LAKE ASSESSMENT PROJECT REPORT
MINA LAKE
EDMUNDS COUNTY, SOUTH DAKOTA

SOUTH DAKOTA CLEAN LAKES PROGRAM
OFFICE OF WATER RESOURCES MANAGEMENT
SOUTH DAKOTA DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES

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EXECUTIVE SUMMARY

Mina Lake is an artificial impoundment on Snake Creek in extreme eastern Edmunds County about 12 miles west of Aberdeen, South Dakota. The lake covers 806 acres and has mean and maximum depths of 9 and 27 feet respectively. The lake is heavily used for recreation and has been designated a domestic water supply for lakeshore residents. The State of South Dakota has assigned to the lake the beneficial uses of : domestic water supply; warmwater permanent fish life propagation; immersion recreation; stock watering; and wildlife propagation.

The contributing watershed of Mina Lake consists of nearly 142,000 acres located primarily in Edmunds and McPherson Counties with a small area extending into Brown County. As with many artificial lakes of this type the watershed to lake surface area ratio is large - approximately 176.

Past studies conducted by the South Dakota Department of Environment and Natural Resources (DENR) from 1979 to 1982 determined Mina Lake was nutrient enriched especially in phosphorus. Runoff data collected from both branches of Snake Creek indicated extremely high loads of phosphorus and nitrogen entered the lake during the 1979-1982 period (Mina Lake WQSA Report, 1985). Sampling frequently detected excessive fecal coliform bacteria numbers in the two tributaries and occasionally high bacteria levels were found in the lake.

In May 1991, the South Dakota Department of Environment and Natural Resources (DENR) began a Lake Assessment Project under a Contract/Letter of Agreement with the Edmunds County Conservation District signed February 5, 1991. The results of that project are presented in this report.

The lake assessment project consisted of water quality monitoring of Mina Lake and its tributaries from May 6, 1991 through April 14, 1992 to evaluate watershed impacts on the lake. In addition, a sediment depth survey was conducted to measure accumulated soft sediments in the lake basin. Probable sources of these sediments as well as the high nutrient levels found in Mina Lake were investigated by means of a watershed land-use survey and a lake shoreline inspection.

Results of the study indicated that the high phosphorus loads recorded from 1979 to 1982 persisted through 1991 but that nitrogen loading to Mina Lake had declined considerably to the present moderate level during the same 10-year interval. Low dissolved oxygen concentrations measured in both tributaries during the 1991 study suggest, moreover, that the potential for organic pollution in Mina Lake from its drainage remains high at the present time. Major sources of nutrients, organic loading, and bacteria to the lake appear to be watershed livestock operations, overfertilization of cropland and eroding soil in the watershed.

The study recommendations for lake restoration include 1.) establishing ten animal waste management systems (AWMS) in the watershed 2.) implementing best management practices (BMP) on croplands and pasture land 3.) stabilizing stretches of eroding lake banks 4.) promoting planned grazing systems (e.g. rotated grazing) to improve range conditions 5.) planting permanent cover on cropped natural stream channels and 6.) other applicable implementation measures.

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INTRODUCTION

Studies conducted by the South Dakota Department of Environment and Natural Resources (DENR) from 1979 through 1982 determined that Mina Lake (a.k.a. Lake Parmley) is nutrient enriched and has reduced water clarity. Algae blooms are common and two incidences of algal toxicity (1979 and 1991) have been suspected. Large aquatic macrophytes are generally not a problem in the main basin although siltation and subsequent encroachment of macrophytes has occurred in the northern inlet areas. Excessive fecal coliform bacteria levels have frequently been reported in the Mina Lake tributaries and on several occasions in the lake proper. These problems appear to be due to a combination of factors related to nonpoint source pollution and include: eroding crop and grassland, shoreline erosion, poor fertilizer management, feedlot runoff, and failing septic tank systems.

In response to local inquiries for assistance the DENR, working in cooperation with the local community and the Edmunds and McPherson County Conservation Districts, designed a Lake Assessment Project Study (Diagnostic/Feasibility (D/F) study) for Mina Lake under a contractual agreement entered into by DENR and the Edmunds County Conservation District on February 5, 1991. The study was implemented to identify and assess the current condition of the lake, determine water quality problems and pollution sources, and develop lake restoration alternatives.

Water quality monitoring of tributary and in-lake waters was conducted during the period from May 6, 1991 to April 14, 1992. A watershed inspection was carried out during 1991 to collect land use information and identify water quality problem areas in the drainage. In addition, a shoreline vegetative survey was conducted during September 1991 in conjunction with a shoreline inspection to identify significant areas of bank erosion around the Mina Lake shoreline.

Study Area Description/Background

Mina Lake is a U-shaped impoundment on Snake Creek located in extreme eastern Edmunds County about 12 miles west of Aberdeen. The lake covers 806 acres and has mean and maximum depths of 9 and 27 feet respectively.

The reservoir formed behind a dam located a short distance downstream from the previous confluence of the East and West Branches of Snake Creek. Construction of the dam was largely financed through the Federal Emergency Relief Administration (ERA) in the early 1930's. Brown and Edmunds Counties provided equipment and some operating funds. Construction began in September 1933 and was completed by February 1934.

The present Mina Lake drainage covers an estimated 141,858 acres. The watershed is located in Edmunds County (76,603 acres), McPherson County (63,389 acres) and Brown County (1,866 acres). Watershed topography is mostly nearly level to

gently sloping, but is steeper along the larger drainageways. The watershed is used mainly for cropland (40%) and pasture (60%).

Approximately 250 residences presently occupy the shoreline of Mina Lake, about one third of which are summer homes. A majority of the residences are situated on the lower east arm of the reservoir, whereas only 15 are located on the west arm. As recently as ten years ago all lakeside residences were served by individual wastewater disposal systems, mainly septic tank drainfields. The present public water supply for lakeshore residences is the WEB Water Development Corporation. All the drinking water is taken from the WEB system. Water for lawns and gardens is pumped directly from the lake.

Mina Lake is located in an area of somewhat impermeable soils, primarily Edgely and Niobell-Noonan loams. Edgely loam is known to contain bedded shale within 40 inches of the surface whereas Niobell-Noonan loams have a massive clay pan subsoil and generally have low permeability. For this reason those soils are not particularly suitable as sites for septic tank drainfields nor, as subsequent experience has made evident, are centralized wastewater systems such as evapotranspiration mounds. A system of three mounds constructed in 1984 began experiencing surface failure soon after it became operational. Pooled, partially treated wastewater was subsequently carried to the east arm of Mina Lake via the old Highway 12 road ditch during periods of snowmelt and stormwater runoff. This source of contamination was eliminated in 1991 when a settling pond system was constructed and brought on-line late in the year. At present, all lakeside residences with the exception of 15 homes on the west arm of the reservoir are served by the new wastewater lagoon system located downstream of the Mina Lake spillway.

Agriculture is the principal enterprise in the Mina Lake watershed. About 40% of the area is cropland and 60% is native grass, tame grass and alfalfa. The main crops are wheat, oats, barley, corn, sunflowers, and alfalfa. Growing cash crops, hay, and raising beef cattle are the main farm activities.

The study area has a continental climate with wide variations in temperature and precipitation. The average annual rainfall in the area is 19 inches and annual lake evaporation is 34 inches. The mean yearly temperature in the Aberdeen area is about 43° oF with extremes of -40° F and 115° F.

Mina Lake provides fishing, boating, swimming, picnicking, and camping opportunities for an estimated 82,000 people residing within a 65-mile radius of the lake. The South Dakota Department of Game, Fish and Parks (GF&P) reports that annual park visitations at the Mina Recreation Area decreased from approximately 49,000 in the mid 1980's to 36,000 in the late 1980's. This decline was due to a decrease in day use of the lake which accounted for the great majority of visitations. GF&P attributed day use decline to fewer swimmers using the beach area because of diminished water quality (algal blooms, water turbidity).

GF&P manages Mina Lake for walleye, northern pike, largemouth bass, perch, and crappie with regular stocking of walleye and pike. To date no major fish kills have been reported.

Water Quality Standards

The water quality standards for Mina Lake are based upon the beneficial uses assigned to the lake by the State of South Dakota. Each beneficial use has an established set of applicable water quality criteria. In those cases where a multiple-use lake has two or more criteria established for the same parameter under different uses, the most stringent criterion will apply.

Mina Lake has the assigned beneficial uses of domestic water supply, warmwater permanent fish life propagation, immersion recreation, limited contact recreation, and wildlife propagation and stock watering. The water quality criteria presented in Table 1 are the water quality standards for Mina Lake.

Mina Lake is one of comparatively few lakes in the state designated as a domestic water supply. That use has assigned to it water quality standards for a number of metals in addition to those for the more routinely tested parameters. Moreover, standards are more stringent for nitrates and total dissolved solids under the domestic water supply use category (Table 1).

Table 1. Mina Lake Water Quality Standards

Parameter	Criterion
Total Chlorine Residual	<0.02 mg/l
Un-Ionized Ammonia Nitrogen	≤0.04 mg/l
Total Cyanide	≤0.02 mg/l
Free Cyanide	≤0.005 mg/l
Dissolved Oxygen	>5.0 mg/l
Undissassociated Hydrogen Sulfide	≤0.002 mg/l
pH	>6.5 units and <8.3 units
Total Alkalinity	≤750 mg/l
Total Dissolved Solids	≤1000 mg/l
Conductivity	≤4000 micromhos/cm
Nitrates	≤10 mg/l (as N)
Suspended Solids	≤90 mg/l
Temperature	≤80° F
Polychlorinated Biphenyls	≤0.000001 mg/l
Fecal Coliform Organisms	≤200 per 100 ml*
Arsenic	≤.05 mg/l
Barium	≤1.0 mg/l
Cadmium	≤.01 mg/l
Chloride	≤250 mg/l
Chromium	≤.05 mg/l
Fluoride	≤4.0 mg/l
Lead	≤.05 mg/l
Mercury	≤.002 mg/l
Selenium	≤.01 mg/l
Silver	≤.05 mg/l
Sulfate	≤500 mg/l

* Based on the mean of a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period, and this value may not be exceeded in more than 20 percent of the samples examined in the 30-day period. A sample may not exceed 400 per 100 ml in any one sample from May 1 to September 30.

METHODS AND MATERIALS

Lake and Tributary Sampling

Water samples were collected from five sampling sites in the Mina Lake study area. Sites 1 and 2 were located on the two principal tributaries to Mina Lake upstream of the inlets to the reservoir (Figure 1). Site 3 was located at the outlet of Mina Lake where the lake flows into Snake Creek. Sites 4 and 5 were in-lake sites (Figure 2). Descriptions of the sampling site locations are presented below:

Figure 1. Tributary sampling sites in the Mina Lake (Lake Parmley) watershed (Brown, Edmunds & McPherson Counties)

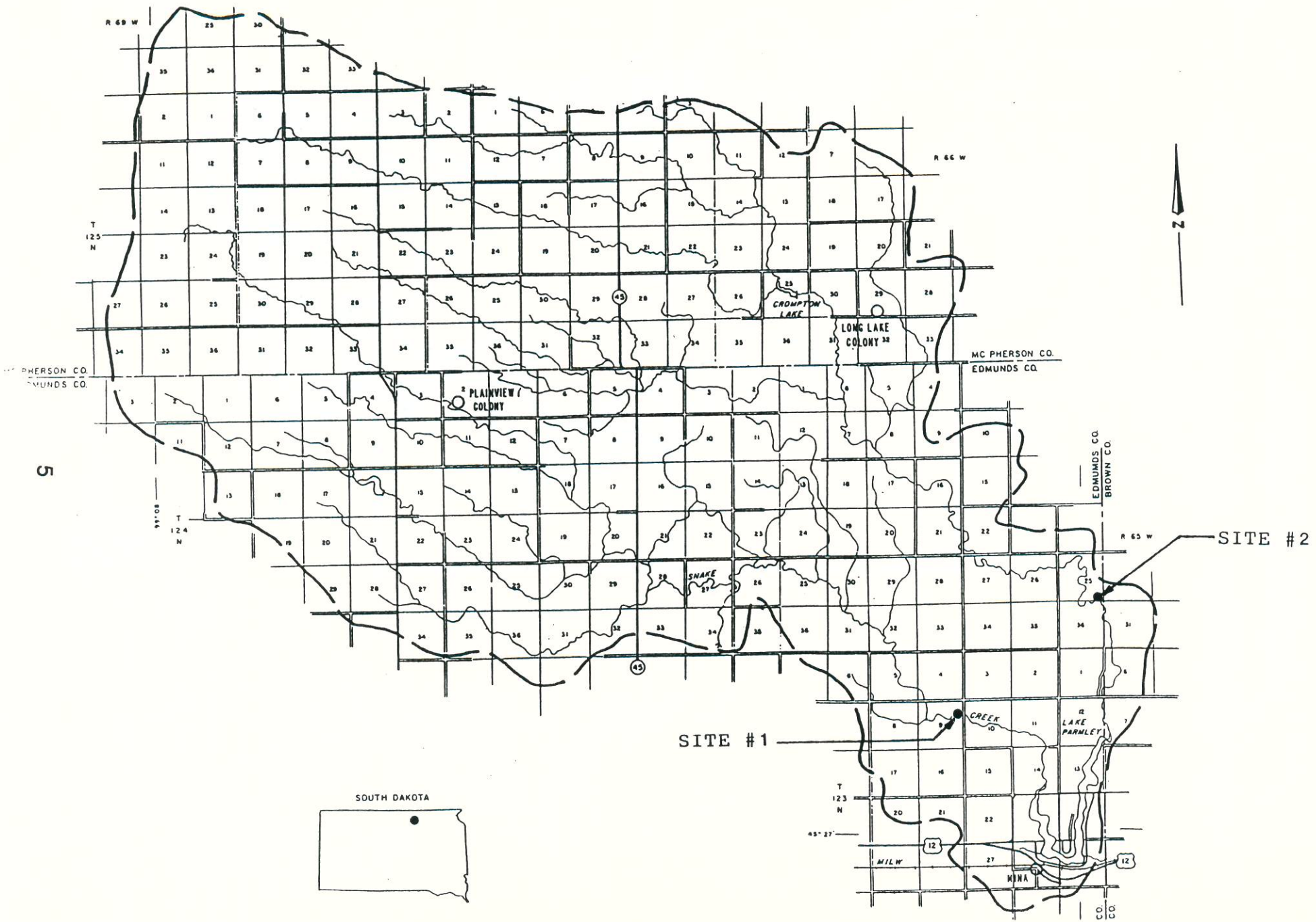
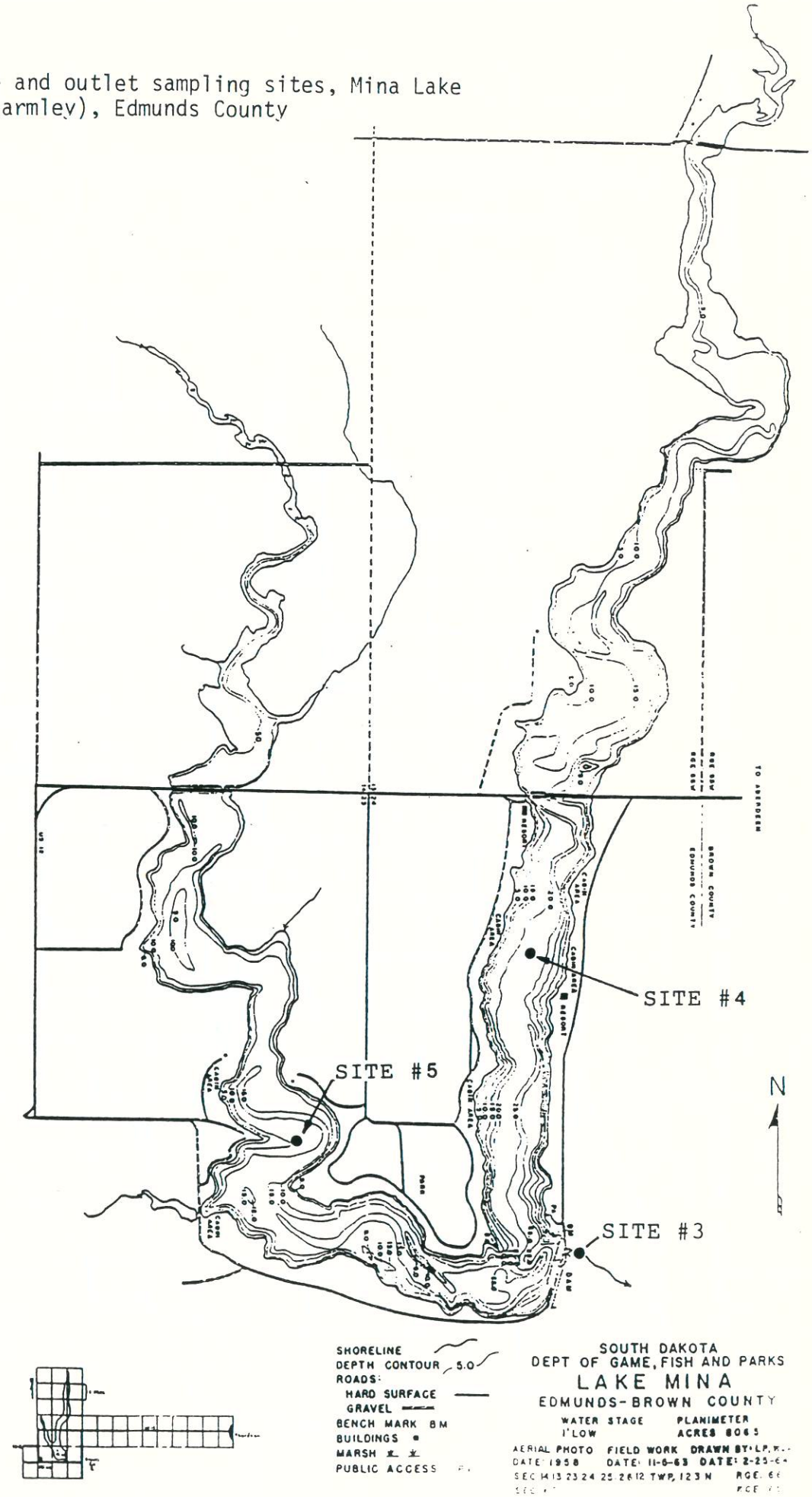


Figure 2. In-Lake and outlet sampling sites, Mina Lake (Lake Parmley), Edmunds County



Site 1 - Latitude 45 Deg., 29 Min., 11 Sec., Longitude 98 Deg., 47 Min., 01 Sec., Township 123N, Range 66 W, Section 10, NW 1/4, NW 1/4, SW 1/4, NW 1/4. West Snake Creek tributary to Mina Lake.

Site 2 - Latitude 45 Deg., 31 Min., 08 Sec., Longitude 98 Deg., 43 Min., 22 Sec., Township 123 N, Range 66 W, Section 25, SE 1/4, SE 1/4, SE 1/4, SE 1/4. East Snake Creek tributary to Mina Lake.

Site 3 - Latitude 45 Deg., 26 Min., 29 Sec., Longitude 98 Deg., 43 Min., 48 Sec., Township 123 N, Range 66 W, Section 25. SE 1/4, NW 1/4, SW 1/4, NE 1/4. Mina Lake outlet to Snake Creek.

Site 4 - Latitude 45 Deg., 27 Min., 15 Sec., Longitude 98 Deg., 44 Min., 15 Sec., Township 123 N, Range 66 W, Section 24, SW 1/4, SW 1/4, SW 1/4, NE 1/4. In-lake site near middle of east arm of Mina Lake approx. 1/2 mile south of Hwy 12 bridge.

Site 5 - Latitude 45 Deg., 26 Min., 43 Sec., Longitude 98 Deg., 44 Min., 53 Sec., Township 123 N, Range 66 W, Section 26, SE 1/4, NW 1/4, NE 1/4, NE 1/4. In-lake site at lower west arm of Mina Lake; west of Mina Recreation Area.

The sampling period for tributary and in-lake sampling extended from May 6, 1991 to April 14, 1992. During that period a total of 74 samples were collected from 5 sites for routine water quality analysis (Table 2). Separate surface and bottom samples collected at the two in-lake sites were combined to yield one surface and one bottom composite sample for each date. In-lake sites were sampled on a monthly basis.

Tributary and lake spillway sites were scheduled to be sampled for water quality twice a week during periods of flow. Tributary stages were measured with a Steven's stage recorder installed at each of the tributary sites. Stage recorders were calibrated for discharge by discrete measurements with a Marsh-McBirney portable flow meter. Daily stream discharges in cubic feet per second (cfs) were obtained by "best-fit" regression lines generated with a computer graphics program that related stage height with stream velocity (ft/sec). Using these generated graphs (Appendix D) the water velocity corresponding to any given stage height can be found. Daily stream flows can then be calculated by multiplying water velocity by a previously determined channel cross-sectional area for each tributary site.

Nutrient and sediment loadings were calculated for each sampling date by multiplying the known nutrient/sediment concentration by the daily water flow (cfs). Daily loads between water quality sampling dates were obtained by assuming constancy in nutrient and sediment concentrations between the given date and the mid-point to the previous and following sampling dates. The derived loadings were then summed and divided by the lake area to provide annual nutrient and sediment loads.

The purpose of the tributary monitoring program (Sites 1, 2 & 3) was to quantify the magnitude and severity of water quality problems associated with tributaries that contribute sediment and nutrient loads to the lake. Data from these sites was used to determine the total loadings from the various sources and will allow restoration efforts to be concentrated in the critical loading areas.

Tributary and lake sampling was carried out by personnel of the Edmunds County Conservation District. Samples were analyzed by the South Dakota State Health Laboratory in Pierre, SD for the parameters listed in Table 3.

TABLE 2. - Sampling Period and Number of Samples

SITE #	SAMPLE TIME PERIOD FROM:		TO:	# OF SAMPLES
1	5/06/91	-	7/17/91	13
2	5/06/91	-	7/10/91	12
3	6/11/91	-	7/30/91	9
4	5/20/91	-	4/14/92	21
5	5/20/91	-	4/14/92	19
			Total Samples:	74

Table 3.-Water Quality Parameters

Water Temperature	Total Solids
Air Temperature	Total Dissolved Solids
Secchi Disk	Total Suspended Solids
Dissolved Oxygen	Ammonia
Field pH	Nitrates + Nitrites
Fecal Coliform Bacteria	Total Kjeldahl Nitrogen
Total Suspended Volatile Solids	Total Phosphorus
Laboratory pH	Total Dissolved Phosphorus
Total Alkalinity	Un-ionized Ammonia

Analytical Methods

The laboratory analyses for parameters listed in Table 3 were conducted by the South Dakota State Health Laboratory using methods of chemical analysis shown in Table 4. Metals were analyzed from two water and sediment samples collected at in-lake sites #4 and #5 on August 8, 1991 by DENR. Laboratory analysis was conducted by the U.S. Army Corps of Engineers (COE) laboratory in Omaha, Nebraska using EPA - approved methodology (Appendix B).

Table 4. Analytical Methods for Physical and Chemical Parameters.

Parameter	Method	Reference
Temperature	Thermometric	APHA (1985)
Secchi disc*	Shaded side of boat	Lind (1974)
Dissolved oxygen	Azide/Winkler	APHA (1985)
pH	pH probe	APHA (1985)
Total alkalinity	Potentiometric	APHA (1985)
Ammonia-N	Phenate	EPA (1983)
Nitrate + Nitrite-N	Cadmium reduction	EPA (1983)
Kjeldahl-N	Colorimetric	APHA (1985)
Total dissolved phosphorus	Filtration Persulfate digestion	EPA (1983)
Total phosphorus	Persulfate digestion	EPA (1983)
Total solids	Gravimetric(103-105° C)	EPA (1983)
Total suspended solids	Gravimetric(103-105° C)	EPA (1983)
Total volatile suspended solids	Gravimetric (550° C)	EPA (1983)
Total dissolved solids	Gravimetric (180° C)	EPA (1983)
Fecal coliforms	Membraned filter (1989)	APHA (1985)

*In-lake samples only

Sediment Sampling and Survey

A sediment and water depth survey of Mina Lake was conducted by DENR and SCS on February 20, 1991. Cross-section transect lines were established on the lake and sediment depths were measured with calibrated rebar and recorded at intervals along the transects.

On August 8, 1991, a sediment core sample and an overlying water sample were collected at each of the two in-lake water quality sites 4 and 5 (Figure 2). Those samples

were submitted to the COE laboratory, Omaha, NE, for analysis of metals, pesticides, and other potentially toxic chemicals.

Biological Sampling

An inventory of the aquatic plants present in Mina Lake and surrounding shoreline was conducted during September 1991 by personnel of the Edmunds County Conservation District. Major plant species were identified and areal coverage determined.

Watershed Inspection

The watershed of Mina Lake was inspected by SCS and Conservation District personnel during 1991 to collect land use data for farms/feedlots and any other areas (or activities) that may be contributing sediments or nutrients to the lake.

The purpose for collecting these data is to determine areas that present the most severe problems in terms of water quality degradation and those tracts of land that exhibit critical erosion and nutrient loss. This will allow a focus of initial efforts on the worst problems thereby making the best use of available funding.

During the data collection process extensive use was made of land use information available at the offices of the Soil Conservation Service, the Agricultural Stabilization and Conservation Service, and other local agencies. Additional information was obtained from individual farmer interviews.

