Correspondence re: "Groundwater resources of the Mississippi basin in Illinois, Iowa, Minnesota, and Wisconsin". 1934

Thwaites, F. T. (Fredrik Turville), 1883-1961
[s.l.]: [s.n.], 1934

ILLINOIS STATE PLANNING COMMISSION

Organized By Authority Of General Assembly
To Make Specific Plans For The Future Of The State Of Illinois

H. E. Hudson, Chief of Staff
HENRY L. KELLOGG, STATE PLANNING ENGINEER
JACOB L. CRANE, JR., CONSULTANT, NATIONAL PLANNING BOARD

1319 South Michigan Avenue
TELEPHONE VAN BUREN 8100
CHICAGO, ILLINOIS

September 20, 1934

Mr. F. T. Thwaites
Science Hall
Madison, Wisconsin

Dear Mr. Thwaites:

Under separate cover, we are sending you outlines of material which the Illinois State Planning Commission has compiled. This material was put together very hurriedly, so that it might reach you as soon as possible.

We shall be glad to cooperate with you further in the matter if you so desire.

Yours very truly,

ILLINOIS STATE PLANNING COMMISSION

H. E. Hudson

Chief of Staff

HEH:RMH

The League of
Minnesota Municipalities

Executive Offices:
Room 16
University Library
Minneapolis, Minn.

September 20, 1934

Mr. F. T. Thwaites
Science Hall
Madison, Wis.

Dear Mr. Thwaites:

Your telegram addressed to Mr. Lambie has been given to me for reply. You state that you are preparing a report for the National Resources Board on the ground water situation in this state, and ask what plans, studies or recommendations are being made in regard to this matter here.

There has been no very recent or complete study of the ground waters of Minnesota made. There was a study that involved the southern part of the state made about fifteen or twenty years ago. I have seen a copy of that report, but I think it is now out of print. The suggestion was made last spring that a project be organized under the C. W. A. together with some Department of Conservation funds to bring this report up to date. However, the C. W. A. was discontinued and it was thought rather unfeasible to attempt to proceed on any other basis at that time.

The State Planning Board is getting out a report at the present time of various activities and resources. The only reference they are making to ground water is the fact that some studies have been made in the Twin City area of a minor character. Also they are discussing the possibility of damming up some of the ditches that we dug up a few years ago when we were "making prosperity" in an attempt to build up a surface water reservoir which in turn will raise the ground water level. The Department of Conservation has certain records on surface water levels - that is, rivers and lakes - which we understand are being either referred to or incorporated in the State Planning Board's coming report.

Yours very truly,

Ambrose Fuller

Ambrose Fuller
Director

AF/HH

IOWA
STATE PLANNING BOARD

Ames, Iowa,
September 20, 1934.

Mr. F. I. Thwaites,
Science Hall,
Madison, Wisconsin.

Dear Sir:-

Your wire to Dean Kildee has been given to the writer for reply. We have finished a preliminary report to the National Resources Board covering the first six months' work. This will not be ready for another ten days but an outline of what we are doing in regard to water will indicate our plans.

The Iowa State Planning Board is making the following studies and upon completion of our present program information will be available on:

1. Public Water Supply.
   A report on the source and adequacy of all municipal supplies and distributing systems.

2. Waste Disposal.
   A description of kinds and extents of treatment for all waste disposal, including completeness of collection facilities.

3. Stream Pollution.
   A detailed survey of all streams for present or future needs, with a view toward balancing the arrangement between water purification and waste treatment.

4. Water Analysis.
   An analysis of all surface and underground water supplies for mineral content and bacteriological condition.

5. Well Core Analysis.
   A microscopic study of deep well cuttings and correlation of the findings with known data for the geology of underground water sources.

6. Precipitation and Flood Control.
   A study and assemblage of all rainfall, runoff and flood data now available.

7. Meandered Streams and Lakes.
   A survey marking line of demarcation between state and privately owned lands and an outline of needed dredging, bank protection and flood control improvements.

Mr. F. I. Thwaites,
Science Hall,
Madison, Wisconsin.

All of the above when finished will be worked into a correlated report on the water situation in Iowa. We propose to add a study of all reliable data on fluctuation in the ground water level and its relation to the other phases. This, then, will provide us with the data necessary for emergency or long time planning, without which, one cannot work satisfactorily.

Very truly yours,

R. H. Matson

R. H. Matson,
Water Resources Coordinator.

RHM:B

STATE OF ILLINOIS
DEPARTMENT OF
REGISTRATION AND EDUCATION
JOHN J. HALLIHAN, DIRECTOR
SPRINGFIELD

STATE WATER SURVEY DIVISION
ARTHUR M. BUSWELL, CHIEF
URBANA, ILL.

September 11, 1934.

Prof. F. T. Thwaites,
Wisconsin Geological Survey
The University of Wisconsin
Madison, Wis.

Dear Prof. Thwaites:

We are pleased to acknowledge your inquiry of September 8th and to supply such information as is available in this State on questions asked.

Your paragraph 3 - The State Water Survey has no information on the recession of ground-water levels which may be attributed to drouth conditions of the state during the past several years. It does have information on recession of water-levels which apparently are produced by excessive pumping, rather than from drouth conditions.

The effect of drouth and rainfall cycles on the position of ground-water tables has been a subject listed, for a number of years, on the work calendar as it is regarded as a most important activity. However, due to conditions over which the Water Survey has no control, such a program has never been put into force.

Your paragraph 4 - The State Water Survey has published no well data material since Bulletin No. 21. We are pleased to send you, under separate cover, some separates which have been published and to which it is presumed you refer as being listed in the bibliography.

Your paragraph 5 - There seems to be a definite and continued recession in water level in the metropolitan area of Chicago, due to the large amount of water extraction. It is difficult to state as to the exact amount of this recession since it is not uniform over the area.

The questions you have asked have been raised on a number of occasions by others and we only wish that we had the organization and equipment to undertake, even the beginning, of such a very important study.

Perhaps we did make a beginning wherein we were able,

under authority of the C.W.A. to build up a staff of over 200 engineers and to gather information on wells in 100 of the Illinois counties, the counties of Lake and Cook being excepted.

During the period of time from December 15th to April 1st a total of nearly 48,000 records of wells were obtained. Some of the material is good and some of it is poor, but at least it has given us an idea of the location of wells and the type of construction that prevails in certain localities.

We are hopeful that facilities may be afforded whereby this work may be continued and finished in a not distant future.

Yours very truly,
STATE WATER SURVEY DIVISION

Winfred D. Gerber, Engineer.

WDG/jh

DEPARTMENT OF
REGISTRATION AND EDUCATION
JOHN J. HALLIHAN, DIRECTOR
SPRINGFIELD

BOARD OF NATURAL RESOURCES
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DEAN CHARLES M. THOMPSON

STATE OF ILLINOIS
STATE GEOLOGICAL SURVEY DIVISION
M. M. LEIGHTON, CHIEF
305 CERAMICS BUILDING
UNIVERSITY OF ILLINOIS CAMPUS
URBANA

September 12, 1934

Mr. F. T. Thwaites
Department of Geology
University of Wisconsin
Madison, Wisconsin.

Dear Mr. Thwaites:

Dr. Leighton has referred your letter of September 8th regarding data for the report on groundwaters of the Upper Mississippi Basin to me for reply.

We have no more recent information than that contained in our Bulletin 34, Artesian Waters of Northeastern Illinois, and the Report of Investigations No. 13, by yourself, bearing on the "extent of depletion" and the "quantities available" with regard to groundwaters of Northern Illinois. The State Water Survey has measurements of water levels and figures on pumpage of various wells which may be of assistance.

Enclosed are two reprints by Mr. Imbt and myself which, however, may not bear on the problem.

With best wishes,

Sincerely yours,

L. E. Workman

Associate Geologist
Subsurface Division

encl.

McCarthy
WELL COMPANY
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MINNEAPOLIS & ST. PAUL

Address Reply to
670 EUSTIS ST.-ST. PAUL, MINN.

Sept. 10, 1934.

Mr. F. T. Thwaites,
Sciehce Hall,
Madison, Wisconsin.

Dear Sir:

In answer to your letter of Sept. 8th we wish to state that the information we have as to the level of the underground water receding in wells in recent dry years is more or less general. We do find that the static levels even in some of the deeper wells in the sandrocks and limerocks have receded. Some places the static levels are from 5 to 10 feet lower than they were 4 or 5 years ago in some parts of the country.

Up in the Northwestern part of Minnesota where the water is obtained out of glacial sand and gravels we have noticed the static water levels in some of those wells have receded as far as 40 to 50 feet below their normal levels. Of course, in that immediate territory the static levels have been gradually receding slightly even in normal rainfall years.

We have had several cases in and about the Twin Cities where the water levels in the underlying limerock and sandrocks have receded to a point where it was necessary to lower pumps down to sufficiently submerge them, but the affect on the deep rock wells was comparatively small in comparison with the shallow sand and gravel wells. We have several instances on the shallow sand and gravel wells from 100 feet deep or less where the static levels have lowered 10 to 20 feet below their normal level.

With reference to he last paragraph in your letter, we do not have any logs of deep wells in the Bayfield or Iron River district which you speak of.

Hoping the above information will throw some light on the subject and assuring you of our hope to cooperate with you further if possible, we remain

Very truly yours,
McCARTHY WELL COMPANY.

FM'D

BY J. Fred McCarthy

C. W. VARNER
WELL
CONTRACTOR

Phone 3693 2054 Marshall St.

DUBUQUE, IOWA,

Sept. 11, 1934

Mr. F. T. Thwaites,
STATE DEPARTMENT OF GEOLOGY,
Madison, Wis.

Dear Mr. Thwaites:

Replying to your letter of September 8th in regard to information on the depletion of water supply in wells, particularly as to the lowering of water levels under ground due to recent dry seasons.

This is rather a broad question and would take considerably study to answer as the conditions are so different over different parts of the country. In some sections of this territory where there are lands that are from 300 to 400' above river levels and some places valleys that are considerably lower the lowering of the water levels are so different that it is hard to say in a general way the causes or the conditions at present.

For instance, in Iowa around what is known as Balltown, Bankston etc., it is approximately 300 to 400' to the bottom of the valleys. The limestone above the Maquoketa shale is anywhere from nothing to 200' thick in the high hills. On top of these hills of course the only water supply is the rainfall and as the Maquoketa shale is impevrious to water if the rain fall is short for a considerable length of time and with the timber cut off that holds this rainfall, what little there is drains off the top of the Maquoketa shale to the valleys and is dissipated there. It is then necessary probably to go through the Maquoketa shale from 100' to 250' thick and through the top of the Galena limestone from 100' to 150'. The Galena limestone at the top section usually is so solid that it does not bear any water.

In sections of the territory where the Maquoketa shale lays below the general underground water level, usually controlled by creeks and rivers, the lowering of the water level is not as great. I would say in general that the only safe underground water supply is a well drilled of large enough capacity and to a depth whereby it taps a water supply that the head or water level is controlled by some surface stream.

If there are any direct questions you would care to ask I will be glad to reply thereto.

Sincerely yours,

C. W. Varner

C. W. Varner.

CWV:AR

RUSSELL COLE, WELL CONTRACTOR
PHONE 1514
ARPIN, WISCONSIN

Sept 10, 1934

Professor O. J. Kwalter
University of Wis.
Madison Wis.

Dear Sir:

In reply to your letter of Sept. the 8th I wish to say that as you know the formation of Wood County is of such a compact nature that water can only get through it in fishers, vones or crevices of some kind. The shallow ones of which are most all dried up now, by shallow vones I mean vones to a depth of fourty or fifty feet deep while vones below this depth have not been effected in any way I don't believe, the amount of water and also the the static

RUSSELL COLE, WELL CONTRACTOR
PHONE 1514
ARPIN, WISCONSIN

level of the water from these zones which a very few exceptions are the same as it always was.

The bed rock comes close to the surface over most of the county thus leaving the drift entirely dry and drilling in granite is very uncertain and also quite expensive so lots of people are in hard shape for water.

If this does not answer your questions I will be glad to tell you anything more that I can.

Yours Truly

Russell Cole

ARTHUR C. TROWBRIDGE
DIRECTOR AND STATE GEOLOGIST
ALLEN C. TESTER
ASSISTANT STATE GEOLOGIST

STATE OF IOWA
IOWA GEOLOGICAL SURVEY
103 GEOLOGY BUILDING
IOWA CITY

Sept. 11, 1934

Dr. F. T. Thwaites
Department of Geology
University of Wisconsin
Madison, Wisconsin

Dear Thwaites:

Because I have recently received and just yesterday answered a letter from Dr. G. E. Condra asking certain questions pertaining to ground water resources in Iowa, I am just a little surprised now to receive your letter of September 8. I had known something about the work on which you are now engaged, but do not understand just what Condra's connection with it is.

I am taking the liberty of sending to you herewith a copy of Condra's letter and copy of my reply. Inasmuch as your question and one of Condra's are identical, my reply to Doctor Condra will perhaps answer yours also. If there is anything else we can do for you that will be of use in your present work please do not hesitate to let us know.

I note that your letter was addressed to Dr. James H. Lees. Apparently you have not previously heard that Dean Kay and Doctor Lees resigned as State Geologist and Assistant State Geologist respectively, and that on July 1st Dr. A. C. Tester and I took their places. I am sorry to say that Doctor Lees is not in good health and is not now connected with the Iowa Geological Survey.

Yours sincerely,

Trowbridge

A. C. Trowbridge

ACT-LCA

C O P Y

September 7, 1934

Dr. A. C. Trowbridge,
State Geologist,
University of Iowa,
Iowa City, Iowa.

Dear Doctor Trowbridge:

As Consultant on Ground Water Supplies for the National Resource Board I have immediate need for information for the following in Iowa:

1. A map showing the ground water regions of Iowa.

2. A list of the leading water-bearing horizons by formations.

3. The chemical nature of the water in each of the water-bearing formations.

4. Your opinion in regard to what conservation measures should be inaugurated to safeguard the future ground water supply of Iowa.

5. The quantity of ground water available in each water-bearing formation.

6. The amount, by feet, the ground water level has lowered in different parts of your state due to the drouth of this year.

No doubt you have made various reports to Washington on the ground water situation and have copies of these reports from which information can be forwarded.

I have read the various admirable reports by your Survey on surface water and ground water. Let me thank you for an early reply.

Very truly yours,

(Signed) G. E. Condra, Director
Conservation and Survey Division

GEC:JK

P.S. Please forward an areal geological map of Iowa.

September 10, 1934

Dr. G. E. Condra, Director
Conservation and Survey Division
University of Nebraska
Lincoln, Nebraska

Dear Doctor Condra:

Before proceeding to answer as best I can the six specific questions of your letter of September 7, please let me explain that preliminary answers to most of them are contained in a preliminary report submitted last week to the Iowa State Planning Board and that we hope to incorporate really satisfactory answers to these and other questions pertaining to surface and sub-surface water supplies in a more comprehensive report to the same board to follow in about six months. In connection with this work there are eight or ten men, including Dr. A. C. Tester and myself, working on a part-time, non-remunerative basis and about forty full-time paid persons. Doctor Tester is supervisor of the sub-project that relates to the geologic sources and mineralization of ground water supplies. He has eight paid persons working under him on this project. They are making complete analytical studies of cuttings from selected wells in the state. Another sub-project under Dr. J.J. Hinman employs chemists to make complete mineral and bacterial analyses of ground waters from different geographical and geological sources. There is still another sub-project under Dr. A. H. Wieters, of the State Board of Health, studying municipal water supplies, including ground water, from the standpoint of pollution. In addition, Doctor Tester is director of an Iowa Emergency Relief Administration Drouth Relief program employing six full-time geologists. These men are studying ground water conditions, locating test wells, directing the drilling of these wells, and feeding into the Planning Board groups large numbers of well cuttings and water samples. The general purpose is to determine accurately the positions and thicknesses of water-bearing strata in all parts of the state and to estimate in advance of later drilling the quantity and quality of ground water to be expected from each horizon or formation. A little later Doctor Tester hopes to start

a study in cooperation with the U. S. Geological Survey for the purpose of determining the depths at which old casings leak and the mineral content of the water leaking into the wells at the different depths. This I.E.R.A. work is not only of immediate use in drouth relief, but with the Planning Board projects it serves to form the basis for what might be called ground water planning, including supplies, production, use, purification, and conservation.

The preliminary report of the Planning Board mentioned above is in process of being multigraphed, and two hundred copies will be ready for distribution before the end of September. I am sorry that there is no copy immediately available for your use. It is expected that all this work will be continued for another six months, after which a more nearly complete report will be submitted.

And now to try to answer your questions:

1) I am not sure I understand just what you mean by "ground water regions of Iowa." All parts of our state are dependent largely upon ground water supplies. If you mean a map dividing the state into different regions on the basis of the depth or geologic sources or chemical compositions of ground water, we have no such map. What you want under this head might be worked out from the hard rock, structural (Plate 1, page 36, volume 33 of our annual reports) and glacial drift (Plate 2, page 14, volume 34) maps of the state.

2) In answering this question I am enclosing a copy of a generalized geologic column for Iowa as it will appear in the preliminary report of the Planning Board. Although any and all of these formations, including both indurated rocks and mantle rocks, yield ground water in varying amounts and different degrees of mineralization in different localities, the leading water-bearing beds are the Mt. Simon, Galesville, Jordan, St. Peter and Dakota sandstones, a sandy horizon (Keosauqua or Pella) just beneath the Pennsylvanian, and the sands and gravels of the Pleistocene. Rather large supplies of rather heavy and sometimes dangerously (flourine) mineralized water comes from such calcareous formations as the Meramec, Osage, Cedar Valley, Hopkinton-Gower, Galena, Platteville, and Prairie du Chien subdivisions.

3) In a general way this is answered under 2. In the central and southwestern parts of the state where even the best sandstone formations are deeply buried the water from these formations is badly mineralized. Because of the practical impossibility of telling from what horizon a given water sample comes unless it is taken by a geologist during the drilling of a well, there are very few authentic data on this point. Six months from now we expect to be in much better position to answer this question.

4) This too is what we are trying to find out. We shall doubtless recommend the abandonment of certain old wells with leaking casings; the drilling of new wells to take their places; the installation of cast iron casings in many wells; the use of some wells exclusively for live-stock, of others exclusively for industrial purposes, still others exclusively for human consumption; the drilling of new wells to specified depths with specified casings, etc. Purification plants for mineralized waters may be recommended in some cases.

5) This can not be answered at present in any definite way. Even the thickest and most porous formations in general are found to be thin or tight in some places. Again, we expect to get quantitative information on this later.

6) There are also no definite figures on this. Numerous wells, surface reservoirs, lakes, streams, and swamps that were considered permanent have proved to be intermittent. Sub-soils usually saturated are now dry. So far there are no "observation wells" in Iowa. All the data available on the lowering of ground water levels in Iowa, and these data are far from conclusive, were published by Dr. James H. Lees in volume 33, pages 375-427.

As requested, I am sending under separate cover an areal geological map of Iowa. You will find a more recent areal map but on a smaller scale and more generalized in volume 33 of our annual reports, page 378.

I have written at some length and can only hope that this letter contains information that will be of use to you. If we can be of any further assistance to you in this connection, please do not hesitate to call on us.

With kindest personal regards,

Yours very sincerely,

A. C. Trowbridge, Chairman
Projects 8--Water Flow and Supply and Stream Pollution and 16--Lower Des Moines River Survey
Iowa State Planning Board

ACT:A

Sept. 8, 1934

Mr. C. W. Varner, Well Driller,
2054 Marshall St.,
Dubuque, Iowa

Dear Mr. Varner:

I have been directed to prepare within the next two weeks a report on underground water conditions in Minnesota, Iowa, Wisconsin and Illinois.

In doing this I am asked to supply information on the depletion of the supplies. It occurred to me that you might have some information on the lowering of the water level underground due to the recent dry seasons. If so would be pleased to learn what you have observed. Stamped envelope is enclosed for reply.

Very truly yours,

F. T. Thwaites, in charge of well records,
Wisconsin Geological Survey
Special regional water consultant,
Water Resources Section, National
Resources Board

Sept. 8, 1934

McCarthy Well Co.,
670 Eustis St.,
St. Paul, Minnesota

Gentlemen:

I have been directed to prepare a birof report on underground water conditions in Minnesota, Iowa, Wisconsin and Illinois for the use of the National Resources Board within the next two weeks.

In preparing this I find that I need information as to the effects of the recent dry years on the level of underground water. I will be very pleased if you can give me any instances of such effect or of the lack of effect as the case might be. Or if such information has not come to your attention perhaps you might refer me to some shallow well drillers in Minnesota who have met with this problem.

I noted in a recent report on waterworks in the Great Lakes region that there are deep wells at Bayfield and Iron River about which we have no information. If you have logs of these wells would be very pleased to get copies.

Very truly yours,

F. T. Thwaites, in charge of well records,
Wisconsin Geological Survey
Special regional water consultant,
Water Resources Division, National
Resources Board

Stamped envelope for reply enclosed

Sept. 8, 1934

Mr. Russell Cole, Well Driller,
Arpin, Wisconsin

Dear Mr. Cole:

I have been asked to prepare a report on underground water conditions in your region for use of the National Resources Board and to finish the same within two weeks.

I would greatly like a statement from you as to the effect of the recent dry years on the level of water in wells in your region.

A stamped envelope for reply is enclosed and anything you can tell me will be greatly appreciated.

Very truly yours,

C. T. Thwaites, In charge of well records,
Wisconsin Geological Survey
Special regional water consultant, Water
Resources Section, National Resources Board

Sept. 8, 1934

Dr. James H. Lees, Assistant State Geologist,
Iowa City, Iowa

Dear Dr. Lees:

I have been asked by Prof. Simpson of North Dakota to prepare a brief report on the underground water supplies of the Upper Mississippi Basin in Minnesota, Iowa, Wisconsin, and Illinois for the use of the National Resources Board within the next two weeks.

Your state is fortunate in having about the best and latest reports on these matters but there is one point on which I thought that you could furnish later information. That is the effect of the recent dry years on the level of the water table.

Anything you can tell me along this line will be greatly appreciated.

Sincerely,

F. T. Thwaites

Sept. 8, 1934

Mr. J. Albert M. Robinson,
228 North La Salle St.,
Chicago, Illinois

Dear Mr. Robinson:

I have been asked to prepare a brief report on the underground water resources of the Upper Mississippi Basin in Minnesota, Iowa, Wisconsin, and Illinois for the National Resources Board within the next two weeks.

Two of the subjects on which I do not have much information are "Amount of Depletion" and "Quantities available."

I would greatly appreciate it if you could write me a letter summarizing what you know of these matters in the region with which you are familiar. I am particularly anxious to learn if there is or is not any progressive decline in specific capacities of wells and how the decline in water levels in the Chicago district has progressed since Anerson's report of nearly 20 years ago. Also I would like to know what effect the recent dry years have had on the water table.

I have telephoned several local engineers and have obtained considerable evidence from them. Anything you can furnish, however brief, will be greatly appreciated.

Sincerely,

F. T. Thwaites

Sept. 8, 1934

Dr. M. M. Leighton, Chief,
State Geological Survey,
Urbana, Illinois

Dear Dr. Leighton:

I have been asked by Prof. Simpson of North Dakota to prepare a report on the underground waters of the Upper Mississippi Basin in Minnesota, Iowa, Wisconsin, and Illinois for the National Resources Board within the next two weeks.

Two of the items on which I have little recent information are "Extent of Depletion" and "Quantities available".

If you could give me a general summary of data you have collected along this line I will greatly appreciate it. As the report will have to be brief it is evident that no large amount of data can be cited. Here I have been getting verbal reports from engineers and well drillers as to the effect or lack of effect of the recent dry years on the water table.

Would also appreciate separates of Workman's recent papers noted in the bibliography if he has them, also any new publications which you may have along these lines.

I spent most of the summer working on glacial geology in northern Wisconsin being supported by a Penrose grant. We obtained some good results and I hope to finish a report on northeastern Wisconsin before the first of July next year.

