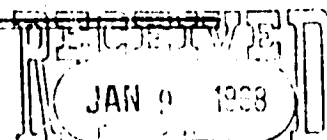


1489-3

1. Considered 3-20, 1968
2. Name of Applicant CITY OF BRITTON
3. Post Office Address _____
4. Amount of water claimed .67
5. Source of water supply WHITE LAKE DAM
6. Water to be used for MUNICIPAL
- Acres to be irrigated _____
7. Water to be diverted and used in MARSHALL county
about 7E 4N miles _____ of BRITTON.
8. Proof of Publication Received ✓
Not received _____
9. Application Approved _____
Subject to _____
Not Approved _____
Action deferred _____
10. Remarks:

No. 1489.3
 Water Division No. 3 JAMES RIVER District
 (Blanks to be Filled by the Engineer for the W. R. C.)



STATE WATER RESOURCES COMM.
 PIERRE, SOUTH DAKOTA

APPLICATION FOR PERMIT To Appropriate Water within the State of South Dakota

(NOTE—Draw a line through items not applicable.)

1. Name of applicant City of Britton
 Postoffice address City Hall, County Marshall, State South Dakota

- I. If a corporation _____
 (a) Name of same City of Britton
 (b) Date and place of incorporation _____
 (c) Amount of capital stock _____
 (d) Amount paid in _____
 (e) Names and addresses of directors _____

(NOTE—A certified copy of articles of incorporation must accompany the application.)

II. Method of accomplishing the work and financial resources of the applicant:

- (a) Method of accomplishing work (Whether by contract, employment of others, or by direct labor.)
Work to be accomplished by Contract
 (b) Cash on hand, \$ _____ (c) Treasury stock, \$ _____
 (d) Bonds to be issued, \$ 424,000.00 (e) Other resources, \$ _____

2. Name of diversion work Municipal Supply from White Lake
 3. Amount of water claimed 0.67 cubic feet per second
 4. Source of water supply Rice Creek Watershed above White Lake Dam
 5. Location of point of diversion 2460 ft. North 37°34' East of the Southwest Corner of
Section 36, T 128 N, R 57 W, on Rice Creek on South bank Marshall County.
 6. Annual period or periods during which water is to be used January - December
 7. To be used for:

- I. Irrigation or domestic use: Gravity, overhead sprinkling or combination system? Municipal Supply
 (a) Number of acres to be irrigated N. A. acres.

(b) Legal subdivisions to be irrigated N. A.
 (NOTE—A list of lands to be irrigated, giving each subdivision and fraction with acreage thereof, should be written here, or may be appended as a part of this application. Same must also be shown on accompanying map.)

(c) Statement as to domestic use (giving location, etc.) To be primary source of Municipal
Water Supply for City of Britton, South Dakota

II. Stockwatering, mining, milling, power, fish culture, fire protection and public recreation.

- (a) Nature of use Domestic Supply and Fire Protection
 Name any of the above uses claimed
 (b) Amount of power to be generated N. A. horse power.
 Amount claimed for engine cooling N. A.
 (c) Location of plant N. A.
 (d) Method of developing power N. A.
 (e) Point where water will be returned to stream N. A.

MAP NO 1079-3

8. Estimated cost of work:

(a) Head Gates, \$..... (b) Pumping plant, \$30,000.00
 (c) Fluming, \$197,000.00 (d) Canal-earth, \$..... Rock, \$.....
 (e) Other structures Treatment Plant \$197,000.00 Total, \$424,000.00

9. Description of diversion works:

I. Nature of works: (Reservoir, dam, ditch, flume, pumping plant, etc.)

White Lake, an artificial impoundment

II. Dimensions of works. Existing White Lake Dam.

(a) Dam: Height.....feet; length at bottomfeet; length at topfeet; thickness at bottomfeet; thickness at topfeet; slope at front water face; slope at back face
 material used in construction earthfill
 (b) Reservoir: Capacity when filled 1320 (estimated) acre feet. Surface area at highwater mark 165 acres.

DEPTH AT OUTLET-Feet	SURFACE AREA AT EACH DEPTH AT OUTLET—ACRES	FEET	ACRE-Feet CAPACITY

(c)* Head gate: Width.....feet; heightfeet;
 Material Measuring to be by Water Meter
 (d) Canal: Total length 8.1 miles. (pipeline)

LOCATION BELOW HEADGATE	DEPTH	BOTTOM WIDTH	WIDTH AT WATER-LINE	GRADE PER MILE
At Mile	 feet	 feet	 feet	 feet
At Mile	 feet	 feet	 feet	 feet
At Mile	 feet	 feet	 feet	 feet
At Mile	 feet	 feet	 feet	 feet
At Mile	 feet	 feet	 feet	 feet
At Mile	 feet	 feet	 feet	 feet

(Give dimensions where reductions in size are made.)

10. Time required for completion of work1.....years.
 11. Time required for complete application of water to the proposed beneficial use1.....years.
 12. Choice of newspaper for publication of notice of intention to appropriate
 The Britton Journal, Britton, South Dakota

STATE OF SOUTH DAKOTA

County of Marshall

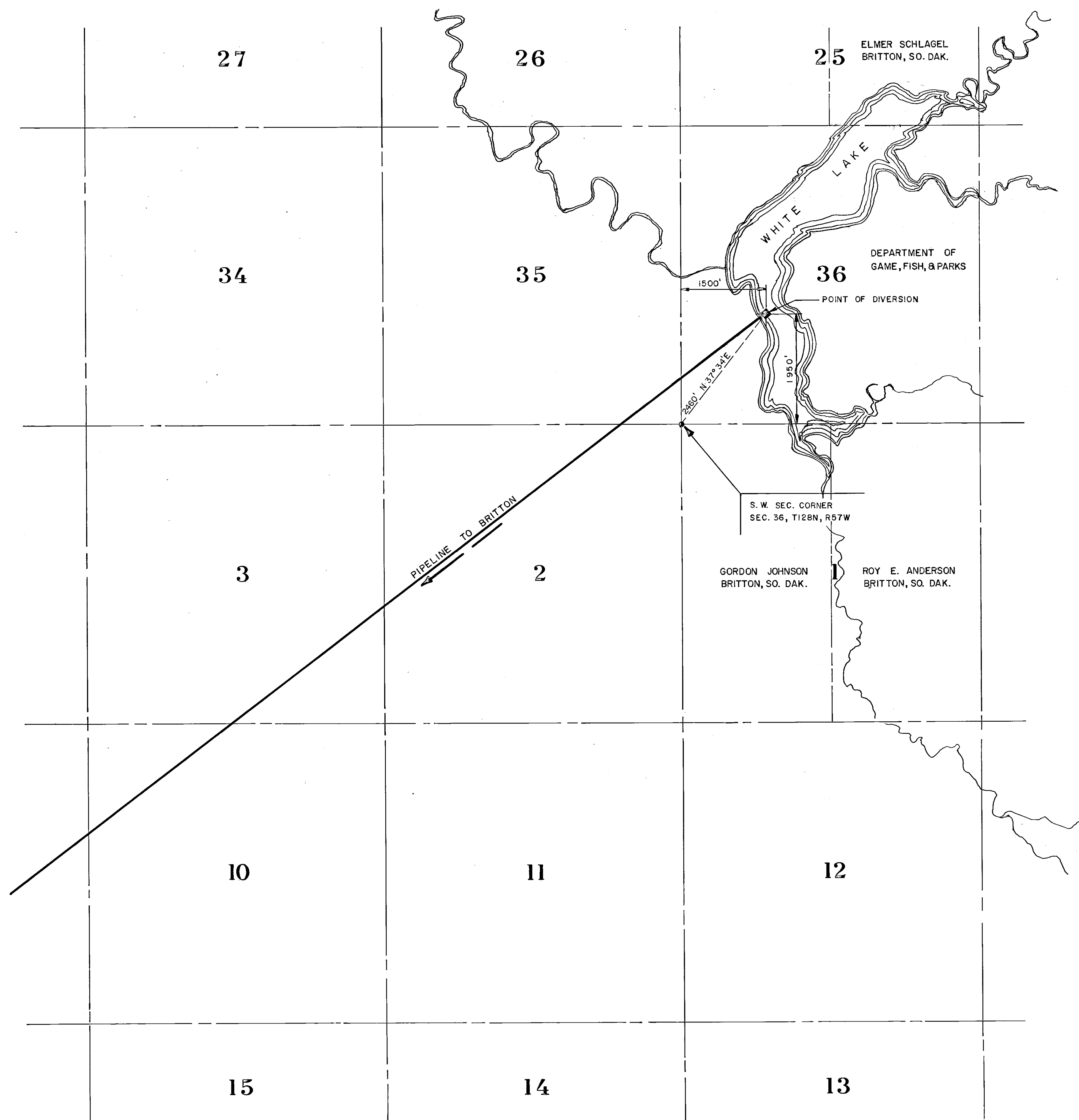
I, Ernest K. Kelley, being first duly sworn on oath depose and say: That my relation to the above described undertaking is that of owner, that I have read the above foregoing statement, examined the map accompanying the same, and that I know of my own personal knowledge that the matters therein stated and shown are true.

Signed Ernest K. Kelley

Subscribed and sworn to before me this 8th day of January, 1918

Ernest K. Kelley
 Notary Public (or other qualified officer.)

*Each diversion must have a headgate or measuring device.



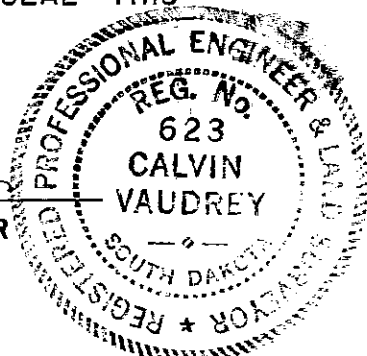
SURVEYOR'S CERTIFICATE

STATE OF SOUTH DAKOTA
COUNTY OF BROOKINGS S.S.

I, CALVIN VAUDREY, A REGISTERED LAND SURVEYOR WITHIN THE STATE OF SOUTH DAKOTA, DO HEREBY CERTIFY THAT AT THE REQUEST OF THE CITY OF BRITTON, I DID SURVEY THE TRACT OF LAND WITHIN THE OWNERSHIP BOUNDARIES FOR WHICH APPLICATION FOR AN APPROPRIATE WATER RIGHT TO WITHDRAW SURFACE WATER FROM WHITE LAKE FOR MUNICIPAL PURPOSES AND THAT THIS MAP IS A TRUE REPRESENTATION THEREOF.

IN WITNESS WHEREOF, I HAVE HEREUNTO SET MY HAND AND SEAL THIS 14TH DAY OF DECEMBER, A.D., 19 67.

Calvin Vaudrey
REGISTERED LAND SURVEYOR



ACKNOWLEDGMENT OF SURVEYOR

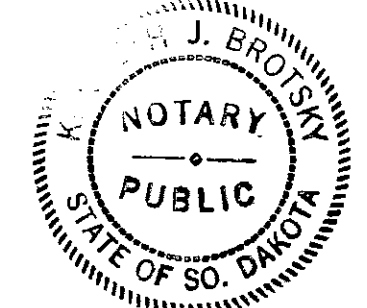
STATE OF SOUTH DAKOTA
COUNTY OF BROOKINGS S.S.

ON THIS DAY, BEFORE ME, THE UNDERSIGNED, A NOTARY PUBLIC WITHIN AND FOR THE STATE AND COUNTY AFORESAID, PERSONALLY APPEARED CALVIN VAUDREY, KNOWN TO ME TO BE THE PERSON WHO EXECUTED THE FOREGOING SURVEYOR'S CERTIFICATE AND ACKNOWLEDGED TO ME THAT HE EXECUTED THE SAME.

WITNESS MY HAND AND SEAL THIS 14TH DAY OF DECEMBER, 1967

Kenneth J. Bostick
NOTARY PUBLIC

MY COMMISSION EXPIRES:
My Commission Expires
January 4, 1973



LEGEND
SYMBOL DESCRIPTION
• PROPERTY CORNERS FOUND

REV.	DATE	DESCRIPTION	MADE	APPR.
J. T. BANNER & ASSOCIATES, INC. CONSULTING ENGINEERS BROOKINGS, SOUTH DAKOTA				
WATER RIGHTS MAP SHOWING DIVERSION LOCATION FOR PERMIT TO APPROPRIATE WATER FOR BRITTON, S. DAK. MUNICIPAL SUPPLY				
DRAWN: D.G.K.	APPROVED: _____			
DESIGNED: C. V.	DATE _____			
CHECKED: R.L.B.	APPROVED: _____			
DATE: NOV. 1967	DATE _____ FOR J. T. BANNER & ASSOC. INC.			
SCALE: 1" = 1000'		DRAWING NUMBER		
SHEET 1 OF 1		5 0 6 1		

Remarks by State Water Resources Commission:

STATE OF SOUTH DAKOTA
County of HUGHES ss.

Pierre, South Dakota, MARCH 25, 1968

This is to certify that the foregoing application was received by the Commission at 8:00 o'clock
9 a.m. upon the 9TH day of JANUARY, 1968

State Water Resources Commission

By:

[Signature]
for Chief Engineer, Executive Officer

Number of permit 1489-3

Date of first receipt of application JANUARY 9, 1968

Date of return to applicant for correction, amendments or changes required as follows: _____, 19____

Date of receipt of corrected application _____, 19____

Date from which applicant may claim right JANUARY 9, 1968

Approved MARCH 20, 1968 Recorded in Book 10 Page 113

This is to certify that we have examined the foregoing application for a permit to appropriate water of the State of South Dakota, and we hereby grant the same as stated herein, subject, however, to the following limitations and conditions:

- 1st. The equivalent of at least one-fifth of the work above specified is to be completed on or before SEPTEMBER 30, 1968 JUNE 3, 1970
- 2nd. The whole of said work is to be completed on or before MARCH 20, 1969
- 3rd. The limit of time for proof of beneficial use of water appropriated in accordance herewith is JUNE 3, 1971
MARCH 20, 1970 EXTENSION APPROVED 3-26-69
- 4th. The water appropriated shall be used for the purpose of MUNICIPAL

5th. The prior right of all persons who, by compliance with the laws of the State of South Dakota, have acquired a right to the use of water must not be injuriously affected by this appropriation.

6th. The amount of the appropriation herein granted shall not exceed .67 cubic feet per second; neither shall it exceed the capacity of the above described system of diversion works, nor the least amount of water that experience may hereafter indicate as necessary for ~~the production of crops in the exercise of the best husbandry; and further, said appropriation must be limited to not more than one acre with (1-70) of one cubic foot of water per second of time for each acre of land to which water is actually~~
USED FOR MUNICIPAL PURPOSES

and beneficially ~~applied for irrigation~~ applied for irrigation on or before MARCH 20, 1970; said water to be used during the following described annual period:

CONTINUOUSLY
Witness my hand this 25TH day of MARCH, 1968.

State Water Resources Commission

By:

[Signature]
Chief Engineer, Executive Officer

Certificate of Construction Issued JUNE 7, 1973

Water License Issued JUNE 7, 1973

Form 15.

Permit No. 1489-3

Water Diversion No. 3 JAMES RIVER Water District

CERTIFICATE OF CONSTRUCTION

This is to Certify, That the City of Britton

Permit No. 1489-3, issued upon Application No. 1489-3, bearing date of priority of January 9, 1968, authorizing the diversion of .67 cu. ft. per second of the waters of White Lake County of Marshall State of South Dakota at a point 2460 feet North 37° 34' East of the SW Corner, Section 36, T128N, R57W, for municipal

purposes, has ^s complied with the provisions of the laws of the State of South Dakota relating to proof of completion of the works of diversion set out and described in said Permit; that said works are found in satisfactory condition for diverting and conveying to the place of intended use 1.1 cu. ft. per second of water.

