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SQUAW CREEK NATIONAL WILDLIFE REFUGE  
Mound City, Missouri

ANNUAL NARRATIVE REPORT  
Calendar Year 1991

U.S. Department of the Interior  
Fish and Wildlife Service  
NATIONAL WILDLIFE REFUGE SYSTEM

REVIEW AND APPROVALS

SQUAW CREEK NATIONAL WILDLIFE REFUGE

Mound City, Missouri

ANNUAL NARRATIVE REPORT

Calendar Year 1991

<u>Donald L. Bell</u>	<u>2/27/92</u>	<u>Wendell L. Kistner</u>	<u>3.3.92</u>
Refuge Manager	Date	Wildlife Associate Manager	Date
		WAM2, Review	

<u>Robert L. Hays</u>	<u>3-9-92</u>
Regional Office Approval	Date

## INTRODUCTION

Squaw Creek National Wildlife Refuge, located in extreme Northwest Missouri near Mound City, was established August 23, 1935, by Executive Order 7156, "in order to effectuate further the purposes of the Migratory Bird Conservation Act"; and lands were to be used "as a refuge and breeding ground for migratory birds and other wildlife." All land is held in fee title and there are no satellite units.

Most of the 7,178 acres comprising the refuge are located along the eastern edge of the Missouri River floodplain in an historic wetland area. Habitat types and acreages are as follows:

Wetlands	2,850
Grasslands	1,998
Forests	1,681
Croplands	569
Administration	80

There are twelve managed impoundments totaling approximately 2,300 acres. All are managed primarily for migrating waterfowl. Water sources include gravity flow from diversion of Squaw and Davis Creeks, a well on Mallard Marsh, and whatever rainfall is received.

Croplands are farmed by three cooperative farmers who plant soybeans and corn in rotation and sow wheat into the bean fields. Refuge shares normally amount to 400 acres of wheat and 200 acres of standing corn on a one-third to two-thirds share basis.

Wildlife include tremendous numbers of waterfowl, a large wintering concentration of bald eagles, pelicans, deer, pheasants and various other species.

Visitors to the refuge enjoy a ten-mile circular auto tour which is open all year from sunrise to sunset. Approximately 100,000 people visit the refuge each year; many are from urban areas such as St. Joseph, Kansas City and Omaha, which are no farther than 125 interstate highway miles distant.





### Land Acquisition Funding

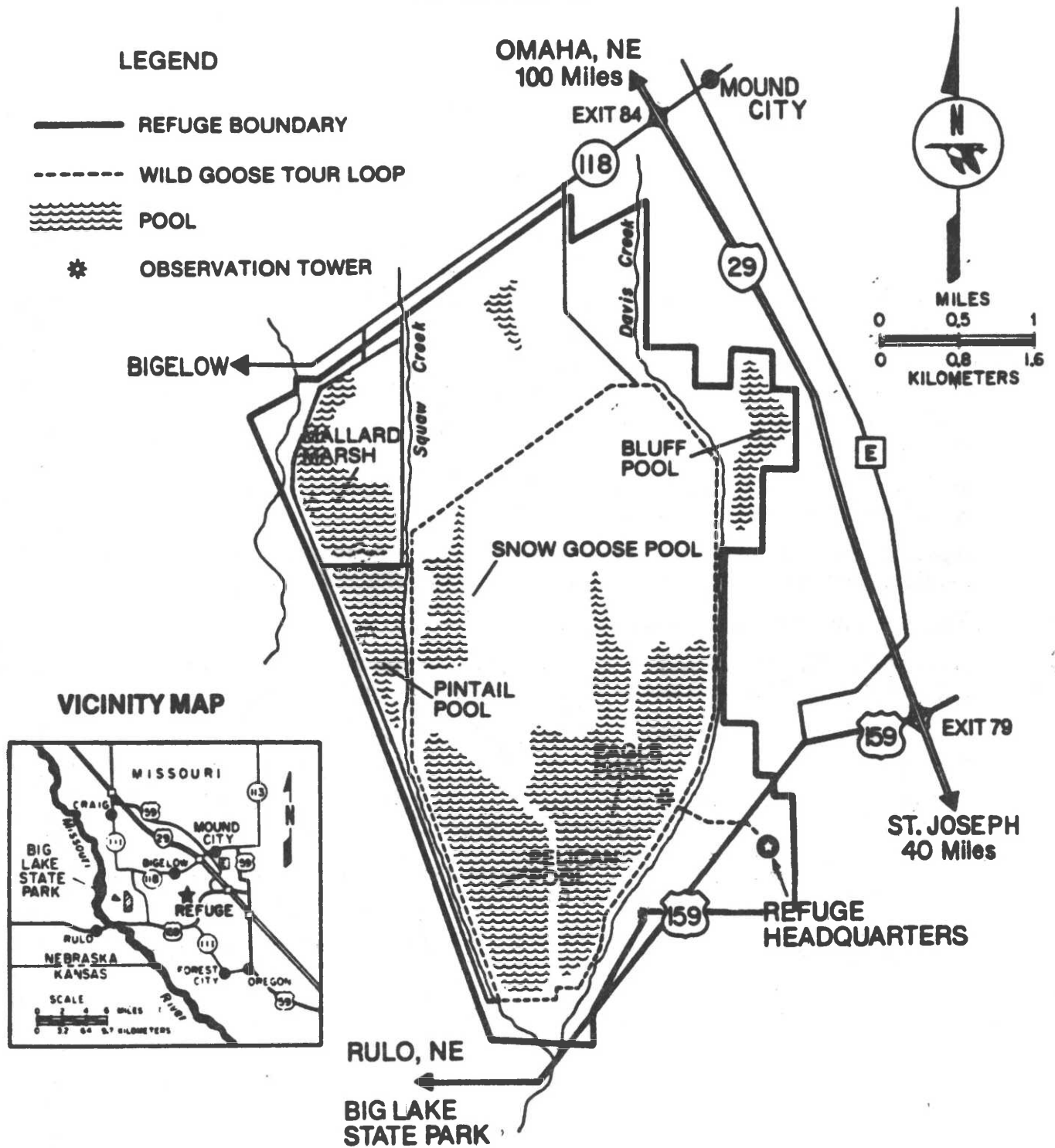
Fund	Acreage	Cost
Six Million	761.32	\$34,275.46
One Million or E.C.F.L.A.	2,161.89	57,081.92
Resettlement Administration or ERA	3,843.91	115,527.16
Duck Stamp Act	40.00	4,000.00
Land and Water Conservation Fund	396.73	262,868.46
Abandoned Right-of-Ways	74.38	0.00

# Squaw Creek National Wildlife Refuge

Mound City, Missouri

## LEGEND

-  REFUGE BOUNDARY
-  WILD GOOSE TOUR LOOP
-  POOL
-  OBSERVATION TOWER



## VICINITY MAP





## INTRODUCTION

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#### **A. HIGHLIGHTS**

A Preliminary Project Proposal was developed for Squaw Creek and the watersheds entering the refuge (Section D.6).

There were several personnel changes in 1991 (Section E.1).

The volunteer program continued to expand with sixty volunteers contributing 900 hours (Section E.4).

Mallard Marsh had an official dedication ceremony October 30 (Section F.2).

Spring water conditions were excellent with all wetlands flooded (Section F.2).

Three major floods damaged the refuge auto tour route (Section F.2).

A private lands program was proposed (Section F.15).

Fall waterfowl migration was shortened by record low temperatures (Section G.3).

Approximately 950 dead birds were picked up. Most died from avian cholera (Section G.17).

The annual Eagle Days was successful (Section H.6).

The Refuge deer hunt harvested a record number of deer. Hunter success rate is high (Section H.8).

Maintenance management funds proved to be a boost to facility maintenance (Section I.3).

The refuge continues to be involved in numerous cooperative ventures (Section J.1).

#### **B. CLIMATIC CONDITIONS**

The weather returned to a more normal pattern in 1991. Temperatures were mild during the winter months and average in the summer. Precipitation was below normal for the year but was characterized by wet spells broken by dryer-than-normal periods.

January and February were milder than usual with only one below-zero night recorded on January 29th. However, it was cold enough to keep the refuge pools frozen until early February. Precipitation was well below normal with the exception of two snows that totaled ten inches.



By mid-March the rains descended and kept things very muddy until June. Over this three-month period rain was recorded on 34 days. This put crop planting far behind schedule and altered a lot of rotation decisions. The last frost of the season was recorded on March 28. Temperatures for this period would be called average.

Temperatures for the summer were average with June, July, and August all seeing days above 100 degrees and brief periods of high humidity. Moisture, being either feast or famine, dried up and resulted in a deficit of 6.73 inches for these months.

Hot dry winds in September resulted in considerable evaporation in the marshes, and little runoff occurred with the 1.74 inches of rain. The first frost of the season occurred the night of September 18 and did considerable damage to late crops, especially soybeans.

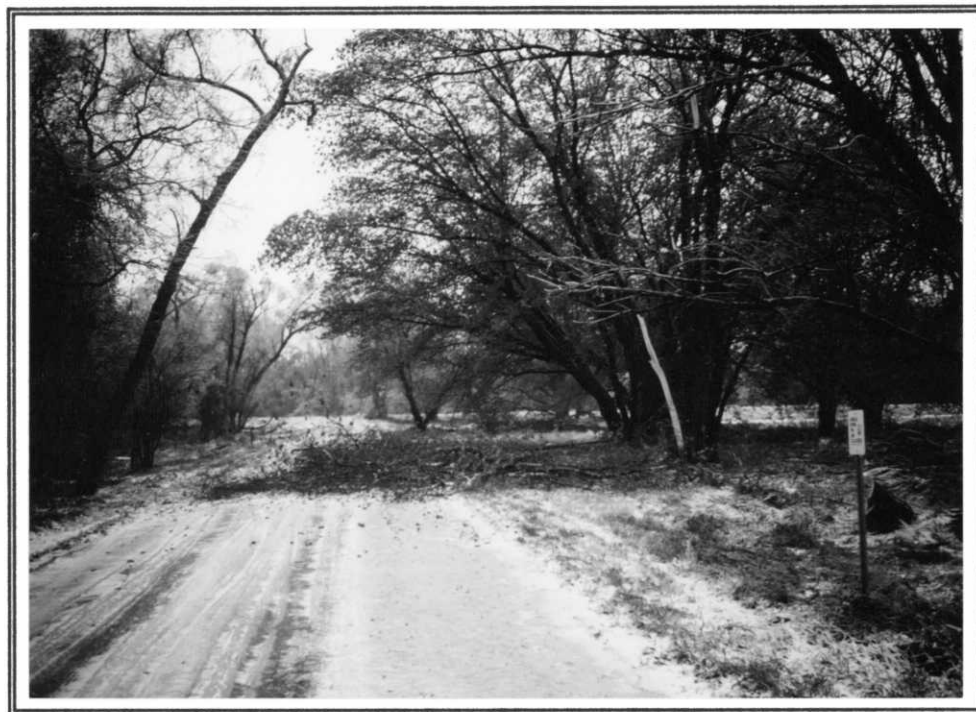
Because of the hot dry conditions, harvest was almost nonstop, and waterfowl had most fields available for feeding on first arrival. In October the rains returned and provided some of the cleanest runoff in years for reflooding marshes.

November and December saw repeated cold and warm spells with slow, persistent rains. This caused the pools to freeze over, thaw, and refreeze on several occasions, but provided a continued source of water for pool recharge. Temperatures remained mild for the period.

A summary of temperature and precipitation is found in Table 1.

Table 1. Precipitation and Temperatures--Squaw Creek NWR 1991

	Precipitation		Temperature	
	Actual	Normal	High	Low
January	.64	1.08	46	-6
February	.26	1.15	72	20
March	3.97	2.39	91	20
April	5.39	3.17	84	34
May	4.22	4.33	97	38
June	2.01	5.43	100	58
July	2.82	3.41	104	58
August	1.18	3.90	104	56
September	1.74	4.15	98	34
October	5.12	2.62	89	25
November	1.72	1.68	66	2
December	2.02	1.21	70	11
Total	31.09	34.52		



A severe ice storm on November 1 broke off many tree branches. The auto tour route had to be closed for a day. 11/91 JMC

### C. LAND ACQUISITION

#### 1. FmHA

Easement activities for Squaw Creek are entirely through FmHA conservation easements. With the lack of clear cut rules for the 1990 FACTA Farm Bill and a reluctance of FmHA to continue under 1985 guidelines, easement activity has gone into a holding pattern and a sharp decline in easement tracts being evaluated. For 1991, 1,571 acres on nine properties were reviewed with no easement requests submitted.

The Service's footing to proceed with development of tracts listed in caretaker status proved to be gelatinous (Section F.14). Consequently, our activities were limited to those tracts with the easement previously recorded on a Quit Claim deed. Additionally, all floodplain requests, except those recorded on deeds, have been rescinded.

The refuge is responsible for a twenty-one county area in Northwest Missouri. Being located on the western boundary of the district it is 125 miles to the outer edges of the district. The bulk of tracts lie in the 75 to 90 mile range from headquarters.

County	Recorded Easements Acreage		Requested Easements Acreage	
Andrew	2	169.6		
Buchanan	1	55.5	1	58.5
Caldwell	2	44.7	1	12.1
Daviess	6	326.1	4	230.4
Gentry	1	27.7	1	10.0
Grundy			1	113.9
Harrison	7	283.1	1	12.0
Johnson	1	94.5	2	185.1
Mercer	3	242.6	3	102.2
Nodaway	3	76.3	2	30.4
Worth	2	70.8		
Total	28	1,390.9	16	754.6

Fee title requests to FmHA are in the same status as easements. Only rumors of the status or level of request were forthcoming. Undoubtedly this will continue until final rulings are made on the 1990 Farm Bill. At that time we will assuredly have to reevaluate these tracts on those criteria.

The following tracts continue to be requested in fee title from FmHA.

County	Tract	Acres
Andrew	Kier	117.0
Atchison	Murphy	330.0
Daviess	Riley	311.5
Gentry	Messner	110.0
Gentry	Johnson	111.0
TOTAL		979.5

## D. PLANNING

### 1. Master Plan

In 1985, members from the Western Energy and Land Use Team (WELUT) met with refuge and regional personnel to examine potential developments and water management alternatives for Squaw Creek. The results of this workshop were developed into a document that supplemented and updated portions of the 1964 Master Plan. Table 2 summarizes most of the alternatives that were developed and progress that has been made since 1985.

Funds to complete the projects have come from a variety of sources and have made it possible to improve water management at the refuge the past two years.

Table 2. Potential Developments and Water Management Alternatives as Developed by WELUT, September 1985

<u>Alternative</u>	<u>Progress/Status</u>	<u>Funds*</u>
Build Davis Creek Structure	Completed 6/89	CON
Rehabilitate Rice Paddies	Outlets Cleaned 8/90	ER
Dikes Rebuilt	4/91                                  CG/ER	
Cattail Pool Converted to MSU	Dike Rebuilt 8/88	ER
Convert Croplands to MSU'S		
Farm Unit A-4   26.2 Acres	Not Feasible--Surveyed 9/90	
Farm Unit A-3   60.2 Acres	Completed 7/87	ER
Farm Unit A-19 29.5 Acres	Completed 10/90	CG/PF
Dike East Bay of Eagle Pool	None	
Build Water Control Structure		
and Dike on Long Slough	Completed 4/89	MAT
Rehabilitate Existing Well #1	None--Gravity Flow Water	
(Near Rice Paddies)	From Davis Creek 4/91	CG
Rehabilitate Existing Well #2	New Well--Mallard Marsh	PF
(Near Squaw Creek Structure)	11/89	
Develop New Water Sources		
for Northeast Pool	None	
Dike Upper End of Pelican Pool		
for MSU	None	
Install Independent Drain in		
Pintail Pool/Control Vegetation	Completed 9/90	CG/ER
Install Independent Drain in		
Mallard Marsh/Control Vegetation	Completed 9/89	CG/PF
Develop Independent Water Control		
for Snow Goose Pool	Completed 10/88	ER
Manage Bluff Pool		
Divert Swope Creek to Davis Creek	Completed 7/87	ER
Install Drain to Davis Creek	Completed 9/89	ER
Install Inlet from Davis Creek	Completed 9/89	ER
Drill New Well along CL #2 and		
Develop Additional MSU'S to South	None	

CON=Construction Funds; ER=Equipment Rental; CG=Challenge Grant;  
PF=Private Funds; MAT=Regional Maintenance Action Team





The ditches in the Rice Paddies (center right) were cleaned and dikes rebuilt. 9/91 RLB

## 2. Management Plan

The annual Water Management Plan was completed January 30 and approved by the Regional Office April 11. The annual Prescribed Burn Plan was submitted December 18. An Oil and Hazardous Spills Contingency Plan, submitted September 14, 1989, has not yet been returned from the Regional Office.

As a result of the November Operations Inspection, some of the objectives in the Refuge Management Plan will be revised and updated in 1992.

## 3. Public Participation

A public meeting was held at the refuge headquarters June 18 for local landowners and hunting clubs to discuss moist soil management and potential payment to owners to maintain water in their properties during the spring migration. Charley Schaiffer, Mingo National Wildlife Refuge Biologist, presented the meeting. Approximately 25 people attended and ten landowners were seriously interested in the idea.

A proposed pilot project fashioned from the success at Mingo NWR was submitted in the fall which included four units totaling about 150 acres at a cost of \$2,000. Due to the lack of funds, it was not authorized in FY 1992 (Section F.15).

## 5. Research and Investigations

Squaw Creek NR88-3: "The Collection and Utilization of Deer Fetuses to Determine Reproduction Performance in the White-tailed Deer Herd at Squaw Creek National Wildlife Refuge" by Billy Fulton and Dr. Donald J. Robbins, Missouri Western State College.

Data were collected at the check station January 5-6 and January 19-20. A preliminary analysis of the data is found in Table 3.

Table 3. Deer Reproductive Data 1991 Squaw Creek NWR

Age	Number Animals Collected	Average Dressed Weight	Fetuses/Deer	Sex of Fetuses		
				M	F	Unk
Fawn (.5 year)	2	55	1.5	2	0	1
Yearling (1.5 year)	8	88	1.6	6	3	4
Adult (2.5+ year)	14	98	1.7	14	6	4
	24			22	9	9

Sample sizes were small. However, two fawns collected were pregnant and overall productivity was comparable to the previous three years. The fetal sex ratio favored males. It appeared that peak conception occurred in early to mid-November with a range of October 21 to December 16.

Squaw Creek NR88-4: "The Use of Kidney Fat Index to Evaluate Nutritional Conditions of Hunter Harvested Deer at Squaw Creek National Wildlife Refuge" by Bernie Fausten and Dr. Donald J. Robbins, Missouri Western State College.

The four years of data were summarized in April 1991. The results are as follows:

Female deer have a higher mean Kidney Fat Index (KFI) than male deer. The mean KFI for female deer has decreased over the last four years. In 1988, the mean KFI for female deer appeared higher than male. The yearling mean KFI is higher for both sexes than that of the other two age classes. In 1989 all three female age classes were about the same and consistently higher than all three male age classes in KFI measurements. In 1990 the male and female yearling age classes were higher than both adults and fawns. In 1991 male fawns had higher KFI'S than the other two male age classes.

Table 4. Age and Sex of Deer Kidney Samples 1988-1991

Year	Male	Female	Fawn	Yearling	Adult
1988	36	18	4	7	43
1989	32	32	19	16	29
1990	24	29	28	7	18
1991	29	36	43	8	14
Total	121	115	94	38	104

Table 5. The Mean Kidney Fat Index (KFI) of 236 Deer by Age and Sex, 1988-1991

Age	Sex	Mean Kidney Fat Index Percent
Fawn	Male	107.10
Fawn	Female	196.63
Yearling	Male	151.01
Yearling	Female	265.92
Adult	Male	103.23
Adult	Female	199.60

## 6. Other

There has been a renewed interest in lands adjacent to and within the watersheds that affect the Refuge due to the private lands program within the Region and the potential for donations and/or willing sellers of significant habitats. In June, Refuge Manager Bell met with Biologist Wayne Weir, Southern Missouri Ascertainment Office, Dr. Paul McKenzie and Mike LeValley, Columbia ES Office, Brad Jacobs, Missouri Department of Conservation and Dr. David Easterla, Northwest Missouri State University to discuss the possibility of acquiring Bigelow Marsh. This 300-acre marsh is one of the largest intact marshes in private ownership in Northwest Missouri and has the honor of having three of the last five sightings of the black rail in the State of Missouri. The black rail is considered a threatened species within the State and has been proposed as a candidate species Federally.

As a follow-up to this meeting, Bell met with Weir and Judy McClendon on October 22-23 to begin the development of a Preliminary Project Proposal (PPP) for Squaw Creek and the watersheds entering the Refuge. A draft was developed in December. The proposal would include the potential

for fee title purchases as well as donations and easements within approximately 75,000 acres. Hopefully, the final will go to Washington for the Director's signature in 1992.

Another issue that has required a lot of time in previous years has been the continued development of the Schuylkill Metals Corporation plant approximately three miles southeast of the refuge. Schuylkill operates a lead smelter to recycle approximately 40,000 to 80,000 automotive batteries weekly. It recycles the plastic, lead, and acid.

A new landfill for Schuylkill was approved in 1990 and was nearly completed when a leak in the plastic liner was discovered in April of 1991. It took six months to repair and they borrowed a propane exploder from the Refuge in an attempt to keep the deer, attracted to the water that was collecting on the plastic, off the liner during repair work.

Schuylkill has been fined several times in past years for environmental pollution violations. Fortunately, they are not within the refuge watershed, but we do not know the potential for air pollution at this time.



An aerial view of the Schuylkill Metals. The triangle shaped green spot in the landfill was the repair location. 9/91 RLB

Interchem, a wood recycling plant proposed for construction along the east side of the Refuge boundary, was put on hold in 1991, and there was no new progress to report. This was good news for a change.



## E. ADMINISTRATION

### 1. Personnel



Left to right: Walker, Callow, Zeliff, Bell and Lehmer

Ronald L. Bell	Refuge Manager	GS-11	PFT
Shirley A. Zeliff	Administrative Technician	GS-06	PFT
J. Michael Callow*	Refuge Operations Specialist	GS-09	PFT
Marvin C. McCarty**	Refuge Operations Specialist	GS-09	PFT
Amy E. Sprunger***	Operations Specialist Trainee	GS-05	PFT
Jacob L. Lehmer	Maintenance Worker	WG-08	PFT
Daryl W. Walker	Tractor Operator	WG-05	PFT

\*EOD August 25, 1991, from Arrowwood NWR (Chase Lake)

\*\*Transferred April 21, 1991, to Windom Wetland Management District

\*\*\*Transferred September 8, 1991, to Wapello District, Mark Twain NWR

There was some turnover of personnel in 1991 after a year of stable conditions. McCarty transferred to the Windom Wetland Management District, Minnesota as primary assistant manager GS-11. His position was filled by Callow in late August. Mike was born and raised in Northwest Missouri, so this move gave him a chance to get back to home territory. He lateraled from Chase Lake Joint Venture Project in North Dakota as a GS-7, but was promoted to GS-9 in October. Sprunger completed her Cooperative Education Program here in 1990 and was hired as a Trainee at that time. She transferred to Wapello in a 5/7/9 Refuge Operations Specialist slot.

The five year staffing pattern for Squaw Creek is listed in Table 6. The total FTE for FY 1992 was one less with the transfer of Sprunger.

