Aquatic Plant and Waterfowl Habitat Survey, 1988

Stillwater Wildlife Management Area and Vicinity

Fallon, NV 89406

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Introduction

This report summarizes the 1988 aquatic plant survey on the Stillwater Wildlife Management Area (WMA) and Lahontan Valley wetlands. Aquatic plant surveys have been conducted on the Stillwater WMA in most years since 1959. The objectives of these surveys are to: 1) determine the distribution, relative abundance, and species composition of submerged aquatic plants in management units, 2) document trends in aquatic vegetation and habitat conditions, and 3) aid the wildlife manager to more effectively manage water for the production of aquatic vegetation in the impoundments.

1988 was the second drought year in a row (70% water year), and wetlands in Lahontan Valley were severely reduced in size (Table 1). Summer temperatures were above normal, and precipitation was negligible. This year, aquatic plant surveys were conducted on all wetlands that were included in the 1987 survey and held water in 1988 as well; these included Stillwater WMA, Carson Lake, Canvasback Club, and several other natural and manmade wetlands in Lahontan Valley (Fig. 1).

Methods

Wetlands were surveyed from August 10 to September 6, 1988. Surveys on Stillwater WMA, Carson Lake Pasture, and the Canvasback Club were conducted using methods consistent with those used in 1987 and previous surveys. In addition, the volume of submerged vegetation was measured in impoundments that contained appreciable amounts of submerged vegetation. No attempt was made to quantify the emergent vegetation (e.g, bulrush, cattail) that occurred on wetlands.

Sampling transects were located in approximately the same locations that were used in 1987, but greater emphasis was given this year to sampling within vegetated portions of ponds. Each transect consisted of 5 one-

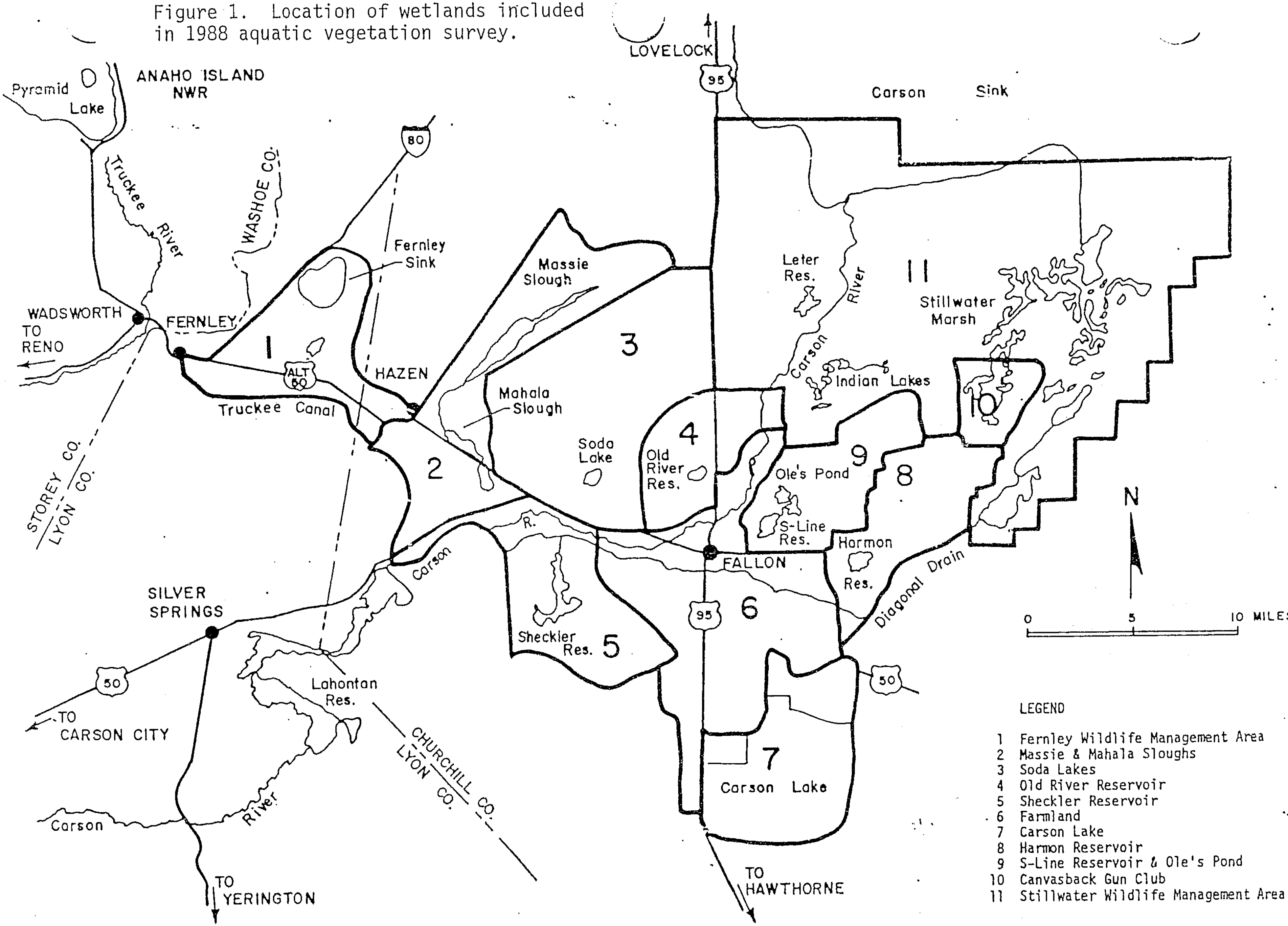
Table 1. Surface Acres of water in Lahontan Valley Wetlands, 1986-1988

Surveys flown 9-5-86, 8-24 to 8-31, 1987, and 9-7 and 9-8, 1988

Wetland Map		1986	1987	1988
Stillwater SW				
Ole's Pond		140	432	18
Twin Lakes		50	68	43
Ole's slough		203	34	0
Upper Lake		64	85	97
Likes Lake		76	91	55
Papoose		147	155	120
Big Indian		190	217	123
Serpa		43	71	21
Vaughn Slough		0	32	0
Misc. Lakes		28	70	75
Estimated flooded, not mapped		3100	0	0
	subtotal	4041	1255	552
Stillwater SE				
Indian Wetlands		361	252	153
East Lake		89	85	0
Cottonwood Lake		103	108	36
West Indian Wetlands		88	90	0
Canvasback Club		3000	2384	3294
	subtotal	3641	2919	3483
Carson Lake SW				
Sprig Pond		2592	2185	1746
Big Water		947	563	182
York Unit		674	164	0
Islands Unit		1318	664	0
Sump		282	0	0
Pasture NE		863	332	634
South pasture		1689	699	586
	subtotal	8365	4607	3148
Carson Lake NW				
S-Line Reservoir		473	460	362
Harmon Reservoir		1332	1060	668
	subtotal	1805	1520	1030
Two tips				
Fernley WMA		367	610	253
Fallon NW				
Sheckler Reservoir		1650	1650	1106
Soda Lake				
Desert Gun Club		395	1215	57
Workman Ponds		77	75	50
Mahala Slough		20	803	142
Soda Lake		425	394	367
Little Soda Lake		20	19	16
Lucas Pond		49	64	42
Upper Workmen Ponds		414	66	82
Soule Ponds		347	119	70
	subtotal	1747	2755	826
Fallon SE				
All Pasture		4300	1017	942

		1986	1987	1988
Stillwater NW				
Leter Reservoir		289	200	107
Old River Reservoir		200	200	200
Foxtail Lake				
Foxtail/Doghead				
East Alkali				
Goose Lake				
Division Pond				
Lead Lake				
Still Pt. Res.				
	subtotal	19000	7660	3540
Canvasback Club				650
TOTAL		45405	24393	15837

Figure 1. Location of wetlands included in 1988 aquatic vegetation survey.



LAHONTAN VALLEY STUDY UNITS

square-meter sample sites, spaced equidistantly at 30-40 yard intervals along a linear transect. At each sample site, a 1 m^2 PVC grid was set on the surface, and the following measurements were made: percent vegetated and species composition within the grid, water visibility (turbidity), and water depth. Where volume measurements were made, a volumetric species composition was estimated to the nearest 5%. Seed production was subjectively rated (e.g., good, fair, poor) at sites that contained vegetation.

Measurements of specific conductance (in microsiemens/cm at 25°C) (Hem 1970) were obtained using a digital, temperature-compensating, conductivity meter at the third sample site in each transect. To save time in the field, water samples were collected in plastic botles thoroughly rinsed with sample water and measured for specific conductance when I returned to the office later in the day. Standards were used to calibrate the meter several times during each measurement session. Water turbidity was measured by submerging a 4-inch Secchi disc until the black and white quadrants were no longer distinguishable (Fig. 2).

At the second and fourth sample site in each transect, the volume of submerged vegetation was measured by using a set of sampling tongs (Fig. 3) (Schwabenland 1965, Barney 1965) that retrieved the vegetation growing from one square foot of lake bottom. All vegetation collected in the tongs and emerging from the mesh was rinsed and wrung out to remove excess soil and water, but not compressed hard enough to squeeze out the plant juices. The volume of the sample was measured to the nearest 10 ml by displacement in a 1000 ml graduated cylinder (Fig. 4). The tonnage of vegetation produced was calculated as: (# acres vegetated) X (average weight of vegetation per square foot [in kg]) X (# square feet per acre = 43,560) X (1.102

Figure 2. Using a Secchi disc to measure water turbidity.

Figure 3. Sampling submerged vegetation using tongs

Figure 4. Measuring the volume of submerged vegetation by displacement in a graduated cylinder.

[conversion factor to English tons]) = number of English tons of vegetation produced.

An airboat was used to survey impoundments where there was adequate water and a suitable boat launch. The airboat was stopped at each sample site by anchoring it with a metal rod stuck into the mud, or by letting the boat drift to a stop. In areas not suitable for use by an airboat, I canoed or walked to sample sites. Samples were made in a consistent manner at each sample site. Water levels were recorded from the staff gauge on the day that each impoundment was surveyed, and the number of surface acres of water was calculated from records relating staff gauge readings to surface acres. Transects and sample sites were plotted on a map of each impoundment, and the approximate distribution of plants, by species, was drawn on the map. Aerial photographs of wetlands were taken on 1 September from a height of about 5,000 to 6,000 feet above ground level and provided an additional means to map the distribution of aquatic vegetation on wetlands. The number of vegetated acres was determined by multiplying the number of surface acres at full capacity by the percentage of total area vegetated at time of survey, but values are only approximate. Transect data and summaries for each wetland surveyed are included in an Appendix.

Monthly readings for staff gauge, conductivity, and inflow and outflow measurements for each impoundment at Stillwater were graphed using Sigmaplot software. The number of acres of submerged vegetation in each impoundment, each year since 1981, was also graphed.

Results

A summary of the aquatic plant survey is included in Table 2. A list of the common and scientific names of plants found during the survey is included in Table 3.

Table 2. Summary of aquatic plant survey in Lahontan Valley wetlands, 1988.

Wetland	Date Surveyed	Surface Acres at Survey Time	% Vegetated	Acres Vegetated	Major Species Present	Seed Production	Average Depth (in)	Average Turbidity (in)	Average Conductance (uS)	Estimated Plant Production (tons)	Average Volume of veg/sample (ml)
Stillwater Point Reservoir	8-10	1300	?	?	Sago pondweed Western pondweed	poor	26.87	3.23	2596	?	0.92
Lower Foxtail/ Doghead	8-17	1150	52.7	678	Sago pondweed	good	22.83	10.27	7273	7547	231.88
East Alkali #1	8-22	590	54.1	314	Sago pondweed Wigeongrass	good	26.50	14.41	8909	2982	197.81
Lead Lake	8-10	?	0	0	none	none	28.25	8.19	7070	0	0
Indian Lakes	8-24	459	<1	<1	Sago pondweed Horned Pondweed Curly pondweed Coontail Duckweed Western pondweed	poor			1124	0	0
Sprig Pond	8-18	1746	0	0	none	none	8.44	3.06	3640	0	0
Canvasback Club	8-11, 8-16	?	0	0	none	none	35.14	7.71	2502	0	0
Fernley WMA	8-23	30	0	0	none	none			24,500	0	0
Desert Gun Club	8-23	57	0	0	none	none		2.5	4363	0	0
Harmon Reservoir	9-1	320	0	0	traces	none	29.40	12.40	513	0	0
Sheckler Reservoir	8-25	1100	0	0	none	none	23.75	6.5	545	0	0
S-Line Reservoir	9-1	444	100 (sparsely)	444	Curly pondweed	poor	37.80	7.88	420	224	10.5
Old River Reservoir	9-6	195	78.4	153	Curly pondweed Muskgrass Horned pondweed Eleocharis Marsilea	poor	31.76	8.48	404	209	28.5
Leter Reservoir	8-24	459	<1	<1	Sago pondweed	poor			744		
Soda Lake	8-23	367	<5	<18	Wigeongrass				28,500		

Table 3. Common and scientific names[1] of aquatic plants found during vegetation surveys in Stillwater Wildlife Management Area and nearby Lahontan Valley wetlands, August and September, 1988.

