Wetland Program Plan for Nebraska

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OVERALL GOAL AND TIME FRAME

The State of Nebraska plans to continue to implement its wetland program over the next three calendar years (2015-2017) with a goal of continuing to protect, restore, and manage wetlands. The State will use information from the Nebraska Wetland Condition Intensification Study to assess the condition of its wetlands (done in 2011-2013) to improve our understanding of baseline wetland conditions, and to prioritize wetland restoration and protection activities. Nebraska will continue to work in partnership with landowners, agencies, and organizations to restore and protect 9,000 acres of wetlands. The priorities for the restoration and protection will be determined by the Nebraska Game and Parks Commission and the local partners. We will also continue the stewardship and management of wetlands in state ownership. To have effective and efficient wetland restoration, protection, and management, we also emphasize that there is an important and ongoing need for improved information and outreach. The State will achieve our goal through implementing the activities identified in this plan. Note that this will be dependent upon obtaining needed funding and the required legislative and/or administrative approvals.

An earlier draft of this plan was sent out for review to 89 individuals, representing 21 different organizations and agencies, including the Nebraska Department of Environmental Quality, and the Nebraska Department of Natural Resources.

INTRODUCTION

Nebraska's wetland resources are as diverse and dynamic as those of any state in the nation. They include marshes, lakes, reservoirs and ponds, river and stream backwaters, oxbows, wet meadows, playas, basins, fens, forested wetlands, and seep areas. These wetlands vary greatly in nature and appearance due to physical features such as geographic location, water source and permanence, and chemical properties. Some wetlands hold water for only a few weeks or less during the spring while others never go completely dry. Many wetlands receive their water from groundwater aquifers while others are totally dependent on precipitation and runoff. Finally, the water

chemistry of wetlands ranges from fresh to saline, and from acidic to basic. These descriptions identify the extremes of wetland characteristics. Nebraska's wetland resources possess these extremes and virtually every combination in between.

For detailed information about Nebraska's wetlands, please see the *Guide to Nebraska's Wetlands and their Conservation Needs* (LaGrange 2005) or visit the website www.NebraskaWetlands.com.

Wetland Definition

The State of Nebraska has adopted the federal definition that wetlands are "*Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas*" (USACE 1987).

Wetland delineation in Nebraska is currently based on the 1987 Corps of Engineers Wetlands Delineation Manual (USACE 1987) and the regional supplements for the Midwest and the Great Plains. The manual uses three diagnostic environmental characteristics to delineate wetlands. These are:

1) **Vegetation** - Defined by a prevalence of hydric plants adapted to growing in inundated or saturated conditions.
2) **Hydric soils** - The presence of soils that developed under inundated or saturated conditions that limit oxygen (anaerobic conditions).
3) **Hydrology** - Defined by inundation or saturation by water at some time during the growing season.

Statewide Wetland Resources

At the time of statehood in 1867, Nebraska contained an estimated 2,910,000 acres of wetlands covering about 6% of the state (Dahl 1990). Through much of the state's history, wetlands were viewed as an impediment to transportation, agriculture, and development. Wetlands have been impacted directly by filling, ditching, tiling, digging concentration pits, channelization, and declining water tables, and indirectly by changes in the surrounding uplands that caused increased sedimentation or the diversion of surface runoff away from wetlands. Wetlands and water areas were also created in some regions due to the construction of farm and livestock ponds, and locally rising water tables due to irrigation canal and reservoir seepage. However, the net result of all of these activities statewide was a reduction in wetlands by an estimated 35%, to 1,905,000 acres covering only 3.9% of the state (Dahl 1990). The destruction of wetlands was much higher in some regions of the state, however the statewide figure is buffered by the large wetland resource still remaining in the Sandhills. For example, approximately 90% of Rainwater Basin playa wetlands and 90% of the Eastern Saline Wetlands have been highly altered. Temporarily-flooded and seasonally-flooded

wetlands were lost at the highest rate throughout the state, and much of this acreage was not compensated for by the construction of lakes and ponds. Most states surrounding Nebraska have lost a greater percentage of their wetlands (Dahl 1990).

Wetland Classification

Numerous classification systems have been developed for wetlands. The one most commonly used is the Cowardin system (Cowardin et al. 1979). This is a hierarchical system that classifies wetlands according to system, plant community and substrate, water regime, water chemistry, and numerous special modifiers such as the presence of dikes, drainage, and/or excavations. In many cases, portions of the same wetland can be classified differently using the Cowardin system.

Systems - The three Cowardin wetland systems that occur in Nebraska are *palustrine*, *lacustrine*, and *riverine*. Palustrine systems are usually marshes and are dominated by vegetation. Lacustrine systems are lakes, reservoirs, and ponds usually deeper than 6.6 feet. Riverine systems are rivers and streams that flow in a defined channel.

Water Regime - Water regime describes the duration and timing of inundation or saturation in a wetland. In Nebraska, most palustrine wetlands are of the temporarily, seasonally, or semi-permanently flooded water regime. Temporarily flooded wetlands contain water for only brief periods, often only a few weeks during the growing season. Seasonally flooded wetlands have water present for extended periods during the growing season, but they tend to dry up by the end of the season in most years. Semi-permanently flooded wetlands have water in them in most years and only occasionally dry up.

The wetlands of Nebraska have been categorized into 14 different complexes (figure 1) that include playas, sandhill wetlands, saline and alkaline wetlands, and riverine wetlands (LaGrange 2005). The *Guide to Nebraska's Wetlands and their Conservation Needs* (LaGrange 2005) provides a detailed description of each of these complexes.

In addition, Nebraska's wetlands have been classified by hydro-geomorphic (HGM) subclass (Jasmer et al. 1997) and their natural plant communities (Rolfsmeier and Steinauer 2010). Appendix A provides a list of the state's HGM subclasses and their corresponding natural plant communities.

Wetland Functions and Services

Our knowledge of how wetlands function has increased dramatically over the past few decades. Wetlands are now known to serve numerous functions or services, many of which have value to society as a whole. As wetland losses increased, the system that was dependent on these functions began to break down. Put another way, the loss of a small percentage of a region's wetlands probably had little effect, but as losses increased, a threshold was crossed and negative impacts began to occur. Examples include declining wildlife diversity and abundance, increased flooding that has occurred

in some watersheds, and deteriorating water quality that has become a problem in many regions. This is why there is now a recognized need for wetlands conservation in Nebraska.

Wetland Functions include:

- Improving Water Quality
- Providing Habitat for Wildlife, Fish, and Unusual Plants
- Reducing Flooding and Soil Erosion
- Supplying Water, including Groundwater Recharge
- Producing Food and Fiber
- Providing Recreation and Education

It is important to note that not all wetlands serve all the functions listed above. Nor will a given wetland necessarily serve these functions equally within a year or over a series of years.

Threats and Stresses to Wetlands

The primary existing threats and stresses to Nebraska's wetlands are listed below:

1) Conversion to Other Uses - This threat exists especially for temporary and seasonal wetlands that are easier to convert. Agricultural conversion and development for building sites, roads, feedlots, etc. are the primary conversion threats these areas face.
2) Alterations in the Watershed - Often not as obvious as direct impacts within the wetland itself, alterations within the watershed, or catchment area can be equally as damaging by disrupting the natural hydrology of the area. Concentration pits, terraces, diversions, stream channelization, ditches, etc. that either divert water away or stop water from reaching the wetland can have severe negative consequences for the area.
3) Culturally-accelerated Sedimentation - For wetlands located in watersheds dominated by row crops or urban development, culturally-accelerated sedimentation is a serious problem. This sediment alters the natural depths and hydro-periods of wetlands and can also encourage the dominance of invasive plant species.
4) Invasive species – In addition to the woody species mentioned below, there are a number of other species that can be invasive in wetlands. These include reed canary grass, hybrid cattail, common reed, river bulrush, purple loosestrife, and salt cedar. These species can form dense monotypic stands that reduce habitat and wildlife diversity.
5) Woody Invasion - Historically, most of Nebraska's wetlands were part of a prairie ecosystem and did not contain trees or shrubs with the exception being some riverine wetlands. In recent times, tree invasion has become a serious problem in wetlands, especially in the eastern two thirds of Nebraska. When left untreated for

a long period of time, managers will be forced to resort to more expensive tree removal methods to restore the wetland to an herbaceous community.

6) Extended Rest - Long-term rest has been a normal practice on public lands, and has occurred on many private wetlands where the owners do not use the area as a source of forage. Long-term rest from disturbance leads to loss of native plant diversity along with increased abundance of invasion by non-native and aggressive wetland plant species. River bulrush, cattail, and reed canary grass are especially adept at out-competing other vegetation and establishing a monoculture in wetlands lacking management.
7) Fragmentation - Fragmentation of wetlands by crop fields, roads, fences, berms, or other factors increases edge effect. This usually leads to increased and more rapid invasion by non-native and aggressive species, loss of genetic diversity, and degradation of wildlife habitat.
8) Repetitive Management - Conducting the same management action every year at the same time can also lead to a reduction of plant diversity and invasion of non-natives. Using a variety of techniques and applying them at different times of the year will help to increase diversity.
9) Lack of Grazing Management - Poor grazing management (either too little or too much intensity) has impacted many of Nebraska's wetlands leading to loss of native plant diversity and abundance, invasion by non-native species, and uniform vegetative structure. In some wetlands, periodic, intensive heavy grazing can produce positive results for wetlands depending on the goals and objectives. Some wetland complexes in the state, such as the Rainwater Basin and the Southwest Playas provide critical migratory habitat for many species of water birds. The migratory species that use these wetlands benefit from a strategy of heavy grazing since it provides open water, bare shorelines, and early succession vegetation. Periodic intensive heavy grazing should be followed by periods of rest to enable plant regrowth, if that is the desired objective. In other wetlands, a lighter grazing prescription may be needed.

