U.S. Department of the Interior
Fish and Wildlife Service
Bear River Migratory Bird Refuge

2155 West Forest St.
Brigham City, Utah 84302
Phone: (435) 723-5887
Fax: (435) 723-8873

Annual Habitat Management Plan
2007

April 4, 2007

Annual Habitat Management Plan
2007
Bear River Migratory Bird Refuge
Brigham City, Utah

April 4, 2007

Prepared by: Budget E. Olson — 4/4/07
Wildlife Biologist, Bear River Migratory Bird Refuge — Date

Recommended by: [signature] — 4/4/07
Acting Project Leader, Bear River Migratory Bird Refuge — Date

Concurred by: [signature] — 4/11/07
Acting Refuge Field Supervisor, Montana/Wyoming/Utah — Date

INTRODUCTION

At Bear River Migratory Bird Refuge (Refuge), we use an adaptive management approach to achieve habitat goals and objectives. These goals and objectives are based on the habitat requirements of priority bird species identified in the Refuge's long-term habitat management plan (HMP; Olson et al 2004). The long-term HMP provides consistency in long-term management while the annual HMP sets a course of action at the beginning of each year.

Refuge staff derived habitat objectives by linking the ecological and physical aspects of Refuge lands with priority species habitat requirements. The objectives concisely state the habitat conditions needed for the priority species. Finally, Refuge staff use ecological data, scientific literature, expert opinion, key historical Refuge data, and staff expertise to generate a list of potential management strategies for each habitat type. The most appropriate management strategy from this list is selected each year in the spring during the annual habitat management process. Our strategy selection is based on the effects of management on the habitat and the species of concern from the previous year, as captured through monitoring, as well as on the predicted water supply for the Bear River.

The first three sections of this plan are organized by broad habitat type: wetlands, grassland ponds, and grassland uplands. These sections include a review of habitat goals and objectives, management actions, and the associated response to habitat manipulation by vegetation and priority bird species from 2006. Following the 2006 review is the management plan for the current year (2007). Within sections, individual management units are described separately or grouped based on the similarity of objectives and strategies. The final two sections of this plan describe the monitoring and evaluation plans for the Refuge for 2007 and propose strategies for addressing unmet needs for more fully implementing adaptive management on the Refuge.

WETLAND HABITAT MANAGEMENT

WETLAND HABITAT OBJECTIVE

The overall wetland habitat objective for Bear River Refuge is to manage the 29,259 wetland acres for 9% deep submergent, 28% shallow submergent, 14% deep emergent, 23% mid-depth emergent and 26% shallow emergent marsh (June-October).

1) 2,500 acres of deep submergent marsh with 18.1 to 36 inches of water (March-December), 60-80% coverage by sago pondweed and < 15% coverage by emergent vegetation (June-October).

2) 8,700 acres of shallow submergent marsh with 4 to 18 inches of water (February-December), 60-80% coverage by sago pondweed and < 15% coverage by emergent vegetation (June-October).

3)2,800 acres of deep emergent marsh with 12.1 to 24 inches of water (February-November), 50-70% coverage by emergent vegetation (predominantly hardstem bulrush and alkali

bulrush) interspersed with 40-50% open water with submerged sago pondweed (June-October).

4) 6,600 acres of mid-depth emergent marsh with 8.1 to 12 inches of water (February-November), with 50% emergent vegetation (alkali bulrush in shallower areas and hardstem bulrush in deeper zones, phragmites, and cattail) and 50% open water with sago pondweed (June-October).

5)8,659 acres of shallow emergent marsh with 2 to 8 inches of water (February-November) with 50-70% coverage by emergent vegetation (90% alkali bulrush, 10% phragmites and/or cattail) and the remainder open water (June-October).

2006 STRATEGY AND ACTIONS SUMMARY

Water levels in the 26 wetland management units (Figure 1) are manipulated or influenced to achieve the objectives. In 2006, these objectives were partially met. Refuge staff anticipated and planned for much above average river flow (110-131%) based on above normal snowpack. Under these predicted water conditions we planned to maintain the five highest priority units (5B, 4C, 4B, 3E and 5C) at their target water levels throughout the driest period of the year.

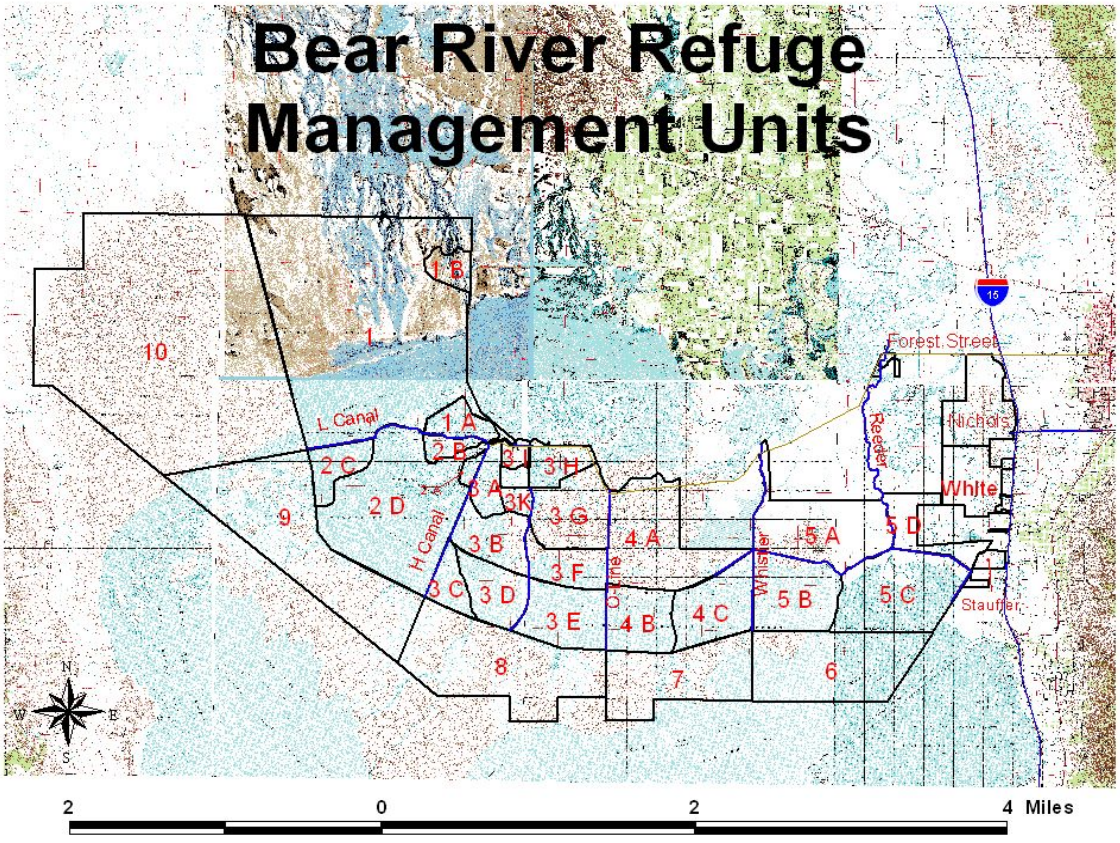


Figure 1. Management units and canals, Bear River Migratory Bird Refuge.

Target water levels (and associated habitat) were actually maintained in eight units through the summer months: Unit 2D, 3C, 3D, 3E, 4B, 4C, 5B, and 5C. Unit 5B was the refuge's highest priority for 2006 because the emergent vegetation in the unit is occupied by a large waterbird colony of several Refuge priority bird species including white-faced ibis and Franklin's gull. Other units received water as available from the Bear River. About 15,800 acres of wetlands were maintained through July and August. This compares to about 27,500 acres in 2005 and a mere 2,803 wetland acres for the same time period in 2004. The eight management units accounted for 14,300 wetland acres while Unit 6 provided 1,500 additional wetland acres though not at target levels. Bear River flows increased in mid-September as irrigation demand dropped. Refuge unit refilling began at that time. Graphs of the unit water levels for 2006 are found in Appendix A.

2006 WATER SUPPLY SUMMARY

Air temperatures were above average for January-February and cooler than average in March. April-August temperatures were all above average (1 to 6°F) . Fall temperatures were cooler than normal with December slightly warmer. The temperatures for the 2006 water year (October 2005-September 2006) was 2.5°F warmer than average. Increased air temperatures equate to higher than average evaporation rates.

Snowpack in the Bear River Basin was 131% of normal on April 6, 2006. The snowpack was considerably higher compared to recent years (Table 1). Snowpack for 2006 was almost double the 72% of normal average for the years 2001-2005. In fact, the amount of snowpack and several cold and wet storms in the spring of 2006 led local hydrologists to liken the conditions to those of 1983 when the flooding of Great Salt Lake began.

Table 1. Bear River Basin snowpack conditions 2001-2006.

Bear River Basin Snowpack	
April 1	
Year	% of Normal
2001	67
2002	78
2003	67
2004	45
2005	102
2006	131

Bear Lake reservoir started out at 25% usable capacity or 325,300 ac-ft. compared to only 9% usable capacity or 122,000 ac-ft. in 2005. Water from snow melt in the Bear River watershed (7500 mi^2) above Bear Lake is diverted to Bear Lake which acts as a reservoir. The watershed area above Bear Lake accounts for about 17% (1266 mi^2) of the total Bear River watershed area. When natural river flow drops below a certain level, this water is then pumped into the Bear River throughout the irrigation season for users of the Bear River Canal Company under an agreement outlined in the Bear River Compact. Therefore, during the irrigation season (May 1-September 30), the water in the Bear River that flows into the Refuge consists mainly of irrigation return flows.

If the amount of usable water in Bear Lake is not adequate for a full irrigation allotment (51% of usable capacity per conversation with Dan Davidson, BR Canal Co.) the amount of water in the

Bear River that reaches the Refuge will be even lower than the forecast amount. A partial irrigation allotment scenario occurred in 2004. Water supply was adequate in 2005 and 2006 for a full allotment. In 2004 the Refuge exercised it's right to "call the river" whereby the state of Utah strictly enforces priority of water rights.

