

MISSOURI RIVER
INTERIOR LEAST TERN AND PIPING PLOVER
POPULATION STATUS AND PRODUCTIVITY SUMMARY
including
Permit Activity Report

1994

Prepared by the U. S. Army Corps of Engineers
Endangered Species Coordinators, Operations Division - Omaha District
215 North 17th Street, Omaha NE 68102

A report submitted to meet condition 4 page 3
of the permit PRT-704930 (subpermit 93-07)
issued to the

U.S. Army Corps of Engineers
Missouri River Division
P.O. Box 103, Downtown Station
Omaha, NE 68101-0103

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1994 AT-A-GLANCE

INTERIOR LEAST TERN (*STERNA ANTILLARIUM*)

MISSOURI RIVER POPULATION SURVEY & PRODUCTIVITY MONITORING

	ADULT CENSUS	MONITORED ADULT CEN...	NESTS	NESTS HATCHED	NEST(S) SUCCESS	EGGS	AVE CLUTCH SIZE	EGGS HATCHED	MONITORED CHICKS FLED	TOTAL CHICKS PLEGGED	PLEGGED RATIO
Port Peck Lake (TPKRES)	9	9	8	3	37.5	14	1.75	6	2	2	0.44
Port Peck River (TPKRIV)	58	27	23*	14*	60.9*	46*	2.00*	31*	19	41**	1.41
Lake Sakakawea (KSKRES)	35	35	18	3	16.7	41	2.28	4	0	0	0.00
Lawson River (LARRRIV)	217	217	132	60	45.5	270	2.05	131	66	66	0.61
Lake Osage (KDHRES)	160	160	71	14	19.7	173	2.44	32	5	5	0.06
Port Randall River (TRLRIV)	43	43	27	15	55.6	63	2.33	37	0	0	0.00
Lewis and Clark Lake (LECLRES)	44	44	21	0	0.0	32	1.52	0	0	0	0.00
Lawns Point River (LAPTRIV)	211	211	218	75	34.2	514	2.36	179	51	51	0.48
TOTAL	777	746	518	184	35.5	1153	2.23	420	143	165	0.42

a = Nests per 100 attempts

b = fledged chicks per pair of adult birds

* = Numbers represent monitored Reach subsample

** = Fledge Ratio x Adult Census Pairs

1994 AT-A-GLANCE

PIPING PLOVER (*CHARADIUS MELODUS*)

MISSOURI RIVER POPULATION SURVEY & PRODUCTIVITY MONITORING

	ADULT CENSUS	NESTS	NESTS HATCHED	NEST(a) SUCCESS	EGGS	AVE CLUTCH SIZE	EGGS HATCHED	CHECKS FLEDGED	FLEDGE(b) RATIO
Port Peck Lake (TPKRES)	4	11	5	45.5	39	3.55	19	3	1.50
Port Peck River (TPKRIV)	9	1	0	0.0	3	3.00	0	0	0.00
Lake Sakakawea (KSKRES)	45	17	13	76.5	63	3.71	43	28	1.24
arrison River (IARRIV)	119	51	35	68.6	179	3.51	126	57	0.96
Lake Oahe (KOHRES)	85	33	18	54.5	124	3.76	61	4	0.09
Port Randall River (TRLRIV)	17	6	4	66.7	21	3.50	13	0	0.00
ewis and Clark Lake (ECLRES)	12	10	1	10.0	37	3.70	4	2	0.33
avins Point River (APTRIV)	62	52	23	44.2	177	3.40	60	19	0.61
TOTAL	353	161	99	54.7	643	3.55	346	113	0.64

a = Nests per 100 attempts

b = fledged chicks per pair of adult birds

* = Numbers represent monitored Reach subsample

** = Fledge Ratio x Adult Census Pairs

1994 AT-A-GLANCE

INTERIOR LEAST TERN (STERNA ANTILLARIUM)

MISSOURI RIVER POPULATION SURVEY & PRODUCTIVITY MONITORING

	ADULT CENSU	MONITORED ADULT CEN	NESTS	NESTS HATCHED	NEST(a) SUCCESS	EGGS	AVE-CLUTCH SIZE	EGGS HATCHED	MONITORED CHICKS FLED	TOTAL CHICKS FLEDGED	FLEDGE(b) RATIO
Port Peck Lake (TPKRÉS)	9	9	8	3	37.5	14	1.75	6	2	2	0.44
Port Peck River (TPKRIV)	58	27	23*	14*	60.9*	48*	2.00*	31*	19	41**	1.41
Lake Sakakawea (KSKRES)	35	35	18	3	16.7	41	2.28	4	0	0	0.00
Harrison River (HARRRIV)	217	217	132	60	45.5	270	2.05	131	66	66	0.61
Lake Oahe (KDHRES)	160	160	71	14	19.7	173	2.44	32	5	5	0.06
Port Randall River (TRLRIV)	43	43	27	15	55.6	63	2.33	37	0	0	0.00
Lewis and Clark Lake (EGLRES)	44	44	21	0	0.0	32	1.52	0	0	0	0.00
Javins Point River (JAPTRIV)	211	211	218	75	34.2	514	2.36	179	51	51	0.48
TOTAL	777	746	518	184	35.5	1153	2.23	420	143	165	0.42

a = Nests per 100 attempts

b = fledged chicks per pair of adult birds

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1994 AT-A-GLANCE

PIPING PLOVER (*CHARADIUS MELODUS*)

MISSOURI RIVER POPULATION SURVEY & PRODUCTIVITY MONITORING

	ADULT CENSUS	NESTS	NESTS HATCHED	NEST(a) SUCCESS	EGGS	AVE CLUTCH SIZE	EGGS HATCHED	CHICKS FLEDGED	FLEDGE(b)
Port Peck Lake (TPKRES)	4	11	5	45.5	39	3.55	19	3	1.50
Port Peck River (TPKRIV)	9	1	0	0.0	3	3.00	0	0	0.00
Lake Sakakawea (KSKRES)	45	17	13	76.5	63	3.71	43	28	1.24
Marion River (MARRIV)	119	51	35	68.6	179	3.51	126	57	0.96
Lake Oahe (KOHRES)	85	33	18	54.5	124	3.76	61	4	0.09
Port Randall River (TRLRIV)	17	6	4	66.7	21	3.50	13	0	0.00
Lewis and Clark Lake (ECLRES)	12	10	1	10.0	37	3.70	4	2	0.33
Avins Point River (APTRIV)	62	52	23	44.2	177	3.40	80	19	0.61
TOTAL	353	181	99	54.7	643	3.55	346	113	0.64

a = Nests per 100 attempts

b = fledged chicks per pair of adult birds

* = Numbers represent monitored Reach subsample

** = Fledge Ratio x Adult Census Pairs

SUBJECT: Annual report on the Missouri River interior least tern (*Sterna antillarum*) and piping plover (*Charadrius melodus*) population status and productivity including activity conducted under endangered species research permit PRT-704930.

PURPOSE: This report is intended to provide annual trend data on the adult populations and production estimates of least terns and piping plovers nesting along monitored reaches of the mainstem Missouri River during 1994. Efforts have been made to standardize data presentation in this report so that comparisons can be made with previous data collected on these reaches. All activities and procedures used to collect this data during the 1994 nesting season are discussed within this document. This report represents compiled data from seven U.S. Army Corps of Engineers Natural Resource Offices and one contracted U.S. Fish and Wildlife Service-Ecological Services Office. If procedural information in greater detail than what is presented herewithin is required for comparative studies, unassimilated field office reports are available from the Operations Division of the Omaha District, U.S. Army Corps of Engineers, Omaha, NE.

INTRODUCTION

The U.S. Army Corps of Engineers (Corps) received a jeopardy Biological Opinion on the operations of the Missouri River Mainstem System from the U.S. Fish and Wildlife Service (USFWS) on November 14, 1990. This Biological Opinion (Opinion) concluded that the operations of the Missouri River would likely jeopardize the continued existence of the interior population of the least tern (*Sterna antillarum*) and the Great Plains population of the piping plover (*Charadrius melodus*). In 1985 the least tern was listed as endangered on the federal Endangered Species List. The northern Great Plains population of the piping plover was listed as threatened in January 1986.

The Opinion included Reasonable and Prudent Measures, Reasonable and Prudent Alternatives, and Conservation Measures that, if implemented, would preclude jeopardy to these species. The preclusion of jeopardy was based on production to be measured by fledge ratios of least terns and piping plovers on the Missouri River. Implementation of recovery measures is to be monitored through annual breeding adult population censuses and productivity surveys. Once productivity standards are achieved they will be maintained and monitored for ten consecutive years.

During the period from 1986-89 the Corps, in anticipation of an Opinion, began funding a series of studies to determine the population distribution of least terns and piping plovers throughout the Missouri River basin, and to determine factors influencing the decline of these species. Based on findings of these studies, measures were initiated to reduce the impacts of human recreation on nesting areas and water release hydrographs were developed to prevent flooding of nests and pre-fledged chicks.

Upon receiving the Opinion in 1990, the corps intensified efforts to gather life history data and vital rates of piping plovers and least terns nesting on the Missouri River. Universities and the USFWS were contracted to collect this information during a second series of studies. Further measures, resulting from these continuing studies, have been

developed and are currently being implemented to deter predation on the nesting colonies, to better control the inundation of low elevation nesting sites, and to retard the loss of habitat due to vegetation encroachment.

1994 represented the second year in the Corps' efforts to undertake census, monitoring, and recovery activities for the two species. Natural Resources staff from four Corps Lake Offices and three satellite offices were involved on six of the eight designated reaches of the Missouri River, conducting adult population surveys and productivity monitoring of nesting sites along 720 miles of river and reservoir shoreline. In addition, the Corps provided funding for a scope-of-work contract with the USFWS-Ecological Services, which surveyed and monitored the two other reaches.

Adult Census and Nest Record data cards that were developed in 1993 were further refined for the 1994 season. (See Appendix A Page &&). Training sessions for all staff involved with either the adult surveys or the productivity monitoring were conducted in Bismarck ND. The first session was held on May 3 & 4. The second session was on June 1 & 2. Topics covered included proper field techniques, chick identification, juvenile aging, permit compliance, and record keeping.

All work was conducted in compliance with the conditions of the endangered species research permit (Regional Blanket Permit PRT-704930, subpermit 93-07). This permit was issued to the U.S. Army Corps of Engineers, Missouri River Division, Omaha, Nebraska, by the USFWS's Denver Regional Office to work on least terns and piping plovers within the Missouri River Basin during 1994. Contracted agencies were individually permitted.

DESIGNATED STUDY AREAS

As in 1993 the study area was divided into river reaches. For 1994 the number of reaches was reduced from nine to eight. (Lake Oahe ND and Lake Oahe SD were combined to form the Lake Oahe Reach.) The agencies and offices responsible for conducting the adult census surveys and productivity monitoring activities during 1994, including river miles of survey and productivity subsample areas, are listed below.

FORT PECK RESERVOIR (FTPKRES)

USFWS Charles M. Russell National Wildlife Refuge-Fort Peck Office
Billings Suboffice, Ecological Services; Assisted by Corps Fort Peck Lake Office, Fort Peck, Montana

Adult Census: River Miles 1785.0-1771.0

Productivity: River Miles 1785.0-1771.0

RIVER BELOW FORT PECK RESERVOIR (FTPKRIV)

USFWS Charles M. Russell National Wildlife Refuge-Fort Peck Office
Billings Suboffice, Ecological Services; Assisted by Corps Fort Peck Lake Office, Fort Peck, Montana

Adult Census: River Miles 1712.5-1581.5

Productivity: River Miles 1712.5-1673.0

LAKE SAKAKAWEA RESERVOIR (LKSKRES)

Corps Lake Sakakawea Williston Resource Office, Williston, ND

Adult Census: River Miles 1568.0-1480.5

Productivity: River Miles 1568.0-1480.5

Corps Lake Sakakawea Lake Office, Riverdale, ND

Adult Census: River Miles 1480.5-1389.6

Productivity: River Miles 1480.5-1389.6

RIVER BELOW LAKE SAKAKAWEA RESERVOIR (GARRRIV)

Corps Lake Sakakawea Lake Office, Riverdale, ND

Adult Census: River Miles 1389.2-1341.2

Productivity: River Miles 1389.2-1341.2

Corps Lake Oahe Bismarck Resource Office, Bismarck, ND

Adult Census: River Miles 1341.2-1299.7

Productivity: River Miles 1341.2-1299.7

LAKE OAHE RESERVOIR, (LKOHRRES)

Corps Lake Oahe Bismarck Resource Office, Bismarck, ND

Adult Census: River Miles 1299.0-1232.0

Productivity: River Miles 1299.0-1232.0

Corps Lake Oahe Mobridge Resource Office, Mobridge, SD

Adult Census: River Miles 1231.5-1165.0

Productivity: River Miles 1231.5-1165.0

Corps Lake Oahe Lake Office, Pierre, SD

Adult Census: River Miles 1165.0-1072.0

Productivity: River Miles 1165.0-1072.0

RIVER BELOW FORT RANDALL DAM (FTRLRIV)

Corps Lake Francis Case Lake Office, Pickstown, SD

Adult Census: River Miles 880.0-845.0

Productivity: River Miles 880.0-845.0

LEWIS AND CLARK RESERVOIR (LECLRES)

Corps Lewis and Clark Lake Office, Yankton, SD

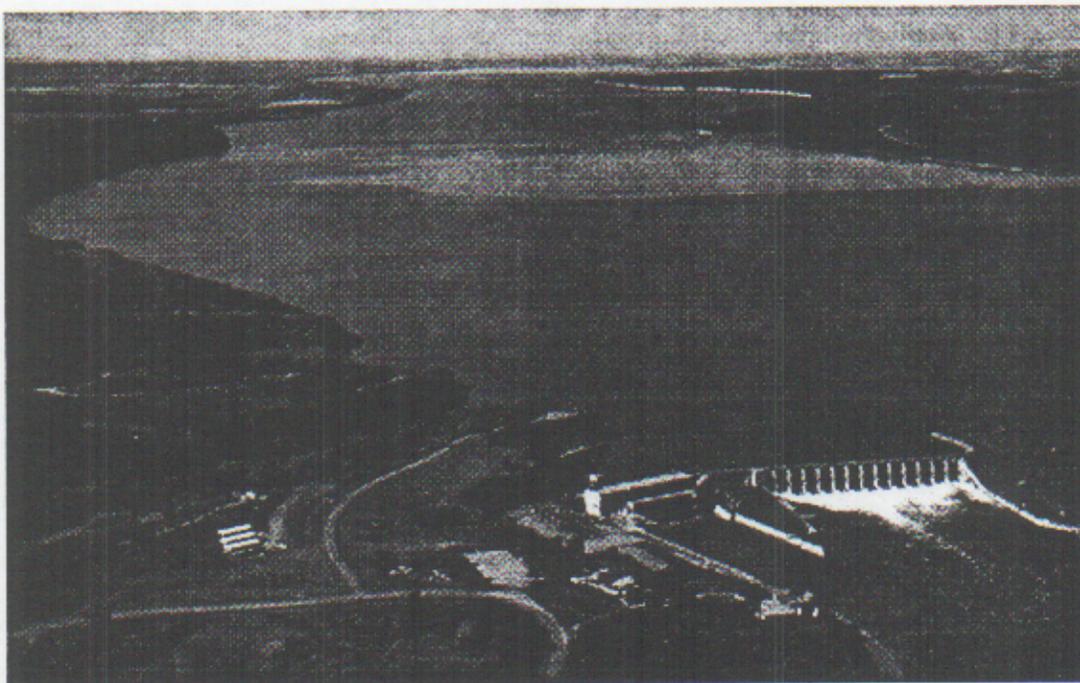
Adult Census: River Miles 845.0-811.0

Productivity: River Miles 845.0-811.0

RIVER BELOW GAVINS POINT DAM (GAPTRIV),
Corps Lewis and Clark Lake Office, Yankton, SD
Adult Census: River Miles 811.0-750.0
Productivity: River Miles 811.0-750.0

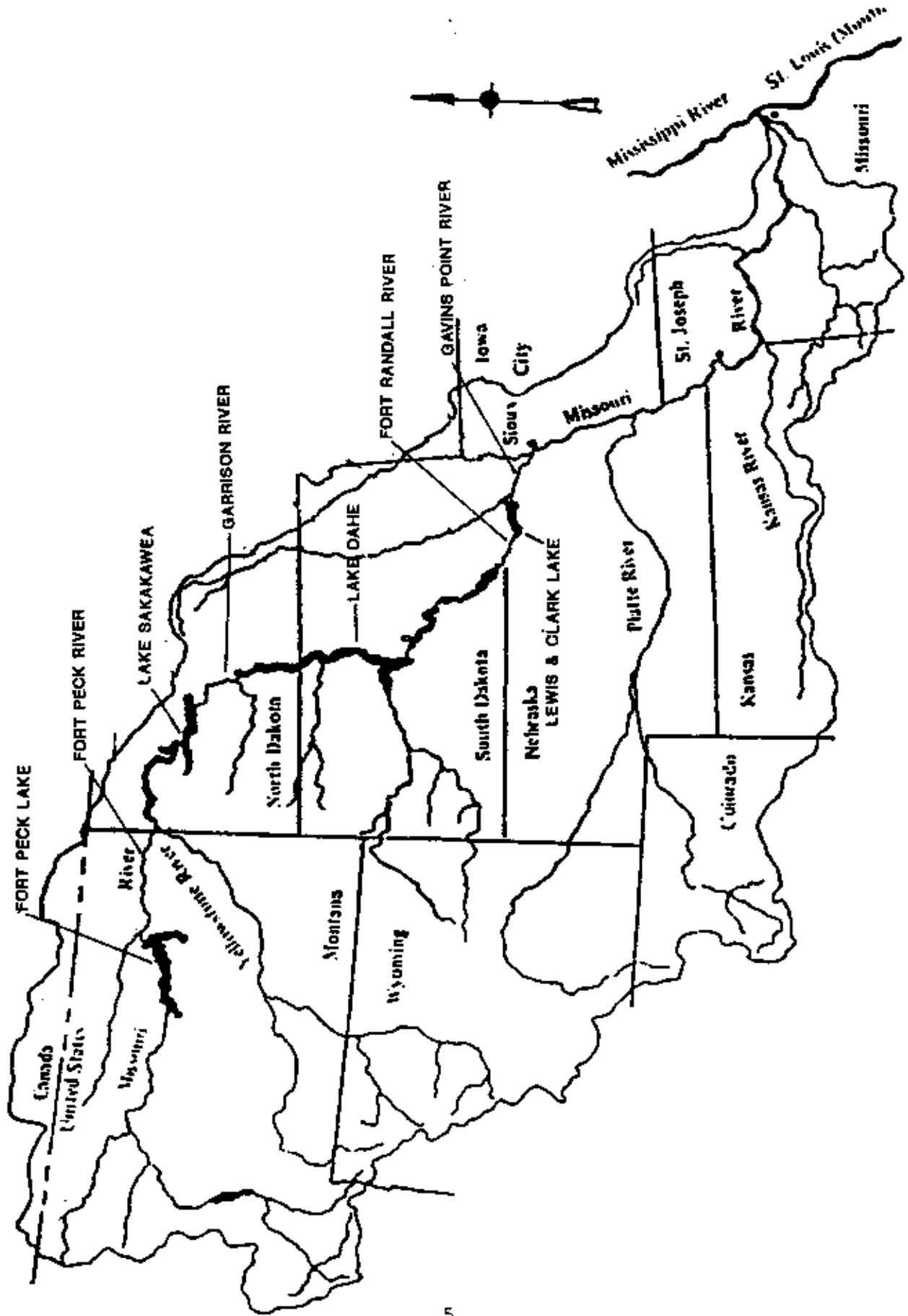
Several changes were made in 1994 as to responsibilities and areas monitored. Instead of monitoring subsamples as in 1993, all of Lake Sakakawea (including Lake Audubon), the Garrison River Reach, and Lake Oahe were monitored for productivity. Monitoring was conducted by Corps offices that had been responsible previously for the adult census in those reaches. Corps personnel also took over adult census and productivity responsibilities from the USFWS Bismarck and Pierre Offices. Lake Oahe's Bismarck Resource Office administered the lower Garrison River Reach (RM 1341.2 - 1299.7). Lake Oahe's Pierre Office collected data for the lower part of Lake Oahe (RM 1110.0 - 1072.0)

The map on the following page depicts the study areas.



Gavins Point Dam and Lewis & Clark Lake

MISSOURI RIVER STUDY AREAS



REACH DESCRIPTIONS AND HISTORICAL BACKGROUND

Missouri River:

The Missouri River and its tributaries dominate the north central region of the United States. The Missouri begins at the confluence of Madison, Jefferson, and Gallatin Rivers near Three Forks Montana. The river travels 2,300 miles north, east, and southeasterly to its joining with the Mississippi River just north of St. Louis, Missouri. The Missouri and its tributaries drain a basin of over 529,000 square miles, including 9,700 square miles in Canada. The Missouri River Basin includes all of Montana and Wyoming east of the Continental Divide, most of North Dakota and South Dakota, all of Nebraska, the northern halves of Kansas, and Missouri, the northeast part of Colorado, and small portions of western Iowa and southwestern Minnesota.

Topographically the western part of the Basin is dominated by the northern Rocky Mountains. Going east the Rockies give way to the Great Plains which encompasses more than half of the Basin. These high relatively flat lands in turn slope down to the central lowlands in the eastern part of the Basin. In the northern plains the major tributary of the Missouri is the Yellowstone River. The Yellowstone originates in northwestern Wyoming and wanders northeasterly through Montana to its confluence with the Missouri just east of the Montana-North Dakota state line. Other important northern tributaries of the Missouri include the Milk, Little Missouri, Cheyenne, White, James, and Niobrara Rivers.

The Missouri River and its ecosystem have seen vast changes since the coming of the first European explorers in the 1700s. Originally the river meandered through a broad riverine/floodplain forest ecosystem forming braided channels, sandbars, sloughs, chutes, islands, and backwater areas. The system was constantly refreshed by the Missouri's high propensity for flooding. In a typical year river flows would rise in March and April with the snow melt on the plains and ice melt from the rivers and streams feeding the Missouri. There would be a second higher peak in the flows in June as the snow melt from the Rockies reached the river. Flows would then decline through the summer and fall. More often than not however, the Missouri's flows were not typical. It has been estimated that the Missouri would flood on average two out of every three years. This flooding benefited the ecosystem by scouring sandbars of vegetation, by building up existing sandbars, and by creating new islands.

Though flooding benefited the Missouri's ecosystem, it proved disastrous to the towns and industries that sprung up along the river. The flooding of towns and farms would cause loss of life, destroy and damage property, and inundate farmland. The creation of sandbars and shifting of the river channel would make navigation hazardous and difficult on the Missouri. Following a series of destructive floods on the Missouri and Mississippi Rivers in the 1930s the Congress took action. In 1944 the Flood Control Act became law. This legislation authorized the construction of dams on the Missouri and its tributaries as a means of obviating the flood threat. The centerpiece of the construction was the building of

five major dams on the Missouri. These dams; Gavins Point on the Nebraska-South Dakota border, Fort Randall, Big Bend, and Oahe in South Dakota, Garrison in North Dakota, and the previously constructed Fort Peck Dam in Montana, became the primary mechanism for controlling floods on the Missouri. To provide for safe navigation the Missouri was channelized and dredged from Sioux City, Iowa to St. Louis.

These construction projects accomplished the goals of reducing flooding on the Missouri and providing a reliable navigation season on the river. However these actions had a detrimental affect on the Missouri's riverine-floodplain forest ecosystem. The reservoirs formed by the dams inundated hundreds of miles of the river. The reservoirs also serve as depositories for sediment carried by the Missouri. The loss of this sediment has had two detrimental effects on the river below the dams. First it has eliminated material for sandbar and island building. Second it has resulted in greater degradation of the riverbed. With the loss of sediment the riverbed deepens and the elevation of the sandbars above the river rises. The elimination of periodic flooding through the controlled releases from the dams have destroyed the river's ability to scour vegetation from the sandbars. This had led to the encroachment of vegetation onto many of sandbars located downriver from the dams. The elimination of the flood threat has also led to more housing developments along the river. This in turn has led to a greater recreational use of the sandbars. Finally the channelization of the Missouri from Sioux City to it's confluence with the Mississippi has despoiled it as a natural system.

Fort Peck Lake Reach:

The Fort Peck Lake Reach of the Missouri River consists of the eastern portion of Fort Peck Lake. Fort Peck Lake is the result of the construction of Fort Peck Dam at Missouri River Mile (RM) 1771.5 Construction on the dam began in 1933 and operation of the facility began in 1940. Fort Peck Lake varies in size from 212,000 acres at elevation 2234 feet mean sea level (msl) to 240,000 acres at elevation 2246 feet msl. The primary water source for the reach is the Missouri River. The Missouri drains around 57,500 square miles of Montana and Canada into the lake.

The land surrounding Fort Peck Lake consists mostly of upland rolling hills and "breaks" containing badlands topography. Several sand and gravel mixed beaches exist along the shoreline of the lake. The size of the beaches varies with the elevation of the lake. Grasslands dominate the vegetation of the reach. Some trees and shrubs will be found in coulees and other drainages.

