STATE OF MINNESOTA

Orville L. Freeman, *Governor*

Department of Conservation

Chester S. Wilson, *Commissioner*

Report of the Division of Waters

For the Period
July 1, 1950 - June 30, 1954
(11th and 12th Bienniums)

Section VI

Division of Waters

Sidney A. Frellsen, *Director*

This report is published in six sections, as follows:

I. Commissioner's Report
II. Division of Forestry
III. Division of Game and Fish
IV. Division of Lands and Minerals
V. Division of State Parks
VI. Division of Waters

"The foundation of the future rests on a knowledge of the basic water resources with which the state is endowed and an insistence that these resources must be conserved, preserved, and managed in the best interests of the people as a whole."—Anon.

January, 1955

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January, 1955

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To the Honorable Orville L. Freeman, Governor
and
To the Legislature of the State of Minnesota

I have the honor of transmitting herewith the report of the Division of Waters of the Department of Conservation for the four-year period, July 1, 1950 to June 30, 1954, being Section VI of the report of the entire department.

For the convenience of those who may be interested only in certain particular conservation subjects but not in the entire field, the reports of the Commissioner and the five divisions are published separately instead of in a single volume as in former years.

Respectfully submitted,

Chester S. Wilson
Commissioner of Conservation

January, 1955

Mr. Chester S. Wilson
Commissioner of Conservation
State Office Building
St. Paul 1, Minnesota

Re: Biennial Report
Division of Waters

Dear Mr. Wilson:

Transmitted herewith is the report of the Division of Waters for the four-year period, July 1, 1950 to June 30, 1954.

Respectfully submitted,

Sidney A. Frellsen
Director

FOREWORD

During the eleventh biennium the division assisted the Commissioner of Conservation in the statewide water resources investigation authorized by the 1951 Legislature. During the current biennium many reports have been made to the Legislative Interim Commission appointed by the 1953 Legislature to study the problems relating to water conservation, drainage and flood control.

This report is brief, but, on the other hand, all essential information as to the basic needs of the state for the protection and enhancement of our water resources — both surface and underground — is included. Whenever possible an attempt has been made to compare past and present progress to indicate future trends.

ACKNOWLEDGMENT

The director desires to express his personal appreciation to the officials of the state and members of the staff of the Conservation Department and all other state and federal agencies concerned with the water resources of Minnesota for their splendid cooperation in advancing the development of the overall conservation program.

The loyalty and cooperation of the staff of the Division of Waters has been largely responsible for whatever success has been attained in the administration of the laws pertaining to the public waters and for the engineering work on conservation department projects.

WATER RESOURCES — GENERAL

With the growing demand for water for all manner of uses, interest in this resource on the part of private users as well as the public has increased and a concern over the ultimate effect on available supplies has developed in certain areas. Water in general has become a subject of study and investigation not only in Minnesota but in the entire nation. Because of the apparent abundance of its waters, Minnesota until recently has paid little attention to the increased demands on this resource by the rapid expansion of agriculture and industry that depend upon and draw upon available supplies.

Except for certain portions of the Red River Valley, however, where the pinch of water shortage is felt during periods of subnormal rainfall and on the iron range where taconite ores are being mined and treatment plants constructed, no serious threat of water shortage is indicated thus far.

The constantly increasing demands on groundwater supplies emphasize our lack of knowledge of groundwater occurrence and fluctuation, and variations in both quality and quantity. An expanded program of groundwater investigation is highly desirable so that its availability with respect to both quantity and quality may be inventoried to meet the growing demand for the use of this resource.

With reference to our surface waters, more data are available. A program of stream gaging and general studies of their behavior has been in effect for several years and this information, though lacking in continuity, is valuable in studies for flood control, drainage, processing of requests for water use for mining operations, power development, storage, conservation and other associated problems.

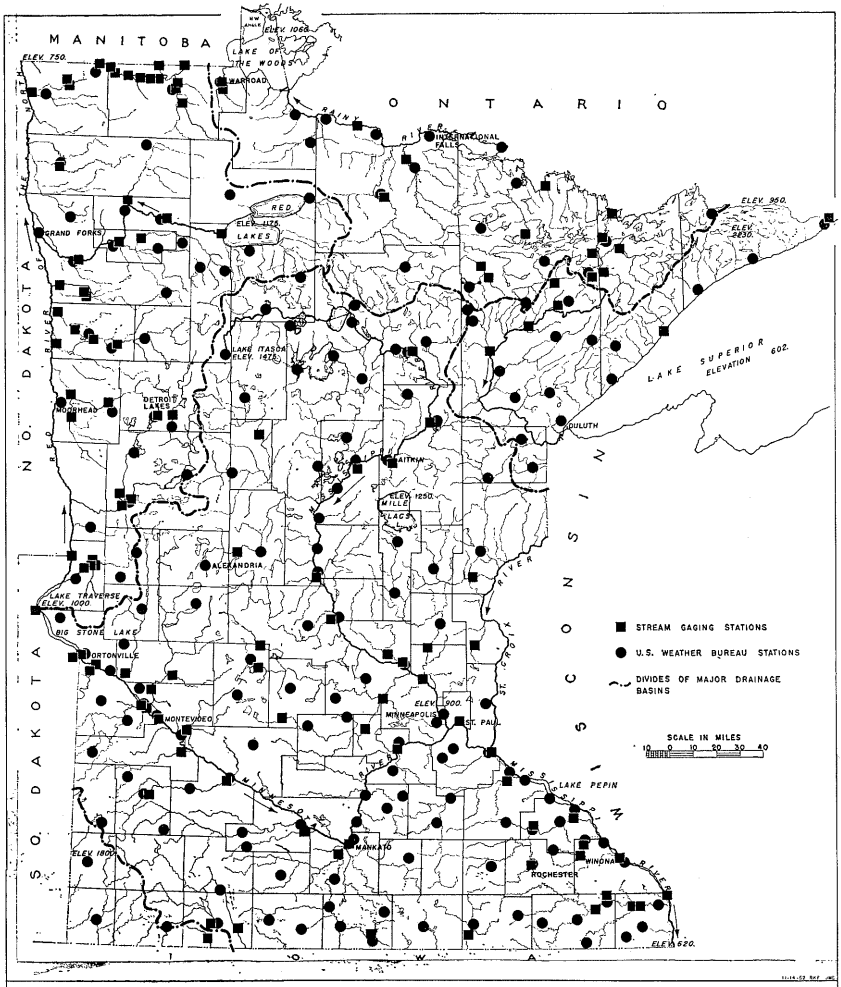
The activities of the Division of Waters during the period covered by this report are discussed in the following pages under appropriate headings.

GROUND WATER

Recent serious water shortages in the western states and along the eastern seaboard have emphasized the water supply problem created by a generally expanding economy, the fluctuating **surface** water supply and the urgent need of exploring the location, extent and quality of ground waters to augment surface water supplies.

In Minnesota, despite a generally abundant surface water supply, 95% of the smaller communities up to 25,000 population use ground water sources for their water supply mostly because of its greater economy, dependability and purity.

In Minnesota supply problems occur where expanding municipal and industrial development create a demand for additional water in areas of limited ground water capacity or where the available supply is of poor quality.



RIVER SYSTEMS OF MINNESOTA

DIVISION OF WATERS
DEPARTMENT OF CONSERVATION — STATE OF MINNESOTA
OCTOBER 31, 1952

Figure 1

The problem of **use regulation** created by competition for available supplies both surface and ground is developing and determination should be made as to what extent, if any, regulation should be effected **and under what authority.** To assist in the solution of its water supply problems the state has entered into a cooperative program with the U. S. Geological Survey, Ground Water Branch, to inventory and investigate its ground water potential, and the progress report of that agency follows.

State-Wide Ground-Water Investigation*

State-wide ground-water investigations, which were started in July, 1950, by the Ground Water Branch of the Water Resources Division, U. S. Geological Survey, in cooperation with the state, were continued during the four years ending June 30, 1954.

The program consists of the compilation of all available data on known ground water supplies including information relative to its availability, use, quality, and recharge. As the data are assembled, they are made available in the offices of the Division of Waters, the Minnesota Geological Survey, and the Ground Water Branch of the U. S. Geological Survey. Emphasis has been placed on collecting data for a report on the public water supplies of northwestern Minnesota.