The National Weather Service forecast for April-July streamflow based on snow-pack was for "above average" runoff (111-130% of normal) in 2006. The actual streamflow for April-July was 117% of normal or within the forecast range. The annual mean flow rate of the Bear River for the 2006 water year (October 2005-September 2006) was 1,636 ft^3/s with an annual runoff of 1,185,000 ac-ft. This is slightly below the annual runoff from 2005 but much higher than in the previous 4 years (Table 2). The long-term average annual mean flow rate for the Bear River at the Corinne gauge is 1,714 ft^3/s and the mean annual runoff is 1,242,000 ac-ft.

Table 2. Bear River Basin, water year data 2001-2006.

Bear River Basin			
Water Year Data			
	Annual Runoff	Annual Mean	Annual Total
Year	ac-ft	ft^3/second	ft^3/second
2001	450,000	622	226,888
2002	506,300	699	255,235
2003	376,000	520	189,868
2004	446,900	616	225,334
2005	1,194,000	1,650	602,089
2006	1,185,000	1,636	597,184
long-term	1,242,000	1,714	

Significant events in the water year (October 2005-September 2006) were lower than mean monthly river flows October-December, February, and June-September (Table 3).

Table 3. Mean monthly flows, Bear River 2002-2006.

	Bear River Mean Monthly Flows (ft^3/s)					
	Long-Term *	**2006**	**2005**	**2004**	**2003**	**2002**
January	1786	1811	1240	869	756	1168
February	1819	1585	1016	1034	899	970
March	2310	2500	2232	1562	993	1300
April	2849	4968	3114	1097	1094	1556
May	2925	3853	5863	405	281	636
June	2172	1200	3241	503	81	250
July	692	123	244	43	40	82
August	601	149	171	47	50	67
September	893	640	297	132	112	306
October	1314	776	540	351	449	233
November	1582	871	745	663	702	629
December	1657	1189	1056	708	819	1219

* Mean data for water years 1950-57, 1964-2006

The high precipitation (mainly rain) and cool weather in the spring months led to flooding in

the Bear River Basin in April and May. Water flowed over the county road to the Refuge in two places: just west of the second cattle guard and immediately west of O-Line canal. This flooding was similar to events in the spring of 2005.

The high spring flows, especially in May, delayed the start of irrigation and therefore allowed for one last filling of wetland units to target levels before Bear River flows became minimal and the period of high evaporation began. The Refuge units were all full to target levels throughout May. Water elevations began dropping in the non-priority units around the first week of June because they were not receiving any inflow to balance evaporative losses. The mean monthly flow rates of the Bear River for July and August were 123 ft^3/s (17% of normal) and 149 ft^3/s (24% of normal), respectively. River flows were not high enough to begin re-filling of units until September 15th. Unit by unit details follow.

2006 MANAGEMENT ACTIONS AND EFFECTS

Unit 1

A. Objective

Manage water levels to achieve 440 acres of deep submergent, 2160 acres of shallow submergent, 1491 acres of mid-depth emergent and 547 acres of shallow emergent wetland habitat, April 1-December 15.

B. Strategy

Re-fill Unit 1 with clear water (minimize addition of silt) to achieve target water elevation of 4204.5' by April 1. Allow to dry naturally, as not a priority unit. First to be re-filled after priority units as fall flows allow.

C. Management Actions

Water level was maintained near or slightly above the target until early June. Went dry by August. Re-filling of the unit began on September 15th.

D. Habitat Response

When the water in the unit is at the target elevation of 4204.5' there are about 2,981 acres of surface water. A survey of the unit in October 2004 indicated that there were 452 acres of emergent vegetation (mainly alkali bulrush). Though a vegetation survey was not conducted in 2006, the vegetation community did not likely change significantly from 2004. An airboat survey of the unit was conducted on July 12th to take salinity readings and estimate sago pondweed colonization and area coverage. To sample sago coverage, a 26" square fashioned out of PVC was thrown randomly from the airboat. The area within the square occupied by sago pondweed is assessed and scored. Sixteen samples yielded an average score of 88 for a grade of “Excellent” (Appendix B). Soil salinity levels averaged 1,550 ppm on June 12th and 2,380 ppm on July 12th. The objective range is 5-10,000 ppm (Appendix B).

E. Response of Resources of Concern

The unit hosted a nesting colony of Franklin’s gulls, white-faced ibis, black-crowned night-heron, great blue heron, cattle egret, and snowy egret. The Refuge priority species in the colony were white-faced ibis with about 720 nests and Franklin’s gulls with 60 nests. The number of nesting birds in the colony was lower than last year, perhaps because ibis and Franklin’s gulls colonized portion of Units 6, 7 and 8.

This unit was important for snowy plover, tundra swan, long-billed curlew, and Wilson’s phalarope. Unit 1 accounted for 86% of all snowy plover use in the summer (June-July), 62% of use by tundra swan, and 47% of use by long-billed curlew in the fall (August-November)(Appendix C). Unit 1 also

accounted for 18% of annual use by Wilson's phalarope (Appendix D).

Units 1A, 3A and 3K

A. Objective

Manage water levels to achieve 50% interspersion of open water with 50% emergent vegetation, April 1-December 1.

B. Strategy

Fill units to target water elevations by April: Unit 1A - 4205.4', Unit 3A - 4206.0', Unit 3K- 4206.0'. Allow to dry as non-priority units. Put cattle on Unit 1A in July-August for temporary density reduction of emergent vegetation.

C. Management Actions

Unit 1A The unit was filled in the spring from Bear River inflows through the drive-through spillway. The unit was then allowed to dry to facilitate a grazing treatment. About 758 acres of the unit was grazed by 185 cow-calf pairs from July 15 to 26. The number of pairs was increased to 330 and grazing continued from July 27 to August 10 (Appendix B). Units 3A and 3K No water elevation data is available as these units have no water gauges. In general, the units were filled with water in the spring, the water levels remained near the estimated targets through early June and the units dried by late July. Re-filling began mid-September via the Bear River inflatable water control structure.

D. Habitat Response

Unit 1A. A survey of the unit in 2003 indicated that 42% (232 acres) of the unit was open water and the remaining 48% (312 acres) was emergent vegetation. This was near the objective levels. It is believed the habitat acreages in 2006 were similar to those from 2003. Units 3A and 3K. Proportions of open water and emergent vegetation were not monitored because of insufficient staff time to monitor lower priority units.

E. Response of Resources of Concern

Unit 1A accounted for about 15% of the annual use of the Refuge by long-billed curlew (Appendix D). Units 3A and 3K. There was no significant use ($\geq$10 % of annual use) of these units by priority species.

Units 2A and 2B

A. Objective

Manage water levels to achieve 75% cover by alkali bulrush and 25% open water (year-round).

B. Strategy

Fill units to target water elevations of 4205.5' and 4206.0' respectively by April 1. Allow units to dry as non-priority units. Graze Unit 2B in late summer for temporary (through spring of following year) emergent vegetation density reduction.

C. Management Actions

No water elevation data is available as these units have no water gauges. Unit 2A and 2B were full in the spring, dry by mid-July and full in late fall. Re-filling of units began September 15th. About 650 acres of unit 2A was grazed by about 330 cow-calf pairs from August 18 to September 7, 2006 (Appendix B). About 281 acres of Unit 2B was also grazed by about 330 pairs from August 11 through 17 (0.33 A.U.M.s/acre).

D. Habitat Response

The habitat objectives in units 2A and 2B were not met because of the dry conditions. In addition, objectives were not met in 2A because the emergent vegetation community is dominated by cattail rather than alkali bulrush. The emergent vegetation community in 2B is near objective levels.

E. Response of Resources of Concern

There was no significant use ($\geq$ 10% of annual use) of Unit 2A or 2B by priority species. An

American bittern was noted as present in Unit 2A, during the Refuge Breeding Bird Survey route. Though this is not a priority species, the presence of bittern during the breeding is notable as no breeding pairs have been observed since flooding of the Refuge and Great Salt Lake (1983-1989).

Unit 2C

A. Objectives

1) Increase sago pondweed to cover 70% of the unit

2) Manage water levels to achieve 504 acres of shallow submergent wetland and 216 acres of shallow emergent wetland (year-round).

B. Strategy

Fill unit to target water elevation of 4204.5' by mid-April and allow to go dry as a non-priority unit.

C. Management Actions

The water level in the unit was maintained near the target elevation through mid-June and the unit was allowed to go dry by mid-August. On September 15th, re-filling of the unit began via L-Canal, and the target water elevation was reached on September 28th.

D. Habitat Response

Habitat objectives were unmet due to dry conditions. An emergent vegetation survey was not conducted in this unit. However, sago pondweed samples averaged 95% coverage for a productivity grade of "excellent" (Appendix B). Soil salinity levels averaged 1,525 ppm with water which is well below objective range of 5-10,000 ppm. Soil salinity monitoring will be discontinued.

E. Response of Resources of Concern

The unit accounted for 19% of the annual use of the Refuge by Wilson's phalarope in 2006.

Unit 2D

A. Objective

Manage water levels to achieve 4,029 acres of deep submergent and 590 acres of deep emergent habitat, October-May.

B. Strategy

Maintain target water elevation of 4205.25' through May. Allow to slowly decrease (no inflow, evaporative loss) to 4204.0' by August 1 to increase shorebird habitat and facilitate grazing in the north end of the unit.

C. Management Actions

The water level in the unit was near target elevation of 4205.25' throughout May. The unit was allowed to naturally dry but did not reach the target water level of 4204.0' until about the third week of August. The water level in the unit reached a low of 4203.77' on September 15th when two radial gates were open about six inches to allow re-filling. The northern 460 acres of the unit was grazed September 8 - 23 at a rate of 0.48 A.U.Ms/acre. A 23 acre peninsula behind the shop building was also grazed. Grazing occurred August 13 - 17 at a rate of 0.13 A.U.Ms/acre (Appendix B).

D. Habitat Response

The habitat objective was partially met. The unit produced a dense stand of sago pondweed covering the entire open water portion of the unit. A sago pondweed productivity survey was not conducted though casual observation would rank productivity as "excellent". Soil salinity averaged 1083 ppm with water salinity at 716 ppm. This is below the soil salinity objective of 2,000 ppm

E. Response of Resources of Concern

This unit is especially important to the Refuge priority species in the fall. In the summer, Unit 2D accounted for 81% of the use by long-billed dowitcher. In the fall, the unit accounted for 31% of the seasonal use by American avocet, 52% of use by black-necked stilt, 46% of white-faced ibis, 25% of use by all shorebirds, 22% of use by American white pelican, and 52% of use by Wilson's phalarope.

