lakes Program. Locations sampled by EWR include the North Sunrise Pool (ID# 13005903), South Sunrise Pool (ID# 13005901), and Pool 10 (ID# 02003100), while locations sampled by the Shallow Lakes Program include Little Coon Lake (ID# 02003200) and Mud Lake (ID# 13005902). Plant types are summarized as Riparian (R), Emergent (E), Floating-leaf (FL), Submersed (S), and Free-floating (FF). Status is indicated as Introduced (I) or Special Concern (SPC).

Common Name	Scientific Name	Status	Type	South Sunrise Pool 7/22/14	North Sunrise Pool 6/18/21	Pool 10 9/21/23	Little Coon Lake 7/12/12	Mud Lake 8/12/14
Bedstraw, Cleavers	*Galium* sp.		*R*	X				
Bottlebrush sedge	*Carex comosa*		*R*	X				
Bulb-bearing water-hemlock	*Cicuta bulbifera*		*R*	X				
Dock, Sorrel	*Rumex* sp.		*R*	X				
Dodder, Amarbel	*Cuscuta* sp.		*R*			X		
Reed canary grass	*Phalaris arundinacea*		*R*	X				
Waterwillow, Swamp loosestrife	*Decodon verticillatus*	*SPC*	*R*			X		
Willow	*Salix* sp.		*R*	X				
Bald spike-rush	*Eleocharis erythropoda*		*E*	X				
Broad-leaved arrowhead	*Sagittaria latifolia*		*E*	X	X			
Common reed grass	*Phragmites australis*		*E*	X				
Giant bur-reed	*Sparganium eurycarpum*		*E*	X	X	X		
Narrow-leaved cattail	*Typha angustifolia*		*E*	X	X	X	X	
Soft stem bullrush	*Schoenoplectus tabernaemontani*		*E*	X	X	X		
Spikerush group	*Eleocharis* sp.		*E*					X

Common Name	Scientific Name	Status	Type	South Sunrise Pool 7/22/14	North Sunrise Pool 6/18/21	Pool 10 9/21/23	Little Coon Lake 7/12/12	Mud Lake 8/12/14
Wild rice	*Zizania palustris*		E	X	X	X	X	X
Water smartweed	*Persicaria amphibia*		FL	X				
White water lily	*Nymphaea odorata*		FL	X	X	X	X	X
Yellow water lily	*Nymphaea variegata*		FL		X	X	X	
Blunt-tipped Sago pondweed	*Stuckenia filiformis*		S	X				
Braun's stonewort	*Chara braunii*		S		X	X		
Bushy pondweed	*Najas flexilis*		S	X	X			X
Canada water weed	*Elodea canadensis*		S		X	X	X	X
Chara sp.	*Chara* sp.		S					X
Common bladderwort	*Utricularia vulgaris*		S	*X*		X	X	X
Coontail	*Ceratophyllum demersum*		S	X	X	X	X	X
Curlyleaf pondweed	*Potamogeton crispus*		S		X			
Fetid stonewort	*Chara contraria*		S		X			
Flatstem pondweed	*Potamogeton zosteriformis*		S	X	X	X	X	X
Fries' pondweed	*Potamogeton friesii*		S		X			X
Globular stonewort	*Chara globularis*		S		X			
Humped bladderwort	*Utricularia gibba*		S			X		

Common Name	Scientific Name	Status	Type	South Sunrise Pool 7/22/14	North Sunrise Pool 6/18/21	Pool 10 9/21/23	Little Coon Lake 7/12/12	Mud Lake 8/12/14
Leafy pondweed	*Potamogeton foliosus*		*S*	X				
Sago pondweed	*Stuckenia pectinata*		*S*	X	X		X	
Small bladderwort	*Utricularia minor*		*S*					X
Southern pondweed	*Najas guadalupensis*		*S*			X		
Water stargrass, Mud plantain	*Heteranthera dubia*		*S*	*X*	X	X		
White-stemmed pondweed	*Potamogeton praelongus*		*S*		X			X
White water buttercup	*Ranunculus aquatilis*		*S*		X			
Wild celery	*Vallisneria americana*		*S*					X
Columbian watermeal	*Wolffia columbiana*		*FF*	X	X			
Greater duckweed	*Spirodela polyrrhiza*		*FF*	X	X	X		
Liver moss	*Riccia fluitans*		*FF*					X
Spotted watermeal	*Wolffia borealis*		*FF*	X	X			
Star duckweed	*Lemna trisulca*		*FF*		X	X		
Turion duckweed	*Lemna turionifera*		*FF*	X	X			

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XII. Appendix C. Carlos Avery WMA Bird Species

Table 24: Common breeding and likely breeding bird species found at Carlos Avery WMA and their associated habitats, in taxonomic order.

Habitat	Game Species	Nongame Species
Lakes, Wetlands, and Waterways	Canada Goose, Wood Duck, Mallard, Blue-winged Teal, Redhead, Ring-necked Duck, Hooded Merganser, Common Merganser[1], Ruddy Duck, American Coot, Sandhill Crane, Virginia Rail[1], Sora, Wilson's (Common) Snipe, American Woodcock[1]	Common Loon[1], Trumpeter Swan[1,2], Pied-billed Grebe, Bald Eagle, Osprey, Spotted Sandpiper, Black Tern[1], American Bittern,[1] Green Heron, Belted Kingfisher[1], Eastern Kingbird, Alder Flycatcher, Purple Martin[1,2], Tree Swallow, Northern Rough-winged Swallow[1], Bank Swallow, Sedge Wren[1], Marsh Wren, Gray Catbird, Common Yellowthroat, , Swamp Sparrow, Song Sparrow, LeConte's Sparrow[1], Yellow-headed Blackbird[1], Red-winged Blackbird
Forests (Coniferous, Deciduous and Mixed)	Wild Turkey, Ruffed Grouse, American Woodcock[1]	Barred Owl, Great Horned Owl, Saw-whet Owl, Turkey Vulture, Cooper's Hawk, Broad-winged Hawk, Red-shouldered Hawk[1,2], Red-tailed Hawk, Bald Eagle, Eastern Whip-poor-will[1], Chimney Swift,[1] Ruby-throated Hummingbird, Black-billed Cuckoo[1], Yellow-billed Cuckoo[1], Red-bellied Woodpecker, Yellow-bellied Sapsucker, Downy Woodpecker, Hairy Woodpecker, Northern Flicker, Pileated Woodpecker, Red-headed Woodpecker[1], Eastern Wood-Pewee, Great Crested Flycatcher, Least Flycatcher, Yellow-throated Vireo, Warbling Vireo, Red-eye Vireo, Blue Jay, Black-capped Chickadee, White-breasted Nuthatch, Red-breasted Nuthatch, House Wren, Blue-gray Gnatcatcher, American Robin, Veery[1], Wood Thrush[1], Ruby-crowned Kinglet, Golden-crowned Kinglet, Brown Thrasher[1], Gray Catbird, Cedar Waxwing, Ovenbird, Golden-winged Warbler[1], American Redstart, Yellow Warbler, Chestnut-sided Warbler, Black-and-white Warbler, Scarlet Tanager, Northern Cardinal, Rose-breasted Grosbeak, Indigo Bunting, Baltimore Oriole, Purple Finch[1]
Brushlands	Ruffed Grouse, American Woodcock[1]	Alder Flycatcher, Willow Flycatcher, Sedge Wren[1], Veery[1], Gray Catbird, Brown Thrasher[1], Northern Waterthrush, Common Yellowthroat, Yellow Warbler, Song Sparrow, Swamp Sparrow, Golden-winged Warbler