Table 6. Staffing Pattern FY 1988-1992 Squaw Creek NWR

Fiscal Year	Full Time	Part Time	Seasonal	Total FTE
1988	4	0	0	4
1989	4	0	1	4.83
1990	5	0	0	5
1991	6	0	0	6
1992	5	0	0	5

Refuge Manager Bell, Administrative Technician Zeliff and Tractor Operator Walker received Special Achievement Awards for their performance in 1991. Zeliff, Callow, Walker, and Lehmer all received On-The-Spot Awards for their extra work and effort toward the Mallard Marsh Dedication in October.

Tractor Operator Walker spent two weeks in Panama, March 15-31, as part of his National Guard training.

The refuge manager's position description was revised to include the accretion of duties resulting from the private lands and other significant duties that have been added the past four years. A final determination had not been made by the end of the year, but the position graded at a GS-12 level.

### 3. Other Manpower Programs

Several members of the refuge staff have been involved in recruitment efforts for the Cooperative Education and other manpower programs in support of the Region's Equal Employment Opportunity. Sprunger attended a Career Day at Northwest Missouri State University on February 19. Bell attended a Career Day March 28 at West Nodaway School District to explain career opportunities in the Service. Bell set up the Recruitment Display April 22 at the Federal Women's Day Program in the downtown Federal building in Kansas City. Bell participated in a Career Day for high school students at Nodaway-Holt School on October 17, while Callow and Bell talked about careers and the Cooperative Education Program to the freshman wildlife class at Northwest Missouri State University on October 24.

November 13-15 Manager Bell and Operations Specialist Callow, along with staff from Flint Hills and Mingo Refuges, as well as several members of the Columbia ES Office, staffed a booth at the National Future Farmers of America Convention in Kansas City to inform interested individuals about careers and other Service programs. Approximately 24,000 attended this annual event.

Manager Bell has been involved in a Teen Outreach Program through the Savannah School District. A high school senior who volunteered 155 hours

this summer has been working in this program at the Refuge. She has an interest in a wildlife career.

#### 4. Volunteer Programs

The volunteer program at Squaw Creek continues to expand. The primary individuals involved in the program the past few years have been members from the Midland Empire Audubon Society, St. Joseph, and the Burroughs Audubon Society, Kansas City. Both chapters have officially adopted the Refuge. However, more and more people want to contribute their time and efforts to the Refuge.

A record number of volunteers and hours were recorded in 1991. Table 7 summarizes volunteer contributions since 1986.

Table 7. Volunteers and Contributions, Squaw Creek NWR, 1986 to 1991

Year	Number of Volunteers	Hours
1986	14	204
1987	19	297
1988	48	478
1989	40	344
1990	38	448
1991	60	900
Total	219	2,670

If these volunteers were paid \$8.00/hour, they would have contributed more than \$21,000 the past six years.

The Refuge had two "work days" in 1991, the fourth year for such a program, to provide projects and a specific day on which we could channel volunteer efforts. This year the rails on the south Squaw Creek bridge were replaced and painted, the radial gate rails were painted, all wood sign posts were stained, paint was scraped from the outside walls of the old shop, the rails and benches at the headquarters were painted and sealed, and the metal frames around the headquarters doors and windows were cleaned and waxed.

Volunteers also staffed the refuge office during fall weekends. They not only provided information to visitors, but also sold interpretive supplies for the Midwest Interpretive Association. Other projects included assisting the staff in spotlight deer counts and computer support. One volunteer provided CPR training for the refuge staff through the American Red Cross.

One of the highlights for 1991 was the effort of ten individuals in the building and completion of the monument for the Mallard Marsh Dedication in October. A total of 94 hours were contributed, but most of the project was engineered by a retired doctor in Mound City, Dr. J. Bruce McRae.

Two high school students spent most of the summer assisting in the maintenance of the headquarters lawn and tree plantings. Together they contributed more than 300 hours of work during most of the hot, humid weather of summer.



Besides maintaining the headquarters lawn, Dan and Kacy mowed and trimmed around the water control structures. 6/91 RLB

The four individuals that contributed the most hours in 1991 were: Kacy Kelly--178 hours; Daniel Fischer--155 hours; George Scheil--96 hours; and Alice Scheil--69 hours. The Scheils now volunteer one day per month and help in surveys and any other job we give them. The two of them, along with their son, produced a map of the fall waterfowl migrations in the Mississippi Flyway and a chart of the peak bald eagle numbers since the establishment of the Refuge.

Both Audubon Societies were semi-finalists at the Washington level in the Take Pride in America program. They were awarded framed certificates at one of their general meetings in November.

##### 5. Funding

One of the greatest challenges, other than working with people, has been working with funds, particularly as more and more specific sources of funds become available to supplement annual budgets. This first became evident in FY 1990 after several years of getting one or two large blocks of dollars. Fiscal Year 1991 was even more diverse. Table 8 shows the funds and sources in the past five fiscal years.



Table 8. Five Year Fund Status, Squaw Creek NWR

Fund	FY 1991	FY 1990	FY 1989	FY 1988	FY 1987
1260	\$336,585	\$229,325	\$196,700	\$183,500	\$187,400
1120	10,000	10,000	0	0	0
1221	6,510	0	0	0	0
1230	1,300	0	0	0	0
1520	0	0	0	0	17,000
9120	1,400	22,500	0	0	0
Total	\$355,795	\$261,825	\$196,700	\$183,500	\$204,400

The large increase in 1260 funds relates directly to money specifically set aside for Maintenance management projects and does not reflect an increase in base operations and maintenance. In reality, the refuge received less base funds than FY 1990.

The 1260 funds were: \$242,035 O&M, including \$22,500 for Trainee's salary; \$30,000 maintenance management; \$54,000 Job Order projects (i.e. Squaw Creek Spillway, Ditch Cleanouts); \$5,000 dozer repair; \$200 fire management; \$900 volunteers; \$4,260 FmHA easements and \$190 law enforcement.

The 1120 funds were for Farm Bill/Private Lands work, 1221 drug interdiction, 1230 for approved nongame bird projects and 9120 fire management. Overall, FY 1991 was a very good year. A lot of progress was made in upgrading facilities at the headquarters. Work was beginning on the private lands. The refuge became more diversified while working with a larger number of cooperators.

Squaw Creek still had a balance of funds with the National Fish and Wildlife Foundation entering FY 1991, left from the Mallard Marsh Restoration Challenge Grant. The Foundation approved the use of these funds for the rehabilitation of the Rice Paddies Moist Soil Unit. The remaining funds (\$5,988.26) were spent cleaning the ditches, repairing dikes and buying culverts.



A tracked excavator was used to rehabilitate the Rice Paddies Moist Soil Unit ditches. 4/91 RLB

#### 6. Safety

Squaw Creek has one reportable accident during the year. Tractor Operator Walker pulled a muscle in his back on May 24 while picking up a push lawnmower and lifting it over a fence. There was no lost time. The remainder of the year went smoothly, with a large number of visitors using the refuge, two deer hunts, a record number of volunteer hours, and no more accidents.

In January, the entire staff was tested for Lymes Disease. Lehmer, Walker and Sprunger were given audiometric exams. A joint safety meeting was held with Missouri Department of Conservation on January 31. A total of five refuge staff and fifteen MDC employees attended the meeting on welding safety given by a local welding supplier.

Bell and McCarty had complete physical exams in February in preparation for law enforcement training. Lehmer, Walker, and Bell successfully passed the Step Test required for prescribed burning.

In April, the entire staff attended an American Red Cross community CPR training class in Maryville. All passed and were certified.

The station safety plan was reviewed in June by the entire staff as well as the two high school volunteers. A list of safety items to be amended to the plan was developed and will be added when the plan is revised. The Material Data Safety Sheets were also reviewed.

Three hours of refresher Defensive Driver's Training were completed during the year. This included films and discussion on safety checking of vehicles and winter driving. One heavy-equipment operation film was shown in October.

Other safety meeting topics included housekeeping in the office and shops and hypothermia. During the required hunter-orientation sessions for the muzzleloading deer hunts, attendees were given a brief talk about the symptoms of frost bite and hypothermia and ways to prevent and alleviate these potential problems.

Ten safety items were identified during the November Operations Inspection. These included items related to several buildings and the nature trail. Work has begun on correcting these deficiencies.

One major problem was found. The refuge quarters contained a small amount of asbestos. A contract will be awarded in early January 1992 for removal. The house will be tested for a variety of other items to ensure it is liveable.

There were no accidents reported by the more than 100,000 people who visited the Refuge in 1991. These mass visits included two special muzzleloading firearms deer hunts and the large crowds present during the annual Eagle Days event held in December when more than 5,000 people visited the Refuge in two days.

All Refuge bridges were inspected by Progressive Consulting Engineers, Inc., Minneapolis, July 9.

A safety evaluation of the south impounding dike was made in December by the Bridge/Dam Safety Office in Denver.

## 7. Technical Assistance

Refuge Manager Bell is a board member of the Midland Empire Audubon Society, St. Joseph, providing them advice and assistance. He has been a member since 1988.

Bell was elected Board Member-At-Large to the Missouri Chapter of the Wildlife Society at the end of the year and will begin his term in 1992. This tenure should offer Bell the opportunity to provide some technical assistance over the year.

Operations Specialists McCarty, Callow, and Sprunger were actively involved in the Farm Bill program throughout the year. This included reviewing FmHA properties for easement or wetland restoration potential and providing assistance on swampbuster and minimal-effect determinations.

The Refuge staff provided technical assistance to several area farmers with depredation problems and to Schuylkill for a similar problem with deer. Propane exploders were issued and advice given concerning proper use to achieve desired results.

As a result of the moist soil meeting at the refuge in June, the number of questions on moist soil farming and water management has increased and recommendations and advice given. Bell provided assistance to twelve members of the Soil Conservation Service Area IV Plant Material Committee on September 18 in moist soil management. He also met with twelve members of the Burroughs Audubon Society Conservation Committee on October 26 regarding water management and moist soil plantings.

Manager Bell provided technical assistance about wetland development to three Missouri Department of Natural Resource managers regarding a 300-acre wetland addition at Big Lake State Park.

#### 8. Other Items

Training, workshops, and meetings attended by refuge personnel during 1991 are summarized in Table 9.

Table 9. Refuge Staff Training 1991

Event	Date	Location	Staff
Fire in Resource Mgmt.	1/7-17	Marana, AZ	Bell
Pesticide Recertification	1/18	K.C., MO	Lehmer/Walker
MO Fish & Wildlife Conf.	2/4-8	L. Ozarks, MO	McCarty/Sprunger
Regional Conference	2/4-8	Mpls., MN	Bell/Zeliff
Regional Conference	2/4-8	Mpls., MN	McCarty/Srpunger
Law Enforcement Refresher	3/18-22	Camp Dodge, IA	Bell/McCarty
Maintenance Workshop	3/18-22	CRO NWR, IL	Lehmer
NEPA Training	4/9-11	Mpls., MN	McCarty
Refuge Manager Training	4/29-5/17	Blair, NE	Sprunger
Heavy Equip. Cert.	6/11-14	Squaw Creek	Lehmer/Walker
Fire Behavior S-390	7/1-3	Sutton, WVA	Bell
Project Leader Meeting	7/1-2	Jeff. City, MO	Sprunger
Intro. to Supervision	8/19-23	Mpls., MN	Sprunger
WAM JAM	9/23-26	Springfield, MO	Bell
Admin. Conference	11/4-8	Mpls., MN	Zeliff

Administrative Technician Shirley Zeliff filled in for WAM2 Secretary Mary Hedgers in the Regional Office on January 14-18. She also spent July 1-12 assisting WAM2 in the vacant secretary position.

Quarterly progress reports were submitted to the Regional Office during the year for Refuge Operations Specialist Trainee Sprunger. Bell and Sprunger traveled to the Regional Office June 24 for Sprunger's nine-month evaluation.

McCarty and Sprunger attended the Annual Missouri Farm Bill Coordination Meeting on January 23.

Jim Hazelman, Columbia ES, visited January 29-30, assisting with three minimal effect cases, an FmHA inventory property inspection, and discussions with a Gentry County landowner about wetland restoration. Hazelman, along with Bell and Sprunger, attempted to negotiate with a private landowner regarding wetland enhancement in Gentry County on May 29.

Bruce Barkley, MIA, DeSoto NWR, delivered supplies for interpretive sales March 29, July 31, and December 5.

Zeliff spent the week of April 1 at Seney NWR helping with administrative duties. She returned May 13-17 and June 24-28 to help their new administrative technician.

Manager Bell and Trainee Sprunger attended a Farm Bill meeting in Columbia April 6.

Bell assisted three Future Farmers of America students April 17 with their insect project.

Bell spoke with Missouri Department of Conservation Agents from Northwest Missouri at their regional meeting April 12 in St. Joseph about wetlands and the reporting of any suspected swampbuster violations.

On May 22, Brad Jacobs and Jim D. Wilson, Biologists with Missouri Department of Conservation, performed a preliminary nesting survey of Eagle Pool via the refuge airboat.

John Allen, Annada District, Mark Twain NWR, certified Maintenance Worker Lehmer and Tractor Operator Walker on the dragline. In addition, Walker was certified on the tractor and backhoe, saving the refuge a week-long trip to Minnesota Valley for training.

Sue McDermott, Regional Engineer and Clare Nelson, Financial Assistant, surveyed the Squaw Creek spillway June 12-13.

Bell met June 14 with Steve Norman, Missouri Highway Department, about the siltation and water-movement problems from Porter Creek affecting Highway 118 and the Refuge. A follow-up meeting was held July 10 with Wildlife Associate Manager Kerschbaum in attendance.

Squaw Creek received recognition from the Renew America campaign, entitled Searching For Success. This is a national campaign to identify, reward, and promote successful environmental programs. The Mallard Marsh restoration project was listed in the 1991 Environmental Success Index and the Refuge received an official Certificate of National Recognition June 4.

On June 27, Bell met with Nature Conservancy State Director G. Rodney Miller regarding the Bigelow Marsh and the Henry Munkres property. Munkres is a former Refuge employee and has indicated that he wishes the Refuge to have his property after his death.

Refuge Manager Tom Bell, Wapello District, Mark Twain NWR, and Laura Reid, Manager Trainee, visited the refuge June 27 as part of Reid's training.

Wildlife Associate Manager Kerschbaum completed his annual visit and inspection July 10.

Bell met with George Brakhage, Regional Ducks Unlimited Director and Joe Laukemper, Mound City DU Chapter President on August 23 to discuss specifics regarding the October 30 Mallard Marsh Dedication.

The Missouri Department of Conservation held hunter-safety classes at the Refuge headquarters August 22-23. Forty-five students attended.

Manager Bell assisted Regional Pilot Foster on September 5 with aerial infrared photos of the refuge.

Bell and Callow consulted with the Harrison County Commissioners on September 11 regarding a proposed bridge and road realignment project on an FmHA tract in that county.

The official dedication of the Mallard Marsh Restoration was held October 30. Approximately 60 people attended the event. Regional Director Gritman, as well as Diane Wilds, Matt Kerschbaum, and Bob Foster from the Regional Office were in attendance.

Manager Bell presented certificates to the Burroughs Audubon Society October 2 and Midland Empire Audubon Society October 8 at their monthly meetings. Both Societies were semi-finalists at the Washington level in the Take Pride in America program.

The Missouri Conservation Commission held their monthly meeting at the Refuge headquarters November 22. The Director, four commissioners, and approximately twenty people attended. Manager Bell gave the group a brief overview of the Refuge before the meeting.

An operations inspection was completed November 18-21 by the Regional Office. A total of seven team members were present during the week.

Bell met with Ginny Wallace, Missouri Department of Conservation, November 12, to finalize the upcoming Eagle Days cooperative program. Jim Rathert, MDC photographer spent three days getting pictures of deer.





MDC Photographer Jim Rather happened to be at the refuge on the day two bucks decided to lock antlers permanently. The one on the ground was dead. 11/91 J. Rathert

A news letter summarizing the highlights from the 1990 Annual Narrative Report was sent to both Federal and state congressional offices and refuge supporters. Congressional aides were also invited to visit the refuge.

Fifty-one Duck Stamps were sold at the headquarters in 1991 compared to 29 in 1990. Most stamps were purchased by non-hunters.

#### F. HABITAT MANAGEMENT

##### 1. General

Habitat conditions at the beginning of 1991 were fair. All pools were frozen and did not thaw until mid-February. Ice reached depths of 10 to 12 inches. Precipitation was below normal until March.

The waterfowl migration began early and very few snow geese used the area during the spring because of ice conditions. Most snow geese in the flyway were reported to be in the Rainwater Basin of Nebraska. However, habitat conditions were better for ducks as mid-March precipitation permitted all pools and moist soil units to reach maximum water levels.





The wetlands were in excellent condition in late spring.  
5/91 RLB

Spring drawdowns in several pools and moist soil units provided some excellent habitat for shorebirds in late April and May. Moist soil plant production was good, though below-normal precipitation in August and September prevented mid-summer irrigations, and plant-seed production appeared to be reduced.

Above normal precipitation in late October resulted in adequate water levels and excellent fall migration habitat. Unfortunately, record low temperatures froze up all pools and wetland areas the first week of November, just as large numbers of ducks and snow geese were beginning to arrive.

Even though most of the snow geese continued their southward migration, ducks remained in the area. As pools opened up later in the year, mallards took advantage of the excellent food and cover conditions. By the end of the year, refuge wetlands were in very good condition. The muskrat population was expanding, nearly doubling since 1990.

## 2. Wetlands

Squaw Creek contains approximately 2,850 acres of seasonally-flooded, shallow fresh-water marsh, most of which is managed for moist soil plant production. The refuge is located on the relatively-flat floodplain of the Missouri River. Water sources prior to 1989 were precipitation and gravity flow from Squaw Creek. However, the installation of the Davis Creek water control structure now permits gravity flow from Davis Creek, and a well and pump in Mallard Marsh now provide additional water from an aquifer.

Water from most of the 46,000 acre watershed on Squaw Creek and 15,000-acre watershed on Davis Creek comes from steeply sloped uplands. The predominant land use is agricultural row crops and, as a result, erosion rates are some of the highest in the nation. Stream flows are silt laden and water appears as chocolate milk.

The water management program is the most important method of attaining Refuge waterfowl and migratory bird objectives. The refuge currently contains twelve independently managed marshes in ten designated pools and fourteen independently managed lowlands in three designated moist soil units. The location of each pool and moist soil unit is marked in Figure 1. There are five creeks that enter the refuge and influence water management in varying degrees. The following is a summary of wetland conditions in 1991:

A. Pools

1. Mallard Marsh

The official dedication of the Mallard Marsh Restoration occurred on October 30. This was a culmination of approximately three years of construction and planning. In total, more than \$96,000 was expended on this project, which also included work on Pintail Pool, South Pintail Pool, Pelican Pool Moist Soil Unit, and Rice Paddies Moist Soil Unit.



Dr. J. Bruce McRae (center), a retired medical doctor, volunteered his time to engineer the entire monument. His helpers were Gary Andler (left) and Bane Drewes (right), all from Mound City.

10/91 RLB

Regional Director Gritman was one of three speakers at the ceremony which also included representatives from Ducks Unlimited and Missouri Department of Conservation. Approximately sixty people attended the event. At the close of the ceremony, a large monument with a plaque containing the names of the six Ducks Unlimited Life Sponsors who donated \$10,000 each was unveiled. A copy of the official invitation is included as Appendix 1.



The finished product after the dedication, all made from red rock, hand picked from the loess bluff farmland near the refuge.  
11/91 F. Cramer

a) North Unit--350 Acres

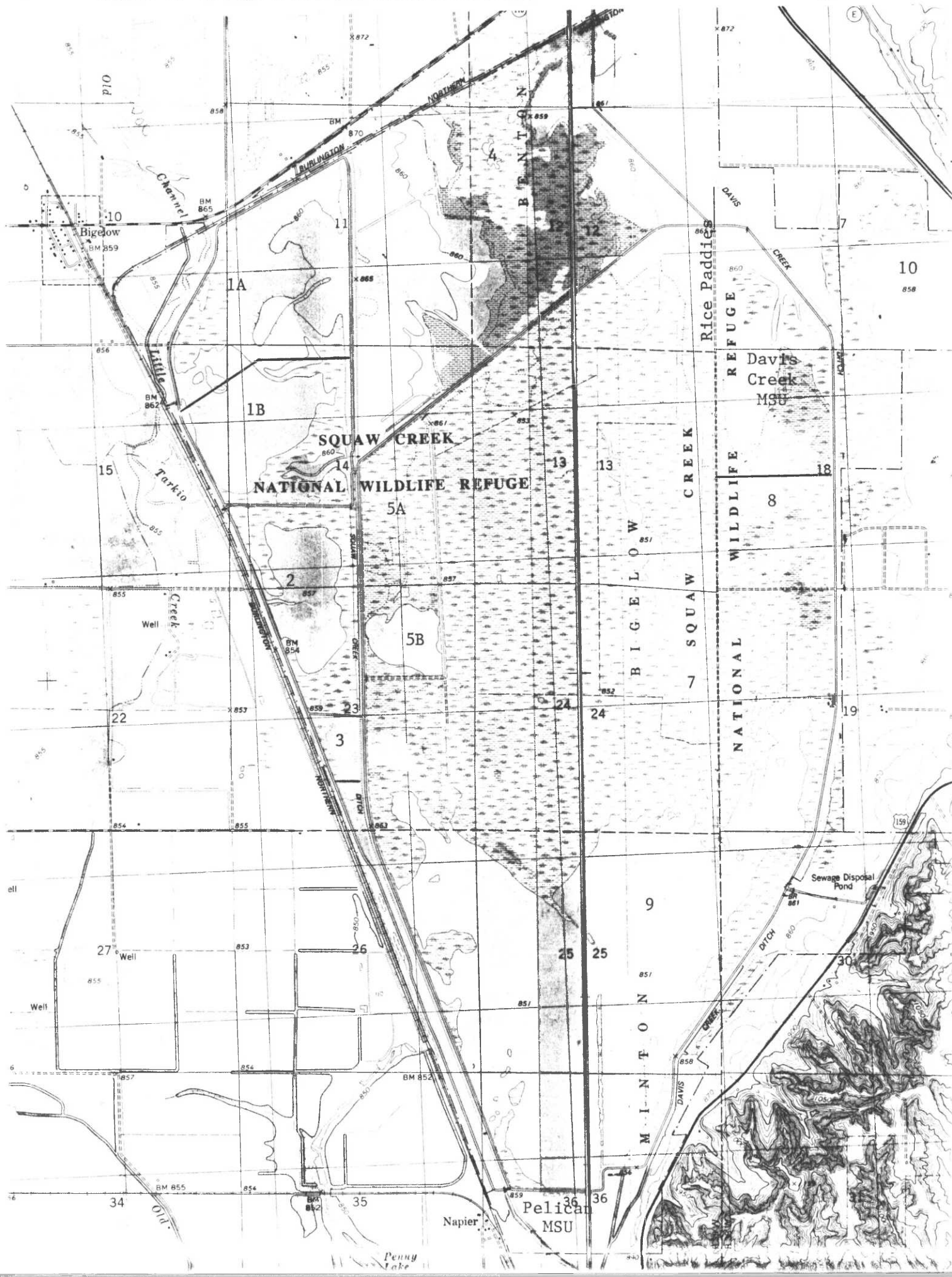
The proposed management for 1991 was to provide full pool for spring migration, to drawdown for moist soil plant production, to mow, burn and disc reed canarygrass, to shallow flood beginning in mid-September and to provide full pool for the fall migration and muskrats. All of these goals were accomplished.