The current investigation also includes a small water-level observation program. As of December 31, 1953, 26 observation wells were being measured, 10 of which were equipped with recording gages, and 16 were measured weekly. Their geographic distribution is as follows:

County	No. of Wells
Brown	1
Carlton	5
Carver	1
Clay	5
Dakota	1
Hennepin	12
Morrison	1

Observation wells near municipalities provide data which are useful in evaluating the adequacy of the supply and the possibilities for additional development in the future. Water-level measurements in wells not affected by municipal or industrial pumping are useful in studying natural changes in underground storage. Part of the observation-well program was financed by federal (non-cooperative) funds and through a cooperative agreement between the U. S. Geological Survey and the Board of County Commissioners of Hennepin County.

In June, 1952, the results of an earlier detailed investigation of the Cloquet area were published as Bulletin 6 of the Division of Waters entitled "Geology and Ground-water Resources of the Cloquet Area, Carlton County, Minnesota." Aside from the valuable basic data obtained during this study,

*This section of report adapted from reports prepared by Robert Schneider, District Geologist, U.S.G.S.

several localities favorable for the development of ground water supplies of moderate size were located. It was concluded that the water-bearing materials were not capable of yielding large supplies for industrial purposes except possibly through a large number of wells distributed over the whole area, the cost of which would be prohibitive at the present time.

On July 1, 1952, an investigation of the geology and ground water resources was started in the vicinity of Redwood Falls as part of the statewide cooperative program. This area is fairly representative of a large segment of the Minnesota River valley where the glacial drift is relatively thin, the underlying cretaceous formations are thin or absent, and the basement rocks are crystalline and relatively impervious. As of June 30, 1954, records for about 350 wells were collected, 64 electrical-resistivity probes were made, water-table and bedrock topography maps were drawn, and four pumping tests were conducted. After most of the data were compiled and studied, the City of Redwood Falls had some test holes drilled and they were able to locate and develop considerable additional water for their present and future needs.

As a result of the mining and beneficiation of taconite on the Mesabi Range, the economy in this area is generally expanding and larger amounts of ground water are needed to meet present and future demands. In view of this situation a program for compiling all the available ground water data was started on July 1, 1952, in cooperation with the State Division of Waters.

Ground water occurs on the range in the Biwabik iron formation and in the glacial deposits. In view of the fact that water supplies developed from the iron formation are in danger of eventual disruption by mining, it was decided to study only the glacial deposits. Through the wholehearted cooperation of the iron mining companies in furnishing drill-hole data, all available information on the bedrock topography of the eastern half of the range have been compiled as transparent overlay maps on the same scale as the standard topographic maps. These maps can be used to delineate ground water basins, show the direction of movement of underground water, and locate glacial or pre-glacial drainageways that might contain water-bearing deposits of sand or gravel.

In general, the glacial drift thickens to the south of the range. There are several areas where the glacial deposits exceed 100 feet in thickness and where there is a trough or depression in the bedrock. One of the largest of these is between Virginia and Mountain Iron. Field work has been started to map the geology and to collect available information on existing wells such as depth, occurrence of water, types of materials drilled through, water levels, yield, and quality of water. It will be necessary to do some test drilling and pumping to aid in mapping the sub-surface geology and to determine the hydraulic characteristics of the water-bearing formations.

As of July 1, 1953, the Iron Range Resources and Rehabilitation Commission has been cooperating with the U. S. Geological Survey in a ground water study of the entire Mesabi Range area.

The cooperative program with the Iron Range Commission also includes parts of Kittson, Marshall, and Roseau counties where an investigation was started to inventory the water resources both as to quantity and quality. Ground water supplies are generally meager in this area and the quality is poor in many places. Water supplies are needed for municipal, industrial, agricultural, and domestic use. In view of the fact that sugar beets are one of the most important crops, the establishment of sugar beet refineries would bolster the economy of the area considerably. This project was started because of the lack of data on water resources and the fact that sugar beet refineries cannot be established without an adequate water supply.

Geologic mapping of the larger sand and gravel deposits has been started and the first of several deep test holes was commenced on June 3, 1954. A well inventory is being made and it will probably be necessary to drill a considerable number of shallow test holes to determine ground water conditions in the glacial deposits.

Federal (non-cooperative) funds were made available for a special compilation report on the Twin Cities area. The report, entitled "Water Resources of the Minneapolis-St. Paul Area, Minnesota," by C. H. Prior, Robert Schneider, and W. H. Durum, was published in 1953 as Circular 274 of the U. S. Geological Survey. It summarizes all the available information on the quantity and quality of both ground and surface water.

The following table indicates the amount and source of funds that were spent in the state during the past four years for the investigation of ground-water resources:

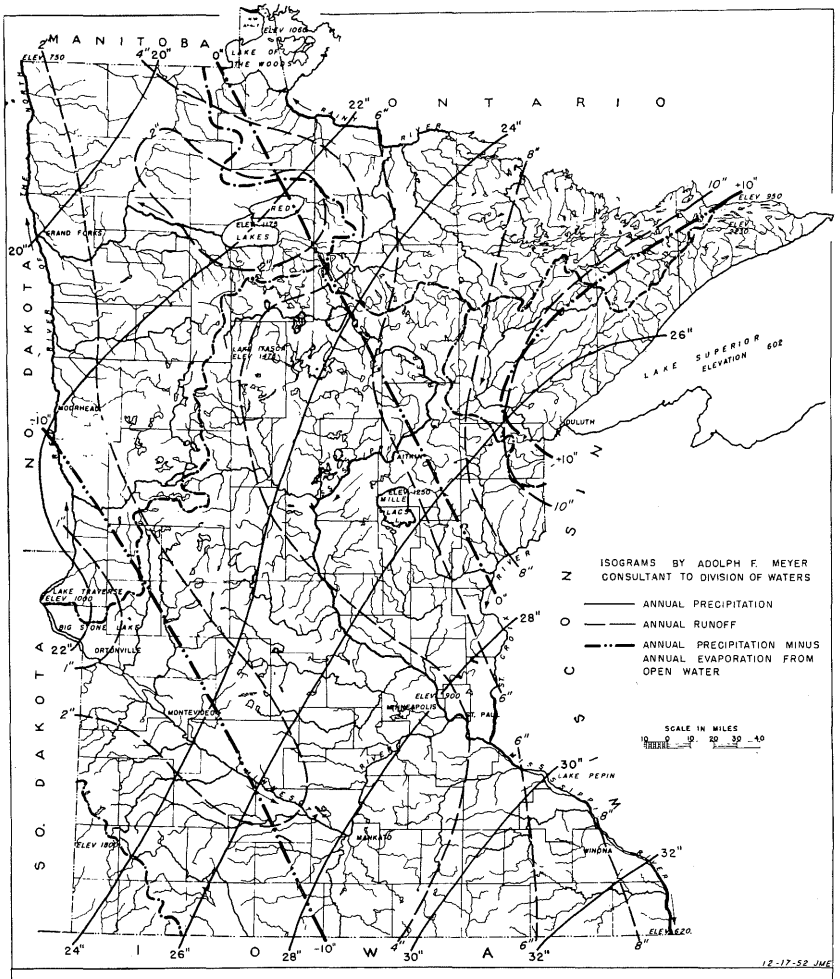
	July 1, 1950 to June 30, 1952	July 1, 1952 to June 30, 1954
Minnesota Division of Waters	$10,000	$ 29,827†
Board of County Commissioners of Hennepin County	500	4,125
Iron Range Resources and Rehabilitation Commission	.....	20,075*
U. S. Geological Survey Cooperative Funds	10,500	53,703*
U. S. Geological Survey Non-Cooperative Funds	3,400	3,208
	$24,400	$110,938

†Includes gifts to Commissioner of Conservation for this purpose.
*Includes funds encumbered by contract for test drilling which is not as yet completed. These figures will probably be reduced.

PREVIOUS GROUND WATER STUDIES

Prior to the inauguration of a state-wide ground water program in 1950, the Ground Water Branch of the Water Resources Division of the U. S. Geological Survey engaged in several cooperative studies of the ground water resources in several localities within the state.

The first of these studies was in the Fargo-Moorhead area and involved work in both North Dakota and Minnesota. These investigations have divulged



MAP OF MINNESOTA
SHOWING
GENERALIZED ISOGRAMS

DIVISION OF WATERS
DEPARTMENT OF CONSERVATION — STATE OF MINNESOTA

Figure 2

seven important aquifers or water-bearing formations in the area and furnished other valuable general information relative to the geology and occurrence of ground water in this section. The results of this work have been published.

Records of wells and water levels were obtained throughout the county. Data on public supplies and well logs were secured from local well drillers and others.

The second cooperative ground water investigation, made in the Cloquet area, has been completed. The results of this investigation are described under "Groundwater" and published in Bulletin 6, Division of Waters, 1952.