In the winter (January, February, December), the unit accounted for 27% of use by waterfowl, 41% of use by tundra swan, and 52% of use by redhead (Appendix C). Over the entire year, the unit accounted for 15% of use by American avocet, 23% of use by black-necked stilt, 18% of use by white-faced ibis, 17% of use by all shorebirds, 36% of use by tundra swan, 21% of use by American white pelican, 11% of use by Redhead, and 32% of use by long-billed dowitcher (Appendix D). Due to the extensive use of this unit by long-billed dowitcher, Refuge staff concentrated mist net and night spotlighting efforts to capture dowitchers for avian influenza sampling on this unit.

Unit 3B

A. Objective

Increase amount of alkali bulrush to account for 60% of emergent vegetation.

B. Strategy

Fill unit to target water elevation of 4205.0' by April 1. Allow to dry naturally as a non-priority unit.

C. Management Actions

No water elevation data is available as this unit has no water gauge. In general, the unit was filled with water in the spring, went dry by mid-June, and was re-filled in mid-September.

D. Habitat Response

The habitat objective was unmet due to drying of the unit. No vegetation survey has been conducted in this unit to determine the amount of coverage by alkali bulrush.

E. Response of Resources of Concern

This unit accounted for 47% of fall use by long-billed curlew and 20% of the total annual use by long-billed curlew which is similar to use by this species in 2005.

Units 3C and 3D

A. Objective

Maximize deep submergent wetland habitat to provide optimum conditions for production of sago pondweed.

B. Strategy

Unit 3C. Fill unit to target water elevation of 4204.0' by April 1. Maintain throughout the summer months as a priority unit. Unit 3D. Fill unit to target water elevation of 4205.0' by April 1. Maintain target throughout the summer months as a priority unit.

C. Management Actions

Water levels within the units were maintained within 0.5' of their target elevations throughout the year with the exception of a peak about 0.8' above the target elevations from mid-October through early November. The units are filled via the inlet from H-canal where screens were used to exclude large fish (particularly carp). Water inflows throughout the summer were maintained to just off-set evaporation.

D. Habitat Response

Though water conditions were optimal in 2005 and 2006, sago pondweed has been slow to colonize either unit. Sago stands are few and scattered in each of the units and can be described as sparse. Habitat objectives have yet to be realized. Soil salinity was measured in Unit 3C on May 31st. Salinity averaged 5,033 ppm (Appendix B). This is within the objective range of 5-10,000 ppm.

E. Response of Resources of Concern

Unit 3C This unit accounted for 19% of the summer use by long-billed curlew as well as 12% of the annual use by redhead (Appendix D). Unit 3D This unit had no significant use by priority species in 2006.

Units 3E, 3F and 3G

A. **Objectives**
Increase amount of sago pondweed to cover 60% of unit.
B. Strategy
Fill units to target water elevation of 4204.6' in Unit 3E, 4205.2' in Unit 3F, and 4205.7' in Unit 3G by April 1. Maintain the water level in Unit 3E at target elevation throughout the summer as a priority unit. Allow Units 3F and 3G to go dry as non-priority units. Maintain soil salinity levels at 5,000 -10,000 ppm, April 1- October 15.
C. Management Actions.
Unit 3E The target water elevation of 4204.6' was maintained throughout the year. At the target water elevation, the tops of the small islands along D-line are exposed. Avocets and black-necked stilts nest on these islands with a high rate of success (0.80 Mayfield; Cavitt 2006). However, because of the shallowness and bottom contours of this unit, it is difficult to maintain water over the entire unit throughout July and August, particularly during wind events. Fish screens were periodically used at the inlet to exclude carp. Units 3F and 3G. There is no water level data available for these units as they have no gauges. In general, the units were filled by sheet water and flood waters to maximum capacity in the spring with some inflows from O-Canal. These shallow units maintained water levels well into June, were dry July-August, and re-filled in early September.
D. Habitat Response. No habitat monitoring was conducted in these units. However, sago pondweed stands were not apparent.
E. Response of Resources of Concern
Unit 3E. This unit was important to long-billed curlew and waterfowl in the summer, accounting for 19% and 18% of the seasonal use, respectively (Appendix C). The unit accounted for 12% of annual use for American avocet (down from 23% in 2005), and 14% for all waterfowl (Appendix D). Unit 3F and 3G. These units received no significant use by priority species in 2006.

Unit 3H, 3I and 3J
A. Objective
Maximize emergent wetland type to encourage colonization of alkali bulrush.
B. Strategy
Fill Units 3H, 3I, and 3J to target water elevations of 4206.0', 4205.0', and 4206.0', respectively, by April 1. Allow units to go dry naturally as non-priority units.
C. Management Actions
There is no water elevation data available as none of these units have water gauges. In general, the units were full in the spring and dry by mid-June. They were re-flooded starting in late September.
D. Habitat Response
No habitat monitoring was conducted in these units. However, Units 3I and 3J are estimated to be about 70% emergent vegetation (cattail) and 30% open water.
E. Response of Resources of Concern
None of these units received significant use by priority species in 2006.

Unit 4B
A. Objectives
1) Increase amount of alkali bulrush to account for 60% of emergent vegetation with a mix of 50% open water to 50% emergent vegetation over the entire unit
2) Manage water levels to achieve 784 acres of mid-depth emergent wetland habitat.
B. Strategy

Fill unit to target water elevation of 4205.25' by April 1. Manage soil salinity levels within the range of 5,000-8,000 ppm, April 1 - October 15. Maintain water levels in the unit at target elevation throughout summer months as a priority unit.

C. Management Actions

In late April the target water elevation was lowered to 4205.0' to dry out the north end of the unit where an island with a large California gull colony is located. In drying out the unit around the colony, we hoped to encourage the birds to nest in other parts of Great Salt Lake. This action was ineffective in dispersing the gulls. The water level in the unit hovered around 4204.0' throughout the summer months. The water level in the unit reached the target elevation of 4205.0' on September 22nd.

D. Habitat Response

The emergent vegetation component does not yet cover 50% of the unit area. The unit will remain a priority unit in the near future to encourage expansion of the fledgling alkali bulrush stand in the unit.

E. Response of Resources of Concern

This unit supported large California gull colonies on the islands with an estimated 3,912 nests. The predatory behavior of these gulls are thought to negatively influence success of both priority nesting species of shorebirds and waterfowl in some years. Unit 4B accounted for 23% of spring use by redhead, 19% of spring use by long-billed curlew, 18% of summer use of American avocet (Appendix C), and 13% of annual use by redhead (Appendix D).

Unit 4C

A. Objectives

1) Manage water levels to achieve 1528 acres of deep submergent wetland habitat
2) Increase amount of sago pondweed to cover 60% of the unit.

B. Strategy

Fill unit to target water elevation of 4205.0' by April 1 and maintain throughout the summer months as a priority unit. Maintain soil salinity levels in the range of 5,000 - 10,000 ppm, April 1-October 15, by only adding enough water in the summer months to offset evaporative loss rather than operating the unit with constant flows at inlet and outlet.

C. Management Actions

The water level in the unit hovered about 1 foot below the target elevation throughout the summer months. Birds on the nesting island initiated nesting at the lower elevation and we believed raising it to the target elevation would have led to nest loss. The water level in the unit was brought up to 4205.0' by mid-September via flow from Whistler Canal. Water inflows throughout the summer were maintained to just off-set evaporation. It is hoped that, in time, the bulrush stand in this unit will be used by colonial nesting waterbirds in place of the *Phragmites* stand in Unit 5B.

D. Habitat Response

Habitat objectives were met. An airboat survey of the unit in 2004 indicated sago pondweed covered at least 60% of the unit with a stand of alkali bulrush covering about 238 acres. The bulrush stand created a fairly dense strip along the south border but was sparse in the central part of the unit. Habitat conditions were similar in 2006.

E. Response of Resources of Concern

The unit accounted for 35% of the fall use of Franklin's gull and 31% of redhead use, and 12% of the annual use all redhead (Appendix D). The unit has three islands which also host large nesting colonies of California gulls. A survey of the islands on June 6th indicated 1,455 California gull nests, 261 double-crested cormorant nests, 40 great blue heron nests and 28 Caspian tern nests.

Unit 5B

A. Objectives

1)Manage water levels to achieve 582 acres of mid-depth emergent wetland habitat, 207 acres of shallow emergent and 994 acres of vegetated mudflat

2) Increase amount of alkali bulrush to account for 60% of emergent vegetation with a mix of 50% open water to 50% emergent vegetation over the entire unit.

B. Strategy

Maintain water at target elevation of 4204.6' April 1-December 15 as a priority unit and manage soil salinity levels in the range of 5,000-8,000 ppm by adding only enough water in the summer months to offset evaporative loss.

C. Management Actions

This unit was the highest priority unit so water in-flows were maintained throughout the summer to just off-set evaporation. The water level in the unit was about 1 foot above the target elevation throughout the spring and summer and slowly decreased to the target elevation by early August. In September, the water level in the unit was raised and maintained about 1 foot above target throughout the rest of the year.

D. Habitat Response The objectives were partially met. Salinity readings taken on July 15th indicated that the soil salinity was around 3,000 ppm while the water salinity was around 3,500 ppm. The soil salinity level was below the objective level. A survey in July 2004 indicated that the unit contained about 1,000 acres of open water habitat and about 245 acres of emergent vegetation, of which about 10% was alkali bulrush. Though no intensive vegetation survey was conducted in 2006, it appears the stand of alkali bulrush continues to diminish and be replaced by *Phragmites*. Though the size of the stand of emergent vegetation does not seem to be growing, Refuge staff have noticed a gradual change in the species composition. Alkali bulrush previously comprised a much larger percentage of the stand than it does currently. When the alkali bulrush stand in Unit 4C grows large enough and dense enough and to support the waterbird colony that current utilizes the Unit 5B stand, Unit 5B will be drained for a management action aimed at reducing the size of the *Phragmites* stand.

