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NORTH DAKOTA STATE AGENCY

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ELEVENTH BIENNIAL REPORT

OF

North Dakota State Water Conservation Commission

FOR THE PERIOD

JULY 1, 1956 — JUNE 30, 1958

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ELEVENTH BIENNIAL REPORT

of the

State Water Conservation Commission

and the

TWENTY-EIGHTH BIENNIAL REPORT

of the

STATE ENGINEER

of

North Dakota

July 1, 1956 to June 30, 1958

BISMARCK TRIBUNE
90836

"Buy Dakota Maid Flour"

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COMMISSIONERS

Einar Dahl
Member
Watford City
Northwest District

Oscar Lunseth
Member
Grand Forks
Northeast District

Earle Tucker
Vice Chairman
Bismarck
Southwest District

Gov. John E. Davis
Chairman

A. M. Christensen
Member
Minot
North Central District

Wm. Corwin
Member
Fargo
Southeast District

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

LETTER OF TRANSMITTAL

Honorable John E. Davis
Governor of North Dakota

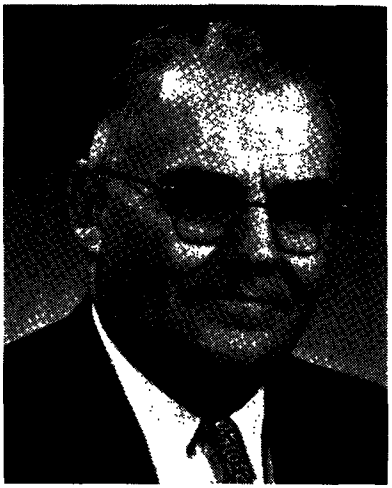
Dear Sir:

In compliance with the provisions of the laws of North Dakota, we transmit herewith for your information and consideration the Eleventh Biennial Report of the North Dakota State Water Conservation Commission and the Twenty-eighth Biennial Report of the North Dakota State Engineer covering the period July 1, 1956 to June 30, 1958.

Respectfully Submitted,
N. D. State Water Conservation Commission
Earle F. Tucker, Vice Chairman
Einar H. Dahl
A. M. Christenson
Oscar Lunseth
Math Dahl
William W. Corwin

Milo W. Hoisveen
Secretary and Chief Engineer
State Engineer

STAFF



Milo W. Hoisveen
Chief Engineer and Secretary
State Engineer

Robert J. Timm
Asst. State Engineer

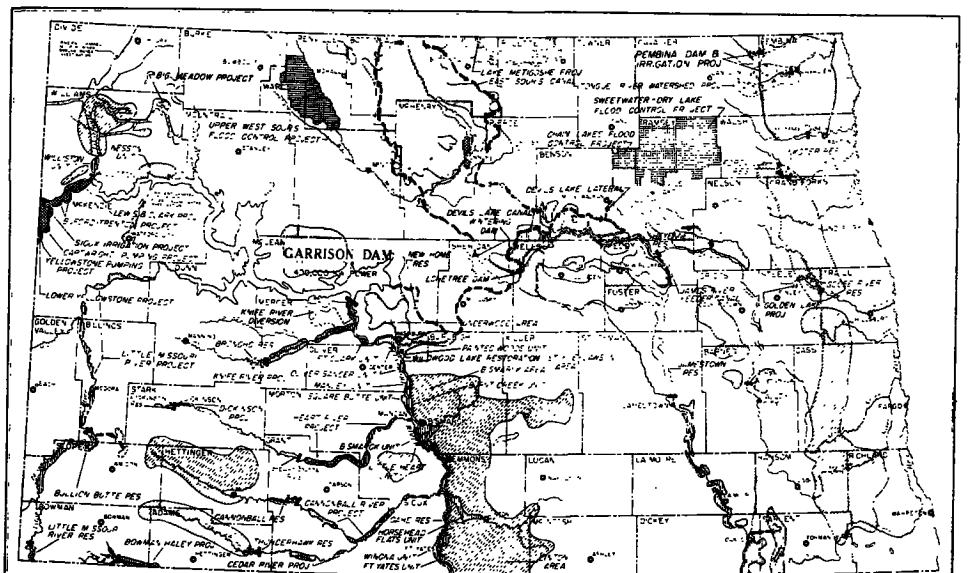
Vernon S. Cooper
Assistant Secretary

Alan Grindberg
Construction
Engineer

Victor E. Ziegler
Investigation
Engineer

Hazen Sandwick
Office
Engineer

Chapter 1
GENERAL DATA


GARRISON DAM
PEMBINA DAM & IRRIGATION PROJ
SWEETWATER-DRY LAKE FLOOD CONTROL PROJECT
UPPER WEST SOURIS FLOOD CONTROL PROJECT
DEVILS LAKE LATERAL
DEVILS LAKE CANAL
LAKE TRENT DAM
KNIFE RIVER DIVERSION
GOLDEN VALLEY
BILLINGS
STARK
DUNN
MERCER
OLIVER
BURLEIGH
MORTON
SIOUX
GRANT
EMMONS
LOGAN
LA MOURE
DICKEY
SARGENT
RICHLAND
CASS
FOSTER
STEELE
BARNES
BALLICY BUTTE RES
LITTLE MISSOURI RIVER RES
BOWMAN HALEY PROJ
CANNONBALL RES
CANNONBALL RIVER PROJECT
CEDAR RIVER PROJ
HORSEHEAD FLATS UNIT
WHOLE FT YATES UNIT
BISMARCK
MINOT
WILLISTON
DICKINSON
JAMESTOWN
FARGO
GRAND FORKS
WAHPETON
WESTON
NORTH DAKOTA STATE WATER CONSERVATION COMMISSION
WATER AND POWER RESOURCES DEVELOPMENT PLAN
GOV. JOHN E. DAVIS
EARLE F. TUCKER
VICE CHAIRMAN
WALD M. HOISVEEN
SECRETARY AND STATE ENGINEER
EDGAR H. DAHL
WM. W. COFFIN
A. ALOIS STEBEN
MATH DAHL
OSCAR LUNSETH
EXISTING IRRIGATED AREAS
RESERVOIR SITES
EXISTING
PROPOSED
CANAL LOCATIONS
POTENTIAL IRRIGATED AREAS
AREAS UNDER INVESTIGATION
FLOOD CONTROL PROJECTS

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 John E. Davis, Ex-Officio Chm.	Jan. 1, 1957	
Earle F. Tucker, Vice Chm., Bismarck	May 1, 1948	July 1, 1961
Einar H. Dahl, Watford City	April 3, 1939	July 1, 1959
A. M. Christensen, Minot	May 27, 1949	July 1, 1961
Oscar Lunseth, Grand Forks	May 1, 1951	July 1, 1959
William W. Corwin, Fargo	July 1, 1957	July 1, 1963
Math Dahl, Comm. 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, 1956 to June 30, 1958, the State Water Conservation Commission held 16 meetings in Bismarck and two meetings in other cities throughout the state.

PERSONNEL EMPLOYED BY THE COMMISSION

Full time personnel employed by the Commission on June 30, 1958, are as follows:

Milo W. Hoisveen	Sec'y. and Chief Engineer, State Engineer
Vernon S. Cooper	Assistant Secretary
Robert J. Timm	Assistant State Engineer
I. A. Acker	Special Assistant Attorney General
Hazen A. Sandwick	Office Engineer
Victor E. Ziegler	Investigations Engineer
Duane Torvik	Construction Engineer
Alan Grindberg	Assistant Construction Engineer
Lloyd Johnson	Construction Foreman
Daniel Reiter	Construction Foreman
Eugene Sackman	Chief of Party
Joseph Krebsbach	Chief of Party
Roy Putz	Exhibit Attendant
Gordon Baesler	Draftsman
Charles Grindberg	Rodman
Dave Helphrey	Rodman
Ernest Reimers	Rodman
Charles Vincent	Rodman
John Monahan	Rodman
Luella Schweigert	Chief Stenographer
Nancy L. Sell	Bookkeeper
Edna Gehring	File Clerk
Jean E. Walterson	Receptionist
Fred J. Fredrickson	Planning Coordinator

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 groundwater supplies throughout the state.

MEETINGS, CONFERENCES AND HEARINGS

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

July 13, 1956—Bismarck	June 14, 1957—Bismarck
August 27, 1956—Bismarck	August 2, 1957—Bismarck
September 24, 1956—Valley City	September 9, 1957—Bismarck
November 7, 1956—Dickinson	October 17, 1957—Bismarck
December 14, 1956—Bismarck	December 20, 1957—Bismarck
January 14, 1957—Bismarck	January 31, 1958—Bismarck
February 15, 1957—Bismarck	March 31, 1958—Bismarck
March 29, 1957—Bismarck	May 5, 1958—Bismarck
May 6, 1957—Bismarck	June 12, 1958—Bismarck

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:

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

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

Forty-two man days in meetings with Water Conservation and Flood Control Districts.

Forty-seven man days for meetings of the Missouri Basin Inter-Agency Committee.

Fifty-seven man days in meeting with various departments of the Corps of Engineers, U. S. Army and Bureau of Reclamation.

Sixty-one man days spent in meetings with County Commissioners relative to drainage problems and flood control.

One hundred and forty 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.

Thirty-five man days attending meetings of State and National Reclamation Associations.

Eleven man days, Western States Engineers conferences.

Nine man days in meetings with inter-state or Canadian officials in regard to joint development of water control projects.

Twenty-five man days, Water Resources Association, and various Lower Basin Interests.

Forty-six man days for appearances before Congressional Hearings both in Devils Lake, North Dakota, and Washington, D. C.

Fifty-four man days—exhibits.

All 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.

Governor John E. Davis presents case for Garrison Diversion Unit to Irrigation and Reclamation Subcommittee of U. S. House of Representatives Interior and Insular Affairs Committee at Devils lake on October 30, 1957. Congressmen shown from left to right: Otto Krueger, N. Dak.; E. Y. Berry, S. Dak.; A. L. Miller, Nebraska; Wayne Aspinall, Colo.; Committee Chairman, Sidney McFarland; Committee Staff Member, Lee Metcalf, Montana; Al Ulman, Oregon and John Burns, Hawaii.

GEOGRAPHICAL DATA CONCERNING NORTH DAKOTA

I. Boundary Lines (to nearest tenth mile).
   A. North—310.0 miles—Follows the 49° parallel.
   B. East—213.5 miles—air-line-river boundary approximately 416 miles
   C. South—360.6 miles—7th Standard parallel.
   D. West—210.8 miles—27th Standard meridian.

II. Boundary Corners (to nearest second of latitude or longitude).
   A. Northeast—49° 00′ 02″ N. Lat.; 97° 13′ 41″ W. Long.
   B. Southeast—45° 56′ 07″ N. Lat.; 96° 33′ 41″ W. Long.
   C. Southwest—45° 56′ 43″ N. Lat.; 104° 02′ 17″ W. Long.
   D. Northwest—49° 00′ 00″ N. Lat.; 104° 02′ 53″ W. Long.

III. Areas
   A. Of State ..... 70,665 Square Miles
      1. Land area ..... 69,362 Square Miles
      2. Water area (including Garrison Reservoir at 1,850) ..... 1,303 Square Miles
   B. Of Basins (Based on line of Bureau of Reclamation)
      1. Red-Souris-Devils Lake to Hudson Bay (Approximately) ..... 29,500 Square Miles
      2. Missouri to Gulf of Mexico (Approximately) ..... 41,200 Square Miles

DRAINAGE BASIN AREAS—NORTH DAKOTA
(Approximate areas in square miles)

I. Hudson Bay Drainage Basin			
a. Devils Lake	3,450 sq. mi.	5%	
b. Lower Red River	7,850 " "	11%	
c. Sheyenne River	7,350 " "	10%	
d. Souris River	8,550 " "	12%	
e. Wild Rice River	2,050 " "	3%	
		41%	29,250 sq. mi.
II. Missouri River Drainage Basin			
a. Cannonball River	1,550 sq. mi.	7%	
b. Grand River	950 " "	1%	
c. Heart River	3,150 " "	4%	
d. James River	7,200 " "	10%	
e. Knife River	2,600 " "	4%	
f. Little Missouri River	4,650 " "	7%	
g. Missouri River (main stem)	17,700 " "	25%	
h. Yellowstone River	600 " "	1%	
		59%	41,400 sq. mi.
TOTAL			70,650 sq. mi.

POWERS AND DUTIES, STATE WATER COMMISSION

Powers and Duties of the Commission. The commission shall have full and complete power, authority, and general jurisdiction:

1. To investigate, plan, regulate, undertake, construct, establish, maintain, control, and supervise all works, dams, and projects, public and private, which in its judgment may be necessary or advisable:

a. To control the low-water flow of streams in the state;

b. To impound water for the improvement of municipal and rural water supplies;

c. To control and regulate flood flow in the streams of the state to minimize the damage of such flood waters;

d. To conserve and develop the waters within the natural watershed areas of the state and, subject to vested and riparian rights, to divert the waters within watershed area to another watershed area and the waters of any river, lake or stream into another river, lake or stream.

e. To improve the channels of the streams for more efficient transportation of the available water in the streams;

f. To provide sufficient water flow for the abatement of stream pollution;

g. To develop, restore and stabilize the waters of the state for domestic, agricultural and municipal needs, irrigation, flood control, recreation, and wildlife conservation, by the construction and maintenance of dams, reservoirs and diversion canals;

h. To promote the maintenance of existing drainage channels in good agricultural lands and to construct any needed channels;

i. To provide more satisfactory subsurface water supplies for the smaller villages of the state;

j. To finance the construction, establishment, and maintenance of public and private works, dams, and irrigation projects, which in its judgment may be necessary and advisable;

k. To provide for the storage, development, diversion, delivery, and distribution of water for the irrigation of agricultural land;

l. To provide for the drainage of lands injured by or susceptible of injury from excessive rainfall or from the utilization of irrigation water and, subject to the limitations prescribed by law, to aid and cooperate with the United States and any department, agency, or officer thereof, and with any county, township, drainage district or irrigation district of this state, or of other states, in the construction or improvement of such drains;

m. To provide water for stock; and

n. To provide water for the generation of electric power and for mining and manufacturing purposes;

2. To define, declare, and establish rules and regulations:

a. For the sale of waters and water rights to individuals, associations, corporations, and political subdivisions of the state, and for the delivery of water to users;

b. For the full and complete supervision, regulation, and control of the water supplies within the state; and

c. For the complete supervision and control of acts tending to pollute watercourses, for the protection of the health and safety of all the people of the state;

3. To exercise full power and control of the construction, operation, and maintenance of works and the collection of rates, charges, and revenues realized therefrom;

4. To sell, lease, and otherwise distribute all waters which may be developed, impounded, and diverted by the commission under the provisions of this chapter, for the purpose of irrigation, the development of power, and the watering of livestock, and for any other private or public use; and

5. To exercise all express and implied rights, powers, and authority, that may be necessary, and to do, perform, and carry out all of the expressed purposes of this chapter and all of the purposes reasonably implied incidentally thereto or lawfully connected therewith.

6. To acquire, own and develop lands for irrigation and water conservation and to acquire, own and develop dam sites and reservoir sites and to acquire easements and rights-of-way for diversion and distributing canals.

7. To cooperate with the United States and any department, agency or officer thereof in the planning, establishment and maintenance of dams, reservoirs, diversion and distributing canals, for the utilization of the waters of the state for domestic and municipal needs, irrigation, flood control, water conservation, generation of electric power and for mining, agricultural and manufacturing purposes, and in this connection the State Water Conservation Commission is hereby authorized, within the limitations prescribed by law, to acquire, convey, contribute or grant to the United States real and personal property, including land or easements for dams and reservoir sites and rights-of-way and easements for diversion and distribution canals.

THE STATE ENGINEER

The State Water Conservation Commission appoints the State Engineer, who shall be a qualified and experienced hydraulic engineer and also shall be an experienced irrigation engineer. He shall serve as secretary and chief engineer of the commission.

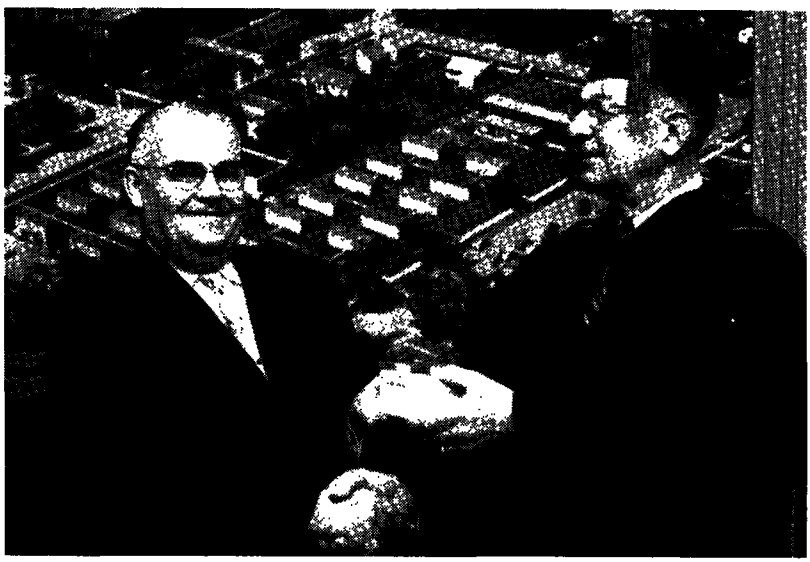
He is required to make a formal printed report to the Governor for the biennium preceding each legislative session. He passes on applications for permits to appropriate water, records the permit when granted, and issues certificates of construction of irrigation works or dams when completed, examines and approves plans and specifications for dams or irrigation works, inspects dam sites and construction works, and collects state fees for same as required by law.

His records are open to public inspection during business hours. He is the custodian of General Land Office maps, field notes and records of surveys of land turned over by the government to the state.

He shall make such rules and regulations necessary to carry into effect the duties devolving upon his office, relating to applications for permits to appropriate water, for the inspection of works, for the issuance of licenses, and for the determination of rights to use of water.

He cooperates with Federal agencies in making hydrographic surveys and investigations of each stream system and source of water supply in the state, and shall obtain and record all available data for the determination, development and adjudication of the water supply of the state, and other duties pertaining thereto.

He cooperates with the U. S. Geological Survey in making topographic maps and surveys.



North Dakota State Engineer, Milo W. Hoisveen, honored as outstanding alumni of N.D.A.C., at ceremonies on May 26, 1958, shown here receiving award from Dr. Fred S. Hultz, President of NDAC.

NORTH DAKOTA'S WATER RESOURCES DEVELOPMENT PROGRAM

North Dakota's most precious resources are its people, its land and its water. Each of these is dependent on the other and each must be conserved and used wisely if North Dakota is to progress and develop with our growing nation.

North Dakota's water resource program has many aspects. Each is important to the entire program. To accomplish the orderly development of our water resources for the maximum possible benefit it is essential that the water program be considered in its entirety.

Water, or the lack of it, is the cause of most of our economic problems. Uncontrolled, the floodwaters of our rivers and streams cause tremendous property damage, occasionally the loss of life and many disruptions in the lives of the citizens of the State. Often more widespread and serious damages result from the lack of water. North Dakota, being primarily an agricultural state based on dryland farming, depends on receiving an adequate and timely amount of rainfall for the production of crops. Seldom do the state's farmers receive rainfall in the quantities required to achieve the maximum yields their soil is capable of producing. During years of severe drought North Dakota's farmers watch their crops wither and die, their cattle become gaunt and emaciated, their precious soil blow away and their financial reserves dwindle.

Through the years many of the state's citizens have recognized that if North Dakota and its people were to prosper it was essential that every effort be made to control and use the life-giving waters from the rivers and streams. Major Powell, in addressing the North Dakota Constitutional Convention in Bismarck in 1889 said—"All other wealth falls into insignificance compared with that which is to come from these lands from pouring on them of the running streams of this country." In spite of efforts and support by many citizens progress in water resource development in North Dakota was slow for many years. The reason for this comparatively slow development can be attributed to several factors, some of which are the lack of required financial resources to develop various project facilities because of their expensive nature, the type of farming practiced in North Dakota and its ability to produce fair to good crops from the rainfall received except during times of drought, the ever present optimism among the people of the state that future floods or droughts will never again be as severe as those they have experienced.

The drouth of the 30's stressed the need for a new and expanded approach to our water resources development program. Prior to that time the Office of the North Dakota State Engineer was responsible for administering the irrigation laws of the state, and to provide technical assistance in matters relating to the waters in North Dakota

rivers and streams. In 1937 the North Dakota State Legislature recognized the need for an agency with broad powers and duties relating to the control, development and use of our water resources if the citizens of the state were to get the maximum benefit. As a result the North Dakota State Water Conservation Commission was established by the legislature in 1937 and on March 27th of that year the North Dakota State Water Conservation Commission was organized.

The Commission was virtually given complete authority over the waters of the state and was made the responsible state agency for the development for the many water projects. It was given the authority and duty to investigate, plan, construct, and develop such projects throughout the state as required and within its ability. The powers and duties as set forth in another section of this report are basically the same as when the Commission was organized in 1937. The North Dakota State Engineer is designated as the Chief Engineer and Secretary of the State Water Conservation Commission by law which in effect combines these two offices.

In 1937 the State Water Conservation Commission recognized that there were four main problems connected with the waters of the state. The solution of these problems was set out as the goal of the state's water resource program proposed by the Commission. These four problems still serve as the goals of our water resources program. They are—

1. Water for human needs, such as drinking, sanitation and recreation.

2. Water for animal needs, such as livestock watering and game and fish life.

3. Water for irrigation to insure crop production for stabilization of a diversified farming and livestock industry.

4. Water controlled to avert flood damages.

In order to spearhead the water resource program in North Dakota, the State Water Conservation Commission has carried on a number of varied and important activities. Each of these activities is vital to the success of the over-all program and each is essential if the sound development of our water resources is to be accomplished. These activities include—

1. The collection and assemblying of basic data.

2. The investigation, survey and review of water resources projects.

3. The review of the basic data and investigational material to determine the feasibility of the projects and to acquaint the local beneficiaries with the merits of the projects and with the problems involved.

4. The organization of water user entities through which the projects can be developed and the local responsibilities assumed.

5. Arranging for financing the construction and development of the water projects.

6. The actual construction of the project works and assisting the local beneficiaries in the operation and use of the facilities, thereby assuring that the maximum benefits at the most economical cost would accrue to the beneficiaries.

These activities are required of every water resource project, whether it be irrigation, flood control, municipal and industrial water supplies, drainage or recreation. The State Water Conservation Commission is also responsible for administering the water laws of the State of North Dakota. Each of these various activities and functions involves the cooperative efforts of many individuals, organizations and federal and state agencies. They serve as the basis for the State Water Conservation Commission program. Briefly they are as follows:

Collection of Basic Data

1. Cooperative programs with various branches of the U.S.G.S.

2. Cooperative activities with the Bureau of Reclamation, the Corps of Army Engineers and the Soil Conservation Service.

3. Conducting surveys and investigations with State Water Conservation Commission survey crews.

Project Planning and Review

1. Surveys and investigations of proposed water resources projects, both local and state-wide in scope.

2. Interpretation of these surveys so as to evolve a project plan for development of a proposed water resources project.

3. Studying the project plan and designing facilities for project to determine its feasibility and desirability.

4. Review of projects proposed and studied by various federal agencies in behalf of the state and the project beneficiaries.

Closely related to the investigation and survey program is the matter of reviewing the project with the local proponents to advise them of its merits and problems, and the required local participation.

Organization of Water User Districts

This involves the establishment of irrigation districts, water conservation and flood control districts, and drainage districts in accordance with state law so as to provide the necessary entity for the development of these water resource projects.

Financial Arrangements

This phase involves providing assistance in obtaining the necessary funds to construct the project facilities, whether these funds are to come from federal, state or private sources, and arranging appropriate participation by various beneficiaries in the repayment arrangements for the reimburseable costs.

Project Construction and Operation

After the planning has been completed for a project, the State Water Conservation Commission often enters into the actual construction of the project facilities, either on a force account or a bid basis. This activity involves the construction of dams, canals and other water control structures to accomplish the purpose for which the project is designed. The Commission also assists the local water user organizations in an advisory capacity in the actual operation and maintenance of the project.

Administering of Water Laws

The administration of the water laws requires the issuance of water rights in accordance with State law, maintaining various records relative to water resource organizations and basic data compiled within the State of North Dakota, and many activities related to the functions of the State Water Conservation Commission as set forth in state law.

These many activities of the State Water Conservation Commission are required in the development of any of the various types of water resource projects considered in the state's water resources program. All of the projects provide benefits to the local people directly affected and thereby to the state as a whole in varying degrees. These benefits include irrigation, development of municipal and industrial water supplies, hydroelectric power, recreational facilities, fish and wildlife, conservation and propagation, flood control and protection, and stream pollution abatement. Each of these anticipated benefits is important to the state and is discussed individually as follows:

Irrigation

North Dakota farmers recognize more and more the value of having a supply of water for their crops available at all times and, consequently, are becoming more and more conscious of the need for

irrigation throughout the State. There are approximately 2½ million acres of rich agricultural farm land that can be irrigated through the establishment of sizeable irrigation projects in North Dakota. In addition there are many small areas that can be irrigated through the development of irrigation systems by individual farmers. At the present in North Dakota only a small portion of the total potential irrigable area has been developed. The irrigable areas in North Dakota extend to all counties with the larger areas being in the 25 county Garrison Diversion Conservancy District that will be concerned with the vast Garrison Diversion Project. Through irrigation the agricultural economy of the State of North Dakota can be stabilized and expanded. Irrigation will materially increase the net income of our farmers, and the detrimental effects of recurring drouths will be minimized.

Flood Control

Each year floods of various magnitude bring damage and devastation to many areas. The property damages often run into millions of dollars. The inconvenience and disruption to our normal activities further increases the severity of the floods. In North Dakota the principle flood damages come from the spring snow melt and resulting run-off. The severity of the floods depends to a great extent on the accumulation of snow and the rapidity of the snow melt in the spring. The devastation caused by floods in numerous cities and towns, and agricultural lands, throughout the State can be prevented or diminished in several ways depending on the circumstances in each case. These methods are, through the construction of storage reservoirs in the upstream areas where these flood waters can be captured and conserved for other beneficial uses, or through the construction of levees and dikes to prevent the flood waters from inundating valuable property and lands, or by constructing drains and improving watercourses to hasten the removal of flood waters. Although in some cases the only feasible method to control floods is through the construction of dikes and levees, the North Dakota State Water Conservation Commission wherever possible advocates the construction of storage reservoirs so that the flood waters can be retained and utilized for other beneficial purposes.

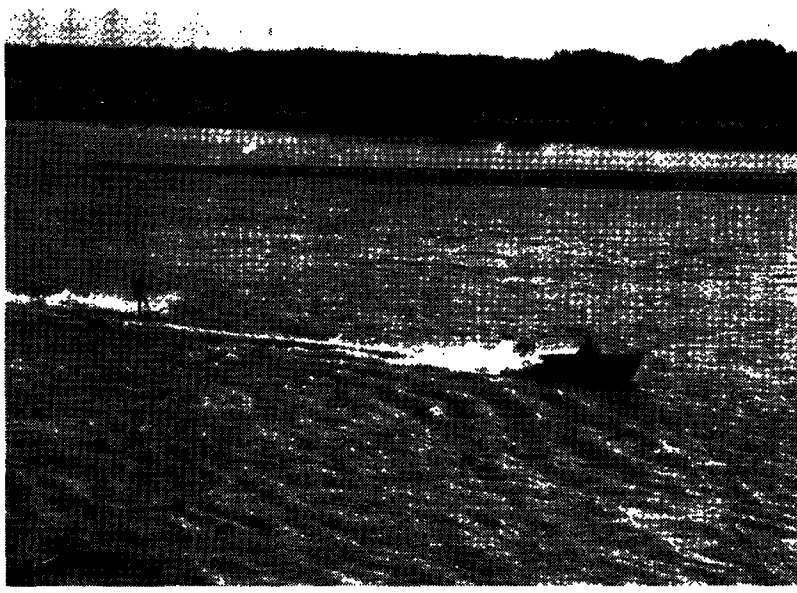
Municipal and Industrial Water Supplies

Many cities, towns and villages in North Dakota are in need of a good and adequate water supply for municipal use that can be economically developed. With the increasing per capita requirements for water this problem is becoming more acute. The State Water Conservation Commission has actively cooperated with many municipalities in efforts to locate and develop adequate groundwater and

surface water supplies. These surveys have resulted, in many instances, in locating a desirable water supply for the municipality concerned and in a few cases located a sufficient supply for future irrigation development. Augmenting our surface water supplies through the Garrison Diversion Project, the Bowman-Haley Dam and other projects will result in an improved water supply for many cities, towns and future industries in the areas concerned.

Hydroelectric Power

As North Dakota develops and expands the demand for additional electric power will grow. The initial production of power from Garrison Dam in January 1955 was significant in that it was the first hydroelectric power produced in North Dakota. Many other opportunities exist in North Dakota for additional hydro power installation in connection with future development of the state's water resources. Notable among these are the proposed Pembina River Dam and the main canal power drops along the McClusky canal of the Garrison Diversion Project. Hydro power produced in connection with these projects would partially fill the increasing demands for power as North Dakota grows.



Water Skiing

Recreation

North Dakota's recreational opportunities will be greatly enhanced through the development of our many water resource projects. Fresh water lakes exist in areas that were once devoid of these facilities. Many other alkali lakes will be converted to fresh water lakes as our water resource program develops. Citizens of the State who before had to travel many miles for fishing, camping, boating and swimming have access to such facilities much nearer their homes. Many new similar areas will be developed in the future.

The several reservoirs that have been created by dams constructed on our rivers in recent years have already proven themselves as excellent recreational attractions. As the state's water resource program is expanded and developed, the economy of the state will be stimulated by the expenditures for recreation that before were channeled to other states.

Fish and Wildlife Conservation and Propagation

Closely allied to recreational development is that of fish and wildlife conservation and propagation. The recently created reservoirs have become popular with North Dakotans because of the excellent fishing provided which surpasses the fishing in lakes in neighboring states. In addition these reservoirs provide rest areas and breeding grounds for waterfowl. They have materially enhanced the fish and wildlife conservation and propagation in the state. These are the major direct benefits that will accrue through North Dakota's water resource development program. There are many secondary benefits that will affect the state's economy to a remarkable degree. New business and industry will be attracted to the state as the economy is expanded and stabilized. The gross annual income of the state will be materially greater and the tax base will thereby be broadened permitting the improvement and expansion of our roads and highways, our schools and the many other facilities that are essential in our modern day life. We can expect a significant growth in our population and will be able to provide a better opportunity to all our citizens for a prosperous living.

WATER RESOURCES AND NORTH DAKOTA'S FUTURE

As the United States grows and develops, the demand for water throughout the nation increases. The expansion of industry and agriculture to meet the needs of a growing population in this country and throughout the world will emphasize to a greater extent the importance of the waters of our rivers and streams. This is true in North Dakota, as it is to a greater or lesser degree in every state in the country. If North Dakota is to grow and prosper along with the rest of the nation, it is essential that the state act now to assert their right to a just share of water from our rivers and streams and to beneficially use such waters.

The North Dakota State Water Conservation Commission has long recognized the need to be ever alert to the encroachment on North Dakota's rightful share of the waters of our international and interstate streams and have followed a program to protect this right. The Commission recognizes not only the need to protect our right to a share of the water from various streams but also has pointed toward the development of the water resources available to the state for the maximum benefit of our citizens now and in the future. Several proposals made by the Commission are being studied at the present and, in addition, various actions have been taken in an effort to assure an adequate water supply to the state for many purposes.

On June 14, 1957, the State Water Conservation Commission passed a resolution reserving 2,640,000 acre feet of water from the Missouri River annually for the Garrison Diversion Unit. Authority to take such action was given the State Water Conservation Commission by the North Dakota Legislature. Although this reservation has been made by the Commission, it is well to recognize that the right to water is ordinarily established by use—with first users having the first claim. If this legal axiom is followed in connection with the Missouri River, it is imperative that the development of the Garrison Diversion Unit be accomplished as soon as possible to establish this right. The Commission has taken a similar action in regard to the waters of the North Branch of the Grand River. The reservation of these waters was originally made in 1951 for the development of irrigation for the Bowman-Haley Project in Bowman County. In 1958 the Commission reaffirmed the reservation of these waters not only for irrigation purposes but also for municipal and industrial use in this area of the state.

The Commission has advanced several proposals relative to various water resource projects in North Dakota that are being investigated and undoubtedly will provide for the more complete development of our waters for the benefit of all the state's citizens. In 1957 the Commission proposed that consideration be given to the possibility of utilizing waters that will be diverted to the Souris River through the Garrison Diversion Unit to augment the flow in the Pembina

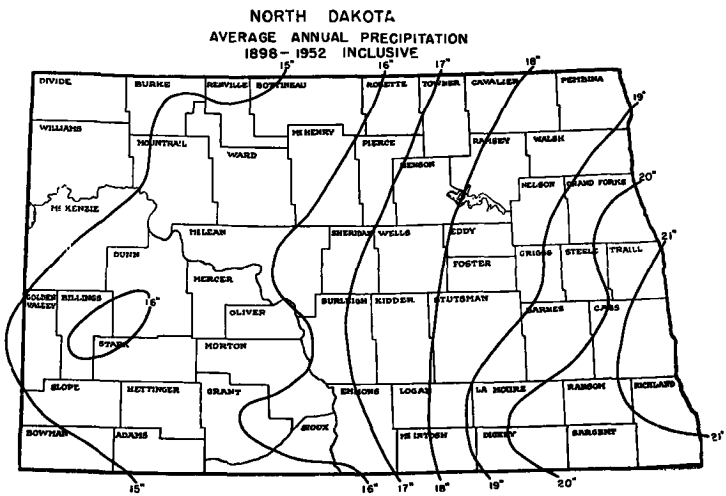
River, thereby increasing the feasibility of the Pembilier Dam and related irrigation and hydro-electric power. This proposal would be accomplished by diverting water from the Souris River in Canada into the ancient channel of the Pembina River. The proposed Pembilier Dam, located on the Pembina River near the Cavalier and Pembina County border, would provide storage for such water and permit it to be utilized for hydro-power production and also for the development of up to 50,000 acres of irrigation in North Dakota. At the present time the International Joint Commission has this proposal under consideration.

In 1958 the Commission also proposed that consideration be given to constructing a causeway or lowhead dam across the Missouri River near Bismarck that could be utilized as a highway crossing for the planned Interstate highway. Such a dam would not only provide a highway crossing but also would enhance the development of irrigation pumping projects along the reservoir above Bismarck, provide an ideal recreation area for citizens in the central North Dakota area and provide a stable source of water supplies for future industrial development. Development of a recreational area of this nature in connection with the interstate highway would be a notable tourist attraction in the state. The Corps of Engineers was appropriated $10,000 by Congress to conduct a study on this proposal.

The Commission has also proposed that consideration be given to the construction of a tunnel or tunnels to replace a portion of the main canal for the Garrison Diversion Unit. Preliminary discussion of the proposal by the Bureau of Reclamation, State Water Conservation Commission and Conservancy District representatives was held, however consideration of the tunnel proposal was deferred. The Commission is of the opinion that the cost of irrigation to the farmers in the Garrison Diversion Unit area can be materially reduced if a tunnel is constructed rather than the open ditch canal now proposed, because of a much lower operation and maintenance cost.

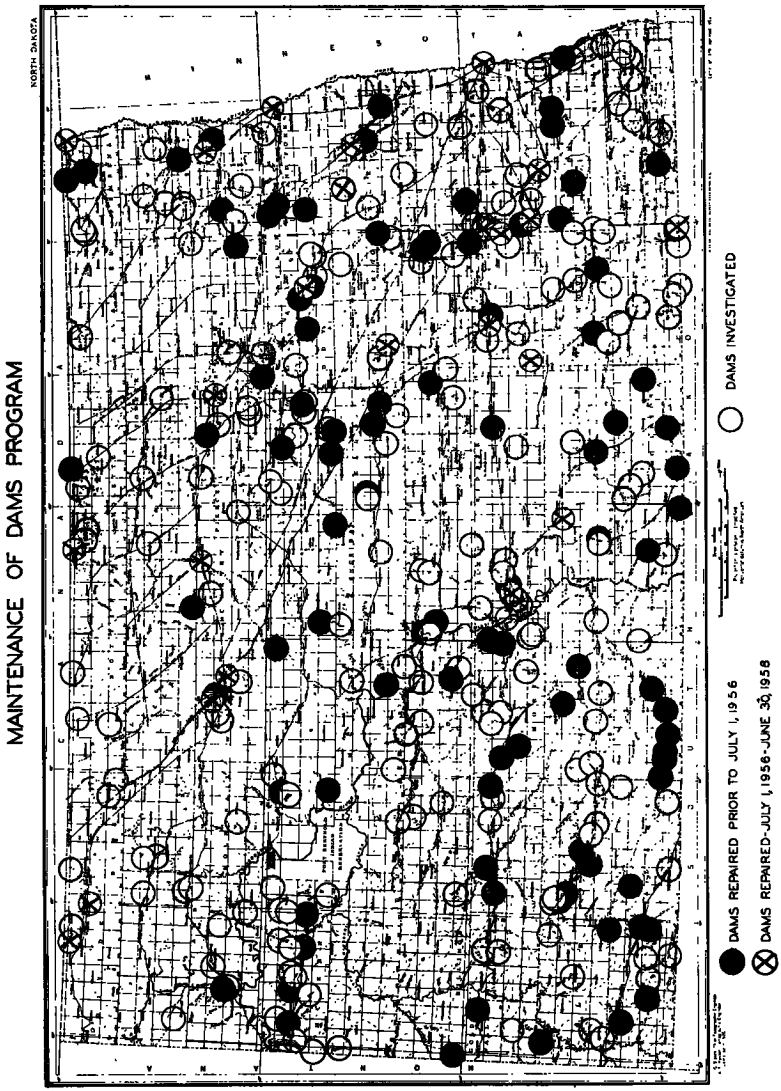
In 1957, at the instigation of the State Water Conservation Commission, a groundwater survey was inaugurated to determine if an aquifer existed in the ancient channel of the Missouri River north of Williston. This survey is being conducted in cooperation with the U. S. Geological Survey. Indications are, according to the geology of this area, that before the glacial period in North Dakota the Missouri River flowed north emptying into Hudson Bay. The channel of the Missouri River then followed approximately the present channel of Little Muddy Creek and thence meandered in a northeasterly direction to the Hudson Bay. These investigations have substantiated the contention of the Commission that such a channel does exist and that there is a sizeable aquifer located therein that may furnish a plentiful water supply for irrigation, municipal, industrial and other uses. Quantitative and qualitative studies are now being made of the water supply existing in this aquifer.

The lack of industrial development in North Dakota is apparent in comparison with other midwestern states. This condition can be attributed to a variety of factors. In an effort to stimulate development of industry in the state, officials and agencies have undertaken an extensive program of presenting facts about North Dakota's industrial potential. The State Water Conservation Commission has actively cooperated in this effort in respect to compiling data relative to North Dakota's water resources and making this information available to potential industrial water users. The availability of an adequate water supply is of prime importance to most industries in determining the location for new plants. The State Water Conservation Commission recognizes the continued need to make available information of this nature if industrial development in North Dakota is to become a reality.



Annual Precipitation in North Dakota

Chapter 2
N. D. SWCC ACTIVITIES


MAINTENANCE OF DAMS PROGRAM
NORTH DAKOTA
DAMS REPAIRED PRIOR TO JULY 1, 1956
DAMS REPAIRED-JULY 1, 1956-JUNE 30, 1958
DAMS INVESTIGATED

CONSTRUCTION

MAINTENANCE OF DAMS

The Commission's Maintenance of Dams program was inaugurated in 1939 when the North Dakota Legislature provided an appropriation of $7,000 for this work. The need for this program became apparent when the program of the various federal agencies, that had constructed over 1,500 small dams in the state, were terminated without making adequate provision for maintenance and repair of these structures. The dams were constructed by the WPA, CCC, PWA, FERA, and other federal agencies as a part of the relief program during the 1930 drought period. The reservoirs created by these dams provide a number of conservation needs. They provide water for livestock, municipal use, recreation purposes, irrigation, and fish and wildlife conservation and propagation.

North Dakota has a present day inventory of over twenty millions of dollars of small dams. This inventory is based on the current cost of replacing spillways that have deteriorated beyond repair. Fourteen such structures have been reconstructed within the last three bienniums at a total cost of $288,000—or an average of $20,570 per structure.

During the past 25 years North Dakota has lost about sixteen millions of dollars worth of small dams. Many of these dams failed due to the original faulty design, poor construction by the federal agencies engaged in this work during the drought period of the 1930's, and also the neglect of state and county agencies to provide adequate maintenance for the structures for which they were responsible.

North Dakota, through the combined efforts of the State Water Conservation Commission and cooperating agencies and organizations, has to a large extent retarded this progressive loss of water resource assets by a coordinated program of small dam repair.

During the past biennium about $238,000 has been spent for the maintenance, repair and reconstruction of small dams with $76,370 of this cost representing the Commission's participation through engineering and construction services, as well as in cash contributions.

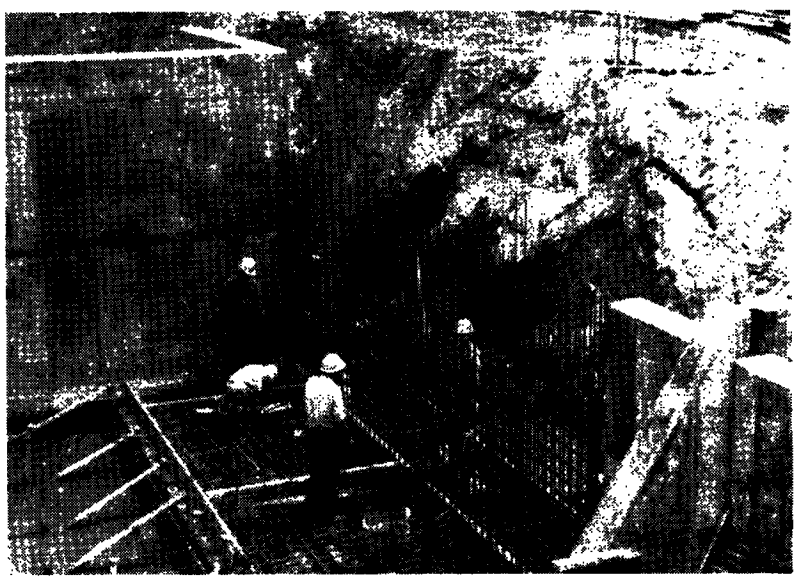
Based on the Commission's program the current ratio of maintenance and reconstruction costs is slightly more than one percent of the present day value of the structures—a ratio which is obviously too small to completely halt the small dam failures. Thus many structures requiring repairs now fail as too frequently no local funds are available for cost participation and the funds appropriated to the Commission are not sufficient to permit carrying the total cost.

The present policy of requiring local funds and interest for the maintenance of small dams has greatly aided in the selective maintenance of only those dams which serve a useful local purpose such as municipal water supply, irrigation, flood control, swimming, fishing, boating and waterfowl habitat.

In September of 1955 the Commission modernized the maintenance and repair work by the purchase of "spray concrete" equipment. This modern equipment makes possible the application of a dense, high strength pneumatically placed concrete to the surface of old masonry, or concrete structures. The same equipment can wet or dry sandblast the old structures to insure good bonding of the new concrete. It can also be used to grout beneath the structures to fill voids caused by settlement or seepage erosion. This method has very materially improved the quality of repairs as well as reducing the cost. During this period the Commission also trained key construction employees to the use of demolitions which has substantially reduced the cost of removing masonry and also to enable their construction forces to construct channels by the use of ditching dynamite.

North Dakota in the past biennium has constructed three new dams, installed one timber control structure, two reinforced concrete flood irrigation control structures, and completed major and minor repairs to nineteen structures.

