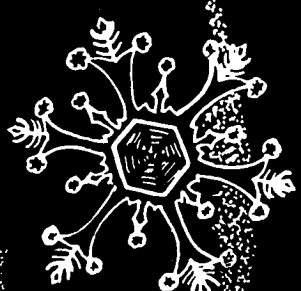
NORTH DAKOTA STATE WATER CONSERVATION COMMISSION



THIRTEENTH BIENNIAL REPORT

FOR THE PERIOD
JULY 1, 1960 – JUNE 30, 1962

THIRTEENTH BIENNIAL REPORT

of the

State Water Conservation Commission

and the

THIRTIETH BIENNIAL REPORT

of the

STATE ENGINEER

of

North Dakota

July 1, 1960 to June 30, 1962

BISMARCK TRIBUNE
4400

"Buy North Dakota Products"

MAPS, GRAPHS AND PICTURES

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COMMISSIONERS

Einar Dahl
Member
Watford City
Northwest District

Oscar Lunseth
Member
Grand Forks
Northeast District

Richard P. Gallagher
Vice Chairman
Mandan
Southwest District

Gov. William L. Guy
Chairman

Henry Steinberger
Member
Donnybrook
North Central District

Wm. Corwin
Member
Fargo
Southeast District

Math Dahl
Ex-Officio Member
Bismarck
Commissioner of Agriculture and Labor

LETTER OF TRANSMITTAL

Honorable William L. Guy
Governor of North Dakota

Dear Sir:

In compliance with the provisions of the laws of North Dakota, we transmit herewith for your information and consideration the Thirteenth Biennial Report of the North Dakota State Water Conservation Commission and the Thirtieth Biennial Report of the North Dakota State Engineer covering the period July 1, 1960, to June 30, 1962.

Respectfully submitted,

North Dakota State Water Conservation Commission
Oscar Lunseth, Vice Chairman
Richard P. Gallagher
Einar H. Dahl
Henry Steinberger
William W. Corwin
Math Dahl

Milo W. Hoisveen
Secretary and Chief Engineer
State Engineer

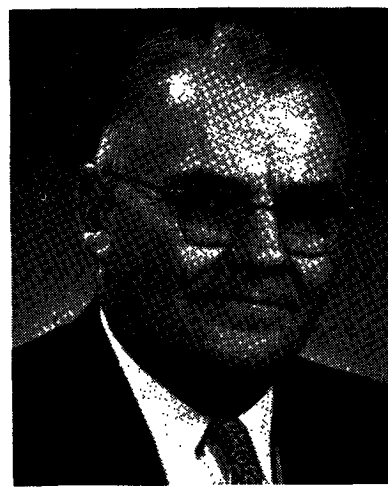
STAFF

Hazen A. Sandwick
Office Engineer

Merril Rivinius
Drainage Engineer

Delton Schulz
Field Engineer

Alan Grindberg
Construction Engineer



Milo W. Hoisveen
Chief Engineer and Secretary
State Engineer

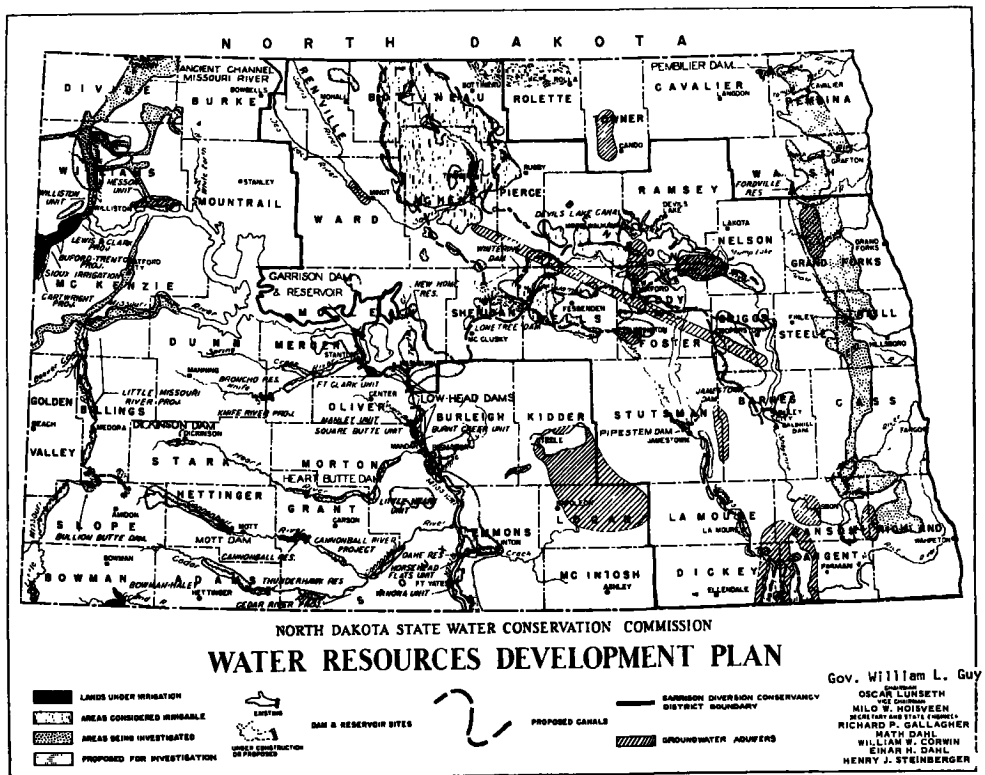
Vernon S. Cooper
Assistant Secretary

Victor E. Ziegler
Operations Engineer

C. Phillip Nelson
Investigations Engineer

Jim Schulz
Accountant

Chapter I
GENERAL DATA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CAVALIER
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ROLETTE
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Gov. William L. Guy
OSCAR LUNSETH
MILO W. HOISVEEN
RICHARD P. GALLAGHER
MATH DAHL
WILLIAM W. CORWIN
EINAR H. DAHL
HENRY J. STEINBERGER

ORGANIZATION OF THE COMMISSION

The North Dakota State Water Conservation Commission was created in 1937 by the 25th Session of the Legislative Assembly of North Dakota. The Governor was designated as ex-officio chairman of the Commission and was given authority to appoint six other qualified electors of the state to serve as members of the Commission. In 1939 the legislature reduced the number of members of the Commission to five including the Governor and in 1949 the Commission was increased in size to seven members including the Governor and the Commissioner of Agriculture and Labor. The Commission selects one of its members to serve as Vice Chairman.

The State Water Conservation Commission is presently composed of the following members:

Name	Appointed	Present Term Ends
Governor William L. Guy, Ex-Officio Chairman	Jan. 1, 1961	
Oscar Lunseth Vice Chairman, Grand Forks	May, 1,1951	July 1, 1965
Richard P. Gallagher Mandan	July 1, 1961	July 1, 1967
Einar H. Dahl Watford City	April 3, 1939	July 1, 1965
Henry Steinberger Donnybrook	July 1, 1961	July 1, 1967
William W. Corwin Fargo	July 1, 1957	July 1, 1963
Math Dahl, Commissioner of Agriculture and Labor, Ex-Officio Member	May 27, 1949	
Milo W. Hoisveen, Secretary and Chief Engineer, State Engineer	July 1, 1954	

The Commission meets at irregular intervals at the call of the Chairman, or, in his absence, of the Vice Chairman, either in the principal office at Bismarck, or at such special places as may be designated. During the period July 1, 1960 to June 30, 1962, the State Water Conservation Commission held 14 meetings in Bismarck and four meetings in other cities throughout the state.

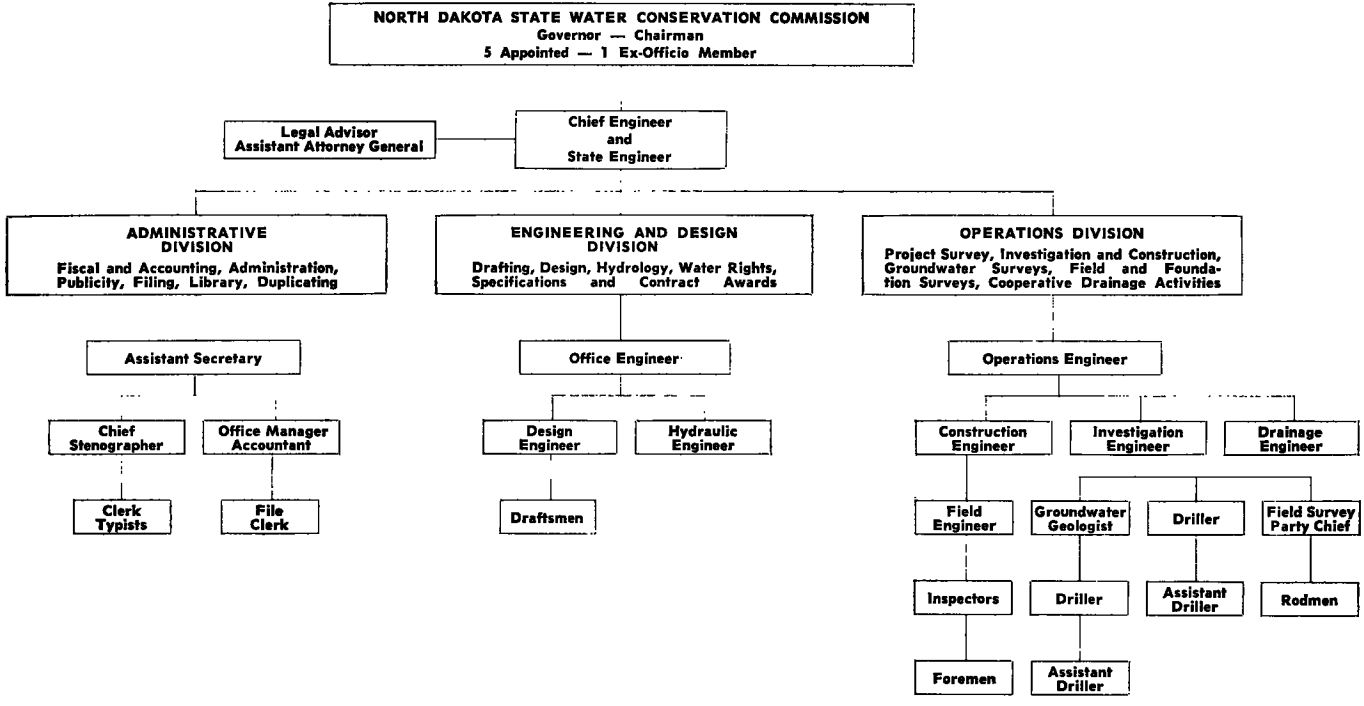
PERSONNEL EMPLOYED BY THE COMMISSION

Full time personnel employed by the Commission on June 30, 1962, are as follows:

Milo W. Hoisveen	Secretary and Chief Engineer, State Engineer
Vernon S. Cooper	Assistant Secretary
I. A. Acker	Special Assistant Attorney General
Hazen A. Sandwick	Office Engineer
Victor E. Ziegler	Operations Engineer
Alan Grindberg	Construction Engineer
C. Philip Nelson	Investigations Engineer
Merril Rivinius	Drainage Engineer
Delton Schulz	Field Engineer
Roger Schmid	Groundwater Geologist
Larry Froelich	Groundwater Geologist
Eugene Sackman	Surveyor
Don Schwinkendorf	Surveyor
Daniel Reiter	Construction Foreman
Howard Walterson	Construction Foreman
Pius Voeller	Assistant Construction Foreman
Lewis Knutson	Driller
G. Burkhartsmeier	Driller
Larry Anderson	Rodman
Roger Olheiser	Rodman
Virgle Engstrom	Rodman
Fred Frederickson	Planning Coordinator
Roy Putz	Office Assistant
Gordon Baesler	Chief Draftsman
Jean Walterson	Draftsman
Jim Schulz	Chief Accountant
Leone Hiland	Chief Stenographer
Rhoda Job	File Clerk
Helen Swenson	Clerk-Typist
Kathleen Bares	Clerk-Typist
Kay Liversage	Receptionist

In addition to the above personnel, the Commission usually employs several temporary employees to assist in engineering work during the summer season and several construction crews consisting of skilled operators, truck drivers, and laborers for work on the various construction projects undertaken by the Commission. A drill crew is maintained by the Commission on a seasonal basis to obtain data on ground water supplies throughout the state.

ORGANIZATION CHART



MEETINGS, CONFERENCES AND HEARINGS

During the period of this report the State Water Conservation Commission has met 18 times to take up routine business of the commission. At these meetings the commission met with various delegations to discuss matters pertaining to the water resources of the state and the development of these resources. Meetings were held at places indicated on the following dates:

August 4, 1960, Bismarck	August 7, 1961, Bismarck
October 24, 1960, Bismarck	September 22, 1961, Bismarck
November 9, 1960, Minot	November 15, 1961, Fargo
December 9, 1960, Bismarck	December 8, 1961, Bismarck
February 1, 1961, Bismarck	January 9, 1962, Bismarck
March 17, 1961, Bismarck	March 13, 1962, Bismarck
April 17, 1961, Bismarck	April 16, 1962, Bismarck
May 23, 1961, Bismarck	May 15, 1962, Bismarck
June 13, 1961, Rugby	June 4, 1962, Devils Lake

Commission members or employees of the commission have attended many meetings and held a number of hearings during the period of this report. The classification of those meetings is as follows:

One hundred eighty-five man days spent in conferences with city officials and local groups throughout the state on problems concerning municipal water supplies, pollution abatement, project investigation and construction.

Forty-one man days in speaking engagements before civic clubs, conservation training programs, Chambers of Commerce, television appearances and other similar groups.

Sixty-one man days in meeting with representatives of various federal agencies such as the Corps of Engineers, U. S. Army, Bureau of Reclamation and others.

Eighty-six man days spent in meetings on drainage problems with county drain boards and water conservation and flood control districts.

One hundred eighty-seven man days pertaining to Garrison Diversion Conservancy District and the establishment of irrigation districts under the Garrison Diversion Unit, including elections held for these irrigation districts.

Seventy-nine man days attending meetings of the North Dakota Water Users' Association, National Reclamation Association, Mississippi Valley Association, National Rivers and Harbors Congress, and others.

Twelve man days, Western States Engineers conferences.

Twenty-eight man days in meetings with officials of other States or Canada, in regard to joint development of water control projects.

Fifty man days for appearances before Congressional hearings held in Washington, D. C.

One hundred forty-three man days — exhibits.

Sixty-three man days attending meetings of the Missouri Basin Inter-Agency Committee and the Missouri River States Committee.

All of the above listed meetings and conferences are in addition to meetings of the State Water Conservation Commission and the regular duties of commission field employees involved in construction and investigation activities.

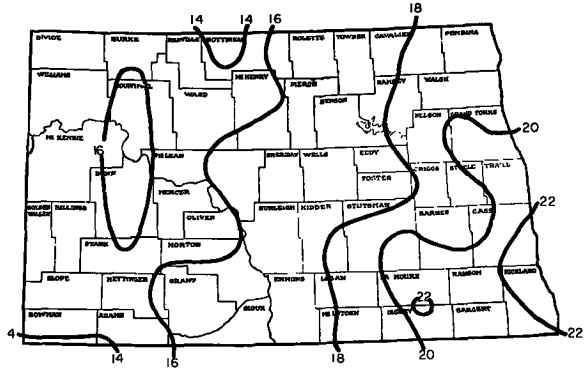
During the biennium over 4,100 people visited the Commission office. A summary of these visitors during the biennium by month is as follows:

Month	Out-of-state	Out-of-town	Local
July, 1960	16	60	60
August, 1960	11	80	100
September, 1960	7	45	89
October, 1960	4	73	112
November, 1960	16	36	67
December, 1960	4	69	87
January, 1961	7	110	58
February, 1961	6	141	69
March, 1961	21	84	72
April, 1961	9	89	85
May, 1961	10	79	151
June, 1961	20	130	106
July, 1961	29	71	79
August, 1961	31	113	82
September, 1961	25	79	78
October, 1961	10	106	51
November, 1961	11	65	69
December, 1961	12	55	48
January, 1962	8	97	75
February, 1962	7	72	56
March, 1962	9	84	69
April, 1962	8	72	79
May, 1962	17	115	57
June, 1962	6	69	50
	304	1,994	1,849

NORTH DAKOTA'S WATER RESOURCES

The economy of an area and consequently a nation is directly dependent upon its resources — its soil, water, mineral, wildlife, forest and human resources. The extent to which each is available in every area ranges widely throughout the nation — a factor that determines, to a great extent, the manner in which the resource is conserved and utilized. An abundance of land, water, forests or wildlife, often results in a careless attitude on the part of humans that leads to exploitation and waste of the various resources. The history of this nation bears out this fact. All civilizations and nations have prospered and remained strong as long as they have husbanded and guarded their natural resources but have deteriorated when they have neglected their resources.

North Dakotans for many years have recognized the importance of their resources. Vast expanses of fertile farmland stretching across this prairie state have been the basis for the predominant dry-land agricultural economy which has developed. North Dakota's extensive lignite coal deposits have long been recognized as a tremendous untapped power source for industrial and domestic use. Recently discovered oil resources are contributing to the economic growth and stability of the state. The state's waterfowl and wildlife resources are famous throughout the nation — in fact most of the ducks produced in the United States come from the prairie pothole region of North Dakota. The limiting factor in the utilization of these resources for a growing economy has been water — water for agriculture, water for industry, water for wildlife, water for people,



NORTH DAKOTA
AVERAGE ANNUAL PRECIPITATION (INCHES)

available in adequate quantity when it is needed and where it is needed — this is the key to North Dakota's growth and development.

The water resources available to man are limited. Our total water supply from our lakes, rivers, oceans, groundwater sources and in our atmosphere is unchanging — it is the same today as it was ages ago and as it will be in years to come. It is available in sufficient quantity to serve all man's needs if man learns to adapt himself to the water supplies received from time to time and place to place.

If the annual precipitation received in the United States were uniformly distributed over the country and if such a uniform distribution were received regularly when needed our water problems could be insignificant. Such is not the case. The nation-wide long-time average precipitation is 30". North Dakota's is 17". The precipitation in North Dakota is extremely erratic and seldom does it equal the average. For example during 1961 the total precipitation received in the northwestern part of North Dakota was 9.52 inches. During the first six months of 1962 the total received was 10.38 inches. These two facts point out the source of North Dakota's water problems — the limited amount of precipitation received that places much of North Dakota in a semi-arid classification and a wide variation in the timing of the precipitation from year to year and even season to season. It is of vital importance therefore, that ways be developed to conserve and utilize the available water resources of North Dakota as fully as possible and to serve the needs of the citizens of the state.

Water resources available to North Dakota come from several sources. The rainfall received is most significant for the state's dry-land agriculture. However, the waters of the rivers and streams that drain the state, (including several that have their sources in other states) are important and, when controlled and developed, will serve many needs. The waters from the state's many groundwater aquifers, more of which are being discovered each year, offer an important potential supply for agricultural and industrial use.

Surface Water

Geographically, North Dakota lies in two drainage basins. Approximately 41% of the state is drained into the Hudson Bay through the Mouse and Red Rivers and their tributaries and about 59% is drained into the Mississippi River and to the Gulf of Mexico through the Missouri River and its tributaries. Of the average annual precipitation received in North Dakota each year approximately three-fourths of an inch escapes from the state in surface run-off through these drainage systems. This average run-off amounts to 2½ billion gallons a day. This run-off plus the water that enters North Dakota through our interstate or international rivers less the amount that must be allowed to flow out of the state constitutes our manageable surface water supply.

The Missouri River

The Missouri River flows through 11 counties in western North Dakota and, with its tributaries, drains 59 percent of the western and central part of the state. It is the only river in North Dakota that can provide a reliable water supply for extensive development, primarily because it has its source in the mountains of Montana and Wyoming and carries much of the run-off from the melting mountain snows. Its major tributaries in the state are the Cannonball, Grand, Heart, Knife, Little Missouri, James, and Yellowstone Rivers. Of these rivers, only the Knife and Heart have their entire watershed within the state. The Missouri River has been harnessed by a series of multiple purpose dams. One of these, Garrison Dam, lies 77 miles above Bismarck. Another, Oahe Dam, when completed, will have a reservoir extending from Pierre, South Dakota, nearly to Bismarck.

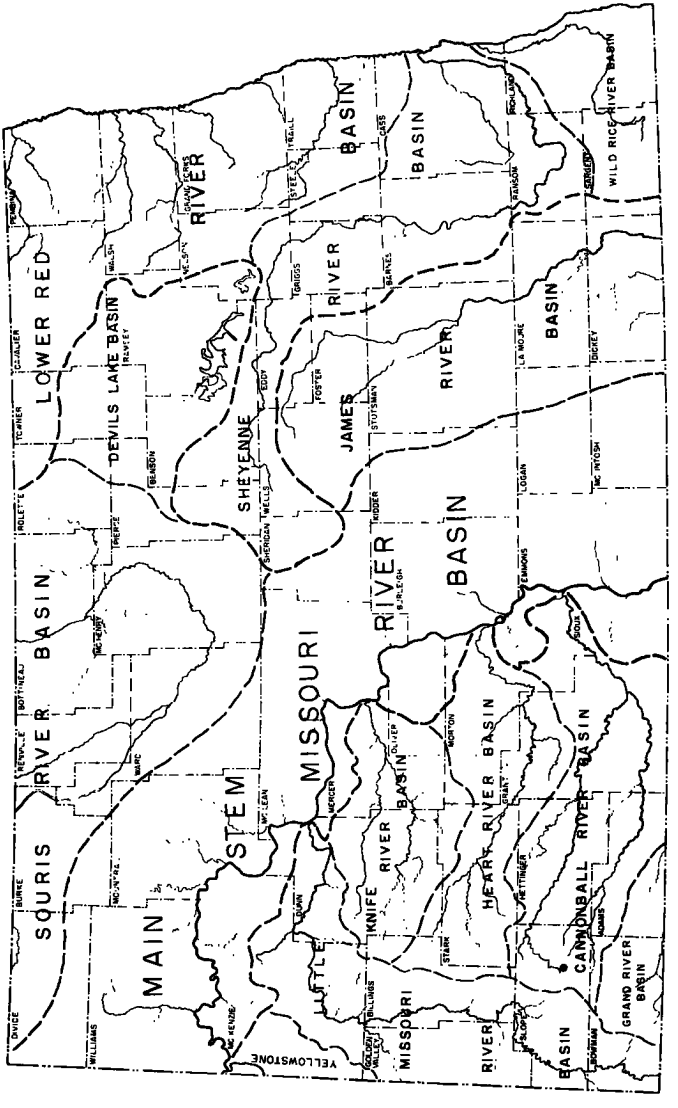
Dams on the Missouri's tributaries in North Dakota include the Heart Butte Reservoir on the Heart River 17 miles south of Glen Ullin, the Dickinson Dam on the Heart River about three miles west of Dickinson, and the Jamestown Reservoir on the James River about one mile north of Jamestown. These dams are a part of the Missouri River Basin project authorized by Congress in 1944 to control and harness the Missouri and its tributaries for several purposes.

The Red River

Extending north from the junction of the Bois de Sioux and Ottertail Rivers to Lake Winnipeg, the Red River of the North forms the eastern boundary of North Dakota. The river courses its way through the flat bottom of ancient glacial Lake Agassiz and during the spring run-off or periods of heavy rainfall it often floods large portions of the Red River Valley. In contrast, often during the summer months the Red has very little flow. The Red River of the North drains an area of 40,200 square miles in North Dakota and Minnesota. One of its tributaries, the Sheyenne, is the longest river in North Dakota, extending in a meandering course from its headwaters in Sheridan County to its confluence with the Red River in Cass County. Because of the extremely flat valley through which the Red winds its way, control of waters in the drainage basin is accomplished by dams on tributary streams. Among these tributary dams are the Baldhill Dam on the Sheyenne with a capacity of 116,500 acre-feet, the Homme Dam on the Park River with a usable capacity of 3,550 acre-feet, and the Orwell Dam on the Ottertail River with a maximum pool of 28,400 acre-feet. Other North Dakota projects such as Sharpe Lake Dam and Golden Lake diversion works impound larger quantities of water than found in Homme Dam.

The Souris River

The Mouse or Souris River enters North Dakota near Sherwood. It flows southward through four North Dakota counties and then loops back north entering Manitoba near Westhope. The Mouse River



NORTH DAKOTA RIVER BASINS

PREPARED BY STATE WATER CONSERVATION COMMISSION

drains 8,550 square miles of North Dakota. The river is subject to erratic flows that have been augmented to some extent by releases from reservoirs that have been constructed. Lake Darling Dam with a usable capacity of 108,500 acre-feet is the most important of these structures. Because the Mouse River is an international stream, control and jurisdiction over its waters rests with the International Joint Commission.

Lakes

Between one and two percent of North Dakota's 70,655 square miles are water area. Included in this area are man-made lakes or reservoirs and countless other natural lakes, serving recreation, irrigation, stock watering, industry, and human needs. Most notable of the natural lakes are Devils Lake in Ramsey County and Lake Metigoshe in Bottineau County. Devils Lake is the largest natural lake in North Dakota. From 1867 to 1940 the level of the lake receded 35 feet and since that time it has fluctuated considerably from year to year. Restoration of Devils Lake is contemplated in the Garrison Diversion Unit. Prominent among the man-made lakes are Garrison Reservoir, Lake Ashtabula (Baldhill Dam), Lake Tschida (Heart Butte Dam), Patterson Lake (Dickinson Dam), Jamestown Reservoir, and Lake Darling.

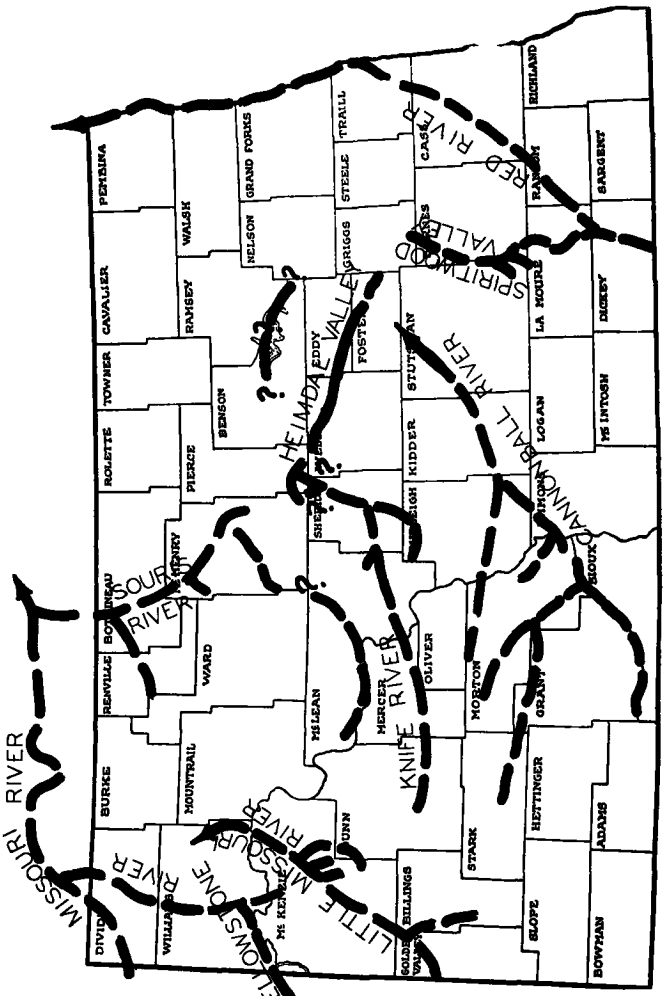
Because of the extreme variation in the flow of our rivers and streams, construction of dams is essential to store flood waters for release downstream for various beneficial purposes. The feasibility of the construction of such projects is dependent on many factors including the quantity and quality of the water supply; needs to be served, costs, dam and reservoir sites and others. Although control of several of our rivers and streams is now in reality because of major structures that have been built in recent years, the need exists for other projects of this nature in other areas of the state.

Groundwater

An important source of water is that found under the surface of the earth in layers and deposits of materials that are saturated with water. Such water is called groundwater and the water bearing minerals found under the surface of the earth are called aquifers or groundwater reservoirs.

The largest amount of fresh water in storage in the United States is contained in groundwater reservoirs — far more than is found in all surface reservoirs and lakes including the Great Lakes. It has been estimated that the total amount of useable water in groundwater reservoirs equals ten years annual precipitation or approximately 38,700 billion gallons.

Some areas of the earth are richly endowed with groundwater resources, others only poorly so. Probably North Dakota would have to be considered an in-between state. Although we have only begun to properly study and evaluate this vital resource in North Dakota, prospects appear bright for moderate to large-scale development of groundwater in a surprisingly large number of areas. On the other hand, the outlook appears somewhat less favorable for several other areas in the state.



POSSIBLE COURSES OF PRE-GLACIAL RIVERS IN NORTH DAKOTA

PREPARED BY STATE WATER CONSERVATION COMMISSION

The importance of groundwater to North Dakota can hardly be overstated. Practically the entire rural population obtains its needed supply of water through wells or from springs which are merely agents discharging groundwater naturally at the earth's surface. Most municipalities in North Dakota are supplied by groundwater. Some of the larger are Minot, Jamestown, Valley City and Devils Lake. Considerable quantities of groundwater are used by industry each year in the Fargo-Moorhead area. Small but rather spectacular beginnings have been made in some parts of the state in the development of groundwater for irrigation.

Groundwater in North Dakota occurs in several types of formations. An important source is the outwash deposits of glacial sand and gravel which were laid down during the glacial period by meltwater streams as they discharged from the edges of the ice sheet. Probably the largest of these deposits are found in south central North Dakota but extensive deposits also occur in other parts of the state, notably south of Devils Lake in Benson, Eddy and Nelson Counties. In places these deposits cover hundreds of square miles and are 100 feet or more thick. These outwash deposits probably contain the most productive aquifers in the state.

A second source of groundwater in North Dakota is the buried aquifers such as the deposits of sand and gravel that are found in ancient stream channels that have been buried with glacial drift. Prior to glaciation the drainage system of North Dakota had quite a different pattern than it does today. However, as the glaciers moved southward they disrupted this pattern. Stream valleys were blocked by ice and filled with glacial drift causing lakes to form and stream courses to be diverted, usually southeastward along the ice margins. Today most of the ancient valleys are completely masked by thick deposits of drift and their locations are determined mainly by test drilling and well data.

Ancient stream valleys in which groundwater aquifers are found include the Little Missouri and Yellowstone Rivers. As further investigations are conducted throughout the state it can be expected that other ancient channels will be discovered and traced out through test drilling.

The existence of groundwater aquifers is determined through the groundwater investigation program conducted cooperatively by the U. S. Geological Survey, North Dakota Geological Survey and North Dakota State Water Conservation Commission. This program was inaugurated in 1946 primarily to locate suitable supplies of groundwater for municipalities throughout the state that were experiencing critical water supply problems. In its original form the program was directed to investigations of limited areas that were located near the municipality concerned so that if a source of groundwater were discovered it would be within the financing ability of the municipality. Recently the program has been expanded to cover larger areas — generally entire counties. This more comprehensive program enables a more complete cataloging of the groundwater resources of the area and has resulted in some significant discoveries

of excellent groundwater aquifers. The groundwater investigation program is discussed more fully in another section of this report.

It is estimated that existing undeveloped groundwater supplies in North Dakota can supply 250 million gallons of water daily. Based on the national average per capita consumption for home and industry this amount of water would support from 166,000 to 170,000 more people. The availability of groundwater in scattered areas throughout the state can enhance agricultural, industrial and over-all economic development of these areas and consequently will benefit the economy of the state.

OBJECTIVES

Shortly after the State Water Conservation Commission was organized in 1937, it recognized water resource problems with which it would have to deal. In solving these problems certain goals were proposed for a water resource program. These goals still remain today as the objectives of the North Dakota State Water Conservation Commission. They include:

1. Water for human needs
2. Water for animal needs
3. Water for irrigation
4. Water for industry other than that available through municipal supplies
5. Water for recreation and wildlife
6. Water control to avert floods

Water for Human Needs

Throughout the United States the demand for water is ever increasing. Demographers estimate by 1980 the population of this country will reach or exceed 250 million people, and the use of water will have increased by 50 percent. It is estimated the domestic wa requirement for farm homes alone will increase from 14 million gallons a day at the present to 38 million gallons a day in 1980. The rapid growth of cities and the anticipated increased demand for water is expected to intensify the need to find and develop new sources of water for domestic and municipal use. The State Water Conservation Commission's groundwater investigation program coupled with its efforts to conserve and utilize surface supplies is directed toward this objective.

Water for Animal Needs

It is estimated that during the next fifteen years in the United States sheep production will need to be increased 25 percent and beef cattle production 50 percent in order to meet consumer demand. By that time livestock raisers will need an additional 68 million gallons a day to meet their needs. A more extensive livestock industry is expected to develop in North Dakota in the future and with it will come a need for a more constant flow in the streams of the state that can be provided through storage reservoirs as well as a greater use of water from underground sources through wells.

Water for Irrigation

With 250 million people in the United States by 1980, the demand for agricultural commodities will increase significantly. This population increase will result in a greater demand for meat products, vegetables and all cereal grains except wheat, even though the per capita consumption of such grains has declined. In addition, world markets can be expected to expand enabling the United States to export more food.

With this expected increase in demand and the constant reduction in the acres of available farm land a more intensified type of agriculture will develop. Approximately 96,000 acres are irrigated at the present time in North Dakota, many of them on a limited basis. Through the development of Garrison Diversion, a million acres more could be irrigated. Other projects can bring the total irrigated land to over 1,600,000 acres in 2025.

Development of Irrigation in North Dakota
(Acres)

Year	Individual Projects	Group Projects	Garrison Diversion Project	Total
1950	35,000	37,000	.....	72,000
1952	37,000	37,000	.....	74,000
1954	40,000	38,000	.....	78,000
1956	45,000	39,000	.....	84,000
1958	53,000	39,000	.....	92,000
1959	56,000	40,000	.....	96,000
1960	62,000	40,000	.....	102,000
1965	82,000	50,000	.....	132,000
1970	102,000	60,000	6,000	168,000
1975	117,000	75,000	68,000	260,000
1980	132,000	90,000	211,000	433,000
1985	147,000	110,000	339,000	596,000
1990	162,000	130,000	392,000	684,000
1995	182,000	150,000	456,000	788,000
2000	202,000	180,000	615,000	977,000
2005	222,000	210,000	783,000	1,215,000
2010	242,000	250,000	909,000	1,401,000
2015	262,000	290,000	982,000	1,534,000
2020	282,000	320,000	1,000,000	1,602,000
2025	302,000	350,000	1,007,000	1,659,000

Water for Industry

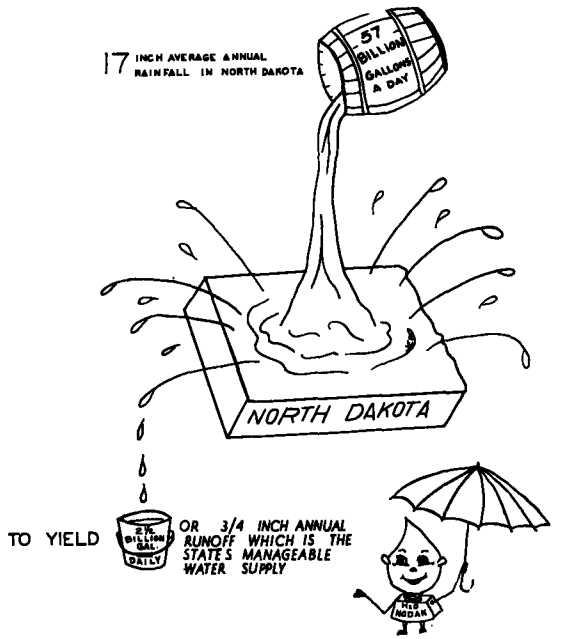
Hand in hand with increased productivity of agriculture through irrigation will come new industries to process the farm commodities. Such industries will require large amounts of water. Stored water, water diverted from the Missouri River and groundwater aquifers that can be developed can provide this need. Excellent industrial water supplies are available from the Missouri River and to a certain extent from the Red.

Water Control for Recreation and Wildlife

Water is a key factor adding to the enjoyment of most outdoor recreation activities. A national recreation survey revealed that 44 per cent of the population preferred waterbased recreation over any other. Even in landbased activities such as camping and picnicking, a lake or stream greatly enhances the recreational desirability of an area. Providing water recreation in the form of hunting and fishing has become big business. It is presently the third largest in the state, exceeded only by the agricultural and oil industries. The large dams and reservoirs and many of the small dams receive extensive recreational use. As our population increases and more free time becomes available to the nation's citizens a greater need for recreational areas will develop.

Flood Control

Flooding is a natural spring occurrence in North Dakota that causes extensive damage to life and property. Flood control can be provided through the construction of dams and reservoirs to store flood waters or by protective works such as levees. These facilities are an important phase of a water resource program. In our semi-arid state every effort should be made to conserve flood waters through storage reservoirs so that they will be available for future beneficial use.



RELATION OF RUNOFF AND RAINFALL

Since its establishment in 1937 the North Dakota State Water Conservation Commission has devoted its efforts to providing for the control, conservation, development and utilization of the water resources of the state. Several major projects that have been constructed in the state by federal agencies have been advocated and promoted by the Commission. These projects store flood waters that are available to serve several purposes. A list of the major water projects constructed in North Dakota by federal agencies is as follows:

Existing Storage Reservoirs

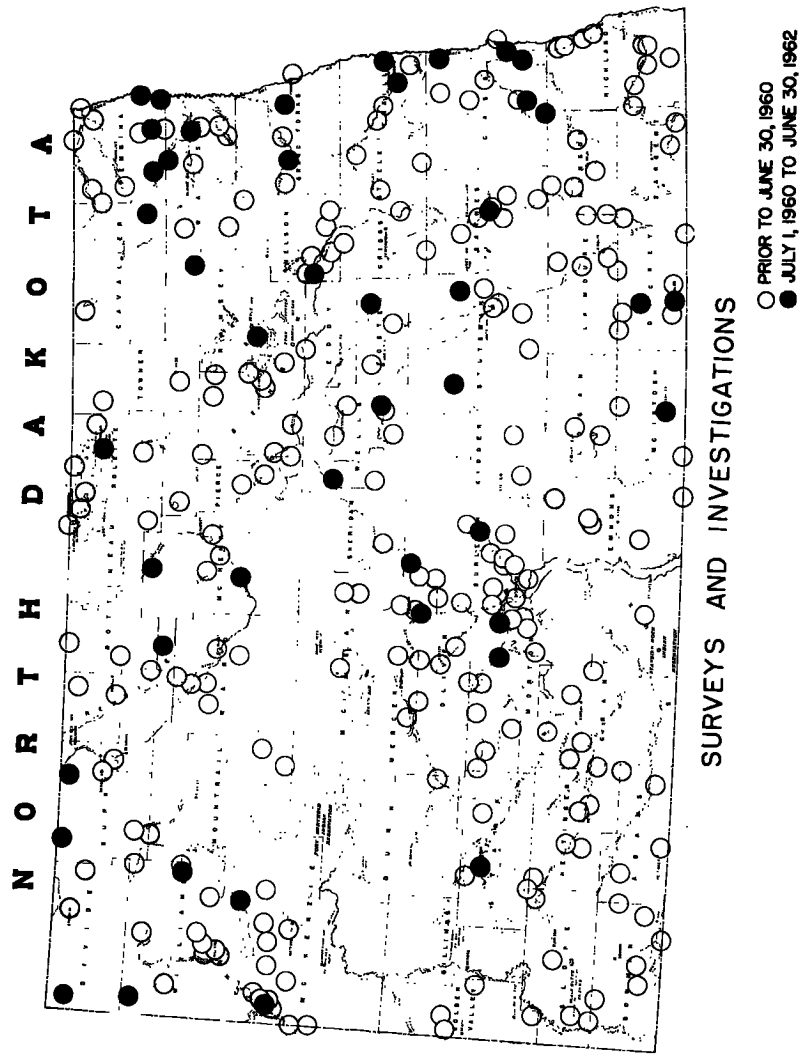
Name	Location	Cooperating Federal Agency	Capacity in Acre-feet	Use
Lake Darling	Northwest	U. S. Fish and Wildlife	112,000	Wildlife refuge and some flood control.
Garrison Dam	Northwest	Corps of Engineers	24,600,000 (2,640,000 now reserved for North Dakota)	Municipal water, irrigation, flood control, navigation, and power.
Dickinson Dam	Southwest	U. S. Bureau of Reclamation	9,500 flood, 4,000 active.	Irrigation and municipal.
Heart Butte Dam	Southwest	U. S. Bureau of Reclamation	428,000 flood, 225,000 active.	Flood control and irrigation.
Oahe Dam	Southwest	Corps of Engineers	23,000,000 reservoir in South Dakota extends into North Dakota	Municipal water, irrigation, flood control, navigation, and power.
Jamestown Dam	Southeast	U. S. Bureau of Reclamation	320,000 flood, 30,000 active.	Flood control, irrigation, and municipal.
Baldhill Dam	Southeast	Corps of Engineers	116,500 flood, 70,000 active	Flood control and municipal water.
Lake Traverse	Southeast	Corps of Engineers	137,000 flood, reservoir in South Dakota extends into North Dakota.	Flood control.
Homme Dam	Northeast	Corps of Engineers	6,700 flood, 3,650 active.	Municipal water supply.

There are a number of projects that have been proposed and investigated or are under consideration at the present time. The construction of these can serve an important function in the area in which they are located and, consequently, to the state. A partial list of potential storage dams and reservoirs that may be constructed in North Dakota is as follows:

Bowman Haley Dam, Pembilier Dam, Bullion Butte Dam, Pipestem Creek Dam, Broncho Dam, Mott Dam, Thunderhawk Dam, Green River Dam, Goose River Dam, Cannonball River Reservoir (Elgin), and Souris River Flood Control Works at Minot and Velva.

Chapter II

N. D. SWCC ACTIVITIES


NORTH DAKOTA
SURVEYS AND INVESTIGATIONS
○ PRIOR TO JUNE 30, 1960
● JULY 1, 1960 TO JUNE 30, 1962

THE STATE WATER RESOURCES PROGRAM

In accomplishing the objectives of the State Water Resources Program a variety of functions, duties, and responsibilities as specified in state law or authorized or directed by the North Dakota Legislature is involved. Generally the program of the State Water Conservation Commission covers the following points:

1. Collection of basic data.
2. Investigation, survey and planning of proposed water resources projects.
3. Construction and repair of dams, drains, and other facilities of water resources projects.
4. Co-ordination with Federal agencies engaged in water resources development in the State of North Dakota.
5. Cooperation with counties, water conservation and flood control districts, and other local organizations or entities in planning and construction of drains and other types of projects.
6. Organizing various types of legal entities through which water resources projects can be constructed and operated.
7. Administering the State Water Laws including the processing of water right applications received from various individuals, cities and industries.
8. Representing the State of North Dakota in compact negotiations with other states and with the International Joint Commission to determine the allocation and use of waters of international and interstate rivers and streams.
9. Representing the state at various conferences relative to the coordination of the activities of Federal and State agencies in water resources development in North Dakota and the Missouri Basin as well as in matters of interest from a national standpoint.
10. Fostering and promoting the development of water resources projects throughout the state that will bring new benefits to the citizens of North Dakota and to the Nation.

These various activities are discussed in the sections of this report that follow.

PROJECT FORMULATION

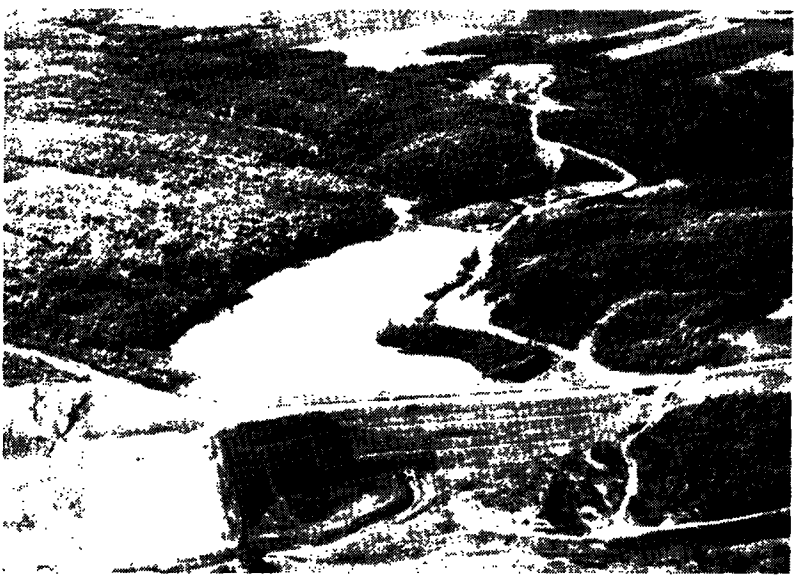
Every water resources project that is built is designed to provide the solution to a water problem or problems in an area and by so doing will provide one or more benefits to that area. The investment in a particular project, whether it be by public or private funds, is evidence of this fact. Each project that is built by a governmental agency, either Federal or State, is subjected to careful scrutiny and review to determine its engineering and economic feasibility.

Water problems that serve as the basis for the construction and development of a water resources project are set forth in the objectives

of the State Water Conservation Commission. Many water problems are local in nature, however, because a given river or stream may affect a large area, what is accomplished to control and utilize the waters of the river or stream in one area of the basin has a direct effect in other areas of the basin. In the construction and development of larger projects these basin-wide effects must be considered. Even in the development of the smaller water resources projects care often must be taken to avoid any major adverse effect that the project may have on either upstream or downstream areas.

In all types of projects consideration should be given to all the various benefits that might be served. Some projects that are designed primarily for flood control can serve other downstream needs if the flood waters are contained in storage reservoirs until they are needed in the downstream area for irrigation, municipal and industrial water supplies, recreation, stream flow improvement and other beneficial purposes. In most instances a project that is designed to serve several purposes will be easier to justify than one to serve a single purpose. The incorporation of several purposes in a project also assures that the operation of the project itself will be to the greatest benefit of the area in which the project is located and consequently the state and nation. In formulating water resources projects these matters must be taken into consideration by the project planners.

The determination as to who will build a water resources project is based on several factors. Most important of these are: 1. The nature of the benefits to be derived; 2. The recognized responsibility to con-



Senator Young Dam — Tongue River Watershed

struct projects of the nature contemplated; 3. The cost of the project. In the case of public projects the determination of whether a project will be constructed and developed by a Federal agency or by a State or local agency is generally made on the basis of the project costs although there are certain types of projects that are recognized as being the responsibility of the Federal Government regardless of the costs. Included in this category are flood control and navigation projects. In the case of irrigation, recreation, and municipal and industrial water supply projects, the state or local unit of government generally builds and finances those projects that are within its ability to finance. Larger projects are usually constructed by Federal Government agencies.

Whether a project is developed by a Federal or a State agency, it is usually conceived and inaugurated by the efforts of local individuals or groups to serve specific needs in an area. Usually these ideas or proposals are submitted to the State agency responsible for water resources development. If the proposal appears to have merit and is within the ability of that agency to undertake, financial and otherwise, the investigations, planning and development of that particular project is ordinarily undertaken by the State agency or jointly by the state and local agencies who have an interest in the particular project. If the proposal falls in the category of a project for which the responsibility is recognized as that of a Federal agency, the proposal is submitted to the appropriate Federal agency.

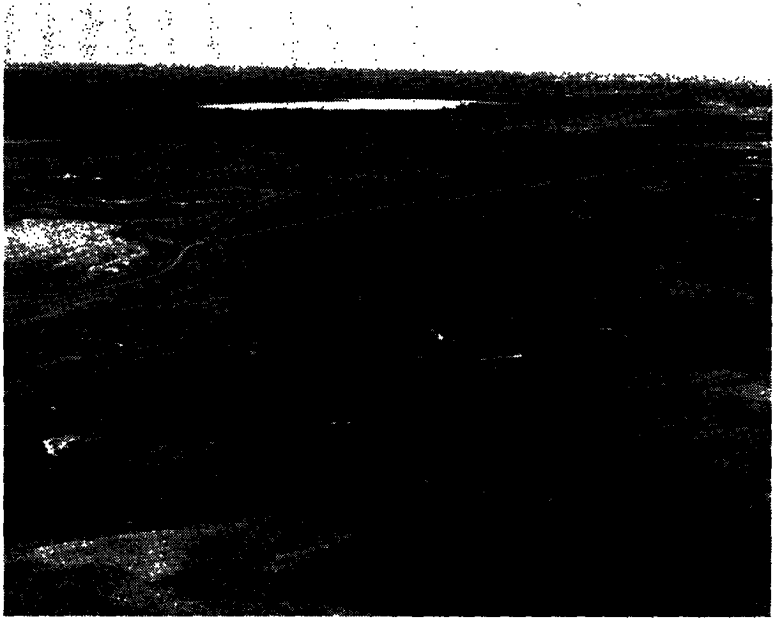
It can logically be said that because every feasible water resources project provides benefits to a certain segment of the economy or a certain area that it will benefit the entire nation, therefore, recognition of the responsibility of the nation to participate in the cost and development of the project is justified. On the other hand, there are many projects whose benefits are so local in nature that it must remain the responsibility of those who would receive the benefits to assume the entire responsibility for financing and developing the project. The main concern in such projects in relationship to other areas is that nothing is done in the development of a public water resource for those projects that will cause any significant adverse affect or interfere with the reasonable use by and rights of citizens in other areas to that public water resource.

Water resources projects that are undertaken by a Federal agency generally require a longer period of time to develop than do those that are undertaken by a state or local agency. In most cases Congressional authorization of the project investigation is necessary. Following the receipt of such authorization the Federal agency concerned embarks on a lengthy and time consuming investigation and analysis of the proposal which is financed by Congressional appropriations. This investigation is directed to determining whether or not the project proposal is engineeringly sound and economically feasible. Through the engineering investigation for the project, the estimated cost of its development is determined. The economic analysis of the

project is directed to a determination of the benefits that will accrue through its development. The cost of the project in relation to the benefits from the project constitutes the project's benefit-cost ratio which is usually expressed in a ratio of dollars and cents. Therefore a project with a ratio of one to one is said to produce benefits amounting to one dollar for every dollar cost of the project.

When the investigations and studies have been completed they are submitted to the appropriate department in Washington for review and recommendation. If approved by the department concerned the project report is submitted to the Bureau of the Budget for review and finally to the Congress for its consideration. The project proposal is again subjected to a review by the appropriate committees of both Houses of Congress. If it is approved by these committees, it is voted on by the entire Congress and if approved by both Houses of Congress and by the President, the project is authorized. Following authorization of a Federal project it is necessary to return to Congress and obtain appropriations to initiate and complete the construction of the project facilities.

There are several other steps involved before a Federal project is constructed including the completion of repayment contract negotiations or arrangements for local participation in the project in the form of assurances or agreements to perform the necessary operation and maintenance. These arrangements are made with local political subdivisions such as irrigation districts and water conservation and flood control districts who are authorized to enter into such agreements.



Golden Lake

Projects that fall in the category of state and local projects ordinarily are completed more rapidly than are Federal projects. One of the principal reasons for this fact is that the projects undertaken by these groups are ordinarily smaller in scope than those of Federal agencies. Insofar as the State Water Conservation Commission's program is concerned, a similar procedure is followed in investigating and determining the feasibility of projects as is followed in the case of Federal projects. Project proposals that are submitted from local groups to the Commission are first subjected to a reconnaissance survey to determine whether or not they merit further investigation. If such investigation is warranted a co-operative agreement is arranged with the local sponsoring group to complete the necessary surveys and studies of the proposed project.

The investigation of a project undertaken by a state or local agency is directed primarily to determining the engineering feasibility and cost of the project. The investigation itself includes topographic mapping and test drilling of sites for dams and other facilities for the project and the design of those facilities from which the estimated cost of the project is determined. Detailed economic analyses of projects to determine benefits is ordinarily not accomplished because the cost of the project and the willingness of the co-operators to share in these costs is considered an adequate recognition by the sponsors of the economic feasibility of the project. In other words, if the project sponsors feel that the project is worth the money that they will be required to invest in it they ordinarily are willing to proceed with the project. If they are not willing to make the investment, it can be construed that they do not feel the project will bring sufficient benefits to warrant its construction.

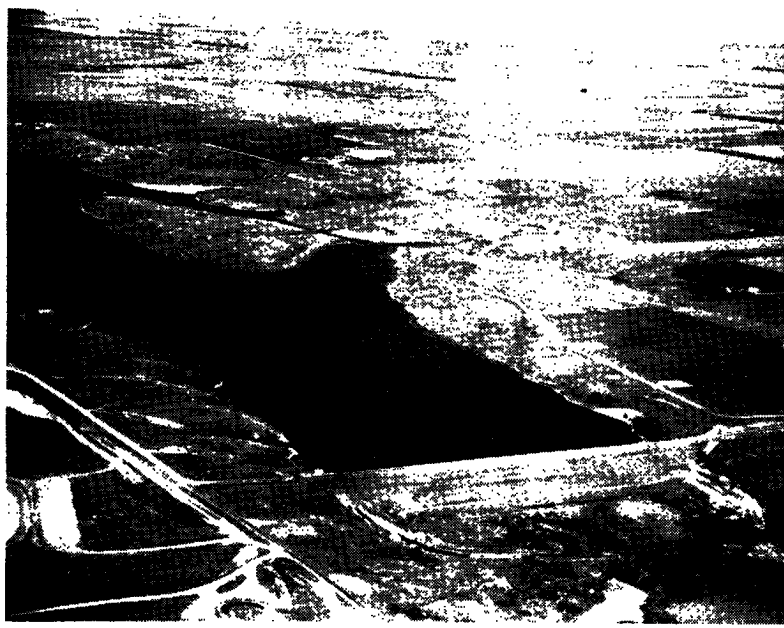
Review by the legislative branch of the government of water resources projects undertaken by state agencies is ordinarily not required. Responsibility for this review is ordinarily delegated by the legislature to the state agency concerned with the project. In the case of projects undertaken by the State Water Conservation Commission a review of the project proposal is accomplished by the State Water Commission at one of its regular meetings and approval of the project plan and financial arrangements is obtained from the Commission before proceeding with the project. The delegation of such authority and appropriation of funds to carry out a continuing program in project development by the Legislature results in a much more expeditious and prompt development of projects through the state agencies than is the case in conjunction with projects under various Federal programs.

Generally all projects constructed by the State Water Conservation Commission are cooperative ventures with other state or federal agencies and local organizations participating in the project costs. Among the state agencies cooperating in various water resources projects are the North Dakota State Game and Fish Department and the North Dakota State Highway Department. Local organizations or

entities cooperating in projects include counties, cities and towns, water conservation and flood control districts, drainage districts, and various voluntary organizations interested in a specific project. Federal participation in state projects has been obtained in the past through the U. S. Fish and Wildlife Service and the Corps of Army Engineers.

Water resources development is everyone's business. The interests of all groups should be recognized in all phases in the development of a water resources project — the initial proposal, the investigation and planning, the construction, and the operation and maintenance of the project. Regardless of who builds a project the local interest and responsibility in the development of that project should be recognized. The responsibilities of the Federal and state government are also an important factor and should be provided for in participation in the project cost and responsibilities for its development and operation.

The procedures followed by the State Water Conservation Commission in conjunction with its activities and the development of various types of water resources projects is covered in the next section of this report. These procedures have been developed over the years the Commission has operated and are subject to change and improvement as new problems and ideas are developed.