E. Response of Resources of Concern

The emergent vegetation attracted colony nesting birds such as the Refuge priority species white-faced ibis and Franklin's gull. The colony was surveyed on June 1st and the number of nesting adults were estimated. The colony supported an estimated 7,815 white-faced ibis nests, 16 Franklin's gull nests, 185 black-crowned night heron nests, 572 snowy egret nests, 236 cattle egret nests, 7 great blue heron nests and 12 great egret nests. In addition, the islands in the unit hosted 9 California gull nests, 43 nests of double-crested cormorant, 135 Caspian tern nests, 95 Forster's tern nests, and 52 American avocet nests. The unit accounted for 10% of the annual use by waterfowl (10%), and redhead (13%) (Appendix D).

Unit 5C

A. Objectives 1) Manage water levels to achieve 1752 acres of deep submergent and 806 acres of shallow submergent wetland habitat,

2) Increase amount of sago pondweed to cover 60% of unit.

B. Strategy

Maintain water level at a target elevation of 4204.75' , April 1-December 15, as a priority unit and manage soil salinity levels for a range of 5,000 - 10,000 ppm, April 1-October 15, by adding only enough water throughout the summer months to offset evaporative loss.

C. Management Actions
The water level in the unit varied in response to flooding throughout the spring months and then remained about 0.5' below the target elevation through the summer months. Water levels are difficult to maintain in the spring in flood conditions as Reeder Canal flows directly into the unit.
D. Habitat Response
The habitat objectives were met. Sago pondweed productivity and density was sampled on July 12th and received an "excellent" rank with the samples averaging 86% coverage (Appendix B). Soil salinities averaged 6,714 ppm which is within the targeted objective range of 5-10,000 ppm (Appendix B).
E. Response of Resources of Concern
The unit was important to pelican, cinnamon teal, redhead, and black tern. Unit 5C accounted for 88% of spring use and 44% of summer use by black tern (including 2 nests), 20% of summer redhead use, 42% of fall use by cinnamon teal, and 54% of winter use by American white pelican (Appendix C). The unit accounted for the greatest use of cinnamon teal (21%), all waterfowl (12%), American white pelican (14%), redhead (13%), and black tern (21%) (Appendix D).

Units 6 through 10
A. Objective
Manage water levels to achieve 1,836 acres of deep submergent, 3,076 acres of shallow submergent, 6,206 acres of mid-depth emergent, 4,962 acres of shallow emergent, and 13,967 acres of vegetated mudflat in median or above median precipitation years.
B. Strategy
When conditions allow in the spring and fall, water is released to these units as follows.
Unit 6. By-pass water to the unit via Whistler and Unit 5C outlet. Units 7 and 8. By-pass water to the unit via O and H Canals. Unit 9. By-pass water to the unit via L-Canal. Unit 10. By-pass water to the unit via Unit 1 outlet.
C. Management Actions
Though not impounded, these units are influenced by water releases through the D-line dike from the various units as well as from the Whistler, O-line, L and H canals. The units, which comprise the south boundary of the Refuge, are seamless with the Great Salt Lake. Once impounded units are full to target levels, river flows are by-passed via unit outlets and various canals, strategically to supply water to these units for beneficial use by migratory birds. River flows were by-passed to these units from December through April and again in October in the 2006 water year.
D. Habitat Response
Unit 6 (Willard Spur) had an estimated 8-16" of shallow water until mid-August. Soil salinity readings averaged 2,000 ppm on June 1st. Units 7 and 8 had a 1-6" sheeting of water through July. Alkali bulrush stands that germinated in Units 7 and 8 expanded in 2006. In Unit 8, soil salinity averaged 1,400 ppm on June 1st (Appendix B). Units 9-10 had a 1-6" sheeting of water on them until early April and again in October when by-pass waters were channeled to these units.
E. Response of Resources of Concern
The units were important to many of the priority species, especially Unit 6. This unit received significant use by 11 out of 16 of the Refuge priority species and species groups (Appendix C). In the spring, Unit 6 accounted for 47% of the use by cinnamon teal, 26% of the use by waterfowl, 34% of the use by tundra swan , 29% of the use by American white pelican, 42% of the use by long-billed dowitcher, and 23% of the use by Franklin's gull . In the summer, the unit hosted 27% of the seasonal use by cinnamon teal, 48% of black-necked stilt, 23% of white-faced ibis, 33% of all shorebirds, 32% of marbled godwit, 49% of pelican, and 37% of Franklin's gull. In the fall, the unit

hosted 17% of waterfowl use, 29% of marbled godwit, 38% of long-billed dowitcher, and 49% of black tern. In the winter, use by American avocet, cinnamon teal, shorebirds, and marbled godwit were mainly on Unit 6. Unit 7. The expanding stands of alkali bulrush were colonized by nesting birds in 2006. A count in early June tallied 195 Forster's tern nests, 3,342 Franklin's gull nests, 161 white-faced ibis nests, 2,990 American avocet nests, and 1,610 black-necked stilt nests. In the spring, the unit also accounted for 48% of use by black-necked stilt, 32% of all shorebirds, 81% of marbled godwit, and 40% of long-billed dowitcher. The unit also hosted 12% of annual use by avocet and 16% of all shorebirds, 31% of marbled godwit, 17% of long-billed curlew, 16% of long-billed dowitcher, and 14% of Franklin's gull. Unit 8. This unit hosted 29% of the white-faced ibis in the spring, 36% of the use by Wilson's phalarope in the summer, and 13%, 34%, and 10% of the annual use by marbled godwit, Wilson's phalarope, and Franklin's gull, respectively. Unit 9. This unit hosted 41% of the Wilson's phalarope in the spring and accounted for 11% of annual use by American avocet. Unit 10. This unit received no significant use by priority species in 2006.

MAINTENANCE ACTIVITIES

The vegetation on side slopes of dikes provide critical cover for nesting waterfowl, so mowing is minimized. A swath about 3' wide was mowed from the edge of the road all the way around the tour loop, mainly for aesthetics, during the summer months. In the closed portion of the Refuge, only the center line of D-line dike was mowed during the spring and summer months. Refuge staff restrict driving of dikes to just D-line from April 1-August 1 as snowy plover and other shorebirds nest directly in the driving path.

Material for road base was hauled and placed around units 4B and 4C. The tour loop road was graded several times throughout the year. D-line is usually graded as moisture allows, after August 1 when the majority of waterfowl nesting has occurred. About 400 acres along dikes and canals were chemically treated for salt cedar, Canada thistle and white top control.

2007 WETLAND HABITAT MANAGEMENT PLAN

The wetland habitat goal at Bear River Refuge is to provide a diversity of wetland types, a diverse and abundant population of aquatic macroinvertebrates, and a range of aquatic plant communities from early to late successional stages.

The following general management strategy applies to all wetlands to achieve the overall Refuge wetland habitat goal and objective. Unit by unit objectives and strategies remain the same as stated in 2006 summary above with the exception of several changes to target water elevations, noted below in Table 4.

The bridge deck on the south 9-bay water control structure of Unit 1 will be replaced in the summer of 2007. The water level target may be adjusted to suit construction needs. The L-Canal to L-Canal 3-way structure bridge deck will also be replaced in 2007. No outflows into Unit 9 via the L-Canal will be possible during the construction phase. The existing water control structure in Unit 3K will be replaced with another type that will allow better management capability.

GENERAL MANAGEMENT STRATEGY

In 2007, pools will be filled to target levels according to the availability and turbidity of Bear River water. Pools should be refilled to target levels just prior to the spring peak to reduce sediment deposits in the pools and turbidity that can inhibit sago pondweed germination, growth, and production. Units should all be brought up to target elevation by April 1 and maintained, when water conditions allow, through December 15. Once at target levels, outflow should be restricted to maintain soil salinity levels appropriate for saline marsh vegetation (hardstem bulrush, alkali bulrush and sago pondweed). Once impounded units are at target elevations, Bear River flows are strategically diverted to Units 6-10 below D-line through the various channels. As Bear River flows drop, only the priority units will be maintained at target elevations. Non-priority units will be allowed to dry naturally through evaporation losses with re-filling (in priority order) beginning in September or when dependable water supply allows, and should be at target level by the first week in November. The larger units (Unit 1, 2D, 4C and 5C), which are subject to ice damage from wind fetch, will be lowered about 12" before ice-up and will remain in draw-down throughout the winter. All units will be maintained at or near target levels through the winter.

A reliable water supply outlook that forecasts the April-July runoff based on snowpack is available around April 1 of each year. Wetland unit target elevations are developed and prioritized for filling (spring and fall) and water level maintenance based on the forecast.

Snowpack in the Bear river basin was 55% of normal on April 1, 2007 (http://www.ewcd.org/snotel/snow_data.php). The water supply forecast for 2007 is for “much below average ”runoff in the Bear River basin which means less than 70% of normal (http://www.cbrfc.noaa.gov/wsup/wsup.cgi). This will likely equate to low flows around 90-100 cfs in the Bear River for July and August when irrigation demand is high and the Bear River Canal Company’s water right is senior to the Refuge’s. The water in the river during these months of high irrigation demand consist only of return flows (water that has been used for irrigation). Under these expected low water conditions, we would only be able to maintain the five or six highest priority units throughout the driest period of the year (Table 4).

When the water supply allows, the units will be re-filled in the order indicated in Table 4. The order of fall fill does not need to be applied to every unit. After about the first five units, water supply is ample enough to fill many of the units simultaneously.

The focus of saltcedar control efforts in 2007 will be in the main river delta of unit 2D, 5D, 4C, and cleanup along the water courses of L, O, and P canals. Whitetop control will focus on a repeat of areas treated in 2006. Treatment methods will include herbicide spraying, discing, mowing and pulling.

Table 4. Management priority order of wetland units with “much below average” runoff forecast, Bear River MBR, 2007.