Common Name	Scientific Name
Sago pondweed	*Potamogeton pectinatus*
Western pondweed	*Potamogeton latifolius*
Curly pondweed	*Potamogeton crispus*
American pondweed	*Potamogeton nodosus*
Horned Pondweed	*Potamogeton palustris*
Widgeongrass	*Ruppia maritima*
Roundleaf Bacopa	*Bacopa rotundifolia*
Marsilea	*Marsilea* spp.
Duckweed	*Lemna* spp.
Water-velvets	*Azolla* spp.
Coontail	*Ceratophyllum demersum*
Dwarf Spikerush	*Eleocharis parvula*
Arrowhead	*Sagittaria* sp.
Muskgrass	*Chara* sp.

[1] Source: Hotchkiss, N. 1967. Underwater and floating-leaved plants of the United States and Canada. U. S. Dept. Interior. Resource Publication 44. 124 pp.

STILLWATER WILDLIFE MANAGEMENT AREA

Most submerged vegetation occurred in the refuge ponds, but there were scattered, sparse stands of submerged vegetation in the Indian Lakes area. Ponds not containing submerged vegetation were sampled for water characteristics only.

Stillwater Point Reservoir

Some growth of sago pondweed was noted in the reservoir 1-2 weeks before vegetation surveys began. However, the water level in the reservoir rose substantially just prior to our survey of the pond on August 10, 1988. Consequently, submerged vegetation that was present in the pond before that time was flooded, and not visible in the highly turbid water. Water depth and turbidity apparently inhibited further growth of sago, and little was noted during the survey and later in the season. Thirty samples were taken in the reservoir (Fig. 5). The average water depth was 27 inches and turbidity averaged 3 inches. Conductivity averaged 2600 mS, but ranged from 1440 mS near the inlet to 3650 mS at the north end.

Lower Foxtail and Doghead Lakes

Lower Foxtail and Doghead Lakes were surveyed by airboat on August 17, 1988. Because Lower Foxtail and Doghead Lake are connected and receive the same water, they were sampled as one unit. Sixty sample sites were established along 12 transects (Fig. 6). Sago pondweed was the only species present in Lower Foxtail and Doghead Lakes; it covered about 53% of the lakes (Figs. 7 and 8). Seed production by sago pondweed was good throughout the pond. Based on volume measurements, an estimated 7,547 tons of sago pondweed were produced in Foxtail. There was much uprooted sago in Foxtail, indicating that birds had grazed heavily on sago before the survey.

Conductivity ranged from 2300 mS where "fresh" water entered Foxtail

Figure 5. Location of sampling sites in Stillwater Point Reservoir, 1988.

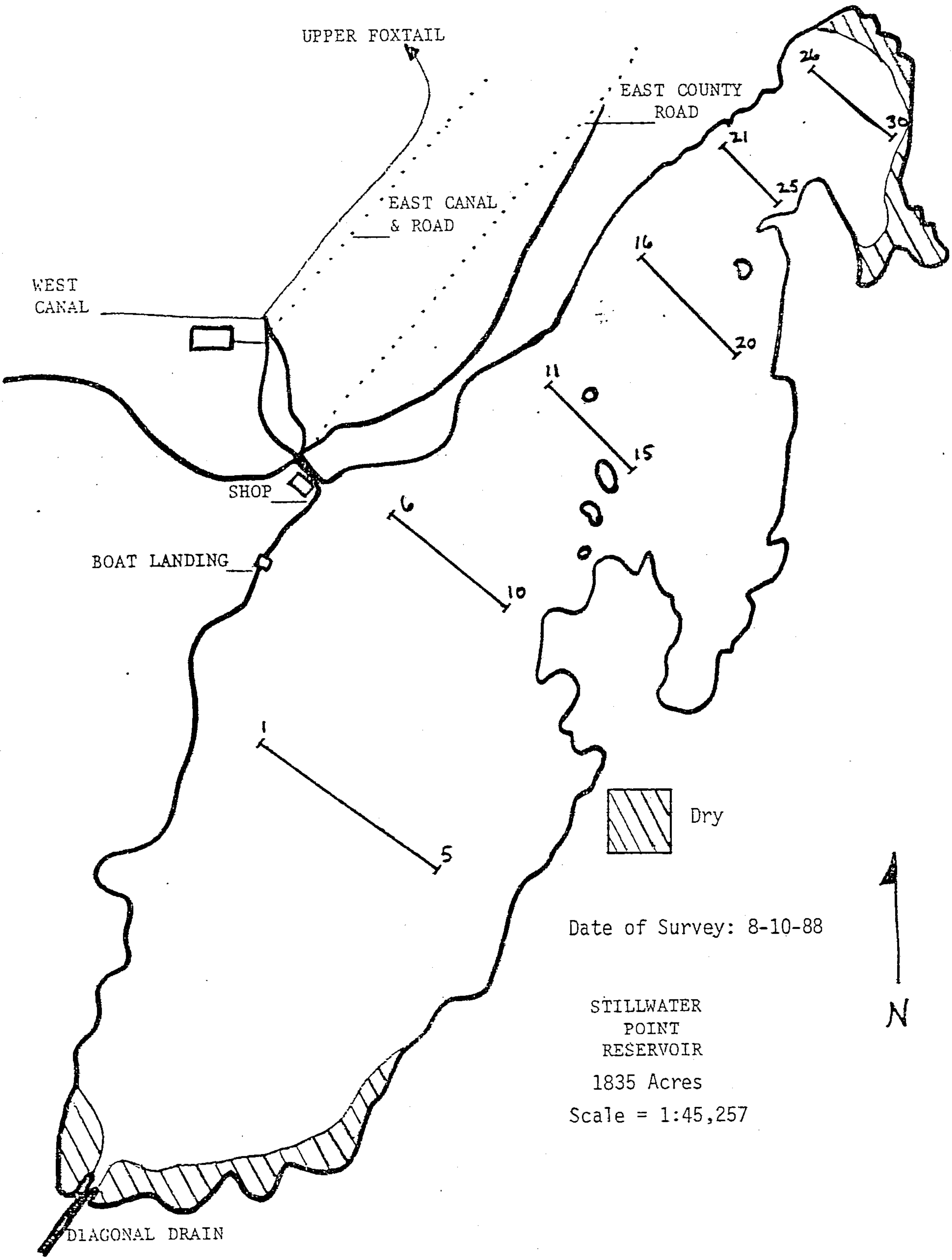
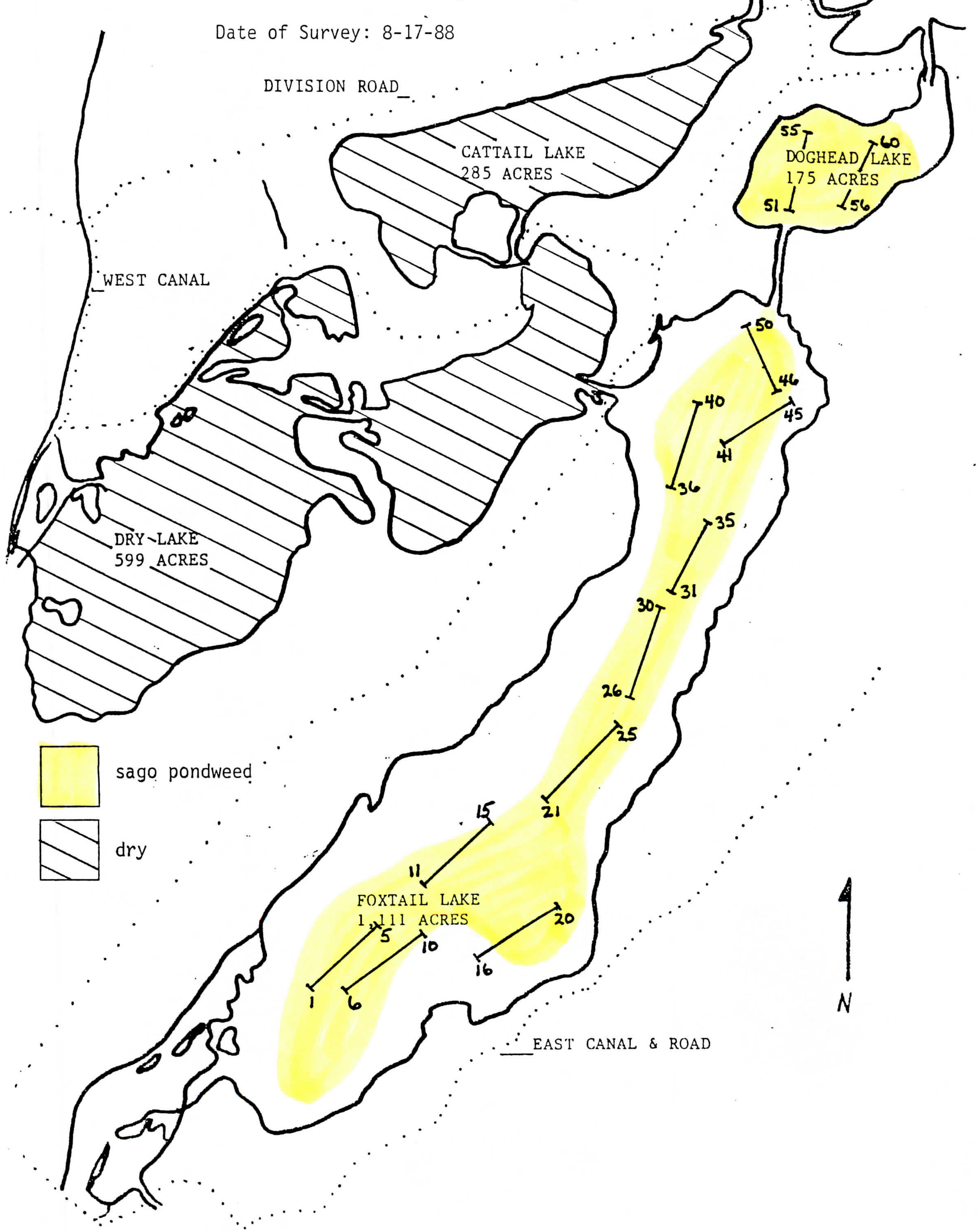


Figure 6. Location of sample sites and submerged vegetation in Lower Foxtail and Doghead Lakes, 1988.