A study has been made of the ground water conditions in the Camp Ripley Military Reservation with funds contributed by the War Department. The Camp Ripley investigation was confined largely to the camp area.

SURFACE WATER

A state-wide cooperative stream gaging program is carried on between the U. S. Geological Survey, Surface Water Branch, and the State of Minnesota, the U. S. Corps of Engineers, the U. S. Department of State and individual counties and municipalities. The purpose of the program is:

(1) To measure continuously the fluctuation in stage and volume of flowing water at various points in the streams to determine the quantity of surface runoff per unit area in the various sizes and types of watersheds of the state.

(2) To publish the data as annual water supply papers as reference works for those interested or concerned with the stage, duration, and volume relationships of streamflow bearing on existing or contemplated works of man.

Obviously, this program is of fundamental importance to the state's economy since the data obtained is basic to the solution of all problems involving land and water and particularly those of public concern such as flood control, drainage, erosion and siltation, water supply, hydro-power, etc.

This program is now providing streamflow records at 134 stations, some being of long duration while others are temporary to secure data for specific problems.

Industrial (taconite and oil and sugar refinery), agricultural (irrigation and drainage), and municipal expansion have created an increased demand for fundamental information on water occurrence and behavior indicating the basic need for this data and the desirability of the continuance of the program. Tables I and II show the extent of participation by the various cooperating agencies, the type of station, location by primary basins, and funds expended during the biennium in cooperation with the U. S. Geological Survey, Surface Water Branch.

MAINTENANCE AND OPERATION OF STATE DAMS

The division is responsible for the maintenance and operation of approximately 320 state dams, most of which were built during the depression and drouth period of the nineteen thirties under federal and state work relief projects. The dams were originally built with stop-log bays so that the crest elevation could be adjusted manually. After ten or more years of experience with operation of these stop-log dams it was concluded that at many locations more satisfactory pool levels would result and less tampering occur if the dams were altered to provide a fixed crest and eliminate all manipulation of stop-logs. Most of the dams have now been thus altered and there has been a decided decrease in complaints on account of tampering.

Approximately 40 dams still require some operation by means of stop-logs or gates. So far as possible, local employees of other divisions of the Department of Conservation carry out the instructions or follow regular plans of operation issued by the Division of Waters.

Since it is difficult for personnel of this division to visit all dams with sufficient frequency, a plan for inspection of dams by personnel of other divisions has been put into operation. Game wardens, forest rangers and other employees stationed near the dams make systematic inspections and report direct to the Division of Waters on the condition of dams and dykes. The division employs a foreman who makes the necessary repairs with local labor.

STREAM GAGING*

The purpose of the stream gaging program in Minnesota is to provide the data needed for the development of the state's surface water resources. In order that development can have a sound economic basis, it is necessary that quantities available at various points on streams be known, so that water uses are within available supplies. It is also important that flood hazards inherent in developments along streams be known, so that structures may be designed and located to minimize these hazards. This cannot be done by sampling or by taking stock at intervals, because water is a natural resource that is more or less continuously being replenished by rainfall. Because it is only more or less continuously replenished, continuous records are necessary at many points to provide sufficient data to assure that water developments are kept within the variations in the available supplies and to forecast future behavior by past performance.

Many factors indicate that Minnesota is on the threshold of a new era of industrial development, based among other facts on the increasing use of taconite, the refining of petroleum, and a growing trend of industry to decentralize and move out of congested areas. The construction of the St. Lawrence Seaway, with lowered transportation costs to world markets, will make Minnesota more attractive to many industries.

*This portion of the report is adapted from reports submitted by the District Engineer, U. S. Geological Survey.

The stream gaging program is now providing streamflow records at 134 gaging stations, three of which are actually located in South Dakota, two in Wisconsin, and one in Manitoba. These latter stations are at or near the state line and are related to water-resource problems in Minnesota.

The processing of taconite ores, which is increasing greatly in the state, requires about 50 tons of water for each ton of ore produced, and to investigate possible sources of supply for this industry, nine gaging stations were installed during the biennium by the U. S. Geological Survey in cooperation with the Iron Range Resources and Rehabilitation Commission. These stations are located on streams in the area where development of taconite appears most likely or where they will provide indices of runoff for other streams. These, with the stations which had previously been installed in these drainage basins, provide a basic network for an evaluation of the available surface water supplies.

Nine gaging stations were installed in the fall of 1953 in Kittson, Roseau and Marshall counties in cooperation with the Iron Range Resources and Rehabilitation Commission, as a part of an investigation of the water resources of this area. Known water supplies of satisfactory quality in this area are inadequate, and this has been a deterrent factor in the development of industry and agriculture. The sugar beet industry in particular has evinced interest from time to time. This investigation is expected to contribute to the knowledge of available supplies, thus forming a basis for well-founded developments.

Two recording lake gages on Lake Minnetonka and one recording stream gaging station on Minnehaha Creek were installed in cooperation with Hennepin County to provide data needed for investigation of lake levels, and the operation of one gaging station on Cedar River near Austin for sewage disposal and flood recording purposes was continued in cooperation with the City of Austin.

Cooperation with the Division of Waters, Minnesota Department of Conservation, was continued, with one additional gaging station being established on the South Fork Root River near Houston, and three stations being greatly improved by installation of automatic recorders.

Cooperative operation of gaging stations with the Corps of Engineers, U. S. Army, and the U. S. Department of State were continued during the biennium, with slightly reduced programs because of reduced funds.

The extreme floods of April, 1952, caused considerable damage to several gaging station structures, and Federal funds were made available for repair of flood damage, as well as to prepare a flood report, which is now in the process of publication. Such funds were also made available for preparation of a report on the floods of June, 1953, in the West Fork Des Moines, Little Sioux and Watonwan basins, which report is also ready for publication.

Water supplies in Minnesota were relatively abundant between July 1, 1950, and June 30, 1952. The floods of 1951 and 1952 on the Minnesota and Mississippi rivers and their tributaries were the maximum of record in many

places. For instance, prior to 1952 the flood of 1951 on the Mississippi River at St. Paul was exceeded only by those of 1881 and 1897. The flood of 1951 was promptly exceeded by that of April 16, 1952, which is the all-time maximum of record. On that date, the stage at the St. Paul gaging station was 22.02 feet and the discharge was 125,000 second-feet.

Stream flow in the Roseau River basin in April, 1952, was below normal, illustrating strikingly the variability of the streamflow pattern and the complexity of the streamflow problems within the state.

Between July 1, 1952, and June 30, 1954, streamflow was generally slightly above average, with no widespread floods or droughts, although there was some local flooding in the vicinity of Aitkin in the Mississippi River, in the West Fork of the Des Moines, Little Sioux, Watonwan and Root River basins.

TABLE I

Funds Spent in Minnesota for Stream Gaging During the Four Years Between July 1, 1950, and June 30, 1954

	July 1, 1950 to June 30, 1952	July 1, 1952 to June 30, 1954
Division of Waters	$ 33,757.50	$ 36,565.00
Iron Range Resources and Rehabilitation Commission	6,700.00	32,885.00
Municipal Cooperation	2,730.00	1,191.00
County Cooperation	800.00	2,017.32
Federal Cooperative Funds	43,987.50	72,266.64
Corps of Engineers, U. S. Army	60,122.30	50,864.73
U. S. Department of State	30,075.00	17,000.00
U. S. Geological Survey	30,400.00	38,063.38
Federal Power Commission Licensees	1,051.23	2,320.57
Total	$209,623.53	$253,173.64

TABLE II

Gaging Stations Maintained and Operated in the State of Minnesota on June 30, 1954 By the United States Geological Survey