	Total	Spring	Priority	Maintenance	Cumulative	Fall Fill	Winter
Unit	Acres	Target	Order	Needs	Needs	Order	Target
		Elevation	2007	(July-Aug.)	(July-Aug.)	2007	Elevation
		2007		cfs			**2007**
5B	1,783	4204.60	1	13.6	13.6	1	
4C	1,528	4205.00	2	26.3	39.9	2	4205.00
4B	1,242	4205.00	3	21.4	61.3	3	4205.00
3E	1,448	4204.60	4	25	86.3	4	
3C	549	4204.00	5	9.5	95.8	5	
3D	1,045	4204.00	6	18	113.8	6	4204.50
2D	4,619	4205.25	7	79.6	193.4	7	4204.75
3H	655	4206.00	8	5.1	198.5	8	
1	12,204	4203.50		59.7	282.6	9	4204.00
1A	544	4205.40		9.4	202.8		
2A	135	4205.50		2.3	213.8		
2B	294	4206.00		4.1	217.9		
2C	720	4204.50		12.4	324.9		
3B	1,085	4205.00		18.7	301.3		
3F	903	15"		15.6	233.5		
3I	211	4205.00		3.6	308.9		
3J	166	4206.00		3.6	312.5		
3G	1,545	12.5"		18.1	251.6		
4A	2,698	4205.50		N/A			
5A	2,405	4205.50		N/A			
5C	2,558	4204.75		24.4	222.9		4205.00
5D	939	N/A		N/A			
3A*	505	4206.00		8.7	211.5		
3K*	230	4206.00		4	305.3		
6	3,185	N/A		54.9	54.9		
7	2,581	N/A		44.5	99.4		
8	4,158	N/A		71.6	171		
9	5,171	N/A		88.6	259.6		
10	15,262	N/A		17.5	277.1		
Total	**70,368**						

*Drain starting March 15 for water control structure replacement

GRASSLAND POND MANAGEMENT

2006 MANAGEMENT ACTIONS AND EFFECTS

A. Objective
Manage 16 ponds on the Nichols, White, and Stauffer grassland units to achieve a mix of 50% open water to 50% emergent vegetation, or hemi-marsh conditions, year-round.
B. Strategy
Maintain water level at 1' below the top of the dike year-round unless otherwise stated.
C. Management Actions
All the units were filled in the spring to the objective level. There are no water level data available as there are no staff gauges on the outlet structures. However, water inflow data were periodically collected from the flume gauges on the Nichols, White, and Stauffer tracts. All or parts of N2, N3 and N4 were disked and mowed for emergent vegetation control. Slag or rock was placed on all the pond dikes to enable all season access.
D. Habitat Response
No aquatic vegetation monitoring was conducted in 2006 so it is not known if the first habitat objective was met. In general, water supply kept the ponds near objective levels with the exception of N1-N3. Construction by a private contractor interrupted flow to the ponds.
E. Response of Resources of Concern
The grassland ponds are utilized primarily by migratory waterfowl in the spring and fall. Cinnamon teal and redhead use them as pair and brood rearing ponds throughout the spring and summer. White-faced ibis use them as feeding areas in spring, summer and fall. Black-necked stilts, American avocet, and long-billed curlew use them as nesting, resting, feeding and brood rearing areas.

Waterfowl breeding pair surveys yielded 82 indicated pairs on May 17th. About 50% of the pairs were cinnamon teal, followed by mallard (18%), gadwall (12%), redhead (8%), northern shoveler (4%), and blue-winged teal (4%), northern pintail (2%), and finally green-winged teal and ruddy duck at 1%.

2007 MANAGEMENT PLAN FOR GRASSLAND PONDS

A. Objective
The 2007 objectives for the grassland ponds remain the same as last year.
B. Strategy
To meet the first objective, the density of cattail needs to be reduced in several ponds. Pond N6 will be mowed and disked if conditions are dry enough. All the other ponds on the Nichols, White, and Stauffer units will be kept as full as the available water supply will allow.

GRASSLAND UPLANDS MANAGEMENT

2006 MANAGEMENT ACTIONS AND EFFECTS

The overall grassland objective is to manage the 2,877 acres of the Nichols, White, and Stauffer

grassland tracts so that native grasses comprise 65-75% of the stand, forbs 5-10%, and woody shrubs 2-5% while decreasing exotic grasses to < 15%, and noxious grass to < 1% by 2015. The remainder of the area is bare ground (approximately 30-35%).

A. Objectives

Based on the soils, each of the units supports four habitat types and associated plant communities. The objectives below describe climax plant communities for each habitat type.

Alkali Bottom Objectives:
1) Increase cover of grasses (saltgrass, alkali sacaton, wheatgrass, Basin wildrye) to 60% by 2015.
2) Increase forb cover to 5% (silverscale, fireweed, and hollyleaf clover) by 2015.
3) Increase shrub cover to 5% (greasewood) by 2015.
4) Decrease cheatgrass cover to < 15% by 2015.

Salt Meadow Objectives:
1) Increase grass cover (alkali bluegrass and saltgrass) to 65-75% by 2015.
2) Increase forb cover (lanceleaf goldenweed, fiddleleaf hawksbeard and sunflower) to 10% by 2015.
3) Increase shrub cover (iodinebush, rabbitbrush and greasewood) to 1-3% by 2015.

Wet Meadow Objectives:
1) Increase grass cover (*Carex* spp.) to 80% by 2015.
2) Increase forb cover (alkali marsh aster and common silverweed) to 5% by 2015.
3) Decrease shrub cover (rabbitbrush and greasewood) to 1% by 2015.

Saltair Mudflat Objectives:
Maintain natural saltair mudflat range condition consisting of strongly saline soils where:
1) 60-65% of the area is barren alkali flats;
2) 30-35% is grasses (saltgrass);
3) 1-5% forbs (pickleweed and seepweed);
4) $\leq$ 1% fresh water marsh (alkali bulrush, hardstem bulrush, and cattail).

B. General strategy

A dormant season graze through a prescribed grazing program is used to invigorate perennial native grasses (wheatgrass species, salt grass, alkali sacaton, Great Basin wildrye, and alkali cordgrass) while suppressing annual cheatgrass *Bromus spp*. Grazing is a tool to improve habitat for ground nesting migratory birds and to improve habitat conditions for other non-target grassland community species. Dormant season grazing reduces the litter layer that inhibits new plant growth and creates growing conditions favorable for invasive plants (*Brassica sp*).

The White and Stauffer unit litter layer becomes very dense after two seasons of rest, effectively shading the ground. In areas of the grassland where the wheatgrass community is dominant and considered in good condition, like White and Stauffer, the general grazing strategy is to graze every two years, (maximum of three years) for maintenance and invigoration.

In areas where wheatgrasses are sparse and colonization/expansion of this community is the goal

(Nichols), dormant season and early spring grazing is prescribed every year to hinder growth and production by cheatgrass *Bromus spp.*, bulbous bluegrass, *Poa bulbosa*, and other undesirables. The grazing prescription may create unoccupied niches for wheatgrasses to expand in to. Though the spring grazing appears to be the most effective in hindering growth of cheatgrass and bluegrass, local cattle operators often move their herds to pasture lands at higher elevations during this time. Due to unavailability of cattle for spring grazing, dormant season grazing is often prescribed instead.

C. Management Actions

Both dormant season and early growing season (April-May) grazes were utilized as management tools on the grasslands in 2006. About 1,435 acres were grazed in 14 designated areas with a total of 1,267 animal unit months (AUMs) removed (Table 5).

An estimated 1,093 acres in nine designated areas within the Nichols Unit were grazed. Both the Jensen and Christensen tracts were also grazed (J1 and C1). These units are considered part of the Nichols grassland unit. About 198 acres in three areas were grazed on the White grassland unit (Figure 2). In addition, the unit adjacent to Whistler canal (Whistler 1) and the wet meadow area south of the Stauffer unit (RR 1) were grazed.

Table 5. Prescribed grazing of grassland units, 2006.

Graze				Days	No. of	AUMs	AUMS/	Head/
Unit	Cooperator	Acres	Dates Grazed	Grazed	Head	Removed	Acre	Acre
N1	Doug George	125	Dec. 28 -Jan. 7	11	250	92	0.70	2.0
N2	Doug George	161	January 8-15	8	250	67	0.40	1.6
N3	Doug George	142	Jan.16-Feb.1	17	250	142	1.00	1.8
N4	Doug George	273	February 2-11	10	250	83	0.80	0.9
			Feb.23-March 10	16	250	133		
N5	Doug George	47	Feb 12-22	11	250	92	2.00	5.3
N6	Doug George	185 refuge[1]	March 11-24	14	250	103 refuge	0.56	1.2
N7	Doug George	76	Mar. 25-April 10	16	250	133	1.75	3.3
W1	Norm Nelson	15	Jan. 15-25	11	30	11	0.70	2.0
W2	Doug George	101	April 11-25	15	250	125	1.24	2.5
W3	Doug George	82	April 26-May 6	11	250	92	1.12	3.0
RR1	Doug George	48 refuge[2]	Nov. 7-20	14	250 pairs[3]	68 refuge	1.40	3.0
C1	Todd Yates	63	Jan. 9-29	21	100	70	1.11	1.6
J1	Todd Yates	21	Feb. 7-8	2	50	3	1.29	2.4
			Feb. 9-20	12	60	24		2.9
Whistler 1	Todd Yates	96	Jan. 25- Feb. 15	22	40	29	0.3	0.4
TOTALS		1435				1267		

[1] Unit N6 was grazed as part of a larger area (208 acres) that included adjacent non-Refuge lands. A 116 total AUMs removed.

[2] Unit RR1 was grazed as part of a larger area (110 acres) that included adjacent non-Refuge lands. A total of 154 AUMs were removed.

[3] Indicates cow/calf pairs.

