Environmental Assessment
for the

Draft
Grays Lake National Wildlife Refuge
Upland and Meadow Complex
Habitat Management Plan

July 2022

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Environmental Assessment for the Draft Grays Lake National Wildlife Refuge Upland and Meadow Complex Habitat Management Plan

Date: July 2022

This Draft Environmental Assessment is being prepared to evaluate the effects associated with the proposed action and complies with the National Environmental Policy Act in accordance with Council on Environmental Quality regulations (40 CFR 1500-1509) and Department of the Interior (43 CFR 46; 516 DM 8) and U.S. Fish and Wildlife Service (550 FW 3) regulations and policies. The National Environmental Policy Act (NEPA) requires examination of the effects of proposed actions on the natural and human environment.

Proposed Action

The U.S. Fish and Wildlife Service (Service) is proposing to implement a series of habitat management actions in accordance with the Grays Lake National Wildlife Refuge (Refuge) Draft Uplands and Meadow Complex Habitat Management Plan (HMP). The Draft HMP (see Appendix 2) provides specific guidance for habitat management related to meadow, uplands, and riparian habitats to support legal mandates as well as the conservation, management, and, where appropriate, restoration of local, regional, and ecosystem fish, wildlife, plant, and habitat resources on specific properties administered by the United States Fish and Wildlife Service (Service). The CMP describes habitat management actions that would be conducted by the Service (e.g., habitat restoration, integrated pest management, and prescribed fire) and actions that would be conducted by permittees under Cooperative Agriculture Agreements (CAAs) for livestock grazing and haying.

A proposed action may evolve during the NEPA process as the agency refines its proposal and gathers feedback from the public, tribes, and other agencies. Therefore, the final proposed action may be different from the original. The proposed action will be finalized at the conclusion of the public comment period for the EA.

Background

National wildlife refuges are guided by the mission and goals of the National Wildlife Refuge System (NWRS), the purposes of an individual refuge, Service policy, and laws and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act of 1966 (NWRSAA; Administration Act), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act), Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations and U.S. Fish and Wildlife Service Manual. Grays Lake NWR was established in 1965 under the authority of a Memorandum of Understanding with the Bureau of Indian Affairs and Refuge Use and Cooperative Agreements with 22 ranchers that owned property adjacent to Grays Lake. The current approved refuge boundary was established in 1972 by the Migratory Bird Conservation Commission.

From these documents the refuge's purposes are broadly stated as the **conservation of native birds and other wildlife and to further the purposes of the Migratory Bird Treaty Act**. Specifically, the purposes for Grays Lake NWR mentions providing quality habitats for sandhill cranes, Canada geese, and ducks.

The NWRSAA, as amended, clearly establishes wildlife conservation as the core NWRS mission. House Report 105-106, accompanying the Refuge Improvement Act, states *"…the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first."* In contrast to some other systems of federal lands which are managed on a sustained-yield basis for multiple uses, the NWRS is a primary-use network of lands and waters. First and foremost, refuges are managed for fish, wildlife, plants, and their habitats. In addition, units of the NWRS are legally closed to all public access and use, including economic uses, unless and until they are officially opened through an analytical, public process called the refuge compatibility process. With the exception of refuge management activities which are not economic in nature, all other uses are subservient to the NWRS' primary wildlife management responsibility and they must be determined compatible before being authorized.

The mission of the NWRS, as outlined by the NWRSAA as amended by the Refuge Improvement Act (16 U.S.C. 668dd et seq.), is

"... to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans"

Additionally, the NWRSAA mandates the Secretary of the Interior in administering the NWRS (16 U.S.C. 668dd(a)(4)) to:

- Provide for the conservation of fish, wildlife, and plants, and their habitats within the NWRS;
- Ensure that the biological integrity, diversity, and environmental health of the NWRS are maintained for the benefit of present and future generations of Americans;
- Ensure that the mission of the NWRS described at 16 U.S.C. 668dd(a)(2) and the purposes of each refuge are carried out;

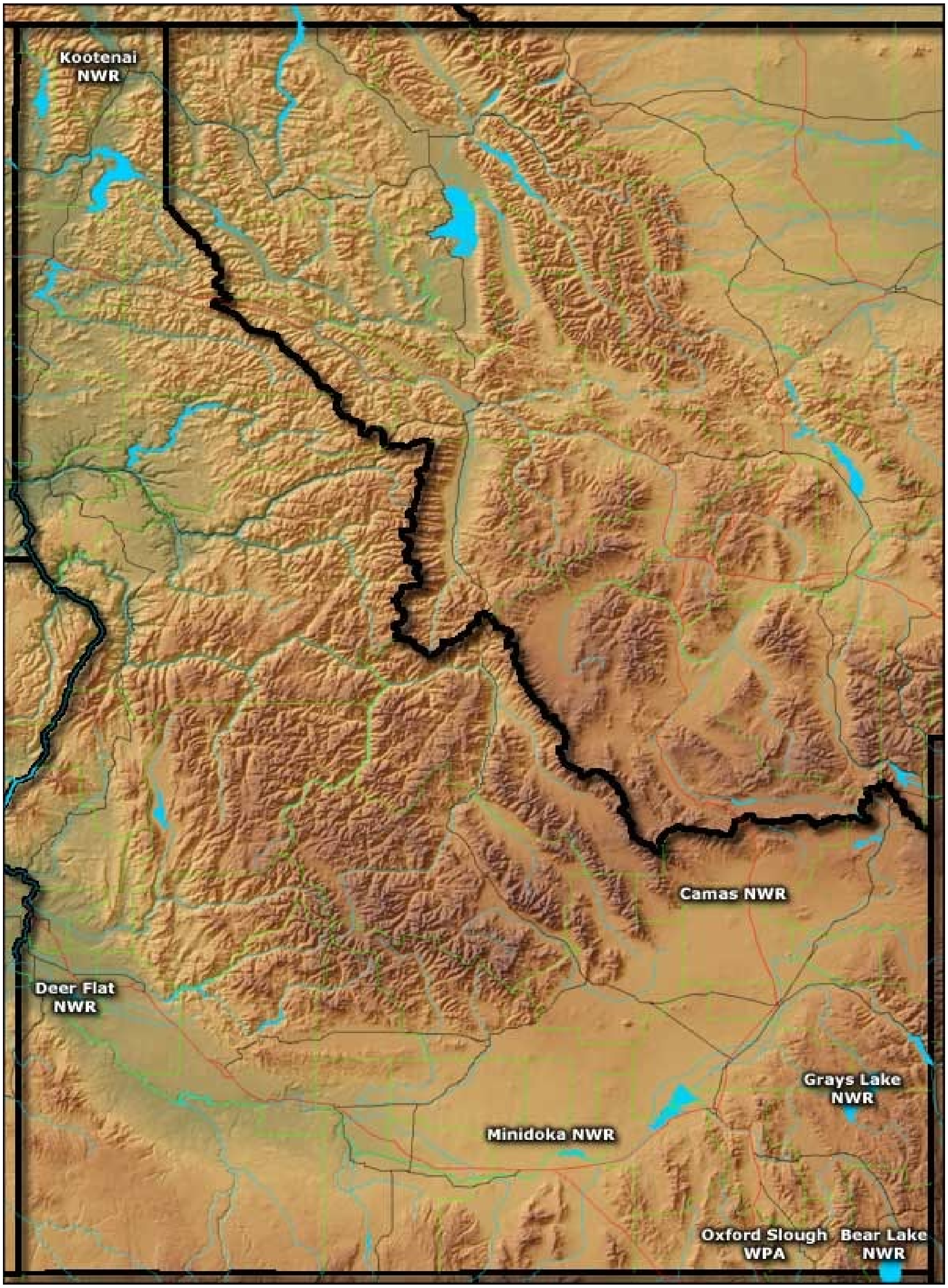
- Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the states in which the units of the NWRS are located;
- Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the NWRS and the purposes of each refuge;
- Recognize compatible wildlife-dependent recreational uses as the priority general public uses of the NWRS through which the American public can develop an appreciation for fish and wildlife; and
- Ensure that opportunities are provided within the NWRS for compatible wildlife-dependent recreational uses; and monitor the status and trends of fish, wildlife, and plants in each refuge.

The Grays Lake NWR is managed as a unit of the Southeast Idaho National Wildlife Refuge Complex along with Bear Lake, Camas, Deer Flat, and Minidoka National Wildlife Refuges, and Oxford Slough Waterfowl Production Area (Map 1). The Complex Office is located in Chubbuck, Idaho, which is 90 miles west of the refuge. The Refuge is located in the Grays Lake valley, in northern Caribou and southern Bonneville Counties. It is about 55 miles southeast of Idaho Falls, and 35 miles north of Soda Springs. It currently comprises about 18,800 acres of marsh and upland habitat (Map 2). The valley floor is 6,386 feet above sea level.

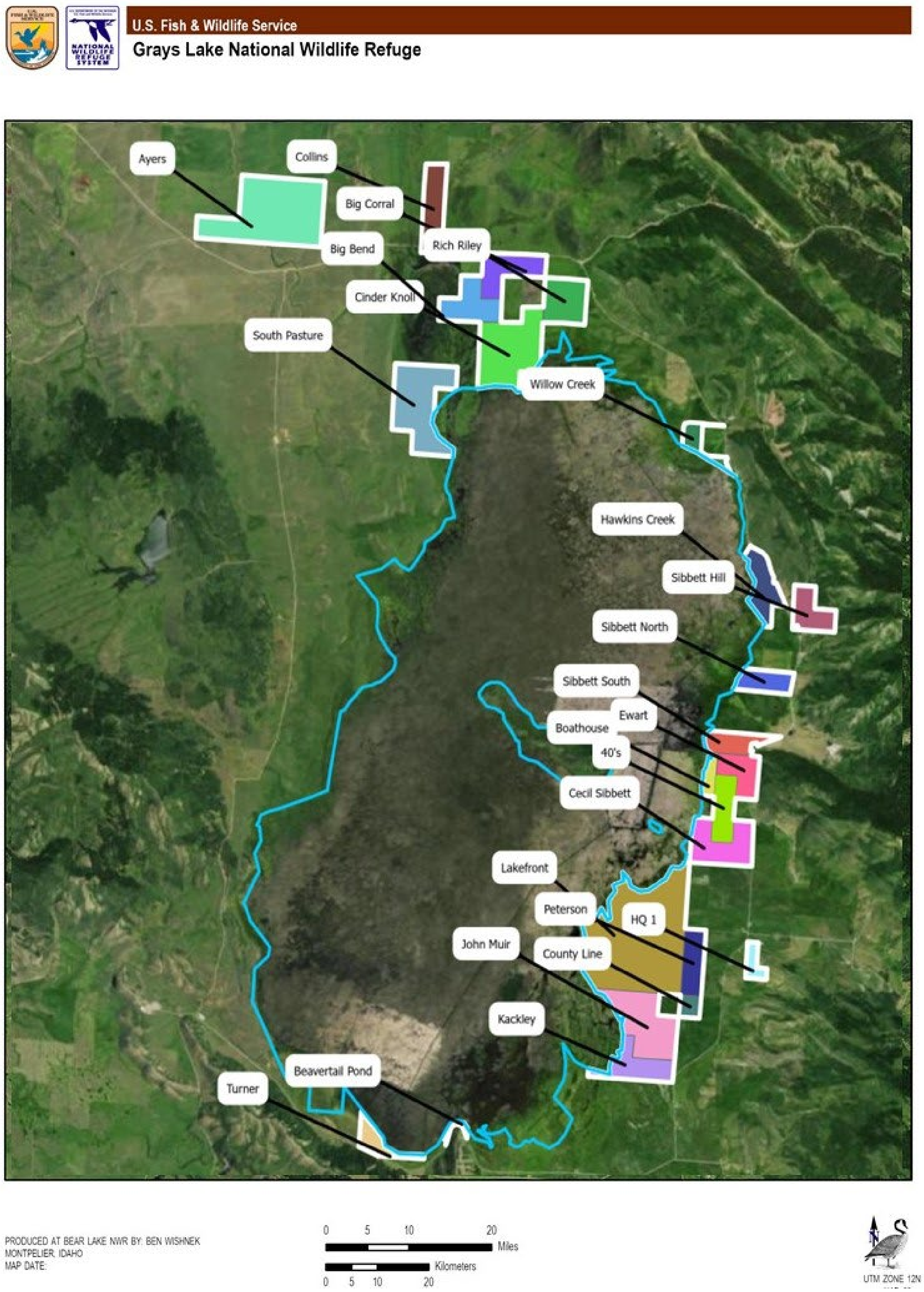
Although the federal government manages the majority of the 13,000-acre lakebed, use of the land is partially driven through agreements with neighboring private landowners. Water levels are currently managed according to a 1964 agreement between the Service and the Bureau of Indian Affairs. After future land acquisitions, water management will be negotiated according the 1990 Fort Hall Indian Water Rights Agreement.

The 20,000-acre Grays Lake (which is actually a large, shallow marsh) is the core of the Refuge. There are areas of open water at the south and north end of Grays Lake, with scattered small ponds throughout the marsh. Because of shallow water and a consistent water draw down schedule, much of the marsh is dominated by hardstem bulrush with some cattails and other emergent aquatic plants. In addition, the Refuge manages about 5,800 acres of upland grasslands; wet meadows; and temporary, seasonal, and semi-permanent wetlands. Management of these upland areas is the subject of the draft HMP.

Management under the guidance of the HMP is designed to provide habitat conditions that meet the life history requirements for a variety of wildlife species, while maintaining healthy plant communities. Grazing, haying, and prescribed fire are three tools used to manage grasslands and wet meadows to modify habitat structure in order to improve habitat conditions for wildlife species dependent upon short-grass meadow conditions.



Map 1. National Wildlife Refuges in Idaho.



Map 2. Grays Lake NWR upland and meadow management units.

Purpose and Need for the Action

The purpose of this proposed action is to improve upland and meadow complex habitat conditions at Grays Lake NWR to meet the life history requirements for a variety of wildlife species which are a management focus for the Refuge, while maintaining healthy plant communities. As described in detail in the Draft Grays Lake National Wildlife Refuge Uplands and Meadow Complex Habitat Management Plan (Appendix 2), grazing, haying, and prescribed fire are three tools used to manage grasslands and wet meadows to modify habitat structure and thereby provide suitable habitat conditions for migratory birds and other wildlife species.

The need of the proposed action is to meet the Service's priorities and mandates as outlined by the NWRSAA to provide for the conservation of fish, wildlife, and plants, and their habitats within the NWRS, ensure that the biological integrity, diversity, and environmental health of the NWRS are maintained for the benefit of present and future generations of Americans, and ensure that the mission of the NWRS described in 16 U.S.C. 668dd(a)(2) and the purposes of each refuge (16 U.S.C. 668dd(a)(4)) are carried out. An additional need is to ensure that Refuge economic uses (grazing and haying) are conducted in accordance with the Service's Cooperative Agriculture policy (620 FW 2), to support objectives for focal species and their associated habitats that represent the Service's desired biological outcomes.

Alternatives

Alternative A – Continue Current Management – No Action Alternative

Meadow Complex Habitats, Current Management

The Meadow Complex habitats at Grays Lake NWR encompass a gradient from dry meadow to wet meadow and the interface with shallow marsh. The meadow complex provides important breeding and foraging habitat for the following focal species: American avocet, cinnamon teal, greater sandhill crane, white-faced ibis, long-billed curlew, Canada goose, and grasshopper sparrow, so long as these meadows are managed for short grass conditions. Unmanaged meadows provide little habitat value for wildlife, particularly for wildlife species which are a management focus for the Refuge, hence the need to manage for short grass meadow conditions.

Grazing by means of permittees under Cooperative Land Management Agreements (CLMAs) is the primary method by which excess vegetation is removed from meadow complex habitats. CLMAs would be replaced by CAAs by the 2023 grazing season, in compliance with the Service's Cooperative Agriculture policy. Currently, grazing permits operated by five permittees allow for 1,600 Animal Unit Months (AUMs) with 735 yearlings and 68 cow/calf pairs. Over the past five years (2017-2021), permittees grazed between 1,233 and 1,562 AUMS on 1,242-1,561 Refuge acres (Table 1). Of all the current management units, only five are ungrazed: Ayers, Cinder

Knoll, South Pasture, Sibbett Hill, and HQ. The eastern portion of the Ewart Unit ("Hillside") has also been retired from grazing, and approximately 26 acres of the Sibbett South unit has been fenced to exclude grazing and allow for riparian restoration. Small portions of the Ayers and HQ management units are planted with crops for wildlife (see Map 2 for locations of Refuge management units).

Currently, five management units and portions of three units, approximately 855 acres, are grazed annually. Nine management units and a portion of one unit, approximately 1,384 acres, are grazed on a three-year rotation which features two years of grazing followed by one year of rest. (The Collins Unit [163 acres] and County Line unit [40 acres] are unfenced parcels which are inadvertently grazed by livestock from adjacent grazing allotments outside the Refuge.) The Sibbett North, Sibbett South, and Sibbett Hill pastures (collectively, "Sibbett pastures") may be grazed annually under warranty deed which expires December 31, 2030; however, the Sibbett Hill pasture is currently ungrazed. In 2019, the warranty deed holder for the Sibbett pastures entered into an Memorandum of Agreement (MOA) with the Service, allowing him to annually graze the Boathouse, west side of Ewart, and North 40 pastures (approximately 144 acres total) until December 31, 2030 in exchange for keeping the southern portion of the Sibbett South unit free of grazing to allow riparian restoration work on Eagle Creek (see HMP, Objective 4.3.1). When the warranty deed and MOA expire, Sibbett North, Sibbett South, Boathouse, the west portion of Ewart, and North 40 pastures would be grazed annually under CAAs.

In total under current management, up to 1,595 acres may be grazed annually under permit. This reflects 672 acres that may be grazed annually under permit, and 1,384 acres that may be grazed two out of every three years under permit. Over the past five grazing seasons (2015-2021), between 1,242 and 1,561 acres have actually been grazed under permit, for an average of 1,441 acres annually (Table 1). Grazing animals are put on meadows at various times and for various durations during the grazing season (June 28 through October 3), depending on grazing history and meadow condition, although some permittees do not remove their grazing animals until November.

Occasionally some portions of meadows are hayed if grazing animals do not remove enough vegetation, and occasionally the Service conducts prescribed burns in meadows to invigorate plant growth. Haying has been conducted using SUPs but as with haying, would convert to CAAs. Acres hayed have ranged from 40 to 200 acres annually over the past decade, but has declined to 40 acres annually by 2021. Haying has been focused on maintaining short-grass conditions and reducing smooth brome in areas adjacent to crop fields in the Ayers and Lakefront units. Since 2011, haying has occurred only in the Lakefront unit.

Table 1. Summary of grazing activity under permit at Grays Lake NWR, 2017 to 2021

Year	2021	2020	2019	2018	2017
Total Acres grazed	1,322	1,242	1,282	1561	1,303
Total AUMS	1,562	1,415	1,555	1,441	1,233
Caw/calf AUMS	278	278	278	310	278
Yearling AUMS	1,284	1,137	1,271	1,131	955

Riparian Habitat, Current Management

Historically, riparian habitats have essentially been unmanaged at the Refuge. Livestock put on meadows during the summer and fall months (July 28-October 3) have access to the scattered strips of riparian habitat along water courses.

However, the Refuge is currently restoring riparian habitat along the portion of Eagle Creek which runs through the Refuge and enters the east side of the Grays Lake marsh just north of the Bear Island right-of-way. In 2018, the Refuge acquired the Sibbett South tract, through which Eagle Creek winds for about 1.1 mile before entering the marsh. Riparian areas such as Eagle Creek are ecologically important, rare, and highly impaired within the Grays Lake basin. Furthermore, Eagle Creek is one of the larger tributaries that flows into the Grays Lake marsh and has some of the best potential to provide riparian habitat that would support native trout, breeding neotropical birds, and other species.

The Refuge received Eagle Creek in a modified state. An incised channel had been excavated along the Bear Lake right-of-way to divert Eagle Creek flows away from the historic channel alignment. The remnant willow-dominated riparian habitat bore the signs of intense grazing pressure: thick, structurally monotypic willow stands with an understory that was cropped to within a few inches of the ground.

In 2021, refuge staff plugged the incised channel to force flows back to the historic channel alignment. Beaver dam analogs (BDAs) were installed at three locations along the historic channel to encourage sediment deposition and to mimic historic flood conditions. Under current management, the Service would fence off and maintain this restored area.

Cropland Habitat, Current Management

At the request of Idaho Department of Fish and Game, the Refuge began farming between 40 and 100 acres annually to lure cranes into the refuge and reduce crop damage on private lands. These fields have drawn between 3 and 1,943 greater sandhill cranes in the fall providing much needed calories to support migration (Phil Thorpe, USFWS, personal communication). Prior to 2018, fields rotated between barley and fallow. Methods focused on repeated tilling for weed control and seed bed preparation. About 2010, management experimented with reducing farmed acres, and planted as few as 42 acres in a year (William Smith, USFWS, personal communication). In 2018, farming objectives and strategies changed again. Farmed acreage has tended toward the upper limit, shifted from barley to a more complex seed mix intended to support a broader range of wildlife and habitat objectives (passerines, pollinators, ungulates, soil health), and relied on chemical control of weeds (USFWS 2021; Cameron Williams, NRCS, personal communication). This most recent iteration of cropland management at Grays Lake has restructured the program around a more diverse cohort of focal species and placed an emphasis on soil health.

There are approximately 89 acres of farm fields within four management units at Grays Lake NWR: 32.91 acres within the Ayers unit; 29.57 acres within the Rich Riley unit; 16.37 acres within the Lakefront unit; and 9.88 acres within the HQ unit.

Alternative B – Adopt Habitat Management Plan – Proposed Action Alternative

Meadow Complex Habitat, Proposed Management

Under the Proposed Action Alternative, the Service would adopt and implement the HMP to protect, maintain, and enhance 1,912 acres of managed short-grass meadow habitat to provide nesting, feeding, and stopover habitat for the benefit of greater sandhill cranes, American avocet, long-billed curlew, Canada geese, and other meadow-dependent wildlife. Actions in the HMP would also protect, maintain, and enhance 1,884 acres of xeric and mesic meadow habitat near areas where open water persists throughout the season to provide nesting and brood-rearing habitat for waterfowl (see Appendix 2, HMP section 4.1).

In order to achieve the desired short-grass habitat conditions on 1,912 acres, the Refuge proposes to implement the following management actions:

- By the 2023 grazing season, convert grazing regimes from the current (mix of season-long perennially grazed and three-year rest/rotation) to a three-year rest/rotation grazing regime (Year 1: Early Graze June 10 to July 31; Year 2: Late Graze August 1 to Sept 30; and Year 3: Rest). Grazing intensity (AUMs) will fall within the Range of Recommended AUMs found in Table 4.1.1. of the HMP. AUMs will be adjusted to achieve habitat objectives. Until 2031, the exception to this three-year rest/rotation will be on the Sibbett North, Sibbett South, and Sibbett Hill (collectively, "Sibbett pastures") which may be grazed annually under warranty deed; and the Boathouse, west side of Ewart, and North 40 pastures (144 acres total), which may be grazed annually under an MOA (see No Action alternative above). Starting in 2031, the Sibbett North, Sibbett South (except riparian area), Boathouse, west portion of Ewart, and North 40 pastures would be grazed under CAAs in a two of three year rotation, in line with other west side pastures. Sibbett Hill would remain ungrazed.
- Permittees would place salt blocks in smooth brome monoculture to better distribute cows away from wetlands and concentrate grazing on non-native grasses.

- Permittees would use a mixture of yearlings and cow/calf pairs to achieve habitat objectives when available.
- The Service would work with permittees to install and maintain fences to hold cattle in designated pastures. Permittees would be responsible for placing temporary fencing in their assigned management units. The Service will install and maintain permanent fencing; however, permittees will check and repair permanent fencing adjacent to or within their permit areas when necessary.
- Control or eradicate invasive/undesirable plant species using Integrated Pest Management (IPM) techniques including mechanical (cutting, mowing, and disking treatments), biological, and chemical (herbicide treatment) means (see HMP Appendix C). All IPM activities would be conducted by the Service.

The management units subject to objective 4.1.1 are located on the east side and southern end of Grays Lake: the Willow Creek, Hawkins Creek, Sibbett North, Sibbett South, Ewart (west of Grays Lake Road), Boathouse, The 40s (N., Center, and S. 40), Cecil Sibbett, Lakefront, Peterson, County Line, John Muir, Kackley, Beavertail Pond, and Turner management units. Yearlings are preferred for targeted invasive perennial grass removal, while cow/calf pairs are preferred for removing excess biomass from native sedge/rush (meadow) habitats. As noted above, a grazer retains the right to graze Sibbett Hill under a warranty deed; however, the unit is not currently grazed and would remain ungrazed. The HQ unit is currently not grazed and once the croplands on that unit are restored to native meadow habitat, the unit would remain ungrazed. The portion of Ewart east of Grays Lake Road ("Hillside") was retired from grazing as of 2021 and would remain ungrazed.

In order to achieve desired dense cover habitat conditions on 1,884 acres of xeric and mesic meadow habitat to support nesting waterfowl, the Refuge proposes to implement the following management actions:

- Continue to exclude grazing on the Ayers, Cinder Knoll, South Pasture, and Sibbett Hill management units, and the portion of Ewart east of Grays Lake Road ("Hillside").
- Discontinue grazing on the Big Bend, Big Corral, Collins, and Rich Riley management units by the 2023 grazing season.
- The Service would repair, construct, and maintain permanent fencing to protect areas where grazing would be excluded.
- In ungrazed units, use either haying under CAAs or prescribed fire to reduce decadent vegetation, in meadows with less than 35 percent live biomass, outside of the nesting waterfowl season (after August 30). All prescribed fire treatments would be conducted by the Service.

- Restore areas dominated by invasive perennial grasses by deep-tilling, planting cover crops (i.e., grain, legumes, tubers) followed by restoration planting of native grass and sedge species used by waterfowl for nesting habitat (See HMP Objective 4.2.1).
- Control or eradicate invasive/undesirable plant species using IPM techniques including mechanical (cutting, mowing, and disking treatments), biological, and chemical (herbicide treatment) means (see HMP Appendix C). All IPM activities would be conducted by the Service.

This alternative would fulfill the Service's mandate under the NWRSAA. The Service has determined that the Proposed Action Alternative (Alternative B) is compatible with the purposes of Grays Lake NWR and the mission of the NWRS.

Riparian Habitat, Proposed Management

Most of the riparian habitat on the refuge occurs along the relatively short watercourses entering the Grays Lake marsh (see Appendix 2, HMP section 2.1) Under the Proposed Action Alternative, the Refuge would protect and restore 26 acres of early to mid-successional riparian habitat along 0.3-1 miles of Eagle Creek by 2040. This section of Eagle Creek flows through the Sibbett South management unit.

Protected and restored areas of Eagle Creek riparian habitat would have the following attributes:

- Community and structural composition: less than 20 percent canopy native trees greater than 12 feet tall, 30 to 70 percent cover of 3 to 12-foot tall native shrubs, with scattered openings containing 30 to 70 percent native herbaceous species (i.e., sedge, rushes, grasses, nettles, forbs).
- Tree and shrub species include willows, twinberry honeysuckle, Utah honeysuckle, black hawthorn, redosier dogwood, Sitka alder, Wood's rose, golden currant, thimbleberry, silver buffaloberry, Rocky Mountain maple, and chokecherry.
- Recruitment: both mature and seedling plants are present for each shrub/tree species
- Less than 15 percent cover of invasive plants (e.g., reed canarygrass, Canada thistle) within the understory.
- Maintain topography and meandering path of natural stream channel, and its connection to adjacent floodplains.

In order to achieve desired riparian habitat conditions, the Refuge proposes to maintain the restored historic channel of Eagle Creek and BDAs to continue to mimic historic flood conditions.

Actions under proposed management would include the following:

- Exclude grazing from the southern portion of the Sibbett South unit (26 acres) once the warranty deed expires (December 31, 2030).
- Maintain existing and, where necessary, install new fencing to exclude cattle grazing on 26 acres along Eagle Creek.
- Allow fall haying under CAAs, and/or prescriptive burning when residual biomass exceeds 35 percent in adjacent meadows to meet management objectives in lieu of grazing.

Croplands, Proposed Management

There are currently approximately 89 acres of farm fields across four units at Grays Lake NWR. Under the Proposed Action Alternative, the Refuge proposes to restore 89 acres of cropland to native grass, forb, and sedge communities through sequential retirement of existing crop fields by 2040. Restoration efforts would begin immediately after crop fields are retired to provide resilient, native-dominated meadow habitat. Restored croplands are characterized by the following attributes:

- Greater than 70 percent native vegetation cover (e.g., Idaho fescue, Basin wildrye, sedges, Sandberg's bluegrass, bluebunch wheatgrass)
- Less than 20 percent invasive weed/non native pasture grass (e.g., smooth brome, timothy, Kentucky bluegrass) and invasive weed cover
- Natural topography (stream channels that overflow onto floodplains during high water); no artificial mounds and berms
- Hydric soil types

Units that would continue to be farmed until restoration are characterized by the following attributes:

- Wildlife-friendly crop mixes, e.g., grain, legumes, and tubers to provide supplemental food for wildlife, including greater sandhill cranes, Canada geese, and mallards, during fall migration, while preventing establishment of invasive species.
- Farming conducted by Refuge staff.

The first farmed unit proposed for restoration is the Rich Riley unit, the second is the Ayers unit, third is the Lakefront unit, and final unit proposed for restoration is the HQ unit. The timing for restoring these units would depend on securing sufficient funding.

A comparison of management under Alternatives A and B, by management unit, follows.

Comparison of Alternatives

Table 2. Comparison of Management By Unit Under Alternatives A and B

Unit Name	Acres	Alternative A. Current Management (No Action Alternative)	Alternative B (Proposed Action Alternative)
Ayers	560	~33 acres farmed, remainder in grassland/shrub	~ 33 acres farmed until retired, entire unit not grazed or farmed
Collins	163	Unfenced, inadvertently grazed by neighboring cattle	Fence off unit, not grazed or farmed
Big Corral	165	Grazed annually	Not grazed or farmed
Big Bend	166	Grazed annually	Not grazed or farmed
Rich Riley	160	~30 acres farmed, remaining 130 acres grazed 2 of 3 seasons	~ 30 acres farmed until retired, entire unit not grazed or farmed
Cinder Knoll	320	Not grazed or farmed.	Not grazed or farmed
South Pasture	350	Not grazed or farmed.	Not grazed or farmed
Willow Creek	83	grazed 2 of 3 seasons	grazed 2 of 3 seasons
Hawkins Creek	201	grazed 2 of 3 seasons	grazed 2 of 3 seasons
Sibbett Hill	122	Unmanaged native shrubland (May be grazed under warranty deed until Dec 31, 2030, but currently ungrazed)	Retire from grazing after 2030; manage as native grassland/shrubland (not farmed or grazed).
Sibbett North	103	Grazed annually	Grazed annually through 2030 Grazed 2 of 3 seasons after 2030
Sibbett South	104	78 ac grazed annually 26 acres (Eagle Creek riparian area) fenced/ungrazed	Graze 78 ac annually through 2030 (26 acres fenced/ungrazed) Graze 78 ac 2 of 3 seasons after 2030. Maintain restored riparian habitat and fencing
Ewart	118	West portion (62 acres) grazed annually East portion ("Hillside," 56 acres) ungrazed	West portion (62 acres) grazed annually through 2030. West portion (62 acres) Grazed 2 of 3 seasons after 2030

Unit Name	Acres	Alternative A. Current Management (No Action Alternative)	Alternative B (Proposed Action Alternative)
			East portion ("Hillside," 56 acres) ungrazed, managed as native grassland/shrubland
Boathouse	42	Grazed annually	Grazed annually through 2030 Grazed 2 of 3 seasons after 2030
The 40's (N. 40, Center 40, S. 40)	120	N. 40 grazed annually Center 40, S. 40 Grazed 2 of 3 seasons	N. 40 grazed annually through 2030.; Center 40, S. 40 grazed 2 of 3 seasons. N. Center, S. 40 Grazed 2 of 3 seasons after 2030
Cecil Sibbett	199	Grazed annually	Grazed 2 of 3 seasons
HQ	81.5	~ 10 acres in crops, remainder unmanaged grassland	~ 10 acres farmed until retired, entire unit not grazed or farmed
Peterson	80.5	Grazed 2of 3 seasons	Grazed 2 of 3 seasons
John Muir	289	Grazed 2 of 3 seasons	Grazed 2 of 3 seasons
Lake Front	296	~ 16 acres farmed, remaining 280 acres grazed 2of 3 seasons	~ 16 acres farmed until retired, entire unit grazed 2 of 3 seasons
Kackley	153	Grazed 2 of 3 seasons	Grazed 2 of 3 seasons
Beavertail Pond	12.5	Grazed 2 of 3 seasons	Grazed 2 of 3 seasons
Turner	75	Grazed 2 of 3 seasons	Grazed 2 of 3 seasons
County Line	40	Unfenced, inadvertently grazed by neighboring cattle	Grazed 2 of 3 seasons

Table 3 compares acreages that are grazed annually or under a three-year rotation, farmed, and not grazed or farmed, under Alternatives A and B. Currently 2,442 acres of the Refuge may be grazed. However, the 163-acre Collins unit and 40-acre County Line unit are inadvertently grazed by permittees on adjacent non-Refuge lands. Therefore, up to 2,239 acres may be grazed under permit, warranty deed, or MOA under current management. The actual number of acres grazed annually would be lower, since most acres are grazed in a two of three-year rotation.

Under proposed management, after a warranty deed and associated MOA expire in 2030, 1,834 acres would be managed using livestock grazing by cooperators under CAAs. Therefore, 405 fewer acres may be grazed under permit after 2030 than under current management, an 18 percent decrease. Again, the actual number of acres grazed annually would be lower, since all acres would be grazed in a two of three-year rotation after 2030. Conversely, there would be a 697-acre (47 percent) increase in lands that are not farmed or grazed.

Table 3. Summary of Current and Proposed Management

Category	Acres Under Alternative A (Current Management)	Acres Under Alternative B (Proposed Management)**
Grazed Annually	855	Through 2030 325 After 2030 0
Grazed 2 of 3 seasons	1,384	Through 2030 1,509 After 2030 1,834
Inadvertently Grazed*	203*	0
Total acres that may be grazed under permit	2,239	1,834
Maximum acres grazed annually under permit	Through 2030 1,597 After 2030 1,778	Through 2030 1,150 After 2030 1,223
Farmed	89	0
Not Grazed or farmed	1,472.5	2,169.5
Total Acres	4,003.5	4,003.5

*Collins and County Line units are not grazed by permittees but inadvertently grazed by neighboring cattle
**Warranty deed and MOA allowing annual grazing expire Dec 31, 2030. Acres do not include Sibbett Hill (122 acres), under warranty deed but currently ungrazed.

Actions Common to All Alternatives

Integrated Pest Management:

Under both the Current Management Alternative and the Proposed Action Alternative the Refuge, in accordance with 517 DM 1 and 569 FW 1, the Refuge would continue to use an IPM approach where practicable to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on Refuge lands. IPM uses cost-effective methods that minimize ecological disruption by considering minimum potential effects to non-target species and the refuge environment. Pesticides may be used where physical, cultural, and biological methods or combinations thereof, are impractical or incapable of providing adequate control, eradication, or containment. If a pesticide would be needed on refuge lands, the most specific (selective) chemical available for the target species would be used unless considerations of persistence or other environmental and/or biotic hazards would preclude it. In accordance with 517 DM 1, pesticide usage would be further restricted because only pesticides registered with the US Environmental Protection Agency (USEPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by USEPA may be applied on lands and waters under refuge jurisdiction.

See Appendix C of the HMP (Appendix 2 of this EA) for the refuge's IPM program documentation to manage pests under the HMP. Along with a more detailed discussion of IPM techniques, this documentation describes the selective use of pesticides for pest management on refuge lands, where necessary. Throughout the life of the HMP, most proposed pesticide uses on refuge lands would be evaluated for potential effects to refuge biological resources and environmental quality. These potential effects would be documented in "Chemical Profiles."

Alternative(s) Considered, But Dismissed from Further Development

No Management Alternative

Under this alternative, meadow habitats, riparian habitats and lands currently planted in crops would no longer be managed and would return to a more natural condition. Livestock grazing would no longer be used as a management tool. This "no management" alternative was considered during development of preliminary alternatives, but dismissed from further consideration primarily due to the detrimental effects that removal of grazing would have on grassland habitat composition and structure. Managed livestock grazing is currently the most economically feasible tool to provide short-grass habitat conditions for focal wildlife species, and to control exotic grasses (e.g., smooth brome). Under this scenario, the meadow complex habitats would quickly become overgrown and unsuitable for the myriad of species which are a management focus for the Refuge.

Research findings show that without disturbances such as grazing, meadow habitats are at risk of conversion to monotypic stands of non-native grasses. In the absence of grazing or other natural disturbances, prairies in the northern Great Plains were rapidly converted to smooth brome and other non-native grass dominated communities (Murphy and Grant 2005; DeKeyser et al. 2009, 2013; Grant et al. 2009, 2020; Printz and Hendrickson 2015). This finding is supported by the work of Murphy and Grant (2005), who found that "managing disturbance-dependent grasslands as relatively static, late-succession systems for many decades" created a "hastened invasion by introduced grass species, especially smooth brome." Smooth brome already exists in various amounts throughout the Grays Lake meadow complex, ranging from small clonal patches to dense monocultures, and have already outcompeted and replaced native vegetation in these areas. Because livestock preferentially forage on grasses, including non-native species, livestock grazing of the meadow complex is an effective management action to control for these non-native species. Because the refuge staff must control the spread of non-native grasses to meet their habitat objectives, livestock grazing is an essential tool to achieve desired habitat structure. In the absence of grazing, smooth brome would continue to spread and could eventually dominate meadow habitat.

Riparian habitats could recover in the absence of grazing, although a complete lack of management could limit riparian recovery since invasive plant species which have become established in riparian areas along Eagle Creek would continue to grow unabated.

Allowing thousands of acres of habitat to become unusable for Refuge focal species would unduly compromise the conservation value of the Refuge and would not meet the purposes for which the Refuge was established, or meet the Refuge System mission.

Meadow Mowing Management Alternative

This alternative proposes that meadows be managed by means of mowing and haying only. This alternative was not carried forward because implementation would be impractical. Mowing acreage currently used for grazing would be physically impossible due the existing meadow topography, which consists of an extensive network of dips and swales. The Service does not have sufficient resources to recontour meadow landscapes to allow for and then conduct mowing and haying on acreage that is currently subject used for grazing. The Service would be unlikely to find cooperators to hay meadows, since the cost of haying exceeds the value of the forage removed and would not provide the same economic return as grazing.

Prescribed Fire Meadow Management

This alternative proposes to only use prescribed fire to manage meadows. This alternative was not forwarded for detailed analysis because implementation is impractical due to the large number of acres that would require annual application. Prescribed fire is an extremely labor intensive and expensive management tool. While it does have value for mimicking natural stochastic events and for reinvigorating grassland habitats, prescribed fire should only be used under certain climatic conditions. Such conditions do not reliably occur on an annual basis and do not exist for the length of time it could require to burn thousands of acres of habitat safely. Meadow complex habitats require annual management in order to maintain short-grass conditions, and multiple tools rather than this single tool are needed to achieve desired habitat conditions.

Grazing-Only Meadow Management

This alternative proposes that meadows be managed by means of livestock grazing alone. Under this alternative, mesic and xeric meadows would also be placed on a two of three-year grazing rotation. This alternative was not forwarded for detailed analysis because experience has shown grazing alone does not achieve desired meadow or riparian habitat conditions. Allowing dense vegetation to grow on mesic and xeric meadows is desirable to support species which require dense nesting cover, but allowing these meadows to get too dense results in habitat conditions becoming unsuitable for dense cover nesting species (see HMP section 4.1.2

for detailed discussion of mesic and xeric meadows). Livestock grazing is a poor tool for attempting to keep mesic and xeric meadows from becoming overgrown. For cattle to be effective in reducing excess biomass, they would need to graze during the bird nesting season which would result in trampling of bird nests and possibly nesting animals. The end of the bird nesting season coincides the end of the grazing season, limiting the time on the ground during which cattle could be removing biomass. Also, cattle find the dense grasses of mesic and xeric meadows somewhat unpalatable, leading to very uneven grass consumption. In addition, grazing permittees prefer their cattle to graze on lands which support vegetation that has a higher protein content than found on the mesic and xeric meadows. Since cattle grazing alone is unlikely to achieve desired habitat conditions and permittees have a preference to have their cattle graze in pastures which allow for faster weight gain, implementing a grazing-only meadow management option is considered largely impractical.