Date June 7, 1973

WATER RESOURCES COMMISSION

By:

J.W. GRIMES, Executive Officer

STATE OF SOUTH DAKOTA

WATER LICENSE NO. 1489-2

(1) WHEREAS, On the 9th day of January A. D. 19 68
the City of Britton

made Water Right Application No. 1489-3 for a permit to use .67 cubic feet per second of the waters
of White Lake

County of Marshall State of South Dakota, for municipal
purposes; and

(2) WHEREAS, On the 20th day of March A. D. 19 68
Permit No. 1489-3 with a date of priority of January 9, 1968

was issued to said applicant for the diversion of said water, and provided for the completion of construction of the water
supply system, therein described on or before the 3rd day of June A. D. 19 70 and for the
application to beneficial use of said water on or before the 5rd day of June A. D. 19 71

and:

(3) WHEREAS, It is hereby certified that the applicant has complied with the provisions of the laws of the State of South Dakota
relating to completion of the construction of the water supply system and is entitled to divert .57 cubic feet
per second of water for beneficial use and,

(4) WHEREAS, It is hereby certified that the applicant has complied with the provisions of the laws of the State of South Dakota
relating to the application of water to beneficial use of the following extent,

water is used for municipal purposes by the City of Britton.

(5) NOW, THEREFORE, By the virtue of the authority vested in us by the laws of the State of South Dakota, We hereby grant and confirm to _____
the City of Britton

_____ as
the holder _____ and owner _____ of said permit No. 1489-3 a water right, dating from January 9, 1966
_____ to use of .67 cubic feet per second of the waters
of White Lake
in the County of Marshall and State of South Dakota, or so much thereof as may be necessary for the
purposes hereinbelow mentioned, to be diverted at a point 2460 feet North 37° 34' East of the SW Corner,
Section 56, T146N, R57W

and ~~XXXXXXXXXXXX~~ conducted through the city water distribution system

for the purpose of Municipal use

Subject to any limitations listed in Water Right Permit No. 1485-3 and subject to the laws of the State of South Dakota.

WITNESS, My hand and seal of our office at Pierre, South Dakota
this 7th day of June A. D.
Nineteen Hundred and Seventy-three

WATER RESOURCES COMMISSION

By:

Chief Engineer, Executive Officer J.W. GRIMES

on or Before **February 15** 19**68**
 (First Publication:, 19..)

APPROPRIATION OF WATER

Office of State Water Resources Commission,

Pierre, S. Dak., **February 1**, 19**68**

Notice is hereby given that **the City of Britton** ~~whose office~~
~~address is~~, S. Dak., has made an application in accordance with
 the provisions of the water laws of South Dakota for a permit to appropriate for beneficial use **.67**
 cubic feet of water per second of time from ~~the~~ **White Lake** through the
Britton Municipal System, the point of diversion of which is to be located ~~on the~~
~~bank of said stream~~ in the **NE** $\frac{1}{4}$ of the **SW** $\frac{1}{4}$ of Section **36**
 Twp. **128N** Range **57W** Said water to be used for the purpose of providing ~~irrigation on the fol~~
~~lowing described lands~~
~~XXXXXXXXXXXXXXXXXXXX~~
municipal supplies for the City of Britton
~~XXXXXX~~

This application will be taken up by the State Water Resources Commission at their office at Pierre for
 consideration upon the **20th** day of **March**, 19**68**, at **2:00 P.** M. All interested persons
 may appear and be heard.

Appropriate action will be taken by the Water Resources Commission after suitable time has elapsed for
 the consideration of any or all information presented.

cc: City of Britton

State Water Resources Commission

By:

~~XXXXXXXXXXXXXXXXXXXX~~

BURTON F. JONES
Water Rights Specialist

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA }
County Marshall }^{ss}C. L. Ward being duly sworn, deposes and says the annexed printed copy of Notice

of Intention to Appropriate Water was taken from the _____

Britton Journal a newspaper which during the whole time of publication of said notice herein after stated, has been and is printed and published in theCity of Britton County of Marshall and State of South Dakota;

that the said notice was published in said newspaper on the following dates:

February 8, 1968February 15, 1968February 22, 1968February 29, 1968in each and every issue of the full number thereof, the first publication being made on the 8th day of February1968 and the last publication on the 29th day ofFebruary 1968 upon which days or times of publication aforesaid the newspaper was regularly published, and that during the whole time of said publication he

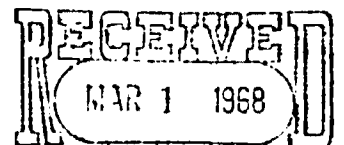
was _____ the printer and publisher of the said newspaper.

APPROPRIATION OF WATER
Office of State Water
Resources Commission
Pierre, South Dakota
February 1, 1968Notice is hereby given that the City of Britton, S. Dak., has made an application in accordance with the provisions of the water laws of South Dakota for a permit to appropriate for beneficial use .67 cubic feet of water per second of time from White Lake through the Britton Municipal System, the point of diversion of which is to be located in the NE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Sec-

tion 36, Twp. 125N, Range 57W. Said water to be used for the purpose of providing municipal supplies for the City of Britton.

This application will be taken up by the State Water Resources Commission at their office at Pierre for consideration upon the 20th day of March, 1968, at 2:00 P. M. All interested persons may appear and be heard.

Appropriate action will be taken by the Water Resources Commission after suitable time has elapsed for the consideration of any or all information presented.

State Water Resources
Commission
Burton E. Jones,
Water Rights Specialist
39-42STATE WATER RESOURCES COMM.
PIERRE, SOUTH DAKOTASubscribed and sworn to before me this 27th day of February A. D. 1968Robert G. ThompsonNotary Public Marshall County, S. D.

---Logs of wells and test holes in the Crow Creek-Sand
Lake area, S. Dak.,

	Thickness (feet)	Depth (feet)
126-58-1ab Altitude of land surface 1510.5		
Loam, clay, gray to black-----	5.0	5.0
Silt, brown-----	9.0	14.0
Sand, fine-----	2.5	16.5
Clay, blue-gray-----	4.5	21.0
Shale-----	0.5	21.5
126-58-3da Altitude of land surface 1512		
Loam, clay, brown-----	12.0	12.0
Silt, brown-----	2.0	14.0
Clay, blue-gray-----	20.0	34.0
Sand and gravel-----	2.0	36.0
Clay and shale-----	3.0	39.0
126-58-5cb Altitude of land surface 1500		
Loam, clay-----	3.0	3.0
Silt, brown-----	11.0	14.0
Sand, fine-----	2.0	16.0
Clay, blue-gray, with some thin layers of fine sand-----	24.0	40.0
Depth to water October 9, 1951; 5.2 feet		
126-58-9cb Altitude of land surface 1298		
Loam, clayey, black-----	10.0	10.0
Silt, brown-----	4.5	14.5
Sand-----	0.5	15.0
Silt, brown, with ferruginous weed casts-----	3.0	18.0
Clay, blue-gray-----	25.0	43.0
Silt-----	3.5	46.5
Clay, blue-gray, with thin layers of brown silt---	2.5	49.0

STATE OF SOUTH DAKOTA - BUREAU OF ADMINISTRATION - OFFICE OF RECORDS MANAGEMENT - CERTIFICATE OF AUTHENTICITY

THIS IS TO CERTIFY THAT THE MICROPHOTOGRAPHIC IMAGE APPEARING ON THIS SLIDE OF MICROFILM IS AN ACCURATE REPRODUCTION OF THE ORIGINAL RECORD AND WAS MICROFILMED IN THE REGULAR COURSE OF BUSINESS ACCORDING TO THE PROVISIONS OF SOUTH DAKOTA COMPILERS' 1-27-4. IT IS FURTHER CERTIFIED THAT THE PHOTOGRAPHIC PROCESS USED FOR MICROFILMING OF THE ABOVE RECORDS WAS IN A PERMANENT AND ON MICROFILM WHICH MEET THE RECOMMENDED REQUIREMENTS OF THE NATIONAL BUREAU OF STANDARDS FOR PERMANENT MICROPHOTOGRAPHIC REPRODUCTIONS.

REDUCTION 25:1 ROLL NO 28 4-12-82

DATE MICROFILMED

Betty J. [Signature]

CMRMA OPERATED

---Logs of wells and test holes in the Crow Creek-Sand
Lake area, S. Dak., continued

	Thickness (feet)	Depth (feet)
127-58-6baba1		
Loam, fine sandy-----	2.0	2.0
Silt, calcareous, brown-----	1.0	3.0
Sand, fine, brown-----	7.0	10.0
Sand, fine, blue-gray-----	11.0	21.0
Gravel, small, made up of basic rocks, well sorted	6.0	27.0
127-58-7abbb1		
Loam, silty, black-----	4.0	4.0
Sand, fine, blue-gray-----	21.0	25.0
Gravel, small, made up of basic rocks, well sorted--	3.0	28.0
2/ 127-58-7ccdc1		
Layers of fine sand and blue-gray clay-----	58.0	58.0
Coal-----	2.0	60.0
Sand, with thin layers of blue-gray clay-----	60.0	120.0
Gravel, small, well sorted-----	3.0	123.0
127-58-7dc1		
Loam, silty, black-----	4.0	4.0
Sand, fine, gray-----	3.0	7.0
Silt, brown-----	4.0	11.0
Silt, sandy, brown-----	14.0	25.0
Silt, brown, with sandy layers-----	12.0	37.0
Silt, brown, with layers of blue-gray clay-----	1.0	38.0
127-58-8acdd1		
Loam, sandy, black-----	3.0	3.0
Sand, fine, blue-gray-----	24.0	29.0
Clay, blue-gray, plastic, with sand-----	1.0	30.0
Sand-----	2.0	32.0
Clay, blue-gray, plastic, with layers of sand-----	6.0	38.0
127-58-9acdd1		
Loam, fine sandy-----	3.0	3.0
Silt, brown-----	7.0	10.0
Sand, fine, blue-gray-----	11.0	21.0

2/ Driller's log, from Walter Minnekaski, Genesec, North Dakota

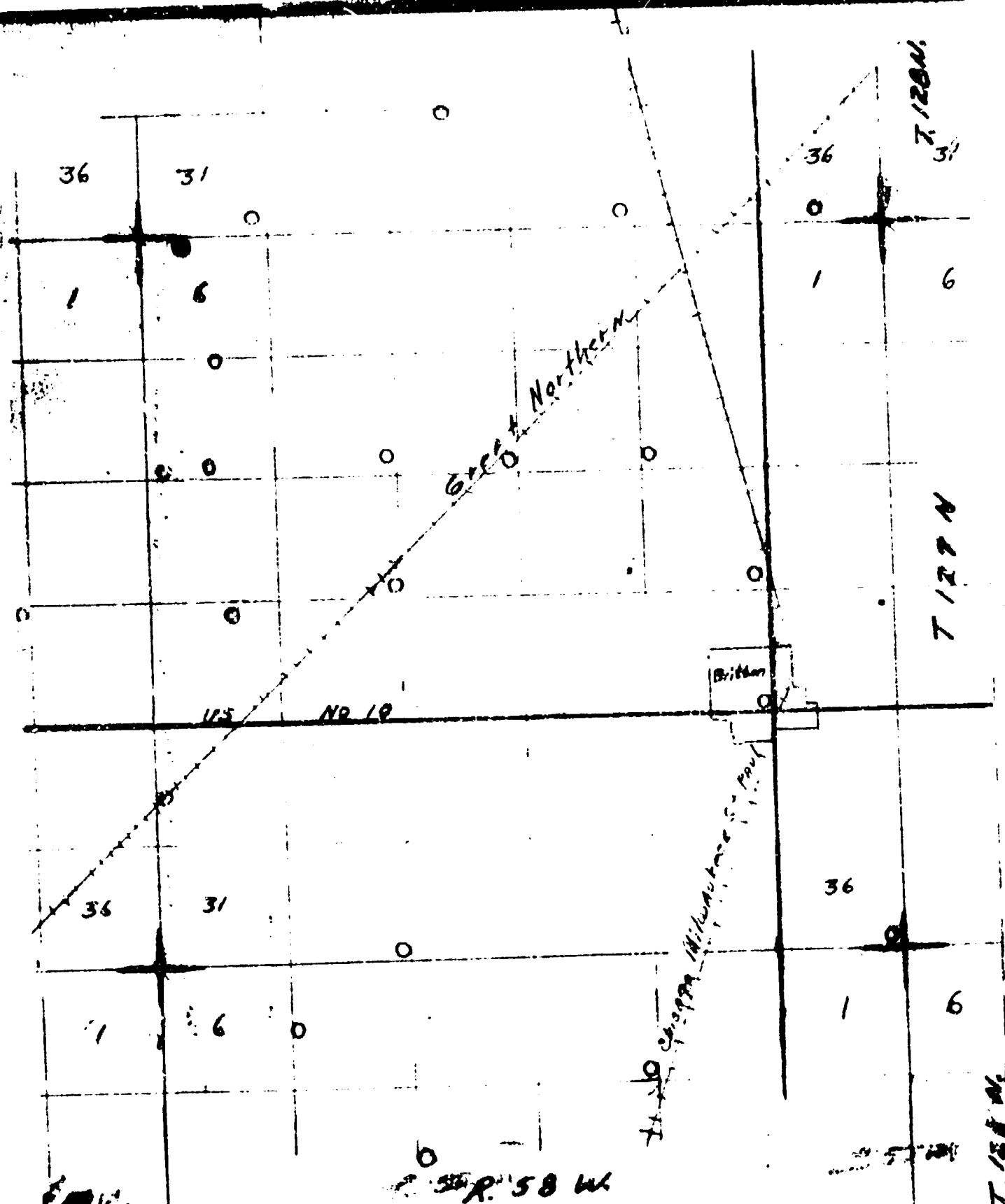
...Logs of wells and Test Holes in the Crow Creek-Sand
Lake area, S. Dak., continued

	Thickness (feet)	Depth (feet)
127-58-11occc		
Loam, clayey, black-----	2.0	2.0
Silt, calcareous, brown-----	1.0	3.0
Silt, brown-----	20.0	23.0
Sand, fine-----	7.0	30.0
Clay, gray-----	1.0	31.0
Sand, fine-----	5.0	36.0
Clay, blue-gray, plastic-----	2.0	38.0
127-58-13occc		
Loam, silty, black-----	2.0	2.0
Silt, brown-----	15.0	17.0
Silt, sandy, brown-----	4.0	21.0
Silt, brown, with layers of blue clay-----	15.0	36.0
Clay, blue-gray, plastic-----	2.0	38.0
Depth to water September 10, 1951; 12.2 feet		
3/ 127-58-14dd		
Clay, medium-----	17.0	17.0
Clay, heavy-----	6.0	23.0
3/ 127-58-17dd		
Loam, fine sandy-----	2.0	2.0
Loam, silty-----	3.0	5.0
Loam, sandy clay-----	9.0	14.0
Sand, fine, loamy-----	5.0	19.0
127-58-19cthd		
Loam, silty, black-----	3.0	3.0
Silt, brown-----	4.0	7.0
Clay, silty, brown-----	3.0	10.0
Sand, fine, silty, brown-----	2.0	12.0
Clay, silty, brown, with ferruginous weed casts---	7.0	19.0
Clay, silty, brown-----	11.0	30.0
Clay, silty, blue-gray-----	7.0	37.0
2/ 127-58-23dd		
Loam, sandy-----	2.0	2.0
Sand, silty with blue clay layers-----	10.0	12.0
Sand, medium, blue-gray-----	33.0	45.0
3/ Bureau of Reclamation test hole		
2/ Miller's Log, from Lehman Bros., Hecla, South Dakota		

Log of wells and test holes in the Crow Creek-Sand
Lake area, S. Dak., continued

	Thickness (feet)	Depth (feet)
127-58-30cbbbl		
Loam, black-----	1.0	1.0
Silt, brown-----	12.0	13.0
Sand, fine, brown-----	10.0	23.0
Sand, fine, blue-gray-----	3.0	26.0
Sand, fine, clayey, blue-gray-----	1.0	27.0
Sand, fine, blue-gray-----	16.0	43.0
Clay, blue-gray, plastic-----	1.0	46.0
2/ 127-58-32ad Altitude of land surface 1313		
Loam, silty clay-----	2.0	2.0
Clay, silty-----	3.0	5.0
Clay, medium-----	14.0	19.0
Clay, heavy-----	4.0	23.0
127-58-36ad Altitude of land surface 1323.5		
Loam, clayey, black-----	3.0	3.0
Silt, brown-----	7.0	10.0
Sand, silty-----	1.0	11.0
Clay, blue-gray, with fragments of shale-----	7.0	18.0
Depth to water October 9, 1951; 6.0 feet		
2/ 127-58-31ad		
Loam, fine sandy-----	1.0	1.0
Sand, fine, loamy-----	1.0	2.0
Loam, fine sandy-----	2.0	4.0
Sand, fine-----	9.0	13.0
128-58-35oacz		
Loam, very fine sandy-----	3.0	3.0
Silt, fine sandy, brown-----	9.0	12.0
Sand, very fine, brown-----	15.0	27.0
Sand, fine, brown to gray-----	5.0	32.0
Sand, fine, blue-gray, with thin layers of blue clay	7.0	39.0
2/ 128-58-34ad		
Loam, silty-----	11.0	11.0
Loam, sandy clay-----	10.0	21.0
2/ 128-58-36ad	Thickness (feet)	Depth (feet)
Loam, silty-----	3.0	3.0
Loam, sandy clay-----	3.0	6.0
Loam, silty-----	8.0	16.0
Loam, silty clay-----	2.0	18.0
Clay, medium-----	3.0	21.0
Clay, silty-----	2.0	23.0

2/ Bureau of Reclamation test hole



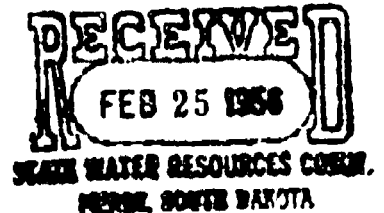
Location of well and test holes in the vicinity of
Britton, S. D.



IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Water Resources Division
Ground Water Branch
P. O. Box 1412
Huron, South Dakota
February 24, 1956



Mr. J. W. Grimes, Chief Engineer
South Dakota Water Resources Commission
State Office Building
Pierre, South Dakota

Dear Joe:

Reference is made to your letter of February 23, 1956 regarding potential ground-water supplies in the vicinity of Britton, S. Dak.

Britton lies within the area of a ground-water investigation made at the request of the Subcommittee on Seepage Areas and Drainage, James River Basin Coordinating Group (South Dakota). Copies of an administrative report, "Ground Water Investigation of the Crow Creek-Sand Lake Area (South Dakota)" by Francis C. Koopman, were sent to official in Pierre in March of 1953. Copy No. 4 was sent the State Engineer and Copy No. 6 the Natural Resources Commission (attn: Fred Henson); either or both should be in your files. A revised version of the report is now in the hands of the editors.

But few of the test holes drilled near Britton during the investigation reached bedrock; most were less than 40 feet. Copies of logs of 23 test holes and wells in the vicinity of Britton are enclosed for your convenience. Of special interest is that of well 127-58-23dd2 in the City of Britton. The driller's log, supplied by Lahman Bros., Hecla, S. Dak., shows sand from a depth of 12 feet to bottom of hole at 45 feet. Depths to water in shallow wells in Britton ranged from about 8 to 31 feet in 1951.

The log mentioned indicates the presence of a saturated thickness of sand which probably would yield the required 300,000 gpd to properly constructed and developed wells. If drawdown were excessive, it might be necessary to use more than one well to supply the required amount. Surface storage facilities might be needed in order to permit moderate pumping rates rather than heavy rates to meet peak demands. Test drilling would be required in order to determine the best locations for production wells and to determine the feasibility of a 300,000 gpd installation.

At present the shallow ground-water reservoirs in the vicinity of Britton are but little pumped. Drawdown from heavily pumped industrial wells might affect pumping levels in shallow wells in town, reported to be used principally for watering lawns.

We have no data on the chemical and physical characters of the shallow waters of the area. Among observation wells in the area of investigation, well 127-58-14ddl, just north of Britton, is still a part of our program. Water-level measurements through November 1955 are on file here.

If the installation need not be situated in town, it might be profitable to prospect northwest of town. The log of well 127-58-7ccdc1, for instance, shows several tens of feet of sand.

It is hoped the above data and comments will be helpful.

Very truly yours,



J. R. Jones
District Geologist

Att: logs, map

February 23, 1956

Dr. E. F. Rothrock, State Geologist
State Geological Survey
University of South Dakota
Vermillion, South Dakota

Dear Dr. Rothrock:

The City of Britton has a possibility of an industry locating there if the City can supply an additional 300,000 gallons of water daily.

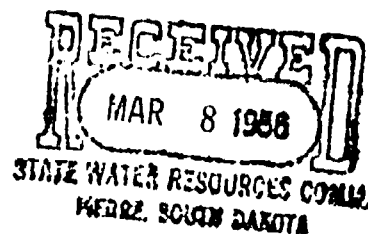
I will appreciate any information you may have regarding possibilities of such a water supply near Britton.

Sincerely,

J. W. CHIKES
Chief Engineer

JWG:rs

SOUTH DAKOTA
STATE GEOLOGICAL SURVEY
STATE UNIVERSITY
VERMILLION



March 7, 1956

Mr. J. W. Grimes
State Water Resources Commission
State Capitol
Pierre, South Dakota

Dear Mr. Grimes:

I was out of the state attending a convention, hence the delay in answering your letter of February 23.

Locating 300,000 gallons of water for the city of Britton is quite a little order. There is no large body of ground or surface water near this town. About the only possibility of developing it would be a well field into the sand at the base of the glacial drift. In this vicinity, this sand would probably lie within 100 feet of the surface. It's thickness, however, is a matter of conjecture as we have no data on any wells in that vicinity.

If this water sand does not prove out, the only chance would be to get down to the basal sand lying on top of the "Granite". This should be struck somewhere around 1000 to 1200 feet. Since Britton is so close to the intake, I imagine it would be a useable water.

Very truly yours,

A handwritten signature in dark ink, appearing to read "E. P. Rothrock". The signature is fluid and cursive, with a large, sweeping "R" and "h".

E. P. Rothrock
STATE GEOLOGIST

EPR:cs

1489-3

March 9, 1956

Mr. Daniel G. Beck, Secretary
Britton Chamber of Commerce
Britton, South Dakota

Dear Mr. Beck:

Your letter of February 13, 1956, asks about possibilities of obtaining an additional 300,000 gallons of water daily to supply your prospective industry.

From test hole data in the vicinity of Britton, indications are that you may be able to obtain water in the amount desired from relatively shallow ground water sources (40 feet or so). More than one well may be necessary, probably, and continuous industrial pumping may affect the wells now used in town, I understand, for lawn sprinkling. Should your industrial prospect decide to locate in or near Britton, water investigations and tests should be made to firmly fix the amount and chemical characteristics of this ground water source of supply.

Very little data exists regarding deeper sources of water. Sands exist at the base of the glacial drift which, in the vicinity of Britton, would be about 100 feet deep. Its thickness, however, is a matter of conjecture. Wells in your area, apparently, have not tapped such a source. Testing would be necessary.

One other possibility exists. The sands lying on top of the "granite" are in the neighborhood of 1000 - 12000 feet deep. Britton is close to the intake of these supplies and the water should be usable. Again, no reliable test data exists in your area. Testing would be necessary.

It is unfortunate that I do not have more specific information for you.

Sincerely,

J. W. GRIMES
Chief Engineer

JWG:rs

BRITTON

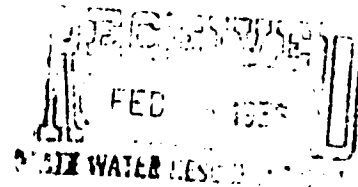


BRITTON BECKONS YOU
... TO OUR VALLEY OF PLENTY

BRITTON, SOUTH DAKOTA

February 13, 1956

Water Resource Commission
Pierre, South Dakota



Re. Water Resources in Britton, S. Dak.

Gentlemen:

We would like to obtain some information from you commission if it is at all possible. We are attempting to attract some new industry to our community and have one possibility in line. It would be necessary for us to furnish this industry with a large quantity of water. The amount in question is 300,000 gal. above the amount being used by our community now.

We are wondering if you have any information on file that would indicate if the water reserve in and around Britton is ample to furnish the required amount of water. If you have this information, would you please reply as soon as possible.

Thank you for your kind attention to this matter.

Very truly yours,

Daniel G. Beck
~~First National Bank~~
Sec. Britton Chamber of Commerce.

APPLICATION FOR EXTENSION OF TIME FOR COMPLETING WORKS

To the State Water Resources Commission
Pierre, South Dakota

March 3, 1969
(date)

Dear Sirs:

I hereby request that an extension of time from March 20, 1969
to June 3, 1970 be granted me for the completion of works to be done under Permit No.
1182-3 and that the time for proof of beneficial use of water be extended to June 3, 1971

Said works are located in Marshall County and are described
as follows:

Location of headworks: In the Northwest 1/4 of the Southwest 1/4
of Section 36 Township 126 North Range 57 West
EX. B. & M. 5th P.M.

The water is to be used for the purpose of Municipal Supply for the City of Britton,
South Dakota

The extension of time for the completion of these works is requested for the following reasons:
Additional construction time is needed for completion of the work now under
contract. This work includes the intake structure at White Lake and the Water
Treatment Plant located in the City of Britton.

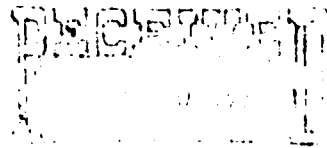
APPROVED: MARCH 26, 1969

State Water Resources Commission

By:

Aurton Z...
for Chief Engineer, Executive Officer

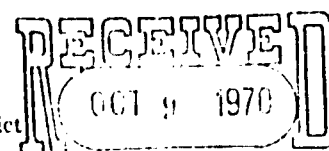
Mayor, City of Britton, South Dakota
Holder of Permit No. 1182-3



Permit No. 1489-3

Water Division No. 3

James River Water District



NOTICE OF COMPLETION OF WORKS

STATE WATER RESOURCES COMM.
PIERRE, SOUTH DAKOTA

This blank must be filled out by the holder of permit and forwarded to the Executive Officer at least 60 days before the time set for completion of works

(P. O.) Britton, South Dakota 57430

(Date) July 17, 1970

TO THE STATE WATER RESOURCES COMMISSION
OF SOUTH DAKOTA, PIERRE:

DEAR SIR: Notice is hereby given of the completion of the works for the diversion of 0.67
cu. ft. per second of the waters of the state from White Lake
through the Intake Structure and Pipeline
for Municipal Supply (Domestic Use and Fire Protection) purposes
in accordance with the terms and conditions of a certain permit heretofore issued by the Water Resources Commission of the State of South Dakota.

1. The name of the person or corporation holding said permit is City of Britton, South Dakota
2. The postoffice address of such person or the place of business of such corporation is City Hall
County of Marshall State of South Dakota
3. The number of such permit is 1489-3 and the date set for the completion of such work is
October 1, 1970
4. Said water to be used for Municipal Supply purposes.
5. Said works of diversion will be fully completed on the date set for such completion, and the amount of water which said works are capable of conducting to the place of intended use, in accordance with the plans accompanying the application for such permit, is 0.67 cubic feet per second.
6. The amount of land for which said water is available is Not Applicable acres,
particularly described as follows.

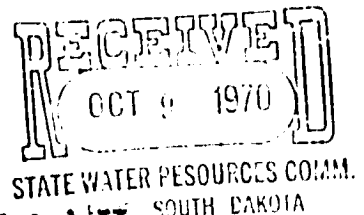
I hereby certify that the facts set forth in the above notice are true.

Donald Franzen, Mayor

(Signature of Owners)

Permit No. 1489-3

Water Division No. 3 James River Water District



Notice of Application of Water to Beneficial Use

(This blank must be filled out by holder of permit and forwarded to the State Water Resources Commission at least sixty days before the time set for application of water.)

(P. O.) Britton, South Dakota 57430

(Date) July 17, 1970

TO THE STATE WATER RESOURCES COMMISSION OF SOUTH DAKOTA, PIERRE:

DEAR SIR: Notice is hereby given that on the 1st day of October
 1970, at Britton, South Dakota County of Marshall State of South Dakota,
 before _____ proof will be submitted of the application to beneficial use
 (Examining Engineer or Officer)
 of 0.67 cubic feet per second of the waters of White Lake
 _____ in accordance with the terms and conditions of Permit No. 1489-3
 heretofore issued by the Water Resources Commission of South Dakota.

1. The name and postoffice address of the person or corporation holding said permit are _____
City of Britton, City Hall, Britton, South Dakota 57430
2. The use to which said water has been applied is Municipal Supply
(Domestic use and fire protection)
3. The amount applied to beneficial use is 0.67 c.f.s.
4. The place where said water is used is (If for irrigation, give full and accurate description of the lands irrigated) City of Britton
5. The name of the canal or ditch or other works by which said water is conducted to such place of use is 8.1 - Mile Pipeline
6. The right to take the water from such works is based upon permit No. 1489-3
7. The source of supply from which such water is diverted is White Lake
8. The date of priority which said user is prepared to establish is January 9, 1968

(Sign)

Donald Franzen, Mayor

Permit No 1489-3

Water Division 3 JAMES RIVER Water District

REPORT OF EXAMINATION OF WORKS
AND/OR APPLICATION OF WATER TO BENEFICIAL USE

TO: Water Resources Commission, State Office Building No. 2, Pierre, South Dakota 57501

I have this day made a thorough examination of the water use system constructed by the City of
Britton of Britton, S.D. holder
of Permit No. 1489-3, hearing date of priority of: January 9, 1968
authorizing the diversion of 0.67 cu. ft. per second of the waters of White Lake
for municipal purposes purposes, in Marshall County.

i have to report on the condition of the same as follows:

The Water Use System consists of,

A. Works used to divert the water.

Existing White Lake, (artificial)

pumphouse - clear well tapping lake water.
Pump No. 1. Point 1.

Pump No. 1, Fairbanks Morse, 8 inch turbine pump, Westinghouse 10 H.P. electric motor.
Pump No. 2, Fairbanks Morse, 6 inch turbine pump, Westinghouse 6 H.P. electric motor.

B. Works used to transport water to place of use,

Approximately 8 miles of 10 inch diameter buried asphalt cement pipe. 35,000 gal. elevated tank, plus two other storage sites and treatment plant.

C. Works used to apply water to beneficial use.

550 Service Connections

The system is in the following condition: Excellent

The point of diversion is located 2460 ft. North 37° 34' East of the SW Corner, Sec. 36,
T128N, R57W

The works are capable of diverting and conveying to the place of use 1.1

cu. ft. per second of water which is to be used for municipal purposes

Water has been put to beneficial use to the maximum extent as follows: system has been constructed and used as indicated.

~~XXXXXXXXXXXXXXXXXXXX~~

Send to Franzen, Mayor.

Date April 18, 1973

(Signature)

DONALD DRISCOLL, Deputy Chief Engineer, W.R.C.

11 200000 1000000
1489-3
September 14, 1959

Mr. Newton J. Jones
City Attorney
Britton, South Dakota

Dear Mr. Jones:

I am sorry to be so slow answering your letter of August 21 concerning the possibilities of using White Lake for a water supply for the City of Britton.

I discussed this matter with the Game, Fish and Parks Department who has interests in White Lake. From this preliminary inquiry I believe that arrangements may be made for the City of Britton to use White Lake waters in return for assumption of operation and maintenance responsibilities by the City. Perhaps other considerations may develop if the City wishes to proceed with development of this source for municipal water supplies.

If the City wishes to proceed, two courses of action occur to me. The City could enter into negotiations with the Game, Fish and Parks Commission seeking an agreement concerning use of the waters in White Lake by the City. Subsequent action would result in a transfer of water rights from Game, Fish and Parks to the City of Britton.

The other course of action would be for the City to make application for water rights to the Water Resources Commission. Procedural clearance by the Water Resources Commission would establish the conditions under which the City could obtain the use of White Lake waters.

Either course of action would clarify the situation definitely and officially.

I hope this information is helpful.