Habitat	Game Species	Nongame Species
Prairies, Grasslands, Savannas	Ring-necked pheasant	American Kestrel[1], Northern Harrier[1], Common Nighthawk[1], Red-headed Woodpecker[1], Eastern Kingbird, Horned Lark, Bank Swallow, Barn Swallow, Loggerhead Shrike[4], Eastern Bluebird, Chipping Sparrow, Field Sparrow[1], Savannah Sparrow, Song Sparrow, Vesper Sparrow, Eastern Towhee[1], Lark Sparrow[1], Grasshopper Sparrow[1], Dickcissel[1], Brown-headed Cowbird, Bobolink[1], Eastern Meadowlark[1], Western Meadowlark[1], Brewer's Blackbird
Agricultural Areas	Canada Goose, Mallard, Ring-necked Pheasant, Wild Turkey, Sandhill Crane, Mourning Dove	Killdeer, Red-tailed Hawk, American Kestrel[1], Eastern Phoebe, Cliff Swallow, Barn Swallow, Tree Swallow, Horned Lark, American Crow, House Wren, American Robin, Eastern Bluebird, Vesper Sparrow, Song Sparrow, Chipping Sparrow, Yellow Warbler, American Goldfinch, House Finch, Common Grackle, Brown-headed Cowbird, Red-winged Blackbird, Vesper Sparrow,

1   [1]SGCN

2   [2]Minnesota Special Concern species

3   [3]Endangered

4   [4]Threatened

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Table 25: Stewardship Species in Minnesota and relationship to Carlos Avery WMA. Stewardship species are those species for which populations in Minnesota represent a significant portion of their North American breeding, migrating, or wintering population, or species whose Minnesota populations are stable, but whose populations outside of Minnesota have declined or are declining in a substantial part of their range.

Species	% Global Population	% of Range in Minnesota	Occurrence in WMA	Habitat
American White Pelican	18	In combo with North Dakota – 40% of global population	Migrant	Uses wetlands during migration
American Woodcock	10	6% of its breeding range	Breeding	Young forests
Baltimore Oriole	5	8% of its breeding range	Breeding	Forest edges, open woodlands
Black-billed Cuckoo	10	10% of its breeding range	Breeding	Forest edges and thickets
Bobolink	13	9% of its breeding range	Possibly Breeding	Open grassland/prairie
Chestnut-sided Warbler	6	6% of its breeding range, and highest U.S. abundance	Breeding	Young forests
Golden-winged Warbler	42	12% of its breeding range	Breeding	Shrub wetlands, and young and old forests in close proximity
Nashville Warbler	5	5% of its breeding range, and highest U.S. abundance	Migrant	Middle-aged forests (15-40 years old)
Rose-breasted Grosbeak	6	10% of its breeding range	Breeding	Mesic upland forests 20-40 years old
Sedge Wren	33	14% of its breeding range, and highest U.S. abundance	Breeding	moist grasslands with shrubby component /wet meadows
Trumpeter Swan	12	Largest population south of Alaska/Canada	Breeding	Marshes and shallow lakes

Veery	6	5% of its breeding range, and highest U.S. abundance	Breeding	Damp deciduous forests/riparian forests

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1   Table 26: Priority forest bird species for the Carlos Avery WMA, their habitat requirements, and characteristics.

Species	Minimum area required	Habitat	Forest Age	Forest Structure	Cavity Trees	Other
Red-shouldered Hawk	250-770 acres	Deciduous forest	Mature	Closed canopy with vernal pools or embedded wetlands	Not needed	Forage on amphibians
Barred Owl	215-915 acres	Deciduous (especially oak) or mixed upland forest	Mature	Large diameter trees or snags (>20 inches dbh) with natural cavities	Natural cavities	
Long-eared Owl	Unknown in winter	Conifers are important in winter		Dense conifers with branches near the ground may be used as a communal roost by wintering owls year after year	Will use	Winter visitor and migrant
Eastern Screech-Owl	10-70 acres	Deciduous forests and woodlots	Mature	Open deciduous forests/woodlots with edges, near wetlands	Any suitable cavity	Habitat and food generalist
Ruffed Grouse	A few acres (each)	Diverse old and young deciduous and coniferous forests	Young and old in close proximity	Dense young aspen for broods, old aspen for winter food, open mature deciduous for nesting, conifers for winter cover	Not needed	
Pileated Woodpecker	320 acres	Mixed upland coniferous and deciduous forest	Mature	Several large diameter aspen (>16 inches dbh)	Create nests and roost cavities	Provide cavities for other game species and furbearers
Red-headed Woodpecker	20 acres	Savannahs and open canopy	Mature	Medium-diameter hardwoods and aspens; semi-open,	Create nest cavities	

		deciduous forest, floodplains and flooded forests		savannah-like habitats preferred		

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XIII. Appendix D. Carlos Avery WMA Mammal Species

Table 27: Mammal species known or suspected to occur at Carlos Avery WMA.