Shoreline Inspection

The shoreline of Mina Lake was traversed by SCS and Conservation District personnel during September 1991 to record any areas of significant lakeshore erosion. The stretches of shoreline with noticeable erosion problems were located on a large photographic map of the lake and their lengths measured and recorded.

RESULTS AND DISCUSSION

In-Lake Water Quality

In-lake water quality mean data are summarized in Table 5 and the complete data set is presented in Appendix A. Discussions of the results have been divided into the components of trophic condition, aquatic plants and algae, fecal coliform bacteria (swimming impacts), dissolved oxygen and suspended solids (fisheries impacts), nutrients, and nutrient/sediment loading to the lake.

Trophic Condition

Lakes are commonly classified according to trophic condition. Three categories are used: 1) oligotrophic lakes are low in nutrients, are generally clear and support low numbers of animals and plants, 2) mesotrophic lakes are intermediate in nutrient load, and 3) eutrophic lakes are high in nutrients and support large numbers of plants and animals. These lakes often experience excessive algal and weed growth.

Lakes naturally age from oligotrophic to eutrophic conditions over thousands of years. Human activities, however, tend to greatly accelerate the process by increasing nutrient and sediment inputs.

The Carlson Trophic State Index (TSI) is a method of ranking the trophic condition of a lake based on total phosphorus, Secchi depth and chlorophyll *a* measurements. The scale runs from 0 to 100 and lakes with values over 50 are considered to be eutrophic. Each division of 10 (10, 20, 30 etc.) indicates a doubling of algal biomass.

Table 5. In-Lake Sampling Data Mean Values (n = 21).

Parameter	Combined mean values for sites 4 & 5
Secchi Depth (May '91 - Dec '91)	3.7 ft. (1.13 m.)
Secchi Depth (Feb '92 - Apr '92)	14.0 ft. (4.3 m.)
D.O.	8.0 mg/l
Field pH	7.98
Fecal Coliform	< 11 per/100 ml
Total Solids	504 mg/l
Total Dissolved Solids	486 mg/l
Suspended Volatile Solids	6 mg/l
Total Suspended Solids	14 mg/l
Ammonia	0.04 mg/l
Nitrate + Nitrite	0.20 mg/l
TKN	0.81 mg/l
Total PO4-P	0.687 mg/l
Dissolved PO4-P	0.646 mg/l

TSI's for Mina Lake are based on mean total phosphorus and mean Secchi depth for both in-lake sampling sites during the growing season of the years 1979, 1989, and 1991 (Table 6). Based on these considerations the TSI values were 90.3 for 1989 and 78.6 for 1991. Those values fall on the high end of Carlson's scale classifying the lake as hypereutrophic. Moreover, for the year 1979 the smaller TSI value for chlorophyll *a* relative to that for total phosphorus (Table 6) suggests that lake algae and aquatic plants are not fully utilizing the large amounts of available phosphorus and that this nutrient is present in overabundance in lake water during the growing season.

Aquatic Plants and Algae

Approximately 46 percent of the Mina Lake shoreline is covered with trees, understory vegetation, and emergent aquatic macrophytes according to the vegetative survey conducted during September 1991 (Figure 3, Table 7.). On most of the remaining shoreline, beach front development and riprapped areas have removed the native emergent and lakeshore plant communities. Floating leaved and submergent plant species were sparse or absent over most of the lake. Vegetation was largely confined to the inlet area of the east arm of Mina Lake where duckweed and coontail beds were prevalent.

The algal communities that were collected during June and August of 1979 (Koth, 1981) are fairly typical of eutrophic state lakes which frequently show a summer dominance of the bloom forming blue-green genera Aphanizomenon and Anabaena. In addition, the diatom species Melosira granulata and Stephanodiscus niagarae are often common within blue-green algal blooms in local nutrient enriched, hard water lakes (Table 6).

A mean summer chlorophyll *a* concentration of 30 mg/m^3 (ibid) indicated Mina Lake was well within the eutrophic range during 1979; a conclusion also supported by Carlson's (1971) Trophic State Index (TSI) values calculated for that year as well as 1989 and 1991 (Table 6). Lakes with TSI values over 50 are considered to be eutrophic and over 65, highly eutrophic (hypereutrophic). Algal analysis could not be repeated in 1991 due to loss of algal samples by leakage of containers which sustained damage during shipment to the laboratory. Chlorophyll *a* samples for 1991 remain to be analyzed.

Fecal Coliform Bacteria

Fecal coliform bacteria cell counts are used as indicators of human pathogens in water. Although the fecal coliforms are not usually pathogens themselves, they exhibit a close relationship with the human pathogens Salmonella and Shigella.

Table 6. Algal Species and Volumes from Mina Lake, Edmunds County, 1979.

	6/23/79		8/14/79	
TAXA	Cells/ml[1]	Volume[2]	Cells/ml	Volume
Anabaena flos-aquae	4,411	507,265		
Aphanizomenon flos-aquae	407	81,400		
Characium limneticum	2	3,660		
Closterium sp.			6	3,000
Cosmarium sp.	5	49,000		
Melosira granulata	27	8,100	330	99,000
Merismopedia tenuissima			10	80
Pediastrum duplex var. clathratum			20	12,500
Peridinium bipes			2	51,300
Schroederia Judayi			6	1,590
Spaerocystis Schroeteri			19	9,975
Staurastrum sp.			1	1,420
Stephanodiscus niagarae	18	254,520		
Trachelomonas pulchella			4	4,520
T. volvocina	20	47,200	1	3,050
TOTAL	4,890	951,145	399	186,435
d (Species diversity)	0.55		1.12	
J (Equitability)	0.20		0.34	
V (Variety)	0.71		1.50	

TSI Values	1979	1989	1991
SD[3]	52.0	82.3	59.7
Chl *a*	63.3	-	-
TP[4]	84.3	98.3	97.4

[1] Calculated total number of cells/species/ml original lake water
[2] Total wet cell volume per species units - um3
[3] Secchi disc visibility
[4] Total phosphorus

Figure 3. Mina Lake Macrophytes

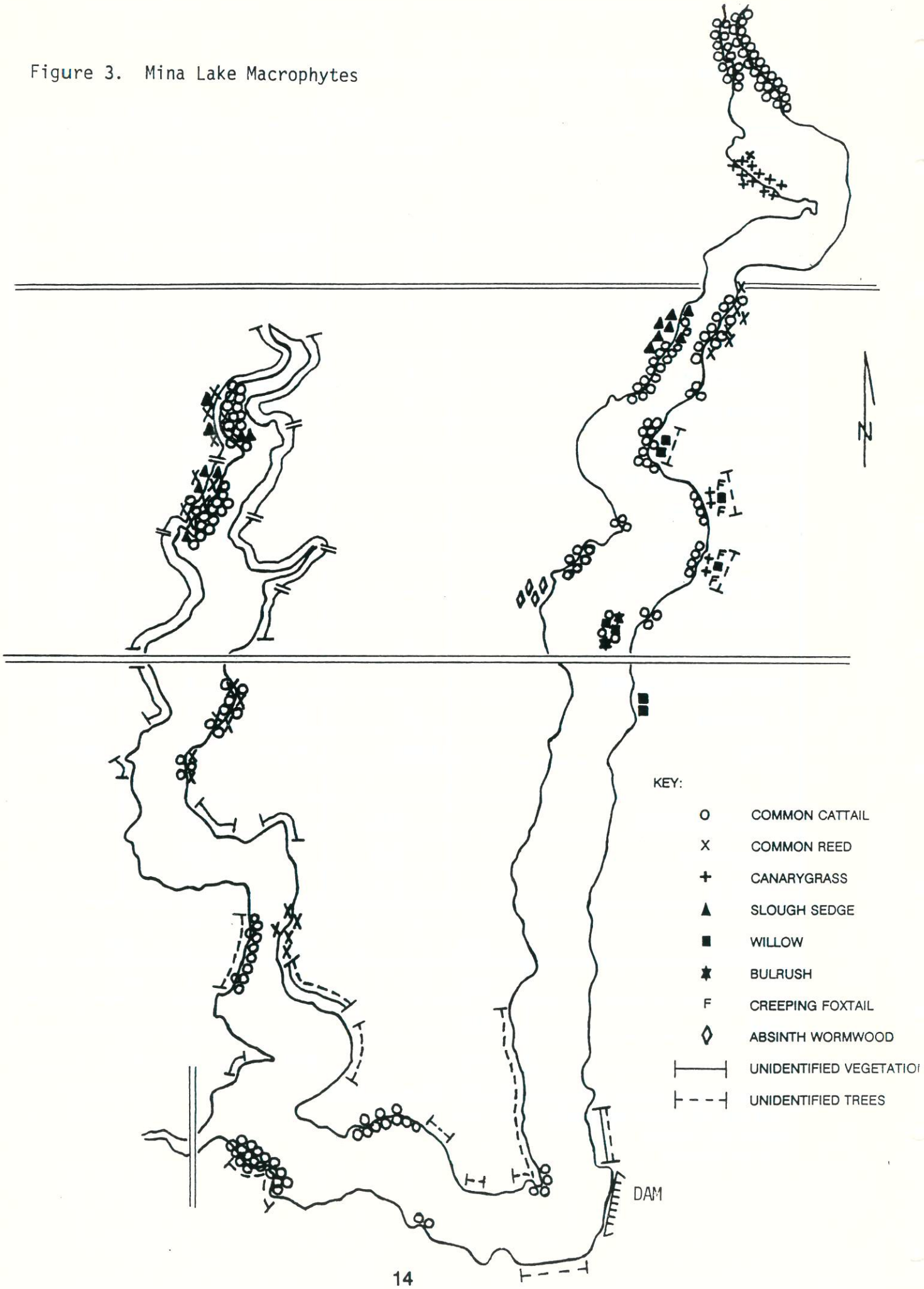


Table 7. Mina Lake Aquatic Plant Inventory

SUMMARY

COMMON NAME	GENUS	SPECIES	DISTRIBUTION	RELATIVE ABUNDANCE
Softstem Bulrush	Scirpus	validus	East Island Northern Tailwaters	Major
Common Cattail	Typha	latifolia	West & South Lakesides Northern Tailwaters	Major
Common Reed	Phragmites	australis	West & South Lakesides	Major
Coontail	Ceratophyllum	demersum	Northern Tailwaters (underwater)	Minor
Garrison Creeping Foxtail	Alopecurus	arundinaceus	Northern Tailwaters	Minor
Duckweed	Lemna	minor	Northern Tailwaters	Minor
Reed Canarygrass	Phalaris	arundinacea	Northern Tailwaters	Minor
Slough Sedge	Carex	atherodes	Northern Tailwaters	Major
Absinth Wormwood	Artemisia	absinthium	Vacant Lots	Major
Willow	Salix	spp.	Eastern Lakesides	Moderate

Mina Lake has been assigned the beneficial use of immersion recreation. Therefore, fecal coliform levels are limited to 200 per 100 ml as a geometric mean based on a minimum of not less than five samples obtained during separate 24-hour periods for any 30-day period, nor shall they exceed this value in more than 20% of the samples examined in the above described 30-day period; nor shall they exceed 400 per 100 ml in any one sample from May 1 to September 30.

Recommended microbiological criteria for South Dakota public swimming beaches are that any single sample exceeding 200 fecal coliform/100 ml of water is considered as "possibly unsafe" and two consecutive samples exceeding 300 fecal coliform/100 ml is considered unsafe for swimming.

Fecal coliform bacteria concentrations in Mina Lake did not exceed the swimming criteria during the study period. Fecal coliform concentrations were low and ranged from <10 to 30 per 100 ml averaging less than 11/100 ml in the surface waters of the lake (Appendix A).

Dissolved Oxygen

The State of South Dakota has assigned the beneficial use of warmwater permanent fish life propagation to Mina Lake. Therefore, dissolved oxygen (DO) concentrations should not decrease below 5.0 mg/l.

During the present study dissolved oxygen levels and other water quality parameters were sufficient to support a healthy warmwater fishery. Oxygen levels averaged 8 mg/l and ranged from 6.6 to 10.0 mg/l in surface waters and from 6.0 to 8.8 mg/l in deepwaters above the lake bottom.

Suspended Solids and Secchi Disk Visibility

The limits for suspended solids established for a warmwater permanent fishery is 90 mg/l. Excessive suspended solids in a body of water can have a detrimental effect on a lake's fishery. In 1965, the European Fisheries Advisory Committee identified four means by which suspended solids can affect fish and fish food populations (EPA, 1976). Fish swimming in waters with high suspended solids can be killed directly, their growth rate reduced, or their resistance to disease reduced. In addition, suspended solids can prevent the successful development of fish eggs and larva and reduce the abundance of food available to fish.

No exceedences of suspended solids (TSS) standards were observed in Mina Lake during the present study. TSS for the combined in-lake sites averaged 14 mg/l and ranged from <1 to 36 mg/l in surface samples and from <2 to 14 mg/l in bottom waters. Suspended volatile solids (algae and other living and dead organic matter) made up 43% of the total suspended solids and ranged from 0 to 12 mg/l in surface waters and from <2 to 14 mg/l in bottom water samples.

The water clarity and aesthetic appearance of a lake is often not apparent on examination of TSS levels. When suspended particles are very small, such as colloidal clays, it does not require a large amount of TSS to make the water turbid. This may represent the situation in Mina Lake whose large drainage area may contain large amounts of dispersed colloidal clay from the predominantly clay-based soils prevalent in the watershed.

Water clarity in Mina Lake as measured by Secchi disk visibility ranged from poor to fair during 1991 (1 ft - 5 ft). However, from February to April 1992 visibility increased dramatically to an average of 14 ft. The excellent visibility in March and April 1992 is unexpected since there was no ice cover during those sampling dates. It may be partially attributed to the lack of snowmelt and storm runoff during this period and/or the absence of strong winds that are typical for the area.

Phosphorus

Phosphorus is an essential nutrient for plant growth and is typically the cause of excessive growth of algae and aquatic plants. Total phosphorus (TP) concentrations as low as 0.03 mg/l can trigger nuisance growth (NIPC, 1989; Wetzel, 1983). According to Reckhow (1980) TP concentrations greater than .05 mg/l are indicative of hypereutrophy.

During the present study, total phosphorus concentrations in Mina Lake far exceeded the above values in both surface and bottom samples. Phosphorus levels ranged from 0.583 to 0.830 mg/l in surface waters and from 0.563 to 0.744 mg/l in deepwater samples. Surface and bottom samples exhibited similarly high phosphorus concentrations indicating the lake remains mixed throughout most of the annual cycle.

The annual TP mean (May 1991 - April 1992) of the combined in-lake samples was 0.687 mg/l (Table 5). It is of interest that 94% of lake TP and 96% of tributary TP during the study period was in the form of dissolved phosphate which may indicate a major watershed pollution source(s). In any case, these are extremely high phosphate levels even for lakes classified as highly eutrophic and represent a large surplus of in-lake phosphorus which is always available to produce algal blooms or nuisance weed growth.

In-lake total phosphorus concentrations appeared to have more than doubled in a little more than 10 years from a summer mean of 0.278 mg/l reported in 1979 (Koth, 1981). Major sources of phosphorus to Mina Lake may be livestock operations, soil erosion and fertilizer applications in the watershed.

Nitrogen

Nitrogen in its various forms is the second most important nutrient for growth of algae and other aquatic vegetation. Inorganic nitrogen concentrations (primarily nitrates and ammonia) in excess of 0.3 mg/l may be sufficient to stimulate algal growth (Sawyer, 1952).

Inorganic nitrogen concentrations in Mina Lake exceeded 0.3 mg/l only during June and July (Appendix A). At other times inorganic nitrogen levels were low, often at or below detection limits. Nitrate + nitrite (NO_3 + NO_2) values ranged from <0.1 to 0.8 mg/l and ammonia (NH_4) values ranged from <0.02 to 0.08 mg/l throughout the study period. High nitrate values (0.6 - 0.8 mg/l) observed in-lake during June and July 1991 may be largely attributed to tributary input during stormwater runoff. Tributary nitrate concentrations during those months were comparable to in-lake readings.

Nitrogen is believed to be the limiting nutrient in algal growth if the ratio of total nitrogen (N) to total phosphorus (P) is less than 10:1 (Wetzel, 1983). Blue-green algae may become dominant in lakes with a low N:P ratio since they are able to utilize atmospheric nitrogen (N_2) present in water. Other algae must rely on inorganic nitrogen. Due to the extremely high phosphorus concentration in Mina Lake, the mean N:P ratio was less than 2:1 indicating a pronounced nitrogen limitation for the lake during the present study.

Nutrient and Sediment Loadings to Mina Lake

Table 8 presents the nutrient and sediment loads for spring and summer of 1991 calculated for tributary sites 1 and 2. Also present are the areal loads. The values suggest that Mina Lake is receiving extremely high loads of phosphorus from its watershed. East Snake Creek (site 2) seems to provide considerably more total phosphorus than West Snake Creek (site 1). Nitrogen and sediment loads are moderate and not expected to degrade the water quality of Mina Lake. Sediment (TSS) loads entering the lake from the drainage appear to be negligible; an estimated 14.6 tons from

East Snake Creek and 10.4 tons from West Snake Creek during the period of tributary flow from May 3 to July 17. While nitrogen and sediment loads are estimated as moderate to minor, watershed phosphorus loads to Mina Lake may have to be reduced by at least 90% in order that acceptable (permissible) levels may be attained.

Table 8. Nutrient and sediment total loads and areal loads to Mina Lake, May 3 to July 17, 1991.

Sites	Total Load (g/yr)			Areal Load ($g/m^2/yr$)		
	Total Phosphorus	Total Nitrogen	Total Sediment (TSS)	Total Phosphorus	Total Nitrogen	Total Sediment
1	483122.1	761755.1	9402496.4	.148	.234	2.882
2	1949113.3	2051978.2	13232827.4	.597	.628	4.055
Total	2432235.4	2813733.3	22635323.8	.745	.862	6.937
Permissible Load[1]	228410.0	3263000.0	-	.070	1.000	-
Dangerous Load[1]	424190.0	6526000.0	-	.130	2.000	-

[1] Vollenweider (1968) phosphorus and nitrogen loadings based on Mina Lake mean depth (<5 meters) and surface area (326.3 ha).

'Permissible' loads are those which would cause the receiving lake to become less eutrophic or mesotrophic.

'Dangerous' loads would cause the receiving lake to become eutrophic or remain eutrophic.

Tributary Water Quality

During the study period, tributary sites #1 and #2 were sampled a total of 13 and 12 times, respectively. Water quality data indicated that these tributaries experience high levels of phosphorus and fecal coliform bacteria contamination and in turn deliver these high concentrations of contamination to Mina Lake (Table 8). Tributary input of sediment (suspended solids) to the lake appears to be a secondary problem at this time.

As previously discussed, fecal coliform concentrations exceeding 200 per 100 ml of water in lakes is considered potentially unsafe. Although this standard does not apply directly to streams, it serves to illustrate the contamination that may be occurring in the tributaries. During the study period, fecal coliform concentrations exceeded 200/100 ml in 82% of samples taken at the east tributary (site #2) but only 23% at the west tributary (site #1) exceeded this standard. Clearly, fecal coliform bacteria are a much greater problem in the eastern tributary to Mina Lake. Fecal coliform concentrations for sites #1 and #2 ranged from 10 to 3,300 and 60 to 1000, respectively (Appendix A). While the

frequently high tributary coliform levels were not reflected in lake samples during the present study, sources of fecal coliform contamination should be identified to protect immersion recreation in the lake.

Excessive nutrient concentrations are the primary cause of excessive blue-green algae and aquatic plant growth in lakes. Tributaries #1 and #2 both contributed high concentrations of nutrients, particularly phosphorus, to Mina Lake throughout the study period. High concentrations of nitrogen (in the form of nitrates) were contributed only in June and July. This was probably a delayed effect of nitrogen fertilizer applications in the watershed earlier in the spring of 1991.

Mean phosphorus levels in the tributaries were more than twice as high as those in the lake (Tables 5 and 8). Highest phosphorus concentrations consistently occurred at tributary site #2. Total phosphorus concentrations for the tributaries ranged from 0.176 to 1.81 at site #1 and from 0.210 to 2.58 at site #2. Dissolved phosphorus for the sites made up 95% and 98% of total phosphorus, respectively. This compares to 94% for the in-lake sites. Nitrate concentrations ranged from <0.10 to 0.70 at site #1 and from <0.10 to 0.60 at site #2. Unlike those for phosphorus, there was little difference in nitrate levels between tributary sites (Appendix A, Table 9).

Table 9. Tributary Sampling Data Mean Values (n = 13, 12, 9).

Parameter	Mean values for sites		
	Site 1	Site 2	Site 3
D.O. (mg/l)	3.4	3.2	7.3
Field pH (s.u.)	7.57	7.56	8.34
Fecal Coliform (#per/100 ml)	380	566	33
Total Solids (mg/l)	843	524	474
Total Dissolved Solids (mg/l)	815	505	451
Suspended Volatile Solids (mg/l)	8	6	8
Total Suspended Solids (mg/l)	20	15	22
Ammonia (mg/l)	0.07	0.07	0.03
Nitrate + Nitrite (mg/l)	0.39	0.35	0.61
TKN (mg/l)	1.50	1.68	0.85
Total PO4-P (mg/l)	1.241	1.874	0.622
Dissolved PO4-P (mg/l)	1.180	1.835	0.584

Low dissolved oxygen (<3 mg/l) recorded in both tributaries under flow conditions suggested the presence of considerable quantities of organic matter upstream of sites #1 and #2 (Appendix A, Table 9). This organic material either natural in origin or, more likely, produced by agricultural activities, is subject to decomposition (oxidation) by bacteria which may result in temporary depletion of oxygen supplies in streams and lakes.

Incoming suspended solids levels did not appear to pose a serious pollution problem to Mina Lake. Mean suspended solids calculated for the study were 20mg/l at site #1 and 15 mg/l at site #2 (Table 6). Most tributary TSS concentrations recorded were far below the 90 mg/l standard for Mina Lake (Appendix A).

Elutriate Analysis

Sediment samples collected from both arms of the lake at water quality in-lake sites #4 and #5 were analyzed for a variety of metals, pesticides and other potentially toxic chemicals. Results indicated no toxic levels of chemicals in the sediment or elutriate water (Appendix B). Therefore, the analysis indicated that disturbance of sediments by dredging activities should not present a toxicity problem to the lake.

Sediment Survey

The DENR in cooperation with the Edmunds County Conservation District conducted a sediment survey on February 20, 1991. Cross-section locations were plotted on a large photographic map, reproductions of which are available upon request from the Division of Water Resources Management (WRM), Pierre, SD.

Mina Lake was divided into eastern and western reaches which encompassed the two arms, and a southern reach covering the base of this U-shaped reservoir. Each reach was further divided with a number of transect lines sufficient to characterize sediment depth in each of the three sectors. Tables containing detailed sediment depth sounding data for every transect are included in Appendix C.

Results of the sediment depth survey indicated average sediment depth in Mina Lake is 1.12 ft. (Table 7). Mean sediment depths in the three sectors (reaches) ranged from 1.8 ft. in the east arm to 0.6 ft. in the south reach. The west arm of Mina Lake was intermediate for sediment depth with 1.0 ft. (Table 10).

These depths represent very moderate accumulations of sediment from the watershed and shoreline over the 58-year life of this reservoir and indicate that sediment build-up is presently not a serious problem in the main basin of Mina Lake.

Table 10. Summary of sediment depth survey, Mina Lake, February 20, 1991.

MINA LAKE SEDIMENT SURVEY

Summary Sheet

Section	Avg depth sed orig. to 1980	Volume orig. to 1980	Avg depth sed 1980 to 1991	Volume 1980 to 1991	Avg depth sed orig. to 1991	Volume orig. to 1991
E Reach	1.3 ft.	56148.4 cu/yds	0.5 ft.	10602.4 cu/yds	1.8 ft.	67393.6 cu/yds
S Reach	0.9 ft.	54169.4 cu/yds	-0.4 ft.	-22970.6 cu/yds	0.6 ft.	31198.8 cu/yds
W Reach	0.8 ft.	17210.2 cu/yds	0.1 ft.	5246.3 cu/yds	1.0 ft.	22456.5 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	3.0 ft.	127528.0 cu/yds	0.3 ft.	-7121.9 cu/yds	3.4 ft.	121048.9 cu/yds

Total distance of Reaches	38640.0 ft.
Average width of Mina Lake	908.6 ft.
Acres of Mina Lake	805.975758 acres
Average depth of sediment (original to 1980)	1.00920623 ft.
Total Volume (original to 1980)	42509.3175 cu/yds
Average depth of sediment (1980 to 1991)	0.09349429 ft.
Total Volume (1980 to 1991)	-2373.96 cu/yds
Average depth of sediment (original to 1991)	1.1207934 ft.
Total Volume (original to 1991)	40349.6454 cu/yds

Watershed Inspection/Land Use

The contributing watershed of Mina Lake is approximately 141,858 acres in size located mainly in Edmunds (76,603 acres) and McPherson Counties (63,389 acres). A small segment of the southeast drainage (1,866 acres) extends into Brown County (Figure 1).

Watershed topography is nearly level to gently sloping, but is steeper along the larger drainageways. Watershed soils are mostly the medium to moderately drained loams and clay-loams of the Niobell-Noonan, Bryant, Williams-Bowbells, Williams-Vida, and Edgely Loam Associations.

Agriculture is the principal enterprise in the watershed. About 40% of the area is cropland and 60% is native grass, tame grass and alfalfa. The main crops are wheat, oats, barley, corn, sunflowers, and alfalfa. Growing cash crops, hay, and raising beef cattle are the main farm activities.

