SD EForm - 0481 V1

Department of Environment and Natural Resources
Minerals and Mining Program
Joe Foss Building
523 East Capitol Avenue
Pierre, South Dakota 57501-3182
Telephone: (605) 773-4201 Fax: (605) 773-5286

RECEIVED
JUL 13 2016
MINERALS & MINING PROGRAM

APPLICATION FOR SMALL SCALE MINING PERMIT

Pursuant to SDCL 45-6B:
Relating to Mineral Extraction in Operations Affecting Less Than 10 Acres Per Year & Removing Less Than 25,000 Tons Per Year

Operator's Name: Cold Spring Granite Company

Mailing address:
17482 Granite West Road
Cold Spring, MN 56320

Telephone:
(320) 685-3621

Physical address:
14982 485th Ave.
Milbank, South Dakota

Telephone:
(605) 432-9389

Fax:
(605) 432-5477

Name and address of surface owner: (Enter additional owners on last page)
Cold Spring Granite Company
17482 Granite West Road
Cold Spring, MN 56320

Name and address of mineral owner: (Enter additional owners on last page)
Cold Spring Granite Company
17482 Granite West Road
Cold Spring, MN 56320

Legal description of affected land:
See Attachment

County: Grant

Name and address of operator's resident agent (if operator is an out-of-state corporation):
C.T. Corporation System
310 S. Coteau St.
Pierre, SD 57501

Minerals to be mined:
Granite

Proposed starting date:
As soon as permit is granted

Size of affected land (acres):
.2 acres

Proposed completion date:
2062

Estimated acres disturbed per year:
.2 acres

Estimated working days per year:
312

Estimated tonnage mined per year: 15840

Estimated duration of operation (years): 47

Estimated tons of ore per year: 4040

Reclamation type:
Wildlife Habitat Area

Overburden/waste tons per year: 11800

INSTRUCTIONS (Reference SDCL 45-6B)

This application must be accompanied by:

1. A narrative description of the type of mining operation proposed and how it will be conducted pursuant to Section 54 (7). This should include a description of the initial work to develop the operation and a description of the workings during the operation.
2. A narrative description of the measures to be taken to comply with the operating and reclamation requirements of SDCL 45-6B-37 through 45-6B-46 pursuant to Section 54 (9).
3. A map showing information sufficient to locate the affected land, including existing and proposed roads or access routes to be used in connection with the mining pursuant to Section 54 (5).
4. A wildlife survey pursuant to Section 54 (8).
5. A fee of $100.00 pursuant to Section 55
6. A list of the names and addresses of the land-owners of the affected land.

Before a hearing on the permit may be conducted by the SD Board of Minerals and Environment, the applicant must submit the following materials:

1. Certified mail receipts confirming mailing of notice to all surface owners and lessees pursuant to Section 17.
2. A copy of the affidavit of publication of notice pursuant to Section 16.
3. Proof of filing a copy of the application with the Register of Deeds pursuant to Section 15.
4. A surety in an amount to be determined by the department pursuant to Section 20 and 55.
5. A copy of instruments of consultation from all surface landowners, if different than the owner of the minerals, including written receipt of the operating and reclamation plans pursuant to Section 12 and 13.

STATE OF Minnesota

COUNTY OF Stearns

On this 7 day of January,

20 16, before me personally appeared

Steve Chouanard who

acknowledged himself to be the Environemental Engineer (Title)

for Cold Spring Granite Company (Operator) and that

he is authorized to execute the Application for Small Scale Mining Permit for the purposes contained therein.

Renae J. Hemmesch
Notary Public

My Commission Expires: 1/31/18

SEAL

RENAE J. HEMMESCH
NOTARY PUBLIC - MINNESOTA
My Comm. Exp. Jan. 31, 2018

Applicant hereby affirms that the mining will be conducted pursuant to SDCL 45-6B, or any regulations promulgated thereunder, that he will grant access to the Board of Minerals and Environment or its agents to the area under application from the date of the application and during the life of the permit as is necessary to assure compliance with SDCL 45-6B.

I declare and affirm under the penalties of perjury that this claim (petition, application, information) has been examined by me, and to the best of my knowledge and belief, is in all things true and correct.

Signature

Environmental Engineer
Title

1/6/2016
Date

FOR DEPARTMENT USE ONLY

DATE APPROVED: BOND AMOUNT: PERMIT NUMBER:

Chairman, SD Board of Minerals & Environment

Legal Description

Lot Two (2) of Cold Spring-Dakota Granite Second Addition located in Outlots A, Three (3), Four (4), Five (5) and Seven (7) of Section Thirteen (13), Township One Hundred Twenty (120) North, Range Forty-eight (48) West of the 5th P.M., Grant County, South Dakota

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JUL 13 2016
MINERALS & MINING PROGRAM

STATE OF SOUTH DAKOTA

BEFORE THE SECRETARY OF

THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IN THE MATTER OF THE APPLICATION OF)
Small Permit - Cold Spring Granite Co)
)
STATE OF Minnesota)
)
COUNTY OF Stearns)

CERTIFICATION OF APPLICANT

I, [signature], the applicant in the above matter after being duly sworn upon oath hereby certify the following information in regard to this application:

I have read and understand South Dakota Codified Law Section 1-40-27 which provides:

"The secretary may reject an application for any permit filed pursuant to Titles 34A or 45, including any application by any concentrated swine feeding operation for authorization to operate under a general permit, upon making a specific finding that:

(1) The applicant is unsuited or unqualified to perform the obligations of a permit holder based upon a finding that the applicant, any officer, director, partner, or resident general manager of the facility for which application has been made:

(a) Has intentionally misrepresented a material fact in applying for a permit;

(b) Has been convicted of a felony or other crime involving moral turpitude;

(c) Has habitually and intentionally violated environmental laws of any state or the United States which have caused significant and material environmental damage;

(d) Has had any permit revoked under the environmental laws of any state or the United States; or

(e) Has otherwise demonstrated through clear and convincing evidence of previous actions that the applicant lacks the necessary good character and competency to reliably carry out the obligations imposed by law upon the permit holder; or

(2) The application substantially duplicates an application by the same applicant denied within the past five years which denial has not been reversed by a court of competent jurisdiction. Nothing in this subdivision may be construed to prohibit an applicant from submitting a new application for a permit previously denied, if the new application represents a good faith attempt by the applicant to correct the deficiencies that served as the basis for the denial in the original application.

All applications filed pursuant to Titles 34A and 45 shall include a certification, sworn to under oath and signed by the applicant, that he is not disqualified by reason of this section from obtaining a permit. In the absence of evidence to the contrary, that certification shall constitute a prima facie showing of the suitability and qualification of the applicant. If at any point in the application review, recommendation or hearing process, the secretary finds the applicant has intentionally made any material misrepresentation of fact in regard to this certification,

consideration of the application may be suspended and the application may be rejected as provided for under this section.

Applications rejected pursuant to this section constitute final agency action upon that application and may be appealed to circuit court as provided for under chapter 1-26."

I certify pursuant to 1-40-27, that as an applicant, officer, director, partner, or resident general manager of the activity or facility for which the application has been made that I; a) have not intentionally misrepresented a material fact in applying for a permit; b) have not been convicted of a felony or other crime of moral turpitude; c) have not habitually and intentionally violated environmental laws of any state or the United States which have caused significant and material environmental damage; (d) have not had any permit revoked under the environmental laws of any state or the United States; or e) have not otherwise demonstrated through clear and convincing evidence of previous actions that I lack the necessary good character and competency to reliably carry out the obligations imposed by law upon me. I also certify that this application does not substantially duplicate an application by the same applicant denied within the past five years which denial has not been reversed by a court of competent jurisdiction. Further;

"I declare and affirm under the penalties of perjury that this claim (petition, application, information) has been examined by me, and to the best of my knowledge and belief, is in all things true and correct."

Dated this 23 day of ~~June~~ May, 2016.

Steve Chouanard
Applicant (print)

Applicant (signature)

Subscribed and sworn before me this 23rd day of May, 2016.

Leah Suess
Notary Public (signature)

My commission expires: 1/31/20

LEAH ANN SUESS
NOTARY PUBLIC-MINNESOTA
My Comm. Exp. Jan. 31, 2020

(SEAL)

PLEASE ATTACH ANY ADDITIONAL INFORMATION NECESSARY TO DISCLOSE ALL FACTS AND DOCUMENTS PERTAINING TO SDCL 1-40-27 (1) (a) THROUGH (e). ALL VIOLATIONS MUST BE DISCLOSED, BUT WILL NOT AUTOMATICALLY RESULT IN THE REJECTION OF AN APPLICATION

Application For

Small Scale Mining Permit

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With

South Dakota Department of Environment and Natural Resources

Minerals and Mining Program

Land exchange with Dakota Granite near Permit Area 373, Carnelian 3

Quarries located near Milbank, South Dakota

Applicant:

Cold Spring Granite Company

17482 Granite West Road

Cold Spring, MN 56320

320-685-4808

Appendix

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Small Permit Application

SDCL 45-6B-54(7) A narrative description of the type of mining operation and how it will be conducted.

This mining permit application is about a parcel of land exchanged on Map 1, Plat Map. This property line has been in dispute for years and this exchange was a way to clear up the misconception of the property line. Cold Spring Granite is transferring 2.1 acres to Dakota Granite. Cold Spring Granite Company is adding .20 acres to the current mining operation. This area that is added has been mined in the past and has very little potential for future mining. At most 15,840 tons of usable granite could be mined from the new area per year. The tonnage is estimated by if the whole .2 acres of land get taken down 20 ft. per year. That is unlikely because of the location of the area on the border of Dakota Granite's property. The mining will continue in Permit area 373 and all conditions for that permit will be used to cover this new .20 acres.

The equipment used in the quarry hole covered by Permit 373 is a loader, drill rig, rock buggy and a couple of wire saws. The process for extraction of granite is basic and does not contain much blasting. The holes are drilled with the drill rig; wire is feed through the holes and hooked to the wire saw. The wire saw cuts the block of granite loose. The loader then comes in and removes the block. The rock buggy is a support vehicle.

Due to the land exchange, the permit boundary is being expanded and modified per the requirements of **ARSD 74.29.03.02(2)**

SDCL 45-6B-54(8) A preliminary wildlife survey will be conducted. Cold Spring Granite requested a survey by the local Game, Fish and Parks officer, Stan Michals. He reviewed the area and the initial wildlife survey. Mr. Michals stated that the original surveys are still pertinent for the new permitting effort. He did state that new endangered species might have critical habitat in the area. There is no species occurrence data available for the location of the expansion letter. The letter from Mr. Michals follows in the attachments.

ARSD 74.29.03.02 (2). New permit application required. A new permit application is required for major modifications. Major modifications include the following:

(1) The addition of proposed affected land not within the approved permits area. The new land in the exchange is outside of the permit boundary.

(2) The expansion of the boundaries of the permit area. The boundary of the permit will be expanded in areas and lessened in others do to the land exchange with Dakota Granite.

(3) A change in the overall post mining land use of the affected land. No change will happen in the post mining land use.

(4) A change in the permit which may adversely affect surface or groundwater. No change in the permit will adversely affect surface of ground water.

(5) The initiation of milling capabilities, excluding crushers. No milling capabilities will be initiated in this new area

ARSD 74:29:07:02. Minimizing of Adverse impacts

1) The mine operation facilities are already in place and no surface disturbance will happen because of the new .2 acres.
2) The mine facilities are in place so no land will be cleared.
3) The area of the new permit already has visual screening because it already is in an existing mine permit area.
4) This permit expansion area will have no more impact on surface and ground water. The expansion area is already near permit area 373, that has no affect on surface and ground water.
5) Cold Spring Granite has fences and gates for the existing quarry and Dakota Granite has the same set up for their side of the affected area.
6) No impacts on wildlife will be felt because this expansion area is in an active quarry where no wildlife is present. Stan Michals, from the Department of Game, Fish and Parks, in a 1-22-16 letter indicated the surveys for the initial permitting areas are still pertinent. Since the time of the first permit two species have been added to the Endangered Species Act of 1973. The Dakota Skipper and Poweshiek skipperling are endangered species that may be located in this area of Grant County. No species occurrence data is available for the expansion area
7) All locations of garbage dumps and topsoil stockpiles will be included on Map 2, site map. Being that this area is only .20 acres, all waste will be controlled the same as they are for the larger quarry area. No environmental impacts will be from grout in the expansion area.
8) Very little mine waste and spoil will be produced in this area if any granite is quarried at all.
9) The mine facilities are in place for Permit Area 373 and will be used for this small permit area.
10) The integration of the mine operations planning with the reclamation plan will be easily done because the expansion area is only .2 acres. The expansion area will be covered for reclamation by large scale permit 373.

ARSD 74:29:07:17 and SDCL 45-6B-9 Underground mines

There are no underground mining areas connected to the granite quarry

SDCL 45-6B-8 previously mined lands

The locations of such mining activity existed prior to July 1, 1971.

SDCL 45-6B-32 Grant of permit if application in compliance with law—grounds for denial. The Board of Minerals and Environment shall grant a permit to an operator if the application complies with the requirements of this chapter and all applicable local, state and federal laws. The board may not deny a permit, except for one or more of the following:

1. **The application is incomplete or the surety has not been posted**

The surety is set up for Permit 373 for $168,807. That should cover the new boundary area set up by this permit

2. **The applicant has not paid the required fee;**

The fee is included in with the mine permit application.

3. **Any part of the proposed mining operation, the reclamation program, or the proposed future use is contrary to the laws or regulations of this state or the united States:**

Cold Spring Granite has designed this quarry operation to comply with the laws and regulations of the state of South Dakota and the United States.

4. **The mining operation will adversely affect the stability of any significant, valuable and permanent man-made structures located within 200 ft. of the affected land, except where there is an agreement between the operator and the persons having an interest in the structure that damage to the structure is to be compensated for by the operator:**

The only significant, valuable, and permanent man-made structures located within 200 ft. of the affected area, belong to the other quarry operator. An understanding exists between Cold Spring Granite and Dakota Granite that should

Cold Spring Granite cause any damage to Dakota Granite's equipment of structures; Cold Spring Granite will compensate Dakota Granite for such damage.

5. The mining operation would be in violation of any county zoning or subdivision regulations

Cold Spring Granite, at the time when they applied for a large mining permit 373, requested and received a letter from Grant County Commissioners stating that to the best of their knowledge, we are in compliance with all county ordinances' and requirements. On January 11, 2016 Grant County Planning and Zoning office sent a letter to Coldspring stating that Cold Spring Granite Company is in compliance with Grant County Zoning Regulations. It also stated that the Plat Recording was completed in the Register of Deeds Office on 12-15-2015 for the land exchange between Dakota Granite and Cold Spring Granite.

6. The proposed mining operation and reclamation cannot be carried out in conformance with the requirement of 45-6B-35

The proposed mining operation and reclamation can be carried out in the land exchange area with the conformance requirements because the existing permit covers the area and meet the requirements. The expansion area can be reclaimed in conformance with the requirements.

7. The Operator is currently found to be in violation of the provisions of this chapter with respect to any mining operation in this state.

Cold Spring Granite has no current violation of the provisions of this chapter with respect to any of its operation in South Dakota.

8. The land is unsuitable for a mining operation, as determined pursuant 45-6B-33:

SDCL 45-6B-33. As pursuant to ARSD 74:29:02:01, each section of this statute needs to be addressed.

SDCL 45-6B-33 Unsuitable land – No permit issued. No permit may be issued for the mining operation proposed on unsuitable land. Land is unsuitable if the following conditions cannot be satisfactory mitigated:

The land in the land exchange area are suitable for mining operation since they have already been used for mining operations in other permits.

1. **Reclamation of the affected land pursuant to the requirements of this chapter is not physically or economically feasible:**

The land around this site can and will be reclaimed, along with the rest of the quarry covered under permit 373.

2. **Substantial disposition of sediment in stream or lake beds, landslides, or water pollution cannot feasibly be prevented;**

If granite is removed from this area the spoils and sludge from the wire saws will be removed and placed on the Grout pile for the reclamation plan. All water used in sawing flows to a holding area and is pumped to holding ponds to let sediment settle out of the water.

3. **The adverse effects of the proposed mining operation on the historic archeological aspects of affected or surrounding land outweigh the benefits of the proposed mining operation:**

Under **ARSD 74:29:10:01**: since the .20 acre expansion area is already within the permit boundaries of Dakota Granites mine permit, it is exempt from special, exceptional, critical, or unique lands determination requirements.

There are no known historic or archaeological aspects on the affected or surrounding land. On the Large Mine Permit 373 Mr. Robert J. Stahl of Aberdeen, SD had conducted a search of the property to identify any potential historic or archeological sites and he found none. A copy of the study was submitted with the permit 373. Since this site is in between two quarries that were in use at the time of the study. The area in question was researched and cleared.

4. **The proposed mining operation will result in the loss or reduction of long-range productivity of aquifer, public and domestic water wells, watershed lands, aquifer recharge areas or significant agricultural areas.**

Operations have been ongoing in this area for some 70 years with no adverse affects to any water supplies. The little area added for this permit will not add anymore water use to the site. When the operation stops in 100 years, the quarry hole will fill with water from natural precipitation and will become a reservoir of water in the area. The post mining land use will have the potential to benefit the surrounding area during periods of drought.

5. **The biological productivity of the land is such that the loss would threatened or endangered species of wildlife indigenous to the area:**

Being this area is in between two quarries, no forms of wildlife live there anymore. In the 1990 permit 373 Mr. Arlo Haase, the conservation officer of the area, makes a statement to this in his letter which is in Permit 373. He makes no comment of any endangered or threatened species in the area. The local wildlife that surrounds this area and could possibly travel through the expansion area includes whitetail deer, pheasant, partridge, cottontail rabbits, jack rabbits, red fox, raccoon, mink and a variety of birds including robins, blue jays, blackbirds, crows and swallows.

In a 1-22-16 letter from Stan Michals of the South Dakota Department of Game, Fish, and Parks, Stan agrees with the initial permit survey. He does however state that two new endangered species could have critical habitat in Grant County. Species occurrence data is not available for the expansion area. With the expansion area being in the middle of two quarries for many years there is no chance that these endangered species use this area as critical habitat.

6. **The Board finds that any probable adverse socioeconomic impacts of the proposed mining operation outweigh the probable beneficial impacts of the operation.**

Small scale operations are exempt from socioeconomic requirements as provided under **SDCL 45-6B-33.2**. The quarry operation has been around for 70 years and has greatly benefited the surrounding communities.

SDCL 45-6B-35, Mining operations –Applicable law. Every operator to whom a permit is issued pursuant to the provisions of this chapter may engage in the mining operation upon the affected lands described in the permit. Upon the performance of the subject to SS 45-6B-36 to 45-6B-46, inclusive with respect to such lands.

A Narrative description of the measures to be taken to comply with the operating and reclamation requirements of SDCL 45-6B-37 through 45-6B-46, ARSD 74:29:02, and ARSD 74:29:06 through ARSD 74:29:08.

Grading: SDCL 45-6B-37, ARSD 74:29:07:03, and ARSD 74:29:07:04

ARSD 74:29:07:03 grading and Backfilling—Necessity

1) **Public Safety and welfare;** The expansion area will be incorporated into the reclamation plan of permit area 373. The area will be reclaimed as a wildlife area and allowed to naturally fill the rain water. The area around the quarry hole will be protected by the placement of a barricade of granite blocks. This is designed to alert everyone entering the area that a hazard exists. Fencing is already in place around the exciting quarry area. Since the expansion area is inside the existing quarry it is already fenced in. Barricades of granite will be placed by the edge of the expansion area.
2) **Technical and economic feasibility;** It would not be technically feasible to backfill an area when the areas around it are going to be filled with water.
3) **Surface and Mineral Ownership;** Cold Spring Granite Company will continue ownership throughout the reclamation process
4) **Land use requirements;** The expansion area does not have special land requirements.
5) **Pollution potential;** The expansion area will be reclaimed as a wildlife area and will add a source of clean water to the area. No pollution potential exists with this reclamation plan.
6) **Mineral resources value;** Cold Spring Granite will continue to mine until it is not economically feasible to mine. At that point the mineral value will be so low so the reclaimed wildlife area will be more valuable.

ARSD 74:29:07:04. Grading and backfilling, criteria.

1) **All reclaimed Slopes and slope combinations must meet the Following requirements:**
    a. **Be visually and functionally compatible with the configuration of the surrounding area;** The edge of the quarry near the expansion area will be covered with topsoil and grasses planted. When the quarry fills with water the wildlife area will be a desirable contrast to the farmland in the area.
    b. **Be suitable for the Post mining Use;** The intended post mining land use will be a wildlife habitat area. Since the edges will be planted and have a granite barrier for safety, the area will provide wonderful habitat for fish, waterfowl and other water animals.
    c. **Be structurally stable;** Being that the quarry walls are solid granite and there is very little slope towards the quarry it is extremely structurally sound. The granite barrier will also prevent edges collapsing into the quarry hole.
    d. **For fill slopes or other slopes composed of unconsolidated material, not exceed the angles of repose;** There will be no slopes in the expansion area. The grout mined out of this area has a natural angle

of repose of approximately 1:1 or 45 degrees. The grout pile has a natural slope on the sides.

2) **All grading, backfilling, and topographic reconstruction must control erosion and sedimentation, protect areas outside the affected land from slides or other damage, and minimize the need for long-term maintenance. Erosion control measures must be implemented during all phases of construction, operation, reclamation, and closure. Detailed plans indicating dimensions, location, spacing, and design of erosion control techniques are required;**
The expansion area is already located in between two quarries and will not cause any more erosion or sedimentation. The erosion control measures are already in place and the detailed plans are covered by permit area 373. The expansion area will have granite blocks along the edge to reduce erosion.

3) **All grading, backfilling, and topographic reconstruction must be completed as soon as feasible after mining ceases. The operator shall establish reasonable timetables consistent with good mining and reclamation practices;** The reclamation process will begin in the expansion area at the same time as in Permit area 373. The reclamation timetable states that reclamation will begin as soon as the quarry has been exhausted of all usable granite. At this time it is not feasible to identify any date for this work to be done. When it starts it will be a 3 year process of reclamation. The first year will be building removal and grading of quarry edge then seeding of quarry edge. It will be closely monitored for the next 2 years then trees will be planted. It will be yearly checked after that for 10 years.

4) **Depressions for the accumulation of water are not allowed unless they are consistent with the approved post mining land use;** The post mining land use will be a wildlife habitat area and the water will be allowed to fill up the existing quarry and expansion area.

5) **Original drainage must be preserved as much as possible. Alternative drainage may be approved by the board if it is functionally compatible with and complements the prevailing hydrologic balance of the surrounding area;** The original drainage in the area has not been changed. The new expansion area or the original quarry area has not affected the original drainage.

6) **When high wall reduction or elimination is not proposed, the applicant must provide justification demonstrating that such reduction or elimination is impossible, impractical, or aesthetically undesirable. If they are not eliminated, all high walls must be stabilized;** The high wall cannot be reduced because it is part of the natural ground and trying to reduce it would only

destabilize a larger area then just the quarry. Being that the expansion area within the quarry is going to be a wildlife habitat area the high wall will not be a factor. The quarry will fill with water and will not be seen. Also the granite barrier along the edge will work as a natural guard from going over the high wall.

74:29:06:01. Presubmission conference -- Determination of post mining land use. The area of the expansion being so small at only .2 acres it was determined that the reclamation will be covered by permit 373. The expansion area edge will be graded and covered with topsoil then planted with native seeds in the spring. The larger part of the expansion area will be under water in the wildlife habitat area.

74:29:06:02. General requirements for determination of reclamation type. For all reclamation types the applicant must present a management plan for the purpose of determining the reclamation type that does the following:

(1) Demonstrates that the affected land has the capability of meeting reclamation criteria in chapter 74:29:07. The expansion area is small and will easily meet reclamation criteria

(2) Demonstrates that the post mining land use is compatible with surrounding land uses. Since the expansion area is surrounded by other quarries that are going to be made into Wildlife habitat area it only makes since that it does too. Farmland is what surrounds the quarries at this time and a wildlife habitat area will be good for wildlife and also supplies an emergency source of water if needed by local farmers.

(3) Details support and maintenance activities required for successful implementation. Test reclamation plots were set up and have been growing for 10 years. They can be found below in **Revegetation ARSD 74:29:07:06 section 3.**

(4) Includes assurance that the proposed post mining land use meets the following requirements:

(a) Is obtainable according to data on expected need and market. The quarry will not shutdown as long as there is a market for the product and it is feasible to extract it.

(b) Is supported by commitments from public agencies where appropriate. Local wildlife conservation officer gave support for the reclamation plan. He committed on the wildlife that would benefit from the wildlife habitat area.

(c) Is practicable on the basis of private financial capability for completion of the proposed operation. Cold Spring Granite Company has put up bond that demonstrates its ability to take on the financial responsibility of the reclamation.

(d) Is planned pursuant to a schedule attached to the reclamation plan that integrates the mining operation and reclamation with the post mining land use. No reclamation plan can be scheduled for the expansion area. The area is located in a quarry that could run for 100 more years.

(e) Is consistent with existing state and local land use plans and programs. The state and county government agencies understand the reclamation plan for the expansion area.

(f) Is of a beneficial use. A wildlife area is more than just beneficial to wildlife. It is a place of recreation for locals and can be used as an emergency source of water for local farmers and residents.

74:29:06:03 Economic study required for determination of future mineral exploration and development as reclamation type. The amount of granite in the expansion area is not that great. The economical impact of these .2 acres cannot determine the future reclamation plan. The amount of usable granite throughout the quarry site cannot be determined at this time because it is not feasible giving the size of the granite deposit.

74:29:06:04 Alternative post mining land use. The only post mining land use considered for this property is wildlife habitat area, so this does not apply to the expansion area.

Disposal of Refuse: SDCL 45-6B-38, ARSD 74:29:07:05, and ARSD 74:29:07:13.

The non-usable granite, called grout will be minimal in the expansion area, because it acts as a natural property boundary between the two quarries. It there is any grout produced it will be hauled over to the Grout pile by Permit 008 and crushed by Fishers Sand and Gravel. The disposal of trash and other waste materials will be handled with the waste materials accumulated from the large scale permit area 373 that is adjacent to the expansion area. The trash disposal facilities for the expansion area will be located near the office on the north side of the Permit area near 150th street. This area can be seen on Map 2, site map.

Revegetation: SDCL 45-6B-39, ARSD 74:29:02:10, ARSD 74:29:07:06

ARSD 74:29:07:06. Revegetation. Revegetation must meet the following general requirements.

1) **Vegetative species and composition must be appropriate for the post mining land use. The species of vegetation to be used must be described in the reclamation plan, indicating the composition of seed mixtures and plant types and the seeding and planting rates per acre. Vegetative species and composition must be selected in consultation with the local conservation district, the landowner, and the department of game, fish, and parks if wildlife habitat is included as a post mining land use. Introduced, naturalized, or nonnative plant species may be used only if they are suitable for the post mining land use and are approved by the board;** The expansion area is in the middle of the quarry and will have very little area to revegetate. The edge of the quarry near the expansion area will have native grasses planted. Most of the expansion area will be under water as the quarry fills with water to make a wildlife habitat area. This area will also be covered by permit area 373.

   In permit 373 the area Soil Conservation Service Agent, Mr. Odell Greene, had examined the plan and made recommendations for plant selection, seed mixtures and planting rates per acre.

   Based on recommendations by Mr. Greene in 1983, a native grass seeding mixture will be used. This will include 20% Switch Grass, 60% Little Blue Stem, and 20% Side Oats Grama. Tree species will include 50% Cottonwood and 50% Norway pine on 14 foot centers. Due to the current letter from the NRCS, Green Ash was removed as a tree and the center position of trees was changed.

   The area Conservation Officer, Mr. Arlo Haase, also examined the plan and provided a letter of recommendation available later in this small permit application.

   Cold Spring Granite Company is the only owner of this land.

2) **The applicant must develop methods and procedures for revegetation which incorporate reference areas, baseline data comparisons, or other procedures to determine post reclamation revegetation success.** Very little revegetation will take place in the expansion area. The revegegation that will happen will be done like the reference areas described in the next section (**3**). Cold Spring Granite Company set up test reference area near Quarry No. 1 during the permit process for permit 373 that will cover the expansion area.

3) **A reference area may serve as a basis for comparatively measuring reclamation success. Reference areas must meet the following requirements:**

a. **Be large enough to make comparisons.** The area that was set up for the test plot was 100 feet by 100 feet and served as the test plot for all three quarries and the expansion area.

b. **Be located in areas where they will not be affected by future mining while serving their designated use.** The test plot is on top of a small grout pile to the East side of Quarry No. 1 that will be set aside for 10 years for this purpose.

c. **Be managed in a way that will not cause significant changes in the cover, productivity, species diversity, and composition of the vegetation.** The test plot was not disturbed for 10 years other then in June to monitor the growth.

d. **Be representative of the post mining land use.** The test plot will be constructed and vegetated in accordance with the standard reclamation plan of the application for permit 373 and the expansion area.

4) **Seeding and planting must be done in accordance with accepted agricultural practices. Affected lands shall be seeded during the first normal period of favorable planting conditions after final topsoil preparation, unless an alternative plan is approved. Any rills or gullies that would preclude successful establishment of vegetation or achievement of the post mining land use must be removed or stabilized.** As areas become available for final reclamation, the seedbed will be prepared and planted in the spring of the year. The trees will be planted after the grasses have had two growing seasons to become established. Rills and gullies will be removed before revegetation begins.

Topsoil Salvage: SDCL 45-6B-40 and 74:29:07:07.

74:29:07:07. Topsoil management. In addition to the requirements of SDCL 45-6B-40, topsoil must be managed as follows:

1) **All salvageable topsoil or other suitable material must be removed from the areas of affected land before the land is disturbed. The board may authorize topsoil to remain on areas where minor disturbances associated with construction and installation activities will occur, such as light-use roads, signs, utility lines, fences, and monitoring stations, provided that the minor disturbances will not adversely affect the soil resource.** The topsoil from the expansion area will be stockpiled before the sand, gravel and clay is removed. The topsoil that can be salvaged from the .20 acre expansion area would be along the ledge indicated in Map 2, Site Map. The area by estimation would

be about 40 feet long by about 10 feet wide and 6 inches deep. This comes to about 7.5 cubic yards.

2) **Where long-term disturbances will occur, the board may authorize the temporary distribution of a portion of stockpiled topsoil or other suitable material to enhance stabilization of affected lands during periods of interim reclamation and temporary cessation of operations under the following conditions.** The area of expansion is in a quarry that runs year round and does not have temporary cessation of operations.

    a. **The topsoil or subsoil capacity and productive capabilities are not diminished by the distribution or can be restored.** Topsoil piles are not distributed is this area because it is under operation.

    b. **The topsoil is protected from erosion.** Topsoil used in the expansion area will be protected from erosion by the granite barrier.

    c. **The topsoil will be available for final reclamation.** Topsoil from the expansion area will be stored at a different location near permit area 373. The location of topsoil stockpile will be at Map 2, Site map.

3) **The board may require topsoil or other suitable material to be analyzed by the operator prior to replacement to determine if fertilizer or other soil amendments are necessary to establish and sustain the required vegetation.** The initial removal of topsoil will go into a long term stockpile for final reclamation. Should the board determine a need to analyze this soil prior to final use, the process will be done.

4) **Topsoil stockpiles must be marked with legible signs containing letters not less than six inches high in sufficient locations to clearly identify stockpiles. Such signs must be in place from the time stockpiling begins.** The stockpile from the expansion area would be minor if any. The topsoil would be added to the pile for permit 373. A granite block with metal signs and letters six inches high will be placed on all four sides of the topsoil pile. The pile is expected to be approximately 300 feet wide by 200 feet long and 25 feet high. The blocks and metal signs will be durable to withstand the 50 to 100 year duration of these operations. Stockpile location will be shown on Map 2, site map.

5) **Topsoil or other suitable material shall be distributed as necessary to establish and sustain the required vegetation. The reclamation plan must contain an estimate of topsoil necessary to complete reclamation.** The topsoil needed for the expansion area is an estimate based on the current quarry ledge. This may change based on quarry expansion. The current edge is 40 feet long with a 10

foot buffer would be 400 square feet. With 6 inches of topsoil it would be 200 cubic feet of topsoil. All topsoil estimates are in the large scale permit 373.

6)) **If excess topsoil is present, the board may approve the use of the excess for reclamation purposes elsewhere.** Based on the numbers from Permit 373, there will be excess topsoil available. No excess topsoil will be available from the expansion area.

7) **Trees, large rocks, and other waste material which may hinder redistribution of topsoil must be separated from the topsoil before stockpiling;** All Trees, large rocks, and other waste material will be removed before the topsoil is stockpiled for future reclamation. Very little soil will come from the expansion area.

8) **If the amount of topsoil necessary for reclamation does not exist on the affected land, other suitable material such as subsoil may be used as a topsoil substitute if it can be demonstrated that the material is capable of establishing and sustaining the required vegetation. If other suitable materials are used in lieu of topsoil, they must be managed in accordance with all topsoil requirements in this section and with the following:**

   a. **Topsoil substitute stockpiles must be segregated from topsoil stockpiles and signed as substitute topsoil stockpiles.** Based on the estimates of topsoil available and need, no substitute material will be needed.

   b. **In addition to soil analyses, the board may require test plots to determine the suitability of topsoil substitutes as a plant-growing medium.** No substitute soils will be needed, abundant amount of topsoil available.

