2015 - 2021

Harney Basin Wetlands Initiative Strategic Action Plan

HIGH DESERT PARTNERSHIP

2015 - 2021

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INTRODUCTION

Nearly half a million acres of wetlands and shallow lakes occur in Harney County both on the Malheur National Wildlife Refuge (MNWR) and on surrounding privately owned ranchlands. These wetlands are well established as among the most important wetland complexes in North America for migratory birds (North American Waterfowl Management Plan, 2012). In recent decades, the use of Malheur Lake by breeding birds has declined significantly with the changes in the shallow lake ecosystem from a clear lake with abundant submerged aquatic vegetation and invertebrate fauna to a turbid lake with nearly no submergent vegetation brought about by the abundance of common carp. Figure 1 illustrates the conceptual model of the effects of carp on Malheur Lake. The model of the relationships between carp abundance and wetland conditions that support waterbirds is being developed to use in the monitoring of changes to Malheur Lake as carp are commercially harvested and otherwise reduced.

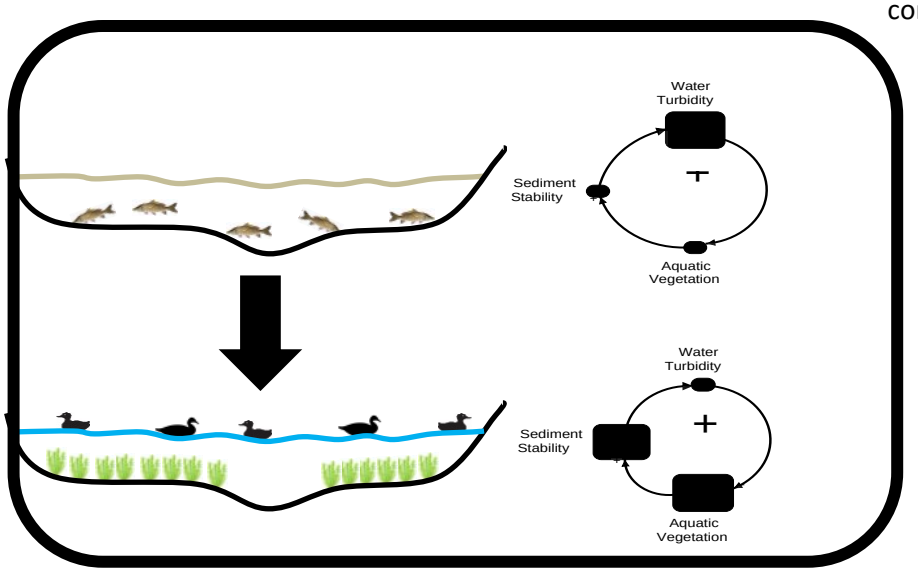


Figure 1. Malheur Lake Conceptual Model

There is also a growing threat to spring migratory bird habitat posed by the conversion of flood irrigation to sprinkler irrigation of the wet meadows in the Harney basin. The flood irrigated pastures and wet meadows are critical staging areas for migratory birds that breed in the Prairie Pothole Region and Arctic. The condition of the birds that leave the flood irrigated emergent wetlands in the Harney basin correlates with their breeding success in the north. Conservation of the feeding and resting habitats in the Harney basin is critical for the migratory waterbirds in the Pacific Flyway.

These wetlands are a significant part of the Southern Oregon-Northeastern California (SONEC) wetland complex that has continental significance for migratory birds of the Pacific Flyway. The wetlands have local, regional and international significance for wetland dependent resident fish and wildlife species and migratory species of waterfowl and waterbirds. The wetland complex is identified as one of the areas of greatest continental significance to ducks, geese and swans in the North American Waterfowl Management Plan (2012). The Harney basin wetlands have the greatest potential for assuring long term conservation within the SONEC because of the protected area status and the cooperative relationships developed to address current conservation issues.

This Strategic Action Plan was developed with a coalition of ranchers, conservation organizations, tribes, local, state and federal agencies, technical experts and others working together for more than five years. Through a collaborative process the Harney Basin Wetlands Initiative (HBWI) partners have produced a common vision and strategy for addressing these challenges (Figure 2). The partners have made significant strides towards bringing about the changes that can reverse these conditions. The Strategic Action Plan outlines the actions necessary to address the known threats, build knowledge, and restore ecological health to the wetlands of the basin while continuing to support the ranching economy in the region. The Harney Basin Wetlands Initiative (HBWI) partners have focused on achieving healthy aquatic systems by adaptively managing invasive common carp, maintaining and enhancing riparian and wet meadow habitats through conservation agreements and by addressing flood irrigation infrastructure.

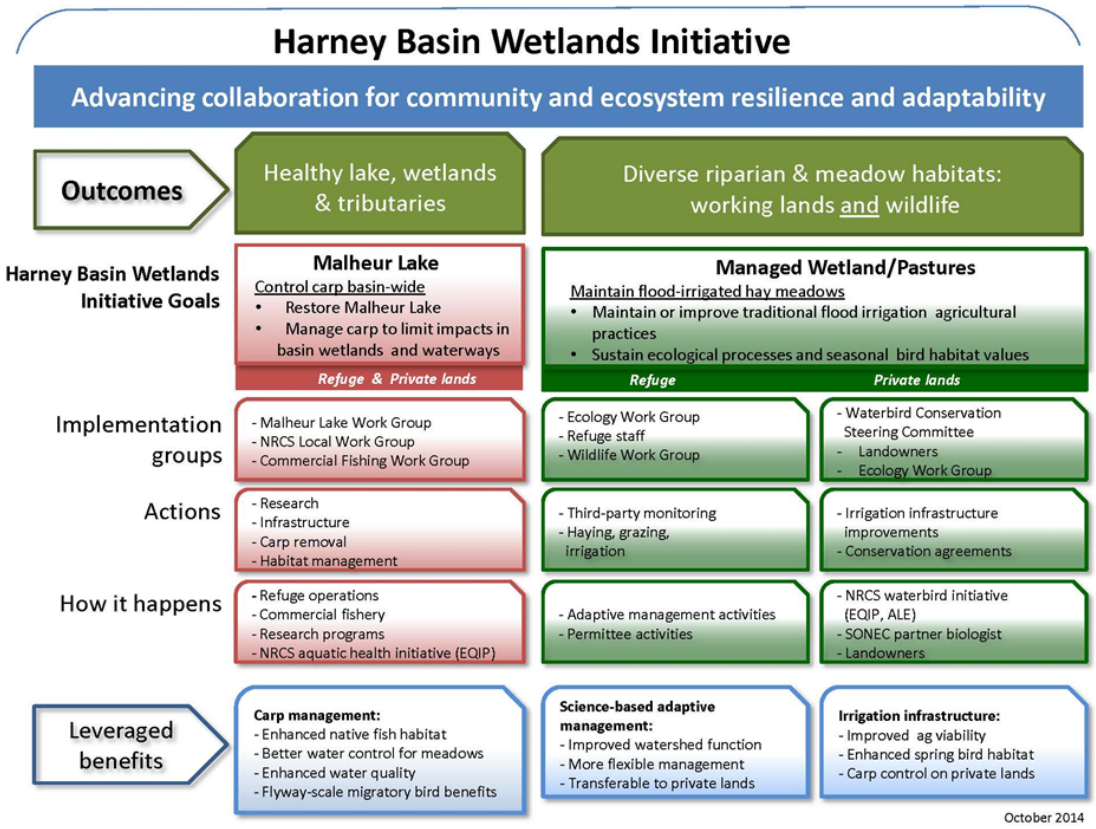


Figure 2. Harney Basin Wetlands Initiative framework outlining the expected outcomes and benefits from implementing conservation projects as part of the Strategic Action Plan.

This Strategic Action Plan is also a guide for and built by the HBWI partners to maintain focus on the dual goals of healthy lakes wetlands, and tributaries and conserved wet meadow habitats. The plan can be used to demonstrate to funders the need and likely outcomes of conservation investments. This document identifies the outcomes, goals, objectives, and actions that the HBWI partners will strive to achieve in the next six years (2016-2022). The plan was developed with input from all partners. The Strategic Action Plan draws from restoration actions identified in several existing plans. The three plans that most directly address the goals of the HBWI are *MNWR Comprehensive Conservation Plan*, the

Conservation Implementation Strategy for Harney Basin Aquatic Health Improvement (Attachment A) and the *Conservation Implementation Strategy for Working Lands Waterbird Habitat Conservation in the SONEC Region* (Attachment B).

Until recently, the specific, detailed strategies for addressing each major emphasis of the HBWI have been housed in separate documents. This Strategic Action Plan represents an effort to bring those separate plans together into a single document. At this time, the HBWI partners have focused on integrating the most immediate objectives and actions from each strategy. Implementation of the plan will be reviewed annually and the plan will be updated as required with information on progress made, lessons learned, and adaptive adjustments.

One of the important elements of this Strategic Action Plan is to increase the understanding of the ecology of the shallow lake and wet meadow systems to judge the efficacy of management actions. Significant and ongoing study of carp behavior, population dynamics and system dynamics of the shallow lake ecosystem is ongoing and will inform management in time.

OUTCOMES

This strategic action plan will focus on three realistic and achievable outcomes for the entire focus area:

Outcome 1: Improved aquatic health by managing invasive carp and implementing habitat improvement projects to improve water quality, native aquatic plant and animal communities, and food resources benefiting migratory and resident bird populations. Aspects of carp management and habitat projects will be carried out by the private sector providing economic benefits to the local economy.

Outcome 2: Assure 10,300 acres of flood-irrigated spring migratory bird habitat on private lands in Harney County over the long-term. Outcome success will be based on private land practices that maintain or enhance management capability for the mutual benefit of migratory birds and forage production. Conservation of strategic landholdings will be pursued particularly where the maintenance of traditional flood irrigation practices among amenable landowners can be assured for the benefits of floodplain function, socioeconomic volatility, and migratory waterbird staging habitat.

Outcome 3: By 2021 the HBWI partners integrated approach to manage carp and improved aquatic health are a model for solving complex natural resource issues and are recognized locally, regionally, and nationally.

SCOPE AND VISION

Vision. The HBWI provides an umbrella for coordination and effective implementation of collaborative efforts to improve and maintain the ecological health of the Basin's wetlands, and the social and economic values they support. A diverse set of partners works to build support for stewardship that generates long-term benefits for the human communities and native fish and wildlife of the Harney Basin wetlands. This effort will build upon the significant contributions private landowners, conservation

organizations, Federal/State agencies, and the Burns Paiute Tribe are already making to the ecological health of the basin.

The HBWI has adopted the vision "*to conserve and enhance the health of Malheur Lake by managing in harmony with ecological forces in collaboration with our neighbors, partners, and friends and to learn from our efforts, successes and failures and the surrounding flood irrigated wet meadows are managed using science based management practices that are common to public and private lands. There is a cooperative relationship between local ranching families and the MNWR staff working to build understanding of how to manage the flood irrigated wet meadows in a manner that reduces carp reintroduction, provides food for migrating waterbirds, and provides a sustainable economic return for ranching families.*"

With organizational support from the High Desert Partnership, the initiative brings together a broad range of public and private partners working to achieve the following:

- Wetland systems: Sustain and improve proper functioning wetland systems and water quality.
- Carp control: Implement a basin-wide carp control strategy to address the greatest threat to the ecological health and functions of Malheur Lake and its associated wetland systems.
- Traditional agricultural practices: Maintain and enhance traditional flood irrigation and haying and grazing practices that sustain important seasonal wetland habitats on private lands.
- Adaptive management: Support adaptive management strategies to meet habitat objectives under MNWR Comprehensive Conservation Plan (CCP) and throughout the basin.
- Local support: Build local support by demonstrating the economic and social benefits of collaborative stewardship and restoration.
- National model: Establish the Harney Basin Wetlands Initiative as a nationally recognized public-private partnership model for landscape-scale restoration.

FOCUS AREA

The focus area for the HBWI partners consists of the watersheds for Harney and Malheur Lakes and the streams and rivers that flow into them – Silver Creek, Silvies River, and Donner und Blitzen River. The focus area includes four 8-digit hydrological units (17120001, 17120002, 17120003, and 17120004). Figure 3 shows the primary subbasins that drain to the closed lakes of Malheur and Harney Lakes. The black outline in Figure 3 is the MNWR boundary which comprises 187,757 acres, nearly all wetlands.

The HBWI partners are focused on improving aquatic health and maintaining wet meadow habitats throughout the focus area, regardless of land ownership, but with a particular focus on MNWR and privately owned flood-irrigated meadows. There are approximately 513,000 acres of wetlands and shallow lakes within the focus area of the HBWI as mapped by the National Wetlands Inventory (Figure 4).

The geography of the focus area has been selected as the critical area necessary to support a holistic, system-wide approach to wetland improvement through water management and carp control. The focus area encompasses the most important spring migratory habitat in Harney County. The HBWI came

out of the recognition of shared interests in ecological and community objectives in this specific geography among the partners. For example, the MNWR CCP identifies aquatic health improvements through carp control in Malheur Lake as the number one priority for Refuge staff, but also recognizes that long-term success in this endeavor will require a basin wide approach. The Natural Resources Conservation Service (NRCS) Harney County Local Work Group identified carp control as the top priority for NRCS. NRCS is positioned to provide technical and financial assistance to private landowners to implement structural and management practices to facilitate carp control and maintain or enhance spring migratory waterfowl habitat on private lands. Oregon Department of Fish and Wildlife (ODFW) has been monitoring and managing fisheries and has an interest in aquatic health improvements as they relate to improving habitat for redband trout and other native fish. Harney Soil and Water Conservation District (SWCD) has identified the Silvies River watershed as a demonstration area for agricultural water quality assessment and improvements. Intermountain West Joint Venture (IWJV) and Ducks Unlimited (DU) have both identified the Harney basin wetlands as a priority area within the SONEC region for conserving the continentally significant wetlands for migratory waterbirds.

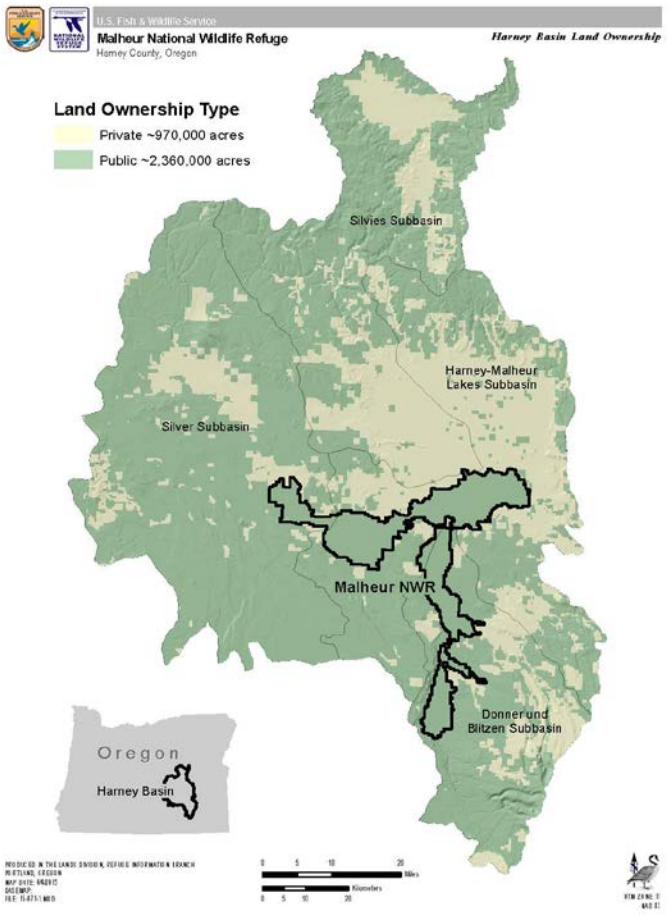
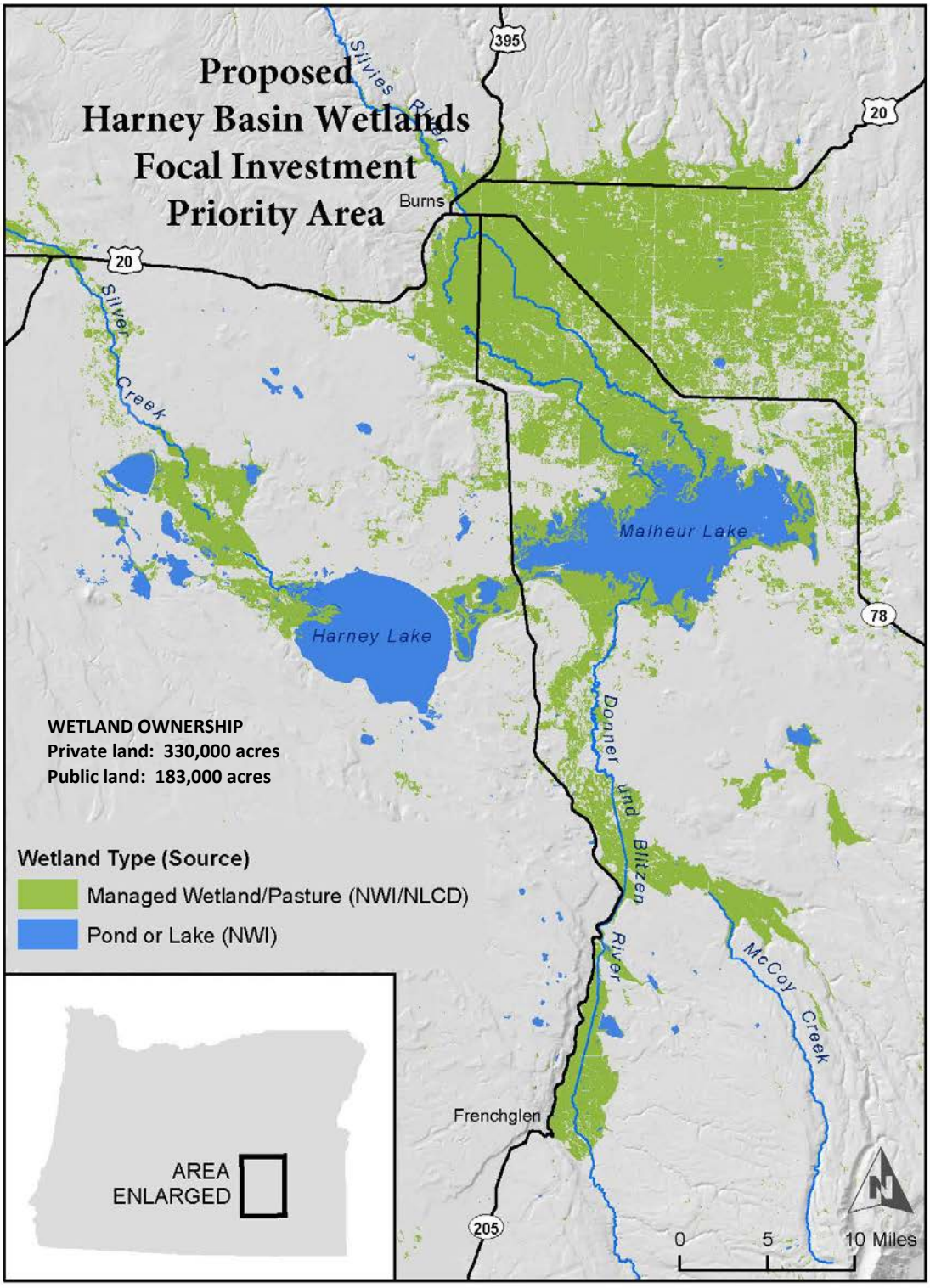


Figure 3. Malheur Lake drainage basins showing public and private land ownership.



Extent of wetlands in the Harney Basin, Oregon. Produced in the U.S. Fish and Wildlife Division of Realty and Refuge Information, Portland, OR. 9/17/2014. File 14-131-2.MXD.

Figure 4. Focused Investment Priority area for Harney Basin Wetlands Initiative. Wetlands mapping from the National Wetlands Inventory (NWI).

Priority Setting within the Focus Area. The priorities for action have been developed as described in Table 1 below and shown in Figure 5 (taken from Corps of Engineers, 2011). "The goal of this carp control strategy differs from previous management plans by including the entire Basin and acknowledging that complete eradication of common carp is impractical. Instead, the focus is on gaining a better understanding of carp population dynamics and using that knowledge to guide investments in a long-term sustainable control program to limit carp to the goal of 100 pounds per acre threshold. Annual carp removal efforts will be required and eradication will only be possible in specific controlled segments of the Basin. Improving the water quality within the Lake will require a shift in the management priorities for the Refuge. Annual removal of carp will be necessary to maintain the basic ecological functions of the Refuge and must be treated as a baseline operating cost. Retrofitting the water delivery system to improve carp management will also require continued capital investment at substantial levels in the years ahead." (Corps of Engineers, 2011)

Table 1: List of priorities for carp removal in Harney Basin based on the phase and management unit

Priority level	Phase	Management Unit
1	Pre-removal monitoring	Malheur Lake
2	Habitat use, Biomass estimate and population structure	Donner und Blitzen Valley
3	Infrastructure modifications	Silvies River
4	Initial removal and long term removal	Double-O

Figure 5. Carp management units of Harney Basin including: Malheur Lake, Donner und Blitzen Valley, Silvies River and Double-O.

Priorities for flood irrigated wet meadow habitat conservation is in the Donner und Blitzen valley by MNWR, however the focus for the FIP work will be in the Silvies River wet meadows. An early effort will

be to develop site specific priorities for irrigation infrastructure improvements in the Silvies River and conservation agreements with private landowners where the greatest benefit for migratory waterfowl can be achieved.