Common Name	Scientific Name	Habitat[1]	Game Species[2]	State Status[3]	Federal Status[3]
Virginia Opossum	*Didelphis virginiana*	F,W,A			
Eastern Cottontail	*Sylvilagus floridanus*	F,B	X		
Snowshoe Hare	*Lepus americanus*	F,B; extirpated from WMA	X		
Masked Shrew	*Sorex cinereus*	F,B,W,P			
Water Shrew	*Sorex palustris*	W			
Arctic Shrew	*Sorex arcticus*	W,P			
Pygmy Shrew	*Sorex hoyi*	F,B,W,P,A			
Short-tailed Shrew	*Blarina brevicauda*	B,W,P,A			
Eastern Mole	*Scalopus aquaticus*	Dry soils			
Star-nosed Mole	*Condylura cristata*	Moist soils			
Big Brown Bat	*Eptesicus fuscus*	F,B,W,P,A		SPC	
Red Bat	*Lasiurus borealis*	F,B		SGCN	
Hoary Bat	*Lasiurus cinereus*	F		SGCN	
Silver-haired Bat	*Lasionycteris noctivagans*	F,P		SGCN	
Little Brown Myotis	*Myotis lucifugus*	F,B,W		SPC	
Northern Long-eared Bat	*Myotis septentrionalis*	F,B,W		SPC	END
Tri-colored Bat	*Perimyotis subflavus*	F,B,W		SPC	Candidate
Gray Wolf	*Canis lupus*	F,B,W,P,A			THR
Coyote	*Canis latrans*	F,B,P,A	X		

Common Name	Scientific Name	Habitat[1]	Game Species[2]	State Status[3]	Federal Status[3]
Red Fox	*Vulpes vulpes*	F,B.P	X		
Gray Fox	*Urocyon cinereoargenteus*	F, B, P, A	X		
Bobcat	*Lynx rufus*	F,B	X		
American Badger	*Taxidea taxus*	P,A		SGCN	
Fisher	*Pekania pennanti*	F	X		
Striped Skunk	*Mephitis mephitis*	F,B,P,A			
Eastern Spotted Skunk	*Spilogale putorius*	Extirpated		THR	
Northern River Otter	*Lontra canadensis*	W	X		
Least Weasel	*Mustela nivalis*	W,P		SPC	
Ermine (Short-tailed Weasel)[4]	*Mustela erminea*	F,B,P	X		
Long-tailed Weasel	*Mustela frenata*	F,B,W,P,A	x		
Mink	*Neovison vison*	W	X		
Raccoon	*Procyon lotor*	F,B,P,A	X		
Black Bear[5]	*Ursus americana*	F,B	X		
White-tailed Deer	*Odocoileus virginianus*	F,B,P,A	X		
Beaver	*Castor canadensis*	W	X		
House Mouse	*Mus musculus*	F,B,P,A			
Woodland Jumping Mouse	*Napaeozapus insignis*	F			
White-footed Mouse	*Peromyscus leucopus*	F,B,A			
Deer Mouse	*Peromyscus maniculatus*	F,B,P,A			

Common Name	Scientific Name	Habitat[1]	Game Species[2]	State Status[3]	Federal Status[3]
Western Harvest Mouse[4]	*Reithrodontomys megalotis*	P		SPC	
Meadow Jumping Mouse	*Zapus hudsonius*	B,W,P			
Meadow Vole	*Microtus pennsylvanicus*	B,P			
Woodland Vole	*Microtus pinetorum*	F		SPC	
Red-backed Vole	*Clethronimys*	F,B,P			
Common Muskrat	*Ondatra zebethicus*	W	X		
Plains Pocket Gopher	*Geomys bursarius*	P,A			
Plains Pocket Mouse	*Perognathus flavescens*	P		SPC	
Southern Bog Lemming	*Synaptomys cooperi*	F,B,W,P			
Northern Flying Squirrel	*Glaucomys sabrinus*	F			
Southern Flying Squirrel[4]	*Glaucomys volans*	F			
Thirteen-lined Ground Squirrel	*Ictidomys tridecemlineatus*	P			
Woodchuck	*Marmota monax*	B,P,A			
Fox Squirrel	*Sciurus niger*	F	X		
Eastern Gray Squirrel	*Sciurus carolinensis*	F	X		
Eastern Chipmunk	*Tamias striatus*	F			
Red Squirrel	*Tamiasciurus hudsonicus*	F			

1   [1]Habitat Key: F=Forest, B=Brushlands, W=Wetlands, P=Prairies/Grasslands, A=Agricultural Lands

1   [2]Game species, may be taken only under DNR regulations
2   [3]END=endangered, THR=threatened, SPC=special concern, SGCN=Species of Greatest Conservation Need (all of
3   Minnesota's endangered, threatened, and special concern species are SGCN, those listed as SGCN in the table
4   are species not on the Minnesota's endangered, threatened, and special concern list)
5   [4]Possible occurrence
6   [5]Occasional
7

XIV. Appendix E. Carlos Avery WMA Fish and Mussel Species

2 Table 28: Fish species sampled electrofishing at three locations on the Sunrise River. The number of fish sampled is
3 indicated. Data was collected in 1998, 2003, and 2008 at mile 14.8, 21.1, and 27.8 upstream from the mouth. Data was
4 provided by the Minnesota Department of Natural Resources, Hinckley Area Fisheries. The North Sunrise Pool dam is at
5 mile 21.4, while the South Sunrise Pool dam is at mile 28.4. Stations 5 and 6 are just downstream of these two dams, while
6 Station 4 is near the northeastern WMA boundary.

Common Name	Scientific Name	Family	Station 4 (Mile 14.8)	Station 5 (Mile 21.1)	Station 6 (Mile 27.8)	Total
Bigmouth Shiner	*Notropis dorsalis*	Cyprinidae	15	0	0	15
Black Bullhead	*Ameiurus melas*	Ictaluridae	1	181	85	267
Black Crappie	*Pomoxis nigromaculatus*	Centrarchidae	8	34	53	95
Blacknose Shiner	*Notropis heterolepis*	Cyprinidae	5	11	0	16
Blackside Darter	*Percina maculata*	Percidae	1	0	0	1
Bluegill	*Lepomis macrochirus*	Centrarchidae	13	114	190	317
Bluntnose Minnow	*Pimephales notatus*	Cyprinidae	160	13	0	173
Bowfin	*Amia calva*	Amiidae	0	6	11	17
Brown Bullhead	*Ameiurus nebulosus*	Ictaluridae	0	8	6	14
Central Mudminnow	*Umbra limi*	Umbridae	19	20	7	46
Common Carp	*Cyprinus carpio*	Cyprinidae	0	1	68	69
Common Shiner	*Luxilus cornutus*	Cyprinidae	2	0	1	3
Fathead Minnow	*Pimephales promelas*	Cyprinidae	18	89	0	107
Golden Redhorse	*Moxostoma erythrurum*	Catostomidae	2	6	0	8
Golden Shiner	*Notemigonus crysoleucas*	Cyprinidae	1	158	60	219
Green Sunfish	*Lepomis cyanellus*	Centrarchidae	8	92	297	397
Hornyhead Chub	*Nocomis biguttatus*	Cyprinidae	9	15	0	24
Hybrid Sunfish	*Lepomis hybrid*	Centrarchidae	30	133	600	763
Johnny Darter	*Etheostoma nigrum*	Percidae	39	5	34	78