Nutrient input from the watershed is a major problem and has undoubtedly accelerated the eutrophication of Mina Lake. Likely sources of some of these nutrients are a number of feedlots that border the main drainageways. These operations should be given a high priority in any future mitigation efforts for the improvement of Mina Lake. Livestock operations are also major sources of high levels of fecal coliform bacteria entering Mina Lake via its two major tributaries, as previously discussed. Some sedimentation is occurring in the upper reaches of the lake in the two inlet areas which is related to watershed soil erosion. Rooted aquatic vegetation (mainly cattails) are encroaching in these areas of sedimentation. However, the actual seriousness of this last problem is under investigation and remains to be determined.

There are approximately 132 livestock operations/farmsteads within the Mina Lake watershed at the present time. Of these, 81 or 61% were found to have a relatively low impact on local water quality, 10 or 8% were rated as having a moderate to severe impact and the remaining 41 operations or 31% could not be rated at the time of the survey.

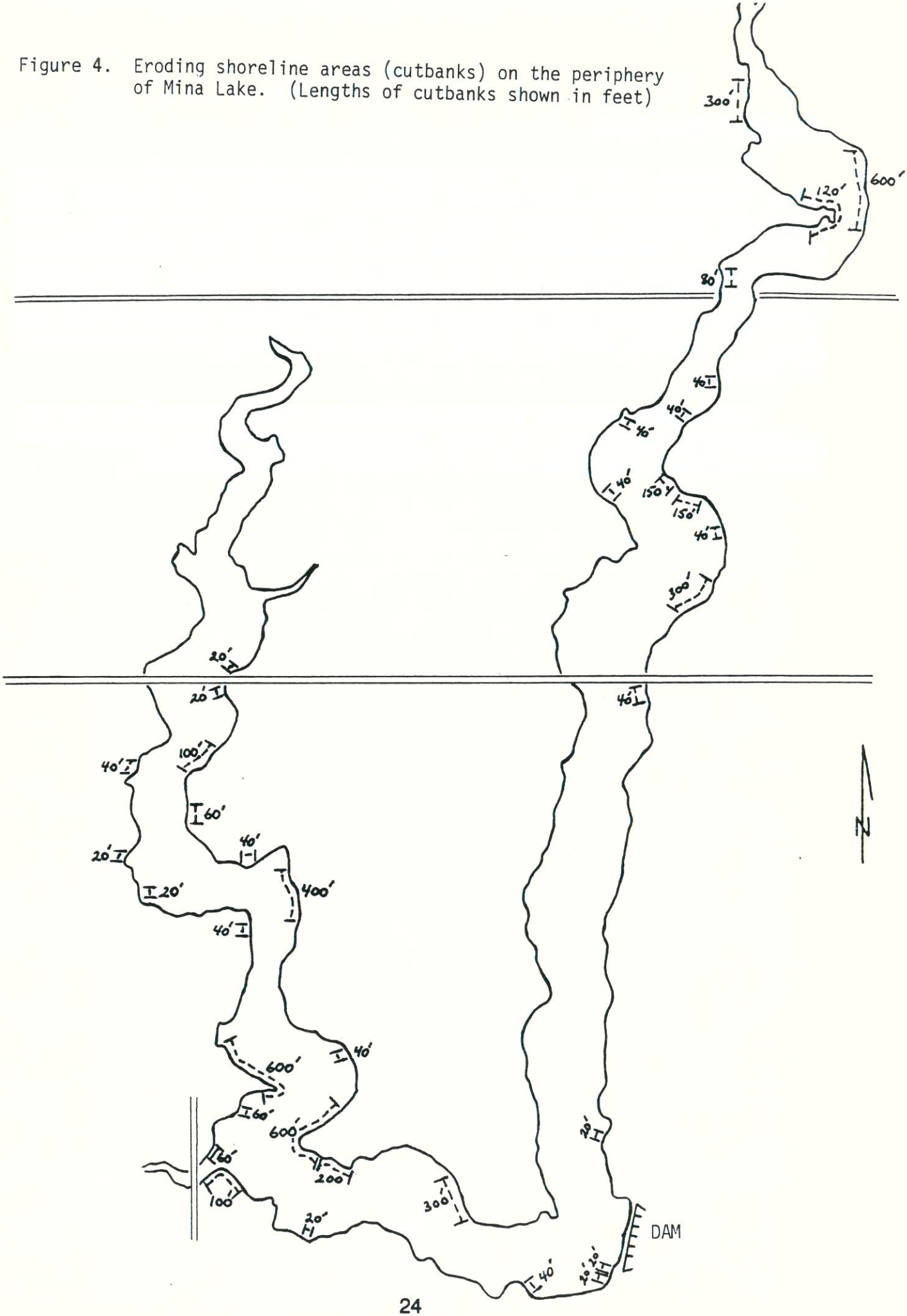
The watershed inspection further indicated there are approximately 19,084 acres of erodible cropland in the drainage where establishment of permanent cover under the CRP program would be beneficial for controlling water and wind erosion; and approximately 50,000 acres of rangeland where planned grazing systems need to be implemented. Sixteen waterways totalling 7500 linear feet were in need of grass cover for retention of waterborne sediments and associated nutrients. Finally, the survey noted 17 natural stream beds within the watershed under cultivation during 1991 and 35 old sediment dams in the drainage that had moderate to severe erosion problems, some of which having been rendered ineffective where waterflows had cut new channels bypassing the dams.

Shoreline Erosion Survey

A shoreline erosion survey was conducted during September 1991 by personnel of the Edmunds County Conservation District to determine those shoreline areas contributing significant sediment loads to the lake. Thirty-six such areas (mainly cutbanks) were identified ranging in length from 20 to 600 feet that were experiencing moderate to severe erosion due to wind and wave action (Figure 4). Those lakeside segments totaled 4780 feet or about 4% of the lake shoreline. Severe erosion problems were noted at a 600 foot cutbank located at the upper end of the east arm of Mina Lake (Figure 4). Sediment yield from eroding lakeshore segments was not quantified during this survey.

In the developed parts of the Mina Lake shoreline most of the lakeshore has been stabilized by private residents. As of 1990, lakeside homeowners have riprapped 35,640 feet of shoreline or slightly less than 1/3 of the entire lake circumference.

Figure 4. Eroding shoreline areas (cutbanks) on the periphery of Mina Lake. (Lengths of cutbanks shown in feet)



CONCLUSIONS

1. Very high concentrations of total phosphorus (mean 0.687 mg/l) were present in Mina Lake from May 20, 1991 to April 14, 1992, the length of the present monitoring period. According to some literature sources, concentrations greater than 0.05 mg/l TP are indicative of extreme lake eutrophy (hypereutrophy).

2. Dissolved phosphorus made up 94% of total phosphorus for in-lake samples during the study suggesting the presence of one or more major pollution sources in the lake watershed.

3. Tributary averages for total phosphorus (TP) were even higher (1.241 and 1.874 mg/l) than that for the lake indicating that the two major tributaries may be the principal contributors of phosphorus to the lake.

4. Similar to in-lake samples, dissolved phosphorus comprised 96% of total phosphorus in tributary samples.

5. In contrast to phosphorus, in-lake organic nitrogen (TKN-ammonia) was present at low to moderate concentrations (mean 0.77 mg/l). Ammonia levels were also low.

6. Organic nitrogen in the tributaries was approximately twice the concentration in the lake, but cannot be considered excessive given the large size of the watershed devoted to agriculture. However, the often low DO (<3 mg/l) readings in the tributaries suggests considerable organic matter was available for oxidation upstream of sites #1 and #2, which may have resulted in the depressed oxygen levels recorded during this study.

7. Nitrate nitrogen concentrations increased sharply in the lake and tributaries (to 0.6-0.8 mg/l) during June and July 1991 from usually low or undetectable levels (<0.10 mg/l). These increases may have been due to runoff following nitrogen fertilizer applications in the watershed.

8. Based on the excessive quantities of phosphorus and relatively moderate amounts of total nitrogen present, Mina Lake can be classified as a nitrogen-limited lake during 1991.

9. Mina Lake is experiencing excessive phosphorus loading and relatively moderate nitrogen loading from its tributaries during periods of stormwater runoff. The lake appears to act as a phosphorus sink and as a nitrogen sink for organic nitrogen but not for nitrate nitrogen.

10. Based on a comparison with in-lake data collected during June and August of 1979, mean TKN for those months declined from 1.34 to 0.85 mg/l between the years 1979 and 1991. However, in-lake total phosphorus appears to have more than doubled from 0.278 to 0.645 mg/l during this interval.

11. The increase in lake phosphorus may be due to increased agricultural activity in the watershed during the past 12 years. However, this cannot account for the concomitant decline in TKN nitrogen, but may partially explain an increase in average lake nitrate from 0.20 to >0.40 (June and August) over the same time period.

12. Average water clarity (Secchi disk visibility) in Mina Lake for 1991 rated as poor (3.7 ft = 1.1 m). From 1979 to 1991 (June and August only) lake water clarity apparently has declined 33% from fair (1.8 m) to poor (1.2m). This decrease may be due to increases in both biotic (algae) and abiotic (suspended clay and silt particles) factors.

13. In-lake and outlet fecal coliform bacteria concentrations were low during the study (<90/100 ml) averaging 14 and 33 organisms/100 ml, respectively. These levels were in compliance with state criteria for surface waters used for immersion recreation.

14. Tributary fecal coliform levels exceeded 200/100 ml in 23% of samples at site #1 and in 82% at site #2. High fecal coliform densities occurred much more frequently at eastern tributary site #2 (Appendix A) even though this subdrainage is only 12% larger in area than the other subdrainage in the watershed monitored by site #1. Although the high tributary fecal densities were not reflected in lake samples (probably owing to the distance of lake sites from the two lake inlets), the source(s) of these high bacterial levels must be identified to protect immersion recreation in Mina Lake.

15. Accumulations of soft sediments in Mina Lake from the watershed and lakeshore erosion appear to be very moderate (mean depth 1.12 ft.) over the 58-year life of this reservoir. However, shoreline bank erosion contributes to water turbidity and degrades nearby littoral lake habitat and sedimentation from the drainage is appreciable in the upper reaches (inlet areas) of the lake where it aids the encroachment of cattails and other aquatic vegetation. Nevertheless, these inlet areas with their cattail beds act as sediment traps that protect the more usable portions of the lake some distance downstream.

16. In general, aquatic vegetation, and particularly floating and submerged macrophytes, are not a serious problem in Mina Lake at the present time.

RECOMMENDATIONS

Based on the results of this study, the DENR recommends the following alternatives for restoration. These recommendations should provide a basis for the development of a complete restoration work plan and subsequent implementation. The recommendations are provided for review only. They are not to be considered as the only possible methods of restoration. In approximate order of importance they are the following:

1. Ag Waste Management Systems:

   Installation of animal waste management systems at the feedlots in the watershed would represent a positive step to reduce nutrient and fecal coliform bacteria input. Approximately 10 systems would be needed to contain most of the feedlot runoff. Another effort should be made to obtain water quality impact estimates for the 31% of watershed livestock operations (41) that could not be rated during the initial survey.

2. Best Management Practices on Cropland:

   Best Management Practices should be applied to cropland and pastures where necessary, to reduce nutrient loading and sedimentation to the lake. Minimum tillage practices should be stressed as a preferred method of crop residue management. Fertilizer application rates and timing should be monitored to determine if they contribute to excessive nutrient loading. Landowners need to maintain established Best Management Practices or else any gains in nutrient and sediment reduction will be lost.

3. Shoreline Erosion:

   Approximately 4,000 linear feet of riprapping is needed to stabilize the severe shoreline erosion areas.

4. Planned Grazing Systems:

   Planned Grazing Systems should be applied on 50,000 acres of native range to improve range condition.

5. Natural Stream Channels Being Cropped:

   Approximately 550 acres of natural stream channels are currently being cropped and should be seeded to permanent vegetation.

6. Grassed Waterways:

   Approximately 12,000 linear feet of grassed waterways are needed in the watershed.

7. Old Dam Site Repair:

   Approximately 35 old dams are located in the watershed. These dams have moderate to severe erosion problems due to poor design. Many of the spillways are eroding and in many cases a new channel is cut around the dam making the dam totally ineffective. Poorly designed sediment dams that have deteriorated to the extent that repair is not practicable should be rebuilt using a more effective design. Many eroding spillways can probably be repaired economically. Dams that have been rendered ineffective should be replaced if their location is in a high sediment area.

8. Elimination of Septic Tank Drainfields on West Side of West Mina Lake:

   Septic tanks of approximately 15 homes should be hooked up to the existing centralized sewer system and individual septic tank drainfields eliminated.

9. Approximately 19,000 acres of eroding crop and rangeland in the Mina Lake drainage may be eligible for protection (permanent grass cover) under the CRP program. For each individual tract appropriate Best Management Practices (BMP) should be applied as needed.

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APPENDIX A
WATER QUALITY DATA

Mina Lake and tributary water quality, May 6, 1991 - April 14, 1992

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	WTEMP	ATEMP	DISOX	FPH	LABPH	FECAL	SDISK ft.	TSOL	TDSOL	TSSOL	VOLATILE SOLIDS	FIXED SOLIDS	AMMON	UNIONIZED AMMONIA	NO3+2	TKN-N	TPO40	TOTAL DISS. PO4
MINA LAKE	06-May-91	1045	1	GRAB	SURFACE	36	36	2	8.04	NA	10	-	2382	2307	8	6	2	0.02		0.1	1.04	0.176	0.17
MINA LAKE	15-May-91	-	1	GRAB	SURFACE	64	62	6	7.57	NA	3300	2	2433	2382	32	6	26	0.04		0.3	1.31	0.454	0.41
MINA LAKE	22-May-91	1045	1	GRAB	SURFACE	72	72	2.4	7.48	NA	30	0	415	411	38	16	22	0.03		0.1	1.49	0.882	0.772
MINA LAKE	28-May-91	1115	1	GRAB	SURFACE	50	51	3.6	7.61	NA	44	1.5	981	936	16	14	2	0.08		0.1	1.49	1.23	1.17
MINA LAKE	03-Jun-91	1000	1	GRAB	SURFACE	72	68	2.7	7.67	NA	100	1.67	695	677	26	6	20	0.03		0.1	1.61	1.64	1.61
MINA LAKE	05-Jun-91	1000	1	GRAB	SURFACE	64	56	3.3	7.49	NA	250	2	736	717	18	16	2	0.11		0.01	2.23	1.81	1.78
MINA LAKE	10-Jun-91	1000	1	GRAB	SURFACE	74	74	2	7.6	NA	50	1.42	637	639	6	4	2	0.06		0.6	1.56	1.54	1.56
MINA LAKE	17-Jun-91	1030	1	GRAB	SURFACE	72	70	2.8	7.6	NA	80	0	457	456	2	2	0	0.05		0.7	1.66	1.51	1.47
MINA LAKE	25-Jun-91	1100	1	GRAB	SURFACE	72	75	6.6	7.74	NA	50	1.67	687	644	4	2	2	0.05		0.6	1.69	1.44	1.42
MINA LAKE	01-Jul-91	900	1	GRAB	SURFACE	69	68	2.4	7.37	NA	640	0	415	379	30	16	14	0.05		0.7	1.23	1.29	1.17
MINA LAKE	08-Jul-91	1100	1	GRAB	SURFACE	69	68	3	7.44	NA	80	0	333	298	24	6	18	0.21		0.6	1.69	1.36	1.27
MINA LAKE	10-Jul-91	1030	1	GRAB	SURFACE	72	64	2.6	7.24	NA	200	0.83	342	344	18	2	16	0.15		0.5	0.97	1.36	1.24
MINA LAKE	17-Jul-91	130	1	GRAB	SURFACE	97	97	5	7.56	NA	100	0.75	444	408	32	14	18	0.04		0.6	1.55	1.441	1.305
MINA LAKE	06-May-91	1130	2	GRAB	SURFACE	45	36	3.2	8.14	NA	870	-	1063	1010	6	4	2	0.02		0.1	0.9	0.21	0.203
MINA LAKE	15-May-91	-	2	GRAB	SURFACE	64	62	7	8.04	NA	820	1	1050	955	62	10	52	0.07		0.2	1.7	0.475	0.288
MINA LAKE	22-May-91	1115	2	GRAB	SURFACE	72	72	2.6	7.6	NA	210	0.5	475	470	30	12	18	0.03		0.1	1.52	1.7	1.7
MINA LAKE	28-May-91	1045	2	GRAB	SURFACE	50	51	2.8	7.43	NA	NA	1	408	399	12	10	2	0.03		0.1	2.1	2.14	2.08
MINA LAKE	03-Jun-91	1100	2	GRAB	SURFACE	72	68	1.6	7.3	NA	1000	1.17	438	427	26	4	22	0.02		0.1	1.54	2.37	2.54
MINA LAKE	05-Jun-91	1100	2	GRAB	SURFACE	64	56	2.6	7.42	NA	950	1.67	382	380	6	4	2	0.07		0.1	1.33	2.19	2.03
MINA LAKE	10-Jun-91	1100	2	GRAB	SURFACE	73	73	2.2	7.62	NA	370	1.33	530	537	4	2	2	0.08		0.6	4.25	2.58	2.56
MINA LAKE	17-Jun-91	1030	2	GRAB	SURFACE	72	71	2.4	7.47	NA	60	2.08	292	288	2	2	0	0.03		0.6	1.34	1.75	1.75
MINA LAKE	25-Jun-91	1115	2	GRAB	SURFACE	73	75	4.8	7.52	NA	670	1	355	330	2	2	0	0.26		0.6	1.7	2.18	2.17
MINA LAKE	01-Jul-91	1000	2	GRAB	SURFACE	69	68	3.2	7.48	NA	710	1	364	360	2	2	0	0.24		0.6	1.65	2.24	2.22
MINA LAKE	08-Jul-91	1130	2	GRAB	SURFACE	69	68	3.8	7.46	NA	140	1	476	443	18	8	10	0.02		0.6	0.69	2.29	2.21
MINA LAKE	10-Jul-91	1100	2	GRAB	SURFACE	72	65	1.8	7.3	NA	430	0.58	460	460	16	10	6	0.02		0.5	1.51	2.36	2.27
MINA LAKE	11-Jun-91	1130	3	OUTL	SURFACE	76	76	4.2	8.04	NA	80	NA	482	435	14	12	2	0.03		0.7	0.91	0.658	0.549
MINA LAKE	17-Jun-91	1200	3	OUTL	SURFACE	73	71	8.8	8.21	NA	10	NA	471	437	30	4	26	0.05		0.8	1.12	0.563	0.495
MINA LAKE	25-Jun-91	1200	3	OUTL	SURFACE	73	75	7.2	7.72	NA	50	NA	477	448	36	8	28	0.04		0.8	0.98	0.617	0.603
MINA LAKE	01-Jul-91	1000	3	OUTL	SURFACE	73	68	7.4	8.96	NA	70	NA	461	437	36	14	22	0.02		0.8	0.65	0.603	0.597
MINA LAKE	08-Jul-91	1200	3	OUTL	SURFACE	68	68	7	8.44	NA	2	NA	485	455	16	4	12	0.02		0.7	0.62	0.637	0.542
MINA LAKE	10-Jul-91	1130	3	OUTL	SURFACE	74	76	7.6	8.4	NA	10	NA	475	471	14	10	4	0.02		0.6	0.83	0.59	0.536
MINA LAKE	17-Jul-91	1400	3	OUTL	SURFACE	79	79	9	8.5	NA	40	NA	455	446	22	10	12	0.02		0.6	0.78	0.644	0.624
MINA LAKE	22-Jul-91	1100	3	OUTL	SURFACE	77	72	8.2	8.32	NA	10	NA	462	454	6	0	6	0.02		0.6	0.82	0.63	0.624
MINA LAKE	30-Jul-91	1000	3	OUTL	SURFACE	74	74	6.4	8.51	NA	30	NA	499	478	20	10	10	0.02		0.5	0.96	0.661	0.686
MINA LAKE	20-May-91	1000	4&5	SURF	COMP.	64	62	8.8	8.3	NA	30	3	445	430	26	6	20	0.07		0.1	1.12	0.593	0.549
MINA LAKE	18-Jun-91	1030	4&5	SURF	COMP.	75	73	7.4	8.3	NA	-	2.6	490	482	10	8	2	0.04		0.8	1.04	0.583	0.515
MINA LAKE	15-Jul-91	1100	4&5	SURF	COMP.	76	73	8.8	7.52	NA	10	1	480	457	12	2	10	0.06		0.6	1.08	0.664	0.61
MINA LAKE	21-Aug-91	0930	4&5	SURF	COMP.	73	82	7	8.06	NA	10	5	465	462	14	6	8	0.02		0.1	0.73	0.722	0.727
MINA LAKE	30-Sep-91	1000	4&5	SURF	COMP.	57	52	8.4	8.17	NA	10	5	508	501	18	4	14	0.04		0.1	0.69	0.746	0.637
MINA LAKE	16-Oct-91	1000	4&5	SURF	COMP.	50	62	8.8	8.15	NA	-	3	522	496	36	10	26	0.02		0.1	0.6	0.739	0.675
MINA LAKE	25-Nov-91	-	4&5	SURF	COMP.	39	20	10	8.48	NA	10	5	509	476	12	12	0	0.02		0.1	0.71	0.661	0.62
MINA LAKE	17-Dec-91	-	4&5	SURF	COMP.	36	20	8	8.22	NA	2	5	544	536	1	0	1	0.02		0.1	0.75	0.717	0.677
MINA LAKE	21-Jan-92	-	4&5	SURF	COMP.	36	22	6.6	8.1	NA	10	-	632	623	1	0	1	0.02		0.1	0.81	0.83	0.803
MINA LAKE	24-Feb-92	1100	4	SURF	COMP.	41	22	7.8	8.55	NA	10	14	472	467	7	6	1	0.02		0.1	0.75	0.608	0.584
MINA LAKE	24-Mar-92	0930	4&5	SURF	COMP.	37	48	7.6	8.02	NA	10	14	503	497	3	3	0	0.02		0.1	1.75	0.681	0.654
MINA LAKE	14-Apr-92	0700	4&5	SURF	COMP.	33	40	8	8.3	NA	10	14	506	480	2	2	0	0.02		0.1	0.63	0.707	0.737
MINA LAKE	20-May-91	1000	4&5	BOT	COMP.	64	62	8.6	8.08	NA	10	NA	455	433	34	6	28	0.08		0.1	0.71	0.61	0.536
MINA LAKE	18-Jun-91	1100	4&5	BOT	COMP.	75	73	7.2	8	NA	-	NA	495	483	14	6	8	0.05		0.8	0.89	0.563	0.515
MINA LAKE	15-Jul-91	1200	4&5	BOT	COMP.	66	73	8.8	7.52	NA	-	NA	478	454	6	2	4	0.06		0.6	0.77	0.685	0.61
MINA LAKE	21-Aug-91	1000	4&5	BOT	COMP.	73	82	6	7.92	NA	-	NA	479	455	14	2	12	0.06		0.1	0.74	0.712	0.708
MINA LAKE	30-Sep-91	1000	4&5	BOT	COMP.	57	52	7.5	7.92	NA	-	NA	524	485	18	8	10	0.04		0.1	0.8	0.752	0.597
MINA LAKE	16-Oct-91	1000	4&5	BOT	COMP.	50	62	8.6	7.6	NA	-	NA	524	491	38	14	24	0.02		0.1	0.52	0.739	0.712
MINA LAKE	24-Feb-92	1100	4	BOT	COMP.	41	22	7.8	7.55	NA	-	NA	542	534	6	4	2	0.02		0.1	0.84	0.744	0.737
MINA LAKE	24-Mar-92	0930	4&5	BOT	COMP.	36	48	8	7.81	NA	-	NA	515	491	6	5	1	0.02		0.1	0.7	0.674	0.651
MINA LAKE	14-Apr-92	0700	4&5	BOT	COMP.	33	40	8	7.6	NA	-	NA	505	484	7	5	2	0.02		0.1	0.62	0.697	0.73

APPENDIX B
ELUTRIATE SAMPLE DATA

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

Project: Section 22 PAS Project for South Dakota
Date Sample Taken: 08 Aug 91
Date Sample Received: 10 Aug 91
Sample Description: Water and Sediment
Time Sample Taken: 1500
Customer Sample Id: Mina Lake - West Branch
Lab Sample No: 910813-W004, W005, & W006
Sample Container: 1-1 gal wide mouth glass (sed)
3-1 gal amber glass (water)

