

# Chapter 4. Management Direction

## Management for Wildlife Diversity

Refuge management will focus on providing habitat for maximum wildlife diversity including migratory birds, and native mammal, mollusk, invertebrate, and amphibian communities. Habitat needs for species other than migratory birds that have not been addressed adequately in past management efforts will be fully integrated into management efforts. Ensuring that the full complements of fauna and flora historically represented on the Refuge are recognized and that full efforts to understand and meet the habitat requirements for these species will be a priority.

Minor changes in water regimes and management activities at eight of the nine ponds will be directed toward creating diverse habitats in terms of water depth, vegetation composition, and habitat structure. Other new strategies include enhancing areas to provide potential rookeries for nesting colonial wading birds, expanding efforts in threatened and endangered species recovery, and conducting a bathymetric survey.

Restoration of the Harrison Unit will be pursued on an experimental basis. Efforts will focus on restoring to the extent possible historical hydrological, physical and biological conditions to the marsh.

Refuge management also will focus on enhancing the native high desert shrubland community. Natural and prescribed fires will be managed in accordance with the Wildland Fire Management Plan (2002).

Weed management described in the Integrated Pest Management Plan (2003) will continue.

Water management of eight of nine ponds (Figure 3) will include a 5-year drawdown rotation and associated burning (Table 6). Water levels in the ponds will be maintained to create optimum conditions for waterfowl production. The goal is to maintain waterfowl migration, wintering, and production habitat. Water management will also maintain water salinity at minimum levels through winter flushing and maintaining water flows throughout the Refuge.

**Table 6. Unit drawdown and prescribed burning sequence.**

Unit(s)	Year <sup>1</sup>	Drain	Burn	Fill
Mallard - Gadwall	2003	Feb	Sept	Oct
Avocet - Spring <sup>2</sup>	2004	Feb	Sept	Oct
Curlew- Ibis	2005	Feb	Sept	Oct
Pintail - Shoveler	2006	Feb	Sept	Oct
Egret - Harrison	2007	Feb	Sept	Oct

<sup>1</sup>This sequence is repeated every 5 years. Dry units are burned according to an approved Prescribed Burning Plan. Currently, however, units with large dense stands of *Phragmites australis* (Avocet, Mallard, Curlew, Shoveler, and Harrison) are not burned due to concerns that fire aids the spread of this invasive species.

<sup>2</sup>Spring unit is not drawn down, but 1/3 is burned during the same year that Avocet is drawn down.

Studies indicate that full pool management is not as productive as management involving drawdowns, whereby management intentionally simulates wet and dry cycles of a natural wetland.

McKnight and Low (1969) conducted a study within the Fish Springs NWR marsh from 1966 to 1968. Their study revealed that marsh units that had been drained, allowed to dry, and then flooded showed a tremendous increase in waterfowl use and production. Brood census data showed that the newly flooded areas were much more attractive to duck broods than the undisturbed marsh areas, and were more heavily used by waterfowl in general.

Drawdowns play an important role in the rate at which nutrients are released into the food chain. The rate of plant material decay is increased. This in turn provides more food to invertebrates in the form of decaying organic matter or detritus.

According to Refuge surveys, invertebrates experience a subsequent population explosion upon reflooding, with both species richness and abundance increasing (Ward and Ward 1996). This provides improved foraging for waterfowl, shorebirds, and water birds. Drawdown in many units results in an invasion of the original pool bottom by opportunistic vegetation, primarily fivehook bassia (*Bassia hyssopifolia*) and summer cypress (*Kochia scoparia*). These plants produce a seed crop that is used by migrating waterfowl when these units are reflooded. The weed crop also provides critical structural habitat used by the burgeoning populations of aquatic invertebrates after reflooding. Salt cedar (*Tamarisk ramosissima*) also appears within most units when the ponds are drawn down; however, this species is killed at nearly 100% after refilling before the plants have developed enough to provide structural habitat for invertebrates or a food source (seed) for waterfowl.

Fire, another important marsh management tool, increases the rate at which nutrients are returned back to the soil, setting back succession and invigorating new plant growth. As wetland vegetation becomes rank, it is of little value to many marsh birds and prescribed burning can improve marsh habitat for migratory waterbirds.

Since 1988, the marsh units at Fish Springs NWR have been dewatered and burned on a set 5-year rotation (Table 6). Draining the units begins in February and reflooding begins between late September and December. Target levels are reached between March and mid-April. These target levels are flexible based on specific seasonal conditions and the professional judgment of the Refuge Manager. Not enough water is available to have all units completely filled during summer and early fall, so some units are left at less than target levels during those times. This actually creates better shorebird nesting and foraging habitat in the spring.

Prior to the summer of 2003, efforts to control *Phragmites* were spring chemical applications of a glyphosate herbicide after the unit had been dewatered and subject to a spring prescribed burn. This method proved to be ineffective in controlling the spread of *Phragmites* on the Refuge. In July 2003, the Refuge experimented with a new approach to the control of *Phragmites*. Stands of *Phragmites* were mowed in July and August, and glyphosate herbicide was applied in September after the re-growth had reached 2 to 3 feet tall. Five areas were treated with this method in FY 2003 and will be monitored for 2 years to determine the effectiveness. Initial results appear encouraging.

This new method of a late summer/early fall manipulation (mowing or burning) to the *Phragmites*, combined with a fall or

spring application of a glyphosate herbicide, will be used in FY 2004 on several sites. The Refuge also will incorporate new techniques in the Avocet Unit, which is scheduled to be burned in September 2004. Several dense *Phragmites* stands on higher sites in the unit will be disked after the burn in late September. Some sites will be disked once, and other sites will be disked twice to expose the roots to hot desiccating temperatures. Disking will be followed by an application of a glyphosate herbicide in October on some sites, and in the spring on other sites after re-growth starts. All sites will be monitored for 2 years to determine the effectiveness of the control methods used.

The high desert shrubland is defined for management purposes as the combined Great Basin Arid Shrubland and Great Basin Cold Desert Shrubland presented on Figure 5. These two shrublands are found on the west side of the Refuge and in smaller patches along the north, east and south sides of the marshlands. Dominant shrubs include Mormon tea, rabbitbrush species, greasewood, shadscale and fourwing saltbrush.

Currently, the high desert shrubland community on Fish Springs NWR is not actively managed. This community historically has been a low management priority and management has been passive. Historical grazing was removed when the Service acquired the Refuge (Banta, pers. comm. 2004). A fence was constructed in the mid-1990s to remedy illegal trespass from livestock on surrounding BLM and U.S. Army properties. Overgrazing of desert shrublands can significantly reduce vegetation diversity and species composition (Bock and Bock 1993; Fleischner 1994). Past cattle grazing and current sheep drives along the county road (Pony Express Trail) on the west side of

the Refuge have promoted the spread of invasive weeds and the understory of large patches of the high desert shrubland community is dominated by cheatgrass.