Station		County	Drainage Basin	Cooperating Agency
Ann River near Mora*	S	Kanabec	Mississippi	State of Minnesota
Baptism River near Beaver Bay	R	Lake	St. Lawrence	Army Engineers, Duluth
Basswood River near Winton	R	Lake	Hudson Bay	U. S. Department of State
Bear Island River near Ely	R	Lake	Hudson Bay	State of Minnesota
Big Fork River at Big Falls	R	Koochiching	Hudson Bay	Border Cos. Power Coop.
Blue Earth River, East Fork, near Bricelyn	W	Faribault	Mississippi	State of Minnesota
Blue Earth River near Rapidan	R	Blue Earth	Mississippi	State of Minnesota
Bois de Sioux River near White Rock, South Dakota	R	Traverse and Roberts	Hudson Bay	Army Engineers, St. Paul
Buffalo River near Dilworth	R	Clay	Hudson Bay	State of Minnesota
Buffalo River near Hawley	R	Clay	Hudson Bay	State of Minnesota
Buffalo River, South Branch, near Sabin	S	Clay	Hudson Bay	State of Minnesota
Cannon River at Welch	R	Goodhue	Mississippi	State of Minnesota
Cedar River near Austin	R	Mower	Mississippi	City of Austin
Chippewa River near Milan	R	Chippewa	Mississippi	Army Engineers, St. Paul
Clearwater River at Plummer	R	Red Lake	Hudson Bay	Army Engineers, St. Paul
Clearwater River at Red Lake Falls	R	Red Lake	Hudson Bay	State of Minnesota
Cottonwood River near New Ulm	R	Brown	Mississippi	State of Minnesota
Crow River at Rockford	R	Hennepin	Mississippi	State of Minnesota
Crow River, Middle Fork, near Spicer	R	Kandiyohi	Mississippi	State of Minnesota
Crow River, North Fork, near Regal	R	Kandiyohi	Mississippi	State of Minnesota
Crow River, South Fork, at Cosmos	W	Meeker	Mississippi	Army Engineers, St. Paul
Crow River, South Fork, near Mayer	W	Carver	Mississippi	State of Minnesota
Crow River at Nimrod	R	Wadena	Mississippi	State of Minnesota
Dark River near Chisholm	R	St. Louis	Hudson Bay	State of Minnesota
Des Moines River, West Fork, at Jackson	R	Jackson	Mississippi	State of Minnesota
Dunka River near Babbitt	R	St. Louis	Hudson Bay	State of Minnesota
Elk River near Big Lake	R	Sherburne	Mississippi	State of Minnesota
Gull River at Gull Lake Dam near Brainerd	S	Cass	Mississippi	Army Engineers, St. Paul
Embarrass River at Embarrass	R	St. Louis	St. Lawrence	State of Minnesota
Embarrass River near McKinley	R	St. Louis	St. Lawrence	State of Minnesota

*Stage station.
At stage stations, flows are not computed.
C — Chain gage.
R — Recorder gage.
W — Wire weight gage.
S — Staff gage.
PP — Power plant record.

TABLE II -- Continued

Station		County	Drainage Basin	Cooperating Agency
Gilmore Creek at Winona	R	Winona	Mississippi	State of Minnesota
Hawk Creek near Maynard	C	Chippewa	Mississippi	Army Engineers, St. Paul
Isabella River near Winton	R	Lake	Hudson Bay	State of Minnesota
Jackson County Ditch 11 near Lakefield	R	Jackson	Missouri	State of Minnesota
Kawishiwi River near Winton	PP	Lake	Hudson Bay	Minnesota Power & Light Co.
Kawishiwi River, South, near Ely	R	Lake	Hudson Bay	State of Minnesota
Lac qui Parle River near Lac qui Parle	R	Lac qui Parle	Mississippi	Army Engineers, St. Paul
Leech Lake River at Federal Dam	S	Cass	Mississippi	Army Engineers, St. Paul
LeSueur River near Rapidan	R	Blue Earth	Mississippi	State of Minnesota
Little Fork River at Little Fork	R	Koochiching	Hudson Bay	U. S. Department of State
Little Minnesota River near Peever, South Dakota	R	Roberts	Mississippi	State of Minnesota
Little Sioux River near Lakefield	R	Jackson	Missouri	State of Minnesota
Marsh River near Shelly	C	Norman	Hudson Bay	Army Engineers, St. Paul
Middle River at Argyle	R	Marshall	Hudson Bay	Federal
Middle River near Strandquist	R	Marshall	Hudson Bay	State of Minnesota
Minnehaha Creek at Minnetonka Mills	R	Hennepin	Mississippi	Hennepin County
Minnesota River near Carver	R	Carver	Mississippi	Army Engineers, St. Paul
Minnesota River near Lac qui Parle	R	Chippewa	Mississippi	Army Engineers, St. Paul
Minnesota River at Mankato	R	Blue Earth	Mississippi	Army Engineers, St. Paul
Minnesota River at Montevideo	R	Yellow Medicine	Mississippi	Army Engineers, St. Paul
Minnesota River near Odessa	W	Big Stone	Mississippi	State of Minnesota
Minnesota River at Ortonville	R	Big Stone	Mississippi	State of Minnesota
Mississippi River at Aitkin	S	Aitkin	Mississippi	Army Engineers, St. Paul
Mississippi River at Winnibigoshish Dam near Deer River	S	Itasca and Cass	Mississippi	Army Engineers, St. Paul
Mississippi River near Anoka	R	Hennepin	Mississippi	Ford Motor Company
Mississippi River at Elk River	R	Sherburne	Mississippi	Federal
Mississippi River at Grand Rapids	S	Itasca	Mississippi	State of Minnesota
Mississippi River at LaCrosse	R	Houston and LaCrosse	Mississippi	Army Engineers, St. Paul
Mississippi River below Sandy River near Libby	R	Aitkin	Mississippi	Army Engineers, St. Paul
Mississippi River at Prescott, Wisconsin	R	Dakota and Pierce	Mississippi	Federal
Mississippi River near Royalton	PP	Morrison	Mississippi	Minnesota Power & Light Co.
Mississippi River at St. Paul	R	Ramsey	Mississippi	Federal
Mississippi River at Winona	R	Winona	Mississippi	Federal
Mud Creek near Sprague, Manitoba	R	Roseau	Hudson Bay	U. S. Department of State
Mustinka Ditch above West Branch Mustinka River near Charlesville	S	Traverse	Hudson Bay	Army Engineers, St. Paul

TABLE II -- Continued

Station		County	Drainage Basin	Cooperating Agency
Mustinka Ditch below West Branch Mustinka River near Charlesville	S	Traverse	Hudson Bay	Army Engineers, St. Paul
Mustinka River, West Branch, below Mustinka Ditch near Charlesville	S	Traverse	Hudson Bay	Army Engineers, St. Paul
Mustinka River above Wheaton	W	Traverse	Hudson Bay	State of Minnesota
Namakan River at outlet of Lac la Croix, Ontario	S	.....	Hudson Bay	U. S. Department of State
Otter Tail River near Detroit Lakes	R	Becker	Hudson Bay	State of Minnesota
Otter Tail River below Orwell Dam near Fergus Falls	R	Otter Tail	Hudson Bay	Army Engineers, St. Paul
Partridge River near Aurora	R	St. Louis	St. Lawrence	State of Minnesota
Pelican River near Fergus Falls	S	Otter Tail	Hudson Bay	Army Engineers, St. Paul
Pigeon River at Middle Falls below International Bridge	R	Cook	St. Lawrence	U. S. Department of State
Pike River near Embarrass	R	St. Louis	Hudson Bay	State of Minnesota
Pine River at Pine River Dam at Cross Lake	S	Crow Wing	Mississippi	Army Engineers, St. Paul
Pomme de Terre River at Appleton	R	Swift	Mississippi	State of Minnesota
Poplar River at Lutsen	R	Cook	St. Lawrence	State of Minnesota
Rabbit River near Crosby	R	Crow Wing	Mississippi	State of Minnesota
Rainy River at Manitou Rapids	R	Koochiching	Hudson Bay	U. S. Department of State
Red Lake River at Crookston	R	Polk	Hudson Bay	Army Engineers, St. Paul
Red Lake River at Highlanding near Goodridge	R	Pennington	Hudson Bay	Army Engineers, St. Paul
Red Lake River near Red Lake	R	Clearwater	Hudson Bay	Army Engineers, St. Paul
Redwood River at Marshall	C	Lyon	Mississippi	Army Engineers, St. Paul
Redwood River near Redwood Falls	R	Redwood	Mississippi	State of Minnesota
Root River near Houston	R	Houston	Mississippi	State of Minnesota
Root River below South Fork near Houston	R	Houston	Mississippi	Army Engineers, St. Paul
Root River near Lanesboro	R	Fillmore	Mississippi	Army Engineers, St. Paul
Root River, South Fork, near Houston	R	Houston	Mississippi	State of Minnesota
Roseau River near Badger*	R	Roseau	Hudson Bay	U. S. Department of State
Roseau River at International Boundary near Caribou*	R	Kittson	Hudson Bay	U. S. Department of State
Roseau River below State Ditch No. 51 near Caribou	R	Kittson	Hudson Bay	U. S. Department of State
Roseau River near Duxby*	S	Roseau	Hudson Bay	U. S. Department of State
Roseau River near Haug*	R	Roseau	Hudson Bay	U. S. Department of State
Roseau River below South Fork near Malung	R	Roseau	Hudson Bay	U. S. Department of State
Roseau River at Oak Point*	S	Kittson	Hudson Bay	U. S. Department of State
Roseau River near Roseau*	S	Roseau	Hudson Bay	U. S. Department of State
Roseau River at Roseau Lake*	S	Roseau	Hudson Bay	U. S. Department of State
Roseau River at Ross	R	Roseau	Hudson Bay	U. S. Department of State
Rum River near St. Francis	R	Anoka	Mississippi	State of Minnesota