High Intensity, Short Duration Meadow Grazing Management

Under this alternative, cattle would be allowed to heavily graze portions of temporarily fenced meadows for a short time, 7 to 10 days, whereupon they would be moved to a different section of temporarily fenced meadow for another 7 to 10 days, until such time as the entire unit had been subjected to high intensity but short duration grazing. Implementing this alternative would be the best approach for achieving desired short-grass conditions with a minimum of adverse effects to plant vigor, riparian habitat, soil condition, and water quality. However, implementing this alternative would require an increase in refuge staffing, equipment needs, and budget. This alternative is infeasible to implement and has not been forwarded for detailed analysis.

Continue Farming on Reduced Acres

This alternative proposes that the Lakefront unit and HQ unit would continue to be farmed, while the croplands on the Ayers and Rich Riley units would be retired from faming and converted to native grassland. The Refuge began farming annually to lure cranes into Refuge grain fields and reduce crop damage on private lands, but the program has had limited success. Farmed lands on the Ayers unit and Rich Riley have seen little to no crane use. Farmed lands on the Lakefront unit and HQ unit have seen some limited crane use on an annual basis. However, maintaining croplands at Grays Lake NWR is a time and resource intensive project that began with a singular objective of reducing crane depredation that has yielded limited results. In light of the expense of farming fields, the limited success farming has had in luring cranes, and the limited need to address future depredation issues in the area, this alternative was not forwarded for detailed analysis. A detailed discussion of the cropland program can be found in section 4.2 of the draft HMP (Appendix 2).

Affected Environment and Environmental Consequences

This section analyzes the environmental consequences of the action on each affected resource. This EA includes the written analyses of the environmental consequences on a resource only when the impacts on that resource could be more than negligible and therefore considered an "affected resource." Any resources that will not be more than negligibly impacted by the action have been dismissed from further analyses.

The following section contains:

- A brief description of the affected resources in the proposed action area that would potentially be affected by the No Action and Proposed Action alternatives;
- Impacts of the proposed action and any alternatives on those resources;
- A brief description of the past, present, and reasonably foreseeable other actions and trends affecting these resources, and the cumulative impacts of the No Action and Proposed Action alternatives.

The following resources either (1) do not exist within the project area or (2) would either not be affected or only negligibly affected by the proposed action. As such, these resources are not further analyzed in this EA:.

- Air Quality: Air quality in the Refuge's airshed is of excellent quality. Refuge associated activities which can affect the area's air quality, such as farming, grazing, and visitor traffic are very limited and have negligible effects on local air quality.
- Wilderness or Special Designation Areas: The Grays Lake basin does not have any proposed or designated wilderness or other special designation areas.
- Visitor Use and Experience: Grays Lake has limited visitor use which is mainly restricted to the public road system surrounding the Refuge. The proposed changes in meadow, riparian and cropland management compared to current management would be indistinguishable to the visiting public. Limited hunting and fall and winter recreation would continue regardless of which alternative is selected for implementation.
- Threatened and Endangered Species and Special Status Species: There are no Threatened, Endangered, or special-status species within the project area.
- Cultural Resources: There are no known cultural resources in the areas which have been subject to Refuge management for decades and thus there would be no effects to cultural resources under proposed changes to meadow, riparian and cropland habitat management.
- Environmental Justice: There are currently no disproportionate adverse effects on human health, economics, or the social environment associated with managing refuge habitats. Implementing the proposed changes to meadow, riparian and cropland

management would not have a disproportionate adverse effect on human health, economics, or the social environment.

Natural Resources

Affected Environment: Refuge Habitats and Associated Wildlife

Meadow Complex Habitats

The Meadow Complex encompasses a gradient from dry meadow to wet meadow and the interface with shallow marsh. The meadow habitats of Grays Lake have a long history of farming and manipulation. These areas were first farmed in the late 1880s and then quickly converted into pasture for cattle grazing, which led to the introduction of non-native grasses. Historic farming practices also are believed to be responsible for the current lack of topographic heterogeneity across the Refuge.

Currently, the meadow complex consists of seasonally and temporarily flooded plant communities that are dominated by spikerush, Baltic rush, various sedges, tufted hairgrass, mat muhly, Kentucky bluegrass, meadow foxtail, and smooth brome. Native forbs such as balsamroot, camas, shooting star, elk thistle, and many others can also be found in abundance during certain times of the year. Wet meadow sites are primarily supplied water from early spring run-off, and later in the year via irrigation from creek flows (overbank flows, subbing) throughout the Basin. Throughout the year, the amount of water naturally held in these areas is believed to be directly linked to water levels in the lake providing both surface and sub-surface supply.

The meadow complex, when in short-grass condition, provides important breeding and foraging habitat for the following focal species: American avocet, cinnamon teal, greater sandhill crane, white-faced ibis, long-billed curlew, Canada goose, and grasshopper sparrow.

Cropland Habitat

Winter wheat and barley within the Grays Lake Valley have been identified as important forage for migrating cranes (Ball et al. 2003). However, there has been a substantial reduction in the area of upland cultivated for barley production (Austin et al. 2007) and an increase in depredation claims from grain farmers around Blackfoot Reservoir. As Grays Lake landowners transitioned from grain farming to cattle production, the Refuge began farming lure crops in the late 1990s that were eventually the only grain fields left in the Valley (William Smith, USFWS, unpublished document). Currently, there are approximately 89 acres of existing grain fields in four management units on the Refuge: 32.81 acres in the Ayers unit, 9.88 acres in the Headquarters unit, 16.37 acres in the Lakefront unit, and 29.57 acres In the Rich Riley unit.

Riparian Habitats

The Grays Lake tributaries provide hydrological conditions for montane riparian habitat. The eight perennial creeks that flow into Grays Lake are Bridge Creek, Clark Creek, Eagle Creek, Gravel Creek, Herman Creek, Jones Creek, Little Valley Creek, and Willow Creek (USGS/IDEQ 2018).

There are two locations where water exits Grays Lake: Clark's Cut and Grays Lake Outlet, which is the only natural drainage of the marsh located at the northwest corner of the marsh. Clark's Cut, which is an excavated ditch at the south end of the marsh, connects Grays Lake to the neighboring watershed by way of Meadow Creek.

Based on current land ownership, the Refuge has approximately 10.34 kilometers of perennial stream within its boundaries (HMP Table 2.1.1). Most of these stream lengths occur on Herman Creek (2.9 km), Grays Lake Outlet (2.34 km), and Eagle Creek (1.79 km). Smaller lengths of Bridge Creek (1.1 km), Clark Creek (1.47 km), and Willow Creek (0.74 km) occur on Refuge land. Although Gravel Creek, Jones Creek, and Little Valley Creek flow into the Grays Lake marsh, no lotic (stream) habitat associated with these drainages occurs on Refuge.

Little data on the natural condition of Grays Lake riparian habitat exist, since modifications to promote grazing and farming occurred well in advance of refuge establishment. It is likely that many of the refuge's riparian areas were dominated by open and dense stands of willow or aspen interspersed with other native trees and shrubs such as twinberry honeysuckle, Utah honeysuckle, black hawthorn, redosier dogwood, Sitka alder, Wood's rose, golden currant, thimbleberry, silver buffaloberry, Rocky Mountain maple, and chokecherry. Scattered stands of willow would have been the predominant species in the flatter more mesic sites, while aspen tended to occur in the transitional xeric sites along natural creek channels.

With the arrival of ranchers and farmers, significant functional modification of these riparian habitats occurred to promote cultivation and grazing. In some instances, streams were excavated, channelized, and forced beneath roads through culverts. At the extreme of these hydrological modifications, Clark's Cut was completed in 1924 and diverted the vast majority of flow away from Grays Lake Outlet (HMP Figure 2.1.2). These actions separated the streams from their natural floodplains and artificially confined riparian vegetation to more narrow bands. A majority of the aspen and willow communities that historically occurred directly within the vicinity of the Grays Lake basin were most likely cleared, and with cows came the introduction of non-native grasses as forage (e.g., smooth brome, timothy, meadow foxtail). Additionally, overgrazing likely restricted recruitment of the remaining scattered willows.

Presently the remnant willow-dominated riparian habitats scattered throughout meadows show signs of intense grazing: thick, structurally monotypic willow stands with an understory that is cropped to within a few inches of the ground.

Today, riparian habitat on the Refuge exists within the confines of these accumulated modifications, and is subject to additional stressors. Riparian habitat is still subject to grazing, haying, and farming activities. Over time, invasive weeds established within this niche, including but not limited to reed canarygrass, Canada thistle, musk thistle, and whitetop. Riparian habitats provide important breeding and foraging habitat for the following focal species: Lazuli bunting, yellow-breasted chat, song sparrow, willow flycatcher, and northern leopard frog. Additional details concerning riparian habitats can be found in the draft HMP (Appendix 2).

Environmental Consequences - Refuge Habitats and Associated Wildlife

Alternative A – Current Management – No Action Alternative

Effects of grazing and haying to Meadow Complex Habitats, Alternative A: Meadows serve as resting and foraging sites for territorial greater sandhill cranes, Canada geese, waterfowl, white-faced ibises, other waterbirds, raptors, and wild ungulates. Short vegetative heights, which can be provided through treatment with grazing or mowing, provide early spring foraging habitat for cranes, waterfowl, and other waterbirds.

In general, grazing or haying treatment of the wet meadow type results in short stubble habitat, which then provides for the foraging needs of numerous migrating species during spring. It also serves as useful shorebird nesting habitat, waterfowl pairing and pre-nesting habitat, and foraging habitat for cranes during nesting season. There are some negative aspects to grazing and haying, including the temporary loss of waterfowl nesting habitat, but overall, the practice results in benefits to a wide suite of avian species compared to unmanaged meadows. If meadows are left unmanaged, the build-up of decadent material is usually so great that it renders the meadows unsuitable as wildlife habitat.

The primary reason for grazing wet meadows is to improve foraging conditions for migratory birds, especially during the pairing season. Wet meadows receive high use by foraging birds in the spring when they are treated with grazing, haying, or burning. Short stubble allows early warming of soil and water and early availability of new green sprouts and invertebrates for birds to eat in the spring. The new plant growth and invertebrates are sources of protein, which is very important to breeding waterfowl and other birds for egg-laying, as described by Eldridge and Krapu (1988). Therefore, areas managed for short structure are valuable as a foraging area for waterfowl, waterbirds, and shorebirds. Important species such as sandhill cranes, white-faced ibises, and many waterfowl focus their foraging on these areas.

Many migrant birds are attracted to the managed meadows (mowed, grazed, burned) because meadow vegetation provides high-protein browse and invertebrate foods for a large variety of birds and other wildlife during the early spring period, when high-protein foods are needed for egg-laying. Theoretically, treated meadow sites receive more solar radiation, resulting in early warming of soils and earlier availability of important invertebrates for food (Rule et al. 1990).

These treated meadow sites on the Refuge generally support high waterfowl and crane use during the early spring period. Meadows subjected to haying and/or grazing provide much needed energy for migratory birds to nest, brood, and rear offspring or to replenish nutritional reserves during migration.

In addition to the importance of short-cover areas for foraging, most shorebird and many wading bird species select very short cover or barren sites for nesting (Eldridge 1992). The short structure of treated meadows is attractive to nesting shorebirds and wading birds such as long-billed curlew, white-faced ibis, Wilson's phalarope, American avocet, and black-necked stilts, as well as some ground-nesting passerine birds such as grasshopper sparrow. Some authors have asserted that essential habitat for breeding shorebirds can be provided through grazing, mowing, or prescribed burning (Eldridge 1992; Helmers 1992).

Sandhill cranes are a primary focal species for the Refuge. The primary importance of meadows to cranes is for feeding and brooding young. The wet meadow zone adjacent to uplands is a preferred area for crane chick brooding (Littlefield 1985), presumably due to invertebrate abundance and availability. Generally, cranes are attracted to intensely managed meadows (grazed, mowed, burned) for feeding during early spring. As noted above, these intensive treatments remove ground cover, allowing solar radiation to warm the soil, causing earlier green-up of vegetation and earlier invertebrate availability (Epperson et al. 1999; Rule et al. 1990). Crane nest initiation is also affected by land use treatments for the same reasons. Also, haying and grazing of wet meadows can encourage cranes to nest in the deeper marsh sites, where nesting success is higher due to reduced predation.

Under current grazing management, meadow conditions become less than ideal for short-grass dependent species because livestock tend to congregate in moist and shady portions of meadows during the course of the grazing season, resulting in excessive grazing in moist areas. Conversely, higher and dryer meadows do not receive nearly as much grazing pressure as moist sites, resulting in more vegetation coverage than Refuge focal species prefer. Thus, rather than having meadows exhibiting somewhat uniform short-grass conditions, under current management meadows have too little or too much vegetation to support species dependent on short-grass conditions.

Under current management, haying is used when grazing has not removed sufficient amount of biomass to achieve desired short-grass conditions. Haying requires the use of equipment normally used for general mowing activities (e.g., tractor, swather or rotary mower, rake) with the addition of balers. Machinery use could negatively impact some small mammals, reptiles, and amphibians, resulting in mortality for species that cannot move away in time. Habitat conversion of tall pasture grasses to mowed grasses results in habitat loss; however, the irregular use of haying as a management tool allows local populations of small mammals, reptiles, and amphibians to recover quickly. The use of noise-producing equipment such as

ATVs, tractors, swather or rotary mowers, rakes, and other equipment may cause localized disturbance to wildlife during the period of the equipment use. In general, use of equipment occurs in the late summer and fall, outside of sensitive breeding periods. In addition, most of the areas accessed with equipment would be dry, with reduced wildlife densities.

Effects to Meadow Complex habitats from prescribed fire, Alternative A: Prescribed fire may be used in meadows at the Refuge to open and thin emergent vegetation, remove decadent material, and stimulate herbaceous production and diversity. All of these are intended to improve the value of the habitat for wildlife species. In addition, fire is used to reduce hazardous fuels. Prescribed fires have little direct immediate effect on wildlife as they are usually conducted when marsh vegetation is dormant, migrants are absent, and reptiles and amphibians are in hibernation. However, the following year, nesting structure will likely be altered enough that individual birds will move to other suitable habitat for the next growing season. This effect normally disappears by the second year after the burn.

Fire moving through meadows clears out dead and decadent material, releases nutrients, stimulates growth of new vegetation, and provides space and opportunity for wildlife to forage and breed (Young 1987). Prescribed fire is used at the Refuge to maintain ecological processes, specifically: removing decadent material, stimulating production and maintaining species diversity of herbaceous plants, and improving wildlife habitat and foraging. The growing season after a prescribed fire usually shows a flush of vigorous new growth. By the end of the growing season, the vegetation has recovered to provide ideal habitat conditions for wildlife.

After application of prescribed fire, there is an immediate reduction in prey for ground- and aerial-foraging species, especially those that prey on invertebrates. There is the potential for direct mortality of ground and low-canopy nesting species if fire occurs during breeding season. Nesting habitat for ground-nesting species would be expected to be completely removed. There can be an immediate benefit to raptors as small mammals are exposed when making their escape from the fire. There could also be an immediate negative effect as many small mammals are likely to die, thereby reducing available prey.

Recovering herbaceous production would produce seeds and attract insects, which would provide forage for insectivores and seedeaters. There would be a reduction in habitat for ground-nesting species caused by removal of vegetative cover. Birds would have to find suitable nest sites elsewhere, which could lead to competition for limited space. Raptors could expect improved hunting success because of improved visibility, but conversely could also suffer from lower small mammal abundance. Overall, there would be a beneficial effect to birds as native forage becomes re-established, invasive species are reduced, and nesting habitat gradually increases. Increased production of native forbs and ground cover would benefit focal species. Refuge populations of ground and water foraging species would gradually increase as forage quality increases.

There would be a recovery in ground nesting species as forage and cover return to conditions suitable to support nesting. Maintenance of proper canopy densities would benefit nesting waterfowl species.

Effects to Mammals, Alternative A: Some mortality can be expected to small mammals, especially when escape routes to water or burrow holes are not readily available. Burrow holes may offer limited protection depending on the intensity and duration of the burn. Direct mortality for large mammals would be limited to those individuals unable to escape (too old, young, or injured). All large mammals would incur some stress from flight and avoidance behaviors along with displacement from home ranges. Effects on mammalian predators would be similar to those on large mammals. Predators can also suffer from increased competition if they are forced to migrate to already occupied home ranges of other predators.

Reduction in habitat for small mammals that require cover near the ground surface (e.g., mice) would continue until debris re-accumulates. Increased production of forage typically increases use of burned sites by large mammals. Mammalian predators would be expected to follow the prey back into the area. Until the prey base is available to support them, recolonization may be slower than the herbivores and small mammals, and in lower numbers than were present before the fire.

Small mammal populations would gradually return to pre-fire levels as the quality of cover and forage increased over time. Burrowing mammals would likely be the first to reach pre-fire densities because their dens would not have been impacted. Large mammals would re-occupy the area within the first year and would continue to use the area depending on how forage developed. Predators would be expected to respond to the population patterns of their prey.

Effects to Reptiles and Amphibians, Alternative A: Prescribed fires conducted during the late fall and winter have little negative effect, since the heat does not reach those depths where reptiles hibernate. Many reptiles and amphibians need to forage for food elsewhere because of the short-term removal of invertebrates. Populations would be expected to remain constant.

Effects to Invertebrates, Alternative A: We would expect rapid recolonization from adjacent unburned areas through natural dispersal methods as forage and egg-laying habitat regenerates during the first growing season and quickly reach pre-burn levels. Those species that are dependent on specific vegetation could benefit if fire helps those plants sprout and outcompete invasive species.

Fire lines that require mowing are required to prevent prescribed fires spreading into adjacent habitats. These fire lines and scars left by fire equipment can create the conditions for colonization by invasive species, such as Canada thistle, musk thistle and whitetop.

As a habitat management tool, fire is used sparingly. Only occasionally does funding, staffing and climatic conditions coincide where it is safe to administer a prescribed fire. As a result, grazing and haying have proven to be more reliable tools for managing meadows habitats on an annual basis.

Effects to Cropland Habitat, Alternative A: The croplands at Grays Lake NWR are a time and resource intensive management activity which began with a singular objective of reducing crane crop depredation, have experienced different management iterations over time, and have yielded limited beneficial results. The limited success of the cropland program may be because sandhill crane depredation of grain crops is highly correlated to a field's proximity to suitable roosting locations (Donnelley et al. 2021). Anteau et al. (2011) found that most crane crop depredation occurred within 4.8 km of wet meadow habitat. Additionally, all roosting habitat is not created equal. Cranes display a preference toward flat topography and low vegetation for roost habitat, possibly for predator detection and evasion (Pearse et al. 2017; Krapu et al. 1984). Since most farm fields are located further from preferred crane roosting habitat, only 28 of the 89 farmed acres at Grays Lake NWR are consistently utilized by cranes (William Smith, USFWS, personal communication).

With the most recent iteration of cropland management at Grays Lake being restructured around a more diverse cohort of focal species and placed an emphasis on soil health, periodic use of more complex seed mixes may have future utility in more proactive soil health management. However, it is also possible that some of the non-grain crops may make the cropland less desirable to migrating cranes, thereby compromising the original main goal of planting croplands.

Effects to Riparian Habitat, Alternative A: Under current management, where cattle are placed on meadow habitats for months at a time, riparian areas will continue to be subject to annual or seasonal grazing, and perhaps occasional haying and farming activities. Livestock are often attracted to the browse, shade, and water found in or near riparian areas. Livestock tend to concentrate in such areas, resulting in a variety of impacts, including reducing or eliminating riparian vegetation, channel aggradation or degradation, widening or incisement of stream channels, changing stream bank morphology, and lowering surrounding water tables (Platts 1986). Established invasive plant species will continue to persist and perhaps increase their footprint within riparian zones. Riparian vegetation would be maintained at a low density, offering limited habitat quality and quantity for riparian focal species. Continued grazing along meadow watercourses will likely continue to have negative impacts to the stream channels, as well as to riparian plant and animal communities.

Effects from Integrated Pest Management, Alternative A: Potential effects to the biological and physical environment associated with the proposed site-, time-, and target-specific use of pesticides (Pesticide Use Proposals [PUPs]) on refuge lands would be evaluated using scientific information and analyses documented in "Chemical Profiles" (see HMP Appendix C). These profiles provide quantitative assessment/screening tools and threshold values to evaluate potential effects to species groups (birds, mammals, and fish) and environmental quality (water, soil, and air). PUPs (including appropriate BMPs) would be approved where the Chemical Profiles provide scientific evidence that potential impacts to refuge biological resources and its physical environment are likely to be only minor, temporary, or localized in nature. Along with the selective use of pesticides, PUPs would also describe other appropriate IPM strategies (biological, physical, mechanical, and cultural methods) to eradicate, control, or contain pest species in order to achieve resource management objectives.

"Environmental harm by pest species" refers to a biologically substantial decrease in environmental quality as indicated by a variety of potential factors including declines in native species populations or communities, degraded habitat quality or long-term habitat loss, and/or altered ecological processes. Environmental harm may be a result of direct effects of pests on native species including preying and feeding on them; causing or vectoring diseases; preventing them from reproducing or killing their young; out-competing them for food, nutrients, light, nest sites or other vital resources; or hybridizing with them so frequently that within a few generations, few if any truly native individuals remain. Environmental harm also can be the result of an indirect effect of pest species. For example, decreased waterfowl use may result from invasive plant infestations reducing the availability and/or abundance of native wetland plants.

Environmental harm may also involve detrimental changes in ecological processes. For example, cheatgrass infestations in shrub-steppe greatly can alter fire return intervals, displacing native communities of bunchgrasses, forbs, and shrubs and shrub-steppe dependent wildlife species. Environmental harm may also cause or be associated with economic losses and damage to human, plant, and animal health. For example, invasions by fire-promoting grasses that alter entire plant and animal communities by increasing fire severity and frequency can also greatly increase fire-fighting costs.

The effects of these non-pesticide IPM strategies (e.g., prescribed fire, tilling, grazing, haying) to address pest species on refuge lands would be similar to those effects described elsewhere within this chapter, where they are discussed specifically as habitat management techniques to achieve resource management objectives on the refuge. For example, the effects of mowing to control invasive plants in an improved pasture would be similar to those effects summarized for mowing, where it would be specifically used to provide short-grass foraging habitat for focal species.

Based on scientific information and analyses documented in "Chemical Profiles" (see HMP Appendix C), most pesticides allowed for use on refuge lands would be of relatively low risk to non-target organisms as a result of low toxicity or short-term persistence in the environment. Thus, potential impacts to refuge resources and neighboring natural resources from pesticide applications would be expected to be minor, temporary, or localized in nature.

Alternative B- Proposed Action Alternative

Effects of grazing and haying to Meadow Complex habitats, Alternative B: It is important to note that grazing has always been part of the ecosystem in which Grays Lake resides. Prior to Euro-American settlement of the area, the amount of water and forage that were around Grays Lake would likely have drawn native ungulates to graze the valley. It is highly likely there was a fairly robust native ungulate grazing component to Grays Lake with grazing likely being a regularly occurring ecological disturbance. While grazing duration and intensity are different today, the Refuge is still using a tool that mimics past ecological processes.

Under the Proposed Action Alternative, livestock grazing will be used to manage vegetation in the Refuge meadow complex by encouraging successional shifts in plant community composition where desired attributes are not being met (See Draft HMP, Objective 4.1.1). Under the proposed action, approximately 82 percent of the grazed meadows (1,509 acres) will be on a two of three-season rotation through 2030, while 100 percent (1,834 acres) after 2030 will be on a two of three-season rotation after 2030 (Table 3). Grazing will be distributed in a mosaic of treatments on Refuge lands, with approximately one-third of the meadow acreage designated for grazing being grazed in early summer, approximately one-third being grazed in late summer and approximately one-third being ungrazed. 325 acres of meadows will be annually grazed under warranty deed or agreement through 2030. These meadows will be grazed in either early summer or late summer. After 2030, these meadows would be managed on the two of three-season rotation described above.

It is well established (Austin et al. 2002, Austin et al. 2007, Holechek et al. 1982, Sollenberger et al. 2012) that a grazing regime which includes seasonal, short duration grazing followed by a year of rest is effective in keeping meadows in a short-grass condition and for maintaining plant vigor. Thus, it is expected that the majority of meadows being managed for short grass habitat conditions on a two of three-season rotation will result in improved nesting and foraging conditions for waterbirds, waterfowl, and shorebirds as compared to current management. Desired short cover vegetation communities would have increased plant vigor, increased early-season invertebrate production, and minimal thatch, which provides higher quality foraging habitat for many of the focal species (USFWS 2021). Wildlife species like sandhill cranes and white-faced ibis require short-cover wet meadow habitat interspersed with shallow and emergent marsh habitats. Sandhill cranes show a preference for areas with shallow marsh adjacent to flat, short-cover habitat, for roosting and foraging respectively. For nesting, they seek islands of dense vegetation isolated from predation by shallow water (Austin et al. 2007). Long-billed curlews require relatively large tracts of contiguous open short cover habitat with intermittently patchy vegetation (greater than 100 acres) free of detrimental human disturbance for breeding and foraging (Dugger and Dugger 2002, Pampush and Anthony 1993, Redmond et al. 1981, Dechant et al. 2002). White-faced ibis forage in a range of conditions from shallow open water to grazed grasses with a variable hydroperiod and abundant macroinvertebrates through late August (Perkins 2003). Light, managed grazing has also been shown to increase plant diversity (Hayes and Holl 2003); however, the way the light grazing is managed is important for achieving improved habitat conditions. For example, yearlings are preferred for targeted invasive perennial grass removal, while cow/calf pairs are preferred for removing excess biomass from native sedge/rush (meadow) habitats. Yearlings tend to roam, distributing pressure across meadow and upland habitat types, but also tend to be harder to keep fenced in. Cow/calf pairs are preferred for removing excess biomass from native sedge/rush (meadow) habitats and they will not pressure uplands unless stocking rates are high. Because cows generally congregate around salt, mineral blocks are routinely used to distribute cattle away from sensitive areas that are easily impacted (e.g., riparian and wet meadow habitats). Under the proposed action it is expected that meadows will be more uniformly grazed and provide more suitable habitat for short-grass dependent species as compared to meadow conditions resulting from current management.

Experience has shown that meadows which are grazed annually show less vigor because they don't get rested, tend to have a less diverse assemblage of meadow species, and shorter vegetation characteristics than desired. Thus, it is expected that the 325 acres of meadows which will continue to be grazed annually through 2030 will support fewer numbers of Refuge focal species that those meadows managed under a two of three-season rotation.

Grazing livestock during the growing season can have adverse effects on birds using short-grass meadows. Livestock can trample nests, disturb feeding and resting birds, and possibly expose birds and eggs to predation. Even though grazing livestock during the growing season may disturb/displace some nesting activity for that year from a particular field unit, since meadows would be managed with different treatments during different times of the year, wildlife should be able to find suitable habitat nearby.

Meadows managed for dense cover (mesic and xeric meadows on the Refuge) provide low-disturbance habitat for species including ducks, geese, passerines, and other wildlife (Holchek et al. 1982). Dense nesting cover is preferred nesting habitat for many waterfowl and passerine birds. These habitats are especially important when adjacent to year-long open water, as found in the northern areas of the Refuge. These dense, ungrazed habitats are even more valuable due to their scarcity, since the vast majority of meadow and upland habitats in the Grays Lake basin are either hayed or grazed every year. However, if left unmanaged, these montane meadows lose habitat quality as dead standing biomass increases (Ganskopp et al. 1992). Haying or burning after the bird nesting season will remove the dead biomass, stimulate growth, and increase biodiversity, while not impacting nesting birds.

For those species which focus primarily on nesting in meadow habitats, managing wet meadows for low structure early in the growing season encourages these species to nest in drier meadows which will be left unmanaged (no haying or burning) until after the nesting season concludes. Under the proposed action, haying will be used to treat mesic and xeric meadows when dense cover conditions exceed the attributes described in section 4.1.2 of the HMP, as opposed to occasional haying under current management. It is estimated that these meadows will need to be treated every five to seven years to clear out decadent growth and improve vegetative vigor.

As stated previously, haying can be harmful to small mammals, reptiles and amphibians. However, at any one time, substantial acreage of meadow habitat will be in an untreated condition, which allows for habitat use by species dependent on meadow habitats.

Haying can play a vital role in maintaining site vigor by preventing excessive litter accumulation from hindering plant species diversity and expression (Foster and Gross 1998; Xiong et al. 2003). Plant species composition and the response of those species to site-specific conditions that may change annually due to climate or refuge management have a significant influence on biomass production and subsequent litter production. Haying treatments will be adjusted on an annual basis to account for these dynamics according to information gleaned from inventory and monitoring efforts.

Early mowing of vegetation is counterproductive towards meeting wildlife conservation objective by destroying nests, killing incubating hens, killing young before fledging, and exposing nests and young to predators. Mowing could potentially impact any bird that nests or rears young in meadow habitats. Delaying Refuge haying dates until after the nesting season concludes (after August 30) will minimize advserse impacts from mowing.

The Refuge expects that implementing the proposed management actions, as compared to current management, will moderately improve nesting and foraging conditions for waterbirds, waterfowl, and shorebirds and nesting habitat for many waterfowl and passerine birds. By improving habitat conditions associated with nesting and foraging, it is expected there will be commensurate improvements in fledging young, thereby enhancing Refuge focal species' prospects for long-term survival. While improving wet, mesic, and xeric meadow habitat conditions is expected to benefit the migratory bird species which are a management focus for the Refuge, in light of all the other survival hazards migratory birds face once away from the Refuge, the proposed action does not represent a significant beneficial effect.

Effects of prescribed fire to Meadow Complex habitats, Alternative B: Under the proposed action alternative, the use of prescribed fire will continue to be used on an opportunistic basis; that is when funding, staffing and climatic conditions dictate that it is safe and feasible to administer a prescribed fire. Thus, it is expected that the effects of prescribed fire on meadow habitats and associated wildlife will be essentially the same as under current management.

Effects to cropland habitat, Alternative B: The Refuge expects that retiring the approximately 89 acres of farm field will have little to no effect on area wildlife and if carefully restored, little effect on area habitats. Since sandhill cranes have infrequently used the farmed areas over the past 30 years, it is expected that retiring the farm fields will little if any effect on crane fitness or survival.

A complete cessation of farming without immediate restoration would likely result in farm fields being occupied by invasive plants and possibly noxious weeds and becoming a source of invasive plants to other nearby land owners. However, since farm field retirement and restoration will be conducted one field at a time, there is limited chance that farm fields will become plots of undesirable plant species. Farm fields restored to meadows dominated by native plant species should provide a more resilient long-term resource for non-crane focal species. Furthermore, periodic use of more complex seed mixes may have future utility in more proactive soil health management.

Farming will continue on select fields until habitat restoration actions can commence. Fields where farming will continue until retirement would be planted to wildlife-friendly crop mixes, (e.g., grain, legumes, tubers) providing supplemental food for wildlife, including sandhill cranes, Canada geese, and mallards, during fall migration, while preventing establishment of invasive plant species. While supplemental foods can prove useful in helping birds bulk up their energy reserves prior to migration, the rather limited amount of farm fields available to birds represents only a modest benefit the Refuge focal species.

Effects to riparian habitat, Alternative B: Under the proposed action, riparian habitat along Eagle Creek is expected to recover and exhibit the described characteristics noted in HMP section 4.3.1. Fencing to preclude livestock from browsing riparian vegetation would be expected to allow riparian vegetation to quickly increase in both density and spatial distribution, particularly in light of the very favorable moisture gradient conditions along watercourses.

These additional acres will provide nesting habitat for additional pairs of riparian-dependent passerines and would be expected to result in a small localized increase in local populations of focal species (i.e., yellow warbler, willow flycatcher, yellow-breasted chat), as well as mammals such as beaver and mule deer.

Prescribed fire would be undertaken for the purpose of stimulating herbaceous vegetation and shrubs to produce new growth. Most willow species respond to browsing by beaver and fluvial disturbances through coppice sprouting from stems, as well as production of root suckers (Rood et al. 1994). These adaptations also contribute to regeneration following fire (Dwire and Kauffman 2003).

Most riparian sedge and grass species recover rapidly following light surface fires, through regeneration from roots and rhizomes (Racine et al. 1987). Willows, cottonwoods, and numerous herbaceous species can establish in high densities on burned riparian sites via post-fire arrival of light, windborne seeds. Fluvial delivery of seeds and vegetative propagules to streamside sites during flood events can also increase recolonization of burned areas (Johansson et al. 1996; Shafroth et al. 2002). Because the occasional use of habitat management methods such as prescribed fire and mechanical disturbance would be expected to maintain and reinvigorate riparian stands, they would be expected to promote the habitat qualities needed by focal species associated with woody riparian habitat. Other riparian habitats will continue to exist in degraded conditions due to grazing pressure.

Effects from Integrated Pest Management, Alternative B: The IPM program will be the same as under Current Management Alternative, and thus effects will be the same as described under Current Management Alternative.

Affected Environment: Geology and Soils

The soils in the Grays Lake marsh consists of very deep, very poorly drained organic soils that formed in organic material of water-tolerant plants. The adjacent wet meadow soils consist of very deep, very poorly drained soils that formed in alluvium. Adjacent mesic and xeric meadows and upland shrublands consist of deep, well drained, medium textured, dark colored soils formed in wind-laid silts (USDA, 1981).

Environmental Consequences – Geology and Soils

Alternative A, Current Management – No Action Alternative

Effects to Geology and Soils, Alternative A: Livestock grazing in meadow habitats does compact soils during the course of the grazing season, however, the compaction is short-lived. The long, hard freeze and thaw cycles in fall, winter and spring in the Grays Lake basin loosen compacted soils by the summer grazing season resulting in no adverse effects to soil porosity and permeability. There is minimal soil compaction from infrequent use of mowing equipment which is soon abated by the seasonal freeze and thaw. Livestock grazing does result in stream banks being incised, leading to soil loss along water courses. Since all water courses except the Grays Lake outlet lead into the marsh basin, eroded soils become mixed with the organic soils in the lowest portion of the basin dominated by hardstem bulrush. Livestock grazing along the banks Grays Lake outlet leads to some soil loss, but with the annual spring draw down of Grays Lake marsh waters, little water leaves Grays Lake through the outlet. Thus, only minor amounts of sediment are moved downstream from Grays Lake.

When the Refuge croplands are tilled, soils are vulnerable to loss by means of wind or precipitation sheet flow. With croplands being within a basin, there is very little wind sufficient to blow soils off the local landscape. Also, the cropland acreage is quite small in the context of the surrounding basin and the croplands are surrounded by thick vegetation. As a result, any soil movement due to precipitation sheet flow is minimal.

Application of prescribed fire can expose small areas of soils after treatments, however, similar to croplands, soils exposed by prescribed fire are minimally exposed to wind and water, making effects to soils minor or negligible.

Alternative B, Proposed Action Alternative

Effects to Geology and Soils, Alternative B: Effects to soils will be essentially the same as described under the Current Management alternative, but over time, there will be reduced impacts to soils. As described in the HMP, the management units on the north end of the Refuge will be managed without grazing, thus any soil impacts from grazing will be eliminated. Also, under the Proposed Action alternative's two of three-year grazing program, fewer acres will be subjected to gazing pressure over the course of any grazing season, thereby reducing the number of livestock grazing near water courses. Fewer livestock grazing along water courses will result in less livestock-caused stream bank erosion.

As riparian habitat along Eagle Creek is fenced off from livestock grazing, soil loss from livestock trampling will be eliminated along the banks of Eagle creek resulting in a minor reduction in soil movement along Eagle Creek into the Grays Lake marsh.

Over time croplands will be retired and restored to native grasses and shrubs essentially eliminating soil exposure except for the infrequent application of prescribed fire.

Affected Environment: Water Quality

Grays Lake and the Refuge are within the Willow Creek Subbasin where land use and management, along with stream conditions throughout the entire subbasin, are primarily homogeneous. Elevated sediment loading within the subbasin is widespread, predominantly attributable to streambank erosion from over-utilization of riparian habitat. Due to land use practices most water courses within the subbasin are water quality limited due to sedimentation and temperature. (Idaho Department of Environmental Quality, 2004).

Environmental Consequences – Water Quality

Alternative A, Current Management – No Action Alternative

Effects to Water Quality, Alternative A: Under current management, water quality is adversely affected by livestock grazing. Livestock trampling of stream banks adds sediment to water courses already experiencing elevated sediment conditions. Livestock grazing of riparian habitats along water courses contributes to elevated water temperatures by reducing shade. Waters entering the refuge already have elevated temperatures for this reason. In addition, nutrients and bacteria from livestock waste enter Refuge streams during the course of the growing season.

Despite these contributions to compromised water quality conditions, Refuge management does not significantly affect water quality in the context of the subbasin. The segments of water courses on the Refuge are relatively short, affording the Refuge limited opportunities to improve water quality conditions on site.

Also, due to the spring water draw down, most water entering the refuge is absorbed in the organic soils of Grays Lake marsh or evaporates, leaving nutrients to be captured in the organic soils of the marsh. The thick vegetation in the marsh metabolizes many of these nutrients. As previously discussed, little water leaves Grays Lake marsh due to the spring draw down, resulting in very little nutrient-laden water leaving the marsh and affecting downstream conditions.

Prescribed fire can have adverse effects on water quality by exposing soils which have the potential to erode into stream and creeks by means of sheet flow. Also, nutrients released by prescribed fire can wash into water courses under certain conditions. However, the very infrequent application of prescribed fire makes the above scenario unlikely to result in any substantial negative effects to local water quality.

Alternative B – Proposed Action Alternative

Effects to Water Quality, Alternative B: Water quality effects under the proposed action are expected to be essentially the same as under the proposed alternative, but slightly less severe. This is because under the Proposed Action alternative, there will be fewer acres being grazed during the grazing season which should result in less nutrients and bacteria from animal waste being washed into water courses and the marsh.

Also, the exclusion of cattle from Eagle Creek combined with riparian restoration should result in less sediment, and less nutrients and bacteria from livestock waste, entering Eagle Creek. A restored, healthy, dense riparian canopy along Eagle Creek should also help cool water before it enters the Grays Lake marsh. While excluding grazing from Eagle Creek riparian habitat should benefit water quality in the short section of the Eagle Creek which flows through the Refuge, in the context of the compromised water quality conditions surrounding the Refuge, these anticipated water quality improvements represent a very minor benefit.

Affected Environment: Refuge Administration

The Grays Lake NWR is managed as a unit of the Southeast Idaho National Wildlife Refuge Complex along with Bear Lake, Camas, Deer Flat, and Minidoka National Wildlife Refuges and Oxford Slough Waterfowl Production Area. The Complex Office is located in Chubbuck, Idaho, 90 miles away. Grays Lake NWR currently has only one staff on-site (Heavy Equipment

Operator). Seasonal Biological Technicians may be hired to complete inventorying and monitoring tasks as funding permits. Grays Lake NWR does not currently have a Refuge Manager or Biologist and must rely on support from other personnel in the Southeast Idaho NWR Complex.

Environmental Consequences – Refuge Administration

Alternative A, Current Management – No Action Alternative

Effects to Refuge Administration, Alternative A: Under current management, there would be one-time costs associated with converting existing CLMAs to CAAs. This one-time cost is estimated at approximately $8,500. Recurring annual costs of upland and meadow habitat management under Alternative A include habitat management activities (e.g. IPM), site assessments and habitat monitoring, maintaining and repairing fencing and facilities, and administering Cooperative Agriculture Agreements. These annual costs are estimated at approximately $29,500 annually.

Alternative B – Proposed Action Alternative

Effects to Refuge Administration, Alternative B: Under the proposed action alternative, there would be one-time costs associated with converting existing CLMAs to CAAs as in the No Action alternative, but also additional costs related to cropland restoration, installing permanent fencing in areas where grazing and farming would not occur, and installing in-pasture water supplies. This one-time cost is estimated at approximately $135,000. However, once these projects are completed, recurring annual costs would be essentially the same as under current management and are estimated at approximately $29,500 annually.