Wetland Dynamics

Nebraska's pre-settlement wetlands were highly adapted to disturbance. They were frequently burned by prairie fires, grazed by both large (e.g., bison and elk) and small herbivores (e.g., muskrats), and endured droughts and flooding. Periodic disturbance is essential to maintain and enhance wetland quality, plant and animal communities, and ecosystem processes. Natural disturbances operate at a variety of scales, intensities, and duration. Climate operates at a large scale, fire and grazing at intermediate scales, and insect herbivory and numerous other factors at small scales. Interaction of disturbances, for example, flooding and grazing, increase the range of patch types within wetlands resulting in more complex systems of species composition and structure.

In pre-settlement Nebraska, the disturbance regimes occurred within a large landscape. Now, most wetlands are managed within a fragmented landscape with a limited

disturbance regime applied on regular intervals. This has resulted in much simpler systems.

A primary goal of wetland management (described in a later section in this plan) is to mimic the natural disturbance regimes to the greatest extent possible. Wetland restoration and protection actions should also consider the importance of the role that these disturbance regimes play. Circumstances in today's world often have reduced natural disturbances. For example, a wetland may be located near a housing subdivision making prescribed burning a challenge, or a small wetland may not have the infrastructure such as fencing or livestock water facilities needed for grazing. In addition, specific management challenges may require alteration of the natural disturbance regime. For example, control of the invasive reed canary grass in a wetland may require several consecutive years of early spring fire followed by intense spring grazing to reduce the reed canary grass. Or, a dense stand of reed canary grass in a wetland may need several passes with a disk followed by an herbicide application.

Wetland Program Plan Components

A. PARTNERSHIP APPROACH

Nebraska has long recognized that implementing wetland conservation is complex and best accomplished by working in partnerships among landowners, agencies, and organizations. Partnerships play a very foundational role in addressing all of the action items listed in Nebraska's Wetland Program Plan. Some examples of partnerships that are working to implement wetland conservation in Nebraska include: the Nebraska Natural Legacy Project (the state's Wildlife Action Plan), Rainwater Basin Joint Venture, Playa Lakes Joint Venture, Upper Mississippi River/Great Lakes Joint Venture, Landscape Conservation Cooperatives, Saline Wetlands Conservation Partnership, Sandhills Task Force, Missouri River Ecosystem Coordination Group, and the Platte River Recovery Implementation Program. The structure of each of these partnerships differs, but most have governing boards and implementation plans. Collectively, these partnerships have secured over $100 million in competitive grant funding for wetland conservation in Nebraska since 1994, and benefited well over 90,000 acres.

Partnership Action Items

Objective: Work in a collaborative manner with at least 20 partner agencies and organizations to ensure that the goal is reached.

Action1: Continue to support the existing wetland conservation partnerships in Nebraska and form new partnerships where needed.

> Activities: The Nebraska Game and Parks Commission's Wetland Program is involved to varying degrees in all of these partnerships and will continue to

coordinate activities to ensure that wetland conservation is being delivered. In addition, numerous other individuals from the State of Nebraska are involved in these partnerships and will continue their involvement.

Timeline: Ongoing.

B. MONITORING AND ASSESSMENT

A monitoring and assessment program is defined as the establishment and operation of appropriate devices, methods, systems and procedures necessary to monitor, compile, and analyze data on the condition of wetlands (adapted from Elements of a State Water Monitoring and Assessment Program, March 2003). Monitoring is the systematic observation and recording of current and changing conditions, while assessment is the use of that data to evaluate or appraise wetlands to support decision-making and planning processes. Wetlands can be characterized both by their condition and functions. Wetland condition is the current state as compared to reference standards for physical, chemical, and biological characteristics, while functions represent the processes that characterize wetland ecosystems.

The EPA refers to a three-tier framework for wetlands monitoring and assessment.

Level 1(landscape assessments): These assessments rely entirely on GIS data, using landscape disturbance indices to assess wetland condition. This approach involves characterizing the lands that surround wetlands through the use of landscape metrics (e.g., percent forest cover and land use category). Assessment results can provide a coarse gauge of wetland condition within a watershed.

Level 2 (rapid assessments): These assessments use relatively simple metrics to assess wetland condition. They are customarily based on the readily observable hydro-geomorphic and plant community attributes of wetlands. They also can employ the use of a "stressor checklist." Rapid assessment methods typically produce a single score that describes where a wetland generally falls along a gradient of human disturbance and with respect to ecological integrity.

Level 3 (intensive site assessments): These assessments provide a more thorough and rigorous measure of wetland condition by gathering direct and detailed measurements of biological taxa and/or hydro-geomorphic functions.

Well designed and executed wetland monitoring and assessment programs are a critical tool to better manage and protect wetland resources. They allow for the establishment of a baseline in wetland extent, condition and function, to detect change, to assess value, and to characterize trends over time. Monitoring and assessment plays a foundational role in the other core elements of wetlands programs. Monitoring and assessment can also inform planning and prioritization at both the individual wetland and watershed scales.

Monitoring and Assessment Action Items

Objective: Increase our understanding of wetland conditions in at least 10 wetland complexes.

Action 1: Complete the analysis of data from the monitoring of wetland indicators (level 1, 2, and 3) within 10 wetland complexes that was done in the 2011-2013 Nebraska Wetland Condition Intensification Study. As the analysis is completed, the final report and other publications will be prepared.

> Activities: This project was implemented by the University of Nebraska-Lincoln (UNL), administered by the Nebraska Game and Parks Commission, with input provided by a Core Team composed of 11 agencies and organizations, including the Nebraska Department of Environmental Quality. The UNL student working on this project is in the process of finalizing the data analysis and is working on his dissertation.
>
> Timeline: The project will be completed in 2015.

Action 2: Use the information collected during the Nebraska Wetland Condition Intensification Study to finalize a rapid assessment method (RAM) for Nebraska's wetlands.

> Activities: This project was implemented by the University of Nebraska-Lincoln, administered by the Nebraska Game and Parks Commission, with input provided by a Core Team composed of 11 agencies and organizations, including the Nebraska Department of Environmental Quality. The UNL student worked to develop the initial two versions of the RAM. The Core Team of partners will need to field test and finalize the RAM.
>
> Timeline: The project will be completed in 2016.

Action 3: Fill in our numerous knowledge gaps about wetland conditions and functions.

> Activities: Implement the monitoring and assessment items listed in this plan's Information Needs section.
>
> Timeline: Ongoing.

Action 4: Update Nebraska's wetland inventory.

> Activities: Generate the most up-to-date GIS information to update the state's wetland inventory data. Appendix B lists the wetland complexes in priority order for updates.

Timeline: Ongoing.

Action 5: Consider participation in the 2016 National Wetland Condition Assessment survey.

Activities: Coordinate with the Nebraska Department of Environmental Quality and the University of Nebraska-Lincoln to determine how to best proceed.

Timeline: 2016.

Action 6: Sample additional wetland complexes in association with the 2016 NWCA.

Activities: Seek additional funding to have a UNL graduate student sample additional wetland complexes using the crew conducting the 2016 NWCA. The protocol established in the 2011-13 Intensification Study will be followed.

Timeline: 2016 and 2017.

Action 7: Set wetland priorities based on updated inventory and condition assessment information.

Activities: Within each wetland complex, work with the local partnership to develop or refine priorities for wetland protection, restoration, and management.

Timeline: Ongoing.

C. REGULATION

Wetland regulatory and permit programs in general consist of a few basic elements: a jurisdictional scope, a method to authorize impacts to aquatic resources and assess proposed authorizations, and a method of assuring compliance. State and tribal wetland and aquatic resource regulatory programs are defined by the authority under which they operate (i.e., Clean Water Act (CWA) §404, CWA §401, Nebraska Title 117) and how the program is implemented.

The State of Nebraska considers wetlands, including geographically isolated wetlands, to be waters of the state. Beneficial uses of wetlands are listed by the Nebraska Department of Environmental Quality and these uses are protected from degradation.

Regulation Action Items

Objective: Work in collaboration with agencies with wetland regulatory authority to ensure that there is no net loss of wetland acreage.

Action 1: Nebraska plans to continue with its current set of wetland regulatory activities. Note that this is dependent upon decisions by the state Unicameral and the state regulatory agencies.

Activities: These include Section 401 certification, State Programmatic General or Regional Permits, Nebraska Statute Title 117, and the state's Nongame and Endangered Species Conservation Act.

Timeline: Ongoing.

Action 2: Advocate for wetlands

Activities: Nebraska will continue to play a role in advocating for the importance of wetlands by providing input into federal regulatory actions (e.g., Clean Water Act), federal policies (e.g., the Farm Bill), and local decision making (such as community planning).

Timeline: Ongoing.

D. VOLUNTARY PROTECTION AND RESTORATION

Wetland protection is defined as removing a threat or preventing the decline of wetland conditions (US EPA, 2007).