Analysis	Sediment Result	Units	Receiving Water Result	Units	Elutriate Water Result	Units
Ca and Mg Hardness			200	mg/L	181	mg/L
Ammonia Nitrogen			0.13	mg/L	0.78	mg/L
Chemical Oxygen Demand			24	mg/L	36	mg/L
Total Cyanide			<0.02	mg/L	<0.02	mg/L
Nitrate-Nitrite Nitrogen			0.05	mg/L	<0.01	mg/L
Total Phosphorus			0.65	mg/L	0.17	mg/L
Total Kjeldahl Nitrogen			1.1	mg/L	1.7	mg/L
Oil and Grease			<5	mg/L	<5	mg/L
Antimony	<0.5	mg/kg	<1	µg/L	2	µg/L
Arsenic	4.6	mg/kg	6.0	µg/L	4	µg/L
Barium	180	mg/kg	60	µg/L	130	µg/L
Beryllium	<0.1	mg/kg	<1	µg/L	<1	µg/L
Cadmium	<0.5	mg/kg	<0.1	µg/L	<0.1	µg/L
Chromium	22	mg/kg	4	µg/L	<1	µg/L
Copper	28	mg/kg	<10	µg/L	10	µg/L
Iron	14000	mg/kg	40	µg/L	<10	µg/L
Lead	12	mg/kg	<1	µg/L	<1	µg/L
Magnesium	3900	mg/kg	20	mg/L	18	mg/L
Manganese	11000	mg/kg	450	µg/L	7200	µg/L
Mercury	<0.10	mg/kg	<0.2	µg/L	<0.2	µg/L
Selenium	0.42	mg/kg	<1.0	µg/L	<1.0	µg/L
Zinc	88	mg/kg	<10	µg/L	<10	µg/L
Nickel	52	mg/kg	35	µg/L	15	µg/L
Aluminum	10000	mg/kg	<50	µg/L	<50	µg/L
Calcium	7000	mg/kg	47	mg/L	43	mg/L
Sodium	260	mg/kg	61	mg/L	61	mg/L
Potassium	2700	mg/kg	19	mg/L	21	mg/L
Silver	<1.0	mg/kg	<10	µg/L	<10	µg/L
Simazine (Princep)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Metribuzin (Lexone)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Atrazine (Aatrex)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Aldrin	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
alpha-BHC	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
beta-BHC	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
gamma-BHC (Lindane)	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Mirex	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Chlordane	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
P'P"DDD	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
P'P"DDE	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
P'P"DDT	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Dieldrin	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Endosulfan I	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Propachlor (Ramrod)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Metolachlor (Dual)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Alachlor (Lasso)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Diazinon	<100	µg/kg	<0.01	µg/L	<0.01	µg/L
Endrin	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Heptachlor	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Heptachlor epoxide	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Methoxychlor	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Toxaphene	<500	µg/kg	<0.50	µg/L	<0.50	µg/L
PCB-1016	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1221	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1232	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1242	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1248	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1254	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1260	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
O'P"DDE	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
O'P"DDD	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
beta-Endosulfan	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Perthane	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
O'P"DDT	<10	µg/kg	<0.01	µg/L	<0.01	µg/L

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

Project: Section 22 PAS Project for South Dakota
Date Sample Taken: 08 Aug 91
Date Sample Received: 10 Aug 91
Sample Description: Water and Sediment
Time Sample Taken: 1500
Customer Sample Id: Mina Lake - West Branch
Lab Sample No: 910813-W004, W005, & W006
Sample Container: 1-1 gal wide mouth glass (sed)
3-1 gal amber glass (water)

Analysis	Sediment Result	Units	Receiving Water Result	Units	Elutriate Water Result	Units
Methyl Parathion			<0.01	µg/L	<0.01	µg/L
Malathion			<0.01	µg/L	<0.01	µg/L
Parathion			<0.01	µg/L	<0.01	µg/L
Methly Trithion			<0.01	µg/L	<0.01	µg/L
Ethion			<0.01	µg/L	<0.01	µg/L
Trithion			<0.01	µg/L	<0.01	µg/L

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

Project: Section 22 PAS Project for South Dakota
Date Sample Taken: 08 Aug 91
Date Sample Received: 10 Aug 91
Sample Description: Water and Sediment
Time Sample Taken: 1500

Customer Sample Id: Mina Lake - East Branch
Lab Sample No: 910813-W001, W002, & W003
Sample Container: 1-1 gal wide mouth glass (sed)
3-1 gal amber glass (water)

Analysis	Sediment Result	Units	Receiving Water Result	Units	Elutriate Water Result	Units
Ca and Mg Hardness			172	mg/L	181	mg/L
Ammonia Nitrogen			0.07	mg/L	0.80	mg/L
Chemical Oxygen Demand			22	mg/L	42	mg/L
Total Cyanide			<0.02	mg/L	<0.02	mg/L
Nitrate-Nitrite Nitrogen			0.05	mg/L	0.07	mg/L
Total Phosphorus			0.56	mg/L	0.23	mg/L
Total Kjeldahl Nitrogen			0.99	mg/L	1.9	mg/L
Oil and Grease			<5	mg/L	<5	mg/L
Antimony	<0.5	mg/kg	<1	µg/L	<1	µg/L
Arsenic	3.3	mg/kg	6.0	µg/L	4	µg/L
Barium	170	mg/kg	70	µg/L	180	µg/L
Beryllium	<0.1	mg/kg	<1	µg/L	<1	µg/L
Cadmium	<0.5	mg/kg	<0.1	µg/L	<0.1	µg/L
Chromium	24	mg/kg	1	µg/L	<1	µg/L
Copper	23	mg/kg	10	µg/L	<10	µg/L
Iron	16000	mg/kg	20	µg/L	260	µg/L
Lead	20	mg/kg	4	µg/L	<1	µg/L
Magnesium	7400	mg/kg	17	mg/L	18	mg/L
Manganese	6000	mg/kg	<5	µg/L	8800	µg/L
Mercury	<0.10	mg/kg	<0.2	µg/L	<0.2	µg/L
Selenium	0.84	mg/kg	2.0	µg/L	<1.0	µg/L
Zinc	96	mg/kg	<10	µg/L	<10	µg/L
Nickel	47	mg/kg	8	µg/L	13	µg/L
Aluminum	18000	mg/kg	<50	µg/L	140	µg/L
Calcium	9900	mg/kg	41	mg/L	43	mg/L
Sodium	550	mg/kg	61	mg/L	61	mg/L
Potassium	3800	mg/kg	20	mg/L	22	mg/L
Silver	<1.0	mg/kg	<10	µg/L	<10	µg/L
Simazine (Princep)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Metribuzin (Lexone)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Atrazine (Aatrex)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Aldrin	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
alpha-BHC	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
beta-BHC	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
gamma-BHC (Lindane)	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Mirex	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Chlordane	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
P'P"DDD	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
P'P"DDE	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
P'P"DDT	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Dieldrin	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Endosulfan I	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Propachlor (Ramrod)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Metolachlor (Dual)	<100	µg/kg		µg/L	<0.10	µg/L
Alachlor (Lasso)	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
Diazinon	<100	µg/kg	<0.01	µg/L	<0.01	µg/L
Endrin	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Heptachlor	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Heptachlor epoxide	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Methoxychlor	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Toxaphene	<500	µg/kg	<0.50	µg/L	<0.50	µg/L
PCB-1016	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1221	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1232	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1242	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1248	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1254	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
PCB-1260	<100	µg/kg	<0.10	µg/L	<0.10	µg/L
O'P"DDE	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
O'P"DDD	<10	µg/kg	.21	µg/L	<0.01	µg/L
beta-Endosulfan	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
Perthane	<10	µg/kg	<0.01	µg/L	<0.01	µg/L
O'P"DDT	<10	µg/kg	<0.01	µg/L	<0.01	µg/L

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
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Omaha, Nebraska

Project: Section 22 PAS Project for South Dakota
Date Sample Taken: 08 Aug 91
Date Sample Received: 10 Aug 91
Sample Description: Water and Sediment
Time Sample Taken: 1500
Customer Sample Id: Mina Lake - East Branch
Lab Sample No: 910813-W001, W002, & W003
Sample Container: 1-1 gal wide mouth glass (sed)
3-1 gal amber glass (water)

Analysis	Sediment Result	Units	Receiving Water Result	Units	Elutriate Water Result	Units
Methyl Parathion			<0.01	µg/L	<0.01	µg/L
Malathion			<0.01	µg/L	<0.01	µg/L
Parathion			<0.01	µg/L	<0.01	µg/L
Methly Trithion			<0.01	µg/L	<0.01	µg/L
Ethion			<0.01	µg/L	<0.01	µg/L
Trithion			<0.01	µg/L	<0.01	µg/L

APPENDIX C
Sediment Depth Data

MINA LAKE SEDIMENT SURVEY

Summary Sheet

Section	Avg depth sed orig. to 1980	Volume orig. to 1980	Avg depth sed 1980 to 1991	Volume 1980 to 1991	Avg depth sed orig. to 1991	Volume orig. to 1991
E Reach	1.3 ft.	56148.4 cu/yds	0.5 ft.	10602.4 cu/yds	1.8 ft.	67393.6 cu/yds
S Reach	0.9 ft.	54169.4 cu/yds	-0.4 ft.	-22970.6 cu/yds	0.6 ft.	31198.8 cu/yds
W Reach	0.8 ft.	17210.2 cu/yds	0.1 ft.	5246.3 cu/yds	1.0 ft.	22456.5 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	3.0 ft.	127528.0 cu/yds	0.3 ft.	-7121.9 cu/yds	3.4 ft.	121048.9 cu/yds

Total distance of Reaches	38640.0 ft.
Average width of Mina Lake	908.6 ft.
Acres of Mina Lake	805.975758 acres
Average depth of sediment (original to 1980)	1.00920623 ft.
Total Volume (original to 1980)	42509.3175 cu/yds
Average depth of sediment (1980 to 1991)	0.09349429 ft.
Total Volume (1980 to 1991)	-2373.96 cu/yds
Average depth of sediment (original to 1991)	1.1207934 ft.
Total Volume (original to 1991)	40349.6454 cu/yds

MINA LAKE SEDIMENT SURVEY

Summary sheet for East Reach

Section	Avg depth sed orig. to 1980	Volume orig. to 1980	Avg depth sed 1980 to 1991	Volume 1980 to 1991	Avg depth sed orig. to 1991	Volume orig. to 1991
RE 1-2	0.8 ft.	60000.0 cu/yds	-0.7 ft.	-49333.3 cu/yds	0.1 ft.	10666.7 cu/yds
RE 2-3	0.8 ft.	68747.5 cu/yds	-0.7 ft.	-53757.4 cu/yds	0.2 ft.	14990.0 cu/yds
RE 3-4	0.7 ft.	55092.6 cu/yds	-0.9 ft.	-69101.9 cu/yds	-0.2 ft.	-14009.3 cu/yds
RE 4-5	1.1 ft.	82714.6 cu/yds	-0.2 ft.	-16245.3 cu/yds	0.9 ft.	66469.3 cu/yds
RE 5-6	1.2 ft.	87238.2 cu/yds	0.9 ft.	62110.8 cu/yds	2.1 ft.	149348.9 cu/yds
RE 6-7	1.2 ft.	71627.3 cu/yds	0.4 ft.	20781.4 cu/yds	1.6 ft.	92408.7 cu/yds
RE 7-8	1.7 ft.	78629.1 cu/yds	1.2 ft.	55753.7 cu/yds	2.9 ft.	134382.8 cu/yds
RE 8-9	1.8 ft.	52566.4 cu/yds	2.0 ft.	50775.2 cu/yds	3.8 ft.	112341.7 cu/yds
RE 9-10	1.5 ft.	35433.1 cu/yds	0.6 ft.	15391.9 cu/yds	2.1 ft.	50825.0 cu/yds
RE 10-11	1.6 ft.	61048.6 cu/yds	0.9 ft.	37011.6 cu/yds	2.5 ft.	98060.2 cu/yds
RE 11-12	1.6 ft.	78491.7 cu/yds	1.5 ft.	70725.5 cu/yds	3.1 ft.	149217.2 cu/yds
RE 12-13	1.6 ft.	32647.6 cu/yds	0.6 ft.	13174.1 cu/yds	2.2 ft.	45821.7 cu/yds
RE 13-14	1.5 ft.	16308.0 cu/yds	0.7 ft.	7992.6 cu/yds	2.3 ft.	24300.6 cu/yds
RE 14-15	1.3 ft.	5532.8 cu/yds	0.8 ft.	3154.7 cu/yds	2.1 ft.	8687.5 cu/yds
	18.4 ft.	786077.5 cu/yds	7.1 ft.	148433.6 cu/yds	25.7 ft.	943511.0 cu/yds

Distance of the East Reach 20010.0 ft.

Average width of the East Reach 834 ft.

Acres of East Reach 383.11157 acres

Average depth of sediment (original to 1980) 1.31428571 ft.

Total Volume (original to 1980) 56148.3929 cu/yds

Average depth of sediment (1980 to 1991) 0.50714286 ft.

Total Volume (1980 to 1991) 10602.4 cu/yds

Average depth of sediment (original to 1991) 1.83571429 ft.

Total Volume (original to 1991) 67393.6429 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RE-1	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	15.2	14.9	0.3	18.3	-3.4	-3.1
	3+00	28.7	25.8	2.9	28.4	-2.6	0.3
	5+00	26.2	24.6	1.6	27.2	-2.6	-1.0
	7+00	20.1	19.7	0.4	18.7	1.0	1.4
	8+00	5.8	5.4	0.4	2.7	2.7	3.1
	9+00	0.0	0.0	0.0	0.0	0.0	0.0
				0.0		0.0	0.0
				0.0		0.0	0.0
				0.0		0.0	0.0
				0.8		-0.7	0.1

Distance between x-sec	1920.0 ft.
Average width of Area	1000.0 ft.
Area between x-sec	1920000.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.8 ft.
Volume (orig. to 1980)	60000.0 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.7 ft.
Volume (1980 to 1991)	-49333.3 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.1 ft.
Volume sed.(orig to 1991)	10666.7 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RE-2	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	10.8	9.9	0.9	14.4	-4.5	-3.6
	3+00	27.9	24.8	3.1	27.6	-2.8	0.3
	5+00	22.4	21.8	0.6	23.1	-1.3	-0.7
	7+00	23.3	22.0	1.3	22.4	-0.4	0.9
	9+00	19.3	18.8	0.5	17.2	1.6	2.1
	10+00	9.7	9.0	0.7	7.1	1.9	2.6
	11+00	0.0	0.0	0.0	0.0	0.0	0.0
				0.0		0.0	0.0
				0.0		0.0	0.0
				0.9		-0.7	0.2

2E

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RE-2	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	10.8	9.9	0.9	14.4	-4.5	-3.6
	3+00	27.9	24.8	3.1	27.6	-2.8	0.3
	5+00	22.4	21.8	0.6	23.1	-1.3	-0.7
	7+00	23.3	22.0	1.3	22.4	-0.4	0.9
	9+00	19.3	18.8	0.5	17.2	1.6	2.1
	10+00	9.7	9.0	0.7	7.1	1.9	2.6
	11+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.9		-0.7	0.2

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RE-3	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	6.2	5.7	0.5	6.9	-1.2	-0.7
	3+00	20.0	19.4	0.6	20.0	-0.6	0.0
	5+00	24.4	22.4	2.0	22.1	0.3	2.3
	7+00	19.9	19.0	0.9	19.6	-0.6	0.3
	9+00	20.9	19.2	1.7	19.2	0.0	1.7
	10+00	6.8	6.3	0.5	9.1	-2.8	-2.3
	11+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.8		-0.6	0.2

Distance between x-sec	2030.0 ft.
Average width of Area	1100.0 ft.
Area between x-sec	2233000.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.8 ft.
Volume (orig. to 1980)	68747.5 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.7 ft.
Volume (1980 to 1991)	-53757.4 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.2 ft.
Volume sed.(orig to 1991)	14990.0 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RE-3	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	6.2	5.7	0.5	6.9	-1.2	-0.7
	3+00	20.0	19.4	0.6	20.0	-0.6	0.0
	5+00	24.4	22.4	2.0	22.1	0.3	2.3
	7+00	19.9	19.0	0.9	19.6	-0.6	0.3
	9+00	20.9	19.2	1.7	19.2	0.0	1.7
	10+00	6.8	6.3	0.5	9.1	-2.8	-2.3
	11+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.8		-0.6	0.2

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RE-4	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	3+00	19.9	18.6	1.3	20.0	-1.4	-0.1
	5+00	18.4	17.0	1.4	17.2	-0.2	1.2
	7+00	17.5	16.1	1.4	18.5	-2.4	-1.0
	8+00	6.0	6.0	0.0	9.3	-3.3	-3.3
	9+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.7		-1.2	-0.5

Distance between x-sec	2040.0 ft.
Average width of Area	1000.0 ft.
Area between x-sec	2040000.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.7 ft.
Volume (orig. to 1980)	55092.6 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.9 ft.
Volume (1980 to 1991)	-69101.9 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	-0.2 ft.
Volume sed.(orig to 1991)	-14009.3 cu/yds

4E

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RE-4	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	3+00	19.9	18.6	1.3	20.0	-1.4	-0.1
	5+00	18.4	17.0	1.4	17.2	-0.2	1.2
	7+00	17.5	16.1	1.4	18.5	-2.4	-1.0
	8+00	6.0	6.0	0.0	9.3	-3.3	-3.3
	9+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.7		-1.2	-0.5

Distance between x-sec	1720.0 ft.
Average width of Area	1168.0 ft.
Area between x-sec	2008960.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.1 ft.
Volume (orig. to 1980)	82714.6 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.2 ft.
Volume (1980 to 1991)	-16245.3 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.9 ft.
Volume sed.(orig to 1991)	66469.3 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RE-5	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	5.9	4.9	1.0	3.7	1.2	2.2
	3+00	3.9	3.8	0.1	2.3	1.5	1.6
	5+00	19.3	15.8	3.5	9.9	5.9	9.4
	7+00	18.0	15.5	2.5	10.9	4.6	7.1
	9+00	19.5	16.0	3.5	14.2	1.8	5.3
	11+00	19.6	16.0	3.6	15.7	0.3	3.9
	13+00	16.1	15.5	0.6	17.7	-2.2	-1.6
	14+00	5.7	5.1	0.6	10.4	-5.3	-4.7
	14+35	0.0	0.0	0.0	0.0	0.0	0.0
				1.5		0.8	2.3

5E

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RE-5	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	5.9	4.9	1.0	3.7	1.2	2.2
	3+00	3.9	3.8	0.1	2.3	1.5	1.6
	5+00	19.3	15.8	3.5	9.9	5.9	9.4
	7+00	18.0	15.5	2.5	10.9	4.6	7.1
	9+00	19.5	16.0	3.5	14.2	1.8	5.3
	11+00	19.6	16.0	3.6	15.7	0.3	3.9
	13+00	16.1	15.5	0.6	17.7	-2.2	-1.6
	14+00	5.7	5.1	0.6	10.4	-5.3	-4.7
	14+35	0.0	0.0	0.0	0.0	0.0	0.0
				1.5		0.8	2.3

Distance between x-sec	1450.0 ft.
Average width of Area	1318.0 ft.
Area between x-sec	1911100.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.2 ft.
Volume (orig. to 1980)	87238.2 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.9 ft.
Volume (1980 to 1991)	62110.8 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	2.1 ft.
Volume sed.(orig to 1991)	149348.9 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RE-6	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	17.6	15.3	2.3	15.3	0.0	2.3
	3+00	14.1	13.4	0.7	12.4	1.0	1.7
	5+00	12.9	11.8	1.1	11.2	0.6	1.7
	7+00	14.0	12.2	1.8	10.6	1.6	3.4
	9+00	11.2	10.7	0.5	9.0	1.7	2.2
	11+00	8.9	7.9	1.0	5.0	2.9	3.9
	12+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.9		1.0	1.9

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RE-6	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	17.6	15.3	2.3	15.3	0.0	2.3
	3+00	14.1	13.4	0.7	12.4	1.0	1.7
	5+00	12.9	11.8	1.1	11.2	0.6	1.7
	7+00	14.0	12.2	1.8	10.6	1.6	3.4
	9+00	11.2	10.7	0.5	9.0	1.7	2.2
	11+00	8.9	7.9	1.0	5.0	2.9	3.9
	12+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.9		1.0	1.9

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RE-7	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	13.5	11.4	2.1	12.0	-0.6	1.5
	3+00	14.4	11.4	3.0	11.5	-0.1	2.9
	5+00	10.7	8.8	1.9	10.5	-1.7	0.2
	7+00	11.4	9.0	2.4	8.3	0.7	3.1
	9+00	11.0	9.9	1.1	10.1	-0.2	0.9
	10+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.5		-0.3	1.2

Distance between x-sec	1450.0 ft.
Average width of Area	1100.0 ft.
Area between x-sec	1595000.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.2 ft.
Volume (orig. to 1980)	71627.3 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.4 ft.
Volume (1980 to 1991)	20781.4 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	1.6 ft.
Volume sed.(orig to 1991)	92408.7 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RE-7	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	13.5	11.4	2.1	12.0	-0.6	1.5
	3+00	14.4	11.4	3.0	11.5	-0.1	2.9
	5+00	10.7	8.8	1.9	10.5	-1.7	0.2
	7+00	11.4	9.0	2.4	8.3	0.7	3.1
	9+00	11.0	9.9	1.1	10.1	-0.2	0.9
	10+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.5		-0.3	1.2

Distance between x-sec	1610.0 ft.
Average width of Area	770.0 ft.
Area between x-sec	1239700.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.7 ft.
Volume (orig. to 1980)	78629.1 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	1.2 ft.
Volume (1980 to 1991)	55753.7 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	2.9 ft.
Volume sed.(orig to 1991)	134382.8 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
* RE-8	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+50	6.0	4.4	1.6	0.0	4.4	6.0
	1+00	11.3	8.8	2.5	4.6	4.2	6.7
	2+00	11.6	9.8	1.8	9.5	0.3	2.1
	3+00	11.5	9.8	1.7	10.3	-0.5	1.2
	4+00	17.2	12.2	5.0	9.2	3.0	8.0
	5+00	13.0	10.2	2.8	0.0	10.2	13.0
	5+40	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.9		2.7	4.6

* RE-8 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

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MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
*RE-8	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+50	6.0	4.4	1.6	0.0	4.4	6.0
	1+00	11.3	8.8	2.5	4.6	4.2	6.7
	2+00	11.6	9.8	1.8	9.5	0.3	2.1
	3+00	11.5	9.8	1.7	10.3	-0.5	1.2
	4+00	17.2	12.2	5.0	9.2	3.0	8.0
	5+00	13.0	10.2	2.8	0.0	10.2	13.0
	5+40	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.9		2.7	4.6

* RE-8 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
* RE-9	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+58	4.4	3.0	1.4	0.0	3.0	4.4
	1+00	7.9	5.7	2.2	2.9	2.8	5.0
	2+00	10.6	8.8	1.8	6.8	2.0	3.8
	3+00	11.9	9.9	2.0	8.0	1.9	3.9
	4+00	13.1	9.0	4.1	9.2	-0.2	3.9
	5+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.6		1.4	3.0

* RE-9 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Distance between x-sec	1530.0 ft.
Average width of Area	520.0 ft.
Area between x-sec	795600.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.8 ft.
Volume (orig. to 1980)	52566.4 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	2.0 ft.
Volume (1980 to 1991)	59775.2 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	3.8 ft.
Volume sed.(orig to 1991)	112341.7 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
* RE-9	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+58	4.4	3.0	1.4	0.0	3.0	4.4
	1+00	7.9	5.7	2.2	2.9	2.8	5.0
	2+00	10.6	8.8	1.8	6.8	2.0	3.8
	3+00	11.9	9.9	2.0	8.0	1.9	3.9
	4+00	13.1	9.0	4.1	9.2	-0.2	3.9
	5+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.6		1.4	3.0

* RE-9 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RE-10	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	11.1	8.5	2.6	8.6	-0.1	2.5
	2+00	7.9	6.9	1.0	6.9	0.0	1.0
	3+00	8.0	6.2	1.8	6.4	-0.2	1.6
	4+00	7.9	5.8	2.1	6.2	-0.4	1.7
	5+00	7.7	5.2	2.5	4.8	0.4	2.9
	6+00	4.5	3.8	0.7	4.0	-0.2	0.5
	7+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.3		-0.1	1.3

Distance between x-sec	1070.0 ft.
Average width of Area	600.0 ft.
Area between x-sec	642000.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.5 ft.
Volume (orig. to 1980)	35433.1 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.6 ft.
Volume (1980 to 1991)	15391.9 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	2.1 ft.
Volume sed.(orig to 1991)	50825.0 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RE-10	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	11.1	8.5	2.6	8.6	-0.1	2.5
	2+00	7.9	6.9	1.0	6.9	0.0	1.0
	3+00	8.0	6.2	1.8	6.4	-0.2	1.6
	4+00	7.9	5.8	2.1	6.2	-0.4	1.7
	5+00	7.7	5.2	2.5	4.8	0.4	2.9
	6+00	4.5	3.8	0.7	4.0	-0.2	0.5
	7+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.3		-0.1	1.3

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
*RE-11	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	7.8	4.8	3.0	8.6	-3.8	-0.8
	3+00	4.8	4.2	0.6	4.9	-0.7	-0.1
	5+00	6.9	4.9	2.0	3.8	1.1	3.1
	6+00	6.8	4.4	2.4	0.0	4.4	6.8
	7+00	6.3	4.4	1.9	0.0	4.4	6.3
	9+00	6.8	4.9	1.9	0.0	4.9	6.8
	10+00	11.3	7.2	4.1	0.0	7.2	11.3
	11+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.8		1.9	3.7

Distance between x-sec	1180.0 ft.
Average width of Area	900.0 ft.
Area between x-sec	1062000.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.6 ft.
Volume (orig. to 1980)	61048.6 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.9 ft.
Volume (1980 to 1991)	37011.6 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	2.5 ft.
Volume sed.(orig to 1991)	98060.2 cu/yds