Following is a table showing the names and locations of dams constructed or repaired during the past biennium with the actual cost of each:



Portland Dam Under Construction

CONSTRUCTION PROGRAM SUMMARY

July 1, 1956—June 30, 1958

Project No.	Name	County	Date	S.W.C.C.	Game & Fish U.S. Wildlife	Local	Total
409	Portland Dam*	Traill	May-Aug. '56	$ 9,750.34		$ 9,750.34	$ 19,500.68
475	Golden Lake Resoration Project	Steele	Aug. '56-Aug. '58	17,500.00	64,855.13	20,000.00	102,355.13
416	Lake Irvine Control Structure	Ramsey	Nov. '56-Mar. '58	7,804.84		7,804.84	15,609.68
520	Grand Forks Park Dam	Grand Forks	Jan.-Mar. '57	5,807.50		5,807.50	11,615.00
584	Alexander Dam	Stutsman	June-July '57	1,890.34		825.44	2,715.78
601	Bucephalia Dam	Foster	June-Aug. '57	2,110.77	2,110.76	2,110.76	6,332.29
342	Hansen Dam	Barnes	Aug. '57	360.21		360.21	720.42
399	Kathryn Dam	Barnes	Aug.-Sept. '57	1,315.96	1,315.96	1,315.95	3,947.87
227	Eaton Project	McHenry	Oct.-Dec. '57	4,255.43		6,383.14	10,638.57
556	Hyatt Duck Propagation Area	Dickey	May-June '57		7,413.86		7,413.86
580	Enderlin Park Dam	Ransom	Aug. '56	668.17		668.17	1,336.34
412	Apple Creek Dam	Burleigh	July-Aug. '56	1,677.06		1,677.06	3,354.12
448	Minto Dam	Walsh	Aug.-Sept. '56	667.77		667.77	1,335.54
266	Tolna Dam	Nelson	Sept.-Oct. '56	1,834.45		1,600.00	3,434.45
299	Pembina City Dam**	Pembina	Aug.-Dec. '56	1,792.50		1,792.50	3,585.00
583	Island Park Dam**	Cass	Oct.-Dec. '56	2,045.39		6,136.18	8,181.57

CONSTRUCTION PROGRAM SUMMARY
(Continued)

July 1, 1956—June 30, 1958

Project No.	Name	County	Date	S.W.C.C.	Game & Fish U.S. Wildlife	Local	Total
264	Braddock Dam	Emmons	April-May '57	5,010.64	3,000.00	3,000.00	11,010.64
354	Jamestown (Ice House) Dam	Stutsman	May-June '57	991.02		991.02	1,982.04
246	Antelope Creek (Schramm) Dam	Mercer	June '57	1,908.79	1,908.78	500.00	4,317.57
221	Burlington Dams No. 1 & No. 2	Ward	July '57	1,972.93		1,972.92	3,945.85
330	Lake Metigoshe	Bottineau	Aug. '57	343.65	343.62	697.24	1,384.51
334	Crosby (Long Creek) Dam	Divide	Aug.-Sept. '57	1,837.42		1,837.42	3,674.84
490	Noonan Park Dam	Divide	Sept. '57	761.37		761.36	1,522.73
569	Valker Dam	Ward	Sept. '57-June '58	4,063.45		4,063.45	8,126.90
				$76,370.00	$80,948.11	$80,723.27	$238,041.38

*Work begun before July 1, 1956.

**Not completed as of July 1, 1958, because of existing high water conditions.

Golden Lake Project - Project No. 475

In addition to the construction, reconstruction and maintenance of dams and drains, the State Water Conservation Commission has completed construction on the Golden Lake Project in Steele County. Under this project water is diverted from the Beaver Creek through a two-mile long canal to restore the level of Golden Lake and thereby enhance its possibilities as a recreational and fish and wildlife conservation and propagation area. The final cost of the project including right-of-way costs, construction of a diversion dam in Beaver Creek, and the diversion canal was $102,355.13. The State Game and Fish Department and the Golden Lake Restoration Corporation cooperated in the project with the Commission. The State Water Conservation Commission limited its cooperation to a share of the costs in constructing the dam in Beaver Creek. The State Game and Fish Department, through its Federal Aid Division, and the Golden Lake Restoration Corporation financed the balance of the costs.

Initial construction consisted of placing the earth embankment material for the Beaver Creek Dam. The next phase of the project was the construction of the reinforced concrete spillway for the dam and proceeding concurrently was the excavation of the diversion canal. All earth work for the project was contracted and the spillway, control structures and road crossing were constructed by the State Water Conservation Commission crews.

When in full operation the project will serve to divert 5,427 acre feet of water initially into Golden Lake and thereafter sufficient water annually to maintain the level of the lake. The restoration project also includes the diversion of water into Rush Lake so as to establish that lake as a water fowl nesting area. Through this diversion the Golden Lake will be raised about 15 feet over its 1954 level. The project report prepared by the State Water Conservation Commission stated that during extended drought periods as were experienced during the 1930's, the water supply in Beaver Creek would not be sufficient to provide the requirements for Golden Lake; however, in normal years the supply would be adequate to provide for the full operation of the project.

When fully restored, Golden Lake will cover an area of 330 acres compared to its present size of 301 acres. The lake will have a maximum depth of about 19 feet. In addition Rush Lake will cover an area of 278 acres to a depth of 2½ feet. The canal for the project has a capacity of 43 cubic feet per second.

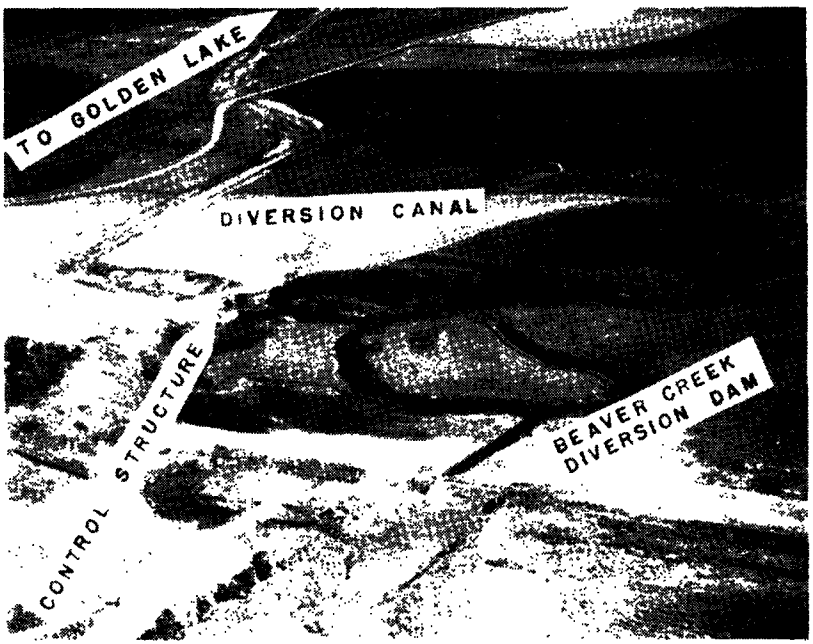
Noteworthy in connection with the Golden Lake Project is the organization and effort of the local proponents in providing their share of the costs. A non-profit corporation known as the Golden Lake Restoration consisting of citizens from the entire area was set up. Each community was assigned quotas of funds to be raised for

the project. Through various promotions approximately $20,000 was raised which has been used to provide the necessary rights-of-way for the project, development of recreational facilities and other features of the project.

Portland Dam - Project No. 409

In 1955 the City of Portland was confronted with a serious municipal water shortage due to low flows in the Goose River, from which the city obtains its water supply. The State Water Conservation Commission investigated the problem and cooperated with the City of Portland in installing facilities used in connection with their municipal water supply system.

A rather novel condition exists at the point where the city intake is located. The city's water supply is obtained from the Goose River through a large diameter well sunk into an excellent aquifer only a few hundred feet from the river bank. This aquifer acts as a natural filter, furnishing a supply of cold, pure water needing no further treatment before distribution into the city's mains. Since the well is located near the river, its level fluctuates directly with the level of the river. Several attempts had been made by the local citizens to build a small overflow dam to stabilize the river stage, but frequent heavy spring flows destroyed the dam and nullified their efforts.



Golden Lake Project

The State Water Conservation Commission proposed that a reinforced concrete spillway be installed downstream from the well site to insure adequate storage to carry the city through periods of low runoff. This plan was approved by city officials, and construction was begun in May of 1956.

The dam is of the buttress type, having a crest length of 58 feet and a drop of 10 feet. Provision is made for installation of flashboards to raise the pool level an additional foot. Construction was completed in August 1956 and the City of Portland has since had a more than adequate water supply. Total cost of the project was $27,533.05, which was shared equally between the State Water Conservation Commission and the City of Portland.

Riverside Dam, Grand Forks - Project No. 520

Location: Riverside Dam is located within the city limits of Grand Forks adjacent to Riverside Park.

Purpose: The dam is a multiple purpose structure and is used for the municipal water supply, cooling water for industry and for swimming and boating. The structure was originally a rock fill timber structure. Numerous repairs have been required to maintain the dam in recent years. In 1956 the State Water Conservation Commission was requested to investigate the possibilities of repairing the structure. A large section of the deck through the central portion of the dam had been removed by ice and heavy water flow. Likewise much of the rock fill material which aided in stabilizing the structure had been washed from the cribs. The structure was in grave danger of being completely washed out. The State Water Conservation Commission crews commenced work on the structure in January 1957 but were forced to vacate the site at the time of the spring break up. Continued high water compelled postponement of the work until the fall of 1958 when the water flow was reduced to approximately 400 cubic feet per second. A concrete deck was placed on the entire spillway section which constituted a self-supporting beam. Sixty cubic yards of reinforced concrete were used in reconstructing the spillway section. Pneumatically applied concrete was used on the training walls of the dam to extend the life of the timber piling which was acting as the training wall. High water had entered behind the training walls and eroded much of the backfill materials on the training walls on both the North Dakota and the Minnesota sides. The structure actually had three points of failure. They being the center of the dam and the possibility of washing around both or either end. The estimated cost of the repairs approximates $40,000. This will be borne jointly by the City of Grand Forks and the State Water Conservation Commission.

Alexander Dam - Project No. 584

Location: Stutsman County eight miles east and four miles north of Gackle.

Purpose: Recreation and wildlife.

Type of structure: Pipe inlet spillway and earth fill embankment.

Condition before repairs: Spillway had been undermined and destroyed by recurring high water.

Repair work accomplished: A pipe inlet structure was placed near the site of the old spillway and an earthen embankment was placed over the inlet. Provisions were also made for a natural type of spillway to care for high flows during flood stage. 610 cubic yards of material were used in riprapping the inlet and discharge section of the pipe drop. The pipe drop was made from 50 lineal feet of 24-inch diameter pipe. The dam impounds water to a depth of 14 feet.

Cost and sponsors: The total cost of the repair work was $2,715.78 which was shared by the Stutsman County Park Board and the State Water Conservation Commission.

Antelope Creek Dam - Project No. 246

Location: Mercer County, three miles northwest of Hazen.

Purpose: Recreation and future water supply for the city of Hazen.

Type of structure: Reinforced concrete spillway.

Condition before repairs: The spillway was badly deteriorated and a large void existed under the spillway section.

Repair work accomplished: The 60 cubic yard void under the spillway was filled with grout material. A wearing surface of approximately 7,500 square feet of pneumatically placed concrete was applied to the face of the spillway.

Cost and sponsors: Total cost of the project was $4,317.57 which was shared by Mercer County, the North Dakota State Game and Fish Department and the State Water Conservation Commission.

Braddock Dam - Project No. 264

Location: Emmons County, one mile south of Braddock, North Dakota.

Type of structure: Rubble masonry spillway constructed in 1937 by the Works Project Administration.

Purpose: Recreation.

Condition before repairs: The broad spillway was deteriorated and there were several voids under the spillway. In addition a seepage plane existed to the west of the dam and erosion occurred below the spillway.

Repair work accomplished: A wearing coat of approximately 6,800 square feet was applied to the surface of the spillway and voids in the spillway were filled with grout. The seepage plane was sealed off and a sheet steel cut off wall was installed 125 feet downstream from the spillway to form a stilling basin and check the erosion below the spillway apron.

Cost and sponsors: Total cost $11,010.64. Shared by Emmons County, State Game and Fish Department and State Water Conservation Commission.

Apple Creek Dam - Project No. 412

Location: Burleigh County on Apple Creek five miles east of Bismarck.

Purpose: Recreation and fish propagation.

Type of Structure: Reinforced concrete channel dam.

Apple Creek Dam

Condition before repairs: The auxiliary spillway about 1,000 feet north of the channel dam was badly deteriorated with walls on the verge of collapse and the surface extensively eroded.

Repair work accomplished: A concrete beam was erected between the training walls to prevent their inward collapse. The entire surface of the dam was sandblasted and a wearing coat of pneumatically applied concrete was placed thereon. A stop-log control structure was installed at the face of the spillway.

Cost and sponsors: The total cost of the work was $3,354.12; 50% of which was paid by the State Water Conservation Commission and the balance by Burleigh County and local sponsors.

Bucephalia Dam - Project No. 601

Location: Foster County on Kelly Creek twelve miles east and five miles south of Carrington.

Purpose: Recreational.

Type of structure: Earth embankment dam and rubble masonry spillway which was constructed by the W.P.A. in the 1930's.

Condition before repairs: Surface of the spillway was deteriorated and voids existed behind wing walls and in gravity section.

Repair work accomplished: A maintenance coat of pneumatically placed concrete was applied to the entire spillway. Voids behind the wings and in the gravity section of the spillway were filled through the use of pneumatically applied grout. Approximately 3,200 square feet of pneumatically applied concrete was placed over the surface of the dam. 1,055 cubic yards of gravel was used in making the dam more accessible to the public. The structure impounds water to a depth of 20 feet and provides one of the most promising fishing areas in Foster County.

Cost and sponsors: Total cost was $6,332.29 which was shared equally by Foster County, the North Dakota State Game and Fish Department and the State Water Conservation Commission.

Burlington Dams No. 1 and No. 2 — Project No. 221

Location: Ward County on the Des Lacs River, two miles west of Burlington, North Dakota.

Purpose: Water supply for the Burlington Irrigation Project.

Type of structure: Rubble masonry arch spillway with rolled earth embankments.

Condition before repairs: Dam No. 1 — wearing surface of roadway and spillway crest deteriorated. Dam No. 2 — face of spillway deteriorated by heavy flow and ice. Gate structure also damaged.

Repair work accomplished: Reinforced concrete pneumatically placed was applied over the area extending six feet up from the stilling basin on the spillway portion of the structure. The materials were applied to conform with the arch shape of the structure and were tied into the center section of the training wall. A new wearing surface was placed on the roadway at the spillway crest elevation on Dam No. 1. Work was also performed on the gate structure at Dam No. 2.

Cost and sponsors: Total cost $3,945.85 which was shared equally by the Bank of North Dakota, custodian of the project, and the State Water Conservation Commission.

Eaton Flood Irrigation — Project No. 227

Location: McHenry County along the west side of the Souris River near Towner.

Purpose: Constructed in 1936 under direction of the State Engineer and financed by the P.W.A. This project provides for the flood irrigation of some 8,000 acres of the flats adjacent to the Souris River in the Towner area. The flood waters are held on the land by a series of 12 headgates.

Condition before repairs: Headgates 4-A and 5-A had been completely destroyed.

Repair work accomplished: The destroyed headgates were replaced by reinforced concrete headgates with plank flashboards for controlling the water level. This involved a total of 74 cubic yards of reinforced concrete.

Cost and sponsors: Total cost was $10,638.57 which was shared 60% by the Eaton Flood Irrigation District and 40% by the North Dakota State Water Conservation Commission.

Enderlin Park Dam - Project No. 580

Location: Ransom County on Maple River in Enderlin.

Type of structure: Rubble masonry channel dam constructed in the drouth period of the 1930's.

Purpose: Recreation.

Condition before repairs: Spillway surface was deteriorated and several cracks existed in the structure resulting in seepage planes.

Repair work accomplished: Pneumatically applied concrete was placed over the entire face of the structure. Grout was pumped into various cracks that appeared in the structure to eliminate seepage planes that were apparent throughout the structure. The total surface area receiving reinforced concrete application amounted to 1,125 square feet.

Cost and sponsors: The cost of this project was $1,336.34 which was shared equally by the Enderlin Park Board and the State Water Conservation Commission.

Hansen Dam - Project No. 342

Location: Barnes County, seven miles south and two miles east of Valley City, North Dakota.

Purpose: Recreation.

Type of structure: Concrete buttress spillway section.

Condition before repairs: A vertical crack had developed in the face of the spillway.

Repair work accomplished: Six cubic yards of concrete were used to reinforce a section between the two center buttresses on the spillway.

Cost and sponsors: The cost of the repairs was $720.42 which was shared equally by the State Water Conservation Commission and Barnes County.

Hyatt Wildlife Propagation Area - Project No. 556

Location: Dickey County near the South Dakota line south of Oakes, North Dakota.

Purpose: Wildlife propagation and public shooting area.

Condition before construction work: Project did not exist. The source of water for the Hyatt Slough had been cut off by the construction of a dam in South Dakota. The construction work by the State Water Conservation Commission was undertaken to divert water to this 480-acre area to create an outstanding propagation and shooting area.

Construction work accomplished: A channel was excavated from the James River west along the South Dakota, North Dakota state line to the Hyatt Propagation area, a distance slightly over one mile. The bottom width of the channel is ten feet and it is capable of carrying a flow of water approximating 30 c.f.s. during flood stage in the James River. A control structure was constructed through the use of stop logs at the inlet. A structure consisting of three corrugated metal pipes equipped with a concrete headwall and automatic flap gates was installed at the entry of Hyatt Slough in order to maintain its water level.

Cost and sponsors: The construction work was accomplished under supervision of the North Dakota State Water Conservation Commission. The North Dakota State Game and Fish Department acquired the project lands and the Federal Fish and Wildlife Service paid the costs of the project which totaled $7,413.56.

Island Park Dam - Project No. 583

Location: Cass County on the Red River of the North at Fourth Street South in the City of Fargo.

Type of structure: Timber crib and rock fill.

Purpose: Industrial and municipal water supply.

Condition before repairs: Heavy ice flows and high water conditions had caused extensive damage to the spillway section, the training walls, the fish ladder and auxiliary spillway. A considerable portion of the spillway section was destroyed and the sheet piling of the dam had been badly damaged.

Repair work accomplished: State Water Conservation Commission construction crews filled the voids in the training walls with grout and applied a coat of pneumatically placed concrete over the entire surface of the structure. The sheet piling was relined and recapped the entire spillway with a self-supporting beam extending from the crest to the toe of the structure. The control structure was rebuilt which provides for regulation of flows below 25 cubic feet per second.

Costs and sponsors: As of the date of this report the repair work for this project has not been completed due to adverse water conditions. The cost of the project to date has been $8,181.57. The project sponsors are the North Dakota State Water Conservation Commission and the City of Fargo. The State Water Commission is to pay $2,000 of the cost of repairs to this dam and the balance of the cost will be borne by the City of Fargo.

Jamestown Ice House Dam - Project No. 534

Location: Stutsman County, Jamestown on the James River.

Type of structure: Control gate with auxiliary spillway.

Purpose: Recreation, enhancement of the municipal water supply and to control backwater heights in both the James and Pipestem Rivers.

Condition before repairs: The concrete control structure and gate structure were deteriorated because of age.

Repair work accomplished: The State Water Conservation Commission crews placed pneumatically applied concrete on approximately 2,075 square feet of the structure. The newly applied concrete will extend the life expectancy of the spillway considerably.

Cost and sponsors: The work was accomplished at a cost of $1,982.04 and the city of Jamestown and the State Water Commission shared the costs equally.

Kathryn Dam - Project No. 399

Location: Barnes County on the Sheyenne River east of Kathryn.

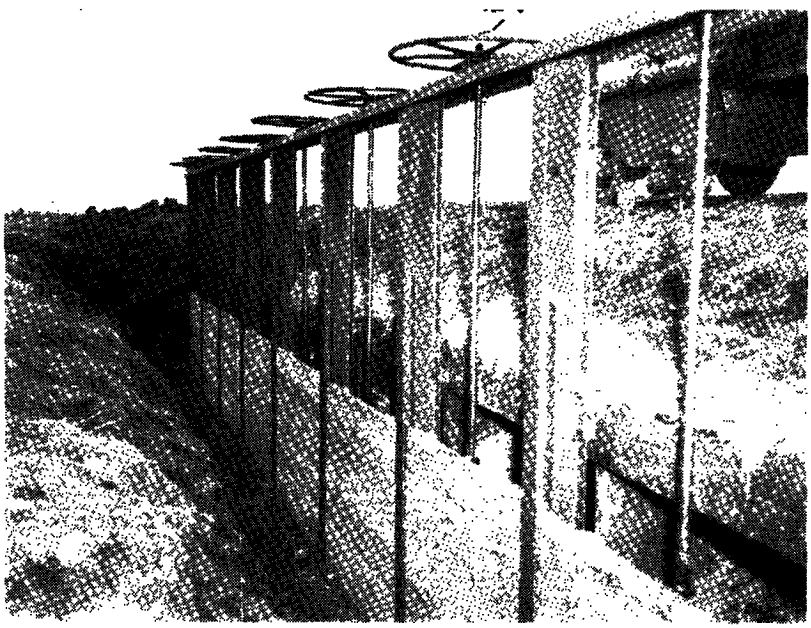
Purpose: Recreational and fish propagation.

Type of structure: Rubble masonry gravity section channel dam constructed by the Civilian Conservation Corps in the 1930's.

Condition before repairs: Erosion around the wing and cutoff walls threatened the spillway structure.

Repair work accomplished: The wing and cutoff walls on the right side of the structure were replaced. A sheet piling cutoff was added to the structure in order to insure against future erosion occurring at that point. The wings were refilled with select earth materials. Twenty-one cubic yards of reinforced concrete were used to make the repairs.

Cost and sponsors: The total cost of $3,947.00 was shared on a three way basis with the Barnes County Board of Commissioners, the State Game and Fish Department and the State Water Conservation Commission.



Lake Irvine Control Structure

Lake Irvine Control Structure - Project No. 416

Location: Ramsey County two miles northeast of Churchs Ferry.

Purpose: Flood control and flow regulation in Mauvais Coulee. The engineering staff of the State Water Conservation Commission has endeavored for the past four years to obtain a flood control project for the Lake Alice and Lake Irvine area through the Corps of Engineers. Studies are presently being made by the Corps in an attempt to arrive at a plan that will eventually care for the flooding that inundates upwards to 20,000 acres under severe flood conditions. The State Water Conservation Commission has proposed a project which could serve in the interim to give partial flood relief to the area.

Work accomplished: At the request of the Chain Lakes Water Conservation and Flood Control District and the Ramsey County Commissioners, the State Water Conservation Commission installed a timber treated box culvert structure in which eight 5 x 5 foot box control gates were attached as features for regulating and controlling flood waters that are now harassing the area. The structure is the initial start to partial control of flood waters in the area.

Cost and sponsors: The work was accomplished at a cost of $15,609.68, which was borne equally by the State Water Conservation Commission and the Ramsey County Board of Commissioners.

Lake Metigoshe - Project No. 330

Location: Bottineau County at the outlet of Lake Metigoshe seventeen miles north of Bottineau, North Dakota.

Purpose: Recreation and wildlife.

Type of structure: Reinforced concrete gravity section.

Condition before repairs: Seepage veins had developed in the concrete spillway and the entire surface of this structure was showing signs of deterioration.

Repair work accomplished: State Water Conservation Commission crews placed a concrete wearing surface over the entire spillway section. This project is part of the project which is contemplated on Sharpe Lake in Canada to impound water for use in maintaining Lake Metigoshe near the spillway crest level.

Cost and sponsors: The work was accomplished at a cost of $1,400.00. The costs were borne by the Oak Creek Flood Control District, the Bottineau County Wildlife Club and the State Water Conservation Commission.

Long Creek Dam - Project No. 334

Location: Divide County on Long Creek, four miles north of Crosby.

Type of structure: Reinforced concrete.

Purpose: Recreation and a future water supply for the City of Crosby. The Crosby City Park Board now maintains a park adjacent to the Long Creek Dam.

Condition before repairs: Erosion was occurring at the lower end of the wing walls and the surface of the spillway was showing signs of deterioration.

Repair work accomplished: State Water Conservation Commission construction crews resurfaced the structure by placing 377 square feet of pneumatically applied concrete over the entire spillway section. Riprap in the form of rock was placed at the lower end of the wingwalls to arrest erosion taking place there. Earth material was also placed behind the wingwalls of the structure. State Water Conservation Commission crews also made a groundwater survey adjacent to the reservoir in an effort to locate a filtration bed for a future intake site for the city municipal water system.

Cost and sponsors: The total cost of the project was $3,674.84 which was shared equally by the State Water Commission and the city of Crosby.

Minto City Dam - Project No. 448

Location: Walsh County on the Forest River at Minto.

Type of structure: Channel dam constructed by Works Projects Administration.

Purpose: Municipal water supply and recreation. It is believed water from the dam's reservoir recharges municipal wells.

Condition before repairs: Earth fill behind training walls had settled and the wing walls were badly cracked.

Repair work accomplished: The State Water Commission crews repaired the dam by compacting the backfill and reinforcing the training walls of the structure through use of pneumatically applied concrete.

Costs and sponsors: The cost of repairs was $1,335.54 and was borne equally by the city and the State Water Conservation Commission.

Noonan Dam - Project No. 490

Location: Near the city of Noonan in Divide County.

Type of structure: Embankment and plain concrete spillway section.

Purpose: Recreation for city of Noonan and adjacent area.

Condition before repair: Spillway surface was deteriorated.

Repair work accomplished: The State Water Conservation Commission repaired the structure through the placement of pneumatically applied concrete over the surface of the dam. This will increase the life expectancy of the dam materially. 1,325 square feet of surface area were covered in this manner.

Cost and sponsors: The work was performed at a cost of $1,522.73 which was shared equally by the State Water Conservation Commission and the city of Noonan.

Pembina City Dam - Project No. 299

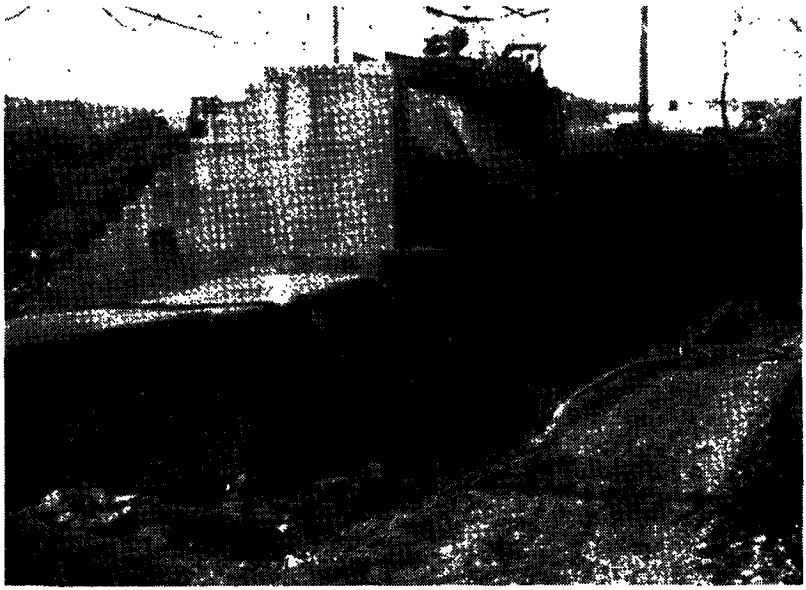
Location: Pembina County on Pembina River in the city of Pembina.

Purpose: Municipal water supply and recreation.

Type of structure: Rubble masonry channel dam.

Condition before repairs: High waters from recurring floods in the Pembina River had caused extensive erosion behind the training walls and greatly endangered the structure.

Repair work accomplished: A course of pneumatically applied concrete was placed over the entire surface of the training walls. Repair work was halted on the project in the spring of 1957 due to



Valker Dam — Repairs Underway

high water conditions in both the Pembina River and the Red River of the North. State Water Commission crews resumed work in 1958 and expect to complete repairs in September of 1958. The areas behind the training walls were repacked with select materials in order to prevent reoccurrence of wingwall erosion. Riprap was placed on the approaches of the upper wing walls as well as the lower downstream end of the wings.

Cost and sponsors: The cost of the repairs will approximate $6,400.00 and will be shared equally by the City of Pembina and the North Dakota State Water Conservation Commission.

Tolna Dam - Project No. 266

Location: Nelson County, one mile south and two miles east of Tolna.

Type of structure: Reinforced concrete spillway and earthen embankment.

Purpose: Recreation.

Condition before repairs: The surface of the spillway was badly deteriorated.

Repair work accomplished: Sixty cubic yards of pneumatically applied concrete was placed over the face of the dam to provide a durable wearing surface on the spillway.

Cost and sponsors: The work was completed at a cost of $3,434.45 which was shared equally by the State Water Conservation Commission and Nelson County.

Valker Dam - Project No. 569

Location: Ward County on the Souris River in Minot.

Purpose: Constructed by the City of Minot in 1923 to provide irrigation water for their park system, cooling water for electrical generating plants and a control structure for sewage dillution.

Type of structure: Reinforced concrete spillway dam.

Condition before repairs: The concrete spillway surface was badly eroded.

Repair work accomplished: State Water Commission crews applied concrete pneumatically to the entire surface of the structure, which was 7,000 square feet.

Cost and sponsors: The total cost of the work was $8,126.90 which was shared equally by the State Water Conservation Commission and the city of Minot.

CONSTRUCTION AND RECONSTRUCTION OF DRAINS OR IRRIGATION FACILITIES

North Dakota is an agricultural state. Because the state depends basically on its agriculture for its economic wealth, the prosperity of the citizens hinges to a great extent on the weather — particularly the rainfall or precipitation received. The difference between a bountiful crop or a crop failure in most cases can be attributed to water — either an excess of it or a deficiency of it. In some areas in western North Dakota the problem of deficient rainfall has been solved through irrigation—a practice which is growing and spreading to central and eastern sections of the state.

In many areas throughout the state the problem of removing excess waters from crop land is as serious as that of providing additional water during dry periods. In many sections of the state, particularly in the Red River Valley of North Dakota, farmers have collectively and individually attempted to solve this problem by constructing drains to remove excess waters, thereby permitting them to utilize as much of their rich farmland as possible for agricultural production.

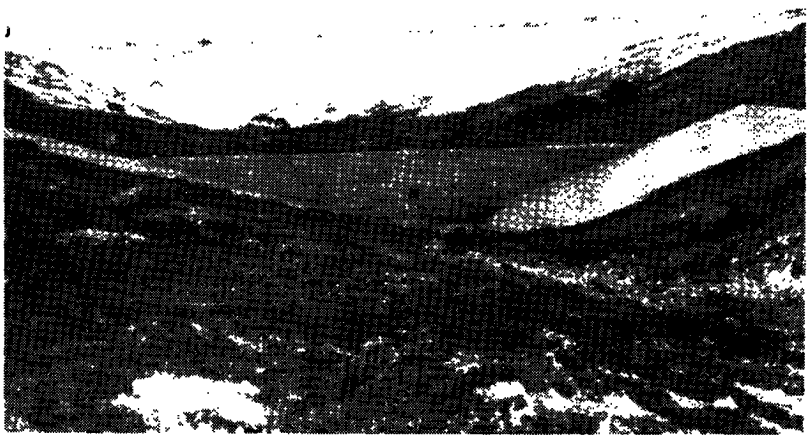
The construction of drains in the Red River Valley of North Dakota dates back many years. The drains constructed are of the open ditch variety and were designed to provide for the removal of excess water from agricultural land during the spring runoff period and during periods of heavy rainfall as rapidly as possible. Without exception these drains have paid for themselves many times by making lands available for cultivation that otherwise would often be useless because of surplus flood waters. Although the bulk of the drains existing in North Dakota are located in the Red River Valley counties, there are many in other counties throughout the state. These drains, as those in the Valley, have proved very valuable to the areas they serve.

All areas in North Dakota have one thing in common insofar as the climate is concerned. This is — all are subjected to periods of drought. During these drought periods, it has been the experience that the development and maintenance of existing drainage ditches and canals has been neglected. This was particularly true in North Dakota during the 1930 drought period when there was no need for drainage. In addition there was not sufficient ready cash available to permit those who wished to be prepared for the floods they were sure would come later to keep their drains in good repair. As a result many of the drainage ditches that had been constructed were neglected and rendered useless when they were filled with brush, trees, blowing sand and other debris.

In 1943 and 1944 after the drought had been broken and wet years returned, various areas in the state suffered severe flood damages because of the neglected drainage systems. In 1943, for example, the

Department of Agriculture estimates that 634,000 acres of land in six Red River Valley counties were damaged by flood waters resulting in a loss of $10,852,000.00. In 1944, 1,026,000 acres were damaged in ten Valley counties at a loss of $13,565,000. During the period 1943 to 1953, it is estimated the loss from inadequate drainage to counties in the Red River Valley alone at almost $60,000,000. These wet years and the resulting damages brought about a greater emphasis on the rehabilitation of existing drains and the construction of new drains throughout the Red River Valley counties and other counties in the state.

Great as the demand was for more drainage work throughout the state, all farmers faced the one problem of having inadequate financial resources to accomplish the needed work. The State Legislature in 1943 recognized this situation and appropriated to the State Water Conservation Commission a sum of $50,000 to assist counties in the construction and repair of existing drainage ditches. Appropriation of funds for this purpose has been continued each biennium by the Legislature and as of the 1957 Legislature, a total of $1,210,000 had been appropriated to the State Water Conservation Commission to assist the counties in the construction and reconstruction of drains and for the development of other water resource projects. Although funds appropriated to the Commission were primarily designated for use in drainage assistance, the Commission was authorized to make expenditures assisting irrigation districts in the rehabilitation of their facilities.



Cass County Drain No. 39 — Drop Structure

In 1957 the Legislature further expanded the purposes for which this appropriation could be used by including assistance to water conservation and flood control districts and other legally organized entities for the construction of flood protective works. In addition, the Commission could use funds from this appropriation to investigate and design facilities for various water resource projects. The title of the fund was changed to "Multiple Purpose Fund" in order to better designate it for the uses for which it was authorized.

In 1955 the Legislature appropriated the funds for this purpose for a longer period than the biennial period usually specified. By so doing they recognized the fact that the period of time involved between the initiation of a drainage or other type of water facility project and its ultimate construction and operation often exceeds the two or four year period for which appropriations are ordinarily made. The 1957 Legislature again recognized this need when they appropriated funds to the Multiple Purpose Fund of the State Water Conservation Commission by making this appropriation available for a continuing period. 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 level sufficient to take care of the anticipated demands during the next two year period.

Of the $1,210,000 appropriated to the State Water Conservation Commission, a total of $887,950.23 has been paid to entities in 17 counties as a share of the cost of constructing drainage and other projects. A total of 185 projects have been involved in this program. In addition a total of $185,410.00 has been allocated by the State Water Conservation Commission for drainage projects or other work under construction or planned. A total of $139,923.60 is available in this fund for future work.

Funds appropriated to the Commission have varied with the need and demand from the individual counties and other entities concerned. The following schedules indicate the expenditures the State Water Conservation Commission has made during the past two year period covered by this report and of the expenditures made since 1943 when the Commission's drainage program was inaugurated by the Legislature.

SUMMARY OF EXPENDITURES — DRAINS OR IRRIGATION — 1943-1957

County or Irrigation District	1943-1945 $50,000 Approp.	1945-1947 $240,000 Approp.	1947-1949 $200,000 Approp.	1949-1951 $150,000 Approp.	1953-1957 $90,000 Approp. Expenditure	Expenditures	Total Expenditures
Barnes	$	$	$	$	$ 3,838.72	.....	$ 3,838.72
Bottineau	.....	2,785.31	.....	.....	.....	6,482.69	9,268.00
Cass	8,930.00	72,171.51	27,823.73	19,446.82	38,288.87	41,338.31	207,999.24
Cavalier	.....	.....	.....	1,595.93	4,856.85	.....	6,452.78
Dickey	.....	.....	.....	.....	3,797.82	.....	3,797.82
Grand Forks	1,954.12	7,820.92	4,618.74	1,415.25	1,792.00	5,908.73	23,509.76
Morton	2,995.00	.....	.....	.....	.....	.....	2,995.00
Pembina	3,760.00	11,212.19	3,945.38	83,013.39	3,100.32	4,030.74	109,062.02
Ramsey	.....	.....	.....	.....	.....	1,056.25	1,056.25
Richland	27,001.01	70,782.51	343.12	18,150.93	6,848.34	11,921.93	135,047.84
Sargent	.....	.....	2,436.55	1,227.94	32.00	2,141.20	5,837.69
Traill	2,350.00	30,756.83	58,847.26	12,331.98	5,996.80	19,078.91	129,361.78
Walsh	3,009.87	.....	.....	4,453.07	.....	1,940.38	9,403.32
Walsh-Pembina	.....	38,964.93	4,324.85	.....	.....	.....	43,289.78
Ward	.....	.....	.....	.....	.....	.....	.....
Burlington Irrigation Project	.....	.....	2,144.80	.....	.....	.....	2,144.80
Eaton Flood Irrigation District	.....	.....	420.00	.....	2,451.19	.....	2,871.19
Lewis & Clark Irrigation District	.....	.....	8,456.35	.....	.....	.....	8,456.35
Sheyenne River Clearing	.....	.....	.....	.....	.....	12,914.32	12,914.32
Sioux Irrigation District	.....	4,816.64	614.64	1,479.78	.....	.....	6,911.06
Flood Control Projects	.....	.....	.....	.....	.....	.....	.....
Snagging and Clearing	.....	.....	.....	.....	.....	11,691.43	11,691.43
Miscellaneous and Unallocated	.....	140.44	13,979.51	1,343.23	.....	21,495.11	36,958.29
	$ 50,000.00	$239,451.28	$127,954.93	$144,458.32	$ 71,002.91	$140,000.00	$772,867.44

Expenditures from 1953 to 1957 Appropriation
Construction and Reconstruction Drains and Irrigation

July 1, 1956—June 30, 1958

County and Drain	State Share (40%)	Dist. Share (60%)	Total Cost
Cass			
3 & 10	$18,527.84	$27,791.77	$ 46,319.61
3	5,663.38	8,495.06	14,158.44
Sheyenne River Channel	6,427.71	9,641.59	16,069.30
Bottineau			
Bauman	6,482.69	9,724.03	16,206.72
Pembina			
No. 17	3,356.52	5,034.80	8,391.32
60	674.22	1,011.34	1,685.56
Richland			
6	398.40	597.60	996.00
2	956.84	1,435.26	2,392.10
5	1,802.96	2,704.43	4,507.39
27	1,282.28	1,923.43	3,205.71
Sargent			
1	559.20	838.80	1,398.00
Traill			
24	1,856.03	2,784.05	4,640.08
TOTALS	$47,988.07	$71,982.16	$119,970.23

Expenditures—Multiple Purpose Fund

July 1, 1956—June 30, 1958

County and Drainage Project	State Share (40%)	Dist. Share (60%)	Total Cost
Bottineau			
Bauman Drain	$ 720.30	$ 1,080.45	$ 1,800.75
Kane-Tacoma Drain	15,365.18	23,047.78	38,412.96
Cass			
Drain No. 39	3,273.67	3,600.00	6,873.67
Grand Forks			
Brenna Drain No. 28	9,354.74	14,032.11	23,386.85
Pembina			
Drain No. 10	8,935.66	13,403.49	22,339.15
Richland			
Drain No. 1	1,147.80	1,721.70	2,869.50
Traill			
Drain No. 18	1,262.70	1,894.05	3,156.75
Other Projects—Construction			
Ramsey			
Lake Alice - Lake Irvine	8,665.17*	6,944.51	15,609.68
Dickey			
Oakes Groundwater Irrigation District	4,946.40	7,419.60	12,366.00
McHenry			
Eaton Flood Irrigation District Headgates 4A & 5A	4,255.43	6,383.14	10,638.57
Other Projects—Investigation			
Including: Cartwright Irrigation District, Golden Lake, Eaton Project, Crosby Water Supply, Lake Metigoshe, Hunter, Ellendale and others	9,167.67		9,167.67
TOTALS	$67,094.72	$79,526.83	$146,621.55

*Work in progress

Multiple Purpose Fund
Allocations and Unobligated Balance

June 30, 1958

Unexpended Balance, June 30, 1958			$325,333.60
Less Obligations (Allocations made by the State Water Conservation Commission but not paid pending completion of construction)			
Drainage			
Cass County			
Drains No. 3 & 10	$13,400.00		
Drain No. 49	4,000.00		
Drain No. 39	7,600.00	$ 25,000.00	
Grand Forks County			
Drain No. 29	5,750.00	5,750.00	
Pembina County			
Rhinelander Drain	2,240.00		
Drain No. 13	10,320.00		
Drain No. 43	2,800.00		
Drain No. 10	9,100.00	24,460.00	
Richland County			
Drain No. 55	1,450.00		
Drain No. 7	1,300.00		
Drain No. 2	10,000.00	12,750.00	
Traill County			
Holman Drain	8,650.00		
Rust Drain No. 24 *	4,000.00	12,650.00	
Bottineau County			
Overgard Lateral *	5,000.00	5,000.00	
Total Drainage			$85,610.00
Flood Control			
Lower Heart Project	40,000.00		
Scranton	15,000.00		
Marmath	15,000.00		
Jamestown	8,800.00		
Walhalla Channel	2,000.00		
Oak Creek Channel	3,000.00		
Total Flood Control			$83,800.00

Multiple Purpose Fund—(Continued)

Irrigation			
Lewis & Clark	8,500.00		
Total Irrigation		8,500.00	
Investigations			
Ancient Missouri River	$ 16,000.00		
Total Investigations		$16,000.00	
Total Obligations			$193,410.00
Unobligated Balance, June 30, 1958			$131,423.60

*Estimated Allocation.

Construction of Drop Structure — Pembina County Drain 13

ENGINEERING INVESTIGATIONS AND SURVEYS

One of the most important aspects of the State Water Conservation Commission's program is that of conducting engineering surveys and investigations throughout the State and, from the data gathered, preparing project plans and reports. The construction of many of the projects investigated in this program is accomplished by the State Water Conservation Commission in cooperation with other agencies or organizations. The Commission's survey and investigation program is financed mainly by appropriations from the State Legislature, and has resulted in the solution of many water problems in our state and also in the determination of the feasibility of new water projects.

The Commission's investigation program includes topographic surveys, water supply studies, soil surveys and analysis, and the related compilation and application of the data into prepared plans and reports. All of the material gathered is available to interested parties and much of it has been used by the Bureau of Reclamation, Corps of Engineers, U. S. Fish and Wildlife Service, United States Geological Survey, and other state and federal agencies in their activities.

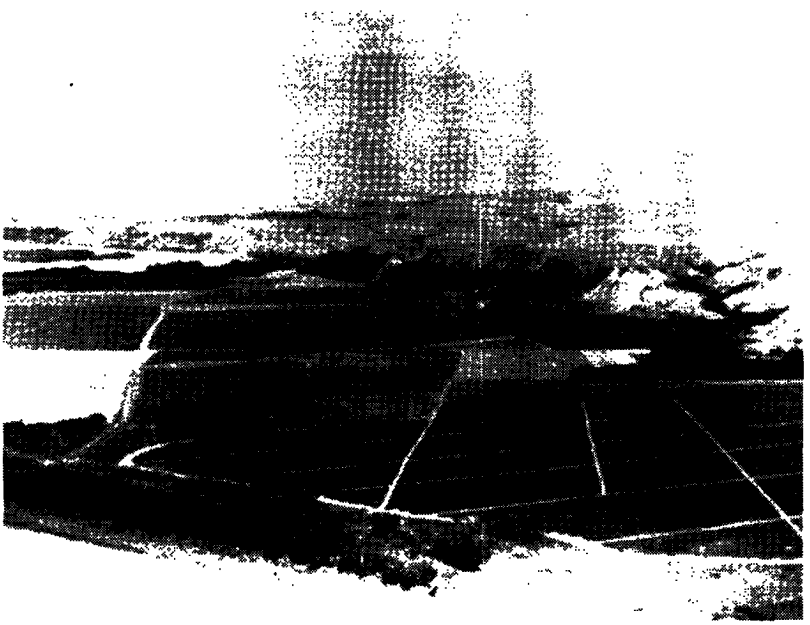
During the period of this report the Commission has maintained two topographic mapping crews, and two drilling crews, to meet the demand for surveys in conjunction with the water program. One of the drilling crews works in cooperation with the United States Geological Survey gathering data on the availability of groundwater in the various areas of the state. The other drilling crew is used to gather undisturbed soil samples to determine the suitability of soils as a construction material for the construction of earth fill dams. The addition of the soils drilling unit in connection with the Commission's program has proved to be an extremely valuable tool in determining the feasibility of development of new water projects.