GOVERNANCE/PARTNERSHIPS

The HBWI partners operate under a General Working Agreement. This working agreement sets forth a structure, roles and responsibilities, and agreed to communication and decision making processes. The partners have agreed to use a Coordinating Committee to develop agendas, frame decisions and other specific roles when all partners are unable to get together. The partners have been convened by the High Desert Partnership and facilitated by Oregon Consensus.

Core Implementation Partners. Table 2 provides a compilation of core implementation partners, the experience they bring to the FIP, and their anticipated contributions.

Table 2. Core Implementation Partners and their Roles

Implementation Partner	Experience	Anticipated Contributions
Malheur Lake Partners		
Malheur National Wildlife Refuge	More than a century of managing Malheur Lake	Focus on carp management for waterbird production
Ducks Unlimited	Private lands conservation for waterfowl habitats	Technical assistance, outreach, project design and implementation oversight
Natural Resources Conservation Service	Conservation Implementation Strategy for Harney Basin: Aquatic Health	Technical Assistance, landowner contacts, cost share funding,
Friends of Malheur Refuge	Decades of supporting the mission of MNWR	Funding, volunteer efforts
Oregon Wildlife	Decades of supporting initiatives to assist wildlife management in Oregon	Funding, outreach, publicity
Portland Audubon Society	Supporting initiatives that improve habitat for bird species	Funding, outreach, volunteer efforts
Floodplain Wet Meadow/Pasture Partners		
The Wetlands Conservancy	Supporting initiatives to improve wetland health	Funding, outreach
Natural Resources Conservation Service	Conservation Implementation Strategy for Working Lands for Waterbird Conservation	Technical Assistance, landowner contacts, cost share funding,
Intermountain West Joint Venture	Regional waterbird technical expertise and management planning	Funding, technical advice and evaluation of effects

Portland Audubon Society	Support to improve habitat for bird species	Funding, outreach, volunteer efforts
Ducks Unlimited	Private lands conservation for waterfowl habitats	Technical assistance, outreach, project design and implementation oversight
OSU Extension Service	Technical Advice for state and transition models	Technical advice, landowner contacts
USDA, Agricultural Research Service	Expertise on State and Transition models and their uses in land management	Technical advice
HBWI Coordination/Cooperation		
High Desert Partnership	Strong support for community based collaborative ventures, convened the HBWI has convened forest collaborative program	Convening the HBWI, Applicant for the FIP application, Collaboration and Developing agreement on projects to implement
Harney County Court	Representatives of all the citizens of Harney County	Political support for the HBWI
Harney Soil and Water Conservation District	Conservation program implementer. Lead in Sage grouse conservation, Water quality focus in the Silvies River drainage	Landowner contact, outreach, Project implementation and management
Harney County Watershed Council	Provides technical expertise and funding for projects in the watershed	Landowner contact, project management, grant administration
Private landowners	Generational knowledge and land management experience	Support wetland improvement, access to private lands
Burns Paiute Tribe	Supporting initiatives of wetland health that promote tribal economic and cultural goals	Funding, outreach and awareness
Universities	Multiple universities with discipline specific science capability	Research to evaluate the mechanisms of change in aquatic and wetland systems

CONTEXT: PROFILE OF THE FOCUS AREA

Physical Geography

Overview of landforms. Harney Basin is a hydrographically closed watershed on the northern reaches of the Great Basin. The climatic and geologic conditions in this portion of Oregon have changed significantly over time. The closed lakes receive drainage from the Silvies River and Silver Creek from the

Blue Mountains to the north and northwest. The Donner und Blitzen River drains the Steens Mountains to the south and flows north into Malheur Lake. Harney Lake is the bottom end of the drainage and all water loss from the lake is through evaporation. The broader Malheur-Harney Lakes basin is relatively flat and was a single large lake during interglacial times. The lower reaches of the streams flowing into Malheur and Harney Lakes have broad floodplains with multiple meandering channels that historically flooded with spring freshets.

Water resources. Three major streams (the Silvies River, the Blitzen River, and Silver Creek) flow from the north, northwest, and south to enter the Harney-Malheur Lakes Sub-basin. Water originates primarily from snowmelt and runoff from higher elevations; however, springs contribute some of the flow. Prior to European settlement, the Basin waterways were free running non manipulated systems (USFWS, 2013). The smaller tributaries into the basin are intermittent and disappear into the alluvial fans of the surrounding uplands. Flow into Malheur Lake is dominated by flow from the Donner und Blitzen River (Hubbard, 1975).

Existing stream network. Since the late 1800's, numerous dikes, canals, drains, and water control structures have been installed across the Basin to facilitate the diversion of water for the benefit of grazing and farming. Early manipulation was done to flood-irrigate the wet meadows for ranching purposes resulting in diverted and drained stream channels. The Civilian Conservation Corps constructed significant water diversions in the MNWR in the 1930's. Silvies River is dammed just above Burns and diverted for agricultural uses. The resulting water conveyance network is complex and difficult to manage. With diversions, flows are intercepted and channels are dewatered often leaving no flow to reach the lakes during dry years.

Malheur Lake. Malheur Lake is a shallow lake that is fully mixed. The lake is subject to long fetches from the prevailing winds which mix the water. The lake elevation rapidly reflects runoff and has significant annual fluctuations (Figure 6) as well as rapid changes during the summer.

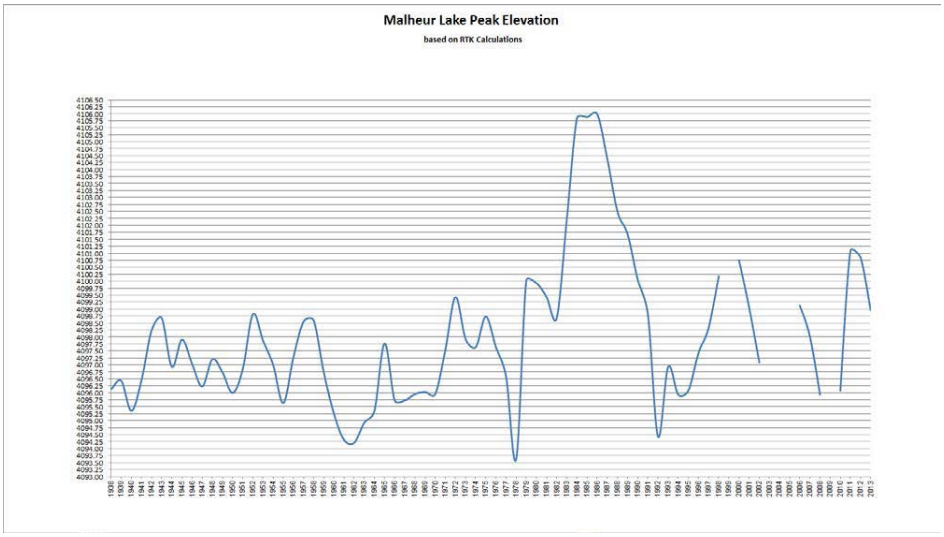


Figure 6. Peak yearly elevations of Malheur Lake from 1938 – 2013. The horizontal axis is years and the vertical axis is lake elevations.

Future Trends. Climatic change is a concern for this Basin. Malheur Lake levels, from 1938 to the 1970's had less variable peak highs and lows when compared to the fluctuations since that date. The past few years have had significant fluctuations from high to low water elevations in the lake. Furthermore, precipitation that has historically come as snow and accumulated as snow pack is predicted to come in rain events which will alter the seasonality of water from the tributaries, lake level elevations, irrigation water availability, wetland habitat management opportunities, and access for carp harvest.

Biotic Systems

Historic vegetation/habitats, fish assemblages, wildlife. Prior to Euro-American settlement, the Harney Basin wetlands responded to the annual cycle of flooding and expanded and contracted with precipitation patterns. The Wallen party of 1859 observed: "the country is a beautiful level valley, covered with luxuriant growth of bunch grass, wild pea vines, and red clover, interspersed with fields of camas on a rich soil abundantly watered by numerous mountain streams This wide savannah or grassy meadow section is abundant; pronghorn, deer, elk, and several species of grouse, prairie chickens, ducks and geese, etc." (Beckham, 1995). This wetland complex was an oasis in the otherwise arid sage steppe landscape of the Northern Great Basin.

The Harney Basin supports a fish fauna mirroring the native fishes of the Columbia. Native species in the basin are the Great Basin redband trout, bridge lip sucker, chiselmouth, northern pikeminnow, red sided, shiner, mountain whitefish, longnose and speckled dace, and Malheur mottled sculpin.

Current vegetation/habitats, fish assemblages, wildlife. Irrigation based hydrologic regimes and livestock grazing have changed the composition and distribution of basin habitats and wildlife. Non-native pasture and forage grasses have been introduced and altered many plant communities. The altered hydrology and loss of variability has permitted reed canarygrass to invade and largely replace the native meadow plant community.

The decline of wildlife species tied to upland or riparian habitats such as the yellow-breasted chat, willow flycatcher, meadowlark, and bobolink has been affected by stream channelization, flow diversion, meadow species conversion and grazing. Conversely, grazing may have benefited other wildlife species such as greater sandhill cranes, horned larks, and snow geese. The current wetlands, flood irrigated pasture, and croplands have helped sustain populations of waterfowl and other birds that prefer short, nutritious grass.

Terrestrial and aquatic exotic species have been introduced either intentionally or unintentionally and have spread throughout the basin. Exotic species such as common carp, sunfish, bluegills, large-mouth bass, and bullheads have impacted native redband trout and Malheur mottled sculpin to a point where the fish are listed as sensitive by the State of Oregon. Significant effort to restore redband trout access throughout the lower Donner und Blitzen River has been undertaken over the last 10 years.

Future Trends. The wetland dependent animal species of the Harney basin will respond to wetland conditions as they are affected by water management, climate change and control of invasive species. Wetland dependent animal communities, especially migratory waterbirds, are the target for restoration efforts of this Strategic Action Plan. As commercial harvest of carp proceeds, improved conditions in Malheur Lake will likely create improved habitat conditions for both migratory and resident waterbirds.

An independent effort to address the habitat needs of sage grouse and other sage-steppe habitat dependent species is active in the Harney basin uplands. The wetland plant communities are important for brood rearing of sage grouse as well.

Local Communities/Human Population

Historic. The profusion of wildlife and plants associated with the Harney Basin wetlands has provided Native Americans with an abundance of food and resources for over 11,000 years. Relatively continuous occupation of sites around Malheur Lake varied with the fluctuation of lake levels. In September of 1872, President Ulysses S. Grant signed into law the 1,778,560 acres Malheur Reservation, centered on Malheur Lake. The reservation was terminated In January of 1883, and converted to public domain, open for settlers to claim under the Homestead Act. A significant portion of the Harney basin was claimed using the Swamp Land Act of 1860 (Pintarich, 1980). The Harney basin was settled by homesteaders and used for ranch expansion from California. The P Ranch in the Donner und Blitzen floodplain has a colorful history and was a dominant force in the settlement of the Harney basin. The ranch site is now part of MNWR. The MNWR was designated by Executive Order in 1908 by President Theodore Roosevelt. The refuge was established to protect the waterbird population from plume hunters at the time. The history of ranching, homesteader-rancher conflict, and public domain land use are reflected in Harney County today.

Current Land Uses. Land ownership in Harney County is approximately 25% private and 75% public. Land cover types are approximately 64% rangelands, 22% forest, 9% crop or pasture land, and 5% wetlands. Today, as in the past, cattle ranching, irrigated hay, and timber and wood products are the major economic enterprises in the county. Climatic characteristics of this semi-arid region of the northern Great Basin limit the types of crops that can be produced. For this reason, irrigated grass hay, pasture, and alfalfa hay dominate the agronomic operations (USGS, 2001).

Future Trends. Land use in Harney County has remained relatively static in recent years. However, there has been a significant increase in irrigated hay land, particularly alfalfa hay, using sprinkler irrigation from ground water. According to the 2012 Census of Agriculture (USDA-National Agricultural Statistics, 2012), irrigated land in Harney County increased by nearly 15,000 acres between 2007 and 2012. During that same time period, harvested irrigated cropland increased by nearly 25,000 acres, while irrigated pastureland decreased by nearly 10,000 acres. It is unclear, however, whether this trend will continue. In 2015, Oregon Water Resources Department announced that they would temporarily stop issuing irrigation well permits in the Harney Basin while the Department conducts monitoring and analysis of declining ground water levels in the basin.

Local Economy

Historic. Harney County has a long and colorful history of resource use and settlement. Fur trappers from the Hudson Bay Company visited the area in 1826 and called the lake "Malheur," the French word for misfortune. The area was traversed by the Meeks Cutoff, an alternative on the Oregon Trail in 1845. Following the 1862 Homestead Act, the area was settled by California based cattle operations, eventually dominated by Pete French (the Cattle King) who amassed more than 140,000 acres of Harney County based on the Donner und Blitzen River (The P Ranch). Logging in the Malheur Forest north of Burns sustained a lumber mill until the late 1980's.

Current Economic Base. Harney County covers approximately 10,000 square miles of high desert and forest land in southeast Oregon. These open spaces are the basis of a rural, outdoor lifestyle enjoyed by approximately 7,150 county residents. The towns of Burns and Hines with approximately 4,240 residents are the hub of a hard working ranching and agricultural community. The community has never quite recovered from the economic loss from closure of the Hines Lumber Mill in 1980. With the majority of the county owned by the federal government, tax revenues necessary to maintain infrastructure are in short supply. One in four children in Harney County exists at or below the poverty level (compared to a 15% state average) and nearly 50% of children in public schools are eligible for free or reduced lunches.

Future Trends. With a renewed emphasis on natural resource sustainability and exploring alternative opportunities for products of natural resource restoration, including small diameter wood products from accelerated forest restoration activities and a commercial fishery for carp management in Malheur Lake, there are a limited number of potentially new jobs in Harney County. Increasing the viability of the wetlands in the Harney Basin can result in increased ecotourism.

CONSERVATION NEED

The decline of the waterbird habitat of Malheur Lake and associated wetlands is a critical problem. The decline occurs in an environment of declining human population from loss of the primary employer in 1980 resulting in high unemployment in Harney County and concern over the potential listing of sage grouse that could affect the ranching community. The leadership in collaboratively addressing sage grouse habitat from Harney County has resulted in part in a no-list decision by the U.S. Fish & Wildlife Service at this time.

There are three major issues in the Malheur basin that need to be addressed by the HBWI; first the cooperative relationship that has developed between private landowners and the MNWR staff needs to be maintained, second the restoration of Malheur Lake through bio-manipulation needs to be done in a way that supports and possibly assists the local economy, and third management of flood irrigated pastures for livestock production needs to be conducted in a cooperative manner to both protect bird habitat and to assure economic return to local ranchers.

Aquatic Health through Carp Control. Common carp (*Cyprinus carpio*), a fish native to Eurasia, were introduced to North America in the 1920s and distributed throughout the country in the 1930s, 40s, and 50s by the U.S. Fish Commission. In the 1950s, common carp became established in the waters of MNWR.

Wide environmental tolerance, high genetic variability, high fecundity, and a broad diet all allow common carp to be a highly successful invasive species. The fish have severe negative impacts on water quality because their feeding behavior removes aquatic vegetation and increases suspended sediments. Carp are a benthic omnivorous feeding fish that disrupts the sediment to find benthic invertebrates and plant materials to eat. Carp impact aquatic animal populations both directly, by feeding on macroinvertebrates, and indirectly, through degraded water quality. In turn, the presence of carp severely impacts migratory bird populations which rely on macroinvertebrates, plants, and fish for food. Their behavior and feeding habits diminish water quality and severely deplete food resources for other aquatic organisms and migratory birds. The result is a shallow, turbid lake with an abundance of carp and few other aquatic organisms.

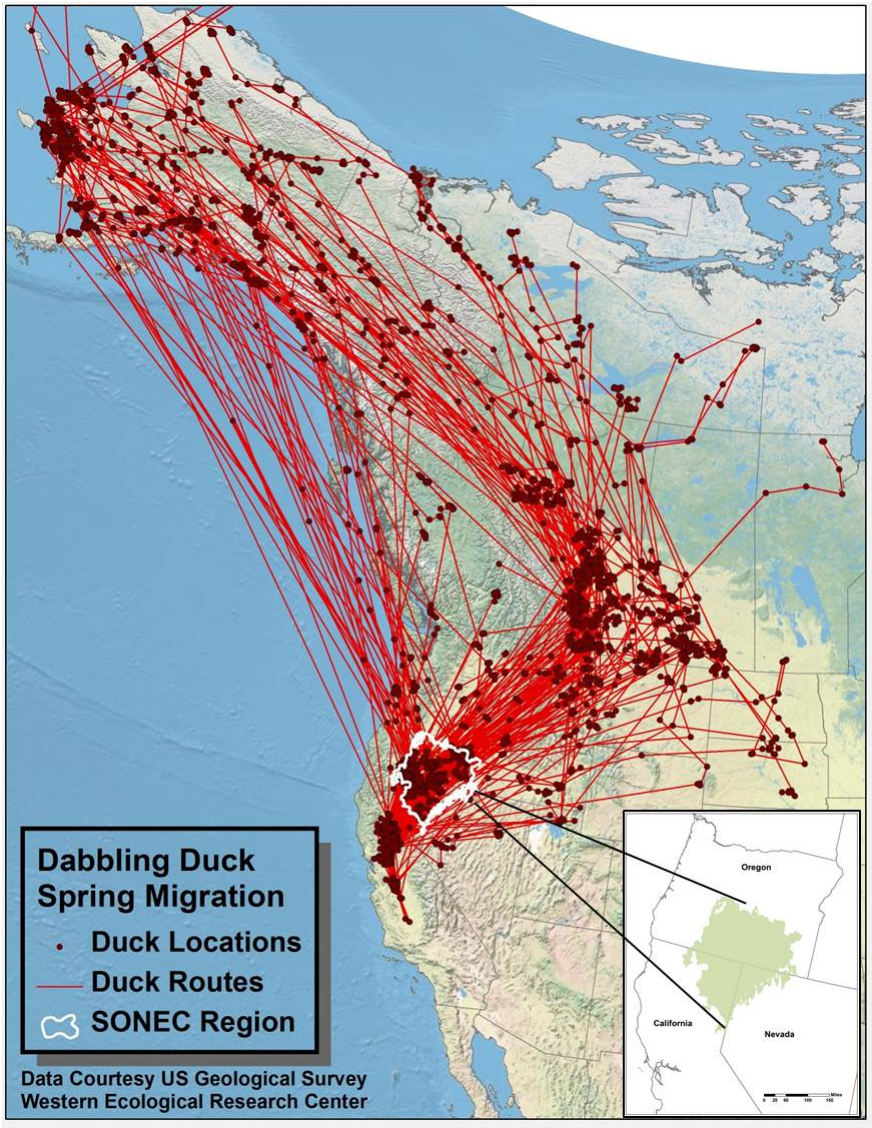
Historically, efforts to remove common carp have focused on the use of Rotenone, a piscicide, in Malheur Lake and the lower Blitzen River. For three to five years following treatment there was improved water quality, increased wetland and aquatic vegetation, and increased bird populations. However, these benefits were temporary (Ivey et.al., 1998). Rotenone treatments resulted in high mortality of the common carp population, but not complete eradication. Some common carp survived the treatments, and others recolonized the treated area from untreated portions of the system (i.e. Silvies River). Bio-manipulation or removal of carp from Malheur Lake to a threshold that allows submerged aquatic vegetation to thrive and water clarity to improve is one goal of this Strategic Action Plan. For greater detail on the carp management efforts see" Improving the Aquatic Health of Malheur National Wildlife Refuge" which is an attachment to the MNWR CCP.

In the past, waterfowl production and use were directly related to the total area of sago pondweed produced annually on MNWR; the more aquatic vegetation available, the higher the level of waterfowl use. Prior to a major influx of carp in 1952, the Lake was noted for high levels of vegetation, especially sago pondweed. Between 1953 and 1954, sago pondweed declined by 80 percent, with no evidence of this plant remaining in the Lake by 1955 (Ivey et al., 1998).

Enhancing wetland conditions of Malheur Lake is crucial because of the critical location within the Pacific Flyway. Historically, Malheur Lake was utilized by up to 35% of the Pacific Flyway's canvasback population, was the second most important redhead production site in the West, and at its peak produced over 100,000 ducklings annually. Malheur National Wildlife Refuge currently averages about 2-7% of its former waterfowl production capability (USFWS, 2010).

Flood Irrigated Wet Meadows. During spring migration, the Silvies River floodplain supports high numbers of migrant waterfowl. A study conducted by the Service in the late 1970s and early 1980s found that 56 percent of the waterfowl use in the Harney Basin occurred on the private lands of the floodplain during the spring. Scientists from the U.S. Geological Survey (USGS) have documented the importance of such flood irrigated areas in southeastern Oregon and northeastern California; these areas support about 80 percent of the Pacific Flyway pintails during spring migration (Miller et al. 2010).

Northern Pintails, as well as most other waterfowl saw a sharp decline in numbers in the late 1970's and early 1980's. Urbanization and changes in agricultural practices throughout the continent created a habitat deficit. This deficit in conjunction with continent wide drought conditions in the 1970's and 1980's led to the sudden decline of these migratory birds. While there has been a recovery of numbers, the threats remain with changing climate and irrigation conversion.