Jamestown Dam and Reservoir

NORTH DAKOTA
STATE WATER CONSERVATION COMMISSION ACTIVITIES

The activities of the North Dakota State Water Conservation Commission can be broken down into four broad categories. They are: (1) engineering investigations and planning; (2) construction; (3) compilation of basic data; (4) administration. Each of these phases of the Commission's program is important to the overall development of the State's water resources. The procedures followed by the Commission in each of these various functions are flexible to some extent to meet the situation that is peculiar to the type of project under consideration or the type of problem to be solved.

Engineering Investigations and Planning

General Investigations

Although the greater portion of the Commission's engineering program is naturally and necessarily devoted to specific water facility projects and water problems, it is desirable to exert a continuing effort for the general investigation and planning for an overall State Water Resources Plan. Involved in such a plan is an inventory of the State's land and water resources to provide the basic data necessary to evolve the various phases of the overall plan. Generally, this is accomplished through the cooperative programs with the U. S. Geological Survey and the compilation of basic data that is discussed in another section of this report. The investigation and planning for specific projects, whether they be by the State Water Conservation Commission or another Federal or State agency, can be incorporated in such overall planning. The Commission has from time to time devoted a certain portion of its efforts to making general investigations in various areas of the State. An inventory of potential dam and reservoir sites in the southwestern portion of the State was inaugurated several years ago to provide a "shelf of projects" for future potential development. In recent months the Commission has attempted to compile an overall drainage map of the Red River Valley areas to provide information as to the need for drains and the efforts of various man-made developments on the drainage pattern in this area. The Commission has a continuing program of collecting water samples of various surface water streams in this State from which information as to water quality is compiled. The development of such a state-wide water plan must be a continuing effort to meet the changing problems and needs in connection with the State's water resources.

At the present time there are numerous Federal and State agencies involved in various phases of water resources development. Each of these agencies is concerned primarily with one phase of water resources development such as flood control, irrigation, municipal and industrial water, and recreation. In every state a definite need exists for the coordination by one state agency of all of the water resources

planning and development accomplished by the various agencies to assure that the overall needs of the areas and the state as a whole are most fully met. The State Water Conservation Commission is constantly working with Federal and State agencies in an effort to achieve the fullest coordination and cooperation in the development of these water resources. All agencies recognize the need for this coordination and, although they have specific responsibilities in their programs, they recognize the importance in coordinating their activities with those of other agencies and groups to meet this overall need. Although it is perhaps inconceivable that one agency could be provided with the financial means to fully coordinate all activities dealing with water resources throughout a state, a greater effort in this phase of water resources planning is desirable. Much duplication of effort could thereby be eliminated and fuller utilization of the limited water resources of the State of North Dakota could be provided through the development of multiple purpose water resources projects.

State Water Commission Survey Crew

Individual Project Investigation and Planning

The greater portion of the Commission's investigation program is devoted to specific water resources projects and problems. Project proposals ordinarily originate with local groups or organizations. These are stimulated by water problems that have developed because of a surplus or a deficiency of water or because of a specific need that exists in the area in which the project is located.

A project proposal which is submitted to the Commission from a local group is first subjected to a field inspection to determine the local interest and whether or not the proposal appears feasible enough to warrant further detailed investigations. If such interest and investigation warrants further consideration of the project, the local proponents are requested to make a deposit of $200 that will be applied to the cost of the investigation. If the project is built, this contribution is included in the local sponsor's share of the project cost when the final allocation is made.

Before the investigation is undertaken the approval of the State Water Conservation Commission is obtained unless the project is of an emergency nature. The investigation made by the Commission includes topographic and hydrographic studies of the area and, if a dam is involved, a foundation study of the site.

The Commission's investigation of a project varies depending on the nature of the project. However, every project investigation requires a certain amount of topographic mapping and surveying. Accurate information is essential relative to the topography of the area to determine the most desirable location of structures and canals as well as to determine capacities, right-of-way requirements, and other essential data relative to the proposed project. In conjunction with the project investigations the Commission also accomplishes the test drilling necessary to determine the suitability of foundation materials for the structures required. In conducting their foundation studies the Commission utilizes drill rigs capable of penetrating the various layers beneath the surface of the earth to determine whether they are sand, clay, rock, or a mixture of these materials. This information is important in arriving at the final decision as to whether or not various sites are satisfactory for the type of structures that will be required for the project.

The Commission maintains two topographic surveying crews and one drill crew in its investigation department. These crews are maintained on a year round basis and spend considerable time in the field conducting investigations of various projects.

After the data from the field investigation has been obtained it is turned over to the design section of the Commission to prepare a preliminary design and cost estimate of the project facilities. This design and cost estimate is essential for further negotiations with the various project proponents. It is from this information that the financial arrangements for the project's construction and development are

made. The data gathered during the field investigation of the project are compiled on maps and drawings prepared by the design section and are then available in a form that can be utilized to determine the capacity and type of structures required for the project. The plans for structures which appear most feasible are carefully analyzed to determine their adequacy, cost, and utility. A hydrologic study of the area is made to determine the adequacy of the water supply and the size of the water control structures needed. The hydraulic characteristics of the proposed structures are studied to insure that they will meet all needs for their expected life without being excessive in size or prohibitive in cost. Details analyzed include the structure size, weight, the hydraulic uplift, strength, stability, weather hazards, etc.

The design department in their preparation for a plan for the project also takes into consideration the lands required for project reservoirs for which easements, rights-of-way, or purchase is required.

Frequently projects in which the State Water Conservation Commission participates are financed on a cooperative basis by the Commission, the State Game and Fish Department, if there are wildlife benefits to be derived, and the local sponsoring group. These cooperative and financial arrangements are negotiated before construction of the project is undertaken. The share of the project costs and the responsibilities of the various agencies or groups in connection with the project are all set forth in an agreement which is signed by all parties involved. The State Water Conservation Commission's participation in a project is subject to review and approval of the Commission before the project is undertaken. The information compiled by the design section in the plans for the project also serves as a basis for invitations for bids for project facilities construction. The actual construction of the project is the responsibility of the construction section as they supply the inspection and supervision necessary to carry it on to completion.

During the past biennium plans, specifications, and bid invitations for 12 water control structures were completed by the design section. In addition plans for 13 other projects are in various stages of completion. Involved in this work was the preparation of over 260 maps and drawings by the design section.

Underground Water Investigations

During the past biennium the State Water Conservation Commission has assumed the responsibility for conducting cooperative groundwater investigations for various individual cities and towns throughout the state in an effort to locate a municipal water supply from groundwater sources for such municipalities. Requests for such surveys usually originate with the consulting engineer or city engineer representing the city involved. These underground water investigations are in addition to those conducted under the U. S. Geological Survey cooperative groundwater program. They are designed to

serve a specific city, town or community and therefore are more limited in nature than the county-wide surveys conducted in cooperation with the U. S. Geological Survey.

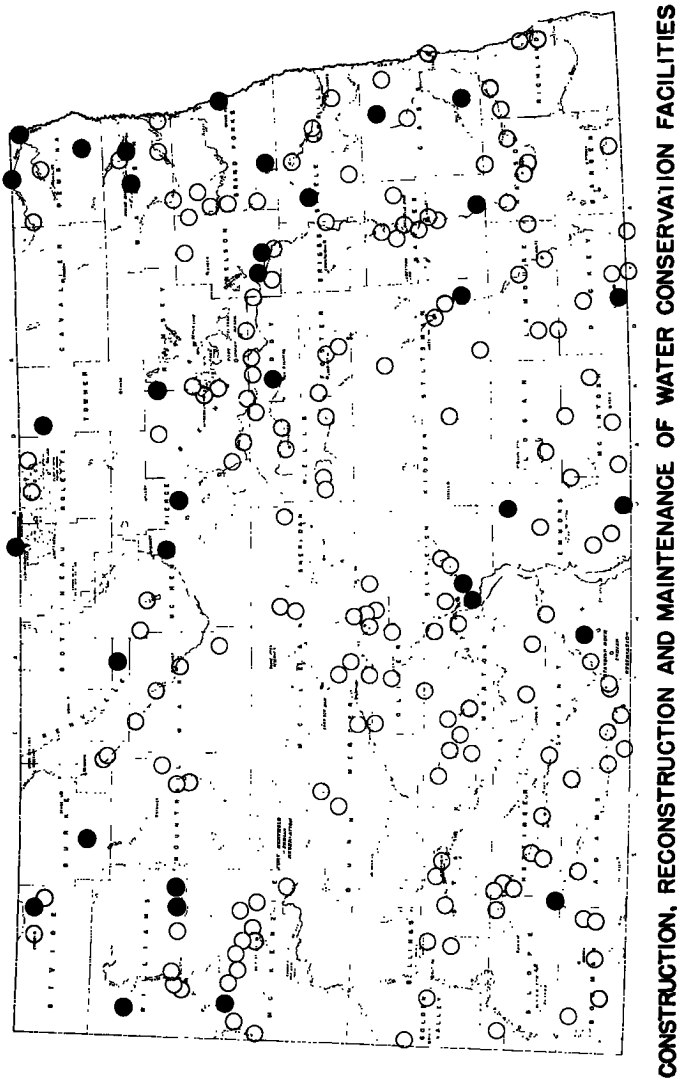
These surveys are financed on a 50-50 basis by the municipality and the State Water Conservation Commission. In addition the Commission has conducted investigations of several of the ancient stream channels throughout the State to determine the availability of groundwater from these sources for irrigation, industrial, and other types of development.

Construction of Water Facility Projects

The State Water Conservation Commission maintenance and construction department consists of two engineers who supervise the Commission's maintenance and construction activities and two maintenance crews who repair and build the facilities for various types of water projects. These crews are trained and experienced in the repair and construction of dams and other types of structures required for water resources projects. The Commission has acquired the necessary equipment, much of which is specialized, for the type of maintenance involved. Included are air compressors and air tools, a dragline, bulldozer, pile driving hammers, concrete forms, pneumatic concrete application equipment, trucks, and other necessary miscellaneous equipment. The Commission endeavors to contract for the heavy earth moving and riprap required for the projects. In some cases this work is accomplished by the County with their road building equipment and the use of this equipment is contributed as the county's share of the project cost. The actual repair and construction of the spillways for dams and other structures required for the project is ordinarily accomplished by the Commission's maintenance crews, although in the case of dams utilizing highway embankments this work is contracted for with private contractors. The construction of water resources projects, whether accomplished entirely by the Commission or under contract, is supervised by the maintenance and construction department of the State Water Commission.

Another phase of the work accomplished under the direction of the Commission construction department is the repair of existing structures. Many of the small dams built during the 1930's are in the need of constant maintenance and repair. The Commission utilizes modern pneumatic concrete application machinery to repair these structures in cooperation with various local groups. Such work is usually done on a force account basis by Commission crews.

When a project has been completed it is turned over to the local project sponsor or the State Game and Fish Department for operation. The maintenance of water facility projects is probably more specialized than any other type of maintenance. As a result, Commission engineers make periodic inspections of these projects. This gives the Commission a better opportunity to determine maintenance requirements and thereby extend the life expectancy of such structures.


NORTH DAKOTA
CONSTRUCTION, RECONSTRUCTION AND MAINTENANCE OF WATER CONSERVATION FACILITIES
● JULY 1, 1960 TO JUNE 30, 1962
○ PRIOR TO JUNE 30, 1960

Basic Data Compilation

An important facet of water resources planning and development is that of collecting and compiling basic data relating to the water resources. Generally basic data refers to the preparation of topographic maps showing the land features and configuration of areas of the state, the gathering of information as to stream flows referred to as hydrographic surveying, and the assembly and inventory of information relating to underground water resources. The Commission has presently three cooperative programs with the U. S. Geological Survey dealing with basic data compilation. Much of the essential information needed for the planning and development of any project by the Commission is obtained from these cooperative programs. In addition, the information gathered by the Commission in their investigation endeavors are often utilized in providing further details and data that augments that collected under the U. S. Geological Survey Cooperative Programs.

Administration of State Water Program

There are many activities concerned with the administration of the state water laws and the state water resources program. Included are the processing and granting of water right applications, maintaining necessary financial records relating to the Commission's activities, public relations work devoted to providing accurate and up-to-date information on water resources plans and developments in the state for the citizens of the state and participation in numerous conferences and meetings with local groups, State and Federal agencies, and hearings before congressional committees relating to water resources development in North Dakota. Each of these activities and functions are discussed in the following sections of this biennial report.

Project Summary

Projects on which the Commission worked during the 1960-1962 biennium are summarized as follows:

EATON DAM — PROJECT No. 227

Nature of Project: Repair.

Location: Seven miles southwest of Towner, McHenry County.

Type of Structure: Two rows of structural steel sheet piling with 8 — 72 inch gated metal pipes.

Purpose: Flood irrigation of 8,000 acres of hay land.

Condition Before Repair: Backfill around wing of dam washed out.

Repair Work Accomplished: Washed out area backfilled with well compacted clay.

Costs and Sponsor: $6,186.07 shared by the Eaton Flood Irrigation District and the State Water Conservation Commission.

OLSON-HARDIE FLOOD IRRIGATION PROJECT No. 251

Nature of Project: Investigation.

Location: Along Mouse River, North of Verendrye, McHenry County.

Purpose: To determine feasibility of establishing a flood irrigation project.

Status: Topographic survey commenced July, 1961. Scheduled date for completion of investigation — indefinite.

Sponsors: Landowners and State Water Conservation Commission.

JACKSON DAM — PROJECT No. 253

Nature of Project: Repair.

Location: Ten miles west of Alexander in McKenzie County.

Type of Structure: Gravity section spillway with rolled earthfill embankment.

Purpose: Recreation.

Condition Before Repair: Concrete spillway spalling and cracked.

Repair Work Accomplished: Spillway resurfaced and reinforced with structural coat of pneumatically applied concrete.

Costs and Sponsors: $9,564.43 shared by McKenzie County and the State Water Conservation Commission.

BRADDOCK DAM — PROJECT No. 264

Nature of Project: Repair.

Location: Five miles southwest of Braddock in Emmons County.

Type of Structure: Rubble masonry gravity section with earthfill embankment.

Purpose: Recreation.

Condition Before Repair: Sheet piling stilling basin partly washed out.

Repair Work Accomplished: Washed out piling replaced, piling wall extended and rock fill replaced.

Costs and Sponsors: $525.97, shared by Emmons County and the State Water Conservation Commission.

OLSON DAM — PROJECT No. 260

Nature of Project: Investigation.

Location: About 15 miles northeast of Wilton, North Dakota, in Burleigh County.

Purpose: Investigation of proposed dam site for replacement of original CCC dam that failed.

Status: Investigation completed. Proposed site found unsuitable because of limited reservoir depth it would provide.

NECHE DAM — PROJECT No. 274

Nature of Project: Repair and Construction.

Location: On the Pembina River in the city of Neche in Pembina County.

Type of Structure: Rubble masonry gravity section spillway.

Purpose: Municipal water supply, park enhancement and swimming.

Condition Before Repair: Rubble loosening, concrete spalling and insufficient reservoir capacity.

Repair Work Accomplished: Spillway and wing walls given maintenance coat of pneumatically applied concrete, spillway crest raised 2½ feet with gunite concrete and flashboard installed to increase reservoir capacity.

Costs and Sponsors: $11,595.82, shared by Neche and the State Water Conservation Commission.

PEMBINA CITY DAM — PROJECT No. 299

Nature of Project: Construction.

Location: In the city of Pembina on the Pembina River.

Type of Structure: Rubble masonry, gravity section spillway.

Purpose: Municipal water supply.

Work Accomplished: The spillway crest elevation was raised three feet with the use of pneumatically applied concrete and flashboards to allow the storage of additional water for use during periods of low flow.

Costs and Sponsors: $4,016.27, shared by the city of Pembina and the State Water Conservation Commission.

LAKE METIGOSHE — PROJECT No. 330

Nature of Work: Construction of dam, a part of the over-all project development.

Location: Approximately 17 miles north of Bottineau, North Dakota, in the Turtle Mountains, Bottineau County.

Purpose: Recreation, fish and wildlife propagation and park enhancement.

Scope of Project: The State Water Conservation Commission in cooperation with the local water conservation and flood control district has developed a long range improvement project for Lake Metigoshe to provide a means to maintain the level of Lake Metigoshe at a relatively constant elevation even during drouth periods. In the previous biennium the construction of Sharpe Lake Dam was completed which provides a water supply that can be diverted and released into Lake Metigoshe as needed. During the past biennium the improvement program was devoted to the replacement of the control dam at the outlet of Lake Metigoshe. The structure that was replaced was badly deteriorated. The new spillway includes

provision for the installation of flashboards through which the level of the lake can be raised an additional foot if desired by the local sponsors of the project. The dam that was constructed has a drop of 3′ and a spillway crest length of 70′. It controls the flow from Lake Metigoshe into Oak Creek which eventually empties into the Souris River.

Costs and Sponsors: The Project was sponsored by the State Game and Fish Department, the Oak Creek Water Conservation and Flood Control District and the State Water Conservation Commission. Total cost of the project was $11,495.34 which was shared equally by the sponsors.

EPPING DAM — PROJECT No. 346

Nature of Project: Repair.

Location: Seven miles southwest of Epping in Williams County.

Type of Structure: Rubble masonry spillway with plain concrete chute and rolled earthfill embankment.

Purpose: Recreation, fish propagation and waterfowl habitat.

Condition Before Repair: Chute beginning to break up and separate at the joints.

Repair Work Accomplished: A four-inch reinforced pneumatically applied concrete slab placed on deck and walls of the chute and voids grouted.

Costs and Sponsors: $11,417.52 shared by the State Game and Fish Department, Williams County and the State Water Conservation Commission.

Epping Dam — Repair Work in Progress

CEDAR DAM — PROJECT No. 353

Nature of Project: Repair.

Location: On the Cedar River, 17 miles north of Reeder in Slope County.

Type of Structure: Concrete gravity spillway with earthfill embankment.

Purpose: Recreation and fish, waterfowl and wildlife propagation.

Condition Before Repair: Rock riprap had washed down and embankment was eroding.

Repair Work Accomplished: Additional riprap placed on embankment to provide protection from erosion.

Costs and Sponsors: $4,309.96, shared by the State Game and Fish Department and the State Water Conservation Commission.

BALTA DAM — PROJECT No. 362

Nature of Work: Construction.

Location: Near village of Balta in Pierce County.

Purpose: Recreation and fish and wildlife propagation.

Scope of Work: Dam consisting of rolled earthfill embankment 800 feet long and reinforced concrete arch spillway with loop of 16 feet. Dam replaces former WPA structure that had failed. Remaining embankment of previous dam was incorporated in new structure. The impoundment created covers 108 acres and has maximum depth of 18 feet. Construction work was started in June, 1960 and completed in July of that year.

Sponsors and Cost: Total cost of project was $32,273.89 that was shared by Pierce County, State Game and Fish Department and the State Water Conservation Commission.

MONANGO DAM — PROJECT No. 386

Nature of Project: Investigation.

Location: About two miles south of Monango in Dickey County.

Purpose: To locate a site of proposed dam on Maple River that could be used for recreational purposes.

Status: Topographic mapping of site of existing dam and reservoir in Sec. 20, Twp. 131, Rge. 63 completed and other possible sites reviewed from aerial photos. Detail studies and cost estimates of reconstructing original dam will be made.

Sponsors: West Dickey County Water Conservation and Flood Control District.

LAKE JUANITA DAM — PROJECT No. 443

Nature of Project: Investigation.

Location: Two miles east of Grace City in Foster County.

Purpose: To investigate feasibility of raising level of Lake Juanita for recreation purposes.

Status: Topographic map of lake completed and foundation test drilling of possible dam sites made. Limited benefits from raising lake level and foundation materials at possible dam sites resulted in determination that proposal investigated for the construction of dam and raising of lake would be too costly.

Sponsor: Grace City Sportsmen's Club.

SYKESTON DAM — PROJECT No. 450

Nature of Project: Investigation.

Location: One mile north of Sykeston in Wells County on Pipestem Creek.

Purpose: To locate site for new dam to replace existing badly deteriorated structure that is used for recreational purposes as well as a reservoir for municipal water supply.

Status: Topographic survey and soil foundation study completed for suitable site about one-fourth mile downstream from existing structure. Design for new dam completed, easements have been obtained and construction scheduled for fall of 1962 or spring of 1963. Estimated cost $42,000.

Sponsors: Wells County Water Conservation and Flood Control District and State Game and Fish Department.

SPIRITWOOD LAKE IMPROVEMENT — PROJECT No. 461

Nature of Project: Investigation.

Location: About 15 miles northeast of Jamestown in Stutsman County.

Purpose: To investigate possibility of raising and stabilizing level of Spiritwood Lake, a popular recreation area.

Status: Available data from aerial photos and USGS topographic maps studied and report on feasibility of project proposal made. Because of limited contributing drainage area and high construction cost raising and stabilizing lake level by improving drainage into lake determined infeasible.

Sponsors: Spiritwood Lake Association and State Game and Fish Department.

GOLDEN LAKE RESTORATION — PROJECT No. 475

Nature of Project: Investigation and Construction.

Location: Northeastern Steele County near Hatton.

Purpose: Recreation area.

Status: Golden Lake has been restored through construction of a diversion dam on Beaver Creek with canals for diverting water to the lake. A dike was constructed in May, 1962, at the North end of Golden Lake to prevent flooding and to allow raising the lake

level two feet. Further development of the North Golden Lake is being planned as funds become available. Approximately 4,200 acre-feet of water was diverted from Beaver Creek during the spring of 1962 for use in Rush Lake and Golden Lake. Rush Lake is used as a wildlife propogation and shooting area. It has a surface area of 286 acres. Golden Lake covers an area approximating 340 acres. It is used as a recreational lake being devoted to fishing, boating and swimming. Crowds approximating 3,000 people are attracted to the lake on weekends.

Sponsors: Golden Lake Restoration Corporation, State Game and Fish Department, and State Water Conservation Commission. $1,617.13 cost of dike was borne by the three sponsoring agencies.

VALLEY CITY MILL DAM — PROJECT No. 477

Nature of Work: Investigation.

Location: On Sheyenne River in city limits of Valley City.

Purpose: Utilized in connection with recharging aquifer from which Valley City obtains municipal water supply and in connection with operation of municipal electric plant.

Status: Inspection indicated abutments of dam in poor condition. Topographic survey of dam site and test drilling for foundation studies completed to provide basic data if necessary to replace dam.

Sponsor: City of Valley City.

LAKE HOSKINS — PROJECT No. 484

Nature of Work: Investigation.

Location: About three miles west of Ashley in McIntosh County.

Purpose: Determine possibility of maintaining level of lake at near spillway crest. Lake provides popular recreation area.

Status: Drainage area into lake studied and hydrologic map prepared wtih recommendations made to local sponsor of actions that can be taken to improve such drainage.

Sponsor: McIntosh County Fish and Wildlife Club.

RAY DAM — PROJECT No. 489

Nature of Work: Repair.

Location: Nine miles south of Ray in Williams County.

Type of Structure: Corrugated metal pipe glory hole spillway, and earth embankment.

Purpose: Fish propagation and recreation.

Condition Before Repair: Seepage through south abutment resulting from a coal seam.

Repair Work Accomplished: A trench cut through seepage vein of coal which was backfilled with well compacted clay.

Costs and Sponsors: $3,040.53, State Water Conservation Commission.

PETERSON DAM — PROJECT No. 495

Nature of Work: Repair.

Location: Three miles southwest of Pekin in Nelson County.

Type of Structure: Rubble masonry gravity section spillway.

Purpose: Recreation, fish propagation.

Condition Before Repair: Spillway settled and cracked, rocks in gravity section loose and missing.

Repair Work Accomplished: A maintenance coat of pneumatic concrete applied to entire structure, voids filled with pneumatic concrete, spillway crest leveled and flashboard installed.

Costs and Sponsors: $5,875.43 shared by Nelson County and the State Water Conservation Commission.

ELM RIVER DAM — PROJECT No. 501

Nature of Work: Design.

Location: On Elm River, seven miles west of Ellendale in Dickey County.

Purpose: Design of structure for dam and spillway that can be utilized as crossing of State Highway No. 11 over Elm River.

Status: Investigation, survey and design complete. Structure will consist of highway fill that will be used as embankment for the dam and a glory-hole type spillway. Reservoir will cover 188 acres and have a capacity of 1,068 acre-feet. Scheduled for construction in 1962.

Sponsors: West Dickey Water Conservation and Flood Control District, State Water Conservation Commission, and North Dakota State Game and Fish Department will share the estimated $63,000 costs.

NIEUWSMA DAM — PROJECT No. 512

Nature of Work: Repair.

Location: Six miles southwest of Hague in Emmons County.

Type of Structure: Rubble masonry cap and clay core spillway and earthfill embankment.

Purpose: Recreation.

Condition Before Repair: Spillway surface cracked and rocks loose in rubble masonry.

Repair Work Accomplished: Spillway given maintenance coat of pneumatically applied concrete.

Costs and Sponsors: $7,148.45, shared by Emmons County, State Water Conservation Commission, and State Game and Fish Department.

RIVERSIDE PARK DAM — PROJECT No. 520

Nature of Work: Repair.

Location: On the Red River in the city of Grand Forks.

Type of Structure: Timber crib spillway with concrete deck and chute.

Purpose: Municipal water supply and pollution control.

Condition Before Repair: Voids in abutments of spillway allowing seepage around dam.

Repair Work Accomplished: Voids pressure grouted.

Costs and Sponsors: $1,205.61, shared by the city of Grand Forks and the State Water Conservation Commission.

KELLY SLOUGH — PROJECT No. 527

Nature of Work: Investigation.

Location: About five miles northeast of Grand Forks Air Force Base in Grand Forks County.

Purpose: To investigate possibility of creating impoundment in Kelly Slough area for recreational purposes.

Status: Detailed topographic mapping and foundation test drilling has been completed. Facilities for proposed project include diversion dam in Saltwater Coulee to be used to store water and divert it to Kelly Lake. Lake created would cover 736 acres and contain about 6,000 acre-feet of water. Development of project deferred until results are known on alkalinity studies to determine effect of restoration of Kelly Slough on surrounding land.

Sponsor: Kelly Lake Improvement Association.

VIGNESS DAM — PROJECT No. 546

Nature of Work: Repair.

Location: On the Park River in Grafton in Walsh County.

Type of Structure: Concrete channel dam with flashboards.

Purpose: Municipal water supply.

Repair Work Accomplished: Flashboards protected against ice by addition of steel edges.

Costs and Sponsors: $139.17, shared by Grafton and the State Water Conservation Commission.

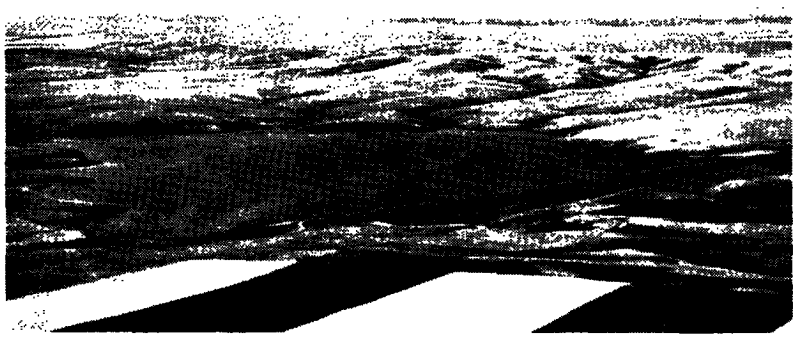
WILDWOOD LAKE RESTORATION — PROJECT No. 550

Nature of Work: Investigation, design and preconstruction activities.

Location: Along the Missouri River in McLean County about nine miles south of Washburn, North Dakota.

Purpose of Project: To restore Wildwood Lake, which since the construction of Garrison Dam has not received an annual water supply from the Missouri River floods and therefore has receded to an excessive extent.

Status of Project: In 1957 the State Water Conservation Commission investigated the Wildwood Lake Project and devised a means to restore the lake by diverting water into Wildwood Lake from Painted Woods Creek and constructing a control structure at the outlet of Wildwood Lake to regulate the lake level. Problems relative to local easements prevented the development of this project at that time. The following year local proponents obtained and installed a pump on the Missouri River to pump water from the river into the lake. This method of providing a water supply for Wildwood Lake was costly and was unsatisfactory and was abandoned after the fall of 1959. In 1960 and 1961 a renewed interest was expressed in the original plan for restoration of Wildwood Lake by the various local proponents. Congress appropriated $35,000 to the Corps of Engineers to share in the cost of this project because the recession of Wildwood Lake was attributed directly to the construction of Garrison Dam. The State Water Conservation Commission and local project proponents would be required to pay the other half of the project costs. Construction of the project has been deferred pending settlement of differences among local project proponents as to the amount of public access that should be made available to the lake itself.



Blacktail Dam

BLACKTAIL DAM — PROJECT No. 560

Nature of Work: Construction.

Location: Twenty-five miles northwest of Williston in Williams County.

Type of Structure: Earthfill embankment and trickle tube spillway with natural emergency spillway.

Purpose: Fishing, recreation and waterfowl habitat.

Work Accomplished: Slopes and emergency spillway finished. Embankment raised two feet and a four-foot section added to outlet of trickle tube spillway.

Costs and Sponsors: $3,956.13, shared by the Williams County Park Board, State Game and Fish Department, and State Water Conservation Commission.

TIOGA DAM — PROJECT No. 561

Nature of Work: Investigation.

Location: About one-half mile north of Tioga in Williams County.

Purpose: To investigate possibility of constructing dam for municipal water and recreation purposes.

Status: Topographic survey of reservoir area, foundation test drilling and preliminary design completed. Area resurveyed in 1962 to establish specific levels of reservoir in relation to new developments adjacent to planned reservoir.

Sponsor: City of Tioga.

SMISHEK LAKE DAM — PROJECT No. 575

Nature of Work: Repair.

Location: Five miles northwest of Powers Lake in Burke County.

Type of Structure: Earthfill embankment using stream bed as a natural spillway.

Purpose: Swimming, boating, fishing and waterfowl habitat.

Condition Before Repair: Downstream slope of embankment eroding.

Repair Work Accomplished: Downstream slope of embankment flattened.

Costs and Sponsors: $1,124.97, shared by the Burke County Water Conservation and Flood Control District and State Water Conservation Commission.

SHORT CREEK DAM — PROJECT No. 586

Nature of Work: Investigation and design.

Location: Six miles northeast of Columbus in Burke County.

Purpose: Investigation to determine feasibility of constructing new dam for recreation and fish and wildlife purposes to replace old WPA dam that is deteriorated beyond repair.

Status: Topographic and foundation survey completed from which it was determined that new dam should be located one and one-fourth miles downstream from old structure. Design for dam is complete and provides for selected rolled earthfill embankment 600 feet long and concrete chute-type spillway with 30-foot drop. Reservoir will have maximum depth of 30 feet. Estimated cost $54,000.

Sponsors: Burke County Water Conservation and Flood Control District, State Game and Fish Department, and State Water Conservation Commission.

SHEYENNE RIVER DIVERSION — PROJECT No. 599

Nature of Work: Investigation.

Location: South of West Fargo in Cass County.

Purpose: To provide a means to divert water from the Sheyenne River as released from Baldhill Dam to a point where it can be utilized by the City of Fargo for their municipal water supply.

Status of Project: When Baldhill Dam was constructed in the late 1940's provision was included in the project for an allocation of a portion of the water stored in the reservoir to the City of Fargo for municipal use. The City of Fargo made a substantial contribution to the Corps of Engineers for this project for the water supply that they would receive. In order for Fargo to utilize the stored water supply that they have in Lake Ashtabula it is necessary for them to provide a means to transport the water from the Sheyenne River to their municipal water supply intake. The present plan being composed is to construct a diversion dam in the Sheyenne River south of West Fargo and divert the water into Cass County Drain No. 27 by a one-mile canal and then into the Red River from where the City of Fargo will obtain the water through its present water intake. An alternate plan being investigated is to pipe the water from the diversion dam directly to the water plant in Fargo, thereby reducing the releases from Lake Ashtabula which will otherwise be required to meet increased seepage and evapo-transpiration in the Red River. Still another proposal that is being considered is the recharging of the groundwater aquifer in the vicinity of Fargo from which the city could pump the water into their municipal system. This proposal would require considerable study to determine its ultimate effect on the aquifer. It does afford several advantages in that the stored water would be free from evaporation and contamination. Studies and negotiations of the various ways to utilize a water supply available to Fargo from Lake Ashtabula are presently being made by the Commission.

CRYSTAL MUNICIPAL WATER SUPPLY — PROJECT No. 600

Nature of Work: Investigation.

Location: Cart Creek and Coulee in vicinity of Crystal in Pembina County.

Purpose: Investigate various possibilities to provide suitable municipal water supply for City of Crystal.

Status: Topographic and foundation test drilling completed for dam and reservoir on Cart Creek but reservoir and available water supply that could be provided determined inadequate for municipality's needs. As a result of further studies an impoundment on the Coulee south of Crystal that could be used by the city of Hoople also recommended for study and is presently being investigated.

Sponsors: City of Crystal.

ROSENQUIST DAM — PROJECT No. 612

Nature of Work: Repair.

Location: Twelve miles northeast of Crosby in Divide County.

Type of Structure: Rubble masonry gravity section.

Purpose: Recreation.

Condition Before Repair: Surface of spillway was cracked and rocks in structure became loosened. Considerable erosion had occurred next to the wings of the spillway.

Repair Work Accomplished: The spillway was given a maintenance coat of pneumatic concrete and the eroded areas were riprapped.

Costs and Sponsors: $8,015.06, shared by Divide County and the State Water Conservation Commission.

HUNTER DAM — PROJECT No. 619

Nature of Work: Repair.

Location: In the city of Hunter in Cass County.

Type of Structure: Reinforced concrete spillway with earthfill embankment.

Work Accomplished: Slopes and top of embankment finished and seeded.

Costs and Sponsors: $741.97, shared by Hunter and the State Water Conservation Commission.

ELLENDALE CITY DAM — PROJECT No. 615

Nature of Work: Construction.

Location: Two miles south of Ellendale in Dickey County.

Purpose: Municipal water supply.

Scope of Work: Low head surface dam constructed above underground dam which had been constructed by the State Water Conservation Commission in 1959 to impound water in a ground water aquifer from which city obtains its water supply. Surface dam which permits impoundment of larger quantity of water for municipal use consists of 19,000 cubic yards embankment of selected rolled earthfill, a

concrete box outlet, and spillway of 48 feet of 84-inch reinforced concrete pipe, and 715 cubic yards of rock riprap.

Sponsors and Costs: State Water Conservation Commission and City of Ellendale shared the total cost of $18,434.99.

McVILLE RAILROAD DAM — PROJECT No. 616

Nature of Work: Construction.

Location: One-half mile east of McVille in Nelson County.

Purpose: Municipal water supply and recreational use.

Scope of Project: The McVille Dam was built to replace a former railroad dam that had served to maintain the level in a coulee sufficiently high to recharge the groundwater aquifer from which the city of McVille obtained its water supply. This dam was constructed in conjunction with the rebuilding of Highway No. 15 east of McVille. A highway embankment was utilized as an embankment for the dam. In addition to the highway embankment the dam consists of a glory-hole type spillway formed by a vertical, rectangular concrete block and a 96" corrugated metal pipe outlet. The dam creates a reservoir with a maximum depth of 25 feet which covers an area of 33 acres and contains 354 acre-feet of water. The reservoir

Froelich Dam

recharges the groundwater aquifer to a greater degree than the previous dam and improves the groundwater reservoir from which the city of McVille obtains its water supply.

Sponsors and Costs: Sponsors of the project are the State Game and Fish Department, City of McVille and State Water Conservation Commission. The total cost of the project $36,354.21 which was shared equally by the cooperators.

ANCIENT CHANNELS OF THE MISSOURI RIVER — PROJECT No. 617

Nature of Work: Groundwater Investigations.

Location: In northwest North Dakota in Williams, McKenzie, Burke and Divide Counties.

Purpose of Project: To define the ancient channels of the Missouri River and tributaries thereof to determine if such channels are groundwater aquifers that can provide a groundwater supply for various uses.

Status of Project: Geologists have established that the Missouri River at one time flowed north and emptied into the Hudson Bay, although the definite channel of this ancient water course has not been established. The channel of the Missouri River was changed to its present course by the glacier moving down from the north and blocking off the ancient channel. It is believed that the glacier deposited huge quantities of rock and gravel in this ancient channel that would provide an excellent groundwater aquifer which, if developed, could supply water for irrigation and industry in this area of the state. From various types of exploratory and investigational work that have been conducted in this vicinity it appears that one of the ancient channels of this river system is in the vicinity of the Little Muddy River, north of Williston. The State Water Conservation Commission is conducting test drilling operations in this vicinity in an effort to trace out the ancient channel. From these investigations it is indicated that a considerable quantity of groundwater exists in the aquifers covered in this area. Arrangements have been made with Divide County and Williams County for county-wide groundwater surveys in order to obtain complete data on these aquifers. These groundwater surveys will be conducted cooperatively by the State Water Conservation Commission, N. Dak. Geological Survey, U. S. Geological Survey, and the Counties concerned.

RICE LAKE — PROJECT No. 622

Nature of Work: Investigation.

Location: About 11 miles north of Sterling, Burleigh County.

Purpose: Restoration of former slough area that had been drained for wildlife purposes.

Scope: Topographic survey of slough was made by State Water Conservation Commission which was used by project sponsors in

acquiring title to land that would be inundated by the slough restoration. Dam at outlet to lake was designed and constructed in 1961 without State Water Conservation Commission assistance.

Sponsor: Missouri Slope Chapter of Isaak Walton League.

FROELICH DAM — PROJECT No. 627

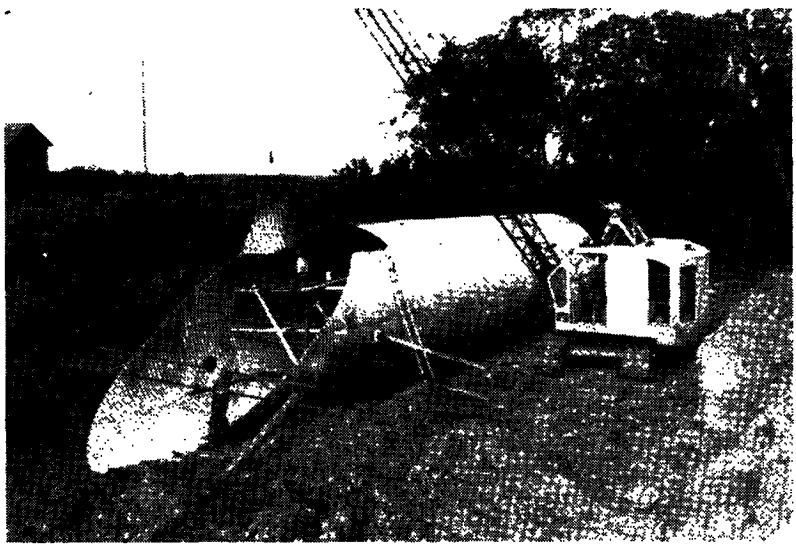
Nature of Work: Construction.

Location: Eleven miles northwest of Selfridge in Sioux County.

Purpose: Recreation, fish and wildlife propagation.

Scope of Work: Embankment consisting of 110,000 cubic yards of select rolled earthfill and a 24-inch trickle tube overflow spillway through embankment was completed in 1961. Two thousand and fifty cubic yards of rock riprap placed on embankment in late fall. Dam creates reservoir which, when full, will cover 170 acres and contain 2,200 acre-feet of water with a maximum depth of 33 feet. A sod emergency spillway is also provided.

Sponsors and Cost: Total cost of project was $59,600 which was shared by Sioux County, Bureau of Indian Affairs, Selfridge Sportsmen's Club, North Dakota State Game and Fish Department, and State Water Conservation Commission. Recreation area development will be accomplished by local sponsoring groups.



Antler Dam — Under Construction

ANTLER DAM — PROJECT No. 632

Nature of Project: Investigation, Design and Construction.

Location: One and one-half miles north of Antler in Bottineau County.

Purpose: Investigate and design dam that can be used for recreation and municipal fire protection purposes.

Status: Topographic and foundation surveys completed. Design of new structure provides for 7,000 cubic yards rolled earthfill embankment that will serve as a roadway, with a concrete drop inlet and a 14½-foot structural pipe under the embankment that will serve as the spillway. Total estimated cost of $42,000 to be shared by the State Water Conservation Commission, the City of Antler and Bottineau County. Construction began in June, 1962.

Sponsors: Antler, Bottineau County, and State Water Conservation Commission.

TOBACCO GARDEN IRRIGATION — PROJECT No. 638

Nature of Work: Investigation and test drilling.

Location: About 15 miles north of Watford City in McKenzie County.

Purpose: To investigate the irrigation potential from a groundwater aquifer located in the ancient channel of the Little Missouri River in this area.

Status of the Project: Groundwater investigations conducted by the State Water Conservation Commission indicated that the ancient channel of the Little Missouri River located in this area had the potential of providing an abundant supply of groundwater for irrigation purposes. A great deal of interest was indicated by local farmers in utilizing such a water supply if available for this purpose. Arrangements were made by the Commission for the construction of a large diameter irrigation well that could provide a water supply for several farmers.

In connection with the test drilling for the location of such well, it was determined that the water from the aquifer was unsuitable for irrigation and therefore the installation of the large diameter well was abandoned.

SWEETBRIAR CREEK DAM — PROJECT No. 642

Nature of Project: Investigation:

Location: Section 11, Township 139 North, Range 84 West, seven miles east of New Salem, Morton County.

Purpose: Recreation, fish and wildlife enhancement, and flood control, provided by Interstate Highway No. 94 creating a 3,300 acre-feet reservoir.

Status: In design at State Highway Department.

Sponsors: Morton County Park Board, State Highway Department, State Game and Fish Department, and State Water Conservation Commission.

YPSILANTI DAM — PROJECT No. 649

Nature of Project: Repair of dam.

Location: On the James River in the city of Ypsilanti in Stutsman County.

Type of Structure: Rubble masonry gravity section.

Purpose: Fishing and swimming.

Condition Before Repair: Masonry structure breaking up and wing walls deteriorated.

Repair Work Accomplished: Wing walls rebuilt and structure given a maintenance coat of pneumatic concrete.

Costs and Sponsors: $8,314.66 shared by Stutsman County, State Game and Fish Department, and State Water Conservation Commission.

BOWBELLS STONEY CREEK DAM — PROJECT No. 650

Nature of Project: Investigation.

Location: Burke-Renville County line east of Bowbells.

Purpose: Recreational area and possible municipal water supply.

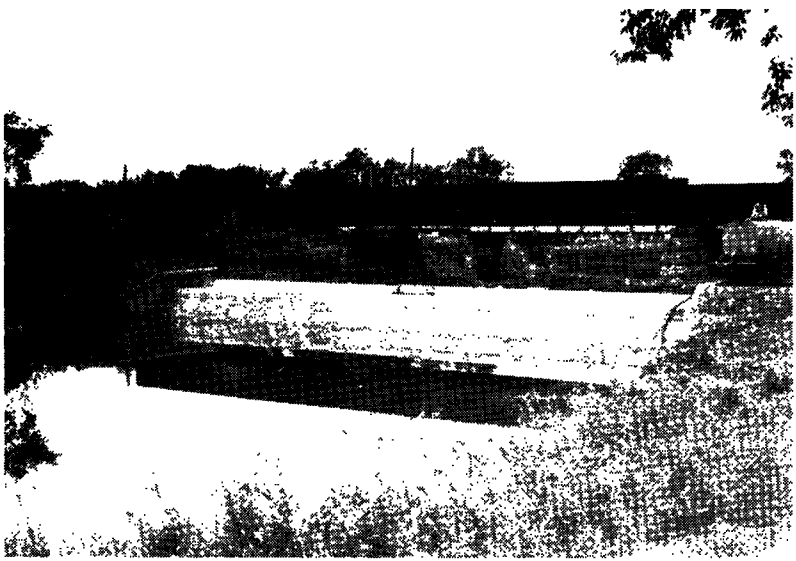
Status: To be re-designed in accordance with additional data obtained in September, 1961.

Sponsors: Burke County Water Conservation and Flood Control District and State Water Conservation Commission.

GRAFTON DAM — PROJECT No. 660

Nature of Project: Repair of dam.

Location: In the city of Grafton, on the Park River in Walsh County.



Grafton Dam — Repair Work Completed

Type of Structure: Timber crib, rock fill.

Purpose: Municipal water supply.

Condition Before Repair: Deck planks eroded.

Repair Work Accomplished: Reinforced concrete deck poured, reinforced concrete wing walls constructed and pneumatic concrete applied to chute spillway.

Costs and Sponsors: $12,234.07, shared by the City of Grafton and the State Water Conservation Commission.

PARK RIVER SNAGGING AND CLEARING — PROJECT No. 662

Nature of Project: Snagging and clearing river channel.

Location: Park River from Homme Dam to Grafton.

Purpose: To clear obstructions from river channel to permit faster releases of flood waters and prevent seepage losses which could be utilized by the cities of Park River and Grafton.

Status: Approximately one-half of the estimated $10,000 project was completed in the 1961-62 winter with the other half scheduled for completion in the winter of 1962-63.

Sponsors: Cities of Park River and Grafton, Walsh County, and the State Water Conservation Commission.

ARMOURDALE DAM — PROJECT No. 665

Nature of Project: Construction of dam.

Location: Nine miles east and one and one-half miles north of Rolla in Towner County.

Armourdale Dam

Purpose: Recreation and fish and wildlife enhancement.

Scope: 68,000 cubic yard embankment and 39-foot drop concrete chute-type spillway completed. Reservoir area of 80 acres with capacity of 1,130 acre-feet; maximum depth, 34 feet. Surveyed and designed by the Commission.

Sponsors and Costs: $63,514.14 allocated as follows: Towner County, $22,757.07; State Game and Fish, $18,000; State Water Conservation Commission $22,757.07.

NORTHGATE DAM — PROJECT No. 667

Nature of Project: Investigation.

Location: South of Northgate, Burke County.

Purpose: Recreation, fish and wildlife enhancement, and municipal water supplies.

Status: Design and preparation of final estimate in progress.

Sponsors: Burke County Water Conservation and Flood Control District and State Water Conservation Commission.

WARSING DAM — PROJECT No. 668

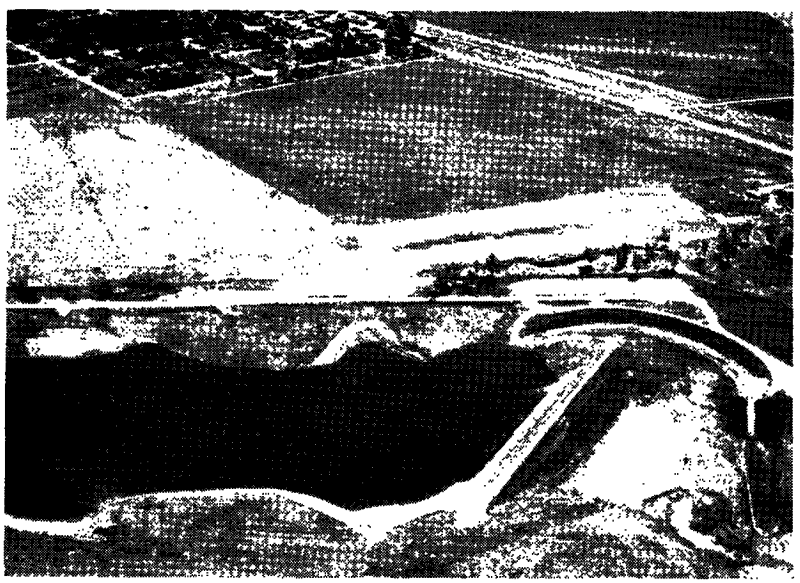
Nature of Project: Construction of dam.

Location: One-half mile north of Sheyenne, Eddy County.

Purpose: Recreation and fish and wildlife enhancement.

Scope: 45,000 cubic yard rolled earthfill embankment and chute-type spillway completed. Reservoir area of 54 acres with capacity of 410 acre-feet; maximum depth 23 feet. Surveyed and designed by Commission.

Sponsors and Costs: $50,287.50 allocated as follows — Eddy County, $18,643.75; State Game and Fish, $13,000; State Water Conservation Commission, $18,643.75.



Warsing Dam and Reservoir

LOWER APPLE CREEK — PROJECT No. 669

Nature of Project: Construction.

Location: South of Bismarck in Burleigh County.

Purpose: Provide flow in lower reaches of Apple Creek.

Status: Siphons installed in Earl Cypert Park Dam to create flow for use by downstream riparian interests.

Costs and Sponsors: $166.50 paid by the State Water Conservation Commission.

HARVEY DAM — PROJECT No. 671

Nature of Project: Investigation.

Location: On Sheyenne River south of Harvey, Wells County.

Purpose: Recreation area.

Status: Possible raising of present dam or construction of new dam under consideration. Final design and estimates pending determination of most feasible project.

Sponsors: Wells County Water Conservation and Flood Control District and the State Water Conservation Commission.

NOME SPRING — PROJECT No. 674

Nature of Project: Construction.

Location: Ten miles west of Nome in Barnes County.

Purpose: Repair pipe collection system in spring to prevent pollution and increase water yield. The spring is the only available potable water supply for several communities and a large farming area. It also provides a water supply to the Little Yellowstone Park which has wide usage as a recreational center.

City of Harvey and Reservoir

Status: Interception pipes cleaned out and pumping basin gated control installed to reduce pumping lift and make water more readily available to the water haulers who depend on the springs for a water supply.

Costs and Sponsors: $789.57 paid by the State Water Conservation Commission.

TOLNA DAM No. 3 — PROJECT No. 675

Nature of Project: Investigation.

Location: Northeast of Tolna, Nelson County.

Purpose: Recreation.

Status: Location not yet determined and land availability is in question.

Sponsors: Stump Lake Development Association, Tolna, and the State Water Conservation Commission.

SKJERMO LAKE — PROJECT No. 676

Nature of Project: Investigation.

Location: Township 163 N., Range 102 West, Divide County.

Purpose: Raise lake level to support fish life.

Status: Test borings indicated permeable lake bottom which precluded construction of clay core to prevent seepage. Project not feasible.

Sponsors: Divide County Park Board and State Water Conservation Commission.

SOURIS RIVER CROSS SECTIONS — PROJECT No. 678

Nature of Project: Investigation.

Location: Souris River Valley between Des Lacs River and Lake Darling Dam.

Purpose: Evaluate hydraulic characteristics of Souris River for flood control.

Status: Corps of Engineers are investigating entire Souris River Valley for possible flood control measures.

Sponsors: Corps of Engineers and State Water Conservation Commission.

DITCH MAPPING — PROJECT No. 679

Nature of Project: Investigation.

Location: Red River Valley.

Purpose: To update 1906-07 Stewart survey for master plan of drainage in connection with roadway construction in progress and proposed.

Status: Inactive at present but is to be continued as time permits. Profiles of a major portion of Interstate Highway No. 29 have been completed.

Sponsors: North Dakota State Highway Department and the State Water Conservation Commission.

GOLDWYN DAM — PROJECT No. 680

Nature of Project: Investigation:

Location: Near Goldwyn, Stutsman County.

Purpose: Recreation.

Status: Planning discontinued. Proposed reservoir too large for available drainage area.

Sponsors: State Water Conservation Commission.

DRAYTON DAM — PROJECT No. 681

Nature of Project: Investigation.

Location: On Red River at Drayton, Pembina County.

Purpose: Municipal and industrial water supply.

Status: Possible construction of $90,000 structure in 1963 depending on availability of funds.

Sponsors: City of Drayton and the State Water Conservation Commission.

WATER COMMISSION SHOP — PROJECT No. 682

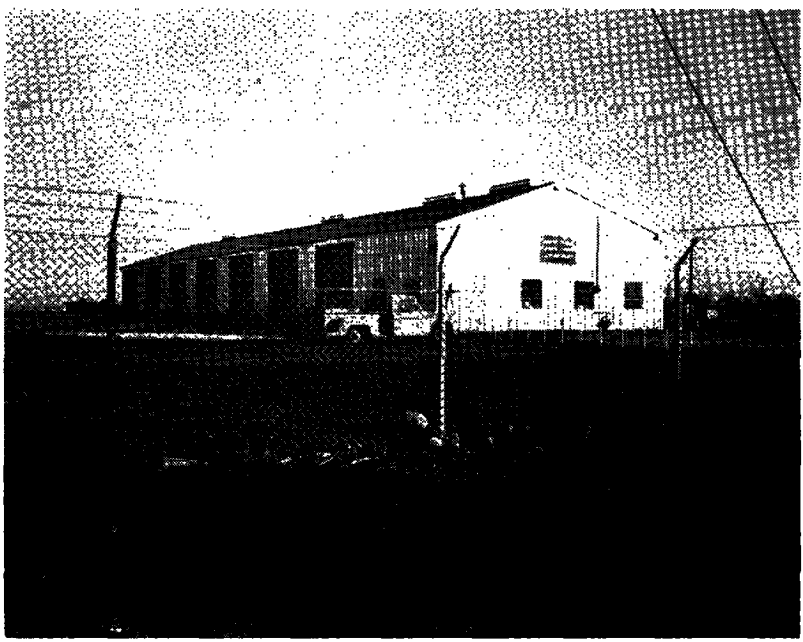
Nature of Project: Construction.

Location: Bismarck.

Purpose: Provide shop and storage space for equipment and materials used in water resource development activities.

Status: A 40x140 foot steel building constructed on state property by private contractors.

Costs: $30,000 special appropriation made by State Legislature for building construction.



Water Commission Shop Building

GRAFTON WATER SUPPLY — PROJECT No. 684

Nature of Project: Investigation.

Location: City of Grafton, Walsh County.

Purpose: Municipal and industrial water supply.

Status: Several proposals for conveying water from Red River to Grafton made. Project inactive at present.

Sponsors: City of Grafton and State Water Conservation Commission.

GLENBURN WATER SUPPLY — PROJECT No. 685

Nature of Project: Construction.

Location: City of Glenburn, Renville County.

Purpose: Municipal water.

Status: Underground core dam was constructed to hold spring runoff to recharge the aquifer from which the city receives its water supply. Level of water table was raised to its highest level in eight years through this construction.

Costs and Sponsors: $6,582 shared equally by Glenburn and the State Water Conservation Commission.

LARIMORE DAM — PROJECT No. 688

Nature of Project: Investigation.

Location: On Turtle River near Larimore, Grand Forks County.

Purpose: Municipal water supply.

Status: Foundation problems for proposed dam halted further investigations. Unless proper subsurface foundation is located, project will be infeasible.

Sponsors: City of Larimore and State Water Conservation Commission.

HILLSBORO DAM — PROJECT No. 689

Nature of Project: Investigation.

Location: On Goose River near Hillsboro, Traill County.

Purpose: Municipal water supply.

Status: Further investigations will be required after results of the Corps of Engineers Goose River flood control survey are available.

Sponsors: City of Hillsboro and State Water Conservation Commission.

BOTTINEAU GROUND WATER SURVEY — PROJECT No. 738

Nature of Project: Investigation.

Location: City of Bottineau area, Bottineau County.

Purpose: Municipal water supplies.

Status: Analysis and cataloguing of ground water supplies completed. Comprehensive report to be issued by spring of 1963.

Costs and Sponsors: $6,000 shared equally by Bottineau and State Water Conservation Commission.

HOOPLE WATER SUPPLY — PROJECT No. 765

Nature of Project: Investigation.

Location: Near City of Hoople, Walsh County.

Purpose: Municipal and industrial water supply.