Hydrologic Balance: SDCL 45-6B-41, ARSD 74:29:02:11, ARSD 74:29:07:08 through ARSD 74:29:07:12, and ARSD 74:29:07:27.

Since this area was previously mined in would have no new affect on the water in the area. Mining in the expansion area will have no affect on the hydrological balance.

Sides, Subsidence or Damage Protection: SDCL 45-6B-42 and ARSD 74:29:07:16.

Since this expansion area is already located between two permitted quarry areas this is covered. Cold Spring Granite Company has chain link or barbed wire fence and a gate located in place along the township road with signs warning people to stay out, "Danger". Granite blocks were also placed around the perimeter of the quarry to form a barricade. Signs will be posted every 500 feet warning people to "Keep Out". As Far as the Dakota Granite side of the area, it should be covered by

Dakota Granites permit. As for subsidence, there is no chance for this. The land around the quarry is solid granite and goes deep into the earth. The granite will not cave or slowly sink into the earth.

Spoil Piles, Weeds: SDCL 45-6B-43, ARSD 74:29:07:14, and ARSD 74:29:07:15.

The expansion area will be within an existing Cold Spring Granite quarry that currently controls two noxious weeds. The same weed control method will be used for the expansion area as it is for the original quarry area. The two noxious weeds are identified as Canadian Thistle and Leafy Spurge. Any infestation of either of these weeds will be controlled by spraying with an appropriate chemical during the spring emergence. This will be followed by mowing as needed during the summer before the plants go to seed. Additional chemical control will be applied during the late summer as needed to control late growth.

Landowner Consultation, reclamation Type Development: SDCL 45-6B-44 and ARSD 74:29:06.

The proposed reclamation plan for this area is a natural wildlife area that will fill with water. The reclamation plan for Permit 373 will be used for this .2 acre area. All adjacent landowners were contacted and it was approved with permit 373. Dakota Granite will be sent a copy of the small permit application before it is submitted; a certified mail return receipt will be submitted.

Reclamation Choices, Operators Requirements: SDCL 45-6B-45, ARSD 74:29:07:18 through ARSD 74:29:07:26 and ARSD 74:29:07:01.

The choice of reclamation for the expansion area is wildlife habitat area. All operator requirements for this permit area will be covered by Cold Spring Granite Company. The expansion area will be reclaimed at the same time as the larger permit area.

Reclamation Timetable, Planting not required under certain conditions, Concurrent Reclamation: SDCL 45-6B-46 and ARSD 74:29:08.

This area is not scheduled for reclamation in the next year and a half. The area is many years away from being in a position for any reclamation to be completed. At this time it is not feasible to identify any date for this work to be done.

74:29:08:01. Requirements for concurrent reclamation. The expansion area is in between two existing quarry so no reclamation can be conducted before the larger quarry is shutdown and ready for reclamation.

74:29:08:02. Requirements for interim reclamation. The expansion area is in between two existing quarry so no reclamation can be conducted before the larger quarry is shutdown and ready for reclamation.

74:29:08:03. Requirements for final reclamation. The expansion area cannot have final reclamation done until the other quarry is ready to have final reclamation. Reclaiming the expansion area first would have an adverse affect on other mining operations.

74:29:08:04. Disturbance to avoid requirements -- Board order. Since the expansion area is within the existing quarry boundary, this does not apply.

Post closure Plan: SDCL 45-6B-91

The post closure plan for this area would be incorporated with the post closure plan for permit area 373. Since this area is smaller and connects to permit 373 all reclamation would be done whenever permit area 373 is done. The post closure plan for Area 373 is Wildlife Habitat area and will be planted and monitored like the test plots mentioned above in Section **ARSD74:29:07:06.**

1) **Treatment of Tailings.** This does not apply to this site
2) **Operation of monitoring systems.** Cold Spring Granite will fence the area and allow vegetation to become established. Revegetation will be monitored and followed like the test plots for Area 373 in Section O) above. Any erosion problems or lack of vegetation efforts will be to stabilize the erosion and reseed the area to help with vegetation growth.
3) **Inspection and Maintenance activities to ensure compliance with all applicable reclamation, design, and operating criteria.** Cold Spring Granite will monitor revegetation success and any erosion concerns well the reclamation is taking place.
4) **Procedures for maintaining the final cover and controlling erosion and fugitive dust.** Erosion and none vegetative areas will be monitored and corrected throughout the reclamation process.

Critical Resources: SDCL 45-6B-92

Since the area in question has been mined between two different mining companies for over 50 years, there are no knew critical resources that would be affected.

1. Wildlife: No wildlife living in expansion area. It has been mentioned in other areas that two endangered species might have critical habitat in Grant County. No data shows they are in the expansion area and with current mining operations it is unlikely any wildlife live in the expansion area.
2. Aquatic Resources: No water flows naturally into the area.
3. Vegetation: Plant life living in the expansion area is very minimal and the endangered species are not known to be present in the expansion area.
4. Water: No drinking water is affected by this area.
5. Visual Resources: The area is in a quarry hole so it does not cause any visual constraint
6. Soils: Most of the soil from this area was removed many years before this permit.
7. Cultural Resources: Nothing is of any historical or cultural significance.
8. Air Quality: There are no homes or recreational areas near the quarry. There are only more quarries and farm fields.
9. Noise: There are no homes or recreational areas near the quarry. There are only more quarries and farm fields.
10. Land designated as special, exceptional, critical, or unique: This expansion area borders permit area 373 and that had no special land designations.

74:29:07:01. General requirements for all reclamation types. All mining operations must comply with the general requirements in §§ 74:29:07:02 to 74:29:07:17, inclusive, and with the following requirements:

(1) Reclamation must rehabilitate the affected land to a condition that meets the selected post mining land use. The post mining land use for the expansion area is wildlife habitat. The edge of the expansion area will be planted with native plants and monitored for years.

(2) All reclamation activities are subject to the concurrent, interim, and final reclamation requirements of chapter 74:29:08. The location of the expansion area makes so that there will be no interim reclamation.

(3) All reclamation required by the approved reclamation plan must be completed prior to final and full bond release. All reclamation will be completed soon after the quarry is closed.

74:29:07:08. Hydrologic balance -- Water quality. To minimize disturbances to the prevailing hydrologic balance of the affected land and adverse effects on the quality and quantity of surface water and groundwater, both during and after the mining operation and during reclamation, the following requirements must be met:

(1) South Dakota water rights laws and regulations must be complied with. The expansion area complies with all water rights laws as do the other permit areas

(2) South Dakota water quality laws and regulations must be complied with. The expansion area will comply with all water quality laws as do the other permit areas.

(3) Dredge and fill laws in sections 401 and 404 of the Federal Clean Water Act as they existed on February 1, 1987, must be complied with. No dredging or filling will take place in the expansion area.

(4) Temporary or large sedimentation, erosion, or drainage control structures must be removed after affected lands have been vegetated and stabilized, if required by the reclamation plan. All man-made erosion control measures will be removed from the expansion area as soon as it reaches full reclamation.

(5) Permanent diversion structures must be designed not to erode during the passage of the approved design precipitation event. The large granite barriers used in the expansion area to control erosion will not erode do to any precipitation event.

(6) Unchannelized surface water must be diverted around the operation as necessary to minimize pollution and erosion and to protect the operation and downstream water users who have prior water rights. No surface water is close enough to the expansion area to cause any pollution downstream.

74:29:07:09. Surface runoff diversions. Surface runoff diversions must meet the following general requirements:

(1) In soils or other unconsolidated material, the sides of diversion ditches may be no steeper than two horizontal to one vertical. The sides and, in ditches carrying intermittent discharges, the bottom must be stabilized by seeding with

grasses or other methods specified in the reclamation plan as soon as practicable. There are no diversion ditches near the expansion area.

(2) In rock, the sides of diversion ditches must be stable. There are no diversion ditches near the expansion area.

(3) Rock riprap, concrete, geosynthetic liners, geosynthetic filter media, soil cement, or other methods must be used where necessary to prevent erosion. Erosion control in the expansion area is controlled by granite barriers.

(4) Culverts or bridges must be installed where necessary to allow access. No culverts or bridges are needed in the expansion area.

(5) Diversion ditches must be constructed to minimize hazards to humans, wildlife, or livestock. There are no diversion ditches near the expansion area.

(6) Surface runoff diversions around milling or processing facilities using potentially toxic chemicals or materials must be capable of carrying the flow from the six-hour probable maximum precipitation event without causing erosion. There are no diversion ditches near the expansion area and no milling or toxic chemicals.

(7) All other surface water diversions must be capable of carrying a minimum of the two-year six-hour precipitation event without causing erosion. There are no diversion ditches near the expansion area.

(8) Diversion ditches may not discharge on topsoil storage areas, spoil, or other unconsolidated material such as newly reclaimed affected lands. There are no diversion ditches or topsoil storage areas in the expansion area. There are no storage areas in the expansion area.

74:29:07:10. Diversions of intermittent and perennial streams. Permanent or temporary diversions of intermittent and perennial streams on affected lands must meet the following general requirements:

(1) Spoil, topsoil, or other unconsolidated materials may not be pushed into or placed within 10 feet of the banks of a perennial or intermittent stream or in a location which may subject them to bankfull flooding except during the construction of the diversion as approved in the permit. There are no perennial or intermittent streams located in or near the expansion area.

(2) The banks of a diverted perennial or intermittent stream must be stabilized and vegetated with approved species as soon as practicable. There are no perennial or intermittent streams located in or near the expansion area.

(3) The banks and channel of a diverted perennial or intermittent stream must be protected where necessary by rock, geosynthetic liners, geosynthetic filter media, riprap, or similar measures to minimize erosion and degradation of water quality. Permanent diversions must be designed and constructed to prevent erosion and to carry flow consistent with the flow produced by stream's original width, depth, shape, and gradient. There are no perennial or intermittent streams located in or near the expansion area.

(4) The board may not permit mining on the flood plain of a perennial or intermittent stream if it would cause the uncontrolled diversion of the stream during bankfull periods. There are no perennial or intermittent streams located in or near the expansion area.

(5) Channel and flood plain diversions must be designed to prevent erosion during the passage of the approved design precipitation event. Cross-sections and other hydrologic data for the existing stream above, below, and within the diversion area must be used to determine the flow capacities, channel configuration, and shape of the diversion. Such design information must be included in the reclamation plan. The expansion area is not in a channel and flood plain. No diversions happen in or near the expansion area.

(6) The water quality of a diverted intermittent or perennial stream must meet surface water quality standards in chapter 74:51:01. There are no perennial or intermittent streams located in or near the expansion area.

74:29:07:12. Roads and railroad spurs. Constructed or upgraded roads and railroad spurs are affected land from the location where they provide exclusive service to the mining operation and must be covered by the reclamation bond. They must meet the following general requirements:

(1) When feasible, roads and railroad spurs must not be constructed within riparian zones. No roads or railroad spurs were built for the expansion area. All roads were constructed before the expansion area was purchased.

(2) Roads within riparian zones must be constructed so that negative effects on streams are minimized; No roads or railroad spurs were built for the expansion

area. All roads were constructed before the expansion area was purchased. No streams are located near the access roads to the expansion area.

(3) Roads or railroad spurs within the riparian zone of a coldwater permanent fishery designated pursuant to chapter 74:51:02 or 74:51:03 may be subject to the requirements of §§ 74:29:07:29 to 74:29:07:32, inclusive. No roads or railroad spurs were built for the expansion area. This does not apply to the expansion area.

(4) Streams must be crossed at or near right angles unless contouring down to the stream bed will result in less potential stream bank erosion. Ford entrances and exits must be constructed to minimize erosion and prevent water from flowing down the roadway. No roads or railroad spurs were built for the expansion area. This does not apply to the expansion area.

(5) Drainage control structures must be used as necessary to control runoff and to minimize erosion, sedimentation and flooding. When used, drainage control structures must be installed as road construction progresses. No roads or railroad spurs were built for the expansion area. This does not apply to the expansion area.

(6) Culverts must be installed at prominent drainage ways. Culverts must be protected from erosion by rock, concrete, riprap, or other approved means. Culverts and drainage pipes must be constructed and maintained to avoid plugging, collapsing, or erosion at inlets and outlets. No roads or railroad spurs were built for the expansion area. This does not apply to the expansion area.

(7) Trees and vegetation may be cleared only to the width necessary to maintain slope stability and to serve traffic needs. No roads or railroad spurs were built for the expansion area. This does not apply to the expansion area.

(8) Access and haul road drainage structures must be routinely maintained. No roads were built for the expansion area. All existing roads are maintained for use in the main quarry site.

(9) Other transport facilities and utilities must be constructed and maintained to control degradation of water quality and quantity. No transport facilities and utilities were constructed for the expansion area.

(10) An applicant may request in writing to the board that a road or railroad spur be permitted to remain unreclaimed if the surface landowner or a local,

state, or federal agency has requested that the road or spur remain unreclaimed and agrees to be responsible for future maintenance. The operator must furnish proof of such a request. No surety is required for reclamation of such a road or spur and reclamation of the road or spur is not required if the request is approved by the board. . No roads or railroad spurs were built for the expansion area. This does not apply to the expansion area.

74:29:07:13. Buildings and structures. All buildings and structures constructed, used, or improved by the operator must be dismantled and removed unless it can be demonstrated to the board's satisfaction that they will be consistent with the approved post mining land use. There are no buildings in the expansion area and none will be built. This does not apply to the expansion area.

74:29:07:14. Spoil. Spoil on all affected land must meet the following general requirements:

(1) Except where diversions are approved by the board, all spoil must be located to avoid blocking intermittent or perennial drainages. Ephemeral drainages may be blocked if the engineering and environmental methods used for dealing with runoff control and sedimentation is approved by the board. There are no drainages in the expansion area and all grout will be removed by dump truck and hauled over to permit area 1, where it will be crushed by Fishers Sand and Gravel.

(2) If permanent spoil dumps are approved by the board, the board may require the operator to demonstrate the long-term stability of the dumps through geotechnical stability analyses conducted by a registered professional engineer competent in the field of geotechnical analysis. No spoil dumps will be located in or near the expansion area.

(3) The board may require the operator to analyze spoil material to determine if it will be a source of water pollution. If the spoil material may be such a source the operator must describe proposed procedures for mitigating the condition. No spoil dumps will be located in or near the expansion area.

(4) All spoil material that is determined to be toxic or acid-forming or that will prevent reestablishment of vegetation on the reclaimed land surface must be properly disposed of during the mining operation unless such materials occur naturally on the land surface. No spoil dumps will be located in or near the expansion area.

74:29:07:18. Requirements for specific types of reclamation. The requirements in §§ 74:29:07:19 to 74:29:07:27, inclusive, apply to the specific type or types of reclamation selected pursuant to SDCL 45-6B-45. These requirements are to be used to develop, when practicable, a multiple-use reclamation plan.

The individual who develops the reclamation plan must be competent in the management and planning of the specific type or types of reclamation selected. The expansion area will be a wildlife habitat area. The 40 feet of quarry edge will be graded and planted with native grasses and trees. It will be monitored for 10 years along with the existing permit area. The individual who developed the reclamation plan used the help of the South Dakota, Game, Fish and Parks officer and the local Soil Conservation Service Agent, Mr. Odell Greene. With their help and the test plots study area, the Cold Spring Granite employee was able to develop the reclamation plan.

74:29:07:22. Wildlife habitat. The following requirements apply to wildlife habitat as an approved post mining land use:

(1) Reclamation shall be directed toward optimizing habitat diversity for game and nongame species. The surrounding unaffected land must be considered in determining habitat diversity goals. The local South Dakota Conservation Officer, Mr. Stan Michals was consulted on wildlife species. Mr. Michals agreed with the original survey that was done on the larger permit area. He added that two endangered species might have critical habitat in Grant County. These species were not considered for the reclamation plan. As for plant diversity in 1983 Mr. Odell Greene was consulted from the Soil Conservation District. He provided the seed mixture for the reclamation found above in section **ARSD 74:29:07:06.**

(2) The applicant must identify the wildlife species to benefit from the proposed reclamation. The local wildlife that surrounds this area and could benefit from the reclamation of the expansion area includes whitetail deer, pheasant, partridge, cottontail rabbits, jack rabbits, red fox, raccoon, mink and a variety of birds including robins, blue jays, blackbirds, crows and swallows. Stan Michals also indicated that the Dakota skippers and Poweshiek skipplerling are two endangered species that might have habitat in Grant County. These species might benefit from the reclamation of the expansion area.

(3) The affected land must be revegetated with native trees, shrubs, forbs, grasses, or other approved alternative vegetation. Revegetation composition, spacing, and arrangement must be based on consultation with the department

of game, fish and parks or on an approved reference area. Woody species and understory vegetation shall be planted at rates which can reasonably be expected to yield densities appropriate for the designated wildlife species. Mr. Odell Greene was consulted from the Soil Conservation District. He provided the seed mixture for the reclamation found above in section **ARSD 74:29:07:06.** The native grasses will be planted first then after 3 years of growth trees and scrubs will be planted.

(4) Alternative wildlife habitat reclamation objectives shall be developed in consultation with the department of game, fish and parks and approved by the board. The size of the expansion area is so small it makes it so alternative wildlife habitat reclamation objectives are not needed.

(5) Sites to be reclaimed for recreational fisheries must provide suitable habitat for the selected fish species. The site will not be designated as specifically a recreational fishery

(6) Surface impoundments to be reclaimed for recreational fisheries must have at least 25 percent of the bottom at a minimum depth of 20 feet to ensure sufficient water during drought, limit growth of undesirable weeds, and reduce the potential for winterkill. The site of the expansion area will not be designated as specifically a recreational fishery.

(7) Streams to be reclaimed for recreational fisheries must have a baseline study prepared by an individual who is competent in the field of fisheries management which addresses faunal, floral, and channel characteristics and is approved by the department of game, fish, and parks. Streams to be reclaimed for recreational fisheries must be reconstructed so that they provide suitable habitat for the selected fish species. Reclamation must achieve to the extent possible the premining pool to riffle ratio, width-to-depth ratio, and stream bed particle sizing and sorting ratio, unless modifications to enhance the stream habitat are approved by the department of game, fish and parks and the department. Reclamation techniques such as stream bank stabilization and revegetation, construction of wing deflectors, k-dams, or other management techniques may be incorporated into the reclamation plan and must have the approval of the department, the department of game, fish and parks, and the board. No streams in the expansion area so this does not apply.

(8) Sites to be reclaimed for recreational fisheries must have safe bank access. The site will not be designated as specifically a recreational fishery

(9) Reclamation is complete when the following conditions are met:

(a) The surviving vegetation species composition is capable of supporting the wildlife species identified as those to benefit from the proposed reclamation. The local wildlife authorities were consulted to make sure the reclamation plan benefits native species.

(b) The understory cover is adequate to control erosion. Grasses will be planted as described in section (3) above.

(c) Stream fisheries approximate or exceed the baseline condition of the stream or that of the approved reference area. The site will not be designated as specifically a recreational fishery

(6) Surface impoundment fisheries meet the post mining land use as described in the approved reclamation plan. The site will not be designated as specifically a recreational fishery

74:29:07:27. Permanent surface impoundment. The following requirements apply to a permanent surface impoundment as an approved post mining land use:

(1) Dams must be designed to contain and, if necessary, pass the design precipitation event. All dam designs must be reviewed and approved by the division of water rights. The expansion area is not considered a dam and neither does the permit area next to it. This does not apply.

(2) If necessary to prevent failure, dams must contain an overflow notch and spillway. Overflow notches and spillways must be riprapped with rock, concrete, or other suitable materials to prevent erosion. The expansion area is not considered a dam and neither does the permit area next to it. This does not apply.

(3) Slopes around surface impoundments, unless otherwise approved by the board, may not exceed two to one, except from five to ten feet below the expected water line where slopes may not exceed three to one. If a swimming area is proposed, the slope, unless otherwise approved by the board, may be no steeper than five to one throughout the area proposed for swimming. All slopes around surface impoundments must be graded and contoured to minimize hazards to humans, livestock, and wildlife. The slopes around the expansion area will be graded before final reclamation. The edges will have granite barriers to prevent accidental falls by people or wildlife.

(4) The board may require the operator to determine if sources of water contamination within the impoundment exist. Such sources must be treated to prevent contamination of the impounded water. The source of water for the expansion area with be ground water or rain water and should not contain any contamination.

(5) Surface impoundments intended for use as recreational fisheries or recreation areas must meet the applicable requirements of § 74:29:07:23. The site will not be designated as specifically a recreational fishery.

(6) Reclamation is complete when the intended use of the surface impoundment has been attained and all other requirements of the reclamation plan have been met. Reclamation will start immediately after shutdown and will be completed within 3 years of shutdown.

Small Permit Application Added items

Certification of Application Form: A copy is found later in the application.

SDCL 45-6B-15: A copy of the letter can be found in the application.

SDCL 45-6B-37, ARSD 74:29:07:04 (1)(d), (2), and (7), and ARSD &4:29:07:27(3):

The final slope along the quarry edge in the expansion area will be a 25% grade or a 4 to 1. There are no plans to allow swimming in the quarry after reclamation. It is to be a wildlife habitat area. The area outside the expansion area will be protected from slides like all other ledges along the permit area 373. The ledges will have a slight grade and will have large granite blocks placed along the ledge to prevent erosion. These blocks also act as a natural safety barrier. The landforms created by grading are a nice flat area with a slight slope. This will compatible with the surrounding area because it is all flat farm fields.

SDCL 45-6B-39, ARSD 74:29:07:06(1), and ARSD 74:29:07:22(3) :

A letter from Grant County NRCS stating that the seed mix in the revegetation section of the small permit application is acceptable for the expansion area. The copy of the letter can be seen later in this report. A copy of a letter from Stan Michals of the Department of Game, Fish, and Parks is also included later in this report. It states that the seed mix is acceptable for the post mine land use of wildlife habitat area.

SDCL 45-6B-41, ARSD 74:29:02:11(1)(2)(9) and (10) and ARSD 74:29:07:04(2):

A copy of Water sampling done in 1990 for Permit area 373 is included in this report. The testing was done for a year and never found any harmful effects on the ground water. A copy of a Water resource survey is also included. It shows information that can help characterize the hydrologic system in the area. A representative geologic cross-section of the expansion area is included with the Water resources report included.

Since the expansion area is only .2 acres it will be covered under permit area 373. The basic drainage, erosion and sedimentation control plan for the expansion area is covered by Permit Area 373. There will be a slight grade on the ledges and large granite barriers will be placed to control erosion. Also native seed will be planted to prevent erosion. No chemicals will be used in the expansion area. No milling will be taken place in the expansion area. No spill contingency plan is needed for the expansion area.

SDCL 45-6B-42 and ARSD 74:29:07:16:

There will be no subsidence in the expansion area. No mining will be done below the surface so there will be no chance for cave-ins. The expansion area in on solid granite that we are not sure how far it goes into the ground. There is no chance the area will sink into the ground.

SDCL 45-6B-43 and ARSD 74:29:07:15:

A copy of a letter from Nathan Mueller of Grant County Weed Department is included later in this application. It states that the weed control plan for the expansion area is in compliance with Grant County Weed Department mandated practices.

SDCL 45-6B-44:

A copy of the certified mail receipt is included later in this application.

SDCL 45-6B-46:

Most of the expansion area will not be revegetated because the quarry will fill with water and be considered a lake. A large piece of the expansion will be under water. There will be no permanent grout piles generated from the expansion area because it will be crushed in permit area 8 by Fishers Sand and Gravel. The little ledge area in the expansion are will be revegetated with the approved seed mix.

SDCL 45-6B-92(1) , (2), (3), and (6):

The expansion area is in the middle of 2 quarries and only .2 acres. Most of that will be under water at the time of quarry reclamation. It is not critical deer winter range

now because it is in a fenced area and will not be critical at the time of reclamation because it is such a small area.

No cold water fisheries will be in the expansion area. If fish happen to be in the quarry after reclamation it will be a natural occurrence.

There are no Riparian zones or Wetlands located in the expansion area. The area is in the middle of two quarries that have been around for 50 years.

The soils in the expansion area are not highly erosive or have low revegetation potential. The area is level ground in between 2 quarries. Due to its location it is unlikely any revegetation will take place until reclamation.

ARSD 74:29:06:02(4) (a) and (e):

The reclamation type is obtainable according to the expected need in the area because it has been approved in the past. The reclamation plan the covers area 373 will also cover the expansion area. That plan has been approved by the Department of Game, Fish, and Parks and SD DENR.

The reclamation plan is consistent with existing state and local land use plans because it has been approved for the much larger permit area 373. All plans for the expansion area have been approved already for permit area 373.

ARSD 74:29:07:01(2) and ARSD 74:29:08:02:

The topsoil salvaged from the expansion area is small and is stockpiled in permit area 373. The topsoil in this area has interim reclamation. The soil is seeded with the approved seed mix to prevent erosion. Blocks of granite were also placed around this area to prevent erosion.

ARSD 74:29:07:02(7):

There will be no waste or spoil disposal in the expansion area. It will all be hauled to Fishers crushing site with all other grout from permit area 373. Map 4 shows the location of this disposal site.

DEPARTMENT OF GAME, FISH, AND PARKS
Division of Wildlife – Regional Office
4130 Adventure Trail
Rapid City, South Dakota 57702-0303

RECEIVED
JUL 13 2016
MINERALS & MINING PROGRAM

January 22, 2016

Dakota Granite
Attn. Jason Redmond
48391 150th Street
PO Box 1351
Milbank, SD 57252

Coldspring
Attn. Steven R. Chouanard
17482 Granite West Road
Cold Spring, MN 56320-4578

Subject: Dakota Granit, Cold Spring Granite Mine Permit Applications

Gentlemen:

This letter is in response to your requests for information on fulfilling both large and small scale permit application requirements for wildlife surveys: SDCL 45-6B-54(8). Your permit application submittals result from Cold Spring Granite and Dakota Granite exchanges of previously permitted parcels in Grant County. Both parcels have GFP preliminary wildlife survey data from initial permits efforts. GFP review of that data indicates existing surveys are still pertinent for the new permitting effort.
Mine permitting also requires description of critical resource as found in SDCL 45-6B-92(1). This section of your permit application may need updating. Since the initial permitting effort, the United States Fish and Wildlife Service has listed the Dakota skippers (Hesperia dacotae) and Poweshiek skipperling (Oarisma poweshiek) as threatened under the Endangered Species Act of 1973. Additionally, the Fish and Wildlife Service has designated about 19,900 acres of critical habitat in Minnesota, North Dakota and South Dakota. Species occurrence data is not available for your specific project area but potential habitat exists in native prairie in Grant County. Please make this addition to your company's permit applications. Please be free to contact me with any wildlife related questions regarding your mining operations.
Thank you and good luck.

Sincerely,

Stan Michals
Energy and Minerals Coordinator

Cc: E. Holm (SD/DENR)

Office (605) 394-2589

E-mail stan.michals@state.sd.us

South Dakota
Department of Game, Fish and Parks

Division of Parks & Recreation

August 21, 1989

Mr. Don Sieger
Cold Spring Grnaite Company
202 South Third Avenue
Cold Spring, MN 56320

Dear Don:

The following information covers the requirements of wildlife habitat as the post-mining land use for your three granite quarry sites near Milbank, SD. These quarries are locatied more specifically as follows:

Carnelian No. 1 located on a portion of the North 1/2 of Section 17, T120N, R47W and the SW 1/4 of Section 8, T120N, R47W.

Carnelian No. 2 located on a portion of the South 1/2 of Section 7, T120N, R47W.

Carnelian No. 3 located on a portion of the North 1/2 of Section 13, T120N, R48W.

The wildlife species present on these lands and surrounding lands include whitetail deer, pheasant, partidge, cottontail rabbit, jack rabbit, red fox, raccoon, mink, and a variety of birds including robins, blue jays, blackbirds, crows, and swallows.

The Company plan to create a habitat suitable for the species noted above is realistic. Since the overall land area is relatively small, these species will naturally populate the affected areas without a stocking program.

Cold Spring Granite Company's plan to vegetate the disturbed land area with a mixture of alfalfa, wheat grass and sweet clover is acceptable. Trees of red pine, black locust, and popple shall be planted on a 10' X 10' staggered spacing. Local shrubs and forbs will invade the lands from the surrounding area and establish a natural density.

The vegetation plan noted above shall be applied to all nearly horizontal land areas that have been disturbed excluding the sides of the grout piles. These sides may be left as broken granite rock without soil, sand, or gravel on them. The size fraction of the final surface should be made of blocks ranging in size from 1 to 3 feet.

DEPARTMENT OF GAME, FISH, AND PARKS
Division of Wildlife – Regional Office
4130 Adventure Trail
Rapid City, South Dakota 57702-0303

RECEIVED
JUL 13 2016
MINERALS & MINING PROGRAM

May 20, 2016

Coldspring
Attn. Steven Chouanard
17482 Granite West Road
Cold Spring, MN 56320-4578

RE: ARSD 74:29:07:06. Revegetation

Dear Steve,

This is in response to your request for agency approval of both the reclamation seed mixture and tree species for the quarry expansion permit. South Dakota Department of Game Fish, and Parks finds the previously approved native grass seeding mixture and tree species appropriate to achieve the post mine land use at the mine expansion area. Please contact me with any reclaimation mixture or tree species change that may result from contact with the local Natural Resources Conservation Service. Also,contact me with your questions or concerns at any of the numbers listed below.
Good luck.

Sincerely

Stan Michals

Energy and Minerals Coordinator
SD/Game, Fish and Parks
Office (605)394-2589
Fax (605)394-1793
Stan.Michals@state.sd.us

CC: E. Holm SD/DENR

I see no endangerment of these species of wildlife by a quarry operation, nor do I see any problem in the future with a quarry type of operation.

Sincerely,

Arlo A. Haase

Arlo A. Haase
Wildlife Conservation Officer
Department of Game, Fish & Parks
PO Box 404
Milbank, SD 57252

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
1102 S DAKOTA ST
MILBANK SD 57252-2707

Phone: (605) 432-6570 Ext. 3

June 17, 2016

Coldspring
Attn: Steven Chouanard
17482 Granite West Road
Cold Spring, MN 56320

Re: Seed plan

Mr. Chouanard,

I looked at the seed plan. I can let you know the seed plan will work, however it would not meet NRCS standards.

When it comes to the tree plan I strongly suggest you use another tree besides green ash since the green ash borer could be an issue in the future. Another thing is I suggest that you use 14 foot spacing instead of the 20 foot.

If you have, any questions call me at the above telephone number.

Sincerely,

Dale J. Thiel
Soil Conservationist
Grant County NRCS

To whom it may concern:

Cold Spring Granite has been and continues to be in compliance with Grant County Weed Department mandated weed control practices.

Cold Spring Granite makes use of Chemical, Mechanical and Bio-Control methods as the need dictates.

In ongoing cooperation Cold Spring Granite consults with Grant County Weed Department when questions or concerns arise.

If you are in need of additional information contact:

Grant County Weed Department

210 E. 5th Ave.

Milbank,SD 57252

Ph.# 605-432-1489

Nathan Mueller Grant County Weed Supervisor

South Dakota Department of Environmental and Natural Resources
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181

Attn: Eric Holm
Natural Resources Engineer III
Mineral and Mining Program

Dear Eric:

Cold Spring Granite Company has applied for a Small Scale Mining Permit to operate dimension stone quarries east of Milbank. A copy of this application has been placed in the Grant County, South Dakota, courthouse for Public review.