Within the Pacific Flyway management region, there are 14 areas of concern named in the North American Waterfowl Management Plan (NAWMP). The Intermountain West contains six of these regions (NAWMP, 2012). IWJV named the Great Salt Lake and the SONEC regions as their two top priorities in 2012. It is estimated that about 50% of the Northern Pintail's continental population uses the Pacific Flyway. Of those, approximately 70% (1/3 of the continental population) pass through the SONEC region before heading north either following the Rockies or west of the Cascades (Figure 7). It is the food resources in the flood-irrigated pasture and hay land that keeps these birds returning annually.

Figure 7: Spring migration routes by strategy category of adult female Northern Pintails PTT-tagged in the northern Central Valley of California during December-January and tracked annually through August each year 2000-2003 (Michael R. Miller, 2005).

The SONEC region is an important staging area for migrating birds to rest, forage, and then continue their journey to the breeding grounds to the north. Common birds that pass through the SONEC include Northern pintails, Trumpeter swans, American widgeon, greater white-fronted geese, and snow geese. The farmed wetlands Harney County provides ideal habitat for redhead ducks, mallards, and Sandhill cranes and other species that nest in the basin. These habitats support the largest breeding population of bobolink west of the Great Plains.

The foraging value of flood-irrigated habitats to the principal waterfowl using them in the SONEC region has been evaluated through field studies. Outside of the Klamath Basin, approximately 70% of northern pintail use occurred on private lands and flood-irrigated habitats used for livestock forage production. The conservation goal of 10,300 acres of protected habitat was based on these models and the knowledge that changes in the Klamath Basin may affect opportunities in that portion of the SONEC (see Attachment B).

CONSERVATION/RESTORATION TARGETS

Aquatic Health through Carp Control. The MNWR CCP established a target of reducing carp densities in Malheur Lake to 100 lb/ac, based on the best available science at the time, which was research on invasive carp in lakes in Minnesota (Bajer et.al., 2009). The applicability of this target as a threshold for conversion to a clear lake system with submerged aquatic vegetation is being tested. The *Conservation Implementation Strategy for Harney Basin Aquatic Health Improvement* focuses on outcomes such as the changes in water quality, macroinvertebrates, native fish populations, aquatic and riparian vegetation, and migratory bird populations that would indicate that the actions taken to control carp are having the intended benefits to aquatic health.

The conservation target is a clearwater lake with abundant submerged macrophytes and invertebrates that support a diverse waterbird population for both migratory and residential waterbirds. The measurements to be taken to assess changes will be water clarity, macroinvertebrate community, submerged aquatic vegetation abundance, and waterbird use. These indicators will provide information on progress towards the target of a clear lake system.

Flood Irrigated Wet Meadows. Conservation targets for spring migratory bird habitat were established on the basis of North American Waterfowl Management Plan population targets for northern pintail in the SONEC region and USGS bioenergetics modeling to calculate habitat acres needed to support the target population.

Formulation of the Strategic Action Plan using applicable plans. This Strategic Action Plan has been developed from the elements of a number of plans of partners in the basin that are collectively seeking to make a difference in the ecological health of the Harney basin wetlands. The planning processes have been variously conducted but the common elements have included multi stakeholder participation and coordination with the Harney County Court and the local ranching community. The Strategic Action Plan takes elements from the existing plans that connect to the ecological outcome of a healthy Malheur Lake and spring migratory bird habitat on private land. Table 3 below describes eight different plans the HBWI partners have drawn from in the development of this Strategic Action Plan.

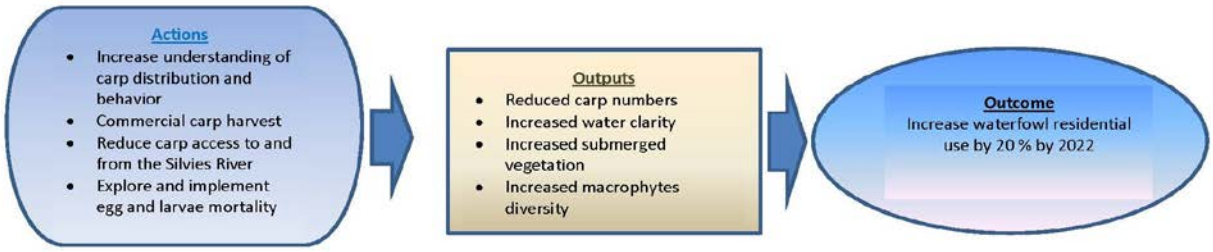
Table 3. Harney Basin regional plans and contributions to this Strategic Action Plan.

Contributing Plans	Primary Partner	Description
1. Malheur National Wildlife Refuge Comprehensive Conservation Plan (2013)	U.S. Fish and Wildlife Service	The U.S. Fish and Wildlife Service, in collaboration with partners, completed the Final CCP to guide management of the MNWR for the next 15 years. Actions for protecting and sustaining the MNWR habitats, migratory bird populations, and other fish and wildlife species, recreational opportunities and cultural resources are identified in the Final CCP.
2. Greater Harney Basin Agricultural Water Quality Management Area Plan and Rules (2011)	Harney Soil and Water Conservation District.	The Harney Soil and Water Conservation District, a primary source of landowner assistance, was a major participant in the development of this plan. The Greater Harney Basin Area Plan guides landowners on how to prevent pollution. Its goal is to "limit water pollution from agricultural activities to help achieve water quality standards that help protect beneficial uses."
3. Conservation Implementation Strategy for Harney Basin Aquatic Health Improvement (2010)	Natural Resources Conservation Service	In a cooperative effort between NRCS and MNWR, a conservation implementation strategy was developed to control invasive common carp and improve aquatic health in Harney and Malheur Lakes and the streams and rivers that flow into them.
4. Conservation Implementation Strategy for Working Lands Waterbird Habitat Conservation in the SONEC Region (2015)	Natural Resources Conservation Service	This plan was developed cooperatively by NRCS, IWJV, and DU to maintain and enhance spring migratory waterbird habitat in Harney and Lake Counties in both the short and long term.
5. Intermountain West Joint Venture Southern Oregon-Northeastern California (SONEC) Habitat Conservation Strategy (2013)	Intermountain West Joint Venture	The IWJV is supporting a science-based, collaborative and partner-driven approach to conservation delivery in SONEC. Over the last 15 years, conservation delivery opportunities have focused on enhancing wetland habitat on public lands and assisting livestock producers with repairing flood-irrigated infrastructure. The primary focus of this effort will be to work cooperatively with private landowners on a watershed scale. The objectives of this effort will be to accelerate riparian habitat restoration, repair flood-irrigated infrastructure and promote conservation easements where amenable.
6. Management of Donner und Blitzen River Redband Trout (2013)	Oregon Department of Fish and Wildlife	ODFW is conducting research on the movements and importance of Malheur Lake for redband trout. The results of the study will allow ODFW to: Thoroughly assess population status and trend, Provide appropriate management to ensure future fishing opportunities,

		Write effective conservation plans, and assess response of fish populations to changes in climatic conditions.
7. Oregon Conservation Strategy (2009)	Oregon Department of Fish and Wildlife	The Oregon Conservation Strategy identifies two Conservation Opportunity Areas within the area of the Harney Basin Wetlands; NBR-07 Silvies River Floodplain, and NBR-08 Harney Malheur Area. The recommended conservation actions include: Initiate or continue wet meadow conservation and restoration efforts, control invasive carp in Malheur Lake area, restore drainage and manage water flows to maintain or enhance wetland habitats.
8. Oregon Closed Lakes Basin Wetland Conservation Plan (2012)	The Wetlands Conservancy report to EPA	This landscape-scale conservation plan focuses on the Guano, Harney, and Warner sub-basins in Harney and Lake Counties. Flood irrigation occurs on about 140,800 acres, and most floodplain areas have extensive networks of irrigation infrastructure. The plan recommends (1) restoring natural hydroperiods where feasible, (2) flexibility in irrigation, grazing, and haying schedules to improve synchronization with annual variations in water quantity, duration and timing of runoff, and (3) developing state and transition models and water balance models to better inform management decisions.

OUTCOMES AND SMART GOALS AND OBJECTIVES

Aquatic Health and Carp Control



Outcome 1: **Improved aquatic health by controlling carp and implementing habitat improvement projects in order to improve water quality, native aquatic plant and animal communities, and food resources for migratory bird populations.**

SMART Goal 1.1: By 2020, determine the extent of the geographic range of common carp within the focus area, estimate the number and age/size distribution of the carp population, identify separate carp populations that may exist, and understand carp movements and the connectivity of carp populations within the hydrologic system. As of June 2015, significant progress has been made toward understanding carp population dynamics in the focus area. Existing data on carp presence/absence and fish assemblage has been collected from multiple partner agencies and is currently being entered into a centralized geodatabase that will enable HBWI partners to view and analyze the data (expected completion date: July 2015). Currently, carp are known to be present in Malheur Lake, the Blitzen River as far south as Page Springs Dam, Diamond Drain, Silver Creek as far north and including Moon

Reservoir, and the Lower Silvies River. Data collected indicate that carp are not present in the Blitzen River above Page Springs Dam. Data are currently being collected and/or analyzed for the tributaries to the Blitzen River and Diamond Drain. The presence and/or distribution of carp in the lower Silvies River, Silver Creek above Moon Reservoir, and the upper Silvies River still needs to be determined. The current understanding is that there are potentially 3 separate carp populations within the focus area: (1) Lower Silvies/Malheur Lake/Diamond Drain/Blitzen River population, (2) Silver Creek population, and (3) Upper Silvies population (if present). Data are currently being collected regarding movements of carp between Malheur Lake and the Blitzen River. Additional data collection is needed to understand seasonal carp movements within Malheur Lake and carp movement between Malheur Lake and lower Silvies River.

Objective 1.1A: Determine the extent of the geographic range of common carp within the focus area and the number and age/size distribution of the carp population by 2018.

Action 1.1A1: Complete fish assemblage survey, including collection of carp otoliths, in the lower Silvies River (ODFW).
Action 1.1A2: Complete fish assemblage survey, including collection of carp otoliths, in Silver Creek (ODFW).
Action 1.1A3: Complete fish assemblage survey, including collection of carp otoliths, in upper Silvies River (ODFW).
Action 1.1A4: Analyze otoliths collected during fish assemblage surveys and develop a relationship between length and age class of carp (MNWR).

Objective 1.1B: Identify separate populations of carp that may exist and develop an understanding of carp movements and connectivity within the hydrologic system by 2020.

Action 1.1B1: Evaluate carp movement between Malheur Lake and Blitzen River (MNWR, ODFW).
Action 1.1B2: Evaluate seasonal carp movements within Malheur Lake, if/when lake conditions are suitable (MNWR, OSU).
Action 1.1B3: Evaluate carp movement between Malheur Lake and lower Silvies River, if/when lake conditions are suitable (MNWR, OSU, ODFW).

SMART Goal 1.2: By 2018, determine the maximum carp population size or density that can be tolerated and still achieve the desired future outcome, and establish target population parameters.
The CCP for MNWR established a target of reducing carp densities in Malheur Lake to 100 lb/ac, based on the best available science at the time, which was research on invasive carp in lakes in Minnesota (P. Bajer, 2009). However, uncertainty remains as to whether this target will be appropriate and sustainable for Malheur Lake and its tributaries, which differ significantly from the waterbodies in Minnesota.

Objective 1.2A: Determine the maximum carp population size or densities that can be tolerated and still achieve the desired future outcome, and establish target population parameters for common carp.

Action 1.2A1: Conduct life stage density study on Malheur National Wildlife Refuge to quantify aquatic health response to varying densities of carp (MNWR, USFWS - Abernathy Fish Tech Center).

Action 1.2A2: Utilize results of life stage density study to establish target population parameters (MNWR).

SMART Goal 1.3: By 2027, isolate portions of the carp population, prevent carp access to key habitat areas, and limit movement between isolated populations, using structural or management practices in strategic locations. In October 2014, LiDAR data was collected for the lower Silvies River floodplain and the entirety of MNWR. This data can assist the HBWI partners greatly in understanding the hydrology of the focus area and identifying strategic locations for restricting carp movement. In addition, MNWR has completed an inventory and evaluation of all water control structures on the Refuge. A similar inventory of structures off-refuge would be useful in identifying where opportunities already exist for restricting carp movement.

Objective 1.3A: Develop maps showing hydrologic connectivity within the focus area in high, medium, and low water years by 2017.

Action 1.3A1: Post-process and analyze LiDAR data, making usable layers at specific elevations (Ducks Unlimited, USFWS, OWEB).

Action 1.3A2: Use Digital Elevation Model to identify areas that are not potential carp habitat (i.e. stream gradient too high).

Action 1.3A3: Obtain LiDAR data for remainder of focus area, as funding allows.

Objective 1.3B: Identify strategic locations for restricting carp movement within the hydrologic system by 2020.

Action 1.3B1: Inventory and map water control structures within the focus area (NRCS, ODFW, WRD).

Action 1.3B2: Incorporate hydrologic data and structure inventory data for both on and off Refuge into geodatabase (NRCS).

Action 1.3B3: Analyze data to identify strategic locations for restricting carp movement (MNWR, NRCS, ODFW).

Action 1.3B4: Conduct an analysis of methods for restricting carp movement that considers effectiveness, cost, frequency of hydrologic connectivity, and other factors.

SMART Goal 1.4: By 2022, initiate full implementation of integrated pest management strategy for carp control. The MNWR Carp Management Plan and CCP Implementation Plan include a literature review and discussion of a wide range of methods for carp control, and lists projects and methodologies for improving aquatic health. To date, significant effort has gone into evaluating and implementing a variety of carp control options. Four ladder traps have been installed on the Blitzen River and have proven very efficacious in trapping carp. Carp have been removed from Boca Lake, on Malheur National

Wildlife Refuge, by drying the lake and installing a fish screen to prevent carp from reentry. Commercial fishing has been shown to be a viable control option on Malheur Lake and a contract for commercial harvest of carp from the lake has been developed between MNWR, Oregon Wildlife, and a private party. University of Minnesota researchers conducted a study of egg and larval predation by resident fish species and found that black bullhead feed voraciously on carp eggs. Abernathy Fish Tech Center has conducted preliminary testing using electrical current to shock eggs and larval carp stages, and found that this methodology warrants further study.

Objective 1.4A: Evaluate effectiveness of commercial harvest of carp control by 2020.

Action 1.4A1: Field test the use of electrical current to kill the egg and larval stages of carp (MNWR, Abernathy Fish Tech Center).

Action 1.4A2: Assess methodologies, such as sonication, for herding carp to locations where they can be removed, genetic manipulation and other methods to control different life stages of carp (MNWR).

Objective 1.4B: By 2022, implement an Integrated Pest Management (IPM) strategy for the reduction of carp populations. Prioritize carp populations or habitat areas for control and address each in a logical order that considers potential for re-infestation, expected success rates, treatment costs, and expected benefits to aquatic health and migratory bird populations.

Action 1.4B1: Manage carp traps and screens on the Blitzen River annually to reduce carp abundance (MNWR).

Action 1.4B2: Implement and continue to evaluate success of commercial harvest of carp from Malheur Lake (MNWR, Oregon Wildlife, private party).

SMART Goal 1.5: Gather baseline data to determine pre-treatment and early stage treatment aquatic health conditions at representative sites within the focal investment priority area, including water quality, macroinvertebrate populations, native and non-native fish populations, aquatic and riparian vegetation, and migratory bird populations. Monitor changes in these parameters through 2040 to determine whether carp control efforts are having the intended benefits to aquatic health conditions. As of June 2015, standardized protocols have been developed for inventory and monitoring of water quality (dissolved oxygen, conductivity, temperature, depth, Secchi depth, salinity, and pH), macroinvertebrates, fish species, submerged aquatic vegetation, and birds. These protocols are being implemented annually on MNWR. Refuge data on water quality are currently being incorporated into the centralized geodatabase. Harney SWCD is currently conducting assessments of riparian vegetation in the Silvies watershed, as part of the implementation of their agricultural water quality demonstration area. Oregon State University (OSU) and ODFW conduct bird surveys in the Harney Basin. Currently, baseline aquatic health data has been collected and will continue to be monitored for the duration of the project on MNWR. However, significant effort will be required to gather baseline data and

implement ongoing monitoring of aquatic health conditions for portions of the focus area outside the Refuge boundaries.

Objective 1.5A: Gather baseline data to determine pre-treatment and early treatment effects on aquatic health conditions through 2020.

Action 1.5A1: Compile aquatic health baseline data for Malheur National Wildlife Refuge and enter into geodatabase (MNWR, NRCS).
Action 1.5A2: Issue a data call and gather existing aquatic health baseline data from all relevant sources for portions of the focus area outside the Refuge boundaries (various).
Action 1.5A3: Compile off-refuge baseline data and enter into geodatabase (MNWR, NRCS).
Action 1.5A4: Develop and implement an inventory and monitoring plan for off-refuge aquatic health conditions (various).
Action 1.5A5: Conduct sediment sampling to characterize the nature and chemical status of the sediments in Malheur Lake (MNWR).
Action 1.5A6: Evaluate trends in emergent and submergent vegetation at Malheur Lake (Brigham Young University, MNWR).

Objective 1.5B: Monitor aquatic health conditions through 2040 (or at least 5 years beyond full carp control efforts) to quantify the response and determine whether aquatic health objectives are being met.

Action 1.5B1: Collect monitoring data annually and enter into geodatabase for analysis (MNWR, NRCS).
Action 1.5B2: Develop a model of carp population dynamics and ecosystem response to assist in analyzing alternative strategies, evaluating expected responses, and prioritizing actions.
Action 1.5B3: Conduct monitoring at control, untreated, and treatment sites during project implementation to determine effects and determine need for adaptive management.
Action 1.5B4: Develop success stories, publications, and educational materials to inform the public and interested parties of the results.

Flood Irrigated Wet Meadows

Outcome 2: **By 2021, secure 10,300 acres of flood-irrigated spring migratory waterbird habitat within the focal investment priority area through either conservation easements or through practices that improve management ability and reduce the incentive for converting to other uses by September 30, 2020.**

SMART Goal 2.1: By 2018, complete an assessment of factors influencing wet meadow habitat loss and the current level of threat to flood-irrigated meadows in the focus area. Currently, there are no good assessments of the extent or rate of flood-irrigated habitat loss or flood to sprinkler irrigation conversion specific to the SONEC region or the Harney Basin Wetlands Initiative focus area. Intermountain West Joint Venture is in the process of analyzing 30 years of aerial photography to develop this assessment for the SONEC.

Objective 2.1A: Assess the expected extent or rate of flood-irrigated habitat loss that would occur in the absence of a targeted conservation effort by 2018.

Action 2.1A1: Develop a cost/benefit analysis of flood to sprinkler irrigation conversion for agricultural producers in the focus area (NRCS).

Action 2.1A2: Utilizing the IWJV assessment of 30 year wetland losses in SONEC and the cost/benefit analysis for flood to sprinkler irrigation conversion, assess the expected changes in the near term for the focus area (NRCS, IWJV, DU).

SMART Goal 2.2: By 2020, local agricultural producers, conservation partners, and interested parties are aware of the benefits of traditional flood-irrigation practices in wet meadow habitats for providing spring migratory waterbird habitat, as evidenced by participation in and support of efforts to maintain and enhance these practices and habitats.

Objective 2.2A: Conduct outreach to local agricultural producers.

Action 2.2A1: Develop and distribute educational materials and/or hold outreach events regarding the benefits of retaining flood-irrigation practices and practices that benefit agricultural production and waterbird habitat.

Action 2.2A2: Distribute cost/benefit analysis of flood to sprinkler conversion for wet meadows in the focus area to local agricultural producers.

Objective 2.2B: Conduct outreach to conservation partners and interested parties.

Action 2.2B1: Develop and distribute educational materials and/or hold outreach events regarding the benefits of retaining flood-irrigation practices and practices that benefit agricultural production and waterbird habitat.

SMART Goal 2.3: By 2020, secure 5,300 acres of privately owned wet meadow habitat under working land conservation easements in focused investment priority area.

Objective 2.3A: By 2020, secure 5,300 acres of privately owned wet meadow habitat under working land conservation easements in the focused investment priority area.

Action 2.3A1: Conduct outreach to third party lands trust(s) to recruit willing and able easement holder(s) (TWC, DU).

Action 2.3A2: Secure conservation easements on 5,300 acres of privately owned wet meadow habitat in the focused investment priority area that ensure maintenance of habitat values sustained by flood irrigation and traditional haying and grazing practices (Land trusts).

SMART Goal 2.4: By 2020, provide technical and financial assistance to improve management ability and reduce the incentive for converting to other uses on 5,000 acres of privately owned wet meadow habitat in the focused investment priority area. As of June 2015, a partner biologist position has been established to facilitate delivery of technical and financial assistance to private landowners. The position is contracted through DU and housed with NRCS. Funding for the position comes from NRCS, IWJV, DU, MNWR, and Harney SWCD. In 2015, NRCS began offering funding for private landowners through the Environmental Quality Incentives Program for improvements to flood-irrigation infrastructure to maintain or enhance wet meadow habitat. The partners have also developed a flood-irrigation enhancement for national consideration and adoption into the Conservation Stewardship Program of NRCS. MNWR is currently conducting a study in the wet meadows of the Refuge to determine the relationship between hydrology and plant community expression. This study will eventually result in the development of a state and transition model for wet meadows, which in turn will be utilized to develop management recommendations for achieving desired plant communities. It would be beneficial to expand this study to wet meadows off the MNWR, in order to capture a wider range of soil types and management regimes.