Status: Investigations for a dam site in a Coulee near Hoople proved economically infeasible. Watershed development in the Hoople area is under investigation for possible alternate project sites.

Sponsors: City of Hoople and State Water Conservation Commission.

LITTLE MUDDY VALLEY GROUND WATER SURVEY — PROJECT No. 776

Nature of Project: Investigation.

Location: A 300 square mile area in Little Muddy Valley, Williams County.

Purpose: Determine groundwater availability for irrigation purposes.

Status: Groundwater study report No. 36 was issued in November, 1961. The report contains logs of the 6,223 feet of test drilling, an inventory of existing wells, chemical analysis, and recommendations by the Commission's Chief Engineer. Further soils studies are required prior to installation of irrigation facilities. A portion of the test drilling was accomplished by Pherrin Township in Williams County.

Costs and Sponsors: $6,857.81 allocated as follows — Pherrin Township and Williams County, $3,000; State Water Conservation Commission, $3,857.81.

PARSHALL GROUND WATER SURVEY — PROJECT No. 791

Nature of Project: Investigation.

Location: 75 square mile area near Parshall, Mountrail County.

Purpose: Municipal water supply.

Status: Groundwater study report No. 41 was issued in June, 1962. The report contains chemical analyses, logs of 2,500 feet of test drilling, and pump test data on the city wells.

Costs and Sponsors: $6,522.73 allocated as follows — City of Parshall $3,000; State Water Conservation Commission, $3,522.73.

ST. THOMAS WATER SUPPLY — PROJECT No. 822

Nature of Project: Investigation.

Location: On Willow Creek at St. Thomas, Pembina County.

Purpose: Municipal Water supply.

Status: Planning of possible reservoirs is presently inactive pending a "Flood Plains of the Park River" report to be issued by the Soil Conservation Service in connection with its watershed planning activities in the St. Thomas area.

Sponsors: City of St. Thomas and State Water Conservation Commission.

GRENORA DAM — PROJECT No. 823

Nature of Project: Investigation.

Location: Near Grenora, Williams County.

Purpose: Recreation and fish and wildlife enhancement.

Status: Topographic mapping and foundation studies have been made with two possible dam sites under study. Preliminary designs and cost estimates are to be made in the near future on the proposed dam.

Sponsors: Tri-County Wildlife Federation and the State Water Conservation Commission.

CREEL BAY — PROJECT No. 824

Nature of Project: Investigation.

Location: Creel Bay arm of Devils Lake, Ramsey County.

Purpose: Freshen Creel Bay for possible development as a recreational area.

Status: Proposal to dam off Creel Bay and freshen with water from City wells proved infeasible. Possible development of this project may be enhanced when the Corps of Engineers completes its study for over-all water management in the Devils Lake Basin.

Sponsors: Devils Lake Jaycees and the State Water Conservation Commission.

CALEDONIA DAM — PROJECT No. 825

Nature of Project: Investigation.

Location: One-half mile east of Caledonia, Traill County.

Purpose: Recreation and municipal water supply.

Status: Preliminary design and cost estimates made. Final decision on project is dependent upon results of the Goose River Flood Control study being conducted by the Corps of Engineers.

Sponsors: Caledonia and the State Water Conservation Commission.

TURTLE MOUNTAIN RESERVATION IMPROVEMENT — PROJECT No. 853

Nature of Project: Investigation.

Location: Turtle Mountain area, Rolette County.

Purpose: Recreation and fish and wildlife enhancement.

Status: Topographic surveying was begun in June, 1962.

Sponsors: Turtle Mountain Tribal Council and the State Water Conservation Commission.

CROWN BUTTE DAM — PROJECT No. 870

Nature of Project: Investigation.

Location: Ten miles west of Mandan, Morton County.

Purpose: Recreation, fish and wildlife habitat, and flood control.

Status: Proposal includes a concrete box inlet with pipe outlet to be constructed through the Interstate Highway No. 94 embankment. Investigations are in progress. The proposed reservoir would cover 38 acres with a maximum depth of 30 feet.

Sponsors: Morton County, State Highway Department and the State Water Conservation Commission.

MILTON HIGHWAY DAM — PROJECT No. 872

Nature of Project: Investigation.

Location: North Branch of Park River near Milton, Cavalier County.

Purpose: Flood control, municipal water supply, recreation.

Status: Topographic surveys and foundation test drilling completed. Project is under study in connection with State Highway No. 66 and Soil Conservation Service projects in the area.

Sponsors: City of Grafton and the State Water Conservation Commission.

DICKINSON FLOOD CONTROL — PROJECT No. 926

Nature of Project: Investigation.

Location: At proposed Interstate Highway No. 94 routing near Dickinson, Stark County.

Purpose: Flood control with possible supplement for municipal water requirements.

Status: Topographic mapping and foundation test drilling in progress. Project feasibility under study in cooperation with State Highway Department.

Sponsors: City of Dickinson and the State Water Conservation Commission.

EDMORE CITY WATER SUPPLY — PROJECT No. 927

Nature of Project: Investigation.

Location: City of Edmore, Ramsey County.

Purpose: Municipal water supply.

Status: Topographic mapping and foundation test drilling completed. Project is presently under design study to determine engineering and economic feasibility.

Sponsors: City of Edmore and the State Water Conservation Commission.

RYDER GROUND WATER SURVEY — PROJECT No. 931

Nature of Project: Investigation.

Location: Six square mile area around Ryder, Ward County.

Purpose: Municipal water supply.

Status: Preliminary report of findings made available to City Engineer. Plentiful supply of potable water was located for the city. Detailed report of investigation to be issued in 1963.

Costs and Sponsors: City of Ryder and the State Water Conservation Commission — Total estimated cost of $3,000 to be shared equally.

Hunter Dam

FLOOD CONTROL PROGRAM FOR AGRICULTURAL LANDS

In many areas of North Dakota good agricultural land is subject to periodic flooding during the spring snow melt and periods of excess rainfall. As a result crop production from this land is significantly reduced and the income of the farmers in the area and, consequently the economy of the state, is adversely affected. The problem of flooding of agricultural land is most acute in the Red River Valley in eastern North Dakota. Here the terrain is extremely flat and the surplus water drains off very slowly or accumulates in large shallow lakes that are dissipated by evaporation. Much of this land, which is subject to damage from excess water, is the most highly productive land in the state when it is properly protected against flooding. For this reason the loss of agricultural production because of excess water is more serious in the terms of dollars and cents than is the loss experienced in other areas because of the lack of water. Because North Dakota's economy is based primarily on agriculture it is essential that the state's water program provide a means of effective management and control of flood waters to assure maximum production.

The State Water Conservation Commission Drainage Program is devoted primarily to the construction of floodways that serve large areas subject to water damage. Generally a number of landowners are benefited by the drain. The drainage involved does not include that ordinarily considered as "pothole" drainage. The drains included in the Commission's flood control program are usually classified as legal drains because they are established and maintained by a county drain board or other legally established political subdivision provided by law with specific powers and duties set forth in law. The construction of a drain is dependent upon the petition of the landowners, and the payment of the costs of the drain are assessed to the benefited lands in accordance with the benefits received.

The construction of floodways in North Dakota, particularly in the Red River Valley area, dates back some 60 years. In this extremely flat area the early settlers soon learned that it was necessary to provide a means to drain off surplus waters if they were to achieve full production from the rich land. The surplus waters on the flat land generally resulted from excess water that flows freely from land possessing a steeper gradient. Because a large number of farmers in the affected areas had the common problem of providing such flood facilities, a number of group drains were constructed. During the drought years of the 1930's the problem of drainage was of less importance and the maintenance of many of the existing drains was neglected. As a result the efficiency of these drains was impaired. With the return of the wet years during the 1940's it was found that an expensive drainage clean out and rebuilding program was necessary, requiring large expenditures of funds from the counties for local drainage districts. In 1943 the North Dakota Legislature recognized the difficult financing problems that these counties faced and appro-

priated funds to the State Water Conservation Commission to assist in this drainage program. In so doing, the State Legislature recognized the importance of the production from these areas to the economy of the state and the state's interest in this drainage program. The initial appropriation made in 1943 was $50,000.00. Since that time the Legislature has made appropriations of varying amounts to continue the Commission's program of assisting counties and local drainage districts in the drainage construction program.

In carrying out the drainage program throughout the state the local drain districts and counties and the State Water Conservation Commission have received the cooperation of the U. S. Soil Conservation Service in providing the necessary on site engineering services to plan, survey, design and supervise construction work on various floodway projects. This service is provided at no cost to the drainage districts or to the Commission.

Funds appropriated to the State Water Conservation Commission by the Legislature for drainage work are allocated for the various drainage projects that qualify for state assistance in accordance with drainage rules and regulations that the Commission has adopted. The extent of state assistance to counties for drainage work is ordinarily 40 per cent of the construction cost of the drain. In conducting its drainage program the Commission has adopted the policy of cooperating only on the construction of legal drains, which are those constructed under the sponsorship of a legal entity such as the Board of Drain Commissioners, a Board of County Commissioners, a Township Board, or a Water Conservation and Flood Control District. Before any state funds are allocated from the Commission's drainage fund for a specific drain, the engineering and design must be completed and submitted to the Commission for approval. The local share of the cost of the drain is paid from special assessments levied on the property benefited by the drain.

In recent years it has become increasingly apparent that conditions which require improvement and additions to existing drainage are due to factors other than those associated with the original topography of the land. Changes that are continually taking place in land use, construction of highways, commercial and urban development all can affect the drainage pattern in an area. The increase in the construction of various individual or group drains under agricultural programs presently in effect in upper areas in the drainage basin often aggravates the drainage problem in the lower areas of that basin. New highway design has called for progressively wider and more streamlined ditch sections that require correspondingly wider rights-of-way. The construction of the additional and modern types of road has had a direct bearing on the design of and the need for drainage construction in many areas of the state.

The State Highway Department and the State Water Conservation Commission recognize the common interest they have in the

drainage problem that has developed in various areas because of the new type of highway construction. In 1959 they jointly employed a drainage engineer who was to devote all of his time to these drainage problems. In March, 1961, the two departments through a written agreement provided for the participation in the payment of costs of construction or reconstruction of legal drains established under North Dakota laws that were affected by highway construction. It is recognized that the road ditches along highways not only drain water from the highway itself but also collect water from the lands through which the highway runs. The proper functioning of a legal drain in that area therefore benefits not only the landowner but also the highway. It was therefore agreed the State Highway Department would participate in the cost of construction of drains which benefit a highway under their supervision, provided that a part of the cost of the construction is also paid by the State Water Conservation Commission. The amount to be paid by the State Highway Department shall not be in excess of 20 percent of the cost of any drainage project and the total amount paid for all drains in any fiscal year cannot exceed $18,000.00.

In order to provide accurate and detailed information on the overall drainage matter in the Red River Valley the State Water Conservation Commission has undertaken a project referred to as the Ditch Mapping Project. It is the purpose of this endeavor to compile information available from a number of sources into a single map that will more accurately reflect the drainage pattern in the Valley, taking into consideration roads and other improvements that have occurred over the years. Work on this project will be accomplished as time permits.

Representatives of various legal entities involved in drainage work in the state have met with the State Legislative Research Committee making the study of the water laws to recommend certain changes to those laws dealing with drainage and water conservation and flood control districts. The informal organization that was established for this purpose consists of one representative from each of the counties interested in drainage matters. Manfred Ohnstad of West Fargo is chairman of the subcommittee.

Others on the Committee are: Paul Sand, Assistant Attorney General, Bismarck; C. Emerson Murry, Director, Legislative Research Committee, Bismarck; Norton Hatlie, Attorney, Wahpeton; F. E. Foughty, Attorney, Devils Lake; Richard Gallagher, Attorney, and member of the State Water Conservation Commission, Mandan.

A summary of the Commission's drainage expenditures during the past biennium can be found in the section of this report dealing with State Water Conservation Commission Projects.

KRAMER DRAIN

Nature of Project: Proposed construction.

Location: West and south of Bottineau in Bottineau County.

Purpose: Drainage of 24,680 acres of agricultural land.

Status: State Water Conservation Commission has authorized participation of $30,088 in total estimated cost of $125,657.14. The project is still in the planning stage, pending approval of landowners.

ZAHN INTERNATIONAL DRAIN

Nature of Project: Drain investigation.

Location: East of Antler, in Bottineau County and continuing 2½ miles into Canada for its outlet.

Purpose: Drainage of area on both sides of International Boundary.

Scope of Work: Canadian surveying and engineering investigation have been completed.

Status: No action has yet been taken by landowners on North Dakota portion and the area has not been surveyed.

Sponsors: Bottineau County and Canada.

CASS DRAIN No. 2

Nature of Project: Drainage investigation.

Location: Northeast of Casselton to Sheyenne River near Harwood, Cass County.

Purpose: Drainage of approximately 19,840 acres of farm land.

Status: Petition from majority of landowners requested review of location, design and assessments of proposed drain. Project is under investigation by the State Engineer.

Sponsors: Cass County Drain Board and the State Water Conservation Commission.

CASS DRAIN No. 12

Nature of Project: Drain reconstruction.

Location: South of Argusville.

Scope of Work: 15,774 cubic yards of excavation, 1.37 miles of spoil bank leveling, 55 feet of cleaning 72-inch corrugated metal pipe culvert.

Sponsors and Costs: Cass County Drain Board 60 percent or $1,674.88; State Water Conservation Commission $1,116.59 or 40 percent.

CASS DRAIN No. 15

Nature of Project: Drainage reconstruction.

Location: Northeast of Leonard.

Status: The State Water Conservation Commission on September 22, 1961, approved $3,837.07 toward the reconstruction of this drain contingent upon the construction of a drop structure at the outlet within a two-year period. Reconstruction of the drain was completed late in 1961. On May 15, 1962, the Commission approved $3,250 for the construction of the drop structure. The structure will be built by Commission crews this year.

CASS DRAIN No. 19

Nature of Project: Drain reconstruction.

Location: Three miles northwest of Gardner and to Red River.

Scope of Work: 18,507 cubic yards of excavation and 2.01 miles spoil bank leveling.

Sponsors and Costs: State Water Conservation Commission $1,746.78, 40 percent; Cass County Drain Board, $2,620.17, 60 percent.

CASS DRAIN No. 21

Nature of Project: Drain reconstruction.

Location: Parallel to Sheyenne River, west and south of Southwest Fargo.

Purpose: Drainage of 30,720 acres of valuable agricultural land.

Status: Reconstruction work completed late in 1961.

Sponsors: Cass County Drain Board and State Water Conservation Commission. Total estimated cost $119,000.

CASS DRAIN No. 29

Nature of Project: Drainage Investigation.

Location: 12 miles north of Fargo.

Purpose: Study of means to eliminate erosion at lower end of drain.

Status: Detailed topographic survey was made by a Commission survey party. Design has been completed on erosion control structure incorporating an earth embankment with a concrete chute spillway. Construction will begin when weather conditions permit.

Sponsors: Cass County Drain Board and State Water Conservation Commission.

CASS DRAIN No. 30

Nature of Project: Drain reconstruction.

Location: South of Harwood.

Purpose: Drainage from U. S. Highway 81 to the Red River.

Scope of Work: A two-mile reach of this drain was reconstructed to provide release of run-off from the area around U. S. Highway No.

81, and to divert excess run-off which previously overloaded Cass Drain No. 13.

Sponsors: Cass Drain Board and State Water Conservation Commission.

CASS COUNTY DRAIN No. 39

Nature of Project: Repair of reinforced concrete drop structure.

Purpose: The structure was undercut by spring run-off resulting in water flowing under structure and scour developing below drop structure.

Scope of Work: Sheet piling cut-off wall placed behind structure with pneumatically applied cap to tie the cut-off to the structure in addition to riprap being placed to prevent scouring.

Costs and Sponsors: $4,129.07, shared by the Cass County Drain Board and the State Water Conservation Commission.

CASS COUNTY DRAIN No. 45

Nature of Project: Drainage investigation.

Location: Eastern edge of Southwest Fargo in Cass County.

Purpose: Construction of Interstate Highway No. 94 changed the drainage pattern of this area so that existing drains were not adequate to release run-off.

Status: Investigations and preliminary design work were done by the State Water Conservation Commission and the State Highway Department. Plans for construction of a dike to provide flood protection was abandoned because right-of-way could not be obtained. At the request of the city of Southwest Fargo the problem of adequate drainage is now being investigated by the Corps of Engineers.

CASS DRAIN No. 49

Nature of Project: Reconstruction of Cass Drain No. 49.

Location: Township 140 North, Range 48 West, north of Fargo city limits.

Scope of Work: 4,169 cubic yards of excavation, .303 miles spoil bank leveling and installation of 60 lineal feet of 42" corrugated metal pipe.

Sponsors: State Water Conservation Commission, $3,746.46 and Cass County Drain Board, $5,619.70.

LEONARD-SHELDON DRAIN PROBLEM

Nature of Project: Investigation of drainage problem.

Location: Leonard-Sheldon area, Cass County.

Purpose: Inadequate drainage of agricultural lands near State Highway No. 46.

Status: A meeting was held with the affected landowners, Cass County Drain Board, Soil Conservation Service, State Highway De-

partment and State Water Commission personnel. The Soil Conservation Service is preparing a survey, design and cost estimate at the request of the County Drain Board.

NOBLE TOWNSHIP DROP STRUCTURE

Nature of Project: Proposed drop structure.

Location: Northeastern Cass County.

Purpose: Erosion control structure to be constructed near the outlet of Cass Drains No. 18, No. 19, No. 31 and No. 32, in combination with a county road crossing.

Scope of Work: Detailed topographic survey and design of structure made by State Water Conservation Commission.

Status: Construction pending easement and right-of-way acquisition by County Drain Board.

Costs and Sponsors: Total estimated cost to be $30,000, Cass County Highway Department's allocation would be about $15,000. Balance to be shared by the Cass County Drain Board and the State Water Conservation Commission.

GRAND FORKS DRAIN No. 12

Nature of Project: Proposed drain construction.

Location: West and north of Manvel and to Forest River.

Status: State Water Conservation Commission authorized approximately $9,000 participation. The contract has been awarded and work is in progress.

GRAND FORKS DRAIN No. 13

Nature of Project: Reconstruction of drain.

Location: Six miles north of Manvel.

Purpose: Reconstruction of existing drain and construction of a drop structure at outlet to drain.

Status: The contract has been awarded and work will start as soon as conditions permit.

GRAND FORKS DRAIN No. 19

Nature of Project: Reconstruction of drain.

Location: East of Inkster.

Status: Work completed in 1961.

Sponsors: Grand Forks County Drain Board 60%, State Water Conservation Commission 40%. Total cost $7,237.25.

PEMBINA DRAIN No. 13

Nature of Project: Drainage investigation.

Location: Seven miles east of St. Thomas and to Red River.

Status: The excessive run-off in the spring of 1962 damaged part

of the embankment of this drop structure.

Proposed Work: The Commission's construction crew will repair the damage on cost sharing basis with the Pembina County Drain Board.

RICHLAND COUNTY DRAIN No. 63

Nature of Project: Legal drain established by Richland County Water Conservation and Flood Control District.

Location: West of Galchutt and into Antelope Creek.

Purpose: To improve local drainage and reduce excess run-off into other legal drains.

Sponsors: In December, 1960 the State Water Conservation Commission paid the Water Conservation and Flood Control District $5,055.96 for participation in construction costs.

RICHLAND DRAIN No. 65

Nature of Project: Drain reconstruction.

Location: Five miles east of Hankinson and to Wild Rice River.

Purpose: Drain agricultural lands and reduce amount of water in highway ditches to reduce maintenance costs.

Status: State Water Conservation Commission authorized $20,000 for cost participation in reconstruction. State Highway Department contributed $2,000 in recognition of benefits to North Dakota Highway No. 11.

RICHLAND COUNTY FIELD CROSSING

Nature of Project: Drain investigation.

Location: Northeast of Walcott.

Purpose: Richland County Drains Nos. 5, 27, 37, 57 and 64 discharge into a common coulee and have augmented flow in the coulee so that water is always present. As a result, a farmer, who has been adversely affected by this situation has need for a private crossing over the coulee.

Status: The State Water Conservation Commission authorized participation of $600 for correction of this situation. Construction is pending acquisition of easements.

WALSH DRAIN No. 27

Nature of Project: Construction of drain.

Location: South and east of Grafton.

Scope of Work: All-new construction was completed in 1960.

Sponsors: State Water Conservation Commission cost participation was $4,988 and balance paid by Walsh County.

RECAP OF DISBURSEMENTS

July 1, 1960 — June 30, 1962

Disbursements to be Accounted for:

Disbursements from Appropriations	$953,828.29	
Materials Used from Inventory (Net) ..	3,734.34	
Depreciation - Office & Field Equipment	41,048.22	
Credit to Project Sponsors	242,696.19	
Credit from U. S. G. S. - GW Branch	45,000.00	
Total Disbursements to be Accounted for		$1,286,307.04

Disbursements Charged to SWCC Projects (details on following pages):

Direct & Indirect Costs	$846,953.06	$ 846,953.06

Disbursements Charged to Programs with U. S. Geological Survey:

Topographic Surveys	$ 30,745.75	
Hydrographic Surveys	39,075.56	
Groundwater Surveys	87,954.92	
Quality of Water Surveys	1,312.50	
Total Disbursements Charged to Programs W/USGS		159,088.94

Disbursements Charged to General Operating Costs:

Personal Services	$138,028.69	
Field Equipment (new)	42,923.17	
(Book Value — $157,536.93)		
Office Equipment (new)	2,912.19	
(Book Value - $19,925.79)		
Shop Building (new)	48,115.08	
(Book Value - $47,700.00)		
Supplies & Small Tools	6,295.43	
Materials (sold)	133.30	
(Inventory - $27,170.56)		
Equipment Oper. Mtce & Depreciation:		
Depreciation $41,048.22		
Operations & Maintenance 55,858.43		
Less Charged to Projects -79,942.49	16,964.16	
Miscellaneous Expenses	24,893.02	
Total Disbursements Charged General Oper. Costs		$ 280,265.04
Total Disbursements Accounted for		$1,286,307.04

PROJECT EXPENDITURES AND COST ALLOCATIONS
JULY 1, 1960 - JUNE 30, 1962

No.	Project	County	Investigation	Design	Construction	Completed	Total Costs	Unallocated	Costs During Biennium Allocated			
									SWCC	G & F	Local	Total Allocated
	Kramer Drain	Bottineau	X				$ 230.47	$ 230.47				
	Zahn-International Drain	Bottineau	X				81.75	81.75				
2	Cass Drain	Cass	X				1,326.55	1,326.55				
12	Cass Drain	Cass				X	2,791.47		1,116.59		1,674.88	2,791.47
13	Cass Drain	Cass	X				6.47	6.47				
15	Cass Drain	Cass		X			380.29	380.29				
19	Cass Drain	Cass				X	4,366.95		1,746.78		2,620.17	4,366.95
21	Cass Drain	Cass	X	X	X		45,190.97	328.97	17,974.48		26,887.52	44,862.00
29	Cass Drain	Cass	X	X			582.74	582.74				
30	Cass Drain	Cass				X	5,493.03		2,197.21		3,295.82	5,493.03
39	Cass Drain	Cass				X	3,604.94		1,802.47		1,802.47	3,604.94
45	Cass Drain	Cass				X	3,824.31		1,551.70		2,272.61	3,824.31
49	Cass Drain	Cass				X	9,506.69		3,886.99		5,619.70	9,506.69
	Noble Twp. Drop Structure	Cass	X	X			1,579.40	1,579.40				
1&2	Grand Forks Drain	Grand Forks	X				20.28		20.28			20.28
12	Grand Forks Drain	Grand Forks	X				104.10	104.10				
13	Grand Forks Drain	Grand Forks	X				168.04	168.04				
19	Grand Forks Drain	Grand Forks				X	7,282.05		2,939.70		4,342.35	7,282.05
	City of Neche	Pembina				X	281.11				281.11	281.11
13	Pembina Drain	Pembina	X	X			621.25	621.25				
55	Pembina Drain	Pembina	X				47.86	47.86				
64	Pembina Drain	Pembina	X				115.38	115.38				
2	Richland Drain	Richland				X	15,705.16		6,414.06		9,291.10	15,705.16
57	Richland Drain	Richland	X				33.33	33.33				
63	Richland Drain	Richland				X	12,660.88		5,076.93		7,583.95	12,660.88
64	Richland Drain	Richland				X	9,815.80		3,938.90		5,876.90	9,815.80
65	Richland Drain	Richland	X				502.08	502.08				
10	Traill Drain	Traill	X				49.02	39.02				
20	Traill Drain	Traill	X				39.02	39.02				
27	Walsh Drain	Walsh			X		12,460.67	296.21	4,865.78		7,298.68	12,164.46
36	Cartwright Irrigation Project	McKenzie	X		X		7,343.61		4,167.73		3,175.88	7,343.61
160	Painted Wood Irrigation Project	McLean	X				64.02	64.02				
175	Lewis & Clark Irrigation Project	McKenzie				X	8,500.00				8,500.00	8,500.00

213	Sioux Irrigation Project	McKenzie	X	X	X	X	9,027.11		4,627.11		4,400.00	9,027.11
216	Bowman-Haley Dam	Bowman	X				30.80	30.80				
217	Park River Dam	Walsh				X	6.60		6.60			6.60
222	Buford-Trenton Irrigation Proj.	Williams	X				203.72	203.72				
227	Eaton Irrigation Project	McHenry			X	X	2,713.64		1,356.82		1,356.82	2,713.64
235	Goose River Flood Control	Traill	X				537.16	337.16			200.00	200.00
237	Missouri River Diversion	Various	X				38.50	38.50				
241	Dodge Dam	Stutsman	X				54.19	54.19				
251	Olson-Hardie Irrigation Project	McHenry	X				1,496.14	1,496.14				
253	Jackson Dam	McKenzie			X	X	9,691.41		4,909.20		4,782.21	9,691.41
260	Olson Dam	Burleigh	X				27.86	27.86				
262	Cannonball and Cedar Dev.	Various	X				53.05	53.05				
264	Braddock Dam	Emmons			X	X	525.97		262.99		262.98	525.97
274	Neche Dam	Pembina			X	X	11,595.82		5,797.91		5,797.91	11,595.82
299	Pembina Dam	Pembina			X	X	4,017.92		2,009.79		2,008.13	4,017.92
305	Red River Flooding	Various	X				1,545.18	1,545.18				
330	Lake Metigoshe	Bottineau	X	X	X	X	19,671.55		12,007.99	3,831.78	3,831.78	19,671.55
353	Cedar Dam	Slope			X	X	4,752.00		1,704.20	3,047.80		4,752.00
362	Balta Dam*	Pierce			X	X	37,712.15		13,235.09	12,177.06	12,300.00	37,712.15
375	Hurdsfield Dam	Wells	X				38.67	38.67				
386	Monango Dam	Dickey	X				1,206.25	1,006.25			200.00	200.00
416	Lake Irvine	Ramsey	X			X	20,987.06		14,906.76		6,080.30	20,987.06
420	Mirror Lake	Adams	X				37.84	37.84				
443	Lake Juanita	Foster	X				1,958.33		1,958.33			1,958.33
450	Sykeston Dam	Wells	X	X			3,720.35	3,720.35				
461	Spiritwood Lake	Stutsman	X				237.52	237.52				
475	Golden Lake*	Steele	X	X	X		10,583.77		5,141.20	3,425.44	2,017.13	10,583.77
477	Valley City Mill Dam	Barnes	X				675.97	675.97				
489	Ray Dam	Williams			X	X	4,096.88		4,096.88			4,096.88
495	Peterson Dam*	Nelson			X	X	5,875.43		2,937.72		2,937.71	5,875.43
501	Elm River Dam	Dickey	X	X			1,647.57	1,647.57				
512	Nieuwsma Dam	Emmons			X	X	7,191.54		2,425.91	2,382.82	2,382.81	7,191.54
520	Grand Forks Dam	Grand Forks			X	X	1,205.61		602.81		602.80	1,205.61
525	Knife River Diversion	Dunn-Mercer	X				462.89	462.89				
527	Kelley Slough	Grand Forks	X				498.38	498.38				
550	Wildwood Lake	McLean	X				830.86	830.86				
556	Hyatt Slough	Dickey	X				63.17	63.17				
560	Blacktail Dam*	Williams			X	X	81,088.82		20,829.50	39,000.00	21,259.32	81,088.82
561	Tioga Dam	Williams	X				34.93	34.93				
565	Buffalo Lake	Pierce	X				74.69	74.69				
567	Pembilier Dam	Pembina-Cav.	X				845.50	845.50				
575	Smisek Lake Dam	Burke			X	X	1,124.97		562.99		561.98	1,124.97
576	Missouri River Erosion	Various	X				945.96	945.96				
578	Apple Creek Diversion	Burleigh	X				103.29	103.29				
586	Short Creek Dam	Burke	X	X	X		5,420.37	5,420.37				
599	Sheyenne Diversion	Cass	X	X			1,818.42	1,818.42				

PROJECT EXPENDITURES AND COST ALLOCATIONS (Continued)
JULY 1, 1960 - JUNE 30, 1962

No.	Project	County	Investigation	Design	Construction	Completed	Total Costs	Unallocated	Costs During Biennium Allocated			
									SWCC	G & F	Local	Total Allocated
600	Crystal Dam	Pembina	X				192.38	192.38				
601	Bucephalia Dam	Foster			X	X	123.24		123.24			123.24
612	Rosenquist Dam	Divide			X	X	8,015.06		4,007.53		4,007.53	8,015.06
615	Ellendale Dam*	Dickey			X	X	22,015.31		12,797.82		9,217.49	22,015.31
616	McVille Dam	Nelson			X	X	37,611.56		13,375.42	12,118.07	12,118.07	37,611.56
617	Ancient Missouri River Survey	Various	X				628.14	628.14				
619	Hunter Dam	Cass			X	X	741.97		741.97			741.97
622	Rice Lake	Burleigh	X				336.45	336.45				
625	Mayville Dam	Traill			X	X	159.25		159.25			159.25
627	Froelich Dam	Sioux			X	X	61,584.21		34,093.65	18,918.24	8,572.32	61,584.21
632	Antler Creek Dam	Bottineau	X	X	X		3,145.98	3,145.98				
635	Walhalla Park Cutoff	Pembina	X	X	X		6,959.29	6,959.29				
637	Little Muddy Dam	Williams	X				119.85	119.85				
638	Tobacco Garden Irrigation	McKenzie	X				3,425.04	3,425.04				
642	Sweetbriar Dam	Morton	X	X			4,075.19	4,075.19				
647	Green River Dam - Belfield	Billings	X				18.87	18.87				
649	Ypsilanti Dam	Stutsman			X	X	8,321.26		2,778.16	2,771.55	2,771.55	8,321.26
650	Bowbells Dam	Burke	X				356.40	356.40				
651	Hoople Dam	Walsh	X				93.65	93.65				
657	Cut Bank Dam	Bottineau	X				981.78	981.78				
660	Grafton RR Dam	Walsh			X	X	12,728.30		6,567.65		6,160.65	12,728.30
662	Park River Snag and Clearance	Walsh			X		4,614.76	4,614.76				
665	Armourdale Dam	Towner			X	X	67,034.42		25,917.90	18,359.45	22,757.07	67,034.42
667	Northgate Dam	Burke	X				2,067.57	2,067.57				
668	Warsing Dam	Eddy			X	X	54,653.58		22,216.24	13,793.59	18,643.75	54,653.58
669	Lower Apple Creek	Burleigh	X				997.14	997.14				
671	Harvey Dam	Wells		X			1,757.87	1,557.87			200.00	200.00
674	Nome Spring	Barnes			X	X	869.54		869.54			869.54
675	Tolna Dam No. 3	Nelson	X				1,006.84	1,006.84				
676	Skjermo Lake	Divide	X				416.27	416.27				
677	Ft. Clark Accretion	Oliver	X				11.72	11.72				2,039.81
678	Souris River Cross-Sections	Ward	X			X	2,039.81		2,039.81			
679	Ditch Mapping	Various	X	X			622.97	622.97				
680	Goldwyn Dam	Stutsman	X				87.82	87.82				
681	Drayton Dam	Pembina	X	X			3,124.47	2,924.47			200.00	200.00
683	Minot Test Drilling	Ward	X			X	3,968.54		1,058.54		2,910.00	3,968.54

684	Grafton Water Supply	Walsh	X				963.67	963.67					
685	Glenburn Dam	Renville			X	X	8,074.04		4,783.04		3,291.00	8,074.04	
686	Harvey Pile Pulling	Wells			X	X	1,645.97		1,645.97			1,645.97	
687	Upper and Lower Souris Hydro. Study	Various	X			X	229.24		229.24			229.24	
688	Larimore Dam	Grand Forks	X	X			670.93	470.93			200.00	200.00	
689	Hillsboro Dam	Traill	X	X			857.54	657.54			200.00	200.00	
702	Boundary Creek W.C. & F.C.D.	Bottineau	X				161.66	161.66					
704	Chain Lakes W.C. & F.C.D.	Ramsey	X				442.58	442.58					
710	Maple River W.C. & F.C.D.	Cass	X				34.98	34.98					
711	Marmarth Flood Control	Slope			X	X	20,117.91		8,577.16		11,540.75	20,117.91	
721	Stone Creek W.C. & F.C.D.	Bottineau	X				282.98	282.98					
730	Alexander GW (report)	McKenzie	X			X	231.00		231.00			231.00	
733	Ashley GW (report)	McIntosh	X			X	250.25		250.25			250.25	
737	Beulah GW (report)	Mercer	X			X	231.00		231.00			231.00	
738	Bottineau GW Survey	Bottineau	X				4,648.56	1,648.56			3,000.00	3,000.00	
749	Drake GW (report)	McHenry	X			X	821.70		627.95		(GS)193.75	821.70	
751	Fairmount GW (report)	Richland	X			X	220.00		220.00			220.00	
757	Gackle GW (report)	Logan	X			X	495.00		253.50		(GS)241.50	495.00	
762	Hatton GW Survey*	Traill	X			X	1,481.96		781.96		700.00	1,481.96	
765	Hoople Water Supply	Walsh	X		X		1,600.17	1,400.17			200.00	200.00	
767	Hunter GW (report)	Cass	X			X	137.50		101.78		(GS) 35.72	137.50	
773	Lehr GW (report)	McIntosh	X			X	231.00		231.00			231.00	
776	Little Muddy GW	Williams	X			X	8,474.73		5,474.73		3,000.00	8,474.73	
777	Maddock GW (report)	Benson	X			X	137.50		101.78		(GS) 35.72	137.50	
780	Michigan GW (report)	Nelson	X			X	220.00		220.00			220.00	
781	Minnewaukan GW (report)	Benson	X			X	275.00		275.00			275.00	
785	Mylo GW (report)	Rolette	X			X	137.50		101.78		(GS) 35.72	137.50	
789	Northwood GW	Grand Forks	X			X	1,260.25		860.25		400.00	1,260.25	
791	Parshall GW Survey	Mountrail	X			X	6,522.73		3,522.73		3,000.00	6,522.73	
794	Powers Lake GW (report)	Burke	X			X	137.50		101.78		(GS) 35.72	137.50	
795	Reynolds GW Survey	Grand Forks	X				2,063.51	563.51			1,500.00	1,500.00	
796	Richardton GW (report)	Stark	X			X	356.40		356.40			356.40	
797	Rolla GW (report)	Rolette	X			X	137.50		101.78		(GS) 35.72	137.50	
798	St. John GW (report)	Rolette	X			X	137.50		101.78		(GS) 35.72	137.50	
799	Sanborn GW (report)	Barnes	X			X	248.22		248.22			248.22	
816	Barnes County GW Survey*†	Barnes	X				141.85	141.85					
817	Burleigh County GW Survey*†	Burleigh	X				5,566.91	5,566.91					
818	Kidder County GW Survey	Kidder	X				199.78	199.78					
819	Stutsman County GW*†	Stutsman	X				4,115.23	4,115.23					
821	Scranton Flood Control	Bowman			X	X	25,034.61		10,013.84		15,020.77	25,034.61	
822	St. Thomas Water Supply	Pembina	X	X			904.78	704.78			200.00	200.00	
823	Grenora Dam	Williams	X	X			3,193.63	2,993.63			200.00	200.00	
824	Creel Bay	Ramsey	X	X			1,133.18	933.18			200.00	200.00	
825	Caledonia Dam	Traill	X	X			1,829.65	1,629.65			200.00	200.00	
834	Deep River Dev. Farm	McHenry			X	X	244.25		244.25			244.25	
839	Elm River Watershed	Various	X				97.12	97.12					
846	Square Butte Watershed	Oliver	X				65.29	65.29					

PROJECT EXPENDITURES AND COST ALLOCATIONS (Continued)
JULY 1, 1960 - JUNE 30, 1962

No.	Project	County	Investigation	Design	Construction	Completed	Total Costs	Unallocated	Costs During Biennium Allocated			
									SWCC	G & F	Local	Total Allocated
851	Wild Rice Watershed	Sargent	X				65.01	65.01				
853	Turtle Mountain Improvement	Rolette	X				837.96	837.96				
856	Forest River GW (report)	Walsh	X			X	137.50		101.78		(GS) 35.72	137.50
857	Minto GW (report)	Walsh	X			X	137.50		101.79		(GS) 35.71	137.50
858	Foster County GW Survey	Foster	X				19.79	19.79				
865	Garrison Negation Study	Various	X			X	2,601.24		2,601.24			2,601.24
866	Cass County GW Survey	Cass	X				62.10	62.10				
867	Richland County GW Survey	Richland	X				25.06	25.06				
868	Traill County GW Survey	Traill	X				103.00	103.00				
870	Crown Butte Dam	Morton	X	X			682.79	682.79				
872	Milton Highway No. 66 Dam	Cavalier	X	X			2,873.19	2,673.19			200.00	200.00
883	Dickey County Water Users	Dickey	X				84.08	84.08				
892	Griggs County Water Users	Griggs	X				144.89	144.89				
899	McKenzie County Water Users	McKenzie	X				17.05	17.05				
903	Mountrail County Water Users	Mountrail	X				25.58	25.58				
909	Ransom County Water Users	Ransom	X				61.53	61.53				
920	Towner County Water Users	Towner	X				61.45	61.45				
925	Williams County Water Users	Williams	X				17.05	17.05				
926	Dickinson Flood Control	Stark	X	X			1,209.21	1,209.21				
927	Edmore Water Supply	Ramsey	X	X			2,070.33	1,870.33			200.00	200.00
929	Forest River Watershed	G. Forks-Walsh	X				382.97	382.97				
931	Ryder Water Supply	Ward	X				2,460.06	1,906.06			500.00	500.00
939	Cedar River Flow Control	Various	X				58.78	58.78				
981	North Souris I. D.	Bottineau	X				51.11	51.11				
983	Coleharbor Water Supply	McLean	X				147.57	147.57				
	TOTALS	190					$846,953.06	$97,071.19	$327,239.10	$129,825.80	$292,816.97	$749,881.87

*Project started prior to July 1, 1960. Costs shown include construction costs incurred prior to July 1, 1960.
SWCC = State Water Conservation Commission
G & F = State Game and Fish Department
GS = North Dakota Geological Survey
GW = Groundwater
WS = Water Supply
ID = Irrigation District
*†Local sponsors paid $3,000 each for Project No. 816 and No. 817 and $4,500 for Project No. 819. Costs shown are direct expenditures of SWCC only. Groundwater survey project costs of U. S. Geological Survey and North Dakota Geological Survey not shown.

INTERNATIONAL AND INTERSTATE COMPACTS

INTERNATIONAL JOINT COMMISSION

As a result of the many varied and complex problems which occurred on the streams that flowed across the boundary of the United States and Canada, the International Joint Commission was created in 1909. This commission was established by treaty between Great Britain and the United States. It was given jurisdiction over the boundary waters of Canada and the United States. The International Joint Commission is composed of three members from each of these two nations. It has been authorized to consider and determine the rights of the two nations or subdivisions thereof to the use of the waters of the rivers, streams and lakes in which both countries have an interest. The commission is divided into two sections, one representing the United States and the other, Canada. A chairman is appointed to direct the work of each section. Problems and disputes arising from the use of such common waters called "references" are referred to the respective sections for consideration by the International Joint Commission.

Saskatchewan, Manitoba and North Dakota are interested in the references under consideration by the International Joint Commission pertaining to the Souris River and the Souris-Red River Reference. The Souris River Reference is dated January 15, 1940, and the Souris-Red River Reference is dated January, 1948. Several subcommittees have been appointed to study specific questions involved in these references. The State Water Conservation Commission has been much concerned in the Souris River Reference. The Engineering Subcommittee for the International Joint Commission has made several important recommendations which are under consideration by the International Joint Commission.

Souris River Reference

Three determinations have been requested in the Souris Reference. They include:

1. The apportionment of waters of the Souris River and its tributaries between the provinces of Saskatchewan and Manitoba, Canada, and the State of North Dakota.
2. The methods of control and operation to regulate the flow of the Souris River and its tributaries.
3. Interim measures to be in effect until final determination of the first two points had been made.

The International Joint Commission issued its interim report containing recommendations as to the use of water from the Souris River pending a determination of the questions contained in the

initial reference. The governments of the United States and Canada approved this report in 1941. The 1941 interim report permitted the province of Saskatchewan and the state of North Dakota to use 1,000 acre-feet of water from the Souris River to meet emergency water requirements. The province of Manitoba was permitted a release flow of ten cubic feet per second to meet municipal and stockwater requirements. In 1942 the International Joint Commission modified the flow to Manitoba from 10 to 20 cubic feet per second from stored waters in North Dakota. The number of applications for water rights in North Dakota and Saskatchewan far exceeded the 1,000 acre-feet allocated to the province and state. To date North Dakota has issued rights covering 710.82 acre-feet and Saskatchewan appropriated 603.7 acre-feet.

In 1959 the International Joint Commission established the International Souris River Board of Control composed of two members — one from the United States and one from Canada. This board was charged with the responsibility of carrying out the provisions of an interim order on the Souris River recommended by the International Joint Commission in 1959 to replace the initial interim order of 1940. Provisions of the 1959 interim order are set forth in the 12th Biennial Report of the State Water Conservation Commission.

Members and alternates appointed to the International Souris River Board of Control are:

United States — Milo W. Hoisveen, Member
State Engineer of North Dakota

Harlan Erskine, Alternate Member
District Engineer, U. S. Geological Survey

Canada — Gordon L. McKenzie, Member
Director, Prairie Farm Rehabilitation Administration, Department of Agriculture

P. W. Strilaeff, Alternate Member
District Engineer, Water Resources Branch
Department of Northern Affairs and Natural Resources

The Board has held six (6) meetings during the period covered by this report, as follows:

Dates	Location
July 21, 1962	Bismarck, North Dakota
January 17, 1961	Estevan, Saskatchewan
July 18, 1961	Minot, North Dakota
January 29, 1962	Regina, Saskatchewan
May 9, 1962	Minot, North Dakota
July 24, 1962	Brandon, Manitoba

INTERNATIONAL SOURIS RIVER BOARD OF CONTROL

Gaging Stations — As the result of a request made by the International Souris River Board of Control, additional gaging stations have been installed on international streams in order to fulfill the objectives of international planning. New stations were placed in operation at the following points: (a) Long Creek, at the international boundary, western crossing (b) Long Creek, at the international boundary near Noonan, eastern crossing (c) Short Creek below the international boundary near Roche Percee, Saskatchewan. Six additional stations are now operating in Saskatchewan which affords the board an opportunity to meet other requirements of the order. The contents of this report were submitted to the International Joint Commission at its semiannual meetings in Washington, D. C., in April of 1961 and 1962. Both reports were accepted by the International Joint Commission, and all recommendations made by the Souris River Board of Control were concurred with by the International Joint Commission.

Evaporation — The United States Geological Survey in cooperation with the North Dakota State Water Conservation Commission and the U. S. State Department have continued to observe losses from a typical small impoundment near Crosby, North Dakota. These observations are used to estimate the aggregate water use of all small impoundments in the North Dakota portion of Long Creek and Short Creek Basins. Similar work for Saskatchewan was originally scheduled to begin in 1961 but was delayed until this year.

Water Development Activities in 1961

Two small community reservoirs were constructed in Canada in 1961 on the tributaries of Long Creek. The Oungre Dam near Oungre, Saskatchewan, will impound 200 acre-feet and the Torquay Dam near Torquay, Saskatchewan will impound 280 acre-feet .

In recent years the Minot sewage treatment plant has not been adequate to properly care for the sewage passing through it. On several occasions it has been necessary to release water from the Lake Darling Reservoir to dilute the effluent. These releases, about 1,100 acre-feet in each instance, are retained in the lower Souris River Wildlife Refuge. The city of Minot has now constructed a lagoon disposal system. In November, 1961, a release was made to dilute raw sewage discharges which occurred during the conversion of the lagoon treatment. The new lagoon will not probably reduce the total quantity of effluent discharge from Minot but will improve the quality materially.

Hydrologic Conditions in 1961

In the Souris River Basin above Sherwood, a dry summer and fall in 1960 was followed with below normal precipitation. These factors, combined with a slow melt rate in the spring, led to the lowest run-off year since 1940. During the summer of 1961, Class

"A" pan evaporation ranged from 50 inches near Williston to 49 inches near Weyburn compared to a normal of 41 inches for both areas. Summer precipitation of 7.14 inches at Williston and of 7.71 inches at Weyburn was below normal. Consequently, heavy reservoir losses were observed and summer run-off was negligible. A steady decline in reservoir storage was apparent during 1961. At the close of the year December 31, 1961, Boundary Dam had 35,850 acre-feet in storage, which is 73 percent of full capacity. This is a sufficient volume to permit efficient operation of the nearby power plant for at least two more dry years. During 1961, 4,452 acre-feet were lost from the reservoir to natural and forced evaporation. Lake Darling at 33,000 acre-feet December 31, 1961, was below the level, at which the board of control declared the existence of a severe drouth condition. The lower refuge contained 5,200 acre-feet, which is 9,580 acre-feet less than the amount set by the board as indicating severe drouth conditions. As of January 30, 1962, snowfall over most of the basin was below normal, and soil conditions in the entire watershed were low. By June 19, 1962, considerable improvement was noted in the soil profile in the entire Souris River Basin. This resulted from the fact that above normal rainfall occurred in the basin. The extremely dry conditions that existed in the basin until May 1, along with the slow rainfall, permitted the soils to absorb most of the moisture with little apparent run-off.

Summary of Flows and Diversions

The natural flow at Sherwood for the calendar year, 1961, was 7,750 acre-feet. The recorded flow was 3,976 acre-feet after depletions of 3,329 acre-feet in Canada and 445 acre-feet in North Dakota. Depletions in Canada amounted to 43 percent of the natural flow at Sherwood, as indicated by the following:

Canadian depletions on Long Creek	14 acre-feet
U. S. depletions on Long and Short Creeks	445 acre-feet
Canadian depletions on Souris River	1,974 acre-feet
Canadian depletions on Moose Mountain Creek	1,369 acre-feet
Total depletions	3,774 acre-feet

Recorded flow of the Souris River at Sherwood	3,976 acre-feet
Natural flow at Sherwood	7,750 acre-feet
Fifty percent of natural flow	3,875 acre-feet
Total Canadian depletions	3,329 acre-feet

No special releases were necessary from stored waters in Saskatchewan to comply with the four cubic feet per second provision of Recommendation No. 1 of the 1959 order. The flow into North Dakota at the western crossing of Long Creek was 88 acre-feet, and the flow into Saskatchewan at the eastern crossing was 307 acre-feet which complies with Recommendation No. 2. Short Creek, which rises in North Dakota, contributed 627 acre-feet to the Souris River above Sherwood.

When the board of control met on July 18, 1961, it reviewed the status of all reservoirs in the basin and agreed that severe drouth conditions threatened. Lake Darling contained 47,000 acre-feet July 13, 1961, and the combined storage in the Lower Souris Refuge was 8,100 July 13, 1961. In accordance with Recommendation No. 3b of the 1959 order of the International Joint Commission and guided by criteria tentatively adopted by the board of control at its February 2, 1960, meeting, Mr. Hoisveen, at the board's request on July 20, 1961, notified the directors of the Water Control and Conservation Branch, province of Manitoba, that Westhope releases would be reduced to ten cubic feet per second commencing on or about July 31. Manitoba acknowledged the necessity of the board's decision and offered its full consideration and cooperation in these matters. Because of difficulties in regulating the Westhope releases, the board requested the Water Resources Branch to make an inspection of channel conditions about 15 miles below Westhope. This inspection revealed several natural and artificial obstructions one of which may have, under certain conditions, adversely affected the operations of the Westhope gage. These conditions were brought to the attention of the director of the Water Control and Conservation Branch who subsequently requested removal of the principal obstruction. In 1962 a new hydrologic station will be operating in Melita, Manitoba, which will give further information on stream losses in this reach of the river.

The meeting of the Souris River Board of Control held in Regina, Saskatchewan, on January 29 and 30, 1962, was devoted primarily to the preparation of the annual report, which is presented to the International Joint Commission in Washington, D. C., during the first week of April each year. It was decided at this meeting that the International Souris River Board of Control would meet in Minot on May 9 following the spring snow melt in order to better evaluate the water availability for 1962 reservoir operations. In view of the continued drouth in the Souris River Basin, it was decided to invite representation from the provinces of Saskatchewan and Manitoba responsible for the administration of the waters in those provinces. At the Minot meeting, spring flow and reservoir conditions were reviewed on the Souris River. Water flow and storage conditions on May 1, 1962, were considerably more severe than on July 20, 1961, when drouth criteria were invoked in the basin. Storage in Lake Darling had been reduced to 31,900 acre-feet on that date. Storage in the Lower Souris Refuges, which have a total capacity of 48,040 acre-feet, had been depleted to 8,330 acre-feet. Stream flow in the tributaries of the Souris River in North Dakota was 5.5 cubic feet per second. In accordance with Recommendation 3b of the 1959 order of the International Joint Commission, Mr. Hoisveen notified the board that severe drouth conditions continued to exist in the North Dakota portion of the Souris Basin and that it would not be practicable to maintain 20 cubic feet per second release at Westhope throughout the summer. He presented a letter to the board which

he believed constituted sufficient reason for continuing the use of drouth criteria for operating the Souris River system during the present season unless more favorable moisture conditions occurred. A letter was forwarded by the state of North Dakota to the province of Manitoba comparing the present drouth conditions with the drouth criteria established in Minutes 60A-7. The letter suggested that a continuous release of one to two cubic feet per second should be made to provide stock water from Westhope to Melita. The letter also suggested that in accordance with drouth criterion A in Minutes 60A-7 the balance of the 3,000 acre-feet should be released insofar as is practical as requested by Manitoba. Above average rainfall occurred in most of the basin during the last two weeks in May and during the month of June. The previous drouth conditions had so depleted the moisture in the soil profile that most of the rainfall was absorbed by the soil. Little increase in stream flow was recorded in the upper basin of the Souris River.

A summary of the natural flow of the Souris River at the international boundary gaging station at Sherwood, North Dakota, for the period of January 1, 1962, to June 15 indicates the following flow:

Total diversions in Canada	7,364 acre-feet
Recorded flow at Sherwood	6,083 acre-feet
Natural flow of Souris River at Sherwood	13,447 acre-feet
Fifty percent of natural flow at Sherwood	6,724 acre-feet
Water diverted by Canada	6,896 acre-feet
Quantity diverted by Canada in excess of allotment approximated	172 acre-feet

A cloudburst occurring north of the Sherwood station in Canada in late June may have compensated for the 172 acre-feet deficit. This question will be clarified at a Souris River Board of Control meeting scheduled to take place in Brandon, Manitoba, on July 24, 1962.

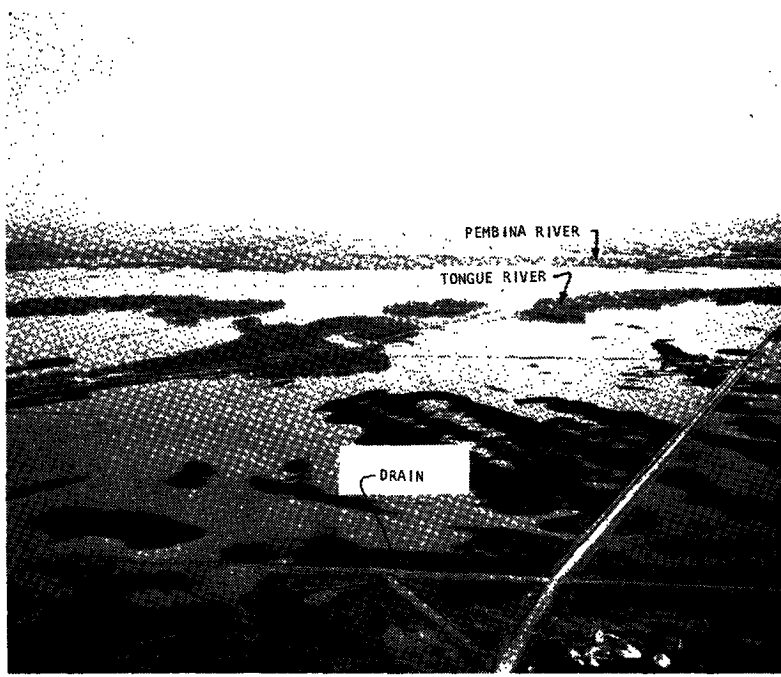
As of July 1, no increases in releases to Manitoba have been made. A sufficient flow is being released from the Westhope station to meet stockwater requirements in Manitoba. The International Joint Commission has expressed considerable optimism over the successful operations of the Souris River Board of Control. This optimism is based on the fact that the board of control was able to operate successfully under the severe drouth conditions of the past two years.

PEMBINA RIVER — INTERNATIONAL NEGOTIATIONS

Geologists volunteer the theory that in the preglacial age the Pembina River was the ancient channel of the Souris River and provided its escape into old Lake Agassiz. It is further contended that remnants of the glacier blocked the passage of the Souris into the present Pembina River and forced it into the Assiniboine River, which is the present pattern of flow. The Pembina River is now one of the principal tributaries of the Red River of the North. The fact that

1,882 square miles of its 3,690 square mile drainage area lies in the United States and the remainder in Canada has established it as an international stream. It is now under the jurisdiction of the International Joint Commission under the provisions of the Red River Reference of 1948. A considerable portion of that area extending from and including a portion of the Turtle Mountains to the confluence of the Pembina and the Tongue Rivers near Pembina is drained by this stream. The main stem of the Pembina River enters the United States approximately 19 miles northwest of Walhalla in northeastern North Dakota.

Records available in the office of the State Water Conservation Commission indicate that the history of flooding on the Pembina River dates back to 1798 at which time the Selkirk Expedition located on its banks where the city of Pembina now stands. Flood damage on the Canadian side is not commensurate with that occurring on the United States side of the boundary. This results from the fact that the Pembina flows in a moderately deep valley which attains canyon proportions in the escarpment near Walhalla. As this stream flows



Pembina Flood

towards the Red River, the channel becomes relatively shallow when it reaches the floor of old Lake Agassiz east of Walhalla. The channel in this area is unable to accommodate the heavy flow of water during flood stage. As a result it overflows its banks and spreads devastation through almost 100,000 acres of rich agricultural land. Many residents of northeastern North Dakota are of the opinion that the 1950 flood was the third to the worst on record. On April 18, 1950, a flow of 20,400 cubic feet per second was recorded at Walhalla. Two days later at which time this flood crested at Neche, 20 miles east of Walhalla, a flow of 10,700 cubic feet per second was recorded. Almost 50 percent of the water had overflowed the banks of the Pembina.