With best regards,

Sincerely,

F. T. Thwaites

Have also made the same request of Mr. Gerber of the Water Survey

Sept. 8, 1934

Mr. W. D. Gerber,
State Water Survey,
Urbana, Illinois

Dear Mr. Gerber:

I have been appointed by Prof. Simpson of North Dakota to prepare a report on the underground water resources of the Mississippi Basin in Minnesota, Iowa, Wisconsin, and Illinois within the next two weeks. This report if for the National Resources Board.

The subjects treated include two items on which I have little information namely "Depletion" and "Quantitiy".

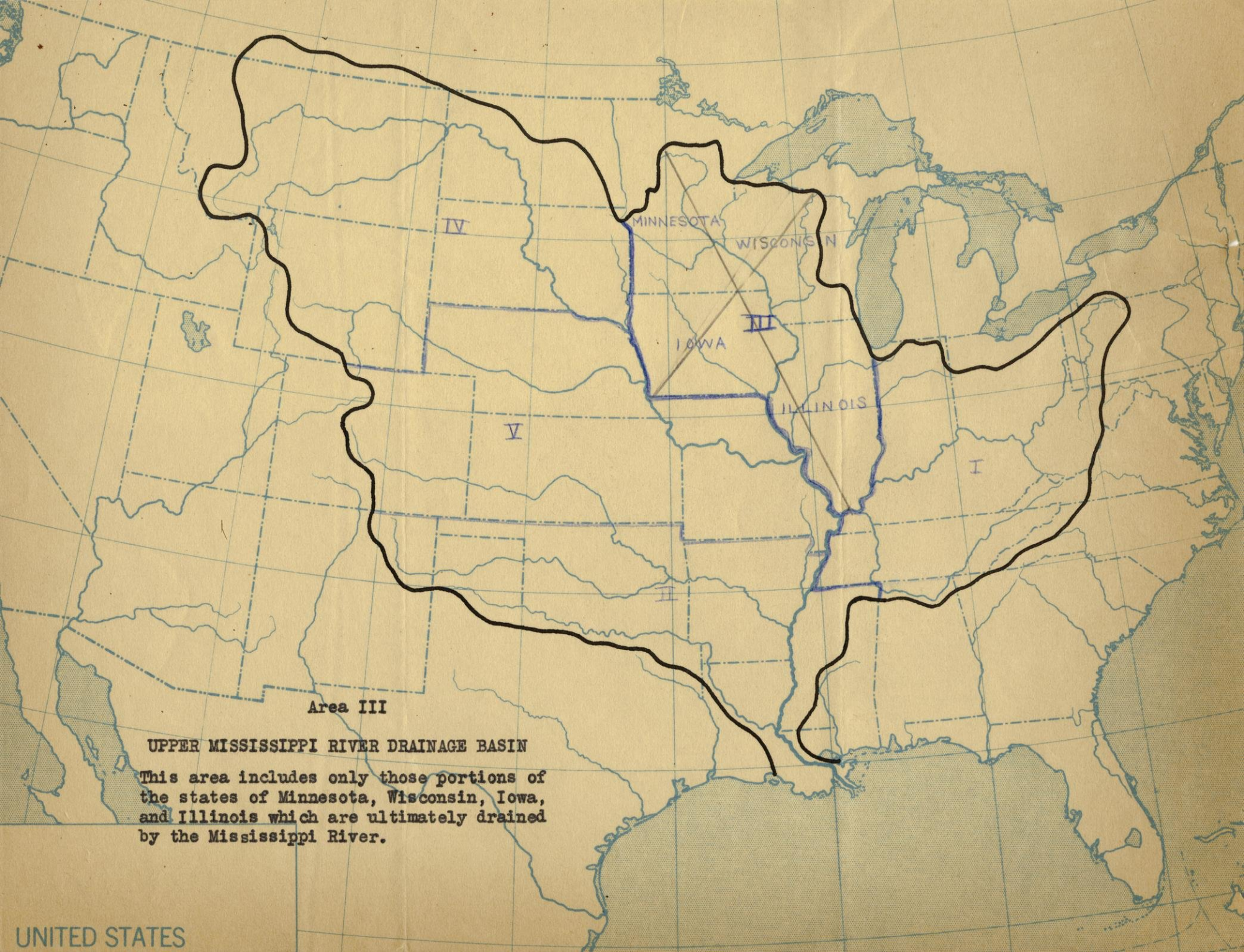
I will appreciate it greatly if you can write me a letter stating what if any evidence you have collected which bears on the question of the effect of the recent dry years on ground water levels in Illinoil Of course, I realize that such data is hard to obtain and is very contradoctory but a brief statement of your experience similar to that which I have obtained from a number of engineers in this city would help me greatly.

Also if your department has published anything along the line of data on well tests, etc. since Bulletin 21 I would greatly appreciate receiving it. Also any separates of your recent articles which I note in the bibliography.

Naturally this report will have to be a more general summary with references to books and papers where more detailed information can be found but specific information on typical localities will help me greatly.

Very truly yours,

F. T. Thwaites, In charge of well records
Wisconsin Geological Survey
Special Regional Water Consultant, Water
Resources Section, National Resources Board


MINNESOTA
WISCONSIN
IOWA
ILLINOIS
IV
V
III
I
II
Area III
UPPER MISSISSIPPI RIVER DRAINAGE BASIN
This area includes only those portions of the states of Minnesota, Wisconsin, Iowa, and Illinois which are ultimately drained by the Mississippi River.
UNITED STATES

Rochester at 3225
elev 1000
= -2225

Iowa wells

~~Clarinda qz @ -1435 elev.~~

(Lime) Cedar Rpds -1412 ? ?   748
660
-088

(Allamakee) Lansing ~~[illegible]~~

(Winneshiek) Decorah elev 1100   1720 = -620

(Cedar) Tipton - 1435 red clastics only

(Ida) Holstein (Ida Co) qz at 2020
1457
-563 elev

(Kossuth) Algona -630

Illinois
#1 McCleary Ogle Co   3760
714
-3046

northern Ill

No 1 Taylor. Ikeno   2925
820
-2105

Osceola Worthington + 870 Osceola Co

Woodbury Hull + 678

Le Mars (Plymouth) elev + 1215
988

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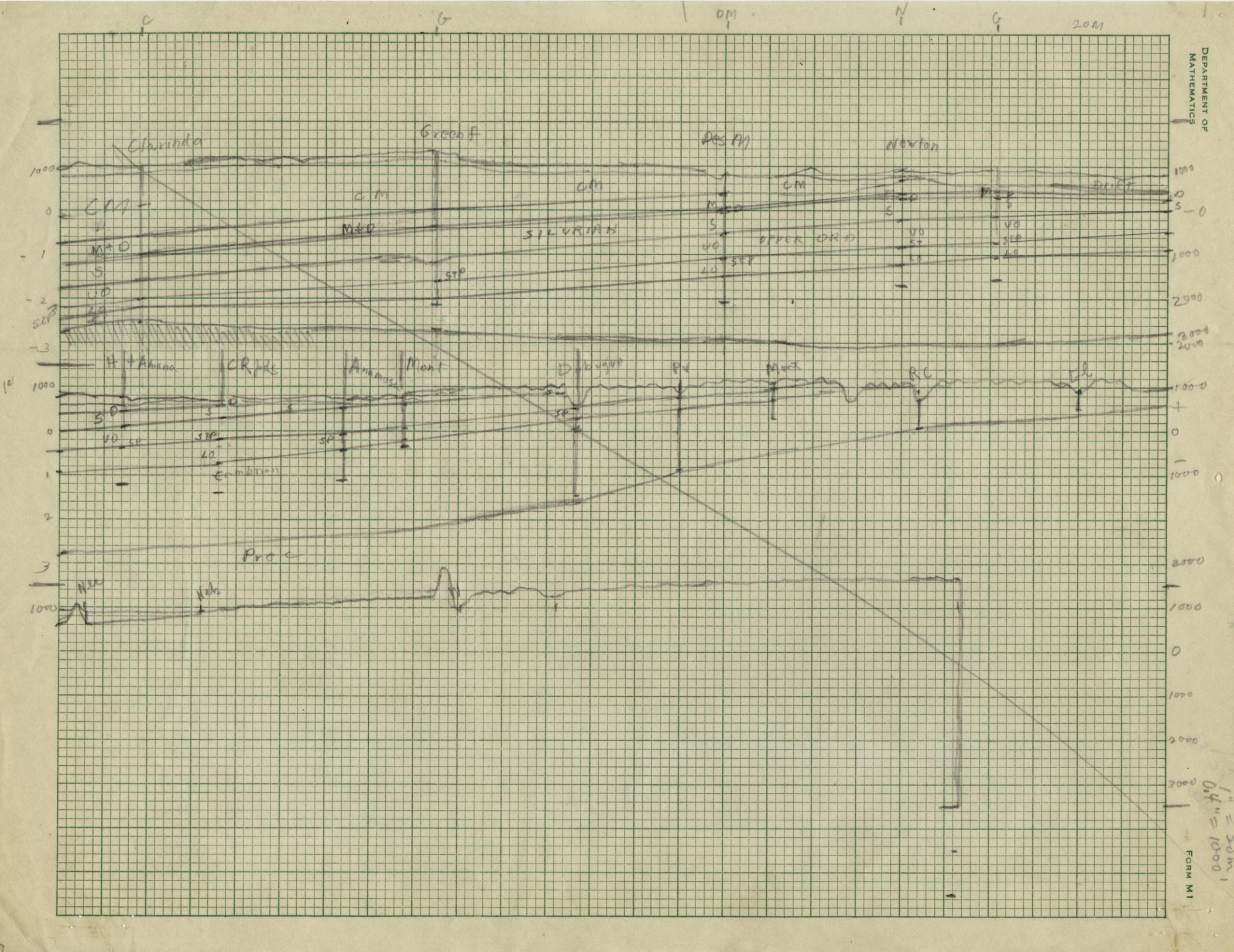
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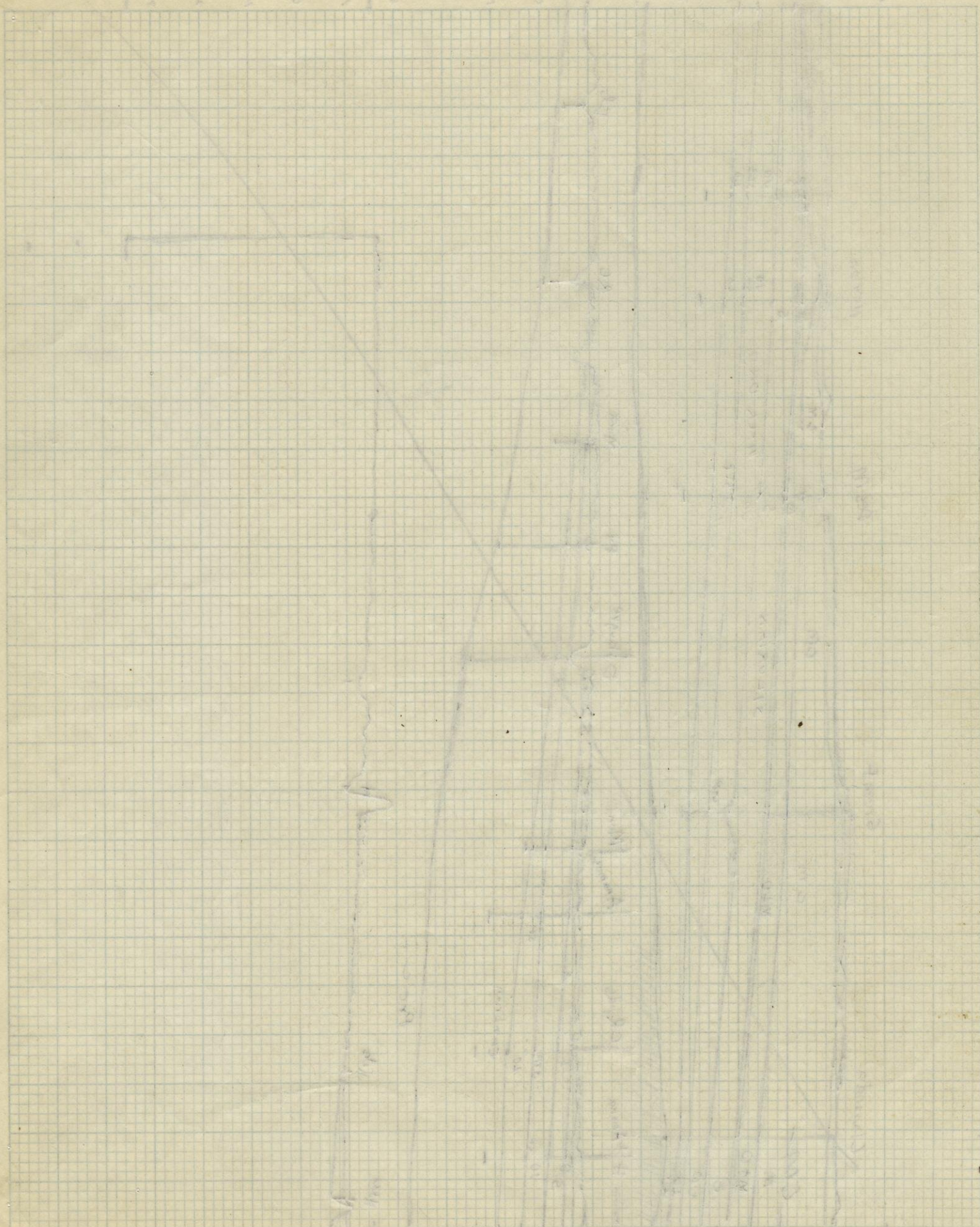
SILURIAN
UPPER ORD
H+Ahrens
CR
Anamosa
Mont
Dubuque
PV
RC
Precam
DEPARTMENT OF MATHEMATICS
FORM M1



Pleistocene (glacial drift) Thickness 0 – 600	to-600 Iowa	Till, sand, gravel, clay	many large supplies soft to very hard.
Cretaceous & Tertiary Dakota	0 to 500? Iowa	Shale, clay, sand and sandstone, gravel and conglomerate, chalky ls. SS clay	good supplies very hard
~~Permian (?)~~	? Iowa	~~Sh, ss, gypsum~~	~~None~~
(Coal measures) of Pennsylvanian	to – ~~1500?~~ 1600 till	Shale, ss, limestone, coal.	Some good water but mostly hard. and S
Mississippian / Osage	280-500	~~Limestone~~, some sandstone & shale	irregular – hard
" / Kinderhook	125-370	~~shale~~	none
Devonian	0-300 Iowa	Limestone, some shale & ss	Irregular
Silurian Salina	0 – 500 Iowa	Dolomite, limestone, some salt and gypsum (Salina)	slight salt water ~~H₂S~~
" Niagara	0 – 500		Irregular – hard
Ordovician (upper) Magnolia	~~100 – 300~~	~~Shale~~ shale, dolomite, limestone	none Irregular – hard
Ordovician (upper) m/ Gal-Platteville	200 – 5̲00		
" St Peter	0-5̲00	Sandstone, shale at bottom	good – moderately hard
" (lower)	[illegible]0-700	Dolomite, some sandstone (New Richmond)	Good – hard
Cambrian (Jordan)	50-200	Sandstone	good – fairly hard
" ~~St Lawrence~~	100 -350	Dolomite, sandy	slight
" Franconia	[illegible]0-150	SS, fine	Fair – ~~moderate~~ moderately hard
" Dresbach	30-200	SS, white	Good – moderately hard
" ~~Eau Claire~~	100-350	SS, sh	Little – moderately hard to soft
" Mt Simon	– 1000	Sandstone	excellent – moderately hard Salty at great depths
? Red Clastics	to 2250	SS, shale, all red	Poor, generally salty
Quartzites	to 7000		
Igneous & met	—		

690
895
1585

Telephone

✓ Smith B260 — no effect noted — pumping station well improving. [illegible] not changed in 10 yrs. [illegible] shows marked lowering of over 10 ft. Many farm wells [illegible] dry. Shallow [illegible] does not [illegible]. There is a progressive lowering of table at Madison.

call Thur Warwick ~~C127~~ (B5100) C74 ~~[illegible]~~ Friday

✓ Nichols F747

✓ Kirchoffer F774 — Park Falls, Stratford [illegible] lower water — Delavan lowered 2' dry — down 6-8' 5 ft + Granite Eagle River down 2'-3'

Ward. B889. [illegible] — [illegible] lowering 200' — Crystal Lake Ill — [illegible] pump @ 800 — [illegible] @ 400 [illegible]

✓ Kessler U140 B580 F8720

Nichols — St Cloud water lowered 3'. Wis ~~[illegible]~~ notice no difference in amount of contamination compared with last year.

228 N LaSalle Chi

Write ✓ E. F. Bean — Robinson — geo. supt of St. of water — ~~Marvin~~ Marshfield new well 250 gpm (Kessler)

out ~~[illegible] [illegible] 101 N 3rd~~ Mew.

out ~~[illegible]~~ Kaukauna

✓ Gerber W D State Water Survey Urbana, Ill. Late developments in Chi

✓ McCarthy Well Co 670 Eustis St, St Paul

~~[illegible]~~ ✓ Leighton M. M. ~~State~~ Geol. Survey Urbana

✓ ~~Kay~~. Trowbridge H. Asst State Geol. Iowa City, Iowa

✓ Varner, 2054 Marshall St. Dubuque, Iowa — See

Public Service Comm. Soule — Keys Well Drilling Co?

✓ Russell Cole, Aspen Wis

Kessler [illegible] water down 43' (??) same spec. caps. no accurate results — feel very poor — might be error in readings — length of pipe?

Normandale down 1 ft per year — 15' total recession — not from telltale

Eagle — no change — depth 807' — McKeo estate.

William Bay unchanged — 10' dd for 850 gpm.

aerated [illegible] — [illegible] settling needed — not enough [illegible].

iron 1.0 – 1.8 — 50-60 ppm CO_2 — down to 17 by aeration

iron lowered & taste removed

Flow removed by casing to 172 — then no flow

water around 38' — Final well 243' T.D. screen & gravel wall below 172

Abbotsford 45' T.D. — 25' to granite — gravel loam.

bought from RR — 20' in granite — pumped dry — good 40 gpm.

from crevices — 24' diam. to 25' — 21½ below

water at 15' — no change — RR [illegible]

1005' away 35' 12' [illegible] 61 gpm [illegible] dry

Marsh

Cedarburg — 600 ppm

2 2 Bonder [illegible] near Fairgrounds

— Mayer — 1½ per year — 850 gpm — no sand

0 sea[illegible] year. — Waterwater flowing wells unchanged.

Spec cap 9.5

Germany etc
Geologic History

Little is known of the pre-C history of Germany. Wherever it is exposed it is highland metamorphosed, an indication of pre-C folding ~~etc~~ addition to the later Hercynian.

During the Paleozoic Germany was a seat of deposition. As it was not affected by Caledonian folding the Devonian is marine. Along the Rhine & the mid-Ger complete Dev section known. In Bohemia, however, peculiar conditions maintained during the ~~Sil~~ Ordov. Sil, for these formations have few fossils in common with ~~those above~~ the Baltic section.

Hercynian deformation took place in the ~~Carboniferous~~ Devonian and with the exception of the Bavarian Alps Vosges Vogelsgebirge, Rhon, ~~and~~ Hessian Highlands produced all the highlands of Germany. Consequent upon this deformation the Permian in large part cont & contains volcanics. The gypsum & salt give indication of arid conditions. Some of the cont of Bohemia may be Permian

The upper & lower members of the Triassic are marine while the intervening are cont ~~The Jurassic~~ two ~~is similar to the~~ The Jurassic is similar to the English section & is in part cont & in part marine.

Conditions in northern Germany in the Cret were similar to those in England. With the uplift of the Alps in the Miocene sedimentation in the N. became dominately cont.

In the Quat. glacial deposits were laid down in the north German Plain and ~~in the~~ adjacent to the mountainous areas.

Hannaberg Pub. Serv. Comm

Warmish reports wells now bad which were formerly good.

Subsurface pol St Cloud reference pollution neg results except leaky liner Tank at store

---

Wawatosa Confidential

well #6 16" only run 39½ ft - open hole below to liner - used well scraper to get samples - electro magnet used.

Van Hise C R Mon 47

pp 423-429

· variation in level of ground water - after Weidman p 427

Weidman Bull 16,

584-585, 664

---

white

cuff = some contam. probably

attrib to drought. Green

Bay - Shawano

one well

only

Shallow wells receding

Galesburg none

Rockford "

Dubuque "

Knoxville Ill receding

shallow wells which have fallen

Pershallow wells at Green Bay

much air

Shawano

Ill. cont.

(1) Anderson C B The artesian waters of northeastern Illinois. I G S, B 34, 1919

(7) Habermeyer G. C Public ground-water supplies in Illinois I S W S, B 21, 1925

(18) Thwaites F T Stratigraphy and geol structure of northern Ill with special reference to underground water supplies I GS. R I 13, 1927

(21) Workman 2926, 2927 L. E geol. interpretation of Aurora city pollution, I S A Sci Trans, 21, 262-272, 1929

(4) Gerber 910 W D (22) The quantity of resource for underground water, I S A Sc Trans, 22, 485-491, 1930

(5) Some idiosyncrasies of ground water, Ill. SWS, Dev. Circ. no 6

Also Am. Water w. Assoc J, 22, 110-116, 1930

(6) Gerber 1038 W D. The hydrology of industrial and municipal water supplies in Ill. I S A C Trans. 23, 400-412, 1931

(13) Mead, D W The hydro-geology of the upper Mississippi valley and of some of the adjoining territory. Assoc. Engs. Soc. Jour. 13, 329-396, 1894

(16) Rolfe, C W The geology of Ill as related to its water supply, Univ of Ill, Chem Survey of the waters of Illinois. Rept 1897-1902, pp 41-56, 1903

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(Tiffany, A S Record of deep well at Dixon Ill. A G 5, 124, 1890

Illinois
Iowa
Minnesota.
Wisconsin

Cretaceous - Interior plateau and western Andes, Guianan Highlands, Orinoco Basin, Parana Valley probable.

Triassic. - Paysandu Brazil, Andes and Argentina probable.

Carboniferous

Permian - Brazil, glacial deposits and Coal

Pennsylvania - Brazil and interior plateau, Altaplanicie

Mississippian - not definitely known.

Devonian - Sandstone and shale Period one of great deposition in S. Am.; Projects through recent sediments in Amazon Valley, is folded in eastern Andes, occurs in Parana and Sao Paulo in Brazil, and also in the Falkland Islands.

Silurian - ~~Fossil~~ ~~fossils~~ Sandstone. Exposed north of Amazon (fossil fiords sandstone) and in eastern Andes.

Ordovician - Shales. Lower Ordovician fossils have been identified on the east side of the Andes.

Cambrian - No Cambrian has been positively identified.

Iowa

(1) Call 91 d RE. Preliminary paper on artesian wells in Iowa. Mo. Ry. Iowa Weather & crop service 2, no. 4
(2) 92 — 1-6, 1891
Artesian wells in Iowa (ab) I A S P 1, 57-63, 189
(3) 92a Iowa artesian wells. Mo. Rv. Iowa weather and crop service 3, no. 3, 1-15, 1892
(4) Calvin 02 b Samuel Artesian wells in Iowa: Iowa Inst. 84, 402-40, 1902
(10) Norton 97 98 W.H. Artesian wells of Iowa, IGS 6, 113-428, 1897
The art. wells of Iowa Iowa Eng. Soc: Proc 10,
(5) Chamberlin 86a T.C. The artesian well at Belle Plaine, Iowa, 98-101, 1898
(14) Moffat 99 HR Artesian wells in the Belle Plaine area, IGS 9, 521- Science 8, 276-277, 1898
(11) ~~Norton 98 The artesian wells of Iowa Iowa Eng. Soc~~ 562, 1899
~~98a~~
~~12~~

(6) Hendrixson 07 W.S. Some features of the Iowa ground water. IA Sci. Proc. 14, 187-190, 1907
16, 135-142, 1909
(12) Norton W.H. 05a Iowa, WSP 114, 220-225, 1905
water supplies at Waterloo, Iowa WSP 145, 148-155, 1905
& others. Underground water resources of Iowa, WSP 293, 1912

(15) Tilton 2 J.L. geol of Clarke Co., IGS 27, pp 1920
(8) Lees 7 J.H. The conservation of underground waters, I A Sci Proc. 27, 187-196, 1922
(7) Kay 124, 241 Chas. water table of the loess at Science n.s. 57, 148, 1923
PAG 46, 401, 1926

(13) Norton 1926 W.H. Deep wells of Iowa, IGS 33, 9-374, 1928 ~~1926~~
(9) Lees 1532 J.H. water well records in Iowa. IGS 33, 375-400, 1928

Due to the aridity ~~etc~~ many of the streams ~~etc~~ do not reach the Sea.