The climate of the Fort Peck Lake Reach is typical of the western Great Plains region, with hot summers, and cold, dry winters. Prolonged droughts and frequent shorter periods of deficient moisture, interspersed with periods of abundant precipitation are characteristic of the area. The average annual temperature is 43 degrees Fahrenheit, with normal summer daily high temperatures ranging in the 80s and 90s, usually accompanied by low humidity. Winter temperatures frequently drop below zero degrees Fahrenheit with

temperatures of minus forty degrees being recorded. The reach is a semi-arid region, with normal annual precipitation between ten to twelve inches, 80% of which occurs during April to September. Hail is also a common occurrence in the project area. The prevailing winds during April to October are predominately west/northwesterly, and east/southeasterly. Summer winds are highly variable since they are subject to passing storm systems and fronts

The primary human activity on Fort Peck Lake is recreation. Recreational use includes fishing, both from shore and boats, pleasure boating, water skiing, camping, and swimming. The majority of project lands that surround the lake are leased to the U.S. Fish & Wildlife Service to form the Charles M. Russell National Wildlife Refuge. Away from the lake agriculture, in the form of livestock raising and some farming, is the dominant industry.

Fort Peck River Reach:

The Fort Peck River Reach of the Missouri River begins at Fort Peck Dam in eastern Montana, RM 1771.5, and travels 203 miles in an easterly direction to the western boundary of Lake Sakakawea in North Dakota (RM 1568). The primary water sources for this reach are the releases from Fort Peck Dam, and inflows from the Milk (RM 1761.5), Poplar (RM 1678.9), and Yellowstone (RM 1582) Rivers. Smaller tributaries such as the Big Muddy Creek and Redwater River also contribute to the discharge, albeit to a lesser extent.

The majority of the sandy/silty substrates typically used by terns and plovers in the upper reach are situated downstream of the Milk River confluence, possibly resulting from the Milk River's relatively high contribution of suspended particulate matter. The Poplar River also transports a considerable amount of suspended fine sediments. The islands and sandbars formed by sediment deposition along the Missouri River system are highly dynamic, and are altered by fluctuating river flows. Pre-dam flows were generally high early in the season (spring) and decreased throughout the summer season. High spring flows, in addition to ice, would scour the river basin, accelerating erosion rates and preventing the establishment of emergent vegetation on seasonally-exposed sandy areas. Flows generally decreased in late spring, exposing the sandy substrate free of dense vegetation, which was ideal for tern and plover nesting. The construction of Fort Peck Dam altered normal seasonal flow rates, creating artificial rates which fluctuate daily.

On the lower part of the reach the Yellowstone has the potential to greatly influence the Missouri below the confluence of the two rivers. The Yellowstone drains over 70,000 square miles. It is the longest free flowing river in the United States with only one dam, Yellowtail, located on a major tributary, the Bighorn River. Spring runoff from the Yellowstone watershed can dramatically change this portion of the Missouri's appearance from year to year. High runoff will inundate many of the sandbars and islands. Conversely a low runoff exposes miles of sandy beaches.

Three landforms; uplands, breaks, and floodplains, dominate the reach. The Missouri River marks the southernmost advance of the Pleistocene glaciers. The glaciated portions of the area are characterized by level to rolling uplands dissected by coulees and gullies, whereas the unglaciated areas are characterized by low hills, rugged breaks and badlands. Soils in the area result from soft, sedimentary bedrock (sandstone, siltstone, shale), local and regional alluvium, and a small amount of glacial till. The dissected badlands area is composed predominately of loam and clay, creating a high erosion potential. The north side of the river tends toward a broad floodplain while the south side is a combination of floodplain and bluffs dissected by coulees.

The riverbank vegetation contain a combination of mature floodplain cottonwood forest, woody draws in the coulees, grasslands, and farm fields. Several sandbars and islands dot this reach. Vegetation on the islands includes grasses, forbs, shrubs, and willows. Mature cottonwoods will be found on some islands.

The climate of the Fort Peck River Reach is typical of the western Great Plains region, with hot summers, and cold, dry winters. Prolonged droughts and frequent shorter periods of deficient moisture, interspersed with periods of abundant precipitation are characteristic of the area. The average annual temperature is 43 degrees Fahrenheit, with normal summer daily high temperatures ranging in the low 80s and 90s, usually accompanied by low humidity. Winters may be extremely cold with temperatures of minus 40 degrees being recorded. The reach is a semi-arid region, with normal annual precipitation of 11.52 inches, 80% of which occurs during April to September. Runoff is rapid due to the fine texture and high clay content of the soil. Thus, sudden rainstorms can cause major flooding on the watershed. Hail is also a common occurrence within the reach.

The prevailing winds during April to October are predominately west/northwesterly, and east/southeasterly. Summer winds are highly variable since they are subject to passing storm systems and fronts

Human activities within the reach include recreation, farming, livestock grazing, bank stabilization projects and water intakes for irrigation. Recreational use includes fishing, both from shore and boats, pleasure boating, and canoeing.

Lake Sakakawea Reach:

The Lake Sakakawea Reach consists of two lakes, Sakakawea and Audubon. Both were created with the impoundment of the Missouri River by the construction of the Garrison Dam. Garrison Dam was constructed in the 1950s by the U.S. Army Corps of Engineers and is the fifth in ascending order of six mainstem dams on the Missouri. The dam is located in central North Dakota at RM 1389.86. From the dam Lake Sakakawea extends 178 miles in a northwesterly direction ending at river mile 1586.00. Lake Audubon is located ten miles northeast of the dam and was created by the placement of a three mile

long causeway across the eastern end of Lake Sakakawea. At full pool (1850 feet mean sea level) Lake Sakakawea covers 364,000 acres, making it the largest man made lake in the United States. Lake Audubon covers 17,500 acres.

Water from 181,400 square miles of the Missouri River Basin flow into Lake Sakakawea. Of this, 57,500 square miles of Missouri River drainage are controlled by Fort Peck Dam in Montana. The remaining 123,900 square miles drain from the Yellowstone River and it's primary tributaries; the Big Horn, the Tongue, and Powder Rivers, and from the Milk, Poplar, and Little Missouri Rivers. The Yellowstone River furnishes about 50% of the 17,500,000 acre feet of water that annually flows into the headwaters of Lake Sakakawea. The Missouri River provides 42%. The remaining 8% flows into the lake via the Little Missouri River, Little Muddy River, White Earth River, Douglas Creek, and Shell Creek. The major source of water for Lake Audubon is Lake Sakakawea via a pumping station maintained by the Bureau of Reclamation.

The pool elevation Lake Sakakawea varies from an average low of 1834.4 feet msl in March to an average high of 1842.3 feet msl in July. Though uncommon, yearly elevation changes of more than fifteen feet have occurred on the lake. These changes can drastically alter the amount of habitat available to shorebirds including the least tern and piping plover. The lake elevation for Lake Audubon is controlled by the Snake Creek Pumping Station. The elevation is kept stable throughout the spring, summer, and fall under a cooperative agreement between the Bureau of Reclamation, the U.S. Fish & Wildlife Service, and the North Dakota Game & Fish Department. The lake elevation is then drawn down before winter to curb shoreline erosion.

The topography of the Lake Sakakawea Reach is dominated by the Missouri Trench through which flows the Missouri River. This river valley has been flooded nearly 180 miles by the impoundment of the Missouri by the Garrison Dam. The trench is generally three to five miles wide with a maximum elevation between 200 and 250 feet. Throughout its length the trench is dissected by intermittent stream valleys and coulees draining into the Missouri.

The Lake Sakakawea Reach is located in the high latitude continental climate. This climate is marked by long cold winters where the temperature frequently drops below zero degrees Fahrenheit with temperatures of -40 degrees Fahrenheit. being recorded. Summer maximums range in the mid 80 degrees Fahrenheit though temperatures above 100 degrees Fahrenheit are not uncommon. The lake surface is frozen about four months out of the year with the average ice up occurring on December 25 and average ice out on April 21. The prevailing wind is from the west to northwest. The wind averages around eleven miles per hour but winds have been clocked at greater than seventy miles per hour. Though infrequent, tornadoes do occur. The precipitation averages around fourteen to fifteen inches per year with 75% occurring during the months of April through September.

Five vegetation communities are found within the project boundaries of the Lake Sakakawea Reach. In ascending order from the lake they are Aquatics, Flood Plain, Riparian-Woody Draws, Lowland Grasslands, and Upland Grasslands.

The land surrounding the Lake Sakakawea Reach is almost entirely owned by the federal government and administered by the U.S. Army Corps of Engineers. Land use activities include wildlife management, livestock grazing, farming, and recreation. Potential conflicts with terns and plovers exist with the last three uses. Livestock use beaches favored by the birds for watering purposes. Farmers use the shoreline for irrigation pumps. People use the shoreline and island beaches for camping, picnicking, sightseeing, off road vehicle driving, exercising pets, and other recreation activities.

The completion of Garrison Dam in the 1950s dramatically changed the hydrograph in the Lake Sakakawea Reach. About 160 to 180 miles of riverine habitat was destroyed and replaced by a reservoir. The presence of nesting least terns and piping plovers within the reach shows the birds have adapted to this changed ecosystem. Despite this adaptation, it must be concluded that the loss of such extensive riverine habitat has detrimentally affected the two species.

Garrison River Reach:

The Garrison Reach of the Missouri River begins at the Garrison Dam in west central North Dakota (RM 1389.9) and travels south 90 miles to the northern boundary of Lake Oahe located just south of Bismarck ND (RM 1299). The vast majority of water for this reach is supplied through releases from Garrison Dam. The only major tributaries within the reach are the Knife (RM 1374.5) and Heart (RM 1311.3) Rivers. The contributions of the two rivers are minimal except for occasional flooding within their watersheds.

The Missouri on this reach is free flowing, however it is constrained by bank stabilization projects and the dam has eliminated periodic flooding. The topography is that of a relatively flat floodplain with some breaks and upland areas. Cutbanks vary from 5 to 35 feet in height. Usable nestings islands and sandbars begin at RM 1380 and continue downstream throughout the stretch. These islands and bars have traditionally been forming and eroding throughout the history of the Missouri River. Since closure of the Garrison Dam the islands and bars have been eroding with little or no additional formation due to the reduced silt load and stabilization projects on both banks of the river.

Vegetation has become established on nearly all of the islands. These include grasses, forbs, and shrubs. The islands which rarely or never become inundated have mature woody vegetation including sand willows and cottonwoods. The existing vegetation along the banks is either overmature dying cottonwoods or some type of agriculture regime - grazing and farm lands.

The reach is located in the high latitude continental climate. This climate is marked by long cold winters where the temperature frequently drops below zero degrees Fahrenheit with temperatures of -40 degrees Fahrenheit being recorded. Summer maximums range in the mid 80 degrees Fahrenheit though temperatures above 100 degrees Fahrenheit are not uncommon. The prevailing wind is from the west to northwest. The wind averages around ten miles per hour but winds have been clocked at greater than seventy miles per hour. Though infrequent, tornadoes do occur. The precipitation averages around fourteen to fifteen inches per year with 75% occurring during the months of April through September.

Human activities within the reach include recreation, agriculture, bank stabilization projects, water intakes for cities and power plants, and housing developments. Recreational use includes fishing, both from shore and boats, pleasure boating, jet skis, canoeing, water skiing, beach sports, swimming and sunbathing. Fishing enthusiasts may be found all over the reach. The other recreational activities are concentrated in the reach areas adjacent to the Bismarck-Mandan metropolitan area. Likewise the majority of the riverside housing developments are found near Bismarck-Mandan. Other riverside communities may be found near Stanton, Washburn, and Wilton ND.

Several bank stabilization projects have been conducted over the years along the river. They have been sponsored by state, Federal and local entities including private individuals and companies. About 50% of the shoreline between the Garrison Dam and Bismarck ND is under some form of bank protection (abutments, jetties and riprap).

Lake Oahe Reach:

The Lake Oahe Reach was created with the impoundment of the Missouri River by the construction of the Oahe Dam. Oahe Dam was constructed in the 1950s and 1960s by the U.S. Army Corps of Engineers and is fourth in ascending order of six mainstem dams on the Missouri. The dam is located in central South Dakota five miles north of Pierre at RM 1072.3. Lake Oahe continues north for 227 miles and ends just south of Bismarck ND (RM 1299). At full pool (1617 feet mean sea level) Lake Oahe covers 360,000 acres, making it the second largest man made lake in the United States. Water from 243,490 square miles of the Missouri River Basin flow into Lake Oahe. Of this, 123,900 square miles of Missouri River drainage are controlled by Garrison Dam in North Dakota. The major contribute of water to Lake Oahe is the Missouri River. Other rivers that flow into the lake include the Cannonball, Grand, Moreau, and Cheyenne.

The topography of the reach consists primarily of rolling hills and plains interspersed with some ridges and buttes. These forms give way in the north to the relatively flat and non-inundated floodplain of the Missouri River. The land surrounding Lake Oahe contains a variety of habitats. In the floodplain the cottonwood forests have been reduced to corridor riverine habitat by the development of farmland and pasture. High islands that remain above water during peak flows are now often heavily to moderately vegetated. The sandbars that emerge during low water levels are clean to lightly vegetated

although these bars easily become inundated. Up from the lake grasses dominate the upland prairies. Mixed in are a variety of wildflowers and some shrubs. Connecting the uplands with lake are numerous coulees and draws that contain an assortment of trees and shrubs.

The land surrounding Lake Oahe is almost entirely owned by the federal government and is administered by the U.S. Army Corps of Engineers. Land use activities include wildlife management, livestock grazing, farming, and recreation. Potential conflicts with terns and plovers exist with the last three uses. Livestock use beaches favored by the birds for watering purposes. Farmers use the shoreline for irrigation pumps. People use the shoreline and island beaches for camping, picnicking, sightseeing, off road vehicle driving, exercising pets, and other recreation activities.

The Missouri River and surrounding land have undergone extensive change since the completion of Oahe Dam. Prior to its impoundment the Missouri River was a meandering and dynamic river which constantly eroded and deposited sandbars and islands. These sandbars and islands had the vegetation continuously scoured off by heavy spring flows and ice. These actions created habitat favorable to nesting terns and plovers. Over two hundred miles of this habitat was inundated by Lake Oahe. Periodic low lake levels temporarily recreates some of this habitat on the northern part of the lake. The current operating procedure for Lake Oahe calls for a peak pool elevation in May followed by slowly declining levels. This regime uncovers shoreline and some islands in the northern part and must be considered favorable for terns and plovers. Naturally, the lower the beginning elevation the more habitat that is available.

For the thirty miles of Lake Oahe below the headwaters, the lake exhibits riverine characteristics. This portion offers the least terns and piping plovers sandbars for nesting when Oahe's pool elevation is below 1604' mean sea level (msl) and discharges from Garrison Dam are less than 15,000 cubic feet per second (cfs). At higher pool levels and or higher discharge rates, most of the sandbars become inundated. The majority of available habitat will become inundated with a increase to only 17,500 cfs flows. Most of the sandbars have a sand/gravel composition although bars that emerge when the high water levels recede are often silty and quickly acquire an algal growth.

Oahe Dam has a greater effect on the rest of Lake Oahe than can be seen on the northern portion. The lake has few sandbars, but does have an extensive shoreline. This leaves limited habitat for the terns and plovers. The few islands that are on the lake are heavily vegetated and the shoreline is subject to rapid change with rising and falling pool levels. The only extensively used habitat in the lower part of the lake is a silt and sand man-made island (Dredge Island) at RM 1270.0 and Porcupine Island at RM 1249.0. New sandbars are rarely created on the lake or the river. The lake's shoreline offers nesting areas where sandbars are not present. The width of the shoreline varies with the pool level. Historically, little lakeshore habitat is available with pool elevations above 1600 feet msl. Lakeshore habitat used for nesting have a sand and pebble composition with an abundance

of driftwood and scattered cottonwoods. This habitat is marginal at best and is often subject to cattle and human disturbance.

Fort Randall River Reach:

The Fort Randall Reach of the Missouri River begins at the Fort Randall Dam in southeast South Dakota (RM 880.0) and travels in a southeasterly direction 39 miles to the western boundary of Lewis & Clark Lake (RM 841). The majority of water for this reach is supplied through releases from Fort Randall Dam. The primary tributary on this reach is the Niobrara River which joins the Missouri at RM 844.

The Missouri here is free flowing, however controlled releases from Fort Randall Dam has eliminated periodic flooding for most of the reach. The last three miles of the reach can be effected by flooding on the Niobrara. The topography is that of a relatively flat floodplain that gives way to upland areas. The uplands in turn are dissected by coulees and ravines that lead down to the river.

The floodplain forest is the dominant ecosystem along the river. In many areas along both banks however the forest has been eliminated and replaced by farm lands. Without the scouring by floods vegetation has become established on most of the islands in the reach. These include grasses, forbs, and shrubs. Some islands that seldom, if ever, are inundated have developed stands of cottonwoods.

The reach is located in an area typical of a continental-interior climate with great variations in weather not only from season to season but also from year to year. Hot summers and cold winters are typical with humidity ranging from an average of 60% in the afternoon to 80% during the night and early dawn. The frost-free period in the area averages 155 days. Precipitation in the region averages 25 inches of rainfall annually with the majority of it occurring during the spring and summer months. The average seasonal snowfall for the reach is around 30 inches. Thunderstorms can be expected to occur about 45 days out of the year. Tornado and severe weather pass through the region infrequently. Temperatures can exceed 100 degrees Fahrenheit in summer and drop to below 0 degrees in the winter months. The average summer daily temperature is 72 degrees and the average winter daily temperature is 24 degrees. The winds are predominantly from the south-southwest during the summer and from the northwest during the winter months. Wind speeds vary greatly, and it is not uncommon to have winds up to 50 mph during the course of the year.

Human activities within the reach include recreation, agriculture, bank stabilization projects, and housing developments. Recreational use includes fishing, both from shore and boats, pleasure boating, jet skis, canoeing, swimming and sunbathing. In the Niobrara Scenic River Designation Act of 1991 this 39 mile portion of the Missouri was designated a National Recreation River. With this designation increased recreation pressure on the reach is expected. With the construction of the Fort Randall Dam and the elimination of a

flood threat several trailer park communities have sprung up along the river. The establishment of these trailers, primarily on the Nebraska side of the river, and the development of agriculture tracts on both sides of the river has led to an increased demand for more bank stabilization projects.

Lewis & Clark Lake Reach:

The Lewis & Clark Lake Reach was created with the impoundment of the Missouri River by the construction of the Gavins Point Dam. Gavins Point Dam was constructed in the 1950s by the U.S. Army Corps of Engineers and is first in ascending order of six mainstem dams on the Missouri. The dam is located on the South Dakota Nebraska border four miles west of Yankton SD at RM 811.1. From the dam Lewis & Clark Lake extends thirty-four miles in a westerly direction ending at RM 845. At full pool (1208 feet mean sea level) Lewis & Clark Lake covers 28,000 acres.

Water from 279,480 square miles of the Missouri River Basin flow into Lewis & Clark Lake. All but 16,000 square miles of this drainage is controlled by Fort Randall Dam which is 39 miles upriver from the lake. Most of Lewis & Clark's uncontrolled drainage comes from the Niobrara River which enters the lake at RM 844. The Niobrara transports a heavy load of silt and sand into the reach. It is estimated the Niobrara contributes 60% of the annual sediment inflow to the lake, making it the major contributor to the accumulation of sand bars and delta formation in the upper third of the lake.

Lewis & Clark is a relatively stable lake that is managed between a three and half foot maximum (1208.0 msl) and minimum (1204.5 msl) operating pool levels. Under flood conditions the lake can be raised an additional two feet to 1210.0 msl. The reach's topography is divided into two distinct types. On the eastern half the lake is confined between hills and ridges that rise to 100 feet above the lake. The western half is a relatively flat floodplain headwaters mixture of braided channels and islands that become rolling hills away from the lake.

The reach is located in an area typical of a continental-interior climate with great variations in weather not only from season to season but also from year to year. Hot summers and cold winters are typical with humidity ranging from an average of 60% in the afternoon to 80% during the night and early dawn. The frost-free period in the area averages 155 days. Precipitation in the region averages 25 inches of rainfall annually with the majority of it occurring during the spring and summer months. The average seasonal snowfall for the project area is 34 inches. Thunderstorms can be expected to occur about 45 days out of the year. Tornado and severe weather pass through the region infrequently.

Temperatures range from an excess of 100 degrees Fahrenheit in summer to below 0 degrees Fahrenheit in the winter months. The average summer daily temperature is 72 degrees and the average winter daily temperature is 24 degrees. Winds in the area of the lake are predominantly from the south-southwest during the summer and from the

northwest during the winter months. Wind speeds vary greatly, and it is not uncommon to have winds up to 50 mph during the course of the year. The highest average wind speed for a one month period occurs during the month of April, with a daily average of 14 mph.

Four vegetation communities are found within the project boundaries of the Lewis & Clark Lake Reach. In ascending order from the lake they are Aquatics, Floodplain, Riparian-Woody Draws, and Upland Tallgrass and Mixed Grass Prairie.

The land surrounding the Lewis & Clark Lake is owned by the federal government and administered by the U.S. Army Corps of Engineers. The primary land use activities are wildlife management and recreation. Recreation activities include camping, picnicking, sightseeing, fishing, hunting, pleasure boating, water skiing, sailing, swimming, scuba diving, and sunbathing. Visitation to the lake topped 2.5 million visitors in 1994.

Gavins Point River Reach:

The Gavins Point Reach of the Missouri River begins at the Gavins Point Dam in southeast South Dakota northeast Nebraska (RM 811.1) and travels in a southeasterly direction 58 miles to Ponca NE (RM 753.0). The majority of water for this reach is supplied through releases from Gavins Point Dam. The two primary tributaries on this reach are the James River which joins the Missouri at RM 800.5 and the Vermillion River which enters at RM 772.0.

The Missouri here is free flowing, however controlled releases from Gavins Point Dam has eliminated periodic flooding for most of the reach. The reach can be effected by flooding from the James and Vermillion Rivers. The topography of the reach is that of a relatively flat floodplain on the South Dakota side with floodplain interspersed with steep, tree covered bluffs on the Nebraska side.

The floodplain contains a mixture of various stages of floodplain forest and cleared land used for farming and livestock grazing. The dominant species of the mature floodplain forest are large cottonwood trees. Understory species include dogwood, willows, eastern red cedars, sumac, wild grape, and poison ivy. On sandbars annual weeds, short lived grasses, sedges, and seedling willows and cottonwoods take root. On the north facing bluffs on the Nebraska side the hardwood forest dominates. Oak, ash, mulberry, and walnut trees will be found with the Bur Oak being the most prevalent. On hilltops and bluffs with southern or western exposures, the hardwood forest gives way to grasslands.

The reach is located in an area typical of a continental-interior climate with great variations in weather not only from season to season but also from year to year. Hot summers and cold winters are typical with humidity ranging from an average of 60% in the afternoon to 80% during the night and early dawn. The frost-free period in the area averages 155 days. Precipitation in the region averages 25 inches of rainfall annually with the majority of it occurring during the spring and summer months. The average seasonal

snowfall for the reach is around 30 inches. Thunderstorms can be expected to occur about 45 days out of the year. Tornado and severe weather pass through the region infrequently. Temperatures can exceed 100 degrees Fahrenheit in summer and drop to below zero degrees in the winter months. The average summer daily temperature is 72 degrees and the average winter daily temperature is 24 degrees. The winds are predominantly from the south-southwest during the summer and from the northwest during the winter months. Wind speeds vary greatly, and it is not uncommon to have winds up to 50 mph during the course of the year.

Human activities within the reach include recreation, agriculture, bank stabilization projects, water intakes for cities, and housing developments. Recreational use includes fishing, both from shore and boats, pleasure boating, jet skis, canoeing, swimming and sunbathing. In 1980 the Congress designated this stretch of the Missouri as a National Recreation River.

An important function of this reach is its service as a corridor to provide water for the Missouri River navigation channel. The navigation channel extends from Sioux City, Iowa (RM 732.3) to the confluence of the Missouri and Mississippi Rivers (RM 0.0) just north of St. Louis, Missouri. Normally the navigation season on the Missouri runs for eight months, from April 1 to December 1. The season can be lengthened or shortened depending upon ice conditions on the river, water storage in the mainstem reservoirs, and water inflows from tributaries downriver from Gavins Point. To provide for minimum navigation service, releases from Gavins Point Dam must average 24,800 cfs in May, 24,000 cfs in June, 26,700 cfs in July, and 28,200 cfs in August. For full navigation service, releases must average 30,800 cfs in May, 30,000 cfs in June, 32,700 cfs in July, and 34,200 cfs in August.

HABITAT OBSERVATIONS & NEST INITIATIONS

Habitat use surveys to locate active nesting colonies and nest sites for monitoring purposes were conducted from May to July on the reaches. Surveys were conducted with the aid of binoculars or spotting scope. Potential nesting areas were typically observed from a boat. Large islands or beach areas accessible from land were searched on foot using bird behavior to indicate active nesting colonies. Sites found to have terns or plovers actively exhibiting nesting or courting behavior were recorded on U.S. Army Corps of Engineers aerial mosaic maps (Appendix C Page &&) and monitored during production surveys. Habitat conditions and nest initiations on the reaches are as follows.

Fort Peck Lake: The elevation of Fort Peck Lake stood at 2238.1 feet mean sea level (msl) on May 2, the date of the first survey of the year. This represented a 27 foot increase in lake elevation compared to the same time the previous year. This had profound impacts on the availability, distribution, and quality of habitat for plovers and terns. For the previous seven years the area above elevation 2238 feet msl had not been inundated which allowed for substantial vegetation growth. This vegetation growth severely diminished both the number of suitable nesting beaches and the size and quality of the beaches available to the

two species. Few gravelly areas were available to the birds for nesting. Field personnel found that the birds nested in these gravelly areas and shorelines dominated by shale substrates. The birds had never been known to previously nest in these shale areas. For the most part the nests located in the shale areas were unsuccessful.