A summary of these surveys and project reports is as follows:

Cartwright Irrigation Project No. 36

The Cartwright Irrigation Project is located about two miles southwest of the Village of Cartwright in the western portion of McKenzie County. An irrigation district for this project was organized by a small group of farmers along the Yellowstone River for the purpose of developing irrigation facilities for approximately 700 acres of irrigable land. Studies of this project, made by the Bureau of Reclamation and the Soil Conservation Service, contemplated installing a pumping station on the Yellowstone River for the project's water supply. Neither agency obtained a favorable benefit-cost ratio for this project in their studies.

During this past biennium, the State Water Commission located a plentiful ground water supply through a survey and approached the project on the basis of using a ground water source of water supply. A test well was drilled and a pump installed in the spring of 1958. At present experimental work is being conducted to determine the suitability of the quality of ground water in this area for irrigation before a cost determination of the project is made. The quality of water appears unfavorable to irrigation now, however, pumping tests are continuing to determine if this quality will improve. If use of this ground water source proves infeasible the Commission feels it will be possible to install suitable wells adjacent to the Yellowstone River. It is predicted that the cost of the project will be materially reduced thereby making the project feasible through the use of wells, providing the water quality is satisfactory. This is one of the first projects in which ground water has been considered as a source for an irrigation water supply in North Dakota. If the Commission's proposal for development of the project proves successful, an entirely new approach in the development of irrigation projects along the Yellowstone and Missouri Rivers in our state will be opened.



Cartwright Irrigation Project, Irrigable Lands

Shaffner Creek - Project No. 201

Shaffner Creek Project is located in Section 10, Township 142 North, Range 91 West, in Dunn County. A soil survey was made to determine whether a dam could be constructed on Shaffner Creek which would store water for use in irrigating approximately 500 acres of land. A soil survey of this land by the Soil Conservation Service indicated that the land was suitable for irrigation. Development of this project can be accomplished when financial arrangements can be worked out with the interested landowners.

Bowman-Haley Dam - Project No. 216

During the past two years the State Water Conservation Commission has conducted a field survey to determine the quantity of water that would be required by municipalities and industries which might be supplied through the construction of the Bowman-Haley Dam. This data was turned over to the Corps of Engineers to be used in connection with their investigations to determine the feasibility of the project. The construction of the Bowman-Haley will provide this area of North Dakota an adequate and stable water supply that is needed if the development of lignite coal and uranium resources in the area is to be accomplished. See Bowman County Water Conservation and Flood Control District for further discussion.

Tolna Dam - Project No. 266

The State Water Conservation Commission made a topographic survey of this existing project on a scale of 400:1 to determine the feasibility of raising the existing spillway structure several feet to increase the storage capacity of the reservoir thereby enhancing the recreation opportunities of the project. A soil survey was also made to determine the stability of the present structure and additional structures that would be required. The dam is located in Section 18, Township 150 North, Range 60 West, in Nelson County. The reservoir covers approximately 250 acres with a storage capacity of 2,000 acre-feet of water. The project is being evaluated and a report will be made to the interested proponents.

Boysen Dam - Project No. 313

At the request of the local proponents, the Commission made a topographic survey and a soils survey of the Boysen Dam located in Sections 10 and 13 of Township 130 North, Range 101 West in Bowman County, to determine the cost of restoring the present project through the construction of a concrete spillway and reconstruction of the existing embankment section. The principal benefit from the project will be from the improved recreational opportunities including fishing, boating, and related activities. A possibility exists that a limited water supply may be available for industrial use from the project.

This proposed Boysen Dam would create an impoundment of 77 acres with a storage capacity of approximately 500 acre feet of water from a drainage area of 12 square miles. Ths maximum depth of water would be 17 feet.

Lake Metigoshe - Project No. 330

The State Water Conservation Commission has, during the past 20 years, investigated several proposals in an effort to determine a feasible method whereby water could be stored for use in maintaining the level of Lake Metigoshe near spillway elevation. From these investigations it has been determined that the most immediate procedure to provide this needed storage is by utilizing Sharpe Lake in Canada as a storage reservoir. To accomplish this proposal it will be necessary to construct a control structure at the outlet of Sharpe Lake and release water through the natural channel as required by Lake Metigoshe. The control structure would serve to raise the level of Sharpe Lake, thereby increasing its capacity and would permit the release of water from this lake to Lake Metigoshe as required. Sharpe Lake which has a surface area at the present of 717 acres would be raised approximately 8 feet to elevation 2165. A total of 8,000 acre-feet of usable storage would be available in Sharpe Lake for storage of water for Lake Metigoshe. Construction of the project is scheduled to begin as soon as the required easements are obtained from the Canadian landowners in the Sharpe Lake area.

Crosby Water Supply - Project No. 334

The present water supply being utilized by the City of Crosby is high in mineral content making it undesirable for domestic purposes including lawn sprinkling and garden irrigation. The Commission was requested by the City of Crosby to make an investigation in the area to determine whether or not a more potable supply of water could be obtained. Drilling operations were performed in the vicinity of the Long Creek reservoir, located approximately three and one-half miles north of the City of Crosby, which located an aquifer with a better quality of water in the immediate vicinity of the Long Creek Dam. It appears that this aquifer is being fed from the Long Creek Reservoir. The Commission proposes that quantity and quality tests be made on this water supply to determine whether or not an adequate and suitable supply exists for the City of Crosby. Should the supply be found to be adequate and of good quality, additional storage could be obtained in the Long Creek reservoir by adding eighteen inches on to the spillway crest of the Long Creek Dam. Examinations showed that the spillway was structurally sound and that the spillway elevation could be raised without detrimental effects upon the structure.

Balta Dam - Project No. 362

At the request of local proponents, the State Water Commission made an investigation of the Balta Dam site located in sections 14, 15 and 16, Township 154 North, Range 73 West, in Pierce County. Balta Dam initially was constructed by the W.P.A. during the 1930's but the rubble masonry spillway failed. The local proponents wish to have the spillway reconstructed so that a greater depth of water would be provided in the reservoir which would support better fishing. A topographic survey on a 400:1 scale was made to determine the amount of additional land needed to rebuild this project in accordance with the local proponents proposal. Plans and estimates have been made and submitted to the project sponsors for consideration and approval. The proposed dam would create a reservoir with a surface area of 110 acres and a storage capacity of about 750 acre-feet. Estimated cost would be $25,000.

Oliver Lake - Project No. 372

At the request of local proponents the State Water Conservation Commission made a topographic survey in the vicinity of Oliver Lake, located in Section 36 of Township 141 North, Range 85 West, in Oliver County, to determine whether it would be feasible to restore this slough into a waterfowl breeding and hunting area. The existing spillway structures for the project have failed. The area, at one time, was a Federal Game Refuge but the easements have expired and the property was returned to its original owners. The Commission's investigation indicated that the cost of rebuilding the required spillway and restoring this area would be approximately $30,000. Financial arrangements must be worked out with local proponents before construction of the project facilities can begin.

Ray Dam - Project No. 489

The Ray Dam, located in Section 22, Township 155 North, Range 97 West, Williams County, was investigated by the State Water Conservation Commission at the request of local proponents to determine the feasibility and costs of repairing and raising the existing spillway. Involved in this investigation was a topographic survey of the reservoir area and foundation materials survey of the site of the dam. Williams County, the North Dakota Game and Fish Department, the Ray Community Club, and the State Water Conservation Commission are cooperating in the project. It is proposed that the water level be raised 19 feet above the existing level by installation of an 84 inch multi-plate pipe drop spillway of the "glory hole" type. This type spillway will permit the use of the embankment of the dam as a roadway for a new county road that is being constructed in the area. Plans have been completed and approved by all participating groups. It is anticipated that construction of this project

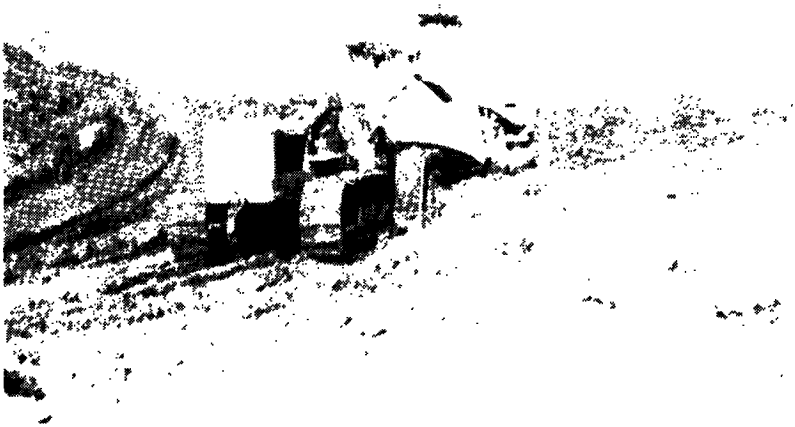
will get underway in the fall of 1958. Estimated cost of the project is $24,000. The impoundment will have a surface area of 50 acres with a storage capacity of 340 acre-feet. The maximum depth of water will be 28 feet.

Noonan Dam - Project No. 490

The Noonan Park Board requested the State Water Conservation Commission to make an investigation, consisting of a topographic map and soils survey, to determine the cost of repairing and improving the spillway on Noonan Park Dam located in Section 16 of Township 162 North, Range 95 West, Divide County. The existing dam has since been repaired by the Commission in cooperation with the Noonan Park Board at a cost of $1,500 through the use of pneumatically applied concrete. The maximum depth of water in this reservoir is approximately 11 feet and affords the community with an excellent swimming spot and fishing resort.

Wildwood Lake - Project No. 550

At the request of local proponents, a detailed survey was made by the Commission of Wildwood Lake located in Sections 8 and 17, Township 143 North, Range 81 West, in McLean County. The purpose of the survey was to obtain accurate descriptions of all property that



Construction of Diversion Canal
Hyatt Wildlife Propogation Project

would be flooded through the restoration of this lake by a diversion from Painted Woods Lake, located approximately two miles north of Wildwood Lake. Plans have been completed and the estimated cost of the project is $10,000. Local proponents are attempting to secure the necessary easements so that construction of the project can proceed.

Hyatt Wildlife Propagation - Project No. 556

Hyatt Slough is located in Sections 25 and 36, Township 129 North, Range 60 West, in Dickey County. The North Dakota Game and Fish Department purchased this property for the establishment of a duck propagation and public shooting area. Water for the project is supplied from the James River through a gravity diversion canal located along the North Dakota and South Dakota state line. The ditch has a capacity of 30 cubic feet per second, and is designed to maintain a water surface elevation in Hyatt Slough of 1288 feet (sea level datum). Upon completion of investigations by the Commission the project was constructed by the State Water Conservation Commission in cooperation with the Federal Fish and Wildlife Service. Ths project is now functioning. Authoritative sources contend that the project is outstanding in both of its intended functions.

Buffalo Lake - Project No. 565

At the request of the State Game and Fish Department, a survey was made of Buffalo Lake, located in Section 12, Township 152 North, Range 72 West, Pierce County, to determine the acreage that would be inundated if Buffalo Lake were raised approximately three feet so as to better support fish life and improve it as a usable recreational facility. Information relative to land and easements required has been turned over to the Game and Fish Department for negotiations with the affected landowners. Construction of this project can get underway when these easements have been obtained. The project possesses an excellent benefit to cost ratio.

Elk Creek Dam - Project No. 572

The Elk Creek Dam site is located in Sections 20, 21, Township 138 North, Range 104 West, in Golden Valley County. It is proposed that a dam be constructed in this area to provide for fishing and better fish management in this portion of Golden Valley County. A State Water Conservation Commission drill crew made a soils survey in the area but no suitable location could be found for the construction of a dam. All locations tested were underlaid with thick layers of lignite coal making construction of a water-tight earth fill dam extremely expensive.

Schmisek Lake - Project No. 575

Schmisek Lake, located in Section 11, Township 159 North, Range 93 West, Burke County is a small lake and located approximately five miles north of Powers Lake. This lake is spring fed and has an inflow of about one cubic foot per second. It is proposed that a dam be constructed to raise the level of the lake ten feet or more. This dam would create a large narrow impoundment about one and one-half miles long and an average of about 500 feet wide with a maximum depth of water of about 22 feet. The reservoir could provide ideal fishing and recreational facilities which are sorely needed in Burke County.

In the Commission's investigation of the project, the area was surveyed and soil borings were taken which determined that it was feasible to construct the proposed dam. The project has a natural spillway which would result in a lower project construction cost. Interested proponents are the Burke County Water Conservation and Flood Control District, North Dakota Game and Fish Department, and the Powers Lake Community Club. Preliminary design has been completed and local proponents are in the process of obtaining easements.

Missouri River Low Head Dams - Project No. 576

A proposal has been made that a series of low head multiple purpose dams be constructed on the Missouri River between Garrison Dam and Bismarck that will enhance recreational opportunities, stabilize the river channel, and provide road crossings over the Missouri River, particularly for the new federal interstate road system, thereby eliminating the costly bridge that would otherwise be required. Profiles were taken across the Missouri at various locations to determine the amount of earthwork needed to construct such a dam and to make preliminary estimates of cost. The proposals have been studied jointly by the North Dakota Highway Department and the State Water Conservation Commission and have now been referred to the U. S. Corps of Engineers for use in connection with the investigation that agency has been directed to make by Congress. Construction of multi-purpose dams would serve to attract industry to our state which would provide for an expanded and improved economy for North Dakota.

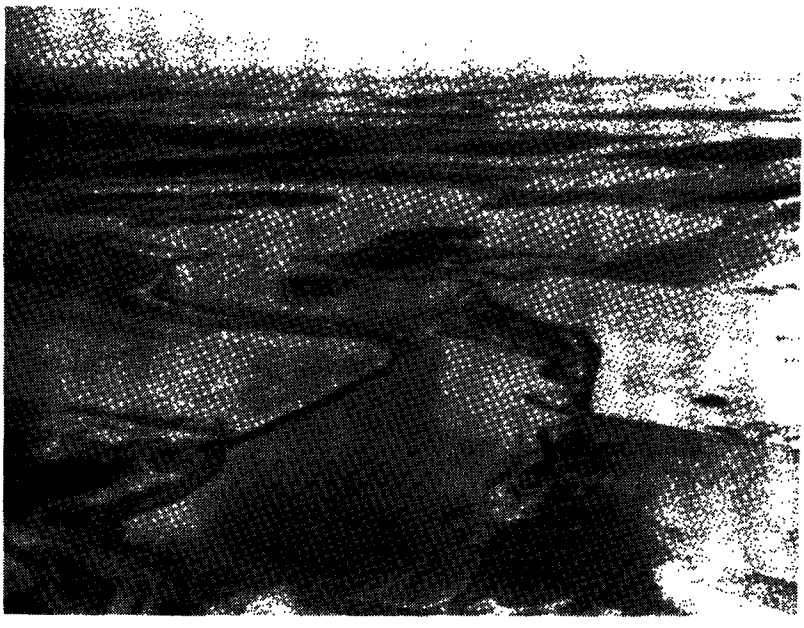
Bowbells Dam - Project No. 579

The State Water Conservation Commission has conducted an investigation in an effort to determine a means whereby the City of Bowbells could obtain an adequate municipal water supply. Several dam sites were investigated in the Bowbells area to locate sites where water could be stored and directed into water bearing aquifers adjacent to the proposed sites. The only location possessing good possibilities

is the site of the old C.C.C. dam located about two miles east of Bowbells on Stony Creek. Gravel and sand pockets were located by State Water Conservation Commission drill crews adjacent to the creek bed which could be used as natural filters and wells could be installed in the gravel beds. Hydro static pressure resulting from the reservoir would recharge the gravel beds. It would be necessary to relocate the city sewer system as the effluent is discharged into the proposed impoundment. Plans and estimates have been prepared by the Commission's engineering department and made available to the city. A ground water survey was made by the Commission in cooperation with the City of Bowbells in the area but an adequate water supply could not be located.

Beaver Creek Dam - Project No. 582

Several sites for dams on Beaver Creek in Stutsman County south of Jamestown have been examined and surveyed by the State Water Conservation Commission. The purpose of such a dam would be to provide recreational facilities for the area. A dam at one of the sites could be used to provide a roadway crossing for U. S. Highway No. 281. Feasibility reports will be prepared as soon as detailed surveys are completed.



Salt Lake — Walsh County

Alexander Dam - Project No. 584

Alexander Dam is located in Section 2, Township 137 North, Range 66 West, in Stutsman County. The Commission made a topographic site survey and prepared plans for repairs to the spillway. This dam, which provides recreational facilities in the Gackle area, was reconstructed by the State Water Conservation Commission, with the Stutsman County Park Board participating as the sponsoring agency.

Short Creek - Project No. 586

The State Water Conservation Commission investigated the Short Creek Dam, located in Section 4, Township 163 North, Range 93 West, in Burke County, to determine the condition of the existing spillway that was constructed in 1937 by the F.E.R.A., and also ascertain the cost of repairing and restoring the project. The estimated cost of the repairs is approximately $40,000. This impoundment created by this dam would have a maximum depth of over 17 feet, a surface area of 38 acres and a storage capacity of 250 acre feet. The drainage area is approximately 160 square miles. Financial arrangements by project cooperators have not yet been completed.

Nome Dam - Project No. 587

A topographic survey was made on the old Nome Dam, located in Section 19, Township 137 North, Range 56 West, Barnes County, to determine the feasibility of restoring this old W.P.A. dam. The original rubble masonry spillway collapsed and a new spillway is needed. The dam has a maximum depth of seventeen feet and the impoundment would have a surface area of 16 acres with a capacity of 55 acre-feet of water. The cost of replacement of the spillway will be between $20,000 and $25,000.

Crooked Lake - Project No. 590

At the request of the State Game and Fish Department, a topographic survey was made by the State Water Conservation Commission on Crooked Lake, located in Sections 4, 5, 8, and 17 of Township 148 North, Range 80 West, McLean County, to determine the amount of land that would be affected if a control structure was placed at the outlet of Crooked Lake so as to raise Crooked Lake one foot higher than the culvert through State Highway No. 41. Raising this lake would afford better facilities for fishing and recreation. Information from this survey has been turned over to the Game and Fish Department for use in negotiating with the landowners concerned.

Sherwood Water Supply - Project No. 593

An investigation for a ground water supply by the State Water Conservation Commission located a very promising water bearing aquifer in the vicinity of Sherwood which has been developed and now provides the city with an adequate water supply. This aquifer is located within one mile of the city. Pumping tests were conducted by a commercial well drilling firm which proved the supply to be an adequate one before installation. The survey by the Commission resulted in locating the city wells three miles closer to Sherwood than previously anticipated.

Silver Lake Restoration - Project No. 597

At the request of local proponents, the State Water Conservation Commission made a topographic survey of the Silver Lake area in Richland County, North of Lidgerwood to determine the possibility of maintaining a chain of lakes in this area at a constant elevation to enhance its value as a duck propagation area. The area consists of three sloughs and it is proposed that a diversion dam be built on the Wild Rice River so as to permit the diversion of water from that river to the lake area. It is possible that the water could be run by gravity through the entire chain of lakes, eastward past Hankinson and then returned again to the Wild Rice River northeast of Hankinson. This project is presently in the planning stage. The surface area of the three lakes is 745 acres and has an average depth of five feet. Preliminary costs on the first stage of development, which includes construction of the diversion dam on the Wild Rice River to accomplish this lake restoration, is $18,000.

James Dam - Project No. 598

James Dam is located in Sections 32 and 33, Township 150 North, Range 101 West, southwest of Rawson, North Dakota in McKenzie County. A topographic survey was made of this site by the State Water Conservation Commission to determine whether or not it would be feasible to restore the project. The James Dam was originally built by the W.P.A. during the 1930's and the grass spillway has eroded, lowering the water surface of the reservoir considerably. The dam presently holds approximately seven feet of water and could easily be raised to provide a depth of water sufficient for good fishing. Further study is needed to determine the advisability of repairing this dam.

Crystal Municipal Water Supply - Project No. 600

Crystal is a small community located in the southwestern part of Pembina County. This municipality requested the aid of the State Water Conservation Commission in trying to find a suitable municipal water supply. The area is typical of the Red River Valley in that

it does not have an available groundwater source that can be developed. The Commission's investigation was directed toward locating a suitable municipal water supply from existing surface sources. Cart Creek flows through the edge of Crystal and it is proposed that water from this creek be used. A topographic survey was made to determine the best site for a reservoir which could be operated so as not to retard the flow in the creek and yet provide an adequate storage capacity for the city's water needs. The Commission has proposed that an 80-foot wide channel dam be constructed at an estimated cost of $25,000.

North Salt Lake - Project No. 602

North Salt Lake, located in Walsh County, northeast of Grafton, is an area covering about 400 acres and has a drainage area of five square miles. When this area fills to its outlet, it drains across the flats southward into the Park River leaving saline deposits on this soil. It has been proposed that a dike and outlet structure be built so that the lake would contain all the runoff making it into a waterfowl breeding area and also alleviate the drainage problem. A topographic survey was made by the State Water Conservation Commission and the project is presently under study.

Upper Mauvais Coulee Survey - Project No. 604

A topographic survey on a scale of 1000:1 was made on a tributary of Mauvais Coulee in Paulson Township north of Cando in Towner County. This survey covered approximately 44 square miles of terrain typical of that which drains into Mauvais Coulee. This survey was made to provide data for a study to determine the cost of improving the Mauvais Coulee channel, and providing a suitable outlet into Devils Lake. This information has been compiled and has been made available to the Corps of Engineers for further consideration and use in the design of the project. This and other data that has been gathered will be the basis for the planning to alleviate the flood problems in the Devils Lake area.

Tobacco Garden Creek - Project No. 605

A topographic survey and a soil survey were made of a dam site on Tobacco Garden Creek north of Watford City for the purpose of determining the possibilities of developing this area into a recreational park. The site is ideal from a topographic standpoint, but the soil survey revealed that the subsoil in the valley contains a great deal of quicksand, which would make construction of an earthfill dam virtually impossible.

Dimmick Lake - Project No. 606

A survey was made by the State Water Conservation Commission of the Dimmick Lake area east of Watford City to determine the gradient between Little Dimmick and Big Dimmick Lakes and to a tributary of Tobacco Garden Creek, to determine if it would be feasible to drain these lakes. It was found that the gradient between the two lakes was eastward and that cuts of up to 19 feet would be required to connect the two lakes. To route the water to Tobacco Garden would be more difficult. At the present time, excavation costs would make drainage of these two lakes prohibitive. Future agricultural demands may increase land values to the point where it may be economically feasible to construct this project.

Marion Dam - Project No. 611

A soil foundation survey was made of Marion Dam located in Section 23 of Township 136 North, Range 62 West, in LaMoure County. This dam was originally constructed by the W.P.A. in 1937, but the reservoir has not held water due to excessive seepage. It was found that the area is underlain with a gravel and sand layer which reaches the surface in the reservoir area. This layer permits seepage of water from the reservoir under and around the earthfill dam. The only solution to the problem would require the placement of a piling cutoff wall completely across the valley where the earth embankment is located. Construction of the wall would cost approximately $26,000. This project appears infeasible under present economic conditions.

Arnegard Dam - Project No. 613

The State Water Conservation Commission made a topographic survey of a dam site located in Section 4, Township 150 North, Range 100 West, McKenzie County, that was proposed to be developed to provide a recreational area. The proposed dam would create a reservoir with a maximum depth approximating twenty-eight feet and would back water into the existing Pischek Dam. The reservoir when complete would be one mile longer than the existing reservoir The Pischek Dam is in poor condition, and this new reservoir would provide better facilities than are now available. It is proposed that a concrete chute spillway be installed for the Arnegard project. The estimated cost of the project would be approximately $23,000. A foundation study of this site indicated the soils to be suitable for the construction of the proposed earthfill dam.

Ellendale Municipal Studies - Project No. 615

The State Water Conservation Commission conducted a groundwater study in an effort to locate a good potable supply of groundwater for municipal use. The City of Ellendale presently has

a well on the east edge of the city near the edge of Dry Branch Creek. This water bearing aquifer is limited in depth and quite near the surface. The Commission investigated the area along Dry Branch Creek south to the South Dakota state line in an effort to find a suitable site at which a dam could be constructed which would maintain the water table in the aquifer from which the city's water supply is obtained. It was determined that the aquifer approaches the ground surface approximately one hundred yards north of the south border of Section 24, Township 129 North, Range 63 West.

The dam could be constructed by driving a sheet steel piling cutoff wall across the valley thus creating an underground reservoir. Estimated cost of developing this project is approximately $13,500. A surface reservoir could also be incorporated in this project but the new city well would have to be raised to be protected from flooding. Further investigation is needed if a surface reservoir is to be added to this project.

Hunter Water Supply - Project No. 619

The City of Hunter requested the aid of the State Water Conservation Commission in locating a water supply adequate for their needs. A topographic survey and soil foundations survey were made in the area of the stream on the west edge of the town. It was found that a large area of this vicinity underlain with sand provides a condition that would permit the entrainment of water in this underground reservoir from a surface reservoir. Utilizing such a reservoir would eliminate the need for a water treatment plant in that the natural sand aquifer would act as a filter.

Included in this project proposal is a dam that would create a reservoir having a maximum depth of water of 16 feet and a storage capacity of 360 acre-feet. This project is presently in the planning stage.

Apple Creek Fish Rearing Ponds No. 1 - Project No. 621

At the request of the State Game and Fish Department, the State Water Conservation Commission made a topographic survey of an oxbow on Apple Creek east of Bismarck to determine whether it would hold sufficient water to serve as a fish rearing pond. It is proposed that water be pumped into the oxbow when flood flows exist in the spring of the year. A control structure would be built at one end of the oxbow so that water could be drained to facilitate retrieving the fish so they could be planted in various lakes and reservoirs throughout the state. The oxbow has a storage capacity of 35 acre-feet and a total surface area of nine acres. This is an ideal site for a fish rearing pond and the project is in the final planning stage.

Rice Lake - Project No. 622

In cooperation with local proponents, the State Water Conservation Commission conducted a topographic survey on Rice Lake, located north of Sterling in Burleigh County. The object of the survey was to gather data to determine if this lake could be restored to its original level so as to make it an ideal waterfowl breeding area. The lake was drained during World War I in an attempt to put more crop land into production for the war effort. This project would be inexpensive as only a small control structure is needed in the outlet ditch to restore this lake. It is proposed that the level of the lake be raised 1½ feet above its present level.

Jamestown River Channel Change - Project No. 624

At the request of the City of Jamestown, a survey was made to determine the amount of excavation required to accomplish a proposed channel change in the James River north of the State Hospital. Also proposed in conjunction with this change is the construction of a new bridge to replace the condemned Hospital Bridge over the James River. The channel change will permit a more unrestricted flow in the James River in the Jamestown vicinity. The spoil material from the channel change could be deposited in the present channel bed to provide additional land for future use. This channel change will be constructed with sufficient capacity to handle future requirements for flood control for Jamestown. The new channel would have a bottom width of 90 feet and a capacity of 16,600 cubic feet per second. Total excavation required is 225,000 cubic yards and the total length of the channel change would be 9,000 feet.

Mayville Dam - Project No. 625

At the request of the City of Mayville, the State Water Conservation Commission made a soils survey of the present dam site located on Goose River near Mayville, to determine the cost of raising the present water surface of the reservoir between two and three feet. This dam and reservoir are used as a source for Mayville's municipal water supply. The Commission proposes that a sheet steel piling cutoff be driven approximately 25 feet upstream from the present dam to the desired crest elevation and the area between the two piling curtains be filled with rock. This would provide the most economical solution to the problem. Cost estimates and detailed plans are being drawn up and will be presented to the local proponents for their consideration.

Upper West Souris Flood Control - Project No. 626

The State Water Conservation Commission has investigated the flood problems that exist in the area included in the Upper West Souris Conservation and Flood Control District. The major portion of this watershed is made up of cultivated lands which lie in a bowl

shaped basin in the Tolley area. Drainage and water management and control on the higher area around the Tolley Flats cannot be accomplished without first solving the problem of finding an outlet for the water from these flats. One solution would be to build a drain in the low lands to the head of Macabee Coulee so the drainage water could be directed into Lake Darling on the Souris River. Several alternate routes are being considered to determine the most economical and practical solution to the flood problems. Construction of an outlet drain from the Tolley Flats to the Souris River will permit good conservation practices on all lands leading into this Tolley flats area. The Soil Conservation Service and the Corps of Engineers, U. S. Army, are expected to participate in this project.

The total production lost from flooding during wet years is approximately 20,000 acres and these losses have occurred about nine out of every ten years since the drought of the 1930's.

The Ancient Channel of the Missouri River and Its Tributaries

Engineers from the State Water Conservation Commission have expressed interest in the redefining of the Ancient Channel of the Missouri River and its tributaries. While it has been definitely established that the Missouri River at one time had its escape through the Hudson Bay, no definite watercourse has been re-established. It is felt that the lower ice cap that constructed the max moraine may

Topographic Survey Crew

have filled the channel of the Missouri River with sufficient rock and gravel to provide a water bearing aquifer. Many believe that the Ancient Channel is in the vicinity of the Little Muddy north of Williston.

Findings by seismograph crews tend to substantiate this thinking. Several artesian wells have been encountered which have been almost impossible to permit controlled flow. The City of Crosby has likewise found a supply of good quality water to the east of that city. Some are of the opinion that this is an extension of the Ancient Channel of the Missouri River.

The State Water Conservation Commission crew has been authorized to investigate the area for its water bearing potential. The crew plans to commence activities in that area no later than October 15th. Work will be commenced in the lower reaches of the Little Muddy River and extend upward as geological conditions dictate. The work will be a cooperative venture with the Groundwater Branch of the United States Geological Survey. It is hoped that an adequate supply of good water may be obtained to afford irrigation and use in municipal and industrial endeavors.

Efforts will also be made to trace out the channel of the Little Missouri River which was also affected by the closure made by the polar ice cap. It is believed that this channel extends from the Little Missouri River through a valley west of Watford City and into Tobacco Garden Creek. This, too, has been substantiated to a certain degree. State Water Commission drill crews a year ago attempted to locate a dam site on Tobacco Garden Creek just north of Watford City. While their findings virtually eliminated the construction of a dam at that site, they did indicate that a considerable water bearing aquifer was available in that location. It is possible that this situation may lead to a more important water development facet as the Commission crews plan to develop and explore this potentiality.

BENCH MARKS

Much information is available to State and Federal agencies as well as consulting firms relative to currently established bench mark elevation based on sea level datum. The State Water Conservation Commission which cooperates with various federal agencies in compiling sea level datum in North Dakota maintains a record of all bench mark elevations established in the state through the Topographic Branch of the U. S. Geological Survey and the Coast and Geodetic Survey. This information has been further supplemented by many of the permanent elevations established by the Corps of Engineers and the U. S. Bureau of Reclamation.

In an attempt to encourage the use of sea level datum throughout the state a list of bench marks, elevations and descriptions of their locations have been made available to the various consulting engineer

firms operating in North Dakota. The adoption of sea level datum by these firms will aid materially in identifying many of the major construction features in our state with this datum.

The value of associating surveys and structures will be significant because it will provide an immediate comparison of such existing structures as dams, highways, streams and lakes with projects being planned. Little or no additional cost should be involved in the use of sea level datum as all cities and villages in the state have sea level datum bench marks within or adjacent to their boundaries. The State Water Commission is in the process of establishing sea level datum on all of its projects. The following is a list of the dams and projects where this datum has been employed. It is being contained herein to provide interested parties with additional bench mark elevations.

Should any person desire to obtain a list of sea level datum bench marks for use in conjunction with projects in North Dakota the information can be obtained by writing to the North Dakota State Water Conservation Commission.

Bismarck Country Club Dam*

Project No. 412, Burleigh County

Location: Section 4, Township 138 North, Range 79 West

Located on top of north retaining wall on west side of combination bridge and dam, southeast of Club House.

Bench Mark Elevation: 1662.12 MSL.

Located on top of northwest corner of concrete pipe support located on south side of pumphouse, approximately 170 feet northeast of bridge. Bench Mark Elevation: 1661.43 MSL.

Spillway Crest Elevation: 1656.30.

Bucephalia Dam*

Project No. 601, Foster County

Location: Section 4, Township 145 North, Range 64 West

SHM No. 2, located in southwest corner of SE¼ of Section 4, Township 145 North, Range 64 West, approximately 97 feet southwest of west edge of west retaining wall of dam, along a fence line. Three feet west of a corner post, and surrounded by large rocks. An iron pin set in top of a concrete post protruding six inches above the ground marked "State Engineer, SHM No. 2, El. 1484.68."

Bench Mark Elevation: 1484.68 MSL.

Spillway Crest Elevation: 1475.10.

Lehr Dam

Project No. 377, McIntosh County

Location: Section 2, Township 132 North, Range 70 West

BM, located in the northwest one-fourth of the section, on a hill, approximately 50 feet south of a telephone pole, on the south side of an east-west road and 330 feet north of the north end of the

spillway. A steel pin set in the top of a concrete post protruding six inches above the ground, marked "State Engineer 1958, El. 2063.24".

Bench Mark Elevation: 2063.24 MSL.

Spillway Crest Elevation: 2038.2.

Ray Dam*

Project No. 489, Williams County

Location: Section 22, Township 155 North, Range 97 West

BM No. 6, concrete monument located along an east-west section line fence, 100 feet west of the original quarter corner stone of the north line of section 22. A steel rod set in top of a concrete post and marked "State Engineer BM No. 6".

Bench Mark Elevation: 2152.87 MSL.

Spillway Crest Elevation: 2120.00.

Yanktonai Dam*

Project No. 364, McLean County

Location: Section 30, Township 143 North, Range 80 West

Top of a three-eights inch iron rod located one foot east of pasture corner fence post, approximately 70 feet southeast of the spillway of the dam.

Bench Mark Elevation: 1837.92 MSL.

Spillway Crest Elevation: 1826.45.

Schultz Dam*

Project No. 540, Burleigh County

Location: Section 10, Township 140 North, Range 80 West

Chiseled square on top west end of south concrete footing, under an old railroad car storage bin, located 200 feet northwest of spillway structure.

Bench Mark Elevation: 1830.54 MSL.

Spillway Crest Elevation: 1825.14.

Danzig Dam*

Project No. 374, Morton County

Location: Section 36, Township 140 North, Range 87 West

A chiseled square on top of south abutment, Danzig Dam, located in the SE¼ of the section.

Bench Mark Elevation: 2112.97 MSL.

Spillway Crest Elevation: 2105.07.

Gascoyne Lake Dam*

Project No. 557, Bowman County

Location: Section 32, Township 131 North, Range 99 West

Top of a railroad spike driven into west side of a tree. Located approximately eight feet north of the northwest corner of ladies bath house on the southeast end of the reservoir.

Bench Mark Elevation: 2750.06 MSL.

Spillway Crest Elevation: 2746.9.

Spring Lake Dam*

Project No. 388, Bowman County

Location: Section 30, Township 132 North, Range 104 West

A chiseled square on the southwest corner of a concrete walk leading to men's bath house at Spring Lake.

Bench Mark Elevation: 2964.22 MSL.

Spillway Crest Elevation: 2959.03.

Braddock Dam*

Project No. 264, Emmons County

Location: Section 4, Township 135 North, Range 75 West

Spike in south side of corner brace post on fence corner located 300 feet north of spillway on north side of creek.

Bench Mark Elevation: 1855.97 MSL.

A chiseled square painted red in top east abutment of spillway.

Bench Mark Elevation: 1865.66 MSL.

Spillway Crest Elevation: 1860.29.

Temvik Dam*

Project No. 441, Emmons County

Location: Section 5, Township 133 North, Range 76 West

A chiseled square painted red on a large rock, marked by a 2x4 post, located 350 feet east and 200 feet south of the east end of spillway, on the west bank of an old pit.

Bench Mark Elevation: 1894.58 MSL.

A chiseled square on east abutment of spillway.

Bench Mark Elevation: 1891.56 MSL.

Spillway Crest: 1889.11.

Nieuwsma Dam

Project No. 512, Emmons County

Location: Section 26, Township 129 North, Range 75 West

An iron pin set in concrete, located 75 feet west of west edge of spillway, and 12 feet north of a large rock marked with a white painted arrow. Marked "State Engineer BM No. 1 1958, El. 1801.86".

Bench Mark Elevation 1801.86 MSL.

Spillway Crest Elevation: 1780.3.

Jund Dam

Project No. 242, McIntosh County

Location: Section 19, Township 129 North, Range 72 West

BM No. 2, located 335 feet west of west edge of spillway and 15 feet south of corner post on fence running parallel to dam. Four feet southeast of corner post, an iron pin set in concrete protruding three inches above ground and marked "State Engineer 1958, BM No. 2, El. 2001.46".

Bench Mark Elevation: 2001.46 MSL.

Spillway Crest Elevation: 2000.2.

Wyard Dam*

Project No. 467, Foster County

Location: Section 19, Township 146 North, Range 67 West

SHM No. 1, 52.2 feet northwest of northwest corner of spillway, 174 feet east from fence corner on east-west fence, on a dirt knob, an iron spike set in concrete protruding six inches above ground and marked "State Engineer SHM No. 1 1958, El. 1576.83".

Bench Mark Elevation: 1576.83 MSL.

Spillway Crest Elevation: 1569.9.

Welk Dam

Project No. 400, Emmons County

Location: Section 33, Township 130 North, Range 77 West

SHM No. 3, 665 feet east of east edge of spillway, 130 feet south from east-west fence line on ¼ line. An iron pin set in concrete post, protruding three inches above ground and marked "SHM No. 3, State Engineer 1958, El. 1874.39."

Bench Mark Elevation: 1874.39 MSL.

Spillway Crest Elevation: 1839.9.

*Indicates survey prior to July 1, 1958

WATER RIGHTS

Laws governing the appropriation of water from surface and ground water sources for beneficial use are becoming more important as the demand for water for irrigation, municipal, industrial and other uses grows. This increasing emphasis on water right laws in North Dakota is indicated by the greater number of water right applications filed with the State Engineer and the State Water Conservation Commission than has been experienced in the past. More and more water users in North Dakota recognize the importance of establishing and protecting their priority to use water from various sources by filing an application for a water right as provided by statute.

The North Dakota State Engineer and State Water Conservation Commission are designated by statute as the responsible state agencies for the administration of laws pertaining to the appropriation of water. It has been apparent for many years that in order to effectively administer our state laws governing the appropriation of water that a thorough investigation of all existing water right applications and established water rights would be required. Such an investigation would reveal the status of these applications and rights including a determination of whether or not existing state laws are being complied with and the extent to which various rivers and streams are under or over appropriated.

The North Dakota State Legislature in 1955 recognized the need for a study of this nature by appropriating $12,000.00 to the State Water Conservation Commission to conduct a Water Right investigation. In conducting this authorized investigation the Commission undertook an extensive review of all water right applications and filing, including actual field investigations as to the present ownership and use of water covered by the water right application. The study was valuable in providing the basis for recommendations of amendments to various provisions of our state laws governing the appropriation of water. It also served to provide the Commission data that could be utilized in setting up rules and regulations for the administration of the water laws.

In January, 1957, the State Water Conservation Commission published a report entitled "The Water Right Status Report", covering the findings of the investigation and the recommendations of the Commission. Copies of this report have been widely distributed to interested agencies and individuals. The information contained on the following pages of this report is a summary of that contained in the January, 1957, report of the Commission. Copies of the full report or information as to individual water rights is available upon request to the State Water Conservation Commission.

The Water Right Status Report of the North Dakota State Water Conservation Commission to the Governor of North Dakota January 1, 1957

Forward

Generally in the United States we point with pride to our bank of natural resources. In most instances our pride is justified. One natural resource in short supply is water. Abundant rainfall occurs only in small areas in the Northwest and Southeast. Most other areas in the United States are frequently faced with periods of deficient rainfall. North Dakota falls in this category. In some years the entire State has been faced with severe drouth periods. Almost annually some section of the State is confronted with drouth during the growing season. As a result of these deficiencies more and more controversies are developing over presently stored water and the use of future water storage possibilities.

Cities and industries, in selecting their sites and plant locations, frequently fail to recognize water availability and choose sites which do not afford an adequate supply of water for sustained use. Factories are occasionally abandoned, or whenever the opportunity exists, demands for water are made on areas that appear to have a more plentiful supply. This plentiful supply may occur in some areas because of under-development, favorable geographic conditions, storage reservoirs or a combination of all three.

North Dakota falls in the latter category. The Missouri River provides an ample supply of water for all but the western portion of our State for which, because of geographic conditions, it is impossible to provide a feasible diversion plan.

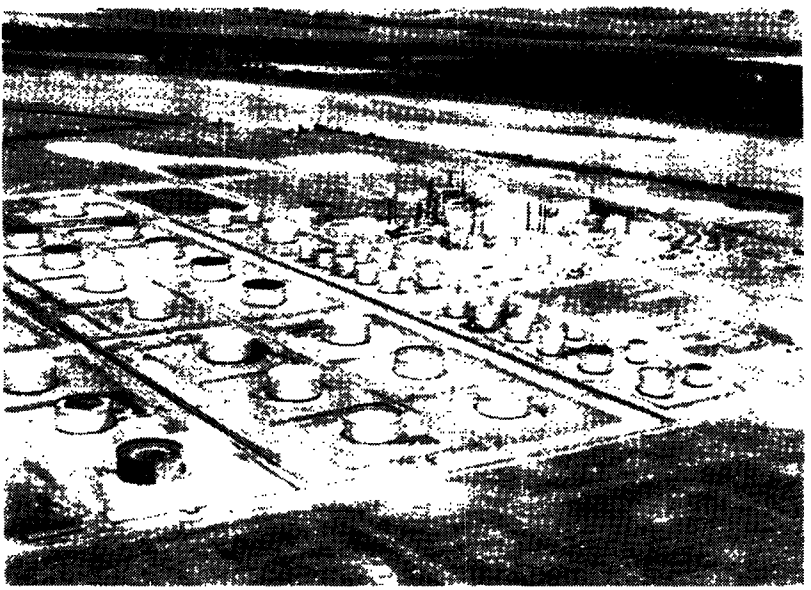
The State Water Conservation Commission has, with other project proponents, obtained the construction of Garrison Dam which will provide the State with an ample supply of stored water. Much of the water which will be stored in the future should be regarded as "money in the bank", as it will be available to North Dakota if we decide to use it. Should present plans for the diversion of Missouri water in North Dakota materialize, North Dakota would have an abundance of water for irrigation, hydroelectric power, municipal, industrial and recreational purposes. We should not waste time in utilizing this water for irrigation, municipal and other uses if we are to avoid future controversies that may compare with some of those that are already going in full tilt.

There are presently water disputes between New York and Philadelphia in the East; California, Arizona, Nevada, New Mexico, Oregon

and Colorado in the West. However, we do not have to look beyond our own boundaries for a water dispute as we in North Dakota are also endeavoring to retain as much of the Souris River water for our own use. Saskatchewan and Manitoba are attempting to obtain additional allocations for municipal, industrial and irrigation purposes. The Souris River is a rather minor stream when compared to the Missouri but it is very possible that the demands for water from it indicate what may occur on the Missouri and other major streams that flow through our State.

Ohio, which is heavily industrialized, is now consuming water at the alarming rate of 1300 gallons per day per person. They anticipate doubling the usage in the near future as industry continues to expand. It is doubtful if a State, such as Ohio, can supply water to meet this increased demand. Should States, such as North Dakota, fail to attract new industry and should these industries elect to locate in the submarginal water areas, it is conceivable that cities and industries will be forced to return cooled and cleaned water to streams or underground for reuse. This would be an expensive procedure and should be a factor to be considered by industry when selecting new sites.

Water disputes are brought to your attention to exemplify the desirability of obtaining water rights for all water uses in North Dakota.



Standard Oil Refinery, Mandan

Our State law also recognizes the right of appropriation as well as the riparian right. As a consequence, it may be possible for a water consuming project to file and establish a water right on a stream that is vital to the water supply of recognized users who have not protected their use with a water right. Under our statutes the first right is the best right and litigation could follow.

Possibly the procedure of the Court would be an evaluation of the situation on the basis of the most people benefited. The city or town involved would more than likely obtain a right to the water. However, the Court would, no doubt, provide that the city or town involved would be required to satisfy the claim of the first parties obtaining a water right on the stream or ground water supply in question for the reason that a water right is a property right. Our Constitution provides that no one can be deprived of property without due process of law. This could, of course, be expensive to the municipality.

It would seem only logical then to recommend to our present water users the desirability of securing a water right. Much of our water flows from our State into other States or into Canada. Demands on the part of downstream out of State water users are being constantly increased. It is very possible that downstream requirements may be sufficient to make demands on our water if we do not assert our needs through water right filings. Certainly the residents of North Dakota should obligate all the water we are now using in our State and a reasonable amount of what we plan to use in the near future.