TABLE II -- Continued

Station		County	Drainage Basin	Cooperating Agency
Rush Creek near Rushford	C	Fillmore	Mississippi	Army Engineers, St. Paul
St. Louis River near Aurora	R	St. Louis	St. Lawrence	State of Minnesota
St. Louis River at Scanlon	R	Carlton	St. Lawrence	Army Engineers, Duluth
Sand Hill Ditch at Beltrami	C	Polk	Hudson Bay	Army Engineers, St. Paul
Sand Hill River at Beltrami	S	Polk	Hudson Bay	Army Engineers, St. Paul
Sand Hill River at Climax	C	Polk	Hudson Bay	Army Engineers, St. Paul
Sandy River at Sandy Lake Dam at Libby	S	Aitkin	Mississippi	Army Engineers, St. Paul
Sauk River near St. Cloud	R	Stearns	Mississippi	State of Minnesota
Shakopee Creek near Benson	S	Swift	Mississippi	Army Engineers, St. Paul
Snake River at Alvarado	R	Marshall	Hudson Bay	State of Minnesota
Snake River near Pine City	R	Pine	Mississippi	State of Minnesota
Snake River at Warren	R	Marshall	Hudson Bay	State of Minnesota
State Ditch 85 near Lancaster	S	Kittson	Hudson Bay	Army Engineers, St. Paul
Stoney River near Babbitt	R	Lake	Hudson Bay	State of Minnesota
Sturgeon River near Chisholm	R	St. Louis	Hudson Bay	State of Minnesota
Sunrise River near Stacy	R	Chisago	Mississippi	State of Minnesota
Swan River near Warba	R	Itasca	Mississippi	State of Minnesota
Swan River near Toivola	R	St. Louis	St. Lawrence	State of Minnesota
Swan River, East, near Toivola	R	St. Louis	St. Lawrence	State of Minnesota
Tamarac River near Stephen	R	Marshall	Hudson Bay	State of Minnesota
Tamarac River near Strandquist	R	Marshall	Hudson Bay	State of Minnesota
Thief River near Gatzke	R	Marshall	Hudson Bay	State of Minnesota
Thief River near Thief River Falls	R	Pennington	Hudson Bay	State of Minnesota
Two Rivers below Hallock	C	Kittson	Hudson Bay	Army Engineers, St. Paul
Two Rivers, North Branch, at Lancaster	R	Kittson	Hudson Bay	State of Minnesota
Two Rivers, North Branch, near Lancaster	S	Kittson	Hudson Bay	Army Engineers, St. Paul
Two Rivers, South Branch, at Lake Bronson	R	Kittson	Hudson Bay	State of Minnesota
Two Rivers, South Branch, at Pelan	R	Kittson	Hudson Bay	State of Minnesota
Vermilion River below Lake Vermilion near Tower	R	St. Louis	Hudson Bay	U. S. Department of State
Warroad River near Warroad	C	Roseau	Hudson Bay	Army Engineers, St. Paul
Warroad River, East Branch, near Warroad	S	Roseau	Hudson Bay	Army Engineers, St. Paul
West Two River near Iron Junction	R	St. Louis	St. Lawrence	State of Minnesota
Whetstone River near Big Stone City, South Dakota	R	Grant, South Dakota	Mississippi	State of Minnesota
Whitewater River at Beaver	R	Winona	Mississippi	Army Engineers, St. Paul
Whitewater River, South Branch, near Altura	R	Winona	Mississippi	State of Minnesota

TABLE II -- Continued

Station		County	Drainage Basin	Cooperating Agency
Wild Rice River at Hendrum	C	Norman	Hudson Bay	Army Engineers, St. Paul
Wild Rice River at Twin Valley	R	Norman	Hudson Bay	State of Minnesota
Yellow Bank River near Odessa	R	Lac qui Parle	Mississippi	State of Minnesota
Yellow Medicine River near Granite Falls	R	Yellow Medicine	Mississippi	State of Minnesota
Zumbro River near Rochester	R	Olmsted	Mississippi	State of Minnesota
Zumbro River at Theilman	R	Wabasha	Mississippi	Army Engineers, St. Paul
Zumbro River at Zumbro Falls	R	Wabasha	Mississippi	State of Minnesota

PERMITS FOR WORK IN PUBLIC WATERS

Minnesota Statutes 1953, Chapter 105, is an attempt to regulate to some extent the waters and waterways of the state and provides that, before any person or agency may appropriate water in any appreciable volume or change the cross-section of the public waters, a permit therefor must first be obtained from the Commissioner of Conservation. There has been a steady increase in applications for permits under this law. The following summary indicates the volume of the work of the division during the past four years in the processing of permit applications. There was an increase of over fifty per cent in the number of applications received during the last biennium.

	1950–52	1952–54
Applications received, including permits pending at the beginning of each biennium	422	645
Applications received, no permit required	25	19
Permits issued	343	534
Applications denied	9	8
Applications pending	34	54
Applications withdrawn or combined	11	30

	1950–52	1952–54
Lake and stream improvement	215	413
Appropriation of surface waters	91	48
Appropriation of ground water	35	37
Public utility water crossings	2	36

PUBLIC DRAINAGE

Conditions of the national economy have created an expansion of agricultural drainage during recent years. This is reflected in the number of public drainage projects which have been submitted to the division for review under the provisions of Minnesota Statutes 1953, Chapter 106, which provides that the Director of the Division of Waters shall examine the engineer's final report in each proceeding and shall report on the adequacy of the design of the proposed drainage system to the county board or the judge of the district court having jurisdiction.

Table III summarizes the drainage reports reviewed between July 1, 1950, and June 30, 1952, while Table IV contains similar information for the period July 1, 1952, to June 30, 1954.

Private ditching not covered by the public drainage statutes has created a problem that makes the protection of public waters more difficult. Violations resulting from private drainage have been investigated when reported to the department and an attempt made to secure proper adjudication under Minnesota Statutes 1953, Chapter 105, and under Section 621.48.

TABLE III

Summary of Reports on Public Drainage Systems Examined by the Division of Waters July 1, 1950, to June 30, 1952

	Number	Open Ditch, Miles	Tile, Miles	Excavation, Cubic Yards	Watershed Area, Acres	Estimated Cost
New Construction						
Judicial Ditches	7	39.3	12.5	1,132,898	37,148	$ 313,716.17
County Ditches	40	125.6	81.7	3,308,950	144,260	1,187,047.44
Total Construction	47	164.9	94.2	4,441,848	181,408	$1,500,763.61
Improvements						
Judicial Ditches	8	52.4	2.6	1,541,330	162,732	$ 400,977.13
County Ditches	35	191.9	29.3	4,191,900	185,099	1,095,659.60
Total Improvements	43	244.3	31.9	5,733,230	347,831	$1,496,636.73
*GRAND TOTAL	90	409.2	126.1	10,175,078	529,239	$2,997,400.34

*Not including repairs.

TABLE IV

Summary of Reports on Public Drainage Systems Examined by the Division of Waters July 1, 1952, to June 30, 1954

	Number	Open Ditch, Miles	Tile, Miles	Excavation, Cubic Yards	Watershed Area, Acres	Estimated Cost
New Construction						
Judicial Ditches	14	81.3	39.4	2,523,146	93,178	$ 789,787.08
County Ditches	74	164.0	103.4	4,519,034	323,096	1,806,977.67
Total Construction	88	245.3	142.8	7,042,180	416,274	$2,596,764.75
Improvements						
Judicial Ditches	18	110.8	7.8	2,824,647	196,617	$ 782,805.54
County Ditches	47	191.7	77.9	5,294,979	298,539	1,925,943.03
Total Improvements	65	302.5	85.7	8,119,626	495,156	$2,708,748.57
*GRAND TOTAL	153	547.8	228.5	15,161,806	911,430	$5,305,513.32

*Not including repairs.

Drain Tile Research

Research work on the resistance of drain tile to the chemical action of ground waters as well as on strength has been conducted under a cooperative agreement between the division, the University Agricultural Experiment Station and the federal government for more than thirty years. The data obtained are of value to farmers in the selection of the type and quality of tile most suitable for use in drainage systems, particularly in those areas of the state where heavy concentrations of alkalies occur.