Objective 2.4A: Objective 2.4A: Evaluate the impacts of various management practices and irrigation infrastructure alterations and improvements on wet meadow productivity and habitat values and incorporate lessons learned into management recommendations. (Ecology Work Group).

Action 2.4A1: Install piezometers and monitor vegetation in wet meadow habitats to determine the relationship between plant expression and depth to water table (MNWR, TWC, DU, USDA-ARS, OSU).

Action 2.4A2: Conduct field-based investigations of hydrology, vegetation, adaptive management, and bird-use to evaluate the effectiveness of restoration treatments and to inform successive treatments. (Ecology Work Group).

Objective 2.4B: Assist private landowners in improving irrigation infrastructure, management efficiency and forage production on 5,300 acres of wet meadow habitat within the focal investment priority area. (DU, NRCS).

Action 2.4B1: Develop an assessment of diversions and fields that more regularly flood as priorities for modifying diversions to assure effective flood irrigation and prioritize areas of the focus area for restoration efforts. (HSWCD, NRCS).

Action 2.4B2: Identify at least three priority diversion structures within priority areas with cooperative landowners and develop designs and implement improved structures and screens as needed to address carp exclusion and effective irrigation management on wet meadows (Ducks Unlimited).

Action 2.4B3: Implement structural and management practices to improve on-farm water delivery and habitat values (NRCS).

Communications and Outreach

Outcome 3: By 2021 the HBWI partners integrated approach to manage carp and improved aquatic health are a model for solving complex natural resource issues and are recognized locally, regionally, and nationally.

SMART GOAL 3.1: By 2017, HBWI will use a shared set of communications strategies to implement a well coordinated internal outreach that keeps partners apprised of project progress.

Objective 3.1A: Develop communications strategy and tools to increase partner's awareness and coordination to achieve our goals.

Action 3.1A1: Work with partners to finalize communications strategy.

Action 3.1A2: Develop a mechanism among partners for sharing information on planning, coordinating and managing projects.

Action 3.1A3: Bring online and keep updated a fully functional website to support our internal and external communication needs.

Objective 3.1B: HBWI partners understand the role of High Desert Partnership

Action 3.1B1: HDP meets regularly with standing HBWI communications committee to foster information flow.

SMART Goal 3.2: By 2018, implement communications and outreach strategies to target audiences that articulate how the projects are positively affecting the ecological health of the region.

Objective 3.2A: Use various communication tools and outreach events to increase awareness and deliver products and messages to local community and land owners in Harney County.

Action 3.2A1: Develop materials to inform and educate land owners of programs available to retain flood irrigation practices and production.

Action 3.2A2: Develop print informational project profiles fact sheets.

Action 3.2A3: Conduct field-based outreach events in the FIP area to educate and demonstrate projects implemented and outcomes achieved.

Objective 3.2B: Communicate science developed as part of the FIP to appropriate audiences and integrate findings into communications strategies and messages.

Action 3.2B1: Researchers submit refereed manuscripts to scientific publications.
Action 3.2B2: Deliver presentations at professional conferences regarding the science and management of wetlands in the Harney Basin

Objective 3.2C: Develop consistent coordinated messages from HBWI partners to constituents that increase impact and demonstrate the value of ecosystem-wide management using website, electronic newsletter, social media, and outreach events.

Action 3.2C1: Augment docent program at MNWR to educate about FIP projects implemented and outcomes achieved

Action 3.2C2: Deliver messages through our social media platforms that partners can also use with their constituencies.

Action 3.2C3: Develop educational video products that speak to target audiences

Action 3.2C4: Develop print products that speak to target audiences

Action 3.2C5: Develop and present presentations in Western Oregon to build support in population centers.

Objective 3.2D: Increase funders understanding of projects being implemented and the collaborative process of HBWI.

Action 3.2D1: Provide targeted and timely communications to funders and decision makers.

SMART Goal 3.3: By 2017, establish mechanism to sustain effective and long term delivery of HBWI communications strategies.

Objective 3.3A: Establish dedicated staffing to support and sustain effective delivery of HBWI communications strategies.

Action 3.3A1: Use capacity to develop outreach materials in cooperation with HBWI partners.

Action 3.3A2: Use capacity to support website and social media messaging strategies.

Objective 3.3B: Develop strategy to ensure continued generation of content for outreach messages.

Action 3.3B1: HBWI communications committee responsible for identifying roles of partners in generating stories and digital content for shared communication.

Action 3.3B2: Make content development a natural part of HBWI projects and activities

Action 3.3B3. Develop success stories to inform public, focal investment area communities and partner constituents of project results.

Action 3.3B4. Develop outreach materials that tell the story of the HBWI impact ecologically, socially, economically to the region

Action 3.3B4: Submit partners for conservation awards as projects are successful.

Action 3.3B5: Document social benefits in local community from commercial removal of carp from Malheur Lake

FUNDING NEED: ESTIMATED COSTS/LEVERAGE OPPORTUNITIES

Table 4. Outcome 1. Improvement of Malheur Lake Wetlands Aquatic Health.

Lead Group	Action	Potential Funding Partners	Estimated Cost to FIP	Estimated Cost Total
ODFW	Action 1.1A1-3: Complete fish assemblage survey, including collection of carp otoliths, in the Malheur Lake drainages.	MNWR, NRCS	$51,000	$90,000
MNWR	Action 1.1A4: Analyze otoliths collected during fish assemblage surveys and develop a relationship between length and age class of carp.	Abernathy FTC	$2,500	$5,000
MNWR, ODFW, OSU	Action 1.1B: Evaluate carp movement between Malheur Lake and tributaries and within the lake		$154,000	$230,000
MNWR, USFWS - Abernathy Fish	Action 1.2A: Conduct life stage density study on Malheur National Wildlife Refuge to quantify aquatic health		$100,000	$152,000

Tech Center	response to varying densities of carp and establish target populations			
DU	Action 1.3A: Post-process and analyze LiDAR data, create digital elevation model identify areas of carp exclusion	MNWR, NRCS, USFWS, County Court	$50,000	$100,000
Various	Action 1.3A3: Obtain LiDAR data for remainder of focus area, as funding allows	NRCS, County Court, BLM, Forest Service	$320,000	$400,000
NRCS, ODFW, OWRD	Action 1.3B: Inventory and map water control structures within the focus area analyze data for carp exclusion options	USFWS-RIB	$25,000	$50,000
MNWR, Abernathy Fish Tech Center	Action 1.4A1: Field alternative methods to manage carp		$80,000	$150,000
MNWR	Action 1.4B1: Manage carp traps and screens on the Blitzen River annually to reduce carp abundance		$25,000	$100,000
MNWR, Oregon Wildlife, private party	Action 1.4B2: Implement, and continue to evaluate success of, commercial harvest of carp from Malheur Lake		0	$25,000
MNWR, NRCS	Action 1.5A: Compile aquatic health baseline data for Malheur National Wildlife Refuge and enter into geodatabase		0	$30,000
Various	Action 1.5A4: Develop and implement an inventory and monitoring plan for off-refuge aquatic health conditions		$5,000	$7,000
MNWR	Action 1.5A5: Conduct sediment sampling to characterize the nature and chemical status of the sediments in Malheur Lake		$5,000	$7,000
MNWR	Action 1.5A6: Evaluate trends in emergent and submergent vegetation at Malheur Lake	Brigham Young University	0	$5,000
MNWR, NRCS	Action 1.5B1: Collect monitoring data annually and enter into geodatabase for analysis		0	$2,000
	Action 1.5B2: Develop a model of carp population dynamics and ecosystem response to assist in analyzing		$250,000	$300,000

	alternative strategies, evaluating expected responses, and prioritizing actions.			
	Action 1.5B3: Conduct monitoring at control, untreated, and treatment sites during project implementation to determine effects and determine need for adaptive management.		0	$5,000
	Action 1.5B4: Develop success stories, publications, and educational materials to inform the public and interested parties of the results.		$16,000	$21,000
	Action 1.6A1: Conduct outreach events in Harney County that demonstrate actions taken and outcomes achieved.		$8,000	$10,500
	Action 1.6A2: Document community benefits from commercial removal of carp from Malheur Lake by conducting a review of the direct and indirect economic effects of the activities by 2021.			$3,000
	Action 1.6A3: Develop outreach materials that tell the story of cooperative conservation and outlines the ecological expectations and proposed treatments.		$2,000	$4,000

Table 4. Outcome 2. Secure 10,300 Acres of Flood-irrigated Migratory Waterbird Wetland Habitat.

.Lead Group	Action	Potential Funding Partners	Estimated Cost to FIP	Estimated Cost Total
NRCS	Action 2.1A1: Develop a cost/benefit analysis of flood to sprinkler irrigation conversion for wet meadows in the focus area	IWJV, DU, USGS, USFWS, ODFW	$5,000	$15,000
NRCS, IWJV, DU	Action 2.1A2: Utilizing the IWJV assessment of 30 year wetland losses in SONEC and the cost/benefit analysis for flood to sprinkler irrigation conversion, assess the expected changes in the near term for the focus area	Universities, ODFW, USFWS	0	$30,000

	Action 2.2A1: Develop and distribute educational materials and/or hold outreach events regarding the benefits of retaining flood-irrigation practices and practices that benefit agricultural production and waterbird habitat		$5,000	$15,000
	Action 2.2A2: Distribute cost/benefit analysis of flood to sprinkler conversion for wet meadows in the focus area to local agricultural producers			
IWJV, DU, NRCS	Action 2.2B1: Develop and distribute educational materials and/or hold outreach events regarding the benefits of retaining flood-irrigation practices and practices that benefit agricultural production and waterbird habitat	HBWI, OWEB, USFWS	$5,000	$25,000
TWC, IWJV, Ducks Unlimited	Action 2.3A1: Conduct outreach to third party lands trust(s) to recruit willing and able easement holder(s)	NRCS, USFWS, HBWI	0	$5,000
NRCS, TWC	Action 2.3A2: Enroll 5,300 acres of privately owned wet meadow habitat in Harney County in voluntary working land conservation easements	DU, OWEB, Land Trusts, IWJV, TWC	$250,000	$5,500,000
MNWR, USDA-ARS, OSU	Action 2.4A1: Install piezometers and monitor vegetation in wet meadow habitats to determine the relationship between plant expression and depth to water table		$15,000	$35,000
DU	Action 2.4B1: Develop an assessment of diversions and fields that more regularly flood as priorities for modifying diversions to assure effective flood irrigation and prioritize areas of the focus area for restoration efforts	NRCS, IWJV	$15,000	$30,000
DU	Action 2.4B2: Identify at least three priority diversion structures within priority areas with cooperative landowners and develop designs for improved structures and screens as needed to address carp exclusion and effective irrigation management on wet	NRCS, ODFW, OWEB, USFWS, IWJV	$25,000	$40,000

	meadows			
DU	Action 2.4B2: Implement at least three diversion replacements	OWEB, IWJV, ODFW, USFWS	$500,000	$1,650,000
NRCS	Action 2.4B3: Implement structural and management practices to improve on-farm water delivery and habitat values	IWJV, USFWS	$100,000	$1,000,000

EVALUATING SUCCESS

The HBWI partners have identified a variety of indicators of success to be tracked and reported on throughout implementation. Some of these indicators are what would be considered "outputs" - tasks accomplished, products produced, acres treated, etc. Others would be considered "outcomes" – improved water quality, stable to increasing bird populations, increased diversity of macroinvertebrates, etc. The full lists of indicators can be found in the Progress Evaluation and Monitoring sections of Attachments A and B. Table 5, below, addresses the types of monitoring that will be carried out in order to evaluate the ecological indicators of success.

Table 5. SMART Goals, Baseline Monitoring and Effectiveness Monitoring Summary.

SMART Goal	Baseline Monitoring	Effectiveness Monitoring
1.1 Understand carp distribution and population dynamics	Inventory and monitor carp distribution and population dynamics in Harney Basin.	Enter data into GIS database and produce a map delineating geographic range of carp in Harney Basin. Update as data becomes available.
1.2 Determine target carp threshold	Conduct a controlled study at different carp densities and determine threshold effects	Monitor carp population decline and improvements in other abiotic and biotic parameters to determine success
1.3 Identify locations to restrict carp movements	Use LiDAR and the DEM to identify and determine priority carp control points	Design and Installation of priority structures and area of decreased carp habitat calculated
1.4 Reduce carp to target threshold	Collect baseline data pre-carp control.	Monitor biotic and abiotic conditions each year during or post carp control efforts
1.5 Gather baseline data and monitor aquatic health conditions	Collect baseline data pre-carp control.	Monitor biotic and abiotic conditions each year during or post carp control efforts
2.1 Assess habitat loss and threats to flood irrigated wet meadows	Implement spatially explicit inventory and monitoring activities to map annual trends in flood-irrigated wet meadows across SONEC (including Harney	Enter data into GIS database and produce mapping tools Compile a databases of land changes over time and monitor shifts in habitat

	County)	
2.2 Local residents are aware of benefits to flood irrigated wet meadows	# of landowners participating in outreach efforts e.g. attend workshops, field tours, etc.	Determine the number of land owners in Harney Basin that are adopting practices that are more beneficial to birds # of private land projects completed
2.3 Secure 5,300 acres of flood irrigated wet meadow through conservation easements	Utilize biological data and wetland trend data to establish criteria for high priority tracts within Harney County	Assess the biological outcome, e.g. # of spring migrating Northern Pintails utilizing flood-irrigated wet meadow habitat protected by conservation easement.
2.4 Aid in management of 5,300 acres of private flood irrigated wet meadow	Utilize biological data and wetland trend data to establish criteria for high and medium high priority tracts within Harney County	Assess the biological outcome, e.g. # of spring migrating Northern Pintails utilizing flood-irrigated wet meadow habitat in Harney County

ADAPTIVE MANAGEMENT

Adaptive management is a key component of the Harney Basin Wetland Initiative, beginning with our Vision Statement, and woven throughout our strategic action plan.

Aquatic Health and Carp Control. Adaptive management is an integral part of the strategy for controlling carp and improving aquatic health. Throughout the process, data will be collected and analyzed in order to inform subsequent decisions. One example of how adaptive management has been used to date is the use of Boca Lake on MNWR as a test site for developing aquatic health monitoring protocols to be used throughout the focus area, and to demonstrate the rate and level of aquatic health recovery that can be expected when carp are removed from a shallow lake system. The HBWI partners have identified two specific tools to assist with adaptive management decisions. The first is a centralized geodatabase where all data related to the effort, regardless of source, will be housed. This geodatabase is currently under construction. The second tool is a model of carp population dynamics and ecosystem response (Action 1.5B2). Similar to the geodatabase, the model will serve as a centralized location to house data related to the effort, but will enable the Harney Basin Wetland Initiative Partners to analyze different strategies, evaluate expected responses, and prioritize actions.

Flood Irrigated Wet Meadows. Adaptive management is also an important part of the strategy for maintaining and enhancing wet meadow habitats. The following are some specific examples of how adaptive management is expected to be used. Intermountain West Joint Venture is currently in the process of analyzing 30 years of aerial photography to quantify wet meadow habitat loss that has occurred in the focus area. This information, in conjunction with a cost/benefit analysis of flood to sprinkler irrigation conversion (Action 2.1A1) will be used to better assess the level of threat to wet meadow habitats and will guide development of appropriate, effective outreach and educational

materials. LiDAR data will be used to map surface water flows within the focus area for different flow scenarios (Action 1.3A1). This information, along with the IWJV assessment of wet meadow habitat loss, may be used to adjust prioritization of proposed restoration projects (Action 2.4B1). In the long term, as state and transition models for wet meadow habitats are developed, these tools will be used to formulate and communicate recommended management practices for achieving and maintaining the desired plant communities in wet meadow habitats.

SUSTAINABILITY

Aquatic Health and Carp Control. The effort to control common carp and improve aquatic health will be a long term and basin wide effort. Past experience has proven that one time treatments in specific waterbodies fail to achieve sustained ecological benefits. The HBWI partners recognize the challenges of maintaining momentum and commitment for a sustained effort, but also recognize that this sustained commitment is what will be required for success. To this end, the partners have identified several strategies to ensure continuity.

First, a concerted effort is being made to develop tools, such as the centralized geodatabase and the carp population dynamics and ecosystem response model, to house the collective knowledge and experience of the partners, so that the information is readily available and easily transferable to new and changing personnel.

Second, the HBWI partners have and will continue to invest in a comprehensive communications strategy to build support among a broad spectrum of stakeholders at the local, state, and national level. The partners are committed to providing frequent updates on activities taking place and reporting on lessons learned and the impacts of conservation efforts to aquatic health. Effective communication is expected to expand and sustain support for and investment in the HBWI.

Third, the Conservation Implementation Strategy for Harney Basin Aquatic Health Improvement explicitly call for the development and implementation of operation and maintenance plans as part of the overall integrated pest management plan, to ensure that carp densities remain at or below target population levels once initial control has been achieved, and to ensure that installed structures are operated and maintained. This includes determining responsibility, schedules, costs, and funding sources for the operation and maintenance.

Finally, the HBWI partners have and will continue to explore alternative solutions that offer economic development opportunities for the local economy. An example of this is the use of commercial fishing to control carp populations in Malheur Lake. Proposed uses for the carp include organic fertilizer and human consumption. These types of solutions support the local economy and also offer opportunities to offset the costs of ongoing carp control and aquatic health improvement projects.

Flood Irrigated Wet Meadows. Conservation easements are a tool specifically suited to maintaining ecological benefits over the long term. The goal of securing 5,300 acres of privately owned wet meadow habitat under working land conservation easements (SMART Goal 2.3) is based on the USGS

bioenergetics model indicating that 5,300 acres of private lands wet meadow habitat are required to support the target population of dabbling ducks identified in the North American Waterfowl Management Plan for the Malheur Sub-basin.

NRCS, IWJV, Ducks Unlimited, MNWR, and Harney SWCD have all contributed funding for capacity to deliver technical and financial assistance related to this effort. Capacity funding is secured to support the position through June 2017. In addition, NRCS is currently providing funding through the Environmental Quality Incentives Program for improvements to flood-irrigation infrastructure and intends to continue to offer this funding for the next 3-5 years. Finally, partners are actively exploring other potential funding opportunities, including a proposal to the NRCS Regional Conservation Partnership Program.

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Conservation Implementation Strategy for

Harney Basin Aquatic Health Improvement

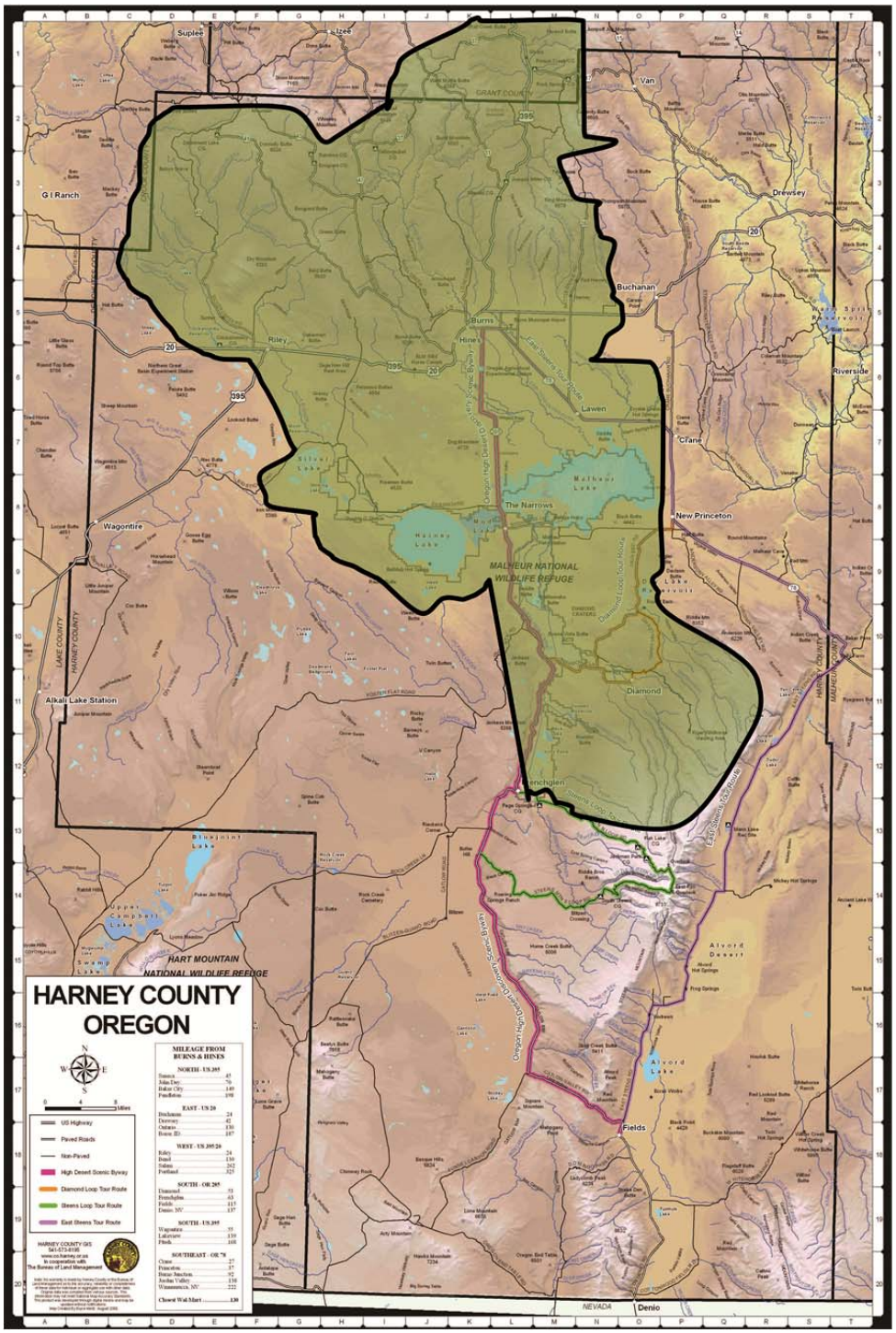


Figure 1. Area of Interest for Harney Basin Aquatic Health Improvement Project

BACKGROUND:
In 2010, NRCS prepared a Natural Resources Long Range Strategy for Harney County with significant input from conservation partners. The Long Range Strategy identified invasive common carp as the number one priority resource problem to be addressed in the next five years (2011 – 2015). The desired future outcome is to eradicate carp or reduce and maintain their numbers to a level that allows for good water quality, healthy native aquatic plant and animal communities, and adequate food for migratory bird populations.