Fires in western high desert shrubland communities have had a profound impact on vegetation composition and structure. Young and Evans (1978) found that cheatgrass (*Bromus tectorum*) increases on post burned areas, frequently out-competing native flora. An increase in fire frequency in shrublands can cause a gradual loss or in some cases dramatic change from a shrub community to an annual dominated community. This shift in plant species composition alters competitive and fire dynamics to maintain annual dominance on the affected sites (Taush et al. 1995). Fire management is conducted on Fish Springs NWR in accordance with the Wildlife Fire Management Plan (2001). Fire is suppressed in shrubland habitats and used as a tool to achieve identified management goals. Prescribed burning of dewatered units is conducted in the fall.

**Overall Goal: Provide habitat for maximum wildlife diversity.**

**Rationale:** Shifting the focus of Refuge management from enhancing and protecting breeding, wintering and migration habitat primarily for migratory birds to providing habitat to maximize wildlife diversity will require a substantive shift in management practices. Restoration of a portion of the Refuge to mimic historical conditions will be a departure from management objectives and prescriptions of the last 40 years. To successfully implement marsh restoration, it is critical to prepare a detailed Habitat Management Plan that will carefully develop and implement habitat management goals, objectives, and strategies.

**Objective: Within 5 years develop a Habitat Management Plan that provides the following:**

- Specific characterization of the existing biological conditions, including: vegetation composition, distribution, and abundance of exotics (plant and animal); vegetation structure (e.g., height, density); and wildlife occurrence, distribution, abundance, productivity and seasonal habitat use patterns.
- Description of existing ecological structure and functions, including food web interactions, predator/prey relationships, foraging patterns and relationships, competition.
- Detailed objectives and strategies and the rationale to support the strategies.
- Detailed description of the expected outcome of habitat management strategies.
- Detailed methods and management tools to be used to meet objectives.
- Detailed inventory and monitoring surveys to evaluate the success of selected strategies, a discussion on how surveys will be used and data assumptions associated with surveys.

## Habitat

**Goal:** Improve and maintain habitats for nesting and wintering migratory birds and other wildlife populations of the Bonneville Basin.

**Rationale:** Fish Springs NWR, by virtue of its substantial wetlands, is one of the most important habitats in the eastern Bonneville Basin. Use of these wetlands by migrating, wintering, and nesting birds is

critical to many species that are found in western Utah. The Refuge is the largest wetland for a radius of over 70 miles and provides such habitat to literally tens of thousands of migratory birds as well as being a true oasis in a very arid region which supports a very diverse population of native wildlife. Efforts to maintain and improve a diverse mosaic of habitats are critical to providing high quality habitat in an area where wetlands and relatively pristine desert shrub communities are exceptionally limited.

### Objectives:

*1. Throughout the life of this Plan, provide nesting and brood-rearing habitat for waterfowl, shorebirds, and water birds by maintaining diverse aquatic habitat, adequate food sources, stable water levels during nesting, and enhancing colonial wading bird nesting habitat.*

### Strategies:

- Drawdown two units each year (Table 6) to maintain an adequate invertebrate supply as a food source and to recycle nutrients through decomposition and prescribed burning.
- Bring five to six units to optimal stable water levels (Table 7) by mid-April when waterfowl, shorebirds, and water birds are selecting nest sites.
- Maintain stable water levels through mid-June for shorebirds and water birds in five to six units to prevent flooding or drying of nests.
- Maintain stable water levels through mid-July for waterfowl in three to four designated units to prevent flooding or drying of nests.
- Seek expert consultation on subdividing northern impoundments (Pintail, Ibis, and Gadwall Units) to

**Table 7. Target water elevations for marsh units under 1991 Marsh Management Plan.**

Unit	Target Water Elevation	Water Surface Acres	Average Depth (feet)	Acre-feet
Avocet	4298.50	575	1.6	920
Mallard	4298.74	192	1.5	288
Curlew	4294.50	480	1.5	720
Shoveler	4295.60 <sup>1</sup>	245	1.5	368
Pintail	4286.00	395	1.7	672
Egret	4291.39	380	1.5	570
Ibis	4288.80	235	2.2	517
Harrison	4282.00	620	1.7	1,054
Gadwall	4282.00 <sup>2</sup>	430	1.8	774
<b>Total</b>		<b>3,552</b>		<b>5,883</b>

<sup>1</sup> Target water elevation shown here for Shoveler Unit is 0.26 feet lower than originally designated in the Marsh Management Plan. With this slight modification, more islands pop-up or are just below the water, creating better foraging for shorebirds.

<sup>2</sup> Gadwall Unit is actually managed at a much lower water elevation in order to create 25 to-35 more acres of shallowly flooded mudflats for western snowy plover foraging. The Refuge Manager determines at which level to stop filling this unit on a yearly basis according to water availability.

Source: Service 1991.

improve production habitat (i.e., stabilized water through hatching) for waterfowl.

- Within 12 years, provide suitable habitat components (dense hardstem bulrush stands, appropriate water depths, lack of disturbance, protection from prescribed burns) to support expansion of existing rookeries for colonial nesting wading birds (great blue heron, snowy egret, cattle egret, white-faced ibis).

*2. Over the next 15 years, maintain existing seasonal closures to minimize disturbance to nesting, wintering, and migrating waterfowl, shorebirds, and waterbirds.*

**Strategies:**

- Close entire Refuge to all forms of boating April 15 to August 15 to

protect breeding waterbirds (Table 8).

- Keep 10,746 acres (60 percent of the Refuge) as year-round sanctuary areas.
- Close all roads except the Pony Express Road and the core auto-tour route from April 15 - August 15.

*3. Within 5 years of CCP approval, consult with experts and conduct a bathymetric survey to better characterize the Refuge and its resources.*

**Strategies:**

- Identify and monitor indicator species that best represent the various refuge habitats. Indicator species, such as suggested in Table 8, will be developed in consultation with appropriate experts and a better understanding of the specific habitat dynamics of the Refuge and

species that best represent selected habitat.

- Conduct a complete bathymetric survey of all marsh impoundments in order to determine how much habitat or surface water is created at varying water elevations for each unit.

*4. Provide spring and fall migration foraging habitat for waterfowl, shorebirds, and water birds. This involves providing a variety of habitat in each marsh unit, including shallowly flooded ( $\leq 4$  inches) and sub-irrigated saltgrass for shorebirds, and emergent vegetation in water 4 to 12 inches deep for water birds.*

**Strategies:**

- Drawdown two units each year (Table 6) to maintain an adequate invertebrate supply as a food source and to recycle nutrients through decomposition and prescribed burning.
- Partially draw down water in some units and increase water in other units during the early spring

(March) to exploit resources not normally available, providing new foraging areas. Where and to what extent water is drawn down will be based on the condition and topography of each unit.