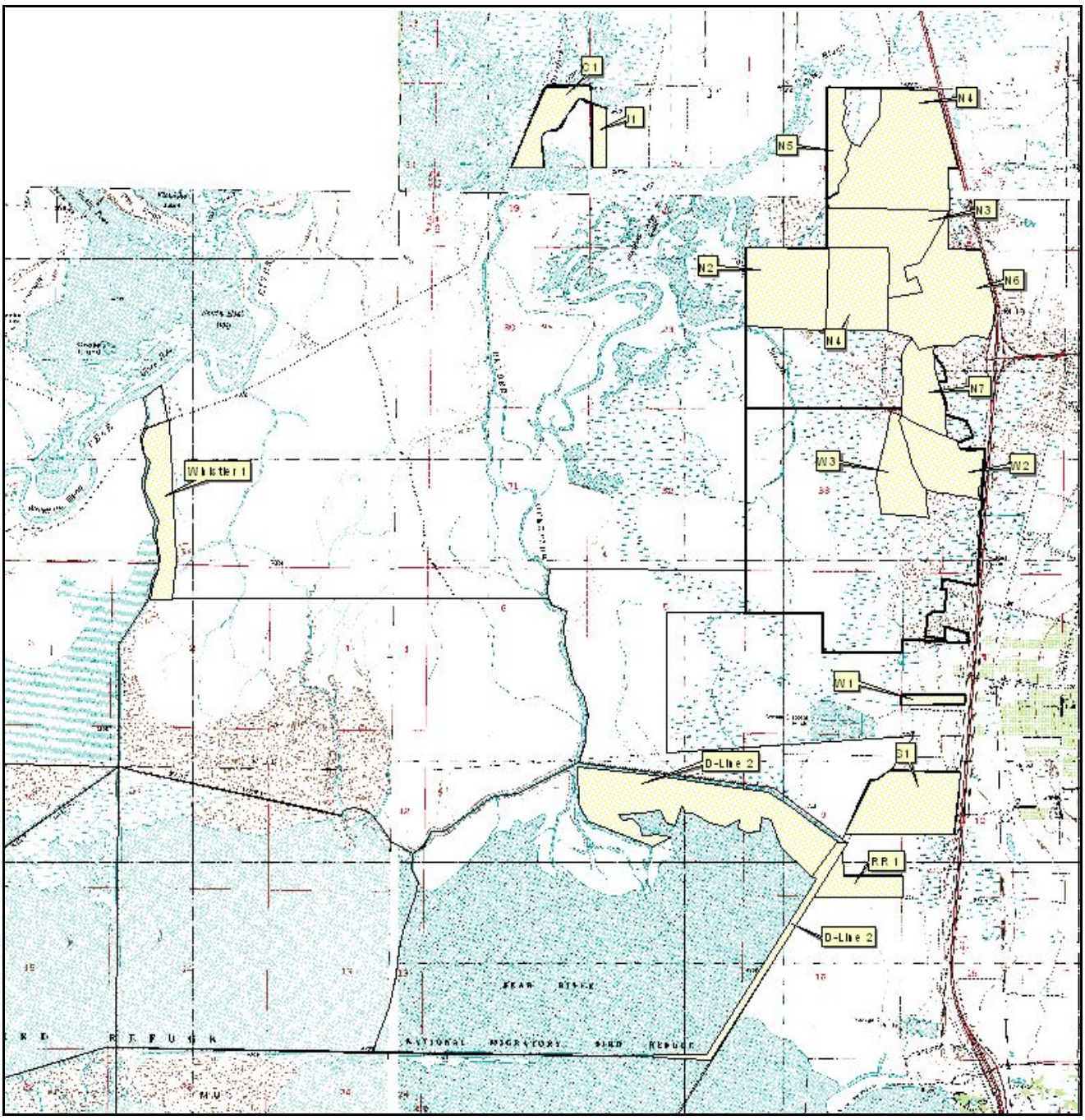


Figure 2. Grazing locations, 2006.

D. Habitat Response A vegetation survey conducted in 2003-2004 indicated that the frequency of occurrence of vegetation types in the grassland units was 67% grass (38% native, 22% non-native, 7% noxious), 2% shrub, 10% forb, 17% bare ground, and 1% classified as "other"(see 2005 AHMP for details). Overall habitat conditions are thought to have changed little since the survey was completed.
E. Response of Resources of Concern Waterfowl nest searching was conducted on the Stauffer and the south portion of the White unit. Only three waterfowl nests were found, and only one of those was successful. In 2006, an estimated three to four pair of long-billed curlews nested in the grasslands as pairs were observed regularly.

2007 UPLAND GRASSLAND MANAGEMENT PLAN

A. Objective The objectives for 2007 in the upland grasslands remain the same as last year.
B. Strategy Dormant season grazing (January-April and September-December) of western portions (marshy areas) of the three grassland units will be attempted for cattail and phragmites control in 2007. Portions of the White and Stauffer units will be dormant season grazed for cheatgrass control and native grass invigoration/enhancement.

MONITORING AND EVALUATION

HABITAT

In May, vegetation surveys of wetland units grazed in the summer of 2006 will be conducted via airboat and GPS to determine amount of open water to emergent vegetation

In July, at the peak of sago pondweed flowering, airboat surveys of the priority units will be conducted with the aid of a GPS unit. The amount of habitat occupied by submergent and emergent vegetation as well as the aquatic plant species diversity will be calculated in order to determine if habitat objectives are being met. Should any of the grassland ponds go dry, the vegetation will be mapped with a GPS unit. The amount of habitat occupied by emergent vegetation in the ponds may also be conducted after winter freeze-up to facilitate surveying.

Wetland management strategies are designed to encourage colonization and productivity of sago pondweed, alkali bulrush, and hardstem bulrush while inhibiting the growth of cattail and *Phragmites*. Optimum germination conditions for all the emergent plant species is on freshwater mudflats. In general, as salinity levels increase, germination, growth and production by these aquatic macrophytes are inhibited though each plant species exhibits some degree of tolerance to salinity. *Phragmites* and cattail are the least tolerant of saline conditions, followed by hardstem bulrush. Alkali bulrush and sago pondweed exhibit the greatest tolerance for high salinity levels. Therefore, salinity ranges that don't inhibit life stages of sago pondweed, alkali bulrush and hardstem bulrush but do negatively effect cattail and *Phragmites* (5,000 - 10,000 ppm) were adopted as wetland objectives. Soil salinity levels were monitored periodically, in the priority units in 2005 and 2006. The salinity readings don't appear to provide any useful information as they are often well below objective levels. Though soil salinity appears to be lower than the desired range, the macrophyte community does contain the desired species. Soil salinity monitoring will be discontinued.

The water depth at the outlets of wetland units will be recorded at least once a month to determine how closely water elevation targets are being met and to associate different water depths with the amounts and types of habitat observed.

Photos will be taken at the established photo points on the Nichols, White, and Stauffer Units to monitor any changes in upland habitat. Another intensive vegetative sampling is planned for 2008 or 2009.

On the grasslands, the amount of water flowing through the Parshall flumes will be recorded monthly. The condition of gates (open, closed, partly open) will be noted at the same time. Records of diversions that are shared with other water right holders will be particularly noted. Staff gauges

need to be installed on all of the ponds and the water depths recorded monthly.

PRIORITY SPECIES

Weekly waterbird surveys of the 26 wetland management units will be conducted to determine use by priority species on a unit by unit basis. If staff time allows, waterbird use of the grassland ponds will also be surveyed.

Canada Goose and duck brood counts will be conducted as an index of the effectiveness of the predator control program.

Waterfowl breeding pair surveys will be conducted on the grassland ponds.

A research investigation into the productivity and identification of predators of high priority shorebirds; (American avocet, black-necked stilt, snowy plover and long-billed curlew) by Dr. John Cavitt, Weber State University, Ogden, UT will continue for a fifth consecutive year. The research was supported by a Challenge Cost-Share Grant in 2004 and again in 2006. Nesting success by shorebirds is also used to measure the effectiveness of our predator control program.

A research investigation to determine Biogeography of Marbled Godwit in North American will continue in 2007. A minimum of five godwits will be equipped with satellite transmitters.

Refuge staff will participate in Great Salt Lake snowy plover breeding bird estimation survey. Areas around the GSL will be surveyed via two visits along a randomly selected transect survey.

Refuge staff may also participate in collecting Avian Influenza samples from live birds as part of the state of Utah's Avian Influenza surveillance plan.

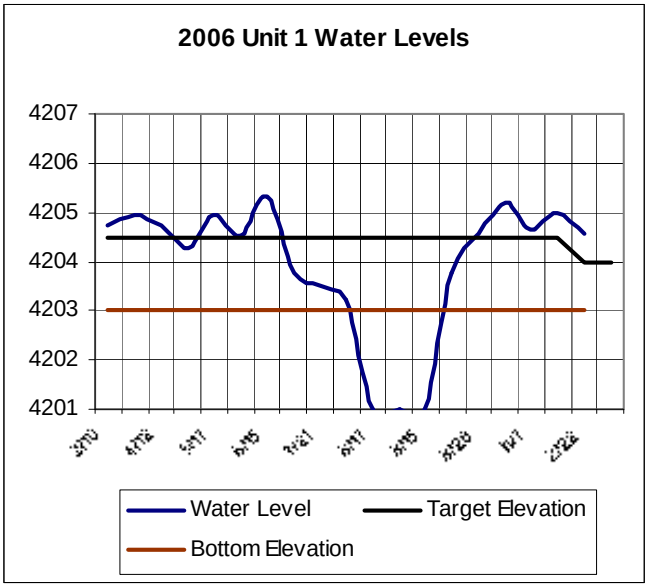
REFUGE UNMET NEEDS

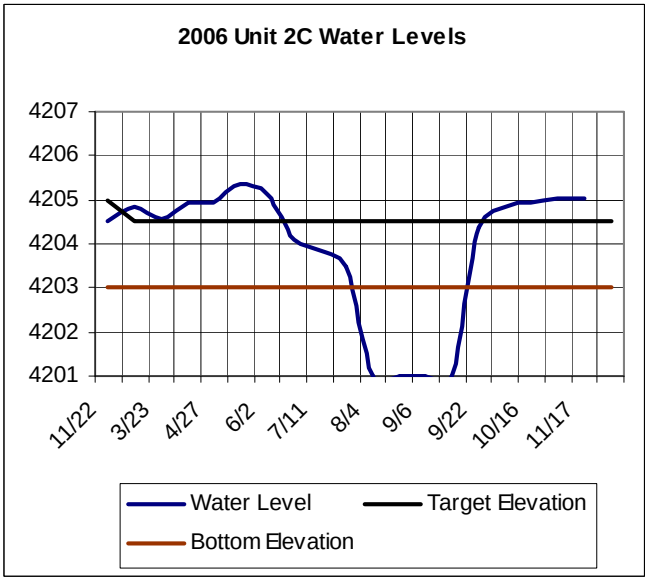
Water is limited on the Nichols, White, and Stauffer Tracts. Any opportunity to acquire additional water for those units (such as water under subdivisions in Perry and Brigham City) should be pursued actively. A water right claim for the excess runoff from Three Mile Creek was investigated in 2005. It is believed at this time that there are no other users below the point of diversion besides the Refuge. Therefore, the excess will by default reach the Refuge via a culvert under Interstate 15 and inundate wet meadows on the Stauffer Unit.