NRCS in Harney County has had little or no involvement in carp management issues in the past. The Long Range Strategy identifies the Malheur National Wildlife Refuge (MNWR) as the lead partner on addressing invasive common carp, as it is their number one priority in the next 15 years as stated in their Draft Comprehensive Conservation Plan (CCP). The CCP provides guidance in the form of goals, objectives, and strategies for Refuge program areas, but may lack some of the specifics needed for implementation. A step-down management plan is being developed to improve aquatic health in the Harney Basin and specifically addresses carp control. To reach MNWR goals, active partners will be needed to assist with assessment and control projects. The desired condition for MNWR aquatic habitats would be represented by teeming masses of phytoplankton and zooplankton, reduced suspended silts, and a flourishing diversity of macroinvertebrates, vegetation, and fish; all for the benefit of migratory birds and resident wildlife.

PROBLEM STATEMENT:
Common carp (*Cyprinus carpio*), a fish native to Eurasia, were introduced to North America in the 1920s and distributed throughout the country in the 1930s, 40s, and 50s by the U.S. Fish Commission. In the 1950s, common carp became firmly established in the waters of the Malheur National Wildlife Refuge. Common carp diminish water quality and severely deplete food resources for other aquatic organisms and migratory birds.

Historically, efforts to remove common carp have focused on the use of a chemical called Rotenone in Malheur Lake and the lower Blitzen River. For three to five years following treatment there was improved water quality, increased wetland and aquatic vegetation, and increased bird populations. However, these benefits were temporary. Rotenone resulted in high mortality of the common carp population, but not complete eradication. Some common carp survived the treatments, and others infiltrated the treated area from untreated portions of the system (i.e. Silvies River).

Common carp spawn in May and June in shallow (less than 2 ft.) water with vegetative cover and water temperatures between 53 and 75° F. Carp are very fecund, with females producing as many as several million eggs each. The eggs are small and attach to vegetation. The young hatch in four to twelve days and are 5-6 mm long. Male carp mature in 2 years. Females normally mature in 3 years, but can mature in 1 to 2 years if the population is actively growing. The average life span of carp in the wild is 20 years.

Juvenile carp eat zooplankton. Sub adults eat benthic macroinvertebrates. Adults are omnivorous, feeding on macroinvertebrates, plants, and detritus. They have a protractible mouth that works like a vacuum cleaner, penetrating 5 to 6 inches into the benthic environment to suck up sediments and harvest food before releasing sediments back into the water. In the process, the fish uproot plants and disturb sediments, which results in increased turbidity.

Common carp exhibit a tolerance for a wide range of environmental conditions, including water temperatures from 2 to 36° C, less than 2 ppm dissolved oxygen, high turbidity, and high algal

concentrations. (Dr. Clay Pierce. *Biology of Invasive Carp.* Meeting Notes from Invasive Carp Control Workshop. 2010.)

Wide environmental tolerance, high genetic variability, fecundity, and a broad diet all allow common carp to be a highly successful invasive species. The fish have severe negative impacts on water quality because their feeding behavior removes aquatic vegetation and increases suspended sediments. They impact aquatic animal populations both directly, by feeding on macroinvertebrates, and indirectly, through degraded water quality. In turn, the presence of carp severely impacts migratory bird populations which rely on macroinvertebrates, plants, and fish for food.

In Harney County, common carp are an invasive species issue in Harney, Mud, and Malheur Lakes and the streams and rivers that feed into them; namely, Silver Creek, Silvies River, and Blitzen River. A fish screen has been installed between Mud and Malheur Lakes to prevent adult common carp from moving from Malheur to Mud Lake when the water is high. However, the structure does not prevent the movement of juvenile carp. Because Mud Lake is frequently dry, these juvenile carp should not be able to survive to adulthood. However, if Mud Lake has water for 2 years or more, then the carp will be able to spawn. In addition, the system is highly variable and there is the potential for Harney and Mud Lakes to be re-infested in high water years via inflow from Silver Creek and the wetlands in the Double O area. The primary concern however is the control of common carp from Malheur Lake, Silvies River, and the Blitzen River. See Figure 1 for a map showing the stream, river and lake systems involved.

Common carp are of particular concern in Harney County because of our location within the Pacific Flyway. Historically, Malheur Lake was utilized by up to 35% of the Pacific Flyway's canvasback population, was the second most important redhead production site in the West, and at its peak produced over 100,000 ducklings annually. Malheur National Wildlife Refuge currently averages about 2-7% of its former waterfowl production capability (Malheur National Wildlife Refuge. *Aquatic Health White Paper.* 2010).

GOAL AND OBJECTIVES:

Goal: The desired future outcome is to improve aquatic health by controlling carp and implementing habitat improvement projects in order to improve water quality, native aquatic plant and animal communities, and food resources for migratory bird populations.

Objective 1: Conduct research to determine the number and distribution of carp in Harney County.

Objective 2: Gather baseline data and conduct research to document pre-treatment aquatic health conditions, including water quality, macroinvertebrate populations, native and non-native fish populations, aquatic and riparian vegetation, aquatic animals, and migratory bird populations.

Objective 3: Conduct research to determine the maximum carp population size that can be tolerated and still achieve the desired future outcome. Determine which, if any, populations could feasibly be eradicated and set target population parameters for populations which cannot be eradicated.

Objective 4: Identify potential points of interaction between populations.

Objective 5: Implement structural or management practices to prevent movement between populations.

Objective 6: Reduce carp populations to target population levels.

Objective 7: Implement aquatic health improvement projects.

Objective 8: Develop and implement an operation and maintenance plan to ensure that carp populations remain at or below target population levels and structures which prevent movement between populations are operated and maintained properly.

Objective 9: Monitor water quality, macroinvertebrate populations, native and non-native fish populations, and migratory bird populations to determine whether aquatic health objectives are being met.

ALTERNATIVES:
There are four alternatives to be considered:

- No Action
- Conventional Chemical Control of Common Carp on MNWR
- Basin Wide Conventional Common Carp Control
- Basin Wide Aquatic Health Improvement, Including Common Carp Control Using Integrated Pest Management

Alternative 1 - No Action
Alternative 1 is the No Action Alternative. Under the No Action Alternative, no changes would be made to current aquatic health and common carp management in the Harney Basin.

The No Action Alternative was evaluated regarding its effects on aquatic health. If the No Action Alternative is selected, the expected impacts include poor water quality, decrease or no increase in emergent or submergent plants, degradation of the aquatic environment, decrease in native fish diversity, and inadequate forage for migratory and resident bird species.

The No Action Alternative is a high risk alternative for the Pacific Flyway. Declines in bird populations are already observed and, without improving aquatic health, bird numbers will potentially continue to decrease in both the short and long term. In addition, reductions in tourism, decrease in scenic beauty and social wellbeing may negatively impact the Harney Basin for the long term.

The benefits of the No Action Alternative are that there are no direct costs and no need for increased labor or management changes.

Alternative 2 – Conventional Chemical Control of Common Carp on MNWR
Alternative 2 is to implement Conventional Chemical Control of Common Carp on MNWR. The only component of this alternative is to use a piscicide to treat the MNWR aquatic environment to for targeted control and reduction of carp. The piscicide would be applied to the Donner und Blitzen River starting at the mouth of Bridge Creek and other drip stations northward, terminating in Malheur Lake. Aerial spraying of Malheur Lake would be conducted. No baseline data would be collected beyond data

collected in the No Action Alternative management, but post treatment monitoring would include vegetation, avian and native fish responses.

The Conventional Chemical Control of Carp on MNWR Alternative was evaluated by reviewing historical rotenone treatments following the above protocol and literature collected on the chemical effects to aquatic organisms.

The recommended piscicide for control of common carp is rotenone. Rotenone is a natural substance derived from several tropical and sub-tropical plants and it is a broad spectrum piscicide that is toxic to most fish (http://www.usbr.gov/lc/phoenix/reports/bonitacreek/bcfbappC.pdf). For carp, it is known to be toxic to juvenile and adult fish. Fish eggs are much more resistant to rotenone treatments than larval or adult stages. (http://www.dfw.state.or.us/fish/local_fisheries/diamond_lake/FAQs.asp). Although both fish and aquatic macroinvertebrates are highly susceptible to rotenone (Skaar 2001), most macroinvertebrate populations quickly recover to pretreatment levels (Lennon 1971, Schnick 1974b). Gill-breathing amphibians (i.e., frog and toad tadpoles and larval salamanders) are also adversely affected (Hamilton 1941). Amphibian adults and reptiles are less sensitive than fish and should not be harmed when rotenone is applied at concentrations typically used in fisheries management (Farringer 1972). Fall applications of rotenone reduce or eliminate impacts on amphibians because most species are in the adult stage of development. Rotenone is very unstable in the environment (half-life measured in days) and completely breaks down within one to four weeks depending on pH, alkalinity, temperature, dilution, and exposure to sunlight (Schnick 1974b). It also adsorbs strongly to organic matter in sediment and is rapidly degraded (Dawson et al. 1991). Rapid neutralization (oxidation) occurs when rotenone is mixed with potassium permanganate or sodium permanganate (Engstrom-Heg 1971, 1972, 1973; Finlayson et al. 2000). Inert ingredients in the liquid formulation of rotenone consist of petroleum hydrocarbons as solvents and emulsifiers (primarily naphthaline, methylnaphthalenes, trichloroethylene, and xylenes). Studies of residual concentrations in water treated with liquid formulations indicate that solvent levels are below toxic thresholds (Ling 2003). The risk to humans is high and rotenone is extremely toxic to fish. Rotenone can be fatal to humans if inhaled, may be fatal if swallowed, harmful if absorbed through the skin, can cause substantial temporary eye injury, skin irritation. Personal protective equipment is required for all personnel who come into contact of the chemical and project area.

Historically, rotenone has been applied on MNWR sporadically from 1955 to the mid 1990's, yielding the same results each time of short term success but not in the long term. Rotenone was the primary piscicide used in the past. Carp control on Malheur Lake using rotenone resulted in dramatic increases 2 years after most treatments in sago pondweed, diving duck use, and tundra swan use.

The effects of the Conventional Chemical Control of Carp on MNWR Alternative are expected to be short term benefits on MNWR, but long term effects similar to the No Action Alternative within 5 years. Chemical treatment as a stand-alone method of common carp control has not proven effective for the long term. Therefore, if the Conventional Chemical Control of Carp on MNWR is selected, common carp will continue to degrade the aquatic health of MNWR, although more slowly than if no treatment was performed. As a result, the long term impacts would include poor water quality, decrease or no increase in emergent or submergent plants, degradation of the aquatic environment, decrease in native fish diversity, and inadequate forage for migratory and resident bird species. Economically Alternative 2 would be more expensive than the No Action Alternative and yield the same results in the long term.

The Conventional Chemical Control of Carp on MNWR Alternative is the highest risk alternative to the basin, with low risk in the short term and high risk in the long term. In the short-term MNWR will incur costs associated with chemical treatment, including additional labor costs. In the long term, the MNWR will face significant reduction in aquatic organism productivity.

The benefits of the Chemical Control of Carp on MNWR Alternative are the short term reductions in the abundance of common carp, increased aquatic vegetation production, improved habitat for breeding and nesting birds and improved water quality.

There would be no direct impacts to cultural resources under the Chemical Control of Carp on MNWR Alternative.

Alternative 3 – Conventional Basin Wide Common Carp Control

Alternative 3 is to use conventional methods to control and manage common carp basin wide. Components of this alternative include:

- Conduct research to determine the number and distribution of carp in Harney County.
- Gather baseline data and conduct research to document pre-treatment native and non-native fish populations.
- Use a piscicide to reduce carp populations basin wide.
- Monitor native and non-native fish populations to determine whether basin wide common carp control and management objectives are being met.

The Conventional Basin Wide Common Carp Control Alternative would be similar to Alternative 2. The Conventional Basin Wide Control Alternative would be primarily chemical application of rotenone to suppress the carp population, however it would be at the Basin Wide level and more inventory, monitoring and research would be conducted to learn more about the carp population prior to treatment.

The effects of the Conventional Basin Wide Common Carp Control Alternative would be a short term decrease in common carp and temporary improvements to aquatic health, followed by a rapid return to pre-treatment conditions and long term effects similar to those described for the No Action Alternative.

Alternative 4 - Basin Wide Aquatic Health Improvement, Including Common Carp Control

Alternative 4 is to implement Basin Wide Aquatic Health Improvement, including common carp control. Components of this alternative include:

- Conduct research to determine the number and distribution of carp in Harney County.
- Gather baseline data and conduct research to document pre-treatment aquatic health conditions, including water quality, macroinvertebrate populations, native and non-native fish populations, aquatic and riparian vegetation, aquatic animals, and migratory bird populations.
- Conduct research to determine the maximum carp population size that can be tolerated and still achieve the desired future outcome. Determine which, if any, populations could feasibly be eradicated and set target population parameters for populations which cannot be eradicated.
- Identify potential points of interaction between populations.
- Implement structural or management practices to prevent movement between populations.
- Reduce carp populations to target population levels.
- Implement aquatic health improvement projects.

- Develop and implement an operation and maintenance plan to ensure that carp populations remain at or below target population levels and structures which prevent movement between populations are operated and maintained properly.
- Monitor water quality, macroinvertebrate populations, native and non-native fish populations, and migratory bird populations to determine whether aquatic health objectives are being met.

Under the Basin Wide Aquatic Health Improvement Alternative, a thorough survey of the Harney Basin would be conducted to identify the number and distribution of native and non native fish species. All survey sites will have a GPS point associated with them. The results of the inventory would be entered into a GIS database and used to determine the distribution of carp within the basin and to develop a list of impacted landowners and land management agencies. In addition, aquatic health data would be collected in order to establish baseline conditions, including water quality, macroinvertebrate populations, aquatic and riparian vegetation, aquatic animals, and bird populations.

Telemetry and/or microchemistry studies would be conducted to determine carp movement patterns and identify separate carp populations that may exist within the basin. This information, along with hydrologic information for the basin, would be used to identify potential points of interaction between carp populations. These points of interaction would represent locations where opportunities exist to utilize structural or management practices to isolate carp populations. Research would be conducted to determine the maximum carp population density that could be tolerated and still achieve the desired future outcome. This information would be used to set target population parameters for each identified carp population in the basin.

Integrated Pest Management (IPM) plans would be developed for the control and management of common carp in the Harney Basin. Integrated Pest Management is a sustainable approach to pest control that combines the use of prevention, avoidance, monitoring and suppression strategies, to maintain pest populations below economically damaging levels, to minimize pest resistance, and to minimize harmful effects of pest control on human health and environmental resources. IPM suppression systems include biological controls, cultural controls and the judicious use of chemical controls.

IPM plans for common carp would be developed with input from aquatic health researchers and professionals from management, fishery, hydrology, ecology, invasive, and vegetation disciplines. The IPM plans will be tailored to the needs of each individual project area. Generally, each IPM plan would identify structures to be constructed or modified in order to restrict carp movement, management practices that would prevent carp movement or spawning or cause congregations of carp for control purposes, carp suppression techniques (chemical control, mechanical removal, mating disruption, commercial fishing, etc.), maintenance plans to ensure structures are operated and maintained properly, and monitoring plans to ensure that carp populations remain at or below target thresholds.

Habitat improvement projects would be implemented as a component of the Basin Wide Aquatic Health Improvement Alternative. These projects would include riparian and upland improvement projects to address resource concerns, other than common carp, that are contributing to degraded aquatic health conditions and accelerate system recovery following carp suppression.

Finally, monitoring would be conducted during and after project implementation to measure impacts and ensure that aquatic health objectives are being met.

The Basin Wide Aquatic Health Improvement Alternative was evaluated regarding its effects on aquatic health. If this alternative is selected, the expected impacts include suppression or eradication of common carp in the Harney Basin, improved water quality, an increase in aquatic and riparian vegetation, increased macroinvertebrates, increased native fish diversity, and increased forage for migratory and resident bird species.

The risks to fish and humans associated with the use of the piscicide rotenone are the same as those described in Alternative 2.

The Basin Wide Aquatic Health Improvement Alternative is a high risk alternative in the short term and a moderate risk alternative in the long term. The high short term risks are associated with the high cost of IPM techniques, increased labor, and significant changes to management levels. In addition, all carp control efforts have an inherent risk of failure although IPM offers the greatest probability for success. Harney Basin landowners and land management agencies will continue to face moderate risks in the long term as there are continued costs associated with monitoring and maintenance as well as a sustained need for increased labor and management levels. However, this alternative is the lowest risk alternative in the long term.

The potential effects to cultural resources would need to be evaluated on a site specific basis, taking into consideration the specific IPM components selected. In particular, construction of fish screens and riparian planting components would need to be assessed.

Finally, it should be noted that one benefit of this alternative, in addition to the positive ecological and economic benefits described above, is improved social well-being for participating landowners and land managers in the long term as successful control of common carp through IPM improves community relations.

PROPOSED SOLUTION AND ACTIONS:

The proposed solution is Alternative 4 – Basin Wide Aquatic Health Improvement, Including Carp Control. This alternative was selected because it offers the greatest conservation benefits and has the highest likelihood of long term success. Alternative 4 is an ecosystem approach that will benefit every level of the food chain.

Listed below are the specific actions to be taken under the selected alternative in order to achieve the project objectives listed earlier in this document.

Objective 1: Conduct research to determine the number and distribution of carp in Harney County.

1 A: Determine the extent of the geographic range of common carp in Harney County.

Action: Gather existing data on the presence of carp in all waters which flow into Harney and Malheur Lakes.

Action: Identify data gaps and conduct research to fill in the gaps.

Action: Delineate project boundary based on range of carp.

1 B: Determine the total number of carp and the age/size distribution of the population.

Action: Review and/or conduct fish assemblage studies for Harney and Malheur Lakes and all waters which flow into them.

1 C: Identify separate populations of carp that may exist.

Action: Conduct telemetry and/or microchemistry studies to determine carp movements and the connectivity of carp populations within the hydrologic system.

Objective 2: Gather baseline data and conduct research to determine pre-treatment aquatic health conditions, including water quality, macroinvertebrate populations, native and non-native fish populations, aquatic and riparian vegetation, aquatic animals, and migratory bird populations.

Action: Gather existing data on aquatic health conditions.

Action: Identify data gaps and conduct research to fill in the gaps.

Objective 3: Conduct research to determine the maximum carp population size that can be tolerated and still achieve the desired future outcome. Determine which, if any, populations could feasibly be eradicated and set target population parameters for populations which cannot be eradicated.

Action: Conduct life stage density studies on Malheur National Wildlife Refuge to determine target population levels.

Action: Set target density levels for each identified carp population, and identify those populations which could feasibly be eradicated.

Objective 4: Identify potential points of interaction between populations.

Action: Obtain or develop maps showing hydrologic connectivity and direction of movement in high, medium, and low water years.

Action: Identify locations where carp from one population could potentially repopulate another population that has been removed.

Objective 5: Implement structural or management practices to prevent movement between populations.

5 A: Install fish screens, diversion structures, head gates, etc. that prevent carp movement between water bodies.

Action: Inventory and map existing structures.

Action: Identify proposed locations for new structures.

Action: Prioritize list of structures (new and existing) for construction or retrofit.

Action: Conduct outreach and education to inform land managers regarding carp issues and seek cooperation in building or modifying structures.

Action: Seek funding for structures.

Action: Implement structure construction or modification projects.

5 B: Utilize management techniques that either create or take advantage of low water to interrupt habitat connectivity.

Action: Identify locations where structures are not feasible or may not be adequate to restrict carp movement, especially in high water years.

Action: Identify management practices that could reasonably be used to create or take advantage of low water to prevent carp movement.

Action: Prioritize proposed management practices.

Action: Conduct outreach and education to inform land managers regarding carp issues and seek cooperation in carrying out proposed management practices.

Action: Seek funding for management practices.

Action: Implement management practices.

Objective 6: Reduce carp densities to target population levels.

6 A: Develop and implement an Integrated Pest Management (IPM) strategy for the reduction of carp populations.

Action: Review literature and conduct research, if necessary, to identify a range of carp control methods that could potentially be used and which are expected to be most successful.

Action: Develop an IPM strategy for the reduction of carp populations and density maintenance that identifies the methods to be used and the parameters for the use of each method.