- Delay impoundment drawdowns until March 15 or later in those units scheduled for full drawdown but not scheduled for prescribed burning.
- Cut off water to three to four units in mid- to late June to allow shrinkage through evapotranspiration and evaporation to create mudflats in late summer and into fall.
- Allow water to drop in three to four other units after mid-July when waterfowl nesting is completed until mid-September. During this time, water is still allowed to flow in, but at a rate less than evapotranspiration and evaporation. Begin refilling units after mid-September.

**Table 8. Suggested indicator species.**

Species	Arrival	Nest	Eggs	Hatch	Fledge
American Bittern	April	April-June	May-Mid July	June-August	July-August
Virginia Rail/Sora	April	April-Early May	June-Early July	July-August	August
Common Yellowthroat	April	May-July	June-July	June-July	July-August
Marsh Wren	April	Mid April-Early May			
Mallard	March	April	April-July	May-July	July-August
Least Chub	Resident				
Utah Chub	Resident				
Possible Negative Indicators					
<i>Gambusia</i>					
Muskrat					

*5. Within 3 years of CCP approval, identify any threatened, endangered or sensitive plant species or rare plant communities identified by the Service or Utah Department of Natural Resources that exist on the refuge, particularly within the high desert shrubland community.*

**Strategies:**

- Determine historical native floral composition of the high desert shrubland community, within 3 years.
- Conduct a complete vegetation survey to determine current composition of the high desert shrubland community and create a layer for the GIS database.

*6. Within 7 years of CCP approval, develop a plan to restore the high desert shrubland community to the historical native composition.*

**Strategies:**

- Compare current and desired conditions to determine how much restoration is necessary.
- Research appropriate restoration methods such as herbicides, prescribed fire, biological controls or mechanical controls. Refuge managers can use some of these control methods to stimulate new growth, remove unhealthy vegetation, recycle soil nutrients, or create fuel breaks to isolate or protect critical shrub communities from cheatgrass invasion.
- Determine necessary resources, budget, specific actions, and time-frame for project.
- Determine indicator species (e.g., plants, birds, invertebrates) for monitoring health of restored communities.

- Begin implementation of selected appropriate restoration actions.

## **Ecological Integrity**

Two goals have been developed under the Ecological Integrity Management Direction. A Refuge-wide goal and a specific goal for restoring the Harrison Unit to a more historical function as a braided marsh. Restoration of the Harrison Unit complies with the intent of the Refuge Administration Act, and strategies were developed following Service guidance (601 FWS).

**Refuge-wide Goal:** Perpetuate the native biodiversity and physical characteristics of the Bonneville Basin as represented on Fish Springs NWR.

**Rationale:** Efforts to gather inventory data on current use by avian species and attempting to reduce the impacts of various influences such as military overflights and invasive vegetation will be vital to maintain the ecological systems at Fish Springs NWR. The physical environment of the Refuge also contains several sites of importance to the understanding of the history of Lake Bonneville. Ensuring that these sites are protected from unreasonable degradation will ensure that the scientific values are maintained for future research needs and interpretation.

Specific actions will be taken on behalf of species of concern, including federally listed species or species proposed for listing. Listed species are Federal trust resources, with the Service having a responsibility to aid their recovery whenever possible. Species proposed for listing are not officially Federal trust resources but are species of concern. Any efforts the Service can make on their behalf is appropriate, and may even help

prevent the species from being listed. Certainly, these efforts are compatible with the Refuge Purpose.

#### Objectives:

*1. Within 5 years of CCP approval, and every 5 years thereafter, assess the status of native biodiversity on the Refuge.*

#### Strategies:

- Conduct community level biological surveys. Include surveying for small mammals, waterfowl, shorebirds, marsh birds, water birds, raptors, passerines, reptiles and amphibians, carnivores, and invertebrates. Create appropriate layers for the GIS database.
- Repeat a complete set of community level surveys every 5 years. Update GIS database accordingly.
- Continue bimonthly bird counts/index, spring and fall mist-netting, and spring and fall shorebird surveys.

*2. Within 5 years of CCP approval, develop a plan to maintain the diversity and distribution of native spring snails.*

#### Strategies:

- Establish current distribution and densities of all spring snails and create a layer for the GIS database.
- Identify very limited native species, monitor them for population declines and threats, and determine appropriate protection and restoration actions.
- Refer to historical snail surveys on snail distribution in springs, including work done by the Smithsonian.
- Determine the impact of nonnative snails (*Melanoides tuberculata*) on native snails and other species.

- Investigate ways to eliminate nonnative snails.

*3. Within 5 years of CCP approval, rewrite the Marsh Management Plan to maintain native species richness of the marsh plant communities.*

#### Strategies:

- Develop GIS-based vegetation database showing current diversity and distribution of marsh plant Communities. Determine if any relict populations of endemic species exist. Update database as necessary.
- Consult with experts on how to restore and maintain native marsh plant communities and relict populations.
- Evaluate the use of prescribed fire in maintaining native plant communities through a review of the existing literature, experimentation and monitoring, and opportunistically through research.

*4. Reduce whitetop by 60 percent and squarrose knapweed by 60 percent within 3 years, tamarisk by 90 percent within 15 years, and cattail stand density by 50 percent within 15 years.*

#### Strategies:

- Develop GIS-based vegetation database showing current distribution as a baseline. Update database as necessary.
- Cooperate with the Bureau of Land Management to treat area above the Refuge for squarrose knapweed.
- Treat invasive species with appropriate chemical control agents and mechanical methods.
- Based on results of experimental control conducted in the Avocet Unit, investigate feasibility of using

biological controls for squarrose knapweed and tamarisk.

- Once target levels are reached, continue to treat invasive species as needed to prevent re-spreading.

**5. Within 6 years of CCP approval, determine the effects of management practices on the spread of *Phragmites australis*.**

**Strategies:**

- Develop GIS-based vegetation database showing current distribution as a baseline. Update database as necessary.
- Monitor spread of *Phragmites australis* after prescribed fire and pool drawdowns.
- Experiment with chemical and mechanical control on *Phragmites australis* to determine if there is any effective level of control.
- Set target for *Phragmites australis* reduction upon completion of above efforts.

**6. Continually preserve sites of geological significance for geomorphological research; both known sites and those identified by experts in the future.**

**Strategies:**

- Do not disturb sites through any earthmoving operations.
- Do not fill, level, or flood sites.

**7. Continue to work to minimize impacts of military overflights on wildlife.**

**Strategies:**

- Monitor violations of established rules stipulating flying at least 3,000 feet above the Refuge.