The north unit of Mallard Marsh was frozen at the beginning of the year and had been since December 13, 1990. It was approximately one-half foot below the approved elevation of 865.0. The inlet on Squaw Creek had been open throughout the end of 1990. Once the inlet into Snow Goose Pool was closed on February 20, water began to enter south Mallard Marsh. By March 4, logs were pulled in the cross dike because south Mallard Marsh had filled, and water was then moved into the north unit. The north unit reached the approved elevation on March 18.



Figure 1. Refuge Pools and Moist Soil Units

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Additional rain and spring runoff increased the level to 856.4 on April 29 and 856.47 on May 6. Spring drawdown began May 28. Due to persistent damp weather through mid-June, the pool did not completely drawdown until the end of the month. The large block of reed canarygrass in the far north end was dry enough by July 26 to support a tractor and mower. About 65 acres were rotary mowed and later prescribe burned on August 1 in an attempt to reduce this large, solid stand of grass.

From August 27 to 29 approximately 45 acres of this same stand were plowed and disked. Pumping began on September 15. As water began to fill the north unit, waterfowl and shorebirds began to respond. Six weeks later the pump was turned off, as the pool level had reached 856.31. The north unit was in excellent condition for the fall migration and for the dedication.



A tractor and plow were rented to turn under this large block of reed canarygrass after it was mowed and burned. 8/91 RLB

Unfortunately a strong cold front swept into Northwest Missouri, dropping temperatures well below freezing, and the entire unit froze up by November 1. By the 13th, all water was ice free, but eleven days later another series of record low temperatures froze up all water areas again. This sequence was repeated one more time before the end of November. Needless to say, waterfowl and other bird use was limited, as large numbers of birds migrated south earlier than normal.



The potholes, built as part of the Mallard Marsh project, looked good in 1991. 7/91 RLB

The north unit was at the approved elevation of 856 at the close of the year. Three of the four potholes contained sufficient water to be useful during the migration. The large block of plowed reed canarygrass should provide some excellent habitat for the spring marsh-, shore-, and water-bird migration.

Waterfowl use in the spring was noticeable in the north end where the reed canarygrass has been mowed. This area was used by a large number of teal and shovelers. Teal were frequently seen in the potholes. Teal, mallard, and pintail utilized the flooded moist-soil plants early in the migration. Due to early freeze up, the north unit received very little use again until early December, when more than 500 mallards were seen feeding and loafing in the shallow water areas.

Bald eagles began to use the trees at the south end of the woodlands on a regular basis in December. Nineteen were counted on December 10.

The dominant vegetative species still continues to be reed canarygrass. However, the plowing and disking should make a difference in 1992. Moist soil plants are still plentiful. Cattail appears to have expanded somewhat.

b). South Unit--240 Acres

The proposed management for 1991 was to maintain water for the spring migration, to drawdown for shorebirds and moist soil plant production,



to shallow flood beginning in mid-September, and to full pool for the fall migration and muskrats. All objectives were accomplished, except for having full pool for the fall migration.

The south unit was completely dry at the beginning of the year. On February 20, the inlet into Snow Goose Pool was closed at Squaw Creek and water began to flow into the south unit. By March 18, the pool had reached the approved elevation just in time to receive waterfowl and other marsh and water bird use. In fact, the south unit received as much use by snow geese early in the migration as most of the other pools because it opened up early with the inflow of water from the ditch.

The level remained relatively stable through most of the spring, except for a minor decline in elevation in mid-April before precipitation increased the level to approved heights again. Drawdown began May 28. Above-normal precipitation in June kept soils damp and provided pockets of shallow water across the basin before the unit dried up in July.

Reed canarygrass was rotary mowed along the wetland fringes and in the southeast corner of the unit in late July. It was burned August 2 to remove litter and to open up these stands to improve bird use when flooded.

The roller gate on Squaw Creek was closed on September 4 and inlet into Mallard Marsh opened. By September 9 some water flowed into the wetland and the gauge reading was 856, approximately one foot below the approved level. However, due to the lack of adequate runoff into Squaw Creek, the pool level continued to decline, and the wetland basin contained damp soil only.

What water was available froze up November 1 and the pool received very little use by birds. A limited amount of inflow was received the remaining two months and the pool ended the year nearly eight tenths of a foot below the approved level.

Early flooding in February attracted a large flock of snow geese for several days. On the 11th, approximately 30,000 snows utilized the newly-flooded moist soil plants and open water. More than 2,000 mallards were also present.

Deeper water about one month later attracted a large variety of dabblers as well as some divers. Most notable were 60 redheads, 60 ringnecks, and several pairs of canvasbacks. Dabblers included mallard, pintail, green-winged and blue-winged teal, gadwall, wigeon and shoveler.

Fall use did not occur until early December when additional water was available for the first time, flooding moist soil plants yet to be utilized by birds since the end of the growing season.





The snow geese spent several days in the south unit of  
Mallard Marsh during early spring. 2/91 MCM

As for vegetation, reed canarygrass dominates the edges. Canarygrass mowed and burned the previous fall left a large bare area of soil on the south end that was utilized by a number of shorebirds in the early spring. Cattail and river bulrush appear to be slowly expanding.

Fourteen snow geese were picked up on November 19 that probably had died from avian cholera. This bacterial disease was identified from other birds picked up in the fall on the Refuge.

## 2. Pintail Pool--200 Acres

The proposed management for 1991 was to maintain full pool for the spring migration, to drawdown for moist soil plant production, to mow and burn, to shallow flood in the fall, and to full pool for the fall waterfowl migration and for muskrats. Most goals were accomplished except little or no water was available during the fall migration to flood the pool until after freeze-up.

The water level in Pintail Pool on January 1 was 855.06, approximately one foot below the approved elevation. Precipitation in late January and February, as well as inflow from Squaw Creek, gradually increased the level until March 4 when 856.15 was achieved. The pool became ice free February 20.

Pool levels remained relatively static during the spring, but above-normal precipitation in May raised the elevation to 856.5. Drawdown

was initiated May 28 and the pool was essentially dry by the end of June.

Reed canarygrass along the east side of the unit adjacent to Squaw Creek was burned August 2. Openings were rotary mowed the 29th in an attempt to encourage duck and goose use when flooded. Unfortunately, the last of early fall rain and precipitation did not permit flooding of Pintail Pool as planned. At freeze up, on November 1, the pool was still one foot below the approved elevation. Most of the water was restricted to the ditch and was only several inches deep in less than twenty acres of habitat.

However, adequate runoff from Squaw Creek the rest of November permitted the unit to reach the approved elevation on November 25. There was some goose and duck use between the freezing and thawing periods. On December 31 the pool was still at the 856 level.

Waterfowl use was rather limited, but there were a few highlights. On March 13, more than 400 dabblers were counted, including mallard, pintail, gadwall, and wood duck. Approximately 100 ringneck and several redhead were counted. About 100 mallards were counted November 21.

American bitterns were heard calling in the spring, but no nests were found. Eleven bald eagles were counted on December 2. They were feeding on a few dead snow geese scattered across the pool, probably victims of avian cholera.

There was no noticeable change in vegetation. Plowing and/or disking will probably be necessary to see any dramatic change in the future.

### 3. South Pintail Pool--25 Acres

This was the first year for the operation of this pool. It was not fully developed until the late fall of 1990. The proposed management objectives in 1991 for South Pintail Pool were to maintain full pool during the spring migration, to drawdown for moist soil plant production, to burn and mow openings in the cattail and river bulrush, to shallow flood in the early fall, and to maintain full pool for the fall migration and for muskrats. Due to the lack of adequate fall moisture, the full pool in the fall was not achieved.

South Pintail Pool began the year frozen up and about one foot below the approved elevation. The inlet screw gate had been left open since last fall so that the pool could fill as water was added to Pintail Pool. Water began to enter the marsh in late February, and by March 4, the approved elevation was achieved. The pool stayed slightly above the approved elevation of 855.5 until April 25, when a slow drawdown was begun to provide shorebird habitat.

By June 1, water in the unit was restricted to the ditch, and the entire basin was dry enough to support equipment by late July. The main basin of cattail and river bulrush was rotary mowed August 29 and was followed up with a prescribed burn September 6. When flooded

this provided some open habitat for birds to use. However, due to the lack of adequate runoff from Squaw Creek, the basin did not receive any moisture until mid-October. Only the ditch contained water before freeze up in late October.

The pool reached the approved elevation of 855.5 in November after some late runoff between winter storms. Unfortunately, it received limited bird use. The pool was at the approved level at the end of the year.

Waterfowl use in South Pintail Pool is combined with Pintail Pool. However, there was some limited use by shorebirds in the spring. Several pairs of ringnecks, mallards, and blue-winged teal were observed. Several bald eagles used the small woodland in the southeast corner.

The cattail and river bulrush stands appeared to be thinner than in 1990. More smartweed was present.

#### 4. North Pool--200 Acres

North Pool has long been abandoned as a manageable wetland, due to severe siltation problems. Much of the pool is now upland in character. There is no open water, and, when flooded, water depth is less than six inches. The former pool is a monotypic stand of cattail and river bulrush.

Since 1985, Porter Creek has been diverted into the refuge from private property north of the boundary. This silt-laden water moves into North Pool, eventually filtering through the wetland before ultimately reaching Long Slough.

Water from Porter Creek entered North Pool three times in 1991. On April 25, May 25, and June 22, water crossed over Highway 118 and under the bridges, gradually reaching what is remaining of North Pool. On July 10, Refuge Manager Bell and Wildlife Associate Manager Kerschbaum met with the State Highway Department to discuss Porter Creek problems and potential solutions. The Department was eventually issued a permit to clean within their right-of-way into the refuge to remove the accumulated silt. This continues to be the bandaid treatment for major surgery needed within the watershed. Hopefully, in the future, watershed improvement will occur.

#### 5. Snow Goose Pool

##### a) North--100 Acres

The proposed management objectives for the north unit of Snow Goose Pool were to provide full pool for the spring waterfowl migration, to drawdown in May for moist soil plant production and for shaping the east dike, and to provide full pool for the fall waterfowl migration and for muskrats. Essentially, all of these goals were accomplished.

The north unit was only one-tenth foot below the approved elevation of 856 beginning 1991. Due to a leak in the stoplogs and the washout of a control on the south unit, the pool was nearly drained in late January. Water was added in early March after the south unit was repaired, and the pool was at the approved elevation in time for the spring migration.

Pool levels were increased above the approved elevation to shallowly flood the far edges of the marsh. Drawdown did not begin until July. The east dike was leveled by August 13, while the spoils on the inlet ditch from Squaw Creek were shaped and smoothed on August 3.

Flooding began October 16. The pool was one foot below the approved level at the end of October before freezing up. The pool eventually reached the 856 elevation and was held nearly one-half foot above through the end of the year in anticipation of higher levels proposed for 1992.

Waterfowl use in the spring and fall was limited, but several hundred mallards were counted. As the water level was extended into the fringes, teal were often seen. Several bald eagles used the trees near the south dike.

b) South--100 Acres

The proposed management for the south unit of Snow Goose Pool was to maintain full pool for the spring waterfowl migration, to begin drawdown in mid-May for shorebirds, to complete drawdown June 15 for moist soil plant production, and to gradually flood for the fall migration. All objectives were achieved.

The south unit of Snow Goose Pool had been frozen since December 13 when it was at the approved elevation of 855.5. A slow leak around the west control developed in January, and by mid-February the pool level had lost more than a foot of water. The leak was repaired February 28.

The inlet on Squaw Creek was opened March 22 and the pool was refilled a week later. Full pool was maintained until April 25 when a gradual drawdown was initiated for shorebirds. The marsh contained less than six inches of water by May 10 and was ideal for the next few weeks for all the marsh, shore, and wading birds using the area.

The pool fringes of cattail and river bulrush were rotary mowed August 20 and were prescribe burned September 6. The main basin contained a good stand of moist soil plants. Fall flooding began October 16 and shallow water was maintained for early migrants. Unfortunately, below normal temperatures in late October caused the entire pool to freeze up November 2. The pool did receive some use later in the fall and early winter when open water was available. By the end of the year, the south unit was about three-tenths above the approved elevation.

Waterfowl use was excellent throughout the entire spring migration. More than 1,000 ducks were counted March 13. A scattering of divers were present April 22, including ringneck, ruddy, scaup, goldeneye, and bufflehead. Teal and shovelers took advantage of the shallow water during spring drawdown that was primarily for shorebirds.

Shorebird use was great from late April through May. Twenty thousand snow geese and 2,500 mallards were counted on November 1, just prior to freeze up. Twenty-three bald eagles were counted on the ice and sitting in the trees December 2, cleaning up snow goose carcasses.

The main basin was dominated by rice cutgrass and millet in 1991. The mowed and burned fringe should be excellent for shorebirds this spring before green up.

#### 6. Pelican Pool--600 Acres

The following was the proposed management objectives for Pelican Pool in 1991: maintain full pool to set back undesirable vegetation and to provide nesting habitat for marsh birds; partial drawdown to allow aquatic emergents to establish along the dike shoreline and to facilitate repair work; and full pool for the fall migration, particularly to encourage snow goose use. All of the objectives were accomplished, but the lack of adequate runoff from Squaw Creek did not permit flooding to full pool by the fall migration.

The proposed elevation for Pelican Pool was 852.5. The pool had frozen up on December 13, 1990 at the 851.6 level. At this level there were approximately ten inches of ice and 1.3 feet of water. The pool began to thaw in mid-February and was ice free on the 20th. Due to the shifting of ice and to strong winds during the winter, the stoplog riser on the outlet was damaged. It was removed April 15, repaired and installed the 22nd.

The proposed elevation was never achieved in the spring, due to the damage to the control. A maximum of 852.2 was reached May 28. The hot, dry summer, coupled with vegetative transpiration, gradually lowered the pool elevation to a low of 850.16 in late October. The water level dropped below the level of the bottom of the outlet, leaving a pool of about 300 acres less than one foot deep.

The combination of shallow water and below-normal temperatures at the end of October caused the pool to freeze up quickly. Habitat conditions had been excellent for ducks (primarily mallards) and the pool was beginning to get a great deal of use by snow geese. However, this came to an abrupt halt once the pool completely froze over.

Inlet from Squaw Creek was continued throughout the end of the year in an attempt to recharge the pool for the spring 1992 waterfowl migration. On December 31 the pool was at 851.54.





American lotus and arrowhead dominated Pelican Pool in the summer.  
7/91 RLB

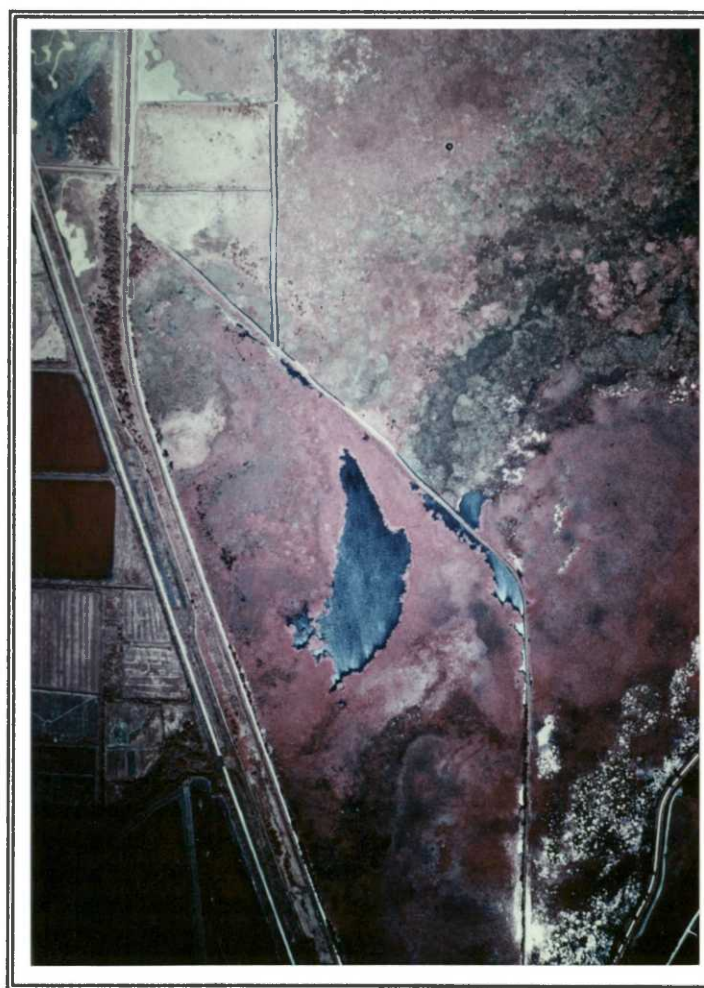


By early December, the muskrats had begun to work on the vegetation.  
12/91 RLB



The dike between Pelican and Eagle Pools received extensive damage, due to the unusual amount of ice and wind action during the winter. Repair work began in early October, using the refuge dragline. More than one mile had been repaired by the end of the year. About 300 yards of dike are left to repair.

Waterfowl use in the spring was outstanding from the standpoint of diversity. However, large concentrations were limited. A peak of only 7,500 snow geese were counted March 7. Most snow geese moved through the area briefly in the spring and were more concentrated in the Nebraska Rainwater Basin this year. Several large flocks of divers (more than 300) were counted in March and April. Most notable were 310 canvasback on March 7 and 300 scaup April 9. Mallard and shoveler were common late in the spring.



Mid-September infrared shows the large open-water area present in Pelican Pool throughout the year.

12/91 RLB

Use in the fall was impressive, but limited due to early freeze up. On the first of November, 130,000 snow geese were counted. About 4,500 mallards were counted the previous week. Approximately 23,000 mallards were concentrated in the open water December 5.

Bald eagles were common since most of the snow goose mortality from avian cholera occurred in this pool. Sixty adults and thirty-five immatures were counted December 2. More than 900 snow geese were picked up by the refuge staff in late November from Pelican Pool. They died from avian cholera.

A total of 452 muskrat houses were counted on November 26, nearly twice as many as 1990. American lotus continued to expand.

#### 7. Long Slough--60 Acres

The proposed management objectives for Long Slough in 1991 were to maintain full pool (2.00 gauge reading) for the spring migration, for aquatic invertebrates, for muskrats, and for marsh bird nesting; to partially drawdown for vegetative plant production; and to return to full pool in the fall for migration and muskrats. Most of these objectives were not achieved due to the lack of adequate inflow from Davis Creek and to dry weather conditions.

On January 1, the water level was below the gauge and the pool contained about 60 acres of water six to eight inches deep. This shallow water thawed out by February 18 after being completely frozen over since December 13, 1990.

Late winter and spring precipitation, as well as some limited inflow from Davis Creek, caused the pool level to increase to a high of 1.38 on May 28th. Evapotranspiration gradually reduced the water levels throughout the summer and into the fall. The elevation again dropped below the gauge in September and remained in that condition until late November. Water levels began to recover in December and the pool level increased to 0.67 feet by the 30th.

Dirt removed from the inlet ditch north and west of the Rice Paddies pump house was leveled and shaped in mid-August.

Large numbers of waterfowl did not use Long Slough during the year. Approximately 400 mallards were counted February 26. There was limited use in the fall due to low water levels and freeze up. Four bald eagles were counted November 13 and December 10.

Long Slough continues to be dominated by American lotus in the south end and arrowhead in the north.

#### 8. Cattail Pool--130 Acres

In 1991, the proposed management objectives for Cattail Pool were to maintain a maximum pool level (2.50 gauge reading) all year to set back undesirable vegetation, to promote muskrat use, to provide marsh bird nesting habitat, and to provide habitat for the fall migration.

The objectives were only partially achieved due to high evapotranspiration during the summer and lack of adequate fall runoff.

The gauge reading on Cattail Pool on January 1 was 0.88. At this level there is very little water within the pool basin, most of which is restricted to the ditch. Spring precipitation gradually increased the pool elevation and excess water from Unit 5 of the Davis creek MSU was moved into the pool. By April 20 the approved elevation had been reached.

Additional precipitation in May caused the pool level to increase another one-half foot. Some water was released in early June to return the pool to 2.50. This level gradually declined throughout the summer. On October 20, the water level had receded to 1.26. At the end of the year the pool had slowly increased to 2.04.

Cattail pool received good waterfowl use during the spring migration. About 250 birds were counted March 13, including a few ringnecks and bufflehead. The pool also received use during the fall, mainly by mallards.

Twenty-three muskrat houses were counted November 26, compared to none in 1990. There was no notable change in vegetative composition in 1991.

#### 9. Eagle Pool--900 Acres

The following were the management objectives for Eagle Pool in 1991: maintain full pool (852.0) all year to set back undesirable vegetation, to increase invertebrate insect production, to provide habitat for marsh nesting birds, and to provide fall migration habitat. These objectives were essentially achieved, even though the approved level did drop about one foot below the desired level.

Eagle Pool had been frozen over since December 13, 1990, approximately one-half foot below the approved elevation. In late January the pool was covered with about ten inches of ice and contained an average depth of 2.2 feet of water. The ice melted by February 19.

Spring and early summer precipitation permitted the water level to increase to 852.0 by April 19. Pool levels were allowed to exceed the proposed elevation in anticipation of the effects of summer evapotranspiration. By May 17, the pool elevation had approached one-half foot above normal and was spreading water north into the edge of the wet prairie.

By mid-June hot, dry weather conditions began to reduce the water levels at a rate of 0.1 foot per week. This continued into late October. On October 21st, the pool elevation had been reduced to 850.9, a 1.6 foot decline since June 3. Fortunately, the pool still contained water depths of about two feet and provided some habitat for early migrating snow geese and other waterfowl.



This is how visitors would like to see Eagle Pool all year.  
3/91 RLB



By summer, the question is: "Where is all the water?"; even though the pool level is the same as the in the above photo.  
7/91 RLB



Unfortunately, like all the other refuge pools, Eagle Pool froze up October 31, greatly reducing the use by waterfowl. Precipitation during the remainder of the fall and early winter caused the pool level to increase. On December 30, the pool elevation was 851.55.

During the spring, Eagle Pool received a lot of use by ducks but limited use from geese. About 150 white-fronted geese were counted February 19 and 200 Canada geese the 21st. The peak for snow geese was only 130 on March 18. Several thousand ducks used the north end during March and April.

In the fall most of the use was concentrated in the northeast corner north of the observation tower. This area received continual use by ducks, geese, and bald eagles. Approximately 35,000 snow geese and 12,000 mallards were counted November 14.

A peak of 67 bald eagles were counted December 6, including 18 adults and 49 immature.

A muskrat house count on November 26 found 1,115, compared to 565 in 1990.

There was a nesting effort by several marsh and water birds this year. Several black-crowned night herons nested again, while least bittern nests were present, but not in numbers like 1990. A common moorhen nest with eight eggs was found.



The upper end of Pelican Pool contained a lot of arrowhead and bladderwort. This area received much late fall waterfowl use.

6/91 RLB



The muskrat population nearly doubled since 1990.  
This photo was taken from the observation tower.

11/91 RLB

#### 10. Bluff Pool--200 Acres

The proposed water management objectives for Bluff Pool in 1991 were to maintain the maximum pool elevation (856.0) to flood out invading cottonwood and willow, to encourage muskrat use, to provide nesting habitat for marsh birds, and to encourage use by fall migrating waterfowl. The objectives were essentially achieved, but at a lower pool elevation.