Sincerely,

Nancy Copeland

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

DuKota Granite
ATTN: Duson Redmond
48391 150th St
Mil Bunk, SD 57252

9590 9401 0051 5168 7168 41

2. Article Number *(Transfer from service label)*

7012 3050 0000 6761 9542

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X Rick Dilts ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* Rick Dilts

C. Date of Delivery 2-4-2016

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

1351

3. Service Type

- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
- ☐ Certified Mail®
- ☐ Certified Mail Restricted Delivery
- ☐ Collect on Delivery
- ☐ Collect on Delivery Restricted Delivery
- ☐ Insured Mail
- ☐ Insured Mail Restricted Delivery (over $500)
- ☐ Priority Mail Express®
- ☐ Registered Mail™
- ☐ Registered Mail Restricted Delivery
- ☐ Return Receipt for Merchandise
- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

PS Form 3811, April 2015 PSN 7530-02-000-9053 Domestic Return Receipt

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JUL 13 2016
MINERALS & MINING PROGRAM

Cold Spring Granite Company
202 South 3rd Avenue
Cold Spring, MN 56320

May 15, 1990
PACE Project
Number: 900419512

Attn: Mr. Donald Sieger

Milbank

Parameter	Units	MDL	145950 Carnelian No.1	145960 Carnelian No.2	145970 Carnelian No.3
PACE Sample Number:			145950	145960	145970
Date Collected:			04/17/90	04/17/90	04/17/90
Date Received:			04/19/90	04/19/90	04/19/90
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Biochemical Oxygen Demand, 05 Day	mg/L	6	6	6	ND
Iron, Dissolved	mg/L	0.05	ND	ND	ND
Nitrogen, Nitrate	mg/L	0.1	0.9	1.3	0.4
Solids, Total Dissolved	mg/L	1	990	810	300
Solids, Total Suspended	mg/L	1	2	1	1
Specific Conductivity	umhos/cm	1	1700	1400	570
Sulfate	mg/L	1	180	250	79
pH		0.1	8.1	7.9	8.4
ORGANIC ANALYSIS					
HEXANE EXTRACTION FOR PETROLEUM PRODUCTS					
Date Analyzed			04/23/90	04/23/90	04/23/90
Date Extracted			04/23/90	04/23/90	04/23/90
Gasoline	mg/L	0.10	ND	ND	ND
Fuel Oil #1	mg/L	0.10	ND	ND	ND
Fuel Oil #2	mg/L	0.10	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

May 15, 1990
PACE Project Number: 900419572

Milbank

PACE Sample Number:			145980
Date Collected:			04/17/90
Date Received:			04/19/90
			Carnelian
Parameter	Units	MDL	H
INORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Biochemical Oxygen Demand, 05 Day	mg/L	6	ND
Iron, Dissolved	mg/L	0.05	ND
Nitrogen, Nitrate	mg/L	0.1	ND
Solids, Total Dissolved	mg/L	1	230
Solids, Total Suspended	mg/L	1	ND
Specific Conductivity	umhos/cm	1	450
Sulfate	mg/L	1	62
pH		0.1	8.3
ORGANIC ANALYSIS			
HEXANE EXTRACTION FOR PETROLEUM PRODUCTS			
Date Analyzed			04/23/90
Date Extracted			04/23/90
Gasoline	mg/L	0.10	ND
Fuel Oil #1	mg/L	0.10	ND
Fuel Oil #2	mg/L	0.10	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

Cold Spring Granite Company
202 South 3rd Avenue
Cold Spring, MN 56320

May 15, 1990
PACE Project
Number: 900419549

Attn: Mr. Donald Sieger

Milbank

PACE Sample Number:			186060	186070	186080
Date Collected:			04/17/90	04/17/90	04/17/90
Date Received:			04/19/90	04/19/90	04/19/90
			Carnelian	Carnelian	Carnelian
Parameter	Units	MDL	f1	f2	f3
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Gross Alpha	pCi/L	2	2+/-1	5+/-3	4+/-2
Gross Beta	pCi/L	3	5+/-4	6+/-4	8+/-4
Radium 226	pCi/L	-	3.8+/-1.8	3.8+/-1.8	3.1+/-1.7

MDL Method Detection Limit

May 15, 1990
PACE Project Number: 900419549

Milbank

PACE Sample Number:			186090
Date Collected:			04/17/90
Date Received:			04/19/90
			Carnelian
Parameter	Units	MDL	H
SUBCONTRACT ANALYSIS			
INDIVIDUAL PARAMETERS			
Gross Alpha	pCi/L	2	4+/-2
Gross Beta	pCi/L	3	10+/-4
Radium 226	pCi/L	-	2.7+/-1.4

MDL Method Detection Limit

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

Starla Enger
Inorganic Chemistry Manager

June 22, 1990

South Dakota Department of Water & Natural Resources
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181

Attn: Eric Holm
National Resources Engineer
Exploration and Mining Program

Dear Eric:

Attached are the results of our water sampling test conducted in mid-May. Also attached is the result of the Radon-222 test.

Call me with questions and comments.

Sincerely,

COLD SPRING GRANITE COMPANY

Don Sieger

Don Sieger
Quarry Engineer

Attachments

cc: Leon Eisenschenk

DS/rl
Holm.let

Controls for Environmental Pollution, Inc.
P.O. BOX 5351 • Santa Fe, New Mexico 87502 OUT OF STATE 800/545-2188 • FAX · 505-982-9289

Pace Laboratories
1710 Douglas Drive North
Minneapolis, MN 55422

Attn: Lisa Leither

Work ID. Environmental
P O # :

Date Received: 05/23/90
Date Reported: 06/06/90
Work Order: 90-05-477
Category:

Test	Units	Quarry No. 1	Quarry No. 2	Quarry No. 3	Quarry No. 4
		05/22/90 09:00	05/22/90 08:30	05/22/90 08:00	05/22/90 08:45
Radon-222	pCi/liter	80+/-1	54+/-1	49+/-1	58+/-1

Test	Units	Quarry "H"
		05/22/90 08:15
Radon-222	pCi/liter	85+/-1

Certified By:

pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Cold Spring Granite Company
202 South 3rd Avenue
Cold Spring, MN 56320

June 14, 1990
PACE Project Number: 900523517

Attn: Mr. Donald Sieger

Milbank

PACE Sample Number:			196720	196730	196740
Date Collected:			05/22/90	05/22/90	05/22/90
Date Received:			05/23/90	05/23/90	05/23/90
Parameter	Units	MDL	Quarry No. 1	Quarry No. 2	Quarry No. 3
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Bacteria, Fecal Coliform	col/100ml	10	50	10	ND
Biochemical Oxygen Demand, 05 Day	mg/L	6	ND	ND	ND
Iron	mg/L	0.05	0.18	0.25	0.06
Nitrogen, Ammonia	mg/L	0.1	0.1	0.1	0.1
Nitrogen, Nitrate	mg/L	0.1	0.5	1.1	0.3
Solids, Total Dissolved	mg/L	1	1000	800	360
Solids, Total Suspended	mg/L	1	8	6	ND
Specific Conductivity	umhos/cm	1	1800	1300	570
Sulfate	mg/L	1	170	230	79
pH		0.1	8.2	8.1	8.4

MDL Method Detection Limit
ND Not detected at or above the MDL.

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Mr. Donald Sieger
Page 2

June 14, 1990
PACE Project Number: 900523517

Milbank

PACE Sample Number:			196750
Date Collected:			05/22/90
Date Received:			05/23/90
			Quarry
Parameter	Units	MDL	No. 4
INORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Bacteria, Fecal Coliform	col/100ml	10	10
Biochemical Oxygen Demand, 05 Day	mg/L	6	ND
Iron	mg/L	0.05	0.11
Nitrogen, Ammonia	mg/L	0.1	0.1
Nitrogen, Nitrate	mg/L	0.1	0.6
Solids, Total Dissolved	mg/L	1	930
Solids, Total Suspended	mg/L	1	16
Specific Conductivity	umhos/cm	1	1300
Sulfate	mg/L	1	430
pH		0.1	8.4

MDL Method Detection Limit
ND Not detected at or above the MDL.

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

Starla Enger
Inorganic Chemistry Manager

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

September 24, 1990

SOUTH DAKOTA DEPARTMENT OF WATER
AND NATURAL RESOURCES
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181

Attn: Eric Holm
National Resources Engineer
Exploration and Mining Program

Dear Eric:

Attached are the results of our water sampling test conducted in late August.

Call me with questions and comments.

Sincerely,

COLD SPRING GRANITE COMPANY

Don Sieger

Don Sieger
Quarry Engineer

Attachments

cc: Leon Eisenschenk

DS/rl
Holm.let

pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

September 14, 1990

Mr. Donald Sieger
Cold Spring Granite Company
202 South 3rd Avenue
Cold Spring, MN 56320

RE: PACE Project No. 900831.502

Dear Mr. Sieger:

Enclosed is the report of laboratory analyses for samples received August 31, 1990.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

R. Lorraine Vokaty

R. Lorraine Vokaty
Project Manager

Enclosures

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

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THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

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OCT 04 1990
MINERALS & MINING

Cold Spring Granite Company
202 South 3rd Avenue
Cold Spring, MN 56320

Attn: Mr. Donald Sieger

September 14, 1990
PACE Project
Number: 900831502

RECEIVED
JUL 13 2016
MINERALS & MINING PROGRAM

PACE Sample Number:			10 0346063	10 0346071	10 0346080
Date Collected:			08/29/90	08/29/90	08/29/90
Date Received:			08/31/90	08/31/90	08/31/90
Parameter	Units	MDL	CARN # 1	CARN # 2	CARN # 3
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Bacteria, Fecal Coliform	col/100ml	1	1 H	5 H	
Bacteria, Fecal Coliform	col/100ml	2			ND H
Biochemical Oxygen Demand, 05 Day	mg/L	6	ND	ND	ND
Iron	mg/L	0.05	0.05	0.05	0.08
Nitrogen, Ammonia	mg/L	0.1	ND	0.2	ND
Nitrogen, Nitrate	mg/L	0.1	0.2	1.0	0.2
Solids, Total Dissolved	mg/L	1	800	450	260
Solids, Total Suspended	mg/L	1	ND	2	ND
Specific Conductivity	umhos/cm	1	1600	830	520
Sulfate	mg/L	2	130	60	75
pH		0.1	8.2	8.1	8.3

MDL Method Detection Limit
ND Not detected at or above the MDL.
H EPA recommended holding time exceeded.

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Mr. Donald Sieger
Page 2

September 14, 1990
PACE Project Number: 900831502

PACE Sample Number:			10 0346098
Date Collected:			08/29/90
Date Received:			08/31/90
Parameter	Units	MDL	CARN # 4
INORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Bacteria, Fecal Coliform	col/100ml	1	24 H
Biochemical Oxygen Demand, 05 Day	mg/L	6	6
Iron	mg/L	0.05	0.06
Nitrogen, Ammonia	mg/L	0.1	ND
Nitrogen, Nitrate	mg/L	0.1	0.5
Solids, Total Dissolved	mg/L	1	820
Solids, Total Suspended	mg/L	1	3
Specific Conductivity	umhos/cm	1	1200
Sulfate	mg/L	2	390
pH		0.1	8.3

MDL Method Detection Limit
ND Not detected at or above the MDL.
H EPA recommended holding time exceeded.

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

Starla Enger
Inorganic Chemistry Manager

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

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MINERALS & MINING PROGRAM

03720

CHAIN-OF-CUSTODY RECORD
Analytical Request

Client: Cold Spring Granite Co.
Address: 202 South 3rd Ave. Cold Spring, MN 56320
Phone: 612-685-3621

Report To: Don Siegen
Bill To: Cold Spring Granite Co.
P.O. # / Billing Reference:
Project Name / No.:

Pace Client No. 075801
Pace Project Manager RLV
Pace Project No. 90083,502
*Requested Due Date:

Sampled By (PRINT): Donald J. Sieger
Sampler Signature: Don Sieger
Date Sampled: 8/29/90

ITEM NO.	SAMPLE DESCRIPTION	TIME	MATRIX	PACE NO.	NO. OF CONTAINERS	PRESERVATIVES: UNPRESERVED	H_2SO_4	HNO_3	VOA	whirlpak	ANALYSES REQUEST: NO_3	SO_4	TDS	sp Cond	pH	FE	TSS	BOD-5	N-NH3	Fecal Col.	REMARKS
1	CARN #1			34606.3	5	2	1	1		1	X	X	X	X	X	X	X	X	X	X	
2	CARN #2			34607.1	5	2	1	1		1	X	X	X	X	X	X	X	X	X	X	
3	CARN #3			34608.0	5	2	1	1		1	X	X	X	X	X	X	X	X	X	X	
4	CARN #4			34609.8	5	2	1	1		1	X	X	X	X	X	X	X	X	X	X	
5																					
6																					
7																					
8																					

COOLER NOS.	BAILERS	SHIPMENT METHOD OUT / DATE	SHIPMENT METHOD RETURNED / DATE	ITEM NUMBER	RELINQUISHED BY / AFFILIATION	ACCEPTED BY / AFFILIATION	DATE	TIME
				1-4	Don Sieger - CSG	HR Pace	8/31/90	1045

Additional Comments:

1/2

RECEIVED
OCT 04 1990
MINERALS & MINING

2

SEE REVERSE SIDE FOR INSTRUCTIONS

December 10, 1990

SOUTH DAKOTA DEPARTMENT OF WATER AND NATURAL RESOURCES
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181

Attn: Eric Holm
National Resources Engineer
Exploration and Mining Program

Dear Eric:

Attached are the results of our water sampling test conducted in early November.

Call me with questions and comments.

Sincerely,

COLD SPRING GRANITE COMPANY

Don Sieger

Don Sieger
Quarry Engineer

Attachments

cc: Leon Eisenschenk

DS/rl
Holm.let

pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Cold Spring Granite Company
202 South 3rd Avenue
Cold Spring, MN 56320

December 05, 1990
PACE Project
Number: 901107508

Attn: Mr. Donald Sieger

Milbank

PACE Sample Number:			10 0436054	10 0436062	10 0436070
Date Collected:			11/06/90	11/06/90	11/06/90
Date Received:			11/07/90	11/07/90	11/07/90
Parameter	Units	MDL	CARN-1	CARN-2	CARN-3
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Biochemical Oxygen Demand, 05 Day	mg/L	12	ND	ND	ND
Iron	mg/L	0.05	3.5	0.28	0.10
Nitrogen, Ammonia	mg/L	0.1	ND	ND	ND
Nitrogen, Nitrate	mg/L	0.1	ND	0.8	0.2
Solids, Total Dissolved	mg/L	1	920	740	300
Solids, Total Suspended	mg/L	1	ND	5	2
Specific Conductivity	umhos/cm	1	1600	1200	520
Sulfate	mg/L	1	90	240	76
pH		0.1	7.8	8.0	8.1
			No Fecal	No Fecal	No Fecal

MDL Method Detection Limit
ND Not detected at or above the MDL.

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

December 05, 1990
PACE Project Number: 901107508

Milbank

PACE Sample Number:			10 0436089
Date Collected:			11/06/90
Date Received:			11/07/90
Parameter	Units	MDL	CARN-4
INORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Biochemical Oxygen Demand, 05 Day	mg/L	12	ND
Iron	mg/L	0.05	0.48
Nitrogen, Ammonia	mg/L	0.1	ND
Nitrogen, Nitrate	mg/L	0.1	0.4
Solids, Total Dissolved	mg/L	1	1100
Solids, Total Suspended	mg/L	1	16
Specific Conductivity	umhos/cm	1	1400
Sulfate	mg/L	1	530
pH		0.1	7.8

No Fecal

MDL Method Detection Limit
ND Not detected at or above the MDL.

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

Starla Enger
Inorganic Chemistry Manager

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

January 22, 1991

SOUTH DAKOTA DEPARTMENT OF WATER
AND NATURAL RESOURCES
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181

Attn: Eric Holm
National Resources Engineer
Exploration and Mining Program

Dear Eric:

Attached is a summarized list of all the water analysis obtained on samples of water from the Milbank quarries during 1990. The lab made a mistake in reporting the dissolved iron at Quarry No. 1 location. A corrected copy of the lab report is attached.

Please review and call me with questions.

Sincerely yours,

COLD SPRING GRANITE COMPANY

Don Sieger

Don Sieger
Quarry Engineer

DS/rl

COLD SPRING GRANITE COMPANY
202 SOUTH 3RD. AVENUE
COLD SPRING, MINNESOTA 56320
(612) 685-3621

Water quality analysis of samples taken from old quarry holes located on Cold Spring Granite Company property near Milbank, South Dakota. These samples were collected and analyzed to fulfill the requirements for Large Scale Mining Permits issued by the State of South Dakota to Cold Spring Granite Company to operate 4 quarries in the area.

WATER QUALITY COMPARISON

			- - QUARRY HOLE - -				
Sample Date	Units	MDL	1	2	3	4	H
Parameter: Biochemical Oxygen Demand, 05 Day							
04/17/90	mg/l	6	6	6	ND	-	ND
05/22/90	mg/l	6	ND	ND	ND	ND	-
08/29/90	mg/l	6	ND	ND	ND	6	-
11/06/90	mg/l	12	ND	ND	ND	(ND)	-

Comments: Minimal values.

			- - QUARRY HOLE - -				
Sample Date	Units	MDL	1	2	3	4	H
Parameter: Iron, Dissolved							
04/17/90	mg/l	0.05	ND	ND	ND	-	ND
05/22/90	mg/l	0.05	0.18	0.25	0.06	0.11	-
08/29/90	mg/l	0.05	0.05	0.05	0.08	0.06	-
11/06/90	mg/l	0.05	ND	0.28	0.10	(0.48)	-

Comments: Value range from 0.05 to .48 mg/l. The 3.5 value reported by the lab for 11/06/90 at Quarry 1 was in error. A corrected lab report is attached.

			- - QUARRY HOLE - -				
Sample Date	Units	MDL	1	2	3	4	H
Parameter: Nitrogen, Nitrate							
04/17/90	mg/l	0.1	0.9	1.3	0.4	-	ND
05/22/90	mg/l	0.1	0.5	1.1	0.3	0.6	-
08/29/90	mg/l	0.1	0.2	1.0	0.2	0.5	-
11/06/90	mg/l	0.1	ND	0.8	0.2	(0.4)	-

Comments: Value range from 0.2 to 1.3 mg/l.

Sample Date	Units	MDL	- - QUARRY HOLE - - 1	2	3	4	H
Parameter: Solids, Total dissolved							
04/17/90	mg/l	1	990	810	300	-	230
05/22/90	mg/l	1	1000	800	360	930	-
08/29/90	mg/l	1	800	450	260	820	-
11/06/90	mg/l	1	920	740	300	1100	-

Comments: Value range 230 to 1100 mg/l.

Sample Date	Units	MDL	- - QUARRY HOLE - - 1	2	3	4	H
Parameter: Solids, Total Suspended							
04/17/90	mg/l	1	2	1	1	-	ND
05/22/90	mg/l	1	8	6	ND	16	-
08/29/90	mg/l	1	ND	2	ND	3	-
11/06/90	mg/l	1	ND	5	2	16	-

Comments: Value range 1 to 16 mg/l.

Sample Date	Units	MDL	- - QUARRY HOLE - - 1	2	3	4	H
Parameter: Specific Conductivity							
04/17/90	umhos/cm	1	1700	1400	570	-	450
05/22/90	umhos/cm	1	1800	1300	570	1300	-
08/29/90	umhos/cm	1	1600	830	520	1200	-
11/06/90	umhos/cm	1	1600	1200	520	1400	-

Comments: Value range 450 to 1800 umhos/cm.

Sample Date	Units	MDL	- - QUARRY HOLE - - 1	2	3	4	H
Parameter: Sulfate							
04/17/90	mg/l	1	180	250	79	-	62
05/22/90	mg/l	1	170	230	79	430	-
08/29/90	mg/l	2	130	160	75	390	-
11/06/90	mg/l	1	90	240	76	530	-

Comments: Value range 62 to 530 mg/l.

Sample Date	Units	MDL	- - QUARRY HOLE - - 1	2	3	4	H
Parameter: pH							
04/17/90		0.1	8.1	7.9	8.4	-	8.3
05/22/90		0.1	8.2	8.1	8.4	8.4	-
08/29/90		0.1	8.2	8.1	8.3	8.3	-
11/06/90		0.1	7.8	8.0	8.1	7.8	-

Comments: Value range 7.8 to 8.4.

Sample Date	Units	MDL	- - QUARRY HOLE - - 1	2	3	4	H
Parameter: Nitrogen, Ammonia							
04/17/90	(Not analyzed for during this test period)						
05/22/90	mg/l	0.1	0.1	0.1	0.1	0.1	-
08/29/90	mg/l	0.1	ND	0.2	ND	ND	-
11/06/90	mg/l	0.1	ND	ND	ND	ND	-

Comments: Minimal variation.

Sample Date	Units	MDL	- - QUARRY HOLE - - 1	2	3	4	H
Parameter: Bacteria, Fecal Coliform							
04/17/90	(not analyzed for during this test period)						
05/22/90	col/100ml	10	50	10	ND	10	-
08/29/90	col/100ml	1	1 H	5 H	-	24 H	-
08/29/90	col/100ml	2	-	-	ND H	-	-
11/06/90	(not analyzed for during this test period)						

Comments: Value range 1 to 50 col/100 ml.

Sample Date	Units	MDL	- - QUARRY HOLE - - 1	2	3	4	H
Parameter: Sulfate							
04/17/90	mg/l	1	180	250	79	-	62
05/22/90	mg/l	1	170	230	79	430	-
08/29/90	mg/l	2	130	160	75	390	-
11/06/90	mg/l	1	90	240	76	530	-

Comments: Value range 62 to 530 mg/l.

Sample Date	Units	MDL	QUARRY HOLE 1	2	3	4	H
Parameter: HEXANE EXTRACTION FOR PETROLEUM PRODUCTS * Date Analyzed: 04/23/90 Date Extracted: 04/23/90							
Gasoline	mg/l	0.10	ND	ND	ND	-	ND
Fuel Oil #1	mg/l	0.10	ND	ND	ND	-	ND
Fuel Oil #2	mg/l	0.10	ND	ND	ND	-	ND

* These items were only analyzed for during this one testing period.

Sample Date	Units	MDL	QUARRY HOLE 1	2	3	4	H
Parameter: RADIONUCLIDES * (Sample date: 04/17/90)							
Gross Alpha	pCi/l	2	2+/-1	5+/-3	4+/-2	-	4+/-2
Gross Beta	pCi/l	3	5+/-4	6+/-4	8+/-4	-	10+/-4
Radium 226	pCi/l	-	Quarry No. 1	3.8+/-1.8			
			Quarry No. 2	3.8+/-1.8			
			Quarry No. 3	3.1+/-1.7			
			Quarry No. 4	-			
			Quarry No. H	2.7+/-1.4			
Radon-222	pCi/l	-	Quarry No. 1	80+/-1			
			Quarry No. 2	54+/-1			
			Quarry No. 3	49+/-1			
			Quarry No. 4	58+/-1			
			Quarry No. H	85+/-1			

* These items were only analyzed for during this one testing period.

MDL Method Detection Limit
ND Not detected at or above the MDL
H EPA recommended holding time exceeded.

Quarry hole locations:

No. 1 is the hole that Cold Spring was operating in through the end of 1989. At that time operations in the deep hole stopped and drive-in operations continued adjacent to the hole.

No. 2 and No. 3 are old holes that exist within the active quarry areas at No. 2 and No. 3.

No. 4 is an old hole on the Steiner-Rausch property adjacent to an active quarry.

No. H is a quarry South of the Dakota Granite Company plant which was operated by Cold Spring Granite Company in the past. This quarry has not been active for a long period of time and was sampled as a comparison of a quarry hole that has stabilized vs. holes that are adjacent to active quarries. The quarry is full of water that runs out over the top of ledge, vegetation has established itself on all areas covered with any type of soil and the pond is used by all sorts of wildlife in the area. This is the type of pond the company expects to develop in the active quarries when mining stops.

NOTE: Stripping activities were taking place near Quarry Hole No. 4 at the time the November 6, 1990 sample was taken. A large amount of soil and rock was dropped into the hole prior to the sample collection and may influence the results.

Compiled by: Donald J. Sieger

Donald J. Sieger

Quarry Engineer

December 10, 1990

file: DS-mb1207

pace
INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

January 18, 1991

Mr. Donald Sieger
Cold Spring Granite Company
202 South 3rd Avenue
Cold Spring, MN 56320

RE: PACE Project No. 901107.508
Milbank

Dear Mr. Sieger:

Enclosed is the revised report of laboratory analyses for samples received November 07, 1990.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

R. Lorraine Vokaty

R. Lorraine Vokaty
Project Manager

Enclosures

LAB7056/gma

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Minneapolis, MN 55422
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FAX: 612-525-3377

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THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Cold Spring Granite Company
202 South 3rd Avenue
Cold Spring, MN 56320

January 18, 1991
PACE Project
Number: 901107508

Attn: Mr. Donald Sieger

Milbank

PACE Sample Number:			10 0436054	10 0436062	10 0436070
Date Collected:			11/06/90	11/06/90	11/06/90
Date Received:			11/07/90	11/07/90	11/07/90
Parameter	Units	MDL	CARN-1	CARN-2	CARN-3
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Biochemical Oxygen Demand, 05 Day	mg/L	12	ND	ND	ND
Iron	mg/L	0.05	ND	0.28	0.10
Nitrogen, Ammonia	mg/L	0.1	ND	ND	ND
Nitrogen, Nitrate	mg/L	0.1	ND	0.8	0.2
Solids, Total Dissolved	mg/L	1	920	740	300
Solids, Total Suspended	mg/L	1	ND	5	2
Specific Conductivity	umhos/cm	1	1600	1200	520
Sulfate	mg/L	1	90	240	76
pH		0.1	7.8	8.0	8.1

MDL Method Detection Limit
ND Not detected at or above the MDL.

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REPORT OF LABORATORY ANALYSIS

Mr. Donald Sieger
Page 2

January 18, 1991
PACE Project
Number: 901107508

Milbank

PACE Sample Number:			10 0436089
Date Collected:			11/06/90
Date Received:			11/07/90
Parameter	Units	MDL	CARN-4
INORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Biochemical Oxygen Demand, 05 Day	mg/L	12	ND
Iron	mg/L	0.05	0.48
Nitrogen, Ammonia	mg/L	0.1	ND
Nitrogen, Nitrate	mg/L	0.1	0.4
Solids, Total Dissolved	mg/L	1	1100
Solids, Total Suspended	mg/L	1	16
Specific Conductivity	umhos/cm	1	1400
Sulfate	mg/L	1	530
pH		0.1	7.8

MDL Method Detection Limit
ND Not detected at or above the MDL.

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

Starla Enger
Inorganic Chemistry Manager

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

February 20, 1991

Mr. Donald Sieger
Cold Spring Granite Company
202 S. 3rd Avenue
Cold Spring, MN 56320

Dear Mr. Sieger:

This letter is in reference to your current NPDES permit No. SD-0026646.

The water quality data received by the Department during the past year indicates that all quarries, except Carnelian no. 4, are in full compliance with the NPDES and South Dakota Surface Water Quality Standards, ARSD CHAPTER 74:03:02. However, one more quarterly sample for Carnelian no. 4 must be submitted to the Department before the operational monitoring plan can be determined.

Our most recent records indicate that each quarry was sampled last on November 6, 1990. The lab results for this period of sampling show that the values for Carnelian no. 4 showed relatively high TDS and Sulfate values. If possible, please inform the Department on the reason(s) for the high values.

Thank you for your cooperation. If you have any questions or comments, please feel free to give me a call.

Sincerely,

Thomas G. Hack
Hydrologist
Exploration & Mining Program
Telephone: (605) 773-4201

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MINERALS & MINING PROGRAM

Parameter	SW	GW	DW
Fe, dissolved			
NO_3	50 mg/l	10 mg/l	10 mg/l
NH_4			
SO_4		500 mg/l	
Fecal Coliform	1,000/100 ml	>2.2/100 ml	1/100 ml
Conductivity	2500 μhos/cm		
TDS	2500 mg/l	1000 mg/l	
TSS	90 mg/l		
PH	6.0 – 9.0	6.5 - 8.5	
BOD	* 7 - 10		
Radon 222	} handbook 9:		300 pCi/l
tot Alpha		15 pCi/l (gross)	15 pCi/L (gross
tot Beta	100 pCi/l (gross)		
Radium 226	5 pCi/l	5 pCi/l	3 pCi/l
Gasoline	10 mg/l (petroleum)		Sec 74:04: :06
Fuel Oil 1	10 mg/l " "		" "
Fuel Oil 2	10 mg/l " "		" "

* Not a standard

Course ground bentonite

≥ 400' deep

COLD SPRING GRANITE
WATER QUALITY DATA

Carnelian No. 1

PARAMETER		SW STANDARD	GW STANDARD	DW STANDARD	4/17/90	5/22/90	8/29/90	11/6/90	MAX	MIN	AVERAGE
Fe, Dissolved	mg/l	--	--	0.3	< .05	0.18	0.05	< .05	0.18	0	0.058
NO3	mg/l	50	10	10	0.9	0.5	0.2	<.1	0.9	0	0.400
NH4	mg/l	--	--	--	--	0.1	<.1	<.1	0.1	0	0.025
SO4	mg/l	--	500	--	180	170	130	90	180	90	142.500
Fecal Coliform	col/100ml	1000	< 2.2	1	--	50	--	--	50	0	12.500
Conductivity	uMHO/cm	2500/4000	--	--	1700	1800	1600	1600	1800	1600	1675.000
TDS	mg/l	2500	1000	1000	990	1000	800	920	1000	800	927.500
TSS	mg/l	90	--	--	2	8	<1	<1	8	0	2.500
pH	--	6.5/9.0	6.5/8.5	6.5/8.5	8.1	8.2	8.2	7.8	8.2	7.8	8.075
BOD	mg/l	--	--	--	6	<6	<6	<12	6	0	1.500
Radon 222	pCi/l	--	--	300	--	80+/-1	--	--	0	0	0.000
Total Alpha	pCi/l	--	15	15	2+/-1	--	--	--	0	0	0.000
Total Beta	pCi/l	100	--	--	5+/-4	--	--	--	0	0	0.000
Radium 226	pCi/l	5	5	3	3.8+/-1.8	--	--	--	0	0	0.000
Gasoline	mg/l	10	--	--	<.1	--	--	--	0	0	0.000
Fuel Oil 1	mg/l	10	--	--	<.1	--	--	--	0	0	0.000
Fuel Oil 2	mg/l	10	--	--	<.1	--	--	--	0	0	0.000

COLD SPRING GRANITE
WATER QUALITY DATA

Carnelian No. 2

PARAMETER		SW STANDARD	GW STANDARD	DW STANDARD	4/17/90	5/22/90	8/29/90	11/6/90	MAX	MIN	AVERAGE
Fe, Dissolved	mg/l	--	--	0.3	< .05	0.25	0.05	0.28	0.28	0	0.145
NO3	mg/l	50	10	10	1.3	1.1	1	0.8	1.3	0.8	1.050
NH4	mg/l	--	--	--	--	0.1	0.2	<.1	0.2	0	0.075
SO4	mg/l	--	500	--	250	230	160	240	250	160	220.000
Fecal Coliform	col/100ml	1000	< 2.2	1	--	10	--	--	10	0	2.500
Conductivity	uMHO/cm	2500/4000	--	--	1400	1300	830	1200	1400	830	1182.500
TDS	mg/l	2500	1000	1000	810	800	450	740	810	450	700.000
TSS	mg/l	90	--	--	1	6	2	5	6	1	3.500
pH	--	6.5/9.0	6.5/8.5	6.5/8.5	7.9	8.1	8.1	8	8.1	7.9	8.025
BOD	mg/l	--	--	--	6	<6	<6	<12	6	0	1.500
Radon 222	pCi/l	--	--	300	--	54+/-1	--	--	0	0	0.000
Total Alpha	pCi/l	--	15	15	5+/-3	--	--	--	0	0	0.000
Total Beta	pCi/l	100	--	--	6+/-4	--	--	--	0	0	0.000
Radium 226	pCi/l	5	5	3	3.8+/-1.8	--	--	--	0	0	0.000
Gasoline	mg/l	10	--	--	<.1	--	--	--	0	0	0.000
Fuel Oil 1	mg/l	10	--	--	<.1	--	--	--	0	0	0.000
Fuel Oil 2	mg/l	10	--	--	<.1	--	--	--	0	0	0.000

COLD SPRING GRANITE
WATER QUALITY DATA

Carnelian No. 3

PARAMETER		SW STANDARD	GW STANDARD	DW STANDARD	4/17/90	5/22/90	8/29/90	11/6/90	MAX	MIN	AVERAGE
Fe, Dissolved	mg/l	--	--	0.3	< .05	0.06	0.08	0.1	0.1	0	0.060
NO3	mg/l	50	10	10	0.4	0.3	0.2	0.2	0.4	0.2	0.275
NH4	mg/l	--	--	--	--	0.1	<.1	<.1	0.1	0	0.025
SO4	mg/l	--	500	--	79	79	75	76	79	75	77.250
Fecal Coliform	col/100ml	1000	< 2.2	1	--	< 10	--	--	0	0	0.000
Conductivity	uMHO/cm	2500/4000	--	--	570	570	520	520	570	520	545.000
TDS	mg/l	2500	1000	1000	300	360	260	300	360	260	305.000
TSS	mg/l	90	--	--	1	< 1	< 1	2	2	0	0.750
pH	--	6.5/9.0	6.5/8.5	6.5/8.5	8.4	8.4	8.3	8.1	8.4	8.1	8.300
BOD	mg/l	--	--	--	< 6	< 6	< 6	<12	0	0	0.000
Radon 222	pCi/l	--	--	300	--	49+/-1	--	--	0	0	0.000
Total Alpha	pCi/l	--	15	15	4+/-2	--	--	--	0	0	0.000
Total Beta	pCi/l	100	--	--	8+/-4	--	--	--	0	0	0.000
Radium 226	pCi/l	5	5	3	3.1+/-1.7	--	--	--	0	0	0.000
Gasoline	mg/l	10	--	--	<.1	--	--	--	0	0	0.000
Fuel Oil 1	mg/l	10	--	--	<.1	--	--	--	0	0	0.000
Fuel Oil 2	mg/l	10	--	--	<.1	--	--	--	0	0	0.000