- Continue dialog with the U.S. Air Force when violations occur and how to avoid future violations.
- Request involvement of the Service's Utah Resident Agent in Charge when needed.

**8. Within 10 years of CCP approval, achieve a nesting success rate of 40 percent for snowy plovers nesting on the Refuge.**

**Strategies:**

- Measure current nesting success rates of snowy plovers.
- Construct elevated nest sites in suitable nesting units.
- Install electric fencing around nesting areas and experiment with the use of scents to condition predators to the presence of the fence.
- Conduct an annual census in cooperation with staff of Dugway Proving Ground.

**9. Within 15 years of CCP approval, establish future roosting sites for bald eagles, a threatened species, on the Refuge.**

**Strategies:**

- Plant three to four Fremont cottonwood trees in two sites in areas with minimum potential for disturbance (e.g., Spring Unit).

**10. Re-establish the least chub, a candidate species, in North, Deadman, Walter, House, and Percy Springs over the next 10 years.**

**Strategies:**

- Continue to make structural adaptations of water management facilities to create structural

barriers to mosquito fish (*Gambusia affinis*) infestation.

- Conduct multiple removal treatments of nonnative fishes to try and eradicate invasive species in the target springs.
- Move fish from existing Refuge stocks, or from other stocks through Utah DWR, to enhance genetic diversity in nonsystemic sites.

**11. Continually inventory, monitor and protect habitat for threatened, endangered and sensitive wildlife species.**

**Strategies:**

- Continue to monitor habitat and populations of wintering bald eagles and least chub.
- Look for new opportunities to cooperate with Utah DWR on the introduction/re-introduction of spotted frog and other sensitive wildlife native to the Bonneville Basin.
- Continually monitor spring discharges.
- Continue to look for additional cooperative opportunities with Utah DWR, universities and other agencies to inventory, monitor and enhance sensitive species habitat.

**Marsh Restoration of Harrison Unit**

**Goal:** Restore a portion of Fish Springs NWR to the native biodiversity and physical characteristics of the Bonneville Basin as represented on Fish Springs, including unimpeded hydrological, physical and biological components (Figure 6).

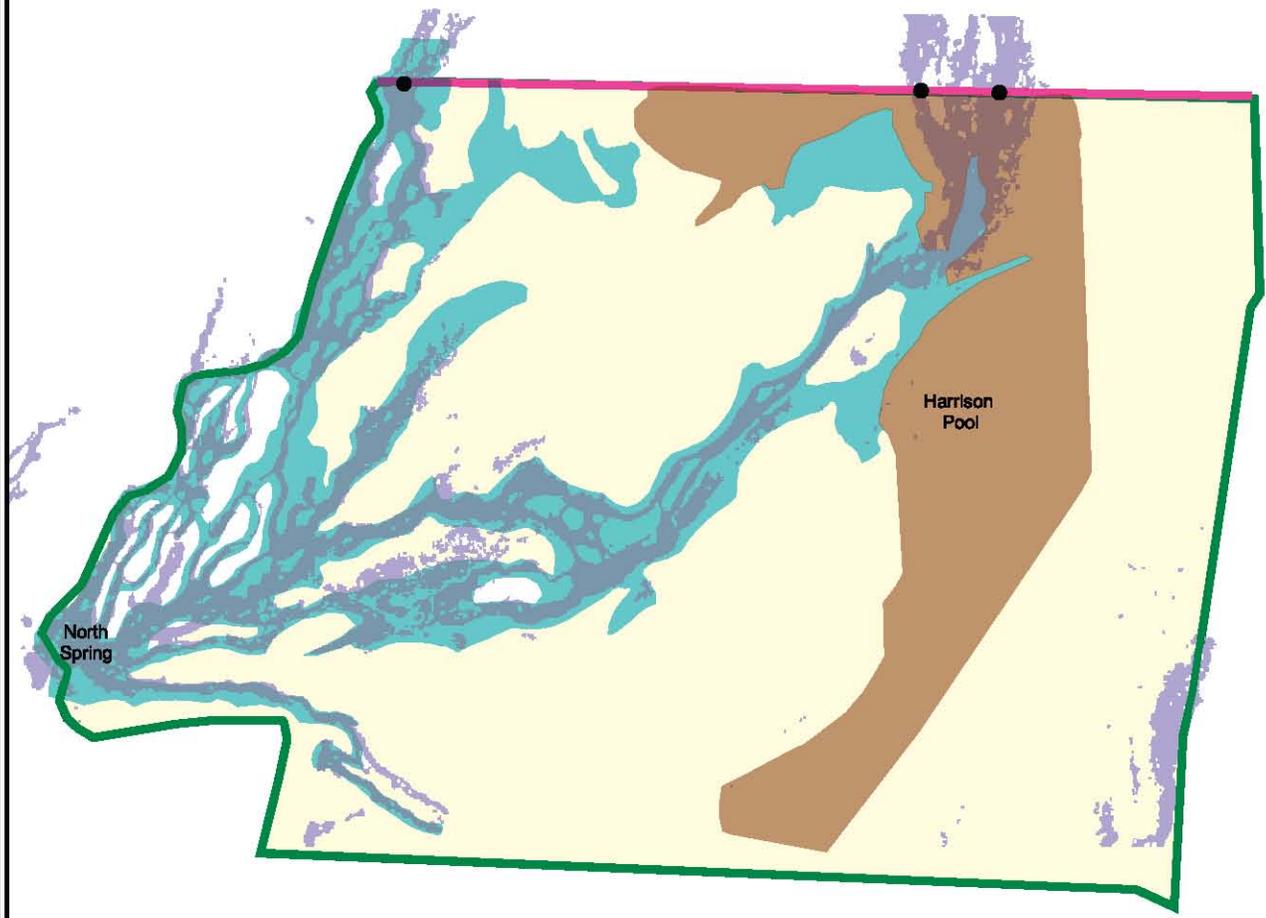
**Rationale:** The Harrison Unit is supplied by a single, isolated spring (North Spring) and retains much of the drainage topography evident in pre-Refuge aerial

photography making this unit suitable for restoration. Consistent with and complementary to the Ecological Integrity goal and current Service guidance, marsh restoration of the Harrison Unit will perpetuate the native biodiversity and physical characteristics endemic to the area. Little information is available on the specific ecological conditions of the Refuge prior to Refuge development and the restoration goal has little to no baseline available to establish objectives or measure success. The Refuge is also unique within the Bonneville Basin limiting the Refuge's ability to use a similar site for comparison.