Wetland restoration is the manipulation of a former or degraded wetland's physical, chemical, or biological characteristics to return its natural functions. Restoration practices include:

- Re-establishment- the rebuilding a of former wetland; and
- Rehabilitation- repairing the functions of a degraded wetland (US EPA, 2007).

Wetland restoration and management projects are often complex and require expertise in biology, engineering, hydrology, and soils. Because of this, wetland projects will be designed by an interdisciplinary team (bio-engineering team) possessing the necessary expertise (biology, engineering, hydrology, and soils).

Wetland restoration projects often will include collaborating with our numerous partners. This partnering is highly encouraged. Some programs, such as the Wetland Reserve Easements program, and Partners for Fish and Wildlife Program can provide essential funding for project completion.

Details about implementing wetland restoration projects are available from the various partners involved. The Nebraska Game and Parks Commission has developed a manual to help guide wetland restoration projects, and this manual is available upon

request. Some of the detailed practices covered in the manual are provided in Appendix C.

Voluntary Protection and Restoration Action Items

Objective: Work with our partners to protect and/or restore a minimum of 5,000 acres of wetlands.

Action 1: Consider watershed planning, wildlife habitat, and other objectives when selecting restoration/ protection sites.

Activities:

- Identify rare, vulnerable, or important wetlands and prioritize them for restoration/protection, this would include wetlands with rare plant or animal species and/or high quality plant communities. Most of this is being done by the local partnerships that were previously discussed.
- Apply tools (GIS, LiDAR, color-infrared photography, mapping, modeling, field inspection of soil, vegetation, and hydrologic conditions) to identify and prioritize restorable wetlands.

Timeline: Ongoing.

Action 2: Provide clear guidance on appropriate wetland restoration and management techniques and success measures.

Activities: Wetland restoration and management guides have been developed that are specific to Nebraska's wetlands. These guides will be kept up to date and shared with other partners as requested. An abbreviated version of these guides is provided in Appendix C and D.

Timeline: Ongoing.

Action 3: Establish and institutionalize long term protection, using mechanisms such as incentives, purchase of land title or easements to protect wetlands.

Activities:

- Most wetland protection activities are determined by the local partnerships that were addressed earlier.
- The Nebraska Game and Parks Commission has a wetland acquisition program that is focused on additions to existing areas (often referred to as roundouts), adding new large blocks of habitat that are easier to manage, and/or protecting the highest quality remaining wetlands.
- The Wetland Reserve Easements (WRE) program, administered by the Natural Resources Conservation Service (NRCS), has been a very important

program to protect and restore wetlands throughout Nebraska. The state will continue to partner with NRCS to deliver this program, and has hired a Biologist to help NRCS with management planning for WRE tracts.

Timeline: Ongoing.

Action 4: Increase wetland acreage through restoration (re-establishment and rehabilitation).

Activities:

- Wetlands will be restored on protected lands whenever possible. Much of this will be accomplished by existing local partnerships that have already been discussed.
- The Nebraska Game and Parks Commission will continue to offer its WILD Nebraska program that helps to restore wetlands on private lands.
- The partners will explore ways to better expedite the permitting process for restoring wetlands.

Timeline: Ongoing.

Action 5: Develop a tracking system for wetland conservation activities.

Activities:

- Develop and populate a tracking database for restoration/protection sites. This is being done by the partners for their respective programs.
- Annually obtain an update from the partners to summarize wetland protection accomplishments.

Timeline: Ongoing.

Action 6: Monitor restoration/protection sites to ensure that they are implemented and managed correctly.

Activities:

- Select a subset of indicators (core indicators) to monitor effectiveness of all restoration and protection sites.
- Monitor effectiveness of restoration/protection sites using core indicators.
    - Acres or percent of restored/protected wetlands monitored for $\geq$ 3 years using core indicators.
    - Acres or percent meeting established performance goals based on function/condition indicators.
    - Update monitoring and performance records regularly.
- Based on ongoing monitoring efforts, information needs will be identified and actions will be taken to address these needs.

Timeline: Ongoing.

Action 7: Modify restoration/protection techniques as needed.

Activities: Based on the monitoring work, an adaptive management framework will be used to modify projects as needed.

Timeline: Ongoing.

E. WETLAND MANAGEMENT

The protection and restoration of wetlands is not adequate to maintain their full suite of natural functions. Management actions are a critical component in the overall conservation of Nebraska's wetlands.

The following information is adapted from a document developed by the Nebraska Game and Parks Commission for use on Wildlife Management Areas. The document should be consulted for detailed information. Some of the detailed information from the document is provided in Appendix D. These management techniques are applicable to both public and private lands. Examples of prescribed management techniques discussed include grazing, prescribed burning, haying/shredding/mowing, herbicide application, mechanical (e.g., disking), water-level manipulation, and tree removal. Usually, there is not one "magic bullet" treatment that can be applied just one time to accomplish objectives. Multiple management activities usually need to be prescribed to obtain the desired effect. Management should be prescribed based upon site conditions and biological justification.

Prior to undertaking wetland management, the need for wetland restoration should be assessed both within the wetland and for the entire watershed. Although the project area may be only on a part of the wetland, it needs to be remembered that the wetland is being impacted by alterations in the entire watershed. Addressing the watershed alterations may require different tools (e.g., private lands programs). For details about restoration, please see the Voluntary Protection and Restoration Section of this document.

Wetland Management Action Items

Objective: Apply appropriate management actions yearly on at least 80% of the wetlands owned by the Nebraska Game and Parks Commission, and work with partners to improve management on at least 50% of their wetland acreage.

Action 1: Identify management needs for wetlands owned by the Nebraska Game and Parks Commission.

Activities: All of the state's Wildlife Management Areas are being mapped to identify natural communities, including wetlands. These communities will be given a condition grade and then steps to improve the grade will be identified and implemented.

Timeline: Completed in 2011 and will now be an ongoing activity.

Action 2: Continue to implement management activities on wetlands owned by the Nebraska Game and Parks Commission.

Activities: Nebraska Game and Parks Commission land management staff will continue to identify needs and carry out management actions as necessary.

Timeline: Ongoing.

Action 3: Assist with the management of other publicly owned wetlands and privately owned wetlands as requested.

Activities:

- The Nebraska Game and Parks Commission offers technical assistance to managers of other public and private lands. In addition, NGPC offers financial assistance to help with the management of privately owned wetlands.
- Continue to work with NRCS to implement management on properties enrolled in the Wetland Reserve Easements program.

Timeline: Ongoing.

Action 4: Evaluate the effectiveness of management activities.

Activity: Based on these evaluation efforts, information needs will be identified and actions will be taken to address these needs. Modify management activities as needed.

Timeline: Ongoing.

F. WATER QUALITY STANDARDS FOR WETLANDS

Water quality standards are the foundation of the water quality-based pollution control program mandated by the Clean Water Act (CWA). They define the goals for a water body by designating its highest attainable uses, setting criteria that reflect the current and evolving body of scientific information to protect those uses, and establishing provisions to protect water bodies from further degradation. Federal regulations (40 CFR part 230.3) implementing the CWA include wetlands as "waters of the U.S." and therefore require water quality standards. Water quality standards developed

specifically for wetlands help ensure that the provisions of the Clean Water Act, which apply to all surface waters, are consistently applied to wetlands; they also provide a more relevant scientific basis for applying these provisions. Water quality standards (WQS) regulations at 40 CFR Parts 131 and 132 provide specific requirements for development of state and tribal standards including specifying appropriate water uses to be achieved and protected, providing appropriate criteria to support those uses, and applying anti-degradation policy to all waters, including wetlands. The regulation also provides states and tribes with the flexibility to adopt sub-categories of uses and associated criteria to allow for differentiation between types of wetlands, their expected uses, functions and condition.

The State of Nebraska considers wetlands, including geographically isolated wetlands, to be waters of the state. The Nebraska Department of Environmental Quality has developed water quality standards for wetlands.

Water Quality Standards Action Items

Objective: Work with the Nebraska Department of Environmental Quality to ensure that wetland water quality standards are maintained and not degraded.

Action 1: Maintain the water quality standards that have been developed for Nebraska's wetlands by the Nebraska Department of Environmental Quality.

Activities: Assess the need to make wetland water quality standards revisions as part of the regular triennial review of the State's water quality standards.

Timeline: Ongoing.

G. OUTREACH AND EDUCATION

There is an ongoing need and demand from the general public, schools, conservation partners, and community organizations for education and outreach materials specifically relating to Nebraska's wetland resources.

Outreach and Education Action Items

Objective: Ensure that materials are available to the public that provide information specific to Nebraska's wetlands to help raise the awareness of the importance of wetlands and to help change attitudes and behaviors to help support conservation.

Action 1: Continue to provide outreach materials to the public about wetlands.

Activities:

- Maintain the Wetlands of Nebraska website (www.NebraskaWetlands.com) and have the approved WPP available on this site.

- Work with the Nebraska Game and Parks Commission's Communications Division staff to keep the public informed about wetland issues.
- Assess the need to update the *Guide to Nebraska's Wetlands*.
- Use social media outlets to help provide information about wetlands.
- Continue the development of wetland apps, such as is being done by UNL with EPA grant funding.

Timeline: Ongoing.

Action 2: Continue to provide support to NGPC and partner agency's outdoor educators to teach students ranging from grade school through college about Nebraska's wetland resources.