Sincerely,

J.W. GRIMES
Chief Engineer

JWG:pt

*Ans'd
9-10-59*

NEWTON J. JONES
ATTORNEY
HAMILTON BUILDING
BRITTON, SOUTH DAKOTA
August 21, 1959

OFFICE HI 8-5101
RESIDENCE HI 3-2220

Water Resources Commission
Pierre, South Dakota

RECEIVED
AUG 24 1959

STATE WATER RESOURCES COMML.
PIERRE, SOUTH DAKOTA

Gentlemen:

I have been requested by our City Council to make a very preliminary inquiry into the possibility of obtaining some time in the future the use of White Lake as a source of municipal water supply.

White Lake is situated 6 miles east and 4 miles north of Britton and covers an area of about 120 acres. Its elevation is about fifty feet higher than a point about 1 mile north of Britton, and from this point on pumps would be necessary. Enclosed is a map of Marshall County which indicates that the lake is almost entirely contained within Section 36, Township 128 North, Range 57, West of the 5th P. M., Marshall County, South Dakota. It is an artificial lake built during the WPA days and the whole section on which it is located is in the name of the State Fish, Game & Parks Department.

Britton obtains its supply of water presently from three artesian wells about a thousand feet deep and since we have been lowering our pumps in these wells slowly but regularly it may be in order to figure out if we can some other future source of water.

If you could, only briefly perhaps, give us any idea as to how to go about preparing future plans it would be very much appreciated. We would be particularly interested in the question of whether this might ever be available, if a survey showed such a project feasible.

Yours very truly,

[Signature]
CITY ATTORNEY

NJ:aa1

MARSHALL COUNTY HIGHWAY MAP

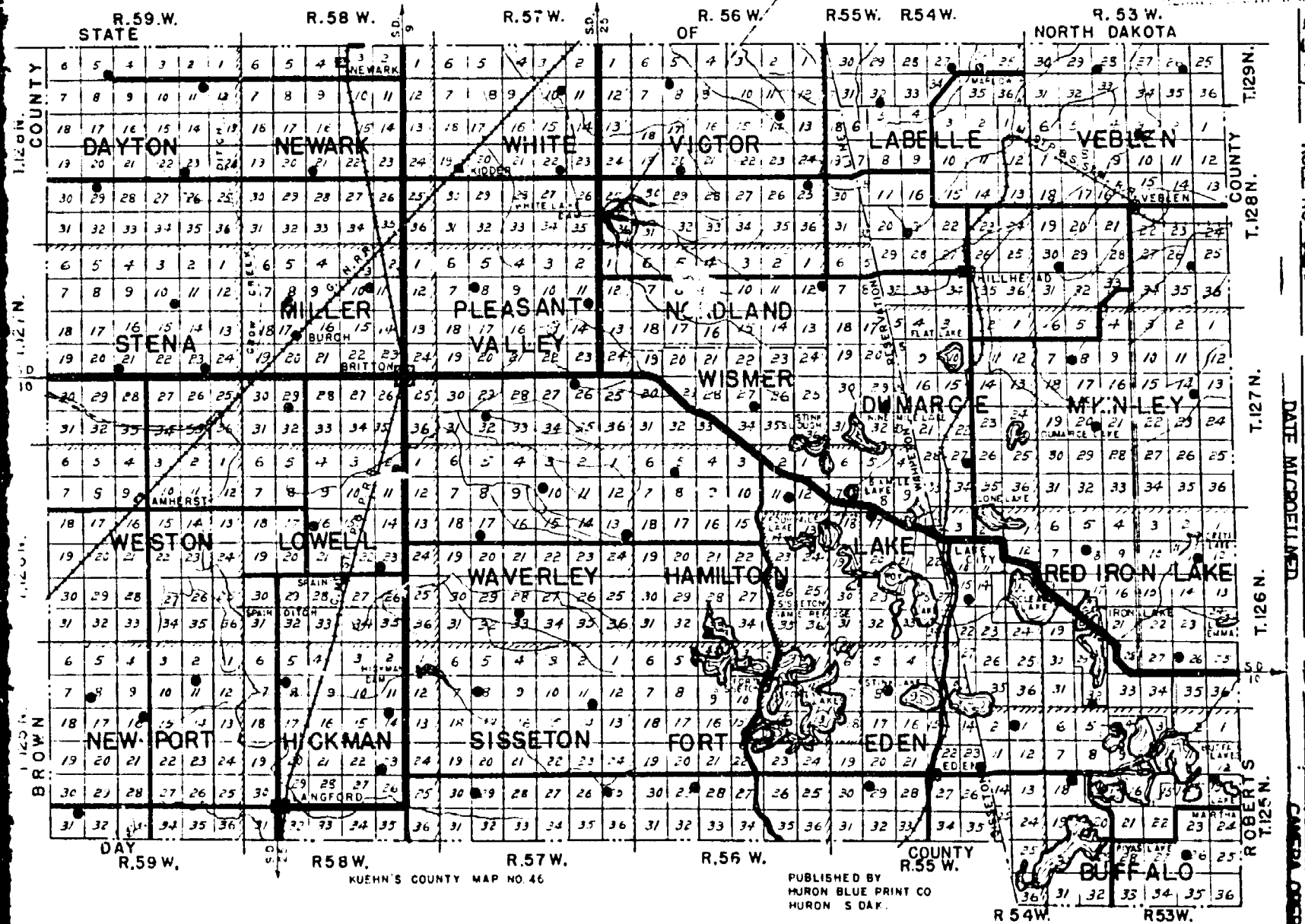
SOUTH DAKOTA

1941

- U.S. & S.D. HIGHWAYS
- COUNTY HIGHWAYS
- INDIAN SERVICE HIGHWAYS
- RURAL SCHOOL

RECEIVED
AUG 21 1952

STATE WATER RESOURCES
BUREAU, SOUTH DAKOTA





INTER-DEPARTMENT CORRESPONDENCE
State of South Dakota



From Dept. of Harvey C. Binger

To Dept. of John Papowski

Jack Opitz

Subject White Lake water use

Date June 22, 1973

John;

I contacted Don Franzen, mayor of Britton, regarding the use of water from White Lake for watering golf course. The city plans on taking the golf course over and leasing it back to the club. This will make it possible for them to get BOR money to put in grass greens. They have been told that the easement they have with the Dept. give the city the right to use water for any city use. They say that if they do not irrigate over one acre a permit for irrigating is not required. This plan has not been completed so I advised him that they should contact the Dept. before they go to far.

At this time I could not make a recommendation either way on this. I would have to know the amount of water to be used and also if this could be stoped if water level should get low in the lake. I will try to keep up on what is being done and keep you posted.

Harvey C. Binger

Binger

Conservation Officer
Britton. So. Dak. 57430

JUN 25 1973



FILE COPY

INTER-DEPARTMENT CORRESPONDENCE
State of South Dakota



Robert L. Hanten
Fisheries Staff Specialist

Warren Jackson

From Dept. of _____ To Dept. of Harvey Binger

Subject _____ Date January 2, 1974

Men:

The City of Britton has submitted application to B.O.R. requesting funds for developing grass greens on "their" golf course. Included in that application are provisions for irrigating 10 greens and 9 tee boxes. Total area of these are 17,000 sq.ft. Thus, they would be under the 1/2 acre restriction on irrigation under the domestic water use permit.

I have no objection to this project if we put some restrictions in the B.O.R. Agreement, which will limit or completely stop green and tee box irrigation when lake levels go below a certain point and that no additional irrigation of fareways or more greens and tee boxes be incorporated into the proposed system. I also suggest that the point at which lawn and golf course irrigation be suspended is when White Lake's water level drops 3 feet below spillway level.

Larry Weires, Recreation Specialist for Parks and Recreation says we can incorporate this into the B.O.R. Agreement.

Please give me your comments and if we agree, it will be written up in the B.O.R. agreement.

Sincerely,

Bob

RLH/mt
cc: Larry Weires, Jerry Streckfuss

FILE COPY



INTER-DEPARTMENT CORRESPONDENCE

State of South Dakota



From Dept. of Harvey C. Binger To Dept. of Robert Hanten

Subject White Lake, water use Date Jan. 8, 1974

Bob:

I am in agreement with you on water use from White Lake for golf club use. I believe that the limit of 3 feet below the spillway should be the limit that we should go with. I hope that a restriction will be made that no other watering, such as fairways, will be made.

I believe that the City should check into the possibility of storing water in one of the watershed dams above White Lake.

Binger
Harvey C. Binger
Conservation Officer
Britton, So. Dak.

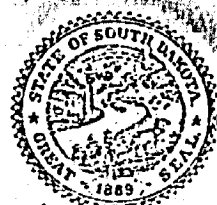
cc Warren Jackson
Jack Opitz
Jerry Streckfuss

JAN - 9 1974



INTER-DEPARTMENT CORRESPONDENCE

State of South Dakota



From Dept. of Game, Fish & Parks To Dept. of Parks & Recreation
Subject Britton Golf Course Date January 9, 1974

Larry:

Enclosed find a copy of Harvey Binger's memo agreeing with my proposal for the water use limit on the City of Britton for their golf course. Warren Jackson has also received this and is in agreement.

Please write up the agreement stating the provisions listed in my memo of January 2, 1974 for the B.O.R. agreement.

Sincerely,

Robert L. Hanton
Fisheries Staff Specialist

RLH/mt

Enc.

cc: Harvey Binger
Warren Jackson

June 16, 1959

Mr. Everett Kelley
City Auditor
City of Britton
Britton, South Dakota 57430

Dear Mr. Kelley:

It was the understanding of the Commission that the City of Britton was assuming maintenance of the structures at White Lake in an "as is" condition.

Our engineer has been aware of the fact that the lower wing wall has tipped. However, the Soil Conservation Service has installed several large detention dams above White Lake which we feel has eliminated the need for flood capability.

In earlier correspondence Banner and Associates were proposing that the rectangular opening which you mention would be plugged by the City. Actually, for our purposes there is no need to plug the opening.

For your information I am enclosing copies of correspondence relating to the agreement for maintenance of the Dam.

Sincerely,

R. A. Hodgins
Director

RAH/dk
Encs.

cc: Murel Trimble

Art Jahnig, Acting Mayor for the City of Britton, by authority duly given him by the City Council on December 13, 1967, hereby agrees that in consideration of the use of the water supply from White Lake, Marshall County, South Dakota, given to them by the South Dakota Game, Fish and Parks Commission, the City of Britton will maintain and repair when necessary, all structures now located on White Lake for as long as the City of Britton uses said lake for their domestic water supply.

Dated: March 15, 1968

Art Jahnig
Acting Mayor of Britton

Attest:

Everett Keding
City Auditor

R. H. Johnson
For the South Dakota Game,
Fish & Parks Commission

*File White L.
Hanshali*

February 15, 1968

Mr. Calvin Vaudrey
Banner & Associates
Brookings, South Dakota 57006

Dear Calvin:

Some time ago you appeared before our Commission with a delegation from Britton with regard to using water from White Lake for municipal water.

At that time the Commission adopted the following motion: THAT THE COMMISSION GRANT THE CITY OF BRITTON SOME RIGHTS CONTINGENT UPON THE CITY'S ASSUMING MAINTENANCE OF THE DAM.

It was my understanding that you were going to work up some type of agreement between the city and our Department, spelling out what maintenance responsibilities the city would undertake. Thus far, we have heard nothing. I would appreciate your immediate assistance in developing this agreement so as to be able to obtain Commission approval at our March 11 and 12 meeting.

Sincerely,

R.A.H.

R. A. Hodgins
Director

RAH/af

cc: Bob Hanten ✓
Murel Trimble

COPY



INTER-DEPARTMENT CORRESPONDENCE

State of South Dakota



From Dept. of Robert L. Eanten
White Lake, Marshall County
Subject: Britton Water

To Dept. of John Popowski

Date June 21, 1973

John:

Attached find copies of our agreement with, and letters to the City of Britton re water from White Lake. The city also has a permit from Water Resources to take water from White Lake at the rate of 300 gallons per minute for municipal use. According to Water Resources (Burt Jones), watering of municipal golf courses is a legitimate use of city water. Greens and tee boxes are no real problem on a nine hole course because they would be like watering 18 to 20 extra lawns in the town. Fairway irrigation, however, would be significant. It appears as though the city does not have enough water volume with their present permit to accomplish fairway irrigation. We should appose any application for that purpose.

In determining the hourly, daily and annual volumes of water available to the city, I have calculated the following:

300 gpm @ 60 min/hr	=	18,000 gals/hr.
18,000 gpm @ 24 hours/day	=	432,000 gals/day
432,000 gpd by 365 days/yr	=	157,680,000 gals/year
157.68 million gpy X 3 ac.ft *	=	473.04 ac.ft./yr
473.04 ac.ft. ÷ by 186.8 (surface acs. White L.)	=	2.5 vertical feet off the lake per year.

* 1 million gallons approximately equals 3 ac.ft.

Thus, the annual effect of the city withdrawing their full allotment could result in a lake level drop of 2½ feet (when full). Usually cities with permits do not comply with the gallon per minute limits, but take water at the capacity of their system and pump only for a few hours a day. They store the water in their standpipes and meter it out as needed. This is acceptable as long as the daily quota is not exceeded.

Normally, this water use would not be detected, but during dry years the summer use by the city plus evaporation will cause a considerable drop in the lake level. This could be as much as 4 to 5 vertical feet (from full stage), in one summer without rain at White Lake.

Under drought or dry conditions the city should be wise enough to limit their use. If they do not conserve their water at these times, I think we should remind them of the other beneficial uses designated to White Lake. If the supply gets critical we may have to ask the city to limit their withdrawals for strictly domestic uses. Lawn watering and other uses would have to be stopped or curtailed. There is no way possible for us to stop the cities use of water for human use, nor would we want to put the fisheries ahead of the people needs.

RLH/mt

Sincerely,



White L. H. H. H. H.

INTER-DEPARTMENT CORRESPONDENCE

State of South Dakota



From Dept. of Larry Weires

To Dept. of Bob Hanten

Subject Britton Golf Course

Date January 24, 1974

Bob,

Enclosed you will find a copy of the agreement between the city of Britton and the department in regard to the irrigation of the city's municipal golf course.

Sincerely,

Larry

Larry Weires
Recreation Specialist

LN/vo

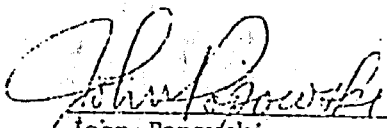
cc: Harvey Binger
Warren Jackson

DECLARATION OF AGREEMENT

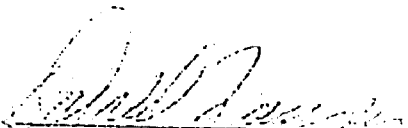
The city of Britton hereby agrees to the following provisions in regard to the irrigation of the Municipal Golf Course.

1. No fairway irrigation will occur.
2. The irrigation system will not be expanded beyond this proposed system.
3. If the water level of White Lake drops more than three (3) feet below the spillway, all irrigation of the golf course will stop.

This agreement made and entered into between the city of Britton and the Game, Fish and Parks Department on the 21 day of January, 1974.


John Popowski

Secretary, Game, Fish & Parks


Donald Frazen, Mayor
City of Britton

Phone 448-5162

Aug 4, 1980

Betty.

Called Don Franzen, Britton, I.D.

Wants to know if it would be possible to obtain water right for irrigation of the furrows out of White Lake. May possibly make two applications: one for ground water and one from White Lake.

Check into ~~the~~ ^{these} items:

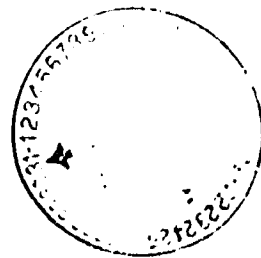
- (1) H & P water rights to White Lake.
- (2) Present Water Rights of the City
- (3) Does H & P have an interest in White Lake or are they willing to turn the Lake over to the City of ~~Britton~~ Britton: Possibility of a Transfer of Water Rights
- (4) Send two sets of application forms to Don Franzen, Box 251, Britton, I.D.
- (5) Write letter of the possibilities

J.W.