Table 4. One-time costs under the No Action Alternative and Preferred Alternative

Tasks	Current Management	Proposed Management
Initial CAA/SUP setup – GS-13 Deputy Project Leader	$8,510	$8,510
Assessment & inventory of existing fence condition – WG-08 & seasonal GS-05 Biological Technician		$2,530
Construction of new permanent fencing and gates		$25,000
Install in-pasture water supplies		$10,000

Tasks	Current Management	Proposed Management
Retire/restore crop fields (89 acres)		$89,000
Total One-Time Costs	$8,510	$135,040

Table 5. Recurring (annual) costs upland and meadow habitat management under both alternatives

Tasks	Estimated Annual Costs[1]
Permit/agreement administration and oversight by GS-13 deputy refuge project leader.	$4,255
Permit/agreement monitoring by GS-05 technician & WG-08	$2,530
Site assessment / habitat condition monitoring by GS-11 biologist	$1,990
Annual fence assessment and repair, if needed by WG-08 & GS-05 technician	$5,065
Supplies, equipment, and facility maintenance and repair	$2,000
Refuge overhead costs associated with the above-listed work[2]	$13,613
Total Costs	$29,453

Socioeconomics

Affected Environment: Local and Regional Economies

Idaho's top five agricultural commodities in 2020 – milk, cattle and calves, potatoes, hay and wheat – had a total production value of $6.61 billion, which accounted for 79 percent of the total value of all agricultural commodities in the state. (Idaho Farm Bureau Federation).

The Refuge is located in Bonneville and Caribou counties, both of which have robust agricultural economies. In the vicinity the Refuge there is little economic activity other than ranching. Thus, the following description of local and county economic activity will focus on the ranching economy.

In 2017, U.S. Department of Agriculture data for Bonneville County shows total market value of agricultural products sold was $167,862,000. Of that, the market value of cattle and calves sold was $54,218,000, representing approximately 32 percent of Bonneville County agricultural market activity (USDA, 2017). In 2017, U.S. Department of Agriculture data for Caribou County shows total market value of products sold = $90,320,000. Of that, the market value of cattle and calves sold was $26,877,000, representing approximately 30 percent of Caribou County agricultural market activity.

Impacts on Local and Regional Economies

Alternative A, Current Management – No Action Alternative

Effects to Local and Regional Economies, Alternative A: The past mechanism for conducting a grazing program on the Refuge has been through the use of Cooperative Land Management Agreements (CLMA) with local ranchers interested in grazing livestock on the Refuge. The Refuge has had CLMAs with five permittees for decades. Current grazing permits allow for 1,600 Animal Unit Months (AUMs) with 735 yearlings and 68 cow/calf pairs operated by the five permittees. After 2030, when a warranty deed expires, 181 more acres would be grazed annually under permit, for a total of 1,887 AUMs.

Under the No Action Alternative, a competitive bid process, consistent with U.S. Fish and Wildlife Service's Cooperative Agricultural Use policy (620 FWS 2), will be employed to find cooperators willing to enter into a Cooperative Agricultural Agreement (CAA) with the Service for grazing and haying on the Refuge by the 2023 season. Grazing under an existing warranty deed and MOA with the warranty deed holder would continue until expiration of the warranty deed on December 31, 2030. Thereafter, these pastures would also be converted to management under CAAs, but would continue to be grazed annually.

Both CAAs and CLMAs are essentially "contracts" between the Refuge and a permittee. For example, a grazing permittee is allowed to graze a certain number of animals for a specified period of time on a specific Refuge management unit. The number of animals and time allowed for grazing is expressed as AUMs. AUMs in a grazing area (calculated by multiplying the number of animal units by the number of months of grazing) provides a useful indicator of the amount of forage consumed. The AUM calculation is used as a management tool to avoid too much forage being consumed which would then lead to habitat degradation. An AUM is also used as a tool for charging permittees a fee for the consumption of Refuge forage.

Under the Cooperative Agricultural Use policy, the Service will provide notice of potential cooperative agricultural opportunities (grazing and haying) on Refuge lands. Applicants will use applicable sections of FWS Form 3-1383-C to apply for the individual CAA. The Service will accept applications at the local refuge or Refuge complex office listed in the notice of potential cooperative agricultural opportunities with the terms and conditions in the notice.

The Service must score and rank each application based on objective criteria and select the most qualified applicant. The Service will notify all applicants individually and in a timely manner about to whom the CAA is awarded as well as notify unsuccessful applicants about why they were unsuccessful and of their right to appeal any adverse decision. Once a CAA has been awarded, the Service and the cooperator will work together to finalize the terms and conditions of the CAA.

Since the grazing lands on the Refuge provide high quality forage, it is expected that there will be substantial interest by local ranchers and quite possibly other ranchers outside of the immediate Grays Lake area to have access to Refuge grazing lands (Ty Matthews, USFWS, personal communication). Thus, while not certain, but likely, ranchers will have to bid more than the $4.00 per AUM which had been the previous permittee cost to graze under CLMAs. It is unknown whether the permittees which have been grazing at Grays Lake in past years will be successful bidders or whether other ranchers will successful bidders, but in light of the highly desirable forage on the Refuge, it is expected all of the acres available for grazing, despite anticipated increased costs, will have permittees grazing that acreage.

The bidding process that is used to award CAAs is expected to generate more income to the Service than the $4.00 per AUM fee which has been employed in the past. In addition, under CLMAs permittees had a choice of paying for herbicides in exchange for grazing fees, whereas under CAAs the Service would cover all costs associated with weed control. Exactly what the amount of revenue the Refuge will receive through the bid process cannot be known at this time. However, since the quality of the forage on the Refuge is similar to that found in irrigated pastures, it is reasonable to assume bid prices for Refuge forage will be similar to prices for irrigated pasture (approximately $31/AUM). Therefore, annual Refuge revenue under CAAs could be approximately $48,422 through 2030 and $58,497 after 2030 when a warranty deed expires and more acres would be grazed under CAAs. However, as with CLMAs, fees collected under CAAs are not retained by the Refuge. Instead, these monies are deposited into the U.S. Treasury Department's National Wildlife Refuge Fund. Monies from this Fund are used for redistribution to refuges to help offset the costs of administering specialized uses (Expenses for Sales) and for payments in lieu of taxes to counties or other local governments under the Refuge Revenue Sharing Act. With increased payments to the National Wildlife Refuge Fund under CAAs, the Refuge may receive increased payments from the Fund to help offset the costs of administering the Cooperative Agriculture program.

In the past, the Refuge typically authorized haying by means of a Special Use Permit (SUP). Under the SUP, the permittee was charged a fee for removing the hay (e.g., $6.00/ton) or was required to make a cooperative payment through purchase an associated product (e.g., fertilizer, herbicide). In 2020 a cooperator removed 32 tons of hay from 40 acres. Therefore, pastures at Grays Lake can be expected to produce approximately 0.8 tons of hay per acre.

Haying, being a cooperative agriculture practice, is subject to the Service's Cooperative Agriculture policy, and has to be advertised and selected in an open, competitive, and transparent process, similar to the process for selecting grazing cooperators. The bidding process that is used to award CAAs is likewise expected to generate more fee revenue to the Service compared to current levels. Since haying at Grays Lake NWR occurs late in the season, the hay is lower in nutritional value than grass hay harvested earlier in the season. Bid prices for haying opportunities on the Refuge would reflect this, but would still be expected to be well over the $6.00/ton charged currently. Potentially, bid prices for late-season hay would be $20/ton. This would represent a small increase in fee revenue compared to current levels.

After the grazing season, permittees typically take their livestock to market, generating economic activity in counties in which the Refuge is located. Based on 2017 USDA data, the market value of cattle and calves sold in Bonneville County totaled $54,218,000. The inventory of cattle and calves that year was 58,072 suggesting the average value of an animal was approximately $934. USDA 2017 data, for Caribou County shows the market value of cattle and calves sold was $26,877,000. The inventory of cattle and calves that year was 25,146 suggesting the average value of an animal is $1,068. Combining the Bonneville County and Caribou County data then suggests the average value for an individual animal is approximately $1000. Thus the 866 animals which were grazed on the Refuge in 2021 would likely have a minimum value of $866,000. In the context of the total market value of cattle and calves for Bonneville and Caribou counties being $81,095,000, the $866,000 value of cattle and calves currently grazing at Grays Lake represents approximately 1 percent of Bonneville and Caribou counties' cattle/calf market activity.

For decades permittees have been charged $4.00 per AUM to graze on Refuge lands. In 2021, Refuge revenues from grazing totaled $6,400 under CLMAs. Under CAAs, this revenue would increase to $48,422-$58,497 annually. As noted above, fee revenues are deposited into the U.S. Treasury Department's National Wildlife Refuge Fund, which is used for payments in lieu of taxes to counties or other local governments under the Refuge Revenue Sharing Act. With increased revenues being generated under the competitive bidding process, a minor increase in the amount of Revenue Sharing dollars going to Bonneville and Caribou counties would be expected.

Alternative B – Proposed Action Alternative

Effects to Local and Regional Economies, Alternative B: As under the No Action Alternative, a competitive bid process, consistent with U.S. Fish and Wildlife Service's Cooperative Agricultural Use policy (620 FWS 2), will be employed to find cooperators willing to enter into a Cooperative Agricultural Agreement (CAA) with the Service for grazing on the Refuge.

Under the Proposed Action Alternative there will be 1,834 acres available for permittee grazing under CAAs after a warranty deed and MOA expire in 2030. However, since all pastures will be managed under the two of three-year rotation system, approximately two thirds of that acreage (~1,223 acres) will be available during any one grazing season. The Refuge will initially allow the medium AUM stocking rate (see HMP Table 4.1.1) for the first few years in order to determine whether that stocking rate will be adequate to achieve habitat objectives. At that stocking rate, approximately 2,095 AUMs will be on the Refuge under permit during any one grazing season through 2030, a 34 percent increase over the No Action Alternative. After 2030, when a warranty deed expires, 2,229 AUMs could be grazed under permit during any one grazing season, an 18 percent increase over the No Action alternative. Assuming a bid rate of $31 per AUM (comparable to rates for irrigated pasture), the Refuge could see revenues in the neighborhood of $ $64,945-$89,099 to under the Preferred Alternative. Although, as noted above, fee revenues collected under CAAs would not be retained by the Refuge, but would be deposited into the U.S. Treasury Department's National Wildlife Refuge Fund. However, with increased deposits to the Fund, the Refuge could see an increase in payments to offset the costs of administering the cooperative agriculture program.

As in the No Action alternative, permittees will see increased costs per AUM for grazing on Refuge lands. However, it is anticipated that there will be a roughly 34 percent increase in the numbers of livestock which will be annually grazing on the Refuge under permit compared to current management. After 2030, total grazing under permit would drop slightly, due to 325 annually grazed acres being converted to a two of three-year rotation, but this would still represent an 18 percent increase over the No Action alternative. It is expected the increased numbers of livestock grazing on the Refuge will go to market at the end of the grazing season, permittees would realize with increased sale profits compared to the No Action alternative, offsetting the increased costs for grazing on Refuge lands. Through 2030, the estimated 1,164 animals which would be grazed under permit would likely have a minimum value of $1.16M. After 2030, the estimated 1,238 animals that would be grazed under permit would likely have a minimum value of $1.24M. In the context of the total market value of cattle and calves for Bonneville and Caribou counties being $81,095,000, the value of cattle and calves that would be grazed annually at Grays Lake would represent approximately 1.4-1.5 percent of Bonneville and Caribou counties' cattle/calf market activity, a minor increase over the No Action alternative.

As with grazing, haying would be managed using CAAs. As noted above, bid prices for late-season hay are estimated at $20/ton. Under the Preferred Alternative, haying would occur on an irregular basis with acreage being hayed determined year by year depending on habitat conditions. Therefore, it is possible that average annual fee revenue from haying may increase compared to the No Action alternative.

As with CLMAs, fee revenues collected under CAAs would be deposited into the U.S. Treasury Department's National Wildlife Refuge Fund. With increased revenues being generated under the Preferred Alternative, it is possible there would be a small increase in Revenue Sharing dollars going to Bonneville and Caribou counties.

Cumulative Impacts

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7).

Climate Change

Climate change refers to the increasing changes in the measures of climate over a long period of time – including precipitation, temperature, and wind patterns. There is no definitive information on how exactly changes in climate will impact species populations.

Climate change has, and will continue to, affect Refuge habitats. The climate of Idaho has changed from historic conditions. Idaho's Hazard Mitigation Plan (IOEM 2018) states:

"Over the past 100 years, most of the State has warmed one to two degrees (°F). In the coming years, it is predicted that streams will be warmer, populations of several fish species will decline, wildfires will become more common, deserts may expand, and water may be less available for irrigation (USEPA 2016). By 2050, Idaho is projected to see a 110 percent increase in drought threat."

In their analysis of Idaho climate data, Klos and collaborators made the following findings (Klos et al. 2015):

Temperature and growing season: The growing season in Idaho has increased by an average of 13 days since early in the 20th century. On average, the last spring frost occurs eight days earlier and the first fall frost is five days later.
Snowpack has been declining in the state over the past 50 years (based on records since 1937).
Spring runoff is occurring earlier and that the total annual volume of flow has decreased (based on records from 1950 to 2005).

Since 2000, the longest duration of drought (D1-D4, where D1 indicates "moderate drought" and D4 indicates "exceptional drought") in Idaho lasted 258 weeks beginning on January 30, 2001 and ending on January 3, 2006. During that drought, D4 conditions affected more than 40 percent of Idaho lands. A less severe drought (D1-D3 conditions) occurred from mid-2013 through early 2017 (NIDIS 2020).

There is no definitive information on exactly how changes in climate will impact species populations, however reduced snowpack, decreased water availability and soil moisture during the growing season, and increased frequency of wildfire is likely to negatively impact meadow, riparian, and wetland ecosystems in the Grays Lake basin. While droughts since 2001 cannot be definitively linked to climate change, it appears likely that drought conditions will become more frequent and severe in Idaho. Soils and wetlands would be more likely to dry out earlier in the season, reducing plant productivity.

Anticipated Cumulative Impacts from Proposed Action and Alternatives

In the Grays Lake basin, reduced snowpack and consequently, reduced soil moisture and drying of wetlands earlier in the season have been observed over the past several years. This in turn has reduced plant productivity. This may have negative effects to migratory birds that use the Refuge for breeding or stopover habitat (reduced fitness or productivity).

We will adjust type, timing, duration, and intensity of habitat management strategies, including livestock grazing, haying, prescribed fire, and integrated pest management, based on habitat conditions and data from monitoring programs. Because monitoring will continue to be done on an annual basis, habitat management strategies, including livestock grazing, should not add to the adverse cumulative impacts of climate change on migratory birds, resident wildlife, and their habitats, but rather at least partially mitigate the impacts of climate change.

Alternative A

See above. Cumulative impacts would be similar under both alternatives.

Alternative B

See above. Cumulative impacts would be similar under both alternatives.

Monitoring

Monitoring will be conducted by Refuge staff, recording when cows are put on a pasture and when they are taken off or moved to another pasture. Pastures will be visually inspected at the end of the grazing season to determine if stocking rates were adequate, or whether stocking rates will need to be increased or decreased to meet desired short-grass meadow conditions in future years.

Summary of Analysis

Alternative A –Current Management (No Action Alternative)

As described above, under current management annual grazing and two of three-year rotation grazing would continue on 2,239 acres of Refuge lands and 89 acres of Refuge lands will continue to grow crops (Table 3). This management would provide a moderate amount of short grass meadow conditions needed by Refuge focal species due to uneven grazing caused by poorly distributed livestock. Lands in crops would likely continue to see limited use by sandhill cranes. Eagle Creek restoration efforts would continue, benefiting riparian dependent species, reducing soil erosion and improving water quality. These beneficial effects would be minor due to the limited acreage involved with Eagle Creek restoration efforts; remaining riparian habitats would continue to be heavily grazed. The local livestock economy would continue to be supported by offering high quality grazing lands to local ranchers. This alternative would support Refuge purposes by providing habitat conditions required by Refuge focal species.

Alternative B –Proposed Action Alternative

As described above, implementing the actions described in the proposed HMP would substantially reduce the number of acres annually grazed (from 855 acres to 325 acres through 2030, and zero acres after 2030) and increase the number of acres available for grazing on a two of three-year rotation. With crop lands being retired and mesic and xeric meadow conditions being managed by mowing rather than grazing, there would be approximately 405 fewer acres available for grazing by permittees (Table 3). Stocking rates on Refuge lands available for grazing would increase by roughly 34 percent compared to the No Action alternative in the first few years with adjustments to stocking rates made based on how well initial proposed stocking rates achieve habitat objectives. If these stocking rates meet habitat objectives and are maintained this would represent a 34 percent increase in AUMs annually grazed on the Refuge compared to the No Action alternative through 2030, and an 18 percent increase compared after 2030. The local livestock economy would continue to be supported by offering high quality grazing lands to ranchers.

It is expected these management changes will result in more acreage being in desired short-grass condition as compared to current management, which should moderately improve conditions for breeding, feeding and long-term survival of focal species. This alternative would support Refuge purposes by providing more acres with improved habitat conditions for Refuge focal species using all meadow habitat types. Riparian habitats will see the same results as described under current management alternative.

This alternative would better support Refuge purposes as compared to the Current Management alternative by providing more acres with better habitat conditions required by Refuge focal species.

List of Sources, Agencies and Persons Consulted

Cameron Williams, Resource Conservationist, Natural Resources Conservation Service, Soda Springs Field Office
William Smith, Supervisory Wildlife Biologist, USFWS Alaska Peninsula National Wildlife Refuge Complex (former Grays Lake NWR Refuge Manager/Biologist)
Adonia Henry, Eastside Zone Biologist, USFWS Pacific Region (former Wetland Ecologist, Willet and Scaup LLC)
Jason Beck, Regional Wildlife Habitat Biologist, Idaho Department of Fish and Game, Southeast Region

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Andrea Kristof, Wildlife Biologist, Camas NWR

State Coordination

SE Idaho National Wildlife Refuge Complex and USFWS Pacific Region staff met and consulted with Jason Beck, Regional Wildlife Habitat Biologist with IDFG's Southeast Region regarding the proposed Habitat Management Plan for Grays Lake NWR. His input and recommendations have been incorporated into the Draft HMP. The IDFG Southeast Regional Office will be given a copy of the Draft HMP and EA and will be invited to provide comments.

Tribal Consultation

Tribal interests are an integral part of the management of the SE Idaho National Wildlife Refuges. The Refuge Complex staff will continue to coordinate and collaborate with the local Tribes on matters of shared interest. We will provide the Shoshone-Bannock Tribes with a copy of the Draft HMP and EA and invite them to provide comments.

Public Outreach

The SE Idaho Refuge Complex maintains a mailing list, for news release purposes, to local newspapers, radio, and websites. In addition, information about the Habitat Management Plan is available at the SE Idaho NWR Complex office, and on the Grays Lake NWR website https://www.fws.gov/refuge/grays-lake.

The Draft Habitat Management Plan and Environmental Assessment will be posted for a 30-day public review and comment period. You may submit comments or requests for additional information through any of the following methods:

Email: Southeast_Idaho_NWR@fws.gov Include "Grays Lake Habitat Management Plan" in the subject line of the message.

Fax: Attn: Grays Lake Habitat Management Plan (208) 237-8213.

U.S. Mail: U.S. Fish and Wildlife Service, Attn: Project Leader, SE Idaho National Wildlife Refuge Complex, 4425 Burley Drive Suite A, Chubbuck, ID 83302.

All comments received from individuals become part of the official public record. All requests for such comments are handled in accordance with the Freedom of Information Act and the

CEQ's NEPA regulations in 40 CFR 1506.6(f). The Service's practice is to make comments, including names and home addresses of respondents, available for public review during regular business hours. Individual respondents can request that we withhold their home address from the record, which we will honor to the extent allowable by law. If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comments.

Determination

This section will be filled out upon completion of the public comment period and at the time of finalization of the Environmental Assessment.

☐ The Service's action will not result in a significant impact on the quality of the human environment. See the attached **"Finding of No Significant Impact."**

☐ The Service's action **may significantly affect** the quality of the human environment and the Service will prepare an Environmental Impact Statement.

Signatures

Submitted By:

Project Leader Signature:

Date:

Concurrence:

Refuge Supervisor Signature:

Date:

Approved:

Regional Chief, National Wildlife Refuge System Signature:

Date:

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Appendix 1. Other Applicable Statutes, Executive Orders, and Regulations

Cultural Resources

American Indian Religious Freedom Act, as amended, 42 U.S.C. 1996 - 1996a; 43 CFR Part 7

Antiquities Act of 1906, 16 U.S.C. 431-433; 43 CFR Part 3

Archaeological Resources Protection Act of 1979, 16 U.S.C. 470aa-470mm; 18 CFR Part 1312; 32 CFR Part 229; 36 CFR Part 296; 43 CFR Part 7

National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470-470x-6; 36 CFR Parts 60, 63, 78, 79, 800, 801, and 810

Paleontological Resources Protection Act, 16 U.S.C. 470aaa-470aaa-11

Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001-3013; 43 CFR Part 10

Executive Order 11593 – Protection and Enhancement of the Cultural Environment, 36 Fed. Reg. 8921 (1971)

Executive Order 13007 – Indian Sacred Sites, 61 Fed. Reg. 26771 (1996)

The proposed action includes no ground-disturbing activities, or other activities that might disturb undocumented paleontological, archaeological, or historic sites. The Service has determined that implementing the HMP is the type of undertaking that does not have the potential to cause effects on historic properties (36CFR800.3.a.1. the implementing regulations of Section 106 of the National Historic Preservation Act - NHPA). No ground disturbing activities are proposed and opening the area would not alter, directly or indirectly, any characteristic of a historic property.

Fish and Wildlife

Bald and Golden Eagle Protection Act, as amended, 16 U.S.C. 668-668c, 50 CFR 22

The Preferred Alternative is consistent with Bald and Golden Eagle Protection Act because the HMP promotes conservation for a wide suite of species, including eagles.

Fish and Wildlife Act of 1956, 16 U.S.C. 742a-m

The proposed action is consistent with this statute in that it promotes conservation of fish, wildlife and plants.

Lacey Act, as amended, 16 U.S.C. 3371 et seq.; 15 CFR Parts 10, 11, 12, 14, 300, and 904

Migratory Bird Treaty Act, as amended, 16 U.S.C. 703-712; 50 CFR Parts 10, 12, 20, and 21

The proposed action is consistent with this statute in that it improves habitat conditions for, and promotes conservation of, migratory birds.

Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds, 66 Fed. Reg. 3853 (2001)

The Preferred Alternative is consistent with the Lacey Act, the Migratory Bird Treaty Act, and Executive Order 13186 in that it promotes conservation of migratory birds.

Endangered Species Act of 1973, as amended, 16 U.S.C. 1531-1544; 36 CFR Part 13; 50 CFR Parts 10, 17, 23, 81, 217, 222, 225, 402, 450

The Refuge contains no species that are listed as threatened or endangered under the ESA.

Natural Resources

Wilderness Act, 16 U.S.C. 1131 et seq.

The Service has evaluated the suitability of the Grays Lake NWR for wilderness designation and concluded that the Refuge does not meet the basic criteria for inclusion into the National Wilderness Preservation System.

Wild and Scenic Rivers Act, 16 U.S.C. 1271 et seq.

The Service has evaluated the eligibility of streams on Grays Lake NWR for wild and scenic river designation and concluded no streams meet the basic criteria for inclusion into the National Wild and Scenic Rivers System.

Executive Order 13112 – Invasive Species, 64 Fed. Reg. 6183 (1999)

The proposed action is consistent with Executive Order 13112 because stipulations in permits would be designed to prevent the introduction of invasive species.

Water Resources

Coastal Zone Management Act of 1972, 16 U.S.C.1451 et seq.; 15 CFR Parts 923, 930, 933
Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.; 33 CFR Parts 114, 115, 116, 321, 322, and 333

The Refuge does not lie in a coastal zone, and contains no rivers, harbors, or navigable waters.

Federal Water Pollution Control Act of 1972 (commonly referred to as Clean Water Act), 33 U.S.C. 1251 et seq.; 33 CFR Parts 320-330; 40 CFR Parts 110, 112, 116, 117, 230-232, 323, and 328

The proposed action is consistent with the Clean Water Act, because implementation of the HMP would have beneficial effects on on water quality or water resources.

Safe Drinking Water Act of 1974, 42 U.S.C. 300f et seq.; 40 CFR Parts 141-148

The Refuge contains no drinking water sources and does not supply drinking water to any community.

Executive Order 11988 – Floodplain Management, 42 Fed. Reg. 26951 (1977)

The proposed action is consistent with Executive Order 11988, because implementation of the HMP would not result in the modification or destruction of floodplains.

Executive Order 11990 – Protection of Wetlands, 42 Fed. Reg. 26961 (1977)

The proposed action is consistent with Executive Order 11990 because implementation of the HMP would protect existing wetlands.

Appendix 2. Draft Grays Lake National Wildlife Refuge Upland and Meadow Complex Habitat Management Plan

Department of the Interior
US Fish and Wildlife Service
Grays Lake National Wildlife Refuge

Grays Lake National Wildlife Refuge Draft Upland and Meadow Complex Habitat Management Plan

July 2022

Approved:

________________________________ _______________

Refuge Manager Date
Grays Lake National Wildlife Refuge

Concur:

________________________________ _______________

Project Leader Date
Southeast Idaho National Wildlife Refuge Complex

Concur:

________________________________ _______________

Regional Chief Date
National Wildlife Refuge System, Pacific Region 1

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1.0 Introduction

1.1 Scope and Rationale

This habitat management plan (HMP) for Grays Lake National Wildlife Refuge (NWR) provides specific guidance for habitat management related to meadow, uplands, and riparian habitats to support legal mandates as well as the conservation, management, and, where appropriate, restoration of local, regional, and ecosystem fish, wildlife, plant, and habitat resources on lands administered by the United States Fish and Wildlife Service (FWS). Because this HMP focuses on meadow and peripheral upland habitats, wetland management will not be discussed. This plan was prepared in accordance with guidance for developing HMPs provided by the FWS' Habitat Management Plans policy (620 FW 1). It also complies with all applicable laws, regulations, and policies governing the management of units of the NWRS. The lifespan of this HMP is fifteen years from the date of approval. HMPs are peer reviewed and revised every five years as necessary. The refuge manager may modify the HMP at any time if new information suggests these plans are inadequate or refuge resources would benefit from changes.

The following guiding principles (620 FW 1) were used to develop this HMP:

• Use best available biological information and ecological principles to provide the foundation for developing habitat goals, objectives, and subsequent management strategies and prescriptions. The conservation and restoration where appropriate, of fish, wildlife, and plant populations depends upon the integration of biological information into management decisions.

• Derive habitat objectives and management strategies from refuge purposes and NWRS mission that provides the foundation to conserve and protect functional communities of native fish, wildlife and plants, and explicitly link international, national, regional, state, and ecosystem goals and objectives, as appropriate. Additionally, ensure HMP consistency with other conservation plans such as threatened and endangered species recovery plans, Service ecosystems plans, the North American Waterfowl Management Plan, state conservation plans, Partners In Flight (PIF) plans, and assist in attaining the goals and objectives of those conservation efforts to the extent practicable.

• Consider the opportunities, constraints, and/or limitations posed by existing special designations (e.g., research natural areas) when implementing management strategies to achieve habitat objectives.

• Consider the highest measure of biological integrity, diversity, and environmental health as those intact and self-sustaining habitats and wildlife populations that existed under historic conditions (see Biological Integrity, Diversity, and Environmental Health policy [601 FW 3]). Individual refuges contribute to biological integrity, diversity, and environmental health at larger landscape scales, especially when they support populations and habitats that have been lost at an ecosystem, national, or international scale. However, refuge purposes may compromise these components at larger landscape scales. When evaluating the appropriate direction for a refuge, the refuge manager should consider their refuge's contribution at multiple landscape scales.

• Consider a range of habitat management strategies to meet specific wildlife or habitat management goals and objectives. To select appropriate strategies, consider the natural/historic frequency and timing of processes such as flooding, fires, and grazing by native herbivores. Where it is not appropriate or feasible to restore ecosystem function, refuge management strategies will mimic natural processes to the extent practicable.

• Use adaptive management to evaluate and modify management strategies to achieve habitat objectives. Monitoring will be used to evaluate if the management strategies and prescriptions achieve desired outcomes (i.e., refuge habitat and wildlife objectives).

• Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and prevent new and expanded infestations of invasive species. Conduct refuge habitat management activities to prevent, control, or eradicate invasive species utilizing integrated pest management approaches.

• Ensure that all refuge uses, including refuge management economic activities, that are a component of the HMP are determined compatible (see 602 FW 3), and all other compliance requirements have been met.

1.2 Legal Mandates

Statutory authority for FWS management and associated habitat management planning on units of the National Wildlife Refuge System (NWRS) is derived from the National Wildlife Refuge System Administration Act of 1966 (Refuge Administration Act), which was significantly amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act, 16 U.S.C. 668dd-668ee). Section 4(a)(3) of the Refuge Improvement Act states, *"With respect to the System [NWRS], it is the policy of the United States that – (A) each refuge shall be managed to fulfill the mission of the System, as well as the specific purposes for which that refuge was established…"* The Refuge Improvement Act established the following mission for the NWRS, *"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."* The Refuge Improvement Act also states that the *"...purposes of the refuge and purposes for each refuge mean the purposes specified in or derived from law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit."*

Grays Lake NWR was established in 1965 under the authority of a Memorandum of Understanding with the Bureau of Indian Affairs and Cooperative Use and Cooperative Agreements with 22 ranchers that owned property adjacent to Grays Lake. The current proposed refuge boundary was established in 1972 by the Migratory Bird Conservation Commission.

From these documents one can conclude that the refuge's purposes are broadly stated as the **conservation of native birds and other wildlife and to further the purposes of the Migratory**

Bird Treaty Act. Specifically, the purposes for Grays Lake NWR mention providing quality habitats for sandhill cranes, Canada geese and ducks.

The Refuge Administration Act, as amended, clearly establishes wildlife conservation as the core NWRS mission. House Report 105-106, accompanying the Refuge Improvement Act, states *"…the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first."* In contrast to some other systems of federal lands which are managed on a sustained-yield basis for multiple uses, the NWRS is a primary-use network of lands and waters. First and foremost, refuges are managed for fish, wildlife, plants, and their habitats. In addition, units of the NWRS are legally closed to all public access and use, including economic uses, unless and until they are officially opened through an analytical, public process called the refuge compatibility process. With the exception of refuge management activities which are not economic in nature, all other uses are subservient to the NWRS' primary wildlife management responsibility and they must be determined compatible before being authorized.

Section 4(a)(4)(B) of the Refuge Improvement Act states, *"In administering the System, the Secretary shall…ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans…"* This legislative mandate represents an additional directive to be followed while achieving refuge purposes and the NWRS mission. It requires the consideration and protection of a broad spectrum of fish, wildlife, plant, and habitat resources found on a refuge. FWS policy guiding implementation of this statutory requirement provides a refuge manager with an evaluation process to analyze his/her refuge and recommend the best management direction to prevent further degradation of environmental conditions; and, where appropriate, and in concert with refuge purposes and NWRS mission, to restore lost or severely degraded resource components. Within the Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3[3.7B]), the relationship between biological integrity, diversity, and environmental health; NWRS mission; and refuge purposes are explained as follows:

"…each refuge will be managed to fulfill refuge purpose(s) as well as to help fulfill the System mission, and we will accomplish these purpose(s) and our mission by ensuring that the biological integrity, diversity, and environmental health of each refuge are maintained, and where appropriate, restored."

The refuge manager is required to conduct the appropriate level of National Environmental Policy Act compliance and public involvement during the development of an HMP. We have prepared an Environmental Assessment to analyze the effects of actions proposed under this HMP.

1.3 Relationship with Other Plans

The plans listed below relate to this HMP in two ways. Some of these plans specify management actions on or adjacent to the refuge. Where possible, the strategies in this plan were designed to be consistent with or to complement those of other plans.

The focus of this habitat management plan is to maintain and restore habitats for selected focal wildlife species. The list of focal species for Grays Lake NWR were derived from refuge purposes (see Section 1.2), then from National Wildlife Refuge System purposes, and finally from purposes listed in other wildlife conservation plans (see Section 3 of this HMP). The habitat requirements of these focal species are then used to develop refuge management objectives and strategies. Regional and statewide plans were included below when possible, rather than national or continental scale plans. The regional and statewide plans step-down from higher level plans and are more applicable to local conditions. This HMP, in turn, steps these regional plans down to local species and habitat conditions.

Listed below are the primary plans used to develop this HMP, and a short statement as to their purposes and applicability to this HMP.

- **North American Waterfowl Management Plan (NAWMP)**: The goal of the NAWMP is "to return waterfowl populations to their 1970s levels by conserving wetland and upland habitat." The North American Waterfowl Conservation Plan highlights population goals for a wide range of waterfowl species. Grays Lake NWR provides molting, nesting and wintering and migration habitat for significant numbers of waterfowl. Species especially well served by the refuge include mallards, cinnamon teal, canvasbacks, redheads, ruddy ducks, Canada geese, and trumpeter swans.

- **Idaho State Wildlife Action Plan:** The Action Plan describes key conservation targets (fish and wildlife species and their habitats), threats to those targets such as invasive weeds and wildfire, and recommended actions to address the threats. Several species in this plan are found on Grays Lake NWR.

- **Idaho Partners in Flight – Idaho Bird Conservation Plan:** This plan focuses on habitats that are used by high priority bird species in Idaho. The goals are to protect and/or restore those habitats and to prevent common species from becoming rare. Several high priority bird species and habitats occur on the refuge. Only those high priority species occurring in Bird Conservation Region (BCR) 10 (Northern Rockies) were used in this HMP.

- **Intermountain West Regional Shorebird Plan:** This purpose of this plan is to preserve shorebirds and their habitats. Grays Lake NWR has limited shorebird habitat and its use by shorebirds is relatively low.

- **Intermountain West Waterbird Conservation Plan:** This purpose of this plan is to preserve waterbirds and their habitats. The refuge provides important nesting and breeding habitat for a number of high and medium priority species including white-faced ibis, Franklin's gulls, eared grebes, and black-crowned night-herons.

- **Intermountain West Joint Venture Implementation Plan:** The Implementation Plans of the 18 U.S. Habitat Joint Ventures are intended to provide Joint Venture (JV) partnerships with a roadmap for the protection, restoration, enhancement, and management of habitat needed to support populations of birds at desired levels. In simple terms, the plans describe the most important areas for birds within the Joint Venture and define what needs to be done in a coordinated fashion to conserve habitat as needed to support bird populations at continental goal levels.

- **Intermountain West Joint Venture Coordinated Bird Conservation Plan:** This plan is a compilation of the North American Waterfowl Management Plan, and regional and state step-down plans from all the bird initiatives. The refuge lies within one of the high priority Bird Habitat Conservation Areas (BCHAs) designated in this plan.

- **Trumpeter Swan Implementation Plan:** The purpose of this plan is to increase the Tri-State Flock of trumpeter swans. The refuge provides breeding and brood rearing habitat for up to 10 nesting pairs of trumpeter swans and serves as a source of eggs used in projects intended to increase the breeding range of the Rocky Mountain Population of trumpeter swans.

- **Audubon Society Globally Important Bird Area:** This program highlights areas of importance to bird conservation. Grays Lake NWR has been designated a Globally Important Bird Area by the National Audubon Society

- **Birds of Conservation Concern:** This list was issued by the U. S. Fish and Wildlife Service to highlight species that may warrant conservation actions.

- **Pacific Flyway Management Plan for the Rocky Mountain Population of Canada Goose:** This plan was written to keep this goose population at levels that would provide recreational hunting, but not so abundant as to cause crop depredation problems. Grays Lake NWR provides important nesting and brood-rearing habitat for Canada geese.

- **Pacific and Central Flyways Management plan for the Rocky Mountain population of greater sandhill cranes:** This plan includes summaries of historical data and information from recent surveys and research that help identify the current and desired population, immediate management issues and management actions necessary and to achieve the desired future condition, including harvest strategies and monitoring to evaluate population status and management progress.

- **Region 1-Pacific Region Partners for Fish and Wildlife Strategic Plan: 2017-2021:** This plan identifies conservation priorities for the USFWS Partners Program in the Pacific Region. Grays Lake NWR was included in the Middle Rocky Mountain focus area.

2.0 Background

The Grays Lake NWR is managed as a unit of the Southeast Idaho National Wildlife Refuge Complex along with Bear Lake, Camas and Minidoka National Wildlife Refuges and Oxford Slough Waterfowl Production Area. The Complex Office is located in Chubbuck, Idaho, 90 miles away.

The Refuge is located in the Grays Lake valley, in northern Caribou and southern Bonneville Counties. It is about 55 miles southeast of Idaho Falls, and 35 miles north of Soda Springs. It currently comprises about 18,800 acres of marsh and upland habitat. The valley floor is 6,386 feet above sea level.

Grays Lake National Wildlife Refuge was established in 1965, under the authority of the Migratory Bird Conservation Act of 1929. The federal government manages the majority of the 13,000-acre lakebed, though use of the land is partially controlled through agreements with neighboring private landowners. Water levels are currently managed according to a 1964 agreement between the Service and the Bureau of Indian Affairs (BIA). After future land acquisitions, water management will be negotiated according the 1990 Fort Hall Indian Water Rights Agreement.

The 20,000-acre Grays Lake (which is actually a large, shallow marsh) is the core of the Refuge. Because of shallow water, and a consistent water draw down schedule, much of the marsh is dominated by hardstem bulrush, with some cattails and other emergent aquatic plants as well. There are areas of open water at the south and north ends, with scattered small ponds elsewhere in the marsh. In addition, the Refuge manages about 5,800 acres of upland grasslands, wet meadows, and temporary, seasonal and semi-permanent wetlands.

Wildlife is fairly diverse. About 200 species of birds have been observed at Grays Lake, including greater sandhill cranes, trumpeter swans, Canada geese, and numerous species of ducks, marsh birds and raptors, including bald eagles and peregrine falcons. There are also at least 50 species of mammals present, including moose, elk, white-tailed deer and mule deer, coyotes and red foxes, and many smaller species. Reptiles and amphibians are limited to striped chorus frogs, leopard frogs and garter snakes.

Management is designed to provide habitat to meet the life history requirements for a variety of wildlife species, while maintaining healthy plant communities. Grazing, haying, and prescribed fire are three tools used to manage grasslands and wet meadows to modify habitat structure in order to provide habitat for some wildlife species.

2.1 Inventory and Description of Habitats

The scope of this plan only concerns the meadow complex (dry meadow, wet meadow, and shallow marsh), riparian, sagebrush steppe, and cropland habitat types. As such, these will be the only habitat types described and discussed in this plan. Below is a brief description of these habitat types based on the most recent sources available.

Meadow Complex

The Meadow Complex as discussed in this plan encompasses dry meadow, wet meadow, and shallow marsh. The meadow habitats of Grays Lake have a long history of farming and manipulation. These areas were first farmed in the late 1880s and were quickly converted into pasture for cattle grazing. This focus on grazing led to the planting of non-native grasses. Similarly, historic farming practices (levelling fields and pastures) are believed to be responsible for the current lack of topographic heterogeneity across refuge property.

Currently, the Meadow Complex consists of seasonally and temporarily flooded plant communities that are dominated by spikerush, Baltic rush, various sedges, tufted hairgrass, mat muhly, Kentucky bluegrass, meadow foxtail, and smooth brome. Native forbs such as balsamroot, camas, shooting star, elk thistle, and many others can also be found in abundance during certain times of the year. Wet meadow sites are primarily supplied water from early spring run-off, and later in the year via irrigation from creek flows throughout the Basin. Throughout the year, the amount of water naturally held in these areas is believed to be directly linked to water levels in the lake, providing both surface and sub-surface feeds.

Current grazing agreements allow for 1,600 Animal Unit Months (AUMs) with 735 yearlings and 68 cow/calf pairs operated by five permittees. Of all the current management units, livestock grazing currently occurs on all but five units: Ayers, Cinder Knoll, South Pasture, Sibbett Hill and HQ (see Figure 2.4.2). The portion of the Ewart unit east of Grays Lake Road, and the Eagle Creek riparian restoration area within the Sibbett South unit, are also currently ungrazed.

The Meadow Complex provides critical breeding and foraging habitat for the following focal species: American Avocet, Cinnamon Teal, Greater Sandhill Crane, White-faced Ibis, Long-Billed Curlew, Canada Goose, Grasshopper Sparrow.

Riparian

The Grays Lake tributaries provide hydrological conditions for montane riparian habitat. The eight perennial creeks that flow into Grays Lake are Bridge Creek, Clark Creek, Eagle Creek, Gravel Creek, Herman Creek, Jones Creek, Little Valley Creek, and Willow Creek (USGS/IDEQ 2018). There are two locations where water exits Grays Lake: Clark's Cut and Grays Lake Outlet. Grays Lake Outlet is the one natural drainage of the marsh located at the northwest corner of the wetland. Clark's Cut is an excavated ditch at the south end of the marsh that connects Grays Lake to the neighboring watershed by way of Meadow Creek.