The Corps of Engineers suggest, in their preliminary report for flood control and related purposes, that the most practical plan of improvement would provide for the development of a dam and a reservoir on the Pembina River upstream from Walhalla. The proposed dam would be about 150 feet in height and would consist of a compacted earth embankment with a 20-foot wide crest at elevation 1,118. The embankment would extend about 1,830 feet across the valley at crest elevation. Rock protection would be provided on the upstream face of the structure extending from a point three feet below the minimum conservation pool level elevation 1,017 to the top of the dam.

The resulting reservoir would have a conservation pool capable of storing 10,000 acre-feet of water below elevation 1,017. Approximately 146,000 acre-feet of storage would be occupied at spillway crest elevation 1,093. 221,000 acre-feet would be utilized in passage of a spillway design flood which would attain an elevation of 1,112. The reservoir at spillway crest would be about one-half mile wide for several miles above the dam and would extend a short distance beyond the international boundary. The proposed reservoir would possess multiple purpose features, such as municipal water supplies, water for irrigation, recreation, fish and wildlife.

A satisfactory benefit-to-cost ratio was arrived at by the St. Paul District of the Corps of Engineers. A brief study of foundation materials, however, resulted in an increase in the cost estimate which lowered the benefit-cost ratio to .99. This is one per cent below unity. A benefit-cost ratio of at least unity is considered necessary for obtaining Congressional approval and subsequent appropriations for construction.

In the fall of 1959, a joint survey was undertaken by the North Dakota State Water Conservation Commission and the Manitoba Water Control and Conservation Branch in an effort to determine the possibility of diverting water from the proposed Pembilier Dam into areas best adapted for irrigation in Manitoba. As a result of this survey, it was determined that an area approximating 140,000 acres

could be reached through a canal system originating from a diversion dam below the proposed Pembilier Dam into areas best adapted for irrigation in Manitoba. Much interest has been manifested by Canadians living in the area to develop irrigation. Considerable progress has been made by the Morden-Manitoba Agricultural Experiment Station in developing quick maturing, frost resistant vegetables and fruits through the use of irrigation. Frequently, this portion of Canada is referred to as the Salad Bowl of Manitoba.

The information obtained as a result of the topographic survey stimulated greater interest in the proposed Pembilier Dam as a storage facility to provide irrigation water on both sides of the international boundary. The State Water Conservation Commission at the April, 1960, meeting of the International Joint Commission invited the group to visit the Pembina River Basin and the proposed Pembilier Dam site in view of undertaking the construction of Pembilier Dam as a joint venture between the two countries. The combined sections of the International Joint Commission inspected the area on August 24, 1960. The International Joint Commission held a hearing in the Provincial Legislative Building in Winnipeg the following day. The director of the Manitoba Water Resources and Conservation Board and the chief engineer of the State Water Conservation Commission presented material relative to the feasibility of the two nations undertaking the project as a joint venture. Local proponents of the project expressed much interest in storing flood water and putting it to useful benefit.

The International Joint Commission took immediate and positive action relative to ascertaining whether or not it would be feasible to undertake the project as a joint venture between the two countries. The engineering board of the International Joint Commission was directed to make further studies regarding the feasibility of the project. The International Pembina Engineering Committee was established by the International Joint Commission. The membership is as follows: Canadian section — J. A. Griffiths, chairman, H. G. Riesen and W. P. Strilaeff; United States section — Colonel William B. Strandberg, Corps of Engineers, Milo W. Hoisveen, North Dakota state engineer and Clarence L. Sundahl, Bureau of Reclamation. The committee informed the International Joint Commission at its meeting in Ottawa, Ontario, on October 4, 1960, that it would require until July 1, 1964, to complete a report on a coordinating plan of development designed to resolve economically the inter-related water problems of the Pembina River Basin. It was estimated that it would require $200,000 in United States funds and $399,800 in Canadian funds to gather and make a report available for Congressional consideration.

The North Dakota State Water Conservation Commission was assigned various items needed to complete the report. These include such information as ascertaining the lake and other storages within the basin, obtaining strip topography for routes for municipal and

industrial water supplies, tabulation of existing water development projects, pollution abatement, determination of contributing areas of the basin, storage requirement and allocation to uses, water allocation to countries, alternative proposals for municipal and industrial water supplies, determination of most economic size of reservoir or reservoirs, joint reservoir cost on the basis of benefits realized, canal cost on the basis of design flow, specific purpose cost as incurred and cost allocations to purposes. The following meetings have been held by the Pembina River International Engineering Committee: St. Paul, Minnesota, March 6, 1961; Winnipeg, Manitoba, November 10, 1961; Winnipeg, Manitoba, December 8, 1961; St. Paul, Minnesota, March 29, 1962; and St. Paul, June 6, 1962. A meeting of the engineering board of the International Joint Commission with the Pembina River International Engineering Committee has been scheduled to be held in Grand Forks on August 9, 1962. A recent review of the material gathered by the Pembina River International Engineering Committee indicates that satisfactory progress is being made toward the eventual committee report. It is anticipated that the report will be completed on or about the date it is scheduled for review by the International Joint Commission.

Pembina River Junctions

INTERSTATE COMPACTS

Yellowstone River Compact

North Dakota, Montana and Wyoming have negotiated a compact on the Yellowstone River which was approved by the representatives of those states and their state legislatures, ratified by Congress in 1951 and signed into law by the President October 30, 1951. This compact provides for the diversion of the waters of the Yellowstone River and its tributaries among these three states affected by the Yellowstone River. The provisions of the compact have been printed in previous biennial reports of the State Water Conservation Commission.

The compact commission in the last biennium has been concerned with industrial water rights, large stockwater dams and the maintenance of gaging equipment along the Yellowstone River. The Yellowstone River drains very little of North Dakota, but does contribute 57 per cent of the water at the confluence of the Missouri and Yellowstone Rivers. Because only a small portion of North Dakota is affected by the Yellowstone, the states of Montana and Wyoming are mainly interested in the compact. These two states have a controlling voice over matters in which the commission is involved and also finance half of the costs of operating the commission. The other half of the costs is borne by the federal government.

COMPACTS UNDER NEGOTIATION

Little Missouri River Compact

The Little Missouri River drains portions of northeast Montana, northwest South Dakota, southeast Montana and southwest North Dakota. It rises in Wyoming and flows northward through the southeastern corner of Montana and the northwestern corner of South Dakota and enters into North Dakota in the extreme southwestern corner of the state. It then flows northward through the North Dakota Badlands to a point approximately 17 miles south of Watford City, then eastward north of the Killdeer Mountains and then empties into the Garrison Reservoir near Elbowoods. The drainage area of the Little Missouri approximates 9,500 square miles of which there are 5,200 in North Dakota, 600 in South Dakota and Wyoming and approximately 3,100 square miles in Montana.

Water shortage problems were called to the attention of the North Dakota State Water Conservation Commission in 1954 when numerous complaints were received from ranchers owning land adjacent to that stream who stated that little or no water was available for irrigation purposes. Since the river is a matter of jurisdiction of each of the states concerned, it was apparent that the problem of allocations could best be provided through a compact arrangement. As a result of action taken in the North Dakota State Legislature,

the North Dakota Congressional delegation instigated federal legislation authorizing compact negotiations among the affected states in 1957. The provisions of the authorization were printed in the Eleventh Biennial Report of the commission.

Major General John S. Seybold, retired, was appointed federal representative of the compact commission, and was designated as chairman by the commission. Members of the engineering board for the commission are Earl Lloyd, Wyoming state engineer; Fred E. Buck, Montana state engineer; Joseph W. Grimes, South Dakota chief engineer, South Dakota Water Resources Board, and Milo W. Hoisveen, North Dakota state engineer. Harlan Erskine, district engineer, U. S. Geological Survey, is adviser for the engineering board. Bismarck was the site of the first meeting of the Little Missouri Compact Commission. The meeting was held on April 24, 1958. The board also inspected the Little Missouri Basin in August, 1958, in order to better evaluate the conditions that contributed to the low flow in the Little Misouri. A second meeting of the commission was held in Bismarck on December 10, 1960. Several meetings of an informal nature have been held individually with the federal representative.

It was apparent at the first meeting of the compact commission that several difficult problems had to be solved that were complicated by the procedure followed in each state in allocations for an administration of water rights. The curtailment of issuance of water rights on the Little Missouri River until compact negotiations were completed was given consideration. The legal differences in the administration of water rights among the states made such action impossible. Currently, consideration is being given to a proposal of allocating water on a time period which would restrict pumping during the growing season which was tentatively considered to be between May 1 and November 1. Much difficulty was encountered in attempts to establish a base flow on the stream. Little in the way of stream flow records was available which further complicated the problems as to the natural flow that existed. In 1962 the period for compact negotiations was extended by Congress until 1965.

COMPACTS PROPOSED FOR FUTURE CONSIDERATION

James River

A tributary of the Missouri, the James River has its source in central North Dakota and flows in a southerly direction through North Dakota and South Dakota, joining the Missouri near Yankton, South Dakota. The James River is one of the principal rivers involved in the developments proposed under Missouri River Basin Projects in North and South Dakota. It will be used as a major channel in connection with the Garrison diversion project in North Dakota and flows through the irrigable land in the proposed Oahe diversion project in South Dakota. Because of the future develop-

ments contemplated in the James River Basin it appears that a compact would be primarily concerned with the imported waters from the Missouri River through the Garrison and Oahe diversion projects. Interest in forming a compact was shown for a while by the James River Development Association, a private organization composed of representatives from the two states, but as of yet no definite action has been taken by Congress in authorizing such a compact nor is any such action contemplated in the near future.

RED RIVER OF THE NORTH

From the confluence of the Bois de Sioux and Ottertail Rivers at Breckenridge, Minnesota, the Red River of the North flows north to form the boundary between North Dakota and Minnesota and then flows into Canada where it empties into Lake Winnipeg. Because the Red River drains portions of South Dakota, North Dakota and Minnesota as well as Manitoba in Canada, it is both an interstate and an international stream. North Dakota for many years has been interested in securing a compact for the division of the waters of the Red River among the interested states and provinces so as to assure the maximum development in this area. In 1937 the United States Congress authorized the states of North Dakota, South Dakota and Minnesota to establish the Tri-State Water Commission to administer and supervise the drainage area for the Red River of the North with the exception of the Ottertail and its tributaries. This commission was active for a few years after its organization, but because of the requirements in the authorizing legislation that commission representatives from all states be present at meetings of the commission, it could not function effectively. South Dakota had only a small interest in the Red River and was not concerned with the commission. The Tri-State Water Commission is still in existence and can be activated as soon as members from the three states are designated and assume responsibility for the commission's operations.

Of primary interest to the states of North Dakota and Minnesota is the division of the waters of the Red River. Several cities along the Red River in North Dakota depend extensively on the Red River for their municipal water supply. North Dakota also has a definite interest in the Sheyenne River which is the major tributary of the Red River in North Dakota. Several attempts have been made by officials in North Dakota to undertake compact negotiations with Minnesota for a division of the waters of the Red River. These attempts have failed, mainly because Minnesota has not indicated any particular interest in negotiating a compact on the Red River. Present planning for the Red River is accomplished through the Red River Basin Planning Committee, an organization consisting of representatives from Minnesota and North Dakota.

NORTH FORK OF THE GRAND RIVER

The North Fork of the Grand River has its source in the extreme southwestern part of North Dakota and flows in an easterly direction

into South Dakota joining the South Fork of the Grand River immediately above the Shadehill Dam near Lemmon, South Dakota. The apportionment of the waters of the North Fork of the Grand River between the states of North and South Dakota is a problem that should be determined in the near future. The Bureau of Reclamation has completed the Shadehill Dam in South Dakota, constructed to provide water for irrigation in that state. This dam stores a major portion of the run-off from both forks of the Grand River.

In North Dakota the Bowman-Haley Project is located on the North Fork of the Grand River. The Corps of Engineers recently completed a study of the Bowman-Haley Project in which it indicated that the project has a favorable benefit to cost ratio. Consideration of the project by Congress is still pending. Although North Dakota's rights to waters originating within the state are set forth in the North Dakota Constitution, these rights should be protected by a compact providing for the reasonable and equitable division of the waters in this river. In order to protect the interests of this district, the State Water Conservation Commission in 1951 passed a resolution reserving the waters of the North Fork of the Grand River in North Dakota for the beneficial use of the Bowman-Haley Irrigation District.

LEGAL WATER USERS ORGANIZATIONS

Irrigation Districts

Throughout history man has attempted to devise ways to improve his standard of living through the control and use of the resources available to him. Irrigation of lands to provide the food and fiber required is an example of his efforts to this end. The science of irrigation was known and practiced by ancient civilizations — in fact in some countries many of the canals and other works constructed to convey water to lands hundreds of years ago are still in use today. In many areas where man has settled, irrigation was a necessity, for without it the production of food crops was impossible. The high state of civilization reached by many ancient nations can be directly associated with irrigation development and with the ingenuity of man to provide the means to bring irrigation waters to his land.

Irrigation development can be accomplished either on an individual basis or a group basis. Even today, as in ancient times, both methods are used successfully. Individuals often develop their own irrigation systems providing they have the financial means to pay the construction and operating costs. In many cases it is beyond the ability of one individual to build the canals and other features of an irrigation system necessary to bring irrigation water to his land, however, if he joins with his neighbors with each contributing a portion of the costs of a larger system to serve the land of all concerned, the development of irrigation becomes possible. Recognition of this approach has given rise to several types of group enterprise

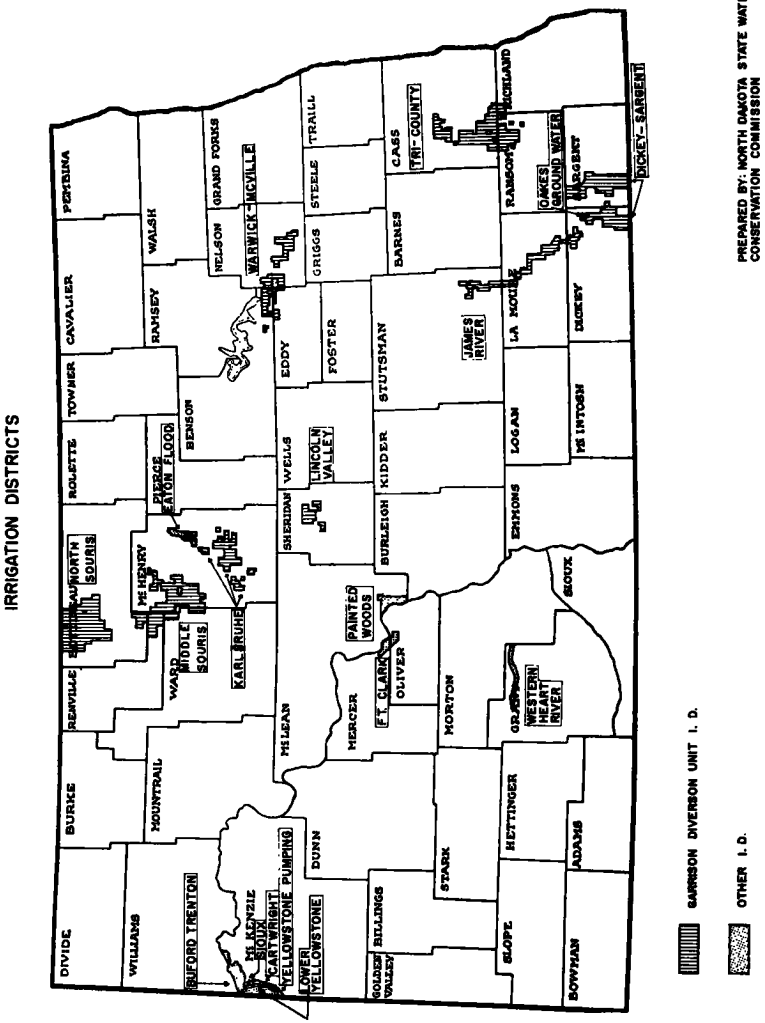
irrigation organizations in the western states of the United States where irrigation is most prevalent.

In North Dakota three such irrigation organizations are provided for by law. They are irrigation companies, cooperative irrigation companies (often referred to as Mutual Aid Corporations in North Dakota) and irrigation districts. Of the three, irrigation districts are most generally used in North Dakota, although through the years several mutual aid corporations have been established for irrigation purposes, some of which are in operation today. No irrigation companies are operating in North Dakota.

Cooperative irrigation companies or mutual aid corporations are ordinarily organized on a non-profit basis. They are governed by a board of directors and have authority to enter into contracts, incur obligations and hold property. Membership in a cooperative irrigation company is voluntary in that those individuals who do not wish to join are not compelled to take stock in the company. If they are members of the cooperative organization they cannot be denied the rightful proportion of the water supply. Water rights may be held by the individual stockholders or by the company. The primary purpose of the company is to own irrigation works to deliver water to its members or farm operators. The affairs of such companies are conducted in accordance with the laws of the state, the articles of incorporation of the company, its bylaws, and the rules and regulations governing the delivery of water. The stockholders of the cooperative companies control the policy of the organization through the board of directors they elect, generally on the basis of one vote for each share of stock. Mutual aid corporations have been important in irrigation development throughout the west and have been used successfully in many states. The cooperative irrigation company is limited in its financing capabilities because the bonds or securities it issues are not tied to the land. The assets of the company which it can use to secure its bond issues are generally the irrigation system to serve certain lands. As a result, this type of organization ordinarily has been unable to finance developments requiring a large expenditure of funds.

Irrigation districts, on the other hand, are public or quasi-municipal corporations organized under state law for the specific purpose of providing a water supply for the irrigation of lands. Irrigation districts are political subdivisions of the State with defined geographical boundaries. They have the power to issue bonds and to tax. Their chief source of revenue is from assessments they levy upon the land benefited. These assessments are levied on all the lands in the district susceptible of irrigation whether the owner of the land approves or objects to the irrigation development of his land.

Irrigation districts are created under authority of the state legislatures and through designated public officials or courts depending


IRRIGATION DISTRICTS
DIVIDE
BURKE
RENVILLE
BOTTINEAU
SOURIS
ROLETTE
TOWNER
CAVALIER
PEMBINA
WILLIAMS
MOUNTRAIL
WARD
MOUSE RIVER
MCHENRY
PIERCE
EATON FLOOD
BENSON
RAMSEY
WALSH
NELSON
GRAND FORKS
WARWICK-MCVILLE
EDDY
FOSTER
GRIGGS
STEELE
TRAILL
CASS
TRI-COUNTY
RAMSEY
RICHLAND
OAKES GROUND WATER
LOGAN
MCINTOSH
DICKEY
LA MOURE
JAMES RIVER
SARGENT
DICKEY-SARGENT
BUFORD TRENTON
MCKENZIE
SIOUX
CARTWRIGHT
YELLOWSTONE PUMPING
LOWER YELLOWSTONE
GOLDEN VALLEY
BILLINGS
DUNN
MILLER
KARL BRUHER
SHERIDAN
WELLS
LINCOLN VALLEY
BURLEIGH
KIDDER
STUTSMAN
EMMONS
SIOUX
PAINTED WOODS
MERCER
FT. CLARK
OLIVER
MORTON
GRANT
WESTERN HEART RIVER
STARK
HETTINGER
SLOPE
ADAMS
BOWMAN
GARRISON DIVERSION UNIT I. D.
OTHER I. D.
PREPARED BY: NORTH DAKOTA STATE WATER CONSERVATION COMMISSION

upon the state concerned. In North Dakota they are organized upon petition filed with the State Engineer by the owners of the irrigable land located within the boundaries of the proposed district. Following the hearing on the petition that the State Engineer is required to hold, the land owners vote on the approval of the establishment of the district. If the majority of the votes cast favor the establishment of the district it is declared established by the State Engineer. The district will include all lands set forth in his Order establishing the district as it is voted on. An irrigation district is governed by a board of directors who are owners of land within its boundaries and have been elected by the electors of the district.

Irrigation districts have the advantage over cooperative irrigation companies in that the obligations they issue are secured by the land that can be benefited by the irrigation system built to serve the district. Another difference between a cooperative irrigation company and an irrigation district is that all lands susceptible of irrigation by a district's system can be included in an irrigation district while only those lands that the owner wishes to have served by an irrigation system can be included in a cooperative irrigation company. This advantage of the irrigation district type of organization enhances the development of an irrigation system in many cases because costs associated with that system can be spread over a greater number of acres than is often the case in mutual aid corporations.

In the matter of raising revenue irrigation districts levy special assessments against benefited lands. These special assessments are spread on the tax rolls and collected by the county treasurer along with other county taxes. They are obligations against the land and laws pertaining to delinquencies apply to such special assessments. Irrigation districts do not have any power to make a general levy to finance their operations. Irrigation districts have the authority to enter into contracts with State or Federal agencies for the construction of irrigation facilities to serve lands in their district. These contracts also generally provide for the operation and maintenance of the irrigation system. Such contracts that the irrigation districts might negotiate must be voted on and approved at an election of the electors of the district. The Bureau of Reclamation is the Federal agency primarily concerned with the development of irrigation in North Dakota.

At the present time there are 17 organized Irrigation Districts in North Dakota. Of these, seven have been organized to function in connection with the development of the Garrison Diversion Unit and ten have been organized to provide for irrigation through their own systems or systems that have been built by the State Water Conservation Commission or by the Bureau of Reclamation. In addition there are three Mutual Aid Corporations operating at the present time in North Dakota. The Irrigation Districts organized in North Dakota are discussed separately in the following section of this report.

BUFORD-TRENTON IRRIGATION DISTRICT

The Buford-Trenton Irrigation District, consisting of approximately 7,500 acres of irrigable land, is located on the north bank of the Missouri River in Wiliams County between the towns of Buford and Trenton and was established in 1950. The district obtains its water supply from the Missouri River. The project was constructed as a Case-Wheeler project and was operated for many years by the Buford-Trenton Mutual Aid Corporation. In 1950 the Buford-Trenton project was turned over to the Bureau of Reclamation and following this action the Buford-Trenton Irrigation District was organized and repayment contracts negotiated.

The project facilities consist of three pumps which pump water from the Missouri River into a 14½-mile canal that carries the water to the irrigable lands.

The Buford-Trenton Irrigation District was faced with a critical problem of erosion along the Missouri River that threatened to cut off a large portion of the project lands and destroy a considerable amount of the main canal. Appropriations were made by Congress to the Corps of Engineers to investigate and provide the necessary protective works for the project lands. This work has been substantially completed.

In 1961 and 1962, because of degradation of the Missouri River channel and low flows in the river, the district was confronted with a severe pumping problem. The State Water Conservation Commission cooperated with the district on two occasions in securing additional releases from Fort Peck Reservoir, which is operated by the Corps of Engineers, to assure sufficient water for the Buford-Trenton and Lewis and Clark Projects.

On June 5, 1962, a meeting was held in Williston attended by representatives of the Corps of Engineers, the State Water Conservation Commission, the Bureau of Reclamation and the Buford-Trenton Irrigation District when a permanent solution to the pumping problem was discussed. As a result of this meeting, the Bureau of Reclamation will submit plans to the irrigation district, and the district will construct a floating vortex break device to aid low flow pumping. The Corps of Engineers, meanwhile, will work on plans for permanent changes.

The directors of the Buford-Trenton Irrigation District are Warren Gathman, secretary-treasurer, Buford; Clarence Johnsrud, Buford; J. D. Cannaway, Trenton; Donald Rider, Buford; and B. N. Nelson, Trenton, manager.

CARTWRIGHT IRRIGATION DISTRICT

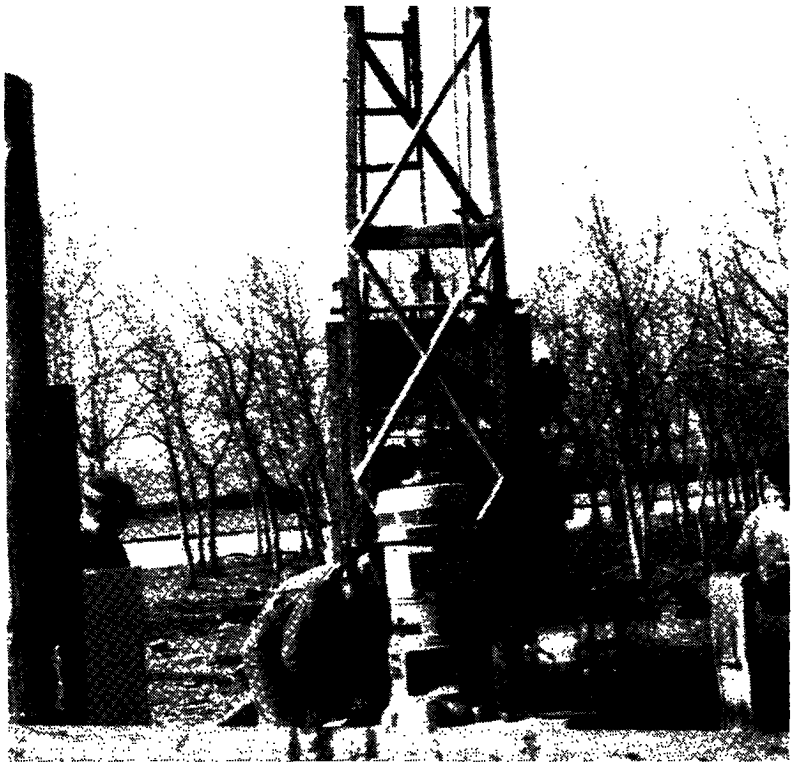
The Cartwright Irrigation District is located in McKenzie County along the Yellowstone River near Cartwright, North Dakota. The district was organized in 1939 and contains about 800 acres of irrigable land that was originally proposed to be irrigated by pumping from

the Yellowstone River. This project was authorized as a part of the Missouri River Basin Project. Bureau of Reclamation investigations of the project have determined that it is infeasible under their criteria.

The State Water Conservation Commission in 1959 investigated the feasibility of using ground water from an excellent aquifer adjacent to the channel of the Yellowstone River that is recharged by flows from the river. In conjunction with these investigations a test well, 45 feet deep, was installed. This well was successfully used to irrigate approximately 200 acres of the project lands.

In May, 1961, when the Yellowstone River level receded to an extremely low level it became necessary to construct a new, deeper well. The Commission cooperated with the District in the installation of a well 75 feet deep which provided adequate water to serve the District lands. The original 45 foot well was retained, since by pump test it was shown that both wells could operate except during periods when the Yellowstone was extremely low. In June of 1962, the Cartwright District negotiated a bond issue to finance its obligations in connection with the installation of the wells, pumps and motors.

Directors of the Cartwright District are William Lassey, Perry Elletson and Henry Iszley, all of Cartwright.



Cartwright Project Pump Installation

EATON FLOOD IRRIGATION DISTRICT

Containing 7,000 acres of hay land adjacent to the Mouse River, the Eaton Flood Irrigation District is located in McHenry County and is served by flooding from the river during the spring of the year. The district was organized in 1935 under a special law enacted by the North Dakota Legislature providing for flood irrigation districts. Land in the district is owned by 38 individuals with ownership varying from 10 to 700 acres. The project facilities were financed by the Public Works Administration and constructed in 1936 under the supervision of the North Dakota State Engineer. The original cost was $5.00 per acre.

A 12-foot high dam on the Mouse River with control gates that regulate the flow of the river are included in the project works. During the spring, water can be diverted from the channel reservoir into and through a series of ponds. These ponds constitute the hay meadows. The depth of water and the duration that it is retained in a pond can be regulated by control works and other pertinent structures that are included in the project.

The State Water Conservation Commission, at the request of the District, is presently investigating the possibility of expanding the District by serving an additional 100 acres of land. The District has a water right for 10,000 acre feet of water from the Mouse River and has requested an allocation of an additional 10,000 acre feet to serve their project.

Members of the board of directors of the Eaton Flood Irrigation District include Richard Oium, chairman, Towner; Vernon Rom, Denbigh; L. U. Cook, Towner; C. E. Follman, Towner; Adam C. Haman, Towner; and Joseph C. McIntee, secretary, Towner.

FORT CLARK IRRIGATION DISTRICT

Located in Mercer and Oliver Counties along the Missouri River between the towns of Stanton and Fort Clark, the Fort Clark Irrigation District was the first irrigation project developed in North Dakota under the Missouri River Basin Project which was authorized by Congress in 1944. The district contains 2,089 acres of irrigable bottom land along the Missouri River that can be served by pumping water from the river. The district was organized in 1948, and a repayment contract with the Bureau of Reclamation was negotiated in 1950. Construction of the facilities began on April 25, 1953, and was completed by August 1 of the same year. The project works include a pumping plant, consisting of three pumps, and two main canals. The cost of the entire unit was $760,000. The District is presently in the seventh year of its 10-year development period. Approximately 1,600 acres of the district's 2,089 acres of irrigable land have been developed and are being irrigated.

On the board of directors of the Fort Clark Irrigation District are Joseph Gustafson, chairman; Leonard Olander, director; Einer

Alderin, director; and Henry Klindworth, secretary-treasurer. The directors are all of Stanton, North Dakota.

LOWER YELLOWSTONE IRRIGATION DISTRICT

Located in northwestern McKenzie County, the Lower Yellowstone District is the oldest irrigation district in North Dakota, having been formed in 1909. The irrigable lands in the District are a part of the Lower Yellowstone Project, one of the first irrigation projects built by the Bureau of Reclamation. The Lower Yellowstone Project contains over 55,000 acres, 20,000 acres of which are located in the North Dakota District. A 72-mile diversion canal conveys water from a diversion dam at Intake, Montana, on the Yellowstone River to irrigable lands. Construction of the project began in 1905 with the first water being delivered to the irrigable lands on April 30, 1909. Two irrigation districts had to be established since the irrigable land is in both Montana and North Dakota. The two irrigation districts, however, have designated a board of control consisting of representatives from each district which serves as the operating board for the entire project.

Construction costs of the project, which amounted to $66 per acre, are being repaid under a contract with the Bureau of Reclamation that provides for annual repayment charges based on the value of crops produced each year. The payments range from $4 an acre for Class I land to $1.20 per acre for Class III land. Besides these assessments, an annual operation and maintenance charge is assessed on the district lands.

Alfalfa, corn, wheat, barley, beans and sugar beets are the principal crops raised on the Lower Yellowstone Project. An extensive livestock feeding operation is one of the major activities of project farmers, with dairying also an important operation.

Members of the Board of directors for the District are Alfred Norby, Fairview; Leonard R. Berry, Fairview; and Marion B. Martin, Fairview.

OAKES GROUNDWATER IRRIGATION DISTRICT

Located in Dickey County, immediately east of the city of Oakes, the Oakes Groundwater District, containing 640 acres of land, was established in 1957. The irrigable lands in the District are served from wells that the individual landowners have installed. There are five landowners in the District and two of them have developed irrigation wells. The lands are irrigated by both gravity and sprinkler methods.

The board of directors of the Oakes Groundwater Irrigation District includes C. E. Roney, Ivan Rodine and Paul Roney, all of Oakes.

PAINTED WOODS IRRIGATION DISTRICT

The Painted Woods Irrigation District, located along the Missouri River in McLean County, was established in 1937.

The irrigable land in the District was included in one of the five pumping projects on the Missouri River in North Dakota under the Missouri River Basin Project in the Flood Control Act of 1944. The project lands can be served either by pumping from the Missouri River or from wells. Development of the project was deferred because of an apparent lack of interest on the part of the landowners.

In 1959 a new interest in irrigation developed among the landowners and several of them proceeded to develop their own system. They requested that the Irrigation District be dissolved but this action was opposed by owners of land in the District not readily accessible to the Missouri River. It was their contention that dissolution of the District would preclude the development of their land. The individuals who proceeded with the development of their own systems organized the Nettle Creek Mutual Aid Corporation, which is operating successfully at the present time. The Painted Woods Irrigation District has not been dissolved and can be utilized if irrigation development for all the project lands is undertaken.

Members of the board of directors of the Painted Woods Irrigation District include Oscar Oberg, chairman, Lambert Chesworth and Robert Bichert, all of Washburn.

SIOUX IRRIGATION DISTRICT

The Sioux Irrigation District is located on the south bank of the Yellowstone River in McKenzie County, four miles northwest of Cartwright, North Dakota. The District includes approximately 800 acres of irrigable land of which 625 are being assessed for irrigation costs. The irrigation facilities for this district were constructed by the North Dakota State Water Conservation Commission in 1938 and 1939 through an arrangement with the Rural Rehabilitation Corporation and the Irrigation District. Irrigation water for the project is pumped from the Yellowstone River through the use of a pump powered by a 110-horsepower natural gas motor. There are six individuals who own the irrigable land in this project and their farming operations are devoted principally to the production of feed, forage crops and small grains. The State Water Commission is holding Sioux Irrigation District bonds in the amount of $17,500 for the construction of the original project facilities. Degradation has occurred in the channel bed in the lower reaches of the Yellowstone River with the result that the District experiences difficulties in operating their pump when the flow in the Yellowstone River is low. To solve this problem the State Water Conservation Commission investigated the feasibility of utilizing a well in the groundwater aquifer that underlies the project as a source for their water supply. A well was

constructed and a pump and motor installed in May of 1960. The pumping unit has a capacity of over 2,000 gallons per minute. When the Yellowstone River is flowing at 3,000 c.f.s. or more it is possible to use both the well and the river intake. Although results to date have been successful the total potential for irrigation cannot be reached until additional well capacity is made available.

A bond issue aimed at providing additional wells and facilities and increasing total capacity to the neighborhood of 6,000 gallons per minute was considered favorably at the District meeting of February 6, 1961, but later rejected.

Directors of the Sioux Irrigation District are M. E. Sandy, Richard Croy, and Lawrence Croy, all of Cartwright. Alfred Gullickson of Cartwright is the secretary of the District while Emil Hartl of Cartwright is the assessor.

WESTERN HEART RIVER IRRIGATION DISTRICT

Organized in December, 1953, the Western Heart River Irrigation District includes 2,463 acres of irrigable land lying along the Heart River in Grant County below the Heart Butte Dam. Water for the District is pumped from the Heart River from releases made from the Heart Butte Reservoir. Twenty-five separate pumping plants convey the water to the irrigable land. The District was organized in December, 1953, and the repayment contract between the District and the Bureau of Reclamation was negotiated in 1955. Construction of the irrigation facilities for the project was substantially completed by June 30, 1956, with the irrigation water made available to some of the lands in the District in the fall of the year. 1958 was the first year of the seven-year development period. Approximately 70 per cent of the land is now developed for irrigation.

Directors of the Western Heart River Irrigation District are John Heintz, secretary, Cleon Striegel, Harold Hager and A. A. Stegmeier.

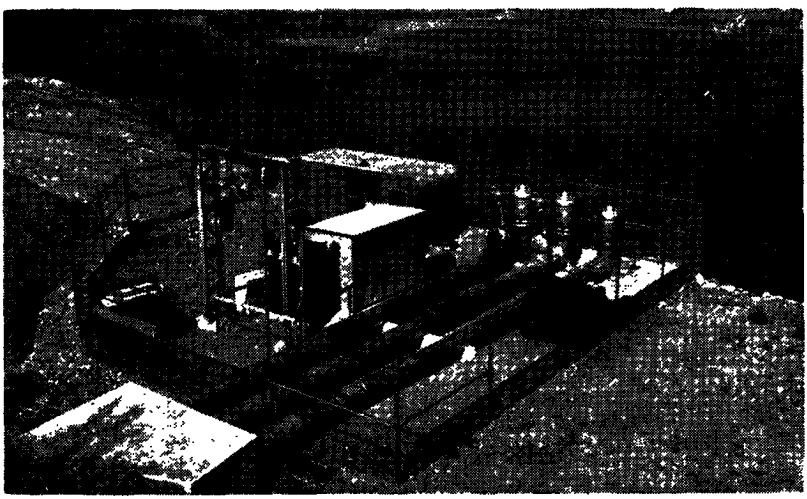
YELLOWSTONE PUMPING IRRIGATION DISTRICT

The Yellowstone Pumping Irrigation District is located in McKenzie County along the Yellowstone River immediately above and adjacent to the Cartwright Irrigation District. Organized in 1938, the district contemplated the development of 2,000 acres of irrigable land in conjunction with the Sidney Pumping Project in Montana. At that time the District arranged for a loan through the State Water Conservation Commission for sufficient funds to enlarge the intake of the Sidney Project to a sufficient size to serve the District lands. Although this enlargement was accomplished, the canals and other facilities to serve the Yellowstone Pumping District lands were not constructed because of the curtailment of such construction activities during World War II. The obligation of the district to the Commission for $3,500 for the enlargement of the intake for the Sidney

Project remained, and a levy of the project lands to repay this loan has been made each year. A total of $4,090.59 has been paid by the District on principal and interest of the loan with $643.29 of the principal still outstanding.

After a well was developed as a water source in the Cartwright District, the landowners in the Yellowstone Pumping District indicated an interest in developing a system of groundwater wells to serve their lands. Amalgamation of the two Districts was proposed in order to develop a joint water system but was abandoned because of legal requirements in handling outstanding indebtedness of the Yellowstone Pumping District.

Directors of the District are R. S. Nutt, secretary, Sidney, Montana; Roy Olson, Cartwright; Gerald Melland, Cartwright; and Bjerne Walla, Cartwright.



Fort Clark Pumping Plant

IRRIGATION DISTRICTS IN THE GARRISON DIVERSION UNIT AREA

Seven irrigation districts have been organized since the fall of 1957, in the Garrison Diversion Unit area that will function when this multiple purpose project is developed. These districts contain approximately 320,000 acres of irrigable land that can be served with a water supply from the Missouri River that will be available through the Garrison Diversion Unit. These districts, together with others in the area that will be organized, and the Garrison Diversion Conservancy District will contract with the Bureau of Reclamation for the construction, operation and maintenance of the million acre Garrison Diversion Unit.

The Garrison Diversion Unit is a multiple-purpose water resources project that will serve a number of different types of water users scattered throughout central and eastern North Dakota. Irrigation is the principal purpose of the project and has been allocated approximately 80 per cent of the total cost. Other important project purposes include municipal and industrial water, recreation, fish and wildlife and lake restoration. All water users will depend on the principal supply works of the project for their water supply and will therefore have a common interest in the over-all development of the Garrison Diversion Unit. The obligations and responsibilities of the water users will be provided for through irrigation districts and other political subdivisions that exist or will be established. The over-all interest of all water users and project beneficiaries will be represented through the 25-county Garrison Diversion Conservancy District.

The seven irrigation districts that have been established in the Garrison Diversion Unit area along with others that will be organized in the future will enter into a contractual relationship with the Garrison Conservancy District and the Bureau of Reclamation for the construction and operation and maintenance of the project works. Since these districts were organized a considerable portion of the work of the districts' boards of directors has been in negotiating satisfactory forms of repayment contracts for the project with the Bureau of Reclamation and the Garrison Diversion Conservancy District. These preliminary negotiations are substantially complete and a draft of a repayment contract that appears to meet all the requirements of the Bureau of Reclamation and is in a form that appears to be acceptable to the irrigation districts has been developed. This repayment contract form that has been approved by the irrigation districts is presently being reviewed by the Department of Interior in Washington, D. C. It will be submitted to the irrigation districts for further negotiations as soon as the authorizing legislation for the Garrison Diversion Unit has been approved by Congress.

Because of the existence of the Garrison Diversion Conservancy District a somewhat different procedure was followed in the establishment of irrigation districts in the Garrison Diversion Unit area than is the case in other irrigation district organizations. Ordinarily

all potentially irrigable land that can be served by an irrigation system must be included in an irrigation district if the development of irrigation facilities for that district is to be feasible. This is necessary because it is essential that all land that can be benefited be assessed for a proportionate share of the costs of the irrigation system.

In every area that has an irrigation potential there are landowners who would prefer not to irrigate and therefore have their land excluded from the irrigation district. The existence of the Garrison Diversion Conservancy District permits the wishes of farmers in this category in the Garrison Diversion Unit area to be recognized. The Conservancy District is in a position, and has pledged a portion of the revenue that it will obtain from the tax levy it can make, to pay the costs associated with lands that can be irrigated by an irrigation system but which are left out of the irrigation district at the owners request. Because these lands are left out of the irrigation district they are not eligible for an irrigation water supply nor can they be assessed for irrigation water charges. In the case of every district organized in the Garrison District Unit area to date the amount of land that is left out of an irrigation district at the owners request is relatively small. These so called "missing acres" range from two percent to 20 percent of the potentially irrigable land in any irrigation district in the Garrison Diversion Unit area that has been organized. It is expected that each of the existing irrigation districts will make a concerted effort to include as many of these missing acres in their irrigation district as is possible prior to the time they will be requested to negotiate repayment contracts for the irrigation facilities to serve their district.

A brief discussion of each of the existing irrigation districts in the Garrison Diversion Unit area is included in the following section of this report.

DICKEY-SARGENT IRRIGATION DISTRICT

Established on September 27, 1957, the Dickey-Sargent Irrigation District contains approximately 34,000 acres of land classified as irrigable by the Bureau of Reclamation detail surveys. It is located in Dickey and Sargent Counties in southeastern North Dakota. Water to serve the irrigable lands in the Dickey-Sargent Irrigation District will be obtained from project waters in the James River that are released to that river from the Lonetree Reservoir. The water will be conveyed through the 11-mile long Oakes Canal designed to serve 46,000 acres of land in this area. Of the irrigable acres in North Dakota, 34,136 are in the irrigation district.

The directors of the Dickey-Sargent Irrigation District include Carl Daniels, chairman, Oakes; William Bossee, Cogswell; Emil Bandert, Straubville; N. A. Dietz, Cogswell; Louis Rehovsky, Oakes; and James Kenward, secretary, Forman.

JAMES RIVER IRRIGATION DISTRICT

Located along the James River in Stutsman, LaMoure and Dickey Counties, the James River Irrigation District contains approximately

13,700 acres of irrigable land and was established on September 20, 1957. It is the first irrigation district established in the Garrision Diversion Unit area. The water supply to serve the District will be obtained from the project waters that will be available in the James River. Water will be pumped from the James River to serve the irrigable lands. The Bureau of Reclamation in its detailed investigations of the James River area has determined that there are 13,690 acres of irrigable land that can be served, of which 13,127 are in the district.

Directors of the James River Irrigation District include Earl Chappell, Dickey; Earl Amundson, Jamestown; Charles Arndt, Fullerton; and Robert Knudson, secretary, LaMoure.

KARLSRUHE IRRIGATION DISTRICT

The Karlsruhe Irrigation District was organized on June 19, 1958, and contains approximately 12,200 acres of irrigable land located in south central McHenry County immediately south of the Souris River. The District will receive its water supply from a canal leading from the Velva Canal. The Bureau of Reclamation surveys reduced the amount of irrigable land to about 12,200 acres of which about 11,000 acres are in the Karlsruhe Irrigation District. In conducting their detailed surveys of the area, the Bureau of Reclamation discovered that much of the land originally contemplated for irrigation was too sandy to be suitable for irrigation development; therefore, it was eliminated in the definite plan report.

Directors of the Karlsruhe Irrigation District include Delbert Krumweide, Voltaire; George Lauinger, Balfour; and Leo Killer, Karlsruhe; and Alvin Kramer, secretary, Towner.

LINCOLN VALLEY IRRIGATION DISTRICT

Located in Sheridan County south of the Lonetree Reservoir, the Lincoln Valley Irrigation District will be served by water from the McClusky Canal before that canal empties into the Lonetree Reservoir. The District contains approximately 5,400 acres of irrigable land, as based on the Bureau of Reclamation's detailed surveys, and was established by order of the State Engineer on March 30, 1960. Because the Lincoln Valley Irrigation District is located adjacent to the Lonetree Reservoir, its irrigable lands can be served rather easily. Approximately 1,100 acres of irrigable land in this area are not included in the Lincoln Valley District.

Lincoln Valley Irrigation District directors include Edwin Rau, chairman, Denhoff; Walter Essig, Lincoln Valley; and Roger Filler, Goodrich; and Warren Tewksbury, secretary, McClusky.

MIDDLE-SOURIS IRRIGATION DISTRICT

The Velva Canal of the Garrison Diversion Project will serve the Middle-Souris Irrigation District which contains approximately 87,000 acres of land in McHenry, Ward, Renville and Bottineau Counties classified as irrigable by the Bureau of Reclamation semi-detail surveys. The Velva Canal, which heads northward from the Lonetree

Reservoir, will convey water to serve the irrigable lands in this District as well as approximately 250,000 acres of additional land in the Souris Loop area. The district was established in September, 1958. Detail investigations are presently being conducted by the Bureau of Reclamation in this area. These studies have indicated a substantial reduction in the land classified as irrigable in the Middle-Souris District. It is estimated that approximately 50,000 acres of land in this district will be classified as irrigable.

Directors of the district are Bill Long, chairman, Upham; Clive Stevenson, Maxbass; E. James Boyd, Deering; Einar Christianson, Glenburn; E. P. Nicolaisen, Minot; Gehard Ronnie, Minot; W. H. Sallee, Kramer; and Alvin Kramer, secretary, Towner.

TRI COUNTY IRRIGATION DISTRICT

The largest irrigation district that has been organized in the Garrison Diversion Unit area, the Tri County Irrigation District, is located in Cass, Ransom and Richland Counties in southeastern North Dakota. The District contains approximately 88,000 acres of irrigable land along the western rim of the Red River Valley which will be served by pumping Missouri River water that has been diverted into the Sheyenne River from that river to the irrigable lands. The District was established April 18, 1958. The irrigable lands in this District are not included in that proposed to be developed in the original one million acre Garrison Diversion Project as set forth by the Bureau of Reclamation. Organization of an irrigation district was desired by the farmers in the area so they could be in a position to utilize project return flow water when it becomes available.

Members of the board of directors of the District include Robert W. Radcliffe, chairman, Leonard; Lawrence Baarstad, Leonard; Ervin Bartholomay, Leonard; Hugo Hoffman, Wheatland; Lorry I. Madsen, Wheatland; Gorden Roesler, Leonard; Walter Geyer, Sheldon; and Clark Richards, secretary, Leonard.

WARWICK-McVILLE IRRIGATION DISTRICT

The Warwick-McVille Irrigation District, located in Nelson, Benson, Eddy and Ramsey Counties, was established in November, 1957. Water for the land in the District will be diverted from the Lonetree Reservoir into the New Rockford and Warwick-McVille Canals. Detail investigations made by the Bureau of Reclamation indicate that there are 47,219 acres of irrigable land in the service area that can be served by this canal of which 35,971 acres are in the Warwick-McVille Irrigation District. It is expected that a number of the landowners of irrigable land in the area, but not presently in the irrigation district, will petition the board to have their land included in the near future.

Members of the board of directors of the Warwick-McVille Irrigation District include Robert Lofthus, chairman, McVille; Richard Morken, Pekin; Edward Reeves, Warwick; William Knauss, Tolna; and Howard Pare, Tolna.

GARRISON DIVERSION CONSERVANCY DISTRICT

The Garrison Diversion Conservancy District was established by the North Dakota Legislature in 1955 as the overall legal entity that would represent the water users who would benefit through the development of the Garrison Diversion Unit in North Dakota. The district was originally established to include 22 counties in central and eastern North Dakota that would be directly or indirectly benefited through the development of this project. Since its establishment three additional counties have been included in the Conservancy District at their request making the district a 25 county organization. The Conservancy District is governed by a Board of Directors consisting of one director elected from each of the 25 counties. Directors serve for a term of four years and are eligible for re-election. The Board of Directors of the Garrison Diversion Conservancy District is presently composed of the following members:

Roy A. Holand, Chairman.....LaMoure, North Dakota
Henry J. Steinberger, Vice Chairman.....Donnybrook, North Dakota
E. G. Ranum.....Valley City, North Dakota
Vernon Sturlaugson.....Minnewaukan, North Dakota
Lester M. Anderson.....Minnewaukan, North Dakota
H. A. Hendrickson.....Fargo, North Dakota
Forrest M. Gottschalk.....Oakes, North Dakota
Wilfred P. Boyle.....New Rockford, North Dakota
Ralph L. Harmon.....Carrington, North Dakota
John S. Dean.....Hatton, North Dakota
Leon A. Sayer, Jr.....Cooperstown, North Dakota
J. C. Eaton.....Denbigh, North Dakota
Dave M. Robinson.....Coleharbor, North Dakota
Earl Burns.....Tolna, North Dakota
Peter L. Hoffart.....Rugby, North Dakota
James B. Collinson.....Devils Lake, North Dakota
Alf N. Larson.....Enderlin, North Dakota
J. E. Little.....Wyndmere, North Dakota
Reese A. Bartlett.....Cogswell, North Dakota
Ben F. Kludt.....McClusky, North Dakota
Arthur Rud.....Portland, North Dakota
Francis H. Simmers.....Jamestown, North Dakota
Gilman A. Strand.....Portland, North Dakota
W. M. Harrington.....Minot, North Dakota
Frank Bishop.....Harvey, North Dakota
Vernon S. Cooper, Secretary-Treasurer.....Bismarck, North Dakota

Since its organization in 1955 the Garrison Diversion Conservancy District has been involved in a number of activities in connection with the Garrison Diversion Unit. These activities range from the negotiation of forms of repayment contracts for the Garrison Diversion Unit with the Bureau of Reclamation and irrigation districts existing in the project area, assisting in the establishment of the irrigation districts, participating in and conducting an extensive public relation program relating to the Garrison Diversion Unit, participating in the

planning for the various phases of the Garrison Diversion Unit with the appropriate Federal and State agencies, supporting legislation and appropriations for the Garrison Diversion Unit before committees of Congress and other interested organizations and associations and carrying out such other functions as are required of the District by law. During the period July 1, 1960 to June 30, 1962 the activities of the district include the following:

One of the principle activities of the Conservancy District since its organization has been related to securing the enactment of legislation by Congress dealing with the authorization of the Garrison Diversion Unit. In 1957 a field hearing was held in Devils Lake by the Irrigation and Reclamation Subcommittee of the House Interior and Insular Affairs Committee on the authorization of a millon acre Garrison Diversion Unit. At that time the project report had not been reviewed by the Bureau of the Budget and submitted to Congress. In 1960 the reviews by the various agencies of the Department of the Interior and the Bureau of the Budget had been completed and a project proposing an initial 250,000 acres phase of the Garrison Diversion Unit was submitted to Congress. In June of that year hearings were held before the House Interior Committee on the bills authorizing this size project but no action was taken by Congress pending receipt of additional information from the Bureau of Reclamation and Department of Interior.

By June, 1961, this information had been submitted to Congress and the Bureau of the Budget recommended that a 250,000 acre Garrison Diversion Unit be authorized. The project received the endorsement of the President the day the hearings were held before the Senate Interior and Insular Affairs Committee on June 26, 1961. The Senate Committee later recommended approval of bills authorizing the Garrison Diversion Unit but a vote of the Senate was not obtained in 1961. During the second session of Congress, in June, 1962, arrangements were made for a hearing before the House Interior Committee and for a vote on the project in the Senate. Before these events transpired the Bureau of Reclamation announced a new report on the 250,000 acre Garrison Diversion Unit which included substantial increases in the cost estimate for the project. As a result the hearings on the project authorizing legislation were cancelled and the bill on the Garrison Diversion Unit that was before the Senate was called back to Committe. It was decided because of the lateness of the present session of Congress it would be impossible to secure action on the project in 1962, therefore no effort has been made by project proponents to obtain further action by the present session of Congress.

In connection with the hearings that have been held and that will be held, the Conservancy District has arranged for witnesses representing various of the project beneficiaries to present testimony in support of the project before Congressional Committees and has compiled various expressions of support from groups throughout the state in support of the project that will be presented at the time of Congressional hearings. It is expected that Congressional hearings will be held early in the next session of Congress so that action can

be taken on the project authorizing legislation. At that time the Bureau of Reclamation will have completed their power payout study that will indicate whether or not the Missouri River Basin power account is sound and able to pay for the cost of irrigation and other features of the Missouri River Basin project that are to be paid from power revenues. The detailed information available to the Garrison Diversion Unit will enable the Bureau of Reclamation to present a much more firm cost figure for the project than is ordinarily the case in the projects presented to Congress for authorization.

The Conservancy District Board of Directors has devoted a considerable amount of time and effort in reviewing various fish and wildlife features of the Garrison Diversion Unit. Approximately 140,000 acres of fish and wildlife development areas is proposed under the initial 250,000 acre project. In some counties the areas proposed for fish and wildlife purposes has been objected to by local groups. In order to resolve these and other problems relating to the Garrison Diversion Unit plan the Conservancy District established a Project Planning Committee with the specific function of reviewing all aspects of the Garrison Diversion Unit and coordinating the various phases of the project to best serve the needs of the project area, the state and the nation. This Committee has conducted several field reviews of proposed fish and wildlife areas and through their efforts a better understanding of this phase of the Garrison Diversion Unit has been reached by all concerned. The Conservancy District has taken an active part in an effort to secure legislation providing for greater payments to counties for tax revenue that is lost because of the acquisition of lands for fish and wildlife purposes. This problem is one of the major reasons for local objections to fish and wildlife acquisitions in the state.

The Conservancy District during the period of this report has also continued their efforts in negotiating a form of repayment contract for the Garrison Diversion Unit. In July, 1961, after lengthy negotiations with the Bureau of Reclamation and irrigation districts the Conservancy District approved a form of repayment contract for the Garrison Diversion Unit and submitted it to the Bureau of Reclamation for transmittal to the Secretary of Interior for his approval for negotiation purposes. The Secretary of Interior is expected to approve the contracts in their present form as approved by the Conservancy District as soon as authorization of the Garrison Diversion Unit is received.

In January, 1961, a study of the indirect benefits of the Garrison Diversion Unit was completed by the Bureau of Business and Economic Research at the University of North Dakota. This study was sponsored by the Conservancy District and the results of the studies substantiate the fact that there will be substantial indirect benefits resulting from the development of irrigation in the Garrison Diversion Unit. The study indicates that the 250,000 acre project will result in an increase in trade and business benefits in excess of 26 million dollars annually. This study will be used in conjunction with hear-

ings on the Garrison Diversion Unit that are expected to be held during the coming session of Congress.

The Conservancy District has also continued its public relations activities throughout the project area, the state and in other states. During the year a publication entitled "Your Water" was completed by the District. This publication is in the form of questions and answers relating to the Garrison Diversion Unit. It has been distributed widely throughout the project area. The District also contemplates publication of other brochures relating to the project as the need arises.

Other activities in which the District has been involved during the past two years includes the arranging of various tours of the Garrison Diversion Unit by officials of the Department of the Interior, the Bureau of Reclamation, members of Congress and others. Directors in the District have continued their activities in promoting and bringing information about the Garrison Diversion Unit to citizens of their country. Many important aspects of the project have been considered by the Board at their quarterly meetings and Board action has resulted in furthering various aspects of the Garrison Diversion Unit.

GARRISON DIVERSION CONSERVANCY DISTRICT
Board of Directors

Left to right, first row: Leon A. Sayer, Griggs County; Wilfred P. Boyle, Eddy County; Frank Bishop, Wells County; J. C. Eaton, McHenry County; J. E. Little, Richland County; Roy A. Holand, Chairman, LaMoure County. Second row: W. M. Harrington, Ward County; Arthur Rud, Steele County; Ben F. Kludt, Sheridan County; Henry J. Steinberger, Vice Chairman, Renville County; Reese A. Bartlett, Sargent County; Gilman A. Strand, Traill County; Francis H. Simmers, Stutsman County. Third and fourth rows: John S. Dean, Grand Forks County; Forrest M. Gottschalk, Dickey County; Dave M. Robinson, McLean County; Earl Burns, Nelson County; Lester M. Anderson, Bottineau County; Peter L. Hoffart, Pierce County; Mark Andrews, Cass County; E. G. Ranum, Barnes County; Ralph L. Harmon, Foster County; Vernon Sturlaugson, Benson County; Alf N. Larson, Ransom County; James B. Collinson, Ramsey County; Vernon S. Cooper, Secretary-Treasurer.