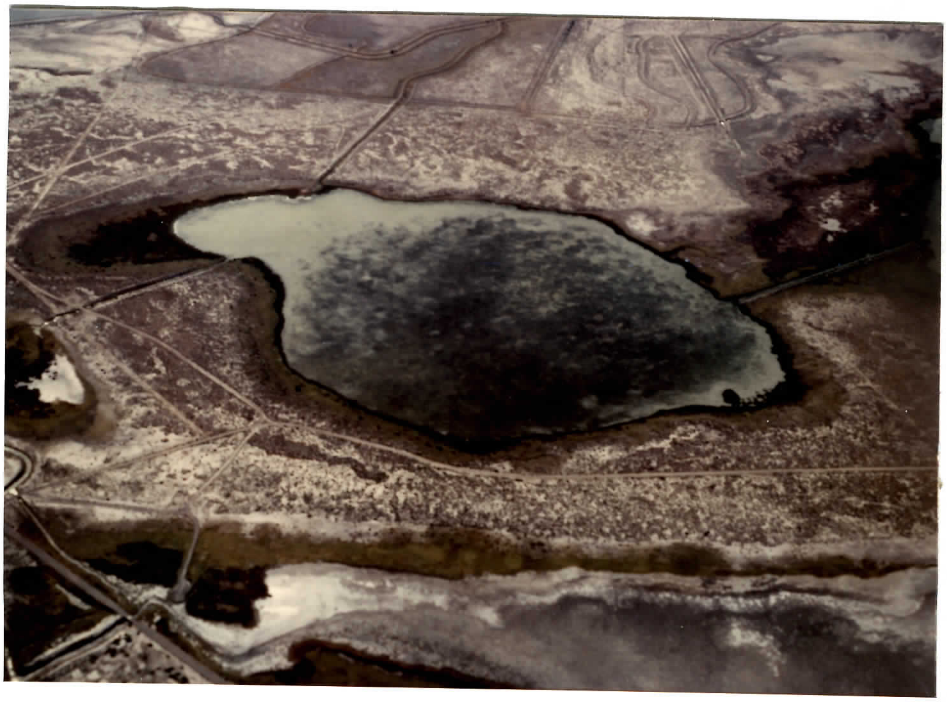


Figure 7. Aerial photograph showing distribution of sago pondweed in Doghead Lake, 1988.

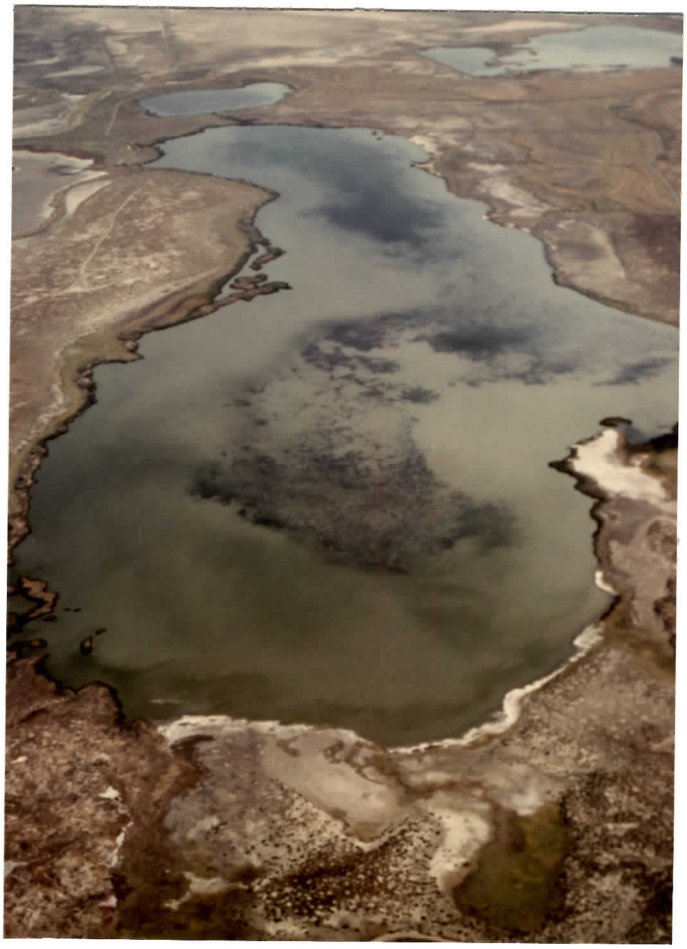


Figure 8. Aerial photograph showing distribution of sago pondweed in Lower Foxtail, 1988.

to 17,100 mS in Doghead Lake. Turbidity averaged 10 inches throughout these impoundments, but water was noticeable clearer in the northern portion of Foxtail and in Doghead Lake (up to 19 in. visibility). There was a noticable absence of carp from these areas, which may have been related to the high salinity there ($\bar{x}$ = 9400 mS in clear, fish-lacking waters vs. 4300 mS in more turbid, carp-infested waters). The upper tolerance limit of specific conductance for Common Carp is about 10,000 - 14,000 uS (USDI 1988). The average water depth in the two impoundments was 23 in.

East Alkali Lake #1

East Alkali #1 was surveyed by airboat on August 22, 1988. Forty sample sites were used along 8 transects (Fig. 9). This impoundment was an excellent producer of sago pondweed; it was 54% vegetated and produced 314 acres of sago (Fig. 10). An estimated 2982 tons of submerged vegetation was produced. Seed production was good. Wigeongrass occurred in the western portion of East Alkali, where salinity was higher (11,000 - 12,000 mS) and water less turbid (possibly related to absence of carp there). Specific conductance varied from about 6540 mS near the inlet to 11,600 mS near the outlet. Average water depth was 27 inches and turbidity averaged 14 in.

Upper Foxtail Lake

Upper Foxtail was dry during the summer and produced no submerged vegetation. However, it produced lush growth of weed seeds (Rumex spp., etc) and provided excellent feeding habitat for waterfowl during fall. It was wet at the start of spring, dried up during summer, and was reflooded in September.

Lead Lake

Lead Lake was the only wet pond on the open hunting area at Stillwater WMA. There was no submerged vegetation in Lead Lake. Water characteristics

Figure 9. Location of submerged vegetation and sample sites in East Alkali #1, 1988.

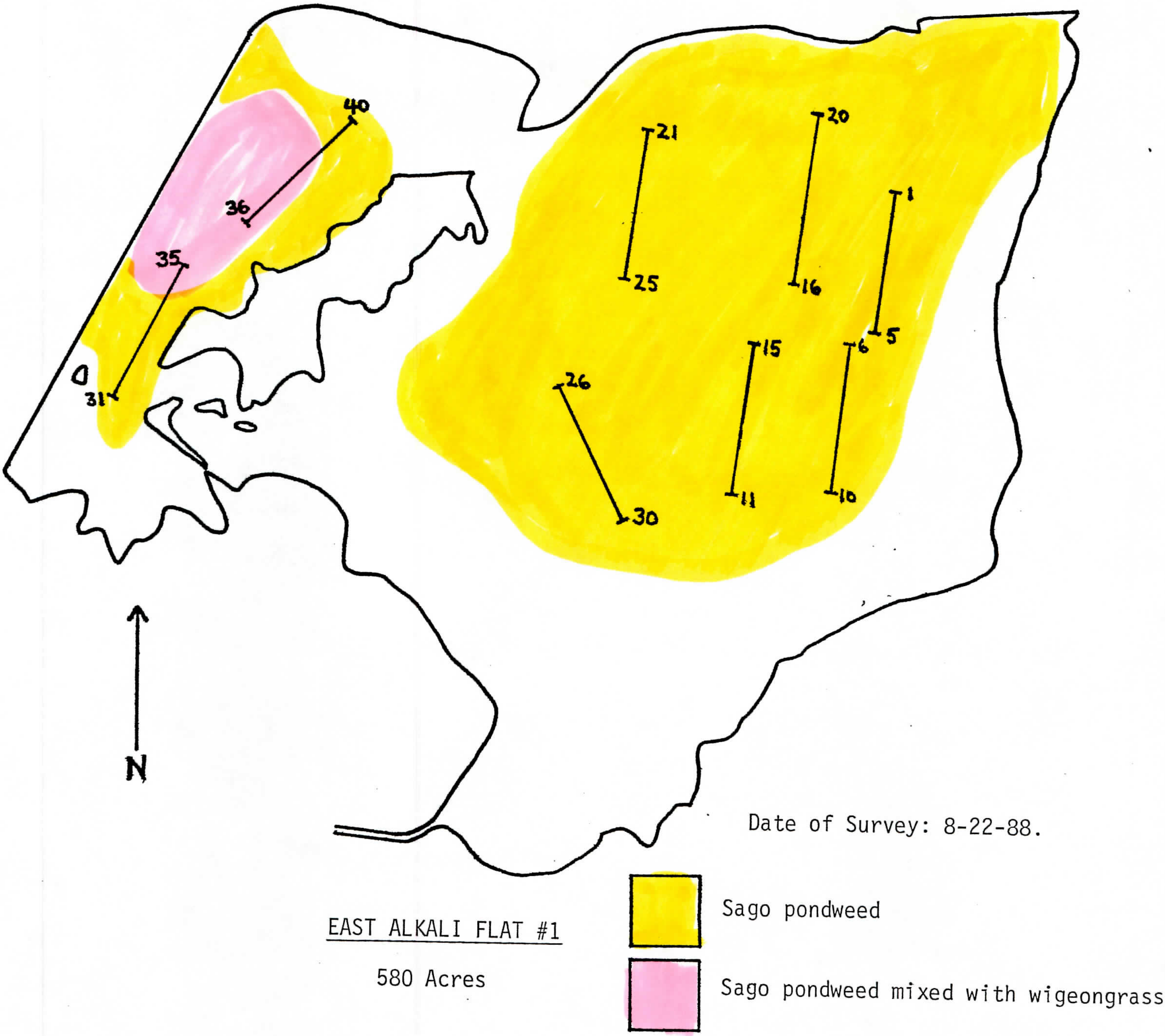


Figure 10. Aerial photograph of East Alkali #1 showing location of submerged vegetation, 1988.

were recorded at 16 sample sites throughout the lake (Fig. 11). Water was deep ($\bar{x}$ = 28 in.) and somewhat turbid ($\bar{x}$ = 8.2 in.), with an average specific conductance of 7070 mS.

Indian Lakes

Most of the Indian Lakes had low water levels and were drying up by late summer. Several species of aquatic plants occurred there (Figs. 12 and 13), but never in substantial quantities. Species included sago pondweed, horned pondweed, curly pondweed, duckweed, western pondweed, American pondweed and coontail. Vegetation was limited mostly to the shallow waters along shorelines. Much of the vegetation that grew along shorelines was exposed by receding waters, and probably provided little food value to waterfowl by fall.

CARSON LAKE PASTURE

Sprig Pond was the only pond at Carson Lake that contained water throughout the summer. It contained no submerged vegetation. Eight sample sites in Sprig Pond (Fig. 14) were sampled using an airboat on August 18, 1988. Water in Sprig Pond was very turbid ($\bar{x}$ = 3 in.), and carp were abundant throughout the unit. The average depth was 8.4 inches and conductivity averaged 3640 mS. There were extensive stands of alkali bulrush (*Scirpus robustus*) with good seed production throughout the southwest section of the pond.