Restoration ecology can be defined as "The return of an ecosystem to a close approximation of its conditions prior to disturbance" (National Resource Council 1992). Ecological systems are dynamic and the restoration objectives will focus on restoring the ecological functions and processes that permit natural succession. The restoration of the Harrison Unit will involve four primary steps:

- 1) Establishing a baseline inventory to include 3 years of data collection of the flora and fauna prior to any direct management implementation of the restoration process.
- 2) Conducting management activities, such as dike removal, to restore unimpeded hydrological, physical, chemical, and biological processes.
- 3) Designing monitoring strategies to evaluate both short term and long-term trends in ecosystem (community) structure and functions (water table dynamics, biodiversity, complete food web, resilience to invasive species). Short-term (1 to 3 years) monitoring to determine establishment and recovery of hydrological and biological components, and long-term

Figure 6 -  
Harrison Unit Restoration



- Harrison Unit
- Historic Hydrology (derived from pre-refuge aerial photo)

Restoration

- Phase I Area - North Spring  
Braided channels targeted for dike and water control structure removal
- Phase II Area - Harrison Pool
  - A) Harrison Pool targeted for dike breach at natural channel crossings (generalized locations)
  - B) Harrison Pool dike targeted for removal



(10 years and more) monitoring to determine management effects on community structure and functions.

4) Refining and establishing new objectives and success criteria based on monitoring that leads to new management activities.

These primary steps will be implemented in a phased approach with monitoring and evaluation of the success of each phase being conducted before proceeding to the next phase. Phase I will remove check dikes and water control structures from water channels to restore unimpeded flow to braided channels. Phase II will breach dikes in the Harrison Unit at natural drainage channels. Phase III, if data indicate restoration is warranted, will remove the entire dike system of the Harrison Unit.

#### Objectives:

*1. Establish a 3-year baseline inventory of existing soil, water, vegetation and fauna conditions of the North Springs stream channels and Harrison Unit pool within 4 years of CCP approval.*

#### Strategies:

- Obtain various expert opinions on the likelihood of a successful restoration effort and relative benefits to the wildlife using that area being considered for restoration.
- Establish Refuge-wide baselines to be used for comparison and monitoring purposes.
- Partner with the Natural Resources Conservation Service to characterize current soil conditions.
- Gather baseline data by 2009 on current flows using portable flumes from a minimum of four locations within the unit (spring, midway on feeder canal, inlet to Harrison Pool, below Harrison Pool).
- Continually monitor spring discharges.
- Establish a minimum of ten shallow ground water monitoring locations by 2006 using simple, inexpensive measuring techniques such as drive point piezometers. This monitoring will provide a simple assessment of changes in water tables and ground water flow that could be correlated with changes in vegetation and community structure
- Coordinate with U.S. Army Dugway Proving Ground during 3-year baseline inventory period to address issues related to water flow onto Army property.
- Establish a baseline inventory for vegetation within the Harrison Unit. Establish long-term (permanent) transects that traverse all macro vegetation communities for monitoring. Map all plant communities within the Harrison Unit, both native and non-native species.
- Conduct weed and invasive plant mapping by 2008 when the Integrated Pest Management Plan is developed, including areas of tamarisk, *Phragmites*, knapweed, fivehook bassia and summer cypress.
- Monitor response of invasive plant species to large-scale soil disturbance.
- Conduct annual bi-monthly bird surveys of Harrison Unit during refuge-wide survey periods conducted between March 15 and May 1, and between July 15 and September 1.

- Conduct annual shorebird surveys specific to Harrison Unit on weeks opposite the bi-monthly bird survey.
- Establish a baseline inventory of small mammals found within the plant communities in the Harrison Unit. Establish long-term (permanent) transects or grids, and predator scent stations within the Harrison Unit when the Wildlife Inventory Plan is developed by 2007. Transects will be co-located with vegetation transects.

***2. Within 3 years of approval of the CCP, develop a set of indicator species that best represent habitat within the Harrison Unit and Refuge-wide as described earlier, and that also provide response data for habitat change.***

**Strategies:**

- Consult with experts to develop a list of indicator species (Table 8) that best indicate changes in hydrologic factors, vegetation cover, and composition, wetland salinity, and biodiversity.
- Develop indicator metrics and methods for monitoring indicator species that best meet objectives such as number of individuals per unit, by season, reproductive success, species distribution, and seasonal habitat.
- Conduct pre- and post-monitoring of target indicator species.

***3. During the course of one complete drawdown of Harrison Pool in 2007 (Table 6), conduct a complete on-the-ground assessment of the unit to evaluate current conditions and how the major***

***original watercourses can be restored and how to restore them.***

**Strategies:**

- Compare aerial photos from pre-development with current aerial photos. Overlay original pre-development marsh photos on structural/dike map to identify natural watercourses and any remnants that may remain.
- Survey remnant channels.
- Conduct fly-over to see how much integrity exists in main drainages.
- Create GIS overlays for current and historical channels.
- Contract with a hydrologic engineering firm to conduct complete hydrologic assessment.
- Assess complications associated with invasive species introduction resulting from soil and vegetation disturbance from restoration of the landscape.

***4. Restore unimpeded hydrological processes to the North Spring (Harrison Unit) in three phases to be completed in 5-year increments.***

**Strategies:**

- Remove check dikes and water control structures by 2010 to restore unimpeded flow to braided channels (Phase I).
- Breach dikes at natural drainage channels by 2015 (Phase II).
- Remove dike system and any berm that diverts, channelizes, or prevents natural flows by 2020 (Phase III).
- Allow unimpeded hydrological processes to restore natural channels.

- Monitor and evaluate success of each phase before proceeding to next phase.

***5. Annually monitor natural vegetation succession within the Harrison Unit.***

**Strategies:**

- Continue to monitor vegetation composition, and community structure on a yearly basis using the line transects established in the baseline inventory. Additional vegetation transects will have to be established once the pool is removed. Plant community (vegetation) characteristics that may be monitored can include: species richness, ocular estimates of ground cover (bare ground, grass/forbs, exotic, and litter), shrub cover, shrub height.
- Establish research partnerships with local colleges and universities to monitor and research vegetation communities and ecological functions.
- Evaluate the need to plant native vegetation by 2009 when the Habitat Management Plan is developed.

***6. Upon implementation of the restoration of the Harrison Unit, annually monitor wildlife presence, abundance, and areas of use based on the evaluation of the original watercourses within 5 years of CCP approval.***

**Strategies:**

- Continue to monitor small mammal transects or grids and predator scent stations on a yearly basis. Additional small mammals transects will have to be established once the pool is

removed. Data collected on small mammals may include species richness, abundance, and guilds.

- Continue annual refuge-wide bird surveys and shorebird surveys specific to Harrison Unit on weeks opposite the bi-monthly bird survey between March 15 and May 1 and between July 15 and September 1.
- Map and monitor wading bird nesting colonies (if any) that become established.
- Establish research partnerships with local colleges and universities to monitor and research animal communities and ecological functions, such as predator/prey relationships, competition, resource partitioning.