Bluff Pool was at the 853.14 elevation on January 1. The pool basin had been frozen since December 13, 1990. The inlet on Davis Creek was open and a small amount of water was entering the pool. On January 31 the ice and water depth was measured in the main basin, due east from the east end of the main outlet ditch. Approximately 24 inches of water was covered by 12 inches of ice. The pool elevation was 853.64.

The pool level continued to rise from water from Davis Creek and Blair and Swope Creeks. By early March the pool level was at 854.35. However, a local landowner adjacent to the east side of Bluff Pool began complaining about water backing up on his property. The drainage on his fields traditionally enters Bluff Pool on the east from both Blair and Swope Creeks. At the present level his agricultural field was beginning to flood.



The water level was subsequently lowered to approximately 854.0 and an attempt was made to maintain this level, since this appears to be the maximum level for Bluff Pool at this time until this drainage situation can be corrected. This elevation is still a major improvement in Bluff Pool, since the inlet and outlet ditches have been cleaned and controls replaced.

Major runoff was received from Blair and Swope Creeks in 1991. This occurred three times: April 25-26, May 13-14, and June 22-23. There was a continual need to monitor the outlets as beaver tried to plug both controls throughout this period and during the summer.



Bluff Pool was extremely attractive to ducks and Canada geese in the fall. 9/91 RLB

The hot, dry weather conditions gradually lowered water levels during the summer. By October 9 the pool elevation was 852.19. It froze up at the end of October, just as the marsh was beginning to get use by waterfowl. By December 30 the pool elevation was 852.98.

Waterfowl use in Bluff Pool during the spring was excellent. The pool was used not only by dabblers, but also by a good number of diver species. Approximately 200 ringnecks were counted March 18 and 600 ducks April 1. Goose use was limited to Canadas. Mallard, teal, and wood ducks were common in the fall. About 1,100 birds were counted October 25. The November 26 muskrat-house count was 54, compared to 50 in 1990.

## B. Moist Soil Units

### 1. Rice Paddies--60 Acres

The Rice Paddies are a group of eight small moist soil units separated by low level dikes that were built in the early 1960's, managed for waterfowl in the mid-60's and early 70's, but abandoned in 1973. They are in juxtaposition to the Davis Creek moist soil units to the east. The original water source for flooding came from a well and pump at the north end.

In 1985, the units were disked to set back prairie cordgrass that had overtaken the units and some pumping was accomplished, but to no avail. This process was also attempted in 1987 with little result.

The management in 1989 and 1990 was an attempt to control prairie cordgrass by disking the units and seeding to winter wheat. This resulted in a reduction of cordgrass, but due to the lack of adequate water management, the winter wheat flooded out and the units stayed too wet to do any further farming.

The management objective in 1991 was to rehabilitate the ditch and dike system and to replace all of the culverts with new tubes and stoplog risers. A preliminary plan was submitted to the National Fish and Wildlife Foundation to get approval to use the remaining money left from the Foundation's Challenge Grant. This was approved early in the year, and there was enough money to clean ditches, rebuild dikes, and purchase all of the metal pipe.

Lyle Derr Construction was awarded the bid to complete the dirt work. Work began April 9 and was completed the 23rd. The inlet and water distribution ditches were cleaned with a track excavator and tied into the outlets (cleaned in 1990). A 36-inch culvert with screw gate was installed in the ditch north of the pump house, and a 24-inch culvert with screw gate was placed under the auto tour route into the newly-cleaned ditch at the north end. Water can now be moved from Davis Creek into the Rice Paddies by gravity flow rather than having to use the old well and pump. Total cost of this work was \$4,182.

Culverts were purchased from J&J Metals, Paola, Kansas, for \$1,806. Unfortunately, there was not enough money to purchase the riser structures to complete the project. Thanks to salary savings, the riser structures were ordered at the end of the fiscal year at a cost of \$3,984 from Grabel Metal Works, St. Joseph. As part of the equipment rental project, the newly rebuilt dikes were leveled and shaped in August.

### 2. Davis Creek

The Davis Creek moist soil units total approximately 250 acres in five units. They are located adjacent to the Rice Paddies on the west and Davis Creek on the east. Prior to development, they comprised three crop fields, a damp savannah field of reed canarygrass and willow, and a lowland softwood forest. Development

was completed in June 1989 with the construction of the Davis Creek water control structure.

a) Unit 1--35 Acres

The proposed management for Unit 1 was to maintain maximum water levels for the spring waterfowl migration, to gradually drawdown for shorebirds and moist soil plant production, to periodically flood to keep soil conditions moist, and to gradually flood in the fall. Due to intermittent runoff during key times in the year, not all of the objectives were accomplished as planned, but the unit was still used by waterfowl and shorebirds.

Unit 1 was dry at the beginning of the year and did not receive any water from Davis Creek until March 25. Water levels were gradually increased over the next three weeks to coincide with movement of waterfowl and gradually lowered for shorebirds through mid-May. The unit was dry by late June.



Waterfowl had cleaned up most of the moist soil vegetation by late spring. 4/91 RLB

The lack of runoff from Davis Creek prevented summer irrigations and fall flooding until October 29. The water levels were eventually restored near the end of the year.

The north end of the west dike was raised approximately one foot in August via a crawler tractor from the equipment rental contract. Dirt from the inlet ditch cleanout in 1990 was also shaped under the same contract.

Waterfowl use was good in the spring. Unit 1 was used primarily by teal. There was some shorebird use in mid-May. There appeared to be an increase in cocklebur, but most of the unit was dominated by millet and smartweed. Reed canarygrass is present in the woodlands to the south.

b) Unit 2--25 Acres

The management objective for Unit 2 was the same as Unit 1. Accomplishments were similar. The unit was dry on January 1 and did not receive any water from Unit 1 until March 25. The water levels were gradually increased until April 15, held at that level until April 30 before a slow drawdown began to attract shorebirds. The unit was dry by early June.

A large number of cottonwood seedlings have invaded during the past two years. They were rotary mowed in mid-August. The west dike was raised about one foot to prevent water from crossing the road and to give Unit 2 better water management capabilities. No water was available to flood during the fall migration. However, the entire unit was flooded the last ten days of the month and provided some excellent habitat for mallards.

Unit 2 received a lot of use during the spring migration by teal, mallards, and pintail. Some birds were still present in mid-April. Fall use was also good, but not until early December when water was available to flood.

c) Unit 3--60 Acres

The management objectives for Unit 3 were identical to those for Units 1 and 2. Accomplishments were the same. Unit 3 was dry at the beginning of the year. Water from Davis Creek was moved into the unit March 22 and maximum flooding was achieved April 15. In an attempt to flood out cottonwood seedlings established in 1990, high water levels were maintained to mid-June before water was released. Those that survived were also rotary mowed in mid-August.

The south impounding dike was raised about one foot by a crawler tractor via the equipment rental contract to increase the height of the dike and to permit better water management capabilities.

Fall flooding was not possible until November 15 when water began to enter Unit 3. By December 30 the entire unit had been inundated.

Unit 3 received excellent use by waterfowl throughout the spring. Wood ducks were commonly seen in the flooded timber in the southeast corner. During the fall, use was limited to November. However, approximately 10,000 mallards were counted November 21.

d) Unit 4--50 Acres

The management objectives for Unit 4 in 1991 were to provide maximum water depths in the timber for the spring and fall waterfowl



migration. The spring objectives were met, but the lack of fall runoff prevented flooding the unit until early November.

Unit 4 was dry until water was successfully moved into the unit March 14. This was the first opportunity to move water into Unit 4 since the inlet ditch was cleaned and control installed in 1990.

The maximum water level was achieved March 27 and held at that elevation until April 5. Water began to move back into the inlet ditch through the inlet control and Unit 4 began to lose water. The control was removed and had to be replaced when two large holes were found in the side of the tube, probably punched in when originally installed.

By mid-July all the water had evaporated. Water was not available from Davis Creek until late October. By the end of December, Unit 4 contained enough water to flood a small portion of the woodland.

During the spring, water in the flooded timber attracted about 20 to 30 pairs of ducks, including mallards, wood ducks, and teal. There was no fall use, due to the lack of water. No change in vegetation is noted.

e) Unit 5--80 Acres

The 1991 management objectives for Unit 5 were to provide water for the spring waterfowl migration, to attempt to flood out the reed canarygrass in the south half and to provide habitat for the fall waterfowl migration. The spring and fall objectives were achieved and excellent progress was made in reducing the canarygrass.

Unit 5 was dry on January 1. Water was moved from Davis Creek on February 12. Water levels were gradually increased until March 27 when some water was allowed to flow into Cattail Pool. The maximum level was reached April 16 and held until June 14. The pool never completely dried out.

The reed canarygrass showed definite signs of stress. Most of the plant was eliminated in the northeast corner within the timber and it was extremely thin along the south end. Some smartweed was visible, but very little vegetation grew within the shaded areas. Reflooding of the unit began in mid-October reaching the maximum level December 17.



The reed canarygrass was getting very thin since last year.  
3/91 RLB

Of all the Davis Creek moist soil units, Unit 5 received the most use for the longest period of time in both the spring and the fall. There were even several wood duck broods seen in the flooded timber, suggesting possible natural cavity nesting.

Most notable spring observations were the large numbers of shovelers and mallards (200+) using the flooded timber and shallow water in the northeast corner. Approximately fifty ringnecks were also counted. In the fall several hundred mallards frequented the unit when the ice was thawed.

### 3. Pelican Pool--40 Acres

This year (1991) was the first full year of operation of the Pelican Pool moist soil unit. Water for this unit comes from Pelican Pool through a 24-inch culvert under the south end of the auto tour route. The maximum elevation within this moist soil unit is approximately 853.0. At this level about 25 acres can be flooded, including the lowland brush east of the inlet ditch.

The management objectives for the Pelican Pool moist soil unit in 1991 were to provide flooded moist soil habitat for the spring waterfowl migration, to drawdown beginning in mid-May for shorebirds, to mow or disk undesirable vegetation during the summer, and to gradually flood in the fall for the waterfowl migration. The spring and summer objectives were achieved, but due to the lack of adequate runoff into Pelican Pool, little water was available to fall flood.



At the beginning of the year the ditches were full but very little water was spread out into the unit. The inlet screw gate was left open, and as water began to rise in Pelican Pool, the water levels in the moist soil unit increased. By May 1, the unit reached 852.86, close to the maximum spread of water. Water was gradually released into Davis Creek and the pool was in excellent condition for shorebirds by the middle of the month. Drawdown was completed in early June.



This is a view of the Pelican Pool Moist Soil Unit from the northwest corner looking southeast. This retired cropland had never been flooded. 3/91 RLB

Beaver were a continual problem at the outlet as well as at the cross-dike tube. Water levels began to slowly increase in early December. The unit ended the year at 852.34, which provided water for about ten acres.

Pelican Pool moist soil unit was used by a variety of marsh and water birds throughout the spring, but, due to the lack of water, was not used in the fall. More than two hundred ducks were counted March 5, including mallard, teal, gadwall, wigeon and wood duck. Approximately 250 Franklin's gulls were seen on the unit May 2.

#### C. Creeks

##### 1. Squaw Creek

The roller gate had been down since August 13, 1990, in an attempt to take any available runoff. In early February some water began to

move into Snow Goose Pool and February 4 and 5 some water actually spilled over the gate. Snow Goose Pool inlet was closed February 20 to force water into Mallard Marsh.

Moisture in early March resulted in a surge of water that spilled over the gate for several days in the middle of the month. The Mallard Marsh inlet was closed March 25th. The pool had been filled and water again diverted into Snow Goose Pool.

By April 15 the roller gate was raised, since all wetland basins recharged from Squaw Creek had reached maximum. The gate had been closed for 245 consecutive days.

Once the gate was raised, a sea-level gauge was attached to the east wing wall. This now improves our ability to determine the rise and fall of the ditch during periods of drought and/or runoff.

Severe thunderstorms May 24-25 caused the creek to overtop the auto tour route, causing erosion north of the control. Some water spilled into both Snow Goose Pool and Mallard Marsh. This also occurred June 22 and 23 when more than four inches of rain fell within the Squaw Creek watershed. Again water overtopped both sides of the creek north as well as south of the control, dumping silt laden water into Mallard Marsh, Snow Goose, and Pintail Pools.

The worst storm of the year developed less than three weeks later. Heavy rain (on already saturated soils) caused the creek to overtop the auto tour route for more than one mile south of the control and sent water into Mallard Marsh, Pintail, South Pintail, and North and South Snow Goose Pools. This continued for about four days, resulting in a severe erosion problem east of the east abutment of the roller gate. The auto tour route had to be closed temporarily. Repairs were completed July 16.

The roller gate was closed September 4 to begin fall flooding of Mallard Marsh and Pintail Pool. Very little water was available. Water was moved into Snow Goose Pool October 16. Late October moisture increased the water level in the ditch to the top of the control briefly November 1. This also happened November 30. The water level in the ditch remained constant in December and permitted a steady flow into Snow Goose and Pelican Pools. The roller gate was down, impounding water for 223 days in 1991.

Bids were solicited for a rock spillway. A total of \$42,000 was available for this project via the Maintenance Management System. However, only one bid was received and it was \$20,000 more than the engineering estimate. Therefore, the money was redistributed by the Regional Office. The Maintenance Action Team is scheduled to complete this project in 1992 for \$30,000.



A large volume of trash and debris collected around the water control structure after the late June flood. A dragline had to be used to clean up. 6/91 RLB



The ground under the dragline nearly washed away in the July storm. 7/91 RLB

## 2. Davis Creek

The bottom of the outlet on the radial gate is 854.0 while the crest of the spillway, as well as the top of the control, is 860.0. The radial gate had been down since August 20, 1990. The inlet into Bluff Pool was open at the beginning of the year to take all available water into this pool.

The Bluff Pool inlet was closed March 4. As the water levels began to rise in the ditch later that month, water was diverted into the Davis Creek moist soil units. Water moved across the spillway briefly on several occasions in late March and the middle of April. By April 19, the control was raised, since all pools and the moist soil units were completely flooded.

Water overtopped the spillway on eight occasions during the next four months as localized heavy rains brought in large volumes of water in short periods of time. This occurred April 26 and 27, May 4, 5, 13 and 16, June 22 and 23, and July 8. The most severe storm occurred in June when water overtopped Davis creek and spilled into Bluff Pool in several spots south of the control and into the Davis Creek moist soil units 1 and 4. Physical damage was minimal.

The radial gate was lowered August 23 in an attempt to irrigate the moist soil units, but a lack of adequate runoff prevented any water movement until September 9, and even this was futile. In late October, sufficient runoff in Davis Creek permitted water movement into the units.

Water briefly overtopped the spillway on three dates during the fall. By the end of the year the Davis Creek moist soil units were nearly filled. The control was closed at the end of the year and had been down for 239 days in 1991.

The dirt piles south and east of the observation tower were leveled and shaped via an equipment rental contract. The dirt had been left over from the last cleanout of Davis Creek in the early 1980's.

## 3. Porter Creek

Water overtopped Highway 118 on six occasions during 1991 causing headaches for the State Highway Department as well as adding silt to an already silted-in North Pool. This occurred on April 25 and 26, May 13 and 25, and June 22 and 23.

Refuge Manager Bell and Wildlife Associate Manager Kerschbaum met with the Highway Department July 10 at their Mound City office to discuss alternatives and solutions to the problem. The 1983 Environmental Assessment was discussed and it appears, for the present, that there are no quick solutions. The problem has to be resolved in the watershed.



A Special Use Permit was issued to the Highway Department to clean silt under both bridges and within their legal right-of-way in the refuge.

4. Swope/Blair Creek

Water from both creeks flowed into Bluff Pool and Davis Creek during six days in 1991. This included April 25 and 26, May 13 and 14, and June 22 and 23. Due to this flow, water had to be released from Bluff Pool continuously during these time periods.

5. Little Tarkio Creek

The Missouri State Highway Department proposed to replace both bridges across the Little Tarkio Creek this year. Both bridges were to be moved north of the present bridges. No work was done in 1991 and they have been considering large culverts instead of bridges.

D. Farm Bill Properties/Easements

At the end of 1991, the refuge had a total of 45 easements; 28 had been recorded and 17 are proposed. There were four fee title requests. The 28 easements included 1,386 acres; the 17 proposed easements contained 744 acres; and the fee title totaled 822 for a grand total of 2,952 acres within the Farm Bill Program. There are nine potential wetland development projects.



Trainee Sprunger inspecting the main basin of the Kier Property.  
7/91 RLB

The most significant restoration to date has been the Kier property, Andrew County. Under a caretaker agreement in 1989, two wetland basins were restored. However, this property, like the other three fee title proposals, is still pending and we have been instructed not to do any further work at this time. An inspection of the property was completed July 25, 1991. All culverts, water controls, and dikes were still intact and the wetland basin was in excellent condition. It appeared to have held water during the spring and to have contained a large mudflat while the ditch still held water.

There was no other water management progress to report.

#### 4. Croplands

Squaw Creek continues to encounter problems meeting its objectives through cooperative farming. The problem is not the farmers, but rather the wildlife. Deer's depredation of crops renders the crops of little value to waterfowl. After overhauling the farm program in recent years toward better rotations, we find ourselves back at square one.

Four cooperators planted approximately 569 acres in 1990. Cooperators are on a three-year contract with various expiration dates. Agreements are for a one-third/two-third share for corn with the Refuge's one-third left standing; one hundred percent of winter wheat to cooperator with the Refuge getting goose browse and clover overseeded into the crop; and one hundred percent of soybeans to cooperator. Cooperators furnish all labor and materials. Herbicide and fertilizer applications are limited to a preapproved listing. The refuge incurs only administrative costs for the program.

Soybeans are the hardest hit by deer. Cooperator Tenney estimated a 7-10 bushel yield with most plants being grazed to 2-3 inches above the ground. Cooperator Whipple left standing 34 acres of soybeans, considering it uneconomical to even run the combine over them. Cooperator Loucks was allowed to harvest one hundred percent of his corn crop in exchange for musk thistle control on adjacent refuge lands. Even at that, he left about fifteen acres standing, as deer had cleaned a portion of the field. Winter wheat is the least susceptible to deer depredation.

As prescribed by the 1991 operations inspection, Squaw Creek's cooperative farming will be reevaluated and a reduction of acreage made. Cooperator Derr's contract is up and his 75-acre allotment will be seeded to grass in 1992, leaving 494 acres scheduled for cropping in the coming year. A quick review shows that most of the small boundary line fields have been withdrawn from production.

#### Recent Cropland Acreage of Squaw Creek

<u>Year</u>	<u>Farm Acreage</u>
1992	494 (planned)
1991	569
1990	584
1989	640
1988	789
1982	800
1979	827



Our cooperative farming program reevaluation will need to consider: Refuge objectives weighed against crop depredation of adjoining private landowners, diversity of refuge habitat, success of deer herd reduction efforts, and needs of the refuge to utilize equipment not owned by the refuge but available from cooperators for other habitat development.

Table 10. Cooperative Farming Program 1991, Squaw Creek NWR

Cooperator	Unit	Field	Crop	Acres	Fertilizer	Herbicide
Derr	D1		Corn	75	195 lb/A Nitrogen	Dual* Beacon*
Loucks	L1	A	Soybeans	68		Pursuit
		B	Wheat	71.6	70 lb/A Nitrogen	
	L2	A&B	Corn	78	150 lb/A Nitrogen	Eradicane and 2-4,D
Tenney	T1	A	Wheat	49	80 lb/A Nitrogen	
		B	Soybeans	44		Pursuit
	T2		Soybeans	30		Pursuit
	T3		Wheat	24	80 lb/A Nitrogen	
	T4		Soybeans	22		Pursuit
Whipple	W1	A	Corn	32	N/A	
		B	Soybeans	32	N/A	
		C	Soybeans	34		Pursuit

\*Not approved--actions pending.



The combine could hardly get low enough to harvest beans after the deer had browsed the plants during the year.

10/91 JMC

##### 5. Grasslands

Retired and abandoned croplands continued to be planted to a mixture of warm-season native grass in 1991 in accordance with the 1988 Operations Inspection. A total of 63 acres was planted in six separate fields in early June to switchgrass, big bluestem, Indiangrass, little bluestem, sideoats grama, and Illinois bundleflower. These areas were mowed twice during the year to control weeds.

Firebreaks were created around two fields planted in 1989 and will be prescribe burned in 1992. Three additional areas were prepared during the fall for spring planting in 1992.

##### 9. Fire Management

Approximately 1,250 acres in five units were proposed for prescribe burning in 1991. Wet weather conditions prevented spring burns. However, 321 acres were burned from August 1 to September 6 in three of the units. A summary of accomplishments is found in Table 11.

Table 11. 1991 Prescribe Burns, Squaw Creek NWR

Unit	Name	Date	Acres Burned	Cost/Acre
2	Mallard Marsh (N)	8/1	85	\$2.06
2	Mallard Marsh (S)	8/2	48	3.96
3	Pintail Pool	8/2	52	1.73
2	Mallard Marsh (S)	8/28	24	1.67
5	Snow Goose	9/6	35	2.14
3	Pintail Pool (S)	9/6	9	5.00
3	Pintail Pool	9/6	68	1.13
	TOTAL		321	\$2.53



The reed canarygrass along the east side was prescribe burned August 2. The air temperature was 100 degrees that day.

8/91 RLB

Summer burns have been fairly successful at Squaw Creek the past few years, particularly with a combination of mowing and high temperatures. Approximately 65 acres of reed canarygrass were rotary mowed in the north end of Mallard Marsh in late July. After three days of temperatures in the high 90's and low 100's, the mowed vegetation cured rapidly. The



vegetation was mowed and burned to facilitate plowing and disking this area to set back canarygrass which has completely dominated this portion of the marsh the past twenty years.

Since burning was so successful on August 1, two additional burns in reed canarygrass in the south unit of Mallard Marsh and Pintail Pool were done the following day without the benefit of being previously mowed and both fires were extremely successful. Air temperature on August 2 was 102 degrees.

Reed canarygrass on the wetland fringes in the south unit of Mallard Marsh was mowed in mid-August and burned August 28. These were areas that also had been mowed and burned in 1990 and had received a lot of use by shorebirds this spring. Hopefully, this use will be duplicated in 1992.

As Pintail and South Pintail Pools dried out from the extended summer drought, openings were mowed in the extensive stands of river bulrush and cattail to provide landing and loafing areas for the fall waterfowl migration. These areas were burned September 6.



Openings in Pintail Pool were mowed in August.  
This infrared was taken September 5. 12/91 RLB

The fringe of river bulrush and cattail around the moist soil plants in Snow Goose Pool was mowed and also burned September 6. All of these areas received limited fall use due to early freeze up, but birds were beginning to discover them in late December. Snow Goose Pool should be in excellent condition for the spring shorebird migration, as well as the plowed flooded ground in Mallard Marsh.

There were no wildfires in 1991, though smoke was commonly seen west of the Refuge on private hunting clubs after the close of the duck season. Four staff members have completed basic fire management training and passed the step test. The Refuge has the following equipment available for prescribed burns and wildfire suppression: one tractor; one small crawler tractor; two disks; one trailer mounted 300 gallon tank; and one new 4x4 one-ton truck. There are enough portable radios for each staff member.

As a result of the November Operations Inspection, the Refuge will amend the present fire management plan. The Regional Fire Management Coordinator will pursue a Cooperative Fire Agreement between the Service and Missouri Department of Conservation. The refuge will pursue establishment of cooperative agreements with the local rural fire departments that would be expected to respond to a structural/wildland fire on the Refuge.