North Dakota has vast deposits of lignite coal within its boundaries. It has been estimated that the deposits total 300 billion tons of usable lignite. This resource should at sometime in the foreseeable future attract industry to our State. However, it should be recognized that water is almost essential to the successful operation of any lignite consuming industry. Most advocates of lignite using industries specifically point out its value in thermal power generation. Thermal power generation plants require large quantities of water for cooling purposes. Likewise most industries that will be attracted to the State to take advantage of the thermally developed electric energy require large quantities of water. It becomes apparent that our future industrial expansion is dependent on our available water supply. It will be necessary to obligate and obtain a priority on this most important resource at an early date as the development of our other resources are dependent upon it.

Irrigation is the greatest single user of fresh water in the U.S.A. with a use approximating 120 billion gallons daily. Industry, including steam plants, use almost as much as irrigation. The following table presents an example of the water requirements for the manufacture of several products.

Product	Unit	Gallons of Water Required Per Manufactured Unit
Gasoline	Gallon	10
Beer	Gallon	300
Coke	Ton	3,600
Finished Steel	Ton	65,000
Synthetic Rubber	Ton	600,000

The Supreme Court of the United States ruled in favor of Nebraska over Colorado when a downstream Nebraska user with the prior right was deprived of water by a water development project in Colorado. This particular case occurred on the South Branch of the Platte River, which has its source in Wyoming and Colorado. The Supreme Court of the United States recognized the stream as a basin and not as a segment thereof and the State boundary was of no consequence.

Appropriation of Water in North Dakota

Section 61-0402 of the North Dakota Revised Code provides that "Any person, association or corporation intending to acquire the right to the beneficial use of any waters, before commencing any construction for such purpose, or before taking the same from any constructed works, shall make application to the State Engineer for a permit to appropriate." Chapter 61-04 of the North Dakota Revised Code sets out the provisions and procedure to be followed in obtaining water rights which generally require the following:

Steps Necessary to Obtain a Water Right

1. Make a survey and prepare map and application (in duplicate) in accordance with the detailed instructions below.

2. Send application (in duplicate) and map to the State Engineer's Department, Bismarck, North Dakota, accompanied with the proper filing fee.

3. If either application or map is defective or unsatisfactory to the State Engineer, he must, within 30 days after receiving them, return them to the applicant for correction.

4. The applicant must amend and refile the application and map in the office of the State Engineer within 60 days after they have been returned to him for correction in order to retain the priority of his claim as of the date of the original filing.

5. Upon receipt of a correct application (in duplicate) and map, the State Engineer, if the application is correct and proper, will prepare a Notice of Heading which he will send to the local newspaper of the county in which the diversion is to be made. The cost of this publication is to be paid by the applicant.

6. An Affidavit of Publication of this Notice must be received in the office of the State Engineer on or before the date of the hearing.

7. A date of public hearing in the office of the State Engineer is set in the notice of appropriation of water at which time any objections to the approval of the application must be made.

8. Appeal from a decision of the State Engineer must be made by the applicant to the district court of the county in which the proposed diversion is situated within 60 days after the State Engineer has acted on the application.

9. The granting of a permit by the State Engineer shall be approved by the State Water Conservation Commission.

10. If the application is approved, the applicant must begin construction in time to complete one-fifth of the work in one-half of the time allowed in the application for completion.

11. When the work is completed, the applicant must notify the State Engineer who will cause it to be inspected and if found satisfactory will issue a Certificate of Completion.

The ability to properly administer a water right program is dependent on background information. This information comprises:

A. Availability of water records on flow of the stream from which water is being diverted.
B. A record of the present water users on the stream.
C. The quantity and quality of water being removed from the stream.
D. The period of time of use.
E. The purpose of use such as irrigation, municipal and industrial.

Since the provision for the appropriation of water was made in the North Dakota Code in 1905, over 800 water right applications have been filed with the State Engineer for purposes of irrigation, municipal or industrial uses. Water rights established prior to the enactment of the 1905 law are recognized as valid and vested rights. The right to use water for irrigation becomes appurtenant to the land to be irrigated and the transfer of title to the land carries with it the right to the beneficial use of water.

Authorization and Method of Survey

In keeping with the constantly increasing demand upon the water resources of our State, water right applications are increasing. At the time the 1955 Legislature convened, over 800 water rights and water right applications were on file in the Office of the State Water Conservation Commission. From 1905 to 1950, approximately 375 applications have been received, and during the six year period 1950-1956, over 425 new applications have been filed. These water right filings are almost entirely for irrigation use. This increase in filings is due partly to the popularity of modern portable sprinkler irrigation systems but mainly because many of our farmers realize the value of being able to provide water for crops when needed, which will assure

them the stability required for successful livestock and agriculture production. With the increase of water right applications, the need for extreme caution in approving them has become apparent in order to prevent the over-appropriation of water of many of our streams. Many of the water right applications filed with the State Engineer may not be valid existing rights because they have not been developed as required by law or the facilities have been abandoned.

The information contained in the report has been obtained largely through personal contact. Interviews were held with valid water right holders, applicants and "old timers" who were aware of diversions from streams and water uses. Questionnaires were mailed to several hundred persons who made water right filings in the office of the State Water Conservation Commission. Replies were received from 138. The questions were identical to those asked by the interviewer.

Following is a summary of water right filings investigated in this study during the period July 1, 1954 to December 15, 1956:

Water right applications filed as of December 15, 1956	699
Water right applications pending approval	26
Water right applications pending construction completion	202
Water right applications investigated	610
Counties investigated	47
Projects operating during last four years	182
Projects never completed	110
Railroad water right applications	59
Railroad projects operating	31
Souris River water rights (right recognized by use)	20

Gravity Irrigation

Following are tabulated all water right applications by counties and information compiled as to water use, past and present:

County	Number water right filings**	Operative water rights***	Total acreage applied for	Total acreage irrigated
Adams	16	4	1,382	198
Barnes	10	6	215	205
Billings	12	4	1,709	193
Bottineau	3	2	180	0
Bowman	17	10	2,049	834*
Burke	1	0	5	0
Burleigh	13	4	1,619	375
Cass	2	4	3,280	654*
Cavalier	3	1	86	0*
Dickey	8	7	1,151	552*
Divide	5	2	515	121
Dunn	37	6	4,591	321*
Eddy	4	3	110	110
Emmons	5	0	478	1
Foster	2	1	75	0
Golden Valley	1	0	0	0
Grand Forks	6	3	170	0*
Grant	16	2	13,971	2,546
Griggs	2	1	0	0
Hettinger	26	13	1,721	321
LaMoure	5	1	515	2*
Logan	1	0	2,560	0
McHenry	12	8	2,310	8,232
McKenzie	73	26	16,300	27,377
McLean	13	2	4,010	110
Mercer	11	3	580	159
Morton	20	5	1,028	86
Mountrail	55	4	3,540	545
Nelson	4	2	145	20*
Oliver	8	1	2,659	2,039
Pembina	5	2	121	0*
Ramsey	5	3	0	0*
Ransom	5	2	85	21*
Renville	9	2	884	77
Richland	3	1	212	0*
Sioux	7	1	157	18
Slope	9	5	1,223	145*
Stark	37	14	4,375	953
Steele	1	1	0	0
Stutsman	8	4	606	234
Traill	5	3	266	26*
Walsh	7	3	0	0*
Ward	44	25	2,880	1,805
Wells	2	1	640	320
Williams	168	20	24,702	24,611
	726	212	103,105	73,211

*Not yet investigated

**Excluding those pending construction completion

***Those operating within the period 1953-1956.

Groundwater

The 1955 Legislative Assembly amended Section 61-0101 of the North Dakota Revised Code of 1943 to read as follows:

"SECTION 1. AMENDMENT.) That Section 61-0101 of the North Dakota Revised Code of 1943 be amended and re-enacted to read as follows:

"SECTION 61-0101. WATERS OF THE STATE; PUBLIC WATERS.) All waters within the limits of the State from the following sources of water supply, namely:

"1. Waters on the surface of the earth excluding diffused surface waters but including surface waters whether flowing in well defined channels or flowing through lakes, ponds, or marshes which constitute integral parts of a stream system, or waters in lakes; and

"2. Waters under the surface of the earth whether such waters flow in defined subterranean channels or are diffused percolating underground waters; belong to the public and are subject to appropriation for beneficial use and the right to the use of these waters for such use, shall be acquired pursuant to the provisions of Chapter 61-04 of the Revised Code of North Dakota of 1943 and acts amendatory thereof.

"SECTION 2. RECIPROCAL RIGHTS OF RIPARIAN OWNERS.) The several and reciprocal rights of a riparian owner, other than a municipal corporation, in the waters of the state comprise the ordinary or natural use of water for domestic and stockwatering purposes."

This amendment permits the North Dakota State Water Conservation Commission a right to issue water rights from groundwater sources for beneficial use. A number of irrigators, industries and municipalities have filed and are filing applications with the State Water Conservation Commission for the right to use water from underground sources. Rules and regulations pertaining to this use will be enacted to protect the early applicants. The State Water Conservation Commission will also protect the rights of the riparian owners to prevent the mining of groundwater.

Recommendations

In 1953 the State Legislature enacted Senate Bill No. 77, an amendment to Section 61-0402 of the North Dakota Revised Code of 1943, relating to application for beneficial use of water irrigation:

"APPLICATION FOR BENEFICIAL USE OF WATER REQUESTED.) Any person, association, or corporation intending to acquire the right to the beneficial use of any waters, before commencing any construction for such purpose, or before taking the same from any constructed works, shall make an application to the State Engineer for a permit to appropriate. If applicant shall designate the use of sprinkler equipment for the irrigation of his land, the State Engineer and State Water Conservation Commission may, in order to permit rotation of crops, grant a permit or license which will be applicable to a gross area containing more than the acreage

which can be irrigated in one year with the quantity of water authorized to be beneficially used under such permit or license."

It is proposed that the act read as follows:

"APPLICATION FOR BENEFICIAL USE OF WATER REQUESTED.) Any person, association, or corporation intending to acquire the right to the beneficial use of any waters, before commencing any construction for such purpose, or before taking the same from any constructed works, shall make an application to the State Engineer for a permit to appropriate. The State Engineer and State Water Conservation Commission may, in order to permit rotation of crops, upon request by the applicant and if found feasible, grant a permit or license which will be applicable to a gross area containing more than the acreage which can be irrigated in one year with the quantity of water authorized to be beneficially used under such permit or license."

The State Water Commission recommends that this law be strictly enforced and a severe penalty clause be enacted to curtail violation of this law. (See Minutes of Meeting January 14, 1957.) The intention of this act is no doubt a good one. However, it does serve to discriminate against the users of the conventional surface or gravity method of irrigation. The act affords the irrigator an opportunity to establish such crops as alfalfa on one tract one year and a similar opportunity to establish alfalfa or some other crop on an equivalent acreage the following year.

This practice can be continued each year. According to our present legislation, the irrigator applying water through the gravity method would be restricted to irrigate only the area designated in his water right. The gravity irrigator should, if this law remains on our statutes, be permitted to rotate his irrigation similar to that of the sprinkler irrigator. The privileges granted in the act will make the administration of our water law difficult. It is conceivable that an irrigation farmer with sufficient equipment could irrigate 400 acres of land in one season, although his water limits him to a 100 acre field. In the event that this privilege is extended to the gravity irrigator, he likewise could irrigate much larger tracts than authorized under his water right if equipped to do so.

Water rights are considered a property right in North Dakota and not a personal right. In other words, a water right is appurtenant to the land for which the right is granted and any transfer of ownership of the land carries with it the right to use water for a right that is issued for that land. Under the law that provides for the rotation of a water right over several different areas as the irrigator sees fit, the water right becomes more or less a personal right. The problem that this situation presents in connection with the transfer of land is readily apparent. For example, if a landowner transfers a portion of his land holdings that are included in such a water right, what method can be used as to the disposition of the water right itself.

The original owner can undoubtedly show that he intends to use the water right for other of his holdings which in effect would leave that land transferred without any claim to water for irrigation which most likely would have a decided bearing on the purchaser's interest in purchasing the land.

Under the statutes providing for the appropriation of water for the gravity method of irrigation, the water right covers certain land specifically described and made a part of the application. In the case of the transfer of such lands, the transfer of the water right presents no problem.

It is our recommendation that the Legislature consider repealing this section of our North Dakota Code that is basically in conflict with the proven water laws in this state and all western states where the appropriation doctrine is in use.

Prescriptive Water Rights

In many instances municipalities, irrigation projects and industries have been established along streams that appear to have adequate flow. These water users have, over a period of years, put the water to beneficial use for the above-mentioned purposes. In many instances these users have inadvertently failed to make water right applications, believing they have a vested right. Many of these individuals, municipalities and industries are now aware that such a law does not exist and desire to have their right established and dated back to the time of the initial use. According to our present water laws, the water rights of these users, if applied for at this late date, would not possess the earlier priority that it would have had an application been made when the water was first put to beneficial use.

It is recommended that legislation be enacted to permit these users a priority dating back to the time the first water was put to beneficial use. Such legislation will require careful wording in order to provide the prescriptive users with the desired protection without litigation. Several affidavits have been received from prescriptive users requesting their right be made effective at the date of initial use.

Recommended Rules and Regulations of State Engineer and State Water Conservation Commission Pertaining to Water Rights

1. Applicant for water right must be owner of land, or have the power to act on behalf of owner. (Sign by proxy to tenant on behalf of owner. Holder of Contract for Deed or long term lease would also be eligible for approval.)

2. When an application has been approved by the State Engineer and State Water Conservation Commission, the following rules shall apply:

a. Provisions of State law as to time for developing the irrigation facilities shall be complied with.

b. When the system is complete and upon request of the applicant, the State Engineer shall inspect it for purposes of issuing a Certificate of Completion.

c. Should the installation meet the necessary requirements, a Certificate of Completion shall be issued by the State Engineer and be recorded by the applicant in the office of the Register of Deeds in the county seat in which the applicant's land is located.

3. Water rights will not be required for irrigation if the land in question is less than two acres and is used for domestic gardening. This is considered a riparian right and the obtaining of a water right will be left to the discretion of the owner.

Water Right Fees

Water right filings have averaged approximately 75 per year during the period 1950-1956. Approximately 200 water rights and Certificates of Completion were issued during the study as it afforded a field representative of the Commission an opportunity to accomplish two objectives during the field examination. In accordance with the steps necessary to process a water right, it is apparent that the procedure is time consuming and expensive to the Commission. No increase in appropriations has been made to the Commission for the purpose of administering this important program. At present the State receives a $5.00 application fee for each application. This fee is not retained by the Commission but is deposited in the general fund. It is recommended that the water right filing fee be increased from $5.00 to a fee more commensurate with the costs of investigation and the resulting revenue be placed in the general fund.

It is further recommended that the Commission be appropriated a sum of Three Thousand ($3,000.00) Dollars per annum for the purpose of administering the water right applications and established

water rights. Such an appropriation would permit the Commission to maintain an accurate up-to-date record of water rights that are actually being exercised. Such information will assist in determining those water rights that should be cancelled for non-use and the extent to which applicants are conforming with state law in putting water to beneficial use as they propose in their applications. This policy would be effective in eliminating the speculative water right applicant and would serve to encourage those who desire to put water to beneficial use.

Priority of Water Use

The following order of priority is suggested:

1. Domestic use—this includes all municipal water supplies, family gardening (not to exceed two acres), stock water use and pollution abatement.

2. Irrigation and industrial consumption. Industrial use—this includes all industry that requires use of water for the operation of some manufacturing process. An approved water right is granted only where there is actual consumptive use. Irrigation—this category will include irrigation by all methods. Pumping from reservoirs, natural stream flow, flood irrigation, sprinkler, gravity systems and spreader dikes. Irrigation is beneficial use of water on land.

Irrigation users will have priority of use as follows:

a. Irrigation of land for human needs.

b. Irrigation of land for protection of livestock feed.

c. Irrigation of land for beautification of land areas—includes trees, flowers and lawns.

3. Hydroelectric power.

4. Wildlife and recreation—includes storage for waterfowl, fishing, swimming. Storage rights will be based on evaporation losses.

5. Navigation—storage releases.

(No. 3 and No. 4 will state use on basis of evaporation and transpiration losses.)

Legislative Action on Recommendations

The 1957 Legislature after considering the various recommendations set forth in the "Water Right Status Report" enacted certain amendments to laws concerned with the appropriation of water. These amendments are as follows:

1. Filing fees to be submitted with water right applications have been increased to the following rates:

a. Municipal use (2500 population and over)	$100.00
b. Municipal use (2500 population and less)	50.00
c. Irrigation	20.00
d. Industrial use (1 c.f.s. or less)	50.00
e. Industrial use (excess of 1 c.f.s.)	100.00
f. Recreation	20.00
g. Commercial recreation	50.00

2. Water users having made beneficial use of water over a period of 20 years prior to January 1, 1934, shall be deemed to have acquired a right to the use of such water without having filed or prosecuted an application to acquire a right to the beneficial use of such water. Such use or attempted use of such waters is hereby declared to be a prescriptive water right and is hereby established as such.

3. The State Engineer and State Water Conservation Commission may, in order to permit rotation of crops, upon request by the applicant, and if found feasible, grant a permit or license which will be applicable to a gross area containing more than the acreage which can be irrigated in one year with the quantity of water authorized to be beneficially used under such permit or license.

Water Right Data Subsequent to Status Report

Since the State Water Conservation Commission published the "Water Right Status Report" in 1956, a large number of water right filings have been made and/or considered by the State Engineer and Commission. A summary of these filings and their present status covering, the period July 1, 1956, to June 30, 1958, is listed below.

Water right applications received	89
Water rights approved	108
Water rights refused	0
Water rights deferred	3
Certificates of Completion issued	143

WATER RIGHT APPLICATIONS
July 1, 1956 to June 30, 1958

No.	Name and Address	County	Source	Acres	Acre Feet	Date of Claim	Status
677	James Lowe, Minot	Ward	Souris River	10.5	21	7- 7-56	Approved
678	Ivan Rodine, Oakes	Dickey	Wells	146.3	187	7-10-56	Approved
679	City of Grafton	Walsh	Park River		10,950	7-25-56	Approved
680	Central Power Co-op, Minot	Ward	Souris River		9 cfs	7-28-56	Approved
681	Claude Sampson, Fayette	Dunn	Unnamed Creek	30.7	46	7-30-56	Approved
683	Louis Signalness, Watford City	Dunn	Little Missouri	41.7	73	8- 3-56	Approved
684	Victor Rohr, Gladstone	Dunn	Unnamed Creek	80	100	8- 6-56	Approved
685	Montana-Dakota Util.	Morton	Wells			8-27-56	Deferred
686	Montana-Dakota Util.	Morton	Missouri		161	8-27-56	Approved
687	Montana-Dakota Util.	Burleigh	Wells		1600	8-27-56	Approved
688	Montana-Dakota Util.	Dickey	Wells		146	8-27-56	Approved
689	Montana-Dakota Util.	Burke	Wells		253	8-27-56	Approved
690	Montana-Dakota Util.	Mercer	Wells		365	8-27-56	Approved
691	Montana Dakota Util.	Emmons	Wells		73	8-27-56	Approved
692	Montana-Dakota Util.	Williams	Wells		73	8-27-56	Approved
693	Armstrong & Erling, Bismarck	Burleigh	Missouri	193	386	8-22-56	Approved
694	Armstrong & Erling, Bismarck	Burleigh	Missouri	82	164	8-22-56	Approved
695	City of Portland	Traill	Goose River		400	9-17-56	Approved
696	City of Casselton	Cass	Swan Creek		2190	11-13-56	Approved
697	City of Park River	Walsh	Park River		2172	11-17-56	Approved
698	Lester Freise, Leonard	Ransom	Sheyenne River	264.5	330.6	11-20-56	Approved
699	City of Tioga	Williams	Garrison Res.		7300	12-12-56	Approved
700	George Schoewe, Valley City	Ransom	Sheyenne River	62	93	12-31-56	Approved
701	Highland Cemetery Ass'n., Jamestown	Stutsman	Pipestem River	20.8	31.2	12-31-56	Approved
702	Chauncy Nelson, Valley City	Barnes	Sheyenne River	95.5	140	12-31-56	Approved
703	City of Devils Lake	Ramsey	Devils Lake		3650	1-12-57	Approved
704	City of Mandan	Morton	Missouri River		16,758	1-24-57	Approved
705	Joseph Berger, Flasher	Morton	Louse Creek	26.2	39.2	1-25-57	Approved
706	City of Oakes	Dickey	Wells		3650	2-18-57	Approved
707	Minard Huckler, Bismarck	Burleigh	Missouri River	101	40	3- 1-57	Approved
708	Anton Jaeger, Jr., Manning	Dunn	Knife River	20.9	31	3-21-57	Approved

709	Grant Sampson, Manning	Dunn	Knife River	15.2	22	3-21-57	Approved
710	Albert Seefeldt, Grand Rapids	LaMoure	James River	57.7	74.0	3-27-57	Approved
711	Val Kary, Killdeer	Dunn	Little Knife River	25.0	37.0	3-28-57	Approved
712	Lew Strang, Williston	Williams	Little Muddy	24.8	37.0	3-28-57	Approved
713	City of Mayville	Traill	Goose River		2190	4-10-57	Approved
714	Harold Ellis, Ft. Clark	Oliver	Missouri	448.7	897.4	4- 3-57	Approved
715	Robert Miller, Ellendale	Dickey	Maple Creek	13.2	20	4-22-57	Approved
716	Mark Andrews, Mapleton	Cass	Wells	320	480	4-25-57	Approved
717	Golden Lake	Steele	Beaver Creek		5500	6- 1-56	Approved
718	Duane Long, Marmarth	Slope	Little Missouri	38.2	47	5-13-57	Approved
719	City of Northwood	Grand Forks	Wells		92	5-11-57	Approved
720	City of Williston	Williams	Missouri		40,325	6- 3-57	Approved
721	Northern States Power, Minot	Ward	Souris River		30	6- 8-57	Approved
722	Northern States Power, Fargo	Cass	Red River		75	6- 8-57	Approved
723	Northern States Power, Grand Forks	Grand Forks	Red River		85	6- 8-57	Approved
724	Northern States Power, Minot	Ward	Souris River		7.5	6- 8-57	Approved
725	City of Bowman	Bowman	Wells		730	6- 6-57	Approved
726	City of Maddock	Benson	Wells		730	6- 8-57	Approved
727	William Corwin, Fargo	Ransom	Sheyenne River	254	381	6-14-57	Approved
728	City of Linton	Emmons	Wells		483	6-19-57	Approved
729	City of Columbus	Burke	Wells, Surface Water		380	6-17-57	Approved
730	City of Fessenden	Wells	Wells		1627	6-19-57	Approved
731	City of Bowdon	Wells	Wells		365	6-19-57	Approved
732	BPOE, Williston	Williams	Muddy River			6-26-57	Pending
733	City of Harvey	Wells	Sheyenne River, Wells		2190	6-21-57	Approved
734	City of Enderlin	Ransom	Wells		452	6-19-57	Approved
735	City of Hankinson	Richland	Wells		285	6-25-57	Approved
736	City of SW Fargo	Cass	Sheyenne River		2190	6-26-57	Approved
737	City of Minto	Walsh	Forest River		2190	6-27-57	Approved
738	City of Beach	Golden Valley	Little Beaver Creek		417	7- 2-57	Approved
739	Groth Brothers, Inkster	Grand Forks	Wells	305	305	7-31-57	Approved
740	Standard Oil Refinery	Morton	Missouri		22,285	6-27-57	Approved
741	City of Bowbells	Burke	Stoney Creek		730	4-23-57	Approved
742	City of Finley	Steele	Wells		330	8- 8-57	Approved
743	Edgar Olson, Harwood	Cass	Sheyenne River	99	124	8-24-57	Approved
744	H. A. Nelson, Fargo	Cass	Red River	310	387	8-28-57	Approved
745	Roy Smith, Wild Rice	Cass	Red River	140	140	9- 9-57	Approved

WATER RIGHT APPLICATIONS
July 1, 1956 to June 30, 1958

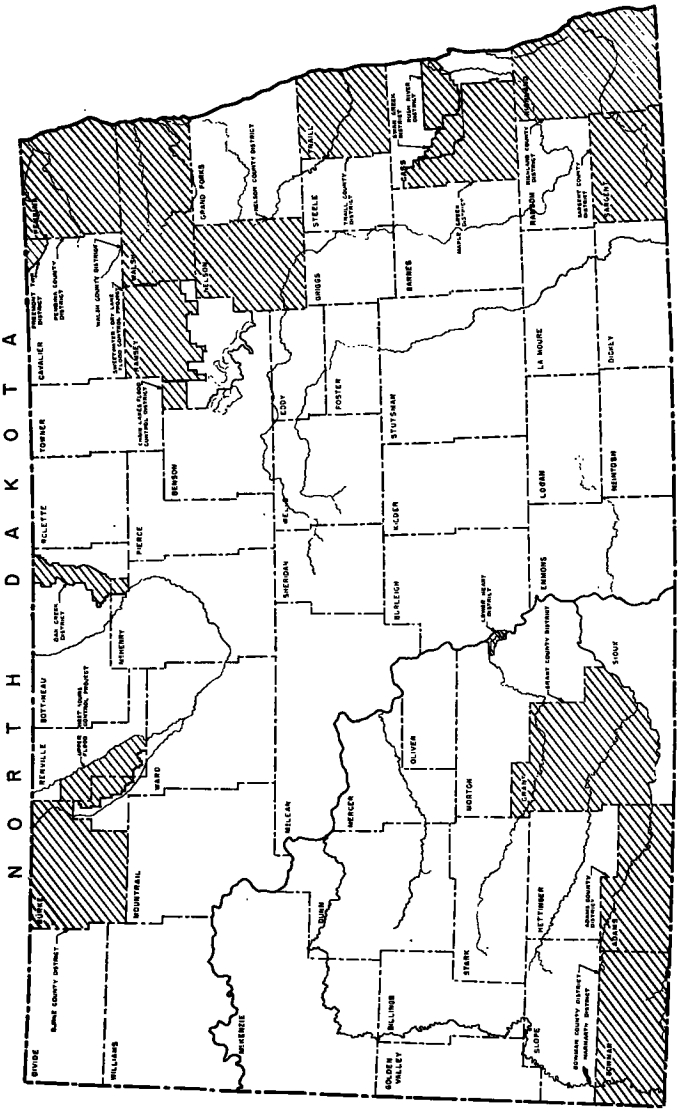
No.	Name and Address	County	Source	Acres	Acre Feet	Date of Claim	Status
746	City of New England	Hettinger	Cannonball River		1630	6-20-57	Approved
747	Irvin Ring, Corinth	Williams	Little Muddy	12.5	19	9-18-57	Approved
748	City of Fargo	Cass	Sheyenne River		38,847	1-26-57	Approved
749	City of Fargo	Cass	Red River		109,500	1-30-57	Approved
750	James Paulsrud, Halstad, Minn.	Cass	Red River	169	169	10- 4-57	Approved
751	City of Ellendale	Dickey	Wells		557	10-16-57	Approved
752	City of Crosby	Divide	Wells		1085	10-17-57	Approved
753	City of Rugby	Pierce	Wells		600	10-28-57	Approved
754	School of Forestry	McHenry	Wells		180	10-18-57	Approved
755	Lee Moore, Gladstone	Stark	Heart River	30	30	11-18-57	Approved
756	Arthur Chenault, Richmond, Mo.	Traill	Elm River			11-18-57	Deferred
757	Argil Froemke, Lisbon	Ransom	Sheyenne	128.5	250	2-20-58	Approved
758	City of Pembina	Pembina	Pembina River		730	2-12-58	Approved
759	Dr. F. O. Beck, Bismarck	Burleigh	Burnt Creek	36.4	40	2-28-58	Approved
760	S. T. Connell, Medora	Billings	Little Missouri	40	60	3-20-58	Approved
761	Lee Hoff, Leith	Grant	Cannonball	30	45	4-10-58	Approved
762	Rudolph Bertsch, Bowman	Bowman	North Fork of Cannonball River			4-25-57	Pending
763	C. O. Howery, Antler	Bottineau	Antler Creek			3-18-58	Pending
764	City of Bottineau	Bottineau	Groundwater			5-12-58	Pending
765	B. T. Nordell, Williston	Williams	Missouri River			5-15-58	Pending
770	Glenn McRae, Sidney, Montana	McKenzie	Hay Draw Creek			3-20-58	Pending

LEGAL WATER USER ORGANIZATIONS

North Dakota Statutes contain provisions for the establishment of various types of water user organizations that can be organized at the request of citizens of an area to serve as the legally constituted entity which will be responsible for the development of the water resources for the benefit of that area. Definite procedures for the establishment of these entities and their powers and duties are set forth in the statutes of the state. Whether the proposed water resource development project is one for irrigation, drainage or flood control, a legally established entity with certain designated authority is essential.

Because there are essential differences in the various types of water resource projects our statutes provide for several distinct types of water user entities. In all cases they are organized at the request of the landowners concerned or by their elected officials. All types of entities have the power to raise funds, by either mill levy taxes or special assessments or both, to finance the construction and operation of their projects. The affairs of the districts are governed by a Board, either appointed by the Board of County Commissioners or elected by the landowners of the district. These Boards vary in size according to the nature and size of the entity. Ordinarily it is through the local water user entities that have been established in the state that our water resources projects have been developed. They are essential to the success of the state's water resource program for they provide the people directly affected by a project the organization they need to represent their views and fulfill their responsibilities relative to a project. It is through these organizations that the local people control the development of their projects. Their governing boards establish the policies and make the decisions that determine the success of the development and operation of the project.

North Dakota statutes provide for the following types of water user entities: irrigation districts, water conservation and flood control districts, drainage and park districts, all of which are concerned with the development of water resources in one form or another. In addition, the 25-county Garrison Diversion Conservancy District has been established by Legislative action to provide an over-all entity responsible for the development of the vast Garrison Diversion Unit. The following section of this report is devoted to a discussion of many of these districts that have been organized.


NORTH DAKOTA
DIVIDE
BURKE COUNTY DISTRICT
WILLIAMS
MOUNTRAIL
MCKENZIE
MORTON
STARK
SLOPE
BILLINGS
GOLDEN VALLEY
DUNN
MERCER
OLIVER
MCLEAN
WARD
BOTTINEAU
ROLETTE
PEMBINA
WALSH COUNTY DISTRICT
TOWNER
CAVALIER
PIERCE
BENSON
NELSON
GRAND FORKS
RAMSEY
EDDY
FOSTER
SHERIDAN
WELLS
STEELE
TRAILL COUNTY DISTRICT
TRAILL
GRIGGS
STUTSMAN
KIDDER
BURLEIGH
BARNES
CASS
RICHLAND
LA MOURE
LOGAN
EMMONS
SIOUX
DICKEY
RANSOM
SARGENT COUNTY DISTRICT
SARGENT
STEELE COUNTY DISTRICT
WALSH COUNTY DISTRICT
MANDAN DISTRICT
MAIN RIVER DISTRICT
SHEYENNE RIVER DISTRICT
SHEYENNE
BAY CREEK DISTRICT
UPPER PLAINS
MISSOURI RIVER CONTROL PROJECT
LOWER HEART RIVER DISTRICT
LOWER HEART RIVER SUPPLY
GRANT COUNTY DISTRICT
SIOUX
SEWARD COUNTY DISTRICT
MORTON DISTRICT
SEWARD COUNTY DISTRICT
MORTON DISTRICT
SLOPE
BILLINGS
STARK
OLIVER
MERCER
MCLEAN
DUNN
MOUNTRAIL
WARD
BOTTINEAU
ROLETTE
PEMBINA
PIERCE
BENSON
NELSON
GRAND FORKS
WALSH
TOWNER
CAVALIER
PEMBINA COUNTY DISTRICT
PEMBINA
WALSH COUNTY DISTRICT
SHEYENNE RIVER DISTRICT
LOWER HEART RIVER DISTRICT
LOWER HEART RIVER SUPPLY

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 serve to provide the local people in a given area a legal entity that has authority over regulation, control and development of water resources in that area. They are established 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 are a type of local entity that give the responsibility for the control, development and utilization of the water resources of an area to the local people who are primarily concerned with these water resources.

Water conservation and flood control districts have the power to investigate and construct projects or to arrange for their construction that will serve to develop the water resources in certain areas within the districts. These projects can be of many types and serve many purposes. For example, they can be dams constructed in water courses within the district to provide conservation storage of water. They can be facilities used to maintain water levels in lakes or 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, control 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 or agencies thereof, or with agencies of the State government, for the construction of projects that will be of benefit to the district.

In order to accomplish the purposes for which water conservation and flood control districts are organized, these districts have the power to levy certain taxes through special assessments and general levies to meet their costs of operation and to meet the costs of the projects in which the district becomes involved. They are authorized to budget for funds that can be raised by a mill levy made by the Board of County Commissioners, not to exceed three mills, to meet their operating costs and the costs of projects in which they become concerned. Or if they so desire, they may make special assessments on property specifically benefited by a project.

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 requesting a water conservation and flood control district to be organized encompassing a certain area which may be in two or more counties. 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 call a hearing in the area concerned. Following the hearing, if it appears that it is desirable to proceed with the organization of 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 State Water Conservation Commsision is issued, the Board of County Commissioners of the county or counties in which the district is located is then 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 a specific term in years by the county commissioners.

The law pertaining to the establishment of water conservation and flood control districts was amended by the 1957 North Dakota Legislative Assembly to broaden the powers and duties of the districts. The changes in the law provided these districts with a specific procedure they could follow in levying special assessments against lands benefited by a specific project. Several other amendments were incorporated in this law by the 1957 Legislative Assembly.

Water conservation and flood control districts have proven very valuable in the State of North Dakota in bringing about the orderly development of needed water resource projects in various areas of the state. At the present time there are 17 water conservation and flood control districts that have been organized in the state. Many of these districts are organized as county wide districts, thereby permitting the benefits this type of organization can provide to all areas of a county. Other districts are organized on a drainage basis or on a specific area for which a specific project is proposed.

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 for the district. Therefore, it has not been activated. Although the district is now inactive, it will be possible for the Board of County Commissioners to reactivate the district without public hearing, should they so desire.

Bowman County District

The Bowman County Water Conservation and Flood Control District was organized in 1949 to provide a legal entity to cooperate with the state and federal agencies in dam repair projects, the Bowman-Haley project and related irrigation projects. In 1956 the Bowman County Water Conservation and Flood Control District became closely concerned in the development of the Bowman-Haley project. That year the Corps of Engineers requested that the State Water Conservation Commission consider permitting that agency to drop this proposed project from their list of authorized projects. The State Water Conservation Commission scheduled a public hearing in May 1956 at Scranton to determine local sentiments before they would recommend the release of the project. Although the hearing was held at a relatively short notice, over 200 people attended and all supported the retention of the project on the authorized list. They also were of the opinion that every conceivable effort should be made to have the project reinvestigated and constructed at the earliest date possible. The need for the project was emphasized because of the possible development of the uraniferous lignite industry which would result in an increased demand for municipal and industrial water.

In view of the enthusiastic endorsement of the project by local proponents, the State Water Conservation Commission immediately requested that funds be made available to the Corps of Engineers, Omaha District, for the purpose of reinvestigating the project. This request was approved and adequate funds were obtained to continue the studies. The Commission is cooperating with the Corps of Engineers, the local flood control district and the Grand River Development Association in determining certain benefits the project would provide the community affected. The Corps of Engineers has made a detailed investigation of the benefits to be derived from flood control features of the Bowman-Haley Dam including an evaluation of the potential recreational benefits of the area.

The State Water Conservation Commission investigated the water requirements for municipal and industrial uses. The Commission's survey revealed that the area comprising municipalities of Bowman, Scranton, Bucyrus and Reeder could use 14,000 acre feet of water annually in the near future. This amount would be required to meet the demands of the four cities and potential industrial users.

Interest has also been indicated in the development of a generating plant by a private power company whereby the large quantities of coal in the Scranton area and a portion of the water in the Bowman-Haley reservoir would be utilized.

At the present time there appears to be only 2,000 acre feet of water available to the area on an annual basis from the wells which take water from the so-called Fox Hills aquifer. The cities of

Bowman, Scranton, Hettinger, North Dakota, and Lemmon, South Dakota, now obtain water from this aquifer and it is indicated that this supply of water is being mined. Approximately 5,000 acre feet of water annually would be available under most adverse conditions through the Bowman-Haley reservoir. During periods of extreme and sustained drought conditions, the water supply may be decreased to 3,000 acre feet. The water supply available from the Fox Hills aquifer combined with that contained in the Bowman-Haley reservoir would meet 50% of the anticipated needs of these communities. The State Water Conservation Commission in February 1958 appropriated all of the unappropriated waters in the Grand River Basin within the North Dakota boundaries for use in connection with this development.

In January 1958 the Corps of Engineers held a hearing in Bowman to determine if the required assurances by the local interests would be met. It was implied that the local communities would be required to pay $325,000 of the construction costs of the dam and reservoir which will be allocated to municipal and industrial uses. The local proponents did not appear to be adverse to the proposal and indicated their ability to meet this assurance. A satisfactory benefit to cost ratio of 2.5 to 1 and feasibility of the project had been established. The project has received favorable endorsements by the Mississippi Valley Association and the National Rivers and Harbors Congress.

The Bowman County Water Conservation and Flood Control District has also agreed to provide the required assurances for the Scranton Flood Protective Works, a project which had been requested by the City of Scranton to provide protection against recurring floods from Buffalo Creek. The Corps of Engineers has investigated the project and established a satisfactory benefit to cost ratio. The project includes a system of levees which will confine flood waters to the main channel of the creek. A bid opening was held in May and construction of the project was scheduled in June 1958. The estimated cost of the project was $131,000.00, of which $38,000.00 has been allocated as the City of Scranton's participation. Floods cresting at 17.0′ occurred in June of 1957 and 1958. Considerable damage resulted from both floods.

Commissioners: Ralph G. Keller, Scranton; Chris Nester, Rhame; Howard White, Bowman and Leinniece Werre, Bowman, North Dakota.

Burke County District

Much interest has been shown by residents of Burke County living in three different areas to construct water facility projects in that county. In two cases difficulties have been encountered in obtaining the necessary rights-of-way to establish these projects. On November 6, 1957, the Board of County Commissioners of Burke

County petitioned the State Water Conservation Commission to create a water conservation and flood control district comprising the entire county.

Two hearings were held by the State Water Conservation Commission on the petition to create the district. The first was held in Powers Lake and the second at Bowbells. Little or no opposition to the formation of the district was encountered at these hearings. As a result of the favorable public sentiment, the State Water Conservation Commission established the district effective December 20, 1957.

The Board of Directors for the district is actively engaged in promoting the Schmisek Lake project located three miles north of Powers Lake, which has been investigated by the State Water Conservation Commission. The Commission investigations indicate that the present Schmisek Lake can be raised from 8 to 10 feet, enlarging the reservoir area considerably. The lake would be raised sufficiently high to permit it to flow in its former ancient channel by constructing an earth rolled fill at the present outlet to an elevation several feet above the former outlet. When complete it would provide the Powers Lake area with one of the most outstanding lakes in northwestern North Dakota. The State Water Conservation Commission has indicated that it would cooperate with the State Game and Fish Department and the Burke County Water Conservation and Flood Control District in the construction costs.

The City of Bowbells has long been confronted with a water problem in respect to both quality and quantity. The State Water Conservation Commission was requested to make a groundwater survey of the area in an effort to determine the best available water supply from this source. A proposal has been made for the construction of a dam in Stoney Creek immediately south and east of the city. The water stored in the reservoir could be made available to the city through the use of a natural filter bed. A firm of consulting engineers has been hired by the City of Bowbells for the purpose of determining the feasibility of utilizing the proposed reservoir as a source of municipal water supply.

Another project in which the State Water Conservation Commission is cooperating with the Burke County Water Conservation and Flood Control District is the reconstruction of a dam on Short Creek in the vicinity of Columbus. This dam was originally built during the 1930's. The Commission has investigated the site and made recommendations as to the construction of the proposed project. At one time some interest was manifested in this proposed project by a private power company to provide a source of water for use in the cooling operations of a power plant. Studies are planned to determine the possibility of constructing dams in the breaks of the Coteau Hills, which would afford the area with much needed outdoor recreational

facilities. It is anticipated that the Burke County Water Conservation and Flood Control District will be of assistance in bringing about the construction of many feasible projects located in that county.

Commissioners: Otto Fisher, Bowbells; Ted Gibson, Powers Lake and Norbert Kihle, Columbus, North Dakota.

Chain Lakes District

The Chain Lakes Water Conservation and Flood Control District is located in northwestern Ramsey County. The district was organized in May 1955 for the purpose of bringing about the construction of facilities that would alleviate the flooding of land in the Lake Alice and Lake Irvine areas. The need for organizing the district was emphasized by the fact that in eight of the past eleven years, approximately 10,000 to 15,000 acres of highly fertile agricultural land have been flooded resulting in considerable financial loss to the residents of the area and to the county. The State Water Conservation Commission recommended that a project be initiated which would involve participation between the Soil Conservation Service, the Corps of Engineers and the State Water Conservation Commission. It was proposed that the Soil Conservation Service be charged with the responsibility of conducting a watershed development program in the upper reaches of Mauvais Coulee and the Corps of Engineers be authorized to construct a channel from the outlet of Lake Irvine to Devils Lake proper through the present Mauvais Coulee.

Discharge measurements obtained from the U. S. Geological Survey Hydrographic Branch indicated that as high as 3300 cubic feet per second of water entered the Lake Alice-Lake Irvine areas during the peak of the flood in June 1954. The maximum quantity of water leaving the Lake Alice-Lake Irvine area through Mauvais Coulee approximated 385 cubic feet per second. The outlet channel has become exceedingly sluggish as a result of two to four feet of soil drift which filled the channel during the 1930 drought period.

In January 1955, the State Water Conservation Commission cooperated with the Federal Fish and Wildlife in blasting a channel between Lake Alice and Lake Irvine. This was done in an effort to expedite the flow of water from inundated areas adjacent to Lake Alice. The cost of the project was shared equally by these two agencies.

The Chain Lakes District requested the State Water Conservation Commission to furnish them with a cost estimate for a project that would provide partial relief until a larger canal could be constructed under the direction of the Corps of Engineers. In 1955 the Commission made a survey extending from Lake Alice to Devils Lake to determine the project costs. A proposal was made which would provide a 40 foot channel from the outlet of Lake Irvine to Pelican Lake,

immediately north of Devils Lake. The estimated cost is $50,000.00. Efforts have been made by Ramsey County, the district and the Commission to have the project extended into Six Mile Bay of Devils Lake. The Chain Lakes Water Conservation and Flood Control District is expected to obtain the necessary rights-of-way for the project soon.

In connection with this project, the Commission and the Board of County Commissioners of Ramsey County in 1957 cooperated in constructing a control structure at the outlet of Lake Irvine. The structure is a timber treated box culvert to which are attached eight gates, each 5'4" wide and 4'2½" high. This installation will serve to provide the needed control of the flow into the canal when it is constructed.

The Commission recently completed a two foot contour survey of 29 sections of land on one of the Mauvais Coulee branches in the upper basin. The data from these surveys have been made available to the Corps of Engineers for use in conjunction with making agricultural economic surveys in an effort to establish a satisfactory benefit to cost ratio for the proposed Mauvais Coulee project.

The State Water Conservation Commission has also cooperated with the Topographic Branch of the U. S. Geological Survey in the preparation of six, seven and one-half minute quadrangle maps in the flooded area which will be of considerable value in making future project studies. The needs for flood control relief for the area are so great that the Commission has made every effort possible to correct the situation.

The Chain Lakes District is now spreading special assessment levies against all benefited lands in an effort to obtain sufficient funds to permit them to participate in the project that would afford them partial relief. If this project is constructed, it is believed that it will provide relief under most conditions and will permit the farming of a considerable portion of land until the Federal government is in a position to construct a project affording maximum relief. The most difficult problem confronting the district at the present time is that of acquiring rights-of-way.