***7. Within 5 years of Plan approval, develop and implement an invasive species plan for the Harrison Unit to annually monitor the effects of restoration on the resource.***

**Strategies:**

- Map and control the spread of non-native and invasive plant species, including tamarisk, knapweed, bassia and summer cypress with appropriate chemical control agents and mechanical methods, according to the Integrated Pest Management Plan.
- Establish study plots to evaluate the efficacy of noxious weed treatments and weed responses to altered hydrology and disturbed soils.
- Identify and contain any non-native animal species with the Harrison Unit, including house

mice, mosquito fish, bull frog, leopard frog and non-native snails, according to the Habitat Management Plan

**8. Consult with Utah DWR to explore the potential for restoration of least chub in the Harrison Unit over the next 10 years.**

- Annually monitor the least chub in the Harrison Unit over the next 10 years and benchmark data against recovery rates in other units.

**9. Develop adaptive management simultaneously with the three phases of marsh restoration described in Objective 4, which allows the Refuge Manager to adapt strategies to better meet objectives or determine whether to proceed with restoration.**

**Strategies:**

- Evaluate quality of monitoring data.
- Re-evaluate restoration approach.
- Evaluate if further restoration is warranted.

**Visitor Services**

**Goal:** Promote an understanding and appreciation of the fish, wildlife, and natural and cultural history of Fish Springs NWR by providing high quality environmental education, interpretation, and wildlife-dependent recreational opportunities for persons of all abilities.

**Rationale:** Increased efforts in visitor services and the reinitiation of a goose hunt will provide additional recreational opportunities at the Refuge. The Refuge will maintain an auto-tour route that traverses a cross section of the habitats and provides opportunity for wildlife viewing and photography. The construction



*Duck Blind on Fish Springs NWR*

of an interpretive boardwalk and an observation platform will further enhance wildlife viewing and photography. Scout groups visiting Fish Springs will find the Refuge to be a wonderful outdoor classroom. Providing service projects, merit badge counseling, and environmental education will enhance the visitor experience and understanding of the Refuge for most of these young visitors. Additional staff, as requested (see Funding and Personnel sections), will make increased efforts in outreach and environmental education possible, thereby enhancing public understanding and appreciation for Fish Springs NWR and the National Wildlife Refuge System.

**Objectives:**

1. *Provide waterfowl hunting opportunities for up to 2,000 visits annually (Figure 7).*

**Strategies:**

- Continue to open up to 40 percent of the Refuge to duck and coot hunting (no swans or snipe).
- Reinitiate a goose hunt on the Refuge.
- Continue an annual youth hunt.
- Increase law enforcement presence during hunting season.
- Maintain and advertise availability of three universally accessible hunting blinds.
- Maintain parking areas and roads for hunter vehicle access.
- Maintain all hunting related signs on the Refuge.
- Identify areas open to hunting and inform the public about Refuge hunting regulations through signs, news releases, pamphlets, and printed State hunting regulations.
- Produce a new Refuge Hunt Plan within 2 years.
- Produce a hunting tear sheet meeting Service graphic standards.
- Post hunting information, such as harvest data and availability of universally accessible hunting blinds, on Refuge web site.

*2. Within 5 years of CCP approval, provide opportunities for up to 5,000 visitors annually to participate in wildlife observation, wildlife photography, and interpretation (Figure 8).*

**Strategies:**

- Open Refuge roads to public access as described on Figure 8. Only core auto-tour route open from April 15 to August 15; close all other roads during that period.
- Maintain all directional signs on the Refuge.

- Maintain 9-mile self-guided auto-tour route with interpretive signs.
- Maintain universally accessible Thomas Ranch Watchable Wildlife Area.
- Allow boating (no gas motors) for wildlife observation, wildlife photography, and interpretation on areas open to the public except for the period from April 15 to August 15.
- Exclude year-round sanctuary areas.
- Maintain three universally accessible wildlife observation and photography blinds.
- Maintain a native plant exhibit near the Headquarters building.
- Maintain the Visitor Contact Kiosk and Headquarters exhibits.
- Construct a universally accessible interpretive boardwalk trail that extends into the marsh area and two viewing platforms. Include interpretive panels along the boardwalk and at the viewing platforms that discuss natural and human history of the Fish Springs area.
- Produce a Refuge general brochure in the Service graphic standard.
- Update and reprint the Refuge Wildlife List as needed.
- Conduct a special event each year for International Migratory Bird Day.
- Host an annual Refuge Open House or similar public event.
- Provide interpretive or environmental education discussions and/or tours for groups as requested. Include discussions about contribution of the Refuge to wildlife resources and ecosystem functioning.