#### 10. Pest Control

Squaw Creek has two major pest problems: musk thistle and marijuana. In 1988 and 1990, musk thistle weevils were released on the Refuge in cooperation with the Missouri Agricultural Extension Service as a form of Integrated Pest Management. Though it may be several years before there are any changes, we still have not seen any major reduction in musk thistle. It seems as if every new area that is disturbed grows up in thistle.

To combat this problem the Refuge continued spraying thistle (in areas far removed from weevil release sites) with 2,4D and Banvel. This combination also has been working well for the control of marijuana.

The year 1991 was an unusual year for the growth of marijuana, since conditions in the southern part of the country were considered poor while wild plants thrived everywhere in Northwest Missouri. A record number of drug cases were logged in Holt County. Hopefully, our control efforts are paying off, since no harvesting was found on the refuge.

Because Holt County has the dubious honor of being the marijuana capital of Missouri, and wild plants seem to thrive on the refuge, \$6,500 was allocated in 1221 funds to combat and control this pest. Chemical, spraying equipment, and mower blades were just a few of the items purchased in FY 1991. Additional money was allocated in FY 1992.

#### 14. FmHA

The Squaw Creek Management District takes in a twenty-one county area in Northwest Missouri. Twelve of the counties have recorded Conservation Easements or requests for easement or fee title. Currently 1,390.9 easement acres are recorded on Quit Claim Deeds with an additional 1,734.1



acres requested in fee title or easement. Due to the low density of existing wetlands and limited potential for wetland restoration/creation, over ninety percent of lands are riparian corridors and associated flood plains having hydric soils.

The year was one of transition for easement development. Assistant Manager McCarty transferred in late April and Trainee Sprunger was saddled with the busy summertime activities. Assistant Manager Callow assumed those duties the first of September.

Management emphasis continues to be on establishment of habitat on former cropland, posting, and identifying wetland development. Two additional special use permits were issued for farming croplands to attain weed control and seedbed preparation. Most of these lands had laid idle for two to five years and have horrendous weed problems. Forestry Management plans were completed on two tracts by Missouri Department of Conservation foresters.

As stated in Section C.4, the footing on tracts in caretaker status (those with requests for fee title or easements) was precarious. In 1990, one hundred acres of fee title request was seeded to warm season native grasses. During routine inspection the area turned up as a soybean field in 1991. Upon investigation county FmHA officials, under state guidance, had rented the crop acres, claiming we had no legal jurisdiction of the area at this point. When pushed, we found the standing of our caretaker agreements was not as solid as thought and had little recourse but to accept it as lessons learned. Although possible actions continue, it hurt to see expensive native grass seed turned into crop fertilizer.



Harrison County stretched their imagination when they said they wanted to clear for a fence line. 9/91 JMC



This was all of the native grass that remained after being turned under, thanks to FmHA. This is the Murphy tract.

9/91 JMC

#### 15. Private Lands

Squaw Creek had been interested in developing a program of leasing acre feet of water on private lands in the vicinity around the Refuge, fashioned after the success at Mingo NWR. However, the proposed program at Squaw Creek would pay an individual for maintaining water from February 1 to April 1 to provide additional habitat in the area for spring migrating waterfowl, and for marsh, shore, and water birds. This would also present the opportunity for some of these areas to grow moist soil plants.

On June 18, Charles Shaiffer, Biologist from Mingo NWR, gave a talk about the Mingo program. He included information on the nutritional needs of waterfowl during the migration period, what managers can do to meet the needs of waterfowl during the migration, and what private land managers and the Fish and Wildlife Service managers can do in a partnership for waterfowl management around the Refuge and Northwest Missouri.

A total of 25 landowners responded to the nearly 100 letters that were sent. There were about twelve individual hunting club owners and managers that expressed interest. They filled out detailed information about the size and cost of their operations and gave an estimate of how much they would need per acre to be interested in participating.

A pilot project proposal was submitted to the Regional Office which included four areas totaling 115 acres at a cost of \$15/acre foot of water six to twelve inches deep from February 1 to April 1. It was not approved



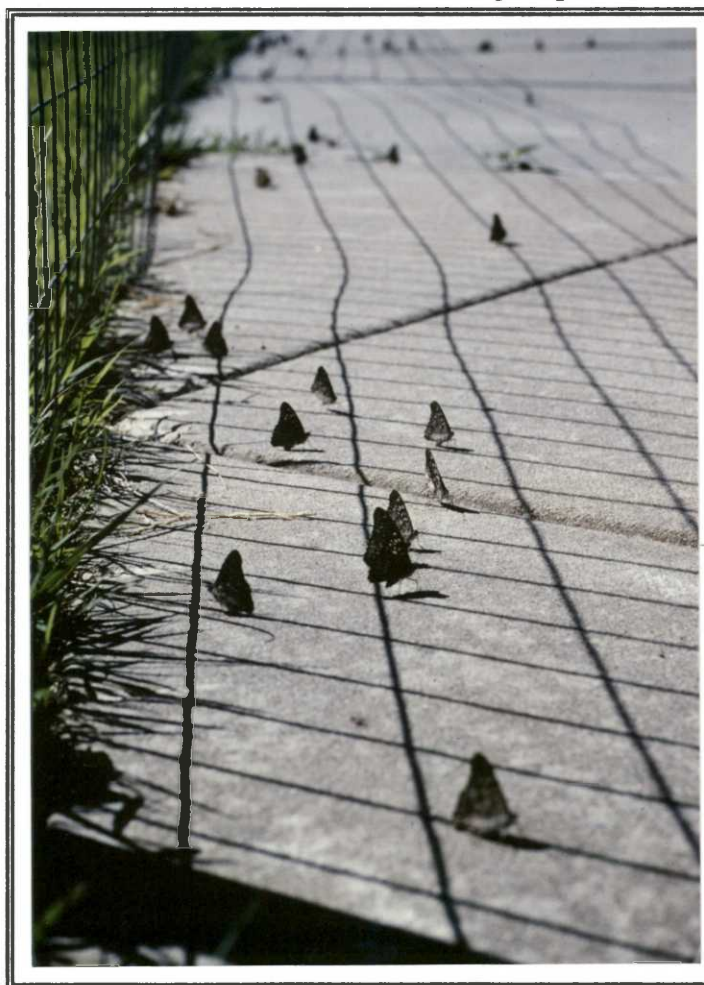
at this time due to the questioning of paying private landowners to maintain areas on a temporary basis. However, it has the promise of providing early migration habitat on areas normally dry and being cultivated during this time of year.

#### G. WILDLIFE

##### 1. Wildlife Diversity

Squaw Creek has a diversity of habitats with the 7,178 acre boundary and a correspondingly diverse wildlife community. Included are 321 bird species, 34 mammals, and 36 reptiles and amphibians known to reside in, or to have utilized refuge habitats. A full inventory of plant species has never been undertaken.

Management of habitats is directed toward achieving the primary refuge objectives as outlined in the Master Plan, the Refuge Management Plan and the report from the Western Energy and Land Use Team. There has been an increasing effort to provide shorebird habitat at Squaw Creek the past few years due to the continental concern for this group of birds.



An unusually large hatch of hackberry butterflies mobbed the headquarters in June. 6/91 RLB

Table 12. Spring Migration 1991, Squaw Creek NWR

Species	February	March	April	May	Spring Use Days
<u>GEESE</u>					
Snow	30,000	7,500	150	1	317,667
White-fronted	250	455	150	176	10,315
Canada	280	250	14		4,914
<u>DUCKS--Dabblers</u>					
Mallard	4,620	2,520	710	71	101,810
Gadwall	28	196	380	73	10,134
Wigeon	20	60	120	41	3,350
Green-winged Teal		485	160	7	8,062
Blue-winged Teal	60	1,245	2,180	950	84,032
Shoveler		470	1,325	425	39,822
Pintail	250	940	180		13,120
Wood Duck		450	205	45	8,705
<u>Divers</u>					
Common Merganser	940	525	80		14,722
Hooded Merganser	25	25	22	6	590
Redhead		205		3	2,455
Canvasback		300	20		3,202
Scaup		350	360	24	9,006
Ring-necked	190	900	425	32	20,754
Goldeneye	32	65	10		1,412
Bufflehead		4	75	1	2,074
Ruddy Duck		40	90		1,804

Fall Migration

With habitat and water conditions the best in several fall seasons, a great migration period was anticipated. But the great uncontrollable variable, weather, came to rain on our parade. Birds were starting to pile up in good numbers by late October. Then, the night before waterfowl hunting opener (November 1), a massive cold front moved through and the marshes were completely frozen in a few days. A warm spell opened them up by mid-

There were several significant occurrences of wildlife species this year. During the spring there was a literal explosion of hackberry butterflies, not only on the refuge, but also in much of Northwest Missouri. There was no known explanation of this unusual phenomenon but it caught the attention of the news media.

During the summer a maple leaf roller defoliated most of the silver maple trees on the refuge. This was the second consecutive year this has happened, but it was more severe this year. The trees did leaf out again late in the summer and held their leaves later than normal.

## 2. Endangered and Threatened Species

Federally listed endangered or threatened species sighted at Squaw Creek in the past few years have included the peregrine falcon, least tern, and bald eagle. While no least tern sightings were reported in 1991, peregrines were reported on five different dates in April and May, and four separate individuals were observed on May 5. The bald eagle is a center-stage attraction on the refuge. Of the lower 48, Missouri typically winters more bald eagles than any other state except Washington.

Peak Bald Eagle Usage at Squaw Creek

Month	Peak	Percent Adult Birds
January	3	33%
February	22	18%
March	8	38%
October	1	0%
November	192	55%
December	209	58%

Bald eagle numbers peaked on December 2 which coincided with our annual Eagle Days (see Section H.6 for more details). Eagle usage is relative to fall snow goose usage. Snow geese peaked on October 31 at 150,000 and declined sharply the remainder of the year with bald eagle usage sliding to 39 birds by year's end.

## 3. Waterfowl

The spring migration of waterfowl began the second week of February as refuge pools began to thaw. Snow goose migration started with a bang in February but the call of the Arctic overpowered Squaw Creek's attraction and numbers quickly dwindled in March and April.

Ducks migrated through in predictable timeliness. The refuge traditionally receives larger numbers of species but small numbers of birds during the spring period.



November and birds began to trickle back, but the freeze/thaw cycle repeated twice more by waterfowl's normal departure time in mid-December. Consequently, we never reached close to normal fall usage.



Snow goose populations were just beginning to build prior to the early fall freeze up. This is Pelican Pool. 10/91 RLB

Another factor should also be considered during the fall migration. The Missouri Department of Conservation went "on-line" with full pumping capabilities for the 3,300 acre Bob Brown Wildlife Area. Five air miles from Squaw Creek, this area has a great mix of standing and harvested crops, both flooded and unflooded, and moist soil units. This sets a mighty attractive table for waterfowl and is adjacent to the Missouri River which remained unfrozen throughout the fall. This combination undoubtedly drew birds away from the refuge, but was a blessing in disguise when avian cholera broke out in November (see Section G.17).

Table 13. Fall Migration 1991, Squaw Creek NWR

Species	September	October	November	December	Fall Use Days
<u>GEESE</u>					
Snow	7	9,500	130,000	23,000	1,615,997
White-fronted		200	200	25	3,832
Canada	50	100	100	1,185	19,145
<u>DUCKS--Dabblers</u>					
Mallards	110	9,000	20,100	32,200	880,729
Gadwall		250	30		2,490
Wigeon	10	350	30		5,940
Green-winged Teal	100	1,200	600	50	21,256
Blue-winged Teal	190	450	10		15,970
Shoveler		100	20		1,125
Pintail		1,350	70	1	16,670
Wood Duck	100	450	10		8,250
<u>--Divers</u>					
Common Merganser				80	1,040
Hooded Merganser			4	1	15
Redhead			1	10	87
Scaup		100	300		2,500
Ring-necked		50			970
Goldeneye				2	16

#### 4. Marsh and Water Birds

While Squaw Creek enjoys a diversity of marsh and water birds, censusing them has taken a back seat to other demands, such as FmHA, Farm Bill, and transfers in personnel. Quality of census data is questionable, but adequate for rough estimates of usage.

Refuge personnel did take advantage of the Region's R-Base Biological Database to analyze data. This tool has sparked interest in revising survey forms and paying closer attention to data collection. After data entry, simply by touching the magic button, usable tables are generated as seen in the direct printout of Table 14. This sure beats the columnar pad and #2 lead computer!

Table 14. Marsh and Waterbirds 1991, Squaw Creek NWR

Marsh/Waterbird Species	Use Days	Peak Use
Pied-billed grebe	3,668	200
Double-crested cormorant	6,363	232
White pelican	20,468	800
American bittern	7	1
Least bittern	77	10
Great blue heron	2,100	48
Great egret	385	14
Snowy egret	14	2
Little blue heron	98	14
Green-backed heron	56	4
Black-crowned night heron	770	88
Common moorhen	7	1
American coot	124,201	2,597
TOTAL USE DAYS	158,214	



Egrets and pelicans liked the spring water conditions this year. They were feeding in the north end of Pelican Pool. 4/91 AES

A favorite of visitors is the white pelican, which was first observed on March 13 and peaked at 800 the first of April. They stayed relatively long as 42 were recorded on May 31. Fall pelican usage was minimal with 250 on September 19 being the largest concentration.



One of the great blue herons that was seen feeding in the shallow water areas this summer.  
7/91 K.Bahr

##### 5. Shorebirds, Gulls, Terns and Allied Species

Shorebird habitat improved considerably in 1991. The addition of the south moist soil units plus the first year of adequate water supply for the Davis Creek moist soil units combined to provide good spring conditions for shorebirds.

Most shorebird activity occurred from mid-April through the end of May. Approximately 5,000 shorebirds were observed on Snow Goose Pool May 11. A total of 24 species was reported by various observers. Species of note for the year was a black-necked stilt (listed as accidental for the Refuge) on Snow Goose Pool, buff-breasted sandpipers and sanderlings.



Gull and tern usage was not well documented, but one observation by staff and visitors should be noted. Relatively large numbers of black terns were reported. Numbers fluctuated from 130 to 150 for the period May 10-17.

#### 6. Raptors

The most notable raptor observations were the bald eagles and peregrine falcons mentioned in Section G.2. There were several sightings of osprey in April and one immature golden eagle March 19.

Twelve members of the Burroughs Audubon Society conducted their annual search of short-eared owls in the cordgrass prairie January 31. None were seen but they did find four fresh pellets that they suspected were from short-eareds.

The most commonly observed species included the red-tailed hawk and great horned owl. Northern harriers were seen in the spring and fall. There were several observations of American kestrels and sharp-shinned hawks. Screech owl pellets were found in several of the wood duck nest boxes during nest box repairs.

#### 7. Other Migratory Birds

With attention of Refuge surveys being focused on waterfowl and larger birds the "other migrants" or little brown birds are often overlooked with regard to census work. The Refuge does obtain valuable information on these species from organized birding events and the help of interested volunteers.

The Audubon Society Birdathon of May 18-19 tallied 124 species. A team from Northwest Missouri State University lead by Dr. David Easterla counted 192 species (versus 188 for 1990) May 11. The most notable find was a sharp-tailed sparrow. Other notable finds are covered in Section G.5.

As a new resident of the Refuge house, Assistant Manager Callow was awed by an estimated one million swallows (mostly bank and cliff) feeding over the Refuge on the evenings of September 26 and 27. The implication of the insect population in the "backyard" was probably the most inspiring.

#### 8. Game Mammals

White-tailed deer is the only game mammal found on Squaw Creek Refuge. Population estimates are made by the use of ground spotlight surveys and aerial surveys when flight time is available. Ground counts are made along two designated driving routes for yearly comparability.

Two ground surveys were completed in 1991. A pre-general-rifle season survey was conducted on November 14. A total of 780 animals were visually observed along the two driving routes. A post-general-rifle season survey on December 11 netted 531 animals being observed. The lower number of deer being observed on the second count was felt to be mostly attributable to

weather conditions and lowered visibility. Total refuge deer population is estimated at 1,000-1,100. This is comparable to estimates for the previous two years.

Kidney fat indexes are compiled by Missouri Western State College students after the special refuge hunt each year. For 1991, data showed adult males to have the lowest fat index (103.23%) and yearling females the highest (265.92%). Comparing mean kidney fat indexes for all female deer age classes 1988, 1989, 1990 and 1991 shows 313.25%, 187.06%, 127.85%, and 185.28% respectfully. Some interstate comparisons of mean kidney fat indexes given in the Missouri Western report for all deer are Michigan 10-150%, Oklahoma 17-46%, Oregon 4-73%, Texas 3-15%, and Missouri 15-910%.

Twenty-four pregnant does were examined for embryo status with a ratio of 1.66 embryos per female. For 1988, 1989 and 1990 the ratio was 1.37, 1.80, and 1.36 respectively. Fourteen of the 24 had conception dates of November 4-17.

This large, fat, and fertile herd of deer continues to create problems for the Refuge. Farming cooperators continue to encounter severe depredation problems (see Section F.4). A distinct browse line is evident in woody vegetation and prescribed burns are actually affected by the deer trail "fire breaks." Also of concern is the attraction to the visiting public, who thrill at the chance to see so many deer (frustrating managers who want theirs to be known as a migratory bird refuge), but fail to leave the Refuge by the well-posted sunset closure.



Does with twins could be commonly seen from the auto tour route.

7/91 K Bahr

#### 10. Other Resident Wildlife

Muskrats were a focus of interest for the Refuge. Countless visitors inquired what all the mounds in the marshes were for and whether Refuge personnel had placed them there or were they natural. Indeed they did have a population explosion. A total of 1,678 huts were counted on November 26, up from 898 in 1990. Their numbers had been greatly depressed since the drought of 1988. With refuge water levels the best in several years, the conditions must have been favorable for muskrat production.



Mink observations are more common as the muskrat population continues to build.

7/91 K. Bahr

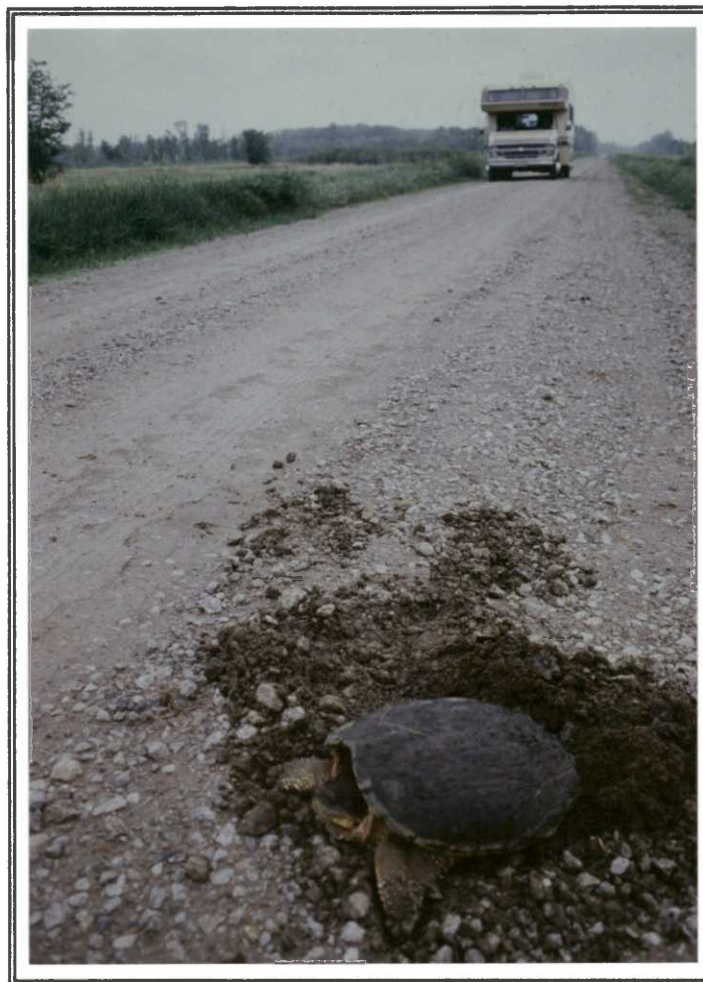
Beaver are common along the Squaw and Davis Creek ditches and lodges were observed in Cattail and Bluff Pools.

Coyotes are frequently heard and the population numbers seem to be healthy, although several individuals appear very ragged, presumably with mange. An occasional red fox is observed.



A pheasant crow count was conducted May 2. A total of 86 calls were heard, compared to 27 in 1990; 97 in 1989; and 135 in 1988.

Wild turkeys are frequently seen in the loess bluff hills and occasionally in the bottomlands. Bob-white quail are sighted occasionally in the bottomland and frequently heard.



During the late spring, snapping turtles were seen laying eggs everywhere, including on the auto tour route.  
6/91 K. Bahr

#### 17. Disease Prevention and Control

In early November word started to circulate about avian cholera problems being encountered on wildlife areas. These outbreaks are no stranger to Squaw Creek and pools are monitored closely for abnormal numbers of dead birds.

Kathy Converse of the Madison Health Lab was sent to the general area to monitor the situation. On November 15-16, large numbers of dead snow geese were found on the Bob Brown State Wildlife Area (see Section G.3). This area is only five air miles from Squaw Creek, and an estimated 200,000 snow



geese were in the general area. It was just a matter of time until the outbreak hit the Refuge.

Refuge Personnel began to pick up dead birds on Sunday, November 17th, by wading and pushing a flat bottom boat. The next day (after minor repairs), the refuge airboat was utilized and efforts continued until November 22 when the outbreak appeared to have run its course on the Refuge.

Several carcasses were sent to the Madison Health Lab where tissue cultures confirmed that the cause of death was due to Pasteurella multocida. Approximately 1,800 birds were picked up at the Bob Brown Area.

Carcasses Collected at Squaw Creek (November 17-22, 1991)

Species	Total
Snow Goose	937
White-fronted Goose	1
Canada Goose (Richardson)	1
Mallard	7
Scaup	1
Pintail	1
Coot	1
Gull spp.	1
TOTAL	950

#### H. PUBLIC USE

##### 1. General

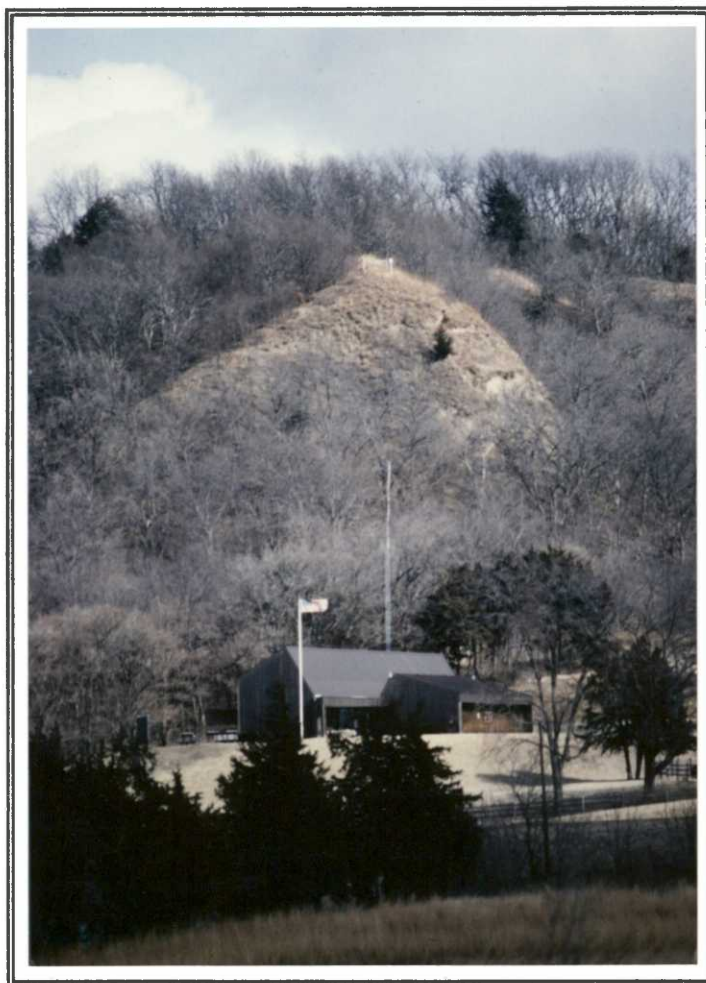
Squaw Creek is located in the natural-attraction-deficient four-corners region of Missouri, Kansas, Nebraska and Iowa. With its large concentrations of waterfowl and eagles, and its proximity to interstate highways, it is a public use magnet for the area. The refuge is 2.5 miles off Interstate 29 and 100 miles distant from both Omaha, Nebraska, and Kansas City, Missouri. St. Joseph, Missouri, population 80,000, is 35 miles south.