* RE-11 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
* RE-11	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	7.8	4.8	3.0	8.6	-3.8	-0.8
	3+00	4.8	4.2	0.6	4.9	-0.7	-0.1
	5+00	6.9	4.9	2.0	3.8	1.1	3.1
	6+00	6.8	4.4	2.4	0.0	4.4	6.8
	7+00	6.3	4.4	1.9	0.0	4.4	6.3
	9+00	6.8	4.9	1.9	0.0	4.9	6.8
	10+00	11.3	7.2	4.1	0.0	7.2	11.3
	11+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.8		1.9	3.7

* RE-11 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
* RE-12	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+78	3.0	2.0	1.0	0.0	2.0	3.0
	1+00	3.9	2.7	1.2	0.4	2.3	3.5
	2+00	3.9	2.8	1.1	1.5	1.3	2.4
	3+00	4.0	2.8	1.2	2.4	0.4	1.6
	4+00	5.2	2.8	2.4	2.0	0.8	3.2
	5+00	7.8	4.8	3.0	1.7	3.1	6.1
	6+00	6.9	4.0	2.9	4.5	-0.5	2.4
	7+00	6.0	3.9	2.1	3.4	0.5	2.6
	8+00	0.0	0.0	0.0	0.0	0.0	0.0
				1.5		1.0	2.5

* RE-12 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Distance between x-sec	1370.0 ft.
Average width of Area	950.0 ft.
Area between x-sec	1301500.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.6 ft.
Volume (orig. to 1980)	78491.7 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	1.5 ft.
Volume (1980 to 1991)	70725.5 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	3.1 ft.
Volume sed.(orig to 1991)	149217.2 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
* RE-I2	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+78	3.0	2.0	1.0	0.0	2.0	3.0
	1+00	3.9	2.7	1.2	0.4	2.3	3.5
	2+00	3.9	2.8	1.1	1.5	1.3	2.4
	3+00	4.0	2.8	1.2	2.4	0.4	1.6
	4+00	5.2	2.8	2.4	2.0	0.8	3.2
	5+00	7.8	4.8	3.0	1.7	3.1	6.1
	6+00	6.9	4.0	2.9	4.5	-0.5	2.4
	7+00	6.0	3.9	2.1	3.4	0.5	2.6
	8+00	0.0	0.0	0.0	0.0	0.0	0.0
				1.5		1.0	2.5

* RE-12 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
* RE-I3	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+27	1.0	0.5	0.5	0.0	0.5	1.0
	0+75	2.5	1.0	1.5	1.0	0.0	1.5
	1+50	4.6	2.9	1.7	2.0	0.9	2.6
	2+25	5.5	2.6	2.9	3.2	-0.6	2.3
	3+00	10.5	5.4	5.1	4.2	1.2	6.3
	3+75	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.7		0.3	2.0

* RE-13 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Distance between x-sec	950.0 ft.
Average width of Area	587.0 ft.
Area between x-sec	557650.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.6 ft.
Volume (orig. to 1980)	32647.6 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.6 ft.
Volume (1980 to 1991)	13174.1 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	2.2 ft.
Volume sed.(orig to 1991)	45821.7 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
* RE-13	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+27	1.0	0.5	0.5	0.0	0.5	1.0
	0+75	2.5	1.0	1.5	1.0	0.0	1.5
	1+50	4.6	2.9	1.7	2.0	0.9	2.6
	2+25	5.5	2.6	2.9	3.2	-0.6	2.3
	3+00	10.5	5.4	5.1	4.2	1.2	6.3
	3+75	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.7		0.3	2.0

* RE-13 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RE-14	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+75	8.4	5.3	3.1	4.3	1.0	4.1
	1+50	4.9	2.6	2.3	0.0	2.6	4.9
	2+25	3.8	2.4	1.4	0.0	2.4	3.8
	3+25	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.4		1.2	2.6

Distance between x-sec	830.0 ft.
Average width of Area	350.0 ft.
Area between x-sec	290500.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.5 ft.
Volume (orig. to 1980)	16308.0 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.7 ft.
Volume (1980 to 1991)	7992.6 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	2.3 ft.
Volume sed.(orig to 1991)	24300.6 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RE-I4	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+75	8.4	5.3	3.1	4.3	1.0	4.1
	1+50	4.9	2.6	2.3	0.0	2.6	4.9
	2+25	3.8	2.4	1.4	0.0	2.4	3.8
	3+25	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.4		1.2	2.6

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RE-I5	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+50	6.9	3.7	3.2	2.5	1.2	4.4
	1+00	5.3	3.6	1.7	3.3	0.3	2.0
	1+50	4.9	3.7	1.2	3.1	0.6	1.8
	2+00	4.8	3.1	1.7	3.3	-0.2	1.5
	3+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.3		0.3	1.6

Distance between x-sec	360.0 ft.
Average width of Area	312.0 ft.
Area between x-sec	112320.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.3 ft.
Volume (orig. to 1980)	5532.8 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.8 ft.
Volume (1980 to 1991)	3154.7 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	2.1 ft.
Volume sed.(orig to 1991)	8687.5 cu/yds

MINA LAKE SEDIMENT SURVEY

Summary sheet for West Reach

Section	Avg depth sed orig. to 1980	Volume orig. to 1980	Avg depth sed 1980 to 1991	Volume 1980 to 1991	Avg depth sed orig. to 1991	Volume orig. to 1991
RS5-RW1	0.5 ft.	30033.9 cu/yds	0.5 ft.	26342.9 cu/yds	1.0 ft.	56376.8 cu/yds
RW 1-2	0.5 ft.	22236.8 cu/yds	0.9 ft.	36156.6 cu/yds	1.4 ft.	58393.4 cu/yds
RW 2-3	0.8 ft.	43662.5 cu/yds	0.7 ft.	38675.0 cu/yds	1.6 ft.	82337.5 cu/yds
RW 3-4	0.9 ft.	32044.7 cu/yds	-0.1 ft.	-3729.5 cu/yds	0.8 ft.	28315.1 cu/yds
RW 4-5	0.7 ft.	35672.0 cu/yds	-0.1 ft.	-3640.0 cu/yds	0.6 ft.	32032.0 cu/yds
RW 5-6	0.8 ft.	27409.6 cu/yds	0.1 ft.	3015.3 cu/yds	0.9 ft.	30424.9 cu/yds
RW 6-7	1.2 ft.	37122.1 cu/yds	-0.4 ft.	-13604.7 cu/yds	0.8 ft.	23517.4 cu/yds
RW 7-8	1.3 ft.	22627.2 cu/yds	-0.3 ft.	-5333.5 cu/yds	1.0 ft.	17293.6 cu/yds
RW 8-9	0.9 ft.	1620.0 cu/yds	0.2 ft.	330.0 cu/yds	1.1 ft.	1950.0 cu/yds
RW 9-10	0.8 ft.	1143.7 cu/yds	0.1 ft.	71.5 cu/yds	0.9 ft.	1215.2 cu/yds
RW 10-11	1.2 ft.	1892.6 cu/yds	0.0 ft.	-25.9 cu/yds	1.2 ft.	1866.7 cu/yds
RW 11-12	0.9 ft.	991.9 cu/yds	-0.1 ft.	-152.6 cu/yds	0.7 ft.	839.3 cu/yds
RW 12-13	0.4 ft.	865.1 cu/yds	0.1 ft.	266.2 cu/yds	0.6 ft.	1131.2 cu/yds
RW 13-14	0.6 ft.	434.0 cu/yds	0.3 ft.	217.0 cu/yds	0.9 ft.	651.0 cu/yds
RW 14-15	0.7 ft.	396.8 cu/yds	0.2 ft.	106.5 cu/yds	0.9 ft.	503.3 cu/yds
	12.2 ft.	258152.9 cu/yds	2.1 ft.	78694.8 cu/yds	14.4 ft.	336847.4 cu/yds

Distance of the West Reach 13720.0 ft.

Average width of the West Reach 467.5 ft.

Acres of South Reach 147.247475 acres

Average depth of sediment (original to 1980) 0.81333333 ft.

Total Volume (original to 1980) 17210.1933 cu/yds

Average depth of sediment (1980 to 1991) 0.14 ft.

Total Volume (1980 to 1991) 5246.32 cu/yds

Average depth of sediment (original to 1991) 0.96 ft.

Total Volume (original to 1991) 22456.4933 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RS-5	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	9.5	9.4	0.1	8.3	1.1	1.2
	3+00	15.1	14.7	0.4	14.7	0.0	0.4
	5+00	17.6	17.1	0.5	17.3	-0.2	0.3
	7+00	21.7	19.0	2.7	19.1	-0.1	2.6
	9+00	10.8	10.4	0.4	6.0	4.4	4.8
	10+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.6		0.7	1.3

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-1	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	20.5	17.7	2.8	16.8	0.9	3.7
	3+00	14.1	13.8	0.3	14.0	-0.2	0.1
	5+00	13.5	13.2	0.3	13.3	-0.1	0.2
	7+00	12.9	12.7	0.2	12.7	0.0	0.2
	9+00	10.1	10.0	0.1	10.1	-0.1	0.0
	11+00	6.9	6.8	0.1	5.8	1.0	1.1
	12+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.5		0.2	0.7

Distance between x-sec	1390.0 ft.
Average width of Area	1100.0 ft.
Area between x-sec	1529000.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.5 ft.
Volume (orig. to 1980)	30033.9 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.5 ft.
Volume (1980 to 1991)	26342.9 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	1.0 ft.
Volume sed.(orig to 1991)	56376.8 cu/yds

2W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-1	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	20.5	17.7	2.8	16.8	0.9	3.7
	3+00	14.1	13.8	0.3	14.0	-0.2	0.1
	5+00	13.5	13.2	0.3	13.3	-0.1	0.2
	7+00	12.9	12.7	0.2	12.7	0.0	0.2
	9+00	10.1	10.0	0.1	10.1	-0.1	0.0
	11+00	6.9	6.8	0.1	5.8	1.0	1.1
	12+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.5		0.2	0.7

Distance between x-sec	1220.0 ft.
Average width of Area	930.0 ft.
Area between x-sec	1134600.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.5 ft.
Volume (orig. to 1980)	22236.8 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.9 ft.
Volume (1980 to 1991)	36156.6 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	1.4 ft.
Volume sed.(orig to 1991)	58393.4 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-2	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	7.2	6.1	1.1	5.0	1.1	2.2
	3+00	12.0	11.4	0.6	11.1	0.3	0.9
	5+00	14.2	13.8	0.4	12.6	1.2	1.6
	6+00	13.8	12.4	1.4	5.8	6.6	8.0
	6+59	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.6		1.5	2.1

3W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-2	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	7.2	6.1	1.1	5.0	1.1	2.2
	3+00	12.0	11.4	0.6	11.1	0.3	0.9
	5+00	14.2	13.8	0.4	12.6	1.2	1.6
	6+00	13.8	12.4	1.4	5.8	6.6	8.0
	6+59	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.6		1.5	2.1

Distance between x-sec	2250.0 ft.
Average width of Area	630.0 ft.
Area between x-sec	1417500.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.8 ft.
Volume (orig. to 1980)	43662.5 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.7 ft.
Volume (1980 to 1991)	38675.0 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	1.6 ft.
Volume sed.(orig to 1991)	82337.5 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-3	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	7.0	6.9	0.1	8.6	-1.7	-1.6
	3+00	12.3	10.8	1.5	10.7	0.1	1.6
	5+00	14.9	11.1	3.8	9.8	1.3	5.1
	6+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.1		-0.1	1.0

4W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-3	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	7.0	6.9	0.1	8.6	-1.7	-1.6
	3+00	12.3	10.8	1.5	10.7	0.1	1.6
	5+00	14.9	11.1	3.8	9.8	1.3	5.1
	6+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.1		-0.1	1.0

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-4	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	8.9	8.2	0.7	9.1	-0.9	-0.2
	3+00	10.9	9.5	1.4	9.7	-0.2	1.2
	5+00	10.8	8.6	2.2	8.2	0.4	2.6
	7+00	11.0	9.8	1.2	10.3	-0.5	0.7
	8+00	5.9	5.9	0.0	5.8	0.1	0.1
	8+15	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.8		-0.2	0.6

Distance between x-sec	1310.0 ft.
Average width of Area	708.0 ft.
Area between x-sec	927480.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.9 ft.
Volume (orig. to 1980)	32044.7 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.1 ft.
Volume (1980 to 1991)	-3729.5 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.8 ft.
Volume sed.(orig to 1991)	28315.1 cu/yds

5W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-4	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	8.9	8.2	0.7	9.1	-0.9	-0.2
	3+00	10.9	9.5	1.4	9.7	-0.2	1.2
	5+00	10.8	8.6	2.2	8.2	0.4	2.6
	7+00	11.0	9.8	1.2	10.3	-0.5	0.7
	8+00	5.9	5.9	0.0	5.8	0.1	0.1
	8+15	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.8		-0.2	0.6

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-5	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	5.9	4.9	1.0	5.4	-0.5	0.5
	3+00	7.0	6.8	0.2	6.8	0.0	0.2
	5+00	8.1	7.0	1.1	5.7	1.3	2.4
	7+00	7.8	6.1	1.7	6.5	-0.4	1.3
	9+00	9.1	8.8	0.3	9.1	-0.3	0.0
	9+50	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.6		0.0	0.6

Distance between x-sec	1560.0 ft.
Average width of Area	882.0 ft.
Area between x-sec	1375920.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.7 ft.
Volume (orig. to 1980)	35672.0 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.1 ft.
Volume (1980 to 1991)	-3640.0 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.6 ft.
Volume sed.(orig to 1991)	32032.0 cu/yds

6W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-5	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	5.9	4.9	1.0	5.4	-0.5	0.5
	3+00	7.0	6.8	0.2	6.8	0.0	0.2
	5+00	8.1	7.0	1.1	5.7	1.3	2.4
	7+00	7.8	6.1	1.7	6.5	-0.4	1.3
	9+00	9.1	8.8	0.3	9.1	-0.3	0.0
	9+50	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.6		0.0	0.6

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-6	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	7.8	6.5	1.3	6.3	0.2	1.5
	2+00	7.8	5.8	2.0	6.1	-0.3	1.7
	3+00	6.2	5.2	1.0	4.7	0.5	1.5
	4+00	5.8	4.9	0.9	4.9	0.0	0.9
	5+00	5.3	4.8	0.5	4.7	0.1	0.6
	6+00	6.4	4.2	2.2	4.0	0.2	2.4
	7+00	5.9	4.9	1.0	3.9	1.0	2.0
	8+00	5.8	5.0	0.8	5.1	-0.1	0.7
	9+00	0.0	0.0	0.0	0.0	0.0	0.0
				1.0		0.2	1.1

Distance between x-sec	1010.0 ft.
Average width of Area	925.0 ft.
Area between x-sec	934250.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.8 ft.
Volume (orig. to 1980)	27409.6 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.1 ft.
Volume (1980 to 1991)	3015.3 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.9 ft.
Volume sed.(orig to 1991)	30424.9 cu/yds

TW

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-6	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	7.8	6.5	1.3	6.3	0.2	1.5
	2+00	7.8	5.8	2.0	6.1	-0.3	1.7
	3+00	6.2	5.2	1.0	4.7	0.5	1.5
	4+00	5.8	4.9	0.9	4.9	0.0	0.9
	5+00	5.3	4.8	0.5	4.7	0.1	0.6
	6+00	6.4	4.2	2.2	4.0	0.2	2.4
	7+00	5.9	4.9	1.0	3.9	1.0	2.0
	8+00	5.8	5.0	0.8	5.1	-0.1	0.7
	9+00	0.0	0.0	0.0	0.0	0.0	0.0
				1.0		0.2	1.1

Distance between x-sec	1270.0 ft.
Average width of Area	666.0 ft.
Area between x-sec	845820.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.2 ft.
Volume (orig. to 1980)	37122.1 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.4 ft.
Volume (1980 to 1991)	-13604.7 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.8 ft.
Volume sed.(orig to 1991)	23517.4 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-7	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	1.9	1.9	0.0	5.3	-3.4	-3.4
	2+00	3.6	2.4	1.2	4.3	-1.9	-0.7
	3+00	5.9	3.5	2.4	5.0	-1.5	0.9
	3+50	7.1	5.0	2.1	6.2	-1.2	0.9
	4+00	9.6	5.5	4.1	4.7	0.8	4.9
	4+33	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.4		-1.0	0.4

8W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-7	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	1.9	1.9	0.0	5.3	-3.4	-3.4
	2+00	3.6	2.4	1.2	4.3	-1.9	-0.7
	3+00	5.9	3.5	2.4	5.0	-1.5	0.9
	3+50	7.1	5.0	2.1	6.2	-1.2	0.9
	4+00	9.6	5.5	4.1	4.7	0.8	4.9
	4+33	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.4		-1.0	0.4

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-8	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	8.7	4.9	3.8	3.7	1.2	5.0
	2+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.3		0.4	1.7

Distance between x-sec	1450.0 ft.
Average width of Area	316.0 ft.
Area between x-sec	458200.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.3 ft.
Volume (orig. to 1980)	22627.2 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.3 ft.
Volume (1980 to 1991)	-5333.5 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	1.0 ft.
Volume sed.(orig to 1991)	17293.6 cu/yds

9W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-8	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	8.7	4.9	3.8	3.7	1.2	5.0
	2+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.3		0.4	1.7

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-9	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	5.6	4.0	1.6	4.1	-0.1	1.5
	2+86	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.5		0.0	0.5

Distance between x-sec	200.0 ft.
Average width of Area	243.0 ft.
Area between x-sec	48600.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.9 ft.
Volume (orig. to 1980)	1620.0 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.2 ft.
Volume (1980 to 1991)	330.0 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	1.1 ft.
Volume sed.(orig to 1991)	1950.0 cu/yds

10W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-9	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	5.6	4.0	1.6	4.1	-0.1	1.5
	2+86	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.5		0.0	0.5

Distance between x-sec	200.0 ft.
Average width of Area	193.0 ft.
Area between x-sec	38600.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.8 ft.
Volume (orig. to 1980)	1143.7 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.1 ft.
Volume (1980 to 1991)	71.5 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.9 ft.
Volume sed.(orig to 1991)	1215.2 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-10	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+50	8.4	5.2	3.2	4.8	0.4	3.6
	1+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.1		0.1	1.2

11W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-I0	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+50	8.4	5.2	3.2	4.8	0.4	3.6
	1+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.1		0.1	1.2

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-II	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+48	9.0	4.9	4.1	5.4	-0.5	3.6
	1+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.4		-0.2	1.2

Distance between x-sec	420.0 ft.
Average width of Area	100.0 ft.
Area between x-sec	42000.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.2 ft.
Volume (orig. to 1980)	1892.6 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.0 ft.
Volume (1980 to 1991)	-25.9 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	1.2 ft.
Volume sed.(orig to 1991)	1866.7 cu/yds

12W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-I1	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+48	9.0	4.9	4.1	5.4	-0.5	3.6
	1+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.4		-0.2	1.2

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-I2	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+53	5.6	4.5	1.1	4.8	-0.3	0.8
	1+06	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.4		-0.1	0.3

Distance between x-sec	300.0 ft.
Average width of Area	103.0 ft.
Area between x-sec	30900.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.9 ft.
Volume (orig. to 1980)	991.9 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.1 ft.
Volume (1980 to 1991)	-152.6 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.7 ft.
Volume sed.(orig to 1991)	839.3 cu/yds

13N

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-I2	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+53	5.6	4.5	1.1	4.8	-0.3	0.8
	1+06	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.4		-0.1	0.3

Distance between x-sec	550.0 ft.
Average width of Area	98.0 ft.
Area between x-sec	53900.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.4 ft.
Volume (orig. to 1980)	865.1 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.1 ft.
Volume (1980 to 1991)	266.2 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.6 ft.
Volume sed.(orig to 1991)	1131.2 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-I3	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+45	6.0	4.5	1.5	3.4	1.1	2.6
	0+90	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.5		0.4	0.9

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-I3	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+45	6.0	4.5	1.5	3.4	1.1	2.6
	0+90	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.5		0.4	0.9

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-I4	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+18	6.3	4.2	2.1	3.5	0.7	2.8
	0+36	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.7		0.2	0.9

Distance between x-sec	310.0 ft.
Average width of Area	63.0 ft.
Area between x-sec	19530.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.6 ft.
Volume (orig. to 1980)	434.0 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.3 ft.
Volume (1980 to 1991)	217.0 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.9 ft.
Volume sed.(orig to 1991)	651.0 cu/yds

15W

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
RW-I4	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+18	6.3	4.2	2.1	3.5	0.7	2.8
	0+36	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.7		0.2	0.9

Distance between x-sec	280.0 ft.
Average width of Area	56.0 ft.
Area between x-sec	15680.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.7 ft.
Volume (orig. to 1980)	396.8 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	0.2 ft.
Volume (1980 to 1991)	106.5 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.9 ft.
Volume sed.(orig to 1991)	503.3 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RW-I5	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+38	5.2	3.2	2.0	2.8	0.4	2.4
	0+76	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.7		0.1	0.8

16W

MINA LAKE SEDIMENT SURVEY

Summary sheet for South Reach

Section	Avg depth sed orig. to 1980	Volume orig. to 1980	Avg depth sed 1980 to 1991	Volume 1980 to 1991	Avg depth sed orig. to 1991	Volume orig. to 1991
RS 1-2	0.9 ft.	36486.3 cu/yds	-0.5 ft.	-21224.7 cu/yds	0.4 ft.	15261.7 cu/yds
RS 2-3	1.0 ft.	52982.2 cu/yds	-0.2 ft.	-8515.0 cu/yds	0.9 ft.	44467.2 cu/yds
RS 3-5	0.8 ft.	73039.6 cu/yds	-0.4 ft.	-39172.1 cu/yds	0.4 ft.	33867.5 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds	0.0 ft.	0.0 cu/yds
	2.7 ft.	162508.1 cu/yds	-1.1 ft.	-68911.8 cu/yds	1.7 ft.	93596.4 cu/yds

Distance of the South Reach 4910.0 ft.

Average width of the South Reach 1050.0 ft.

Acres of South Reach 118.353994 acres

Average depth of sediment (original to 1980) 0.9 ft.

Total Volume (original to 1980) 54169.3667 cu/yds

Average depth of sediment (1980 to 1991) -0.3666667 ft.

Total Volume (1980 to 1991) -22970.6 cu/yds

Average depth of sediment (original to 1991) 0.56666667 ft.