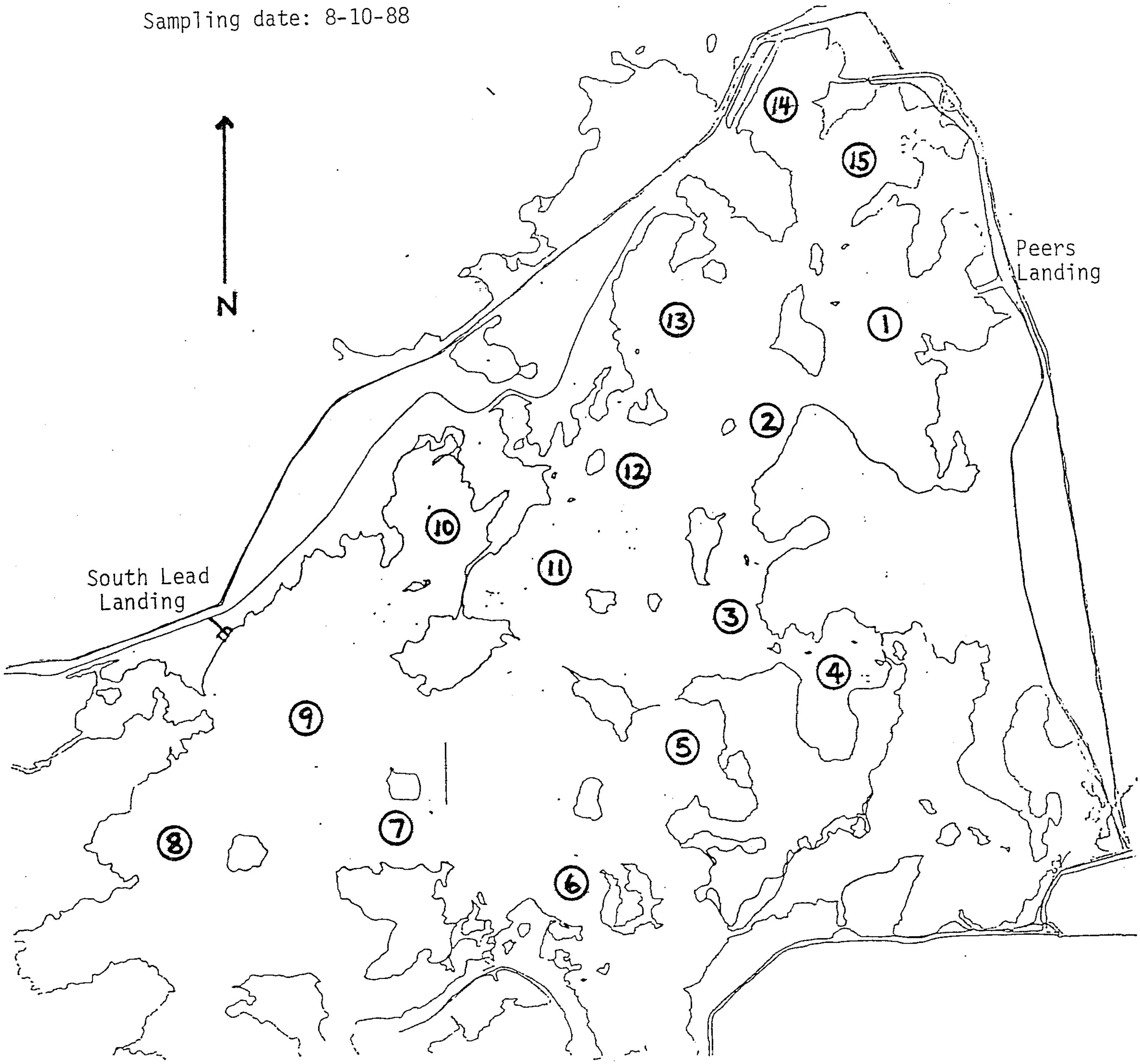
Most of the ditches at Carson Lake were also dry this year, but good growth of sago pondweed was noted in the West Carson Lake Drain, and in the East Drain.

CANVASBACK GUN CLUB

No submerged vegetation was found on the major wetlands of the Canvasback Gun Club. This finding is consistent with surveys done in past

Figure 11. Location of sampling sites at Lead Lake, 1988.

Sampling date: 8-10-88



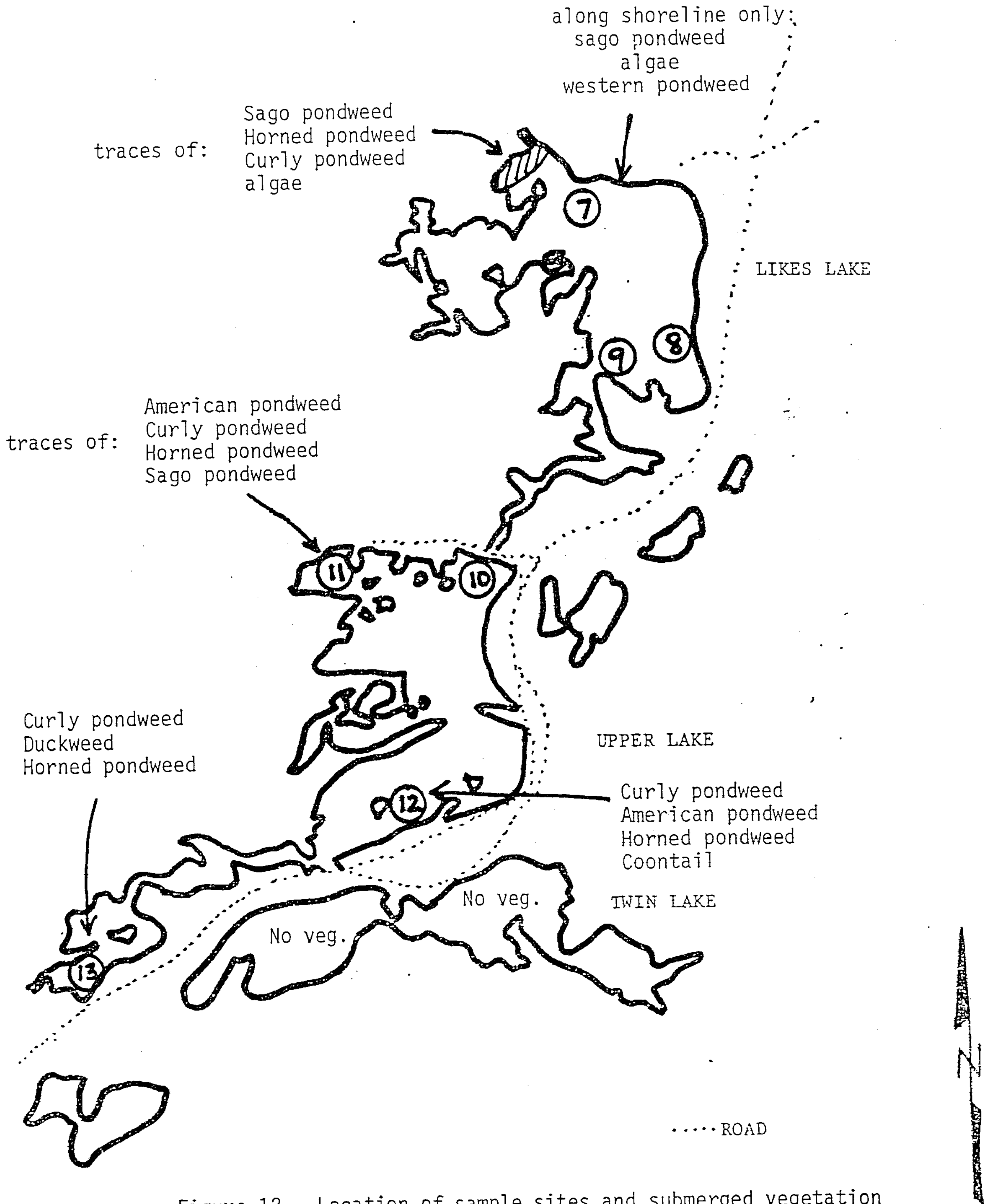
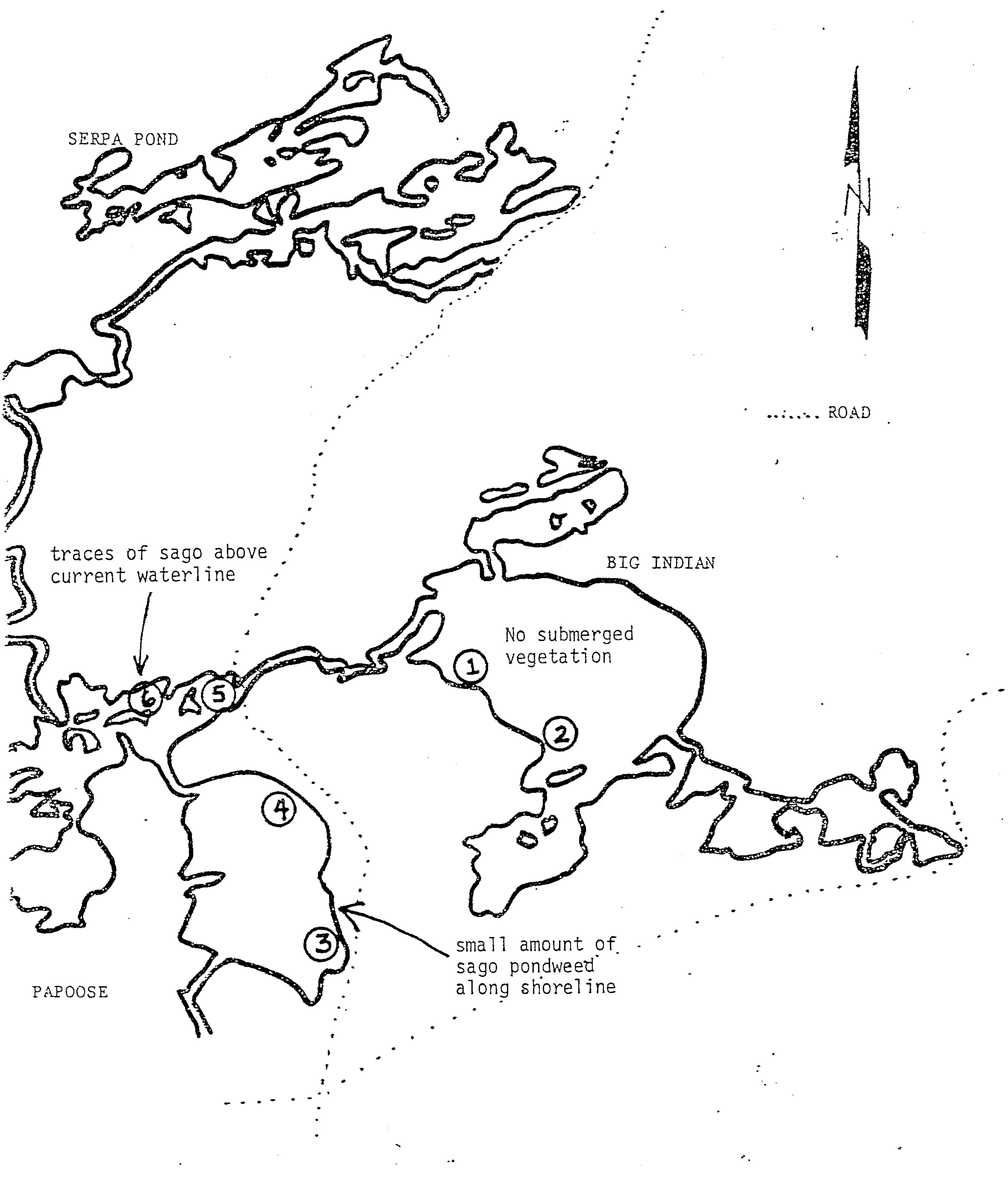


Figure 12. Location of sample sites and submerged vegetation in Likes Lake and Upper Lake, SWMA, 1988

Figure 13. Location of sample sites and submerged vegetation in Papoose and Big Indian Lakes, SWMA, 1988.