Based on current land ownership, the Refuge has approximately 10.34 kilometers of perennial stream within its boundaries (Table 2.1.1). Most of these stream lengths occur on Herman Creek (2.9 km), Grays Lake Outlet (2.34 km), and Eagle Creek (1.79 km). Smaller lengths of Bridge Creek (1.1 km), Clark Creek (1.47 km), and Willow Creek (0.74 km) occur on Refuge land. Although Gravel Creek, Jones Creek, and Little Valley Creek flow into the Grays Lake marsh, no lotic habitat occurs on Refuge.

Stream	Refuge Tract(s)	Stream kilometers on-refuge (approx.)	Water rights
Bridge Creek	Lakefront	1.1	25-4032, 25-14084, 25-13737
Clark Creek	Collins	1.47	None
Eagle Creek	Sibbetz South	1.79	25-4034B, 25-4005, 25-13722, 25-2152
Gravel Creek		0	25-275B
Herman Creek	Rich Riley, Big Bend	2.9	25-229A, 25-14118
Jones Creek		0	None
Little Valley Creek		0	None
Willow Creek	Willow Creek	0.74	25-14096
Grays Lake Outlet	Ayers	2.34	None

Table 2.1.1. Location, length, and water rights by Grays Lake tributary associated with Grays Lake NWR.

Little data on the natural condition of Grays Lake riparian habitat exists, since modifications to promote grazing and farming occurred well in advance of refuge establishment. It is likely that many of the refuge's riparian areas were dominated by open and dense stands of willow or quaking aspen interspersed with other native trees and shrubs such as twinberry honeysuckle, Utah honeysuckle, black hawthorn, redosier dogwood, Sitka alder, Wood's rose, golden currant, thimbleberry, silver buffaloberry, Rocky Mountain maple, and chokecherry. Scattered stands of willow were the predominant species, which occurred mostly in the flatter, more mesic sites, while aspen tended to occur in the transitional xeric sites along natural creek channels.

With the arrival of ranchers and farmers, significant functional modification of these riparian habitats occurred to promote cultivation and grazing. In some instances, streams were excavated, channelized, and forced beneath roads through culverts. At the extreme of hydrological modifications, the vast majority of flow from Grays Lake was diverted away from Grays Lake Outlet to the newly completed Blackfoot Reservoir via Clark's Cut, starting in 1925 (Figure 2.1.2). These actions separated the streams from their natural floodplains and artificially confined riparian vegetation to more narrow bands. A majority of the aspen and willow communities that historically occurred directly within the vicinity of the lake basin were most likely cleared and with cows came the introduction of non-native grass as forage (e.g. smooth brome, timothy, meadow foxtail). Additionally, overgrazing likely restricted recruitment of the remaining scattered willows.

Today, the riparian habitat on the Refuge exists within the confines of these accumulated modifications, and is subject to additional stressors. They are still subject to grazing, haying, and farming activities. Over time, more invasive weed species arrived and became established within this niche, including but not limited to reed canarygrass, Canada thistle, musk thistle, and whitetop.

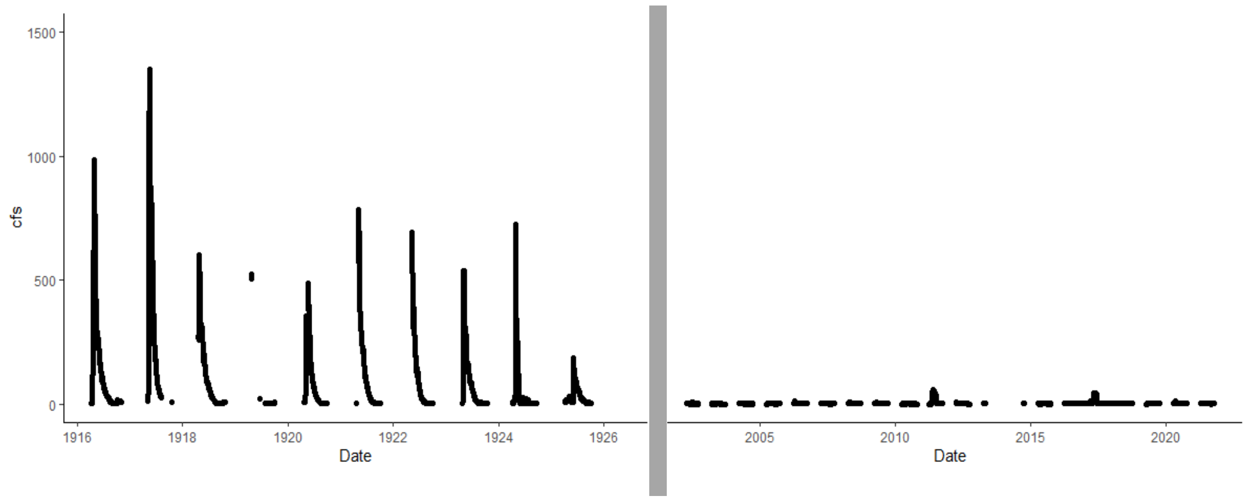

Figure 2.1.2. USGS stream gauge at Grays Lake Outlet near Herman, ID, 1916-1926 and 2004 to 2021 shows impact of Clark's Cut on Grays Lake Outlet hydrology (USGS, unpublished data)

Sagebrush Steppe

Plant communities either hosting or having the capacity to host woody shrubs are confined to meadow perimeters, alluvial fans, hillsides, and/or elevated islands. The shrub species that are known to occur at Grays Lake include basin big sagebrush, mountain big sagebrush, threetip sagebrush, mountain silver sagebrush and rabbitbrush. Dominant upland understory species include bluebunch wheatgrass, Sandberg's bluegrass, Columbia needlegrass, pale agoseris, needle-and-thread, phlox, purple milkvetch, and lupine. Sagebrush steppe provides nesting, brood rearing, and foraging habitat for these focal species: Greater Sage-Grouse, Sage Thrasher, Northern Pintail.

Croplands

Winter wheat and barley within the Grays Lake Valley have been identified as important forage for migrating cranes (Ball et al. 2003). However, there has been a substantial reduction in the area of upland cultivated for barley production (Austin et al. 2007) and an increase in depredation claims from grain farmers around Blackfoot Reservoir. Whereas many Grays Lake landowners transitioned from grain farming to cattle production, the Refuge began farming lure crops in the late 1990s and was eventually the only grain farmer left in the valley (William Smith, unpublished document). Currently, there are approximately 89 acres of grain fields across four management units at Grays Lake NWR: Ayers (32.81 acres), Headquarters (9.88 acres), Lakefront (16.37 acres) and Rich Riley (29.57 acres).

2.2 Factors Causing Change from Historic Conditions

Several factors have caused changes from historic conditions. Individual factors can interact with other factors to cause a broader scale of changes. These changes are dynamic events; they are still happening as new factors come into play, and/or new interactions occur. The habitat management practices described in this plan were developed in response to these habitat changes, but must also be dynamic to meet future changes. In some cases, irreversible changes may make recovery to pre-European settlement conditions very difficult or impossible.

Prior to the establishment of the Refuge, meadow and sagebrush steppe habitats in and around Grays Lake had been significantly altered by homesteading efforts and associated farming and ranching practices. For example, some areas of sagebrush steppe were converted to grain fields and then progressed into a monoculture of smooth brome. In addition to these homesteading activities, past Service and Natural Resources Conservation Service (NRCS) efforts promoted the seeding of non-native grasses such as smooth brome, meadow foxtail, and Kentucky bluegrass. Similarly, the hydrologic regime has been altered by the creation of Clark's Cut in the early 1900s, and diversion of water from the Grays Lake outlet to the Blackfoot Reservoir in the 1920s, which initiated a major shift in the composition of aquic-xeric transitional plant communities. A 1964 MOU between the refuge and the BIA defines an annual lake level drawdown schedule which rapidly removes water from above 6,387.4 feet before May 10th to 6,386.0 by June 24th. This agreement results in the draining of all but 0.5 feet of water from the Grays Lake wetland each spring (BIA 1964, FWS 2012). The loss of seasonal and annual stochasticity that resulted from this agreement has greatly affected plant communities across all habitat types at Grays Lake NWR, and greatly reduces management options for manipulating marsh and other habitats.

2.3 Biological Integrity, Diversity, and Environmental Health

The FWS Policy on Biological Integrity, Diversity, and Environmental Health (601 FW 3) specifies the rationale and thought process to be used for managing National Wildlife Refuges. Management must be directed first at specified refuge purposes, secondly at the species and habitats meeting the National Wildlife Refuge System (NWRS) goals and thirdly at species and habitats meeting other management goals. This is a hierarchical order of priority: refuge purposes must come first, and so forth. Where management practices among groups of species or habitats might conflict, those specified in higher purposes take precedence. Management for refuge purposes is meant to impact habitats and species primarily at the local scale, on the refuge. Management for NWRS or other ecological purposes implies that management actions are designed to benefit species and habitats at a larger scale, such as range-wide, regional, national or continental scales. It implies integration with, or at least consideration of, what is happening beyond the refuge boundaries.

Grays Lake NWR purposes (see discussion in Section 1.2) are rather broad, allowing management to focus on NWRS and other ecosystem purposes and therefore to manage with broader landscape scales in mind. The selection of species and habitats is based on purposes of the NWRS and other plans' purposes (see Sect. 1.3 for a short review of these plans and Sect. 3 for a discussion of the focal species selection process).

The Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3) specifies that refuges maintain and, where possible, restore natural historic conditions and processes (e.g., hydrology). The maintenance of biological integrity, diversity, and environmental health pertains to the protection of habitat composition and structure, as well as functional natural ecosystem processes that shaped and maintained the historic landscape for native fish, wildlife, plants, and their habitats. Generally, historic conditions refer to pre-European settlement conditions and can sometimes be reconstructed from old records where they can be found. The policy allows for "sound professional judgment" in determining historic conditions if old records are lacking, or in determining management objectives other than historical conditions. These could occur when refuge specific purposes require habitats that are different from historical conditions or where historical conditions are no longer possible to attain due to extreme degradation, where some of the habitats were created more recently, or where broader scale purposes require habitats that are different from historical conditions.

At Grays Lake NWR these concepts translate into localized management, but with the larger scale in mind: the 'act locally, think globally' concept. Management practices will for the most part benefit species that have life cycles that are not confined to the refuge. For example, the refuge will act as a travel corridor to some species, a nest site for some, and a migration stop for others. Management actions will range from maintaining current habitat conditions all the way to complete restoration if possible, depending on refuge resources, management techniques available, and objectives.

2.4 Grays Lake NWR -- HMP Unit Descriptions

Table 2.4.1. Descriptions and acreages of management units at Grays Lake NWR.

Unit Name	Acres	Description
Ayers	560	Dominated by smooth brome, potential for riparian restoration
Collins	163	Mixed grassland and sagebrush, with some small semi-permanent wetlands on the south side
Big Corral	165	Mixed native grassland
Big Bend	166	Mixed native grassland
Rich Riley	160	A mix of mesic grassland and sagebrush
Cinder Knoll	320	A mixture of wetlands, sagebrush grassland, and bluegrass meadows.
South Pasture	350	Relatively short, sparse grasses, interspersed with some temporary, seasonal and semi-permanent wetlands. This unit is most representative of reference habitat type.
Willow Creek	83	Mixture of diverse grasses, including significant portions of bentgrass (*Agrostis* spp.) (an unpalatable grass except early in the season).
Hawkins Creek	201	Fairly mesic grassland, about equally divided between tame and native grasses.
Sibbett Hill	122	A mix of mountain brush and aspen-conifer cover.
Sibbett North	103	A mix of wet and dry meadow with some willow habitat.
Sibbett South	104	Predominantly meadow foxtail; potential for riparian restoration
Ewart	118	Strong moisture gradient running from drier grasslands on the eastern side to more mesic sites still dominated by graminoids on the west. It had been very heavily grazed every year for many years prior to acquisition.
Boathouse	42	Primarily wet meadow; it was grazed in conjunction with the Ewart unit.
The 40's	120	Composed of approximately equal parts of tame grasses and rushes (*Juncus* spp.), with a moisture gradient running from wetter on the north to drier on the south end.
Cecil Sibbett	199	High percentage of smooth brome
HQ	81.5	Dry grasslands
Peterson	80.5	Dry grasslands
John Muir	289	Predominantly wet meadow.
Lake Front	296	Very diverse grassland habitats with areas of naturally short native bunchgrass, as well as tall, dense brome and timothy.

Kackley	153	Well-watered with numerous small wetlands, and has a very diverse vegetation community
Beavertail Pond	12.5	Meadow rimmed by tall emergents. It is heavily used for foraging by Canada geese and their broods. This unit is long and narrow and has considerable amount of coarse and unpalatable grasses that make it difficult to treat evenly.
Turner	75	Predominantly meadow foxtail; comprised of approximately equal portions of dry upland and wetlands. Because it is a fairly wet unit it generally sustains good grass growth and provides taller grasses for cover dependent wildlife. Higher elevation sites are used extensively by foraging Canada geese and sandhill cranes, and their broods.
County Line	40	Dry grasslands

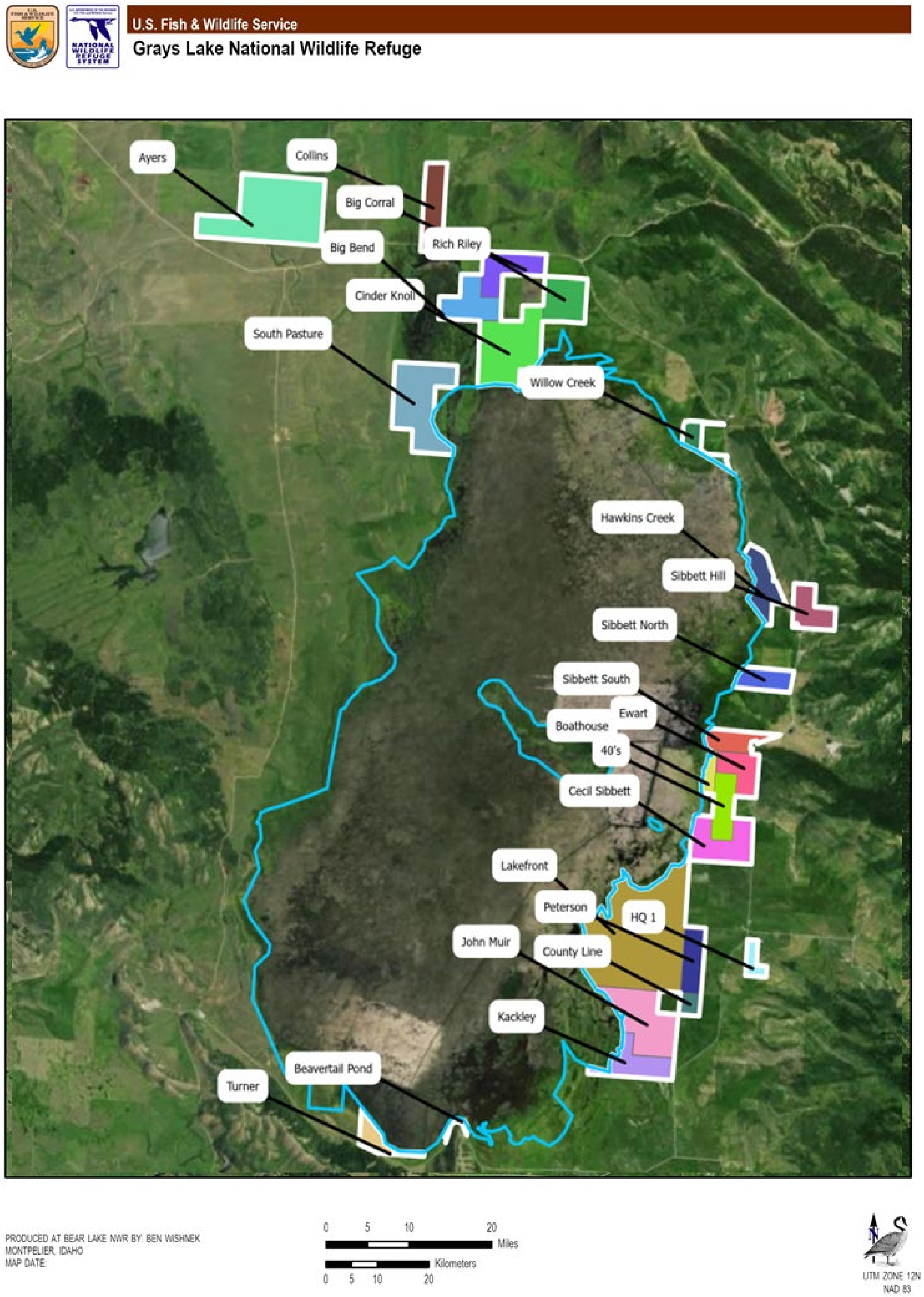

Figure 2.4.2. Grays Lake upland and meadow management units. The meander line is depicted in blue.

3.0 Resources of Concern

As stated in the Biological Integrity, Diversity, and Environmental Health policy (601 FW 3), the goal of habitat management on units of the NWRS is to ensure the long-term maintenance and, where possible, restoration of healthy populations of native fish, wildlife, plants, and their habitats. To accomplish this goal, **resources of concern**, also known as **focal species**, are selected for each refuge as a way of identifying which habitats should be managed and how. It is difficult to manage these species directly, because many things (such as weather, conditions on the breeding or wintering grounds, etc.) are beyond refuge control. The best way to benefit these species is by managing to meet their habitat needs while they use the refuge, be it yearlong, or only briefly during migration. The habitat management strategies in this HMP are derived from the local habitat needs of the Refuge's focal species.

The rationale for using the focal species approach is to emphasize habitat attributes most in need of conservation or most essential for functional ecosystems. By restoring ecological processes such as grazing, fire, flooding and drought, and utilizing these natural disturbances to manage habitat for focal species will improve biological integrity, diversity, and environmental health. This is true not just on the refuge, but on a larger scale. Because the purposes of the plans discussed in Section 1.3, biological integrity, diversity, and environmental health will be improved on a regional, national and continental scales. Because there is a wide diversity of species and habitats within this area, the approach to habitat management articulated in this HMP considers the historic, current, and the potential complex array of conditions and constraints associated with Grays Lake NWR and surrounding area.

3.1 Identification of Refuge Resources of Concern

Priorities associated with wildlife and habitat management for the Grays Lake NWR and the NWRS are determined through directives, policies, and legal mandates. Resources of concern include species, species groups, and/or communities that first, support refuge purposes, second, FWS trust resource responsibilities (including threatened and endangered species and migratory birds), and third, species listed in other plans and covered by the Biological Integrity, Diversity, and Environmental Health policy (601 FW 3). Resources of concern include native species and natural, functional communities such as those found under historic conditions that are to be maintained and, where appropriate, restored on a refuge (601 FW 3.10B[1]). These resources of concern were selected from the three hierarchical purposes listed in Section 2.3 above. Species groups included in purposes of the NWRS System are called the "trust species." They are threatened and endangered species, migratory birds, inter-jurisdictional fish and marine mammals. Of these, the only trust species found at Grays Lake NWR are migratory birds. Other potential resources of concern were identified using the numerous plans listed in Section 1.3 above.

Species selected as resources of concern (Table 3.2.1) were species that occur or might occur in appreciable numbers on the refuge or there is suitable or potentially suitable habitat on the refuge. Species where little is known about their distribution and abundance were not selected as focal species. If they are found to occur on the refuge at some later date, this HMP can be modified to incorporate their needs. Basically, the focal species function as umbrella species: if their needs are met, the needs of many other species will also be met. Table 3.2.1 lists the focal species and the other species that will also benefit if life-history needs of focal species are met. By managing ecological process we can meet their needs, and the goal of maintaining biological integrity, biodiversity and environmental health will also be met. This list of species will change as new information is added and updated plans are released. Some groups, such as invertebrates and bats, have been inadequately sampled on the refuge. As species lists grow through more sampling, more species can be added to this HMP. Most of these focal species are not rare, but they serve as a good measure of environmental health. The goal of many regional and state plans is to "keep common species common." It is much easier to keep species from becoming rare than to try to recover them from low population levels.

3.2 Identification of Habitat Requirements

Habitat requirements that are necessary to support resources of concern for Grays Lake NWR are listed in Table 3.2.1. These habitat requirements were derived from published, scientific literature including Partners in Flight Bird Conservation Plans, IDFG priority species, and USFS general technical reports; Grays Lake NWR reports and data from inventory and monitoring activities; and local area, species, or plant community experts. The specific types of information representing habitat requirements for Grays Lake NWR focal species included the following:

- Size, configuration, and juxtaposition of different habitats or seral stages;
- Presence or absence of edge habitats;
- Temporal distribution of required habitat elements or conditions based on cyclic life history needs of a species;
- Necessity for connectivity to other habitats in the landscape for dispersal of young, seasonal migration, and genetic flow;
- Need for buffers from adjacent land uses or land cover negatively impacting refuge habitat;
- Existence of appropriate hydrologic, climatic, and topographic conditions to support the resources of concern; and
- Conservation, and where appropriate, restoration of the remnant habitats (e.g. alluvial riparian and landscape connectivity) that are or potentially support the potential native biological communities or processes.

Table 3.2.1. Habitat requirements for priority Resources of Concern at Grays Lake NWR.

Focal Species	Habitat Requirements	Life History Requirements	Other benefitting Species
Meadow Complex			
American Avocet	Sparsely vegetated salt flats or mudflats adjacent (<0.2 mi) to shallow (<3 feet deep); Short, sparse vegetation (<24 in) (Dechant et al. 2002).	Foraging/ Migration/ Nesting	Wilson's phalarope, black-necked stilt, willet
Cinnamon Teal	Dense emergent cover of graminoids, *Eleocharis* or *Carex* < 1m tall, usually within 50m open water (Bellrose 1976, Palmer 1976).	Breeding/ Foraging	American widgeon, cinnamon teal, gadwall, mallard, northern shoveler, meadow vole, montane vole
Greater Sandhill Crane	Tall to short emergent graminoids, *Carex*, *Juncus* usually surrounded by shallow (0.25m) to deep (0.65m) open water (Austen et al. 2007)	Breeding	Canada goose, long-billed curlew (Foraging)
White-faced Ibis	Shallow open water (<12 cm) to scattered emergent *Carex, Juncus* stands with variable hydroperiod and abundant macroinvertebrates through late August (Perkins 2003)	Foraging	Snowy egret, Franklin's gull, Virginia rail, Greater yellow-legs (migration)
Long-billed Curlew	Open short-grass or mixed grass-forb habitat with level to slightly rolling topography (Dugger and Dugger 2002) with intermittent patchy vegetation (<2.5 acres, <5% of total area) of tall, dense foliage (>7 inches high) (Pampush and Anthony1993, Neel 1999), void of trees, high-density shrubs, and tall, dense grasses (Pampush and Anthony 1993). Contiguous suitable habitat >100 acres (capable of supporting at least 1 breeding pair) protected from detrimental human disturbance (Redmond et al. 1981 and Dechant et al. 2003)	Breeding/Foraging	Greater sandhill crane, vesper sparrow, killdeer
Canada Goose	Lightly grazed areas with taller (>0.3m) graminoids, *Carex, Juncus*, etc. near water. (Austin and Pyle 2004, Austin 2002)	Nesting	Horned lark, bobolink
Grasshopper Sparrow	Low grass or forbs, with taller stems or shrubs for display and singing, with abundant seeds, insects, especially grasshoppers and beetles (Byers et al. 1997).	Nesting/Foraging	Lesser scaup (nesting), short eared owl (nesting)

Focal Species	Habitat Requirements	Life History Requirements	Other benefitting Species
Riparian			
Lazuli Bunting	Scattered shrubs and low trees. Interspersion of shrub patches and herbaceous openings where neither is <25% or >70% of the cover of the area (Altman and Holmes 2000).	Breeding/Migration	
Yellow-breasted Chat	Willow and/or alder in a patchy shrub layer of dense, mature woody vegetation (3-12 feet tall, 30-80% cover; tree cover <20%) interspersed with several scattered herbaceous openings (Altman and Holmes 2000).	Breeding/Foraging	
Song sparrow	Shrubs on moist ground along streams, rarely wanders more than 20 meters from this habitat type, absent from grazed areas (Arcese et al. 2020)	Breeding	Wilson's Snipe, Black-necked stilt
Willow Flycatcher	Willow stands, riparian shrubs and open woodlands with trees 1-8 m tall, with edges of open understory (DeGraaf et al. 1991)	Breeding/Foraging	Other *Empidonax* flycatchers, yellow warbler
Northern Leopard Frog	Use wide variety of wetland sizes, especially <4 ha, and types with variable hydroperiods (>30 days and < 365 days), in complexes <300 m apart with good water quality (no pollutants), moderate emergent vegetation cover, with high invertebrate densities, and substrates suitable for burrowing (hibernation), without predatory fish, and associated wet meadows (Black 1970, Nussbaum et al. 1983, Semlitsch 2000, Burton 2007).	Breeding/Foraging	Red-winged blackbird
Sagebrush Steppe			
Greater Sage-Grouse	Habitats dominated by low sagebrush (<15 inches high; 10-25% cover) with native forbs (10-20% cover), native perennial grasses (10-15% cover) (Connelly et al. 2000). Late-seral sagebrush 10-14 inches tall and 10-20% canopy cover above snow during winter (Connelly et al. 2000). Mid-seral sagebrush 12-31 inches tall and 15-20% canopy cover. Native bunchgrasses and forbs >7 inches tall and >15% cover (Connelley et al. 2000).	Pre-nesting/Brood-rearing	Sharp-tailed grouse, sagebrush sparrow, ferruginous hawk, merlin, Swainson's hawk, golden eagle, prairie falcon, Brewer's sparrow. Merriam's shrew, Idaho pocket gopher, Wyoming ground squirrel, burrowing owl

Focal Species	Habitat Requirements	Life History Requirements	Other benefitting Species
Sage Thrasher	Habitats dominated by basin big sagebrush. Clumped sagebrush (5-20% cover, 11-24 inches tall) with patches of taller shrubs (>31 inches tall) and native herbaceous species (5-20% cover) (Altman and Holmes 2000). Western juniper density <4 trees/acre and <6% tree cover (OSU 2005). Patches >40 acres (Altman and Holmes 2000).	Nesting/Foraging	Loggerhead shrike, Brewer's sparrow, burrowing owl
Northern Pintail	Brush and shrubs provide attractive nesting habitat. An early nester, pintails rely on residual cover for nest concealment and are more likely to be negatively affected by grazing or other management techniques that reduce residual cover than are later-nesting species. (Kruse and Bowen 1996, Austin and Pyle 2004).	Nesting	White-crowned sparrow, Lazuli bunting

4.0 Grays Lake NWR Habitat Objectives and Strategies

A CCP has not been completed for Grays Lake NWR to date. Management direction for the Refuge's wildlife and habitats is found in the Grays Lake NWR Master Plan (USFWS 1982). Over the years there have been several efforts to update habitat management strategies in the Master Plan. A Strategy for Management of Grasslands of Grays Lake National Wildlife Refuge (USFWS 1996) was developed to gather data for the planned preparation of a Grassland Management Plan in 2000; however, this plan was not completed. A 2007 internal draft Habitat Management Plan was prepared, but not finalized.

This HMP has been prepared to meet the need for updated strategies to manage upland habitats and comply with the Service's Cooperative Agriculture policy. To identify management issues and recommendations, a Meadow and Upland Habitat Management Review was conducted by USFWS regional and refuge staff with participation from Idaho Department of Fish and Game (IDFG) and NRCS staff in August 2021 (USFWS 2021). In addition, a Weed Prioritization Workshop was held in 2021 to compile all existing weed data and collaboratively identify nearby threats to strategically prioritize limited management resources for invasive weed prevention and control. This HMP utilizes information and recommendations from the Meadow and Upland Habitat Management Review in combination with information compiled for the internal draft Grays Lake NWR CCP, the 2007 internal draft Grays Lake Habitat Management Plan, the Weed Prioritization Workshop Report (Wenick 2021), and expert opinions from William Smith (former Grays Lake NWR Refuge Manager/Biologist) and Adonia Henry (Zone Biologist, SE Idaho NWRC).

We identified three principles for Grays Lake NWR habitat management based upon applicable legal mandates, refuge purpose, and the above-mentioned state, regional, and federal plans for priority wildlife and habitat resources. These goals are:

1. Where practical, maintain and/or restore native plant communities within all meadow and upland habitats and limit invasive weeds.

2. Support diverse, abundant, and productive populations of native resident and migratory birds to the extent that populations can be influenced on Refuge lands.

3. Promote the conservation and recovery of federal and state species of concern.

To achieve each of these principles, we have developed management objectives for meadows, riparian habitats, and croplands at Grays Lake NWR. These objectives were obtained from the habitat needs of the resources of concern that were selected from Service legislative mandates (refuge purpose; trust resources; and biological integrity, diversity, and environmental health) and from other conservation needs as stated in other plans. The habitat needs of the resources of concern were used to describe desired (hereafter reference) habitat conditions which we quantitatively described as habitat objectives. Following the objective statement, we discuss why that objective was selected and trade-offs among focal species. Finally, we list habitat management strategies and tasks needed to implement each strategy.

4.1 Meadow Complex

Objective 4.1.1: Protect, maintain, and enhance 1,912 acres of managed short-grass meadow habitat to provide nesting, feeding, and stopover habitat for short grass resources of concern, including greater sandhill cranes, American avocet, long-billed curlew, and Canada goose.
Managed short-grass meadows have the following attributes:

- 50% to 80% of the Refuge eastside meadows in short (4-6 inches stubble height) cover at the end of growing season
- 20% to 50% of xeric and mesic meadows comprised predominately of grasses, rushes, and sedges at a height ≥ 8” from April-September
- >70% native vegetation cover in managed meadows (e.g., Idaho fescue, Basin wildrye, sedges, Sandberg’s bluegrass, bluebunch wheatgrass)
- <20% invasive plant species cover in managed meadows (e.g., smooth brome, timothy, Kentucky bluegrass)

Rationale:

Meadows managed for short grass habitat benefit nesting and foraging waterbirds, waterfowl, and shorebirds. Desired short cover vegetation communities are structurally characterized by increased site vigor and reduced thatch which provides higher quality foraging habitat for many of the focal species (USFWS 2021). Wildlife species like sandhill cranes and white-faced ibis require short-cover wet meadow habitat interspersed with shallow and emergent marsh habitats. Sandhill cranes show a preference toward areas with shallow marsh adjacent to flat, short-cover habitat, for roosting and foraging respectively. For nesting, they seek islands of dense vegetation isolated from predation by shallow water (Austin et al. 2007). Long-billed curlews require relatively large tracts of contiguous open short cover habitat with intermittently patchy vegetation (> 100 acres) free of detrimental human disturbance for breeding and foraging (Dugger and Dugger 2002, Pampush and Anthony 1993, Redmond et al. 1981, Dechant et al. 2002). White-faced ibis forage in a range of conditions from shallow open water to grazed grasses with a variable hydroperiod and abundant macroinvertebrates through late August (Perkins 2003). Light, managed livestock grazing has also been shown to increase plant diversity (Hayes and Holl 2003).

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Strategies and Prescriptions:

- By the 2023 grazing season, convert current livestock grazing regimes from current (mix of season-long perennially grazed and 3-year rest/rotation) to a 3-year rest/rotation grazing regime (Year 1: Graze June 10 to July 31; Year 2: Graze August 1 to Sept 30; Year 3: Rest). Grazing would be conducted under Cooperative Agriculture Agreements (CAAs), except for the Sibbett and Boathouse, Ewart, and North 40 pastures. The grazer on the Sibbett Hill, Sibbett North, and Sibbett South pastures (collectively, "Sibbett pastures") has a warranty deed that reserves the right to graze these pastures every year until the year 2030, unless alternate pastures are agreed upon. A 2019 Memorandum of Agreement allows this grazer to graze on the Boathouse, the portion of Ewart west of Grays Lake road, and North 40 pastures (approximately 144 acres total) until 2030 in exchange for keeping the southern portion of Sibbett South along Eagle Creek free of grazing to allow for riparian restoration work (see Objective 4.3.1). Annually grazed meadows (those not in the 2 or 3 season rotation or grazed under warranty deed) will be grazed in either early summer or late summer. When the warranty deed expires in 2030, the Sibbett North, Sibbett South, Boathouse, west portion of Ewart, and North 40 pastures will be managed under CAAs, using the same three-year rest/rotation grazing regime described above. Sibbett Hill would be retired from grazing (see below).
- Grazing intensity (Animal Use Months; AUMs) will fall within the Range of Recommended AUMs found in Table 4.1.1. AUMs will be adjusted to match habitat objectives.
- Place salt blocks in smooth brome monoculture to better distribute cows away from wetlands and concentrate grazing on non-native grasses.
- Use a mixture of yearlings and cow/calf pairs to achieve habitat objectives when available.
- Work with permittees to install and maintain fences to hold cattle in designated pastures. Grazing permittees will provide, install and remove temporary fencing around or within assigned grazing unit(s). The Service will install and maintain permanent fencing; however, permittees will check and repair permanent fencing adjacent to or within their permit areas when necessary.
- The Service will control or eradicate invasive/undesirable plant species using Integrated Pest Management (IPM) techniques including mechanical (cutting, mowing and, disking treatments), biological, and chemical (herbicide treatment) means (see Appendix C).

The management units subject to objective 4.1.1 are located on the east side and southern end of Grays Lake, those being the Willow Creek, Hawkins Creek, Sibbett North, Sibbett South, Ewart, Boathouse, The 40s (North 40, Center 40, and South 40), Cecil Sibbett, Lakefront, Peterson, County Line, John Muir, Kackley, Beavertail Pond, and Turner management units. Yearlings are preferred for targeted invasive perennial grass removal, while cow/calf pairs are preferred for removing excess biomass from native sedge/rush (meadow) habitats. As noted above, Sibbett Hill may be grazed under warranty deed until 2030, but is not currently grazed. After 2030, this unit would remain ungrazed. The portion of Ewart east of Grays Lake Road ("Hillside") has been retired from grazing and would remain ungrazed. HQ is currently not grazed and once the croplands on that unit are restored, the entire unit will not be grazed.

Table 4.1.1. Habitat units at Grays Lake NWR, proposed management, and recommended range of Animal Use Months (AUM) under the HMP.

Unit Name	Acres	Low AUM	Medium AUM	High AUM	Proposed Management
Ayers	560	-	-	-	Not grazed or farmed
Collins	163	-	-	-	Not grazed or farmed
Big Corral	165	-	-	-	Not grazed or farmed
Big Bend	166	-	-	-	Not grazed or farmed
Rich Riley	160	-	-	-	Not grazed or farmed
Cinder Knoll	320	-	-	-	Not grazed or farmed
South Pasture	350	-	-	-	Not grazed or farmed
Willow Creek	83	126	158	192	Grazed 2 of 3 seasons
Hawkins Creek	201	197	247	296	Grazed 2 of 3 seasons
Sibbett Hill	122	NA	NA	NA	Warranty deed holder reserves right to graze annually until 2030, but currently ungrazed. Not grazed or farmed after 2030.
Sibbett North	103	149	188	227	Grazed every year until 2030; Grazed 2 of 3 seasons thereafter
Sibbett South	104	109	137	164	78 ac grazed every year until 2030, 2 of 3 seasons thereafter. Fence off Eagle Creek riparian (26 acres)
Ewart (Ewart Muir, Hillside)	118	76	93	110	62 ac west of Grays Lake Road grazed every year until 2030; Grazed 2 of 3 seasons thereafter.

					56 ac portion east of Grays Lake Road ("Hillside") not grazed.
Boathouse	42	65	78	92	Grazed every year until 2030; 2 of 3 seasons thereafter
The 40s (N, Center, S)	120	183	227	271	North 40 grazed every year until 2030; Grazed 2 of 3 seasons thereafter. Center 40 and South 40 grazed 2 of 3 seasons.
Cecil Sibbett	199	303	377	452	Grazed 2 of 3 seasons
HQ	81.5	-	-	-	Not grazed or farmed
Peterson	80.5	172	225	279	Grazed 2 of 3 seasons
John Muir	289	423	541	660	Grazed 2 of 3 seasons
Lake Front	296	455	560	660	Grazed 2 of 3 seasons
Kackley	153	224	286	348	Grazed 2 of 3 seasons
Beavertail Pond	12.5	18	22	26	Grazed 2 of 3 seasons
Turner	75	102	132	163	Grazed 2 of 3 seasons
County Line	40	56	73	91	Grazed 2 of 3 seasons

Objective 4.1.2: Protect, maintain, and enhance 1,884 acres of xeric and mesic meadow habitat near areas where open water persists throughout the season to provide nesting and brood-rearing habitat for waterfowl. These habitats have the following attributes:

- All xeric and mesic meadows comprised predominately of grasses, rushes, and sedges at a height ≥ 8" from April-September
- >70% native vegetation cover in managed meadows (e.g., Idaho fescue, Basin wildrye, sedges, Sandberg's bluegrass, bluebunch wheatgrass)
- <20% invasive weed/non native pasture grass cover in managed meadows (e.g., smooth brome, timothy, Kentucky bluegrass)
- >35% live vegetative biomass
- No livestock grazing.

Rationale:
Meadows managed for dense cover provide low disturbance habitat for species including ducks, geese, passerines, and other wildlife (Holchek et al. 1982). Dense nesting cover is preferred nesting habitat for many waterfowl and passerine birds. These habitats are especially important when adjacent to yearlong open water, as found in the northern areas of the Refuge. These dense, ungrazed habitats are even more valuable due to their scarcity, since the vast majority of meadow and upland habitats in the Grays Lake basin are either hayed or grazed every year. However, if

left unmanaged, these montane meadows lose habitat quality as dead standing biomass increases (Ganskopp et al. 1992). Haying and burning after the bird nesting season (August 30) will remove the dead biomass, stimulate growth, and increase biodiversity, while not impacting nesting birds.

Strategies and Prescriptions:

- Continue to exclude grazing on the Ayers, Cinder Knoll, and South Pasture management units, and the portion of Ewart east of Grays Lake Road.
- Discontinue grazing on the Big Bend, Big Corral, Collins, and Rich Riley management units by 2023 grazing season. Discontinue grazing on Sibbett Hill after the 2030 grazing season.
- Ensure these units are protected by fencing in good condition.
- Use either haying or prescribed fire to reduce decadent vegetation (<35% live biomass) outside of the nesting waterfowl season (after August 30).
- Restore areas dominated by invasive perennial grasses by deep-tilling, planting cover crops (i.e., grain, legumes, tubers) followed by restoration planting of grass and sedge species used by waterfowl for nesting habitat (See Objective 4.2.1).
- Control or eradicate invasive/undesirable plant species using IPM techniques including mechanical (cutting, mowing and, disking treatments), biological, and chemical (herbicide treatment) means (see Appendix C).

4.2 Croplands

<u>Objective 4.2.1: Restore 89 acres of cropland to native grass, forb, and sedge communities through sequential retirement of existing crop fields by 2040.</u>

There are currently approximately 89 acres of farm fields across four units. These croplands will be sequentially retired and restored. Restoration efforts will begin immediately after removal of crops to provide resilient, native-dominated meadow. Restored croplands are characterized by the following attributes:

- >70% native vegetation cover (e.g., Idaho fescue, Basin wildrye, sedges, Sandberg's bluegrass, bluebunch wheatgrass)
- <20% invasive weed/non native pasture grass cover (e.g., smooth brome, timothy, Kentucky bluegrass)
- Natural topography (stream channels that overflow onto floodplains during high water); no artificial mounds and berms
- Hydric soil types

Until croplands are retired and restored, croplands will continue to be annually planted primarily with barley to function as lure crops for sandhill cranes. Cropland plantings may also include legumes and tubers to provide supplemental food for wildlife such as sandhill cranes, Canada geese, and mallards during fall migration.

Rationale:
At the request of Idaho Department of Fish and Game, the Refuge began farming between 40 and 100 acres annually in the late 1990s to lure cranes onto the Refuge lands and reduce crop damage on private lands. These fields have drawn between 3 and 1,943 sandhill cranes in the fall providing much needed calories to support migration (Phil Thorpe, USFWS, personal communication). Prior to 2018, fields rotated between barley and fallow. Methods focused on repeated tilling for weed control and seed bed preparation. In the early 2010s, management experimented with reducing farmed acres, and planted as few as 42 acres in a year (William Smith, USFWS, personal communication). In 2018, farming objectives and strategies changed again. Farmed acreage has tended toward the upper limit, shifted from barley to a more complex seed mix with additional objectives (passerines, pollinators, ungulates, soil health), and relied on chemical control of weeds (USFWS 2021; Cameron Williams, NRCS, personal communication).