Re: John Hatch South Dakota *Water Rights, F. 10711R*
DEPARTMENT OF GAME, FISH AND PARKS

March 27, 1981

1489.3



Charles Wismer, Mayor
P. O. Box 91
Britton, SD 57430

Dear Mayor Wismer:

Enclosed find two copies of the agreement which we talked about and agreed upon at the City Council meeting on March 19, 1981. Please sign in the appropriate place and return one copy to me.

Thank you.

Sincerely,

Jack Merwin, Secretary
Department of Game, Fish & Parks

JM/RLH/mt
Enc.

MEMORANDUM OF AGREEMENT

March, 1981

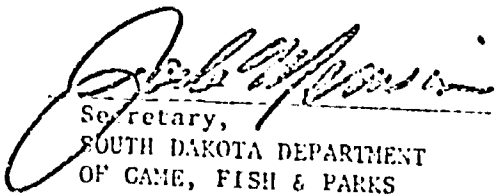
The City of Britton and the Department of Game, Fish & Parks agree to the following criteria for water withdrawal from White Lake, Marshall, County:

1. In order to accurately determine the water level elevation, the City shall install and maintain a staff gauge which will be placed at a site and in a manner acceptable to the Department.
2. The City may withdraw water from White Lake for any municipal purposes whenever the lake level is within three (3) vertical feet of the spillway elevation.
3. Whenever the lake elevation is three feet or more below the spillway elevation, the City may withdraw water from the lake provided the water is immediately replaced with equal or greater amounts from the City well or other sources.
4. This agreement shall supercede and replace the 1974 amendment to the original 1968 agreement. It shall not negate or replace the original agreement, but shall be a part thereof.

Signed

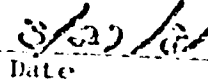
Mayor of Britton

Date



Secretary,

SOUTH DAKOTA DEPARTMENT
OF GAME, FISH & PARKS



Date

PRELIMINARY REPORT
on
WATER SUPPLY FACILITIES
for
CITY of BRITTON, SOUTH DAKOTA

Prepared For
CITY COUNCIL

R. G. Fortner, Mayor

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Arthur Jahnig
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OCTOBER - 1965

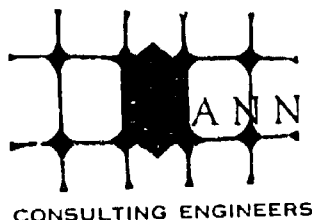
Prepared By
J. T. Banner & Associates, Inc.
Consulting Engineers
Brookings, South Dakota

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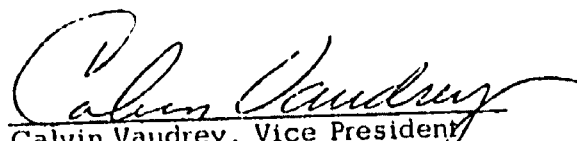
Honorable Mayor and
City Council
City of Britton, South Dakota

Gentlemen:

We are submitting herewith our Preliminary Report on Water Supply Facilities and Proposed Improvements for the City of Britton, South Dakota in accordance with our Contract dated April 5, 1965.

This investigation and report of water supply facilities for the City includes engineering and economic study and evaluation of existing water supply facilities; recommendations for improvements and modernization of the facilities along with cost estimates for each proposed improvement. The Report is divided into various sections, each of which deal with a particular phase of the investigation and study. The summary of our findings and recommendations are outlined in Section VI of the Report.

Respectfully submitted,


Calvin Vaudrey, Vice President
J. T. Banner & Associates, Inc.

CV/dh

I. INTRODUCTION

A. AUTHORITY

This preliminary study and report on Water Supply Improvements for the City of Britton, South Dakota was prepared at the request of the City Council under Contract dated April 5, 1965.

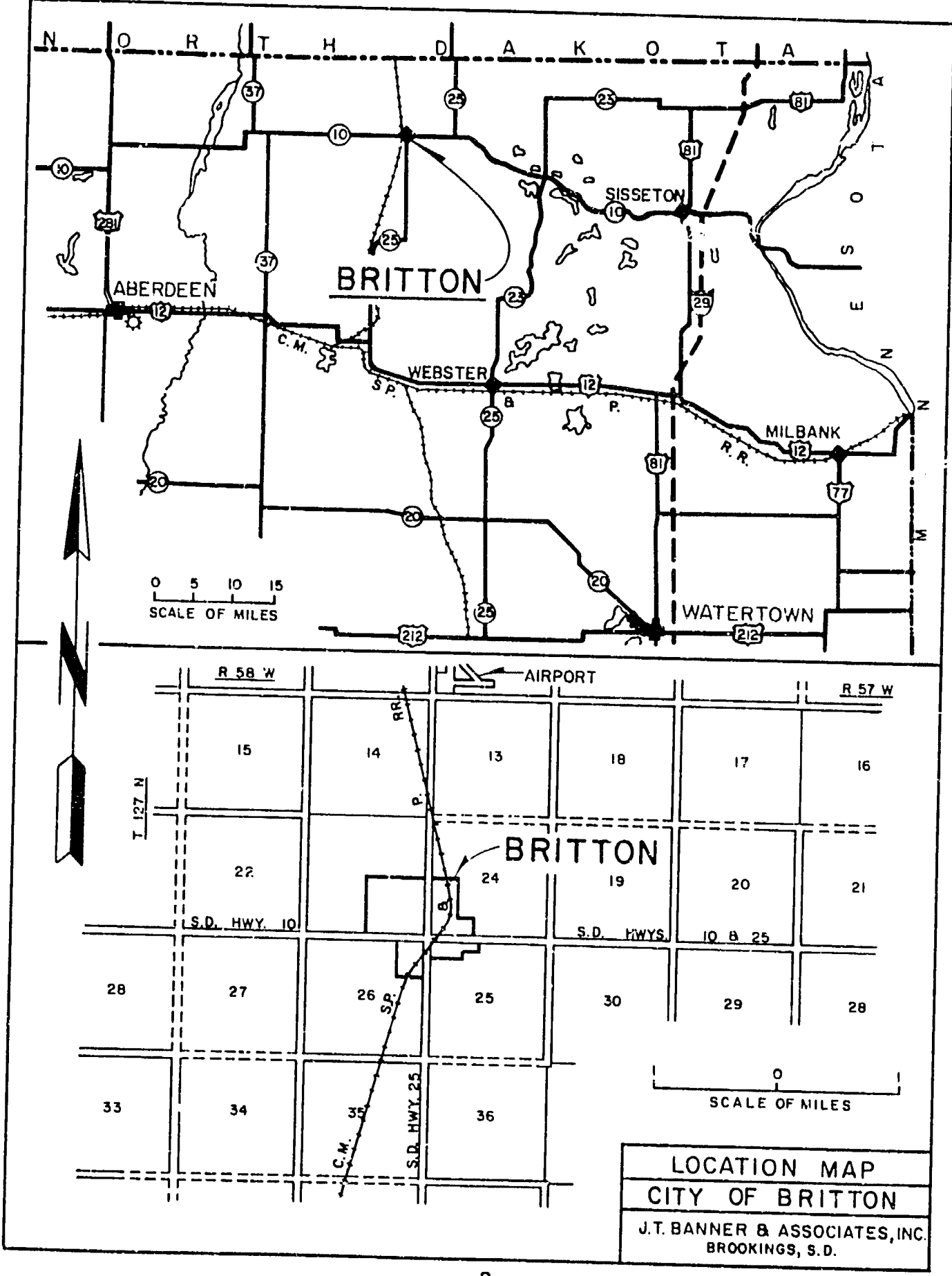
B. SCOPE OF WORK

This preliminary study and report includes: (1) the preparation of maps showing the existing water supply facilities, (2) a review of the present water supplies and an evaluation of the testing program to determine availability of supplies to meet present and future needs, (3) an analysis of the existing water distribution and storage facilities, (4) the preparation of maps and diagrams showing the proposed modernization and rehabilitation of existing facilities and necessary replacements and additions required, (5) an economic evaluation of all possible alternate improvements including recommended types of construction, operation, maintenance and financing, (6) the preparation of detailed cost estimates for proposed improvements and recommended rate structures for financing the various improvements.

C. DESCRIPTION OF THE AREA

The City of Britton, South Dakota is located in Marshall County about 45 miles northeast of Aberdeen. The topography of the area is gently rolling. The location and layout map of Britton is shown in Figure No. 1.

The transportation requirements of the community are served by the Chicago, Milwaukee, St. Paul and Pacific Railroad and State Highways 10 and 25.



D. POPULATION

The City of Britton is incorporated under the laws of the State of South Dakota.

The population of the City of Britton at the time of each regular United States census beginning in 1930 together with average fluctuations for the various periods is shown in Table No. 1.

TABLE NO. 1 -- POPULATION -- BRITTON, SOUTH DAKOTA

YEAR	POPULATION	AVERAGE INCREASE or DECREASE	PERCENTAGE CHANGE
1930	1312		
1940	1500	+188	14.3
1950	1430	- 70	4.7
1960	1442	+ 12	0.8

The above table shows that the population of the City of Britton has not changed appreciably since 1940. By virtue of being the County Seat of Marshall County its stable population condition can be expected to continue into the future. Figure No. 2 shows the growth in population from 1930 to 1960 with estimated projection to 1985, based upon present trends and past history. From this graph the estimated future population of the City of Britton is shown in Table No. 2.

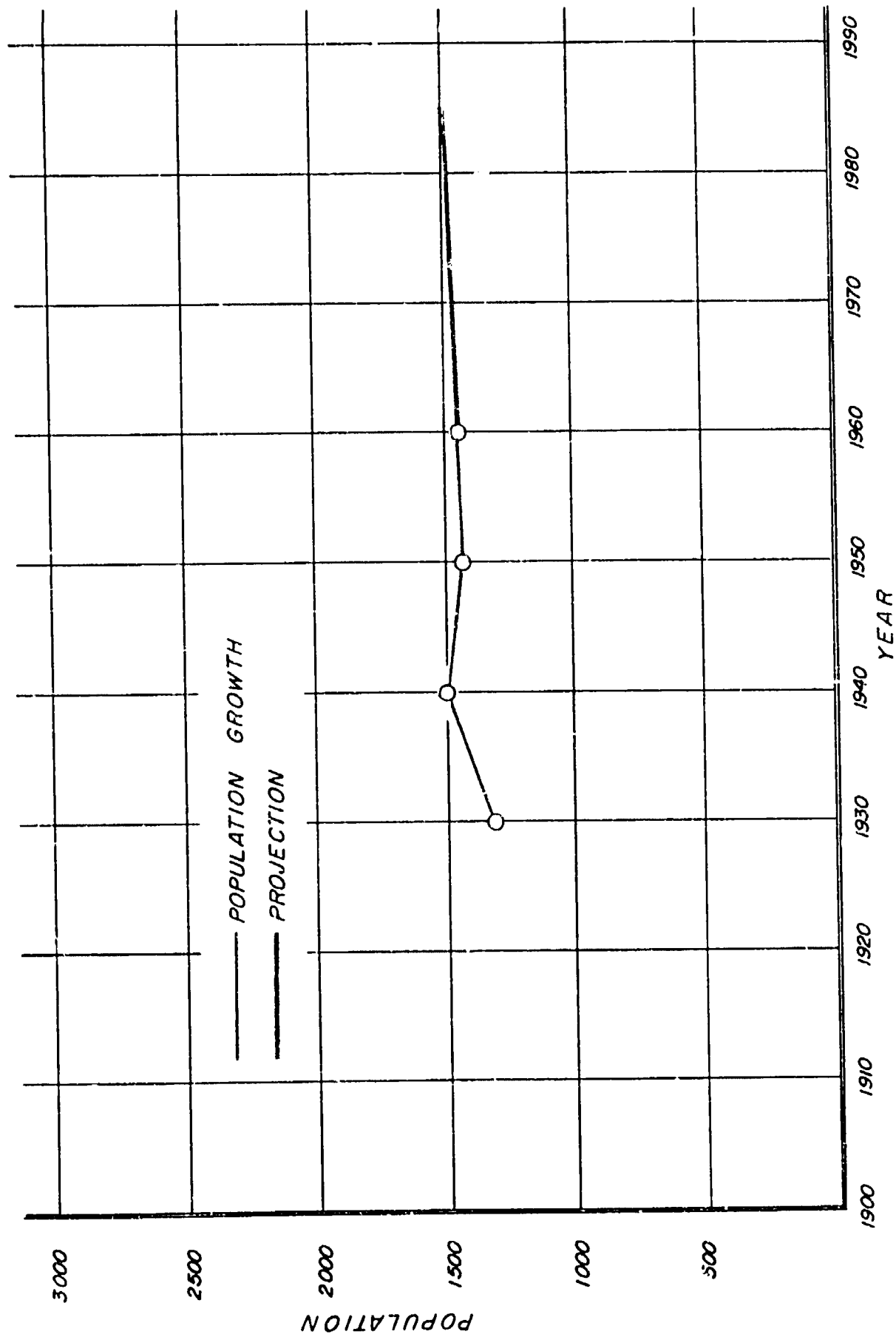


FIG. — POPULATION GROWTH — CITY OF BRITTON

TABLE NO. 2 -- ESTIMATED POPULATION -- BRITTON, SOUTH DAKOTA

YEAR	ESTIMATED POPULATION
1965	1454
1970	1466
1975	1478
1980	1490
1985	1500

The water supply requirements for the City of Britton are based upon a population of 1500 persons which provides for a normal rate of growth or allowance for some industrial development.

E. THE REPORT

This report is divided into several sections, each dealing with a specific area of the problem.

Part II is a review of the existing water supply facilities available to the City of Britton and its evaluation. Part III deals with water supply requirements of the City. The proposed improvements are outlined in Part IV. Part V consists of the estimated costs necessary to construct the proposed improvements. Part VI is a summary of findings and recommendations from our study and analysis.

Appendices to the report include supporting data for the findings contained within the report. Plates showing layouts of the water supply facilities, existing and proposed, make up the remainder of the report.

F. ACKNOWLEDGEMENTS

We wish to express our appreciation and thanks for the excellent cooperation and assistance afforded by the City of Britton officials and employees and the South Dakota Department of Health during the investigation and preparation of this report.

II. EXISTING WATER SUPPLY FACILITIES

A. GENERAL

The City of Britton is served by a municipal water supply system. Basically the system consists of three water wells, a defluoridation plant, a 35,000 gallon elevated storage reservoir and a water distribution system providing for domestic water needs and limited fire protection for the City.

B. SOURCE OF SUPPLY

The present water supply for the City is obtained from three wells located within the City Limits. These wells are 1000 feet in depth and 8-inch and 12-inch diameter. The most recent of these water wells was constructed in 1946.

C. WATER QUALITY

The results of an analysis of samples from existing wells are presented in Table No. 3. This data was obtained from laboratory tests conducted by the South Dakota Department of Health. The raw water from the wells is compared here with recommended limits established by the U.S. Public Health Service.

TABLE NO. 3 --- CHEMICAL ANALYSIS OF EXISTING WATER SUPPLY
BRITTON, SOUTH DAKOTA

DETERMINATION	RAW WATER Mg/L			Treated Water Mg/l	*Drinking Water Standards
	Well No. 1	Well No. 2	Well No. 3		
pH - Units	7.7	8.0	7.7	7.3	
Alkalinity CaCO ₃	264	274	260	254	
Total Hardness	65	65	67	76	
Calcium Ca	10.82	18.82	19.22	24.43	
Magnesium Mg	4.37	4.37	0.37	3.67	
Bicarbonate HCO ₃	322.10	334	317.20	310	
Sulfate SO ₄	1146	1145	1156	1153	250
Iron Fe	0.15	0.25	0.27	0.01	0.3
Manganese Mn	0.01	0.02	0.01	0.02	0.05
Sodium Na	828	828	828	828	
Potassium K	14.86	14.86	14.86	14.86	
Chloride Cl	300	305	300	300	250
Fluoride F	6.9	6.9	6.9	3.2	0.9-1.7
Nitrate NO ₃	1.5	1.5	1.5	1.5	45
Total Solids	2614	2555	2547	2553	500-1000

* Recommended maximum concentrations based on Public Health Service
Drinking Water Standards, 1962.