COLD SPRING GRANITE
WATER QUALITY DATA

Carnelian No. 4

PARAMETER		SW STANDARD	GW STANDARD	DW STANDARD	5/22/90	8/29/90	11/6/90	MAX	MIN	AVERAGE
Fe, Dissolved	mg/l	--	--	0.3	0.11	0.06	0.48	0.48	0.06	0.217
NO3	mg/l	50	10	10	0.6	0.5	0.4	0.6	0.4	0.500
NH4	mg/l	--	--	--	0.1	<.1	<.1	0.1	0	0.033
SO4	mg/l	--	500	--	430	390	530	530	390	450.000
Fecal Coliform	col/100ml	1000	< 2.2	1	10	--	--	10	0	3.333
Conductivity	uMHO/cm	2500/4000	--	--	1300	1200	1400	1400	1200	1300.000
TDS	mg/l	2500	1000	1000	930	820	1100	1100	820	950.000
TSS	mg/l	90	--	--	16	3	16	16	3	11.667
pH	--	6.5/9.0	6.5/8.5	6.5/8.5	8.4	8.3	7.8	8.4	7.8	8.167
BOD	mg/l	--	--	--	< 6	6	<12	6	0	2.000
Radon 222	pCi/l	--	--	300	58+/-1	--	--	0	0	0.000
Total Alpha	pCi/l	--	15	15	--	--	--	0	0	0.000
Total Beta	pCi/l	100	--	--	--	--	--	0	0	0.000
Radium 226	pCi/l	5	5	3	--	--	--	0	0	0.000
Gasoline	mg/l	10	--	--	--	--	--	0	0	0.000
Fuel Oil 1	mg/l	10	--	--	--	--	--	0	0	0.000
Fuel Oil 2	mg/l	10	--	--	--	--	--	0	0	0.000

COLD SPRING GRANITE
WATER QUALITY DATA

Carnelian H

PARAMETER		SW STANDARD	GW STANDARD	DW STANDARD	4/17/90	5/22/90
Fe, Dissolved	mg/l	--	--	0.3	< .05	--
NO3	mg/l	50	10	10	< .1	--
NH4	mg/l	--	--	--	--	--
SO4	mg/l	--	500	--	62	--
Fecal Coliform	col/100ml	1000	< 2.2	1	--	--
Conductivity	uMHO/cm	2500/4000	--	--	450	--
TDS	mg/l	2500	1000	1000	230	--
TSS	mg/l	90	--	--	< 1	--
pH	--	6.5/9.0	6.5/8.5	6.5/8.5	8.3	--
BOD	mg/l	--	--	--	< 6	--
Radon 222	pCi/l	--	--	300	--	85+/-1
Total Alpha	pCi/l	--	15	15	4+/-2	--
Total Beta	pCi/l	100	--	--	10+/-4	--
Radium 226	pCi/l	5	5	3	2.7+/-1.4	--
Gasoline	mg/l	10	--	--	<.1	--
Fuel Oil 1	mg/l	10	--	--	<.1	--
Fuel Oil 2	mg/l	10	--	--	<.1	--

sidered: _____ WATER PERMIT NO. 5564-3

Phone: 612-685-3621

RECEIVED
JUL 13 2016
MINERALS & MINING PROGRAM

Name of Applicant: Cold Spring Granite Company

Post Office Address: 202 South 3rd Ave, Cold Spring MN 56320

Amount of Water Claimed: 0.67 (0.27-well 0.10-each hole) Total Acres: NA

Source of Water Supply: groundwater

Water to be used for: de-watering project County: Grant

About _____ miles _____ of Milbank

PROOF OF PUBLICATION: Received _____ Not Received _____

APPLICATION: Approved _____ Subject to _____

F.F.& C/.L. Adopted _____ Not Approved _____ Deferred _____

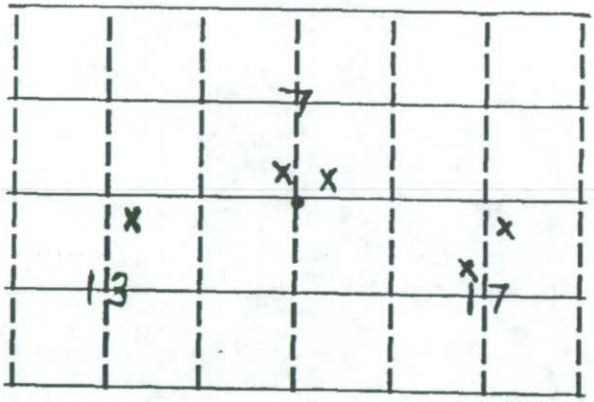
PRIORITY Date Received: 7-15-91 Fee: $225.00 Remarks _____

Corrected Application Received _____ Period of Annual Use Jan 1- Dec 31

WATER QUALITY APPROVAL RECEIVED NA APPROVED/CONDITIONAL (Circle one)

WI-1 Description same as Application YES ___ NO ___ REMARKS _____

Diversion Point: Hole No. 1-SE 1/4 NW 1/4 Sec 17-T120N-R47W; No. 2-SE 1/4 SW 1/4 and well-SW 1/4 SE 1/4 Sec 7-T120N-R47W; No. 3-NW 1/4 NE 1/4 Sec ~~Land to be Irrigated~~ 13-T120N-R48W; No. 4-NW 1/4 NE 1/4 Sec 17-T120N-R47W



Well Log: Driller: _____ Licensed YES ___ NO ___

Depth of Well: about 60' REMARKS not necessary

Type of Map: plat PREPARED BY: Donald R Larson, PE Reviewed and the Number Assigned on 7-17-91 By Karen Schlaak

WATER RESOURCES OF CODINGTON AND GRANT COUNTIES, SOUTH DAKOTA

By Donald S. Hansen

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 89-4147

Prepared in cooperation with the
SOUTH DAKOTA GEOLOGICAL SURVEY,
EAST DAKOTA WATER DEVELOPMENT DISTRICT,
and CODINGTON AND GRANT COUNTIES

Huron, South Dakota
1990

DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

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Box 25425
Denver, CO 80225-0425

CONTENTS

ILLUSTRATIONS

TABLES

CONVERSION FACTORS

For readers who may prefer to use metric (International System) units rather than inch-pound units, the conversion factors for the terms in this report are listed below:

Multiply inch-pound unit	By	To obtain metric unit
acre	4,047	square meter
acre-foot (acre-ft)	1,233	cubic meter
cubic foot per second (ft^3/s)	0.028317	cubic meter per second
foot (ft)	0.3048	meter
foot per day (ft/d)	0.3048	meter per day
foot per mile (ft/mi)	0.1894	meter per kilometer
gallon per minute (gal/min)	0.06309	liter per second
inch	25.4	millimeter
inch per year (in/yr)	25.4	millimeter per year
mile (mi)	1.609	kilometer
million gallons per day (Mgal/d)	0.04381	cubic meter per second
square mile (mi^2)	2.590	square kilometer

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

WATER RESOURCES OF CODINGTON AND GRANT COUNTIES, SOUTH DAKOTA

By Donald S. Hansen

ABSTRACT

The primary sources of surface water in Codington and Grant Counties are Lakes Kampeska and Pelican and numerous potholes and sloughs in western Codington County. Seasonal variations in streamflow and lake levels are directly related to seasonal variations in precipitation and evapotranspiration. Long-term lake-level fluctuations indicate correlation with departure from normal precipitation. Dissolved-solids concentrations in water from streams and lakes increase as stream discharge decreases and lake levels decline.

Seven glacial aquifers and two bedrock aquifers were delineated in Codington and Grant Counties. The areal extent of the glacial aquifers was determined to be 30 square miles for the Antelope Valley aquifer; 140 to 190 square miles for the Lonesome Lake, Big Sioux, and Revillo aquifers; 260 square miles for the Veblen aquifer; 760 square miles for the Prairie Coteau aquifer; and 840 square miles for the Altamont aquifer.

The average thickness of the glacial aquifers ranges from 21 to 63 feet. Recharge to glacial aquifers is from direct infiltration and subsequent percolation of precipitation mostly in the spring and early summer and by leakage from till. The Big Sioux and Antelope Valley aquifers generally are less than 10 feet below land surface, the Veblen aquifer averages about 52 feet below land surface, the Prairie Coteau aquifer averages 138 feet below land surface, the Lonesome Lake aquifer averages 170 feet below land surface, the Revillo aquifer averages 295 feet below land surface, and the Altamont aquifer averages 460 feet below land surface. The buried aquifers are overlaid and underlaid by till except for the Revillo and Altamont aquifers which, in most locations, lie on shale bedrock.

Discharge from glacial aquifers is by evapotranspiration where the aquifers are close to land surface; by withdrawals from domestic, stock-watering, irrigation, and municipal wells; and by outflow to nearby streams and lakes. Reported well yields are the largest (800 gallons per minute or more) from the Big Sioux, Antelope Valley, and Prairie Coteau aquifers.

Predominant chemical constituents are calcium and bicarbonate in water from the Big Sioux, Antelope Valley, Prairie Coteau, Veblen, Revillo, and Lonesome Lake aquifers. Significant concentrations of sulfate also are present in water from the Veblen and Revillo aquifers. Sodium and sulfate are predominant in water from the Altamont aquifer. Average dissolved-solids concentrations in water from the aquifers range from 350 to 2,120 milligrams per liter.

The two bedrock aquifers delineated are the Dakota and granite wash. The Dakota aquifer is at about 1,230 feet below land surface and the water level has declined 10 feet from 1958-85. Predominant chemical constituents in water from the Dakota aquifer are sodium and sulfate. The water has a dissolved-solids concentration of 1,480 milligrams per liter. The granite

wash aquifer is limited to eastern Grant County and has an average thickness of 37 feet. Predominant chemical constituents in water from the granite wash aquifer are sodium and sulfate.

The average annual water use in Codington and Grant Counties is 18.34 million gallons per day. Seventeen percent of the water used is for irrigation.

INTRODUCTION

Codington and Grant Counties encompass 1,415 mi^2 of northeastern South Dakota. Codington County and western Grant County are within the Coteau des Prairies, a highland plateau between the Minnesota River lowland to the east and the James River lowland to the west (fig. 1). Eastern Grant County lies in the western part of the Minnesota River lowland. Land-surface altitudes range from 970 ft in northeast Grant County to 2,015 ft above sea level on the crest of the coteau in northern Codington County.

Previous water-resource studies within the Big Sioux River basin were designed for a specific purpose and were completed as county water-resource investigations, ground-water simulation studies, or city water-supply studies. The studies never were intended to assess hydrologic conditions and evaluate the water-supply potential of the entire basin. As a result, water development has occurred at a rapid rate in some areas of the basin while, in other areas, development has proceeded much more slowly.

The Big Sioux basin hydrologic study, which started in 1982, is a 7-year comprehensive investigation of the water-resources of Codington, Grant, Minnehaha, Lincoln, and Union Counties to develop a hydrologic data base and subsequently to develop digital models of the Big Sioux aquifer. This report is the result of a 4-year water-resources investigation of Codington and Grant Counties.

Purpose and Scope

This report describes the results of a hydrogeologic study in Codington and Grant Counties. The study included test drilling through the glacial drift to bedrock, installation of observation wells, measurement of water levels, and chemical analysis of ground water. Figure 2 shows the test-hole and geologic-section locations and observation-well and water-quality sampling sites in Codington and Grant Counties. The wells and test holes are numbered according to the Federal land survey system (fig. 3).

This report describes: (1) The surface-water resources; (2) the extent of the major glacial outwash and bedrock aquifers; (3) the recharge to, movement, and discharge from the major glacial aquifers; and (4) the quality of the surface and ground water in Codington and Grant Counties.

Acknowledgments

The author would like to acknowledge the cooperation of residents of Codington and Grant Counties for providing information on their water wells, and of the local drilling companies for supplying test-hole information.

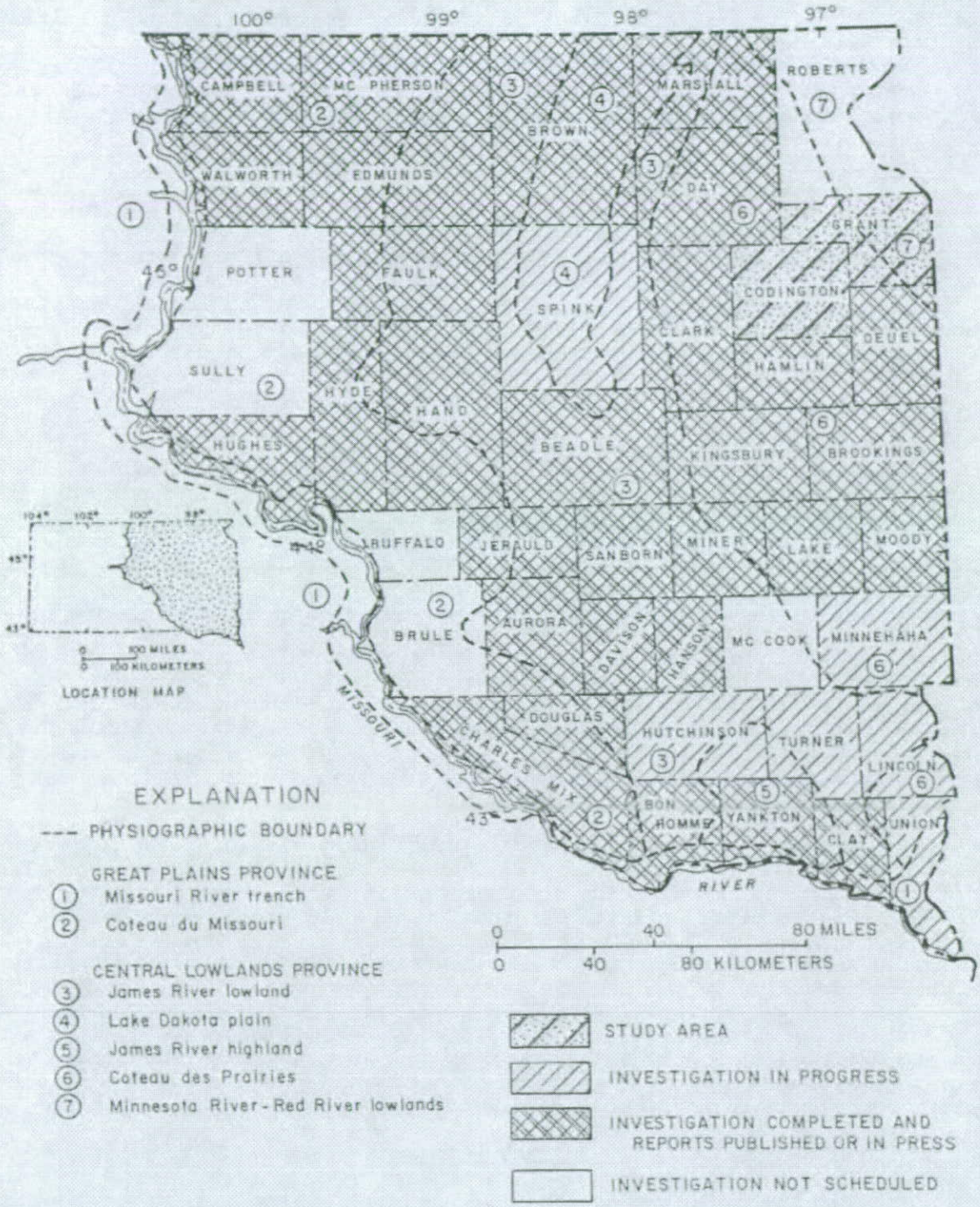


Figure 1.--Index map of eastern South Dakota showing area of this report, status of county investigations, and major physiographic divisions.

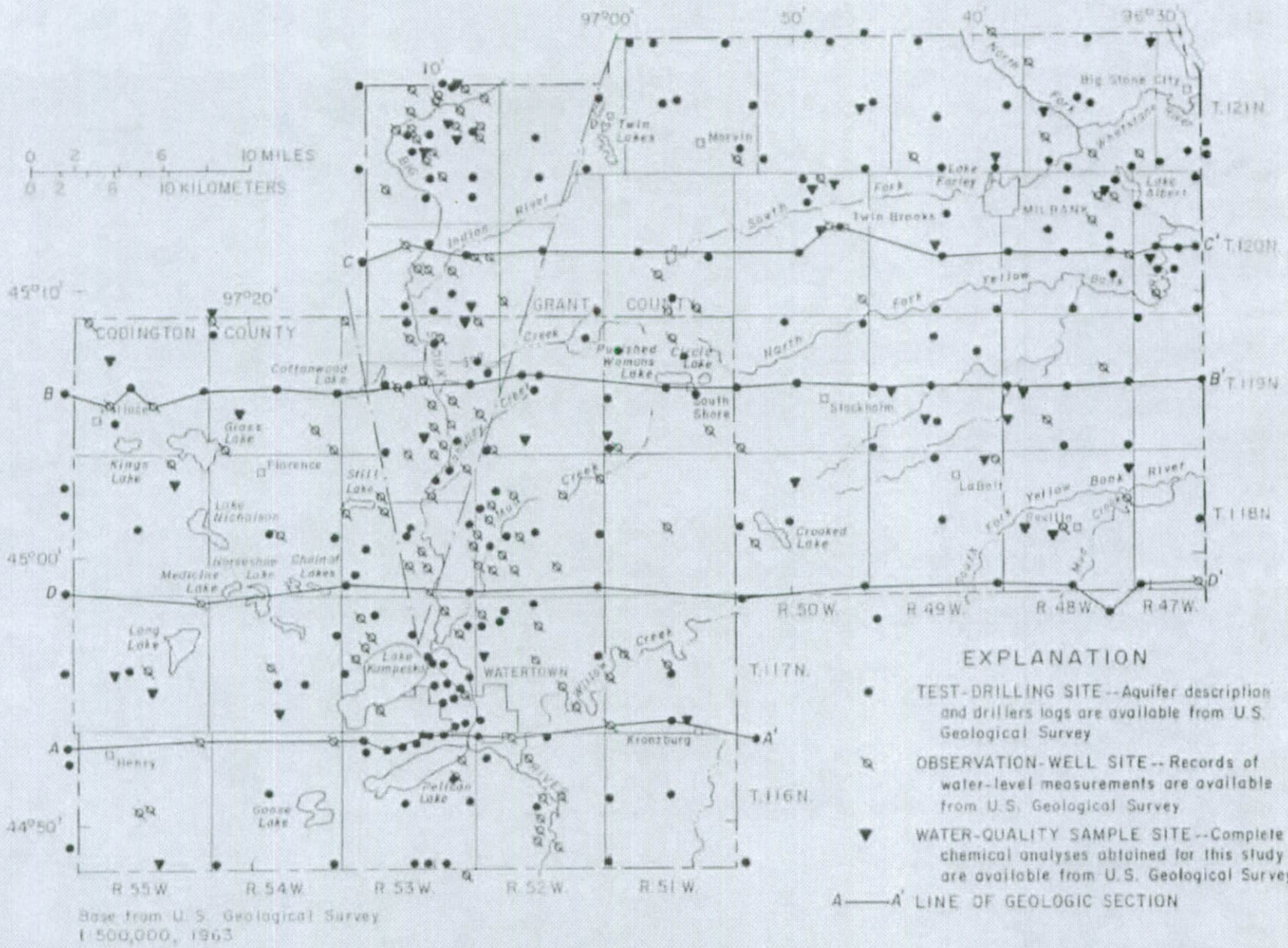


Figure 2.--Location of data sites and geologic sections in Codington and Grant Counties.

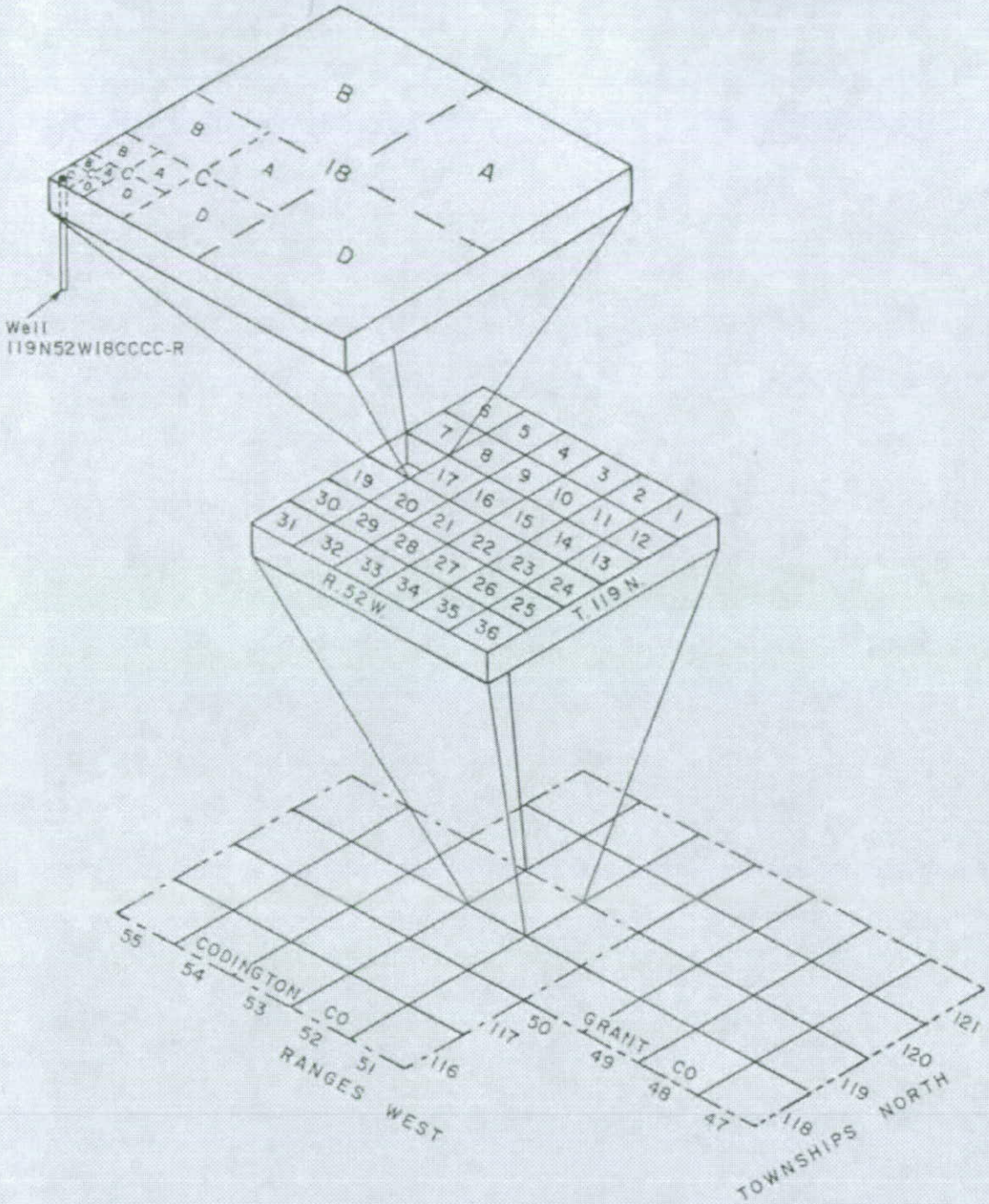


Figure 3.--Well-numbering diagram. The well number consists of township followed by "N," range followed by "W," and section number, followed by a maximum of four uppercase letters that indicate, respectively, the 160-, 40-, 10-, and 2½-acre tract in which the well is located. These letters are assigned in a counter clockwise direction beginning with "A" in the northeast quarter. A serial number following the last letter is used to distinguish between wells in the same 2½-acre tract. The last letter "R" in well designation denotes that the well is located on the Sisseton Indian Reservation.

WATER RESOURCES

The average annual precipitation at Watertown from 1951-80 was 22.3 inches (U.S. National Oceanic and Atmospheric Administration, 1987). About 75 to 85 percent of the precipitation is returned to the atmosphere by evaporation and transpiration. About 5 percent of the average annual precipitation becomes streamflow; however, this quantity may vary from year to year because of climatic variations. Ten to 20 percent of the precipitation percolates through the root zone to become ground water. In a given year, the water budget shows a change in ground-water storage that can be detected by, and calculated from, water-level changes in observation wells in the aquifers. The long-term (greater than 10 years) changes in storage are small, unless ground-water discharge to wells increases.

Drainage in eastern Codington and western Grant Counties (fig. 4) is primarily by the Big Sioux River and its tributaries. Western Codington County is poorly drained, is characterized by numerous closed-basin lakes that do not have an outlet, and is a noncontributing part of the Big Sioux River drainage basin. Drainage in eastern Grant County is well developed and consists of the North and South Forks of the Whetstone and Yellow Bank Rivers. These rivers drain into the Minnesota River. The drainage divide between the Minnesota and Big Sioux River basins is located in extreme northeastern Codington and western Grant Counties (Amundson and others, 1985). This area is characterized by numerous small lakes and potholes.

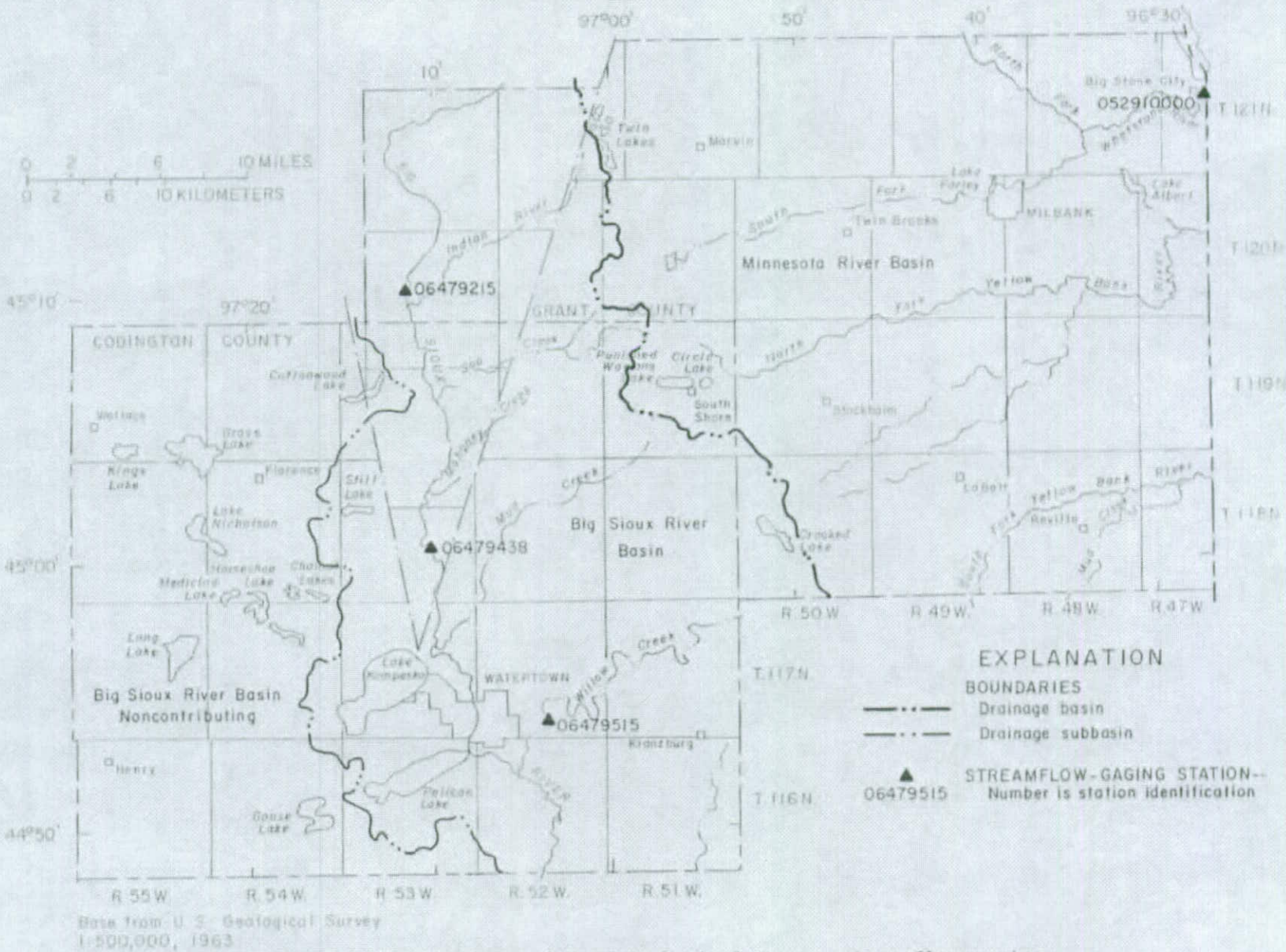
Surface Water

Streamflow

Streamflow depends on seasonal variations in precipitation, evapotranspiration, and ground-water storage. Rivers and creeks generally flow during spring and early summer because of snowmelt and rainfall runoff and because of peak storage in aquifers. Creeks and the upper reaches of the Big Sioux River in Grant County generally do not flow during late fall and winter because of: (1) Decreased runoff; (2) decreased ground-water discharge; (3) evaporation; and (4) ice formation. During years of above-normal precipitation, Willow Creek and the North and South Forks of the Whetstone and Yellow Bank Rivers may not go dry during late fall and winter. Under normal precipitation conditions, the Big Sioux River may receive 15 to 25 ft^3/s from ground water between the Grant-Roberts County line and the streamflow-gaging station on the Big Sioux River near Castlewood, located 5 mi south of the Codington-Hamlin County line. A summary of data for streamflow-gaging stations within the study area is given in table 1.

Specific conductance of water from rivers and streams varies with the volume of streamflow. Specific conductance generally decreases as stream discharge increases because of dilution from snowmelt and rainfall runoff. The observed specific conductance of water from the Big Sioux River near Watertown decreased from 650 $\mu S/cm$ (microsiemens per centimeter at 25 °Celsius) when the instantaneous discharge was 12 ft^3/s in October 1985 to 260 $\mu S/cm$ when the instantaneous discharge was 2,140 ft^3/s in March 1986.

Flooding in Grant County is unlikely because of the well-developed drainage. Valley bottoms and areas of internal drainage in western Codington County are flooded almost every year because of snowmelt and rainfall runoff. Maps of flood-prone areas adjacent to the Big Sioux River have been prepared and are available from the U.S. Geological Survey, Huron, South Dakota 57350. The flood-prone areas, shown on topographic maps at a scale of 2.5 inches to the mile, are areas that have about a 1 in 100 chance, on the average, of being inundated during any year.



Base from U.S. Geological Survey
1:500,000, 1963

Figure 4.--Drainage basins and U.S. Geological Survey streamflow-gaging stations in Codington and Grant Counties.

Table 1.--Summary of data for streamflow-gaging stations in Codington and Grant Counties

[--, not computed]

Station no.	Station name	Contributing drainge area (square miles)	Period of record (water years)	Discharge (cubic feet per second)		
				Maximum instan-taneous	Minimum daily	Average
06479215	Big Sioux River near Florence, S. Dak.[1]	67.9	1984-85	268	0	--
06479438	Big Sioux River near Watertown, S. Dak.	228	1972-85	3,720	0	21.3
06479515	Willow Creek near Watertown, S. Dak.	110	1971-85	4,040	0	15.2
05291000	Whetstone River near Big Stone City, S. Dak.	389	1932-85	6,870	0	47.0
05293000	Yellow Bank River near Odessa, Minn.[2]	398	1939-85	6,970	0	54.8

[1]Streamflow-gaging station established June 6, 1984.
[2]Streamflow-gaging station located 6 miles southeast of Big Stone City. The North and South Forks of the Yellow Bank River join 6 miles south and 5 miles east of Big Stone City.

Lakes

Lakes in Codington and Grant Counties cover about 27 mi^2, or about 3 percent of the study area. Lakes Kampeska and Pelican (fig. 4) cover about 7,600 acres and were formed by stagnant ice blocks positioned at the margin of the receding Wisconsin age glacier (J. P. Gilbertson, South Dakota Geological Survey, written commun., 1986).

Long-term records of lake-level fluctuations for Lake Kampeska indicate correlation with departure from normal precipitation (fig. 5). Lake levels rose from 1970-73, 1977-80, and 1984-86 because of above-normal precipitation. Lake levels generally declined from 1973-76 and from 1980-83 because of below-normal precipitation. In recorded history, Lake Kampeska has never been known to dry up completely (South Dakota State Lakes Preservation Committee, 1977).