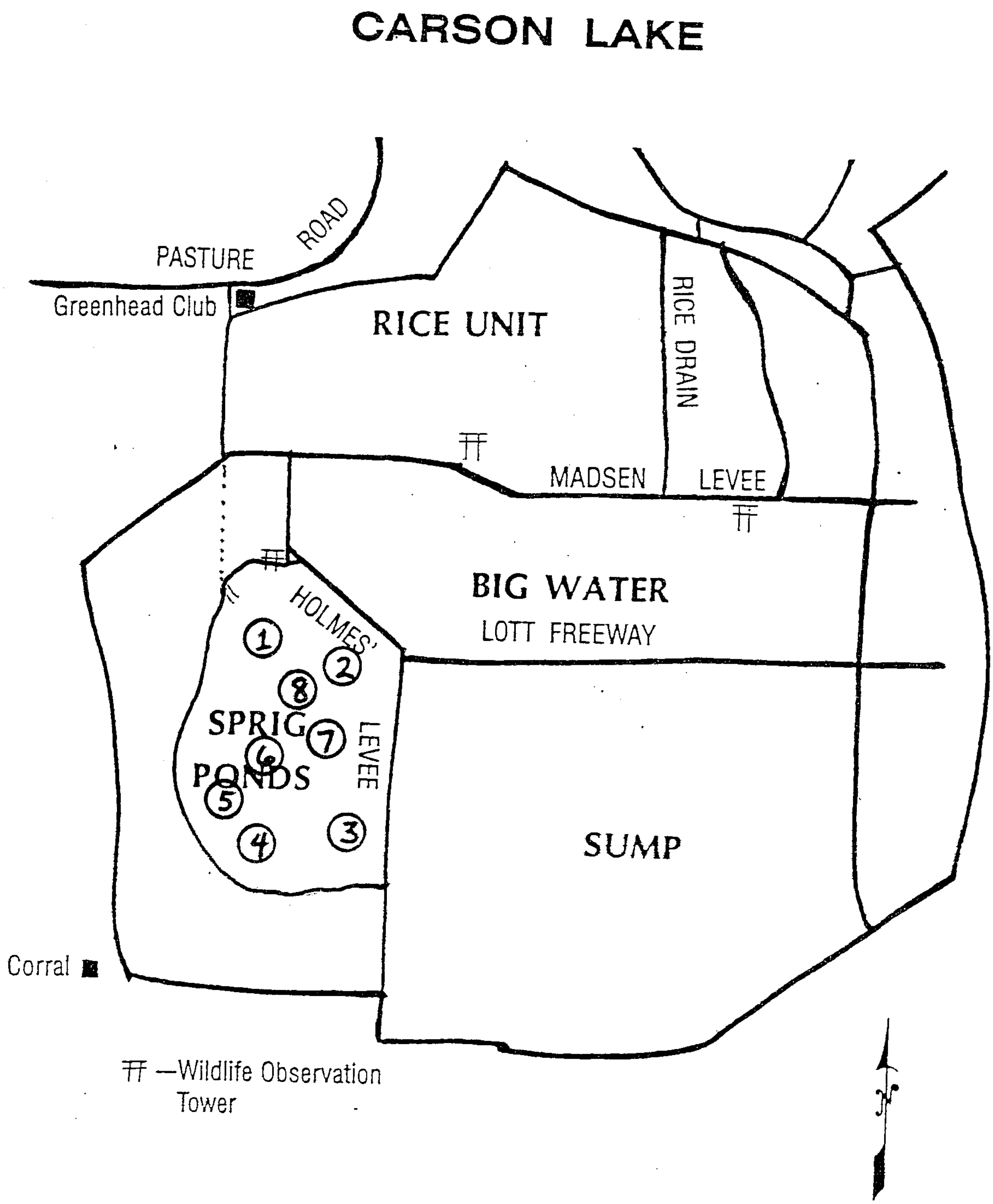


Figure 14. Location of sample sites at Sprig Pond, Carson Lake, 1988.

years. Ponds were sampled on August 11 and 16, 1988 using an airboat (Fig. 15). Most of these ponds were deepwater ponds which contained turbid water. Carp were common in all ponds. Water levels in ponds north of the east-west road were normal, but dropping at the time of the survey. Ponds south of the east-west road (Big and Little Freeman, Kirkley) contained relatively fresh water. Information on water characteristics within the ponds that were sampled is contained in the Appendix.

OTHER LAHONTAN VALLEY WETLANDS

S-Line Reservoir

S-Line Reservoir was surveyed by airboat on September 1, 1988. Twenty-five sample sites were located along 5 transects. S-Line was sparsely vegetated with curly pondweed over 100% of its surface, with the densest growth in the southern half of the reservoir (Fig. 16). An estimated 224 tons of curly pondweed was produced at S-Line. Seed production was variable, but generally was poor. Conductivity was low ($\bar{x}$ = 420 mS) and turbidity averaged 8 inches. Average water depth was 38 inches. This reservoir could be an excellent producer of aquatic plants if managed for that purpose.

Harmon Reservoir

Harmon Reservoir was surveyed by airboat on September 1, 1988. Water depth, turbidity, conductivity and temperature were recorded at 5 sites. Tongs were used for "haphazard" sampling at 10 sites, but no submerged vegetation was found; only traces of duckweed, Eleocharis, and curly pondweed were noted. Specific conductance in Harmon Reservoir was low ($\bar{x}$ = 513 mS) and turbidity was relatively low ($\bar{x}$ = 12 in.).

Fernley Wildlife Management Area

Pond #1 was nearly dry on August 23, and contained very salty water

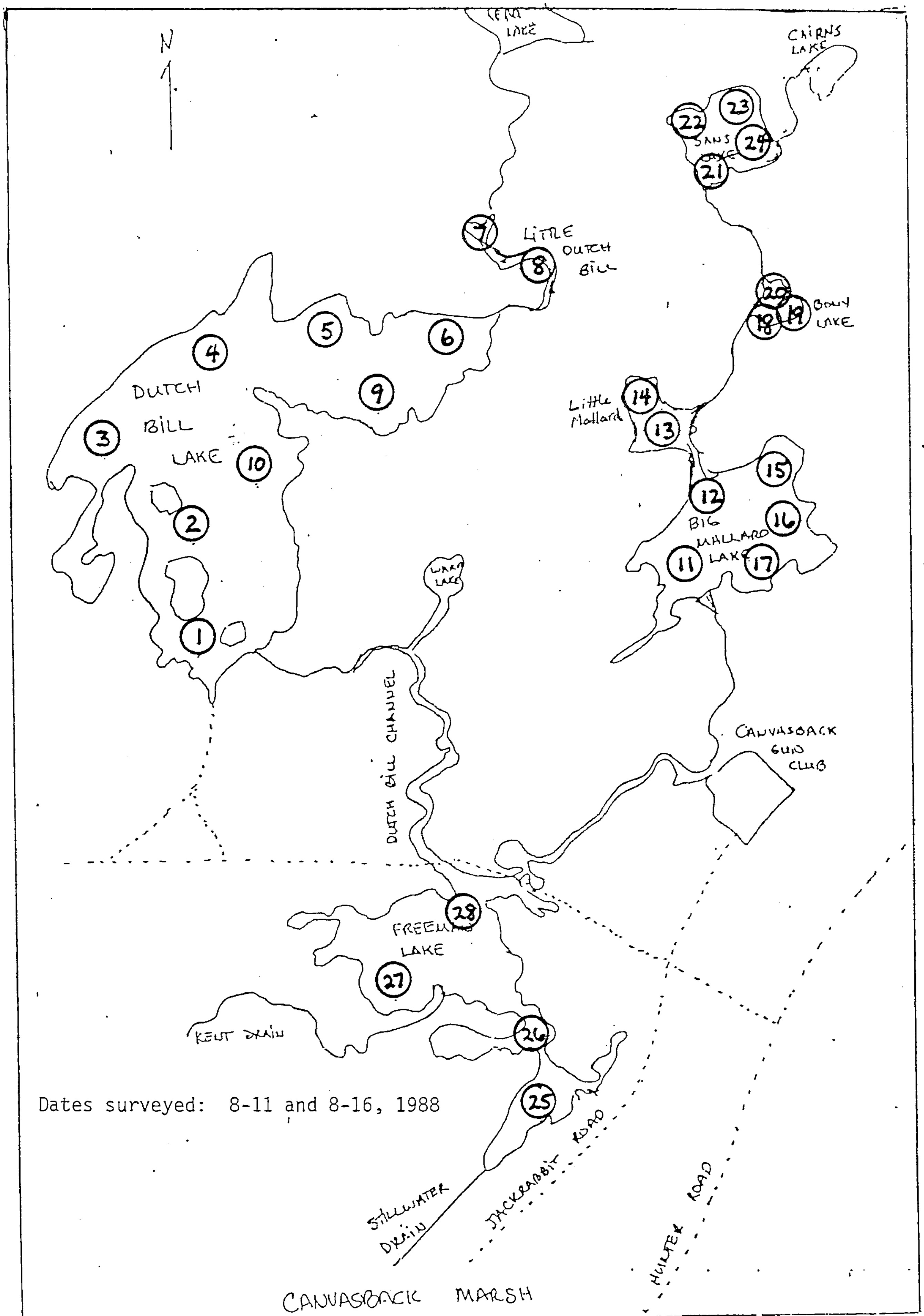


Figure 15. Location of sample sites in wetlands of the Canvasback Gun Club, 1988

S-Line Reservoir
444 Acres
Scale = 1:10,908

Figure 16. Location of sampling sites and submerged vegetation at S-Line Reservoir, 1988.

(24,500 mS). All other ponds were dry.

Massie-Mahala Slough

Mahala Slough was dry on August 23, and only Clubhouse Pond (Desert Gun Club) held water in Massie Slough. There was no submerged vegetation in the pond. Water samples were taken at 3 sites in Clubhouse Pond; specific conductance averaged 4360 mS, and water was turbid (2-3 in).

Leter Reservoir

When surveyed on August 24, Leter was mostly dry and contained no vegetation. However, aerial photos taken on August 30 showed considerably more water in Leter than when sampled only 1 week earlier. During November, water levels were even higher and some sago pondweed was noted then. Perhaps there was a late growth of sago after it was flooded.

Old River Reservoir

Old River Reservoir was surveyed by airboat on September 6, 1988. Twenty-five samples were taken along 5 transects (Fig. 17). An abundance of aquatic vegetation was present composed of 9 species of plants: muskgrass, horned pondweed, curly pondweed, Eleocharis, marsilea, duckweed, roundleaf bacopa, algae, and arrowhead. An estimated 209 tons of submerged vegetation was produced there. The most abundant species were muskgrass and curly pondweed. Conductivity was low ($\bar{x}$ = 404 mS) and turbidity averaged 8.5 in. The average water depth was 32 inches.

Sheckler Reservoir

Sheckler Reservoir contained no vegetation. Water characteristics were measured at 4 sites there. Average water depth was 24 in., conductance was 545 mS. and turbidity averaged 6.5 in. There was a noticeable difference in water quality between the east and west portions of the reservoir, the western portion being somewhat stagnant because of the low water level that

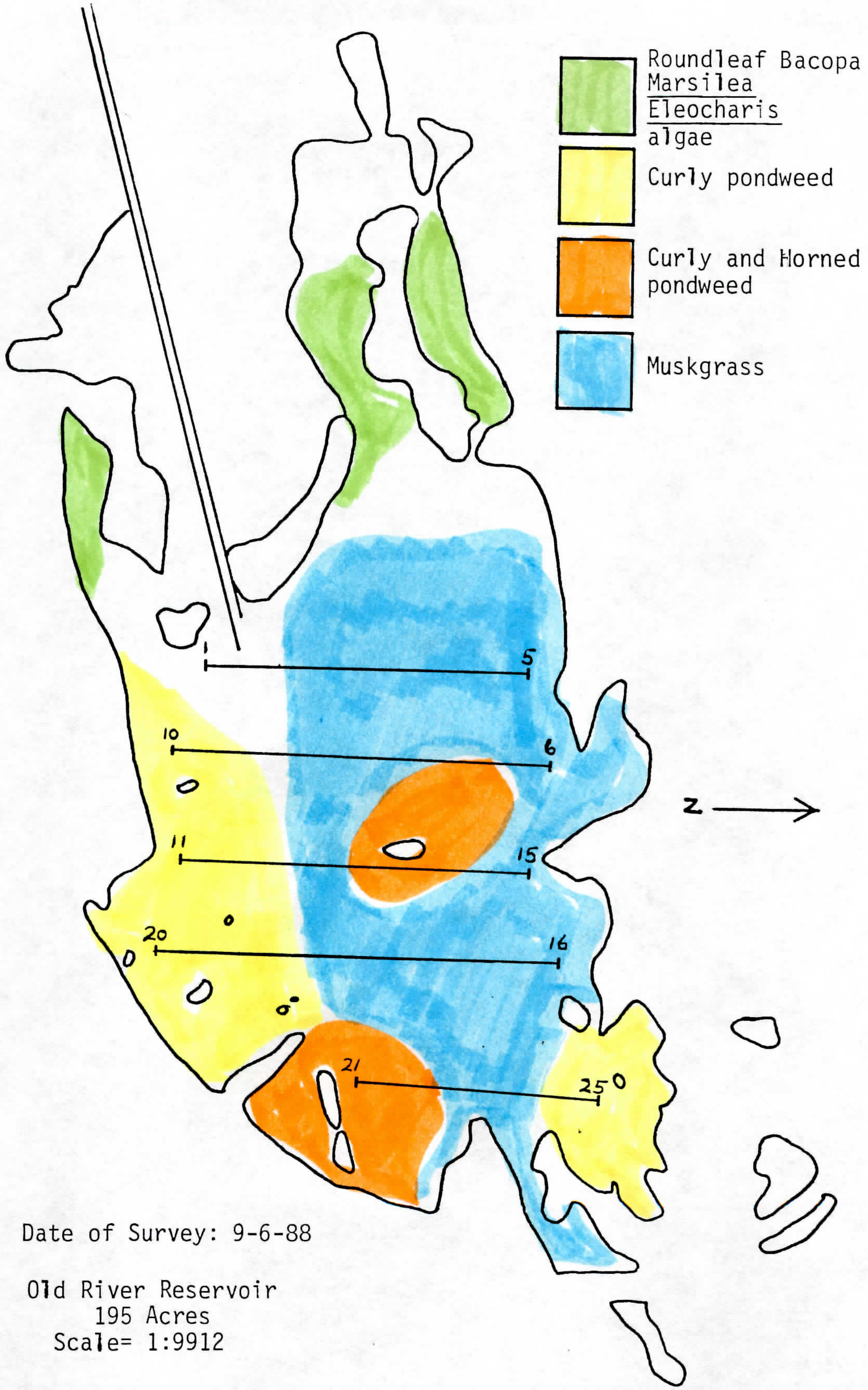


Figure 17. Areas of submerged vegetation and location of sampling sites at Old River Reservoir, 1988.

dried the channel between the 2 main portions.