Residents from this four-state region are frequent visitors to the refuge, especially during migration periods. A large percentage are repeat visitors. Many locals enjoy late evening tours to see the large deer herd and a chance to observe one of the big bucks.

Wildlife observation is the primary refuge activity. Picnicking is the only non-wildlife activity, though most visitors combine this with a tour

of the refuge. Although public use demands have increased over the years, public use is still largely consistent with refuge objectives. Some denial of habitat use by wildlife is noted during high-volume public use of the tour route, but as yet hasn't proved inconsistent with objectives.

Total visitation in 1991 at 96,780 was down from the previous year's count of 144,250. The early freeze up in November and lower numbers of waterfowl in November and December (the highest use months) curtailed visitation for this period.



The refuge headquarters is nestled up against the loess bluffs. 2/91 MCM

#### 4. Interpretive Foot Trails

Squaw Creek Refuge has two interpretive foot trails. The half mile loess bluff trail starts at the headquarters building and climbs 200 feet to a small shelter atop the bluffs with a commanding view of Refuge pools and the Missouri River floodplain. On a clear day the states of Missouri, Kansas, and Nebraska can be seen in one panorama.

The recent operations inspection pointed out the need to level up the 206 limestone steps of the final segment of the trail. These steps were built by the CCC soon after the Refuge was established in 1935 and are of irregular spacing. This action and the addition of better handrails are being initiated by refuge personnel.

The second foot trail is a flat, three-fourths mile hike along the dike separating Pelican and Eagle Pools. When geese are here in abundance, it presents a great close-up viewing opportunity and some species of marsh inhabitants are sure to be observed at any time of year.

An estimated 4,850 people took advantage of these trails. Teachers especially like them to wear down active school groups.

#### 5. Interpretive Tour Route

The ten mile self-guided tour route is the most heavily used public use facility by far. An estimated 89,450 people took the opportunity to view and photograph a variety of wildlife wonders in 1991. This is down from 136,000 in 1990. The period of mid-October to mid-December is normally the busiest, but an early icing of the pools and lack of birds curtailed visitation for this period in 1991.

The condition of the tour route has been improved the past few years with addition of gravel. In 1991, approximately two miles of cross levee #2 received additional gravel. The tour route was closed four days in July to repair flood damage, one day in October to clear ice storm damage, and a two-day period in November due to muddy roads. Additionally, it was closed for two weekends in January for the special deer hunts.

#### 6. Interpretive Exhibits/Demonstrations

The headquarters building contains a small visitor contact station and display room with mounted species representative of the Refuge. Leaflet dispensers and educational materials are available at the contact station. Interpretive panels located just outside the building and overlooking the main Refuge pools inform visitors about water management, wildlife, and the Refuge system. Sales of educational materials, wildlife photography, caps and tee shirts, and books are sponsored by the Midwest Interpretive Association.

An estimated 10,360 people spent 2,590 hours at the visitor contact station, which is about two-thirds as many contacts as recorded in 1990. Visitors from 43 states, Washington D.C., and 14 foreign countries signed the visitor log. Foreign visitors were from Canada (Saskatchewan and Ontario), England, Denmark, New Zealand, Italy, Costa Rica, Netherlands, Austria, France, Germany, Sweden, Australia, Cuba, Israel and Guatemala.

The biggest interpretive event was the fourteenth annual Eagle Days weekend, held December 7 and 8. This two day event is cosponsored by the Refuge, Missouri Department of Conservation, Dickerson Park Zoo in Springfield, Missouri, and the St. Joseph Museum.

Missouri Department of Conservation personnel set up and staff spotting scope stations at the headquarters and viewing tower, answer questions and dispense education material in the display room, and operate video displays. The St. Joseph Museum provides eagle mounts for display while refuge personnel provide book sales, traffic control, and patrol functions. The local Kiwanis set up a concession stand in the new shop building. A commemorative print by Charles Schwartz, who passed away in the winter, was given to those who toured the display room.

The highlight of the event is a live eagle demonstration provided hourly by Mike Lampe, a volunteer from the Dickerson Park Zoo. This year an immature bald eagle named Phoenix was the star. Several sessions were standing room only. In addition, a rehabilitated immature eagle was released back to the wild the first day.

Weather for the event cooperated with above normal temperatures in the 60's and sunny skies. An estimated 3,000 people took in the displays with a total visitation of 5,000 for the weekend.



Weather conditions were ideal for Eagle Days.  
Traffic on the auto tour route was steady.

12/91 RLB



As part of a funded non-game bird project, a bluebird interpretive exhibit was added to the refuge headquarters displays. The exhibit contains two carved bluebirds in association with a nest box. An interpretive leaflet was also completed as part of the project.



This bluebird display was carved by Bob Sipes, Big Lake, as part of a non-game project. A leaflet was also developed. 8/91 RLB

#### 7. Other Interpretive Programs

Squaw Creek continued to disperse information about the refuge and other management and wildlife-related topics through the news media. Both regional and local newspapers regularly carried articles. Radio and television spots were also used.

The primary information source about the refuge activities to the local news media was from the "Squaw Creek Digest." This column was distributed to four local Missouri newspapers (Mound City, Oregon, Savannah, and Fairfax) and the Falls City, Nebraska, newspaper. A total of thirty "Digest" articles were issued in 1991, compared to twenty-nine in 1990.

The outdoor editor for the St. Joseph News-Press/Gazette is a refuge supporter, and thirty-one articles were printed about refuge activities. The Kansas City Star printed four articles, while the Omaha World Herald published one.

Articles about Squaw Creek appeared in a variety of publications. The March/April issue of Bird Watcher's Digest carried a five-page article. The March issue of the Conservationist, a monthly magazine of Missouri Department of Conservation, contained an article about Squaw Creek and the other four National Wildlife Refuges in the state. The Missouri Audubon Society publication, Bluebird contained an article about the Refuge in the March/April issue.

Articles were submitted to both the Burroughs and Midland Empire Audubon Society's bimonthly publications three times in 1991 and all were printed. This was a good source to keep these active refuge supporters informed of current activities.

The refuge was interviewed by two radio stations during the year. Channel 2, St. Joseph, covered a story about Mallard Marsh, as did Channel 5, Kansas City. The "Outdoor Beat," a weekly half hour program on St. Joseph cable television produced five programs about Squaw Creek in 1991, on such topics as Mallard Marsh, the deer hunt, and Eagle Days.

There is a continued demand for programs both on and off the refuge. Groups that came to the headquarters were given a fifteen-minute introduction to the refuge before continuing their tour. Approximately 1,000 students, scouts, church groups, and senior citizens were given brief talks.

Bell gave talks to the Mound City Kiwanis Club in February and the Chamber of Commerce in September to inform them of Refuge activities and accomplishments for the year and proposed projects for the following year.

An annual summary of events, a condensed version of the annual narrative report, was sent to all State and Federal Congressional offices to keep them abreast of Refuge activities.

Interest in moist soil plants and developments increased in 1991. Bell gave three programs related to this topic. The Soil Conservation Service Area IV plant materials committee was given a talk and tour September 18, as well as the conservation committee of the Burroughs Audubon Society October 10. Bell also gave an elementary moist soil plant identification workshop to Greenwings from Ducks Unlimited on October 12.

Charles Shaiffer, Biologist, Mingo National Wildlife Refuge, presented a program on June 18 to approximately 25 local duck club owners/operators about moist soil plants, nutritional requirements for spring migrating waterfowl and a potential private land venture (Section F.15).

The Refuge mammal leaflet, originally developed in the early 1970's, was revised and reprinted by the Midwest Interpretive Association at no cost to the Refuge. Approximately 5,000 were printed.

## 8. Hunting

The only hunting opportunity on the refuge is a muzzleloader-only white-tailed deer hunt. This event is a continuing management tool in an effort to gain control of an ever-increasing herd, to slow depredation which decimates refuge crops planted for waterfowl, and to provide a quality hunt consistent with refuge goals. As in 1990, the hunt was restricted to antlerless animals. Hunters with both an unfilled general tag and an unfilled bonus tag are permitted to harvest two animals.

The fourth annual special hunt was held the weekends of January 5-6 and January 19-20, 1991. Applications for the hunt were received from November 19 to December 1. Missouri Department of Conservation handles all the applications, computer drawings, and issuance of the permits.

All successful applicants must attend an orientation session before each hunting period. A slide/tape presentation developed by Manager Bell and Missouri Western State College is given and general orientation to the Refuge and biological data to be collected is outlined to each hunter.

For the first hunt, 324 applicants vied for 100 available permits. Ninety-three hunters showed up and had 30 unfilled bonus tags for a total of 123 possible takes. A total of 80 animals, including 32 shed antler and button bucks and 48 females, were harvested for a hunter success of 86 percent.

On the second hunt, 379 applicants applied for 100 permits. Seventy-three hunters showed up and had 15 bonus tags for a total of 88 possible takes. Sixty-two animals, including 24 shed antler and button bucks and 38 females were harvested for a hunter success of 85 percent.

According to a computer model developed by State deer biologists, 86 does need to be harvested each year to maintain the same size herd. This year's harvest of exactly 86 does will be watched closely to see if the desired results are obtained.

Refuge personnel were assisted by local conservation agents in patrolling the hunt. Several lesser state violation citations were written by the conservation agents. Missouri Western State College instructors and students again collected biological data (see Section G.8).

## 11. Wildlife Observation

Wildlife observation is an extremely high quality form of recreation at Squaw Creek and the primary reason for most visitor use. Thousands of snow geese and ducks, as well as several hundred bald eagles, deer, and a variety of other species can be seen from the comfort of an automobile along the ten-mile auto tour route.

For hikers, there are two walking trails through various habitat types that add to the diversity of viewable wildlife species. The Eagle Overlook Trail provides an excellent view of marsh-dwelling species, while the Loess Bluff Trail travels through a mature hardwood forest leading to a panoramic overlook of the Refuge.

Total visits to the refuge in 1991 were 96,780, considerably less than the 141,800 recorded in 1990. Most of this reduction could be related directly to the record cold temperatures in late October that froze up all marshes. This resulted in most of the snow geese making a very short stop at the Refuge before migrating further south for the winter. As a result there was very little media attention and the usual large influx of visitors did not materialize.

The decline in visitation did not take away from the excellent opportunity for wildlife observations. Many photographers took advantage of these opportunities in 1991.



Ken Bahr, Falls City, Nebraska, frequently donates slides to the refuge. This was an interesting photo of two raccoons resting on a public use sign early in the morning. 7/91 K Bahr

## 12. Other Wildlife-Oriented Recreation

Photography remains a very popular form of recreation at Squaw Creek. Excellent photo opportunities abound with the multitudes of waterfowl migrating through and large concentrations of bald eagles for which the refuge is well known. Scenic photography changes with the seasons along the trails and tour route. The large blossoms of the American lotus are a favorite of summer visitors.

Both amateur and professionals enjoy the variety of opportunities that exist. The entire spectrum of equipment is encountered from the basic to gadgetry that would amaze the most experienced camera salesman. Camcorders might even outnumber still photographers.



Special Use Permits are issued on a limited basis to a few photographers who wish to work from a blind or spend more than one day on the refuge. Most of these individuals are most willing to donate a few copies of their better works and have proven to be a good source for the refuge.

Jim Rathert, Photographer for Missouri Department of Conservation, spent a few fall days photographing wildlife. Ken Bahr from Falls City, Nebraska, spent about 200 hours working from a blind, primarily taking pictures of deer. Copies of their work are included in this narrative.

#### 14. Picnicking

Seven tables and six grills are available near the headquarters building. Most school groups utilize the area and many weekenders combine a picnic with a hike up the Loess Bluff Trail.

Approximately 2,920 visitors used the picnic area in 1991, down from the 3,950 reported for 1990.

#### 17. Law Enforcement

Transfer of law enforcement personnel affected the quantity of patrol efforts this year. Refuge personnel with law enforcement credentials were Manager Bell and Assistant Managers McCarty and Callow. McCarty transferred to Windom, Minnesota, in April, and Callow did not enter on duty until late August. A total of eight violations were written.

Table 15. Summary of Violations 1991, Squaw Creek NWR

Offense	Citations	Disposition
Trespass After Hours	1	\$ 50
Trespass In Closed Area	4	\$150*
Trespass To Retrieve Game	1	\$ 50
Possession of Firearms on NWR	2	\$150

\*One pending

Other than the special deer hunt, no hunting opportunities are available on the Refuge. Nonetheless, Squaw Creek is ringed by hunt clubs, and numerous deer tree stands are precariously close to the Refuge boundary. Admittedly, the Refuge law enforcement staff needs more time for patrolling these situations, but has become (overly?) dependent on excellent cooperation from local conservation officers to cover this base.

With the high visitation rates at Squaw Creek comes a corresponding rate of on-refuge violations. The biggest problems continue to be trespass and possession of firearms on the Refuge. Many of the trespassers become overly engrossed in wildlife observation and just have to get a little closer or "forget" what time closing time was. We are currently experimenting with the proactive vs. reactive tack to late departures by closing the entrance gate one-half hour before sunset. It appears that

most late visitors are getting the message that they cannot make a ten mile trip at 25 miles per hour when they enter five minutes before posted closure of sundown.

The addition of the wetland management district has increased the enforcement responsibility off the refuge. There was one easement violation reported and investigated in 1991. An adjacent landowner to the Hackenback tract made several calls to the Refuge and to Special Agent Bob Lumadue about possible violations.

Manager Bell and Special Agent Lumadue made several investigative trips. The landowner had burned, dozed, and tilled on the easement without permission and without a Special Use Permit. As a result, they (Ken Mort and Bill Fort) will be required to prepare the seedbed for warm-season native grasses in 1992, as well as buy the designated seed mixture and control weeds.

The annual 40-hour law enforcement refresher training was completed by Bell and McCarty at Camp Dodge, Iowa, in March. Bell and Callow requalified on firearms at DeSoto Refuge in September. Refuge personnel attended the quarterly Four States conservation law enforcement meetings which are very informative and cover topics of mutual interest.

#### 18. Cooperative Associations

The Midwest Interpretive Association has sponsored a sales outlet at Squaw Creek since October 1987. Midwest Manager Bruce Barkley, who works from an office at DeSoto Refuge, supplies the sales outlet. In 1991, 43 items were available and included education materials, tee-shirts, coffee mugs, wildlife posters and the addition of a Refuge eagle logo hat just before Eagle Days.

An estimated 16,260 visitors passed through the sales area. Gross sales for the calendar year were \$8,601.30, up slightly from the previous year's sales of \$7,982.09.

### I. EQUIPMENT AND FACILITIES

#### 1. New Construction

There was no new construction in 1991. The last new facility built on Squaw Creek was the Davis Creek water control in 1989 and Mallard Marsh work.

#### 2. Rehabilitation

Rehabilitation work continued on water management facilities in 1991. After approval from the National Fish and Wildlife Foundation, the remaining money left from the Mallard Marsh Challenge Grant was spent on the Rice Paddies moist soil units.

Lyle Derr Construction, Forest City, was awarded the contract to clean out the ditches with a tracked excavator. Mr. Derr also installed two control

structures used as inlets for the units. Work began April 9 and was completed April 23. Total cost was \$4,182 at a rate of \$88/hour. The rest of the Grant money was used to buy culverts. They were purchased from J&J Metal Products, Paola, Kansas, at a cost of \$1,806.26. With salary savings from Operation Specialist McCarty's transfer, enough money was available to purchase the stoplog risers and logs. They will be installed in 1992.

Landscaping of the headquarters was initiated once a final plan was approved. On April 5 more than 300 shrubs and small trees were planted. Most species were ordered from Missouri Department of Conservation at no cost. Fencing was erected around the plantings to protect them from the deer and rabbits. Survival was about ninety percent. The plantings complicated mowing operations, but two high school volunteers provided most of the labor in 1991, much to the delight of the tractor operator.



Wire fencing closed in most plantings to protect them from deer. It is hoped that we will be able to remove the fencing next year.

9/91 RLB

An equipment rental contract to level spoils from ditch cleanouts the past three years was awarded in July to Showalter and Son, Craig (Contract No. 14-16-003-91-00029). The contract was for the rental of a crawler dozer with a minimum four-way blade and 140-rated net-flywheel-horsepower with operator. His bid was \$53.50/hour.

Leveling and shaping of spoils included those along Davis Creek south of the tower, Squaw Creek inlet at the roller gate, the east dike of north Snow Goose Pool, the Long Slough inlets, the Rice Paddies work done in April, Cattail Pool west dike, and dikes in the Davis creek moist soil units 1, 2, and 3. The original bid was for 140 hours, but the contract was extended twenty-five percent and the total cost was \$9,362.50.



Leveling the dirt piles along Davis Creek will facilitate brush and noxious weed control next year. 7/91 RLB

A spillway has been planned for the Squaw Creek control structure the past few years and was funded in FY 1991. A total of \$42,000 was Job Ordered by the Regional Office. On June 12-13, Engineer Sue McDermott and Financial Assistant Clare Nelson surveyed the spillway. The work would also include repositioning both the Mallard Marsh and Snow Goose inlet screw gates that had been put on backwards in the early 1980's.

Bids were solicited in late July with a bid opening date of September 5. Unfortunately, only one bid was received and it was about \$20,000 more than expected. Since it was too late in the fiscal year to resolicit bids and there was not extra money, the project was not funded and the money was reprogrammed within the Region. The project has been proposed for the Regional Maintenance Action Team in FY 1992.





The old shop was in dire need of new shingles and general repair. Paint was scraped by members of the Audubon Societies as a work day project. 5/91 RLB



A new furnace was installed, heated section insulated, new shingles added and entire building painted to match the new shop. 10/91 RLB

### 3. Major Maintenance

Major maintenance got a big boost in FY 1991 when \$30,000 was allocated via the Maintenance Management System to Squaw Creek. Some of the money was spent in the following manner:

Old Shop	Roof resingled, new furnace installed, new gutters and downspouts added, heated section insulated, entire building painted.
YCC Building	New Insulated overhead door installed, chemical storage section added, shingles and gutters purchased (installed in 1992), entire building painted.
Corn Crib	Shingles purchased (installed in 1992), entire building painted.
Public Restrooms	All new toilet facilities (handicap) installed.
Headquarters	Handicap accessible water fountain installed.

A gravel contract was awarded in late June to James Smith Trucking, Fairfax, Missouri, to cover the Mallard Marsh road. A total of 945 tons were delivered at a cost of \$8.50/ton. The contract was increased by twenty-five percent due to salary savings, bringing the total gravel investment to \$10,338.28. This made a definite difference on the road throughout the wet fall.

The road adjacent to the Squaw Creek water control structure was overtopped by flood waters in May, June, and July. The last storm caused considerable damage to the auto tour route and was threatening to wash out the east abutment of the control. It was repaired with the refuge dragline in late July.

In early October, a leak developed in the flat section of the headquarters roof. The elastic membrane began to split and shatter. Thanks to the quick response of the Regional Contracting Office, a bid was received and the repair completed within three days. Hausmann Metal Works, St. Joseph, Missouri, did the work for \$5,284.

One of the headquarters furnaces decided to quit in late November and remained down through December. A Lennox expert had to be called in to track down the problem, but the cost was minimal (believe it or not).

Several maintenance items were identified during the November Operations Inspection. Project Proposal Worksheets were developed on them. Of major concern was the Refuge quarters. Asbestos was discovered in the basement, wrapped around the pipes, and several sheets attached to the floor. A contract was awarded to Asbestos Abatement Service, St. Joseph, Missouri, for \$2,475. Work was to be done in January 1992. Other tests were to be completed to determine the present conditions in the house.



The elastic membrane began to split. Rain would run off directly under the membrane and exit through a recessed light below.

10/91 RLB



A new rubber liner was installed the entire length of the roof after the old membrane was removed. 10/91 RLB

#### 4. Equipment Utilization and Replacement

A new one-ton, four-wheel-drive Dodge pickup was received April 2, purchased with FY 1991 fire funds. Running boards and a tool box were added. A 1982 Chevrolet two-wheel-drive truck, transferred from Wapello District of Mark Twain NWR in 1988, was transferred to Patoka River NWR, Indiana, in June. A topper was added to the 1990 Dodge.

Some new equipment purchased with Maintenance management funds during the year included a new riding lawnmower, two push mowers, a weed trimmer and a grooming mower for the small tractor. A magnetic locator and Laser plane 350 with grade rod were purchased with Farm Bill money.

In the spring, the John Deere 350C dozer broke down and required major repairs. Money was allocated from the Regional Office, and Mid-America Industrial Equipment Company, Kansas City, Missouri provided all the parts to the tune of \$4,579.67.

#### 5. Communications

An FTS 2000 telephone line was installed January 23. The phone number is 751-0187. The installation of this line has been a great benefit to this station. The refuge now has two business lines, a line for the computer, a line for the FAX, and a line for FTS.

#### 6. Computer

During the course of the year, Squaw Creek acquired two additional computers. Administrative Technician Zeliff, the local computer support person, uses the IBM PS/2, Model 60. In late July, a Dell 325D was purchased from Farm Bill money in support of this program, just in time for the arrival of Operations Specialist Callow. A laser printer was also added. Then in late October, the Regional Office transferred a CompuAdd for Manager Bell. All three computers have been valuable additions to the office staff and have been getting good use.

Administrative Technician Zeliff's son continued to give the refuge a lot of help in setting up our systems and his volunteer assistance and knowledge have been invaluable.

#### 7. Energy Conservation

Squaw Creek has been involved in three recycling programs in 1991: used oil, aluminum cans, and plastic liter pop containers. Crankcase oil is stored in a 300 gallon tank and sold to Industrial Service Company, Kansas City. Aluminum cans are recycled by one of our volunteers. The same volunteer takes the plastic pop containers and makes bird feeders.

There were improvements to several of the headquarters buildings because of the Maintenance Management funds available this year. A new insulated overhead door was installed in the heated garage of the YCC building. A new, more energy-efficient furnace was installed in the old shop, and the walls and ceiling were insulated.



## 8. Other

The headquarters building was cleaned by contract. This has been a very important service to the Refuge, particularly during high public use periods. Other service contracts include trash removal, and computer, copy machine, telephone, and typewriter maintenance.