Publication of more of these data in non-technical form, as exemplified by "Making Durable Concrete Drain Tile on Packer-Head Machines," referred to below, in order to make the information more readily available for application by farmers and tile manufacturers, is needed. Funds to continue the laboratory work, testing and inspection of tile submitted by farmers and manufacturers are necessary for protection of farmers against the use of inferior tile, and to stimulate manufacture of high quality products.

The following report provides the details of the program.

REPORT OF THE COOPERATIVE DRAIN TILE TESTING LABORATORY*

This report briefly covers the research and testing activities of the cooperative tile testing laboratory located in the Agricultural Engineering Building at University Farm, University of Minnesota, for the period July 1, 1950, to June 30, 1954.

About 1500 drain tile and 300 silo staves were tested for strength and absorption between July 1, 1950, and June 30, 1952. Similar tests were performed on 1900 drain tile and 100 silo staves between July 1, 1952, and June 30, 1954. The primary purpose of the drain tile work has been to encourage the production by the manufacturer and use by the farmer of durable tile as determined by means of the tests prescribed by the standard specifications of the American Society for Testing Materials.

Farm drainage in Minnesota is considered one of the more important soil and water conservation practices. It is estimated that for the single year 1953, over 40,000,000 feet of drain tile were laid in Minnesota at a cost of about $15,000,000. This testing program will insure high quality tile which in turn will add many years of satisfactory tile drainage at no added cost.

Perhaps 85 per cent of the tile used in Minnesota are of the concrete type made at 45 plants. In order that there might be a coherent organization with which to work, the manufacturers were encouraged to create an association of "Minnesota Concrete Drain Tile Manufacturers" and to affiliate with the national organization, "American Concrete Agricultural Pipe Association." Twenty-five of the 45 drain tile plants in Minnesota, which now produce at least 75 per cent of all Minnesota concrete tile, are now members of both the state and national organizations. The laboratory, working

*Adapted from reports prepared by P. W. Manson.

through these organizations, is improving the quality of concrete drain tile in Minnesota so that it will equal or surpass in quality concrete tile produced in any other state, thus realizing the ultimate objective of the preceding years of research on drain tile conducted at the Institute of Agriculture, University of Minnesota.

The drain tile laboratory is cooperating with the St. Anthony Falls Hydraulic Laboratory, University of Minnesota, and the Soil Conservation Service, U.S.D.A., in a study to determine drain tile capacities as influenced by flow characteristics. During the past year an elaborate model has been constructed in the St. Anthony Falls Laboratory to determine the friction losses that result where different size drain tile laterals enter different size drain tile mains at various angles. This one phase of the work will require at least two years study. The objective of this study is to provide information that will make possible better design and somewhat reduce the cost of drainage systems.

The following papers were published during the four years:

1. "Long-time Tests of Concretes and Mortars Exposed to Sulfate Waters." Technical Bulletin 194, University of Minnesota, May, 1951.
2. "Long-time Performance of Some Clay Draintile." Journal of American Society of Agricultural Engineers, February, 1951.
3. "Bibliography on Sulfate Resistance of Portland Cements, Concretes and Mortars, Annotated." There are 133 single spaced mimeographed pages of this paper and 405 references are cited. Dated April, 1952, although it did not appear until April, 1953. Dalton G. Miller, Philip W. Manson, and Robert T. Chen.
4. "Making Durable Concrete Drain Tile on Packer-Head Machines." Agricultural Experiment Station, University of Minnesota, August, 1954. Philip W. Manson and Dalton G. Miller.

In addition to the foregoing, the manuscript has been completed for the following bulletin:

> "Groundwater Fluctuations in Certain Open and Forested Bogs of Northern Minnesota with Notes on Effects of Open Drainage Ditches on Swamp Forest Growth." Philip W. Manson and Dalton G. Miller.

TOPOGRAPHIC MAPPING

Minnesota has, for the past five years, been cooperating with the federal government in a topographic or contour mapping program, after a lapse of nearly thirty years during which period no state appropriations had been made for this important work and only relatively small areas had been mapped by federal agencies. It is believed that the work now underway is so conclusive as to its value to the state and communities concerned that each succeeding legislature will continue on the course set by the legislature of 1949 by making funds available until the state is completely mapped.

Topographic maps are essential in the study of problems bearing on all phases of conservation activity as well as other works of man. Heretofore, their lack has, in too many instances, resulted in haphazard and unrelated consideration of drainage, erosion, and water conservation problems. Much time and money can be saved by being able to make preliminary studies of problems from an over-all map showing the topography of the areas which aids in establishing from the outset the practicability of a proposed project. Many worthwhile projects may well have been abandoned in the past because of the lack of basic topographic maps. On the other hand, projects which have been undertaken and have proved a disappointment or failure might not have been attempted had this basic data been available.

The U. S. Geological Survey, in cooperation with the states or from all-federal funds, has been making topographic maps of the states of the nation for more than 60 years. By and large, the work has been financed by the states and federal government on a 50-50 division of cost. Specifically, the cooperative work has been confined to states which have made appropriations of their own to qualify them for participation in federal funds. During this time slightly over 50 per cent of the entire nation has been mapped. Some sixteen states have had their areas completely mapped. On June 30, 1954, maps had been published for only 17 per cent of the area of the State of Minnesota.

TABLE V

Expenditures for Topographic Mapping in Minnesota

I	Department of Conservation		
	State appropriation, each biennium, July 1, 1950, to June 30, 1954		$100,000
	Federal appropriation, each biennium, July 1, 1950, to June 30, 1954		100,000
II	Iron Range Resources and Rehabilitation Commission		
	State Appropriation	fiscal year 1951*	30,000
		fiscal year 1952	30,000
		fiscal year 1953	40,000
		fiscal year 1954	40,000
	Federal Allotment	fiscal year 1951	30,000
		fiscal year 1952	30,000
		fiscal year 1953	40,000
		fiscal year 1954	40,000
III	Federal Defense Program		
		fiscal year 1951	46,000
		fiscal year 1952	83,000
		fiscal year 1953	143,000
		fiscal year 1954	122,000

*Fiscal year 1951, for example, is the year ending June 30, 1951.

TABLE VI

Minnesota Topographic Maps Published**
July 1, 1950, to June 30, 1954

Topographic Maps Published Under Conservation Department Program
Fiscal Years 1951* and 1952

Map	Area	Scale	Contour Interval
Hudson 7½ (Afton)	47.5	1:24,000	10 feet
Lake Elmo (Hudson NW)	52.9	1:24,000	10
Prescott (Hudson SE)	39.3	1:24,000	10
St. Paul Park	53.0	1:24,000	10
Graceville	209.6	1:62,500	10
Maiden Rock	38.8	1:62,500	10
Mankato East (Mankato)	214.6	1:62,500	10
St. Cloud	209.2	1:62,500	10
Wheaton	208.7	1:62,500	10
Total	1073.6	square miles	

Fiscal Years 1953 and 1954

Annandale (Clearwater)	210.1	1:62,500	10 feet
Barnesville	205.4	1:62,500	10
Campbell	207.3	1:62,500	5
Lake City	210.4	1:62,500	20
Mankato West (Lake Crystal)	214.6	1:62,500	10
Morton	212.8	1:62,500	10
Red Lake Falls	200.7	1:62,500	10
Red Wing	110.0	1:62,500	20
Redwood Falls	212.8	1:62,500	10
Rothsay	206.4	1:62,500	10
Stillwater	35.0	1:24,000	10
Wabasha	142.9	1:62,500	20
White Bear Lake East (North St. Paul)	52.8	1:24,000	10
Total	2221.2	square miles	

Topographic Maps Published Under Iron Range Program
Fiscal Years 1951 and 1952

Biwabik	50.5	1:24,000	10 feet
Biwabik NE	50.4	1:24,000	10
Biwabik NW	50.4	1:24,000	10
McKinley	50.5	1:24,000	10
Total	201.8	square miles	

**This part of report adapted from reports submitted by U. S. Geological Survey, Topographic Branch.

*Fiscal year 1951, for example, is the year ending June 30, 1951.