Geologic History

The Parana is a structural depression and on the east the beds dip ~~slight~~ gently to the west.

The Devonian rocks seem to rest directly on the Brazilian complex and therefore ~~probably~~ indicate an erosion interval or at least a lapse of deposition. The Tertiary sediments seem to rest upon eroded Mesozoics.

The Patagonian Pampas are characterized by a thick series of ~~Ter~~ Tertiary sediments which are alternately marine and continental but the latter predominate.

Stratigraphy

Tertiary. marine and continental, latter in predominance
Unconformity
Mesozoic
Palezoic
Permian
Carboniferous } Postulates from present to E
Devonian
Unconformity
Brazilian Complex.

Stratigraphy of South America in General

The sediments of South America are in the main sandstone and shale, deposits which indicate an adjacent highland. There is very little limestone in South America.

Tertiary. ~~The~~ Consists mainly of continental sediments: Some marine in Patagonia; volcanics in western Andes and interior plateau.

Minnesota

(7) Todd 96 C J E The hydraulic gradient of the main artesian basins of the Northwest (ab). AG 18

~~Ferguson Hall CM 05 [illegible] #117 219-220, 1896,~~

(1) Hall CW 89 b The geol. conditions which control artesian borings in southeastern Minn. Minn Ac. Nat Sci 13 3, 128-143, 1889

(2) 04 — Minnesota. WSP 102 441-488, 1904

(3) 05 — WSP 114, 226-232 1905

(8) Winchell NH 05 Deep wells as a source of water supply for Mpls, AG 35, 266-291, 1905

06 b abstract

(4) Hall CW 11 The natural condition of a municipal supply in Mpls & St Paul, Minn. Science NS 33, 468-469, 1911

~~Winchell NH 78~~

(5) Hall CW 11 a and Meinzer O E and Fuller ML Geol and underground waters of southern Minn. USGS WSP 256, 1911

(6) Schwartz, RR, artesian water for Minneapolis, Minn. Layne-Northwest Co. 1932

The Cordillera real has a crystalline core of granites and gneisses which is flanked by ~~Paleozoic~~ metamorphosed Paleozoics, schists, slates, and quartzites, which range in age up to and including the Lower Devonian. Adjacent ranges composed of Mesozoic strata do not share the metamorphism typical of the Cordillera Real.

Lowlands

Coastal Plain

Extent

A coastal plain occurs along the east coast of S. America and on the west coast one is developed only in the vicinity of the Gulf of Guayaquil. ~~As at~~ ~~the eastern~~ ~~On the east the~~ ~~of Argentina, the Amazon, and the Orinoco~~ ~~On the east~~ the coastal plain merges with the Pampas, and the Amazon and Orinoco valleys.

Amazon Valley

Extent.

The Amazon Valley is a slight downwarp between the Guiana Highlands on the north and the Brazilian Highlands on the south.

Physiography.

The Amazon Valley is due to erosion and downwarping. In places the older rocks project thru the thin veneer of recent sediments. The mouth of the Amazon has been drowned by a recent submergence.

Geologic History.

Its history is essentially the same as that of the highlands to the north and south.

Wisconsin to 1918 687-791

general

(1) Chamberlin T C 83a Artesian wells; Wis G. S. 1, 1883

(2) Kirchoffer 05 W G Sources of water supply in Wisconsin; Wis Univ Bull 106, 163-249, 1905

(5) Mead, D W [illegible] The hydro-geology of the upper Mississippi Valley and some of the adjoining territory. Am. Eng Soc Jour. 13, 329-396, 1894

(6) Schultz 05 A R

(8) Weidman 15 The geology of Wisconsin water supplies, 1894

S and Schultz A R Wisconsin district WSP 114, 233-241, 19[illegible]

Local

~~Grant 05a~~ [illegible]

The underground and surface water supplies of Wisconsin WGS B 35, 1915

~~Th 1918~~ The Paleozoic [illegible] of and in

geol only (7) Thwaites Deep wells ~~[illegible]~~ Wis and northern Illinois JG 31, 529-555, [illegible]

(3) Kirchoffer. W G. Increasing the capacity of ground water supplies; Am. W W Assoc. Jour. 15, 141-151, 1926

(4) " Rept on condition of Wausau water supply; Wausau Daily Record-Herald Dec 19, 1918

Illinois

(15) Rolfe 90 - C W artesian water from drift A G 6, 32-35, 1890

local (19) Udden 08 c J. A - Artesian well in Peoria and vicinity I S A E 8, 313-334, 190[illegible]

(3) local Bowman 07 Isaiah and Reeds, C A water resources of the East St Louis district IGS B 5, 1907

(12) Mead 92 D W notes on the hydrogeology of Illinois in relation to its water supp[illegible]

(20) Udden 09 - J A geol. classification of the Sone Engin. Rpt. 8, 48-66, 1893 [illegible] water of Illinois

cont Glenn 06 c, L. C. The hydrology and geology of the gulf embayment area of western Kentucky ... IGS B 10, 8-21, 8[illegible]

out Bowman 06 A H. Middle portion of [illegible] Illinois valley [illegible] (all) Survey ... 23, 2[illegible]

(2) Barton 09 Edward; The mineral content of Ill waters; IGS B 8, 77-80, 1908

(14) Palmer 09 G T. The medicinal springs of Illinois IGS B 10, 62-75, 1909

out Udden 12 - J A Geol. and min. resources of the Peoria quadrangle, Ill USGS, B 506, 1912

(17) local Savage 07 T E. water resources of the Springfield quad IGS B 4, 235-244, 1907

Leverett Frank 96, 99, 05

(8) The water resources of Illinois. USGS 17 AR. pt 2 695-828, 1896

(9) The Illinois glacial lobe; USGS mon 38, pp 550-787 1899

(10) Illinois, Indiana, Ohio USGS WSP 114, 248-270, 1905

Brittany was deformed by the American branch of Hercynian folding. A graben, Basin of Chateaulin on the west and Basin of Savalow the east, runs ~~through the~~ in an east-west direction thru the central part; this massive ~~and~~ the pre-Cambrian, is brought into contact with Carboniferous strata by the faulting which forms the graben. The hills of Brittany vary between 1100 & 1400 feet in height. The northern extensions is known as the Colentin Peninsula. The Loire is apparently an antecedent stream.

The Ardennes is the ~~northern~~ northwestern portion of the Slate Mts and was deformed in the Hercynian. The folding was very intense and involved Cambrian and later strata. One ~~coal~~ mine, for example, passes through the same bed 7 times.

Toulon or the Maures is a portion of the Tyrrhenian Massive which was broken up by faulting.

The Vosgis is a monoclinal mt. ~~This structure~~ The Schwarzwald is the other limb of the graben which found in the middle to form the Rhine graben. The Vosges were produced ~~as a result of~~ by the Hercynian deformation. ~~The is formed of Cambrian sediments~~ The ~~Carb~~ Upper Cambrian is exposed on the east and west ends of the Vosges. It is ~~badly~~ dominantly clastic and badly metamorphosed ~~Iron~~ There are no sediments in the Vosges from the Beckmantown to the Dev.

Geologic History

Though the Cambrian of France has not been worked out in detail ~~there~~ ~~there~~ it probably was affected by one or more periods of deformation. During the Early Paleozoic France was a basin of sedimentation. The coarse sediments of the Rutogne Massive, like those of Wales, indicate a highland to the west & south. The Vosges were either out of water and in the realm of wave activity from the Beckmantown to the Devonian.

~~Brittany was deformed by the American Branch of Hercynian folding, but~~ the American Branch of Hercynian ~~folding~~ deformation produced folds, some of which are close or even overturned, and faults in Brittany and also affected the western portion of the Central Upland. The Variscian Branch deformed the eastern portion of the Central Upland and the Vosges. The Ardennes were deformed by a branch of this same movement. ~~The~~ Pennsylvanian sediments in Basins on the Central Plateau indicate this

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Cambrian (fig 13)

	South Wales	North Wales	Malverns	Shropshire	Warwickshire	North-west Scotland
Basal Ordov. U.S.	Shumardia series	Tremadoc slates	Tremadoc slates	Gray shales	Shineton shales	
				Black shales		
	Olenus series	Lingula flags	Lingula flags		Stockingford	Durness lime-stone
	Paradoxides series	Menevian beds Solva beds	Menevian beds		shales	
			Harlech grits and Llanberis slates			
	Olenellus series	Caerfai beds		Hollybush sandstone	Comley con-glomerate, limestone, and sand-stone	Hartshill quartzite	Serpulite grit Fucoid beds Quartzites

Pre-Cambrian (fig 14)

Torridonian - Sedimentary
Pebidian or Uriconian - Volcanic
Lewisian or Hebridean - Gneissic

GROUND WATER SUPPLIES OF UPPER MISSISSIPPI BASIN IN ILLINOIS, IOWA, MINNESOTA, AND WISCONSIN

F. T. Thwaites

o

Gology of water supplies
- Surficial Deposits — ~~map of sand and gravel plains~~
- Bed rocks — map of top of St. Peter ✓ III ✓
- Discuss each group of rocks — " " granite ✓ I ✓
  - 2 cross sections ✓ II
  - geological column with remarks (table)

IV Distribution of flowing wells

Depletion of supplies
- Statement of problem
- Origin of waters — ~~map showing accumulated rainall deficienies~~
- Observations, construction of wells, etc.
  - Effect of recent drought

Quantities available — typical
- Data, table of specific capacities of wells if obtainable
- ~~map of area of flowing wells~~

hemical quality waters
- Table of typical ~~wells~~ from several districts, formations, etc.

✓ ~~VII~~ ~~IV~~ map of distr. of total mineralization
- ~~Section showing relation of mineralization to depth~~

Base exchange problem

Measures of conservation

~~III~~ ~~V~~
~~IV~~ A Recession of water at chicago
B composition of typical waters.

~~VII~~
VI Distribution of diff. kinds municipal supplies

- a soft water unfiltered
- water conn
- 2 sulphate
- 2 alkaline soft water
- saline water

Geological
Municipal well water supplies
219
Mineralization of ground water
in relation to geology
Figures are parts per million of total solids
B F woon
2-6 4 R
contours interval 500 ft
Buried-

Western Plateau.- The last marine sediments in this area are Ordovician. The Palaeozoics and some of the pre-Cambrian are horizontal Evidently some minor folding has occurred in this region since Ordovician times.

Interior Lowland.- This area was a part of the western plateau until the Jurassic although slight invasions of the Silurian and Devonian seas occurred on the east. This area was submerged from the Jurassic until post-Cretaceous time. In the late Tertiary a rift valley was formed in the south and the Murray Darling Basin and other parts of the area were depressed.

Eastern Highlands.- The rocks give evidence of pre-Cambrian deformation. Strong folding occurred at the end of the Ordovician and also affected the McDonnel Range of the western plateau. Deformation at the end of the Silurian continued into the Devonian and huge volumes of plutonic and volcanic rocks were poured forth. At the end of the Permo-Carboniferous it was again deformed. In the Tertiary vulcanism occurred along fracture lines in Victoria and New South Wales. Uplift occurred in the Miocene and also in the Pliocene.

Major Diastrophic Events

(1) Pre-Cambrian deformation

(2) Folding at end of Ordovician which affected Eastern Highlands and McDonnel Range

(3) Deformation which extended from the end of the Silurian into the Devonian and was accompanied by vulcanism - Eastern Highlands

(4) Depression of Interior Lowland in Jurassic

(5) Emergence of Interior Lowland in post-Cretaceous time

(6) Tertiary uplift or depression

Stratigraphy

Pleistocene and recent.- Glacial deposits and alluvium

Tertiary

Werrikoolan Series - Upper Pliocene

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X Weidman, Samuel, and Schultz, A. R., The underground and surface water supplies of Wisconsin: Wisconsin Geol. and Nat. Hist. Survey Bull. 35, 1915

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fluctuations of ground water

artesian pressure.

acidizing water wells.

Strong, Moses Geology of the [illegible] region [illegible] of the Wis. [illegible] Geol. of Wis. vol IV, pp 57-63, 1882

glacial origin.[1]" These beds may be of Cambrian age although none of the beds yields any positive evidence.

In Cambrian time a sea advanced from the Kimberley District in northwestern Australia and spread into New South Wales and Victoria. The Ordovician Sea extended beyond the limits of the Cambrian. There is no evidence that the Dividing Range was in existence at this time, but it came into existence at the close of the Ordovician.

The Silurian Sea came from the south and reached the Broken Hill district. It is known to have covered Tasmania and the western part of South Island. Orogenic movement occurred at the end of this period. The Devonian Sea spread as arms in the depressions produced by the Silurian deformation and was more restricted than the Silurian. In New South Wales there are deposits of radiolaria. At this time great volumes of plutonic rocks were poured forth. The Permo-Carboniferous is continental in Australia. At the end of this period the Eastern Highlands were again deformed.

The Jurassic Sea came in from the north and spread over the Interior Lowland as far south as Lake Torrens. This submergence continued until post-Cretaceous times.

In the late Tertiary Faulting produced the Great Valley of South Australia and the Basin of the Murray River, Bass Strait, and the Tasman Sea foundered.

Australia was separated from thntact with other land areas in the Cretaceous. The fauna of Australia is Mesozoic. It is true, however, that some Tertiary birds did get into this region.

---

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Dakota is for our western plains.

It is interesting to note how near the east coast the Darling River rises. This is due to the structural depression immediately west of the Great Dividing Range.

The western plateau is a very old area. The mountains, however, rise several thousand feet above the general level and are either horsts or monadnocks. It has a characteristic desert topography.

The coastal plains are very narrow and occur on downdropped blocks along the west coast and also in the Eucla district.

Australia is bounded by faults and is in reality a large horst.

Structural Trends

There are two main structural trends in Australia: Gondwand and Himalayan. The northwest-southeast Gondwana trend can be found in the western plateau, the South Australia Highlands, and Tasmania. The trends of the Great Dividing Range are also Gondwana. The Himalayan folds, in which four trends have been worked out, wrap around Australia. South Island (New Zealand) has a northeast-southwest trend and North Island has this and also a northwest-southeast trend.

Geologic History

Australia seems to have a basal complex of gneisses and granites which corresponds to our Laurentian and an overlying complex of schistose rocks, quartzites, marbles, phyllites which corresponds to our Huronian. and is called the Mosquito Creek Series.

The basal conglomerate of the Nullagine System which has been compared to the Transvaal System of South Africa and the Cuddapah of India "hontains flattened and striated pebbles, and may be of

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AUSTRALIA

Physiography

Australia may be divided into three major and a minor physiographic divisions: (1) Eastern Highlands or Great Dividing Range, (2) Interior Lowland, (3) Western Australia, and (4) Coastal Plains.

The Eastern Highlands have a structural trend roughly parallel to the east coast of Australia and extend from Tasmania to Cape York. They are not very wide and are the stumps of old mountains which have been elevated by epeirogenic uplift. When Dr. Andrews was here last fall, he pointed out the level tableland at the summit and also the canyons which headed in these mountains.

The Interior Lowland extends from a line which runs from western Tasmania to central Queensland westward to the plateau of western Australia. This lowland may be divided into four parts (1) northern division which extends from the Gulf of Carpentaria south to Lake Torrens, (3) Murray-Darling Basin, South Australian Highlands, and (4) Rift Valley which includes Lake Eyre and Spender's Gulf.

The northern part has a broad, flat, monotonous topography. The Murray-Darling Basin is structural and contains continental Tertiary sediments. Uplift of the South Australian Highlands apparently took place in the late Miocene. The Great Valley of South Australia (rift valley) was formed in the late Tertiary.

The Interior Lowland is floored by sediments which range in age from Jurassic to recent. The ~~Rolling Downs of Lower~~ Artesian Series Cretaceous age is the great reservoir for this area just as the Jurassic

A STUDY

of

WATER RESOURCES

in

ILLINOIS

ILLINOIS STATE PLANNING COMMISSION
1934

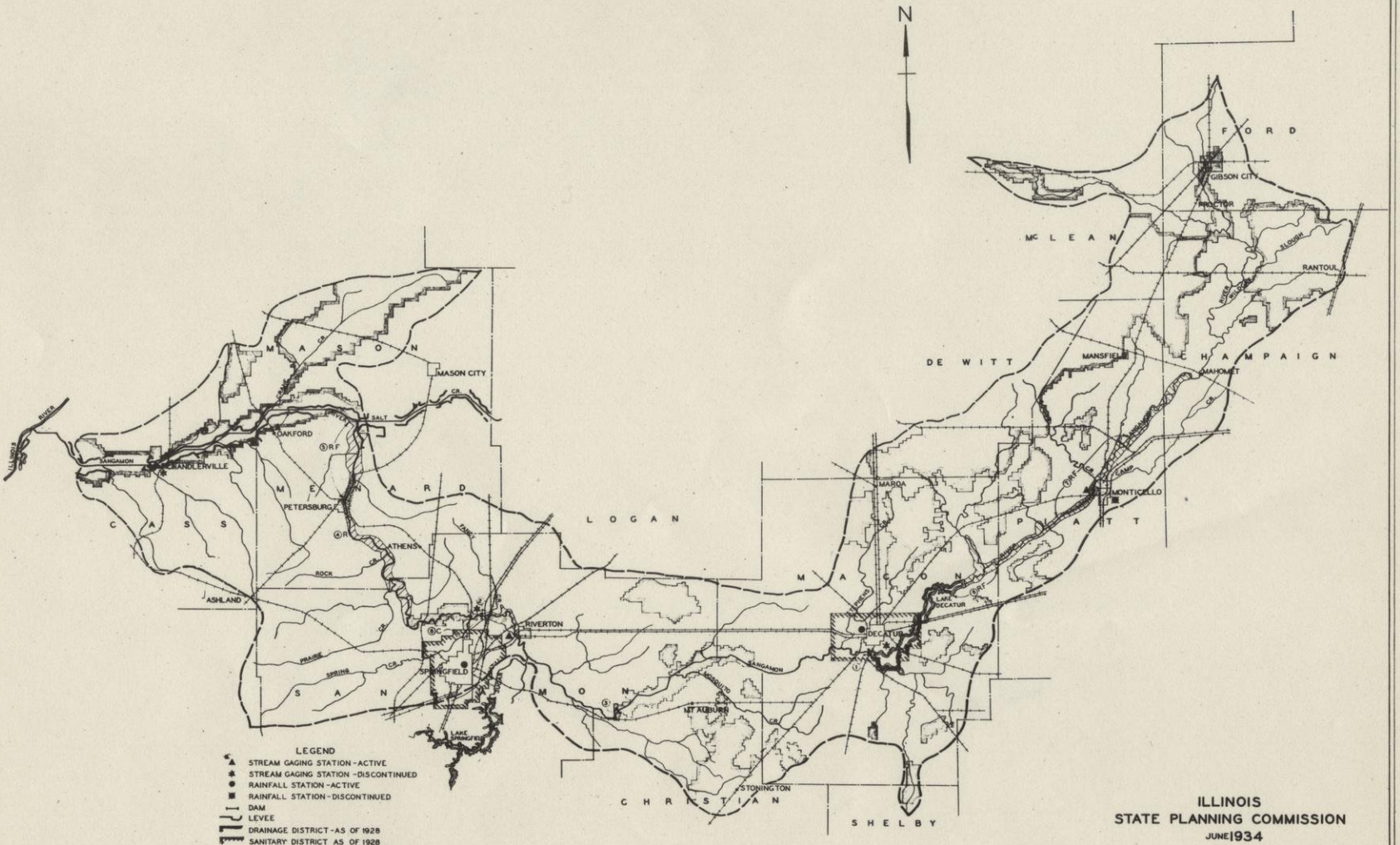
Robert Kingery
Chairman

Henry L. Kellogg
State Planning Engineer

H. E. Hudson
Chief of Staff

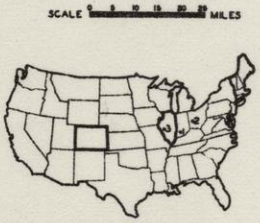
SANGAMON RIVER WATERSHED

The map of the Sangamon River Watershed is typical of the kind of intensive study each of the 28 watersheds in the state is receiving. This map and the data sheets which have been prepared to accompany it, graphically illustrate the physical characteristics, existing improvements and other pertinent information necessary in the study of land use or improvements which have been or might be recommended.