Activities:

- Develop additional educational materials, such as the Wetlands of Nebraska video, for use by educators.
- Continue to lead field trips for students of all ages for hands-on wetland education.
- Deliver presentations to students in classroom settings as requested.

Timeline: Ongoing.

H. INFORMATION NEEDS

Wetland conservation is a complex undertaking and there are many uncertainties that should be addressed to help improve our efforts. Broadly, we need better information on how wetlands function and how to best restore and protect wetlands. An itemized list of information needs is provided in Appendix E. This list is not all inclusive and is subject to change as we become aware of gaps in our knowledge base.

Information Needs Action Items

Objective: Continue to improve the level of knowledge possessed by NGPC, local partnerships, and the scientific community about Nebraska's wetlands.

Action 1: Develop and maintain a wetland conservation information needs priority list for Nebraska.

Activities: Work with the local partnerships and the scientific community to obtain input of information needs and priorities.

Timeline: Ongoing.

Action 2: Address the priority Information Needs.

Activities: Work with the scientific community to secure funding to address the information needs.

Timeline: Ongoing.

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Appendix A- HGM Subclasses

HGM subclasses in Nebraska and their corresponding natural community.

Wetland Subclass[1]	Description	Predominate Region or complex[2]	Natural Community Crosswalk[3]
Riverine Channel	Vegetated river or stream channels or vegetated wetland fringe along unvegetated river or stream channels.	Statewide	Sandbar Willow Shrubland, Perennial Sandbar, Western Streamside Wet Meadow, Sandbar/Mudflat,
Riverine Floodplain Rapid Permeability, w/minimal out of bank flooding	Wetlands (wet meadows) situated on floodplain soils with rapid permeability and receiving minimal out of bank flooding.	Platte River	Eastern Riparian Forest, Western Riparian Woodland, Eastern Cottonwood-Dogwood Riparian Woodland, Eastern Cottonwood- Willow Riparian Woodland, Diamond Willow Woodland, Riparian Dogwood- False Indigobush Shrubland, Eastern Cordgrass Wet Prairie, Eastern Sedge Wet Meadow, Northern Sedge Wet Meadow, Northern Cordgrass Wet Meadow, Western Streamside Wet Meadow
Riverine Floodplain Rapid Permeability, w/regular out of bank flooding	Wetlands (wet meadows) situated on floodplain soils with rapid permeability and receiving regular out of bank flooding.	Elkhorn and Loup rivers	Eastern Riparian Forest, Western Riparian Woodland, Eastern Cottonwood-Dogwood Riparian Woodland, Eastern Cottonwood- Willow Riparian Woodland, Riparian Dogwood-False Indigobush Shrubland, Eastern Cordgrass Wet Prairie, Eastern Sedge Wet Meadow, Northern Sedge Wet Meadow, Northern Cordgrass Wet Meadow, Western Streamside Wet Meadow
Riverine Floodplain Moderate to Slow Permeability, w/minimal out of bank flooding	Wetlands situated on floodplain soils with moderate to slow permeability and receiving minimal out of bank flooding.	Missouri River, from Sioux City to Omaha	Eastern Riparian Forest, Western Riparian Woodland, Eastern Cottonwood-Dogwood Riparian Woodland, Eastern Cottonwood- Willow Riparian Woodland, Riparian Dogwood-False Indigobush Shrubland, Eastern Cordgrass Wet Prairie, Eastern Sedge Wet Meadow, Northern Cordgrass Wet Meadow, Western Streamside Wet Meadow

Riverine Floodplain Moderate to Slow Permeability, w/regular out of bank flooding	Wetlands situated on floodplain soils with moderate to slow permeability and receiving regular out of bank flooding.	Missouri River, downstream from Plattsmouth	Eastern Riparian Forest, Western Riparian Woodland, Eastern Cottonwood-Dogwood Riparian Woodland, Eastern Cottonwood- Willow Riparian Woodland, Riparian Dogwood-False Indigobush Shrubland, Eastern Cordgrass Wet Prairie, Eastern Sedge Wet Meadow, Northern Cordgrass Wet Meadow
Saline Depressions	Wetlands situated on floodplain soils with slow permeability and receiving inputs of saline groundwater	Eastern Saline Wetlands	Eastern Saline Marsh, Eastern Saline Meadow
Playa Depressions	Wetlands situated in wind-formed depressions that receive water predominately from surface runoff. They are episaturated with short or long duration ponding.	Rainwater Basins, Southwest Playas, Central Table Playas, Todd Valley	Pond Marsh, Playa Wetland, Wheatgrass Playa Wetland
Floodplain Depressions	Wetlands situated in floodplain depressions with long duration ponding, such as oxbows.	Statewide	Pondweed Aquatic Wetland
Sandhill Depressions, episaturated	Wetlands situated in Sandhill depressions located on episaturated soils (e.g., sand over clay).	Sandhills and Sandhill Borders	Sandhills Aquatic Wetland, Sandhills Freshwater Marsh

Sandhill Depressions, endosaturated	Wetlands situated in Sandhill depressions located on endosaturated soils. This would include most Sandhill marshes.	Sandhills	Sandhills Aquatic Wetland, Sandhills Freshwater Marsh
Western Alkaline Floodplain Depressions	Wetlands situated on fine textured alkaline floodplain soils.	North Platte River valley	Western Alkaline Marsh, Western Alkaline Meadow
Sandhill Alkaline Depressions	Wetlands situated on coarse textured alkaline Sandhill soils.	Western Sandhills	Western Alkaline Marsh
Mineral Soil Flats	Wetlands situated on flat endosaturated Sandhill mineral soils. This would include most Sandhill wet meadows	Sandhills	Northern Sedge Wet Meadow, Northern Cordgrass Wet Prairie
Organic Soil Flats	Wetlands situated on flat endosaturated Sandhill organic soils. These wetlands are termed fens.	Sandhills	Sandhills Fen, Marsh Seep
Slope Wetlands	Wetlands situated on slopes that receive water from springs and seeps discharging due to an aquatard (e.g., glacial till over clay).	Eastern third of state	Marsh Seep, Spring Seep, Prairie Fen

Slope Wetlands, Canyon Springs	Wetlands situated on slopes that receive water from springs and seeps discharging due to an aquatard (e.g., sand over bedrock).	Niobrara River valley	Marsh Seep, Spring Seep
Slope Wetlands, Sandhill Springs	Wetlands situated on slopes that receive water from Sandhill springs.	Sandhills	Marsh Seep, Spring Seep

[1] Subclass is based on hydro-geomorphic classification system, applied to Nebraska by Jasmer et al. 1997.

[2] There is the potential for many of these subclasses to be found throughout Nebraska.
[3] From Rolfsmeier and Steinauer 2010.

Appendix B- NWI Priorities

National Wetland Inventory re-mapping priorities for Nebraska[1]

Prepared by: Ted LaGrange and Randy Stutheit
July 5, 2007

Wetland Complex	Biologically Unique Landscape (BUL)	NWI re-mapping priority- entire landscape	NWI re-mapping priority- trends only	Rationale
Lower North Platte River	Platte Confluence	1	3	Small BUL with lots of wetlands likely impacted by reduced river flow.
Missouri River	Verdigre-Bazile Creek Watershed	2	NA	Need better inventory of Niobrara silt delta.
Missouri River (entire)		3	1	Wetlands likely impacted by silt delta and dams. Need to compare trends in delta vs. unchannelized river.
Platte River (entire)		4	4	Important to obtain updated inventory and trends in Platte River reaches outside of Big Bend Reach.
Sandhills Borders	Willow Creek Prairies	5	8	Lots of saturated meadows, with much drainage activity.
Sandhills	Elkhorn Headwaters	6	NA	Eastern Sandhills seem most impacted by stream down cutting. Existing Sandhills NWI seems to underestimate wetlands, especially meadows.
Sandhills	Cherry County Wetlands	7	NA	Existing Sandhills NWI seems to underestimate wetlands, especially meadows.
Sandhills	Dismal Headwaters	8	NA	Existing Sandhills NWI seems to underestimate wetlands, especially meadows.
Sandhills Borders	Elkhorn Confluence	9	9	Eastern Sandhills seem most impacted by stream down cutting. Existing Sandhills NWI seems

Wetland Complex	Biologically Unique Landscape (BUL)	NWI re-mapping priority-entire landscape	NWI re-mapping priority-trends only	Rationale
				to underestimate wetlands, especially meadows.
Sandhills	Sandhills Alkaline Lakes	10	NA	Existing Sandhills NWI seems to underestimate wetlands, especially meadows.
Sandhills (entire)		11	7	Existing Sandhills NWI seems to underestimate wetlands, especially meadows.
Central Table Playas	Central Loess Hills	12	NA	Existing NWI and soils data seem to adequately describe where the playas are.
Central Table Playas (entire)		13	2	These playa wetlands have likely been impacted by sedimentation and pit construction. Updated trend data would help to quantify this.
Southwest Playas (entire)		14	6	Only a very small portion of this complex is w/in the RWBJV admin. Boundary.
Todd Valley Playas		15	5	Only a small portion of this complex is w/in the RWBJV admin. Boundary. Existing NWI and soils data seem to adequately describe where the playas are.
Elkhorn River (entire)		16	10	Wetlands along the river appear to not have changed greatly over the years.
Sandhills Borders	Keya Paha Watershed	17	15	Not very familiar with the wetlands and trends in this area.
Niobrara River	Middle Niobrara River Valley	18	18	Wetlands along the river appear to not have changed greatly over the years.
Niobrara River (entire)	Niobrara River	19	19	Wetlands along the river appear to not have changed greatly over the years.
	Lower Loup River	20	12	Wetlands along the river appear to not have changed greatly over the years.
	Calamus	21	13	Wetlands along the

Wetland Complex	Biologically Unique Landscape (BUL)	NWI re-mapping priority-entire landscape	NWI re-mapping priority-trends only	Rationale
	River			river appear to not have changed greatly over the years.
	Middle Loup River	22	14	Wetlands along the river appear to not have changed greatly over the years.
	North Loup River	23	16	Wetlands along the river appear to not have changed greatly over the years.
	Snake River	24	17	Wetlands along the river appear to not have changed greatly over the years.
Republican River		25	11	River does not have a lot of wetlands and is not in a formal complex or BUL. With flow issues, some trend data would be useful. Prioritize upstream from Swanson Res.
	Sandstone Prairies	26	20	Few wetlands in area.
Sandhills Borders (entire)		27	21	Few wetlands in area, outside of BULS covered above.
	Loess Canyons	28	22	Few wetlands in area.