Fremont District

On May 11, 1956, the State Water Conservation Commission received a petition from the Board of Township Supervisors of Fremont Township, Cavalier County, requesting that a water conservation and flood control district be created embracing all of that township. The establishment of the district was desired to provide a legal entity that could bring about the development of facilities that would alleviate flood damages and soil erosion which had become excessive in this township. Bridges and roads within

the township are repeatedly being exposed to excessive damages resulting from flood water. At a hearing held on June 5, 1956, all present appeared to favor the formation of the district and the State Water Conservation Commission issued an order establishing the district on June 15, 1956. The district has worked with the Soil Conservation Service in an effort to establish a watershed program for the area, referred to as the North Walhalla tributary of the Pembina River, which would serve in alleviating future flood conditions.

The Soil Conservation Service watershed planning for this project is 60% complete and will be completed by September 1, 1958, with construction possible in fiscal year 1960. The total cost of the project will exceed $350,000.00. It will consist of three dams and channel improvements. In order to accomplish the objective of the project, it is quite possible that some channel improvement will be required in Canada as Fremont Township borders Canada.

Commissioners: John Ermer, Walhalla; Joe Bodenstiner, Walhalla; Albert Gapp, Walhalla and Leo A. Verville, Walhalla, North Dakota.

Lower Heart District

The Lower Heart Water Conservation and Flood Control District was organized in 1953 and embraces the area along the Heart River, including the City of Mandan from the confluence of the Missouri and Heart Rivers to a point about seven miles west of Mandan. The district was created for the purpose of providing a legal entity to cooperate with the Corps of Engineers in the construction, operation and maintenance of additional facilities needed for flood protection of the City of Mandan and the State Training School.

The required construction for the project will entail the raising of Highway No. 10 approximately 5½ feet so as to constitute a dike to protect the Northern Pacific rights-of-way, the raising of the State Highway bridge over the Heart River and other work to protect the Northern Pacific mainline right-of-way. Other features include a system of dikes that will extend from the State Highway No. 10 to the confluence of the Heart River and the Missouri River. The dikes will be so constructed so as to afford protection to the industrial and commercial properties north of the levee. A tax in the amount of three mills has been levied against all taxable property within the district.

Funds were appropriated to the Corps of Engineers in the amount of $200,000.00 in fiscal year 1958 to initiate construction. The Water Conservation and Flood Control District requested and received bids for the raising of the bridge over the Heart River on Highway No. 10. Construction of this feature will be accomplished during 1958 and will fulfill one of the local assurances. It is anticipated that an

additional $500,000.00 in funds will be appropriated by Congress to the Corps of Engineers for construction purposes during fiscal year 1959. Approximately $2,400,000 will be needed to complete the project. Upon completion of the project the levees and the channel capacities will be increased to permit a flow of 50,000 c.f.s. without adversely affecting the property included in the district.

The State Water Conservation Commission has cooperated with the district in obtaining necessary legislation to permit the district to proceed with the flood protective program. The Commission will also participate to the extent of $40,000.00 in the cost of flood protective features of the project. The State Highway Department plans to participate in the cost of the raising of the bridge on Highway No. 10. The Board of Administration will also contribute toward the cost of constructing levees to protect the State Training School which lies to the west of the project.

Commissioners: L. C. Hulett, Mandan; R. E. Sylvester, Mandan and Carl Keidel, Mandan, North Dakota.

Maple River District

On July 3, 1956, the Cass County Board of County Commissioners petitioned the State Water Conservation Commission to form the Maple River Water Conservation and Flood Control District. It was proposed that this district be so created to absorb the then existing Swan Creek District and additional lands within the Maple River watershed area to provide an entity which could contract with the Soil Conservation Service for the construction of needed flood control facilities. At a hearing held on July 30, 1956, in the City Hall at Casselton on the petition, no opposition was expressed to establishing the district. The State Water Conservation Commission issued its Order creating the district on August 29, 1956.

The Maple River District includes the tributaries known as the Swan and the Buffalo Creeks. Surveys were undertaken immediately by the Soil Conservation Service and a project proposal was submitted and approved by Congress setting forth the needed construction features. It is anticipated that the construction surveys will be underway in July 1958, construction contracts awarded during fiscal year 1959 and construction completed in 1961.

Commissioners: Harvey Wheeler, Wheatland; William Martin, Chaffee and Francis Archbold, Sheldon, North Dakota.

Marmarth District

The Marmarth Water Conservation and Flood Control District, including the area within the city limits of Marmarth and adjacent thereto, was organized in 1956 at the request of the City Commissioners of that city. It was formed to provide a legal entity to contract

with the Corps of Engineers for the construction of flood protective works for that city. It is presently levying a three mill tax on all property within the district boundaries to obtain funds to meet the local requirements for the project facilities.

In 1954 Congress authorized a local flood protection project for Marmarth and in July 1956 approximately $260,000.00 was made available to the Corps of Engineers for constructing the levee and appurtenant flood control works. The availability of the funds was conditioned upon local interests furnishing rights-of-way and other participation required by the authorization. Construction features include the construction of a levee extending from above the confluence of the Little Beaver and Little Missouri Rivers west of the city to a bluff lying north of the Milwaukee Railroad to the east of Marmarth. It also includes necessary internal drainage to provide an escape for waters that would otherwise be impounded within the limits of the dike. Although funds have been available for a two year period, construction has been delayed because of easement difficulties. Negotiations were first initiated with a railroad company in October 1956. Some objection was voiced by that firm as to the amount of riprap protective works to be placed around the railroad bridge heads. The Corps of Engineers has indicated they will initiate construction of the project facilities as soon as the necessary easements have been obtained. The State Water Commission has agreed to cooperate with the local district in furnishing necessary assurances and paying 40% of the local costs.

Citizens of Marmarth are anxious to see this project proceed as they have been subjected to recurring devastating floods in the past. The terrain above the City of Marmarth in the upper Little Missouri basin is of such character that the run-off is rapid during periods of heavy rainfall or rapid snowmelt.

Commissioners: R. C. Rushford, Marmarth; B. Dohland, Marmarth and Earl Cornell, Marmarth, North Dakota.

Oak Creek District

The Oak Creek Water Conservation and Flood Control District was established by order of the State Water Conservation Commission January 5, 1956. The district includes that area within the Oak Creek watershed which drains a considerable portion of the western Turtle Mountains in eastern Bottineau County. The organization of the district was spearheaded by the Lake Metigoshe Improvement Association and residents in the lower portion of the watershed who requested the Board of County Commissioners of Bottineau County to petition for its establishment.

The district is involved in planning facilities for a project that will be utilized in maintaining the level of Lake Metigoshe at near spillway level. The project will include the construction of im-

poundments from which water can be released to the lake as needed to maintain a sufficient depth in the lake to enhance recreational uses and support fish life through the winter months. Surveys to determine the storage capabilities above Lake Metigoshe were first initiated by the North Dakota State Engineer in 1931 which resulted in submitting several proposals to accomplish this objective. The State Water Conservation Commission, since that time, has made additional investigations for this project.

One proposal being considered provides for the storage of water in Rost Lake, located northeast of Lake Metigoshe and supplementing the supply of water available to Rost Lake by diversion from a Canadian Lake. This proposal has been complicated by right-of-way problems. A second proposal investigated and advanced by the State Water Conservation Commission would utilize Sharpe Lake located in Canada, to store approximately 9,000 acre feet of water for use in maintaining the level of Lake Metigoshe through the construction of a ten foot high dam. This proposal has been approved by the Board of Commissioners of the Oak Creek Water Conservation District as one that would provide for the immediate stabilization of Lake Metigoshe. Negotiations have been undertaken with Canadian officials relative to securing easements and rights-of-way for the project.

The possibilities of bringing about the early construction of the facilities for the stabilization of Lake Metigoshe appear good. Canadian officials have willingly cooperated to bring about a realization of the project. The utilization of Lake Metigoshe for recreational purposes and the development of over 500 cottages around the lake, of which over 50 are in Canada, has enhanced the interest in the stabilization project both in Canada and the United States. Plans for the project have been completed by the State Water Conservation Commission and turned over to the Board of Commissioners of the Water Conservation and Flood Control District for further negotiations with the Canadians. It is expected that construction of the project will get underway in September, 1958.

The Oak Creek Water Conservation and Flood Control District is also cooperating with the Soil Conservation Service in developing and improving the basin insofar as it affects the lower watershed area.

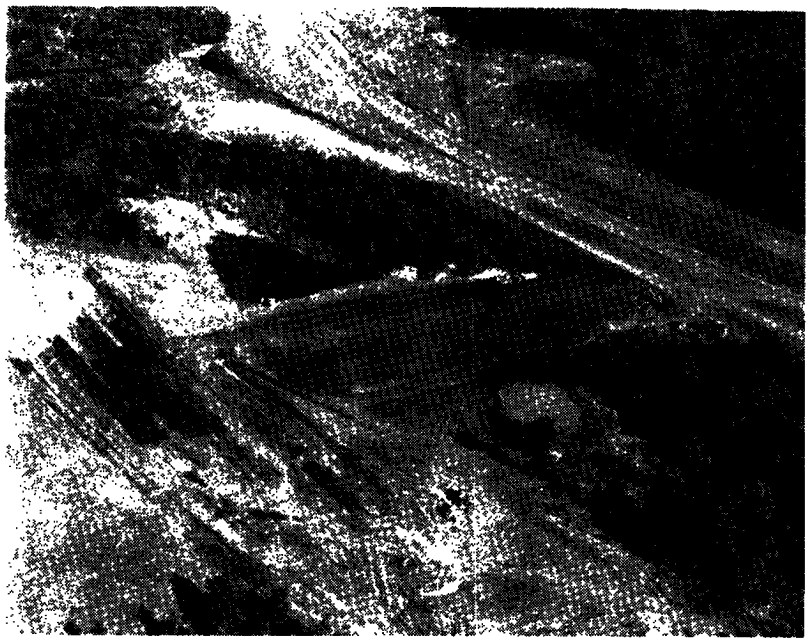
Commissioners: Carl Bullinger, Gardena; Fred Brandt, Bottineau and Glenn Swanson, Bottineau, North Dakota.

Pembina County District

Pembina County since settlement has been harassed by recurring flood because of an inadequately developed drainage pattern. In order to provide a legal entity to deal with this problem, the Board of County Commissioners in 1950 requested that a county wide water conservation and flood control district be created by the State Water

Conservation Commission. Since its organization this district has actively been engaged in a program to alleviate flood damages in the county.

It has actively cooperated with the U. S. Soil Conservation Service in connection with the Tongue River Project in Pembina County, which was authorized as a pilot watershed project by Congress in 1952. This project, when complete, will aid in controlling floods through the central portion of the county. It involves the protection of the entire 415,000 acre Tongue River watershed through the construction of detention dams and channel improvements. To date eight detention dams in the upper reaches of the Tongue River and a floodway which provides drainage for lands between the Tongue and the Pembina Rivers have been completed. Another floodway which will provide drainage north and west of Cavalier is now under consideration. In addition rights-of-way are being acquired for the purpose of constructing a cut-off channel east of Bathgate which, when complete, will afford a more rapid discharge of waters from the Bathgate area. Remaining to be completed are two main stream structures. One structure will be located near the village of Akra which will impound approximately 5,000 acre feet of water during the run-off period.



Tongue River Watershed Project Detention Dam

The district board is also concerned with providing flood control facilities for the lower Pembina River area. They are actively supporting the construction of the Pembilier Dam which was authorized originally by Congress in the Flood Control Act of 1944. This dam would be located immediately below the confluence of the main stem of the Pembina River and the Little Pembina River which is presently being investigated by the Corps of Engineers. Indications are that the project will be found feasible and construction recommended. When complete it would eliminate flooding that threatens extensive erosion damage on approximately 80,000 acres of fertile land at frequent intervals. The Pembilier Dam would provide control of Pembina River flood waters and also pass over a considerable portion of the Tongue River watershed area when at high flood stage.

The Pembilier Dam has received endorsement of the Mississippi Valley Association and the National Rivers and Harbors Congress. Proponents of the project feel confident that they will obtain funds for the construction of the project whenever the project report has been made available to Congress.

Commissioners: C. R. Howell, Walhalla; Ed Thomson, Cavalier and Otto Pudil, Pembina.

Rush River District

The Rush River Water Conservation and Flood Control District was established in 1949 by the State Water Conservation Commission at the request of the Board of County Commissioners of Cass County to provide the needed legal entity that could arrange for the construction of drainage facilities to alleviate flood conditions affecting approximately 197,000 acres of rich agricultural land located in the east and central portion of Cass County. Rush River, for which the project is named, possessed many channel irregularities which, along with a 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 the Rush River. The construction of this project was completed in the fall of 1956 at a cost of approximately $250,000.00.

In April 1957 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.

A hearing was held in Amenia, North Dakota, on August 8, 1957, and no opposition was indicated towards the boundary modification. The State Water Conservation Commission ordered the modification of the boundaries in September 1957. By this modification 107 square miles were added to the district increasing its size to 304 square miles.

Commissioners: Kenneth McIntyre, Harwood; L. F. Chaffee, Amenia and Robert Lewis, Jr., Fargo, North Dakota.

Sargent County District

In November 1956 a petition and a resolution were received from the Sargent County Board of Commissioners requesting that a water conservation and flood control district be established embracing that entire county. A hearing was held by the State Water Conservation Commission on December 20, 1956, at which unanimous support for establishing this district was indicated. The objectives of the district would be to cooperate with the Commission in the repair and maintenance of certain dams in that county and to cooperate with the Soil Conservation Service in establishing a watershed project for the Wild Rice Basin located in the eastern portion of Sargent County. Through Commission action an order was made establishing the Sargent County District on January 14, 1957. The County Commissioners appointed the following members to the Board at a regular meeting held on February 15, 1957: Chairman Milton Bergsjoe, DeLamere; Ole Breum, Rutland and William Bosse, Brampton, North Dakota.

Sioux County District

The Sioux County Water Conservation and Flood Control District was established by Order of the State Water Conservation Commission on October 24, 1938. It was created to cooperate with state and federal agencies in maintaining and repairing dams that were constructed in that county. To date the district has been inactive.

Slope County District

The Slope County Water Conservation and Flood Control District was established on April 28, 1936. It was created for the purpose of cooperating with state and federal agencies in maintaining dams that had been constructed by federal agencies during the 1930 drought period. The district has not been actively engaged in water conservation or flood control work.

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.

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.

One proposal for this project provides for excavating a canal from the south end of Sweetwater Lake into Devils Lake. The proposed canal would be 9.6 miles in length, with a capacity of 700 cubic feet per second and is estimated to cost $390,000.00. This plan also provides for the storage of some of the flood waters in Sweetwater Lake and for diversion of a portion of such flood waters into Dry Lake where it could be utilized for the propagation of wildlife. The project was designed for a maximum flood contribution approximating 47,000 acre feet in one year. Allowances were made for an additional 16,000 acre feet which would result from drainage practices initiated in the upper Sweetwater Lake watershed area. The anticipated frequency of a flood peaking at 63,000 acre feet per year would occur on the basis of once every five years. The proposed 700 cubic feet per second canal would permit farmers to continue farming operations within two and one-half weeks after each flood had receded. The project as proposed would also enhance the success of the Mauvais Coulee project as the flood waters from Sweetwater Lake now pass from that area into Dry Lake and then flow across country into the Lake Irvine-Lake Alice area. The movement of the water during flood stage is exceedingly slow because the terrain between Sweetwater-Dry Lake and the Lake Alice-Lake Irvine areas is extremely flat. Normally several months are required to permit the passage of the water from the area through the sluggish Mauvais Coulee outlet. The Sweetwater-Dry Lake Water Conservation and Flood Control District has been levying a tax on all properties within the district and is now in a position to meet its obligation in cooperating with a state or federal agency in pushing the project to its completion.

Commissioners: Thelmer Ivesdal, Edmore; Henry Anderson, Webster and Gordon Perry, Webster, North Dakota.

Traill County District

The Traill County Water Conservation and Flood Control District was established by the State Water Conservation Commission on April 16, 1956. The primary objective of the district at the present is to bring about the construction of facilities to provide flood control and drainage on farm lands adjacent to Elm Creek. The district will

also be concerned with drainage improvements and channel clearance practices that can be conducted on the Goose River and Buffalo Creek watershed.

Immediately upon establishment of the district, the newly appointed district board requested that the Soil Conservation Service make a survey in view of a watershed project for the Elm River. The survey has now been completed and their report has been forwarded to Congress. It has been passed by the Senate Public Works Committee and is now in the hands of a similar committee in the House of Representatives. In that the approval of the project seems assured, it is expected that construction surveys will commence in July, 1958.

Commissioners: Theo. O. Peterson, Buxton; Iver Smith, Galesburg; Theo Wheeler, Buxton; Gerhard D. Olson, Hillsboro and John S. Flaa, Hillsboro, North Dakota.

Upper West Souris District

The State Water Conservation Commission created the Upper West Souris Water Conservation and Flood Control District on June 10, 1955, upon petitions and resolutions submitted by the County Commissioners of Renville and Ward 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, making a combined total of 223,000 acres in the two counties.

The district is presently concerned in the construction of a project that will alleviate flood conditions that occur in the so-called Tolley flats. That is an elongated basin which exists between the Des Lacs and the Souris Rivers which has no immediate outlet to either stream. Frequently snowmelt and heavy rainfall gathers in the basin and floods approximately 3,000 acres to such a degree that the crops are totally destroyed. There are approximately 20,000 acres of other land within the district that are severely flooded. The areas subjected to flooding have suffered severe losses nine of the past thirteen years.

The State Water Conservation Commission proposes that the Corps of Engineers be designated to do heavy construction which would entail opening up a channel to the Upper Souris River area. A considerable gradient exists from the Tolley basin to the Souris River which would require the installation of a number of drop structures in order to curtail erosion. The Commission proposal further provides that the Soil Conservation Service initiate soil treatment practices in the upper basin which would aid materially in holding the moisture where it falls. The State Water Conservation Commission is in the process of making a survey relative to possibilities of providing an outlet to the Souris River through Macabee Coulee.

The average annual estimated loss for the area approximates $240,300.00. Other damages include inconveniences to farming operations, disrupting crop rotations, late seedings, difficulty in establishing conservation practices, road and bridge damages, railroad damages, the spread of obnoxious weeds and the loss of trade to the community as a whole. Numerous highway detours also cause a financial loss which has not been evaluated as yet. Recent information received from the Corps of Engineers and made available to the office of the State Water Conservation Commission indicates that the project proposal is a feasible one. The benefit to cost ratio is such that the project could be constructed in accordance with the recommendations of the State Water Conservation Commission.

The district board levied a three mill tax for a period of one year in order to have money available for expenditures in connection with project development. The immediate demand for funds did not arise and the board requested that the levy be discontinued. The money raised from the levy is now available for participation with federal and state agencies.

Commissioners: Henry Steinberger, Donnybrook; Harry E. Stanley, Tolley; E. Wm. Jensen, Kenmare; H. A. Bodmer, Kenmare and Claude James, Kenmare, North Dakota.

Walsh County District

The topography of Walsh County is such that a variation of over 1,000 feet exists between the eastern part of the county and the higher western area. As a result, snowmelt and heavy rainfall occurring in the western portion of the county discharge at a rapid rate on to the flat lowlands that extend from almost Park River to the Red River of the North. Frequently discharges in the Forest and Park Rivers are so great that the waters leave the stream channel and flood the vast area lying between the two rivers. Besides the severe loss suffered to farm land, the cities of Minto, Forest River and Grafton are frequently devastated by these floods. In a six year period between 1950 and 1956, it was estimated that Walsh County suffered $621,000.00 flood damages to roads and bridges alone. The cost of other damages to farm land and property is estimated to be in the millions. Walsh County has suffered eleven major floods since 1850

On July 20, 1956, the Board of County Commissioners of Walsh County petitioned the State Water Conservation Commission to create a water conservation and flood control district embracing all of Walsh County. Three hearings were held to determine the sentiments of the Walsh County residents towards the formation of a district. The initial hearing was held at Grafton on August 21st.

A second hearing was held in Adams on September 7th and the third hearing in Park River on November 20th. The State Water Conservation Commission issued its order creating the district on December 19, 1956. Indications are that the Board of Directors for the district plan to cooperate with the Soil Conservation Service in creating a watershed project in an effort to provide the control of floods on the Forest and the Park Rivers. The Soil Conservation Service has initiated a survey on the Forest River which is in the southern portion of Walsh County. It is anticipated that when the Forest River survey is completed a survey of the Park River will be commenced.

Commissioners: Milton E. Johnston, Grafton; Charles Zahradka, Lawton and Joseph L. Bina, Conway, North Dakota.

Grafton Flood

WATER CONSERVATION AND FLOOD CONTROL DISTRICTS UNDER CONSIDERATION

Richland County District

The Board of County Commissioners for Richland County has on three occasions expressed a desire to have representatives of the State Water Conservation Commission explain the advantage of water conservation and flood control district entities to them. Commission staff members discussed the possibilities offered through district formation on all three occasions. On May 6th the Richland County Board forwarded a petition and a resolution to the State Water Conservation Commission requesting that a district be established for that county. A hearing was held at Wahpeton on June 13, 1958. The purpose of the district would be as follows: (1) To provide flood control and drainage of valuable farm lands within the Wild Rice River watershed. (2) Flood control and drainage of valuable agricultural land in the Sheyenne River watershed. (3) Flood control and drainage of valuable agricultural land within the watershed adjacent to the Bois de Sioux and Red River, commonly known as the Red River of the North. (4) Control and regulation of water draining into reservoirs proposed for the Wild Rice watershed. (5) The utilization of proposed water detention reservoirs for recreation and wildlife activities on all streams within the boundaries of Richland County. The county would also be equipped with a legal entity which could cooperate in the channel clearance of the various streams flowing into and passing through that county. This endeavor would aid in alleviating flood conditions that occur in towns, villages and cities adjacent to the stream. Sentiments expressed by those attending the hearing favored the formation of a district. Several expressed opposition to the district. The formation of the district was recommended to the Commission for favorable action.

IRRIGATION DISTRICTS

Irrigation districts are public corporations established in accordance with specific procedures set forth in the laws of the State of North Dakota. They are organized by the North Dakota State Engineer at the request of the owners of the land included. In all cases irrigation districts comprise a defined area of land which include irrigable lands that can be irrigated from a common water supply system. The district's boundaries are determined entirely by the land to be benefited and can over-lap township and county boundaries. Irrigation districts are governed by a Board of Directors composed of landowners in the district who are elected by the districts electors. The powers and duties of irrigation districts and their Boards of Directors are set forth in the laws of the state relating to these entities as are certain procedures governing their operations.

The procedure that must be followed in organizing irrigation districts is outlined below:

Organization of Irrigation Districts

1. A petition signed by landowners who together own a majority of the whole number of acres to be benefited by the proposed irrigation development is submitted to the North Dakota State Engineer requesting him to establish an irrigation district including certain designated lands This petition must be accompanied by a map showing the lands proposed for irrigation, the boundaries of the district and the location of proposed canals and facilities to bring the water from the source to the irrigable lands. The petition must be signed by owners of a majority of the land to be benefited and must also contain a description of the lands proposed to be included in the district.

2. Upon receipt of the petition the State Engineer will examine it for sufficiency as to signature and form and will determine whether or not in his opinion it is feasible to develop irrigation as proposed in the plan presented him in the petition If he determines such development feasible he will proceed to file copies of the petition in the offices of the County Auditors of the counties in which the irrigable land is located and will call for a hearing on the petition in the area in which the proposed district is to be located. This hearing is advertised in the official county newspapers of the counties in which the district is located for two consecutive weeks. The purpose of the hearing is to permit the State Engineer to receive evidence from the landowners concerned as to why or why not the district should be organized.

3. Following the hearing, if the State Engineer determines it desirable to proceed with the organization of the district, he will issue his Order declaring the irrigation district established subject to the approval of the electors of the district at an election he schedules. Copies of this order and related documents are filed with the appropriate county auditors and are open to public inspection. The election called by the State Engineer is advertised for two weeks in the official newspapers of the counties concerned. This notice specifies that any elector in the district may have his name placed on the ballot as a candidate for the Office of Director for the district by notifying the State Engineer in writing at least 10 days prior to the election. The State Engineer, in his order, will if the district contains more than 10,000 acres, divide the district into three, five or seven divisions primarily for the convenience of the voters and to provide for the geographic distribution of the directors elected to the district's Board of Directors.

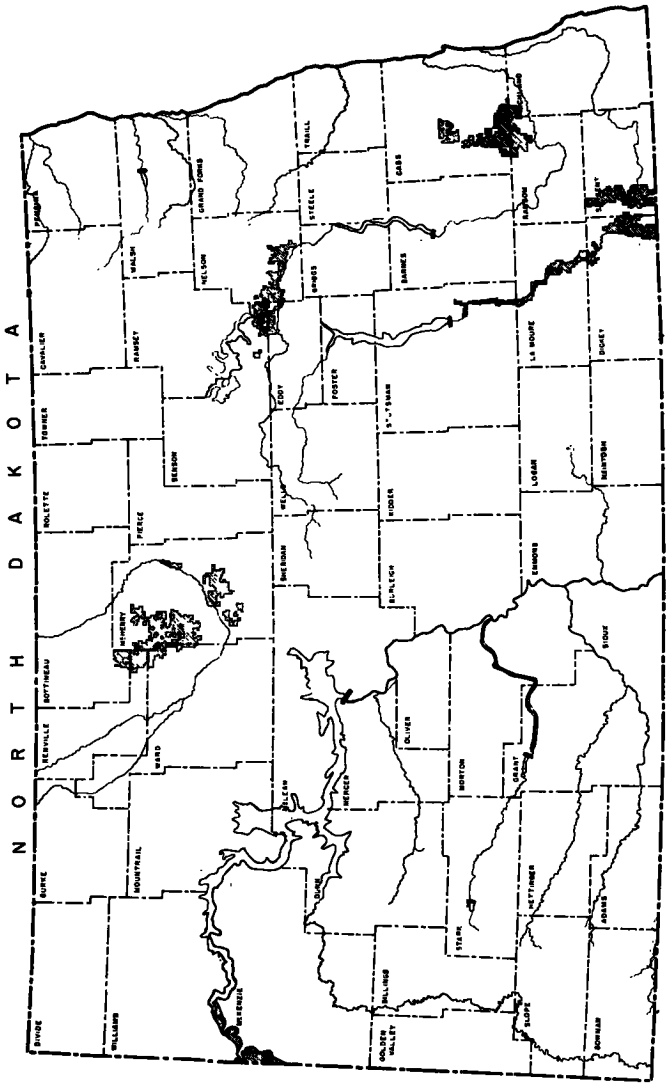
4. At the election called by the State Engineer, all qualified electors are entitled to cast the ballots to which they are entitled based on the number of irrigable acres of land they own, either for

or against the establishment of the irrigation district. The number of votes to which each elector is entitled is based on the number of irrigable acres of land he owns that are included in the district. He will receive one vote for each 20 acres of irrigable land or major fraction thereof he owns up to a maximum of eight votes for an individual landowner. In the case of land held in co-ownership, the maximum number of votes allowed is up to eight for each co-owner with the total for all co-owners not to exceed the number of votes to which the land they own is entitled. The electors of the district will elect a Board of Directors composed of one Director from each of the divisions in the District who will serve if establishment of the district is approved by the electors.

5. If the establishment of the district is approved by the electors at the election, the State Engineer will issue his order declaring the irrigation district duly established and that the Directors elected will constitute the Board of Directors for the District. From this point on the Board of Directors become the governing body for the district and functions as such. Their functions will be mainly directed, first to bringing about the construction of facilities to bring irrigation to the lands in the district, and, after this has been accomplished, to serve as the governing body in the operation and maintenance of these facilities. Funds required for the district are raised by the levy of special assessments against the benefited lands to pay the construction and operation and maintenance costs of irrigation.

The government and decisions relative to irrigation development in the district is entirely in the hands of the landowners of the district. It is through their elected board of directors the district functions. All contracts the district board wishes to negotiate must be submitted to the electors for their approval at an election before they can become effective. The directors of the districts are elected for terms of three years.

In North Dakota there are 15 organized irrigation districts at the present. Of the organized districts, there are five districts which have been organized in the Garrison Diversion Unit area during the period of this report. These districts include approximately 225,000 acres of land in central and eastern North Dakota that will be served by the diversion of water from the Missouri River at Garrison Dam. Petitions are on file in the Office of the State Engineer for the establishment of a sixth district in the Garrison Diversion Unit area of about 87,000 acres of irrigable land. These districts and the other existing districts in North Dakota are discussed in the following section of this report.



IRRIGATION DISTRICTS IN NORTH DAKOTA

Lower Yellowstone Irrigation District

The Lower Yellowstone Irrigation District, which is located in McKenzie County, is the oldest irrigation district in North Dakota. It was organized in 1909 and includes over 20,000 acres of irrigable land in North Dakota, which combined with some 35,000 acres of irrigable land in Montana forms the Lower Yellowstone Irrigation project. This project was one of the first to be constructed under the Reclamation Act that was enacted into law by Congress in 1902. Construction of the project facilities was started in 1905 and completed in 1909. The first water was delivered to the irrigable lands of the project on April 30, 1909.

In that the irrigable land of this project is located in North Dakota and Montana, it was necessary that two irrigation districts be established which provide the governing bodies for the irrigation project. They in turn have selected a Board of Control consisting of representation from each of the irrigation districts which serves as the operating agency for the project.

The construction costs chargeable to this project amounted to $66.00 per acre. The annual repayment charge is based on the value of crops produced each year and averages about $3.00 per acre. In addition the annual operation and maintenance charge for the district is, at the present, approximately $2.50 per acre.

The principal crops raised in the Lower Yellowstone project are alfalfa, wheat, corn, barley, beans and sugar beets. The feeding of lambs and cattle is one of the major operations of the project, and grain and forage crops are utilized in the feeding operations. Dairying is also an important operation.

On the Board of Directors for the North Dakota district are: Harry Kreis of Sidney, Montana, and Don Taylor of Fairview, Montana.

Sioux Irrigation District

The Sioux Irrigation District is located on the right bank of the Yellowstone River in McKenzie County approximately six miles northwest of Cartwright, North Dakota, and 20 miles southwest of Williston. The irrigation facilities for the district were constructed by the North Dakota State Water Conservation Commission in 1938 and 1939. The original project provided for the irrigation of about 1400 acres of Yellowstone bench land. At the present time about 700 acres are being irrigated and the possibility exists of the remaining area being developed in the near future. Irrigation water for the project is pumped from the Yellowstone River. The pump is powered by a 110 H.P. natural gas motor and has a capacity of 15 cubic feet per second.

Construction of the facilities for the project was financed through the North Dakota State Water Conservation Commission with a bond issue paid by the irrigation district. The principal amount of the original issue was $25,000 and the balance of this issue at the time of this report is $19,500. The bonds are being retired over a period of thirty years and bear interest at the rate of 2¼%. The farmers residing on the project were for the most part the original settlers. The topography is generally favorable for irrigation and little leveling is required prior to the actual irrigation. Some brush and timber has been cleared in recent years. The district has also experienced some loss of project lands due to channel changes in the river when it is at flood stage.

The district board of directors is composed of the following electors of the district: M. E. Sandy, Cartwright; Richard Croy, Cartwright; Emil Hartl, Cartwright and Alfred Gullickson, Cartwright, North Dakota.

Buford-Trenton Irrigation District

The Buford-Trenton Irrigation District was developed under the Case-Wheeler Act by the Department of Agriculture and the Bureau of Reclamation during the 1930's. The project is located along the left bank of the Missouri River in Williams County between the towns of Buford and Trenton and contains approximately 14,000 acres of irrigable land. The project was operated for several years by the Buford-Trenton Mutual Aid Corporation and in 1950 after the Department of Agriculture had turned the project over to the Bureau of Reclamation, the Buford-Trenton Irrigation District was organized. This district now serves as the governing board for the Buford-Trenton Irrigation project.

The facilities to bring the irrigation water to the lands in the Buford-Trenton Irrigation project consist of three pumps of 80 cubic feet per second capacity, 14½ miles of main canal and 42 miles of laterals. Water for the project is taken from the Missouri River Southwest of Trenton, North Dakota. In the original development of the project by the Department of Agriculture, the irrigation facilities were installed, land clearing and leveling accomplished and farm dwellings and buildings constructed on each of the units of the project. These units as developed were then sold to the project operators.

With the construction of Garrison Dam in North Dakota certain portions of the eastern section of the Buford-Trenton Irrigation District were acquired for the operation of the Garrison reservoir. The landowners preferred to sell their lands out-right to the government, rather than have protective facilities in the form of dikes constructed.

The Buford-Trenton Irrigation District has in recent years been faced with a critical problem in that channel changes in the Missouri River have threatened to cut off a large portion of the project lands and destroy a considerable amount of the main canal for the project. Appropriations were secured from Congress to investigate this problem and provide a means whereby protective facilities could be built for the project. This work is presently underway by the Corps of Engineers.

The directors of the Buford-Trenton Irrigation District are: D. L. Houston, Williston; Henry A. Bowen, Trenton; Ronald Gordon, Trenton and Bernhard Rossmiller, Trenton, North Dakota.

Eaton Flood Irrigation District

The Eaton Flood Irrigation District is located along the Souris River in McHenry County. This district contains about 8,000 acres of hayland adjacent to the Souris River which can be irrigated from facilities that have been developed to flood the land during the spring run-off period each year. The irrigation facilities for the project were built in 1936 under the direction of the North Dakota State Engineer and financed by the P.W.A. The total cost of the project was approximately $53,000.00, or about $7.00 per acre.

Facilities for the project include a 12 foot high dam on the Souris River that impounds the spring runoff in an extensive channel reservoir on that river. After the reservoir is full additional floodwaters are impounded in a series of seven ponds adjacent to the river channel and along the river below the dam. Six of these ponds are located on the west side of the river and one on the east side. A natural levee exists between the river and the ponds permitting the retention of the floodwaters in these ponds for a period after the spring runoff period is over. Water is released from the upper pond to the next lower and to each of the seven ponds in turn flooding the hay land located therein. Flow from the reservoir into the ponds and back to the river is controlled by a series of 12 headgates and waste gates. The Eaton Flood Irrigation District has operated successfully since the project facilities were installed in 1936. Through the irrigation provided for this district, large hay crops are produced which are utilized in the extensive cattle operation in that area. The operation of the Eaton Flood Irrigation project is under the direction of the Eaton Flood Irrigation District.

Members of the Board of Directors of this district who are appointed by the Board of County Commissioners of McHenry County are: Edward Keyes, Towner; L. G. Hardie, Towner and Richard Oium, Towner, North Dakota.

The Eaton Flood Irrigation District was organized and operates under a specific law dealing with flood irrigation districts.

Fort Clark Irrigation District

The Fort Clark Irrigation District is located on the west bank of the Missouri River in Mercer and Oliver Counties between the towns of Stanton and Fort Clark, North Dakota. Water to serve the irrigable lands in the district is pumped from the Missouri River. The Fort Clark project is the first of five pumping units to be constructed in North Dakota that were authorized in the Missouri River Basin Project in the Flood Control Act of 1944.

Project facilities are designed to serve 2,089 acres of irrigable land along the Missouri River bottoms and on the first bench. Delivery of water was made in 1953. The 25 landowners in the project voted unanimously to organize the Fort Clark Irrigation District in 1948, and in 1950 approved a repayment contract with the Bureau of Reclamation for the construction of facilities to serve the irrigable land.

Irrigation facilities constructed to serve the irrigible lands in the Fort Clark project include a pumping plant consisting of three vertically mounted, electrically driven pumps that discharge water through conduits into two main canals which convey the water to two bodies of land that are separated topographically. In addition there are two relift pumping plants to serve land above one of the main canals. The distribution system is designed to provide delivery of water to the high point of each 80 acres of irrigable land.

The total cost of the project to the Federal government, including planning, investigations, construction of the project facilities and overhead was $763,000. The repayment contract entered into by the Irrigation District with the Bureau of Reclamation calls for the repayment to the government of $66,000 over a period of 40 years. The balance of the construction costs for the project will be paid from surplus power revenues in the Missouri River Basin account. A ten year development period is provided in the repayment contract that the Fort Clark Irrigation District has negotiated with the Federal government. The first year of this development period was in 1956, three years after the initial delivery of water to the irrigable lands in the Fort Clark District occurred. During the development period, the irrigators are required to pay only the costs of operation and maintenance of the project facilities with the repayment of construction costs being delayed until the end of the development period. From 800 to 900 acres of the 1,780 acres of irrigable land that are being assessed for irrigation costs, received irrigation water during 1958. It is anticipated that the balance of the irrigable land will be leveled and developed for irrigation in the near future. A more rapid rate of development of irrigation in the Fort Clark project was noted during the past year than has occurred during the first two years of the development. The reason for this increased rate was primarily because of the dry spring experienced in this area.

The Board of Directors of the Fort Clark Irrigation District are: Halvor Pearson, Stanton; R. E. Thompson, Stanton; Joe Gustafson, Stanton and Henry Klindsworth, Stanton, North Dakota.

Western Heart River Irrigation District

The Western Heart River Irrigation District includes 2,463 acres of irrigable land along the Heart River in Grant County below the Heart Butte Dam. Water to serve the irrigable land in this district is released from the Heart Butte reservoir to the Heart River and then pumped from that river to the irrigable land by 25 separate pumping plants. There are 26 land ownerships in the district which range in size from 10 acres to 240 acres of irrigable land.

The Western Heart River Irrigation District was originally a part of the Heart River Irrigation District which contained some 13,000 acres of land between the Heart Butte Dam and the confluence of the Heart and Missouri Rivers. This large district was dissolved in 1953 and in December of that year the Western Heart River Irrigation District was organized. The repayment contract between the Irrigation District and the Bureau of Reclamation was negotiated in 1955 and construction of the irrigation facilities for the project was substantially completed by June 30, 1956.

1958 marked the first year of the seven year development period provided to the irrigators in the Western Heart River Irrigation District under their contract. During this year it is estimated that four to five hundred acres of land received irrigation water. The assessment levied by the Board of Directors of the Western Heart River Irrigation District in 1958 was $2.50 per acre. The repayment contract entered into by the Irrigation District calls for the repayment of $145,200 for the distribution facilities for the project in 40 years and $20,550 for the supply works construction (Heart Butte Dam) in a period of 30 years.

The directors of the Western Heart River Irrigation District are: Andrew Willman, Almont; William Sellmer, Elgin; John Bay, Carson and John Heinz, Secretary, Carson, North Dakota.

Bowman-Haley Irrigation District

The Bowman-Haley Irrigation District includes about 5,000 acres of irrigable valley land along the North Fork of the Grand River in Bowman County in southwestern North Dakota. This irrigation district was organized during the 1930's in connection with the proposed Bowman-Haley Dam on the Grand River and related irrigation development that was being investigated at that time. The Bowman-Haley project has long been advocated by the local people and has been investigated several times by various agencies over a period of 50 years. The most recent investigation based on irrigation

development for the Bowman-Haley Unit that was completed by the Bureau of Reclamation indicated that the project was infeasible. Investigations of the Bowman-Haley project were renewed during the past biennium when the State Water Conservation Commission requested the Corps of Engineers to investigate the project with the view of providing a water supply for municipal and industrial use in the Bowman-Haley area. Indications from these studies are that the construction of the Bowman-Haley Dam is feasible and it is expected that a report by the Corps of Engineers establishing feasibility of the project will be submitted to Congress shortly. This project is discussed further under the Bowman County Water Conservation and Flood Control District in another section of this report.

It is possible that some irrigation will be developed along the Grand River if the Bowman-Haley Dam is constructed, although the extent of irrigation development will probably not be as extensive as was originally contemplated. The Bowman County Water Conservation and Flood Control District has taken over the active sponsorship of the Bowman-Haley Dam and related development.

Cartwright Irrigation District

The Cartwright Irrigation District was organized in 1939 for the purpose of developing irrigation of about 800 acres along the Yellowstone River in McKenzie County near the town of Cartwright, North Dakota. The Cartwright Unit was authorized by Congress as a Missouri River Basin project in the Flood Control Act of 1944 and has been investigated by the Bureau of Reclamation. The Bureau's investigation resulted in an adverse report of the Cartwright Unit because of the high construction costs of the project facilities in relation to the anticipated benefits that would be derived from irrigation.

The State Water Conservation Commission has maintained that because of the small size of this project it would be more feasible for it to be developed by the State Water Commission or a local agency whose forces are geared to the smaller type construction program. The Commission cites the possibility that this project could be developed under the Small Projects Act.

During the past biennium the Commission has investigated the possibility of utilizing groundwater as a source of supply for irrigation in the Cartwright Unit. At the present time pumping tests are being conducted to determine if the groundwater supply that has been located by Commission survey crews will be satisfactory for irrigation in the area. If this supply is adequate, it is anticipated that irrigation can be developed at a fraction of the cost required if water from the Yellowstone River were to be utilized. A more

complete discussion of this investigation can be found under the engineering investigation section of this report. The Cartwright Irrigation District has become active during the past year in connection with the investigations that are being conducted by the State Water Conservation Commission. They indicate that if irrigation development is feasible by the use of groundwater sources and if proper financing arrangements can be made, the irrigation district is willing and anxious to proceed with the development of the Cartwright Unit.

Directors of the Cartwright Irrigation District are: William Lassey, Cartwright; Perry Elletson, Cartwright; Henry Iszley, Cartwright and Ruth A. Schriver, Secretary, Cartwright, North Dakota.

Yellowstone Pumping Irrigation District

The Yellowstone Pumping Irrigation District includes about 2,000 acres of irrigable land along the right bank of the Yellowstone River in McKenzie County. This district adjoins the Cartwright Irrigation District. The district was organized in 1938 and at that time it was proposed that the irrigation water supply for the district would be supplied by extending the main canal of the Sidney project located in Montana. It is contemplated that irrigation in this district may be developed concurrently with the Cartwright District utilizing groundwater sources.

Directors of the Yellowstone Pumping Irrigation District are: R. S. Nutt, Sidney, Montana; Roy Olson, Cartwright; Gerald Melland, Cartwright and Bjarne Walla, Secretary, Cartwright, North Dakota.

Oakes Groundwater Irrigation District

The Oakes Groundwater Irrigation District, a small 640 acre district located in Dickey County, North Dakota, was organized in 1957. It provided the local landowners in the district an entity through which they could bring about the development of irrigation from groundwater sources in that area. There are five landowners concerned in the Oakes Groundwater Irrigation District. The lands being irrigated are served by wells that they have installed on their land. The actual development of irrigation in this area was undertaken prior to the organization of the irrigation district.

The Oakes Groundwater Irrigation District was organized by the State Water Conservation Commission and the North Dakota State Engineer in order to provide the irrigators in this area a means whereby assistance from the State Water Commission could be made available to them. The irrigators have agreed with the State Water Conservation Commission to set aside certain portions of the irrigable land in the district for experimental purposes and to provide data that will be available to other farmers in the area when irrigation on a larger scale is developed.

The Oakes Groundwater Irrigation District Board of Directors consists of the following: C. E. Roney, Oakes; Ivan Rodine, Oakes and Paul Roney, Oakes, North Dakota.

Lewis and Clark Irrigation District

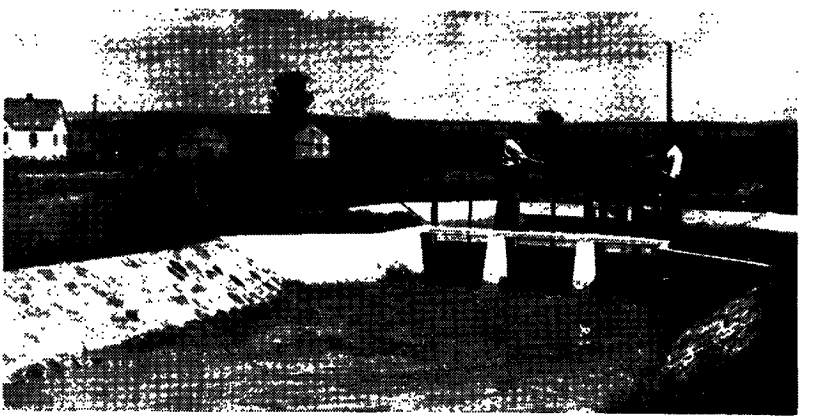
The 5,000 acre Lewis and Clark Irrigation District located along the Missouri River about six miles southwest of Williston was organized in the late 1930's in connection with the development of the Lewis and Clark Irrigation project by the State Water Conservation Commission and the North Dakota Rural Rehabilitation Corporation. The 58 units in the project were served by facilities that included a pumping plant and system of canals that brought the water from the Missouri River to the irrigable lands in the district. The Lewis and Clark Irrigation District operated from 1940 when the first irrigation water was furnished to the lands until 1957 when the district was dissolved. Irrigation in the area is still being carried on by the Lewis and Clark Mutual Aid Corporation.