Soda Lake

Soda Lake was surveyed on August 23, 1988 by driving along the surrounding ridge and occasionally hiking down the embankment to measure specific conductance and submerged vegetation. Wigeongrass was the only species present, and occurred in the shallow waters along the periphery of the lake. Wigeongrass grew densely where it occurred, but no seeds were observed. The water was clear (>16 in. visibility) and highly saline ($\bar{x}$ = 28,500 mS).

Discussion

Methodology

Several suggestions should be made regarding the methods used in this survey. These surveys are long-term studies, which started in 1959. Because habitat conditions change and because different observers may conduct surveys in different years, it is important for methods to be simple and standardized so that results are comparable among years. I make several recommendations which should improve the quality of the survey:

Although methods used to sample vegetation in the past few surveys have likely given an accurate estimate of species composition, they have not indicated how much vegetation was produced. This year, we used a volumetric sampling method that was used at Stillwater WMA in 1965-67, but was subsequently discontinued because of the many man-hours it required. Although this new method indeed took longer to accomplish than in past surveys, we minimized man-hour requirements in 1988 by sampling fewer sites with the tongs than were sampled in 1965-67. Therefore, the results are certainly not statistically sound and should be viewed only as a rough estimate of tonnage of vegetation produced.

The advantages of using the "tongs" method are 1) it is standardized and is easily duplicated, 2) it provides a more accurate portrayal of species composition. For example, the extensive beds of muskgrass that grew in deep water at Old River Reservoir would not have been detected using the conventional method because the muskgrass was not visible at the surface, and 3) it enables the wildlife biologist to compare the current densities of vegetative growth in ponds to densities observed historically. For example, when volumetric measurements were made in Foxtail in 1965-67, the average density was 427 ml/ft^2. In contrast, an average density of only 232 ml/ft^2 was recorded in 1988, indicating that vegetative density has decreased (as well as overall abundance and species diversity).

One of the most time-consuming activities of the survey is recording measurements of specific conductance because it involves calibration, actual measurements, and time for equilibration. We saved considerable time by collecting water samples in the field and measuring them in the office. Some accuracy may be sacrificed by doing this, but the time savings justifies this method. Measurements of specific conductance varied only +/- 10% within 24 hours after collection, and for the purposes and objectives of the vegetation survey, that degree of accuracy seems acceptable.

Management Implications and Recommendations

Because Stillwater is an important staging area for migratory birds, the production of foods for waterfowl is critical, and is a high priority management objective for the refuge. Probably the most useful application of the aquatic plant survey data is to identify the water management system that results in the greatest production of aquatic vegetation.

Even moderate changes in water level and turbidity can decrease necessary light penetration and decrease growth of sago (Kantrud and Nelson

1954). Water turbidity is increased by the activities of carp and by the increasing proportion of drainwater, high in dissolved solids, that enters the refuge. Both of those factors will continue to be problems at Stillwater. Therefore, a prime consideration in wetland management at Stillwater should be to maintain ponds at levels that ensure adequate light penetration for growth of sago pondweed and other aquatic plants.

Growth of submerged vegetation and water characteristics have been intensively monitored for the past 2 years, and some general management recommendations can now be made for 3 impoundments on the refuge. Suggested guidelines for water management are given in Table 4. These guidelines are designed to maintain ponds at levels condusive to growth of submerged vegetation, and to keep salinities below levels which inhibit germination or growth of submerged plants. The guidelines are offered as recommendations given the current water quality. Should fresh water become available, management may become more flexible as turbidity and salinity are reduced in primary ponds.

Stillwater Point Reservoir - This impoundment serves primarily as a storage reservoir and, although it sometimes produces good crops of sago and western pondweed (Fig. 18), it is not managed specifically for that purpose. Because of dwindling water receipts, its role as a reservoir will likely become more important, and greater fluctuations in water level, often detrimental to growth of submerged vegetation, are likely. The reservoir will continue to be managed as it has been, with no specific objectives for production of submerged vegetation.

Lower Foxtail and Doghead - Sago production has fluctuated widely since 1981 (Fig. 19), but shows an average upward trend. Sago production in 1988 was slightly greater than in 1987, probably due to better management of

Table 4. Suggested guidelines for management of water levels in Lower Foxtail, Dry Lake, and East Alkali #1.

	Staff Gauge Readings		
Month	Lower Foxtail	Dry Lake	East Alkali #1
March	1.3	9.20	2.30
April	1.4	9.25	2.40
May	1.6	9.30	2.50
June	1.7	9.50	2.55
July	1.8	9.60	2.65
August	1.9	9.70	2.70
September	1.9	9.70	2.70
October	1.7	9.50	2.60
November	1.5	9.30	2.50
December	1.3	9.20	2.20

water (i.e., lower levels) during the growing season for sago pondweed. This unit should be managed according to guidelines (Table 4) designed to flush salty water from the pond in winter or early spring, then increase water levels gradually throughout the growing season to maintain good light penetration for plant growth. Water levels will be lowered starting in October as migratory birds graze the vegetation. Water will be run through Doghead Pond as much as possible to keep salinities acceptable in the northern portion of Foxtail and Doghead.

East Alkali #1 - Production this year was less than in 1987 (Fig. 20), but water levels may have been too high during much of the growing season this year and inhibited growth of sago. East Alkali has not been drawn down and dried since 1981, and based on recent production, it is recommended to keep the pond dry in 1989. Guidelines for water management, based on the

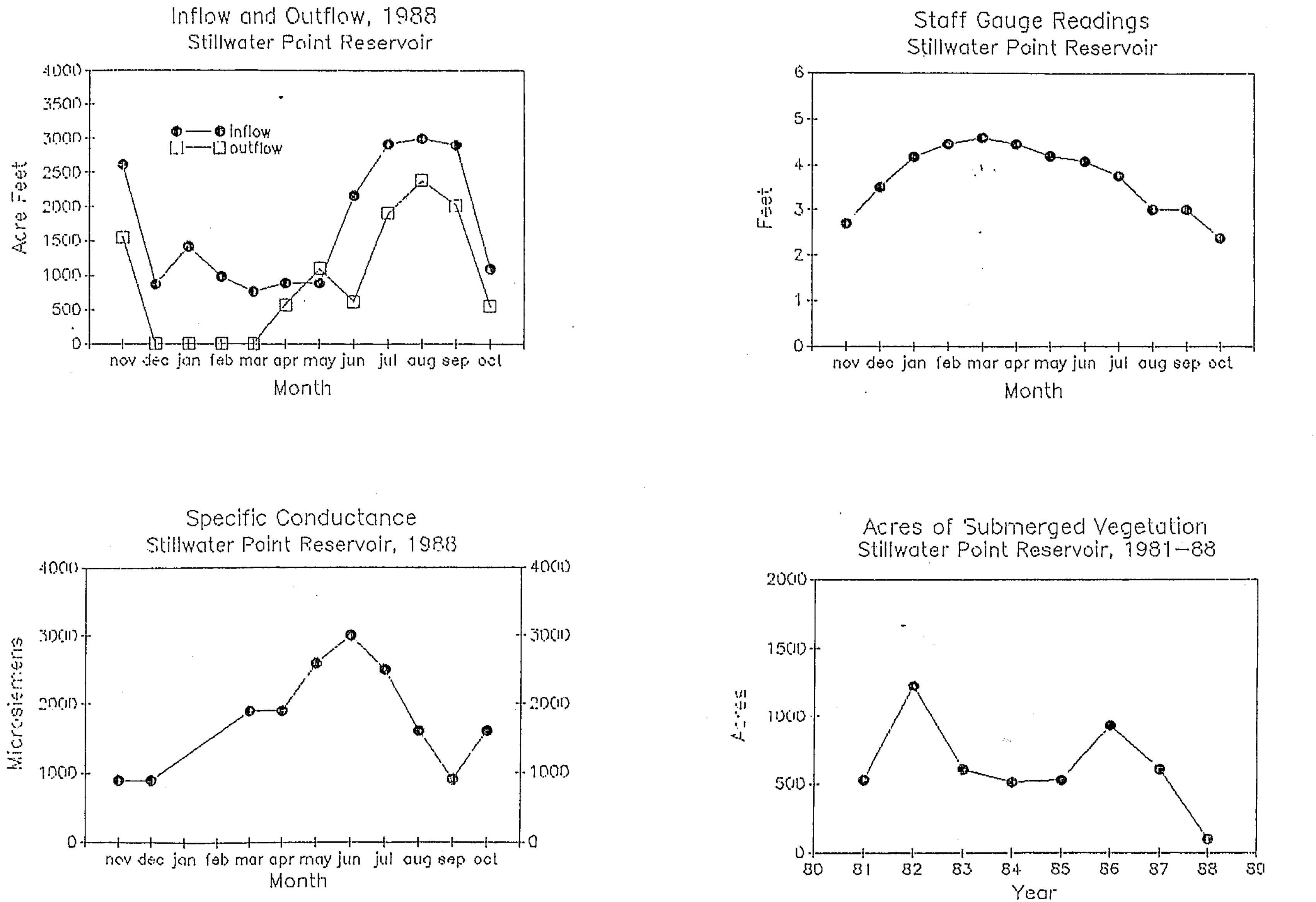


Figure 18. Information on water levels, flows, and specific conductance, 1987-88, and annual trends in production of submerged vegetation, Stillwater Point Reservoir.