It is noted from the above tabulation these waters contain excessive concentrations of minerals. This is particularly true in the concentrations of sulfates and total hardness present. It is also noted the natural fluoride concentration is considerably in excess of acceptable limits. It is essential the present practice of fluoride removal through treatment be continued on the water from these wells.

D. TREATMENT

The present treatment facility consists of a plant for the partial removal of fluorides. Modification of the treatment plant in the Fall of 1962 consisted of the use of sulfuric acid instead of carbon dioxide for lowering pH after the caustic soda rinse.

E. DISTRIBUTION SYSTEM

The existing distribution system serves the City and is available to all users. The lengths of the various sizes of water mains which make up the existing distribution system are given in Table No. 4

TABLE NO. 4 -- INVENTORY OF WATER DISTRIBUTION SYSTEM
BRITTON, SOUTH DAKOTA

Main	Quantity (lin. ft.)	Per Cent of Total	Fire Hydrants
8"	2,460	5.16	1
4"	25,155	52.76	14
3"	2,990	6.27	5
2"	6,380	13.38	--
1 1/2"	5,805	12.17	--
3/4"	4,890	10.26	--
Total	47,680	100.00	20

Water mains less than 6 inches in diameter are considered inadequate for proper fire protection. At present 19 hydrants are connected to 4-inch and smaller pipe.

F. DISTRIBUTION STORAGE

The present storage facilities consist of a 35,000 gallon elevated storage tank. This tank was inspected and repaired in May 1965.

III WATER REQUIREMENTS

A. GENERAL

Water usage is metered and records of consumption are maintained. These records show the average winter usage is about 130,000 gallons per day, the summer average is 175,000 gallons per day and the maximum day usage is about 300,000 gallons per day.

Major factors affecting water demand include population, quality of water, distribution pressure, sewer facilities, climate, use of meters and cost. An evaluation of these factors considering the type of community and the degree of commercial or industrial water use allows the assignment of water consumption rates.

B. WATER CONSUMPTION

The City of Britton is primarily a residential area, serving a farming community with small commercial businesses and light industry not requiring any abnormally high usage of water.

Considering this, along with other factors affecting water use in a community of this nature, the water consumption rates as shown in Table No. 5 can be expected.

TABLE NO. 5 -- UNIT WATER CONSUMPTION RATES
BRITTON, SOUTH DAKOTA

Annual Average	150	galions	per	capita	per	day
Winter Average	100	"	"	"	"	"
Summer Average	200	"	"	"	"	"
Maximum Month	230	"	"	"	"	"
Maximum Week	300	"	"	"	"	"
Maximum Day	350	"	"	"	"	"

For a city the size of Britton, the comparative rate of water consumption during a fire is very high, when compared with other demands. Thus fire flow requirements are in general the determining factor in designing a water system when fire flow is weighed in the design as recommended by the National Board of Fire Underwriters.

On the basis of the design population and the estimated water consumption rates outlined in Table No. 5, the water requirements in gallons per minute and total gallons per day for the City of Britton for various critical periods throughout the year are tabulated in Table No. 6 for a future population of 1500.

TABLE NO. 6 -- ESTIMATED WATER REQUIREMENTS
BRITTON, SOUTH DAKOTA

Period (Based upon 1500 design population)	Requirements	
	gpd	gpm
Maximum Day	525,000	365
Maximum Week	450,000	313
Maximum Month	345,000	240
Summer Average	300,000	208
Winter Average	150,000	104
Annual Average	225,000	156
Fire Demand (1)	375,000	1250

gpm = gallons per minute

gpd = gallons per day

(1) = National Board of Fire Underwriters grading schedule 5 hour fire at 1250 gpm.

C. PRODUCTION REQUIREMENTS

The water requirements outlined in the above table show the critical flows averaged over a 24-hour period. However, under normal conditions the demands are concentrated during the daylight hours. This condition is most prevalent

during the summer months when air conditioning and lawn sprinkling are commonplace and when businesses reach a peak demand. It is estimated that 70 to 80 percent of the normal daily water consumption occurs between the hours of 8:00 A. M. to 8:00 P. M. It therefore follows that this heavy demand period coupled with an emergency situation would create the most critical condition. This condition must be satisfied through additional supply facilities, adequate storage facilities or a combination of both.

Sufficient quantity of water should be provided from the source of supply to allow for proper maintenance of these facilities and/or emergencies which may occur. Water supply facilities along with storage should be sufficient to prevent curtailment of usage to customers or jeopardize fire protection during critical demand periods.

Adequacy of storage depends upon the available direct supply. Storage may be provided through ground or elevated reservoirs.

Appendix "A" shows the water use requirements which would occur during critical periods without and with full fire demand.

In order to insure adequate supply for fire fighting purposes as well as maintaining full supply to the users, additional water supply development is required.

Table No. 7 is a summary of Appendix A showing required amounts of additional supply to insure against shortage during critical periods.

TABLE NO. 7 -- ADDITIONAL WATER SUPPLY REQUIREMENT
BRITTON, SOUTH DAKOTA

Condition	Additional Requirement during 5-hour Fire (gallons)	Additional Requirement during critical 12-hr. Daily Use Period (gallons)
Maximum Day	446,000	219,400
Maximum Week	421,000	159,400
Maximum Month	386,000	75,400
Summer Average	371,000	39,400
Winter Average	321,000	Adequate
Annual Average	346,000	Adequate

The above requirements are based on water wells which will maintain a safe yield of 230 gallons per minute. It is apparent that the critical water shortage will occur during a fire or with one well out for maintenance during a critical period. The above requirements for additional water supply are necessary to provide maximum fire protection with a continued supply to other users during the fire. It is possible to provide this additional water requirement through production facilities and storage. It is recommended, however, that at least one half of the total requirement during such a critical period be provided through storage.

On the basis of past water use records for the City of Britton and that an additional 250,000 gallon storage reservoir will be provided, the rates of production required from supply sources to insure no shortage of supply for the various critical conditions are shown in Table No. 8.

TABLE NO. 8 -- REQUIRED WATER PRODUCTION RATES
(assumed 250,000 gallons additional storage provided)

Condition	PRODUCTION CAPABILITY	
	Fire Demand GPM	No Fire Demand GPM
Maximum Day	650	Adequate
Maximum Week	570	Adequate
Maximum Month	450	Adequate
Summer Average	400	Adequate
Winter Average	235	Adequate
Annual Average	320	Adequate

Table Nos. 7 and 8 indicate the City's present water supply requirements without fire demand can be met through the provision for 250,000 gallons of storage. This additional storage will also partially satisfy the City's fire demand requirements during a critical demand period. To completely satisfy these requirements the added storage must be supplemented through increased supply facilities capable of providing 650 gallons per minute, further additional storage in the amount of 200,000 gallons, or a combination of additional supply and storage. However, improvements to the distribution system consisting of looping existing mains, replacement of inadequate-sized mains and the addition of fire hydrants must be undertaken before additional supply and storage facilities can be utilized effectively in fire protection.

IV. PROPOSED IMPROVEMENTS

A. WATER SUPPLY FACILITIES

The adequacy of a municipal water system depends primarily upon the ability of the source of supply facilities to provide water in sufficient quantity to satisfy critical needs. It is not always practicable nor economically feasible to provide facilities to meet all anticipated or possible disasters. However, provision should be made to meet critical demand periods with long-range plans for continual improvement of service.

To adequately meet present supply needs it is recommended a continuing program of well and well pump preventative maintenance be developed and carried out. This will insure year-around reliability and safeguard the ability to satisfy current demand requirements.

In order to provide for water supply needs of the future the City should undertake a study of future sources of supply. This study would encompass determining the location of a source or sources of future supply as well as the quantity and quality of water to be expected. The City should then take the necessary steps to secure future water rights thereby insuring the availability of future supplies when needed. Such a study of future sources of supply would enable systematic development of necessary improvements before the demand requirements exceed the currently available supply.

B. DISTRIBUTION SYSTEM

Examination of the City's existing water distribution system reveals a high percentage of undersized water mains affording insufficient volume and inadequate pressure for fire-fighting purposes.

A continuing program of up-grading the present distribution system is of utmost importance. Such a program would eliminate "dead-ends" through looping. Replacement of portions of the existing distribution network with mains of not less than six-inch diameter is necessary to provide adequate fire protection. Priorities must be established to assure the elimination of most critical areas in their order of importance.

The rehabilitation of the distribution system is divided into two phases to allow for stage construction as shown on Plate No. 1. Phase I provides coverage for the entire city with a minimum degree of fire protection. Proposed water mains are 6-inch and 8-inch diameter with fire hydrants located at block corners. Phase II completes coverage for the entire City with full fire protection and looping of the distribution system to equalize distribution pressure.

C. STORAGE FACILITIES

Adequate storage is dependent upon the available direct supply. In order to insure an adequate supply for fire fighting purposes as well as maintaining full supply to consumers, additional storage facilities are required.

Reference to Table Nos. 7 and 8 indicates 250,000 gallons of water in proposed storage would provide ample supply to meet peak demand periods without full fire demand. An additional requirement of 200,000 gallons storage is necessary to satisfy peak demand periods with full fire demand.

D. WHITE LAKE SOURCE OF SUPPLY

White Lake located about 8 miles northeast of Britton is an artificial impoundment created by a dam across Rice Creek. This provides a possible source of surface water supply for the City.

The drainage area behind White Lake dam is approximately 40 square miles. The water surface area of the lake is about 165 acres. Based upon an average overall depth of 8 feet the total volume of the lake is estimated to be 1320 acre feet. Based upon a design population of 1500 and an average annual demand requirement of 150 gallons per capita per day the annual water consumption for the City of Britton is 250 acre-feet. With normal runoff the lake should be capable of providing for this withdrawal by the City and to sustain a reasonable pool level.

Plate No. 2 shows the location of the lake in relation to the City of Britton.

A chemical analysis of a water sample obtained from White Lake was made by the South Dakota Department of Health. The results of this analysis are shown in Table No. 9 and compared with Drinking Water Standards as recommended by the U.S. Public Health Service and with the water obtained from the present City wells.

TABLE NO. 9 -- WATER QUALITY COMPARISON
BRITTON, SOUTH DAKOTA

Chemical	White Lake (ppm)	Well No.1 (ppm)	Well No.2 (ppm)	Well No.3 (ppm)	**Drinking Water Standards (ppm)
Total Solids	765	2614	2555	2547	500-1000
Iron	0.2	2.0	0.6	0.3	} 0.3 combined
Manganese	0.01	0.0	0.0	0.0	
Sulphates	333	1144	1155	1207	250
Bicarbonates	187	328	325	317	----
Fluorides	0.23	7.0	7.0	6.7	1.5
Total Hardness	408	70	70	69	----

** Recommended maximum concentrations based upon Public Health Service Drinking Water Standards, 1962.

This chemical analysis indicates the overall quality of the lake source of supply to be much superior to the present source. The lake water supply can be treated more easily than the present ground water supply. A detailed breakdown of the estimated costs of capital improvements is given in Appendix C and summarized under Section V.

E. FACILITIES

1. INTAKE STRUCTURE

An intake structure and pumping station would be required to obtain the water from the lake. This would be designed to minimize the amount of silt and algae entering the system. Dual pumping units would be required to provide flexibility of operation, normal maintenance of equipment and the ability to meet emergency conditions.

The intake structure would be located adjacent to the dam to allow the lowest possible placement, thereby assuring supply at low lake levels. Due consideration would be given to the formation of ice in order to avoid freezing problems.

2. TRANSMISSION PIPELINE

A transmission pipeline would be required to transport the water to the treatment facility to be located in or near the City. An 8-inch diameter pipeline would provide 300 gallons-per-minute capacity with a head loss of about 40 feet. At a pumping rate of 150 gallons-per-minute the friction loss in the pipeline is about 26 feet. For normal operation this rate will provide sufficient capacity to satisfy demand requirements.

3. TREATMENT PLANT

A water treatment plant would be required. The most desirable location of the plant would be in the northeast part of the City as shown on Plate No. 2 and receive water from the White Lake source of supply through the transmission pipeline. The water would be treated for clarification, reduction of tastes and odors, and partial softening if desired, by the use of chemicals, mixing, settling, and filtration. The most desirable treatment would be obtained by a gravity type treatment plant.

The water would enter the plant through the raw water meter which would provide proportional operation of the chemical feeders for adding the various chemicals for treatment. After feeding chemicals the water would pass into the mixing basin with a minimum detention time of 30 minutes. After thorough mixing the water would travel into the coagulation basin for removal of the precipitated chemicals through sedimentation. The resultant sludge would be removed periodically and disposed of in lagoons provided for this purpose. Filtration would be provided to complete the treatment process. Treated water would enter the clear well storage which should contain a minimum 250,000 gallons capacity. High service pumps would pump treated water from the clear well through a meter for proportioning chlorine feed. After chlorination, the water would enter the distribution system.

V ESTIMATED COSTS

A. SCOPE

This section summarizes the costs of the various improvements and new facilities required to provide an adequate water supply facility for the City of Britton.

B. ALTERNATE WATER SUPPLY FACILITIES - PLAN A

The proposed water supply facilities under Plan A consists of utilizing the existing water supply wells, defluoridation plant and elevated storage. New facilities required include one water supply well and provision for additional treated water storage. The estimated cost of the projects required to provide the proposed facilities included in Plan A are summarized in Table No. 10.

TABLE NO. 10 -- ESTIMATED COSTS - PLAN A
BRITTON, SOUTH DAKOTA

Project No.	Description	Total Cost	Annual Cost	Cost/1000 gallons
1.	Storage Facilities	\$48,240.00	3,870.78	\$0.047
2.	Water Supply Well	35,376.00	2,838.57	0.035
	Operation and Maintenance	-----	7,075.60	0.086
	TOTAL COST- PLAN A	\$83,616.00	13,784.95	0.168

* Based upon interest rate of 5% and 20 year repayment.

** Pumping rate assumed to be 82,125,000 gal./year

It is also probable that treatment facilities will require improvements in the near future to keep pace with the increased use of water and maintain modern facilities.

C. ALTERNATE WATER SUPPLY FACILITIES - PLAN B

The proposed water supply facilities under Plan B consists of developing the White Lake source of supply with the construction of intake and pumping facilities to be located at the Lake. Water treatment and storage facilities would be constructed near the north City limits. Also included would be a transmission pipeline for conducting the water from the Lake to the treatment facilities. The estimated cost of the projects required to provide the proposed facilities required to develop the Lake source of supply as included in Plan B are summarized in Table No. 11. The detailed estimates of these facilities are shown in Appendix "C".

TABLE NO. 11 -- ESTIMATED COSTS - PLAN B
BRITTON, SOUTH DAKOTA

Project No.	Description	Total Cost	*Annual Cost	**Cost/1000 Gal.
3.	White Lake Supply and Transmission Pipeline	\$227,680.00	\$18,269.04	\$0.222
4.	Water Treatment Plant	197,040.00	15,810.49	0.193
	Operation and Maintenance	-----	13,964.00 /	0.170
	TOTAL COST - PLAN B	\$424,720.00	\$48,043.53	\$0.585

* Based upon interest rate of 5% and 20 year repayment

** Pumping rate assumed to be 82,125,000 gal/year.

/ Includes costs for softening water to 75 ppm.

Note: If financing is arranged through an F.H.A. loan having an interest rate of 4 1/2% and a 40-year repayment period, the cost per 1000 gallons becomes \$0.451.

D. DISTRIBUTION SYSTEM IMPROVEMENTS - PLAN C

Improvements to the distribution system consist of replacement of inadequately-sized mains and elimination of dead ends through looping of the system. This would result in increased distribution pressure and improved fire-fighting capabilities. Plan C is developed in two separate phases to allow stage construction. Phase I, if constructed immediately, would provide minimum standards for distribution and fire protection. Phase II to be constructed in 5 - 10 years would complete the ultimate upgrading of the presently-developed areas of the City. The estimated cost of the projects required to provide the proposed facilities included in Plan C are summarized in Table No. 12.