Common Name	Scientific Name	Family	Station 4 (Mile 14.8)	Station 5 (Mile 21.1)	Station 6 (Mile 27.8)	Total
Largemouth Bass	*Micropterus salmoides*	Centrarchidae	4	27	101	132
Mimic Shiner	*Notropis volucellus*	Cyprinidae	0	2	0	2
Northern Hogsucker	*Hypentelium nigricans*	Catostomidae	6	0	0	6
Northern Pike	*Esox lucius*	Esocidae	14	29	43	86
Pumpkinseed	*Lepomis gibbosus*	Centrarchidae	20	54	225	299
River Redhorse	*Moxostoma carinatum*	Catostomidae	1	0	0	1
Rock Bass	*Ambloplites rupestris*	Centrarchidae	1	1	0	2
Shorthead Redhorse	*Moxostoma macrolepidotum*	Catostomidae	14	0	0	14
Silver Redhorse	*Moxostoma anisurum*	Catostomidae	3	20	0	23
Slenderhead Darter	*Percina phoxocephala*	Percidae	1	0	0	1
Smallmouth Bass	*Micropterus dolomieu*	Centrarchidae	11	0	0	11
Spotfin Shiner	*Cyprinella spiloptera*	Cyprinidae	67	59	7	133
Tadpole Madtom	*Noturus gyrinus*	Ictaluridae	2	5	8	15
Walleye	*Sander vitreus*	Percidae	2	1	1	4
White Sucker	*Catostomus commersonii*	Catostomidae	22	38	8	68
Yellow Bullhead	*Ameiurus natalis*	Ictaluridae	5	61	108	174
Yellow Perch	*Perca flavescens*	Percidae	2	12	92	106

1
2

Table 29: Mussel species sampled on the Sunrise River upstream and downstream of the Kost Dam. Sampling was completed at mile 21.4. The number of mussels sampled is indicated. Data was collected in 2010, 2011, 2012, 2014, 2022, and 2023. Data was provided by the Minnesota Department of Natural Resources, Division of Ecological and Water Resources, Center for Aquatic Mollusk Programs, Lake City, MN. The host fish family is indicated. Generalist is indicated for mussel species that utilize numerous host fish families.

Common Name	Scientific Name	Sunrise River Upstream of Kost Dam	Sunrise River downstream of Kost Dam	Host Fish Family
Black Sandshell	*^Ligumia recta*	0	102	Percidae
Creeper	*Strophitus undulatus*	15	7	generalist
Cylindrical Papershell	*Anodontoides ferussacianus*	0	8	generalist
Deertoe	*Truncilla truncata*	0	43	Sciaenidae
Elk Toe	**Alasmidonta marginata*	0	19	Catostomidae
Fat Mucket	*Lampsilis siliquoidea*	262	220	Centrarchidae, Percidae
Fluted shell	**Lasmigona costata*	5	199	generalist
Fragile Papershell	*Potamilus fragilis*	0	55	Sciaenidae
Giant Floater	*Pyganodon grandis*	9	0	generalist
Mucket	**Actinonaias ligamentina*	1	3,417	Centrarchidae, Percidae
Pimpleback	*Cyclonaias pustulosa*	0	4	Ictaluridae
Pink Heelsplitter	*Potamilus alatus*	0	112	Sciaenidae
Pocketbook	*Lampsilis cardium*	2	290	Centrarchidae, Percidae
Purple Wartyback	**Cyclonaias tuberculata*	0	3	Ictaluridae
Round Pigtoe	*^Pleurobema sintoxia*	9	24	Cyprinidae
Spike	**Eurynia dilatata*	0	120	Centrarchidae, Percidae
Three Ridge	*Amblema plicata*	851	600	generalist
Wabash Pigtoe	*Fusconaia flava*	16	10	Cyprinidae

* Threatened, ^ Special Concern

Table 30: Aquatic invertebrate species sampled on Carlos Avery WMA. Aquatic invertebrate species were sampled at four locations on the Sunrise River (06SC009 (A), 09SC006 (B), 96SC024 (C), 09SC024 (D)), one location on the West Branch of the Sunrise River (09SC005 (E)), and one tributary to the North Sunrise Pool (04SC011 (F)) by the MPCA. Surveys were conducted in 1996, 2004, 2006, 2009, 2011, 2019, and 2020. The number of aquatic invertebrates sampled by site, date, and species is indicated.

Species Found			Number of Species Found by Location and Year									
Order	Family	Genus and Species	A	B	B	B	C	C	D	E	E	F
			06	09	19	20	96	06	11	09	19	04
ARTHROPODA	Hydrachinidiae	*Acari (water mites)*	5	1		1			1		8	
CRUSTACEA	Gammaridae	*Gammarus*				80	2	1	41	1		50
	Hyalellidae	*Hyalella*	32	372	68			66		110	30	2
		Hyalella azteca					184					
	Cambaridae	*Faxonius virilis*					1					
MOLLUSCA	Ancylidae	*Ferrissia*				12			9			
	Lymnaeidae	*Lymnaea*						1				
		Lymnaeidae		2	2	1						
		Pseudosuccinea columella			2							2
		Stagnicola						2				1
	Physidae	*Physella*	1	8	6	54	5	25	3	7	11	3
	Planorbidae	*Gyraulus*			3	14					9	
		Planorbidae		1	1			1	7			
	Hydrobiidae	*Hydrobiidae*									3	
	Unknown snail						11					
	Pisidiidae	*Pisidiidae*			7			8	1	36		49
	Unk bivalve						8					
COLEOPTERA	Dytiscidae	*Dytiscidae*		1								1
		Laccophilus								1		
		Liodessus			1				1			2
	Elmidae	*Dubiraphia*	1	1				3	2	2	5	4
		Macronychus		1				1				
		Macronychus glabratus			1	1			1		2	

| Species Found			Number of Species Found by Location and Year									
Order	Family	Genus and Species	A	B	B	B	C	C	D	E	E	F
			06	09	19	20	96	06	11	09	19	04
		Optioservus										1
	Gyrinidae	Dineutus									1	
		Gyrinus						1				1
	Hydraenidae	Hydraenidae										1
	Haliplidae	Haliplus	1	2				4				
		Peltodytes					1					
	Hydrophilidae	Anacaena								1		
		Helophorus										1
		Paracymus								2		
		Tropisternus										1
	Scirtidae	Scirtidae								1		
DIPTERA	Ceratopogonidae	Bezzia/Palpomyia	1				2					
		Ceratopogoninae						2				
		Culicoides					2					
		Dasyhelea		2								
		Probezzia										1
		Sphaeromias										1
	Chironomidae	Chironomini	2				2		1			5
		Cryptochironomus	1									1
		Cryptotendipes	2									
		Dicrotendipes	1				1		2			
		Endochironomus							42			
		Glyptotendipes									2	
		Microtendipes				8			15		7	1
		Parachironomus	2									
		Paralauterborniella nigrohalterale			1			2				
		Paratendipes									8	