The Lewis and Clark Irrigation District is so situated that its irrigable lands are located in the upper area of the Garrison reservoir and would be affected by the operation of that reservoir. Included as a part of the Garrison Dam and reservoir and project was a system of levees or dikes to protect the Lewis and Clark Irrigation District. The landowners of the Lewis and Clark Irrigation District objected to the installation of this system of dikes by the Corps of Engineers because they maintained that protection for their irrigable land would not be afforded by the dikes to the extent that would be necessary for the continued successful operation of the project. The landowners proposed that rather than installing the system of levees and dikes, that the Corps of Engineers acquire the land in the Lewis and Clark Irrigation District. This proposal was approved by the Corps of Engineers and authorized by Congress. In 1957 the Corps of Engineers completed negotiations with the landowners of the Lewis and Clark Irrigation District to acquire all of the land in that project. These lands were purchased outright by the Corps of Engineers and development of the system of levees and dikes for the project was abandoned.

With the acquisition of all of the lands in the Lewis and Clark Irrigation District by the federal government for the Garrison reservoir operation, the need for the existence of the Lewis and Clark Irrigation District ceased to exist. The district, therefore, was dissolved in 1957 and the operation of the irrigation facilities was taken over by the Lewis and Clark Mutual Aid Corporation. Under the existing arrangement the landowners on the Lewis and Clark project lease the irrigable lands from the Corps of Engineers at a given rental rate each year and the Lewis and Clark Mutual Aid Corporation operates the irrigation facilities for the project so as to serve the irrigable land with the irrigation water they need.

This arrangement is possible because it is not anticipated that the Garrison reservoir will be at an elevation that will affect the lands in the Lewis and Clark Irrigation project for many years. Even when the reservoir gets to an elevation that will affect the land in this project, it is not expected that it will remain at this elevation for such an extensive period that it will adversely affect the project throughout the whole season of any one year.

After the lands in the Lewis and Clark Irrigation project were sold to the federal government, the Corps of Engineers proposed to rebuild a portion of U. S. Highway No. 85 that is routed through the project. If all of the lands in the Lewis and Clark project were to be served after this highway construction work was completed, it would require the installation of a structure that would permit water to be channeled under the highway to serve the lands in the project east of the highway. Through the efforts of the State Water Conservation Commission and local proponents of the Lewis and Clark Irrigation project, funds were made available to provide for the installation of the necessary structures to serve all of the lands in the Lewis and Clark project. The State Water Commission agreed to provide certain funds on a loan basis to the Mutual Aid Corporation to accomplish this purpose, which were matched by the federal government.



Lewis and Clark Project — Main Canal Headgates

IRRIGATION DISTRICTS IN GARRISON DIVERSION PROJECT AREA

During the past year and a half several irrigation districts have been organized in the Garrison Diversion project area. It will be these districts and others that will be organized in the project area, along with the Garrison Diversion Conservancy District that will contract for the construction and operation and maintenance of the facilities for the vast 1,000,000-acre Garrison Diversion Unit. Water to serve the districts in this project will be diverted from the Missouri River at Garrison Reservoir through a major diversion system and to the individual districts through a vast network of smaller canals.

At the time of this report, five irrigation districts including about 225,000 acres of irrigable land have been organized in the Garrison Diversion Unit area. In addition, petitions are on file with the North Dakota State Engineer for the organization of a sixth district of approximately 87,000 acres of irrigable land. The circulation of petitions for the establishment of irrigation districts in several other areas in the Garrison Diversion Unit is presently underway, and it is expected that these irrigation district petitions will be filed with the State Engineer within the next year.

Each of the irrigation districts that has been organized to date has indicated to the Bureau of Reclamation, the Garrison Diversion Conservancy District and other interested State and Federal agencies that they desire to begin contract negotiations for their irrigation facilities as soon as possible. It is anticipated that these contract negotiations will be carried on within the next year. The proposed contract arrangements for the Garrison Diversion project provides for contracts between the irrigation districts and the Federal government, the Conservancy District and the Federal government, and the irrigation districts and the Conservancy District. Drafts of these contracts are now being prepared by the Bureau of Reclamation and are expected to be submitted to the other contracting entities within the near future.

In organizing irrigation districts in the Garrison Diversion Unit area, a procedure whereby land would be included voluntarily at the landowner's request has been followed. Under this procedure all land that landowners requested be left out of an irrigation district was not included. The purpose for following this procedure was to avoid the complications that inevitably result when landowners are forced into irrigation districts against their will. In all cases in the Garrison Diversion Project area where irrigation districts have been organized, from 80 percent to 95 percent of the irrigable land in a given area has been included in the districts that have been organized. It is expected that the land originally left out of districts will gradually be included as irrigation develops. The following irrigation districts have been organized in the Garrison Diversion Unit area:

James River Irrigation District

This irrigation district contains approximately 13,700 acres of irrigable land located along the James River in Stutsman, LaMoure and Dickey Counties. It is the first district in the Garrison Diversion Unit area on which all phases of organization were completed. The district was established September 20, 1957, and the district Board of Directors that was elected at the initial election was organized on November 13, 1957.

Semi-detailed surveys of the Bureau of Reclamation indicated that there were 14,400 acres of arable land located in the service areas in which the James River Irrigation District was concerned. Approximately 95 percent of this total potential, or 13,720 acres was included in the district.

Irrigation water to serve the irrigable lands in the James River Irrigation District will be released from the Lonetree Reservoir, the major regulating reservoir of the Garrison Diversion Unit, into a canal that will carry it to the James River where it will be stored in the Jamestown Reservoir and released as needed downstream. A series of pumping stations will pump the water from the James River to the irrigable lands in the irrigation district.

Since the James River Irrigation District was organized, the Bureau of Reclamation has completed their detailed surveys and investigations of the James River area and are in the process of preparing a definite planned report for this area.

The members of the Board of Directors of the James River Irrigation District are: J. H. Winslow, LaMoure; John Earle Chappel, Dickey; Art Whitney, Ypsilanti and James Stine, LaMoure, North Dakota.

Dickey-Sargent Irrigation District

The Dickey-Sargent Irrigation District contains approximately 48,000 acres of irrigable land located in Dickey and Sargent Counties in south-central North Dakota. This district was established on September 27, 1957, after the election on the question of organizing the district had been held by the State Engineer. The District Board of Directors was organized on November 12, 1957. There were 55,730 acres of arable land in the service areas in which this irrigation district was concerned. The original petitions submitted to the State Engineer called for the inclusion of approximately 90 percent of this acreage in the Irrigation District. The District boundaries were modified following the hearing to exclude certain lands, reducing the percentage of land included in the district to approximately 85 percent.

Water to serve the irrigable lands in the Dickey-Sargent Irrigation District will be available from that stored and regulated in the Lonetree Reservoir and released to the James River, re-regulated in the Jamestown Reservoir, and released down the James River to the Dickey-Sargent area. A pumping plant will be installed in the vicinity of Oakes which will pump water from the James River to serve the irrigable acres in this district. The water that is pumped from the James River will be further stored and re-regulated in Taayer Reservoir to serve the areas in Sargent County in the eastern portion of the district.

The District Board of Directors has been actively working on matters to firm up the irrigation district organization. This Board of Directors is composed of the following electors of the District: Emil Banderet, Straubville; William Bosse, Cogswell; Norval A. Dietz, Cogswell; Carl Daniels, Oakes and Chester Ahlin, Oakes, North Dakota.

Warwick-McVille Irrigation District

The Warwick-McVille Irrigation District which contains approximately 47,000 acres of irrigable land located in Nelson, Benson, Eddy and Ramsey Counties, North Dakota, was organized in November of 1957. There was a total potential acreage in the service areas in this section of the Garrison Diversion project of 55,000 acres. At the election held on the organization of this district, 98 percent of the votes cast favored establishing the Warwick-McVille Irrigation District. The irrigable lands in the Warwick-McVille Irrigation District will receive their water supply from the New Rockford canal, one of the main canals leading from the Lonetree Reservoir in the Garrison Diversion project. This canal will lead eastward from the James River near Lonetree Reservoir to the irrigable lands in the district. The New Rockford canal will also serve several other service areas before reaching the Warwick-McVille District. Irrigation districts in these other areas have not been organized to date.

The Board of Directors of the Warwick-McVille Irrigation District has been actively working towards the early development of irrigation in the district.

The members of the Board of Directors of this District are: R. R. Lofthus, McVille; Fyllis Burthold, Pekin; Earl Burns, Tolna; Howard Pare, Tolna and Edward Reeves, Warwick, North Dakota.

Tri-County Irrigation District

The Tri-County Irrigation District contains approximately 88,000 acres of land located in Cass, Ransom and Richland Counties in southeastern North Dakota. This district was organized by the North Dakota State Engineer upon petition from the landowners concerned on April 18, 1958. There were approximately 110,000 acres of irrigable land in the service areas in which this district was concerned.

The irrigable land in the Tri-County Irrigation District is not included in the first million acres proposed for development in the Garrison Diversion Unit Report that has been submitted to the Department of Interior by the Bureau of Reclamation. The land in this district is located in the Sheyenne Delta area and is so situated that irrigation development under the Garrison Diversion Unit will be feasible. It is anticipated that waters which will be diverted into the Sheyenne River will be available to develop irrigation in this area. These waters will be the return flows from irrigation developed in the Garrison Diversion project farther west.

Although the land in this district is not located in the initial 1,000,000 acre proposed Garrison Diversion Unit, it was organized into an irrigation district at the request of the many landowners in the area who were anxious to be in a position to obtain a water supply from the Garrison Diversion Unit as soon as possible. It is possible that irrigation in the Tri-County Irrigation District can serve as substitute acreage for areas in the initial million-acre project for which development is not desired by the local landowners.

The Board of Directors of the Tri-County Irrigation District are keenly interested in the early development of the Garrison Diversion Unit. Since their organization on August 4, 1958, they have actively supported the Garrison Diversion Unit and the addition of land to their irrigation district so as to be in a position to contract for a water supply at an early date.

The members of the Board of Directors of the Tri-County Irrigation District are: Robert Radcliffe, Leonard; Ervin Bartholomay, Sheldon; Walter Geyer, Sheldon; Leon Beadles, Leonard; Lawrence Baarstad, Leonard; Hugo Hoffman, Wheatland and Lorry I. Madsen, Wheatland, North Dakota.

Karlsruhe Irrigation District

The Karlsruhe Irrigation District was organized June 19, 1958 and contains approximately 25,000 acres of irrigable land located in south-central McHenry County immediately south of the Souris River. This district contains approximately 80 percent of the total arable acres available for irrigation in the service areas concerned. At the election for the organization of the district held on June 17, 1958, over 98 percent of the votes cast favored the establishment of the irrigation district.

The Karlsruhe Irrigation District will receive their water supply from a lateral canal leading from the Velva canal. The Velva canal, one of the major canals that will be constructed to serve lands in the Souris Loop area, will carry water from the Lonetree Reservoir to the irrigable land located in north-central North Dakota. The total potential acreage in the service areas involved in the Karlsruhe Irrigation District was 32,000 acres.

The Karlsruhe Irrigation District Board of Directors, as have all the other Board of Directors of Irrigation Districts organized in the Garrison Diversion Unit, has actively supported the program to firm up the boundaries of their district. By so doing they hope to be in a position whereby they can negotiate contracts for irrigation facilities for their area with the Bureau of Reclamation and the Conservancy District at an early date.

The members of the Board of Directors of the Karlsruhe Irrigation District are: George Lauinger, Balfour; Jack Keller, Bergen; and Delbert Krumweide, Voltaire, North Dakota.

Ducks and Geese — Souris Refuge

GARRISON DIVERSION CONSERVANCY DISTRICT

The Garrison Diversion Conservancy District was established by the North Dakota Legislature in 1955 to provide the overall legal entity that could deal for the construction, operation and maintenance of the Garrison Diversion Unit. As originally established by the legislature, the district consisted of all of 22 counties in the State that contained areas that would be benefitted by the development of the Garrison Diversion Unit. Since the district was established, three additional counties have applied to the Board of Directors of the Conservancy District for admission to the district and have been admitted, now making the Conservancy District a 25 county organization. The Conservancy District, as established by the legislature, was given specific powers and duties relative to the development of the Garrison Diversion Unit, including the power to contract for the project, promote its development and levy a tax within definite limits to meet its obligations in respect to the project.

The Garrison Diversion Unit is the outgrowth of proposals and plans that have been studied by various agencies and promoted by various proponents over the past seventy years. For may years North Dakotans have visualized the widespread potential benefits to the State by diverting water from the Missouri River to be utilized for irrigation and other purposes in the central and eastern portion of the State. These proposals have evolved into the Garrison Diversion Unit plan.

The Conservancy District and many other agencies and local organizations are directing their efforts toward the early construction and development of this project. Through the construction of the Garrison Diversion Unit, water will be available to areas located in 25 counties in the State for the irrigation of between one and two million acres of land for lake restoration, for municipal and industrial water supplies, for development of recreational facilities and for the propagation and conservation of fish and wildlife resources. Investigation of the Garrison Diversion Unit has been under the direction of the United States Bureau of Reclamation. It will be this agency that will be responsible for the construction and development of the project plan. A more detailed discussion of the Garrison Diversion plan can be found in the section of this report devoted to the Bureau of Reclamation's activities. In enacting the Garrison Diversion Conservancy District law and establishing this Conservancy District, the North Dakota legislature not only provided an entity that would be directly responsible for the development of the Garrison Diversion Unit, but it also demonstrated North Dakota's good faith in promoting the project.

The Conservancy District is governed by a Board of Directors consisting of one person appointed by the Board of County Commissioners of each of the 25 counties included in the district. This 25

manned Board of Directors is responsible for conducting the business of the Conservancy District and has carried on an extensive program in promting the early development of the Garrison Diversion Unit. The Board of Directors is presently composed of the following appointees:

Name	Address	Term Expires
Roy A. Holand, Chairman	LaMoure, N. Dak.	June 30, 1961
Henry J. Steinberger, Vice Chairman	Donnybrook, N. Dak.	June 30, 1961
E. G. Ranum	Valley City, N. Dak.	June 30, 1960
Clarence Jensen	Esmond, N. Dak.	June 30, 1961
Lester Wyman	Westhope, N. Dak.	June 30, 1961
Mark Andrews	Mapleton, N. Dak.	June 30, 1959
Forrest M. Gottschalk	Oakes, N. Dak.	June 30, 1959
Russell L Belquist	New Rockford, N. Dak.	June 30, 1959
Ralph L. Harmon	Carrington, N. Dak.	June 30, 1961
James H. Erickson	Larimore, N. Dak.	June 30, 1961
Leon Sayer, Jr.	Cooperstown, N. Dak.	June 30, 1960
Walter J. Boye	Willow City, N. Dak.	June 30, 1959
Clarence W. Johnson	Underwood, N. Dak.	June 30, 1960
S. B. Tingelstad	McVille, N. Dak.	June 30, 1961
A. F. Gronvold	Rugby, N. Dak.	June 30, 1960
James B. Collinson	Devils Lake, N. Dak.	June 30, 1959
Alf N. Larson	Enderlin, N. Dak.	June 30, 1959
Kenneth L. Morgan	Walcott, N. Dak.	June 30, 1959
Reese A. Bartlett	Cogswell, N. Dak.	June 30, 1961
Ben F. Kludt	McClusky, N. Dak.	June 30, 1959
Francis Simmers	Jamestown, N. Dak.	June 30, 1960
Harry Olson	Finley, N. Dak.	June 30, 1959
Gilman Wastvedt	Hatton, N. Dak.	June 30, 1960
W. M. Harrington	Minot, N. Dak.	June 30, 1960
R. L. Bessel	Harvey, N. Dak.	June 30, 1960
Vernon S. Cooper, Secretary-Treasurer	Bismarck, N. Dak.	

Roy A. Holand, the director from LaMoure, North Dakota, serves as Chairman of the Board of Directors. Henry Steinberger of Donnybrook, the director from Renville County, serves as vice Chairman and Vernon S. Cooper, Assistant Secretary of the State Water Conservation Commission, serves as Secretary-Treasurer for the district. These officers are the same officers who were initially elected at the organization meeting of the Conservancy Board of Directors. They have been re-elected each year since that meeting.

The Conservancy District has been given the authority to finance its operations by making a tax levy over all of the property located within the district area. This levy cannot exceed one mill, of which nine-tenths must be used to pay the cost of contracts that the Conservancy District enters into for the construction, operation and maintenance of the project facilities for the Garrison Diversion Unit. The other one-tenth mill is earmarked for use in financing the district's administrative costs, including the per diem and expenses of its directors, salaries and other expenses of its employees in district operations. The district has made a levy of one-tenth of a mill each year during its existence to finance these costs. This one-tenth of a mill raises approximately $35,000 per year.

The program that the Conservancy District directors have followed during the three years of its existence has been designed to bring about the early development of the Garrison Diversion Unit. This program has involved many undertakings, several of which are discussed in the following section of this report.

Project Information

The Conservancy District has sponsored an extensive program designed to disseminate information about irrigation and the Garrison Diversion Unit to the many people, farmers, businessmen and others in the project area who will benefit from the development of the project. This program which has been sponsored by the Conservancy District's Project Information Committee, has been directed mainly to the potential irrigators in the project with the object of providing them factual information about irrigation and the Garrison Diversion Unit upon which they can base their decision and either accept or reject the project.

In conducting the information program, the newspapers, radio and television stations have cooperated extensively. A series of six news articles was prepared under the sponsorship of the District that were made available to all newspapers in the Conservancy District area and others from elsewhere in the State that indicated they wished to use the series. Several newspapers in the state have undertaken to assign staff writers to certain stories concerned with the Garrison Diversion Unit and irrigation. Other publications from other states have also carried stories dealing with the project.

One of the most effective programs sponsored by the Conservancy District in which all interested water resource organizations cooperated was that of bringing irrigation farmers from the Lower Yellowstone project and other existing irrigation projects into the Garrison Diversion Unit area to discuss irrigation farming, its benefits and disadvantages with the potential Garrison Diversion Unit irrigation farmer. This program resulted in numerous meetings arranged under the direction of the farm development committees assisted by county agents in each of the counties and the North Dakota Extension Service. These meetings were at the rate of two and three a day during the time the visiting irrigation farmers were available and were kept as small and informal as possible. They did provide the prospective irrigators in the Garrison project area much valuable information and answers to many of their questions.

The first step taken by this committee was that of organizing farm development committees in most of the 25 Conservancy District counties. These committees were volunteer organizations composed of farmers who owned land that was classed as irrigable in the project. Their primary purpose was to represent all the potential irrigators in their areas and assist them in securing the factual information about irrigation. These committees also have served as the local group that has spearheaded the circulation of petitions for the establishment of irrigation districts in those areas where such action has been desired and accomplished. Throughout the Conservancy District area 22 farm development committees have been organized consisting of about 300 members.

Also a part of the project information program conducted by the Conservancy District was that of organizing tours of irrigation projects that were attended by many farmers from the Conservancy District area. These tours provided the visiting farmers the opportunity to see irrigation practiced and to gain first hand information from the actual irrigation farmers as to their opinion about irrigation. Tours were made of the Lower Yellowstone project, the Deep River and Sheyenne Development farms in North Dakota, and the Redfield Development farm in South Dakota, the Lewis and Clark and Buford-Trenton projects, and irrigation farms in the Dickinson vicinity.

The Conservancy District in cooperation with the Missouri Souris Projects Association and the North Dakota Reclamation Association, the Bureau of Reclamation, the State Water Conservation Commission and the North Dakota Extension Service cooperated in the publication of a booklet titled "Basic Facts on Irrigation in North Dakota" that has been distributed widely throughout the project area and the state. The district also sponsored the preparation of a film on the Lower Yellowstone project and the Garrison Diversion Unit.

The Conservancy District's information program is being continued through the Boards of Directors of the irrigation districts that have been organized in the project area and with the farmer development committees in counties where districts have not as yet been established.

Coordinating and Review Project Planning

Soon after the Garrison Diversion Conservancy District was established, its Board of Directors recognized the importance of the district actively participating in the planning for the Garrison Diversion Unit as this planning was carried on. A committee consisting of nine of the members of the Board of Directors was established to function in this capacity. Several vitally important matters relative to the Garrison Diversion Unit and its development insofar as the Conservancy District is concerned has been referred to this committee for consideration.

Early in 1956 the Conservancy District and other organizations became aware of the need of having a definite cost of irrigation to the individual farmer in the project area that could be announced. Many of the potential irrigators in the area were interested in irrigation farming but wanted the answer to the question "What will irrigation cost me?" The cost of water is made up of two major components, the amount to be repaid on the construction cost and the cost of operation and maintenance of the project facilities. The irrigators are required to pay the actual cost of operation and maintenance which cost ordinarily makes up two-thirds of the water cost. It was essential, therefore, that before a cost of water could

be announced, the estimated cost of operation and maintenance be as accurate as possible. The Bureau of Reclamation in their studies had made such an estimate. However, both the Bureau and the Conservancy District desired to have this estimate reviewed by an uninterested expert to determine its accuracy. The Conservancy District in 1956 employed Mr. H. A. Parker of Ephrata, Washington, former manager of the Columbia Basin Project in Washington and a highly qualified expert in the field of irrigation, to review the operation and maintenance estimates for the Garrison Diversion Unit. His study was completed in December, 1956, and resulted in several recommendations that will effect considerable savings to the irrigators in the Garrison Diversion project. It was also used to determine the cost of irrigation that has been recommended by the Conservancy District to the irrigation districts that will be established and will determine the actual assessments to be made. The cost of water as submitted to the district by the Bureau of Reclamation and recommended by the Conservancy District is as follows:

	Class 1 Land		**Class 2 Land**		**Class 3 Land**	
	Percent in Division	Cost	Percent in Division	Cost	Percent in Division	Cost
Northern Division	8%	$7.00	29%	$6.30	63%	$5.43
Central Division	12%	$7.25	40%	$6.51	48%	$5.76
Southern Division	12%	$7.50	37%	$6.85	51%	$6.10

The Coordinating and Review Committee of the Conservancy District has also cooperated with the Bureau of Reclamation, the State Water Conservation Commission and other agencies that are interested in the Garrison Diversion Unit in reviewing various phases of the project. One of these reviews has been concerned with alternate plans for the project main supply works. It is expected that as development of the project progresses, this committee will be actively engaged in the project review.

The committee has participated in a study to determine the adequacy of the Conservancy District revenue to finance various aspects of the project as is presently contemplated. This study is designed to determine the extent to which the district will be able to finance "missing acres", and assist irrigators in operation and maintenance costs during the ten year development period, and at the same time meet its anticipated obligation for a portion of the costs of the project costs. The original study, which was conducted by the Bureau of Reclamation, is being augmented by a second study by the Bureau using a different set of assumptions as to the rate of development, amount of Conservancy District revenue available, the number of missing acres that will be financed and other related matters.

The Conservancy District's Coordinating and Review Committee has also been designated by the Board of Directors to be responsible for the details involved in the contract negotiations for the project. Contract considerations were initiated in July of 1957 and have received an increasingly greater amount of attention since that time. The committee has studied proposals relative to the contracting arrangements for the project that have been made by the Bureau of Reclamation and has recommended certain basic provisions be approved by the Board of Directors. Following the Board of Director's action on this recommendation, expected in July 1958, the Bureau of Reclamation has indicated they will proceed in preparing drafts of repayment contracts. The basic contract arrangements being considered provides for a three way contracting set-up. One contract would be negotiated between the federal government and each irrigation district for the distribution system to serve the irrigable lands in each district; a second contract would be negotiated between the federal government and the Conservancy District for the water supply system of the project and the third contract would be negotiated between the Conservancy District and each irrigation district for the irrigation district's interest in the water supply system, the operation and maintenance assistance the Conservancy District would make available to the irrigation districts and the extent to which the Conservancy District would assume the responsibility for the "missing acres" in each irrigation district. The arrangements further provide that the Conservancy District would be the fiscal agent for the federal government and all payments from the irrigation districts would be channeled through the Conservancy District. The Conservancy District would also be named the operating organization for the project. The many details that will be involved in the contracts for the Garrison Diversion Unit will be subject to a great deal of study and review by the Coordinating and Review Committee and the Board of Directors, as well as the individual irrigation districts during the next year in order to bring about construction of the project facilities at an early date.

One of the major events to occur in the state in respect to the Garrison Diversion Unit was the hearing held in Devils Lake October 30, 1957, by the Sub-Committee on Irrigation and Reclamation of the United States House of Representatives Committee on Interior and Insular Affairs. This Sub-Committee, which was headed by Congressman Wayne Aspinall of Colorado, heard testimony from 52 witnesses from North Dakota, headed by Governor John E. Davis, in support of the Garrison Diversion Unit at the day-long hearing that was attended by approximately 2,500 interested farmers and businessmen from the state. The hearings were actually on a bill introduced by Congressman Otto Krueger providing for certain modifications to the Garrison Diversion Project authorization. These field hearings will be followed by additional hearings in Washington when the project comes up for Congressional consideration there.

Other Congressmen attending the hearings were Lee Metcalf of Montana; A. L. Miller of Nebraska; E. Y. Berry of South Dakota; Al Ulman of Oregon and John A. Burns of Hawaii. Mr. Sidney L. MacFarland, Engineering Consultant for the Committee, was also present.

Arrangements for the hearing were in charge of a Coordinating Committee appointed by Governor Davis consisting of representatives of the State Water Conservation Commission, the Garrison Diversion Conservancy District, the Missouri-Souris Projects Association, the North Dakota Reclamation Association and several farm leaders throughout the state.

The Conservancy District has also joined with the State of North Dakota as defendants in a court action to determine the right of the state to inundate certain lands bordering Devils Lake as is contemplated under the Garrison Diversion plan. The point involved is whether or not this reliction land will have to be purchased or whether the state has the right to flood it without compensating the landowner. This action is in the nature of a friendly lawsuit to determine this point of law prior to the actual construction of project facilities. The decision of the District Court that the state must pay for such land has been appealed to the North Dakota Supreme Court.

The district has actively participated in appearances before Congressional Appropriations Committees for funds to continue investigations for the Garrison Diversion Unit and in conferences with various government agencies relative to various aspects of the project. As the tempo increases in the development of the project, it is expected that the Conservancy District's activity in this phase will increase.

The North Dakota Legislature provided a unique organization that could represent the local interests in the Garrison Diversion Unit when it established the Garrison Diversion Conservancy District. Although there are other conservancy district organizations in the country, there is none as large as North Dakota's, nor are there any that attempt to bring in the interest of the indirect beneficiaries in a project as does the North Dakota district. Through the district's Board of Directors and the irrigation districts that are being organized, it is expected that the control of the Garrison Diversion Unit can remain with the local people.

INTERNATIONAL AND INTERSTATE RIVER COMPACTS

Several of North Dakota's major streams are international or interstate in nature and as such affect areas outside of North Dakota. As the demand for water increases, it is essential to provide for the equitable divisions of the waters of these international or interstate streams between the states and provinces concerned. This division can be accomplished in various ways. It can be through court litigation among the states concerned, or it can be accomplished by direct congressional action. The third and most desirable method is by compact whereby the states negotiate and agree as to the proper division of the waters of the streams involved.

The Constitution of the United States requires that states obtain the consent of Congress before entering into compacts or agreements. Congress has in many instances authorized various states to negotiate compacts for the division of the waters of certain streams. Such compact arrangements provide the states concerned, who have the vital interest in the waters of the river, to determine how these waters should be allocated. Although the negotiation of a compact between states is ordinarily a time-consuming transaction because of the many complex problems involved, it is the most just method to determine the proper division of these waters.

The procedure in negotiating an interstate river compact is as follows: Authorization obtained from Congress for two or more states to enter into compact negotiations. This authority is usually limited as to time and ordinarily the President of the United States designates the Federal representative to the compact negotiations. When this authority has been obtained, representatives from the various states meet periodically over as long a period as is necessary to arrive at their recommendations as to their equitable division of the waters of the stream. Any agreement reached by the representatives in compact negotiations must be ratified by the state legislature of each of the states concerned and also approved by Congress before that compact becomes law.

Two rivers in which North Dakota has an interest are considered international rivers. These are the Souris which flows through portions of North Dakota, Saskatchewan, and Manitoba, and the Red which serves as the boundary between Minnesota and North Dakota, then enters Manitoba, Canada and empties into Lake Winnipeg. Matters pertaining to international streams come under the jurisdiction of the International Joint Commission which was set up by treaty between the two countries and is composed of representatives of these two countries.

In North Dakota there are seven rivers that are either international or interstate in nature. In addition to the Red and Souris Rivers which are international streams, there are the James River and the Grand River in which North Dakota and South Dakota have an interest, the Little Missouri River in which North Dakota, South Dakota, Montana and Wyoming have an interest, the Yellowstone River on which a compact has been negotiated between the states of North Dakota, Montana and Wyoming and the Missouri River which affects the ten Missouri River Basin states. The following discussion in this report covers the compact negotiations that have been made or are underway for these rivers.

INTERSTATE COMPACTS APPROVED

Yellowstone River Compact

The states of 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 on October 30, 1951. This compact provides for the division of the waters of the Yellowstone River and its tributaries between these three states affected by the Yellowstone River. The compact has successfully operated during the seven years it has been in force. The provisions of the Yellowstone River Compact have been published in previous biennial reports of the State Water Conservation Commission.

In November 1957, the Commissioners of the Yellowstone River Compact approved an application presented through the Wyoming Commissioner by the Columbia Geneva Steel Company to divert 5.3 cubic feet per second of water from the Big Horn River, a tributary of the Yellowstone, out of the Yellowstone River Basin to be utilized in connection with an industrial development in Wyoming. The approval of the Yellowstone Compact Commission of this request was given insofar as that Commission's authority to approve such trans-basin diversions extended. The State Water Conservation Commission approved this action on December 20, 1957.

Only a small portion of North Dakota is affected by the Yellowstone River, therefore the states of Montana and Wyoming are primarily interested in the division of the waters of this river. These states have the controlling voice over matters in which the Compact Commission is involved and also finance the entire costs of administering the Yellowstone River Compact.

INTERNATIONAL JOINT COMMISSION

The International Joint Commission has jurisdiction over the boundary waters of Canada and the United States. This Commission was created under a treaty between the two countries entered into

in 1909. The International Joint Commission composed of three members from each of the countries, has the authority to consider and determine the rights of the two countries or subdivision thereof, to the use of waters from rivers, streams and locks in which both countries have an interest. Questions relative to the use of water from such common waters are referred to the International Joint Commission for consideration by the respective countries.

North Dakota has an interest in the references under consideration by the International Joint Commission pertaining to the Souris River dated, January 15, 1940 and the Souris-Red River Reference dated January 1948. Various sub-committees have been appointed to study specific questions involved in these references, particularly in respect to the Souris River Reference, in which the State Water Conservation Commission has been concerned. Several important recommendations relative to the Souris River References are under consideration by the International Joint Committee.

Souris River Reference

The three determinations requested in the Souris River Reference are:

(1) The apportionment of waters of the Souris River and its tributaries between the Provinces of Saskatchewan and Manitoba, Canada, and 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.

In October, 1940, the International Joint Commission issued its interim report containing recommendations as to the use of water from the Souris River pending similar determination of the questions contained in the initial records. This report was approved by the governments of the United States and Canada early in 1941. The 1942 interim report authorized the provinces of Saskatchewan and Manitoba and the state of North Dakota to use certain quantities of water from the Souris River and also required that certain quantities of water be released from the State of North Dakota to the Province of Manitoba. This report permitted the construction of certain reservoirs by both the province of Saskatchewan and the State of North Dakota. In 1942 the interim report was modified to increase the flow to be released from North Dakota to Manitoba from 10 to 20 cubic feet per second. The interim report was further clarified in 1943 to authorize the Province of Saskatchewan and the State of North Dakota to make application to meet stock water requirements and similar works which would not remove a quantity of water exceeding 1,000 acre-feet from the stream flow. A number

of applications for such projects has been approved by both governments. 603.7 acre-feet have been appropriated in Saskatchewan and 710.82 acre-feet in North Dakota.

In 1952 the International Joint Commission approved the application of the City of Minot to divert 6,700 acre feet of water per year at a rate of 2.92 cubic feet per second for a municipal water supply. This diversion was in addition to the 1,000 acre feet storage permitted under the interim order of 1943. The International Joint Commission presently has applications pending requesting permission by the Province of Saskatchewan to construct a dam on Long Creek for a capacity of 48,500 acre-feet and for a smaller reservoir for the town of Radville, Saskatchewan. Visual inspection of the Long Creek site indicates that this dam has been constructed. The North Dakota State Water Conservation Commission has filed with the International Joint Commission an application requesting the right for the City of Minot to divert an additional 6,700 acre-feet of water to provide for immediate needs. None of the above applications has been acted on by the International Joint Commission.

The International Joint Commission has given much consideration to the Souris River Reference in the past biennium. They are in the process of presenting their recommendations as to the determination of the reference on the Souris River. It appears that their recommendations will provide, among other things, that the provinces of Manitoba and Saskatchewan and the state of North Dakota will have the right to use waters originating within the provinces or state providing that certain minimum flows will be available at designated points. The construction of reservoirs undoubtedly will be permitted provided that in the regulation of flow from these reservoirs consideration will be given to the minimum flows at certain points on the Souris River. The recommendations of the International Joint Commission undoubtedly will recognize that the use of water for human and livestock consumption will have a prior claim over other uses. It is expected that a Board of Control consisting of representatives from each of the countries will determine the matters relative to the Souris River. It is also expected that during periods of severe drought the state of North Dakota will be relieved of the responsibility of a maximum flow from the Souris River for the Province of Manitoba. It is expected that the International Joint Commission will make its determination as to the Souris River Reference within the next year.

The Souris-Red River Reference was initiated in January, 1948, by the governments of the United States and Canada. It is primarily interested in the waters of the Souris and Red Rivers insofar as North Dakota is concerned with the use of these waters. This reference has an engineering sub-committee composed of members from the United States and Canada and has been appointed to

review the problems involved and to determine the water requirements of the two countries for municipal, industrial, irrigation, hydroelectric and stream pollution abatement uses.

COMPACTS UNDER CONSIDERATION

Little Missouri River Compact

The Little Missouri River is located in southwestern North Dakota and is of concern to four states. It has its source in northeastern Wyoming and flows northerly through the southeastern corner of Montana and the northwestern corner of South Dakota and then north and east through western North Dakota emptying into the Garrison Reservoir on the Missouri River near Elbowoods, North Dakota. Approximately 50.13 percent of the Little Missouri Drainage Basin is in North Dakota. The Little Missouri River is located in the portion of North Dakota where the least amount of precipitation occurs resulting in the greatest demand for water for irrigation and other purposes.

The need for a compact on the Little Missouri River between the four affected states has been recognized for many years. In 1940, Congress authorized these states of Wyoming, Montana, South Dakota and North Dakota to enter into such compact negotiations. No agreement was reached on this authorization before its expiration on January 1, 1943.

In 1955, the North Dakota Legislature adopted a resolution requesting that Congress again authorize the four states to enter into compact negotiations. Members of the North Dakota Legislature introduced such a resolution in the 85th session of Congress which was approved and enacted into law on August 28, 1957, when it was signed by the President. Public Law 85-184 authorized this compact as follows:

Public Law 85-184

85th Congress, S. 1556

August 28, 1957

AN ACT

Granting the consent of Congress to the States of Montana, North Dakota, South Dakota, and Wyoming, to negotiate and enter into a compact relating to their interest in, and the apportionment of, the waters of the Little Missouri River and its tributaries as they affect such States, and for related purposes.

BE IT ENACTED BY THE SENATE AND HOUSE OF REPRESENTATIVES OF THE UNITED STATES OF AMERICA IN CONGRESS ASSEMBLED, That the consent of the Congress is hereby given to the States of Montana, North Dakota, South Dakota, and Wyoming to negotiate and enter into a compact relating to the interests of such States in the development, protection from pollution, and the use of the water resources of the Little Missouri River and

its tributaries, and providing for an equitable apportionment among them of the waters of the Little Missouri River and its tributaries, and for matters incidental thereto, upon the condition that one qualified person appointed by the President of the United States shall participate in such negotiations as chairman, representing the United States, and shall make a report to the President of the United States and the Congress of the proceedings and of any compact entered into. Such compact shall not be binding or obligatory upon any of the parties thereto unless or until the same shall have been ratified by the legislature of each of the respective States, and consented to by the Congress of the United States.

Sec. 2 (a) The Federal representative shall be appointed by the President, and shall report to the President either directly or through such agency or official of the Government as the President may specify.

(b) The Federal representative shall receive compensation and shall be entitled to travel expenses, including per diem in lieu of subsistence in the same manner as provided for experts and consultants under sections 5 and 15 of the Administrative Expenses Act of 1946 and the Travel Expense Act of 1949, except (1) that his term of service shall be governed by the terms of this Act and shall not be affected by the time limitations of said section 15, and (2) his per diem rate of compensation shall be in such amount, not in excess of $100, as the President shall specify, but the total amount of compensation payable in any one calendar year shall not exceed $15,000; PROVIDED, That if the Federal Representative be an employee of the United States he shall serve without additional compensation: PROVIDED FURTHER, That a retired military officer, or a retired Federal civilian officer or employee, may be appointed as such representative without prejudice to his retired status, and he shall receive compensation as authorized herein in addition to his retired pay or annuity, but the sum of his retired pay or annuity and such compensation as may be payable hereunder shall not exceed $15,000, in any one calendar year.

(c) The Federal representative shall be provided with office space, consulting, engineering, and stenographic service, and other necessary administrative services.

(d) The compensation of the Federal representative shall be paid from the current appropriation for salaries in the White House Office. Travel and other expenses provided for in subsections (b) and (c) of this section shall be paid from any current appropriation or appropriations selected by the head of such agency or agencies as may be designated by the President to provide for such expenses.

Sec. 3. The authority granted in this Act shall expire four years from the date of enactment.

Approved August 28, 1957

Major General John S. Seybold was named as the federal representative for the Little Missouri Compact Commission by the President. This commission had its first meeting at Bismarck on April 24, 1958. The meeting was attended by representatives from the four states and, in addition, various federal representatives and interested observers from other states were present. The following were present at the meeting:

Major General John S. Seybold, Chairman, Washington, D. C.

J. C. Alexander, State Engineer of Missouri as an observer.

North Dakota

Milo W. Hoisveen, State Engineer, Bismarck, North Dakota

Earle F. Tucker, Bismarck, North Dakota

Einar H. Dahl, Watford City, North Dakota

William W. Corwin, Fargo, North Dakota

R. J. Timm, Assistant State Engineer, Bismarck, North Dakota

I. A. Acker, Special Assistant Attorney General, Bismarck, North Dakota

Harlan M. Erskine, U. S. Geological Survey, Bismarck, North Dakota.

South Dakota

Joe W. Grimes, Chief Engineer, Pierre, South Dakota.

Montana

Fred E. Buck, State Engineer, Helena, Montana
Harry Scoggin, Alzada, Montana.

Wyoming

Earl Lloyd, State Engineer, Cheyenne, Wyoming.

Bureau of Reclamation

C. T. Judah, Billings, Montana
Bruce Johnson, Bismarck, North Dakota.

At the meeting of the Little Missouri Compact Commission an engineering sub-committee was established to determine the base flow of the Little Missouri River for use in determining a proper allocation from waters from that river. Members of the Committee were as follows:

Chairman, Major General Seybold; members, Milo W. Hoisveen, Joe W. Grimes, Earl Lloyd, Fred E. Buck, and Harlan Erskine.

This Committee has made a tour of the Little Missouri Basin in order to observe various water uses from the Little Missouri River. Of particular concern to the Engineering Committee as well as the Little Missouri Compact Commission is the matter of the use of water in the past for irrigation and stock watering purposes. It is expected that meetings will be held in the near future of the Little Missouri Compact Commission will result in an early determination of the division of waters of the river among the four states. Lack of base flow data at the boundaries of the affected states will cause some delay in apportionment. The Hydrographic Branch of the U. S. Geological Survey is now collecting base flow data.

COMPACTS PROPOSED FOR FUTURE CONSIDERATION

James River

The James River, a tributary of the Missouri, has its source in central North Dakota and flows in a southerly direction through North Dakota and South Dakota, joining the Missouri River near Yankton, South Dakota. The James River is one of the principal rivers involved in the developments proposed under the Missouri River Basin Projects in North Dakota and South Dakota. It will be outlined 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 developments contemplated in the James River Basin it appears that a compact between the states of North Dakota and South Dakota on this river will be desirable in the future. Such a compact would be primarily interested with the division of the normal flows of the James River in considering the imported waters from the Missouri River through the Garrison and Oahe Diversion projects. The James River Development Association, a private organization, composed of representatives from the two states, has indicated an interest in arranging for a compact on the James River. No definite action has been taken by Congress authorizing such a compact to date nor is any such action contemplated in the near future.

Red River of the North

The Red River of the North is an interstate and international stream. It has its source near Breckenridge, Minnesota, where the Bois-de-Sioux, and Ottertail River join and flow north from the boundary between North Dakota and Minnesota and drains into Canada where it empties into Lake Winnipeg. The Red River drains portions of South Dakota, North Dakota and Minnesota as well as Manitoba in Canada. North Dakota for many years has been interested in providing 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 Congress of the United States 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 of the commission 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 of the North and was not concerned in the affairs of 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.

The division of the waters of the Red River is primarily of interest to the States of North Dakota and Minnesota. 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. In view of recent developments in the Moorhead vicinity in Minnesota it appears that the State of Minnesota will undoubtedly display a greater interest in the equitable division of the waters of the Red River in the near future than they have in the past.

BASIC DATA

COOPERATIVE PROGRAMS WITH THE U. S. GEOLOGICAL SURVEY

In any program for the development of the water and other natural resources of an area such as is underway in North Dakota at the present, one of the most important phases is that of collecting basic data for use in the planning for this program. This data takes several forms of which the more important are preparation of topographic surveys, measurement of stream flows and surveys of ground water resources. From the information gathered in these surveys the many features of the water development program can be planned and designed based on accurate data.

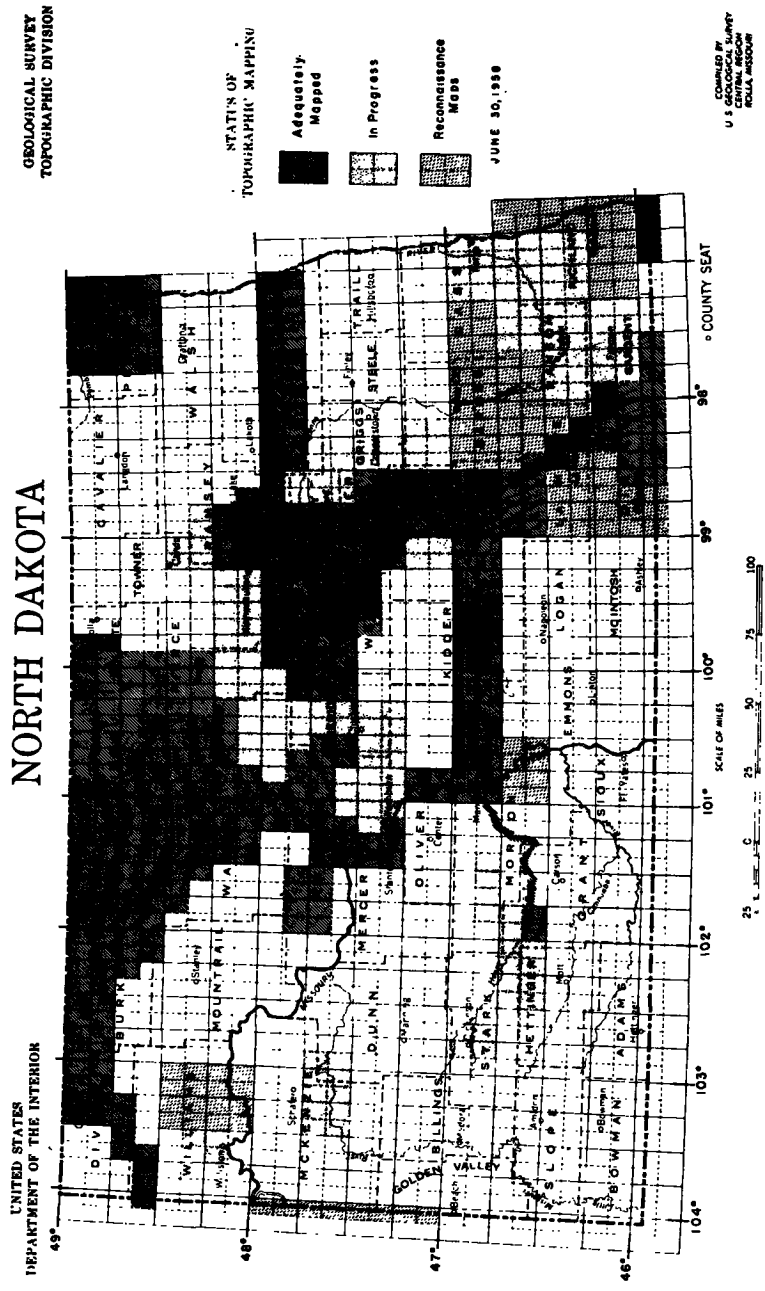
The State Water Conservation Commission has cooperated with the branches of the U. S. Geological Survey who have as their function the collection and compilation of this type of basic data. These cooperative programs are accomplished under the direction of the U. S. Geological Survey with the state and the survey contributing 50 percent of the costs each. During the past several bienniums the State Water Conservation Commission has received appropriations from the state legislature to participate in programs for topographic, hydrographic and underground water surveys. These programs are discussed individually on the following pages.