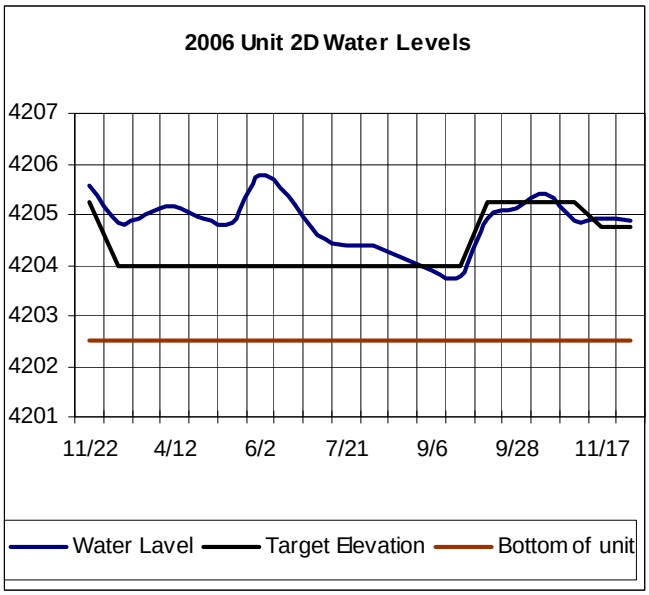
Another permanent, year-round staff position is needed at the Biologist or Biological Technician level to accomplish all of the monitoring activities necessary to manage priority species and habitat types. Monitoring is crucial to the adaptive management process. Currently, only portions of needed monitoring activities are fully completed in a timely manner. Little to no inventory work is being completed on non-priority species, weeds, and other invasive species.

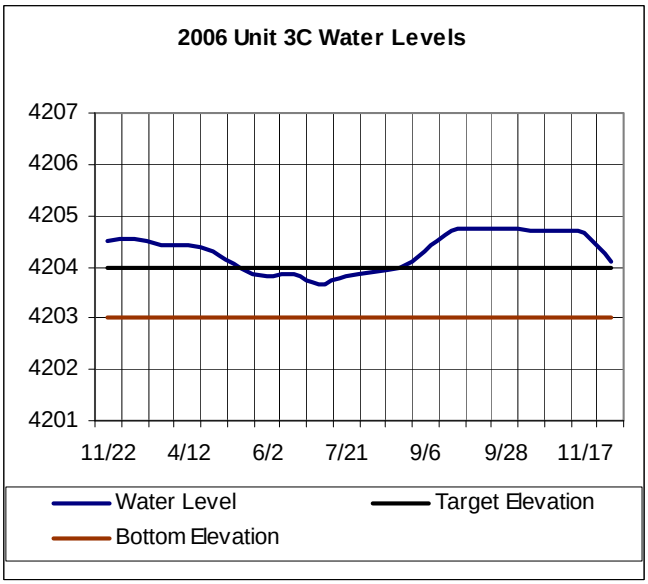
Staff gauges are needed in many units in order to more accurately monitor water depths. As noted in each of the unit summary details, the wetland units needing staff gauges are Units 3A, 3B, 3F, 3G, 3H, 3I, 3J, 2A and 2B. Staff gauges are also needed in all sixteen of the grassland ponds.

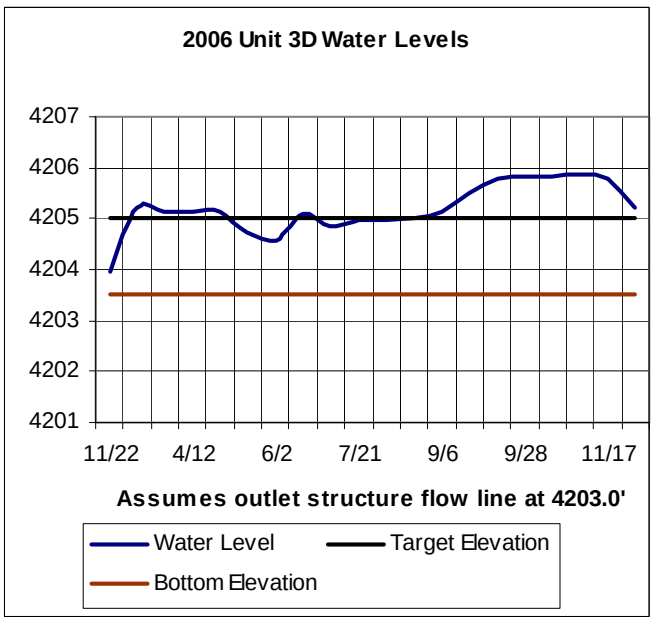
Appendix A. 2006 Unit Water Levels

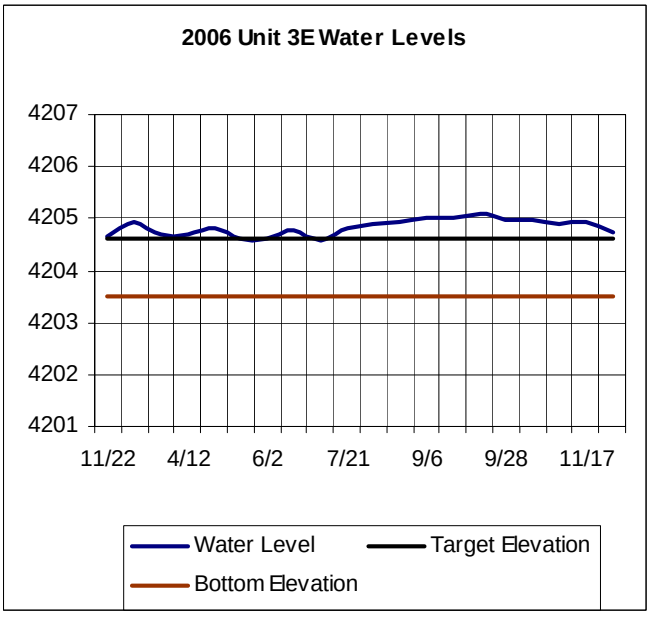




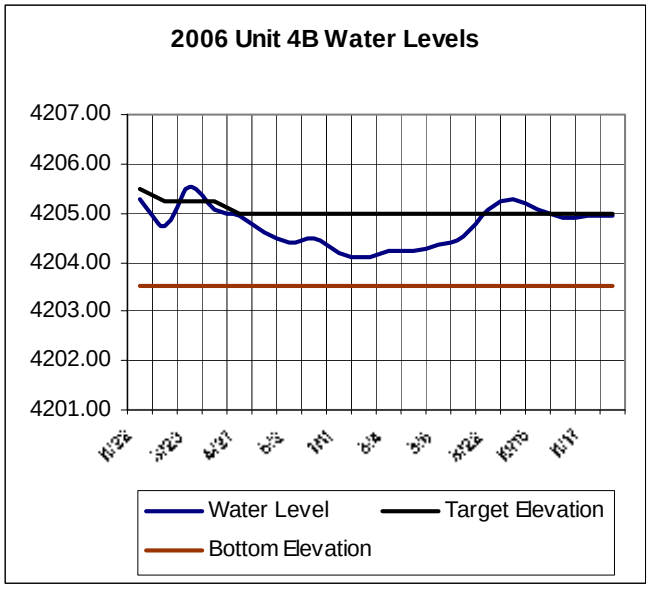


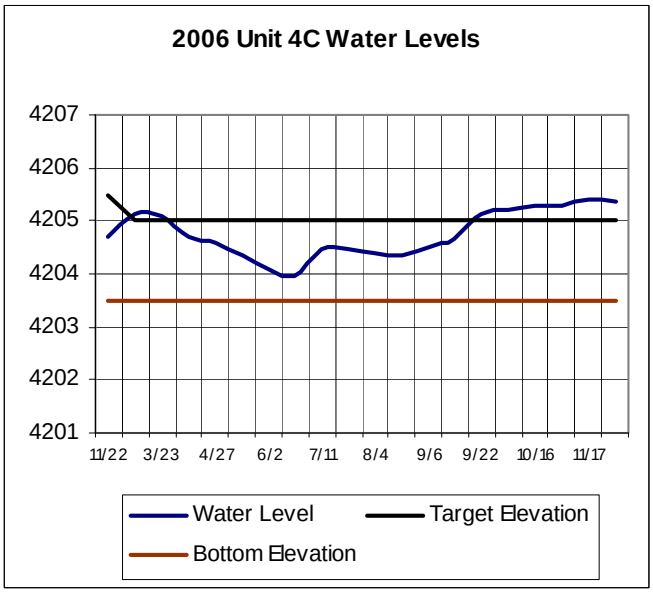


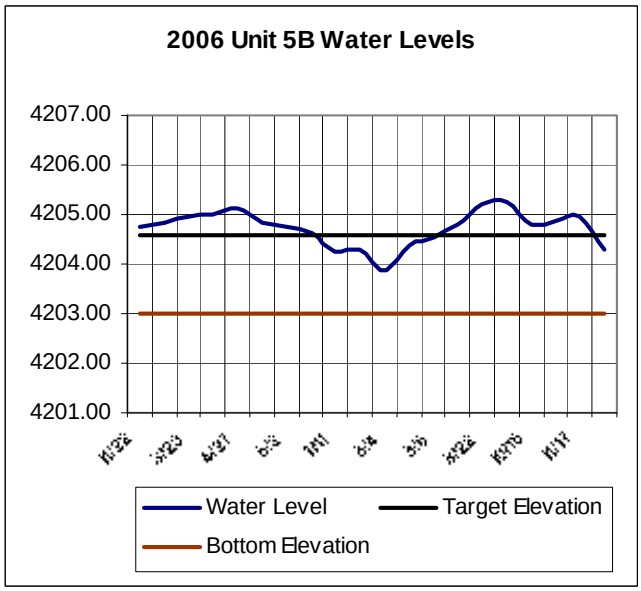


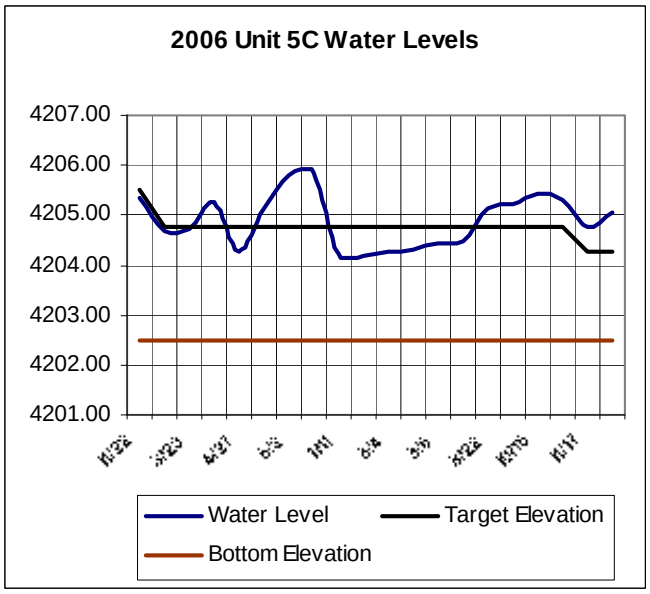


Appendix A. 2006 Unit water levels (continued)









Appendix B. Summer wetland grazing, 2006.