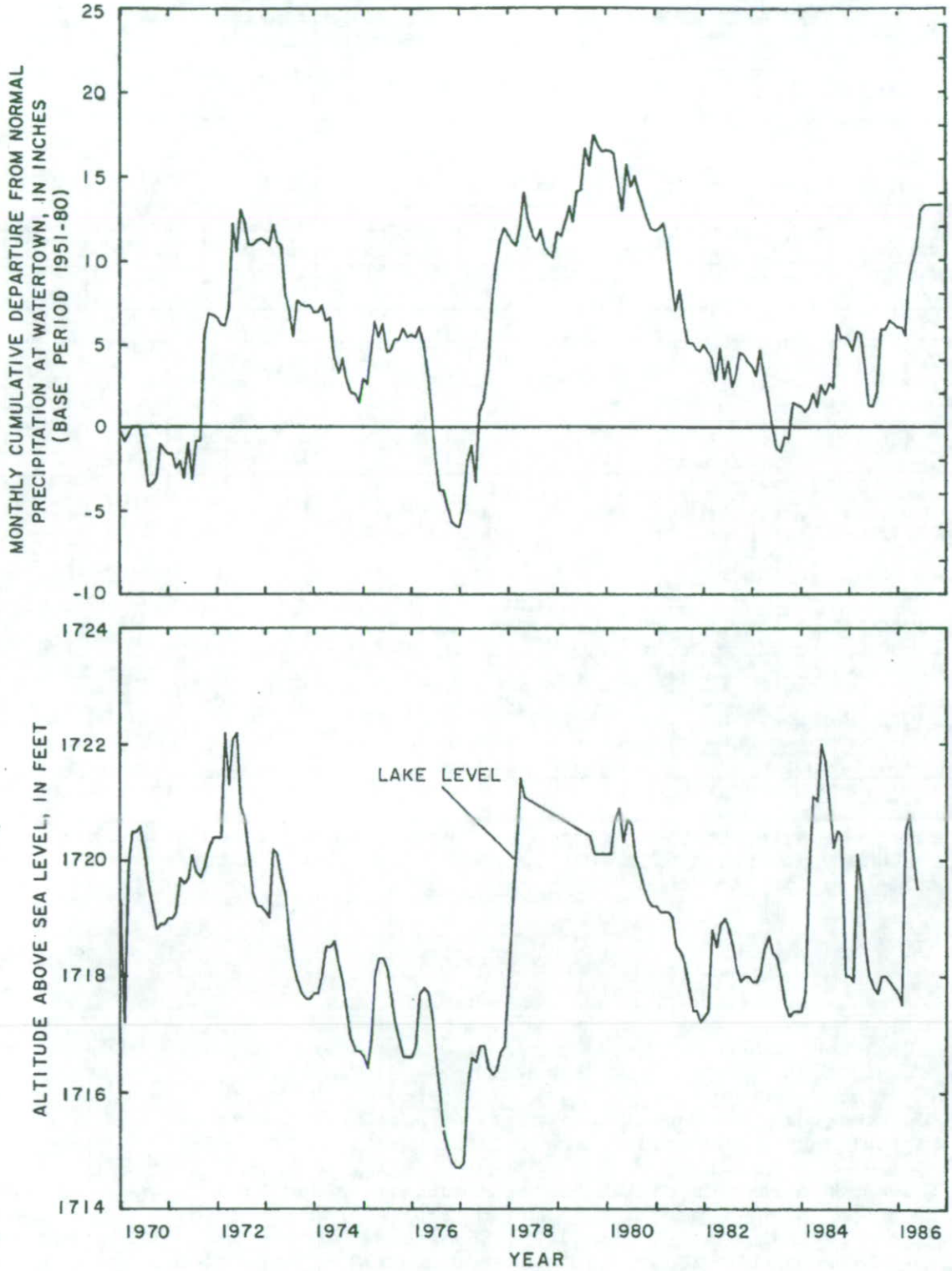


Figure 5.--Lake-level fluctuations for Lake Kampeska and monthly cumulative departure from normal precipitation at Watertown.

Table 2.--Summary of chemical analyses for selected lakes in Codington County

[Analyses based on data collected from 1964-75, State Lakes Preservation Committee, 1977. Results are average value in milligrams per liter except as indicated; --, not analyzed]

	Lakes connected to an aquifer and having an outlet		Lakes not connected to an aquifer and having no outlet		
	Kampeska	Pelican	Medicine	Nicholson	Long
Specific conductance (microsiemens per centimeter at 25 °C)	490	1,280	--	61,000	4,700
pH	8.5	8.8	8.1	9.1	8.2
Alkalinity, total	220	260	1,820	2,200	110
Dissolved solids	330	970	87,500	148,000	13,000
Dissolved calcium	44	60	590	1,400	410
Dissolved magnesium	32	100	12,000	14,000	1,200
Dissolved sodium	11	55	8,000	23,000	1,300
Dissolved potassium	10	22	1,270	1,700	190
Dissolved sulfate	68	280	57,000	99,000	9,000
Dissolved chloride	4.2	21	1,100	1,100	250
Dissolved nitrogen	.1	.1	.17	--	--
Dissolved phosphorus	1.1	<.01	1.1	--	--

The chemical quality of water in lakes is determined by the hydrologic setting of the lake and seasonal changes in precipitation. Lakes in areas of internal drainage having no outlet generally contain water that is one to two orders of magnitude higher in dissolved solids than lakes having external drainage or having good hydraulic connection with a surficial aquifer. Table 2 shows the average chemical quality of water of selected lakes in Codington County. Lakes Kampeska and Pelican are in hydraulic connection with the Big Sioux aquifer and have a total dissolved-solids concentration two orders of magnitude less than Medicine, Nicholson, and Long Lakes. Medicine, Nicholson, and Long Lakes receive recharge by overland runoff and rainfall; however, the only source of discharge is by evaporation. Dissolved-solids concentrations in water from lakes generally decrease during the spring because of dilution from snowmelt and rainfall runoff and then increase during summer and late fall because of reduced inflow and increased evaporation. Dissolved-solids concentrations in water from Medicine Lake increase with depth. Dissolved solids increase from 65,000 mg/L (milligrams per liter) at 2.5 ft to 171,000 mg/L at 7.5 ft (South Dakota State Lakes Preservation Committee, 1977).

Ground-Water Occurrence and Chemical Quality

Glacial Aquifers

Seven aquifers were delineated in Codington and Grant Counties. Hydrologic characteristics of these aquifers are given in table 3. Glacial-outwash aquifers consist of unconsolidated sand and gravel deposited by meltwaters from receding glaciers. Test drilling has shown that the aquifers are overlaid and underlaid by till. Till in Codington and Grant Counties consists of grayish-blue clay with minor amounts of sand and silt. Till in

Table 3.--Summary of the hydrologic characteristics of the major aquifers in Codington and Grant Counties

[--, not determined]

Aquifer	Areal extent (square miles)	Maximum aquifer thickness (feet)	Average aquifer thickness[1] (feet)	Range in aquifer depth below land surface (feet)	Average depth of aquifer below land surface[1] (feet)	Range of ground-water level below land surface[2] (feet)	Average water level below land surface[3] (feet)	Artesian (A) and (or) water-table (WT) aquifer	Estimated volume of water in storage[4] (acre-feet)	Range of reported well discharges[5] (gallons per minute)	Suitability[6] for irrigation
					GLACIAL AQUIFERS						
Big Sioux	150	50	24	0-12	3	-1 - 31	8	WT	350,000	50-1,100	Yes.
Antelope Valley	30	52	34	1-57	9	2 - 22	10	WT	100,000	50-800	Yes
Prairie Coteau	590	62	20	21-380	138	-2.54 - 101	33	A	1.5 million	50-1,100	Yes.
Veblen	330	155	28	1-210	52	1 - 81	29	A	700,000	10-50	Yes.
Lonesome Lake	140	98	32	200-380	270	80 - 100	90	A	430,000	10-20	Yes.
Revillo	210	150	63	105-665	295	-1 - 71	30	A	1.0 million	50-150	No.
Altamont	860	94	40	319-668	460	5 - 250	150	A	3.3 million	10-50	No.
					BEDROCK AQUIFERS						
Dakota[7]	--	--	--	>1,230(?)	--	--	--	A	--	--	No.
Granite wash	230	94	37	75-444	190	-3 - 116	22	A	650,000	10-550	No.

[1] Arithmetic mean from test-hole data.
[2] A negative number indicates feet above land surface.
[3] Arithmetic mean from observation-well data.
[4] Storage was estimated by multiplying average thickness by areal extent and multiplied by specific yield of 0.15 (Hansen, 1987).
[5] Reported data.
[6] Based on the South Dakota irrigation-water classification diagram (fig. 6).
[7] Data for aquifer available from only one well.

eastern South Dakota has a hydraulic conductivity of about 10^{-5} ft/d (Barari, 1985). The till will not yield a sufficient quantity of water to wells even for domestic use; however, locally it may contain thin, discontinuous sand and gravel lenses that reportedly yield 2 to 15 gal/min to domestic and stock-watering wells.

Water-level fluctuations in observation wells screened in the glacial aquifers, with the exception of the Altamont, are caused by seasonal changes in recharge and discharge. Water levels generally rise from February through June because recharge from snowmelt and spring rainfall is greater than discharge. Water levels generally decline from July through January because discharge from wells and evapotranspiration are greater than recharge.

Suitability of water for irrigation from the glacial aquifers may be determined by use of the South Dakota irrigation-water diagram (fig. 6) (Koch, 1983). The diagram is based on South Dakota irrigation-water standards, revised January 7, 1982, and shows the State of South Dakota's water-quality and soil-texture requirements for the issuance of an irrigation permit.

Big Sioux aquifer

The Big Sioux aquifer (fig. 7) consists of poorly to well-sorted surficial outwash that ranges from medium sand to medium gravel; it generally is less than 10 ft below land surface. The aquifer is limited to the flood plain of the Big Sioux River and its tributaries, and is underlaid by till. In most locations, the aquifer becomes coarser and more sorted with depth. The aquifer generally is under water-table conditions, except in the Lake Pelican area where the aquifer is confined by 3 to 5 ft of till. A geologic section of the aquifer is shown in figure 8.

Recharge to the aquifer is by direct infiltration and subsequent percolation of rainfall and snowmelt through the overlying 1 to 2 ft of topsoil. Recharge to the aquifer ranges from 4 to as much as 10 in/yr (Hansen, 1988). The general direction of water movement in the aquifer is to the south and toward the Big Sioux River (fig. 9), which flows from north to south. The gradient of the water-table surface generally is about 6 to 10 ft/mi. Lakes Kampeska and Pelican are connected hydraulically to the Big Sioux aquifer. During spring and early summer, lake levels commonly exceed the water level in the aquifer and, thus, the lakes recharge the aquifer. During summer and fall, when evaporation exceeds precipitation, the lake levels are less than water levels in the surrounding Big Sioux aquifer and water from the aquifer discharges to the lakes.

Discharge from the Big Sioux aquifer is by withdrawals from irrigation, domestic, municipal, and stock-watering wells; by evapotranspiration; and by ground-water discharge to lakes and the Big Sioux River. The average annual reported pumpage by irrigation and municipal wells was about 2,100 acre-ft from 1972-80 (South Dakota Department of Water and Natural Resources, written commun., 1972-80). The average annual reported pumpage by irrigation wells was 2,800 acre-ft during the drought years of 1975-77. Reported discharge from irrigation wells in the Big Sioux aquifer is as much as 1,100 gal/min.

Records of long-term water-level fluctuations in well 118N52W21BBCB show correlation with long-term trends in precipitation (fig. 10). The water-level rise during 1972, 1977-79, and 1984-86 was caused by above-normal precipitation. The decline from 1973-76 and 1980-81 was caused by below-normal precipitation.

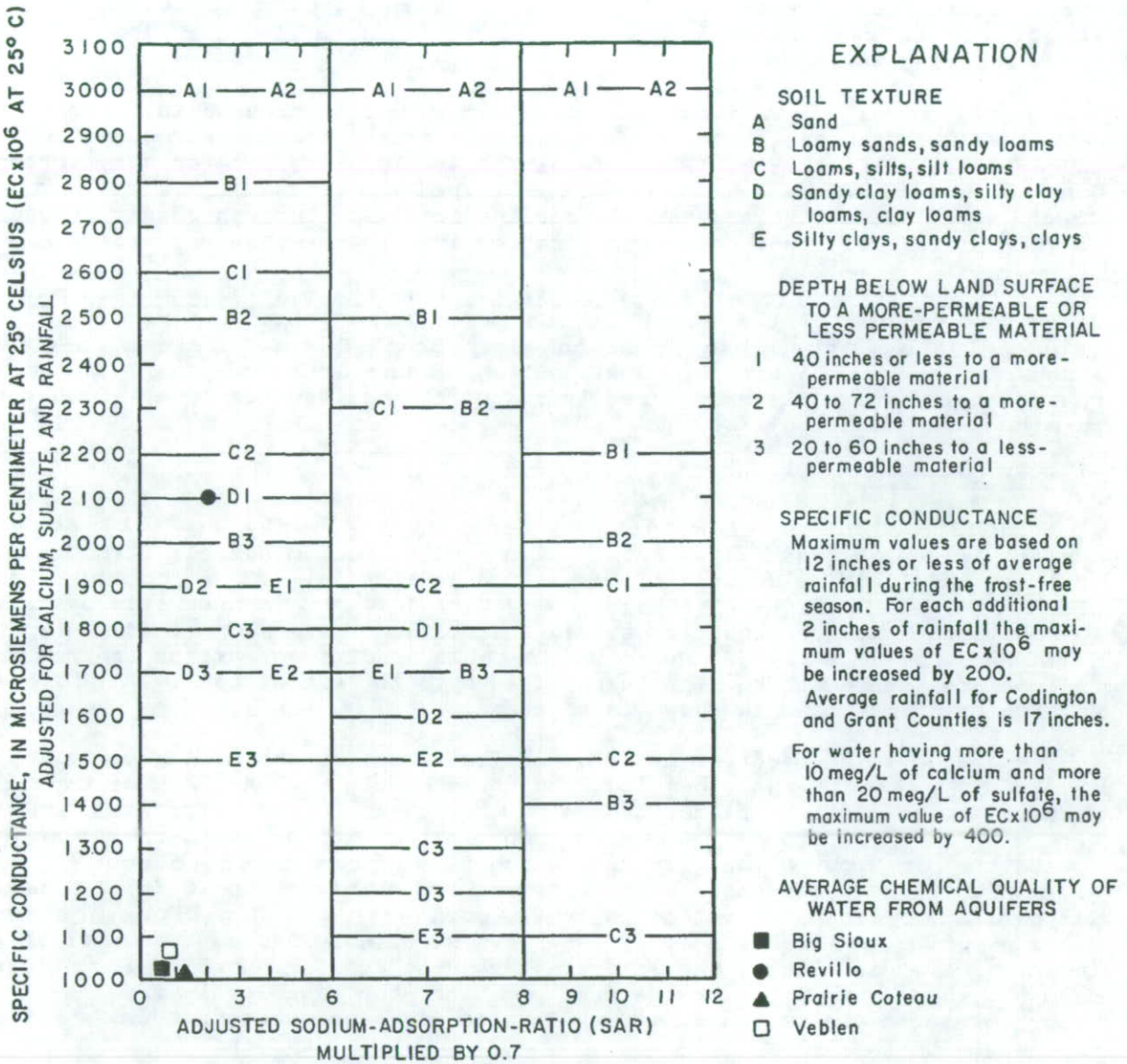


Figure 6.--South Dakota irrigation-water classification diagram based on South Dakota standards (revised Jan. 7, 1982) for maximum allowable specific conductance and adjusted sodium-adsorption-ratio values for which an irrigation permit can be issued for applying water under various soil-texture conditions. Water can be applied under all conditions at or above the plotted point but not below it provided other conditions as defined by the State Conservation Commission are met.

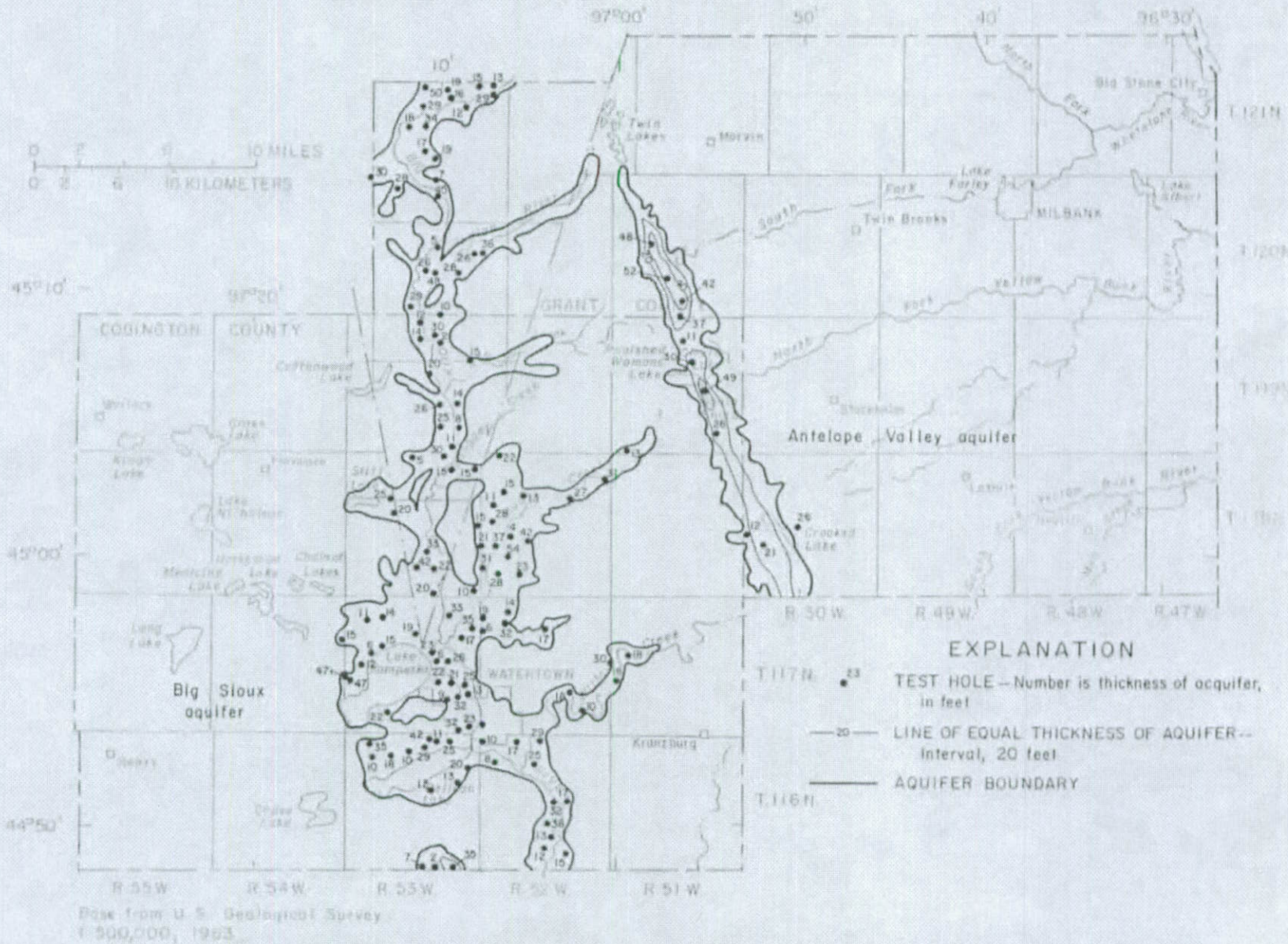


Figure 7.--Extent and thickness of the Big Sioux and Antelope Valley aquifers in Codington and Grant Counties.

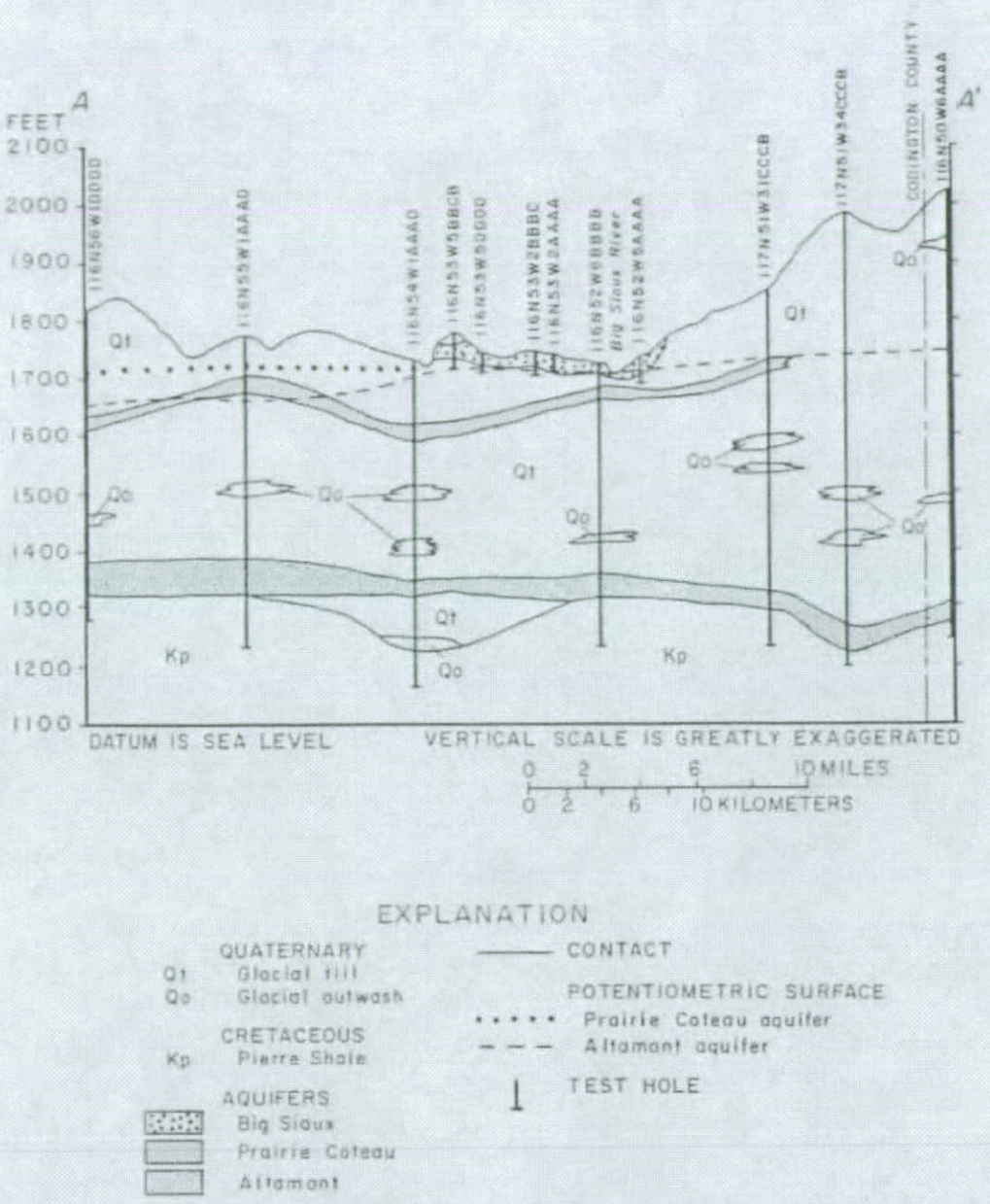


Figure 8.--Geologic section A-A' showing the Big Sioux, Prairie Coteau, and Altamont aquifers. (Section A-A' is shown in figure 2.)

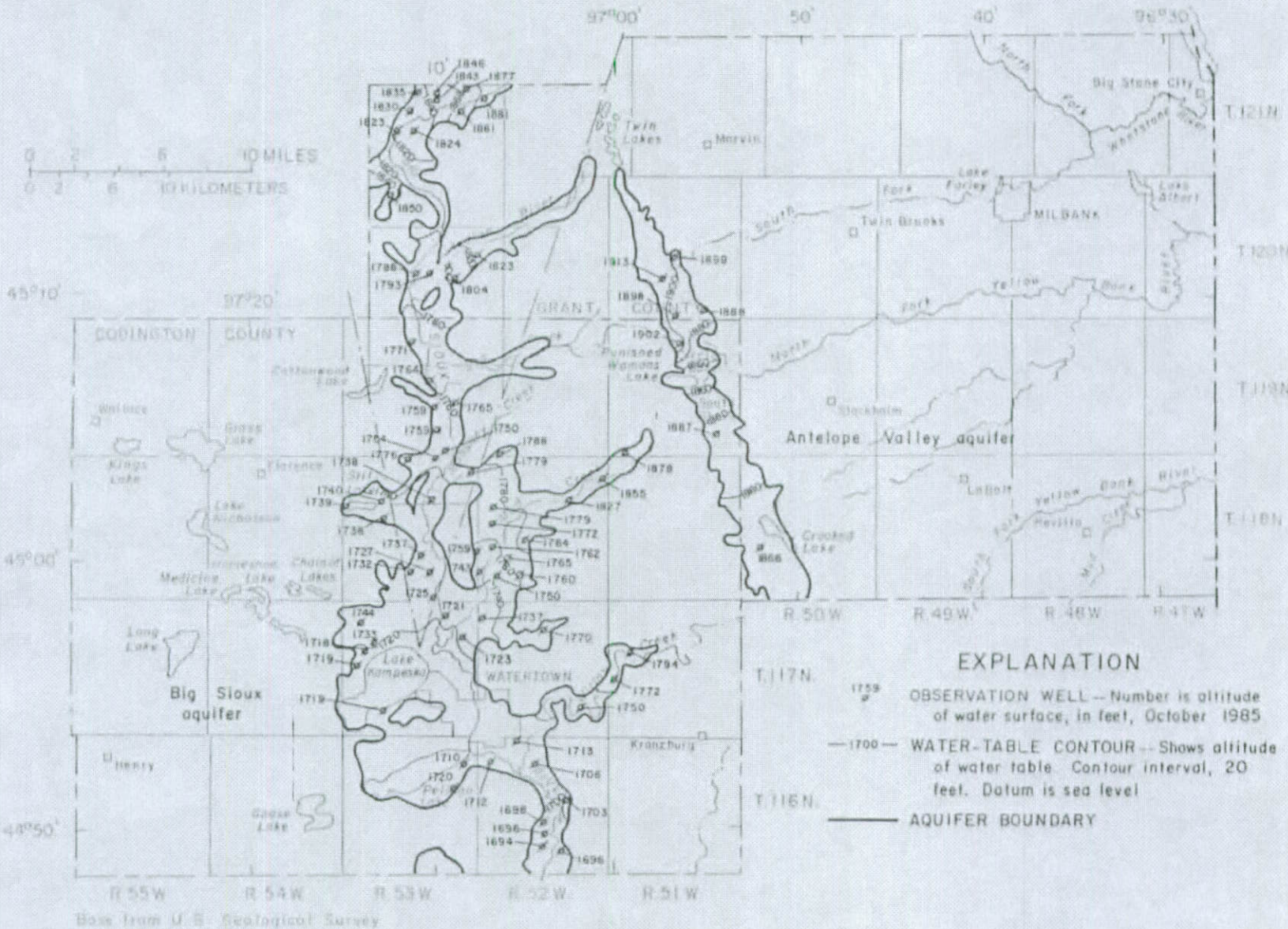


Figure 9.--Water-table surface of the Big Sioux and Antelope Valley aquifers in Codington and Grant Counties, October 1985.

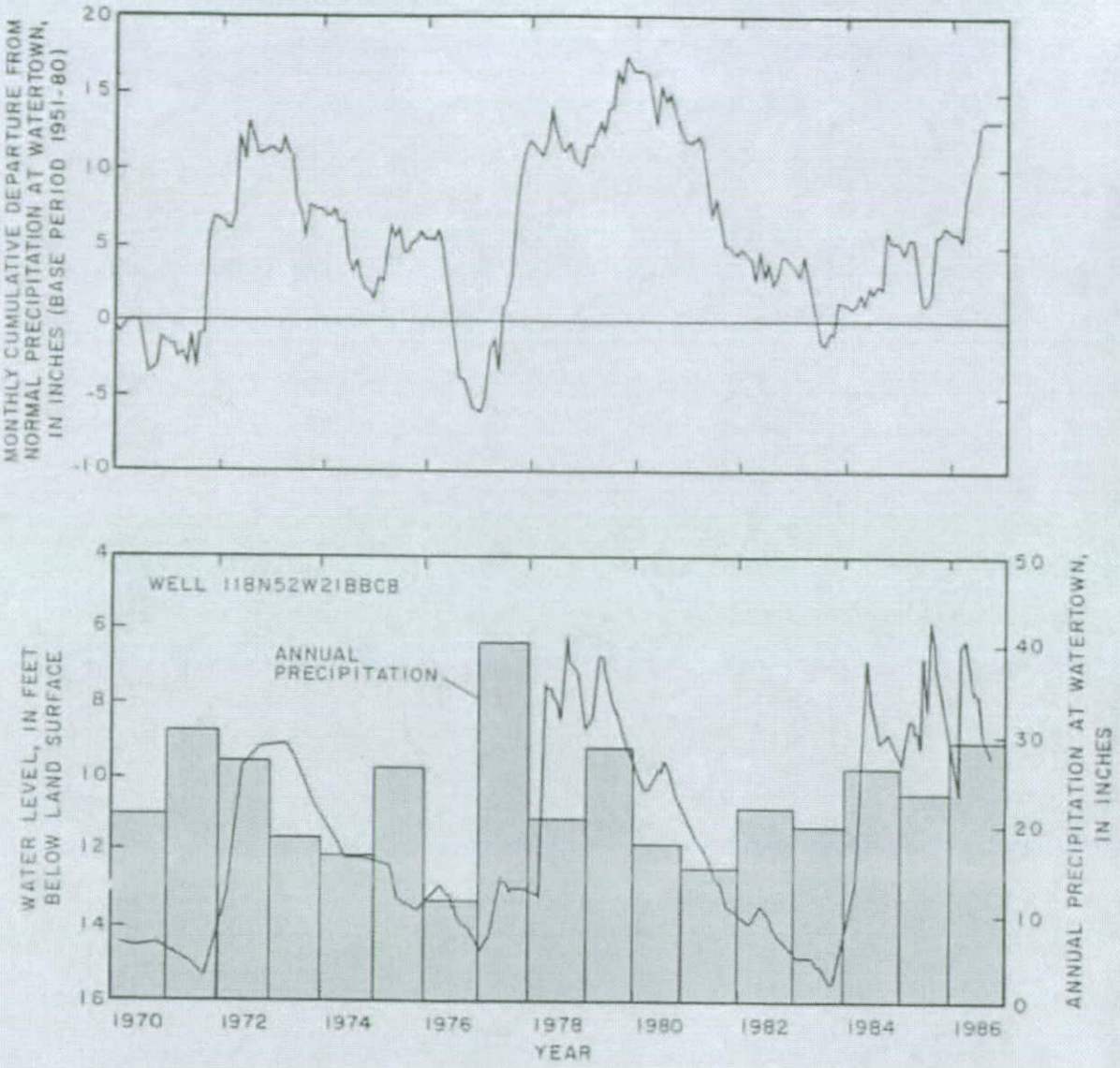


Figure 10.--Water-level fluctuations in the Big Sioux aquifer and annual precipitation and monthly cumulative departure from normal precipitation at Watertown.

Predominant chemical constituents in water from the Big Sioux aquifer are calcium and bicarbonate (table 4). Dissolved-solids concentrations averaged 580 mg/L. Hardness concentrations determined by onsite analysis averaged 400 mg/L. Water from the aquifer is of suitable quality for irrigation (fig. 6). Water from the aquifer also is used for municipal, industrial, domestic, and stock-watering purposes.

Antelope Valley aquifer

The Antelope Valley aquifer is an unconfined glacial-outwash aquifer that lies at or near land surface in northeastern Codington and western Grant Counties (fig. 7). The aquifer is located in the axis of the drainage divide between the Big Sioux and Minnesota Rivers (fig. 4) and is hydraulically connected to numerous small lakes and sloughs. The aquifer is composed of brown, very coarse sand to coarse gravel. The aquifer generally is under water-table conditions; however, at well 119N51W3CCCC the aquifer is covered by 43 ft of till and is under artesian conditions. The aquifer is shown in geologic section B-B' (fig. 11), and hydrologic characteristics are given in table 3.

Recharge to the aquifer is by direct infiltration and subsequent percolation of rainfall and snowmelt through the overlying 1 to 2 ft of topsoil. Test-hole data indicate that Crooked, Punished Womans, and Round Lakes are hydraulically connected to the aquifer. The general direction of water movement in the aquifer is from northwest to southeast. The direction of water movement within 2 mi of Punished Womans, Round, and Crooked Lakes, and numerous sloughs and small lakes located in T. 120 N., R. 51 W. is toward these lakes and sloughs.

Discharge from the aquifer is by: (1) irrigation, domestic, and stock-watering wells; (2) evaporation directly from the water-table surface where the aquifer is at or near land surface; (3) outflow to Punished Womans, Round, and Crooked Lakes; and (4) outflow to small lakes and sloughs in T. 120 N., R. 51 W. near the eastern edge of the aquifer.

Records of long-term water-level fluctuations in wells 119N51W3DDDA and 120N51W34CCCC (fig. 12) show correlation with long-term trends in precipitation. The water-level decline from 1979-83 was caused by below-normal precipitation. The water-level rise from 1983-87 was caused by four years of above-normal precipitation. The sharp annual decline during June and July in well 119N51W3DDDA is caused by pumpage from nearby irrigation wells.

Predominant chemical constituents in water from the Antelope Valley aquifer are calcium and bicarbonate. Specific conductance, determined from onsite analyses, ranged from 320 to 1,850 μS/cm and averaged 1,000 μS/cm. Hardness concentrations, also determined by onsite analyses, ranged from 150 to 890 mg/L and averaged 500 mg/L. A summary of laboratory analyses of water from the aquifer is given in table 4. Water from the aquifer is used for irrigation, domestic, and stock-watering purposes.

Table 4.--Summary of chemical analyses of water from the Big Sioux and Antelope Valley aquifers in Codington and Grant Counties

[Analyses by U.S. Geological Survey. Results in milligrams per liter except as indicated; --, not analyzed]

	Big Sioux aquifer				Antelope Valley aquifer			
	Number of samples	Mean	Minimum value	Maximum value	Number of samples	Mean	Minimum value	Maximum value
Specific conductance, (microsiemens per centimeter at 25 °C)	10	890	650	1,300	17	820	480	1,970
pH, field (units)	8	[1]7.6	7.1	8.4	16	[1]7.4	6.9	8.0
Temperature, water (°C)	4	5.5	5	6.0	5	11.5	7.0	20.5
Dissolved solids	16	580	280	1,140	4	350	344	352
Dissolved calcium	18	100	52	180	17	110	70	220
Dissolved magnesium	18	40	14	65	17	35	7	130
Dissolved sodium	16	26	5.0	82	17	13	2.6	37
Dissolved potassium	16	3	1	7	13	4	2	8
Bicarbonate	9	320	210	380	15	330	220	550
Dissolved sulfate	17	130	19	260	17	150	18	590
Dissolved chloride	18	14	.8	45	17	13	1.0	120
Dissolved fluoride	12	.3	.2	.9	2	.3	.2	.3
Dissolved nitrate	12	4.2	0	14	3	.13	0	.32
Dissolved boron (micrograms per liter)	9	220	20	450	4	120	0	370
Dissolved iron (micrograms per liter)	4	320	40	600	2	1,600	480	2,700
Dissolved manganese (micrograms per liter)	4	160	70	240	--	--	--	--

[1]Median value.