Piping plovers were observed during the first survey of May 2 and probably arrived at the lake during the last week in April. Nest initiation dates for the plovers ranged from May 11 to June 20. Both of these dates are notably later compared with first and last initiation dates for 1993 (May 3 and June 11). The first least tern sighting was made on May 24. The earliest tern nest initiation was on June 16. The last nest initiation was between July 15 and July 21. This again was later compared to 1993 when the earliest nest initiation was on June 11.

Fort Peck River: In May 1994 releases from Fort Peck Dam were increased to simulate the natural hydrograph of high spring flows of the Missouri River. These releases averaged 12,000 cubic feet per second (cfs) and resulted in the inundation of nearly all suitable nesting habitat within the reach subsample. Releases were reduced to an average of 8,000 cfs by June 11 and the sandbars and low islands reappeared. The first surveys of the subsample were completed on June 14 and 15. Both species were observed. The birds undoubtedly had arrived earlier for both species had initiated nests on June 7. The latest nest initiation for least terns on the subsample was July 7. The plover nest initiated on June 7 was the only nest discovered in the subsample area.

Lake Sakakawea: Habitat conditions on Lake Sakakawea continued to be dynamic for the 1994 nesting season as Lake Sakakawea returned to normal operational pools after five years of drought. The lake rose from 1837 feet msl in February to a peak of 1845.4 feet msl in late June. Several islands used by the birds during the drought years of 1988 -1992 were totally submerged. A surprisingly large amount of habitat became available as sandy beaches on the shoreline and large islands that previously were hundreds of yards from the lake became waterfront property. The plovers colonized these areas and were highly dispersed around the lake. The terns however were concentrated for the most part at two colonies on the lake.

Surveys of the birds began on Lake Sakakawea on May 24. The plovers however had arrived at least a month earlier as the first nest was initiated the week of April 25. The latest plover nest initiation was on June 20. These dates are both earlier and later compared to 1993 when the earliest initiation was May 3 and the latest was June 17. The terns began arriving in the first two weeks of June though a tern was not seen until June 12. A tern nest was found on May 31 but was subsequently destroyed without the parents being observed. The latest date for a tern nest initiation on the lake was the week of July 11. By comparison the earliest nest initiation for terns in 1993 was June 13 and the latest was July 10.

Garrison River : Releases from the Garrison Dam were increased to an average of 25,000 cfs in mid May to mimic the natural spring runoff of the Missouri River. This flow was held

through mid June when releases were reduced to an average of 19,500 cfs. This regime resulted in substantial portions of the terns' and plovers' habitat being inundated during this time period.

Plovers were already in the reach by the time first surveys were conducted the week of May 22. The earliest nest initiation by the plovers was the week of May 16, the latest the week of June 27. By comparison the earliest plover nest initiation in 1993 for this reach was May 8. The first sighting of a least tern on the reach was May 31. The birds had arrived earlier for a nest was initiated on May 27. The latest initiation date for a tern nest was the week of July 10.

Lake Oahe: Like Fort Peck Lake and Lake Sakakawea, Lake Oahe saw a substantial rise in the water level in 1993, going up 15.4 feet. In 1994 the lake peaked at 1611.7 feet msl in April. The lake declined a foot and remained near elevation 1610.5 feet msl throughout the summer. The lake's 1993 rise eliminated most of the habitat for the birds. The northern half of the lake was limited to five nesting sites, the southern half to two sites.

Piping Plovers arrived at Oahe during the last week in April with the earliest nest initiation occurring that week. The latest nest initiation for the plovers was the week of June 20. Least terns were first observed on the lake the last week of May. The earliest nest initiation for terns also occurred at this time. The latest nest initiation for the terns was the week of July 11.

Fort Randall River: Releases from Fort Randall Dam in the late spring and early summer of 1994 took their cue from the downriver Gavins Point Dam. Releases averaged 19,800 cfs in April, 28,000 cfs in May, 25,700 cfs in June and 25,400 cfs in July. Unlike the river reaches below Fort Peck and Garrison Dams, releases out of Fort Randall were not manipulated to simulate a natural hydrograph of high flows due to mountain snowpack melt. However releases from the dam were "spiked" every third day. "Spiking" consisted of a cycle of relatively high releases for one day followed by two days of low releases. The purpose of the spiking was to force the birds to nest at higher locations that would not be subject to flooding.

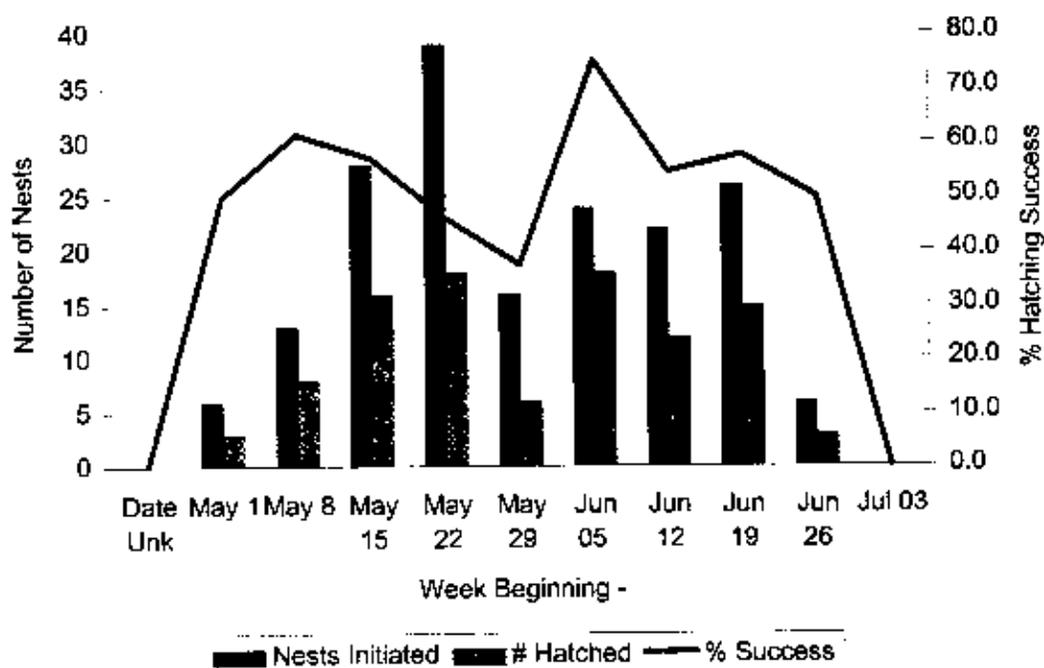
Historically nesting habitat within the reach is limited to a couple of islands. However these islands are quite large and can support tern colonies. Piping plovers and least terns were observed on this reach during an initial inspection trip conducted on June 7, 1994. Both species had arrived earlier as the earliest plover nest was initiated on May 27 and the earliest tern nest on May 31. These dates represent a week earlier for the plovers compared to 1993 (June 3) and two weeks earlier for the terns (June 15). The latest date for a plover to initiate a nest was June 27, the latest for a tern was July 18.

Lewis & Clark Lake: Lewis & Clark Lake was targeted for elevation 1206 feet msl throughout the spring and summer of 1994. At this elevation nesting habitat is available for the birds in the upper part of the lake. During April and May the lake fluctuated between

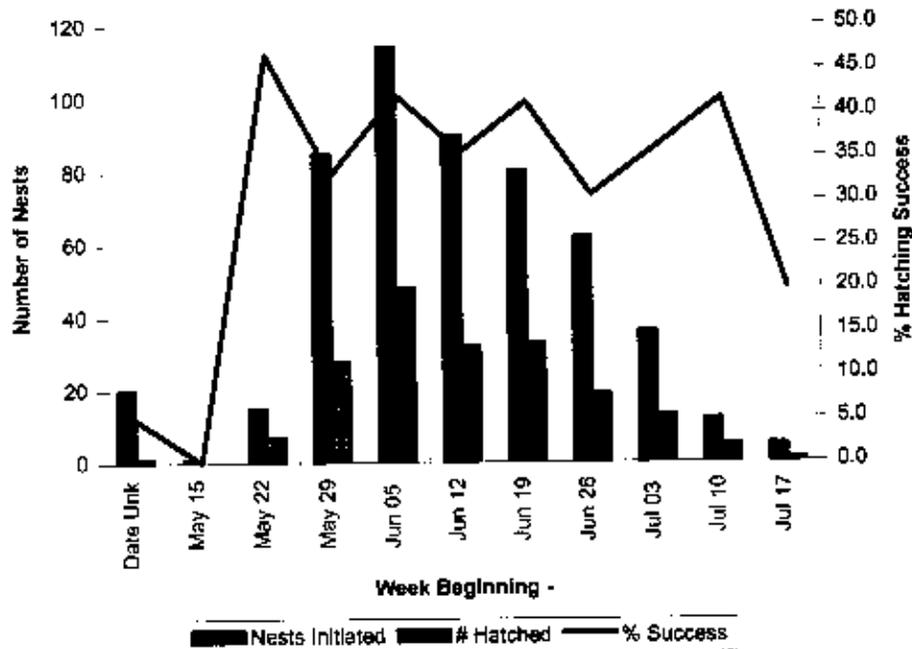
1205.2 to 1206.8 feet msl. Plovers were first observed on Lewis & Clark on May 23 with the earliest nest initiation occurring on May 15. The latest nest initiation for plovers on the lake was June 25. Least tern nests were not found on the lake until June 22. The earliest nest initiation for the terns was June 20, with the latest being July 5.

Gavins Point River: Adequate nesting habitat was available for the birds at the beginning of the nesting season for the Missouri River below Gavins Point Dam. Releases from the dam were increased to the summer flow rate of 32,000 cfs on May 3. Piping plovers were first observed on the reach on May 24. The plovers however had arrived much earlier with the earliest nest initiation having occurred on May 9. The latest plover nest initiation was on June 16. Least terns were observed on the reach on May 25. Like the plovers they had arrived earlier than this first observation as the earliest nest initiation for terns was May 19. The latest nest initiation for the terns on the reach was July 15. The charts on the following page shows by week the nest initiations and nest success for tern and plovers on the Missouri River system in 1994.

Piping Plover Nest Initiation & Nest Success by Week - 1994



Least Tern Nest Initiations & Nest Success by Week- 1994



ADULT CENSUS

The adult census, as in previous years, was conducted during the last week in June and the first week in July. Census activities were conducted with the aid of a boat and binoculars or spotting scope. Adults were counted either while incubating clutches, loafing on the sandbar, or flying overhead near the natal areas. If heavy vegetation existed on an area preventing observation of adults on the ground, sites were entered, causing the birds to flush where they were then counted in the air. On sites with large nesting colonies, where bird activity makes actual counts improbable, the census count was recorded as twice the number of active nests plus the brooding pairs. Date, time, observers, and site location was recorded during entry of each census record. All terns and plovers observed on the Missouri River having adult plumage were recorded as breeding adults.

The dates when the adult census was conducted, by reach, are listed below.

Fort Peck Lake	July 7
Fort Peck River	July 11 - 12
Lake Sakakawea	June 26, 28 - 30, July 1, 7
Garrison River	June 28, 29, July 1
Lake Oahe	June 24, July 6-8
Fort Randall River	June 29
Lewis and Clark Lake	June 28
Gavins Point River	June 27, 29, 30, July 1

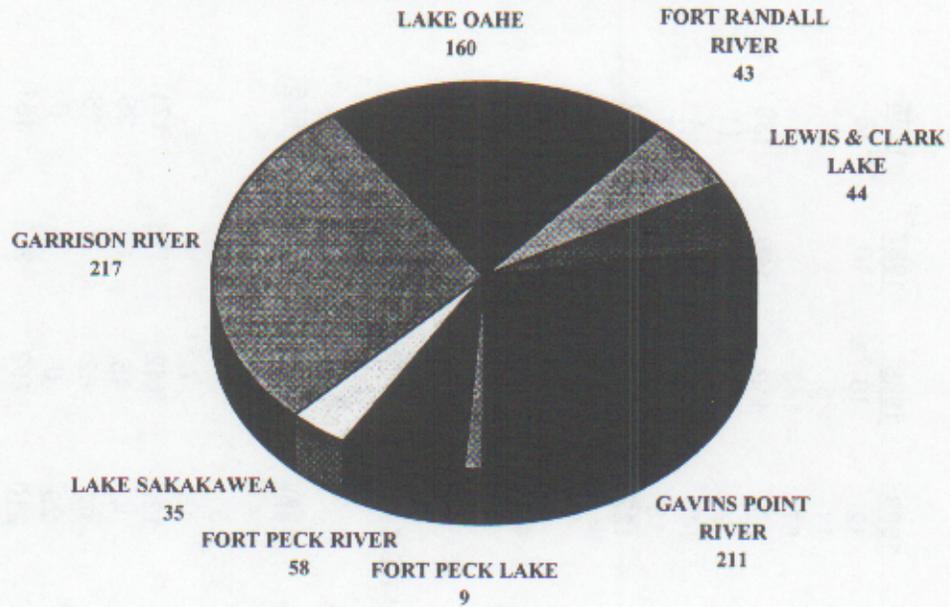
The 1994 population distribution of piping plovers and least terns on the Missouri River, remained similar to past years, with Lake Oahe joining the Gavins Point and Garrison River Reaches as supporting the largest concentrations (See Charts Page 23). System wide there were 777 adult least terns and 353 adult piping plovers counted in 1994. This was the highest count ever for least terns since the census began in 1986. The Lake Sakakawea, Garrison River, and Lake Oahe Reaches all recorded record highs. The 1994 least tern adult census represented an 9% increase (777/711) over the 1993 adult census. Overall the least tern population on the Missouri River system over the last five years may be characterized as stable to rising (See Table Page 24).

Piping plover numbers however declined for the third consecutive year. Plover numbers were down 10% (353/388) compared to 1993 and down 43% compared to 1991's system high of 618 adult birds (See Table Page 24). The decline in plover numbers was most severe in the Lewis & Clark Lake and Gavins Point River Reaches where the population was down 48% (74/141) compared to 1993.

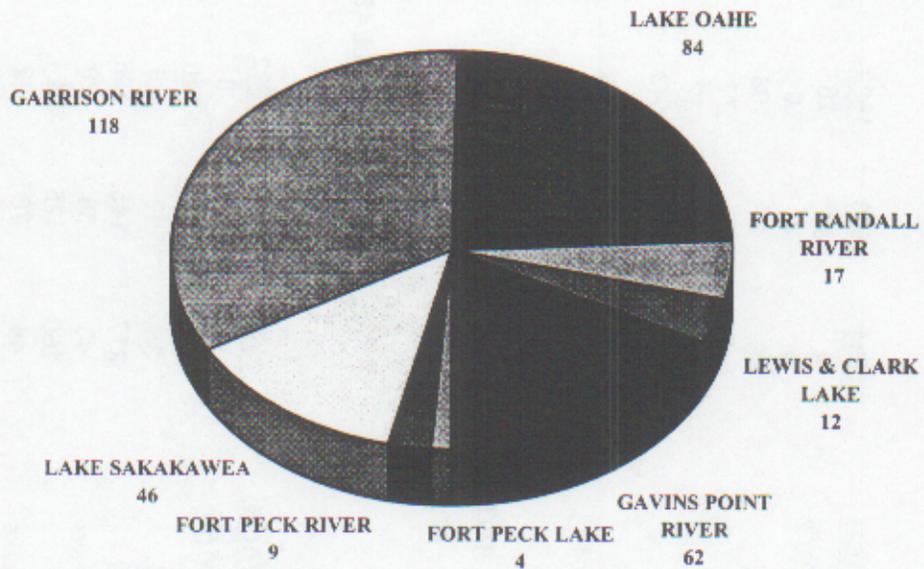


Ranger conducting the adult census.

LEAST TERN ADULT CENSUS BY REACH - 1994



PIPING PLOVER ADULT CENSUS BY REACH - 1994



ANNUAL ADULT PIPING PLOVER POPULATION COUNTS, 1986-1994

<u>SURVEY REACH</u>	<u>1994</u>	<u>1993</u>	<u>1992</u>	<u>1991</u>	<u>1990</u>	<u>1989</u>	<u>1988</u>	<u>1987</u>	<u>1986</u>
FORT PECK RESERVOIR	4	30	26	25	22	12	10	10	16
FORT PECK RIVER	9	4	0	13	17	11	5		
LAKE SAKAKAWEA	45	8	108	150	132	57	143	160	139
GARRISON RIVER	119	127	77	121	71	88	113	16	11
FORT RANDALL RIVER	17	12	12	45	31	0	31	4	4
LAKE OAHE	85	66	143	87	88	140	55	4	0
LEWIS & CLARK LAKE	12	32	1	12	11	18	0	0	0
GAVINS POINT RIVER	62	109	111	165	144	122	212	177	172
TOTAL	353	388	478	618	516	446	569	367	342

ANNUAL ADULT LEAST TERN POPULATION COUNTS, 1986-1994

<u>SURVEY REACH</u>	<u>1994</u>	<u>1993</u>	<u>1992</u>	<u>1991</u>	<u>1990</u>	<u>1989</u>	<u>1988</u>	<u>1987</u>	<u>1986</u>
FORT PECK RESERVOIR	9	7	0	10	6	4	3	4	
FORT PECK RIVER	58	31	110	66	92	51	18		
LAKE SAKAKAWEA	35	17	29	8	6	15	7		
GARRISON RIVER	217	145	198	195	174	122	142	175	171
FORT RANDALL RIVER	43	38	20	62	67	4	45	60	25
LAKE OAHE	160	125	124	143	100	97	82	21	16
LEWIS & CLARK LAKE	44	76	22	25	21	29	0	0	0
GAVINS POINT RIVER	211	272	186	193	166	210	252	232	181
TOTAL	777	711	689	702	632	532	549	492	393

PRODUCTIVITY AND RECRUITMENT OF FLIGHTED CHICKS

Productivity monitoring provides a standard of measurement onto which success or failure of implemented management practices can be evaluated. The most critical scale of any recovery effort must be rated with the return gained from annual reproductive efforts or in the recruitment of young to the adult population. No matter how much habitat is created or prudent measures implemented, nothing will recover piping plover and least tern populations unless annual productivity exceeds annual mortality. In light of this, fledge ratio goals (number of juveniles produced annually per pair of breeding adults) were established by the Biological Opinion to give the Corps a target to meet in implementing management activities on the Missouri River. Correct estimates of these ratios are essential to evaluate the success of efforts applied towards meeting recovery goals. Every effort was made to accurately collect and report all aspects of the productivity monitoring activities during 1994.

Sites identified, through early habitat use surveys, to contain active nesting colonies were revisited every seven - ten days during the duration of the summer to record nesting activity and chick survival. (The exception to this was on the Fort Peck River Reach where productivity was geographically subsampled.) Active nesting sites were searched to determine the number of nests and principle causative factors responsible for any nest being prematurely terminated. Each colony was searched on foot with the aid of binoculars. Nests were located by observing adult behavior or by doing systematic searches of the colony site. Each nest was identified by placing a numbered wooden tongue depressor within one meter of the nest. Nests were relocated every seven to ten days until the nest was terminated. All on site activity was limited to thirty minutes or less including any passive predator management activities.

Information collected from each nest was recorded on a standardized nest card and included species, number of eggs, stage of incubation-obtained through use of the egg flotation method, nest location, nest initiation date, and nest fate. Cause of nest termination was recorded as hatched or destroyed, with hatched nests being determined by the presence of piping fragments or chick excrement in the nest bowl. A nest was considered successful if it hatched a single egg from the clutch. In a change from 1993, eggs were not identified by writing the nest number on the egg. Destroyed nests were identified to a principle causative factor including but not limited to, flooding, weather, human disturbance, predation, and abandonment. If a cause could not be determined the nest was listed as destroyed - unknown.

Chick survival was recorded during weekly nest searches of nesting areas. As the breeding season progressed, efforts were concentrated on locating chicks and keeping track of fledged chicks using natal areas. Chicks were typically flushed ahead of observers on the nesting sites and were aged by visual observation of size and primary feather development. Care was taken to prevent chicks from fleeing into the water in efforts to escape from the observers. Chicks were tracked during the fledging period by recording each observation

on a chick record portion of the adult census card. Because of a high probability of fledging before the next week's visit twenty-two day old plovers and fifteen day old least terns were considered fledged.

The 1994 breeding season saw a return to a more normal operation of the mainstem dams following the extraordinary flood conditions of 1993. Results of the 1994 production surveys are given for plovers (Table Page 30) and for terns (Table Page 30). See Appendix B for a site by site synopsis of the mainstem system. Productivity by Reach is as follows.

Fort Peck Lake: Least tern nesting was restricted to one beach on the lake where eight nests were found. Three of these nests had successful hatching which resulted in two fledged chicks being produced. One nest was lost to flooding and one was lost to unknown causes. The fate of the other three nests the fate could not be determined but predation by gulls is suspected. The gulls had been kept a bay by the presence of nesting common terns on the beach. Once the common terns left the beach, the gulls occupied the area.

The piping plovers were more widely distributed than the terns with nests being found at eight sites around the lake. Only five of the eleven plover nests on the lake successfully hatched and of these, only three chicks from one nest fledged. The prime culprit appears to have been gulls. Gulls were often seen cruising the shoreline and the reduced amount of beach habitat may have concentrated the gulls near the plovers. The only successfully fledged chicks came from the beach that was home to the common tern colony.

Fort Peck River: The subsample of the reach that was monitored produced five least tern nesting sites; one major colony containing seventeen nests, a minor colony of three nests, and three single nest sites. Generally the terns were very successful with a nest hatching success of 61% (14/23) and a fledge ratio of 1.46 (19 fledged chicks/13 pairs of adults) for the subsample. Ten of the fourteen successful nests came from the major colony. Likewise fourteen of the nineteen fledged chicks were from the major colony. Due to the size of the colony and time constraints set forth in the permit, tracking of all the nests could not always be accomplished. Of the seven unsuccessful nests at the colony, one was lost to unknown causes, for three the fate was unknown, and three nests were abandoned.

Piping plover nests were virtually absent from the subsample of the reach. Only one nest was found and this was located at the site of the major tern colony. The fate of this nest was undetermined, as two of the eggs may or may not have hatched.

Lake Sakakawea: Least terns nested at four sites on Lake Sakakawea, two colony sites and two single nest sites. The largest tern colony was in the headwaters area of the lake, about a mile east of the US Highway 85 bridge. This colony contained eleven nests, only one of which had a successful hatching. The other ten nests were lost to unknown causes. The second tern colony was located along the shore of the lake south of Independence Point. This colony contained five nests of which two had successful hatchings. None of the chicks from the three successful nests fledged however.

The piping plovers on Lake Sakakawea were widely distributed across nine nesting sites ranging from the northwest corner of the Van Hook Arm to the eastern shore of Lake Audubon. This may have been the result of former nesting sites such as Sheep Island and Shell Creek Island being inundated by the 1993 and 1994 rises in the lake elevation. The shoreline south of Independence Point, which previously had not been known to harbor plovers, was the site of three plover nests. Nest success for plovers on the lake was very good with a hatching success of 76.5% (13/17). This success may be due to the wide distribution of the nests. Except for two nests located on a small island in the Van Hook Arm, no nests were closer than a half mile to each other. Nesting success translated into fledging success with 28 plover chicks fledging for a fledge ratio of 1.22 chicks per pair of adults.

Garrison River: The Garrison River Reach produced nineteen least tern nesting sites including three major colonies of more than ten nests apiece, seven moderate sized colonies of between five to nine nests, and nine sites of between one to four nests. Nest success was 45.5% (60/132). The two highest categories of nest failure were destroyed unknown (29) and fate unknown (22) which accounted for 70.8% (51/72) of the nest failures. A total of 66 tern chicks fledged off the reach for a very good fledge ratio of 0.61 (66 chicks/106 adult pairs).

Piping plovers nested at seventeen sites within the Reach. One site contained more than ten nests, three sites had between five to ten nests, and thirteen sites had between one to four nests. The plovers had a very good nest success of 68.6% (35/51). This in turn led to a fledge ratio of 0.99 (57 fledged chicks/58 adult pairs). Nest failures were evenly spread through several causes with abandoned and destroyed unknown being the leading cause at four apiece.

Lake Oahe: The Lake Oahe Reach had a record number of adult terns for the reach and the third highest number of terns of the eight reaches. Unfortunately this did not translate into a production of fledged chicks. Four sites within the reach contained nests with over 76.0% (54/71) being concentrated at one site, Dredge Island, in the northern part of the lake. Another thirteen nests were at a second site and the two remaining sites contained two nests each. Nest success was poor at Dredge Island with only eleven nests hatching. Fate unknown and destroyed unknown accounted for 79.1% (34/43) of the failures. At the thirteen nest colony only one nest had a successful hatching. Flooding from the rising of the lake and destruction from grazing livestock accounted for five nest failures each. Overall only five tern chicks fledged off the Lake Oahe Reach for a poor fledge ratio of 0.06 (5 chicks/80 adult pairs).