N
FORD
GIBSON CITY
PROCTOR
McLEAN
RANTOUL
DE WITT
CHAMPAIGN
MANSFIELD
MAHOMET
MASON
MASON CITY
SALT
OAKFORD
SANGAMON
CANDLERVILLE
MENARD
PETERSBURG
CASS
ATHENS
ROCK
ASHLAND
LOGAN
MACON
MAROA
MONTICELLO
PIATT
LAKE DECATUR
RIVERTON
DECATUR
SPRINGFIELD
PRAIRIE
SPRING
SANGAMON
MOULTRIE
MT AUBURN
LAKE SPRINGFIELD
SAN
MON
STONINGTON
CHRISTIAN
SHELBY
LEGEND
STREAM GAGING STATION - ACTIVE
STREAM GAGING STATION - DISCONTINUED
RAINFALL STATION - ACTIVE
RAINFALL STATION - DISCONTINUED
DAM
LEVEE
DRAINAGE DISTRICT - AS OF 1928
SANITARY DISTRICT AS OF 1928
BOTTOM LAND SUBJECT TO OVERFLOW
R STATE RECREATION AREA - EXISTING
RF STATE RECREATION AREA - FUTURE
C STATE CONSERVATION AREA - EXISTING
STREAM POLLUTION
NOTE:- NUMBERS, WITHIN CIRCLES, REFER TO DESCRIPTIVE SYNOPSIS OF WATERSHED
ILLINOIS
STATE PLANNING COMMISSION
JUNE 1934
WATERSHED MAP OF THE
SANGAMON RIVER
SCALE 0 5 10 MILES
1934

ILLINOIS
STATE PLANNING COMMISSION
JUNE 1934

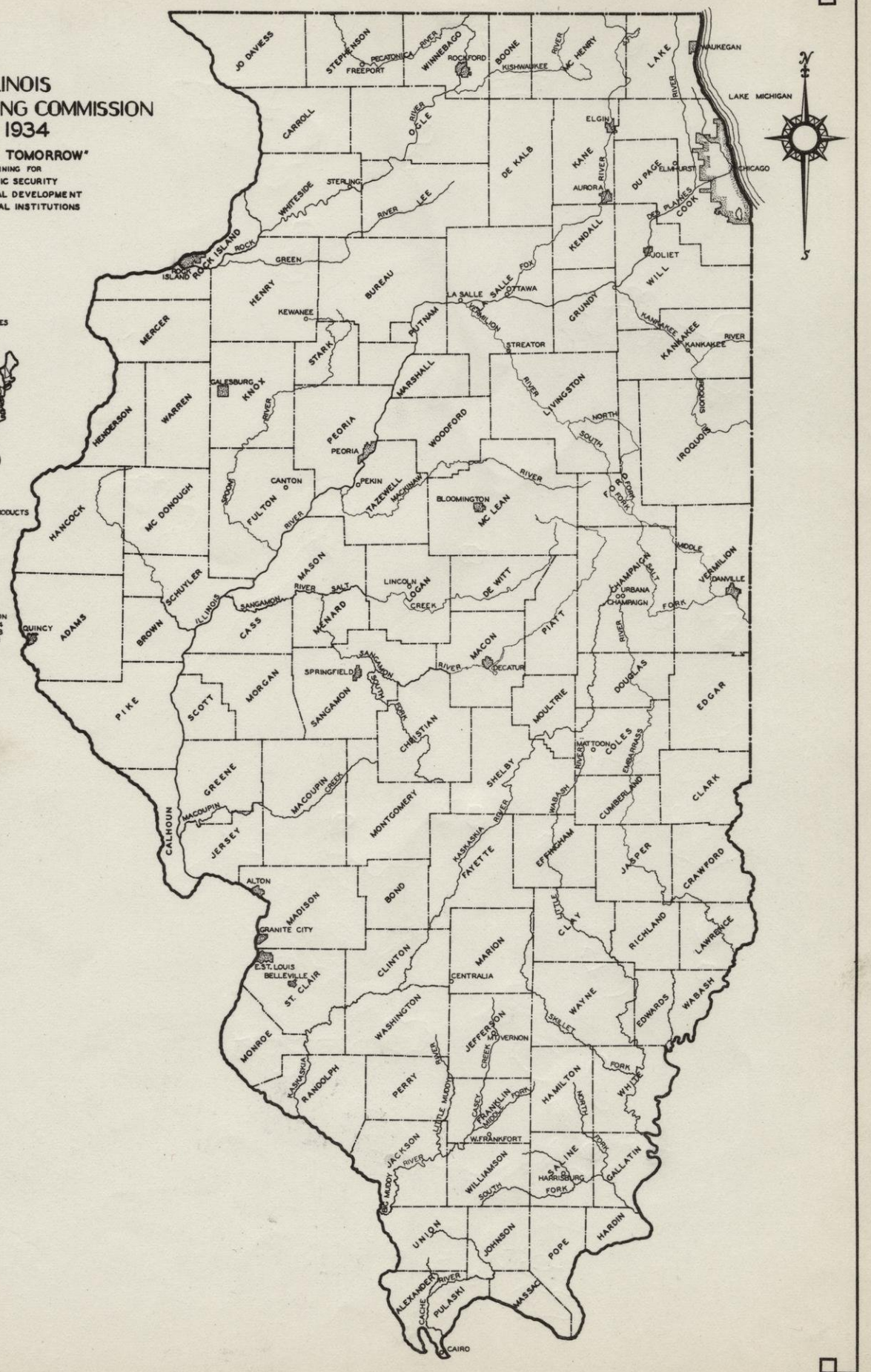
"ILLINOIS TOMORROW"
PLANNING FOR
ECONOMIC SECURITY
WISE PHYSICAL DEVELOPMENT
SOUND SOCIAL INSTITUTIONS



ECONOMIC CENTERS OF THE UNITED STATES
1. POPULATION
2. MANUFACTURES-VALUE OF PRODUCTS
3. GROSS FARM INCOMES

SIZE OF ENGLAND
POPULATION-37,932,000

	SQ. MILES	POPULATION
ILLINOIS	56,665	7,630,654
NEW ENGLAND STATES	61,459	6,552,438
COLORADO	103,948	1,035,791



FROM RELIEF MAP ILL. AGRICULTURAL EXP. STATION

MEMO TO
COL. KELLOGG:

March 31, 1934

WATER RESOURCES AND THEIR UTILIZATION

Water Supply & Sewerage:

A. Water Supply:

1. We have a map showing water sources by classes and geographic distribtuion.
2. Several metropolitan water districts in sketch form.
3. Descriptive copy.

B. Sewerage:

1. We have a map showing location of municipal stream pollution.
2. Tabulation of pollution source.
3. Tabulation of sewage works.
4. Tables showing sewages works progress.
5. Diagram of organization and administration for pollution control.
6. Diagram for sewage treatment.
7. Tabulations and curves for all stream gaging station records in Illinois.

Mr. H. F. Ferguson has about completed the following tabulations for us:

1. Table showing presence or absence of sewerage and water supply for every city in the state.
2. Table showing class, source, etc., on every public water supply.
3. Table showing type, number of outlets, etc., for every sewerage system.
4. Table showing extent of sewer systems composed wholly of farm tile.
5. Table of existing sewage works with remarks as to adequacy, etc.

Group 4-D-I April 2, 1934

WATER RESOURCES AND THEIR UTILIZATION

I - Flood and Flow Control

Referring to pages 5 and 6 of the "Outline of Survey Program," dated March 13, 1934:

(a) Drainage Basin Maps.

The 40 basic maps on tracing cloth for the 28 watersheds have been completed with regard to main streams and branches, the more important towns, and railroads. The platting of the drainage and levee and sanitary district locations is about 50% complete. The other items called for on the list have not yet been incorporated on the maps, but the data therefor are available. (Watershed synopses in files.)

(b) Drainage Basin Statements. (Water shed synopses)

Preliminary typewritten drafts for all 28 watersheds have been prepared and are in process of revision.

(c) Hydrographs and Duration Records.

Complete hydrographs for 11 gaging stations have been prepared in pencil and are ready for inking. A descriptive outline, with explanatory data and notes for each of these 11 gaging stations has been completed through the year 1923. It will be necessary to complete these pertinent notes (from U.S.G.S. Water Supply papers) for the years succeeding 1923.

Forty-seven duration curves have been prepared (in pencil) and are in process of inking.

(e) Summary of Flood and Flow Control Problems, with State and local maps.

An outline of the major city flood situations in the State and a statement on overall flood and flow control planning are in process of preparation. This work to date consists largely of data collection and no conclusions have been expressed. No information has yet been forthcoming relative to the possible abandonment or repair of levee districts, our contacts through the Agricultural College at Urbana, the land bank at St. Louis, the proposed survey by Professors Leighton and Pickels, and the Division of Waterways having resulted in no tangible data up to the present.

In addition to the objectives above, as defined in the "Outline of Survey Program," the following work has been in preparation:

1. A tabulation has been made of stream gaging references for Illinois streams. This is in readiness for setting up in type or putting in tracing form.

2. A bibliography of publications relating to the Illinois flood and stream control situation has been in process of preparation. This is about 65% complete.

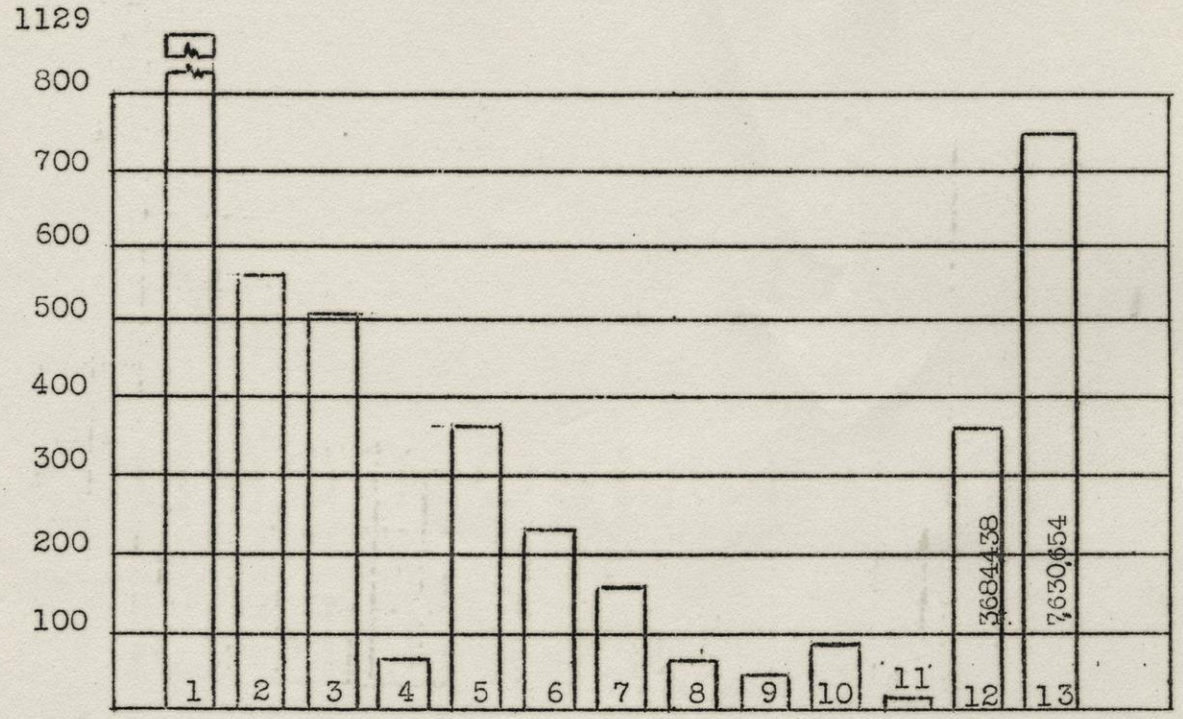
3. A set of maps and questionnaires were prepared for contacting the Agricultural and Conservation Department representatives regarding drainage and levee districts. These have not been sent out to date, but are ready. The stencils for the questionnaires are attached to this memorandum; the maps are in the Division #4 file.s.

There are various publications, reports, maps, and other information in the files which have been collected in the past three months and which are requisite in the completion of our report and maps.

(Signed) A. N. Wardle
Supervisor
Divicion # 4
Stream Control

PUBLIC WATER SUPPLIES IN ILLINOIS

Look at the numbered bars and then the corresponding numbered sentences below



1. There are 1129 municipalities in the state of Illinois
2. Of these, 560 have public water supplies;
3. But 504 have no municipal supply watever.
4. However, 65 have proposed to develop supplies with the aid of the PWA or other agencies.
5. Of the 560 which have public supplies, 398 get their water from wells,
6. And 232 of these wells are in rock,
7. Whereas 166 are in glacial drift.
8. Then, 66 municipalities pipe their supplies from neighboring towns.
9. Chicago supplies water to 32 municipalities with a total population of some 310,000 persons outside the city of Chicago. East St. Louis supplies 16 other towns.
10. Again, 84 municipal supplies are derived from surface waters, 73 of which have water filtration plants.
11. Only 12 municipalities have spring water supplies.
12. If we consider Item 9 from the standpoint of population, we find that Chicago and the 32 cities which it supplies comprise 3,684,438 persons,
13. Which is more than 48% of the state's population of 7,630,654.

ILLINOIS
STATE PLANNING COMMISSION
JUNE 1934

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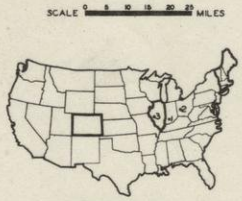
ILLINOS WATER SUPPLIES

GEOGRAPICAL DISTRIBUTION OF PRINCIPAL TYPES



ECONOMIC CENTERS OF THE UNITED STATES
1. POPULATION
2. MANUFACTURES-VALUE OF PRODUCTS
3. GROSS FARM INCOMES

SIZE OF ENGLAND
POPULATION-37,932,000

	SQ.MILES	POPULATION
ILLINOIS	56,665	7,630,654
NEW ENGLAND STATES	61,459	6,552,438
COLORADO	103,948	1,035,791

LEGEND

TYPES
- ROCK WELL
- DRIFT WELL
- SURFACE WATER SUPPLY
- SPRINGS
- TREATED SUPPLY

GEOGRAPHICAL DISTRIBUTION
- ROCK WELLS
- DRIFT WELLS
- SURFACE SUPPLIES

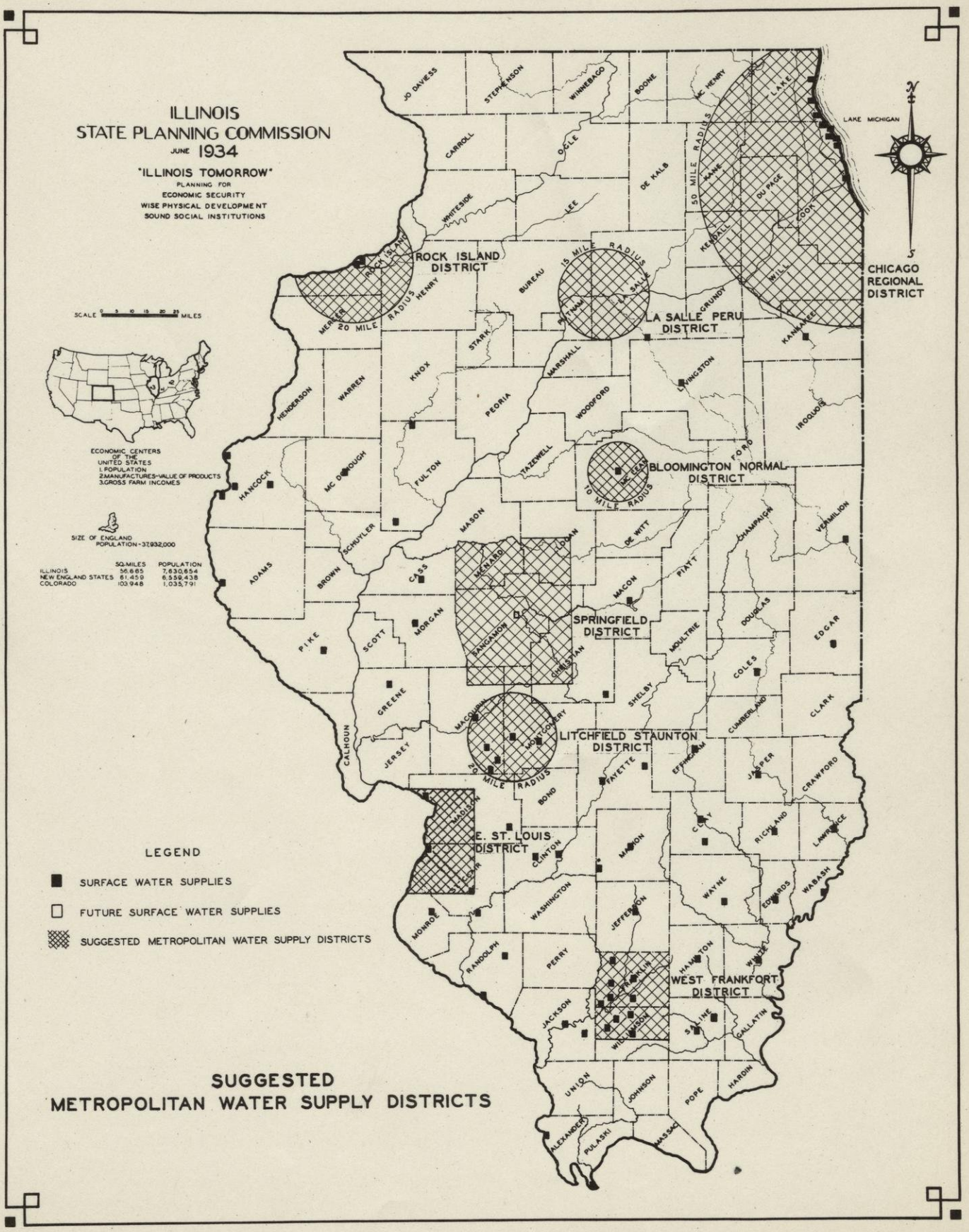
DATA FROM:
H.F.FERGUSON — CHIEF ENGINEER,
DIVISION OF SANITARY ENGINEERING,
ILLINOIS DEPARTMENT OF PUBLIC HEALTH

METROPOLITAN WATER DISTRICTS

Since so many smaller communities receive their water supplies from large neighboring systems, the question is asked: "Why not district supplies all through the state?" In other words, would it not be economically justifiable to spend considerable sums in developing what might be called "metropolitan" systems? It is probably generally true that small municipal water plants are inferior to large installations. Metropolitan district plants demand the best not only in equipment and service but also personnel.

The map showing the geographical distribution of the types of water supplies indicates how clearly cut are the natural lines separating the different kinds of supply: that municipalities in the same type region will have practically identical problems. Knowing that, it is much simpler to talk of metropolitan districts. A map produced herewith shows where such districts might be justifiable.

As an indication of how a district supply would affect a metropolitan area, the map of the La Salle-Peru region has been prepared. This is a typical study of the possibilities of combining a number of small systems or creating an entirely new one, thereby eliminating duplication of costly supervision and administration expense.


ILLINOIS
STATE PLANNING COMMISSION
JUNE 1934
"ILLINOIS TOMORROW"
PLANNING FOR
ECONOMIC SECURITY
WISE PHYSICAL DEVELOPMENT
SOUND SOCIAL INSTITUTIONS
SCALE 0 5 10 15 20 25 MILES
ECONOMIC CENTERS OF THE UNITED STATES
1. POPULATION
2. MANUFACTURES-VALUE OF PRODUCTS
3. GROSS FARM INCOMES
SIZE OF ENGLAND
POPULATION - 37,932,000
SQ. MILES POPULATION
ILLINOIS 56,665 7,630,654
NEW ENGLAND STATES 61,459 6,552,438
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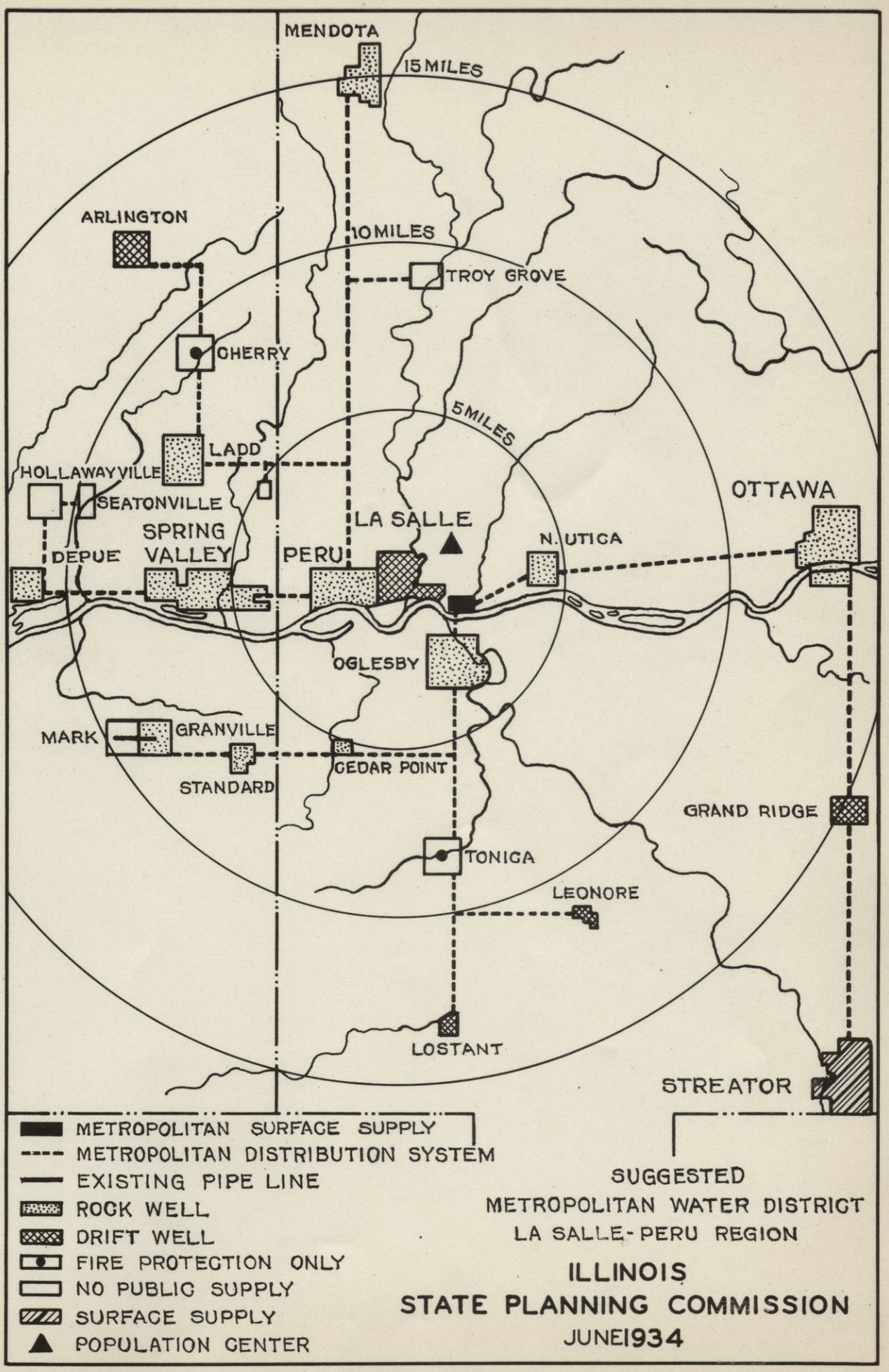
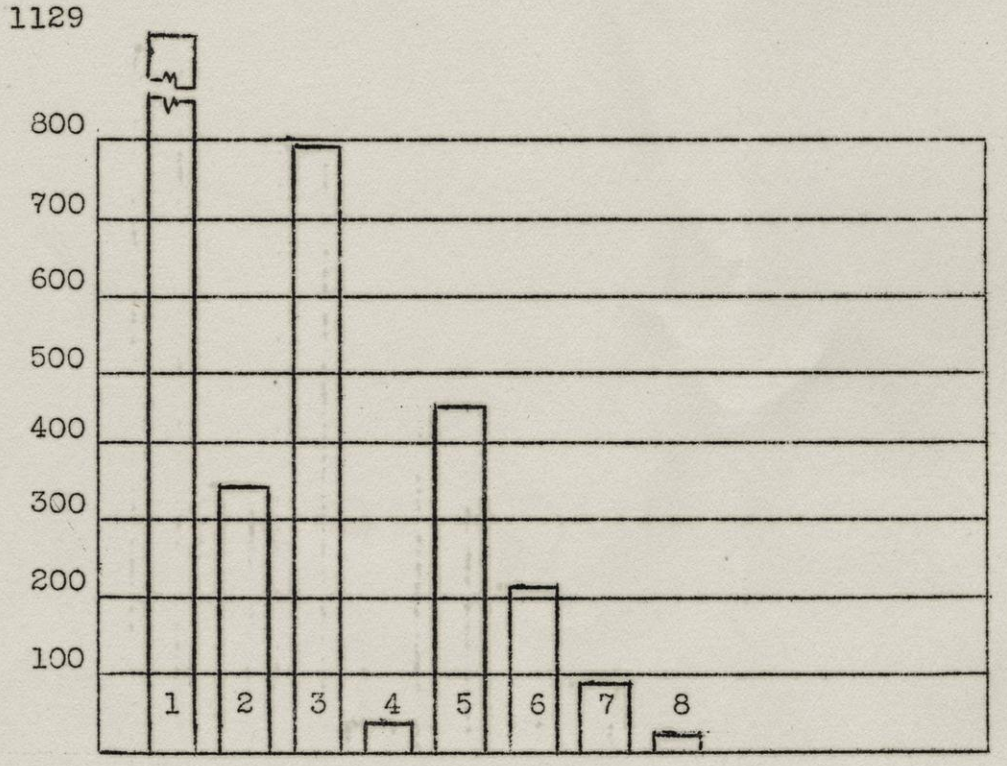
LEGEND
SURFACE WATER SUPPLIES
FUTURE SURFACE WATER SUPPLIES
SUGGESTED METROPOLITAN WATER SUPPLY DISTRICTS
ROCK ISLAND DISTRICT
LA SALLE PERU DISTRICT
BLOOMINGTON NORMAL DISTRICT
SPRINGFIELD DISTRICT
LITCHFIELD STAUNTON DISTRICT
E. ST. LOUIS DISTRICT
WEST FRANKFORT DISTRICT
CHICAGO REGIONAL DISTRICT
LAKE MICHIGAN
50 MILE RADIUS
20 MILE RADIUS
15 MILE RADIUS
10 MILE RADIUS
SUGGESTED
METROPOLITAN WATER SUPPLY DISTRICTS


MENDOTA
15 MILES
ARLINGTON
10 MILES
TROY GROVE
CHERRY
5 MILES
LADD
HOLLAWAYVILLE
SEATONVILLE
OTTAWA
LA SALLE
SPRING VALLEY
N. UTICA
DEPUE
PERU
OGLESBY
MARK
GRANVILLE
CEDAR POINT
STANDARD
GRAND RIDGE
TONICA
LEONORE
LOSTANT
STREATOR
METROPOLITAN SURFACE SUPPLY
METROPOLITAN DISTRIBUTION SYSTEM
EXISTING PIPE LINE
ROCK WELL
DRIFT WELL
FIRE PROTECTION ONLY
NO PUBLIC SUPPLY
SURFACE SUPPLY
POPULATION CENTER
SUGGESTED
METROPOLITAN WATER DISTRICT
LA SALLE-PERU REGION
ILLINOIS
STATE PLANNING COMMISSION
JUNE 1934

MUNICIPAL SEWER SYSTEMS IN ILLINOIS

Look at the numbered bars, and then the corresponding numbered sentences below.