6 B: Prioritize carp populations or habitat areas for control and address each in a logical order that considers potential for re-infestation, expected success rates, treatment costs, and expected benefits to aquatic health and migratory bird populations.

Action: Prioritize carp populations or habitat areas.

Action: Conduct outreach and education to inform land managers regarding carp issues and seek cooperation in implementing the IPM strategy.

Action: Seek funding for carp control.

Action: Implement the IPM strategy to reduce carp populations.

Objective 7: Implement aquatic health improvement projects.

Action: Identify areas needing improvement, including aquatic health parameters to be addressed.

Action: Identify practices to address identified issues.

Action: Prioritize proposed aquatic health improvement projects.

Action: Conduct outreach and education to inform land managers regarding carp issues and seek cooperation in carrying out aquatic health improvement projects.

Action: Seek funding for aquatic health improvement projects.

Action: Implement aquatic health improvement projects.

Objective 8: Develop and implement an operation and maintenance plan to ensure that carp densities remain at or below target population levels and structures which prevent movement between populations are operated and maintained appropriately.

Action: Identify structures which will require regular operation and/or periodic maintenance and determine responsibility, schedules, costs, and funding sources.

Action: Implement density maintenance provisions of the IPM plan to ensure carp densities remain at or below target population levels. Determine responsibility, schedules, costs, and funding sources.

Objective 9: Monitor water quality, macroinvertebrate populations, native and non-native fish populations, aquatic and riparian vegetation, and migratory bird populations to determine whether aquatic health objectives are being met.

Action: Conduct monitoring at control, untreated, and treatment sites during project implementation to determine effects and determine need for adaptive management.

Action: Conduct final post-treatment monitoring to document project impacts and determine whether aquatic health objectives have been met.

Action: Develop success stories, publications, and educational materials to inform the public and interested parties of the results.

PARTNERSHIP AND FUNDING SOURCES:
The Malheur National Wildlife Refuge (MNWR) is the lead partner for the project. Other partners include:

- The Audubon Society
- Bureau of Land Management (BLM)
- Burns Paiute Tribe (BPT)
- Harney County Watershed Council (HCWC)
- Harney Soil and Water Conservation District (Harney SWCD)
- High Desert Partnership (HDP)
- Intermountain West Joint Venture (IWJV)
- Malheur Wildlife Associates
- Natural Resources Conservation Service (NRCS)
- Oregon Department of Fish and Wildlife (ODFW)
- Oregon Natural Desert Association (ONDA)
- Oregon State University (OSU)
- Oregon Water Resources Department (OWRD)
- The Nature Conservancy (TNC)
- Trumpeter Swan Society
- University of Minnesota
- United States Forest Service (USFS)
- US Fish and Wildlife Service (USFWS)

Partner Roles and Funding Sources for Objective 1 – Carp Distribution and Population Dynamics
It is estimated that $427,860 will be needed to conduct research to determine the geographic range, number, and population dynamics of common carp in the Harney Basin.

MNWR will contribute approximately $135,948 for gathering existing data, identifying data gaps, and collecting telemetry and microchemistry studies.

ODFW will contribute approximately $88,272 for gathering existing data, identifying data gaps, and collecting telemetry and microchemistry studies.

An additional $203,640 still needs to be secured in order to accomplish Objective 1, including fish assemblage studies to determine the distribution of carp within the basin.

Partner Roles and Funding Sources for Objective 2 – Determine Pre-Treatment Aquatic Health Conditions
It is estimated that $101,684 will be needed to conduct inventory to determine pre-treatment aquatic health conditions, including water quality, macroinvertebrate populations, native and non-native fish populations, aquatic and riparian vegetation, aquatic animals, and migratory bird populations.

MNWR will contribute approximately $16,108 to gather existing data, identify data gaps, and inventory water quality, emergent and submergent vegetation, and macroinvertebrates.

ODFW will contribute approximately $1,536 to gather existing data and identify data gaps.

Data provided by established bird surveys will be utilized to determine pre-treatment bird populations. This data will be provided by ODFW, OSU, BLM, MNWR, USFS, Trumpeter Swan Society, and the Audubon Society.

An additional $84,040 will be needed to conduct a basin-wide inventory of water quality, aquatic and riparian vegetation, macroinvertebrate populations, and aquatic mammals.

Partner Roles and Funding Sources for Objective 3 – Set Target Population Parameters
It is estimated that $35,764 will be needed to determine the maximum carp population size that can be tolerated and still achieve the desired future outcome. However, this figure does not include funding for a life stage assessment study to look at reproduction, growth rates, and mortality.

MNWR will contribute approximately $20,988 to conduct population density studies and set target population parameters. USFWS has contributed an additional $12,000 toward the population density study.

ODFW will contribute approximately $576 to help set target population parameters for carp populations within the basin.

The University of Minnesota will provide technical support to develop protocols for a life stage assessment study. At this time, we are unsure of the costs of this study.

An additional $2,200 will need to be secured in order to achieve Objective 3.

Partner Roles and Funding Sources for Objective 4 – Identify Potential Points of Interaction
Approximately $4,192 will be needed to identify potential points of interaction between carp populations in the Harney Basin.

USFWS will contribute $3,840 to develop maps showing hydrologic connectivity and direction of movement in high, medium, and low water years.

MNWR will contribute $128 of staff time to identify potential points of interaction.

NRCS will contribute $128 of staff time to identify potential points of interaction.

ODFW will contribute $96 of staff time to identify potential points of interaction.

Partner Roles and Funding Sources for Objective 5 – Implement Structural or Management Practices to Prevent Carp Movement
It is not possible to accurately estimate the total amount of funding that will be needed to implement structural and management practices to prevent carp movement. The cost of actual construction or implementation will depend on the size and complexity of each identified structure or management practice. However, it is estimated that $54,896 will be needed to inventory and map existing structures, identify and prioritize structural and management practices to be implemented, and conduct outreach to seek cooperation from landowners.

MNWR will contribute approximately $13,008 to inventory structures, prioritize structural and management practices, and conduct outreach.

OWRD will contribute approximately $3,456 to inventory structures, prioritize structural and management practices, and conduct outreach.

ODFW will contribute approximately $13,776 to inventory structures, prioritize structural and management practices, and conduct outreach.

NRCS will contribute approximately $6,272 to prioritize structural and management practices and conduct outreach.

Harney SWCD and HCWC will each contribute approximately $3,264 to prioritize structural and management practices and conduct outreach.

USFS and BLM will each contribute approximately $4,560 to prioritize structural and management practices and conduct outreach.

Burns Paiute Tribe will contribute approximately $2,736 to prioritize structural and management practices and conduct outreach.

Partner Roles and Funding Sources for Objective 6 – Carp Control

It is not possible to accurately estimate the total cost to reduce carp populations to the target population levels at this time. Two components of this objective are particularly difficult to project costs for until more is known. One is the cost of conducting research into carp control methods. The other is the actual cost of implementing carp control measures throughout the basin. However, at this time, it is estimated that approximately $47,054 will be needed to review literature on carp control, develop an Integrated Pest Management (IPM) strategy, prioritize carp populations for control, conduct outreach to seek support for carp control, and secure funding for carp control.

MNWR will contribute approximately $9,088 to review literature, develop an IPM strategy, prioritize carp populations, conduct outreach, and seek funding.

ODFW will contribute approximately $6,816 to review literature, develop an IPM strategy, prioritize carp populations, conduct outreach, and seek funding.

USFS will contribute approximately $6,960 to review literature, prioritize carp populations, conduct outreach, and seek funding.

The University of Minnesota will contribute approximately $7,000 to review literature and develop an IPM strategy.

NRCS will contribute approximately $4,160 to develop an IPM strategy, prioritize carp populations, conduct outreach, and seek funding.

Harney SWCD, HCWC, and OWRD will each contribute approximately $720 to prioritize carp populations, conduct outreach, and seek funding.

BLM will contribute approximately $3,008 to prioritize carp populations, conduct outreach, and seek funding.

Burns Paiute Tribe will contribute approximately $912 to prioritize carp populations, conduct outreach, and seek funding.

IWJV, Audubon, TNC, and ONDA will each contribute approximately $300 to seek funding.

HDP will contribute approximately $600 to seek funding.

Malheur Wildlife Associates will contribute approximately $150 to seek funding.

An additional $5,000 will need to be secured in order to pay a contractor to write the IPM strategy.

Partner Roles and Funding Sources for Objective 7 – Aquatic Health Improvement Projects

It is impossible to accurately estimate the costs of aquatic health improvement projects until the specific projects have been identified. However, it is estimated that $24,160 will be needed to identify areas needing aquatic health improvement and the practices to be implemented, prioritize habitat improvement projects, and conduct outreach to seek landowner cooperation.

MNWR will contribute approximately $3,184 to achieve these tasks.

OWRD, Harney SWCD, and HCWC will each contribute approximately $2,016.

ODFW will contribute approximately $4,368.

NRCS will contribute approximately $4,608.

USFS will contribute approximately $2,480.

BLM will contribute approximately $1,984.

Burns Paiute Tribe will contribute approximately $1,488.

Partner Roles and Funding Sources for Objective 8 – Operation and Maintenance

Costs for operation and maintenance of structures and for maintaining carp population densities at or below target levels are unknown at this time. Operation and maintenance costs for structures are to be identified during the planning and design phase of each structure. Costs of maintaining carp populations at or below target densities will be developed as part of the Integrated Pest Management plan.

Partner Roles and Funding Sources for Objective 9 – Monitoring

It is estimated that approximately $646,280 will be needed to conduct interim and post-treatment monitoring and to develop publications to inform stakeholders regarding project accomplishments.

All $646,280 needed to accomplish Objective 9 still needs to be secured.

Budget Summary

A budget table can be found in Exhibit 1. The total cost of the project (excluding those components for which an estimate cannot yet be made) is $1,341,890. Figure 2 shows the contribution of each partner to the overall project costs.

Figure 2. Summary of Partner Contributions

Partner	Amount
Malheur National Wildlife Refuge	$ 198,452.00
Oregon Department of Fish and Wildlife	$ 115,440.00
US Fish and Wildlife Service	$ 15,840.00
Natural Resources Conservation Service	$ 15,168.00
Unites States Forest Service	$ 14,000.00
Bureau of Land Management	$ 9,552.00
University of Minnesota	$ 7,000.00
Oregon Water Resources Department	$ 6,192.00
Harney Soil and Water Conservation District	$ 6,000.00
Harney County Watershed Council	$ 6,000.00
Burns Paiute Tribe	$ 5,136.00
High Desert Partnership	$ 600.00
Intermountain West Joint Venture	$ 300.00
Audubon Society	$ 300.00
The Nature Conservancy	$ 300.00
Oregon Natural Desert Association	$ 300.00
Oregon State University	$ 2000.00
Malheur Wildlife Associates	$ 150.00
To Be Determined - Unsecured	$ 941,160.00
Total	**$ 1,341,890.00**

IMPLEMENTATION TIMELINE:

The project will be implemented from 2011 through 2040. A timeline is provided below, indicating the specific tasks to be completed in order to achieve the identified actions, objectives, and overall goal of the project.

Inventory and Planning Activities

Oct. 2010 – Oct. 2013 MNWR to conduct telemetry study to determine movement of carp caught on Refuge.

Jun. – Sept. 2011 Review literature to identify a range of carp control methods that could potentially be used and which are expected to be most successful. Identify research needs.

Jun. – Oct. 2011 Gather existing data on the presence of carp in all waters which flow into Harney and Malheur Lakes. All data to be compiled in a centralized location.

Jun. – Dec. 2011 Gather existing data on aquatic health conditions.

Jul. – Sept. 2011	Develop research proposal to conduct microchemistry study on Refuge to better understand carp movements and connectivity.
Jul. – Sept. 2011	Develop research proposal to conduct study on Refuge to determine life stage target population threshold levels.
Jul. – Nov. 2011	Obtain maps of known existing structures.
Sept. 2011	Delineate initial project boundary based on the maximum potential geographic range of carp.
Sept. 2011 – Sept. 2012	Seek funding for microchemistry study on Refuge.
Sept. 2011 – Sept. 2012	Seek funding for life stage population threshold study.
Oct. 2011 – Oct. 2014	Conduct life stage population threshold study on Refuge.
Nov. – Dec. 2011	Review existing fish assemblage studies for Harney and Malheur Lakes and all waters which flow into them.
Dec. 2011	Review existing aquatic health data and identify data gaps.
Dec. 2011 – Jun. 2012	Seek funding to ground truth maps of existing structures and conduct additional inventory of structures within the project area.
Jan. – Jun. 2012	Develop research proposals to conduct basin wide aquatic health research to establish baseline conditions.
Jan. – Dec. 2012	Identify data gaps in carp distribution data and develop research proposal for carp inventory to include: fish assemblage, telemetry and/or microchemistry, water quality, macroinvertebrates, aquatic and riparian vegetation, and bird populations.
Jan. – Dec. 2012	Seek funding for Carp Inventory.
Jun. – Dec. 2012	Seek funding for basin wide aquatic health research projects to establish baseline conditions.
Jul. – Mar. 2012	Obtain maps showing hydrologic connectivity in high, medium, and low water years.
Jul. 2012 – Sept. 2015	Conduct ground truthing and inventory of existing structures within the project area.
Jan. 2013 – Jun. 2014	Conduct microchemistry study on Refuge.
Jan. 2013 – Dec. 2015	Conduct aquatic health research projects to establish baseline conditions.

Jan. 2013 – Dec. 2015	Conduct Carp Inventory.
Jan. 2016	Delineate final project boundary based on actual geographic range of carp.
Jan. – Jun. 2016	Determine number and age/size distribution of carp within the project boundary based upon existing fish assemblage studies and those conducted during Carp Inventory.
Jul. – Sept. 2016	Develop research proposal for telemetry and/or microchemistry study to determine carp movements and the connectivity of carp populations within the project area.
Oct. 2016– Oct. 2017	Seek funding for telemetry and/or microchemistry study for full project area.
Oct. 2016 – Oct. 2018	Develop research proposals and seek funding for any carp control research needs identified as a result of literature review.
Jan. 2018 – Dec. 2020	Conduct telemetry and/or microchemistry study for full project area.
Jan. 2019 – Dec. 2021	Conduct carp control research.
Jan. – Jun. 2021	Identify separate carp populations that exist within the project area. Identify those populations which can feasibly be eradicated. Set target population levels for remaining populations.
Jan. – Jun. 2021	Identify locations where carp from one population could potentially repopulate another population that has been removed. Identify existing structures that could be modified and locations for proposed new structures.
Jan. – Jun. 2021	Identify locations where structures are not feasible or may not be adequate to restrict carp movement, especially in high water years, and identify management practices that could reasonably be used to create or take advantage of low water to prevent carp movement.
Jul. – Dec. 2021	Prioritize list of structures and management practices.
Jul. – Dec. 2021	Identify “Aquatic Health Improvement Phases”.
Jan. – Mar. 2022	Develop research proposals for conducting monitoring at control, untreated, and treatment sites during project implementation to determine effects and determine need for adaptive management.
Jan. – Mar. 2022	Develop research proposals for conducting post treatment monitoring to document project impacts and determine whether aquatic health objectives have been met.
Apr. 2022 – Apr. 2023	Seek funding for interim and post treatment monitoring.

Aquatic Health Improvement Phase 1

Jan. – Jun. 2022	Develop draft Integrated Pest Management (IPM) strategy for Aquatic Health Improvement Phase 1. The IPM strategy should identify structures to be built/modified, management practices to be implemented, carp control methods to be used (and the parameters for the use of each method), and habitat improvement projects to be implemented.
Jul. – Dec. 2022	Conduct outreach and education to inform Phase 1 land managers regarding aquatic health issues and seek cooperation in implementing the IPM strategy.
Jul. 2022– Jul. 2023	Seek funding for Phase 1 structures and management practices.
Jul. 2022 – Jul. 2023	Seek funding for Phase 1 carp control.
Jul. 2022 – Jul. 2023	Seek funding for Phase 1 habitat improvements.
Jul. 2022 - Jul. 2024	Conduct inventory, planning, and design work for Phase 1 structures and management practices.
Jan. 2023 – Dec. 2033	Develop success stories, publications, and educational materials to inform the public and interested parties of project results and lessons learned.
Aug. 2023 – Aug. 2027	Implement Phase 1 structural and management practices.
Aug. 2023 – Aug. 2027	Implement carp control for Phase 1.
Aug. 2023 – 2030	Implement habitat improvement projects for Phase 1.
Aug. 2023– Aug. 2033	Conduct interim monitoring for Phase 1.
Sept. 2027	Review Operation and Maintenance plans for structures to ensure they are adequate and that responsibility and funding have been assigned.
Sept. 2027	Review density maintenance provision of IPM strategy to ensure carp densities remain at or below threshold levels and that responsibility and funding have been assigned.

Aquatic Health Improvement Phase 2

2024 - 2035

Aquatic Health Improvement Phase 3

2026 - 2037

Post Implementation Activities

2027 – 2040*	Review and implement operation and maintenance plans for all structures to ensure that they continue to function properly throughout the expected service life. Review and implement density maintenance provisions of IPM strategy to ensure that carp densities remain at or below target populations levels over the long term. Conduct post treatment monitoring to determine whether activities have resulted in reductions in carp to target population levels, improvements in water quality, improvements and increases in macroinvertebrate populations, improvements in native fish populations, improvements in aquatic and riparian vegetation, and improvements in bird populations. Develop success stories, publications, and educational materials to inform the public and interested parties of project results and lessons learned.

**Dates of Post Implementation Phase will be dependent on the number of Aquatic Health Improvement Phases identified.*

PROGRESS EVALUATION AND MONITORING:
The following outputs and outcomes will be used as indicators of success in achieving each of the project objectives.

Objective 1 A: Determine the extent of the geographic range of common carp in Harney County

Indicator of Success:	A map showing geographic range of common carp in Harney County and delineating the project boundary will be developed by January 31, 2016.
Reporting Party:	MNWR
Report To:	Carp Partnership, Funders of fish assemblage study
Report Date:	January 31, 2016

Objective 1 B: Determine the total number of carp and the age/size distribution of the population

Indicator of Success:	A report stating the estimated number of carp within the project area, based on fish assemblage studies, will be developed by June 30, 2016.
Reporting Party:	ODFW
Report To:	Carp Partnership, Funders of fish assemblage study
Report Date:	June 30, 2016

Objective 1 C: Identify separate populations of carp that may exist

Indicator of Success: A map and report identifying separate carp populations within the project area will be developed by June 30, 2021.
Reporting Party: ODFW
Report To: Carp Partnership, Funders of telemetry and/or microchemistry studies
Report Date: June 30, 2021

Objective 2: Gather baseline data and conduct research to determine pre-treatment aquatic health conditions, including water quality, macroinvertebrate populations, native and non-native fish populations, aquatic and riparian vegetation, aquatic animals, and migratory bird populations.

Indicator of Success: A report summarizing baseline aquatic health conditions in the basin by June 30, 2016.
Reporting Party: ODFW & OSU
Report To: Carp Partnership, Funders of research
Report Date: June 30, 2016

Objective 3: Conduct research to determine the maximum carp population size that can be tolerated and still achieve the desired future outcome. Determine which, if any, populations could feasibly be eradicated and set target population parameters for populations which cannot be eradicated

Indicator of Success: A report stating the maximum carp population size that can be tolerated, based on the population threshold study on MWNR and existing literature, will be prepared by April 30, 2015.
Reporting Party: MNWR
Report To: Carp Partnership, Funders of population threshold study
Report Date: April 30, 2015

Indicator of Success: A map and report identifying target population levels for each separate carp population within the project area, including an indication of those populations which could feasibly be eradicated, will be developed by January 1, 2022.
Reporting Party: ODFW
Report To: Carp Partnership
Report Date: January 1, 2022

Objective 4: Identify potential points of interaction between populations

Indicator of Success: Maps showing hydrologic connectivity in high, medium, and low water years will be developed and marked with potential points of interaction by January 1, 2022.
Reporting Party: ODFW
Report To: Carp Partnership
Report Date: January 1, 2022

Objective 5 A: Install fish screens, diversion structures, head gates, etc. that prevent carp movement between water bodies

Indicator of Success: A map showing the potential points of interaction, existing structures needing no modification, existing structures needing modification, proposed locations for new structures, and locations where structures are not feasible or will be inadequate will be developed by January 1, 2022.
Reporting Party: ODFW, Ducks Unlimited
Report To: Carp Partnership
Report Date: January 1, 2022

Indicator of Success: A prioritized list of all structures to be modified or constructed will be developed by January 1, 2022.
Reporting Party: ODFW, Ducks Unlimited
Report To: Carp Partnership
Report Date: January 1, 2022

Indicator of Success: All Phase 1 structures will be constructed and/or modified by August 31, 2027.
Reporting Party: Project managers for each phase 1 structure
Report To: Carp Partnership, Funders
Report Date: August 31, 2027

Indicator of Success: All Phase 2 structures will be constructed and/or modified by August 31, 2029.
Reporting Party: Project managers for each phase 2 structure
Report To: Carp Partnership, Funders
Report Date: August 31, 2029

Indicator of Success: All Phase 3 structures will be constructed and/or modified by August 31, 2031.
Reporting Party: Project managers for each phase 3 structure
Report To: Carp Partnership, Funders
Report Date: August 31, 2031

Objective 5 B: Utilize management techniques that either create or take advantage of low water to interrupt habitat connectivity

Indicator of Success: A report on proposed management activities to be used in areas where structures are not feasible or will be inadequate to restrict carp movement, including a prioritized list of those management activities, will developed by January 1, 2022.
Reporting Party: ODFW, Ducks Unlimited
Report To: Carp Partnership
Report Date: January 1, 2022

Indicator of Success: All Phase 1 management practices will be implemented by August 31, 2027.
Reporting Party: Project managers for each phase 1 management practice
Report To: Carp Partnership, Funders
Report Date: August 31, 2027

Indicator of Success: All Phase 2 management practices will be implemented by August 31, 2029.
Reporting Party: Project managers for each phase 2 management practice
Report To: Carp Partnership, Funders
Report Date: August 31, 2029

Indicator of Success: All Phase 3 management practices will be implemented by August 31, 2031.
Reporting Party: Project managers for each phase 3 management practice
Report To: Carp Partnership, Funders
Report Date: August 31, 2031

Objective 6A: Develop and implement an Integrated Pest Management (IPM) strategy for the reduction of carp populations.