Species Found			Number of Species Found by Location and Year									
Order	**Family**	**Genus and Species**	A	B	B	B	C	C	D	E	E	F
			06	09	19	20	96	06	11	09	19	04
		Phaenopsectra			3	2		2	1		5	
		Polypedilum	39	3	26	36	2	47	18	1	22	9
		Tribelos						1				
		Brillia										17
		Corynoneura	4	2				19	4			24
		Cricotopus	2	1	1		1		3		1	
		Nanocladius	4			5	3	1		1	3	
		Limnophyes										5
		Orthocladiinae	1		1							7
		Parametriocnemus		2								
		Psectrocladius	2	4								
		Rheocricotopus				1						
		Thienemanniella	2		4	10			8		2	
		Prodiamesa										3
		Pseudochironomus	3	11								
		Ablabesmyia	4	2				8		5	4	
		Clinotanypus		2			3		1			
		Labrundinia	5	5	1	3		2		4		
		Paramerina		5				2	1			
		Pentaneura	23	26	8	7	1	27	1	11	43	
		Procladius								8		
		Tanypodinae	7			1	1	6			2	3
		Thienemannimyia Gr.	3	9	5	5		6	6	6	5	12
		Cladotanytarsus			1							
		Micropsectra			2		1			2		
		Paratanytarsus				2			3			

Species Found			Number of Species Found by Location and Year									
Order	Family	Genus and Species	A	B	B	B	C	C	D	E	E	F
			06	09	19	20	96	06	11	09	19	04
		Rheotanytarsus	3	7	3	101	1	17	57		1	
		Stempellinella	1									
		Tanytarsini	13					15	3		2	7
		Tanytarsus	43	16	2	13		190			9	
	Culicidae	*Anopheles*				1		3			1	
		Culicidae							1	1		
	Dixidae	*Dixa*										2
		Dixella								1		5
	Empididae	*Empididae*	1			1						1
		Hemerodromia	4			13			5			1
	Ephydridae	*Ephydridae*						1	1			
	Simuliidae	*Simuliidae*								4		
		Simulium	8		27	151			1	46	24	2
	Stratiomyidae	*Odontomyia*	1					1				
		Stratiomyidae						1				
EPHEMEROPTERA	Baetidae	*Acentrella parvula*									1	
		Acerpenna	21	45	27	4		17	1	28	28	
		Acerpenna pygmaea			9							
		Anafroptilum	1									
		Baetidae		3								
		Baetis brunneicolor									1	
		Callibaetis								1		
		Iswaeon			26	2					3	
		Labiobaetis frondalis									1	

Species Found			Number of Species Found by Location and Year									
Order	Family	Genus and Species	A	B	B	B	C	C	D	E	E	F
			06	09	19	20	96	06	11	09	19	04
		Labiobaetis propinquus			1	1					11	
		Plauditus	24									
		Pseudocloeon	7	6				4		25		
	Caenidae	*Caenis*	1	29			4	34	2	4		
		Caenis diminuta			3	3						
		Caenis hilaris									3	
		Caenis youngi							1			
	Heptageniidae	*Heptagenia*		2								
		Heptageniidae	2					2	1	1	5	
		Maccaffertium								4	2	
		Stenacron		2	22	3		1			2	
		Stenonema femoratum	1									
	Leptohyphidae	*Leptohyphes*										43
	Unknown						2					
HEMIPTERA	Belostomatidae	*Belostoma*		1								1
		Belostoma flumineum			4	1			2		1	
	Corixidae	*Corixidae*		2	1					2		
		Hesperocorixa										4
		Sigara								2		
		Trichocorixa									1	
	Mesoveliidae	*Mesovelia*		2	1						1	
	Nepidae	*Ranatra*							2	1		
	Notonectidae	*Notonecta*									1	
	Pleidae	*Neoplea*	1	28				16		1		5
		Neoplea striola					19		7			
	Veliidae	*Microvelia*									1	

Species Found			Number of Species Found by Location and Year									
Order	Family	Genus and Species	A	B	B	B	C	C	D	E	E	F
			06	09	19	20	96	06	11	09	19	04
HIRUDINEA	Unknown								1		6	1
LEPIDOPTERA	Crambidae	*Crambidae*			1	2			12		1	
	Pyralidae	*Paraponyx*						1				
		Parapoynx			2	5			6			
		Petrophila					1	1				
	Unknown						2					
MEGALOP-TERA	Corydalidae	*Nigronia*									1	
	Sialidae	*Sialis*										1
ODONATA	Aeshnidae	*Aeshna*		2								2
		Aeshnidae		1				1				
		Anax		1								
		Basiaeschna janata		1								
	Calopterygidae	*Calopteryx*		5						1		2
		Calopteryx aequabilis			11	5			1			
	Coenagrionidae	*Argia*	1					1				
		Coenagrionidae	7	14	18	14		79	15		24	
		Enallagma					25	17	25			
	Gomphidae	*Gomphidae*							1			
	Libellulidae	*Libellulidae*		1				1				
OLIGOCHAETA			1		1			5	3		1	9
TRICHOPTERA	Hydropsychidae	*Ceratopsyche*								1		
		Cheumatopsyche	4		8	7	4		2		4	
		Hydropsyche	2			2			3	2		1
		Hydropsyche betteni				8						
		Hydropsyche simulans				1			2		1	