1. There are 1129 municipalities in the state of Illinois.

2. Of this number, 343 have sewer systems

3. But 786 have no systems recognized as such by the State Sanitary Water Board.

4. However, 28 have taken steps to prepare some sort of proposal.

5. Of the 786 municipalities having no systems, 450 have less than 500 population;

6. And 215 have a population of between 500 and 1000;

7. Then 80 others have populations between 1000 and 2000,

8. And 13 have populations between 2000 and 3000.

STREAM POLLUTION IN ILLINOIS

There are 202 recorded polluters of Illinois streams. The geographical distribution of these polluters is shown on the "Map of Illinois Stream Pollution Areas." Of the 202 polluters 74 have plants which need rehabilitation, additions or betterments; 54 polluters have applied for PWA funds with which to build sewage-works. Urgent pollution abatement is needed in 40 cases, and in 24 cases of pollution, abatement is recommended primarily to clean the Illinois River —— in other words for esthetic reasons.

Stream pollution, whether it results from domestic sewage or trade wastes, admittedly needs general elimination or abatement. State planning toward this objective does not contemplate absurd perfection. Whether the objective of pollution abatement is the elimination of a public menace or nuisance, clarification of streams to support fish and plant life, or simply the removal of unsightly areas, cost and feasibility must always be fundamental considerations. What is wanted are clean

streams — made so without the imposition of too great a burden on either individual, municipality or industry.

To make pollution abatement effective it must be a regularly organized and administered state function. Two charts — one organization set-up; the other administrative — are reproduced herewith. These charts embody what are believed to be sound suggestions as to how stream pollution can be controlled.

ILLINOIS
STATE PLANNING COMMISSION
JUNE 1934

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ILLINOIS STREAM POLLUTION AREAS

ECONOMIC CENTERS OF THE UNITED STATES
1. POPULATION
2. MANUFACTURES-VALUE OF PRODUCTS
3. GROSS FARM INCOMES

SIZE OF ENGLAND
POPULATION-37,932,000

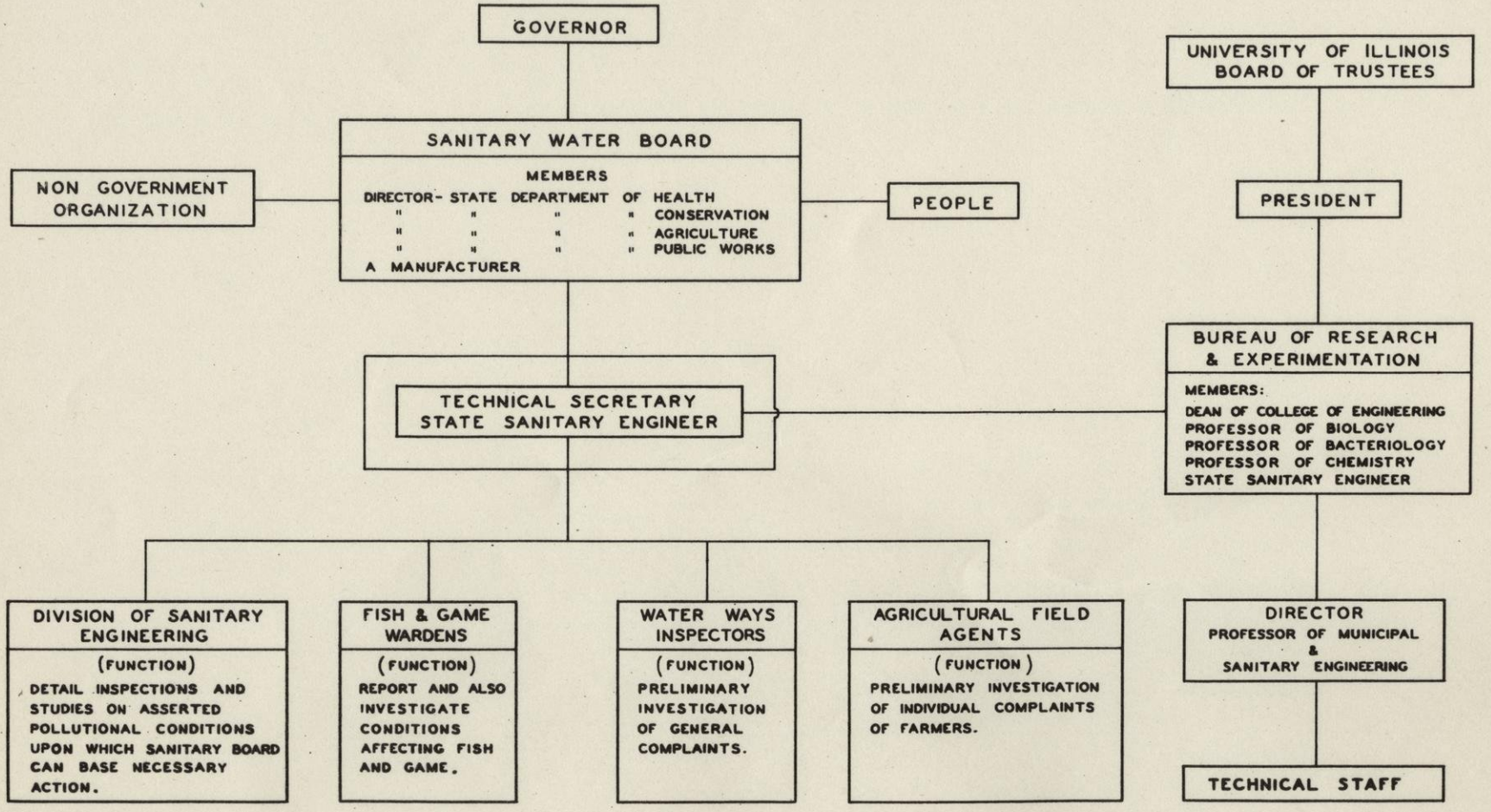
	SQ.MILES	POPULATION
ILLINOIS	56,665	7,630,654
NEW ENGLAND STATES	61,459	6,559,438
COLORADO	103,948	1,035,791

LEGEND

- POLLUTION AREA WITHOUT TREATMENT WORKS
- POLLUTION AREA WITH TREATMENT WORKS IN NEED OF IMPROVEMENTS
- POLLUTION AREA TAKING STEPS TOWARD BETTERMENT

DATA FROM:
H.F. FERGUSON—CHIEF ENGINEER
DIVISION OF SANITARY ENGINEERING,
ILLINOIS DEPARTMENT OF PUBLIC HEALTH,
PUBLIC WORKS ADMINISTRATION PROJECT LIST

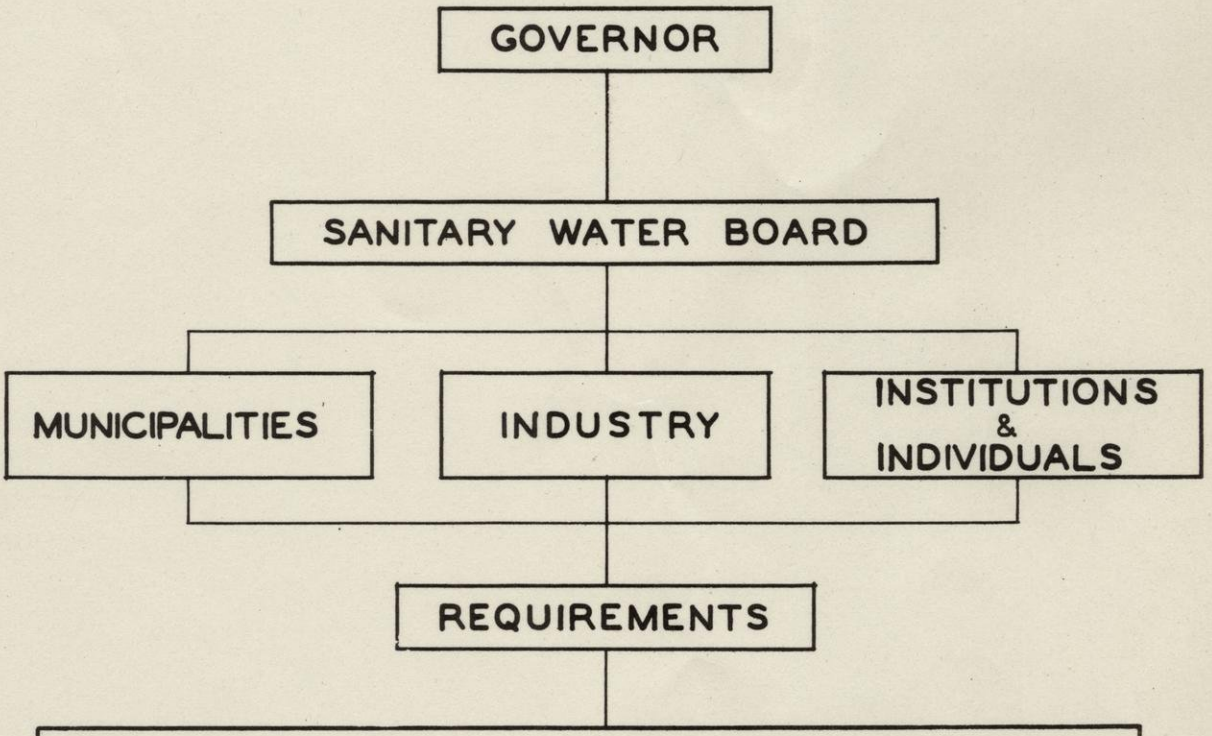
ORGANIZATION CHART
FOR POLLUTIONAL CONTROL



ILLINOIS STATE PLANNING COMMISSION

JUNE 1934

ADMINISTRATIVE CHART
FOR POLLUTIONAL CONTROL



SUBMIT

"A" PRELIMINARY PLANS AND ESTIMATES ON ENGINEERING SURVEY FOR SOLUTION OF SEWERAGE PROBLEM.

"B" CONSTRUCTION PLANS AND SPECIFICATIONS FOR SELECTED OR APPROVED PROJECT AND SECURE PERMIT FOR CONSTRUCTION AND OPERATION.

"C" OPERATION RECORDS.

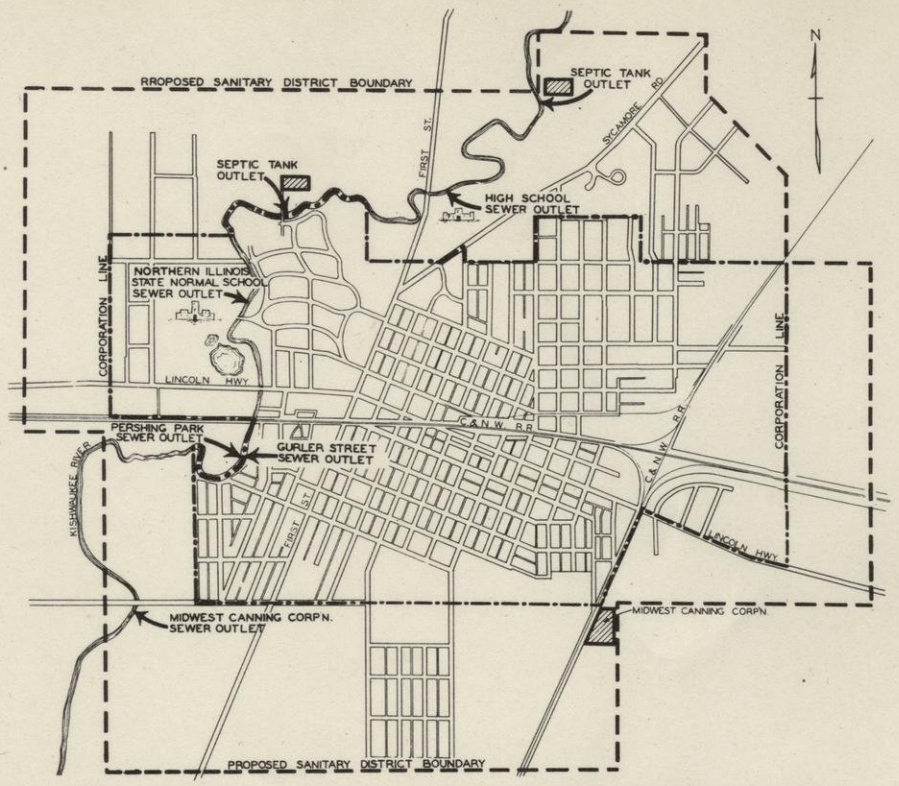
"D" TO COOPERATE WITH STATE ENGINEERS WHEN PERIODIC OPERATION CHECKUP IS MADE.

ILLINOIS STATE PLANNING COMMISSION
JUNE 1934

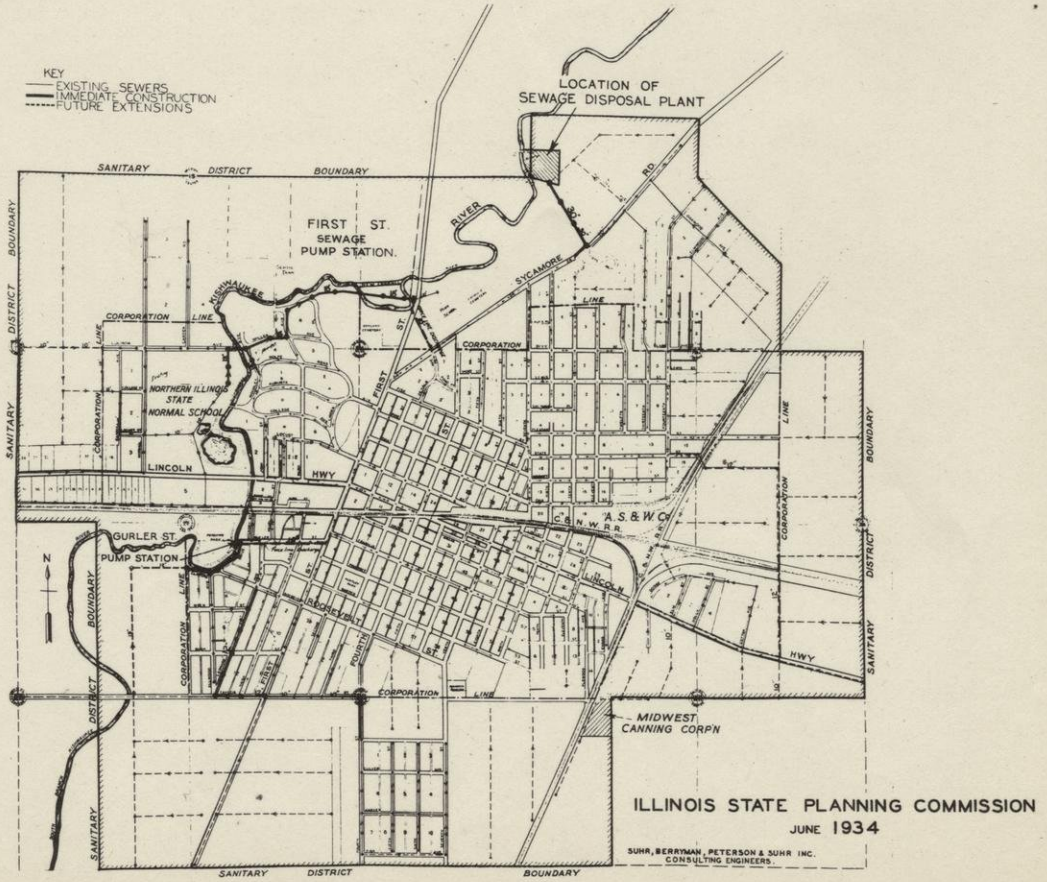
THE VALUE OF THE SANITARY DISTRICT LAW

Cities often may have stream pollution areas or sources of sewage nuisances just outside their corporate limits. These nuisance sources may be industrial plants, or institutions housing many persons.

Through the creation of a sanitary district, made possible by the 1917 act, the sanitary requirements of the whole area can be met. What this actually amounts to is graphically shown in the map of DeKalb, Illinois. One map shows what the city of DeKalb faced before the sanitary district was formed. The other map shows how the sewage-disposal problems for the whole area were solved through creation of the sanitary district.



HERE ARE SEVEN MAJOR POINTS OF POLLUTION IN THE DEKALB AREA.
A SERIOUS MENACE TO THE HEALTH OF THE COMMUNITY.



WHAT THE DEKALB SANITARY DISTRICT DID FOR THIS AREA IS WHAT OTHER COMMUNITIES CAN DO TO CORRECT SIMILAR OFFENSIVE CONDITIONS.

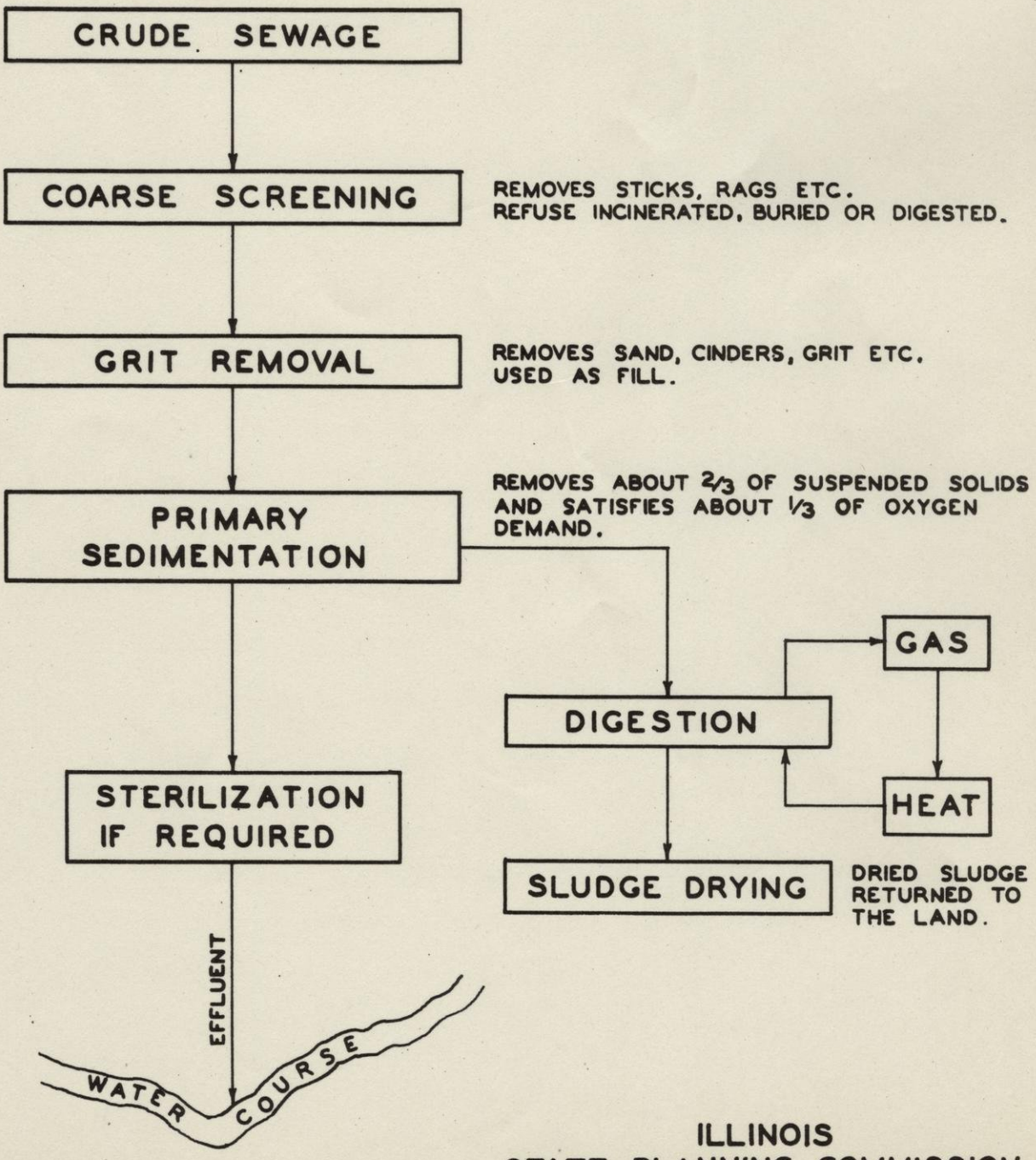
SEWAGE-TREATMENT PRACTICE

Municipalities without sewage-treatment works often balk at constructing them because of the costs involved. However, there are various degrees of treatment, and when a city merely begins to remove dirt, grit, rags, sticks, etc., from its raw sewage, the first step in pollution control has been taken.

Two diagrams are reproduced in the following pages to show what is done (1) to accomplish partial sewage treatment and (2) to obtain complete treatment wherein from 85 to 95 per cent of the suspended solids are removed, and the same percentage of total oxygen demand is met. Sterilization of the effluent to eliminate pollution entirely is the last step in complete treatment.

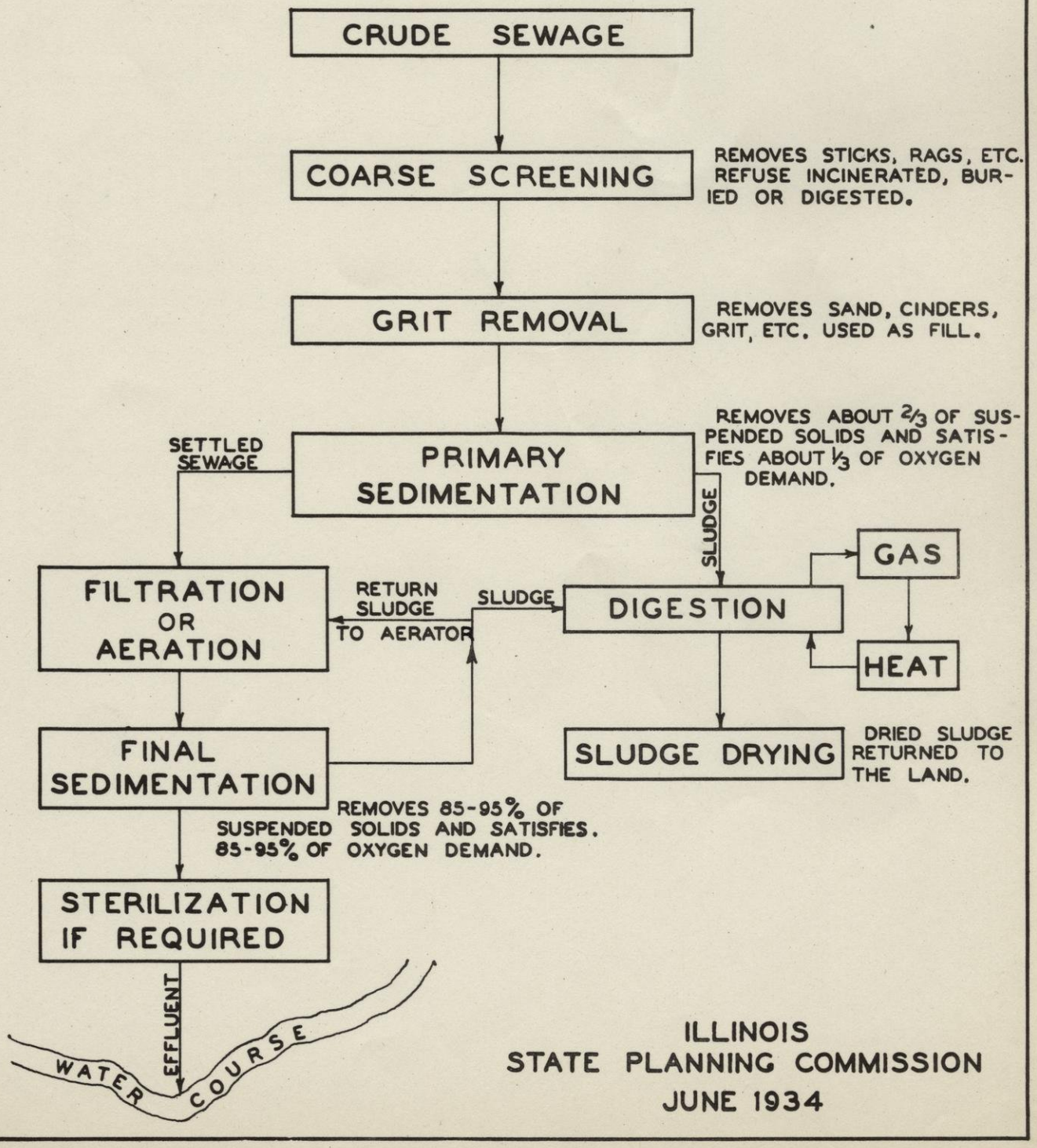
Cities, then, who can afford to go only part way should become acquainted with all the steps toward complete treatment, fitting the treatment to the money available. What these successive steps are, the two following diagrams explain.

DIAGRAM OF PARTIAL SEWAGE TREATMENT AS COMMONLY PRACTICED IN ILLINOIS



ILLINOIS
STATE PLANNING COMMISSION
JUNE 1934

DIAGRAM OF COMPLETE SEWAGE TREATMENT AS COMMONLY PRACTICED IN ILLINOIS



ILLINOIS
STATE PLANNING COMMISSION
JUNE 1934

FLOW DURATION RECORDS

Steam gaging has many uses. Knowledge of maximum and average flows is required to determine watershed yields upon which are based water-supply studies, waterpower resources, etc. Minimum flow records are extremely valuable in determining the need for artificial sewage treatment to prevent depletion of oxygen in the stream. High flow records are the bases upon which flood-control or prevention works are designed. On the chart "Flow Duration Records" data covering 51 Illinois gaging stations are tabulated, and are the record of maximum and minimum flows for only 20 of the 28 rivers and streams of the state. The periods of record of the several gaging stations show how spotty and lacking in continuity most of the flow records are. It is obvious that what is needed are more gaging stations continuously operated so that long-time flow records on all our streams will be made available.

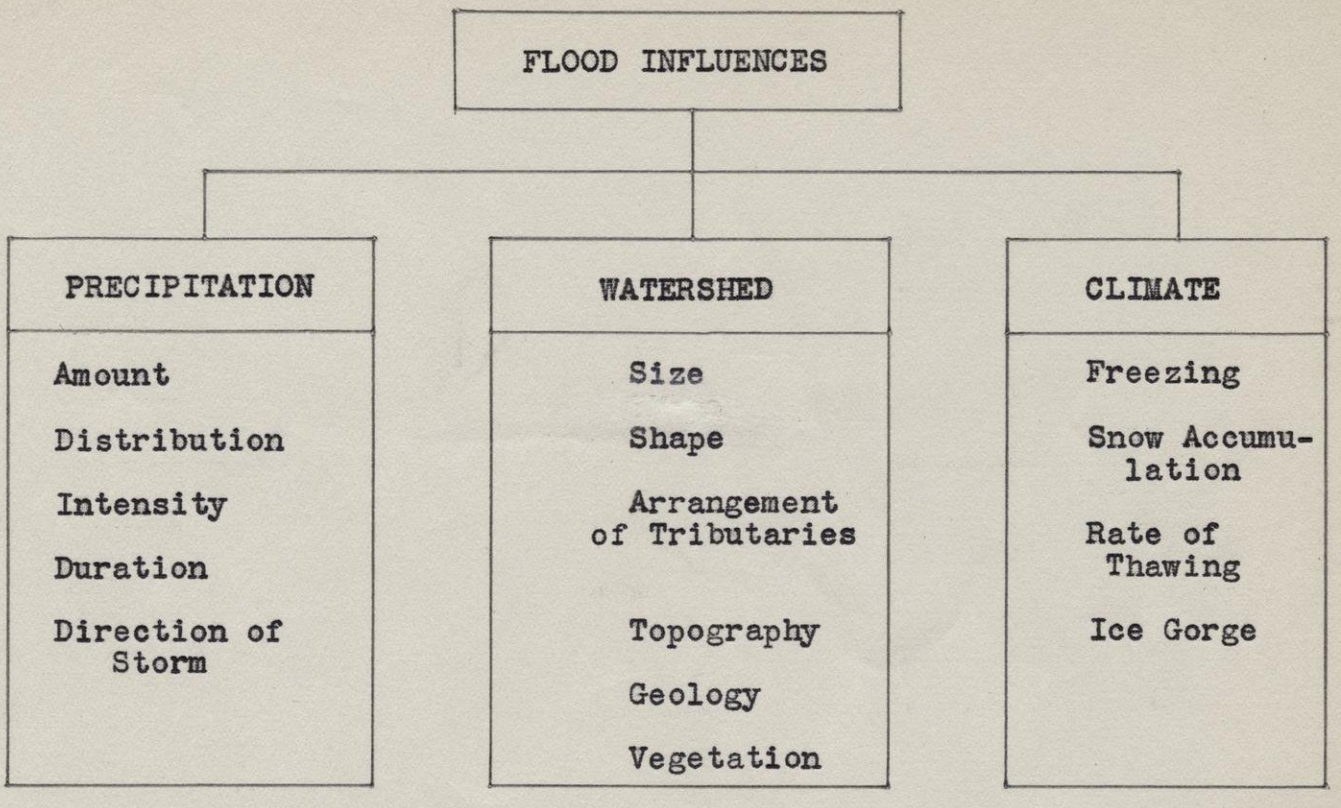
FLOW DURATION RECORDS

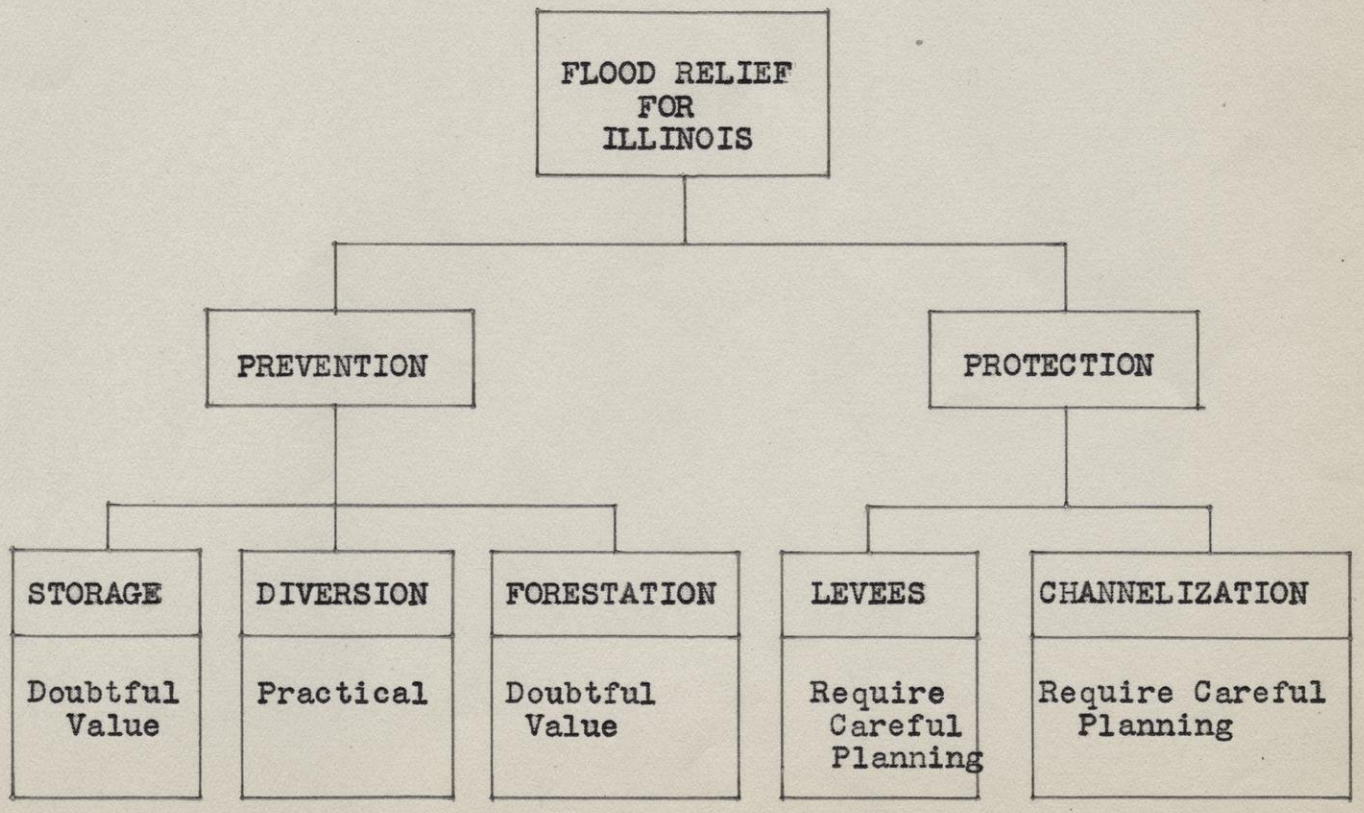
ILLINOIS GAGING STATIONS

ILLINOIS STATE PLANNING COMMISSION JUNE 1934

DATA FROM: UNITED STATES GEOLOGICAL SURVEY.

GAGING STATION	PERIOD OF RECORD USED	DRAINAGE AREA IN SQ. MI.	MAXIMUM FOR PERIOD C.F.S.	MINIMUM FOR PERIOD C.F.S.	95% OF TIME		90% OF TIME		80% OF TIME		70% OF TIME		60% OF TIME		50% OF TIME		40% OF TIME		30% OF TIME		20% OF TIME		10% OF TIME		5% OF TIME	
					C.F.S.	C.F.S. PER SQ. MI.	C.F.S.	C.F.S. PER SQ. MI.	C.F.S.	C.F.S. PER SQ. MI.	C.F.S.	C.F.S. PER SQ. MI.	C.F.S.	C.F.S. PER SQ. MI.	C.F.S.	C.F.S. PER SQ. MI.	C.F.S.	C.F.S. PER	C.F.S.	C.F.S. PER SQ. MI.	C.F.S.	C.F.S. PER SQ. MI.	C.F.S.	C.F.S. PER SQ. MI.	C.F.S.	C.F.S. PER SQ. MI.
1. BEAUCOUP CREEK near PINCKNEYVILLE-ILL.	3.9 YRS. 1909-1912-Incl.	227	2170	0.6	1.5	0.007	2	0.009	3.5	0.02	5	0.02	9	0.04	16	0.07	27	0.12	48	0.21	95	0.42	320	1.41	910	4.01
2. BIG MUDDY RIVER near CAMBON-ILL.	3.75 YRS.-1909-1912-Incl.	735	11,000	0	3	0.004	6	0.008	17	0.02	29	0.04	56	0.08	88	0.12	172	0.23	325	0.44	700	0.95	2,270	3.09	4000	5.44
3. BIG MUDDY RIVER at PLUMFIELD-ILL.	19 YRS. 1915-1933-Incl.	753	16,300	0	3	0.004	5	0.007	11	0.02	23	0.03	47	0.06	100	0.13	229	0.30	540	0.72	1,150	1.53	2,260	3.0	3,890	5.16
4. BIG MUDDY RIVER at MURPHYSBORO-ILL.	3 YRS. 1931-1933-Incl.	2170	28,600	1	20	0.009	30	0.01	49	0.02	82	0.04	155	0.07	265	0.12	600	0.28	1,250	0.58	2,680	1.19	6,230	2.87	9,800	4.51
5. CACHE RIVER at FORMAN-ILL.	10.5 YRS. 1923-1933-Incl.	240	9,030	0	1	0.004	3	0.01	8	0.03	21	0.09	51	0.21	110	0.46	190	0.79	325	1.35	540	2.25	925	3.85	1,460	6.08
6. CAHOKIA CREEK near POAG-ILL.	2 YRS. 1910-1911-Incl.	259	3,600	2	10	0.04	16	0.06	26	0.10	37	0.14	47	0.18	59	0.23	72	0.28	100	0.39	172	0.66	410	1.58	1160	4.5
7. DES PLAINES RIVER at JOLIET-ILL.	16.4 YRS. 1915-1931-Incl.	Indeterminate	18,400	No Record	7,030		7.300		7,875		8,170		8,425		8,700		8,925		9,450		10,000		11,000		11,900	
8. DES PLAINES RIVER at LEMONT-ILL.	18.9 YRS. 1915-1933-Incl.	705	5,520	0	10	0.01	18	0.03	35	0.05	55	0.08	100	0.14	180	0.26	288	0.41	420	0.60	670	0.95	1,165	1.65	1,900	2.7
9. EMBARRASS RIVER at LAWRENCEVILLE-ILL.	3 YRS. 1931-1933-Incl.	2260	18,400	40	40	0.02	50	0.02	100	0.04	170	0.07	285	0.13	450	0.20	670	0.30	1,300	0.58	2,750	1.22	6,250	2.76	8,750	3.87
10. EMBARRASS RIVER near OAKLAND-ILL.	3.9 YRS. 1910-1915-Incl.	535	4,680	0	4	0.007	7	0.01	25	0.05	53	0.10	99	0.18	175	0.33	290	0.54	385	0.72	590	1.1	1200	2.25	1,925	3.6
11. EMBARRASS RIVER at ST. MARIE-ILL.	20.9 YRS. 1910-1933-Incl.	1540	39,000	1	30	0.02	52	0.03	115	0.08	210	0.14	325	0.21	485	0.31	740	0.48	1,130	0.74	1,825	1.18	3,775	2.44	5,600	3.64
12. FOX RIVER at ALGONQUIN-ILL.	16.8 YRS. 1915-1933-Incl.	1340	7,120	47	138	0.1	197	0.15	272	0.20	342	0.26	420	0.31	535	0.40	680	0.51	900	0.67	1,340	1	1,910	1.42	2,500	1.86
13. FOX RIVER at DAYTON-ILL.	8 YRS. 1925-1933-Incl.	2570	14,300	151	255	0.1	335	0.13	455	0.18	560	0.22	690	0.27	945	0.37	1,320	0.51	1,810	0.70	2,600	1.01	3,850	1.50	5,580	2.17
14. FOX RIVER at SO. ELGIN-ILL.	1 YR. 1915	1500	4,280	130	210	0.14	240	0.16	310	0.21	390	0.26	510	0.34	625	0.42	775	0.52	1,050	0.70	1,710	1.14	1,980	1.32	2,725	1.82
15. FOX RIVER at WEDRON-ILL.	9.9 YRS. 1915-1924-Incl.	2500	17,900	105	290	0.12	350	0.14	455	0.18	590	0.24	760	0.30	990	0.40	1,280	0.51	1,600	0.64	2,300	0.92	3,500	1.40	5,050	2.02
16. IROQUOIS RIVER near CHEBANSE-ILL.	10 YRS. 1923-1933-Incl.	2120	27,000	12	45	0.02	60	0.03	110	0.05	205	0.10	360	0.17	670	0.27	1,145	0.54	1,740	0.82	2,600	1.23	4,800	2.26	7,350	3.46
17. KANKAKEE RIVER at CUSTER PARK-ILL.	18.9 YRS. 1915-1933-Incl.	4870	33,700	250	600	0.12	680	0.14	880	0.18	1150	0.24	1475	0.30	1,900	0.39	2,650	0.55	3,600	0.74	5,200	1.07	8,250	1.69	11,900	2.44
18. KANKAKEE RIVER at MOMENCE-ILL.	18.8 YRS. 1915-1933-Incl.	2340	12,600	306	487	0.21	565	0.24	720	0.31	903	0.39	1,060	0.45	1,300	0.55	1,600	0.69	2,030	0.87	2,680	1.14	3,800	1.62	4,870	2.08
19. KANKAKEE RIVER at SHELBY-IND.	2 YRS. 1931-1932-Incl.	1760	3,870	522	525	0.3	565	0.32	640	0.36	720	0.41	785	0.45	960	0.54	1,175	0.67	1,425	0.81	1,690	0.96	1,935	1.10	2,425	1.38
20. KASKASKIA RIVER near ARCOLA-ILL.	3.9 YRS. 1919-1912-Incl.	390	3,290	0	2	0.005	4	0.01	21	0.05	67	0.17	135	0.35	198	0.51	260	0.67	340	0.87	525	1.35	890	2.28	1,300	3.33
21. KASKASKIA RIVER at CARLYLE-ILL.	5.75 YRS. 1908-1915-Incl.	2680	20,000	23	41	0.02	60	0.02	158	0.06	370	0.14	680	0.25	1,030	0.38	1,500	0.56	2,350	0.88	3,640	1.36	5,850	2.18	8,350	3.11
22. KASKASKIA RIVER at NEW ATHENS-ILL.	9.9 YRS. 1910-1921-Incl.	5220	63,100	102	175	0.03	255	0.05	425	0.08	640	0.12	975	0.19	1,580	0.30	2,350	0.45	3,800	0.73	7,000	1.34	11,800	2.26	17,000	3.26
23. KASKASKIA RIVER at SHELBYVILLE-ILL.	4.8 YRS. 1908-1912-Incl.	1030	10,600	0.2	17	0.02	26	0.03	61	0.06	123	0.12	283	0.27	420	0.41	720	0.70	1,070	1.04	1,740	1.69	3,150	3.06	4,600	4.47
24. KASKASKIA RIVER at VANDALIA-ILL.	23.5 YRS. 1908-1933-Incl.	1980	20,000	3.5	32	0.02	57	0.03	95	0.05	190	0.10	350	0.18	555	0.28	870	0.44	1,300	0.66	2,200	1.11	4,500	2.27	6,000	3.03
25. SOUTH BRANCH OF KISHWAUKEE RIVER at DE KALB-ILL.	8 YRS. 1925-1933-Incl.	70	960	0.01	0.2	0.003	0.3	0.004	2.5	0.04	6	0.09	12	0.17	20	0.29	32.5	0.47	47.5	0.68	75	1.07	140	2.0	230	3.28
26. LA MOINE RIVER at RIPLEY-ILL.	11 YRS. 1922-1933-Incl.	1310	12,500	8.9	26	0.02	41	0.03	75	0.06	128	0.10	193	0.15	280	0.21	427	0.33	630	0.48	1,000	0.76	1,900	1.45	3,390	2.69
27. LITTLE WABASH RIVER at WILCOX-ILL.	18.9 YRS. 1915-1933-Incl.	1"30	14,000	0.1	8	0.007	13	0.01	28	0.03	49	0.04	91	0.08	163	0.14	270	0.24	458	0.41	1,100	0.98	2,980	2.64	4,320	3.82
28. MACKINAW RIVER at GREEN VALLEY-ILL.	12 YRS. 1921-1933-Incl.	1100	21,800	22	30	0.03	40	0.04	70	0.06	125	0.11	200	0.18	300	0.27	470	0.43	705	0.64	1,120	1.02	2,020	1.84	3,100	2.82
29. MACOUPIN CREEK near KANE-ILL.	12.57 YRS. 1921-1933-Incl.	865	22,200	1	5	0.006	9	0.01	22	0.03	43	0.05	76	0.09	124	0.14	189	0.22	288	0.33	520	0.60	1,500	1.74	3,460	4
30. PECATONICA RIVER at FREEPORT-ILL.	19 YRS. 1915-1933-Incl.	1330	18,400	124	295	0.22	340	0.26	415	0.31	475	0.36	550	0.41	640	0.48	765	0.58	930	0.70	1,230	0.92	1,840	1.38	2,860	2.15
31. ROCK RIVER at AFTON-WISC.	18 YRS. 1915-1932-Incl.	3190	13,000	70	510	0.16	625	0.19	760	0.24	880	0.28	1,020	0.32	1,225	0.38	1,580	0.49	2,100	0.66	2,770	0.87	4,175	1.31	6,225	1.95
32. ROCK RIVER at LYNDON-ILL.	18.6 YRS-1915-1933-Incl.	9010	39,000	655	1,550	0.17	1,915	0.21	2,475	0.28	3,000	0.33	3,530	0.39	4,100	0.46	5,150	0.57	6,400	0.71	8,400	0.93	12,750	1.42	17,150	1.9
33. ROCK RIVER at ROCKFORD-ILL.	4 YRS. 1915-1919-Incl.	6520	32,000	483	1,280	0.20	1,570	0.24	2,110	0.32	2,540	0.39	2,980	0.46	3,600	0.55	4.300	0.66	5350	0.82	7,630	1.17	11,250	1.73	14,600	2.24
34. MIDDLE FORK OF SALINE RIVER near HARRISBURG-ILL.	8.72 YRS. 1923-1932-Incl.	198	4,050	0.2	0.5	0.003	1	0,005	2	0.01	3	0.02	6	0.03	15	0.08	27	0.14	45	0.23	150	0.76	625	3.15	1,350	6.82
35. SALT CREEK near KENNEY-ILL.	4.8 YRS 1908-1912 Incl.	459	4,680	1	10	0.02	14	0.03	24	0.05	39	0.09	69	0.15	108	0.24	172	0.38	260	0.57	425	0.93	875	1.90	1,500	3.26
36. SANGAMON RIVER at MONTICELLO-ILL.	22.8 YRS. 1909-1933 Incl.	550	15,400	1	8	0.01	12	0.02	24	0.04	48	0.09	90	0.16	157	0.29	240	0.44	365	0.66	565	1.03	1,140	2.07	1,750	3.18
37. SANGAMON RIVER near OAKFORD-ILL.	8.56 YRS. 1910-1912 Incl. 1929-1933 Incl.	5000	37,600	45	145	0.03	195	0.04	295	0.06	425	0.09	650	0.13	1,010	0.20	1,475	0.30	2,245	0.45	3,600	0.72	7,100	1.42	11,750	2.35
38. SANGAMON RIVER at RIVERTON-ILL.	21.6 YRS. 1908-1933 Incl.	2560	30,200	3	35	0.01	55	0.02	130	0.05	230	0.09	390	0.15	670	0.26	1,030	0.40	1,640	0.64	2,700	1.05	5,500	2.15	8,150	3.18
39. SOUTH FORK OF SANGAMON RIVER near KINCAID-ILL.	14 YRS. 1917-1933 Incl.	510	11,800	0	2	0.004	5	0.01	18	0.04	39	0.08	70	0.13	120	0.24	180	0.35	290	0.57	515	1.01	1,300	2.55	2,125	4.17
40. SOUTH FORK OF SANGAMON RIVER near TAYLORVILLE-ILL.	6.7 YRS. 1908-1917 Incl.	427	9,460	0.9	3	0.007	7.5	0.02	18	0.04	41	0.10	71	0.17	97	0.23	160	0.38	240	0.56	410	0.96	1,050	2.46	1,525	3.57
41. SHOAL CREEK near BREESE-ILL.	2.9 YRS. 1910-1912 Incl.	760	11,600	23	41	0.05	48	0.06	68	0.09	93	0.12	123	0.16	163	0.21	210	0.28	370	0.49	840	1.10	2,140	2.82	3,000	3.95
42. SILVER CREEK near LEBANON-ILL.	2.9 YRS. 1910-1912 Incl.	335	4,030	0.2	4.5	0.01	8	0.02	17	0.05	27	0.08	40	0.12	57.5	0.17	90	0.27	150	0.45	320	0.96	825	2.46	1,476	4.40
43. SKILLET FORK near WAYNE CITY-ILL.	15.9 YRS. 1909-1933 Incl.	475	15,800	0	1	0.002	3	0.006	6	0.01	10	0.02	19	0.04	34	0.07	62	0.13	150	0.32	330	0.70	1425	3.0	3100	6.53
44. SPRING CREEK at JOLIET-ILL.	8 YRS. 1925-1933 Incl.	19.7	1,070	0.8	2.5	0.13	3.2	0.16	4.0	0.20	4.7	0.24	6.0	0.30	7.8	0.40	9.7	0.49	13.3	0.68	20.7	1.05	37	1.88	65	3.3
45. SPOON RIVER at SEVILLE-ILL.	17.94 YRS. 1915-1933 Incl.	1600	28,900	3.8	53	0.03	72	0.05	140	0.09	220	0.14	325	0.20	460	0.29	650	0.41	935	0.58	1,425	0.89	2,410	150	4,250	2.68
46. BIG VERMILLION RIVER at DANVILLE-ILL.	11.3 YRS. 1915-1921 Incl. 1929-1933 Incl.	1280	20,200	0.8	17	0.01	27	0.02	45	0.04	75	0.06	140	0.11	233	0.18	405	0.32	650	0.51	1,000	0.78	1,920	1.50	3,125	2.44
47. VERMILLION RIVER at LOWELL-ILL.	2 YRS 1931-1933 Incl.	1230	19,700	9.3	15	0.01	20	0.05	40	0.03	72	0.06	175	0.14	385	0.31	605	0.49	800	0.65	1,300	1.06	2,200	1.79	2,975	2.42
48. VERMILLION RIVER at STREATOR-ILL.	15 YRS. 1915-1930 Incl.	1080	16,500	0	3	0.003	5	0.005	14	0.01	38	0.04	88	0.08	190	0.18	360	0.33	550	0.51	880	0.82	1,770	1.64	2,850	2.64
49. WABASH RIVER at MT CARMEL-ILL.																										
* ILLINOIS RIVER at BEARDSTOWN-ILL.	7 YRS 1921-1927-Incl.	25,445 increased by Div. from St. Law. Basin by Chi. Drain. Canal	109,000	9,550					14,100		14,600		16,800		19,400		23,100		29,000		34,250		51,750		64,750	
* ILLINOIS RIVER at PEORIA-ILL.	21 YRS. 1911-1931-Incl.	Indeterminate	58,300	7,250																						


FLOOD INFLUENCES
PRECIPITATION
Amount
Distribution
Intensity
Duration
Direction of Storm
WATERSHED
Size
Shape
Arrangement of Tributaries
Topography
Geology
Vegetation
CLIMATE
Freezing
Snow Accumulation
Rate of Thawing
Ice Gorge


FLOOD RELIEF FOR ILLINOIS
PREVENTION
PROTECTION
STORAGE
Doubtful Value
DIVERSION
Practical
FORESTATION
Doubtful Value
LEVEES
Require Careful Planning
CHANNELIZATION
Require Careful Planning

SANGAMON RIVER WATERSHED

INTRODUCTION

The objectives in this watershed are several and listed in order of importance, include:

a. Flood abatement
b. Completion of channel straightening throughout its important length
c. Removal of levee encroachments at some locations
d. Establishment of additional rainfall stations
e. Establishment of additional stream gaging stations
f. Formulation of plans anticipating eventual waterway navigation for its important length.
g. Formulation of plans anticipating future municipal water supplies for centers of population or augmentation of existing supplies for center of rapidly increasing population.