Indicator of Success: A report identifying a range of carp control methods that could potentially be used, which are expected to be most successful, will be developed by June 30, 2022.
Reporting Party: MNWR
Report To: Carp Partnership
Report Date: June 30, 2022

Indicator of Success: An IPM strategy for Implementation Phase 1 which identifies structures to be built/modified, management practices to be implemented, carp control methods to be used (and the parameters for the use of each method), and habitat improvement projects to be implemented will be developed by June 30, 2022.
Reporting Party: ODFW
Report To: Carp Partnership
Report Date: June 30, 2022

Indicator of Success: An IPM strategy for Implementation Phase 2 which identifies structures to be built/modified, management practices to be implemented, carp control methods to be used, and the parameters for the use of each method will be developed by June 30, 2024.
Reporting Party: ODFW
Report To: Carp Partnership
Report Date: June 30, 2024

Indicator of Success: An IPM strategy for Implementation Phase 3 which identifies structures to be built/modified, management practices to be implemented, carp control methods to be used, and the parameters for the use of each method will be developed by June 30, 2026.
Reporting Party: ODFW
Report To: Carp Partnership
Report Date: June 30, 2026

Objective 6B: Prioritize carp populations or habitat areas for control and address each in a logical order that considers the potential for re-infestation, expected success rates, treatment costs, and expected benefits to aquatic health and migratory bird populations.

Indicator of Success:	A report based on monitoring information indicating that carp populations within the Phase 1 area have been eradicated or reduced to below the target population level identified for each population will be developed by August 31, 2033.
Reporting Party:	ODFW, MNWR
Report To:	Carp Partnership, Funders of carp control
Report Date:	August 31, 2033

Indicator of Success:	Carp populations within the Phase 2 area will be eradicated or reduced to below the target population level identified for each population by August 31, 2035.
Reporting Party:	ODFW, MNWR
Report To:	Carp Partnership, Funders of carp control
Report Date:	August 31, 2035

Indicator of Success:	Carp populations within the Phase 3 area will be eradicated or reduced to below the target population level identified for each population by August 31, 2037.
Reporting Party:	ODFW, MNWR
Report To:	Carp Partnership, Funders of carp control
Report Date:	August 31, 2037

Objective 7: Implement aquatic health improvement projects.

Indicator of Success:	A report on proposed aquatic health improvement projects to be implemented, including a prioritized list of those projects, will developed by January 1, 2022.
Reporting Party:	ODFW
Report To:	Carp Partnership
Report Date:	January 1, 2022

Indicator of Success:	All Phase 1 aquatic health improvement projects will be implemented by August 31, 2030.
Reporting Party:	Project managers for each phase 1 aquatic health improvement project
Report To:	Carp Partnership, Funders
Report Date:	August 31, 2030

Indicator of Success:	All Phase 2 management practices will be implemented by August 31, 2032.
Reporting Party:	Project managers for each phase 2 aquatic health improvement project
Report To:	Carp Partnership, Funders
Report Date:	August 31, 2032

Indicator of Success:	All Phase 3 management practices will be implemented by August 31, 2034.
Reporting Party:	Project managers for each phase 3 aquatic health improvement project
Report To:	Carp Partnership, Funders
Report Date:	August 31, 2034

Objective 8: Develop and implement a monitoring and maintenance plan to ensure that carp populations remain at or below target population levels and structures which prevent movement between populations are operated and maintained appropriately

Indicator of Success:	An operation and maintenance plan, which includes appropriate O&M activities and schedules, assignment of responsibility, anticipated costs, and funding sources, will be developed during the planning and design of each structure and management practice.
Reporting Party:	Project managers for each structure or management practice
Report To:	Carp Partnership
Report Date:	Phase 1 – July 31, 2024 Phase 2 – July 31, 2026 Phase 3 – July 31, 2028

Indicator of Success:	Each Aquatic Health Improvement Phase IPM Strategy will include density maintenance provisions to ensure that carp densities remain at or below threshold levels. Density maintenance provisions will be developed at the time that the IPM strategy is developed.
Reporting Party:	ODFW, MNWR
Report To:	Carp Partnership
Report Date:	Phase 1 – June 30, 2022 Phase 2 – June 30, 2024 Phase 3 – June 30, 2026

Indicator of Success:	Structures and management practices perform satisfactorily throughout their expected service life.
Reporting Party:	Responsible party identified in O&M plan
Report To:	Carp Partnership
Report Date:	As defined in O&M plan

Indicator of Success:	Carp populations remain at or below target population levels.
Reporting Party:	ODFW, MNWR
Report To:	Carp Partnership
Report Date:	December 31, 2040 and then as defined in O&M plans

Objective 9: Monitor water quality, aquatic and riparian vegetation, macroinvertebrate populations, native fish populations, and migratory bird populations and evaluate whether carp removal efforts are having the desired impacts

Indicator of Success:	Water quality (turbidity, pH, conductivity, water temperature, dissolved oxygen) improves within 3 years following carp control.
Reporting Party:	ODFW
Report To:	Carp Partnership, funders
Report Date:	Phase 1 – December 31, 2030 Phase 2 – December 31, 2032 Phase 3 – December 31, 2034

Indicator of Success:	Diversity of aquatic macroinvertebrates increases within 3 years following carp control.
Reporting Party:	ODFW
Report To:	Carp Partnership, funders
Report Date:	Phase 1 – December 31, 2030 Phase 2 – December 31, 2032 Phase 3 – December 31, 2034

Indicator of Success:	Numbers of native fish increase within 3 years following carp control.
Reporting Party:	ODFW
Report To:	Carp Partnership
Report Date:	Phase 1 – December 31, 2030 Phase 2 – December 31, 2032 Phase 3 – December 31, 2034

Indicator of Success:	Productivity of aquatic and riparian vegetation increases within 3 years following carp control.
Reporting Party:	MNWR, ODFW, NRCS
Report To:	Carp Partnership
Report Date:	Phase 1 – December 31, 2030 Phase 2 – December 31, 2032 Phase 3 – December 31, 2034

Indicator of Success:	Species and structural composition of aquatic and riparian vegetation improves within 5 years following carp control.
Reporting Party:	MNWR, ODFW, NRCS
Report To:	Carp Partnership
Report Date:	Phase 1 – December 31, 2032 Phase 2 – December 31, 2034 Phase 3 – December 31, 2036

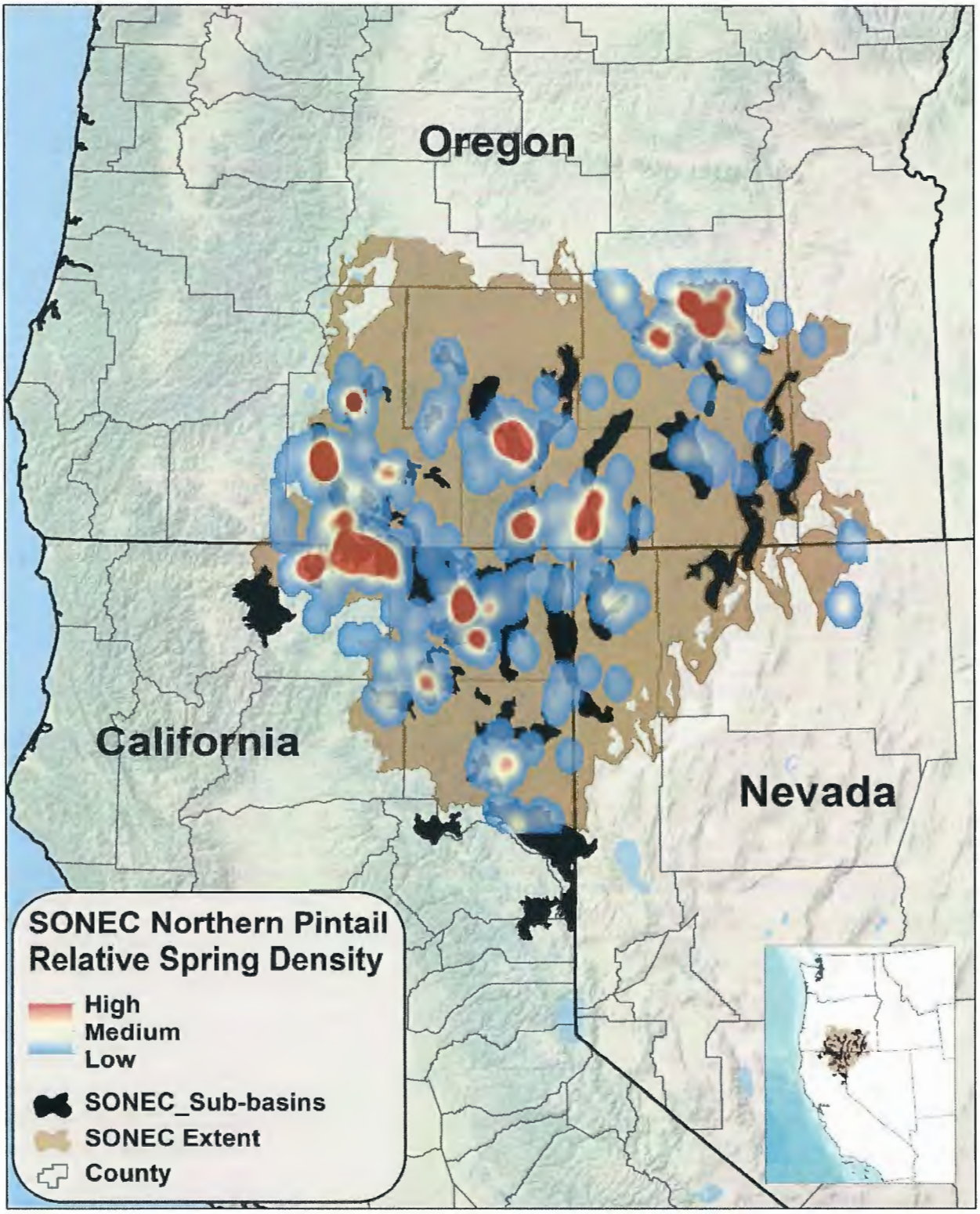
Indicator of Success:	Migratory bird populations increase within 5 years following carp control.
Reporting Party:	ODFW, MNWR, OSU
Report To:	Carp Partnership
Report Date:	Phase 1 – December 31, 2032 Phase 2 – December 31, 2034 Phase 3 – December 31, 2036

Indicator of Success:	A report on project results, including changes in carp populations, water quality, macroinvertebrate populations, native fish populations, aquatic and riparian vegetation, and migratory bird populations, as well as lessons learned during project implementation will be developed by December 31, 2041.
Reporting Party:	Carp Partnership
Report To:	The World!
Report Date:	December 31, 2041 (Zola and Linda will be retired!)

Attachment B

Conservation Implementation Strategy for

Working Lands Waterbird Habitat Conservation in the SONEC region



BACKGROUND:

In 1986, the U.S. Fish and Wildlife Service in collaboration with the Canadian government created the North American Waterfowl Management Plan (NAWMP). This plan was the first of its kind due to the intention of the plan being implemented not only between all the U.S. states, but also in Canada to create a holistic approach to waterbird conservation. This management plan addresses the need to preserve or repair degraded habitat used by migrating birds and listed 34 areas of major concern in the U.S. and Canada. The wetlands of the Intermountain West region are on this list.

The NAWMP underwent a few updates in 1994, 1998, and 2004. The 1994 update added Mexico as a partner with the U.S. and Canada. The 1998 revision gave way to the development of joint ventures, a partnership of public and private entities. These joint ventures work outside of the normal state and national boundaries, working within ecological and geographical areas. In 2004, the U.S., Canada, and Mexico worked together and reassessed the plan to strengthen the science base, give joint ventures a more stable platform to work from, and determine which region or joint venture was a higher priority.

In 2012, the NAWMP was given a complete revision. Within this revision, the NAWMP changed to give power to the joint ventures to carry out projects that are a high priority within their area. The Intermountain West Joint Venture (IWJV) immediately went to work to develop a science plan for the years 2013-2018 and determine which areas were of the highest priority. Two regions were identified by IWJV as their highest priority: Great Salt Lake basin and the SONEC region (Southern Oregon, North East California) due to their contribution in supporting significant proportions of waterfowl and other wetland dependent migratory birds in the Pacific Flyway.

In 2012, IWJV approached the NRCS seeking to discuss partner opportunities in the High Desert Basin (Harney, Lake, and Klamath Counties). In Harney County the NRCS was already working with the Harney Basin Wetlands Initiative (HBWI), a collaborative partnership working to conserve wetland habitat for migratory birds in the Harney Basin across ownership boundaries. Communication and shared goals led to the development of the SONEC partnership between NRCS, IWJV, Ducks Unlimited, and the Malheur National Wildlife Refuge.

The partners created two positions to provide technical and financial assistance to landowners to help improve flood irrigation infrastructure and practices. These two partner biologists are located in Lake and Harney Counties. It is the goal of this partnership to be able to secure enough flood irrigated acres to supply the demand needed for migratory birds both passing through and nesting in the SONEC region.

PROBLEM STATEMENT:

Northern Pintails, as well as most other waterfowl saw a sharp decline in numbers in the late 1970's and early 1980's. Urbanization and changes in agricultural practices throughout the continent created a habitat deficit. This deficit in conjunction with continent wide drought conditions in the 1970's and 1980's created a condition that led to the sudden decline of these migratory birds. Waterfowl populations near historical lows in 1985 led to the creation of the NAWMP. The U.S. Fish and Wildlife service and other partner organizations immediately went to work restoring breeding ground habitat in the northern U.S. and southern Canada. Restoration efforts and favorable climactic conditions in the Dakota's and in Southern Canada have allowed for almost all of the declining waterfowl populations to recover to what the USFWS has determined to be appropriate long term goals for population levels. Northern Pintails on the other hand, haven't recovered from their decline in the 1970's (Figure 1).

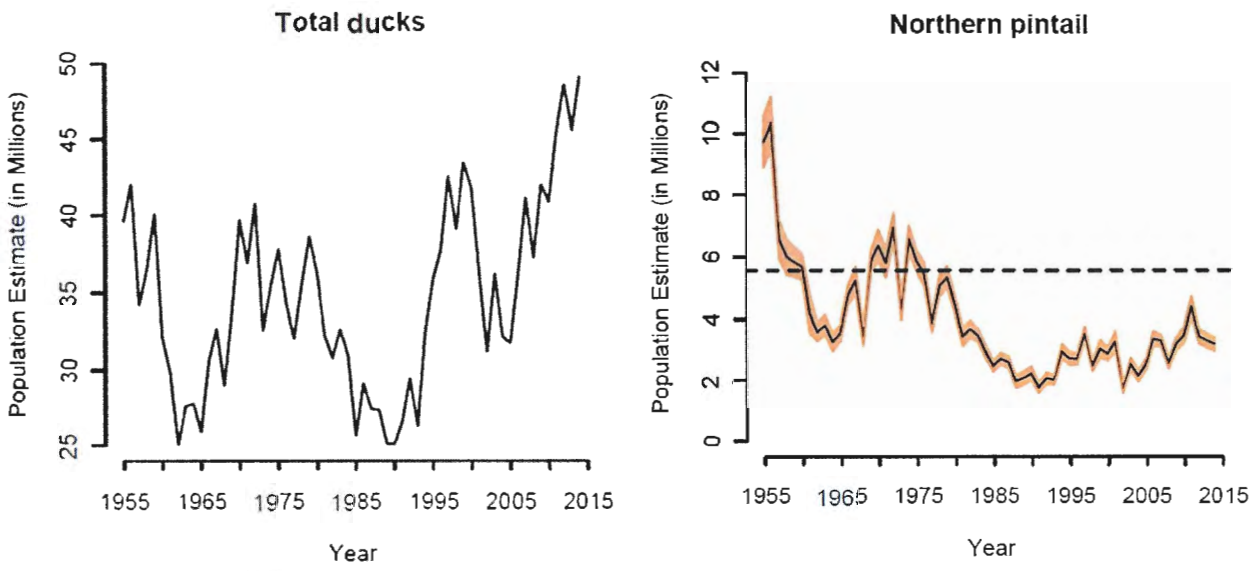


Figure 1: From 2014 Pacific Flyway Data Book. Left shows total U.S. duck population from 1955-2014. Right shows Northern Pintail populations. The dashed line is the long-term population goal set by NAWMP and the shaded area is the 90% confidence interval.

With the recovery of almost all species except the Northern Pintail, it begs the question, why haven't the Pintails recovered yet? Uncertainty remains as to why pintail populations have not recovered but a leading hypothesis is reduced reproductive performance due to landscape change, particularly on the Canadian Prairies. Research is ongoing to address the population decline and recovery. In the meantime, biologists under direction of the NAWMP are focused on ensuring adequate quantity and quality of habitat throughout their annual cycle to prevent an ecological bottleneck from occurring in any of their seasonal habitats. The primary focus has been on restoration of breeding habitat in the Prairie Pothole region. Additionally, significant conservation efforts have been focused on winter habitat. For example, in the Central Valley of California, many natural wetlands have been converted into rice fields. Biologists have worked with rice farmers to implement management practices that provide winter habitat while allowing for rice production. On the continental scale, relatively little consideration has been given to spring migratory habitat thus far.

Migratory bird management in the U.S. is broken up into four different administrative zones called flyways. These administrative flyway borders do not exactly mimic the biological flyways but instead use landmarks that divide each zone into an easily defined unit. Each flyway has a council made up of administrators and biologists that manage migratory birds throughout and compile data that is used to make harvesting decisions for each state. The four flyways are the Pacific Flyway, the Central Flyway, the Mississippi Flyway, and the Atlantic Flyway. During migration waterfowl may move in and out of the boundaries of each flyway but typically will winter and summer in relatively the same areas every year. The Pacific Flyway consists of the lower 48 states west of the eastern slope of the Rockies and Alaska, taking up all or part of 12 U.S. states.

Within the Pacific Flyway management region, there are 14 areas of concern named in the NAWMP. The Intermountain West contains six of these regions (NAWMP 2012). IWJV named the Great Salt Lake and the SONEC regions as their two top priorities in 2012. It is estimated that about 50% of the Northern Pintail's continental population uses the Pacific Flyway. Of those, approximately 70% (1/3 of the continental population) pass through the SONEC region before heading north either following the

Rockies or west of the Cascades (Figure 2). It is the flood-irrigated farm land that keeps these migratory birds returning through the area year after year in such high numbers.

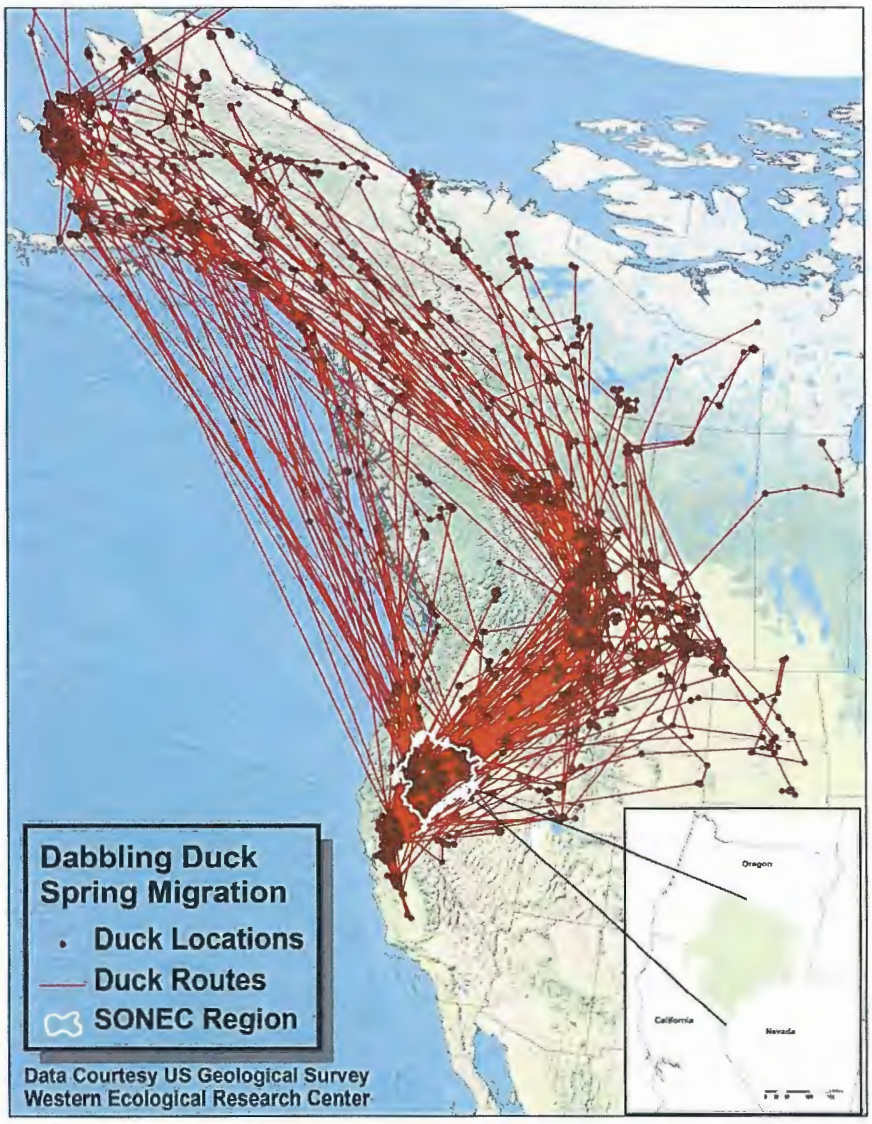


Figure 2: Spring migration routes by strategy category of adult female Northern Pintails PTT-tagged in the northern Central Valley of California during December-January and tracked annually through August each year 2000-2003 (Miller et al, 2005)

The SONEC region is an important staging area for migrating birds to rest, eat, and then continue their journey to the breeding grounds to the north. Common birds that pass through the SONEC include Northern Pintails, Trumpeter swans, American Wigeon, Greater White-fronted geese, and Snow geese. The farmed wetlands in Klamath, Lake and Harney counties make perfect habitat for birds passing through and for those species who choose to nest in the region such as Redhead ducks, Mallards, and Sandhill cranes.