WATER CONSERVATION AND FLOOD CONTROL DISTRICTS

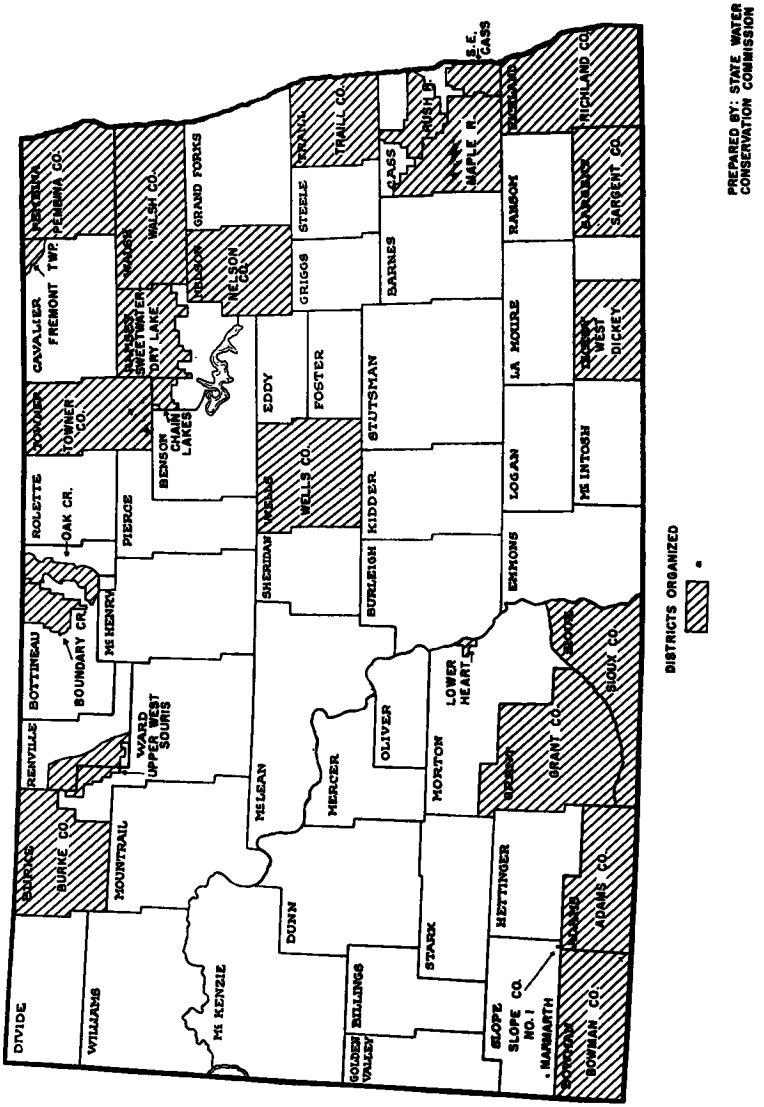
Provision exists in North Dakota statutes for the organization and establishment of water conservation and flood control districts. These districts provide the local people in a given area a legal entity through which they can provide for the development and control of water resources in their area. The districts are established by the State Water Conservation Commission at the request of local landowners or their elected representatives and are governed by a board composed of local people.

Water conservation and flood control districts have the power to investigate, construct or to arrange for the construction of water resource projects in their areas. These projects can be of many types and can serve many purposes. They can be dams to provide conservation storage of water; they can be facilities used to maintain water levels in lakes or to augment flows in streams; they can be facilities to regulate and control flood waters; they can be drainage projects that will provide for removing surplus waters from agricultural lands, or they can be projects of a related nature that will provide benefits to the district through the conservation and regulation of the water resources of that district.

Water conservation and flood control districts have the authority to enter into contracts with the United States, its agencies or with agencies of the state government for the construction of projects that will benefit the district.

In order to accomplish the purposes for which water conservation and flood control districts are organized, the districts have the power to levy special assessments or raise funds through a general mill levy, not exceeding three mills, to meet their costs of operation and the costs of the projects in which the district becomes involved. The levy for the budget of a water conservation and flood control district is made by the board of county commissioners of the county in which the district is located.

The procedure provided in state law for the organization of water conservation and flood control districts is as follows: A petition is filed with the State Water Conservation Commission by the governing board of a municipality, county or other political subdivision or by 51 percent of the freeholders of the proposed district requesting that a water conservation and flood control district be established. The proposed district can extend across county boundaries. The State Water Conservation Commission, upon receipt of this petition, determines whether or not it would be advisable to establish such a district and, if they believe it would be advantageous to do so, calls a hearing or hearings on the petition that is held in the area concerned. Following the hearing, if it appears that it is desirable to organize the district, the State Water Conservation Commission will issue its order declaring the water conservation and flood control district established. After the order of the Commission is issued, the board of county commissioners of the county or counties in which the dis-


WATER CONSERVATION & FLOOD CONTROL DISTRICTS
DIVIDE
WILLIAMS
MCKENZIE
BURKE
BURKE CO.
MOUNTRAIL
RENVILLE
BOTTINEAU
BOUNDARY CR.
WARD
UPPER WEST SOURIS
MCHENRY
ROLETTE
OAK CR.
PIERCE
TOWNER
TOWNER CO.
BENSON
CHAIN LAKES
CAVALIER
FREMONT TWP.
PEMBINA
PEMBINA CO.
WALSH
WALSH CO.
RAMSEY
SWEETWATER
DRY LAKE
NELSON
NELSON CO.
GRAND FORKS
STEELE
GRIGGS
TRAILL
TRAILL CO.
CASS
BARNES
RUSH R.
MAPLE R.
S.E. CASS
RICHLAND
RICHLAND CO.
RANSOM
SARGENT
SARGENT CO.
LA MOURE
DICKEY
MCINTOSH
LOGAN
EMMONS
SHERIDAN
WELLS
WELLS CO.
EDDY
FOSTER
GRIGGS
STUTSMAN
KIDDER
BURLEIGH
MERCER
OLIVER
MORTON
LOWER HEART
GRANT
GRANT CO.
SIOUX
SIOUX CO.
HETTINGER
STARK
DUNN
MCLEAN
GOLDEN VALLEY
BILLINGS
SLOPE
SLOPE CO. NO. 1
MARMARTH
ADAMS
ADAMS CO.
BOWMAN
BOWMAN CO.
DISTRICTS ORGANIZED
PREPARED BY: STATE WATER CONSERVATION COMMISSION

trict is located is required to appoint a board of commissioners for the water conservation and flood control district. This board of commissioners is responsible for governing the affairs of the water conservation and flood control district. The commissioners are appointed for terms of three or five years.

The Commission has cooperated extensively with many of the water conservation and flood control districts that have been organized in planning, constructing and developing various types of water projects, administering the law under which the districts operate and advising them in matters dealing with their operation.

Water conservation and flood control districts have proven very valuable in North Dakota in bringing about the orderly development of needed water resource projects in various areas of the state. Water resource projects which the various districts have sponsored include construction and maintenance of dams, construction of watershed projects and flood protective works. In addition several of the county-wide districts are cooperating with the commission and the U. S. Geological Survey in conducting ground water surveys.

At the present time there are 26 water conservation and flood control districts that have been organized in the state of which 14 are county-wide districts. Other districts are organized on the basis of drainage basins or consisting of an area for which a specific project is proposed. Should a federal works program ever be required, this type of entity would be an ideal one to sponsor projects and cooperate in their construction.

The water conservation and flood control districts that are in existence in North Dakota are discussed in the following sections of the report. Included in this discussion are the purposes for which each district was organized and the progress that these districts have made since their organization.

Adams County District

The Adams County Water Conservation and Flood Control District was created in 1949 to provide the county a legal entity that would be responsible for maintaining and reconstructing dams that had been constructed in that county by federal agencies during the 1930's. Local authorities have not appointed a board of commissioners; therefore, it has not been activated. Although the district is presently inactive, it will be possible for the board of county commissioners to activate the district without public hearing, if they should so desire.

Boundary Creek District

On April 15, 1960, landowners within the Boundary Creek Watershed in northern Bottineau County requested the Bottineau County Board of Commissioners to petition the State Water Conservation Commission to establish the Boundary Creek Water Conservation and Flood Control District. A hearing on the petition was held June 1,

1960, at which it was determined that a majority of the landholders were in favor of the organization of this district. The order establishing the Boundary Creek district was issued on July 6, 1960, and the county commissioners appointed a board in November, 1961. The organizational meeting of the original board was held on March 10, 1962.

One of the principal reasons for establishing the district was to provide an entity with authority to deal with the flood problem that resulted because of the drainage of land in the watershed area. The district board has requested the Soil Conservation Service to investigate this problem.

Commissioners of the district are Marion Condit, Marvin Norstegaard and Lawrence Herslip, all of Souris.

Bowman County District

The Bowman County Water Conservation and Flood Control District was established in 1949 upon petition of the Bowman County Commissioners to provide an organization that could cooperate with state and federal agencies in the repair of dams, construction of flood protective facilities and in the development of the Bowman-Haley Project.

The Bowman-Haley Dam, a proposed earthfill dam that would be built on the North Fork of the Grand River, is 15 miles south from Bowman. The project has been investigated at several different times by the Corps of Engineers and the Bureau of Reclamation since 1905. During early stages of planning, irrigation was thought to be the only major benefit from the impoundment. Recent developments, however, have indicated that the primary benefit from the dam and reservoir would be for municipal and industrial water. The water supply that would be available would enhance opportunities for the development of coal fields and processing uraniferous lignite and for steam generating plants. Water from the Bowman-Haley Reservoir could be provided to the cities of Bowman, Scranton, Gascoyne and Reeder. Flood damages estimated at $85,000 annually would be prevented by the dam. In addition the project will provide substantial recreation benefits.

The dam would be 79 feet high with a storage capacity of 73,000 acre-feet below the emergency spillway crest. Approximately 16,000 acre-feet would be used for conservation purposes and 4,000 acre-feet of the reservoir would be allocated for sediment storage. A 53,000 acre-foot allocation would be exclusively for flood control. The total estimated cost of the project is $4,185,000 of which $2,670,000 would be required for the immediate construction of the dam and reservoir. At the appropriate time, prior to initial use of the water supply from the reservoir, the local interests would be required to enter into a contract for reimbursement to the United States, with interest, of 27.8 percent of the actual cost of the dam, which would approximate $743,000. The project has a benefit cost ratio of two to one.

Strong support for the project exists locally. The Corps of Engineers has received necessary assurances from the water conservation and flood control district that the local requirements will be met and has recommended that construction of the project be approved by Congress.

Difficulty has been experienced in securing endorsement of the project from South Dakota because of concern that Bowman-Haley dam would prevent sufficient water from reaching Shadehill Reservoir, a Bureau of Reclamation irrigation project on the Grand River in South Dakota. Studies indicate that the total depletion to the flow in the Grand River reaching Shadehill Reservoir would not exceed 5% of the normal flow. It is possible that the project will be authorized by Congress in 1962 in the Omnibus bill.

The Bowman County District has also sponsored the construction of the flood control levees at Scranton. This project was constructed by the Corps of Engineers sharing costs with local and state interests. The State Water Conservation Commission participated in the cost to the extent of $10,014.

Commissioners of the Bowman County Water Conservation and Flood Control District are Ralph Keller, Scranton; Howard White, Bowman; Christ Nester, Rhame; and John A. Amundson, secretary-treasurer, Bowman.

Burke County District

The Burke County Water Conservation and Flood Control District was created on December 27, 1957, by the State Water Conservation Commission upon petition from the Burke County Board of County Commissioners. The county-wide district was organized to facilitate the construction and maintenance of various small dams within the county.

The district presently is sponsoring the construction of Short Creek Dam to be completed in 1962.

Proposed dams near Bowbells and Northgate are presently being investigated for the District by the State Water Conservation Commission. A county-wide groundwater survey is being considered and may be scheduled for 1964.

Present commissioners of the Burke County Water Conservation and Flood Control District are Otto Fischer, Bowbells; Ted Gibson, Powers Lake; and Norbert Kihle, Columbus.

Chain Lakes District

Flooding of agricultural land in the Lake Alice-Lake Irvine areas stimulated the establishment of the Chain Lakes Water Conservation and Flood Control District in northwestern Ramsey County in May, 1955. The flooding is caused chiefly because channels between Lake Alice and Lake Irvine and the Mauvais Coulee have become filled with an accumulation of soil drift and silt, greatly reducing the

capacity of those channels to drain off surplus water. The flooding covers lake bottomland used for farming in drier years.

The State Water Conservation Commission has cooperated with the District and has made several investigations to determine a solution to the problem. In addition the Corps of Engineers and the Soil Conservation Service are cooperating in studies in the Lake Alice-Lake Irvine area. Reports of studies by the Corps of Engineers will be completed in 1962.

The District and the State Water Conservation Commission are now considering two possible solutions to the problem. The first proposal would require an excavation of the channel between Lake Irvine and Lake Alice and improving the channel of Mauvais Coulee to expedite the flow of water into Devils Lake. The second plan, proposed by the Corps of Engineers is a modification of one previously advanced by the Commission. It would involve the storage of a considerable portion of the water coming from Mauvais Coulee. A storage reservoir for this purpose would be constructed east of Lake Irvine. Levees would contain the reservoir located in the east system of Chain Lakes swamps. Dry Lake and Sweetwater Lake would also be utilized during extreme high flows as storage reservoirs. The stored water would be released during low flow periods. This arrangement would greatly enhance the wildlife potential of Lake Alice as well as provide landowners protection against flooding.

Commissioners of the Chain Lakes Water Conservation and Flood Control District are L. A. Anderson, John Magnuson, and Roy Cowan, all of Churchs Ferry.

Fremont Township District

The Fremont Township Water Conservation and Flood Control District was established June 15, 1956, on petition from the Board of Township Supervisors of Fremont Township, Cavalier County. The primary reason for the formation of the District was to prevent severe flood and resultant erosion damage to agricultural lands during the spring run-off.

The District has worked with the Soil Conservation Service toward the creation of the North Walhalla Watershed Project that would serve to reduce flood damages and soil erosion.

Planning for this project is complete. It includes three retention dams, which are designed to reduce the maximum water flow to the principal drain during peak run-off. Three drop structures incorporated in existing drains and extensive channel improvements would be provided. Construction of this project has been delayed pending negotiations with Canadian authorities.

Fremont Township Water Conservation and Flood Control District Commissioners include John Ermer, Joe Bodensteiner, Jr., Albert Gapp and Leo A. Verville, all of Walhalla.

Grant County District

The Grant County Water Conservation and Flood Control District was established on October 24, 1938, to promote the development of water resources within the county. The District, when active, cooperated with the Works Progress Administration, the Soil Conservation Service and the State Water Conservation Commission in the establishment of small dams on the Cannonball and Cedar Rivers for irrigation of small community gardens. Although the District is presently inactive, it can be reactivated, without a public hearing, by the Board of County Commissioners of Grant County, if they so desire.

Lower Heart District

Organized in 1953, the Lower Heart Water Conservation and Flood Control District includes the area along the Heart River together with the city of Mandan from the confluence of the Missouri River and Heart River to a point about seven miles west of Mandan. The district was established to provide a legal entity that could cooperate with the Corps of Engineers and State Water Conservation Commission in the construction, operation and maintenance of additional facilities needed for flood protection for Mandan and for agricultural and commercial property along the Heart River and below the City.

The District cooperated in the extension and addition to the levee system constructed by the Corps of Engineers in 1950 and 1951 and in raising the Highway No. 10 bridge west of Mandan across the Heart River five and one-half feet. In addition, the district assumed the responsibility of operating and maintaining the project. The State Water Conservation Commission shared in the district's portion of project costs to the extent of $40,000. All project activities related to construction have now been completed. The City of Mandan as well as valuable commercial and agricultural lands lying between Mandan and Bismarck are adequately protected from floods resulting from the Heart River.

Commissioners of the District are L. C. Hulett, chairman; R. E. Sylvester; and Carl G. Keidel all of Mandan.

Maple River District

The Maple River Water Conservation and Flood Control District was formed in August, 1956, upon petition from the Cass County Board of County Commissioners. This District includes approximately the southwestern half of Cass County and, when it was established absorbed the former Swan Creek District. The Soil Conservation Service is presently constructing the Swan-Buffalo Watershed project in cooperation with the Maple River District.

Principal features of the Swan-Buffalo Watershed project are four detention dams, four miles of channel improvement on Buffalo Creek and one four mile floodway. Construction of detention dams

and channel improvements has been progressing as rapidly as possible depending mainly on the ability of the District to provide rights-of-way. The watershed project will provide adequate control and drainage of run-off thereby reducing the peak flow during flood periods. To date, four miles of channel improvement and two detention dams have been completed on Buffalo Creek by the Soil Conservation Service. One four-mile floodway and two detention dams remain to be constructed.

Commissioners of the Maple River Water Conservation and Flood Control District are H. H. Wheeler, chairman, Wheatland; William Martin, Chaffee, and Francis Archbold, Sheldon.

Marmarth District

At the request of the city commissioners of Marmarth, the Marmarth Water Conservation and Flood Control District was organized in 1956. The District includes the city of Marmarth and adjacent lands which could be benefited by proposed flood control measures. Funds adequate to maintain the project are raised through the District's annual mill levy.

Flooding in Marmarth which caused extensive damage occurred during peak run-off from the Little Missouri River and Little Beaver Creek, which joins the Little Missouri just upstream from Marmarth. In 1954 Congress authorized investigation of a local flood protection project for the city by the Corps of Engineers. The Corps of Engineers developed a plan for a system of levees utilizing existing roads, railroads and levees to provide the needed protection. Before construction and actual funds could be made available to the Corps of Engineers for the project, local assurances of furnishing right-of-way, moving utilities, and in general taking responsibility for the local phases of the project had to be furnished. The Water Conservation and Flood Control District provided the local sponsorship of the project and assumed the responsibility for operation and maintenance of the project. Appropriations were made available to the Corps of Engineers in July, 1956, to construct the project. The State Water Conservation Commission shared the District's costs of the project to the extent of $8,577.

The levees have been completed and benefits which have accrued extend beyond those that can be measured in terms of specific flood damage reduction. Local people now can locate buildings and facilities within the protected area with confidence, and it is expected that further commercial and residential buildings will be constructed.

District commissioners are R. C. Rushford, Chairman, S. W. Childers and Earl Corneil.

Nelson County District

The Nelson County Water Conservation and Flood Control District was established July 30, 1946, but remained inactive until District Commissioners were appointed on April 1, 1961. The District

was originally created to maintain the various dams and water conservation projects established by State and Federal Agencies such as the Works Project Administration and Federal Emergency Relief Administration.

The validity of the District was challenged by a group of property owners in 1961. To date this challenge has not been upheld by the Court and the District is still recognized as duly organized.

Present Nelson County Water Conservation and Flood Control Commissioners are Oscar Fjestad, Dahler; Milo E. Engen, Tolna, and George F. McHugh, Lakota.

Oak Creek District

The Oak Creek Water Conservation and Flood Control District which was created in January, 1956, includes the major portion of the Oak Creek Watershed in eastern Bottineau County. The District has provided the legal means for the construction of projects that have been deferred for more than 30 years for lack of a sponsoring agency.

The chief project the District has sponsored is the improvement and stabilization of the level of Lake Metigoshe. This project provides for the impoundment of water in Sharpe Lake in Canada which can be released to Lake Metigoshe to maintain the level of that lake. The project consists of a dam at the outlet of Sharpe Lake and a canal from Sharpe Lake to Lake Metigoshe.

Of recent concern to the Oak Creek District has been the annual spring flooding of the Oak and Willow Creeks in the downstream areas of these streams. Improved drainage in the Oak Creek area, snags and other debris in Oak and Willow Creeks have aggravated this problem. Temporary moratoriums were placed on group and individual drains emptying into Willow Creek to attempt to alleviate the flooding problem. In addition, snagging and clearing of Oak and Willow Creeks have been considered by both the Water Conservation Commission and the Corps of Engineers. A proposal to divert water from Oak Creek into Stone Creek has also been discussed.

The District is now considering extending the boundary of their district to include the entire Willow Creek Watershed. This would include 967 square miles of Bottineau, Pierce, McHenry and Rolette counties. Such an enlarged district would enable the District to provide a solution to the problem on a regional drainage basis.

Commissioners of the Oak Creek Water Conservation and Flood Control District include Lyle Knoepfle, Dr. Kenneth W. Kihle, Hartley Carlson, and Glenn Swanson, secretary.

Pembina County District

The Pembina County Water Conservation and Flood Control District was formed in July, 1950, to provide an effective legal entity to deal with drainage and flood control problems which are county-wide in scope. The District, since its organization, has been actively

engaged in a program to alleviate flood damages in the county, including river channel improvement by bridge construction, channel straightening and other projects.

Under the District's sponsorship the Soil Conservation Service has constructed the Tongue River Pilot Watershed Project. This project provides for the protection of the entire 415,000 acres of the watershed. Features of the project include several detention dams, floodways and channel improvement. As of June 30, 1962, ten detention dams along with 31 miles of channel improvements had been completed by the Soil Conservation Service.

The county-wide District is also actively advocating the construction of Pembilier Dam, a Corps of Engineers' project that will be located on the Pembina River in North Dakota. The project was authorized originally by Congress in the Flood Control Act of 1944 and recently has been approved for planning by the International Joint Commission. Presently it is being investigated by several Federal, State and Canadian agencies. Benefits of the project would include flood control, prevention of extensive erosion, irrigation of approximately 80,000 acres and power generation up to 10,000 kilowatts. The project could be enhanced by a diversion of water that would be available in the Souris River through the Garrison Diversion Unit, to the Pembina River in Canada.

In connection with the project, the State Water Conservation Commission has made topographic surveys of 16,640 acres in cooperation with the Water Control and Conservation Branch of the Department of Agriculture and Conservation of Manitoba. It has also been cooperating with the Surface Water Branch of the U. S. Geological Survey in a study of stream flow on the Pembina and Little Pembina Rivers. Water quality samples were also taken by the State Water Conservation Commission to determine the suitability of the water for irrigation.

The Pembilier Dam has received the endorsement of the Mississippi Valley Association and the National Rivers and Harbors Congress.

Commissioners of the District include C. R. Howell, Walhalla; Ed Thompson, Cavalier; Otto Pudil, Pembina, and William J. Sturlaugson, secretary, Cavalier.

Richland County District

Upon petition from the Richland County Commissioners, the Richland County Water Conservation and Flood Control District was established by the State Water Conservation Commission in August, 1958. The county-wide District replaced a previous county drain board. In this respect the board is unique as it has functioned in a dual capacity in a most capable manner. No other Board now operating in the State has absorbed the functions of a drain board.

Major projects of the Richland County District have been drainage improvement and flood control. It has directed much of its efforts toward forestalling potential drainage problems prior to road bridge and culvert construction.

In achieving its goals, the District has been actively working with the Soil Conservation Service in providing local right-of-way and other necessary assurances for some watershed projects. During the biennium the Soil Conservation Service completed a project known as West Tributary, Bois de Sioux, a project involving channel improvement. Investigations are being made on another watershed project known as Wild Rice B. The District is cooperating with the Commission and the groundwater branch of the U. S. Geological Survey in a county-wide groundwater study. Work on the study is to commence in July, 1962.

Richland County Water Conservation and Flood Control District commissioners include Holger Bertelson, Fairmount; Tollef A. Lee, Kindred, and LaVerne Olson. Alternate members are Dan L. Riley and Henry Ehlers. Odin J. Wold, Wahpeton, is secretary of the District.

Rush River District

At the request of the Cass County Board of Commissioners, the Rush River Water Conservation and Flood Control District was established in 1949 by the State Water Conservation Commission. This District has sponsored the construction of the Rush River Flood Protective Project by the Corps of Engineers which provides protection to 197,000 acres of rich agricultural land located in the east and central portion of Cass County. Rush River possessed many channel irregularities which, along with restriction of this channel caused by soil drift, greatly retarded the flow of run-off waters in the river. The condition was so severe that it resulted in normally low flows leaving the banks of the River and flooding adjacent agricultural lands.

Through the efforts of the Rush River Water Conservation and Flood Control District, and the State Water Conservation Commission, the Corps of Engineers initiated construction of a project in 1954 to improve the channel of Rush River. The construction of this project was completed in the fall of 1956 at a cost of approximately $250,000.

In April, 1959, the State Water Conservation Commission was requested to modify and extend the boundaries of the Rush River District so as to include additional land in the upper reaches of the Rush River in order to allow channel improvement work in this area.

Following a hearing held in Amenia, North Dakota, on August 8, 1957, at which no opposition was voiced toward the boundary modification, the State Water Conservation Commission modified the District boundaries to include an additional 107 square miles thereby increasing its size to 304 square miles.

Since that time the District has been cooperating with the Soil Conservation Service in improvement of the drainage of the enlarged District and are using the improved Rush River channel to advantage.

Commissioners of the District include Kenneth McIntyre, chairman, Harwood; Robert C. Lewis, Jr., South Fargo, and L. F. Chaffee, Amenia.

Sargent County District

The Sargent County Board of Commissioners on October 2, 1956, petitioned the State Water Conservation Commission to establish a county-wide water conservation and flood control district. As the result of this action, a hearing was held by the State Water Conservation Commission December 20, 1956, at which unanimous support for establishing a district was indicated. The District was established January 14, 1957, by the order of the State Water Conservation Commission.

The District is sponsoring the Wild Rice and the Tewaukon Watershed projects under the direction of the Soil Conservation Service. Both of these projects are in the construction stage. The Wild Rice Project, located in the western part of Sargent County and northwest Marshall County in South Dakota, includes four detention dams and 25 miles of channel improvement. When completed the project will provide flood protection for about 160,000 acres of land in North Dakota. The construction cost of the project is estimated at $1,248,290.

Cutler Dam, Wild Rice Watershed — Sargent County

The Tewaukon Watershed plan is located in southeastern Sargent County and northeastern Marshall County in South Dakota. Project facilities include five detention dams with a total capacity of 4,840 acre-feet and 11.7 miles of channel improvement including three drop structures. The total cost of the project is $1,054,797. To date one detention dam has been completed on this project.

Commissioners of the District appointed February 15, 1957, are Ole Breum, Rutland; William Bosse, Cogswell, and Milton Bergsjoe, Delamere.

Sioux County District

Established January 5, 1938, the Sioux County Water Conservation and Flood Control District was active for a few years and then was abandoned. The District's main function was the promotion of dams to impound water for irrigation. It cooperated with both the Works Progress Administration and the State Water Conservation Commission in achieving this end. Although the District is presently inactive, it is possible for the Board of County Commissioners to reactivate the District, without a public hearing, if they should so desire.

Slope County District

After a petition signed by the County Commissioners of Slope County was filed in the office of the State Engineer on April 15, 1936, the Slope County Water Conservation and Flood Control District, consisting of one and one-half sections in southeastern Slope County, was established. The District is presently inactive. Because of the very limited area included in this District and very limited purpose it could serve it is recommended that steps be taken to dissolve this District.

Southeast Cass District

The Southeast Cass County Water Conservation and Flood Control District was established by the Commission upon petition of the Board of County Commissioners of Cass County in June, 1960. The District comprises the southeast portion of Cass County, extending to Richland County on the south, the boundary of the existing Maple River District on the east, and north edge of Township 139 on the north, and the Red River on the east, excluding the corporate area of the City of Fargo.

The area of Southeast Cass included in the District covers the lower portion of the Wild Rice Watershed and is nearly centered on the course of the Sheyenne. The commercial and industrial development with concurrent improvement in roads and highways has emphasized the need for the kind of water management available through a locally appointed and legally responsible board.

The principal initial aims of the District are to make provisions for channel improvements in the Sheyenne, adequate control of water impounded in upstream areas, flood protective works for municipali-

ties within the District, and flood control and drainage of agricultural land. At the present time the Corps of Engineers is investigating the flood problem on the Lower Sheyenne River to develop a flood control plan for this area. Southwest Fargo has been subjected to flood damage during the spring snow melt and periods of heavy rainfall. Construction of Interstate Highway 94 has altered the drainage pattern resulting in a need for the installation of additional facilities. The Corps studies are expected to be completed in 1964. At a hearing held by the Corps of Engineers at Southwest Fargo on November 14, 1961, a preliminary proposal that had been advanced to construct a dam on the Sheyenne River in the Kindred vicinity was opposed by various interests from that area. In view of the opposition, the Corps is investigating other areas along the Sheyenne River for possible dam sites.

Sweetwater — Dry Lake District

The Sweetwater — Dry Lake District located in the northeast portion of Ramsey County was established by the State Water Conservation Commission on June 10, 1955. It includes an area of approximately 720 square miles. Consideration has been given to the amalgamation of this district with the Chain Lakes District because the objectives of the two are essentially the same. The District was created for the purpose of cooperating with the Commission, the Corps of Engineers and the Soil Conservation Service in an effort to provide a means to alleviate flood conditions which have occurred repeatedly in that area. Approximately 72,000 acres of valuable agricultural land within the boundaries of the District are subjected to floods. The State Water Conservation Commission in cooperation with the Soil Conservation Service has made surveys in the area to be used in conjunction with flood control projects.

The Sweetwater - Dry Lake District adjoins the Chain Lakes District in Ramsey County and, in that most of the drainage from the area of the two districts flows into Devils Lake through Mauvais Coulee, both Districts are concerned with the investigations underway by the Corps of Engineers, the Soil Conservation Service and the State Water Conservation Commission of the recurring flood problem experienced in this area. The Corps of Engineers recently submitted a preliminary proposal to solve this problem which contemplates improving the drainage channels in the area and utilizing Sweetwater and Dry Lakes as storage reservoirs during periods of high flow. Also under consideration in the plan is a channel from Dry Lake to Six Mile Bay of Devils Lake. Consideration is also being given to ways of improving the drainage from the upper areas of the drainage basin into Dry Lake. The Corps expects to complete its studies in 1962.

Commissioners of the District are Thelmer Ivesdal, Edmore; Henry Anderson, Webster, and Gordon Perry, Webster.

Towner County District

The Towner County Water Conservation and Flood Control District was established on June 14, 1960, upon petition to the State Water Conservation Commission from the Board of County Commissioners of Towner County. Preliminary investigations revealed three major needs for establishing the district: (1) a need for drainage of valuable agricultural land, (2) a need for water control structures for the prevention of flooding, recreational purposes and irrigation, and (3) a need for a local legal entity to cooperate with Federal and State Agencies in a county-wide groundwater survey.

On April 25, 1960, hearings were held in Rock Lake and Cando at which time the proposed District was discussed. Some opposition to the District was expressed during the early phases of the Rock Lake hearing as the northern part of the county was in a different drainage area. It was finally established that both areas had drainage problems and that a county-wide District would be the most effective way of coping with these problems.

The District is at present inactive because the Board of County Commissioners of Towner County has failed to appoint three district commissioners. As soon as these appointments are made, however, the District can activate and carry out the functions for which it was created.

Traill County District

The Traill County Water Conservation and Flood Control District was established by the State Water Conservation Commission in April, 1956, upon petition from the Traill County Board of County Commissioners. The District was formed on a county-wide basis as it was felt that most of the watersheds within the county were in need of improvements.

The Soil Conservation Service has cooperated with the District in the planning of the Elm River Watershed Project. This project is presently under construction. As of June 30th, 24 miles of channel improvement have been completed with 41 miles of floodways and channel improvements and four detention dams remaining to be finished.

Traill County Water Conservation and Flood Control District commissioners include Theo. O. Peterson, Buxton; Iver Smith, Galesburg, and Theo. Wheeler, Buxton.

Upper West Souris District

The State Water Conservation Commission created the Upper West Souris Water Conservation and Flood Control District June 10, 1955, upon petition by the Boards of County Commissioners of Ward and Renville Counties. The District comprises an area west of the Souris River containing 163,000 acres in Renville County and 60,000 acres in Ward County for a combined total of 223,000 acres in the two counties.

The primary reason for organizing the District was to establish a legal entity that could cooperate with State and Federal agencies in providing a solution to the flood problem in the Tolley Flats area. The Corps of Engineers included this area in their study of the Souris River and on December 28, 1959, held a hearing in Kenmare relative to the problem in the Upper West Souris District. At that hearing considerable opposition was voiced by local residents to the District because only 3,000 acres in the District would be directly benefited by the flood protective works that might be constructed. Because of the local opposition nothing further has been accomplished to solve the problem for which the District was established.

Commissioners of the Upper West Souris Water Conservation and Flood Control District are Henry J. Steinberger, chairman, Donnybrook; H. A. Bodmer, Kenmare; Claude James, Kenmare; Harry E. Stanley, Tolley, and E. William James, Kenmare.

Walsh County District

The Walsh County Water Conservation and Flood Control District, a county-wide district established December 19, 1956, is principally concerned with the flood problem in the Forest and Park River watersheds.

The need for a responsible local entity to take concerted action within the area of Walsh County toward flood control is illustrated by the topography of the county. Because of the topography, a rapid run-off from the western slope onto the sluggishly drained central and eastern flats occurs. Often the run-off in the Forest and Park River channels is so great that the vast area lying between the two rivers is one big lake. The cities of Minto, Forest River and Grafton are frequently inundated by these floods with roads and bridges also suffering extensive damages.

Besides working independently, the Walsh County District has cooperated with the Soil Conservation Service in several watershed projects including the North Branch Forest River which is under construction; the Middle-South Branch Forest River for which planning has been completed and construction authorized; the Lower Forest River for which planning is complete, and three segments of the Park River for which planning has been authorized. The North Branch Forest River project consists of 25.4 miles of channel improvement of which 23.4 miles are under construction and three detention dams, none of which are under construction. The Middle-South Branch Forest River project will consist of 3.7 miles of channel improvement and three detention dams.

Concern has been expressed by the State Water Conservation Commission over the procedure being followed in the development of the watershed projects in Walsh County in that the flow from the upper areas is being expedited through improved channel capacities

before the lower reach of the river is developed. This procedure could result in aggravating the flood problem in the Lower Forest River area.

Commissioners of the district include Joseph L. Bina, chairman, Conway; Milton Johnson, Grafton; Charles Zahradka, Lawton, and E. R. Nyman, secretary, Grafton.

Wells County District

The Wells County Water Conservation and Flood Control District was established by the State Water Conservation Commission on May 23, 1961, after hearings were held in Harvey and Fessenden May 9. The purpose of the formation of the District was to provide a local legal entity for the financing of the construction of dams.

Projects of special interest to the county-wide District are the reconstruction of Sykeston Dam and raising and repairing Harvey Dam to provide a deeper reservoir for fishing and other recreational purposes. Other impoundments under consideration by the District are dams at Hurdsfield and Bowdon. The District is also interested in promoting a county-wide groundwater survey. The approximate cost of the survey would be $54,000 which would be shared on the following basis: The district $12,000, the State Water Conservation Commission would expend $15,000, and the Ground Water Branch of the U. S. Geological Survey would pay the remaining cost of $27,000.

The District has also negotiated an agreement with the State Water Conservation Commission and the State Game and Fish Department for the reconstruction of the Sykeston Dam estimated to cost $48,000. Under this agreement each party thereto will pay one-third of the cost or $16,000. In addition the District and the State Game and Fish Department will share the land acquisition costs for the project.

District commissioners include Albert Martin, Fessenden; Paul G. Schadewald, Sykeston, and Don Miller, Harvey.

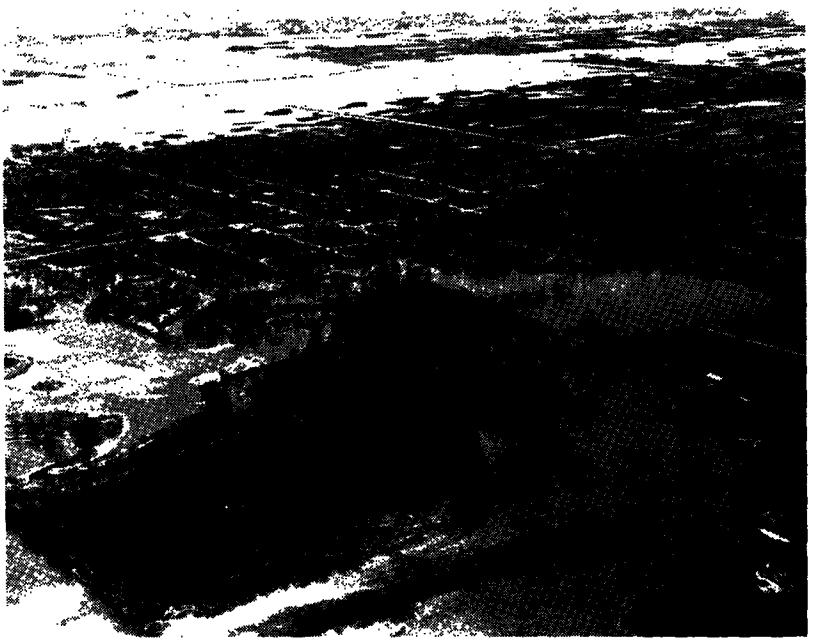
West Dickey District

The West Dickey County Water Conservation and Flood Control District was established January 6, 1961, by the State Water Conservation Commission at the request of the Dickey County Board of County Commissioners. The district comprises the western eleven-sixteenths of the County which includes the drainage basins of the Maple and Elm Rivers. There were six needs for the establishment of the District:

1. To survey and catalog both ground and surface water supplies in Dickey County.
2. To control, conserve and regulate the surface waters for agricultural, municipal and industrial use.
3. To control, conserve and regulate the ground water resources for agricultural, municipal and industrial use.

4. To create impoundments to provide much needed water supplies for agricultural, municipal, industrial and recreational use.
5. To serve as a county drain board in those instances where such a board is required.
6. To serve as the local legal entity representing the people of Dickey County in dealing and cooperating with State and Federal agencies on water resource development in Dickey County.

Before the district was established, public hearings were held in Ellendale and in Oakes January 30, 1961, to determine public sentiment. One hundred eighty-two people attended the Ellendale meeting, and all but four voted for the establishment of the district. At the Oakes meeting, however, only 27 individuals were in attendance with 17 persons voting against the district's establishment.



Floodwaters at Grafton, North Dakota
Looking Southeast, April 22, 1962

WATER RIGHTS

The economic growth and development of any area is dependent upon the resources of that area of which water is of vital importance. In North Dakota it is imperative that the substantial development of our water resources be accomplished in order to provide prospective industrial and agricultural water users with adequate supplies. In the more arid southwestern part of the state this need is most pronounced. Even in the Red River Valley area where rainfall is greatest and generally considered adequate, several localities face the threat of water shortages. As the demand for water for beneficial purposes grows, the importance of water rights becomes more apparent. In recent years there has been a noticeable increase in the water right filings with the State Engineer for irrigation, municipal, industrial and other beneficial purposes.

A water right does not guarantee the holder a water supply of a certain quantity but it does give him protection as to a priority to use the available water supply. A water right does not give private ownership in the water itself but does give the owner a permit or license to make use of the flow of a water course or of the contents of an aquifer. This is the case whether the water right is based upon ownership of riparian land or upon the statutory right of appropriation. The right of use is a property right and is entitled to protection to the same extent as other forms of property.

There are two basic doctrines applied to water rights — the riparian doctrine and the appropriation doctrine. Under the riparian doctrine the owner of the land adjacent to a stream has certain rights, in common with other similarly situated owners, in the flow of the water by virtue of such land ownership. Under the appropriation doctrine the first user of water acquires a priority to continue the use of that water and the nearness of the land he owns to the water course is not a factor in his right. The appropriation doctrine requires the filing of a water right with a designated state agency in order to establish the water right holders priority date as to the use of the water.

North Dakota and several other western states recognize both of these doctrines. In some of the western states the riparian doctrine has been abandoned entirely through court decisions and legislation. In many of the eastern states the riparian doctrine is the only water law doctrine that is recognized. In North Dakota the riparian doctrine has been construed to mean that the riparian landowner has the right to use a limited amount of water from a stream because of his ownership of the contiguous land, but if he intends to use an excess amount for beneficial purposes, such as is required for irrigation, he is required to file a water right.

It can be seen that the application of both of these doctrines in a given state can lead to certain conflicts. The priority of the water right holder under the appropriation doctrine in relation to that of

the riparian landowner, the amount of water to which a riparian landowner is entitled, the extent of riparian land, and the type of use involved are all causes for the conflicts that exist between the two doctrines.

North Dakota water laws insofar as water rights are concerned have developed over a number of years. One of the earliest provisions of North Dakota water law that remains in our statutes today, although it has been superseded in part by recent enactments, can be found in the Act of the Territorial Legislature of 1866. It provided that: "The owner of the land owns water standing thereon, or flowing under its surface, but not forming a definite stream. Water running in a definite stream formed by nature, over or under the surface may be used by him as long as it remains there, but he may not prevent the natural flow of the stream or of the natural spring from which it commences its definite course, not pursue nor pollute the same." This section implies that the landowner owned the diffused water upon and the percolating water under his land but that he had only riparian rights to surface waters flowing in the definite stream. The term "definite stream" has been construed to mean the same as natural water course.

In 1881 the territorial legislature further indicated that water flowing in a definite stream was considered to be only for the use of the owner under a riparian right, and that actual ownership of diffused water both upon and under his land was vested in him. This is the inference of the enactment by that body, which later became section 210 of Article 17 of the North Dakota Constitution which reads: "All flowing streams and natural watercourses shall forever remain the property of the state for mining, irrigating, and manufacturing purposes."

The rights of riparian landowners and those of appropriators of water were determined in an early Dakota case that was decided by the United States Supreme Court in 1890. In this case the court held that the riparian rights which had vested prior to those of an appropriator were protected by territorial law. North Dakota courts in general have affirmed the riparian doctrine as being enforceable before and since statehood. It was also recognized that these rights were valuable property and were protected by the State Constitution and that they vested upon possession of the land, despite their non-use.

In 1905 the enactment of the Irrigation Code marked a significant change in, and enlargement of, water rights in North Dakota. The principal features of the code were:

1. A declaration that all waters within the limitations of the state from all sources of water supply belong to the public and, except as to navigable waters, are subject to appropriation for beneficial use.
2. Establishment of the test of prior appropriation for beneficial use by providing that "beneficial use shall be the basis, the

measure, and the limit of the right to use of water" and that "priority in times shall give the better right."

3. A declaration that the "United States, the state, or any person, a corporation or association may exercise the right of eminent domain to acquire for a public use any property or rights for the application of water to beneficial uses," and for the creation and establishment of administrative machinery, such as a state engineer and water commissioners to apportion waters, grant water rights, and in general supervise the system.

Since the enactment of the Irrigation Code in 1905 many changes and modifications have been made to the North Dakota water laws dealing with water rights. Principal among these are the provisions defining public waters subject to appropriation for beneficial use as set forth in Section 61-01-01 of the North Dakota Century Code. This section defines the waters within the limits of the state that belong to the public and which are subject to the appropriation for beneficial use as waters on the surface of the earth excluding diffused surface waters, waters under the surface of the earth, residual waters resulting from beneficial use and all waters artificially drained, and all waters in non-contributing drainage areas as defined in this section.

In order to obtain an appropriative water right in North Dakota it is necessary to proceed as follows:

1. Prepare, complete and execute in duplicate an application in the prescribed form and file it with the State Engineer accompanied by the proper filing fees and a transparency and two prints of the map showing the land and the area involved:
2. The receipt in the State Engineers office of a properly completed application usually establishes the priority date of the water right;
3. The State Engineer reviews the application and determines whether water is available to serve the needs of the applicant and that the requested permit to appropriate water is not contrary to the public interest;
4. If found to be in satisfactory form, the State Engineer will cause to be published in a newspaper in an area in which the diversion of water is sought to be accomplished a notice of hearing on the application, which notice will be published once each week for two consecutive weeks, and the cost of the publication will be paid by the applicant;
5. At the time and place of the hearing the State Engineer will hear testimony from interested parties and make his determination as to the water right. The State Engineer can reduce the amount of water requested to be diverted, specify when diversion may not be made, and specify the time within which the construction of the works shall be completed;

6. Approval of an application by the State Engineer is subject to review, concurrence or amendment by the State Water Conservation Commission before processing of the application has been completed;
7. When construction of the project has been completed the applicant must notify the State Engineer who then inspects the project. If the project is found satisfactory the State Engineer will issue a certificate of completion;
8. A water license will be issued by the State Engineer after construction and approval of a project has been given and the water has been put to beneficial use. This license becomes evidence of the water right and may be recorded in the office of the Register of Deeds in the County of which the water is beneficially used;
9. Approval of a water right application by the State Engineer and the State Water Conservation Commission does not in itself grant a water right. Frequently water right applicants are of the opinion that they have obtained a water right upon receipt of approval of the water right application, however, the construction of facilities to apply the water to beneficial use must be completed and approved and the water must have been beneficially used before a water right is granted.

There are very few court decisions in North Dakota dealing with the right to use water, therefore, many of the procedures followed in administering the water right laws are based on practices and court interpretations in the other 17 Western states. In the interpretation of laws relating to water rights there are many legal and technical questions that are difficult to determine.

A recent district court decision in North Dakota — if it is upheld — would pose a serious doubt as to the validity of any water right obtained in this state under the appropriation doctrine. In 1957 the City of Crosby obtained a permit to develop a water right from underground sources near the city. After the well was installed, it was determined that interference occurred during the city pumping operations with the well of a landowner in the vicinity. The landowner no longer had water under pressure in his house when the city pump was in operation and instituted action in the district court and received a judgment in his favor. This is the case that is being appealed to the State Supreme Court. If the judgment in the appealed case is unfavorable to the City of Crosby, it can be expected that water use from wells will be seriously hampered. Should the decision indicate that a person can obtain damages if his water supply is not maintained at a given elevation, no doubt several actions against irrigators could result in areas where the water table has receded as a result of their pumping operations. This, in effect, would tend to greatly curtail the development of our underground water resources and thereby adversely effect our economy.

In administering the state's water right laws, the State Water Conservation Commission thoroughly reviews and investigates every application as the quantities allowed must be in proportion to the water available and not in excess of the water actually required. Even an apparently abundant water supply can rapidly become depleted or overappropriated according to records of the State Engineer but actually have an adequate water supply which could be available to other water users anxious to develop such a supply. This situation exists in some North Dakota streams because water right laws do not have provision for a procedure to cancel undeveloped or abandoned water rights.

A very urgent need in water right legislation is the provision for procedure to cancel water rights that are not being used. On practically every stream in the state there are water right applications on record which have never been developed. Many others have been developed or partially developed and then abandoned. Although the water right laws require the applicant to develop for beneficial use the water provided for in his application within a specified period of time, there is no specific procedure outlined for the State Engineer or the State Water Conservation Commission to follow if the applicant does not comply. Cancellation of rights on these unused waters would make them available for development by other potential water users.

In an attempt to determine the status of existing water rights in the state, the 1955 legislature made an appropriation to the Commission to conduct a water right study. The valuable information gained from this study has been beneficial to the Commission and the State in the administration of water laws. A report on this study was published in 1957 and was printed in the Eleventh Biennial Report of the Commission. Later Legislatures also recognized the problem involved in the administration of water rights and provided small appropriations to enable the Commission to continue its work in this field.

To alleviate the problems involved in the administration of water rights, the Commission has undertaken a comparison of water rights requested with the availability of water in several of the streams in the state. Data obtained from stream flow records of the U. S. Geological Survey is correlated with water usage and proposed water usage. In many instances water is allowed to go to waste because of under development. This study has great merit and will provide valuable data that would greatly enhance the development of North Dakota's natural resources for both agricultural and industrial purposes. Plans for enlarging this study have been formulated and the program will be accelerated in the fall of 1962.

In addition to the information that will be obtained from this study in determining the future development possible on many of the State's streams, the Commission is investigating how much water can be safely used without trespassing on priority of existing rights. The

Commission has found it necessary to discontinue or drastically curtail the allotments to water right applicants in a large portion of the state. The restrictions will continue until some provision is made for the storage of surplus waters during the spring of the year for release as needed downstream later in the season. Specific streams which fall in this category include the Mouse, Green, Cannonball, Cedar and Grand Rivers and Apple Creek. If water right applications continue at their present high rate, a similar action will undoubtedly be necessary on appropriations from other streams.

The water problem in the Cedar River area has been one of the most acute in the state. During the summer months of 1959, 1960 and 1961, flow in this stream had ceased entirely. The cattlemen along the stream assumed the irrigators were the cause of the problem while the irrigators contended that they were allowing sufficient water to pass their points of diversion to care for the cattle requirements. After considerable study, and several trips to the area, the State Water Conservation Commission informed the irrigators that they would not be permitted to divert water when the flow in the river was less than three cubic feet per second. This was later increased to five cubic feet per second. That is the amount which appears to be required to supplant the losses such as evaporation, transpiration and seepage, and still leave water in the stream available for livestock and riparian uses. Two gaging stations on the Cedar have been designated as control stations for different areas along the river, and are used to determine when irrigators in each specific area may divert water from the river. It is possible that as water problems increase in other areas, restrictions on appropriations will be necessay to maintain flows for the longest possible period of time.

Although most of the water right applications received by the Commission are for irrigation purposes, there has been an increasing number from municipalities for water supplies for their needs. These municipalities have found it necessary to develop new water supplies to meet the demands created by increased population and industrial expansion. Presently the average per capita use of water in North Dakota is 101 gallons per day. Bismarck has a per capita use of 179 gallons a day because of the availability of an excellent water supply from the Missouri River. The per capita usage would increase in other communities if a more ample supply were readily available.

Many of the state's municipalities depend on groundwater aquifers for their water supply. In many cases these aquifers are limited in the quantity and quality of water that they can produce. Several municipalities in the state have had to look to new sources for water as their needs increase. Of primary concern to industry when locating new plants is the water supply that will be available to them. If such a needed supply is not available at a chosen site, the industry must look elsewhere for its plant location.

Most states at present require a permit for the drilling of wells. Some, however, exclude the permits on small wells, such as stock watering wells. The State Water Conservation Commission, on the other hand, generally advocates that a water right should be obtained on a well which will be pumped at a rate of 50 gallons per minute or greater. Consideration should be given to the adoption of a permit system on all wells that are pumped at a rate of 50 gallons per minute or in excess thereof. This would provide some regulation over any large irrigation, industrial or municipal wells. If such legislation were enacted, a small fee should be charged for processing the permit in line with the water right filing fee. The driller or well owner, preferably the driller, should also be required to file the log on the well, yield data and the water levels following the pumping tests. As the ground water resources of the state become utilized more extensively, it is expected that further legislation will be necessary in this field.

Legislation is needed that would enhance the administration of North Dakota water right laws and insure the full beneficial use of the limited water resources for the most important purposes. Consideration should be given to provide under law for a "priority of use system" in the appropriation of the public waters of North Dakota. As the demand for water increases and as the usable supply diminishes, it is apparent that some priority as to the usage of the remaining water should be established. The suggested order of priority of use is as follows: domestic, irrigation and industrial, hydroelectric power, wildlife and recreation, and navigation. However, establishing such a priority of use system, there are inherent problems that would conflict with the priority of time system now followed under the State's appropriation doctrine. Consideration should also be given to determine the feasibility of granting priority to uses of water which have a high economic return.

Much of North Dakota's precious water is lost each year through evaporation from reservoir storage. Evaporation losses increase as the surface area or number of reservoirs increases. The loss of water by evaporation from stock water ponds through construction of an excessive number of such ponds in a small area has been been very apparent in several river basins. The Commission is encouraging the use of dugouts and the limitations of surface area and proper spacing of stock water ponds and reservoirs in an attempt to reduce the loss attributed to evaporation. This practice may permit the use of stock-water ponds to others who have insufficient flow to meet their present requirements.

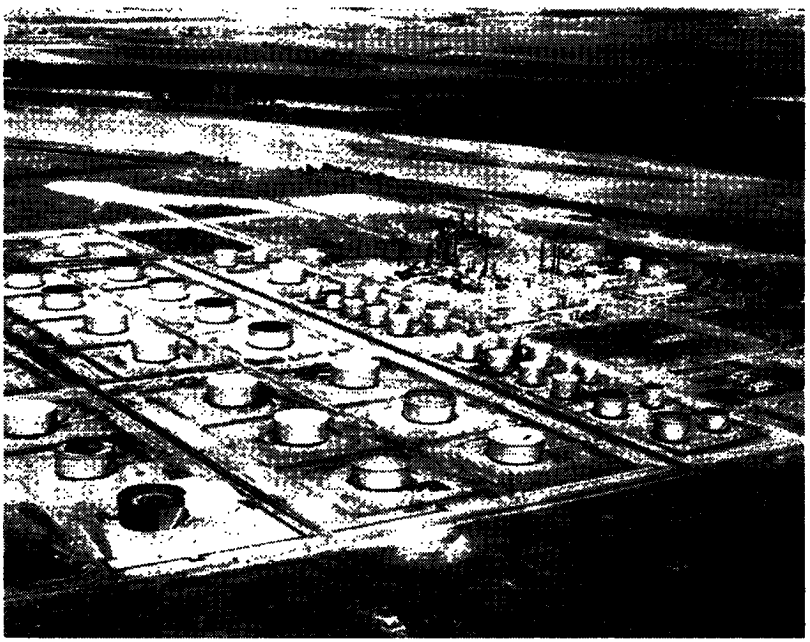
Compatibility problems also occur between identical uses of water. An example of this is the preference of some to store stock water in small impoundments in upper basins and the conflicting desire of others who prefer to see the water flowing into the principal streams to provide a flowing stream for a stock water supply for riparian

owners. This problem can be further aggravated by irrigators who need water during periods of low flow in the streams.

Officials of the State Water Conservation Commission and the Soil Conservation Service have formulated a policy that would best meet the needs of all three classes of users. A policy statement will be released in July, 1962, which will be helpful in resolving this problem.

The use of a water master for control of water use in the State has often been advocated. It is intended that the water master would protect the rights of small users and also the downstream users who have rights prior to those of upstream appropriators.

During the period July 1, 1960 to June 30, 1962, 154 water right applications were received by the State Engineer. This represents nearly a 50 percent increase over the previous biennium. A summary of these applications and those approved are on the following pages.