Total Volume (original to 1991) 31198.8 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
* RS-1	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+24	0.0	0.0	0.0	4.2	-4.2	-4.2
	1+00	11.0	10.7	0.3	15.9	-5.2	-4.9
	3+00	22.5	21.5	1.0	22.4	-0.9	0.1
	5+00	25.8	23.7	2.1	26.0	-2.3	-0.2
	7+00	28.3	27.2	1.1	26.5	0.7	1.8
	9+00	22.4	20.8	1.6	25.4	-4.6	-3.0
	11+00	23.2	22.0	1.2	25.2	-3.2	-2.0
	13+00	4.5	3.8	0.7	6.2	-2.4	-1.7
	13+24	0.0	0.0	0.0	3.4	-3.4	-3.4
	13+48	0.0	0.0	0.0	0.0	0.0	0.0
				0.7		-2.3	-1.6

* RS-1 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
* RS-2	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	12.7	9.8	2.9	11.2	-1.4	1.5
	3+00	19.1	18.2	0.9	19.1	-0.9	0.0
	5+00	23.9	23.0	0.9	21.4	1.6	2.5
	7+00	24.9	22.8	2.1	22.6	0.2	2.3
	9+00	26.7	25.8	0.9	23.7	2.1	3.0
	11+00	9.5	8.5	1.0	0.0	8.5	9.5
	12+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.1		1.3	2.3

* RS-2 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Distance between x-sec	820.0 ft.
Average width of Area	1324.0 ft.
Area between x-sec	1085680.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.9 ft.
Volume (orig. to 1980)	36486.3 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.5 ft.
Volume (1980 to 1991)	-21224.7 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.4 ft.
Volume sed.(orig to 1991)	15261.7 cu/yds

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
* RS-2	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	12.7	9.8	2.9	11.2	-1.4	1.5
	3+00	19.1	18.2	0.9	19.1	-0.9	0.0
	5+00	23.9	23.0	0.9	21.4	1.6	2.5
	7+00	24.9	22.8	2.1	22.6	0.2	2.3
	9+00	26.7	25.8	0.9	23.7	2.1	3.0
	11+00	9.5	8.5	1.0	0.0	8.5	9.5
	12+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.1		1.3	2.3

* RS-2 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Distance between x-sec	1310.0 ft.
Average width of Area	1040.0 ft.
Area between x-sec	1362400.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	1.0 ft.
Volume (orig. to 1980)	52982.2 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.2 ft.
Volume (1980 to 1991)	-8515.0 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.9 ft.
Volume sed.(orig to 1991)	44467.2 cu/yds

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
* RS-3	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+40	0.0	0.0	0.0	3.0	-3.0	-3.0
	1+00	5.0	4.5	0.5	7.2	-2.7	-2.2
	3+00	22.8	19.8	3.0	20.2	-0.4	2.6
	5+00	27.6	24.4	3.2	22.8	1.6	4.8
	7+00	16.2	14.8	1.4	18.1	-3.3	-1.9
	8+40	0.0	0.0	0.0	5.0	-5.0	-5.0
	8+80	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.0		-1.6	-0.6

* RS-3 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

MINA LAKE SEDIMENT SURVEY
(Summary Sheet)

Bench Mark Location: north end of spillway apron at outlet lip.
(Top of Ice in 1990 is .9 lower than in 1980)

1980 - BM = 4.54; Top of Ice = 5.64;

1991 - BM = 3.35; Top of Ice = 5.30;

reach	station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total Or/91
* RS-3	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	0+40	0.0	0.0	0.0	3.0	-3.0	-3.0
	1+00	5.0	4.5	0.5	7.2	-2.7	-2.2
	3+00	22.8	19.8	3.0	20.2	-0.4	2.6
	5+00	27.6	24.4	3.2	22.8	1.6	4.8
	7+00	16.2	14.8	1.4	18.1	-3.3	-1.9
	8+40	0.0	0.0	0.0	5.0	-5.0	-5.0
	8+80	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				1.0		-1.6	-0.6

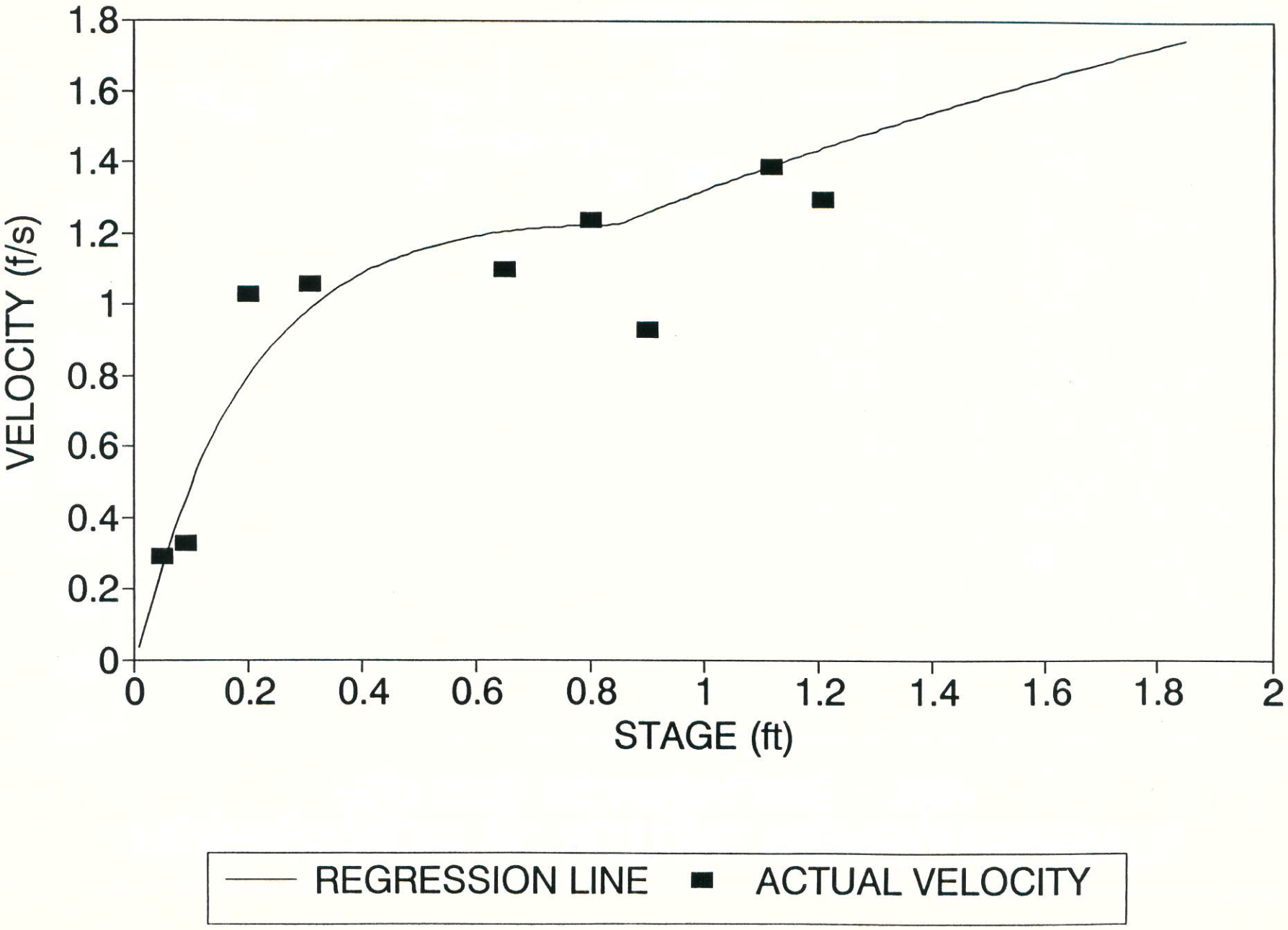
* RS-3 depths were taken from being plotted, due to the added sediment at the lake shore from 1980 to 1991.

Reach	Station	Orig. d/ft.	1980 d/ft.	diff. Or/80	1991 d/ft.	diff. 80/91	Total diff.
RS-5	0+00	0.0	0.0	0.0	0.0	0.0	0.0
	1+00	9.5	9.4	0.1	8.3	1.1	1.2
	3+00	15.1	14.7	0.4	14.7	0.0	0.4
	5+00	17.6	17.1	0.5	17.3	-0.2	0.3
	7+00	21.7	19.0	2.7	19.1	-0.1	2.6
	9+00	10.8	10.4	0.4	6.0	4.4	4.8
	10+00	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
				0.6		0.7	1.3

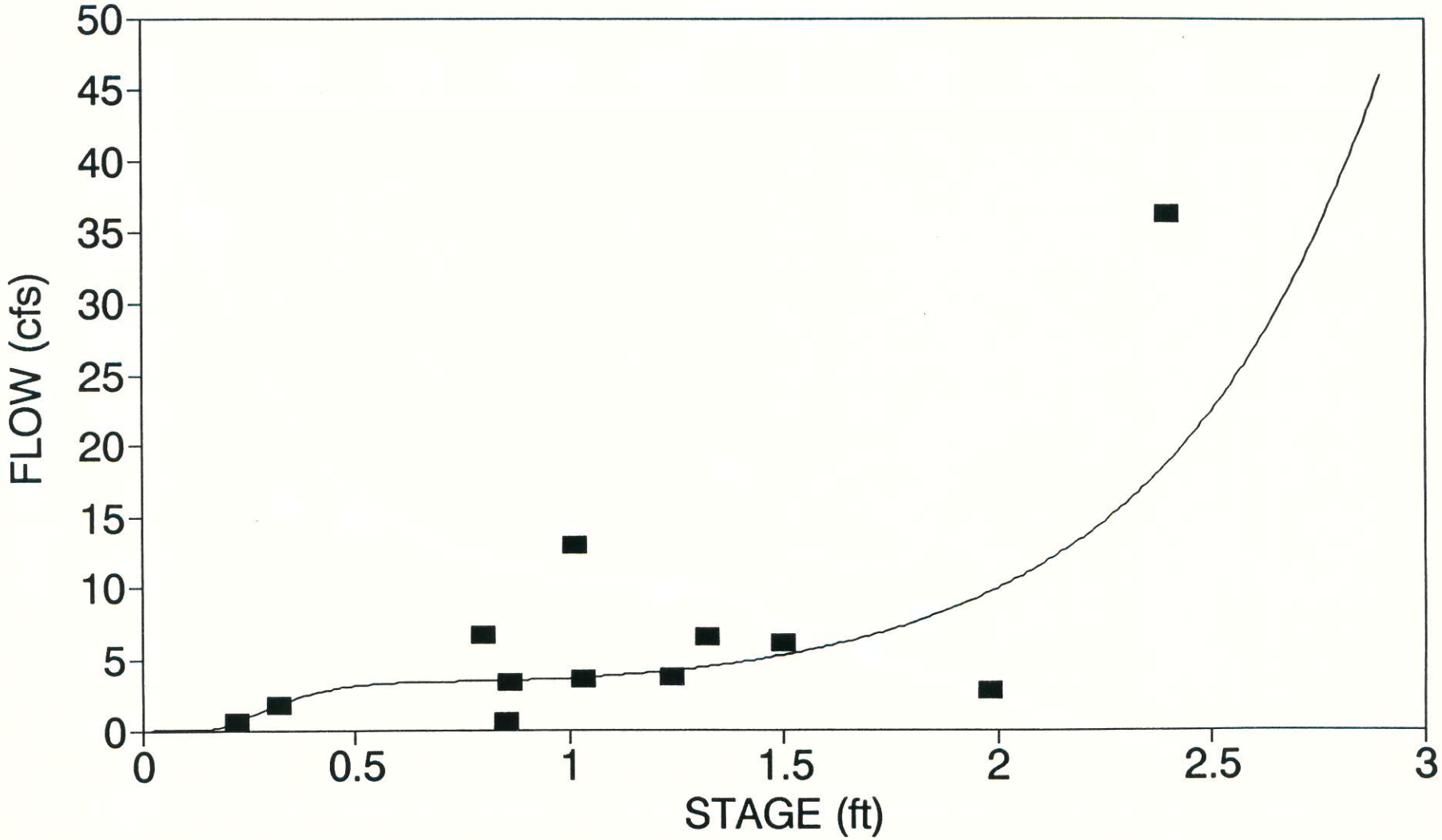
Distance between x-sec	2560.0 ft.
Average width of Area	964.0 ft.
Area between x-sec	2467840.0 sq/ft
Avg. depth sediment bet. x-sec. (orig to 1980)	0.8 ft.
Volume (orig. to 1980)	73039.6 cu/yds
Avg. depth sediment bet. x-sec. (1980 to 1991)	-0.4 ft.
Volume (1980 to 1991)	-39172.1 cu/yds
Avg. depth sediment bet. x-sec. (orig. to 1991)	0.4 ft.
Volume sed.(orig to 1991)	33867.5 cu/yds

APPENDIX D
STREAM FLOW DATA

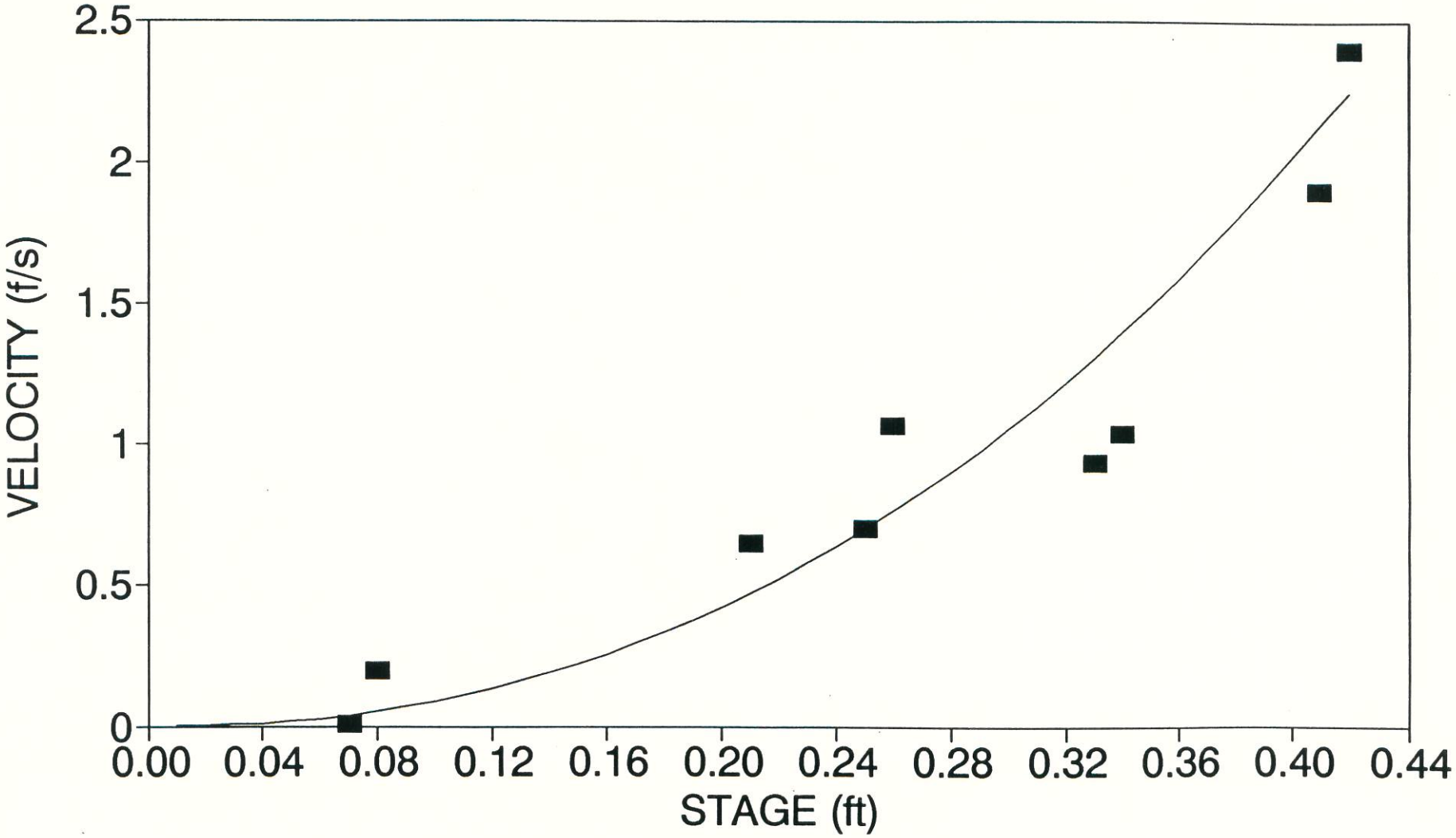
REGRESSION LINE vs. ACTUAL MEASUREMENTS
FOR SITE #1 -- MINA LAKE -- 1991



REGRESSION vs. ACTUAL MEASUREMENTS
FOR SITE #2 MINA LAKE -- 1991

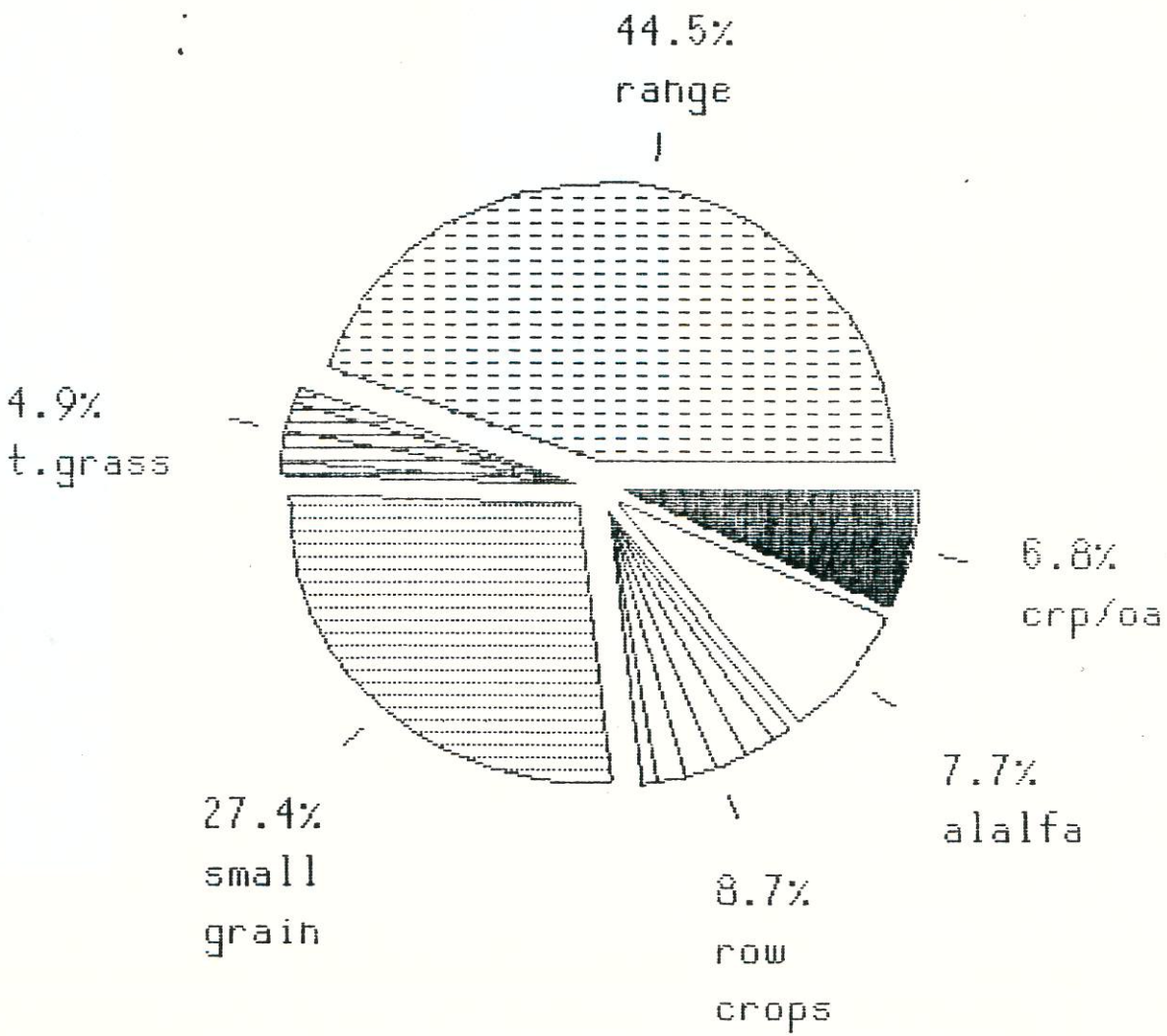


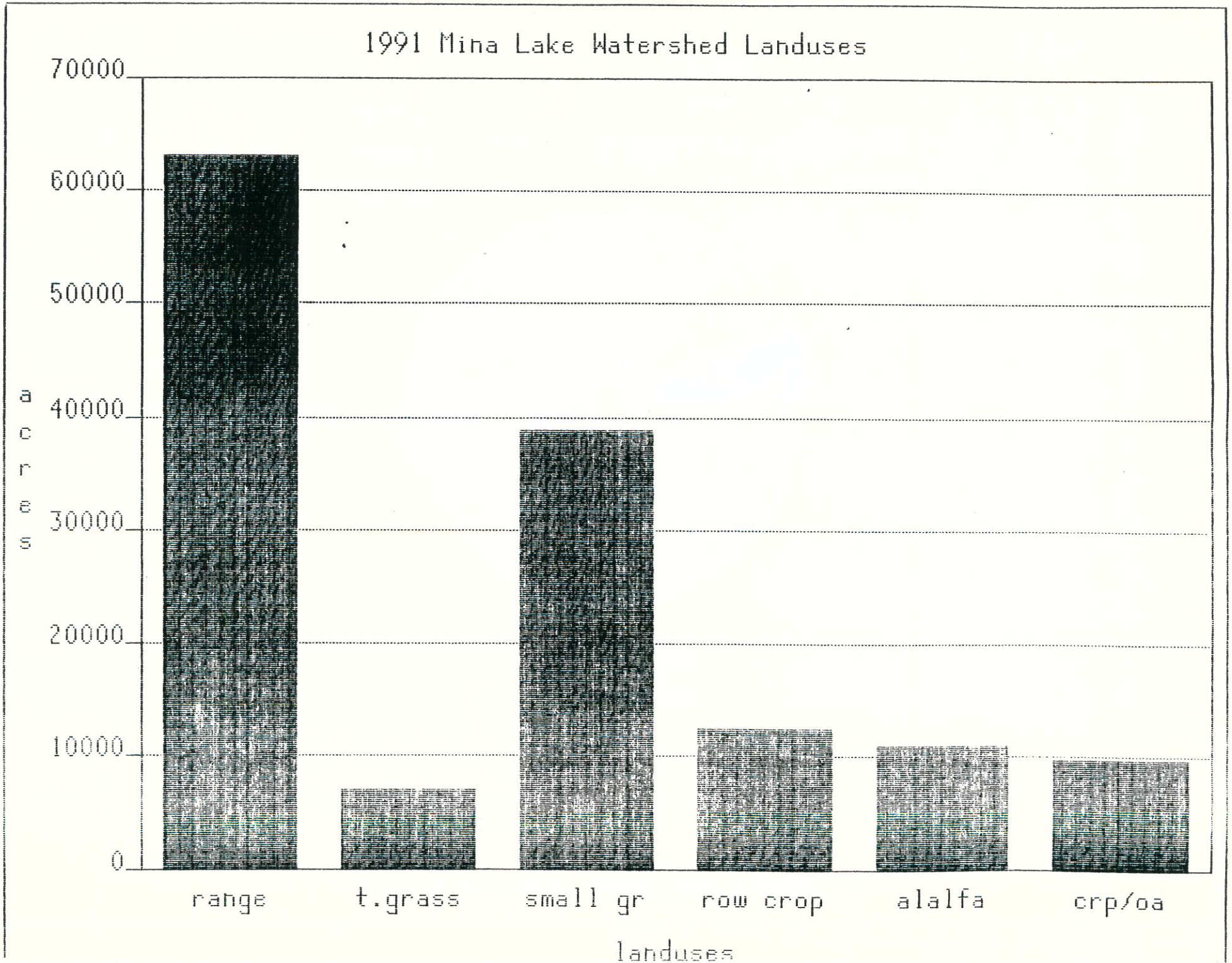
REGRESSION vs. ACTUAL MEASUREMENTS
FOR SITE #3 -- MINA LAKE -- 1991

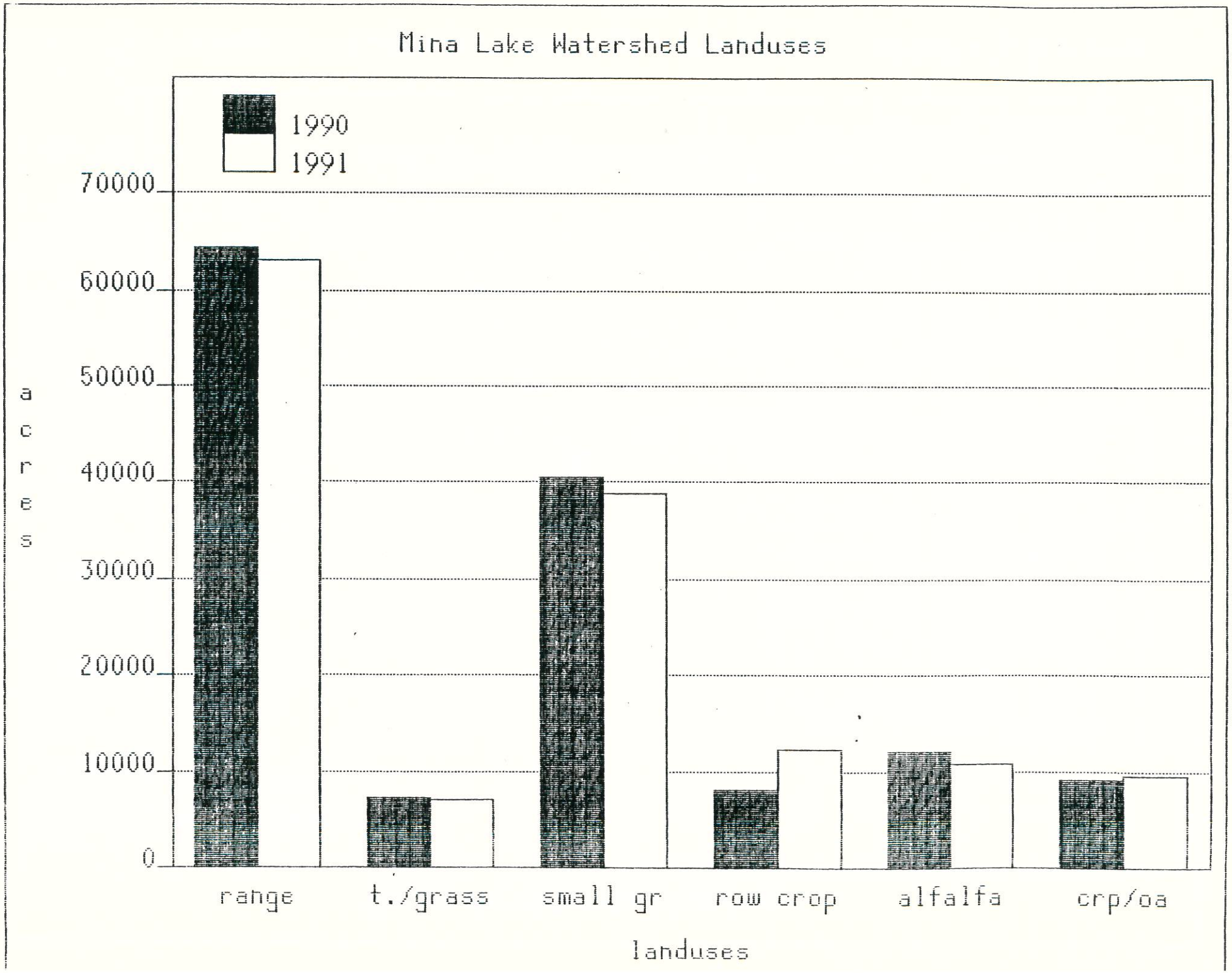


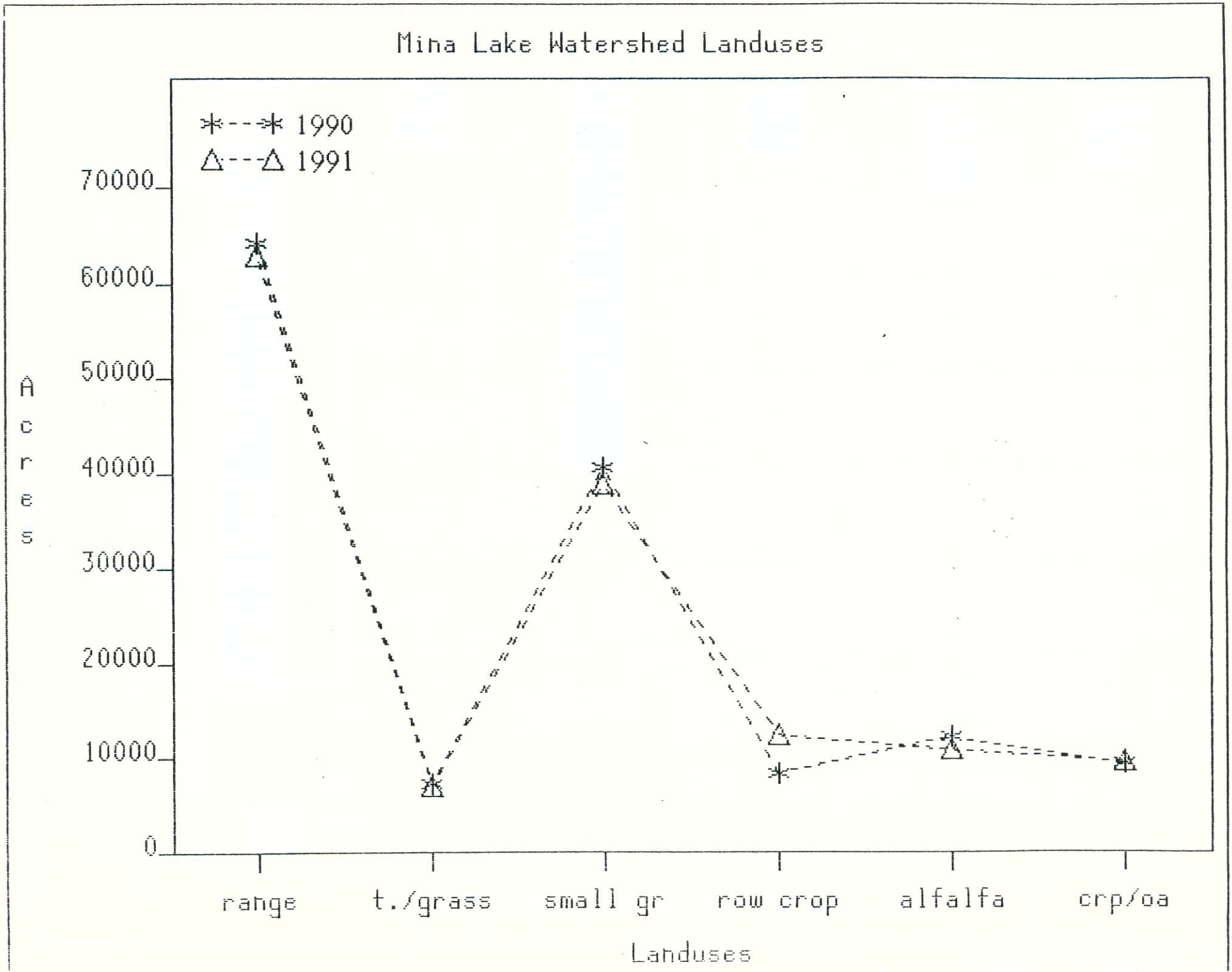
APPENDIX E
LAND USE DATA

1991 Mina Lake Watershed Landuses




1991 Mina Lake Watershed Landuses
70000
60000
50000
40000
30000
20000
10000
0
acres
range
t.grass
small gr
row crop
alalfa
crp/oa
landuses