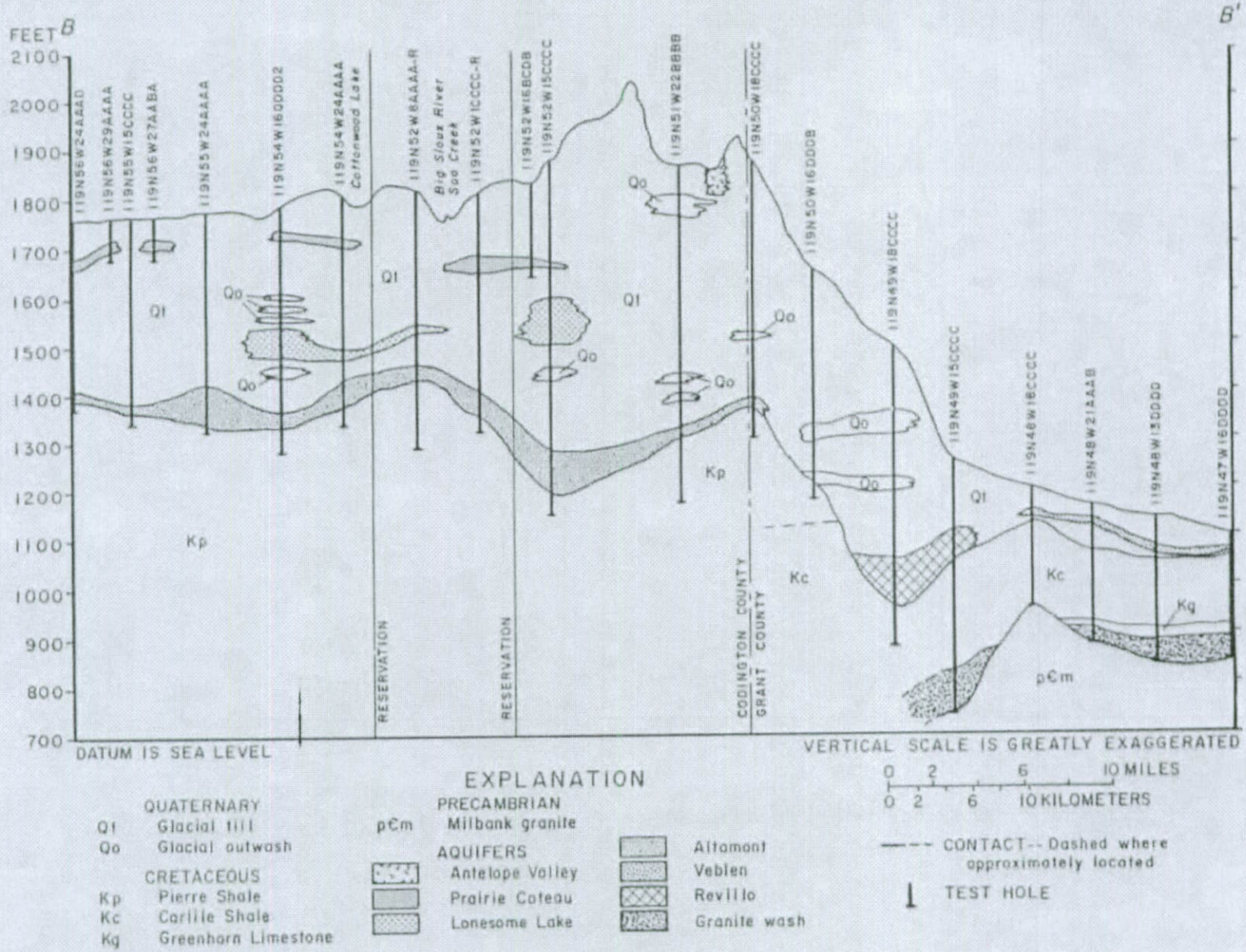


Figure 11.--Geologic section B-B' showing the Antelope Valley, Prairie Coteau, Lonesome Lake, Altamont, Veblen, Revillo, and granite wash aquifers. (Section B-B' is shown in figure 2.)

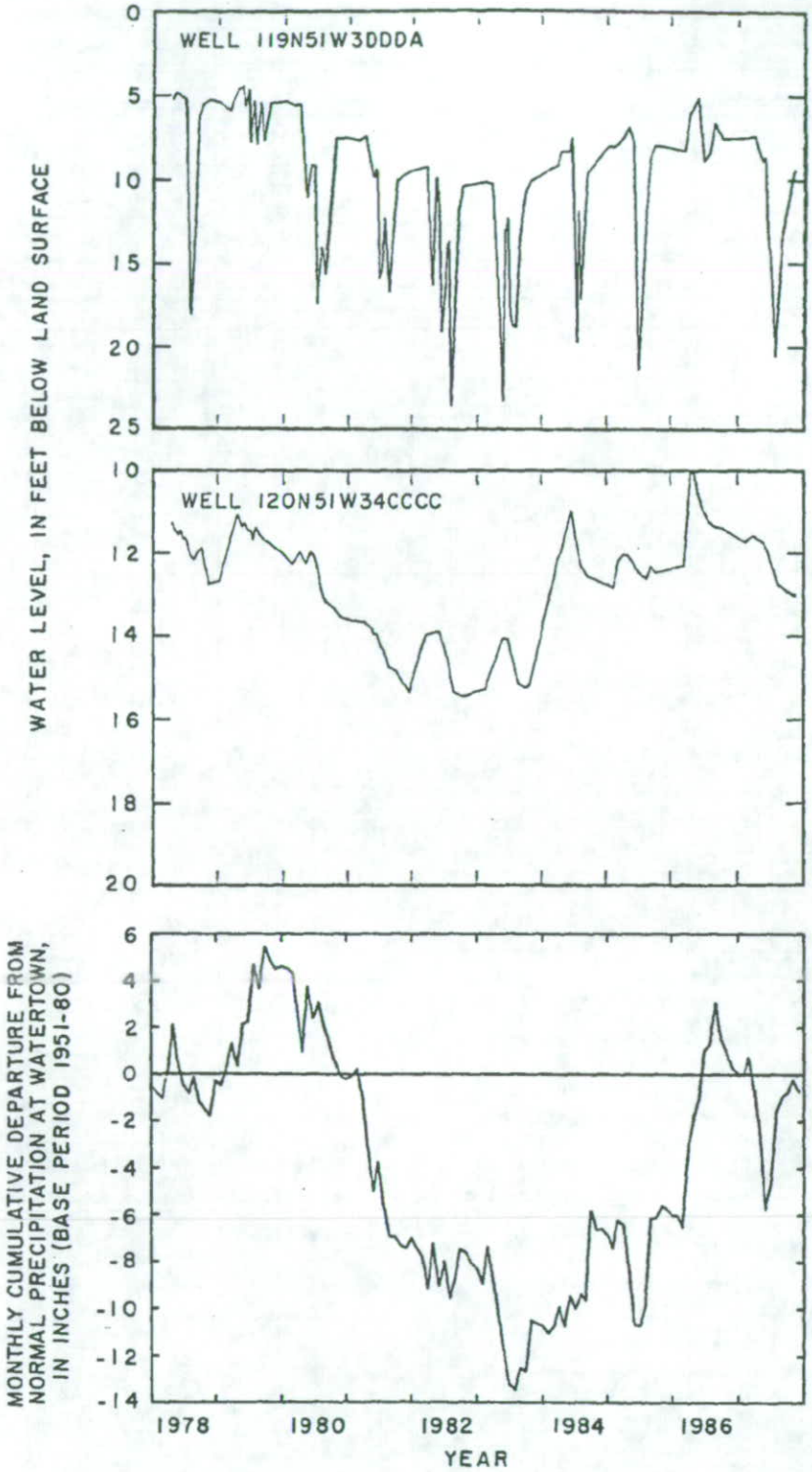


Figure 12.--Water-level fluctuations in the Antelope Valley aquifer and cumulative departure from normal precipitation at Watertown.

Prairie Coteau aquifer

The Prairie Coteau aquifer is composed of brown to gray, coarse to very coarse, well-rounded sand and fine gravel. The aquifer covers most of western Codington County and the western two townships of Grant County (fig. 13). The top of the aquifer may be as much as 380 ft below land surface in eastern Codington County to as little as 21 ft below land surface in northwestern Codington County. Geologic sections of the aquifer are shown in figures 8 and 11. Hydrologic characteristics are given in table 3.

Test-hole data in T. 122 N., R. 52 W. (Roberts County, fig. 1) indicate surficial outwash in that area as much as 65 ft thick. The outwash, known as the Coteau Lakes aquifer (J. A. Goodman, South Dakota Department of Water and Natural Resources, written commun., 1987) may be in hydraulic connection with the Prairie Coteau aquifer and may be the principle source of recharge to the Prairie Coteau aquifer. Recharge to the Prairie Coteau aquifer in western Codington County may be by direct infiltration and subsequent percolation of rainfall and snowmelt in areas where the aquifer is near land surface (fig. 11). These areas include T. 119 N., R. 54 and 55 W.; T. 118 N., R. 54 and 55 W.; and T. 117 N., R. 52 and 53 W. Recharge to the aquifer also may be by leakage from the Big Sioux aquifer. The Big Sioux aquifer and the Prairie Coteau aquifer are separated by 15 to 25 ft of silty, sandy till in T. 120 N., R. 52 W. and T. 116 N., R. 52 W. Recharge to the Prairie Coteau aquifer also may be by leakage from the till. The direction of water movement in the aquifer is from northeast to southwest toward Clark and Hamlin Counties. The gradient of the potentiometric surface is about 6 ft/mi (fig. 14). In T. 119 N., R. 52 W., the gradient is 20 ft/mi, which may be caused by finer aquifer material in this area.

Discharge from the Prairie Coteau aquifer is by: (1) Irrigation wells in western Grant and northern Codington Counties, (2) stock-watering and domestic wells, and (3) possibly, to Long Lake in western Codington County. Specific conductance of water from Long Lake is an order of magnitude less than of water from Nicholson and Medicine Lakes (table 2), which may indicate discharge from the Prairie Coteau aquifer to Long Lake. The average annual reported pumpage from 1980-85 from irrigation wells in western Grant and northern Codington Counties was about 1,700 acre-ft (South Dakota Department of Water and Natural Resources, written commun., 1980-85).

Records of long-term water-level fluctuations in well 121N52W22CCCC-R (fig. 15) show correlation with long-term trends in precipitation. The water-level decline from 1979-83 was caused by below-normal precipitation. The water-level rise from 1983-87 was caused by four years of above-normal precipitation.

Water from the Prairie Coteau aquifer is of the calcium bicarbonate type, based on predominant ions, in western Grant County and eastern Codington County and is of the calcium sulfate type in western Codington County (table 5). Dissolved-solids concentrations ranged from 650 to 2,250 mg/L and averaged 1,490 mg/L in western Codington County. Dissolved-solids concentrations ranged from 430 to 660 mg/L and averaged 510 mg/L in western Grant County and eastern Codington County. The smaller dissolved-solids concentrations in eastern Codington and western Grant Counties probably result from the inflow of less-concentrated water from the nearby recharge area in Roberts County (T. 122 N., R. 52 W.). Water from the aquifer is of suitable quality for irrigation based on South Dakota irrigation-water standards, revised January 1982 (fig. 6).

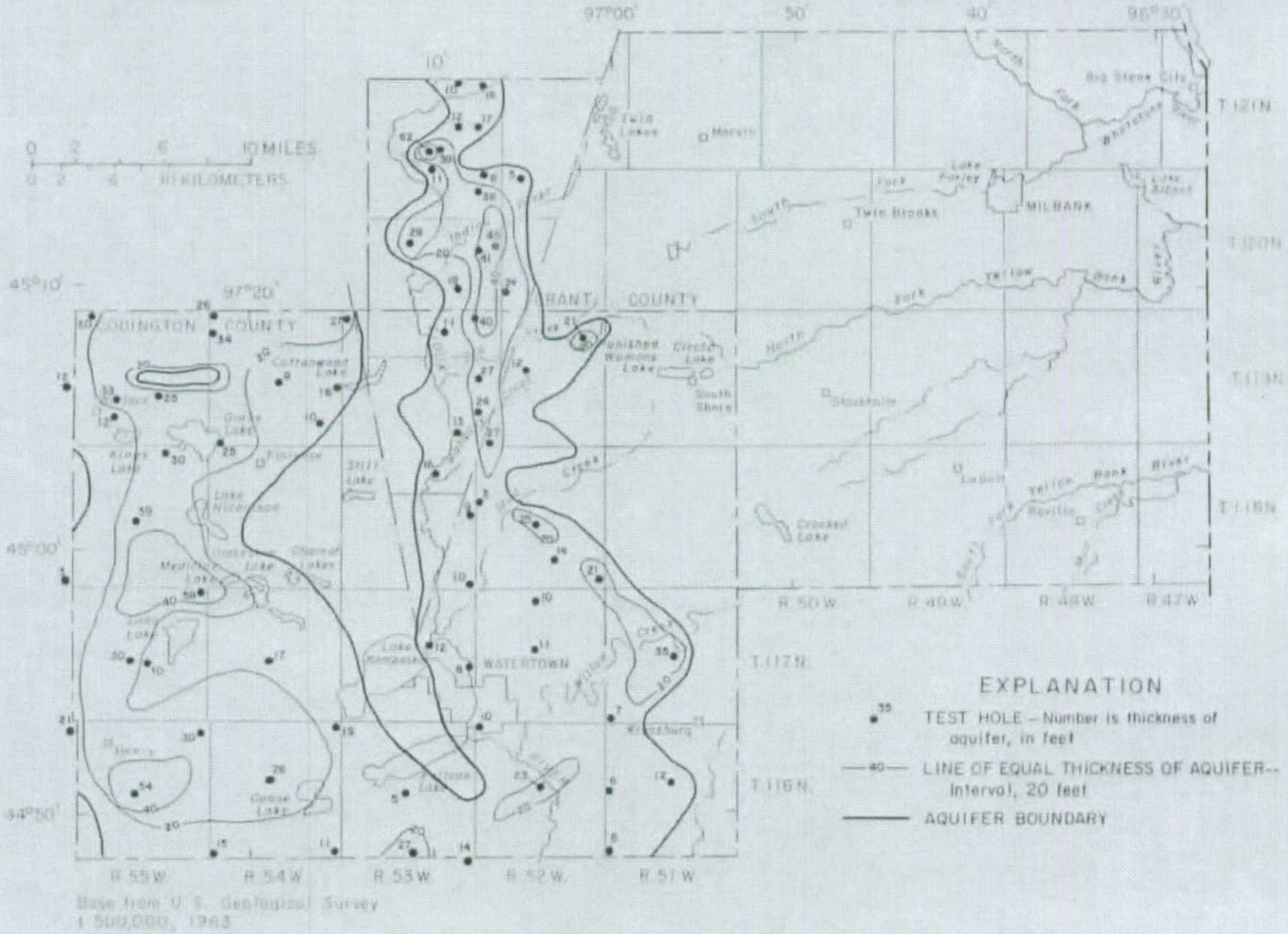


Figure 13.--Extent and thickness of the Prairie Coteau aquifer in Codington and Grant Counties.

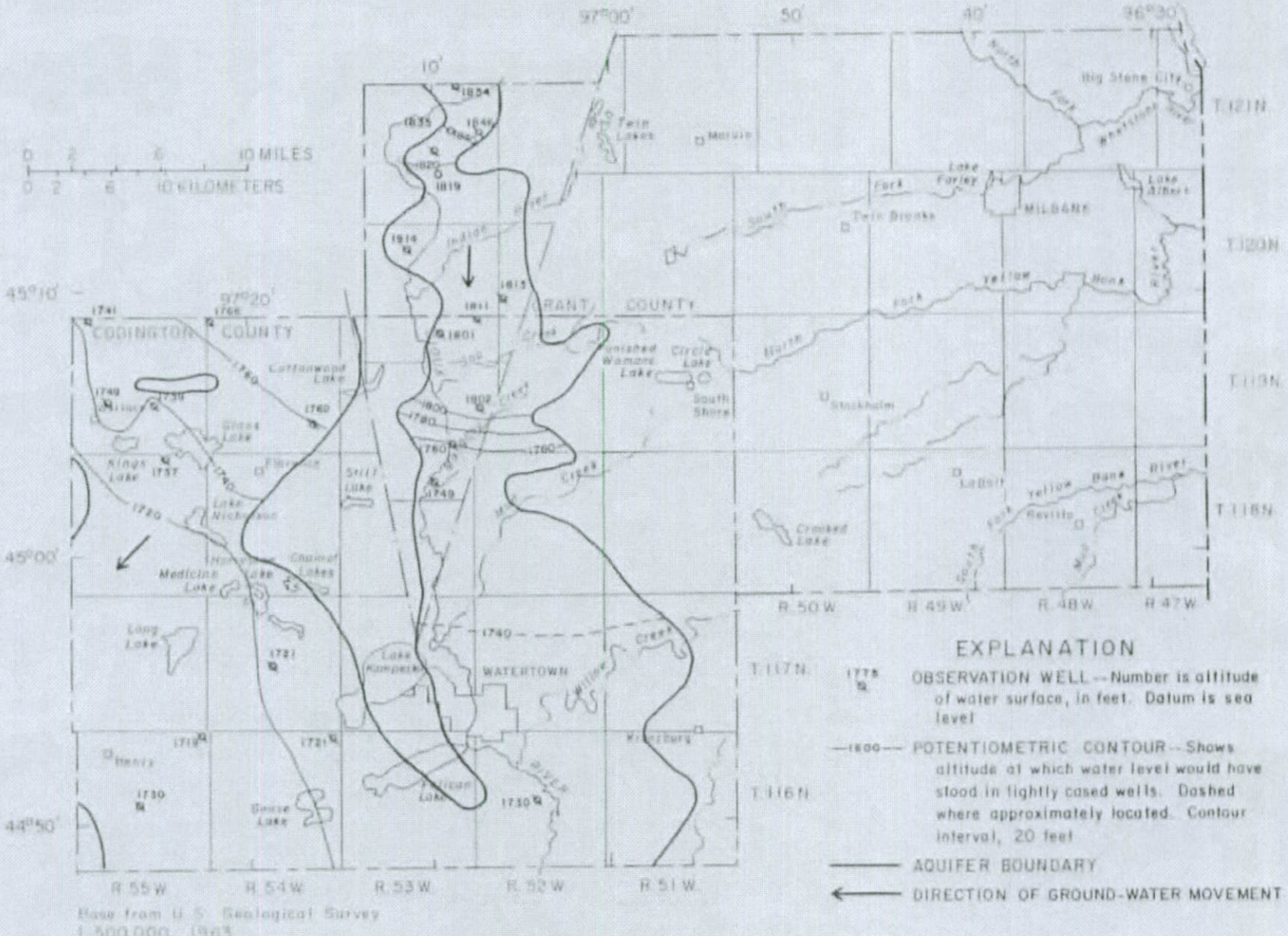


Figure 14.--Potentiometric surface of the Prairie Coteau aquifer in Codington and Grant Counties, October 1985.

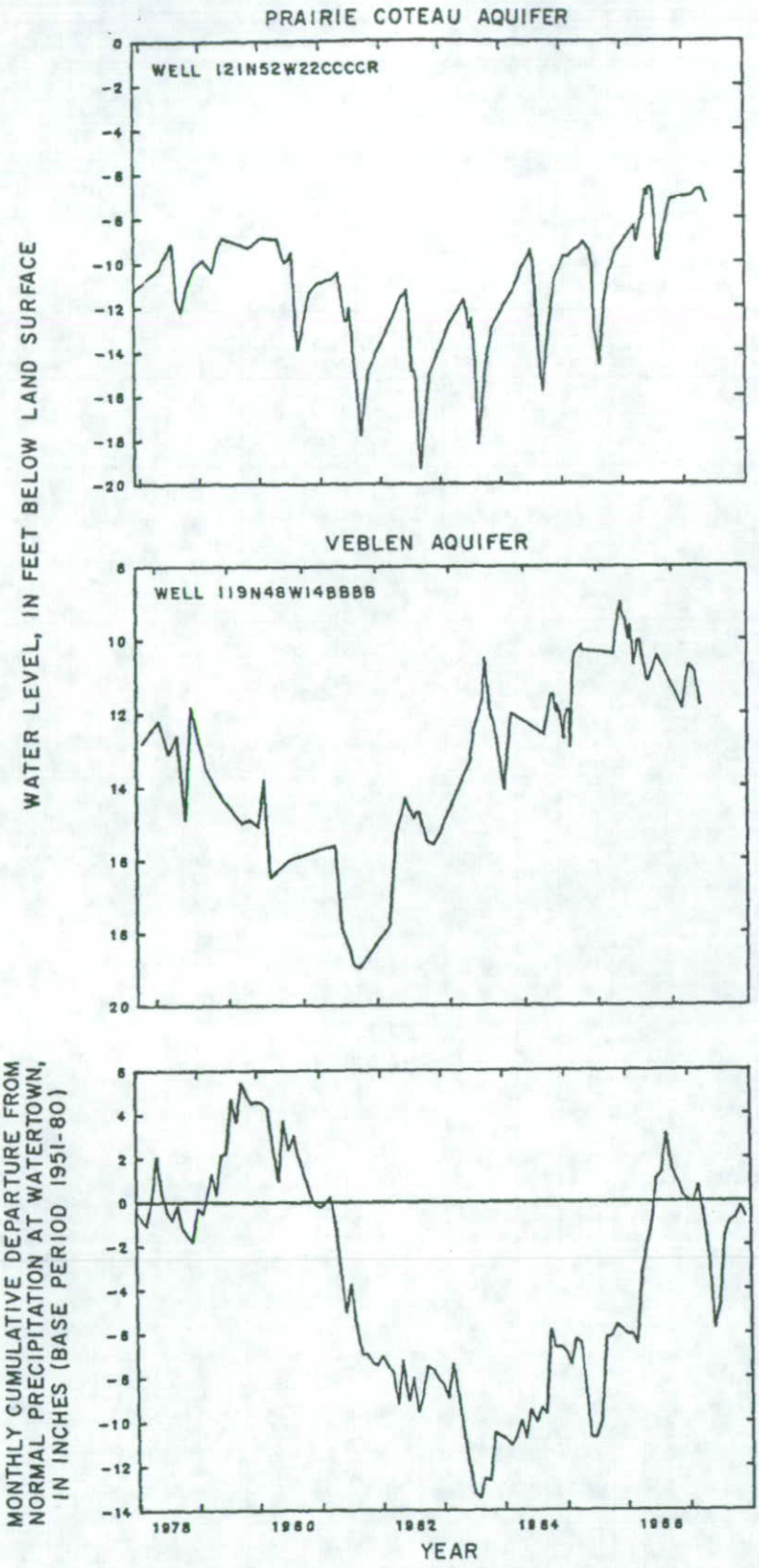


Figure 15.--Water-level fluctuations in the Prairie Coteau and Veblen aquifers and monthly cumulative departure from normal precipitation at Watertown.

Table 5.--Summary of chemical analyses of water from the Prairie Coteau aquifer in Codington and Grant Counties

[Analyses by U.S. Geological Survey and South Dakota Geological Survey. Results in milligrams per liter except as indicated; --, not analyzed]

	Western Grant County and eastern Codington County				Western Codington County			
	Number of samples	Mean	Minimum value	Maximum value	Number of samples	Mean	Minimum value	Maximum value
Specific conductance, field (microsiemens per centimeter at 25 °C)	8	920	630	1,200	32	2,000	1,010	6,510
Dissolved solids	8	510	430	660	16	1,490	650	2,250
Hardness	8	440	320	520	41	1,090	490	3,500
Alkalinity	8	410	250	500	26	360	250	500
Dissolved calcium	8	95	61	140	41	250	110	500
Dissolved magnesium	8	42	29	56	41	75	25	310
Dissolved sodium	8	26	14	48	41	110	14	540
Dissolved potassium	8	2	1	3	16	11	4	43
Bicarbonate	8	500	300	610	25	450	200	860
Dissolved sulfate	8	77	26	130	40	900	250	3,200
Dissolved chloride	8	8.2	1	42	28	18	1	42
Dissolved nitrate	3	4	3	5.8	17	2.1	0	17
Dissolved iron (micrograms per liter)	--	--	--	--	5	2,500	20	6,800
Dissolved manganese (micrograms per liter)	--	--	--	--	5	1,050	50	4,200

Veblen aquifer

The Veblen aquifer is located in eastern Grant County (fig. 16) and is composed of brown, medium to coarse sand and fine gravel. Coarse sand to coarse gravel was found in T. 121 N., R. 47 W., near the North and South Forks of the Whetstone River. As much as 154 ft of sand and gravel is present 2 to 3 mi northeast of Milbank. The extent of this thick section of sand and gravel was limited to about 1 mi^2. The aquifer slopes to the east at about 13 ft/mi and is under artesian conditions in most areas. In T. 120 N., R. 47 W. and the southern part of T. 121 N., R. 46 and 47 W., the aquifer is at or near land surface and is under water-table conditions. A geologic section of the aquifer is shown in figure 11 and hydrologic characteristics are given in table 3.

Recharge to the Veblen aquifer in Grant County is by direct infiltration and subsequent percolation of rainfall and snowmelt in T. 121 N., R. 46 W. where the aquifer is at land surface. The aquifer may be at land surface near the western aquifer boundary in Range 49 West, however, test drilling could not confirm this because of inaccessibility. Recharge to the Veblen aquifer also occurs in Marshall and Roberts Counties (Koch, 1975) where the aquifer is at land surface. Recharge to the aquifer also may occur by leakage from the till.

The direction of water movement (fig. 17) in the aquifer generally is from west to east. The direction of water movement in T. 121 N., R. 47 W. is toward the Whetstone River.

Discharge from the aquifer is: (1) From municipal, domestic, and stock-watering wells; (2) to the Whetstone River in northern Grant County; (3) to the Yellow Bank River in T. 120 N., R. 47 W.; (4) to Big Stone Lake; (5) to granite quarries located 6 mi east of Milbank; and (6) to the Minnesota River located 3 mi east of the Minnesota-South Dakota State line.

Water-level fluctuations (fig. 15) are caused by seasonal changes in recharge and discharge. Water levels in observation wells generally rose from September 1985 to April 1986 because of recharge from snowmelt and spring rainfall. Above-normal precipitation from September 1983 to April 1986 (about 11 inches) caused water levels in well 119N48W14BBBB to rise about 9 ft (fig. 15). The water-level decline from 1980-83 was caused by below-normal precipitation.

Water from the Veblen aquifer is a mixed chemical type in which calcium and sulfate are predominant but which also contains significant concentrations of magnesium and bicarbonate (table 6). Ninety percent of the reacting cations in water from the aquifer are calcium and magnesium, 65 percent of the anions are sulfate, and 35 percent are bicarbonate (fig. 18). Dissolved-solids concentrations ranged from 880 to 3,000 mg/L and averaged 1,300 mg/L. Hardness concentrations ranged from 390 to 2,170 mg/L and averaged 860 mg/L. The average concentration of chemical constituents in water from the aquifer was used to plot the datum point on the South Dakota irrigation-water classification diagram (fig. 6), which indicates that water from the aquifer generally is of suitable quality for irrigation.

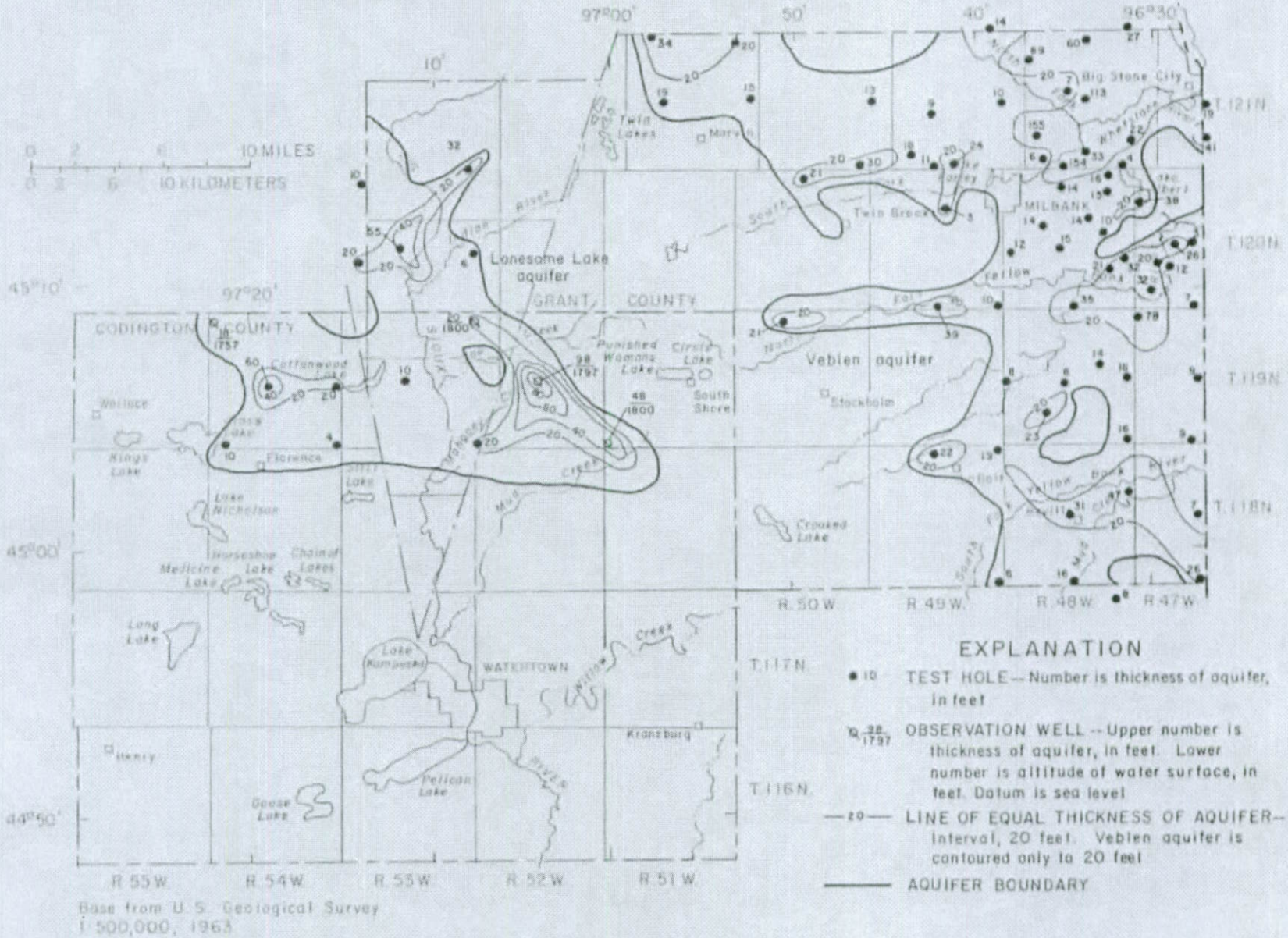


Figure 16.--Extent, thickness, and water-surface altitude of the Lonesome Lake and Veblen aquifers in Codington and Grant Counties, October 1985.