Mandan Refinery

WATER RIGHTS

For Period July 1, 1960 to June 30, 1962

Number Filed		154
Number for Irrigation		117
Acres Requested	19,818.06	
Acre-Feet Requested	36,978.02	
Number for Industrial Use		6
Acre-Feet	28,526.92	
Number for Municipal and Industrial Use		18
Acre-Feet	23,044	
Number for Recreation		9
Acre-Feet	10,940	
Number for Stock Water Use		3
Acre-Feet	257	
Number for Flood Control and Wildlife Enhancement		1
Acre-Feet	5,400	
Number Approved		124
Number for Irrigation		92
Acres	14,151.95	
Acre-Feet	24,709.52	
Number for Industrial Use		5
Acre-Feet	28,526	
Number for Municipal and Industrial Use		16
Acre-Feet	22,952	
Number for Recreation		7
Acre-Feet	9,880	
Number for Stockwater Use		3
Acre-Feet	242	
Number for Flood Control and Wildlife Enhancement		1
Acre-feet	5,400	

Number Pending June 30, 1962 — 30

WATER RIGHT APPLICATIONS
July 1, 1960 to June 30, 1962

No.	NAME AND ADDRESS	County	Source	Acre Feet	Acres	Date of Claim	Status
871	A. F. Wosepka, Dickinson	Golden Valley	Bullion Creek	22.5	15.0	7- 2-60	Approved
872	Marion Knudson, Washburn	McLean	Missouri River	463	231.6	7-22-60	Approved
873	Fred Wipperling, NewRockford	Eddy	Underground dugouts	95	76	7-26-60	Approved
874	City of Neche	Pembina	Pembina River	530.6		8- 4-60	Approved
875	Wachter Ranch, Bismarck	Burleigh	Underground	744	372	7-10-60	Approved
876	Eddie Susag, Rhame	Bowman	Little Missouri River	30		8-24-60	Approved
877	Henry andArmon Wolf, Golden Valley	Mercer	Unnamed Creek Trib. to Spring Creek	60		9- 8-60	Approved
878	Mona Peterson, Sheyenne	Eddy	Sheyenne River	33	22.5	9-10-60	Approved
879	Carl Kuehn, Washburn	McLean	Missouri River	1,160.6	580.3	10- 6-60	Approved
880	Raymond Delzer, Bismarck	Burleigh	Missouri River	724.12	362.06	10-10-60	Approved
881	Nettle Creek Mutual Aid Cooperative, Washburn	McLean	Missouri River	1,700	847.7	10-22-60	Approved
882	Meinrad Huchler, Bismarck	Burleigh	Missouri River	166	83	11-16-60	Approved
883	Husky Oil Co., Dickinson	Stark	Underground	240		11-29-60	Approved
884	Logan and Robert Ward, Bismarck	Burleigh	Underground	910	405.6	12- 2-60	Approved
885	O. T. and Dennis Solberg, Bismarck	Burleigh	Underground	904	602.8	12- 5-60	Approved
886	City of Mohall	Bottineau	Underground	250		2- 1-61	Approved
887	Clarence Klandl, Sidney, Montana	McKenzie	Unnamed Trib. to Bennie Pierre Creek	36.8	36.8	2- 3-61	Approved
888	Oakes Nursery, Oakes	Dickey	Underground	120	60	2- 9-61	Approved
*889P	George Johnson, Burlington	Ward	Souris River	174	87	1914	Approved
890	Lew Strang, Williston	Williams	Unnamed Trib. to Little Muddy River	51	51	2-28-61	Approved
891	Ervin Bourgois, Bismarck	Burleigh	Missouri River and Underground	730.8	365.4	3- 1-61	Approved
892	Lester R. Schatz, Glen Ullin	Morton	Unnamed Creek Trib. Big Muddy River	15	15	2- 2-61	Approved
893	City of Grafton	Walsh	Red River	7,500		3- 3-61	Approved
894	T. Clem Casey, Bismarck	Burleigh	Underground	580	290	2- 3-61	Approved
895	Geo. F. Grenz, Livona	Emmons	Missouri River	1,318.8	659.4	3- 3-61	Approved
896	Charles Henderson, LaMoure	LaMoure	James River	80	80	3- 8-61	Approved

897	Oscar Quarne, Grenora	Williams	Scoria Creek	100	100	3-14-61	Approved
898	Larry Martin, Marmarth	Bowman	Missouri River	47.4	47.4	3-22-61	Approved
899	Alfred Thompson, New Town	Mountrail	White Earth River and Unnamed Trib. to White Earth River	22.5	15	3-23-61	Approved
900	Richland County Water Conservation and Flood Control District, Wahpeton	Richland	Wild Rice River	5,400		3- 9-61	Approved
901	City of New Rockford	Eddy	Underground	732		3-23-61	Approved
902	Henry O. Grev, Zahl	Williams	Pats Coulee	31	31	4-10-61	Approved
903	Robert Larson, Minot	Ward	Schofield Lake	41.5	41.5	3-28-61	Approved
904	William R. Brown, Williston	Williams	Unnamed Trib. of Little Muddy River	67.2	67.2	4-15-61	Approved
905	Lignite Electric Power Cooperative, Bismarck	Mercer	Missouri River	26,700		4-24-61	Approved
906	Esther Hauge, Leith	Grant	Unnamed Creek, Trib. to Cannonball River	27	27	3-23-61	Approved
907	William L. Smith, Steele	Kidder	Unnamed Slough	91.2	45.6	4-28-61	Approved
908	Jamestown Country Club, Jamestown	Stutsman	Ground Water	90	60	5- 5-61	Approved
909	Wetzstein Bros., Mandan	Oliver	Missouri River	865	432.6	5-18-61	Approved
910	Theo Folkvord, Sidney, Mont.	McKenzie	Unnamed Trib. of Bennie Pierre Creek	25	30	5-22-61	Approved
911	North Dakota Game and Fish Department, Bismarck (Froelich Dam)	Sioux	Unnamed Creek, Trib. of Porcupine Creek	2,300		5-29-61	Approved
912	G. D. Adams, McKenzie	Burleigh	Underground	313	208.8	6-15-61	Approved
913	Lisbon Sand and Gravel, Lisbon	Ramsey	Sheyenne River	1,325		5-24-61	Approved
914	City of Bowman	Bowman	Grand River	1,968.4		6-27-61	Approved
915	Melvin Schenstad, Hanks	Divide	Unnamed Stream	20	20	7-10-61	Approved
916	Patterson Land Co., Bismarck	Burleigh	Horseshoe Lake	135	135	7-11-61	Approved
917	Jacob Heinle, Richardton	Stark	Spring Creek	20	24	7-15-61	Approved
918	Minot Special School District No. 1, Minot	Ward	Souris	13	13.7	7-18-61	Approved
919	Village of Tolna	Nelson	Underground	112		7-18-61	Approved
920	City of Langdon	Cavalier	Unnamed Trib. of Pembina River	138		7-24-61	Approved
921	City of Southwest Fargo, West Fargo	Cass	Underground Baldhill Dam Sheyenne River	1,460 954 2,190		7-25-61	Approved
922	John Storseth, Grenora	Divide	Swamp	25	25	7-28-61	Approved
923	N. D. Game and Fish Dept., Bismarck (Armourdale Dam)	Towner	Mauvais Coulee	300		7- 9-61	Approved

WATER RIGHT APPLICATIONS
July 1, 1960 to June 30, 1962

No.	NAME AND ADDRESS	County	Source	Acre Feet	Acres	Date of Claim	Status
924	N. Dak. Game and Fish Dept., Bismarck (Warsing Dam)	Eddy	Unnamed Stream	200		8- 9-61	Approved
925	John L. Quinnell, Sidney, Mont.	McKenzie	Bennie Pierre Creek	26.3	26.3	8-20-61	Approved
926	U. S. Fish and Wildlife Service, Minneapolis, Minnesota	McLean	Missouri River	5,150		8-21-61	Approved
927	W. C. Dodge, Watford City	McKenzie	Dry Run Creek	32.3	32.3	8-23-61	Approved
928	Louis Bradac, Marmarth	Bowman	Buffalo Creek	74.7	74.7	8-23-61	Approved
929	Louis Bradac, Marmarth	Bowman	Dry Run Creek	51.9	51.9	8-23-61	Approved
930	Gene McCormick, Bismarck	Burleigh	Missouri River	539	269.7	8-24-61	Approved
931	Walter Small, Bismarck	Burleigh	Missouri River	640	382.5	8-24-61	Approved
932	Ernest Leland, Sidney, Mont.	McKenzie	Hay Draw Creek	140	140	8-25-61	Approved
933	Rudolf Kruckenberg, Stanton	Mercer	Missouri River	914	457	8-25-61	Approved
934	Harold Wallner, Tappen	Kidder	Underground	128	85.4	8-29-61	Approved
935	William Anderson, McKenzie	Burleigh	Underground	960	933.8	8-30-61	Pending
936	Emil Gustafson, Dodge	Dunn	Unnamed Trib. of Spring Creek	10.5	11	8- 1-61	Approved
937	Robert H. Olsen, Sidney, Mont.	McKenzie	Bennie Pierre Creek	68.7	68.7	9- 1-61	Approved
938	Ell Torrance, Bismarck	Burleigh	Missouri River	1,297.8	648.86	9-22-61	Approved
939	N. D. State Penitentiary, Bismarck	Burleigh	Underground	720	482.3	9-29-61	Approved
940	Mrs. Mamie Crighton, Sidney, Mont.	McKenzie	Dry Run Creek	52.3	52.3	9-29-61	Approved
941	John Rouzie, Bowman	Slope	Little Missouri River	98.4	98.4	10- 4-61	Approved
942	Guy Shaide, Cartwright	Dunn	Charbonneau Creek	51.4	53.3	10-10-61	Approved
943	E. E. Ueckert, Beach	Golden Valley	North Branch Garner Creek	127	63.5	10-17-61	Approved
944	Reuben Schneider, Manning	Dunn	Trib. of Crooked Creek	67	67	10-17-61	Approved
945	H. R. Tenborg, Carrington	Foster	Underground	100	156.1	10-20-61	Approved
946	Harris Goldsberry, Trotters	Billings	Dry Run Creek	92.8	92.8	10-23-61	Approved
947	Farmers Union Livestock Feeding Assn., Velva	Ward	Underground	225		10-24-61	Approved
948	Cecil Metcalf, Beach	Golden Valley	Dry Run Creek	42	21	10-24-61	Pending
949	John A. Anderson, Charlson	McKenzie	Dry Run Creek	56.8	56.8	10-26-61	Approved

950	Goose River Golf Assn., Hillsboro	Traill	Goose River	24	24	10-27-61	Approved
951	Raymond Gieser, Gladstone	Dunn	Deep Creek	42	42	10-16-61	Approved
952	City of Ellendale	Dickey	Elm River	500		10-30-61	Approved
953	N. D. Game and Fish Dept., Bismarck (Elm River Dam)	Dickey	Elm River	650		11- 1-61	Approved
954	Garvey Rolla, Watford City	McKenzie	Clear Creek	13.5	13.5	11- 3-61	Approved
955	Lambert Chesworth, Washburn	McLean	Painted Woods Creek	111	55.6	11- 6-61	Approved
956	Elton S. Aarestad, McHenry	Eddy	Round Lake and Unnamed Trib. to Round Lake	152		11- 2-61	Approved
957	Ray Baeth, McKenzie	Burleigh	Underground	960	480	12- 2-61	Pending
958	John E. and Ruth Williams, Washburn	McLean	Painted Woods Lake	425	212.73	12-19-61	Approved
959	Milton K. Higgins, Bismarck, and G. Wilson Hunter, Fargo	McLean	Painted Woods Lake	443	221.92	12-19-61	Approved
960	City of Wahpeton	Richland	Red River	4,563		12-27-61	Approved
961	Kenneth and Lloyd Lohstreter, Mandan	Morton	Missouri River	328	164	1- 2-62	Approved
962	Willard Bahr, Almont	Morton	Muddy Creek	40	40	1- 5-62	Approved
963	Erland Berglund, Sheyenne	Eddy	Underground	210	80	1-20-61	Approved
964	N. D. Game and Fish Dept., Bismarck (Kota Ray Dam)	Williams	Nelson Creek	80		1-18-62	Approved
965	City of Souris	Bottineau	Underground	168		1-31-62	Approved
966	Verl Mausehund, Temvik	Emmons	Unnamed Creek	70.4	70.4	2- 1-62	Approved
967	Glenn H. Olson, Northwood	Nelson	Sheyenne River	22.5	22.5	2- 3-62	Approved
968	City of Beulah	Mercer	Underground	1,000		2-10-62	Approved
969	City of Dunseith	Rolette	Underground	336		2-15-62	Approved
970	Raymond Schmidt, Manning	Dunn	Knife River and Unnamed Trib. to Knife River	32	23	2-17-62	Approved
971	A. C. Graner and Sons, Huff	Morton	Missouri River	1,200	600.38	2-21-62	Approved
972	Milton K. Higgins, Bismarck	Williams	Missouri River	246	135	2-24-62	Approved
973	Christ F. Klein, Brantford	Eddy and Foster	Underground	135	90	2-16-62	Approved
974	Joseph Vetter, Linton	Logan	Beaver Creek	71.2	35.6	3- 1-62	Approved
975	Melvin L. Hansen, Bismarck	Burleigh	Missouri River	30.4	15.2	3- 5-62	Approved
976	John F. Sullivan, Bismarck	Morton	Cannonball and back flow of Missouri River	975	488.9	2-28-62	Approved
977	Sunset Ranch, Bismarck	Burleigh	Missouri River	1,070.6	535.3	3-12-62	Approved
978	Erling Paulson, Taylor	Dunn	Unnamed Tributaries of Knife River	66	66	3-13-62	Approved

WATER RIGHT APPLICATIONS
July 1, 1960 to June 30, 1962

No.	NAME AND ADDRESS	County	Source	Acre Feet	Acres	Date of Claim	Status
979	City of Belfield	Stark	Underground	360		3-13-62	Approved
980	City of Sherwood	Renville	Underground	40		3-19-62	Approved
981	Albert Peterson, Stanton	Mercer	Knife River and back water of Missouri River	380	190	3-23-62	Approved
982	A. W. Nelson, Watford City	McKenzie	Dry Run Creek	56.3	56.3	3-23-62	Approved
983	N. D. Game and Fish Dept., Bismarck (Short Creek Dam)	Burke	Short Creek	1,200		3-24-62	Approved
984	Chas. V. Dvorak, Manning	Dunn	Crooked Creek	15	15	3-24-62	Approved
985	Engleman & Engleman, Hazelton	Emmons	Long Lake Creek	53.8	53.8	3-29-62	Approved
986	Alfred Gustafson, Marshall	Dunn	Unnamed Creek	82	41	4- 2-62	Approved
987	Earl T. Northrup, West Fargo	Ransom	Underground	459	306	4- 3-62	Approved
988	Walter Maas, Jamestown	Stutsman	Underground	111	74	4- 9-62	Approved
989	Godfrey Grenz, Livona	Emmons	Horsehead Creek	1,059.2	529.6	4-13-62	Pending
990	Leo. W. Schiermeister, Hazelton	Emmons	Missouri River	152.8	76.4	4-16-62	Approved
991	Dale Case, Milnor	Ransom	Underground	122	81.2	4-17-62	Approved
992	Doris Connell, Medora	Billings	Little Missouri River	140	140.8	4-17-62	Approved
993	Earl L. Hartsoch, Ray	Williams	Missouri River	47	47	4-18-62	Approved
994	Alfred O. Benson, Valley City	Barnes	Sheyenne River	4.6	2.30	4-18-62	Pending
995	Edward Dannewitz, White Earth	Mountrail	White Earth Creek and Unnamed Trib.	22.5 42	15 42	4-23-62	Approved
996	Peter L. Mitchell, Sidney, Mont.	McKenzie	Dry Run Creek	39.2	19.6	4-24-62	Approved
997	City of Antler	Bottineau	Antler Creek	150		4-24-62	Approved
998	Thomas Boe, Turtle Lake	McLean	Underground	180	120	4-24-62	Approved
999	Montana-Dakota Utilities, Minneapolis, Minn.	Stark	Ground Water	0.92		4-30-62	Pending
1000	Elmer and Carol Anderson, Carrington	Foster	James River	36		4-30-62	Approved
1001	Stanley Malmberg, Oakes	Dickey	Underground	190	95.3	3-27-62	Pending
1002	N. D. Game and Fish Dept., Bismarck (Sweetbriar Dam)	Morton	Sweetbriar Creek	950		12-31-61	Pending
1003	Henry Entzel, Mandan	Morton	Missouri River	545	272.8	4-25-62	Pending
1004	Fred Hall, Chaseley	Wells	Underground	530	310	4-20-62	Pending

1005	Emma B. Voigt, Mandan	Morton	Sweetbriar Creek	133	133	5- 5-62	Pending
1006	August Feil, Fortuna	Divide	Undefined and Unnamed Watercourse	38	38	5- 7-62	Pending
1007	Carlyle Wheeler, Ray	Williams	Unnamed Stream	92	45	5-18-62	Pending
1008	Mrs. Clemens Clooten, Bismarck	Burleigh	Missouri River	300	150.2	5-18-62	Pending
1009	Walter Will, Trustee Edw. L. Will Trust, Stanley	Mountrail	Paulson Creek	80	44	5-19-62	Pending
1010	Daniel P. Rosted, Kelso	Traill	Elm River	88.2	44.1	5-22-62	Pending
1011	Alwin C. Carus, Oakdale M. Elizabeth Carus, LaSalle, Ill.	Dunn	Little Missouri River	90	45	5-23-62	Pending
1012	Arnold Jorgenson, Powers Lake	Burke	White Earth Creek	150	150	5-23-62	Pending
1013	Larry Woznick, Washburn	Burleigh	Missouri River	332	166	5-29-62	Pending
1014	Dan McDonald, Jr., Bismarck	Burleigh	Underground	387.6	193.8	5-29-62	Pending
1015	Ralph Tormaschy, Dickinson	Dunn	Crooked Creek	34	17	5-31-62	Pending
1016	Chris G. Schmalz, Manning	Dunn	Little Knife and Unnamed Trib.	126	63	6-12-62	Pending
1017	Frank Salveson, Wildrose	Divide	Underground	286	143	6-13-62	Pending
1018	Lawrence Pease, Emmet	McLean	Dry Draw	45	22.5	6-18-62	Pending
1019	Olaf Norstog, Watford City	McKenzie	Dry Run Creek	35	20.4	6-21-62	Pending
1020	N. D. Game and Fish Dept., Bismarck (Sykeston Dam)	Wells	Pipestem Creek	110		6-20-62	Pending
1021	Albert Sadowsky, Gladstone	Dunn	Unnamed Dry Creeks Trib. of Crooked Creek	16	8	6-21-62	Pending
1022	Village of Ryder	Ward	Underground	82		6-27-62	Pending
*1023P	Village of Sykeston	Wells	Lake Hiawatha	10		6-28-62	Pending
1024	Carl O. Knudson, Almont	Morton	Muddy Creek	35	17.6	6-29-62	Pending
	**Gordon Nurenburger, Velva	McHenry	Spring Creek	154	77	2-28-62	Pending
	**City of Belfield	Stark	Green River	120		3-19-62	Pending
	**J. C. Stevenson, Carson	Grant	Boxelder Creek	85	56	5- 4-62	Pending
	**Francis M. Rime, Emmet	McLean	Missouri River	179.2	89.6	5-25-62	Pending

*Prescriptive Water Right
**Incomplete, acre-feet and acres not included in totals

WATER LAW STUDY

North Dakota's water laws have been developed gradually over the years since territorial days. Although the state's water laws have a good basis, conflicts have resulted from the piecemeal revisions and additions to the laws that have been adopted. In 1961 the North Dakota Legislature recognized the need for a complete review and modernization of the North Dakota water laws to eliminate the various conflicts and clarify and improve other laws to better meet the present-day need.

The North Dakota Legislature directed the Legislative Research Committee to make this study of the water laws and recommend necessary changes. It is expected that the study will require an extended period of time to complete although a number of recommendations will be made to the 1963 Legislature. A Subcommittee on Natural Resources of the Legislative Research Committee established to make the study conducted five hearings during the biennium at which water law amendments were discussed. The locations and dates of these hearings are as follows:

Blue Room, State Capitol Building, June 2, 1961
Traill County Courthouse, Hillsboro, July 11, 1961
Stark County Courthouse, Dickinson, October 30, 1961
Blue Room, State Capitol Building, Bismarck. October 31, 1961
Blue Room, State Capitol Building, Bismarck, March 23-24, 1962

Two other meetings of the Subcommittee on Natural Resources are scheduled before the Legislature convenes in January.

Some of the proposed changes to the water laws that are being studied by the committee are summarized in the following paragraphs.

Appropriation of Water

Proposed legislation that would, in effect, give greater emphasis to the appropriation doctrine in North Dakota water laws dealing with water rights is under study by the Committee. The purpose of these amendments will be to eliminate many of the inherent conflicts that exist between the appropriation and riparian doctrines, both of which are applied in North Dakota at the present time. Other amendments to water laws concerning water rights being considered are those establishing a procedure to cancel unused or abandoned water rights.

Acquisition of Necessary Property and Power of Condemnation

This proposed amendment would give the State Water Conservation Commission the right to condemn land under the right of eminent domain it deems necessary for public use in the construction of water resource projects and sets forth the method of determining the damages for such land or property acquired. The procedure followed would be similar to that used by the Highway Department in acquiring land for highway purposes.

Water Management Districts

The Committee has recommended legislation to establish water management districts that serve the same purposes as water conservation and flood control districts and drainage districts. One of its purposes is to encourage the formation and utilization of water conservation and flood control districts by providing a means for local authority to consolidate drainage districts into larger districts with broader powers in the entire field of water law. The bill would provide a means whereby districts could be merged at the option of the local districts. Several provisions included separately in the water conservation and flood control district law and the drainage laws would be incorporated in the proposed water management district law. In addition several new provisions have been proposed.

Approval of Commission Necessary Before Constructing Certain Size Dams

At the present time there is a state law that requires the approval of the State Water Conservation Commission before constructing a dam exceeding ten feet in height or capable of impounding more than 30 acre-feet of water. Because of depletion of run-off in streams and the waste of water impounded through evaporation in connection with many stockwater dams that have been constructed, the Committee has recommended an amendment to this section of the Code that would require permission of the Commissioner for construction of a dam that was capable of impounding more than ten acre-feet of water.

Conservancy District

The subcommittee examined an amendment of Section 61-24-16 of the North Dakota Century Code which would allow counties to be excluded from the Garrison Conservancy District only if they will not be benefited in any way by the Garrison Diversion according to a definition of benefits that would be written in the law.

Watermaster Bill

The Committee has recommended a bill that will provide for state watermasters who shall have the authority to regulate, divide and control as far as practicable the use of water by users from the various sources of supply according to the respective rights of the users. Such watermasters would be appointed by the State Engineer.

There are several other sections of the water laws which are being studied for possible amendment including various of the irrigation district laws, laws governing the Water Commission, the Garrison Conservancy District law and others.

STATUS OF 1961 - 1963 APPROPRIATIONS
as of June 30, 1962

FUND	AVAILABLE FUNDS Appropriation	Receipts	DISBURSEMENTS To Date	June '62	FUND BALANCES Unexpended	Encumbered	Unencumbered
1. Commissioners Per Diem and Expenses	$ 6,000.00	$ .00	$ 2,471.05	$ 144.48	$ 3,528.95	$ 58.30	$ 3,470.65
2. Administration	62,000.00	827.44	31,293.72	1,889.16	31,533.72	2,225.78	29,307.94
3. Maintenance of Dams	150,000.00	58,719.30	160,841.44	7,154.87	47,877.86	14,855.50	33,022.36
4. International and Interstate Expenses	10,000.00	.00	2,361.48	80.95	7,638.52	50.00	7,588.52
5. Topographic Surveys	30,000.00	.00	13,580.88	4,159.22	16,419.12	16,419.12	.00
6. Hydrographic Surveys	27,500.00	.00	13,044.54	.00	14,455.46	14,455.46	.00
7. Engineer and Geological Surveys	50,000.00	19,200.00	39,692.22	3,203.28	29,507.78	12,465.60	17,042.18
8. Coop with U.S. Dept., etc.	60,000.00	.00	21,327.31	2,593.64	38,672.69	4,827.08	33,845.61
9. Engineering Investigations	145,000.00	2,200.00	68,518.64	6,553.29	78,681.36	8,715.95	69,965.41
10. Adm. of Water Rights	10,000.00	.00	3,866.84	151.43	6,133.16	89.42	6,043.74
	$550,500.00	$80,946.74	$356,998.12	$25,930.32	$274,448.62	$74,162.21	$200,286.41

STATUS OF CONTINUING APPROPRIATIONS
as of June 30, 1962

FUND	AVAILABLE FUNDS Appropriation	Receipts	DISBURSEMENTS To Date	June '62	FUND BALANCES Unexpended	Encumbered	Unencumbered
20. Multiple Purpose	$300,000.00						
"Carried Forward"	163,583.61	$29,623.07	$56,050.62	$4,841.19	$437,156.06	$349,535.90	$87,620.16
21. Construction Bond Guarantee	90,000.00	18,272.94	20,539.00	.00	87,733.94	.00	87,733.94
22. Shop Building "Special"	30,000.00	.00	29,998.04	.00	1.96	.00	1.96

Note: Fund No. 21 receipts are obtained from retirement of and interest on securities that were in the Commission's sinking fund in excess of the amount required to retire the series "J" bond issue on December 10, '57. Original disbursements from Fund No. 21 were made during the early 1940's in accordance with Section 61-02-56 of the Century Code which provides that the Commission may guarantee or insure, or agree to pay, the interest on and principal of commission revenue bonds, not exceeding 20% of the par value of any such bonds.

SCHEDULE OF BONDS AND INTEREST RECEIVABLE — FUND No. 21

TYPE	Due Date	Interest Rate	Interest Rec. to Maturity	Principal Amount	Total Income Anticipated
U. S. Series K Bonds	5-65	2.76%	$ 124.20	$ 1,500.00	$ 1,624.20
U. S. Series K Bonds	4-67	2.76%	276.00	2,000.00	2,276.00
U. S. Treasury Bonds	12-68	2.50%	487.50	3,000.00	3,487.50
Sioux Irrigation District Bonds	1984 Serially	2.25%	4,938.75	17,500.00	22,438.75
			$ 5,826.45	$24,000.00	$29,826.45
			Fund Balance		87,733.94
			Less Original Appropriation		—90,000.00
			Excess		$27,560.39

The Construction Bond Guarantee Fund will attain its original cash level of $90,000 in 1964 at which time legislation will be required to determine disposition of the funds in excess of the original appropriation as noted in the Attorney General opinion dated 1-2-58.

STATEMENT OF COLLECTIONS

July 1, 1960 — June 30, 1962

FUND CREDITED	Source	Fiscal 1961	Fiscal 1962
Administration	Sales of Maps and Field Notes	$ 449.65	$ 827.44
Maintenance of Dams	Participant's Share of Projects	94,886.64	58,719.30
International and Interstate Expenses	Transportation Refunds	41.93	
Engineering and Geological Surveys	Participant's Share of Ground Water Survey Projects		19,200.00
Engineering Investigations	Participant's Share of Survey Projects	1,419.10	2,200.00
OASIS Contributions	Contingency Fund	2,957.83	
Multiple Purpose	Participant's Share of Projects	37,587.89	29,623.07
Construction Bond Guarantee	Bond Retirement and Interest	1,712.15	5,727.85
General Fund	Water Right Filing Fees	1,450.00	2,856.00
	Participant's Share of Ground Water Survey Projects	8,200.00	
	Drainage Board Appeal	71.41	
	Yellowstone Pumping Irrigation District Warrant	121.84	896.43

SUMMARY OF PROPOSED BUDGET
ADMINISTRATIVE FUND

1963-1965 Biennium (Includes Consolidation Proposed)

	Exp. '59-'61 Bi.	Exp. 1st yr. '61-'63 Bi.	Est. Exp. 2nd yr.—'61-'63	Present Budget	'63-'65 Proposed	Inc. (Dec.)
1. Comm. Per Diem and Exp.	$ 5,491.84	$ 2,471.05	$ 3,520.00	$ 6,000.00	$ 6,500.00	$ 500.00
2. Administration and OASIS	59,075.81(a)	31,293.72(a1)	31,500.00(a2)	62,000.00	76,500.00	14,500.00
3. Maintenance of Dams.....	276,981.19(b)	160,841.44(b1)	139,100.00(b2)	150,000.00	156,000.00	6,000.00
4. Intl. and Interstate Exp.....	10,026.20(c)	2,361.48	7,600.00	10,000.00	14,500.00	4,500.00
5. Topographic Surveys	29,892.01	13,580.88	16,419.00	30,000.00	30,000.00	.....
6. Hydrographic Surveys	28,400.00(d)	13,044.54	14,455.00	27,500.00	33,000.00	5,500.00
7. Eng. and Geol. Surveys	57,359.37(e)	39,692.22(e1)	50,300.00(e2)	50,000.00	120,000.00	70,000.00
8. Coop. with U. S. Dept., etc.	57,003.19(f)	21,327.31	38,700.00	60,000.00	76,000.00	16,000.00
9. Engineering Investigations	142,742.75(g)	68,518.64(g1)	81,200.00(g2)	145,000.00	169,000.00	24,000.00
10. Administration of Water Rights	5,977.78	3,866.84	6,100.00	10,000.00	10,000.00	.....
	$672,950.14	$356,998.12	$388,894.00	$550,500.00	$691,500.00	$141,000.00

(a) Includes $744.38 refunds; $2,957.83 Emergency funds
(a1) Includes $827.44 refunds
(a2) Includes $500.00 estimated refunds
(b) Includes $161,981.19 refunds
(b1) Includes $58,719.30 refunds
(b2) Includes $91,200.00 estimated refunds
(c) Includes $41.93 refunds
(d) Includes $900.00 refunds
(e) Includes $20,000.00 Emergency funds
(e1) Includes $19,200 refunds
(e2) Includes $20,800.00 estimated refunds
(f) Includes $6.44 refunds
(g) Includes $4,742.75 refunds
(g1) Includes $2,200.00 refunds
(g2) Includes $2,500.00 estimated refunds

See next page for suggested consolidation of funds.

SUGGESTED CONSOLIDATION OF FUNDS

Present Line Items	'63-'65 Proposed	'61-'63 Budget	Inc. (Dec.)
1. Commissioners Per Diem and Expenses	$ 6,500.00	$ 6,000.00	$ 500.00
2. Administration and OASIS	76,500.00	62,000.00	14,500.00
4. International and Interstate Expenses	14,500.00	10,000.00	4,500.00
8. Coop. with United States Department — partial	28,500.00	22,500.00	6,000.00
Consolidation			
(1) Administration	$126,000.00	$100,500.00	$25,500.00
5. Topographic Surveys, Coop. W/U.S.G.S.	$ 30,000.00	$ 30,000.00	$.....
6. Hydrographic Surveys, Coop. W/U.S.G.S.	33,000.00	27,500.00	5,500.00
7. Engineering and Geological Surveys	120,000.00	50,000.00	70,000.00
8. Coop. with United States Department — partial	47,500.00	37,500.00	10,000.00
9. Engineering Investigations	169,000.00	145,000.00	24,000.00
10. Administration of Water Rights	10,000.00	10,000.00	.....
Consolidation			
(2) Investigations	$409,500.00	$300,000.00	$109,500.00
3. Maintenance of Dams	$156,000.00	$150,000.00	$ 6,000.00
Consolidation			
(3) Construction	$156,000.00	$150,000.00	$ 6,000.00
TOTAL APPROPRIATION	$691,500.00	$550,500.00	$141,000.00

These three consolidated line items would correspond with the major commission functions of Administration, Investigations, and Construction and provide for more efficient budget administration in that personal services, supplies, equipment, printing, cooperative programs, contract work, and equipment operation costs could be accounted for more accurately in accordance with the major commission functions.

EXPLANATION OF INDIVIDUAL FUNDS

Commissioners' Per Diem and Expenses

The appropriation for this item will be used to pay the $7.00 per day per diem allowance and actual travel and maintenance expenses of State Water Conservation Commission members while attending meetings, hearings, and performing other work for the Commission. Increased awareness of the water resources development program requires attendance by Commission members at more meetings and hearings.

The budget request for this item is $500 above the $6,000 appropriation of the 1959-61 Biennium.

Administration and OASIS

This item of the Commission's budget will be used to pay for the administrative and general office expenses such as salaries, travel expenses, office supplies, office equipment, printing and publications, telephone calls, postage, and payroll taxes.

An increased technical staff necessitates an increased appropriation for OASIS contributions included in this item. We would suggest that the Legislature appropriate a sufficient sum for OASIS for all state agencies thereby reducing each department's appropriation request by the amount required for OASIS. This would eliminate unnecessary administrative costs for completing forms and processing vouchers for each separate department.

Salaries of the Assistant Secretary, accountant, chief stenographer, two stenographers, file clerk, and part-time clerk are included in this item. To maintain the administrative functions of the Commission efficiently and provide increments for key personnel and provide necessary services required by an increased technical staff, it is requested that the Commission's administration and OASIS budget be increased $14,500 to $76,500.

Maintenance of Dams

This item of the Commission's budget will be used to construct dams and repair existing structures which were built by Federal works programs in the 1930's drought. Structures built under these programs are valued at approximately $20 million dollars. Many of these structures provide municipal water supplies, recreational areas, irrigation developments, and fish and wildlife habitats all over the State.

Repair and construction of dams is financed on a cost-sharing basis with the State Game and Fish Department in cases where fish and wildlife interests are involved, and with cities, counties, and water conservation and flood control districts. Costs of easements and land acquisition are paid either by the local sponsors or the Game and Fish Department or both.

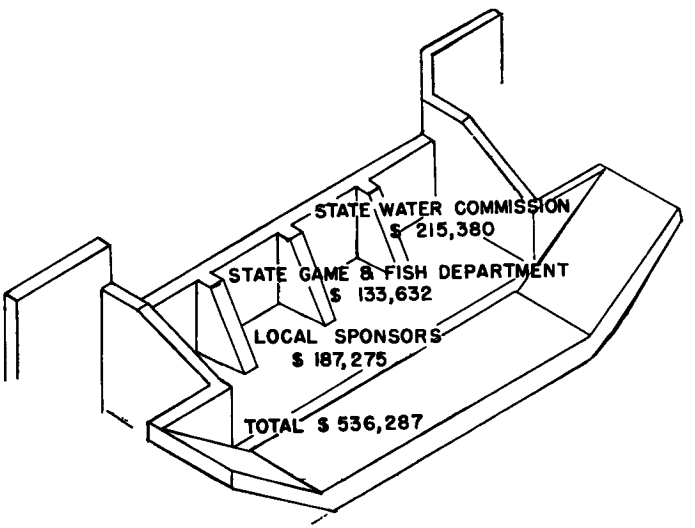
Construction crews and equipment are maintained by the Commission for this program and a large portion of the work, whenever feasible, is done by private contractors with contract awards made on the basis of competitive bids.

Several large projects are being planned with the State Highway Department in conjunction with state and Federal Highway projects whereby roadways are used as the embankment for the reservoir. Multi-purpose benefits can be obtained in this manner with a cost-saving to all concerned.

Many requests have been received from local entities for water conservation and utilization projects during the first year of the current biennium. Projects which could be scheduled for construction during the next biennium include:

Tioga Dam, Williams County
Sweetbriar Creek Dam, Morton County
Harvey Dam, Wells County
Monango Dam, Dickey County
Valley City Mill Dam, Barnes County
Caledonia Dam, Traill County
Drayton Dam, Pembina County
Milton Highway No. 66 Dam, Cavalier County

Local cost participation on these projects is being firmed with actual construction dependent upon availability of Commission funds.



COST PARTICIPATION
NORTH DAKOTA STATE WATER CONSERVATION COMMISSION
DAM CONSTRUCTION PROGRAM
JULY 1, 1960 — JUNE 30, 1962

These projects are quite large in comparison with the last biennium's appropriation for such work. We anticipate many repair and reconstruction requests again in the 1963-1965 biennium as some of the older structures deteriorate. Excessive run-off which occurred in most of our state will have erosive effects on many of the structures built from local materials. It is requested that the dam construction and maintenance appropriation be increased $6,000 to $156,000 for the 1963-1965 biennium for the regular program.

International and Interstate Commissioners and Conference Expenses

This appropriation is used for expenses of Commission members and staff while engaged in work of an international or interstate nature, such as international and interstate river compacts, out-of-state conferences on Missouri River Basin Development and other conferences concerning North Dakota water resources, Congressional hearings, and other activities.

More and more emphasis is being placed on compact negotiations and agency coordination in water resource development. During the past biennium the Commission has been involved in compact negotiations with all neighboring states and Canada on interstate streams. In 1961 the vital importance of these compacts was emphasized as the Souris River Basin suffered a year of extremely deficient precipitation. Despite unfavorable reports on the proposed Pembilier Dam the Commission took the lead in having this project continued as a joint venture between Canada and the United States. Indications are that a favorable report will result. Much time has been devoted by the Commission in caring for items related to this project. Completion of negotiations with South Dakota should assure the Bowman-Haley project.

Garrison Diversion Project hearings and conferences require participation by the commission to obtain authorization for this top priority North Dakota project. Other large projects under consideration by Federal water resource development agencies require considerable coordination with these agencies to obtain optimum development of our water resources.

In view of increased interest in water resource development, it is requested that this appropriation be increased $4,500 to $14,500 for the 1963-1965 biennium.

Topographic Surveys, Cooperation with United States Geological Survey

Costs of the topographic mapping program conducted cooperatively with the United States Geological Survey — Topographic Branch are paid from this appropriation.

One half of North Dakota is already mapped under this continuing program where costs are shared equally with the Federal government. These maps are essential in planning and developing water resources projects and also for industrial, highway, defense, and urban planning and development.

The appropriations request of $30,000.00 for this item is the same as for the past biennium.

Hydrographic Surveys, Cooperation with United States Geological Survey

Costs of the stream gaging program conducted cooperatively with the United States Geological Survey — Hydrographic Branch are paid from this appropriation with the Federal government matching state funds in full.

Basic data on discharge of rivers and streams in the state is gathered and compiled under this program for planning water resource development, highway, industrial, and drainage projects and for apportionment of waters under international and interstate compacts. Complete stream flow records are essential in project development for sound engineering of these projects.

Of the 97 gaging stations in North Dakota the Commission program maintains 44 either wholly or partially and in addition special stations and studies are supported under the program such as water right allocation determinations, low flow frequency study of the Red River, Cedar Creek flow control and the like.

New stations are required on the Canadian border so North Dakota can gauge and lay claim to water which is rightfully hers.

To maintain this program at an efficient level it is requested the appropriation for this item be increased $4,500 to $33,000.

Engineering and Geological Surveys, Cooperation with United States Geological Survey

Costs of the groundwater survey program conducted in cooperation with the United States Geological Survey — Groundwater Branch are paid from this appropriation.

Groundwater surveys for cities, towns, and counties are conducted under this program to determine the location of underground water for municipal, irrigation, and industrial uses. A survey includes field geology and hydrology, test drilling, well inventory of the area, and quality analyses. This information is analyzed and compiled for use by municipalities and others for development of these underground water resources.

During the current biennium demand for these surveys increased to the point where they have had to be forestalled until later years. Surveys under the cooperative program are being conducted for

county-wide areas and the Commission is continuing surveys for cities and towns where the need for immediate water supplies exists.

County-wide studies now underway include Barnes, Burleigh, Cass, Divide, Eddy, Foster, and Richland counties. Total estimated cost of these surveys over a four-year period is $541,000 with the county and state paying one-half the costs.

Renville, Williams, Ward, McKenzie, Bottineau, Benson, Nelson, Pembina, Cavalier, and Wells counties have requested estimates for groundwater surveys and there have been numerous requests from individuals in all sections of the state regarding surveys. Numerous irrigation wells have been developed in several areas in the state which attest to the value of this program. As these installations increase, greater knowledge of the aquifers being utilized, will be required to better enable the Commission to allocate water rights.

This phase of the Commission's work has increased to such a degree that it is necessary to request a $70,000 increase to $120,000 for the 1963-1965 biennium.

Cooperation with United States Departments and for Organizing Conservation and Irrigation Districts

Appropriations for this item are used to finance cooperative planning programs with Federal agencies such as the Corps of Engineers, Bureau of Reclamation, and Soil Conservation Service which construct various water resource projects in the State which are too large for construction by the Commission. Salaries and related costs of employees engaged in this work are paid from this appropriation. During the current biennium a hydrologist was employed by the Commission to carry on hydrologic studies for the Commission in connection with Federal projects as well as the administration of water rights throughout the state.

Organizations which promote the development of water resources throughout the state and nation have been paid dues by the Commission. Provision has been made in this item for dues to the organizations which provide much assistance to the development of our water resources including the National Reclamation Association, Mississippi Valley Association, National Rivers and Harbors Congress, Association of Western State Engineers, North Dakota Water Users Association, United States Committee on Large Dams, and Water Resources Associated.

Costs of organizing water conservation and flood control districts and irrigation districts are paid from this item. These water management and utilization districts are organized for the purpose of providing water resources development of a local area, in many cases an entire county.

These districts have been instrumental in providing necessary projects in various areas of the state, cooperating with the Commission as well as with Federal agencies.

It is requested that this item be increased $16,000 to $76,000 so the Commission can continue the state-wide hydrologic study, assist in organization of water management and utilization districts, and continue to cooperate with Federal agencies in planning water resource projects necessary to North Dakota.

Engineering Investigations, Surveys, and Design of Water Resources Projects

Funds appropriated to this item maintain the Commission's engineering staff and also finance much of the investigational, survey, and design work. Costs paid from this appropriation include salaries and travel expenses of the engineering force, engineering equipment and supplies, and vehicle purchases and operations.

Organization of the Commission staff was altered during the 1961-1963 biennium to better coordinate field and office engineering work. The position of Assistant State Engineer has been temporarily eliminated and the position of operations engineer created. Costs of this engineer are to be paid from this fund during the 1963-1965 biennium.

Project investigations conducted with the appropriation include dams for municipal water supplies, recreation development, industrial development, flood control, and irrigation as well as irrigation development from underground water supplies.

Local sponsors of projects deposit a minimum of $200 with the Commission to defray costs of the investigation or if the project is found economically and engineeringly feasible, the local sponsors deposit is applied to the sponsor's share of the construction costs.

The demand for investigational and design work increased during the 1961-1963 biennium and it is anticipated this demand will continue to increase in the 1963-1965 biennium as county water user's councils are being formed to coordinate local efforts in promoting and developing water resources. It is requested that this appropriation be increased $24,000 to $169,000 for the 1963-1965 biennium.

Administration of Water Rights

The State Engineer is responsible for investigating and issuing water rights for individuals, firms and municipalities. These water rights provide priorities of use of water from North Dakota streams and underground sources. These rights are very important in that when a project is developed the applicant for the right receives a Certificate of Completion and water license which gives the owner actual title to the amount of water specified in the license.

Water right applications filed with the State Engineer have increased tremendously during the first year of the current biennium as noted below:

Fiscal Year	Water Right Applications Filed
1959	37
1960	66
1961	43
1962	105

Many of the prior water right applications require investigations as well as the new applications being received. To administer these water rights effectively and efficiently and to protect the interests of the persons concerned as well as the State, it is important that the part-time of one engineer be devoted to this phase of the Commissioner's activities.

It is requested that this item of the Commission's appropriation be retained at the same level for the 1963-1965 biennium.

SUMMARY AND EXPLANATION OF PROPOSED BUDGET

* MULTIPLE PURPOSE FUND
1963-65 Biennium

Expenditures 1959-61 Biennium		$ 257,737.54 (a)
Expenditures 1st year 1961-63		$ 56,050.62 (b)
Estimated Expenditures 2nd year 1961-63		$ 467,156.00 (c)
Present Budget	$ 300,000.00	
Proposed 1963-65	$ 300,000.00 (no change)	

Footnotes (a) and (b) follow

(c) Includes $30,000.00 estimated refunds.

* The Multiple Purpose Fund is appropriated for a continuing period or to be available until expended.

(a)

Appropriations by Legislature, July 1, 1959		$200,000.00
Refunds — 1959-1961 Biennium		42,569.17
Brought Forward from 1957-1959 Continuing Approp.		178,751.98
		$421,321.15
Expenditures for Drainage, Flood Control, Irrigation and other Water Resource Projects, July 1, 1959-June 30, 1961:		
Bottineau County - Ovregaard Lateral	$ 11,137.09	
Cass County - Drain No. 12	1,116.59	
Cass County - Drain No. 19	1,746.78	

Cass County - Drain No. 21	18,674.93	
Cass County - Drain No. 22	15,792.61	
Cass County - Drain No. 30	2,197.21	
Cass County - Drain No. 39	524.13	
Cass County - Drain No. 45	1,941.63	
Cass County - Noble Twp. Drop Structure	791.60	
Grand Forks County - Drains Nos. 1 & 2	14,827.73	
Pembina County - Drain No. 11	4,025.46	
Pembina County - Drain No. 13	226.90	
Pembina County - Drain No. 43	4,629.32	
Pembina County - Rhinelander Drain	2,116.79	
Richland County - Drain No. 2	14,834.00	
Richland County - Drain No. 5	5,774.34	
Richland County - Drain No. 17	2,433.50	
Richland County - Drain No. 63	5,076.93	
Richland County - Drain No. 64	3,938.90	
Richland County - Drain No. 65	309.99	
Traill County - Drains Nos. 4 and 14	10,718.02	
Walsh County - Drain No. 27	5,154.37	
Cartwright Irrigation Project No. 36	6,323.85	
Lewis and Clark Irrigation Project No. 175	8,500.00	
Sioux Irrigation Project No. 213	4,487.60	
Eaton Irrigation Project No. 227	23,097.28	
Jackson Dam No. 253	4,488.53	
Neche Dam No. 274	11,797.68	
Long Creek No. 334	201.47	
Lake Irvine No. 416	3,055.53	
Golden Lake No. 475	8,415.92	
Fargo Flood Control No. 583	27,138.30	
Ypsilanti Dam No. 649	8,321.26	
Park River Channel Change No. 661	551.26	
Marmarth Flood Control No. 711	8,577.16	
Minot Test Drilling No. 782	1,250.00	
Northwood Observation Well No. 789	1,029.25	
Scranton Flood Control No. 821	10,013.84	
Hydrographic Surveys—Coop W/U.S.G.S.	2,499.79	$257,737.54
Allocations made for projects in progress or to be under construction in the biennium. Balance available until expended and used in making allocations in 1961-1963 biennium.		$163,583.61

(b)

Appropriations by Legislature, July 1, 1961	$300,000.00
Refunds — July 1, 1961 - June 30, 1962	29,623.07
Brought Forward from 1959-1961 Biennium	163,583.61
	$493,206.68

Expenditures for Drainage, Flood Control, Irrigation and other Water Resources Projects, July 1, 1961 - June 30, 1962:		
Grand Forks Drain No. 19	$ 2,894.90	
Cass County Drain No. 49	3,746.46	
Deep River Development Farm No. 834	244.25	
Cass County Drain No. 39	3,604.94	
Park River Snagging and Clearing No. 662	4,695.97	
Jackson Dam No. 253	6,440.14	
Golden Lake No. 475	400.00	
Investigations and Equipment	4,400.89	
Sponsor's Share of Projects	29,623.07	$ 56,050.62
Unexpended Balance as of June 30, 1962		$437,156.06
Estimated Refunds, July 1, 1962 - June 30, 1963		30,000.00
		$467,156.06

Allocations made for projects in progress or to be surveyed or constructed in near future:	
Cass County Drain No. 2	$21,200.00
Cass County Drain No. 13	4,294.00
Cass County Drain No. 15	7,237.07
Cass County Drain No. 15 (Drop Structure)	2,100.00
Cass County Drain No. 21 (Balance)	10,025.52
Cass County Drain No. 29 (Drop Structure)	2,000.00
Bottineau County - Kramer Drain	6,000.00
Grand Forks Drain No. 12	30,088.00
Grand Forks Drain No. 13	8,925.33
Pembina Drains No. 4 and 18	18,169.60
Pembina Drain No. 6	14,615.84
Pembina Drain No. 7	11,200.00
Pembina Drain No. 13 (Drop Structure)	7,450.00
Pembina Drain No. 64	3,444.29
Richland Drain No. 65	20,000.00
Richland County - Field Crossing	600.00
Traill Drain No. 35	8,632.00
Walsh Drain No. 27 (Balance)	122.22
Sioux Irrigation Project No. 213	3,000.00
Sykeston Dam No. 450	42,000.00
Elm River Dam No. 501	21,000.00
Ancient Missouri River Survey No. 617-8	6,950.00
James River Channel Change No. 624	8,800.00
Park River Channel Change No. 661	500.00
Park River Snagging and Clearing No. 662 (Balance)	5,000.00

Lower Apple Creek No. 669	3,600.00	
Oak Willow Creek Clearing No. 820	3,000.00	
Divide County Groundwater - Pilot Well No. 862	800.00	
Jamestown 4-H Irrigation Project No. 930	500.00	
Fiscal Year 1963 Groundwater Program	55,000.00	$331,983.09
Additional allocations for Drainage, Flood Control, Irrigation, and other Water Resource Projects through June 30, 1963		$135,172.97

MULTIPLE PURPOSE FUND

Plans and Recommendations

The Multiple Purpose Fund was established in 1955 as a continuing appropriation to replace the appropriation for Construction and Reconstruction of Drains. There was a definite need to establish this fund as a continuing appropriation as the water resource projects financed through this fund usually require more than a biennial period to complete which made the fund difficult to administer prior to its being changed to a continuing fund.

The State Water Conservation Commission through the Multiple Purpose Fund aids the various counties, cities, towns, drainage districts, irrigation districts, and water conservation and flood control districts in the State in drainage, flood control, irrigation, stream clearing, groundwater investigations, and other water resource projects of a multi-purpose nature.

Expenditures for drainage have been made mainly for the removal of excess water from the fertile lands of the Red River Valley. The cost of drains built by the local entities in cooperation with the State Water Conservation Commission is shared on the basis of 60% by the local entity and 40% by the Commission. One can readily comprehend the value of these drains when it is shown by reliable estimates that during the period 1943 to 1953 loss from inadequate drainage to counties in the Red River Valley alone was almost $60,000.00.

The various projects in which the Commission has participated during the biennial period 1959-1961 and the first year of the 1961-1963 biennial period are shown on pages 2 and 3 of this budget request. The allocations made for projects in progress or to be constructed in the near future is also shown in pages 2 and 3.

Budget requests to the Legislature from the State Water Conservation Commission for this fund are based on the amount of money required to restore the fund to its original level or to a sufficient level to take care of the anticipated demands during the next two year period. It is anticipated that during the 1963-1965 biennial period the requests for participation in various multi-purpose water

resource projects will be accelerated. This is based on past experience as shown by the amount available for additional allocations for the last year of the present biennium and also the need for flood control and drainage in the Red River Valley which suffered greatly from extensive flooding in the spring of 1962.

It is requested that $300,000.00 be appropriated to continue this fund.

PUBLIC RELATIONS

The State Water Conservation Commission conducts a limited public relations program designed to inform the public about North Dakota's water resources. The commission provides both general and specific information in a variety of ways — exhibits, public appearances, news releases, personal interviews, printed material and personal replies to inquiries.

Throughout the year the commission makes available for display at fairs, conventions and other functions in North Dakota cities, an exhibit containing maps, pictures, graphs and written explanations pertaining to specific projects and general information about North Dakota's water resources. The exhibit occupies a space of approximately 24 feet and is available upon request for display at appropriate functions. A State Water Conservation Commission employee devotes a portion of his time to accompanying the exhibit. The traveling exhibit has appeared at the following 19 functions during the biennium:

July 1-5, 1960.....Stutsman County Fair, Jamestown
July 9-15, 1960.....Red River Valley State Fair, Fargo
July 16-23, 1960.....North Dakota State Fair, Minot
Aug. 31-Sept. 2, 1960....McLean County Fair Assn., Underwood
Oct. 24-27, 1960.....Walsh County Fair and State Potato Show, Park River
Nov. 22, 1960....Community Betterment Awards Day Ceremony, Minot
Dec. 1-3, 1960....State Soil Conservation Convention, Bismarck
Jan. 9-11, 1961.....County Commissioners Assn., Jamestown
March 4-10, 1961.....North Dakota Winter Show, Valley City
June 25-July 1, 1961.....Grand Forks State Fair, Grand Forks
July 2-5, 1961.....Stutsman County Fair, Jamestown
July 8-14, 1961.....Red River Valley State Fair, Fargo
July 15-21, 1961.....North Dakota State Fair, Minot
Sept. 7-8, 1961....Dakota Plowing Contest and Farm Forum, Inc. Ashley
Sept. 16, 1961.....Farm Festival Day, Tioga
Oct. 23-27, 1961.....Walsh County Fair and State Potato Show, Park River
Oct. 27-28, 1961.....State Wheat Show, Williston
Nov. 9-10, 1961.....Second Annual Convention of North Dakota Water Users Association, Minot
June 23-30, 1962.....Grand Forks State Fair, Grand Forks

During the biennium the State Water Conservation Commission received from 750 to 1,000 inquiries pertaining to North Dakota's water resources. The requests for information were from interested citizens of other states as well as inhabitants of North Dakota. The inquiries were answered with both printed brochures and personal replies.

As another part of the public relations program, State Water Conservation Commission employees appeared before television audiences and spoke at public meetings. Topics of the speeches ranged from subjects like Garrison diversion to an explanation of the status and potential of North Dakota's water resources. During the biennium Water Conservation Commission speakers appeared on television 12 times, radio ten times and addressed public assemblies at an average of three meetings per week.

Periodically the State Water Conservation Commission distributes news releases through the press associations and the Capitol News Service. These releases contain summaries of Water Conservation Commission activities in various fields. Approximately 50 of these news releases were made during the biennium.

RECOMMENDATIONS

The State Water Conservation Commission by law is charged with the responsibility for the control and development of the water resources of North Dakota for the benefit of the citizens of the State. To fulfill this responsibility a variety of activities and programs are involved each of which is directed to a specific object and, combined, constitute the whole effort of the Commission to bring about the full development and utilization of these resources. The Commission's program is geared to the need and demand that exists both of which vary from time to time and both of which are dependent mainly on legislative authorizations, directives and appropriations. In several fields there are opportunities for greater coordination and cooperation that can be accomplished under existing legislation that the agencies concerned have. Steps are being taken to establish such cooperative endeavors in such a manner that they will be adaptable to the needs and demands of the people of the State. Many of the recommendations necessarily are dependent on Legislative action dealing with amendments to the water laws or with funds available to the Commission to carry out its various programs. The recommendations contained herein are set forth by the programs to which they refer. No specific mention is made to several of the continuing programs of the Commission, however it is recommended that they be provided for in accordance with the Commissions 1963-65 budget request.

Groundwater Investigations

During the past biennial period a tremendous increase in the interest in county-wide groundwater investigations has been noted. This program is discussed in detail in another section of this report.

It is recommended that the county-wide groundwater investigation program be geared to completing surveys for three counties and beginning three new county-wide studies each year. A total of 4 years would be required to complete a specific study therefore this program would provide for having 12 county-wide studies underway annually after the third year. Under this program it will be possible to complete the inventory of the available groundwater resources in the State over a period of 18 years.

This survey work would constitute the cooperative groundwater program with the U. S. Geological Survey and the affected counties. Approximately 50% of the funds to finance such an endeavor would be provided by the U. S. Geological Survey with the balance from State and local funds. The extent of participation required from the counties would be based on the square miles of area involved and generally will amount to one fourth the total cost of the survey. The total cost of performing such surveys ranges between $60 and $90 per square mile depending on the geology of the area considered. This phase of the Commission's groundwater investigation program will require the major portion of the funds requested in the Engineering and Geological Surveys item in the Commission's 1963-65 budget.

The other phase of this program is directed toward locating ground water sources for specific municipalities. At one time studies of this nature were conducted in cooperation with the U. S. Geological Survey and the cities and towns concerned. However, since the inauguration of the county-wide groundwater investigation program the municipal studies have been carried on cooperatively by the Commission and the municipalities. The cost of these studies is shared equally by the cooperating parties.

The budget recommended for the Commission's groundwater investigation program for the 1963-65 biennium under the item Engineering and Geological Surveys will be adequate to carry out the survey program outlined above. Consideration has been given to the matching funds that will be available from the U. S. Geological Survey and the payments that will be received from the various counties in which surveys will be conducted.