The croplands at Grays Lake are a time and resource intensive project that began with a singular objective, have experienced different management iterations over time, and have yielded limited significant results. It is unclear what criteria were used to determine the location of farm fields, but sandhill crane ecology does not appear to have been a driving factor. Sandhill crane depredation of grain crops is highly correlated to a field's proximity to suitable roosting locations (Donnelley et al. 2021). Anteau et al. (2011) found that most crane crop depredation occurred within 4.8 km of wet meadow habitat. Additionally, all roosting habitat is not created equal. Cranes display a preference toward flat topography and low vegetation for roost habitat, possibly for predator detection and evasion (Pearse et al. 2017; Krapu et al. 1984). Without these considerations in mind, it is perhaps unsurprising that only 28 of the farmed acres at Grays Lake NWR are consistently utilized by cranes (William Smith, USFWS, personal communication).

The most recent iteration of cropland management at Grays Lake has restructured the program around a more diverse cohort of focal species and placed an emphasis on soil health. However, restored native meadows should provide a more resilient long-term resource for these non-crane focal species. Furthermore, it is possible that some of the non-grain components may make the cropland less desirable to migrating cranes, thereby compromising the main goal of the project. Thus, the Refuge proposes to continue to annually plant croplands primarily to barley until they are retired and restored to native grassland conditions.

This plan recommends sequentially retiring and restoring all farm fields as time and resources to facilitate their restoration to a native dominated vegetation community become available. Retirement and restoration will be conducted one field at a time. No more than one field will be undergoing active restoration at a time. Farming should continue until restoration objectives have been met. Priority for retirement and restoration is outlined in table 4.2.1 and will begin with the Rich Riley fields. Lakefront and HQ are utilized more by cranes than Rich Riley and Ayers. As such, they will fall last in line to be retired as to provide the most benefit to sandhill cranes.

Cropland Planting Strategies and Prescriptions:

- Plant wildlife-friendly crop mixes, e.g., grain, legumes, tubers, in fields awaiting restoration to provide lure crops for sandhill cranes and supplemental food for wildlife, including sandhill cranes, Canada geese, and mallards, during fall migration, while preventing establishment of invasive plant species.
- Farming will be conducted by Refuge staff.

Cropland Retirement and Restoration Strategies and Prescriptions:

- Remove all artificial mounds and berms that were constructed to improve crop yield of farmed units.
- Recontour stream channel and floodplain to mimic natural conditions.
- Conduct soil remediation to support native vegetation.
- Control or eradicate invasive/undesirable plant species using IPM techniques including mechanical (cutting, mowing and, disking treatments), biological, and chemical (herbicide treatment) means (see Appendix C)

Table 4.2.1 Overview of management plan for existing croplands.

Field	Acres farmed	Current	Management Action	Restoration Priority
Ayers	32.91	Farmed annually	Retire	2
Rich Riley	29.57	Farmed annually	Retire	1
Lakefront	16.37	Farmed annually	Retire	3
HQ	9.88	Farmed annually	Retire	4

4.3 Eagle Creek Restoration

<u>Objective 4.3.1: Protect and by 2040, restore 26 acres of early to mid-successional riparian habitat along 0.3-1 miles of Eagle Creek.</u>

Protected and restored areas of Eagle Creek have the following attributes:

- Community and structural composition: <20% canopy native trees >12 feet tall, 30-70% cover of 3-12 feet tall of native shrubs, with scattered openings containing 30-70% native herbaceous species (i.e., sedge, rushes, grasses, nettles, forbs),
- Tree and shrub species include willow (Salix spp), twinberry honeysuckle, Utah honeysuckle, black hawthorn, redosier dogwood, Sitka alder, Wood's rose, golden currant, thimbleberry, silver buffaloberry, Rocky Mountain maple, chokecherry
- Recruitment: both mature and seedling plants are present for each shrub/tree species
- <15% invasive plants (e.g., reed canarygrass, Canada thistle) within the understory.

- Maintain topography and meandering path of natural stream channel, and its connection to adjacent floodplains.

Rationale:
Eagle Creek enters the east side of the marsh just north of the Bear Island right-of-way. In 2018, the Refuge acquired the Sibbett South tract, through which Eagle Creek winds for about 1.1 mile before entering the marsh. Riparian areas such as Eagle Creek are ecologically important, rare, and highly impaired within the Grays Lake basin. Furthermore, Eagle Creek is one of the larger tributaries that flows into the Grays Lake marsh and has some of the best potential to provide riparian habitat that would support native trout, breeding neotropical birds as well as other species.

The refuge received Eagle Creek in a modified state. A straight deep channel had been excavated along the Bear Lake right-of-way and Eagle Creek flows were diverted away from the historic channel near Grays Lake Road and into this canal. The remnant willow-dominated riparian habitat bore the signs of intense grazing. The large willows that could exist with grazing pressure formed thick, structurally monotypic stands while the understory was cropped to within a few inches of the ground. Continued grazing along Eagle Creek can have negative impacts to the stream channels as well as to the plant and animal communities that could make use of this riparian habitat if properly restored.

In 2021, refuge staff deposited fill on the canal side of the junction between the artificial ditch and the historic channel, thereby forcing water back into the historic channel. Beaver dam analogs (BDAs) were installed at three locations along the historic channel to mimic natural flooding. The Eagle Creek restoration is at a critical juncture in its progress. Recovery of the vegetation community will require rest from spring and summer grazing. Although the refuge now owns Sibbett South, the former landowner retains a warranty deed to graze this unit annually until 2030. To advance these riparian restoration efforts, a 2019 Memorandum of Agreement (MOA) allows this grazer to graze livestock on the Boathouse, Ewart (west of Grays Lake Road), and North 40 units (approximately 144 acres total) until 2030, in exchange for keeping the southern portion of the Sibbett South unit (approximately 26 acres) free of grazing.

Strategies and Prescriptions:

- Exclude grazing from the southern portion of the Sibbett South unit (26 acres) once the warranty deed expires (December 31, 2030).
- Maintain existing and, where necessary, install new fencing to exclude cattle grazing on approximately 26 acres along Eagle Creek.
- Allow fall haying and/or prescriptive burning when residual biomass exceeds 35% in adjacent meadows to meet management objectives in lieu of grazing.

5.0 Constraints

There are two primary constraints that will cross the habitat types discussed in this HMP and are unlikely to be able to be modified easily. The proposed projects and recommendations in this plan are likely to be affected by one or both of the following.

- Refuge staff has little to no control of the hydrological regime. The 1964 MOU between the USFWS and BIA results in the draining of all but 0.5 feet of water from the Grays Lake wetland each spring and requires this reduced water level to be maintained for the rest of the growing season (BIA 1964, FWS 2012). The inability to control water can affect plant species composition in the submergent beds. The drawdown favors emergent species like hardstem bulrush and cattail and over the years, has led to the loss of open water areas (USFWS 2021). In addition to altering the distribution and composition of the native vegetation community, this MOU removes a key management tool. Refuge staff do not have the ability to use water level manipulation to control invasive plants or affect seral stages of the wetland and hydrologically connected habitats. Moreover, the rapid rate of water level decrease limits that amount of usable habitat for nesting birds. This MOU, as currently implemented, limits the ability of the Service to manage Grays Lake NWR to meet its purposes (migratory birds) and the ability of refuge staff to effectively manage for desirable habitat outcomes.

- Limited available funding/Staffing. Funding is the most widespread constraint among the proposed projects. Funding includes, but is not limited to, hiring seasonal technicians to complete inventorying and monitoring tasks; funds to purchase seeding mixes for restoration, herbicide, and land acquisition; and time investment from permanent staff. Grays Lake NWR does not currently have a Refuge Manager or Biologist and must rely on support from other personnel in the Southeast Idaho NWR Complex.

Additional constraints:
In addition to the primary constraints above, there are secondary constraints as well. Many of the management units have been compromised by invasive, non-native plant species such as smooth brome and leafy spurge. These introduced exotic species are highly competitive once established and easily invade after disturbance. While refuge staff will make efforts to control these invasives, careful monitoring will be required to ensure that management and restoration activities do not create conditions that invasives can exploit. Another potential constraint is that the riparian zone is quite narrow in most places, possibly limiting the type of habitat that can be achieved. It is unlikely that the refuge will be able to produce large blocks of mixed riparian vegetation without the cooperation of neighboring landowners. The refuge will only be able to serve as nesting habitat for those species that use smaller patches. For species that prefer large patches, the refuge may serve only as a migration corridor.

Given the Service's limited resources, working with partners will be essential to achieve Refuge purposes. Given the impact of the 1964 MOU on Refuge wildlife and habitat, the Service should work with the BIA and Shoshone-Bannock Tribes to explore ways to lessen or mitigate for the detrimental effects of rapid water draw down on marsh-dependent species. Similarly, refuge staff will need to work with local landowners to achieve stream restoration goals, since many of the streams that feed into Grays Lake flow through private property before entering the refuge. Partnering with local landowners could lead to a greater amount of riparian habitat being restored and protected. The Refuge will seek to build relationships with other stakeholders in the Grays Lake basin to ensure the success of the restoration projects discussed in this plan.

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Appendix A – List of acronyms used in this document

Acronym	Name
AUM	Animal Use Month
BCHA	Bird Habitat Conservation Area
BCR	Bird Conservation Region
BIA	Bureau of Indian Affairs
BIDEH	Biological Integrity, Diversity and Ecosystem Health
CCP	Comprehensive Conservation Plan
FWS	U. S. Fish and Wildlife Service
HMP	Habitat Management Plan
IBA	Important Bird Area
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IPM	Integrated Pest Management
MOU	Memorandum of Understanding
NAWMP	North American Waterfowl Management Plan
NEPA	National Environmental Policy Act
NRCS	Natural Resource Conservation Service
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
PIF	Partners In Flight
USFS	U. S. Forest Service
USGS	U.S. Geological Survey

Appendix B – List of common and scientific names used in this HMP

Plants

Arrowleaf Balsamroot	*Balsamorhiza sagittata*
Baltic Rush	*Juncus arcticus balticus*
Basin Big Sagebrush	*Artemisia tridentata tridentata*
Basin Wildrye	*Leymus cinereus*
Bentgrass	*Agrostis spp.*
Black Hawthorn	*Cratageus douglasii*
Bluebunch Wheatgrass	*Pseudoregneria spicatum*
Broadleaf Cattail	*Typa latifolia*
Camas	*Camassia sp.*
Canada Thistle	*Cirsium arvense*
Chokecherry	*Prunus virginiana*
Columbia needlegrass	*Achnatherum nelsonii*
Coyote Willow	*Salix exigua*
Elk thistle	*Cirsium foliosum*
Golden Currant	*Ribes aureum*
Hardstem Bulrush	*Schoenoplectus acutus*
Whitetop	*Cardaria draba*
Idaho Fescue	*Festuca idahoensis*
Kentucky bluegrass	*Poa pratensis*
Leafy Spurge	*Euphorbia esula*
Lupine	*Lupinus spp.*
Mat Muhly	*Muhlenbergia richardsonis*
Meadow foxtail	*Alopecurus pratensis*
Mountain big sagebrush	*Artemisia tridentata ssp. vaseyana*
Mountain silver sagebrush	*Artemisia cana ssp. viscidula*
Musk thistle (Nodding plumeless)	*Carduus nutans*
Needle-and-thread	*Stipa comata*
Pacific Willow	*Salix lasiandra*
Pale Agoseris	*Agoseris glauca*
Peachleaf Willow	*Salix amygdaloides*
Purple milkvetch	*Astragalus agrestis*
Quaking aspen	*Populus tremuloides*
Redosier dogwood	*Cornus sericea*
Reed Canarygrass	*Phalaris arundinacea*
Rocky Mountain Maple	*Acer glabrum*
Rubber Rabbitbrush	*Ericameria nauseosa*
Rush	*Juncus spp.*
Sandberg's Bluegrass	*Poa secunda*
Shootingstar	*Dodecatheon sp.*
Silver buffaloberry	*Shepherdia argentea*
Sitka alder	
Smooth Brome	*Bromus inermis*
Spikerush	*Eleocharis spp.*

Thimbleberry	*Rubus parviflorus*
Three Square Rush	*Scirpus americana*
Threetip Sagebrush	*Artemisia tripartita*
Timothy	*Phleum pratense*
Tufted hairgrass	*Deschampsia cespitosa*
Twinberry honeysuckle	*Lonicera involucrata*
Utah honeysuckle	*Lonicera utahensis*
Whitetop	*Cardaria draba*
Wood's Rose	*Rosa woodsii*

Birds

American Wigeon	*Mareca americana*
Bald Eagle	*Haliaeetus leucocephalus*
Black-crowned Night-heron	*Nycticorax nycticorax*
Black-necked Stilt	*Himantopus mexicanus*
Bobolink	*Dolichonyx oryzivorus*
Brewer's Sparrow	*Spizella breweri*
Burrowing Owl	*Athene cunicularia*
Canada Goose	*Branta canadensis*
Canvasback	*Aythya valisineria*
Cinnamon Teal	*Anas cyanoptera*
Eared Grebe	*Podiceps nigricollis*
Ferruginous Hawk	*Buteo regalis*
Franklin's Gull	*Larus pipixcan*
Gadwall	*Anas strepera*
Golden Eagle	*Aquila chrysaetos*
Grasshopper Sparrow	*Ammodramus savannarum*
Greater Sage-grouse	*Centrocercus urophasianus*
Greater Sandhill Crane	*Antigone Canadensis tabida*
Greater Yellowlegs	*Tringa melanoleuca*
Horned Lark	*Eremophila alpestris*
Killdeer	*Charadrius vociferous*
Lazuli Bunting	*Passerina amoena*
Lesser Scaup	*Aythya affinis*
Loggerhead Shrike	*Lanius ludovicianus*
Long-billed Curlew	*Numenius americanus*
Mallard	*Anas platyrhyncos*
Merlin	*Falco columbarius*
Northern Pintail	*Anas acuta*
Northern Shoveler	*Anas clypeata*
Peregrine Falcon	*Falco peregrinus*
Prairie Falcon	*Falco mexicanus*
Redhead	*Aythya americana*
Red-winged Blackbird	*Agelaius phoeniceus*
Ruddy Duck	*Oxyura jamaicensis*
Sage Thrasher	*Oreoscoptes montanus*
Sagebrush Sparrow	*Artemisiospiza nevadensis*
Sharp-tailed Grouse	*Tympanuchus phasianellus*
Short-eared Owl	*Asio flammeus*
Snowy Egret	*Egretta thula*

Song Sparrow	*Passerella iliaca*
Swainson's Hawk	*Buteo swaisonii*
Trumpeter Swan	*Cygnus buccinator*
Vesper Sparrow	*Pooecetes gramineus*
Virginia Rail	*Rallus limicola*
White-crowned Sparrow	*Zonotrichia leucophrys*
White-faced Ibis	*Plegadis chihi*
Willet	*Tringa semipalmata*
Willow Flycatcher	*Empidonax traillii*
Wilson's Phalarope	*Phalaropus tricolor*
Wilson's Snipe	*Gallinago delicata*
Yellow Warbler	*Dendroica petechia*
Yellow-breasted Chat	*Icteria virens*

Mammals

Coyote	*Canis latrans*
Rocky Mountain Elk	*Cervus elaphus canadensis*
Idaho Pocket Gopher	*Thomomys idahoensis*
Meadow Vole	*Microtus pennsylvanicus*
Merriam's Shrew	*Sorex merriami*
Montane Vole	*Microtus montanus*
Moose	*Alces alces*
Mule Deer	*Odocoileus hemionus*
Red fox	*Vulpes vulpes*
White-tailed Deer	*Odocoileus virginianus*
Wyoming Ground Squirrel	*Urocitellus elegans*

Reptiles and Amphibians

Boreal Chorus Frog	*Pseudacris maculata*
Common Garter Snake	*Thamnophis sirtalis*
Northern Leopard Frog	*Rana pipiens*

Appendix C – Integrated Pest Management (IPM) Program

1.0 Background

IPM is an interdisciplinary approach utilizing methods to prevent, eliminate, contain, and/or control pest species in concert with other management activities on refuge lands and waters to achieve wildlife and habitat management goals and objectives. IPM is also a scientifically based, adaptive management process where available scientific information and best professional judgment of the refuge staff as well as other resource experts would be used to identify and implement appropriate management strategies that can be modified and/or changed over time to ensure effective, site-specific management of pest species to achieve desired outcomes. In accordance with 43 CFR 46.145, adaptive management would be particularly relevant where long-term impacts may be uncertain and future monitoring would be needed to make adjustments in subsequent implementation decisions. After a tolerable pest population (threshold) is determined considering achievement of refuge resource objectives and the ecology of pest species, one or more methods, or combinations thereof, would be selected that are feasible, efficacious, and most protective of non-target resources, including native species (fish, wildlife, and plants), and Service personnel, Service authorized agents, volunteers, and the public. Staff time and available funding would be considered when determining feasibility/practicality of various treatments.

IPM techniques to address pests are presented as HMP prescriptions (see HMP Section 4.0 HMP) in an adaptive management context to achieve refuge resource objectives. In order to satisfy requirements for IPM planning as identified in the Director's Memo (dated September 9, 2004) entitled *Integrated Pest Management Plans and Pesticide Use Proposals: Updates, Guidance, and an Online Database*, the following elements of an IPM program have been incorporated into this HMP:

- Habitat and/or wildlife objectives that identify pest species and appropriate thresholds to indicate the need for and successful implementation of IPM techniques; and
- Monitoring before and/or after treatment to assess progress toward achieving objectives including pest thresholds.

Where pesticides would be necessary to address pests, this Appendix provides a structured procedure to evaluate potential effects of proposed uses involving ground-based applications to refuge biological resources and environmental quality in accordance with effects analyses presented in the Environmental Consequences section of the associated Environmental Assessment. Only pesticide uses that likely would cause minor, temporary, or localized effects to refuge biological resources and environmental quality with appropriate BMPs, where necessary, would be allowed for use on the refuge.

This Appendix does not describe the more detailed process to evaluate potential effects associated with aerial applications of pesticides. However, the basic framework to assess potential effects to refuge biological resources and environmental quality from aerial application of pesticides would be similar to the process described in this Appendix for ground-based treatments of other pesticides.

2.0 Pest Management Laws and Policies

In accordance with Service policy 569 FW 1 (Integrated Pest Management), plant, invertebrate, and vertebrate pests on units of the National Wildlife Refuge System can be controlled to ensure balanced wildlife and fish populations in support of refuge-specific wildlife and habitat management objectives. Pest control on federal (refuge) lands and waters also is authorized under the following legal mandates:

- National Wildlife Refuge System Administration Act of 1966, as amended (16 USC 668dd-668ee);
- Plant Protection Act of 2000 (7 USC 7701 *et seq*.);
- Noxious Weed Control and Eradication Act of 2004 (7 USC 7781-7786, Subtitle E);
- Federal Insecticide, Fungicide, and Rodenticide Act of 1996 (7 USC 136-136y);
- National Invasive Species Act of 1996 (16 USC 4701);
- Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 USC 4701);
- Food Quality Protection Act of 1996 (7 USC 136);
- Executive Order 13148, Section 601(a);
- Executive Order 13112; and
- Animal Damage Control Act of 1931 (7 USC 426-426c, 46 Stat. 1468).

Pests are defined as "…living organisms that may interfere with the site-specific purposes, operations, or management objectives or that jeopardize human health or safety" from Department policy 517 DM 1 (Integrated Pest Management Policy). Similarly, 569 FW 1 defines pests as "…invasive plants and introduced or native organisms, that may interfere with achieving our management goals and objectives on or off our lands, or that jeopardize human health or safety." 517 DM 1 also defines an invasive species as "a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health." Throughout the remainder of this HMP, the terms pest and invasive species are used interchangeably because both can prevent/impede achievement of refuge wildlife and habitat objectives and/or degrade environmental quality.

In general, control of pests (vertebrate or invertebrate) on the refuge would conserve and protect the nation's fish, wildlife, and plant resources as well as maintain environmental quality. From 569 FW 1, animal or plant species, which are considered pests, may be managed if the following criteria are met:

- Threat to human health and well-being or private property, the acceptable level of damage by the pest has been exceeded, or State or local government has designated the pest as noxious;
- Detrimental to resource objectives as specified in a refuge resource management plan (e.g., comprehensive conservation plan, habitat management plan), if available; and
- Control would not conflict with attainment of resource objectives or the purposes for which the refuge was established.

The specific justifications for pest management activities on the refuge are the following:

- Protect human health and well-being;
- Prevent substantial damage to important to refuge resources;
- Protect newly introduced or re-establish native species;
- Control non-native (exotic) species in order to support existence for populations of native species;
- Prevent damage to private property; and
- Provide the public with quality, compatible wildlife-dependent recreational opportunities.

In accordance with Service policy 620 FW 1 (Habitat Management Plans), there are additional management directives regarding invasive species found on the refuge:

- "We are prohibited by Executive Order, law, and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere."
- "Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and prevent new and expanded infestations of invasive species. Conduct refuge habitat management activities to prevent, control, or eradicate invasive species..."

Animal species damaging/destroying federal property and/or detrimental to the management program of a refuge may be controlled as described in 50 CFR 31.14 (Official Animal Control Operations). For example, the incidental removal of beaver damaging refuge infrastructure (e.g., clogging with subsequent damaging of water control structures) and/or negatively affecting habitats (e.g., removing woody species from existing or restored riparian) managed on refuge lands may be conducted without a pest control proposal. We recognize beavers are native species and most of their activities or refuge lands represent a natural process beneficial for maintaining wetland habitats. Exotic nutria, whose denning and burrowing activities in wetland dikes causes cave-ins and breaches, can be controlled using the most effective techniques considering site-specific factors without a pest control proposal. Along with the loss of quality wetland habitats associated with breaching of impoundments, the safety of refuge staffs and public (e.g., auto tour routes) driving on structurally compromised levees and dikes can be threatened by sudden and unexpected cave-ins.

Trespass and feral animals also may be controlled on refuge lands. Based upon 50 CFR 28.43 (Destruction of Dogs and Cats), dogs and cats running at large on a national wildlife refuge and observed in the act of killing, injuring, harassing or molesting humans or wildlife may be disposed of in the interest of public safety and protection of the wildlife. Feral animals should be disposed by the most humane method(s) available and in accordance with relevant Service directives (including Executive Order 11643). Disposed wildlife specimens may be donated or loaned to public institutions. Donation or loans of resident wildlife species will only be made after securing State approval (50 CFR 30.11 [Donation and Loan of Wildlife Specimens]). Surplus wildlife specimens may be sold alive or butchered, dressed and processed subject to federal and state laws and regulations (50 CFR 30.12 [Sale of Wildlife Specimens]).

3.0 Strategies

To fully embrace IPM as identified in 569 FW 1, the following strategies, where applicable, would be carefully considered on the refuge for each pest species:

- **Prevention.** This would be the most effective and least expensive long-term management option for pests. It encompasses methods to prevent new introductions or the spread of the established pests to un-infested areas. It requires identifying potential routes of invasion to reduce the likelihood of infestation. Hazard Analysis and Critical Control Points (HACCP) planning can be used determine if current management activities on a refuge may introduce and/or spread invasive species in order to identify appropriate BMPs for prevention. See http://www.haccp-nrm.org/ for more information about HACCP planning.

  Prevention may include source reduction, using pathogen-free or weed-free seeds or fill; exclusion methods (e.g., barriers) and/or sanitation methods (e.g., wash stations) to prevent re-introductions by various mechanisms including vehicles, personnel, livestock, and horses. Because invasive species are frequently the first to establish newly disturbed sites, prevention would require a reporting mechanism for early detection of new pest occurrences with quick response to eliminate any new satellite pest populations. Prevention would require consideration of the scale and scope of land management activities that may promote pest establishment within un-infested areas or promote reproduction and spread of existing populations. Along with preventing initial introduction, prevention would involve halting the spread of existing infestations to new sites (Mullin et al. 2000). The primary reason for prevention would be to keep pest-free lands or waters from becoming infested. Executive Order 11312 emphasizes the priority for prevention with respect to managing pests.

  The following would be methods to prevent the introduction and/or spread of pests on refuge lands:
    - Before beginning ground-disturbing activities (e.g., disking, scraping), inventory and prioritize pest infestations in project operating areas and along access routes. Refuge

staff would identify pest species on-site or within reasonably expected potential invasion vicinity. Where possible, the refuge staff would begin project activities in un-infested areas before working in pest-infested areas.

- The refuge staff would locate and use pest-free project staging areas. They would avoid or minimize travel through pest-infested areas, or restrict to those periods when spread of seed or propagules of invasive plants would be least likely.
- The refuge staff would determine the need for, and when appropriate, identify sanitation sites where equipment can be cleaned of pests. Where possible, the refuge staff would clean equipment before entering lands at on-refuge approved cleaning site(s). This practice does not pertain to vehicles traveling frequently in and out of the project area that will remain on roadways. Seeds and plant parts of pest plants would need to be collected, where practical. The refuge staff would remove mud, dirt, and plant parts from project equipment before moving it into a project area.
- The refuge staff would clean all equipment, before leaving the project site, if operating in areas infested with pests. The refuge staff would determine the need for, and when appropriate, identify sanitation sites where equipment can be cleaned.
- Refuge staffs, their authorized agents, and refuge volunteers would, where possible, inspect, remove, and properly dispose of seed and parts of invasive plants found on their clothing and equipment. Proper disposal means bagging the seeds and plant parts and then properly discarding of them (e.g., incinerating).
- The refuge staff would evaluate options, including closure, to restrict the traffic on sites with on-going restoration of desired vegetation. The refuge staff would revegetate disturbed soil (except travel ways on surfaced projects) to optimize plant establishment for each specific site. Revegetation may include topsoil replacement, planting, seeding, fertilization, liming, and weed-free mulching as necessary. The refuge staff would use native material, where appropriate and feasible. The refuge staff would use certified weed-free or weed-seed-free hay or straw where certified materials are reasonably available.
- The refuge staff would provide information, training, and appropriate pest identification materials to permit holders and recreational visitors. The refuge staff would educate them about pest identification, biology, impacts, and effective prevention measures.
- The refuge staff would require grazing permittees to utilize preventative measures for their livestock while on refuge lands.
- The refuge staff would inspect borrow material for invasive plants prior to use and transport onto and/or within refuge lands.
- The refuge staff would consider invasive plants in planning for road maintenance activities.

- The refuge staff would restrict off-road travel to designated routes.

The following would be methods to prevent the introduction and/or spread of pests into refuge waters:

- The refuge staff would inspect boats (including air boats), trailers, and other boating equipment. Where possible, the refuge staff would remove any visible plants, animals, or mud before leaving any waters or boat launching facilities. Where possible, the refuge staff would drain water from motor, live well, bilge, and transom wells while on land before leaving the site. If possible, the refuge staff would wash and dry boats, downriggers, anchors, nets, floors of boats, propellers, axles, trailers, and other boating equipment to kill pests not visible at the boat launch.
- Where feasible, the refuge staff would maintain a l00-foot buffer of aquatic pest-free clearance around boat launches and docks or quarantine areas when cleaning around culverts, canals, or irrigation sites. Where possible, the refuge staff would inspect and clean equipment before moving to new sites or one project area to another.

These prevention methods to minimize/eliminate the introduction and/or spread of pests were taken verbatim or slightly modified from Appendix E of US Forest Service (2005).

- **Mechanical/Physical Methods.** These methods would remove and destroy, disrupt the growth of, or interfere with the reproduction of pest species. For plants species, these treatments can be accomplished by hand, hand tool (manual), or power tools (mechanical) and include pulling, grubbing, digging, tilling/disking, cutting, swathing, grinding, sheering, girdling, mowing, and mulching of the pest plants.

  For animal species, Service employees or their authorized agents could use mechanical/physical methods (including trapping) to control pests as a refuge management activity. Based upon 50 CFR 31.2, trapping can be used on a refuge to reduce surplus wildlife populations for a "balanced conservation program" in accordance with federal or state laws and regulations. In some cases, non-lethally trapped animals would be relocated to off-refuge sites with prior approval from the state.

  Each of these tools would be efficacious to some degree and applicable to specific situations. In general, mechanical controls can effectively control annual and biennial pest plants. However, to control perennial plants, the root system has to be destroyed or it would resprout and continue to grow and develop. Mechanical controls are typically not capable of destroying a perennial plant's root system. Although some mechanical tools (e.g., disking, plowing) may damage root systems, they may stimulate regrowth producing a denser plant population that may aid in the spread depending upon the target species (e.g., Canada thistle). In addition, steep terrain and soil conditions would be major factors that can limit the use of many mechanical control methods.

Some mechanical control methods (e.g., mowing), which would be used in combination with herbicides, can be a very effective technique to control perennial species. For example, mowing perennial plants followed sequentially by treating the plant regrowth with a systemic herbicide often would improve the efficacy of the herbicide compared to herbicide treatment only.

- **Cultural Methods.** These methods would involve manipulating habitat to increase pest mortality by reducing its suitability to the pest. Cultural methods would include water-level manipulation, mulching, winter cover crops, changing planting dates to minimize pest impact, prescribed burning (facilitate revegetation, increase herbicide efficacy, and remove litter to assist in emergence of desirable species), flaming with propane torches, trap crops, crop rotations that would include non-susceptible crops, moisture management, addition of beneficial insect habitat, reducing clutter, proper trash disposal, planting or seeding desirable species to shade or out-compete invasive plants, applying fertilizer to enhance desirable vegetation, prescriptive grazing, and other habitat alterations.

- **Biological Control Agents.** Classical biological control would involve the deliberate introduction and management of natural enemies (parasites, predators, or pathogens) to reduce pest populations. Many of the most ecologically or economically damaging pest species in the United States originated in foreign countries. These newly introduced pests, which are free from natural enemies found in their country or region of origin, may have a competitive advantage over cultivated and native species. This competitive advantage often allows introduced species to flourish, and they may cause widespread economic damage to crops or out compete and displace native vegetation. Once the introduced pest species population reaches a certain level, traditional methods of pest management may be cost prohibitive or impractical. Biological controls typically are used when these pest populations have become so widespread that eradication or effective control would be difficult or no longer practical.

  Biological control has advantages as well as disadvantages. Benefits would include reducing pesticide usage, host specificity for target pests, long-term self-perpetuating control, low cost/acre, capacity for searching and locating hosts, synchronizing biological control agents to hosts' life cycles, and the unlikelihood that hosts will develop resistance to agents. Disadvantages would include the following: limited availability of agents from their native lands, the dependence of control on target species density, slow rate at which control occurs, biotype matching, the difficulty and expense of conflicts over control of the target pest, and host specificity when host populations are low.

  A reduction in target species populations from biological controls is typically a slow process, and efficacy can be highly variable. It may not work well in a particular area although it does work well in other areas. Biological control agents would require specific environmental conditions to survive over time. Some of these conditions are understood; whereas, others are only partially understood or not at all.

Biological control agents would not eradicate a target pest. When using biological control agents, residual levels of the target pest typically are expected; the agent population level or survival would be dependent upon the density of its host. After the pest population decreases, the population of the biological control agent would decrease correspondingly. This is a natural cycle. Some pest populations (e.g., invasive plants) would tend to persist for several years after a biological control agent becomes established due to seed reserves in the soil, inefficiencies in the agents search behavior, and the natural lag in population buildup of the agent.
The full range of pest groups potentially found on refuge lands and waters would include diseases, invertebrates (insects, mollusks), vertebrates and invasive plants (the most common group). Often it is assumed that biological control would address many if not most of these pest problems. There are several well-documented success stories of biological control of invasive weed species in the Pacific Northwest including Mediterranean sage, St. Johnswort (Klamath weed) and tansy ragwort. Emerging success stories include Dalmatian toadflax, diffuse knapweed, leafy spurge, purple loosestrife and yellow star thistle. However, historically, each new introduction of a biological control agent in the United States has only about a 30% success rate (Coombs et al 2004). Refer to Coombs et. al (2004) for the status of biological control agents for invasive plants in the Pacific Northwest.

Introduced species without desirable close relatives in the United States would generally be selected as biological controls. Natural enemies that are restricted to one or a few closely related plants in their country of origin are targeted as biological controls (Center et al. 1997, Hasan and Ayres 1990).

The refuge staff would ensure introduced agents are approved by the applicable authorities. Except for a small number of formulated biological control products registered by USEPA under FIFRA, most biological control agents are regulated by the US Department of Agriculture (USDA)-Animal Plant Health Inspection Service, Plant Protection and Quarantine (APHIS-PPQ). State departments of agriculture and, in some cases, county agricultural commissioners or weed districts, have additional approval authority.

Federal permits (USDA-APHIS-PPQ Form 526) are required to import biocontrols agents from another state. Form 526 may be obtained by writing:

USDA-APHIS-PPQ
Biological Assessment and Taxonomic Support
4700 River Road, Unit 113
Riverdale, MD 20737

or

through the internet at:
http://www.aphis.usda.gov/ppq/permits/bioligical/weedbio.html.

The Service strongly supports the development, and legal and responsible use of appropriate, safe, and effective biological control agents for nuisance and non-indigenous or pest species.

State and county agriculture departments may also be sources for biological control agents or they may have information about where biological control agents may be obtained. Commercial sources should have an Application and Permit to Move Live Plant Pests and Noxious Weeds (USDA-PPQ Form 226 USDA-APHIS-PPQ, Biological Assessment and Taxonomic Support, 4700 River Road, Unit 113, Riverdale, MD 20737) to release specific biological control agents in a state and/or county. Furthermore, certification regarding the biological control agent's identity (genus, specific epithet, sub-species and variety) and purity (e.g., parasite free, pathogen free, and biotic and abiotic contaminants) should be specified in purchase orders.

Biological control agents are subject to 7 RM 8 (Exotic Species Introduction and Management). In addition, the refuge staff would follow the International Code of Best Practice for Classical Biological Control of Weeds (http://sric.ucdavis.edu/exotic/exotic.htm) as ratified by delegates to the X International Symposium on Biological Control of Weeds, Bozeman, MT, July 9, 1999. This code identifies the following:

- Release only approved biological control agents,
- Use the most effective agents,
- Document releases, and
- Monitor for impact to the target pest, non-target species and the environment.

Biological control agents formulated as pesticide products and registered by the USEPA (e.g., *Bti*) are also subject to PUP review and approval (see below).

A record of all releases would be maintained with date(s), location(s), and environmental conditions of the release site(s); the identity, quantity, and condition of the biological control agents released; and other relevant data and comments such as weather conditions. Systematic monitoring to determine the establishment and effectiveness of the release is also recommended.

NEPA documents regarding biological and other environmental effects of biological control agents prepared by another federal agency, where the scope is relevant to evaluation of releases on refuge lands, would be reviewed. Possible source agencies for such NEPA documents include the Bureau of Land Management, US Forest Service, National Park Service, US Department of Agriculture-Animal and Plant Health Inspection Service, and the military services. It might be appropriate to incorporate by reference parts or all of existing document(s) from the review. Incorporating by reference (43 CFR 46.135) is a technique used to avoid redundancies in analysis. It also can reduce the bulk of a Service NEPA document, which only must identify the documents that are incorporated by reference. In addition, relevant portions must be summarized in the Service NEPA document to the extent necessary to provide the decision maker and public with an understanding of relevance of the referenced material to the current analysis.

- **Pesticides.** The selective use of pesticides would be based upon pest ecology (including mode of reproduction), the size and distribution of its populations, site-specific conditions (e.g., soils, topography), known efficacy under similar site conditions, and the capability to utilize best management practices (BMPs) to reduce/eliminate potential effects to non-target species, sensitive habitats, and potential to contaminate surface and groundwater. All pesticide usage (pesticide, target species, application rate, and method of application) would comply with the applicable federal (FIFRA) and state regulations pertaining to pesticide use, safety, storage, disposal, and reporting. Before pesticides can be used to eradicate, control, or contain pests on refuge lands and waters, pesticide use proposals (PUPs) would be prepared and approved in accordance with 569 FW 1. PUP records would provide a detailed, time-, site-, and target-specific description of the proposed use of pesticides on the refuge. All PUPs would be created, approved or disapproved, and stored in the Pesticide Use Proposal System (PUPS), which is a centralized database only accessible on the Service's intranet (https://systems.fws.gov/pups). Only Service employees would be authorized to access PUP records for a refuge in this database.

Application equipment would be selected to provide site-specific delivery to target pests while minimizing/eliminating direct or indirect (e.g., drift) exposure to non-target areas and degradation of surface and groundwater quality. Where possible, target-specific equipment (e.g., backpack sprayer, wiper) would be used to treat target pests. Other target-specific equipment to apply pesticides would include soaked wicks or paint brushes for wiping vegetation and lances, hatchets, or syringes for direct injection into stems. Granular pesticides may be applied using seeders or other specialized dispensers. In contrast, aerial spraying (e.g., fixed wing or helicopter) would only be used where access is difficult (remoteness) and/or the size/distribution of infestations precludes practical use of ground-based methods.

Because repeated use of one pesticide may allow resistant organisms to survive and reproduce, multiple pesticides with variable modes of action would be considered for treatments on refuge lands and waters. This is especially important if multiple applications within years and/or over a growing season likely would be necessary for habitat maintenance and restoration activities to achieve resource objectives. Integrated chemical and non-chemical controls also are highly effective, where practical, because pesticide-resistant organisms can be removed from the site.

Cost may not be the primary factor in selecting a pesticide for use on a refuge. If the least expensive pesticide would potentially harm natural resources or people, then a different product would be selected, if available. The most efficacious pesticide available with the least potential to degrade environment quality (soils, surface water, and groundwater) as well as least potential effect to native species and communities of fish, wildlife, plants, and their habitats would be acceptable for use on refuge lands in the context of an IPM approach.

- **Habitat restoration/maintenance.** Restoration and/or proper maintenance of refuge habitats associated with achieving wildlife and habitat objectives would be essential for long-term prevention, eradication, or control (at or below threshold levels) of pests. Promoting desirable plant communities through the manipulation of species composition, plant density, and growth rate is an essential component of invasive plant management (Masters et al. 1996, Masters and Shelly 2001, Brooks et al. 2004). The following three components of succession could be manipulated through habitat maintenance and restoration: site availability, species availability, and species performance (Cox and Anderson 2004). Although a single method (e.g., herbicide treatment) may eliminate or suppress pest species in the short term, the resulting gaps and bare soil create niches that are conducive to further invasion by the species and/or other invasive plants. On degraded sites where desirable species are absent or in low abundance, revegetation with native/desirable grasses, forbs, and legumes may be necessary to direct and accelerate plant community recovery, and achieve site-specific objectives in a reasonable time frame. The selection of appropriate species for revegetation would be dependent on a number of factors including resource objectives and site-specific, abiotic factors (e.g., soil texture, precipitation/temperature regimes, and shade conditions). Seed availability and cost, ease of establishment, seed production, and competitive ability also would be important considerations.

4.0 Priorities for Treatments

For many refuges, the magnitude (number, distribution, and sizes of infestations) of pest problems is too extensive and beyond the available capital resources to effectively address during any single field season. To manage pests in the refuge, it would be essential to prioritize treatment of infestations. Highest priority treatments would be focused on early detection and rapid response to eliminate infestations of new pests, if possible. This would be especially important for aggressive pests potentially impacting species, species groups, communities, and/or habitats associated refuge purpose(s), NWRS resources of concern (federally listed species, migratory birds, selected marine mammals, and interjurisdictional fish), and native species for maintaining/restoring biological integrity, diversity, and environmental health.

The next priority would be treating established pests that appear in one or more previously un-infested areas. Moody and Mack (1988) demonstrated through modeling that small, new outbreaks of invasive plants eventually would infest an area larger than the established, source population. They also found that control efforts focusing on the large, main infestation rather than the new, small satellites reduced the chances of overall success. The lowest priority would be treating large infestations (sometimes monotypic stands) of well-established pests. In this case, initial efforts would focus upon containment of the perimeter followed by work to control/eradicate the established infested area. If containment and/or control of a large infestation is not effective, then efforts would focus upon halting pest reproduction or managing source populations. Maxwell et al. (2009) found treating fewer populations that are sources represents an effective long-term strategy to reduce of total number of invasive populations and decreasing meta-population growth rates.

Although state-listed noxious weeds would always of high priority for management, other pest species known to cause substantial ecological impact would also be considered. For example, cheatgrass may not be listed by a state as noxious, but it can greatly alter fire regimes in shrub steppe habitats resulting in large monotypic stands that displace native bunch grasses, forbs, and shrubs. Pest control would likely require a multi-year commitment from the refuge staff. Essential to the long-term success of pest management would be pre- and post-treatment monitoring, assessment of the successes and failures of treatments, and development of new approaches when proposed methods do not achieve desired outcomes.