Species Found			Number of Species Found by Location and Year									
Order	Family	Genus and Species	A	B	B	B	C	C	D	E	E	F
			06	09	19	20	96	06	11	09	19	04
		Hydropsychidae				9	3					
	Hydroptilidae	*Hydroptila*	5	1	6	1						
		Hydroptilidae						1				
		Oxyethira	1									
	Lepidostomatidae	*Lepidostoma*										2
	Leptoceridae	*Leptoceridae*		12				12				
		Leptocerus	1									
		Nectopsyche	6									
		Oecetis					6	1				
		Oecetis persimilis							2			
		Oecetis testacea			11	19					10	
		Triaenodes				7	5					
	Limnephilidae	*Limnephilidae*										1
		Limnephilus										3
	Phryganeidae	*Phryganeidae*		1						1	1	
		Ptilostomis				1						2
	Polycentropo-didae	*Neureclipsis*			3	1						
		Polycentropodidae				1						
	Unknown				1	1						
TURBELLARIA		*Trepaxonemata*			2						4	
	Unknown		6									
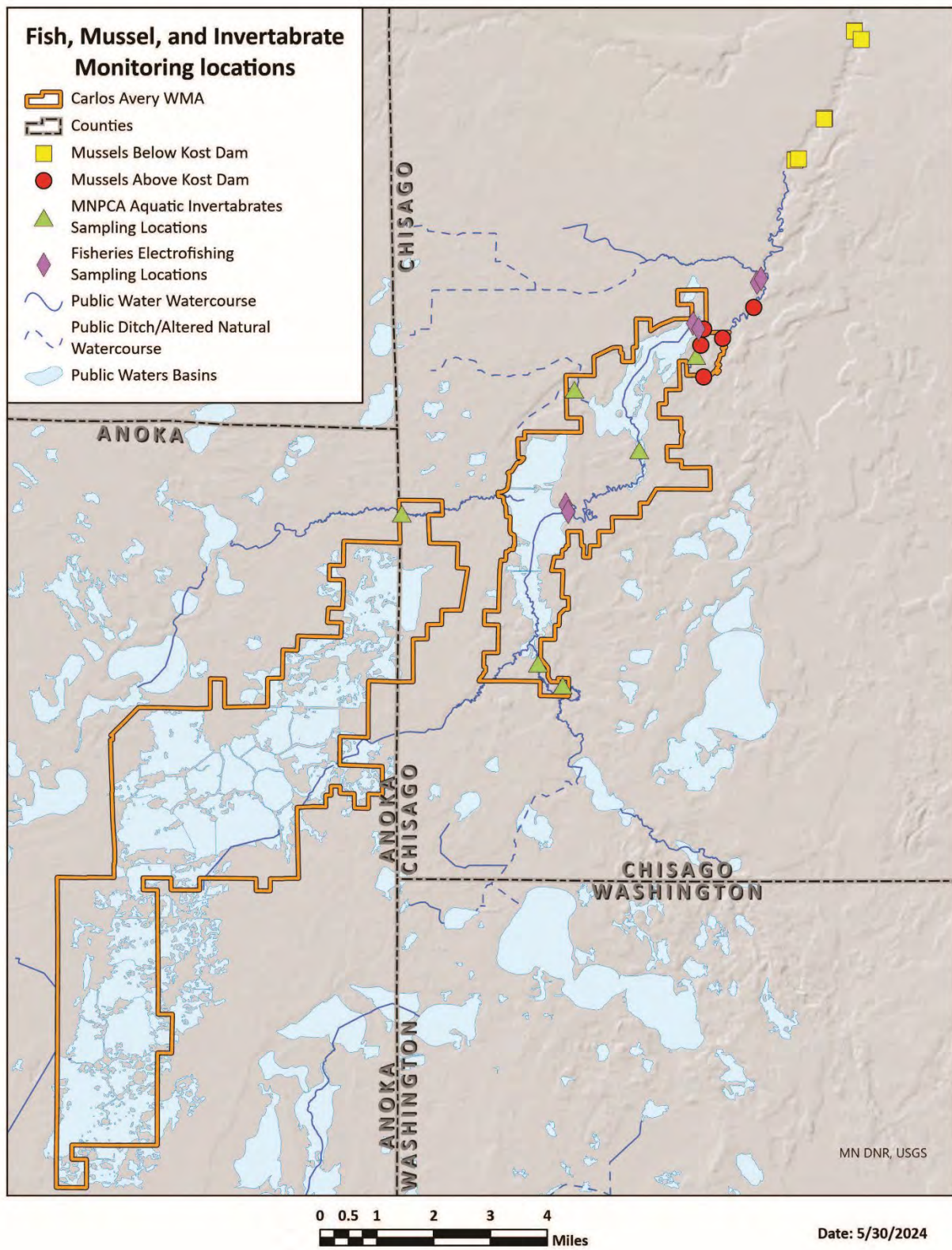
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2   Figure 28: Fish, mussel, and invertebrate monitoring locations on the Carlos Avery WMA.

XV.   Appendix F. Carlos Avery WMA Reptile and Amphibian Species

Table 31: Reptiles and amphibians known to occur in Carlos Avery WMA. This table does not include listed species so as to protect local populations from potential harm.

Taxa	Common Name	Scientific Name
Amphibian	Eastern Tiger Salamander	*Ambystoma tigrinum*
Amphibian	Blue-spotted Salamander	*Ambystoma laterale*
Amphibian	American Toad	*Anaxyrus americanus*
Amphibian	Cope's Gray Tree Frog	*Hyla chrysoscelis*
Amphibian	Gray Tree Frog	*Hyla versicolor*
Amphibian	Green Frog	*Lithobates clamitans*
Amphibian	Mink Frog	*Lithobates septentrionalis*
Amphibian	Spring Peeper	*Pseudacris crucifer*
Amphibian	Boreal Chorus Frog	*Pseudacris maculata*
Amphibian	Northern Leopard Frog	*Lithobates pipiens*
Amphibian	Wood Frog	*Lithobates sylvaticus*
Reptile	Snapping Turtle	*Chelydra serpentina*
Reptile	Painted Turtle	*Chrysemys picta*
Reptile	Spiny Softshell Turtle	*Apaloe spinifera*
Reptile	Red-bellied Snake	*Storeria occipitomaculata*
Reptile	Common Garter Snake	*Thamnophis sirtalis*
Reptile	Plains Garter Snake	*Thamnophis radix*

Taxa	Common Name	Scientific Name
Reptile	Eastern Hognose Snake	*Heterodon platirhinos*
Reptile	Fox Snake	*Elaphe vulpina*
Reptile	Prairie Skink	*Eumeces septentrionalis*

1

1 XVI. Appendix G. Invasive plants

2 Table 32: Invasive plant species in Carlos Avery WMA.

Common Name	Scientific Name	Species of potential concern
Velvetleaf	*Abutilon theophrasti*	
Amur maple	*Acer ginnala*	x
Common yarrow	*Achillea millefolium*	
Garlic mustard	*Alliaria petiolata*	x
Common burdock	*Arctium minus*	
Asparagus	*Asparagus officinalis*	
Yellow rocket	*Barbarea vulgaris*	
Japanese barberry	*Berberis thunbergii*	x
Hoary alyssum	*Berteroa incana*	
Smooth brome	*Bromus inermis*	
Narrowleaf bittercress	*Cardamine impatiens*	x
Round leaf bittersweet	*Celastrus orbiculatus*	x
Spotted knapweed	*Centaurea stoebe*	x
Lambsquarters	*Chenopodium album*	
Canada thistle	*Cirsium arvense*	x
Bull thistle	*Cirsium vulgare*	
Narrowleaf hawksbeard	*Crepis tectorum*	
Orchardgrass	*Dactylis glomerata*	
Quackgrass	*Elymus repens*	
Winged burning bush	*Euonymus alatus*	x