[1] Excludes the Rainwater Basin and Central Platte wetland complexes since they were already re-mapped for NWI.

Appendix C- Restoration Practices

The following are Wetland Priority Practices from the Nebraska Game and Parks Commission's WILD Nebraska private lands program manual.

Priority 1—Wetland Restoration:

1a) Re-establishment (Full Hydrologic Restoration)—Activities that restore hydrology to an area that historically was a wetland but has been drained to the extent that none of the area is currently a wetland.

1b) Rehabilitation (Partial Hydrologic Restoration)—Activities that restore hydrology to an area that historically was a wetland but has been partially drained to extent that only some of the area is currently a wetland.

1c) Rehabilitation (Vegetative Restoration)—Activities that restore natural plant communities on areas not hydrologically modified, but where the natural vegetation has been substantially altered.

Priority 2—Wetland Vegetation Management and Maintenance:

Activities intended to improve or maintain existing desirable vegetation.

Priority 3—Wetland Enhancement (Alteration):

Activities that alter the physical characteristics of an existing wetland to achieve specific social benefits without restoring the natural ecological functions (e.g., island construction, altering a seasonal wetland to make it a semi-permanent wetland).

Priority 4—Wetland Establishment (Creation):

Activities that establish a wetland where one did not previously exist.

General

The eight wetland activities listed in this document are generally organized *by Priority Practice Category*, however, within a category no attempt has been made to prioritize. The following Activities are provided:

- Drain Closure
- Irrigation Re-use Pit Closure
- Quick-Cycle Tailwater Recovery System Installation

- _ Water-control Structure Installation
- _ Stream-weir Installation
- _ Silt and Fill Removal
- _ Vegetation Management
- _ Wetland Creation

DRAIN CLOSURE

Priority Practice Category

_ Priority 1—Full or Partial Hydrologic Restoration.

Purpose

_ To restore hydrology to wetlands that have been fully or partially drained.

General Concept

Many wetlands have been fully or partly drained by ditches, culverts, head-cutting gullies, and tiling. Closure of these drains will result in an increase of wetland acres and also restore, or partially restore, the natural hydrology to the wetland. The water-control activity will often be used in association with this activity.

The Seasonal Habitat Improvement Program (SHIP) of the Rainwater Basin Joint Venture is included as part of this activity. An existing cooperative agreement between the Commission, U.S. Fish and Wildlife Service, and the National Fish and Wildlife Foundation is in place to implement this activity in the Rainwater Basin. The main difference between SHIP and other drain closure projects is that SHIP closes the drainage only during the non-cropping season to provide water bird migration habitat. During the cropping season the cooperator is allowed to remove the water and crop the site. In some cases, this activity may be offered outside of the Rainwater Basin.

This activity works well when coupled with our partners' programs. An example is WRP and some CRP activities where those programs cover a portion of the cooperator's restoration costs and this activity under *WILD Nebraska* could pay the remaining cost-share.

Requirements and Technical Specifications

Commission approved seeding of construction areas will be used as prescribed to provide wildlife habitat and to prevent erosion.

IRRIGATION RE-USE PIT CLOSURE

Priority Practice Category

_ Priority 1—Full or Partial Hydrologic Restoration.

Purposes

_ Improve hydrology within a wetland and/or wetland watershed

General Concept

Irrigation re-use pits have two major negative impacts on wetlands. When located within the hydric soil footprint of a wetland, pits "concentrate" water and partially drain the surrounding wetland. This is especially damaging to small, temporary and seasonal

wetlands. The wetland surrounding the pit dries much more frequently, disrupting the natural wet/dry cycle and allowing for the conversion of the wetland. Pits located in the watershed of a wetland, although primarily designed to capture irrigation runoff, will also capture precipitation runoff. Intercepting natural runoff and preventing it from reaching the wetland also causes the wetland to dry more frequently than normal.

Irrigation re-use pit closure aids in the restoration of wetland hydrology. Should a cooperator determine that a pit is no longer necessary for farming activities, this activity can assist in filling the pit with soil back to original grade. An alternative would be the placement of a low-level earthen berm, with a control structure around the pit, to control water movement into it. The structure can be opened during irrigation season to capture tailwater, then closed the rest of the year to allow natural runoff to bypass the pit and reach the wetland. Quick-cycle tailwater recovery systems and Seasonal Habitat Improvement Projects are activities that can often be paired.

Requirements and Technical Specifications

Excavations to obtain fill for the pit will need to be designed so they do not puncture the clay seal of the wetland. Seeding of the construction area will usually not be necessary. However, if necessary, a Commission approved seeding will be used to provide wildlife habitat and to prevent erosion.

QUICK-CYCLE TAILWATER RECOVERY SYSTEM INSTALLATION

Priority Practice Category

- Priority 1—Partial Hydrologic Restoration.

Purpose

- To the fullest extent possible, restore and/or maintain the natural hydrology of wetlands by encouraging the use of quick-cycle tailwater recovery systems.

General Concept

In Nebraska's Rainwater Basin and elsewhere, pits have been dug in and near wetlands to make these areas more suitable for cropping. Because most pits capture water during the entire year, the natural hydrology of the wetland is usually interrupted. By providing financial incentives to install quick-cycle tailwater recovery systems, cooperators may be able to fill-in existing pits or eliminate the need to excavate a new pit.

The quick-cycle works like a sump pump. Excess water from irrigation is directed into a small earthen pit or tank. A pump, switched on by a float returns the tailwater to the irrigation system resulting in increased efficiency. In the absence of a larger volume pit, runoff from precipitation reaches the wetland at a higher rate. Quick cycle systems can also benefit wetlands by directing irrigation tailwater away from a wetland to facilitate natural drawdown processes. Pit closure or pit filling or some other type of hydrologic modification must accompany this activity.

Requirements and Technical Specifications

The system should be designed to capture irrigation tailwater and allow most precipitation runoff to enter the wetland. Cost of return lines is not eligible for cost-share through the Commission.

WATER CONTROL STRUCTURE INSTALLATION

Priority Practice Category

_ Priority 1—Partial Hydrologic Restoration, Vegetation Restoration

_ Priority 2—Vegetation Management and Maintenance

_ Priority 3—Alteration

Purpose

_ To facilitate wetland restoration

_ To maintain the productivity of the wetland by effectively managing water levels

General Concept

Wetland plant and animal communities are well adapted to the wet and dry cycles that wetlands undergo. However, the hydrology of many wetlands has been altered to the point that the natural wet and dry cycles no longer occur. When this is the case, it is often necessary to provide for water control to restore the wetland or to maintain the productivity of the wetland. This activity will usually be paired with the Drain Closure activity.

Requirements and Technical Specifications

This activity is only applicable for development of shallow water wetlands (average depth of < 2.5 ft). This activity will not be used to cost-share on deep-water projects (e.g., lakes, and fish ponds), except in unique cases where the District staff design the project to benefit wetlands and wetland wildlife.

STREAM WEIR INSTALLATION

Priority Practice Category

_ Priority 1—Full or Partial Hydrologic Restoration

Purposes

_ To stop or reverse streambed degradation that negatively impacts wetlands.

General Concept

Many streambeds in Nebraska have become severely degraded. Degradation occurs when a stream cuts at an unnaturally accelerated rate, forming an incised channel with steep banks. A highly degraded stream affects wetlands by isolating them from over-bank flood flows, by potentially lowering ground water levels across the floodplain, and by allowing the development of erosive gullies that drain adjacent wetlands. Stopping degradation ensures that the wetlands on the floodplain will not become further isolated from ground water or over-bank water sources. Reversing degradation helps to restore wetlands by reconnecting them with ground water and over-bank water sources. This activity will often be paired with the Drain Closure activity where floodplain headcuts (erosive gullies draining wetlands) are plugged.

Requirements and Technical Specifications

Approval of final plans by a registered professional engineer is needed for these projects. Natural Heritage Program and Fisheries Division staff at the Game and Parks Commission will review these projects to ensure that the movement of aquatic life is not impaired.

STREAM RESTORATION

Priority Practice Category

_ Priority 1—Full or Partial Hydrologic Restoration

Purposes

_ To restore streams that have been altered by straightening or bank stabilization.