Topographic Surveys

The U. S. Geological Survey cooperates with states and other federal agencies in making these surveys. In North Dakota a large portion of the area mapped has been accomplished under the Missouri River Basin program at no cost to the state. Such surveys have been confined to areas that are included in the areas proposed for development under the Missouri River Basin program. The Cooperative mapping program between the State of North Dakota and the U. S. Geological Survey has covered areas not included in the Missouri River Basin program for which other development is proposed. In all cases the U. S. Geological Survey does the actual survey work, and compiles the data gathered and publishes the quadrangle maps.

The topographic quadrangles produced by the Geological Survey are commonly called the "mother map". These related maps include among many others, geologic, mineral and water resource data, road maps, county and state maps, as well as the base map of the United States, its territories and possessions.

In its published form the modern topographic quadrangle 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,



Status of Topographic Mapping

streams, lakes and other bodies of water. These features are shown in their correct size and true position. The topographic quadrangle, however, is unique in that it shows the elevations, slope and configuration of all the ground surfaces. In short, it presents the same information as represented by a true scale model of the terrain.

After a project is authorized studies are made to determine the proper scale and the contour interval which may be 5, 10, 20, 40 or 80 feet, depending on the scale and the type of terrain to be mapped.

The Missouri River Basin development plan presents a striking example of the civilian needs for basic data in the form of 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 properly 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 the office. In fact, topographic maps of the Basin might well be called "blue prints for progress". It is axiomatic that topographic maps, to be of maximum value should be available in the early stages of project planning.

Standard topographic maps of the Federal Government are required to comply with national map accuracy specifications as adopted in 1941, and map sheets are tested to insure compliance with these specifications. Several worthwhile objectives motivated the adoption of these specifications. One objective is to make each original topographic map of sufficient accuracy so that it can be revised at any time without the necessity of a basic resurvey.

The State Water Conservation Commission cooperative program with the U. S. G. S. Topographic Branch, provides for surveying of designated areas in the state and preparing topographic maps for those areas. These maps are called quadrangle maps. The unit of survey of a quadrangle map is bounded by parallels of latitude and meridians of longitude and usually cover either 7½ minutes or 15 minutes in latitude and longitude. The 7½ minute quadrangle maps are prepared at a scale of 1:24,000 (1 inch equals 2,000 feet) and cover an area of approximately 49 square miles, and the 15 minute quadrangles have a scale of 1:62,500 (1 inch equals nearly 1 mile) and cover an area of about 195 square miles.

Topographic maps for a large part of North Dakota have been completed and are available from the U. S. Geological Survey or the North Dakota State Water Conservation Commission at a nominal cost. The status of this mapping program is shown on a map accompanying this section of the report. During the period covered by this report 8 - 7½′ quadrangle maps under the State Water Conservation Commission cooperative program, and 12 - 7½′ maps under the Missouri River Basin program have been completed and

published. In addition mapping was in progress on 12 - 7½′ quadrangle maps under the Commission cooperative program and on 135 - 7½′ maps under the Missouri River Basin program. The State Water Conservation Commission's appropriation for this cooperative mapping program was $30,000 for the 1957-1959 biennium.

During the 1959-1961 biennium the Commission proposes to have one additional 7½′ quadrangle map for both the Dickinson and Williston areas as well as two quadrangle maps each for the Valley City and Grafton areas. The specific areas for these maps will be determined in cooperation with the municipalities involved.

Maps in North Dakota Completed During the Period July 1, 1956 to June 30, 1958

Name	Size	Cooperator*	Name	Size	Cooperator*
Berlin	7½	MRB	Hecla NE	7½	MRB
Blackwater Lake	7½	COOP	Hecla NW	7½	MRB
Blackwater Lake NW	7½	COOP	Lake McArthur	7½	SIR
Blue Hill	7½	COOP	Makoti SW	7½	COOP
Carbury	7½	SIR	Metigoshe Lake	7½	SIR
Cogswell	7½	MRB	Newark NW	7½	MRB
Douglas-West	7½	COOP	Roseglen	7½	COOP
Ellendale - North	7½	MRB	Savo NE	7½	MRB
Elliott SW	7½	MRB	Savo NW (Cannon Hill)	7½	MRB
Emmet	7½	COOP	Silverleaf	7½	MRB
Emmet NE	7½	COOP	Straubville	7½	MRB
Havana	7½	MRB			

***Coop—State Cooperative Project**
MRB—Missouri River Basin
SIR—Surveys, Investigations and Research (Federal Topographic Mapping)

Progress of U.S.G.A. Quadrangle Maps in North Dakota
Maps in Progress, June 30, 1958

Name	Size	Cooperator*	Name	Size	Cooperator*
Arnegard 3 NE	7½	MRB	Brinsmade	7½	MRB
Arnegard 3 NW	7½	MRB	Brinsmade SE	7½	MRB
Arnegard 3 SE	7½	MRB	Brinsmade SW	7½	MRB
Arnegard 3 SW	7½	MRB	Cando NE	7½	COOP
Arnegard 4 NE	7½	MRB	Cando NW	7½	COOP
Arnegard 4 NW	7½	MRB	Cando SE	7½	COOP
Arnegard 4 SE	7½	MRB	Casselton 1 NE	7½	SIR
Arnegard 4 SW	7½	MRB	Casselton 1 NW	7½	SIR
Aylmer NE	7½	MRB	Casselton 1 SE	7½	SIR
Aylmer NW	7½	MRB	Casselton 1 SW	7½	SIR
Balfour NE	7½	MRB	Casselton 3 NE	7½	MRB
Balfour NW	7½	MRB	Casselton 3 NW	7½	MRB
Balfour SE	7½	MRB	Casselton 3 SE	7½	MRB
Balfour SW	7½	MRB	Casselton 3 SW	7½	MRB
Balta NE	7½	MRB	Casselton 4 NE	7½	MRB
Balta NW	7½	MRB	Casselton 4 NW	7½	MRB
Balta SE	7½	MRB	Casselton 4 SE	7½	MRB
Balta SW	7½	MRB	Casselton 4 SW	7½	MRB
Bergen	7½	MRB	Churchs Ferry	7½	COOP
Binford NE	7½	MRB	Coleharbor SE	7½	MRB
Binford NW	7½	MRB	Comstock	7½	MRB
Binford SE	7½	MRB	Dazey 2 NE	7½	MRB
Binford SW	7½	MRB	Dazey 2 NW	7½	MRB
Blue Butte 3 NW	7½	MRB	Dazey 2 SE	7½	MRB
Blue Butte 3 SW	7½	MRB	Dazey 2 SW	7½	MRB

Name	Size	Cooperator*	Name	Size	Cooperator*
Dazey 3 NE	7½	MRB	Hamar SE	7½	MRB
Dazey 3 NW	7½	MRB	Hamar SW	7½	MRB
Dazey 3 SE	7½	MRB	Heart Butte NE	7½	MRB
Dazey 4 NW	7½	MRB	Heart Butte NW	7½	MRB
Dazey 4 SW	7½	MRB	Karlsruhe	7½	MRB
Dickinson 1 SW	7½	COOP	Kongsberg NE	7½	MRB
Dickinson 2 NE	7½	COOP	Lincoln Val. NE	7½	MRB
Dickinson 2 SE	7½	COOP	Lincoln Val. NW	7½	MRB
Drake NE	7½	MRB	Lincoln Val. SE	7½	MRB
Drake NW	7½	MRB	Lincoln Val. SW	7½	MRB
Drake SE	7½	MRB	Lisbon 1 NE	7½	MRB
Drake SW	7½	MRB	Lisbon 1 NW	7½	SIR
Elliott SE	7½	MRB	Lisbon 1 SE	7½	MRB
Esmond NE	7½	MRB	Lisbon 1 SW	7½	SIR
Esmond NW	7½	MRB	Lisbon 2 NE	7½	SIR
Esmond SE	7½	MRB	Lisbon 2 NW	7½	SIR
Esmond SW	7½	MRB	Lisbon 4 NE	7½	SIR
Fargo 2 NE	7½	SIR	Lisbon 4 NW	7½	SIR
Fargo 2 NW	7½	SIR	Lisbon 4 SE	7½	MRB
Fargo 2 SE	7½	SIR	Lisbon 4 SW	7½	MRB
Fargo 2 SW	7½	SIR	McClusky NE	7½	MRB
Fargo 3 NE	7½	SIR	McClusky NW	7½	MRB
Fargo 3 NW	7½	SIR	McClusky SE	7½	MRB
Fargo 3 SE	7½	SIR	McClusky SW	7½	MRB
Fargo 3 SW	7½	MRB	McHenry NE	7½	MRB
Glen Ullin 1 SE	7½	MRB	McHenry NW	7½	MRB
Glen Ullin 1 SW	7½	MRB	McHenry SE	7½	MRB
Glen Ullin 2 SE	7½	MRB	McHenry SW	7½	MRB

Name	Size	Cooperator*	Name	Size	Cooperator*
New Salem 2 SW	7½	MRB	Vashti NE	7½	MRB
Pelican Lake SW	7½	MRB	Vashti NW	7½	MRB
Picardville NE	7½	MRB	Vashti SE	7½	MRB
Picardville NW	7½	MRB	Vashti SW	7½	MRB
Picardville SE	7½	MRB	Wahpeton 2 NE	7½	MRB
Picardville SW	7½	MRB	Wahpeton 2 NW	7½	MRB
Rangeley SE	7½	MRB	Wahpeton 2 SE	7½	MRB
Rangeley	7½	MRB	Wahpeton 2 SW	7½	MRB
Richardton 3 NE	7½	MRB	Washburn NE	7½	MRB
Richardton 3 NW	7½	MRB	Washburn NW	7½	MRB
Richardton 3 SE	7½	MRB	Washburn SE	7½	MRB
Richardton 3 SW	7½	MRB	Webster	7½	COOP
Richardton 4 NE	7½	MRB	Williston 1 SE	7½	COOP
Richardton 4 NW	7½	MRB	Williston 4 NE	7½	COOP
Richardton 4 SE	7½	MRB	Williston 4 NW	7½	COOP
Richardton 4 SW	7½	MRB	Wolf NE	7½	MRB
Sisseton NE	7½	MRB	Wolf NW	7½	MRB
Sisseton NW	7½	MRB	Wolf SE	7½	MRB
Starkweather	7½	COOP	Wolf SW	7½	MRB
Stirum	7½	MRB	Wyndmere 1 NE	7½	MRB
Tower 4 NE	7½	MRB	Wyndmere 1 NW	7½	MRB
Tower 4 SE	7½	MRB	Wyndmere 1 SE	7½	MRB
Turtle Creek NE	7½	MRB	Wyndmere 1 SW	7½	MRB
Turtle Creek NW	7½	MRB	Wyndmere 2 NE	7½	MRB
Turtle Creek SE	7½	MRB	Wyndmere 2 NW	7½	MRB
Turtle Creek SW	7½	MRB	Wyndmere 2 SE	7½	MRB
Turtle Lake SE	7½	MRB	Wyndmere 2 SW	7½	MRB
Turtle Lake SW	7½	MRB	Wyndmere 3 NE	7½	MRB
			Wyndmere 3 NW	7½	MRB
			Wyndmere 3 SE	7½	MRB
			Wyndmere 3 SW	7½	MRB

***Coop—State Cooperative Project**

MRB—Missouri River Basin

SIR—Surveys, Investigations, and Research (Federal Topographic Mapping)

UNDERGROUND WATER SURVEYS

During the past thirteen years ground-water investigations by the Ground Water Branch of the United States Geological Survey have been in progress in various parts of the State. These investigations are being made in financial cooperation with the North Dakota State Water Conservation Commission, under the general supervision of the State Geologist who acts as technical advisor for the State Water Conservation Commission in their program.

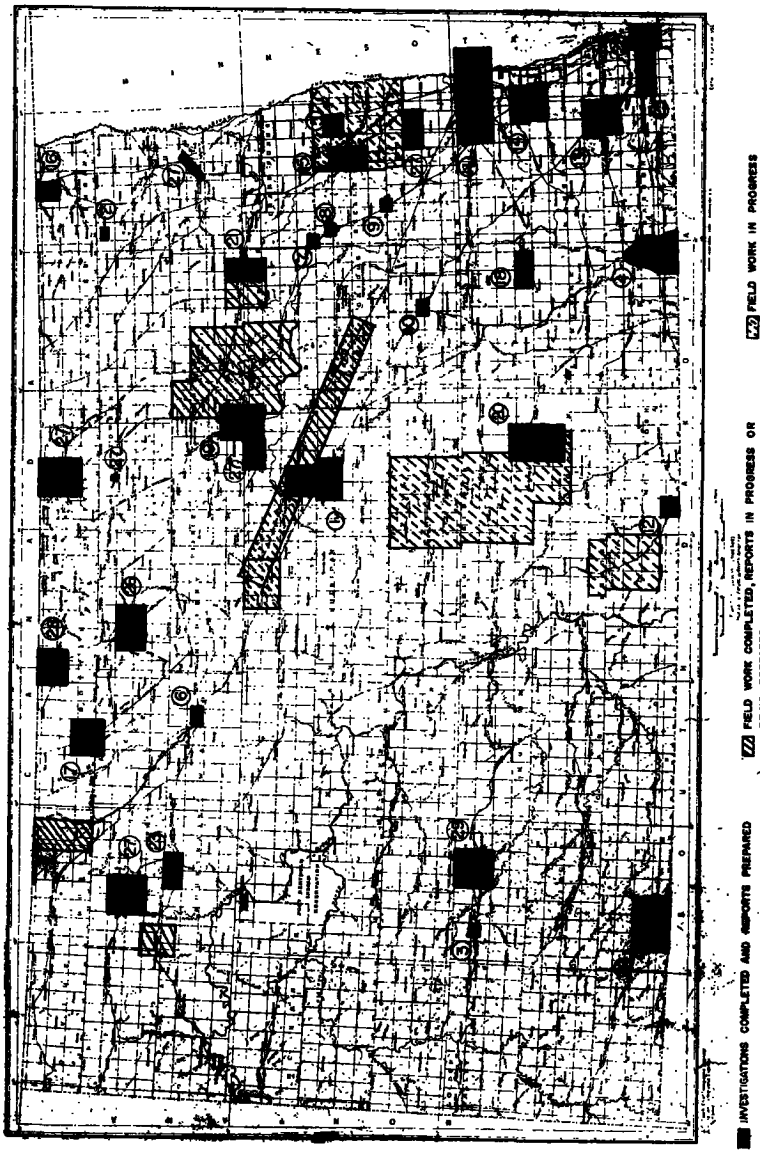
The ultimate aim of the program is to obtain an overall knowledge of the ground-water resources in the entire State which would be adequate for effectively directing the optimum development of this resource for domestic, municipal, industrial and irrigation purposes and for effectively programming conservation and administrative measures which may be necessary or desirable in connection with its development and use.

However, there has been and currently is a great need for adequate and perennial ground-water supplies for numerous communities throughout the State which are attempting to construct public water-supply and sewage facilities for the first time or which have experienced shortages under present facilities. Therefore, about 50 percent of the investigation work has been directed toward securing data on the ground-water resources that would be within reach of these communities.

At the present time, investigations have been completed or are under way in 44 areas in the State. Reports have been released on 26 areas. Nine other reports have been completed but not officially released as yet. New cooperative projects started were Traill County and 400 square miles in the Strasburg-Linton area of Emmons County. Work has continued on the Kidder County and Drake area projects. Special projects conducted by the Water Conservation Commission alone are in the area of Lehr, Ellendale, Carrington, and central Ransom County. Over 9,800 square miles have been investigated or are under investigation.

Up to January 1, 1958 more than 1,350 test holes had been drilled with the State-owned drilling rig in connection with investigational work and represents more than 176,500 feet of drilling.

The reports on the investigations may be had free of charge unless the supply for distribution has been exhausted, in which case copies may be examined in any of the State College libraries, the North Dakota Research Foundation library in Bismarck, offices of the State Water Conservation Commission in Bismarck, North Dakota Geological Survey and the United States Geological Survey both at the University of North Dakota in Grand Forks.



Underground Water Surveys in North Dakota

Request for report should be made to one of the following agencies:

North Dakota State Water Conservation Commission
Bismarck, North Dakota
North Dakota Geological Survey
University Station
Grand Forks, North Dakota
United States Geological Survey
University Station
Grand Forks, North Dakota

The following list shows the reports that have been completed and whether or not they are currently available. A brief abstract giving the essential information has been prepared for the State Water Conservation Commission by the State Geologist and is available at the office of the State Water Conservation Commission on request:

No. 1 Ground Water in the Fessenden Area, Wells County, North Dakota by Leonard Filaseta, 1946.

No. 2 Ground Water in Beach Deposits of Glacial Lake Agassiz near Mountain, Pembina County, North Dakota, by P. D. Akin, 1946.

No. 3 Ground Water at Dickinson, North Dakota, by T. G. McLaughlin, 1946.

No. 4 Ground water in the Deposits of Ancient Lake Dakota, Dickey County, North Dakota by William C. Rasmussen, 1947.

No. 5 Ground Water near Buxton, Traill County, North Dakota, by P. E. Dennis, 1947.

No. 6 Geology and Ground Water Conditions at Minot, North Dakota, by P. D. Akin, 1947.

No. 7 Ground water in the Aneta Area, Nelson County, North Dakota, by P. E. Dennis, 1947.

No. 8 Ground Water in the Sharon Area, Steele County, North Dakota, by P. E. Dennis, 1947.

No. 9 Ground Water in the Hope Area, Steel County, North Dakota by P. E. Dennis, 1948.

No. 10 Ground Water in the Wimbledon Area, Barnes and Stutsman Counties, North Dakota, by P. E. Dennis, 1948.

No. 11 Geology and Ground Water Resources of Parts of Cass and Clay Counties, North Dakota and Minnesota, by P. E. Dennis, P. D. Akin, and G. F. Worts, 1949.

No. 12 Ground Water in the Zeeland Area, North Dakota, by Wilson M. Laird, 1948.

No. 13 Ground Water in the Wyndmere Area, Richland County, North Dakota by P. E. Dennis, P. D. Akin, and Suzanne L. Jones, 1950.

No. 14 Ground Water in the Kindred Area, Cass and Richland Counties, North Dakota by P. E. Dennis, P. D. Akin, and Suzanne L. Jones, 1950.

No. 15 Ground Water in the Portland Area, Traill County North Dakota by P. E. Dennis and P. D. Akin, 1950.

No. 16 Ground Water in the Neche Area, Pembina County, North Dakota, by Quentin F. Paulson, 1951.

No. 17 Ground Water in the Mohall Area, Bottineau and Renville Counties, North Dakota, by P. D. Akin, 1951.

No. 18 Ground Water in the Litchville Area, Barnes County, North Dakota, by P. D. Akin. 1952

No. 19 Geology and Ground Water Resources in the Minnewaukan Area, Benson County, North Dakota, by Saul Aronow, P. E. Dennis, and P. D. Akin, 1953.

No. 20 Geology and Occurrence of Ground Water in the Streeter Area, Stutsman, Logan, and Kidder Counties, North Dakota, by Quentin F. Paulson, 1952.

No. 21 Geology and Ground Water Resources of the Michigan City Area, Nelson County, North Dakota, by Saul Aronow, P. E. Dennis, and P. D. Akin, 1953.

No. 22 Ground Water in the Fairmont Area, Richland County, North Dakota, and Adjacent Areas in Minnesota, by Quentin F. Paulson, 1953.

No. 23 Geology and Occurrence of Ground Water in the Stanley Area, Mountrail County, North Dakota, by Quentin F. Paulson, 1954.

No. 24 Geology and Ground Water Resources of the Hettinger Area, Adams County, North Dakota by C. J. Robinove, 1956.

No. 25 Geology and Ground Water Resources of the Hankinson Area, Richland County, North Dakota by J. E. Powell, 1956.

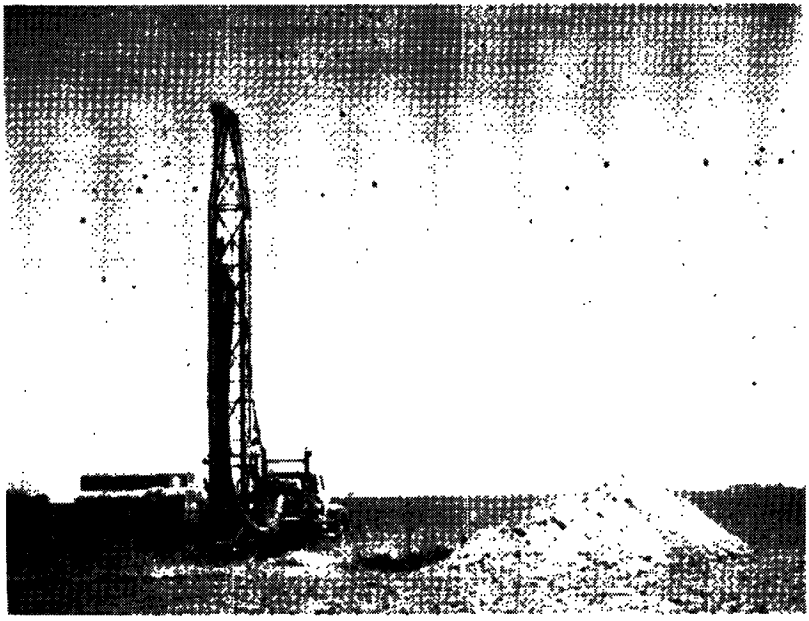
No. 26 Geology and Occurrence of Ground Water in the Upham Area, McHenry County, North Dakota by Q. F. Paulson, and J. E. Powell, 1957.

No. 27 Results of Test Drilling, Geologic and Ground-Water Reconnaissance in North Dakota of the Rolla-St. John Area and Mylo Area, Rolette County, Minto-Forest River Area, Walsh County, Powers Lake Area, Burke County, Maddock Area, Benson County and Hunter Area, Cass County, by J. W. Brookhart, and J. E. Powell. (This report has not yet received final review prior to release to the public.)

No. 28 Geology and Ground Water Resources of the Westhope, Area, Bottineau County, North Dakota, by J. E. Powell (This report has not yet received final review prior to release to the public.)

No. 29 Geology and Ground-Water Resources of the Richardton Area, Stark County, North Dakota, by J. E. Powell and Q. F. Paulson. (This report has not yet received final review prior to release to the public.)

U.S.G.S. Water-Supply Paper 1428 — Saline Water Resources of North Dakota by C. J. Robinove, R. H. Langford, and J. W. Brookhart. (This report has been released but not printed.)



Test Drilling — Underground Water Surveys

HYDROGRAPHIC SURVEYS

The world's total water supply is constant for all practical purposes. The perpetual process through which it moves is usually called the hydrologic cycle. The movement of a quantity of water in this cycle can be traced by beginning with its position in the clouds.

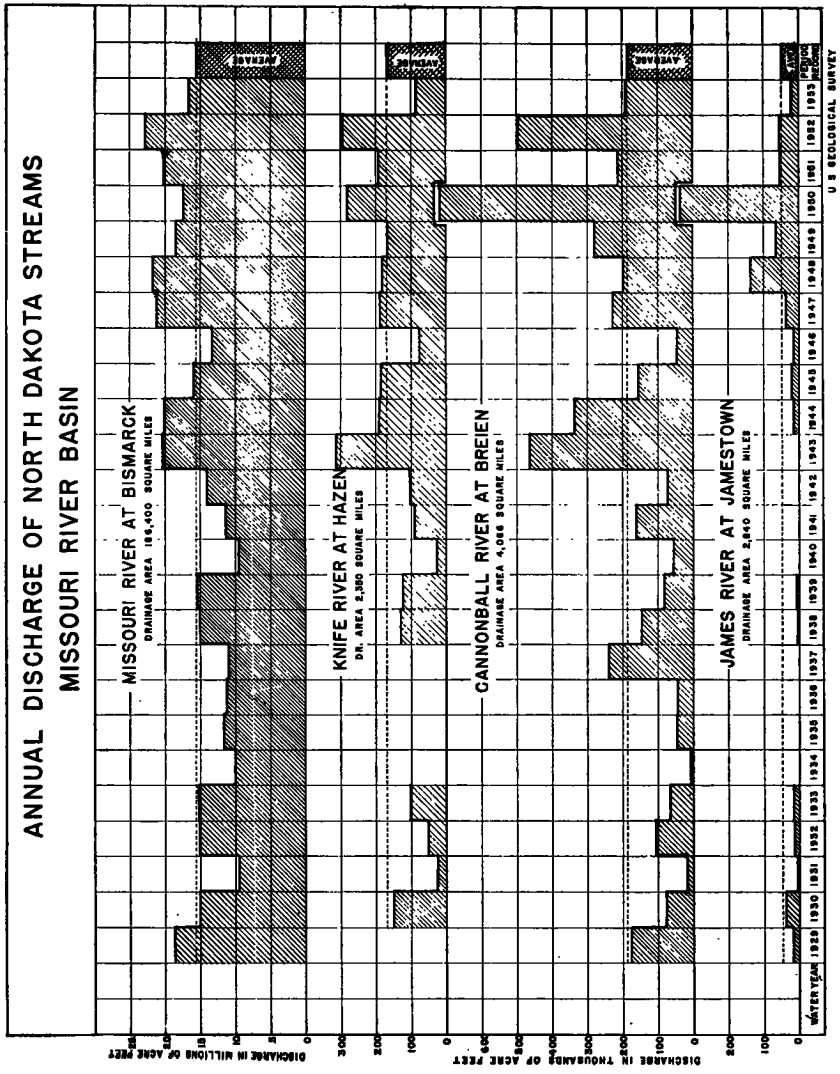
Upon cooling, the vapor forming the clouds is condensed and falls upon the earth in the form of rain, snow or ice. If this precipitation occurs during the growing season, part of that which falls on plants is taken directly into their structures or is held on their surfaces until it is evaporated and returned to the atmosphere as vapor. Part of the remainder that reaches the soil enters the ground, and a part of this is taken up by plant roots to enter the plant structure or to be evaporated from the plant surfaces and returned to the atmosphere. Another part of the water that enters the soil and remains at shallow depths is evaporated to the atmosphere directly from the land surface, while still another part may percolate downward to varying depths to add to the ground-water supply. This ground-water supply, which varies greatly in depth and quantity depending upon the porosity of the soil and the precipitation, tends to move slowly but steadily toward an outlet at some lower level and thus eventually returns to the earth's surface from seeps and springs.

If precipitation falls upon the earth faster than the earth's immediate capacity to absorb it, the excess flows over the surface of the earth or at shallow depths in the soil and enters the stream channels directly. Thus it is apparent that our surface-water supplies are composed of water from two sources: direct or storm runoff and ground water flowing from seeps and springs. In the case of precipitation in the form of snow, the process is similar except that the movement through and over the earth's surface is merely delayed until thawing takes place.

Water that reaches the streams, flows toward the sea, and in this process is continuously being evaporated from the streams as well as from the sea. Through this perpetual motion device set up by nature the water will eventually return to the clouds and then back to the earth in the form of precipitation.

The discharge hydrograph of a typical North Dakota stream is illustrated in Figure 1. The condition that prevails in our streams a greater part of the time is a gradual recession as illustrated by the dashed line near the left side of the figure. Here the flow is composed entirely of water coming from seeps and springs and is referred to as base flow. The flow from the ground-water reservoirs lowers the elevation of the ground-water table, and thus the head or pressure on the seeps and springs decreases so that the rate of flow from them declines.

The solid line termed storm runoff illustrates what happens when rainfall or snowmelt occurs at a rate in excess of the soil's capacity to absorb it. Part of the precipitation reaches the stream channel as direct flow causing most of the rise shown. At the same time a

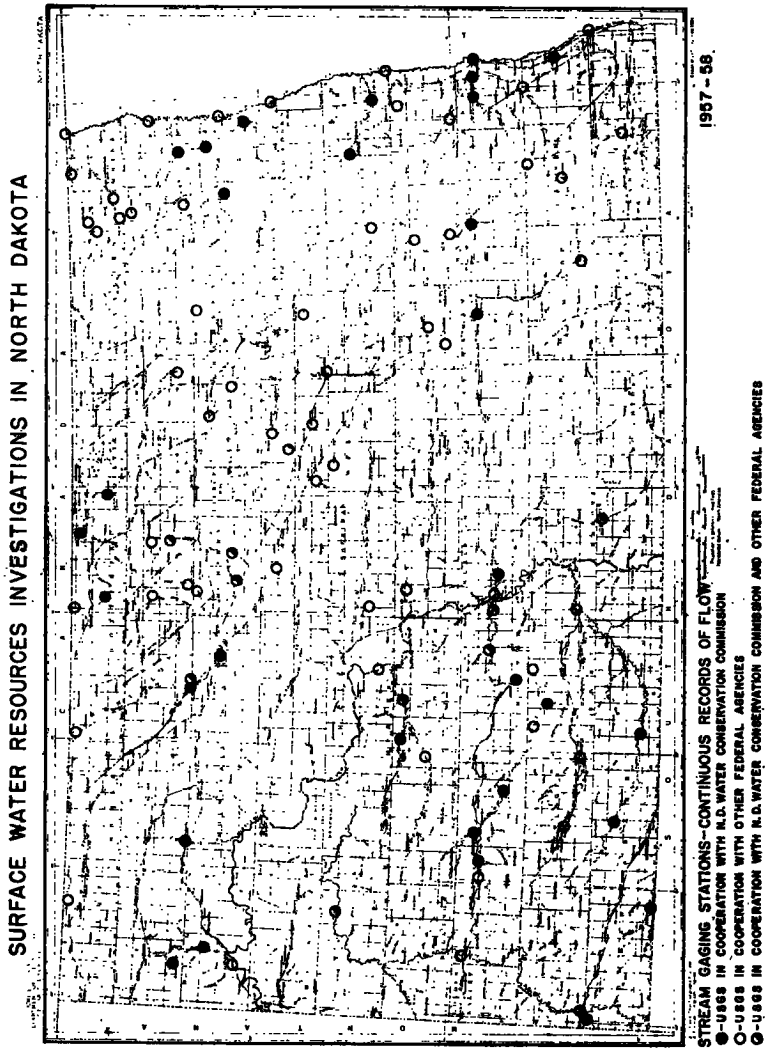

ANNUAL DISCHARGE OF NORTH DAKOTA STREAMS
MISSOURI RIVER BASIN
MISSOURI RIVER AT BISMARCK
DRAINAGE AREA 186,400 SQUARE MILES
KNIFE RIVER AT HAZEN
DR. AREA 2,380 SQUARE MILES
CANNONBALL RIVER AT BREIEN
DRAINAGE AREA 4,066 SQUARE MILES
JAMES RIVER AT JAMESTOWN
DRAINAGE AREA 2,640 SQUARE MILES
AVERAGE
DISCHARGE IN MILLIONS OF ACRE FEET
DISCHARGE IN THOUSANDS OF ACRE FEET
WATER YEAR
1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953
U S GEOLOGICAL SURVEY
BISMARCK, N. DAK.

portion of the precipitation is seeping further into the ground causing a rise in the ground water level with a corresponding increase in the base flow. Sometime after the storm or snowmelt period, all of the storm runoff will have passed down the stream. This point is illustrated by the merging of the solid and the dashed line and signifies a return to the base flow condition.

In the fall of the year a small increase in stream flow usually occurs near the end of the growing season. This is attributed to a reduction in the amount of water that plants are drawing from the ground water (thus permitting an increase in outflow from seeps and springs), a decrease in the amount of water being consumed by the plants in the area adjacent to and closely bordering the streams, and a decrease in evaporation from the land as well as water surfaces as a result of lower temperatures.

During the initial part of the severe winter period we experience a sharp decrease in stream flows as illustrated in the sharp drop in the dashed line at the right-hand side of the figure. During this period a large part of the flow entering the stream channels goes into storage in the form of a heavy ice cover on the streams. This ice in turn increases the resistance to flow for the remaining flowing water so that it must build up a higher head in order to force its way down the restricted channel. This increase in head (depth) results in a substantial additional amount of water being held in storage in the stream channels. Also much of the water from seeps and springs is frozen as it comes from the ground, or the ground is frozen so intensely that the seeps are entirely shut off for the remainder of the winter period. Frequently all these factors combine to produce very low flows, sometimes the minimum for the year, during the first period of severe freezing weather each winter.

It is essential that we know what to expect of our streams in order that they may be made to serve the needs of mankind and in order that they be controlled where necessary. For public and industrial water supplies, for considerations involving the dilution of wastes, and for irrigation purposes, we must know the minimum flows that may be expected at various times during the year. If the minimum flows are less than the amount needed to meet the demand, storage of water must be considered. The amount of storage necessary to make up the deficiency during the 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. Similar problems must be answered in connection with power development studies. The administration of water rights and the equitable distribution of water among the people competing for its use requires factual information relative to the available supply. In considering flood control and drainage projects it is essential that the peak flow rates and volume of runoff during major flood periods be known in order that satisfactory solutions may be found for the complex problems associated


SURFACE WATER RESOURCES INVESTIGATIONS IN NORTH DAKOTA
1957-58
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

with them. It is important that there be adequate information relative to the magnitude and frequency of flood flows, particularly on the smaller streams, if culvert and bridge designs are to be economically sound.

The only means we have of determining our water supplies and the probable future behavior of our streams is on the basis of their past performance. This requires the collection of continuous records of stream flow at strategic points over long periods of time.

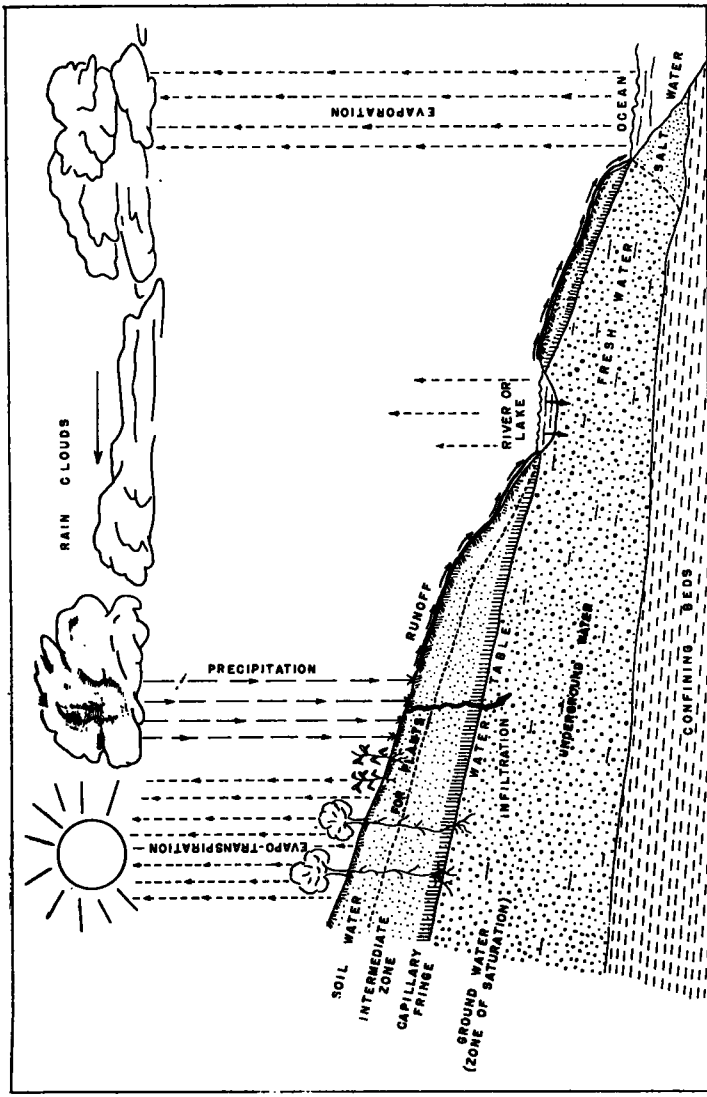
Congress recognized that work of this kind was essential in connection with the proper use and development of our water resources, and as early as 1888 instructed the U. S. Geological Survey to make an irrigation survey which resulted in the beginning of a program for systematically gaging the flow of streams in the United States. This was a huge assignment and during the early years relatively little could be done in view of the meager funds available and the vast area over which they had to be used.

In 1902 and 1903 several gaging stations were established in North Dakota and flow records obtained primarily in connection with possible irrigation development. Most of these stations were operated only a few years and discontinued. A few were operated rather sporadically until about 1929. At about this time the federal government undertook flood control activities on a nation wide basis and gaging stations were established and operated on several of our large streams. The State of North Dakota took an active part in the program a few years later. Federal agencies interested in water development and conservation soon found that they had urgent need for stream-flow information and began to assist with the financing of the program.

Figure 2 is a map of North Dakota showing the location of the 95 gaging stations being operated in the state at this time. The basic financing of 41 of these stations is through a cooperative arrangement between the North Dakota State Water Conservation Commission and the U. S. Geological Survey whereby the cost is shared equally by these agencies. A few stations on larger streams are financed entirely with Geological Survey funds.

The Corps of Engineers, Bureau of Reclamation, and Fish and Wildlife Service cooperate by furnishing funds for use in the operation of stations closely associated with projects of these agencies, and the U. S. State Department furnishes financial support for several stations along the Canadian border where international considerations are involved.

An investigation recently completed indicates that there is a definite need for 12 additional primary stream gaging stations in the state. These stations would be established on a permanent basis and would provide the information on stream flow essential to provide the basic coverage for North Dakota. In order to provide a means whereby run-off data for a specific area or stream not covered in the



HYDROLOGIC CYCLE

The above Underground Water illustration is not applicable where surface soils are water tight.

stream gaging program can be obtained by correlation from existing stations it is further recommended that consideration be given to the establishment of a series of secondary stations to be operated for a short period. The information from these secondary stations along with that available from the primary stations would provide sufficient information to serve as a basis for estimating the run-off in any area in the state with a reasonable degree of accuracy.

U. S. SOIL CONSERVATION SERVICE

The Soil Conservation Service cooperates with the State Water Conservation Commission on activities involving the conservation, utilization and disposal of water. The three programs of the Soil Conservation Service that require closest coordination of functions are: the watershed protection and flood prevention program, drainage in the Red River Valley, and irrigation and stock water developments throughout the state.

Watershed Protection and Flood Prevention

The watershed protection and flood prevention program in North Dakota has gotten off to a good start with the Tongue River Watershed the first approved for construction. Eight of the ten dams planned for this project have been completed, the one floodway which was 13 miles long is in operation and much of the 48 miles of channel improvement planned has been installed or is in the design and contract stage. The project should be completed within the next two years. Three other watersheds have been approved for construction. They are the Elm River Watershed in Traill County, the Swan-Buffalo Creek Watershed in Cass County, and the Wild Rice Creek Watershed in Sargent County and extending into Marshall County, South Dakota. Three other plans will be presented to Congress in 1959. They are the Tewaukon Watershed in Sargent County, the North Walhalla Tributary of the Pembina River Watershed in Pembina County, and the North Branch of the Forest River Watershed in Walsh County. Plans are progressing on two other watersheds, both branches of the Forest River. Under the watershed protection program, land treatment practices that increase the amount of water the soil can absorb are given first consideration. These practices include increased plantings of grass and legumes in the crop rotation, stubble mulching, tree planting to reduce erosion and help keep floodways and channels free from snow and dirt, the proper use of grass land so that more mulch is left on the ground, and many others. At least 50% of the people living within the watershed must be cooperators with soil conservation districts before dams or floodways can be constructed. Water which cannot be absorbed by the land after these improved farming practices have been applied is retarded behind dams or carried safely to the outlets in floodways and through improved channels if existing channels are inadequate.

The State Water Conservation Commission is responsible for organizing the local water conservation and flood control districts, the local governmental entities through which the watershed projects are developed. A discussion of these districts can be found on pages 95 to 112 of this report. The Commission also cooperates in this program by reviewing plans for the proposed project, and, in some cases, providing financial assistance.

Red River Valley Drainage

Under the legal drainage program which is carried out primarily in the Red River Valley area, the Soil Conservation Service in most instances provides the engineering which includes field surveys, design and supervision of construction. The State Water Conservation Commission approves the plans and designs, inspects the project, and cost shares construction with the local people.

Irrigation and Stock Water

The Soil Conservation Service has assisted farmers in a number of cases in the survey, design and installation of irrigation facilities for their individual projects. Water rights for these projects are granted by the State Water Conservation Commission based on application from the farmers to the Commission. Almost 50,000 acres have been developed for irrigation in North Dakota by the individual farmers during the past ten years.

The Soil Conservation Service also provides the technical assistance to farmers in the planning, design and installation of stock water ponds throughout the state. Over 11,000 of these ponds have been developed in the state since 1948.

OTHER COOPERATIVE ACTIVITIES

There are several organizations that have as their primary function that of coordinating or promoting the development of water resources in North Dakota or the Missouri River Basin. The Commission has cooperated with the groups throughout the years and has participated actively in many of the meetings. There are also several agencies of the state that are concerned with our water resources on a state level with whom the State Water Conservation Commission cooperates. These organizations and agencies are discussed in the following section of this report:

MISSOURI BASIN INTERAGENCY COMMITTEE

The Missouri Basin Inter-Agency Committee was established in 1945 to provide a committee composed of the governors of the ten Missouri River Basin states and designated representatives of the federal agencies involved in the Missouri River Basin project as authorized by the Flood Control Act of 1944 which could coordinate the activities of all agencies and states in this program. As presently composed the Interagency Committee has representatives from the following seven Federal agencies: Department of Agriculture, Department of Interior, Corps of Engineers, Department of Labor, Department of Commerce, Department of Health, Education and Welfare and the Federal Power Commission. In addition the Governors of the states of Colorado, Wyoming, Montana, North Dakota, South Dakota, Minnesota, Kansas, Nebraska, Iowa and Missouri have membership on the Committee.

The Committee meets about six times a year to discuss and review various aspects of the Missouri River Basin program so as to bring about a better understanding of the development and needs of the Basin. A great deal of the work of the Interagency Committee is accomplished through subcommittees that have been established. The principal of these is the Programming Subcommittee which arranges the programs for the Interagency Committee. Several other subcommittees have been established from time to time to consider certain specific items.

The Governor of North Dakota and State Water Conservation Commission have taken an active part in the activities of the Missouri Basin Inter-Agency Commission since that organization was established.

ASSOCIATION OF WESTERN STATE ENGINEERS

The Association of Western State Engineers is composed of the State Engineers of the seventeen western reclamation states, namely: Washington, Oregon, California, Idaho, Montana, Wyoming, Nevada, Colorado, New Mexico, Arizona, North Dakota, South Dakota, Ne-

braska, Kansas, Oklahoma, Utah and Texas. This association was established to provide the representatives of each of these seventeen states who are primarily concerned with the water programs in each state, an opportunity to discuss problems of common interest. The Association meets once a year at which time various aspects of water resource development and related activities are discussed. The Association makes recommendations through resolutions it adopts to Congress and various federal agencies as matters relating to water resource development. Officers for the Association of Western Engineers for 1959 are:

Mr. S. E. Reynolds, President

Mr. Harvey O. Banks, 1st Vice President

Mr. Milo W. Hoisveen, 2nd Vice President

Mr. Fred D. Hahn, Secretary

Mr. Milo W. Hoisveen, North Dakota State Engineer represents North Dakota in this organization.