TABLE NO. 12 - ESTIMATED COSTS - PLAN C
BRITTON, SOUTH DAKOTA

Project No.	Description	Total Cost	*Annual Cost	**Cost/1000 gallons
5.	Distribution System - Phase I	\$152,172.00	\$12,210.28	\$ 0.149
6.	Distribution System - Phase II	65,250.00	5,235.66	0.064
	Operation & Maintenance	-----	1,800.00	0.022
	TOTAL COST - PLAN C	\$217,422.00	\$19,245.94	\$ 0.234

* Based upon interest rate of 5% and 20 year repayment.

** Pumping rate assumed to be 82,125,000 gal./year

Note: If financing is arranged through an FHA loan having an interest rate of 4 1/2% and a 40-year repayment period, the cost per 1000 gallons becomes \$0.165.

VI SUMMARY OF FINDINGS AND RECOMMENDATIONS

The following summary of findings and recommendations has been developed from the survey and study of water supply facilities for the City of Britton, South Dakota.

1. A population of 1500 was used as a basis for future design in this study.
2. The City is presently served by a water supply system and water is available in all areas of the City which are developed.
3. The system consists of three water wells, a defluoridation plant, a 25,000 gallon elevated storage reservoir and water distribution lines.
4. The water from existing wells contains excessive concentrations of fluorides as well as excessive amounts of sulphates, chlorides and total solids. It is recommended the present practice of defluoridation be continued on the water from these wells.
5. The existing elevated storage reservoir should be maintained in service. Additional storage must be provided either in the form of ground level or elevated reservoirs.
6. The existing distribution system is inadequate to provide sufficient capacity and maintain water pressure for fire fighting purposes. It is recommended a general upgrading and reconstruction of the water distribution system be given consideration.
7. The future water needs for the City of Britton can be met by development of additional wells or development of White Lake as a source of supply.
8. Facilities required to develop the water supply from White Lake consists of an intake structure, pumping station, transmission pipeline and treatment plant.

9. The estimated annual costs per 1000 gallons for all the proposed improvements and alternates are:

Project No. 1 - Storage Facilities =	\$0.047
Project No. 2 - Water Supply Well =	0.035
Project No. 3 - Lake Supply & Pipeline =	0.222
Project No. 4 - Water Treatment Plant =	0.193
Project No. 5 - Water Distribution System - Phase I =	0.149
Project No. 6 - Water Distribution System - Phase II =	0.064

10. The estimated annual cost per 1000 gallons including operation and maintenance costs for the various plans proposed are as follows:

Plan A - Water Wells and Storage -	\$ 0.168/1000 gallons
Plan B - Lake supply, pipeline, treatment & storage -	0.585/1000 gallons
Plan C - Distribution System -	0.234/1000 gallons

APPENDIX A

WATER STORAGE REQUIREMENTS AND FLOW CALCULATIONS

The following table shows the amounts of additional water storage required in order to insure a full supply during critical periods, based upon a design population of 1500.

ADDITIONAL WATER SUPPLY REQUIREMENT TO MEET DEMAND
DURING PERIOD OF 12 HOURS - WITHOUT FIRE - BRITTON, SOUTH DAKOTA

Condition *	12-Hour City Demand (gallons)	Max. Safe Capacity of Wells (gallons)	Existing Storage (gallons)	Additional Storage Req'd to Meet Demand (gals.)
Maximum Day	420,000	165,600	35,000	219,400
Maximum Week	360,000	165,600	35,000	159,400
Maximum Month	276,000	165,600	35,000	75,400
Summer Average	240,000	165,600	35,000	39,400
Winter Average	120,000	165,600	35,000	None
Annual Average	180,000	165,600	35,000	None

Assumptions: (1) That the daily City demand is critical during the 12-hour period, 8:00 A.M. to 8:00 P.M. During this period 80% of the daily water requirements will occur.

(2) That safe capacity of present City wells is 230 gpm.

* See Table No. 5 for Unit Water Consumption Rates.

**ADDITIONAL WATER SUPPLY REQUIREMENTS TO MEET DEMAND DURING
A CRITICAL PERIOD OF 5 HOURS WITH FULL FIRE DEMAND**

Condition*	Full Fire Demand** 5- hr fire	Normal City Demand	Max. Safe Capacity of Wells	Existing Storage	Add'l. Supply Req'd to meet demand (gals)
Maximum Day	375,000	175,000	69,000	35,000	446,000
Maximum Week	375,000	150,000	69,000	35,000	421,000
Maximum Month	375,000	115,000	69,000	35,000	386,000
Summer Average	375,000	100,000	69,000	35,000	371,000
Winter Average	375,000	50,000	69,000	35,000	321,000
Annual Average	375,000	75,000	69,000	35,000	346,000

The following assumptions were made above:

- (1) Full fire demand would occur during a peak consumer period.
- (2) That daily city demand will be critical during the 12-hour period of 8:00 A.M. to 8:00 P.M. During this period 80% of daily requirement will occur.
- (3) That safe capacity of present city wells is 230 gpm.

* See Table No. 5 for Unit Water Consumption Rates.

** National Board of Fire Underwriters Rate Scale.

APPENDIX B

I CHEMICAL REQUIREMENTS

White Lake Water Source

Average Annual Consumption:

Basis : 82,125,000 gallons/year

Quality Basis:

Raw Water:

Magnesium	45 ppm
HCO ₃ as CaCO ₃	187 ppm
Hardness as CaCO ₃	408 ppm
Non-carbonate	
Hardness as CaCO ₃	221 ppm

Treated water to have total hardness of about 100 mg/liter or about 6 grains/gallon.

Estimated Chemical Quantities:

Lime - (considered as slaked lime)

$$\text{Alkalinity} \times \frac{74}{100} = 153 \times \frac{74}{100} = 113$$

$$\text{Magnesium} \times \frac{74}{24.3} = \frac{45 \times 74}{24.3} = 137$$

$$\text{Excess to precipitate Mg.} = \underline{50}$$

$$\text{Total mg./l.} = 300$$

$$\text{Tons/year} = \frac{82,12 \text{ M.G./yr.} \times 8.34 \times 300}{2000} = 102.6 \text{ tons/yr.}$$

Soda Ash -

Consider 75 mg/liter of remaining hardness to be non-carbonate hardness.

$$\text{Non-carbonate hardness} = 408 - 187 = 221 \text{ mg/l}$$

$$\text{Non-carbonate hardness removed - mg/l.} = 146 \text{ mg/l.}$$

$$\text{Soda Ash required - mg./l.} = 152 \text{ mg/l.}$$

$$1.04 \times \text{mg/l. NCH}$$

$$\text{Soda Ash required - tons/yr.}$$

$$\frac{82.12 \times 8.34 \times 152}{2000} = 52 \text{ tons/yr.}$$

Annual Cost of Softening Chemicals:

$$\text{Lime } 102.6 \text{ T @ } \$40.00/\text{ton} = \$4104.00$$

$$\text{Soda Ash } 52 \text{ T @ } \$80.00/\text{ton} = \$4160.00$$

$$\text{Annual Cost} = \underline{\$8264.00}$$

$$\text{Unit Cost/1000 gals (based upon 82,125,000 gal/yr)} = \$0.101/1000 \text{ gal.}$$

II TREATMENT PLANT DESIGN

A. Size mixing basin required

$$Q = 225,000 \text{ gpd} = 156 \text{ gpm}$$

$$\text{Use detention time} = 30 \text{ min.}$$

$$\text{Size basin} = 156 \times 30 = 4680 \text{ gal.}$$

$$= 625 \text{ cu. ft.}$$

$$\text{If depth} = 5 \text{ ft. then } L \times W = \frac{625}{5} = 125$$

$$\text{let } L = 2W$$

$$\text{then } 2W^2 = 125$$

$$W = \sqrt{62.5}$$

$$\text{Use } W = 8 \text{ ft.}$$

$$L = 16 \text{ ft.}$$

B. Size coagulation basin required

$$Q = 225,000 \text{ gpd} = 156 \text{ gpm}$$

$$\text{Use detention time} = 6 \text{ hours}$$

$$\text{Size basin} = 156 \times 360 = 56,160 \text{ gal.}$$

$$= 7520 \text{ cu.ft.}$$

$$\text{If depth} = 15 \text{ ft.} \quad \text{then } L \times W = 500$$

$$\text{let } L = 2W$$

$$\text{then } 2W^2 = 500$$

$$W = \sqrt{250}$$

$$\text{Use } W = 16 \text{ ft.}$$

$$L = 32 \text{ ft.}$$

C. Size filters required

$$Q = 225,000 \text{ gpd} = 156 \text{ gpm}$$

$$\text{Max. flow rate} = 2 \text{ gal/sq.ft./min.}$$

$$\text{Size filter} = \frac{156 \text{ gal/min}}{2 \text{ gal/sq.ft./min}} = 78 \text{ sq.ft.}$$

$$\text{Size filter} = 8 \text{ ft.} \times 10 \text{ ft.}$$

III TRANSMISSION PIPELINE COMPUTATIONS

Headloss in Pipeline

$$L = 42,800 \text{ lin.ft.} \quad Q = 300 \text{ gallons per minute}$$

A. Fry 10" Pipeline

$$H_L = 1.0 \text{ ft./1000 ft. (for } C = 100)$$

$$H_L = (\text{total}) = \frac{42,800 \times 1.0}{1000} = 42.8 \text{ ft.}$$

$$\text{For } C = 120 \quad H_L = 42.8 \times 0.71 = \underline{\underline{30.4 \text{ ft.}}}$$

B. Try 8" Pipeline

For Q = 400 gallons per minute

$$H_L = 5.4 \text{ ft./1000 ft. (for } C = 100)$$

$$H_L \text{ (total)} = \frac{42,800 \times 5.4}{1000} = 231.1 \text{ ft.}$$

$$\text{For } C = 120 \quad H_L = 231.1 \times 0.71 = \underline{\underline{164.1 \text{ ft.}}}$$

For Q = 300 gallons per minute

$$H_L = 3.0 \text{ ft./1000 ft. (for } C = 100)$$

$$H_L \text{ (total)} = \frac{42,800 \times 3.0}{1000} = 128.4 \text{ ft.}$$

$$\text{For } C = 120 \quad H_L = 128.4 \times 0.71 = \underline{\underline{91.2 \text{ ft.}}}$$

For Q = 150 gallons per minute

$$H_L = 0.85 \text{ ft./1000 ft. (for } C = 100)$$

$$H_L \text{ (total)} = \frac{42,800 \times 0.85}{1000} = 36.4 \text{ ft.}$$

$$\text{For } C = 120 \quad H_L = 36.4 \times 0.71 = \underline{\underline{25.8 \text{ ft.}}}$$

Energy Requirements

Based on 82,125,000 gal/yr. and 90 ft. head

$$\text{KW-Hrs.} = \frac{82,125,000 \times 90 \text{ ft.} \times 0.00315}{1000 \times 0.80}$$

$$= 29,000 \text{ KW-Hrs/yr.}$$

APPENDIX C

PROJECT 1 - STORAGE FACILITIES

<u>Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total Cost</u>
1.	250,000 gal. Clearwell Storage & Pump Housing			Lump Sum	\$31,000.00
2.	Pumps	2	ea.	2,000.00	4,000.00
3.	Meter			Lump Sum	1,200.00
4.	Piping & Connections			Lump Sum	2,000.00
5.	Automatic Controls			Lump Sum	<u>2,000.00</u>
Total Estimated Const. Cost					\$40,200.00
Engineering & Inspection, 10%					4,020.00
Contingencies, 10%					<u>4,020.00</u>
TOTAL ESTIMATED COST					\$48,240.00

PROJECT 2 - WATER SUPPLY WELL

<u>Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total Cost</u>
1.	Drilling 12" dia. hole	1000	L.F.	15.00	\$15,000.00
2.	12" Stainless Steel Screen	20	L.F.	80.00	1,600.00
3.	12" O.D. Casing	980	L.F.	8.00	7,840.00
4.	Gravel Pack	10	Tons	50.00	500.00
5.	Concrete Curb & Pump Base	2	C.Y.	50.00	100.00
6.	Pump & Controls			Lump Sum	2,000.00
7.	Pump Test	12	Hrs.	20.00	240.00
8.	Pumphouse			Lump Sum	1,200.00
9.	Pumphouse Piping			Lump Sum	1,000.00
	Total Estimated Const. Cost				\$29,480.00
	Engineering & Inspection, 10%				2,948.00
	Contingencies , 10%				2,948.00
	TOTAL ESTIMATED COST				\$35,376.00

PROJECT 2 - WATER SUPPLY WELL

<u>Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total Cost</u>
1.	Drilling 12" dia. hole	1000	L.F.	15.00	\$15,000.00
2.	12" Stainless Steel Screen	20	L.F.	80.00	1,600.00
3.	12" O.D. Casing	980	L.F.	8.00	7,840.00
4.	Gravel Pack	10	Tons	50.00	500.00
5.	Concrete Curb & Pump Base	2	C.Y.	50.00	100.00
6.	Pump & Controls			Lump Sum	2,000.00
7.	Pump Test	12	Hrs.	20.00	240.00
8.	Pumphouse			Lump Sum	1,200.00
9.	Pumphouse Piping			Lump Sum	1,000.00
	Total Estimated Const. Cost				\$29,480.00
	Engineering & Inspection, 10%				2,948.00
	Contingencies , 10%				2,948.00
	TOTAL ESTIMATED COST				\$35,376.00

PROJECT 3 - WHITE LAKE SUPPLY AND TRANSMISSION PIPELINE

<u>Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total Cost</u>
1.	Intake Structure		Lump Sum		\$15,000.00
2.	Pumps & Controls	2	each	\$4,000.00	8,000.00
3.	Meter		Lump Sum		1,500.00
4.	Pipeline (8")	42,800	lin. ft.	3.50	149,800.00
5.	Air Valves	4	each	500.00	2,000.00
6.	Blow Off Valves	3	each	200.00	600.00
7.	Creek Crossing		Lump Sum		2,500.00
8.	Gate Valves (8")	8	each	250.00	2,000.00
TOTAL ESTIMATED CONSTRUCTION COST					\$181,400.00
Engineering Services 10%					18,140.00
Contingencies 10%					18,140.00
Easements					10,000.00
TOTAL ESTIMATED PROJECT COST					\$227,680.00

PROJECT 4 -- WATER TREATMENT PLANT

<u>Item</u>	<u>Description</u>	<u>Total Cost</u>
1.	Site and Preparation of Site	\$ 4,000.00
2.	Building Construction	20,000.00
3.	Reinforced Concrete Tanks	15,000.00
4.	Clearwell	30,000.00
5.	Water Treatment Equipment Meters, Chemical Feeders, Chlorination, Mixing, Settling, Filters, Media, Pumps, and Backwash, etc.	60,200.00
6.	Chemical Handling	6,000.00
7.	Electrical and Automatic Controls	10,000.00
8.	Heating, Ventilation and Plumbing	5,000.00
9.	Painting	3,000.00
10.	Laboratory Equipment and Furniture	1,000.00
11.	Sludge Disposal	10,000.00
TOTAL ESTIMATED CONSTRUCTION COST		\$164,200.00
Engineering Services 10%		16,420.00
Contingencies 10%		16,420.00
TOTAL ESTIMATED PROJECT COST		\$197,040.00

PROJECT 5 - DISTRIBUTION SYSTEM - PHASE I

<u>Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total Cost</u>
1.	8" Pipe	4,240	L.F.	\$ 4.00	\$ 16,960.00
2.	6" Pipe	23,600	L. F.	3.50	82,600.00
3.	Fire Hydrants	49	each	250.00	12,250.00
4.	8" Gate Valves & Boxes	6	each	250.00	1,500.00
5.	6" Gate Valves & Boxes	30	each	200.00	6,000.00
6.	Fittings			Lump Sum	7,500.00
Total Estimated Construction Cost					\$126,810.00
Engineering & Inspection, 10%					12,681.00
Contingencies, 10%					12,681.00
TOTAL ESTIMATED PROJECT COST					\$152,172.00

PROJECT 6 - DISTRIBUTION SYSTEM - PHASE II

<u>Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total Cost</u>
1.	6" Pipe	11,150	L.F.	\$ 3.50	\$ 39,025.00
2.	Fire Hydrants	31	each	250.00	7,750.00
3.	6" Gate Valves and Boxes	18	each	200.00	3,600.00
4.	Fittings			Lump Sum	4,000.00
Total Estimated Construction Cost					\$54,375.00
Engineering & Inspection, 10%					5,437.50
Contingencies, 10%					5,437.50
TOTAL ESTIMATED PROJECT COST					\$65,250.00

OPERATION and MAINTENANCE COSTS

1. Plan A - Water Well Supply

The estimated annual costs for operation and maintenance for the water supply system utilizing the present water well source of supply are itemized below.