Mina Lake Watershed Landuses
1990
1991
70000
60000
50000
40000
30000
20000
10000
0
a
c
r
e
s
range
t./grass
small gr
row crop
alfalfa
crp/oa
landuses


Mina Lake Watershed Landuses
1990
1991
70000
60000
50000
40000
30000
20000
10000
0
Acres
range
t./grass
small gr
row crop
alfalfa
crp/oa
Landuses

1990 Mina Lake Watershed Land Uses

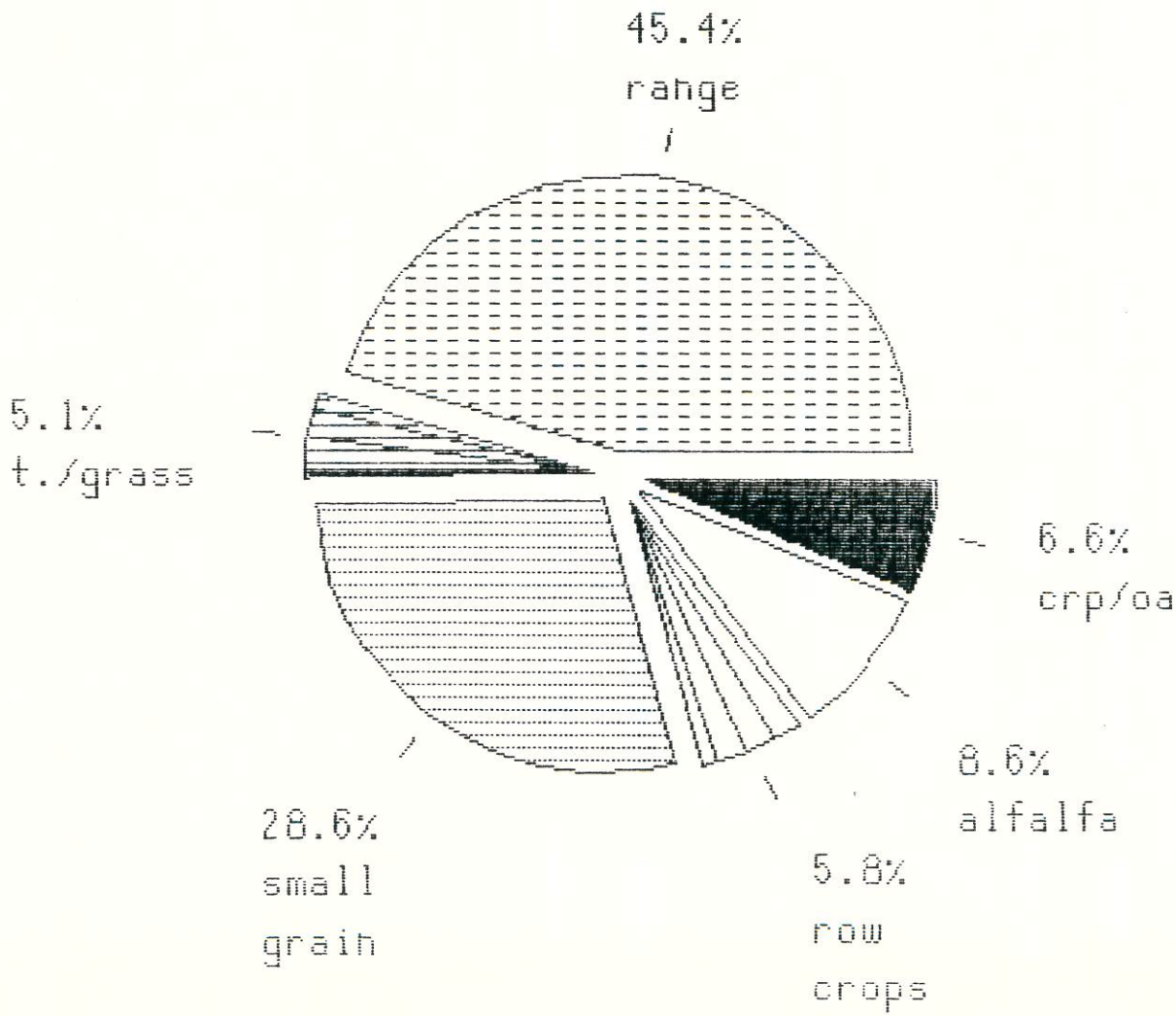
Alfalfa	Row Crops	Grain Crops	Range	T-Grass	CRP	FS/OA
12,208.4	8,237.4	40,528.7	64,371.8	7,213.8	6,858.5	2,439.0
					9,297.5	

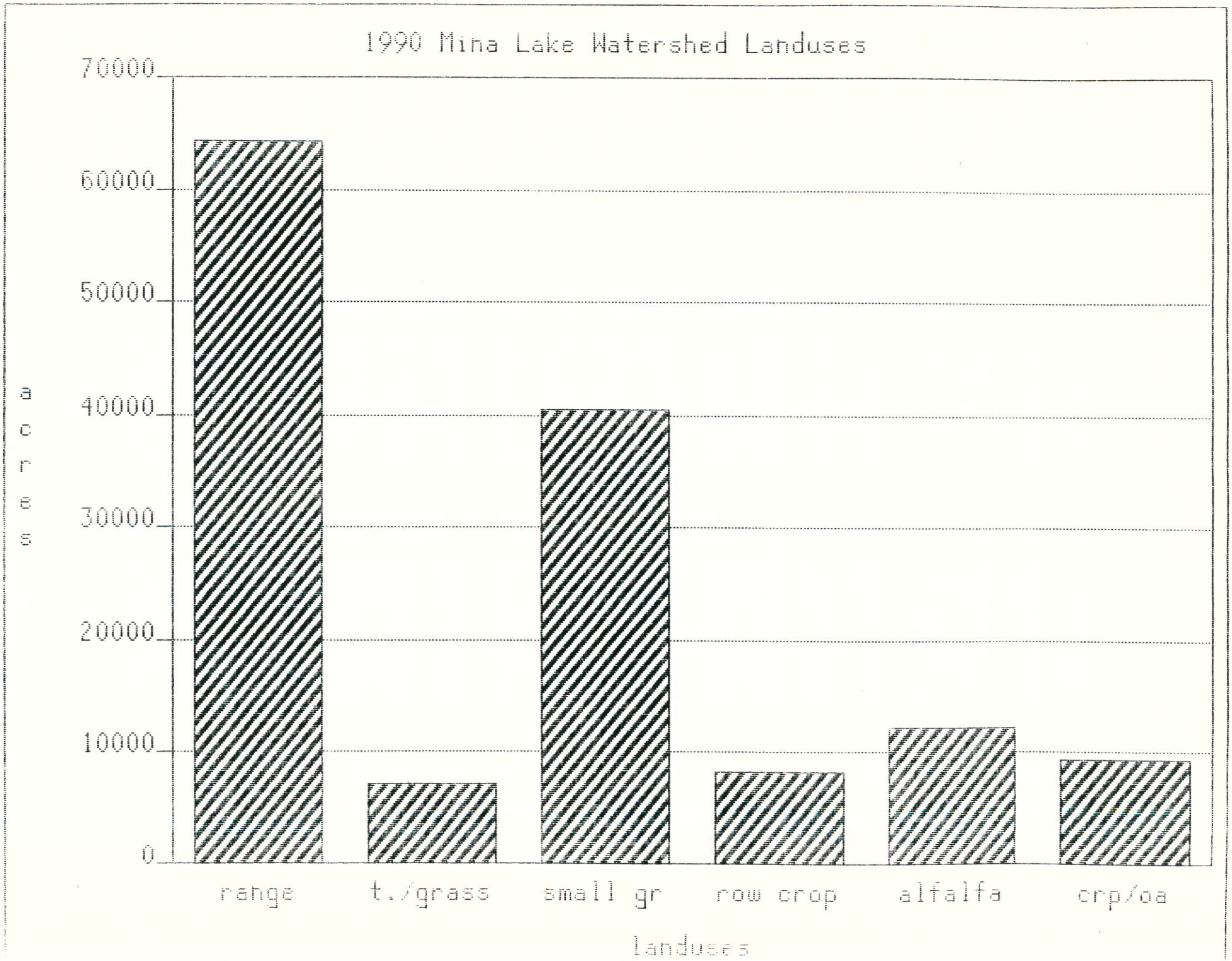
1991 Mina Lake Watershed Land Uses

Alfalfa	Row Crops	Grain Crops	Range	T-Grass	CRP	FS/OA
10,949.5	12,365.2	38,813.0	63,086.0	7,018.0	6,850.9	2,775.0
					9,625.9	

Total = 141,857.6

1990 Mina Lake Watershed Landuses




1990 Mina Lake Watershed Landuses
70000
60000
50000
40000
30000
20000
10000
0
acres
range
t./grass
small gr
row crop
alfalfa
crp/oa
landuses

1991

MINA LAKE WATERSHED - CROP HISTORY

TOWNSHIP	ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
											BROWN COUNTY											
MERCIER	123.3	0.0	0.0	3.4	56.3	0.0	29.0	58.8	0.0	0.0	0.0	19.8	0.0	1055.2	52.6	65.5	0.0	0.0	337.7	55.0	0.0	9.3
1865.9																						
											EDMUNDS COUNTY											
ADRIAN	0.0	0.0	73.3	0.0	132.6	0.0	39.0	0.0	0.0	0.0	150.0	0.0	0.0	2755.4	169.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BELLE	1912.4	50.0	4999.0	758.8	693.3	1498.0	686.5	183.3	0.0	405.0	2597.6	707.0	0.0	5244.7	544.2	320.4	0.0	1277.7	0.0	169.7	0.0	10.4
CORTLANDT	1308.1	0.0	1037.2	559.0	74.6	331.4	195.2	553.6	0.0	0.0	73.0	386.1	17.5	6140.4	1412.0	217.9	0.0	1276.0	15.4	324.2	0.0	28.3
FOUNTAIN	69.7	0.0	102.0	104.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IPSWICH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PEMBROOK	2512.7	44.6	917.4	542.0	56.4	219.7	670.9	388.5	0.0	0.0	0.0	270.4	14.0	8084.3	2071.4	275.6	53.9	520.3	189.3	17.5	0.0	55.1
ROSETTE	1119.6	0.0	3706.4	646.9	99.7	2102.9	295.2	412.7	0.0	0.0	2409.1	1049.3	0.0	5310.8	308.1	274.2	0.0	2057.3	106.0	46.6	0.0	23.3
SUBTOTAL	6922.5	94.6	10835.3	2610.7	1056.6	4152.0	1886.8	1538.1	0.0	405.0	5229.7	2412.8	31.5	27662.4	4505.4	1088.1	53.9	5131.3	310.7	558.0	0.0	117.1
76602.5																						
											MCPHERSON COUNTY											
ARENA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2080.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEWEY	191.5	0.0	110.1	41.5	0.0	0.0	65.5	15.8	0.0	0.0	0.0	0.0	0.0	8166.2	0.0	140.3	25.8	43.3	0.0	0.0	0.0	0.0
HOWARD	2008.2	43.3	2767.0	679.4	964.2	998.2	1181.6	333.1	77.4	0.0	1245.7	510.8	0.0	10256.6	414.8	231.9	0.0	1206.1	0.0	24.6	0.0	0.0
LINCOLN	429.0	53.5	515.6	45.0	0.0	1282.7	34.9	0.0	0.0	0.0	321.3	55.2	0.0	4184.0	178.1	183.0	0.0	0.0	0.0	10.0	0.0	0.0
SPRING	128.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	2051.0	0.0	0.0	0.0	117.0	0.0	0.0	0.0	0.0
WASHINGTON	1146.1	158.8	2762.1	1437.4	205.4	1237.4	745.2	1390.9	50.5	0.0	346.1	1016.9	1.0	7630.6	352.7	290.4	14.8	320.7	866.0	1.0	0.0	0.8
SUBTOTAL	3903.7	255.6	6154.8	2203.3	1169.6	3518.3	2027.2	1739.8	127.9	0.0	1913.1	1585.2	1.0	34368.4	945.6	845.6	40.6	1687.1	866.0	35.6	0.0	0.8
63389.2																						
141857.6																						
TOTALS	10949.5	350.2	16990.1	4817.4	2282.5	7670.3	3943.0	3336.7	127.9	405.0	7142.8	4017.8	32.5	63086.0	5503.6	1999.2	94.5	6818.4	1514.4	648.6	0.0	127.2

BROWN COUNTY - 1991

MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
64.0			3.4	56.3		29.0	58.8				10.1		239.6	52.6	24.0			337.7	55.0		9.3
59.3											9.7		227.6		41.5						
													532.1								
													55.9								
123.3	0.0	0.0	3.4	56.3	0.0	29.0	58.8	0.0	0.0	0.0	19.8	0.0	1055.2	52.6	65.5	0.0	0.0	337.7	55.0	0.0	9.3

EDMUNDS COUNTY - 1991
ADRIAN TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
		73.3		132.6		39.0				150.0			27.4	52.7							
													480.0	117.0							
													40.0								
													640.0								
													640.0								
													260.0								
													390.7								
													277.3								
0.0	0.0	73.3	0.0	132.6	0.0	39.0	0.0	0.0	0.0	150.0	0.0	0.0	2755.4	169.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

EDMUNDS COUNTY - 1991
BELLE TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
406.4	50.0	239.1	35.9	44.5	418.7	73.0	14.8		35.0	68.6	6.2		158.4	102.8	129.1		249.8		6.6		2.7
149.6		389.3	142.2	59.0	8.2	11.8	8.6		110.0	40.0	6.3		176.8	29.1	11.8		12.0		9.0		2.6
156.4		184.4	121.1	35.9	136.8	94.3	57.7		260.0	419.8	5.0		75.4	126.6	39.8		153.0		11.5		5.1
29.1		205.0	42.1	6.5	87.0	47.6	80.2			131.5	21.4		121.1	71.4	6.2		384.0		20.0		
129.2		67.0	80.0	12.2	212.6	38.0	22.0			368.7	24.0		320.7	61.3	12.7		160.0		15.0		
212.9		65.0	58.8	246.0	143.6	71.6				301.1	42.5		81.0	14.5	9.4		109.9		48.2		
50.6		130.3	80.6	61.3	71.7	35.0				136.0	30.8		282.0	5.0	35.7		131.0		20.0		
12.5		67.3	48.0	15.0	149.8	66.5				395.4	50.2		121.8	1.8	7.2		78.0		15.0		
143.3		79.4	99.8	212.9	69.3	66.5				453.9	71.5		224.8	78.5	22.9				15.0		
96.0		614.3	50.3		111.0	24.0				125.0	73.9		86.8	10.8	10.0				4.0		
118.9		156.8			37.3	19.0				157.6	52.2		191.2	42.4	13.0				2.4		
134.0		533.7			13.0	139.2					23.7		15.3		1.0				3.0		
34.2		92.4			39.0						26.0		371.8		21.6						
88.5		156.0									147.0		91.2								
34.2		65.7									86.7		36.1								
3.6		57.2									20.2		205.4								
113.0		410.2									19.4		25.7								
		609.0											208.2								
		46.1											2.9								
		157.0											37.8								
		474.1											63.9								
		77.3											67.7								
		66.9											171.1								
		55.5											273.5								
													193.0								
													252.1								
													211.7								
													346.8								
													30.0								
													4.0								
													139.4								
													184.1								
													46.5								
													426.5								
1912.4	50.0	4999.0	758.8	693.3	1498.0	686.5	183.3	0.0	405.0	2597.6	707.0	0.0	5244.7	544.2	320.4	0.0	1277.7	0.0	169.7	0.0	10.4

EDMUNDS COUNTY - 1991
CORTLANDT TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
238.4		36.9	66.2	10.0	51.8	26.7	39.3			36.9	7.7	3.2	309.3	88.3	20.5		92.3	15.4	13.0		2.2
105.4		46.2	91.9	63.6	52.0	15.6	148.5			36.1	35.6	6.0	219.6	202.5	5.4		103.3		151.2		4.2
38.3		1.0	94.8	1.0	43.6	9.0	92.4				36.4	8.3	219.6	85.7	8.3		69.0		160.0		5.5
20.4		157.9	4.8		84.0	43.7	26.8				93.2		233.7	8.8	18.2		115.8				16.4
83.6		13.5	10.6		86.7	4.5	160.2				38.9		347.5	32.0	20.0		90.9				
33.2		32.5	15.5		1.0	70.7	3.0				56.7		236.7	28.8	8.5		81.0				
115.7		64.6	47.0		12.3	25.0	24.8				26.6		11.0	126.7	15.0		21.0				
46.4		121.0	11.9				37.2				10.0		228.7	83.5	11.3		223.4				
10.4		144.0	106.5				21.4				45.7		305.9	13.5	12.0		103.4				
158.8		145.6	40.0								6.8		306.7	140.7	28.7		257.5				
33.0		24.9	56.3								4.2		397.8	29.3	42.2		118.4				
25.1		31.1	13.5								24.3		255.0	51.8	3.8						
48.0		46.5											121.5	74.9	24.0						
113.9		26.9											107.3	87.2							
15.7		53.2											212.5	177.1							
15.0		7.9											562.7	134.3							
40.0		59.5											322.6	18.0							
45.0		24.0											9.0	28.9							
100.3													119.5								
4.8													105.8								
16.7													304.3								
													156.8								
													214.6								
													164.0								
													275.1								
													163.0								
													16.7								
													100.5								
													93.0								
													20.0								
1308.1	0.0	1037.2	559.0	74.6	331.4	195.2	553.6	0.0	0.0	73.0	386.1	17.5	6140.4	1412.0	217.9	0.0	1276.0	15.4	324.2	0.0	28.3

EDMUNDS COUNTY - 1991
FOUNTAIN TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
52.0		78.0	104.0										6.8								
17.7		24.0																			
69.7	0.0	102.0	104.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

EDMUNDS COUNTY - 1991
IPSWICH TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
													120.0								
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

EDMUNDS COUNTY - 1991
PEMBROOK TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
40.6	35.6	68.0	26.2	41.0	38.6	5.7	159.8				3.5	10.0	110.0	38.7	19.3	53.9	63.7	43.5	15.5		5.2
67.8	9.0	122.4	108.2	15.4	34.0	30.8	21.1				140.8	4.0	305.2	175.0	15.7		22.7	2.0	2.0		2.3
239.3		32.3	42.2		21.5	63.6	28.6				37.5		416.7	31.6	23.0		110.0	143.8			1.0
57.3		53.0	75.8		23.9	35.8	10.2				2.7		370.7	27.8	2.2		29.3				3.2
10.0		90.8	10.1		36.0	25.0	48.7				3.8		174.1	170.5	16.0		157.0				7.5
88.4		19.5	51.7		10.7	72.7	15.0				44.4		153.7	114.4	11.8		137.6				4.0
245.5		150.5	71.9		55.0	49.9	85.8				5.9		253.9	171.4	24.8						17.7
110.3		54.5	33.7			54.0	13.5				23.9		80.0	17.0	10.8						14.2
146.9		1.5	3.5			24.0	5.8				7.9		77.6	209.9	12.4						
278.6		153.3	17.0			24.7							264.3	22.5	20.0						
117.1		71.1	22.0			11.0							338.5	20.7	2.2						
144.7		19.4	46.9			18.0							234.0	39.5	15.7						
6.4		81.1	31.1			75.6							296.4	5.7	9.6						
155.6			1.7			40.0							168.8	139.9	19.7						
272.6						18.5							219.4	15.2	21.9						
50.3						107.3							211.2	6.1	26.0						
141.9						14.3							371.9	115.2	24.5						
10.0													64.6	80.8							
65.5													55.3	159.4							
80.7													346.8	119.3							
126.6													412.3	57.8							
56.6													288.6	186.7							
													454.8	126.1							
													223.9	20.2							
													224.7								
													281.8								
													320.7								
													326.3								
													271.7								
													227.7								
													538.7								
2512.7	44.6	917.4	542.0	56.4	219.7	670.9	388.5	0.0	0.0	0.0	270.4	14.0	8084.3	2071.4	275.6	53.9	520.3	189.3	17.5	0.0	55.1

EDMUNDS COUNTY - 1991
ROSETTE TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
74.5		154.1	36.0	30.0	139.4	122.5	43.4			301.1	4.0		45.4	6.8	70.4		93.3	106.0	0.5		10.7
91.3		308.6	81.9	17.7	505.9	29.0	45.0			321.6	1.4		48.9	155.1	14.8		378.0		30.0		1.7
58.5		135.2	30.0	52.0	46.4	42.1	13.6			104.6	116.2		230.4	10.0	77.3		110.2		15.0		2.5
116.7		317.5	31.0		31.9	51.0	84.5			278.3	306.0		304.2	87.2	17.9		65.5		0.5		1.9
42.8		99.8	133.2		42.5	17.7	6.4			338.6	71.5		555.6	5.0	12.1		234.9		0.6		6.5
126.6		62.9	143.2		40.0	32.9	105.8			217.6	22.4		548.7	44.0	16.0		305.9				
41.0		40.2	15.7		308.3		114.0			76.4	376.8		384.3		18.0		85.3				
68.4		125.8	21.0		23.3					129.2	82.2		209.5		3.2		64.5				
40.9		616.0	44.9		48.5					203.2	26.0		379.3		12.5		87.0				
122.9		265.7	20.9		304.7					438.5	42.8		92.1		20.0		203.1				
143.7		603.6	89.1		77.1								110.9		12.0		156.0				
100.0		208.6			66.6								97.3				70.4				
76.0		238.7			50.1								19.9				68.3				
16.3		240.0			62.6								17.8				134.9				
		206.7			22.0								165.8								
		83.0			255.4								451.9								
					78.2								398.1								
													67.2								
													10.3								
													11.5								
													123.7								
													36.4								
													194.1								
													25.1								
													40.9								
													95.3								
													19.5								
													80.0								
													45.0								
													20.8								
													106.2								
													374.7								
1119.6	0.0	3706.4	646.9	99.7	2102.9	295.2	412.7	0.0	0.0	2409.1	1049.3	0.0	5310.8	308.1	274.2	0.0	2057.3	106.0	46.6	0.0	23.3

MCPHERSON COUNTY - 1991
ARENA TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
													560.0								
													320.0								
													560.0								
													640.0								
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2080.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MCPHERSON COUNTY - 1991
DEWEY TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
91.1		2.5	2.5			33.5	15.8						600.4		39.6	5.0	43.3				
1.3		107.6	6.0			8.0							472.1		24.0	20.8					
24.7			33.0			24.0							10.0		28.4						
27.8													480.3		25.0						
46.6													578.9		23.3						
													612.2								
													640.0								
													20.0								
													200.0								
													640.0								
													511.4								
													600.9								
													640.0								
													320.0								
													560.0								
													640.0								
													640.0								

MCPHERSON COUNTY - 1991
HOWARD TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/DA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
37.4	43.3	31.0	120.0	69.0	45.0	184.0	41.4	49.6		105.7	4.9		58.7	57.7	18.6		95.6		3.6		
182.8		36.0	34.0	2.7	24.0	148.5	13.0	27.8		171.8	90.3		349.9	26.7	3.1		287.3		21.0		
98.9		105.7	47.1	31.7	14.0	47.1	21.7			354.1	13.3		364.3	304.3	15.0		38.6				
118.7		175.5	20.6	18.2	58.6	82.7	18.7			308.2	21.5		25.9	26.1	25.4		80.0				
48.8		93.0	48.9	117.9	18.1	14.5	20.7			305.9	10.9		644.0		28.0		455.3				
128.1		187.6	23.3	49.5	182.3	28.7	44.2				166.5		509.7		20.2		63.0				
63.7		50.2	112.6	197.7	97.0	19.6	58.2				27.0		409.6		16.7		40.4				
4.0		164.0	13.4	258.1	83.3	40.1	6.9				18.3		367.7		38.0		145.9				
2.3		115.9	45.0	18.1	269.9	29.6	32.8				45.0		273.8		33.5						
56.6		44.4	131.5	7.6	32.0	11.7	75.5				30.0		305.1		28.0						
34.4		73.0	83.0	64.2	18.0	5.2					29.0		227.6		5.4						
79.2		155.2		129.5	156.0	32.0					14.1		188.6								
108.2		160.8				39.5					40.0		35.5								
236.6		23.6				33.9							332.0								
60.0		313.2				34.0							544.4								
53.0		21.0				91.0							640.0								
321.0		75.4				165.4							379.8								
74.8		93.0				174.1							484.7								
99.8		230.0											223.2								
46.7		150.3											272.6								
15.5		193.0											500.0								
58.3		130.0											51.6								
79.4		145.2											82.7								
													7.6								
													38.8								
													92.9								
													302.3								
													419.0								
													383.6								
													559.3								
													333.3								
													556.7								
													247.0								
													44.7								
2008.2	43.3	2767.0	679.4	964.2	998.2	1181.6	333.1	77.4	0.0	1245.7	510.8	0.0	10256.6	414.8	231.9	0.0	1206.1	0.0	24.6	0.0	0.0

MCPHERSON COUNTY - 1991
LINCOLN TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
144.7	17.7	39.2	45.0		209.8	34.9				31.9	8.5		20.8	74.5	9.9				10.0		
76.0	35.8	134.1			57.0					140.9	46.7		469.5	103.6	48.0						
208.3		120.0			383.1					25.5			260.0		55.1						
		222.3			365.4					123.0			75.0		50.0						
					267.4								398.3		20.0						
													640.0								
													357.6								
													256.9								
													60.0								
													14.3								
													480.0								
													249.6								
													194.0								
													234.9								
													105.3								
													367.8								
429.0	53.5	515.6	45.0	0.0	1282.7	34.9	0.0	0.0	0.0	321.3	55.2	0.0	4184.0	178.1	183.0	0.0	0.0	0.0	10.0	0.0	0.0

MCPHERSON COUNTY - 1991
SPRING TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
23.0											2.3		40.0				102.0				
77.7													297.0				15.0				
20.2													640.0								
8.0													540.0								
													438.0								
													96.0								
128.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	2051.0	0.0	0.0	0.0	117.0	0.0	0.0	0.0	0.0

MCPHERSON COUNTY - 1991
WASHINGTON TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
65.3	158.8	15.0	63.5	20.3	174.1	15.0	63.1	50.5		34.0	20.8	1.0	160.0	198.9	12.0	14.8	182.2	45.0	1.0		0.8
8.0		64.5	317.7	10.0	60.5	161.7	143.7			312.1	15.0		212.7	10.8	29.4		95.6	262.4			
101.1		71.0	97.2	46.1	53.8	120.0	8.7				101.2		121.1	77.4	14.0		42.9	85.0			
109.4		227.0	39.0	129.0	163.8	76.0	57.2				173.1		41.5	51.6	20.0			201.4			
40.9		112.0	259.7		90.7	194.3	353.3				65.9		125.6	11.5	28.9			201.7			
22.4		246.2	32.9		16.9	36.7	54.4				106.7		186.2	2.5	57.0			70.5			
150.6		46.0	160.0		116.1	141.5	308.4				83.6		172.0		17.3						
61.0		395.9	322.5		409.7		334.2				41.7		101.2		50.0						
6.4		355.6	144.9		151.8		67.9				9.8		6.2		15.0						
92.8		321.2									210.3		440.0		6.8						
220.6		33.0									58.5		640.0		16.0						
148.0		141.8									130.3		58.8		24.0						
119.6		72.6											16.4								
		146.3											71.0								
		151.0											110.9								
		12.5											10.3								
		22.0											48.7								
		200.0											245.8								
		128.5											295.4								
													53.6								
													311.3								
													165.6								
													88.2								
													45.3								
													176.9								
													125.9								
													319.0								
													101.3								
													480.0								
													184.6								
													480.0								
													640.0								
													426.5								
													968.6								
1146.1	158.8	2762.1	1437.4	205.4	1237.4	745.2	1390.9	50.5	0.0	346.1	1016.9	1.0	7630.6	352.7	290.4	14.8	320.7	866.0	1.0	0.0	0.8

1990

MINA LAKE WATERSHED - CROP HISTORY

TOWNSHIP	ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/DA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
											BROWN COUNTY											
MERCIER	124.3	0.0	0.0	58.8	59.7	0.0	86.0	29.0	0.0	0.0	0.0	40.9	0.0	1055.2	52.6	65.5	0.0	0.0	229.6	55.0	0.0	9.3
1865.9																						
											EDMUNDS COUNTY											
ADRIAN	0.0	0.0	0.0	0.0	28.0	0.0	212.7	0.0	0.0	0.0	0.0	2.0	0.0	2757.6	319.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BELLE	2579.3	242.8	5747.3	795.3	712.0	2702.2	793.5	228.1	0.0	0.0	201.4	232.8	0.0	5569.3	502.1	314.2	34.6	1277.7	115.0	0.0	0.0	10.4
CORTLANDT	1289.6	0.0	1723.8	470.9	91.0	137.0	329.4	268.5	0.0	0.0	36.5	132.6	15.5	6109.8	1512.2	217.9	0.0	1276.0	0.0	311.2	0.0	28.0
FOUNTAIN	69.7	0.0	78.0	14.0	10.0	0.0	95.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IPSWICH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PEMBROOK	2697.6	22.2	681.4	602.7	209.3	253.7	654.8	441.3	0.0	0.0	0.0	246.2	24.6	8100.7	1915.4	257.5	9.2	520.3	204.4	15.5	0.0	47.2
ROSETTE	1188.3	98.1	4108.7	705.0	215.9	2341.8	516.7	80.9	0.0	0.0	1920.9	272.3	0.0	5422.3	622.6	277.4	0.0	2057.3	106.0	0.6	10.0	23.3
SUBTOTAL	7824.5	363.1	12339.2	2587.9	1266.2	5434.7	2602.1	1018.8	0.0	0.0	2158.8	885.9	40.1	28086.5	4881.0	1067.0	43.8	5131.3	425.4	327.3	10.0	108.9
76602.5																						
											MCPHERSON COUNTY											
ARENA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2080.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEWEY	245.6	0.0	29.3	63.0	70.8	0.0	41.5	0.0	0.0	0.0	0.0	0.0	0.0	8166.2	0.0	140.3	0.0	43.3	0.0	0.0	0.0	0.0
HOWARD	1954.1	146.0	3484.0	639.6	693.0	623.5	937.5	861.5	88.4	0.0	611.5	481.5	0.0	10604.8	382.0	223.4	0.0	1206.1	0.0	0.0	0.0	6.0
LINCOLN	574.3	58.0	0.0	134.1	0.0	590.3	176.2	81.4	0.0	0.0	516.5	239.7	0.0	4589.8	174.1	157.9	0.0	0.0	0.0	0.0	0.0	0.0
SPRING	51.2	0.0	0.0	0.0	0.0	38.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2051.0	41.7	0.0	0.0	117.0	0.0	0.0	0.0	0.0
WASHINGTON	1434.4	352.3	3511.8	714.1	149.3	597.9	1220.9	1387.0	45.0	0.0	753.1	454.2	0.0	7738.3	398.9	267.6	0.0	320.7	628.5	0.0	0.0	0.8
SUBTOTAL	4259.6	556.3	7025.1	1550.8	913.1	1850.0	2376.1	2329.9	133.4	0.0	1881.1	1175.4	0.0	35230.1	996.7	789.2	0.0	1687.1	628.5	0.0	0.0	6.8
63389.2																						
141857.6																						
TOTALS	12208.4	919.4	19364.3	4197.5	2239.0	7284.7	5064.2	3377.7	133.4	0.0	4039.9	2102.2	40.1	64371.8	5930.3	1921.7	43.8	6818.4	1283.5	382.3	10.0	125.0

BROWN COUNTY - 1990

MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
65.0			58.8	59.7		86.0	29.0				31.2		239.6	52.6	24.0			165.6	55.0		9.3
59.3											9.7		227.6		41.5			64.0			
													532.1								
													55.9								
124.3	0.0	0.0	58.8	59.7	0.0	86.0	29.0	0.0	0.0	0.0	40.9	0.0	1055.2	52.6	65.5	0.0	0.0	229.6	55.0	0.0	9.3

EDMUNDS COUNTY - 1990
ADRIAN TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
				28.0		102.6					2.0		27.4	117.0							
						110.1							480.0	202.7							
													40.0								
													640.0								
													640.0								
													260.0								
													392.9								
													277.3								
0.0	0.0	0.0	0.0	28.0	0.0	212.7	0.0	0.0	0.0	0.0	2.0	0.0	2757.6	319.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

EDMUNDS COUNTY - 1990
BELLE TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
413.0	40.0	268.2	147.1	150.5	268.8	44.5	67.1			104.2	2.3		227.0	35.5	129.1	33.6	249.8	115.0			2.7
149.6	156.4	149.6	98.6	91.2	356.9	156.0	31.0			97.2	12.7		176.8	29.1	11.8	1.0	12.0				2.6
133.0	46.4	29.4	22.8	6.2	166.3	33.0	29.1				9.0		75.4	126.6	39.8		153.0				5.1
63.3		477.0	15.0	29.0	49.2	21.0	30.0				18.9		121.1	71.4	12.7		384.0				
217.0		84.4	88.6	24.2	78.8	67.0	20.6				14.9		328.3	5.0	9.4		160.0				
124.0		159.4	49.0	154.6	67.0	63.5	50.3				123.4		89.6	78.5	35.7		109.9				
129.2		301.1	90.0	28.0	467.7	69.3					30.0		282.0	10.8	7.2		131.0				
230.9		614.3	19.9	31.5	122.8	34.0					5.6		121.8	42.4	22.9		78.0				
50.6		156.8	13.5	149.8	71.6	101.9					16.0		224.8	102.8	10.0						
62.7		50.0	102.0	14.0	396.5	50.0							86.8		13.0						
30.6		533.7	36.0	33.0	69.6	110.6							249.3		1.0						
185.3		161.5	57.3		102.1	31.0							20.3		21.6						
121.0		349.4	55.5		484.9	11.7							371.8								
187.3		156.0											91.2								
119.3		104.0											36.1								
85.8		97.9											205.4								
88.5		410.2											25.7								
135.0		609.0											208.2								
53.2		46.1											2.9								
		401.3											37.8								
		474.1											63.9								
		91.9											67.7								
		22.0											332.7								
													273.5								
													193.0								
													252.1								
													211.7								
													361.9								
													30.0								
													4.0								
													139.4								
													184.1								
													46.5								
													426.5								
2579.3	242.8	5747.3	795.3	712.0	2702.2	793.5	228.1	0.0	0.0	201.4	232.8	0.0	5569.3	502.1	314.2	34.6	1277.7	115.0	0.0	0.0	10.4

EDMUNDS COUNTY - 1990
CORTLANDT TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
236.4		39.3	66.2	22.1	47.4	1.0	9.0			36.5	14.6	3.2	309.3	87.3	20.5		92.3		151.2		2.2
105.4		91.2	71.3	20.7	89.6	40.0	20.2				69.7	4.0	219.6	202.5	5.4		103.3		160.0		4.2
38.3		91.9	56.2	20.4		34.0	150.0				38.9	8.3	219.6	85.7	8.3		69.0				5.2
20.4		85.6	6.8	27.8		148.2	40.0				6.3		231.9	8.8	18.2		115.8				16.4
83.6		149.4	38.1			57.4	17.0				3.1		347.5	32.0	20.0		90.9				
34.4		106.5	16.3			38.9	10.3						236.7	25.9	8.5		81.0				
9.3		67.5	43.6			9.9	22.0						11.0	126.7	15.0		21.0				
93.7		47.0	15.0										228.7	83.5	11.3		223.4				
84.6		154.2	22.8										305.9	13.5	12.0		103.4				
25.6		145.6	64.8										306.7	142.7	28.7		257.5				
119.9		68.6	56.3										398.1	29.3	42.2		118.4				
25.1		51.4	13.5										255.0	51.8	3.8						
48.0		47.0											121.5	15.4	24.0						
113.9		57.2											107.3	74.9							
15.7		45.7											212.5	87.2							
15.0		112.6											562.7	177.1							
40.0		41.4											322.6	134.3							
45.0		39.2											9.0	47.1							
100.3		70.1											119.5	15.2							
33.0		7.9											105.8	71.3							
		59.5											304.3								
		24.0											156.8								
		121.0											185.5								
													164.0								
													275.1								
													163.0								
													16.7								
													100.5								
													93.0								
													20.0								
1289.6	0.0	1723.8	470.9	91.0	137.0	329.4	268.5	0.0	0.0	36.5	132.6	15.5	6109.8	1512.2	217.9	0.0	1276.0	0.0	311.2	0.0	28.0

EDMUNDS COUNTY - 1990
FOUNTAIN TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
52.0		78.0	14.0	10.0		95.0							6.8	9.0							
17.7																					

EDMUNDS COUNTY - 1990
IPSWICH TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/DA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
													120.0								
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

EDMUNDS COUNTY - 1990
PEMBROOK TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
40.6	22.2	34.1	59.0	19.5	54.0	9.0	20.0				0.7	20.0	110.0	38.7	15.7	3.5	63.7	32.8	15.5		1.4
22.0		2.9	19.7	105.8	24.5	119.8	30.8				10.2	0.6	305.2	175.0	23.0	5.7	22.7	27.8			2.3
72.8		15.0	117.2	17.6	91.8	13.9	22.3				4.0	4.0	416.7	9.6	16.0		110.0	143.8			1.0
175.9		178.8	21.2	6.8	30.4	61.4	34.0				11.4		374.1	26.6	11.8		29.3				3.2
57.3		83.7	50.1	23.8	53.0	25.7	8.0				29.3		174.1	172.5	24.8		157.0				7.5
65.1		121.2	43.5	19.4		41.6	33.3				7.9		153.7	114.4	10.8		137.6				4.0
166.2		37.1	43.5	16.4		108.3	29.9				48.5		253.9	106.3	12.4						14.8
10.0		53.1	11.0			65.5	42.9				5.9		80.0	17.0	20.0						13.0
52.7		78.3	30.0			13.0	18.0				128.3		77.6	197.2	3.4						
17.6		33.7	60.0			25.0	95.6						264.3	25.5	2.2						
191.7		26.6	60.8			4.0	53.5						338.5	9.0	15.7						
97.3		16.9	45.8			11.6	25.0						234.0	41.4	9.6						
146.9			2.3			57.6	5.8						296.4	5.7	19.7						
278.6			38.6			20.3	4.5						168.8	139.9	21.9						
83.8						21.1	17.7						219.4	5.0	26.0						
139.7						55.0							211.2	15.2	24.5						
1.9						2.0							371.9	6.1							
6.4													77.6	89.4							
155.6													55.3	82.8							
54.5													346.8	134.4							
272.6													412.3	119.3							
52.6													288.6	57.8							
144.4													454.8	186.7							
35.0													223.9	118.6							
65.5													224.7	20.0							
80.7													281.8	1.3							
126.6													320.7								
58.6													326.3								
25.0													271.7								
													227.7								
													538.7								
2697.6	22.2	681.4	602.7	209.3	253.7	654.8	441.3	0.0	0.0	0.0	246.2	24.6	8100.7	1915.4	257.5	9.2	520.3	204.4	15.5	0.0	47.2

EDMUNDS COUNTY - 1990
ROSETTE TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
187.0	60.0	440.5	168.3	30.0	154.1	88.5	29.5			424.5	13.8		45.4	6.8	70.4		93.3	106.0	0.6	10.0	10.7
74.5	38.1	205.3	31.3	17.3	291.4	59.9	11.4			29.8	39.3		55.5	155.1	17.4		378.0				1.7
91.3		59.7	111.9	9.3	134.6	49.8	40.0			616.0	61.9		230.4	87.2	77.3		110.2				2.5
147.7		134.7	41.4	31.9	36.0	21.0				152.5	82.2		304.8	5.0	17.9		65.5				1.9
42.8		437.8	104.6	127.4	81.9	62.2				448.6	2.5		555.6	368.5	12.1		234.9				6.5
95.6		244.7	43.6		38.1	81.5				156.4	72.6		548.7		16.0		305.9				
41.0		109.4	60.9		134.4	100.0				93.1			384.3		18.0		85.3				
68.4		70.6	50.1		308.6	16.3							209.5		3.8		64.5				
40.9		338.6	21.6		317.5	37.5							379.3		12.5		87.0				
163.1		240.0	71.3		227.3								92.1		20.0		203.1				
143.7		481.3			69.2								110.9		12.0		156.0				
76.0		194.2			43.9								97.3				70.4				
16.3		349.9			155.0								28.2				68.3				
		105.8			231.9								17.8				134.9				
		84.5			117.9								165.8								
		44.0											451.9								
		210.1											398.1								
		160.6											67.2								
		197.0											10.3								
													11.5								
													123.7								
													36.4								
													194.1								
													25.1								
													40.9								
													95.3								
													115.5								
													80.0								
													45.0								
													20.8								
													106.2								
													374.7								
1188.3	98.1	4108.7	705.0	215.9	2341.8	516.7	80.9	0.0	0.0	1920.9	272.3	0.0	5422.3	622.6	277.4	0.0	2057.3	106.0	0.6	10.0	23.3

MCPHERSON COUNTY - 1990
ARENA TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
													560.0								
													320.0								
													560.0								
													640.0								

MCPHERSON COUNTY - 1990
DEWEY TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
91.1		2.5	2.5	5.0		33.5							600.4		39.6		43.3				
48.4		26.8	60.5	50.0		8.0							472.1		24.0						
24.7				15.8									10.0		28.4						
27.8													480.3		25.0						
53.6													578.9		23.3						
													612.2								
													640.0								
													20.0								
													200.0								
													640.0								
													511.4								
													600.9								
													640.0								
													320.0								
													560.0								
													640.0								
													640.0								

MCPHERSON COUNTY - 1990
HOWARD TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
37.4	96.0	175.0	108.4	39.0	89.4	62.0	37.0	88.4		158.3	23.5		58.7	98.9	18.6		95.6				6.0
182.8	50.0	38.8	33.0	11.7	16.0	60.5	107.2			308.2	6.7		349.9	4.0	15.0		287.3				
118.7		153.1	37.4	75.4	11.0	21.0	9.1			145.0	13.5		364.3	146.3	25.4		38.6				
62.6		217.7	9.3	108.7	65.2	70.2	55.4				2.0		25.9	60.0	28.0		80.0				
168.7		209.8	28.7	312.1	20.0	31.4	33.1				12.1		644.0	26.7	20.2		455.3				
63.7		26.0	107.7	54.0	73.2	111.7	18.8				57.7		509.7	20.0	16.7		63.0				
2.3		60.7	91.4	29.2	91.1	51.0	156.0				16.2		409.6	26.1	38.0		40.4				
56.6		156.8	36.0	38.9	60.4	19.6	24.4				193.0		367.7		33.5		145.9				
34.4		219.7	5.0	24.0	52.0	41.0	60.0				20.3		315.5		28.0						
67.1		112.5	110.0		145.2	69.2	20.3				2.0		305.1								
108.2		155.2	72.7			29.6	20.8				33.3		227.6								
231.6		49.5				17.3	156.1				101.2		188.6								
53.0		160.8				48.3	77.2						35.5								
321.0		29.8				76.0	86.1						332.0								
74.8		165.7				27.1							544.4								
77.8		39.0				30.6							640.0								
44.0		176.5				91.0							379.8								
42.0		391.0				80.0							484.7								
128.0		203.3											223.2								
79.4		258.1											272.6								
		174.1											500.0								
		310.9											51.6								
													82.7								
													7.6								
													38.8								
													92.9								
													302.3								
													419.0								
													383.6								
													361.5								
													304.3								
													333.3								
													556.7								
													491.7								
1954.1	146.0	3484.0	639.6	693.0	623.5	937.5	861.5	88.4	0.0	611.5	481.5	0.0	10604.8	382.0	223.4	0.0	1206.1	0.0	0.0	0.0	6.0

MCPHERSON COUNTY - 1990
LINCOLN TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
150.9	58.0		134.1		31.9	94.5	78.9			209.8	8.5		20.8	74.5	9.9						
144.7					57.0	45.0	2.5			151.7	40.5		469.5	99.6	48.0						
70.4					252.0	36.7				155.0	144.0		260.0		50.0						
208.3					130.1						46.7		75.0		30.0						
					119.3								398.3		20.0						
													640.0								
													357.6								
													256.9								
													60.0								
													14.3								
													480.0								
													249.6								
													194.0								
													391.1								
													367.8								
													354.9								
574.3	58.0	0.0	134.1	0.0	590.3	176.2	81.4	0.0	0.0	516.5	239.7	0.0	4589.8	174.1	157.9	0.0	0.0	0.0	0.0	0.0	0.0

MCPHERSON COUNTY - 1990
SPRING TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
23.0					38.3								40.0	41.7			102.0				
20.2													297.0				15.0				
8.0													640.0								
													540.0								
													438.0								
													96.0								
51.2	0.0	0.0	0.0	0.0	38.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2051.0	41.7	0.0	0.0	117.0	0.0	0.0	0.0	0.0

MCPHERSON COUNTY - 1990
WASHINGTON TOWNSHIP
MINA LAKE WATERSHED - CROP HISTORY

ALFALFA	RYE	WHEAT	CORN	SORGHUM	BARLEY	OATS	MILLET	FLAX	SOYBEANS	FLOWERS	FALLOW	FOOD PLOT	RANGE	GRASS (T)	FS/OA	SUDAN	CRP	BROME	WET	WATERBANK	TREES
65.3	193.5	15.0	48.8	24.8	15.0	103.2	215.4	45.0		91.6	61.4		160.0	198.9	12.0		182.2	1.6			0.8
8.0	158.8	64.5	265.4	106.8	10.0	195.0	8.1			99.5	54.7		212.7	33.4	29.4		95.6	159.6			
101.1		71.0	81.3	17.7	69.5	173.1	129.8			409.7	11.8		121.1	90.9	14.0		42.9	201.4			
122.8		210.4	173.0		175.0	60.0	8.3			152.3	22.0		41.5	51.6	20.0			195.0			
40.9		88.5	4.8		45.7	96.6	166.1				18.0		125.6	10.1	28.9			70.9			
60.5		245.4	90.7		30.0	24.3	40.9				58.5		138.8	11.5	57.0						
395.9		200.1	50.1		43.0	89.4	124.9				35.0		172.0	2.5	17.3						
44.5		101.2			209.7	91.0	36.1				32.5		101.2		24.0						
71.0		367.0				123.6	67.9				30.0		114.1		50.0						
85.0		426.1				151.8	146.3				130.3		640.0		15.0						
119.6		349.4				32.9	137.5						440.0								
6.4		36.2				80.0	151.0						640.0								
92.8		128.5					9.8						640.0								
220.6		61.7					144.9						58.8								
		308.4											16.4								
		65.0											71.0								
		312.1											110.9								
		102.3											10.3								
		46.1											106.7								
		83.9											245.8								
		229.0											426.5								
													461.9								
													169.8								
													106.0								
													346.7								
													311.3								
													165.6								
													88.2								
													46.0								
													176.9								
													125.9								
													335.6								
													146.4								
													664.6								
1434.4	352.3	3511.8	714.1	149.3	597.9	1220.9	1387.0	45.0	0.0	753.1	454.2	0.0	7738.3	398.9	267.6	0.0	320.7	628.5	0.0	0.0	0.8