Common Name	Scientific Name	Species of potential concern
Leafy spurge	*Euphorbia virgata*	x
Low baby's-breath	*Euphorbia virgata*	x
Wild buckwheat	*Fallopia convolvulus*	x
Janpanese knotweed	*Fallopia japonica*	x
Glossy buckthorn	*Frangula alnus*	x
Creeping Charlie	*Glechoma hederacea*	x
Venice mallow	*Hibiscus trionum*	
Orange hawkweed	*Hieracium aurantiacum*	
Motherwort	*Leonurus cardiaca*	
Oxeye daisy	*Leucanthemum vulgare*	
Yellow toadflax	*Linaria vulgaris*	x
Exotic honeysuckles	*Lonicera spp.*	x
Birdsfoot trefoil	*Lotus corniculatus*	x
Pineapple-weed	*Matricaria discoidea*	
Black medic	*Medicago lupulina*	
White sweetclover	*Melilotus alba*	x
Yellow sweet-clover	*Melilotus officinalis*	x
White mulberry	*Morus alba*	x
Wild parsnip	*Pastinaca sativa*	x
Marsh-pepper smartweed smartweed	*Persicaria hydropiper*	?
Timothy	*Phleum pratense*	
Ground ivy	*Pilea nummulariifolia*	

Common Name	Scientific Name	Species of potential concern
Buckthorn plantain	*Plantago lanceolata*	
Broadleaf plantain	*Plantago major*	
Canada bluegrass	*Poa compressa*	x
Kentucky bluegrass	*Poa pratensis*	
Silvery cinquefoil	*Potentilla argentea*	
Sulfur cinquefoil	*Potentilla recta*	
Common buckthorn	*Rhamnus cathartica*	x
Black locust	*Robinia pseudoacacia*	x
Multiflora rose	*Rosa multiflora*	x
Red sorrel	*Rumex acetosella*	
Curly dock	*Rumex crispus*	
Bouncingbet	*Saponaria officinalis*	
Squil	*Scilla siberica*	x
Purple crown-vetch	*Securigera varia*	x
White campion	*Silene latifolia*	
Bittersweet nightshade	*Solanum dulcamara*	
Perennial sowthistle	*Sonchus arvensis*	
Sowthistle	*Sonchus spp.*	
Common chickweed	*Stellaria media*	
Common comfrey	*Symphytum officinale*	
Common tansy	*Tanacetum vulgare*	x
Dandelion	*Taraxacum officinale*	

Common Name	Scientific Name	Species of potential concern
Field pennycress	*Thlaspi arvense*	
Japanese hedge-parsley	*Torilis japonica*	
Western salsify	*Tragopogon dubius*	
Rabbitfoot clover	*Trifolium arvense*	
Large hop clover	*Trifolium campestre*	
Alsike clover	*Trifolium hybridum*	
Red clover	*Trifolium pratense*	
White clover	*Trifolium repens*	
Siberian elm	*Ulmus pumila*	x
Common mullein	*Verbascum thapsus*	
Corn speedwell	*Veronica arvensis*	
Thymeleaf speedwell	*Veronica serpyllifolia*	
Cow vetch	*Vicia cracca*	
Hairy vetch	*Vicia villosa*	

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XVII. Appendix G. Acronyms Used in the Carlos Avery WMA Plan

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Acronym	Definition
CDV	Canine Distemper Virus
CWD	Chronic Wasting Disease
DBH	Diameter at breast height
DPA	Deer Permit Area
DNR	Minnesota Department of Natural Resources
EAB	Emerald Ash Borer
ECS	Ecological Classification System
EHD	Epizootic Hemorrhagic Disease
END	Endangered
EWR	Ecological and Waters Resources Division
FAW	Fish and Wildife Division
FOR	Forestry Division
LCCMR	Legislative-Citizen Commission on Minnesota Resources
LSOHC	Lessard-Sams Outdoor Heritage Council
LTE	Labor Trades & Equipment
MBS	Minnesota Biological Survey
MFRC	Minnesota Forest Resources Council
MNWAP	Minnesota's Wildlife Action Plan
MPCA	Minnesota Pollution Control Agency
NIACS	Northern Institute of Applied Climate Science
NPC	Native Plant Communities

Acronym	Definition
OSD	Operations Services Division
PAT	Parks and Trails Division
SGCN	Species of Greatest Conservation Need
SPC	Species of Special Concern
SSURGO	Soil Survey Geographic Database
THR	Threatened
TSI	Timber Stand Improvement
USFWS	United States Fish and Wildlife Service
WAHMA	Wildlife and Aquatic Habitat Management Application
WMA	Wildlife Management Area
WNS	White Nose Syndrome
WSI	Winter Severity Index

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XVIII.   Appendix H. Stakeholder and Public Engagement Summary

Scoping engagement

Scoping engagement was conducted to better understand how people use the WMA and to identify what topics people would like to see addressed in the Carlos Aver WMA Plan.

An non-randomized, non-representative, online questionnaire was conducted between February 8th and March 15th, 2024 and 360 responses were received. Two public meetings were held, an in-person meeting at Carlos Avery WMA on February 28th (18 participants) and an online meeting on March 6th (5 participants). At these public meetings, DNR staff provided an overview of, and answered questions on, the Carlos Avery WMA and the Carlos Avery WMA Plan process. In addition, meeting participants described why they are interested in the Carlos Avery WMA and what topics they would like to see addressed in the WMA plan. These engagement opportunities were advertised via a press release and targeted emails to key stakeholder groups.

Key findings from the public meetings include:

- Participants expressed an appreciation the public land base available for hunting, fishing, trapping and compatible uses including dog walking, wildlife viewing, and foraging.
- Participants were mixed in their perspectives, with some expressing a desire to keep the WMA focused on hunting, trapping, and fishing and some expressing a desire for more focus to be given to increasing other compatible recreational opportunities.
- Participants expressed a variety of particular concerns or issues they'd like to see addressed in the Carlos Avery WMA plan, including:
    - Better address illegal activities
    - Improve invasive species management
    - Reduce unsafe hunting on Carlos Avery WMA that impacts other WMA users and WMA neighbors
    - Expand accessible use of Carlos Avery WMA
    - Potentially increase road access to facilitate use and potentially decrease road access to protect wildlife
    - Increase pollinator friendly planting
    - Keep this land wild and peaceful in the midst of growth happening around it
- People expressed a desired to have more regular updates from Carlos Avery WMA staff including potential email updates, yearly meetings, or a yearly volunteer event on the WMA.