TABLE VI — Continued

Topographic Maps Published Under Iron Range Program
Fiscal Years 1953 and 1954

Map	Area	Scale	Contour Interval
Bovey	50.7	1:24,000	10 feet
Buhl (Hibbing NE)	50.6	1:24,000	10
Calumet	50.7	1:24,000	10
Eveleth (Eveleth NE)	50.6	1:24,000	10
Gilbert (Sparta NW)	50.6	1:24,000	10
Hibbing (Hibbing NW)	50.6	1:24,000	10
Keewatin	50.6	1:24,000	10
Kinney (Mountain Iron)	50.5	1:24,000	10
Kirk (Eveleth NW)	50.6	1:24,000	10
Nashwauk	50.6	1:24,000	10
Palo (Sparta NE)	50.6	1:24,000	10
Pengilly	50.7	1:24,000	10
Silica (Swan Lake SE)	50.7	1:24,000	10
Virginia	50.5	1:24,000	10
Total	708.6	square miles	

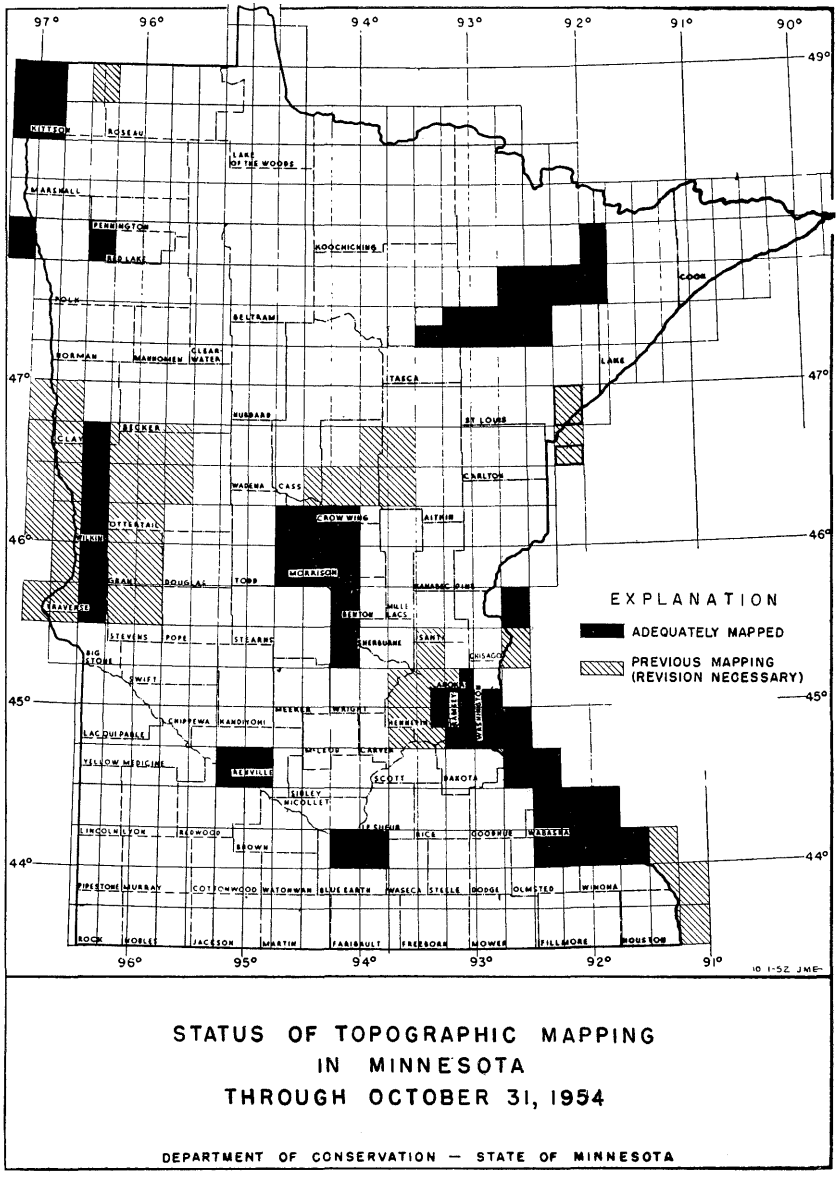
Topographic Maps Published Under Federal Mapping Program
Fiscal Years 1951 and 1952

*New Richmond	0.6	1:62,500	20 feet
*Milltown (Trade Lake)	4.3	1:62,500	
Allen	50.5	1:24,000	10
Aurora	50.5	1:24,000	10
Embarrass	50.4	1:24,000	10
Isaac Lake (Mesaba NE)	50.4	1:24,000	10

Fiscal Years 1953 and 1954

Babbitt	50.4	1:24,000	10 feet
Babbitt NE (Dunka River NE)	50.4	1:24,000	10
Babbitt SE (Dunka River SE)	50.5	1:24,000	10
Babbitt SW (Dunka River SW)	50.5	1:24,000	10
Britt (Brittmount)	50.4	1:24,000	10
Casco (Eveleth SW)	50.7	1:24,000	10
Centerville	52.7	1:24,000	10
Central Lakes (Sparta SW)	50.7	1:24,000	10
Idington (Virginia NW)	50.4	1:24,000	10
Inver Grove	53.0	1:24,000	10
Little Swan (Hibbing SE)	50.7	1:24,000	10
Makinen (Sparta SE)	50.7	1:24,000	10
New Brighton	52.8	1:24,000	10
Riley (Hibbing SW)	50.7	1:24,000	10
St. Paul East	52.9	1:24,000	10
St. Paul West	52.9	1:24,000	10
St. Paul SW	53.0	1:24,000	10
White Bear Lake West	52.8	1:24,000	10
Zim	50.7	1:24,000	10
Total	976.9	square miles	

*Portions of Wisconsin mapping program lying partially in Minnesota.