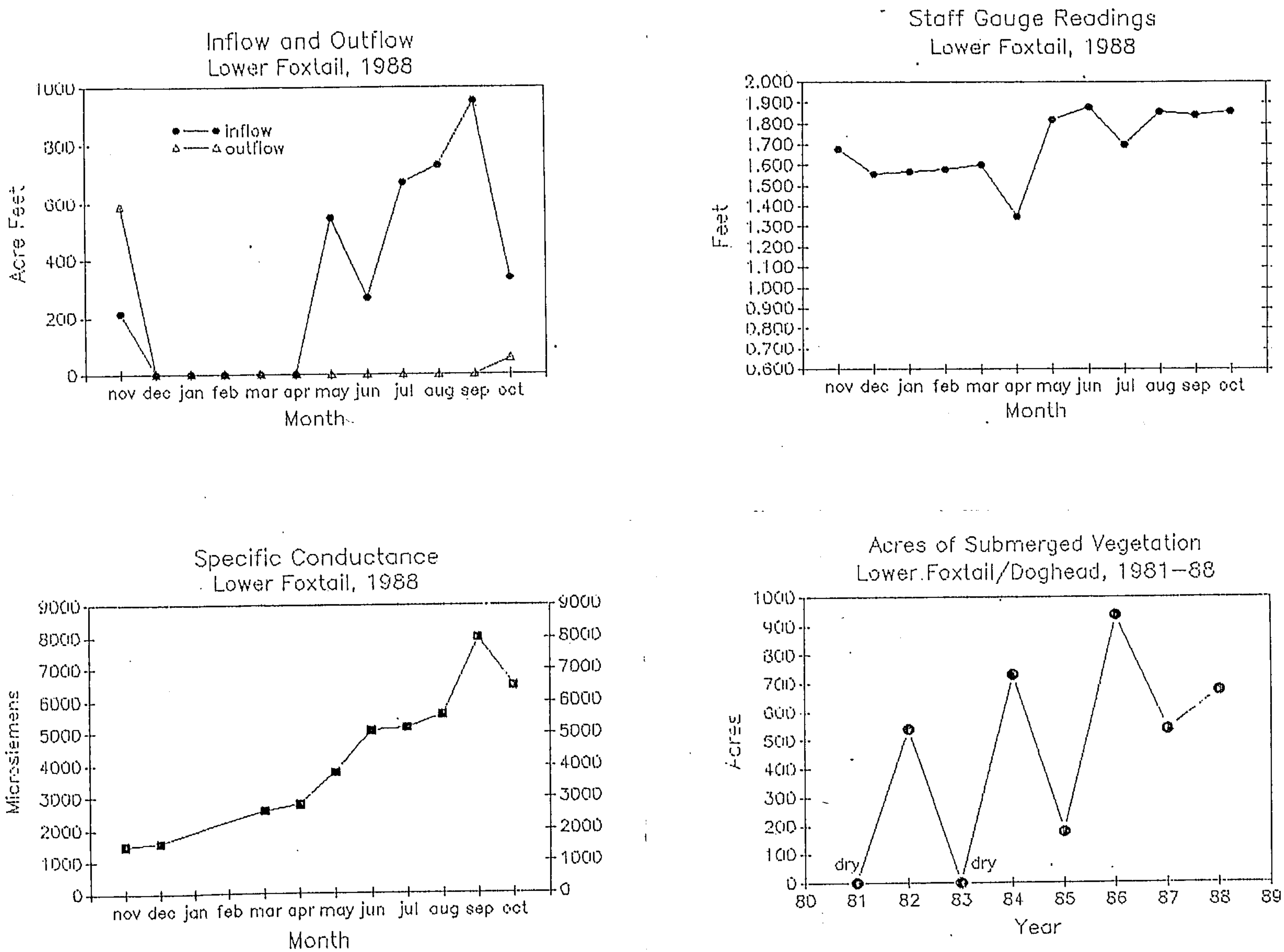


Figure 19. Information on water levels, flows, and specific conductance, 1987-88, and annual trends in production of submerged vegetation, Lower Foxtail/Doghead.

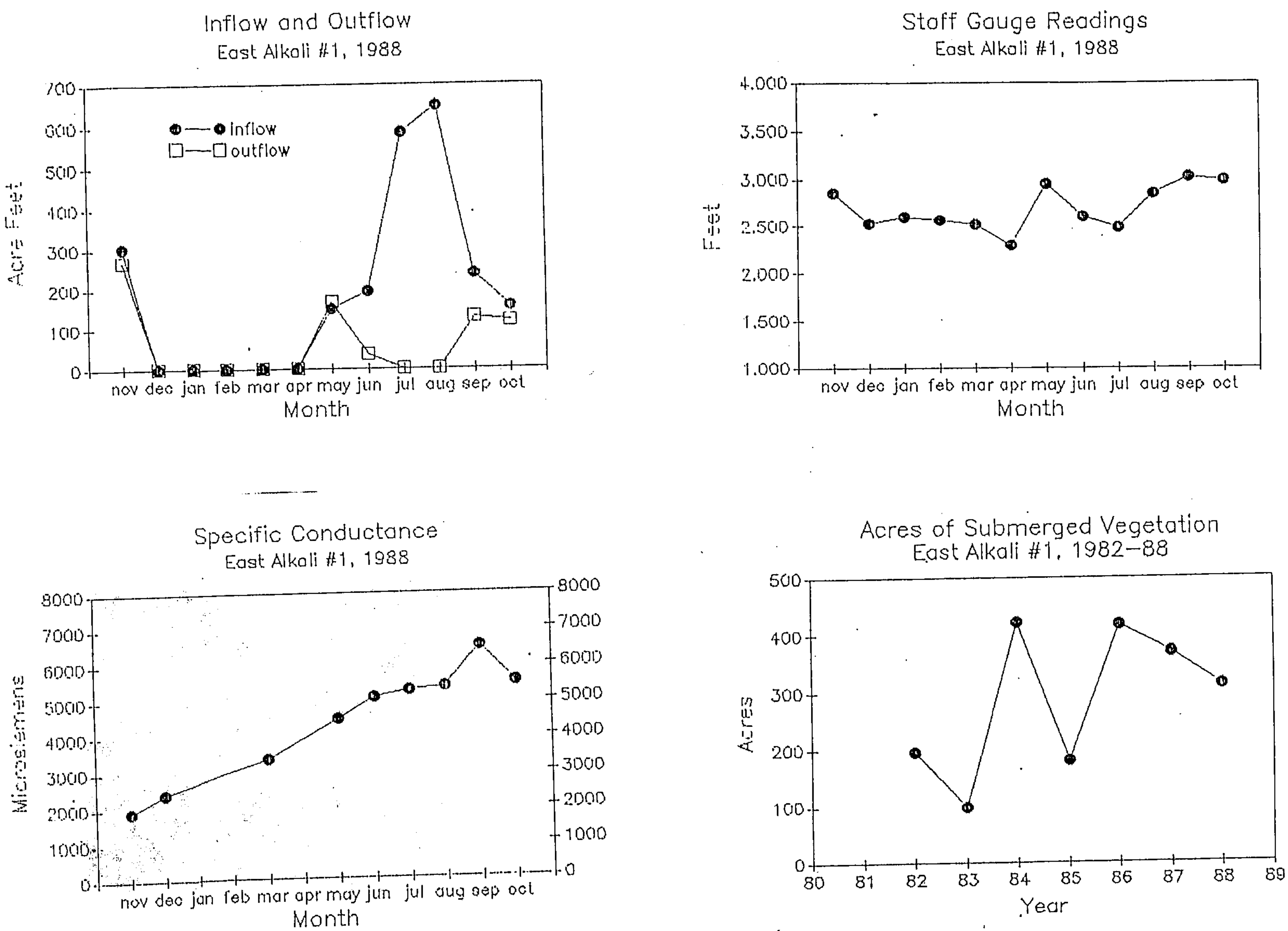


Figure 20. Information on water levels, flows, and specific conductance, 1987-88, and annual trends in production of submerged vegetation, East Alkali #1.

past 2 years, is included for East Alkali in Table 4.

Dry Lake - Dry Lake was dry this year and should be reflooded in 1989. Water management guidelines for Dry Lake (Table 4) were determined from 1987 water records and production of sago pondweed that year.

Upper Foxtail - Upper Foxtail should again be managed as a moist soil unit in 1989. This will involve a gradual drawdown in early spring that will keep 1-6 inches of water on the unit until mid-May and provide some feeding habitat for spring migrant waterfowl, and kept moist only until early June. It will then be reflooded in the fall.

Summary

Aquatic vegetation surveys were conducted on Stillwater WMA, Canvasback Club, Carson Lake, and several other wetlands in Lahontan Valley, Nevada. This was the second drought year in a row, and wetland acreage was severely reduced. Species diversity was low on most wetlands, and sago pondweed was the dominant species. The greatest production of submerged vegetation occurred in Lower Foxtail and East Alkali #1 at Stillwater WMA. Old River Reservoir and S-Line Reservoir were the only other wetlands that produced substantial amounts of submerged vegetation. No submerged vegetation was found on the major wetland units of the Canvasback Club or Carson Lake.

The volume of submerged vegetation was estimated using a pair of sampling tongs in some ponds. Estimated production of submerged aquatics was 7,547 tons at Lower Foxtail, 2982 tons at East Alkali, 224 tons at S-Line Reservoir, and 209 tons at Old River Reservoir.

Management recommendations were made that focus on maintaining ponds at levels that permit adequate penetration of light, and keeping salinity levels within limits acceptable for plant germination and growth. It is recommended that East Alkali #1 be kept dry in 1989, and that Lower Foxtail and Dry Lakes be managed as principal ponds for production of sago pondweed, whereas Upper Foxtail be managed as a moist soil unit.

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APPENDICES

Appendix I.

Aquatic Vegetation Survey -- 1988
Wetland: Stillwater Point Reservoir
Date of Survey: August 10, 1988
Staff Gauge Reading: 3.02
Surface Acres at Survey Time: 1300
Surface Acres at Full Capacity: 1890
General Water Conditions: Risen recently, very turbid.
Seed Production: None noted
% Vegetated Based on Mapped Distribution: 0
Acres of vegetation in pond: Unable to determine: none visible
Kg of Submerged Vegetation Produced: Unable to determine

Species Composition (%)

Sample #	Sago Pondweed	Western Pondweed		% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1				0	27	3	1444	
2				0	26	2.5		0
3				0	27	2		
4				0	27	2		0
5				0	28	3	1778	
6				0	31	3	2420	
7	100			0	32	3.5		5
8		100		0	32	3.5		
9				0	33	3.5		1
10				0	30	3.5	2270	
11				0	30	3.5	2740	
12				0	31	3		0
13				0	35	3		
14				0	34	3.5		0
15				0	34	3.5	2740	
16				0	25	3.5	2600	
17				0	29	4		0
18				0	28	3		
19				0	28	3		0
20				0	30	3	2640	
21				0	24	4	2680	
22				0	26	3		0
23				0	26	3.5		
24				0	22	3.5		0
25				0	22	3.5	2760	
26				0	17	3.5	3430	
27	100			0	19	3		1
28				0	19	3.5		
29	100			0	18	3		4
30				0	16	4	3650	
			Average	0.00	26.87	3.23	2596.00	0.92
			Std Dev	0.00	5.19	0.48	578.60	1.66
			Minimum	0.00	16.00	2.00	1444.00	0.00
			Maximum	0.00	35.00	4.00	3650.00	5.00

Appendix II.

Aquatic Vegetation Survey -- 1988

Wetland: Lower Foxtail and Doghead Lakes
Date of Survey: August 17, 1988
Staff Gauge Reading: 1.83
Surface Acres at Survey Time: 1150
Surface Acres at Full Capacity: 1286
General Water Conditions: About normal level
Seed Production: Good
% Vegetated Based on Mapped Distribution: 52.7
Acres of vegetation in pond: 678
Tons of Submerged Vegetation Produced: 7547 English tons

	Species Composition (%)					
Sample #	Sago Pondweed	% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1	100	20	20	5.5		
2	100	30	20	5		240
3	100	50	20	4.5	7480	
4	100	10	23	4.5		160
5	100	70	20	4		
6	100	80	21	5		
7	100	100	18	4		270
8	100	90	20	4	5420	
9	100	25	22	4		50
10	100	90	21	5		
11	100	90	22	6		
12	100	80	22	4		330
13	100	20	22	5	2680	
14	100	20	23	4		330
15	100	80	24	5		
16	100	50	21	3.5		
17	100	0	22	4		120
18	100	95	20	4	2300	
19	100	50	20	3		440
20	100	40	22	3		
21	100	80	30	5		
22	100	20	27	5		85
23		0	20	4.5	3600	
24	100	50	23	5		80
25	100	50	23	4.5		
26	100	100	29	7		
27	100	100	30	17		180
28	100	100	29	15	4840	
29	100	100	29	17		200
30	100	100	31	19		
31	100	100	28	16		
32	100	80	33	15		140
33	100	90	31	13.5	6930	
34	100	100	30	14		440
35	100	100	30	14.5		
36	100	60	31	13		
37	100	70	31	11		340

Appendix II (cont.).

38	100		60	31	12	8200	
39	100		100	29	13.5		330
40	100		60	28	14		
41	100		100	27	16		
42	100		100	25	16		370
43	100		100	25	17	8310	
44	100		100	23	18		190
45	100		100	22	18		
46	100		100	22	19		
47	100		100	23	17		220
48	100		100	25	16	8600	
49	100		100	23.5	16		330
50	100		100	24.5	17		
51	100		100	13	9.5		
52	100		100	11	9		260
53	100		90	13.5	12.5	11870	
54	100		95	11.5	11.5		180
55	100		100	14	13		
56	100		100	13	13		
57	100		100	15	15		190
58	100		100	16	16	17050	
59	100		90	13.5	13		90
60	100		95	13	11		
		Average	76.33	22.83	10.27	7273.33	231.88
		Std Dev	30.55	5.66	5.39	3971.24	110.35
		Minimum	0.00	11.00	3.00	2300.00	50.00
		Maximum	100.00	33.00	19.00	17050.00	440.00

Appendix III.