5.0 Best Management Practices (BMPs)

BMPs can minimize or eliminate possible effects associated with pesticide usage to non-target species and/or sensitive habitats as well as degradation of water quality from drift, surface runoff, or leaching. Based upon the Department of Interior Pesticide Use Policy (517 DM 1) and the Service Integrated Pest Management policy (569 FW 1), the use of applicable BMPs (where feasible) also would likely ensure that pesticide uses may not adversely affect federally listed species and/or their critical habitats through determinations made using the process described in 50 CFR part 402.

The following are BMPs pertaining to mixing/handling and applying pesticides for all ground-based treatments of pesticides, which would be considered and utilized, where feasible, based upon target- and site-specific factors and time-specific environmental conditions. Although not listed below, the most important BMP to eliminate/reduce potential impacts to non-target resources would be an IPM approach to prevent, control, eradicate, and contain pests.

5.1 Pesticide Handling and Mixing

- As a precaution against spilling, spray tanks would not be left unattended during filling.
- All pesticide containers would be triple rinsed and the rinsate would be used as water in the sprayer tank and applied to treatment areas.
- All pesticide spray equipment would be properly cleaned. Where possible, rinsate would be used as part of the make-up water in the sprayer tank and applied to treatment areas.
- The refuge staff would triple rinse and recycle (where feasible) pesticide containers.
- All unused pesticides would be properly discarded at a local "safe send" collection.
- Pesticides and pesticide containers would be lawfully stored, handled, and disposed of in accordance with the label and in a manner safeguarding human health, fish, and wildlife and prevent soil and water contaminant.
- The refuge staff would consider the water quality parameters (e.g., pH, hardness) that are important to ensure greatest efficacy where specified on the pesticide label.
- All pesticide spills would be addressed immediately using procedures identified in the refuge spill response plan.

5.2 Applying Pesticides

- Pesticide treatments would only be conducted by or under the supervision of Service personnel and non-Service applicators with the appropriate, state or BLM certification to safely and effectively conduct these activities on refuge lands and waters.

- The refuge staff would comply with all federal, state, and local pesticide use laws and regulations as well as Departmental, Service, and NWRS pesticide-related policies. For example, the refuge staff would use application equipment and apply rates for the specific pest(s) identified on the pesticide label as required under FIFRA.
- Before each treatment season and prior to mixing or applying any product for the first time each season, all applicators would review the labels, MSDSs, and Pesticide Use Proposal (PUPs) for each pesticide, determining the target pest, appropriate mix rate(s), PPE, and other requirements listed on the pesticide label.
- A 1-foot no-spray buffer from the water's edge would be used, where applicable and where it does not detrimentally influence effective control of pest species.
- Use low-impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, Thinvert system applications) rather than broadcast foliar applications (e.g., boom sprayer, other larger tank wand applications), where practical.
- Use low-volume rather than high-volume foliar applications where low-impact methods above are not feasible or practical, to maximize herbicide effectiveness and ensure correct and uniform application rates.
- Applicators would use and adjust spray equipment to apply the coarsest droplet size spectrum with optimal coverage of the target species while reducing drift.
- Applicators would use the largest droplet size that results in uniform coverage.
- Applicators would use drift reduction technologies such as low-drift nozzles, where possible.
- Where possible, spraying would occur during low (average<7mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically <85 ºF).
    - Where possible, applicators would avoid spraying during inversion conditions (often associated with calm and very low wind conditions) that can cause large-scale herbicide drift to non-target areas.
- Equipment would be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.
- Spray applications would be made at the lowest height for uniform coverage of target pests to minimize/eliminate potential drift.
- If windy conditions frequently occur during afternoons, spraying (especially boom treatments) would typically be conducted during early morning hours.
- Spray applications would not be conducted on days with >30% forecast for rain within 6 hours, except for pesticides that are rapidly rain fast (e.g., glyphosate in 1 hour) to minimize/eliminate potential runoff.

- Where possible, applicators would use drift retardant adjuvants during spray applications, especially adjacent to sensitive areas.
- Where possible, applicators would use a non-toxic dye to aid in identifying target area treated as well as potential over spray or drift. A dye can also aid in detecting equipment leaks. If a leak is discovered, the application would be stopped until repairs can be made to the sprayer.
- For pesticide uses associated with cropland and facilities management, buffers, as appropriate, would be used to protect sensitive habitats, especially wetlands and other aquatic habitats.
- When drift cannot be sufficiently reduced through altering equipment set up and application techniques, buffer zones may be identified to protect sensitive areas downwind of applications. The refuge staff would only apply adjacent to sensitive areas when the wind is blowing the opposite direction.
- Applicators would utilize scouting for early detection of pests to eliminate unnecessary pesticide applications.
- The refuge staff would consider timing of application so native plants are protected (e.g., senescence) while effectively treating invasive plants.
- Rinsate from cleaning spray equipment after application would be recaptured and reused or applied to an appropriate pest plant infestation.
- Application equipment (e.g., sprayer, ATV, tractor) would be thoroughly cleaned and PPE would be removed/disposed of on-site by applicators after treatments to eliminate the potential spread of pests to un-infested areas.

6.0 Safety

6.1 Personal Protective Equipment

All applicators would wear the specific personal protective equipment (PPE) identified on the pesticide label. The appropriate PPE will be worn at all times during handling, mixing, and applying. PPE can include the following: disposable (e.g., Tyvek) or laundered coveralls; gloves (latex, rubber, or nitrile); rubber boots; and/or an NIOSH-approved respirator. Because exposure to concentrated product is usually greatest during mixing, extra care should be taken while preparing pesticide solutions. Persons mixing these solutions can be best protected if they wear long gloves, an apron, footwear, and a face shield.

Coveralls and other protective clothing used during an application would be laundered separately from other laundry items. Transporting, storing, handling, mixing and disposing of pesticide containers will be consistent with label requirements, USEPA and OSHA requirements, and Service policy.

If a respirator is necessary for a pesticide use, then the following requirements would be met in accordance with Service safety policy: a written Respirator Program, fit testing, physical examination (including pulmonary function and blood work for contaminants), and proper storage of the respirator.

6.2 Notification

The restricted entry interval (REI) is the time period required after the application at which point someone may safely enter a treated area without PPE. Refuge staff, authorized management agents of the Service, volunteers, and members of the public who could be in or near a pesticide treated area within the stated re-entry time period on the label would be notified about treatment areas. Posting would occur at any site where individuals might inadvertently become exposed to a pesticide during other activities on the refuge. Where required by the label and/or state-specific regulations, sites would also be posted on its perimeter and at other likely locations of entry. The refuge staff would also notify appropriate private property owners of an intended application, including any private individuals who have requested notification. Special efforts would be made to contact nearby individuals who are beekeepers or who have expressed chemical sensitivities.

6.3 Medical Surveillance

Medical surveillance may be required for Service personnel and approved volunteers who mix, apply, and/or monitor use of pesticides (see 242 FW 7 [Pesticide Users] and 242 FW 4 [Medical Surveillance]). In accordance with 242 FW 7.12A, Service personnel would be medically monitoring if one or more of the following criteria is met: exposed or may be exposed to concentrations at or above the published permissible exposure limits or threshold limit values (see 242 FW 4); use pesticides in a manner considered “frequent pesticide use”; or use pesticides in a manner that requires a respirator (see 242 FW 14 for respirator use requirements). In 242 FW7.7A, “**Frequent Pesticide Use** means when a person applying pesticide handles, mixes, or applies pesticides, with a Health Hazard rating of 3 or higher, for 8 or more hours in any week or 16 or more hours in any 30-day period.” Under some circumstances, individuals may be medically monitored who use pesticides infrequently (see section 7.7), experience an acute exposure (sudden, short term), or use pesticides with a health hazard ranking of 1 or 2. This decision would consider the individual’s health and fitness level, the pesticide’s specific health risks, and the potential risks from other pesticide-related activities. Refuge cooperators (e.g., cooperative farmers) and other authorized agents (e.g., state and county employees) would be responsible for their own medical monitoring needs and costs.

Standard examinations (at refuge expense) of appropriate refuge staff would be provided by the nearest certified occupational health and safety physician as determined by Federal Occupational Health.

6.4 Certification and Supervision of Pesticide Applicators

Appropriate refuge staff or approved volunteers handling, mixing, and/or applying or directly supervising others engaged in pesticide use activities would be trained and state or federally

(BLM) licensed to apply pesticides to refuge lands or waters. In accordance with 242 FW7.18A and 569 FW 1.10B, certification is required to apply restricted use pesticides based upon USEPA regulations. For safety reasons, all individuals participating in pest management activities with general use pesticides also are encouraged to attend appropriate training or acquire pesticide applicator certification. The certification requirement would be for a commercial or private applicator depending upon the state. New staff unfamiliar with proper procedures for storing, mixing, handling, applying, and disposing of herbicides and containers would receive orientation and training before handling or using any products. Documentation of training would be kept in the files at the refuge office.

6.5 Record Keeping

6.5.1 Labels and material safety data sheets

Pesticide labels and material safety data sheets (MSDSs) would be maintained at the refuge shop and laminated copies in the mixing area. These documents also would be carried by field applicators, where possible. A written reference (e.g., note pad, chalk board, dry erase board) for each tank to be mixed would be kept in the mixing area for quick reference while mixing is in progress. In addition, approved PUPs stored in the PUPS database typically contain website links (URLs) to pesticide labels and MSDSs.

6.5.2 Pesticide use proposals (PUPs)

A PUP would be prepared for each proposed pesticide use associated with annual pest management on refuge lands and waters. A PUP would include specific information about the proposed pesticide use including the common and chemical names of the pesticide(s), target pest species, size and location of treatment site(s), application rate(s) and method(s), and federally listed species determinations, where applicable.

In accordance with Service guidelines (Director's memo [December 12, 2007]), a refuge staff may receive up to five-year approvals for Washington Office and field reviewed proposed pesticide uses based upon meeting identified criteria including an approved IPM plan, where necessary (see http://www.fws.gov/contaminants/Issues/IPM.cfm). For a refuge, an IPM plan (requirements described herein) can be completed independently or in association with a CCP or a habitat management plant (HMP) if IPM strategies and potential environmental effects are adequately addressed within appropriate NEPA documentation.

PUPs would be created, approved or disapproved, and stored as records in the Pesticide Use Proposal System (PUPS), which is centralized database on the Service's intranet (https://systems.fws.gov/pups). Only Service employees can access PUP records in this database.

6.5.3 Pesticide usage

In accordance with 569 FW 1, the refuge Project Leader would be required to maintain records of all pesticides annually applied on lands or waters under refuge jurisdiction. This would encompass pesticides applied by other federal agencies, state and county governments, non-government applicators including cooperators and their pest management service providers with Service permission. For clarification, pesticide means all insecticides, insect and plant growth regulators, dessicants, herbicides, fungicides, rodenticides, acaricides, nematicides, fumigants, avicides, and piscicides.

The following usage information can be reported for approved PUPs in the PUPS database:

- Pesticide trade name(s)
- Active ingredient(s)
- Total acres treated
- Total amount of pesticides used (lbs or gallons)
- Total amount of active ingredient(s) used (lbs)
- Target pest(s)
- Efficacy (% control)

To determine whether treatments are efficacious (eradicating, controlling, or containing the target pest) and achieving resource objectives, habitat and/or wildlife response would be monitored both pre- and post-treatment, where possible. Considering available annual funding and staffing, appropriate monitoring data regarding characteristics (attributes) of pest infestations (e.g., area, perimeter, degree of infestation-density, % cover, density) as well as habitat and/or wildlife response to treatments may be collected and stored in a relational database (e.g., Refuge Habitat Management Database), preferably a geo-referenced data management system (e.g., Refuge Lands GIS) to facilitate data analyses and subsequent reporting. In accordance with adaptive management, data analysis and interpretation would allow treatments to be modified or changed over time, as necessary, to achieve resource objectives considering site-specific conditions in conjunction with habitat and/or wildlife responses. Monitoring could also identify short- and long-term impacts to natural resources and environmental quality associated with IPM treatments in accordance with adaptive management principles identified in 43 CFR 46.145.

7.0 Evaluating Pesticide Use Proposals

Pesticides would only be used on refuge lands for habitat management as well as croplands/facilities maintenance after approval of a PUP. In general, proposed pesticide uses on refuge lands would only be approved where there would likely be minor, temporary, or localized effects to fish and wildlife species as well as minimal potential to degrade environmental quality. Potential effects to listed and non-listed species would be evaluated with quantitative ecological risk assessments and other screening measures. Potential effects to environmental quality would be based upon pesticide characteristics of environmental fate (water solubility, soil mobility, soil persistence, and volatilization) and other quantitative screening tools. Ecological risk assessments as well as characteristics of environmental fate and potential to degrade environmental quality for pesticides would be documented in Chemical Profiles (see Section

7.5). These profiles would include threshold values for quantitative measures of ecological risk assessments and screening tools for environmental fate that represent minimal potential effects to species and environmental quality. In general, only pesticide uses with appropriate BMPs (see Section 4.0) for habitat management and cropland/facilities maintenance on refuge lands that would potentially have minor, temporary, or localized effects on refuge biological and environmental quality (threshold values not exceeded) would be approved.

7.1 Overview of Ecological Risk Assessment

An ecological risk assessment process would be used to evaluate potential adverse effects to biological resources as a result of a pesticide(s) proposed for use on refuge lands. It is an established quantitative and qualitative methodology for comparing and prioritizing risks of pesticides and conveying an estimate of the potential risk for an adverse effect. This quantitative methodology provides an efficient mechanism to integrate best available scientific information regarding hazard, patterns of use (exposure), and dose-response relationships in a manner that is useful for ecological risk decision-making. It would provide an effective way to evaluate potential effects where there is missing or unavailable scientific information (data gaps) to address reasonable, foreseeable adverse effects in the field as required under 40 CFR Part 1502.22. Protocols for ecological risk assessment of pesticide uses on the refuge were developed through research and established by the US Environmental Protection Agency (2004). Assumptions for these risk assessments are presented in Section 6.2.3.

The toxicological data used in ecological risk assessments are typically results of standardized laboratory studies provided by pesticide registrants to the USEPA to meet regulatory requirements under FIFRA. These studies assess the acute (lethality) and chronic (reproductive) effects associated with short- and long-term exposure to pesticides on representative species of birds, mammals, freshwater fish, aquatic invertebrates, and terrestrial and aquatic plants. Other effects data publicly available would also be utilized for risk assessment protocols described herein. Toxicity endpoint and environmental fate data are available from a variety of resources. Some of the more useful resources can be found in
Section 7.5.

Table 1. Ecotoxicity tests used to evaluate potential effects to birds, fish, and mammals to establish toxicity endpoints for risk quotient calculations.

Species Group	Exposure	Measurement endpoint
Bird	Acute	Median Lethal Concentration (LC_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[1]
Fish	Acute	Median Lethal Concentration (LC_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[2]
Mammal	Acute	Oral Lethal Dose (LD_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[3]

[1]Measurement endpoints typically include a variety of reproductive parameters (e.g., number of eggs, number of offspring, eggshell thickness, and number of cracked eggs).
[2]Measurement endpoints for early life stage/life cycle typically include embryo hatch rates, time to hatch, growth, and time to swim-up.
[3]Measurement endpoints include maternal toxicity, teratogenic effects or developmental anomalies, evidence of mutagenicity or genotoxicity, and interference with cellular mechanisms such as DNA synthesis and DNA repair.

7.2 Determining Ecological Risk to Fish and Wildlife

The potential for pesticides used on the refuge to cause direct adverse effects to fish and wildlife would be evaluated using USEPA's Ecological Risk Assessment Process (US Environmental Protection Agency 2004). This deterministic approach, which is based upon a two-phase process involving estimation of environmental concentrations and then characterization of risk, would be used for ecological risk assessments. This method integrates exposure estimates (estimated environmental concentration [EEC] and toxicological endpoints [e.g., LC_{50} and oral LD_{50}]) to evaluate the potential for adverse effects to species groups (birds, mammals, and fish) representative of legal mandates for managing units of the NWRS. This integration is achieved through risk quotients (RQs) calculated by dividing the EEC by acute and chronic toxicity values selected from standardized toxicological endpoints or published effect (Table 1).

RQ = EEC/Toxicological Endpoint

The level of risk associated with direct effects of pesticide use would be characterized by comparing calculated RQs to the appropriate Level of Concern (LOC) established by US Environmental Protection Agency (1998 [Table 2]). The LOC represents a quantitative threshold value for screening potential adverse effects to fish and wildlife resources associated with pesticide use. The following are four exposure-species group scenarios that would be used to characterize ecological risk to fish and wildlife on the refuge: acute-listed species, acute-nonlisted species, chronic-listed species, and chronic-nonlisted species.

Acute risk would indicate the potential for mortality associated with short-term dietary exposure to pesticides immediately after an application. For characterization of acute risks, median values from LC_{50} and LD_{50} tests would be used as toxicological endpoints for RQ calculations. In contrast, chronic risks would indicate the potential for adverse effects associated with long-term dietary exposure to pesticides from a single application or multiple applications over time (within a season and over years). For characterization of chronic risks, the no observed concentration (NOAEC) or no observed effect concentration (NOEC) for reproduction would be used as toxicological endpoints for RQ calculations. Where available, the NOAEC would be preferred over a NOEC value.

Listed species are those federally designated as threatened, endangered, or proposed in accordance with the Endangered Species Act of 1973 (16 USC 1531-1544, 87 Stat. 884, as amended-Public Law 93-205). For listed species, potential adverse effects would be assessed at the individual level because loss of individuals from a population could detrimentally impact a species. In contrast, risks to nonlisted species would consider effects at the population level. A

RQ<LOC would indicate the proposed pesticide use "may affect, not likely to adversely affect" individuals (listed species) and it would not pose an unacceptable risk for adverse effects to populations (non-listed species) for each taxonomic group (Table 2). In contrast, an RQ>LOC would indicate a "may affect, likely to adversely affect" for listed species and it would also pose unacceptable ecological risk for adverse effects to nonlisted species.

Table 2. Presumption of unacceptable risk for birds, fish, and mammals (US Environmental Protection Agency 1998).

Risk Presumption		Level of Concern	
		Listed Species	Non-listed Species
Acute	Birds	0.1	0.5
	Fish	0.05	0.5
	Mammals	0.1	0.5
Chronic	Birds	1.0	1.0
	Fish	1.0	1.0
	Mammals	1.0	1.0

7.2.1 Environmental exposure

Following release into the environment through application, pesticides would experience several different routes of environmental fate. Pesticides which would be sprayed can move through the air (e.g., particle or vapor drift) and may eventually end up in other parts of the environment such as non-target vegetation, soil, or water. Pesticides applied directly to the soil may be washed off the soil into nearby bodies of surface water (e.g., surface runoff) or may percolate through the soil to lower soil layers and groundwater (e.g., leaching) (Baker and Miller 1999, Pope et. al. 1999, Butler et. al. 1998, Ramsay et. al. 1995, EXTOXNET 1993*a*). Pesticides which would be injected into the soil may also be subject to the latter two fates. The aforementioned possibilities are by no means complete, but it does indicate movement of pesticides in the environment is very complex with transfers occurring continually among different environmental compartments. In some cases, these exchanges occur not only between areas that are close together, but it also may involve transportation of pesticides over long distances (Barry 2004, Woods 2004).

7.2.1.1 Terrestrial exposure

The ECC for exposure to terrestrial wildlife would be quantified using an USEPA screening-level approach (US Environmental Protection Agency 2004). This screening-level approach is not affected by product formulation because it evaluates pesticide active ingredient(s). This approach would vary depending upon the proposed pesticide application method: spray or granular.

7.2.1.1.1 Terrestrial-spray application

For spray applications, exposure would be determined using the Kanaga nomogram method (US Environmental Protection Agency 2005*a*, US Environmental Protection Agency 2004, Pfleeger et al. 1996) through the USEPA's Terrestrial Residue Exposure model (T-REX) version 1.2.3

(US Environmental Protection Agency 2005*b*). To estimate the maximum (initial) pesticide residue on short grass (<20 cm tall) as a general food item category for terrestrial vertebrate species, T-REX input variables would include the following from the pesticide label: maximum pesticide application rate (pounds active ingredient [acid equivalent]/acre) and pesticide half-life (days) in soil. Although there are other food item categories (tall grasses; broadleaf plants and small insects; and fruits, pods, seeds and large insects), short grass was selected because it would yield maximum EECs (240 ppm per lb ai/acre) for worst-case risk assessments. Short grass is not representative of forage for carnivorous species (e.g., raptors), but it would characterize the maximum potential exposure through the diet of avian and mammalian prey items. Consequently, this approach would provide a conservative screening tool for pesticides that do not biomagnify.

For RQ calculations in T-REX, the model would require the weight of surrogate species and Mineau scaling factors (Mineau et. al. 1996). Body weights of bobwhite quail and mallard are included in T-REX by default, but body weights of other organisms (Table 3) would be entered manually. The Mineau scaling factor accounts for small-bodied bird species that may be more sensitive to pesticide exposure than would be predicted only by body weight. Mineau scaling factors would be entered manually with values ranging from 1 to 1.55 that are unique to a particular pesticide or group of pesticides. If specific information to select a scaling factor is not available, then a value of 1.15 would be used as a default. Alternatively, zero would be entered if it is known that body weight does not influence toxicity of pesticide(s) being assessed. The upper bound estimate output from the T-REX Kanaga nomogram would be used as an EEC for calculation of RQs. This approach would yield a conservative estimate of ecological risk.

Table 3. Average body weight of selected terrestrial wildlife species frequently used in research to establish toxicological endpoints (Dunning 1984).

Species	**Body Weight (kg)**
Mammal (15 g)	0.015
House sparrow	0.0277
Mammal (35 g)	0.035
Starling	0.0823
Red-winged blackbird	0.0526
Common grackle	0.114
Japanese quail	0.178
Bobwhite quail	0.178
Rat	0.200
Rock dove (aka pigeon)	0.542
Mammal (1000 g)	1.000
Mallard	1.082
Ring-necked pheasant	1.135

7.2.1.1.2 Terrestrial – granular application

Granular pesticide formulations and pesticide-treated seed would pose a unique route of exposure for avian and mammalian species. The pesticide is applied in discrete units which birds or mammals might ingest accidentally with food items or intentionally as in the case of some bird species actively seeking and picking up gravel or grit to aid digestion or seed as a food source. Granules may also be consumed by wildlife foraging on earthworms, slugs or other soft-bodied soil organisms to which the granules may adhere.

Terrestrial wildlife RQs for granular formulations or seed treatments would be calculated by dividing the maximum milligrams of active ingredient (a.i.) exposed (e.g., EEC) on the surface of an area equal to 1 square foot by the appropriate LD_{50} value multiplied by the surrogate's body weight (Table 3). An adjustment to surface area calculations would be made for broadcast, banded, and in-furrow applications. An adjustment also would be made for applications with and without incorporation of the granules. Without incorporation, it would be assumed that 100% of the granules remain on the soil surface available to foraging birds and mammals. Press wheels push granules flat with the soil surface, but they are not incorporated into the soil. If granules are incorporated in the soil during band or T-band applications or after broadcast applications, it would be assumed only 15% of the applied granules remain available to wildlife. It would be assumed that only 1% of the granules are available on the soil surface following in-furrow applications.

EECs for pesticides applied in granular form and as seed treatments would be determined considering potential ingestion rates of avian or mammalian species (e.g., 10-30% body weight/day). This would provide an estimate of maximum exposure that may occur as a result of granule or seed treatment spills such as those that commonly occur at end rows during application and planting. The availability of granules and seed treatments to terrestrial vertebrates would also be considered by calculating the loading per unit area (LD_{50}/ft^2) for comparison to USEPA Level of Concerns (US Environmental Protection Agency 1998). The T-REX version 1.2.3 (US Environmental Protection Agency 2005*b*) contains a submodel which automates Kanaga exposure calculations for granular pesticides and treated seed.

The following formulas will be used to calculate EECs depending upon the type of granular pesticide application:

- In-furrow applications assume a typical value of 1% granules, bait, or seed remain unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/acre)(\%\ a.i.)(453{,}580\ mg/lbs)(1\%\ exposed))] / \{[(43{,}560\ ft.^2/acre)/(row\ spacing\ (ft.))] / (row\ spacing\ (ft.)\}$$

or

$$mg\ a.i./ft^2 = [(lbs\ product/1000\ ft.\ row)(\%\ a.i.)(1000\ ft\ row)(453{,}580\ mg/lb.)(1\%\ exposed)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Incorporated banded treatments assume that 15% of granules, bait, and seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/1000\ row\ ft.)(\%\ a.i.)(453{,}580\ mg/lb.)(1\text{-}\%\ incorporated)] / (1{,}000\ ft.)(band\ width\ (ft.))$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Broadcast treatment without incorporation assumes 100% of granules, bait, seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/acre)(\%\ a.i.)(453{,}590\ mg/lb.)] / (43{,}560\ ft.^2/acre)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

Where:

- *% of pesticide biologically available = 100% without species specific ingestion rates*

- *Conversion for calculating mg a.i./ft.*^{2} *using ounces: 453,580 mg/lb. /16 = 28,349 mg/oz.*

The following equation would be used to calculate an RQ based on the EEC calculated by one of the above equations. The EEC would divided by the surrogate LD_{50} toxicological endpoint multiplied by the body weight (Table 3) of the surrogate.

$$RQ = EEC / [LD_{50}\ (mg/kg) * body\ weight\ (kg)]$$

As with other risk assessments, an RQ>LOC would be a presumption of unacceptable ecological risk. An RQ<LOC would be a presumption of acceptable risk with only minor, temporary, or localized effects to species.

7.2.1.2 Aquatic exposure

Exposures to aquatic habitats (e.g., wetlands, meadows, ephemeral pools, water delivery ditches) would be evaluated separately for ground-based pesticide treatments of habitats managed for fish and wildlife compared with cropland/facilities maintenance. The primary exposure pathway for aquatic organisms from any ground-based treatments likely would be particle drift during the pesticide application. However, different exposure scenarios would be necessary as a result of contrasting application equipment and techniques as well as pesticides used to control pests on agricultural lands (especially those cultivated by cooperative farmers for economic return from crop yields) and facilities maintenance (e.g., roadsides, parking lots, trails) compared with other managed habitats on the refuge. In addition, pesticide applications may be done <25 feet of the high water mark of aquatic habitats for habitat management treatments; whereas, no-spray buffers (≥25 feet) would be used for croplands/facilities maintenance treatments.

7.2.1.2.1 Habitat treatments

For the worst-case exposure scenario to non-target aquatic habitats, EECs (Table 4) would be would be derived from Urban and Cook (1986) that assumes an intentional overspray to an entire, non-target water body (1-foot depth) from a treatment <25 feet from the high water mark using the max application rate (acid basis [see above]). However, use of BMPs for applying pesticides (see Section 4.2) would likely minimize/eliminate potential drift to non-target aquatic habitats during actual treatments. If there would be unacceptable (acute or chronic) risk to fish and wildlife with the simulated 100% overspray (RQ>LOC), then the proposed pesticide use may be disapproved or the PUP would be approved at a lower application rate to minimize/eliminate unacceptable risk to aquatic organisms (RQ=LOC).

Table 4. Estimated Environmental Concentrations (ppb) of pesticides in aquatic habitats (1 foot depth) immediately after direct application (Urban and Cook 1986).

Lbs/acre	EEC (ppb)
0.10	36.7
0.20	73.5
0.25	91.9
0.30	110.2
0.40	147.0
0.50	183.7
0.75	275.6
1.00	367.5
1.25	459.7
1.50	551.6
1.75	643.5
2.00	735.7
2.25	827.6
2.50	919.4
3.00	1103.5
4.00	1471.4
5.00	1839
6.00	2207
7.00	2575
8.00	2943
9.00	3311
10.00	3678

7.2.1.2.2 Cropland/facilities maintenance treatments

Field drift studies conducted by the Spray Drift Task Force, which is a joint project of several agricultural chemical businesses, were used to develop a generic spray drift database. From this database, the AgDRIFT computer model was created to satisfy USEPA pesticide registration spray drift data requirements and as a scientific basis to evaluate off-target movement of pesticides from particle drift and assess potential effects of exposure to wildlife. Several versions of the computer model have been developed (i.e., v2.01 through v2.10). The Spray Drift Task Force AgDRIFT® model version 2.01 (SDTF 2003, AgDRIFT 2001) would be used to derive EECs resulting from drift of pesticides to refuge aquatic resources from ground-based pesticide applications >25 feet from the high water mark. The Spray Drift Task Force AgDRIFT model is publicly available at http://www.agdrift.com. At this website, click

"AgDRIFT 2.0" and then click "Download Now" and follow the instructions to obtain the computer model.

The AgDRIFT model is composed of submodels called tiers. Tier I Ground submodel would be used to assess ground-based applications of pesticides. Tier outputs (EECs) would be calculated with AgDRIFT using the following input variables: max application rate (acid basis [see above]), low boom (20 inches), fine to medium droplet size, EPA-defined wetland, and a ≥25-foot distance (buffer) from treated area to water.

7.2.2 Use of information on effects of biological control agents, pesticides, degradates, and adjuvants

NEPA documents regarding biological and other environmental effects of biological control agents, pesticides, degradates, and adjuvants prepared by another federal agency, where the scope would be relevant to evaluation of effects from pesticide uses on refuge lands, would be reviewed. Possible source agencies for such NEPA documents would include the Bureau of Land Management, US Forest Service, National Park Service, US Department of Agriculture-Animal and Plant Health Inspection Service, and the military services. It might be appropriate to incorporate by reference parts or all of existing document(s). Incorporating by reference (40 CFR 1502.21) is a technique used to avoid redundancies in analysis. It also would reduce the bulk of a Service NEPA document, which only would identify the documents that are incorporated by reference. In addition, relevant portions would be summarized in the Service NEPA document to the extent necessary to provide the decision maker and public with an understanding of relevance of the referenced material to the current analysis.

In accordance with the requirements set forth in 43 CFR 46.135, the Service would specifically incorporate through reference ecological risk assessments prepared by the US Forest Service (http://www.fs.fed.us/r6/invasiveplant-eis/Risk-Assessments/Herbicides-Analyzed-InvPlant-EIS.htm) and Bureau of Land Management (http://www.blm.gov/wo/st/en/prog/more/veg_eis.html). These risk assessments and associated documentation also are available in total with the administrative record for the Final Environmental Impact Statement entitled *Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants* (US Forest Service 2005) and *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic EIS (PEIS)* (Bureau of Land Management 2007). In accordance with 43 CRF 46.120(d), use of existing NEPA documents by supplementing, tiering to, incorporating by reference, or adopting previous NEPA environmental analyses would avoid redundancy and unnecessary paperwork.

As a basis for completing "Chemical Profiles" for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide and adjuvant uses prepared by the US Forest Service would be incorporated by reference:

- 2,4-D
- Chlorosulfuron
- Clopyralid

- Dicamba
- Glyphosate
- Imazapic
- Imazapyr
- Metsulfuron methyl
- Picloram
- Sethoxydim
- Sulfometuron methyl
- Triclopyr
- Nonylphenol polyethylate (NPE) based surfactants

As a basis for completing "Chemical Profiles" for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide uses as well as evaluation of risks associated with pesticide degradates and adjuvants prepared by the Bureau of Land Management would be incorporated by reference:

- Bromacil
- Chlorsulfuron
- Diflufenzopyr
- Diquat
- Diuron
- Fluridone
- Imazapic
- Overdrive (diflufenzopyr and dicamba)
- Sulfometuron methyl
- Tebuthiuron
- Pesticide degradates and adjuvants (*Appendix D – Evaluation of risks from degradates, polyoxyethylene-amine (POEA) and R-11, and endocrine disrupting chemicals*)

7.2.3 Assumptions for ecological risk assessments

There are a number of assumptions involved with the ecological risk assessment process for terrestrial and aquatic organisms associated with utilization of the US Environmental Protection Agency's (2004) process. These assumptions may be risk neutral or may lead to an over- or under-estimation of risk from pesticide exposure depending upon site-specific conditions. The following describes these assumptions, their application to the conditions typically encountered, and whether or not they may lead to recommendations that are risk neutral, underestimate, or overestimate ecological risk from potential pesticide exposure.

- Indirect effects would not be evaluated by ecological risk assessments. These effects include the mechanisms of indirect exposure to pesticides: consuming prey items (fish, birds, or small mammals), reductions in the availability of prey items, and disturbance associated with pesticide application activities.

- Exposure to a pesticide product can be assessed based upon the active ingredient. However, exposure to a chemical mixture (pesticide formulation) may result in effects that are similar or substantially different compared to only the active ingredient. Non-target organisms may be exposed directly to the pesticide formulation or only various constituents of the formulation as they dissipate and partition in the environment. If toxicological information for both the active ingredient and formulated product are available, then data representing the greatest potential toxicity would be selected for use in the risk assessment process (US Environmental Protection Agency 2004). As a result, this conservative approach may lead to an overestimation of risk characterization from pesticide exposure.

- Because toxicity tests with listed or candidate species or closely related species are not available, data for surrogate species would be most often used for risk assessments. Specifically, bobwhite quail and mallard duck are the most frequently used surrogates for evaluating potential toxicity to federally listed avian species. Bluegill sunfish, rainbow trout, and fathead minnow are the most common surrogates for evaluating toxicity for freshwater fishes. However, sheep's head minnow can be an appropriate surrogate marine species for coastal environments. Rats and mice are the most common surrogates for evaluating toxicity for mammals. Interspecies sensitivity is a major source of uncertainty in pesticide assessments. As a result of this uncertainty, data is selected for the most sensitive species tested within a taxonomic group (birds, fish, and mammals) given the quality of the data is acceptable. If additional toxicity data for more species of organisms in a particular group are available, the selected data will not be limited to the species previously listed as common surrogates.

- The Kanaga nomogram outputs maximum EEC values that may be used to calculate an average daily concentration over a specified interval of time, which is referred to as a time-weighted-average (TWA). The maximum EEC would be selected as the exposure input for both acute and chronic risk assessments in the screening-level evaluations. The initial or maximum EEC derived from the Kanaga nomogram represents the maximum expected instantaneous or acute exposure to a pesticide. Acute toxicity endpoints are determined using a single exposure to a known pesticide concentration typically for 48 to 96 hours. This value is assumed to represent ecological risk from acute exposure to a pesticide. On the other hand, chronic risk to pesticide exposure is a function of pesticide concentration and duration of exposure to the pesticide. An organism's response to chronic pesticide exposure may result from either the concentration of the pesticide, length of exposure, or some combination of both factors. Standardized tests for chronic toxicity typically involve exposing an organism to several different pesticide concentrations for a specified length of time (days, weeks, months, years or generations). For example, avian reproduction tests include a 10-week exposure phase. Because a single length of time is used in the test, time response data is usually not available for inclusion into risk assessments. Without time response data it is difficult to determine the concentration which elicited a toxicological response.

- Using maximum EECs for chronic risk estimates may result in an overestimate of risk, particularly for compounds that dissipate rapidly. Conversely, using TWAs for chronic risk estimates may underestimate risk if it is the concentration rather than the duration of exposure that is primarily responsible for the observed adverse effect. The maximum EEC would be used for chronic risk assessments although it may result in an overestimate of risk. TWAs may be used for chronic risk assessments, but they will be applied judiciously considering the potential for an underestimate or overestimate of risk. For example, the number of days exposure exceeds a Level of Concern may influence the suitability of a pesticide use. The greater the number of days the EEC exceeds the Level of Concern translates into greater the ecological risk. This is a qualitative assessment, and is subject to reviewer's expertise in ecological risk assessment and tolerance for risk.

- The length of time used to calculate the TWA can have a substantial effect on the exposure estimates and there is no standard method for determining the appropriate duration for this estimate. The T-REX model assumes a 21-week exposure period, which is equivalent to avian reproductive studies designed to establish a steady-state concentration for bioaccumulative compounds. However, this does not necessarily define the true exposure duration needed to elicit a toxicological response. Pesticides, which do not bioaccumulate, may achieve a steady-state concentration earlier than 21 weeks. The duration of time for calculating TWAs will require justification and it will not exceed the duration of exposure in the chronic toxicity test (approximately 70 days for the standard avian reproduction study). An alternative to using the duration of the chronic toxicity study is to base the TWA on the application interval. In this case, increasing the application interval would suppress both the estimated peak pesticide concentration and the TWA. Another alternative to using TWAs would be to consider the number of days that a chemical is predicted to exceed the LOC.

- Pesticide dissipation is assumed to be first-order in the absence of data suggesting alternative dissipation patterns such as bi-phasic. Field dissipation data would generally be the most pertinent for assessing exposure in terrestrial species that forage on vegetation. However, these data are often not available and it can be misleading particularly if the compound is prone to "wash-off". Soil half-life is the most common degradation data available. Dissipation or degradation data that would reflect the environmental conditions typical of refuge lands would be utilized, if available.

- For species found in the water column, it would be assumed that the greatest bioavailable fraction of the pesticide active ingredient in surface waters is freely dissolved in the water column.

- Actual habitat requirements of any particular terrestrial species are not considered, and it is assumed that species exclusively and permanently occupy the treated area, or adjacent areas receiving pesticide at rates commensurate with the treatment rate. This assumption would produce a maximum estimate of exposure for risk characterization. This assumption would likely lead to an overestimation of exposure for species that do not permanently and exclusively occupy the treated area (US Environmental Protection Agency 2004).

- Exposure through incidental ingestion of pesticide contaminated soil is not considered in the USEPA risk assessment protocols. Research suggests <15% of the diet can consist of incidentally ingested soil depending upon species and feeding strategy (Beyer et al. 1994). An assessment of pesticide concentrations in soil compared to food item categories in the Kanaga nomogram indicates incidental soil ingestion will not likely increase dietary exposure to pesticides. Inclusion of soil into the diet would effectively reduce the overall dietary concentration compared to the present assumption that the entire diet consists a contaminated food source (Fletcher et al. 1994). An exception to this may be soil-applied pesticides in which exposure from incidental ingestion of soil may increase. Potential for pesticide exposure under this assumption may be underestimated for soil-applied pesticides and overestimated for foliar-applied pesticides. The concentration of a pesticide in soil would likely be less than predicted on food items.

- Exposure through inhalation of pesticides is not considered in the USEPA risk assessment protocols. Such exposure may occur through three potential sources: spray material in droplet form at time of application, vapor phase with the pesticide volatilizing from treated surfaces, and airborne particulates (soil, vegetative matter, and pesticide dusts). The USEPA (1990) reported exposure from inhaling spray droplets at the time of application is not an appreciable route of exposure for birds. According to research on mallards and bobwhite quail, respirable particle size (particles reaching the lung) in birds is limited to maximum diameter of 2 to 5 microns. The spray droplet spectra covering the majority of pesticide application scenarios indicate that less than 1% of the applied material is within the respirable particle size. This route of exposure is further limited because the permissible spray drop size distribution for ground pesticide applications is restricted to ASAE medium or coarser drop size distribution.

- Inhalation of a pesticide in the vapor phase may be another source of exposure for some pesticides under certain conditions. This mechanism of exposure to pesticides occurs post application, and it would pertain to those pesticides with a high vapor pressure. The USEPA is currently evaluating protocols for modeling inhalation exposure from pesticides including near-field and near-ground air concentrations based upon equilibrium and kinetics-based models. Risk characterization for exposure with this mechanism is unavailable.

- The effect from exposure to dusts contaminated with the pesticide cannot be assessed generically as partitioning issues related to application site soils and chemical properties of the applied pesticides render the exposure potential from this route highly situation specific.

- Dermal exposure may occur through three potential sources: direct application of spray to terrestrial wildlife in the treated area or within the drift footprint, incidental contact with contaminated vegetation, or contact with contaminated water or soil. Interception of spray and incidental contact with treated substrates may pose risk to avian wildlife (Driver et al. 1991). However, available research related to wildlife dermal contact with pesticides is extremely limited, except dermal toxicity values are common for some mammals used as human surrogates (rats and mice). The USEPA is currently evaluating protocols for modeling dermal exposure. Risk characterization may be underestimated for this route of exposure, particularly with high risk pesticides such as some organophosphates or carbamate insecticides. If protocols are established by the USEPA for assessing dermal exposure to pesticides, they will be considered for incorporation into pesticide assessment protocols.

- Exposure to a pesticide may occur from consuming surface water, dew or other water on treated surfaces. Water soluble pesticides have the potential to dissolve in surface runoff and puddles in a treated area may contain pesticide residues. Similarly, pesticides with lower organic carbon partitioning characteristics and higher solubility in water have a greater potential to dissolve in dew and other water associated with plant surfaces. Estimating the extent to which such pesticide loadings to drinking water occurs is complex and would depend upon the partitioning characteristics of the active ingredient, soils types in the treatment area, and the meteorology of the treatment area. In addition, the use of various water sources by wildlife is highly species-specific. Currently, risk characterization for this exposure mechanism is not available. The USEPA is actively developing protocols to quantify drinking water exposures from puddles and dew. If and when protocols are formally established by the USEPA for assessing exposure to pesticides through drinking water, these protocols will be incorporated into pesticide risk assessment protocols.