Description	Total Estimated Cost
Labor, O. & M., Billing, etc.	\$4,000.00
Chemicals	2,500.00
Power (based on \$6.30/mo.)	75.60
Materials, Repairs, etc.	500.00
TOTAL Estimated Annual O. & M. Costs =	\$7,075.60

OPERATION and MAINTENANCE COSTS

2. Plan B - White Lake Supply

The estimated annual costs for operation and maintenance for the water supply system utilizing the White Lake source of supply are itemized below.

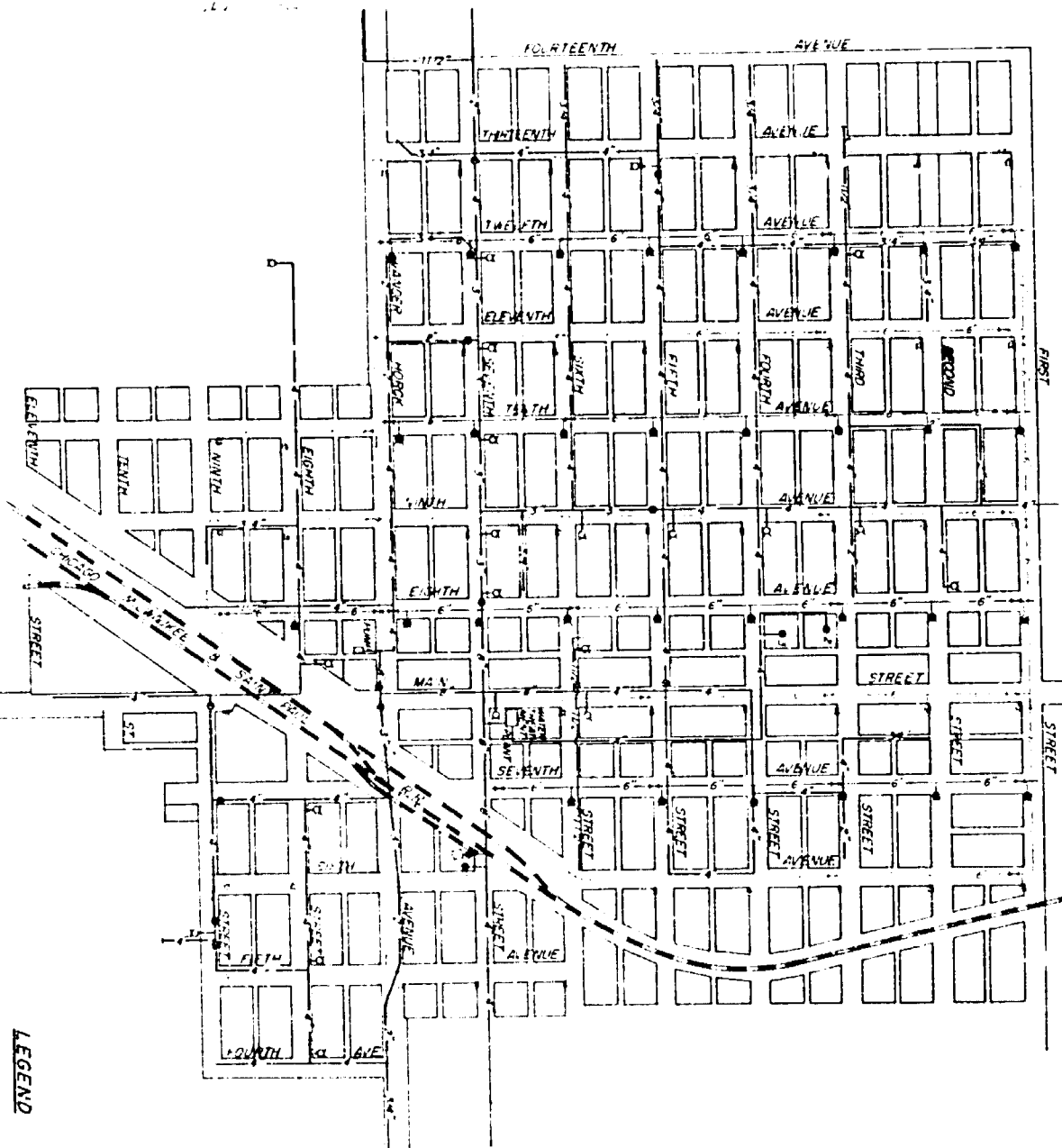
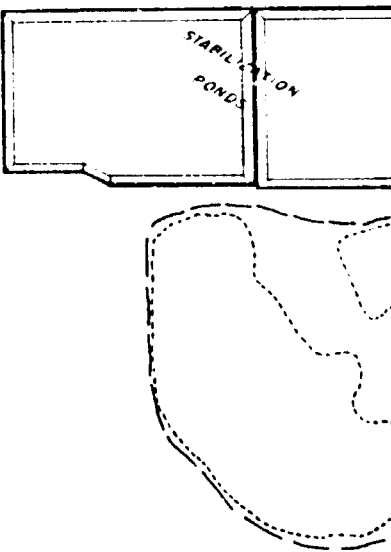
Description	Total Estimated Cost
Labor, O. & M., Billing, etc.	\$4,000.00
Chemicals (including softening)	8,264.00
Power (based on 2¢/KW hour)	1,200.00
Materials, Repairs, etc.	500.00
TOTAL Estimated Annual O. & M. Costs =	\$13,964.00

OPERATION and MAINTENANCE COSTS (Cont'd)

3. Plan C - Water Distribution System

The estimated annual costs for operation and maintenance for the water distribution system are itemized below.

Description	Total Estimated Cost
Labor, O. & M., etc.	\$1,000.00
Materials, repairs, etc.	800.00
TOTAL Estimated Annual O. & M. Costs	<u>\$1,800.00</u>

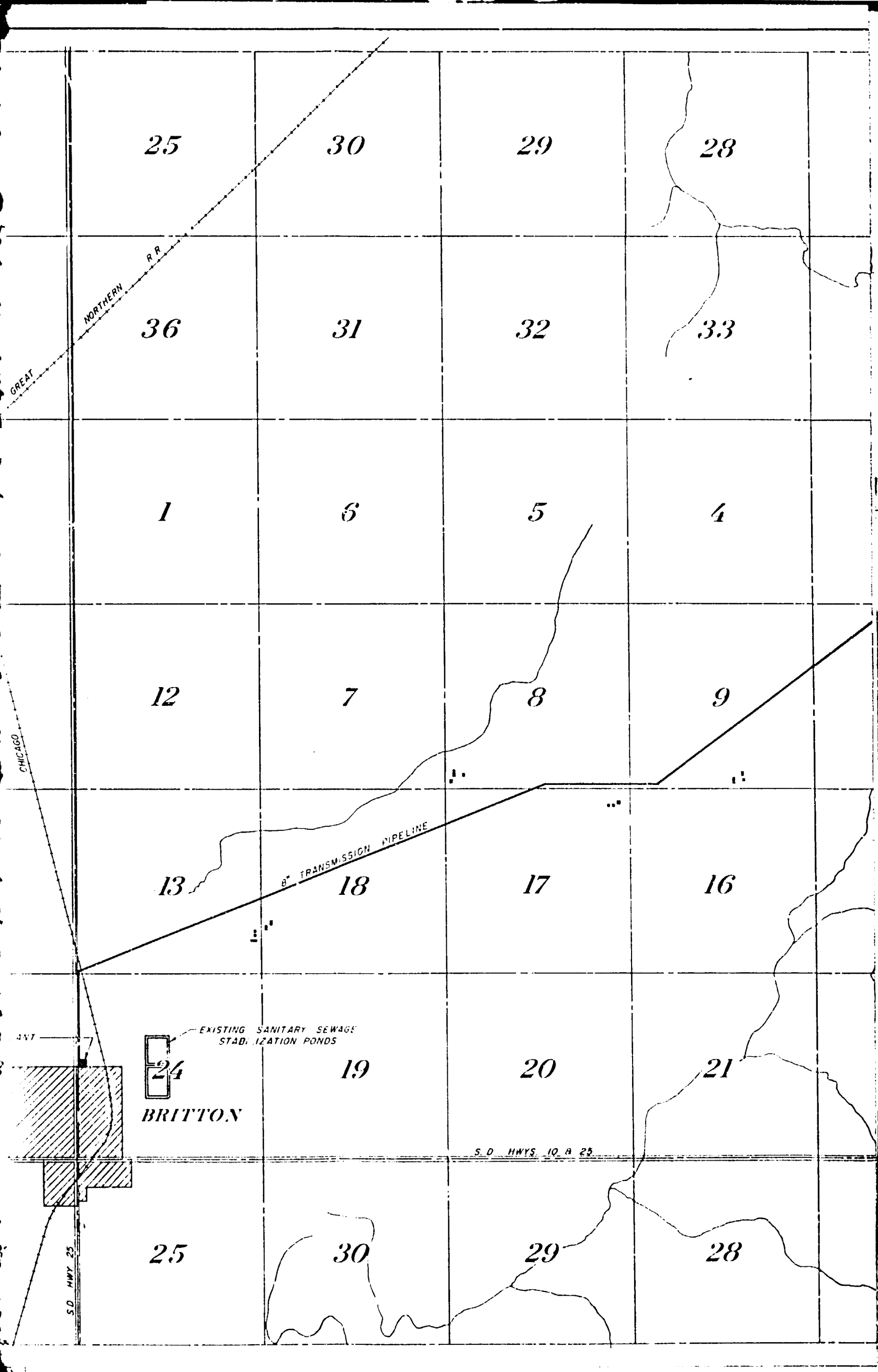


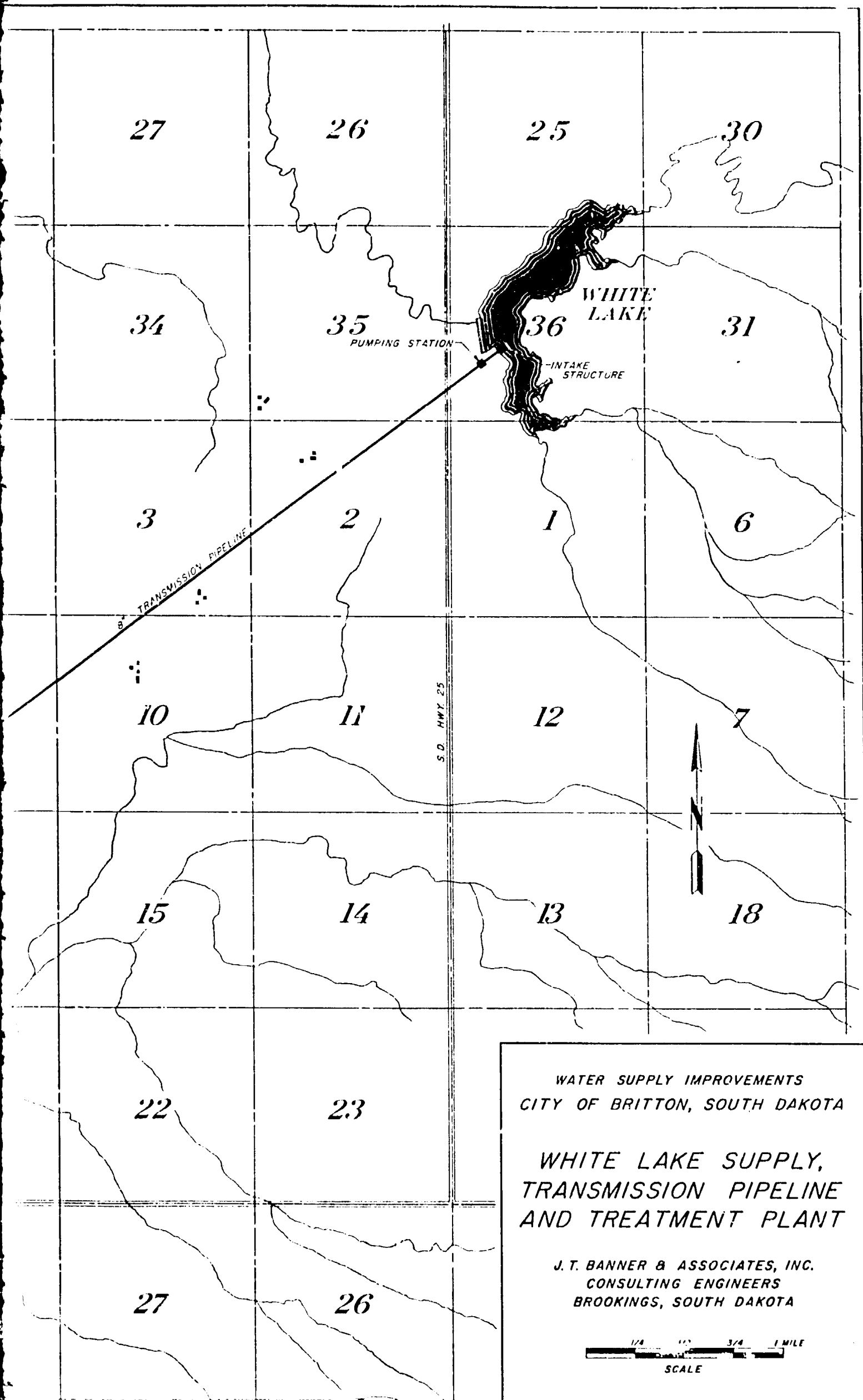
- LEGEND
- WATER MAIN ——— LINE SIZE
 - FIRE HYDRANT ———
 - GATE VALVE ———
 - WATER DISTRIBUTION SYSTEM
 - PHASE I - RED
 - PHASE II - BLUE

WATER SUPPLY IMPROVEMENTS
CITY OF BRITTON, SOUTH DAKOTA

WATER DISTRIBUTION
SYSTEM
PHASE I
PHASE II

A.T. BANNER & ASSOCIATES, INC.
CONSULTING ENGINEERS
BROOKINGS, SOUTH DAKOTA





WATER SUPPLY IMPROVEMENTS
CITY OF BRITTON, SOUTH DAKOTA

WHITE LAKE SUPPLY,
TRANSMISSION PIPELINE
AND TREATMENT PLANT

J.T. BANNER & ASSOCIATES, INC.
CONSULTING ENGINEERS
BROOKINGS, SOUTH DAKOTA

1489-3



803 8th Street P.O. Box 91
Britton, SD 57430
(605) 448-5721

January 29, 1992

John Hatch
SD Department of Environment & Natural Resources
Joe Foss Building
523 East Capitol
Pierre, SD 57501

RE: Water Right #1489-3 for Municipal use from White Lake.

Dear Mr. Hatch:

Please send a copy of Water Right No. 1489-3 for Municipal use from White Lake and a copy of the Water License if it has been issued, or notify us of the correct procedure to procure them. I cannot locate either document in this office.

We do have Water License No. 3915-3 for water rights from groundwater (one well) which was issued December 20, 1985.

Thank you for your assistance.

Sincerely,

A handwritten signature in cursive script that reads "Delaine Heer".

Delaine Heer
Finance Officer



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES
JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3181

February 5, 1992

Delaine Heer, Finance Officer
City of Britton
PO Box 91
Britton SD 57430

Dear Ms. Heer:

In reference to your letter dated January 29, 1992 to John Hatch,
enclosed is a copy of the water permit and water license for Water
Right No. 1489-3, the City of Britton.

If you have any questions, please contact this office.

Sincerely,

Karen Schlaak
Natural Resources Analyst
605 773-3352

enclosures