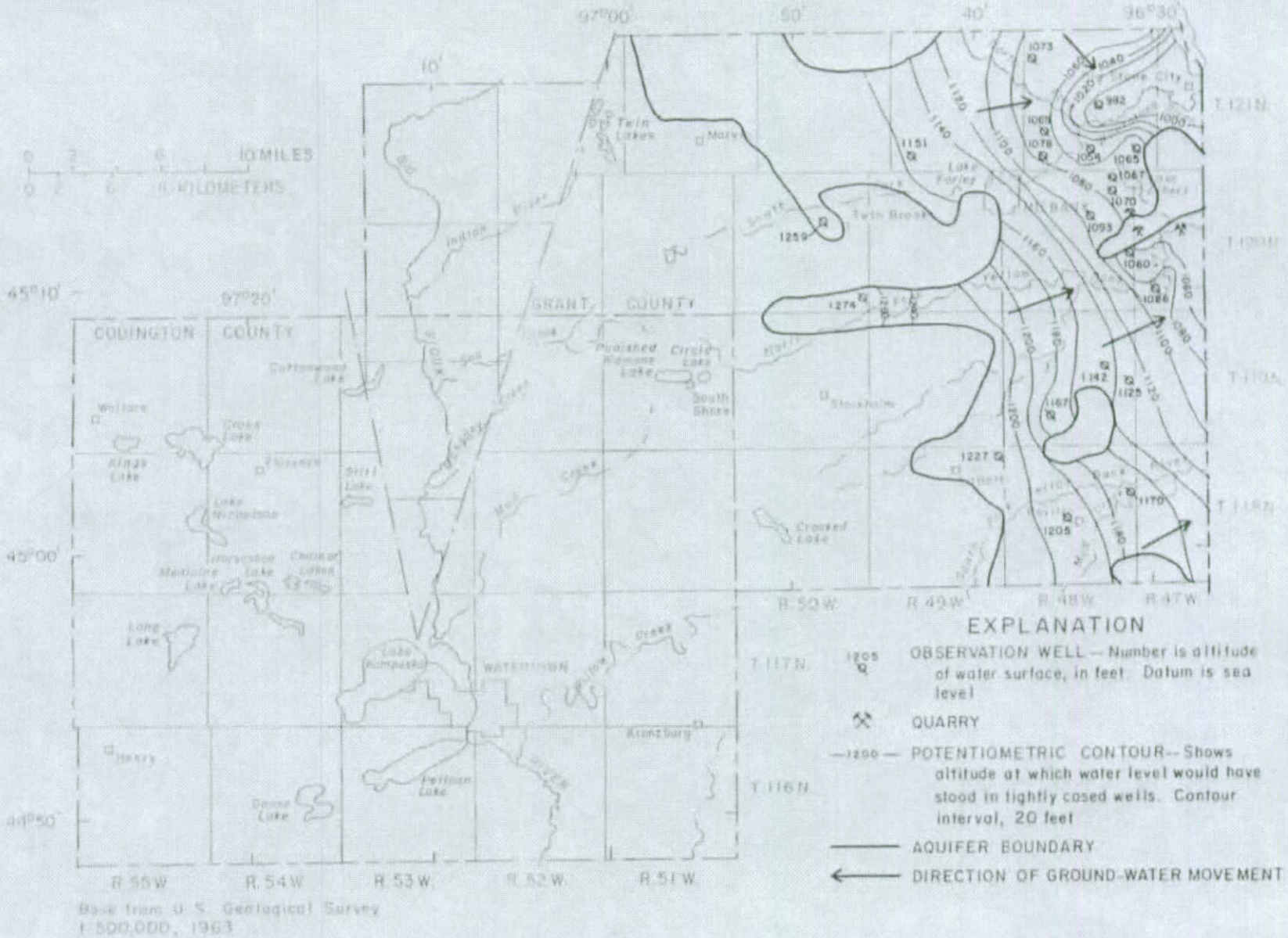


Figure 17.--Potentiometric surface of the Veblen aquifer in Grant County, October 1985.

Table 6.--Summary of chemical analyses of water from the Veblen and Revillo aquifers in Grant County

[Analyses by U.S. Geological Survey and South Dakota Geological Survey. Results in milligrams per liter except as indicated; --, not analyzed]

	Veblen aquifer				Revillo aquifer			
	Number of samples	Mean	Minimum value	Maximum value	Number of samples	Mean	Minimum value	Maximum value
Specific conductance, field (microsiemens per centimeter at 25 °C)	9	1,600	1,100	2,900	8	1,480	1,070	1,900
Hardness	9	860	390	2,170	8	625	490	1,000
Dissolved solids	8	1,300	880	3,000	8	1,200	870	1,500
Dissolved calcium	9	220	86	600	8	160	120	210
Dissolved magnesium	9	78	36	160	8	54	45	80
Dissolved sodium	9	65	26	250	8	120	55	260
Sodium absorption ratio	9	1	.3	6	0	--	--	--
Dissolved potassium	9	10	4	12	8	8	6	9
Bicarbonate	9	420	140	530	8	420	400	460
Dissolved sulfate	9	590	310	1,500	8	520	350	800
Dissolved chloride	9	22	2.0	96	8	22	4.0	43
Dissolved nitrate	8	<.04			8	<.04		
Dissolved iron (micrograms per liter)	9	2,600	0	18,000	8	2,600	50	7,200
Dissolved manganese (micrograms per liter)	9	420	40	1,200	8	220	96	480

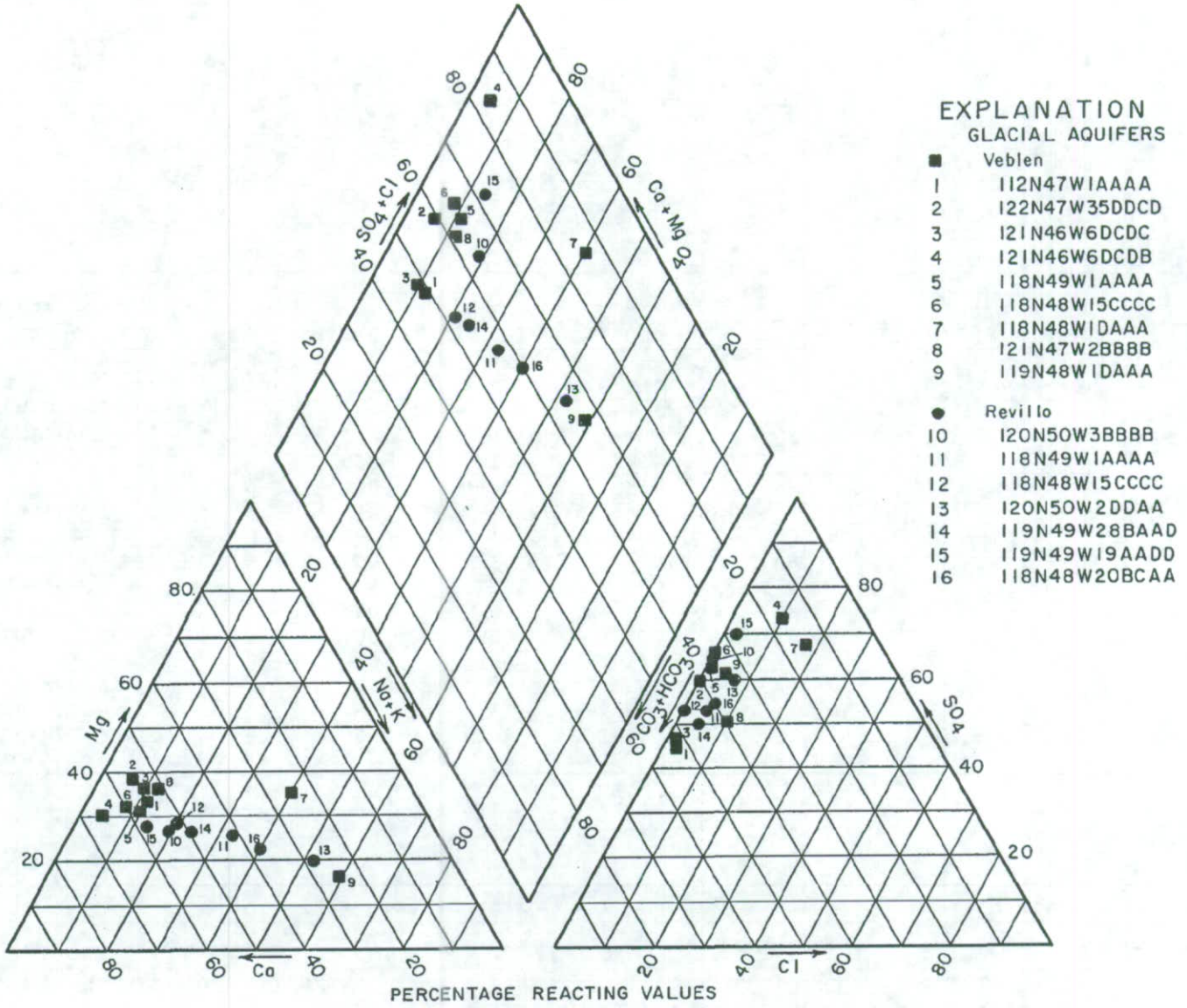


Figure 18.--Trilinear diagram of predominant chemical constituents in water from the Veblen aquifer are calcium and sulfate, and from the Revillo aquifer are calcium, bicarbonate, and sulfate.

Lonesome Lake aquifer

The Lonesome Lake aquifer, located in northern Codington and western Grant Counties (fig. 16), consists of light brown to gray, coarse sand to fine gravel. The sand grains and pebbles are subangular to well rounded and may contain as much as 20 percent clay near the bottom of the aquifer. The aquifer generally occurs between 1,500 and 1,600 ft above sea level, is overlaid by as much as 380 ft of till in eastern Codington County, and is under artesian conditions. A geologic section of the aquifer is shown in figure 11, and hydrologic characteristics of the aquifer are given in table 3.

Water-level fluctuations in four observation wells screened in the aquifer (fig. 16) indicate seasonal changes in recharge and discharge. Water levels in observation well 120N52W26AAAA-R (fig. 19) rose about 4 ft from October 1985 through May 1986 and declined about 1 ft from June 1986 to September 1986. Above-normal precipitation from October 1986 to June 1987 caused water levels to rise about 2 ft. Recharge to the Lonesome Lake aquifer is by leakage from till and by direct infiltration and subsequent percolation of rainfall and snowmelt where the aquifer is at or near land surface in Day County. Test drilling showed that the Lonesome Lake aquifer ranged from 200 to 380 ft below land surface in Codington County.

Predominant chemical constituents in water from the Lonesome Lake aquifer are calcium and sulfate (table 7). Field specific conductance in water samples from three observation wells were 1,380, 1,220, and 2,730 µS/cm.

Revillo aquifer

The Revillo aquifer, located in central Grant County (fig. 20), lies in a buried, preglacial bedrock valley that trends northwest-southeast. In northern Grant County, the aquifer is separated from the Veblen aquifer to the east by a buried shale bedrock ridge (figs. 11 and 21). Test-hole data in Roberts County, 20 mi north of Twin Brooks, indicate that the Revillo and Veblen aquifers may be in hydraulic connection. Koch (1972) described the Veblen aquifer in northeast Marshall County (fig. 1) as glacial outwash that lies in a buried bedrock valley and extends to land surface. The Veblen aquifer in Marshall County (Koch, 1972) may be the same hydrologic unit as the Revillo aquifer described in this report.

The Revillo aquifer consists of glacial outwash composed of gray, fine to very coarse gravel. The aquifer is as much as 150 ft thick in southern Grant County. The base of the aquifer in T. 121 N., R. 49 W. occurs at about 1,050 ft above sea level, declines to 1,000 ft above sea level at Twin Brooks (fig. 22), and declines to 950 ft above sea level at the Grant-Deuel County line. Hydrologic characteristics of the aquifer are given in table 3.

Recharge to the aquifer is by direct infiltration and subsequent percolation of rainfall and snowmelt in Roberts and Marshall Counties where the aquifer is at or near land surface (Koch, 1972) and by leakage from till. The direction of water movement in the aquifer is from north to south. The gradient of the potentiometric surface, based on five observation wells screened in the aquifer, increases from 0.15 ft/mi between Twin Brooks and LaBolt, to about 5.5 ft/mi from LaBolt to the Grant-Deuel County boundary. Discharge from the aquifer primarily is by municipal wells located at Twin Brooks for the city of Milbank, a municipal well located at Revillo for the town of Revillo, and by stock-watering and domestic wells.

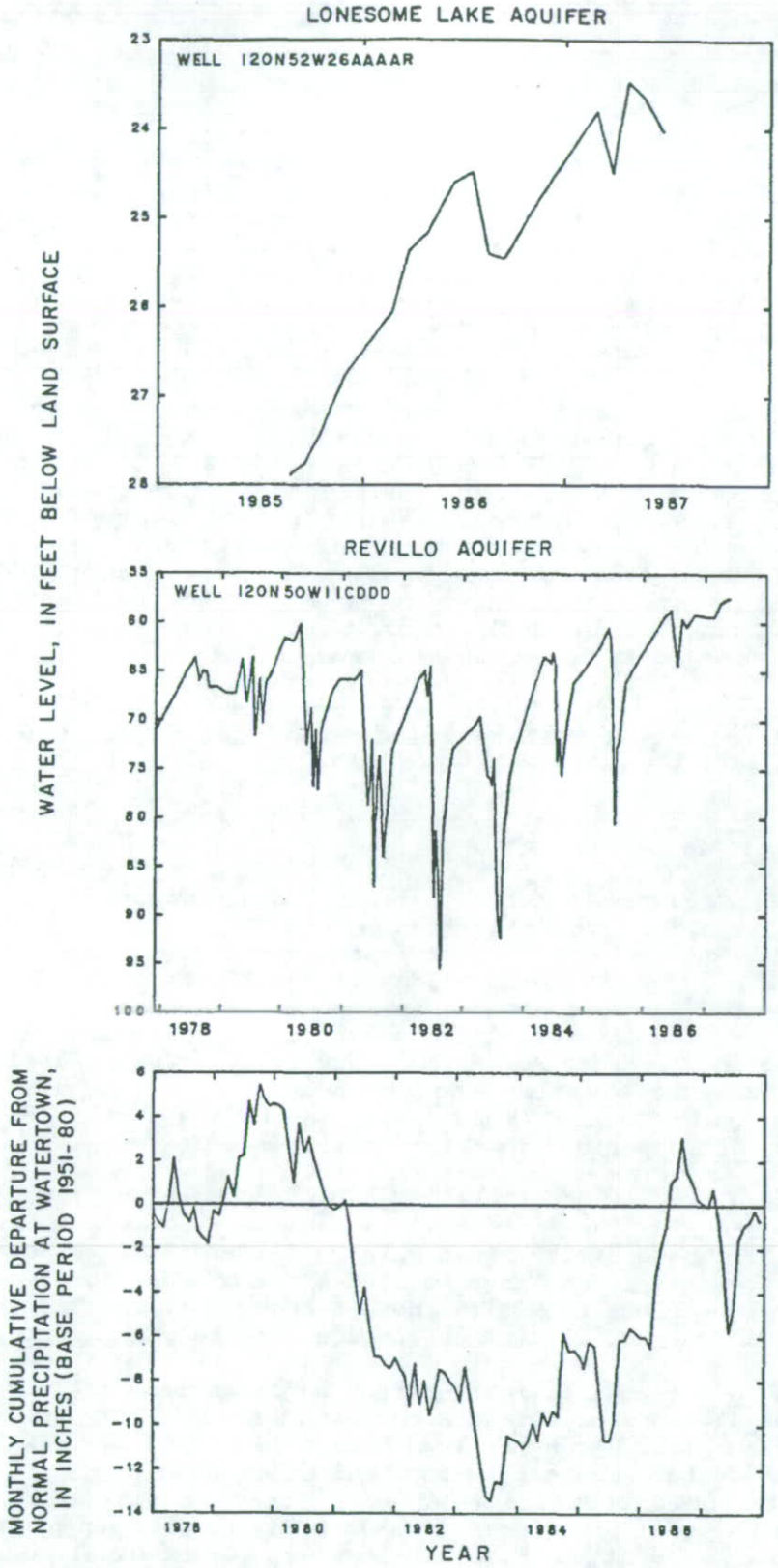


Figure 19.--Water-level fluctuations in the Lonesome Lake and Revillo aquifers and monthly cumulative departure from normal precipitation at Watertown.

Table 7.--Chemical analyses of water from the Altamont, granite wash, Lonesome Lake, and Dakota aquifers in Codington and Grant Counties

[Analyses by U.S. Geological Survey. Results in milligrams per liter except as indicated; --, not analyzed; <, less than]

Location	Dissolved calcium	Dissolved sodium	Dissolved magnesium	Dissolved potassium	Alkalinity	Dissolved sulfate	Dissolved nitrate
			Lonesome Lake aquifer				
119N51W31CCCC	72	130	100	15	220	1,400	0.10
119N52W15CCCC2	140	56	55	7	340	330	.10
119N54W 6BBBB	190	46	56	10	330	470	.10
			Altamont aquifer				
116N51W 4AAB	260	240	120	7	430	1,200	0.1
116N55W34BABB	87	600	61	10	320	1,500	.1
117N55W21BBCB	71	390	58	8	300	970	.1
118N55W11ABBD	140	430	56	15	280	1,200	.1
			Dakota aquifer				
116N52W 2CBBC	6.5	449	27	9	200	760	--
			Granite wash aquifer				
119N48W24AAAA	30	440	8.6	10	310	930	--
119N47W 7DAAD	40	510	11	12	300	1,000	--
119N48W 4DDCC	70	630	19	14	200	1,100	--
120N48W30DAAA	24	580	10	15	420	1,100	--
120N49W 8AAAB	17	590	5.5	14	360	1,200	--
121N49W35DDDC	15	540	5.6	9	370	1,600	--

Table 7.--Chemical analyses of water from the Altamont, granite wash, Lonesome Lake, and Dakota aquifers in Codington and Grant Counties--Continued

Location	Dissolved chloride	Dissolved iron (micrograms per liter)	Dissolved manganese (micrograms per liter)	Dissolved fluoride	Dissolved solids	Specific conductance (field) (microsiemens per centimeter)	pH (field) (units)
			Lonesome Lake aquifer				
119N52W31CCCC	3.6	20	20	0.3	--	2,730	7.6
119N52W15CCCC2	2.6	<10	150	.4	--	1,220	7.3
119N54W 6BBB	7.0	<10	1,700	.5	--	1,380	7.2
			Altamont aquifer				
116N51W 4AAB	17	920	1,500	0.5	2,100	2,600	7.0
116N55W34BABB	96	1,700	210	.2	2,600	3,440	7.6
117N55W21BBCB	9.5	730	240	.2	1,700	2,660	7.8
118N55W11ABBD	92	3,700	230	.4	2,100	2,870	7.5
			Dakota aquifer				
116N52W 2CBBC	110	90	50	--	1,480	2,310	9.5
			Granite wash aquifer				
119N48W24AAAA	--	10	<2	--	--	4,190	7.5
119N47W 7DAAD	--	<10	22	--	--	3,990	8.0
119N48W 4DDCC	--	<10	19	--	--	6,050	7.8
120N48W30DAAA	--	<10	<2	--	--	4,430	8.0
120N49W 8AAAB	--	<10	<2	--	--	4,440	7.7
121N49W35DDDC	--	<10	10	--	--	4,350	8.3

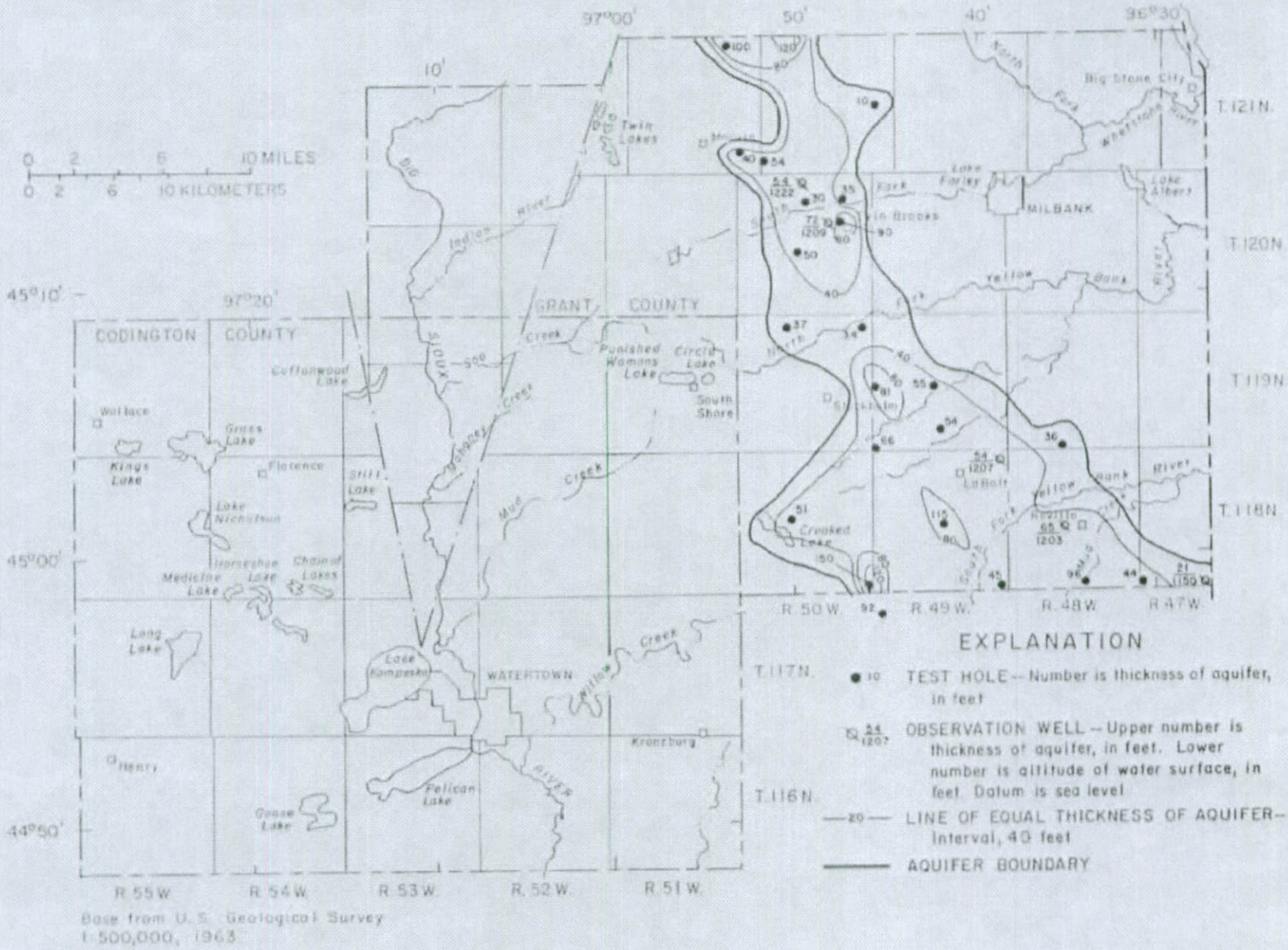


Figure 20.--Extent and thickness of the Revillo aquifer in Grant County.

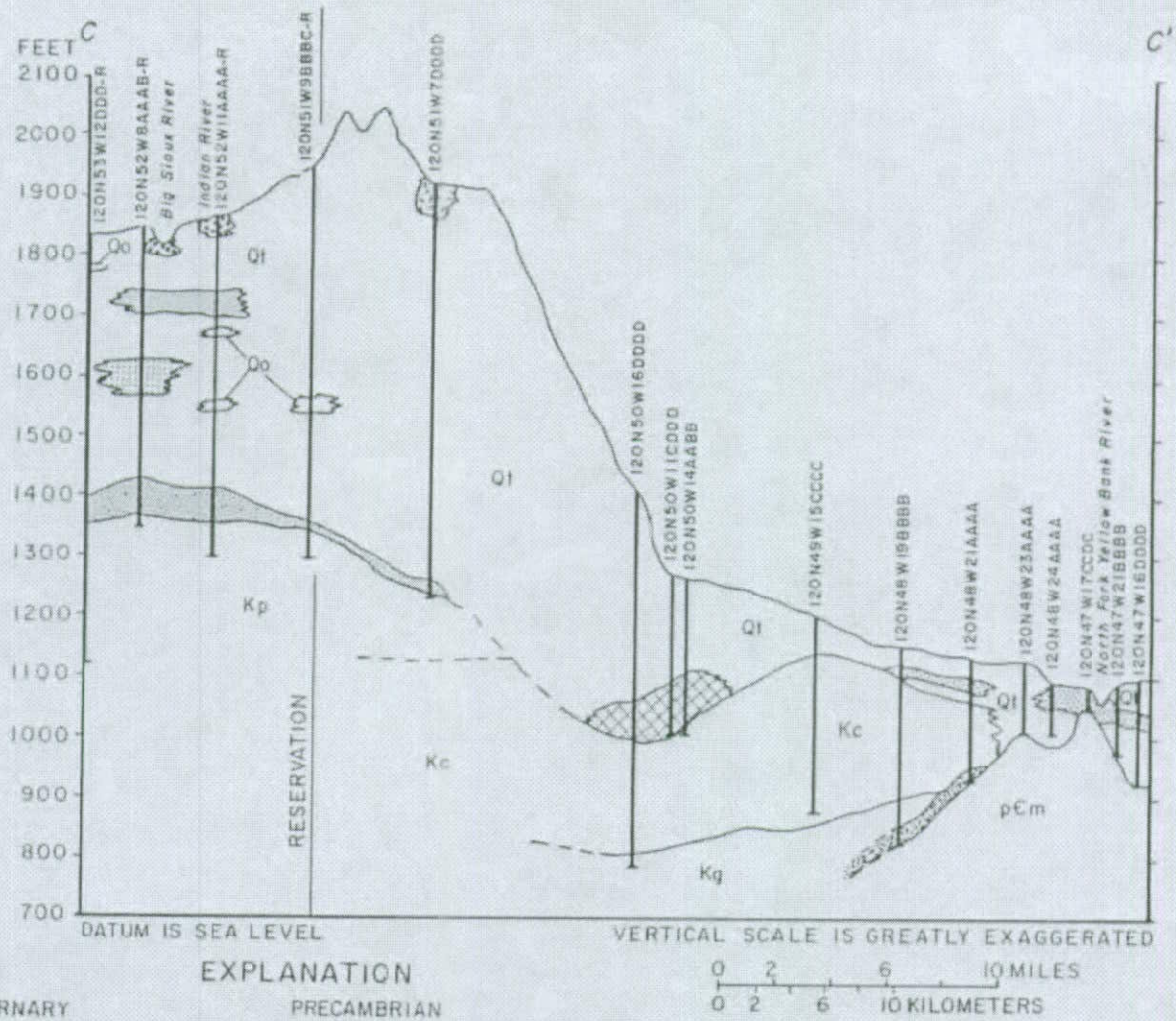


Figure 21.--Geologic section C-C' showing the Antelope Valley, Big Sioux, Prairie Coteau, Lonesome Lake, Altamont, Veblen, Revillo, and granite wash aquifers. (Section C-C' is shown in figure 2.)

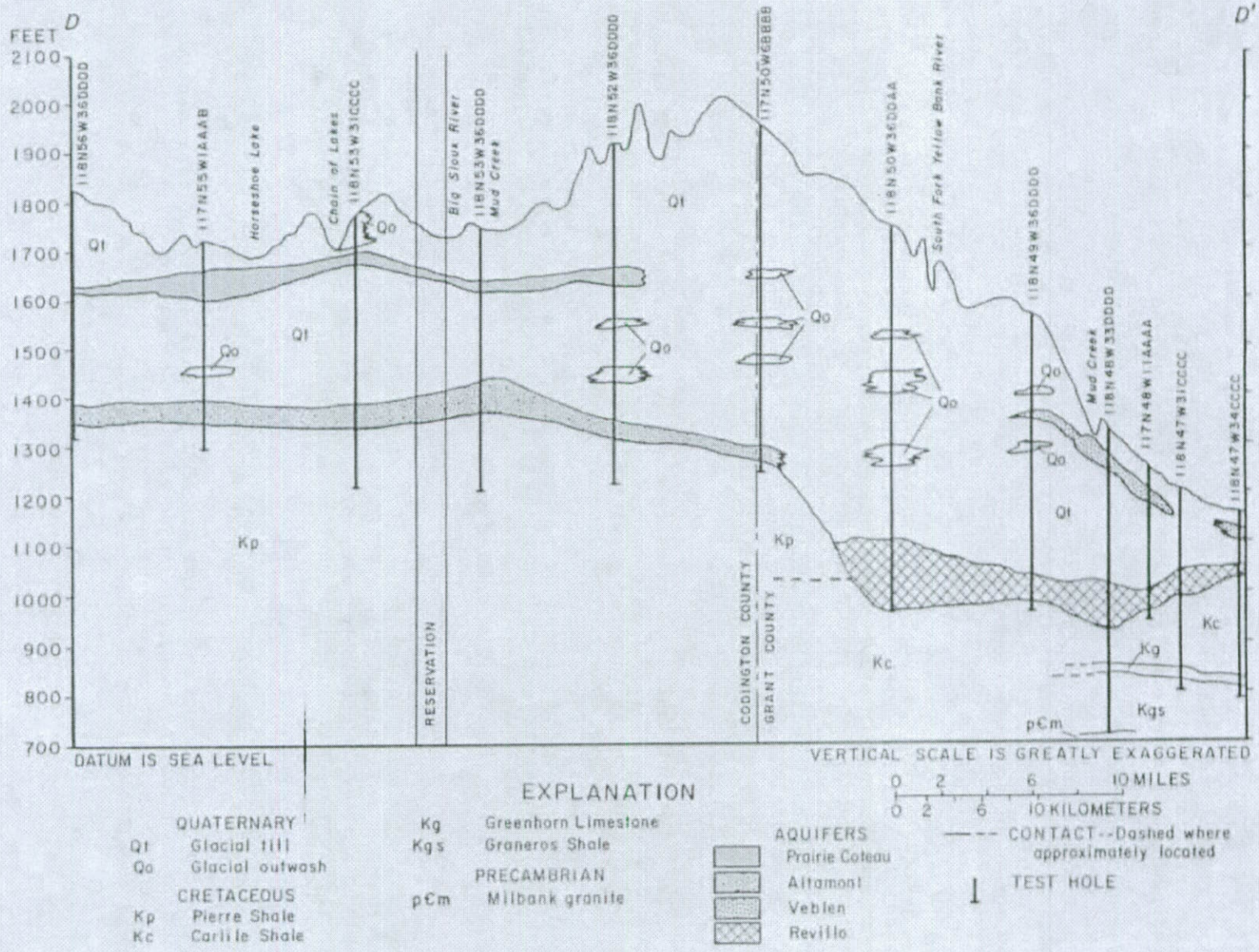


Figure 22.--Geologic section D-D' showing the Prairie Coteau, Veblen, Revillo, and Altamont aquifers. (Section D-D' is shown in figure 2.)

Water-level fluctuations in 5 observation wells screened in the aquifer reflect seasonal changes in recharge and discharge, as well as pumpage from municipal wells (fig. 19). Water levels generally declined from May to August because discharge from municipal wells was greater than recharge. Water levels rose from September to April because recharge from snowmelt and rainfall was greater than discharge. Records of long-term water-level fluctuations in well 120N50W11CDDD show correlation with long-term trends in precipitation. The water-level decline from 1979-83 was caused by below-normal precipitation. The water-level rise from 1983-87 was caused by four consecutive years of above-normal precipitation.

Predominant chemical constituents in water from the Revillo aquifer are calcium and sulfate with significant concentrations also of bicarbonate (table 6). Dissolved calcium ranged from 120 to 210 mg/L and averaged 160 mg/L. Dissolved-sulfate concentrations ranged from 350 to 800 mg/L and averaged 520 mg/L. Specific conductance of water from the aquifer, determined by onsite analysis, ranged from 1,070 to 1,900 µS/cm and averaged 1,480 µS/cm. A comparison of the chemical analysis of water from the Veblen and Revillo aquifers shows that dissolved calcium, bicarbonate, sulfate, and dissolved-solids concentrations are similar. Percent-reacting values of the major constituents in water from the Revillo aquifer are shown in figure 18. Sodium concentrations range from 16 to 52 percent. The variation may be the result of cation exchange with calcium in the clay layers within the aquifer. Water from the aquifer is used primarily for municipal and domestic use and may be suitable for irrigation based on South Dakota irrigation-water standards, revised January 1982 (fig. 6).

Altamont aquifer

The Altamont aquifer is present in most of Codington County and western Grant County (fig. 23). It is composed of well-rounded, medium to coarse sand. The aquifer is interbedded with silt and clay layers in the northwest quarter of Codington County. The average depth to the top of the aquifer is 460 ft below land surface; it occurs between 1,250 and 1,500 ft above sea level. The average thickness of the aquifer is about 40 ft; however, in T. 121 N., R. 52 W. and T. 118 N., R. 52 W., average aquifer thickness is about 65 ft. Hydrologic characteristics of the aquifer are given in table 3 and geologic sections of the aquifer are shown in figures 8, 11, and 21.

Recharge to the Altamont aquifer probably is by leakage from the overlying till. The direction of water movement is to the southwest at a gradient of about 5 ft/mi (fig. 24). Water-level fluctuations in an observation well screened in the aquifer are shown in figure 25. Discharge from the aquifer is primarily by pumping from stock-watering and domestic wells; however, with the introduction of rural water systems (public supply of water to the rural community), stock-watering and domestic wells are being abandoned and water use is declining.

Predominant chemical constituents in water from the Altamont aquifer are sodium and sulfate (table 7). Dissolved-solids concentrations ranged from 1,700 to 2,600 mg/L and averaged 2,120 mg/L. Specific conductance, determined from 40 onsite analyses, ranged from 1,950 to 4,020 µS/cm and averaged 3,160 µS/cm. Hardness concentrations, determined from 40 onsite analyses, ranged from 530 to 1,800 mg/L and averaged 840 mg/L.