FLOODS:

The flood history of this watershed follows true to form for the central portion of Illinois. It is one of continual destruction of crops, damage to property of all kinds, business suspension, etc.

A few references are here pertinent.

Year	Data
Feb.1929	Two bridges at Chandler carried out by ice gorge
Apr. 1927	River 10' over dam at Springfield
May 1927	River 6' over dam at Springfield
Dec. 1927	River in flood first half of month
July 1926	Illipolis flooded - Harvested crops destroyed Estimated damages, $50,000
Sept.1926	Menard County Flooded. Loss in Springfield $25,000 40-acre lake formed in southern part of Springfield. River flooded throughout month Damage estimated at $2,600,000.
Oct.1926	Lake Decatur near flood 14,000 cub. yd. land slide below dam. Lake Decatur 6' above dam on 3rd of month. River stage 15.3'. Oakford levee broke, flooding 2,500 acres.

Sangamon River Watershed.

Mar. 1922	River in flood.
June 1919	Streams in Sangamon County flooded. Corn and wheat destroyed. Serious flooding east of Springfield
Jan. 1916	Flood stage at Oakford, 19.1'.
Mar. 1913	Flood stage at Oakford, 21'.
1907-1908-1911	Flood stage at Oakford, about 21' Six feet of water on land in vicinity.
March 1904	Floods caused by excessive rainfall in the watershed widespread, including areas about Monticello, Decatur, Taylorville (South Fork Watershed), Springfield, Lincoln and Bloomington (Salt Creek Watershed), Oakford and Chandlerville.
1883 to 1904	Eight floods of varying intensities occurred
1883	Above Salt Creek, river obtained average height of 8-1/2 feet above banks; below Salt Creek a height of about 6 feet above banks.
1875	Flood stage about a half foot lower than that of 1883.
May 1858	Severe flood caused approximately $2,000,000 damage in and around Springfield. Many bridges in surrounding country carried away.
1844	Constant rainfall all through spring and into June. All crops destroyed. Transportation by boat only.
	Sangamon attained usual width of Mississippi in many places.
Mar. 1835	Flood heights claimed to have been greater than in 1844.
Jan. 1831	Heavy snows (3' average) combined with spring rains flooded watershed from bank to bank. 19' of depth in river near Springfield.

Sangamon River Watershed.

PHYSICAL CHARACTERISTICS

The watershed has an area approximating 2,360 square miles and includes parts of the following counties:

Cass	Logan	Morgan
Champaign	Macon	Moultrie
Christian	Mason	Piatt
DeWitt	McLean	Sangamon
Ford	Menard	Shelby

The river basin in its lower reaches is from two and a half to three miles wide. Numerous lakes, sloughs and marshes prevail. From Oakford to Petersburg the river bottom is one and one half to two miles wide. It gradually narrows and is less marshy farther upstream. From Petersburg to Decatur, a distance of about sixty five miles, the bottom-lands range from a half to a mile in width. From Decatur to Mahoment they are less than one half mile in width.

The main stream is about 200 miles in length. Its principal tributaries are South Fork and Salt Creek. Originally the waterway was quite tortuous. Some portions of the river between Decatur and Springfield and below Springfield have been straightened.

PRECIPITATION:

Annual mean rainfall is about 36". Rainfall stations maintained and operated by the U. S. Weather Bureau are listed, as follows:

Town	County	Elev.	Years Duration	Years of Record
Decatur	Macon	682	46	1870-1873 1886-1887 1894-1934
Monticello	Piatt	700	3	
Springfield	Sangamon	636	55	1879-1934

Sangamon River Watershed.

GAGING STATIONS:

Six stream gaging stations have been maintained and operated by various agencies. The following information is available.

Location	County	Years Duration	Years of Record
Chandlerville	Cass	1	1908
Decatur	Macon	1	1905
Monticello (I.C.R.R. Brdg)	Piatt	26	1908 - 1934
Oakford (2½ mi.above Menard C.P.&St.L. Ry.Brdg.)	Menard	19	1909 - 1912 1914 - 1922 1928 - 1934
Riverton (Wab.R.R.Brdg.)	Sangamon	25	1909- 1912 1914 - 1934
Springfield	Sangamon		1903

DAMS:

No hydro developments have been attempted. The valley is so wide and shallow that only the pondage of an immense area, accomplished by a high dam, would justify a development. This, of itself would not be justified owing to the greater value of the submerged areas for other purposes. One dam 28.5 feet high has been built at Decatur the effect of which has created a lake at this city, for the use of a municipal supply. In this connection foundations for a hydro-electric plant were placed. No equipment or building has been placed due largely to lack of a reasonable constant flow which would justify the installation.

Another dam about 9.5 feet high has been erected on the river near Springfield, to create a reservoir for municipal water supply.

LAKES:

Numerous natural lakes and sloughs exist throughout the watershed. Most of these are concentrated in the lower reaches.

Sangamon River Watershed:

NAVIGATION:

Navigation from the mouth of the river to Decatur has been analized by the U. S. Engineers. The project would require eighteen dams and locks, the dams would be of the movable type and locks 60' x 350'. A six foot channel would be provided. In addition to this thirty five fixed bridges would require considerable changes in order to provide traffic clearance. The project was not considered justifiable at the time the report was submitted, which was during 1931.

FLOOD CONTROL RESERVOIRS:

Reservoir systems for assisting in the regulation of flood waters on the Mississippi were analysed and found not to be justifiable. The total capacity would have amounted to 162,000 acre-feet. The project cost was estimated at $40. per acre foot.

PARKS AND RECREATION AREAS:

One State Park is located in this watershed; the New Salem State Park .200 acres in extent located on Sangamon River, 3 miles south of Petersburg.

The State Board of Park Advisers, in its 1932 report recommends the development of three tracts of land along the banks of the Sangamon River for recreation areas, viz;

From Petersburg, Menard County, north to Salt Creek, approximately 8 miles.
6 mile strip of land in Macon County abutting the east line of Macon County
10 mile strip of land in Piatt County centering on Monticello.

WILD LIFE CONSERVATION:

No fish hatcheries are located in this watershed.

A quail farm comprising 40 acres is located at State Fair Grounds north of Springfield.

Sangamon River Watershed.

LAND RECLAMATION AND DRAINAGE:

Reclamation of bottom and wt lands for various agrarian purposes has been proceeding for years. It has been estimated that floods in unlevied areas have taken three out of five crops; and in bottom lands five out of six crops.

Hence the population have intensively organized districts for their protection.

Existing records indicate about 380,950 acres were included in ninety-three organized drainage districts in 1927. No later data is available. There are two sanitary districts, viz; Springfield and Decatur which include 44,360 acres. Districts in process of organization at that time included about 22,500 acres, leaving 15,000 acres still in overflow. It is evident that the drainage problem has been vigorously prosecuted in this watershed. Stream straightening and clearance have been partially effected. Considerable tiling and levee development have also been completed. In some instances the levees have been located too close to the river bed. The effect has been to constrict the channel area to such a degree that flood waters create higher stages due to sluggish run-off.

Channel straightening has been completed in some portions, and proposed in others. Specifically, near the mouth between the junction of the River with the Illinois, Waterway straightening has been indicated and sponsored by the U. S. Engineers. Much opposition by local interests has blocked all efforts in this locality. Waterway straightening has been completed from about the line between sections 23 and 26, Twp. 19 N R11W of 3rd principal meridian, to the Junction

Sangamon River Watershed.

of the main river with Salt Creek (SW 1/4 sec. 6, Twp. 19 N. R6 W of 3rd principal meridian, a distance of about thirty miles.

Channel straightening and cutoffs have been projected and indicated, beginning at the junction and continuing past Petersburg and Springfield for about 65 miles to a point in the N.W. 1/4 sec. 15, Twp 15 N. R 3W of 3rd principal meridian. Some portions of this probably have been completed.

Beyond the last mentioned point the channel has been straightened to about a mile 85, a distance of twenty miles, this point being located in N.E. 1/4 Sec. 32, Twp. 16 N.R. 1 E of 3rd principal meridian.

From this point the U. S. Engineers have projected and indicated channel straightening and cut off excavation past Decatur, Monticello and through to Mahomet, a distance of about 70 miles. Here again local opposition, especially throughout that portion immediately above Decatur has frustrated the consummation of this portion of the project.

Almost all of the levee construction has been confined to the lower reaches, specifically between the junction of the Salt Creek with the Sangamon River, and the mouth of the latter.

The setback of some portions of this levee system is quite necessary in order to increase rate of runoff during flood stages.

In recent years steps have been taken to enlarge and increase the heights of some of the levees to compensate for flood stage estimates in excess of those occurring during 1926 and 1927. No state record is available as regards the present status of this phase.

SOIL REPORTS:

Of the fifteen counties forming this watershed, five have not been reported upon for soil formation and content. These are Cass, Christian, DeWitt, Menard and Shelby. Those for which records are available are indicated.

Report	County	Year	Report	County	Year
18	Champaign	1918	10	McLean	1915
54	Ford	1933	42	Morgan	1928
39	Logan	1927	2	Moultrie	1911
45	Macon	1929	47	Piatt	1930
28	Mason	1924	4	Sangamon	1912

COMMENTS:

Future land reclamation should be coordinated with adjoining watersheds, specifically those of Salt Creek and South Fork.

The fact is quite apparent that abnormal and sustained floods leave their traces on the entire central Illinois vicinity. Hence disconnected individual efforts will result eventually in a waste of finance, time and effort. This is emphasized by the fact that each additional channel constriction caused by a new levee serves only to aggravate any succeeding flood condition over the entire area.

The possibility of reservoir development for control of average floods should be further studied and reported upon.

REPORTS:

Bulletin #42. Ill. State Geological Survey. Land Drainage.

U. S. Engineers. Document 186 - 72nd Cong. 1st Session

Soil Reports 2, 4, 10, 18, 28, 39, 42, 45, 47, 54 - issued by U. of I. Experimental Station of the Department of Agriculture.

WATER SOFTENING

The degree of hardness of public water supplies and the nature of industrial water requirements are important items in the consideration of water softening programs. Ordinarily when surface waters are used and when filtration plants treat such waters, it requires little additional equipment or expense to soften the water, and when the results warrant, water softening should be undertaken.

Where the public water supply is derived from under ground sources, and local usages would benefit from water softening, great care must be exercised before engaging in such projects. In many cases good engineering judgment has placed the wells in widely scattered locations with water delivery directly into the distribution system. In such cases it is obviously expensive to conduct the highly mineralized well water thru newly laid force mains to a central point for softening, and individual softening plants at the various wells are likely to be uneconomical. In other cases where wells are located conveniently to a central point, consideration must be given to the possible future life of the existing wells, and the possible future location of new wells, to say nothing of the probability of abandoning well supplies in favor of other water sources.

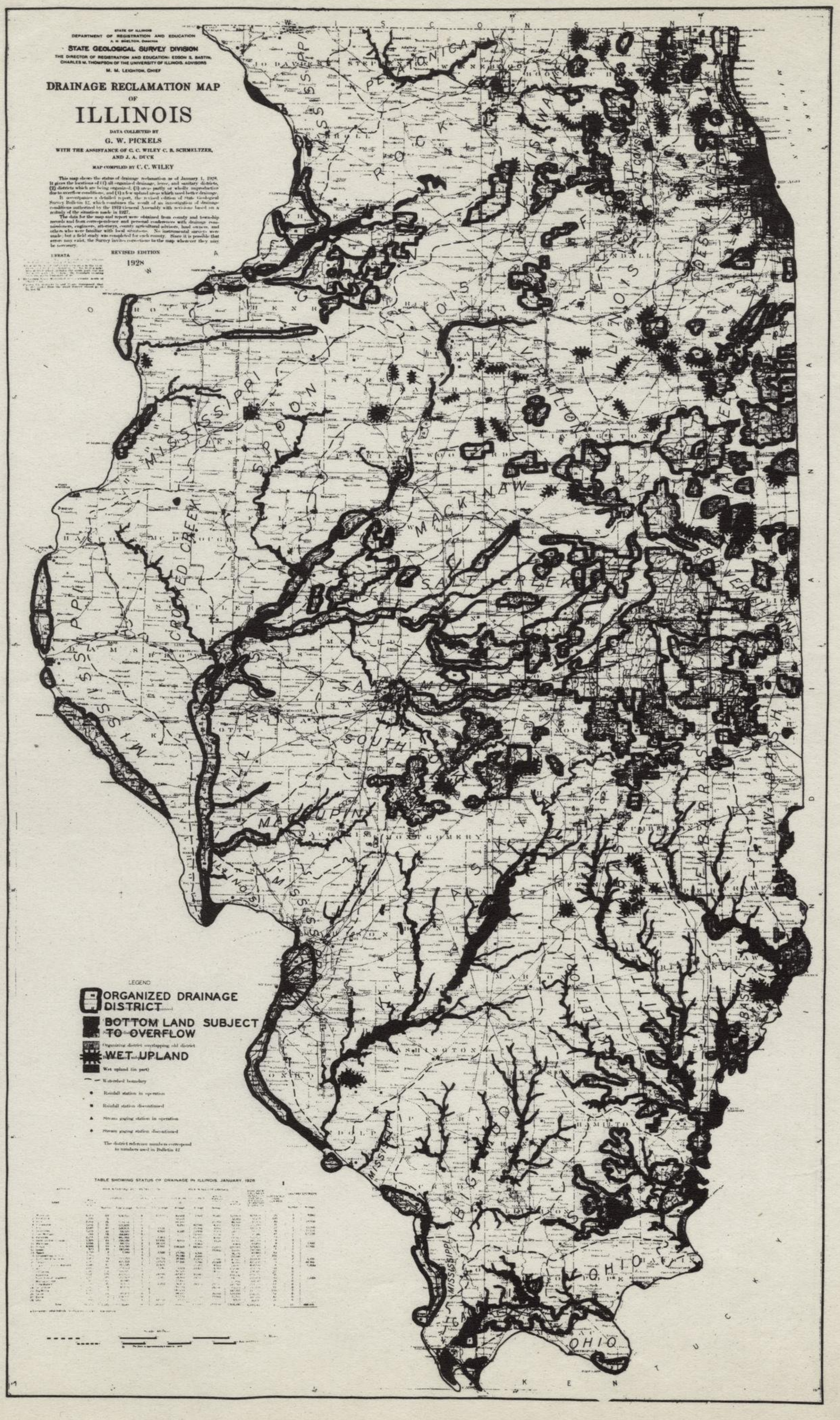
In general, well waters are definitely in need of softening, but in actual practice there are very few softening plants in conjunction with well supplies as compared with the total number of well supply systems.

The answer to the water softening problem may possibly be found in the following:

1. Pipe line connection to an abundant volume of desirable water.

2. Development of a surface supply.

3. Possible justification for a treated well supply.


STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION
A. M. SHELTON, Director
STATE GEOLOGICAL SURVEY DIVISION
THE DIRECTOR OF REGISTRATION AND EDUCATION: EDSON S. BASTIN, CHARLES M. THOMPSON OF THE UNIVERSITY OF ILLINOIS, ADVISORS
M. M. LEIGHTON, CHIEF
DRAINAGE RECLAMATION MAP OF ILLINOIS
DATA COLLECTED BY G. W. PICKELS
WITH THE ASSISTANCE OF C. C. WILEY C. B. SCHMELTZER, AND J. A. DUCK
MAP COMPILED BY C. C. WILEY
This map shows the status of drainage reclamation as of January 1, 1928. It gives the locations of (1) all organized drainage, levee, and sanitary districts, (2) districts which are being organized, (3) areas partly or wholly unproductive due to overflow conditions, and (4) a few upland areas which need better drainage.
It accompanies a detailed report, the revised edition of State Geological Survey Bulletin 42, which combines the result of an investigation of drainage conditions authorized by the 1919 General Assembly with revisions based on a restudy of the situation made in 1927.
The data for the map and report were obtained from county and township records and from correspondence and personal conferences with drainage commissioners, engineers, attorneys, county agricultural advisers, land owners, and others who were familiar with local situations. No instrumental surveys were made; but a field study was completed for each county. Since it is possible that errors may exist, the Survey invites corrections to the map wherever they may be necessary.
REVISED EDITION
1928
ERRATA
WISCONSIN
LAKE MICHIGAN
INDIANA
KENTUCKY
MISSISSIPPI
PECATONICA
ROCK
KISHWAUKEE
FOX
DES PLAINES
ILLINOIS
VERMILION
KANKAKEE
SPOON
CROOKED CREEK
MACKINAW
SALT CREEK
SANGAMON
SOUTH FORK
MACOUPIN
KASKASKIA
EMBARRAS
WABASH
LITTLE WABASH
SKILLET FORK
BIG MUDDY
OHIO
MONTGOMERY
LEGEND
ORGANIZED DRAINAGE DISTRICT
BOTTOM LAND SUBJECT TO OVERFLOW
Organizing district overlapping old district
WET UPLAND
Wet upland (in part)
Watershed boundary
Rainfall station in operation
Rainfall station discontinued
Stream gaging station in operation
Stream gaging station discontinued
The district reference numbers correspond to numbers used in Bulletin 42
TABLE SHOWING STATUS OF DRAINAGE IN ILLINOIS, JANUARY 1928

C O P Y

#5 STREAM SANITATION & WATER SUPPLY March 30, 1934

GENERAL STATEMENT OF THE WATER SUPPLY SITUATION

An abundance of good quality water is available for every Illinois Municipality subject to its financial limitations. These financial aspects have created the water supply picture as it exists today, and tabulations or pictorial presentations of the geographic distribution of public water supplies by water sources do not necessarily represent ideal developments. It is rather a representation of present water resource uses. Lake Michigan supplies by far the largest proportion of our state needs, and it is capable of increased development. The Mississippi River is also a major source of public water supply, particularly in the East St. Louis metropolitan area and for the Rock Island, Moline area. Well supplies are used very extensively in the northern portion of the state, and while it is becoming increasingly more difficult to secure the volume of water from wells necessary to assure continued growth, it is nevertheless true that every city in Illinois with more than 5,000 population now using a well supply can readily secure an abundance of water thru development of surface supplies.

The well supplies of our larger cities (5,000 population or more) penetrate various sub-surface formations ranging from sand and gravel strata in the drift formation down thru the limestones and into the deeper sandstones. As the draft of water from the various formations increased, the water yield diminished until certain strata are no longer capable of yielding satisfactory volumes of water. Wherever it has been possible to drill wells into deeper formations to improve water supplies, the communities have usually adopted this method. In instances such as Bloomington, Normal, Springfield, and others, where only the drift formation originally offered a satisfactory supply, inadequate volumes of water have been replaced with impounded surface supplies.

Cities such as Cicero, Berwyn, Oak Park, Forest Park, and others, who found the very deepest wells to yield insufficient water have turned to surface supplies in the form of pipe line connections with the City of Chicago distribution system. Other cities with deep wells whose location is not advantageous for pipe line connection with communities of abundant volume are giving serious thought to the development of surface supplies. Joliet is an example of this latter class, and engineers have planned a project for impounding water from the DuPage River. Wells have served a very useful purpose in supplying water, but the waters have invariably been highly mineralized. The degree of hardness is not at all uniform, and water softening is a reasonable objective for every community using well water, especially so if it has an industrial development or if it wishes to attract industry.

(Con'd)

The southern portion of the state is largely dependent upon impounded surface waters for public supply. Many satisfactory installations have been developed. However, the cost of completing such improvements has been high, and since the average municipality dependent upon surface supplies in the southern part of Illinois has but a relatively small population, the capital investment per water user is high compared with a similar investment in communities using well supplies and reflects itself in higher water rates.

COPY

#5 STREAM SANITATION & WATER SUPPLY March 29, 1934

STREAM FLOW AND THE NEED FOR SEWAGE TREATMENT

The uses of streams and the nature of the wastes to be discharged therein are the governing factors which create the sewage treatment problem. Obviously small stream flows receiving large volumes of wastes are nothing more than open sewers carrying diluted sewage creating an unsatisfactory situation from every standpoint. Similarly a large stream flow receiving a moderate volume of sewage can conceivably be objectionable where down-stream water use requires a relatively clean water. It must be recognized, however, that there is an average situation in many instances where neither of these conditions exist, and that one of the major uses of our streams is for reasonable waste disposal. To say that our streams should be entirely set apart for bathing, boating and fishing, free of all pollution, is quite unreasonable.

For cases where the down-stream use of water is not of the highest order, we may readily establish minimum stream flow requirements sufficient for dilution of ordinary domestic sewage, without resorting to treatment.