Table B-1. Wetland units grazed and grazing intensity for summer, 2006.

Graze				Days	No. of	AUM'S	AUMS/	HEAD/
Unit	Cooperator	Acres	Dates Grazed	Grazed	Head	Removed	Acre	Acre
1A	John Ferry	758	July 15-26	12	185 pairs[1]	89	0.37	0.30
			July 27- August10	15	330 pairs	198		0.52
2B	John Ferry	281	August 11-17	7	330 pairs	92	0.33	1.40
Shop peninsula	John Ferry	23	August 13-17	5	16	3	0.13	0.70
2A	John Ferry	650	August 18-September 7	21	330 pairs	277	0.44	0.63
2A			August 18-September 7	21	16	11		
2D	John Ferry	460	September 8-23	16	330 pairs	211	0.48	0.90
2D			September 8-23	16	16	9		
TOTALS		2172				890		

[1] "Pairs" indicates cow/calf pair.

Figure B-1. Map of wetland units grazed in summer, 2006.

Appendix C. Monitoring of wetland management units for sago pondweed, *Stuckenia pectinata*, and soil salinity in 2006.

Table C-1. Sago pondweed, *Stuckenia pectinata*, density measured in wetland management units in 2006.

2006 Sago Colonization			
Date	Unit	Avg. %	Grade
12-Jul	1	88	Excellent
12-Jul	2C	95	Excellent
12-Jul	5C	86	Excellent

Table C-2. Sago pondweed colonization scale.

Grading Key	
Grade	% coverage
Poor	0-25
Fair	26-50
Good	51-75
Excellent	76-100

Table C-3. Wetland unit soil salinity readings, 2006.

2006 Salinity Readings				
		soil	**H_20**	**Objective**
Date	**Unit**	**ppm**	**ppm**	**ppm**
31-May	3C	5033	6500	5-10,000
1-Jun	6	2000	500	5-10,000
1-Jun	8	1400	800	2,000
12-Jul	5C	6714	7000	5-10,000
12-Jul	2C	1525	1863	5-10,000
12-Jun	1	1550	1883	5-10,000
12-Jul	1	2380	3550	5-10,000

Appendix D. Seasonal use of wetland units by priority species, 2006.

2006	Spring (Mar-May)			Use Days on	Annual total	Peak Unit Use/
Species	**Peak No.**	**Peak Date**	**Peak Unit**	**Peak Unit**	**Use Days**	**Annual Use (%)**
American Avocet	9,321	25-Apr	9	116,088	412,194	28
Cinnamon Teal	4,483	7-Apr	6	72,431	153,428	47
Black-necked Stilt	3,437	1-May	7	56,420	116,621	48
White-faced Ibis	6,565	10-May	8	92,814	319,860	29
Shorebirds	16,857	25-Apr	7	199,433	632,726	32
Waterfowl	240,999	24-Mar	6	2,332,132	8,966,244	26
Tundra Swan	19,227	9-Mar	6	161,566	476,887	34
Snowy Plover	Not observed					
Marbled Godwit	3,867	25-Apr	7	26,883	33,120	81
Long-billed Curlew	5	25-Apr	7	84	210	40
Am. White Pelican	284	25-Apr	6	5,501	18,687	29
Redhead	8,579	24-Mar	4B	84,769	375,784	23
Wilson's Phalarope	33	10-May	9	504	1,224	41
Long-billed Dowitcher	1,931	10-May	6	30,150	72,623	42
Franklin's Gull	10,813	25-Apr	6	62,256	273,671	23
Black Tern	52	10-May	5C	1,656	1,872	88

2006	Summer (June-July)			Use Days on	Annual total	Peak Unit Use/
Species	**Peak No.**	**Peak Date**	**Peak Unit**	**Peak Unit**	**Use Days**	**Annual Use (%)**
American Avocet	3,190	28-Jul	4B	23,128	129,021	18
Cinnamon Teal	2,370	26-Jun	6	18,953	69,940	27
Black-necked Stilt	14,976	14-Jul	6	179,706	372,406	48
White-faced Ibis	21,205	14-Jul	6	150,189	641,154	23
Shorebirds	22,416	14-Jul	6	258,613	781,441	33
Waterfowl	31,469	14-Jul	3E	178,359	998,281	18
Tundra Swan	Not Present					
Snowy Plover	7	14-Jul	1	133	155	86
Marbled Godwit	3,190	28-Jul	6	56,434	176,252	32
Long-billed Curlew	4	26-Jun	3C,3E,4B	14	72	19
Am. White Pelican	5,338	14-Jul	6	78,831	161,485	49
Redhead	1,533	26-Jun	5C	13,426	66,612	20
Wilson's Phalarope	1,011	28-Jul	8	7,417	20,357	36
Long-billed Dowitcher	5,201	28-Jul	2D	60,200	74,295	81
Franklin's Gull	4,808	14-Jul	6	78,553	209,562	37
Black Tern	13	28-Jul	5C	98	224	44

Appendix D. (Continued) Seasonal use of wetland units by priority species, 2006.

2006	Fall (Aug-Nov)			Use Days on	Annual total	Peak Unit Use/
Species	**Peak No.**	**Peak Date**	**Peak Unit**	**Peak Unit**	**Use Days**	**Annual Use (%)**
American Avocet	10,232	12-Sep	2D	162,966	520,760	31
Cinnamon Teal	2,988	11-Aug	5C	60,692	143,172	42
Black-necked Stilt	6,895	11-Aug	2D	145,050	278,707	52
White-faced Ibis	8,366	11-Aug	2D	148,894	323,530	46
Shorebirds	27,938	12-Sep	2D	450,817	1,834,116	25
Waterfowl	338,063	30-Oct	6	3,495,280	20,266,533	17
Tundra Swan	25,855	15-Nov	1	280,304	452,867	62
Snowy Plover	Not observed					
Marbled Godwit	10,131	25-Sep	6	155,036	528,805	29
Long-billed Curlew	10	11-Oct	1,3B	95	203	47
Am. White Pelican	2,747	11-Aug	2D	24,805	112,067	22
Redhead	3,651	11-Oct	4C	66,897	214,501	31
Wilson's Phalarope	30	11-Aug	2D	512	992	52
Long-billed Dowitcher	6,204	11-Aug	6	183,288	480,493	38
Franklin's Gull	745	11-Aug	4c	10,720	30,315	35
Black Tern	426	11-Aug	6	6,980	14,340	49

2006	Winter (Jan-Feb, Dec.)			Use Days on	Annual total	Peak Unit Use/
Species	**Peak No.**	**Peak Date**	**Peak Unit**	**Peak Unit**	**Use Days**	**Annual Use (%)**
American Avocet	5	3-Feb	6	35	35	100
Cinnamon Teal	8	10-Feb	6	167	206	81
Black-necked Stilt	Not present					
White-faced Ibis	Not present					
Shorebirds	5	3-Feb	6	57	83	69
Waterfowl	80,984	10-Feb	2D	1,417,901	5,325,361	27
Tundra Swan	22,963	7-Dec	2D	423,162	1,037,194	41
Snowy Plover	Not present					
Marbled Godwit	2	20-Dec	6	22	22	100
Long-billed Curlew	Not present					
Am. White Pelican	2	20-Dec	5C	26	48	54
Redhead	456	23-Feb	2D	4,735	9,183	52
Wilson's Phalarope	Not present					
Long-billed Dowitcher	Not present					
Franklin's Gull	Not present					
Black Tern	Not present					

Appendix E. Significant use (≥ 10%) of management units by priority species as a proportion of total Refuge annual use, 2006.

Priority Rank

1

American Avocet	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
2D	162,966	15
3E	126,681	12
4B	150,552	14
7	123,860	12
9	116,598	11

2

Cinnamon Teal	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
5C	78,732	21
6	120,214	33

3

Black-necked Stilt	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
2D	176,284	23
6	201,590	26

4

White-faced Ibis	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
2D	236,179	18
6	225,929	18

5

Shorebirds	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
2D	542,573	17
6	728,274	22
7	530,614	16

6

Waterfowl	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
3E	5,118,439	14
5B	3,615,314	10
5C	4,241,982	12
6	7,298,892	21

7

Tundra Swan	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
1	454,203	23
2D	700,915	36
6	383,138	19

8

Snowy Plover	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
1	133	86

9

Marbled Godwit	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
6	212,002	29
7	225,504	31
8	96,990	13
Grassland Marsh	93,280	13

10

Long-billed Curlew	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
1	95	20
1A	72	15
3B	95	20
7	84	17

11

Am. White Pelican	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
2D	61,461	21
5C	42,093	14
6	100,376	34

12

Redhead	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
2D	72,813	11
3C	81,412	12
4B	88,949	13
4C	77,605	12
5B	84,235	13
5C	83,832	13

13

Wilson's Phalarope	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
1	4,174	18
2C	4,200	19
8	7,633	34

14

Long-billed Dowitcher	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
2D	200,050	32
6	213,438	34
7	102,288	16

15

Franklin's Gull	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
6	146,956	29
7	72,902	14
8	51,634	10

16

Black Tern	Annual	Proportion of
Unit	Unit Use	Annual Use (%)
5C	3,482	21
6	7,266	44
Grassland Marsh	3192	19