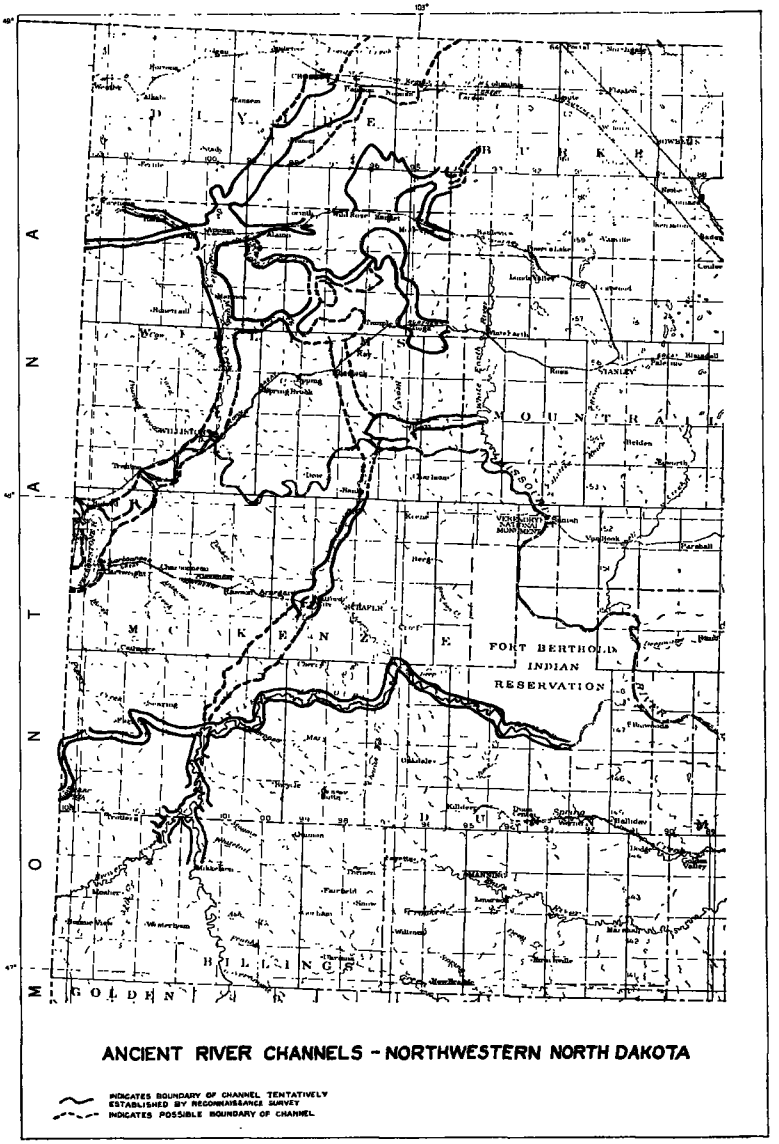
MISSOURI RIVER STATES COMMITTEE

The Missouri River States Committee was set up in 1945 and it was through this organization that the Missouri Basin Inter-Agency Committee was established. This Committee is composed of the governors of the ten Missouri River Basin states and two representatives each named by the Governors. In addition to Governor John E. Davis, the North Dakota representatives on the Missouri River States Committee are: A. R. Weinhandl, Minot, and Curtis Olson, Bismarck. This Committee has been very influential in establishing the policies under which development in the Missouri River Basin has occurred. It generally meets in conjunction with the Missouri Basin Inter-Agency Committee, ordinarily twice each year. The Missouri River States Committee has had under consideration various proposals for a compact on the Missouri River among the ten basin states. The Committee is composed entirely of representatives of the states that are affected by the Missouri River Basin program and does represent the views of these states. At its meeting in Des Moines, Iowa, on January 23, 1958, the following resolution was adopted by the Missouri River States Committee:

RESOLUTION OF MISSOURI RIVER STATES COMMITTEE REAFFIRMING ITS SUPPORT OF THE MISSOURI RIVER BASIN PROJECT

RESOLVED by the Missouri River States Committee at a meeting in Des Moines, Iowa, on January 23, 1958, that it reaffirms its belief in and support of the Missouri River Basin Project as approved and authorized by the Flood Control Act of 1944, and as planned and

programmed by the affected States and interested Federal agencies, and the Committee does declare that the best interests of the entire Basin are dependent upon and can best be served by the early and orderly development of the Basin's water resources for domestic, municipal and industrial needs, abatement of stream pollution, storage and use of water for irrigation and other agricultural purposes, navigation, generation of hydroelectric power, propagation of fish and wildlife, and the enhancement of recreational opportunities: That the Committee encourages the unity and cooperative efforts of all groups and interests in the Basin for the achievement of the total program.



ANCIENT RIVER CHANNELS - NORTHWESTERN NORTH DAKOTA

INDICATES BOUNDARY OF CHANNEL TENTATIVELY ESTABLISHED BY RECONNAISSANCE SURVEY

INDICATES POSSIBLE BOUNDARY OF CHANNEL

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 194 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 that become involved 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 because they 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 and create drainage problems. 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 be restricted by such highway construction. The State Water Conservation Commission has cooperated with the Highway Department in resolving certain problems of this nature that have arisen.

OTHER ORGANIZATIONS

North Dakota Reclamation Association

The North Dakota Reclamation Association is a private voluntary organization, interested in the development of the water resources of North Dakota, composed of members from all sections of the state. This organization is interested in the development of the water projects throughout the state, not of one particular project. It is affiliated with the National Reclamation Association, an organization composed of representatives from all 17 western reclamation states, which is very influential on the national level in matters pertaining to reclamation and water projects. The president of the North Dakota Reclamation Association is Leo Gardner of New England and the Secretary is S. W. Thompson of Warwick.

Missouri-Souris Projects Association

The Missouri-Souris Projects Association is a voluntary organization composed of members primarily from the area that will be affected by the Garrison Diversion Unit. This organization has actively supported the establishment of a project to divert water from the Missouri River into central and eastern North Dakota for many years by assisting in securing Congressional appropriations for project investigations and in promoting the project in North Dakota and in other states. President of the Missouri-Souris Projects Association is R. L. Dushinske of Devils Lake and Executive Secretary of the organization is Oscar N. Berg of Minot.

Greater North Dakota Association

The Greater North Dakota Association has actively supported the development of the water resources of North Dakota as proposed in the State Water Resource Development plan. It has assisted in publicizing this phase of the development of North Dakota throughout the state and country and has advocated and assisted in gaining Congressional support for many of our state water projects. The Greater North Dakota Association has prepared a pictorial record of the state's water resource development program in cooperation with the State Water Conservation Commission.

Mississippi Valley Association

The Mississippi Valley Association is a voluntary association of various individuals, organizations and agencies concerned with the development of the water resources of the 23 state watershed area of the Mississippi River and its tributaries. The Association is one of the most influential water resource organizations in the country and actively promotes the development of various projects throughout the area of the Mississippi Valley. The State Water Conservation Commission and several other legal entities in North Dakota as well as various organizations and individuals from the state are members of this Association.

The Mississippi Valley Association endorses specific projects throughout the area in which it is interested. This list of endorsed projects constitutes those the Association supports before Congress. The State Water Conservation Commission submitted the Garrison Diversion Unit, the Pembilier Dam and the Bowman-Haley Dam for consideration at the Convention of the Mississippi Valley Association held in St. Louis, Missouri, February 9 and 10, 1958. The Association indicated its support of the Bowman-Haley and Pembina River Projects in North Dakota. The Garrison Diversion Unit was approved by the Projects and Resolution Committees but because of opposition that developed from the interests in the Lower Missouri River Basin area was refused endorsement by the Convention. Since that time proponents of the Garrison Diversion Unit headed by Governor John E. Davis have met with representatives from the lower Missouri River Basin from the Kansas City area in an effort to bring about a better understanding of the needs of the over-all Missouri River Basin and the interests the various areas have in the Missouri River Basin Project. This action has resulted in the appointment of a special study committee consisting of members representing the various sections of the Missouri River Basin to make a recommendation relative to the Garrison Diversion Unit. The study Committee named included R. L. Bessel of Harvey, Oscar N. Berg of Minot, Fred J. Fredrickson of Valley City and Henry J. Steinberger of Donnybrook. The Committee has scheduled a meeting at Sioux City, Iowa on November 13, 1958, at which time the Garrison Diversion Unit will be considered.

The National Rivers and Harbors Congress

The National Rivers and Harbors Congress is a nation-wide organization composed of federal, state and local leaders interested in the sound development of the water resources of the country. It was organized in 1901 and has become one of the most influential groups in the country in working in the water resources field. All members of Congress are Ex-Officio members of the organization. Close liaison is maintained with the Corps of Engineers, Bureau of Reclamation and the many other federal agencies dealing with water resources development projects.

The National Rivers and Harbors Congress has four standing committees, namely: the Resolutions Committee, through which the official position of the association is voiced; the Projects Committee, which screens various projects and endorses those it deems worthwhile; the Committee on Industrial Water Use, Pollution Abatement, Wildlife and Recreation; and the Committee on Irrigation and Reclamation.

At the annual meeting of the National Rivers and Harbors Congress held in Washington, D.C., May 14-16, 1958, three projects located in North Dakota which were submitted by the State Water Conservation Commission to the Projects Committee of this organization were considered and endorsed. The Garrison Diversion Unit was given the highest priority that this organization gives and the Pembilier Dam and the Bowman-Haley Projects were endorsed for investigation. The State Water Conservation Commission and several other organizations from North Dakota are members of the National Rivers and Harbors Congress.

Chapter 3

COOPERATIVE ACTIVITIES WITH FEDERAL AGENCIES

SNAKE CREEK EMBANKMENT
GARRISON DAM AND RESERVOIR PROJECT

This embankment separates the main portion of Garrison Reservoir (to left of embankment) from the Snake Creek Reservoir (to right of embankment). Diversion of water to central and eastern North Dakota as proposed in the Garrison Diversion Project will be accomplished from the Snake Creek Reservoir.

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 portion of North Dakota drained by the Red River of the North and the Souris River. These 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, and about 271 river miles above the mouth of the river. The dam creates a reservoir that is used to provide a substantial degree of flood control to the cities, villages, and urban areas along the Sheyenne River and to provide water supply and pollution abatement for the section of the Sheyenne River below the dam and a section of the Red River of the North. The plan also provides for the construction of a low diversion dam in the Sheyenne River 35 miles above the mouth and a short ditch leading thence to the existing Stanley ditch, the latter to be cleared and deepened to the Red River of the North which it enters about nine miles above Fargo so as to provide the city of Fargo with a supplemental city water supply from water stored in Lake Ashtabula. Construction of this project was completed in 1956 at a total Federal cost of $2,706,300.

Homme Reservoir and Dam

The project is located on the South Branch of the Park River about 4 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 a minimum flow of about five second-foot in the river to meet the water supply and pollution abatements needs from the dam to Grafton, N. Dak. In addition, a 16-inch cast iron pipe water-supply outlet through the dam has been provided at the request of local interests. During the biennium just completed, a recreational area was improved by construction of an access road, a well, and privies. Federal cost of this project to date is $1,321,300.

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.

The main features of this project are: (1) the Bois de Sioux channel improvement (2) the White Rock Dam (3) the Reservation Highway Dam, (4) the Brown's Valley Dike. The main purpose of the project is to provide flood protection for some 50,000 acres of agricultural land located in this area. Other benefits to be achieved are the creation of a lake that will be ideal for boating, swimming, fishing and wildlife conservation. Construction of this project was completed in 1941 at a Federal cost of $1,332,200.

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, which have been substantially completed under a contract awarded on March 5, 1954, consist of construction of a 5,163-foot levee and a 771.5-foot flood wall with the necessary interceptor lines, sewers and a pumping plant to provide for interior drainage. Due to foundation difficulties requiring a realignment of levees and resulting in construction of the flood wall, certain lands were acquired by the Government. Total Federal cost of construction and special land acquisition is estimated to be $972,000. 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.

Rush River Improvements

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 initiated in November 1954 are substantially completed and consist of clearing and snagging along approximately 14 miles of the river and excavation deepening, widening, and straightening the channel in an additional 14-mile reach. The improvement extends for a distance of 28 miles above the river mouth. The estimated Federal cost of the work is $243,000. The project was transferred to local interest for maintenance 4 December 1956.

Snagging and Clearing Operations

Snagging and clearing projects, consisting of the removal of snags, debris, brush and timber within channel banks to eliminate obstructions, have been completed in the localities noted in the following tabulation and the projects have been transferred to local interests for maintenance:

Stream	Miles	FY Year Clearing Completed	Total Cost
Bois de Sioux:			
6-9 miles above mouth	3	1949	$ 30,000
Park River:			
Park River to Grafton	28	1950	29,000
Grafton to 10 miles above mouth; Middle Branch mile 30 to mouth	46	1953	43,700
North Branch — Hoople to mouth of Middle Branch	33	1957	46,152
Sheyenne:			
Mouth of Rush to Kindred	56	1951	51,287
Mouth to mouth of Rush	12	1953	22,700
Tongue:			
Mouth to mile 64 above Akra	64	1952	39,088
Forest:			
3 miles below Minto to G. F. county	18	1952	26,900
Maple:			
Vicinity of Enderlin	2	1957	19,751
			$308,578

PROJECTS UNDER CONSTRUCTION

There are no projects under construction at this time.

OTHER AUTHORIZED PROJECTS

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. A plan of improvement for the protection of Fargo has been developed and a contract for construction is expected to be awarded about 1 September 1958. The plan provides for construction 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 3 short cutoffs downstream of Fargo. Local interests are required to (a) provide all lands, easements and rights-of-way, and spoil disposal areas for construction and maintenance; (b) hold and save the United States free from damages due to the construction and maintenance of the works; (c) maintain and operate all of the channel and levee improvement works after completion in accordance with regulations prescribed by the Secretary of the Army; (d) make all necessary changes to utilities, highways, and bridges, including approaches, except that construction of the new city dam and extension

of the Northern States Power Company's water lines will be accomplished by the Federal Government with the costs therefor to be reimbursed by local interests; and (e) obtain appropriate legal control over a pondage area and prevent encroachment in such area until a substitute area or equivalent additional pump or outlet capacity has been provided without cost to the United States. The assurances of local cooperation have been approved and the city of Fargo is currently obtaining the necessary rights-of-way.

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 Red River of the North in the vicinity of Wahpeton, N. Dak., and similar improvements on the lower Sheyenne and Maple Rivers in the vicinity of West Fargo, N. Dak. No work is being done on these units.

Snagging and Clearing Operations

Funds are presently available for snagging and clearing of about nine miles on the North Branch of the Park River in Pembina County extending upstream from the Walsh-Pembina County line and about nine miles on the Pembina River extending from the junction with the Tongue River to near Pembina, N. Dak. Estimated costs of work on the Park and Pembina Rivers are $36,000 and $24,000, respectively.

PROJECTS UNDER INVESTIGATION

Red River of the North Drainage Basin Studies

Based upon the recommendations contained in a preliminary examination completed in December 1956, a survey of the flood problems remaining at a number of points in the basin has been authorized. A separate interim survey report covering the flood and major drainage problems in the vicinity of Devils Lake is under way. Funds for the survey of the other problem areas have not been made available to date.

Souris River Study

In accordance with a recommendation contained in a preliminary examination completed in July 1956, a survey has been authorized for flood control and allied purposes at and in the vicinity of Minot, N. Dak., and for flood control and major drainage in an upland area near Tolley, N. Dak. Funds have not been made available for this survey to date.

Pembina and Tongue River Surveys

A survey of the Pembina and Tongue Rivers has been undertaken. Public hearings have been held at three locations on this matter and work on the report is 95 percent complete at the present. Current Corps of Engineers activities are confined largely to consideration of the feasibility of a multiple-purpose dam and reservoir on the Pembina River near Walhalla.

U. S. ARMY ENGINEER DISTRICT GARRISON

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.

Existing Project. The existing project was authorized by the Flood Control Act of 22 December 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 23 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 13,850,000 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 4,250,000 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 and initial protection in the vicinity of Williston, North Dakota, is $294,000,000.

Operations and Results During the Past two Fiscal Years. Surveys, foundations explorations, and engineering studies were continued. Design memoranda completed include Project and Directional Signs, Raise Lost Bridge and Approaches, Lewis and Clark Roads — Raising U. S. Highway 85, Public Service Building and Appurtenances, Warning System for Protection of Floating Craft, and Audio-Visual Presentation. Construction features completed include Little Muddy Creek Bridge, Alteration to Railing — Four Bears Bridge, Reservation Mutual Aid Telephone Corporation Relocation, Mountrail Electric Coops. relocations, protective works levee section I, piezometer and movement points, main embankment stage V, east abutment grouting

section IV A, concrete aggregates lot 3, reservoir clearing, spillway stilling basin, stilling basin and powerhouse foundation, penstocks and surge tanks*, powerhouse and switchyard*, turbines and generators*, pavement and guard rail on the embankment, main control switchboards*, main transformers*, purchase of a number of items of permanent operating equipment, and maintenance of construction facilities.

* For units 1, 2, and 3 only.

In addition to the work completed, the following work items were initiated or carried on during the period: Williams County Roads, Stony Creek crossing and bridge approaches; protective works Great Northern Railroad; Stony Creek Mutual Aid Telephone Corporation; relocation of power distribution lines, gas lines, and telephone lines belonging to Williams Electric Cooperative, Montana-Dakota Utilities Company and Northwestern Bell Telephone Company; protective works Williston levee section II; penstocks and surge tanks**; powerhouse and switchyard**; turbines; generators; governors; main control switchboards; 14.4 Kv. generator lead and neutral grounds; electrical test equipment; main transformers; oil-filled pipe cable system and oil circuit breakers**; maintenance of tree-planted areas; replacement of habitat; access roads; parking areas and tree planting; bank stabilization (Buford-Trenton area); boat yard; purchase of a number of construction facilities; and maintenance of construction facilities. Since the last report, all land acquisition scheduled for the project has been completed except for some minor title work and a few pending court cases.

** For units 4 and 5.

The Sedimentation program is divided into three main parts — degradation observations downstream from Garrison Dam, aggradation observations upstream from the dam, and suspended sediment sampling at several stations on the Missouri River and tributaries. Resurveys of the degradation ranges downstream from Garrison Dam were made in September 1956, June 1957, and June 1958. During 1957 and 1958, nineteen additional ranges were established between Garrison Dam and Bismarck. The 1956 survey of aggradation ranges in Garrison Reservoir indicated that most of the deposition has been confined to the channel. In connection with the Reservoir survey program, the 38-foot survey launch "Ellis" was christened in June 1958. The launch is equipped with Raydist electronic distance measuring equipment and a Bludworth-Marine depth recorder which are used for sounding work in the Reservoir. A special boom is installed on each side of the bow deck for sediment sampling.

Operation and Maintenance. Garrison Reservoir, although filled to less than half capacity, has contributed to all functions for which it was authorized. Runoff has been below normal but there has been a gain in storage of two ¾ million acre-feet from 1 July 1956 to 30 June

1958. During the period a total of 24,620,000 acre-feet was discharged from the reservoir, of which 20,510,000 acre-feet went through the power plant. Gross electrical energy amounted to 2,032,190,000 kilowatt hours, and net energy, exclusive of power for station use, was 2,020,620,000 kilowatt hours. Two generators were in operation at the beginning of the period and the third went on the line in August, 1956. In addition to releases for generation of power, discharges were made for navigation, domestic and industrial water supply, and stream sanitation. There has been a large increase in recreation activities on the reservoir during the period. In 1957 there were 282,500 visitors to the area and 559 boats were registered. One hundred and forty-four cabin sites were under lease on 30 June 1958. The reduction in sediment in the water downstream from the dam, due to the reservoir, has resulted in increased use of the river for boating and swimming, with active boat clubs at Underwood, Washburn, and Bismarck.

Condition at End of Fiscal Year. In addition to the completed plans and specifications listed under operations and results above, design and preparation of plans and specification are under way for: protective works — Great Northern Railway, Williston levee, pumping plant and relief wells, raise Lost Bridge and approaches, Lewis and Clark roads, roads and parking areas, and permanent operating equipment. Negotiations for agreements and plans and specifications are in progress for a number of relocation items. Permanent work on the project is about 91.7 percent complete. The percentages of completion of major features, based on the project estimate (July 1958), are as follows:

Feature	Percent Complete
Lands and Damages	97
Relocations	79
Roads	92
Railroads	81
Cemeteries, Utilities, Structures	53
Reservoir	100
Dam	97
Fish and Wildlife Facilities	72
Power Plant	75
Powerhouse	87
Turbines and Generators	68
Switchyard, Accessory, and Miscellaneous	74
Roads, Railroads, and Bridges	100
Recreation Facilities	76
Bank Stabilization	2
Buildings, Grounds, and Utilities	94
Permanent Operating Equipment	83
Engineering and Design	94
Supervision and Administration	91

Mandan, North Dakota

Location. The project is located on both banks of the Heart River at Mandan, North Dakota.

Existing Project. 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 south branch line; a levee on the right bank from 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 existing project was authorized by the Flood Control Act of 24 July 1946 and modified by the Flood Control Act of 17 May 1950. The estimated cost of the improvement is $822,600 of which $667,000 is Federal cost for construction and $155,600 is local cost for lands and relocations.

Local Cooperation. Local interests have met the requirements of local cooperation in connection with the levee project and interior drainage facilities. Rights-cf-way for the interior drainage work have been obtained.

Status. Construction of levees and appurtenant facilities is complete. The operation and maintenance manual for this portion of the project has been furnished local interests. The design memorandum for the Interior Drainage Facilities has been completed and approved. Plans and specifications have been completed and the contract was awarded 30 June 1958.

Lower Heart River, North Dakota

Location. This project will be 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.

Existing Project. The project has not been constructed. The plan of improvement provides for three units — (1) the Sunny unit which would include a closure levee between U. S. Highway 10 and high ground, (2) the Mandan unit which would consist of raising existing levees, floodwall, and bridges, and (3) the unit below Mandan which would consist of channel relocation, cleared floodway, and an additional levee from the south branch bridge to the Missouri River.

The project was authorized by the Flood Control Act of 3 September 1954. The estimated cost of the improvement is $2,413,000 of which $2,100,000 is Federal cost of construction and $313,000 is local cost.

Local Cooperation. Local interests are in the process of preparing the assurances of local cooperation. Right-of-way acquisition is nearing completion.

Status. The design memorandum was completed and approved. Plans and specifications for the Mandan unit have been completed. Bids have been asked and construction is expected to start in August 1958.

Marmarth, North Dakota

Location. The project will be located on the left banks of the Little Missouri River and Little Beaver Creek at Marmarth, North Dakota.

Existing Project. Although some levees exist at Marmarth, they are inadequate for flood protection. The plan of improvement provides for raising the existing levees and extending the protection to include the Browning Addition north of the railroad. Main features of the plan other than levees are a county road raise and four outlet structures for interior drainage.

The project was authorized by the Flood Control Act of 3 September 1954. The estimated cost of improvement is $272,000 of which $260,000 is Federal cost of construction and $12,000 is local cost for lands and utility modifications.

Local Cooperation. The assurances of local cooperation have been furnished. Acquisition of rights-of-way is nearing completion.

Status. Design memorandum and plans and specifications have been completed. Construction cannot be intiated until the necessary rights-of-way acquisition is completed. Funds are available for construction.

Mott, North Dakota

Location. This project will be located along both banks of the Cannonball River at Mott, North Dakota.

Existing Project. 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 concrete arch bridge, channel improvement, and pumping station. The estimated cost of the improvement is $775,000 of which $490,000 is Federal cost of construction and $285,000 is local cost.

Local Cooperation. Local interests will be required to furnish all lands, easements and rights-of-way necessary for the proposed construction; furnish assurances that they will hold and save the United States free from damages due to the construction works, and agree to maintain the protection works after construction. In addition, they will be required to remove the existing concrete arch bridge and construct a new highway bridge in a manner that would maintain the project channel capacity, provide rights-of-way for and prevent encroachment upon designated ponding areas, and make all required utility relocations necessitated by construction of the project.

Status. The project as presented in House Document No. 35-85th Congress was included in the 1958 Omnibus bill for authorization. Construction funds are not yet available.

U. S. ARMY ENGINEER DISTRICT OMAHA

General. The Omaha District Engineer office has jurisdiction over a relatively small portion of North Dakota within the Missouri River Division of the Corps. This area includes the upper reaches of the Oahe Reservoir which extends into North Dakota and the Grand River and its tributaries, the upper reaches of which lie in the southwest portion of the state.

Oahe. Construction of the Oahe Dam, on the Missouri River, six miles north of Pierre, South Dakota, is progressing on schedule with closure of the dam planned for July 1958. After closure, the impoundment will gradually build up, depending on runoff, so that some flooding of lands in North Dakota may occur about 1960. Completion of the reservoir in North Dakota will require relocation of approximately 14 miles of Northern Pacific Railroad near Cannonball, and about 8½ miles of North Dakota State Highway No. 24 near Fort Yates. The upper reaches of the reservoir will extend to a point downstream from Bismarck and Mandan. The Omaha District is cooperating with the state and Federal agencies concerned in the planning of facilities for public recreation and wildlife management on Oahe Project lands.

Grand River. The Corps of Engineers initiated an investigation of the Grand River and its tributaries with a public hearing held at Bowman, North Dakota, on 28 August 1956. Interest expressed in this investigation has been confined entirely to the development of a water storage project on the North Fork of the Grand. The investigation is nearing completion and a plan for a dam and reservoir at the Bowman-Haley site has been formulated. Design studies are complete and detailed economic analyses and cost allocation studies are in the final stages. It is anticipated that a project report will be completed in the fall of 1958. The project developed would provide for the conservation of water for municipal water supply, fish and wildlife conservation, recreation opportunities, and impoundment for flood control. Prospects for a favorable recommendation by the District Engineer at Omaha appear bright.

Scranton, North Dakota. The Omaha District of the Corps developed and recommended a local flood protection project at Scranton in 1957. This project consists of channel improvements and levees on Buffalo Creek to protect the town from floods. Favorable construction bids were received and construction initiated in August 1958. The project will be essentially completed in about three months after start of construction and turned over to the Bowman County Flood Control and Conservation District for future operation and maintenance.

BUREAU OF RECLAMATION

MISSOURI RIVER BASIN PROJECT
GARRISON DIVISION

Garrison Diversion Unit

The diversion of Missouri River water to central and eastern North Dakota has been urged by local and State interests for nearly 70 years. In 1890 the Geological Survey investigated a proposal to divert water from the Missouri River in eastern Montana to central North Dakota but found it financially infeasible at that time. In the 1920's diversion from the Missouri in the vicinity of Garrison, North Dakota was first investigated and reported on by the State Engineer. During the 1930's, the Corps of Engineers, State Engineer and several consulting engineers made studies and reports on Garrison Diversion.

The Bureau of Reclamation made its first investigations of the scheme for Missouri River diversion in the late 30's and early 40's. These investigations and the report on them provided the basis for part of the Department of Interior's plan of development for the Missouri River Basin contained in Senate document 191, 78th Congress. This plan and the Corps of Engineers' plan were coordinated in the basin plan authorized by Congress in the Flood Control Act of 1944 and the Rivers and Harbors Act of 1945.

The development consists of three main parts—Garrison Reservoir, the principal supply works and the water use works. Garrison Reservoir, on the main stem of the Missouri River, is the storage facility from which the water supply for the unit will be diverted. The reservoir, being constructed by the Corps of Engineers, has a capacity of 23,000,000 acre-feet at the top of its flood control storage pool. It will be operated for irrigation, power, navigation, flood control, recreation and silt detention. The range in operating level is expected to be about 75 feet—from elevation 1,775 to 1,850. The Principal Supply Works will extend from the diversion point at Garrison Reservoir to and including Lonetree Reservoir, a regulating basin in the headwaters of the Sheyenne River southwest of Harvey.

Major features of the principal supply works are:

1. **Snake Creek Pumping Plant.** This structure is to be designed and constructed by the Bureau of Reclamation. It will pump water from Garrison Reservoir into the adjacent Snake Creek Reservoir which is just beginning to form behind the Snake Creek embankment, already built by the Corps of Engineers northwest of Coleharbor. When the level in Garrison Reservoir is lower than elevation 1,850, water must be pumped into Snake Creek Reservoir. A maximum pump lift of 75 feet may be required during prolonged dry spells. The pumping plant will have a capacity of about 8,850 cubic feet per second (6 units, 1475 c.f.s. each) for a 1,007,000-acre development

and pump about 2,627,000 acre-feet a year for irrigation and other uses. Power requirements of the plant will be about 80,200 kilowatts; the average annual energy requirement, 118,600,000 kilowatt-hours.

2. **McClusky Canal.** This canal, to be built by the Bureau of Reclamation, will carry water from Snake Creek Reservoir, through low country south of Turtle Lake and Mercer, and thence northeasterly into Lonetree Reservoir. It will be about 73 miles long and have a beginning capacity of about 8,200 second-feet. Along the canal route between Snake Creek and Lonetree Reservoirs there is a total drop of over 217 feet that could ultimately be used for power generation. Plants to capture the energy from water falling through this drop will not be constructed, however, until the value of power generated exceeds the cost of the power generation.

3. **Lonetree Reservoir.** This reservoir is located in the uppermost reaches of the Sheyenne River southwest of Harvey. It is so near the drainage basins of the James and Souris Rivers that dikes will be needed at several points to prevent escape of stored waters to these rivers. The reservoir taking area will be about 30,000 acres and the reservoir will have a maximum depth of 70 feet. The reservoir, which will act as a regulator for water flowing through the McClusky Canal, will have a storage capacity available for regulating purposes of 280,000 acre-feet. Because of its function as a regulator, the reservoir water surface is expected to fluctuate about 20 feet in elevation each year. Lonetree Reservoir will be the focal point for main canals reaching out to the major areas of water use.

The water use works will consist of the main canal systems originating at Lonetree Reservoir and the pumping plants, laterals and drains within the bodies of irrigable land. Major features of the water use works will be:

1. **Velva Canal.** This canal, which will run in a northwesterly direction from Lonetree Reservoir, will deliver water to 333,000 irrigable acres in the Souris River Basin. It will have an initial capacity of about 5,270 c.f.s. and be about 128 miles long, terminating near the Canadian boundary west of Westhope. Major structure along this canal is a 3,250-foot siphon across the Souris River near Velva.

2. **East Souris Canal.** This canal will irrigate 152,000 acres lying east of the Souris River and deliver excess Souris River flows to the Sheyenne River. The canal, with an initial capacity of about 3,000 c.f.s., will begin near the Canadian boundary and run in a southeasterly direction for 122 miles, emptying into the north fork of the Sheyenne. The water supply, consisting mainly of return flows from irrigation west of the river, will be pumped from the Souris River at a point east of Westhope.

3. **Devils Lake Canal.** This canal will lead from Lonetree Reservoir in a northeasterly and easterly direction to serve 86,000

irrigable acres in the Harvey-Maddock Area. It will have an initial capacity of 1,620 c.f.s. and be 81 miles long, terminating near Oberon, North Dakota. Major structure along the canal is a siphon across the north fork of Sheyenne River. A relatively short feeder canal through Round, Stoney and Long Lakes south of Minnewaukan will lead from the Devils Lake Canal into Devils Lake. Through this canal, water can be diverted to restore the level of Devils Lake from its present elevation of about 1,418 to about 1,425. A feeder canal connecting Devils Lake with Stump Lake, and an outlet canal from Stump Lake to the Sheyenne River will permit continuous flow through the system. The Devils Lake Feeder will be about 10 miles long and the smaller Stump Lake Feeder Canal about 9½ miles long. The outlet canal from Stump Lake will be about 2½ miles long and will empty into the Sheyenne River via Tolna Coulee.

4. **Sykeston Canal.** The canal will originate at the McClusky Canal just above the drop into Lonetree Reservoir. It will run in an easterly direction for about 72 miles, terminating near Carrington. The canal will serve about 37,000 acres and have an initial hydraulic capacity of 700 c.f.s.

5. **New Rockford Canal.** For the first 30 miles this canal will utilize the channel of the James River which flows in an easterly direction from Lonetree Reservoir. The canal capacity, at its beginning point, will be 4,380 c.f.s. It will supply water to 67,000 irrigable acres in the New Rockford Area, 41,000 acres in the Warwick-McVille Area, and 97,000 acres in the Baldhill Area. It will also supply water to supplement return and natural flows in the James River for the irrigation of about 12,000 acres in the LaMoure Section and 108,000 acres in the Oakes Section. At a point about three miles southwest of the town of Bremen, the Hamburg Diversion Dam will divert the canal to the north of the James River. From that point it runs in an easterly and southeasterly direction for 42 miles. At the Hamburg Diversion Dam, water will also be diverted to the James River Feeder Canal to the south of the James River. This canal will transport water for about 5,600 acres south of the river and also for release to the James River below New Rockford for regulation through Jamestown Reservoir and a water supply for the LaMoure and Oakes Sections. The James River Feeder Canal will have a capacity of 1,000 c.f.s. and will be 22 miles long.

6. **Warwick Canal.** This canal will begin at a point 27 canal miles northeast of the Hamburg Diversion Dam. The canal, with an initial capacity of 782 c.f.s. and a total length of 65 miles, will terminate near the town of McVille. From a point near its beginning where it will be siphoned across the Sheyenne River, the canal will extend along the north edge of the Sheyenne River Valley, serving 41,000 irrigable acres*.

*Warwick Canal can be extended to the east to serve irrigable lands in Steele, Grand Forks, Trail and Cass counties.

7. **Baldhill Canal.** This canal will begin at the end of the New Rockford Canal. It will have an initial capacity of 1,850 c.f.s. and will bring irrigation water to 97,000 acres in the Baldhill Area. The canal will run in a southeasterly direction from its beginning point west of McHenry for about 74 miles, terminating near Rogers, North Dakota. A major canal about 42 miles long will branch off the Baldhill Canal near its beginning and will run down the left bank of Baldhill Creek to the Cooperstown locality.

8. **Jamestown Dam and Reservoir.** This feature of the water use system has already been constructed and is discussed separately.

9. **Oakes Canal.** This canal, together with the Oakes Pumping Plant, will deliver water from the James River near Oakes to the 108,000-acre Oakes Section in North and South Dakota. (About 52,000 acres of this section is in North Dakota.) The canal will have an initial capacity of 1,420 c.f.s. and will extend 11 miles eastward to be regulated at Taayer Reservoir. For the western portion of Oakes Section, water will be taken directly from the Oakes Canal; for the eastern section, it will be supplied both from the Oakes Canal and storage in Taayer Reservoir. This reservoir will have active storage of 40,500 acre feet and will be used to help meet peak demands in the east portion of the Oakes section.

10. **Coleharbor Canal.** This feature will supply water to the 40,000-acre Coleharbor Section which lies between Snake Creek Reservoir and the town of Washburn. It will begin at a point about three miles east of the town of Coleharbor, where water will be pumped 105 feet from Snake Creek Reservoir. The canal will be about 50 miles long and have a capacity at its heading of 748 c.f.s.

Besides Snake Creek, Lonetree, Jamestown and Taayer Reservoirs, there are five regulating impoundments of minor size. These are located in the Souris Section and have a combined storage capacity of 107,000 acre-feet. There will be a considerable number of pumping plants, other than those already mentioned. Six of them will have capacities over 500 c.f.s., 39 will range in size from 50 to 500 c.f.s., and about 600 will be smaller than 50 c.f.s. The water use system also will include a network of smaller laterals sufficient to make delivery to every quater section of the project area. The entire canal and lateral system will include:

Canals and laterals	Length in miles
Over 500 c.f.s.	764
51 to 500 c.f.s.	980
50 c.f.s. and under	5,029
Total	6,773

Over 35,000 canal structures will be included in the canal and lateral system. Project works for the unit also will include 980 miles of main drains, 2,020 miles of shallow surface drains, 6,300 miles of sub-surface drains, and about 20,000 drainage structures.

Electric power for pumping will be supplied from the Missouri River Basin System, either by direct connection to existing or proposed Transmission Division facilities, or by wheeling over electric cooperative or utility company lines.

Municipal and industrial water supplies will be delivered at canal-side. Consequently, no works will be constructed specifically for these purposes. Seasonal off-peak canal capacity will be adequate for these deliveries.

The plan of development for the unit includes 62 areas for fish and wildlife purposes. Two of these areas will replace the Sheyenne Lake National Wildlife Refuge and the downstream pool of the Lower Souris National Wildlife Refuge, which are being flooded by regulating reservoirs. The remaining areas are for mitigation of damages to waterfowl habitat, resulting primarily from agricultural drainage, and for general enhancement of fish and wildlife values over the project area.

To provide improved recreation opportunities in the project area, the National Park Service recommended development of receation facilities at major reservoirs.

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 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. Work is presently underway on the preparation of definite plans for the Oakes and LaMoure sections and the Warwick-McVille area. Submission of reports to the Commissioner is scheduled for November 1959, May 1960, and May 1961, respectively, for these three segments.

Red River Valley Areas

In the Red River Valley there are about 1,000,000 acres along the shoreline of ancient Lake Aggassiz that are generally suitable for irrigation. These lands are in Richland, Ransom, Cass, Steele, Traill, Grand Forks, Walsh and Pembina Counties. They are not included in the first-stage development plan but can be considered as an additional or substitute market for water. By extending the operating season for the principal supply works and providing additional storage on the Sheyenne River, these lands can be served without increasing the size of any important features of the Garrison Diversion Unit. Interest in water development on the delta lands is clearly evident, five counties in the Red River Valley having joined the Garrison Diversion Conservancy District to reinforce their claim for a share in the unit water supply.

Jamestown Unit

Jamestown Unit is located on the James River in Foster and Stutsman counties in east-central North Dakota. Jamestown Dam is about ¼ 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 main feature of the unit is Jamestown Dam and Reservoir. 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 its becomes feasible, and it was so constructed 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. Relocation of Arrowwood Wildlife Refuge facilities and installation of relief wells downstream from the dam remain to be done.

Management of the reservoir area is the responsibility of the Stutsman County Park Commission under an agreement with that organization.

As indicated above, Jamestown Reservoir will function in connection with the Garrison Diversion Unit.

Irrigation Development Farms

Three development farms have been established by the Bureau of Reclamation in cooperation with the North Dakota Agricultural College 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. Seventeen of the irrigated acres are reserved for research. This farm has been in operation since the spring of 1953.

The Sheyenne Farm is located in Eddy County immediately west of and adjacent to Sheyenne, North Dakota. This farm includes 394 acres, with 118 ares irrigated in 1958. Operation of the Sheyenne Farm was started in the spring of 1956.

The Ransom Farm is located in Ransom County about 6 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.

The development farms illustrate the integrated dryland and irrigated type of farm unit which is expected to evolve in the Garrison Diversion Unit.

Heart Division

The Heart Division consists of Dickinson and Heart Butte Units.

Dickinson Unit

Dickinson Unit is located in Stark County in southwestern North Dakota. Dickinson Dam and Reservoir are on the Heart River, about 1½ 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 opportunities.

The principle feature of the unit is a rolled earth-fill dam with a combined concrete spillway and outlet works structure and a 16,500 acre-foot reservoir. Construction of the dam was started in March of 1949, and substantially completed in August, 1950. Subsequent work has included extension of the outlet works farther into the reservoir, 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. 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.

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 include 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 the irrigable 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. Construction of facilities to serve the rest of the 13,100 irrigable acres will not be started until appropriate repayment arrangements have been made.

The reservoir area is administered by the State Game and Fish Department under an agreement between that agency and the Bureau of Reclamation.

The 70-acre Mandan Development Farm, is operated by the State Training School.

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, Square Butte, 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 new 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 farm irrigation layouts and land leveling. By June 30, 1958 approximately 1,000 acres had been prepared for irrigation.

TRANSMISSION DIVISION

Under the Flood Control Act of 1944, the responsibility for marketing the power generated by 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 prosecution of the power marketing program. In North Dakota the major source of Missouri River Basin power will be 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 will have an installed capacity of 400,000 kilowatts and an average annual 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 will interconnect the Missouri River power plants and provide power at the major load centers. A network of 115-kilovolt and 69-kilovolt lines will supply 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, 1958, the following lines and substations were complete and in service:

Lines	Length Miles	Substations	Capacity Kva
Garrison-Bismarck 230-kv[1]	62.70	Bismarck	32,000
Bismarck-Mobridge 230-kv	94.97	Washburn	15,000
Bismarck-Jamestown 230-kv	98.32	Jamestown	77,000
Jamestown-Fargo 230-kv	83.03	Fargo	118,000
Williston-Garrison 115-kv	170.19	Devils Lake	17,500
Garrison-Voltaire 115-kv	57.17	Grand Forks	30,000
Voltaire-Rugby 115-kv	55.95	Valley City	15,000
Rugby-Devils Lake 115-kv	58.85	Lakota	15,000
Devils Lake-Lakota 115-kv	26.09	Leeds	16,500
Devils Lake-Carrington 115-kv	52.46	Rugby	15,000
Carrington-Jamestown115-kv	48.35	Bisbee	1,500
Jamestown-Valley City 115-kv	35.01	Rolla	4,500
Jamestown-Edgeley 115-kv	37.36	Carrington	11,500
Edgeley-Groton 115-kv	80.49	Edgeley	21,500
Fargo-Grand Forks 115-kv	83.01	Ellendale	15,000
Leeds-Rolla 69-kv	42.55	Forman	12,000
Edgeley-Forman 69-kv	66.42	Watford City	5,000
Bismarck-DeVaul 69-kv	45.03	Beulah	7,500
		Custer Trail	1,500
		DeVaul	2,500
		Fort Clark	750
TOTALS	1,197.95		434,250

[1]Double circuit.

NORTH DAKOTA STATE WATER CONSERVATION COMMISSION
MONTHLY REPORT OF APPROPRIATIONS AS OF JUNE 30, 1958
1955-1957 APPROPRIATIONS

Fund No.		Available July, 1955	Expended June 1, '58	Balance June 30, '58
1.	Commissioners' Per Diem and Expenses	$ 6,000.00	$ 5,822.11	$177.89
2.	Administration	40,000.00	42,453.03	41.19
	Collections, Refunds, Transfers	2,494.22		
3.	Maintenance of Dams	100,000.00	220,556.13	38.53
	Collections and Refunds	120,594.66		
4.	International and Interstate Commission's Conference Expenses	8,000.00	8,040.42	.18
	Collections and Refunds	40.60		
5.	Topographic and Conservation Cooperation with U. S. G. S.	30,000.00	30,000.00	NIL
6.	Hydrographic and Conservation Cooperation with U. S. G. S	25,000.00	25,000.00	NIL
7.	Engineering and Geological Surveys and Demonstrations	35,000.00	35,223.93	NIL
	Transfer from Number 1	223.93		
8.	Cooperation with U. S. Departments and for Organizing Conservation and Irrigation Districts	40,400.00	40,374.92	25.08
9.	Small Projects and Investigations and Surveys	106,000.00	125,994.37	NIL
	Collections and Refunds	19,994.37		
10.	Water Right Investigations	12,000.00	11,994.23	5.77
		$545,747.78	$545,459.14	$288.64

NORTH DAKOTA STATE WATER CONSERVATION COMMISSION
MONTHLY REPORT OF APPROPRIATIONS AS OF JUNE 30, 1958
1957 - 1959 APPROPRIATIONS

Fund No.		Available July, 1957	Expended June 30, '58	Balance June 30, '58
1.	Commissioners' Per Diem and Expenses	$ 6,000.00	$ 1,298.62	$ 4,701.38
2.	Administration	47,000.00	22,945.15	25,756.03
	Refunds and Deposits	1,701.18		
3.	Maintenance of Dams	105,000.00	77,732.54	62,290.74
	Refunds and Deposits	35,023.28		
4.	International and Interstate Commission's Conference Expenses	8,000.00	5,228.35	2,786.50
	Refunds and Deposits	14.85		
5.	Topographic Surveys, Cooperation with U. S. G. S.	30,000.00	11,021.77	18,978.23
6.	Hydrographic Surveys, Cooperation with U. S. G. S.	27,500.00	10,717.23	16,782.77
7.	Engineering and Geological Surveys and Demonstrations	37,500.00	22,133.76	15,634.43
	Refunds and Deposits	268.19		
8.	Cooperation with U. S. Departments and for Organizing Conservation and Irrigation Districts	50,000.00	16,819.39	33,190.61
	Refunds and Deposits	10.00		
9.	Small Projects, Investigations, Surveys, Etc.	118,000.00	68,859.51	51,394.17
	Refunds and Deposits	2,253.68		
10.	Administration of Water Laws	6,000.00	1,158.24	4,841.76
	OASIS Refunds	3,800.00	3,023.25	776.75
		$478,071.18	$240,937.81	$237,133.37

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