- Risk assessments are based upon the assumption that the entire treatment area would be subject to pesticide application at the rates specified on the label. In most cases, there is potential for uneven application of pesticides through such plausible incidents such as changes in calibration of application equipment, spillage, and localized releases at specific areas in or near the treated field that are associated with mixing and handling and application equipment as well as applicator skill. Inappropriate use of pesticides and the occurrence of spills represent a potential underestimate of risk. It is likely not an important factor for risk characterization. All pesticide applicators are required to be certified by the state in which they apply pesticides. Certification training includes the safe storage, transport, handling, and mixing of pesticides; equipment calibration; and proper application with annual continuing education.

- The USEPA relies on Fletcher (1994) for setting the assumed pesticide residues in wildlife dietary items. The USEPA (2004) "believes that these residue assumptions reflect a realistic upper-bound residue estimate, although the degree to which this assumption reflects a specific percentile estimate is difficult to quantify". Fletcher's (1994) research suggests that the pesticide active ingredient residue assumptions used by the USEPA represent a 95th percentile estimate. However, research conducted by Pfleeger et al. (1996) indicates USEPA residue assumptions for short grass was not exceeded. Baehr and Habig (2000) compared USEPA residue assumptions with distributions of measured pesticide residues for the USEPA's UTAB database. Overall residue selection level will tend to overestimate risk characterization. This is particularly evident when wildlife individuals are likely to have selected a variety of food items acquired from multiple locations. Some food items may be contaminated with pesticide residues whereas others are not contaminated. However, it is important to recognize differences in species feeding behavior. Some species may consume whole above-ground plant material, but others will preferentially select different plant structures. Also, species may preferentially select a food item although multiple food items may be present. Without species specific knowledge regarding foraging behavior characterizing ecological risk other than in general terms is not possible.

- Acute and chronic risk assessments rely on comparisons of wildlife dietary residues with LC_{50} or NOEC values expressed as concentrations of pesticides in laboratory feed. These comparisons assume that ingestion of food items in the field occurs at rates commensurate with those in the laboratory. Although the screening assessment process adjusts dry-weight estimates of food intake to reflect the increased mass in fresh-weight wildlife food intake estimates, it does not allow for gross energy and assimilative efficiency differences between wildlife food items and laboratory feed. Differences in assimilative efficiency between laboratory and wild diets suggest that current screening assessment methods are not accounting for a potentially important aspect of food requirements.

- There are several other assumptions that can affect non-target species not considered in the risk assessment process. These include possible additive or synergistic effects from applying two or more pesticides or additives in a single application, co-location of pesticides in the environment, cumulative effects from pesticides with the same mode of action, effects of multiple stressors (e.g., combination of pesticide exposure, adverse abiotic and biotic factors) and behavioral changes induced by exposure to a pesticide. These factors may exist at some level contributing to adverse effects to non-target species, but they are usually characterized in the published literature in only a general manner limiting their value in the risk assessment process.

- It is assumed that aquatic species exclusively and permanently occupy the water body being assessed. Actual habitat requirements of aquatic species are not considered. With the possible exception of scenarios where pesticides are directly applied to water, it is assumed that no habitat use considerations specific for any species would place the organisms in closer proximity to pesticide use sites. This assumption produces a maximum estimate of exposure or risk characterization. It would likely be realistic for many aquatic species that may be found in aquatic habitats within or in close proximity to treated terrestrial habitats. However, the spatial distribution of wildlife is usually not random because wildlife distributions are often related to habitat requirements of species. Clumped distributions of wildlife may result in an under- or over-estimation of risk depending upon where the initial pesticide concentration occurs relative to the species or species habitat.

- For species found in the water column, it would be assumed that the greatest bioavailable fraction of the pesticide active ingredient in surface waters is freely dissolved in the water column. Additional chemical exposure from materials associated with suspended solids or food items is not considered because partitioning onto sediments likely is minimal. Adsorption and bioconcentration occurs at lower levels for many newer pesticides compared with older more persistent bioaccumulative compounds. Pesticides with RQs close to the listed species level of concern, the potential for additional exposure from these routes may be a limitation of risk assessments, where potential pesticide exposure or risk may be underestimated.

- Mass transport losses of pesticide from a water body (except for losses by volatilization, degradation and sediment partitioning) would not be considered for ecological risk assessment. The water body would be assumed to capture all pesticide active ingredients entering as runoff, drift, and adsorbed to eroded soil particles. It would also be assumed that pesticide active ingredient is not lost from the water body by overtopping or flow-through, nor is concentration reduced by dilution. In total, these assumptions would lead to a near maximum possible water-borne concentration. However, this assumption would not account for the potential to concentrate pesticide through the evaporative loss. This limitation may have the greatest impact on water bodies with high surface-to-volume ratios such as ephemeral wetlands, where evaporative losses are accentuated and applied pesticides have low rates of degradation and volatilization.

- For acute risk assessments, there would be no averaging time for exposure. An instantaneous peak concentration would be assumed, where instantaneous exposure is sufficient in duration to elicit acute effects comparable to those observed over more protracted exposure periods (typically 48 to 96 hours) tested in the laboratory. In the absence of data regarding time-to-toxic event, analyses and latent responses to instantaneous exposure, risk would likely be overestimated.

- For chronic exposure risk assessments, the averaging times considered for exposure are commensurate with the duration of invertebrate life-cycle or fish-early life stage tests (e.g., 21-28 days and 56-60 days, respectively). Response profiles (time to effect and latency of effect) to pesticides likely vary widely with mode of action and species and should be evaluated on a case-by-case basis as available data allow. Nevertheless, because the USEPA relies on chronic exposure toxicity endpoints based on a finding of no observed effect, the potential for any latent toxicity effects or averaging time assumptions to alter the results of an acceptable chronic risk assessment prediction is limited. The extent to which duration of exposure from water-borne concentrations overestimate or underestimate actual exposure depends on several factors. These include the following: localized meteorological conditions, runoff characteristics of the watershed (e.g., soils, topography), the hydrological characteristics of receiving waters, environmental fate of the pesticide active ingredient, and the method of pesticide application. It should also be understood that chronic effects studies are performed using a method that holds water concentration in a steady state. This method is not likely to reflect conditions associated with pesticide runoff. Pesticide concentrations in the field increase and decrease in surface water on a cycle influenced by rainfall, pesticide use patterns, and degradation rates. As a result of the dependency of this assumption on several undefined variables, risk associated with chronic exposure may in some situations underestimate risk and overestimate risk in others.

- There are several other factors that can affect non-target species not considered in the risk assessment process. These would include the following: possible additive or synergistic effects from applying two or more pesticides or additives in a single application, co-location of pesticides in the environment, cumulative effects from pesticides with the same mode of action, effects of multiple stressors (e.g., combination of pesticide exposure, adverse abiotic [not pesticides] and biotic factors), and sub-lethal effects such as behavioral changes induced by exposure to a pesticide. These factors may exist at some level contributing to adverse effects to non-target species, but they are not routinely assessed by regulatory agencies. Therefore, information on the factors is not extensive limiting their value for the risk assessment process. As this type of information becomes available, it would be included, either quantitatively or qualitatively, in this risk assessment process.
- USEPA is required by the Food Quality Protection Act to assess the cumulative risks of pesticides that share common mechanisms of toxicity, or act the same within an organism. Currently, USEPA has identified four groups of pesticides that have a common mechanism of toxicity requiring cumulative risk assessments. These four groups are: the organophosphate insecticides, N-methyl carbamate insecticides, triazine herbicides, and chloroacetanilide herbicides.

7.3 Pesticide Mixtures and Degradates

Pesticide products are usually a formulation of several components generally categorized as active ingredients and inert or other ingredients. The term active ingredient is defined by the FIFRA as preventing, destroying, repelling, or mitigating the effects of a pest, or it is a plant regulator, defoliant, desiccant, or nitrogen stabilizer. In accordance with FIFRA, the active ingredient(s) must be identified by name(s) on the pesticide label along with its relative composition expressed in percentage(s) by weight. In contrast, inert ingredient(s) are not intended to affect a target pest. Their role in the pesticide formulation is to act as a solvent (keep the active ingredient is a liquid phase), an emulsifying or suspending agent (keep the active ingredient from separating out of solution), or a carrier (such as clay in which the active ingredient is impregnated on the clay particle in dry formulations). For example, if isopropyl alcohol would be used as a solvent in a pesticide formulation, then it would be considered an inert ingredient. FIFRA only requires that inert ingredients identified as hazardous and associated percent composition, and the total percentage of all inert ingredients must be declared on a product label. Inert ingredients that are not classified as hazardous are not required to be identified.

The USEPA (September 1997) issued Pesticide Regulation Notice 97-6, which encouraged manufacturers, formulators, producers, and registrants of pesticide products to voluntarily substitute the term "other ingredients" for "inert ingredients" in the ingredient statement. This change recognized that all components in a pesticide formulation potentially could elicit or contribute to an adverse effect on non-target organisms and, therefore, are not necessarily inert. Whether referred to as "inerts" or "other ingredients," these constituents within a pesticide product have the potential to affect species or environmental quality. The USEPA categorizes regulated inert ingredients into the following four lists (http://www.epa.gov/opprd001/inerts/index.html):

- List 1 – Inert Ingredients of Toxicological Concern
- List 2 – Potentially Toxic Inert Ingredients
- List 3 – Inerts of Unknown Toxicity
- List 4 – Inerts of Minimal Toxicity

Several of the List 4 compounds are naturally-occurring earthen materials (e.g., clay materials, simple salts) that would not elicit toxicological response at applied concentrations. However, some of the inerts (particularly the List 3 compounds and unlisted compounds) may have moderate to high potential toxicity to aquatic species based on MSDSs or published data.

Comprehensively assessing potential effects to non-target fish, wildlife, plants, and/or their habitats from pesticide use is a complex task. It would be preferable to assess the cumulative effects from exposure to the active ingredient, its degradates, and inert ingredients as well as other active ingredients in the spray mixture. However, it would only be feasible to conduct deterministic risk assessments for each component in the spray mixture singly. Limited scientific information is available regarding ecological effects (additive or synergistic) from chemical mixtures that typically rely upon broadly encompassing assumptions. For example, the US Forest Service (2005) found that mixtures of pesticides used in land (forest) management likely would not cause additive or synergistic effects to non-target species based upon a review of scientific literature regarding toxicological effects and interactions of agricultural chemicals (ATSDR 2004). Moreover, information on inert ingredients, adjuvants, and degradates is often limited by the availability of and access to reliable toxicological data for these constituents.

Toxicological information regarding "other ingredients" may be available from sources such as the following:

- TOMES (a proprietary toxicological database including USEPA's IRIS, the Hazardous Substance Data Bank, the Registry of Toxic Effects of Chemical Substances [RTECS]).
- USEPA's ECOTOX database, which includes AQUIRE (a database containing scientific papers published on the toxic effects of chemicals to aquatic organisms).
- TOXLINE (a literature searching tool).

- Material Safety Data Sheets (MSDSs) from pesticide suppliers.
- Other sources such as the Farm Chemicals Handbook.

Because there is a lack of specific inert toxicological data, inert(s) in a pesticide may cause adverse ecological effects. However, inert ingredients typically represent only a small percentage of the pesticide spray mixture, and it would be assumed that negligible effects would be expected to result from inert ingredient(s).

Although the potential effects of degradates should be considered when selecting a pesticide, it is beyond the scope of this assessment process to consider all possible breakdown chemicals of the various product formulations containing an active ingredient. Degradates may be more or less mobile and more or less hazardous in the environment than their parent pesticides (Battaglin et al. 2003). Differences in environmental behavior (e.g., mobility) and toxicity between parent pesticides and degradates would make assessing potential degradate effects extremely difficult. For example, a less toxic and more mobile, bioaccumulative, or persistent degradate may have potentially greater effects on species and/or degrade environmental quality. The lack of data on the toxicity of degradates for many pesticides would represent a source of uncertainty for assessing risk.

A USEPA-approved label specifies whether a product can be mixed with one or more pesticides. Without product-specific toxicological data, it would not possible to quantify the potential effects of these mixtures. In addition, a quantitative analysis could only be conducted if reliable scientific information allowed a determination of whether the joint action of a mixture would be additive, synergistic, or antagonistic. Such information would not likely exist unless the mode of action would be common among the chemicals and receptors. Moreover, the composition of and exposure to mixtures would be highly site- and/or time-specific and, therefore, it would be nearly impossible to assess potential effects to species and environmental quality.

To minimize or eliminate potential negative effects associated with applying two or more pesticides as a mixture, the use would be conducted in accordance with the labeling requirements. Labels for two or more pesticides applied as a mixture should be completely reviewed, where products with the least potential for negative effects would be selected for use on the refuge. This is especially relevant when a mixture would be applied in a manner that may already have the potential for an effect(s) associated with an individual pesticide (e.g., runoff to ponds in sandy watersheds). Use of a tank mix under these conditions would increase the level of uncertainty in terms of risk to species or potential to degrade environmental quality.

Adjuvants generally function to enhance or prolong the activity of pesticide. For terrestrial herbicides, adjuvants aid in the absorption into plant tissue. Adjuvant is a broad term that generally applies to surfactants, selected oils, anti-foaming agents, buffering compounds, drift control agents, compatibility agents, stickers, and spreaders. Adjuvants are not under the same registration requirements as pesticides and the USEPA does not register or approve the labeling of spray adjuvants. Individual pesticide labels identify types of adjuvants approved for use with it. In general, adjuvants compose a relatively small portion of the volume of pesticides applied.

Selection of adjuvants with limited toxicity and low volumes would be recommended to reduce the potential for the adjuvant to influence the toxicity of the pesticide.

7.4 Determining Effects to Soil and Water Quality

The approval process for pesticide uses would consider potential to degrade water quality on and off refuge lands. A pesticide can only affect water quality through movement away from the treatment site. After application, pesticide mobilization can be characterized by one or more of the following (Kerle et al. 1996):

- Attach (sorb) to soil, vegetation, or other surfaces and remain at or near the treated area;
- Attach to soil and move off-site through erosion from runoff or wind;
- Dissolve in water that can be subjected to runoff or leaching.

As an initial screening tool, selected chemical characteristics and rating criteria for a pesticide can be evaluated to assess potential to enter ground and/or surface waters. These would include the following: persistence, sorption coefficient (K_{oc}), groundwater ubiquity score (GUS), and solubility.

Persistence, which is expressed as half-life ($t_{½}$), represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially). Persistence in the soil can be categorized as the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et. al. 1996). Half-life data is usually available for aquatic and terrestrial environments.

Another measure of pesticide persistence is dissipation time (DT_{50}). It represents the time required for 50% of the deposited pesticide to degrade and move from a treated site; whereas, half-life describes the rate for degradation only. As for half-life, units of dissipation time are usually expressed in days. Field or foliar dissipation time is the preferred data for use to estimate pesticide concentrations in the environment. However, soil half-life is the most common persistence data cited in published literature. If field or foliar dissipation data is not available, soil half-life data may be used. The average or representative half-life value of most important degradation mechanism will be selected for quantitative analysis for both terrestrial and aquatic environments.

Mobility of a pesticide is a function of how strongly it is adsorbed to soil particles and organic matter, its solubility in water, and its persistence in the environment. Pesticides strongly adsorbed to soil particles, relatively insoluble in water, and not environmentally persistent would be less likely to move across the soil surface into surface waters or to leach through the soil profile and contaminate groundwater. Conversely, pesticides that are not strongly adsorbed to soil particles, are highly water soluble, and are persistent in the environment would have greater potential to move from the application site (off-site movement).

The degree of pesticide adsorption to soil particles and organic matter (Kerle et. al. 1996) is expressed as the soil adsorption coefficient (K_{oc}). The soil adsorption coefficient is measured as micrograms of pesticide per gram of soil (µg/g) that can range from near zero to the thousands. Pesticides with higher K_{oc} values are strongly sorbed to soil and, therefore, would be less subject to movement.

Water solubility describes the amount of pesticide that will dissolve in a known quantity of water. The water solubility of a pesticide is expressed as milligrams of pesticide dissolved in a liter of water (mg/L or parts per million [ppm]). Pesticide with solubility <0.1 ppm are virtually insoluble in water, 100-1000 ppm are moderately soluble, and >10,000 ppm highly soluble (US Geological Survey 2000). As pesticide solubility increases, there would be greater potential for off-site movement.

The Groundwater Ubiquity Score (GUS) is a quantitative screening tool to estimate a pesticide's potential to move in the environment. It utilizes soil persistence and adsorption coefficients in the following formula.

$$GUS = \log_{10} (t_{½}) \text{ x } [4 - \log_{10} (K_{oc})]$$

The potential pesticide movement rating would be based upon its GUS value. Pesticides with a GUS <0.1 would considered to have an extremely low potential to move toward groundwater. Values of 1.0-2.0 would be low, 2.0-3.0 would be moderate, 3.0-4.0 would be high, and >4.0 would have a very high potential to move toward groundwater.

Water solubility describes the amount of pesticide dissolving in a specific quantity of water, where it is usually measured as mg/L or ppm. Solubility is useful as a comparative measure because pesticides with higher values are more likely to move by runoff or leaching. GUS, water solubility, $t_{½}$, and K_{oc} values are available for selected pesticides from the OSU Extension Pesticide Properties Database at http://npic.orst.edu/ppdmove.htm. Many of the values in this database were derived from the SCS/ARS/CES Pesticide Properties Database for Environmental Decision Making (Wauchope et al. 1992).

Soil properties influence the fate of pesticides in the environment. The following six properties are mostly likely to affect pesticide degradation and the potential for pesticides to move off-site by leaching (vertical movement through the soil) or runoff (lateral movement across the soil surface).

- Permeability is the rate of water movement vertically through the soil. It is affected by soil texture and structure. Coarse textured soils (e.g., high sand content) have a larger pore size and they are generally more permeable than fine textured soils (i.e., high clay content). The more permeable soils would have a greater potential for pesticides to move vertically down through the soil profile. Soil permeability rates (inches/hour) are usually available in county soil survey reports.

- Soil texture describes the relative percentage of sand, silt, and clay. In general, greater clay content with smaller the pore size would lower the likelihood and rate water that would move through the soil profile. Clay also serves to adsorb (bind) pesticides to soil particles. Soils with high clay content would adsorb more pesticide than soils with relatively low clay content. In contrast, sandy soils with coarser texture and lower water holding capacity would have a greater potential for water to leach through them.

- Soil structure describes soil aggregation. Soils with a well-developed soil structure have looser, more aggregated, structure that would be less likely to be compacted. Both characteristics would allow for less restricted flow of water through the soil profile resulting in greater infiltration.

- Organic matter would be the single most important factor affecting pesticide adsorption in soils. Many pesticides are adsorbed to organic matter which would reduce their rate of downward movement through the soil profile. Also, soils high in organic matter would tend to hold more water, which may make less water available for leaching.

- Soil moisture affects how fast water would move through the soil. If soils are already wet or saturated before rainfall or irrigation, excess moisture would runoff rather than infiltrate into the soil profile. Soil moisture also would influence microbial and chemical activity in soil, which effects pesticide degradation.

- Soil pH would influence chemical reactions that occur in the soil which in turn determines whether or not a pesticide will degrade, rate of degradation, and, in some instances, which degradation products are produced.

Based upon the aforementioned properties, soils most vulnerable to groundwater contamination would be sandy soils with low organic matter. In contrast, the least vulnerable soils would be well-drained clayey soils with high organic matter. Consequently, pesticides with the lowest potential for movement in conjunction with appropriate best management practices (see below) would be used in an IPM framework to treat pests while minimizing effects to non-target biota and protecting environmental quality.

Along with soil properties, the potential for a pesticide to affect water quality through runoff and leaching would consider site-specific environmental and abiotic conditions including rainfall, water table conditions, and topography (Huddleston 1996).

- Water is necessary to separate pesticides from soil. This can occur in two basic ways. Pesticides that are soluble move easily with runoff water. Pesticide-laden soil particles can be dislodged and transported from the application site in runoff. The concentration of pesticides in the surface runoff would be greatest for the first runoff event following treatment. The rainfall intensity and route of water infiltration into soil, to a large extent, determine pesticide concentrations and losses in surface runoff. The timing of the rainfall after application also would have an effect. Rainfall interacts with pesticides at a shallow soil depth (¼ to ½ inch), which is called the mixing zone (Baker and Miller 1999). The pesticide/water mixture in the mixing zone would tend to leach down into the soil or runoff depending upon how quickly the soil surface becomes saturated and how rapidly water can infiltrate into the soil. Leaching would decrease the amount of pesticide available near the soil surface (mixing zone) to runoff during the initial rainfall event following application and subsequent rainfall events.

- Terrain slope would affect the potential for surface runoff and the intensity of runoff. Steeper slopes would have greater potential for runoff following a rainfall event. In contrast, soils that are relatively flat would have little potential for runoff, except during intense rainfall events. In addition, soils in lower areas would be more susceptible to leaching as a result of receiving excessive water from surrounding higher elevations.

- Depth to groundwater would be an important factor affecting the potential for pesticides to leach into groundwater. If the distance from the soil surface to the top of the water table is shallow, pesticides would have less distance to travel to reach groundwater. Shallower water tables that persist for longer periods would be more likely to experience groundwater contamination. Soil survey reports are available for individual counties. These reports provide data in tabular format regarding the water table depths and the months during which it is persists. In some situations, a hard pan exists above the water table that would prevent pesticide contamination from leaching.

7.5 Determining Effects to Air Quality

Pesticides may volatilize from soil and plant surfaces and move from the treated area into the atmosphere. The potential for a pesticide to volatilize is determined by the pesticide's vapor pressure which would be affected by temperature, sorption, soil moisture, and the pesticide's water solubility. Vapor pressure is often expressed in mm Hg. To make these numbers easier to compare, vapor pressure may be expressed in exponent form ($I \times 10^{-7}$), where I represents a vapor pressure index. In general, pesticides with $I<10$ would have a low potential to volatilize; whereas, pesticides with $I>1,000$ would have a high potential to volatilize (Oregon State University 1996). Vapor pressure values for pesticides are usually available in the pesticide product MSDS or the USDA Agricultural Research Service (ARS) pesticide database.

7.6 Preparing a Chemical Profile

The following instructions would be used by Service personnel to complete Chemical Profiles for pesticides. Specifically, profiles would be prepared for pesticide active ingredients (e.g., glyphosate, imazapic) that would be contained in one or more trade name products that are registered and labeled with USEPA. All information fields under each category (e.g., Toxicological Endpoints, Environmental Fate) would be completed for a Chemical Profile. If no information is available for a specific field, then "No data is available in references" would be recorded in the profile. Available scientific information would be used to complete Chemical Profiles. Each entry of scientific information would be shown with applicable references.

Completed Chemical Profiles would provide a structured decision-making process utilizing quantitative assessment/screening tools with threshold values (where appropriate) that would be used to evaluate potential biological and other environmental effects to refuge resources. For ecological risk assessments presented in these profiles, the "worst-case scenario" would be evaluated to determine whether a pesticide could be approved for use considering the maximum single application rate specified on pesticide labels for habitat management and croplands/facilities maintenance treatments pertaining to refuges. Where the "worst-case scenario" likely would only result in minor, temporary, and localized effects to listed and non-listed species with appropriate BMPs (see Section 5.0), the proposed pesticide's use in a PUP would have a scientific basis for approval under any application rate specified on the label that is at or below rates evaluated in a Chemical Profile. In some cases, the Chemical Profile would include a lower application rate than the maximum labeled rate in order to protect refuge resources. As necessary, Chemical Profiles would be periodically updated with new scientific information or as pesticides with the same active ingredient are proposed for use on the refuge in PUPs.

Throughout this section, threshold values (to prevent or minimize potential biological and environmental effects) would be clearly identified for specific information presented in a completed Chemical Profile. Comparison with these threshold values provides an explicit scientific basis to approve or disapprove PUPs for habitat management and cropland/facilities maintenance on refuge lands. In general, PUPs would be approved for pesticides with Chemical Profiles where there would be no exceedances of threshold values. However, BMPs are identified for some screening tools that would minimize/eliminate potential effects (exceedance of the threshold value) as a basis for approving PUPs.

Date: Service personnel would record the date when the Chemical Profile is completed or updated. Chemical Profiles (e.g., currently approved pesticide use patterns) would be periodically reviewed and updated, as necessary. The most recent review date would be recorded on a profile to document when it was last updated.

Trade Name(s): Service personnel would accurately and completely record the trade name(s) from the pesticide label, which includes a suffix that describes the formulation (e.g., WP, DG, EC, L, SP, I, II or 64). The suffix often distinguishes a specific product among several pesticides with the same active ingredient. Service personnel would record a trade name for each pesticide product with the same active ingredient.

Common chemical name(s): Service personnel would record the common name(s) listed on the pesticide label or material safety data sheet (MSDS) for an active ingredient. The common name of a pesticide is listed as the active ingredient on the title page of the product label immediately following the trade name, and the MSDS, Section 2: Composition/ Information on Ingredients. A Chemical Profile is completed for each active ingredient.

Pesticide Type: Service personnel would record the type of pesticide for an active ingredient as one of the following: herbicide, dessicant, fungicide, fumigant, growth regulator, insecticide, pisicide, or rodenticide.

EPA Registration Number(s): This number (EPA Reg. No.) appears on the title page of the label and MSDS, Section 1: Chemical Product and Company Description. It is not the EPA Establishment Number that is usually located near it. Service personnel would record the EPA Reg. No. for each trade name product with an active ingredient based upon PUPs.

Pesticide Class: Service personnel would list the general chemical class for the pesticide (active ingredient). For example, malathion is an organophosphate and carbaryl is a carbamate.

CAS (Chemical Abstract Service) Number: This number is often located in the second section (Composition/Information on Ingredients) of the MSDS. The MSDS table listing components usually contains this number immediately prior to or following the % composition.

Other Ingredients: From the most recent MSDS for the proposed pesticide product(s), Service personnel would include any chemicals in the pesticide formulation not listed as an active ingredient that are described as toxic or hazardous, or regulated under the Superfund Amendments and Reauthorization Act (SARA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Toxic Substances Control Act (TSCA), Occupational Safety and Health Administration (OSHA), State Right-to-Know, or other listed authorities. These are usually found in MSDS sections titled "Hazardous Identifications", "Exposure Control/Personal Protection", and "Regulatory Information". If concentrations of other ingredients are available for any compounds identified as toxic or hazardous, then Service personnel would record this information in the Chemical Profile by trade name. MSDS(s) may be obtained from the manufacturer, manufacturer's website or from an on-line database maintained by Crop Data Management Systems, Inc. (see list below).

Toxicological Endpoints

Toxicological endpoint data would be collected for acute and chronic tests with mammals, birds, and fish. Data would be recorded for species available in the scientific literature. If no data are found for a particular taxonomic group, then "No data available is references" would be recorded as the data entry. Throughout the Chemical Profile, references (including toxicological endpoint data) would be cited using parentheses (#) following the recorded data.

Mammalian LD_{50}: For test species in the scientific literature, Service personnel would record available data for oral lethal dose (LD_{50}) in mg/kg-bw (body weight) or ppm-bw. Most common test species in scientific literature are the rat and mouse. The lowest LD_{50} value found for a rat would be used as a toxicological endpoint for dose-based RQ calculations to assess acute risk to mammals (see Table 1 in Section 7.1).

Mammalian LC_{50}: For test species in the scientific literature, Service personnel would record available data for dietary lethal concentration (LC_{50}) as reported (e.g., mg/kg-diet or ppm-diet). Most common test species in scientific literature are the rat and mouse. The lowest LC_{50} value found for a rat would be used as a toxicological endpoint for diet-based RQ calculations to assess acute risk (see Table 1 in Section 7.1).

Mammalian Reproduction: For test species listed in the scientific literature, Service personnel would record the test results (e.g., Lowest Observed Effect Concentration [LOEC], Lowest Observed Effect Level [LOEL], No Observed Adverse Effect Level [NOAEL], No Observed Adverse Effect Concentration [NOAEC]) in mg/kg-bw or mg/kg-diet for reproductive test procedure(s) (e.g., generational studies [preferred], fertility, new born weight). Most common test species available in scientific literature are rats and mice. The lowest NOEC, NOAEC, NOEL, or NOAEL test results found for a rat would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table 1 in Section 7.1).

Avian LD_{50}: For test species available in the scientific literature, Service personnel would record values for oral lethal dose (LD_{50}) in mg/kg-bw or ppm-bw. Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest LD_{50} value found for an avian species would be used as a toxicological endpoint for dose-based RQ calculations to assess acute risk (see Table 1 in Section 7.1).

Avian LC_{50}: For test species available in the scientific literature, Service personnel would record values for dietary lethal concentration (LC_{50}) as reported (e.g., mg/kg-diet or ppm-diet). Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest LC_{50} value found for an avian species would be used as a toxicological endpoint for dietary-based RQ calculations to assess acute risk (see Table 1 in Section 7.1).

Avian Reproduction: For test species available in the scientific literature, Service personnel would record test results (e.g., LOEC, LOEL, NOAEC, NOAEL) in mg/kg-bw or mg/kg-diet consumed for reproductive test procedure(s) (e.g., early life cycle, reproductive). Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest NOEC, NOAEC, NOEL, or NOAEL test results found for an avian species would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table 1 in Section 7.1).

Fish LC_{50}: For test freshwater or marine species listed in the scientific literature, Service personnel would record a LC_{50} in ppm or mg/L. Most common test species available in the scientific literature are the bluegill, rainbow trout, and fathead minnow (marine). Test results for many game species may also be available. The lowest LC_{50} value found for a freshwater fish species would be used as a toxicological endpoint for RQ calculations to assess acute risk (see Table 1 in Section 7.1).

Fish Early Life Stage (ELS)/Life Cycle: For test freshwater or marine species available in the scientific literature, Service personnel would record test results (e.g., LOEC, NOAEL, NOAEC, LOAEC) in ppm for test procedure(s) (e.g., early life cycle, life cycle). Most common test species available in the scientific literature are bluegill, rainbow trout, and fathead minnow. Test results for other game species may also be available. The lowest test value found for a fish species (preferably freshwater) would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table 1 in Section 7.1).

Other: For test invertebrate as well as non-vascular and vascular plant species available in the scientific literature, Service personnel would record LC_{50}, LD_{50}, LOEC, LOEL, NOAEC, NOAEL, or EC_{50} (environmental concentration) values in ppm or mg/L. Most common test invertebrate species available in scientific literature are the honey bee and the water flea (*Daphnia magna*). Green algae (*Selenastrum capricornutum*) and pondweed (*Lemna minor*) are frequently available test species for aquatic non-vascular and vascular plants, respectively.

Ecological Incident Reports: After a site has been treated with pesticide(s), wildlife may be exposed to these chemical(s). When exposure is high relative to the toxicity of the pesticides, wildlife may be killed or visibly harmed (incapacitated). Such events are called ecological incidents. The USEPA maintains a database (Ecological Incident Information System) of ecological incidents. This database stores information extracted from incident reports submitted by various federal and state agencies and non-government organizations. Information included in an incident report is date and location of the incident, type and magnitude of effects observed in various species, use(s) of pesticides known or suspected of contributing to the incident, and results of any chemical residue and cholinesterase activity analyses conducted during the investigation.

Incident reports can play an important role in evaluating the effects of pesticides by supplementing quantitative risk assessments. All incident reports for pesticide(s) with the active ingredient and associated information would be recorded.

Environmental Fate

Water Solubility: Service personnel would record values for water solubility (S_w), which describes the amount of pesticide that dissolves in a known quantity of water. S_w is expressed as mg/L (ppm). Pesticide S_w values would be categorized as one of the following: insoluble <0.1 ppm, moderately soluble = 100 to 1000 ppm, highly soluble >10,000 ppm (US Geological Survey 2000). As pesticide S_w increases, there would be greater potential to degrade water quality through runoff and leaching.

Sw would be used to evaluate potential for bioaccumulation in aquatic species [see **Octanol-Water Partition Coefficient (K_{ow})** below].

Soil Mobility: Service personnel would record available values for soil adsorption coefficient (K_{oc} [µg/g]). It provides a measure of a chemical's mobility and leaching potential in soil. K_{oc} values are directly proportional to organic content, clay content, and surface area of the soil. K_{oc} data for a pesticide may be available for a variety of soil types (e.g., clay, loam, sand).

K_{oc} values would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below).

Soil Persistence: Service personnel would record values for soil half-life ($t_{½}$), which represents the length of time (days) required for 50% of the deposited pesticide to degrade (completely or partially) in the soil. Based upon the $t_{½}$ value, soil persistence would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et. al. 1996).

Threshold for Approving PUPs:

If soil $t_{½}$ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.

If soil $t_{½}$ >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Along with K_{oc}, soil $t_{½}$ values would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below).

Soil Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade and move from a treated site; whereas, soil $t_{½}$ describes the rate for degradation only. As for $t_{½}$, units of dissipation time are usually expressed in days. Field dissipation time would be the preferred data for use to estimate pesticide concentrations in the environment because it is based upon field studies compared to soil $t_{½}$, which is derived in a laboratory. However, soil $t_{½}$ is the most common persistence data available in the published literature. If field dissipation data is not available, soil half-life data would be used in a Chemical Profile. The average or representative half-life value of most important degradation mechanism would be selected for quantitative analysis for both terrestrial and aquatic environments.

Based upon the DT_{50} value, environmental persistence in the soil also would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days.

Threshold for Approving PUPs:

If soil DT_{50} ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.
If soil DT_{50} >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Along with K_{oc}, soil DT_{50} values (preferred over soil $t_{½}$) would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below), if available.

Aquatic Persistence: Service personnel would record values for aquatic $t_{½}$, which represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially) in water. Based upon the $t_{½}$ value, aquatic persistence would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et. al. 1996).

Threshold for Approving PUPs:

If aquatic $t_{½}$ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.
If aquatic $t_{½}$ >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Aquatic Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade or move (dissipate); whereas, aquatic $t_{½}$ describes the rate for degradation only. As for $t_{½}$, units of dissipation time are usually expressed in days. Based upon the DT_{50} value, environmental persistence in aquatic habitats also would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days.

Threshold for Approving PUPs:

If aquatic DT_{50} ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.
If aquatic DT_{50} >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*

- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Potential to Move to Groundwater: Groundwater Ubiquity Score (GUS) = $\log_{10}$(soil t ½) x [4 – $\log_{10}(K_{oc})$]. If a DT_{50} value is available, it would be used rather than a t ½ value to calculate a GUS score. Based upon the GUS value, the potential to move toward groundwater would be recorded as one of the following categories: extremely low potential<1.0, low - 1.0 to 2.0, moderate - 2.0 to 3.0, high - 3.0 to 4.0, or very high>4.0.

Threshold for Approving PUPs:

If GUS ≤4.0, then a PUP would be approved without additional BMPs to protect water quality. If GUS >4.0, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Volatilization: Pesticides may volatilize (evaporate) from soil and plant surfaces and move off-target into the atmosphere. The potential for a pesticide to volatilize is a function of its vapor pressure that is affected by temperature, sorption, soil moisture, and the pesticide's water solubility. Vapor pressure is often expressed in mm Hg. To make these values easier to compare, vapor pressure would be recorded by Service personnel in exponential form ($I \times 10^{-7}$), where I represents a vapor pressure index. In general, pesticides with I<10 would have low potential to volatilize; whereas, pesticides with I >1,000 would have a high potential to volatilize (Oregon State University 1996). Vapor pressure values for pesticides are usually available in the pesticide product MSDS or the USDA Agricultural Research Service (ARS) pesticide database (see **References**).

Threshold for Approving PUPs:

If I ≤1,000, then a PUP would be approved without additional BMPs to minimize drift and protect air quality.
If I >1,000, then a PUP would only be approved with additional BMPs specifically to minimize drift and protect air quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to reduce volatilization and potential to drift and degrade air quality:*

- *Do not treat when wind velocities are <2 or >10 mph with existing or potential inversion conditions.*
- *Apply the large-diameter droplets possible for spray treatments.*
- *Avoid spraying when air temperatures >85°F.*
- *Use the lowest spray height possible above target canopy.*
- *Where identified on the pesticide label, soil incorporate pesticide as soon as possible during or after application.*

Octanol-Water Partition Coefficient (K_{ow}): The octanol-water partition coefficient (K_{ow}) is the concentration of a pesticide in octanol and water at equilibrium at a specific temperature. Because octanol is an organic solvent, it is considered a surrogate for natural organic matter. Therefore, K_{ow} would be used to assess potential for a pesticide to bioaccumulate in tissues of aquatic species (e.g., fish). If K_{ow} >1,000 or S_w<1 mg/L and soil $t_{½}$>30 days, then there would be high potential for a pesticide to bioaccumulate in aquatic species such as fish (US Geological Survey 2000).

Threshold for Approving PUPs:

If there is not a high potential for a pesticide to bioaccumulate in aquatic species, then the PUP would be approved.
If there is a high potential to bioaccumulate in aquatic species (K_{ow}>1,000 or S_w<1 mg/L and soil $t_{½}$>30 days), then the PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

Bioaccumulation/Bioconcentration: The physiological process where pesticide concentrations in tissue would increase in biota because they are taken and stored at a faster rate than they are metabolized or excreted. The potential for bioaccumulation would be evaluated through bioaccumulation factors (BAFs) or bioconcentration factors (BCFs). Based upon BAF or BCF values, the potential to bioaccumulate would be recorded as one of the following: low – 0 to 300, moderate – 300 to 1,000, or high >1,000 (Calabrese and Baldwin 1993).

Threshold for Approving PUPs:

If BAF or BCF≤1,000, then a PUP would be approved without additional BMPs.
If BAF or BCF>1,000, then a PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

Worst-Case Ecological Risk Assessment

Max Application Rates (acid equivalent): Service personnel would record the highest application rate of an active ingredient (ae basis) for habitat management and cropland/facilities maintenance treatments in this data field of a Chemical Profile. These rates can be found in Table CP.1 under the column heading “Max Product Rate – Single Application (lbs/acre – AI on acid equiv basis)". This table would be prepared for a Chemical Profile from information specified in labels for trade name products identified in PUPs. If these data are not available in pesticide labels, then write "NS" for "not specified on label" in this table.

EECs: An estimated environmental concentration (ECC) represents potential exposure to fish and wildlife (birds and mammals) from using a pesticide. EECs would be derived by Service personnel using an USEPA screening-level approach (US Environmental Protection Agency 2004). For each max application rate [see description under **Max Application Rates (acid equivalent)**], Service personnel would record 2 EEC values in a Chemical Profile; these would represent the worst-case terrestrial and aquatic exposures for habitat management and croplands/facilities maintenance treatments. For terrestrial and aquatic EEC calculations, see description for data entry under **Presumption of Unacceptable Risk/Risk Quotients**, which is the next field for a Chemical Profile.

Presumption of Unacceptable Risk/Risk Quotients: Service personnel would calculate and record acute and chronic risk quotients (RQs) for birds, mammals, and fish using the provided tabular formats for habitat management and/or cropland/facilities maintenance treatments. RQs recorded in a Chemical Profile would represent the worst-case assessment for ecological risk. See Section 7.2 for discussion regarding the calculations of RQs.

For aquatic assessments associated with habitat management treatments, RQ calculations would be based upon selected acute and chronic toxicological endpoints for fish and the EEC would be derived from Urban and Cook (1986) assuming 100% overspray to an entire 1-foot deep water body using the max application rate (ae basis [see above]).

For aquatic assessments associated with cropland/facilities maintenance treatments, RQ calculations would be done by Service personnel based upon selected acute and chronic toxicological endpoints for fish and an EEC would be derived from the aquatic assessment in AgDRIFT® model version 2.01 under Tier I ground-based application with the following input variables: max application rate (acid basis [see above]), low boom (20 inches), fine to medium/coarse droplet size, 20 swaths, EPA-defined wetland, and 25-foot distance (buffer) from treated area to water.

See Section 7.2.1.2 for more details regarding the calculation of EECs for aquatic habitats for habitat management and cropland/facilities maintenance treatments.

For terrestrial avian and mammalian assessments, RQ calculations would be done by Service personnel based upon dietary exposure, where the "short grass" food item category would represent the worst-case scenario. For terrestrial spray applications associated with habitat management and cropland/facilities maintenance treatments, exposure (EECs and RQs) would be determined using the Kanaga nomogram method through the USEPA's T-REX version 1.2.3. T-REX input variables would include the following: max application rate (acid basis [see above]) and pesticide half-life (days) in soil to estimate the initial, maximum pesticide residue concentration on general food items for terrestrial vertebrate species in short (<20 cm tall) grass.