Aquatic Vegetation Survey -- 1988
Wetland: East Alkali #1
Date of Survey: August 22, 1988
Staff Gauge Reading: 3.06
Surface Acres at Survey Time: 590
Surface Acres at Full Capacity: 580
General Water Conditions: Very high level, with high conductivity
Seed Production: Good
% Vegetated Based on Mapped Distribution: 54.1
Acres of vegetation in pond: 314
Tons of Submerged Vegetation Produced: 2982 English tons

Species Composition (%)

Sample #	Sago Pondweed	Wigeongrass	algae		% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1	100				100	28	11.5		
2	100				100	32	11		215
3	100				95	28	11	8030	
4	100				95	29	13		140
5	100				100	31	13.5		
6	100				100	26	14		
7	100				100	26	17		240
8	100				100	23	18	7270	
9	100				100	24	17		230
10	100				100	24	12		
11	100				10	26	7		
12	100				60	29	8		70
13	100				20	25	11	6540	
14	100				100	26	11		200
15	100				100	29	15.5		
16	100				100	28	15		
17	100				100	27	14		400
18	100				100	28	15	8970	
19	95		5		80	28	13		130
20	100				90	29	11		
21	100				70	29	12		
22	100				90	29	11		150
23	100				100	29	14	10200	
24	100				90	28	13		320
25	100				100	27	12		
26	100				100	25	13		
27	100				100	25	14		350
28	100				100	23	15	9150	
29	100				100	24	13		230
30	100				100	24	12		
31	100				40	23	10		
32	100				90	22	16		180
33	100				90	23	21	9480	
34	100				100	25	20		120
35	100				100	24	20		
36	100				100	27	20		
37	100				50	28	25		120
38	70	30			40	26	20	11630	
39	100				50	26	19		70
40	100				80	27	18		
				Average	86.00	26.50	14.41	8908.75	197.81
				Std Dev	23.83	2.36	3.79	1521.90	93.02
				Minimum	10.00	22.00	7.00	6540.00	70.00
				Maximum	100.00	32.00	25.00	11630.00	400.00

Appendix IV.

Aquatic Vegetation Survey -- 1988

Wetland: Lead Lake
Date of Survey: August 10, 1988
Staff Gauge Reading: 6.56
Surface Acres at Survey Time:
Surface Acres at Full Capacity:
General Water Conditions: Slightly below normal and dropping
Seed Production: None
% Vegetated Based on Mapped Distribution: None
Acres of vegetation in pond: 0
Kg of Submerged Vegetation Produced: 0

Species Composition (%)

Sample #	% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1	0	31	8	7330	0
2	0	34	8	7340	0
3	0	28	9	7200	0
4	0	13	5.5	8700	0
5	0	30	9	6760	0
6	0	29	10	6700	0
7	0	33	12	6210	0
8	0	30	12	6300	0
9	0	33	12.5	6740	0
10	0	22	7	6100	0
11	0	30	6.5	6560	0
12	0	38	6.5	6600	0
13	0	34	6	6620	0
14	0	23	6.5	7200	0
15	0	26	7.5	6890	0
16	0	18	5	9880	0
Average	0.00	28.25	8.19	7070.63	0.00
Std Dev	0.00	6.29	2.30	937.37	0.00
Minimum	0.00	13.00	5.00	6100.00	0.00
Maximum	0.00	38.00	12.50	9880.00	0.00

Appendix V.

Aquatic Vegetation Survey -- 1988

Wetland: Indian Lakes
Date of Survey: August 24, 1988
Staff Gauge Reading:
Surface Acres at Survey Time:
Surface Acres at Full Capacity:
General Water Conditions: Low everywhere
Seed Production:
% Vegetated Based on Mapped Distribution: negligible
Acres of vegetation in pond: negligible
Kg of Submerged Vegetation Produced:

Species Composition (%)

Sample #		% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1					2030	
2					2110	
3					1260	
4					1290	
5					1460	
6					1430	
7					856	
8					840	
9					824	
10					590	
11					610	
12					567	
13					739	
	Average				1123.54	
	Std Dev				503.52	
	Minimum				567.00	
	Maximum				2110.00	

Appendix VI.

Aquatic Vegetation Survey -- 1988

Wetland: Carson Lake, Sprig Pond
Date of Survey: August 18, 1988
Staff Gauge Reading: 1.30
Surface Acres at Survey Time: 1746
Surface Acres at Full Capacity: about 2700
General Water Conditions: A bit low, turbid
Seed Production: none
% Vegetated Based on Mapped Distribution: 0
Acres of vegetation in pond: 0
Kg of Submerged Vegetation Produced: 0

Species Composition (%)

Sample #		% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1		0	11	3	1480	
2		0	10.5	3	5530	
3		0	8	3.5	5780	
4		0	7	3	3590	
5		0	6	2.5	1820	
6		0	7	3		
7		0	8	3.5		
8		0	10	3		
	Average	0.00	8.44	3.06	3640.00	
	Std Dev	0.00	1.72	0.30	1796.23	
	Minimum	0.00	6.00	2.50	1480.00	
	Maximum	0.00	11.00	3.50	5780.00	

Appendix VII.

Aquatic Vegetation Survey -- 1988

Wetland: Canvasback Club
Date of Survey: 8-16-88: Sans, Bony, Mallard. 8-11-88: Dutch Bill, Freeman, Kirkley
Staff Gauge Reading:
Surface Acres at Survey Time:
Surface Acres at Full Capacity:
General Water Conditions: Normal to above normal levels
Seed Production: none
% Vegetated Based on Mapped Distribution: 0
Acres of vegetation in pond: 0
Kg of Submerged Vegetation Produced: 0

Species Composition (%)

Sample #		% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1		0	31	7.5	2310	0
2		0	36	7.5	2590	0
3		0	37	7	2920	0
4		0	48	7.5	2820	0
5		0	44	7	2950	0
6		0	42	8	2880	0
7		0	24	8	3600	0
8		0	20	7	3140	0
9		0	39	7	3060	0
10		0	37	9	2450	0
11		0	35	8	1540	0
12		0	40	9	1620	0
13		0	35	5	1710	0
14		0	28	6	1630	0
15		0	42	8.5	1510	0
16		0	45	9	1540	0
17		0	43	9	1500	0
18		0	30	6	2390	0
19		0	35	7.5		0
20		0	33	8	2580	0
21		0	41	6.5	4520	0
22		0	42	6	4090	0
23		0	45	6.5	4200	0
24		0	49	7	4520	0
25		0	19	8	1410	0
26		0	21	11.5	1361	0
27		0	23	10	1250	0
28		0	25	8	1450	0
	Average	0.00	35.14	7.71	2501.52	0.00
	Std Dev	0.00	8.67	1.26	1006.13	0.00
	Minimum	0.00	19.00	6.00	1250.00	0.00
	Maximum	0.00	49.00	11.50	4520.00	0.00

Appendix VIII.

Aquatic Vegetation Survey -- 1988

Wetland: Old River Reservoir
Date of Survey: September 6, 1988
Staff Gauge Reading:
Surface Acres at Survey Time: 195
Surface Acres at Full Capacity: 195
General Water Conditions: Reservoir full, fresh water
Seed Production: poor
% Vegetated Based on Mapped Distribution: 78.4
Acres of vegetation in pond: 153
Tons of Submerged Vegetation Produced: 209 English tons

Species Composition (%)

Sample #	Muskgrass	Horned Pondweed	Curly Pondweed	algae	Eleocharis	% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1						0	33	13		
2	100					0	32	13		35
3						0	30	10	373	
4	90	10				0	30	7		70
5				100		5	19	5.5		
6						0	16	6.5		
7	75				25	0	25	5.5		20
8						0	28	7	401	
9		tr				0	25	8.5		0
10						0	17	8		
11						0	29	9		
12		tr				0	30	11		0
13						0	32	8	400	
14		tr				0	34	9.5		0
15						0	33	6.5		
16						0	40	8		
17	90	10				0	40	8		20
18						0	24	7.5		
19	30		70			0	36	8		25
20						0	33	9		
21	100		100			5	32	8		
22		tr				0	46	8		15
23						0	43	8	443	
24						0	45	9.5		100
25						0	42	10		
					Average	0.40	31.76	8.48	404.25	28.50
					Std Dev	1.36	7.96	1.87	25.03	31.07
					Minimum	0.00	16.00	5.50	373.00	0.00
					Maximum	5.00	46.00	13.00	443.00	100.00

Appendix IX.

Aquatic Vegetation Survey -- 1988

Wetland: S-Line Reservoir
Date of Survey: September 1, 1988
Staff Gauge Reading:
Surface Acres at Survey Time: 444
Surface Acres at Full Capacity: 444
General Water Conditions: Reservoir Full, fresh water
Seed Production: None observed
% Vegetated Based on Mapped Distribution: 100%, but sparse
Acres of vegetation in pond: 444
Tons of Submerged Vegetation Produced: 224 English tons

Species Composition (%)

Sample #	Curly Pondweed		% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1			0	36	6		
2			0	40	6.5		0
3			0	43	5	433	
4			0	44	5		0
5			0	41	5		
6			0	36	5.5		
7	tr		0	42	5		0
8			0	39	5	426	
9			0	30	5.5		0
10			0	36	5.5		
11			0	31	5.5		
12			0	33	6		0
13			0	34	5	437	
14	tr		0	35	5.5		0
15			0	35	6		
16			0	55	9.5		
17			0	50	8		0
18			0	45	6.5	421	
19			0	44	11		0
20			0	37	13		
21			0	23	15		
22			0	31	16		50
23			5	32	15.5	385	
24			5	34	10.5		55
25			0	39	10		
		Average	0.40	37.80	7.88	420.40	10.50
		Std Dev	1.36	6.69	3.56	18.54	21.03
		Minimum	0.00	23.00	5.00	385.00	0.00
		Maximum	5.00	55.00	16.00	437.00	55.00

Appendix X.

Aquatic Vegetation Survey -- 1988

Wetland: Harmon Reservoir
Date of Survey: September 1, 1988
Staff Gauge Reading:
Surface Acres at Survey Time: about 320
Surface Acres at Full Capacity: 345
General Water Conditions: Near normal levels, fairly fresh
Seed Production: none
% Vegetated Based on Mapped Distribution: 0
Acres of vegetation in pond: 0
Kg of Submerged Vegetation Produced: 0

Species Composition (%)

Sample #	duckweed	Eleocharis	Curly Pondweed		% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1	tr	tr			0	14	14	569	0
2					0	25	10	529	0
~~3~~					~~0~~	~~29~~	~~13~~	~~476~~	~~0~~
4					0	29	12	476	0
5			tr		0	50	13		0
				Average	0.00	29.40	12.40	512.50	0.00
				Std Dev	0.00	11.67	1.36	39.14	0.00
				Minimum	0.00	14.00	10.00	476.00	0.00
				Maximum	0.00	50.00	14.00	569.00	0.00

Appendix XI.

Aquatic Vegetation Survey -- 1988

Wetland: Sheckler Reservoir
Date of Survey: August 25, 1988
Staff Gauge Reading:
Surface Acres at Survey Time: 1100
Surface Acres at Full Capacity: 1840
General Water Conditions: Very low
Seed Production: none
% Vegetated Based on Mapped Distribution: 0
Acres of vegetation in pond: 0
Kg of Submerged Vegetation Produced: 0

Species Composition (%)

Sample #		% Vegetated at Surface	Depth (in)	Turbidity (in)	Specific Conductance	Volume (ml) per Cubic foot
1		0	38	9.5	397	0
2		0	25	10	366	0
3		0	11	3	689	0
4		0	21	3.5	726	0
	Average	0.00	23.75	6.50	544.50	0.00
	Std Dev	0.00	9.68	3.26	163.89	0.00
	Minimum	0.00	11.00	3.00	366.00	0.00
	Maximum	0.00	38.00	10.00	726.00	0.00