Figure 7  
**Hunting**  
Fish Springs National Wildlife Refuge

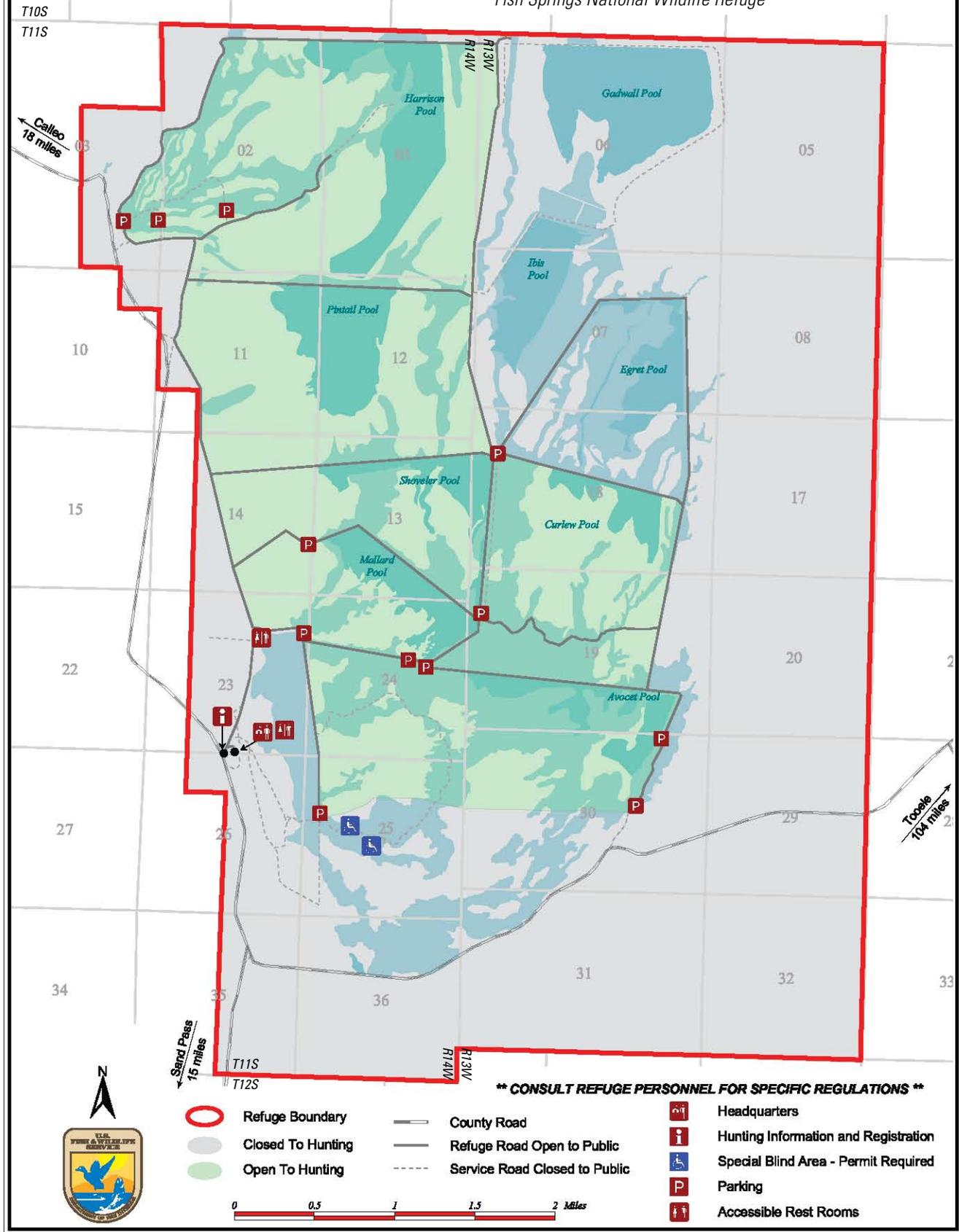
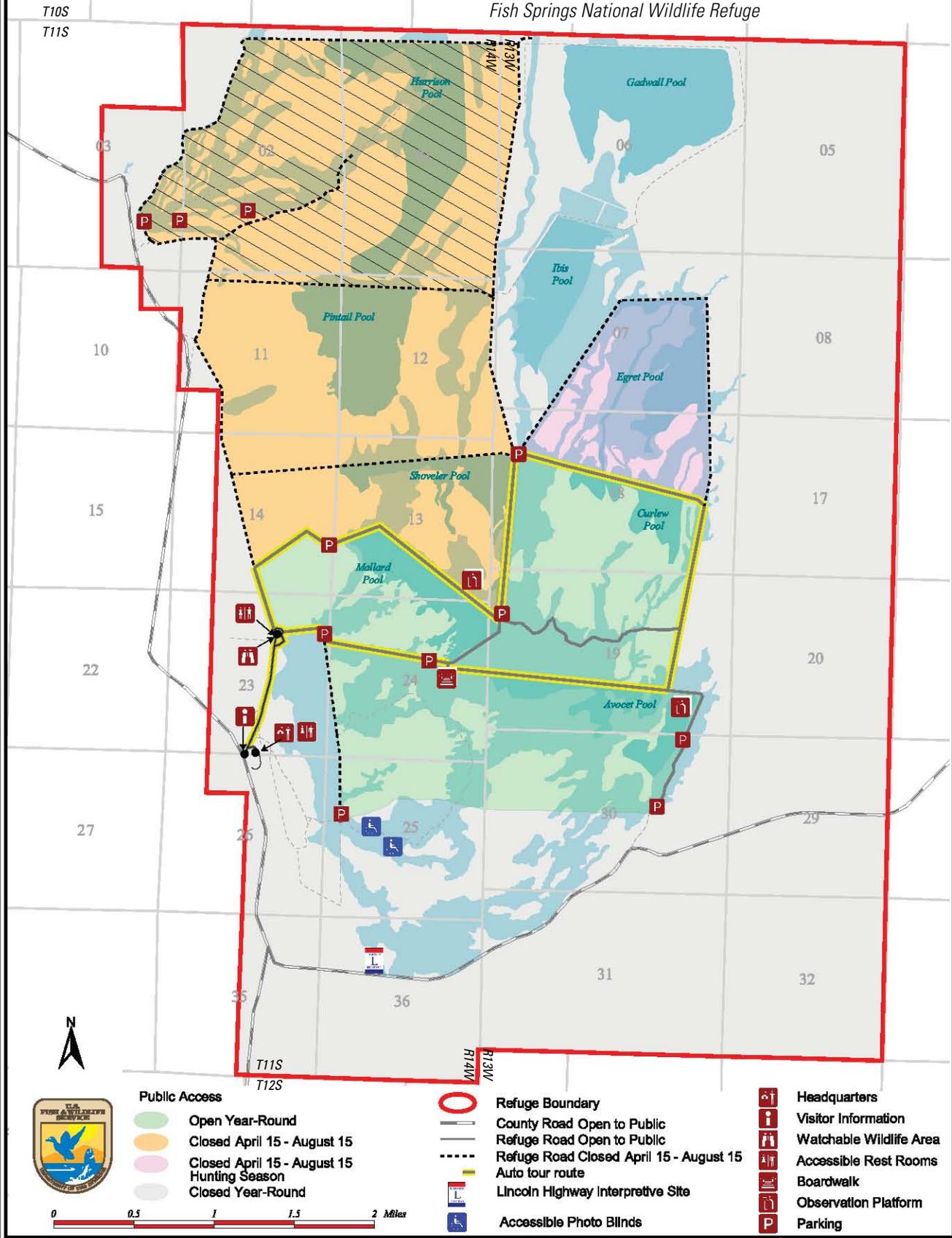


Figure 8  
**Public Use**  
 Fish Springs National Wildlife Refuge



- Co-sponsor other special events as opportunities arise.

**3. Upon approval of the CCP, implement at least five different outreach efforts to foster appreciation for the resources of Fish Springs NWR and the National Wildlife Refuge System.**

**Strategies:**

- Accommodate and host Boy Scouts and Girl Scouts as requested. Trips usually include a Refuge tour, service project, merit badge counseling, and environmental education activities. Allow troops to camp at Thomas Ranch Watchable Wildlife Area with special permit when deemed compatible.
- Host one to two school visits to the Refuge and make two to four visits to area schools annually, with the target being to increase the number of students reached each year from 50/year currently to 200/year.
- Make three presentations to professional and/or civic organizations annually.
- Write press releases announcing public events.
- Visit County Commissioners at least once a year.
- Visit regional offices of State and Federal Congressional representatives once a year.
- Maintain a Refuge web site with current information.

**4. Within 3 years of CCP approval, increase the Refuge volunteer program to reach 1,000 donated hours/year.**

**Strategies:**

- Organize three volunteer days each year with the goal of accomplishing a major task during each event.