The Lake Oahe Reach had the second highest number of piping plovers of the eight reaches, but like the terns this did not translate into fledged chicks. Plover nests were found at six sites on the lake with largest concentration being on Dredge Island 69.7% (23/33). The Reach had a very good nest hatching success at 54.5% (18/33). However only four

chicks fledged off the reach, none from Dredge Island. The fledge ratio for the Reach was only 0.10 (4 chicks/42 adult pairs).

Fort Randall River: Least terns nested at two locations with the Fort Randall River Reach, one being a major colony of twenty nests, the other a minor colony of seven nests. Nest success was fairly high with 55.6% (15/27) of the nests hatching eggs. Weather (five) and flooding (four) were the primary causes of nest failures. The nest success however was not replicated in fledge success. No tern chicks from the Reach were known to have fledged.

Piping plovers nested at only one site with the Reach, at the major tern colony. Like the terns the plovers had above average nest success 66.7% (4/6) hatching eggs. However, just like the terns, no plover chicks fledged off of the Reach.

Lewis & Clark Lake: There were 21 Least tern nests located at four sites on Lewis & Clark Lake. This included one colony of ten nests and another of seven nests. Nesting success for the terns was zero on the reach. The ten nest colony was destroyed by predation. The other eleven nests at the three other sites were lost to flooding.

There were ten piping plover nests at five locations on the lake. Four of the five nesting sites contained single nests. The fifth site, was the site of the ten nest least tern colony and contained six nests. These six nests suffered the same fate as the tern colony and all were lost to predation. Only one of the other four plover nests successfully hatched and this nest produced two fledged chicks.

Gavins Point River: In mid June "spiking" of releases from Gavins Point Dam was conducted for a two and half week period. The "spiking," one day of relative high releases followed by two days of flow releases, was done to prevent the birds from nesting too low when releases were reduced due to downriver flooding. Despite this tactic some low lying nests were lost to flooding.

Overall productivity was very good on the reach. A total of 219 least tern nests were found at fourteen sites within the reach. Five of these sites contained more than twenty nests each. Nest success was 34% (75/219). The tern nests were heavily predated with 32% (70/219) being lost. Other nests were lost to flooding (13), weather events (11), abandoned (10), destroyed unknown (14), and fate unknown (21). A total of 51 tern chicks fledged off the reach for a fledge ratio of .48. The plovers nested at eighteen sites within the reach with 51 nests being found. Nest success was 45% (23/51). As with the terns, predation was leading cause for failure for plover nests, accounting for 27% (14/51) of all losses. The heaviest plover nest losses to predators occurred on sites associated with tern colonies. Nineteen plover chicks fledged off the reach for a fledge ratio of 0.61.

MAINSTEM MISSOURI RIVER PIPING PLOVER PRODUCTIVITY MONITORING, 1994.

REACH	NESTS	NEST HAT	NEST SUCC	EGGS	EGGS HAT	EGGS HAT	FEDDB	FEDDB	FEDDB	FATE DESTROYED							
FTPKRES	11	5	45.5	39	19	0	0	0	0	2	0	2	0	2	4	3	
FTPKRIV	1	0	0.0	3	0	0	0	0	0	0	0	0	1	0	9	0	
LKSKRES	17	13	76.5	63	43	3	0	0	0	0	0	0	1	0	45	28	
GARRIV	51	35	68.6	179	128	0	2	0	1	3	0	4	2	4	119	57	
LKOHRES	33	16	55.0	124	61	3	0	0	0	1	0	9	2	2	85	4	
FTLRIV	6	4	66.7	21	13	0	0	0	0	1	0	1	0	0	17	0	
LECLRES	10	1	10.0	37	4	1	6	1	0	0	0	0	0	1	12	2	
GAPTRIV	52	23	44.2	177	80	0	15	0	1	2	0	7	2	2	62	19	
TOTAL	181	99	54.7	643	346	7	23	1	2	8	1	14	15	11	353	113	

MAINSTEM MISSOURI RIVER LEAST TERN PRODUCTIVITY MONITORING, 1994

REACH	NESTS	NEST HAT	NEST SUCC	EGGS	EGGS HAT	EGGS HAT	FEDDB	FEDDB	FEDDB	FATE DESTROYED							
FTPKRES	8	3	37.5	14	6	1	0	0	0	0	0	1	3	0	9	2	
FTPKRIV	23	14	60.9	46	31	0	0	0	0	0	0	2	3	4	58	19	
LKSKRES	18	3	16.7	41	4	0	1	1	0	1	0	11	0	1	35	0	
GARRIV	132	60	45.5	270	131	1	3	1	3	10	0	6	45	3	217	66	
LKOWRES	71	14	19.7	173	32	5	4	0	0	2	5	2	35	4	160	5	
FTLRIV	27	15	55.6	63	37	4	0	1	0	5	0	1	1	0	43	0	
LECLRES	21	0	0.0	32	0	11	10	0	0	0	0	0	0	0	44	0	
GAPTRIV	218	75	34.4	514	179	13	69	0	5	11	0	14	21	10	211	51	
TOTAL	518	184	35.5	1153	420	35	87	3	8	29	5	37	108	22	777	143	

HABITAT MANAGEMENT

Several projects were completed throughout the Missouri River System to maintain and improve existing nesting habitat and to create new habitat. Habitat work on the various reaches is as follows.

Fort Peck Reservoir: No habitat improvement work was done.

Fort Peck River: As in 1993, artificial nesting islands were field tested within the reach's subsample area. Three two unit islands were constructed from six floatable, triangular, plastic units. The ten foot long per side triangles were attached together to form a diamond pattern. The units were towed by boat to natural islands, where they were attached and placed.

The artificial islands were placed at high points on the natural islands. The six inch high artificial islands were buried to a depth of about three to four inches in the natural island substrate (sand). This was done to partially conceal them while allowing them to remain the high point of the island. At least one guy-wire anchor and rope were used to hold the artificial island on site. The anchor and rope were concealed beneath the sand. A mixture of gravel and sand was used to cover the artificial island to a depth of two to three inches. A broad area around the artificial island was also sprinkled with gravel to allow the artificial island to blend in with its surroundings. All human tracks were swept away with a broom.

The purpose of the artificial islands was to provide an attractive high area nesting least terns that would survive flooding. In the event the natural island flooded, the nests and chicks on the artificial island would not be inundated as the artificial nest would float. Likewise chicks that had not hatched on the artificial island could escape to the artificial island if the natural island flooded.

Artificial island #1 was placed on an island at RM 1700.0 on May 26. On June 21 artificial islands #2 and #3 were placed on islands at RM 1688.0 and 1682.8 respectively. Artificial Island #1 was washed out as the river channel eroded out the island it had been placed upon. The anchor was also washed out and the artificial island traveled about 30 feet down river before coming to rest. Much of the gravel had been washed from the surface of the artificial island. This may provide a clue as to how the islands may respond to high water when they remain anchored in place. In this case, nests or chicks, had they been present on the island, could have been washed into the river. The artificial nest was repositioned on what remained of the natural island.

During the 1994 nesting season there was no documented use of any of the three artificial islands by terns or plovers. It was noted that Canada geese used artificial islands #2 & #3 as resting areas.

Lake Sakakawea: As a part of a four island - one peninsula wetlands complex construction project, a 2.3 acre island is being created to benefit least terns and piping plovers. The complex is being built below Garrison Dam as a joint effort between the Corps of Engineers and the North American Coal/Falkirk Mine Company. The wetlands complex will be the result of restoration work done by the Falkirk Mine following the removal of coal piles that former occupied the site.

Garrison River: Three habitat improvement projects were conducted within the Garrison River Reach in 1994, vegetation removal, oyster shell spreading, and island build up.

1. Vegetation Removal: Portions of four islands were treated with the herbicide Rodeo to reduce vegetation. Six acres of vegetation were treated on the island at RM 1371.5, one acre was treated on the island at RM 1369.0, three acres were treated on an island at RM 1300.9, and one and half acres were treated on an island at RM 1299.5.

2. Oyster shell spreading: As part of an eagle scout project, boy scouts spread 150 bags of oyster shells over one acre on an island at RM 1354.5. The oyster shells were spread over selected sandy high spots on the north side of the island. The purpose of the project was to hold the sand in place. Five nests on this island were lost during the 1994 season due to wind blown sand inundation.

3. Island build up: The Cooperative Power Association applied for a Department of the Army Permit to perform a dredging operation in front of their water intake on the Missouri River. Following negotiations between Cooperative Power, the Corps of Engineers, the ND Game & Fish Department, and the ND Health Department it was agreed the spoil material from the project would be placed on an island downriver from the intake at RM 1362.4. The spoil material would be used to build up the island. This in turn would provide habitat for nesting birds during high water discharges from Garrison Dam. The project was completed in the fall of 1994 and resulted in the island's height being raised from three to five feet.

Lake Oahe: The following habitat improvement projects were completed at Lake Oahe in 1994.

1. RM 1293.0: In late July six acres of vegetation on this island were treated with the herbicide Rodeo. In mid August the vegetation was then cut and burned. The island was then disked. The transportation of equipment to the work site was provided by the North Dakota National Guard.

2. RM 1270.0: In late August about 100 six to eight inch DBH cottonwood trees were removed from Dredge Island.

3. Mobridge Area: Habitat work in the Mobridge area consisted of tree removal and vegetative spraying on the Blue Blanket peninsula. This area is a high use spot that in 1994

was less than an acre in size. The area will be mechanically manipulated prior to bird arrival in 1995.

4. Pierre Area: Habitat work in this area was limited to spraying on islands and shorelines to eliminate vegetation. A contract sprayer completed work on September 8, 1994. The work was done utilizing an all terrain vehicle mounted boom and hand held wand. The following sites were treated: Okobojo Creek Island - four acres, Plum/Dry Creek shoreline two acres, Agency Creek shoreline, one acre, and Mission Creek peninsula eight acres. These areas will be mechanically treated to site prep the substrate in the spring prior to May 15 depending on lake elevations.

Fort Randall River: No habitat improvement work was done.

Lewis & Clark Lake: No habitat improvement work was done.

Gavins Point River: In April 1994 a major habitat reconstruction project was completed utilizing Corps of Engineers personnel, the South Dakota National Guard, and a private contractor. Nine sites were selected based on their potential for creating nesting habitat and on their height above the anticipated 1994 flows. Chainsaws and brush hog mowers were used to remove vegetation from nearly 150 acres at these sites. Bulldozers, followed by tractors pulling discs, were used to cap the areas with unconsolidated sediments to provide vegetation free nesting areas. The project was completed over three weeks and created 118.5 acres of habitat. The project proved to be very successful with over 250 nests being initiated on these sites and sites created in the fall of 1993.

In late July and early August 110 acres of habitat were treated with the herbicide RODEO to prepare the nesting areas for the 1995 nesting season.

OTHER ACTIVITIES AND MANAGEMENT ACTIONS

Predator Aversion

Predator exclosure cages were utilized to increase survivability of piping plover nests. Cages were assembled on site during the time allowed for productivity monitoring activities. Hands were washed with no scent soap prior to the handling of any cage components. Cages used on the Lake Sakakawea, Garrison River, and Lake Oahe were constructed of 2" X 4" welded wire mesh and held in place with electric fence t-posts. Assembly and installation time was approximately five minutes. Cages used on Lewis & Clark Lake and Gavins Point River were constructed of 2" X 2" welded wire mesh and held in place by six 14" wire hook stakes, assembly and installation time was similar. After cage installation the nest was monitored to ensure that the nesting adult returned to the nest. No apparent avoidance of caged nests by piping plovers was detected.

Piping plover nest cages were used to various degrees on five of the eight reaches. (Cages were not used on the Fort Peck Reservoir, Fort Peck River, and Fort Randall River Reaches.) Overall 48% (87/180) of the piping plover nests on the Missouri River System were caged. Excluding the three reaches where cages were not used the figure rises to 54% (87/162). There are several reasons why cages were not placed over every plover nest. In some cases it was not possible to place a cage due to the proximity of vegetation or other features next to the nest. Cages were not placed over nests where the eggs were pipping or already hatched. On several occasions cages were not available when the nest was discovered.

In general, nests that were caged had a higher survivability - 59% (51/87), than uncaged nests - 52% (48/93). The survivability of uncaged nests in the five reaches where cages were used was not significantly different - 52% (39/75), than in the three reaches where cages were not used - 50% (9/18). Using cages increased survivability in four of the five reaches that employed cages. The sole exception was Lake Oahe where the survivability of uncaged nests was 74% (20/27), compared to 63% (15/24), for caged nests. Results of cage use during 1994 by reach are listed below (See Table Page 35).

Strobe light systems were again used in 1994 to deter nocturnal ocular dependent predators. Strobe light systems were set up at least tern colony sites at River Miles 804.6, 803.8, 802.7, and 799.2 on the Gavins Point River Reach and at Dredge Island (RM 1270) in Lake Oahe. The strobe light systems were highly successful on the four sites in the Gavins Point Reach. Least tern nest success was 69% (46/67) and piping plover nest success was 100% (8/8). By comparison least tern nest success for non strobe light sites was only 19% (29/152). The strobe light system was not as successful for least terns at Dredge Island in Lake Oahe. Nest success was only 21% (11/52). However at non strobe light sites on Lake Oahe tern nest success was worse with only 16% (3/19) nests having a successful hatch. The piping plover nests on Dredge Island covered by the strobe system showed a 61% (11/18) hatching success. Overall, the five sites equipped with the strobe light system showed a 48% (57/119) nest hatching success for least terns and a 73% (19/26) nest hatching success for piping plovers (See Table Page 34).

MAINSTEM MISSOURI RIVER PIPING PLOVER NEST CAGE SUCCESS, 1994

REACH	NESTS	NEST HAT	NEST SUCC.	NO. CAGE NESTS	NO. NEST HAT	NO. NEST SUCC.	CAGES NEST	C. NEST HAT	C. NEST SUCC.
TPKRES	11	5	45.5	11	5	45.5	0	0	0
FTPKRIV	1	0	0.0	1	0	0.0	0	0	0
KSKRES	17	13	76.5	7	5	71.4	10	8	80.0
GARRIV	51	35	68.6	27	20	74.1	24	15	62.5
KOHRES	33	18	54.5	15	6	40.0	18	12	66.7
FTRLRIV	6	4	66.7	6	4	66.7	0	0	0
ECLRES	10	1	10.0	4	0	0.0	6	1	16.7
GAPTRIV	51	23	45.1	22	8	36.4	29	15	51.7
TOTAL	180	99	55.0	93	48	51.6	87	51	58.6

MISSOURI RIVER STROBE LIGHTS SITES, 1994

REACH	RIVER MILE	LAKE LOCATION	LT NESTS	LT NEST HAT	LT NEST SUCC.	PP NESTS	PP NEST HAT	PP NEST SUCC.
DAHERES	1270.0	DREDGE IS.	52	11	21.2	18	11	61.1
3AVPTRIV	804.6		11	9	81.8	5	5	100.0
	803.8		12	9	75.0	0	0	0.0
	802.7		21	14	66.7	2	2	100.0
	799.2		23	14	60.9	1	1	100.0
3P TOTAL			67	46	68.7	8	8	100.0
TOTAL			119	57	47.9	26	19	73.1

At Dredge Island in Lake Oahe different combinations of predator aversion measures were employed. There were a total of 23 piping plover nests on the island in 1994. Four combinations were utilized; not caged and not within the strobe light system (NC-NS), caged and not within the strobe light system (C-NS), not caged and within the strobe light system, (NC-S), and caged and within strobe light system (C-S). The results are in the table below.

	# of Nests	# Nests Hatched	% Hatched
NC-NS	1	1	100%
C-NS	4	2	50%
NC-S	7	3	43%
C-S	11	8	73%
TOTAL	23	16	70%

Discounting the one nest where no protection measures were employed, the most productive measure was caging a nest within the strobe light system.

Predator Removal

Predator removal was accomplished at one site on Lake Sakakawea. A fox was observed on an island in the Van Hook Arm where plovers had established a nest and where terns had been seen along the shoreline. An interagency agreement was developed with the North Dakota USDA Animal Control Unit and the fox was removed by a government trapper.

Nest Relocation

One piping plover nest on the Gavins Point Reach was relocated due to bank erosion threatening the nest.

Specimen Collection for Contaminate Analysis

A total of seventeen tern eggs, six piping plover eggs, one adult tern, one adult plover and three plover chicks were collected during field activities and forwarded to respective federal contaminate labs for analysis.

Global Positioning System

A global positioning system (GPS) network was set up on the Gavins Point Reach in the fall of 1994. The network extends from RM 810.5 to RM 754.0 and consists of 48 stations. This GPS network will be used for island mapping, geomorphological studies, nest locations, and nest elevations.

Yellowstone River Least Tern & Piping Plover Study

A two year study of least terns and piping plovers on the Yellowstone River began in the spring of 1994. The Yellowstone River in central Montana provides a unique opportunity to study the chronology of least tern and the piping plover nesting and reproductive success on a near natural free-flowing river system. The study, which is being conducted by a graduate student from Montana State University, will investigate the responses of least terns and piping plovers to a natural river hydrograph and develop a scientific database. This database will assist in determining future big river system operations that may impact the two species.

Thank you to the following people and their crew of dedicated staff who have diligently conducted the surveys, compiled the data, and submitted the annual field report.

**MR. GORDON WARRICK - FTPKRES and FTPKRIV
MR. GREG PAVELKA - LKSKRES
Mr. LEROY PHILLIPS - GARRRIV
MR. BILL MAY - GARRRIV and LKOARES
MS. TERRI THOMAS - LKOARES
MR. JIM SUEDKAMP - LKOARES
MR. MERRITT STEGMEIER - FTRLRIV
STAFF OF LEWIS AND CLARK LAKE**

Casey D. Kruse

**Casey D. Kruse
Wildlife Biologist/Field Coordinator**

APPENDIX A

Nest Record & Adult Census Cards

NEST RECORD PROCEDURES

SPECIES

Box 1-3
A.O.U. Species No.
277 Piping Plover
074 Least Tern

SITE

Box 4
River Reach (See Box 16)
Box 5-6
Site Number

SITE SUMMARY (Data Control 1)

Box 7-9
Total Nests w/in Reach
Box 10-13
Year Nest Located
Box 14-15
Nest Site Habitat
River Systems
01 Sandbar
02 Beach or Shore
03 Island
04 Island Beach
Reservoir Systems
05 Beach
06 Peninsula/Point
07 Island
08 Island Beach
09 Isl. Peninsula/Point
10 Other
Box 16
Reach Nest Located In
1 Fort Peck Reservoir
2 Fort Peck River
3 Lake Sakakawea
4 Garrison River
5 Lake Oahe, ND
6 Lake Oahe, SD
7 Fort Randall River
8 Lewis and Clark
9 Gavins Point River

Box 17-21
River Mile of Colony Site
to Nearest 10th of Mile
Box 22-38
Legal Description of
Colony Site (Reservoirs)

NEST DATA (Data Control 2)

Box 39
Number of Nest Visit
T Final Nest Visit
Box 40-42
Date of Nest Visit
Box 43-45
Observers Initials
Box 46-47
Temp to Nearest 5°F
Box 48-49
Wind to Nearest 5mph
Box 50
No. Eggs in Nest

Box 51-52
Incubation Stage
(See Diagram Below)
00 Laying Stage
nn Number Days Inc.
44 Pipped
55 Hatched

Box 53
Status of Nest
0 Unknown
1 Undist/Normal
2 Abandoned
3 Eggs Missing from
Previous Visit
4 Hatched
5 Destroyed
6 Other

NEST SUMMARY

Box 54
Number of Eggs Hatched
Box 55
Nonviable Eggs in Nest
Box 56-58
Nest Initiation Date
Plovers
(2(50)-1)+51&52-41&42
Terns
(1(50)+51&52)-41&42
Box 59-61
Exact Term Date
(Only if Known)
000 Unknown
Box 62-64
Computer Generated
Box 65-66
Computer Generated
Box 67
From Productivity Rec.

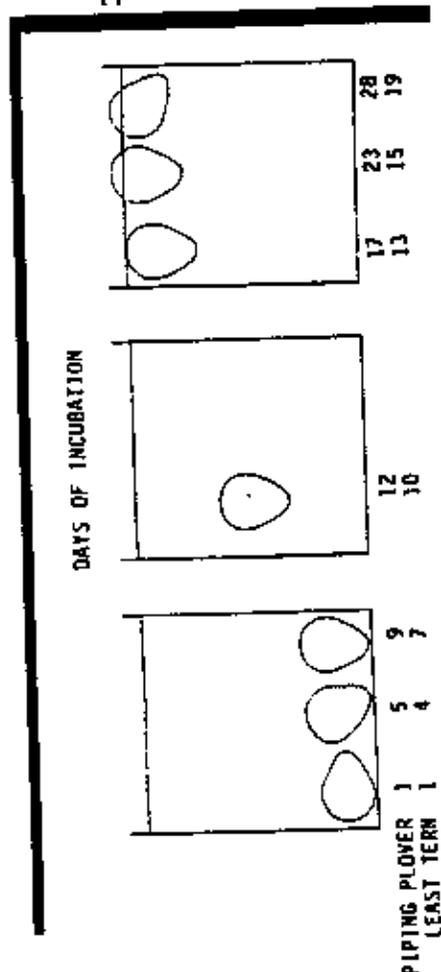
NEST FATE

Box 68 Fate
1 Hatched
2 Destroyed
3 Abandoned
4 Nonviable Eggs
5 Unknown
Box 69-70 Cause
Hatched
10 Other (explain)
11 Chicks in Bowl
12 Chicks on Site
13 Hatched Egg Shells
14 Pipping Fragments
15 Chick Droppings
Destroyed Flooded
20 Other (explain)
21 Eggs Washed Out
22 Nest Filled,
No Eggs
23 Flood Debris
Destroyed Weather
30 Other (explain)
31 Eggs Suspended
32 Eggs Smashed
33 Eggs Blown Out
Destroyed Predator
40 Other (explain)

41 Tracks w/in 2m
of Nest
42 Des. Egg Shells
43 Egg Yolk in Bowl
44 Predator Observed
Destroyed
50 Sandbar Erosion
60 Human Disturbance
70 Other (explain)
Abandoned
80 Other (explain)
81 Observer Disturb.
Box 71 Known Predator
1 Mink
2 Raccoon
3 Coyote
4 Red Fox
5 Domestic Dog
6 Striped Skunk
7 Ring-billed Gull
8 American Crow
9 Other
Box 72 Factor For
Predator Identification
1 Predator Observed
2 Tracks Near Nest
3 Destroyed Egg
Characteristics

PREDATOR MANAGEMENT

Box 73-81
Date of Management
Applications



ADULT CENSUS SITE RECORD WITH PRODUCTIVITY ESTIMATES

1 2 3 <input type="text"/> <input type="text"/> <input type="text"/> SITE	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> SITE SUMMARY	4 5 6 7 8 9 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> MONTH DAY YEAR
10 <input type="text"/> SURVEY TYPE	11 <input type="text"/> SURVEY TECH	12 13 <input type="text"/> <input type="text"/> HABITAT
14 <input type="text"/> REACH	15 16 <input type="text"/> <input type="text"/> TEMP WEATHER	17 18 <input type="text"/> <input type="text"/> WIND
19 20 21 22 23 24 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> OBSERVERS INITIALS		

(For River Use)	(For Reservoir Use Only)
25 26 27 28 29 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> RIVER MILE	30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 <input type="text"/> <input type="text"/> STATE TOWNSHIP RANGE SECTION 1/4-1/4 SECTION

PIPING PLOVERS 47 48 <input type="text"/> <input type="text"/> TOTAL ADULTS 49 50 <input type="text"/> <input type="text"/> NESTS 51 52 <input type="text"/> <input type="text"/> BROODS	LEAST TERNS 53 54 <input type="text"/> <input type="text"/> TOTAL 55 56 <input type="text"/> <input type="text"/> NESTS 57 58 <input type="text"/> <input type="text"/> BROODS
---	---

DATE			AGE OF CHICKS OBSERVED																
MO	DAY	SPECIES	0-5	5-7	7-10	10-15	15-20	20-24	FLEDGE										
59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
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<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Additional Record Space on Back



Threatened & Endangered
Species Program 1994

79 80 <input type="text"/> <input type="text"/> PLOVERS FLEDGE	81 82 <input type="text"/> <input type="text"/> TERNS FLEDGE
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APPENDIX B