General Concept

The functions of many streams in Nebraska have been altered by straightening (channelization) and bank stabilization. These alterations have often resulted in a loss of fish and wildlife habitat because the natural dynamic processes of the stream are reduced or eliminated. This can result in a loss of total channel length, decreased structural diversity in the streambed, elimination of fringe wetlands, loss of adjacent grasslands and woodlands, altered nutrient dynamics in the stream, and reduced frequency of out-of-bank flows. This activity will be used to restore meanders to straightened streams and allow the stream bank to function naturally. This activity will often be paired with Stream Weir Installation.

Requirements and Technical Specifications

Approval of final plans by a registered professional engineer is needed for these projects. Natural Heritage Program and Fisheries Division staff at the Game and Parks Commission will review these projects to ensure that the movement of aquatic life is not impaired.

SILT AND FILL REMOVAL

Priority Practice Category

_ Priority 1—Full and partial hydrologic restoration, Vegetation Restoration,

_ Priority 3—Alteration

Purposes

_ To restore wetlands in areas that were filled and leveled.

_ To remove silt and sediment washed into wetlands in order to restore original basin profile, depths, and hydrology.

_ To remove invasive plant species and expose native plant seed banks.

_ To create varying water depths within the wetland and provide habitat diversity.

General Concept

Many wetlands throughout the state have been filled (with soil, etc.) and leveled. Other wetlands have been severely impacted by removal of perennial vegetation from the watershed leading to the deposition of silt into the wetland. The highly accelerated

rate of silt deposition leads to an alteration of wetland hydrology and can result in the establishment of invasive plants such as hybrid cattail, reed canary grass, and river bulrush, all of which out-compete more desirable plants. Also, silt buries the seed bank of desirable plant species preventing germination, acts as a "sponge"—absorbing water and making it unavailable to wildlife, and has a leveling effect—creating a wetland with a nearly flat bottom eliminating the micro-topography that provides habitat diversity.

This activity must be accompanied by a prescribed vegetative buffer and/or silt trap.

Requirements and Technical Specifications

Wetlands that have been filled and leveled, as well as wetlands from which silt is to be removed will need to have a depth-of-fill/silt and a topographic survey conducted to determine how much material should be excavated. Care must be taken when excavating in "perched" wetlands (such as Rainwater Basins and other playa wetlands) so that the clay seal underlying the area is not breached allowing water to seep away. A vegetated buffer and/or silt trap will almost always accompany this activity.

WETLAND CREATION

Priority Practice Category

_ Priority 4—Creation

Purpose

_ To create wetlands for the benefit of wildlife.

General Concept

Although wetland creation is not a priority of this program, there are instances in which creations can replace wetlands that have been drained or to complement the functions of existing wetlands. Creation, most often, is accomplished through excavation or by construction of a dam. This activity will generally be paired with one of the other wetland activities.

Requirements and Technical Specifications

A wetland will not be created in an area where it will degrade existing wetlands or other unique natural communities. This activity is intended to emphasize shallow water habitat for wildlife; it is not intended for development of fisheries habitats. Creation of fish ponds will not be allowed under this activity, except in unique cases where the District staff design the project to benefit wetlands and wetland wildlife.

Appendix D- Wetland Management Information

The information below is an excerpt from the Nebraska Game and Parks Commission document entitled *Wetland Management Guidelines for Nebraska's Wildlife Management Areas*, authored by Ted LaGrange and Randy Stutheit in 2011.

Management Philosophy

Management philosophy can be just as critical to sound wetland management as choosing the proper technique(s). The management philosophy on WMAs should include the following considerations:

1) **Management is a Long-Term Process** - Wetland management is usually a long-term process. However, some management objectives, such as modifying vegetation structure, can be accomplished in the short term. Managers should choose strategies that will accomplish both short-term and long-term objectives. Management regimes should be designed to mimic the natural processes that originally formed and maintained the wetlands. Particular emphasis should be placed on integration of burning and grazing to achieve long-term objectives.
2) **Set Management Objectives** - Management progress and effectiveness can only be measured if objectives have been set. These objectives should be quantifiable and timed-based, such as reduce reed canary grass by 50% in five years, or raise the wetland to Grade B quality in 10 years.
3) **Use Adaptive Management** - Adaptive management is simply the process of setting objectives, taking action through experimentation, measuring progress, and then adjusting strategies. Once management plans are implemented, they need to be evaluated yearly to see if management objectives are being met.
4) **Be Flexible and Use Diverse Management** - Flexibility is the key to sound management. Managers should be willing to use a diversity of techniques and change management methods, timing, and intensity on any given wetland to mimic natural disturbance regimes and help meet objectives. Also, management techniques don't have to be applied over the entire wetland, but can be targeted to the portions of the wetlands in need. The primary tools to be used are water level management, invasive species control, fire, and grazing. Diverse management promotes both species and structural diversity. Simplified management, for example, use of only prescribed fire in the spring, can simplify diversity. External factors may also require managers to be flexible. Wetlands are resilient systems so it is often better to take action and learn from it as opposed to taking no management action at all.
5) **Be Familiar With Native Plants** - Knowledge of wetland plants is vital to sound management. Native plants, as well as exotic and invasive species, are indicators of condition and management needs. Changes in condition, both good and bad, will be reflected in the plant species composition. Many wetland plant species are good for wildlife and the ability to identify these species is valuable to wildlife managers. At-risk plant species may also be a management priority and managers should be able to identify these in the field.

6) **Make High Quality Wetlands a Management Priority** - Many high quality wetlands occur on WMAs. These wetlands are uncommon and need proper management to preserve them into the future. However, management resources and staff are limited and because of this, it is possible that not all wetland habitats on WMAs will receive proper management. It is essential that the high quality sites be given priority.
7) **Management can be complex and challenging to implement and evaluate** – Due to the complexities of natural systems, it can be difficult to know how to best manage a given site and to evaluate your results. When unsure what the best course of action is, seek counsel from other managers and people with wetland expertise and the most up-to-date information. Such a team approach may be very helpful in deciding on a course of action.

Guiding Principles

Guiding principles are general rules to direct management of wetlands on WMAs. Individual guiding principles may not apply to all situations. For example, it may not be feasible to provide structural diversity, or do large-scale management on a small wetland. Managers are encouraged to follow these guidelines where applicable:

1) Manage for native species diversity.
2) Mimic natural disturbance regimes.
3) Strive for structural diversity.
4) Decrease fragmentation.
5) Restore natural communities.
6) Emphasize large-scale management.
7) Control invasive species.
8) Manage for at-risk species where present.

CHAPTER 4 – MANAGEMENT

Need for Management

As noted earlier, Nebraska's wetlands evolved with, and are dependent on natural disturbances such as fire and grazing. Lack of periodic disturbance (management) has severe consequences for wetlands. In previous decades, land managers sometimes assumed that little or no management was good for wildlife. Research has shown that in nearly all cases this assumption is false. In wetlands, a major consequence of little or no management is a dense and often monotypic stand of vegetation.

Another consequence of no management is uniform vegetative structure that is not conducive to use by a diverse suite of wildlife. Lack of management in wetlands can also lead to woody species encroachment resulting in habitat fragmentation and loss. Wetlands lacking proper management will move toward a state of dense, perennial vegetation such as cattails or reed canary grass. Active management not only

maintains and enhances habitat quality, but also is necessary to sustain healthy populations of wildlife.

The lack of management can lead to long-term damage to wetlands and can result in the need for a more expensive and time consuming restoration or enhancement project to be completed before proper management can begin.

Management Options

1) Grazing

Bison and elk were the primary pre-settlement large ungulate grazer of Nebraska's landscape. Today, under several management scenarios cattle can be used as a substitute for native grazers to attain management goals. Species other than cattle (e.g., goats, horses, hogs) may also be able to be used for management, but we currently have little experience with these species. When properly applied, cattle grazing can be used to alter wetland species composition, diversify vegetative structure, increase the amount of bare ground, reduce invasive species, increase the productivity of selected species, and increase the nutritive quality of the forage. Grazing is a tool that allows managers' flexibility with regard to timing, frequency, and intensity of plant defoliation and trampling.

There are two basic methods of using grazing as a management tool in wetlands. One is to use cattle infrequently and for a limited period of time to address a particular management issue. The other scenario is to use cattle as part of a permanent grazing system such as rotational grazing. Which grazing system is best for a specific wetland depends on the land management objectives, existing plant composition, wetland size and condition, existing grazing infrastructure, and other factors.

The most critical issue when planning livestock grazing for wildlife management is determining the goals and objectives of the property you manage. How wetlands are managed varies across the state, according to the wildlife species desired, stocking rates, season of use, availability of livestock, and soil conditions. For example, the Rainwater Basin wetland complex is critical for spring and fall migration of waterfowl and shorebirds, thus early succession habitat conditions, and some exposed shoreline, in the spring and fall would be desirable. This could be accomplished by periodic heavy grazing in the spring and early summer. In the Sandhills, wetlands are part of the normal ranching operation and interspersed in upland rangeland, fenced in large pastures, and grazed in planned grazing systems. The waterfowl focus of the region is generally for waterfowl production rather than migratory habitat.