Aerial infrared photos were taken of the refuge September 5 by Regional Pilot Bob Foster.

Scrap iron and aluminum left from the Derr property clean up was sold via public sale in April.

## J. OTHER ITEMS

### 1. Cooperative Programs

Every year the staff at Squaw Creek become more involved in new cooperative programs. In 1991, these involved a variety of Federal, State and private organizations.

#### A. Federal

Soil Conservation Service--Participated in all aspects of the Farm Bill program, including CRP, Swampbuster, Commenced Determinations, and Minimal Effects with approximately 21 District Conservationists and staff, and in other programs, such as the Porter Creek watershed and Partners for Wildlife.

Agricultural Stabilization and Conservation Service--Cooperated on Farm Bill activities, such as Swampbuster, Commenced Determinations, and Minimal Effects.

Farm and Home Administration--Conducted Farm and Home inventory and preinventory reviews; dealt with twenty different FmHA administrators; and developed conservation easements on their properties.

Department of Agriculture--Coordinated depredations program, involving issuing of propane exploders to local farmers with crop depredation problems.

U.S. Army Corps of Engineers--Provided meeting room for several Missouri River Mitigation meetings.

National Wildlife Refuges--Shared equipment and personnel for a variety of tasks such as enforcement, interpretation, administration, and management.

Ecological Services--Assisted with environmental monitoring.

Other--Conducted mourning dove survey, installed gypsy moth traps, monitored waterfowl disease, and facilitated various other migratory bird assistance.

## B. State

Missouri Department of Conservation--Deer hunts, Eagle Days, Farm Bill, prescribe burning, hunter safety classes, safety meetings, breeding bird surveys, eagle census, waterfowl census, pheasant crow counts, law enforcement, native grass plantings, landscaping, reptile/amphibian information, moist soils.

Missouri Department of Natural Resources--Prescribe burning, wetland developments, moist soils.

Iowa Department of Natural Resources--Waterfowl surveys, waterfowl disease monitoring.

Kansas Department of Wildlife and Parks--Waterfowl surveys, waterfowl disease monitoring.

Missouri Western State College--Deer hunter orientation, biological collections, biological studies, deer census, non-game bird projects.

Northwest Missouri State University--Marsh, shore, and water bird nesting.

University of Missouri Cooperative Extension--Cooperative farming program, weed control, musk thistle weevil release.

## C. Private

National Fish and Wildlife Foundation--Challenge Grant for restoration of Mallard Marsh and Pintail Pool.

Ducks Unlimited--Restoration of Mallard Marsh, Pintail Pool, South Pintail Pool, and Pelican Pool moist soil unit, Greenwing Day.

Audubon Societies--Midland Empire and Burroughs Chapters in work days, fall volunteers in office, Challenge Grant projects, Christmas bird count, bird-a-thon, reprint leaflets.

Springfield Zoo--Live bald eagle for annual Eagle Days event.

St. Joseph Museum--Eagle display.

Mound City Kiwanis--Refreshment stand for Eagle Days, Mallard Marsh dedication monument.

Midwest Interpretive Association--Books and educational materials sales outlet.

Burlington-Northern Railroad--Prescribe burning.

Nature Conservancy--Land acquisition/donations.

### 3. Items of Interest

Families of the refuge staff increased during the year. Administrative Technician Zeliff's granddaughter, Leslie Nicole Zeliff, was born June 6, to John and Nancy Zeliff. William Wesley Walker was born to Tractor Operator Daryl Walker and his wife, Ann, August 7. Shannon Rose Callow, daughter of Mike and Dawn Callow, was born December 27.

### 4. Credits

The 1991 Narrative Report was written by Refuge Manager Bell and Operations Specialist Callow. It was typed by Administrative Technician Zeliff. Specific writing assignments were as follows:

Bell--A; D; E; F1-4, 5-10; I; J; and K  
Callow--B; C; F4, 11-16; G; H.

### K. FEEDBACK

#### State Wildlife Management Areas

The Bob Brown State Wildlife Management Area, just five air miles south of the Refuge, completed a \$1.5 million rehabilitation and improvement of their wetlands and water pumping facilities in 1991 after about two years of construction. They can now flood more than 1,200 acres of the approximately 3,000-acre area. These wetlands were very attractive to waterfowl this year since they were pumping water from the Missouri River during the record cold temperatures in late October and the marshes did not freeze up as Squaw Creek did.

As a result, Bob Brown held a large number of ducks, snow geese and bald eagles (in the refuge portion) that normally do not use the area. Unfortunately, they also suffered an outbreak of avian cholera and were assisted in cleanup by the National Wildlife Health Center in Madison, Wisconsin.

The Missouri Department of Conservation also purchased another area of over 3,000 acres in the Nodaway River bottom this summer, which is less than ten air miles east of the refuge. They plan to develop and flood wetlands on this area in the next five years. There will be controlled waterfowl hunting on this unit, as on the Brown Area.

There has been some concern about the effect that all of this wetland development will have on Squaw Creek in the future. It is hard to predict but I cannot help but applaud the State of Missouri for the efforts being put into wetland restorations in Northwest Missouri and across the state. After all, wetlands have caught the attention of everyone, including the President of the United States.

The more wetlands that are present, the more habitat that will be available not only for waterfowl, but also for other marsh, shore, and water birds in the future, and the more cleansing power and flood reduction we might see in the area.

We may not see so large a concentration of ducks and snow geese as in the past. However, in the long run, smaller numbers may be the better for the health and welfare of the birds and the resource. Only time will tell!



Appendix 1



DUCKS  
UNLIMITED

## **SQUAW CREEK MARSH DONOR PROJECT**

**D**ucks Unlimited, Inc., the U.S. Fish & Wildlife Service, and the National Fish & Wildlife Foundation cordially invite you to attend a ceremony dedicating the Squaw Creek MARSH Donor Project.

Wednesday, October 30, 1991  
at 11:00a.m.  
at the Squaw Creek National Wildlife Refuge  
Mound City, Missouri

Luncheon to follow at the  
Mound City Community Center

Please R.S.V.P. with enclosed card  
by October 18, 1991

Casual Attire

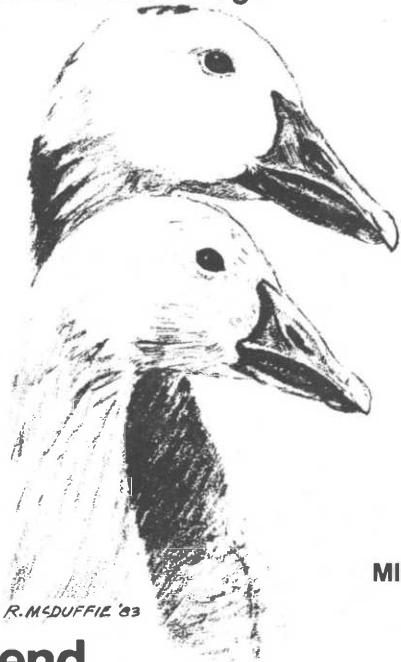
## **FUNDS FOR RENOVATING 800 ACRES OF REFUGE WETLANDS WERE COOPERATIVELY PROVIDED BY**

THE U.S. FISH & WILDLIFE SERVICE, THE  
NATIONAL FISH & WILDLIFE FOUNDATION,  
103 INDIVIDUALS, AND THESE LIFE SPONSORS  
OF DUCKS UNLIMITED:

FRED HERSHBERGER  
PAUL L. KNICK  
SUSAN C. KNICK  
JOSEPH S. MORROW, JR.  
RALPH L. SUTTON  
HOYT H. THOMPSON

# Birds of

SQUAW CREEK  
National Wildlife Refuge



MISSOURI

## Legend

This bird list contains 268 species which have been recorded on the refuge. Another 33 birds, listed under "Accidental" birds, have been reported but are not normally expected to be present.

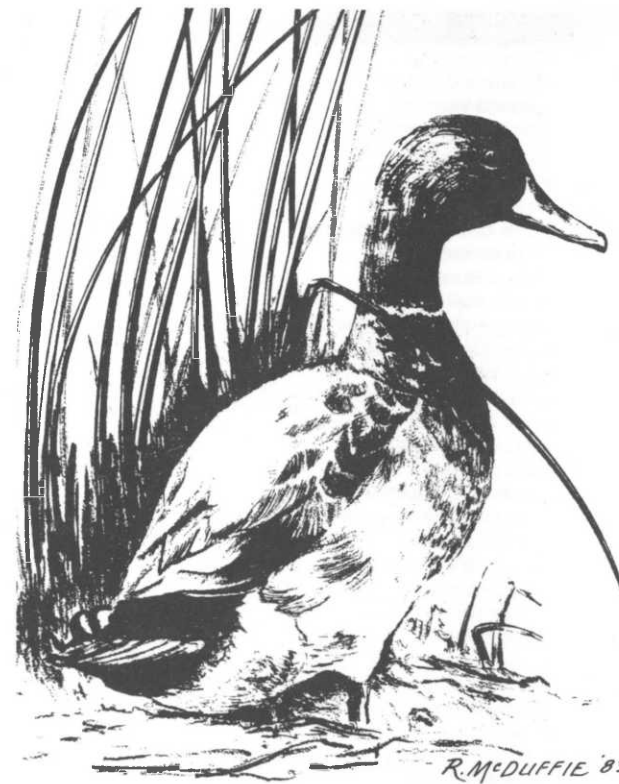
**S**—Spring ..... March-May  
**s**—Summer ..... June-August  
**F**—Fall ..... September-November  
**W**—Winter ..... December-February

**a**—abundant—common species that is very numerous  
**c**—common—certain to be seen in suitable habitat  
**u**—uncommon—present but not certain to be seen  
**o**—occasional—seen only a few times during a season  
**r**—rare—seen at intervals of 2-5 years  
**(E)**—Endangered

\*Indicates birds which nest locally

Birds	S	s	F	W
Common Loon	r		r	
Pied-billed Grebe*	c	u	c	r
Horned Grebe	u		u	
Eared Grebe	u	r	u	
Western Grebe	r		r	
American White Pelican	a	u	a	
Double-crested Cormorant	c	r	c	
American Bittern*	o	o	u	r
Least Bittern*	u		u	
Great Blue Heron	c	c	c	r
Great Egret	u	u	u	
Snowy Egret	r	u	r	
Little Blue Heron	o	u	r	
Cattle Egret	o	u	u	
Green-backed Heron*	u	c	o	
Black-crowned Night-heron*	o	c	o	
Yellow-crowned Night-heron*	o	u	o	
White-Faced Ibis	o	r	r	
Tundra Swan	r		r	r
White-fronted Goose	u		c	r
Snow Goose	a	r	a	o
Ross' Goose	u		a	r
Canada Goose	a	u	a	c
Wood Duck*	o	c	a	r
Mallard*	a	c	a	a
American Black Duck	o	o	o	u
Northern Pintail*	a	r	a	o
Green-winged Teal	c	r	c	u
Blue-winged Teal*	c	o	c	r
Cinnamon Teal	o		r	
Gadwall	c	r	c	r
American Wigeon	c	r	c	o
Northern Shoveler	c	r	c	r
Canvasback	u		u	r
Redhead	o	r	o	r
Ring-necked Duck	c		u	r
Greater Scaup				
Lesser Scaup	c	r	c	u
Common Goldeneye	o		o	u
Bufflehead	u		u	
White-winged Scoter				
Ruddy Duck	u	o	u	r
Hooded Merganser	u	u	u	r
Common Merganser	c		o	c
Red-breasted Merganser	o		o	r
Turkey Vulture	u	c	u	
Osprey	o		o	c
Bald Eagle (E)	u		u	c
Northern Harrier*	u	o	u	u
Sharp-shinned Hawk	u	r	u	u

Birds	S	s	F	W
Cooper's Hawk	o	r	o	o
Northern Goshawk				
Red-shouldered Hawk	r	r	r	r
Broad-winged Hawk	r	r	r	o
Swainson's Hawk	o		o	c
Red-tailed Hawk*	c	o	c	c
Rough-legged Hawk				o
Golden Eagle			o	o
American Kestrel	o	o	o	r
Merlin	r		r	r
Peregrine Falcon (E)	r		r	r
Prairie Falcon			r	r
Ring-necked Pheasant*	c	c	c	c
Wild Turkey*	u	u	u	u
Northern Bobwhite*	u	u	u	u
Yellow Rail	r		r	
King Rail*	u	u	u	
Virginia Rail*	u	o	u	
Sora	c	u	c	
Common Moorhen	o	o		
American Coot*	a	o	a	r
Sandhill Crane	r		r	
Black-bellied Plover	c		u	
Lesser Golden-Plover	c		u	
Snowy Plover	r		u	
Semipalmated Plover	u	u	o	
Piping Plover	o	o	r	
Killdeer*	c	c	c	o
American Avocet	u	o	u	
Greater Yellowlegs	c	u	c	
Lesser Yellowlegs	c	c	c	
Solitary Sandpiper	u	u	u	
Willet	u	r	o	
Spotted Sandpiper*	c	c	c	
Upland Sandpiper*	o	o	o	
Whimbrel	r			
Long-billed Curlew	r	r		
Hudsonian Godwit	o	r		
Marbled Godwit	o	o	r	
Ruddy Turnstone	u	o	r	
Red Knot	r		r	
Sanderling	o	o	o	
Semipalmated Sandpiper	c	c	c	
Western Sandpiper	o	o	r	
Least Sandpiper	c	c	c	
White-rumped Sandpiper	c	u	u	
Baird's Sandpiper	u	u	u	
Pectoral Sandpiper	c	u	c	
Dunlin	u	r	u	
Stilt Sandpiper	u	u	o	
Buff-breasted Sandpiper	r	o	o	



Birds	S	s	F	W
Short-billed Dowitcher	u	u		
Long-billed Dowitcher	c	o	c	
Common Snipe	u	o	u	r
American Woodcock*	u	o	o	
Wilson's Phalarope	u	o	o	
Red-necked Phalarope	u	o	o	
Franklin's Gull	c	o	c	
Bonaparte's Gull	o	r	o	
Ring-billed Gull	c	o	c	o
Herring Gull	u	r	u	r
Caspian Tern	o	r	o	
Common Tern	o		u	
Forster's Tern	u	o	u	
Least Tern	r	o	r	
Black Tern	c	c	o	
Rock Dove*	o	o	o	o
Mourning Dove*	c	c	c	o

Birds	S	s	F	W
Black-billed Cuckoo*	u	u	u	
Yellow-billed Cuckoo*	c	c	u	
Common Barn Owl*	r	r	r	r
Eastern Screech Owl*	c	c	c	c
Great Horned Owl*	c	c	c	c
Barred Owl*	c	c	c	u
Long-eared Owl	o		r	u
Short-eared Owl	o	r	o	u
Northern Saw-whet Owl				o
Common Nighthawk	o	u	o	
Chuck-wills Widow*	u	u	u	
Whip-poor-will*	u	u	r	
Chimney Swift*	u	u		
Ruby-throated Hummingbird*	o	u	o	
Belted Kingfisher	u	u	u	r
Red-headed Woodpecker*	c	c	c	u
Red-bellied Woodpecker*	c	c	c	u
Yellow-bellied Sapsucker	o		o	u
Downy Woodpecker*	c	c	c	u
Hairy Woodpecker*	u	u	u	u
Northern Flicker*	c	c	c	u
Olive-sided Flycatcher	u	r	u	
Eastern Wood Pewee*	u	u	o	
Yellow-bellied Flycatcher	r	u	r	
Acadian Flycatcher*	u	u	u	
Alder Flycatcher	u	u	u	
Willow Flycatcher*	u	u	u	
Least Flycatcher	u	u	u	
Eastern Phoebe*	u	u	u	
Great Crested Flycatcher*	u	u	u	
Western Kingbird	o	r	o	
Eastern Kingbird*	c	c	u	
Horned Lark*	u	u	u	c
Purple Martin*	c	c	c	
Tree Swallow*	c	u	c	
Northern Rough-winged Swallow	u	u	u	
Bank Swallow*	a	c	a	
Cliff Swallow	c	a	a	
Barn Swallow*	c	c	a	
Blue Jay*	c	c	c	c
American Crow*	c	c	c	c
Black-capped Chickadee*	c	c	c	c
Tufted Titmouse*	c	c	c	c
Red-breasted Nuthatch	r		r	o
White-breasted Nuthatch*	u	u	u	u
Brown Creeper	u		u	u
Carolina Wren*	o	o	o	o
Bewick's Wren	r	r	r	
House Wren*	c	c	u	



Birds	S	s	F	W
Winter Wren	o		o	o
Sedge Wren*	u	u	u	
Marsh Wren*	u	u	u	
Golden-crowned Kinglet	u		u	c
Ruby-crowned Kinglet	c		c	o
Blue-gray Gnatcatcher*	u	u		
Eastern Bluebird*	u	u	u	r
Veery	r		r	
Gray-cheeked Thrush	u		u	
Swainson's Thrush	c		c	
Hermit Thrush	o		o	r
Wood Thrush*	u	u		
American Robin*	c	c	c	o
Gray Catbird*	c	o	o	
Northern Mockingbird*	o	o	o	r
Brown Thrasher*	c	c	u	
Water Pipit	r		r	
Bohemian Waxwing				o
Cedar Waxwing*	c	u	c	o
Northern Shrike				r
Loggerhead Shrike	u	u	u	u
European Starling*	c	c	c	a
White-eyed Vireo	o	r	r	
Bell's Vireo*	c	c	u	
Solitary Vireo	o		o	
Yellow-throated Vireo*	o	u	o	
Warbling Vireo*	c	c	u	
Philadelphia Vireo	u		u	
Red-eyed Vireo*	c	c	u	
Golden-winged Warbler	o		o	
Tennessee Warbler	u		u	
Orange-crowned Warbler	u		u	
Nashville Warbler	u		u	
Northern Parula	u		u	
Yellow Warbler*	c	c	u	
Chestnut-sided Warbler	u		u	
Magnolia Warbler	u		u	
Yellow-rumped Warbler	c		u	
Black-throated Green Warbler	u		u	
Blackburnian Warbler	u		u	
Palm Warbler	u		u	
Blackpoll Warbler	u		u	
Black-and-white Warbler	u		u	
American Redstart*	c	u	u	
Prothonotary Warbler*	r	r	r	
Ovenbird*	u	u	u	
Northern Waterthrush	u		u	
Louisiana Waterthrush	o		o	
Kentucky Warbler*	o	u		
Mourning Warbler	o		o	

Birds	S	s	F	W
Common Yellowthroat*	c	c	u	r
Wilson's Warbler	u		u	
Canada Warbler	o		o	
Yellow-breasted Chat*	c	c		
Summer Tanager*	r		u	
Scarlet Tanager*	o	o	r	
Northern Cardinal*	c	c	c	c
Rose-breasted Grosbeak*	u	u	o	
Blue Grosbeak*	o	u		
Indigo Bunting*	c	c	o	
Dickcissel*	c	c		
Rufous-sided Towhee*	c	c	c	c
American Tree Sparrow	c		c	c
Chipping Sparrow*	u	u	o	
Clay-colored Sparrow	o		o	
Field Sparrow*	c	o	c	
Vesper Sparrow*	c	o	c	
Lark Sparrow*	u	u	o	
Savannah Sparrow	u	r	u	
Grasshopper Sparrow*	o	u	o	
Henslow's Sparrow	r	r	r	
Le Conte's Sparrow	o		o	r
Sharp-tailed Sparrow	r		r	
Fox Sparrow	u		o	u
Song Sparrow*	c	c	c	u
Lincoln's Sparrow	u		u	
Swamp Sparrow*	c	r	c	u
White-throated Sparrow	c		c	o
White-crowned Sparrow	c		c	o
Harris' Sparrow	o		u	u
Dark-eyed Junco	c		c	c
Lapland Longspur			o	o
Bobolink*	u	r	u	
Red-winged Blackbird*	a	c	a	a
Eastern Meadowlark*	c	u	c	o
Western Meadowlark	o	o	o	o
Yellow-headed Blackbird*	u	u	u	r
Rusty Blackbird	c		c	o
Brewer's Blackbird	u		u	r
Great-tailed Grackle	o		o	o
Common Grackle*	a	c	a	c
Brown-headed Cowbird*	a	c	a	o
Orchard Oriole*	c	c	o	
Northern Oriole*	c	c	r	
Purple Finch			u	u
Red Crossbill			r	
White-winged Crossbill			r	
Common Redpoll			r	
Pine Siskin			u	
American Goldfinch*	c	c	c	u
House Sparrow*	a	a	a	a

## Accidental Birds

These 33 additional species are considered accidentals; they have been observed on the refuge only once or twice.

Tri-colored Heron	Red Phalarope
Glossy Ibis	Black-legged Kittiwake
White Ibis	Parasitic Jaeger
Greater Flamingo	Sabine's Gull
Brant	Laughing Gull
Barnacle Goose	Common Ground Dove
Black-bellied Tree Duck	Snowy Owl
Fulvous Whistling Duck	Three-toed Woodpecker
Eurasian Wigeon	Scissor-tailed Flycatcher
Surf Scoter	Black-billed Magpie
Oldsquaw	Mountain Bluebird
Mississippi Kite	Townsend's Solitaire
Gyrfalcon	Bronzed Cowbird
Greater Prairie Chicken	Evening Grosbeak
Whooping Crane (E)	Lark Bunting
Ruff	Snow Bunting
Black-necked Stilt	

## Sighting Notes

Time in Field \_\_\_\_\_ Date \_\_\_\_\_

Weather \_\_\_\_\_

Observers \_\_\_\_\_

Species Total \_\_\_\_\_

Location \_\_\_\_\_

Reprinted with Financial Assistance from The Burroughs Audubon Society, Kansas City and the Midwest Interpretive Association.

For additional information contact: Refuge Manager, Squaw Creek National Wildlife Refuge, P.O. Box 101, Mound City, Missouri 64470. Phone 816/442-3187.



**DEPARTMENT OF THE INTERIOR  
U.S. FISH AND WILDLIFE SERVICE**

RF3-33580-2-8/83

Mammals  
of



# SQUAW CREEK

NATIONAL  
WILDLIFE  
REFUGE





**SQUAW CREEK NATIONAL WILDLIFE REFUGE** lies in northwestern Missouri near Mound City in Holt County, near the center of that broad intermediate zone where plants and animals of the grasslands meet those of the eastern deciduous forest. The refuge, established in 1935 and now containing 7,178 acres of open water, marsh, cropland, and loess-bluff woodland and dry prairie, is one link in a chain of refuges extending from the Gulf of Mexico to Canada. A principal function of the refuge is to furnish sanctuary and habitat for migrating waterfowl. In so doing, it provides a refuge also for other types of wildlife-and plants from prairie wild flowers to native mammals.

Mammals are much more difficult to see than birds because of their nocturnal habits and the dense habitats they choose. However, an interested person may see fox squirrels in the woodlands along the loess bluffs, while in the evening he may observe whitetail deer, raccoons, opossums, and coyotes along the roads, and bats hawking for insects or drinking from ponds and streams.

One of the best ways to detect the presence of mammals is to look for their tracks in snow, dust, or mud. The drama of their lives may be to read in these-how they raise their young, catch their food, and in turn may be caught for food. Signs of beaver and muskrat are easily found along creeks and drains. Field mice leave narrow winding runs under thick vegetation. Pocket gophers push up large mounds of obvious dirt along rights-of-ways and in cultivated fields. Smaller mounds and linear ridges indicate the presence of moles.