Provide all necessary training, materials, and lodging as needed. Schedule the event in conjunction with national volunteer efforts, such as Volunteer Week, National Public Lands Day or Earth Day, or in conjunction with special events on the Refuge, such as Migratory Bird Day or the Open House. Write a press release announcing each Volunteer Day and project to be accomplished. Write a press release after each Volunteer Day that recognizes volunteer efforts and what was accomplished during the event.

- Notify area schools, civic groups, and hunting, birding, and environmental organizations of volunteer opportunities on the Refuge.
- Work with the Service's regional volunteer coordinator to develop a volunteer program that meets Refuge needs.
- Provide room and board for volunteers working on the Refuge for extended periods.
- Provide two or more trailer pads for volunteer use.

**Cultural Resources**

**Goal:** Preserve, protect, and promote an understanding of cultural resources on Fish Springs NWR.

**Rationale:** Access for archaeologists will be limited but the majority of the cultural resources would still be reasonably accessible due to their proximity to roads that would remain on the Refuge's west side. Enhanced and expanded efforts to inventory and analyze yet unmapped cultural resources sites, fully understanding known sites, and vigilant protection of these critical and

irreplaceable trust resources will allow a better understanding of the human history of the eastern Bonneville Basin. This additional information, coupled with that which is already known about the area, can provide for a richer and more complete interpretation of the Fish Springs area. Efforts to provide increased interpretation of important sites and a cultural resources brochure that provides an overview of the Refuge's substantial cultural resource values will increase the public's understanding of the important role Fish Springs has played for humans through the ages and appreciation for the Service's responsibility to protect some of this nation's important cultural resources.

Previous work done on the Refuge has suggested such a rich assemblage of prehistoric and historic cultural resource sites and resources that the entire Refuge should be nominated as a National Archeological District. Such a designation will bring increased visibility to the tremendous cultural resources protected within the Refuge's boundary and will likely be valuable in ensuring that full consideration of management project impacts is given in relation to these resources in the future.

#### **Objectives:**

***1. Increase preservation and protection of known archaeological resources on the Refuge, within 10 years.***

#### **Strategies:**

- Increase law enforcement presence during peak times of public use.
- Use standard law enforcement practices to protect known resources on the Refuge.
- Upgrade existing barricades on two caves known to have been used by prehistoric cultures; replace vertical

barricades with horizontal barricades to allow access by bats.

- Install remote sensing devices on the two caves.
- Catalog, map, and remove surface artifacts in limited cases where public use poses a severe threat.
- Enforce closures of year-round sanctuary areas; most known archaeological sites are within these areas.
- Consult with the Regional Historic Preservation Officer prior to all proposed ground-disturbing actions.
- Avoid areas of known cultural resources and potential sensitive areas when practical during management actions.
- Investigate the suitability of nominating the entire Refuge as a National Archeological District.

***2. Within 15 years of CCP approval, perform a complete cultural resources survey to identify important cultural resources on the Refuge.***

#### **Strategies:**

- Continue to host the University of Utah archaeological summer field school whenever possible.
- Contract with a qualified organization to complete a cultural resources inventory.
- Produce a cultural resources overlay for the GIS database.

***3. Within 15 years of CCP approval, have two known archaeologically important caves excavated.***

#### **Strategies:**

- Work with existing partners, such as University of Utah, Brigham Young University, Institute of Archaeology at University of Nevada - Las

Vegas, and University of Nevada - Reno, to develop a grant proposal to fund the project.

- Provide nonmonetary support to partners, such as vehicles, lodging, and computer support.

***4. Within 7 years of CCP approval, develop and implement an expanded cultural and historic interpretation program to include four new initiatives.***

**Strategies:**

- Design and install an interpretive display at the Thomas Ranch Watchable Wildlife Area. Display will discuss the uses of the Fish Springs area from prehistoric occupation up to the early days of the Refuge.
- Construct a turnout along the Pony Express Route where the Lincoln Highway runs close by. Include an interpretive display that discusses the Fish Springs area as a major transportation corridor through time and a foot trail to the remnant portion of the Lincoln Highway.
- Design and install an interpretive sign for the Fish Springs Pony Express site.
- Produce a leaflet that provides information on the rich prehistoric and historic cultural resources of the Refuge.
- Maintain cultural resources display and Lincoln Highway marker and sign in Headquarters building.

**Partnerships**

**Goal:** Promote partnerships to preserve and enhance the natural characteristics of the Bonneville Basin ecosystem in which Fish Springs NWR plays a key role.

**Rationale:** It is not enough that staff from Fish Springs NWR simply strive to provide critical habitat in a very arid and harsh environment. Coordination with a diverse array of partners is necessary to ensure that the Refuge can maximize its contribution to natural resource conservation at the landscape level. Fostering and increasing opportunities for participation in and contribution to larger landscape and regional level conservation initiatives will help ensure that the Refuge meets this obligation. Opportunities for academic institutions, other Federal, State, and county agencies, non-government organizations, and private citizens to partner with the Refuge to further this goal are nearly unlimited and can provide an important leveraging of resources toward this end.

The capability of the Refuge staff to participate in and contribute to these potential partnerships, which are geared toward protecting wildlife, cultural, and physical resources at the landscape level, will be maximized. The capability of the Refuge to provide critical habitats for the full complement of native flora and fauna will be enhanced and a broader array of species of concern will be a focus of management. Increased participation in partnerships will enable the Refuge to realize more fully the context of its habitats and populations relative to landscape level efforts and should allow it to focus resources to best complement those efforts and the National Wildlife Refuge System and Service missions.

**Objectives:**

***1. Participate in local partnering opportunities over the next 15 years that will benefit the Refuge by increasing knowledge of Refuge resources or accomplishing specific tasks.***

**Strategies:**

- Continue partnership with University of Utah's Museum of Natural History. Currently, this partnership has resulted in archaeological, geomorphological, and small mammal research being conducted on the Refuge, but the Cooperative Agreement covers many other disciplines.
- Continue partnerships with Brigham Young University and Southern Utah University, which focus on biological research projects.
- Continue cooperative efforts with Utah Division of Wildlife Resources (e.g., least chub re-introduction, fencing, Partners for Fish and Wildlife).
- Assist in the formation of the Eastern Bonneville Basin partnership with Dugway Proving

Ground, Utah Division of Wildlife Resources, and The Nature Conservancy. The focus of this partnership is common natural resources management issues.

*2. Within 3 years of CCP approval, renew participation in existing national and international partnerships at the regional level.*

**Strategies:**

- Renew participation in Partners in Flight, an international bird conservation program.
- Renew participation in the Intermountain West Joint Venture All Birds Conservation planning efforts.
- Initiate participation in the Intermountain West Regional Shorebird Plan team.