This accelerated program would be accomplished with equipment presently owned by the Commission. Additional test drilling that cannot be accomplished with the Commission's drill rig would be accomplished on a contract basis with private drillers. Personnel to supervise and administer the program would be provided from the Commission's staff or by the U. S. Geological Survey.

It is recommended that, as a part of the groundwater investigation program arrangements be made to establish a cooperative quality of water program with the State Laboratories and the Commission cooperating. The cost of quality water analysis will be charged to the cooperative groundwater program and subsequently will be shared by all cooperators in the various studies. This arrangement can be accomplished without specific legislative directive providing funds are available to the appropriate agencies to carry on the necessary work.

Small Irrigation Projects

North Dakota has a number of small irrigation projects that can be developed on a State or local level more economically than if undertaken by a Federal agency. At the present time Federal legislation is in effect that provides for loans to water user organizations that can qualify for projects of this nature. In order to meet the requirements for a loan under this act a complete plan for the project must be prepared and submitted to the Bureau of Reclamation for an approval along with a $1,000 application fee. In most instances the entire loan made for such a project must be repaid unless flood control and benefits other than irrigation are contained therein whereas in the case of units of the Missouri River Basin Project a large percentage of the construction cost is paid from surplus power revenues. Loans obtained under the Small Project Act for irrigation purposes are non interest bearing.

Although some provision is made in the Commission's budget request for the 1963-65 biennium for survey and planning work for

a limited number of projects in this category no provision is made for State participation in the construction costs for such projects. It is well recognized that the benefits from irrigation development extend far beyond the irrigation farmer and stimulate the entire economy of an area or state. In order to recognize these benefits and enhance the development of small irrigation projects it is recommended that the North Dakota Legislature consider appropriating funds to the State Water Conservation Commission for a continuing period earmarked to assist in small irrigation project development.

Highway Dams

During the past biennium the Commission has negotiated two agreements with the State Highway Department to utilize the road fill for the embankment for dams that can be used to store water for recreation, fish and wildlife, municipal water supplies and other purposes. These combination highway-dam projects provide for a maximum return from the tax dollar invested and such development should be extended to other potential sites in the State. It is anticipated that other projects of this kind will be proposed in the future and it is recommended that every effort be made to extend the use of this program wherever feasible.

Water Law Study

In 1961 the North Dakota Legislature authorized and directed a study of the North Dakota Water Laws by the Legislative Research Committee in cooperation with the State Water Conservation Commission. Significant progress has been made in this study and recommendations will be made to the Legislature for basic changes in several provisions of North Dakota's water laws. It was impossible to complete the study of all phases of the water laws in the interim period between the 1961 and 1963 Legislatures therefore it is recommended that the Legislative Research Committee be authorized and directed to continue this study and that adequate funds for this work be made available.

Water Resources Planning

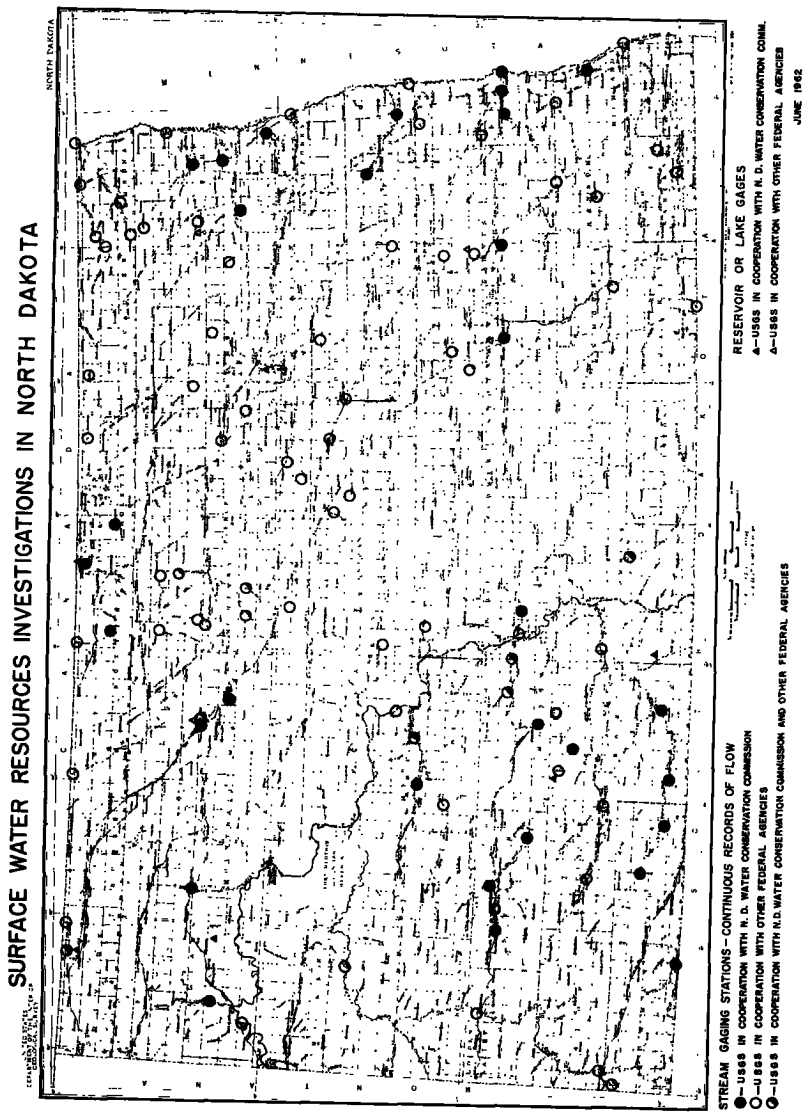
The last Congress has had before it bills which proposed to bring about basin-wide planning of water and related resources with affected States participating actively in the work and in Federal funds proposed to be made available therefor. This type of program, with adequate safeguards of State water rights, has many advantages over the present piece-meal procedure generally followed whereby several federal and state agencies are given responsibilities with unequal opportunities for such planning. It is suggested that the next Legislature endorse the principle of basin-wide planning of natural resources development with safeguards insuring that rights of states in relation to water be amply protected.

Water Rights

In 1934 the then Bureau of Biological Survey, under an existing state law, filed a reservation on all unappropriated water in the streams of North Dakota. The actual appropriation and use of only a small portion of all the water filed upon has been accomplished and the state law giving authority to a Federal agency to file such a reservation has been repealed. However, the original filing is an apparent cloud on North Dakota water right filings subsequent to that of the Biological Survey. In order to clear up this matter it is recommended that the North Dakota Legislature adopt a Concurrent Resolution requesting Congress through appropriate legislation to quit claim, relinquish and release any and all claim to and interest in all water for which appropriation has not been completed under the Biological Survey filing aforesaid.

Chapter III

COOPERATIVE ACTIVITIES


SURFACE WATER RESOURCES INVESTIGATIONS IN NORTH DAKOTA
NORTH DAKOTA
STREAM GAGING STATIONS—CONTINUOUS RECORDS OF FLOW
●—USGS IN COOPERATION WITH N. D. WATER CONSERVATION COMMISSION
○—USGS IN COOPERATION WITH OTHER FEDERAL AGENCIES
◑—USGS IN COOPERATION WITH N.D.WATER CONSERVATION COMMISSION AND OTHER FEDERAL AGENCIES
RESERVOIR OR LAKE GAGES
▲—USGS IN COOPERATION WITH N. D. WATER CONSERVATION COMM.
△—USGS IN COOPERATION WITH OTHER FEDERAL AGENCIES
JUNE 1962

FEDERAL AGENCIES

Hydrographic Surveys — Cooperation with U. S. Geological Survey

Since the early 1930's, the state of North Dakota has had a cooperative program underway with the Hydrographic Branch of the U. S. Geological Survey for conducting stream gaging activities in North Dakota. When the State Water Conservation Commission was established in 1937, it was designated as the agency to cooperate with the U. S. Geological Survey in a stream gaging program. The data collected from this cooperative program has been of great importance in the planning and development of water resource projects.

In order to serve the needs of mankind and to control the state's streams, it is paramount that knowledge is required as to the flow of North Dakota streams. A knowledge of minimum flows is essential in order to provide public and industrial water supplies, to assure dilution of wastes and to insure an adequate water supply for irrigational purposes. The amount of storage needed to alleviate a deficiency during low flow periods must be determined, and the amount of runoff the stream will yield to fill this storage must be known to satisfactorily solve such problems. Power development also demands stream flow information. In order to administer water rights fairly, factual information concerning the amount of water available is important. During flooding it is helpful to know the peak flow rates and the runoff volume. In finding solutions to flooding, it is valuable to know the magnitude and frequency of flood flows.

Future flows and water supplies can only be determined by studying past performances of streams. This requires a collection of continuous records over a long period of time. The State Water Conservation Commission and the United States Geological Survey have cooperatively been collecting the needed information.

The present surface water resources investigations program includes the operation of 104 gaging stations where continuous records of stream flow are obtained at strategic locations in North Dakota and on its boundaries. Thirty-two of these stations are operated wholly through the cooperative program between the U. S. Geological Survey and other federal agencies including the Corps of Engineers, the State Department, the Fish and Wildlife Service, the Bureau of Reclamation through the Missouri Basin Program and the Soil Conservation Service.

Records of elevation, and contents in most cases, are being obtained at twelve reservoirs or lakes. Five of these stations are being operated by the U. S. Geological Survey in cooperation with the Water Conservation Commission and the remaining seven by cooperation between the U. S. Geological Survey and the Soil Conservation Service.

During the biennium a stream gaging station on Cedar Creek near Shields and a reservoir station on Froelich Reservoir near Self-

ridge were added to the cooperative program. The Froelich Reservoir represents a relatively new type of installation in this area, and it is expected to provide rather comprehensive hydrologic data including runoff from a small drainage basin and seepage from evaporation loss information from what is believed to be a representative impoundment. Through cooperative programs between the U. S. Geological Survey and other federal agencies, new gaging stations were established on Middle Branch Forest River near Whitman, Long River near Sarles and Hidden Island Coulee near Hansboro.

The cooperative program may be divided into two general types of work: (1) the operation of long-term basic network gaging stations which are the source of hydrologic information for use with the numerous water problems that may arise from time to time in any part of the state, and (2) special gaging activities, investigations and studies usually of quite an urgent nature relative to some specific problem and area. Among the projects in the latter category are base-flow measurements associated with the Little Missouri River Compact negotiations, gaging on Cedar Creek related to water rights, water use and distribution problems, special investigations and studies in the Souris River Basin required in connection with the division of water among North Dakota, Saskatchewan and Manitoba, special gaging associated with the Lake Metigoshe Improvement Project and Mauvais Coulee Basin drainage problems.

The financing of the cooperative program is on a fifty-fifty basis with the State Water Conservation Commission's share determined by legislative appropriation which at the present amounts to $27,500 for the current biennium. Other special studies that are being conducted on a cooperative basis include the Red River Low Flow study and Cedar Creek study. The Commission's share of these studies is $3,750.

Preliminary work was done on the preparation of low-flow frequency curves for some western North Dakota streams, particularly for some of the gaging stations in the Cannonball River Basin. These curves are designed to show the probable frequency of recurrence of low flows during the critical months of the irrigation seasons, as well as during the full year. The continuation of these studies, as well as the possible preparation of reports on the frequency of low flows in the principal Missouri River tributary streams will depend upon the provisions of future cooperative programs.

Red River — Frequency of Low Flows

Cooperating with the State Water Conservation Commission, the U. S. Geological Survey has prepared a report entitled "Frequency of Low Flows, Red River of the North, North Dakota and Minnesota". This technical survey contains compiled data pertaining to low flows in the Red River under natural flow conditions, under present regulation, and under proposed future regulation.

As the Red River is the main source of water supply for several cities and industries in the Red River Valley, the report is especially

written for municipalities and industries that are concerned with minimum flows and the frequency at which they are likely to occur. Low-flow frequency curves of the river are given for Wahpeton, Fargo, Halstad, Grand Forks, Drayton, and Emerson based on stream flow records accumulated from gaging stations at those locations.

Chiefly written for use by technical personnel, the report requires interpretation for the layman. Copies can be obtained by writing to the North Dakota State Water Conservation Commission, 1301 State Capitol, Bismarck, North Dakota, or to the U. S. Geological Survey, 202½ Third Street, Bismarck, North Dakota.

Park River Water Losses

A cooperative investigation by the U. S. Geological Survey and the State Water Conservation Commission on the flow of the Park River from Homme Dam to Grafton during the fall of 1961 revealed that 38 per cent of the water released from Homme Dam was lost as the result of infiltration and evaporation before it reached Grafton. The reason for this high water loss was attributed to the large amount of debris and snags in the river. Steps were then taken to alleviate the situation as both Grafton and Park River rely on the Park River and water stored in Homme Dam for their municipal water supply.

The snagging and clearing operation began in the winter of 1961. Cooperative gaging operations will be continued on the river to determine the effect of the snagging and clearing operations in increasing the rate of flow.

Cedar Creek Studies

Low flows of the Cedar Creek in 1960 and 1961 in Adams and Sioux Counties created a controversy between ranchers and irrigators over the use of the limited water supply. The problem became so severe that the State Water Conservation Commission finally issued an order prohibiting irrigation when the flow was less than five cubic feet per second.

Upon request of the State Water Conservation Commission the Hydrographic Branch of the U. S. Geological Survey is continuing studies of the flow of Cedar Creek so that the Commission may find an effective solution to the problem. Because of the need for additional information, two new gaging stations were added in the last three years to the two stations that had been in existence on Cedar Creek. Gaging information as well as other data can be obtained from either the U. S. Geological Survey or the State Water Conservation Commission, although the study is, as of yet, incompleted.

Topographic Surveys — Cooperation with the U. S. Geological Survey

Under the topographic mapping program conducted cooperatively between the State Water Conservation Commission and the Topographic Branch of the U. S. Geological Survey, topographic quadrangle

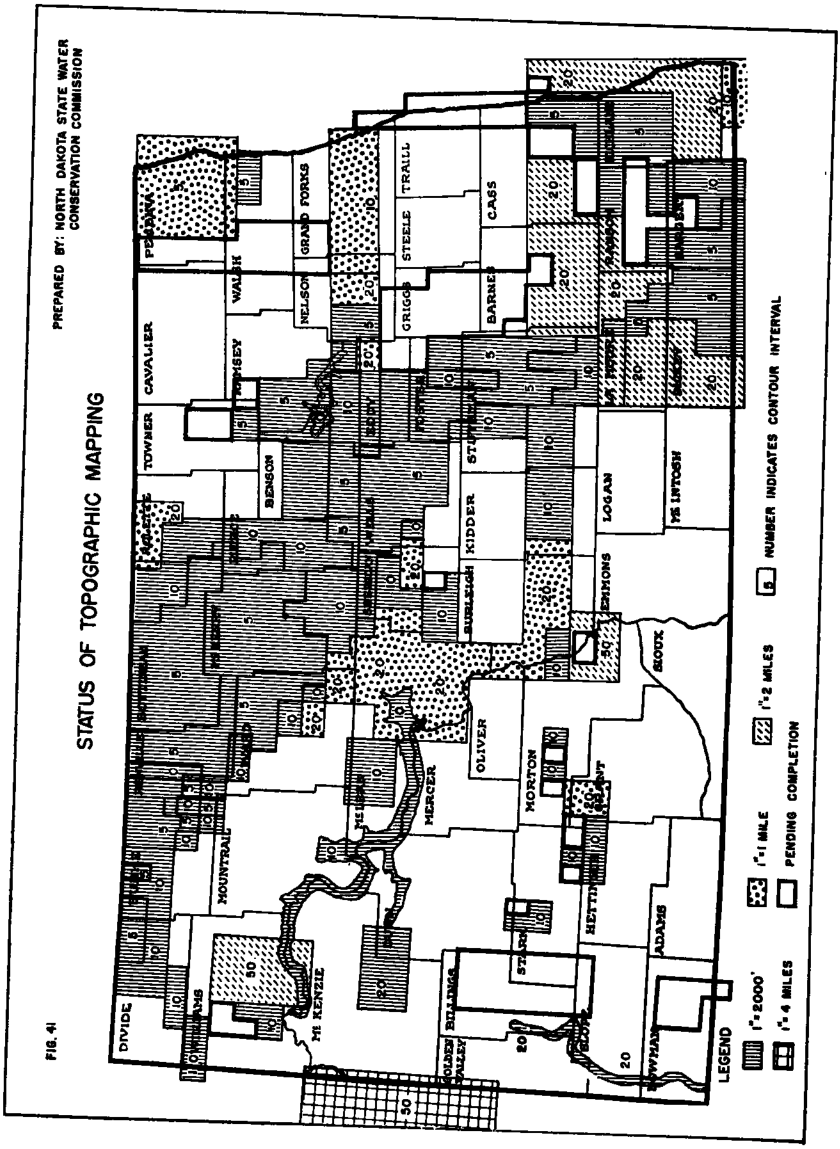

STATUS OF TOPOGRAPHIC MAPPING
PREPARED BY: NORTH DAKOTA STATE WATER CONSERVATION COMMISSION
DIVIDE
WILLIAMS
MOUNTRAIL
Mc KENZIE
MERCER
OLIVER
MORTON
GRANT
HETTINGER
ADAMS
BOWMAN
SLOPE
STARK
BILLINGS
GOLDEN VALLEY
DUNN
CAVALIER
TOWNER
BENSON
RAMSEY
WALSH
PEMBINA
GRAND FORKS
NELSON
GRIGGS
STEELE
TRAILL
CASS
BARNES
KIDDER
BURLEIGH
STUTSMAN
FOSTER
EDDY
WELLS
LOGAN
EMMONS
Mc INTOSH
SIOUX
LA MOURE
RANSOM
SARGENT
RICHLAND
DICKEY
LEGEND
1"=2000'
1"=1 MILE
1"=2 MILES
1"=4 MILES
PENDING COMPLETION
NUMBER INDICATES CONTOUR INTERVAL

FIG. 41

maps are made of various sections of the state as designated by the Commission. In addition to the cooperative program with the Commission, the U. S. Geological Survey cooperates with various other branches of the federal government in making topographic maps of North Dakota in conjunction with the Missouri River Basin program at no cost to the state. The Missouri River Basin topographic maps are confined to areas that are included for proposed development under the Missouri River Basin Project. The state's cooperative program with the U. S. Geological Survey is directed to making topographic maps of other areas as determined necessary and desirable. Maps prepared under either of these programs are made and published by the U. S. Geological Survey in accordance with their standards.

The modern topographic quadrangle map provides essential basic data for a wide variety of land and water utilization projects. Because it is a graphic portrayal of a part of the earth's surface, it shows such features as roads, railroads, highways, buildings, section lines, canals, ditches and reservoirs, rivers, streams, lakes and other bodies of water. These features are shown in their correct size and true position in relation to the scale of the map. The topographic quadrangle map, however, is unique in that it shows the elevations, slope and configuration of all ground surfaces. In short, it contains the same information as would be represented by a true scale model of the terrain.

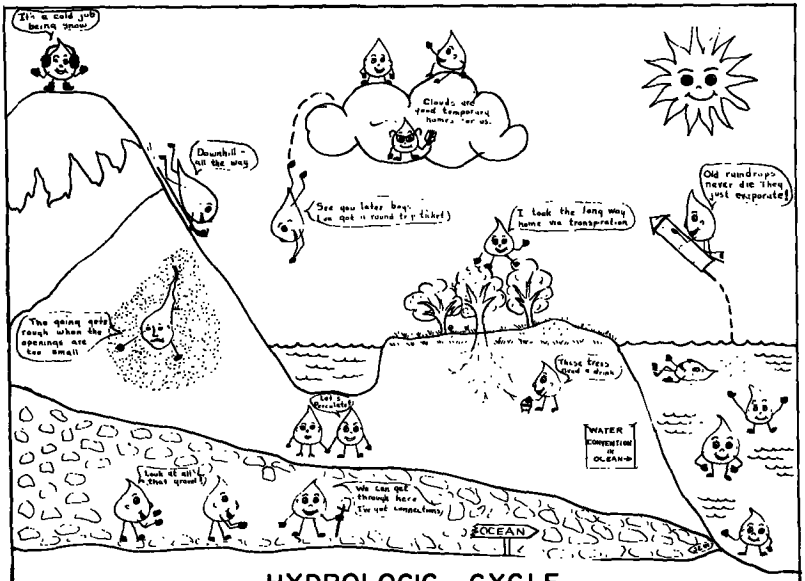
There is a definite need for the basic data that can be obtained from good topographic maps. Both irrigation and flood control projects must be planned with knowledge of the topography of the area involved. Dam sites can be selected and property located, and the capacity of large and small reservoirs can be estimated on the map. Preliminary location of ditches and canals that conform to the slope of the land can be made in this office. These maps are valuable for road and highway locations, power line locations and in proposed industrial development. In fact, topographic maps of an area may well be called the "blueprints for progress". Modern up-to-date topographic maps are invaluable in the development of any area.

The State Water Conservation Commission's cooperative program with the U. S. Geological Survey provides for the preparation of maps of designated areas in the state. These maps, commonly called quadrangle maps, are bounded by parallels of latitude and meridians of longitude. The 7½ minute quadrangle maps are prepared at a scale of 1 to 24,000 (1" - 2000') and cover an area of approximately 49 square miles, and the 15' quadrangles have a scale of 1 to 62,500 1" - nearly 1 mile) and cover an area of about 195 square miles.

During the period covered by this report, nine 7½-minute quadrangle maps under the Commission's cooperative program, forty-eight 7½-minute quadrangle maps under the Missouri River Basin program and seven 7½-minute maps for other federal projects were completed and published. There are an additional one hundred sixty-nine 7½-minute and four 15-minute quadrangles on which mapping was in pro-

gress as of June 30, 1962, of which ten 7½-minute maps are in the Commission's cooperative program; one hundred fifteen 7½-minute maps are under the Missouri River Basin program; and forty-six maps, including the four 15-minute maps, under the sponsorship of the U. S. Geological Survey. Two of the 15-minute maps were controlled, compiled and field checked under 1:24,000-scale mapping standards, which means that the 7½-minute units can be finished and published should the need for maps at the larger scale arise. The other two 15-minute maps are authorized for series conversion after the 7½-minute units are ready for publication. The State Water Conservation Commission appropriation to support the cooperative mapping program is $30,000 for the 1961-1963 biennium and was the same for the previous period, which accounts for the cooperative contribution for the period covered by this report.

The status of topographic mapping is indicated on the following pages of this report.



HYDROLOGIC CYCLE

Progress of U.S.G.S. Quadrangle Maps in North Dakota
Maps in Progress June 30, 1962

Quadrangle	Size	Allot.*	Status of Mapping, June 30, 1962
Ardoch NW	7½	MRB	In basic control
Ardoch SW	7½	MRB	In basic control
Belfield 1 NE	7½	SIR	Ready for cartography
Belfield 1 NW	7½	SIR	In field completion
Belfield 1 SE	7½	SIR	Ready for cartography
Belfield 1 SW	7½	SIR	Ready for field completion
Belfield 2 NE	7½	SIR	Ready for field completion
Belfield 2 NW	7½	SIR	Ready for field completion
Belfield 2 SE	7½	SIR	Ready for field completion
Belfield 2 SW	7½	SIR	Ready for field completion
Belfield 3	15	SIR	In Rocky Mountain Area jurisdiction (In cartography)
Belfield 4	15	SIR	In Rocky Mountain Area jurisdiction (In cartography)
Binford NE	7½	MRB	In cartography
Binford NW	7½	MRB	In cartography
Binford SE	7½	MRB	In cartography
Binford SW	7½	MRB	In cartography
Bismarck (R)	7½	SIR	Field revision completed
Bismarck NE	7½	COOP	Ready for field completion
Bismarck NW	7½	COOP	Ready for field completion
Bismarck 3 NE	7½	COOP	Ready for field completion
Bismarck 4 NW	7½	COOP	Ready for field completion
Casselton 1 NE	7½	SIR	In cartography
Casselton 1 NW	7½	SIR	In cartography
Casselton 1 SE	7½	SIR	In cartography
Casselton 1 SW	7½	SIR	In cartography
Casselton 3 NE	7½	MRB	In cartography
Casselton 3 NW	7½	MRB	In cartography
Cavalier NE	7½	MRB	Authorized
Cavalier NW	7½	MRB	Authorized
Cavalier SE	7½	MRB	Authorized
Cavalier SW	7½	MRB	Authorized
Cole Harbor SE	7½	MRB	In cartography
Crystal NE	7½	MRB	Authorized
Crystal NW	7½	MRB	Authorized
Crystal SE	7½	MRB	In basic control
Crystal SW	7½	MRB	In basic control
Dazey 1 NE	7½	MRB	In cartography
Dazey 1 NW	7½	MRB	In cartography
Dazey 1 SE	7½	MRB	In cartography
Dazey 1 SW	7½	MRB	In cartography
Dazey 2 NE	7½	MRB	In cartography
Dazey 2 NW	7½	MRB	In cartography
Dazey 2 SE	7½	MRB	In cartography

Progress of U.S.G.S. Quadrangle Maps in North Dakota (Continued)

Maps in Progress June 30, 1962

Quadrangle	Size	Allot.*	Status of Mapping, June 30, 1962
Dazey 2 SW	7½	MRB	In cartography
Dazey 3 NE	7½	MRB	In cartography
Dazey 3 NW	7½	MRB	In cartography
Dazey 3 SE	7½	MRB	In cartography
Dazey 4 NE	7½	MRB	In cartography
Dazey 4 NW	7½	MRB	In cartography
Dazey 4 SE	7½	MRB	In cartography
Dazey 4 SW	7½	MRB	In cartography
Dickinson 1 NW	7½	COOP	Ready for field completion
Eckelson 1 NE	7½	COOP	Ready for final review
Egeland NE	7½	MRB	Ready for cartography
Egeland NW	7½	MRB	In field completion
Egeland SE	7½	MRB	In field completion
Egeland SW	7½	MRB	Field completion completed
Eldred NW	7½	SIR	Authorized
Eldred SE	7½	SIR	Authorized
Eldred SW	7½	SIR	Authorized
Emerado	15	SIR	Authorized for series conversion
Emerado NE	7½	MRB	In basic control
Emerado NW	7½	MRB	In basic control
Emerado SE	7½	MRB	In basic control
Emerado SW	7½	MRB	In basic control
Fargo 4 SW	7½	SIR	Authorized
Fisher SW	7½	SIR	Authorized
Gardar NE	7½	MRB	Authorized
Gardar NW	7½	MRB	Authorized
Gardar SE	7½	MRB	In basic control
Glen Ullin 2 SE	7½	MRB	In reproduction
Gorham 3 NE	7½	SIR	Authorized
Gorham 3 NW	7½	SIR	Authorized
Gorham 3 SE	7½	SIR	Authorized
Gorham 3 SW	7½	SIR	Authorized
Gorham 4 NE	7½	SIR	Authorized
Gorham 4 NW	7½	SIR	Authorized
Gorham 4 SE	7½	SIR	Authorized
Gorham 4 SW	7½	SIR	Authorized
Hamar SE	7½	MRB	In field contouring
Hamar SW	7½	MRB	Ready for contouring
Hendrum NE	7½	SIR	Authorized
Hendrum NW	7½	SIR	Authorized
Hendrum SE	7½	SIR	Authorized
Hendrum SW	7½	SIR	Authorized
Kloten NW	7½	MRB	In cartography
Kloten SW	7½	MRB	In cartography
Larimore	15	SIR	Authorized for series conversion

Progress of U.S.G.S. Quadrangle Maps in North Dakota (Continued)

Maps in Progress June 30, 1962

Quadrangle	Size	Allot.*	Status of Mapping, June 30, 1962
Larimore NE	7½	MRB	In basic control
Larimore NW	7½	MRB	In basic control
Larimore SE	7½	MRB	In basic control
Larimore SW	7½	MRB	In basic control
Lisbon 1 NW	7½	SIR	Ready for cartography
Lisbon 1 SW	7½	SIR	Ready for field completion
Lisbon 2 NE	7½	SIR	In field contouring
Lisbon 2 NW	7½	SIR	In field contouring
Lisbon 4 NE	7½	SIR	Ready for field completion
Lisbon 4 NW	7½	SIR	Ready for field completion
McHenry NE	7½	MRB	In cartography
McHenry NW	7½	MRB	In cartography
McHenry SE	7½	MRB	In cartography
McHenry SW	7½	MRB	In cartography
McVille SE	7½	MRB	Supplemental control completed
McVille SW	7½	MRB	In cartography
Mandan (R)	7½	SIR	Ready for field revision
Menoken (R)	7½	SIR	Ready for field revision
Niagara NE	7½	MRB	In basic control
Niagara SE	7½	MRB	In basic control
Niagara SW	7½	MRB	In basic control
Pelican Lake SW	7½	MRB	In cartography
Perley NE	7½	SIR	Authorized
Perley NW	7½	SIR	Authorized
Perley SE	7½	SIR	Authorized
Perley SW	7½	SIR	Authorized
Pisek 1 NE	7½	MRB	In basic control
Pisek 1 NW	7½	MRB	In basic control
Pisek 1 SE	7½	MRB	In basic control
Pisek 1 SW	7½	MRB	In basic control
Pisek 2 NE	7½	MRB	In basic control
Pisek 2 SE	7½	MRB	In basic control
Pisek 3 NE	7½	MRB	In basic control
Pisek 3 SE	7½	MRB	In basic control
Pisek 4 NE	7½	MRB	In basic control
Pisek 4 NW	7½	MRB	In basic control
Pisek 4 SE	7½	MRB	In basic control
Pisek 4 SW	7½	MRB	In basic control
Sisseton 1 NE	7½	SIR	Authorized
Sisseton 1 NW	7½	SIR	Authorized
Starkweather NE	7½	MRB	In field completion
Starkweather NW	7½	MRB	In field completion & contouring
Tower 2 NW	7½	COOP	In cartography
Tower 4 NE	7½	MRB	In cartography
Turtle Creek NE	7½	MRB	In cartography

Progress of U.S.G.S. Quadrangle Maps in North Dakota (Continued)

Maps in Progress June 30, 1962

Quadrangle	Size	Allot.*	Status of Mapping, June 30, 1962
Turtle Creek NW	7½	MRB	In cartography
Turtle Creek SE	7½	MRB	In cartography
Turtle Creek SW	7½	MRB	In cartography
Turtle Lake SE	7½	MRB	In cartography
Turtle Lake SW	7½	MRB	In cartography
Wahpeton 3 NE	7½	MRB	Authorized
Wahpeton 3 NW	7½	MRB	Authorized
Wahpeton 3 SE	7½	MRB	Authorized
Wahpeton 3 SW	7½	MRB	Authorized
Walhalla NE	7½	MRB	Authorized
Walhalla NW	7½	MRB	Authorized
Walhalla SE	7½	MRB	Authorized
Walhalla SW	7½	MRB	Authorized
Washburn NE	7½	MRB	In cartography
Washburn NW	7½	MRB	In cartography
Washburn SE	7½	MRB	In cartography
Williston 1 NE	7½	COOP	Authorized
Williston 1 NW	7½	COOP	Authorized
Williston 1 SW	7½	COOP	Authorized
Wyndmere 2 NE	7½	MRB	In cartography
Wyndmere 4 NE	7½	MRB	Authorized
Wyndmere 4 NW	7½	MRB	Authorized
Wyndmere 4 SE	7½	MRB	Authorized
Wyndmere 4 SW	7½	MRB	Authorized
Wyndmere 2 NW	7½	MRB	In reproduction
Wyndmere 2 SW	7½	MRB	In reproduction

*COOP - State Cooperative Project

MRB - Missouri River Basin

SIR - Surveys, Investigations, and Research — formerly TS and/or TSS

(R) - Revision

Maps in North Dakota Completed During the Period July 1, 1960 to June 30, 1962

Name	Cooperator*	Name	Cooperator*
Barrie	MRB	Lone Butte NW	MRB
Big Woods NW	COOP	Marmon SE	COOP
Christine	SIR	McClusky	MRB
Clark Butte	MRB	Mercer	MRB
Clark Butte NE	MRB	Mercer SE	MRB
Clark Butte NW	MRB	Mercer SW	MRB
Coburn	MRB	Mooreton East	MRB
Croff	MRB	Mooreton NW	MRB
Dengate	MRB	Mooreton West	MRB
Denhoff	MRB	New Salem	MRB
De Lamere	MRB	Norman	SIR
Dickinson North	COOP	North Almont	MRB
Dickinson South	COOP	Oakwood	COOP
Enderlin South	MRB	Pickardville	MRB
Fargo North	SIR	Power	MRB
Fargo South	SIR	Sheldon	MRB
Florence Lake	MRB	South West Fargo	SIR
Galchutt	MRB	Sperati Point	MRB
Grafton	COOP	Stocke Butte	MRB
Heart Butte	MRB	Teepee Buttes	MRB
Heart Butte NW	MRB	Walcott	MRB
Hickson	SIR	West Fargo	SIR
Horse Lake	MRB	White Butte East	MRB
Kindred	MRB	White Butte NE	MRB
Lehigh	COOP	White Butte NW	MRB
Leonard	MRB	White Butte West	MRB
Lincoln Valley	MRB	Williston East	COOP
Lincoln Valley NW	MRB	Williston West	COOP
Lincoln Valley SE	MRB	Wyndmere	MRB
Lincoln Valley SW	MRB	Wyndmere NE	MRB
Lisbon NE	MRB	Wyndmere NW	MRB
Lisbon SE	MRB	Wyndmere SE	MRB

*COOP — State Cooperative Project

MRB — Missouri River Basin

SIR — Surveys, Investigations and Research (Regular U.S.G.S. Appropriation)

Note: All of the above maps are 7½-minute quadrangle maps prepared at a scale of 1 to 24,000.

GROUND WATER SURVEYS

Cooperation with U. S. Geological Survey, Ground Water Branch

The State Water Conservation Commission and the Ground Water Branch of the U. S. Geological Survey have had a cooperative ground water survey program underway in North Dakota for the past 17 years. This program has been financed on a fifty-fifty basis. The State Geologist acts as the technical adviser for the State Water Conservation Commission in matters pertaining to ground water resources and assists in this program.

The ultimate aim of the ground water survey program is to obtain an overall knowledge of the ground water resources in the entire state of North Dakota, that would provide a sound basis for effectively directing development of this resource for domestic, municipal, industrial and irrigation purposes. The ground water investigation program also serves as a basis for determining administrative measures which are necessary or desirable in connection with the development and use of ground water resources of the state.

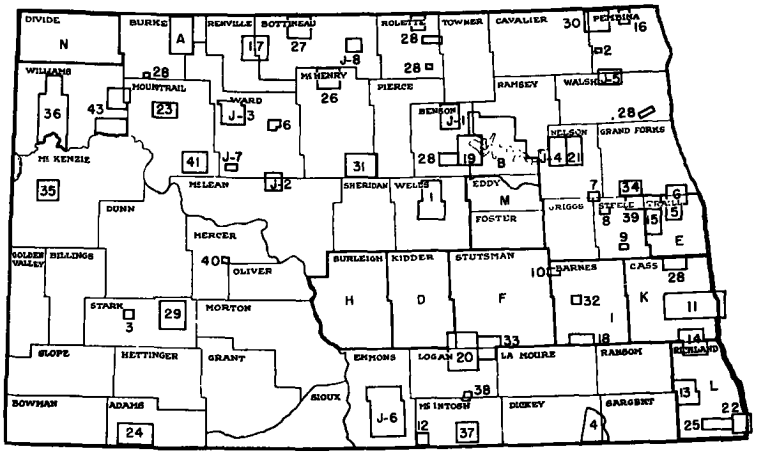
Because of the critical problems that many municipalities in the state face in obtaining an adequate and suitable ground water supply to meet their municipal needs, a greater portion of this program has been directed to studying the ground water resources from which various municipalities could economically develop a municipal water supply. In recent years the scope of the ground water investigation program has been broadened to include large-area studies, with greater emphasis being placed on county-wide surveys. Early in 1961, the increasing number of requests for county-wide ground water surveys caused a change in policy of the U. S. Geological Survey which resulted in a discontinuance of their participation in the costs of studies aimed at providing water supply to individual communities. This was done in order to channel all possible effort into the studies which by the larger area covered lent themselves to the state-wide inventory of ground water potential which is the principal aim of the United States Geological Survey.

The nature of a ground water survey is essentially different than a project aimed at managing surface water. The basic differences and the reasons for them are outlined under the "projects" heading. However, a brief outline of the procedure for a county-wide survey will help to clarify its scope and the time involved.

As soon as agreement is reached between a county and the Commission to conduct a ground water survey over the entire area of the county, a project manager is assigned by the U. S. Geological Survey. A great share of the first year of his work will consist of geologically mapping the area, compiling a complete well inventory throughout the county and in general, working toward a familiarity with evidence of geologic formations which can be used to intelligently formulate a search pattern to be followed in exploratory drilling. The second working season will generally be principally occupied

FIG 35

GROUND-WATER STUDIES IN NORTH DAKOTA



10 PUBLISHED REPORTS D STUDIES IN PROGRESS

PREPARED BY: NORTH DAKOTA STATE WATER CONSERVATION COMMISSION

KEY TO "GROUNDWATER STUDIES IN NORTH DAKOTA"

Investigations Completed and Reports Prepared

1. Fessenden
2. Mountain
3. Dickinson
4. Lake Dakota, Dickey County
5. Buxton
6. Minot
7. Aneta
8. Sharon
9. Hope
10. Wimbledon
11. Cass and Clay Counties — N. Dak. and Minn.
12. Zeeland
13. Wyndmere
14. Kindred
15. Portland
16. Neche
17. Mohall
18. Litchville
19. Minnewaukan
20. Streeter
21. Michigan
22 Fairmount
23. Stanley
24. Hettinger
25. Hankinson
26. Upham
27. Westhope
28. Rolla, Mylo, St. John, Minto, Forest River, Powers Lake, Maddock, and Hunter
29. Richardton
30. Walhalla
31. Drake
32. Sanborn
33. Gackle
34. Northwood
35. Alexander
36. Little Muddy Valley
37. Ashley
38. Lehr
39. Hatton
40. Beulah
41. Parshall
43. Tioga and Hofflund Flats

Field Work Completed — Reports in Progress

A. Bowbells
B. Devils Lake
D. Kidder County
E. Traill County
F. Stutsman County
G. Reynolds (47)
J-1. Leeds (44)
J-2. Max (45)
J-3. Berthold (46)
J-4. Lakota (48)
J-5. Hoople (49)
J-6. Linton-Strasburg (50)
J-7. Ryder
J-8. Bottineau

Field Work in Progress

H. Burleigh County
I. Barnes County
K. Cass County
L. Richland County
M. Foster and Eddy Counties
N. Divide County

with the collection of field data through the test drilling program. With the rather wide variation between county areas and complexity of geologic structure, the total time required for gathering, analyzing and compiling the wealth of information into a meaningful report — the end product of the survey — varies between counties. However, a four-year payment period, set up for standardization of survey agreements, is a reasonably close estimate of the time required from the start of the geological study to the publishing of the report covering a typical survey.

The increased interest, plus the commitment of several additional counties to ground water surveys has sparked major alteration of the services at state level to facilitate the work. Prior to the change in policy by the U. S. Geological Survey, the Commission's participation in the program consisted of providing a drill crew, equipment and drilling supplies as a part of its contribution to the program. Following the change, the state's role enlarged to include supervision of drilling operations by graduate geologists and assistance in several phases of data gathering. This has required acquisition of a large core barrel for obtaining samples of underground formations not otherwise obtainable; a pump for extracting typical water samples from test holes through 2-inch pipe and an adaptation of a high pressure compressor for air lifting water samples through 1¼-inch pipe; a conductance meter for field check of water quality; two binocular microscopes for field examination and precise geologic identification of samples from underground strata; provision of panel trucks outfitted as field offices for the supervising geologists; pipe casing and fittings needed for observation wells; and provision of assistance in pump testing known aquifers, toward resolving problems which affect well capacity and spacing.

At the present time investigations have been completed or are underway in 63 areas of the state. Reports have been completed on 42 of these area studies while the field work has been completed and the reports are in progress in 14 areas. The field work is presently being conducted in seven areas.

To date, ground water surveys covering approximately 5,000 square miles of the state's 72,000 square miles have been completed and reports on these surveys completed. This does not include, however, the areas of the state that are in the process of being surveyed or that have been surveyed but have not had reports published. Investigations completed or underway cover approximately 15,000 square miles. Test drilling accomplished with the state-owned drilling rig in connection with the cooperative program totals more than 282,823 feet of drilling.

The reports on the investigations that have been completed and published are free of charge and available, unless the supply has been exhausted, from the office of the State Water Conservation Commission at Bismarck, the North Dakota Geological Survey at

Grand Forks and the U. S. Geological Survey, University Station, Grand Forks.

The ever-increasing demands for more water in many of the state's communities and other areas have pointed out the need for the continuation and expansion of the ground water investigation program. It is expected that the basic data that are made available through this investigational work will be extremely valuable in the economic development of North Dakota.

UNITED STATES GEOLOGICAL SURVEY QUALITY OF WATER INVESTIGATIONS

As the unappropriated supply of fresh water dwindles in many portions of the state, an increased emphasis is being placed on the use of water of poorer quality. It has become evident that as the natural flows of streams are reduced the salinity increases. In a few streams in the western part of the state it has been noted that, during periods of low flow, the per cent of dissolved salts appears to be approaching the point where the water will be unsuitable for irrigation and other uses.

The U. S. Geological Survey — Quality of Water Branch has been making a limited number of studies on the quality of surface waters in North Dakota during the past 16 years. During this biennium the State Water Conservation Commission and the State Game and Fish Department shared in costs of this program with the Quality of Water Branch. A summary of the data compiled under this program will be published by the State Water Conservation Commission in the near future.

Plans are being formulated to establish the quality of water investigations in North Dakota on a state-operated basis. Water samples of surface and ground water will be collected in conjunction with all county-wide ground water surveys. Samples of surface water will also be collected by the U. S. Geological Survey Surface Water Branch at cooperative gaging stations. All samples can then be analyzed by the State Laboratories for chemical and sedimentation characteristics. It is expected that this approach to the program will concentrate activities in the areas of greatest need and greatly accelerate collection of essential data.

U. S. ARMY ENGINEER DISTRICT, OMAHA

General

Effective April 1, 1960, the U. S. Army Engineer District, Omaha, was delegated the responsibility for Corps of Engineers activities in all areas of North Dakota tributary to the Missouri River .

Completed Projects

Mandan — The project is located on both banks of the Heart River at Mandan, North Dakota. The Mandan project consists of a levee on the left bank of the Heart River from U. S. Highway 10 west of Mandan to the Northern Pacific Railway to high ground; a west closure levee between U. S. Highway 10 and the Northern Pacific Railway; two bridge raises; a stoplog structure on U. S. Highway 10; highway raises; railroad blanketing; drainage culverts; bank protection; flood wall; and interior drainage.

The project, which was authorized by the Flood Control Act of 1946 and modified by the Flood Control Act of 1950, was completed in July, 1959, and turned over to local interests for operation and maintenance. Total federal cost of the improvement was $677,000. In addition it is estimated that local interests expended $155,600 for lands and relocation.

Marmarth — The project is located on the left banks of the Little Missouri River and Little Beaver Creek at Marmarth, North Dakota. Existing levees at Marmarth were inadequate for flood protection. The project consisted of raising the existing levees around Marmarth and extending the protection to include the Browning Addition north of the railroad.

The project, which was authorized by the Flood Control Act of 1954, was completed in December of 1959 and turned over to local interests for operation and maintenance. Total federal cost of the improvement was $169,500. In addition it is estimated that local interests spent $12,000 for lands and relocation.

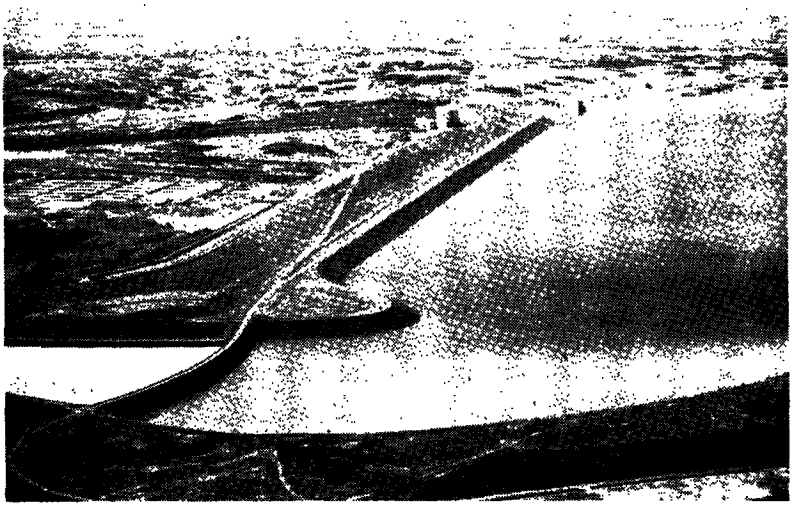
Scranton — The project, which is located on Buffalo Creek, a tributary of the North Fork of the Grand River adjacent to Scranton, consists of about one mile of channel improvement and one mile of levee together with necessary railroad improvement and appurtenant works.

The project was constructed under authority of Public Law 685 at a federal cost of $103,000. In addition it is estimated that local interests spent $34,500 to provide lands and other items of local cooperation.

Projects Under Construction

Garrison Dam and Reservoir — Garrison Dam is located on the Missouri River in McLean and Mercer Counties, North Dakota, about 11 miles south of Garrison, North Dakota. It is 1,455 miles above the mouth of the river and 77 miles above Bismarck. The existing project was authorized by the Flood Control Act of December 22, 1944, as part of the general comprehensive plan for the Missouri

River basin. The project plan provided for the construction of a dam and reservoir for flood control, irrigation, navigation, hydroelectric power, and other purposes. The dam, built of rolled earthfill, extends more than two miles across the valley and has a maximum height of 210 feet above the stream bed. The spillway, located in the east abutment, is of the concrete-chute type and is controlled by 28 Tainter gates, each 40 feet wide by 29 feet high. The outlet works, located on the west side of the river, consist of an intake tower, eight tunnels, a stilling basin and a tailrace. Three tunnels are for reservoir regulation and flood control, and the other five are for power generation. A hydroelectric power generating plant is located on the downstream toe of the dam below the outlet works. The reservoir storage capacity of 24.5 million acre-feet is divided into zones. The bottom 4,900,000 acre-feet is for inactive storage and is ample to accumulate the river's silt for at least 100 years. The operating zone, which is the multiple-purpose storage capacity, will store 13,600,000 acre-feet of water assigned to power development, irrigation releases, and improvement of river flow for navigation, municipal water supply and stream sanitation. The top zone of approximately 6,000,000 acre-feet is set aside for flood control and will be used to impound excess flows during flood seasons. The reservoir, with a shoreline of approximately 1,500 miles, affords almost unlimited public recreational opportunities. The estimated cost for the project, which includes a power installation of five 80,000 kilowatt units, is $291,000,000.



Garrison Dam and Reservoir

As of June 30, 1962, the overall project was 99 percent complete with project completion scheduled for 1965.

Oahe Dam and Reservoir — Oahe Dam is located on the Missouri River in Hughes and Stanley Counties, South Dakota, about six miles northeast of Pierre, South Dakota, and 1,123 miles above the mouth of the river.

The existing project was authorized by the Flood Control Act of December 22, 1944, as part of the general comprehensive plan for the Missouri River basin. The dam has been under construction by the Corps of Engineers since September, 1948. It is 9,300 feet long, 242 feet high above the river bed and contains over 90 million cubic yards of earth fill.

The gated spillway, about a mile from the right or west abutment, has an overall crest length of 456 feet. Six tunnels, each nearly 20 feet in diameter, have been built in the right abutment to handle flood control discharges, and initially to divert flow during the closure. Seven additional tunnels, 24 feet in diameter, are under construction in the left abutment to serve the power installation.

The powerhouse, under construction on the downstream toe of the dam on the east side, will house generators with total installed capacity of 595,000 kilowatts. Other power facilities will include surge tanks, transformers and the switchyards.

The reservoir will have a shore line of 2,350 miles. It will extend approximately 250 miles upstream, almost to Bismarck, North Dakota. The lake will be over 200 feet in maximum depth, and at full operating level will cover 376,000 acres.

Full capacity of the reservoir is 23,600,000 acre-feet of which 4,300,000 acre-feet will be set aside for exclusive and seasonal flood control. During periods of water shortage, water for irrigation, power, navigation and other beneficial uses will be drawn from the 13,800,000 acre-feet of joint use storage, and the remaining 5,500,000 acre-feet will provide a pool for power head and sediment reserve. Impoundment was begun with the dam closure in August, 1958.

In years of normal run-off, the pool levels will vary only about seven feet. Should drought conditions such as those of the 1930's reoccur, the reservoir could be drawn down about 70 feet. The reservoir will be so regulated that the maximum pool elevation will be reached in late spring and the lowest elevation during the winter months.

As of June 30, 1962, the project, which has an estimated cost of $355,000,000, was 82 percent complete with project completion scheduled for 1965.

Lower Heart River — The project is located on both banks of the Heart River in the 14 mile reach upstream from the mouth of the river. It is in the vicinity of Mandan, North Dakota. The plan of improvement provides for three units — (1) The Sunny Unit which includes a closure levee between U. S. Highway 10 and high ground, (2) the Mandan Unit which consists of raising existing levees, floodwall, and bridges, and (3) the unit below Mandan which consists of

channel relocation, cleared floodway, and an additional levee from the south branch bridge to the Missouri River.

The project which was authorized by the Flood Control Act of 1954 was essentially complete except for minor modification on June 30, 1962. The estimated cost of the project is $2,510,000 of which $2,200,000 are federal and $310,000 are local costs.

Authorized Projects

Mott—This project which would be located along both banks of the Cannonball River at Mott, North Dakota, was authorized by the Flood Control Act of 1958. There is no flood protection project in existence at the present time. The plan of improvement provides for levees on the left bank to protect, "Mott original", levees on the right bank to protect "west Mott", replacement of a concrete arch bridge, channel improvement and a pumping station. The estimated cost of the improvement is $855,000, of which $570,000 is federal cost of construction and $285,000 is local cost.

Authorized Investigations

Grand River — Authority for study of the Grand River is contained in the Flood Control Acts of 1944 and 1958. The investigation has formulated a plan for a dam and reservoir at the Bowman-Haley site for municipal water supply, fish and wildlife conservation, recreational opportunities and impoundment for flood control. The study was completed in early 1962 and as of June 30, 1962, was being reviewed at the Washington level.

Green River — Congressional Committees have authorized a review report on the Green River with a view to providing storage for flood control, irrigation and related water resources development. The Report will be completed in early 1963.

James River — Resolutions by the United States Senate and the House of Representatives have requested a review report on the James River with a view to provision of flood control and other water resources development. The report will be completed in early 1963.

Missouri River, Garrison Dam to Oahe Dam — In response to a Senate resolution a review report on the erosion problem in the reach from Garrison Dam to Oahe Dam has been completed. The report submission has been delayed at the request of the State of North Dakota.

Missouri River, North Dakota, South Dakota and Nebraska — In response to numerous Senate and House resolutions a review report on the need and justification for extending navigation from Sioux City, Iowa, to the North Dakota-Montana state line is under preparation. Completion of the report is scheduled for 1964.

U. S. ARMY ENGINEER DISTRICT, ST. PAUL

The St. Paul District has the responsibility for the planning, construction and, where appropriate, maintenance and operation of federal improvements for flood control and allied purposes in that por-

tion of North Dakota drained by the Red River of the North and the Souris River. The projects are described briefly in the following paragraphs under headings designating their stage of progress.

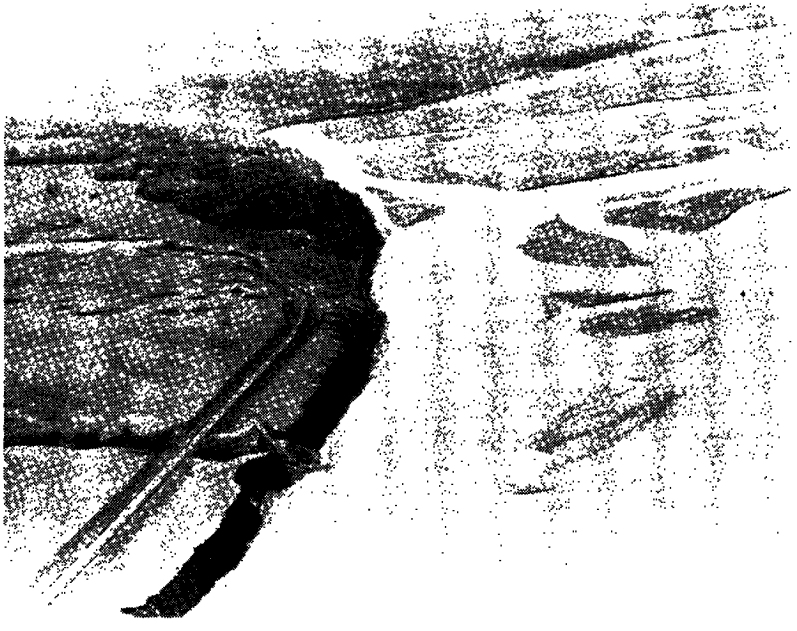
PROJECTS COMPLETED

Baldhill Dam and Lake Ashtabula

The project is located on the Sheyenne River 16 miles upstream from Valley City, North Dakota. The dam, which creates a reservoir of 70,700 acre-feet, provides a substantial degree of flood control to the cities, villages and urban areas along the Sheyenne River and a water supply and pollution abatement for that section of the Sheyenne River below the dam and a section of the Red River of the North. Construction of the basic project was completed in 1956.

Homme Reservoir and Dam

The project is located on the South Branch of the Park River about four miles upstream from Park River, North Dakota. The 3,650 acre-foot reservoir created by the dam affords partial flood protection to areas below the dam and provides minimum flows in the river to meet the water supply and pollution abatement needs from the dam to Grafton, North Dakota. A contract awarded in conjunction with the park board to improve an access road for recreational purposes was completed in 1961. Additional work on wells and toilets at public use areas is being completed. Federal cost of this project to date is $1,334,300.



Erosion on Banks of Missouri River

Lake Traverse and Bois de Sioux Project

Lake Traverse located on the boundary between the states of Minnesota and South Dakota and the north end of an extension to the lake reaches within one mile of the North Dakota border. The Bois de Sioux River is the outlet stream from Lake Traverse. It flows from the lower end of Lake Traverse between the state of Minnesota and the states of South Dakota and North Dakota to Wahpeton, North Dakota, and Breckenridge, Minnesota, where it joins the Ottertail River to form the Red River of the North. This project provides some flood control to areas along the Red River in North Dakota.

Grand Forks Protection System

This unit of work is a part of the comprehensive flood control project in the Red River of the North Basin authorized in 1948 and 1950. Improvements completed in 1959, consist of a 5,163-foot levee and 771.5-foot flood wall with the necessary interceptor lines, sewers and a pumping plant to provide for interior drainage. Because of foundation difficulties requiring a realignment of levees and resulting in construction of the flood wall, certain lands were acquired by the government. Federal cost to date of construction and special land acquisition is $971,000. Local interests have acquired all land except that required for construction of flood wall and realignment of levees which was acquired by the government as mentioned above. The project was transferred to the city for maintenance on May 1, 1959.