For granular pesticide formulations and pesticide-treated seed with a unique route of exposure for terrestrial avian and mammalian wildlife, see Section 7.2.1.1.2 for the procedure that would be used to calculate RQs.

All calculated RQs in both tables would be compared with Levels of Concern (LOCs) established by USEPA (see Table 2 in Section 7.2). If a calculated RQ exceeds an established LOC value (in brackets inside the table), then there would be a potential for an acute or chronic effect (unacceptable risk) to federally listed (T&E) species and nonlisted species. See Section 7.2 for detailed descriptions of acute and chronic RQ calculations and comparison to LOCs to assess risk.

Threshold for approving PUPs:

If RQs≤LOCs, then a PUP would be approved without additional BMPs.
If RQs>LOCs, then a PUP would only be approved with additional BMPs specifically to minimize exposure (ecological risk) to bird, mammal, and/or fish species. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs) section** *to reduce potential risk to non-listed or listed species:*

- *Lower application rate and/or fewer number of applications so RQs≤LOCs*
- *For aquatic assessments (fish) associated with cropland/facilities maintenance, increase the buffer distance beyond 25 feet so RQs≤LOCs.*

Justification for Use: Service personnel would describe the reason for using the pesticide based control of specific pests or groups of pests. In most cases, the pesticide label will provide the appropriate information regarding control of pests to describe in the section.

Specific Best Management Practices (BMPs): Service personnel would record specific BMPs necessary to minimize or eliminate potential effects to non-target species and/or degradation of environmental quality from drift, surface runoff, or leaching. These BMPs would be based upon scientific information documented in previous data fields of a Chemical Profile. Where necessary and feasible, these specific practices would be included in PUPs as a basis for approval.

If there are no specific BMPs that are appropriate, then Service personnel would describe why the potential effects to refuge resources and/or degradation of environmental quality is outweighed by the overall resource benefit(s) from the proposed pesticide use in the BMP section of the PUP. See Section 4.0 of this document for a complete list of BMPs associated with mixing and applying pesticides appropriate for all PUPs with ground-based treatments that would be additive to any necessary, chemical-specific BMPs.

References: Service personnel would record scientific resources used to provide data/information for a chemical profile. Use the number sequence to uniquely reference data in a chemical profile.

The following on-line data resources are readily available for toxicological endpoint and environmental fate data for pesticides:

1. California Product/Label Database. Department of Pesticide Regulation, California Environmental Protection Agency. (http://www.cdpr.ca.gov/docs/label/labelque.htm#regprods)

2. ECOTOX database. Office of Pesticide Programs, US Environmental Protection Agency, Washington, DC. (http://cfpub.epa.gov/ecotox/)

3. Extension Toxicology Network (EXTOXNET) Pesticide Information Profiles. Cooperative effort of University of California-Davis, Oregon State University, Michigan State University, Cornell University and University of Idaho through Oregon State University, Corvallis, Oregon. (http://extoxnet.orst.edu/pips/ghindex.html)

4. FAO specifications and evaluations for plant protection products. Pesticide Management Unit, Plant Protection Services, Food and Agriculture Organization, United Nations. (http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPP/Pesticid/)

5. Human health and ecological risk assessments. Pesticide Management and Coordination, Forest Health Protection, US Department of Agriculture, US Forest Service. (http://www.fs.fed.us/foresthealth/pesticide/risk.htm)

6. Pesticide Chemical Fact Sheets. Clemson University Pesticide Information Center. (http://entweb.clemson.edu/pesticid/Document/Labels/factshee.htm)

7. Pesticide Fact Sheets. Published by Information Ventures, Inc. for Bureau of Land Management, Department of Interior; Bonneville Power Administration, U.S. Department of Energy; and Forest Service, US Department of Agriculture. (http://infoventures.com/e-hlth/pesticide/pest-fac.html)

8. Pesticide Fact Sheets. National Pesticide Information Center. (http://npic.orst.edu/npicfact.htm)

9. Pesticide Fate Database. US Environmental Protection Agency, Washington, DC. (http://cfpub.epa.gov/pfate/home.cfm).

10. Pesticide product labels and material safety data sheets. Crop Data Management Systems, Inc. (CDMS) (http://www.cdms.net/pfa/LUpdateMsg.asp) or multiple websites maintained by agrichemical companies.

11. Registered Pesticide Products (Oregon database). Oregon Department of Agriculture. (http://www.oda.state.or.us/dbs/pest_products/search.lasso)

12. Regulatory notes. Pest Management Regulatory Agency, Health Canada, Ontario, Canada. (http://www.hc-sc.gc.ca/pmra-arla/)

13. Reptile and Amphibian Toxicology Literature. Canadian Wildlife Service, Environment Canada, Ontario, Canada. (http://www.cws-scf.ec.gc.ca/nwrc-cnrf/ratl/index_e.cfm)

14. Specific Chemical Fact Sheet – New Active Ingredients, Biopesticide Fact Sheet and Registration Fact Sheet. U.S Environmental Protection Agency, Washington, DC. (http://www.epa.gov/pestidides/factsheets/chemical_fs.htm)

15. Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas. The Invasive Species Initiative. The Nature Conservancy. (http://tnsweeds.ucdavis.edu/handbook.html)

16. Wildlife Contaminants Online. US Geological Survey, Department of Interior, Washington, D.C. (http://www.pwrc.usgs.gov/contaminants-online/)

17. One-liner database. 2000. US Environmental Protection Agency, Office of Pesticide Programs, Washington, D.C.

Chemical Profile

Date:			
Trade Name(s):		**Common Chemical Name(s):**	
Pesticide Type:		**EPA Registration Number:**	
Pesticide Class:		**CAS Number:**	
Other Ingredients:			

Toxicological Endpoints

Mammalian LD_{50}:	
Mammalian LC_{50}:	
Mammalian Reproduction:	
Avian LD_{50}:	
Avian LC_{50}:	
Avian Reproduction:	
Fish LC_{50}:	
Fish ELS/Life Cycle:	
Other:	

Ecological Incident Reports

Environmental Fate

Water solubility (S_w):	
Soil Mobility (K_{oc}):	
Soil Persistence ($t_{½}$):	
Soil Dissipation (DT_{50}):	
Aquatic Persistence ($t_{½}$):	
Aquatic Dissipation (DT_{50}):	
Potential to Move to Groundwater (GUS score):	
Volatilization (mm Hg):	
Octanol-Water Partition Coefficient (K_{ow}):	
Bioaccumulation/Biocentration:	**BAF:`** **BCF:**

Worst Case Ecological Risk Assessment

Max Application Rate (ai lbs/acre – ae basis)	**Habitat Management:** **Croplands/Facilities Maintenance:**
EECs	**Terrestrial (Habitat Management):** **Terrestrial (Croplands/Facilities Maintenance):** **Aquatic (Habitat Management):** **Aquatic (Croplands/Facilities Maintenance):**

Habitat Management Treatments:

Presumption of Unacceptable Risk		**Risk Quotient (RQ)**	
		Listed (T&E) Species	**Nonlisted Species**
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]

	Mammals	[1]	[1]
	Fish	[1]	[1]

Cropland/Facilities Maintenance Treatments:

Presumption of Unacceptable Risk		**Risk Quotient (RQ)**	
		Listed (T&E) Species	**Nonlisted Species**
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]
	Mammals	[1]	[1]
	Fish	[1]	[1]

Justification for Use:	
Specific Best Management Practices (BMPs):	
References:	

Table CP.1 Pesticide Name

Trade Name[a]	Treatment Type[b]	Max Product Rate – Single Application (lbs/acre or gal/acre)	Max Product Rate - Single Application (lbs/acre - AI on acid equiv basis)	Max Number of Applications Per Season	Max Product Rate Per Season (lbs/acre/season or gal/acre/season)	Minimum Time Between Applications (Days)

[a]From each label for a pesticide identified in pesticide use proposals (PUPs), Service personnel would record application information associated with possible/known uses on Service lands.

[b]Treatment type: H – habitat management or CF – cropland/facilities maintenance. If a pesticide is labeled for both types of treatments (uses), then record separate data for H and CF applications.

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Appendix 3
Draft Compatibility Determination for Haying and Grazing, Grays Lake NWR

Draft Compatibility Determination

Title

Draft Compatibility Determination for Grazing and Haying, Grays Lake National Wildlife Refuge.

Refuge Use Category

Agriculture, Aquaculture, and Silviculture

Refuge Use Type(s)

Grazing. The feeding on vegetation by domestic livestock. This includes trailing and watering of livestock.

Haying or ensilage. The cutting or mowing of vegetation for fodder.

Refuge

Grays Lake National Wildlife Refuge

Refuge Purpose(s) and Establishing and Acquisition Authority(ies)

" ... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act).

" ... suitable for -- (1 l incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." 16 U.S.C. § 46Ok-1 (Refuge Recreation Act).

National Wildlife Refuge System Mission

The mission of the National Wildlife Refuge System, otherwise known as Refuge System, is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (Pub. L. 105-57; 111 Stat. 1252).

Description of Use

Is this an existing use?

Yes. This compatibility determination (CD) updates and replaces the 1994 compatibility determinations for grazing and haying. This CD has been prepared in conjunction with the draft Grays Lake National Wildlife Refuge Meadow and Upland Complex Habitat Management Plan (HMP) and associated draft Environmental Assessment.

What is the use?

Grays Lake National Wildlife Refuge (Refuge) will allow grazing and haying, to be conducted by permittees under Cooperative Agriculture Agreements (CAA), for the purpose of habitat management. Cooperative agriculture is when a person or entity uses agricultural practices on National Wildlife Refuge System (NWRS or Refuge System) lands in support of objectives for target species or their associated habitats that represent the biological outcomes the U.S. Fish and Wildlife Service (USFWS or Service) desires, and there is substantial involvement (i.e., collaboration, participation, or intervention) between the Service and the person or entity. The Service uses CAAs as the legal instruments to formalize the cooperative agreement between the Service and the cooperator. CAAs describe the objectives, roles, responsibilities, terms, and conditions of cooperative agriculture on Refuge System land and must be documented on a Commercial Activities Special Use Permit (SUP), Form 3-1383-C.

Is the use a priority public use?

No

Where would the use be conducted?

Through 2030, grazing under CAAs would occur on 1,509 acres of meadow habitats located on the east and south ends of Grays Lake marsh to improve or maintain grassland and wet meadow habitat for Refuge focal species. After 2030, grazing under CAAs would occur on 1,834 acres (due to expiration of a warranty deed and Memorandum of Agreement, and conversion to management under CAAs).

More specifically, grazing under CAAs would occur on the Willow Creek, Hawkins Creek, southern two-thirds of the 40s (Center 40 and South 40), Cecil Sibbett, Lakefront, Peterson, John Muir, County Line, Kackley, Beavertail Pond, and Turner management units (see map). Sibbett North and 78 acres of Sibbett South are currently grazed by a warranty deed holder through 2030. Boathouse, the portion of Ewart west of Grays Lake Road, and northern third of the 40s (North 40) units (approximately 144 acres total) are grazed by the warranty deed holder of the Sibbett units under a Memorandum of Agreement (MOA) with the Service, to allow for riparian restoration on the Sibbett South unit. After this warranty deed and MOA expire, grazing on the Sibbett North, Sibbett South, Boathouse, Ewart, and North 40 units would be managed under CAAs as described in “How Would the Use Be Conducted” below.

Grazing would continue to be excluded on the Ayers, Cinder Knoll, and South Pasture management units, and the portion of Ewart east of Grays Lake Road ("Hillside"). Grazing on the Big Bend, Big Corral, Collins, and Rich Riley management units would be discontinued by the 2023 grazing season. Although the warranty deed holder for the Sibbett Hill unit retains the right to graze this unit through 2030, it is currently ungrazed and would be retired from grazing after 2030.

Haying by permittees under CAAs would primarily occur on 1,884 acres of xeric and mesic meadows located on the north end of Grays Lake marsh in order to provide dense, short-grass conditions for Refuge focal species. More specifically, haying would occur on the Ayers, Collins, Big Corral, Big Bend, Rich Riley, Cinder Knoll, and South Pasture management units (see map). In addition, haying could occur on any of the management units identified for grazing should grazing not remove enough unwanted biomass.

When would the use be conducted?

Livestock grazing would occur on specified meadows during the summer and fall months (June 10-September 30). End dates for grazing may vary annually depending on environmental conditions and pasture utilization to meet objectives as determined by refuge staff (see Stipulations to Ensure Compatibility). Haying would occur after the waterfowl nesting season (August 30 or later). Access to refuge meadows would be between 9:00 am and 4:00 pm to prevent undue disturbance to sandhill cranes, waterfowl, and other wildlife using those areas. Alternate times to conduct operations outside the core hours (i.e., for haying operations) may be negotiated with the Refuge Manager on a case-by-case basis.

How would the use be conducted?

The use of grazing as a management tool is described in the draft HMP. Yearlings are preferred for targeted invasive perennial grass removal, while cow/calf pairs are preferred for removing excess biomass from native sedge/rush (meadow) habitats.

Haying and grazing would be conducted by permittees under Cooperative Agriculture Agreements (CAA) for livestock grazing and haying, except for grazing under warranty deed and MOA for specific pastures through 2030 as noted above. CAAs would be documented on Commercial Activities Special Use Permit (SUP), Form 3-1383-C. Permittees would be entered into CAAs through an open and competitive process. The process for awarding CAAs includes the following:

1. The Service would provide the public with a notice of cooperative agricultural opportunities. This would include publication of a Notice of Funding Opportunity on Grants.gov, notification on a national Service website (https://www.fws.gov/refuges/whm/cooperativeAgriculture.html), and local outreach. The notice would include details on the cooperative agricultural opportunity such as the objective criteria that would be used to rank and score

applications.

2. Applicants would apply directly to the SE Idaho NWR Complex using the application guidance provided in the CAA prospectus.
3. The SE Idaho NWR Complex Project Leader, along with a selection panel, would score and rank all applicants and notify each applicant regarding whether they were awarded the CAA and the reasoning for the panel's decision. Unsuccessful applicants have the right to appeal the decision in accordance with 50 CFR 25.45.
4. Once the CAA has been awarded, the cooperator and the Service would work together to finalize the specific terms and conditions of the CAA, including a plan of operations.

In order to achieve the desired short-grass habitat conditions on 1,912 acres of xeric and mesic meadow habitat on the east and south ends of Grays Lake marsh, the Refuge proposes to implement the following management actions under CAAs:

1. By the 2023 grazing season, convert livestock grazing regimes from the current (mix of season-long perennially grazed and 3-year rest/rotation) to a 3-year rest/rotation grazing regime (Year 1: Early Graze June 10 to July 31; Year 2: Late Graze August 1 to Sept 30; and Year 3: Rest).

   The exception to this rest rotation will be on Sibbett Hill, Sibbett North, Sibbett South (collectively "Sibbett pastures"), and the Boathouse, Ewart (west portion) and North 40 pastures. The grazer on the Sibbett pastures has a warranty deed that allows annual grazing up to 350 AUMs on these pastures every year, for no more than 165 days per year, until December 31, 2030, unless alternate pastures are agreed upon. (Although the deed holder reserved the right to graze Sibbett Hill through 2030, it is ungrazed and likely to remain ungrazed.) A 2019 Memorandum of Agreement allows the warranty deed holder to annually graze the Boathouse, Ewart (west portion) and North 40 pastures (approximately 144 acres total) in exchange for keeping the southern portion of the Sibbett South unit free of grazing to allow riparian restoration work. See HMP, Objective 4.3.1 (USFWS 2022). After the warranty deed and MOA expire, the Sibbett North and South, Boathouse, Ewart (west portion) and North 40 pastures will be managed under CAAs, using the same three-year rest/rotation regime described above. The Sibbett Hill pasture will be ungrazed and managed as shrub-steppe habitat.

2. Grazing intensity (AUMs) will adhere to the Range of Recommended AUMs found in Table 4.1.1 of the HMP (USFWS 2022). AUMs will be adjusted, as needed, to achieve habitat objectives.

3. Place salt blocks in smooth brome monoculture to better distribute cows away from wetlands and concentrate grazing on non-native grasses.

4. Use a mixture of yearlings and cow/calf pairs to achieve habitat objectives

when available.

5. Work with permittees to install and maintain fences to hold cattle in designated pastures. The Service will install permanent fencing. Grazing permittees will be responsible for performing fence maintenance on the grazing unit, including the installation and removal of temporary electric fence and repairs and maintenance of boundary fence of the grazing unit.

In order to achieve desired dense cover habitat conditions on 1,884 acres of xeric and mesic meadow habitat on the north end of Grays Lake marsh, the Refuge proposes to implement the following haying regime:

1. Exclude cattle from the Ayers, Cinder Knoll, and South Pasture units, and discontinue grazing on the Big Bend, Big Corral, and Rich Riley Units by the 2023 grazing season. Ensure that ungrazed units are protected by permanent fencing in good condition.
2. Use haying to reduce decadent vegetation (<35% live biomass) outside of the nesting waterfowl season (after August 30).
3. Both grazing and haying treatments will be assigned based on logistical considerations; accessibility for equipment and prospective permittees, and existing infrastructure (fences, livestock water, etc.).

Why is this use being proposed or reevaluated?

As identified in the HMP there is a need to maintain short-grass meadow conditions in order to support Refuge focal species on the management units on the east and south end of Grays Lake. There is also a need to maintain dense cover conditions in order to support Refuge focal species on management units on the north end of Grays Lake. Refuge management economic activities included in this CD include high intensity, short duration grazing and infrequent haying that will be used in conjunction with other habitat management strategies such as prescribed fire. High intensity, short duration livestock grazing reduces competition for light, space and nutrients, removes the accumulated thatch layer, and breaks up thatch by hoof action. Haying removes accumulated thatch in mesic and xeric meadows. The primary objective of using grazing and haying is to manage vegetation to maintain or increase its value to wildlife at a relatively low cost to the government.

Availability of Resources

The refuge's livestock grazing and haying program can be implemented using existing staff. Administration and planning of these agricultural uses may be up to $29,500 per year. Monitoring the effects of agricultural uses may cost up to $2,000 per year. One-time costs, including preparing a Habitat Management Plan and NEPA document, initial setup of CAAs and HMP, and repair and construction of fencing and in-pasture water supplies, would total approximately $96,000.

Table 1. Estimated One-time costs associated with the cooperative agriculture program at Grays Lake NWR under the Habitat Management Plan (USFWS 2022). A portion of these costs may be cost-shared.

Tasks	Estimated Costs
Preparing HMP/EA and CD	$25,000
Assessment & inventory of existing fence condition – WG-08 & seasonal GS-05 Biological Technician	$2,530
Construction of fences and gates	$25,000
Initial CAA/SUP setup – GS-13 Deputy Project Leader	$8,510
In-pasture water supplies	$10,000
Total Costs	**$71,040**

Table 2. Estimated annual costs associated with administering cooperative agriculture at Grays Lake NWR.

Tasks	Estimated Costs per Year[1]
Permit/agreement administration and oversight by GS-13 deputy refuge project leader.	$4,255
Permit/agreement monitoring by GS-05 technician & WG-08	$2,530
Site assessment / habitat condition monitoring by GS-11 biologist	$1,990
Annual fence assessment and repair, if needed by WG-08 & GS-05 technician	$5,065
Supplies, equipment, and facility maintenance and repair	$2,000
Refuge overhead costs associated with the above-listed work[2]	$13,613
Total Costs	**$29,453**

[1] Annual personnel costs = 2022 step 1 salary for appropriate GS or WG level (including locality payment of 16.81%) x 40% for benefits.
[2] Overhead costs = salary + benefit costs x 0.22. Overhead expenses include building rent, utilities, equipment and supplies, and support personnel, and do not include salary-related benefits.

Anticipated Impacts of the Use

Potential impacts of a proposed use on the refuge's purpose(s) and the Refuge System mission

The grazing and haying activities within the CAA program would contribute to achieving the Refuge purpose of providing " ... inviolate sanctuary, or for any other management purpose, for migratory birds" as well as the National Wildlife Refuge System mission, by providing valuable foraging areas for migrating waterfowl and sandhill cranes, and habitat for nesting, foraging, and brood rearing for a variety of migratory birds and resident wildlife. As a result, grazing and haying activities contribute to achieving refuge purpose(s); contributes to the Mission of the NWRS; and helps maintain the biological integrity, diversity, and environmental health of the Refuge.

Short-term and Long-term impacts

This CD includes the written analyses of the environmental consequences on a resource only when the negative effects on that resource could be more than negligible and therefore considered an "affected resource." Because air quality, cultural resources, visitor use and experience, Refuge operations and administration will not be more than negligibly impacted by the action, they have been dismissed from further analyses. There is no Wilderness in the resource area nor are there any threatened, endangered or special status species. There are currently no disproportionate adverse effects on human health, economics, or the social environment environmental associated with managing refuge habitats. Flood plains do exist in the resource area, but livestock grazing and haying will have no or negligible impacts.

Effects of livestock grazing and haying on wildlife and habitats: It is important to note that grazing has always been part of the ecosystem in which Grays Lake resides. In pre-settlement times, available water and forage around Grays Lake would likely have drawn native ungulates to the area to graze the valley. It is highly likely there was a fairly robust native ungulate grazing component to Grays Lake with grazing likely being a regularly occurring ecological process. While livestock grazing tends to be of longer duration and greater intensity than grazing by native ungulates, timing and intensity can be manipulated to mimic past ecological processes.

Livestock grazing will be used to manage uncut vegetation to achieve desired characteristics of the meadow complex across the Refuge by encouraging successional shifts in plant community composition. Over 80% of the grazed meadows will be on a two of three-season rotation through 2030, and all will be in a two of three-season rotation after 2030. Grazing will be distributed in a mosaic of treatments on Refuge lands, with approximately one-third of the meadow acreage designated for grazing being grazed in early summer, approximately one-third of meadow acreage designated for grazing being grazed in late summer, and approximately one-third of meadow acreage designated for grazing being idle. Annually grazed meadows (those not in the two of three season rotation) will be grazed in either early summer or late summer.

It is well established (Austin et al. 2002, Austin et al, 2007, Holechek et al. 1982, Sollenberger et al. 2012) that a livestock grazing regime which includes seasonal, short duration grazing followed by a year of rest is effective in keeping meadows in a short-grass condition while maintaining plant vigor. Thus, it is expected that the majority of meadows being managed for short-grass habitat conditions on a two of three-season rotation will result in improved nesting and foraging conditions for waterbirds, waterfowl, and shorebirds as compared to current management. Desired short cover vegetation communities are structurally characterized by increased site vigor and reduced thatch that provides higher quality foraging habitat for many of the Refuge's focal species (USFWS 2021). Wildlife species like sandhill cranes and white-faced ibis require short-cover wet meadow habitat interspersed with shallow and emergent marsh habitats. Sandhill cranes show a preference toward areas with shallow marsh adjacent to flat, short-cover habitat, for roosting and foraging respectively. For nesting, they seek islands of dense vegetation isolated from predation by shallow water (Austin et al. 2007). Long-billed curlews require relatively large tracts of contiguous open short cover habitat with intermittently patchy vegetation (> 100 acres) free of detrimental human disturbance for breeding and foraging (Dugger and Dugger 2002, Pampush and Anthony 1993, Redmond et al. 1981, Dechant et al. 2002). White-faced ibis forage in a range of conditions from shallow open water to grazed grasses with a variable hydroperiod and abundant macroinvertebrates through late August (Perkins 2003).

Light, managed grazing with livestock has also been shown to increase plant diversity (Hayes and Holl 2003). That being said, the way light grazing is managed is important for achieving improved habitat conditions. For example, yearlings are preferred for targeted invasive perennial grass removal, whereas cow/calf pairs are preferred for removing excess biomass from native sedge/rush (meadow) habitats. Yearlings tend to roam, distributing pressure across meadow and upland habitat types. Yearlings tend to be harder to keep fenced in. Cow/calf pairs are preferred for removing excess biomass from native sedge/rush (meadow) habitats since they will not pressure uplands unless stocking rates are high. Cows generally congregate around salt; therefore, mineral blocks are routinely used to distribute cattle away from sensitive areas that are easily impacted (e.g., riparian, wet meadow habitats). Under the proposed action it is expected that meadows will be more uniformly grazed and provide more suitable habitat for short-grass dependent species.

Experience has shown that meadows which are grazed annually show less plant vigor because they don't get rested, tend to have a less diverse assemblage of plant species, and shorter vegetation (less biomass) than desired. Thus, it is expected that meadows that will continue to be grazed annually through 2030 will support lower numbers of Refuge focal species that those meadows managed under a two of three-season rotation.

Grazing livestock during the growing season can have adverse effects on birds using short-grass meadows. Livestock can trample nests, disturb feeding and resting birds, and possibly expose birds and eggs to predation. Even though grazing livestock during the growing season may disturb/displace some nesting activity for that year from a particular field unit, with meadows being managed with different treatments during different times of the year, wildlife should be able to find suitable habitat nearby.

Meadows managed for dense cover (mesic and xeric meadows on the Refuge) provide low-disturbance habitat for ground-nesting species including ducks, geese, passerines, and other wildlife (Holchek et al. 1982). Dense cover is preferred nesting habitat for many waterfowl and passerine birds. These habitats are especially important when adjacent to yearlong open water, as found in the northern areas of the Refuge. These dense, ungrazed habitats are even more valuable due to their scarcity, given that the vast majority of meadow and upland habitats in the Grays Lake basin are either hayed or grazed every year. However, if left unmanaged, these montane meadows lose habitat quality as dead standing biomass increases (Ganskopp et al. 1992). Haying (alone or in conjunction with prescribed fire) after the bird nesting season will remove the dead biomass, stimulate growth, and increase biodiversity, but not impact nesting birds.

For those species which primarily nest in meadow habitats, managing wet meadows for low structure early in the growing season encourages nesting in drier meadows which will be left unmanaged (no haying or burning) until after the nesting season concludes. Haying will be used to treat mesic and xeric meadows when dense cover conditions exceed the attributes described in section 4.1.2 of the HMP. It is estimated that these meadows will need to be hayed and burned every five to seven years to clear out decadent growth and improve vegetative vigor.

Haying has negative impacts to some small mammals, reptiles, and amphibians. In addition to mortality from machinery, the conversion of tall pasture grasses to mowed grasses results in habitat loss. However, the irregular use of haying as a management tool allows local populations of small mammals, reptiles, and amphibians to recover quickly. The use of noise-producing equipment such as ATVs, tractors, swather or rotary mowers, rakes, and other potential equipment may cause localized disturbance to wildlife during the period of the equipment use. In general, use of equipment will occur in the fall and thus occurs outside of the sensitive breeding period. Most of the areas that will be accessed with equipment would be dry at this time of year, with reduced wildlife use.

Haying would maintain site vigor by preventing excessive litter accumulation from hindering plant species diversity and expression (Foster and Gross 1998; Xiong et al. 2003). Plant species composition and the response of those species to site-specific conditions that may change annually due to climate or refuge management have a significant influence on biomass production and subsequent litter production. Haying treatments will be adjusted on an annual basis to account for these dynamics according to information gleaned from survey efforts.

Early mowing of vegetation is counterproductive towards meeting wildlife conservation objectives since it destroys nests, kills incubating hens, kills young before fledging, and exposes nests and young to predators. Mowing could potentially impact any bird that nests or rears young in meadow habitats. Therefore, delaying Refuge haying dates until after the nesting season concludes will minimize mowing conflicts.

The Refuge expects that implementing the proposed management actions will moderately improve nesting and foraging conditions for waterbirds, waterfowl, and shorebirds and nesting habitat for many waterfowl and passerine birds. By improving habitats conditions associated with nesting and foraging, it is expected there would be commensurate improvements in fledging young, thereby enhancing Refuge focal species prospects for long-term survival. While improving wet, mesic, and xeric meadow habitat conditions is expected to benefit the migratory bird species that are a management focus for the Refuge, in light of all the other survival hazards migratory birds face once away from the Refuge, the proposed action does not represent a significant beneficial effect.

Effects of grazing and haying on soils:

The soils in the Grays Lake marsh consists of very deep, very poorly drained organic soils (peat) that formed largely from the decay of water-tolerant plants. The adjacent wet meadow soils consist of very deep, very poorly drained soils that formed in alluvium. Adjacent mesic and xeric meadows and upland shrublands consist of deep, well drained, medium textured, dark colored soils formed in wind-laid silts (USDA, 1981).

Livestock grazing in meadow habitats does compact soils during the course of the grazing season, however, the compaction is short-lived. The long, hard freeze and thaw cycles in fall, winter and spring loosens compacted soils by the summer grazing season resulting in no adverse effects to soil porosity and permeability. There is minimal soil compaction from infrequent use of mowing equipment which is soon abated by the seasonal freeze and thaw. Livestock grazing does result in stream banks being incised, leading to soil loss along water courses. Since all water courses except the Grays Lake outlet lead into the marsh basin, eroded soils become mixed with the organic soils in the lowest portion of the basin dominated by hardstem bulrush. Livestock grazing along the banks of Grays Lake outlet leads to some soil loss, but with the annual spring draw down of Grays Lake marsh waters, little water leaves Grays Lake through the outlet. Thus, only minor amounts of sediment are moved downstream from Grays Lake.

Effects of grazing and haying on water quality:

Grays Lake and the Refuge are within the Willow Creek Subbasin where land use and management, along with stream conditions throughout the entire subbasin, are primarily homogeneous. Sediment loading within the subbasin is widespread, predominantly attributable to streambank erosion from over-utilization of riparian habitat. Due to land use practices most water courses within the subbasin are water quality limited due to sedimentation and temperature (Idaho Department of Environmental Quality, 2004).

Livestock trampling of stream banks adds sediment to water courses already experiencing elevated sediment conditions. Livestock grazing of riparian habitats along water courses typically results in elevated temperatures compared to ungrazed water courses, since grazing removes vegetative cover. In addition, nutrients and bacteria from livestock waste enters Refuge streams during the course of the growing season.

Despite these contributions to compromised water quality conditions, Refuge management does not significantly affect water quality in the context of the subbasin. The segments of water courses on the Refuge are relatively short, affording the Refuge limited opportunities to improve water quality conditions on site. Water entering Refuge water courses already have elevated temperatures.

Also, due to the spring water draw down, most water entering the refuge is absorbed in the organic soils of Grays Lake marsh or evaporates, leaving nutrients to be captured in the marsh organic soils. The thick vegetation in the marsh metabolizes many of these nutrients. As previously discussed, little water leaves Grays Lake marsh due to the spring draw down, resulting in very little nutrient-laden water leaving the marsh and affecting downstream conditions.

Public Review and Comment

The draft compatibility determination will be available for public review and comment for 30 days, in conjunction with the public comment period for the Draft Habitat Management Plan and Environmental Assessment. The public will be made aware of this comment opportunity through newspapers, listings at local libraries, letters to potentially interested people such as adjacent landowners, states, and tribes. The State of Idaho and Tribes have been asked to review and comment on the draft compatibility determination. A hard copy of this document will be posted at the Refuge Headquarters located at 74 Grays Lake Rd, Wayan, ID. It will be made available electronically on the refuge website (https://www.fws.gov/refuge/grays-lake). Please let us know if you need the documents in an alternative format. Concerns expressed during the public comment period will be addressed in the final.

Determination

Is the use compatible?

Yes

Stipulations Necessary to Ensure Compatibility

The stipulations below include those that are standard for the U.S. Fish and Wildlife Service Cooperative Agriculture Agreements, as well as additional Refuge-specific stipulations. Both standard and Refuge-specific stipulations are listed below.

1. Administration of the livestock grazing and haying programs will be conducted in accordance with Service's Cooperative Agriculture Policy. Permission to graze or hay on the Refuge will be officially authorized through a CAA and

documented on a Commercial Activities SUP, one to each Cooperator/Permittee (hereafter referred to as Cooperator).

2. All livestock grazing and haying activities will be restricted to designated areas and time periods prescribed in the Cooperative Agriculture Agreement (CAA) and Commercial Activities Special Use Permit (SUP).
3. Livestock grazing would occur on specified meadows during the summer and fall months (June 10-September 30). End dates for grazing may vary annually depending on environmental conditions and pasture utilization to meet specific habitat management objectives (e.g. biomass reduction). The Cooperator will be responsible for coordinating closely with Refuge staff to ensure these objectives are met. Cattle will not be removed from any given pasture until the target consumption level has been reached, regardless of permit date. The overall use season will remain in effect. If biomass goals are achieved early within a designated unit, it will be the Cooperator's responsibility to move livestock to the next pasture identified in his rotation and record the dates the cattle were moved out of the first unit and into the second unit. If biomass reduction targets are met early near the end of the livestock grazing season, alternative off-refuge pasturing of livestock will be the sole responsibility of the Cooperator.
4. The Cooperator will remove all stock, and associated equipment, within 24 hours of the assigned closing date as specified on the Cooperator's permit.
5. Cooperator access of refuge meadows should be during the time period 9:00 am and 4:00 pm to prevent undue disturbance to sandhill cranes or other waterfowl and wildlife using those areas. Alternate times required to conduct operations outside the core hours (i.e., for haying operations) may be negotiated with the Refuge Manager on a case-by-case basis.
6. Harassment (hazing) of wildlife under any circumstances from any refuge fields or farming units is strictly prohibited.
7. Animal damage or predator control by the Cooperator is strictly prohibited.
8. The Cooperator is responsible for keeping all gates closed and locked and will allow only him/herself and their immediate work force onto the Refuge. Only those persons directly associated with the farming operations shall be allowed access to Refuge fields and only for the purposes of conducting authorized business.
9. All Refuge signs, gates, fencing, fence posts, etc. removed to facilitate movement of agricultural equipment or livestock will be replaced at the end of each day.
10. Cooperators are required to have proof of ownership of livestock used in the Refuge grazing program. Each animal must be branded or otherwise permanently marked.

11. Cooperators will be responsible for performing fence maintenance on their grazing units, including the installation and removal of temporary electric fence and repairs and maintenance of boundary fence of the grazing units. With the exception of these temporary livestock fences, associated gates, and other grazing-related structures specifically described in SUPs, Cooperators are prohibited from constructing new or maintaining existing structures on the Refuge without specific, prior written approval of the Refuge Manager.
12. Providing stockwater will be the responsibility of the Cooperator. If circumstances dictate supplying additional water through alternate sources, all additional irrigation/stockwater costs will be the responsibility of the Cooperator, including electricity, fuel, pumps, pump maintenance, and irrigation pipe. The Cooperator must furnish said equipment at their own expense.
13. Refuge ditches, ditch banks, and riparian/willow areas may be maintained only with the written consent of the Refuge Manager. The Refuge Manager must be notified prior to conducting any ditch, ditch bank, or willow/brush maintenance activities.
14. The Cooperator is not to alter any water flows or water diversions on the Refuge without prior consent of the Refuge Manager.
15. Consistent with Service policy regarding management of nonhazardous solid waste on refuges (Resource Conservation and Recovery Act of 1976 [RCRA], as amended (42 U.S.C. 6901–6992k)—Solid Waste (Nonhazardous); 50 CFR 27.93, Abandonment of Property; 50 CFR 27.94, Disposal of Waste; and 561 FW 5, Managing, Recycling, and Disposing of Non-Hazardous Solid Waste), Cooperators are prohibited from dumping, storing or otherwise disposing of refuse on refuge lands without the permission of the Refuge Manager. Cooperators are responsible for removing all equipment and refuse resulting from their operations on the Refuge by the end of each season.
16. The United States shall not be responsible for any loss or damage to property; or injury to the Cooperator or his representative; or for any damages or interference caused by wildlife or employees or representatives of the Government carrying out their official responsibilities.
17. Upon termination of a CAA, the Cooperator shall leave the fields in as good condition as when received except for alterations approved by the parties for restoration and management improvements, and reasonable wear and tear, or damage occurring without fault or negligence, including without limitation flood damage. Cooperators shall be responsible for repairing damage to any government owned fields, roads, dikes, equipment or facilities, beyond normal wear and tear, resulting from their use of the refuge within a reasonable amount of time, as negotiated with the Refuge Manager, and at the full expense

of the Cooperator.

18. In addition to the stipulations listed here, the Commercial Activities SUP conditions and requirements, Cooperators and their employees are required to comply with Refuge System-related and other applicable laws, regulations, and policies including "Prohibited Acts" listed in 50 CFR 27.
19. A record must be provided to the Refuge Manager by November 15 of each year detailing by field unit, the date on, date off, and total numbers for livestock grazed. The Refuge will also keep records to compare to the Cooperator's original reporting.
20. Livestock are to be contained at all times to fields the Cooperator is assigned under individual CAA or as negotiated with the Refuge Manager. Cattle that escape the refuge boundary are the responsibility of the Cooperator and not the U.S. Fish and Wildlife Service (USFWS).
21. In the case of escaped livestock the Cooperator will have 24 hours (once notified by the Refuge) to get livestock back into the permit unit.
22. Cooperator tractors, farming implements, vehicles, and ATVs/ UTVs will be washed prior to moving onto the Refuge and also be cleaned of all mud, dirt and plant parts between sites within the Refuge to reduce the likelihood of moving noxious weed seeds and plant parts.
23. All trailers, stock equipment and vehicles used during the duration of the grazing period must be removed from the grazing unit and may not be left overnight without Refuge Manager approval.
24. Haying may occur between August 30 and September 30, subject to modification or termination of the permit or agreement if habitat conditions warrant.
25. Bales must be removed from the unit within one week (7 days) after baling. Refuge staff are not responsible for any damage to bales that may occur from wildlife or cattle that escape grazing units.
26. Hay is for personal livestock use only and may not be sold.
27. Use of insecticides including applicators, sprays, dust bags, etc., will not be permitted on the Refuge. Insecticide-treated ear tags will be permitted if implanted before cattle are delivered to the Refuge.
28. Mineral and salt blocks will be placed in dense stands of smooth brome and moved periodically to prevent major ground disturbance. When the blocks are gone, additional blocks used in the same year or future years must be at least 150 feet from an old location. Blocks should not be placed near water.
29. The Cooperator shall notify the Refuge Manager of any noxious weeds located in the unit.

30. Carcasses of dead livestock must be promptly removed from the Refuge by the Cooperator and disposed of in accordance with State of Idaho regulations.
31. The Cooperator must comply with all State of Idaho livestock disease and branding regulations.
32. Areas will be monitored to ensure treatments are improving habitat conditions and to ensure livestock grazing and haying are the appropriate management strategies for a particular site.
33. Refuge staff will monitor Cooperator activities to ensure that special conditions required under the CAA are met.
34. Cooperators or their representatives are required to participate in an annual meeting with Refuge management after the conclusion of the grazing season. The purposes of such meetings would be to share new information, discuss results of monitoring, review compliance with these stipulations, and address other issues.
35. Cooperative Agriculture Agreements (CAAs) are reviewed annually, and a Plan of Operation is developed for the field season to carry out the prescribed treatments. The CAA does not imply or establish a use precedent. Future use of the area will be based on the most satisfactory use of the land for wildlife benefits, cooperator performance, habitat management needs, and administrative needs.

Justification

Livestock grazing and haying, as described in this Compatibility Determination, contribute to fulfilling the mission of the National Wildlife Refuge System and to the purposes of Grays Lake National Wildlife Refuge by managing meadow complex plant communities to provide habitat for migratory birds and conserve native plants. Livestock grazing and haying may be effective strategies to help control aggressive invasive plants and therefore can assist the Refuge in achieving its habitat objectives.

Based on the stipulations presented above, it is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the Refuge will not be measurably lessened as a result of allowing these uses. The relatively limited number of individual animals expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of species present will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted.

Based on available science and best professional judgement, the Service has determined that haying and grazing at Grays Lake National Wildlife Refuge, in accordance with the stipulations provided here, would not materially interfere with or detract from the National Wildlife Refuge System mission or the purposes of the refuge.

As a management tool, grazing and haying are beneficial Refuge operations in meeting purposes of the Refuge as well as objectives established in the HMP. The grazing and haying activities within the CAA program contribute to achieving Refuge purposes and objectives identified in the HMP, as well as the National Wildlife Refuge System mission, by providing valuable foraging areas for migrating waterfowl and sandhill cranes, and habitat for nesting, foraging, and brood rearing for a variety of migratory birds and resident wildlife. As a result, grazing and haying activities contribute to achieving refuge purpose(s); contributes to the Mission of the NWRS; and, in turn, help maintain the biological integrity, diversity, and environmental health of the Refuge.

Signature of Determination

Refuge Manager Signature and Date

Signature of Concurrence

Regional Chief Signature and Date

Mandatory Reevaluation Date

2032

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Figure(s)

Grays Lake National Wildlife Refuge management units.