Season of grazing is critical to consider. Depending on management objectives, determining the desired plant(s) growing dates will dictate when grazing will be most effective. Invasive plant species will often require season-long grazing to hinder plant development. In wetlands with severe invasive plant problems, grazing should begin as soon as the plants start to develop as this is the time when the plants are most palatable. In wetlands that have a combination of native species and invasive species, such as reed canary grass, it may be necessary to graze two times, resting the site during annual plant growth, and then resuming grazing during the second growing phase. In wetlands where the goal is to provide more open water/bare ground and

annual plants, spring and early summer grazing may be sufficient. In these cases, cessation of grazing by mid-summer will allow for annual plant seed production that is an important source of wildlife food. Wetlands can be grazed annually in the Sandhills under conservative stocking rates, but the season of use should vary when planned grazing rotations are applied.

The stocking rate (animal unit months per acre) influences the overall intensity of herbivory and the physical impacts to wetlands. Light stocking rates allow cattle to select favored grazing species or areas. Heavy stocking rates force cattle to consume more plant species, including undesirable plants, and the hoof action can help to compact wetland soils, shred stems and tubers, and promote more bare ground. In the Rainwater Basin, you may desire a moderate to heavy stocking rate for a short duration while in the Sandhills, you may strive for conservative stocking rates to meet rangeland objectives and sustain good or excellent range condition. Wetlands in the Sandhills may be choked with cattails or bulrush whereby some temporary fencing with high stocking rates may be desirable to create open water habitat.

Conservation land managers sometimes avoid using high stocking rates in fear of damaging native wetland plant communities and wildlife habitat. Nebraska's wetlands are adapted to severe periodic disturbances such as heavy grazing, fire, and drought. Wetlands will recover quickly from high-intensity, short-duration grazing. In some circumstances it may be necessary to conduct intense short-duration grazing for consecutive years. There are several grazing methods and systems that can be used on WMAs to benefit wetlands, biodiversity, and wildlife and that are acceptable to tenants. Some traditional grazing systems designed for livestock production, such as deferred rotational grazing and high intensity/short duration grazing, generally promote uniform disturbance through even distribution of grazing animals within a year. However, uniform disturbance generally does not promote the plant community heterogeneity desired by ecologists and wildlife biologist. In addition, deferred rotational grazing and high intensity/short duration grazing systems often require extensive grazing infrastructure and management and are not recommended for use on WMAs. On the other hand, if a WMA is adjacent to a private grazing operation, fitting the WMA grazing need into the private operation would be desirable with little infrastructure needed to meet wetland management objectives. Some grazing systems, such as fire-driven rotational grazing or patch-burn grazing, offer an alternative, heterogeneity-based approach to traditional grazing systems. The heterogeneity associated with patch-burn grazing and some other grazing systems may be critical for conservation of many wetland species.

There are even reasons to promote grazing systems that use intensive season-long grazing (up to 2-3 times the traditional stocking rate) in wetlands while other areas are rested for an extended period (1 to 2 years in some cases). Such systems promote heterogeneity of vegetation structure with both short and tall vegetation and open water/bare ground, within wetlands, which is important to wildlife. Native plant species may also be more adapted to such disturbance regimes than exotic species. In addition, many wetland species when rested for one or two years, then burned, are highly nutritious and palatable for large ungulates and other wildlife. For tenants, the increase in forage quality and quantity should make up for any perceived loss in forage due to the extended rest period.

2) Prescribed Burning

Lightning and Native American set fires were a primary disturbance in pre-settlement Nebraska prairies and wetlands. The pre-settlement fire return interval was estimated to be 3 to 5 years for tallgrass prairie (including the wetlands contained within the larger prairie landscape), 5 to 10 years for moist mixed-grass prairie, and 25 years for dry mixed-grass prairie (Samson and Knopf 1996). Native American set fires occurred primarily in two periods: March through May with a peak in April, and July through early November with a peak in October. Fires caused by lightning occurred generally during summer and early fall with most in July and August (Higgins 1986).

Managers need not exactly mimic pre-settlement fire return intervals as more frequent or infrequent fire return intervals may be needed to manage native habitats in today's altered ecosystems. Also, present day season-of-fire need not follow historic season-of-fire as invasive species, limited resources, and burn windows require that prescribed fire be used during all seasons of the year when management objectives can be achieved. Burning can be justified for any season of the year as long as management objectives are met. For example, late spring fires can be used to control exotic cool-season grasses such as reed canary grass, late-summer fires can be used to reduce bulrush and cattail stands in wetlands, and winter or early spring fires can be used to open up wetlands for the spring migration.

3) Grazing and Fire Interaction

The fire-grazing model (patch-burn grazing system) is based on information that on Great Plains prairies, fire and grazing interacted through a series of positive and negative feedbacks to cause a shifting mosaic of vegetation patterns across the landscape (Fuhlendorf and Engle 2004). This same interaction likely also occurred in wetlands. The interruption of landscape scale processes, such as the fire-grazing interaction, may be the primary mechanism for loss of biodiversity in the Great Plains. Recently burned areas are typically preferred grazing sites for large ungulates and the combination of burning and grazing impacts vegetation composition and diversity to a greater extent than each action operating alone (Collins and Steinauer 1996).

4) Haying, Shredding, or Mowing

Haying, shredding, or mowing of wetlands is often less effective than grazing or burning for managing wildlife habitat. Like burning, these methods are nonselective management practices that cut and/or remove all vegetation. From a vegetative standpoint, haying, shredding, or mowing stress actively growing desirable and undesirable plants species equally. Though, if properly timed, these methods can place more stress on the undesirable species you are targeting. For example, summer haying can be effective in controlling some woody species and late spring haying or mowing can stress reed canary grass.

Timing of haying is often dictated by the forage quality of the hay. Producers prefer to hay when forage quality is high. Many Nebraska producers prefer to hay in

July to compromise between forage quality and quantity. Many nesting birds don't complete hatching until late June, and others nest until mid-July. Early- to mid-summer haying can destroy nests or kill nestlings. In addition, annual, mid-summer haying stresses native warm-season plants and promotes exotic cool-season species, such as reed canary grass. Another option is to mow reed canary grass in late spring before it goes to seed. Allowing the mowed reed canary grass to dry, and then burning the mowed area can produce a hotter fire that may damage the roots and the unwanted seed bank. Most plants are low in below-ground energy (i.e. carbohydrate) reserves just prior to and during flowering, so mowing them at that time is the best way to stress them and over time possibly reduce their abundance.

Resting portions of wetlands, and then haying, shredding, or mowing on alternative years is a management option. Rest periods will allow native plants to restore root reserves and complete reproductive cycles. Rest from haying, shredding, or mowing should also increase forage production. Rested wetlands can also be spring burned to remove thatch and allow for easier hay removal later in the year.

In addition to the grazing-fire interaction that was discussed earlier, there can also be a grazing-mowing interaction. An early spring mowing can result in a rapid re-growth of vegetation that grazing animals will find very palatable.

5) <u>Herbicide Application</u>

Herbicide application is not always a preferred management technique, but unfortunately, due to the difficulties that can be encountered in wetland management, it has become a necessary method of controlling some of the more aggressive species such as river bulrush, common reed, cattails, or reed canary grass. There are several strategies for using herbicide application:

1) **Broadcast Application Using a Floater** - Because temporary and seasonal wetlands dry more frequently during the year, it is often possible to utilize a float applicator to apply the herbicide.
2) **Broadcast Application Using a Spray Plane -** On larger and/or semi-permanent or permanent wetlands (e.g. reservoir or pond edge), it is often necessary and more economical to hire a spray plane for aerial application of the herbicide.
3) **Spot Treatment Using a Pickup, Boat, or ATV** - Wetlands that have scattered populations of the vegetation you are wanting to control do not need to be broadcast sprayed but should instead be spot treated with application of the herbicide directly to the target plants.

New herbicides are put on the market and labels are subject to change, so it is best to keep current with the latest developments and not to rely solely on recommendations in this guide. There are several commercially available herbicides such as Rodeo® and other glyphosates labeled for use over water. Two other herbicides that are reportedly grass specific are Vantage® and Poast®. However, Vantage® and other herbicides not labeled for over water use (e.g. Roundup) must be applied only when the wetland site is dry. Spraying bulrush, cattail, or reed canary

grass in late August and early September with glyphosate controls these plants and has less effect on your other desirable wetland plants.

6) Mechanical (Disking, Roto-tilling)

Using a heavy construction disk or roto-tiller to mechanically disturb the soil can be effective in reducing the population of unwanted vegetation on a site. Experience has shown that for disking alone to be effective, especially on species such as reed canary grass, a minimum of 3-4 passes with a heavy disk must be made. Roto-tilling is more effective because the tiller blades bring the roots, rhizomes, and tubers to the soil surface where they die more quickly by drying in the heat of summer, or freezing during the winter. However, most roto-tillers are narrow and require the tractor operator to go very slow which greatly limits the number of acres that can be effectively treated in a day. Roto-tilling is a good technique to use for smaller stands of undesirable vegetation or to create small openings.

A more effective means of vegetation control utilizing a disk is the spray-disk-spray combination of treatments, especially for reed canary grass. Applying an herbicide in the summer when the reed canary grass is flowering and root reserves are at their lowest will usually kill most of the mature plants. Disking 10-14 days later will further destroy the vegetation and open the seedbed for new plants to sprout from the seed bank. Once the seedlings have reached a sufficient size, treating with the herbicide again will kill the new vegetation.

It should be remembered that mechanical methods can destroy desirable vegetation along with the invasive species, so care should be applied when using this technique. The positive aspect of mechanical control is that it opens the wetland up for annual vegetation to quickly grow and establish.

7) Water Level Manipulation

Water level manipulation has limited application on most of our Wildlife Management Areas. Many areas lack water control structures or groundwater wells to supplement and manipulate hydrology. Plus, many of our wetlands are shallow and it is difficult to flood the undesirable vegetation deep enough for a long enough period of time to eliminate it. An exception to this is managing the wetland fringe on ponds and reservoirs where this technique can actually be very successful. If this is a management technique available to you, preparing the site for flooding beforehand can increase success. Cut or burn the site prior to flooding. Next, flood the vegetation with a minimum of 6-18 inches of water over the top of the vegetation for at least 3 months during the growing season. After 3 months drain the site, if possible, or allow it to dry up naturally. Then, cut or burn the re-growth again in late fall, winter, or early spring and submerge once more during the next growing season. It is important that no stems or leaves be allowed to emerge from the water during the growing season as they will supply the plant they are originating from with oxygen thus preventing it from drowning. This requires close monitoring of the wetland and the water level during the 3-month period to ensure the vegetation remains submerged.

Water level manipulation can also be used to encourage desirable plant species. For detail on this, please refer to Chapter 5.

8) Mechanical Woody Vegetation Removal

As used here, the term mechanical means cutting, sawing, clipping, mowing, and uprooting to remove woody vegetation. A variety of tools and equipment can be used to cut back or remove the vegetation, depending on the size of the wetland as well as the size and density of the woody vegetation to be removed. Tools used can range from limb loppers to chain saws to tractor driven shredders to dozers and backhoes. The amount of time required for different techniques is also an important consideration. If there are a significant number of trees, and/or they are of a large size, it may be necessary to hire a contractor to do the job for you.

In most cases, all woody debris generated by this type of work should be cleaned up and hauled to an upland site where it can be burned and the residue buried. It may be acceptable in some eastern Nebraska wooded wetlands and riverine sites to leave a few logs and tree limbs in the wetland as would naturally occur in these situations.

Many hardwood species such as willow, green ash, or cottonwood will re-sprout if simply cut off at ground level. Stumps of these species should be chemically treated within 5 minutes of cutting to prevent this from occurring.

Note that the mechanical removal of wood vegetation may trigger Swampbuster and 404 permit compliance issues and if you are in doubt the appropriate agency should be contacted. Also, woody vegetation removal, including the timing, needs to be done in compliance with the Migratory Bird Treaty Act.

9) Wetland Management Considerations and Recommendations for Ponds and Reservoirs

Ponds and reservoirs are artificially created deepwater habitats with fringe wetlands generally found within the littoral zone. They were constructed for the primary purposes of flood control and livestock watering. These water bodies can also provide important fish, wildlife, and water-based recreation opportunities on some Wildlife Management Areas. However, as the ponds and reservoirs have aged, these opportunities have been reduced due to a decline in the quality of the water and the fish and wildlife habitat. The Nebraska Game and Parks Commission has produced a Guide to help managers to improve wetlands associated with ponds and reservoirs, and this should be consulted for detailed information.

Appendix E- Table of Information Needs

Wetland conservation information needs for Nebraska.

Category	Project/Actions to address information needs	Region or complex
Fauna	Evaluate wildlife use and selection	Central Table Playas
Fauna	Survey the breeding and/or migrating birds	Eastern Saline
Fauna	Measure the diversity and abundance of the invertebrate community	Eastern Saline
Fauna	Survey the breeding and/or migrating birds	Missouri River
Fauna	Survey the breeding bird community	Rainwater Basin
Fauna	Measure the diversity and abundance of the invertebrate community	Rainwater Basin
Fauna	Conduct a spring migration shorebird study	Rainwater Basin
Fauna	Evaluate methods to allow fish passage around structures used to address head-cutting streams	Sandhills
Fauna	Evaluate wildlife use and selection	Southwest Playas
Fauna	Study the ecology of muskrats, esp. their response to sedimentation making wetlands shallower	Statewide
Fauna	Study reptile/amphibian use	Statewide
Fauna	Evaluate wildlife use and selection	Todd Valley
Fauna	Evaluate wildlife use and selection	Western Alkaline
Fauna	Evaluate factors affecting amphibian community composition	Sandhills
Fauna	Evaluate pollinator use of wetlands	Statewide
Fauna	Monitor the health of cold water streams and their associated wetlands	Statewide
Fauna	Develop population estimates for focal species using bird population survey by BCR, BUL, or other logical ecoregion, to track population change	Statewide
Fauna	Determine if focal species are limited during the annual cycle by habitat quantity or quality	Statewide
Flora	Conduct vegetation monitoring	Eastern Saline
Flora	Evaluate vegetation management actions	Rainwater Basin
Flora	Evaluate techniques to control cattail and reed canary grass	Statewide
Flora	Evaluate moist-soil management techniques	Statewide
Flora/Fauna	Evaluate the plant and animal community response to wetland restorations	Statewide
Flora/Fauna	Evaluate Platte River slough restoration response by plants and wildlife	Platte River

Flora/Fauna	Evaluate Sandhills grazing systems on wetland plants and wildlife	Sandhills
Flora/Fauna	Evaluate grazing in wetlands: Influence of timing, stocking rate, and type of livestock	Statewide
Flora/Fauna	Evaluate the response of wetland flora and fauna to the removal of invasive carp from Sandhills lakes/wetlands	Sandhills
Functions	Evaluate Missouri River habitat improvement and mitigation projects	Missouri River
Functions	Quantify historic and current playa numbers and assess function	Southwest Playas
Functions	Evaluate overall changes in wetland distribution and condition	Statewide
Functions	Evaluate the change in wetland size in relation to precipitation	Statewide
Functions	Evaluate management practices (burning, grazing, disking, spraying, etc.)	Statewide
Functions	Quantify greenhouse gas mass balance in Great Plains wetlands	Statewide
Functions	Develop Hydrogeomorphic Models (HGM) for wetland subclasses	Statewide
Functions	Evaluate the role of Great Plains wetlands in sequestering carbon	Statewide
Functions	Evaluate the role of Great Plains wetlands in providing pollinator habitat	Statewide
Functions	Develop and validate models quantifying wetland functions and services	Statewide
Functions	Evaluate and model the effects of climate change on the condition of wetlands	Statewide
Functions	Deploy webcams to evaluate wildlife use, and change in wetlands over time	Statewide
Functions	Compare the amount of wetland wildlife foods produced among various wetland types	Statewide
Functions	Evaluate importance the public places on various ecological goods and services (e.g., water filtration, hunting/viewing, etc.) provided by wetlands important to birds and other wildlife	Statewide
Hydrology	Evaluate the hydrology of Eastern Saline wetlands, including supplementing the wetlands with saline groundwater	Eastern Saline
Hydrology	Quantify the role of Southwest Playas and/or Central Table Playas in groundwater recharge	Playas
Hydrology	Conduct a hydrology study to determine water budgets	Rainwater Basin
Hydrology	Evaluate the relationship between wetlands and groundwater recharge	Rainwater Basin

Hydrology	Evaluate the relationship between wetlands and water quality, esp. nitrates and pesticides	Rainwater Basin
Hydrology	Evaluate the influence of culturally-accelerated sedimentation on groundwater recharge	Playas
Hydrology	Evaluate the influence of various hydrology drivers on plant and wildlife communities	Sandhills
Hydrology	Study the hydrology of Western Alkaline wetlands	Western Alkaline
Landuse	Evaluate the effects of urban encroachment and disturbance	Eastern Saline
Landuse	Evaluate conservation efforts on privately-owned wetlands	Statewide
Planning	Prioritize Missouri River wetlands for restoration	Missouri River
Planning	Conduct the aerial Annual Habitat Survey to quantify wetlands and evaluate functions	Rainwater Basin
Planning	Develop a GIS/waterfowl model to evaluate and rank wetland restoration and acquisition	Rainwater Basin
Planning	Develop BMPs for playas related to bird communities	Playas
Planning	Evaluate wetland buffer needs and effectiveness	Statewide
Planning	Categorize and evaluate of publicly owned wetlands	Statewide
Planning	Determine the frequency of farming of wetlands	Statewide
Planning	Develop a restorable wetlands database for private lands and public lands	Statewide
Planning	Develop a mitigation monitoring system	Statewide
Planning	Establish a cooperative tracking system between Partners for Fish and Wildlife and WIP	Statewide
Planning	Establish a water-level monitoring program on WMA's	Statewide
Planning	Track the extent and rate of tree encroachment in wetlands	Statewide
Planning	Implement Structured Decision Making to evaluate wetland management actions	Statewide
Planning	Evaluate wetland response to changing climate	Statewide
Planning	Use techniques developed for the RWB Annual Habitat survey to evaluate wetlands in other regions of the state	Statewide
Planning	Track the presence and spread of invasive species and evaluate and implement methods to control these species	Statewide
Planning	Conduct human dimensions surveys to better understand human perceptions of wetlands	Statewide
Planning	Conduct studies to evaluate the economic benefits of wetlands	Statewide

Planning	Develop GIS landscape design and decision support tools to help guide and prioritize wetland conservation	Statewide
Planning	Use crowdsourcing data to understand human behaviors with wetland use	Statewide
Soils	Determine sedimentation rates into playa wetlands, including the age of deposition	Playas
Soils	Evaluate the effects of removing sediment, including on the wetland flora and fauna	Rainwater Basin
Soils	Evaluate soil health of wetlands	Statewide
Soils	Evaluate the relationship between hydric soil indicators and hydrology	Statewide