Fargo Protection System

This unit of work is a part of the comprehensive flood control project in the Red River of the North Basin authorized in 1948 and 1950. Improvements substantially completed in October 1960 consist of about 3,550 feet of levee, with pumping station, sewers and ditches for interior drainage; a channel cutoff in the vicinity of Island Park; and three short cutoffs downstream from Fargo. A contract for erosion and sewer outfall extension will be awarded about July 1, 1962. Local interests, with the aid of the Corps in acquiring Minnesota land, have acquired all lands. Transfer of the project was made March 10, 1961 and the city has assumed operation and maintenance although formal acceptance will be withheld until completion of the contract to be awarded. Federal cost to date is $1,543,500.

Rush River Improvements

This unit of work, a part of the comprehensive flood control project in the Red River of the North Basin authorized in 1948 and 1950, consisted of snagging and clearing approximately 14 miles of the river and excavation to deepen, widen and straighten the channel in an additional 14-mile reach. The improvement extends for a distance of 28 miles above the river mouth. The federal cost of the completed work is $246,300. The project was transferred to local interests for maintenance December 4, 1956.

Inactive Projects

Improvements authorized under the comprehensive Red River of the North Basin flood control project include channel improvements

on the Bois de Sioux River and the Red River of the North in the vicinity of Wahpeton, North Dakota, and similar improvements on the lower Sheyenne and Maple Rivers in the vicinity of West Fargo, North Dakota. No work is being done on the former and authorization of the latter expired in October 1961 because of the lack of local cooperation.

PROJECTS UNDER INVESTIGATION

Goose River

Work on this study was initiated in November 1961 with completion scheduled for the summer of 1963. The feasibility of a multiple-purpose reservoir, primarily for flood control, water supply and water quality control, is being studied. The Corps of Engineers has completed a flood damage survey and has initiated economic and hydraulic studies. The Public Health Service is preparing a report on the water needs of the basin. Other recreational values, including recreation and fish and wildlife conservation, will be studied.

Devils Lake Area

This investigation for flood control and drainage is scheduled to be completed late in 1962. The most probable plan of improvement for the area includes a new or improved outlet channel to Devils Lake and dikes and control works on the upstream lakes and channel to obtain additional storage. Studies to date include field surveys, flood damage surveys, preliminary economic and hydrologic studies and foundation investigations. The U. S. Soil Conservation Service, the U. S. Fish and Wildlife Service, and the State Water Conservation Commission are cooperating in the study.

Pembina River

The Pembina River International Engineering Committee of the International Joint Commission prepared a proposed plan of investigation for water resource development on the Pembina River and a feasibility report on water resource development for consideration by the International Joint Commission. The latter report concluded that a joint development of the water resources of the basin would be economically justified based upon the preliminary favorable comparison of benefits to costs. As a result a joint study with Canada was initiated in November 1961 with completion scheduled for the summer of 1964. A multiple-purpose reservoir or reservoirs will be considered to reduce flood damages and to provide storage for irrigation and water supply. During the past year, the Corps of Engineers conducted a flood damage survey, initiated hydraulic and economic studies, obtained topography of the proposed reservoir area in the United States, arranged for the installation of equipment for the collection of data on sedimentation and water quality and coordinated studies and progress with participating agenices in the United States and Canada.

Souris River Study

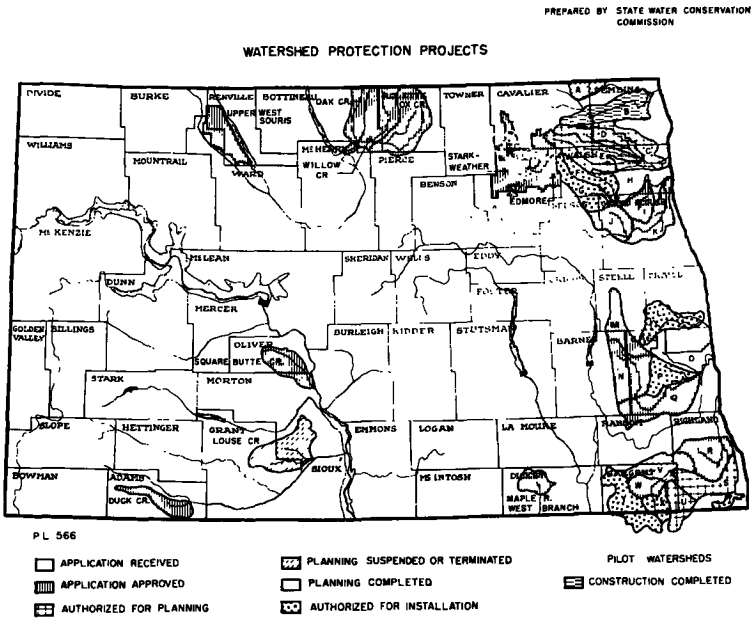
A survey is in progress for flood control and allied purposes at and in the vicinity of Minot, North Dakota.

U. S. SOIL CONSERVATION SERVICE

The U. S. Soil Conservation Service cooperates with the State Water Conservation Commission in three areas of water conservation — watershed protection and flood prevention, drainage, and irrigation and stock water developments.

Watershed Protection and Flood Prevention

The initial approach to flood prevention through the development of entire watersheds was made in 1955 when the Tongue River Watershed Project was authorized. This project, completed in 1961, consists of the improvement of 295,575 acres in Pembina and Cavalier Counties through ten detention dams and 48 miles of floodway.



KEY FOR "WATERSHED PROTECTION PROJECTS"

A. North Walhalla Tributary of Pembina River
B. Tongue River (Pilot Watershed)
C. Park River Flood Plains
D. North Branch Park River
E. South Branch Park River
F. North Branch Forest River
G. South Branch Forest River
H. Lower Forest River
I. Salt Lake - Forest River
J. Upper Turtle River
K. Lower Turtle River
L. Elm River
M. Upper Maple River
N. Middle Maple River
O. Rush River
P. Swan Creek - Buffalo Creek
Q. Lower Maple River
R. Antelope Creek
S. Wild Rice "B"
T. West Tributary Bois de Sioux River
U. Veblen
V. Storm Lake - Elk Creek
W. Crooked Creek
X. Tewaukon
Y. Wild Rice Creek

Since the construction of this pilot watershed project, 16 other watershed projects out of 32 applicants have been authorized for planning assistance by the administrator of the Soil Conservation Service under Public Law 566. Of these, six watersheds comprising a total area of approximately 800,000 acres are presently under construction. These watersheds include the Elm River Watershed in Traill County; the Swan-Buffalo Creek Watershed in Cass County; the Wild Rice Creek Watershed in Sargent County and extending into Marshall County, South Dakota; the Tewaukon Watershed in Sargent County; the North Branch of the Forest River Watershed in Walsh County; and the West Tributary of the Bois-de-Sioux River Watershed in Richland County and extending into Roberts County, South Dakota. Planning is completed for two other watersheds, the Middle-South Branch of the Forest River Watershed and the Lower Forest River Watershed. The planning is being completed on five other watersheds.

Under the watershed protection program, land treatment practices that increase the amount of water that the soil can absorb are given primary consideration. These practices include increased plantings of grass and legumes in the crop rotation, stubble mulching, tree planting to reduce erosion and to help keep floodways and channels free from snow and dirt, the proper use of grassland so that more mulch is left on the ground, and many others.

Soil conservation districts within the watershed must have the cooperation of at least fifty per cent of the people before dams or floodways can be constructed. With this cooperation, the dams and floodways are constructed allowing excess water to be retarded and then carried away.

The State Water Conservation Commission cooperates in this part of the Soil Conservation Service program by reviewing plans for dams that impound over 10 acre-feet. The Commission also organizes water conservation and flood control districts that provide local entities through which the watershed projects are developed.

Drainage

As part of its drainage program, the Soil Conservation Service provides surveying, designing and engineering for the construction of legal drains and some group drains. The State Water Conservation Commission usually participates in financing the construction of legal drains and in such cases reviews the Soil Conservation Service plans and designs before construction of the drains and drop structures begins. Most of this work is carried out in the Red River Valley.

Irrigation and Stock Water

In the promotion of soil and water conservation, the Soil Conservation Service assists farmers in the design, survey and installation of stock water dams and irrigation facilities. If a stock water dam

will exceed an impoundment of 10 acre-feet, the Soil Conservation Service notifies the rancher that he must obtain a permit for the dam from the State Water Conservation Commission before the dam can be constructed. The service also assists farmers in making surveys for individual irrigation water right applications that are processed by the State Engineer and State Water Conservation Commission.

Snake Creek Embankment

BUREAU OF RECLAMATION

Missouri River Basin Project
Garrison Diversion
Garrison Diversion Unit

The Garrison Diversion Unit is a part of the Missouri River Basin Project authorized by Congress in the Flood Control Act of 1948.

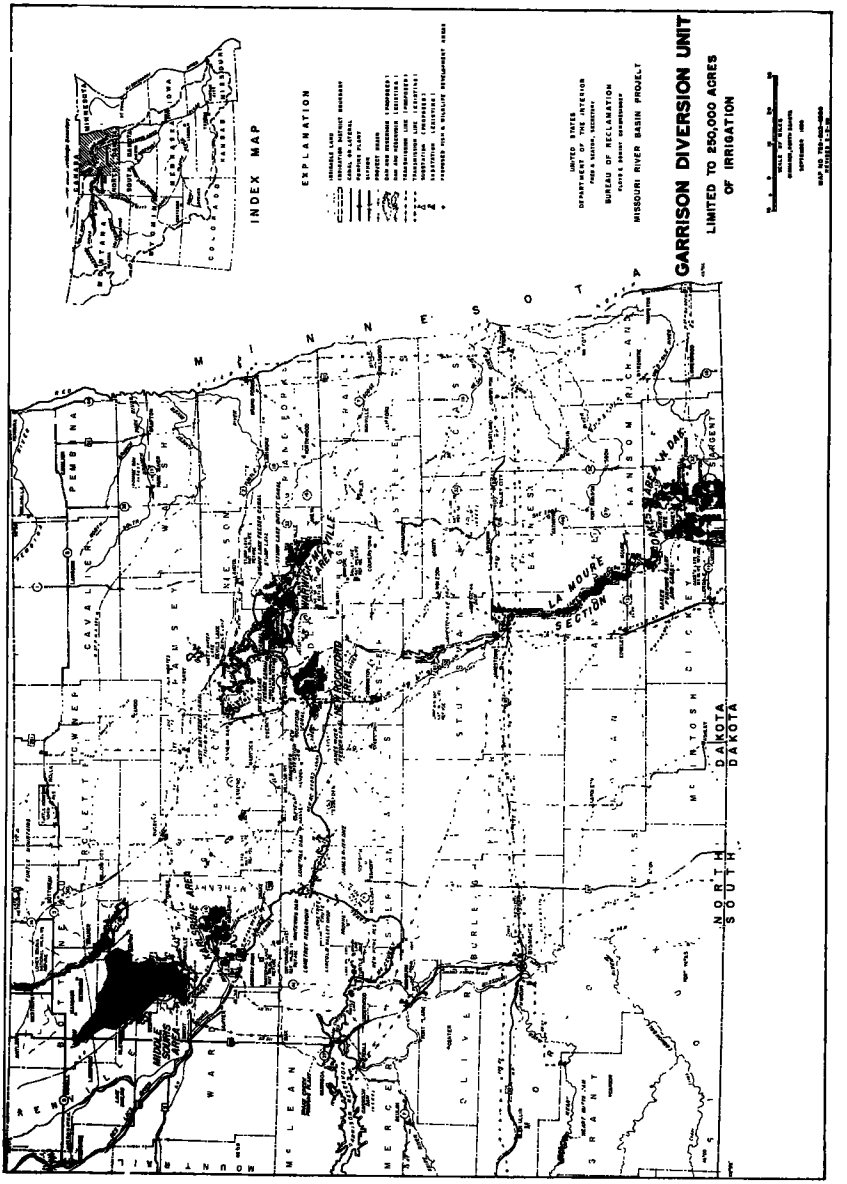
The plan for the project that has been developed by the Bureau of Reclamation proposes the irrigation of one million acres of land in central and eastern North Dakota with water diverted from the Missouri River at Garrison Reservoir. Water would also be available for municipal and industrial recreation, fish and wildlife lake restoration and other purposes. The details of the plan for the million acre Garrison Diversion Unit are set forth in the 12th Biennial Report of the State Water Conservation Commission.

The Bureau of Reclamation, since the original report on the Garrison Diversion Unit was completed in 1957, has completed a report on an initial 250,000 acre phase of the Garrison Diversion Unit that was presented to Congress in 1961 to serve as the basis for hearings on legislation dealing with authorization of the project.

A feasibility-type report on the unit, together with supporting appendixes, was completed in January 1957. The report includes definite plan coverage for the principal diversion works. In June of 1957 the report was transmitted to other federal agencies and the states concerned for review and comment. On June 21, 1958, the report was approved by the Secretary of the Interior and transmitted to the President of the United States through the Bureau of the Budget. This report with letters of comment, has been printed as House Document No. 235, 86th Congress, 2nd Session (1960). At this time detailed investigations have been completed on 113,000 acres of the project in preparation for a definite plan report on the initial stage of the Garrison Diversion Unit.

The plan of development for the initial stage provides for irrigation of 250,000 acres, a municipal and industrial water supply for 15 towns and cities, 36 major areas and a number of smaller areas for fish and wildlife conservation, and recreation development at nine major water impoundments. Flood control and incidental drainage of nonirrigable lands are also provided. The initial stage includes Jamestown Reservoir, and the restoration of Devils and Stump Lakes for recreation, fish and wildlife conservation, and municipal industrial water supply.

Seven areas make up the 250,000-acre initial stage. The Lincoln Valley Area (6,515 acres) will be furnished a water supply directly from the McClusky Canal. The Oakes Area, North Dakota (45,980 acres), LaMoure Section (13,350 acres), Warwick-McVille Area (47,220 acres), and the New Rockford Area (20,935 acres) will be furnished


GARRISON DIVERSION UNIT
LIMITED TO 250,000 ACRES OF IRRIGATION
INDEX MAP
EXPLANATION
MISSOURI RIVER BASIN PROJECT
BUREAU OF RECLAMATION
LA MOURE SECTION
NORTH DAKOTA
SOUTH DAKOTA
MINNESOTA
MONTANA

a water supply diverted from Lonetree Reservoir into New Rockford Canal. The Karlsruhe Area (12,200 acres) and Middle Souris Area (103,800 acres) will receive Lonetree Reservoir water through the Velva Canal.

These seven areas constitute a feasible development of 250,000 acres, but other areas could also be used in the initial development. If for any reason, one of the areas listed should drop out of the initial development, another area could be substituted.

The entire 250,000-acre system includes 1,865 miles of canals and laterals, four regulating reservoirs (Snake Creek and Jamestown, both of which have been constructed, and Lonetree and Taayer which are proposed), 141 pumping plants, and about 2,670 miles of drains to control ground and surface water. Capacities of some of the more important reservoirs and canals are:

Reservoir	Capacity (acre-feet)		
	Inactive	Active	Total
Snake Creek	365,000	62,000*	427,000
Lonetree	130,000	280,000	410,000
Jamestown	10,000	220,000**	230,000
Taayer	3,000	18,000	21,000

* Approximate capacity between elevations 1,847 and 1,850 feet.

** Of this capacity, 20,000 acre-feet is for conservation and regulation of flows, and the remainder is for flood control.

Canal	Initial capacity (c.f.s.)	Length (miles)
McClusky	1,950	75
Velva	2,000	93
New Rockford	1,600	60
Warwick	770	55
James River Feeder	400	20
Oakes	600	11

The facilities to serve 250,000 acres will be constructed during a period of about 11 years to full initial size, with first delivery of water for irrigation during the fifth year of construction. Construction of deferred drains is expected to continue for another 20 years.

Jamestown Unit

Jamestown Dam, the main feature of the Jamestown Unit, is about one-fourth mile north of Jamestown and the reservoir extends about 40 miles upstream from that city. It is a multiple-purpose unit with flood control for Jamestown and other cities being the initial purpose to be served. It will impound natural runoff and return irrigation flows from areas of the Garrison Diversion Unit for use

on irrigable lands in the LaMoure and Oakes sections. Other benefits are recreation, fish and wildlife conservation, municipal water, and silt control.

The dam is of rolled earth-fill construction with a glory-hole type spillway and gated outlet works. The dam was designed to permit future installations for power generation when it becomes feasible, and it was constructed so that connections can be made to provide Jamestown with municipal water. The reservoir capacity is 230,000 acre-feet. Development of public-use and recreation facilities in the reservoir area is well advanced. Installation of relief wells downstream from the dam remains to be done.

Management of the reservoir area is the responsibility of the Stutsman County Park Commission through an agreement with that organization. Nearly 350,000 visitor-days by the public were recorded during 1961.

Irrigation Development Farms

Two development farms are in operation by the Bureau of Reclamation in cooperation with the North Dakota State University and the United States Department of Agriculture. They have been developed to demonstrate the influence of irrigation on crops and livestock production, and the reaction of soils to irrigation water. The benefits and operation methods of irrigation under soil and climatic conditions in the Garrison Diversion Unit are being observed on these farms.

The Deep River Farm is located in McHenry County about three miles west of Upham. It includes 215 acres, 133 of which are presently being irrigated. This farm has been in operation since the spring of 1953.

The Ransom Farm is located in Ransom County about six miles south of Sheldon. The farm unit includes 365 acres, of which 132 are irrigated, 61 are dry farmed and the remainder is pasture, farmstead, roads, and timbered river bottom. Twenty-three irrigated acres have been set aside for research purposes. The water supply is pumped from the Sheyenne River. Construction and land development work were started in the fall of 1957 and the farm was first irrigated in the summer of 1958.

Dickinson Unit

Dickinson dam and reservoir is located on the Heart River, about one and one-half miles upstream from the city of Dickinson. It is a multiple-purpose unit which provides storage for municipal water, flood control for downstream areas, sedimentation control, fish and wildlife conservation and recreation.

The principal feature of the unit is a rolled earth-fill dam with a combined concrete spillway and outlet works structure and a 6,800 acre-foot reservoir. Construction of the dam was started in March of 1949, and was substantially completed in August, 1950. Subsequent work has included extension of the outlet works farther into the reser-

voir, repair of the spillway damaged by flood in the spring of 1954, and development of public-use areas adjacent to the reservoir.

The city of Dickinson has obtained most of its municipal water supply from Dickinson reservoir beginning in 1951, with the water requirement rapidly increasing since then. A water service contract with the city provides for payment of $950,000 to the federal government in 40 years. A supplemental contract was consummated in 1962 to provide an additional 900 acre-feet of water to the city at a price of $17.50 per acre-foot. Water is available for irrigation of about 400 acres, and the irrigation facilities to serve the individual tracts have been developed by the landowners. The Dickinson-Heart River Mutual Aid Corporation was organized in 1956 and has contracted with the Bureau of Reclamation for the irrigation water supply.

The reservoir area, including the recreational facilities, is administered by the Dickinson City Park Board. Use of the reservoir by the public has steadily increased, with 44,000 visitor-days recorded in 1961.

Heart Butte Unit

Heart Butte Unit is located on the Heart River in Grant and Morton Counties in southwestern North Dakota. State Highway No. 49 crosses Heart Butte Dam about 15 miles south of Glen Ullin and the irrigable areas extend eastward from there for about 60 miles along the Heart River to the city of Mandan. The unit is a multiple-purpose development designed to provide controlled conservation storage for irrigation of 13,100 acres, flood control for downstream areas, sedimentation control, fish and wildlife conservation, and recreational benefits.

The principal features of the unit included a rolled earth-fill dam with a combined glory-hole spillway and gated outlet works, a 225,500 acre-foot reservoir, wildlife habitat areas to replace those inundated by the reservoir, and the necessary pumping plants, laterals and drains to serve irrigible lands. Construction of the dam was substantially completed in December 1949, and it has since played a major role in providing flood protection, particularly to the city of Mandan. Wildlife habitat replacement areas and minimum recreational facilities have been developed. Construction of pumping plants, laterals and drains to serve the 2,463 irrigable acres of the Western Heart River Irrigation District was substantially complete by June 30, 1956. By June 30, 1962, more than 2000 acres in the district had been developed for gravity irrigation. Construction of facilities to serve the rest of the 13,100 irrigable acres will not be started until appropriate repayment arrangements have been made. Farmers not in the irrigation district were purchasing water on a temporary basis to irrigate 1000 acres in 1962. The reservoir area is administered by the State Game and Fish Department under an agreement between that agency and the Bureau of Reclamation.

North Dakota Pumping Division

The North Dakota Pumping Division consists of 14 separate pumping units along the course of the Missouri River in North Dakota. These units will be irrigated by pumping from the Missouri River or from Garrison and Oahe reservoirs. A total of approximately 63,000 acres can be irrigated in the potential units. Included in the division are Williston, Nesson, Hancock Flats, Fort Clark, Oliver-Sanger, Painted Woods, Manley, Wogansport, Burnt Creek, Bismarck, Little Heart, Horsehead Flats and Winona units.

Construction of Fort Clark Unit, started in 1952, was substantially completed in 1953. All other units are in an inactive status.

Fort Clark Unit

Fort Clark Unit is located in Oliver and Mercer Counties in west central North Dakota near the town of Stanton and about 45 miles northwest of Mandan. Facilities of the unit provide a full water supply for the irrigation of 2,039 acres of land lying on two benches adjacent to the Missouri River. These irrigation facilities consist of a river pumping plant, two relift plants and a system of canals, laterals and drains. Except for deferred drains, construction of these facilities was substantially completed in August 1953. A formal dedication ceremony on August 14, 1953, marked the first delivery of water to the unit lands.

The Soil Conservation Service is assisting the farmers with irrigation layouts and land leveling. By June 30, 1962, approximately 1,600 acres had been prepared for irrigation.

Transmission Division

Under the Flood Control Act of 1944, the responsibility for market ing power generated by the Missouri River Basin Project power plants was assigned to the Secretary of the Interior. The Bureau of Reclamation has been designated as the agency responsible for administration of the power marketing program. In North Dakota the major source of Missouri River Basin power is Garrison Dam, although exchange of mainstem power between areas has been provided for in the design of the high-voltage transmission system. The Garrison Power Plant has an installed capacity of 400,000 kilowatts and an average energy production in excess of one billion kilowatt hours.

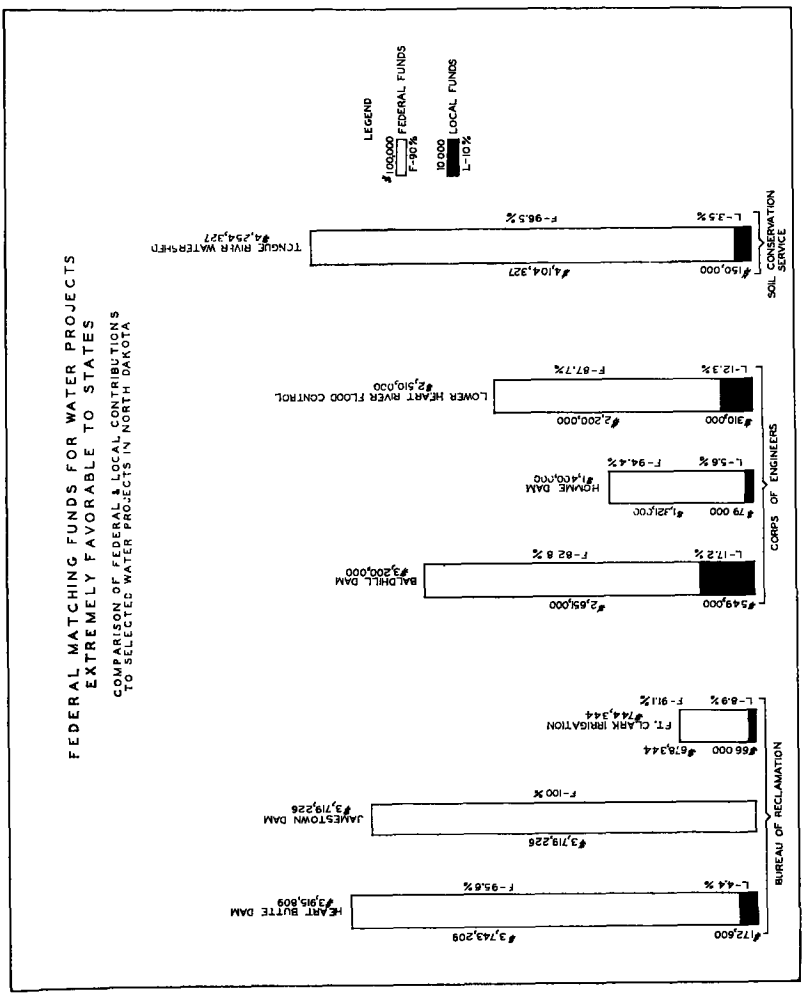
To market this power, an adequate and efficient power transmission system is necessary. A backbone grid of 230 kilovolt transmission lines interconnects the Missouri River power plants and provides power at the major load centers. A network of 115 kilovolt and 69 kilovolt lines supplies power to smaller load centers and irrigation pumping developments throughout the state.

A portion of the system was used initially under contracts with Central Power Electric Cooperative, Inc., to transmit power from its Voltaire steam plant, and with Ottertail Power Company to carry its power to their customers in North Dakota.

As of June 30, 1962, the following lines and substation were complete and in service:

LINES	Length (Miles)	Substations	Capacity (Kva)
Garrison - Bismarck 230-kv*	62.70	Bismarck	32,000
Bismarck - Mobridge 230-kv	94.97	Washburn	15,000
Bismarck - Jamestown 230-kv[1]	98.32	Jamestown	123,750
Bismarck - Jamestown 230-kv[2]	99.33	Fargo	293,334
Jamestown - Fargo 230-kv[1]	83.03	Devils Lake	22,500
Jamestown - Fargo 230-kv[2]	84.30	Grand Forks	100,000
Fargo - Morris 230 kv	104.73	Valley City	20,000
Williston - Garrison 115-kv	170.68	Lakota	20,000
Garrison - Voltaire 115-kv	57.17	Leeds	16,500
Voltaire - Rugby 115-kv	55.95	Rugby	20,000
Rugby - Devils Lake 115-kv	58.85	Bisbee	1,500
Devils Lake - Lakota 115 kv	26.09	Rolla	4,500
Devils Lake - Carrington 115-kv	52.49	Carrington	14,000
Carrington - Jamestown 115-kv	48.37	Edgeley	23,550
Jamestown - Valley City 115-kv	35.31	Ellendale	15,000
Jamestown - Edgeley 115-kv	37.36	Forman	12,000
Edgeley - Groton 115-kv	80.49	Watford City	5,000
Fargo - Grand Forks 115-kv	83.01	Beulah	9,375
Leeds - Rolla 69-kv	42.55	Custer Trail	1,500
Edgeley - Forman 69-kv	66.42	DeVaul	2,500
Bismarck - DeVaul 69-kv	45.03	Fort Clark	750
Garrison - Minot - Rugby 115-kv	113.49		
Jamestown - Grand Forks 115-kv	110.36		
Bismarck - Dawson County 230-kv	208.97		
TOTALS	1,919.97		752,759

* Double Circuit


FEDERAL MATCHING FUNDS FOR WATER PROJECTS
EXTREMELY FAVORABLE TO STATES
COMPARISON OF FEDERAL & LOCAL CONTRIBUTIONS
TO SELECTED WATER PROJECTS IN NORTH DAKOTA
LEGEND
$100,000 FEDERAL FUNDS F-90%
10,000 LOCAL FUNDS L-10%
BUREAU OF RECLAMATION
CORPS OF ENGINEERS
SOIL CONSERVATION SERVICE
HEART BUTTE DAM
$3,915,809
$172,600
$3,743,209
L-4.4 %
F-95.6%
JAMESTOWN DAM
$3,719,225
F-100 %
FT. CLARK IRRIGATION
$744,344
$66,000
$678,344
L-8.9 %
F-91.1%
BALDHILL DAM
$3,200,000
$549,000
$2,651,000
L-17.2 %
F-82.8 %
HOMME DAM
$1,420,000
$79,000
$1,341,000
L-5.6 %
F-94.4%
LOWER HEART RIVER FLOOD CONTROL
$2,510,030
$310,000
$2,200,000
L-12.3 %
F-87.7%
TOUGUE RIVER WATERSHED
$4,254,327
$150,000
$4,104,327
L-3.5 %
F-96.5%

NORTH DAKOTA STATE AGENCIES

STATE HEALTH DEPARTMENT

North Dakota state laws give the State Water Conservation Commission the control over all waters of the state including certain responsibilities as to the control of pollution of such public waters. In this connection the Commission and the State Health Department cooperate in various administrative functions to prevent or alleviate pollution problems and also review and approve plans for all municipal water supply and sewage facilities. The two agencies have also adopted certain rules and regulations relative to the control of pollution of the streams and rivers of the state. During the past biennium the State Health Department and the State Water Conservation Commission have reviewed and approved 258 plans for municipal water supply and sewage projects. The Health Department also cooperates with the Commission in representing the state before the International Joint Commission and other organizations interested in the waters of North Dakota.

State Game and Fish Department

The State Game and Fish Department and the State Water Conservation Commission have cooperated extensively for many years in the development of various water resources projects that are utilized as recreational areas and afford opportunities for fish and wildlife conservation and propagation. The Commission works very closely with the State Game and Fish Department in the investigation and construction of facilities for projects that are utilized for this purpose. The greater amount of work accomplished in cooperation with the Game and Fish Department is in the construction and repair of small dams throughout the state. This program is discussed more fully in another section of this report. In addition the Commission has provided engineering services to the Game and Fish Department to investigate various projects that serve specifically to develop fish and wildlife conservation and propagation areas.

State Highway Department

The State Highway Department cooperates with the State Water Conservation Commission in matters pertaining to the construction of highways throughout the state insofar as they affect the natural drainage pattern. The state legislature designated the State Water Conservation Commission as the agency responsible for determining the size of culverts or bridges required on various watercourses crossed by highways so that the normal drainage would not be restricted by such highway construction.

The State Water Conservation Commission and the State Highway Department recognize the problem that is involved in the construction of highways insofar as their effect on the drainage pattern of an area is concerned, and have jointly employed a drainage engineer to work under the direction of the State Water Conservation Commission

to assist in matters relating to drainage. The costs associated with this activity are divided equally between the State Highway Department and the State Water Conservation Commission.

It has become apparent that on many highway stream crossings the fill for a dam can be utilized as a highway crossing and can be built at less cost than two separate structures. A program is being instituted whereby the State Water Conservation Commission will review proposed highway stream crossings in an effort to determine their desirability and feasibility for multiple-purpose structures of this type The State Highway Department has cooperated with the State Water Conservation Commission, the State Game and Fish Department and the city of McVille in constructing a combination dam and highway crossing near that town. Similar cooperation has been agreed on for the construction of a dam and highway crossing on the Elm River about six miles west of Ellendale. Several sites for future cooperation have been selected and studies are being carried on for these projects. A memorandum working agreement between the State Highway Department, the State Game and Fish Department and the State Water Conservation Commission is being drawn up. This will be used as a guide in determining the responsibilities of each department for the construction of this type of project.

Economic Development Commission

The North Dakota Economic Development Commission was organized in 1957 to promote a state-wide development of business. In achieving that goal, the commission cooperates with other state agencies including the State Water Conservation Commission. Liaison activities between the two commissions chiefly center around water resource inventories as availability of water is an important factor in an industry's decision to locate within a state. As part of this program, the State Water Conservation Commission has prepared for the Economic Development Commission a water resource inventory covering 22 counties. This report includes a list of both ground water and surface aquifers in each county.

In addition, the two commissions exchange publications dealing with industrial development in North Dakota. The Economic Development Commission provides the State Water Conservation Commission reports on industries and their particular water needs. In turn the State Water Conservation Commission makes available to the Economic Development Commission ground water reports and other factual information concerning North Dakota water resources.

Soil Conservation Committee

The North Dakota Soil Conservation Committee is the state agency established to coordinate, from a state-wide level, the activities of the soil conservation districts in North Dakota. The Soil Conservation Committee has been designated as the state agency to review plans for watershed projects. The State Water Conservation Committee

cooperates with the Committee in reviewing the engineering aspects of these projects.

NORTH DAKOTA STATE UNIVERSITY STUDIES

North Dakota State University has cooperated with the State Water Conservation Commission in the preparation of reports valuable to the work of the Commission. During the past biennium, the University conducted a study of negative impacts of the Garrison and Oahe Reservoirs on the economy of North Dakota and completed several soil surveys. The field data for the negation study were gathered by the State Water Conservation Commission with the University making the economic interpretation.

Garrison Negation Studies

Losses to the state's economy as the result of the Garrison and Oahe Reservoirs can be grouped in two main divisions, agricultural land losses and annual income losses. Potential use of land acquired for Garrison and Oahe Reservoirs is as follows: irrigated crop land — 156,000 acres, dry crop land 140,000 acres, high quality range and grazing land 232,000 acres and land in other classifications — 40,000 acres.

In addition to this immediate loss of agricultural lands as the result of flooding, however, there is a continuous acreage loss from uncontrolled stream bank erosion. This problem affects 80 river-miles of bottomlands between Garrison Dam and the backwaters of the Oahe Reservoir. Water flowing from Garrison Dam is presently clear and desilted and, therefore, has a great capacity for erosion in contrast with the silt-saturated waters of the Missouri River before the dam was constructed. The eroding of the river is further increased by the fluctuations of water releases from the dam. Property owners of the bottomlands estimate that approximately 440 acres are lost annually because of erosion. If the releases of water are increased, erosion may occur at the rate of 900 to 1000 acres per year. This bank disintegration has discouraged the development of irrigation as pumping sites are rapidly destroyed.

In considering the annual losses of income resulting from the land inundated by the reservoirs both the land-use pattern before dam construction and the potential land-use pattern of more intensive irrigation must be considered. Land taken for both the Garrison and the Oahe Reservoirs would have currently returned $5.8 million annually under the land-use pattern at the time of acquisition and $15.7 million annually under the potential irrigation land-use pattern. Damages resulting from severance of upland from bottomland is estimated at $2¼ million annually.

Annual income loss as the result of bank erosion is $110,000. In 25 years a total of 11,000 acres of agricultural land capable of producing $3.6 million annually will have been destroyed.

The net annual loss to the fish and wildlife resources of the area as a result of the inundation by Garrison and Oahe Reservoirs is

estimated at $216,000. The total of these losses plus the indirect loss to the business economy is $9.9 million annually based on land-use patterns at the time of taking and $18.5 million based on a potential irrigation land-use pattern. Other losses that should be recognized but are not included in the above amounts include $38.6 million for forestry resources and tremendous loss in potential revenue from coal and oil.

It is estimated that there are 5,850 million tons of lignite and possibly 5 million barrels of oil in deposits covered by Garrison Reservoir. The lignite left in the ground at $2.30 per ton would be worth $13,455 million in today's prices, and the petroleum deposits would probably be valued at $14.75 million.

Annual benefits to North Dakota from Garrison Dam at the present time are estimated $5.5 million annually.

In considering benefits to North Dakota's economy, the study reports that most of the advantages of the dams, such as navigation, flood control, etc., occur downstream and not in North Dakota. Furthermore, in contrasting these benefits with the losses experienced in North Dakota because of the Garrison and the Oahe Reservoirs, the report concluded that the over-all economic effect still remains negative, mainly because the greatest boon to North Dakota's economy, Garrison diversion for irrigation, remains as of yet undeveloped.

Cooperative Soil Surveys

During this past biennium, the State Water Conservation Commission has cooperated with the North Dakota Agricultural Experiment Station in projects requiring soil surveys.

One survey was conducted by personnel from the Soils Department in an effort to determine the suitability for irrigation of soils in the Tobacco Garden Valley from Watford City north to the Missouri River. Most of the irrigable lands generally were not so situated that they could be served from the potential ground water aquifer in this valley. There were two areas which did show some promise, but after detailed test drilling, it was found that one area suitable for irrigation was overlying a ground water aquifer containing water of unsuitable quality. The aquifer for the other area would not yield sufficient water for irrigation purposes.

The other soil survey was made in conjunction with the ground water research on irrigation wells on the Cartwright Irrigation Project. The soils survey consisted of taking soil samples before irrigation and after irrigation had taken place to determine the effects of the quality of the irrigation water on various soils encountered in the project area. It was found that the water quality had little effect on the Arnegard silty loam soils but that the Havre silty clay soils indicated a build up of salts and that drainage measures would have to be installed after several years of irrigation to keep the soil from becoming sterile.

Chapter III

COOPERATIVE ACTIVITIES OTHER AGENCIES

Missouri River States Committee

The Missouri River States Committee was created in December of 1941 for the purpose of securing flood control, irrigation, navigation, power development and related improvements of the entire Missouri River Basin. The governors of the ten Missouri Basin states in addition to two representatives named by each governor compose the committee. Delegates from North Dakota during the last biennium include Governor William L. Guy, Oscar Berg and Henry Steinberger. Governor Guy is chairman of the committee while Milo W. Hoisveen, state engineer and secretary of the State Water Conservation Commission, is secretary. The committee generally meets twice a year in conjunction with the Missouri Basin Inter-Agency Committee.

The Missouri River States Committee evaluates projects presented as well as acting as a forum for the discussion of water resource problems of the Missouri Basin states. The organization has been influential in promoting the Missouri River Basin Project.

The following is the list of resolutions passed by the Missouri River States Committee in the 1960-62 biennium:

1. December 15, 1960 — Resolution for the expedition of bank stabilization and channelization of the Missouri River with a view to completion by 1965.
2. May 24, 1961 — Resolution to reaffirm the Committee's support of the Missouri River Basin Project as approved and authorized by the Flood Control Act of 1944.
3. December 13, 1961 — Resolution encouraging comprehensive planning and surveys for bank stabilization of the Missouri River between Garrison Dam and the Oahe Reservoir.
4. February 14, 1962 — Resolution for study to improve relationship of federal government with landowners concerning the acquisition of land for use in the development of the water resources of the Missouri Basin.
5. February 14, 1962 — Resolution petitioning the Corps of Engineers to maintain their horizontal and vertical standards concerning bridges over the Missouri River.
6. February 14, 1961 — Resolution to request that South Dakota name the Big Bend Reservoir Sharpe Lake in memory of the late M. Q. Sharpe, former governor of South Dakota and the first chairman of the Missouri River States Committee.

Some of the most important work of the committee is accomplished in subcommittees. One of these committees, the Subcommittee on Mapping headed by Milo W. Hoisveen, N. D. State Engr., has prepared

a booklet, "Water and Related Land Resources Development". This booklet contains a map and tabulation reflecting the Missouri River Basin development program and its current status. The pamphlet was prepared with the cooperation of the Bureau of Reclamation, the Corps of Engineers and the Soil Conservation Service and can be obtained by writing the State Water Conservation Commission.

MISSOURI BASIN INTER-AGENCY COMMITTEE

The Missouri Basin Inter-Agency Committee was created in 1945 to provide an organization, composed of representatives of the states and federal agencies concerned in the Missouri River Basin project, that could coordinate the policies, programs and activities of the federal and state governments in the development of this project. Coordination by agencies is encouraged in the following:

1. Collection and interpretation of basic data.
2. Investigation and planning of water and related land resources projects.
3. Programming of water and related land resources construction and developments.

The committee at present is composed of seven federal and ten state members. The federal members are the Corps of Engineers, the Federal Power Commission, the Department of Agriculture, the Department of Commerce, the Department of Health, Education and Welfare, the Department of Labor and the Department of the Interior. Member states include Colorado, Iowa, Kansas, Montana, Minnesota, Missouri, Nebraska, North Dakota, South Dakota and Wyoming. The Missouri Basin Inter-Agency Committee meets once every two months to discuss problems and exchange ideas.

The major work of the committee is accomplished in subcommittees of which two are standing, the Executive Committee and the Annual Reports Committee. Ad hoc subcommittees are also established from time to time to carry out special assignments.

Governor William L. Guy is a regular member of the agency while Richard P. Gallagher of Mandan is an alternate member.

NATURAL RESOURCES COUNCIL

The North Dakota Natural Resources Council was established by the State Legislature in 1961 to promote the welfare of the state by providing a method of collecting, analyzing and interpreting information and making recommendations to the several state agencies responsible for the various phases of resource management on matter relating to soils, water, forests, fish and wildlife. The council consists of the heads of various state departments and has met twice officially during the last biennium.

C. N. Nelson, state forester, is serving as the chairman of the organization while Milo W. Hoisveen, State Water Conservation Commission secretary, is the ex-officio secretary.

RED RIVER BASIN PLANNING COMMITTEE

The Red River Basin Planning Committee was created on January 9, 1962. It is composed of representatives from North Dakota and Minnesota and has as its objective the comprehensive planning for the development of water resources in the Red River Valley. The committee consists of three representatives from North Dakota and Minnesota with the governors of both states as ex-officio members.

Activities of the committee, as stated in its constitution, are as follows:

1. Cooperate with other agencies in the preparation of plans and programs for the development and conservation of all natural resources.
2. Assist in correlating action programs of federal and state agencies.
3. Stimulate and encourage local and state planning.
4. Serve as a clearing house of information for local, state, and federal planning agencies.
5. Give consideration to the formulation of a Red River of the North Basin Compact.
6. Develop and annually update a five-year action program.
7. Establish and annually review priority ratings of public works projects for the conservation and development of water resources in each of the state areas and on a basin-wide basis.
8. Make annual reports to the governors of Minnesota and North Dakota of its operations, accomplishments and plans.
9. Exercise and perform such functions for or incidental to the achievement of the purposes and objectives hereunder.

Two regular meetings of the committee must be held annually. The committee has met three times in the 1960-62 biennium July 1, 1960, and ending June 30, 1962. The dates and places of these meetings were as follows: November 15, 1961, Fargo, North Dakota; January 9, 1962, Moorhead, Minnesota; and May 4, 1962, Crookston, Minnesota. At these meetings the committee gave major consideration to committee organization, pollution problems, flood and drouth conditions and a review and analysis of completed Red River projects.

North Dakota members of the Red River Basin Planning Committee are Oscar Lunseth, chairman, Grand Forks; Milo Hoisveen, secretary, Bismarck, and William Corwin, Fargo. Committee members from Minnesota include Carl Ash, Crookston, Carsten Mead, Red Lake Falls, and Richard Canning, Hendrum. Governor William L. Guy of North Dakota and Governor Elmer L. Andersen of Minnesota are ex-officio members.

OTHER ORGANIZATIONS

National Reclamation Association

The National Reclamation Association is a voluntary organization composed of citizens, organizations and governmental agencies in the 17 Western Reclamation States and has as its primary objective the development of sound reclamation projects in these states. The association maintains an office in Washington, D. C., and has a board of directors consisting of one director elected from each of the 17 Western Reclamation States. Milo W. Hoisveen, secretary-chief engineer of the State Water Conservation Commission and state engineer, is the North Dakota director.

The National Reclamation Association is very influential in all matters pertaining to reclamation development and serves to unite the interest of all proponents of reclamation development in the West. It has been principally concerned with the enactment of federal legislation to provide for protection of states' rights and the authority of the states to control the waters within their boundaries. The association supports the Water Resources Planning Act of 1961 and continued and expanded soil and water research.

THE NATIONAL RIVERS AND HARBORS CONGRESS

Organized in 1901, the National Rivers and Harbors Congress is a nationwide organization consisting of federal, state and local leaders devoted to the development of America's water resources. Fred Fredrickson, planning coordinator for the State Water Conservation Commission, is North Dakota's director. Senators Burdick and Young and Representatives Short and Nygaard are ex-officio members.

The National Rivers and Harbors Congress at its annual convention endorses certain water projects throughout the nation. Because the organization carefully scrutinizes a project before it endorses it, the association's endorsements are very effective. The organization has endorsed several North Dakota projects. Its highest recommendation was given to Garrison Diversion. Also endorsed were the Bowman-Haley Dam and Pembilier Dam. Fred Fredrickson, planning coordinator for the NDSWCC, is Director representing the Missouri Basin.

MISSISSIPPI VALLEY ASSOCIATION

The Mississippi Valley Association is a voluntary, regional organization with the objective of promoting the better and wiser use of water resources in the 23 states of the watershed of the Mississippi River and its tributaries. The State Water Conservation Commission and several other organizations from North Dakota are members of the association. Directors of the Mississippi Valley Association from North Dakota are James Moore of Bismarck and Homer W. Ludwick of Fargo.

Every year at its national convention the association adopts a platform recommending specific projects for Congress to consider in

order to have continued progress in developing the Mississippi Valley's and nation's water resources. This year at the 43rd annual meeting of the association, the organization endorsed the Garrison Diversion project and Missouri River bank stabilization immediately below major dams on the Missouri River. It also recommended the immediate expedition of the releasing of the Corps of Engineers' reports on the Bowman-Haley and Pembilier Dams.

OAHE LANDOWNERS ASSOCIATION

The Oahe Landowners Association is an association of landowners from Burleigh, Emmons, Morton and Sioux Counties whose land will be inundated by the reservoir of Oahe Dam. The purpose of this organization is to obtain a uniform land acquisition policy which will give the affected landowners equal, fair compensation for the properties they are asked to sacrifice for the development of the Missouri River Basin.

The major goals of the Oahe Landowners Association are as follows:

1. That the operating pool of Oahe Reservoir should be at an elevation of 1,610 feet and that all land above an elevation of 1,615 feet be acquired by the Corps of Engineers at the landowners' option of purchase or of flood easement.
2. That evaluations and compensations for land acquired be consistent with prices established by recent free sales.
3. That lands acquired follow the contour of the established taking line so that landowners can retain ownership of as much land as is possible.
4. That the landowners retain all oil and gas rights.
5. That the provision for leasing of land acquired be conveyed in the deed for the land acquired.
6. That lands within the taking line which will be inundated remain in the hands of the owner until inundation, thereby realizing the productive capacity of the land as long as possible.

The association has held several meetings at various times with Corps of Engineers representatives to negotiate differences between the landowners and the federal government. The end result of this association's work was that their problems were recognized and referred to the Missouri River States Committee for study. The Corps of Engineers was requested to give the MRSC their land acquisition policy for review. The matter is currently under study and it is hoped that future projects will benefit from the changes which may be adopted to make the acquisition of lands more equitable to all concerned.

ASSOCIATION OF WESTERN STATE ENGINEERS

The Association of Western State Engineers is composed of state engineers or the state officials responsible for the control of the waters of the states which make up the 17 Western Reclamation

States. The Association provides its members an opportunity to review various phases of water resource development and has been active in obtaining Congressional approval of various policy matters dealing with water resources. It has strongly supported full recognition of the states' rights to control and allocate water within their boundaries. Milo W. Hoisveen, State Engineer of North Dakota, was president of the organization for 1961.

The Association also provides the state officials an opportunity to meet and discuss problems of mutual interest and to gain from the experience of other states who have faced similar problems. The 1961 convention was held at the North Dakota State Capitol in Bismarck August 15-17.

A number of outstanding leaders in the water resources field appeared on the program at the Bismarck Convention including: Lt. General Walter K. Wilson, Chief, U. S. Army Engineers; Governor William L. Guy; Don S. Williams, Administrator, Soil Conservation Service; William I. Palmer, Assistant Commissioner of Reclamation; J. Karl Lee, Chief Economist, Bureau of Reclamation; Thad McLaughlin, Branch Area Chief, Groundwater Branch, U. S. Geological Survey; Ernest Sieveka, Office of Saline Water, Department of Interior, and Mrs. Charles Ruzicka, President, League of North Dakota Women Voters.

In addition each of the members of the Association presented a report on various aspects of water resources development and management in their state.

General Wilson in his address to the annual 1961 banquet of the Association outlined the new criteria that was to be used by the Corps of Engineers in making the economic evaluation of water resources projects. He stated "Whereas in the past we have generally used a life span of 50 years in our analysis of the economic justification of a project, in the future we shall use for this purpose the estimated and realistic useful life expectancy of a project, whatever it may be, up to perhaps 100 years."

"We are seeking ways to bring the intangible values of projects into focus when they are significant to the need and the justification of a development plan. Such values are difficult to measure in the cold dollars - and - cents evaluation of a project, but nevertheless they must be taken into account if we are to make the wisest use of our limited water resources."

"Further, we are taking steps to improve our estimates of tangible benefits in monetary terms so they will more adequately reflect the total values which projects return to the economy."

Resolutions adopted by the Convention included one urging the enactment of legislation providing protection to the states' rights to issue water rights and compliance by Federal agencies of state water right laws; urging the establishment of water resources councils upon request of majority of Governors of affected states with equal representation of non-federal members and federal members; urging

the continuation of consultation with the states by Federal agencies with respect to the development and operation of water Resources projects; urging that any wilderness legislation approved by Congress provide for Congressional approval in the designation of such areas and opposing the inclusion of any provisions in such legislation that will impede water resources development in areas designated as wilderness areas; urging the use of and compliance with interstate compacts by state and Federal agencies in water resources planning and development; urging the regulation of use of flood plains; urging that contracts for water rights for water stored in Corps of Engineers projects be extended throughout the useful life of the project rather than for a limited period and resolutions relating to several other matters.

The 1962 convention of the Association will be held in Salt Lake City, Utah. Wayne Criddle, State Engineer of Utah is the Association President.

NORTH DAKOTA WATER USERS' ASSOCIATION

In February, 1959, the North Dakota Reclamation Association and the Missouri-Souris Projects Association amalgamated to form the North Dakota Water Users' Association. This association is composed of individuals and organizations interested in furthering the water resources development program in North Dakota. Each of the two organizations which were amalgamated had been concerned with water resource development in the state. The North Dakota Reclamation Association was composed of members from all areas of the state and was concerned with the state's water resources program in general. The Missouri-Souris Projects Association was specifically concerned with the development of the Garrison Diversion Unit and devoted its efforts to this end. The overlapping and duplication of efforts in connection with the water resources program, that resulted from the efforts of these organizations, was eliminated with the merging into one organization.

The North Dakota Water Users' Association maintains an office in Minot and employs a full time executive secretary, who directs the activities of the association. The board of directors of the association is composed of 20 directors — four from each of the northeast, southeast, northwest and southwest districts and four who are selected at large.

President of the association is R. L. Dushinske of Devils Lake; first vice president, James W. Moore, Bismarck; second vice president. H. A. Hendrickson, Fargo; treasurer, Murray A. Baldwin, Fargo, and executive secretary, Oscar N. Berg, Minot.

Since its organization, the North Dakota Water Users' Association has built up a membership of approximately 3,000 individuals and organizations from North Dakota and other neighboring states. The association has actively participated in several major events

concerning the North Dakota water resources development program. During the biennium beginning July 1, 1960, and ending June 30, 1962, it held 35 meetings for the purpose of organizing county water users' councils, in conjunction with the North Dakota Water Conservation Commission and the U. S. Geological Survey. These councils were organized to study and assemble information concerning water problems and resources on the county level. It supported legislation dealing with water laws and appropriations for an expanded water resources program before the North Dakota Legislature. The association sponsored the appearance of witnesses at hearings on the Garrison Diversion Unit in Washington, D.C. It conducted meetings in 14 southwestern counties of North Dakota in an attempt to form a Southwestern Development District, patterned after the Garrison Conservancy District legislation, for purposes of development of all natural resources in the affected areas. It assisted in the arrangements for Congressmen Aspinall and Rogers' tour and examination of North Dakota's water resources and development in October, 1961. The association publishes a monthly newsletter covering various phases of the water resources program and has cooperated in furthering the public relations and education program dealing with water resources development in the state.

PUBLICATIONS AND MAPS AVAILABLE THROUGH THE STATE WATER CONSERVATION COMMISSION

Ground Water Study Reports

Ground water surveys have been conducted in various sections of North Dakota by the State Water Conservation Commission in cooperation with the U. S. Geological Survey and the North Dakota Geological Survey.

Areas surveyed are shown on a map found in this report under "Cooperative Activities — U. S. Geological Survey — Ground Water." Copies of these reports are available for reference in major libraries throughout the state. A limited number of copies is available from the State Water Conservation Commission at Bismarck or at the North Dakota Geological Survey at Grand Forks.

The reports generally contain a geological map of the area showing locations of test holes, well inventory, logs of test holes drilled, chemical analyses and a narrative on the findings of the survey.

Topographic Maps

Topographic maps have been prepared for approximately one-half of the state which has been surveyed under a cooperative program with the U. S. Geological Survey — Topographic Branch.

Areas for which maps are available from the State Water Conservation Commission are shown on a map found in this report in the section entitled "Cooperative Activities — U. S. Geological Survey — Topographic Mapping." Copies of these maps and army maps of a scale 1:250,000 (1" = 4 miles) are available from the State Water Conservation Commission at fifty cents and one dollar respectively per copy.

Emergency Flood Operations Manual

A report entitled "Manual for Emergency Flood Operations for Use of Governing Boards of Local Governmental Subdivisions of North Dakota" was published by the State Water Conservation Commission in March, 1962. The manual was prepared as a guide and aid to the flood control personnel in North Dakota and suggests a type of organization to coordinate flood fighting activities. The manual's intent is to aid the local organization in developing a plan that will outline a procedure to follow that will minimize the confusions and time delays ordinarily associated with a flood fighting effort.

Copies of the manual are available upon request at the State Water Conservation Commission office in Bismarck.

Low Flow Frequency Report — Red River of the North

Expected low flows in the Red River of the North at stream gaging stations along the North Dakota-Minnesota boundary are defined in a report prepared by the U. S. Geological Survey in cooperation with the North Dakota State Water Conservation Commission. The report pertains to low flows under natural flow conditions, under present regulations and under proposed future regulation.

The report contains low-flow frequency curves for the river at Wahpeton, Fargo, Halstad, Grand Forks, Drayton and Emerson based upon stream flow records collected at gaging stations at those locations. All records are adjusted to the period 1882 to 1960, and the curves presented for each location show the average frequency at which average annual 7, 15, 30, 60, 120, and 183 day, and 9 month minimum flows may be expected. This group of curves is based essentially upon natural flow conditions.

As the report is rather technical, it requires considerable professional interpretation. Requests for copies should be directed to the State Water Conservation Commission, 1301 State Capitol, Bismarck, North Dakota, or to the U. S. Geological Survey, 202½ Third Street, Bismarck, North Dakota.

Missouri River Basin Water Development

"Water and Related Land Resources Development — Missiouri River Basin" is a booklet prepared for distribution by the Subcommittee on Mapping of the Missouri River States Committee. This subcommittee chairmanned by Milo W. Hoisveen, prepared the pamphlet in cooperation with the Bureau of Reclamation, the Corps of Engineers and the Soil Conservation Service. It was published in January of 1962.

The booklet contains a map and tabulation reflecting the Missouri River Basin development program and its current status. Proposed projects for the next six years are also included. Capsuled information concerning the status, constructing agency, function, description and cost of each project is presented in the compilation of projects listed under each of the ten Missouri River states.

The pamphlet can be obtained by writing the State Water Conservation Commission at its office in the State Capitol in Bismarck.

Irrigation Districts and Related Organizations

As there are presently 17 organized irrigation districts in North Dakota and as irrigation is becoming increasingly important in the state, the State Water Conservation Commission believed that there was a substantial need to publish compiled information concerning irrigation districts. As a result, in May, 1962, the commission released a 50-page booklet entitled "Irrigation Districts and Related Organizations."

This mimeographed pamphlet, written by Vernon S. Cooper, assistant secretary of the commission and secretary of the Garrison Conservancy District, contains a history of irrigation throughout the world and the United States, a history and explanation of federal and North Dakota irrigation laws and a description of the organization, government and financing of irrigation districts. This informative booklet provides a centralized source of valuable information for irrigators and other interested individuals.

The booklet can be obtained by writing to the North Dakota State Water Conservation Commission, 1301 State Capitol, Bismarck, North Dakota.

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