Site by Site Productivity Records

MAINSTEM MISSOURI RIVER LEAST TERN PRODUCTIVITY MONITORING, 1984

REACH	RIVER MILE	LAKE LOCATION	NESTS	NEST HAT.	NEST SUCC.	EGGS HAT.	EGGS FLOOD	DEST. PRED.	DEST. H. DST.	DEST. BANK E	DEST. WTHR.	DEST. IVSTC	DEST. UNKN.	FAYE		ADULT CHICKS		
														UNKN.	ABAN.	CENSUS	FLEDGE	
FTPKRES	TOTAL	25N 42E 05	8	3	37.5	14	1	0	0	0	0	0	1	3	0	0	9	2
			8	3	37.5	14	1	0	0	0	0	0	0	1	3	0	0	9
FTPKRIV	1712.9		3	2	86.7	5	0	0	0	0	0	0	0	0	1	4	2	
	1709.3		1	1	100.0	2	0	0	0	0	0	0	0	0	0	2	2	
	1709.2		1	0	0.0	3	0	0	0	0	0	0	1	0	0	0	0	
	1669.2		1	1	100.0	2	0	0	0	0	0	0	0	0	0	2	1	
	1681.4		17	10	58.8	34	0	0	0	0	0	0	1	3	3	18	14	
	1674.5		0	0	0.0	0	0	0	0	0	0	0	0	0	0	1	0	
	1668.2		0	0	0.0	0	0	0	0	0	0	0	0	0	0	3	0	
	1659.3		0	0	0.0	0	0	0	0	0	0	0	0	0	0	2	0	
	1645.8		0	0	0.0	0	0	0	0	0	0	0	0	0	0	11	0	
	1629.0		0	0	0.0	0	0	0	0	0	0	0	0	0	0	1	0	
	1623.5		0	0	0.0	0	0	0	0	0	0	0	0	0	0	4	0	
	1582.0		0	0	0.0	0	0	0	0	0	0	0	0	0	0	10	0	
	TOTAL		23	14	60.9	46	31	0	0	0	0	0	2	3	4	58	19	
LKSKRES	DOUGLAS CR		1	0	0.0	1	0	0	0	0	1	0	0	0	0	0	0	
	ELBOWOODS		1	0	0.0	1	0	0	0	0	0	0	1	0	0	2	0	
	INDEPENDENC		5	2	40.0	8	0	1	0	0	0	0	0	0	1	11	0	
	HWY 85 BRIDGE		11	1	9.1	31	1	0	0	0	0	0	10	0	0	22	0	
TOTAL		18	3	16.7	41	4	0	1	1	0	1	0	11	1	35	0		
GARRIV	1380.0		3	3	100.0	7	0	0	0	0	0	0	0	0	0	8	3	
	1375.6		0	0	0.0	0	0	0	0	0	0	0	0	0	0	1	0	
	1374.5		2	1	50.0	4	2	1	0	0	0	0	0	0	0	2	3	
	1369.8		24	20	83.3	61	0	0	0	0	3	0	1	0	0	49	18	
	1365.2		0	0	0.0	0	0	0	0	0	0	0	0	0	0	2	0	
	1364.7		0	0	0.0	0	0	0	0	0	0	0	0	0	0	1	0	
	1362.9		1	1	100.0	3	0	0	0	0	0	0	0	0	0	2	3	
	1361.1		1	1	100.0	3	0	0	0	0	0	0	0	0	0	2	2	
	1358.0		2	1	50.0	4	2	0	0	0	0	0	0	1	0	2	0	
	1354.0		9	6	66.7	18	13	0	0	0	0	0	0	0	1	12	2	
	1351.8		9	8	88.9	17	15	0	0	0	0	0	0	1	0	16	1	
	1349.8		4	1	25.0	8	3	0	0	0	3	0	0	0	0	6	0	
	1343.4		0	0	0.0	0	0	0	0	0	0	0	0	0	0	1	0	
1337.6		3	3	100.0	5	5	0	0	0	0	0	0	0	0	2	5		
1336.7		0	0	0.0	0	0	0	0	0	0	0	0	0	0	1	0		
1335.7		0	0	0.0	0	0	0	0	0	0	0	0	0	0	2	0		
1335.0		26	8	30.8	52	16	0	0	0	0	0	0	0	17	46	13		
1329.0		3	0	0.0	4	0	0	0	0	0	0	0	1	2	1	0		

MAINSTEM MISSOURI RIVER LEAST TERN PRODUCTIVITY MONITORING, 1994

REACH	RIVER MILE	LAKE LOCATION	NESTS	NEST HAT.	NEST SUCC.	EGGS HAT.	EGGS	DEST. FLOOD	DEST. PRED.	DEST. H. DST.	DEST. BANK E	DEST. WTHR.	DEST. IVSTC	DEST. UNKN.	DEST. UNKN.	DEST. UNKN.	FATE	ABAM.	CENSUS	ADULT	CHICKS
	774.8		2	0	0.0	4	0	0	1	0	0	0	0	1	0	0	0	0	2	0	0
	772.5		1	0	0.0	3	0	0	0	0	0	0	0	1	0	2	0	0	2	0	0
	770.0		27	0	0.0	65	0	0	23	0	0	0	0	1	3	0	3	0	2	0	0
	769.5		9	2	22.2	16	3	6	0	0	0	0	0	1	0	0	0	0	14	0	0
	768.4		4	0	0.0	11	0	0	0	0	0	0	0	2	2	0	2	0	3	0	0
	766.5		0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
	761.7		10	0	0.0	20	0	0	0	0	0	0	0	2	0	2	0	0	2	0	0
TOTAL			218	75	34.4	514	179	13	69	0	5	11	0	14	21	10	21	10	211	51	
TOTAL			519	184	35.5	1153	420	35	87	3	8	29	5	37	108	22	108	22	777	143	

MISSOURI RIVER PIPING PLOVER PRODUCTIVITY MONITORING, 1994.

REACH	RIVER MILE	LAKE LOCATION	NESTS	NEST HAT.	NEST SUCC.	EGGS	EGGS HAT.	EGGS	FLOOD	DEST. PRED.	DEST. H. DIST.	DEST. WTHR.	DEST. LIVSTG	DEST. BANK'E	DEST. UNKN.	FATE UNKN.	ABAN.	ADULT CHICKS	
																		CENSU	FLEDGE
TOTAL			10	1	10.0	37	4	1	6	1	0	0	0	0	0	0	1	12	2
GAPTRIV	807.7		0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
	804.6		8	5	62.5	27	18	0	0	0	0	0	0	1	1	1	1	13	0
	804.5		6	6	100.0	23	20	0	0	0	0	0	0	0	0	0	0	14	15
	803.8		3	3	100.0	8	6	0	0	0	0	0	0	0	0	0	0	4	2
	802.7		2	2	100.0	8	8	0	0	0	0	0	0	0	0	0	0	2	0
	801.7		0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
	801.5		3	0	0.0	11	0	0	2	0	0	0	0	0	0	0	0	2	0
	801.0		1	0	0.0	1	0	0	0	0	0	0	0	0	0	0	0	2	0
	799.2		2	2	100.0	8	8	0	0	0	0	0	0	0	0	0	0	2	0
	797.8		2	1	50.0	7	4	0	0	0	0	0	0	0	0	0	0	5	0
	797.0		2	1	50.0	5	4	0	0	0	0	0	0	0	0	0	1	0	0
	793.9		1	1	100.0	4	4	0	0	0	0	0	0	0	0	0	0	0	0
	791.2		1	0	0.0	2	0	0	1	0	0	0	0	0	0	0	0	0	0
	790.6		6	0	0.0	17	0	0	3	0	0	0	0	0	0	0	0	2	0
	775.0		0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
	772.5		1	1	100.0	4	4	0	0	0	0	0	0	0	0	0	0	1	0
	770.0		10	1	10.0	36	4	0	9	0	0	0	0	0	0	0	0	4	0
	769.5		1	0	0.0	4	0	0	0	0	0	0	0	0	0	0	0	2	0
	768.4		1	0	0.0	4	0	0	0	0	0	0	0	0	0	1	0	0	0
	761.7		1	0	0.0	4	0	0	0	0	0	1	0	0	0	0	0	2	0
	757.3		1	0	0.0	4	0	0	0	0	1	0	0	0	0	0	0	0	0
TOTAL			52	23	44.2	177	80	0	15	0	2	0	0	1	7	2	2	62	19
TOTAL			181	99	54.7	643	346	7	23	1	8	1	2	14	15	11	11	353	113

APPENDIX C

Nesting & Adult Census Site Maps

FORT PECK LAKE

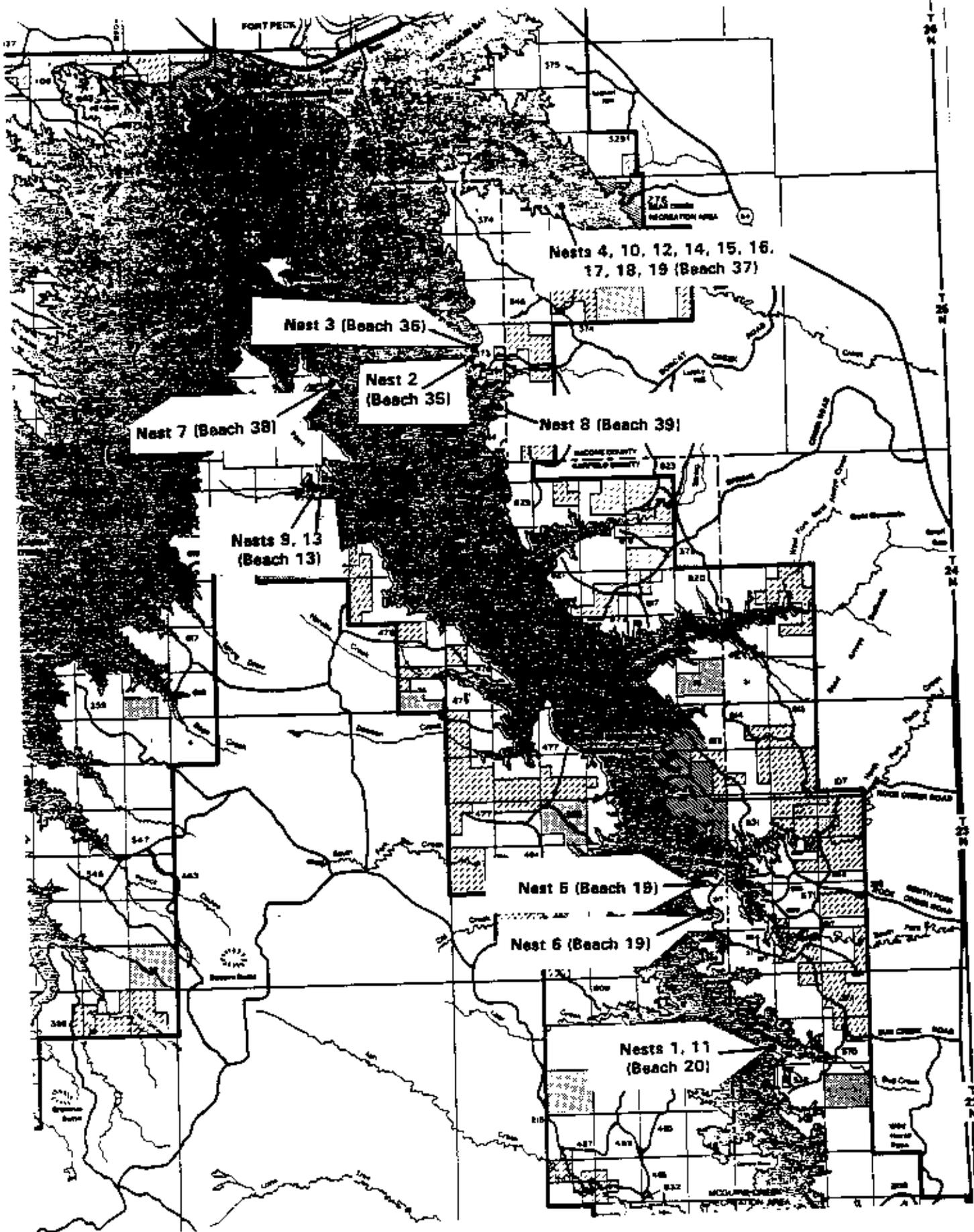
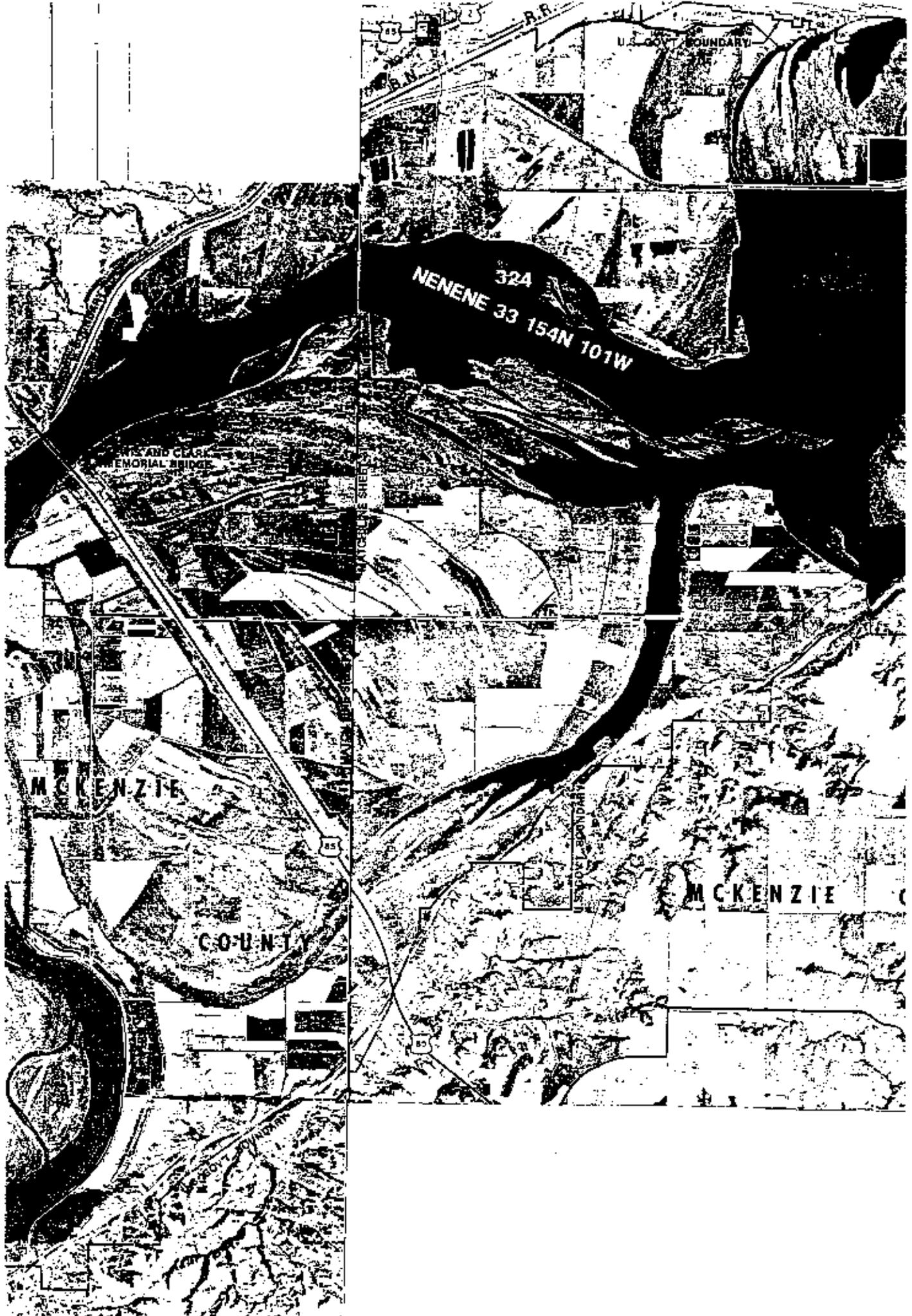


Figure 1. Nests and beaches used for nesting by least terns and piping plovers on Fort Peck Reservoir, Montana, 1994.

FORT PECK RIVER

LAKE SAKAKAWEA



U.S. GOVT. BOUNDARY

FORT

BERTHOLD

311

SWNESW 24 152N 92W

312
NENWSE 26 152N 92W

NWSESW 25 152N 92W

322

12

YAN HOOK AREA

YAN
GAME MANAGEMENT
AREA

321 SENWNW 18 151N 91W

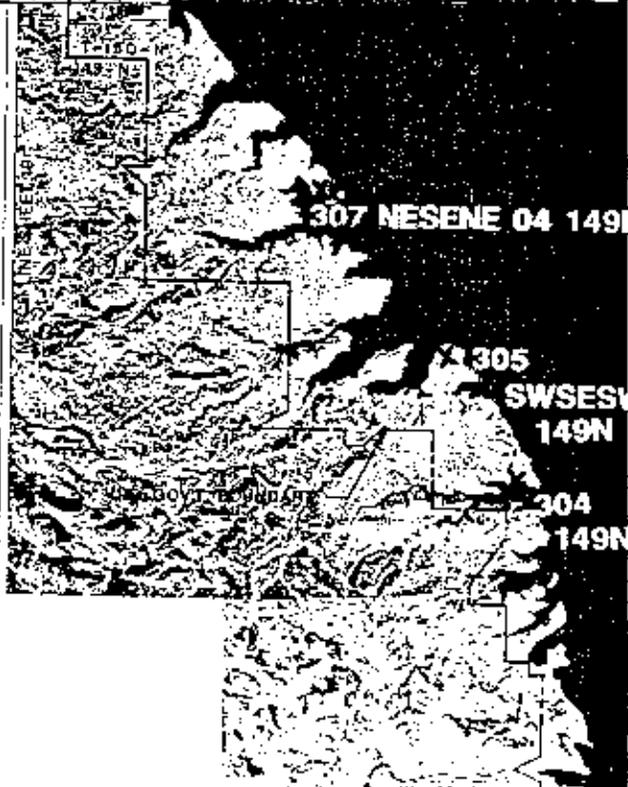
RESERVATION



RESERVATION

316 NESWSW 25 150N 92W

DUNN CO
U.S. GOVT BOUNDARY
FORT BERTHOLD
INDIAN RESERVATION



307 NESENE 04 149

305
SWSESW
149N

304
149N

150

150

150

150

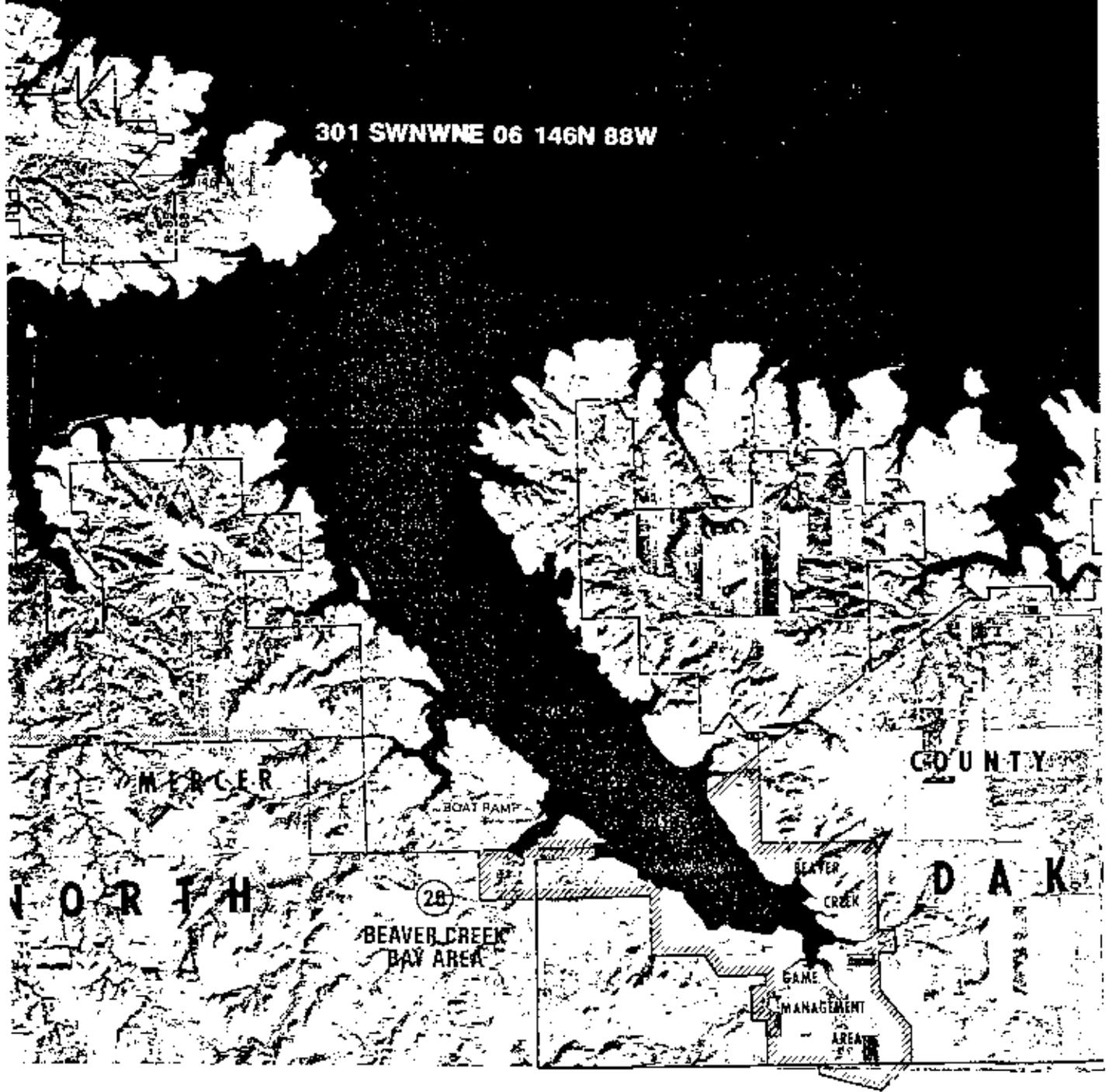
150



LEGEND:

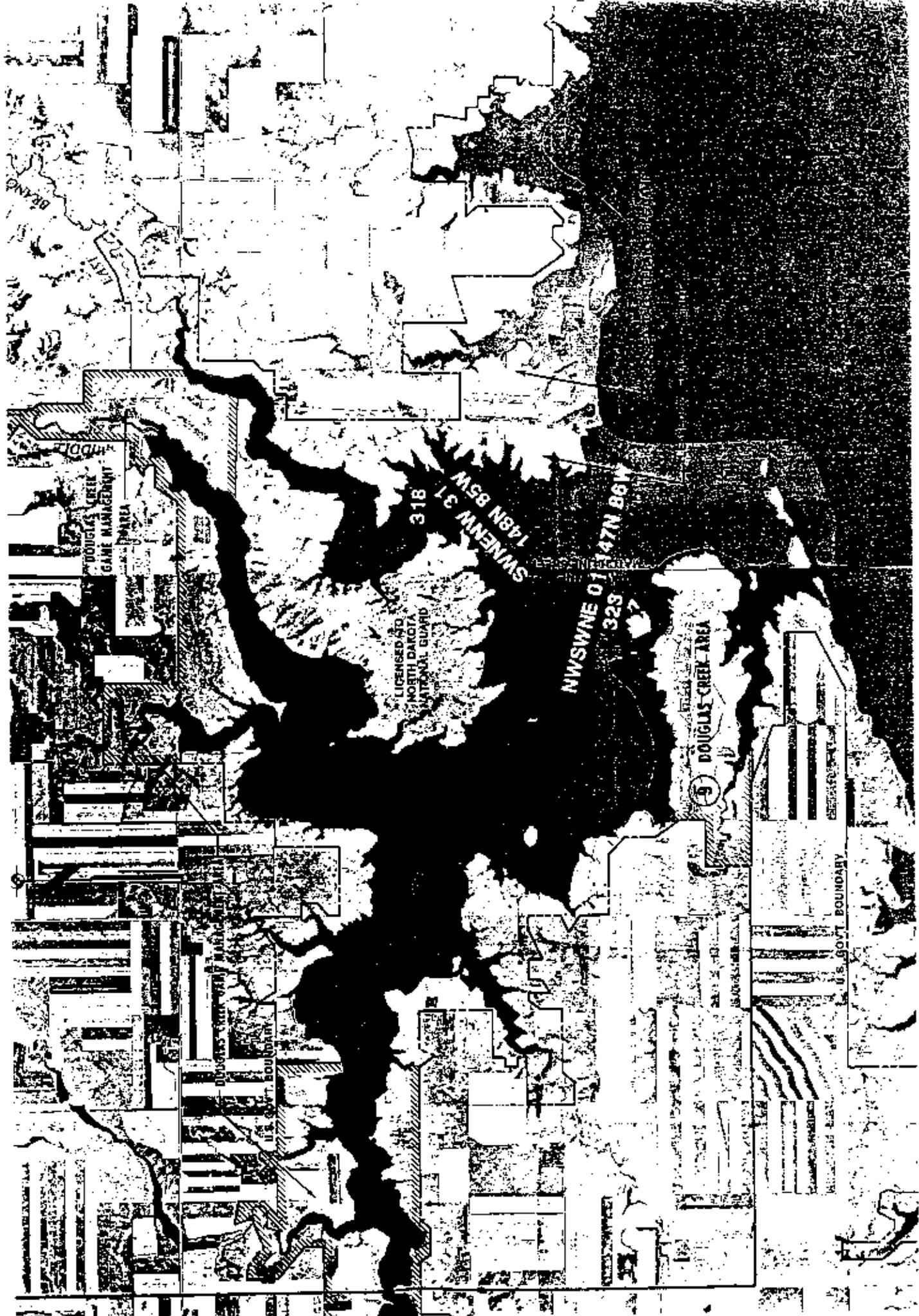
————— RECOMMENDED ACCESS ROADS

301 SWNWNE 06 146N 88W



LEGEND:

RECOMMENDED ACCESS ROAD



DOUGLAS CREEK
GAME MANAGEMENT
AREA

LICENSED TO
NORTH DAKOTA
NATIONAL GUARD

DOUGLAS CREEK AREA

U.S. GOVT. BOUNDARY

148N 85W
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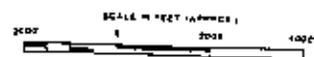
147N 86W
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BEAKING
LIVE



LEGEND:

————— RECOMMENDED ACCESS ROADS



LEGEND:

— RECOMMENDED ACCESS ROADS
LAKE SAKAKAWEA

GARRISON RIVER



RM 1380
PIPING PLOVERS 3 NESTS
INTERIOR LEAST TERNS 3 NESTS

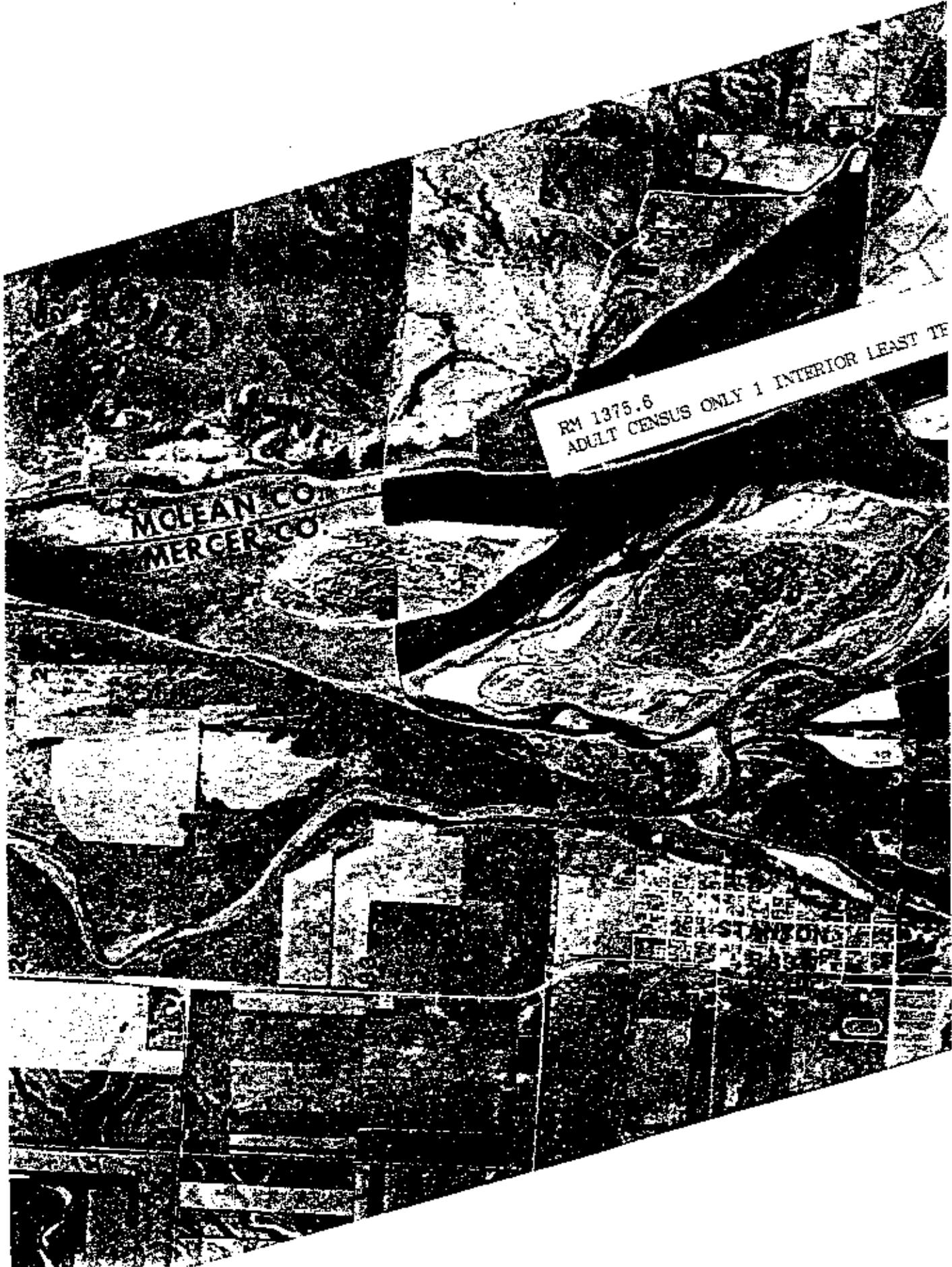


PHOTOS TAKEN 3 JU

RM 1377.3

ADULT CENSUS ONLY 1 PIPING PLOVER





MCLEAN CO
MERCER CO

RM 1375.6
ADULT CENSUS ONLY 1 INTERIOR LEAST TE

STANBOND

RM 1374.5
PIPING PLOVERS 1 NEST
INTERIOR LEAST TERN 3 NESTS

STANLEY

STANLEY



An aerial photograph of a coastal area, possibly a wetland or marsh. The terrain is a mix of dark and light patches, indicating different vegetation or water levels. A prominent road or path runs diagonally across the middle. In the lower right, there are several rectangular structures, possibly buildings or enclosures. A white label is placed over the middle of the image, containing text. The image is tilted clockwise. A north arrow is located in the bottom right corner.

RM 1371.4
ADULT CENSUS ONLY 2 PIPING PLOVER

LEAN C
MERCER

NORTH





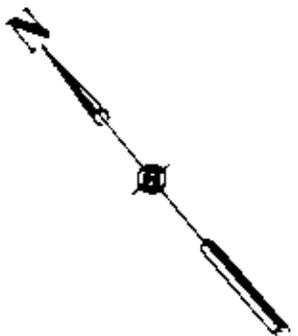
RM 1369.8
PIPING PLOVERS 6 NESTS
INTERIOR LEAST TERNS 24 NESTS

MCGLENN CO.
MERCER CO.

70

ALBANY CO.

The photograph is a high-contrast, black and white aerial view of a coastal region. It shows a mix of land and water, with various geographical features and structures. A prominent road or path runs through the lower-left quadrant. Several areas are labeled with county names: 'MCGLENN CO.' and 'MERCER CO.' in the upper-middle section, and 'ALBANY CO.' in the lower-middle section. A small, dark, rectangular object is visible in the lower-left, possibly a building or a structure. The overall image has a grainy, high-contrast quality typical of older aerial photography.



PHOTOS TAKEN 3 JUNE 1981

The compass rose is a simple line drawing with a central point and four lines extending outwards, representing the cardinal directions. It is positioned in the lower-left corner of the page, below the main photograph.



RM 1365.2

ADULT CENSUS ONLY 1 INTERIOR LEAST TERN

SCALE: 1 INCH = 2000 FEET

RM 1365
PIPING PLOVERS 1 NEST

32
MGLEAN CO.
OLIVER CO.



22

RM 1364.7
ADULT CENSUS ONLY 1 INTERIOR LEAST TERN

MCLEAN CO.
OLIVER CO.

1365

RM 1364.1
ADULT CENSUS ONLY 1 PIPING PLOVER

MGEAN CO.
OLIVER CO.

ORRIS





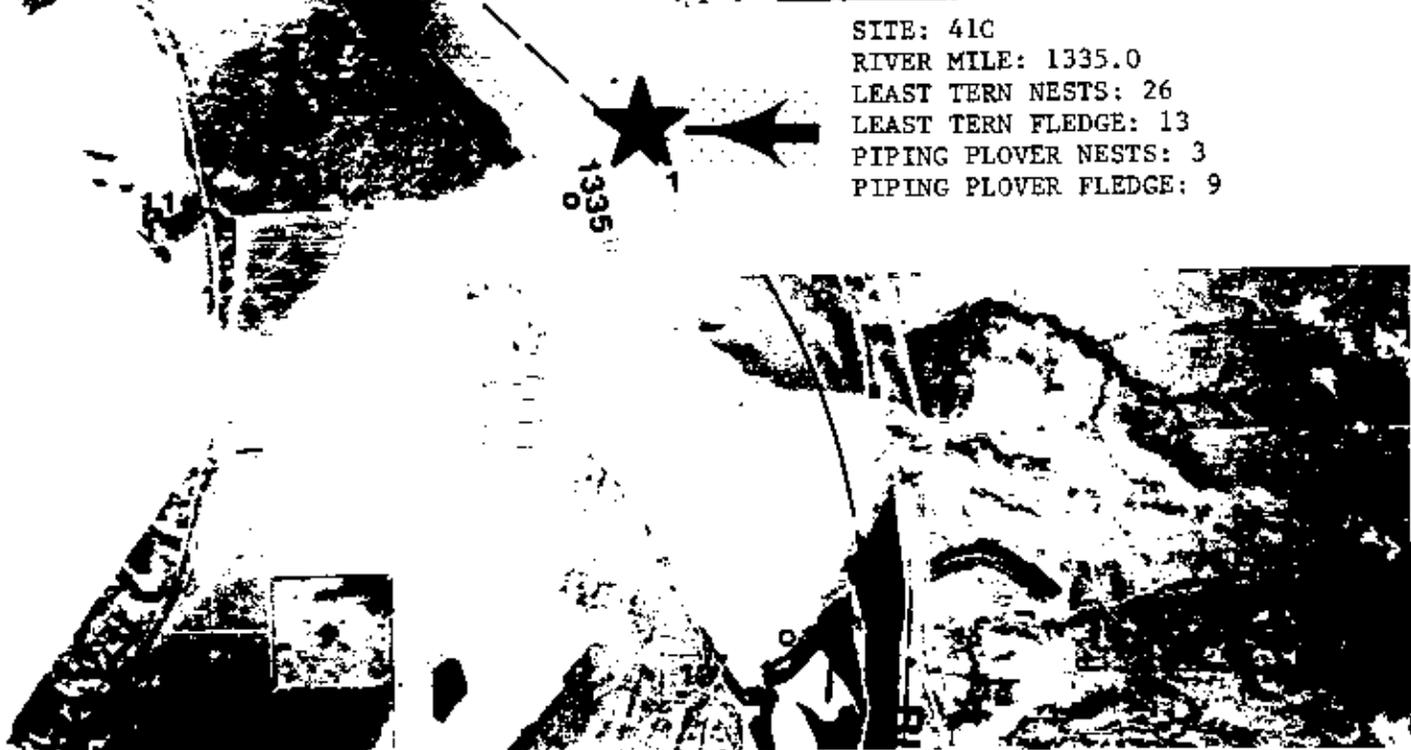
WILTON BOAT RAMP STARTING BOUNDARY
OF REACH 4 BISMARCK OFFICE. RIVER
MILE: 1341.7

SITE: 41A
RIVER MILE: 1341.2
LEAST TERN NESTS: 0
LEAST TERN FLEDGE: 0
PIPING PLOVER NEST: 1
PIPING PLOVER FLEDGE: 0

REACH 4
MAP A



SITE: 41B
RIVER MILE: 1336.7
LEAST TERN NESTS: 0
LEAST TERN FLEDGE: 0
PIPING PLOVER NESTS: 1
PIPING PLOVER FLEDGE: 2



SITE: 41C
RIVER MILE: 1335.0
LEAST TERN NESTS: 26
LEAST TERN FLEDGE: 13
PIPING PLOVER NESTS: 3
PIPING PLOVER FLEDGE: 9

LIVER CO.
ORTON CO.

SITE: 42B
RIVER MILE: 1329.0
LEAST TERN NESTS: 3
LEAST TERN FLEDGE: 0
PIPING PLOVER NESTS: 0
PIPING PLOVER FLEDGE: 0

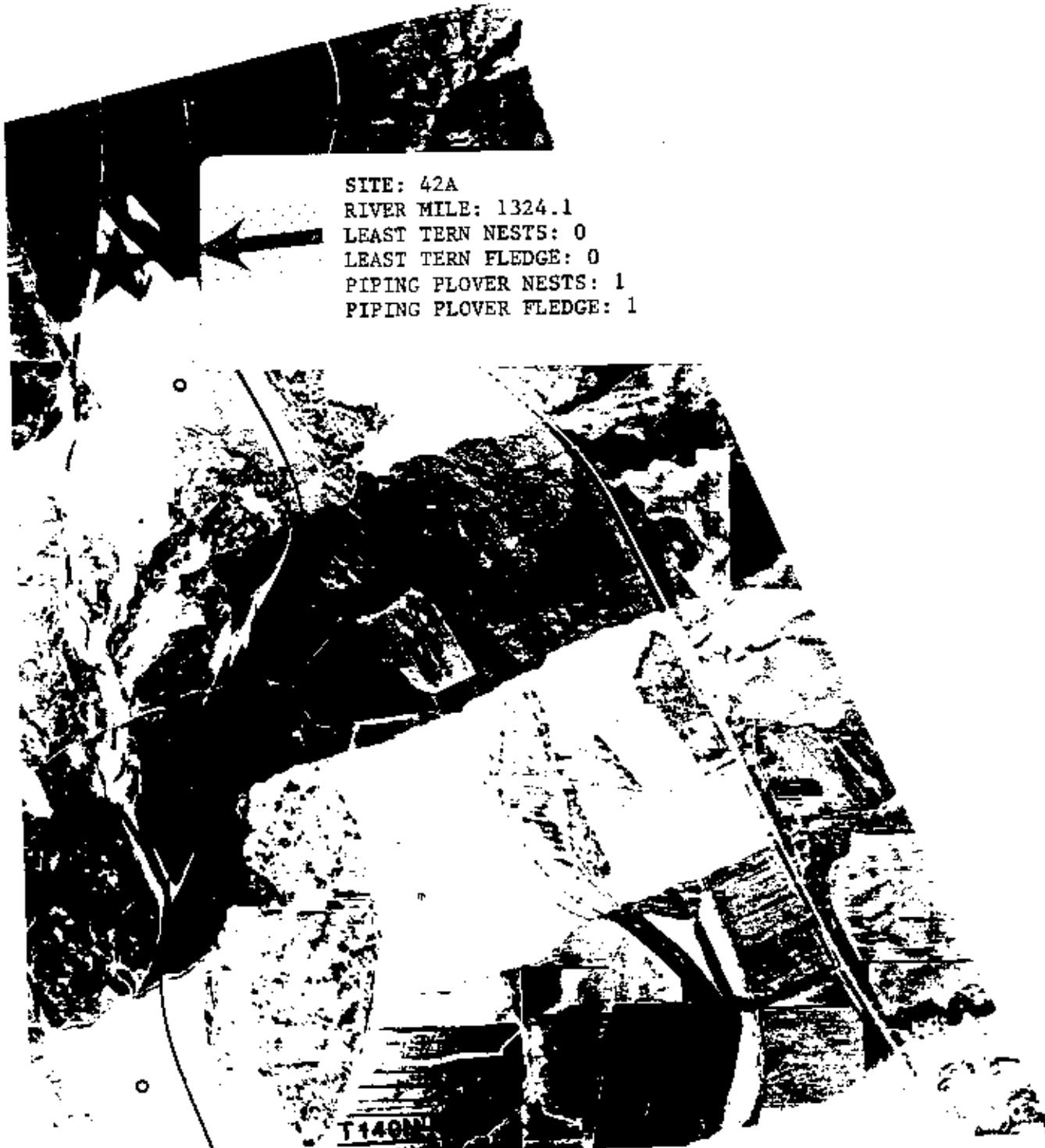
5

SITE: 42E
RIVER MILE: 1328.0
LEAST TERN NESTS: 6
LEAST TERN FLEDGE: 0
PIPING PLOVER NESTS: 1
PIPING PLOVER FLEDGE: 0

SITE: 42C
RIVER MILE: 1327.3
LEAST TERN NESTS: 15
LEAST TERN FLEDGE: 3
PIPING PLOVER NESTS: 7
PIPING PLOVER FLEDGE: 0

16

REAC
MAP



SITE: 42A
RIVER MILE: 1324.1
LEAST TERN NESTS: 0
LEAST TERN FLEDGE: 0
PIPING PLOVER NESTS: 1
PIPING PLOVER FLEDGE: 1

T140N

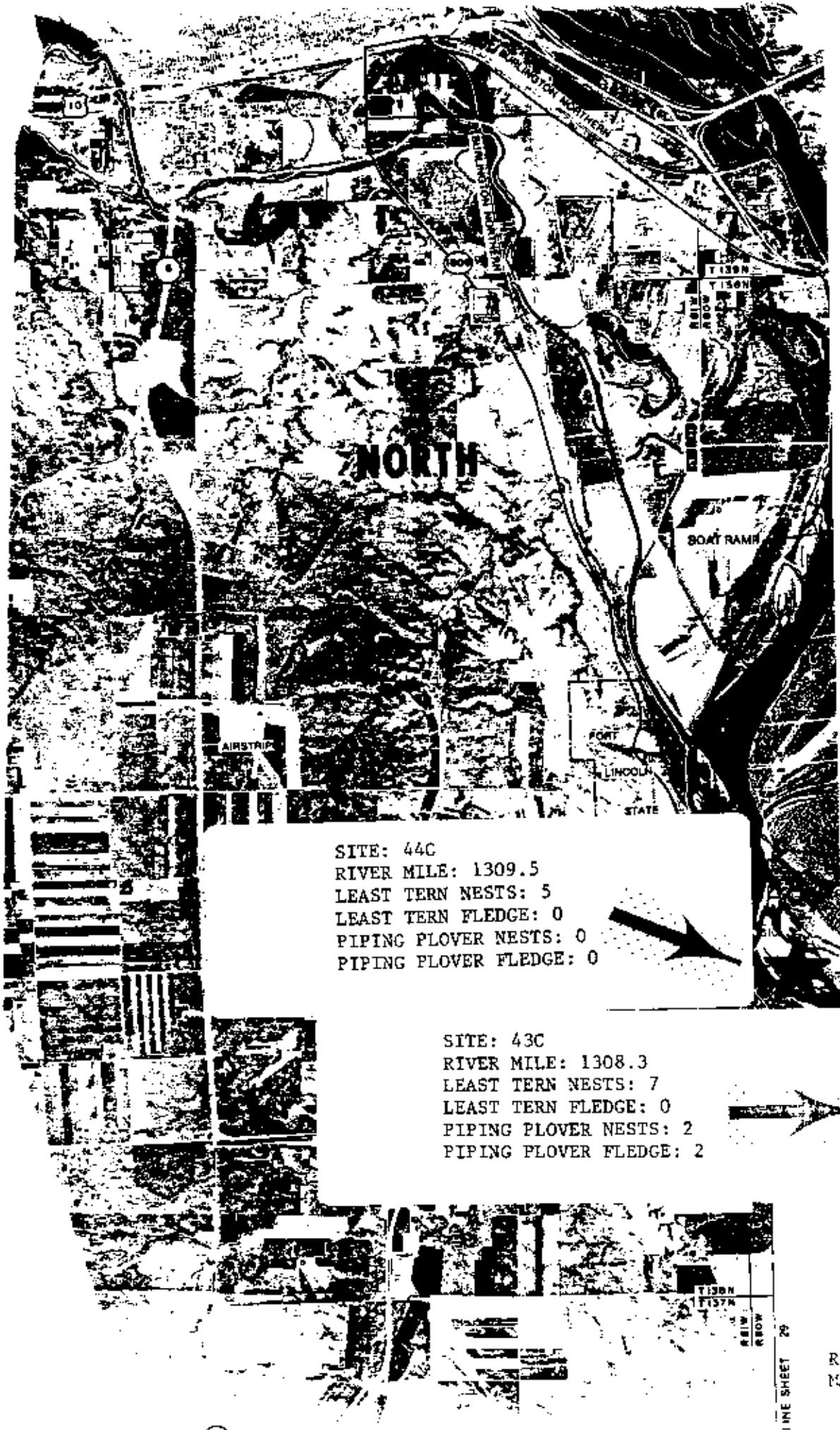
REACH
MAP D

T139



←
SITE: 42F
RIVER MILE: 1320.0
LEAST TERN NESTS: 5
LEAST TERN FLEDGE: 13
PIPING PLOVER NESTS: 2
PIPING PLOVER FLEDGE: 4

REACH 4
MAP E



SITE: 44C
RIVER MILE: 1309.5
LEAST TERN NESTS: 5
LEAST TERN FLEDGE: 0
PIPING PLOVER NESTS: 0
PIPING PLOVER FLEDGE: 0

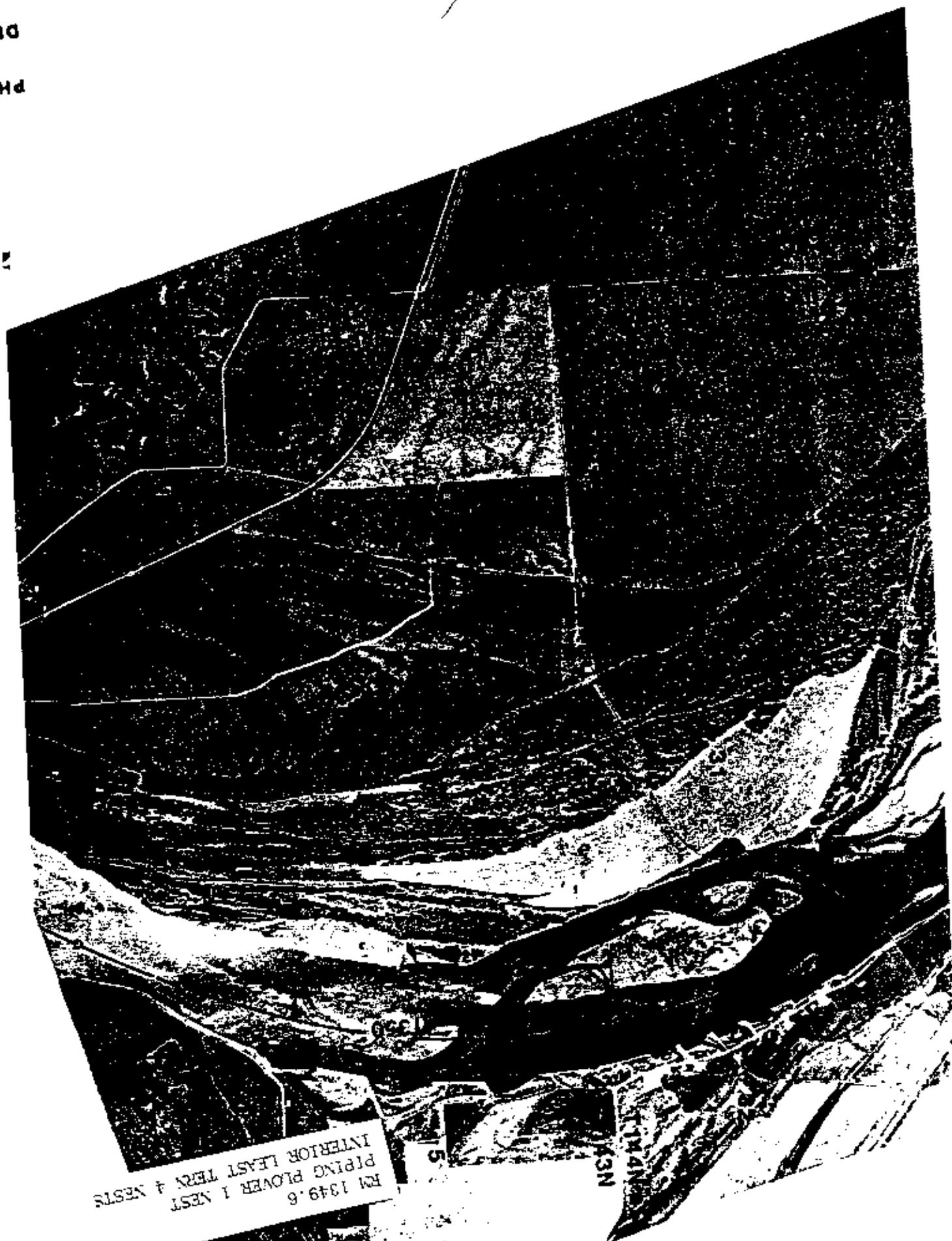
SITE: 43C
RIVER MILE: 1308.3
LEAST TERN NESTS: 7
LEAST TERN FLEDGE: 0
PIPING PLOVER NESTS: 2
PIPING PLOVER FLEDGE: 2



RM 1343.6
ADULT CENSUS ONLY 1 INTERIOR LEAST TERN

PH:

PH:

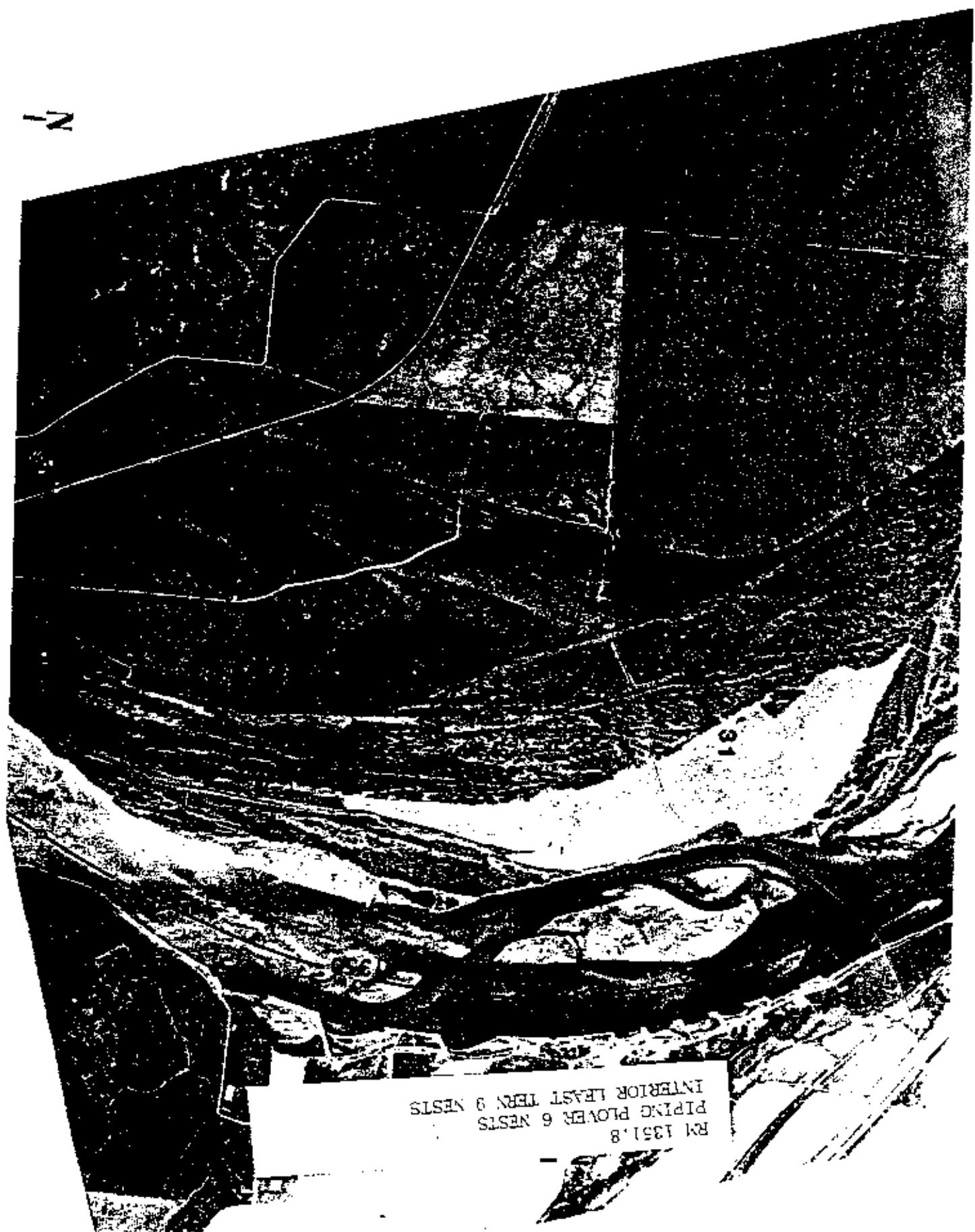


FM 1349.6
PIPING PLOVER 1 NEST
INTERIOR LEAST TERN 4 NESTS

50

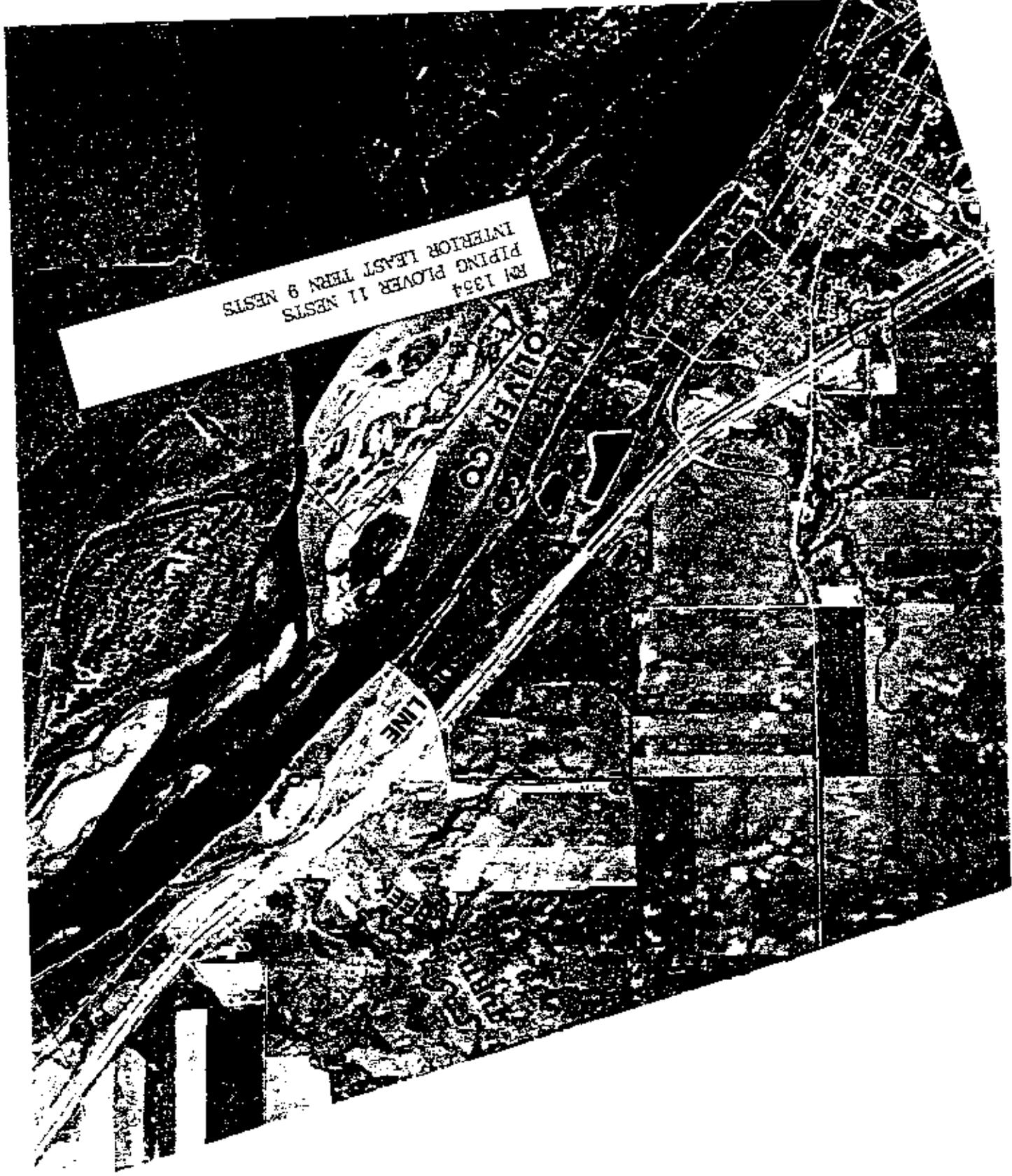
NEST

N



RM 1351.8
PIPING PLOVER 6 NESTS
INTERIOR LEAST TERN 9 NESTS

RM 1354
PIPING PLOVER 11 NESTS
INTERIOR LEAST TERN 9 NESTS





RM 1358
INTERIOR LEAST TERN 3 NESTS
PIPING PLOVER 11 FLEDGED CHICKS

20

19

8



1365

MCCORMICK & CO.
OLIVER CO.

27

RM 1361.1
INTERIOR LEAST THEN 1 NEST
PIPING PLOVER 1 FLEDGED CHICK

22

1365

MCLEAN, CO.
OLIVER CO.

RM 1362
PIPING PLOVER 1 FLEDGED CHICK

22

27



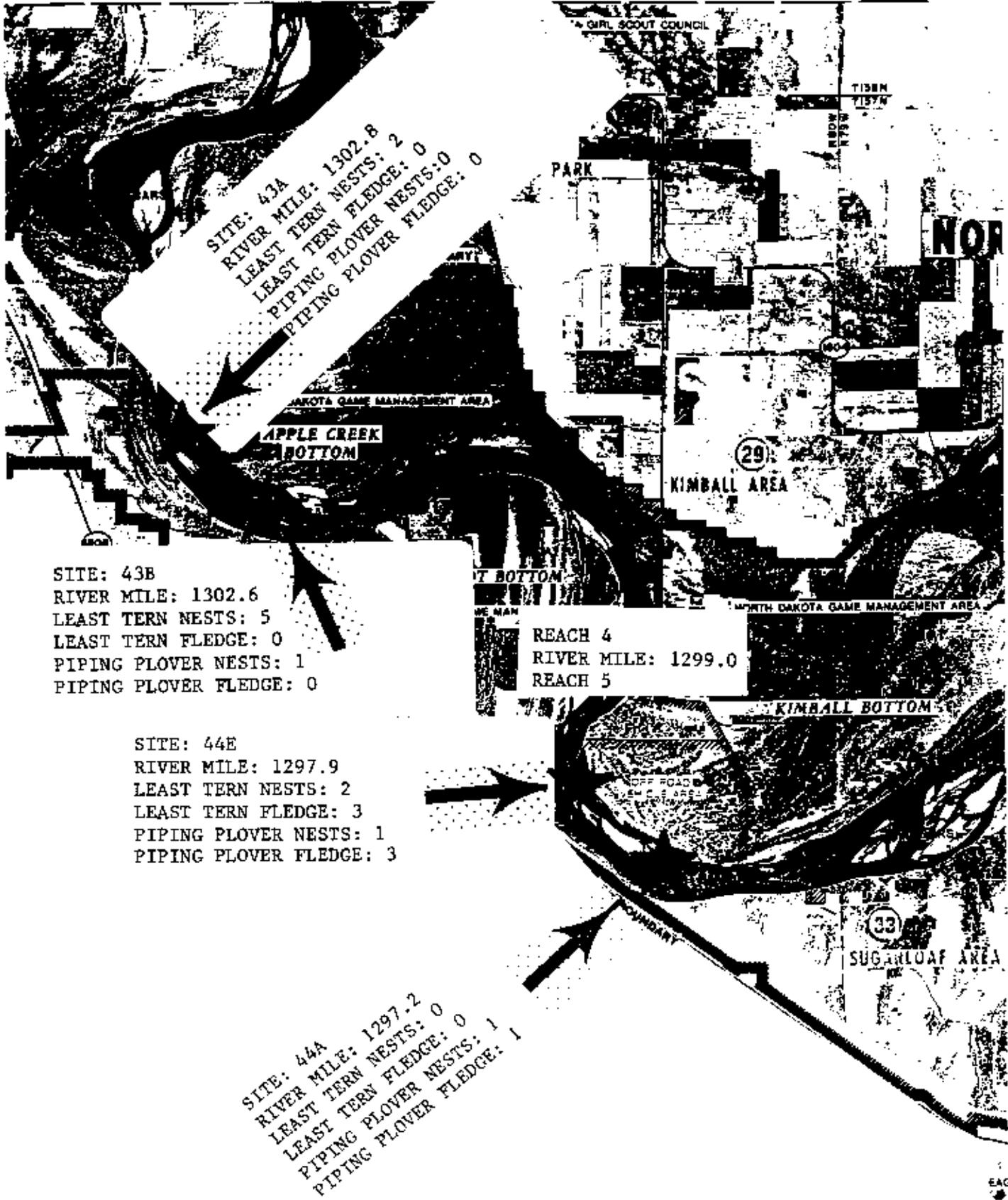
MCLEAN CO.
OLIVER CO.

RM 1362.9
INTERIOR LEAST TERN 1 NEST

1365

27

22



SITE: 43A
 RIVER MILE: 1302.8
 LEAST TERN NESTS: 2
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NESTS: 0
 PIPING PLOVER FLEDGE: 0

SITE: 43B
 RIVER MILE: 1302.6
 LEAST TERN NESTS: 5
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NESTS: 1
 PIPING PLOVER FLEDGE: 0

SITE: 44E
 RIVER MILE: 1297.9
 LEAST TERN NESTS: 2
 LEAST TERN FLEDGE: 3
 PIPING PLOVER NESTS: 1
 PIPING PLOVER FLEDGE: 3

SITE: 44A
 RIVER MILE: 1297.2
 LEAST TERN NESTS: 0
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NESTS: 1
 PIPING PLOVER FLEDGE: 1

RECOMMENDED ACCESS ROADS, PAVED

REACH 4 RE
 MAP G MA

LAKE OAHU



U.S. GOV'T BOUNDARY

U.S. GOV'T BOUNDARY

DARY

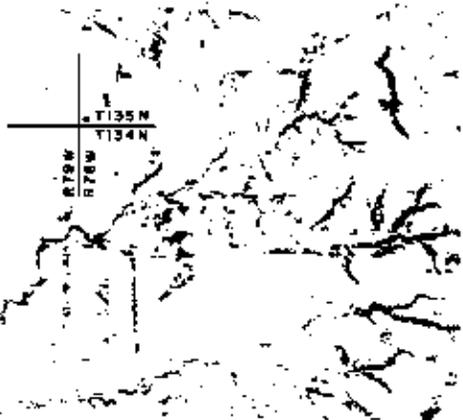
NORTH

CANNONBALL
COMMUNITY

CANNONBALL
MONUMENT

COUNTY

U.S. GOV'T BOUNDARY



SITE: 51A
RIVER MILE: 1270.0
LEAST TERN NESTS: 54
LEAST TERN FLEDGE: 2
PIPING PLOVER NESTS: 23
PIPING PLOVER FLEDGE: 0



U.S. GOV'T BOUNDARY

DAKOTA

T134N
T133N



RE
MA

T 130N
129N
R 75W
R 76W

DAKOTA

EMMONS COUNTY
LANGELIER BAY

24A

STATION CAMP

U.S. GOV'T BOUNDARY

SITE: 57A
RIVER MILE: 1232.1
LEAST TERN NESTS: 0
LEAST TERN FLEDGE: 0
PIPING PLOVER NESTS: 3
PIPING PLOVER FLEDGE: 0

T 129N
T 128N

NORTH DAKOTA
SOUTH DAKOTA

1804 ENDS

DAKOTA
CAMPBELL COUNTY

REAR
MAP

MATCH LINE SHEET 23

LEGEND:

1978

C. N. ST. P. & P.
BLUE BLANKET AREA

13

U.S. GOV'T BOUNDARY

CORSON COUNTY

STANDING ROCK INDIAN RESERVATION

CORSON COUNTY
DEWEY COUNTY

PRAIRIE DOG TOWN

CHEYENNE RIVER INDIAN RESERVATION

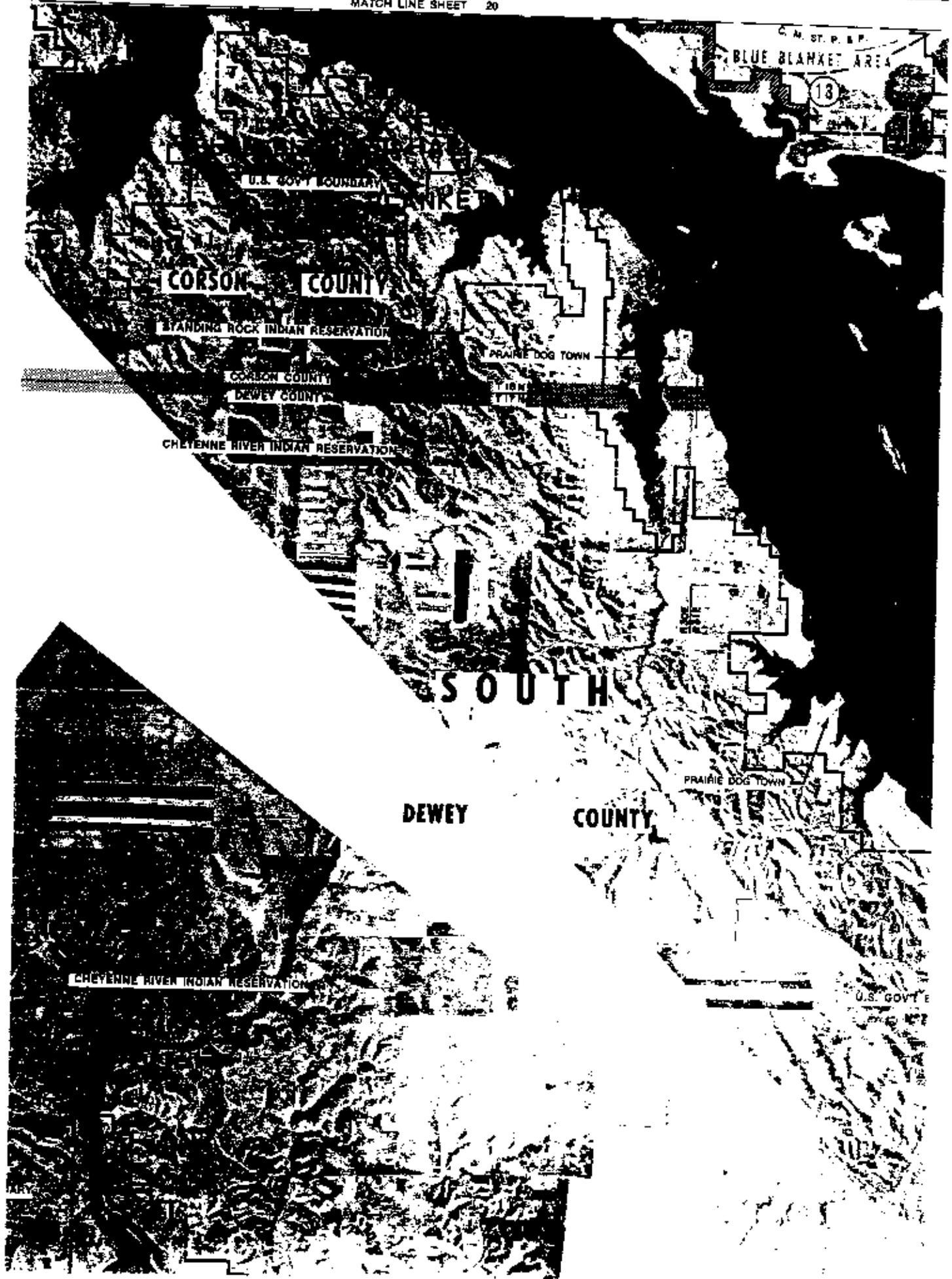
SOUTH

DEWEY COUNTY

PRAIRIE DOG TOWN

CHEYENNE RIVER INDIAN RESERVATION

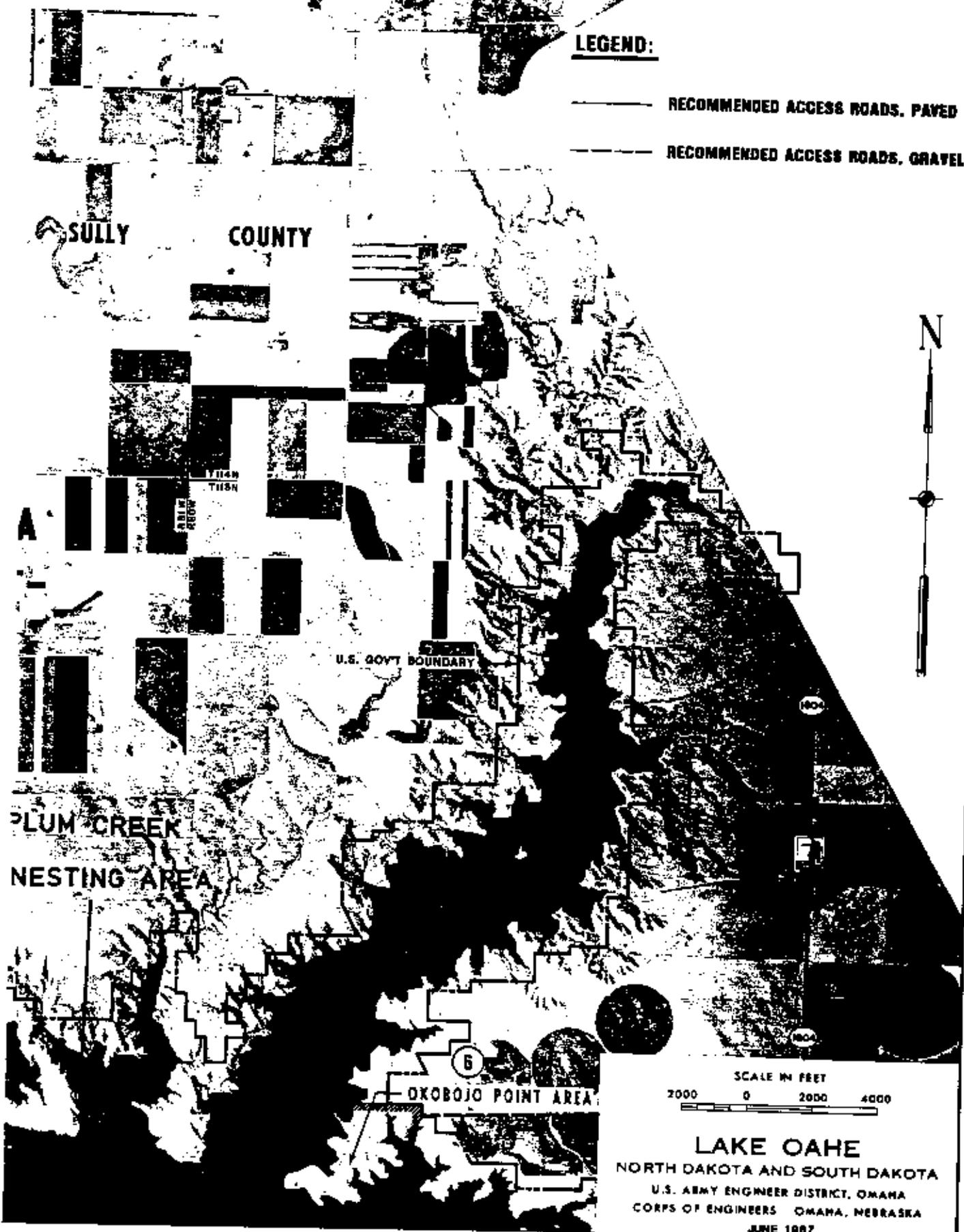
U.S. GOV'T





LEGEND:

- RECOMMENDED ACCESS ROADS, PAVED
- RECOMMENDED ACCESS ROADS, GRAVEL



SULLY COUNTY

PLUM CREEK
NESTING AREA

U.S. GOV'T BOUNDARY

OKOBOJO POINT AREA



LAKE OAHE
NORTH DAKOTA AND SOUTH DAKOTA
U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA
JUNE 1987
SHEET 9 OF 10

LEGEND:

- RECOMMENDED ACCESS ROADS, PAVED
- RECOMMENDED ACCESS ROADS, GRAVEL

SULLY COUNTY



U.S. GOVT BOUNDARY

OKOBOJO CREEK
HABITAT ENHANCEMENT

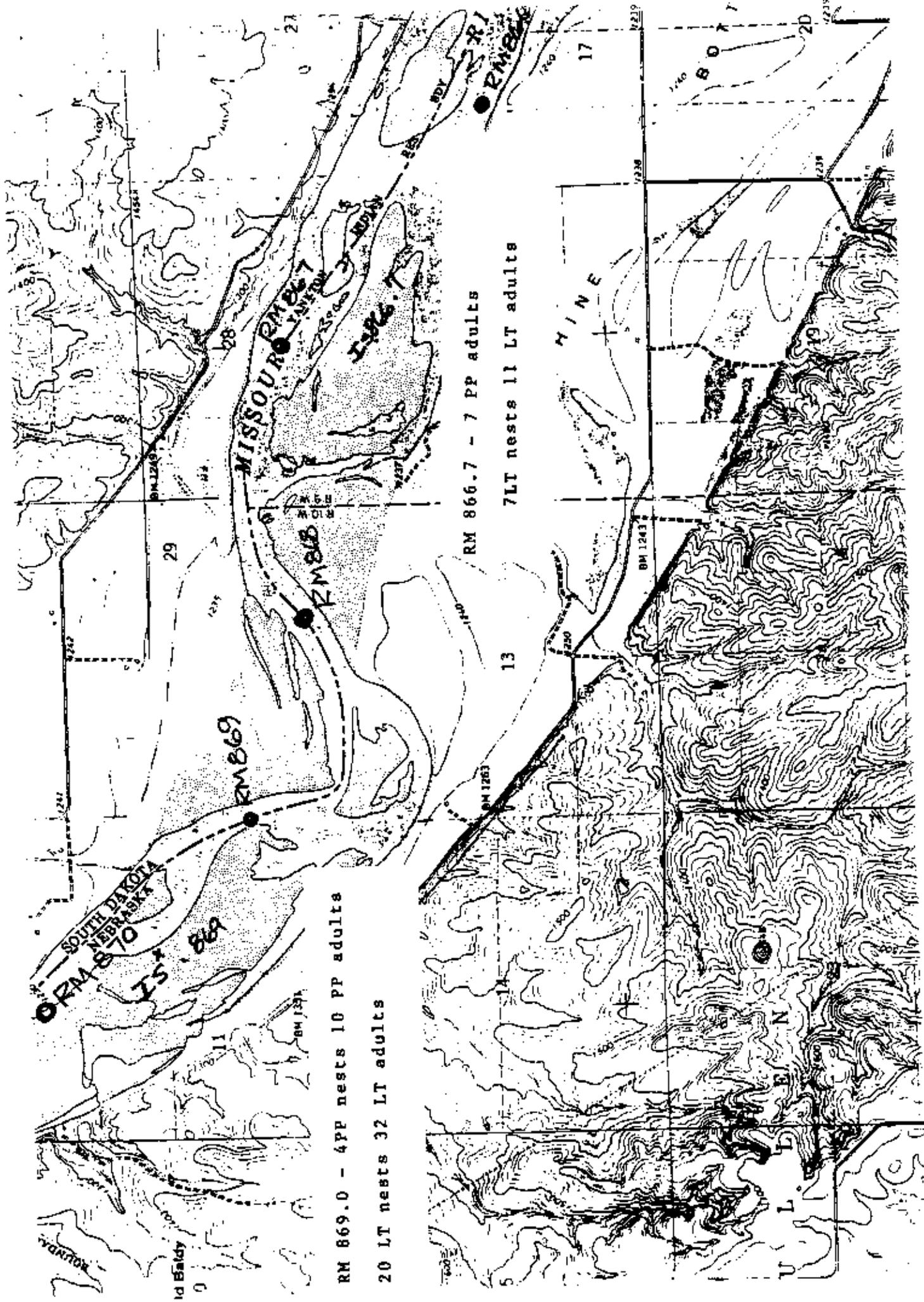
DRY CREEK
HABITAT ENHANCEMENT

6
OKOBOJO POINT AREA



LAKE OAHE
NORTH DAKOTA AND SOUTH DAKOTA
U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA
JUNE 1967
SHEET 9 OF 30

FORT RANDALL RIVER



RM 869.0 - 4PP nests 10 PP adults
 20 LT nests 32 LT adults

RM 866.7 - 7 PP adults
 7LT nests 11 LT adults

SOUTH DAKOTA
 NEBRASKA
 RM 870.0

RM 869.0

MISSOURI RIVER
 RM 866.7

BM 1263

BM 1243

MINE

1600

14

13

17

11

12

13

14

15

16

1000

1100

1200

1300

1400

1500

1600

1700

1800

1900

2000

2100

2200

2300

2400

2500

2600

2700

2800

2900

3000

3100

3200

3300

3400

3500

3600

3700

3800

3900

4000

LEWIS & CLARK LAKE

PROPOSED NEW
NIORARA STATE PARK

U.S. GOVT
BOUNDARY

SOUTH

843.4 1 PP 7LT nests **OTA**

843.0 6PP 10LT nests

COUNTY

842.2 1LT nest

NIORARA

CEMETERY

SEASONAL FERRY CROSSING

COUNTY

U.S. GOVT BOUNDARY

17

11

12

13

7

15





BON

HOMME

COI

SEWAGE LAGOON

UNIVERSITY OF
SOUTH DAKOTA
AT SPRINGFIELD

SPRINGFIELD

37

CIVIC BOUNDARY

832.8 1PP nest

833.0 1PP nest

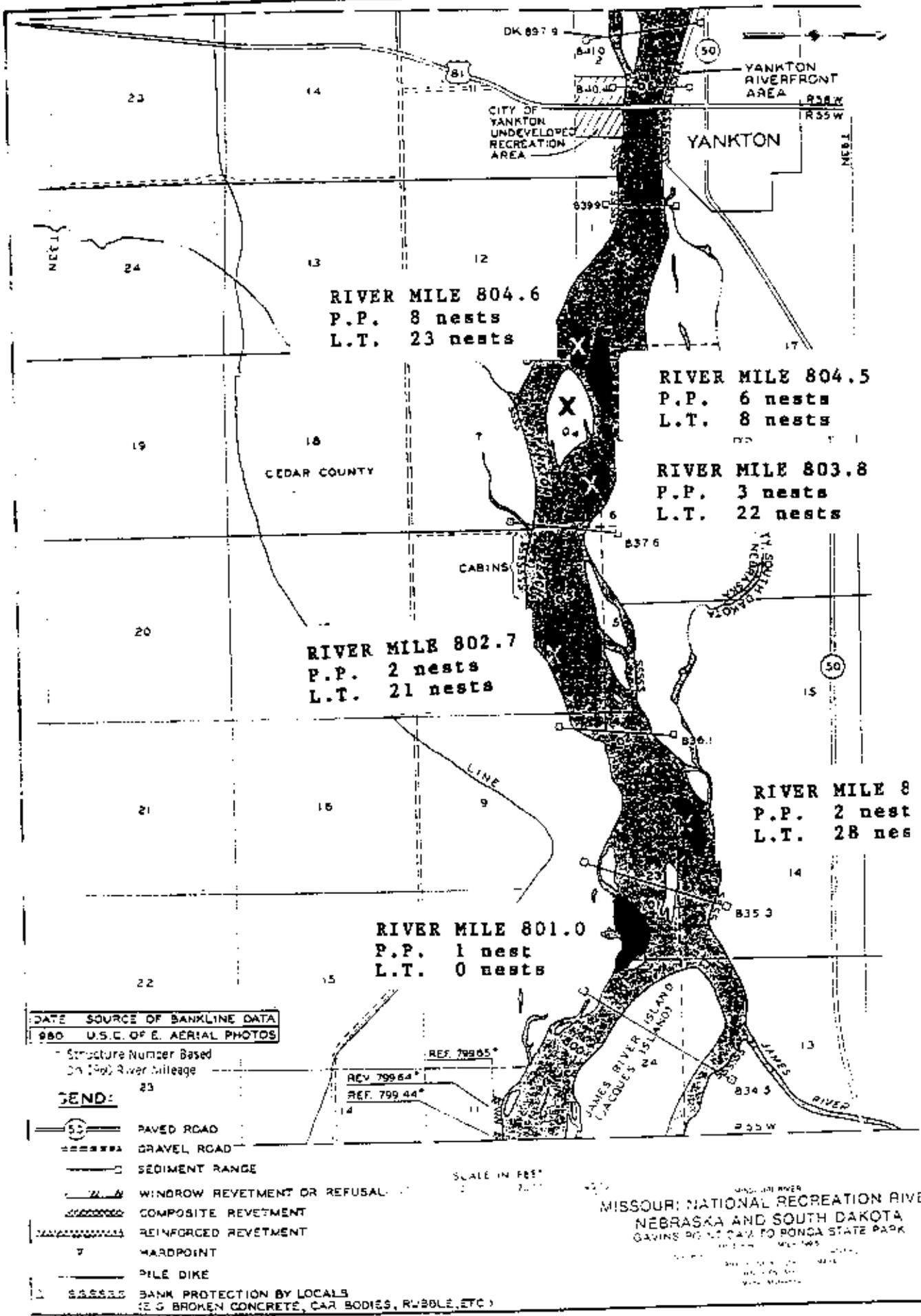
833.7 1PP nest

NOTE: 100000

CIVIC BOUNDARY

SCALE

GAVINS POINT REACH



RIVER MILE 804.6
 P.P. 8 nests
 L.T. 23 nests

RIVER MILE 804.5
 P.P. 6 nests
 L.T. 8 nests

RIVER MILE 803.8
 P.P. 3 nests
 L.T. 22 nests

RIVER MILE 802.7
 P.P. 2 nests
 L.T. 21 nests

RIVER MILE 8
 P.P. 2 nest
 L.T. 28 nes

RIVER MILE 801.0
 P.P. 1 nest
 L.T. 0 nests

DATE SOURCE OF BANKLINE DATA
 980 U.S.C. OF E. AERIAL PHOTOS

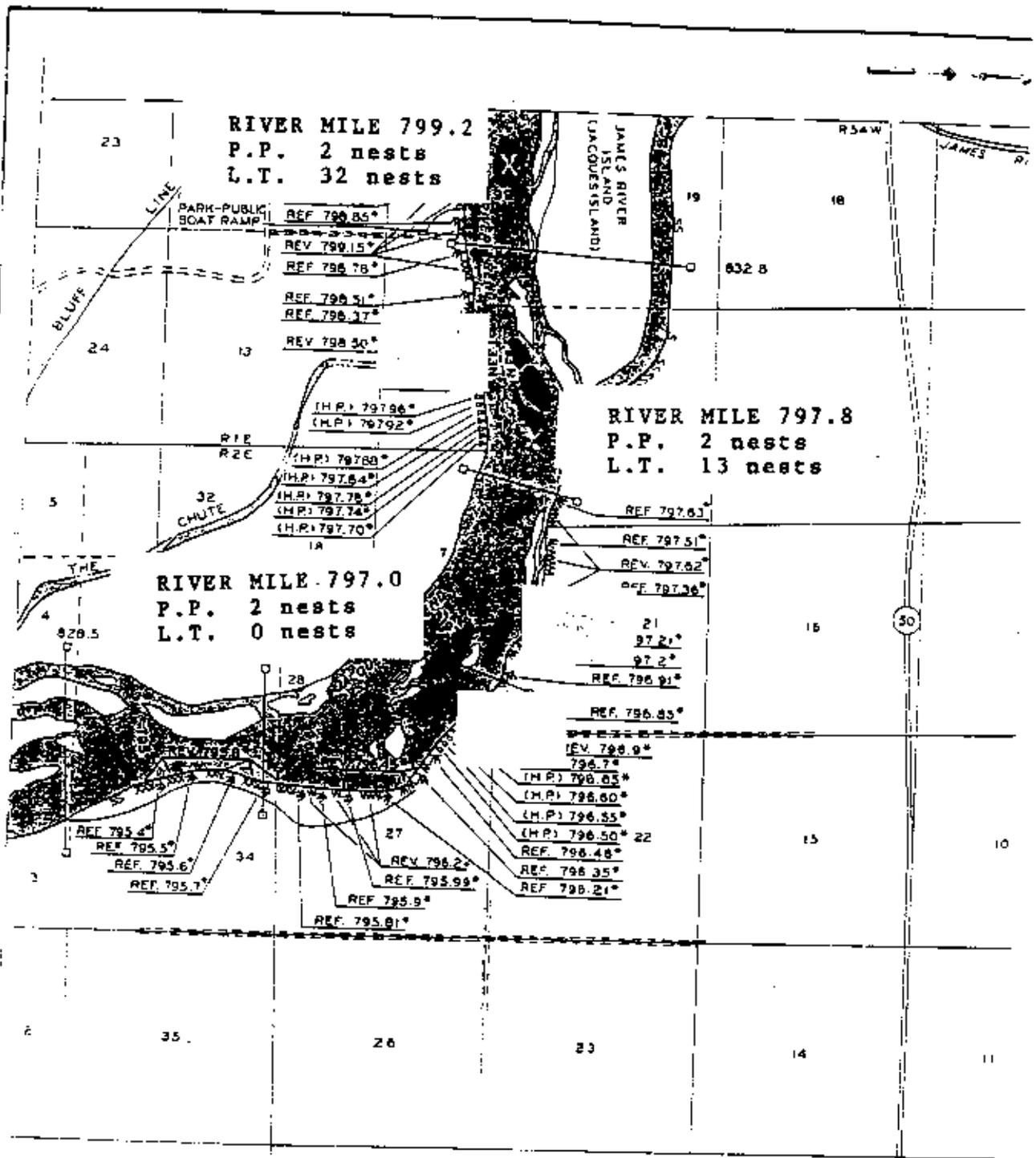
Structure Number Based
 On 1990 River Mileage

Legend:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVETMENT OR REFUSAL
- COMPOSITE REVETMENT
- REINFORCED REVETMENT
- HARDPOINT
- PILE DIKE
- BANK PROTECTION BY LOCALS
 (E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC)

SCALE IN FEET

MISSOURI NATIONAL RECREATION RIVER
 NEBRASKA AND SOUTH DAKOTA
 GAVINS POINT DAM TO FONDA STATE PARK



DATE SOURCE OF BANKLINE DATA
 1980 U.S.C. OF E. AERIAL PHOTOS

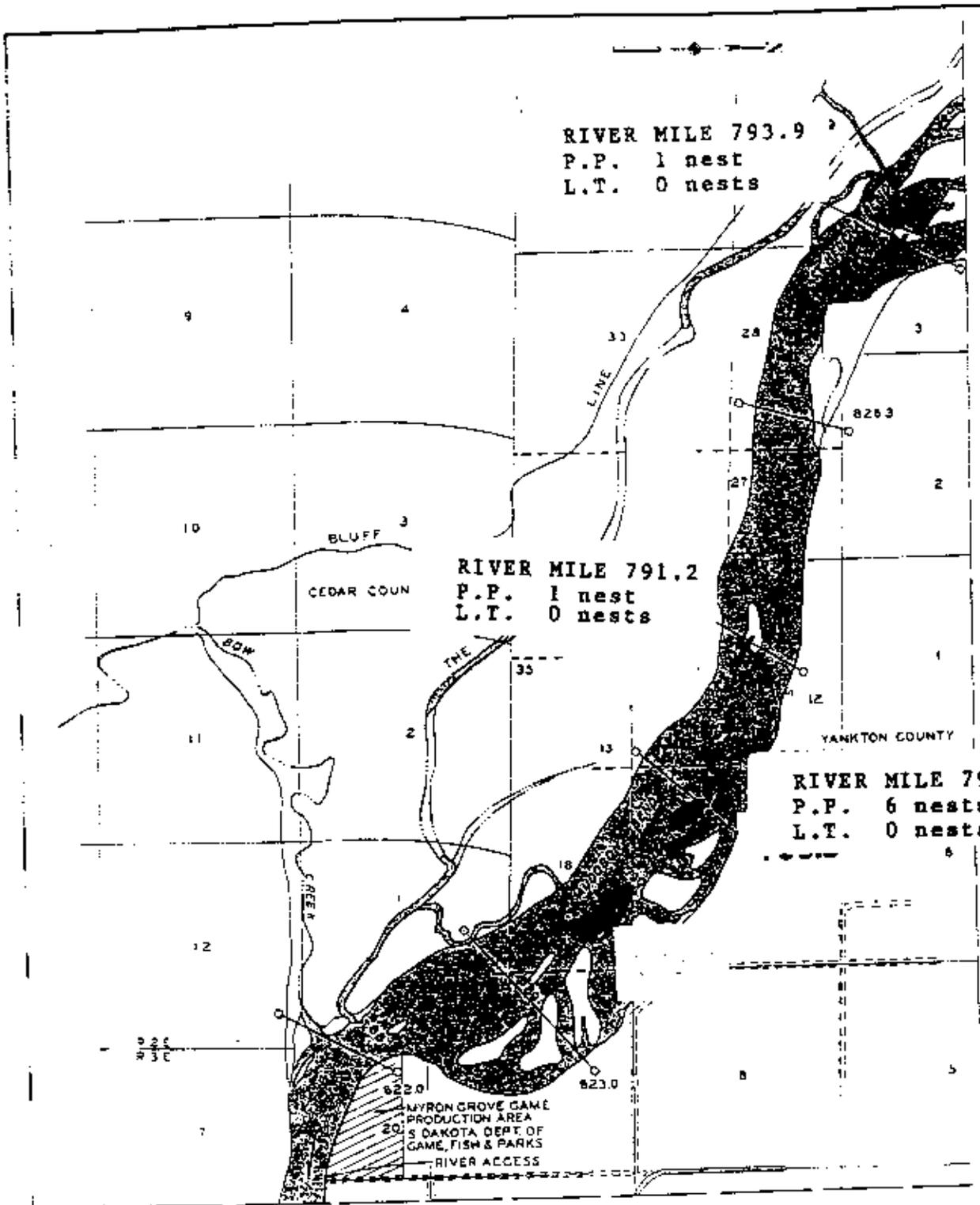
Structure Number Based
 on 1960 River Mileage

SCALE IN FEET
 0 1000 2000 3000 4000

LEGEND:

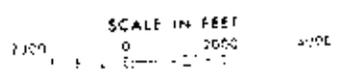
- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVETMENT OR REFUSAL
- COMPOSITE REVETMENT
- REINFORCED REVETMENT
- HARPOINT
- BANK PROTECTION BY LOCALS
 (E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)

MISSOURI NATIONAL RECREATION RIVER
 NEBRASKA AND SOUTH DAKOTA
 GAVINS POINT DAM TO PONCA STATE PARK
 RIVER MILE 795 TO RIVER MILE 794.5
 PROJECT NO. 100-100-100-100
 DATE 1980-10-10



DATE	SOURCE OF BANKLINE DATA
980	U.S.C. OF E. AERIAL PHOTOS

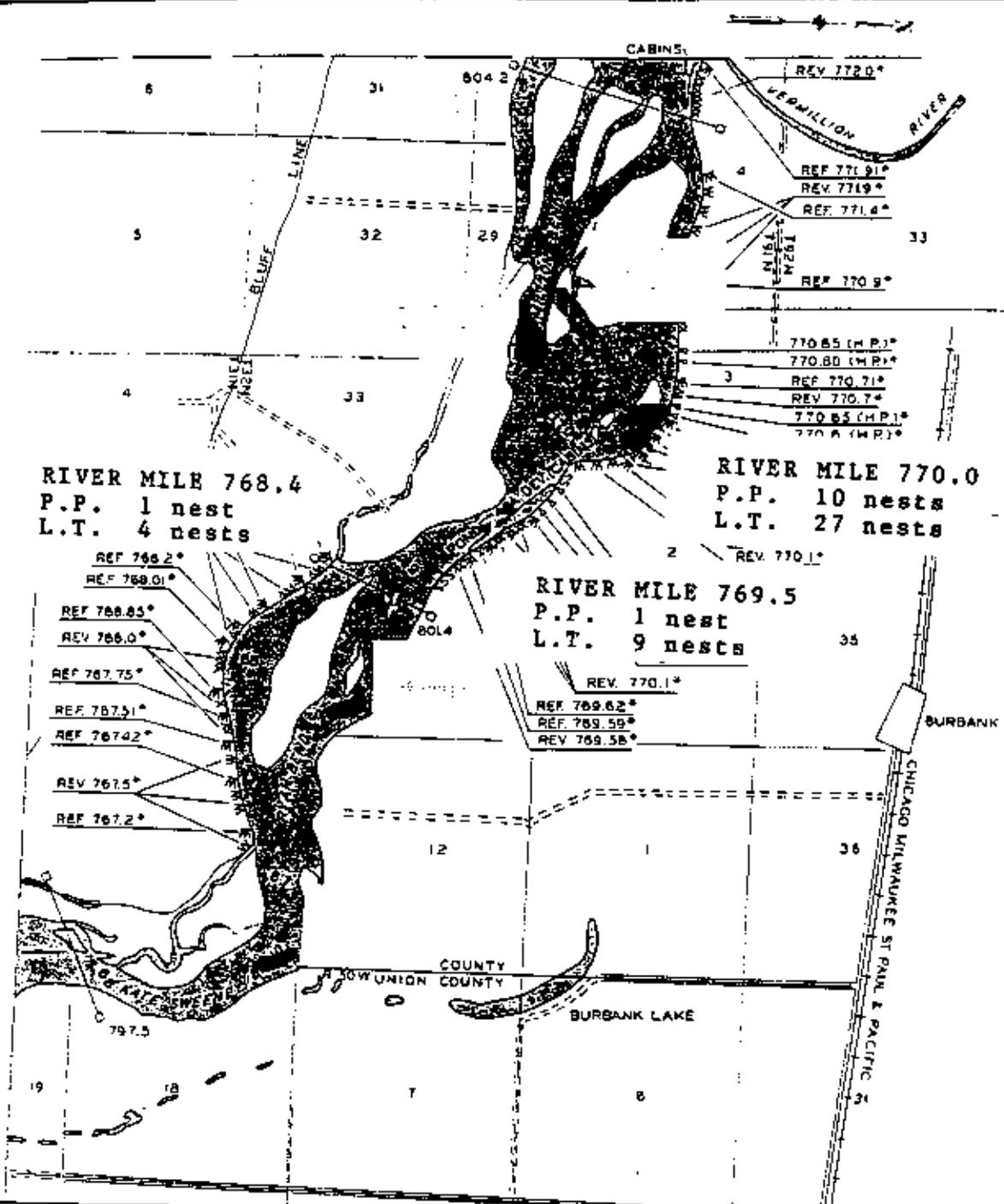
* Structure Number Based
On 1960 River Mileage



LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVETMENT OR REFUSAL
- COMPOSITE REVETMENT
- REINFORCED REVETMENT
- HARDPOINT
- BANK PROTECTION BY LOCALS
(E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)

MISSOURI RIVER
MISSOURI NATIONAL RECREATION RIVER
NEBRASKA AND SOUTH DAKOTA
GAVINS POINT DAM TO FONCA STATE PARK
MILE 790.6 TO MILE 793.9
U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
P.L. 8-5000-1
JULY 1980



RIVER MILE 768.4
P.P. 1 nest
L.T. 4 nests

RIVER MILE 770.0
P.P. 10 nests
L.T. 27 nests

RIVER MILE 769.5
P.P. 1 nest
L.T. 9 nests

1 SOURCE OF BANKLINE DATA
2 U.S.C. OF E. AERIAL PHOTOS

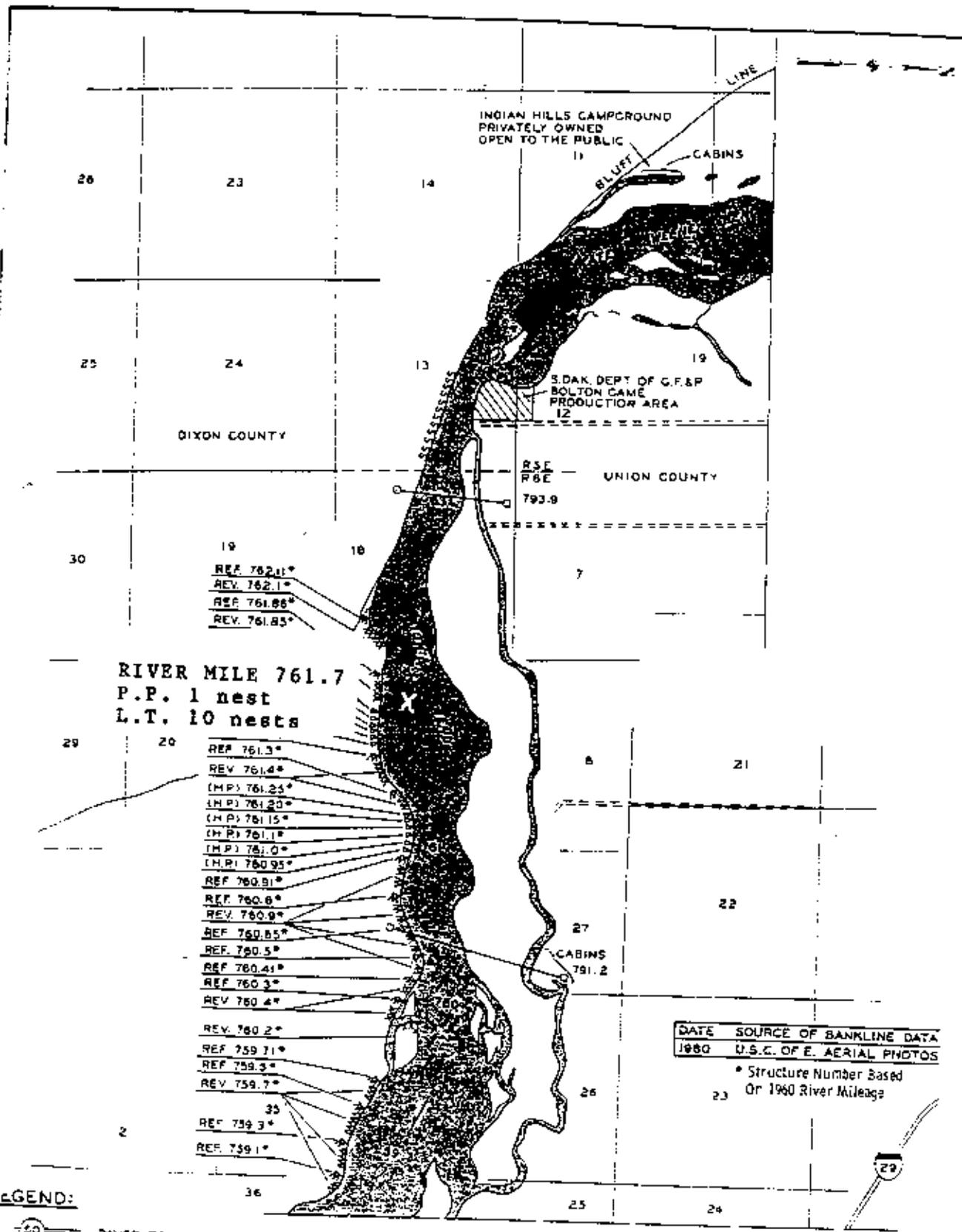
Section Number Based
on 1960 River Mileage

LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVETMENT OR REFUSAL
- COMPOSITE REVETMENT
- REINFORCED REVETMENT
- HARDPOINT
- BANK PROTECTION BY LOCALS
(E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)

SCALE IN FEET
0 2000 4000

MISSOURI RIVER
MISSOURI NATIONAL RECREATION RIVER
NEBRASKA AND SOUTH DAKOTA
GAVINS POINT DAM TO PONCA STATE PARK
MILE 771.9 TO MILE 758
N. STATE
U.S. ARMY CORP. DISTRICT OFFICE
P.O. BOX 100
MANKATO, MINN.



RIVER MILE 761.7
 P.P. 1 nest
 L.T. 10 nests

REF 762.11*
 REV 762.1*
 REF 761.86*
 REV 761.85*

REF 761.3*
 REV 761.4*
 (IMP) 761.25*
 (IMP) 761.20*
 (IMP) 761.15*
 (IMP) 761.1*
 (IMP) 761.0*
 (IMP) 760.95*
 REF 760.91*
 REF 760.8*
 REV 760.9*
 REF 760.85*
 REF 760.5*
 REF 760.41*
 REF 760.3*
 REV 760.4*
 REV 760.2*
 REF 759.71*
 REF 759.3*
 REV 759.7*
 REF 759.3*
 REF 759.1*

DATE	SOURCE OF BANKLINE DATA
1980	U.S.C. OF E. AERIAL PHOTOS

* Structure Number Based
 Or 1960 River Mileage

LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVESTMENT OR REFUSAL
- COMPOSITE REVESTMENT
- REINFORCED REVESTMENT
- HARPOINT
- BANK PROTECTION BY LOCALS
 (E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)

SCALE IN FEET
 0 2000 4000

MISSOURI NATIONAL RECREATION RIVER
 NEBRASKA AND SOUTH DAKOTA
 GAVINS POINT DAM TO PONCA STATE PARK
 RIVER MILE 761.7