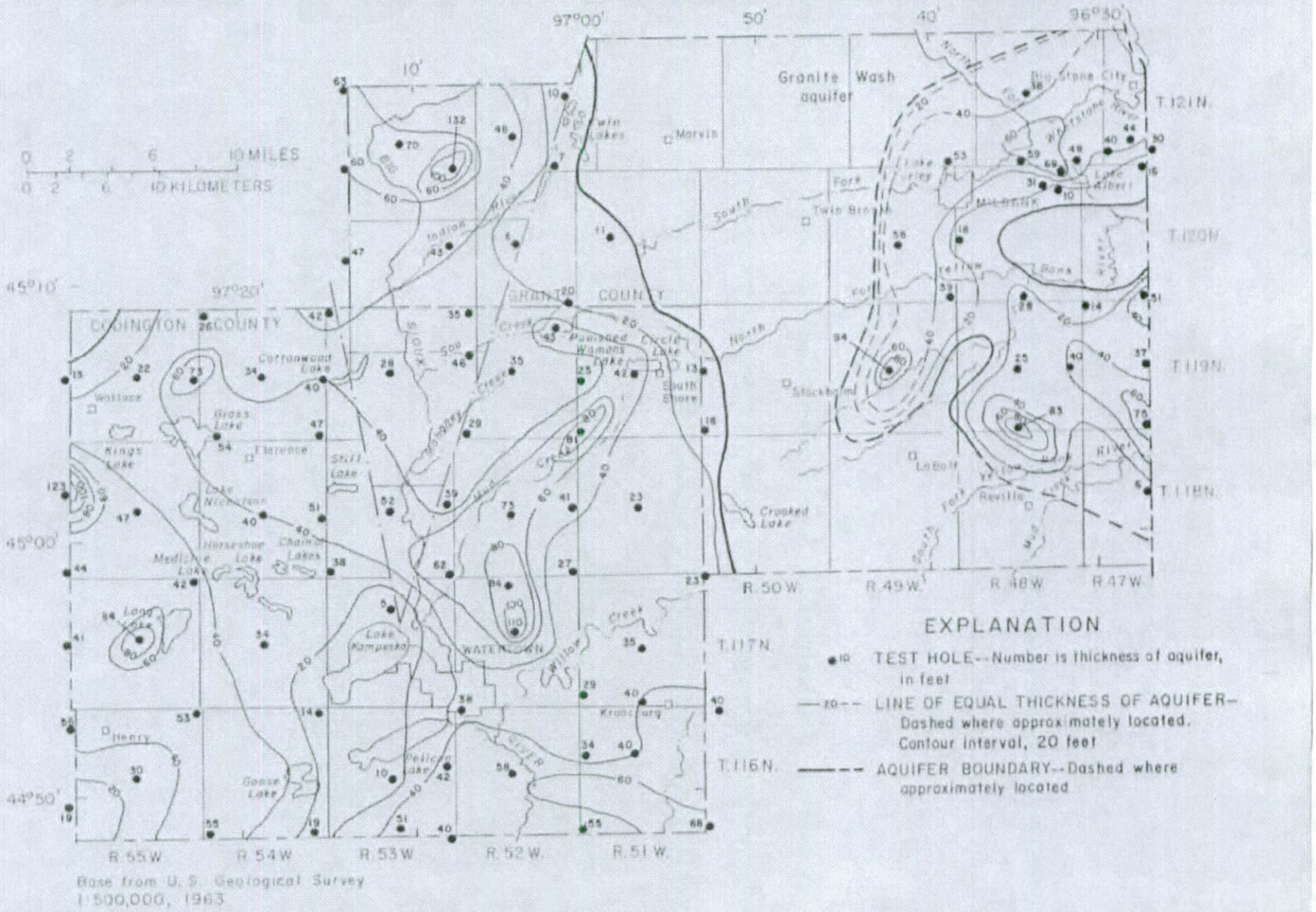


Figure 23.--Extent and thickness of the Altamont and granite wash aquifers in Codington and Grant Counties.

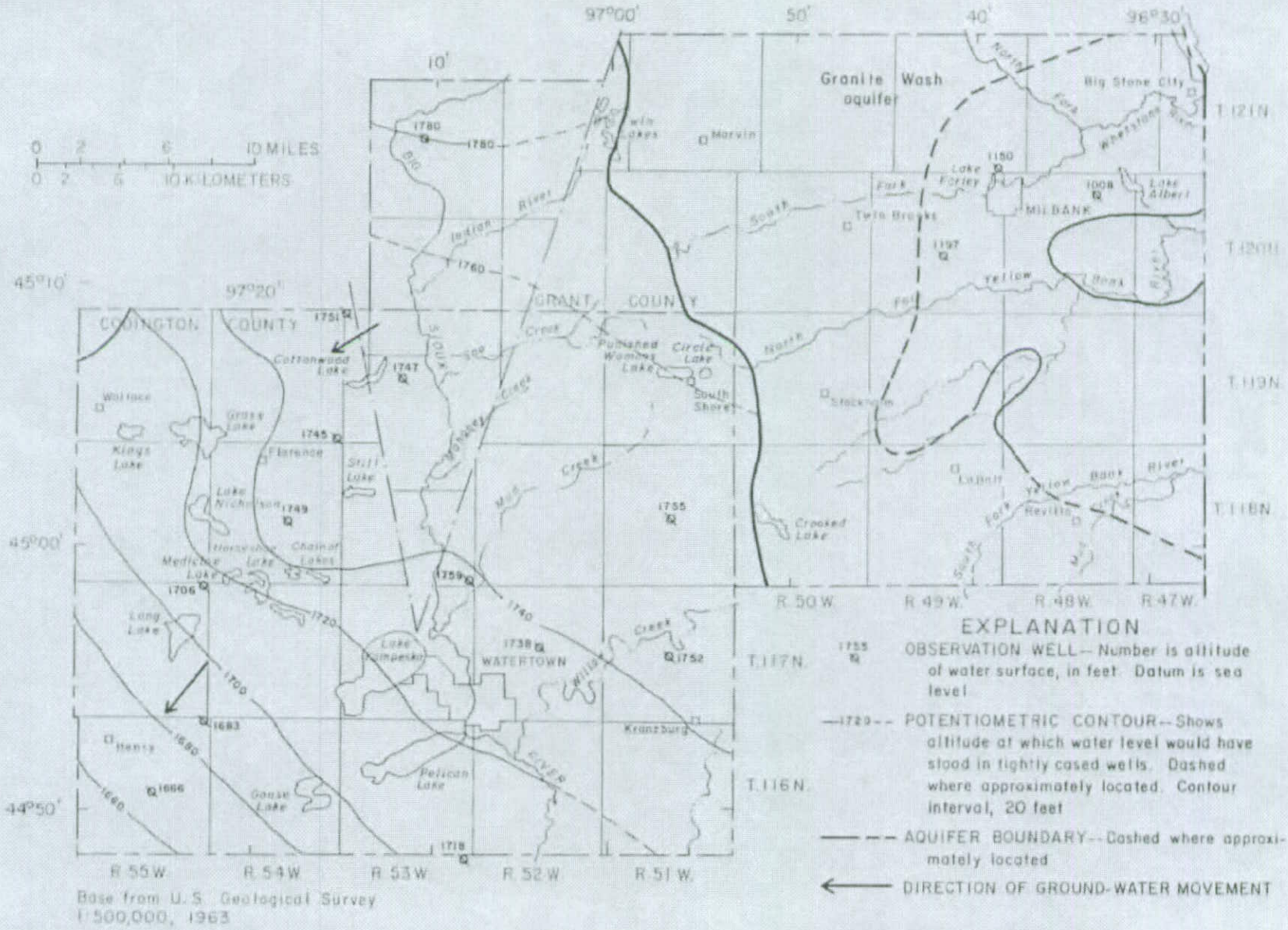


Figure 24.--Potentiometric surface of the Altamont aquifer in Codington and Grant Counties, October 1985.

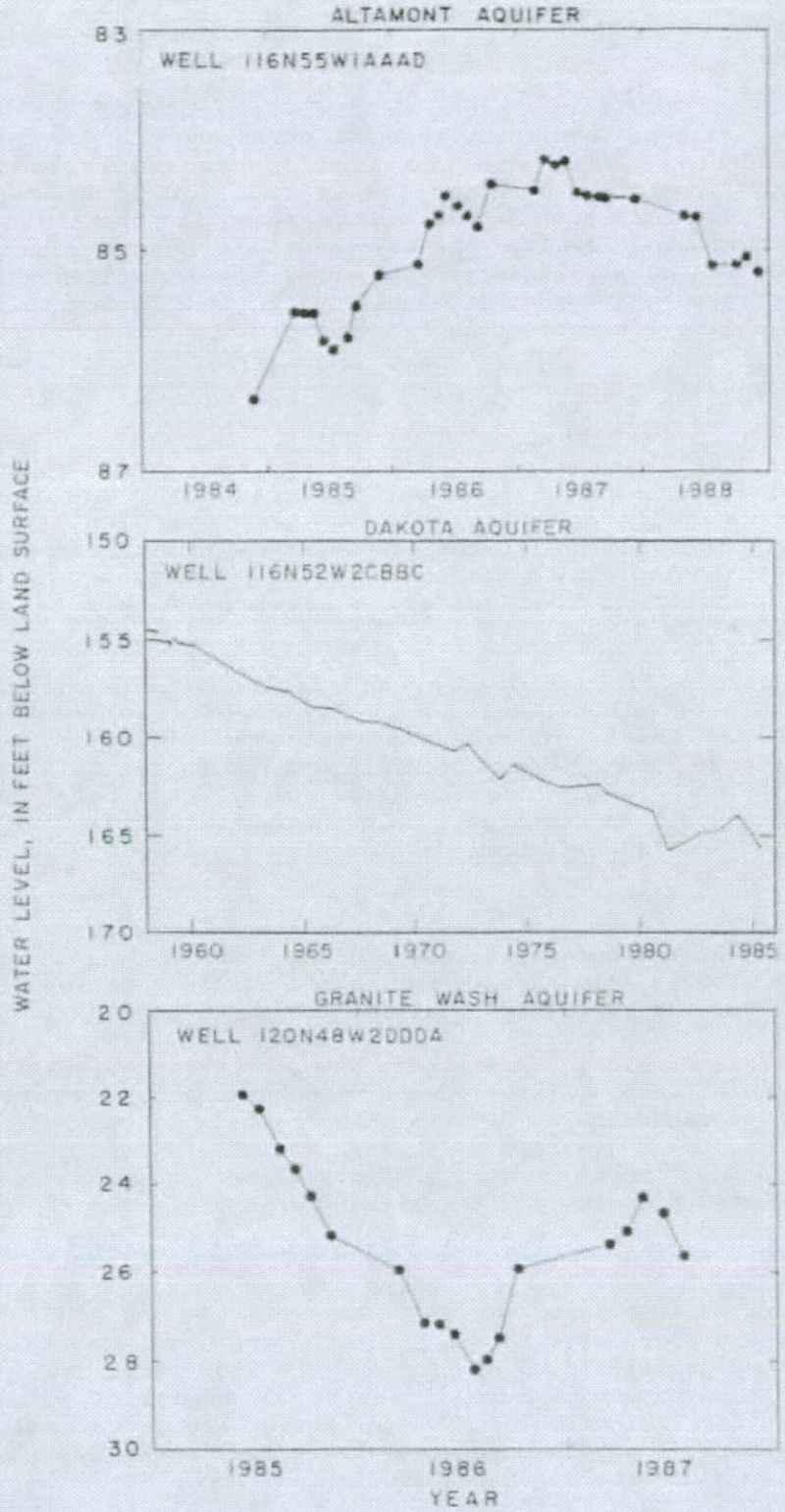


Figure 25.--Water-level fluctuations in the Altamont, Dakota, and granite wash aquifers.

Bedrock Aquifers

Dakota aquifer

The Dakota aquifer, in the Dakota Formation of Cretaceous age, is composed of a fine-grained, gray to brown sandstone that contains interbedded layers of shale. Data for the aquifer are available only from well 116N52W2CBBC. The top of the aquifer is at 1,230 ft below land surface. Water-level fluctuations in the well screened in the aquifer are shown in figure 25. The water level in the Dakota aquifer has declined about 10 ft from 1958-85. A chemical analysis of water from well 116N52W2CBBC, shown in table 7, indicates that water from the aquifer is a sodium sulfate type with a dissolved-solids concentration of 1,480 mg/L.

Granite wash aquifer

The granite wash aquifer (fig. 23) is composed of uncemented, coarse, sub-angular to well-rounded, pink to blue to gray, quartzose and feldspathic sand, containing about 50 percent feldspar. The aquifer overlies the informally named Milbank granite in eastern Grant County. The western boundary of the aquifer in Grant County was approximated because test holes did not penetrate the entire thickness of the Cretaceous sedimentary rocks. A geologic section of the aquifer is shown in figure 11 and hydrologic characteristics are given in table 3.

Water-level fluctuations in observation well 120N48W2DDDA (fig. 25) generally indicate seasonal changes in recharge to and discharge from the aquifer. Water levels in the well rose about 4 ft from September 1985 to June 1986 because recharge from snowmelt and spring rainfall was greater than discharge. Water levels declined from July 1986 to July 1987 because discharge was greater than recharge. Below-normal snowmelt and precipitation probably caused the continued decline of the water level during the spring months of 1987.

Based on three observation wells, the author believes that the direction of water movement in the aquifer may be from west to east. Discharge from the aquifer also is from stock-watering and domestic wells, fractures in the Milbank granite, and to granite quarries located 6 and 15 mi east of Milbank.

Predominant chemical constituents in water from the granite wash aquifer are sodium and sulfate. Dissolved-sodium concentrations ranged from 440 to 630 mg/L and averaged 550 mg/L. Dissolved-sulfate concentrations ranged from 930 to 1,600 mg/L and averaged 1,200 mg/L. Specific conductance ranged from 3,990 to 6,050 μS/cm and averaged 4,575 μS/cm. Chemical analyses of water samples collected from the aquifer are given in table 7.

WATER USE

The primary users of water in Codington and Grant Counties during 1985 (table 8) were gravel-mining companies. The 1985 water use by the companies was 7 Mgal/d. Seventeen percent of the total amount of water used in the counties was for irrigation, and 98 percent of the water used for irrigation was ground water. About 33 percent of the ground water used for irrigation was withdrawn from the Big Sioux aquifer and about 66 percent was withdrawn from the Prairie Coteau aquifer. All the withdrawals in Codington and Grant Counties for public-water supply were from ground water. The city of Watertown and the Sioux Rural Water System obtain water from the Big Sioux aquifer. The cities of Milbank and Revillo obtain their supply from the Revillo aquifer. About sixty percent of the water used for stock watering

was derived from surface-water sources and 40 percent from ground-water sources. Well-inventory data indicate that the primary source of ground water for stock watering is the Prairie Coteau and Altamont aquifers. Total water use in Codington and Grant Counties in 1985 was about 18 Mgal/d.

Table 8.--Water use, in million gallons per day, for Codington and Grant Counties during 1985

	Live-stock	Public water supply	Power generation	Self-supplied domestic	Self-supplied commercial/ industrial/ gravel mining	Irrigation	Total
Codington County							
Ground water	0.22	2.41	0	0.08	3.92	1.55	8.18
Surface water	.36	0	0	0	4.19	.05	4.60
Grant County							
Ground water	.24	.67	.03	.05	.10	1.50	2.08
Surface water	.36	0	2.59	0	0	.02	3.48
Total	1.18	3.08	2.62	.13	8.21	3.12	18.34

SUMMARY

The primary sources of surface water in Codington County include Lakes Kampeska and Pelican and numerous small lakes, potholes, and sloughs in the western part of the county. Seasonal variations in streamflow and lake levels are directly related to seasonal variations in precipitation. Long-term lake-level fluctuations indicate correlation with departure from normal precipitation. Specific conductance of water from streams and lakes is inversely related to stream discharge and lake levels, respectively. Dissolved-solids concentration in water from streams and lakes increases as stream discharge decreases and lake levels decline.

Seven glacial aquifers and two bedrock aquifers were delineated in Codington and Grant Counties. The Big Sioux and Antelope Valley aquifers, composed of glacial outwash, generally are less than 10 feet below land surface. The Prairie Coteau, Lonesome Lake, and Veblen aquifers are overlaid by as much as 380 feet of till and are underlaid by till. The Altamont and Revillo aquifers are overlaid by as much as 668 feet of till and, in most locations, lie on top of shale bedrock.

The average thickness of the Big Sioux aquifer is 24 feet and the average thickness of the Antelope Valley aquifer is 34 feet. Recharge to these aquifers is by direct infiltration and subsequent percolation of snowmelt and spring rainfall. Discharge is by domestic, stock-watering, irrigation, and municipal wells, evapotranspiration, outflow to the Big Sioux River from the Big Sioux aquifer, and by outflow to Punished Womans Lake from the Antelope Valley aquifer. Predominant chemical constituents in water from

the aquifers are calcium and bicarbonate. Dissolved solids in the Big Sioux aquifer averaged 580 milligrams per liter and dissolved solids in the Antelope Valley aquifer averaged 350 milligrams per liter.

The average thickness of the Prairie Coteau, Lonesome Lake, and Veblen aquifers ranged from 21 to 32 feet. The Veblen aquifer is as much as 155 feet thick. Recharge to the Prairie Coteau and Veblen aquifers is by direct infiltration and subsequent percolation of snowmelt and spring rainfall. Recharge to the Lonesome Lake aquifer is by leakage from till. Test-hole and observation-well data indicate that the recharge area of the Prairie Coteau aquifer may be in T. 122 N., R. 52 W. in Roberts County. Discharge from these aquifers is by evapotranspiration and by domestic, stock-watering, irrigation, and municipal wells. Discharge from the Prairie Coteau aquifer also may occur as outflow to Long Lake. Discharge from the Veblen aquifer also is to granite quarries 6 miles east of Milbank and to Big Stone Lake. Predominant chemical constituents in water from the Prairie Coteau aquifer in northern Codington and western Grant Counties are calcium and bicarbonate and in western Codington are calcium and sulfate. Predominant chemical constituents in water from the Veblen aquifer are calcium and sulfate with significant concentrations of bicarbonate. Dissolved-solids concentrations in water from the Prairie Coteau aquifer averaged 510 milligrams per liter in northeastern Codington and western Grant Counties and 1,490 milligrams per liter in western Codington County. Dissolved-solids concentrations in water from the Veblen aquifer averaged 1,300 milligrams per liter.

The average thickness of the Revillo aquifer is 63 feet and the average thickness of the Altamont aquifer is 40 feet. Recharge to the Revillo aquifer is by direct infiltration and subsequent percolation of snowmelt and rainfall north of the study area in Roberts and Marshall Counties. Water-level fluctuations in the Revillo aquifer are caused by seasonal changes in recharge and by pumpage from municipal wells. Records of long-term water-level fluctuations show correlation with long-term trends in precipitation. Recharge to the Altamont aquifer is by leakage from till. Discharge from the aquifers is by stock-watering and domestic wells. Discharge from the Revillo aquifer also is by municipal wells.

Predominant chemical constituents in water from the Big Sioux, Antelope Valley, Prairie Coteau, Veblen, Revillo, and Lonesome Lake aquifers are calcium and bicarbonate. Significant concentrations of sulfate also are present in water from the Veblen and Revillo aquifers. Sodium and sulfate are predominant in water from the Altamont aquifer. Average dissolved-solids concentrations in water from the aquifers range from 350 to 2,120 milligrams per liter.

The Dakota aquifer is 1,230 ft below land surface in Codington County. The water level in one observation well screened in the aquifer has declined 10 ft in the last 30 years. Water from the aquifer is a sodium sulfate type with a dissolved-solids concentration of 1,480 milligrams per liter.

The average thickness of the granite wash aquifer is 37 feet. Water-level fluctuations in an observation well indicate seasonal changes in recharge and discharge. Discharge from the aquifer is primarily from stock-watering and domestic wells and to granite quarries located 6 and 15 miles east of Milbank. Predominant chemical constituents in water from the granite wash aquifer are sodium and sulfate.

Total water use in Codington and Grant Counties during 1985 was about 18 million gallons per day. The primary users of water in Codington and Grant Counties are gravel-mining companies. Seventeen percent of total water use was for irrigation, of which 98 percent was ground water.

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Cold Spring Granite Company
Permit Conditions
Permits (New large and small expansion areas)

74:29:03:16. Technical revisions

(1) Monitoring plans or parameters;
(2) Plans and specifications for permitted facilities;
(3) Seeding mixtures or rates;
(4) Relocation of proposed roads within permitted affected land;
(5) Relocation of chemical or petroleum product storage areas;
(6) Modification or relocation of erosion, sedimentation, or drainage control;
(7) Compliance limits for chemical parameters;
(8) Quality control and quality assurance plans;
(9) Topsoil stripping or storage; and
(10) Relocation or Modification of ancillary facilities, including equipment storage areas, parking lots, perimeter fencing, and stock piles:
(11) Implementing new and improved reclamation techniques as they are developed:
(12) Implementing new surface mining techniques and/or equipment as they are developed

Permit Boundary #1 Large Permit near Carnelian 2 Permitted acreage 7.8

Permit Boundary #2 Small Permit near Carnelian 3 Permitted acreage .2

Technical revisions must comply with § 74:29:03:03, as applicable, and must be submitted to the department in writing. The department shall approve, disapprove, conditionally approve, or request additional information within 30 days after receipt.

22106-00

PLAT OF

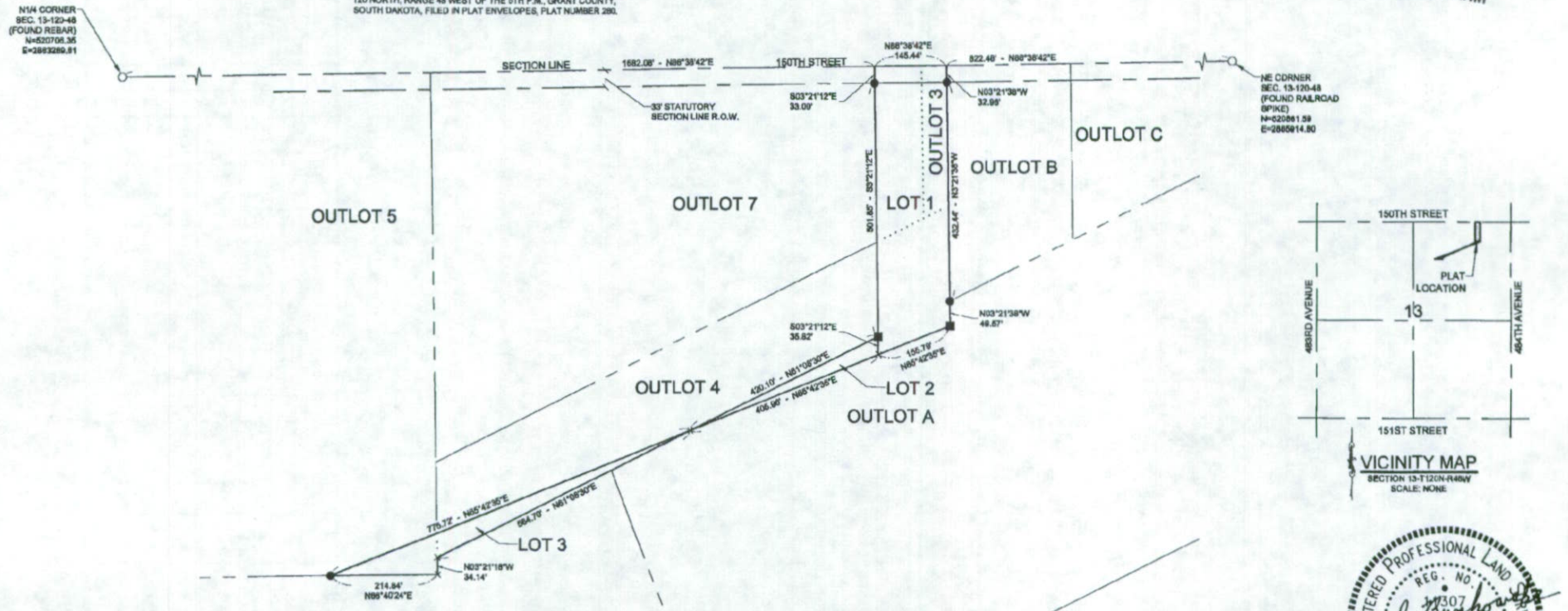
LOTS 1, 2 AND 3 OF COLD SPRING-DAKOTA GRANITE SECOND ADDITION

LOCATED IN OUTLOTS A, 3, 4, 5 AND 7 OF SECTION 13, TOWNSHIP 120 NORTH,
RANGE 48 WEST OF THE 5TH P.M., GRANT COUNTY, SOUTH DAKOTA

RECEIVED
JUL 13 2016
MINERALS & MINING PROGRAM

VACATION NOTICE

THIS PLAT SHALL VACATE A PART OF LOTS 3, 4, 5 AND 7 OF THE PLAT OF OUTLOTS 3, 4, 5, 7 IN THE NE1/4 OF SECTION 13, TOWNSHIP 120 NORTH, RANGE 48 WEST OF THE 5TH P.M., GRANT COUNTY, SOUTH DAKOTA, FILED IN PLAT BOOK 8, PLAT NUMBER 51 AND
SHALL VACATE A PART OF OUTLOT A OF THE PLAT OF PROPERTY OF DAKOTA GRANITE COMPANY IN NE1/4, SECTION 13, TOWNSHIP 120 NORTH, RANGE 48 WEST OF THE 5TH P.M., GRANT COUNTY, SOUTH DAKOTA, FILED IN PLAT ENVELOPES, PLAT NUMBER 280.



VICINITY MAP
SECTION 13-T120N-R48W
SCALE: NONE

LOT 1 CONTAINS 1.6± ACRES OF WHICH
0.1± ACRES BEING STATUTORY
SECTION LINE R.O.W.
LOT 2 CONTAINS 0.2± ACRES
LOT 3 CONTAINS 0.6± ACRES

GEODETIC BEARING
SCALE: 1" = 200'

LEGEND

- ○ MONUMENT FOUND
- ● MONUMENT SET THIS SURVEY (5/8" REBAR WITH STAMPED PLASTIC CAP #11307)
- ■ MONUMENT SET THIS SURVEY (PAINT MARK ON GRANITE)
- × CORNER FALLS IN QUARRY PIT AND INACCESSABLE AT THE TIME OF THIS SURVEY.

HORIZONTAL DATUM: NAD 83 (2007)

PROJECTION:
SOUTH DAKOTA STATE PLANE
COORDINATES NORTH ZONE (4001)

BASIS OF BEARING: GEODETIC NORTH

ALL DIMENSIONS SHOWN ARE IN TERMS OF U.S. SURVEY FEET

REGISTERED PROFESSIONAL LAND SURVEYOR
REG. NO. 11307
JONATHAN J. BUNKOWSKE
12/3/15
SOUTH DAKOTA

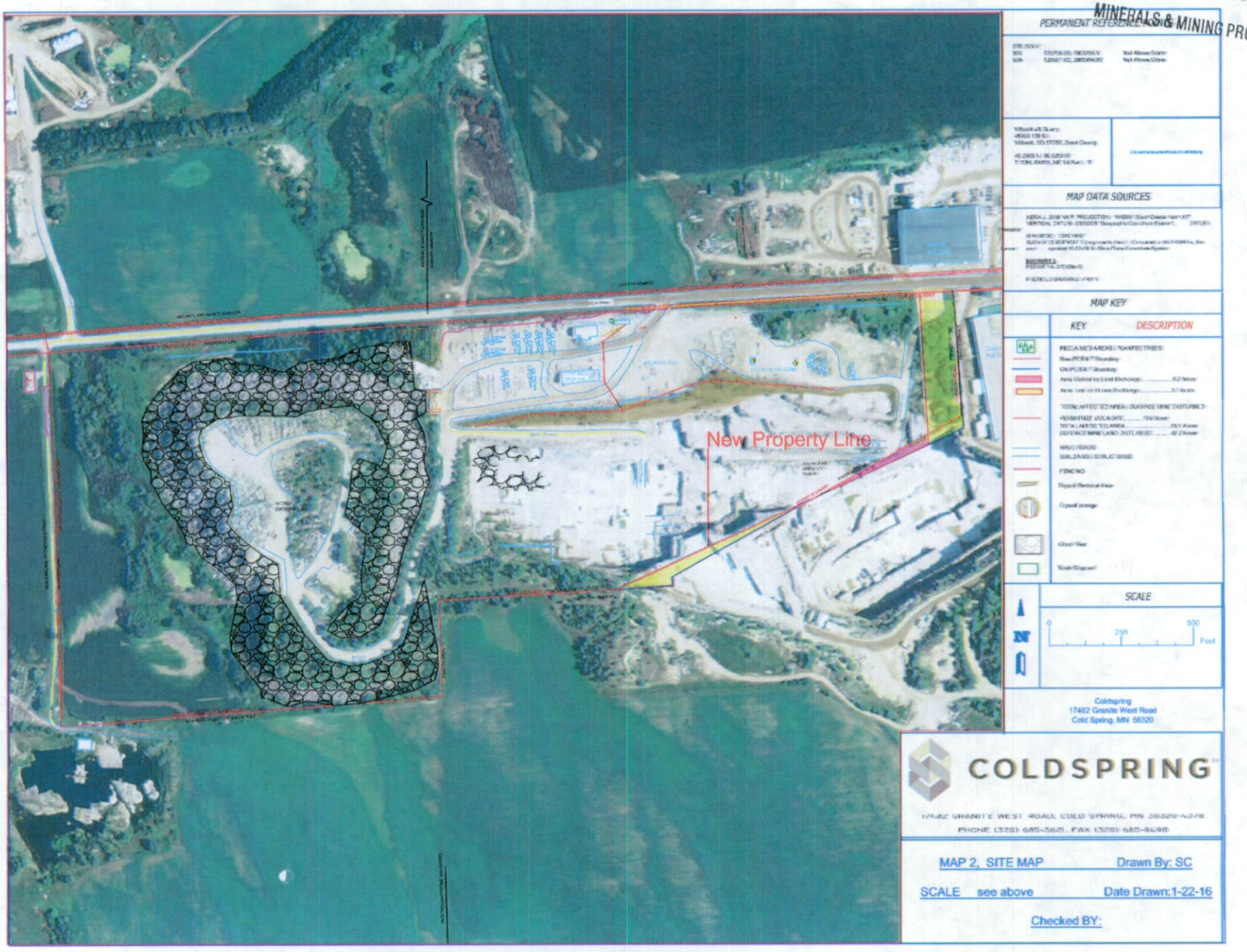
Jonathan J. Bunkowske

PREPARED BY:
BANNER ASSOCIATES, INC.
MILBANK, SOUTH DAKOTA
(855) 323-6342
SEPTEMBER 2015

Document #
STATE OF SOUTH DAKOTA COUNTY OF GRANT-ss
Recorded this _____ day of _____, A.D., 20_____
at _____o'clock ___ .M., Plat Case_____ Plat No. _____
Register of Deeds

SHEET 1 OF 2

Rev. 1



PERMANENT REFERENCE POINTS

MAP DATA SOURCES

MAP KEY

KEY	DESCRIPTION
	RECLAIMED AREAS / PLANTED TREES
	New PERMIT Boundary
	Old PERMIT Boundary
	Area Gained by Land Exchange: ..... 6.2 Acres
	Area Lost in Land Exchange: ..... 3.1 Acres
	TOTAL AFFECTED AREA / SURFACE MINE DISTURBED
	PERMITTED ACREAGE ..... 70.0 Acres
	TOTAL RECLAIMED AREA ..... 58.1 Acres
	EXISTING QUARRY WALL AREA ..... 14 Acres
	RECLAIMED GREAT FREE AREA ..... 22 Acres
	RECLAIMED ROADS AND OFFICE AREA ..... 20.1 Acres
	RECLAIMED LEDGE IN EXTENSION AREA ..... 450 Sq FT.
	FENCING

SCALE

0 250 500 Feet

N

Coldspring
17482 Granite West Road
Cold Spring, MN 56320

COLDSPRING

17482 GRANITE WEST ROAD, COLD SPRING, MN 56320-4078
PHONE (320) 685-3621, FAX (320) 685-8490

MAP 3, RECLAMATION MAP Drawn By: SC

SCALE see above Date Drawn: 1-22-16

Checked BY:

RECEIVED
JUL 13 2016
MINERALS & MINING PROGRAM

PERMANENT REFERENCE POINTS

Villbank #8 Quarry
49568 150 th
Villbank, SD 57252, Grant County

45.7366 N, 96.9259 W
T120N, R49W, NE 1/4 Sec. 13

MAP DATA SOURCES

AERIAL: 2008 NAIP PROJECTION: NAD83 / South Dakota North (ft)*
VERTICAL DATUM: GEOIDO6 "Geographic Coordinate System", DATUM:

SPHEROID: "GRS 1980"
SURVEY QUESTIONS: (for property lines) Compiled on 8-24-1994 by Don Larson, and updated 10-22-05 for State Plane Coordinate System.

BOUNDARY 2
FOREST CA 371 (Site 2)

THOMAS DRAWING: 74015

MAP KEY

KEY	DESCRIPTION
	RECLAIMED AREAS / PLANTED TREES
	New PERMIT Boundary
	Old PERMIT Boundary
	Area Gained by Land Exchange ..... 3.3 Acres
	Area Lost do to land Exchange ..... 2.1 Acres
	TOTAL AFFECTED AREA / SURFACE MINE DISTURBED
	PERMITTED BOUNDARY ..... 70.9 Acres
	TOTAL AFFECTED AREA ..... 56.1 Acres
	SURFACE MINE LAND DISTURBED ..... 42.2 Acres
	HAUL ROADS
	BUILDINGS / STRUCTURES
	FENCING
	Topsoil Removal Area
	Topsoil storage
	Grout Piles
	Trench Disposal

SCALE

N

0 750 1500 Feet

Coldspring
17482 Granite West Road
Cold Spring, MN 56320

COLDSPRING™

17482 GRANITE WEST ROAD, COLD SPRING, MN 56320-4578
PHONE (320) 685-5621, FAX (320) 685-8490

MAP 4, GROUT PILE Drawn By: SC

SCALE see above Date Drawn:5-22-16

Checked BY: