

Chapter 4. Environmental Consequences

Environmental consequences for the three alternatives are discussed in this chapter. Table 11 summarizes the comparison of environmental consequences.

4.1 Alternative A - No Action (Current Management)

Marsh (Open Water, Shallow Water Marsh, and Wetland)

Under current management, there would be a slow continuous decrease in waterfowl wintering, migration, and nesting habitat due to the expansion of cattail and common reed (*Phragmites australis*). Cattails have greatly expanded under current marsh management, with some units developing very dense stands that are of lesser habitat quality. Control measures to date (mowing and some herbicide spraying) have failed. Plans are underway to try other control measures on a small experimental basis during the spring of 2004. However, even if these efforts prove effective, it is unlikely that control efforts would keep pace with cattail expansion if marsh water management remains as it is.

To date, Refuge staff has found no effective means to control common reed (*Phragmites australis*) on the Refuge. *Phragmites* can occupy upland sites with seeps, or grow in brackish to fresh water several feet deep. Large monocultures are usually associated with impounded areas with resultant stabilized water regimes (Cross and Fleming 1989). A possible contributing factor is the more recent drawdown

schedule that permits *Phragmites* to invade and gain a foothold in former deep water areas unsuitable for the species. *Phragmites* seeds do not germinate and seedlings do not grow in completely saturated (0% oxygen) soils (Wijte and Gallagher 1996a, 1996b).

Due to concerns that prescribed burning is actually aiding the spread of *Phragmites australis*, no burning currently occurs in Avocet, Mallard, Curlew, Shoveler, or Harrison Units. This lack of burning decreases aquatic invertebrate productivity, thereby decreasing the quality of foraging habitats in those units. Fire as a control method for *Phragmites* has variable results. Generally fire is most effective in late summer; winter burning provides no control and often increases densities of *Phragmites* in spring (Cross and Fleming 1989; Frederick 2004). Spring and mid-summer burning without other control treatments is ineffective because burned stands are replaced with a more vigorous growth (Cross and Fleming 1989).

Under this alternative, it is highly unlikely that research into how best to control common reed (*Phragmites australis*) would be conducted over the length of time necessary to reach viable solutions.

Shorebird nesting habitats would be maintained at existing levels, with no opportunities for expansion. Shorebird migration habitat would be substantially degraded due to reductions in burning and resulting nutrient loss.

Current levels of potential nesting habitat for colonial water birds would be maintained. Enhancement of areas for potential rookery habitat would not be established and the failure to periodically burn rookeries under Alternative A may lead to a long-term decline in their productivity. Providing a diverse array of habitat with a mosaic of vegetation types and structure that provide cover, nesting substrate and protection from predators and human disturbance is optimal for maintaining/providing nesting habitat for colonial nesting waders. This may require periodic burning or mechanical disturbance of rookeries or patches within the rookeries to maintain preferred vegetation component (hardstem bulrush), successional stage, and vegetation structure.

The quality of habitat in the marsh uplands (marsh meadows, sub-irrigated meadows) would decline due to the spread of *Phragmites australis* and cattail. The amount of saltgrass and Baltic rush would decline. Further decline would occur in those units that are not burned due to decadence and the lack of plant revitalization that burning brings.

Predator numbers are expected to remain about the same. The Refuge would continue to attract waterfowl, maintaining the primary prey base for raptors.

No baseline data is available to evaluate possible changes, if any, in the small mammal and invertebrate populations.

High Desert Shrubland (Great Basin Arid Shrubland and Great Basin Cold Desert Shrubland)

Under current management, the restoration of the high desert shrubland habitat would be passive (natural regeneration of native vegetation). Based on observations of shrubland restoration since the successful removal of cattle, passive restoration would result in a slow and unpredictable

restoration of native grasses. Most native species still exist on the Refuge. With continued passive management, it is expected that they would slowly increase in abundance. The continued suppression of all wildfires would reduce cheatgrass expansion on the Refuge.

Ecological Integrity

Under this alternative, comprehensive biological assessments would not be conducted.

Phragmites australis would continue to expand due to lack of knowledge and resources to effectively control it.

Native snail diversity likely would continue to decline. Studies to date show a decrease in snail biodiversity over historical conditions. Without taking measures to control the invasion by and spread of nonnative snails, or to address possible habitat threats, there is no reason to expect the downward trend to reverse itself.

The least chub, a candidate species, would not be reintroduced into any additional Refuge springs, reducing the opportunity for recovery and recruitment of this species because other lands, where it occurs, offer less protection than does Fish Springs NWR. Measures to increase snowy plover nesting success would not take place, nor would new roosting sites for bald eagles be established. Fish Springs NWR would not be maximizing its contribution to the survival and recruitment of the snowy plover. Eagles would continue to have no daytime roosting places free from disturbance as the only current daytime roosting place is at the Thomas Ranch Watchable Wildlife Area where Refuge staff must drive directly under the roost several times a day. This arrangement is not beneficial for the eagles.

Visitor Services

Under this alternative, public use opportunities would remain stable. Waterfowl hunters in winter occasionally disturb loafing bald eagles at the Thomas Ranch Watchable Wildlife Area, particularly during weekends. Hunter activity likely displaces eagles from the roost or temporarily alters eagle behavior. Eagles may adjust the times they leave and enter the roost in response to visitor activity. It is expected that hunter visitation would remain at a level close to current numbers, about 1,000/year. Eventually hunter visitations may rise, but is not likely to exceed 2,000 during the life of the CCP (15 years).

No other plans are in place under current management to alter public use opportunities. The auto-tour route, boating with current restrictions, educational programs, public events, universally accessible hunting blinds, the Thomas Ranch Watchable Wildlife Area, cultural displays, and visitor kiosk would not change.

Visitation to Fish Springs NWR currently ranges between 2,000 and 3,100 visitors each year. Visitor use is generally low enough that no substantial impact is made upon the wildlife resources of the Refuge. No substantial changes are expected in these numbers under this alternative.

Permanent and temporary sanctuary areas would remain unchanged (Figure 5). Access to Refuge roads remain as described on Figure 5. Only the core auto-tour route would remain open during the spring nesting season, May 15 to August 15. This core auto-tour route would represent the primary disturbance to wildlife. Additional disturbance would result along other roads from staff activities (e.g., water control, weed control, surveys).

Cultural Resources

Continued surveying for cultural resources by the University of Utah would lead to improved protection of cultural resources by identifying and prioritizing sites for protection. As important sites are discovered, the limited law enforcement resources on the Refuge would be directed to better monitor them. Additionally, identified sites would be protected from adverse harm due to Refuge management activities by avoiding either vulnerable sites, modifying activities, or clearing artifacts for curation, whichever is most appropriate. However, insufficient law enforcement capabilities would still exist on the Refuge. Under current management, loss of cultural artifacts would continue due to theft. Two archaeologically important caves are occasionally breached and artifacts are removed from the ground in both opened and closed parts of the Refuge.

The University of Utah survey activities would not have an adverse impact on any wildlife resources. Crews generally would be small, 10 to 15 people, divided into small groups working in different areas on a daily basis. Most activities would be concentrated in the dunes and springs, away from the marsh. Crews would not use any equipment that would substantially alter the soil or plant communities, nor any that would substantially disturb wildlife.

Partnerships

Current partnership projects with the University of Utah Museum of Natural History would continue to provide the Service with a better understanding of the archaeological and geological significance of the Refuge. Projects conducted with Brigham Young University and Southern Utah University would provide biological information, which would allow for more informed management decisions on the Refuge. The Service also would work with the Utah Division of Wildlife Resources on

specific projects such as least chub reintroduction and fencing.

All of these partnerships offer a network of resources and experts available to help achieve Refuge objectives. For instance, archaeological surveys conducted by the University of Utah help to better understand the rich cultural resources found on Fish Springs NWR. This, in turn, helps the Refuge better interpret the cultural legacy of Fish Springs for the public.

Socioeconomics

Because all uses are maintained at current levels, there should be minimal to no socio-economic impacts under this alternative. This alternative would not increase infrastructure investment in the Refuge, nor increase Refuge staffing levels. The lack of these increases would not take anything away from the local economy, but at the same time, would not add any extra opportunities. Supplies necessary for management of public lands, (e.g., gas, seed, fence posts) would continue to be bought from the local area, maintaining current sources of revenue for area business. By maintaining public use at existing levels, the current tourism contribution to the economy from the Refuge would remain the same.

Protecting habitat and providing healthy ecosystems have additional socioeconomic benefits such as providing clean water and air, reducing soil erosion, increasing flood control and increasing the quality of life. These tangible benefits, as well as more intangible ones, would remain the same under this alternative.

4.2 Alternative B (Restoration)

Marsh

Marsh hydrological restoration would change the habitat qualities of the marsh. There would be no ability to control water

levels and no water impoundments. Large expanses of open water and islands would be replaced with deep narrow braided channels interspersed with marsh uplands and salt flats.

Wintering, migrating, and nesting habitat for waterfowl and shorebirds would be reduced without the ability to control water. This would lead to an inability to provide stable water during the waterfowl nesting season or shallow water and mud flats for shorebird foraging and nesting. It is expected that use by these birds would eventually return to levels similar to pre-development when inventories showed fewer numbers of waterfowls than currently use the Refuge. Historical records show only a few thousand waterfowl during spring and fall, versus peak usage of 18,000 to 20,000 currently. Shorebirds would be expected to decline given their foraging and nesting requirements. Foraging habitat, and perhaps nesting habitat, would likely be reduced for wading birds as well. For instance, the amount of open shallow water would decrease, causing the number of white-faced ibis to decline.

The effect on piscivorous birds (e.g., great blue herons, snowy egrets, black-crowned night-herons) is difficult to determine. The deep narrow water channels may or may not support fish. Deeper and, most likely, faster flowing channels would not be as conducive to foraging by these species, which usually forage in water less than 12 inches in depth and with very low flow rates. In addition, the surrounding habitat may not support their roosting and other needs.

Wetland nesting passerines (e.g., rails, marsh wrens, yellowthroats) would likely increase over the short-term as dense cover for nesting would expand with more marsh uplands. Populations would likely stabilize, or possibly decrease, as open water habitats would decrease and reducing the benefits of open water for providing warmer, sunnier

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conditions for increased productivity of food resources for these species.

High Desert Shrubland

The high desert shrubland would eventually be restored to a plant composition that more closely resembles its historical native composition. It is unlikely that it will ever be completely restored to its native composition as some level of invasive/nonnative species, especially cheatgrass, will always occur. Under this alternative, however, native grasses, already present but not widespread, would increase. The relative abundance of natives versus nonnatives would improve along with the percent of ground covered by native species. Very little is known about the wildlife component of the high desert shrubland, but a return to a more native floristic condition would provide better habitat for native bird, invertebrate, and mammal wildlife species.

Ecological Integrity

The least chub (candidate species), bald eagle (threatened species), and western snowy plover (State species of concern, species of high concern under the United States Shorebird Conservation Plan 2001) would be adversely impacted were this alternative to be implemented. The least chub would be more vulnerable to predation by the nonnative invasive mosquito fish. The bald eagle would have a smaller prey base with fewer waterfowl and other birds using the Refuge. The snowy plover may experience degraded foraging and nesting habitat. Water would flow unimpeded onto the salt flats, but it is difficult to predict if those areas would be wet or dry during nesting and brood rearing.

Opportunities to assist least chub, bald eagle, and snowy plover populations would be eliminated. Least chub reintroduction would not take place due to the inability to keep mosquito fish out of reintroduction

sites without a water control infrastructure. This would further threaten the survival and recruitment of this species because other lands where it occurs offers less protection than does Fish Springs NWR. No new roosting sites would be established for the bald eagle. Eagles would continue to have no roosting places free from disturbance as the only roosting place would be at the Thomas Ranch Watchable Wildlife Area. This arrangement is not energetically beneficial for the eagles. Raised nesting sites and electric fencing around nesting areas for snowy plovers would be infeasible. Thus, Fish Springs NWR would not be maximizing its contribution to the survival and recruitment of the snowy plover.

Migrating and wintering habitats for birds of prey, such as bald eagles, golden eagles, and harriers, would be reduced as their primary prey base, waterfowl, would shrink. The same is true for some other predators, namely coyotes and red fox. Predators such as kit fox and bobcat would be unaffected.

Native marsh plants would benefit under this alternative with management focusing on ways to promote native species. Invasive plants, such as whitetop and tamarisk, would be greatly reduced, minimizing the impacts of invasives that form large monotypic stands with little habitat value. However, their control would be much more difficult without the aid of roads and airboats for access to problem areas. Marsh restoration itself would probably allow *Phragmites australis* to continue spreading, but an aggressive research effort would reveal how best to control this species. The increase in native marsh plants will benefit some wildlife species such as wetland-nesting passerines.

Native spring snails would also benefit under this alternative, with species richness preserved and sustainable population levels supported. The overall number of *Melanoides tuberculata*, a nonnative snail,

would decline if appropriate control measures can be developed and implemented. Eradication would be unlikely. Some *Melanoides tuberculata* would still exist in many springs, with the potential for distribution to other springs via avian species.

Visitor Services

Opportunities for wildlife-dependent recreation would be slightly different in this alternative from the current or proposed management. More emphasis would be placed on passive recreational uses such as environmental education, interpretation, wildlife observation and photography. The restoration and subsequent monitoring of the marsh ecosystem would provide expanded opportunities for interpretation and environmental education.

The addition of a goose hunt would expand hunting opportunities at the Refuge. Many of the existing roads on the Refuge would be eliminated as a result of marsh restoration, which will limit vehicle access to current hunting areas. Hunter parking areas would be located along remaining roads. Access to hunting areas would be via boat and/or foot passage. Boating opportunities would be expanded under this alternative although open water boating opportunities would decrease. Hunting opportunities for people with disabilities would continue, with a minimum of one accessible hunting blind. It is predicted that hunting visits may decrease from about 1,000/year currently to about 500/year due to limited vehicle access to the Refuge.

The Pony Express road crossing on the south end of the Refuge would provide wildlife viewing opportunities. Additional viewing opportunities would occur where the road passes near North Spring and its associated drainage at the Thomas Ranch Watchable Wildlife Area (Figure 7). The construction of an interpretive boardwalk

and an observation platform would further enhance wildlife viewing and photography.

The number of students reached each year through environmental education programs would increase from 50/year currently to 200/year. Outreach efforts also would increase. The combined effect of these two programs should result in a greater understanding of Refuge resources and the National Wildlife Refuge System in general. Increased volunteer efforts would assist in achieving many Refuge habitat and visitor services objectives.

Cultural Resources

Protection of cultural resources would be improved under this alternative; less theft and damage will occur. Increased law enforcement capability, improved security at the caves, and better knowledge of the resources would aid Refuge staff in the goal to protect cultural resources.

There would be an increased awareness and appreciation of the cultural resources on the Refuge and the significance of the Fish Springs area through the ages. Visitors would realize that public land agencies are preserving, protecting, and interpreting the cultural legacy of the areas they manage, which should translate into increased support for the National Wildlife Refuge System.

Continued surveying for cultural resources by the University of Utah would lead to improved protection of those resources. As important sites are discovered, the limited law enforcement resources on the Refuge would be directed to better monitor them. Additionally, identified sites would be protected from adverse harm due to Refuge management activities by avoiding either vulnerable sites, modifying activities, or clearing artifacts for curation, whichever is most appropriate.

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The University of Utah survey activities would not be expected to have an adverse impact on any wildlife resources. Crews of 10 to 15 people would be divided into small groups working in different areas on a daily basis. Most activities would be concentrated in the dunes and springs, away from the marsh. Crews would not use any equipment that would substantially alter the soil or plant communities, nor any that would substantially disturb wildlife.

Any contracted archaeological organizations that may assist in Refuge survey activities would be required to follow guidelines designed to minimize disturbance to wildlife.

Partnerships

Current partnership projects with the University of Utah Museum of Natural History would continue to provide the Service with a better understanding of the archaeological and geological significance of the Refuge. Projects conducted with Brigham Young University and Southern Utah University would provide biological information that would allow for more informed management decisions on the Refuge. The Service also would work with the Utah Division of Wildlife Resources on specific projects such as least chub reintroduction and fencing.

All of these partnerships offer a network of resources and experts available to help achieve Refuge objectives. For instance, archaeological surveys conducted by the University of Utah help to better understand the rich cultural resources found on Fish Springs NWR. This, in turn, helps the Refuge better interpret the cultural legacy of Fish Springs for the public.

Increased participation in regional partnerships, such as Partners in Flight and the Intermountain West Regional Shorebird Plan, would provide the Refuge with an

even greater network of resources and experts, and make the Refuge and the Service a greater contributor at the regional level.

Socioeconomics

Under this alternative, marsh restoration will be accomplished through a major construction effort conducted throughout the 15-year life of this CCP and beyond. Construction services, labor, equipment, and supplies will be purchased and/or rented from local and regional area businesses, increasing revenue opportunities for businesses supporting the construction effort. Supplies necessary for management of public lands (e.g., gas, seed, fence posts, etc.) will continue to be bought from the local area for the life of the CCP, maintaining current sources of revenue for area businesses. As restoration nears completion and natural systems recover and require less intensive management, supply needs will decrease. Public use will decrease, decreasing the tourism contribution to the economy.

Protecting habitat and providing healthy ecosystems have additional socioeconomic benefits such as providing clean air and water, reducing sedimentation, and increasing the quality of life. These tangible benefits, as well as more intangible ones, will increase under this alternative.

4.3 Alternative C (Proposed Action)

Marsh

Under this alternative, the quality of waterfowl wintering, migration, and nesting habitat would improve due to reductions in cattail and *Phragmites australis*. Results from research on the effects of prescribed burning on the spread of *Phragmites australis* would help the Refuge staff design an effective control program. With this, prescribed fire would be used in all marsh

units, including Avocet, Mallard, Curlew, and Shoveler, allowing for enhanced production of invertebrates. This enhanced food resource is expected to increase brood survival rates for waterfowl and shorebirds.

Shorebird fall migration and nesting habitat would be maintained at existing levels, with no opportunities for expansion or improvement. Spring migration habitat would increase.

Nesting habitat for colonial water birds would increase through the creation of additional stands of hardstem bulrush for use as a second rookery. This would provide potential nesting for at least 150 more pairs.

Predator numbers are expected to remain about the same. The Refuge would continue to attract waterfowl, their primary prey base.

Marsh hydrology in the Harrison Unit would be restored. This would restore historical hydrological, physical, and biological processes, increasing the biodiversity of native flora and fauna communities. Flora and fauna communities and species dependent on open water habitats would decline.

Loss of peat by past burning would delay or preclude restoration.

No baseline data is available to evaluate possible changes, if any, in the small mammal and invertebrate populations.

High Desert Shrubland

The high desert shrubland would eventually be restored to a plant composition that more closely resembles its historical native composition. It is unlikely that it will ever be completely restored to its native composition as some level of invasive/nonnative species, especially cheatgrass, will always occur. Under this alternative, however, native grasses,

already present but not widespread, would increase. The relative abundance of natives versus nonnatives would improve along with the percent of ground covered by native species. Very little is known about the wildlife component of the high desert shrubland, but it is reasonably expected that this return to a more native floristic condition would provide better habitat for native bird, invertebrate, and mammal wildlife species.

Ecological Integrity

The least chub (candidate species), bald eagle (threatened species), and western snowy plover (State species of concern, species of high concern under the United States Shorebird Conservation Plan 2001) would benefit under this alternative. Least chub reintroduction would take place in nonsystemic springs. Fish Springs NWR offers the best level of protection for this fish; other public and private lands where it is found do not offer the same level of protection as a National Wildlife Refuge. Populations at Fish Springs, once established and protected, could be used as gene stock for other areas.

New roosting sites would be established for the bald eagle. Raised nest sites and electric fencing around nesting areas for snowy plovers would be constructed, offering a level of protection not available in most of this bird's range.

Migrating and wintering habitats for birds of prey, such as bald eagles, golden eagles, and harriers, may be enhanced slightly as their primary prey base, waterfowl, experience slight gains due to improved habitat. The same is true for some other predators, namely coyotes and red fox. Predators, such as kit fox and bobcat, would be unaffected.

Native marsh plants would benefit under this alternative with management focusing on ways to promote native species. Invasive

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plants, such as whitetop and tamarisk, would be greatly reduced, minimizing the impacts of invasives that form large monotypic stands with little habitat value. The increase in native marsh plants would benefit many wildlife species such as wetland-nesting passerines, waterfowl, shorebirds, and water birds.

Native spring snails also would benefit under this alternative, with species richness preserved and sustainable population levels supported. The overall number of *Melanoides tuberculata*, a nonnative snail, would decline if appropriate control measures can be developed and implemented, as is hoped. Eradication is highly unlikely. Some *Melanoides tuberculata* would still exist in many springs, with the potential for distribution to other springs via avian species.

Visitor Services

Opportunities for wildlife-dependent recreation would be improved under this alternative (Figure 8), including additional facilities for people with disabilities, increased outreach, and initiation of a goose hunt. The construction of an interpretive boardwalk and an observation platform would further enhance wildlife viewing and photography. Total annual visits are expected to increase up to 5,000 over the life of the CCP.

It is predicted that hunting visits would increase from about 1,000/year currently to about 2,000/year due to increased outreach efforts and the addition of a goose hunt. Hunting opportunities designed especially for people with disabilities would continue.

The number of students reached each year through environmental education programs would increase from 50/year currently to 200/year. Outreach efforts would also increase. The combined effect of these two programs should result in a greater understanding of Refuge resources and the

National Wildlife Refuge System in general. Increased volunteer efforts will assist in achieving many Refuge habitat and visitor services objectives.

Cultural Resources

Protection of cultural resources would be improved under this alternative; less theft and damage would occur. Increased law enforcement capability, improved security at the caves, and better knowledge of the resources would aid Refuge staff in the goal to protect cultural resources.

There would be an increased awareness and appreciation of the cultural resources on the Refuge and the significance of the Fish Springs area through the ages. Visitors would realize that public land agencies are preserving, protecting, and interpreting the cultural legacy of the areas they manage, which should translate into increased support for the National Wildlife Refuge System.

Continued surveying for cultural resources by the University of Utah would lead to improved protection of those resources. As important sites are discovered, the limited law enforcement resources on the Refuge would be directed to better monitor them. Additionally, identified sites would be protected from adverse harm due to Refuge management activities by avoiding either vulnerable sites, modifying activities, or clearing artifacts for curation, whichever is most appropriate.

The University of Utah survey activities are not expected to have an adverse impact on any wildlife resources. Crews of 10 to 15 people divided into small groups would work in different areas on a daily basis. Most activities would be concentrated in the dunes and springs, away from the marsh. Crews would not use any equipment that would substantially alter the soil or plant communities, nor any that would substantially disturb wildlife.

Any contracted archaeological organizations that may assist in Refuge survey activities would be required to follow guidelines designed to minimize disturbance to wildlife.

Partnerships

Current partnership projects with the University of Utah Museum of Natural History would continue to provide the Service with a better understanding of the archaeological and geological significance of the Refuge. Projects conducted with Brigham Young University and Southern Utah University would provide biological information that would allow for more informed management decisions on the Refuge. The Service also would work with the Utah Division of Wildlife Resources on specific projects such as least chub reintroduction and fencing.

All of these partnerships offer a network of resources and experts available to help achieve Refuge objectives. For instance, archaeological surveys conducted by the University of Utah are invaluable in better understanding the rich cultural resources found on Fish Springs NWR. This, in turn, helps the Refuge better interpret the cultural legacy of Fish Springs for the public.

Increased participation in regional partnerships, such as Partners in Flight and the Intermountain West Regional Shorebird Plan, would provide the Refuge with an even greater network of resources and experts, and make the Refuge and the Service a greater contributor at the regional and landscape level.

Socioeconomics

Infrastructure investment in the Refuge and Refuge staffing levels will increase

under this alternative. Additional housing, vehicle support, food and other staple items will be required to support three new full-time employees. These increases will create additional revenue opportunities for regional and local area businesses. New housing requirements will increase demand for construction services. Supplies necessary for management of the Refuge will increase with the expansion of management activities (e.g., grass, seed, fence posts, etc.). Supplies will continue to be bought from the local area, increasing revenue opportunities for area businesses.

Public use is expected to increase with the addition of a goose hunt and expanded wildlife observation opportunities. Construction services will be required to build the interpretive boardwalk and viewing platforms. Marsh restoration of the Harrison Unit will add to the increased demand for construction services. Labor, equipment and supplies will be purchased and/or rented from local and regional area businesses, increasing revenue opportunities for businesses supporting the construction effort. Increased public use will increase the tourism contribution to the economy from the Refuge.

Protecting habitat and providing healthy ecosystems have additional socioeconomic benefits such as providing clean water and air, reducing soil erosion, increasing flood control, and increasing the quality of life. These tangible benefits, as well as more intangible ones, will increase with expansion of habitat management, research, and monitoring programs in this alternative.

Table 11. Summary comparison of environmental consequences.

Goal Area	Alternative A (Current Management)	Alternative B	Alternative C (Proposed Action)
Marsh	<ul style="list-style-type: none"> • Slow erosion of waterfowl wintering, migration, and nesting habitat • Decreased aquatic invertebrate productivity • Decreased quality of foraging in some units • Shorebird and colonial waterbird nesting habitats maintained at existing levels • Substantial degradation of shorebird migration habitat • Degradation of marsh upland habitat • Less saltgrass and Baltic rush 	<ul style="list-style-type: none"> • Open water and islands replaced by braided channels • Drastic reductions in wintering, migration, and nesting habitat for waterfowl and shorebirds • Reduction in use of Refuge by waterfowl and shorebirds to fraction of present • Less foraging habitat for wading birds • Increase in habitat preferred by wetland-nesting passerines • Indeterminate effect on habitat needs of piscivorous birds 	<ul style="list-style-type: none"> • Improved wintering, migration, and nesting habitat for waterfowl • Increased production of aquatic invertebrates • Increased brood survival rates for waterfowl and shorebirds • Increased spring migration habitat for shorebirds • Nesting habitat for up to 150 more pairs of colonial water birds • Enhanced potential habitat for colonial waterbirds • Restoration of historical marsh hydrology and wildlife communities in Harrison Unite • Increased biodiversity of native flora and fauna and a diverse mosaic of habitat • Decreased flora and fauna dependent on open water habitat
High Desert Shrubland	<ul style="list-style-type: none"> • Unpredictable restoration of native grasses • Native plants slowly increase in abundance • Very limited expansion of cheatgrass 	<ul style="list-style-type: none"> • Historical native plant composition restored • Increase in native grasses • Improvement in relative abundance of native to nonnative plants • Improved quality of habitat for high desert shrubland dependent bird, mammal, and invertebrate species 	<ul style="list-style-type: none"> • Same as Alternative B

Goal Area	Alternative A (Current Management)	Alternative B	Alternative C (Proposed Action)
Ecological Integrity	<ul style="list-style-type: none"> • Spread of <i>Phragmites australis</i> • Decline in native snail diversity • Possible decline in least chub population • No increases in snowy plover nesting success • No bald eagle roosting sites free from disturbance 	<ul style="list-style-type: none"> • Greatly improved natural ecosystem integrity • Reductions in <i>Phragmites australis</i>, whitetop, and tamarisk • Preservation of native spring snail species richness • Drastic decline in least chub population • Large increase in mosquito fish population • Possible degraded foraging and nesting habitat for snowy plover • No bald eagle roosting sites free from disturbance • Smaller prey base for bald eagles and other birds of prey, coyotes, and red fox • Increase in native marsh plants • Increased wetland-nesting passerine populations 	<ul style="list-style-type: none"> • Reduction in <i>Phragmites australis</i>, whitetop, and tamarisk • Preservation of native spring snail species richness • Increase in least chub population • Increased snowy plover nesting success • Disturbance-free bald eagle roosting sites • Slight increases in prey base for bald eagles and other birds of prey, coyotes, and red fox • Increase in native marsh plants • Improved habitat for wetland-nesting passerines, waterfowl, shorebirds, and water birds • Increased protection for breeding waterbirds
Visitor Services	<ul style="list-style-type: none"> • Currently ranges between 2000-3100 annual visitations • Increased hunting opportunities • 50 students/year reached through environmental education programs 	<ul style="list-style-type: none"> • Decrease to 1,500 annual visitations • Increased hunting opportunities • Vehicle access to Refuge limited, due to elimination of roads • Increased boat and foot access opportunities • Loss of open water for boating • 200 students/year reached through environmental education programs 	<ul style="list-style-type: none"> • Increase to 5,000 annual visitations • Increased hunting opportunities • Increased opportunities for wildlife observation and photography • 200 students/year reached through environmental education programs • Opportunities for boating closed until August 15
Cultural Resources	<ul style="list-style-type: none"> • Continued loss of cultural artifacts due to theft • Better protection of important sites • No significant disturbance to wildlife resources 	<ul style="list-style-type: none"> • Decreased loss of cultural artifacts due to theft • Improved protection of all sites • Increased opportunities for learning about cultural significance of Fish Springs area • No significant disturbance to wildlife resources 	<ul style="list-style-type: none"> • Same as Alternative B

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Goal Area	Alternative A (Current Management)	Alternative B	Alternative C (Proposed Action)
Partnerships	<ul style="list-style-type: none"> • More informed management of Refuge biological and cultural resources • Higher likelihood of achieving Refuge objectives 	<ul style="list-style-type: none"> • More informed management of Refuge biological and cultural resources • Higher likelihood of achieving Refuge objectives • Greater regional contribution by Refuge 	• Same as Alternative B