STATUS OF TOPOGRAPHIC MAPPING
IN MINNESOTA
THROUGH OCTOBER 31, 1954

DEPARTMENT OF CONSERVATION — STATE OF MINNESOTA

Figure 3

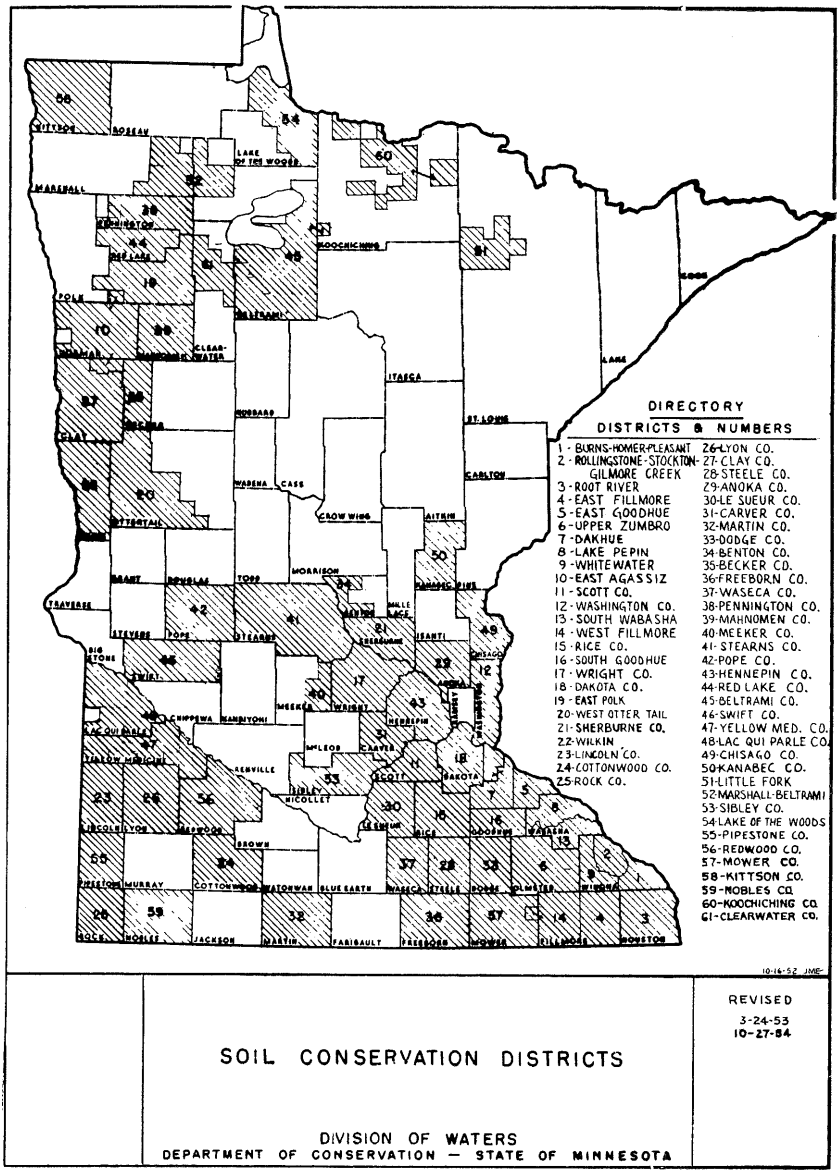

DIRECTORY
DISTRICTS & NUMBERS
1 - BURNS-HOMER-PLEASANT
2 - ROLLINGSTONE-STOCKTON-GILMORE CREEK
3 - ROOT RIVER
4 - EAST FILLMORE
5 - EAST GOODHUE
6 - UPPER ZUMBRO
7 - DAKHUE
8 - LAKE PEPIN
9 - WHITEWATER
10 - EAST AGASSIZ
11 - SCOTT CO.
12 - WASHINGTON CO.
13 - SOUTH WABASHA
14 - WEST FILLMORE
15 - RICE CO.
16 - SOUTH GOODHUE
17 - WRIGHT CO.
18 - DAKOTA CO.
19 - EAST POLK
20 - WEST OTTER TAIL
21 - SHERBURNE CO.
22 - WILKIN
23 - LINCOLN CO.
24 - COTTONWOOD CO.
25 - ROCK CO.
26 - LYON CO.
27 - CLAY CO.
28 - STEELE CO.
29 - ANOKA CO.
30 - LE SUEUR CO.
31 - CARVER CO.
32 - MARTIN CO.
33 - DODGE CO.
34 - BENTON CO.
35 - BECKER CO.
36 - FREEBORN CO.
37 - WASECA CO.
38 - PENNINGTON CO.
39 - MAHNOMEN CO.
40 - MEEKER CO.
41 - STEARNS CO.
42 - POPE CO.
43 - HENNEPIN CO.
44 - RED LAKE CO.
45 - BELTRAMI CO.
46 - SWIFT CO.
47 - YELLOW MED. CO.
48 - LAC QUI PARLE CO.
49 - CHISAGO CO.
50 - KANABEC CO.
51 - LITTLE FORK
52 - MARSHALL-BELTRAMI
53 - SIBLEY CO.
54 - LAKE OF THE WOODS
55 - PIPESTONE CO.
56 - REDWOOD CO.
57 - MOWER CO.
58 - KITTSON CO.
59 - NOBLES CO.
60 - KOOCHICHING CO.
61 - CLEARWATER CO.
10-16-52 JME
REVISED
3-24-53
10-27-84
SOIL CONSERVATION DISTRICTS
DIVISION OF WATERS
DEPARTMENT OF CONSERVATION — STATE OF MINNESOTA

Figure 4

ENGINEERING SERVICE

The Division of Waters provides engineering service for other Divisions of the Department of Conservation from field reconnaissance, surveys, and reports through planning, design, and construction. The extent of the work is indicated by the following:

Projects — Contract Construction:	
1950-52	$860,000
1952-54	894,500
Requisitions for Service:	
1950-52	143
1952-54	329

Included in the number of requisitions for the twelfth biennium are 36 requisitions for engineering services to assist the Division of Game and Fish in the acquisition of wetlands to aid in the preservation and propagation of wildlife for the future.

SOIL CONSERVATION

Of vital interest from a water conservation standpoint is the management of the private lands from which water flows into the public lakes and streams. Poor land management which results in the erosion of soil and land results in sedimentation in lakes and streams and attendant evils.

Consequently, the increase in recent years in the number of soil conservation districts in the state is gratifying.

Figure 4 is a map of Minnesota on which organized soil conservation districts are shown. In addition to the districts which are now organized, there are districts in Big Stone, Jackson, Watonwan, Kandiyohi, Murray, Chippewa and Douglas counties which are now in the process of organization.

Additional information on Soil Conservation Districts in Minnesota is contained in the Biennial Reports of the Minnesota Soil Conservation Committee.

CONSERVANCY AND FLOOD CONTROL DISTRICTS

Under Minnesota law it is possible to organize the legal units, on a watershed basis, necessary to deal with certain types of problems involving the waters of the state under Chapters 111 and 112 of the statutes.

Chapter 111 outlines the procedure for establishing Drainage and Conservancy Districts, which are empowered to:

(1) Increase the capacity or improve the use of water courses;

(2) Construct dikes to protect lands from overflow;

(3) Provide for irrigation;

(4) Protect agricultural land against peat or forest fires;

(5) Regulate and control flood waters by excavating channels and constructing dikes and reservoirs;

(6) Under certain conditions, divert water from streams and regulate its use;

(7) Provide for sanitation and public health through the regulation of water courses; and

(8) Construct the necessary works to carry out the purposes for which the districts may be organized.

The districts are organized by the district court upon petition of 25 per cent of the resident free-holders in the territory to be served but in no case are more than 50 signatures required. In the event that two or more counties or 5 or more cities or villages desire the establishment of the district, resolutions of the governing bodies are sufficient and the signatures of free-holders are not required. After the petition is presented the court thereafter has jurisdiction over all matters pertaining thereto.

Drainage and Conservancy Districts are governed by court-appointed boards of directors which develop plans, make contracts, and finance projects by issuing bonds and levying assessments on benefited property.

Under the statutes, it is necessary for Drainage and Conservancy Districts to have project plans approved by the Commissioner of Conservation before proceeding with their execution.

Drainage and Flood Control Districts, authorized by Chapter 112 of the statutes, have purposes and powers similar in many respects to Drainage and Conservancy Districts, with the exception that Flood Control Districts may include land lying in adjacent states within their boundaries.

Table VII lists the Drainage and Conservancy Districts and Drainage and Flood Control Districts which have been organized in Minnesota.

TABLE VII

Drainage and Conservancy Districts in Minnesota

Name	Date Established
Red Lake	February 13, 1920
Roseau River	August 13, 1920
Minnesota Valley	May 18, 1921
Houston County Number One	June 15, 1922
Wild Rice — Marsh River	April 25, 1949
Sand Hill River	May 20, 1949
Wilkin County Number One	May 20, 1950
Aitkin	December 19, 1951
Rushford Area	February 20, 1953
Worthington	July 21, 1954

Drainage and Flood Control Districts in Minnesota

Minnesota Valley	September 28, 1917
Lake Traverse and Bois de Sioux	October 13, 1917

SPECIAL PROJECTS

Big Stone Lake Reservoir

Because of its interstate (Minnesota-South Dakota) character and its flood control potential, the Big Stone Lake project should logically be a federal project similar to the other interstate project on Traverse Lake. As a federal project it would eliminate difficulties which arise from conflicting jurisdictions of the two states and make for a more orderly operation than appears possible under any plan of cooperation between the two states. Unless these states are both willing to appropriate large sums of money to put into effect the recommendations of the South Dakota-Minnesota Boundary Waters Commission, a satisfactory solution can hardly be expected under state programs.

During the twelfth biennium this division completed plans for facilities to relieve flood conditions in the Minnesota Valley downstream from Big Stone Lake and presented these plans to the above commission for consideration.

Legislative Interim Commission on Water Conservation, Drainage, and Flood Control

The 1953 Legislature provided for the appointment of an Interim Commission to study the water problems of the state, namely: flood control, drainage and water conservation.

This division has been called upon frequently to assist the commission and has done so to the extent of its facilities.

Watkins Municipal Water Supply, Meeker County

Late in the spring of 1953 the Village of Watkins appealed to the state for assistance in their problem of water supply. Village funds were exhausted in a futile effort to locate an adequate underground water supply by test drilling in and near the village. The problem had reached the point where the village was dependent upon water trucked in from neighboring communities to supplement the existing supply.

The State Executive Council appropriated from emergency funds $5,000 to be used to locate an adequate water supply source for the village.

At the request of the State Department of Administration, this division cooperated with the Ground Water Branch of the U. S. Geological Survey in doing the necessary engineering in the search for water. A suitable source was located and a supply system has been developed by the village.

Midwestern States Flood Control Conference

On June 23, 24 and 25, 1953, the 8th Midwestern States Flood Control Conference was held at Itasca State Park. The Director of the Division of

Waters acted as chairman of the conference, which was well attended. The papers presented at this conference were published by the division in May, 1954, largely from funds collected as registration fees at the conference.

The Midwestern States Flood Control Conference originated in 1947 and has had annual meetings ever since. These conferences afford state officials whose agencies are concerned with flood control and water resources problems an annual opportunity to discuss methods and procedures for coordinated planning for flood control at the state level and to exchange ideas and methods of dealing with water problems.

The conference is composed of officials of state flood control and water agencies of the thirteen states bordering on the Mississippi and Ohio rivers and the states of Michigan and Oklahoma. Organizations interested in flood control such as the U. S. Corps of Engineers and other federal agencies participate in these conferences.