Wetland loss is an issue that is being fought across the United States. Thomas Dahl of the Fish and Wildlife service published a report in 1990 on wetland loss across the U.S. from 1780-1980. At the time of its writing, Oregon had lost 38% of its wetlands and California had lost 91%. Draining natural wetlands for urbanization and change in agriculture uses still goes on today. The USDA Economic Research Service takes census of agricultural land. From 1998 to 2008 in Oregon, sprinkler irrigation increased from 769,310 total acres to 1,029,446. The amount of total irrigated acres for all use types increased from 1,534,961 acres in 1998 to 1,630,275 acres in 2008. With the addition of 95,314 acres that were not previously irrigated, there was 164,822 acres of irrigated farm and ranchland statewide that underwent a change in irrigation practice. Presumably, the majority of these conversions were from flood to sprinkler irrigation. Currently, there are no good assessments of the extent or rate of wetland loss or flood to sprinkler irrigation conversion specific to the SONEC region. IWJV is in the process of analyzing 30 years of aerial photography to develop this assessment for the SONEC. The loss

of wetlands spells a loss of habitat not only for waterbirds, but for fish and other wildlife that use the highly productive wetlands as well.

Northern Pintails are one of the earliest migrators, starting departure from the Central Valley, California as early as late January. Being an early nesting species, typically when they arrive in Canada and Alaska, there is not an abundance of food available when they arrive. Having the flood irrigated hay land habitat available when they pass through the region is absolutely critical to the Northern Pintail's nesting success. Research on northern pintails and other early nesting species such as mallards have identified that habitat conditions during winter and spring migration are important to breeding performance. Birds that arrive on breeding areas in good body condition have higher breeding propensity, clutch sizes, and nest success. Sustaining adequate habitat resources during spring migration in SONEC is therefore important to ensure birds arrive on breeding areas in good body condition. Inadequate spring migration habitat in SONEC may have population scale impacts because such a large proportion of North America's northern pintails rely on SONEC during spring.

Field research by USGS (funded by IWJV and DU) has estimated the foraging value of flood-irrigated habitats in the SONEC region to these principal species of waterfowl. Outside of the Klamath Basin, approximately 70% of northern pintail use occurred on private lands and flood-irrigated habitats used for livestock forage production. This information was used in a bioenergetics model to quantify habitat needs and conservation targets for these birds. Within the SONEC sub-regions found in Oregon (Klamath excluded: Modoc Plateau, Summer Lake, Warner Valley, and Malheur), it is expected that 25% of the habitat demand of spring migrating waterfowl will be met on National Wildlife Refuges and State Wildlife Areas. In order to achieve the SONEC habitat objectives and support waterfowl populations at goal levels, private lands and principally those which are flooded irrigated will need to provide the balance (75%) of the habitat demands (Table 1).

SONEC Sub-regions	Existing Habitat (acres)	Habitat Required to Meet 75% of Dabbling Duck Needs (acres)
Modoc Plateau	13,000	13,500
Malheur	15,300	5,300
Summer Lake	4,100	8,300
Warner Valley	7,500	10,500
Upper Klamath	*18,000*	*17,300*
Lower Klamath	*7,100*	*not determined*
TOTAL	**65,000**	**54,900**

Table 1: From IWJV, estimates of existing habitat by basin and estimate acre needs to support 75% of dabbling duck needs in SONEC region.

Although current assessments suggest a surplus of flood-irrigated habitats exist in Harney County (Malheur sub-region) to meet the needs of spring migrating dabbling ducks, recent trends in sprinkler conversion regionally suggest availability of flood-irrigated habitats may be declining across SONEC. Additionally, a high proportion of overall dabbling duck use was assumed to be met by public habitats in

the Klamath Basin. Recent changes in water use priorities in the Klamath Basin have compromised the ability of those areas to provide adequate foraging habitat (up to 70% reduction). Consequently, birds migrating through SONEC must find additional foraging habitat in the region to account for these losses. Therefore, sustaining more than 5,300 acres of flood-irrigated habitats in Harney County will be prudent to ensuring adequate resources are available at the SONEC regional scale. Likewise in Lake County, it is crucial to maintain existing surface-irrigated pasture and hay land acreages in the Warner Valley, Summer Lake, and Modoc Plateau (Goose Lake Basin portion) sub-regions to enhance habitat for spring migrating waterbirds. It may not be possible to establish new habitat on 7,700 acres, as indicated in Table 1, but NRCS in Lake County will work with private landowners to improve habitat on 25 percent of the existing 38,000 acres of irrigated lands in these areas.

GOAL AND OBJECTIVES:

Goal: Secure 24,800 acres of flood-irrigated habitat in Lake and Harney Counties through either conservation easements or through practices that improve management ability and reduce the incentive for converting to other uses by September 30, 2020.

Objective 1: Conduct research into habitat loss that has occurred and establish trends and the level of current threat to flood-irrigated meadows within the SONEC region.

Objective 2: Provide outreach to local agricultural producers to inform them of the importance of flood irrigation and traditional haying and grazing practices to spring migration habitat and garner participation in conservation programs.

Objective 3: Secure 10,300 acres of flood-irrigated habitat long-term through enrollment in working land conservation easements.

Objective 4: Provide technical assistance and financial assistance to improve management ability and reduce the incentive for converting to other uses on 14,500 acres.

County	Objective 3: Easement Acres	Objective 4: Infrastructure/Management Improvement Acres	Total Acres
Lake	5,000	9,500	14,500
Harney	5,300	5,000	10,300
TOTAL	10,300	14,500	24,800

Table 2: Breakdown of Goal and Objectives Acres by County.

ALTERNATIVES

There are four alternatives to be considered:

- No Action
- Easements
- Infrastructure Improvements to Reduce Incentives for Conversion
- Blended Approach

Alternative 1 – No Action

Alternative 1 is the No Action Alternative. Under the No Action Alternative, no changes would be made to the current land management practices. If the No Action Alternative is selected, the expected impacts include continued degradation of existing structures which could lead to stream bank erosion and insufficient water on flood-irrigated lands. These issues could push producers to convert to sprinkler irrigation which would take away habitat from migratory birds. Also, if producers aren't able to properly irrigate their fields, there could be a problem of land subdivision which can also negatively affect migratory bird habitat.

Alternative 2 – Easements

Alternative 2 is to acquire working lands conservation easements, using programs such as the Agricultural Conservation Easement Program (ACEP), on flood-irrigated pasture and hayland in high priority spring habitat areas. The benefit of using easements is that it secures the land and keeps it in agriculture. With the secured land remaining in agriculture, easements eliminate the threat of subdivision, allowing fish and wildlife habitat to remain available, and keeps habitat from being fragmented for the duration of the easement. This would also ensure that the best available management practices would be used for both agriculture production and to benefit fish and wildlife. However, this alternative does not include improvements to flood-irrigation infrastructure. Therefore, under this alternative we expect to see continued degradation of existing structures, continued stream bank erosion, and insufficient water on irrigated lands in some areas. In addition, participation in easement programs has historically been low among landowners in Harney and Lake Counties.

Alternative 3 – Infrastructure Improvements

Alternative 3 is to make improvements to existing infrastructure on flood-irrigated meadows. Infrastructure would be evaluated and necessary improvements made to increase the reliability, distribution, and duration of flooding in priority spring habitat areas, in order to maintain and improve waterbird habitat quality and quantity. Infrastructure that might need repaired/replaced includes: head gates, flash board risers, diversion structures, and existing ditch work. Replacing or repairing the existing infrastructure would increase the efficiency of flood irrigation practices, aid in erosion reduction, and help create incentive for producers to keep from converting to sprinkler irrigation. However, this alternative does not provide for long-term security of habitat. Landowners would be obligated to continue to operate and maintain any structures for which they had received financial assistance for the service life of that structure, or according to the terms and conditions of their funding agreements. Beyond that period, the landowner is under no legal obligation to continue their flood-irrigation practices. Participation rates in a program to improve infrastructure are expected to be high.

Alternative 4 – Blended Approach

Alternative 4 is the Blended Approach. Under this alternative, landowners will be offered financial and technical assistance to improve flood-irrigation infrastructure and management, as well as opportunities to enroll in conservation easements. The expected benefits of this alternative are long-term security of waterbird habitat on a limited number of acres through conservation easements, short-term security and improvements to habitat quality and quantity over a much larger acreage across Harney and Lake Counties, as well as reductions in soil erosion. Under the Blended Approach, the threat of land being broken up and habitat fragmentation is decreased, infrastructure will be improved to help reduce erosion, improve irrigation efficiency, and by extension reduce the threat of sprinkler conversion on flood irrigated wetlands.

PROPOSED SOLUTION AND ACTIONS:

The proposed solution is Alternative 4. This alternative was selected because it addresses immediate resource concerns, such as stream bank erosion, insufficient water on flood-irrigated lands, and habitat degradation, which in turn reduces the immediate incentives for landowners to convert these lands to sprinkler irrigation or other lands uses. In addition, this alternative offers long-term security of habitat through conservation easements for those landowners who are willing and able to enroll. This alternative combines two good alternatives to create a holistic solution to all perceived threats. It fixes current problems faced by producers and will keep high risk lands from being sub-divided in the future.

Listed below are the specific actions to be taken under the selected alternative in order to achieve the project objectives listed earlier in this document.

Objective 1: Conduct research into habitat loss that has occurred and establish the level of current threat to flood-irrigated meadows within the SONEC region.

Action: Research trends in sprinkler irrigation conversion

Action: Research other limiting factors that contribute to Pintail's lack of recovery

Objective 2: Provide outreach to local agricultural producers.

Action: Educate on the benefits of retaining flood-irrigation practices

Action: Develop practice techniques with landowners that benefit water birds

Action: Provide cost/benefit analysis for sprinkler conversion

Objective 3: Secure 10,300 acres of flood-irrigated agriculture land under working land easements in Lake and Harney Counties.

Action: Identify third party land trust(s) to hold conservation easements

Action: Enroll 5,300 acres of flood-irrigated agriculture land in Harney County in conservation easements

Action: Enroll 5,000 acres of flood-irrigated agriculture land in Lake County in conservation easements

Objective 4: Provide technical assistance and financial assistance to improve management ability and reduce the incentive for converting to other uses on 14,500 acres.

Action: Provide assistance on 5,000 acres of flood-irrigated lands in Harney County

- EQIP funding to be used for repairing or installing new infrastructure
- CSP funding to be used for implementing practices that favor migratory bird use and for making small changes to infrastructure
- OWEB grants used to repair or install new infrastructure not covered by EQIP due to funding constraints or size of structure
- Use NAWCA grants to help fund structure changes

Action: Provide assistance on 9,500 acres of flood-irrigated lands in Lake County

- EQIP funding to be used for repairing or installing new infrastructure
- CSP funding to be used for implementing practices that favor migratory bird use and for making small changes to infrastructure
- OWEB grants used to repair or install new infrastructure not covered by EQIP due to funding constraints or size of structure
- Use NAWCA grants to help fund structure changes

PARTNERSHIP AND FUNDING SOURCES (Harney County):
NRCS is the lead agency for this project. Other partners and potential partners include: Intermountain West Joint Venture (IWJV), Ducks Unlimited (DU), Malheur National Wildlife Refuge (MNWR), Harney Soil and Water Conservation District (Harney SWCD), Harney Basin Wetlands Initiative (HBWI), Oregon Department of Fish and Wildlife (ODFW), and the Harney County Watershed Council (HCWC).

PARTNERSHIP AND FUNDING SOURCES (Lake County):
NRCS is the lead agency, with financial assistance through Farm Bill programs (EQIP, CSP, and ACEP). Other partners contributing to this CIS with technical assistance and potential financial assistance include: Intermountain West Joint Venture (IWJV), Ducks Unlimited (DU), Lakeview Soil and Water Conservation District, Fort Rock/Silver Lake Soil and Water Conservation District, Oregon Department of Fish and Wildlife (ODFW), and Lake County Umbrella Watershed Council (LCUWC).

Proposed Funding Sources
Objective 1: Conduct research into habitat loss that has occurred and establish the level of current threat to flood-irrigated meadows within the SONEC region.

Intermountain West Joint Venture is the lead agency for this objective. IWJV has secured $133,500 in funding and personnel to analyze aerial photography over the last 30 years to mark trends in the changing landscape to gain a perspective on land use changes in Lake and Harney Counties.

Objective 2: Provide outreach to local agricultural producers.

Outreach is to be performed by the 2 partner biologists. Funding is provided by NRCS, IWJV, DU, Malheur National Wildlife Refuge, and Harney SWCD. The anticipated funding need for outreach is $383,500. DU has secured $50,000 in OWEB funding for outreach in Harney County, and has applied for $50,000 in OWEB funding for outreach in Lake County.

Objective 3: Secure 10,300 acres of flood-irrigated agriculture land under working land easements in Lake and Harney Counties.

NRCS is the lead agency for securing working land easements. IWJV and DU will take the lead in recruiting a third party land trust agency to hold the NRCS working land easements. An estimated $9,270,000 in financial assistance will be needed to acquire easements on 10,300 acres. It is anticipated that approximately 75% ($6,952,500) would come from NRCS, with the remaining 25% ($2,317,500) coming from partner funding and landowner contributions. An estimated $1,854,000 in technical assistance will be needed. It is anticipated that approximately 50% ($927,000), with the remaining 50% coming from partner contributions.

Objective 4: Provide technical assistance and financial assistance to improve management ability and reduce the incentive for converting to other uses on 14,500 acres.

NRCS is the lead agency for this objective. EQIP funding will be used to fix failing/improper infrastructure. CSP funding will be used to fix small infrastructure issues and to provide incentives to maintain management practices that favor migratory bird use. IWJV and DU will also contribute to this objective by securing OWEB and NAWCA funding for projects that cannot be covered through EQIP or are too large to be feasible to the landowner to fix through Farm Bill programs.

It is estimated that approximately $875,000 in financial assistance will be needed for infrastructure and management improvements on 14,500 acres. $725,000 is proposed to come from NRCS, with the remaining $150,000 to be provided through partner programs such as OWEB or NAWCA grants. An estimated $131,250 in technical assistance will be needed to achieve this objective. It is anticipated that $108,750 in TA funds will come from NRCS, with partners contributing the remaining $22,500.

Budget Summary

	NRCS	Partners	Total
Financial Assistance	$7,677,500	$2,467,500	$10,145,000
Technical Assistance	$1,035,750	$1,466,500	$2,502,250
Total	$8,713,250	$3,934,000	$12,647,250

Table 3: Summary of Project Budget showing anticipated financial and technical assistance contributions by NRCS and Partners.

IMPLEMENTATION TIMELINE:

Implementation will occur over a five year period, beginning in fiscal year 2016. The goal is to secure 24,800 acres of flood-irrigated habitat in Lake and Harney Counties through either conservation easements or through practices that improve management ability and reduce the incentive for converting to other uses. It should be noted that NRCS has been operating under a "pilot" Conservation Implementation Strategy (CIS), which was developed in fiscal year 2013. EQIP funding was offered in Lake County in 2014 and in both Lake and Harney Counties in 2015. This new CIS replaces the pilot CIS, and progress made under the pilot CIS will be counted toward achieving the goals and objectives established in this CIS. Lake County NRCS contracted with 1 landowner through EQIP in 2014 and anticipates funding 4 contracts in 2015. Harney County NRCS anticipates funding 2 contracts in 2015. NRCS will start implementation of Conservation Stewardship Program contracts and working land easements starting in fiscal year 2016.

If the objectives are met, NRCS along with partner organizations, will have improved or secured 24,800 acres for migratory bird habitat in Lake and Harney Counties through working land easements, EQIP, or CSP contracts by 2020.

Outreach will be provided throughout the implementation period by the two partner biologist to recruit landowner participation throughout Lake and Harney Counties in the high priority zones determined by IWJV and DU. In Harney County, the Harney SWCD will help with outreach by helping place the Harney partner biologist on private lands in the priority areas performing riparian assessments for the district.

In addition, DU and IWJV will aid in implementing projects throughout the target areas by securing OWEB and NAWCA funding where available.

PROGRESS EVALUATION AND MONITORING:
The following outputs and outcomes will be used as indicators of success in achieving each of the project objectives.

Objective 1 – Conduct research into habitat loss that has occurred and establish the level of current threat to flood-irrigated meadows within the SONEC region

Indicator of Success:	Will have a reliable database indicating the areas and acres where migratory bird habitat loss has occurred due to change in practices throughout Lake and Harney Counties.
Reporting Party:	IWJV
Report To:	NRCS
Report Date:	December 31, 2015

Objective 2 – Provide outreach to local Ag producers

Indicator of Success:	Landowners educated on the benefits of retaining flood-irrigated practices.
Reporting Party:	DU
Report To:	NRCS, IWJV, DU
Report Date:	January, April, July, and October 2015 – 2020 (Quarterly progress reports)

Indicator of Success:	Landowners in Lake and Harney Counties adopt practices that are more beneficial to migratory bird habitat.
Reporting Party:	NRCS, DU
Report To:	NRCS, IWJV, DU
Report Date:	January, April, July, and October 2015 – 2020 (Quarterly progress reports)

Indicator of Success:	Provide a cost/benefit analysis for conversion from flood irrigation to center pivot irrigation.
Reporting Party:	NRCS
Report To:	NRCS, IWJV, DU
Report Date:	2015

Objective 3 – Secure 10,300 acres of flood-irrigated agriculture land under working land easements in Lake and Harney Counties

Indicator of Success:	Secure a third party land trust agency to hold NRCS easements
Reporting Party:	IWJV, DU
Report To:	NRCS
Report Date:	September 30, 2016

Indicator of Success:	Secure 5,300 acres of flood-irrigated agriculture land in Harney County
Reporting Party:	NRCS
Report To:	NRCS, IWJV, DU
Report Date:	Annual progress reported 2015-2020

Indicator of Success:	Secure 5,000 acres of flood-irrigated agriculture land in Lake County
Reporting Party:	NRCS
Report To:	NRCS, IWJV, DU
Report Date:	Annual progress reported 2015-2020

Objective 4 – Provide technical assistance and financial assistance to improve management ability and reduce the incentive for converting to other uses on 14,500 acres.

Indicator of Success:	Provide assistance on 5,000 acres of flood-irrigated lands in Harney County through EQIP and CSP funding pools and OWEB and NAWCA grants.
Reporting Party:	NRCS, IWJV, DU
Report To:	NRCS, IWJV, DU
Report Date:	Annual progress reported 2015-2020

Indicator of Success:	Provide assistance on 9,500 acres of flood-irrigated lands in Lake County through EQIP and CSP funding pools and OWEB and NAWCA grants.
Reporting Party:	NRCS, IWJV, DU
Report To:	NRCS, IWJV, DU
Report Date:	Annual progress reported 2015-2020

Goal - Secure 24,800 acres of flood-irrigated habitat in Lake and Harney Counties through either conservation easements or through practices that improve management ability and reduce the incentive for converting to other uses.

Indicator of Success:	Conserved and/or improved migratory bird habitat on 24,800 acres in Lake and Harney counties
Reporting Party:	NRCS, IWJV, DU
Report To:	NRCS, IWJV, DU
Report Date:	Annual progress reported 2015-2020

Indicator of Success:	Acres of spring migratory habitat with improved reliability, distribution, and/or duration of flooding.
Reporting Party:	NRCS
Report To:	NRCS, IWJV, DU
Report Date:	Annually reported 2015-2020

Indicator of Success:	Acres of spring migratory habitat with improved micro-topography and/or vegetative composition for habitat quality.
Reporting Party:	NRCS
Report To:	NRCS, IWJV, DU
Report Date:	Annually reported 2015-2020

Indicator of Success:	Stable to increasing migratory bird numbers during spring migration throughout Lake and Harney Counties
Reporting Party:	ODFW

Report To:	NRCS, IWJV, DU
Report Date:	Annually reported 2015-2025