Sanitary engineers and chemists have determined that on the average each 1,000 population contributes in a year's time sewage containing suspended solids aggregating about 50,000 lbs. dry weight. The sewage has an oxygen requirement equivalent to approximately 75,000 lbs. A reasonably clean stream will contain oxygen in solution available to meet the oxygen requirement of the sewage in whole or in part depending upon the dilution ratio. To completely deplete the oxygen supply of the diluting water is not to be attempted; but if a balance of about 2½ parts per million of dissolved oxygen is reserved, then it will be possible to support many forms of fish life and still leave an available supply to carry on natural sewage purification. If we assume an average of 7.5 parts per million of oxygen in the stream of which 5 parts are available for sewage, then each 1,000 population contributing sewage would require dilution water in the stream to the extent of about 7-3/4 cubic feet per second. This oxygen would be used up over a period of 5 days or more. The beneficial effects of riffles and water falls in reaeration would aid in the restoration of the oxygen content of the stream, as also would algae and sunlight, so that it is possible to preserve all reasonable stream conditions under dilution conditions of from possibly 6 to 7 cubic feet of stream flow per 1,000 population. It must be understood, however, that special conditions may not be tolerant of this process in which case measures must be undertaken to lessen the load placed upon the stream.

Another consideration is that stream flows are not uniform, and ample dilution may be available for only a portion of the year. Here the municipality may take advantage of large dilution thru the construction of a low first cost works, spend relatively larger sums on operation, and arrive at an economical balance thru part time treatment.

F. T. THWAITES

September 5, 1934

MEMORANDUM #1

Ground Water Survey, Mississippi River Basin

Information for Special Water Consultants for the Water Resources Section of the National Resources Board.

You are requested to make a brief intensive report on the ground water resources of your area along the following lines: the body of the report will be obtained from three sources:

1. Library material including existing publications of the United States Geological Survey, the separate State Geological Surveys, and the publications of the State Boards of Health in the area.

2. Personal observation during your work in the past.

3. Contacts with the State Planning Boards which should yield outlines of their plans and policies.

Your report will be divided into five distinct sections, one for each of the following subjects:

1. Local Horizons
2. Extent of Depletion
3. Quantities Available
4. Chemical Quality
5. Measures of Conservation

Section (1), Local Horizons, is primarily a matter of geology.
Section (2), Extent of Depletion, could probably best be obtained from study of water supply papers, both state and federal, and also reports of municipal water supplies.
Section (3), Quantities Available, will, for the most part, be obtained from reports of municipal water supplies and state and federal water supply papers.
Section (4), Chemical Quality, in addition to being obtained from these sources, should probably be augmented by a review of the reports of the State Boards of Health and municipal health officers.
Section (5), Measures of Conservation, will be primarily your own section although it should include the plans and policies of the Planning Boards.

2 cross sections map of Top of St Peter sandstone Top of Granite

The time allowed for this report will be two weeks, and, because of the short time which has been allowed for completion of the final report on the ground waters of the Mississippi River Basin, it will be necessary to have your report on file 48 hours after the expiration of your two week time allowance.

Memorandum #1 - 2

Referring to memorandum #12 of Thorndike Saville, Executive Engineer for the Water Resources Section, I quote the following:

> "Regional Water Consultants are advised that the reports which they render to the Washington office will be subject to review, revision, condensation, and alteration in the interests of uniformity, brevity, and balance, to form part of a relatively small report to be submitted through the National Resources Board to the President. The procedure of the Mississippi Valley Committee regarding anonymity of sections of the final report will be followed.
>
> "Bearing these facts in mind, it is essential that reports from regional water consultants be considered as confidential documents of the Water Resources Section, to avoid misunderstanding and controversy as to the ultimate final report. These are not to be reviewed by or submitted to any other individuals or groups.
>
> "The emergency requires that so much be done in what would normally be considered an entirely inadequate time that I feel that I owe it to the field staff to guard them against organizational complications and so safeguard their time."

The above quotation, although intended for Regional Water Consultants is equally applicable to Special Water Consultants.

Howard E. Simpson
Principal Water Geologist
National Resources Board

September 8, 1934

MEMORANDUM #2c

Ground Water Survey, Mississippi River Basin

Information for Special Water Consultants for the Water Resources Section of the National Resources Board.

BIBLIOGRAPHIC INDEX
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PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY
RELATING TO GROUND WATER
in the
MISSISSIPPI DRAINAGE BASIN

From USGS, WSP 427, 1916

Sub-Region III, Upper Mississippi River Drainage Basin

September 11, 1934

MEMORANDUM #4c

Ground Water Survey, Mississippi River Basin

Information for Special Water Consultants for the Water Resources Section of the National Resources Board.

BIBLIOGRAPHIC INDEX
of the
PUBLICATIONS OF THE STATE GEOLOGICAL SURVEYS
RELATING TO GROUND WATER
in the
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(This is an incomplete bibliography referring to publications to which we were directed by state planning boards, state geologists, and state health officers. It will be supplemented by a more complete bibliography.)

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September 10, 1934

MEMORANDUM #5

Ground Water Survey, Mississippi River Basin

Information for Special Water Consultants for the Water Resources Section of the National Resources Board.

KEY TO BIBLIOGRAPHIC INDEX
of the
PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY
RELATING TO GROUND WATER
in the
MISSISSIPPI DRAINAGE BASIN

W, Water-supply paper

A, Annual report

M, Monograph

P, Professional paper

B, Bulletin

MR, Report on mineral resources

GF, Geologic folio

S, Cooperative report not published by the United States Geological Survey

To accompany memorandums 2a-e.

Howard E. Simpson
Principal Water Geologist
NRB

September 11, 1934

MEMORANDUM #6c

Ground Water Survey, Mississippi River Basin

Information for Special Water Consultants for the Water Resources Section of the National Resources Board.

BIBLIOGRAPHIC INDEX
of the
PUBLICATIONS OF THE STATE GEOLOGICAL SURVEYS
RELATING TO GROUND WATER
in the
MISSISSIPPI DRAINAGE BASIN

Sub-Region III. Upper Mississippi River Drainage Basin

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(6) Slichter, C S. The motions of underground water: US Geol Survey, Wtr S paper 67, 1902 WPG

September 12, 1934

MEMORANDUM #7

Ground Water Survey, Mississippi River Basin

Information for Special Water Consultants for the Water Resources Section of the National Resources Board.

I wish to call your attention particularly to two publications of the United States Department of Agriculture, Bureau of Soils.

(3) ✓ **Bulletin No. 92.** Wells and Subsoil Water, by W J McGee. Issued March 26, 1913.

(4) also ✓ Subsoil water of central U.S. US Dept agr. year Book 1911, pp 479-490, 1912

not in district **Bulletin No. 93.** Field Records Relating to Subsoil Water, by W J McGee. Issued February 20, 1913.

(1) ✓ Bode, I T The relation of the smaller forest areas in non-forested regions to evaporation and movement of soil water: Iowa Acad Sci, Proc. 27. 137-157, 1920

(7) ✓ Fernow, Raphael, Forests and water in the light of scientific investigation, Final Rept Nat water ways comm. app. p. V, 1927

(5) ✓ Schwartz, G. F. The diminished flow of the Rocks River in Wisconsin and Illinois; US Dept agr. Bull Forestry, Bull 44, 1903

(2) McGee, WJ Principles of water-power development, Science, n s vol 34 pp 813-825, 1911

See WSP 2 34 Needs check

September 12, 1934

MEMORANDUM #8

Request for information from Special Regional Water Consultants:

Kindly furnish this office with the following information at your earliest convenience:

1. A brief summary of less than one page outlining the progress of your study to date.

2. A statement as to the earliest and latest dates upon which your report will be in the mail to us.

Howard N. Simpson
Principal Water Geologist
NRB

✓ Imbt, W.C. geological conditions governing location, drilling and casing of wells; Am. W.W. Assoc. Jour. vol 25, pp 1207-1215, 1933

✓ Habermeyer, G.C. well water recessions in Illinois; Illinois State water survey, circular 1, 1928

September 12, 1934

MEMORANDUM 10

Ground Water Survey, Mississippi River Basin

Information for Special Water Consultants for the Water Resources Section of the National Resources Board.

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in the
MISSISSIPPI DRAINAGE BASIN
~~AS OBTAINED FROM THE STATE GEOLOGICAL SURVEYS~~

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MEMORANDUM #11.

Ground Water Surveys, Mississippi River Basin.

Information for Special Water Consultants for the Water Resources Section of the National Resources Board.

The following is a copy of Memorandum #1, Water Resources Section which is quoted to you for special emphasis:

1. "It is suggested that you contact the District Chairman of the National Resources Board and the State Planning Boards of the several states within your region. A list of these is attached hereto.

2. "The State Planning Boards are voluntary state groups originally set up by the Governors to cooperate with the National Planning Board to consider long-term planning procedure for the natural and social resources of each state. The powers and duties of the National Planning Board was transferred to the National Resources Board by the Executive Order of June 30, 1934.

3. "In consideration of the relation of the State Planning Boards to the National Resources Board, under the Mississippi Valley Committee (Water Resources Section) of which the Regional Water Consultants function, it is of particular importance that prior to formulation of regional water resources policies the regional water consultants thoroughly familiarize themselves with the surveys, studies and recommendations which may have been made or which may be in process of being made by the state planning consultants and water resources committees of the State Planning Board."

Because of the fact that Special Water Consultants on this survey will be required to carry on considerable correspondence, the following authorizations have been made:

1. Special Water Consultants are authorized to use franked envelopes for all communications pertaining to this survey. If franked envelopes are not already on hand, a supply will be sent from this office.

2. Special Water Consultants are also urged to make liberal use of air mail and special delivery for urgent communications with all distant points. Stamps for air mail and special delivery will be furnished upon request or reimbursement for postage expenditures will be made from this office.

3. Telegrams for Special Water Consultants may be sent to this office "Official Business, Government Rate, collect." Attention is called to the fact that four forms of telegrams are authorized including regular telegrams, day letters, night messages, and night letters, and care should be taken to use the lower rate when there will be no marked loss of time.

4. In an emergency telegrams may be sent by Special Water Consultants to any point in their region marked "Official Business, Government Rate, prepaid," and charged to this office. Copies of all such telegrams must be mailed to this office. This authorization has been made for you for the purpose of contacting Planning Boards as indicated in the memorandum quoted above.

The Government does not authorize the incurrment of expenses for any stenographic or clerical help except at the base of study, in this case Grand Forks, North Dakota. Therefore, single reports sent to this office in any legible form will be duplicated and finished copy returned to the Special Water Consultant if this is desired.

Howard E. Simpson
Principal Water Geologist
NRB

No. _____

DRAFTING ROOM
PRODUCTION ORDER
UNIVERSITY EXTENSION DIVISION

5416

Name Prof T. Shvartsa Address Private

Date Ordered 9/21/34 Wanted _____ Delivered _____

Kind of Work	No. Wanted	No. Plates	Size of Plates	Rate	Price	Remarks
Y.P.	1	7	1	.10	.70	
B.L.P.	1	7	1	2½	1.75	
			Total cost of work		2.45	

White = White Prints or Blue-line Prints
Pos. = Photostat Positives
Neg. = Photostat Negatives
BP = Blue Prints
VD = Van Dykes
Oil = Oiling Charge

PLEASE PAY BOOKKEEPER IN ROOM 107

Sept. 24, 1934

Prof. Howard E. Simpson,
University Station,
Grand Forks, North Dakota

Dear Prof. Simpson:

Enclosed please find corrected negative for Plate V. The only difference is in the length of the lines for carbonate in the Minnesota analyses. All these were given as HCO_3 and I had reduced to CO_3 but neglected to divide by two. I greatly regret the error but those things just will happen. Please destroy first negative

Sincerely,

F. T. Thwaites

Sujday, Sept. 23, 1934

Prof. Howard E. Simpson,
University Station,
Grand Forks, North Dakota

Dear Prof. Simpson:

When I awoke this morning I realized a mistake that had gotten by me in the haste of preparing Plate V-B. I forgot to reduce the bicarbonate analyses to normal carbonate. I did redude to CO_3 but then neglected to divide by two.

PLEASE DESTROY the negative of this plate. I have already revised the original and will get another negative made tomorrow which should reach you on Tuesday.

Sincerely,

F. T. Thwaites

10 P. M., Sept. 22, 1934

Prof. Howard E. Simpson,
University Station,
Grand Forks, North Dakota

Dear Prof. Simpson:

As promised the report on District III will be in the mail tonight ready to go out on the plane which leaves soon after 4 in the morning. Mrs. Thwaites has helped in the typing and checking. It is not as finished a job as we could have wished for but it was the best we could do in the time available.

The papers to be returned, appointment blanks, etc. will be sent by ordinary mail Monday.

I decided to enclose the negatives for the illustrations and to retain the original tracings which I may want to alter and use at some future date. The drafting is the best I could do when one has to work on the same scale as that of publication and that scale is so small.

If anything is not satisfactory plese wire me.

Now to drive in to the Post Office.

Sincerely,

F. T. Thwaites

Sept. 19, 1934

Prof. Howard E. Simpson,
University Station,
Grand Forks, North Dakota

Dear Prof. Simpson:

Your letter of the 17th with enclosed papers and telegram of the 18th are at hand. Thank you for them.

It is now too late to send any franks but I will turn in a statement of postage when finished.

Today I sent night letters to the several persons listed

An preparing report for national resources board on ground water situation in ——— stop please write me at once science hall Madison Wisconsin what plans studies or recommendations you are making in regard to this matter stop have to complete report Saturday and wish to mention your work

These were filed at the State Street office of the Western Union and charged to my personal account as they would not transfer charges to you. Can you kindly take care of this. Charge is $1.63 I think at usual rate.

I have added two more illustrations, one a map showing distribution of drift and rock municipal supplies, the other some diagrams showing recession of water level at Chicago and illustrating different types of waters by graphs. As you only want one copy of the report I think that it will be best to send you the original tracings and retain negatives for my files or would it be better to reverse this. Negatives will cost me 10 cents each unless raised since last spring.

Forgot to mention another map showing distribution of drift and rock flowing wells., making seven in all, each 8½" x 11"

The text is almost finished in rough draft but will have to be copied over again. Mrs. Thwaites is helping on this. She was editor of publications in the palmy days of the Wisconsin Survey.

Very truly yours,

F. T. Thwaites

NATIONAL RESOURCES BOARD
INTERIOR BUILDING
WASHINGTON

University Station
Grand Forks, N. Dak.
September 17, 1934

Dr. Frederik T. Thwaites
Special Regional Water Consultant
Upper Mississippi River Basin
University of Wisconsin
Madison, Wisconsin

Dear Dr. Thwaites:

I have your letter of September 14, outlining the work that you have completed to date on your survey, and giving us your date September 22 when the report will be in the mail to us. These are both entirely satisfactory, and I believe that the four illustrations listed in your letter will cover the subject very thoroughly.

It will not be necessary for you to furnish us with any more than one copy of your report as this work will all have to be copied on government bond paper by us, so as to be included in my report to Washington.

I am enclosing, herewith, appointment papers for you to fill out and send to Washington, which should take care of any question you may have as to your pay on this project.

Allow me to congratulate you on the progress you have made with your report, and let me again express my heartiest appreciation for your help in this undertaking.

Very truly yours,

Howard E. Simpson

Howard E. Simpson
Principal Water Geologist
NRB

HES:p
enc.

In mailing the report to this office use air mail.

Sept. 19, 1934

Mr. William O'Bryan,
Chairman State Planning Board,
Highway Commission,
State Capitol,
Madison, Wisconsin

Dear Sir:

I have been appointed by Prof. Howard E. Simpson of North Dakota to write a report on the ground water situation in Wisconsin, Minnesota, Iowa, and Wisconsin. The following is a copy of the night letter which I have just sent to the other Chairmen in this region.

Am preparing report for national resources board on ground water situation in Wisconsin stop please write me at once Science Hall Madison Wisconsin what plans studies or recommendations you are making in regard to this matter stop have to complete report Saturday and wish to mention your work

Would be glad to hear from you along this line. A very brief statment will be all that I can include.

Very truly yours,

F. T. Thwaites Special regional water consultant, National Resources Board

1207-A

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NEWCOMB CARLTON, CHAIRMAN OF THE BOARD
J. C. WILLEVER, FIRST VICE-PRESIDENT

CHECK
ACCT'G INFMN.
TIME FILED

Send the following message, subject to the terms on back hereof, which are hereby agreed to

19

To Robert Kingery

Street and No. Chairman State planning board

Place Springfield, Illinois

Am preparing report for national resources board on ground water situation in Illinois Stop please write me at once Science Hall Madison Wisconsin what plans, studies or recommendations you are making in regard to this matter Stop have to complete report Saturday ~~and can include~~ ~~that~~ and wish to mention your work

F. T. Thwaites

R. D. 4

Sender's address for reference

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TJ8 30 NL GOVT=GRANDFORKS NDAK SEP 18

DR FREDERICK T THWAITES=

SPECIAL REGIONAL WATER CONSULTANT UNIV OF WIS=

NO DISTRICT CHAIRMEN WIRE ROBERT KINGERY SPRINGFIELD ILL DEAN KILDEE STATE COLLEGE AMES IOWA DR MORRIS LANDIE STATE CAPITOL STPAUL MINNESOTA WILLIAM OBRYAN HIGHWAY COMMISSION MADISON WISCONSIN PLANNING BOARD CHAIRMEN=

HOWARD E SIMPSON PRINCIPAL WATER GEOLOGIST NATIONAL RESOURCES BOARD.

912A..

~~TELEGRAM~~ DAY LETTER OFFICIAL BUSINESS GOVT RATE COLLECT

Prof. Howard E. Simpson,
University Station,
Grand Forks, North Dakota

List of District charimen and state planning boards omitted from memorandum eleven stop please send stop will write but contacts here and Iowa do not suggest much value stop please send franks stop will include tracings with report retaining negatives stop manuscript nearly completed

TELEGRAM OFFICAL BUSINESS GOVERNMENT RATE COLLECT

Howard E. Simpson
University Station,
Grand Forks, North Dakota

Please send list of district chairmen and state planning boards

Thwaites

F 1940-R planned 1 40 PM Sept 18

NATIONAL RESOURCES BOARD
INTERIOR BUILDING
WASHINGTON

University Station
Grand Forks, N. Dak.
September 18, 1934

Dr. Frederik T. Thwaites
Special Regional Water Consultant
Upper Mississippi River Basin
University of Wisconsin
Madison, Wisconsin

Dear Dr. Thwaites:

I am enclosing, herewith, two bulletins which may be of some value to you in the compilation of your report.

When you have obtained as much information as you think necessary from these reports, please return them to this office.

Very truly yours,

Howard E. Simpson
Principal Water Geologist
Water Resources Section, NRB

FWV:EC
Enc. 2

by Frederic St. Voodiach
Research Technician

Sept. 14, 1934

Prof. Howard E. Simpson,
Dept. of Geology,
University of North Dakota,
Grand Forks, North Dakota

Dear Prof. Simpson:

In reply to memorandum No. 8 I had been intending to write you but as I have to do all my own clerical work had delayed.

In the preparation of the report my first aim was to make up a bibliography of what I considered important authorities. Many of the folios, county reports, and older water supply papers can hardly be termed important. However, your bibliography contained some references on Minnesota which I had not obtained and was a great help.

Next I started on illustrations in order to save space in the text. These are: (1) contour map of surface of the pre-Cambrian crystallines, interval 500 feet, scale about 90 miles to the inch; (2) contour map of top of St. Peter sandstone, same interval and scale; (3) map showing total mineralization of underground waters from deep wells in relation to surface distribution of pre-Cambrian, Pennsylvanian, Cretaceous, and limestone-bearing drift where on pre-Cambrian, same scale; (4) geological cross section from southwest corner of Iowa to north line of Wisconsin. All these plates (8½" X 11") are virtually done and will be presented as blue-line prints.

The general geological column has been prepared as a table without the almost useless graphical column and remarks on water capacity and water quality added.

I will have the report in the mail on or before the evening of Sept. 22 so that it should reach you by Sept. 24. If this date is not satisfactory please advise me.

Please advise me if more than one copy is to be sent.

Please advise me how and when to turn in bill for my work.

I have also written to several well drillers who I know to be trustworth and asked them for observations on recession of water levels. I also sought information on the same subject from the Illinois Water Survey, Illinois Geological Survey, and Iowa Geological Survey. All have now replied except one engineer in Chicago. Prof. Trowbridge told me that Dr. Condra had written them also for the same information. I have also telephoned several local engineers, the Board of Health, etc and have secured much information from them.

I will begin on the text this afternoon.

Sincerely,

FEDERAL EMERGENCY ADMINISTRATION
OF PUBLIC WORKS

WASHINGTON, D.C.
University Station
Grand Forks, N. Dak.
September 10, 1934

Mr. Frederik T. Thwaite
Special Regional Water Consultant
Upper Mississippi River Basin
University of Wisconsin
Madison, Wisconsin

My dear Mr. Thwaite:

Enclosed, herewith, you will find copies of memorandums 2c and 4c. Memorandum 2c in a complete bibliographic index of publications of the United States Geological Survey relating to the ground water in your sub-region, whereas memorandum 4c is a rather incomplete bibliography of publications of the geological surveys of the several states, which was obtained from the offices of the state geologists. A complete bibliography of state publications relating to ground waters will be forwarded to you within a day or two.

The number of publications which you will find of value in making up your report is of course problematical, but I have had these compiled with the idea in mind of saving you the trouble of looking them up and thereby allowing you more time for your report.

We would appreciate from you a list of publications used in your research. This may be included as a bibliography in an appendix.

Wishing you the best of success in your strenuous undertaking,
I remain

Very truly yours,

Howard E. Simpson

Howard E. Simpson
Principal Water Geologist
NRB

HES;p

Memorandum 4c follows under separate cover

FEDERAL EMERGENCY ADMINISTRATION
OF PUBLIC WORKS

WASHINGTON, D.C.
University Station
Grand Forks, N. Dak.
September 7, 1934

Professor F. T. Thwaites
University of Wisconsin
Madison, Wisconsin

Dear Professor Thwaites:

Accept my sincere appreciation of your willingness to undertake the important emergency service referred to in my telegram of this date.

I enclose herewith memorandum #1, dated September 5, 1934, with information for Special Regional Water Consultants for the Water Resources Section of the National Resources Board. This memorandum covers the ground fully with the possible exception of the length of the report. This should be long enough to adequately cover the subject and not longer than necessary.

Enclosed also is a map of sub-region #3, the Upper Mississippi River Basin, which we are asking you to cover in your report. Your area may seem overlarge but, in view of the fact that we are only allowed five Consultants on this type of work for the entire Mississippi Basin, you will understand that it is not larger than necessary.

Again I most sincerely thank you for your assistance in this matter since I know that it is a service added to that of an intensely busy life.

Feel free to consult me by Western Union collect on any highly important matter.

Very truly yours,

Howard E. Simpson
Principal Water Geologist
NRB

HESeg
enc. 2

(COPY)

WESTERN UNION TELEGRAM

September 7, 1934

F. T. THWAITES
UNIVERSITY OF WISCONSIN
MADISON, WISCONSIN

ON RECOMMENDATION DOCTOR BEAN YOU ARE HEREBY APPOINTED SPECIAL REGIONAL WATER CONSULTANT NATIONAL RESOURCES BOARD TIME TWO WEEKS. SALARY TWENTY DOLLARS PER DAY TO PREPARE REPORT GROUND WATER RESOURCES UPPER MISSISSIPPI BASIN. WORK STARTS IMMEDIATELY. PLANS FOLLOW AIR MAIL. EXTREMELY IMPORTANT FEDERAL EMERGENCY SERVICE. WIRE ACCEPTANCE WESTERN UNION COLLECT.

HOWARD E SIMPSON
PRINCIPAL WATER GEOLOGIST
NRB

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WESTERN UNION

1102A.

NEWCOMB CARLTON, PRESIDENT J. C. WILLEVER, FIRST VICE-PRESIDENT

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HOWARD E SIMPSON PRINCIPAL WATER GEOLOGIST NATIONAL RESOURCES BOARD.