Scoping Questionnaire Findings

Findings emerging from the voluntary, non-representative online scoping questionnaire completed by 360 people include:

- 77% of the respondents said that they had used the Carlos Avery WMA within the past two years. About 17% of respondents said that they have used the Carlos Avery WMA, but it was

1 more than two years ago. 6% of respondents said that they have never used Carlos Avery
2 WMA.

3 • 41% of respondents have used the Carlos Avery WMA for hunting.

4 • Species (and seasons) that respondents have hunted at Carlos Avery WMA, including how many
5 respondents participated in each:
6 o Deer (archery), 75 respondents
7 o Deer (firearm), 46 respondents
8 o Deer (muzzleloader), 26 respondents
9 o Waterfowl (in Pool 2 controlled hunt area), 40 respondents
10 o Teal (early season), 31 respondents
11 o Other waterfowl hunting, 58 respondents
12 o Turkey (spring hunt), 45 respondents
13 o Turkey (fall hunt), 24 respondents
14 o Grouse, 60 respondents
15 o Pheasant, 53 respondents
16 o Squirrel, 35 respondents
17 o Rabbit, 28 respondents
18 o Woodcock, 28 respondents
19 o Coyote, 19 respondents
20 o Mourning dove, 18 respondents
21 o Fox, 10 respondents
22 o Rail, 6 respondents
23 o Bear, 5 respondents
24 o Raccoon, 5 respondents

25 • 3% of respondents have participated in trapping activities at Carlos Avery WMA.

26 • Species that respondents have trapped at Carlos Avery WMA, including how many respondents
27 have trapped each species:
28 o Beaver, 6 respondents
29 o Muskrat, 6 respondents
30 o Otter, 4 respondents
31 o Mink, 4 respondents
32 o Raccoon, 3 respondents
33 o Coyote, 3 respondents
34 o Fox, 3 respondents
35 o Fisher, 2 respondents
36 o Skunk, 1 respondent
37 o Weasel, 1 respondent

38 • 19% of respondents have participated in fishing activities at Carlos Avery WMA.

- Types of fishing that respondents have participated in, including number of respondents who participate in each type:
    - Summer angling, 61 respondents
    - Winter angling, 14 respondents
    - Bowfishing, 9 respondents
    - Spearing, 6 respondents
- 46% of respondents have participated in foraging activities at Carlos Avery WMA.
- Plants that respondents have foraged at Carlos Avery WMA, including number of respondents who have foraged for each plant:
    - Mushrooms, 68 respondents
    - Berries, 57 respondents
    - Fiddlehead ferns, 26 respondents
    - Ramps, 23 respondents
    - Wild rice, 20 respondents
    - Hazelnuts, 19 respondents
    - Leaks, 18 respondents
    - Chaga, 14 respondents
    - Other, 10 respondents
- Other recreational activities that respondents take part in, including the number of respondents who participated in each:
    - Enjoying solitude/relaxing in the outdoors, 288 respondents
    - Hiking, 274 respondents
    - View or photographing wildlife/nature, 252 respondents
    - Bird watching, 225 respondents
    - Dog walking, 141 respondents
    - Outdoor cultural and/or spiritual activities, 113 respondents
    - Deer shed hunting, 107 respondents
    - Boating/canoeing/kayaking, 96 respondents
    - Skiing/snowshoeing, 81 respondents
    - Naturalist program/citizen science, 75 respondents
    - Biking, 57 respondents
- How respondents judged the overall quality of their visit to Carlos Avery WMA:
    - 37% of respondents described visits as very good
    - 45.4% of respondents as good
    - 14.5% of respondents as fair
    - 1.8% as poor
    - 1.2% as very poor
- How likely respondents said they were to use Carlos Avery WMA in the next year:
    - 73.7% respondents said very likely

1   o   16% likely

- o 16% likely
- o 7% unlikely
- o 3.4% very unlikely
- Most common suggestions from respondents concerning how to improve the quality of visits to the Carlos Avery WMA included:
  - o Better enforcement to address littering, dumping, and other illegal use.
  - o Better maintenance of roads and parking areas.
  - o Improve hunting and trapping opportunities.
  - o Making it easier to participate in recreational uses like wildlife viewing and foraging.
  - o Better signage to clarify what activities can be conducted and where/when.
- Most important things to prioritize for improvement in the update to the Carlos Avery WMA plan, and how many respondents judged each thing as needing major or minor improvement:
  - o Enforcement of illegal activities (e.g., dumping)
    (Needs major improvement – 87 respondents; Needs minor improvement – 119 resp.)
  - o Wetland conservation and management
    (Needs major improvement – 67 respondents; Needs minor improvement – 103 resp.)
  - o Invasive species management
    (Needs major improvement – 66 respondents; Needs minor improvement – 92 resp.)
  - o Forest conservation and management
    (Needs major improvement – 60 respondents; Needs minor improvement – 119 resp.)
  - o Game species abundance
    (Needs major improvement – 54 respondents; Needs minor improvement – 88 resp.)
  - o Prairie conservation and management
    (Needs major improvement – 53 respondents; Needs minor improvement – 103 resp.)
  - o Development and maintenance of parking lots and signage
    (Needs major improvement – 48 respondents; Needs minor improvement – 143 resp.)
  - o Wildlife biodiversity
    (Needs major improvement – 43 respondents; Needs minor improvement – 106 resp.)
  - o Development and maintenance of public roads
    (Needs major improvement – 32 respondents; Needs minor improvement – 117 resp.)
- Key areas of concern and other topics concerning Carlos Avery WMA that respondents would like to see addressed during the update of the Carlos Avery WMA master plan:
  - o Improve signage and information
    - Make it easier for WMA users to understand what activities are allowed and where and how to practice them safely, including compatible recreational activities like foraging, biking, dog walking, and wildlife viewing.
    - Improve maps and trail marking, including where the refuge area are.
  - o Clarify and improve foraging opportunities
    - Clarify where and how foraging can take place on the WMA.
    - Ensure any pesticide use is labeled.

1   ▪   Support native plant communities and species used in foraging.
2   o   Improve invasive species management
3   ▪   Better address buckthorn in the Carlos Avery WMA.
4   o   Increase populations of game species
5   o   Better address enforcement issues
6   ▪   Address ongoing trash and dumping issues.
7   ▪   Enforce existing regulations to make WMA feel less threatening to a non-hunter.

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9   **Draft plan public comment period**

10   *Summary responses to public comments to be added after public comment period*

11