Although quiet and usually inconspicuous, mammals are important in the ecology of the refuge. Herbivores such as mice and rabbits convert plant food energy into animal protein which then becomes available to predators-coyotes, mink, hawks, and owls. Larger mammals including foxes, coyotes, raccoons, and opossums often play the role of scavenger as well as that of predator.

The following 31 mammals have been observed on the refuge since 1935 by refuge personnel and by mammalogists from educational institutions. Common and scientific names provided here follow the respective arrangements of Burt and

Grossenheider, *A Field Guide to the Mammals*, Houghton Mifflin Co. 1962; and Miller and Lellogg, *List of North American Recent Mammals*, U.S. National Museum Bulletin No. 205. Information concerning specific ranges and the life histories may be found in Schwartz and Schwartz, *The Wild Mammals of Missouri*, University of Missouri Press, 1959. Information on related mammal distribution can be obtained from *Handbook of Mammals of Kansas* by E.R. Hall, University of Kansas Museum of Natural History Misc. Publ. No. 7 (1955), and *Distribution and Taxonomy of Mammals of Nebraska* by J.K. Jones, UKMNH Publ., Vol. 16, No. 1 (1964).

**Virginia Opossum (*Didelphis marsupialis*).** A common mammal of the refuge and the only one in which the mother carries the young in an abdominal pouch. Its omnivorous diet includes everything from fruit to carrion.

**Shorttail Shrew (*Blarina brevicauda*).** This mouse-sized animal is relatively common in dense vegetation where it uses some of the same trails and runs as mice. It feeds on any animal it can subdue, including insects and mice.

**Least Shrew (*Cryptotis parva*).** A tiny mammal whose weight approximates that of a penny. It is found infrequently in old fields and grassy areas, and often around or under rocks, boards, and piles of grass. Its diet is similar to the shorttail shrew.

**Eastern Mole (*Scalopus aquaticus*).** An abundant insectivore that spends most of its life underground burrowing for insects, worms, etc. Molehills may be confused with gopher mounds, but the latter are larger and are carefully and tightly plugged with dirt.

**Little Brown Myotis (*Myotis lucifugus*).** This bat has not been found on the refuge, but one was caught in nearby Mound City. Little brown myotis bats develop nursery colonies in buildings during the summer, but spend the winter in mines and caves.

**Red Bat (*Lasiurus borealis*).** One of the more handsome North American bats. It is swift-flying, often seen late in the evening hawking near a woodlot or group of trees. Females give birth to three or four young in a tree and are often preyed upon by blue jays and small hawks.

**Eastern Cottontail (*Sylvilagus floridanus*).** Found throughout the refuge, this prolific animal is an important prey of the larger predators like the coyote, great horned owl, and hawks.

**Woodchuck (*Marmota monax*).** An important mammal because of its dens which serve as shelters for other mammals. This species has declined drastically in numbers in recent years.

**Franklin Ground Squirrel (*Citellus franklinii*).** This ground squirrel is found in Missouri only in prairie regions north of the Missouri River. It is occasionally seen sitting in the short vegetation along refuge roads. It hibernates from early autumn to mid-spring.

**Eastern Fox Squirrel (*Sciurus niger*).** A larger squirrel, often found in fence rows and isolated clusters of trees. Leaf nests constructed in late spring and early summer become easily visible in the fall and winter. The black phase is occasionally observed on the refuge.

**Plains Pocket Gopher (*Geomys bursarius*).** Colonies of this burrowing mammal are found in the refuge's loess soils, and often in fields of deep-rooted legumes.

**Beaver (*Castor canadensis*).** The first were seen on the refuge in 1941. They have since become a common animal of the waterways. Beaver cuttings, including those of cottonwoods and willows, maybe seen in many parts of the refuge. Lodges are seldom constructed, homes are dug into ditch banks instead.

**Western Harvest Mouse (*Reithrodontomys megalotis*).** A small seed-eating mouse that, judging from the number of skeletons found in pellets cast by the saw-whet owls, may be more common than trapping records indicate.

**Deer Mouse (*Peromyscus maniculatus*).** An abundant mouse of the grasslands throughout the refuge. Although a seed eater, it takes quantities of insects. It is food for many predators.

**White-footed Mouse (*Peromyscus leucopus*).** A common mouse quite similar to the deer mouse, but restricted to woodlots and old fields being invaded by trees.

**Southern Bog Lemming (*Synaptomys cooperi*).** The only lemming of Missouri. It looks like the prairie vole and occupies a more moist habitat. Few have been caught in traps, but the occurrence of their bones in pellets of long-eared owls indicates that they may be common.

**Prairie Vole (*Microtus ochrogaster*).** An abundant short-tailed mouse found in grass on the loess bluffs as well as in marsh areas. An important prey species of nearly all predators.

**Muskrat (*Ondatra zibethicus*).** The largest "mouse" and the most important furbearer of the refuge. Its burrows and holes often cause severe damage to dikes and levees. Muskrats build lodges in water each fall and spend the winter in them.

**Norway Rat (*Rattus norvegicus*).** Like the house mouse, the Norway rat was introduced to North America from Asia via Europe. Its preference for the habitat of man causes extensive damage to buildings and grain.



**House Mouse (*Mus musculus*).** Another alien invader, the house mouse is common in the area, and most people are very familiar with this pest. Those living in fields are often brighter colored than those in buildings and develop deep brown and red-brown pelages.

**Meadow Jumping Mouse (*Zapus hudsonius*).** Only one record for the refuge exists, indicating that it is one of the rarest mammals of the refuge. Its long tail, large hind feet, and ability to hop cause it to be confused with kangaroo mice and kangaroo rats which are not found in Missouri. It hibernates.

**Coyote (*Canis latrans*).** Now the most common of the "wild dogs" of the refuge. It is often seen in early morning on refuge roads. It is an omnivorous opportunist eating everything that is available. This makes the coyote a very successful predator.

**Red Fox (*Vulpes fulva*).** A grassland species that preys heavily on mice. Its numbers are inversely related to those of the coyote. When coyotes are numerous, red fox are uncommon, and vice versa.

**Gray Fox (*Urocyon cinereoargenteus*).** A rare denizen of woodlands seldom seen on the refuge. Like the red fox, it is omnivorous.

**Raccoon (*Procyon lotor*).** Abundant throughout the refuge. Omnivorous, it can be a serious predator of nesting birds.

**Longtail Weasel (*Mustela frenata*).** Formerly common; now rarely seen. No apparent reason for the decline.

**Mink (*Mustela vison*).** A large member of the weasel family, it is the most important predator of the muskrat and is relatively common.

**Badger (*Taxidea taxus*).** The largest weasel of the area. These are prairie mammals that live on mice and ground squirrels, but are rare on the refuge.

**Spotted Skunk (*Spilogale putorius*).** Formerly common; now rarely observed.

**Striped Skunk (*Mephitis mephitis*).** Common in the more brushy areas. Skunks are slow and methodical and usually take much provocation before spraying.

**Whitetail Deer (*Odocoileus virginianus*).** Most deer had disappeared from northwestern Missouri by 1910. The first deer reappeared on the refuge in 1946, and the deer now number between 800 and 1,000.

The following 16 mammals may occur in the nearby counties in Kansas as well as Missouri:

**Masked Shrew (*Sorex cinereus*)**  
**Silver-haired Bat (*Lasiomycteris noctivagans*)**  
**Eastern Pipistrel (*Pipistrellus subflavus*)**  
**Big Brown Bat (*Eptesicus fuscus*)**  
**Hoary Bat (*Lasiurus cinereus*)**  
**Evening Bat (*Nycticeius humeralis*)**  
**Whitetail Jackrabbit (*Lepus townsendii*)**  
**Thirteen-lined Ground Squirrel (*Citellus tridecemlineatus*)**  
**Southern Flying Squirrel (*Glaucomys volans*)**  
**Plains Pocket Mouse (*Perognathus flavescens*)**  
**Plains Harvest Mouse (*Reithrodontomys montanus*)**  
**Meadow Vole (*Microtus pennsylvanicus*)**  
**Pine Vole (*Pitymys pinetorum*)**  
**Mountain Lion (*Felis concolor*)**  
**Bobcat (*Lynx rufus*)**  
**Mule Deer (*Odocoileus hemionus*)**

For further information, contact the:

**Refuge Manager**  
**Squaw Creek National Wildlife Refuge**  
**Box 101**  
**Mound City, Missouri 64470**  
**Telephone: 816/442-3187**

Squaw Creek National Wildlife Refuge is one of a system of refuges administered by the U.S. Fish and Wildlife Service and is dedicated to the preservation and conservation of wildlife. The financial base for this system was established in 1934 through the passage of the Migratory Bird Hunting Stamp Act. This Act requires waterfowl hunters to purchase an annual migratory bird or "duck stamp." Funds collected from duck stamp sales have been used to purchase numerous refuges that provide habitats necessary to sustain a variety of wildlife for both hunters and non hunters to enjoy.

**U.S. DEPARTMENT OF THE INTERIOR  
FISH AND WILDLIFE SERVICE**



This guide was printed with funding provided by the Midwest Interpretive Association. A not-for-profit corporation supporting educational activities on the Squaw Creek National Wildlife Refuge.



## Calendar of Events

**Squaw Creek  
National Wildlife Refuge  
P.O. Box 101  
Mound City, Missouri**

Wildlife measures a year not in days, weeks and months, but in the greening of the trees, the arrival of the geese, the birth of young, and a million other natural events. Some of the significant natural events occurring on the refuge are listed below.

**January 1—February 1:** Most prominent species—pheasants, hawks, coyotes and a large wintering deer herd. Dress warmly, and be prepared to walk as the roads may be closed by snow drifts.

**February 1—April 1:** Northward migration of waterfowl; best time of year to observe greatest variety of waterfowl in bright plumage. Some years the birds bypass the refuge and there are no large concentrations of waterfowl. Beaver cuttings seen along refuge creeks.

**Mid-March—May 1:** Spring, red bud time—a wonderful time for a hike in the loess hills to observe wild flowers, passerine birds.

**April 1—December 31:** Refuge open to public fishing. No special permit required, just state license. State laws govern methods and limits.

**May 1—May 20:** Warbler migration.

**Late July—Early August:** American lotus (water lily) in bloom on refuge impoundments. Deer with fawns may be seen along the tour routes.

**Mid-August—Mid-September—**Shorebirds on mudflats around refuge impoundments.

**October 1—December 1:** Fall waterfowl migration in full swing, concentrations of up to 200,000 snow geese and 250,000 ducks common.

**Mid-November—January 1:** One of the largest concentrations of bald eagles in United States may be seen here. More than 300 birds peak population.

Restrooms and picnic tables available at headquarters, five miles south of Mound City, Highway 159 exit off I-29.

Ten miles of auto touring roads provide ready access to refuge (or bring your bicycle).







**UNITED STATES DEPARTMENT OF THE INTERIOR  
FISH & WILDLIFE SERVICE**



# Squaw Creek National Wildlife Refuge

Mound City, Missouri

## LEGEND

-  REFUGE BOUNDARY
-  WILD GOOSE TOUR LOOP
-  POOL
-  OBSERVATION TOWER

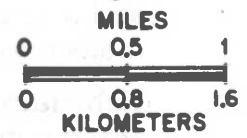
OMAHA, NE  
100 Miles

EXIT 84

MOUND CITY

118

29



BIGELOW

Squaw Creek  
BALLARD MARSH

BLUFF POOL

SNOW GOOSE POOL

PINTAIL POOL

EAGLE POOL

PELICAN POOL

EXIT 79  
ST. JOSEPH  
40 Miles

REFUGE HEADQUARTERS

159

RULO, NE

BIG LAKE STATE PARK

## VICINITY MAP





# SQUAW CREEK

National Wildlife Refuge  
Mound City, Missouri



For further information, contact the Refuge Manager, Squaw Creek National Wildlife Refuge, P.O. Box 101, Mound City, Missouri 64470.

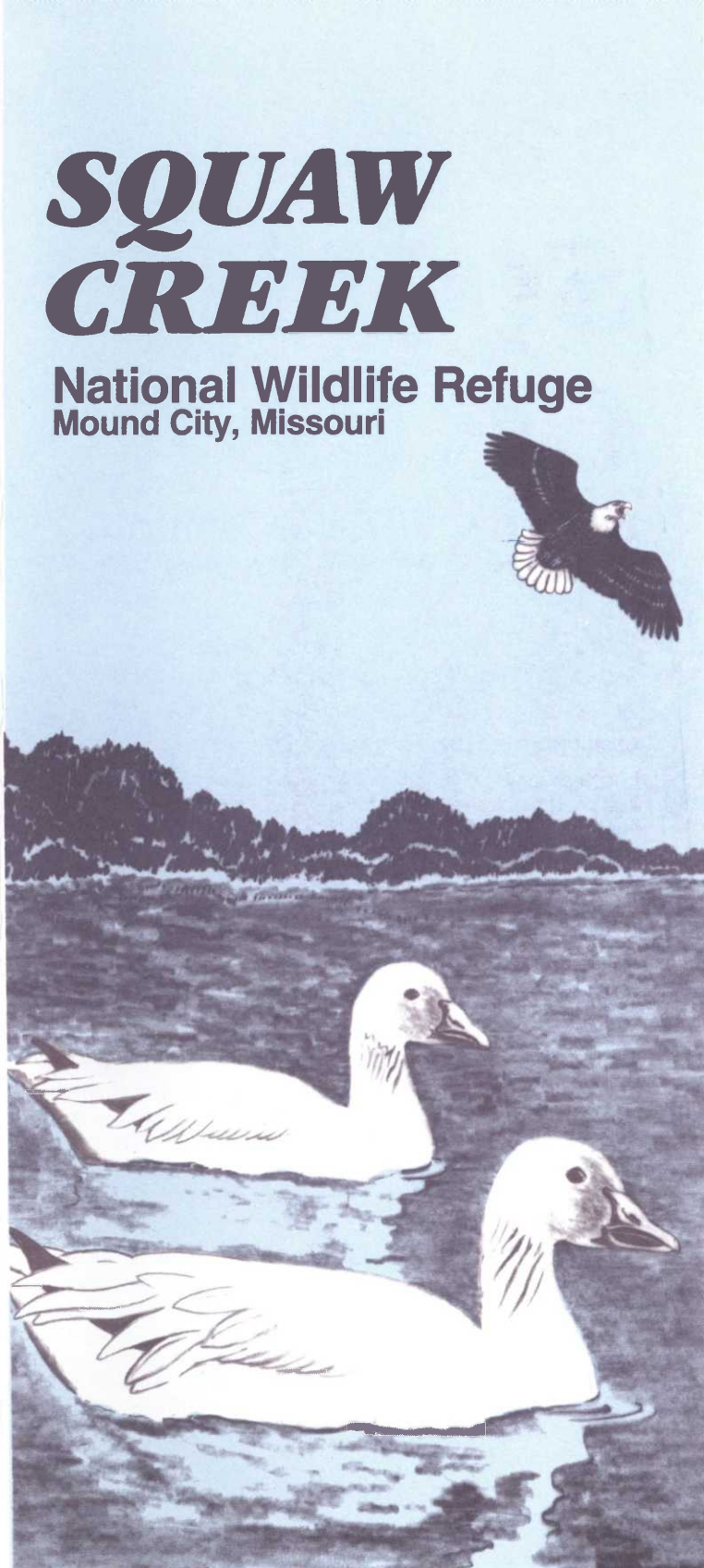
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**U.S. FISH AND WILDLIFE SERVICE**  
Department of the Interior



RF-3-33560-1-5/87





# SQUAW CREEK

National Wildlife Refuge  
Mound City, Missouri

## WINGBEATS FROM THE NORTH

For thousands of years, time in the Missouri River Basin has been measured by the twice annual migration of waterfowl. Each spring and fall, northwestern Missouri was inundated by a noisy confusion of ducks and geese. From northern Canada and the prairie pothole country, they flocked into the marshes and backwaters of the wild Missouri.

However, far-reaching changes have transformed the valley in the past 150 years. Oxbow lakes and marshes and the natural, sandbar-studded Missouri River channel have largely disappeared as a result of marshland drainage and the deepening and straightening of the channel. To partially meet the needs of wildlife in a changed, less hospitable environment, Squaw Creek Refuge was established in 1935. Here, amidst 6,919 acres of manmade marshes, waterfowl and other wildlife can still find critically needed food, water and shelter.

## THE BLUFFS

Overlooking the refuge from the east are the loess bluffs, a geologic formation of wind-deposited soil from the past glacial period. On top of the bluffs are some of the last remnants of the once vast native prairie that dominated the area prior to the influx of immigrants during the past three centuries. Against the backdrop of the bluffs, hundreds of thousands of migratory birds provide a stirring spectacle, just as they did for Lewis and Clark and the Indians before them.



Photo by Don Bradley — St. Joseph, Missouri

## INVITATION TO SQUAW CREEK

Squaw Creek Refuge furnishes the public with an excellent opportunity to enjoy wildlife in its natural setting. Refuge roads and foot trails provide access to many wildlife observation areas. Viewing towers and wayside exhibits located at key points, are excellent vantage points for viewing and photographing wildlife. From a high point on the Loess Bluff Trail, hikers can view the Missouri River floodplain and much of the refuge. Parts of Kansas and Nebraska can also be seen on a clear day.

Squaw Creek Refuge is open daily from sunrise to sunset, although some roads may be closed during wet weather. In addition to the spectacular viewing of waterfowl, eagles and deer, seasonal activities such as fishing and photography can be enjoyed by refuge visitors.

No camping is permitted on the refuge; however, camping facilities are available at Big Lake State Park, 8 miles (13 kilometers) west of the refuge. Restroom facilities are available at the Refuge Headquarters complex. Office hours are Monday through Friday from 7:30 a.m. to 4:00 p.m.





### REFUGE MANAGEMENT

The primary objective of the refuge is to provide habitat for migratory birds and other species of wildlife. The refuge uses a variety of management practices to meet the needs of wildlife. Marsh and water management provide feeding and resting areas for migratory birds. Farming, haying and mowing – as well as controlled burning provide the diversity of habitat types needed by the many different types of wildlife.

### FUR AND FEATHERS

Migratory birds stop to rest and feed at Squaw Creek Refuge during their long spring and fall migrations. In September, pelicans are among the first heralds of fall. Great blue herons wade in shallow ponds, fishing for their dinner. Sandpipers running along the water's edge leave fragile patterns in the mud and are startled into flight by a swiftly passing shadow.

Other early migrants, pintail, gadwalls, and teal are soon joined by mallards, snow geese, and Canada geese. At peak migration times, 300,000 geese and as many as 200,000 ducks feed and rest in the marshes.

In the late fall and early winter bald eagles migrate into the refuge to feed on the sick and injured waterfowl. As many as 300 of these birds, the American national symbol, may be found here at the peak and a few may spend the winter.

The refuge is rich in its variety of wildlife. It is home for 33 kinds of mammals, 35 species of reptiles and amphibians, and 301 species of birds. Beaver and muskrat find food and cover in the marsh. Coyotes hunt the uplands and whitetail deer seek shelter in willow thickets and groves of cottonwood trees. Fields of prairie grass hide mice and voles – the prey of many species of hawks and owls.

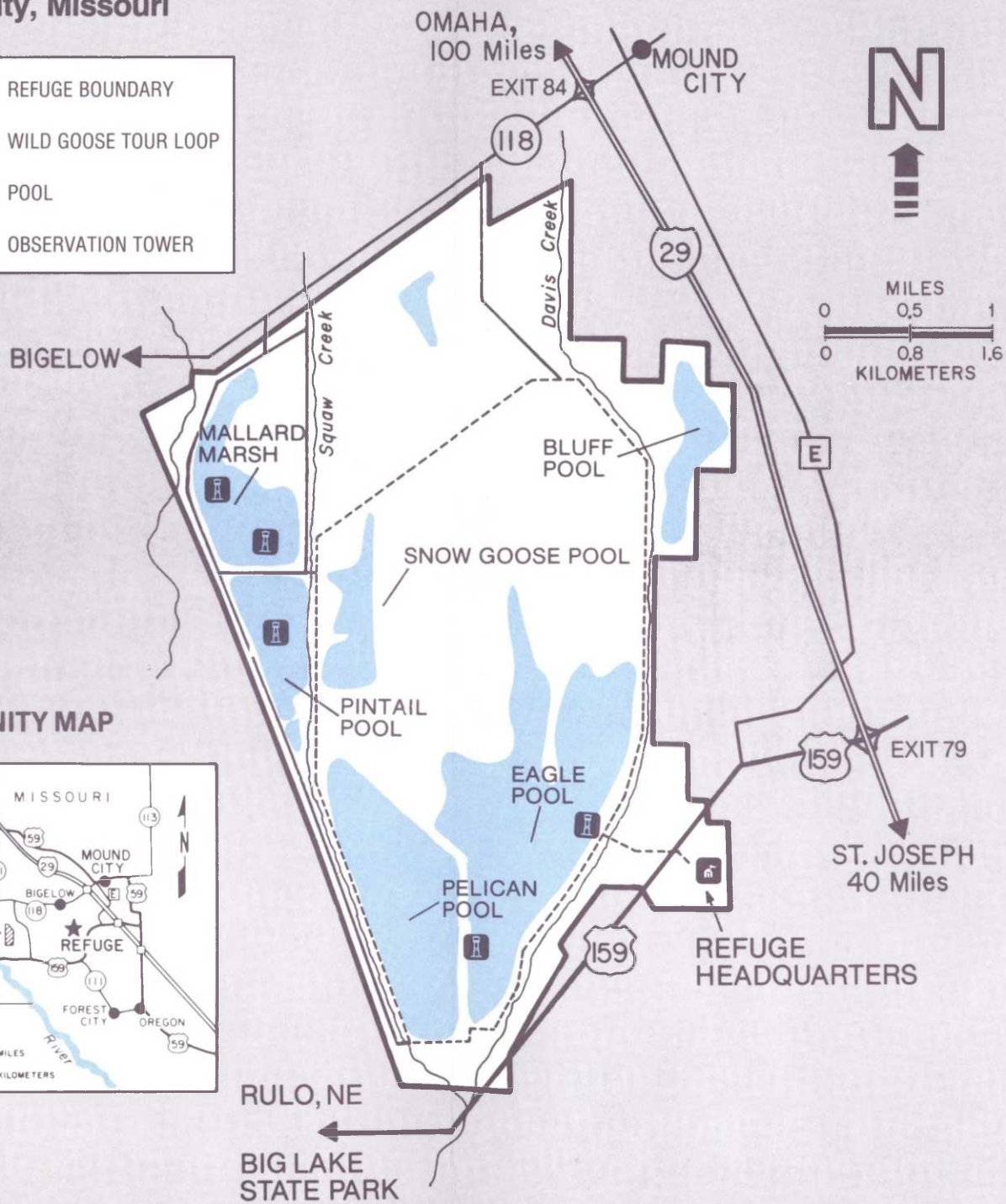
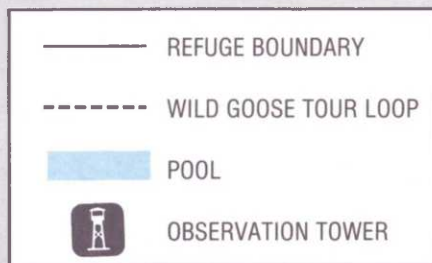
"These first cold nights set the birds a-wing on long, strong flights . . ." — Olaus Murie

"Snow Geese Take Wing" Photo by Mary Tremaine — Omaha, Nebraska



# SQUAW CREEK

National Wildlife Refuge  
Mound City, Missouri



## VICINITY MAP

